

Chapter 5

Heavy Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 5.1	Heavy single-unit trucks, 2006	
	<i>Registration (thousands)</i>	6,649
	<i>Vehicle miles (millions)</i>	80,331
	<i>Fuel economy (miles per gallon)</i>	8.2
Table 5.2	Combination trucks, 2006	
	<i>Registration (thousands)</i>	2,170
	<i>Vehicle miles (millions)</i>	142,706
	<i>Fuel economy (miles per gallon)</i>	5.1
Tables 5.11 and 5.12	Freight Shipments, 2002 Commodity Flow Survey	
	<i>Value (billion dollars)</i>	8,397
	<i>Tons (millions)</i>	11,668
	<i>Ton-miles (billions)</i>	3,138
Table 5.13	Transit buses in operation, 2005	82,642



Heavy single-unit trucks include all single-unit trucks which have more than two axles or more than four tires. Most of these trucks would be used for business or for individuals with heavy hauling or towing needs.

Table 5.1
Summary Statistics for Heavy Single-Unit Trucks, 1970–2006

Year	Registrations (thousands)	Vehicle travel (million miles)	Fuel use (million gallons)	Fuel economy (miles per gallon)
1970	3,681	27,081	3,968	6.8
1975	4,232	34,606	5,420	6.4
1980	4,374	39,813	6,923	5.8
1981	4,455	39,568	6,867	5.8
1982	4,325	40,658	6,803	6.0
1983	4,204	42,546	6,965	6.1
1984	4,061	44,419	7,240	6.1
1985	4,593	45,441	7,399	6.1
1986	4,313	45,637	7,386	6.2
1987	4,188	48,022	7,523	6.4
1988	4,470	49,434	7,701	6.4
1989	4,519	50,870	7,779	6.5
1990	4,487	51,901	8,357	6.2
1991	4,481	52,898	8,172	6.5
1992	4,370	53,874	8,237	6.5
1993	4,408	56,772	8,488	6.7
1994	4,906	61,284	9,032	6.8
1995	5,024	62,705	9,216	6.8
1996	5,266	64,072	9,409	6.8
1997	5,293	66,893	9,576	7.0
1998	5,414	67,894	9,741	7.0
1999	5,763	70,304	9,372	7.5
2000	5,926	70,500	9,563	7.4
2001	5,704	72,448	9,667	7.5
2002	5,651	75,866	10,321	7.4
2003	5,849	77,757	8,881	8.8
2004	6,161	78,441	8,959	8.8
2005	6,395	78,496	9,501	8.3
2006	6,649	80,331	9,843	8.2
<i>Average annual percentage change</i>				
1970–2006	1.7%	3.1%	2.6%	0.5%
1996–2006	2.4%	2.3%	0.5%	1.9%

Source:

U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2006*, Washington, DC, 2007, Table VM1 and annual. (Additional resources: www.fhwa.dot.gov)

Note: *Highway Statistics 1999* data were not used.



Combination trucks include all trucks designed to be used in combination with one or more trailers. The average vehicle travel of these trucks (on a per truck basis) far surpasses the travel of other trucks due to long-haul freight movement.

Table 5.2
Summary Statistics for Combination Trucks, 1970–2006

Year	Registrations (thousands)	Vehicle travel ^a (million miles)	Fuel use (million gallons)	Fuel economy (miles per gallon)
1970	905	35,134	7,348	4.8
1975	1,131	46,724	9,177	5.1
1980	1,417	68,678	13,037	5.3
1981	1,261	69,134	13,509	5.1
1982	1,265	70,765	13,583	5.2
1983	1,304	73,586	13,796	5.3
1984	1,340	77,377	14,188	5.5
1985	1,403	78,063	14,005	5.6
1986	1,408	81,038	14,475	5.6
1987	1,530	85,495	14,990	5.7
1988	1,667	88,551	15,224	5.8
1989	1,707	91,879	15,733	5.8
1990	1,709	94,341	16,133	5.8
1991	1,691	96,645	16,809	5.7
1992	1,675	99,510	17,216	5.8
1993	1,680	103,116	17,748	5.8
1994	1,681	108,932	18,653	5.8
1995	1,696	115,451	19,777	5.8
1996	1,747	118,899	20,192	5.9
1997	1,790	124,584	20,302	6.1
1998	1,831	128,159	21,100	6.1
1999	2,029	132,384	24,537	5.4
2000	2,097	135,020	25,666	5.3
2001	2,154	136,584	25,512	5.4
2002	2,277	138,737	26,480	5.2
2003	1,908	140,160	23,815	5.9
2004	2,010	142,370	24,191	5.9
2005	2,087	144,028	27,689	5.2
2006	2,170	142,706	28,075	5.1
<i>Average annual percentage change</i>				
1970–2006	2.5%	4.0%	3.8%	0.2%
1996–2006	2.2%	1.8%	3.4%	-1.4%

Source:

U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2006*, Washington, DC, 2007, Table VM1 and annual. (Additional resources: www.fhwa.dot.gov)

Note: *Highway Statistics 1999* data were not used.

^a The Federal Highway Administration changed the combination truck travel methodology in 1993.



Though sales of trucks under 10,000 lbs. declined in 2006, they continue to dominate truck sales.

