



Two Decades of Change in Transportation Reflections from Transportation Statistics Annual Reports

1994–2014



U.S. Department of Transportation
Bureau of Transportation Statistics

Two Decades of Change in Transportation

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Table of Contents

INTRODUCTION.....	1
TWO DECADES OF CHANGE IN TRANSPORTATION	2
Changes in the Demand for Transportation.....	3
Changes in the Transportation System	10
Changes in Transportation Costs and Spending	12
Changes in the Consequences of Transportation.....	15
TWO DECADES OF CHANGE IN THE DEVELOPMENT AND DISSEMINATION OF TRANSPORTATION STATISTICS.....	20
LOOKING AHEAD: WHAT MORE DO WE NEED TO KNOW?	23
REFERENCES.....	25



“Statistics will save us from doing what we do, in wrong places.” [LINCOLN, A; 1848]

Introduction

The Bureau of Transportation Statistics (BTS) provides information to support understanding and decision-making related to the transportation system, including the size and extent of the system, how it is used, how well it works, and its contributions and consequences for the economy and the environment. Congress recognized the Nation’s evolving requirements for transportation and changes in the transportation system throughout the provisions of the *Intermodal Surface Transportation Efficiency Act of 1991* and created BTS as part of that law to provide more and better information on the changing world. One provision of the law requires the BTS Director to publish an annual report on the state of the transportation system, documentation of the methods used to obtain the statistics presented and ensure the quality of those statistics, and recommendations for improving transportation statistical information [PL 102-240, Dec. 18, 1991, section 6006].

BTS published the first *Transportation Statistics Annual Report* in 1994.

This 20th anniversary edition of the *Transportation Statistics Annual Report* departs from the normal review of current transportation statistics to highlight how the world of transportation and the methods to measure that world have changed over the last two decades. Rather than cataloging trends enumerated in other BTS publications, this report focuses on three questions:

1. Are transportation challenges and opportunities relatively unchanged after 20 years, or have new issues emerged?
2. Do statistics developed over the last 20 years support effective understanding of transportation challenges and opportunities, or are new statistics needed?
3. Will new methods of measurement provide new perspectives on transportation?

Two Decades of Change in Transportation

While the 1994 and the latest editions of the *Transportation Statistics Annual Report* have different chapter titles and structure, they cover the same basic set of topics: extent, use, condition, and performance of the system; economic aspects of transportation; safety; energy and the environment; and the state of transportation statistics. (Table 1 highlights some of these topics.) The 1994 edition included a special section on disruptions to the transportation network by the 1993

floods that ranged from North Dakota to Missouri. Subsequent editions included large feature sections on economic performance of transportation (1995), transportation and the environment (1996), mobility and access (1997), and long-distance travel and freight (1998). *Freight Facts and Figures* and *Passenger Travel Facts and Figures* supplement the most recent editions. While these feature sections and the *Facts and Figures* series reflect varying emphases over time, they also reflect the longevity of basic issues and conditions in transportation.

Table 1 Twenty Years of Key Transportation Indicators

System component	1994	2014	CAGR
Highway vehicle-miles traveled (millions)	2,296,378 ¹	2,988,323 ²	1.33%
Highway ton-miles (millions)	4,676,163 ³	5,899,165 ⁴	1.17%
Highway public road mileage	3,905,211 ¹	4,115,462 ²	0.26%
Air enplaned revenue passengers	508,458,194	708,401,299	1.67%
Air enplaned revenue tons (freight and mail)	8,718,082	12,390,344	1.77%
Domestic air ton-miles (millions)	8,860 ³	12,134 ⁴	1.58%
Aiports	18,317 ¹	19,453 ²	0.30%
Rail intercity/Amtrak passenger-miles (millions)	6,091 ⁵	6,804 ⁶	0.56%
Rail ton-miles (millions)	1,041,929 ¹	1,725,634 ²	2.55%
Class I rail mileage	116,626 ³	95,387 ⁴	-1.00%
Transit passenger-miles of travel (millions)	40,241 ⁵	55,169 ⁶	1.59%
Domestic water ton-miles (millions)	848,399 ³	499,748 ⁴	-2.61%
U.S. gross domestic product (billions of chained 2009 \$)	\$9,905	\$15,962	2.41%
Transportation fatalities	42,962 ¹	34,509 ²	-1.09%
Transportation injuries	3,185,361 ¹	2,332,808 ²	-1.55%

¹ Statistics for 1993. ² Statistics for 2013. ³ Statistics for 1991. ⁴ Statistics for 2011. ⁵ Statistics for 1992. ⁶ Statistics for 2012.

KEY: CAGR = Compound Annual Growth Rate.

SOURCE: Various sources cited in U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics*, available at www.bts.gov as of July 2015.

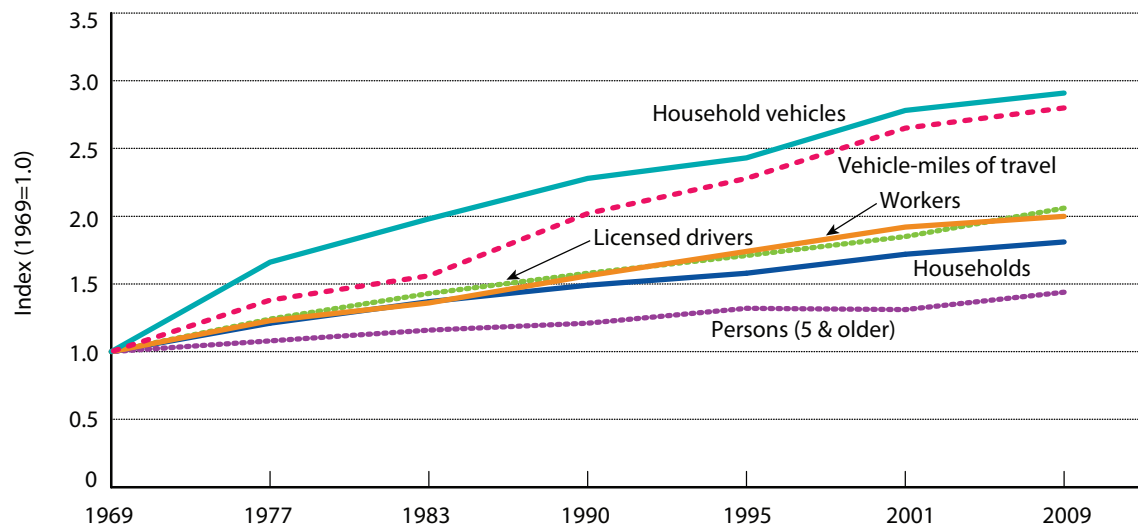
Changes in the Demand for Transportation

The first *Transportation Statistics Annual Report* reflected a half-century of growth in the demand for travel, while the last edition reflected stagnation in travel demand over the past half-decade (figure 1). The last edition also examined whether recent stagnation of demand is due to temporary economic conditions or a longer term generational shift.

Early *Transportation Statistics Annual Reports* recognized many contributors to growth in vehicle-miles of travel, including population growth; increased vehicle ownership; increased

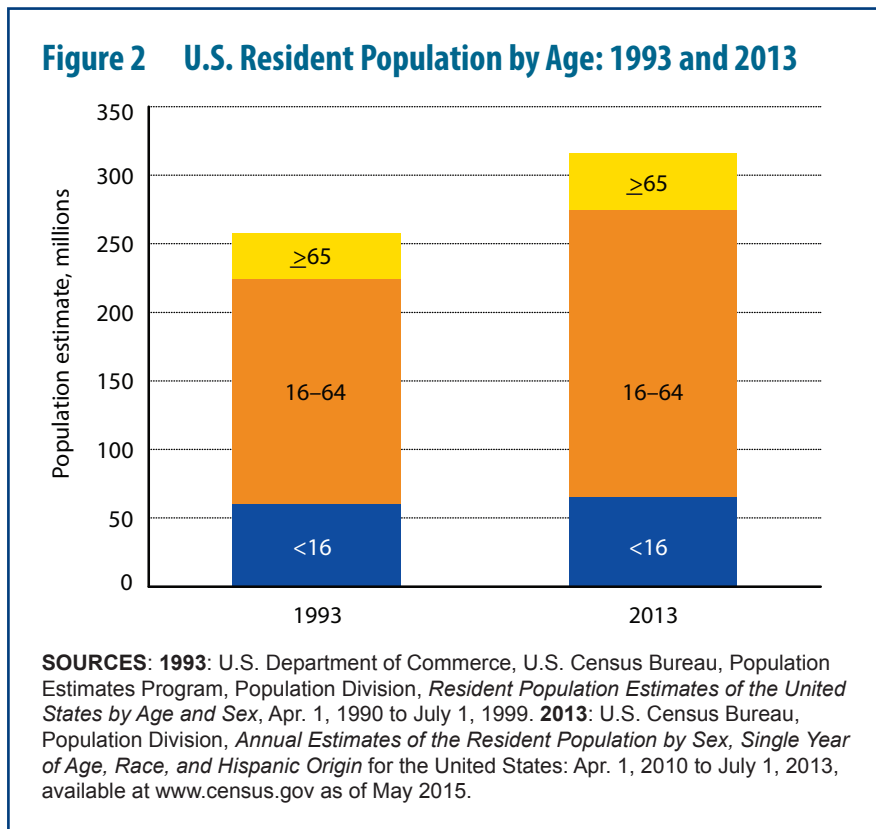
share of the population with driver licenses; declining number of persons per automobile; increased number of trips per person; longer average trip lengths; and increased vehicle travel by the younger and older populations, by women, and by lower income groups. The reports noted that some factors, such as share of population with driver licenses, were reaching saturation levels and that future growth in vehicle travel might be more closely aligned with population growth. Figure 1 illustrates the growth of several contributing factors to travel, and figure 2 shows the increased share of working age population that contributes to work-related travel.

Figure 1 Changes in Travel and Demographics: 1969, 1977, 1983, 1990, and 1995 NPTS, and 2001 and 2009 NHTS



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

SOURCES: U.S. Department of Transportation, Federal Highway Administration, *Summary Statistics on Demographic Characteristics and Total Travel: 1969, 1977, 1983, 1990, and 1995 NPTS (October 1999)*, Table NPTS-1, available at <https://www.fhwa.dot.gov> as of July 2015.

