V. SAFETY, ENERGY, AND ENVIRONMENTAL IMPLICATIONS OF FREIGHT TRANSPORTATION

Growing demand for freight transportation heightens concerns about its safety, energy consumption, and environmental impacts. While safety in all freight modes continues to be monitored actively, the availability of energy consumption data has declined with the discontinuation of the Vehicle Inventory and Use Survey.

While the amount of freight transportation activity has increased in recent decades, the number of fatalities has declined or remained stable in each mode, with the exception of

Table 5-1. Fatalities by Freight Transportation Mode: 1990, 2000, and 2009-2011

	1990	2000	2009	2010	2011
Total transportation fatalities (passenger and freight)	**47,350**	**44,384**	**35,929**	**U**	**U**
Highway (passenger and freight)	**44,599**	**41,945**	**(R)33,883**	**32,885**	**U**
Large truck occupants[1]	705	754	(R)499	529	U
Others killed in crashes involving large trucks	4,567	4,528	(R)2,551	3,146	U
Large truck occupants[1] (percent)	1.6	1.8	1.5	1.6	U
Others killed in crashes involving large trucks (percent)	10.2	10.8	7.5	9.6	U
Railroad (passenger and freight)	**1,297**	**937**	**695**	**(R)730**	**694**
Highway-rail crossing[2]	698	425	247	(R)257	249
Railroad[2,3]	599	512	448	(R)473	445
Waterborne (passenger and freight)	**186**	**111**	**185**	**160**	**232**
Vessel-related[4]	85	42	54	28	41
Freight ship	0	0	1	1	10
Tank ship	5	0	1	0	1
Tug/towboat	13	1	3	0	4
Offshore supply	2	0	0	0	1
Fishing vessel	47	26	25	14	9
Mobile offshore drilling units	0	0	1	0	0
Platform	1	0	0	0	0
Freight barge	0	0	0	0	0
Tank barge	0	0	0	0	1
Miscellaneous[5]	11	15	23	13	15
Not vessel-related[4]	101	69	131	132	191
Pipeline	**9**	**38**	**13**	**(R)19**	**12**
Hazardous liquid pipeline	3	1	4	1	1
Gas pipeline	6	37	9	(R)18	11

Key: R = revised; U = unavailable at date of publication.
[1]Large trucks are defined as trucks over the 10,000 pound gross vehicle weight rating, including single-unit trucks and truck tractors.
[2]Includes Amtrak.
[3]Includes train accidents and other incidents. Most fatalities involve trespassers who are included under other incidents (411 in 2011).
[4]Vessel-related casualties include those involving damage to vessels such as collisions or groundings. Fatalities not related to vessel casualties include deaths from falling overboard or from accidents involving onboard equipment.
[5]Includes industrial vessel, passenger (inspected), passenger (uninspected), recreational, research vessel, unclassified, and unknown data.
Notes: Caution must be exercised in comparing fatalities across modes because significantly different definitions are used. Numbers may not add to totals because some fatalities are counted in more than one mode.

Table 5-1. Fatalities by Freight Transportation Mode: 1990, 2000, and 2009-2011
Sources: Total: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, available at www.bts.gov as of October, 1, 2012. **Highway: 1990 and 2000:** U.S. Department of Transportation, National Highway Transportation Safety Administration, National Center for Statistics and Analysis, *Traffic Safety facts, Large Trucks* (annual issues). **2009- 2011:** U.S. Department of Transportation, National Highway Transportation Safety Administration, National Center for Statistics and Analysis, *Traffic Safety Facts - Highlights* (March 2012). **Railroad:** U.S. Department of Transportation, Federal Railroad Administration, Office of Safety Analysis, available at http://safetydata.fra.dot.gov/officeofsafety/default.asp as of October 1, 2012. **Waterborne:** U.S. Department of Homeland Security, U.S. Coast Guard, Data Administration Division, personal communication, September 15, 2012. **Pipeline:** U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Pipeline Safety Program, Pipeline Library, available at http://primis.phmsa.dot.gov/comm/PipelineLibrary.htm as of October 1, 2012.

waterborne casualties that are not vessel related. Trucks accounted for approximately 11 percent of all highway fatalities in 2010. The vast majority of fatalities involve passenger travel on highways.

The highway mode accounted for nearly all injuries in freight transportation, but the number of injuries has dropped substantially since 2000.

Table 5-2. Injured Persons by Freight Transportation Mode: 1990, 2000, and 2009-2011

	1990	2000	2009	2010	2011
Highway (passenger and freight)	**3,230,666**	**3,188,750**	**2,217,000**	**1,542,000**	**U**
Large truck occupants[1]	41,822	30,832	17,000	20,000	U
Others injured in crashes involving large trucks	108,000	109,000	56,000	60,000	U
Large truck occupants[1] (percent)	1.3	1.0	0.8	1.3	U
Others injured in crashes involving large trucks (percent)	3.3	3.4	2.5	3.9	U
Railroad (passenger and freight)	**25,143**	**11,643**	**7,968**	**(R) 8,337**	**8,228**
Highway-rail grade crossing[2]	2,407	1,219	741	(R) 875	1,002
Railroad[2,3]	22,736	10,434	7,227	(R) 7,462	7,226
Waterborne (passenger and freight)	**NA**	**665**	**722**	**509**	**912**
Vessel-related[4]	175	151	186	135	247
Freight ship	10	5	8	17	24
Tank ship	13	3	4	0	10
Tug/towboat	19	18	39	0	27
Offshore supply	9	6	0	3	1
Fishing vessel	31	21	35	15	46
Mobile offshore drilling units	13	0	1	10	6
Platform	9	0	0	0	0
Freight barge	3	2	0	0	4
Tank barge	3	0	1	0	0
Miscellaneous[5]	12	96	98	90	129
Not related to vessel casualties[4]	NA	514	536	374	665
Pipeline	**76**	**81**	**(R) 62**	**(R) 104**	**55**
Hazardous liquid pipeline	7	4	4	4	2
Gas pipeline	69	77	(R) 58	99	53

