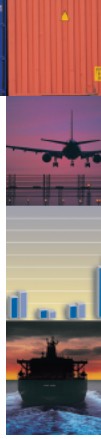
V. SAFETY, ENERGY, AND ENVIRONMENTAL IMPLICATIONS OF FREIGHT TRANSPORTATION



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 demise of the Vehicle Inventory and Use Survey, and the environmental implications of freight transportation only recently have been considered separately from passenger travel.

Table 5-1. Fatalities by Freight Transportation Mode: 1980-2007

	1980	1990	2000	2006	2007
Total transportation fatalities (passenger and freight)	**NA**	**47,350**	**44,384**	**(P) 44,912**	**NA**
Highway (passenger and freight)	**51,091**	**44,599**	**41,945**	**(R) 42,708**	**41,059**
Large truck occupants[1]	1,262	705	754	805	802
Others killed in crashes involving large trucks	4,709	4,567	4,528	4,222	4,006
Large truck occupants[1] (percent)	2.5	1.6	1.8	(R) 1.9	2.0
Others killed in crashes involving large trucks (percent)	9.2	10.2	10.8	(R) 9.9	9.8
Railroad (passenger and freight)	**1,417**	**1,297**	**937**	**(R) 910**	**851**
Highway-rail crossing[2]	833	698	425	(R) 369	338
Railroad[2,3]	584	599	512	(R) 541	513
Waterborne (passenger and freight)	**487**	**186**	**111**	**(R) 107**	**98**
Vessel-related[4]	206	85	42	(R) 55	51
Freight ship	8	0	0	1	3
Tank ship	4	5	0	0	1
Tug/towboat	14	13	1	(R) 7	4
Offshore supply	NA	2	0	0	1
Fishing vessel	60	47	26	(R) 23	19
Mobile offshore drilling units	NA	0	0	(R) 2	1
Platform	NA	1	0	0	0
Freight barge	NA	0	0	(R) 1	3
Tank barge	NA	0	0	0	0
Miscellaneous[5]	56	11	15	(R) 21	21
Not vessel-related[4]	281	101	69	(R) 52	47
Pipeline	**19**	**9**	**38**	**19**	**18**
Hazardous liquid pipeline	4	3	1	0	4
Gas pipeline	15	6	37	19	14

Key: NA = not available; P = preliminary; R = revised.
[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 (472 in 2007).
[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.
Note: Caution must be exercised in comparing fatalities across modes because significantly different definitions are used.

While the amount of freight transportation activity has increased in recent decades, the number of fatalities has declined or remained stable in each mode. Most fatalities involve people who are not in the freight business, such as trespassers on freight railroads.

Table 5-1. Fatalities by Freight Transportation Mode: 1980-2007
Sources: Total and Pipeline: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics 2008*, available at www.bts.gov/ as of August 14, 2008. **Highway:** National Center for Transportation Analysis, National Highway Transit Safety Administration, *Traffic Safety Facts, Large Trucks* (annual issues). **2006:** National Center for Transportation Analysis, National Highway Transit Safety Administration, *Traffic Safety Facts* (August 2008). **Highway-Rail Grade Crossings:** U.S. Department of Transportation, Federal Railroad Administration, Office of Safety Analysis, available at safetydata.fra.dot.gov/officeofsafety/default.asp as of August 14, 2008. **Waterborne:** U.S. Department of Homeland Security, U.S. Coast Guard, Data Administration Division, personal communication, August 14, 2008.

Highways and railroads account for almost all of the people injured by freight transportation, and the number of those injuries has dropped substantially over the last 25 years.

