RITA *Bureau of Transportation Statistics*

Transportation Statistics Annual Report 2012

U.S. Department of Transportation

Research and Innovative Technology Administration

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Transportation Statistics Annual Report 2012

Bureau of Transportation Statistics

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Recommended citation

U.S. Department of Transportation, Research and Innovative Technology Administration Bureau of Transportation Statistics, *Transportation Statistics Annual Report 2012* (Washington, DC: 2013)

Note: Box A-1 and table 2-1 were revised on Aug. 19, 2013.

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Editing, Design and Layout

William Moore of RITA edited the report, and Alpha Wingfield of RITA provided the design and layout.

Special Acknowledgment

Special thanks to our colleagues throughout the Department of Transportation who provided data used in this report and critical review of the narrative.

Introduction

The *Transportation Statistics Annual Report* describes the Nation's transportation system, the system's performance, its contributions to the economy, and its effects on the environment. This 17th edition of the report, covering 2011 and 2012, is based on information collected or compiled by the Bureau of Transportation Statistics (BTS), a Federal statistical agency in the Research and Innovative Technology Administration (RITA) of the U.S. Department of Transportation (USDOT).

Over 4 million miles of roads, nearly 139,000 miles of railroads, over 25,000 miles of navigable waterways, over 2 million miles of pipelines, and more than 5,000 public use airports connect the Nation's people and businesses across a continent and with the rest of the world.

The estimated value of U.S. transportation assets in 2010 was over $7 trillion. The public owns one-half of the total transportation asset value, mostly highways and streets, but also publicly held airports, waterways, and transit facilities. Private companies own 31.6 percent of transportation assets, including railroads, pipelines, trucks, planes, and ships. Consumer-owned motor vehicles account for the remaining 18.1 percent.

The average person travels more than 13,000 miles per year, and domestic businesses ship and receive 57 tons of freight per year for every man, woman, and child in the United States. Transportation accounts for:

- over $1 trillion in purchases and investments,
- $134 billion of public expenditures on operations and maintenance,
- 11 million jobs in transportation-related industries,
- more than $8,000 average expenditures for each household,
- nearly 35,000 lives lost and over 2.2

million nonfatal injuries each year,

- 70.2 percent of total petroleum consumption in the United States, and
- over 1.7 billion annual metric tons of carbon dioxide emissions.

BTS compiles these and other statistics under Section 52011: *Moving Ahead for Progress in the 21st Century Act* (Public Law No. 112-141), which requires information on:

i. transportation safety across all modes and intermodally;

ii. the state of good repair of United States transportation infrastructure;

iii. the extent, connectivity, and condition of the transportation system, building on the national transportation atlas database developed;

iv. economic efficiency across the entire transportation sector;

v. the effects of the transportation system on global and domestic economic competitiveness;

vi. demographic, economic, and other variables influencing travel behavior, including choice of transportation mode and goods movement;

vii. transportation-related variables that influence the domestic economy and global competitiveness;

viii. economic costs and impacts for passenger travel and freight movement;

ix. intermodal and multimodal passenger movement;

x. intermodal and multimodal freight movement; and

xi. consequences of transportation for the human and natural environment.

This report of the BTS Director to the President and the Congress summarizes the Bureau's findings through 2012. Chapter 1 describes the extent and condition of transportation infrastructure, passenger travel, and freight movement. Chapters 2 and 3 highlight recent trends in passenger travel and freight movement. Chapter 4 covers the role of transportation in the economy. Chapter 5 discusses performance of the system from the perspectives of congestion, safety, energy use, and the environment. Chapter 6 concludes this report with an assessment of the data programs that support understanding of the transportation system and its consequences.

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CHAPTER 1

Transportation System Characteristics — An Overview

The U.S. transportation system is the largest in the world in several key respects. It has more airports and more miles of road and rail than any other country and is fourth in miles of navigable waterways [USCIA 2012]. An interconnected network of highways, railroads, airports, public transit systems, waterways, and pipelines makes possible high levels of personal mobility and freight movement and links the country to the rest of the world for trade, travel, and tourism. The system serves nearly 312 million Americans and about 7.4 million business establishments spread across the world's third largest nation by area.

Physical connections are provided by over 4.1 million miles of roads, nearly 139,000 miles of railroad lines, over 25,000 miles of navigable waterways for commercial shipping, and 2.6 million miles of oil and gas pipelines. More than 5,000 public use airports, 8,000 commercial waterway and lock facilities, 3,155 transit stations and many thousands of rail terminals provide access to these networks.

People, businesses, and governments have about 270 million vehicles—land, air, and water conveyances of all kinds and sizes—that circulate

- The nation's transportation assets are valued at over $7 trillion.
- Infrastructure conditions are generally improving but more improvements are needed: over 10.7 percent of all bridges are structurally deficient, 20 percent of runways are in fair or poor condition, and more than half of all locks are more than 50 years old and 6.1 percent are more than 100 years old.
- The transportation system is used by 312 million U.S. residents, 60 million visitors and tourists, and 7.4 million business establishments.
- Our freight system moves 17.6 billion tons of freight per year.
- Freight shipments have returned to the prerecession level and are more than 16 percent above the recession low as of December 2012.

BOX 1-A Overview of the U.S. Transportation System

	2005	2011	Percent change
POPULATION (millions)	**296**	**312**	**5.4**
AIR (Civil)			
Extent			
Public use airports	5,270	5,171	-1.9
Commercial service airports	575	547	-4.9
Private use airports and landing fields	14,584	14,339	-1.7
Aircraft and use (domestic)			
Air carrier passenger/cargo aircraft	8,225	7,185	-9.7
Air carrier airplane miles flown, billions	6.7	6.0	-10.6
Passenger enplanements, millions	657	638	-2.9
RPM, billions[a]	569	564	-1.0
Freight ton-miles, billions	14.9	11.9	-20.4
General aviation aircraft	224,352	222,520	-0.4
HIGHWAYS			
Extent			
Public Roads:			
Miles of public roads, millions	4.0	4.1	2.1
Lane miles of public roads, millions	8.4	8.6	2.3
Bridges	590,553	605,087	2.5
Personal vehicles and use			
Cars, SUVs, vans, pickups			
Vehicles, millions	231.9	230.2 (2010)	-0.6
VMT, billions[b]	U	2,647.7 (2010)	
PMT, billions[c]	U	3,645.4 (2010)	
Motorcycles			
Vehicles, millions	6.2	8.2 (2010)	31.9
VMT, billions	U	18.5 (2010)	
PMT, billions	U	19.9 (2010)	
Commercial vehicles and buses			
Combination trucks			
Vehicles, millions	2.1	2.6 (2010)	22.3
VMT, billions	U	175.9 (2010)	
Single-unit trucks			
Vehicles, millions	6.4	8.2 (2010)	28.5
VMT, billions	U	110.7 (2010)	
Buses			
Vehicles, millions	807,053	846,051 (2010)	4.8
VMT, billions	U	13.8 (2010)	
PMT, billions	U	292.3 (2010)	

BOX 1-A *continued*

	2005	2011	Percent change
PIPELINE			
Extent			
Miles of pipeline			
Oil and hazardous liquid	166,760	182,135	9.2
Natural gas gathering and transmission	324,222	324,606	0.1
Natural gas distribution	1,164,997	1,233,000	5.8
RAIL			
Extent			
Miles of railroad operated by:			
Class I freight railroads	95,664	95,387	-0.3
Regional railroads	15,388	10,355	-32.7
Local railroads	29,197	32,776	12.3
Amtrak (intercity passenger service), route miles	22,007	21,225	-3.6
Equipment and use			
Class I freight cars in service	474,839	380,699	-19.8
Locomotives in service	22,779	24,250	6.5
Revenue ton-miles of freight, billions	1.7	1.7	1.9
Amtrak			
Stations	518	517	-0.2
Passenger cars	1,186	1,301	9.7
Locomotives in service	258	287	11.2
Revenue passengers carried, millions	25.1	31.3	25.0
Revenue passenger-miles, billions	5.4	6.7	24.0
TRANSIT			
Extent			
Directional route-miles[d]			
Bus routes	166,279	231,372	39.1
Commuter rail	7,118	7,576	6.4
Heavy rail	1,622	1,617	-0.3
Light rail	1,188	1,741	46.5
Transit rail stations	2,899	3,155	8.8
Vehicles and use			
Transit buses			
Vehicles	62,284	61,606	-1.1
PMT, billions	19.6	20.7	5.7
Unlinked trips, billions	5.3	5.2	-1.9
Heavy rail cars			
Vehicles	11,110	14,794	33.2
PMT, billions	14.4	17.3	20.1
Unlinked trips, billions	2.8	3.6	29.9

continued next page

BOX 1-A *continued*

	2005	2011	Percent change
TRANSIT (*continued*)			
Commuter rail cars and locomotives			
Vehicles	6,290	6,971	10.8
PMT, billions	9.5	11.3	19.5
Unlinked trips, billions	0.4	0.5	9.1
Light rail cars			
Vehicles	1,645	2,284	38.8
PMT, billions	1.7	2.4	39.1
Unlinked trips, billions	0.4	0.5	27.1
Demand responsive vehicles (e.g., paratransit)			
Vehicles	28,346	31,846	12.3
PMT, billions	0.7	0.9	19.0
Unlinked trips, billions	0.1	0.1	17.9
Other (e.g., ferryboat, vanpool)			
Vehicles	11,622	18,965	63.2
PMT, billions	1.2	1.7	44.6
Unlinked trips, billions	0.1	0.2	9.1
WATER			
Extent			
Miles of navigable waterways	26,000	25,320 (2010)	-2.6
Waterway facilities (including cargo handling docks)	9,399	8,197	-12.8
Lock chambers	257	239	-7.0
Lock sites	212	193	-9.0
Vessels			
Nonself-propelled vessels	33,152	31,412 (2010)	-5.2
Self-propelled vessels	8,976	9,100 (2010)	1.4
U.S.-flag oceangoing privately owned fleet	366	192 (2010)	-47.5
Recreational boats, millions	12.9	12.2	-5.9

[a] Revenue Passenger-Miles (RPM): Calculated by multiplying number of paying passengers by miles traveled. [b] Vehicle-Miles Traveled (VMT): *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. *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.

[c] Passenger-Miles Traveled (PMT): Total miles traveled by all passengers. For example, a car that carries 5 passengers a distance of 3 miles accrues 15 passenger-miles traveled.

[d] The mileage in each direction over which public transportation vehicles travel while in revenue service.

KEY: PMT=Passenger-Miles Traveled; RPM=Revenue Passenger-Miles; SUV= Sport Utility Vehicle; U=unavailable; comparable data are unavailable due to a change in FHWA estimation methodology.VMT= Vehicle-Miles Traveled

NOTE: Data is taken from multiple sources, thus the number of significant digits may vary.

SOURCES: **Population**: U.S. Department of Commerce, U.S. Census Bureau, Population Estimates, Vintage 2009 and 2012, available at www.census.gov/popest as of March 2013. **Air**: airports, aircraft, VMT—U.S. Department of Transportation (USDOT), Federal Aviation Administration, as cited in USDOT, Research and Innovative Technology Administration (RITA), Bureau of Transportation Statistics (BTS), National Transportation Statistics (NTS), table 1-3, 1-11, 1-35, available at www.bts.gov as of May 2012. Enplanements, PMT, ton-miles—USDOT RITA BTS, Air Carrier Traffic Statistics, available at bts.gov as of March 2013. **Highways:** USDOT Federal Highway Administration (FHWA), *Highway Statistics* (multiple years) as cited in USDOT RITA BTS NTS, op cit., table 1-4 (roads), 1-6 (lane miles), 1-11 (vehicles), 1-35 (VMT), table 1-40 (PMT); bridges—USDOT FHWA Office of Bridge Technology, National Bridge Inventory Database, as cited in USDOT RITA BTS NTS, op cit., table 1-28. **Pipeline**: USDOT Pipeline and Hazardous Materials Administration, as cited in USDOT RITA BTS NTS, op cit., table 1-1 and 1-10. **Rail**: Association of American Railroads, Railroad Facts 2006 and 2012 (Washington, DC). Stations—Amtrak, as cited in USDOT RITA BTS NTS, op cit., table 1-7. **Transit**: USDOT Federal Transit Administration, National Transit Database, 2010 National Transit Profile Summary-All Agencies, available at www.ntdprogram.gov as of June 15, 2012. Water: Various sources as cited in USDOT RITA BTS NTS, op cit., table 1-1 (waterways) and table 1-11 (vessels) as of August 2013.

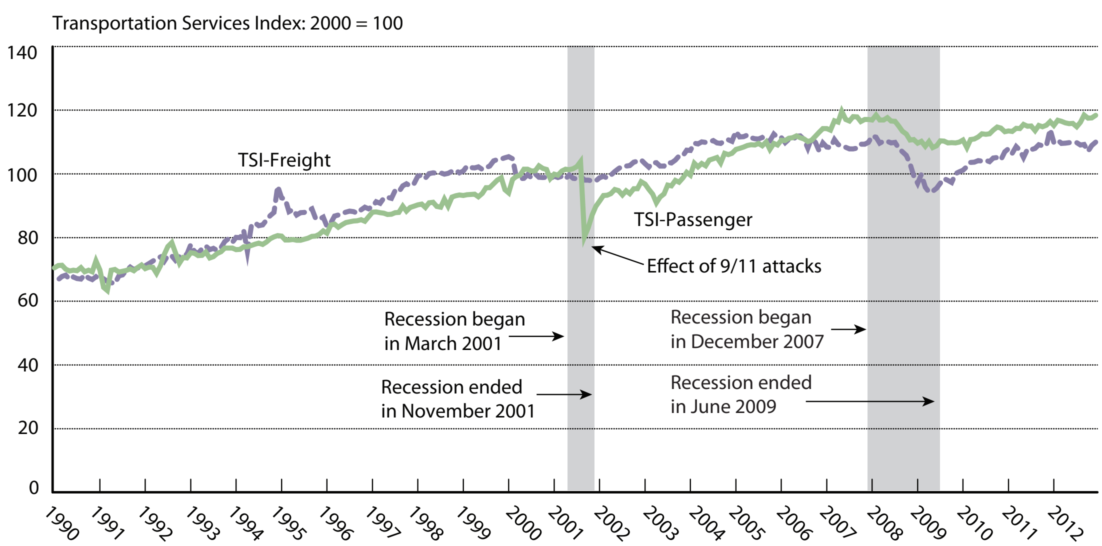
on the U.S. transportation system. Of these, 250 million are highway vehicles—approximately one-fifth of the world's passenger vehicles and 40 percent of its trucks and buses [USDOE ORNL, p. 3.1]. Box 1-A gives overview data on infrastructure extent as well as the number and use of vehicles and conveyances for highway, air, rail, water, transit, and pipeline modes.

In addition, there are thousands of firms and millions of workers that provide transportation services; build, maintain, and operate the infrastructure; and produce and service vehicles, making transportation a major component of the economy (see chapter 4 for detailed discussion). Government agencies at all levels have a wide range of responsibilities with regard to transportation, including direct operation and maintenance of public highways and transit, regulation of public safety and security, and planning and administering funds for construction of new infrastructure.

System use is intensive and has grown over the last several decades, exceeding levels that might be expected from population growth alone. Recent growth in travel has been dampened by stresses, including repercussions from the September 2001 terrorist attacks, rising fuel prices, and two economic downturns in the 1st decade of the 21st century. For these and other reasons, some indicators of transportation activity in 2011, although well above their levels in 1990 or even 2000, are still below the historic highs reached before the economic downturn of 2007–2009.

Figure 1-1 shows the volume of for-hire passenger and freight services provided by airlines, railroads, trucking companies, tran-

FIGURE 1-1 Transportation Services Index of Passenger and Freight Transportation: January 1990–December 2012



SOURCE: **TSI**: U.S. Department of Transportation. Research and Innovative Technology Administration. Bureau of Transportation Statistics. Transportation Services Index (Updated monthly). Available at www.bts.gov as of March 2013. **Recession Dates**: National Bureau of Economic Research, U.S. Business Cycle Expansions and Contractions, available at www.nber.org/cycles.html as of February 2013.

sit agencies, inland waterway operators, and pipeline companies for each month between January 1990 and December 2012, as compiled by the Bureau of Transportation Statistics' (BTS's) Transportation Services Index (TSI).[1] Despite several temporary declines in this 22-year period, the pattern has been for these for-hire transportation services to regain momentum and move upwards over time. Freight shipments have returned to the prerecession level and are more than 16 percent above the recession low as of December 2012. In December 2012, the volume of freight transportation services in the United States stood 66.7 percent higher than it did at the beginning of 1990 and 4.3 percent higher than it did in 2000.[2] The volume of for-hire passenger services in the United States stood 68.1 percent higher than it did at the beginning of 1990 and 25.9 percent higher than it did in 2000.

Travel in personal vehicles, such as passenger cars, minivans, and sport utility vehicles (SUVs), has also grown since 1990. Much of this transportation activity is not commercial and thus is not covered in the TSI. Survey data on personal travel collected by the Federal Highway Administration identified about 2.2 trillion vehicle-miles of such travel in 2009, 32.4 percent more than that found by a similar survey in 1990 [USDOT FHWA 2011a, table 4].[3] Chapter 2 discusses personal travel in detail.

Assets and Investment

The estimated value of U.S. transportation assets in 2010 was over $7.0 trillion as shown in table 1-1. These transportation capital stocks include infrastructure (e.g., structures and facilities) and equipment (e.g., vehicles and conveyances). The measure, derived from data published by the Bureau of Economic Analysis of the U.S. Department of Commerce, shows the accumulated total value of the U.S. transportation system and how it has changed over time.[4]

The public owns one-half of the total transportation asset value, mostly highways and streets, but also publicly held airports, waterways, and transit facilities. Private companies own 31.6 percent of these assets, including railroads and pipelines, trucks, planes, and ships. Consumer-owned motor vehicles account for the remaining 18.1 percent.

Highway-related assets account for nearly three-fourths of transportation capital stock. Besides public highways and consumer-owned

[1] The index does not include all for-hire transportation as intercity bus service, taxi, and sightseeing services are not covered.

[2] The TSI does not include a large amount of not-for-hire private or in-house trucking carried out within firms. Commodity Flow Surveys conducted by BTS and the U.S. Census Bureau show private trucking declining as a percentage of total trucking between 1993 and 2007, when it accounted for 21 percent of the trucking total [USDOT RITA BTS NTS, table 1-58]. Comparable data are not available on in-house trucking for the 1990 through 2012 period.

[3] The Federal Highway Administration (FHWA) also estimates vehicle-miles of travel. Beginning in 2007, FHWA revised its vehicle-miles data based on a new methodology. These data are not comparable to previous years.

[4] Subtracted out from the reported totals are the amount of depreciation of aging equipment and infrastructure and the value of assets taken out of service.

TABLE 1-1 Estimated Value of Transportation Capital Stock by Mode: 2005–2011
Billions of current dollars

	2005	2006	2007	2008	2009	2010	2011
Public highways and streets	2,056	2,354	2,641	2,810	2,837	2,939	3,132
Consumer-owned motor vehicles and parts	1,302	1,306	1,318	1,261	1,284	1,272	1,310
In-house transportation	1,137	1,202	1,240	1,245	1,175	1,164	U
Other publicly owned transportation	413	470	522	556	564	590	635
Railroad transportation	316	325	337	351	355	363	373
Air transportation	209	212	215	226	216	214	215
Other privately owned transportation	120	127	128	130	125	123	124
Pipeline transportation	112	119	129	157	154	168	181
Commercial truck transportation	98	113	113	114	108	107	113
Water transportation	38	40	40	41	41	41	41
Private transit and ground passenger transportation	40	42	43	44	43	43	44
Total	**5,839**	**6,309**	**6,725**	**6,933**	**6,900**	**7,025**	**U**

KEY: U = unavailable.

NOTES: Data include only privately owned capital stock except for those otherwise noted. Capital stock data are reported after deducting depreciation. *Consumer motor vehicles* are considered consumer durable goods. *In-house transportation* includes transportation services provided within a firm whose main business is not transportation. For example, grocery companies often use their own truck fleets to move goods from their warehouses to their retail outlets. *In-house transportation* figures cover the the current cost net capital stock for fixed assets (e.g., autos, aircraft, ships, etc.) owned by a firm. *Other publicly owned transportation* includes publicly owned airway, waterway, and transit structures but does not include associated equipment. *Other privately owned transportation* includes sightseeing, couriers and messengers, and transportation support activities, such as freight transportation brokers. Details may not add to totals due to rounding.

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, *Fixed Asset Tables*, tables 3.1ES, 7.1B, 8.1, and *Nonresidential Detailed Estimates*, available at http://www.bea.gov/ as of January 2013.

vehicles, the next largest category is in-house transportation, most of which is highway-related (e.g., fleets of trucks owned by grocery chains to transport foodstuffs between outlets). For-hire commercial trucking and private transit/ground transportation account for the remaining highway assets. The net asset value for all other modes, including rail, air, pipelines, and water transportation, comprise the remainder with railroads accounting for the largest share.

There was an increase in spending for transportation construction between 2005 and 2010, in part because of a temporary increase in Federal funding provided by the *American Recovery and Reinvestment Act* (ARRA) of 2009 (Public Law 111-5). The total value of transportation construction put in place in 2011 was $114 billion in public and private spending, compared to $89 billion in 2005. Table 1-2 shows the total value of this spending, both public and private, from 2005 to 2011. Chapter 4 discusses spending for transportation infrastructure in more detail and also examines overall government spending and revenues for all aspects of transportation.

In recent years, numerous projects involving public-private partnerships to build, maintain, and operate transportation facilities have been launched in the United States. Several involve highways. A few governments have leased existing, publicly financed toll facilities to private

TABLE 1-2 Estimated Value of Construction Put in Place: 2005–2011
Millions of dollars

	2005	2006	2007	2008	2009	2010	2011
Total Transportation Construction	**86,537**	**97,381**	**105,608**	**113,588**	**115,771**	**117,696**	**111,073**
Private Transportation Construction	7,124	8,654	9,009	9,934	9,056	9,894	9,841
Public Construction, total	79,413	88,727	96,599	103,654	106,715	107,802	101,232
Air, Land, Water Transport Facilities	16,256	17,695	21,144	23,230	25,461	26,493	23,234
Highway and Streets	63,157	71,032	75,455	80,424	81,254	81,309	77,998

NOTE: Numbers may not add to totals due to rounding.

SOURCE: U.S. Department of Commerce, Census Bureau, Construction Spending Survey, available at www.census.gov/construction/c30/c30index.html as of January 2013.

concessionaires under long-term agreements. Typically, the firm pays an initial concession fee, agrees to operate and maintain the facility, and in some cases make improvements in return for retaining tolls or other revenues from these facilities. Examples include the Chicago Skyway and the Indiana Toll Road. In other cases, the private firm designs and builds a new road or facility in return for keeping tolls. The Dulles Greenway in Virginia is a prominent example. Many other arrangements are being explored. In 2011, 65 public-private partnership projects were underway in the 50 states, the District of Columbia, and Puerto Rico [USDOT FHWA 2011b].

Extent, Use, and Condition by Transportation Mode

Highways and Bridges

Public roads, ranging from unpaved local routes to 16-lane freeways, handle nearly 87.6 percent of passenger-miles[5] and over 40.9 percent of freight ton-miles [RITA BTS 2013b]. Public roads totaled over 4.1 million miles in 2010, showing little change in recent years. However, lane-miles[6] of roads have increased as heavily traveled roads have been expanded from two to four or six lanes to increase capacity. Nearly 360,000 lane-miles have been added since 2000, bringing the total to nearly 8.6 million nationwide in 2010.

Interstate highways and other major arterials account for a very high proportion of traffic, both in terms of number of vehicles and vehicle-miles traveled (VMT). The Interstates

[5] *Air*: One passenger transported 1 mile; passenger-miles for one interairport flight or trip are calculated by multiplying aircraft-miles flown by the number of passengers carried on the flight. The total passenger-miles for all flights or trips are the sum of passenger-miles for all interairport flights or trips. *Highway*: One passenger traveling 1 mile; e.g., one car transporting two passengers 4 miles results in 8 passenger-miles. *Transit*: The total number of miles traveled by transit passengers; e.g., one bus transporting five passengers 3 miles results in 15 passenger-miles.

[6] One mile of roadway that is designed as a driving lane (e.g., a two lane road has 2 lane-miles per linear mile).

BOX 1-B Condition of the U.S. Transportation System

	2005	2011	Percent change
AIR			
Airport runway condition			
All NPIAS Airports, percent			
Good condition	75	80	5
Fair condition	21	18	-3
Poor condition	4	2	-2
Commercial Service Airports, percent			
Good condition	79	82	3
Fair condition	19	16	-3
Poor condition	2	2	0
Average age of aircraft			
All commercial aircraft	11.3	13.3	17.7
Major airlines aircraft	11.3	13.3	17.7
HIGHWAYS			
Highway surface condition, percent			
Mileage with a International Roughness Index[a] over 171			
Rural Routes			
Interstates	1.7	1.7 (2009)	-0.1
Other principal arterials	3.6	3.1 (2009)	-0.6
Minor arterials	5.4	6.2 (2009)	0.8
Collectors	16.1	16.2 (2009)	0.0
Urban Routes			
Interstates	6.0	5.0 (2009)	-1.0
Other freeways and expressways	7.8	6.5 (2009)	-1.4
Other principal arterials	27.4	26.4 (2009)	-1.1
Minor arterials	33.6	30.2 (2009)	-3.4
Collectors	49.7	44.8 (2009)	-5.0
Condition of highway bridges, percent			
All structurally deficient bridges	12.9	10.7	-2.1
Urban structurally deficient	2.1	1.9	-0.2
Rural structurally deficient	10.7	8.8	-1.9
All functionally obsolete	13.6	12.1	-1.5
Urban functionally obsolete	5.3	5.4	0.0
Rural functionally obsolete	8.3	6.8	-1.5
Average age of vehicles			
Passenger cars	10.1	11.1	9.9
Light trucks	8.7	10.4	19.5
All light vehicles	9.5	10.8	13.7

continued next page

BOX 1-B *continued*

	2005	2011	Percent change
RAIL			
Rebuilt equipment, percent			
Rebuilt locomotives as share of all new locomotives	9.2	29.1	19.9
Rebuilt freight cars as share of all new freight cars	2.2	0.3	-1.9
Age of locomotives, percent			
< 5 years old (2005), < 6 years old (2011)	22.6	20.0	-2.6
6 to 10 years old (2005), 7 to 11 years old (2011)	19.1	17.6	-1.5
11 to 15 years old (2005), 12 to 16 years old (2011)	12.2	18.4	6.2
16 to 20 years old (2005), 17 to 21 years old (2011)	7.8	9.8	1.9
> 20 years old (2005), > 21 years old (2011)	38.2	34.2	-4.0
TRANSIT (urban)			
Average age of vehicles			
Heavy-rail passenger cars	20.8	19.2	-7.7
Commuter-rail passenger coaches	18.6	19.4	4.3
Full-size transit buses	7.4	7.9	6.8
Light-rail vehicles	14.5	16.5	13.8
Transit vans	3.4	3.5	2.9
Ferry boats	25.6	20.3	-20.7
WATER			
Age of locks			
Average age	55.0	50.1	-8.9
Age of U.S. flag vessels, percent			
< 5 years old	13.9	18.7 (2010)	4.8
6 to 10 years old	17.0	11.5 (2010)	-5.4
11 to 15 years old	9.6	17.1 (2010)	7.4
16 to 20 years old	5.0	8.8 (2010)	3.7
21 to 25 years old	18.0	4.3 (2010)	-13.6
> 25 years old	36.6	39.6 (2010)	3.0

[a] International Roughness Index values are based on objective measurements of pavement roughness. A low IRI represents a smooth riding roadway.

KEY: NPIAS—National Plan of Integrated Airport Systems

NOTE: Data is taken from multiple sources, thus the number of significant digits may vary. The NPIAS identifies existing and proposed airports significant to air transportation.

SOURCES: **Air**—U.S. Department of Transportation, Federal Aviation Administration, as cited in U.S. Department of Transportation (USDOT), Research and Innovative Technology Administration (RITA), Bureau of Transportation Statistics (BTS), National Transportation Statistics (NTS), table 1-25, available at www.bts.gov as of January 2012. USDOT, RITA, BTS, Office of Airline Information, TranStats Database, Form 41, Schedule B-43, special tabulation, October 2010. **Highways**—U.S. Department of Transportation, Federal Highway Administration, as reported in USDOT RITA BTS NTS, op cit., table 1-26 (vehicles), table 1-27 (Highway surface condition), and table 1-28 (Bridges). **Rail**—Association of American Railroads, *Railroad Facts 2006 and 2012* (Washington, DC). **Transit**—U.S. Department of Transportation, Federal Transit Administration, as reported in USDOT RITA BTS NTS, op cit., table 1-29. **Water**—U.S. Army Corps of Engineers, Navigation Data Center, *General Characteristics of Locks and Waterborne Transportation Lines of the United States* available at www.ndc.iwr.usace.army.mil as of January 2013.

account for 1.1 percent of highway route-miles but 24.2 percent of the total vehicle-miles traveled [USDOT FHWA and FTA 2012, ES].

The number of vehicles using the Nation's highway system increased by about 29.6 percent between 1990, when there were 193 million vehicles, and 2010, when there were 250 million vehicles. The growth rate has varied by vehicle type. Among commercial vehicle categories, the fastest growth rate has been in large, heavy commercial vehicles. The number of combination trucks increased 49.4 percent, and single-unit trucks increased 83.1 percent. As for personal vehicles, the motorcycle nearly doubled in numbers since 1990, growing from 4.3 million to 8.2 million. The number of conventional automobiles has been flat for most of the period, while there was dramatic growth in larger passenger vehicles such as SUVs, minivans, and pickup trucks.

The condition of the Nation's highway system is a key concern. Judging from a measure of road roughness used to gauge highway system condition,[7] it appears that most functional categories of roadways improved somewhat from 2005 through 2010. The percentage of rough roads in highly traveled urban areas is much higher than the percentage of rough roads in rural areas. As shown in box 1-B, about 5.0 percent of urban Interstate mileage and 6.5 percent of other urban freeways and expressways were given the poorest condition grade in 2009, compared to 1.7 percent of Interstates in rural areas. Among other principal arterial roads, 26.4 percent of mileage in urban areas was in poor condition compared to 3.1 percent in rural areas.

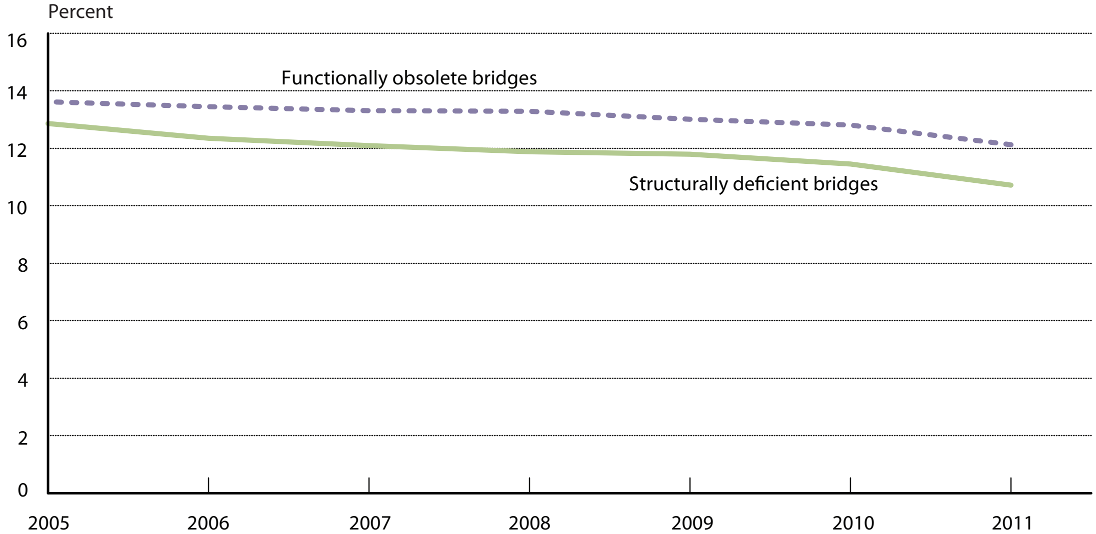
The Nation's 630,141 highway bridges are a critical part of the road infrastructure. Many bridges are located in rural areas, but traffic is greatest on urban bridges. U.S. bridges are aging, with two-thirds of bridges over 25 years of age. Less than 1 percent of bridges under 10 years old are structurally deficient, but the number rises to about 10 percent for bridges 26 to 50 years of age and to about 40 percent for bridges over 100 years old [USDOT FHWA and FTA 2012, Exhibits. 3-19, 3-20].

The overall condition of highway bridges has improved slowly over time. In 2011, 67,522 bridges (slightly less than 10.7 percent) were considered structurally deficient, a circumstance characterized by the deteriorated condition of bridge elements and reduced load bearing capacity. This was an improvement from 2005, when 75,923 bridges (12.9 percent) were considered structurally deficient (figure 1-2). Such bridges are not necessarily unsafe, but do require maintenance and repair to remain in service and eventual rehabilitation or replacement [USDOT FHWA and FTA 2012, p. ES-4]. The portion of structurally deficient bridges varies greatly among states, from 2 percent in Nevada to 26 percent in Pennsylvania.

Many bridges are considered functionally obsolete even though structurally sound. Often, this is because traffic volume exceeds that

[7] The measure, called the International Roughness Index (IRI), reports data in inches per mile. Lower IRI indicates smoother riding roadways [USDOT RITA BTS NTS, table 1-27].

