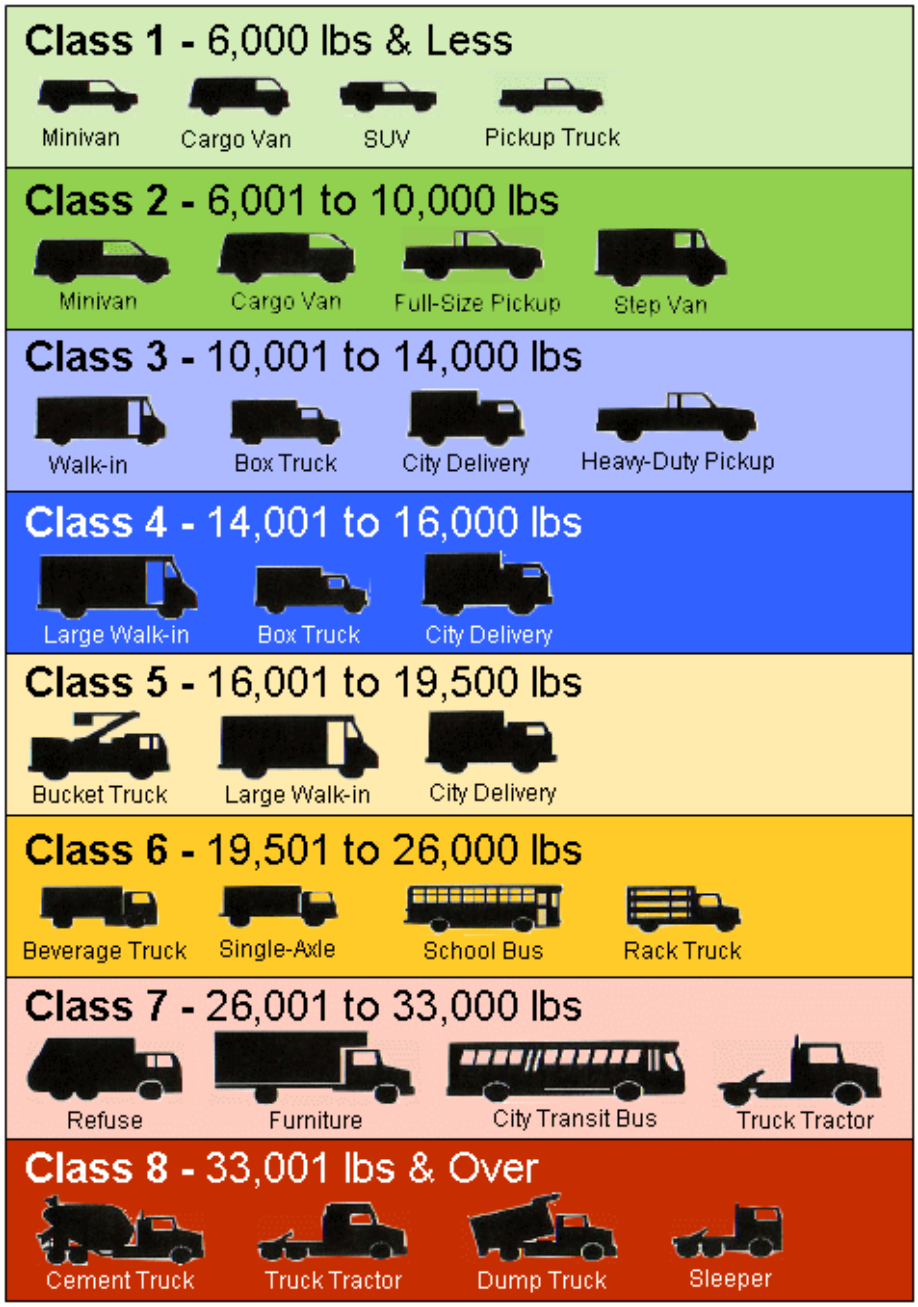
Chapter 5
Heavy Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 5.1	Class 3-8 single-unit trucks, 2016	
	Registration (thousands)	*8,747*
	Vehicle miles (millions)	*113,338*
	Fuel economy (miles per gallon)	*7.4*
Table 5.2	Class 7-8 combination trucks, 2016	
	Registration (thousands)	*2,752*
	Vehicle miles (millions)	*174,557*
	Fuel economy (miles per gallon)	*5.9*
Table 5.15	Freight Shipments, 2012 Commodity Flow Survey	
Table 5.15	*Value (billion dollars)*	*13,852*
Table 5.16	*Tons (millions)*	*11,299*
Table 5.17	*Ton-miles (billions)*	*2,970*

There are eight truck classes, categorized by the gross vehicle weight rating that the vehicle is assigned when it is manufactured. The pictures below show examples of some of the different body types that would be included in each class. Many of the body types can be in more than one category, depending on the vehicle's attributes. Examples of this include pickups, box trucks, buses, and truck tractors.

Figure 5.1. Examples of Body Types in Each Truck Class



Source:
Oak Ridge National Laboratory, National Transportation Research Center, Oak Ridge, TN. Gross vehicle weight category definitions from 49CFR565.6 (2000).

Class 3-8 single-unit trucks include trucks over 10,000 lb gross vehicle weight with the cab/engine and cargo space together as one unit. Most of these trucks would be used for business or for individuals with heavy hauling or towing needs. Very heavy single-units, such as concrete mixers and dump trucks, are also in this category. The data series was changed by the FHWA back to 2007.

Table 5.1
Summary Statistics for Class 3-8 Single-Unit Trucks, 1970–2016

Year	Registrations (thousands)	Vehicle travel (million miles)	Average annual miles per vehicle	Fuel use (million gallons)	Average fuel economy per vehicle (miles per gallon)	
1970	3,681	27,081	7,357	3,968	6.8	
1975	4,232	34,606	8,177	5,420	6.4	
1980	4,374	39,813	9,102	6,923	5.8	
1981	4,455	39,568	8,882	6,867	5.8	
1982	4,325	40,658	9,401	6,803	6.0	
1983	4,204	42,546	10,120	6,965	6.1	
1984	4,061	44,419	10,938	7,240	6.1	
1985	4,593	45,441	9,894	7,399	6.1	
1986	4,313	45,637	10,581	7,386	6.2	
1987	4,188	48,022	11,467	7,523	6.4	
1988	4,470	49,434	11,059	7,701	6.4	
1989	4,519	50,870	11,257	7,779	6.5	
1990	4,487	51,901	11,567	8,357	6.2	
1991	4,481	52,898	11,805	8,172	6.5	
1992	4,370	53,874	12,328	8,237	6.5	
1993	4,408	56,772	12,879	8,488	6.7	
1994	4,906	61,284	12,492	9,032	6.8	
1995	5,024	62,705	12,481	9,216	6.8	
1996	5,266	64,072	12,167	9,409	6.8	
1997	5,293	66,893	12,638	9,576	7.0	
1998	5,414	67,894	12,540	9,741	7.0	
1999	5,763	70,304	12,199	9,372	7.5	
2000	5,926	70,500	11,897	9,563	7.4	
2001	5,704	72,448	12,701	9,667	7.5	
2002	5,651	75,866	13,425	10,321	7.4	
2003	5,849	77,757	13,294	8,881	8.8	
2004	6,161	78,441	12,732	8,959	8.8	
2005	6,395	78,496	12,275	9,501	8.3	
2006	6,649	80,344	12,084	9,852	8.2	[a]
2007	8,117	119,979	14,781	16,314	7.3	
2008	8,228	126,855	15,417	17,144	7.4	
2009	8,356	120,207	14,386	16,253	7.4	
2010	8,217	110,738	13,477	15,097	7.3	
2011	7,819	103,803	13,276	14,214	7.3	
2012	8,190	105,605	12,894	14,376	7.3	
2013	8,126	106,582	13,116	14,502	7.3	
2014	8,329	109,301	13,123	14,894	7.3	
2015	8,456	109,597	12,961	14,850	7.4	
2016	8,747	113,338	12,958	15,338	7.4	
			Average annual percentage change			
1970–2016	1.9%	3.2%	1.2%	3.0%	0.2%	
2007–2016	0.8%	-0.6%	-1.5%	-0.7%	0.2%	

Source:
U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2016*, Washington, DC, 2017, Table VM-1 and annual. (Additional resources: www.fhwa.dot.gov)

[a] Due to FHWA methodology changes, data from 2007-on are not comparable with previous data.

Class 7-8 combination trucks include all trucks designed to be used in combination with one or more trailers with a gross vehicle weight rating over 26,000 lb. 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. The data series was changed by the FHWA back to 2007.