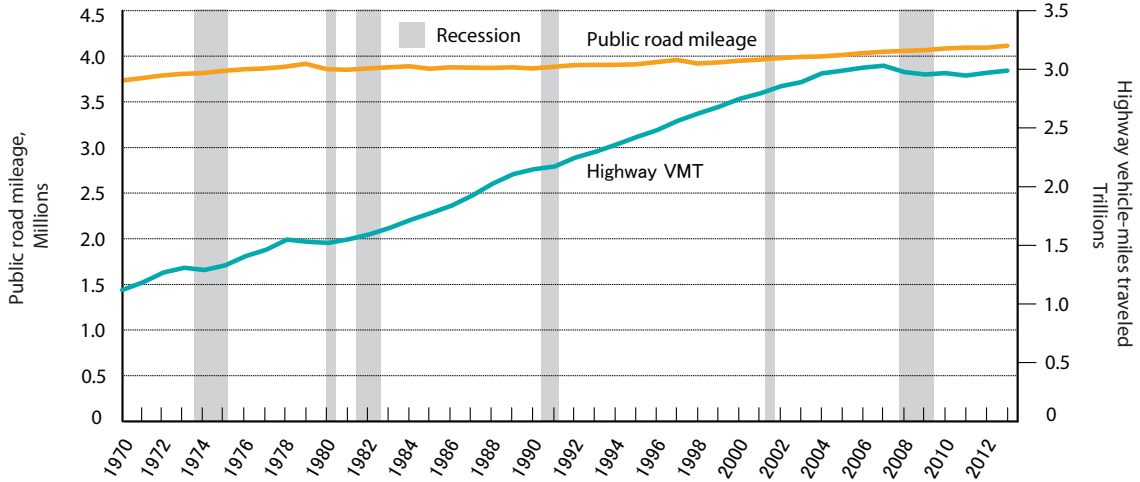


While the U.S. population has grown steadily in the last two decades, the growth in vehicle-miles of travel (vmt) stagnated after 2007. Figure 3 shows that previous periods of stagnation were not as long, and that public road mileage has remained relatively constant whether vehicle travel was growing or not. The 2013 *Transportation Statistics Annual Report* notes that the recent decline may be due to economic conditions or to reduced vehicle travel by the younger population. Median household income, a major indicator of economic conditions that affect travel demand, grew steadily until 1999, sagged and rebounded by 2007, and then declined and stagnated (see figure 4) [USDOC CENSUS 2014]. Travel demand is likely to remain flat if income stagnation continues for a large share of the population or if recent travel

behavior of the younger population does not change as that cohort ages. Travel demand is likely to return to modest growth if economic conditions improve and if housing and travel choices by Millennials, those born between 1980 and 2000, begin to resemble more closely their Baby Boomer parents, born between 1945 and 1965, as the Millennials enter family formation years.

Housing and travel choices affect more than personal vehicle use. Shifts in housing choices between central cities and suburban communities affect the market for public transit, which has shown recent growth. Although the number of commuters who drove to work increased between 2001 and 2012, the overall share of drive-alone commuters decreased from 88.0 percent to 86.0

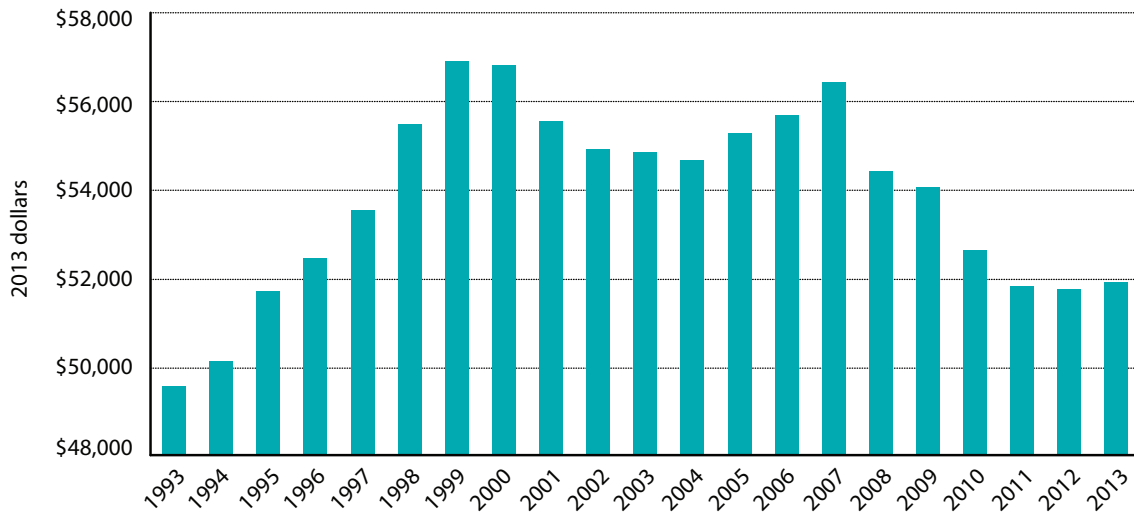
Figure 3 Public Road Mileage and Highway Vehicle-Miles Traveled: 1970–2013



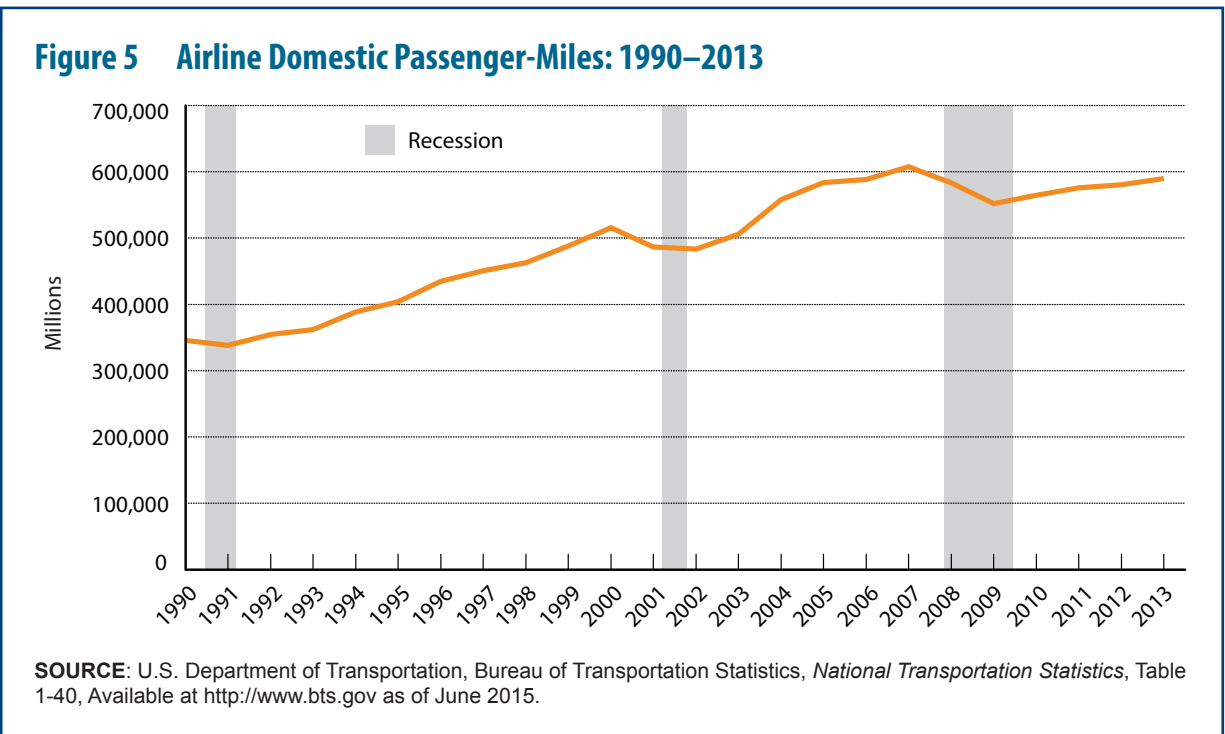
NOTE: Data for 2007 and later years are not comparable to previous years due to changes in methodology.

SOURCE: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, available at <http://www.fhwa.dot.gov/policyinformation/statistics.cfm> as of May 2015.

Figure 4 Median Household Income: 1993–2013



SOURCE: U.S. Department of Commerce, Census Bureau, *Income and Poverty in the United States: 2013*, Table A-1. Available at <http://www.census.gov/> as of June 2015.

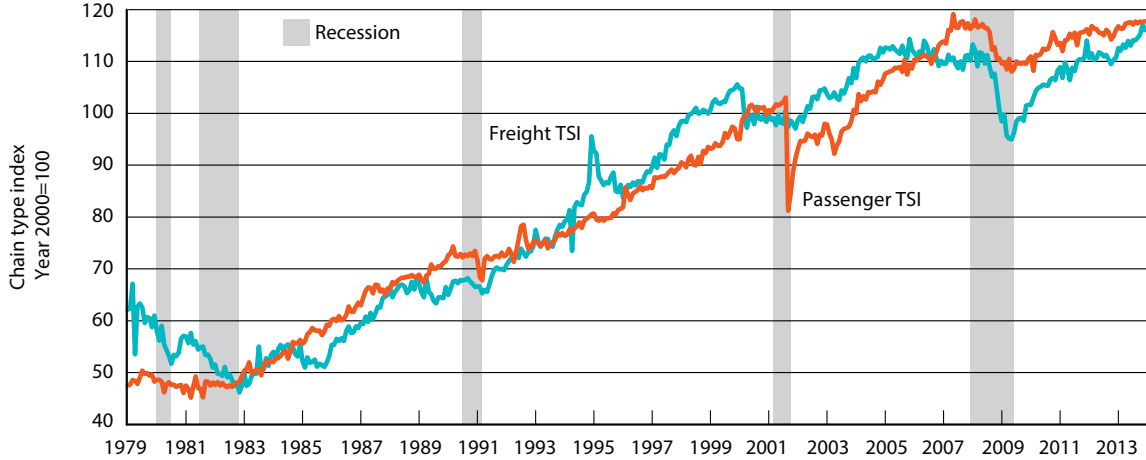


percent in that period. Transit riders increased from 4.7 percent of all commuters in 2001 to 5.0 percent in 2012. Anecdotal evidence suggests that travelers are turning more frequently to bicycles, revitalized intercity bus service, new forms of taxicab service, and the availability of vehicle rentals by the hour, little of which was anticipated in the 1990s. The long-term growth in commercial airline travel followed a pattern similar to highway travel, with a decline and rebound in recent years (see figure 5). By 2003 over 80 percent of Americans had flown on a commercial airline [USDOT BTS 2003].