Table 5.3
New Retail Truck Sales by Gross Vehicle Weight, 1970–2006^a
(thousands)

Calendar year	Class 1 6,000 lbs. or less	Class 2 6,001– 10,000 lbs.	Class 3 10,001– 14,000 lbs.	Class 4 14,001– 16,000 lbs.	Class 5 16,001– 19,500 lbs.	Class 6 19,501– 26,000 lbs.	Class 7 26,001– 33,000 lbs.	Class 8 33,001 lbs. and over	Total
Domestic sales (import data are not available)									
1970 ^b	1,049	408	6	12	58	133	36	89	1,791
1975	1,101	952	23	1	9	159	23	83	2,351
1980	985	975	4	c	2	90	58	117	2,231
1981	896	850	1	c	2	72	51	100	1,972
1982	1,102	961	1	c	1	44	62	76	2,248
1983	1,314	1,207	c	c	1	47	59	82	2,710
1984	2,031	1,224	6	c	5	55	78	138	3,538
1985	2,408	1,280	11	c	5	48	97	134	3,983
Domestic and import sales									
1986	3,380	1,214	12	c	6	45	101	113	4,870
1987	3,435	1,175	14	2	8	44	103	131	4,912
1988	3,467	1,333	14	21	8	54	103	148	5,149
1989	3,313	1,297	19	27	7	39	93	145	4,942
1990	3,451	1,097	21	27	5	38	85	121	4,846
1991	3,246	876	21	24	3	22	73	99	4,365
1992	3,608	1,021	26	26	4	28	73	119	4,903
1993	4,119	1,232	27	33	4	27	81	158	5,681
1994	4,527	1,506	35	44	4	20	98	186	6,421
1995	4,422	1,631	40	53	4	23	107	201	6,481
1996	4,829	1,690	52	59	7	19	104	170	6,930
1997	5,085	1,712	53	57	9	18	114	179	7,226
1998	5,263	2,036	102	43	25	32	115	209	7,826
1999	5,707	2,366	122	49	30	48	130	262	8,716
2000	5,965	2,421	117	47	29	51	123	212	8,965
2001	6,073	2,525	102	52	24	42	92	140	9,050
2002	6,068	2,565	80	38	24	45	69	146	9,035
2003	6,267	2,671	91	40	29	51	67	142	9,357
2004	6,458	2,796	107	47	36	70	75	203	9,793
2005	6,586	2,528	167	49	46	60	89	253	9,777
2006	6,136	2,438	150	50	49	70	91	284	9,268
<i>Average annual percentage change</i>									
1970–1986	5.7%	7.9%	4.1%	-	-15.1%	-6.6%	6.8%	2.8%	5.5%
1986–2006	3.0%	3.5%	13.5%	-	11.1%	2.2%	-0.5%	4.7%	3.3%

Source:

Ward's Communication's, *Motor Vehicle Facts and Figures 2007*, Southfield, MI, 2008, p. 26, and annual. (Additional resources: www.wardsauto.com)

^a Sales include domestic-sponsored imports.

^b Data for 1970 is based on new truck registrations.

^c Data are not available.



Vehicle Inventory and Use Survey

The Vehicle Inventory and Use Survey (VIUS), which was formerly the Truck Inventory and Use Survey (TIUS), provides data on the physical and operational characteristics of the Nation's truck population. It is based on a probability sample of private and commercial trucks registered (or licensed) in each state. In 1997, the survey was changed to the Vehicle Inventory and Use Survey due to future possibilities of including additional vehicle types. The 2002 VIUS, however, only includes trucks. Copies of the 2002 VIUS report or CD may be obtained by contacting the U.S. Bureau of the Census, Transportation Characteristics Surveys Branch (301) 457-2797. Internet site: www.census.gov/svsd/www/tiusview.html

Since 1987, the survey has included minivans, vans, station wagons on truck chassis, and sport utility vehicles in addition to the bigger trucks. The 1977 and 1982 surveys did not include those vehicle types. The estimated number of trucks that were within the scope of the 2002 VIUS and registered in the U.S. as of July 1, 2002, was 85.2 million. These trucks were estimated to have been driven a total of 1,115 billion miles during 2002, an increase of 6.8% from 1997. The average annual miles traveled per truck was estimated at 13,100 miles.

In the 2002 VIUS, there are several ways to classify a truck by weight. The survey respondent was asked the average weight of the vehicle or vehicle-trailer combination when carrying a typical payload; the empty weight (truck minus cargo) of the vehicle as it was usually operated; and the maximum gross weight at which the vehicle or vehicle-trailer combination was operated. The Census Bureau also collected information on the Gross Vehicle Weight Class of the vehicles (decoded from the vehicle identification number) and the registered weight of the vehicles from the State registration files. Some of these weights are only provided in categories, while others are exact weights. Since all these weights could be quite different for a single truck, the tabulations by weight can be quite confusing. In the tables presented here, the Gross Vehicle Weight Class was used.

The Census Bureau has discontinued the Vehicle Inventory and Use Survey; it was not conducted in 2007. The 2002 data remain the latest available.



Table 5.4
Truck Statistics by Gross Vehicle Weight Class, 2002

Manufacturer's gross vehicle weight class	Number of trucks	Percentage of trucks	Average annual miles per truck	Harmonic mean fuel economy	Percentage of fuel use
1) 6,000 lbs and less	51,941,389	61.0%	11,882	17.6	42.7%
2) 6,001 – 10,000 lbs	28,041,234	32.9%	12,684	14.3	30.5%
Light truck subtotal	79,982,623	93.9%	12,163	16.2	73.2%
3) 10,001 – 14,000 lbs	691,342	0.8%	14,094	10.5	1.1%
4) 14,001 – 16,000 lbs	290,980	0.3%	15,441	8.5	0.5%
5) 16,001 – 19,500 lbs	166,472	0.2%	11,645	7.9	0.3%
6) 19,501 – 26,000 lbs	1,709,574	2.0%	12,671	7.0	3.2%
Medium truck subtotal	2,858,368	3.4%	13,237	8.0	5.2%
7) 26,001 – 33,000 lbs	179,790	0.2%	30,708	6.4	0.9%
8) 33,001 lbs and up	2,153,996	2.5%	45,739	5.7	20.7%
Heavy truck subtotal	2,333,786	2.7%	44,581	5.8	21.6%
Total	85,174,776	100.0%	13,088	13.5	100.0%

Source:

U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Microdata File on CD, 2005. (Additional resources: www.census.gov/svsd/www.tiusview.html)