FIGURE 1-2 Condition of U.S. Highway Bridges: 2005–2011



SOURCE: U.S. Department of Transportation, Federal Highway Administration, Office of Bridge Technology, National Bridge Inventory (NBI), *Count of Bridges by Highway System*, available at http://www.fhwa.dot.gov/bridge/britab.htm as of January 2013 as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, table 1-28, available at http://www.bts.gov/publications/national_transportation_statistics/ as of January 2013.

anticipated when the bridge was built, so the bridge may need to be widened or replaced. Functional obsolescence of bridges often occurs in urban areas due to growth in bridge traffic volumes. In 2011, there were about 33,742 functionally obsolete bridges in urban areas, compared to 31,391 in 2005. The number of functionally obsolete bridges declined in rural areas during the period. Figure 1-2 shows the percent of functionally obsolete and structurally deficient bridges also declined.

Air Transportation

The United States has more airports than any other nation [USCIA 2012]. Most air traffic is at about 500 commercial service airports that provide scheduled air services. However, 5,171 airports are open to the public and, of these, 3,355 are eligible for improvement grants from the Federal Aviation Administration [USDOT FAA 2013, p. 9]. Individual states include these airports in their own aviation plans as well as many of the other 1,816 public use airports.[8]

The rapid growth in the number of flight operations that U.S. airports experienced between 1990 and 2000 slowed from 34.4 percent during that period to 7.5 percent between 2000 and 2010. The slower growth over the last decade reflects the impact of the 2001 terrorist attacks, spikes in jet fuel costs, and the recession of late 2007 to mid 2009 [USDOT RITA BTS 2012b].[9] In 2010, there were about 9.6 million aircraft departures, compared to 8.9 million in

[8] Another 25 airports are proposed.

[9] Airline fuel costs jumped from $1.15 per gallon in 2004 to a high of $3.06 per gallon in 2008, then fell to $1.89 per gallon in 2009, before rising to $2.86 per gallon in 2011, according to the latest BTS data (www.transtats.bts.gov/fuel.asp).

2000 and 6.6 million in 1990 [USDOT RITA BTS NTS 2013a, table 1-37]. Air traffic is concentrated at a relatively few large airports: the top 20 airports accounted for 56 percent of passenger boardings in 2010, nearly the same percentage as 10 years earlier (although some airport rankings in the top 20 have changed). The top 25 airports for all-cargo operations accounted for 76 percent of the landed weight of all air cargo in 2010 versus 70 percent in 2000 [USDOT FHWA 2011c, p. 24].

Some improvement in runway pavement conditions of airports serving commercial traffic occurred between 2005 and 2010. At these airports, 82 percent of the runways were in good or better condition (no visible deterioration or all cracks and joints sealed) in 2011 while 16 percent were fair, leaving 2 percent in poor condition. In 2005, the numbers were 79 percent, 19 percent, and 2 percent respectively (as shown in box 1-B).

There are 223,000 general aviation and 7,185 air carrier cargo/passenger aircraft, operated by approximately 617,000 active pilots, in the country. There are over 14,615 small airports and landing fields used primarily in general aviation—many of which have only one associated aircraft [USDOT FAA 2013, p. 1].

Transit

Transit services include transit bus; commuter, subway, elevated, and light rail trains; and other kinds of public transit, such as ferry boats. Some 729 urban transit agencies and nearly 1,580 rural and tribal government transit agencies reported data to the National Transit Database (NTD) of the Federal Transit Administration in 2010 [USDOT FTA NTD 2012]. In addition, there are several thousand demand-response providers. While much of the van and other demand response services are provided by private companies, they are often carried out under contract with the transit system and/or a local social service agency. Urban transit ridership has grown appreciably in recent years. Transit ridership reported to the NTD increased by one-third between 1995, when 7.5 billion unlinked trips were reported, and 2010, when the reported number was nearly 10 billion unlinked transit trips on these systems.[10] In contrast to most other passenger modes, ridership exceeded 2006 levels in subsequent years and was at its highest level in several decades in 2008 (although well below high points reached during World War II). Buses account for the vast majority of transit routes and passengers, but rail ridership has grown rapidly in recent years due, in part, to considerable public investment. Between 2005 and 2010, 178 new transit rail stations were added to the system, bringing the total to 3,124.

Freight Rail

The freight rail network in the United States comprises 139,000 miles of rail lines, including nearly 96,000 miles of rail operated by the seven Class I railroads (those having revenues

[10] Unlinked trips are the number of boardings onto transit vehicles. Hence, a transit passenger who transfers from one bus to another would take two unlinked trips.

of at least $398.7 million per year).[11] The remaining 43,000 miles are operated by 21 regional and more than 500 local railroads. Railroads have reduced network miles in recent decades, due to consolidation and rationalization of rail operations, with abandonment or sale of little used lines. However, the remaining trackage is used more intensively: in 1990, Class I railroads moved slightly more than 1 trillion ton-miles of freight; in 2010, the number stood at just less than 1.7 trillion ton-miles [USDOT RITA BTS NTS 2013a, table 1-49, and AAR 2011b, p. 27].

Most investment to maintain and upgrade the freight rail system comes from the railroads themselves. The Association of American Railroads (AAR) reports that $480 billion has been spent since 1980 on rail equipment and infrastructure [AAR 2011a]. Some railroads have augmented capacity in higher density corridors by doubling, tripling, or quadrupling tracks on some stretches. In many cases, the additional tracks represented restoration of trackage that was removed decades earlier. The AAR estimates that about 65,000 miles of high-density track has the capacity to carry at least 20 million freight ton-miles per year [AAR 2012]. In 2011, railroads carried 1.7 trillion freight ton-miles.

Passenger Rail

The National Railroad Passenger Corp., better known as Amtrak, provides nearly all intercity passenger rail service in the United States.[12] In operation since 1971, Amtrak runs trains on over 21,000 miles of rail line, 97 percent of which is owned by Class I railroads or commuter rail operators. Amtrak currently services over 500 stations in 46 states, carrying 29 million passengers and 6.4 billion passenger-miles in its 2010 fiscal year [Amtrak 2010].

The average age of Amtrak locomotives increased each year from 2000 through 2009, rising from 11.2 years to 20.6 years, but then declined to 19.1 years in 2010. The average age of passenger cars/other rolling stock has risen each year since 2000, from 19.4 years to 25.6 years in 2010 [USDOT RITA BTS NTS 2013a, table 1-33]. In 2011, about one-fifth of Amtrak locomotives were less than 6 years old and over one-third were older than 21 years (as shown in box 1-B).

Increased resources are being devoted to development of high-speed intercity passenger rail service in the United States. Under *the American Recovery and Reinvestment Act* of 2009, Congress provided $8 billion for intercity passenger rail projects in 32 states. It also provided $2 billion more in fiscal year 2010 for high-speed rail development.

Seaports

In 2010, approximately 8,000 maritime facilities handled the Nation's waterborne commerce. Inland waterways and associated facilities handle barges and other shallow-draft vessels used primarily to transport bulk com-

[11] Two Canadian and two Mexican railroads also have operations in the United States.

[12] Intercity rail service in Alaska is provided by the Alaska Railroad.

modities, while facilities on the shores of the Great Lakes and coastal ports accommodate a broader mixture of commodities and service the deep-draft vessels used in international trade.

Over 62,000 vessels called at approximately 8,000 cargo-handling marine facilities in 2010, carrying goods from around the world. Tankers and containerships account for about two-thirds of the vessel calls [USDOT MARAD 2012]. The average age of vessels calling at U.S. ports dropped from 11.8 years in 2004 to 10.3 years in 2009, reflecting replacement of vehicles. The role of waterborne international trade and the coastal ports is discussed in greater detail in chapter 3.

Inland Waterways

In contrast to seaports, the tonnage of goods moving along the inland waterways has been decreasing for many years from the high points reached in the 1980s. These waterways, which primarily carry bulk cargo, handled 450 billion ton-miles of cargo in 2007, 7.8 percent of the 5,739 billion U.S. ton-miles of freight. [USDOT FHWA 2013].

There are over 12,000 miles of navigable inland waterways in the United States, with the Mississippi and Ohio River Systems comprising most of the mileage, and the Gulf Intracoastal Waterways and Columbia River system accounting for much of the rest. A key condition challenge for the inland waterways is the age and capacity of the 192 locks that raise and lower water in the system so that barges and other vessels can pass through. The average age of federally owned locks is 60 years [ASCE 2009]. The barges and other vessels that carry cargo are also aging. Nearly three-fourths of the Nation's tow boats were over 25 years of age in 2010 [USDOT RITA BTS NTS 2013a, table 1-34].

Ferry Services, Tourism, and Recreational Use of Ports and Waterways

Ferries carrying both passengers and freight operate in 36 states and two territories, according to a National Census of Ferry Operators (NCFO) conducted by BTS in 2010 and 2011. The NCFO identified 233 ferry operators with 640 active vessels providing service through 515 terminals. The latest NCFO counted 43 more operators, 15 more terminals, and 60 more vessels than tallied in the 2008 NCFO [USDOT RITA BTS 2012a].

As for tourism, 17 major cruise lines operate over 100 cruise ships calling at U.S. ports. The average capacity of these ships was over 2,000 passengers in 2009; the largest has a capacity of over 6,000 passengers and 2,000 crew members [USDOT RITA BTS 2011]. In 2010, cruise ships booked about 10.6 million passengers on North American cruises, up from 9.9 million the year before [USDOT MARAD 2012]. Cruise lines discounted fares to retain occupancy rates during the economic downturn.

There are over 12 million recreational boats registered by state in the United States, although many of these may not be in active use. Numerous other small boats may not be registered with any governmental authority and remain uncounted.

Pipelines

Approximately 182,135 miles of oil and other hazardous liquid pipelines are in place in the United States. There are also 324,606 miles of natural gas gathering and transmission, and about 1.2 million miles of natural gas distribution pipelines. These pipelines are operated by approximately 360 private entities [USDOT PHMSA 2012].

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CHAPTER 2

Moving People

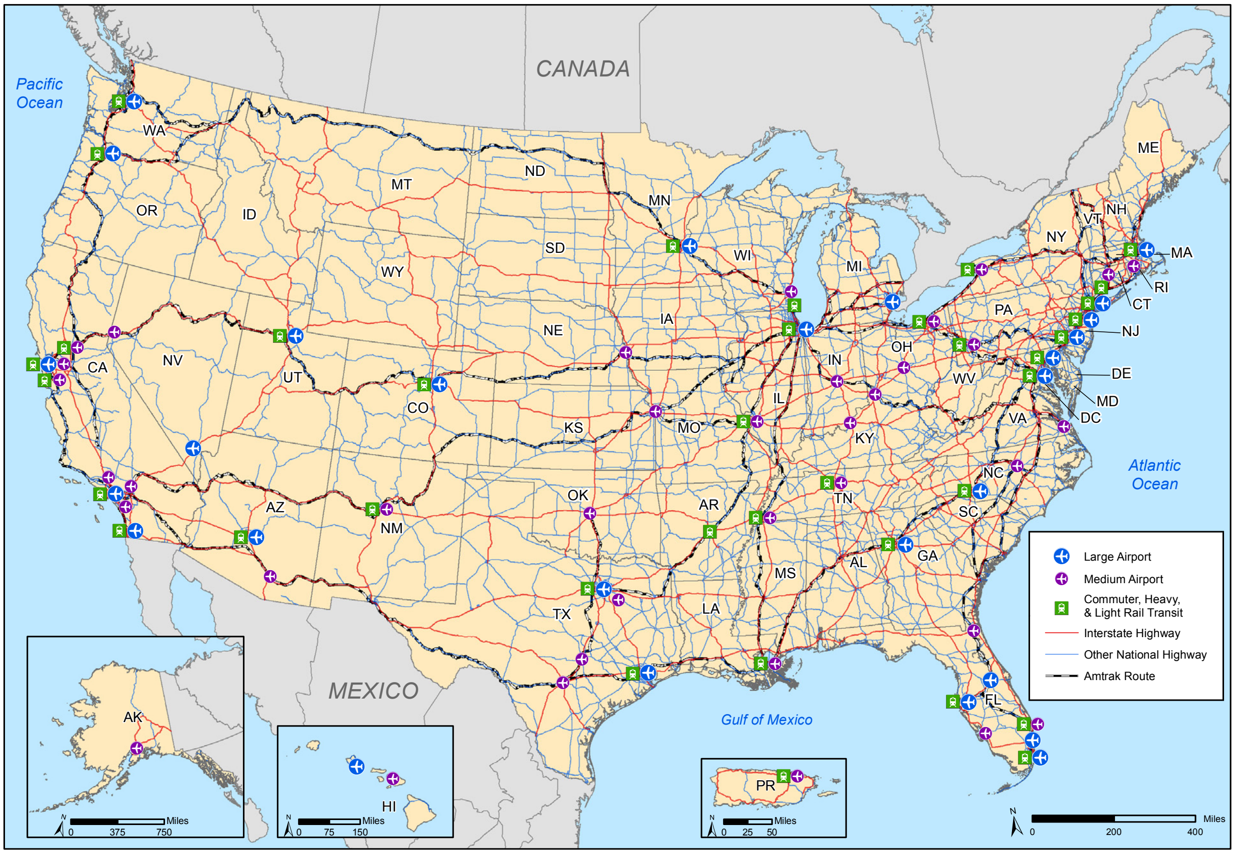
The personal mobility delivered by the transportation system is an essential part of life in the United States. Americans travel on average more than 13,000 miles per year[1] [USDOT FHWA NHTS 2011, p. 7]. Americans travel on a daily basis to and from work, school, shopping, and for social and personal purposes. They make long-distance trips for business, pleasure, and to visit others. While personal vehicles and air travel account for 92.3 percent of passenger-miles, buses, trains, ferries, and other forms of public transportation also move large numbers of people. Figure 2-1 shows the major U.S. passenger transportation facilities that serve the passenger travel system. Even though the passenger transportation system is able to handle huge numbers of trips, matters such as access to transportation for households without a personal vehicle or for people with disabilities create challenges for the system in fully meeting the Nation's mobility needs.

U.S. residents and foreign visitors traveled about 4.6 trillion passenger-miles within the United

[1] Include trips by passenger vehicle, transit, walking, etc.

- U.S. residents and foreign visitors traveled about 4.6 trillion miles within the United States in 2010, down from 5.3 trillion in 2007.
- The average resident travels more than 13,000 miles per year, taking an average of 4 local trips that total 36 miles per day.
- The United States ranks the highest in the world in terms of per capita vehicle ownership—828 motor vehicles per 1,000 people. About 10 million, or 9 percent, of American households do not own or have access to a vehicle.
- On average, daily commutes account for slightly more than one-quarter of the total daily travel in miles.
- Domestic air travel peaked in 2007 at almost 608 billion revenue-passenger-miles (a measure of the total miles traveled by all passengers who paid fares), dropped to 552 billion in 2009, and recovered slightly to 565 million in 2010.

FIGURE 2-1 Major Passenger Transportation Facilities: 2013



SOURCES: **Airports**: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Office of Airline Information, T-100 Domestic Market (U.S. Carriers) Data, available at http://transtats.bts.gov/ as of February 2013. *Large Hub Airports* account for 1 percent or more of 2011 enplanements and *Medium Hub Airports* account for at least 0.25 percent but less than 1 percent of 2011 enplanements. **Rail Transit**: U.S. Department of Transportation, Federal Transit Administration, *National Transit Database 2011*, available at http://www.ntdprogram.gov/ as of February 2013. **Interstates/Highways and Amtrak**: U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Geospatial Information Systems, *National Transportation Atlas Databases 2012*, available at http://www.rita.dot.gov/publications/national_transportation_atlas_database as of February 2013.

States in 2010, compared to 5.3 trillion passenger-miles in 2007, before the economic downturn. People used personal vehicles—such as cars, minivans, sport utility vehicles (SUVs), and pickup trucks—for 79.9 percent of this travel. Domestic air travel accounted for about 12.4 percent of passenger-miles. Although the number of people using public transit, intercity trains, and buses has increased, and far surpasses the number of people traveling by air, these modes together account for less than 8 percent of total passenger-miles traveled (table 2-1).

The large share of passenger-miles in personal vehicles reflects a century of growth in vehicle ownership. In 2009, there were about 828 motor vehicles for every 1,000 people in the United States—this is by far the highest per capita vehicle ownership in the world. Canada, next on the list, reported 621 vehicles per 1,000 people. For comparison, China, with fast

TABLE 2-1 U.S. Passenger-Miles: 2005–2010

Millions

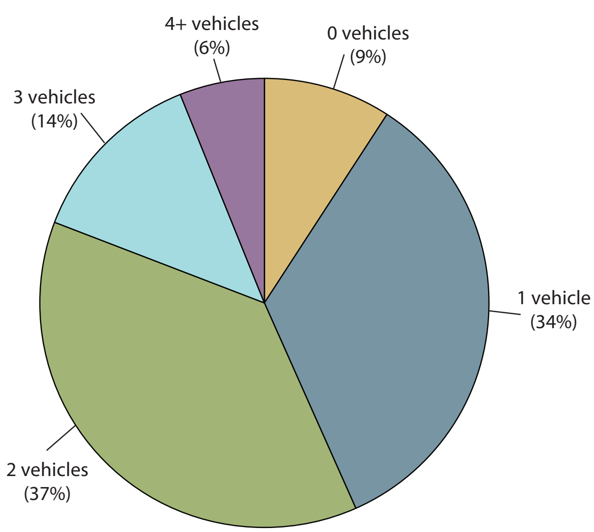
	Air, certificated, domestic, all services	Light duty vehicle	Bus	Transit	Amtrak
2005	583,771	U	U	47,125	5,381
2006	588,471	U	U	49,504	5,410
2007	607,564	4,341,984	307,753	51,873	5,784
2008	583,292	4,248,783	314,278	53,712	6,179
2009	551,741	3,625,597	305,014	53,898	5,914
2010	564,790	3,645,367	292,319	52,627	6,420

KEY: U = unavailable; comparable data are unavailable due to a change in FHWA estimation methodology.

NOTES: *Light duty vehicle* includes short wheel base passenger cars, light trucks, vans, and sport utility vehicles (SUVs) with a wheel base equal to or less than 121 inches and long wheelbase large passenger cars, pickup trucks, vans, and SUVs with a wheel base longer than 121 inches. Bus and demand response are included in both *Bus* and *Transit*, which results in some double counting. *Amtrak* does not include contract commuter passengers. The data above may not be consistent with other sources, particularly data that are revised on an irregular or frequent basis. Different vehicle occupancy rates were used to estimate passenger-miles for *Light duty vehicles* and *Bus* beginning with 2009.

SOURCES: Various sources as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, table 1-40, available at http://www.bts.gov/publications/national_transportation_statistics/ as of August 2013.

FIGURE 2-2 Motor Vehicles per Household: 2011



NOTE: Data cover the household population and exclude the population living in institutions, college dormitories and other group quarters.

SOURCE: U.S. Department of Commerce, Census Bureau, *2011 American Community Survey*, table B25044, available at http://www.census.gov/acs/www/index.html as of January 2013.

growing automobile ownership, reports only 46 vehicles per 1,000 people [USDOE ORNL, tables 3.4 and 3.5].

U.S. households with two vehicles outnumber those with one vehicle, and nearly one-fifth of households have three or more vehicles. Those without a vehicle comprise 9.3 percent of households (figure 2-2).

Daily Travel

Personal and household daily travel increased rapidly during the 1970s, 1980s, and 1990s, but has since tapered off as shown by seven national travel surveys conducted by the Federal Highway Administration (FHWA).[2] The latest National Household Travel Survey (NHTS) shows an average of 36 daily person-miles of travel and 3.8 daily person trips in 2009, down from 1995 and 2001, but slightly more than in 1990 (table 2-2). While the 2001 and 2009 surveys were conducted during economic downturns, many factors have impacts on

[2] Nationwide travel surveys were conducted in 1969, 1977, 1983, 1990, 1995, 2001, and 2009.

TABLE 2-2 Daily Trip Rates and Travel Miles per Person: 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS

	1977	1983	1990	1995	2001	2009
Person Trips	2.92	2.89	3.76	4.30	4.09	3.79
Person Miles of Travel	25.95	25.05	34.91	38.67	40.25	36.13

KEY: NPTS=National Personal Transportation Survey; NHTS=National Household Transportation Survey.

NOTES: Except for 1969, which is not shown, the data source adjusted data for all other years to compensate for differences in methodology and terminology. For additional information, please refer to the source cited. The 1990 data have been adjusted to make them more comparable with later data in the series. The 2001 data exclude persons aged 0 to 4 since such persons were not included in the 1990 and 1995 surveys.

SOURCE: U.S. Department of Transportation, Federal Highway Administration, *Summary of Travel Trends: 2009 National Household Travel Survey*, table 11, available at www.nhts.ornl.gov as of May 2012.

person trips. For example, fluctuations in fuel prices, workforce demographics, and Internet shopping may influence travel choices. About 83.4 percent of daily person-miles of travel averaged by Americans in 2009 were in a personal vehicle. The remaining 16.6 percent were distributed among other travel modes such as all modes of transit, walking, taxi, biking, and other intercity passenger carriers.

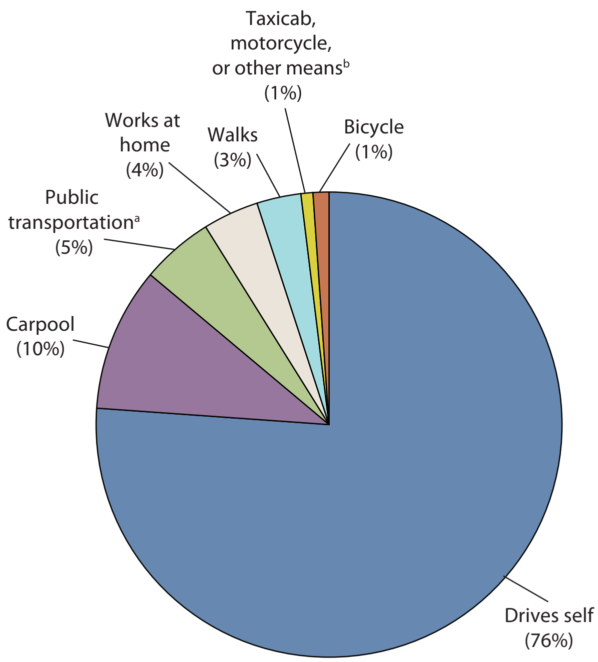
The amount of daily travel varies depending on such factors as location, employment status, age, and gender. Drivers in rural areas averaged 11 more miles in vehicle travel per day than their urban counterparts—34 versus 23 miles [USDOT FHWA NHTS 2011, p. 56]. Drivers who work generate 84 percent more vehicle-miles per year than nonworking drivers [USDOT FHWA NHTS 2011]. For drivers over 50 years of age, vehicle-miles taper off with each successive decade in longevity. Those 50 to 59 years of age averaged nearly 32 vehicle-miles per day; those aged 60 to 69 averaged 28 daily vehicle-miles, while those aged 70 to 79 averaged nearly 19 vehicle-miles per day. Drivers over 80 years of age averaged 12 vehicle-miles per day [USDOT FHWA NHTS 2011; pp. 18, 26, 28, and 55]. Men took slightly fewer trips but traveled about 10 more miles per day than women—41 versus 31 miles.

The U.S. Census Bureau measures how people get to work independent of distance (figure 2-3) as part of its annual American Community Survey and as part of the decennial censuses from 1970 through 2000. (The survey covers the trip from home to work). The most recent 1-year survey estimates found that in 2011:

- 76.4 of commuters drove to work alone;
- 9.7 percent carpooled, but rates were higher for people commuting to another metropolitan area;
- 5.0 percent of workers took public transportation to work, chiefly the bus, but the rate was higher for people residing within the principal city of a metropolitan area;
- 3.4 percent walked or biked to work; and
- 4.3 percent worked at home, up from 3 percent in 1990.

Commuters took about 25.1 minutes on average

FIGURE 2-3 How People Get to Work: 2011



[a] *Public transportation* category includes workers who used a bus or trolley bus, streetcar or trolley car, subway or elevated, railroad, or ferryboat. [b] *Other means* includes ferryboats, surface trains, and van service and other means not classified.

NOTE: Percents may not add to 100 due to rounding. For additional information, please refer to the *American Community Survey's 2011 Subject Definitions*, available at http://www.census.gov/acs/. Workers are civilians and members of the Armed Forces, 16 years and older, who were at work the previous week. Persons on vacation or not at work the prior week are not included.

SOURCE: U.S. Department of Commerce, Census Bureau, 2011 American Community Survey, table B08006, available at http://www.census.gov/acs/www/index.html as of January 2013.

to get to work in 2009. This was a bit less time than in 2000 (25.5 minutes) but 12.1 percent more than the mean travel time in 1990 (22.4 minutes)[3] [USDOC CENSUS 2011a and 2011b].

Behind the private automobile, public transportation was the second most widely used mode for getting to work. Although only 5 percent used transit nationally, a much larger share of commuters used transit in those large metropolitan regions with extensive transit systems. The New York metro area[4] outpaced all others with 30.5 percent of workers taking transit, followed by San Francisco, CA metro area (14.6 percent), and the Washington, DC, metro area (14.1 percent). Boston, MA, and Chicago, IL, are the other metro areas where more than 10 percent of commuters took transit to work [USDOC CENSUS 2011a].

Despite the large number of commuting trips made on a daily basis, personal travel not related to work accounts for about 74.8 percent of total daily person-miles of travel. As to travel purpose, people on average devoted about 30.3 percent of their person-miles of travel for social purposes and recreation in 2009. Another 29.6 percent of person-miles of travel were divided about equally between shopping and running family or personal errands (e.g., taking a child or elderly parent to a doctor's appointment). Travel related to school and church accounted for 6.2 percent of person-miles of travel [USDOT FHWA NHTS 2011, table 12].

Long-Distance Travel

The long-distance trip to destinations greater than 50 miles away is another important di-

[3] While the Census survey did not ask respondents the distance of their commute, the NHTS did. It found that both travel time and travel distance increased between 1990 and 2009, average travel speed for all modes decreased from 33 mph in 1990 to about 28 mph in 2009 (USDOT FHWA NHTS, pp. 48-49).

[4] Metro areas refer to Metropolitan Statistical Areas and Combined Statistical Areas as defined by the Office of Management and Budget (OMB) for collecting, tabulating, and publishing Federal statistics.

mension of passenger travel. Americans chose the personal vehicle or air travel for most of their long-distance trips. The most recent comprehensive survey of long-distance travel in the United States, conducted by BTS and FHWA in 2001, found that personal vehicles accounted for 89 percent of long-distance trips and 56 percent of long-distance passenger-miles, while 7 percent of trips and about 41 percent of the long-distance passenger-miles were by air. A traveler's reliance on the air mode increases with the length of the trip. Charter bus, intercity bus, trains, ships, boats, and other means of travel accounted for the remaining long-distance travel [USDOT RITA BTS NTS 2012, table 1-42].[5]

[5] While these data are more than a decade old, it is safe to assume that the personal vehicle and the airplane still account for the overwhelming majority of long-distance trips and passenger-miles.

Since 1990, domestic air travel increased from about 346 billion revenue-passenger-miles[6] to 608 billion in 2007, and then fell back to 552 billion in 2009 in response to the economic downturn. Domestic air travel in 2010 edged upwards to 565 billion revenue-passenger-miles as shown in table 2-1. The number of enplanements[7] showed a similar pattern reaching a peak in 2007, falling in 2008 and 2009, but growing between 2010 and 2012.

International air travel is another component of long-distance travel. From 134 million in

[6] A revenue passenger is a person receiving air transportation in return for renumeration to an air carrier; travelers using frequent flyer miles are considered revenue passengers, but crew and other carrier employees are not.

[7] This includes the number of passengers boarding planes, including passengers connecting from a different plane. Hence, a passenger on a flight originating in Chicago with a connecting flight in Atlanta would count as two enplanements.

TABLE 2-3 Annual Airline (U.S. and Foreign Carriers) Passenger Enplanements: 2005–2012

Scheduled flights only

	Domestic enplanements	Domestic load factor (percent)	International enplanements	International load factor (percent)	Total domestic and international enplanements	Total domestic and international load factor (percent)
2005	657,261,487	77.2	143,588,422	78.7	800,849,909	77.8
2006	658,362,620	79.1	149,740,591	78.6	808,103,211	78.9
2007	679,185,500	79.9	156,250,990	79.1	835,436,490	79.5
2008	651,710,304	79.7	157,737,629	77.6	809,447,933	78.7
2009	618,067,511	81.1	149,749,333	78.3	767,816,844	79.7
2010	629,537,813	82.2	157,938,675	81.6	787,476,488	81.9
2011	638,247,850	82.9	163,820,880	80.3	802,068,730	81.6
2012	642,207,399	83.4	170,734,777	81.7	812,942,176	82.5

NOTE: International enplanements include U.S. and foreign carriers. *Load factor* is calculated by dividing production, as measured by revenue passenger-miles (RPMs), by capacity, as measured in available seat-miles (ASMs).

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Office of Airline Information, *Airline Data and Statistics, Passengers*, available at http://www.bts.gov/programs/airline_information/ as of January 2013.

2000, international enplanements[8] fell in 2001 (the year of the September 11 terrorist attacks) to 123 million and then to 119 million in 2002 and 118 million in 2003. International enplanements rebounded to 144 million in 2005 and grew to 171 million in 2012 (table 2-3).

Amtrak ridership has increased over the last decade, reaching 29 million passengers and 6.4 billion passenger-miles in its 2010 fiscal year, compared to 24.2 million passengers and 5.4 billion passenger-miles 5 years earlier. The percent of rural residents covered by intercity rail declined from 42 to 40 percent of the rural population [USDOT RITA BTS 2011b, p. 1].

Travel To and From the United States

Travel by Americans abroad and foreign visitors to the United States places significant demands on international gateways and are a major source of economic activity. In 2010, a record 60 million foreign visitors came to the United States and stayed in the country at least one night. They spent an estimated $103 billion while visiting the United States in addition to spending $31 billion on air fares with U.S. carriers [USDOC ITA]. Canadians and Mexicans accounted for well over half the overnight travelers (20 million from Canada and over 13 million from Mexico). While most came to the United States in personal vehicles, 6.9 million Canadians and 2.3 million Mexican overnight travelers came by air [NATS OD table 9-1b and 9-1c]. Additionally, about 27 million residents of overseas countries arrived by air. The largest numbers of these overseas travelers came from the United Kingdom (3.9 million) and Japan (3.4 million), followed by residents of Germany, France, Brazil, and South Korea, with each generating more than one million travelers to the United States [USDOC ITA]. Table 2-4 shows the top 15 U.S. ports used for entry to the United States by overseas visitors (excluding visitors from Canada and Mexico).

While there are about 33 million overnight visitors from Canada and Mexico annually, about 216 million people crossed into the United States in 2011 through one of the 110 crossing stations along the land borders with those two countries. By far, the greatest number of crossings into the United States is from the land border with Mexico. Most people enter by personal vehicle, but foot traffic is also considerable (table 2-5).

The number of people entering from both Canada and Mexico dropped in 2001, and a decade later the number of entrants remained well below 2000 levels. For example, in 2009, there were 40.9 percent fewer pedestrian crossings at the Canadian border than in 2000, while pedestrian crossings at the Mexican border were down 36.4 percent. All border states saw a decline in border crossings except New Mexico, which accounts for less than 1 percent of all people crossings [USDOT RITA BTS 2011a]. Along the southern border, crossings in

[8] This includes international air travel between the United States and foreign countries on U.S. airlines.

TABLE 2-4 Top 15 Ports of Entry to the United States by Overseas Visitors: 2010 and 2011

	Rank	2011	2010	Percentage Change
New York, NY	1	4,562,166	4,207,877	8.4
Miami, FL	2	3,674,560	3,277,227	12.1
Los Angeles, CA	3	2,907,304	2,593,090	12.1
Newark, NJ	4	1,672,973	1,784,598	-6.3
Honolulu, HI	5	1,605,192	1,455,430	10.3
San Francisco, CA	6	1,471,264	1,364,996	7.8
Chicago, IL	7	1,221,011	1,206,958	1.2
Agana/Hagåtña, GU	8	992,665	1,064,790	-6.8
Atlanta, GA	9	931,089	952,665	-2.3
Washington, DC	10	853,136	837,961	1.8
Orlando, FL	11	851,535	836,963	1.7
Houston, TX	12	627,448	599,710	4.6
Boston, MA	13	510,889	496,701	2.9
Detroit, MI	14	429,131	363,711	18.0
Dallas, TX	15	403,400	350,075	15.2

NOTE: Overseas excludes Canada and Mexico.
SOURCE: U.S. Department of Commerce, International Trade Administration, Office of Travel & Tourism Industries, *International Visitation to the United States: A Statistical Summary of U.S. Visitation*, available at http://tinet.ita.doc.gov/outreachpages/download_data_table/2011_Visitation_Report.pdf as of January 2013.

Texas fell from about 162 million in 2000 to 96 million in 2009. California crossings fell from about 96 million in 2000 to 65 million in 2009, and Arizona crossings fell from 36 million to 26 million over the last decade. On the northern border, crossings in Michigan fell from 37 million to 15 million and New York crossings fell from 31 million to 21 million; other states along the border also showed declines.

Challenges for Passenger Travel

Access to transportation for people without a personal vehicle, transportation for the elderly and people with disabilities, diminishing travel options for rural Americans, and the degree of connectivity[9] between public transportation modes are all challenges for the passenger transportation system. Another area that has become a growing concern over the last decade is security for travelers.

[9] Connectivity gives shippers and travelers additional transportation alternatives that unconnected, parallel systems do not offer.

Access to Transportation for People Without a Vehicle

Many people without access to a personal vehicle, especially the poor, have difficulty reaching stores, services, and workplaces outside of their immediate neighborhoods. While the share of households without a vehicle has declined from over 20 percent 50 years ago to about 8.7 percent today, about 10 million households did not have a personal vehicle in 2009, and this number grew by one million between 2001 and 2009 [USDOT FHWA NHTS 2011, p. 34]. In the most densely populated parts of cities (10,000 plus people per square mile), 28.4 percent of households had no vehicle in 2009 [USDOT FHWA NHTS 2011, p. 36].