Table 5.2
Summary Statistics for Class 7-8 Combination Trucks, 1970–2016

Year	Registrations (thousands)	Vehicle travel[a] (million miles)	Average annual miles per vehicle	Fuel use (million gallons)	Average fuel economy per vehicle (miles per gallon)	
1970	905	35,134	38,822	7,348	4.8	
1975	1,131	46,724	41,312	9,177	5.1	
1980	1,417	68,678	48,467	13,037	5.3	
1981	1,261	69,134	54,825	13,509	5.1	
1982	1,265	70,765	55,941	13,583	5.2	
1983	1,304	73,586	56,431	13,796	5.3	
1984	1,340	77,377	57,744	14,188	5.5	
1985	1,403	78,063	55,640	14,005	5.6	
1986	1,408	81,038	57,555	14,475	5.6	
1987	1,530	85,495	55,879	14,990	5.7	
1988	1,667	88,551	53,120	15,224	5.8	
1989	1,707	91,879	53,825	15,733	5.8	
1990	1,709	94,341	55,202	16,133	5.8	
1991	1,691	96,645	57,153	16,809	5.7	
1992	1,675	99,510	59,409	17,216	5.8	
1993	1,680	103,116	61,379	17,748	5.8	
1994	1,681	108,932	64,802	18,653	5.8	
1995	1,696	115,451	68,073	19,777	5.8	
1996	1,747	118,899	68,059	20,192	5.9	
1997	1,790	124,584	69,600	20,302	6.1	
1998	1,831	128,159	69,994	21,100	6.1	
1999	2,029	132,384	65,246	24,537	5.4	
2000	2,097	135,020	64,387	25,666	5.3	
2001	2,154	136,584	63,409	25,512	5.4	
2002	2,277	138,737	60,930	26,480	5.2	
2003	1,908	140,160	73,459	23,815	5.9	
2004	2,010	142,370	70,831	24,191	5.9	
2005	2,087	144,028	69,012	27,689	5.2	
2006	2,170	142,169	65,516	28,107	5.1	[b]
2007	2,635	184,199	69,905	30,904	6.0	
2008	2,585	183,826	71,113	30,561	6.0	
2009	2,617	168,100	64,234	28,050	6.0	
2010	2,553	175,789	68,856	29,927	5.9	
2011	2,452	163,791	66,809	28,181	5.8	
2012	2,469	163,602	66,262	27,975	5.8	
2013	2,471	168,436	68,155	28,795	5.8	
2014	2,577	169,830	65,897	29,118	5.8	
2015	2,747	170,246	61,978	28,886	5.9	
2016	2,752	174,557	63,428	29,555	5.9	
			Average annual percentage change			
1970–2016	2.4%	3.5%	1.1%	3.1%	0.4%	
2007–2016	0.5%	-0.6%	-1.1%	-0.5%	-0.2%	

Source:
U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2016*, Washington, DC, 2017, Table VM-1 and annual. (Additional resources: www.fhwa.dot.gov)

[a] The Federal Highway Administration changed the combination truck travel methodology in 1993.
[b] Due to FHWA methodology changes, data from 2007-on are not comparable with previous data.

Truck sales rose in 2010 for the first time since the sales peak in 2004 and have thus far continued to rise. Trucks under 10,000 lb continue to dominate truck sales.

Table 5.3
New Retail Truck Sales by Gross Vehicle Weight, 1970–2017[a]
(thousands)

Calendar year	Class 1 6,000 lb or less	Class 2 6,001–10,000 lb	Class 3 10,001–14,000 lb	Class 4 14,001–16,000 lb	Class 5 16,001–19,500 lb	Class 6 19,501–26,000 lb	Class 7 26,001–33,000 lb	Class 8 33,001 lb 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
2007	5,682	2,623	166	51	45	54	70	151	8,842
2008	4,358	1,888	135	36	40	39	49	133	6,680
2009	3,528	1,306	112	20	24	22	39	95	5,145
2010	4,245	1,513	161	12	31	29	38	107	6,137
2011	4,714	1,735	195	10	42	41	41	171	6,951
2012	5,164	1,811	223	9	55	40	47	195	7,544
2013	5,615	2,077	254	12	60	47	48	185	8,298
2014	6,209	2,275	264	13	67	52	54	220	9,154
2015	7,161	2,417	283	14	72	55	59	249	10,310
2016	7,724	2,572	296	14	72	62	60	193	10,993
2017	8,102	2,637	317	19	79	63	62	192	11,470
Average annual percentage change									
1970–1985	5.7%	7.9%	4.1%	[c]	-15.1%	-6.6%	6.8%	2.8%	5.5%
1986–2017	2.9%	2.5%	11.1%	7.8%[d]	8.7%	1.0%	-1.7%	1.7%	2.8%
2007–2017	3.6%	0.1%	6.7%	-9.4%	5.8%	1.6%	-1.2%	2.4%	2.5%

Source:
Ward's Communications, www.wardsauto.com. (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.
[d] 1987-2017.

Based on factory sales, the share of diesel medium/heavy trucks sold has declined from 1995 to 2017 for truck gross vehicle weight rating (GVWR) classes 4, 5, and 7. Class 6 diesel sales share increased in that period and class 8 continued to be 100% diesel. The result for all class 4 through 8 trucks combined was a decline from 87% diesel share in 1995 to 75% in 2017.

Table 5.4
Diesel Share of Medium and Heavy Truck Sales by Gross Vehicle Weight, 1995–2017[a]

Calendar year	Class 4 14,001–16,000 lb	Class 5 16,001–19,500 lb	Class 6 19,501–26,000 lb	Class 7 26,001–33,000 lb	Class 8 33,001 lb and over	Total (Class 4 - Class 8)
1995	68%	87%	70%	74%	100%	87%
1996	66%	92%	69%	68%	100%	85%
1997	61%	90%	82%	70%	100%	85%
1998	72%	91%	88%	72%	100%	88%
1999	62%	86%	90%	74%	100%	88%
2000	62%	93%	54%	68%	100%	83%
2001	91%	90%	70%	59%	100%	84%
2002	68%	93%	66%	54%	100%	82%
2003	74%	92%	77%	47%	100%	83%
2004	71%	92%	76%	54%	100%	85%
2005	74%	92%	73%	56%	100%	87%
2006	76%	92%	75%	59%	100%	88%
2007	78%	92%	52%	50%	100%	81%
2008	81%	92%	58%	50%	100%	84%
2009	87%	91%	56%	36%	100%	80%
2010	94%	93%	92%	39%	100%	87%
2011	82%	80%	95%	49%	100%	91%
2012	14%	79%	95%	49%	100%	89%
2013	39%	80%	96%	46%	100%	88%
2014	32%	80%	91%	45%	100%	88%
2015	24%	80%	98%	48%	100%	89%
2016	21%	54%	89%	45%	100%	78%
2017	16%	52%	87%	45%	100%	75%

Source:
Ward's Communications, www.wardsauto.com. (Additional resources: www.wardsauto.com)

[a] Estimates based on available factory sales. May not represent the entire industry.

The Vehicle Inventory and Use Survey (VIUS) was discontinued, thus the 2002 VIUS data remain the latest 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. Internet site: **www.census.gov/econ/overview/se0501.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 United States 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.

The California Department of Transportation is conducting a survey to collect data on the physical and operational characteristics of the State's commercial vehicle population called the California Vehicle Inventory Use and Survey. Internet site:
www.dot.ca.gov/hq/tpp/offices/omsp/statewide_modeling/cal_vehicle_survey.html

Table 5.5
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 lb and less	51,941,389	61.0%	11,882	17.6	42.7%
2) 6,001 – 10,000 lb	28,041,234	32.9%	12,684	14.3	30.5%
3) 10,001 – 14,000 lb	691,342	0.8%	14,094	10.5	1.1%
4) 14,001 – 16,000 lb	290,980	0.3%	15,441	8.5	0.5%
5) 16,001 – 19,500 lb	166,472	0.2%	11,645	7.9	0.3%
6) 19,501 – 26,000 lb	1,709,574	2.0%	12,671	7.0	3.2%
7) 26,001 – 33,000 lb	179,790	0.2%	30,708	6.4	0.9%
8) 33,001 lb and up	2,153,996	2.5%	45,739	5.7	20.7%
Total	85,174,777	100.0%	13,088	13.5	100.0%
Light truck subtotal	79,982,623	93.9%	12,163	16.2	73.2%
Medium truck subtotal	2,858,368	3.4%	13,237	8.0	5.2%
Heavy truck subtotal	2,333,786	2.7%	44,581	5.8	21.6%

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 5.6
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 lb and less	17.2	17.1	17.6
2) 6,001–10,000 lb	13.0	13.6	14.3
3) 10,000–14,000 lb	8.8	9.4	10.5
4) 14,001–16,000 lb	8.8	9.3	8.5
5) 16,001–19,500 lb	7.4	8.7	7.9
6) 19,501–26,000 lb	6.9	7.3	7.0
7) 26,001–33,000 lb	6.5	6.4	6.4
8) 33,001 lb and over	5.5	5.7	5.7
Light truck subtotal	15.7	15.8	16.2
Medium truck subtotal	7.3	8.6	8.0
Large truck subtotal	5.6	6.1	5.8

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

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)

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 5.7
Truck Statistics by Size, 2002

	Manufacturer's gross vehicle weight class			
	Light (< 10,000 lb)	Medium (10,001–26,000 lb)	Heavy (> 26,000 lb)	Total
	Typical trip miles or range of operation[a]			
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[b]	**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%
Total[b]	**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)

[a] The respondent was asked to choose the category which best described the trips made by the vehicle.
[b] Percentages may not sum to totals due to rounding.