Key: NA = not available; R = revised; U = unavailable at date of publication.
[1]Large trucks are defined as trucks over the 10,000 pound gross vehicle weight rating, including single-unit trucks and truck tractors.
[2]Includes Amtrak.
[3]Includes train accidents and other incidents. Most injuries involve workers on duty and are included under other incidents (4,199 in 2011).
[4]Vessel-related injuries include those involving damage to vessels, such as collisions or groundings. Injuries not related to vessel casualties include those from falls overboard or from accidents involving onboard equipment.
[5]Includes industrial vessel, oil recovery, passenger (inspected), passenger (uninspected), recreational, research vessel, unclassified, and unknown data.

Table 5-2. Injured Persons by Freight Transportation Mode: 1990, 2000, and 2009-2011
Sources: Total: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, National Transportation Statistics, available at www.bts.gov as of October, 1, 2012. **Highway: 1990 and 2000:** U.S. Department of Transportation, National Highway Transportation Safety Administration, National Center for Statistics and Analysis, *Traffic Safety Facts, Large Trucks* (annual issues). **2009-2011:** U.S. Department of Transportation, National Highway Transportation Safety Administration, National Center for Statistics and Analysis, *Traffic Safety Facts - Highlights* (March 2012). **Railroad:** U.S. Department of Transportation, Federal Railroad Administration, Office of Safety Analysis, available at http://safetydata.fra.dot.gov/officeofsafety/default.asp as of October 1, 2012. **Waterborne:** U.S. Department of Homeland Security, U.S. Coast Guard, Data Administration Division, personal communication, September 15, 2012. **Pipeline:** U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Pipeline Safety Program, Pipeline Library, available at http://primis.phmsa.dot.gov/comm/PipelineLibrary.htm as of October 1, 2012.

Table 5-3. Crashes, Accidents, and Incidents by Freight Transportation Mode: 1990, 2000, and 2009-2011

	1990	2000	2009	2010	2011
Highway (passenger and freight)	**6,471,000**	**6,394,000**	**5,505,000**	**5,419,000**	**U**
Large truck[1]	371,801	437,861	296,000	276,000	U
Large truck[1] (percent of total)	5.7	6.8	5.4	5.1	U
Rail (passenger and freight)					
Highway-rail grade crossing[2,3]	5,715	3,502	(R)1,932	(R)2,027	2,011
Railroad[2,4]	2,879	2,983	(R)1,910	(R)1,902	2,003
Waterborne (passenger and freight)					
Vessel-related	3,613	5,403	5,475	5,434	6,381
Pipeline					
Hazardous liquid pipeline	140	135	106	(R)121	140
Gas pipeline	290	290	271	(R)257	281

Key: NA = not available; R = revised; U = unavailable at date of publication.
[1]Large trucks are defined as trucks over the 10,000 pound gross vehicle weight rating, including single-unit trucks and truck tractors.
[2]Includes Amtrak.
[3]Includes both accidents and incidents. Most highway-rail grade crossing accidents are also counted under highway.
[4]Train accidents only.

The number of crashes and other freight transportation accidents has declined in all modes except water over the last 20 years, despite an increase in freight transportation activity.

Because most hazardous materials are transported by truck, most incidents related to the movement of hazardous materials occur on highways or in truck terminals. A very small share of hazardous materials transportation incidents are the result of a

Table 5-4. Hazardous Materials Transportation Incidents: 1990, 2000, and 2009-2011

	1990	2000	2009	2010	2011
Total	**8,879**	**17,557**	**(R)14,818**	**(R)14,796**	**15,016**
Accident-related	297	394	290	(R)359	375
Air	**297**	**1,419**	**(R)1,356**	**1,293**	**1,400**
Accident-related	0	3	2	2	2
Highway	**7,296**	**15,063**	**12,730**	**12,635**	**12,803**
Accident-related	249	329	251	(R)321	333
Rail	**1,279**	**1,058**	**(R)642**	**(R)749**	**742**
Accident-related	48	62	37	(R)35	40
Water[1]	**7**	**17**	**90**	**105**	**71**
Accident-related	0	0	0	1	0
Other[2]	**0**	**0**	**NA**	**NA**	**NA**
Accident-related	0	0	NA	NA	NA

Key: NA = not available; R = revised.
[1]Water category includes only packaged (nonbulk) marine. Non-packaged (bulk) marine hazardous materials incidents are reported to the U.S. Coast Guard and are not included.
[2]Other category includes freight forwarders and modes not otherwise specified.
Notes: Hazardous materials transportation incidents required to be reported are defined in the Code of Federal Regulations (CFR), 49 CFR 171.15, 171.16 (Form F 5800.1). Hazardous materials deaths and injuries are caused by the hazardous material in commerce. Accident related means vehicular accident or derailment. Each modal total also includes fatalities caused by human error, package failure, and causes not elsewhere classified. As of 2005, the "Other" data is no longer included in the hazardous materials information system report.

Table 5-3. Crashes, Accidents, and Incidents by Freight Transportation Mode: 1990, 2000, and 2009-2011
Sources: Highway: U.S. Department of Transportation, National Highway Transportation Safety Administration, National Center for Statistics and Analysis, *Traffic Safety Facts, Large Trucks* (annual issues). **2008-2010:** U.S. Department of Transportation, National Highway Transportation Safety Administration, National Center for Statistics and Analysis, *Traffic Safety Facts - Highlights* (August 2012). **Railroad:** U.S. Department of Transportation, Federal Railroad Administration, Office of Safety Analysis, available at http:// safetydata.fra.dot.gov/officeofsafety/default.asp as of September 20, 2012. **Waterborne:** U.S. Department of Homeland Security, U.S. Coast Guard, Data Administration Division, personal communication, September 6, 2012. **Pipeline:** U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Pipeline Safety Program, Pipeline Library, available at http://phmsa.dot.gov/pipeline/library/data-stats as of September 20, 2012.