Table 5.5
Truck Harmonic Mean Fuel Economy by Size Class, 1992, 1997, and 2002
(miles per gallon)

Manufacturer's gross vehicle weight class	1992 TIUS	1997 VIUS	2002 VIUS
1) 6,000 lbs and less	17.2	17.1	17.6
2) 6,001–10,000 lbs	13.0	13.6	14.3
Light truck subtotal	15.7	15.8	16.2
3) 10,000–14,000 lbs	8.8	9.4	10.5
4) 14,001–16,000 lbs	8.8	9.3	8.5
5) 16,001–19,500 lbs	7.4	8.7	7.9
6) 19,501–26,000 lbs	6.9	7.3	7.0
Medium truck subtotal	7.3	8.6	8.0
7) 26,001–33,000 lbs	6.5	6.4	6.4
8) 33,001 lbs and over	5.5	5.7	5.7
Large truck subtotal	5.6	6.1	5.8

Sources:

Estimates are based on data provided on the following public use files: U.S. Department of Commerce, Bureau of the Census, Census of Transportation, Washington, DC, *1992 Truck Inventory and Use Survey*, 1995; *1997 Vehicle Inventory and Use Survey*, 2000, and *2002 Vehicle Inventory and Use Survey*, 2005. (Additional resources: www.census.gov/svsd/www.tiusview.html)

Note: Based on average fuel economy as reported by respondent.



As expected, most light trucks travel within 50 miles of their home base and refuel at public stations. About sixty percent of heavy trucks travel over 50 miles from their home base and 36% of them refuel at central company-owned refueling stations.

Table 5.6
Truck Statistics by Size, 2002

	Manufacturer's gross vehicle weight class			Total
	Light (< 10,000 lbs)	Medium (10,001– 26,000 lbs)	Heavy (> 26,000 lbs)	
	Range of operation			
Under 50 miles	69.2%	61.5%	40.7%	68.2%
51–100 miles	8.5%	11.7%	13.5%	8.7%
101–200 miles	2.4%	3.2%	6.7%	2.5%
201–500 miles	1.1%	1.8%	7.6%	1.3%
501 miles or more	1.4%	2.2%	10.4%	1.7%
Off-road	1.1%	3.5%	3.2%	1.2%
Vehicle not in use	2.2%	4.4%	3.2%	2.3%
Not reported	14.1%	11.7%	14.7%	14.1%
Total	100.0%	100.0%	100.0%	100.0%
	Primary refueling facility			
Gas station	96.9%	62.4%	28.4%	93.9%
Truck stop	0.7%	7.7%	31.9%	1.8%
Own facility	2.0%	27.3%	36.2%	3.7%
Other nonpublic facility	0.3%	2.6%	3.5%	0.5%
Other	0.0%	0.0%	0.0%	0.0%
All	100.0%	100.0%	100.0%	100.0%

Source:

U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Microdata. File on CD, 2005. (Additional resources: www.census.gov/svsd/www/tiusview.html)



More medium truck owners listed construction as the truck's major use than any other major use category. Construction was the second highest major use for light trucks and heavy trucks.

Table 5.7
Percentage of Trucks by Size Ranked by Major Use, 2002

Rank	Light (< 10,000 lbs average weight)	Medium (10,001 – 26,000 lbs average weight)	Heavy (> 26,000 lbs average weight)
1	Personal 81.5%	Construction 18.4%	For hire 30.1%
2	Construction 4.6%	Agriculture 16.2%	Construction 15.9%
3	Other services^a 2.5%	For hire 9.6%	Agriculture 12.2%
4	Not in use 2.2%	Retail 7.1%	Retail 5.4%
5	Agriculture 1.9%	Not in use 6.4%	Not in use 5.1%
6	Retail 1.5%	Leasing 6.2%	Waste management 5.0%
7	Unknown 1.3%	Wholesale 5.5%	Manufacturing 4.9%
8	Leasing 0.7%	Waste management 5.4%	Wholesale 4.8%
9	Manufacturing 0.7%	Utilities 5.0%	Leasing 4.6%
10	Utilities 0.6%	Personal 4.8%	Unknown 3.2%
11	Waste management 0.6%	Unknown 4.4%	Personal 2.5%
12	Wholesale 0.6%	Manufacturing 3.3%	Mining 2.4%
13	Information services 0.4%	Other services^a 3.2%	Other services^a 1.3%
14	For hire 0.4%	Food services 1.6%	Utilities 1.1%
15	Food services 0.3%	Information services 1.3%	Food services 1.1%
16	Arts 0.2%	Mining 1.1%	Arts 0.3%
17	Mining 0.1%	Arts 0.5%	Information services 0.1%

Source:

U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*,
Micro data File on CD, 2005. (Additional resources: www.census.gov/svsd/www/tiusview.html)

^a Business and personal services.



Nearly half of trucks in fleets of 11-20 and 21-50 vehicles use company-owned facilities. Most trucks in smaller fleets use public gas stations for fueling.

Table 5.8
Percentage of Trucks by Fleet Size and Primary Fueling Facility, 2002

Truck fleet size	Primary refueling facility				Total
	Gas station	Truck stop	Own facility	Other's facility	
1-5	73.8%	6.1%	18.2%	1.9%	100.0%
6-10	55.3%	5.7%	35.5%	3.4%	100.0%
11-20	41.1%	5.1%	48.9%	4.9%	100.0%
21-50	42.9%	3.7%	49.8%	3.6%	100.0%
51 or more	48.3%	6.3%	44.4%	1.0%	100.0%
Fleets of 6 or more vehicles	47.6%	5.2%	43.9%	3.4%	100.0%
No fleet	96.4%	1.6%	1.7%	0.3%	100.0%

Source:

U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Microdata File on CD, 2005. (Additional resources: www.census.gov/svsd/www/tiusview.html)



Most trucks are fueled at gas stations but for-hire or warehousing trucks are more often fueled at truck stops. Mining trucks and vehicle leasing or rental trucks fuel at the companies' own facility more than 30% of the time.