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 5.8
Percentage of Trucks by Size Ranked by Major Use, 2002

Rank	Light (< 10,000 lb average weight)	Medium (10,001 – 26,000 lb average weight)	Heavy (> 26,000 lb average weight)
1	**Personal**	**Construction**	**For hire**
	81.5%	18.4%	30.1%
2	**Construction**	**Agriculture**	**Construction**
	4.6%	16.2%	15.9%
3	**Other services [a]**	**For hire**	**Agriculture**
	2.5%	9.6%	12.2%
4	**Not in use**	**Retail**	**Retail**
	2.2%	7.1%	5.4%
5	**Agriculture**	**Not in use**	**Not in use**
	1.9%	6.4%	5.1%
6	**Retail**	**Leasing**	**Waste management**
	1.5%	6.2%	5.0%
7	**Unknown**	**Wholesale**	**Manufacturing**
	1.3%	5.5%	4.9%
8	**Leasing**	**Waste management**	**Wholesale**
	0.7%	5.4%	4.8%
9	**Manufacturing**	**Utilities**	**Leasing**
	0.7%	5.0%	4.6%
10	**Utilities**	**Personal**	**Unknown**
	0.6%	4.8%	3.2%
11	**Waste management**	**Unknown**	**Personal**
	0.6%	4.4%	2.5%
12	**Wholesale**	**Manufacturing**	**Mining**
	0.6%	3.3%	2.4%
13	**Information services**	**Other services[a]**	**Other services[a]**
	0.4%	3.2%	1.3%
14	**For hire**	**Food services**	**Utilities**
	0.4%	1.6%	1.1%
15	**Food services**	**Information services**	**Food services**
	0.3%	1.3%	1.1%
16	**Arts**	**Mining**	**Arts**
	0.2%	1.1%	0.3%
17	**Mining**	**Arts**	**Information services**
	0.1%	0.5%	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 5.9
Percentage of Trucks by Fleet Size and Primary Fueling Facility, 2002

	Primary refueling facility				
Truck fleet size	Gas station	Truck stop	Own facility	Other's facility	Total[a]
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)

[a] Percentages may not sum to totals due to rounding.

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 5.10
Share of Trucks by Major Use and Primary Fueling Facility, 2002

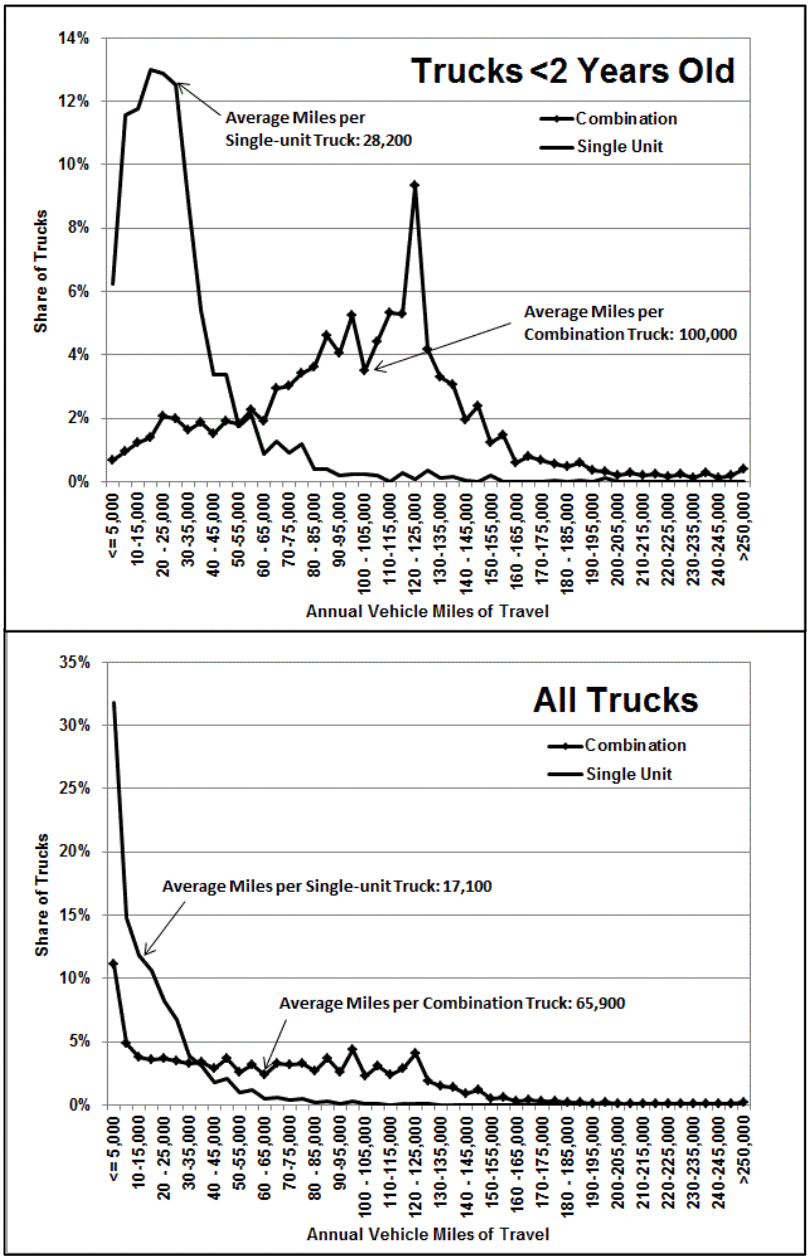
Major use	Gas station	Truck stop	Own facility	Others facility	Other	All[a]
Personal	98.6%	0.6%	0.7%	0.1%	0.1%	100.0%
Other services	96.0%	1.4%	1.6%	0.9%	0.1%	100.0%
Information services	92.3%	0.4%	7.2%	0.1%	0.0%	100.0%
Retail trade	86.6%	3.5%	8.6%	1.2%	0.0%	100.0%
Construction	84.7%	3.3%	9.8%	2.2%	0.0%	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)

[a] Percentages may not sum to totals due to rounding.

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 all trucks and trucks two years old or less. 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. Most of the single-unit trucks in the survey travel 40,000 miles per year or less.