Table 5-2. Injured Persons by Freight Transportation Mode: 1980-2007

	1980	1990	2000	2006	2007
Total injured persons (passenger and freight)	**NA**	**NA**	**3,259,673**	**2,604,648**	**NA**
Highway (passenger and freight)	**NA**	**3,230,666**	**3,188,750**	**2,575,000**	**2,491,000**
Large truck occupants[1]	NA	41,822	30,832	23,000	23,000
Others injured in crashes involving large trucks	NA	108,000	109,000	83,000	NA
Large truck occupants[1] (percent)	NA	1.3	1.0	0.9	0.9
Others injured in crashes involving large trucks (percent)	NA	3.3	3.4	3.2	NA
Railroad (passenger and freight)	**62,246**	**25,143**	**11,643**	**(R) 8,630**	**8,960**
Highway-rail grade crossing[2]	3,550	2,407	1,219	(R) 1,067	1,039
Railroad[2,3]	58,696	22,736	10,424	(R) 7,563	7,921
Waterborne (passenger and freight)	**NA**	**NA**	**665**	**(R) 1,054**	**710**
Vessel-related[4]	180	175	151	(R) 368	169
Freight ship	8	10	5	(R) 21	8
Tank ship	9	13	3	2	3
Tug/towboat	27	19	18	(R) 33	20
Offshore supply	NA	9	6	(R) 7	6
Fishing vessel	28	31	21	(R) 35	28
Mobile offshore drilling units	NA	13	0	(R) 3	5
Platform	NA	9	0	0	1
Freight barge	NA	3	2	(R) 1	7
Tank barge	NA	3	0	0	0
Miscellaneous[5]	98	12	96	(R) 266	91
Not related to vessel casualties[4]	NA	NA	514	(R) 686	541
Pipeline	**192**	**76**	**81**	**35**	**62**
Hazardous liquid pipeline	15	7	4	2	9
Gas pipeline	177	69	77	(R) 33	53

Key: NA = not available; R = revised.
[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 (5,282 in 2007).
[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, passenger (inspected), passenger (uninspected), recreational, research vessel, unclassified, and unknown data.
Note: Numbers may not add to totals because some injuries are counted in more than one mode.

Table 5-2. Injured Persons by Freight Transportation Mode: 1980-2007
Sources: Total and Pipeline: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics 2008*, available at www.bts.gov/ as of August 14, 2008. **Highway:** National Center for Transportation Analysis, National Highway Transit Safety Administration, *Traffic Safety Facts, Large Trucks* (Washington, DC: annual issues). **2006-2007:** National Center for Transportation Analysis, National Highway Transit Safety Administration, *Traffic Safety Facts* (August 2008). **Highway-Rail Grade Crossings:** U.S. Department of Transportation, Federal Railroad Administration, Office of Safety Analysis, available at safetydata.fra.dot.gov/officeofsafety/default.asp as of August 14, 2008. **Waterborne:** U.S. Department of Homeland Security, U.S. Coast Guard, Data Administration Division, personal communication, August 14, 2008.

Table 5-3. Accidents by Freight Transportation Mode: 1980-2007

	1980	1990	2000	2006	2007
Highway (passenger and freight)	**NA**	**6,471,000**	**6,394,000**	**5,973,000**	**NA**
Large truck[1]	NA	371,801	437,861	367,920	NA
Large truck[1] (percent of total)	NA	5.7	6.8	6.2	NA
Rail (passenger and freight)					
Highway-rail grade crossing[2,3]	10,612	5,715	3,502	(R) 2,937	2,749
Railroad[2,4]	8,205	2,879	2,983	(R) 2,962	2,610
Waterborne (passenger and freight)					
Vessel-related	4,624	3,613	13,546	(R) 5,419	5,671
Pipeline					
Hazardous liquid pipeline	246	180	146	(R) 103	106
Gas pipeline	1,524	198	234	(R) 265	281

Key: NA = not available; R = revised.
[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 accidents in freight transportation has declined in all modes, except water, over the last quarter century in spite of the increase in freight 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 vehicular crash or derailment

Table 5-4. Hazardous Materials Transportation Incidents: 1980-2007

	1980	1990	2000	2006	2007
Total	**15,719**	**8,879**	**17,557**	**(R) 20,333**	**19,185**
Accident-related	486	297	394	(R) 355	350
Air	**223**	**297**	**1,419**	**(R) 2,411**	**1,550**
Accident-related	0	0	3	7	7
Highway	**14,161**	**7,296**	**15,063**	**(R) 17,150**	**16,832**
Accident-related	347	249	329	(R) 304	291
Rail	**1,271**	**1,279**	**1,058**	**(R) 704**	**742**
Accident-related	134	48	62	(R) 44	52
Water[1]	**34**	**7**	**17**	**68**	**61**
Accident-related	2	0	0	0	0
Other[2]	**30**	**0**	**0**	**NA**	**NA**
Accident-related	3	0	0	NA	NA