Table 5.9
Share of Trucks by Major Use and Primary Fueling Facility, 2002

Major use	Gas station	Truck stop	Own facility	Others facility	Other	All
Personal	98.6%	0.6%	0.7%	0.1%	0.1%	100.0%
Other services	96.0%	1.4%	1.6%	0.9%	0.1%	100.0%
All	93.9%	1.8%	3.7%	0.5%	0.0%	100.0%
Information services	92.3%	0.4%	7.2%	0.1%	0.0%	100.0%
Retail trade	86.6%	3.5%	8.6%	1.2%	0.0%	100.0%
Construction	84.7%	3.3%	9.8%	2.2%	0.0%	100.0%
Accommodation or food services	82.4%	7.5%	8.8%	1.3%	0.0%	100.0%
Manufacturing	81.5%	5.1%	11.9%	1.5%	0.0%	100.0%
Arts, entertainment, recreation services	81.1%	4.3%	14.2%	0.3%	0.0%	100.0%
Waste mgmt, landscaping, admin/support services	78.2%	3.0%	17.1%	1.6%	0.0%	100.0%
Wholesale trade	76.2%	6.6%	12.0%	5.1%	0.0%	100.0%
Utilities	72.6%	1.8%	24.3%	1.3%	0.0%	100.0%
Agriculture, forestry, fishing, hunting	62.7%	6.7%	29.4%	1.0%	0.1%	100.0%
Vehicle leasing or rental	60.2%	1.3%	31.8%	6.8%	0.0%	100.0%
Mining	48.7%	8.5%	34.3%	8.5%	0.0%	100.0%
For-hire or warehousing	33.3%	38.7%	25.8%	2.3%	0.0%	100.0%
Overall	93.9%	1.8%	3.7%	0.5%	0.0%	100.0%

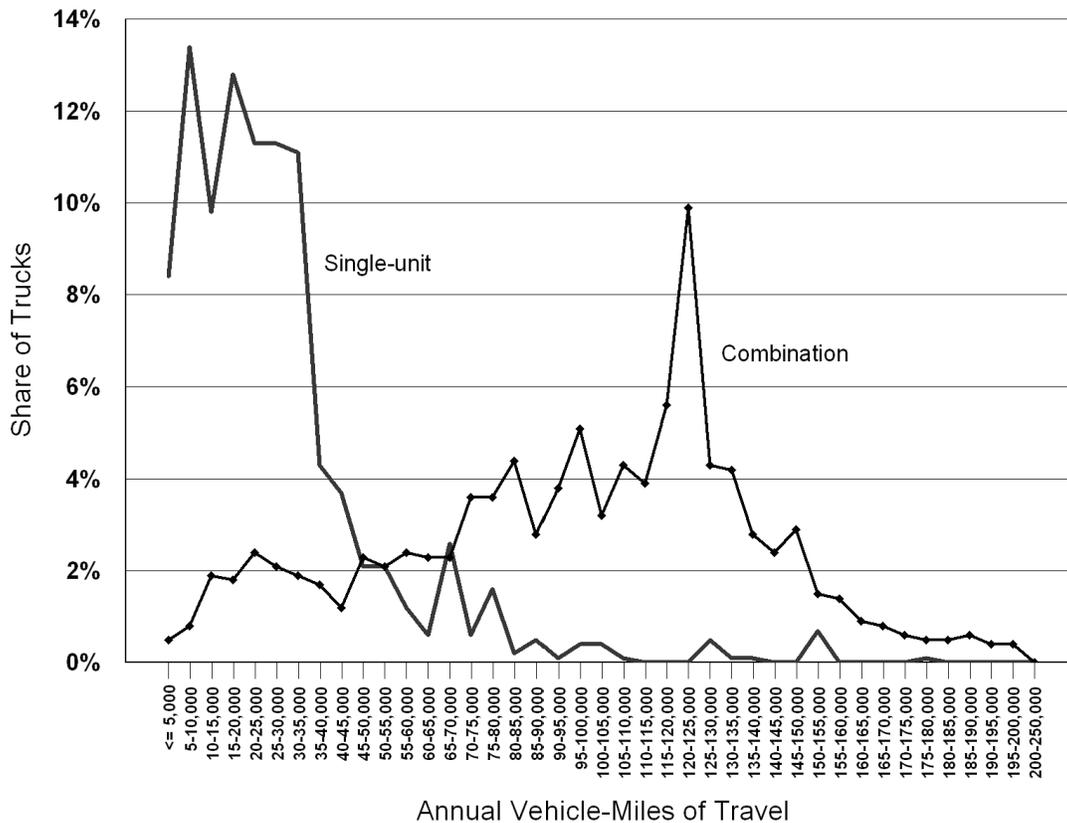
Source:

U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Microdata File on CD, 2005. (Additional resources: www.census.gov/svsd/www/tiusview.html)



The figure below shows the distribution of annual travel the two types of Class 7 and 8 vehicles—combination units (separate tractor and trailer) and single units (tractor and trailer on a single chassis). This information is for vehicles two years old or less and comes from the 2002 VIUS. Combination trucks, dominated by box-type trailers, display the greatest amount of annual travel of all heavy vehicle types, as is evidenced both by the range of annual use which is up to 200,000 miles per year, and the peaking that occurs in the 100,000 to 140,000-mile segments. Most of the single-unit trucks in the survey travel 40,000 miles per year or less.