For-hire passenger travel and for-hire freight transportation trends have mirrored each other since the early 1980s, except for the temporary drop in passenger travel following the terrorist attacks on Sept. 11, 2001 (see figure 6). Early *Transportation Statistics Annual Reports* anticipated continued growth in demand for freight movement, especially with implementation of the North American Free Trade Agreement (NAFTA) in 1994. Freight movement increased through 2007, followed by a decline and rebound that mirrored fluctuations in the general economy (see figure 7).

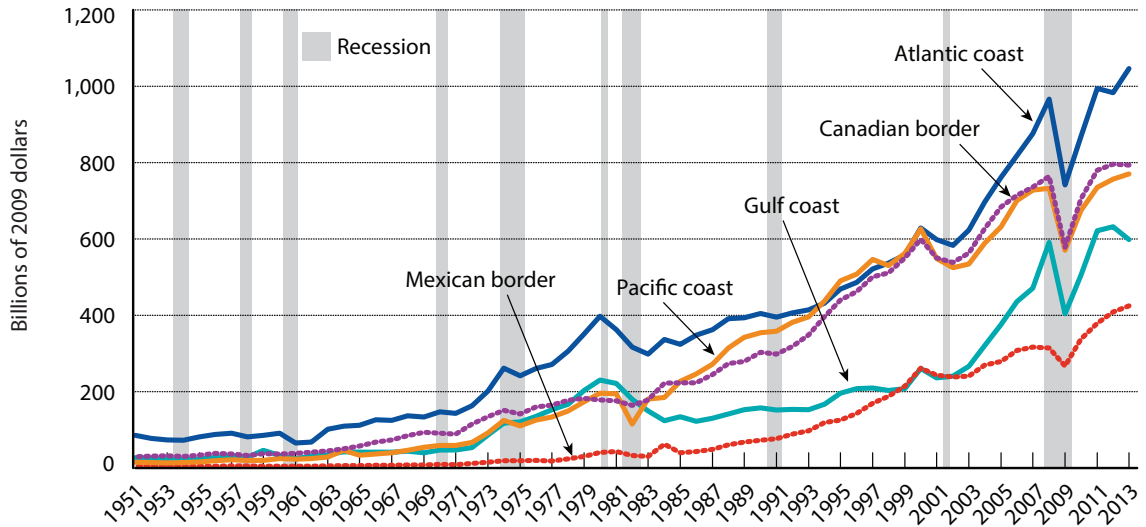


Figure 6 Freight and Passenger Transportation Services Index: January 1979–December 2013



SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2015.

Figure 7 Value of U.S. International Merchandise Trade by Coasts and Borders: 1951–2013



NOTE: The value of coal exports through Mobile, AL, is counted with the Atlantic coast trade to protect proprietary data.

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); **1971–1999:** U.S. Department of Commerce, Census Bureau, *Statistical Abstract of the United States* (Washington, DC: annual issues); **2000–2013:** 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 June 2014.

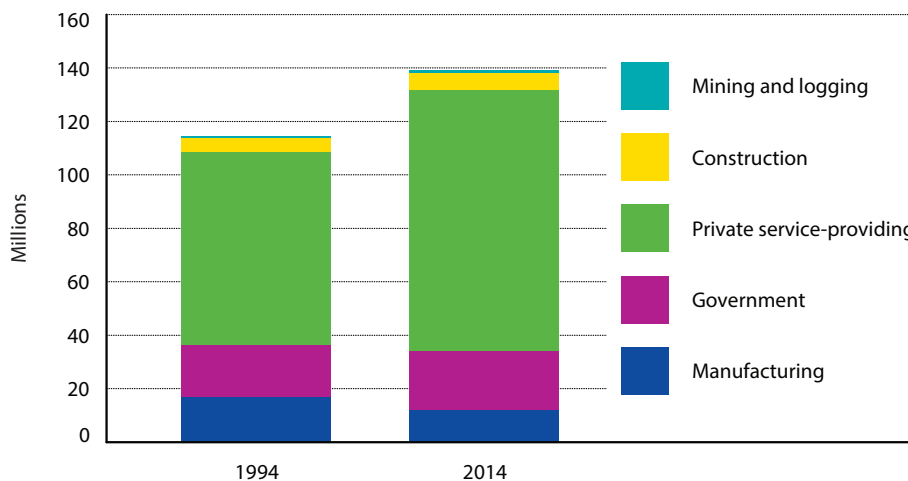
Early *Transportation Statistics Annual Reports* questioned if “dematerialization” of the economy through the increasing importance of services over manufacturing and a shift to higher value, lighter goods would affect the demand for freight movement. The increased economic importance of services is evident in employment (see figure 8) [USDOL BLS 2015]. The number of private service-providing jobs grew from 72 to 98 million between 1994 and 2014, while the number of jobs in manufacturing declined from 17 to 12 million. The shift to higher-value, lighter goods is less clear. The value per ton of goods shipped in inflation-adjusted dollars grew only one-tenth of one percent between 1997 and 2012 [USDOT FAF 2015].

While the manufacturing sector experienced a decline in jobs, the tons of goods shipped in the

United States increased 1.2 percent per year and ton-miles 0.9 percent per year between 1997 and 2012 [USDOT FAF 2015]. The growth in the tonnage of freight did not keep pace with the economy; 1.485 million tons moved in 1997 per billion dollars of gross domestic product (in 2009 dollars) declined to 1.279 million tons in 2012 [USDOT FAF 2015 and USDOC BEA 2015]. This decline is consistent with the “dematerialization” hypothesis.

The 1994 report, reflecting the early 1990s interest in intermodalism, projected that intermodal freight movements would become increasingly important. Tons moved domestically by multiple modes (plus all mail) increased 4.2 percent per year from 1997 to 2012, reaching 3.2 percent of total tonnage and 11.5 percent of total value in 2012 [USDOT FAF 2015].

Figure 8 Annual Number of Jobs in the United States: 1994 and 2014



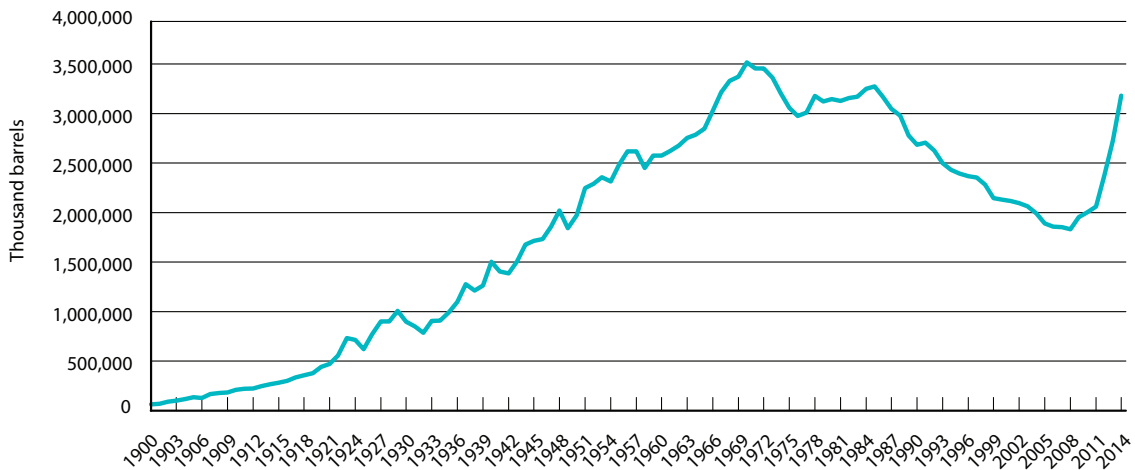
NOTES: Total includes an estimate of the number of nonfarm, civilian payroll jobs in the U.S. economy. It includes the number of persons on establishment payrolls, employed full or part-time, who received pay for any part of the pay period that includes the 12th day of the month. Data exclude proprietors, self-employed, unpaid family or volunteer workers, farm workers, domestic workers, and uniformed members of the armed services. *Government* includes Federal (90–91), State (90–92), and local governments (90–93). *Private service-producing* includes estimates of the number of private, nonfarm, and civilian payroll jobs in the following sectors: Trade, Transportation, and Utilities (40); Information (50); Financial Activities (55); Professional and Business Services (60); Education and Health Services (65); Leisure and Hospitality (70); and Other Services (80) and EXCLUDES Government (90). Estimates are not seasonally adjusted.

SOURCE: United States Department of Labor, U.S. Bureau of Labor Statistics, Current Employment Statistics Survey (CES), *Current Employment Statistics—CES* (national), available at <http://www.bls.gov/ces> as of May 2015.

The 1994 report reflected a decline in freight movement related to a drop in domestic oil production that has since reversed dramatically (see figure 9). The recent growth in domestic oil production has resulted in increases in the movement of crude petroleum by rail, from

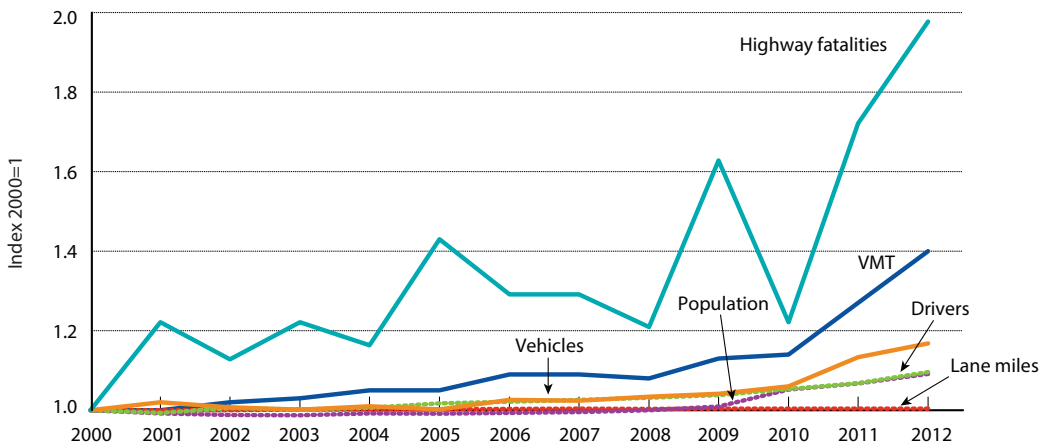
630,000 barrels in January 2010 to 33,706,000 barrels in January 2015 [USDOE EIA 2015]. Localized impacts of this oil boom on population, vehicle travel, and highway fatalities are substantial in places such as North Dakota (see figure 10).

