



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			
Nonselved-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.

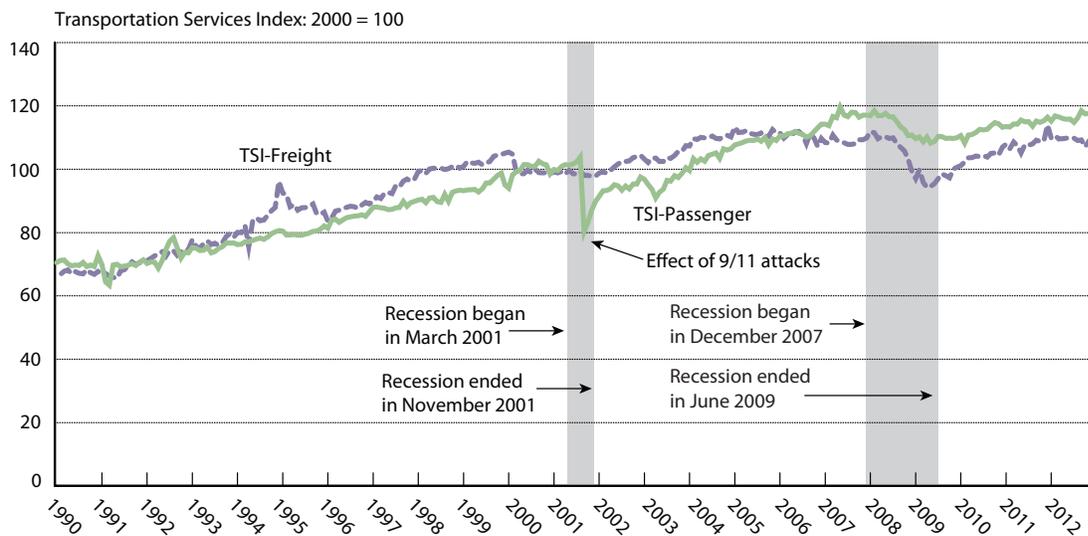
In addition, there are thousands of firms and millions of workers that provide transportation services; build, maintain, and operate the infrastructure; and produce and service vehicles, making transportation a major component of the economy (see chapter 4 for detailed discussion). Government agencies 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

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.

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

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-miles⁵ 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-miles⁶ 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

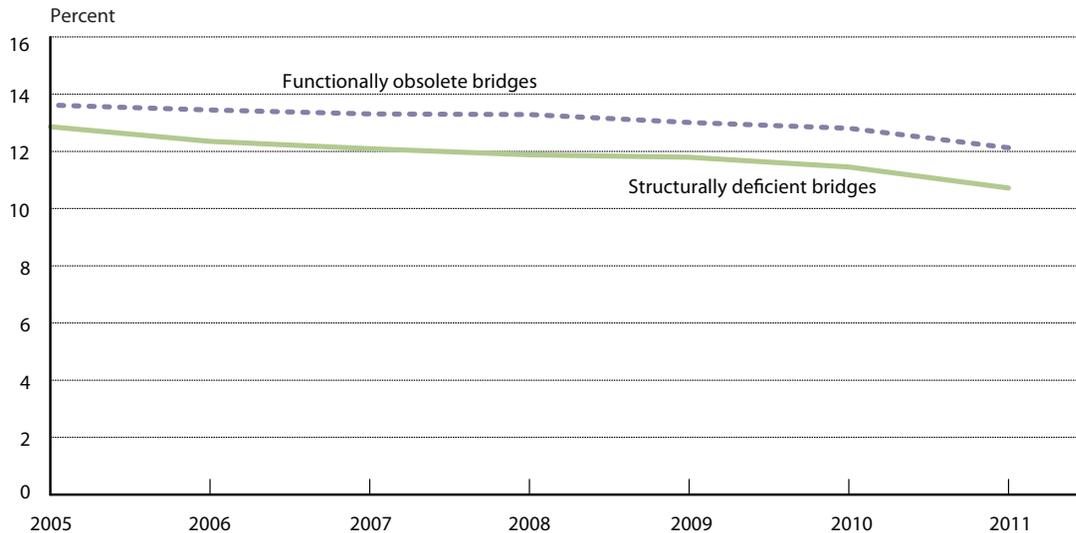
in 2009, compared to 1.7 percent of Interstates in rural areas. Among other principal arterial roads, 26.4 percent of mileage in urban areas was in poor condition compared to 3.1 percent in rural areas.