Table 5-4. Hazardous Materials Transportation Incidents: 1990, 2000, and 2009-2011
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Hazardous Materials Safety, Hazardous Materials Information System Database, available at www.phmsa.dot.gov/ hazmat/library/data-stats as of September 20, 2012.

vehicular crash or derailment (referred to as "accident related"). Approximately two percent of incidents were accident related in 2011, but they accounted for 76 percent of all property damage. Most hazardous materials incidents occur because of human error or package failure, particularly during loading and unloading.

Table 5-5a. Commercial Motor Carrier Compliance Reviews by Safety Rating: 2011

	2011		
Safety rating	**Federal**	**State**	**Total**
Satisfactory	3,466	1,862	5,328
Conditional	2,365	1,175	3,540
Unsatisfactory	207	114	321
Not rated	158	1,620	1,778
Total	**6,196**	**4,771**	**10,967**

Notes: These data include any review that resulted in a safety rating, including Motor Carrier Safety Compliance Reviews or CSA2010 reviews. As a result, the total number of reviews in this table differs from the total in Table 5- 5b because that table includes reviews that did not result in a formal safety rating. A compliance review is an on-site examination of a motor carrier's records and operations to determine whether the carrier meets the Federal Motor Carrier Safety Administration's safety fitness standard.

The safety fitness of motor carriers is a top priority of the U.S. Department of Transportation. As part of its efforts to improve safety, federal and state governments conducted 10,967 safety compliance reviews that resulted in a formal safety rating in 2011. Of that total, only about three percent of motor carriers received an unsatisfactory rating.

Federal and state governments also conduct shipper, cargo tank facility, and onsite comprehensive safety analysis reviews.

Table 5-5b. Commercial Motor Carrier Compliance Reviews by Type: 2008-2011

	2008			2009			2010			2011		
Review Type	**Federal**	**State**	**Total**	**Federal**	**State**	**Total**	**Federal**	**State**	**Total**	**Federal**	**State**	**Total**
Total Reviews	**11,105**	**7,007**	**18,112**	**12,326**	**7,979**	**20,305**	**12,309**	**7,877**	**20,186**	**11,094**	**7,335**	**18,429**
Motor Carrier Safety Compliance Reviews	9,642	5,971	15,613	10,084	6,429	16,513	8,859	5,705	14,564	4,614	3,657	8,271
Cargo Tank Facility Reviews	79	15	94	84	22	106	121	23	144	78	19	97
Shipper Reviews	293	50	343	341	38	379	310	80	390	271	61	332
Non-Rated Reviews (excludes SCR & CSA2010)	841	669	1,510	1,243	815	2,058	1,725	636	2,361	959	541	1,500
CSA Offsite	209	267	476	136	207	343	333	356	689	316	300	616
CSA Onsite Focused / Focused CR	36	29	65	260	260	520	591	615	1,206	4,324	1,903	6,227
CSA Onsite Comprehensive*	5	6	11	178	208	386	369	458	827	529	853	1,382
Total Security Contact Reviews	**1,310**	**487**	**1,797**	**1,378**	**581**	**1,959**	**1,276**	**621**	**1,897**	**603**	**301**	**904**

Key: SCR = Security Contact Reviews; CSA = Compliance, Safety, Accountability; CR = Compliance Review.
Notes: These data include all compliance reviews conducted in the specified years. As a result, the total number of reviews in this table differs from the total in Table 5-5a because that table only includes reviews that reulted in a formal safety rating. A compliance review is an on-site examination of a motor carrier's records and operations to determine whether the carrier meets the Federal Motor Carrier Safety Administration's safety fitness standard.

Table 5-5a. Commercial Motor Carrier Compliance Reviews by Safety Rating: 2011
Source: U.S. Department of Transportation, Federal Motor Carrier Administration, Motor Carrier Management Information System (MCMIS), Compliance Review Activity by Safety Rating for Calendar Years, available at www.fmcsa.dot.gov as of September 3, 2012.

Table 5-5b. Commercial Motor Carrier Compliance Reviews by Type: 2008-2011
Source: U.S. Department of Transportation, Federal Motor Carrier Administration, Motor Carrier Management Information System (MCMIS), Compliance Review Activity by Safety Rating for Calendar Years, available at www.fmcsa.dot.gov as of September 3, 2012.

Table 5-6. Roadside Safety Inspection Activity Summary By Inspection Type: 2000 and 2009-2011

	2000		2009		2010		2011	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All inspections								
Number of inspections	2,453,776	100.0	3,530,382	100.0	3,569,373	100.0	3,601,302	100.0
With no violations	639,593	26.1	1,176,351	33.3	1,225,324	34.3	1,342,133	37.3
With violations	1,814,183	73.9	2,354,031	66.7	2,344,049	65.7	2,259,169	62.7
Driver inspections								
Number of inspections	2,396,688	100.0	3,429,882	100.0	3,470,871	100.0	3,484,536	100.0
With no violations	1,459,538	60.9	2,100,760	61.2	2,316,960	66.8	2,422,611	69.5
With violations	937,150	39.1	1,329,122	38.8	1,153,911	33.2	1,061,925	30.5
With OOS violations	191,031	8.0	196,625	5.7	183,350	5.3	173,980	5.0
Vehicle inspections								
Number of inspections	1,908,300	100.0	2,349,072	100.0	2,413,094	100.0	2,425,973	100.0
With no violations	584,389	30.6	779,891	33.2	834,551	34.6	880,172	36.3
With violations	1,323,911	69.4	1,569,181	66.8	1,578,543	65.4	1,545,801	63.7
With OOS violations	452,850	23.7	506,878	21.6	480,416	19.9	491,730	20.3
Hazardous materials inspections								
Number of inspections	133,486	100.0	222,587	100.0	211,154	100.0	208,852	100.0
With no violations	101,098	75.7	153,219	68.8	180,522	85.5	183,150	87.7
With violations	32,388	24.3	69,368	31.2	30,632	14.5	25,702	12.3
With OOS violations	9,964	7.5	10,323	4.6	9,210	4.4	7,998	3.8