Figure 5.2. Distribution of Trucks over 26,000 lb by Vehicle-Miles Traveled



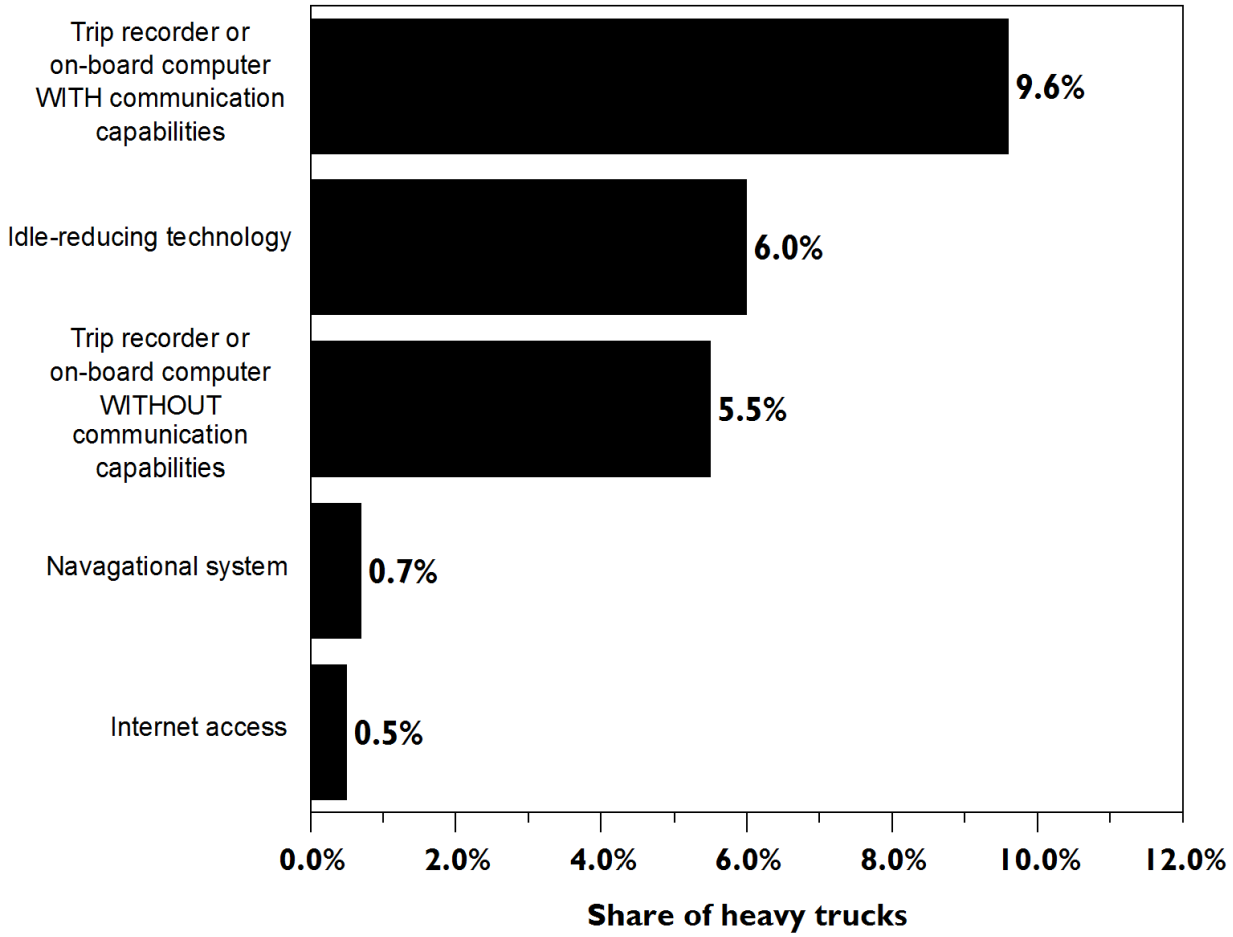
Note: Heavy trucks (class 7 & 8) are greater than 26,000 pounds gross vehicle weight based on the manufacturer's rating.

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 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 5.3. Share of Heavy Trucks with Selected Electronic Features, 2002



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

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

Fuel Economy Study for Class 8 Trucks

As part of a study sponsored by the U.S. Department of Energy (DOE) Vehicle Technologies Office (VTO), 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 model-year 2005 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. The final report on this project is available on-line at: cta.ornl.gov/cta/Publications/Reports/ORNL_TM_2008-122.pdf.

The type of terrain a truck is traveling on can cause significant differences in fuel efficiency. This study (see page 5–15 for project description) shows fuel economy on severe upslopes is less than half that on flat terrain. On severe downslopes, the fuel economy was two times higher than on flat terrain.

Table 5.11
Effect of Terrain on Class 8 Truck Fuel Economy

		Average fuel efficiency (mpg)			
Type of terrain	Share of data records	All trucks	Tractors with dual tires	Tractors with single (wide) tires	Difference between dual and single tires (percent)
Severe upslope (>4%)	0.7%	2.90	2.86	2.94	2.91%
Mild upslope (1% to 4%)	13.2%	4.35	4.25	4.44	4.35%
Flat terrain (1% to 1%)	72.4%	7.33	7.08	7.58	7.13%
Mild downslope (-4% to -1%)	12.6%	15.11	14.64	15.57	6.36%
Severe downslope (<-4%)	1.1%	23.5	21.82	25.3	15.97%

Source:

Capps, Gary, Oscar Franzese, Bill Knee, M.B. Lascurain, and Pedro Otaduy. *Class-8 Heavy Truck Duty Cycle Project Final Report*, ORNL/TM-2008/122, Oak Ridge National Laboratory, Oak Ridge, TN, December 2008. (Additional resources: cta.ornl.gov/cta/Publications/Reports/ORNL_TM_2008-122.pdf)

This table 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 5-15 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 the table 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 5.12
Fuel Economy for Class 8 Trucks as Function of Speed and Tractor-Trailer Tire Combination

	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		
Speed (mph)	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	368.0	124.2	3.0	156	52.8	2.96
5+ to 10	674	198.8	3.39	368	103.2	3.56	808.0	245.4	3.3	331	98.8	3.35
10+ to 15	723	192.0	3.77	396	98.3	4.03	848.0	216.5	3.9	343	87.0	3.95
15+ to 20	744	199.1	3.73	404	100.9	4.00	882.0	221.6	4.0	361	90.5	3.98
20+ to 25	938	228.4	4.11	489	113.6	4.31	1,111.0	244.2	4.6	462	101.1	4.57
25+ to 30	1,178	266.9	4.41	609	131.5	4.63	1,420.0	286.9	5.0	580	117.6	4.93
30+ to 35	1,481	336.8	4.40	753	154.2	4.88	1,774.0	341.1	5.2	708	141.1	5.02
35+ to 40	1,917	403.5	4.75	1,000	193.6	5.17	2,284.0	433.6	5.3	941	184.3	5.10
40+ to 45	2,955	584.1	5.06	1,543	285.9	5.40	3,380.0	603.6	5.6	1,350	254.4	5.31
45+ to 50	4,935	907.9	5.43	2,573	447.7	5.75	5,410.0	872.8	6.2	2,177	360.4	6.04
50+ to 55	9,397	1,629.8	5.77	4,962	811.5	6.11	10,046.0	1,622.7	6.2	3,877	625.5	6.20
55+ to 60	20,656	3,297.2	6.26	11,707	1,721.9	6.80	22,373.0	3,257.8	6.9	8,710	1,246.9	6.99
60+ to 65	38,964	5,879.6	6.63	21,472	2,980.8	7.20	34,517.0	4,840.0	7.1	14,944	2,049.4	7.29
NOT ADJUSTED FOR TERRAIN: See note below.												
65+ to 70	58,304	8,313.2	7.01	27,931	3,652.2	7.65	65,063.0	9,256.4	7.0	27,144	3,880.1	7.00
70+ to 75	56,378	7,483.2	7.53	21,751	2,745.5	7.92	66,882.0	8,435.6	7.9	32,887	4,056.1	8.11
75+ to 85	7,849	808.2	9.71	3,610	403.2	8.95	11,513.0	911.1	12.6	6,817	512.2	13.31
Total[a]	207,374	30,831.0	6.73	99,714	13,994.0	7.13	228,680.0	31,913.0	7.2	101,790	13,858.0	7.35
Percent increase in fuel economy from dual tire trac/trail			0.00%			5.93%			6.53%			9.20%

Note: These data were not adjusted to account for the effects of terrain. The increase in fuel economy for speeds above 70 mph is likely due to the vehicle achieving high speeds while traveling down slope. Therefore, this increase in fuel economy is not expected to be characteristic of all travel at these higher speeds.

Source:

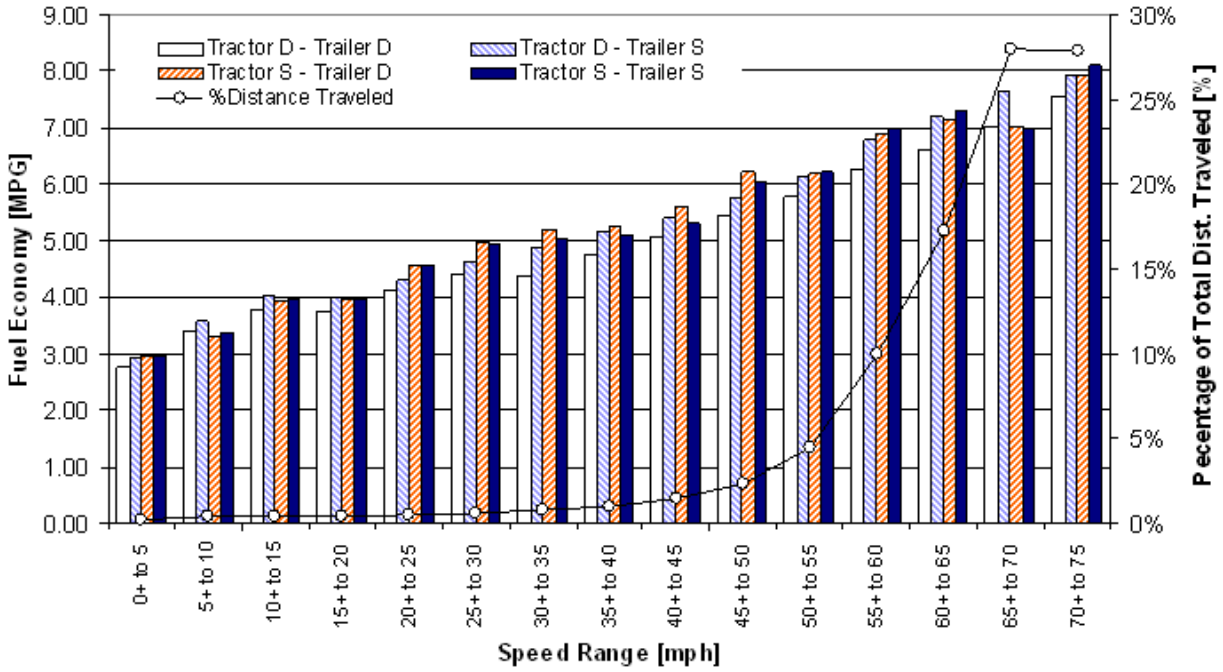
Capps, Gary, Oscar Franzese, Bill Knee, M.B. Lascurain, and Pedro Otaduy. *Class-8 Heavy Truck Duty Cycle Project Final Report*, ORNL/TM-2008/122, Oak Ridge National Laboratory, Oak Ridge, TN, December 2008. (Additional resources: cta.ornl.gov/cta/Publications/Reports/ORNL_TM_2008-122.pdf)

[a] Total fuel consumed does not include fuel consumed while idling.

