

As of January 1998, only five states offered tax exemptions to encourage the use of gasohol for transportation purposes. This list is quite short compared to the 30 states which offered gasohol tax exemptions fifteen years ago. Still, the Federal Government encourages gasohol use via a difference in the Federal tax rates of gasoline and gasohol.

Table 4.8
State Tax Exemptions for Gasohol, January 1998

State	Exemption (Cents/gallon of gasohol)
Alaska	8.0
Connecticut	1.0
Idaho	2.5
Iowa	1.0
South Dakota	2.0

Source:

U.S. Department of Transportation, Federal Highway Administration, "Monthly Motor Fuel Reported by the States, November 1997," February 1998, Washington, DC, Table MF-121T. (Additional resources: <http://www.fhwa.dat.gov>)

Table 4.9
Federal Excise Taxes on Motor Fuels

Fuel		Cents per gallon
Gasoline		18.40
Diesel ^a		24.40
Gasohol	10% Ethanol	13.00
	7.7% Ethanol	14.24
	5.7% Ethanol	15.32
Gasohol	10% Methanol	12.40
	7.7% Methanol	13.78
	5.7% Methanol	14.98
Methanol	Qualified ^b	12.85
	Partially exempt ^c	9.20
Ethanol	Qualified ^b	12.85
	Partially exempt ^c	9.25
CNG		48.54/mcf ^d
LNG		11.90
LPG		13.60

Source:

J. E. Sinor Consultants, Inc., Niwot, CO, March 1998.
(Additional resources: <http://phidias.colorado.edu/sinor>)

^a Reduced diesel rates are specified for marine fleets, trains and certain intercity buses. Diesel rates are also reduced for diesel/alcohol blends. Diesel used exclusively in state and local government fleets, non-profit organization vehicles, school buses and qualified local buses is exempt from Federal taxes.

^bQualified - contains at least 85 percent methanol or ethanol or other alcohol produced from a substance other than petroleum or natural gas.

^cPartially exempt - > 85 percent alcohol and produced from natural gas.

^dThousand cubic feet.



Table 4.10
States With Ethanol Tax Incentives

State	Ethanol tax incentives
AK	\$0.08/ethanol gallon (blender)
CA	E85 and M85 excise tax is half of the gasoline tax. Neat alcohol fuels are exempt from fuel taxes.
FL	County governments receive waste reduction credits for using yard trash, wood, or paper waste as feed stocks for fuel.
HI	4% ethanol sales tax exemption
ID	\$0.21 excise tax exemption for ethanol or biodiesel
IN	10% gross income tax deduction for improvements to ethanol producing facilities.
IL	2% sales tax exemption for 10% volume ethanol blends
IA	\$0.01 (blender)
MN	\$0.25 (producer), \$0.005 (blender) until Oct. 1, 1997
MO	\$0.20 (producer)
MT	\$0.30 (producer)
NE	\$0.20 (producer), \$0.50 ETBE (producer)
NC	Individual income and corporate tax credit of 20% for the construction of an ethanol plant using agricultural or forestry products; an additional 10% if the distillery is powered with alternative fuels.
ND	\$0.40 (producer)
OH	\$0.01 (blender), income tax credit
SD	\$0.20 (blender), \$0.20 (producer) Alternative fuels are taxed at \$0.06/gal
WY	\$0.40 (producer)

Source:

U.S. Department of Energy, *Clean Cities Guide to Alternative Fuel Vehicle Incentives and Laws*, 2nd edition, Washington, DC, November 1996.

(Additional resources: <http://www.cities.doe.gov>)



Table 4.11
Average Price of a New Car, 1970-97

Year	Domestic ^a		Import		Total		Estimated Average New Car Price for a 1967 "Comparable Car"	
	Current dollars	Constant 1990 dollars ^b	Current dollars	Constant 1990 dollars ^b	Current dollars	Constant 1990 dollars ^b	With added safety & emissions equipment ^c	Without added safety & emissions equipment ^d
1970	3,708	12,479	2,648	8,912	3,542	11,920	3,601	3,459
1971	3,919	12,645	2,769	8,935	3,742	12,074	3,777	3,601
1972	4,034	12,601	2,994	9,352	3,879	12,117	3,789	3,570
1973	4,181	12,295	3,344	9,834	4,052	11,915	3,903	3,572
1974	4,524	11,988	4,206	11,146	4,440	11,766	4,237	3,779
1975	5,084	12,344	4,384	10,645	4,950	12,019	4,686	4,103
1976	5,506	12,640	4,923	11,301	5,418	12,438	4,988	4,362
1977	5,985	12,906	5,072	10,938	5,814	12,538	5,272	4,593
1978	6,478	12,976	5,934	11,886	6,379	12,778	5,687	4,944
1979	6,889	12,403	6,704	12,070	6,847	12,327	6,176	5,337
1980	7,609	12,067	7,482	11,886	7,574	12,012	6,863	5,764
1981	8,912	12,805	8,896	12,782	8,910	12,802	7,700	6,115
1982	9,865	13,356	9,957	13,480	9,890	13,390	8,078	6,350
1983	10,516	13,797	10,868	14,259	10,606	13,915	8,387	6,544
1984	11,172	14,054	12,354	15,541	11,450	14,404	8,685	6,742
1985	11,589	14,081	12,853	15,616	11,902	14,461	8,984	6,958
1986	12,526	14,931	13,815	16,467	12,894	15,370	9,395	7,259
1987	12,922	14,860	14,470	16,641	13,386	15,394	9,743	7,518
1988	13,542	14,964	15,378	16,993	14,065	15,542	9,995	7,668
1989	14,193	14,959	15,829	16,684	14,645	15,436	10,248	7,825
1990	14,886	14,886	17,164	17,164	15,472	15,472	10,581	7,938
1991	15,773	15,126	17,019	16,321	16,083	15,424	11,152	8,224
1992	16,389	15,258	19,601	18,249	18,141	16,889	11,458	8,424
1993	16,673	15,089	21,477	19,437	17,678	15,999	11,806	8,631
1994	17,575	15,501	23,211	20,472	18,657	16,455	12,427	8,925
1995	17,174	14,718	23,995	20,564	18,360	15,735	12,857	9,115
1996	18,199	15,160	27,695	23,070	19,620	16,343	13,196	9,281
1997	18,624	15,160	29,708	24,182	20,444	16,644	13,324	9,297
1970-97	6.2%	0.7%	9.4%	3.8%	6.7%	1.2%	5.0%	3.7%
1987-97	3.7%	0.2%	7.5%	3.8%	4.3%	0.8%	3.2%	2.1%

Average annual percentage change

Source:

American Automobile Manufacturers Association, *Motor Vehicle Facts and Figures 1997*, Detroit, MI, 1997, p.60.
1997 Data: American Automobile Manufacturers Association, *Economic Indicators*, Fourth Quarter 1997, Detroit, MI, February 1998, p.24.
(Additional resources: <http://www.aama.com>)

^aIncludes transplants.

^bAdjusted by the Consumer Price Inflation Index.

^c1967 "Average Transaction Price" plus the value of added safety and emissions equipment as determined by the U.S. Bureau of Labor Statistics (BLS), all inflated to current dollars, using the U.S. BLS, "New Car Consumer Price Index - All Urban Consumers." For example, 1969 is equal to the 1968 value plus the BLS stated value of added safety and emissions equipment for the 1969 model year multiplied by 1968-1969 monthly changes in the New Car Consumer Price Index.

^d1967 "Average Transaction Price" inflated to current dollars.

The total cost of operating an automobile is the sum of the fixed cost (depreciation, insurance, finance charge, and license fee) and the variable cost, which is related to the amount of travel. The cost of operating a car in 1997 (constant 1990 cents) was approximately 43 cents per mile. Gas and oil accounted for more than 12% of total cost per mile in 1997, which was up almost 1% from 1996.