Figure 5.1. Distribution of Trucks over 26,000 lbs. Less than Two Years Old by Vehicle Miles Traveled



Source:

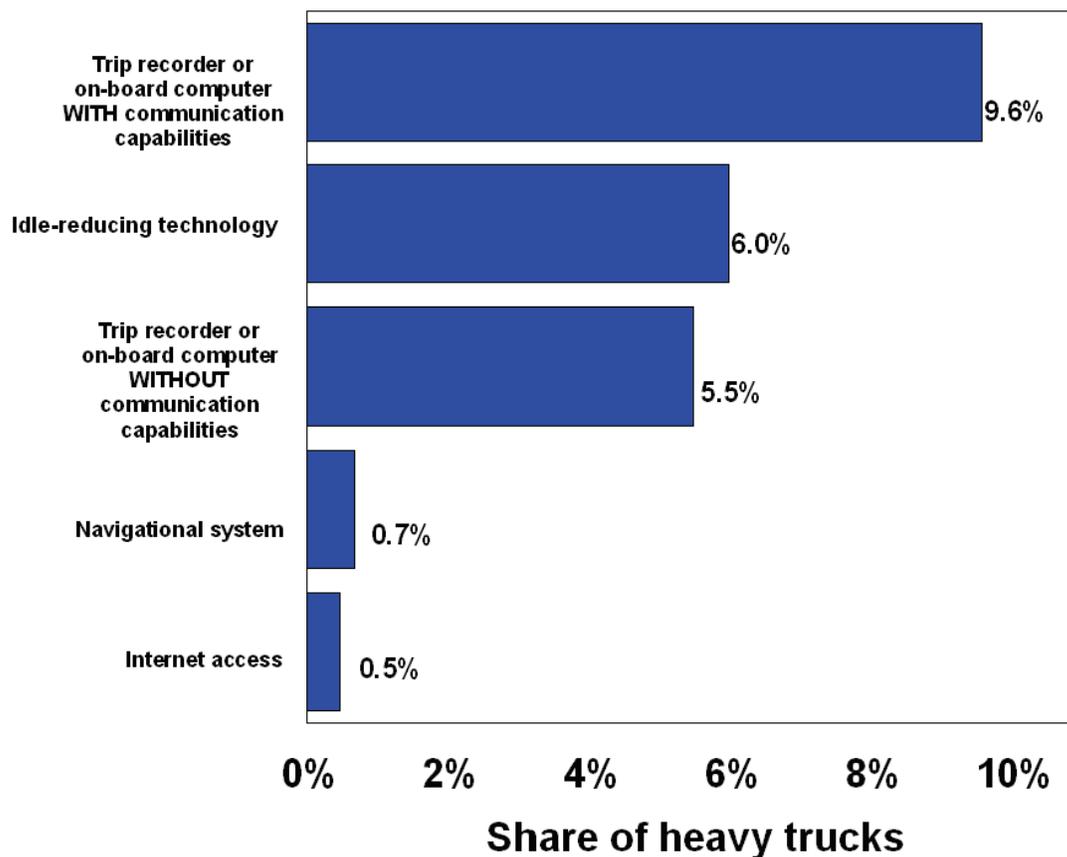
U.S. Department of Commerce, Bureau of the Census, 2002 Vehicle Inventory and Use Survey, Microdata File on CD, 2005. (Additional resources: www.census.gov/svsd/www/tiusview.html)

Note: Heavy trucks (class 7 & 8) are greater than 26,000 pounds gross vehicle weight based on the manufacturer’s rating.



The latest Vehicle Inventory and Use Survey asked truck owners if the truck had certain features as permanent equipment on the truck. Some of the features asked about were onboard computers, idle-reduction devices, navigational systems, and Internet access. Of the 2.3 million heavy trucks (class 7 & 8) in the United States, nearly 10% were equipped with onboard computers that had communication capabilities and another 5% had onboard computers without communication capabilities. Six percent of heavy trucks were equipped with idle-reducing technology. Navigational systems and Internet access were available in less than one percent of heavy trucks.

Figure 5.2. Share of Heavy Trucks with Selected Electronic Features, 2002



Source:

U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and User Survey*, Microdata File on CD, 2005.

Note: Heavy trucks (class 7 & 8) are greater than 26,000 pounds gross vehicle weight based on the manufacturer's rating.



Fuel Economy Study for Class 8 Trucks

As part of a long-term study sponsored by the U.S. Department of Energy (DOE) Office of Vehicle Technologies (OVT), the Oak Ridge National Laboratory (ORNL) in conjunction with several industry partners has collected data and information related to heavy-truck operation in real-world highway environments. The primary objective of the project was to collect real-world performance and spatial data for long-haul operations of Class 8 tractor-trailers from a fleet engaged in normal freight operations. Six Class 8 trucks from the selected fleet, which operates within a large area of the country extending from the east coast to Mountain Time Zone and from Canada to the US-Mexican border, were instrumented and 60 channels of data were collected for over a year at a rate of 5 Hz (or 5 readings per second). Those channels included information such as instantaneous fuel rate, engine speed, gear ratio, vehicle speed, and other information read from the vehicle's databus; weather information (wind speed, precipitation, air temperature, etc.) gathered from an on-board weather station; spatial information (latitude, longitude, altitude) acquired from a GPS (Global Positioning System) device; and instantaneous tractor and trailer weight obtained from devices mounted on the six participating tractors and ten trailers. Three of the six instrumented tractors and five of the ten instrumented trailers were mounted with New Generation Single Wide-Based Tires and the others with regular dual tires. Over the duration of this phase of the project (just over a year) the six tractors traveled nearly 700,000 miles.

To find out more about this project, contact Oscar Franzese, franzeseo@ornl.gov, 865-946-1304.



Table 5.10 presents a distribution of distance traveled, fuel consumed, and fuel economy by speed and by type of tires for the vehicles participating in the project (see page 5-13 for project description). The speed bins are divided into 5-mile intervals, going from 0+ mph (i.e., speed > 0.00 mph) to 85 mph, while the four main columns of Table 5.10 are organized by the type of tires that were mounted on the tractor and trailers. The first row of the table contains information about fuel consumed while the vehicle was idling (i.e., the vehicle was static with the engine on) with the following rows presenting information about the distance traveled, fuel consumed, and fuel economy for each one of the speed intervals. The next-to-the-last row shows the totals for both traveled distances and fuel consumed as well as the overall fuel economy for each tire-combination category. The latter are then used to compute the percentage difference in terms of fuel economy from dual tire tractors and trailers, which is the most common tire setup for large trucks at the present time.