The fuel economy information presented in Table 5.12 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 5.4 shows the information from Table 5.12 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 types of trucks. Figure 5.4 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 5.4. 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

NOT ADJUSTED FOR TERRAIN: See note below.



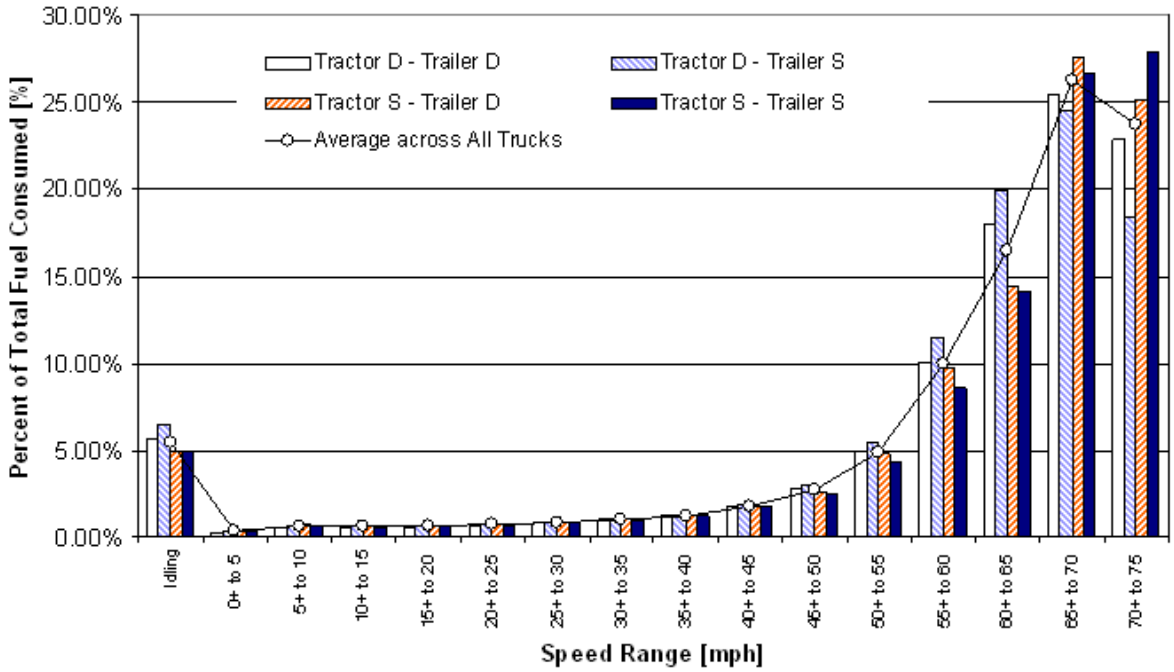
Note: D = Dual tire. S = Single (wide) tire.
These data were not adjusted to account for the effects of terrain. The increase in fuel economy for speeds above 70 mph is likely due to the vehicle achieving high speeds while traveling down slope. Therefore, this increase in fuel economy is not expected to be characteristic of all travel at these higher speeds.

Source:
Capps, Gary, Oscar Franzese, Bill Knee, M.B. Lascurain, and Pedro Otaduy. *Class-8 Heavy Truck Duty Cycle Project Final Report*, ORNL/TM-2008/122, Oak Ridge National Laboratory, Oak Ridge, TN, December 2008. (Additional resources: cta.ornl.gov/cta/Publications/Reports/ORNL_TM_2008-122.pdf)

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 5.12, the total fuel consumed on this graph includes the fuel consumed while idling.

Figure 5.5. Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and Tractor-Trailer Tire Combination

NOT ADJUSTED FOR TERRAIN: See note below



Note: D = Dual tire. S = Single (wide) tire.
These data were not adjusted to account for the effects of terrain. The increase in fuel economy for speeds above 70 mph is likely due to the vehicle achieving high speeds while traveling down slope. Therefore, this increase in fuel economy is not expected to be characteristic of all travel at these higher speeds.

Source:
Capps, Gary, Oscar Franzese, Bill Knee, M.B. Lascurain, and Pedro Otaduy. *Class-8 Heavy Truck Duty Cycle Project Final Report*, ORNL/TM-2008/122, Oak Ridge National Laboratory, Oak Ridge, TN, December 2008. (Additional resources: cta.ornl.gov/cta/Publications/Reports/ORNL_TM_2008-122.pdf)

A typical class 8 truck tractor weighs about 17,000 lb. The powertrain is nearly a quarter of the weight (24%) while the truck body structure is 19%.

Table 5.13
Class 8 Truck Weight by Component

	Pounds	Share of total
Wheels and tires	1,700	10%
Chassis/frame	2,040	12%
Drivetrain and suspension	2,890	17%
Misc. accessories/systems	3,060	18%
Truck body structure	3,230	19%
Powertrain	4,080	24%
Total	17,000	100%

Notes:
- Powertrain includes engine and cooling system, transmission and accessories.
- Truck body structure includes cab-in-white, sleeper unit, hood and fairings, interior and glass.
- Miscellaneous accessories/systems include batteries, fuel system, and exhaust hardware.
- Drivetrain and suspension includes drive axles, steer axle, and suspension system.
- Chassis/frame includes frame rails and crossmembers, fifth wheel and brackets. Wheels and tires include a set of 10 aluminum wheels, plus tires.

Source:
National Academy of Sciences, *Technologies and Approaches to Reducing the Fuel Consumption of Medium and Heavy-Duty Vehicles*, 2010, p. 117.

The gross weight of a vehicle (GVW) is the weight of the empty vehicle plus the weight of the maximum payload that the vehicle was designed to carry. In cars and small light trucks, the difference between the empty weight of the vehicle and the GVW is not significantly different (1,000 to 1,500 lb). The largest trucks and tractor-trailers, however, have a payload capacity share of 200%, which means they can carry 200% of their empty weight. The medium-sized trucks (truck classes 3-6) have payload capacity shares between 50% and 100%.

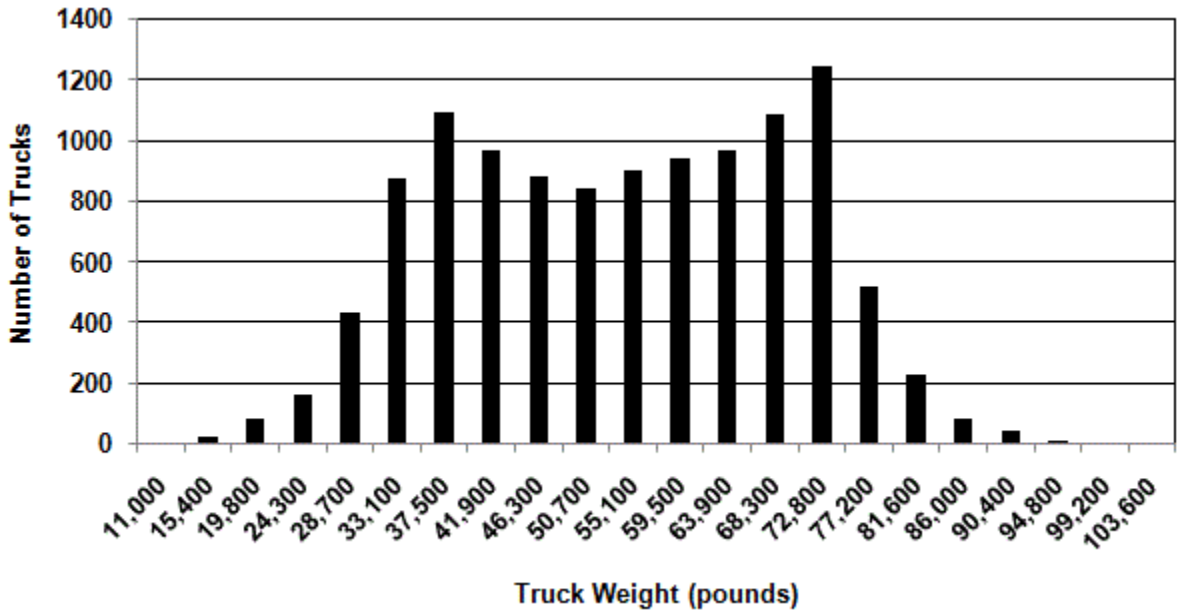
Table 5.14
Gross Vehicle Weight vs. Empty Vehicle Weight