Table 4.12
Automobile Operating Cost per Mile, 1975-97

Model year ^c	Variable costs (constant 1990 cents per mile ^a)					Constant 1990 dollars per 10,000 miles ^a			Total cost per mile ^b (constant 1990 cents ^a)
	Gas and oil	Percentage gas and oil of total cost	Maintenance	Tires	Variable cost	Fixed cost	Total cost		
1975	11.70	26.3%	2.36	1.60	1,566	2,880	4,446	44.46	
1977	8.86	20.3%	2.22	1.42	1,251	3,103	4,354	43.54	
1979	7.40	17.1%	1.98	1.17	1,055	3,260	4,315	43.15	
1980	9.29	21.0%	1.78	1.01	1,208	3,224	4,433	44.33	
1981	9.01	19.6%	1.70	1.03	1,174	3,413	4,586	45.86	
1982	9.12	21.5%	1.35	0.97	1,133	3,145	4,243	42.43	
1983	8.71	19.9%	1.36	0.89	1,097	3,287	4,384	43.84	
1984	7.79	19.8%	1.31	0.79	989	2,952	3,940	39.40	
1985	7.48	22.6%	1.49	0.79	977	2,328 ^d	3,304 ^d	33.04 ^d	
1986	5.34	15.1%	1.63	0.80	777	2,750 ^d	3,577 ^d	35.27 ^d	
1987	5.52	14.7%	1.84	0.92	828	2,925 ^d	3,753 ^d	37.53 ^d	
1988	5.74	15.6%	1.77	0.88	840	2,851 ^d	3,691 ^d	36.91 ^d	
1989	5.48	13.6%	2.00	0.84	833	3,194 ^d	4,027 ^d	40.27 ^d	
1990	5.40	13.2%	2.10	0.90	840	3,256 ^d	4,096 ^d	40.96 ^d	
1991	6.43	15.4%	2.11	0.86	940	3,245 ^d	4,185 ^d	41.85 ^d	
1992	5.59	13.1%	2.05	0.84	847	3,414 ^d	4,261 ^d	42.61 ^d	
1993	5.43	13.3%	2.17	0.81	842	3,244 ^d	4,085 ^d	40.85 ^d	
1994	4.94	12.0%	2.21	0.97	811	3,303 ^d	4,115 ^d	41.15 ^d	
1995	5.14	12.3%	2.23	1.20	857	3,335 ^d	4,192 ^d	41.92 ^d	
1996	4.91	11.5%	2.33	1.17	841	3,443 ^d	4,284 ^d	42.84 ^d	
1997	5.37	12.4%	2.28	1.14	879	3,442 ^d	4,321 ^d	43.21 ^d	
1975-84	-4.4%		-6.3%	-7.5%	-5.0%	0.3%	-1.3%	-1.3%	
1987-97	-0.3%		2.2%	2.2%	0.6%	1.6%	1.4%	1.4%	

Source:

American Automobile Association, *Your Driving Costs*, 1997 Edition, Heathrow, FL, and annual. (Additional resources: <http://www.aaa.com>, <http://www.runzheimer.com>)

^a Adjusted by the Consumer Price Inflation Index.

^b Based on 10,000 miles per year.

^c Data for 1976 and 1978 are not available.

^d Fixed and total operating costs preceding 1985 are not comparable with 1985 and later data. Fixed cost depreciation from 1975-84 was based on four years or 60,000 miles. After 1984, the depreciation was based on six years or 60,000 miles.



Table 4.13
Fixed Automobile Operating Costs per Year, 1975-97
(constant 1990 dollars)^a

Model Year	Fire & Theft ^b	Collision ^c	Property Damage & Liability ^d	License, Registration & Taxes	Depreciation	Finance Charge	Total	Average Fixed Cost Per Day
1975	129	342	459	73	1,877	e	2,880	7.89
1977	172	405	539	160	1,826	e	3,102	8.49
1978	114	276	459	148	1,791	e	2,788	7.63
1979	133	302	434	162	1,696	533	3,260	8.93
1980	111	273	393	130	1,646	671	3,224	8.83
1981	109	259	365	126	1,849	704	3,413	9.35
1982	72	207	329	73	1,836	730	3,247	8.90
1983	105	264	291	134	1,762	732	3,288	9.01
1984	101	252	283	133	1,518	664	2,951	8.09
1985	112	241	259	140	1,522	693	2,966	8.13
1986	103	228	277	155	1,573	759	3,094	8.48
1987	100	225	290	161	1,732	691	3,199	8.76
1988	95	224	314	154	1,971	624	3,382	9.27
1989	115	258	326	159	2,207	660	3,725	10.20
1990	110	247	318	165	2,357	680	3,877	10.62
1991	110	247	339	162	2,439	747	4,044	11.08
1992	105	243	347	167	2,588	775	4,225	11.57
1993	97	210	348	166	2,609	630	4,060	11.12
1994	80	182	353	180	2,635	613	4,043	11.08
1995	81	181	351	181	2,656	625	4,075	11.17
1996	91	206	355	191	2,672	648	4,163	11.40
1997	86	246	326	179	2,660	646	4,143	11.36

Source:

American Automobile Association, "Your Driving Costs," 1997 Edition, Heathrow, FL, and annual. (Additional resources: <http://www.aaa.com>, <http://www.runzheimer.com>)

^a Adjusted by the Consumer Price Inflation Index.

^b \$50 deductible 1975 through 1977; \$100 deductible 1978 through 1992; \$250 deductible for 1993 through 1996.

^c \$100 deductible through 1977; \$250 deductible 1978 through 1992; \$500 deductible for 1993 through 1996.

^d Coverage: \$100,000/\$300,000.

^e Data are not available.



Table 4.14
Economic Indicators, 1970-97
(billion dollars)

Year	Gross National Product		Total transportation outlays		Transportation as a percent of GNP
	Current	Constant 1990 ^a	Current	Constant 1990 ^a	
1970	1,015.5	3,031.3	195.2	582.7	19.2%
1980	2,732.0	4,167.4	542.9	827.9	19.8%
1990	5,567.8	5,567.8	964.6	964.6	17.3%
1996	7,637.7	6,430.9	1,245.6	1,048.8	16.3%

Year	Personal Consumption Expenditures		Transportation Personal Consumption Expenditures ^b		Transportation PCE as a percent of total PCE
	Current	Constant 1990 ^a	Current	Constant 1990 ^a	
1970	640.0	1,910.4	81.5	243.3	0.127
1980	1,732.6	2,642.9	238.5	363.8	13.8%
1990	3,761.2	3,761.2	453.9	453.7	12.1%
1997	5,488.1	4,621.0	624.3	525.7	11.4%

Sources:

GNP - U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, April 1998, Table 1.9, p. D-4, and annual. (Additional resources: <http://www.bea.doc.gov>)

Transportation outlays - Eno Transportation Foundation, *Transportation in America 1997*, Fifteenth Edition, Lansdowne, VA, 1998, p. 38.

PCE - U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, March 1998, Table 2.2, p. D-6, and annual. (Additional resources: <http://www.bea.doc.gov/bea/scbinf.html>)

Table 4.15
Consumer Price Indices, 1970-97
(1970 = 1.000)

Year	Consumer Price Index	Transportation Consumer Price Index ^c	New car Consumer Price Index	Used car Consumer Price Index	Gross National Product
1970	1.000	1.000	1.000	1.000	1.000
1980	2.122	2.216	1.667	1.995	2.690
1990	3.365	3.213	2.283	3.769	5.483
1997	4.134	3.848	2.674	4.843	7.937

Source:

Bureau of Labor Statistics, Consumer Price Index Table 1A for 1997, and annual. [GNP—see above.] (Additional resources: <http://stats.bls.gov/cpihome.htm>)

^a Adjusted by the implicit GNP price deflator.

^b Transportation Personal Consumption Expenditures include user operating expenses (new and used auto purchases, gas and oil, repair, greasing, washing, parking, storage, rental, other motor vehicles, insurance premiums, tires, tubes and other parts); purchased intercity transportation; and purchased local transportation.

^c Transportation Consumer Price Index includes new and used cars, gasoline, auto insurance rates, intracity mass transit, intracity bus fare, and airline fares.