Figure 9 U.S. Field Production of Crude Oil: 1990–2014



SOURCE: U.S. Department of Energy, Energy Information Agency, *U.S. Field Production of Crude Oil* (thousand barrels), Table MCRFPUS1, available at <http://tonto.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPUS1&f=A> as of June 2015.

Figure 10 Transportation Demand, Supply, and Consequences in North Dakota following the Oil Boom: 2000–2012



KEY: VMT = vehicle-miles traveled

SOURCES: Various sources as cited in U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics*, available at www.bts.gov as of July 2015.

Changes in the Transportation System

The physical extent of the Nation's transportation infrastructure has changed little in two decades. Public road and street mileage increased nearly three-tenths of a percent per year while vehicle-miles of travel grew 1.3 percent per year between 1993 and 2013; the total number of airports, including general aviation facilities, increased three-tenths of a percent per year, while the number of public use airports declined; the mileage of navigable waterways remained unchanged; and the mileage of class I railroads shrank 1 percent per year from 1991 to 2011.

Each edition of the *Transportation Statistics Annual Report* has tracked incremental changes in fleets operating on the transportation system, capacity of the system, and delay caused by congestion. Some of the changes in the transportation system not anticipated in the 1994 edition involve aviation and maritime connections between the United States and the rest of the world.

The number of U.S. airports with nonstop international service increased from 72 in 1993 to 89 in 2013, offering more locations throughout the country with commercial air service to the world [USDOT BTS 2015]. While 14 airports lost international service, 31 airports gained international service in that time. The number of air passengers traveling between the United States and foreign points reached a new high in 2010 and has increased each succeeding year.

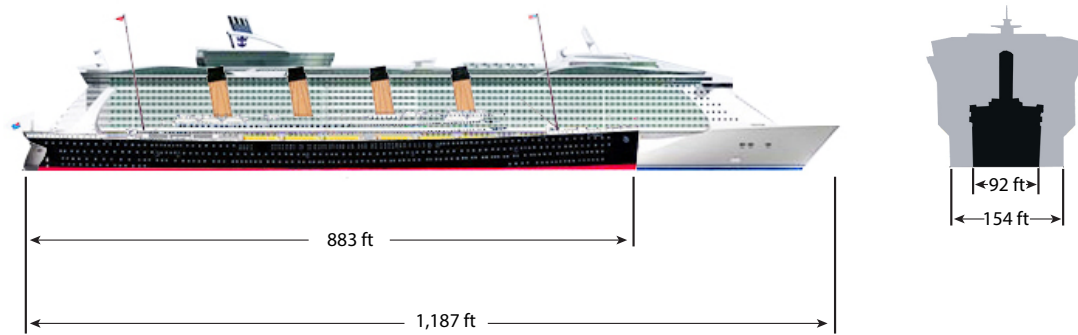
Maritime connections with the world involve increasingly larger vessels. Containerships calling in the United States had an average capacity of 3,903 twenty-foot equivalent units (TEUs) in 2012, up 28.9 percent from 2002 [USDOT

MARAD 2014]. The newest container ships carry upwards of 18,000 TEUs of cargo [ABS 2014], and even larger containerships are on order. This increase in size is not limited to container ships. Today's largest cruise ships are more than 225,000 gross tons and carry nearly 6,400 passengers and 2,400 crew [RCL 2014]. By comparison, the *Titanic* was about 46,000 gross tons and carried 1,300 passengers and 900 crew (see figure 11) [CP 2012].

The 1994 *Transportation Statistics Annual Report* did not anticipate two major changes in the maritime transportation network, both of which are beyond U.S. territorial waters. One is the expansion of the Panama Canal with a third set of locks that will allow post-Panamax vessels up to 13,000 TEUs to transit the canal (see figure 12). Because the United States accounts for 69.2 percent of the total tonnage passing through the canal, this expansion could affect the share of international traffic flowing to and from the coasts described previously [PCA 2014]. The other change is a consequence of climate change. The current Arctic maritime season lasts from about June through October, with unaided navigation (without icebreaking, etc.) occurring within an even more limited time frame. If shrinkage of the Arctic ice cap continues, an extended maritime season may make the once fabled Northwest Passage a commercial reality. For many major port cities, the Northwest Passage through the Arctic Ocean may seasonally offer shorter routes than those that traverse the Panama and Suez Canals [CMTS 2015].

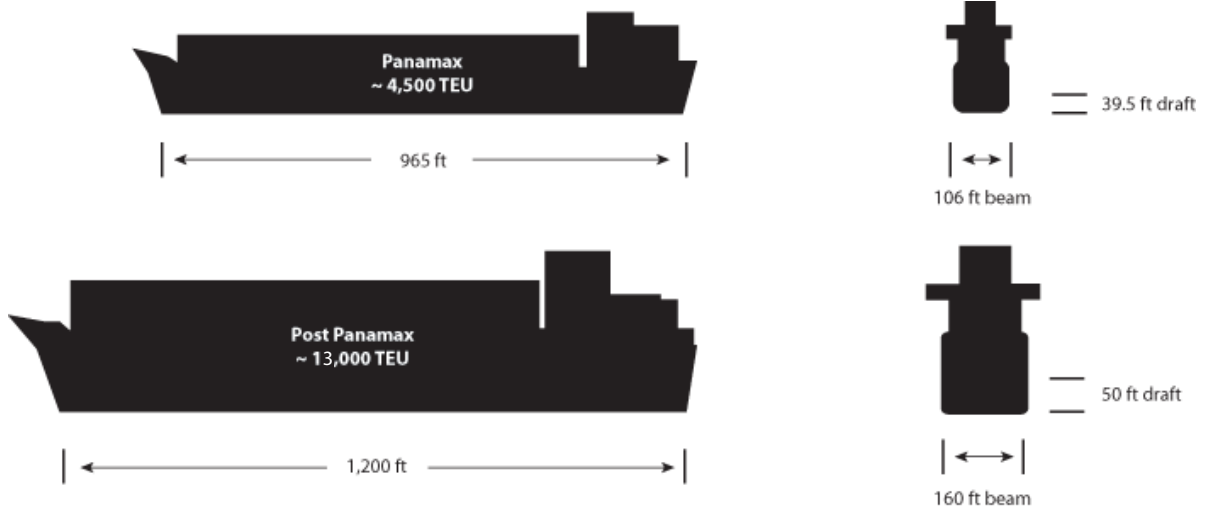
Perhaps the biggest pending change in the transportation system not anticipated in 1994 is the rapid development of autonomous, or self-driven, vehicles. Long considered in the realm

Figure 11 RMS *Titanic* (black) Compared to MS *Oasis of the Seas*



SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2015.

Figure 12 Panamax v. Post Panamax Vessels



NOTES: Panamax refers to the largest size vessel that can traverse the Panama Canal. Current maximum dimensions are: length 294.1 meters (965 feet); width 32.3 meters (106 feet); draft 12.0 meters (39.5 feet) in tropical fresh water; height 57.91 meters (190 feet) above the water. Post Panamax refers to vessels that exceed these dimensions

SOURCE: U.S. Department of Transportation (USDOT), Bureau of Transportation Statistics, based upon data from the US-DOT, Maritime Administration, *Glossary of Shipping Terms*, available at <http://www.marad.dot.gov/> as of June 2015.

of science fiction and futurists, a handful of experimental automobiles and trucks are in actual operation on public streets. The rate of adoption and the consequences of automated vehicles for vehicle-miles of travel, safety, freight economics, and mobility for the aging population are all subject to speculation and are yet to be measured.

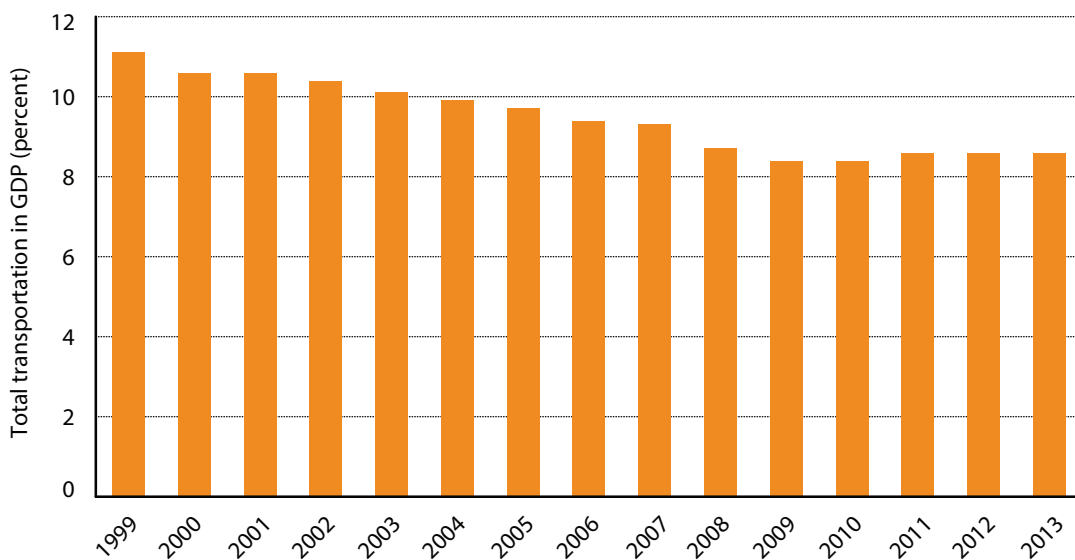
In addition to driverless trucks, automation in the freight system includes package handling in warehouses operating today and the possibility of parcel delivery by unmanned aerial vehicles in the near future. These changes could have significant consequences for transportation costs and employment.