People living below the poverty level are less

TABLE 2-5 Passenger Crossings Into the U.S. by Personal Vehicles, Bus, Train, and Foot From Canada and Mexico: 2005–2011

Thousands

	Personal Vehicles		Bus		Train		Foot	
	Mexico	Canada	Mexico	Canada	Mexico	Canada	Mexico	Canada
2005	186,067	62,501	3,170	3,855	18	236	45,830	605
2006	179,255	62,986	3,187	3,499	22	245	46,251	534
2007	164,534	58,409	3,389	3,685	20	233	49,539	441
2008	157,982	57,424	3,456	3,404	22	239	44,842	500
2009	141,017	53,528	2,429	2,503	4	218	41,315	380
2010	125,750	56,789	2,680	2,451	3	255	39,915	395
2011	110,962	59,192	2,720	2,452	4	277	40,021	407

NOTES: Passengers in *Personal Vehicles* (privately owned vehicles) include persons arriving by private automobile, pickup truck, motorcycle, recreational vehicle, taxi, ambulance, hearse, tractor, snow-mobile, and other motorized private ground vehicles. *Bus* passengers include both driver(s) and passengers. *Train* passengers include both passengers and crew. Passengers traveling by *Foot* include persons arriving on foot or by certain conveyances (e.g., bicycles, mopeds, or wheel chairs).

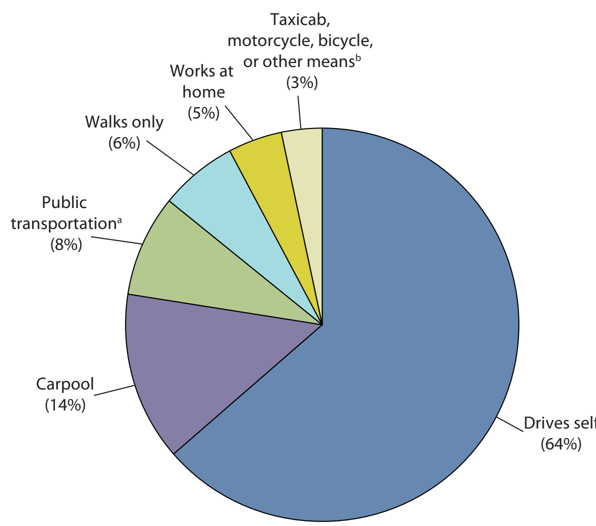
SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *Border Crossing/Entry Data*, available at http://www.bts.gov/programs/international/transborder/TBDR_BC/TBDR_BC_Index.html as of July 2012, as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, tables 1-47 and 1-48, available at http://www.bts.gov/publications/national_transportation_statistics/ as of January 2013.

likely to own, or have access to, a personal vehicle to get to work than the population as a whole. In 2011, about 15.9 percent (46.2 million) of the U.S. population had incomes below the poverty level [USDOC CENSUS ACS, p. 1]. A BTS analysis of the 2009 NHTS found that households with annual incomes less than $25,000 were 7 times more likely to be zero-vehicle households than households with annual incomes above that level [USDOT RITA BTS 2003, p.7]. Of workers below the poverty level, 63.5 percent drive to work compared to 76.4 percent of workers overall. Compared to commuters as a whole, people below the poverty level are more likely to take public transportation, walk, or use other transportation modes (compare figure 2-3 to figure 2-4).

Transportation Access for the Elderly and Disabled

An increasing percentage of public transportation facilities and vehicles have been built or

Figure 2-4 How Workers Below the Poverty Level Get To Work: 2011



[a] Public transportation category includes workers who used a bus or trolley bus, streetcar or trolley car, subway or elevated, railroad, or ferryboat. [b] Other means includes ferryboats, surface trains, and van service and other means not classified.

NOTE: Percents may not add to 100 due to rounding. For the methodology used to calaculate the proverty level, please see *How Poverty is Calculated in the ACS*, which is available at http://www.census.gov/hhes/www/poverty/poverty-cal-in-acs.pdf.

SOURCE: U.S. Department of Commerce, Census Bureau, *2011 American Community Survey*, table B08122, available at http://www.census.gov/acs/www/index.html as of January 2013.

TABLE 2-6 Transit Rail Stations that are ADA-Compliant by Service Type: 2005–2011

Number of stations

	Commuter rail	Heavy rail	Light rail	Other rail	Total number of ADA-compliant stations	Total number of stations	ADA-compliant stations (percent)
2005	686	459	596	12	1,753	2,948	59.5
2006	712	479	635	12	1,838	2,987	61.5
2007	725	493	642	12	1,872	2,999	62.4
2008	753	508	665	12	1,938	3,029	64.0
2009	784	515	721	12	2,032	3,103	65.5
2010	798	522	734	12	2,066	3,126	66.1
2011	802	530	691	52	2,075	3,107	66.8

KEY: ADA = Americans with Disabilities Act.

NOTES: *Other rail* includes monorail and Alaska Railroad. Table does not include station data for automated guideway, jitney, and inclined plane transit services. Data are for both directly operated and purchased transportation system stations. *ADA-compliant stations* are those that are fully compliant with the ADA. Under the ADA, many older stations with elevators were given time, some to year 2020, for replacement or remodeling. In addition, they were given time to add ramps, tile strips along the platform, and communication equipment for full ADA compliance.

SOURCE: U.S. Department of Transportation, Federal Transit Administration, *National Transit Database*, table 21, available at http://www.ntdprogram.gov/ as of January 2013.

retrofitted to ease the concerns and facilitate travel by people with disabilities or the elderly. The percentage of urban transit buses considered to comply with the *Americans with Disabilities Act of 1990* (ADA) now exceeds 99 percent, up from 94 percent in 2005. The percentage of rail transit stations considered to be in compliance with the ADA grew from just under 60 percent in 2005 to 67 percent in 2011 during a time of rapid increase in the number of transit stations (table 2-6).

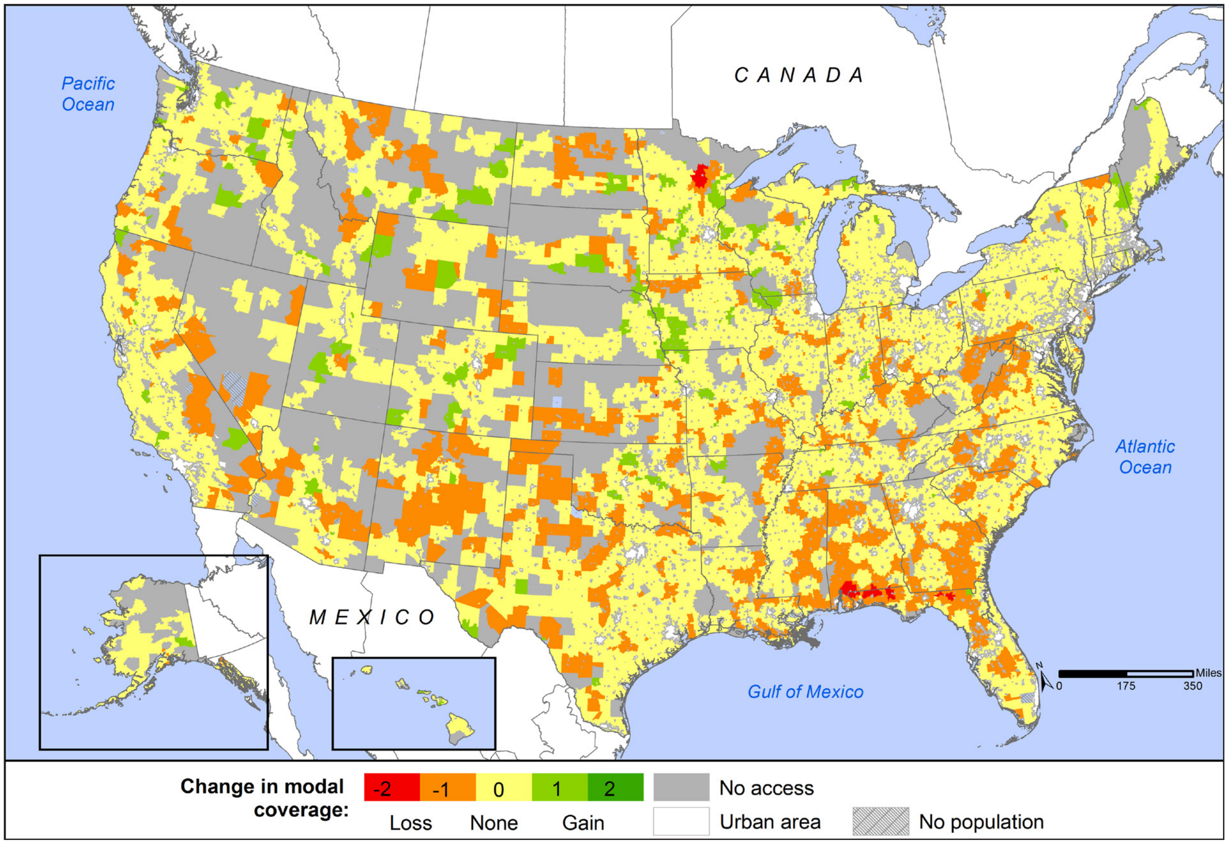
Many communities now provide demand-response transit services (also called paratransit) for the elderly, people with disabilities, or those with medical or other conditions that make it difficult for them to use regularly scheduled transit services or to travel in their own vehicle. Often, a van or other vehicle equipped to transport people in wheelchairs picks passengers up at their residence and drops them at their destination. The number of demand-response trips by providers reporting to the Federal Transit Administration (FTA) increased from 77 million in 2001 to 93 million in 2010 [USDOT FTA NTD 2012, p. 55].[10] With large numbers of baby boomers now entering retirement age, accommodating their evolving transportation needs will be a continuing challenge for the transportation system.

Travel Options in Rural America

More than 95 percent of rural households have a personal vehicle, and rural residents tend to drive more than those in urban areas. Many rural areas

[10] Providers reporting to FTA also reported 5.6 million unlinked trips in demand responsive taxi service in 2010, the first year these data were reported.

FIGURE 2-5 Change in the Number of Intercity Passenger Transportation Modes Serving Rural Areas: 2005–2010

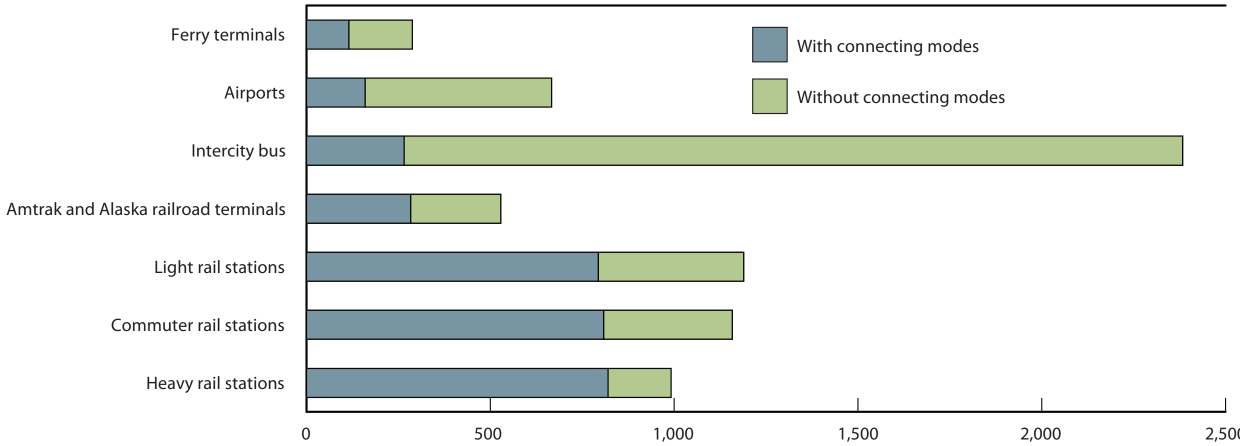


SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *The U.S. Rural Population and Scheduled Intercity Transportation in 2010: A Five-Year Decline in Transportation Access* (February 2011). Available at http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/scheduled_intercity_transportation_and_the_us_rural_population/index.html as of March 2013.

also offer transit services, especially demand-response services in which the customer calls or otherwise arranges rides from the provider. Since 2007, rural transit operators receiving grants from the U.S. Department of Transportation, Federal Transit Administration have been providing summary information about these agencies:

- about 74.5 percent of counties nationwide offered some kind of rural transit service in 2009;
- ridership on rural transit systems totaled 116 million in 2009, 1.1% of the 10,381 million in total transit ridership;
- fixed route rural service accounted for 71 million rides, and 44 million rides were on demand-response service; and
- ADA compliance for all the different kinds of vehicles used in rural transit averaged 77 percent, while for buses, compliance reached 92 percent [NDSU 2011].

FIGURE 2-6 Number of Passenger Transportation Terminals with Connectivity to Other Modes: March 2013



NOTES: As of March 7, 2013, the Intermodal Passenger Connectivity Database contains 7,114 facilities. There are 1,595 facilities on the national railroad network served by intercity and/or commuter trains; 93 of these facilities are served by both commuter and intercity rail.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Adminstration, Bureau of Transportation Statistics, Intermodal Passenger Connectivity Database, available at http://www.transtats.bts.gov/ as of March 2013.

People in rural areas often live many miles from public transportation facilities such as an airport. For some years now, as carriers have dropped unprofitable or sparsely used routes, there has been a decline in passenger rail and intercity bus service in rural communities. Historically, people in rural areas could take scheduled intercity bus service to a distant destination, or to an airport or a train station where they could make connections. The 2010 BTS report, *U.S. Rural Population and Scheduled Intercity Transportation,* estimated that, between 2005 and 2010, 3.5 million rural residents lost access to scheduled intercity transportation, increasing the percent of rural residents without access to intercity transportation from 7 to 11 percent. In 2005, 5.4 million rural residents lacked access to intercity transportation, with that total increasing to 8.9 million rural residents in 2010. Of the 71.7 million rural residents retaining access in 2010, 3.7 million lost access to more than one intercity transportation mode during the 5-year period [USDOT RITA BTS, 2011b].

Declines in access to bus and rail service are among the changes illustrated in figure 2-5. In 2005, 89.0 percent of the rural population could get on an intercity bus within 25 miles of their residence; by 2010, this share had declined to 78.3 percent. There also was a slight (1.8 percent) decline in the share of the rural population living within 25 miles of a train station [USDOT RITA BTS 2011b].

Connections Between Public Transportation Modes

Passengers using public transportation often need or desire to make a connection from one mode of transportation to another in order to get to their destination. Intermodal links between modes of transportation (e.g., transit, intercity bus, or train station access at airports) give travelers more mobility options as well as more transportation options for people residing in communities near intermodal stations, thus enhancing livability. BTS has created an Intermodal Passenger Connectivity Database to show the extent to which passenger modes are linked with each other. Of the 7,114 bus, rail, air, and ferry terminals with scheduled intercity passenger transportation, 45.1 percent offer connections to at least one other mode. For example, 82.7 percent of the heavy rail stations offer connections with other modes and are the most connected (figure 2-6). Just over half of the Amtrak and Alaska Railroad stations (53.5 percent) offer connections with other modes as do 11.2 percent of intercity bus facilities, 24.0 percent of airports, and 40.3 percent of ferry terminals [USDOT RITA BTS 2011c].

Security Concerns

Efforts to prevent terrorist attacks include screening people as they go through security checkpoints at airports and other passenger facilities. The Transportation Security Administration (TSA) of the U.S. Department of Homeland Security reports that 889 firearms and 128,000 incendiaries (any substance or device that could be used to start a fire) were confiscated at airport screening checkpoints in 2009. TSA no longer provides specific details on intercepted items [USDOT RITA BTS 2012, Table 2-16b].

International piracy on the high seas is another security concern affecting U.S. citizens traveling overseas. The number of piracy incidents and armed robberies varies considerably from year to year. In 2011, there were 544 attempts and threatened actions, a 34.0 percent increase from 406 such incidents in 2009. The previous high years were 2003 (452 incidents) and 2000 (471) [IMO data shown in USDOT RITA BTS 2013, table 1-9]. A BTS report examined over 3,600 incidents of piracy and armed robbery occurring between 1998 and 2008. The report found that these incidents were declining or had stabilized in many regions of the world, with the exception of East Africa, where the number of incidents had grown and accounted for a growing share of the total [USDOT RITA BTS 2010].

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CHAPTER 3

Moving Goods

An efficient and reliable freight transportation network is critical for linking natural resources, manufacturing facilities, labor markets, and customers across the nation and with international trading partners. In 2009, the freight transportation system served 7.4 million business establishments, 117 million households, and more than 89,000 government units [USDOC Census CBP, StatAb, and Govs]. In recent years the freight transportation network has handled growth in domestic freight and increasing amounts of international freight shipments in response to large increases in U.S. international trade. Not only has the network had to adapt to handle international traffic, but the growth in international freight has also had an effect on the way that freight moves domestically. All of these changes in the freight network have created new challenges for the industry.

- The Nation's freight system moves 48.3 million tons of goods worth $46 billion each day. This amounts to 57 tons of freight per year for every man, woman, and child in the United States.
- While nearly three-quarters of those 48.3 million tons are moved to places within 250 miles of where the shipment originates, the remainder accounts for over 80 percent of the ton-miles moved in the United States.
- Trucks carry the largest share of shipments moving 500 miles or less from the point of origin. Railroads and pipelines, combined, carry over half of the tonnage shipped between 750 and 1,000 miles. Air cargo and shipments by multiple modes (e.g., shipments transferred from rail to truck) account for over half the value of freight moving more than 2,000 miles.
- The value of international trade has increased from $1.5 trillion in 1990 (adjusted for inflation using the Consumer Price Index) to $3.2 trillion in 2010. This increase has created additional traffic between international gateways and domestic destinations.

Volume and Value

The U.S. freight transportation system moved more than 17.6 billion tons of goods valued at $16.8 trillion in 2011, according to estimates derived from the Federal Highway Administration's Freight Analysis Framework (FAF) (table 3-1). That means the freight transportation system carried, on average, about 48.3 million tons of goods worth more than $46 billion each day [USDOT FHWA 2012]. This amounts to 57 tons of freight per year for every man, woman, and child in the United States. See box 3-A for information about the FAF and the Commodity Flow Survey.

Following the economic turndown in 2007, freight volumes registered large decreases in 2008 and 2009. However, there were clear signs of a recovering economy in 2011 as volumes reached 93 percent of the 2007 levels. FAF paints a similar picture for the value of freight shipments: value decreased in 2008 and 2009 and increased in 2011 to approximately 101 percent of 2007 estimates in inflation adjusted dolars.

FAF forecasts freight volumes will grow 1.7 percent annually between 2011 and 2040. The value of goods moved, in constant dollars, is expected to increase faster than tonnage during this time [USDOT FHWA 2012].

Exports and imports accounted for 13 percent of the weight and 21 percent of the value of freight transported throughout the United States in 2011. FAF forecasts that exports and imports will account for an even greater share of freight movements in 2040, reaching 19 percent of the weight and 31 percent of the value of goods [USDOT FHWA 2012].

Population growth and economic activity are the primary factors that determine freight

TABLE 3-1 Weight and Value of Shipments by Transportation Mode: 2007, 2011, and 2040 Estimates

	2007		2011		2040	
	Weight	Value	Weight	Value	Weight	Value
	Millions of tons	Billions of 2007 U.S. Dollars	Millions of tons	Billions of 2007 U.S. Dollars	Millions of tons	Billions of 2007 U.S. Dollars
All modes, total	**18,879**	**16,651**	**17,622**	**16,804**	**28,520**	**39,265**
Truck	12,778	10,780	11,301	10,573	18,786	21,465
Rail	1,900	512	1,895	515	2,770	898
Water	950	340	825	279	1,070	337
Air, air & truck	13	1,077	17	1,219	53	5,043
Multiple modes & mail	1,415	2,877	1,618	3,099	3,575	9,925
Pipeline	1,507	723	1,652	779	1,740	776
Other & unknown	316	341	313	341	526	821

NOTES: Numbers may not add to total due to rounding. The 2011 data are provisional estimates based on selected modal and economic trend data. All truck, rail, water, and pipeline movements that involve more than one mode, including exports and imports that change mode at international gateways, are included in multiple modes & mail to avoid double counting. As a consequence, rail and water totals in this table are less than those reported in other sources.

SOURCE: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework, version 3.4, 2012.

BOX 3-A The Commodity Flow Survey (CFS) and the Freight Analysis Framework (FAF)

The CFS is the foundation for the FAF. The CFS is conducted every 5 years by the Bureau of Transportation Statistics (BTS) in partnership with the U.S. Census Bureau as part of the Economic Census. The CFS provides data for most of the economy on commodities shipped, their value and weight, mode of transport, and origin and destination within and between all U.S. regions. The survey covers about three-fourths of the tonnage shipped from a domestic origin to a domestic destination.

The FAF supplements CFS data with a variety of other sources to estimate total tonnage and value, commodity type, mode, origin, and destination for 1997, 2002, 2007, 2011, and 2040. It also assigns truck flows to the highway network for 2007 and 2040 to provide a picture of freight truck volumes.

While the FAF is more complete, the CFS provides greater commodity detail and additional shipment characteristics, such as hazardous materials class. The most recently published CFS data covers 2007, while earlier surveys cover 1993, 1997, and 2002. The 2012 CFS data are being processed as this report goes to press.

FAF forecasts are based on long-term U.S. economic projections, including real gross domestic product growth, nonfarm business productivity, real oil prices, and the Federal budget deficit. Detailed information on CFS data and methodologies are available at www.bts.gov/publications/commodity_flow_survey/. Information on FAF data and methodologies are available at www.ops.fhwa.dot.gov/freight/freight_analysis/faf/index.htm.

demand. As population increases or economic activity expands, more goods are produced and used resulting in additional freight movement.

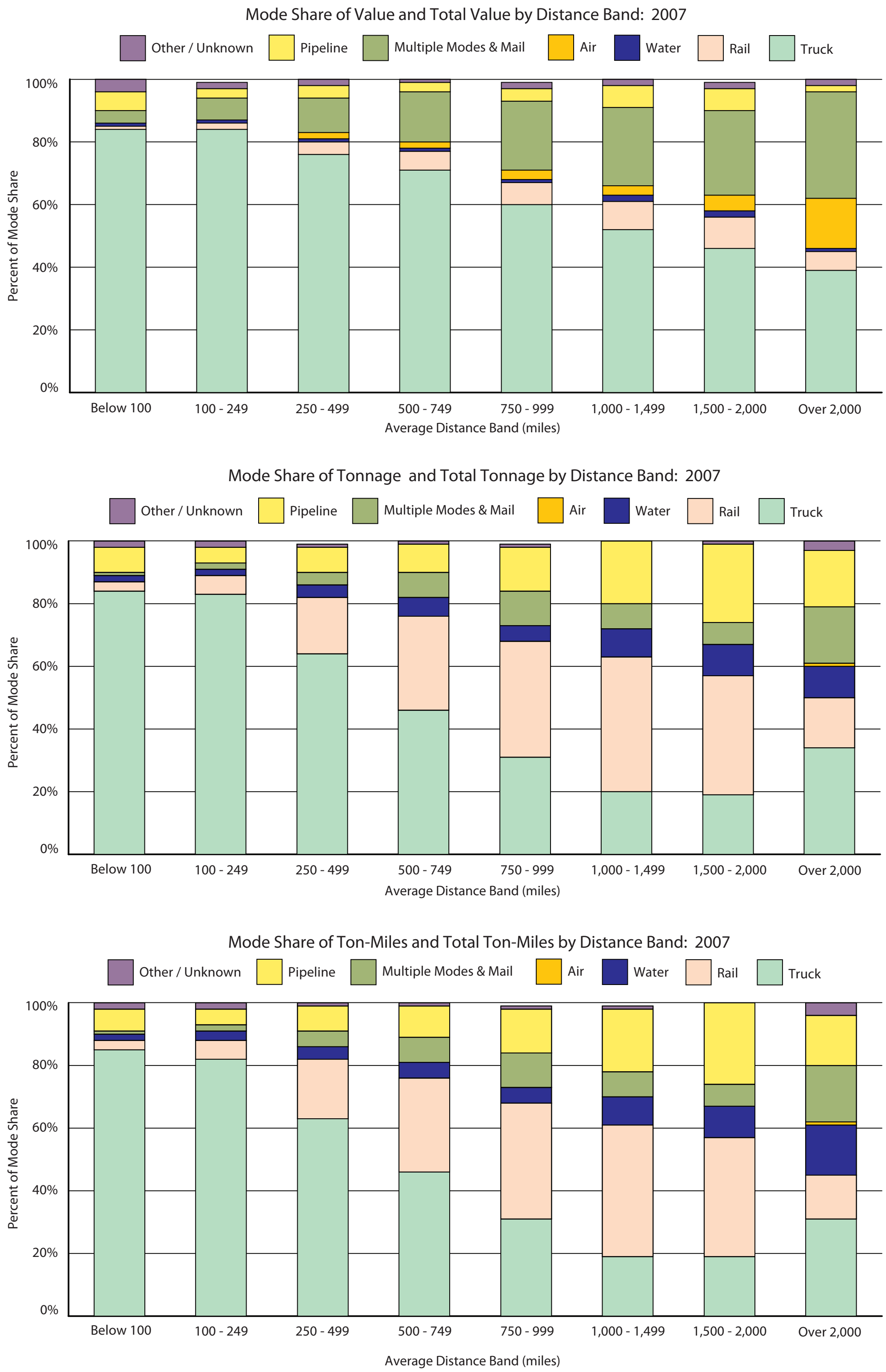
Since 1990, the U.S. population increased by 24.9 percent [USDOC Census 2011], and U.S. gross domestic product grew by nearly 65.7 percent [USDOC BEA 2011]. In addition to these factors, changes in the composition of goods demanded affect what goods are moved, the modes used to transport them, and where they go. Freight traffic, which fluctuates with economy activity, remained stable after 2011. According to the Freight Transportation Service Index, developed by the Bureau of Transportation Statistics (BTS), freight movements were unchanged from January through December 2012.

How Domestic Freight Moves

The freight industry moves goods over a network that includes 4.1 million miles of highways, 139,000 miles of railroads, 12,000 miles of inland and intercoastal waterways, 2.6 million miles of pipelines, more than 5,000 U.S. public use airports, and over 170 maritime ports (see box 1-A in chapter 1).

Each transportation mode plays a distinct role in goods movement, and often multiple modes are used to transport any given shipment. The distance a shipment must travel,

FIGURE 3-1 Modal Shares of Shipments by Value, Weight, and Ton-Miles: 2007



SOURCE: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework, version 3.4, 2012.

either by single mode or during any particular leg of a multimodal journey, plays a major part in determining what mode or modes are used. An understanding of the distance, weight, and value of a shipment, the availability and cost of transportation modes, and the relationships these variables have to one another is essential to a complete comprehension of freight transportation (see figure 3-1).

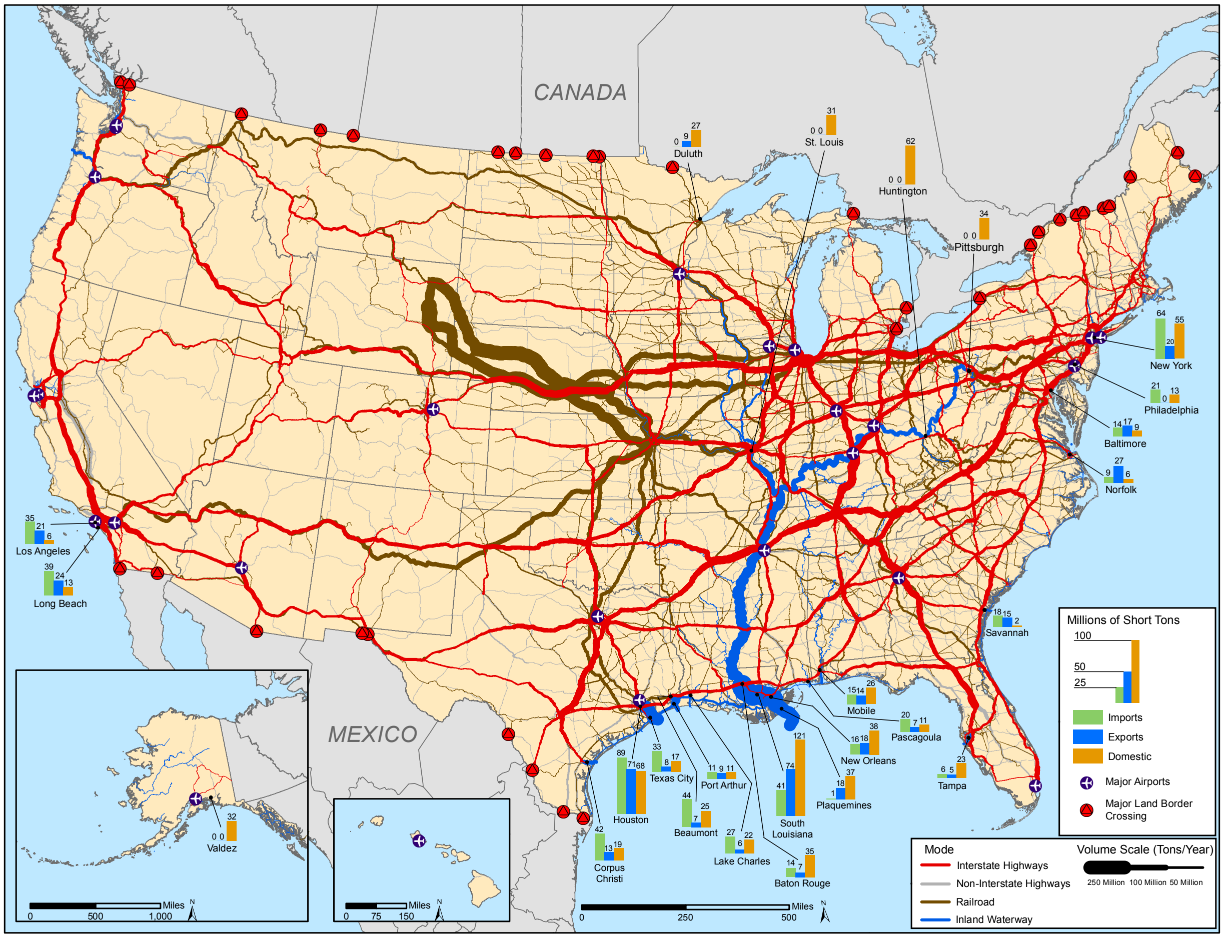
Most goods are moved short distances (less than 250 miles), accounting for over one-half of the value and nearly three-quarters of the weight of all shipments within the United States. Because of the mileages involved, shipments of more than 250 miles constitute 83.3 percent of ton-miles. Modal shares of freight vary considerably by distance. While trucks carry the largest share of value, tons, and ton-miles for shipments moving 500 miles or less, rail and pipeline together account for over half the tons and ton-miles of shipments between 750 and 2,000 miles, and air and multiple modes account for over half the value of shipments moving more than 2,000 miles [USDOT FHWA 2012].

Although trucks carry the highest percentage of the tonnage and the value of goods in the United States, railroads and waterways also carry large volumes, especially bulk commodities, over long distances (figure 3-2). Rail and water combined account for about 15.4 percent of the total volume and 4.7 percent of the total value of freight moved in the United States in 2011. The use of air carriers as movers of high-value, low-weight products is underscored by the relatively extreme value-to-weight ratio of air cargo, which exceeds $70,000 per ton. In comparison, the overall value-to-weight ratio of cargo carried by all modes combined is less than $1,000 per ton. Pipelines move 1.7 billion tons and $779 billion in commodities, which is approximately the same annual tonnage as rail, which moved nearly 1.9 billion tons, valued at $515 billion in 2011. Rail represents approximately 10.8 percent of the total tonnage and 3.1 percent of the total value of shipments, about the same shares as reported in 2007. While rail shipments by tonnage are projected to increase by 46.2 percent between 2011 and 2040, this volume increase is expected to be in line with the overall increase in freight volumes, thus rail's share of total shipments will likely remain unchanged [USDOT FHWA 2012].

The water mode typically carries low-value, bulk products.[1] In 2011, the maritime industry moved 825 million tons worth $279 billion, representing about 4.7 percent of the tonnage and 1.7 percent of the value of all freight shipments. Shipping via inland waterways is subject to influence from both high and low water levels as experienced in recent years. The Mississippi River, our Nation's busiest waterway, handles large volumes of agricultural and petroleum products moving between U.S. markets and to and from ports. In 2011, approximately 500 million tons of cargo was

[1] Many shipments arriving in the United States by rail and water are transferred to another mode for delivery to their final destination. These shipments are counted under multiple modes. Thus, the rail and water numbers discussed here may be lower than other published sources.

FIGURE 3-2 Freight Flows by Highway, Railroad, Air, and Waterway: 2010



NOTES: Air gateways include a low level (generally less than 3% of the total value) of freight shipped through small user-fee airports located in the same area as the gateways listed. Air gateways not identified by airport name (e.g., Chicago, IL) include major airport(s) in that area and small regional airports. Due to Census Bureau confidentiality regulations, courier operations are included in airport totals for only New York (JFK), Los Angeles, Chicago, and Anchorage.

SOURCES: **Air**—U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, USA Trade Online, **Land**—U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, TransBorder Freight Data, **Water**— U.S. Army Corps of Engineers, Navigation Data Center, personal communication, as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, National Transportation Statistics, table 1-51, available at http://www.bts.gov/publications/national_transportation_statistics/ as of October 2012.

moved by vessel along the Mississippi River [USACE 2011].

While waterborne shipments, by tonnage and value, declined in 2008 and 2009, they have since rebounded. Between 2011 and 2040, waterborne freight tonnage and value are projected to increase by 29.6 and 21.0 percent, respectively [USDOT FHWA 2012].

In comparison with the rail and water modes, air transport carries high-value products, such as electronics, precision instruments, and pharmaceuticals that require quick delivery. Of all modes, the value of air-freight shipments is projected to increase the fastest from 2011 to 2040, growing by 313.6 percent [USDOT FHWA 2012].