Vehicle description	Truck class	Gross vehicle weight range (pounds)	Empty vehicle weight range (pounds)	Maximum payload capacity (pounds)	Payload capacity share (percent of empty weight)
Cars		3,200-6,000	2,400-5,000	1,000	20%
Minivans, small SUVs, small pick-ups	1	4,000-2,400	3,200-4,500	1,500	33%
Large SUVs, standard pick-ups	2a	6,001-8,500	4,500-6,000	2,500	40%
Large SUVs, standard pick-ups	2b	8,501-10,000	5,000-6,300	3,700	60%
Utility van, multi- purpose, mini-bus, step van	3	10,001-14,000	7,650-8,750	5,250	60%
City delivery, parcel delivery, large walk-in, bucket, landscaping	4	14,001-16,000	7,650-8,750	7,250	80%
City delivery, parcel delivery, large walk-in, bucket	5	16,001-19,500	9,500-10,000	8,700	80%
City delivery, school bus, large walk-in, bucket	6	19,501-26,000	11,500-14,500	11,500	80%
City bus, furniture, refrigerated, refuse, fuel tanker, dump, tow, concrete, fire engine, tractor-trailer	7	26,001-33,000	11,500-14,500	18,500	125%
Refuse, concrete, furniture, city bus, tow, fire engine (straight trucks)	8a	33,001-80,000	20,000-26,000	54,000	200%
Tractor-trailer: van, refrigerated, bulk tanker, flat bed (combination trucks)	8b	33,001-80,000	20,000-26,000	54,000	200%

Source:
National Academy of Sciences, *Technologies and Approaches to Reducing the Fuel Consumption of Medium and Heavy-Duty Vehicles*, 2010, pp. 18 and 116.

According to weigh-in-motion data collected by fifteen states, the majority of 5-axle tractor-trailers on the road weigh between 33,000 and 73,000 lb. Eleven percent of the tractor-trailers had weight recorded around 72,800 lb and 10% around 68,300 lb. Another 10% of tractor-trailers were on the lighter end of the scale – around 37,500 lb. These data show that only a small percent of trucks on the road are near the maximum roadway gross vehicle weight of 80,000 lb. Thus, most trucks are filling the trailer space to capacity (cubing-out) before they reach the maximum weight limit (weighing-out).

Figure 5.6. Distribution of Class 8 Trucks by On-Road Vehicle Weight, 2008[a]



Note: Data are from these 15 States: California, Connecticut, Florida, Georgia, Hawaii, Iowa, Minnesota, Missouri, Montana, North Carolina, Oregon, Pennsylvania, South Dakota, Texas, and Washington.

Source:
National Academy of Sciences, *Technologies and Approaches to Reducing the Fuel Consumption of Medium and Heavy-Duty Vehicles*, 2010, p. 118. Original source: Federal Highway Administration, Vehicle Travel Information System, 2008.

[a] Study reported data on 5-axle tractor-trailers which are class 8 trucks. Single-unit class 8 trucks were not considered in the study.

Commodity Flow Survey

The Commodity Flow Survey (CFS) designed to provide data on the flow of goods and materials by mode of transport. The survey was first conducted in various years from 1963 to 1977, and was again conducted in 1993, 1997, 2002, 2007, and 2012 with improvements in methodology, sample size, and scope. Data collection for the 2017 survey began in late 2016 and preliminary data are expected in December 2018. It is a shipper-based survey which covers business establishments from these industries:

- Mining
- Manufacturing
- Wholesale trade
- Select Retail and Services

Industries not covered by CFS include transportation, construction, most retail and services industries, farms, fisheries, foreign establishments, and most government-owned establishments. Before 1993 data were collected only on the principal mode of travel, but after that time all modes of a shipment were captured in the data.

The CFS is a joint effort of the Bureau of Transportation Statistics and the U.S. Census Bureau. Additional information on the survey can be found at:

www.bts.gov/content/commodity-flow-survey-overview
www.census.gov/programs-surveys/cfs.html

Industries covered by the 2012 Commodity Flow Survey (CFS) shipped goods worth over $13 trillion. Compared to the 1993 CFS, the value of shipments is up 1.7% per year and tons shipped are up 0.8% per year. By value, multiple mode shipments increased 2.8% per year from 1993 to 2012.

Table 5.15
Value of Goods Shipped in the United States: Comparison of the 1993, 1997, 2002, 2007 and 2012 Commodity Flow Surveys[a]

	1993 (billion 2012 dollars)	1997 (billion 2012 dollars)	2002 (billion 2012 dollars)	2007 (billion 2012 dollars)	2012 (billion dollars)	Average annual percent change (1993-2012)
All modes	**10,106.6**	**9,933.3**	**10,716.8**	**12,938.9**	**13,852.1**	**1.7%**
Single modes	**8,542.3**	**8,181.8**	**8,996.6**	**10,562.8**	**11,900.4**	**1.8%**
Truck[b]	7,612.4	7,126.0	7,957.3	9,230.4	10,132.2	1.5%
For-hire truck	4,538.0	4,150.4	4,794.9	5,487.5	6,504.6	1.9%
Private truck	3,035.4	2,913.2	3,120.8	3,742.8	3,627.6	0.9%
Rail	427.7	457.2	396.8	483.3	473.1	0.5%
Water	106.6	108.5	114.0	127.2	301.6	5.6%
Inland water	70.4	77.1	73.3	100.8	218.9	6.2%
Great Lakes	[c]	2.2	1.1	[c]	0.4	[c]
Deep sea	34.2	29.2	39.6	25.5	59.9	3.0%
Multiple waterways	[c]	[d]	[d]	[d]	22.3	[c]
Air (includes truck and air)	240.4	327.7	338.1	279.4	450.6	3.4%
Pipeline[e]	155.4	162.4	190.4	442.5	542.9	6.8%
Multiple modes	**1,145.4**	**1,353.1**	**1,377.3**	**2,067.1**	**1,950.8**	**2.8%**
Parcel, U.S.P.S. or courier	973.7	1,224.4	1,260.6	1,729.5	1,688.2	2.9%
Truck and rail	143.6	108.3	89.2	207.3	224.8	2.4%
Truck and water	16.2	11.8	18.3	64.7	29.0	3.1%
Rail and water	6.4	2.5	4.2	15.4	8.0	1.2%
Other multiple modes	5.6	6.1	4.9	50.2	0.7	-10.3%
Other and unknown modes	**418.8**	**398.5**	**342.8**	**309.1**	**1.0**	**-27.2%**

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *1993, 1997, 2002, 2007, and 2012 Commodity Flow Surveys*, Table 1a. (Additional resources: www.census.gov/programs-surveys/cfs.html)

[a] Detail may not add to total because of rounding.
[b] "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.
[c] Denotes data do not meet publication standards because of high sampling variability or poor response quality.
[d] Data are not available.
[e] CFS data for pipeline exclude most shipments of crude oil.

Industries covered by the 2012 Commodity Flow Survey (CFS) shipped over 11 billion tons of goods nationwide. Nearly three-quarters of the freight tonnage was shipped by truck.