Table 4.16
Motor Vehicle Manufacturing Employment Statistics, 1972-96

Year	Motor vehicle manufacturing employees (thousands)	Sales of domestic automobiles ^a (thousands)	Sales of domestic light trucks ^b (thousands)	Employees per hundred vehicles sold	Expenditure per new domestic vehicle	Total domestic vehicle expenditures ^c (millions)	Employees per million dollar expenditure (current)	Employees per million dollar expenditure (constant 1990 ^d)
1972	415	9,327	2,096	3.6	\$4,034	\$46,080	9.0	3.3
1973	462	9,676	2,512	3.8	\$4,181	\$50,958	9.1	3.5
1974	416	7,454	2,163	4.3	\$4,524	\$43,507	9.6	4.0
1975	375	7,053	2,053	4.1	\$5,084	\$46,295	8.1	3.7
1976	416	8,611	2,720	3.7	\$5,506	\$62,388	6.7	3.2
1977	442	9,109	3,108	3.6	\$5,985	\$73,119	6.0	3.1
1978	470	9,312	3,473	3.7	\$6,478	\$82,821	5.7	3.1
1979	463	8,341	2,844	4.1	\$6,889	\$77,053	6.0	3.6
1980	368	6,581	1,959	4.3	\$7,609	\$64,981	5.7	3.7
1981	359	6,209	1,745	4.5	\$8,912	\$70,886	5.1	3.6
1982	318	5,759	2,062	4.1	\$9,865	\$77,154	4.1	3.1
1983	349	6,795	2,518	3.7	\$10,516	\$97,936	3.6	2.7
1984	392	7,952	3,257	3.5	\$11,172	\$125,227	3.1	2.5
1985	409	8,205	3,691	3.4	\$11,589	\$137,863	3.0	2.4
1986	400	8,215	3,671	3.4	\$12,526	\$148,884	2.7	2.3
1987	381	7,081	3,785	3.5	\$12,922	\$140,410	2.7	2.4
1988	357	7,526	4,195	3	\$13,542	\$158,725	2.2	2.0
1989	350	7,073	4,108	3.1	\$14,193	\$158,692	2.2	2.1
1990	329	6,897	3,948	3	\$14,886	\$161,439	2.0	2.0
1991	316	6,137	3,595	3.2	\$15,773	\$153,503	2.1	2.1
1992	314	6,277	4,233	3	\$16,389	\$172,248	1.8	2.0
1993	319	6,742	4,987	2.7	\$16,673	\$195,558	1.6	1.8
1994	340	7,255	5,638	2.6	\$17,575	\$226,594	1.5	1.7
1995	355	7,129	5,663	2.8	\$17,174	\$219,690	1.6	1.9
1996	352	7,254	6,088	2.6	\$16,998	\$226,787	1.6	1.8
1972-96	-0.7%	-1.0%	4.5%	-1.3%	6.2%	6.9%	-6.9%	-2.5%
1986-96	-1.3%	-1.2%	5.2%	-2.6%	3.1%	4.3%	-5.1%	-2.4%

Source:

Employees - American Automobile Manufacturers Association, *Economic Indicators*, Fourth Quarter, 1997, Detroit, MI, 1998, p. 18.

Sales and expenditures - American Automobile Manufacturers Association, *Motor Vehicle Facts and Figures 1997*, Detroit, MI, 1997, pp. 19, 20, 60, and annual.

^a Vehicles produced in North America.

^b Less than 10,000 pounds gross vehicle weight.

^c Estimated as vehicle sales multiplied by average expenditure.

^d Adjusted by the implicit Gross National Product price deflator.

Table 4.17
Employees of Motor Vehicle and Related Industries, 1990 and 1994

Industry	1990			1994			Percent change 1990-94
	Employees	Percent of total motor vehicle	Percent of total U.S. employment ^a	Employees	Percent of total motor vehicle	Percent of total U.S. employment ^a	
Motor vehicle and equipment manufacturing	1,055,595	15.0%	1.1%	1,118,948	15.5%	1.2%	6.0%
<i>Motor vehicles and equipment</i>	707,160	10.0%	0.8%	760,209	10.6%	0.8%	7.5%
<i>Travel trailers and campers</i>	14,301	0.2%	0.0%	^b	^b	^b	^b
<i>Transportation equipment not elsewhere classified</i>	17,263	0.2%	0.0%	51,370	0.7%	0.1%	197.6%
<i>Automotive stampings</i>	111,548	1.6%	0.1%	112,162	1.6%	0.1%	0.6%
<i>Carburetors, pistons, piston rings, and valves</i>	19,674	0.3%	0.0%	17,667	0.2%	0.0%	-10.2%
<i>Vehicular lighting equipment</i>	15,586	0.2%	0.0%	15,494	0.2%	0.0%	-0.6%
<i>Storage batteries</i>	23,518	0.3%	0.0%	22,338	0.3%	0.0%	-5.0%
<i>Electrical equipment for internal combustion engines</i>	61,675	0.9%	0.1%	56,302	0.8%	0.1%	-8.7%
<i>Tires and inner tubes</i>	68,505	1.0%	0.1%	66,678	0.9%	0.1%	-2.7%
<i>Cold-rolled steel sheet, strip, and bars</i>	16,365	0.2%	0.0%	16,728	0.2%	0.0%	2.2%
Road construction and maintenance	261,461	3.7%	0.3%	^b	^b	^b	^b
Motor freight transportation and related services	1,662,836	23.6%	1.8%	1,780,880	24.7%	1.8%	7.1%
<i>Trucking and courier services, except by air or by the U.S. Postal Service</i>	1,458,847	20.7%	1.6%	15,286,991	22.0%	1.6%	8.8%
Petroleum refining and wholesale distribution	264,820	3.8%	0.3%	258,658	3.6%	0.3%	-2.3%
Passenger transportation	672,271	9.5%	0.7%	763,973	10.6%	0.8%	13.6%
Automotive sales and servicing	3,135,783	44.5%	3.4%	3,281,525	45.6%	3.4%	4.6%
Total of motor vehicle and related industries	7,052,766	100.0%	7.5%	7,203,984	100.0%	7.4%	2.1%
U.S. Total ^a	93,476,087		100.0%	96,733,300		100.0%	3.5%

Source:

American Automobile Manufacturers Association, *Motor Vehicle Facts and Figures 1997*, Detroit, MI, 1997, p. 71, and annual. (Additional resources: <http://www.aama.com>)

^aData for employees of establishments totally exempt from FICA are excluded, as are self-employed persons, domestic service workers, railroad employees, agricultural production workers and most government employees.

^bData are not available.



Table 4.18
Employment in Transportation and Related Industries, 1960-96
 (persons in thousands)

	1960	1965	1970	1975	1980	1985	1990	1995	1996
Transportation Service									
Air transport	191	229	351	362	453	537	789	766	818
Bus, intercity	41	42	43	39	38	36	20	24	24
Local transport	101	83	77	69	79	90	136	222	257
Railroads	885	735	627	538	532	346	285	239	281
Oil pipeline	23	20	18	17	21	19	20	16	16
Taxi	121	110	107	83	53	38	33	34	36
Trucking & truck materials	770	882	998	996	1,189	1,285	1,534	1,878	2,293
Water	232	230	215	190	213	214	173	160	182
Total	2,364	2,331	2,436	2,294	2,578	2,565	2,990	3,339	3,907
Transportation Equipment Manufacturing									
Aircraft & parts	646	624	669	514	652	647	709	442	404
Motor vehicles, equipment, tires	829	945	914	892	904	964	886	1,071	1,305
Railroad equipment	43	56	51	52	71	34	34	38	37
Ship & boat building & repair	141	160	170	194	221	193	189	162	182
Other transportation equipment	33	57	111	115	149	130	46	51	76
Total	1,692	1,842	1,915	1,767	1,997	1,968	1,864	1,764	2,004
Transportation Related Industries									
Automotive/accessory retail dealers	807	902	996	1,076	1,048	1,185	1,292	1,388	1,330
Automotive wholesalers	215	255	320	367	418	433	451	484	498
Automotive service & garages	251	324	384	400	571	730	926	981	1,256
Gasoline service stations	461	522	614	616	561	611	641	643	646
Highway & street construction	294	324	331	297	268	264	245	228	240
Petroleum ^a	311	292	333	390	533	568	521	490	487
Other industries									
Truck drivers & deliverymen	1,477	1,521	1,565	1,796	1,931	2,050	2,148	2,861	2,542
Freight handlers	365	411	456	613	622	574	504	536	551
Total	4,181	4,551	4,999	5,545	5,952	6,415	6,728	7,611	7,550
Government Transportation Employees									
U.S. Department of Transportation	38	45	66	75	72	61	65	65	63
Highways, state & local	499	550	568	569	532	549	569	582	543
U.S. Postal Service ^b	83	83	103	98	92	104	115	118	119
Other ^c	18	16	12	13	13	11	11	11	11
Total	638	694	749	755	709	725	760	776	736
Total transportation employment	8,875	9,418	10,099	10,361	11,236	11,673	12,342	13,490	14,197
Total employed civilians	65,778	71,088	78,627	85,783	99,303	107,150	117,914	125,136	126,708
Transportation percent of total	13.5%	13.2%	12.8%	12.1%	11.3%	10.9%	10.5%	10.8%	11.2%

Source:

Eno Transportation Foundation, *Transportation in America 1997*, Lansdowne, VA, 1997, p. 61.

^a Estimated by assuming transport share of total petroleum industry employment is same as transport share of petroleum domestic demand.

^b Estimated share (approximately 14%) of total employees engaged in transportation work.

^c Agencies include Civil Aeronautics Board (sunset in 1985), Federal Maritime Commission, Federal Energy Regulatory Commission, Interstate Commerce Commission, Railroad Retirement Board, and Panama Canal Commission.