Over the last 20 years, the U.S. transportation system has become increasingly intermodal. Although intermodal services account for a relatively small share (9.2 percent) of freight tonnage, they moved approximately 18.4 percent of the value of the goods in 2011. FAF forecasts the value of intermodal shipments to increase significantly between 2011 and 2040 [USDOT FHWA 2012].[2]

The growth in intermodal freight movement is driven, in part, by global supply chain requirements to move goods quickly, cost effectively, and reliably. It also reflects a growing trend over the last few decades for each mode to focus on its most profitable market segment or commodity, rather than trying to transport the type of shipments that it cannot handle competitively. Between 1990 and 2010, the railroad industry reported an 82 percent increase in trailer and container traffic [AAR 2011]. Preliminary data from the Association of American Railroads show that rail intermodal traffic accounted for nearly 13 percent of U.S. Class I railroad revenue in 2011. Only coal along with chemicals and allied products accounted for a larger share of revenue [AAR 2013]. With the growth in container trade and improvements in information and logistics technologies, the stage is set for increased reliance on intermodal transportation to move goods from manufacturers to consumers.

Pipelines move vast quantities of petroleum, petroleum products, and natural gas to meet U.S. energy needs. In 2011, pipelines moved 1.7 billion tons worth $779 billion. Their share of total tonnage is projected to decrease from 9.4 percent in 2011 to 6.1 percent in 2040 [USDOT FHWA 2012].

Commodities Moved Domestically

Bulk products, such as gravel, cereal grains, natural gas, coke, and asphalt, comprise a large share of the tonnage moved in any given year, but not a large share of the value of the Nation's freight. In fact, in 2011 the top 10 commodities by weight accounted for 65 percent of total tonnage but only 19 percent of the value of goods. Rounding out the top 10 by weight were coal, waste/scrap, nonmetallic products, gasoline, fuel oils, crude petroleum, and natural sands [USDOT FHWA 2012].

[2] The FAF category for multiple modes and mail includes all multimodal movements and is not limited to traditional intermodal services, such as trailer-on-flatcar and container-on-flatcar rail.

TABLE 3-2 Hazardous Materials Shipments by Hazard Class: 2007

		Value		Tons		Ton-miles	
Hazard Class	Description	Billions of 2007 U.S. Dollars	Percent	Millions	Percent	Billions	Percent
Class 1	Explosives	12	0.8	3	0.1	<1	<0.1
Class 2	Gases	132	9.1	251	11.2	55	17.1
Class 3	Flammable liquids	1,170	80.8	1,753	78.6	182	56.1
Class 4	Flammable solids	4	0.3	20	0.9	6	1.7
Class 5	Oxidizers and organic peroxides	7	0.5	15	0.7	7	2.2
Class 6	Toxic (poison)	21	1.5	11	0.5	6	1.8
Class 7	Radioactive materials	21	1.4	<1	<0.1	<1	<0.1
Class 8	Corrosive materials	51	3.6	114	5.1	44	13.7
Class 9	Miscellaneous dangerous goods	30	7.1	7.1	7.1	7.1	7.1
Total		**1,448**	**100.0**	**2,231**	**100.0**	**323**	**100.0**

NOTE: Numbers and percents may not add to totals due to rounding.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics and U.S. Department of Commerce, Census Bureau, *2007 Commodity Flow Survey, Hazardous Materials, table 1a* (Washington, DC: February 2010), available at www.bts.gov/publications/commodity_flow_survey/ as of August 2011.

The picture changes significantly when looking at the value of goods shipped. The highest value goods were those that are time-sensitive, including electronics, pharmaceuticals, and textiles. Other top commodities by value are machinery, motorized vehicles, and plastics/rubber. In 2011, the top 10 commodities by value accounted for 57 percent of total value but only 16 percent of total tonnage [USDOT FHWA 2012].

Hazardous Materials

According to the CFS, more than 2.2 billion tons of hazardous materials were moved by all transportation modes combined in 2007. That volume is essentially unchanged from the tonnage of hazardous materials reported in the 2002 CFS. However, the value of those materials doubled between 2002 and 2007, fueled by increases in the price of refined petroleum products [USDOT RITA BTS 2011b]. Flammable liquids are by far the most dominant class of hazardous materials shipped, followed by gases, a distant second (table 3-2).

Trucks moved more than half of all hazardous materials shipments, calculated both by weight and value. Pipelines handled about 28.2 percent of the tonnage, followed by water (6.7 percent) and rail (5.8 percent). Trucks accounted for approximately 32.2 percent of all hazardous materials ton-miles because of the relatively short distances these products are transported. Rail accounted for 28.5 percent of the hazardous material ton-miles (table 3-3).

Safety and environmental issues associated with transportation of hazardous materials are discussed in chapter 5.

International Trade

Households and businesses increasingly rely on imports to satisfy their demand for goods and services, and U.S. businesses also seek to export goods to other countries. As a result, between 1990 and 2010, the value of total U.S. international merchandise trade increased from $1.5 trillion in 1990[3] to $3.2 trillion in 2010 [USITC DataWeb 2013]. This is a 115.1 percent inflation adjusted increase. Several factors have brought about this growth, including the shift from a manufacturing to a service economy in the United States, globalization of international trade spurred by advancements in information technologies and supply-chain management tools, and the liberalization of trade policies.

[3] The 1990 U.S. International Trade Commission trade data has been adjusted to 2010 dollars using the U.S. Department of Labor Bureau of Labor Statistics' Consumer Price Index (CPI) Inflation Calculator.

The growth in trade has created additional traffic within our domestic transportation network as imported and exported goods flow to and from international gateways. Not only has the growth in international trade affected the domestic freight network, it has changed the geography of trade, the distance goods are shipped, how they are shipped, and the location of transportation facilities. The increased international freight flows have especially been felt at transportation facilities along the U.S. border and at ports.

Seven of the top 15 U.S. trading partners were Asian countries in 2010. Trade with China has grown the fastest, from 6 percent of the total

TABLE 3-3 Hazardous Materials Shipments by Transportation Mode: 2007

	Value		Tons		Ton-miles		Miles
Transportation mode	$ Billions	Percent	Millions	Percent	Billions	Percent	Average distance per shipment
TOTAL All modes	**1,448**	**100.0**	**2,231**	**100.0**	**323**	**100.0**	**96**
Single modes, total	**1,371**	**94.6**	**2,112**	**94.6**	**279**	**86.3**	**65**
Truck[a]	837	57.8	1,203	53.9	104	32.2	59
For-hire	359	24.8	495	22.2	63	19.6	214
Private[b]	478	33.0	708	31.7	41	12.6	32
Rail	69	4.8	130	5.8	92	28.5	578
Water	69	4.8	150	6.7	37	11.5	383
Air	2	0.1	S	S	S	S	1,095
Pipeline[c]	393	27.2	629	28.2	S	S	S
Multiple modes, total	**71**	**4.9**	**111**	**5.0**	**43**	**13.3**	**834**
Parcel, U.S. Postal Service, or Courier	8	0.5	<1	<0.1	<1	<0.1	836
Other multiple modes	28	1.9	57	2.5	17	5.3	233
Unknown and other modes, total	**7**	**0.5**	**8**	**0.4**	**1**	**0.5**	**58**

[a] Truck as a single mode includes shipments that went by private truck only, for-hire truck only, or a combination of both. [b] Private truck refers to a truck operated by a temporary or permanent employee of an establishment or the buyer/receiver of the shipment. [c] Excludes crude oil shipments.

KEY: S = data are not published because of high sampling variability or other reasons.

NOTE: Numbers and percents may not add to totals due to rounding.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics and U.S. Department of Commerce, Census Bureau, *2007 Commodity Flow Survey, Hazardous Materials table 1a* (Washington, DC: February 2010), available at www.bts.gov/publications/commodity_flow_survey/ as of August 2011.

value of U.S. merchandise trade in 2000 to 14 percent in 2011 [USDOC ITA 2012]. In 2000, China ranked 10th; today it is second only to Canada while Mexico, Japan, and Germany, respectively, round out the top five U.S. trading partners.

Together, trade with Canada and Mexico represents about 29 percent ($1.06 trillion) of the value of U.S. merchandise trade [USDOC ITA 2012]. Over the 2000 to 2011 period, trade with Mexico increased by 59 percent while trade with Canada grew by 29 percent. Trucks carried about 30.8 percent of the tonnage and 59.2 percent of the value of trade with these two countries (table 3-4). Rail is also an important mover of exports and imports between the United States and these two countries, and pipelines carry a large volume of imports, mostly oil, from Canada [USDOT RITA BTS 2012a].

In 2011, U.S.-Canada merchandise trade by surface transportation modes was split about evenly between exports and imports, while U.S. imports from Mexico exceeded exports to that country. The top commodity category for goods transported by land modes between the United States and Canada was "automotive vehicles and parts." The leading state for surface trade with Canada was Michigan, which has a high auto industry concentration and which borders southern Ontario, which also has a high concentration. Texas, which accounts for almost two-thirds of the U.S.-Mexico border, led all other U.S. states in surface trade with Mexico. "Electrical machinery, equipment, and parts" was the top commodity category transported between the United States and Mexico [USDOT RITA BTS 2012b].

A large volume of U.S. international merchandise trade passes through a relatively small

TABLE 3-4 Value and Tonnage of U.S. Merchandise Trade with Canada and Mexico by Transportation Mode: 2000, 2005, 2010, and 2011

Billions of current U.S. dollars and millions of short tons

	2000		2005		2010		2011	
Mode	**Value**	**Weight**	**Value**	**Weight**	**Value**	**Weight**	**Value**	**Weight**
Truck[a]	429	NA	491	191	557	187	626	208
Rail[a]	94	NA	116	141	131	134	152	142
Air	45	<1	33	<1	45	<1	46	<1
Water	33	194	58	256	81	210	108	188
Pipeline[a]	24	NA	52	86	63	106	81	123
Other[a]	29	NA	39	5	40	9	46	13
Total[a]	**653**	**NA**	**790**	**679**	**918**	**646**	**1,058**	**675**

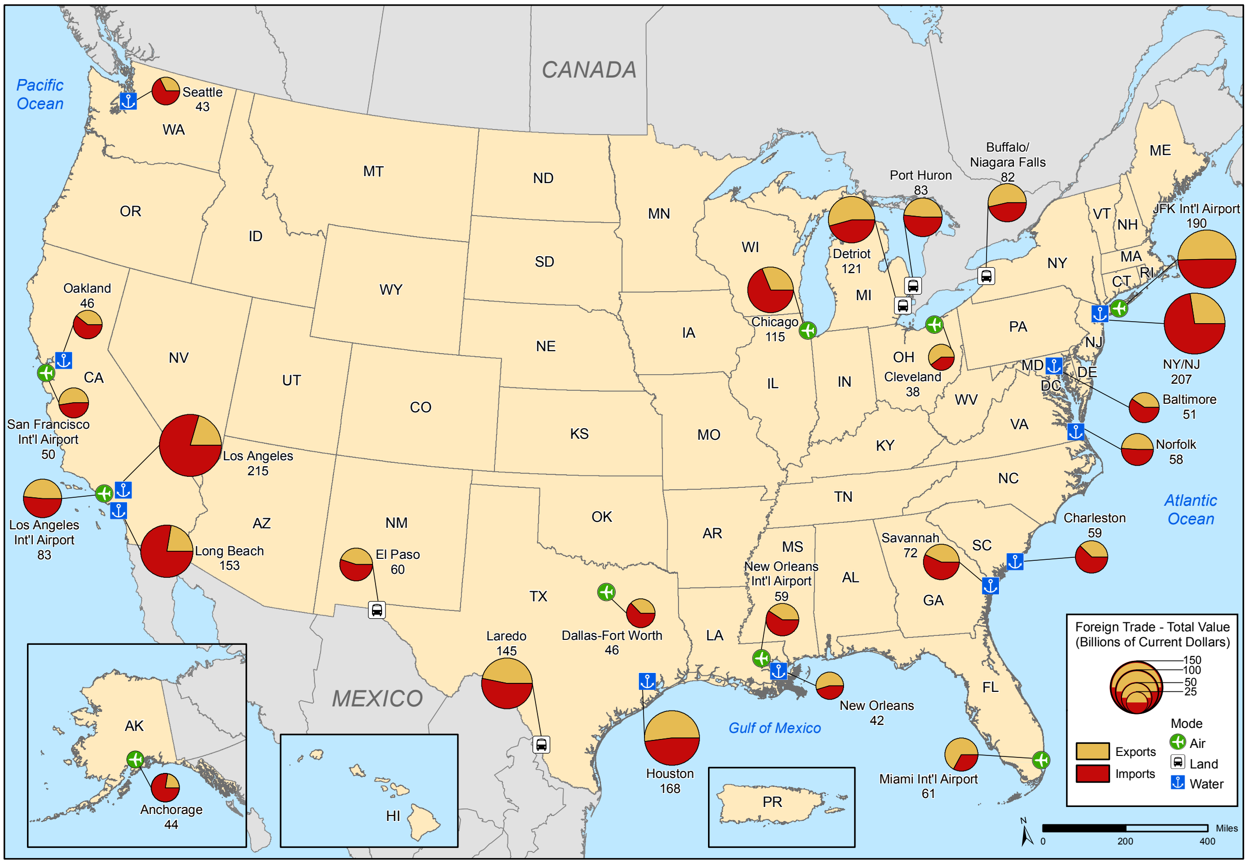
[a] The U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics estimated the weight of exports for truck, rail, pipeline, and other modes using weight-to-value ratios derived from imported commodities.

KEY: NA = not available.

NOTES: 1 short ton = 2,000 pounds. "Other" includes shipments transported by mail, other and unknown modes, and shipments through Foreign Trade Zones. Numbers may not add to totals due to rounding.

SOURCES: **Truck, Rail, Pipeline, and Other modes:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, North American Transborder Freight Data, available at www.bts.gov/transborder as of June 2012; **Air and Water:** U.S. Department of Commerce, Census Bureau, Foreign Trade Division, *FT920 - U.S. Merchandise Trade: Selected Highlights* (Washington, DC: annual issues).

FIGURE 3-3 Top 25 U.S. Foreign-Trade Gateways by Value: 2011



NOTES: Air gateways include a low level (generally less than 3% of the total value) of freight shipped through small user-fee airports located in the same area as the gateways listed. Air gateways not identified by airport name (e.g., Chicago, IL) include major airport(s) in that area and small regional airports. Due to Census Bureau confidentiality regulations, courier operations are included in airport totals for only New York (JFK), Los Angeles, Chicago, and Anchorage.

SOURCE: **Air**—U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, *USA Trade Online*, **Land**—U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *TransBorder Freight Data*, **Water**— U.S. Army Corps of Engineers, Navigation Data Center, personal communication, as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, table 1-51, available at http://www.bts.gov/publications/national_transportation_statistics/ as of October 2012.

number of freight gateways—the entry and exit points for trade between the United States and other countries. In 2011, the Port of Los Angeles was the top water gateway, handling more than $215 billion in cargo, most of which were imports, while on the other coast the port of New York and New Jersey ranked second handling $207 billion, three-fourths of which were imports (figure 3-3). That year, John F. Kennedy International Airport was the leading air gateway handling $190 billion, with the value of exports slightly exceeding imports, while Laredo, the top land-border crossing, handled $145 billion [USDOT RITA BTS 2013].

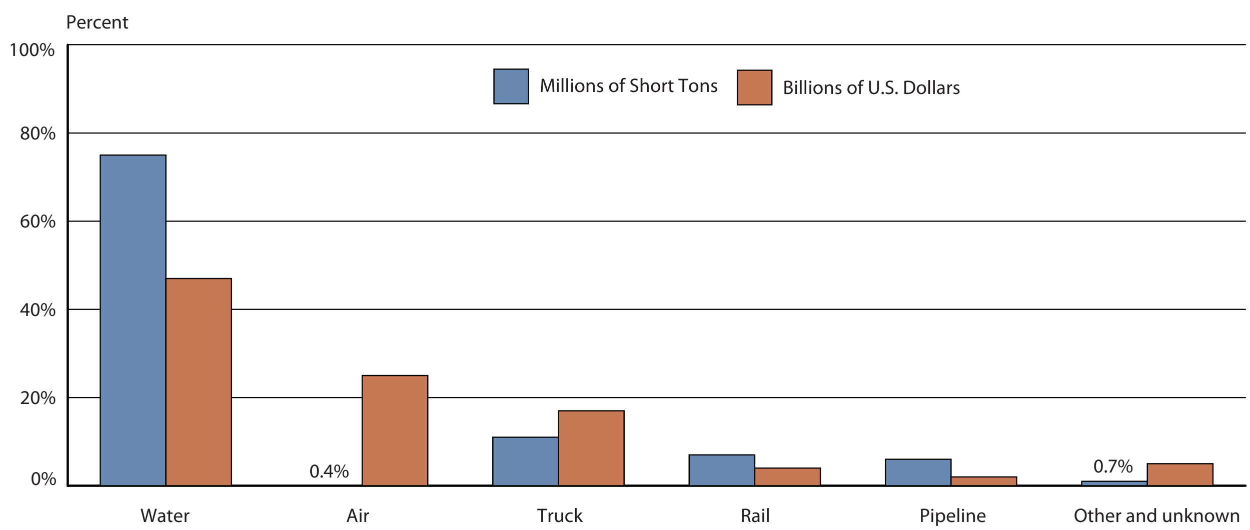
Water is the leading transportation mode for U.S. foreign trade both in terms of tonnage and value. Ships account for more than three-fourths of trade tonnage and 46.9 percent of trade value. Although air handles less than one percent of trade tonnage, air's focus on high-value, time-sensitive, and perishable commodities gives the mode a 24.9 percent share of import-export freight value. Trucks, which carry a significant share of imports and exports between U.S. international gateways and inland locations, handle 10.5 percent of the tonnage and 17.0 percent of the value of total U.S. international trade (figure 3-4).

As a result of the growth in international trade, the number of container vessels calling at U.S. ports has increased. Between 2009 and 2010, container vessel calls at U.S. ports rose by 7.3 percent after declining in 2008. In 2010, U.S. ports handled 27 million twenty-foot equivalent units[4] (TEUs) of containerized cargo, approximately 55 percent more than what was handled in 2000 [USDOT MARAD 2011b].

The geographic distribution of container ports (figure 3-5) is more concentrated along the Pacific and Atlantic coasts, without the large volumes of bulk commodity movements through the gulf coast (figure 3-2).

[4] TEU is a nominal unit of measure equivalent to a 20' x 8' x 8' shipping container. For example, a 50 ft. container equals 2.5 TEU.

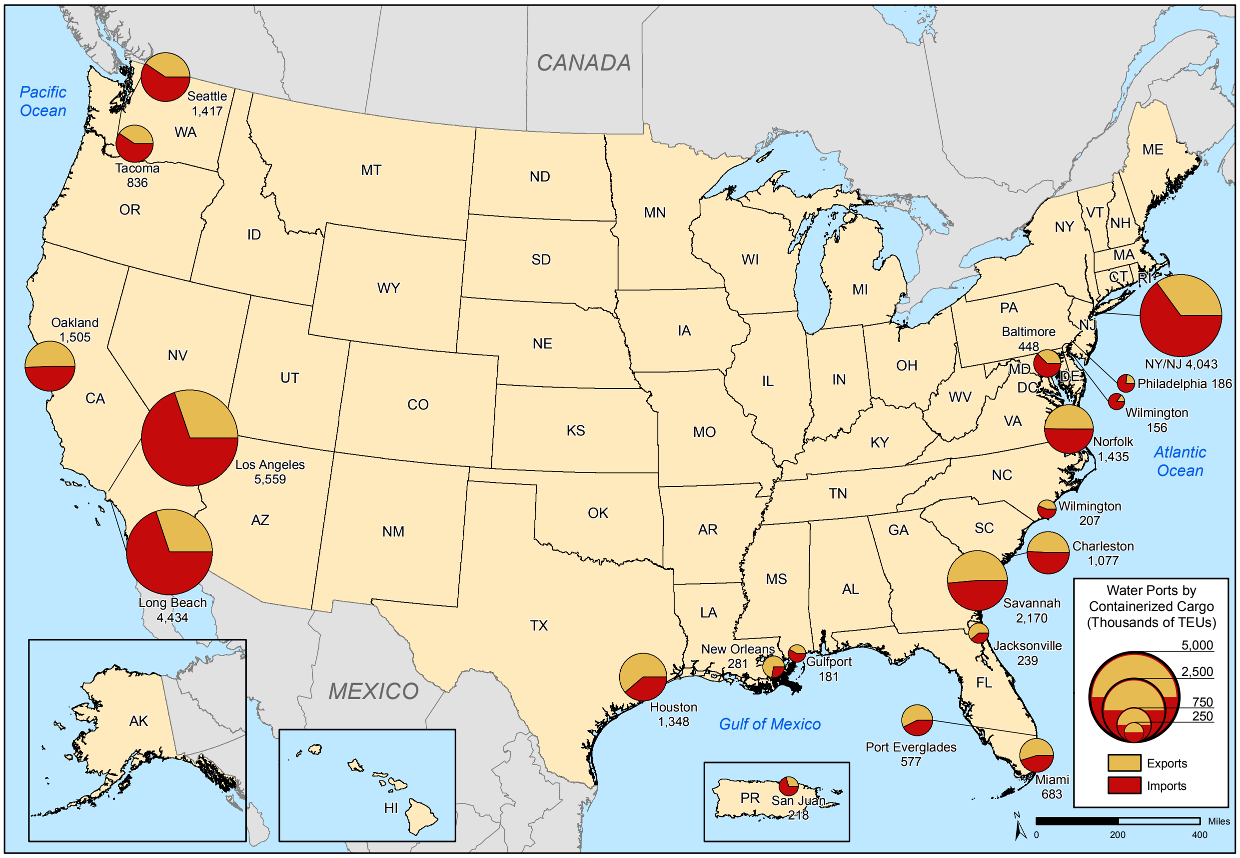
FIGURE 3-4 U.S. International Merchandise Trade by Transportation Mode: 2011



NOTES: 1 short ton = 2,000 pounds. The U.S. Department of Transportation (USDOT), Research and Innovative Technology Administration, Bureau of Transportation Statistics estimated 2010 weight data for truck, rail, pipeline, and other and unknown modes using value-to-weight ratios derived from imported commodities. Totals for the most recent year differ slightly from the USDOT, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework (FAF) due to variations in coverage and FAF conversion of values to constant dollars. Numbers may not add to totals due to rounding.

SOURCES: **Total, water and air data**: U.S. Department of Commerce, Census Bureau, Foreign Trade Division, *FT920 - U.S. Merchandise Trade: Selected Highlights* (Washington, DC: December 2011). **Truck, rail, and pipeline data**: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transporation Statistics, North American Transborder Freight Data, available at www.bts.gov/transborder as of August 2012. **Other and unknown**: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transporation Statistics, special tabulation, August 2012.

FIGURE 3-5 Top 20 Water Ports by Containerized Cargo: 2010



KEY: TEUs = twenty-foot equivalent units.

NOTE: The statistics include both government and non-government shipments by vessel into and out of U.S. foreign trade zones, the 50 states, District of Columbia, and Puerto Rico.

SOURCE: U.S. Department of Transportation, Maritime Administration, *U.S. Waterborne Container Trade by U.S. Custom Ports*, based on data provided by Port Import/Export Reporting Service, available at www.marad.dot.gov/library_landing_page/data_and_statistics/Data_and_Statistics.htm as of August 2011.

The average displacement of container vessels has increased from 42,158 deadweight tons (DWT) in 2002[5] to 51,262 DWT in 2010, an increase of 21.6 percent. The movement toward larger containerships has led to a concentration of liner service at ports with ample overhead clearance and water draft; intermodal connections, such as double stack rail; and room to grow. This trend is expected to continue, especially as the new larger Panama Canal locks open next year [USDOT RITA BTS 2011a]. The top 10 container ports accounted for 57.9 percent of all oceangoing vessel calls at U.S. ports in 2010 [USDOT MARAD 2011a].

The major increase in trade with China has resulted in the large share of trade through

[5] DWT is the total weight of cargo, fuel, fresh water, stores and crew that a ship can carry when immersed to its load line.

Pacific coast ports since 1990 (figure 3-6). Between 2002 and 2010, container vessel calls at Atlantic and gulf coast ports increased by 22.5 percent and 54.0 percent, respectively, while Pacific coast container vessel calls declined by 4.8 percent [USDOT RITA BTS 2011a].

Increases in U.S. international trade over the past 20 years have increased freight volumes on major freight highway, rail, and waterway routes as international trade competes with domestic freight and passenger traffic for use of the transportation infrastructure. Moreover, trade growth between Canada and Mexico generates increased north-south traffic flows on a domestic transportation infrastructure that was initially developed along east-west corridors during the westward development of the nation.

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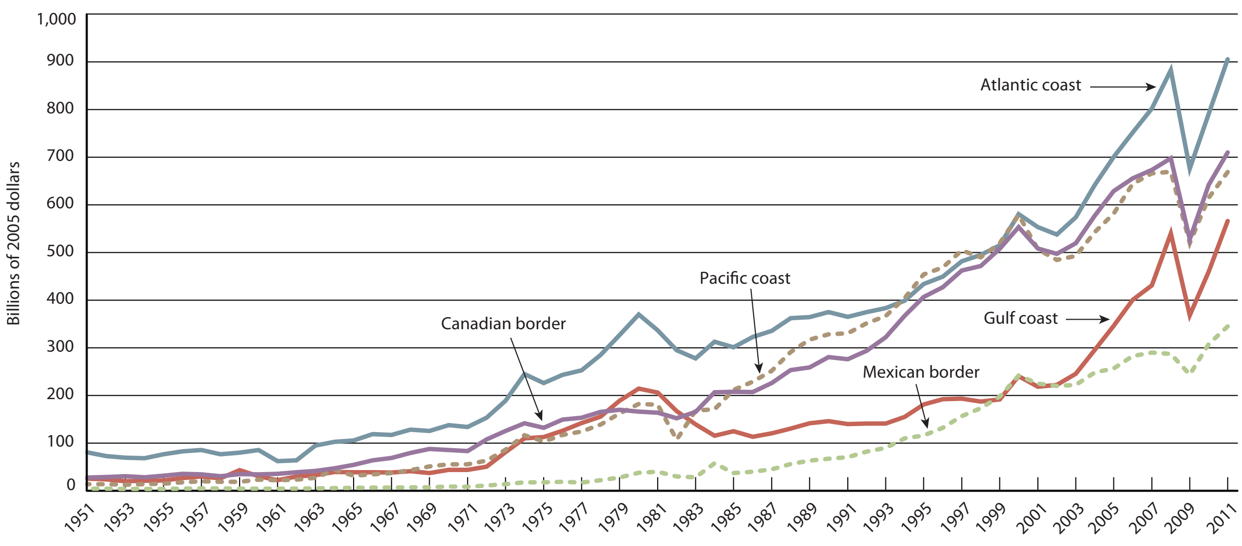
FIGURE 3-6 Value of U.S. Merchandise Trade by Coasts and Borders: 1951-2011



NOTES: The value of 2011 coal exports ($9.42 bilion) from Mobile, AL, Charleston, SC, and Norfolk, VA are considered proprietary information and are consolidated. In this figure, the total value of coal exports for the above three cities are included under the Atlantic Coast Customs District.

SOURCES: **1951-1970**: U.S. Department of Commerce, Census Bureau, *Historical Statistics of the United States, Colonial Times to 1970, Bicentennial Edition* (Washington, DC: 1975); **1970-2000**: U.S. Department of Commerce, Census Bureau, *Statistical Abstract of the United States* (Washington, DC: annual issues); **2000-2011**: U.S. Department of Commerce, Census Bureau, *Foreign Trade Division, FT920 - U.S. Merchandise Trade: Selected Highlights* (Washington, DC: annual issues). **Implicit GDP Deflator**: U.S. Department of Commerce, Bureau of Economic Analysis, Current-Dollar and "Real" Gross Domestic Product, available at www.bea.gov as of August 2012 as cited in U.S. Department of Transportation, Federal Highway Administration, *Freight Facts and Figures 2012*, available at http://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/ as of February 2013.

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CHAPTER 4

Transportation and the Economy

The Nation's transportation system makes possible the efficient movement of both people and goods throughout the country and internationally. As discussed in chapter 1, transportation assets, totaling $7 trillion in 2010, are a major underpinning of our Nation's wealth and our prosperity. Besides facilitating activity in all segments of the economy, the for-hire transportation sector directly employs over 4 million people, generates revenues through taxes and user fees, and invests in infrastructure and equipment needed to move people and goods. Beyond its contribution toward development of the Nation's gross domestic product (GDP), transportation is also an important element in both household and government budgets. The average household spends nearly $8,000 per year on transportation, while the public sector spends about $800 per capita on transportation expenditures.

- Personal, business, and government purchases of transportation goods and services account for nearly 8.7 percent of U.S. Gross Domestic Product.
- Transportation and related sectors employed over 11 million workers in 2011, representing nearly 8.7 percent of the Nation's labor force.
- American households spend, on average, over $8,000 per year on transportation, representing nearly 16.7 percent of household expenditures. Transportation expenditure is the second largest household spending category, next to housing.
- The transportation revenues of Federal, state and local governments totaled $156 billion in 2009, while government transportation expenditures totaled $243 billion – a deficit of $87 billion, up from $50 billion in 1995.

Transportation and U.S. Gross Domestic Product

Transportation is both a part of the economic output of the economy and a contributor to that economic output. The nation's economic output, measured as GDP, included near $1.5 trillion in personal consumption, private domestic investment, government purchases, and exports related to transportation goods and services in 2011 (measured in 2005 chained dollars). After subtracting $334 billion in transportation-related imports, transportation accounted for 8.7 percent of U.S. GDP (table 4-1).

When the effects of inflation are removed, spending on transportation in 2011 as a part of final demand is up 16.9 percent from 1995 but down 4.1 percent since 2000. Many of these changes are due to personal consumption of transportation and private domestic investment in transportation equipment, both of which were growing through the 1990s but suffered significant declines during the recent recession. While both categories have rebounded since 2009, neither has returned to levels achieved through years of growth.

Transportation is also a contributor to economic output, making possible the production and sale of nearly everything made in the nation. For-hire transportation contributes $448 billion (3.0 percent) to U.S. GDP when the goods and services consumed by for-hire transportation

TABLE 4-1 U.S. Gross Domestic Product Attributed to Transportation-Related Final Demand 1995, 2000, 2008–2011

Chained 2005 dollars, billions

	1995	2000	2008	2009	2010	2011
U.S. Gross Domestic Product (GDP), total	**9,086**	**11,216**	**13,162**	**12,758**	**13,063**	**13,299**
Transportation's share of GDP (percent)	10.9	10.8	8.9	8.6	8.6	8.7
Domestic transportation-related final demand, total	**994**	**1,212**	**1,176**	**1,102**	**1,121**	**1,163**
Personal consumption of transportation, total	**703**	**904**	**884**	**833**	**838**	**854**
Motor vehicles and parts	256	356	347	323	330	347
Motor vehicle fuels, lubricants, and fluids	234	261	265	264	265	257
Transportation services	214	286	272	246	244	249
Gross private domestic investment, total	**137**	**194**	**152**	**77**	**129**	**165**
Transportation structures	6	8	9	8	9	9
Transportation equipment	132	186	143	69	120	157
Government transportation-related purchases, total	**197**	**223**	**228**	**235**	**236**	**226**
Federal purchases	22	23	31	32	34	34
State and local purchases	163	189	179	183	181	173
Defense-related purchases	12	11	18	21	22	19
Transportation-related Exports (+), total	**163**	**205**	**246**	**199**	**227**	**251**
Transportation-related Imports (-), total	**-207**	**-314**	**-334**	**-242**	**-308**	**-334**

NOTES: Total domestic transportation-related final demand is the sum of total personal consumption of transportation, total gross private domestic investment, net exports of transportation-related goods and services, and total government transportation-related purchases. Defense-related purchases are the sum of the transportation of material and travel.

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, *National Income and Product Accounts Tables*, tables 1.1.6, 2.3.6, 2.4.6, 3.11.6, 3.15.6, 4.2.6, 5.4.6, and 5.5.6, available at http://www.bea.gov/national/nipaweb/SelectTable.asp?Selected=N#S2 as of November 2012 as reported in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, table 3-4, available at http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/index.html as of January 2013.

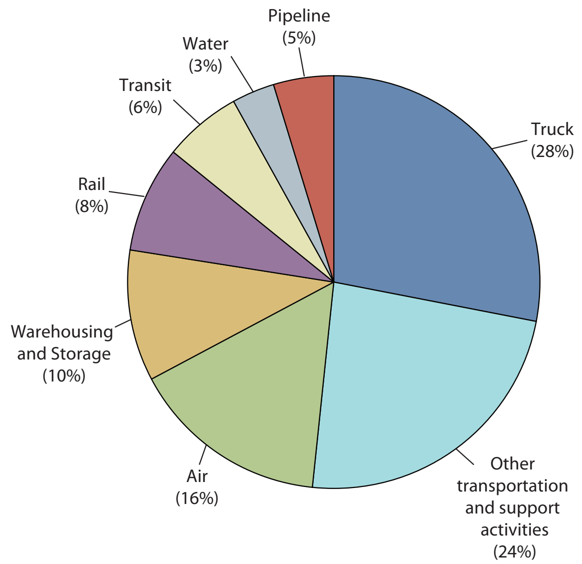
are netted out to avoid double counting. Nearly one-third of this contribution is made by for-hire trucking, with the next largest share coming from commercial aviation (figure 4-1).

Many nontransportation industries provide transportation services for their own use, called in-house transportation, such as trucking services operated for a grocery store chain or a construction company. The contribution of in-house transportation services to the economy had not been separately broken out until the Transportation Satellite Accounts were developed jointly by the Bureau of Transportation Statistics (BTS) and the Bureau of Economic Analysis (BEA). In 1997, the latest year for which estimates are available, in-house transportation accounted for approximately one-third of the total value added by both for-hire and in-house transportation services to the U.S. economy [USDOT RITA BTS 2011]. Based on the 1:3 ratio established in 1997, in-house transportation likely contributed about one-third, or about $175 billion, of the more than $500 billion estimated as the combined contribution of both for-hire and in-house transportation to the economy in 2010 [USDOT RITA BTS 2011].