Changes in Transportation Costs and Spending

The 1994 *Transportation Statistics Annual Report* painted a picture of increasing costs and spending related to transportation, but not enough to change transportation as a share of the economy or impact consumer spending.

In more recent times, the portion of gross domestic product (GDP) attributable to the final demand for transportation products and services (figure 13) and transportation as a share of personal consumption (figure 14) are both down slightly, primarily because spending on motor vehicles has declined. The portion of

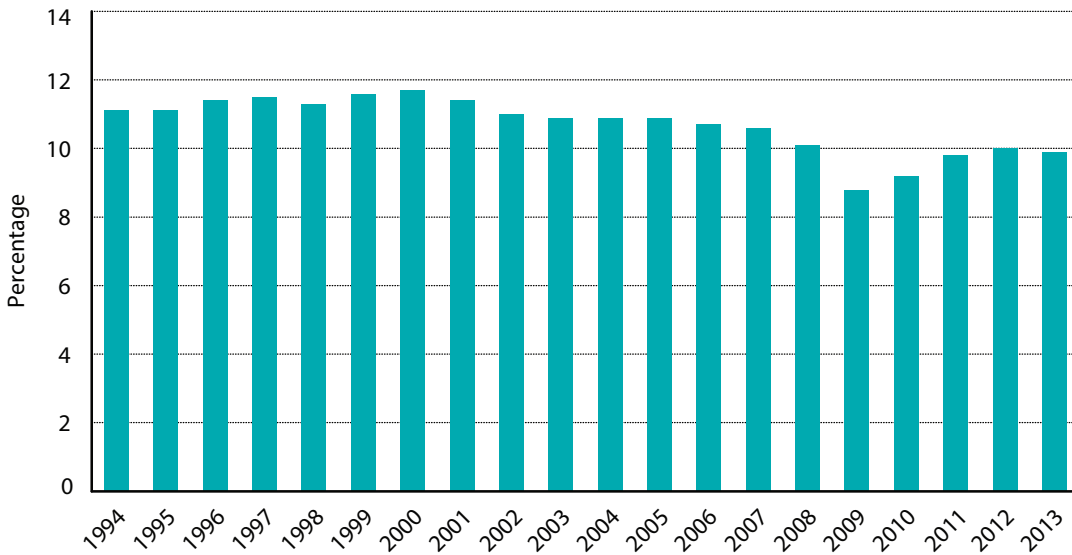
Figure 13 Transportation as Share of Final Demand: 1999–2013



NOTES: The Bureau Economic Analysis has changed the reference year for chained dollar estimates from 1999 onward as part of the comprehensive revision of the national income and product accounts in 2014. *Chained (2009) dollar* series are calculated as the product of the chain-type quantity index and the 2009 current-dollar value of the corresponding series, divided by 100. Because the formula for the chain-type quantity indexes uses weights of more than one period, the corresponding chained-dollar estimates are usually not additive. This table is not comparable with the previous' version.

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/> as of September 2014 as cited in U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics*, available at <http://www.bts.gov> as of June 2015.

Figure 14 Transportation as Share of Personal Expenditures: 1994–2013



NOTE: The categories have been revised due to the Comprehensive Benchmark revision by the source in 2010, thus this table is not comparable to the 2009 and earlier editions of the *Transportation Statistics Annual Report*.

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, *National Income and Product Accounts Tables*, table 2.3.5u, available at http://www.bea.gov/national/nipaweb/nipa_underlying/SelectTable.asp as of September 2014 as cited in U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics*, Table 1-30, available at <http://www.bts.gov> as of June 2015.

GDP created by for-hire transportation services has remained stable (see figure 15).

The cost of for-hire transportation services as measured by the Producer Price Indices of the

Bureau of Labor Statistics (see table 2) has risen steadily since the 1990s, except for declines during the recession in 2007 and 2008. The price of fuel is among the most volatile of cost elements (see figure 16).

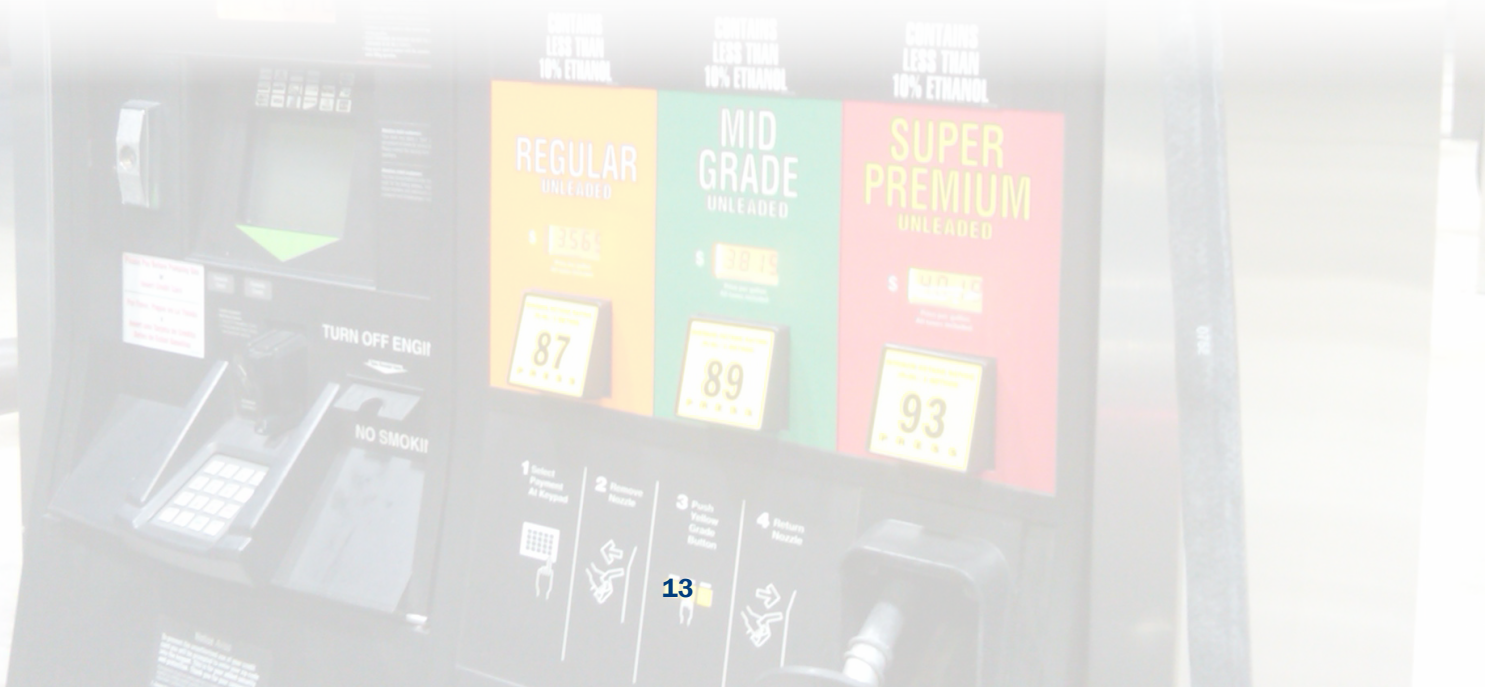
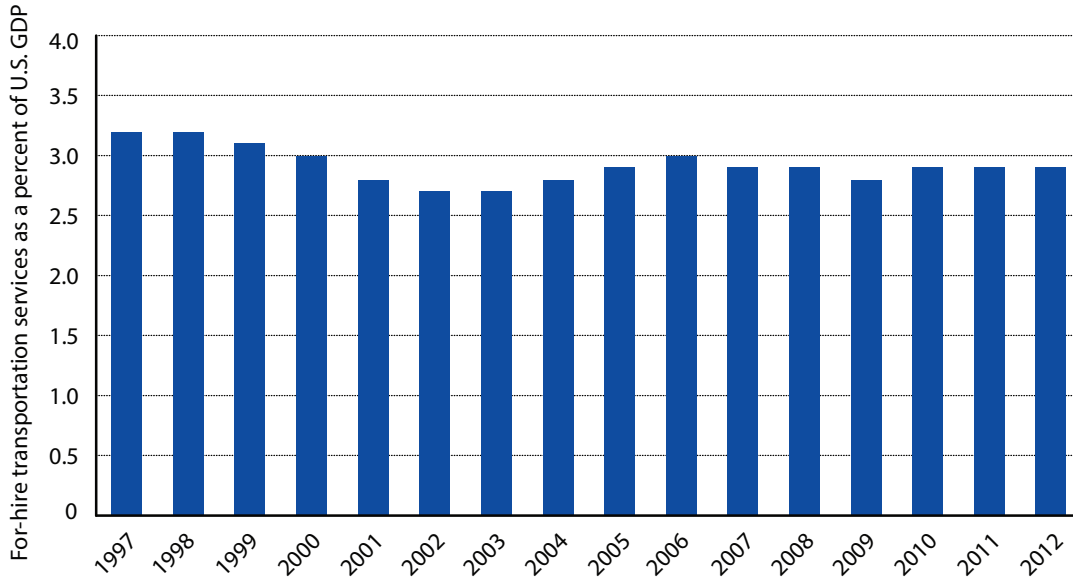


Figure 15 U.S. Gross Domestic Product (GDP) Attributed to For-Hire Transportation Services: 1997–2012



NOTES: At the time of this publication the Bureau of Economic Analysis (BEA) had only published chained 2009 dollar estimates from 1997 onward. Current dollar estimates for earlier years can be found in table 3-1, and chained 2005 dollars estimates for earlier years can be found in the 2013 edition of NTS, table 3-2. Chained (2009) dollar series are calculated as the product of the chain-type quantity index and the 2009 current-dollar value of the corresponding series, divided by 100. Because the formula for the chain-type quantity indexes uses weights of more than one period, the corresponding chained-dollar estimates are usually not additive.