Chapter 5

Highway Vehicles and Characteristics

Summary Statistics

Table		
5.1	U.S. share of world automobile registrations, 1996	26.7%
5.2	U.S. share of world truck & bus registrations, 1996	41.3%
5.3	Number of automobiles, 1996 (Polk - in thousands)	124,613
5.3	Number of trucks, 1996 (Polk - in thousands)	73,681
5.5	Vehicle miles traveled, 1996	(million miles)
	<i>Automobiles</i>	1,467,703
	<i>Motorcycles</i>	9,906
	<i>Two-axle, four-tire trucks</i>	815,302
	<i>Other single-unit trucks</i>	63,967
	<i>Combination trucks</i>	118,789
	<i>Buses</i>	6,535
5.8	Average age of vehicles, 1996	(years)
	<i>Automobiles</i>	8.6
	<i>Trucks</i>	8.3
	Average lifetime of vehicles	(years)
5.9	<i>Automobiles, 1990 model year</i>	13.7
5.10	<i>Trucks, 1979-89 model years</i>	16.0



Table 5.1
Automobile Registrations for Selected Countries, 1950-96
 (thousands)

Year	China	India	Japan	France	United Kingdom	Germany ^a	Canada ^b	United States ^c	U.S. percentage of world ^c	World total ^d
1950	e	e	43	e	2,307	e	1,913	40,339	76.0%	53,051
1955	e	e	153	e	360	e	2,961	52,145	71.4%	73,036
1960	e	e	457	4,950	5,650	4,856	4,104	61,671	62.7%	98,305
1965	e	e	2,181	8,320	9,131	9,719	5,279	75,258	53.8%	139,776
1970	e	e	8,779	11,860	11,802	14,376	6,602	89,244	46.1%	193,479
1975	e	e	17,236	15,180	14,061	18,161	8,870	106,706	41.0%	260,201
1980	351	e	23,660	18,440	15,438	23,236	10,256	121,601	38.0%	320,390
1985	795	1,607	27,845	20,800	18,953	26,099	11,118	127,885	34.5%	370,504
1986	966	1,780	28,654	21,090	19,415	27,224	11,586	130,004	34.1%	380,923
1987	1,112	2,007	29,478	21,500	20,108	28,304	11,686	131,482	33.9%	388,188
1988	1,304	2,295	30,776	21,970	20,977	29,190	12,086	133,836	33.0%	405,491
1989	1,464	2,486	32,621	22,520	21,919	30,152	12,380	134,559	32.4%	415,844
1990	1,622	2,694	34,924	23,010	22,528	30,695	12,622	133,700	30.7%	435,050
1991	1,852	2,954	37,076	23,550	22,744	31,309	12,578	128,300	29.1%	441,377
1992	2,262	3,205	38,963	24,020	23,008	37,579	12,781	126,581	28.0%	452,311
1993	2,860	3,361	40,772	24,385	23,402	39,202	12,927	127,327	28.3%	450,473
1994	3,497	3,569	42,678	24,900	23,832	39,918	13,122	127,883	27.0%	473,487
1995	4,179	3,837	44,680	25,100	24,307	40,499	13,183	128,387	26.9%	477,010
1996	4,700	4,246	46,868	25,500	24,864	41,045	13,300	129,728	26.7%	485,954
1950-96	e	e	16.4%	e	5.3%	e	e	e	e	4.9%
1970-96	e	e	6.7%	3.0%	2.9%	e	e	e	e	3.6%
1986-96	17.1%	9.1%	5.0%	1.9%	2.5%	e	e	0.0%	e	2.5%

Average annual percentage change

Source: Motor Vehicle Manufacturers Association, *World Motor Vehicle Data*, 1998 Edition, Detroit, MI, 1998, pp. 8, 23, 28, 42, 85, 98, 169, 206, 230 and annual. (Additional resources: <http://www.aama.com>)

^a Data for 1991 and prior include West Germany only. Kraftwagen are included with automobiles.

^b Data from 1991 and later are not comparable to prior data.

^c Data from 1985 and later are not comparable to prior data.

^d World totals were recalculated from 1985-94 based on change in U.S. data.

^e Data are not available.

Table 5.2
Truck and Bus Registrations for Selected Countries, 1950-96
 (thousands)

Year	China	India	Japan	France	United Kingdom	Germany ^a	Canada ^b	United States ^c	U.S. percentage of world ^e	World total ^d
1950	•	•	183	•	1,060	•	643	8,823	50.9%	17,349
1955	•	•	318	•	1,244	•	952	10,544	46.1%	22,860
1960	•	•	896	1,540	1,534	786	1,056	12,186	42.6%	28,583
1965	•	•	4,119	1,770	1,748	1,021	1,232	15,100	39.6%	38,118
1970	•	•	8,803	1,850	1,769	1,228	1,481	19,175	36.2%	52,899
1975	811	•	10,854	2,210	1,934	1,337	2,158	26,243	38.8%	67,698
1980	1,480	•	14,197	2,550	1,920	1,617	2,955	34,195	37.7%	90,592
1985	2,402	1,045	18,313	3,310	3,278	1,723	3,149	43,804	37.4%	117,038
1986	2,884	1,090	19,319	3,980	3,336	1,760	3,213	45,697	38.6%	118,373
1987	3,247	1,229	20,424	4,200	3,452	1,801	3,576	47,428	37.4%	126,890
1988	3,716	1,383	21,674	4,370	3,621	1,846	3,766	50,557	37.6%	134,294
1989	4,118	1,457	22,472	4,570	3,754	1,914	3,889	52,797	37.4%	141,184
1990	4,496	1,536	22,773	4,748	3,774	1,989	3,931	55,097	37.2%	148,073
1991	4,721	1,687	22,839	4,910	3,685	2,114	3,402	59,837	38.9%	153,695
1992	5,177	1,872	22,694	5,040	3,643	2,672	3,413	63,781	39.6%	161,219
1993	5,316	1,967	22,490	5,065	3,604	2,842	3,409	66,736	40.1%	166,614
1994	5,922	2,083	22,333	5,140	3,605	2,960	3,466	70,162	45.1%	155,591
1995	6,221	2,221	22,173	5,195	3,635	3,062	3,485	73,143	43.1%	169,749
1996	6,750	2,506	21,933	5,255	3,621	3,122	3,515	76,637	41.3%	185,404
1950-96	•	•	11.0%	•	2.7%	•	•	•	•	5.3%
1970-96	•	•	3.6%	4.1%	2.8%	•	•	•	•	4.9%
1986-96	8.9%	8.7%	1.3%	2.8%	0.8%	•	•	5.3%	•	4.6%
<i>Average annual percentage change</i>										

Source:

Motor Vehicle Manufacturers Association, *World Motor Vehicle Data*, 1998 Edition, Detroit, MI, 1998, pp. 8, 23, 28, 42, 85, 98, 169, 206, 230 and annual. (Additional resources: <http://www.aama.com>)

^a Data for 1991 and prior include West Germany only. Kraftwagen are included with automobiles (Table 1.1).

^b Data from 1991 and later are not comparable to prior data.