Table 5.10
Fuel Economy for Class 8 Trucks as Function of Speed
and Tractor-Trailer Tire Combination

Speed (mph)	Dual Tire Tractor - Dual Tire Trailer			Dual Tire Tractor - Single (Wide) Tire Trailer			Single (Wide) Tire Tractor - Dual Tire Trailer			Single (Wide) Tire Tractor - Single (Wide) Tire Trailer		
	Distance Traveled (miles)	Fuel Cons. (gal)	Fuel Econ. (MPG)	Distance Traveled (miles)	Fuel Cons. (gal)	Fuel Econ. (MPG)	Distance Traveled (miles)	Fuel Cons. (gal)	Fuel Econ. (MPG)	Distance Traveled (miles)	Fuel Cons. (gal)	Fuel Econ. (MPG)
Idling	N/A	1,858.5	N/A	N/A	967.9	N/A	N/A	1,676.4	N/A	N/A	706.0	N/A
0+ to 5	281	101.8	2.76	148	50.4	2.93	368	124.2	2.97	156	52.8	2.96
5+ to 10	674	198.8	3.39	368	103.2	3.56	808	245.4	3.30	331	98.8	3.35
10+ to 15	723	192.0	3.77	396	98.3	4.03	848	216.5	3.92	343	87.0	3.95
15+ to 20	744	199.1	3.73	404	100.9	4.00	882	221.6	3.98	361	90.5	3.98
20+ to 25	938	228.4	4.11	489	113.6	4.31	1,111	244.2	4.55	462	101.1	4.57
25+ to 30	1,178	266.9	4.41	609	131.5	4.63	1,420	286.9	4.95	580	117.6	4.93
30+ to 35	1,481	336.8	4.40	753	154.2	4.88	1,774	341.1	5.20	708	141.1	5.02
35+ to 40	1,917	403.5	4.75	1,000	193.6	5.17	2,284	433.6	5.27	941	184.3	5.10
40+ to 45	2,955	584.1	5.06	1,543	285.9	5.40	3,380	603.6	5.60	1,350	254.4	5.31
45+ to 50	4,935	907.9	5.43	2,573	447.7	5.75	5,410	872.8	6.20	2,177	360.4	6.04
50+ to 55	9,397	1,629.8	5.77	4,962	811.5	6.11	10,046	1,622.7	6.19	3,877	625.5	6.20
55+ to 60	20,656	3,297.2	6.26	11,707	1,721.9	6.80	22,373	3,257.8	6.87	8,710	1,246.9	6.99
60+ to 65	38,964	5,879.6	6.63	21,472	2,980.8	7.20	34,517	4,840.0	7.13	14,944	2,049.4	7.29
65+ to 70	58,304	8,313.2	7.01	27,931	3,652.2	7.65	65,063	9,256.4	7.03	27,144	3,880.1	7.00
70+ to 75	56,378	7,483.2	7.53	21,751	2,745.5	7.92	66,882	8,435.6	7.93	32,887	4,056.1	8.11
75+ to 85	7,849	808.2	9.71	3,610	403.2	8.95	11,513	911.1	12.64	6,817	512.2	13.31
Total ^a	207,374	30,831	6.73	99,714	13,994	7.13	228,680	31,913	7.17	101,790	13,858	7.35
Percent increase in fuel economy from dual tire trac/trail			0.00%			5.93%			6.53%			9.20%

Source:

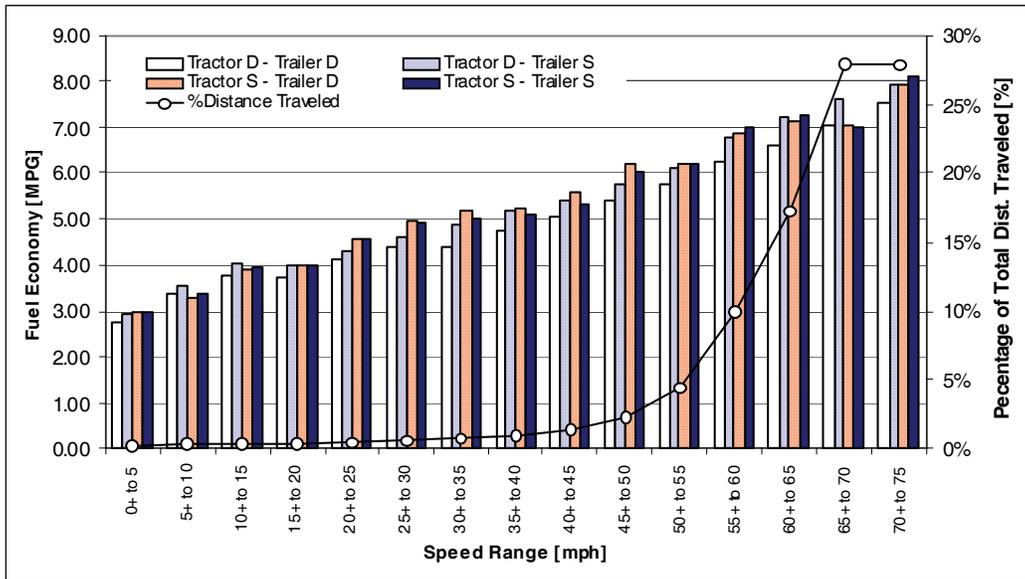
Oak Ridge National Laboratory, Heavy Truck Duty Cycle Project, sponsored by the U.S. Department of Energy. See page 5-13 for project details.

^a Total Fuel Consumed does not include fuel consumed while idling.