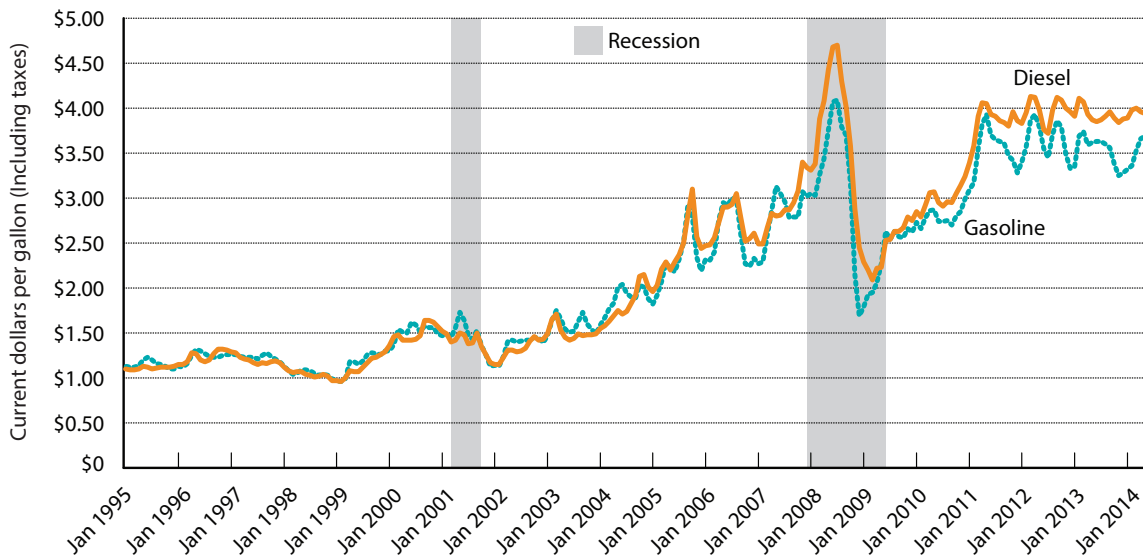
SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, *Industry Economic Accounts, Interactive tables*, available at <http://www.bea.gov/industry/index.htm> as of September 2014 as cited in the U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics*. Available at <http://www.bts.gov> as of June 2015.

Table 2 Producer Price Indices for Selected Transportation and Warehousing Services: 2013

	Base year when index=100	Index in 2013
Air transportation (NAICS 481)	1992	226.0
Rail transportation (NAICS 482)	1996	183.1
Water transportation (NAICS 483)	2003	135.1
Truck transportation (NAICS 484)	2003	132.7
Support activities for transportation (NAICS 488)	2003	117.5
Postal service (NAICS 491)	1989	202.4
Couriers and messengers (NAICS 492)	2003	189.4

KEY: NAICS = North American Industry Classification System

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, *Producer Price Index Industry Data*, available at www.bls.gov/data/sa.htm as of September 2014 as cited in U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics*, Table 3-13, available at www.bts.gov as of June 2015.

Figure 16 Gasoline and Diesel Retail Price: January 1995–June 2014

NOTES: Gasoline includes unleaded regular gasoline, U.S. city average retail price. Diesel includes on-highway diesel fuel price.

SOURCE: U.S. Department of Energy, Energy Information Agency, *Retail Motor Gasoline and On-Highway Diesel Fuel Prices*, available at <http://www.eia.gov/totalenergy/data/monthly/#prices> as of August 2014.

The past decade has generally seen steady increases in transportation prices, especially those related to travel by private automobiles. However, in 2014 a major dynamic impacted passenger travel and transportation as a whole. That year gasoline and diesel prices dropped to levels not seen since before 2005 and again, briefly, during the trough of the last recession in January 2009. This recent drop in gasoline and fuel prices contributed to a decrease in the overall cost of transportation for consumers.

Government spending on transportation continues to be dominated by State and local governments. Total spending grew through 2003, declined and then rebounded to a high in 2009, and then declined and rebounded again following

the recession (see figure 17). Following the peak at \$362.3 billion in 2009, total expenditures dropped to \$340.6 billion in 2011 and climbed to \$347.6 billion in 2012 in chained 2009 dollars. Federal expenditures and grants are only one fourth of these totals.

Changes in the Consequences of Transportation

Safety on the transportation system has continued to improve since the 1994 *Transportation Statistics Annual Report*. Fatalities have declined for the major modes of transportation even as the population continued to grow. Fatalities in smaller categories, such as bus occupants and motorcycles, have increased (see table 3). The biggest safety improvement is in highway

fatalities, especially among those in their late teens and early twenties (see figures 18 and 19).

In recent years, distracted driving has joined traditional safety concerns, such as alcohol-impaired vehicle and boat operation. While fatality rates have improved, highway fatalities per capita in the United States exceed all Western European countries and Canada [IRTAD 2014].

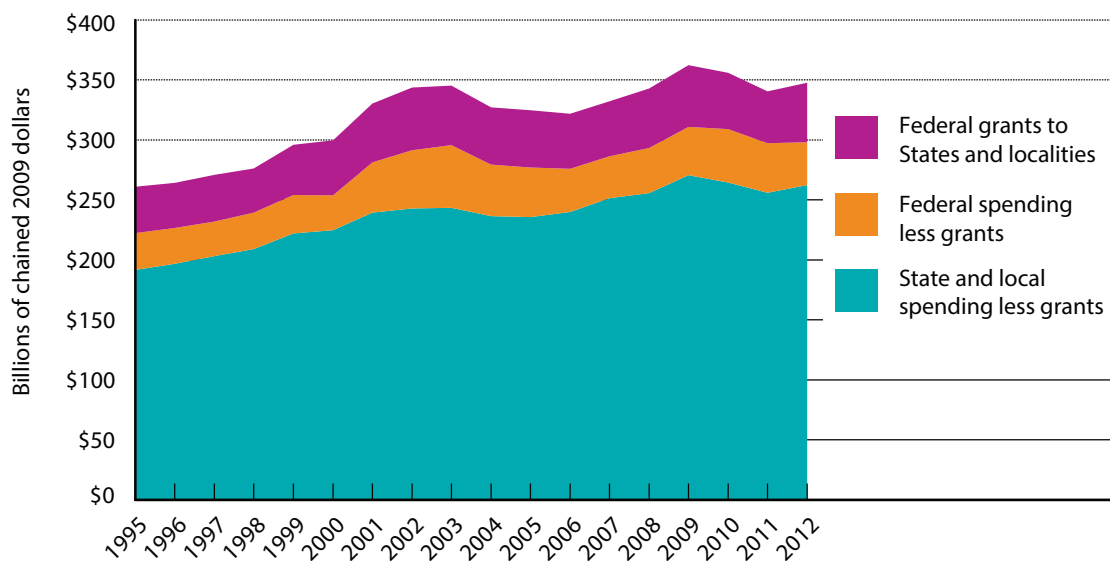
The 1994 report included a brief discussion of acts of terrorism and the number of firearms and explosives detected by airport security screenings. The brevity reflected the smaller focus on terrorism in the years before hijacked aircraft were used in the Sept. 11, 2001 attacks, resulting in destruction of the World Trade Center in New York City and crashed into the Pentagon and a field in rural Pennsylvania,

although explosives in motor vehicles were used to attack the World Trade Center in 1993 and to destroy the Alfred P. Murrah Federal Building in Oklahoma City on April 19, 1995.

In 1994 the energy and environment section of TSAR highlighted energy consumption, air quality, and the noise aspects of transportation. The section also featured municipal solid waste as an environmental problem that created a major market for transportation. Waste and scrap shipments, by tonnage, grew 2.9 percent per year between 1997 and 2012, increasing in share of total tons moved from 5.5 to 7.0 percent.

Greenhouse gas (GHG) emissions have joined the list of environmental concerns since 1994, adding transition of vehicles from petroleum to low-carbon energy as an energy topic. Two

Figure 17 Chained Federal, State, and Local Transportation Expenditures: 1995–2012



SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, *Government Transportation Financial Statistics 2014*, Available at <http://www.bts.gov/> as of June 2015. Financial Statistics 2014