Key: R = revised; NA = not available.
[1]Water category only includes 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. Accidents by Freight Transportation Mode: 1980-2007
Sources: Highway: National Center for Transportation Analysis, National Highway Transit Safety Administration, *Traffic Safety Facts, Large Trucks* (Washington, DC: annual issues). **2006:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics 2008*, available at www.bts.gov/ as of August 15, 2008. **Highway-Rail Grade Crossings:** U.S. Department of Transportation, Federal Railroad Administration, Office of Safety Analysis, available at safetydata.fra.dot.gov/officeofsafety/default.asp as of August 15, 2008. **Waterborne:** U.S. Department of Homeland Security, U.S. Coast Guard, Data Administration Division, personal communication, August 15, 2008. **Pipeline:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics 2008,* available at www.bts.gov/ as of August 15, 2008.

Table 5-4. Hazardous Materials Transportation Incidents: 1980-2007
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Hazardous Materials Safety, Hazardous Materials Information System Database, available at hazmat.dot.gov/pubs as of May 22, 2008.

(referred to as "accident-related"). In 2007, less than 2 percent of incidents were accident-related. Most incidents occur because of human error or package failure, particularly during loading and unloading. While less than 2 percent of incidents were accident-related in 2007, they accounted for nearly 70 percent of all property damage.

Table 5-5. Commercial Motor Carrier Compliance Review Activity by Safety Rating: 2000-2007

	2000		2006		2007	
Safety rating	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Satisfactory	5,309	51.1	(R) 6,867	(R) 66.0	6,221	65.0
Conditional	3,354	32.3	(R) 2,593	(R) 25.3	2,143	22.4
Unsatisfactory	1,481	14.3	(R) 656	(R) 6.3	422	4.4
Not rated	245	2.4	(R) 244	(R) 2.4	790	8.3
Total	**10,389**	**100.0**	**(R) 10,360**	**100.0**	**9,576**	**100.0**

Key: R = revised.
Notes: 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. This entails having adequate safety management controls in place to ensure acceptable compliance with applicable safety requirements to reduce the risk associated with: alcohol and controlled substance testing violations; commercial driver's license standard violations; inadequate levels of financial responsibility; the use of unqualified drivers; improper use and driving of motor vehicles; unsafe vehicles operating on the highways; failure to maintain crash registers and copies of crash reports; the use of fatigued drivers; inadequate inspection, repair, and maintenance of vehicles; transportation of hazardous materials; driving and parking rule violations; violation of hazardous materials regulations; and motor vehicle crashes and hazardous materials incidents. Percents may not add to totals due to rounding.

The safety fitness of motor carriers has improved markedly over the past few years. In 2007, the share of motor carriers rated satisfactory was 65 percent, up from 51 percent in 2000.

Less than one-fourth of all roadside inspections of commercial vehicles result in the vehicle being taken out-of-service (OOS) for a serious violation. A much lower percentage of driver and hazardous materials inspections results in OOS orders. In 2007 only 7 percent of driver inspections and about 5 percent of hazardous materials inspections resulted in an OOS order.

The number of gallons of fuel burned by commercial trucks increased significantly over the past 26 years. Between 1980 and 2006, the fuel consumed in highway freight transportation increased from 20 billion to 38 billion gallons annually. This is due to a substantial increase in the number of trucks on the road, an increase in the average num-

TABLE 5-5. COMMERCIAL MOTOR CARRIER COMPLIANCE REVIEW ACTIVITY BY SAFETY RATING: 2000-2007
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 May 22, 2008.

Table 5-6. Roadside Safety Inspection Activity Summary by Inspection Type: 2000-2007