Key: OOS = out of service.
Notes: A roadside inspection is an examination of individual commercial motor vehicles and drivers to determine if they are in compliance with the Federal Motor Carrier Safety Regulations and/or Hazardous Materials Regulations. Serious violations result in the issuance of driver or vehicle OOS orders. These violations must be corrected before the driver or vehicle can return to service. Moving violations also may be recorded in conjunction with a roadside inspection.

Less than one-fourth of all roadside inspections of commercial vehicles resulted in the vehicle being placed out of service (OOS) for a serious violation. A much lower percentage of driver and hazardous materials inspections results in OOS orders. In 2011, five percent of driver inspections and less than four percent of hazardous materials inspections resulted in an OOS order.

Table 5-6. Roadside Safety Inspection Activity Summary By Inspection Type: 2000 and 2009-2011
Source: Source: U.S. Department of Transportation, Federal Motor Carrier Administration, Motor Carrier Management Information System (MCMIS), Roadside Inspection Activity Summary for Calendar Years, special tabulation, July 17, 2012.

Table 5-7. Fuel Consumption by Transportation Mode: 2007-2010

	2007	2008	2009	2010
Highway[1]				
Gasoline, diesel and other fuels (million gallons)	176,203	170,765	168,140	169,679
Truck, total	47,219	47,704	(R) 44,303	44,957
Single-unit 2-axle 6-tire or more truck	16,314	17,144	(R) 16,253	15,072
Combination truck	30,904	30,561	(R) 28,050	29,885
Truck (percent of total)	26.8	27.9	(R) 26.3	26.5
Rail, Class I (in freight service)				
Distillate / diesel fuel (million gallons)	4,062	3,886	3,192	3,494
Water				
Residual fuel oil (million gallons)	6,327	5,066	4,543	4,206
Distillate / diesel fuel oil (million gallons)	1,924	1,187	1,266	1,343
Gasoline (million gallons)	1,222	1,136	1,130	1,167
Pipeline				
Natural gas (million cubic feet)	621,364	647,956	(R) 670,174	668,847

Key: R = revised.
[1]Based on a new methodology, FHWA revised its annual vehicle miles travelled, number of vehicles, and fuel economy data beginning with 2007. Information on the new methodology is available at www.fhwa.dot.gov/policyinformation/statistics.cfm. Data in this table should not be compared to those in pre-2011 editions of *Freight Facts and Figures*.

Fuel consumption is a major concern for environmental and other reasons. In recent years, increases in fuel costs, a slight decrease in the number of trucks on the road, and improved energy efficiency have affected the number of gallons of fuel burned by commercial trucks. From 2007 to 2010, truck fuel consumption declined by nearly five percent. Fuel use in Class I freight railroads declined 14 percent, from 4.1 billion gallons in 2007 to 3.5 billion gallons in 2010.

In 2010, trucking accounted for a large majority of freight transportation energy consumption, followed by water, a distant second.

Table 5-8. Energy Consumption by Transportation Mode: 2007-2010 (trillions of BTUs)

	2007	2008	2009	2010
Truck	6,326	6,382	(R)5,922	6,029
Class I Rail	563	539	443	485
Water	1,367	1,065	997	962
Pipeline (natural gas only)	642	668	(R)691	690

Key: BTU = British Thermal Unit; R = revised.
[1]Based on a new methodology, FHWA revised its annual vehicle miles travelled, number of vehicles, and fuel economy data beginning with 2007. Information on the new methodology is available at www.fhwa.dot.gov/policyinformation/statistics.cfm. Data in this table should not be compared to those in pre-2011 editions of *Freight Facts and Figures*.

Table 5-7. Fuel Consumption by Transportation Mode: 2007-2010
Sources: Highway: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: annual issues), table VM-1. **Rail:** Association of American Railroads, *Railroad Facts* (Washington, DC: annual issues), p. 40. **Water:** U.S. Department of Energy, Energy Information Administration, *Fuel Oil and Kerosene Sales 2010* (Washington, DC: 2011), tables 2, 4, and similar tables in earlier editions; U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: annual issues), table MF-24, available at www.fhwa.dot.gov/policyinformation/statistics/2010/ as of July 20, 2012. **Pipeline:** U.S. Department of Energy, *Natural Gas Annual 2010*, (Washington, DC: December 2011), table 15 and similar tables in earlier editions.

Table 5-8. Energy Consumption by Transportation Mode: 2007-2010
Source: Highway: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: annual issues), table VM-1. **Rail:** Association of American Railroads, *Railroad Facts* (Washington, DC: annual issues), p. 40. **Water:** U.S. Department of Energy, Energy Information Administration, *Fuel Oil and Kerosene Sales 2010* (Washington, DC: 2011), tables 2, 4, and similar tables in earlier editions; U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: annual issues), table MF-24, available at www.fhwa.dot.gov/policyinformation/statistics/2010/ as of July 20, 2012. **Pipeline:** U.S. Department of Energy, *Natural Gas Annual 2010*, (Washington, DC: December 2011), table 15 and similar tables in earlier editions.

Miles per gallon for single-unit trucks (based on total travel and fuel consumption) have been relatively stable in recent years. In 2010, single-unit trucks consumed nearly 1.2 billion fewer gallon than the previous year.