Transportation and Trade

An efficient and reliable domestic transportation system with good connections to the international transportation network allows U.S. businesses to compete for customers in the global marketplace and to connect domestic manufacturers with distant sources of raw materials and other inputs to produce goods.

FIGURE 4-1 Modal For-hire Transportation Services Contribution to U.S. Gross Domestic Product (GDP): 2011



SOURCES: U.S. Department of Commerce, Bureau of Economic Analysis, Industry Economic Accounts, as cited in the U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, table 3-1, available at http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/index.html as of March 2013.

The transportation industry moves trade goods and provides international transportation services. U.S. international trade grew faster than the economy as a whole over the past 20 years. Between 1990 and 2010, the value of U.S. international trade tripled and GDP nearly doubled [USDOC BEA NIPA] while at the same time household income increased by only 2 percent [USDOC Census 2011]. As a share of GDP, U.S. merchandise trade, which includes goods but not services, grew from about 16 percent in 1990 to 22 percent in 2010 [USDOC Census FTD Annual Issues]. Canada, China, and Mexico are the top trading partners in merchandise trade for the United States, as discussed in chapter 3.

The growth in international trade is driven, in large part, by U.S. demand for imported goods. Since the 1970s, the United States has annually imported more goods than it has exported. The 2011 goods deficit ($726 billion) was the highest since 2008 ($816 billion). The 2011 services surplus ($179 billion) was the highest on record. The imports of automobiles ($254 billion) were the highest since 2007 ($257 billion), outpacing automobile exports ($133 billion) in 2011 [USDOC Census Foreign Trade].

Transportation-Related Employment and Productivity

Beyond the direct and indirect value provided by the transportation sector, it is a significant employer in the United States. In 2011, about 4.3 million people worked in the for-hire transportation sector, with trucking accounting for 30 percent of that total (table 4-2). Employment in many for-hire transportation industries has grown or remained steady since 1995, while employment in air, railroads, and pipe-

TABLE 4-2 Employment in For-Hire Transportation and Selected Transportation-Related Industries: 1995, 2000, and 2008–2011[a]

Thousands

	1995	2000	2008	2009	2010	2011
TOTAL U.S. labor force	**117,298**	**131,785**	**136,790**	**130,807**	**129,874**	**131,359**
TOTAL transportation and related labor force	**12,705**	**13,907**	**13,212**	**12,234**	**12,086**	**11,381**
Transportation and related as a share of Total U.S. labor force	10.8%	10.6%	9.7%	9.4%	9.3%	8.7%
For-Hire Transportation and warehousing	**3,838**	**4,410**	**4,508**	**4,236**	**4,191**	**4,292**
Air transportation	511	614	491	463	458	456
Rail transportation	233	232	231	218	216	229
Water transportation	51	56	67	63	62	63
Truck transportation	1,249	1,406	1,389	1,268	1,250	1,299
Transit and ground passenger transportation	328	372	423	422	430	436
Pipeline transportation	54	46	42	43	42	43
Scenic and sightseeing transportation	22	28	28	28	27	29
Support activities for transportation	430	537	592	549	543	564
Couriers and messengers	517	605	573	546	528	529
Warehousing and storage	444	514	672	637	633	646
Transportation-related manufacturing, total[b]	**2,391**	**2,447**	**1,965**	**1,669**	**1,646**	**1,684**
Other transportation-related industries, total	**4,727**	**5,297**	**5,097**	**4,723**	**4,680**	**4,774**
Postal service, total	**850**	**880**	**747**	**703**	**659**	**631**
Government employment, total[c]	**899**	**873**	**895**	**902**	**911**	**U**

[a] Annual averages. [b] Includes transportation equipment; petroleum products; tires; rubber; plastics; search, detection, navigation, guidance, aeronautical, and nautical systems; and instrument manufacturing. [c] Fiscal year data. Includes USDOT and state and local personnel. State and local component of government employment includes highway, air, transit, and water modes.

KEY: U = unavailable.

NOTE: Details may not add to totals due to independent rounding.

SOURCES: U.S. Department of Labor, Bureau of Labor Statistics; U.S. Census Bureau; and U.S. Department of Transportation, as cited in the U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, table 3-23, available at http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/index.html as of January 2013.

lines has declined [USDOL BLS CES]. The employment decline in these three industries is due partly to productivity improvements and, in the case of railroads and airlines, mergers and discontinuance of unprofitable lines and services.

Employment in transportation is not limited to carriers and warehousing. Millions more work in vehicle sales and repairs, vehicle and equipment manufacturing, and a host of other businesses with transportation-related functions. Including jobs from these various industries, transportation-related employment accounted for about 8.7 percent of civilian workers in 2011 (see table 4-2).

Employment by transportation occupation versus industry provides a different perspective. For example, a for-hire transportation company employs people in a variety of occupations, from the chief executive's office to the loading dock—all of which, by association, are in transportation industries. Workers in transportation occupations are also found in other industries. In 2011, there were approximately 2.7 million people employed as truck drivers in the United States, many of them working for companies whose business focus is non-transportation related, but nevertheless rely on transportation to function, such as grocery chains with in-house truck fleets (table 4-3).

Productivity, measured by output per hour worked, is an important indicator of economic growth and health. Improvement in productivity helps the United States maintain its international competitiveness despite having higher wages, fuel costs, and other transportation expenditures. Although labor productivity for the transportation sector as a whole is not available, the Bureau of Labor Statistics (BLS) reports labor productivity for several for-hire transportation industries: air, line-haul railroads, general (long distance) freight trucking, and postal services (figure 4-2). Air transportation and line-haul railroads doubled productivity between 1990 and 2010 from divestiture of unprofitable lines and other efficiency improvements.[1] Air carriers improved productivity, as measured by the number of available seat-miles flown per gallon of fuel, and fuel efficiency, as measured by the number of gallons consumed per block hour [USDOT RITA BTS 2012b]. Over the same period, postal service productivity improved by 19.5 percent and general freight trucking by 28.9 percent. In comparison, overall business productivity increased by 43.9 percent. The relatively low increase for freight trucking may be due to increasing quality-of-service demands by shippers and the public.

Household Expenditures on Transportation

In 2011, the average household expenditure on transportation was $8,293. This translates to almost 16.7 percent of average household expenditures, the second largest household expenditure (figure 4-3). In comparison, households spent more than twice that amount on housing. On average, rural households spent

[1] Prior to 2009, all air transportation workers were considered full time. BLS revised its data beginning in 2009 to include both full-time and part-time workers.

TABLE 4-3 Employment in Selected Freight Transportation and Freight Transportation-Related Occupations: 2000 and 2008–2011

Thousands

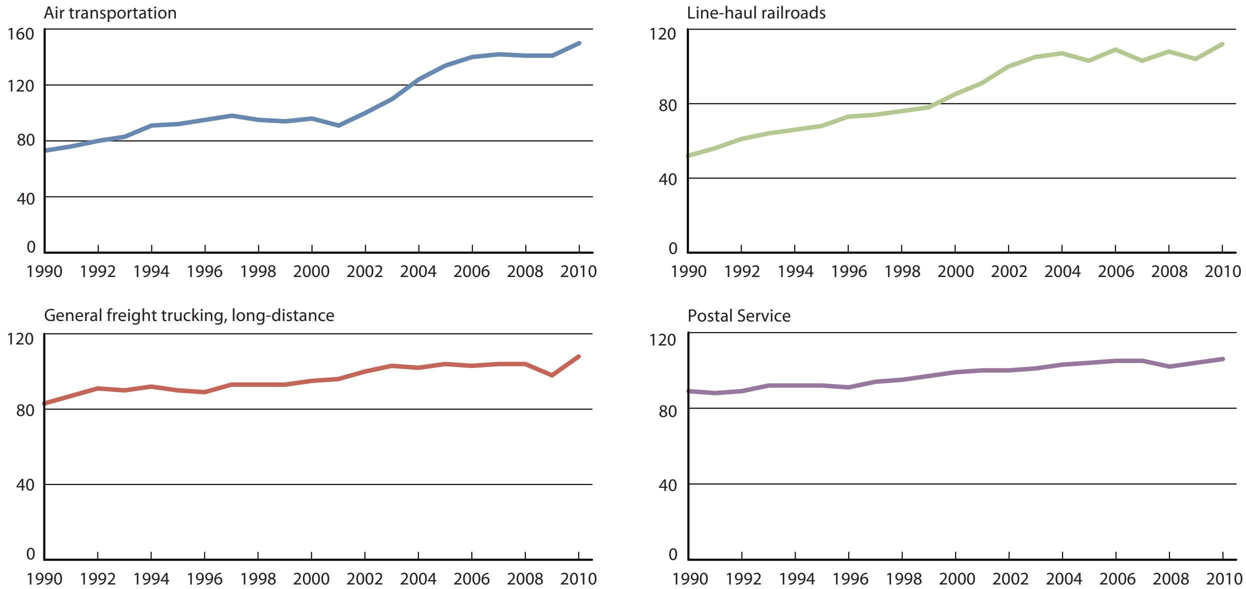
Occupation (SOC code)	2000	2008	2009	2010	2011
Vehicle operators, pipeline operators, and primary support	**3,158**	**3,159**	**2,956**	**2,818**	**2,871**
Driver/sales worker (53-3031)	374	373	363	372	388
Truck drivers, heavy and tractor-trailer (53-3032)	1,577	1,673	1,551	1,467	1,509
Truck drivers, light or delivery services (53-3033)	1,033	909	835	780	771
Locomotive engineers (53-4011)	29	43	44	41	39
Rail yard engineers, dinkey operators, and hostlers (53-4013)	4	5	5	6	5
Railroad brake, signal, and switch operators (53-4021)	17	25	24	23	24
Railroad conductors and yardmasters (53-4031)	40	40	42	43	44
Sailors and marine oilers (53-5011)	30	32	32	32	31
Captains, mates, and pilots of water vessels (53-5021)	21	31	30	29	30
Ship engineers (53-5031)	7	11	11	9	10
Bridge and lock tenders (53-6011)	5	4	4	3	3
Gas compressor and gas pumping station operators (53-7071)	7	4	4	4	4
Pump operators, except wellhead pumpers (53-7072)	14	9	10	9	12
Transportation equipment manufacturing and maintenance occupations	**269**	**269**	**254**	**242**	**242**
Bus and truck mechanics and diesel engine specialists (49-3031)	259	249	233	223	223
Rail car repairers (49-3043)	11	21	21	19	19
Transportation infrastructure construction and maintenance occupations	**19**	**24**	**23**	**25**	**25**
Rail-track laying and maintenance equipment operators (47-4061)	10	15	15	16	16
Signal and track switch repairers (49-9097)	6	7	6	7	8
Dredge operators (53-7031)	3	2	2	2	2
Secondary support service occupations	**1,431**	**1,346**	**1,275**	**1,228**	**1,221**
Dispatchers, except police, fire, and ambulance (43-5032)	167	193	185	181	182
Postal service mail carriers (43-5052)	355	355	339	325	315
Shipping, receiving, and traffic clerks (43-5071)	865	761	715	688	688
Transportation inspectors (53-6051)	27	25	24	24	25
Tank car, truck, and ship loaders (53-7121)	17	12	12	10	11

KEY: SOC = Standard Occupational Classification.

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, *Occupational Employment and Wages, 2011*, available at www.bls.gov/oes as of July 2012.

FIGURE 4-2 Labor Productivity Indices for Selected Transportation Industries: 1990–2010

Index, 2002 = 100



NOTES: Bureau of Labor Statistics developed labor productivity indexes for all manufacturing and retail trade of the North American Industry Classification System (NAICS) industries as well as selected mining, transportation, communications and services industries. Data in this table are not comparable to the data published in previous editions of the report due to change in base year of the index from 1997 to 2002.

SOURCES: U.S. Department of Labor, Bureau of Labor Statistics, *Industry Productivity and Costs*, available at http://www.bls.gov/data/ as of January 2011.

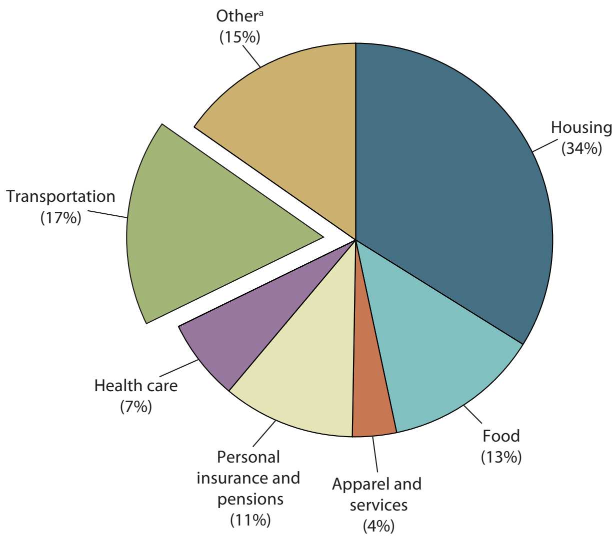
more on transportation ($9,517) than urban households ($7,990). This difference is driven, in part, by longer trips in rural areas and greater use of public transportation in urban households [USDOL BLS CEX].

The lion's share of household transportation expenditures went to the purchase and upkeep of vehicles (93.8 percent), including the cost of gasoline. After generally holding steady from 1994 to 1999, gasoline and diesel prices have nearly tripled since 2000. As shown in figure 4-4, prices increased from $1.29/gallon for regular gasoline in January 2000 to a monthly average price of $3.63/gallon in 2012 [USDOE EIA 2012].[2] These increases have caught the attention of consumers who have responded by driving less to reduce fuel use, using more efficient vehicles, or both. Spending on all modes of purchased transportation accounted for the remaining 6.2 percent of household transportation spending in 2011.[3] Airline fares were the largest purchased transportation expenditure (among those who fly), followed by mass

[2] After peaking in early 2012, gasoline prices started to decline in mid-year, before dropping below $3.00/gallon in some markets in December.

[3] The Bureau of Labor Statistics refers to for-hire and other services available to the public as public transportation (in contrast to private transportation). This should not be confused with public transportation such as government-provided transit.

FIGURE 4-3 Average Household Expenditures by Major Spending Category: 2011



[a]Includes alcoholic beverages, entertainment, personal care products and services, reading, education, tobacco products and smoking, miscellaneous, and others.

NOTES: Individual categories may not sum to total due to rounding.

SOURCES: U.S. Department of Labor, Bureau of Labor Statistics, *Consumer Expenditure Survey*, 2011, personal communication, September 2012.

transit, a distant second [USDOT RITA BTS 2012a]. However, only about one-third of all individuals fly in a one-year period.

Over the last 20 years, the costs of owning a car have kept pace with the 67 percent increase in the Consumer Price Index (CPI). According to the CPI, the cost of owning and operating a personal vehicle grew by 60 percent. As components of owning a car, automobile insurance and maintenance costs doubled while the cost of parts remained about the same. In addition, the CPI notes the cost of public transportation exceed the overall price increase, given that public transportation costs doubled during the 1990-2010 period [USDOL BLS CPI]. [4]

Public- and Private-Sector Spending on Transportation

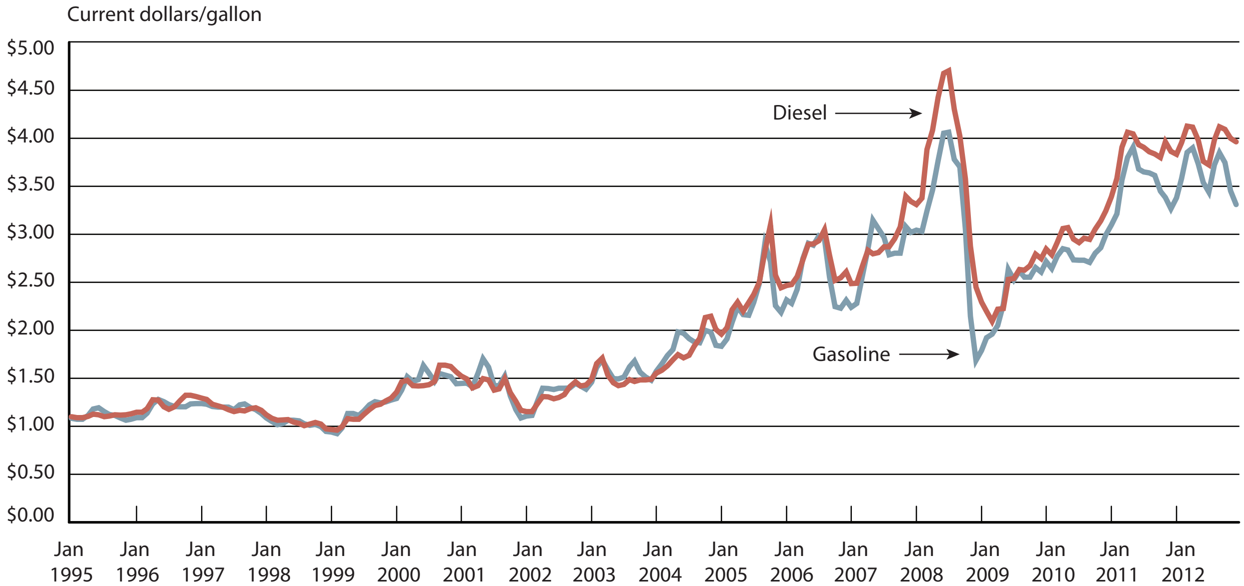
Federal, state, and local governments spent approximately 4 percent ($243 billion) of their expenditures on transportation in 2009, according to the *Government Transportation Financial Statistics 2012* report produced by BTS. The same report calculates per capita government spending on transportation at about $800 per year [USDOT RITA BTS 2012a]. These expenditures are used, among other things, to build, operate, and maintain publicly owned transportation facilities, implement public policy in such areas as safety and security, and undertake many other activities.

In 2009, the latest year for which comprehensive data have been published, governments spent $243 billion on transportation, with state and local governments spending 82.4% of that total (table 4-4). Government transportation expenditures more than doubled between 1995 and 2009. Nearly 50.8 percent of government expenditures went to highways, followed by transit (22.4 percent), air (19.7 percent), and water (5.7 percent).

The public sector is the major funding source for transportation infrastructure construction in the United States. In 2010, the value of gov-

[4] Public transportation costs include fares for airlines, intercity bus, intercity train, ship, and intracity transportation (intracity mass transit) in the Consumer Price Index.

FIGURE 4-4 Gasoline and Diesel Retail Price: January 1995–December 2012



SOURCES: U.S. Department of Energy, Energy Information Agency, U.S. Petroleum Prices, available at www.eia.doe.gov as of January 2013.

ernment-funded construction underway was $108 billion, approximately one-third more than the 2005 figure of $79 billion (see table 1-2 in chapter 1). Approximately three-fourths of this public investment was for highways; the remainder supported such construction as airport terminals and runways, transit facilities, water transportation facilities, and pedestrian and bicycling infrastructure.

During this same period, the private sector also substantially increased spending on transportation construction, but from a much lower level of initial spending. In 2005, the value put in place by private construction was $7 billion; rising by more than 40 percent to nearly $10 billion in 2010. Most of this outlay was for rail projects, with spending increasing more than 50 percent between 2005 and 2010. Private spending for air transportation construction declined during this period [USDOC Census Construction Spending].

Transportation-Related Revenues

Public dollars spent on transportation come from user taxes and fees, such as gasoline taxes and tolls, air ticket taxes and fees, and general revenues. In 2009, the latest year for which data from all levels of government have been assembled, government transportation revenues from all sources totaled $156 billion (current dollars). State and local governments collected 67.9 percent of all transportation-related revenues, while the Federal Government collected the balance. As shown in table 4-5, the highway sector generated the greatest revenues (mainly from gas taxes), accounting for $104 billion (67.0 percent), followed by air,

TABLE 4-4 Government Transportation Expenditures: 1995, 2000, 2007–2009
Millions of current dollars

	1995	2000	2007	2008	2009
Total, all modes	**143,278**	**186,913**	**279,989**	**295,830**	**242,950**
Federal	19,955	21,826	36,948	40,575	42,755
State and local	123,323	165,087	243,041	255,255	200,194
Highway, total	**90,099**	**119,932**	**175,510**	**182,057**	**123,649**
Federal	1,708	2,211	2,986	3,853	5,843
State and local	88,391	117,720	172,524	178,204	117,806
Transit, total	**25,460**	**35,417**	**45,753**	**50,893**	**54,341**
Federal	1,277	4,390	98	90	92
State and local	24,183	31,027	45,655	50,803	54,249
Rail, total	**1,049**	**778**	**1,528**	**1,528**	**1,880**
Federal	1,023	765	1,523	1,527	1,880
State and local	26	13	5	1	0
Air, total	**19,204**	**22,445**	**43,806**	**46,593**	**47,831**
Federal	10,807	9,285	23,745	25,329	24,970
State and local	8,397	13,160	20,061	21,264	22,861
Water, total	**6,666**	**7,634**	**12,075**	**13,396**	**13,766**
Federal	4,357	4,493	7,314	8,456	8,547
State and local	2,309	3,141	4,761	4,940	5,219
Pipeline, total	**26**	**55**	**89**	**92**	**99**
Federal	14	37	66	61	55
State and local	12	18	23	31	44
General support, total	**775**	**653**	**1,229**	**1,271**	**1,384**
Federal	769	645	1,216	1,259	1,368
State and local	6	8	13	12	16

NOTES: Federal expenditures include direct Federal spending, excluding grants to State and local governments. State and local expenditures include outlays from all sources of funds, including federal grants, except rail and pipeline modes. Rail and pipeline modes include outlays funded by Federal grants only. The part of expenditures that may be funded by other State and local government funding sources are not covered due to lack of data. Outlays for U.S. Army Corps of Engineers' civilian transportation-related activities, such as construction, operation, and maintenance of channels, harbors, locks and dams, are not included.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics. *Government Transportation Financial Statistics 2012*. Available at http://apps.bts.gov/publications/government_transportation_financial_statistics/2012/ as of January 2013.

a distant second at $30 billion (mainly from air ticket taxes and fees).

Total transportation revenues increased (without adjusting for inflation) by about 66.2 percent, from $94 billion in 1995 to $156 billion in 2009, while government transportation expenditures increased from $143 billion in 1995 to $243 billion in 2009. Over the same period, highway revenues rose by 56.5 percent. In 2009, transportation revenues covered only about 64.1 percent of expenditures. When revenues from transportation user taxes and fees do not cover expenditures, general tax receipts (e.g., from sales and property taxes), trust fund balances, and borrowing are needed to cover shortages. This gap between transportation expenditures and revenues has widened from $49.6 billion in 1995 to $87.2 billion in 2009.

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TABLE 4-5 Government Transportation Revenues: 1995, 2000, 2007–2009

Millions of current dollars

	1995	2000	2007	2008	2009
Total, all modes	**93,698**	**127,295**	**162,821**	**162,385**	**155,729**
Federal	30,478	47,138	54,456	52,053	49,954
State and local	63,220	80,157	108,365	110,332	105,775
Highway, total	**66,716**	**90,275**	**113,297**	**110,464**	**104,379**
Federal[a]	22,200	34,986	40,061	37,080	35,144
State and local	44,516	55,289	73,236	73,384	69,235
Transit, total[b]	**8,575**	**10,670**	**13,874**	**14,591**	**15,292**
Railroad, total[c]	**36**	**1**	**0**	**0**	**0**
Air, total[d]	**14,497**	**22,235**	**29,384**	**30,702**	**29,818**
Federal	6,291	10,544	11,994	12,484	12,491
State and local	8,206	11,691	17,390	18,218	17,327
Water, total	**3,832**	**4,058**	**6,191**	**6,551**	**6,142**
Federal[e]	1,909	1,551	2,325	2,412	2,221
State and local	1,923	2,507	3,866	4,139	3,921
Pipeline, total[c]	**35**	**30**	**60**	**63**	**78**

[a] Includes both Highway and Transit Accounts of the Highway Trust Fund (HTF) and other receipts from motor fuel and motor vehicle taxes not deposited in the HTF. [b] Includes state and local government only. [c] Includes Federal only. [d] Receipts from aviation user and aviation security fees also included. [e] Includes Harbor Maintenance Trust Fund, St. Lawrence Seaway tolls, Inland Waterway Trust Fund, Panama Canal receipts through 2000, Oil Spill Liability Trust Fund, Offshore Oil Pollution Fund, Deep Water Port Liability Fund, and excise taxes of the Boat Safety Program.

NOTES: Government transportation revenue consists of money collected by govenrments from transportation user charges and taxes to finance transportation program. The revenue of a transportation mode includes all transportation revenues designated to that mode regardless of the sources or instruments from which the revenues are collected. Tolls from highways, bridges, and tunnels, etc., designated for transit use are counted as transit revenue.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics. *Government Transportation Financial Statistics 2012*. Available at http://apps.bts.gov/publications/government_transportation_financial_statistics/2012/ as of January 2013.

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CHAPTER 5

Transportation Performance: System Reliability, Safety, Energy Use, and Environmental Impacts

Performance of the U.S. transportation system includes how reliably and safely the system serves travelers and shippers and how the movement of people and goods on the system affects the economy and the environment. The elements of performance are highlighted in the *USDOT Strategic Plan* and the *Moving Ahead for Progress in the 21st Century Act* (Public Law No. 112-141) under the topics of safety, state of good repair, economic competitiveness, environmental sustainability, and livable communities. State of good repair and economic competitiveness are already covered in chapters 1 and 4, respectively. System reliability (a component of economic competitiveness), safety, and environmental consequences are discussed below. Livable communities will be discussed in a future edition of this report.

- Traffic congestion costs a commuter, on average, 34 hours in delay and 14 extra gallons of gasoline per year—roughly double the costs of two decades ago.
- All modes of freight transportation experience substantial congestion. Truck congestion alone cost $23 billion in wasted fuel and hours of delay in 2010.
- While fatalities have declined over the last four decades, transportation still accounts for nearly 35,000 lives lost and over 2.2 million injuries each year.
- The transportation sector accounts for 70.2 percent of total petroleum consumption in the United States. It is the second largest consumer of energy, next to the industrial sector.
- Almost all transportation pollution emissions have decreased by 50 percent or more, despite an increase in vehicle use since 1990; only ammonia has increased.
- Transportation is the single largest sector generating greenhouse gas emissions, accounting for about one-third of the U.S. total; transportation's 1.8 billion metric tons of carbon dioxide emissions in 2010 is down from 1.9 billion metric tons in 2005.

System Reliability

Transportation network capacity has not kept pace with growth in travel and commerce. The resulting congestion makes travel times longer and arrival times less predictable for both passengers and freight shippers. The Federal Highway Administration has identified seven root causes for transportation system congestion:

1. *Physical Bottlenecks*—insufficient capacity in the system to handle the volume without delays.
2. *Fluctuations in Normal Traffic Volume*—especially in regard to highways, some days of the week see much higher traffic volumes than others.
3. *Incidents*—breakdowns or accidents on the highway, rights-of-way, and runways can delay traffic.
4. *Weather*—can lead to changes in driver behavior that affect traffic flow.
5. *Special Events*—create surges in demand on the system that are significantly greater than usual.
6. *Work Zones*—repair or maintenance work on highways, railways, airports, or port facilities can reduce the ability of the system to handle normal traffic volumes.
7. *Traffic Control Devices*—interruptions from railroad crossings, drawbridges, poorly timed traffic lights, etc. can cause delays that impact travel reliability [USDOT FHWA 2005a].

For the majority of travelers, the most frequently experienced form of transportation system delays occur on highways. Highway travel demand, as measured by vehicle-miles traveled, increased by 38.3 percent over the 1990–2010 period, while highway capacity, as measured by lane-miles, increased by about 6.6 percent [USDOT RITA BTS 2012a tables 1-35, 1-6]. About half of highway system delays are recurring; resulting from two of the root causes identified above—physical bottlenecks and recurring fluctuations in normal traffic volume [USDOT FHWA 2005b].

Road congestion, measured in terms of costs and hours, has increased in the past 20 years. The recession that began in December 2007 led to a significant drop in 2008 road congestion levels, which started to partially rebound in 2009 (table 5-1). In 2010, road congestion costs totaled $101 billion dollars in wasted time and fuel compared to $46 billion (2010 dollars) in 1990. Over the same period, total annual hours of delay grew from 2.4 billion hours to 4.8 billion hours while the amount of wasted fuel increased from about 0.9 billion to 1.9 billion gallons [TTI 2011].

Impact of Congestion and Delay on Passenger Travel

The Texas Transportation Institute (TTI) estimated that in 2010 the average commuter spent an additional 34 hours annually (the equivalent of 4 workdays) and wasted 14 gallons of gas sitting in traffic. Together, delay and wasted fuel cost $713 more per car commuter

TABLE 5-1 Annual Congestion Delay and Costs: 1990, 2000, 2005–2010

439 Urban Areas[a]

	Total delay (billion hours)	Delay per auto commuter (hours)	Total fuel wasted (billion gallons)	Total cost (2010 $ billion)
1990	2.4	28.5	0.9	46.4
2000	4.0	34.8	1.6	82.6
2005	5.2	39.1	2.2	108.1
2006	5.3	39.1	2.2	110.0
2007	5.2	38.4	2.2	110.3
2008	4.6	33.7	1.9	97.0
2009	4.8	34.0	1.9	100.9
2010	4.8	34.4	1.9	100.9

[a] Includes 15 very large urban areas (population over 3 million); 32 large urban areas (population over 1 million but less than 3 million); 33 medium urban areas (population over 500,000 but less than 1 million); 21 small urban areas (population less than 500,000; and 338 other urban areas.

SOURCE: Texas Transportation Institute and Texas A&M University, *2011 Urban Mobility Report*. 2011. available at http://tti.tamu.edu/documents/mobility-report-2011.pdf as of March 2012.

(driver and passengers) in 2010. For commuters in some areas, congestion costs were much higher: $1,495 in the Washington, DC metro area and $1,568 in the Chicago metro area [TTI 2011]. TTI has not quantified the air quality effects of congestion.

Drivers experienced the biggest bottlenecks at 173 highway interchanges, which alone create an estimated 250,000 truck hours of delay annually [USDOT FHWA 2005b]. In the largest urban areas, recurring congestion can last for up to 6 hours with the evening hours having the worst congestion and the highest percent of delay by time of day. In addition, congestion builds as the week progresses: Sunday is the best day and Friday the worst [TTI 2011]. Roadway congestion is no longer considered only an issue in very large urban areas [TTI 2011]. According to TTI, highway-sector operational improvements and high-occupancy vehicle lanes saved 327 million hours of delay and 131 million gallons of fuel in the 439 urban areas analyzed in 2010. By keeping additional cars off the road, availability of public transportation services is estimated to have saved commuters an additional 796 million hours of delay and an additional 303 million gallons of fuel [TTI 2011, pp. 14 and 15].

Congestion and delay are not limited to roadways. Amtrak reports that sharing track with other passenger and freight rail service providers is a major source of delay. This resulted in 21.9 percent of all Amtrak trains arriving late at their final destination in 2011 [Amtrak 2011a]. Seventy-two percent of the miles traveled by Amtrak trains are over lines owned by freight railroads [Amtrak 2011b]. The host freight railroads are responsible for 72.6 percent of the minutes of delay to Amtrak service in 2011 [Amtrak 2011a].

Airline flight delays are triggered by bad weather and heavy passenger flight volumes, among other factors. Approximately 20 percent of flights arriving at their scheduled destination are delayed by at least 15 minutes, although the percentage has declined every year since 2007. Between 2007 and 2011, late departures[1] decreased from 21.1 to 17.3 percent (for all carriers and all airports), while late arrivals declined from 24.2 to 18.2 percent [BTS 2012c]. The average length of arrival delay for late flights is over 50 minutes (table 5-2). According to BTS, weather was responsible for nearly 38.67 percent of total delays in 2011 [USDOT RITA BTS 2012b]. These arrival and departure delays often ripple throughout the U.S. system and sometimes extend to airports overseas.

[1] A flight is considered delayed if it arrived at or departed from the gate 15 or more minutes after the scheduled arrival/departure time, as reflected in the computerized reservation system of that airline.

Freight Reliability

The Federal Highway Administration estimates that about 11 percent of the National Highway System (NHS) experienced recurring peak-period congestion in 2007 that resulted in passenger and freight traffic slowing below posted speed limits or encountering stop-and-go conditions [USDOT FHWA 2011] (figure 5-1). High-volume truck segments of the NHS—sections of the NHS that carry more than 8,500 trucks per day and where trucks account for more than 25 percent of total traffic—experienced substantial congestion, particularly near metropolitan areas. In 2007, recurring congestion on high-volume truck segments slowed traffic on 4,700 miles of the NHS (out of the 4.1 million miles of public roads) and created stop-and-go conditions on an additional 3,700 miles (figure 5-2). Between 2007 and 2040, those congested miles are projected to increase by nearly 366 percent, assum-

TABLE 5-2 Percentage of Delayed Arriving Flights by Duration: 2005–2011

				Percentage of all delayed flights by length of time delayed				
	Total number of arriving flights	Percentage of arriving flights, delayed	Average length of delay (minutes)	15-29 minutes	30-59 minutes	60-89 minutes	90-119 minutes	More than 120 minutes
2005	7,140,596	20.5	52	42	31	12	6	8
2006	7,141,922	22.6	54	44	34	14	7	10
2007	7,455,458	24.2	56	48	38	16	8	12
2008	7,009,726	21.8	57	41	32	14	7	11
2009	6,450,285	18.9	54	34	26	11	6	8
2010	6,450,117	18.2	54	33	25	10	5	7
2011	6,085,281	18.2	56	31	23	10	5	7

NOTES: These numbers include scheduled-service domestic operations by carriers reporting on-time data. For the monthly number of carriers reporting, please refer to the *Air Travel Consumer Reports* available at http://airconsumer.dot.gov/reports/index.htm. A flight is considered delayed when it arrived 15 or more minutes later than scheduled. Average minutes are calculated for delayed flights only. Percents may not add to 100 due to rounding.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Transtats Database, *Airline, On-Time Performance*, available at http://www.transtats.bts.gov/ as of January 2013.