	2000		2005		2006		2007	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All inspections								
Number of inspections	2,453,776	100.0	(R) 3,028,443	100.0	(R) 3,334,477	100.0	3,279,486	100.0
With no violations	639,593	26.1	(R) 823,256	27.2	(R) 940,086	28.2	986,877	30.1
With violations	1,814,183	73.9	(R) 2,205,187	72.8	(R) 2,394,391	71.8	2,292,609	69.9
Driver inspections								
Number of inspections	2,396,688	100.0	(R) 2,966,688	100.0	(R) 3,192,216	100.0	3,136,496	100.0
With no violations	1,459,538	60.9	(R) 1,884,408	63.5	(R) 2,015,123	63.1	1,982,276	63.2
With violations	937,150	39.1	(R) 1,082,280	36.5	(R) 1,177,093	36.9	1,154,220	36.8
With OOS violations	191,031	8.0	(R) 195,842	6.6	(R) 225,653	7.1	215,226	6.9
Vehicle inspections								
Number of inspections	1,908,300	100.0	(R) 2,203,881	100.0	(R) 2,414,442	100.0	2,297,189	100.0
With no violations	584,389	30.6	(R) 690,209	31.3	(R) 789,259	32.7	775,849	33.8
With violations	1,323,911	69.4	(R) 1,513,672	68.7	(R) 1,625,183	67.3	1,521,340	66.2
With OOS violations	452,850	23.7	(R) 514,710	23.4	(R) 552,409	22.9	514,453	22.4
Hazardous materials inspections								
Number of inspections	133,486	100.0	(R) 180,911	100.0	(R) 191,614	100.0	189,657	100.0
With no violations	101,098	75.7	(R) 147,569	81.6	(R) 156,399	81.6	155,598	82.0
With violations	32,388	24.3	(R) 33,342	18.4	(R) 35,215	18.4	34,059	18.0
With OOS violations	9,964	7.5	(R) 9,889	5.5	(R) 10,142	5.3	9,872	5.2

Key: OOS = out of service; R = revised.
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.

Table 5-7. Fuel Consumption by Transportation Mode: 1980-2006

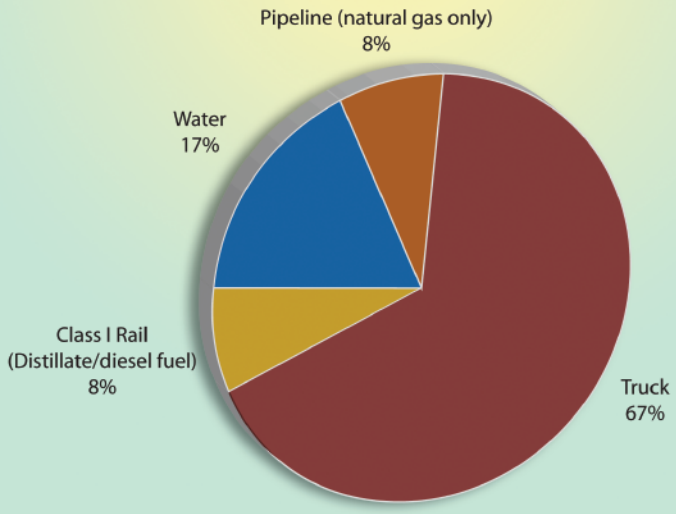
	1980	1990	2000	2005	2006
Highway					
Gasoline, diesel and other fuels (million gallons)	114,960	130,755	162,555	(R) 174,787	174,930
Truck, total	19,960	24,490	35,229	(R) 37,190	37,918
Single-unit 2-axle 6-tire or more truck	6,923	8,357	9,563	(R) 9,501	9,843
Combination truck	13,037	16,133	25,666	(R) 27,689	28,075
Truck (percent of total)	17.4	18.7	21.7	(R) 21.3	21.7
Rail, Class I (in freight service)					
Distillate / diesel fuel (million gallons)	3,904	3,115	3,700	4,098	4,192
Water					
Residual fuel oil (million gallons)	8,952	6,326	6,410	5,179	5,754
Distillate / diesel fuel oil (million gallons)	1,478	2,065	2,261	2,006	1,903
Gasoline (million gallons)	1,052	1,300	1,124	1,261	1,237
Pipeline					
Natural gas (million cubic feet)	634,622	659,816	642,210	(R) 584,026	584,497

Key: R = revised.

Table 5-6. Roadside Safety Inspection Activity Summary by Inspection Type: 2000-2007
Source: U.S. Department of Transportation, Federal Motor Carrier Administration, Motor Carrier Management Information System (MCMIS), Roadside Inspection Activity Summary for Calendar Years, available at www.fmcsa.dot.gov as of May 22, 2008.

Table 5-7. Fuel Consumption by Transportation Mode: 1980-2006
Sources: Highway: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2006* (Washington, DC: 2006), table VM-1 and similar tables in earlier editions. **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 2006* (Washington, DC: 2007), tables 2, 4, and similar tables in earlier editions. **Pipeline:** U.S. Department of Energy, *Natural Gas Annual 2006*, DOE/EIA-0131(04) (Washington, DC: January 2008), table 15 and similar tables in earlier editions.