Table 3 Transportation Fatalities by Mode: 1993 and 2013

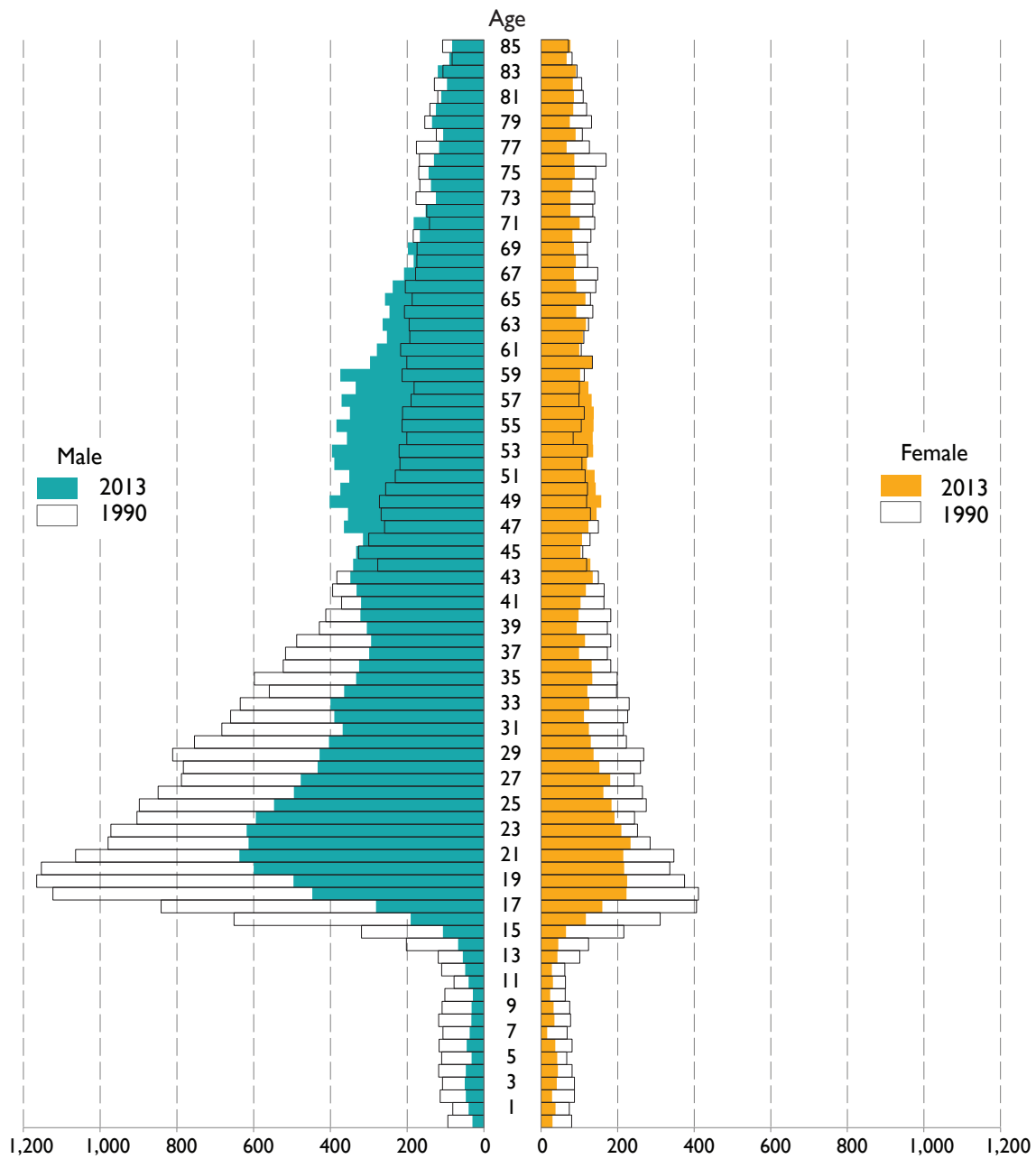
	1993	2013
TOTAL fatalities	42,962	34,509
Air, total	811	429
U.S. air carrier	1	9
Commuter carrier	24	6
On-demand air taxi	42	27
General aviation	744	387
Highway, total	40,150	32,719
Passenger car occupants	21,566	11,977
Motorcyclists	2,449	4,668
Truck occupants, light	8,511	9,155
Truck occupants large	605	691
Bus occupants	18	48
Pedestrians	5,649	4,735
Pedalcyclists	816	743
Other	536	702
Railroad, total	1,279	706
Train accidents	67	11
Highway-rail grade crossing	626	231
Other incidents	586	464
Transit, total	281	266
Passenger/Occupant	N	60
Employee/Worker	N	10
Other	N	196
Water, total	1,026	642
Passenger	N	57
Freight	N	8
Industrial/Other	N	17
Recreational boating	800	560
Vessel-related	105	N
Not related to vessel casualties	121	N
Pipeline, total	17	9
Hazardous liquid pipeline	0	1
Gas pipeline	17	8
Other counts, redundant with above		
Railroad, trespasser deaths not at highway-rail crossing	523	432
Railroad, killed at public crossing with motor vehicle	517	140
Passenger rail	292	198
Freight rail	987	509
Transit, non-rail	85	122
Transit, rail	196	144

KEY: N = data do not exist.

NOTES: Please see *National Transportation Statistics* table 2-1 for complete source notes. 2013 is the most recent year for which data are available for all modes.

SOURCES: Various sources as cited in the U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics*, Table 2-1, available at <http://www.bts.gov> as of June 2015.

Figure 18 Number of Highway Fatalities by Age and Gender: 1990 and 2013

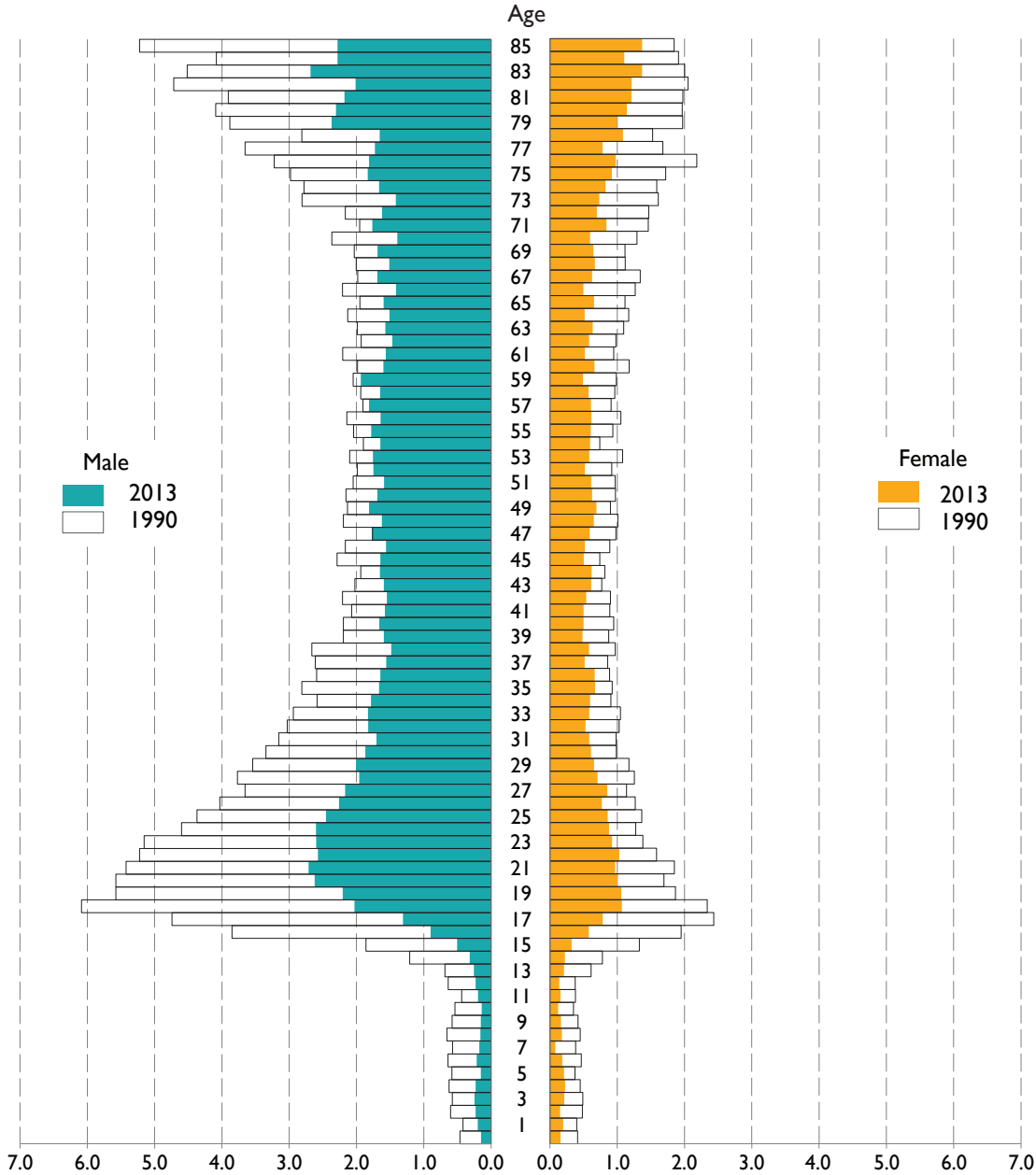


NOTE: Data for persons over the age of 85 are not shown.

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Fatality Analysis Reporting System (FARS)*, available at: <http://www.nhtsa.gov/FARS> as of September 2013 as cited in U.S. Department of Transportation, Bureau of Transportation Statistics. *Passenger Travel Facts and Figures 2014* (July 2014). Figure 5-2. Available at <http://www.bts.gov> as of July 2014.

Figure 19 Rate of Highway Fatalities by Age and Gender: 1990 and 2013

Fatalities per 10,000 population



NOTE: Data for persons over the age of 85 are not shown.

SOURCE: Fatality Data - U.S. Department of Transportation, National Highway Traffic Safety Administration, *Fatality Analysis Reporting System (FARS)*, available at: <http://www.nhtsa.gov/FARS> as of September 2013. **Population Data** - U.S. Department of Commerce, United States Census Bureau, *1980 and 2011 Population Estimates* available at <http://www.census.gov/popest.data/state/asrh/2011/index.html> as of September 2013 as cited in U.S. Department of Transportation, Bureau of Transportation Statistics. *Passenger Travel Facts and Figures 2014* (July 2014). Figure 5-3. Available at <http://www.bts.gov> as of July 2014.

current options for light-duty vehicles are plug-ins and fuel cells. In order to gauge the market potential and impacts on energy and GHG emissions of alternative-fuel vehicles, it is important to understand the strengths and limitations of each vehicle type, how they will be used and refueled, refueling and other operating costs, and vehicle operating range allowed by supporting infrastructure.

Two Decades of Change in the Development and Dissemination of Transportation Statistics

Congress required that the *Transportation Statistics Annual Report* include an assessment of the quality of statistics used in the report and a summary of efforts by BTS to improve transportation information. BTS published the first *Transportation Statistics Annual Report* one year after the Bureau started operations. The inaugural edition featured an extensive array of statistics from many sources, described how BTS would develop data through surveys and estimation models to fill information gaps, and highlighted measurement issues.

During its first half decade, BTS launched the Commodity Flow Survey to measure freight flows, the American Travel Survey to measure long-distance travel, and the Transborder Freight Data Program to identify the portion of international trade carried by each mode of surface transportation. BTS inherited carrier reporting systems that originated in the Civil Aeronautics Board and the Interstate Commerce Commission to measure financial and operating statistics for commercial airlines and major trucking companies.

BTS developed estimates of the freight not captured by the Commodity Flow Survey and an estimation model for a more complete enumeration of spending on and by transportation as part of the Nation's economy, called a shadow account in 1994 and now known as the Transportation Satellite Account. BTS also sponsored an experimental program to extract volume and speed data from traffic management centers in four cities to estimate minute-by-minute variations in travel and congestion.