Table 5-9. Single-Unit Truck Fuel Consumption and Travel: 2007-2010

	2007	2008	2009	2010
Number registered (thousands)	8,117	8,288	8,356	8,217
Vehicle miles (millions)	119,979	126,855	(R)120,207	110,674
Fuel consumed (million gallons)	16,314	17,144	(R)16,253	15,072
Average miles traveled per vehicle	14,782	15,306	(R)14,386	13,469
Average miles traveled per gallon	7.4	7.4	7.4	7.3
Average fuel consumed per vehicle (gallons)	2,010	2,068	(R)1,945	1,834

Key: R = revised.
Notes: Based on a new methodology, FHWA revised its annual vehicle miles travelled, number of vehicles, and fuel economy data beginning with 2007. Information on the new methodology is available at www.fhwa.dot.gov/policyinformation/statistics.cfm. Data in this table should not be compared to those in pre-2011 editions of *Freight Facts and Figures*.

Table 5-10. Combination Truck Fuel Consumption and Travel: 2007-2010

	2007	2008	2009	2010
Number registered (thousands)	2,635	2,585	2,617	2,553
Vehicle miles traveled (millions)	184,199	183,826	(R)168,100	175,911
Fuel consumed (million gallons)	30,904	30,561	(R)28,050	29,885
Average miles traveled per vehicle	69,896	71,106	(R)64,231	68,907
Average miles traveled per gallon	6.0	6.0	6.0	5.9
Average fuel consumed per vehicle (gallons)	11,727	11,821	(R)10,718	11,706

Key: R = revised.
Notes: Based on a new methodology, FHWA revised its annual vehicle miles travelled, number of vehicles, and fuel economy data beginning with 2007. Information on the new methodology is available at www.fhwa.dot.gov/policyinformation/statistics.cfm. Data in this table should not be compared to those in pre-2011 editions of *Freight Facts and Figures*.

Miles per gallon by combination trucks (based on total travel and fuel consumption) also remained stable between 2007 and 2010. During the same period, vehicle miles traveled by combination trucks declined by 8.3 billion (about 4 percent).

Table 5-9. Single-Unit Truck Fuel Consumption and Travel: 2007-2010
Source: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: annual issues), table VM-1. available at www.fhwa.dot.gov/policyinformation/statistics/2010/ as of June 25, 2012.

Table 5-10. Combination Truck Fuel Consumption and Travel: 2007-2010
Source: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: annual issues), table VM-1. available at www.fhwa.dot.gov/policyinformation/statistics/2010/ as of June 25, 2012.

Table 5-11. Energy Intensities of Domestic Freight Transportation Modes: 2007-2010

	2007	2008	2009	2010
Highway[1] (Btu per vehicle mile)	21,238	21,008	(R)21,024	21,463
Railroad (Class I) (Btu per freight car mile)	14,846	14,573	13,907	13,733
Railroad (Class I) (Btu per ton mile)	320	305	291	289
Domestic Water (Btu per ton mile)	225	252	225	217

Key: Btu = British thermal unit; R = revised.
[1]Based on a new methodology, FHWA revised its annual vehicle miles travelled, number of vehicles, and fuel economy data beginning with 2007. Energy intensity data is based on FHWA fuel use methodology. Information on the new methodology is available at www.fhwa.dot.gov/policyinformation/statistics.cfm. Data in this table should not be compared to those in pre-2011 editions of *Freight Facts and Figures*.

Energy intensity is the amount of energy used to produce a given level of output or activity, in this case vehicle miles and ton miles. In recent years, the energy intensity of trucking has remained stable, while rail and water have improved.

Table 5-12. Estimated National Average Vehicle Emissions Rates of Heavy-Duty and Light-Duty Vehicles: 2000, 2005, 2010, and 2011 (grams per mile)

	2000	2005	2010	2011
Gasoline				
Cars				
Exhaust HC	0.88	0.49	0.29	0.26
Nonexhaust HC	0.61	0.38	0.22	0.19
Total HC	1.49	0.87	0.51	0.45
Exhaust CO	15.21	8.44	5.17	4.75
Exhaust NO_x	1.98	1.24	0.77	0.69
Light trucks				
Exhaust HC	1.31	0.98	0.74	0.69
Nonexhaust HC	0.63	0.44	0.33	0.31
Total HC	1.94	1.43	1.08	1.00
Exhaust CO	23.44	16.08	11.77	11.06
Exhaust NO_x	2.85	2.04	1.59	1.50
Heavy trucks				
Exhaust HC	2.75	1.87	1.30	1.19
Nonexhaust HC	1.22	0.94	0.76	0.70
Total HC	3.96	2.81	2.06	1.89
Exhaust CO	62.89	47.27	35.27	32.95
Exhaust NO_x	5.84	4.50	3.56	3.45
Diesel				
Cars				
Exhaust HC	0.26	0.16	0.08	0.07
Exhaust CO	1.14	0.57	0.54	0.63
Exhaust NO_x	1.36	1.96	1.23	1.09
Light trucks				
Exhaust HC	0.65	0.66	0.60	0.55
Exhaust CO	3.51	3.74	3.40	3.15
Exhaust NO_x	6.04	5.83	4.62	4.26
Heavy trucks				
Exhaust HC	1.06	1.10	0.92	0.86
Exhaust CO	4.59	4.64	3.57	3.28
Exhaust NO_x	23.20	16.84	10.97	9.84

Key: CO = carbon monoxide; HC = hydrocarbon; NO_X = nitrogen oxides.
Notes: This table is based on MOVES, the latest U.S. Environmental Protection Agency's (EPA) highway vehicle emissions factor model. Tables in pre-2011 editions of *Freight Facts and Figures* were based on the MOBILE6 model. Thus, the data in this table should not be compared to those in pre-2011 editions. Data are for July of each year.