The fuel economy information presented in Table 5.10 is on the upper limits of today's large-truck fleets and is mostly a result of driver training and the extensive vehicle maintenance (including constant tire pressure) to which the fleet company participating in this project adheres. Nevertheless, the results of this extensive test indicate that there are substantial gains in terms of fuel economy for large trucks when single (wide) tires are used in combination with dual tires or alone (best case). Figure 5.3 shows the information from Table 5.10 in a graphical form (bars) and also displays for each speed bin the percentage of the total distance that is traveled at that speed (line). It is possible to observe that above 80% of the distance traveled by long-haul Class 8 trucks is done at speeds above 55 mph. Therefore, any gains in fuel economies at these speeds derived from a given tire combination would have a very large impact on the overall fuel economy of these type of trucks. Figure 5.3 shows that, except for the D-S combination within the 65+ to 70 mph, the combinations with all single (wide) tires perform better and, therefore, obtain the largest overall fuel economy.

Figure 5.3. Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire Combination and Percentage of Total Distance Traveled as a Function of Speed



Source:

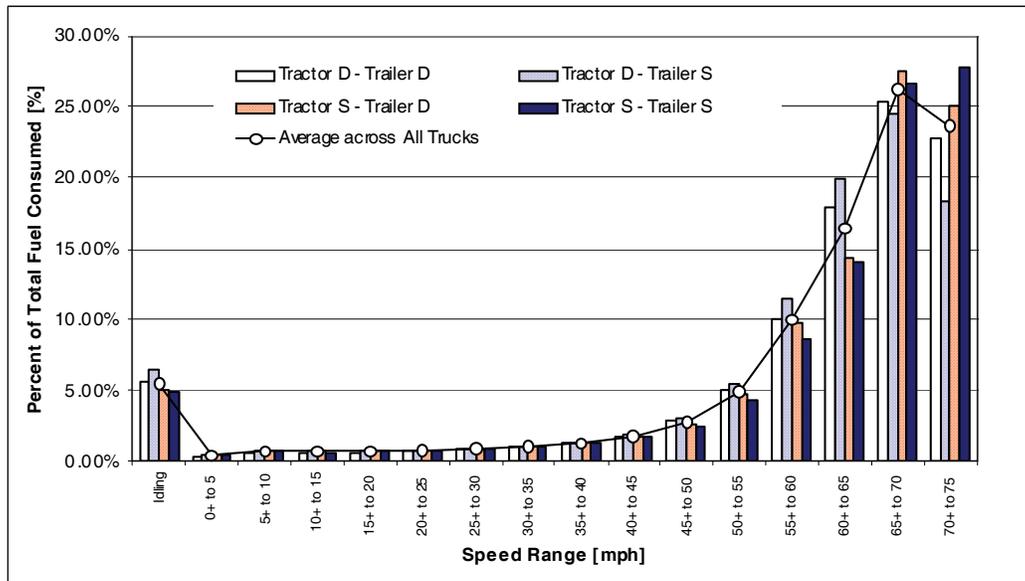
Oak Ridge National Laboratory, Heavy Truck Duty Cycle Project, sponsored by the U.S. Department of Energy. See page 5-13 for project details.

Note: D = Dual tire. S = Single (wide) tire.



This graph presents for each one of the four tire-combination categories the percent of total fuel that is consumed when traveling at different speeds (bars) as well as the average percent of fuel consumed for each speed bin (line). As opposed to Table 5.10, the total fuel consumed on this graph includes the fuel consumed while idling.

Figure 5.4. Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and Tractor-Trailer Tire Combination



Source:

Oak Ridge National Laboratory, Heavy Truck Duty Cycle Project, sponsored by the U.S. Department of Energy. See page 5-13 for project details.

Note: D = Dual tire. S = Single (wide) tire. Includes fuel consumed while idling.



Commodity Flow Survey

The Commodity Flow Survey (CFS) is designed to provide data on the flow of goods and materials by mode of transport. The 1993, 1997, and 2002 CFS are a continuation of statistics collected in the Commodity Transportation Survey from 1963 through 1977, and include major improvements in methodology, sample size, and scope. The 2002 CFS covers business establishments with paid employees that are located in the United States and are classified using the 1997 North American Industry Classification System (NAICS) in mining, manufacturing, wholesale trade, and select retail trade industries, namely, electronic shopping and mail-order houses. Establishments classified in services, transportation, construction, and most retail industries are excluded from the survey. Farms, fisheries, foreign establishments, and most government-owned establishments are also excluded.^a

The 1993, 1997, and 2002 CFS differ from previous surveys in their greatly expanded coverage of intermodalism (i.e., shipments which travel by at least two different modes, such as rail and truck). Earlier surveys reported only the principal mode. Route distance for each mode for each shipment was imputed using methodologies developed by Oak Ridge National Laboratory. Distance, in turn, was used to compute ton-mileage by mode of transport.

The CFS was conducted in 2007 but the data have not yet been released. Look for the data in December 2008 at: www.bts.gov/publications/commodity_flow_survey.

^a Bureau of Transportation Statistics and U.S. Bureau of the Census, 2002 Economic Census, *2002 Commodity Flow Survey*, December 2004.



Industries covered by the 2002 Commodity Flow Survey (CFS) shipped over 11 billion tons of goods worth over \$8 trillion. Compared to the 1997 CFS, the value of shipments is up 1.5% per year and ton shipped are up 1.0% per year. By value, intermodal shipments increased 0.4% per year from 1997 to 2002.