Figure 5-1. Energy Consumption by Freight Transportation Mode: 2006



Note: Data do not include energy consumed by oil pipelines (crude petroleum and petroleum products) nor coal slurry/water slurry pipelines.

ber of miles traveled per truck, and a doubling of truck miles traveled. Over the same period, fuel use in Class I freight railroads increased slightly from 3.9 billion gallons to 4.2 billion gallons.

In 2006, trucking accounted for two-thirds of freight transportation energy consumption. Water was a distant second with roughly one-sixth of freight energy consumption.

Since 1980, miles per gallon by single-unit trucks (based on total travel and fuel consumption) increased by more than 40 percent. Total fuel consumed increased 42 percent whereas miles traveled nearly doubled, indicating that miles per gallon increased from 5.8 to 8.2 between 1980 and 2006.

Table 5-8. Single-Unit Truck Fuel Consumption and Travel: 1980-2006

	1980	1990	2000	2005	2006
Number registered (thousands)	4,374	4,487	5,926	6,395	6,649
Vehicle miles (millions)	39,813	51,901	70,500	(R) 78,496	80,331
Fuel consumed (million gallons)	6,923	8,357	9,563	(R) 9,501	9,843
Average miles traveled per vehicle	9,103	11,567	11,897	(R) 12,274	12,081
Average miles traveled per gallon	5.8	6.2	7.4	(R) 8.3	8.2
Average fuel consumed per vehicle (gallons)	1,583	1,862	1,614	(R) 1,486	1,480

Key: R = revised.

Figure 5-1. Energy Consumption by Freight Transportation Mode: 2006
Sources: Truck: 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: 2007), p. 40. **Water:** U.S. Department of Energy, Energy Information Administration, *Fuel Oil and Kerosene Sales* (Washington, DC: annual issues), tables 2 and 4; U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: annual issues), table MF-24. **Pipeline:** U.S. Department of Energy, *Natural Gas Annual 2006,* DOE/EIA-0131(04) (Washington, DC: January 2008), table 15.

Table 5-8. Single-Unit Truck Fuel Consumption and Travel: 1980-2006
Source: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: annual issues), table VM-1 and similar tables in earlier editions.

In contrast to single-unit trucks, miles per gallon by combination trucks (based on total travel and fuel consumption) decreased by about 4 percent over the past 26 years. Vehicle miles traveled more than doubled over the same period. Consequently, the gallons of fuel consumed more than doubled between 1980 and 2006.

Table 5-9. Combination Truck Fuel Consumption and Travel: 1980-2006

	1980	1990	2000	2005	2006
Number registered (thousands)	1,417	1,709	2,097	2,087	2,170
Vehicle miles traveled (millions)	68,678	94,341	135,020	(R) 144,028	142,706
Fuel consumed (million gallons)	13,037	16,133	25,666	(R) 27,689	28,075
Average miles traveled per vehicle	48,472	55,206	64,399	(R) 69,020	70,986
Average miles traveled per gallon	5.3	5.8	5.3	(R) 5.2	5.1
Average fuel consumed per vehicle (gallons)	9,201	9,441	12,241	(R) 13,269	13,965

Key: R =revised.

Diesel prices were about 239 percent higher in July 2008 than 10 years earlier (in inflation-adjusted terms).