Air quality is affected by freight vehicle emissions. Compared with gasoline-fueled cars and trucks, diesel-fueled heavy trucks emit small amounts of carbon monoxide (CO), but large amounts of nitrogen oxides (NO_X). However, since 2000 heavy-duty truck emissions of NO_X have declined by 58 percent.

Table 5-11. Energy Intensities of Domestic Freight Transportation Modes: 2007-2010
Source: Oak Ridge National Laboratory, *Transportation Energy Data Book: Edition 31* (Oak Ridge, TN: annual issues), table 2.15, available at http://cta.ornl.gov/data/index.shtml as of August 5, 2012.

Table 5-12. Estimated National Average Vehicle Emissions Rates of Heavy-Duty and Light-Duty Vehicles: 2000, 2005, 2010, and 2011
Source: U.S. Environmental Protection Agency, National Vehicle and Fuel Emissions Laboratory, personal communication, September 19, 2011.

Most PM-10 emissions come from agricultural fields, wildfires, and fugitive dust. Consequently, freight transportation is a minor factor when considering total PM-10 emissions.

Table 5-13. Freight Nitrogen Oxides (NO_X) and Particulate Matter (PM-10) Emissions by Freight Transportation Mode: 2002

Mode	NO_x Emissions: Tons (thousands)	NO_x Emissions: Percent	NO_x Emissions: As a percent of: All mobile sources	NO_x Emissions: As a percent of: All sources	PM-10 Emissions: Tons (thousands)	PM-10 Emissions: Percent	PM-10 Emissions: As a percent of: All mobile sources	PM-10 Emissions: As a percent of: All sources
Heavy-duty vehicles	3,782.0	66.8	33.0	17.9	120.0	64.7	23.3	0.5
Freight railroads	857.2	15.1	7.5	4.1	21.3	11.5	4.1	0.1
Marine vessels	1,011.0	17.9	8.8	4.8	44.0	23.7	8.5	0.2
Air freight	8.2	0.1	0.1	0.0	0.3	0.2	0.1	0.0
Total	**5,658.4**	**100.0**	**49.4**	**26.8**	**185.6**	**100.0**	**36.0**	**0.8**

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

Trucks are by far the largest contributor to freight emissions nationally, producing two-thirds of NO_X from the freight sector. However, enormous strides have been made in reducing freight emissions of NO_X since the U.S. Environmental Protection Agency required the use of ultra low sulfur diesel (ULSD) fuel in heavy-duty trucks and other diesel-powered highway vehicles beginning in 2006.

Table 5-14. Nitrogen Oxides (NO_X) Emissions by Freight Transportation Mode: 2002 and 2020

	Tons (thousands)		
	2002	2020	Percent change, 2002 to 2020
Heavy-duty trucks	3,782.0	662.6	-82.5
Freight rail	857.2	486.4	-43.3
Commercial marine	1,011.0	938.6	-7.2
Air freight	8.2	12.4	51.2
Total freight	**5,658.4**	**2,100.0**	**-62.9**

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

Table 5-13. Freight Nitrogen Oxides (NO_X) and Particulate Matter (PM-10) Emissions by Freight Transportation Mode: 2002
Source: U.S. Department of Transportation, Federal Highway Administration, *Assessing the Effects of Freight Movement on Air Quality at the National and Regional Level, Final Report* (Washington, DC: 2005), available at www.fhwa.dot.gov/environment/freightaq/ as of July 16, 2012.

Table 5-14. Nitrogen Oxides (NO_X) Emissions by Freight Transportation Mode: 2002 and 2020
Source: U.S. Department of Transportation, Federal Highway Administration, *Assessing the Effects of Freight Movement on Air Quality at the National and Regional Level, Final Report* (Washington, DC: 2005), available at www.fhwa.dot.gov/environment/freightaq/ as of July 16, 2012.

Table 5-15. Particulate Matter (PM-10) Emissions by Freight Transportation Mode: 2002 and 2020

	Tons (thousands)		
	2002	2020	Percent change, 2002 to 2020
Heavy-duty trucks	120.0	34.8	-71.0
Freight rail	21.3	13.0	-39.0
Commercial marine	44.0	44.1	0.2
Air freight	0.3	0.3	-10.0
Total freight	**185.6**	**92.1**	**-50.4**

Trucks produced two-thirds of PM-10 emissions from the freight sector. Freight-related PM-10 emissions are forecast to decline by 50 percent from 2002 to 2020, primarily from a reduction in heavy-duty truck emissions. The required use of ULSD fuel in heavy-duty trucks and other diesel-powered highway vehicles has helped to reduce PM emissions and enabled the use of advanced pollution control technologies to meet emissions standards.

In addition to CO, NO_X, and particulate matter emissions, the transportation sector releases large quantities of greenhouse gases (GHGs), such as carbon dioxide (CO_2), methane, nitrous oxide, and hydrofluorocarbons. Transportation is responsible for about 27 percent of all greenhouse gases emitted in the United States and nearly 7 percent of all greenhouse gases emitted globally.[1] When emissions from electricity generation are allocated among end-use sectors (on the basis of each sector's share of electricity consumption), the industrial sector produces the largest amount of GHG emissions, followed closely by transportation.

[1]Intergovernmental Panel on Climate Change, Climate Change 2007: Synthesis Report (Geneva, Switzerland: 2008).

Table 5-15. Particulate Matter (PM-10) Emissions by Freight Transportation Mode: 2002 and 2020
Source: U.S. Department of Transportation, Federal Highway Administration, *Assessing the Effects of Freight Movement on Air Quality at the National and Regional Level, Final Report* (Washington, DC: 2005), available at www.fhwa.dot.gov/environment/freightaq/ as of July 16, 2012.