FIGURE 5-1 Peak Period Congestion on the National Highway System: 2007

NOTES: Uncongested segments have volume/service flow ratios between 0 and 0.75. Congested segments have reduced traffic speeds with volume/flow ratios between 0.75 and 0.95. Highly congested segments are stop-and-go conditions with volume/service flow ratios greater than 0.95.

SOURCES: U.S. Department of Transportation, Federal Highway Administration, Office of Highway Policy Information, Highway Performance Monitoring System, and Office of Freight Management and Operations, Freight Analysis Framework, version 3.1, 2010.

ing no change in network capacity and predicted increases in truck and passenger traffic [USDOT FHWA 2011].

According to TTI, truck congestion alone cost $23 billion in wasted fuel and hours of delay in 2010. While trucks accounted for approximately 6 percent of vehicle-miles traveled in urban areas in 2010, they shouldered nearly 26 percent of congestion costs [TTI 2011, pp. 1, 5, and 8].

According to the Association of American Railroads (AAR), congestion on freight railroads is becoming a widespread problem. AAR indicates that 30 percent of the rail network will experience service breakdowns and unstable flow conditions in 2035 if current capacity is not increased [AAR 2007].

On inland waterways, congestion is caused by several factors, including aging infrastructure and weather-related events (e.g., flooding,

FIGURE 5-2 Peak Period Congestion on High-Volume Truck Portions of the National Highway System: 2007

NOTES: High-volume truck portions of the National Highway System carry more than 8,500 trucks per day, including freight-hauling long-distance trucks, freight-hauling local trucks, and other trucks with six or more tires. Uncongested segments have volume/service flow ratios between 0 and 0.75. Congested segments have reduced traffic speeds with volume/service flow ratios between 0.75 and 0.95. Highly congested segments are stop-and-go conditions with volume/service flow ratios greater than 0.95.

SOURCES: U.S. Department of Transportation, Federal Highway Administration, Office of Highway Policy Information, Highway Performance Monitoring System, and Office of Freight Management and Operations, Freight Analysis Framework, version 3.1, 2010.

drought, and ice). In 2011, nearly 795,928 vessels passed through Federal and state locks. Of that total, about 37 percent experienced delays that averaged 1 hour and 29 minutes in 2011 for tows, compared to 1 hour and 10 minutes in 2005 [USACE 2012]. More than 50 percent of locks are over 50 years old, and many are too small for today's larger vessels. Because of their age, older locks are more susceptible to closure for maintenance and repairs [USACE 2009].

Transportation Safety

The rates and actual numbers of both injuries and fatalities in the transportation system have declined in recent decades. Transportation fatalities in 2011 were down about 22.5 percent from 2000 and 27.4 percent from 1990 (table 5-3). In 2011, the 2.3 million injuries were 30.9 percent less than in 2000. In contrast, the number of injuries in 2000 was down only slightly more than 1 percent from

1990 (table 5-4). These declines in the actual number of fatalities and injuries were made despite U.S. Census numbers that show a 24.9 percent increase in the U.S. population—from 249 million in 1990 to nearly 312 million in 2011 [USDOT RITA BTS 2013]. The majority of transportation fatalities and injuries take place on the Nation's highways, which carry most of the passenger and freight traffic in the United States. In 2011, 32,367 of the 34,387 transportation fatalities were highway related, accounting for 93.9 percent. Over 98.3 percent of transportation injuries occurred on the Nation's roads, accounting for 2.2 million out of the overall 2.3 million. That means that even though 2011 was the safest year since 1949 on the highways in terms of the number and rate of traffic fatalities [USDOT NHTSA 2011a], 89 people per day died and over 6,074 per day were injured on the highways. Transportation, including highways and the other modes, accounts for about one-third of the accidental deaths in the United States and is the leading cause of death for people between the ages of 5 and 24 [USHHS CDC 2012].

Fatalities

In 2011, 32,367 people died in highway motor vehicle crashes, including pedestrians and bystanders struck down by vehicles. The death toll in 2011 was 11,143 fewer than in 2005 [USDOT NHTSA NCSA]. Some of the 25.6 percent decline in fatalities may be due to fewer vehicle-miles of travel (VMT), which

TABLE 5-3 Transportation Fatalities by Mode: 1990, 2000, and 2005–2011

	1990	2000	2005	2006	2007	2008	2009	2010	2011
Total, all modes	**47,379**	**44,376**	**45,645**	**45,018**	**43,314**	**39,504**	**35,921**	**34,980**	**34,388**
Air[a]									
Large U.S. air carrier	39	92	22	50	1	3	52	2	0
Commuter air carrier	6	5	0	2	0	0	0	0	0
On-demand air taxi	51	71	18	16	43	69	17	17	41
General aviation	770	596	563	706	496	495	479	454	444
Highway[b]	44,599	41,945	43,510	42,708	41,259	37,423	33,883	32,999	32,367
Pipeline, gas and hazardous liquid	9	38	14	21	15	8	13	22	14
Railroad[c]	729	631	626	636	624	604	535	600	570
Transit[d]	125	110	57	40	65	75	103	121	132
Waterborne									
Vessel-related, commercial ship	85	53	78	73	67	51	50	41	28
Nonvessel-related, commercial ship[e]	101	134	60	56	59	67	53	52	34
Recreational boating	865	701	697	710	685	709	736	672	758

[a]Aircraft and ground fatalities. [b]Motor vehicle occupant and nonoccupant fatalities, including public highway-rail grade crossing fatalities. [c]Train and commuter rail occupant and nonoccupant fatalities, excluding public highway-rail grade crossing fatalities involving motor vehicles. [d]All reportable fatalities for heavy rail, light rail, and automated guideway. [e]Fatalities unrelated to vessel accidents, e.g., individual falling overboard and drowning.

NOTES: Highway data for 2010 and 2011 are preliminary. General aviation, pipeline, and railroad data for 2010 are revised. Waterborne data for 2000 and 2010 are revised.

SOURCES: **Air**—National Transportation Safety Board. **Highway**—National Highway Traffic Safety Administration. **Railroad**—Federal Railroad Administration. **Transit**—Federal Transit Administration and personal communication. **Waterborne**—U.S. Coast Guard. **Recreational boating**—U.S. Coast Guard, Office of Boating Safety. **Pipeline**—Pipeline and Hazardous Materials Safety Administration as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, table 2-1, available at http://www.bts.gov/publications/national_transportation_statistics/ as of April 2013.

TABLE 5-4 Injured Persons by Transportation Mode: 1990, 2000, and 2005–2011

Mode	1990	2000	2005	2006	2007	2008	2009	2010	2011
Total	**3,269,465**	**3,217,117**	**2,716,556**	**2,593,866**	**2,510,227**	**2,366,519**	**2,235,309**	**2,259,482**	**2,237,029**
Air[a]									
Large U.S. air carrier	29	31	14	9	16	16	23	16	20
Commuter air carrier	11	7	0	1	0	2	1	2	0
On-demand air taxi	36	12	23	16	20	13	4	6	15
General aviation	409	309	267	264	255	258	273	254	327
Highway[b]	3,230,666	3,188,750	2,699,000	2,575,000	2,491,000	2,346,000	2,217,000	2,239,000	2,217,000
Pipeline, gas and hazardous liquid	76	81	48	36	50	57	64	109	60
Railroad[c]	22,957	10,614	8,675	7,896	8,826	8,223	7,434	7,655	7,510
Transit[d]	11,284	12,201	4,434	5,399	5,638	8,003	6,579	8,573	8,230
Waterborne									
Vessel-related, commercial ship	175	150	140	177	190	152	196	172	105
Nonvessel-related, commercial ship[e]	U	607	504	594	559	464	377	542	654
Recreational boating	3,822	4,355	3,451	4,474	3,673	3,331	3,358	3,153	3,108

[a]Serious injuries as defined by the Federal Aviation Administration only. [b]Motor vehicle occupant and nonoccupant fatalities, including public highway-rail grade crossing fatalities. [c]Train and commuter rail occupant and nonoccupant fatalities, excluding public highway-rail grade crossing fatalities involving motor vehicles. [d]All reportable fatalities for heavy rail, light rail, and automated guideway. The definition of an injury in the National Transit Database was revised in 2002. Only incidents involving medical treatment away from the scene are now reportable. Previously, any reported injury was reported. Includes commuter rail. [e]Injuries unrelated to vessel operations.

KEY: U = unavailable

NOTE: Reporting criteria and/or estimation methods for injuries are not standardized across modes. Railroad and transit data are revised.

SOURCES: **Air**—National Transportation Safety Board. **Highway**—National Highway Traffic Safety Administration. **Railroad**—Federal Railroad Administration. **Transit**—Federal Transit Administration and personal communication. **Waterborne**—U.S. Coast Guard. **Recreational boating**—U.S. Coast Guard, Office of Boating Safety. **Pipeline**—Pipeline and Hazardous Materials Safety Administration as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, table 2-2, available at http://www.bts.gov/publications/national_transportation_statistics/ as of April 2013.

can be attributed, in part, to the 2007 economic downturn and rising fuel prices.[2] However, the drop in the rate of fatalities outpaced the drop in the rate of VMT. As a result, the fatality rate per VMT, a key indicator used to measure the risk of death on the road, was the lowest on record. In 2011, there were 1.10 fatalities for every 100 million VMT on our highways. This compares to 1.46 fatalities per 100 million VMT in 2005 [USDOT NHTSA 2012].

The recent declines in fatality and injury rates are part of a longer trend. Over approximately the last four decades, the number of highway vehicle fatalities has declined by about one-third despite much higher volumes of highway traffic. There were over 50,000 motor vehicle fatalities annually between 1966 and 1973. In 1970, more than 4 fatalities per hundred million miles of vehicle travel were reported—nearly four times the 2010 rate. By 1990, the fatality rate had fallen by half, but this was still twice the 2011 rate [USDOT NHTSA 1994, table 2; and 2009, table 2].

[2] A National Highway Traffic Safety Administration analysis of the 2008 fatality decline found appreciable declines during prior recessions as well. The study concluded that the 2008 decline in fatalities resulted from large decreases in crashes involving young drivers, multiple-vehicle crashes, and crashes occurring over weekends. Areas where unemployment rates rose the fastest also had greater reductions in fatalities. U.S. Department of Transportation, National Highway Traffic Safety Administration, An Analysis of the Significant Decline in Motor Vehicle Traffic Crashes in 2008 (DOT HS 811 346), June 2010, p. 24.

TABLE 5-5 Distribution of Transportation Fatalities: 2011

Category	Number of fatalities	Percent of all transportation fatalities
Total, all modes[a]	**34,388**	**100.00**
Passenger car occupants	11,981	34.84
Light-truck occupants	9,272	26.96
Motorcyclists	4,612	13.41
Pedestrians struck by motor vehicles	4,432	12.89
Recreational boating	758	2.20
Pedalcyclists struck by motor vehicles	677	1.97
Large-truck occupants	635	1.85
Other and unknown motor vehicle occupants	506	1.47
General aviation	444	1.29
Railroad trespassers[b] (excluding highway-rail grade crossings)	412	1.20
Other nonoccupants, involving motor vehicles[c]	198	0.58
Heavy rail transit	96	0.28
Highway-rail grade crossings, not involving motor vehicles[d]	94	0.27
Bus occupants (school, intercity, and transit)	54	0.16
Air taxi	41	0.12
Light rail transit	36	0.10
Waterborne transportation (nonvessel-related)	34	0.10
Private highway-rail grade crossings, involving motor vehicles	29	0.08
Waterborne transportation (vessel-related)	28	0.08
Railroad-related, not otherwise specified (excluding highway-rail grade crossings)	17	0.05
Railroad employees, contractors, and volunteers on duty (excluding highway-rail grade crossings)	16	0.05
Gas distribution pipelines	13	0.04
Passengers on railroad trains (excluding highway-rail grade crossings)	2	0.01
Hazardous liquid pipelines	1	0.00
Air carriers	0	0.00
Commuter air	0	0.00
Gas transmission pipelines	0	0.00
Automated guideway	0	0.00
Other counts, redundant with above		
Large-truck occupants and nonoccupants[e]	3,757	
Public highway-rail grade crossing fatalities involving motor vehicles[f]	148	
Commuter rail[g]	57	

[a]Includes occupant and nonoccupant fatalities, unless otherwise specified. [b]Includes fatalities outside trains. [c]Includes nonoccupant fatalities, except pedalcyclists and pedestrians. [d]Fatalities at public highway-rail grade crossings involving motor vehicles are included under motor vehicle categories. [e]Fatalities resulting from crashes involving at least one large truck. [f]Public highway-rail grade crossing fatalities are included in motor vehicle categories. [g]Commuter rail fatalities are included in rail categories.

NOTES: Highway, railroad, transit, and waterborne data are preliminary.

SOURCES: **Air**—National Transportation Safety Board. **Highway**—National Highway Traffic Safety Administration. **Railroad**—Federal Railroad Administration. **Transit**—Federal Transit Administration and personal communication. **Waterborne**—U.S. Coast Guard. **Recreational boating**—U.S. Coast Guard, Office of Boating Safety. **Pipeline**—Pipeline and Hazardous Materials Safety Administration as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, table 2-4, available at http://www.bts.gov/publications/national_transportation_statistics/ as of April 2013.

Table 5-5 shows the distribution of fatalities among different users of the U.S. transportation system in 2011. Figure 5-3 shows how the fatality risk has changed since 1985 for selected modes of transportation. As shown in table 5-5, 94.1 percent of all transportation fatalities were due to highway motor vehicle crashes in 2011. Passenger car and light-truck occupants accounted for 61.8 percent of all the transportation fatalities, while motorcycles accounted for another 13.4 percent. In contrast to other highway users, both the share and number of motorcycle fatalities have gone up over the last decade during a time of significant increase in motorcycle use [USDOT RITA BTS 2012, table 2-4]. Motorcycle fatalities have increased 59.2 percent from 2000 to 2011. However, motorcycle fatalities per VMT have declined in recent years after peaking in 2005. Pedestrians, bicyclists, and bystanders struck by motor vehicles accounted for nearly 15.5 percent of transportation fatalities.

Even though crashes involving large trucks claimed 3,757 lives, only 635 of transportation fatalities were occupants of those trucks, with most of the remaining fatalities occurring among occupants of other vehicle types or bystanders (table 5-5). Accordingly, large-truck occupants accounted for about 1.9 percent of transportation fatalities.

Of all transportation related fatalities, 6.1 percent occur on modes other than highways. The 758 recreational boating and the 444 general aviation fatalities account for most of the other transportation fatalities in 2011. In addition, 505 people died trespassing on railroad tracks or highway-rail crossings, not involving motor vehicles. No commercial airliner crash occurred in 2011, although 41 people died in air taxi crashes (table 5-5).

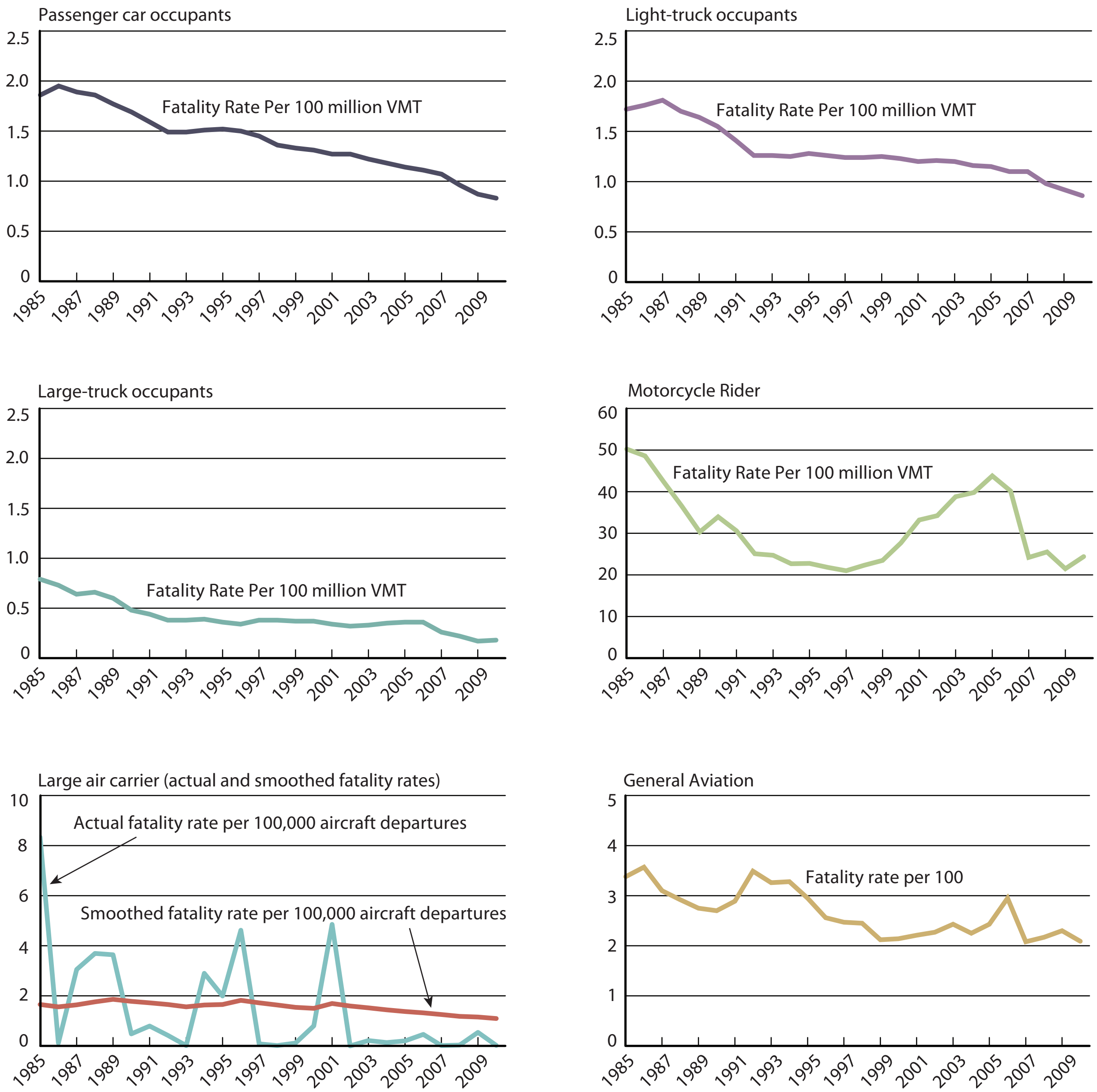
Unlike the large and commuter U.S. air carriers that had no fatal accidents in scheduled passenger service in 2011, general aviation has accounted for at least 400 fatalities annually over the last 10 years. The general aviation fleet consists of 223,000 aircraft of various types. The 444 fatalities in general aviation accidents for 2011 is about one-third of the 1970 toll of 1,310 deaths when the general aviation fleet consisted of 131,743 aircraft [USDOT RITA BTS 2012, table 1-11].

Injuries

An estimated 2.2 million people were injured in highway motor vehicle crashes in 2011. The percentage of injuries in highway crashes reported to be incapacitating has ranged from just under 10 percent to 12 percent in recent years, accounting for 175,000 injuries in 2010 (7.9 percent).[3] Highway crashes represent over 99.1 percent of transportation injuries, with all other modes combined accounting for about 20,029 people injured in 2011. As with fatalities, the number of injuries from transportation crashes and accidents has gone down over time. In 1990, there were an estimated 3.2 million injuries related to highway vehicle crashes

[3] USDOT NHTSA, *Traffic Safety Facts* (Final Editions), 1997 (table 53); 2008 (table 54), 2009 (table 54), 2010 (table 54), available at www.nhtsa.gov as of January 2013.

FIGURE 5-3 Fatality Rates for Selected Modes: 1985–2010



NOTES: Not all graph scales are comparable. Air carrier data were smoothed using an exponential smoothing model with a weight of 0.945 to reduce the year-to-year fluctuations. Air carrier fatalities resulting from the Sept. 11, 2001, terrorist attacks include only onboard fatalities. Highway fatality rates for 1999 through 2008 are revised.

SOURCES: **Passenger car occupants, Light-truck occupants, Large-truck occupants, and Motorcycle riders**—U.S. Department of Transportation, National Highway Traffic Safety Administration, National Center for Statistics and Analysis, *Traffic Safety Facts (Annual Issues)*, available at http://www-nrd.nhtsa.dot.gov as of January 2013. **Large air carriers and General aviation**—National Transportation Safety Board, *Annual Review of Aircraft Accident Data—U.S. Air Carrier Operations and U.S. General Aviation*, available at http://www.ntsb.gov/ as of October 2011 as reported in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, tables 2-9 and 2-14, available at http://www.rita.dot.gov/bts/publications as of January 2013.

and about 38,799 injuries for the other modes (table 5-4)—about a million more injured people than in 2011.[4]

The Centers for Disease Control determined that the medical costs and productivity losses arising from injuries incurred in motor vehicle crashes eclipsed $99 billion in 2005. Motorcyclists accounted for 6 percent of the deaths but 12 percent of the costs, and pedestrians accounted for 5 percent of the injuries and 10 percent of the costs [USHHS CDC 2010]. The $99 billion in injury-related costs may understate the full economic impact of these crashes because it does not allow for non-quantifiable costs, such as future loss of earning power for those injured, costs for treatment of ongoing residual physical or emotional pain, or the long term costs for treatment of resulting disabilities.

Total Crashes and Accidents

Highway crashes account for the vast majority of transportation accidents [USDOT RITA BTS 2012, table 2-3]. However, the total number of highway crashes has decreased by about 16.3 percent over the past two decades. Air, railroad, and transit all reported significant declines during this time. Waterborne accidents decreased by 11.2 percent. Only pipeline, mostly hazardous material, reported an increase in the number of accidents.

[4] Due to a reporting change, the 1990 number for transit counted more kinds of injury circumstances than the 2010 number.

Hazardous Material Transportation

Transporting hazardous materials requires special precautions, handling, and reporting, with separate safety regulatory systems in place for pipelines and vehicles. These special requirements recognize that incidents involving the transportation of hazardous materials can affect the environment in addition to creating the potential for risk of injury and death to persons. Table 5-6 shows 15,614 hazardous materials incidents in 2011. Of these, only 373 were related to highway and rail accidents, resulting in 13 fatalities; most incidents involve loading, unloading, package failure, and human error. In regard to personal safety, there were 13 fatalities arising from gas pipeline incidents, 12 fatalities related to hazardous materials accidents involving highways, and 1 fatality involving oil or hazardous liquid pipelines.

Occupant Protection Equipment

Improved occupant protection equipment and its use are a major contributor to reduced fatalities and injuries. The National Highway Traffic Safety Administration estimates that occupant protection devices, such as safety belts, air bags, and motorcycle helmets, saved the lives of 16,566 people on the highway in 2011 (table 5-7). While such devices are available for all vehicles, their success in improving safety depends on vehicle operators and passengers using them.

Safety belt use by occupants of cars, vans, and sport utility vehicles (SUVs) now averages about 86 percent. Only about 77 percent

TABLE 5-6 Hazardous Materials Transportation Incidents: 2005–2011

	2005	2006	2007	2008	2009	2010	2011
TOTAL Incidents	**16,649**	**20,978**	**19,917**	**17,593**	**15,445**	**15,385**	**15,614**
Highway incidents	**13,460**	**17,159**	**16,932**	**14,805**	**12,730**	**12,650**	**12,807**
Accident related	323	308	322	302	251	321	333
Injuries	178	192	160	153	153	152	129
Fatalities	24	6	9	6	11	8	12
Rail	**745**	**703**	**753**	**748**	**642**	**749**	**742**
Accident related	51	44	54	27	37	35	40
Injuries	693	25	57	63	38	13	20
Fatalities	10	0	0	0	1	0	1
Air	**1,654**	**2,406**	**1,556**	**1,278**	**1,356**	**1,293**	**1,400**
Accident related	9	7	7	8	2	2	2
Injuries	44	2	8	7	10	2	7
Fatalities	0	0	0	0	0	0	0
Water	**69**	**68**	**61**	**99**	**90**	**105**	**71**
Accident related	0	0	0	0	0	1	0
Injuries	0	15	3	0	0	2	8
Fatalities	0	0	0	3	0	0	0
Pipeline							
Liquid	**369**	**355**	**332**	**375**	**341**	**349**	**347**
Injuries	2	2	10	2	4	4	2
Fatalities	2	0	4	2	4	1	1
Natural gas transmission and gathering	**182**	**145**	**132**	**141**	**129**	**118**	**126**
Injuries	7	4	7	5	11	61	1
Fatalities	0	3	2	0	0	10	0
Natural gas distribution	**170**	**142**	**151**	**147**	**157**	**121**	**121**
Injuries	39	30	33	52	49	44	57
Fatalities	12	18	9	7	9	11	13

NOTES: *Accident related* excludes human errors, package failures, and unreported cases. *Water* data are for incidents involving packaged materials only and do not include incidents where the vessel is the container (e.g., a barge or oil tanker). In previous years, carriers were exclusively responsible for reporting hazardous materials release incidents. In 2005, PHMSA expanded the reporting requirements to include: reports by person(s) in physical possession of a hazardous material at the time an incident occurs during transport; reports on nonrelease incidents such as structural damage to cargo tanks specified for 1,000 gallons or more and undeclared shipments of hazardous materials. *Pipeline* data are derived from three unique data sets, and a comprehensive total for pipeline incidents is not applicable. As of March 2010, the secondary cause designations of incidents in these reports have been updated and improved. Please note that secondary cause category counts and distributions have changed as a result of these improvements and also as a result of preparations for new accident/incident reporting forms which became effective January 1, 2010.

SOURCES: **Highway, Rail, Air, and Water**: U.S. Department of Transportation (USDOT), Pipeline and Hazardous Materials Safety Administration (PHMSA), *Incident Statistics*, as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, National Transportation Statistics, table 2-6, available at http://www.bts.gov/publications/national_transportation_statistics/ as of January 25, 2013; **Pipeline**: USDOT, PHMSA, Office of Pipeline Safety, *Accident/Incident and Mileage Summary Stats*, available at http://primis.phmsa.dot.gov/comm/reports/safety/ as of January 2012.

TABLE 5-7 Estimated Lives Saved by Occupant Protection, Motorcycle Helmets, and Drinking Age Laws: 2005–2011

	2005	2006	2007	2008	2009	2010	2011
Safety belts[a]	15,688	15,458	15,223	13,312	12,763	12,582	11,949
Air bags	2,752	2,824	2,800	2,557	2,387	2,315	2,204
Motorcycle helmets	1,554	1,667	1,788	1,836	1,486	1,556	1,617
Age 21 minimum legal drinking age	882	888	831	716	626	552	533
Child restraints	424	427	388	286	307	303	263

[a] Represents all adults and children age 5 and older. Data are for passenger vehicles, which include cars, light trucks, vans, pickups, and utility vehicles. Excludes medium and heavy trucks.

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Lives Saved in 2011 by Restraint Use and Minimum Drinking Age Laws* (Washington DC: December 2012), available at http://www-nrd.nhtsa.dot.gov/Pubs/811702.pdf as of January 2013.

of pickup truck occupants wear safety belts. USDOT certified helmets offer some protection to motorcycle operators and riders in accidents and crashes, but only about two-thirds of people on motorcycles use helmets (table 5-8). At one time, most states required use of helmets by all riders, but the number of states that require all riders to wear helmets decreased from 26 in 1997 to 19 in 2012 [GHSA 2012].

Seventy percent of the 758 people who died in recreational boating accidents during 2011 drowned (table 5-5), and 84 percent of those who drowned were not wearing a life jacket [USDHS USCGS 2012, p. 6]. Boating safety classes are offered to boaters, but 65 percent have not taken one, according to a U.S. Coast Guard survey [USDHS USCG 2002].

Alcohol Use

There has been a 24.6 percent reduction in motor vehicle-related fatalities arising from drunk driving between 2005 and 2010 [USDOT NHTSA 2012]. However, the percentage of fatal crashes involving some presence of alcohol in the blood (either the driver or a person struck outside the vehicle) has remained in the 36.3 to 37.6 percent range between 2005 and 2010 and in the 31.1 to 31.8 percent range for blood alcohol levels of 0.08 percent and above (table 5-9).

Alcohol impairment is also a factor in many of the fatalities associated with recreational boating. These fatalities include not just operators of boats but also inebriated passengers falling into the water and drowning. The U.S. Coast Guard estimates that alcohol was a leading contributing factor in 16 percent of the 758 deaths in recreational boating accidents in 2010 [USDHS USCG 2012, p. 6].

Distracted Operating of Vehicles

The National Highway Traffic Safety Administration (NHTSA) estimates that 9.4 percent of the highway fatalities in 2011 involved drivers who were distracted by such activities as using a cell phone, texting, eating or drinking, using navigation systems or a map, or grooming themselves (table 5-10). As of December 2012, 39 states and the District of Columbia had laws banning texting while driving, and

TABLE 5-8 Safety Belt and Motorcycle Helmet Use: 2005-2012

Percent

	2005	2006	2007	2008	2009	2010	2011	2012
Overall Safety Belt Use	**82**	**81**	**82**	**83**	**84**	**85**	**84**	**86**
Drivers	83	82	83	84	85	86	84	87
Passengers	78	78	81	81	82	83	82	84
Passenger cars	**83**	**82**	**84**	**84**	**86**	**86**	**85**	**87**
Vans and sport utility vehicles	**85**	**84**	**86**	**86**	**87**	**88**	**87**	**89**
Pickup trucks	**73**	**74**	**72**	**74**	**74**	**75**	**74**	**77**
Motorcycle Helmet Use[b]	**48**	**51**	**58**	**63**	**67**	**54**	**66**	**U**
Operators	56	57	59	64	69	55	70	U
Riders	29	33	56	54	55	51	64	U

[a] Seat belt use is as of the Fall each year except in 2005 (June). Motorcycle helmet use is as of the Fall each year except in 2005 (June). [b] Only those operators and riders wearing safety helmets that met U.S. Department of Transportation (DOT) standards are counted. Those safety helmets that do not meet DOT standards are treated as if the operator/rider were not wearing a helmet.

KEY: U = data are unavailable.

NOTE: Occupants of commercial and emergency vehicles are excluded.

SOURCES: U.S. Department of Transportation, National Highway Traffic Safety Administration, Traffic Safety Facts: Research Notes, *Seat Belt Use in 2012—Overall Results* (Annual issues for specific year); and *Motorcycle Helmet Use--Overall Results* (Annual issues for specific year), available at http://www-nrd.nhtsa.dot.gov as of March 2012.

TABLE 5-9 Fatalities by Highest Blood Alcohol Concentration (BAC) in Highway Crashes: 2005–2010

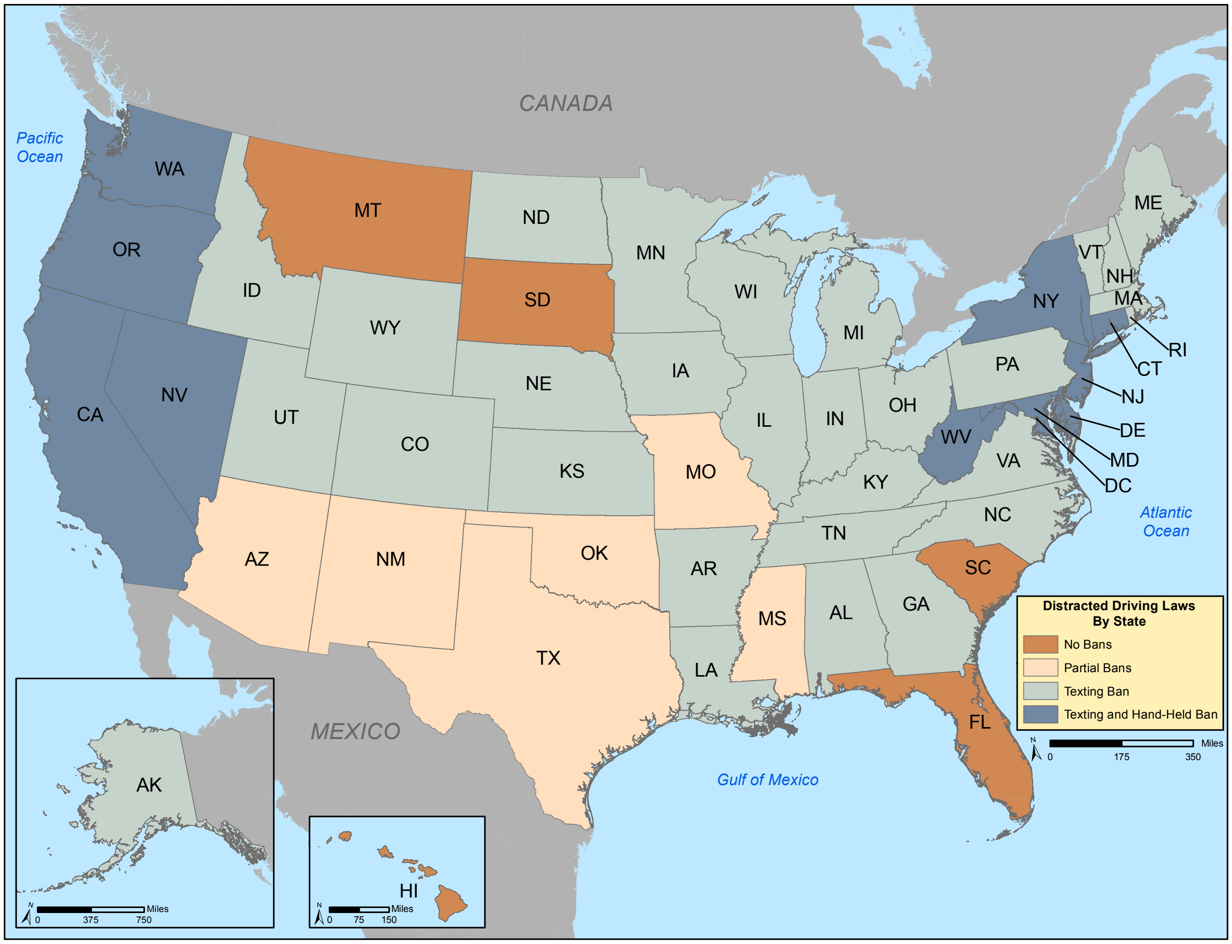
	2005	2006	2007	2008	2009	2010
Total fatalities	**43,510**	**42,708**	**41,259**	**37,423**	**33,883**	**32,885**
Fatalities in alcohol-related crashes (BAC = .01+)	**15,985**	**15,970**	**15,534**	**13,826**	**12,731**	**11,948**
Percent	36.7	37.4	37.6	36.9	37.6	36.3
BAC = 0.00						
Number	27,423	26,633	25,611	23,499	21,051	20,838
Percent	63.0	62.4	62.1	62.8	62.1	63.4
BAC = 0.01 - 0.07						
Number	2,404	2,479	2,494	2,115	1,972	1,720
Percent	5.5	5.8	6.0	5.7	5.8	5.2
BAC = 0.08+						
Number	13,582	13,491	13,041	11,711	10,759	10,228
Percent	31.2	31.6	31.6	31.3	31.8	31.1

KEY: BAC = blood alcohol concentration.