Sources of data have evolved since those early days. Household surveys are increasingly expensive to conduct and suffer from declining response rates. BTS and its partners turn increasingly to administrative records and sensor-based data to replace or supplement surveys. For example, the Bureau of Economic Analysis is using tabulations of credit card purchases to replace surveys for data on expenditures during foreign travel, and BTS plans to use a similar approach to estimate long-distance travel.

BTS, the Federal Highway Administration, and partners outside the U.S. Department of Transportation are examining the use of onboard sensors and administrative records from vehicle registration systems to supplement paper surveys as part of plans to restore the Vehicle Inventory and Use Survey, a vital data source that was discontinued in 2002 by the Census Bureau due to budget constraints. This combination of traditional surveys, administrative records, and sensor data follows a similar hybrid measurement strategy used by Transport Canada to collect data for its Canadian Vehicle Use Study.

While individuals are reluctant to fill out questionnaires, extensive location and travel information is gathered by private companies through cell phone tracking software, tweets, and other social media. Vehicle locations are captured by license plate readers used for toll collection and parking enforcement—a largely untapped reservoir of information on travel. Availability of this reservoir may be limited by public reactions to the privacy implications of license plate tracking for security purposes.

The newest source of travel data may come from unmanned aerial vehicles, also known as drones, which can fly for extended hours at low altitudes and collect images that can be turned into traffic counts for everything from trucks to bicycles. As in the other new sources of data, accuracy and statistical validity of the measurements as well as public acceptability remain unexplored.

Estimation models have evolved since 1994 almost as much as the data sources. BTS made aggregate national estimates of total freight not covered by the Commodity Flow Survey in the 1990s. Now BTS and the Federal Highway Administration together make detailed estimates of value, tons, and ton-miles by commodity, region of origin, and region of destination with the Freight Analysis Framework (FAF). The FAF integrates data from the Commodity Flow Survey, the Transborder Freight Data Program, and other sources, filling data gaps with models of likely freight flows in order to provide detailed estimates of total freight flows and to update those estimates for years between Commodity Flow Surveys.

BTS uses other estimation techniques to create useful indicators, such as the Transportation

Services Index, and to improve analysis. The Transportation Services Index is the broadest monthly measure of U.S. domestic transportation services, encompassing five modes of freight transportation and three modes of for-hire passenger transportation. BTS is adjusting selected statistics, such as commercial aviation load factors and passenger enplanements, to remove recurring seasonal variations and facilitate comparisons of underlying changes between months.

Big data analytics represents a new and entirely different challenge for estimation models. Methods have been developed to extract information from unstructured data sets that are continually updated. Big data analytics were originally developed to analyze markets, social and political trends, and the performance of professional athletes.

These methods are being adapted by private shippers to monitor and manage supply chains and are now being explored by public agencies as early indicators of changing social and economic conditions. The potential for revolutionizing transportation analysis is great, but research is needed to determine the reliability and validity of statistics from these methods and to establish access to large databases that are primarily in the private sector. BTS and its partners in the statistical and transportation communities are pursuing these research questions as resources permit.

Open data access is another new aspect of the statistical world that has come into play since the 1994 *Transportation Statistics Annual Report*. The 1994 report recommended “democratizing data” to improve access by all potential users to statistical products. Executive

departments are now required to provide public access to the data on which statistical products and research reports are built as long as the data are not restricted by confidentiality or licensing limitations. DOT's open data initiatives are now managed by the National Transportation Library, which BTS established within 3 years of the initial 1994 report.

As part of its “democratizing data” theme in 1994, BTS decided to disseminate its new statistical products for free even though most statistical agencies charged for data. Today, almost all products of Federal statistical agencies are available at no charge.

The technology of data dissemination is perhaps the most changed aspect of the Bureau's business since 1994. BTS published the initial releases of *Transborder Freight Data* on 3.5-inch floppy discs. BTS pioneered the dissemination of transportation data on CD-ROMs, starting with *Transportation Data Sampler Number 1*. Graphical user interfaces for Internet browsers became available shortly after BTS started operations, and BTS now distributes all products over the web. An early project to share information for metropolitan planning organizations on CD-ROM evolved into the National Transportation Library. None of this was foreseen in the first *Transportation Statistics Annual Report*.

BTS approached the Federal Aviation Administration early in the Bureau's history about capturing DOT's biggest data set, tracks of individual flights through the air traffic control system, for possible analysis of the capacity and performance of the commercial aviation system. BTS abandoned the effort because only very expensive technology of the

1990s could handle the daily volume of these data. Today, individuals can track flights on privately run websites that pull real-time data from the air traffic control system, and many government and private organizations mine that data for capacity and safety analysis.

While BTS did not pursue the air traffic data, the Bureau's experimental program to extract volume and speed data from traffic management centers has evolved into the National Performance Measure Research Data Set managed by the Federal Highway Administration. The geographic locations of vehicles over time are combined with traffic management center data to measure the

Box A Freight Performance Measures

The Freight Transportation Condition and Performance Report under development in DOT includes a number of performance measures such as the value and tonnage of shipments by region and mode of transportation, delay and system resiliency, cost, safety, and environmental consequences.

A congressman from Illinois largely anticipated this list over 160 years ago. “The surplus, that which is produced in one place to be consumed in another; the capacity of each locality for producing a greater surplus; the natural means of transportation, and their susceptibility for improvement; the hindrances, delays, and losses of life and property during transportation, and the causes of each, would be among the most valuable statistics in this connection. From those it would readily appear where a given amount of expenditure would do the most good.” [Lincoln, A; 1848]

speed and reliability of the National Highway System.

Current discussions beyond big data include a strong emphasis on performance, often treating performance measurement as a new topic. *Data for Decisions*, the document that guided the creation of BTS and its early program, included an entire chapter on creating a “National Transportation Performance Monitoring System” [TRB 1998]. Indeed, discussions of transportation performance measures precede the U.S. Civil War (see box A).

Whether for performance measurement or other policy concerns, most measures requested by public officials are variations on those that BTS was mandated to collect or compile in the 1990s. Basic measures of people movement, freight flows, and vehicle activity remain as priority topics. Some of the energy and environmental measures are now clustered under the concept of sustainability, and measures formerly categorized as quality of life are now labeled as livability. Speed and reliability of freight movement is now characterized as fluidity.

Looking Ahead: What More Do We Need to Know?

The *Transportation Statistics Annual Report* asks the question: what more do we need to know? Desired additional information enumerated in 1994 included:

- A meaningful, comprehensive set of performance indicators for the transportation system as a whole to identify needs and opportunities for improvement of the system.
- Basic information on the geography of passenger travel and goods movement to understand how the transportation system is used, who is served by the system, what portions of the system are essential, and where transportation activity exposes the population to safety and environmental risks.
- Activities of large fleets of vehicles, such as rental cars, company vehicles, and vehicles owned by governments and utilities, which are major elements of passenger travel and the goods movement as well as the safety, economic, and environmental consequences of travel.
- Inventory of the geographic locations and characteristics of transportation facilities, hubs, and services, particularly those involving intermodal transfers, to support management and use of the system.
- Location, characteristics, and use of bicycle facilities to understand the role of non-motorized, active transportation in mobility, health, and safety issues.
- System condition across all modes to understand infrastructure investment needs.
- Rethinking of basic measures of transportation and its consequences, such as congestion and economic productivity, including a better characterization of the product of transportation than passenger-miles of travel or ton-miles for use in measures of productivity.
- Business use of and spending on transportation services and equipment to understand the role of transportation in the economy.

- More effective representation of transportation in the national economic accounts to identify the economic consequences of changes in transportation costs.
- Characteristics, itineraries, and expenditures of tourist activities to understand transportation's role in supporting a vital economic activity for many areas.
- Basic revenue and expenditure data for many segments of the transportation industry and models of the relationships between transportation and economic activity, whether by industry or geography, to understand how much transportation costs the nation and how much it contributes to economic health.
- More uniform reporting of accident statistics throughout the Nation.
- More accurate and detailed measures of exposure to safety risks, including better information about environmental conditions (weather, lighting, road hazards) and other potentially contributory risk factors to guide safety improvement efforts.
- Direct measures rather than modeled estimates of emissions performance to provide accurate and credible information to guide efforts to reduce environmental consequences.

BTS and its partners have made major progress in all of these areas. The Commodity Flow Survey and the Freight Analysis Framework provide basic information on the geography of goods movement. The BTS Transportation

Satellite Account and a related account for tourism by the Bureau of Economic Analysis provide an improved representation of transportation in the national economy, identifying the importance of transportation to businesses and providing a basis for analyzing economic productivity of transportation. BTS provides a comprehensive inventory of transportation facilities and links in its National Transportation Atlas Database, which is being expanded to capture non-traditional modes such as bicycle facilities. BTS and its partners are exploring new technologies to measure vehicle activity, safety exposure, and real-world emissions of vehicles. BTS publishes comparable safety data across all modes of transportation, and works with the Department's Traffic Records Coordinating Committee to improve uniform accident reporting. BTS continues to improve and expand its online National Transportation Statistics, which is a comprehensive compilation of condition and performance statistics for the transportation system.

Many information gaps remain:

- Long-distance travel remains poorly measured since BTS conducted the American Travel Survey in 1995.
- Understanding of the domestic movement of international trade is based on models and assumptions more than on data from observations.
- Basic performance measures are much improved for some modes, such as trucking, maritime vessels, and commercial aircraft, but are lacking for other modes, such as freight railroads.

- Cost data cover most forms of passenger travel but are limited for freight movement.
- The value of transportation to the economy and society is poorly articulated.
- Availability of data on causation of safety problems varies by mode.
- Integration of data on crashes, the conditions surrounding the crash, and consequences of the crash remains elusive.

Data quality is a growing problem with an increasing use of new data sources compromised by poorly understood errors, strengths, and weaknesses. Many of the statistics published in 1994 are no longer included because the source data and methods of calculation were suspect and potentially misleading. BTS has replaced some of the suspect data, such as estimates of ton-miles, with estimates that use transparent and consistent methods. Work continues to improve other questionable estimates, such as passenger-miles of travel.

The topics covered in the first *Transportation Statistics Annual Report* remain vital two decades later. The Bureau intends to continue making progress on providing timely and relevant information as well as data on emerging topics with the most cost-effective methods.

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