Table 5.16
Tons of Freight in the United States: Comparison of the 1993, 1997, 2002, 2007 and 2012 Commodity Flow Surveys[a]

	1993 (millions)	1997 (millions)	2002 (millions)	2007 (millions)	2012 (millions)	Average annual percent change (1993-2012)
All modes	**9,688.50**	**11,089.7**	**11,667.9**	**12,543.4**	**11,299.4**	**0.8%**
Single modes	**8,922.30**	**10,436.5**	**11,086.7**	**11,698.1**	**10,905.5**	**1.1%**
Truck[b]	6,385.9	7,700.7	7,842.8	8,778.7	8,060.2	1.2%
For-hire truck	2,808.3	3,402.6	3,657.3	4,075.1	4,298.7	2.3%
Private truck	3,543.5	4,137.3	4,149.7	4,703.6	3,761.3	0.3%
Rail	1,544.10	1,549.8	1,873.9	1,861.3	1,628.5	0.3%
Water	505.4	563.4	681.2	403.6	576.0	0.7%
Inland water	362.5	414.8	458.6	343.3	424.5	0.8%
Great Lakes	33	38.4	38.0	17.8	31.4	-0.3%
Deep sea	109.9	110.2	184.6	42.5	73.0	-2.1%
Multiple waterways	[c]	[c]	[c]	[c]	47.1	[c]
Air (includes truck and air)	3.1	4.5	3.8	3.6	4.8	2.3%
Pipeline[d]	483.6	618.2	685.0	650.9	636.0	1.5%
Multiple modes	**225.7**	**216.7**	**216.7**	**573.7**	**357.0**	**2.4%**
Parcel, U.S.P.S. or courier	18.9	23.7	25.5	33.9	28.5	2.2%
Truck and rail	40.6	54.2	43.0	225.6	213.8	9.1%
Truck and water	68	33.2	23.3	145.5	56.7	-1.0%
Rail and water	79.2	79.3	105.1	54.9	55.6	-1.8%
Other multiple modes	18.9	26.2	19.8	113.8	2.5	-10.1%
Other and unknown modes	**540.5**	**436.5**	**364.6**	**271.6**	**36.8**	**-13.2%**

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *1993, 1997, 2002, 2007, and 2012 Commodity Flow Survey*, Table 1a. (Additional resources: www.census.gov/programs-surveys/cfs.html)

[a] Detail may not add to total because of rounding.
[b] "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.
[c] Data are not available.
[d] CFS data for pipeline exclude most shipments of crude oil.

Industries covered by the 2012 Commodity Flow Survey (CFS) accounted for 2.9 trillion ton-miles on the nation's highways, railways, waterways, pipelines, and aviation system. Ton-miles increased an average of 1.1% per year from 1993 to 2012.

Table 5.17
Ton-Miles of Freight in the United States: Comparison of the 1993, 1997, 2002, 2007 and 2012 Commodity Flow Surveys[a]

	1993 (billions)	1997 (billions)	2002 (billions)	2007 (billions)	2012 (billions)	Average annual percent change (1993-2012)
All modes	**2,420.90**	**2,661.4**	**3,137.9**	**3,344.7**	**2,969.5**	**1.1%**
Single modes	**2,136.90**	**2,383.5**	**2,867.9**	**2,894.3**	**2,697.4**	**1.2%**
Truck[b]	869.5	1,023.5	1,255.9	1,342.1	1,247.7	1.9%
For-hire truck	629	741.1	959.6	1,055.6	1,050.9	2.7%
Private truck	235.9	268.6	291.1	286.5	196.8	-0.9%
Rail	942.6	1,022.5	1,261.6	1,344.0	1,211.5	1.3%
Water	272	261.7	282.7	157.3	192.9	-1.8%
Inland water	164.4	189.3	211.5	117.5	118.7	-1.7%
Great Lakes	12.4	13.4	13.8	6.9	11.0	-0.6%
Deep sea	95.2	59.0	57.4	33.0	22.1	-7.4%
Multiple waterways	[c]	[c]	[c]	[c]	41.0	[c]
Air (includes truck and air)	4	6.2	5.8	4.5	5.8	2.0%
Pipeline[d]	[c]	[e]	[e]	[e]	[e]	[c]
Multiple modes	**191.5**	**204.5**	**225.7**	**416.6**	**271.8**	**1.9%**
Parcel, U.S.P.S. or courier	13.2	18.0	19.0	28.0	22.7	2.9%
Truck and rail	37.7	55.6	45.5	196.8	169.5	8.2%
Truck and water	40.6	34.8	32.4	98.4	48.6	1.0%
Rail and water	70.2	77.6	115.0	47.1	29.2	-4.5%
Other multiple modes	[c]	18.6	13.8	46.4	1.9	[c]
Other and unknown modes	**92.6**	**73.4**	**44.2**	**33.8**	**0.3**	**-26.0%**

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *1993, 1997, 2002, 2007 and 2012 Commodity Flow Surveys*, Table 1a. (Additional resources: www.census.gov/programs-surveys/cfs.html)

[a] Detail may not add to total because of rounding.
[b] "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.
[c] Data are not available.
[d] CFS data for pipeline exclude most shipments of crude oil.
[e] Denotes data do not meet publication standards because of high sampling variability or poor response quality.

Industries covered by the 2012 Commodity Flow Survey (CFS) had an average shipment length of 630 miles, a 49% increase from the 1993 survey. For single mode shipments, air had the highest shipment length in 2012; for multiple modes, truck and water had the highest length.

Table 5.18
Average Miles per Shipment in the United States: Comparison of the 1993, 1997, 2002, 2007 and 2012 Commodity Flow Surveys[a]

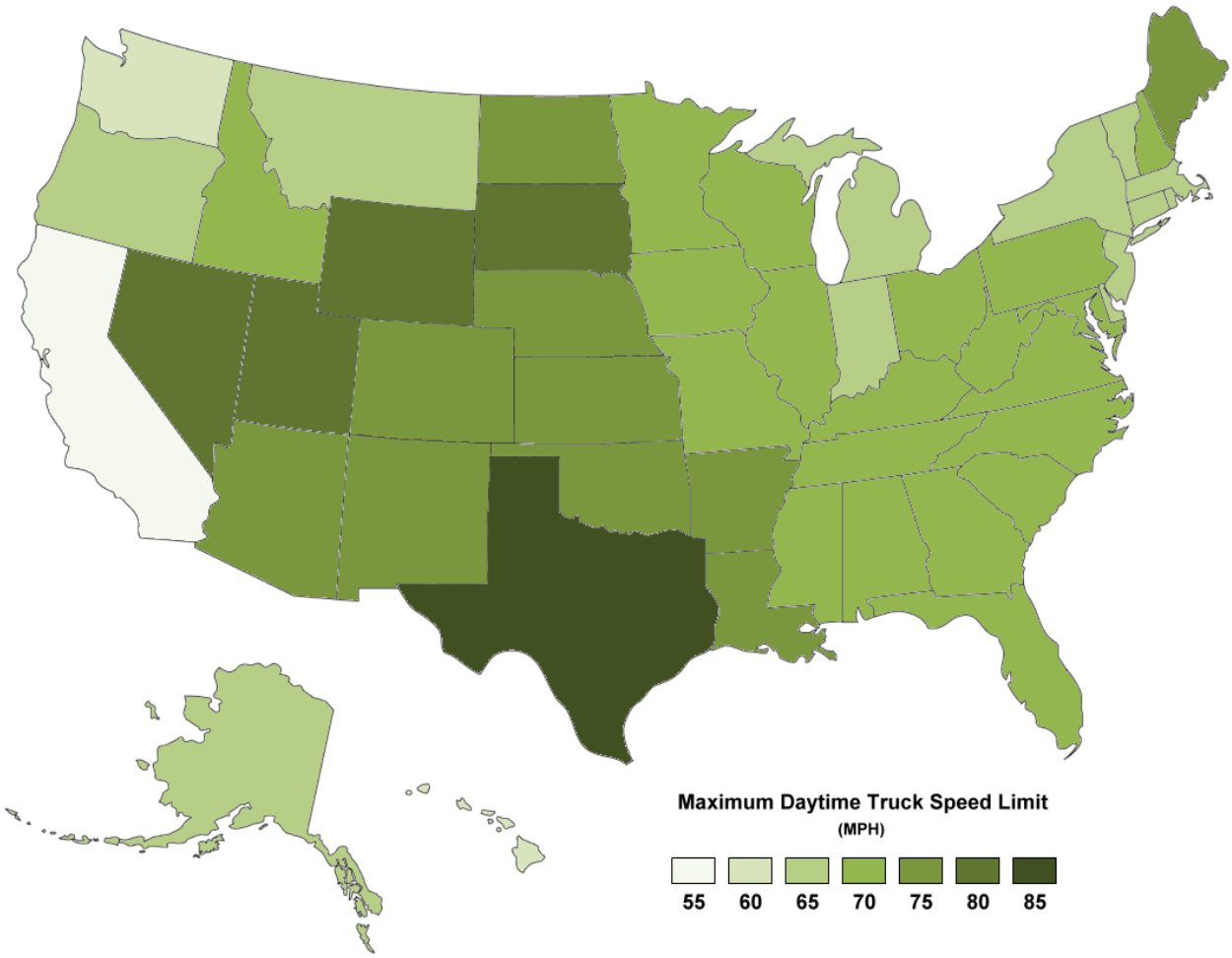
	1993 (miles)	1997 (miles)	2002 (miles)	2007 (miles)	2012 (miles)	Average annual percent change (1997-2012)
All modes	**424**	**472**	**546**	**619**	**630**	**2.1%**
Single modes	**197**	**184**	**240**	**234**	**262**	**1.5%**
Truck[b]	144	144	173	206	227	2.4%
For-hire truck	472	485	523	599	508	0.4%
Private truck	52	53	64	57	58	0.6%
Rail	766	769	807	728	805	0.3%
Water	[c]	482	568	520	908	[c]
Inland water	[c]	177	450	144	275	[c]
Great Lakes	534	204	339	657	347	-2.2%
Deep sea	1,861	1,024	664	923	1,157	-2.5%
Multiple waterways	[c]	[c]	[c]	[c]	1,034	[c]
Air (includes truck and air)	1,415	1,380	1,919	1,304	1,295	-0.5%
Pipeline[d]	[c]	[e]	[e]	[e]	[e]	[c]
Multiple modes	**736**	**813**	**895**	**975**	**922**	**1.2%**
Parcel, U.S.P.S. or courier	734	813	894	975	922	1.2%
Truck and rail	1,403	1,347	1,413	1,007	988	-1.8%
Truck and water	1,417	1,265	1,950	1,429	1,562	0.5%
Rail and water	627	1,092	957	1,928	1,073	2.9%
Other multiple modes	1,082	[e]	[e]	1,182	[e]	[c]
Other and unknown modes	**229**	**122**	**130**	**116**	**2**	**-22.1%**