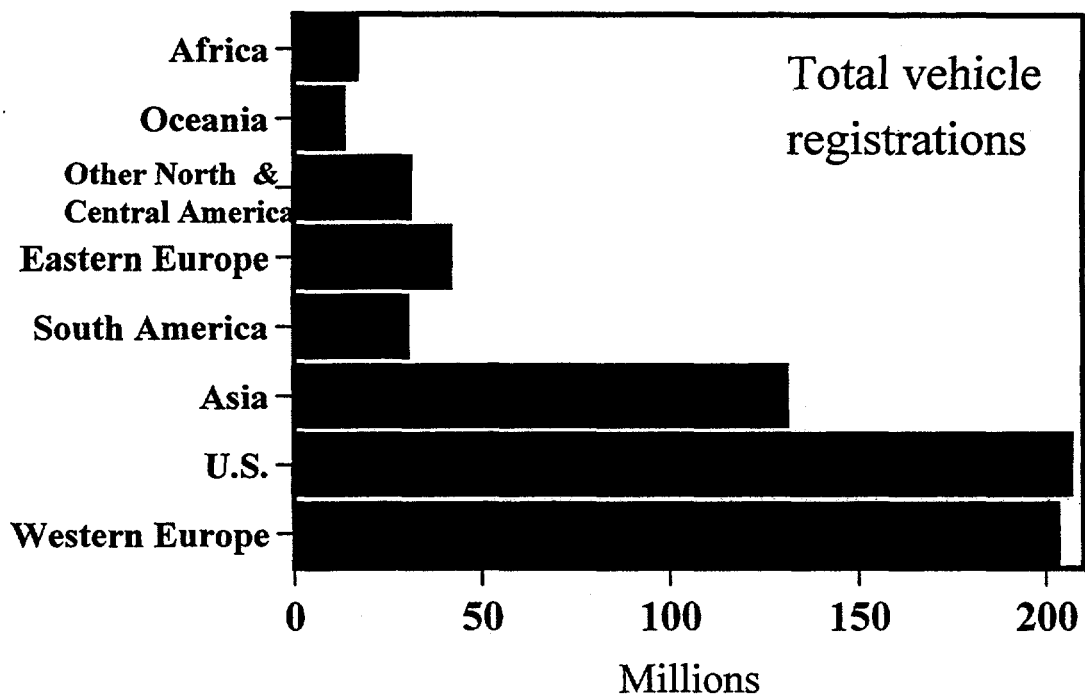
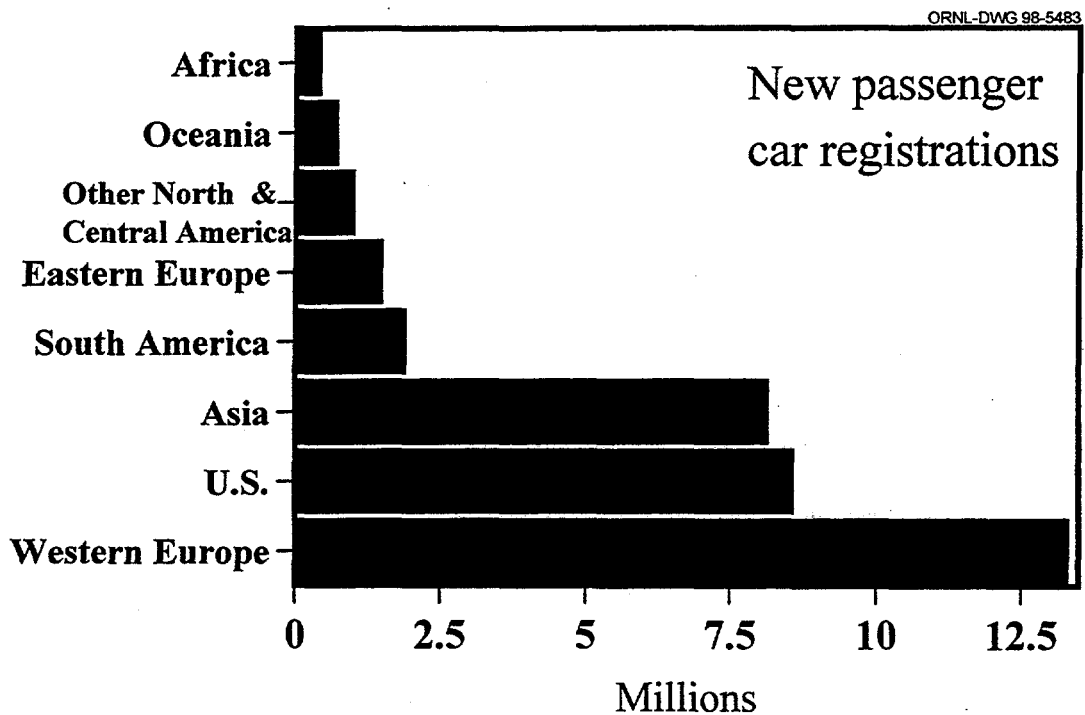
^c Data from 1985 and later are not comparable to prior data.

^d World totals were recalculated from 1985-94 based on change in U.S. data.

^e Data are not available.



Figure 5.1. World Vehicle Registrations by Region, 1996



Source:

American Automobile Manufacturers Association, *World Motor Vehicle Data*, 1997 Edition, Detroit, MI, 1997, pp. 6-11.



VEHICLES IN USE

Both the Federal Highway Administration (FHWA) and The Polk Company report figures on the automobile and truck population each year. The two estimates, however, differ by as much as 25.6% for trucks (1992). The differences can be attributed to several factors:

- The FHWA data include all vehicles which have been registered at any time throughout the calendar year. Therefore, the data include vehicles which were retired during the year and may double count vehicles which have been registered in different states or the same states to different owners. The Polk Company data include only those vehicles which are registered on July 1 of the given year.
- The classification of mini-vans, station wagons on truck chasses, and utility vehicles as passenger cars or trucks causes important differences in the two estimates. The Polk Company data included passenger vans in the automobile count until 1980; since 1980 all vans have been counted as trucks. Recently, the Federal Highway Administration adjusted their definition of automobiles and trucks. Starting in 1993, some minivans and sport utility vehicles that were previously included with automobiles were included with trucks. This change produced a dramatic change in the individual percentage differences of cars and trucks. The difference in total vehicles has been less than 5% each year since 1990 and does not appear to be significantly affected by the FHWA reclassifications.
- The FHWA data include all non-military Federal vehicles, while The Polk Company data include only those Federal vehicles which are registered within a state. Federal vehicles are not required to have State registrations, and, according to the General Services Administration, most Federal Vehicles are not registered.

According to The Polk Company statistics, the number of passenger cars in use in the U.S. declined from 1991 to 1992. This is the first decline in vehicle stock since the figures were first reported in 1924. However, the data should be viewed with caution. A redesign of Polk's approach in 1992 allowed a national check for duplicate registrations, which was not possible in earlier years. Polk estimates that, due to processing limitations, its vehicle population counts may have been inflated by as much as 1½ percent. Assuming that percentage is correct, the number of passenger cars in use would have declined from 1991 to 1992 under the previous Polk method. The growing popularity of light trucks being used as passenger vehicles could also have had an impact on these figures.



Table 5.3
Automobiles and Trucks in Use, 1970-96
 (thousands)

Year	Automobiles			Trucks			Total		
	FHWA	The Polk Company	Percentage difference	FHWA	The Polk Company	Percentage difference	FHWA	The Polk Company	Percentage difference
1970	89,243	80,448	10.9%	18,797	17,688	6.3%	108,040	98,136	10.1%
1971	92,718	83,138	11.5%	19,871	18,462	7.6%	112,589	101,600	10.8%
1972	97,082	86,439	12.3%	21,308	19,773	7.8%	118,390	106,212	11.5%
1973	101,985	89,805	13.6%	23,244	21,412	8.6%	125,229	111,217	12.6%
1974	104,856	92,608	13.2%	24,630	23,312	5.7%	129,487	115,920	11.7%
1975	106,706	95,241	12.0%	25,781	24,813	3.9%	132,487	120,054	10.4%
1976	110,189	97,818	12.6%	27,876	26,560	5.0%	138,065	124,378	11.0%
1977	112,288	99,904	12.4%	29,314	28,222	3.9%	141,602	128,126	10.5%
1978	116,573	102,957	13.2%	31,336	30,565	2.5%	147,909	133,522	10.8%
1979	118,429	104,677	13.1%	32,914	32,583	1.0%	151,343	137,260	10.3%
1980	121,601	104,564	16.3%	33,667	35,268	-4.5%	155,267	139,832	11.0%
1981	123,098	105,839	16.3%	34,644	36,069	-4.0%	157,743	141,908	11.2%
1982	123,702	106,867	15.8%	35,382	36,987	-4.3%	159,084	143,854	10.6%
1983	126,444	108,961	16.0%	36,723	38,143	-3.7%	163,166	147,104	10.9%
1984	128,158	112,019	14.4%	37,507	40,143	-6.6%	165,665	152,162	8.9%
1985	127,885	114,662	11.5%	43,210	42,387	1.9%	171,095	157,049	8.9%
1986	130,004	117,268	10.9%	45,103	44,826	0.6%	175,106	162,094	8.0%
1987	131,482	119,849	9.7%	46,826	47,344	-1.1%	178,308	167,193	6.6%
1988	133,836	121,519	10.1%	49,941	50,221	-0.6%	183,777	171,740	7.0%
1989	134,559	122,758	9.6%	52,172	53,202	-1.9%	186,731	175,960	6.1%
1990	133,700	123,276	8.5%	54,470	56,023	-2.8%	188,171	179,299	4.9%
1991	128,300	123,268	4.1%	59,206	58,179	1.8%	187,505	181,447	3.3%
1992	126,581	120,347	5.2%	63,136	61,172	3.2%	189,717	181,519	4.5%
1993	127,327	121,055	5.2%	66,082	65,260	1.3%	193,409	186,315	3.8%
1994	127,883	121,997	4.8%	69,491	66,717	4.2%	197,375	188,714	4.6%
1995	128,387	123,242	4.2%	72,458	70,199	3.2%	200,845	193,441	3.8%
1996	129,728	124,613	4.1%	75,940	73,681	3.1%	205,669	198,294	3.7%

Source:

FHWA - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1996*, Washington, DC, 1997, Table VM-1, p. V-94, and annual. (Additional resources: <http://www.fhwa.dot.gov>)

Polk - The Polk Company, Detroit, Michigan. **FURTHER REPRODUCTION PROHIBITED.** (Additional resources: <http://www.polk.com>)

The data on automobile stock by size class are estimations based on historical sales data. This method assumes a constant scrappage rate for all size classes. The data on trucks by weight class are based on estimates from the 1992 Truck Inventory and Use Survey (latest available survey).