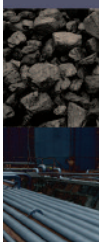

Table 5-16. U.S. Greenhouse Gas Emissions by Economic End-Use Sector: 1990, 2005, and 2007-2010 (electricity-related emissions distributed among sectors)[1] (millions of metric tonnes of CO2 equivalent)

Sector	(R)1990	(R)2005	2007	(R)2008	(R)2009	2010
Industry[2]	2,237.7	2,159.9	2,185.9	2,131.5	1,905.8	2,019.0
Transportation[3]	1,548.3	2,022.3	2,007.6	1,894.6	1,823.9	1,838.6
Commercial	939.4	1,193.6	1,216.9	1,213.3	1,151.3	1,171.0
Residential	953.2	1,244.6	1,238.5	1,227.3	1,162.9	1,226.6
Agriculture	462.9	525.5	550.5	533.3	518.9	521.1
U.S. Territories[4]	33.7	58.2	53.5	48.4	45.5	45.5
Total	**6,175.2**	**7,204.2**	**7,252.8**	**7,048.3**	**6,608.3**	**6,821.8**

Key: CO_2 = carbon dioxide; R = revised.

[1]Emissions from electricity generation are allocated to each economic end-use sector on the basis of each sector's share of aggregate electricity consumption. This method assumes each sector consumes electricity that is generated from the national average mix of fuels according to their carbon intensity.

[2]Industry includes manufacturing, construction, and mining. Six manufacturing industries--petroleum refinieries, chemicals, primary metals, paper, food, and nonmetallic mineral products--represent the vast majority of energy use and thus GHG emissions in the industrial sector.

[3]Includes emissions from military aircraft (12.5 million of metric tonnes in 2010) and "other" transportation, primarily lubricants (9.5 million of metric tonnes in 2010). Emissions from international bunker fuels are not included.

[4]Electricity-related emissions were not distributed to U.S. Territories.

Notes: Greenhouse gas (GHG) emissions include CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. CO_2 equivalent is computed by multiplying the weight of the gas being measured by its estimated Global Warming Potential (GWP). The Intergovernmental Panel on Climate Change developed the GWP concept to compare the ability of one GHG to trap heat in the atmosphere to another gas. Carbon comprises 12/44 of CO_2 by weight. Numbers may not add to totals due to rounding.

From 1990 to 2010, transportation GHG emissions rose by nearly 19 percent. However, transportation sector emissions decreased by 8 percent from 2007 to 2010, likely the result of the economic downtown and higher fuel prices, which led to a decrease in vehicle miles traveled and fuel consumption.

Table 5-16. U.S. Greenhouse Gas Emissions by Economic End-Use Sector: 1990, 2005, and 2007-2010
Source: U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010*, EPA 430-R-12-001 (Washington, DC: April 15, 2012), table ES-8, available at http://epa.gov/climatechange/emissions/usinventoryreport.html as of May 10, 2012.

CO_2 accounts for nearly all of the transportation sector's GHG emissions, primarily from the combustion of fossil fuels. Almost all of the energy consumed by the sector is petroleum-based and includes motor gasoline, diesel fuel, jet fuel, and residual oil.

Gasoline-fueled passenger cars and light-duty trucks are responsible for about 62 percent of transportation sector CO_2 emissions while the combustion of diesel fuel in heavy-duty trucks and jet fuel in aircraft produced much of the rest.

Table 5-17. U.S. Transportation Sector CO_2 Emissions from Fossil Fuel Combustion by Fuel Type: 1990, 2005, and 2007-2010 (millions of metric tonnes of CO_2 equivalent)

Fuel	1990	2005	2007	2008	(R)2009	2010
Petroleum	**1,449.9**	**1,863.5**	**1,858.7**	**(R)1,753.2**	**1,690.0**	**1,705.4**
Motor gasoline	983.7	1,187.8	1,181.2	1,130.3	1,128.5	1,117.0
Distillate fuel oil	262.9	458.1	476.3	443.5	402.9	418.9
Jet fuel	176.2	194.2	168.7	155.1	139.6	140.5
Residual fuel[1]	22.6	19.3	29.0	19.9	15.4	25.3
Aviation gasoline	3.1	2.4	2.2	2.0	1.8	1.9
Liquefied petroleum gas	1.4	1.7	1.4	(R)2.5	1.7	1.8
Natural Gas	**36.0**	**33.1**	**35.2**	**(R)36.7**	**37.9**	**40.1**
Transportation Total[2]	**1,485.9**	**1,896.6**	**1,893.9**	**(R)1,789.8**	**1,727.9**	**1,745.5**
U.S. Total[2]	**(R)4,738.3**	**(R)5,746.5**	**5,757.8**	**(R)5,571.5**	**5,206.2**	**5387.8**
Transportation Sector as % of Total	**31.4**	**33.0**	**32.9**	**(R)32.1**	**33.2**	**32.4**

Key: CO_2 = carbon dioxide; R = revised.
[1]Fluctuations in emissions estimates reflect data collection problems.
[2]Electricity-related emissions are not included in the transportation sector and U.S. totals.
Notes: CO_2 equivalent is computed by multiplying the weight of the gas being measured by its estimated Global Warming Potential (GWP). The Intergovernmental Panel on Climate Change developed the GWP concept to compare the ability of one GHG to trap heat in the atmosphere to another gas. Carbon comprises 12/44 of CO_2 by weight. Numbers may not add to totals due to rounding. Electricity-related emissions are not included in this table.

Table 5-17. U.S. Transportation Sector CO_2 Emissions from Fossil Fuel Combustion by Fuel Type: 1990, 2005, and 2007-2010
Source: U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010*, EPA 430-R-12-001 (Washington, DC: April 15, 2012), Annex 2, tables A-11, A-12, A-13, A-14, A-16, and A-31, available at http://epa.gov/climatechange/emissions/usinventoryreport.html as of May 10, 2012.