Figure 5-2. Monthly Diesel Prices: January 1998-July 2008

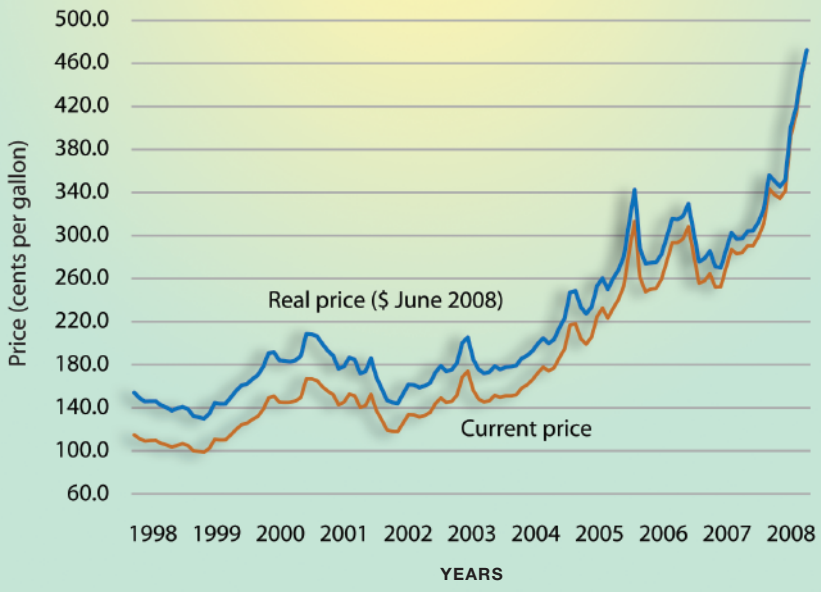


Table 5-9. Combination Truck Fuel Consumption and Travel: 1980-2006
Source: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: annual issues), table VM-1 and similar tables in earlier editions.

Figure 5-2. Monthly Diesel Prices: 1998-2008
Sources: Diesel price: U.S. Department of Energy, Energy Information Agency, U.S. Petroleum Prices, available at www.eia.doe.gov as of August 8, 2008. Consumer price index: U.S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index – All Urban Consumers, Monthly, available at www.bls.gov as of August 8, 2008.

Energy intensity is the amount of energy used in producing a given level of output or activity, in this case vehicle miles and ton miles. Compared with 1980, the energy intensity of both trucking and freight rail has improved. However, over the same period, domestic freight water transportation, measured by Btu per ton mile, has become less energy efficient.

Table 5-10. Energy Intensities of Domestic Freight Transportation Modes: 1980-2006

	1980	1990	2000	2005	2006
Highway (Btu per vehicle mile)	24,757	22,795	23,448	(R) 22,866	23,260
Railroad (Class I) (Btu per freight car mile)	18,742	16,619	14,917	15,152	14,990
Railroad (Class I) (Btu per ton mile)	597	420	352	337	330
Domestic water (Btu per ton mile)	358	387	473	514	NA

Key: Btu = British thermal unit; R = revised; NA = not available.

Table 5-10. Energy Intensities of Domestic Freight Transportation Modes: 1980-2006
Source: Oak Ridge National Laboratory, *Transportation Energy Data Book* (Oak Ridge, TN: annual issues), table 2.16, available at cta.ornl.gov/data/index.shtml as of November 23, 2008.

Air quality is affected by emissions from freight vehicles. 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).

Freight transportation is a major source of NO_X emissions, accounting for 27 percent of all NO_X emissions in the United States and one-half of emissions from mobile sources. Freight transportation also accounts for about one-third of emissions of particulate matter 10 microns in diameter (PM-10) from mobile sources. Most PM-10, however, comes from agricultural fields, wildfires, and fugitive dust. Consequently, freight transportation is a minor factor when considering total PM-10 emissions.

Table 5-11. Estimated National Average Vehicle Emissions Rates of Heavy-Duty and Light-Duty Vehicles: 1990-2007 (grams per mile)

	1990	2000	2006	2007
	Gasoline (assuming zero RFG)			
Cars				
Exhaust HC	2.79	0.97	0.46	0.42
Nonexhaust HC	1.21	0.92	0.68	0.62
Total HC	3.99	1.89	1.13	1.04
Exhaust CO	42.89	18.53	10.87	10.28
Exhaust NO_x	2.70	1.29	0.79	0.73
Light trucks				
Exhaust HC	3.68	1.45	0.69	0.64
Nonexhaust HC	1.36	0.97	0.71	0.66
Total HC	5.04	2.42	1.40	1.31
Exhaust CO	56.23	26.81	14.33	13.52
Exhaust NO_x	2.62	1.54	1.09	1.02
Heavy trucks				
Exhaust HC	3.66	1.22	0.53	0.48
Nonexhaust HC	2.74	1.62	1.14	1.07
Total HC	6.40	2.84	1.67	1.54
Exhaust CO	85.61	31.08	14.51	13.55
Exhaust NO_x	7.19	5.26	3.73	3.33
	Diesel			
Cars				
Exhaust HC	0.68	0.80	0.48	0.36
Exhaust CO	1.49	1.78	1.41	1.21
Exhaust NO_x	1.83	1.81	1.11	0.85
Light trucks				
Exhaust HC	1.59	1.02	0.79	0.63
Exhaust CO	2.67	1.77	1.34	1.06
Exhaust NO_x	2.71	1.76	1.30	1.09
Heavy trucks				
Exhaust HC	2.21	0.79	0.51	0.48
Exhaust CO	10.06	4.10	2.90	2.66
Exhaust NO_x	23.34	18.05	10.55	9.60