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

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

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-

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 aver-

age 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].

References

- Association of American Railroads (AAR):
- 2011a: *America's Freight Railroads: Global Leaders*. 2011. April. Available at www.aar.org as of March 2012.
 - 2011b. *Railroad Facts 2011* (Washington, DC: November).
 - 2012. Class I Railroad Statistics, May 10, 2012. Available at www.aar.org as of June 2012.
- American Society of Civil Engineers (ASCE). *The 2009 Report Card for America's Infrastructure: Executive Summary*. Available at www.asce.org as of March 2012.
- National Railroad Passenger Corp. (Amtrak). *Amtrak: America's Railroad Annual Report for 2010*. Available at www.amtrak.com as of March 2012.
- U.S. Central Intelligence Agency (USCIA). *The World Factbook: United States*. Available at www.cia.gov as of April 2012.
- U.S. Department of Energy (DOE), Oak Ridge National Laboratory (ONRL), Center for Transportation Analysis (CTA). 2011. *Transportation Energy Data Book: 30th Edition*. Available at <http://info.ornl.gov/sites/publications> as of March 2012.
- U.S. Department of Transportation (USDOT), Federal Aviation Administration (FAA). 2012. *National Plan of Integrated Airport Systems (NPIAS) 2013-2017*. Available at www.faa.gov as of March 2013.
- U.S. Department of Transportation (USDOT). Federal Highway Administration (FHWA) and Federal Transit Administration (FTA):
- 2012: *2010 Status of the Nation's Highways, Bridges and Transit: Condition and Performance Report to Congress*. Available at www.fhwa.dot.gov as of April 2012.
- U.S. Department of Transportation (USDOT). Federal Highway Administration (FHWA):
- 2013: *Freight Facts and Figures 2012*. Available at www.fhwa.dot.gov as of March 2013.
 - 2011a: *2009 National Household Travel Survey: Summary of Travel Trends*. June. Available at nhts.ornl.gov as of March 2012.
 - 2011b: Office of Innovative Program Delivery. Available at www.fhwa.dot.gov as of November 2011.
 - 2011c: *Freight Facts and Figures 2011*. Available at www.fhwa.dot.gov as of March 2012.
- U.S. Department of Transportation (USDOT). Federal Transit Administration (FTA). National Transit Database (NTD). 2012. *National*

- Transit Profile Summary – All Agencies* (various years). Available at www.ntdprogram.gov as of June 2012.
- U.S. Department of Transportation (USDOT). Maritime Administration (MARAD). Vessel Calls. Available at www.marad.dot.gov as of May 2012.
- U.S. Department of Transportation (USDOT). Pipeline and Hazardous Materials Administration (PHMSA). 2012. Pipeline data provided by PHMSA. June.
- U.S. Department of Transportation (USDOT). Research and Innovative Technology Administration (RITA). Bureau of Transportation Statistics (BTS):
- 2013a. *National Transportation Statistics* (NTS). Online. Available at www.rita.dot.gov/bts as of March 2012.
 - 2013b. *Pocket Guide to Transportation 2013*. Available at www.rita.dot.gov/bts as of February 2013.
 - 2012a: National Census of Ferry Operators. Online. Available at www.rita.dot.gov/bts as of May 2012.
 - 2012b: BTS Special Report: *A Decade of Change in Fuel Prices and U.S. Domestic Passenger Aviation Operations* (March 2012). Available at www.rita.dot.gov/bts as of February 2013.
 - 2011: BTS Special Report: *Making Sense of Passenger Vessel Data* (July 2011). Available at www.rita.dot.gov/bts as of February 2013.