Table 5.4
Vehicle Stock and New Sales in United States, 1996 Calendar Year

	Vehicle stock ^a		New sales		
	Thousands	Percentage	Domestic (thousands)	Import ^b (thousands)	Total (thousands)
Autos	124,613	100.0%	7,254 (85.1%)	1,273 (14.9%)	8,527 (100.0%)
Two seaters	2,326	1.9%	33 (53.1%)	29 (46.9%)	61 (100.0%)
Minicompact	1,546	1.2%	0 (0.0%)	34 (100.0%)	34 (100.0%)
Subcompact	28,876	23.2%	958 (64.3%)	338 (35.7%)	1,296 (100.0%)
Compact	38,794	31.1%	3,018 (87.7%)	425 (12.3%)	3,442 (100.0%)
Midsize	35,903	28.8%	2,044 (83.4%)	408 (16.6%)	2,452 (100.0%)
Large	17,168	13.8%	1,201 (96.8%)	40 (3.2%)	1,241 (100.0%)
Autos	124,613	100.0%	c	c	c
Business fleet autos ^d	9,124	7.3%	c	c	c
Personal autos	115,489	92.7%	c	c	c
Motorcycles	3,871^e	100.0%	c	c	c
Recreational vehicles	c	c	467 (100.0%)	0 (0.0%)	467 (100.0%)
Trucks	73,681	100.0%	6,478 (93.6%)	451 (6.4%)	6,929 (100.0%)
Light (0–10,000 lbs)	68,744	93.3%	6,088 (93.5%)	431 (6.5%)	6,519 (100.0%)
Medium (10,001–26,000 lbs)	2,432	3.3%	118 (86.1%)	19 (13.9%)	137 (100.0%)
Heavy-heavy (26,001 lbs and over)	2,505	3.4%	272 (99.3%)	1 (0.7%)	273 (100.0%)
Trucks	73,681	100.0%	c	c	c
Business fleet trucks ≤ 19,500 lbs ^d	6,466	8.8%	c	c	c
Personal trucks ≤ 19,500 lbs	63,825	86.6%	c	c	c
Trucks > 19,500 lbs.	3,389	4.6%	c	c	c

Source:

See Appendix A for Table 5.4. (Additional resources: <http://www.aama.com>, <http://www.polk.com>)

^a Total auto and truck vehicle stock as of July 1 from The Polk Company (FURTHER REPRODUCTION PROHIBITED).

^b Includes domestic-sponsored imports.

^c Data are not available.

^d In fleets of four or more vehicles.

^e Includes mostly on-highway motorcycles. Many states do not require registration for off-highway vehicles.



Table 5.5
Highway Vehicle Miles Traveled by Mode, 1970-96
 (million miles)

Year	Automobiles	Motorcycles	Two-axle, four-tire trucks	Other single-unit trucks	Combination trucks	Buses ^a	Total
1970	916,700	2,979	123,286	27,081	35,134	4,544	1,109,724
1971	966,330	3,607	137,870	28,985	37,217	4,802	1,178,811
1972	1,021,365	4,331	156,622	31,414	40,706	5,348	1,259,786
1973	1,045,981	5,194	176,833	33,661	45,649	5,792	1,313,110
1974	1,007,251	5,445	182,757	33,441	45,966	5,684	1,280,544
1975	1,033,950	5,629	200,700	34,606	46,724	6,055	1,327,664
1976	1,078,215	6,003	225,834	36,390	49,680	6,258	1,402,380
1977	1,109,243	6,349	250,591	39,339	55,682	5,823	1,467,027
1978	1,146,508	7,158	279,414	42,747	62,992	5,885	1,544,704
1979	1,113,640	8,637	291,905	42,012	66,992	5,947	1,529,133
1980	1,111,596	10,214	290,935	39,813	68,678	6,059	1,527,295
1981	1,133,332	10,690	296,343	39,568	69,134	6,241	1,555,308
1982	1,161,713	9,910	306,141	40,658	70,765	5,823	1,595,010
1983	1,195,054	8,760	327,643	42,546	73,586	5,199	1,652,788
1984	1,227,043	8,784	358,006	44,419	77,377	4,640	1,720,269
1985	1,246,798	9,086	390,961	45,441	78,063	4,478	1,774,826
1986	1,270,167	9,397	423,915	45,637	81,038	4,717	1,834,872
1987	1,315,982	9,506	456,870	48,022	85,495	5,330	1,921,204
1988	1,370,271	10,024	502,207	49,434	88,551	5,475	2,025,962
1989	1,401,221	10,371	536,475	50,870	91,879	5,670	2,096,487
1990	1,408,266	9,557	574,571	51,901	94,341	5,726	2,144,362
1991	1,358,185	9,178	649,394	52,898	96,645	5,750	2,172,050
1992	1,371,569	9,557	706,863	53,874	99,510	5,778	2,247,151
1993	1,374,709	9,906	745,750	56,772	103,116	6,125	2,296,378
1994	1,406,089	10,240	764,634	61,284	108,932	6,409	2,357,588
1995	1,438,294	9,797	790,029	62,705	115,451	6,420	2,422,696
1996	1,467,703	9,906	815,302	63,967	118,789	6,535	2,482,202
<i>Average annual percentage change</i>							
1970-96	1.8%	4.7%	7.5%	3.4%	4.8%	1.4%	3.1%
1986-96	1.5%	0.5%	6.8%	3.4%	3.9%	3.3%	3.1%

Source:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1996*, Washington, DC, 1997, Table VM-1, p. V-94, and annual.

(Additional resources: <http://www.fhwa.dot.gov>)

^aThe data do not correspond with vehicle-miles of travel presented in the "Bus" section of this chapter due to differing data sources.



Table 5.6
Automobiles in Operation and Vehicle Travel by Age, 1970 and 1996

Age (years)	1970			1996			1996 Estimated vehicle travel		
	Vehicles (thousands)	Percentage	Cumulative percentage	Vehicles (thousands)	Percentage	Cumulative percentage	Percentage	Cumulative percentage	Cumulative percentage
Under 1 ^a	6,288	7.8%	7.8%	6,153	4.9%	4.9%	6.4%	6.4%	6.4%
1	9,299	11.6%	19.4%	9,179	7.4%	12.3%	9.0%	15.5%	15.5%
2	8,816	11.0%	30.3%	7,973	6.4%	18.7%	7.5%	23.0%	23.0%
3	7,878	9.8%	40.1%	8,040	6.5%	25.2%	7.2%	30.2%	30.2%
4	8,538	10.6%	50.8%	7,474	6.0%	31.2%	6.4%	36.7%	36.7%
5	8,506	10.6%	61.3%	7,753	6.2%	37.4%	6.7%	43.4%	43.4%
6	7,116	8.8%	70.2%	7,932	6.4%	43.7%	6.7%	50.1%	50.1%
7	6,268	7.8%	78.0%	8,692	7.0%	50.7%	7.2%	57.3%	57.3%
8	5,058	6.3%	84.3%	8,803	7.1%	57.8%	6.6%	63.9%	63.9%
9	3,267	4.1%	88.3%	8,431	6.8%	64.5%	6.4%	70.3%	70.3%
10	2,776	3.5%	91.8%	8,134	6.5%	71.1%	5.5%	75.7%	75.7%
11	1,692	2.1%	93.9%	7,191	5.8%	76.8%	4.8%	80.6%	80.6%
12	799	1.0%	94.9%	6,107	4.9%	81.7%	4.1%	84.7%	84.7%
13	996	1.2%	96.1%	3,945	3.2%	84.9%	2.7%	87.3%	87.3%
14	794	1.0%	97.1%	2,871	2.3%	87.2%	1.9%	89.3%	89.3%
15 and older	2,336	2.9%	100.0%	15,935	12.8%	100.0%	10.7%	100.0%	100.0%
Subtotal	80,427	100.0%		124,613	100.0%		100.0%		
Age not given	22			0					
Total	80,449			124,613					
Average age		5.6			8.6				
Median age		4.9			7.9				

Source:

The Polk Company, Detroit, MI. FURTHER REPRODUCTION PROHIBITED.