NOTES: Total fatalities include those in which there was no driver or motorcycle rider present. BAC values have been assigned by U.S. Department of Transportation, National Highway Traffic Safety Administration (NHTSA) when alcohol test results are unknown. *Alcohol-related crashes* pertain to the BAC of the driver and nonoccupants struck by motor vehicles. For some years, numbers for *Fatalities* in alcohol-related crashes (BAC = .01+) may not add to totals due to rounding.

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, National Center for Statistics and Analysis, *Traffic Safety Facts* (Washington, DC: Annual Issues), available at http://www-nrd.nhtsa.dot.gov/ as of February 2012, as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, National Transportation Statistics, table 2-26, available at http://www.rita.dot.gov/bts/publications as of January 2013.

FIGURE 5-4 Distracted Driving Laws on Mobile Devices by State: 2012



NOTE: District of Columbia has a Texting and Hand-Held Ban, Guam has a Texting Ban and the Virgin Islands have a Hand-Held Ban. Partial bans refer to States that have laws prohibiting certain groups of drivers from using a hand-held device or texting behind the wheel. Often, these bans are directed towards novice or bus drivers. With the exception of Michigan, New Hampshire, and Utah, all States with a texting ban also have a partial hand-held cell phone usage ban in place. New Mexico's hand-held ban is for drivers with in state vehicles and novice drivers.
For more information on State-specific laws and regulations, please refer to: http://www.distraction.gov/content/get-the-facts/state-laws.html.

SOURCES: U.S. Department of Transportation, National Highway Traffic Safety Administration, *State Laws* (December 19, 2012), Available at http://www.distraction.gov/content/get-the-facts/state-laws.html of December 2012.

10 states prohibit drivers' use of handheld cell phones (figure 5-4). No state had banned all cell phone use by drivers, although 33 states do so for novice drivers and 19 states for school bus drivers [GHSA 2013].

There is widespread awareness that distracted drivers are more likely to have accidents. While more than one-half of drivers queried in a 2010 survey said that their own driving performance was not adversely affected by using a hand held cell phone while driving, over 85 percent of these respondents said they would feel "very unsafe" riding as a passenger in a vehicle where the driver talked on a hand held device, texted, web surfed, or e-mailed while

TABLE 5-10 Distracted Driving and Motor Vehicle Crashes, Deaths and Injuries: 2005–2010

	Crashes			Fatalities			Injuries		
	Overall	Distraction	Percent	Overall	Distraction	Percent	Overall	Distraction	Percent
2005	39,252	4,026	10.3	43,510	4,472	10.3	2,699,000	604,000	22.4
2006	38,648	5,245	13.6	42,708	5,836	13.7	2,575,000	503,000	19.5
2007	37,435	5,329	14.2	41,259	5,917	14.3	2,491,000	448,000	18.0
2008	34,172	5,307	15.5	37,423	5,838	15.6	2,346,000	466,000	19.9
2009	30,797	4,898	15.9	33,808	5,474	16.2	2,217,000	448,000	20.2
2010	30,196	2,843	9.4	32,885	3,092	9.4	2,239,000	146,000	18.6

NOTES: Distracted driving is any activity that could divert a person's attention away from the primary task of driving. All *Distractions* endanger driver, passenger, and bystander safety. These types of *Distractions* include: texting; using a cell phone or smartphone; eating and drinking; talking to passengers; grooming; reading, including maps; using a navigation system; watching a video; adjusting a radio, CD player, or MP3 player. Injury data are estimated by U.S. Department of Transportation's National Highway Safety Administration.

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts - Distracted Driving*, tables 1 and 3, available at http://www.distraction.gov/research/PDF-Files/Distracted-Driving-2009.pdf as of February 2013.

driving. Large majorities supported bans on handheld cell phone use and texting while driving [USDOT NHTSA 2011b, p. v1]. In January 2013, BTS released a special report that shows result from the 2009 Omnibus Household Survey, which indicate that the public is open to a ban on hand-held cell phone use and texting.[5]

Fatigue

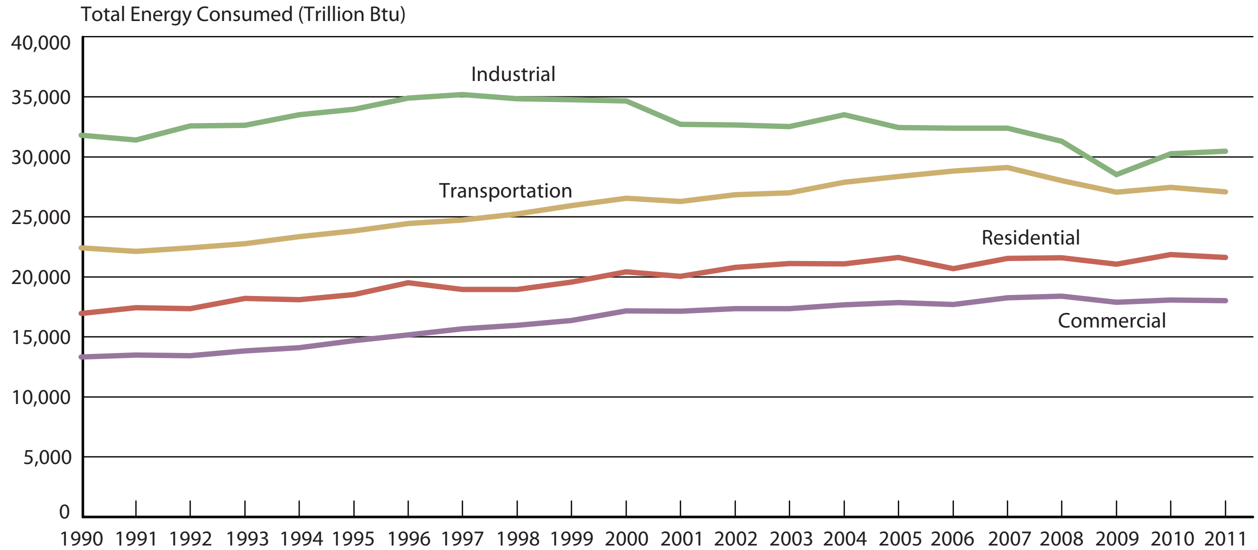
Fatigue is a key safety concern, affecting both vehicle operators, such as truck and bus drivers, pilots, and railroad engineers, as well as workers responsible for safe system operations, such as air traffic controllers. Many highway crashes involve drowsy or otherwise fatigued drivers. Among commercial vehicle drivers in crashes, an estimated 12.8 percent were considered fatigued [USDOT FMCSA 2007, table 2]. A 2010 survey found that 3.9 percent of all drivers admitted to having nodded off or fallen asleep at the wheel in the prior month [AAA Foundation, p. 4].

[5] The complete report is available at http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/special_report_january_2013.pdf.

Transportation Energy Use

Transportation system reliability affects energy consumption, as noted in the previous section, and energy consumption in turn affects the economy and the environment. The transportation sector of the U.S. economy is the second largest consumer of energy in the United States. In 2011, the transportation sector accounted for about 27.9 percent of total U.S. energy consumption (figure 5-5), compared to 31.4 percent for the industrial sector [USDOE EIA 2011a]. About 94 percent of the transportation sector's energy needs are supplied by petroleum, of which 44.8 percent of petroleum was imported in 2011 [USDOE EIA 2012a figure 3.3a]. The transportation industry accounts for about 70.2 percent of total U.S. petroleum consumption of 19.1 million barrels of oil per day (figure 5-6). The United States is

Figure 5-5 Energy Consumption by Sector: 1990–2011



SOURCE: U.S. Energy Information Administration, *Monthly Energy Review (July 2012)*, available at http://www.eia.gov/energy/data/monthly/index.cfm#petroleum as of July 2012.

the world's largest oil consumer [USDOE EIA 2011b].

Between 1990, when transportation accounted for 64 percent of U.S. petroleum consumption, [USDOE EIA 2011a] and 2010, transportation petroleum use increased by about 24 percent. In comparison, the commercial and residential sectors reduced petroleum consumption by 24 percent and 2 percent, respectively; while industrial petroleum consumption increased by only 2 percent over the 1990–2010 timeframe [USDOE EIA 2011a, tables 5.13a-d]. Other transportation energy sources include natural gas in a gaseous state that powers pipeline compressors, liquefied natural gas for some vehicles, electricity for transit rail and oil pipelines, and alcohol for blending with gasoline.

Energy Consumption by Mode

The highway mode accounted for more than 84.2 percent of total transportation energy consumption in 2010. Cars and other light-duty vehicles, such as pickup trucks, SUVs, and minivans, accounted for 60.9 percent of the sector's energy use in 2010, while single-unit/combination trucks and buses accounted for 23.3 percent (table 5-11). Between 2007 and 2010, all highway modes registered a decline in energy consumption per mile, but single-unit trucks reported the biggest percentage decrease (7.6 percent).[6] In addition to improvements in new vehicle efficiency in terms of miles per gallon, the drop in energy consumption for the

[6] Light-duty vehicle fuel efficiency data for 2007 through 2010 are based on a new Federal Highway Administration methodology and are not comparable to previous years.

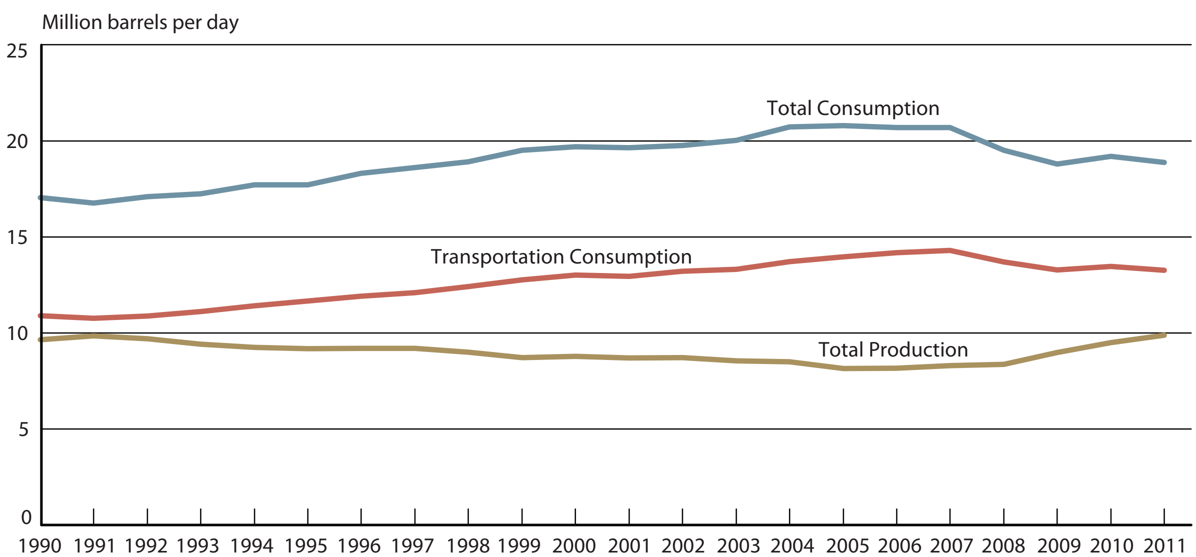
highway mode can also be attributed in part to a 2.1 percent decline in vehicle-miles driven, the economic downturn, and rising fuel prices.

Among nonhighway modes, air transportation is the biggest energy user, accounting for approximately 6.8 percent of transportation energy use, followed by water, pipeline, and rail. From 2007 to 2010, the air carriers reduced their energy consumption by 14.9 percent, while water and rail reduced their energy use by 29.6 and 14.0 percent, respectively. Over the same period, transit and natural gas pipelines increased energy use. Natural gas pipelines, which used about 2.7 percent of the transportation sector energy, are the only mode that does not depend on petroleum for fuel. Natural gas pipelines use natural gas to fuel compressors, and oil pipelines use electric pumps to maintain flow. Oil pipeline pumping stations may use fuel oil to generate electricity for their own use.

Vehicle Efficiency

Energy consumption is affected by vehicle fuel efficiency. During the last 20 years, the average fuel efficiency of the total U.S. car and light-truck fleet improved very little while new vehicle efficiency increased nominally. The fuel efficiency of new cars rose by 14.1 percent, from 31.2 miles per gallon (mpg) in 2007 to 35.6 mpg in 2012 (table 5-12). New imported cars were more fuel efficient than domestic brands (table 5-12). During the same period, new light truck mpg increased by 8.2 percent, from 23.1 mpg to 25.0 mpg. Light truck is a category that includes vehicles such as pickup trucks, minivans, and SUVs.

FIGURE 5-6 U.S. Petroleum Production and Consumption: 1990–2011



NOTE: 2011 is preliminary. 2010 and 2009 are revised.

SOURCE: U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2011* (Washington: DC: September 2012), tables 5.13a, available at http://www.eia.gov/totalenergy/data/annual/pdf/aer.pdf as of March 2012.

TABLE 5-11 Energy Consumption by Mode of Transportation: 1990, 2000, 2007–2010

Trillion Btu, domestic activities only

	1990	2000	2007	2008	2009	2010
Air						
Jet Fuel						
Certificated carriers	1,649	1,877	1,755	1,683	1,505	1,493
General aviation	90	131	201	230	195	193
Aviation gasoline						
General aviation	42	40	33	30	27	26
Highway						
Gasoline, diesel and other fuels						
Light duty vehicle, short wheel base, and motorcycle	8,720	9,159	11,256	10,760	10,767	10,833
Light duty vehicle, long wheel base	4,451	6,617	4,614	4,366	4,464	4,517
Single-unit truck	1,159	1,195	2,039	2,143	2,032	1,884
Combination truck	2,238	3,208	3,863	3,820	3,506	3,736
Bus	124	139	253	257	248	240
Transit						
Electricity	17	18	21	22	16	22
Motor fuel						
Diesel and biodiesel	90	82	74	74	91	81
Gasoline and other nondiesel fuels	4	3	4	4	13	13
Compressed natural gas	U	6	15	16	20	18
Rail, Class I (in freight service)						
Distillate / diesel fuel	432	513	563	539	443	485
Amtrak						
Electricity	1	2	2	2	2	2
Distillate / diesel fuel	11	13	9	9	9	9
Water						
Residual fuel oil	947	960	947	758	680	630
Distillate / diesel fuel oil	286	284	267	165	176	186
Gasoline	163	141	153	142	141	146
Pipeline						
Natural gas	680	662	641	668	691	690

KEY: Btu = British thermal unit, U = data are unavailable.

NOTES: *Certificated carriers* are domestic operations only. *General aviation* includes fuel used in air taxi operations, but not commuter operations. 2010 *General aviation* data are estimated.

Highway data for 2007-09 were calculated using a new methodology developed by FHWA. Data for these years are based on new categories and are not comparable to previous years. The new category *Light duty vehicle, short wheel base* includes passenger cars, light trucks, vans and sport utility vehicles with a wheelbase equal to or less than 121 inches. The new category *Light duty vehicle, long wheel base* includes large passenger cars, vans, pickup trucks, and sport/utility vehicles with wheelbases larger than 121 inches.

The following conversion rates were used:

Jet fuel = 135,000 Btu/gallon

Aviation gasoline = 120,200 Btu/gallon

Compressed natural gas = 138,700 Btu/gallon

Distillate fuel = 138,700 Btu/gallon

Automotive gasoline = 125,000 Btu/gallon

Residual fuel oil = 149,700 Btu/gallon

Diesel motor fuel = 138,700 Btu/gallon

Natural gas = 1,031 Btu/ft3

Electricity 1kWh = 3,412 Btu, negating electrical system losses. To include approximate electrical system losses, multiply this conversion factor by 3.

SOURCES: **Air**: Federal Aviation Administration; **Highway**: Federal Highway Administration; **Transit**: American Public Transportation Association; **Rail**: Association of American Railroads; **Amtrak**: National Railroad Passenger Corporation (Amtrak), Energy Management Department; **Water**: U.S. Department of Energy, Energy Information Administration and U.S. Department of Transportation, Federal Highway Administration; **Pipeline**: U. S. Department of Energy as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, table 4-6, available at http://www.rita.dot.gov/bts/publications as of January 2013.

Light truck sales nearly doubled between the 1990 and 2000 [USDOT RITA BTS 2012a]. However, after peaking at 52 percent in 2004, the light truck share of the market has declined to about 40 percent [USEPA 2011, table 1 and figure 1]. Because new passenger cars are 42.2 percent more efficient in terms of miles per gallon (35.6 mpg for new cars compared to 25.0 mpg for light trucks), an increase in the passenger car share of the market results in improved overall fuel efficiency simply because the more efficient vehicle represent a larger share of passenger cars and light trucks. Ongoing improvements in fuel efficiency for both segments of the market can be tracked to the Corporate Average Fuel Economy (CAFE)[7] standard, established by Congress in 1995 to improve vehicle efficiency. The 27.5 mpg standard for cars was unchanged until new laws were enacted in December 2007, beginning with model year 2011.[8] These standards established a fuel economy standard of

[7] CAFE is the sales weighted average fuel economy (expressed in mpg) of a manufacturer's fleet of cars or light trucks with a gross vehicle weight rating of 8,500 pounds or less, and manufactured for sale in the United States for any given year. *The Energy Policy Conservation Act of 1975* (Public Law 94-163) established the first CAFE standards in response to the 1973-1974 Arab oil embargo.

[8] *The Energy Independence and Security Act of 2007* (Public Law 110-140).

TABLE 5-12 Average Fuel Efficiency of U.S. Passenger Cars and Light Trucks: 1990, 2000, and 2005–2012

Miles per gallon

	Average U.S. passenger car fuel efficiency (calendar year)		New vehicle fuel efficiency (model year)				CAFE standards (model year)	
	Light duty vehicle, short wheel base	Light duty vehicle, long wheel base	Passenger car	Domestic passenger car	Imported passenger car	Light truck (<8,500 lbs GVWR)	Passenger car	Light truck
1990	20.3	16.1	24.3	26.9	29.9	20.8	27.5	20.2
2000	21.9	17.4	28.5	28.7	28.3	21.3	27.5	20.7
2005	22.1	17.7	30.3	30.5	29.9	22.1	27.5	21.0
2006	22.5	17.8	30.1	30.3	29.7	22.5	27.5	21.6
2007	22.9	17.1	31.2	30.6	32.2	23.1	27.5	22.2
2008	23.7	17.3	31.5	31.2	31.8	23.6	27.5	22.5
2009	23.5	17.3	32.9	32.1	33.8	24.8	27.5	23.1
2010	23.5	17.2	33.9	33.1	35.2	25.2	27.5	23.5
2011	U	U	33.8	32.5	35.3	24.5	30.2	24.2
2012	U	U	35.6	34.4	37.5	25.0	32.8	25.2

KEY: CAFE = Corporate Average Fuel Economy; GVWR = Gross vehicle weight rating; U = data are unavailable.

NOTES: *New vehicle fuel efficiency* and *CAFE standards* assume 55% city and 45% highway-miles. The fuel efficiency figures for light duty vehicles represent the sales-weighted harmonic average of the combined passenger car and light truck fuel economies. Beginning with model year 2008, *Light truck* manufacturers have the option to comply with the unreformed standard values or the new reformed standard values based upon each manufacturers unique vehicle fleet characteristics. In model years 2008-2010, the values shown for *CAFE standards* for *Light truck* are the standard values applicable under the existing "unreformed" CAFE program.

Average U.S. passenger car fuel efficiency (calendar year) data for 2007-09 are based on a new FHWA methodology and are not comparable to previous years in this table. The vehicle categories also only apply to 2007-09; *Light duty vehicle, short wheel base* replaces *Passenger car* and *Lighty duty vehicle, long wheel base* replaces *Other 2-axle 4-tire vehicle* for previous years.

SOURCES: **Average U.S. passenger car fuel efficiency**: Federal Highway Administration; **New vehicle fuel efficiency** (based on model year production) and **CAFE standards**: National Highway Traffic Safety Administration as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, table 4-23, available at http://www.rita.dot.gov/bts/publications as of January 2013.

35 mpg by 2020 for all passenger cars and light trucks. Newly proposed CAFE standards are projected to require an average combined fleet average of 40.1 mpg in 2021 and 49.6 mpg in 2025 [USDOT NHTSA 2011].

Alternative Vehicles and Fuels

Initially spurred by the *Energy Policy Act of 1992* (Public Law 102-486) and the *Clean Air Act Amendments of 1990* (Public Law 101-549) and more recently by higher fuel prices, the use of alternative and replacement fuels and the number of alternative-fuel vehicles has risen. Alternative fuels include liquefied petroleum gas, compressed natural gas, liquefied natural gas, E85[9], biodiesel, and hydrogen as shown in table 5-13. Between 2000 and 2010, alternative fuel use, including biodiesel, nearly doubled from a yearly total of 332 million gallons to 693 million gallons (table 5-13). Even so, alternative and replacement fuels displace a small share of total gasoline consumption. In 2010, the United States consumed about 138 billion gallons/year, or 378 million gallons/day of gasoline [USDOE EIA 2012b]. Thus at the 2010 level of use, total annual alternative/replacement fuel use would replace about 2 days of total U.S. gasoline consumption.

[9] A fuel mixture containing 85 percent ethanol and gasoline or other hydrocarbon.

TABLE 5-13 Estimated Alternative and Replacement Fuels Consumption: 1995, 2000, 2007–2010

Thousand gasoline-equivalent gallons

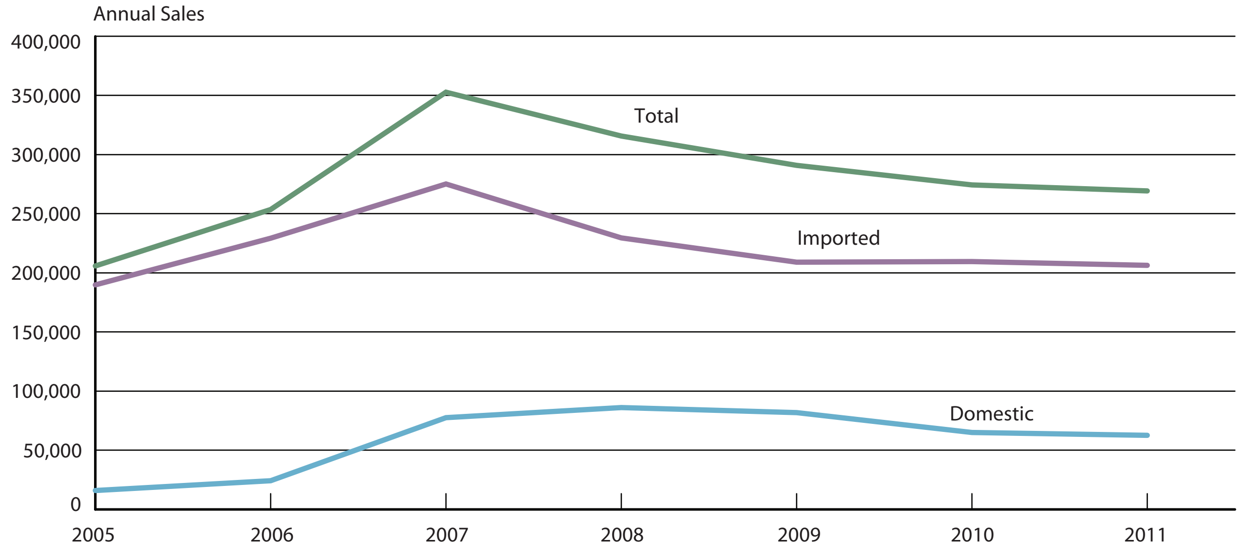
	1995	2000	2007	2008	2009	2010
Alternative Fuel						
Liquefied petroleum gas	223,178	213,012	152,360	147,784	129,631	126,354
Compressed natural gas	35,865	88,478	178,565	189,358	199,513	210,007
Liquefied natural gas	2,821	7,423	24,594	25,554	25,652	26,072
E85[a]	195	12,388	54,091	62,464	71,213	90,323
Electricity[b]	663	3,058	5,037	5,050	4,956	4,847
Hydrogen	0	0	66	117	140	152
Biodiesel	NA	6,828	367,764	324,329	325,102	235,188
Other[c]	5,398	627	64	2	2	0
Subtotal	**NA**	**331,814**	**782,479**	**754,658**	**756,209**	**692,943**
Replacment Fuel						
MTBE[d]	2,693,407	3,298,803	0	0	0	0
Ethanol in gasohol[e]	934,615	1,114,313	4,694,304	6,442,781	7,343,133	8,527,431
Total	**3,906,142**	**4,744,930**	**5,476,783**	**7,197,439**	**8,099,342**	**9,220,374**

KEY: NA = not available.

[a] Remaining portion is motor gasoline. Data include motor gasoline portion of fuel. [b] Excludes gasoline-electric hybrids. [c] Includes methanol, 85 percent (M85); methanol, neat (M100); ethanol, 95 percent (E95); and other fuels, such as a fuel designated by the Secretary of Energy as an alternative fuel. [d] Methyl Tertiary Butyl Ether includes small amount of other ethers, primarily tert-Amyl methyl ether and ethyl tert-butyl ether. [e] Data do not include motor gasoline portion of the fuel.

SOURCE: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 2011 (September 2012) table 10.5, available at http://www.eia.gov/totalenergy/data/annual/pdf/sec10_15.pdf as of January 2013.

FIGURE 5-7 U.S. Hybrid Vehicle Sales: 2005–2011



SOURCE: Ward's Automotive Group, WardsAuto.com, personal communication, January 2012, as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, National Transportation Statistics, table 1-19, available at http://www.rita.dot.gov/bts/publications as of April 2012.

The use of fuel additives or replacements such as alcohols and ethers (oxygenates) far exceeds alternative fuels usage. Oxygenates are blended with gasoline to promote a more complete combustion of motor fuel, which reduces emissions. Between 1995 and 2009, oxygenate consumption doubled, from 3.6 billion gallons to 7.3 billion gallons [USDOE EIA 2011a, table 10.5].

Although not considered alternative-fueled vehicles as defined in the *Energy Policy Act* of 1992, hybrid vehicles have become very popular since the early 2000s as a replacement for traditional gasoline- and diesel-fueled vehicles. Powered by both gasoline/diesel and electric engines, hybrids provide more fuel economy, lower emissions, and fuel flexibility. Sales increased nearly 30-fold from 9,350 vehicles in 2000 to 269,000 in 2011. Escalating fuel prices and government support helped to increase hybrid vehicle sales over this period, but a combination of factors, including the economic recession; competition from fuel-efficient, gasoline-powered vehicles; and a drop in the number of vehicles manufactured has slowed the rate of hybrid sales in recent years, down 24 percent from their peak in 2007 (as shown in figure 5-7).

Environmental Impacts

As the U.S. transportation system moves people and goods, it impacts the environment. In addition to effects on the natural landscape and habitats, other unintended byproducts include air pollution, greenhouse gases, oil spills, and noise.

Air Pollutants

Air pollution from transportation has declined in recent decades, even though travel has increased. Figure 5-8 shows the estimated decline in most of the transportation emissions for six common air pollutants identified in the *Clean Air Act* and covered by EPA health-related standards. The six air pollutants include carbon monoxide (CO), nitrogen oxide (NO), volatile organic compounds (VOC), particulate matters (PM), sulfur dioxide (SO_2), and ammonia. Such pollutants can harm human health and the environment. Of the six, four (CO, VOC, PM, and SO_2) decreased by 50 percent or more despite an increase in vehicle use since 1990. Sulfur dioxide decreased by almost 100 percent. Ninety-five percent of U.S. automobiles are equipped with 3-way catalysts for pollution control, which may produce ammonia [NOAA ERSL, p. 5].

Greenhouse Gas Emissions

Transportation is the single largest sector generating greenhouse gas (GHG) emissions in the United States, accounting for about one-third of the U.S. total GHG arising from energy consumption in 2010. This is a result of the use of petroleum-based fuel for transportation, discussed in the previous section. While only about one-fourth of transportation GHG emissions are from the freight modes, their GHG emissions have been growing twice as quickly as GHG emissions from the passenger modes [USDOT FHWA 2011, p. 63].

Carbon dioxide (CO_2) emissions from transportation reached highs in 2005 and 2007, and then declined during the economic downturn. The highway sector accounts for over 85 percent of total CO_2 emissions from the U.S. transportation sector (table 5-14).

Fuel Spills

The USDOT Pipeline and Hazardous Materials Administration (PHMSA) publishes data on hazardous liquid pipeline spills (table 5-15). PHMSA reported 108,140 net barrels were

TABLE 5-14 Greenhouse Gas Emissions by Mode: 2005, 2007–2011
Millions of metric tons of CO2, domestic activities only

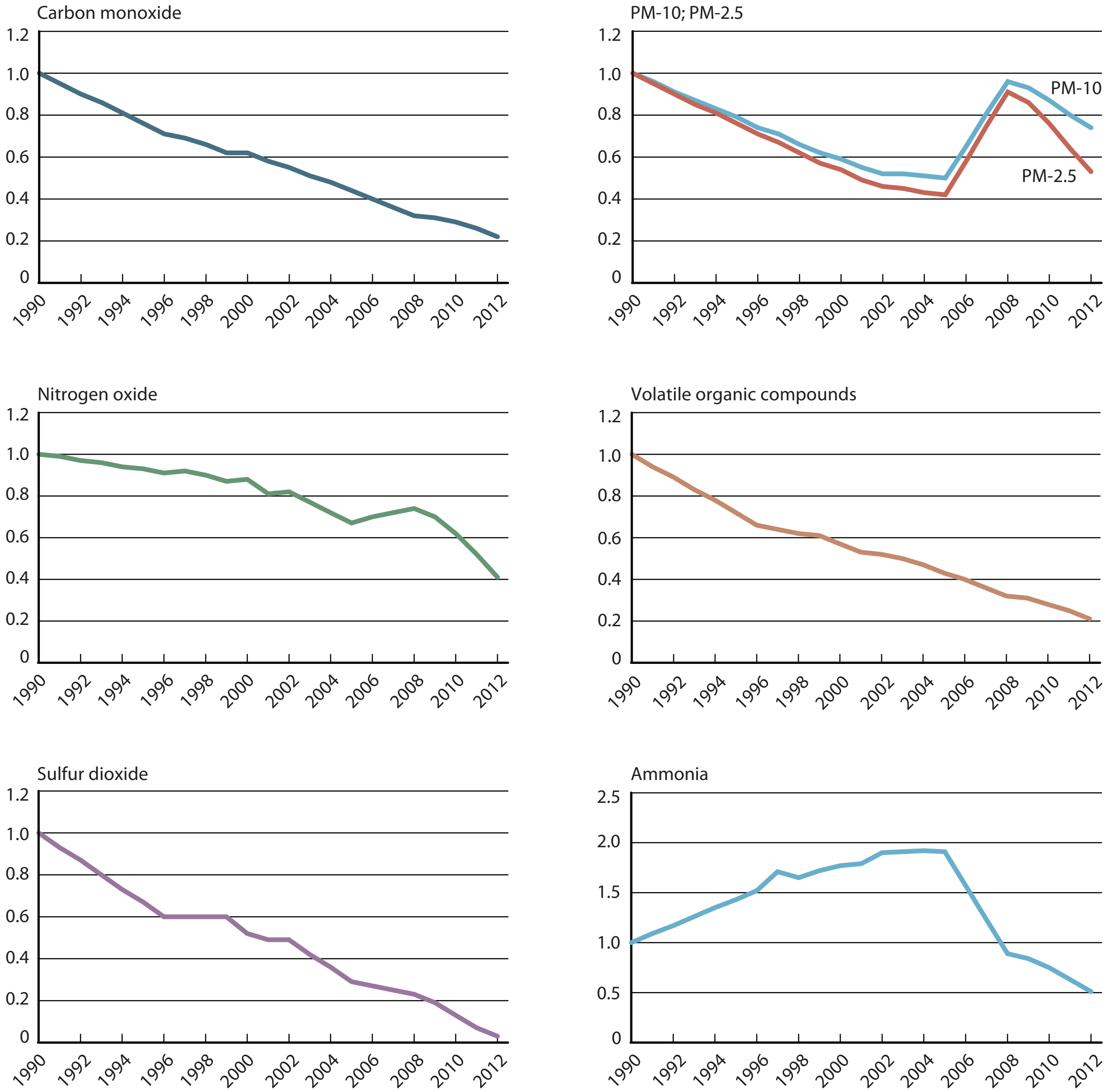
	Passenger cars	Light-duty trucks	Medium- and Heavy- trucks	Buses	Aircraft	Ships and boats	Rail	Other	Total, all modes
2005	662.3	505.9	396.0	11.8	172.1	44.5	50.3	44.0	1,886.9
2007	804.4	330.1	431.6	17.6	176.6	54.4	51.6	48.7	1,915.0
2008	769.3	312.8	413.9	17.0	165.8	36.6	47.9	49.5	1,812.8
2009	766.0	317.4	376.3	16.1	152.9	33.5	40.7	49.4	1,752.3
2010	763.0	318.2	390.2	15.9	145.0	36.7	43.5	50.2	1,762.7
2011	745.2	310.9	394.5	16.1	145.1	47.7	45.3	50.5	1,755.3

NOTES: *Other* greenhouse gas emissions are from motorcycles, pipelines, and lubricants. International bunker fuel emissions (not included in the total) result from the combustion of fuels purchased in the United States but used for international aviation and maritime transportation. *U.S. Total, all modes; Aircraft;* and *Ships and boats* include emissions data for only domestic activity only as do all other data shown. International emissions from bunker fuels purchased in the United States are not included. Alternative-fuel vehicle emissions are allocated to the specific vehicle types in which they were classified (i.e., *Passenger cars, Light-duty trucks, All other trucks,* and *Buses*).