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *1993, 1997, 2002, 2007 and 2012 Commodity Flow Surveys*, Table 1a. (Additional resources: www.census.gov/programs-surveys/cfs.html)

[a] Detail may not add to total because of rounding.
[b] "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.
[c] Data are not available.
[d] CFS data for pipeline exclude most shipments of crude oil.
[e] Denotes data do not meet publication standards because of high sampling variability or poor response quality.

Ranging from a speed limit of 55 miles per hour (mph) to 85 mph, the maximum speed limit for trucks varies from state to state and sometimes from year to year. Currently, California has the most conservative maximum speed limit for trucks – 55 mph. At the other end of the spectrum, Texas has some roads where the truck speed limit is 85 mph. Because of the varying limits, there is not one common highway speed at which trucks travel. This precludes truck manufacturers from engineering truck engines that peak in efficiency after reaching the speed at which the vehicles most commonly travel. Instead, manufacturers design the vehicle to perform well over the entire range of speeds.

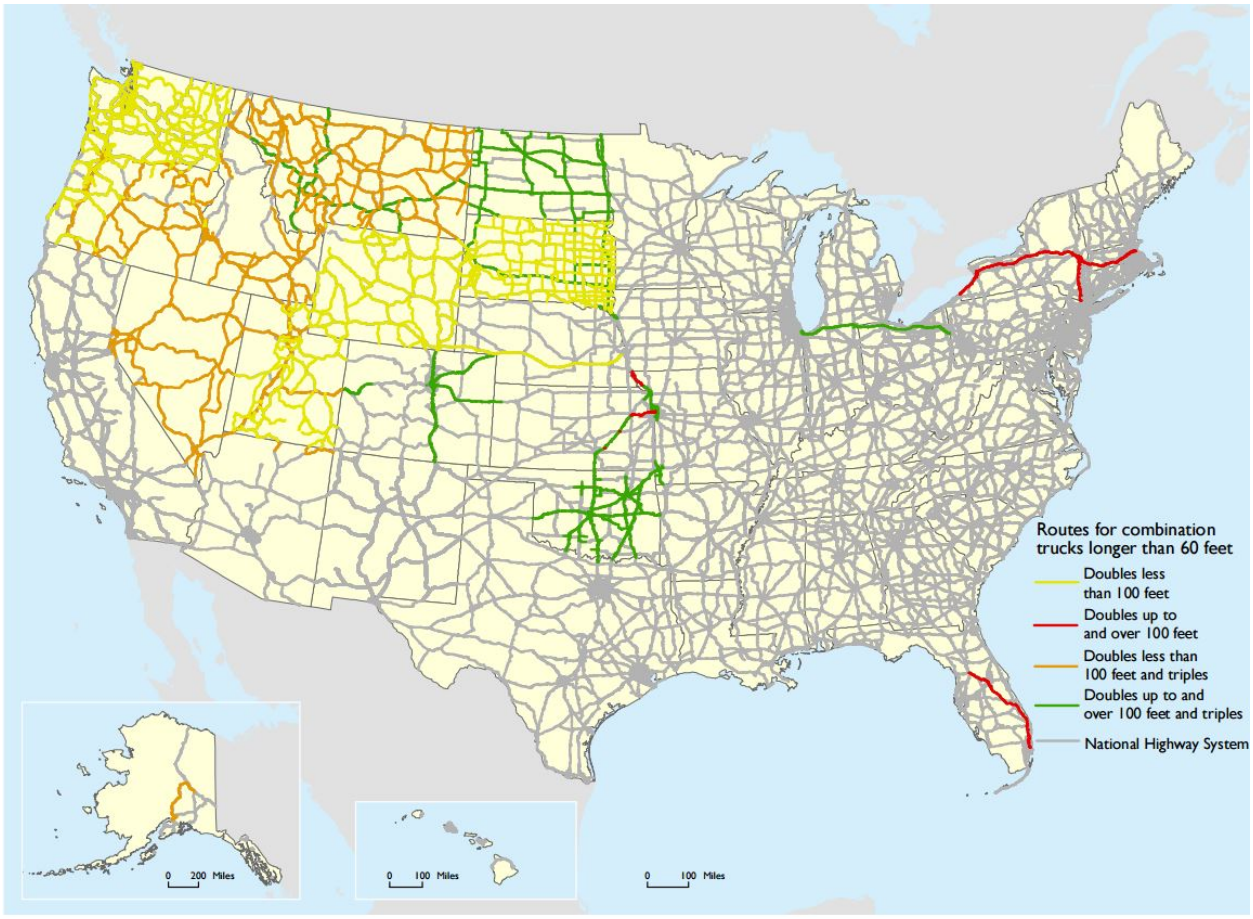
Figure 5.7. Maximum Daytime Truck Speed Limits by State, 2017



Source:
Insurance Institute for Highway Safety, Highway Loss Data Institute, "Speed Limits," September 2018. (Additional resources: www.iihs.org/iihs/topics/laws/speedlimits)

Although all states allow the conventional combinations consisting of a 28-foot semi-trailer and a 28-foot trailer, only 14 states and six state turnpike authorities allow longer combination vehicles (LCVs) on at least some parts of their road networks. LCVs are tractors pulling a semi-trailer and trailer, with at least one of them – the semi-trailer, the trailer, or both – longer than 28 feet. The routes that these LCVs can travel have not changed since 1991.

Figure 5.8. Routes Where Longer Combination Vehicles Are Permitted, 2017



Note: Empty triples are allowed on I-80 in Nebraska.

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics, *Freight Facts and Figures 2017,* 2018. (Additional resources: www.bts.gov/product/freight-facts-and-figures).

The U.S. Department of Transportation mandates that truckers rest for 10 hours after driving for 11 hours, during which time they often park at truck stops idling the engines to provide heating, cooling and use of electrical appliances. Electrification at truck stops allows truckers to "plug-in" vehicles to operate the necessary systems without idling the engine. There are currently 103 publicly accessible electrification sites across the nation. Some of these sites require special equipment to be installed on the truck and others do not.

Table 5.19
Truck Stop Electrification Sites by State, 2018

State	Number of Truck Stop Electrification Sites
Alabama	1
Alaska	0
Arizona	1
Arkansas	3
California	6
Colorado	2
Connecticut	10
Delaware	2
Dist. of Columbia	0
Florida	0
Georgia	4
Hawaii	0
Idaho	0
Illinois	1
Indiana	0
Iowa	1
Kansas	1
Kentucky	1
Louisiana	2
Maine	1
Maryland	1
Massachusetts	0
Michigan	2
Minnesota	1
Mississippi	1
Missouri	1
Montana	1
Nebraska	0
Nevada	0
New Hampshire	0
New Jersey	2
New Mexico	2
New York	4
North Carolina	3
North Dakota	0
Ohio	4
Oklahoma	0
Oregon	5
Pennsylvania	6
Rhode Island	0
South Carolina	2
South Dakota	0
Tennessee	7
Texas	12
Utah	4
Vermont	0
Virginia	3
Washington	4
West Virginia	0
Wisconsin	0
Wyoming	2
Total	103

Source:
Alternative Fuels and Advanced Vehicles Data Center, U.S. Truck Stop Electrification Locations (Data through 9/17/2018). (Additional resources: www.afdc.energy.gov/truckstop)