Vehicle travel - Average annual miles per auto by age were multiplied by the number of vehicles in operation by age to estimate the vehicle travel. Average annual miles per auto by age - generated by ORNL from the *Household Vehicle Energy Consumption 1994*, provided by the U.S. Department of Energy, Energy Information Administration, Office of Markets and End Use, Energy End Use Division, 1996.
(Additional resources: <http://www.polk.com>, <http://www.eia.doe.gov>)

^aAutomobiles sold as of July 1 of each year.



Table 5.7
Trucks in Operation and Vehicle Travel by Age, 1970 and 1996

Age (years)	1970		1996		1996 Estimated vehicle travel		Average annual miles per vehicle
	Vehicles (thousands)	Percentage	Vehicles (thousands)	Percentage	Percentage	Cumulative percentage	
Under 1 ^a	1,262	7.1%	4,497	6.1%	6.8%	6.8%	14,288
1	1,881	10.6%	6,448	8.8%	11.2%	18.0%	16,439
2	1,536	8.7%	5,847	7.9%	11.4%	29.4%	18,388
3	1,428	8.1%	4,976	6.8%	9.3%	38.6%	17,601
4	1,483	8.4%	4,097	5.6%	7.3%	45.9%	16,775
5	1,339	7.6%	4,020	5.5%	6.8%	52.7%	16,020
6	1,154	6.5%	3,906	5.3%	6.0%	58.7%	14,574
7	975	5.5%	4,498	6.1%	6.5%	65.3%	13,710
8	826	4.7%	4,385	6.0%	6.1%	71.4%	13,255
9	621	3.5%	3,844	5.2%	5.0%	76.4%	12,237
10	658	3.7%	3,969	5.4%	3.5%	79.8%	8,224
11	583	3.3%	3,360	4.6%	2.9%	82.8%	8,224
12	383	2.2%	2,847	3.9%	2.5%	85.2%	8,224
13	417	2.4%	1,748	2.4%	1.5%	86.7%	8,224
14	414	2.3%	1,414	1.9%	1.2%	88.0%	8,224
15 and older	2,710	15.3%	13,825	18.8%	12.0%	100.0%	8,224
Subtotal	17,670	100.0%	73,681	100.0%	100.0%		
Age not given	15		0				
Total	17,685		73,681				
Average age	7.3		8.3				
Median age	5.9		7.7				

Source:

The Polk Company, Detroit, MI. **FURTHER REPRODUCTION PROHIBITED.**

Vehicle travel—The average annual vehicle-miles per truck by age were multiplied by the number of trucks in operation by age to estimate the vehicle travel. Average annual miles per truck by age were generated by ORNL from the 1992 *Truck Inventory and Use Survey* public use tape provided by U.S. Department of Commerce, Bureau of the Census, Washington, DC, 1995. (Additional resources: <http://www.polk.com>, <http://www.census.gov>)

^aTrucks sold as of July 1 of each year.

The average age of automobiles continued to grow in 1996 while trucks declined slightly. The increasing popularity of light trucks as personal passenger vehicles may have had an influence on the average age of trucks.

Table 5.8
Average Age of Automobiles and Trucks in Use, 1970–96
(years)

Calendar year	Automobiles		Trucks	
	Mean ^a	Median ^b	Mean ^a	Median ^b
1970	5.6	4.9	7.3	5.9
1971	5.7	5.1	7.4	6.1
1972	5.7	5.1	7.2	6.0
1973	5.7	5.1	6.9	5.8
1974	5.7	5.2	7.0	5.6
1975	6.0	5.4	6.9	5.8
1976	6.2	5.5	7.0	5.8
1977	6.2	5.6	6.9	5.7
1978	6.3	5.7	6.9	5.8
1979	6.4	5.9	6.9	5.9
1980	6.6	6.0	7.1	6.3
1981	6.9	6.0	7.5	6.5
1982	7.2	6.2	7.8	6.8
1983	7.4	6.5	8.1	7.2
1984	7.5	6.7	8.2	7.4
1985	7.6	6.9	8.1	7.6
1986	7.6	7.0	8.0	7.7
1987	7.6	6.9	8.0	7.8
1988	7.6	6.8	7.9	7.1
1989	7.6	6.5	7.9	6.7
1990	7.8	6.5	8.0	6.5
1991	7.9	6.7	8.1	6.8
1992	8.1	7.0	8.4	7.2
1993	8.3	7.3	8.6	7.5
1994	8.4	7.5	8.4	7.5
1995	8.5	7.7	8.4	7.6
1996	8.6	7.9	8.3	7.7

Source:

The Polk Company, Detroit, MI. **FURTHER REPRODUCTION PROHIBITED.**

(Additional resources: <http://www.polk.com>)

^aMean is the sum of the products of units multiplied by age, divided by the total units.

^bMedian is a value in an ordered set of values below and above which there are an equal number of values.



1990 model year (MY) automobiles will be in service an average of three years longer than their 1970 counterparts. The average lifetime of autos increased by 1.4 years from MY 1970 to MY 1980, then rose another 1.6 years in MY 1990.

Table 5.9
Scrappage and Survival Rates for Automobiles
1970, 1980 and 1990 Model Years

Vehicle age (years)	1970 model year		1980 model year		1990 model year	
	Scrappage rate ^a	Survival rate ^b	Scrappage rate ^a	Survival rate ^b	Scrappage rate ^a	Survival rate ^b
0	0.000000	1.000000	0.000000	1.000000	0.000000	1.000000
1	0.006050	0.993950	0.005553	0.994447	0.005255	0.994745
2	0.009650	0.984359	0.007636	0.986854	0.007538	0.987246
3	0.014590	0.969997	0.011011	0.975988	0.010522	0.976858
4	0.022892	0.947792	0.013567	0.962746	0.014414	0.962778
5	0.030522	0.918864	0.020498	0.943011	0.019623	0.943885
6	0.040956	0.881231	0.034718	0.910272	0.025096	0.920197
7	0.057029	0.830975	0.047366	0.867156	0.032690	0.890116
8	0.084560	0.760708	0.055299	0.819204	0.042014	0.852719
9	0.118527	0.670543	0.071153	0.760915	0.053468	0.807126
10	0.151858	0.568716	0.092931	0.690202	0.066230	0.753669
11	0.166996	0.473743	0.117300	0.609241	0.081338	0.692367
12	0.171955	0.392280	0.158696	0.512557	0.096959	0.625236
13	0.201774	0.313128	0.187663	0.416369	0.114297	0.553773
14	0.198887	0.250851	0.208822	0.329422	0.131169	0.481135
15	0.233611	0.192250	0.228359	0.254196	0.149005	0.409444
16	0.271810	0.139994	0.238412	0.193592	0.166710	0.341186
17	0.283363	0.100325	0.250547	0.145088	0.183826	0.278467
18	0.283078	0.071925	0.261438	0.107157	0.199477	0.222919
19	0.287708	0.051232	0.270527	0.078168	0.211449	0.175783
20	0.292908	0.036226	0.277234	0.056497	0.223461	0.136502
Average lifetime	10.7 years		12.1 years		13.7 years	

Source:

Miaou, Shaw-Pin, "Factors Associated with Aggregated Car Scrappage Rate in the United States: 1966-1992," Oak Ridge National Laboratory, Oak Ridge, TN, January 1995.

(Additional resources: <http://www-cta.ornl.gov>)

^aThe probability that a 1970/80/90 model year automobile will be retired from use within a given year.

^bThe probability that a 1970/80/90 model year automobile will be in use at the end of a given year.