SOURCE: U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks* (Washington, DC: Annual Issues), table 2-15, available at http://epa.gov/climatechange/emissions/usinventoryreport.html as of January 2013.

FIGURE 5-8 Index of Key Air Pollutant Emissions from U.S. Transportation: 1990–2012

Index: 1990 = 1.0



KEY: PM-10 = airborne particulates of less than 10 microns; PM-2.5 = airborne particulates of less than 2.5 microns.

NOTES: Not all graph scales are comparable. The indices are calculated using data on emissions from highway vehicles only. Particulate matters include PM without condensibles.

SOURCES: U.S. Environmental Protection Agency, Clearinghouse for Inventories and Emissions Factors, *1970 - 2012 Average annual emissions* (all criteria pollutants), available at http://www.epa.gov/ttn/chief/trends/index.html as of January 2013.

TABLE 5-15 Volume of Hazardous Liquid Pipeline Spills: 2005–2011

Year	Gross Barrels Spilled	Net Barrels Lost
2005	138,094	46,246
2006	137,693	53,905
2007	94,981	68,941
2008	102,076	69,510
2009	55,014	32,307
2010	174,931	123,420
2011	139,017	108,140

NOTE: *Net Barrels Lost* applies only to Liquid incidents and is the difference between *Gross Barrels Spilled* and barrels recovered.

SOURCE: U.S. Department of Transportation, Pipeline and Hazardous Material Safety Administration; *National All Pipeline Systems: All Reported Incidents Summary Statistics: 1992-2011*; available at http://primis.phmsa.dot.gov/comm/reports/safety/AllPSI.html as of January 2013.

recovered of the 139,017 gross barrels spilled in 2011. In addition, the U.S. Coast Guard estimates that oil spills from tankers and other sources discharged into U.S. waters were at a record low in 2009, with a nationwide total of 211,600 gallons of spilled in U.S. waters [USDHS USCG 2012].

Noise

According to an article published by the National Academy of Engineering, "Transportation noise can be annoying, disrupt sleep, interfere with communication, reduce property values, adversely impact health, and adversely affect academic performance [WAITZ 2007]." The article cites estimates from the Environmental Protection Agency that people in the United States exposed to average sound levels over 65 dB in 1981 included 16.3 million from highway traffic, 4.7 million from aircraft, and 2.5 million from rail traffic. The number of people exposed to aviation noise dropped to 500,000 with the introduction of quieter aircraft, and sound-mitigation efforts around airports have likely reduced the number further. More recent estimates for highways and rail are not available.

While noise barriers have reduced population exposure on major highways, increases in the volume, speed, and mix of traffic affect a wider range of locations. The Federal Highway Administration notes that highway traffic at 65 miles per hour sounds twice as loud as traffic at 30 miles per hour, 2,000 vehicles per hour sound twice as loud as 200 vehicles per hour, and 1 truck at 55 miles per hour sounds as loud as 28 cars at 55 miles per hour [USDOT FHWA 1980].

A current national noise exposure inventory across all modes of transportation does not exist in the United States. The "Noise Mapping England" website maintained by the Department of Environment, Food, and Rural Affair in the United Kingdom provides a capability that could further analysis of noise issues in the United States [UK DEFRA 2012].

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CHAPTER 6

The State of Transportation Statistics

Congress underscored the importance of statistical information for transportation investment decisions, policy initiatives, and other public actions when it established the Bureau of Transportation Statistics (BTS) and required BTS to assess the state of statistics in an annual report. The transportation community's current emphasis on performance measurement underscores the continuing importance of data for decisions two decades after the creation of BTS.

The diversity of information needed to support the wide range of transportation decisions makes the development of useful and timely transportation statistics a challenging task. Some of these decisions require data on transportation infrastructure, vehicles, and traffic flows. Other decisions require data on the human factors involved in transportation.

- We have extensive data on local passenger travel but limited data on long distance travel; conversely, we have extensive data on long distance freight movement but limited data on local freight movement.
- We have extensive data on the condition and performance of highways, bridges, airports, and waterway facilities, but little data on the condition of privately owned railroads and pipelines.
- We have extensive data on accidents and air emissions, but limited data on noise and other forms of environmental and community disruptions caused by transportation.
- We have information about transportation's share of gross domestic product, but little knowledge of the impact of transportation on our nation's economy and on our citizens' quality of life.
- Alternatives to increasingly expansive surveys, such as the use of administrative records and technology-based monitoring, are needed to develop transportation statistics. The digital revolution presents opportunities and challanges for improving transportation statistics.

For example, to help meet the Administration's National Export Initiative goal of doubling U.S. exports by the end of 2014, information is needed to identify bottlenecks in our Nation's transportation infrastructure that impede the timely and most economical movement of exports through the system. The information needs include, but are not limited to, the wait time at different transportation facilities (e.g., a lock on the Ohio River, a railroad yard in Chicago, a border crossing in Arizona); the time it takes for intermodal transfers (i.e., transferring shipments from one mode to the next); system capacity and capability to handle different commodities at different ports and terminals; and the investment needed to meet future demand.

In contrast to the geographic focus of exports, combating distracted driving requires statistics involving individual's behavior. Data is needed to answer questions such as:

- What activities distract a driver's attention?
- Which activities are more distracting than others?
- What age group is most likely to engage in activities that distract attention while driving?
- How effective are enforcement actions, outreach, and educational strategies?
- What has been the progress over time in addressing distracted driving?

The challenge in developing useful and timely transportation statistics is further complicated by the enormous size and complex nature of our Nation's transportation system.

Progress made in compiling and distributing statistics on passenger travel, freight transportation, transportation's role in the economy, and transportation and its unintended consequences are briefly summarized below. This chapter also highlights the major transportation data gaps and the challenges and opportunities facing future transportation statistics programs.

Passenger Travel

Passenger travel data are collected by various government agencies, some on a periodic basis and others on a continual basis. The collection of these data can be categorized into two groups.

The first group collects overall system usage data without collecting data on individual travelers' characteristics. The data programs in this group include, but are not limited to, the Highway Performance Monitoring System [USDOT FHWA HPMS 2010]; the Federal Transit Administration's National Transit Database [USDOT FTA NTD 2012]; and the Bureau of Transportation Statistics' monthly passenger enplanement data [USDOT RITA BTS 2012a], National Census of Ferry Operators [USDOT RITA BTS NFCO 2010], and Intermodal Passenger Connectivity Database [USDOT RITA BTS IPCD 2012b]. These data programs are crucial in the development of baseline information, the analysis of overall usage trends over time, and for understanding how changes in the economy influence the use of our transportation systems.

The second group of passenger travel data programs collects data at the individual traveler's level (without identifying personal identifiable information) from which travel patterns and traveler characteristics for the population as a whole can be estimated. The most prominent program in this group is the National Household Travel Survey (NHTS), sponsored mainly by the Federal Highway Administration (FHWA) and with increased co-sponsorship by states and metropolitan planning organizations [USDOE ORNL 2012]. The NHTS collects not only information on individual trips but also demographic, household vehicle ownership, neighborhood characteristic data, and other factors that influence a household member's decision on when, how, and how far to travel. Although the NHTS collects all personal travel taken by all modes of transportation, it mainly captures local travel. The high cost of conducting this type of nationwide survey has limited the frequency of this survey to once every 5 to 8 years. Despite these limitations, NHTS remains the only source that provides the comprehensive data needed to understand travel decisions and predict travel demand.

The Census Bureau's American Community Survey (ACS) is another commonly used source of passenger travel information. The ACS collects commute-to-work data from an annual survey of the population. This survey provides small-area information every year, unlike the once-per-decade information formerly provided by the decennial census. The ACS also provides statistics for small units of geography averaged over several years, while the NHTS provides national statistics by size of place [USDOC ACS 2011].

Based on these national statistics and on information from metropolitan area studies, the FHWA is exploring options to develop a national picture of passenger movements from county to county and state to state by all transportation modes. The robustness of the final results depend heavily on estimation models because the last physical measure of intercity passenger traffic is the BTS American Travel Survey conducted almost two decades ago. Costs of repeating the American Travel Survey are prohibitive.

Freight Transportation

The U.S. transportation system moves more than 4.6 trillion ton-miles of freight annually. Due to the complexity of freight transportation, there is no single data source capable of providing a comprehensive picture of annual freight movement from origin to destination, by all modes of transportation, and by all commodity types. Among the various data sources, the Commodity Flow Survey (CFS) serves as the backbone for developing a comprehensive picture of U.S. freight flows. The CFS is the only source of national- and state-level data on domestic freight shipments by major U.S. business establishments and selected retail industries. It also provides comprehensive data on domestic hazardous material shipments.

The CFS, sponsored mainly by the Bureau of Transportation Statistics (BTS) and cosponsored by the Census Bureau, is conducted every 5 years as part of the Economic Census.

To develop an integrated national picture of freight movement, FHWA's Freight Analysis Framework (FAF) relies on CFS data as the base and supplements it with multiple, publicly available data sources, such as the data on freight flows across U.S. land borders and data on the international movement of air cargo collected by BTS [USDOT RITA BTS 2012c]. This comprehensive picture is updated with annual statistics on railroad and waterway freight flows and foreign trade statistics. The FAF also includes forecasts.

The performance of our Nation's freight transportation system in handling the 4.6 trillion ton-miles that move through it annually is primarily measured by freight travel time, including, but not limited to:

- average train speed and average waiting time for loaded train cars to proceed for each major railroad,
- vessel delay times for each lock on the inland waterway system,
- truck speed and reliability on major highways and at border crossings, and
- throughput measures for selected ports.

The major national data sources for freight movement and performance are described at USDOT's freight transportation website (www.freight.dot.gov).

Transportation's Role in the Economy

In 2010, transportation-related expenditures as part of final demand accounted for nearly 9.8 percent of U.S. gross domestic product (GDP) and enabled linkages among natural resources, manufacturing, distribution centers, and consumers [USDOT RITA BTS NTS 2013, table 2-2].

Transportation's direct economic contribution is derived from statistics on the costs paid by households and businesses for transportation services, employment in transportation industries and occupations, and the value of transportation infrastructure and equipment. These statistics come from the Census Bureau, the Bureau of Economic Analysis (BEA), and the Bureau of Labor Statistics (BLS), each of which treats transportation as a significant sector of the economy.

For-hire transportation is one of the many sectors covered in the Economic Census, conducted every 5 years. This sector is also covered in the Census Bureau's Services Annual Survey, which collects operating revenue and other industry-specific data. These data are used by the BEA to estimate the flow of expenditures among sectors of the economy in order to understand how changes in the costs in a specific sector affect the rest of the economy. However, accounting for only the for-hire transportation sector misses the sizable contribution to the economy made by in-house transportation services within nontransportation industries, such as truck fleets operated by large retail companies (see box 6-A). Chapter 4 discusses the differences between for-hire and in-house transportation employment.

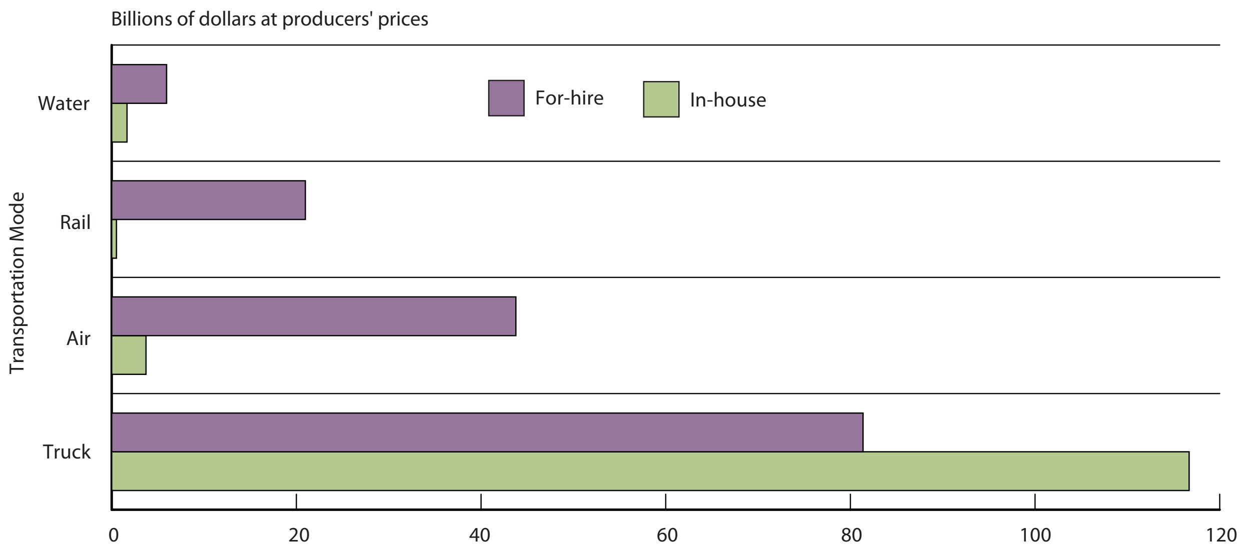
Transportation is not often highlighted in monthly national economic statistics. To provide a perspective on transportation's role in a dynamic economy, BTS developed the monthly Freight Transportation Services Index (TSI) [USDOT RITA BTS TSI 2012d]. This index is based on activity in all modes of for-hire freight transportation services and affords a better understanding of the relationship between

BOX 6-A Measuring the Economic Impact of For-Hire and In-House Transportation

To measure the full scope of transportation services and their contribution to the economy, BTS and BEA jointly developed the Transportation Satellite Accounts (TSA). The TSA measure the contribution of both for-hire and in-house transportation to the economy, totaling about $370 billion in 1997, accounting for 4.4 percent of the gross domestic product.

The TSA also estimate the value added by different modes of transportation (figure 6-1), facilitating analysis of trends and comparative assessments across modes. In both for-hire and in-house transportation, truck transportation services contributed the most to U.S. Gross Domestic Product: $81.4 billion and $116.7 billion, respectively. BTS will explore the possibility of enhancing future versions of the TSA to capture the economic contribution of personal transportation and other transportation services, such as the in-house use of automobiles.

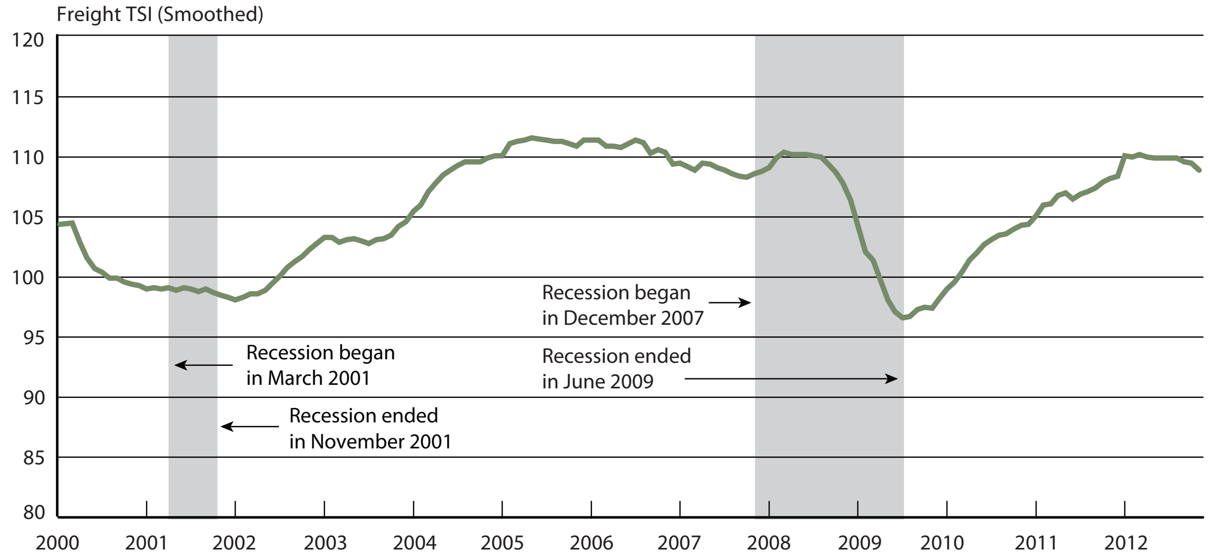
FIGURE 6-1 Value Added by Transportation Mode: 1997



SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *Transportation Satellite Accounts: A Look at Transportation's Role in the Economy* (Washington, DC: 2011). Available at http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/transportation_satellite_accounts/index.html as of February 2013.

FIGURE 6-2 Recent Fluctuations in Freight: January 2000–November 2012

Chain-type Freight Transportation Services Index: 2000 = 100



SOURCE: **Freight TSI**: U.S. Department of Transportation. Research and Innovative Technology Administration.Bureau of Transportation Statistics.Transportation Services Index (Updated monthly).Available at www.bts.gov as of March 2013. **Recession Dates**: National Bureau of Economic Research, U.S. Business Cycle Expansions and Contractions, available at www.nber.org/cycles.html as of February 2013.

transportation and the current and future course of the economy. After adjusting for long-term growth and seasonal variation, it appears that declines in freight movements proceeded the two most recent recessions (figure 6-2). The March 2001–November 2001 recession followed an extended period of decline in the Freight TSI index. The December 2007–June 2009 recession [NBER] was preceded by a general decline in the index beginning in late 2005. Although there was a short upward movement in the freight TSI for several months before and during the start of the most recent recession, the declines in the index continued during both recessions. The drop in the TSI was especially precipitous during the December 2007–June 2009 recession. The increases in the index slightly lag the end of the recessions.

Transportation and its Unintended Consequences

In addition to the intended economic activity that transportation creates, its notable unintended consequences are in the areas of safety, energy consumption, environmental issues, and community impacts. Of these, safety dominates the statistical activities of the USDOT. The National Highway Traffic Safety Administration (NHTSA) and the Federal Motor Carrier Safety Administration account for 40 percent of the expenditures on major statistical programs in the Department [USEOP OMB 2011]. One of the major safety data efforts is the modernization of NHTSA's Fatal Accident Reporting System to ensure the reliability and timeliness of safety data collection and analysis. The Pipeline and Hazardous Materials Safety Administration and FHWA also have large-scale safety programs. Altogether, the Department's annual expenditures on safety data exceed $50 million.

Recognizing that roadway safety improvement requires stronger partnerships and collective efforts across all modes of transportation and stakeholders, senior USDOT leadership initiated the development of the *Roadway Safety Plan* to bring an integrated focus to roadway safety issues [USDOT OST RSP 2012]. One of the priorities of this plan is to improve the systematic collection of safety data and analytical tools. These improvements are intended to help better identify high-risk road users and commercial vehicle operators, prioritize safety investment decisions, and evaluate the effectiveness of safety countermeasures.

The *Roadway Safety Plan* proposes two programs that are pertinent to safety statistics. First is the Highway Safety Improvement Program in which an electronic base map of all public roads will be developed that can be used to geographically reference and integrate all safety data. Second is the Safety Data Program that will integrate safety data across all modes by reconciling definitional inconsistencies and other data incompatibility issues. Furthermore, the Safety Data Program will identify and address data gaps in existing departmental safety programs.

The lower fatality rates in nonhighway modes, such as commercial aviation, railroads, and transit, do not reduce the need for data to understand risks and maintain or improve safety. The focus of data programs shifts from determining causes of crashes to understanding circumstances surrounding near misses or other mishaps that could have resulted in a serious incident. The National Aeronautics and Space Administration (NASA) provides a close calls reporting system for the Federal Aviation Administration that allows airline employees to make confidential reports that can be used to identify and mitigate safety problems. Nearly 5,000 reports are filed each month [NASA 2012, p. 15]. NASA provides a similar reporting system for Amtrak. BTS developed a similar program for freight railroads [C3RS 2012] and is working with a major transit system to initiate the first urban close calls reporting system.

The transportation sector accounts for more than two-thirds of the petroleum consumed in the country and produces between one-quarter and one-third of all of the carbon dioxide (CO_2) emitted by the country's energy consumption. The U.S. Department of Energy has a major data program that tracks energy consumption by the transportation sector [USDOE EIA 2012], and transportation's contributions to greenhouse gases and other emissions are tracked by the Environmental Protection Agency [USEPA OTAQ 2012]. While individual agencies are compiling information to meet their specific needs, integrating the data gathered from multiple perspectives and developing analytical techniques from many disciplines are the keys to effectively using the data sources to bring about a reduction in transportation-related energy consumption and emissions. For example, the relationships between vehicle usage patterns and energy usage intensity are crucial to measuring and assessing the effectiveness of different energy and emission reduction opportunities and policies. Unfortunately, with the discontinuation of the Vehicle Inventory and Use Survey in 2002, much of the data necessary to help make these assessments are now more than 10 years out of date [USDOC CB VIUS 2002].

Information Gaps and Challenges

To understand transportation activity, its contributions to the economy, consequences for the environment, and the potential impacts of policies and investments, it is crucial to estimate the interactions among the following components:

- *Sectors of the economy* that produce the demand for transportation and depend on transportation for productivity and health;
- The response of *businesses within supply chains* to regulations, private and public investment, and the impact those responses have on both the time and location of transportation activities;
- *Household* mobility needs and expenditures that determine the time and location of transportation activity and how travelers respond to transportation investments and regulations;
- *Infrastructure and assets* that are needed to serve the mobility requirements of households and businesses, to stimulate local economic growth, and to mitigate the adverse safety and environmental impacts of passenger and freight transportation; and
- *Transportation investments* that improve transportation services and promote economic growth and global competitiveness.

Data that are lacking on each of the components are highlighted in table 6-1.

Future Opportunities

The digital revolution presents the biggest opportunities and challenges for improving transportation statistics to support public decisions. Nearly all business transactions are now electronic, and a growing share of personal activity leaves an electronic trail. The databases created by business transactions and credit card purchases, communications systems, traffic management systems, and onboard vehicle diagnostics can be mined to estimate passenger and freight movement, identify the costs to travelers and businesses of those movements, and even measure the emissions created by vehicles in motion or idling. The coverage of databases continues to expand and the tools for mining them, popularly known as Big Data, Data Analytics, and other terms, have improved dramatically. Technology promises timelier, more accurate, and less expensive data, especially when compared to surveys.

Technology-based data typically provide much narrower windows on the phenomena being measured than surveys and place a premium on

TABLE 6-1 Major Information Gaps and Challenges

Topic	Importance	Examples of missing, inadequate, or threatened information
Economic interactions: purchases of goods, employment and production, and consumption of goods and services	Creates the demand for passenger and commodity flows, which in turn creates the demand for transportation activity to serve those flows; indicates the portions of the economy that will be affected by increases in transportation costs and disruptions in transportation services	• Risk of reductions in data on economic activity that generate freight movement and business travel collected through the Economic Census
Business interactions: freight flows within and among regions; logistical arrangements and expenditures among individual shippers, carriers, and service providers in supply chains	Commodity flows which create the demand for transportation facilities and services; decision variables used by businesses that affect their responses to public investments in, and regulation of, transportation	• Local movement of goods within metropolitan and rural areas • Domestic transportation of U.S. foreign trade • Cost of shipping goods • Characteristics of supply chains that generate commodity flows [NRC TRB SR 2011] • Access to administrative records of shippers
Household interactions: passenger flows within and among regions; travel behavior	Passenger flows which create the demand for transportation facilities and services; decision variables used by households that affect their responses to public investments in, and regulation of, transportation; very different from business interactions because the purposes of many personal trips (e.g., family visits and recreational activities) are for reasons other than market or economic factors.	• Intercity passenger travel by personal vehicles, charter buses, and general aviation [NRC TRB SR 2011] • Declining response rates to telephone interviews undermine the primary form of data collection on households
Transportation infrastructure and vehicles: vehicle, vessel, railcar, and aircraft fleets and their movement through the transportation network	Assets and use of assets to meet mobility needs; source of negative consequences for safety, energy consumption, environmental issues	• Discontinuation of Vehicle Inventory and Use Survey that provided national and state-level data on the physical and operational characteristics of the Nation's truck population [NRC TRB SR 2011] • Availability and use of non-motorized transportation • Relationships between land use and freight demand by type of travel
Transportation investments: revenues and expenditures	Statistics on the amount of funds being invested in transportation and the revenue sources of those funds	• Effective accounting of debits and credits related to public private partnerships in statistics on public revenues and expenditures • Methods and data to support scenario analysis for investment planning • Effective incorporation of investment data into output performance measures

NOTE: In-house estimates are available for only truck, rail, water and air.

data integration and statistical representativeness. Technology also raises major privacy, confidentiality, and intellectual property issues. Beyond improved data collection and processing applications, technology shows promise in enhanced understanding of transportation activities and impacts. The processing power of personal computers creates opportunities for widespread use of new analytical and visualization techniques.

The Challenge of Performance Measurement

MAP-21, the *Moving Ahead for Progress in the 21st Century Act* of 2012 (Public Law 112-141) requires states and the USDOT to publish performance measures and progress toward performance targets for many aspects of surface transportation. These requirements reflect a growing emphasis on accountability and management for improved performance in all fields of public administration. Performance measurement involves many statistical challenges and opportunities in addition to institutional concerns for the transportation community.

MAP-21 and the *Government Performance and Results Act* (GPRA) (Public Law 103-62) ask whether government actions are making a difference. The answer requires statistics beyond basic indicators of a general condition, such as the number of fatalities, tied to a generally stated goal, such as improved safety. More detailed statistics and more complex analysis are typically needed to answer the questions identified in table 6-2.

Performance measures are typically defined as output or outcome measures, though many performance measures are actually basic indicators that reflect goals or basic conditions. For example, the number of fatalities is a basic indicator. Fatalities by cause provide a more useful measure against which outputs and outcomes can be considered.

Outputs of government programs should be relatively easy to define, except that programs often involve a variety of specific actions that are difficult to characterize in simple measures. Furthermore, the output of one program may be the input of another. The major output of Federal agencies implementing MAP-21 is spending on safety and other aspects of surface transportation. The outputs of recipients of Federal funds may involve a wide variety of facilities and services purchased with those funds. Statistics on the facilities and services may be lacking for formula grant programs, leaving total expenditures as the only available measure of output.

While outputs should be relatively easy to define in most cases, outcomes are the most dif-

TABLE 6-2 Examples of Safety Performance Measures

Question to be answered	Type of performance measure	Examples
What is state of the world?	Basic indicators	• Fatalities per quantity of travel on the transportation system
What aspects of the state of the world are problems to fix or opportunities to pursue?	Actionable conditions	• Fatalities involving distracted driving
What actions are taken to fix problems or pursue opportunities?	Outputs	• Federal investment in distracted driving countermeasures • Number of states with distracted driving laws • Number of local school districts that include distracted driving in driver education courses
Have the actions made a difference?	Outcomes	• Evidence that fatalities involving distracted driving were reduced as a consequence of the investments, laws, or courses

ficult to measure. Outcomes are not just changes in an actionable condition following an output. Simple correlation is not enough. To be an outcome, some evidence of causality is required from targeted monitoring, such as before and after studies.

Given resource limitations for expensive new data collection programs, managers of transportation statistics will be challenged to adapt existing data program and analytical techniques to serve performance measurement. For example, current transportation planning models and supporting data are designed to measure problems such as congestion and predict how proposed changes, such as new capacity, will affect those problems. Research is underway to estimate basic indicators and actionable conditions with these models and use forecasting elements to set targets by which actual outcomes can be judged.

Performance measurement will ultimately require some new data collection. MAP-21, GPRA, and the *American Recovery and Reinvestment Act of 2009* (Public Law 111-5) all encourage the development and publication of better output and outcome measures. Outcome data from before-and-after studies and other quasi-experimental designs that measure program effectiveness can both serve performance measurement and become a new source of data for planning models.

Priority Areas Requiring Focused Attention by BTS

MAP-21 establishes priorities for transportation statistics in the years ahead. MAP-21 reaffirms the mandate for BTS and adds the establishment of a safety data program on behalf of the Secretary. MAP-21 requires performance measurement for most surface transportation programs such as safety improvement and infrastructure preservation. MAP-21 also adds new provisions for freight transportation that require data, including designation of freight corridors, development of investment analysis tools, and creation of a national freight strategic plan and state freight plans. MAP-21 also encourages states to maintain a base map of all public roads on which fatal and serious injury accidents can be located and analyzed.

In response to MAP-21 and departmental goals, BTS will emphasize the following areas over the next 2 years:

- Complete the Intermodal Transportation Database, which includes data on passenger movement by purpose; freight movement by commodity and by origin, destination, and mode; and transportation economic accounts for capital stocks, transportation expenditures, and employment. Central to this activity are completion of the 2012 Commodity Flow Survey and statistical integration of FHWA's Freight Analysis Framework and intercity passenger flow estimates into the Intermodal Transportation Database.
- Enhance the National Transportation Atlas Database, which includes an analytical network for estimating the routes of passenger and freight movement; link this database

to an inventory network file for locating transportation facilities and attributes of those facilities; and link this to population, economic, and environmental data from other Federal agencies. The inventory network, started under the Transportation Network for the Nation initiative of the Federal Geographic Data Committee, will be reviewed as a mechanism for integrating highway safety base maps.

- Expand the compilation of statistics on transportation performance and impacts to include performance measures developed in response to MAP-21.
- Establish the safety data program with integrated safety data across all modes, and prepare a safety data improvement action plan.
- Continue to enhance the quality, timeliness, and efficiency of the airline information program.
- Expand the functions of the National Transportation Library to serve as a depository and clearinghouse for research as called for in MAP-21.
- Explore new methods of transportation data collection, analysis, and visualization to support public decision-making, with a particular focus on open data, geospatial data integration, and freight investment data and planning tools.

Some of these BTS initiatives will address several of the gaps and challenges discussed above, and some will explore identified opportunities. Through these and other efforts, BTS will continue to strive toward achieving the vision of Abraham Lincoln who said, in reference to proposed Federal investments in transportation facilities, "Statistics will save us from doing what we do, in wrong places [Lincoln, A; 1848, pp. 709-711]."

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APPENDIX A: List of Acronyms, Abbreviations, and Initialisms

A

AAR: Association of American Railroads

ACS: American Communities Survey

ADA: Americans with Disabilities Act

ARRA: American Reinvestment and Recovery Act

ASCE: American Society of Civil Engineers

B

BAC: blood alcohol concentration

BEA: Bureau of Economic Analysis

BLS: Bureau of Labor Statistics

BTS: Bureau of Transportation Statistics

Btu: British thermal unit

C

CAFE: Corporate Average Fuel Economy

CBP: County Business Patterns

CES: Current Employment Statistics

CEX: Consumer Expenditure Survey

CFS: Commodity Flow Survey

C3RS: Confidential Close Calls Reporting System

CO: carbon monoxide

CO_2: carbon dioxide

CPI: Consumer Price Index

D

DOE: U.S. Department of Energy

DOT: U.S. Department of Transportation

dwt: deadweight tons

E

E85: ethanol 85%

EIA: Energy Information Administration

EPA: U.S. Environmental Protection Agency

F

FAA: Federal Aviation Administration

FAF: Freight Analysis Framework

FHWA: Federal Highway Administration

FMCSA: Federal Motor Carrier Safety Administration

FRA: Federal Railroad Administration

FTA: Federal Transit Administration

FTD: Foreign Trade Division

FY: fiscal year

G

GDP: Gross Domestic Product

GHG: greenhouse gas

GHSA: Governors Highway Safety Association

GPRA: Government Performance and Results Act

GVWR: gross vehicle weight rating

H

HMIS: Hazardous Materials Information System

I

ITA: International Trade Administration

M

MARAD: Maritime Administration

mpg: miles per gallon

mph: miles per hour

N

NAICS: North American Industry Classification System

NASA: National Aeronautics and Space Administration

NCFO: National Census of Ferry Operators

NHTS: National Household Travel Survey

NHTSA: National Highway Traffic Safety Administration

NIPA: National Income and Product Accounts

NO_x: nitrogen oxides

NPIAS: National Plan of Integrated Airport Systems

NPTS: National Personal Transportation Survey

NRC: National Research Council

NTD: National Transit Database

NTL: National Transportation Library

NTS: National Transportation Statistics

NATS-OD: North American Transportation Statistics Online Database

O

OMB: Office of Management and Budget

ORNL: Oak Ridge National Laboratory

P

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

R

RITA: Research and Innovative Technology Administration

rpm: revenue passenger-mile

S

SOC: Standard Occupational Classification

SO2: sulfur dioxide

STOL: short take-off and landing

SUV: sport utility vehicle

T

TEU: 20-foot equivalent unit

TSAR: Transportation Statistics Annual Report

TRB: Transportation Research Board

TSI: Transportation Services Index

TTI: Texas Transportation Institute

U

USACE: U.S. Army Corps of Engineers

USCG: U.S. Coast Guard

USDA: U.S. Department of Agriculture

USDHS: U.S. Department of Homeland Security

USDOC: U.S. Department of Commerce

USDOE: U.S. Department of Energy

USDOL: U.S. Department of Labor

USDOT: U.S. Department of Transportation

USITC: U.S. International Trade Commission

UT: Unlinked Trips

V

VIUS: Vehicle Inventory and Use Survey

VMT: vehicle-miles of travel

VOC: volatile organic compounds

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