Table 5.11
Growth of Freight in the United States: Comparison of the 2002 and 1997 Commodity Flow Surveys
 (Detail may not add to total because of rounding)

Mode of Transportation	Value of goods shipped			Tons		
	2002 (billion 2002 dollars)	1997 (billion dollars)	Average annual percent change	2002 (millions)	1997 (millions)	Average annual percent change
All modes	8,397.2	7,783.3	1.5%	11,667.9	11,089.7	1.0%
Single modes	7,049.4	6,410.9	1.9%	11,086.7	10,436.5	1.2%
Truck ^a	6,235.0	5,583.7	2.2	7,842.8	7,700.7	0.4%
For-hire truck	3,757.1	3,252.0	2.9	3,657.3	3,402.6	1.5%
Private truck	2,445.3	2,282.7	1.4	4,149.7	4,137.3	0.1%
Rail	311.9	358.3	-2.7%	1,873.9	1,549.8	3.9%
Water	89.3	85.0	0.9%	681.2	563.4	3.9%
Shallow draft	57.5	60.4	-1.0%	458.6	414.8	2.0%
Great Lakes	0.8	1.7	-14.0%	38.0	38.4	-0.2%
Deep draft	31.0	22.9	6.2%	184.6	110.2	10.9%
Air (includes truck and air)	265.0	256.7	1.4%	3.8	4.5	-3.3%
Pipeline ^b	149.2	127.2	3.2%	685.0	618.2	2.1%
Multiple modes	1,079.2	1,060.2	0.4%	216.7	216.7	0.0%
Parcel, U.S. Postal Service or courier	987.8	959.3	0.6%	25.5	23.7	1.5%
Truck and rail	69.9	84.8	-3.8%	43.0	54.2	-4.5%
Truck and water	14.4	9.2	9.4%	23.3	33.2	-6.8%
Rail and water	3.3	2.0	10.5%	105.1	79.3	5.8%
Other multiple modes	3.8	4.8	-4.6%	19.8	26.2	-5.4%
Other and unknown modes	268.6	312.2	-3.0%	364.6	436.5	-3.5%

Source:

U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *2002 Commodity Flow Survey*, Table 1a, and *1997 Commodity Flow Survey*, Table 1a. (Additional resources: www.bts.gov/cfs)

^a "Truck" as a single mode includes shipments which went by private truck only, for-hire truck only, or a combination of private truck and for-hire truck.

^b CFS data for pipeline lack most shipments of crude oil.



Industries covered by the 2002 Commodity Flow Survey (CFS) accounted for about 3.1 trillion ton-miles on the nation's highways, railways, waterways, pipelines, and aviation system. Ton-miles increased an average of 3.3% per year from 1997 to 2002.

Table 5.12
Growth of Freight Miles in the United States: Comparison of the 2002 and 1997 Commodity Flow Surveys
(Detail may not add to total because of rounding)

Mode of Transportation	Ton-miles			Average miles per shipment		
	2002 (billions)	1997 (billions)	Average annual percent change	2002	1997	Average annual percent change
All modes	3,137.9	2,661.4	3.3%	546	472	3.0%
Single modes	2,867.9	2,383.5	3.8%	240	184	5.5%
Truck ^a	1,255.9	1,023.5	4.2%	173	144	3.7%
For-hire truck	959.6	741.1	5.3%	523	485	1.5%
Private truck	291.1	268.6	1.6%	64	53	3.8%
Rail	1,261.6	1,022.5	4.3%	807	769	1.0%
Water	282.7	261.7	1.6%	568	482	3.3%
Shallow draft	211.5	189.3	2.2%	450	177	20.5%
Great Lakes	13.8	13.4	0.6%	339	204	10.7%
Deep draft	57.4	59.0	-0.5%	664	1,024	-8.3%
Air (includes truck and air)	5.8	6.2	-1.3%	1,919	1,380	6.8%
Pipeline ^b	^c	^c	^c	^c	^c	^c
Multiple modes	225.7	204.5	2.0%	895	813	1.9%
Parcel, U.S. Postal Service or courier	19.0	18.0	1.1%	894	813	1.9%
Truck and rail	45.5	55.6	-3.9%	1,413	1,347	1.0%
Truck and water	32.4	34.8	-1.4%	1,950	1,265	9.0%
Rail and water	115.0	77.6	8.2%	957 ^c	1,092 ^c	-2.6%
Other multiple modes	13.8	18.6	-5.8%			
Other and unknown modes	44.2	73.4	-9.6%	130	122	1.3%

Source:

U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *2002 Commodity Flow Survey*, Table 1a, and *1997 Commodity Flow Survey*, Table 1a. (Additional resources: www.bts.gov/cfs)

^a "Truck" as a single mode includes shipments which went by private truck only, for-hire truck only, or a combination of private truck and for-hire truck.

^b CFS data for pipeline lack most shipments of crude oil.

^c Denotes data do not meet publication standards because of high sampling variability or other reasons. Some unpublished estimates can be derived from other data published in this table. However, figures obtained in this manner are subject to these same limitations.



The energy use per passenger-mile for transit buses and trolleybuses has remained relatively constant over the last decade.

Table 5.13
Summary Statistics on Transit Buses and Trolleybuses, 1994–2005

Year	Number of active buses	Vehicle-miles (millions)	Passenger-miles (millions)	Btu/passenger-mile	Energy use (trillion Btu)
1994	69,000	2,176	19,019	4,261	81.0
1995	67,992	2,198	19,005	4,303	81.8
1996	72,549	2,234	19,280	4,335	83.6
1997	73,629	2,259	19,793	4,425	87.6
1998	73,022	2,188	20,542	4,382	90.0
1999	75,087	2,290	21,391	4,327	92.6
2000	75,964	2,329	21,433	4,510	96.7
2001	76,675	2,389	22,209	4,120	91.5
2002	76,790	2,425	22,030	4,101	90.3
2003	78,000	2,435	21,438	4,155	89.1
2004	81,630	2,484	21,550	4,318	93.1
2005	82,642	2,508	21,998	4,230	93.1
<i>Average annual percentage change</i>					
1994–2005	1.7%	1.3%	1.3%	-0.1%	1.3%

Source:

American Public Transportation Association, *2007 Public Transportation Fact Book*, Washington, DC, May 2007, Tables 7, 11, and 17. (Additional resources: www.apta.com)