Key: CO = carbon monoxide; HC = hydrocarbon; NO_X = nitrogen oxides; RFG = reformulated gasoline.

Table 5-12. Nitrogen Oxides (NO_X) and Particulate Matter (PM-10) Emissions by Freight Transportation Mode: 2002

	NO_x Emissions				PM-10 Emissions			
			As percent of:				As percent of:	
Mode	Tons	Percent	All mobile sources	All sources	Tons	Percent	All mobile sources	All sources
Heavy-duty vehicles	3,782,000	66.8	33.0	17.9	120,000	64.7	23.3	0.5
Freight railroads	857,200	15.1	7.5	4.1	21,300	11.5	4.1	0.1
Marine vessels	1,011,000	17.9	8.8	4.8	44,000	23.7	8.5	0.2
Air freight	8,200	0.1	0.1	0.0	300	0.2	0.1	0.0
Total	5,658,400	100.0	49.4	26.8	185,600	100.0	36.0	0.8

TABLE 5-11. ESTIMATED NATIONAL AVERAGE VEHICLE EMISSIONS RATES OF HEAVY-DUTY AND LIGHT-DUTY VEHICLES: 1990-2007
Source: U.S. Environmental Protection Agency, National Vehicle and Fuel Emissions Laboratory, personal communication, August 13, 2008.

TABLE 5-12. 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,* April 2005, available at www.fhwa.dot.gov/environment/freightaq/ as of April 24, 2008.

Table 5-13. Current and Projected Nitrogen Oxides (NO_X) Emissions by Freight Transportation Mode: 2002, 2010, and 2020

	Tons			Percent change,	Percent change,
	2002	2010	2020	2002-2010	2002-2020
Heavy-duty trucks	3,782,000	2,186,900	662,600	-42	-82
Freight rail	857,200	563,200	486,400	-34	-43
Commercial marine	1,011,000	987,200	938,600	-2	-7
Air freight	8,200	10,000	12,400	22	51
Freight total	5,658,400	3,747,299	2,099,999	-34	-63

Trucks are by far the largest contributor to freight emissions nationally, producing two-thirds of NO_X from the freight sector. However, freight emissions of NO_X are forecast to decline by almost two-thirds over the next two decades. Beginning in June 2006, 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. ULSD will reduce emissions of NO_X and enable the use of advanced pollution control technologies to meet emissions standards.

As in the case of NO_X, trucks also are by far the largest contributor to PM-10 emissions from the freight sector. However, freight emissions of PM-10 are forecast to decline by one-half over the next two decades. The required use of ULSD fuel in heavy-duty trucks and other diesel-powered highway vehicles will reduce PM emissions and enable the use of advanced pollution control technologies to meet emissions standards.

Table 5-14. Current and Projected Particulate Matter (PM-10) Emissions by Freight Transportation Mode: 2002, 2010, and 2020

	Tons			Percent change,	Percent change,
	2002	2010	2020	2002-2010	2002-2020
Heavy-duty trucks	120,000	65,380	34,760	-46	-71
Freight rail	21,300	15,730	12,990	-26	-39
Commercial marine	44,000	42,930	44,080	-2	0
Air freight	300	290	270	-3	-10
Freight total	185,600	124,329	92,099	-33	-50

Table 5-13. Current and Projected Nitrogen Oxides (NO_X) Emissions by Freight Transportation Mode: 2002, 2010, 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,* April 2005, available at www.fhwa.dot.gov/environment/freightaq/ as of April 24, 2008.

Table 5-14. Current and Projected Particulate Matter (PM-10) Emissions by Freight Transportation Mode: 2002, 2010, 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,* April 2005, available at www.fhwa.dot.gov/environment/freightaq/ as of April 24, 2008.