Table 5-18. U.S. Greenhouse Gas Emissions from Domestic Freight Transportation: 1990, 2005, and 2007-2010 (millions of metric tonnes of CO_2 equivalent)

Mode	1990	2005	2007	(R)2008	(R)2009	2010	Percent change, 1990 to 2010
Trucking	231.1	(R)408.5	444.7	427.1	389.3	402.2	74.0
Freight Rail	34.5	46.7	47.8	44.4	37.2	40.0	15.6
Ships and Other Boats[1]	30.6	27.9	37.9	(R)22.6	17.0	26.5	-13.4
Pipelines[2]	36.0	32.2	34.2	35.6	36.6	38.8	7.5
Commercial Aircraft	23.7	26.0	20.3	17.3	15.6	16.4	-30.8
Freight Total	**356.0**	**(R)541.3**	**584.9**	**546.9**	**495.7**	**524.0**	**47.2**
Passenger Total	**1,145.7**	**1,452.5**	**1,396.1**	**1,321.7**	**1,305.3**	**1,292.3**	**12.8**
Transportation Total[3]	**1,548.3**	**(R)2,022.3**	**2,007.6**	**1,894.6**	**1,823.9**	**1,838.6**	**25.2**
Freight as % of Transportation Total	**23.0**	**26.8**	**29.1**	**28.9**	**27.2**	**28.5**	**23.9**

Key: CO_2 = carbon dioxide; R = revised.
[1]Fluctuations in emissions estimates reflect data collection problems.
[2]Includes only CO_2 emissions from natural gas used to power pipelines.
[3]Includes greenhouse gas emissions from military aircraft (12.5 million metric tonnes in 2010); "other" transportation, primarily lubricants (9.5 million metric tonnes in 2010); and electricity-related emissions. Emissions from international bunker fuels are not included.
Notes: U.S. Environmental Protection Agency (EPA) used U.S. Department of Energy fuel consumption data to allocate freight and passenger rail emissions. EPA used U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics data on freight shipped by commercial aircraft and the total number of passengers enplaned to split commercial aircraft emissions. Each passenger was estimated to weigh an average of 150 pounds and luggage was estimated to weigh 50 pounds. Previous Inventories included commercial aircraft emissions under passenger travel. CO2 equivalent is computed by multiplying the weight of the gas being measured by its estimated Global Warming Potential (GWP). The Intergovernmental Panel on Climate Change developed the GWP concept to compare the ability of one GHG to trap heat in the atmosphere to another gas. Carbon comprises 12/44 of CO2 by weight. Numbers may not add to totals due to rounding.

Since 1990, the rate of growth of GHG emissions from freight sources has been nearly four times as fast as that for passenger travel. Trucking accounted for the lion's share of freight emissions followed by freight rail, a distant second.

Table 5-18. U.S. Greenhouse Gas Emissions from Domestic Freight Transportation: 1990, 2005, and 2007-2010
Source: U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010*, EPA 430-R-12-001 (Washington, DC: April 15, 2012), table ES-8 and Annex 3, tables A-113 and A-114, available at www.epa.gov/climatechange/emissions/usinventoryreport.html as of May 10, 2012.

Between 1990 and 2010, medium- and heavy-duty truck emissions rose by 74 percent, the largest percentage increase of any major transportation mode. An increase in truck freight movement is largely responsible for the rise in emissions over the last 20 years.

Table 5-19. Medium- and Heavy-Duty Truck Greenhouse Gas Emissions: 1990, 2005, and 2007-2010 (millions of metric tonnes of CO_2 equivalent)

	1990	2005	2007	(R)2008	(R)2009	2010
Carbon dioxide	230.1	396.0	431.6	413.9	376.3	389.3
Methane	0.2	(R)0.2	0.2	0.2	0.2	0.2
Nitrous Oxide	0.8	(R)1.2	1.5	1.4	1.2	1.1
Hydrofluorocarbons	<0.05	(R)11.1	11.5	11.6	11.6	11.6
Total Truck	**231.1**	**(R)408.5**	**444.7**	**427.1**	**389.3**	**402.3**
Total U.S. Transportation[1]	**1,548.3**	**(R)2,022.3**	**2,007.6**	**1,894.6**	**1,823.90**	**1,838.6**
Total U.S.[1]	**(R)6,175.2**	**(R)7,204.2**	**7,252.8**	**7,048.3**	**6,608.30**	**6,821.8**
Truck share of transportation total (percent)	**14.9**	**20.2**	**22.2**	**22.5**	**21.3**	**21.9**
Truck share of U.S. total (percent)	**3.7**	**5.7**	**6.1**	**5.7**	**5.9**	**5.9**

Key: CO_2 = carbon dioxide; R = revised.
[1]Transportation and U.S. totals include greenhouse gas emissions from military aircraft (12.5 million metric tonnes in 2010); "other" transportation, primarily lubricants (9.5 million metric tonnes in 2010); and electricity-related emissions. Emissions from international bunker fuels are not included.
Notes: CO_2 equivalent is computed by multiplying the weight of the gas being measured by its estimated Global Warming Potential (GWP). The Intergovernmental Panel on Climate Change developed the GWP concept to compare the ability of one GHG to trap heat in the atmosphere to another gas. Carbon comprises 12/44 of CO_2 by weight. Medium- and heavy-duty trucks weigh 8,501 pounds and above. Numbers may not add to totals due to rounding.

Table 5-19. Medium- and Heavy-Duty Truck Greenhouse Gas Emissions: 1990, 2005, and 2007-2010
Source: U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010*, EPA 430-R-12-001 (Washington, DC: April 15, 2012), tables 2-15 and ES-8, available at http://epa.gov/climatechange/emissions/usinventoryreport.html as of May 10, 2012.