Table 5.10
Scrapage and Survival Rates for Trucks

Vehicle age (years)	All trucks						Light trucks	
	(1966-73) ^a		(1973-78) ^a		(1978-89) ^a		(1978-89) ^a	
	Scrapage rate	Survival rate	Scrapage rate	Survival rate	Scrapage rate	Survival rate	Scrapage rate	Survival rate
0	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000
1	0.0058	0.99418	0.00505	0.99495	0.00312	0.99688	0.00249	0.99751
2	0.00814	0.98608	0.00698	0.98801	0.00461	0.99228	0.00383	0.99369
3	0.01129	0.97495	0.00958	0.97854	0.00676	0.98557	0.00583	0.98790
4	0.01550	0.95983	0.01306	0.96576	0.00980	0.97591	0.00877	0.97923
5	0.02101	0.93967	0.01762	0.94873	0.01399	0.96226	0.01296	0.96654
6	0.02798	0.91337	0.02347	0.92647	0.01957	0.94343	0.01869	0.94848
7	0.03649	0.88005	0.03073	0.89800	0.02663	0.91830	0.02606	0.92376
8	0.04638	0.83923	0.03943	0.86260	0.03507	0.88609	0.03488	0.89154
9	0.05730	0.79114	0.04940	0.81999	0.04445	0.84671	0.04454	0.85182
10	0.06863	0.73685	0.06026	0.77058	0.05408	0.80092	0.05416	0.80569
11	0.07970	0.67812	0.07147	0.71551	0.06320	0.75030	0.06285	0.75505
12	0.08987	0.61718	0.08239	0.65656	0.07121	0.69687	0.07006	0.70215
13	0.09872	0.55625	0.09247	0.59585	0.07776	0.64268	0.07562	0.64905
14	0.10605	0.49726	0.10130	0.53548	0.08285	0.58944	0.07967	0.59734
15	0.11189	0.44162	0.10871	0.47727	0.08662	0.53838	0.08251	0.54805
16	0.11638	0.39023	0.11468	0.42254	0.08932	0.49029	0.08443	0.50178
17	0.11976	0.34349	0.11936	0.37210	0.09122	0.44557	0.08571	0.45877
18	0.12225	0.30150	0.12294	0.32636	0.09253	0.40434	0.08655	0.41907
19	0.12406	0.26410	0.12562	0.28536	0.09343	0.36656	0.08710	0.38257
20	0.12536	0.23099	0.12761	0.24894	0.09403	0.33209	0.08745	0.34911
21	0.12629	0.20182	0.12906	0.21681	0.09444	0.30073	0.08768	0.31850
22	0.12696	0.17620	0.13012	0.18860	0.09471	0.27225	0.08783	0.29052
23	0.12743	0.15374	0.13089	0.16392	0.09490	0.24641	0.08793	0.26498
24	0.12776	0.13410	0.13144	0.14237	0.09502	0.22300	0.08799	0.24166
25	0.12799	0.11694	0.13183	0.12360	0.09510	0.20179	0.08803	0.22039
Average lifetime	14.0 years	14.6 years	15.8 years	16.0 years				

Source:

Miaou, Shaw-Pin, "Study of Vehicle Scrapage Rates," Oak Ridge National Laboratory, Oak Ridge, TN, August 1990.
(Additional resources: <http://www.cta.ornl.gov>)

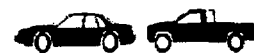
^aAverage scrapage and survival rates for all vehicles registered within this time period.

Chapter 6

Light Vehicles and Characteristics

Summary Statistics

Table		
6.1	Passenger cars, 1996	
	<i>Registrations (thousands)</i>	129,728
	<i>Vehicle miles (million miles)</i>	1,467,703
	<i>Fuel economy (miles per gallon)</i>	21.3
6.8	Two-axle, four tire trucks, 1996	
	<i>Registrations (thousands)</i>	68,934
	<i>Vehicle miles (million miles)</i>	815,302
	<i>Fuel economy (miles per gallon)</i>	17.3
6.3	Automobile sales, 1997 sales period	
	<i>Minicompact</i>	39,519
	<i>Subcompact</i>	1,510,050
	<i>Compact</i>	2,937,064
	<i>Midsized</i>	2,531,196
	<i>Large</i>	1,162,290
	<i>Two-seater</i>	80,921
6.10	Light truck sales, 1997 sales period	
	<i>Small pickup</i>	520,834
	<i>Large pickup</i>	2,051,144
	<i>Small van</i>	1,215,776
	<i>Large van</i>	386,563
	<i>Small utility</i>	1,715,259
	<i>Large utility</i>	637,140
6.12	Corporate average fuel economy	(mpg)
	<i>Automobile standard, MY 1998</i>	27.5
	<i>Automobile fuel economy, MY 1998</i>	28.8
	<i>Light truck standard, MY 1998</i>	20.7
	<i>Light truck fuel economy, MY 1998</i>	20.8
6.17	Average fuel economy loss from 55 to 70 mph	17.1%



The Federal Highway Administration released revised historical data in their "Highway Statistics Summary to 1995" report. As a result, the data in this table have been revised. The data in this table **DO NOT** include minivans, pickups, or sport utilities.

Table 6.1
Summary Statistics for Passenger Cars, 1970-96

Year	Registrations ^a (thousands)	Vehicle travel (million miles)	Fuel use (million gallons)	Fuel economy ^b (miles per gallon)
1970	89,244	916,700	67,820	13.5
1971	92,718	966,330	71,346	13.5
1972	97,082	1,021,365	75,937	13.5
1973	101,985	1,045,981	78,233	13.4
1974	104,856	1,007,251	74,229	13.6
1975	106,706	1,033,950	74,140	13.9
1976	110,189	1,078,215	78,297	13.8
1977	112,288	1,109,243	79,060	14.0
1978	116,573	1,146,508	80,652	14.2
1979	118,429	1,113,640	76,588	14.5
1980	121,601	1,111,596	69,981	15.9
1981	123,098	1,133,332	69,112	16.4
1982	123,702	1,161,713	69,116	16.8
1983	126,444	1,195,054	70,322	17.0
1984	128,158	1,227,043	70,663	17.4
1985	127,885	1,246,798	71,518	17.4
1986	130,004	1,270,167	73,174	17.4
1987	131,482	1,315,982	73,308	18.0
1988	133,836	1,370,271	73,345	18.7
1989	134,559	1,401,221	73,913	19.0
1990	133,700	1,408,266	69,568	20.2
1991	128,300	1,358,185	64,318	21.1
1992	126,581	1,371,569	65,436	21.0
1993	127,327	1,374,709	67,047	20.5
1994	127,883	1,406,089	67,874	20.7
1995	128,387	1,438,294	68,072	21.1
1996	129,728	1,467,703	68,897	21.3
<i>Average annual percentage change</i>				
1970-96	1.4%	1.8%	0.1%	1.8%
1986-96	0.0%	1.5%	-0.6%	2.0%

Source:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1996*, Washington, DC, 1997, Table VM-1, p. V-94, and annual.

(Additional resources: <http://www.fhwa.dot.gov>)

^a This number differs from R.L. Polk's estimates of "number of automobiles in use." See Table 3.3.

^b Fuel economy for automobile population.



Table 6.2
New Retail Automobile Sales in the United States, 1970-97

Calendar year	Domestic ^a	Import ^b	Total	Percentage imports	Percentage transplants ^c	Percentage imports and transplants	Percentage diesel
	(thousands)				on model year basis		
1970	7,119	1,285	8,404	15.3%	d	d	d
1971	8,681	1,568	10,249	15.3%	d	d	0.06%
1972	9,327	1,623	10,950	14.8%	d	d	0.05%
1973	9,676	1,763	11,439	15.4%	d	d	0.06%
1974	7,454	1,399	8,853	15.8%	d	d	0.20%
1975	7,053	1,571	8,624	18.2%	d	d	0.31%
1976	8,611	1,499	10,110	14.8%	0.0%	14.8%	0.22%
1977	9,109	2,074	11,183	18.5%	0.0%	18.5%	0.34%
1978	9,312	2,002	11,314	17.7%	0.0%	17.7%	1.02%
1979	8,341	2,332	10,673	21.8%	1.3%	23.1%	2.54%
1980	6,581	2,398	8,979	26.7%	2.1%	28.8%	4.31%
1981	6,209	2,327	8,536	27.3%	1.8%	29.1%	6.10%
1982	5,759	2,223	7,982	27.9%	1.4%	29.3%	4.44%
1983	6,795	2,387	9,182	26.0%	1.3%	27.3%	2.09%
1984	7,952	2,439	10,391	23.5%	2.0%	25.5%	1.45%
1985	8,205	2,838	11,043	25.7%	2.2%	27.9%	0.82%
1986	8,215	3,238	11,453	28.3%	2.8%	31.1%	0.37%
1987	7,081	3,197	10,278	31.1%	5.2%	36.3%	0.16%
1988	7,526	3,099	10,626	29.2%	5.8%	35.0%	0.02%
1989	7,073	2,825	9,898	28.5%	7.3%	35.8%	0.13%
1990	6,897	2,404	9,301	25.8%	11.2%	37.0%	0.08%
1991	6,137	2,038	8,175	24.9%	13.7%	38.6%	0.10%
1992	6,277	1,937	8,213	23.6%	14.1%	37.7%	0.06%
1993	6,742	1,776	8,518	20.9%	14.9%	35.8%	0.03%
1994	7,255	1,735	8,990	19.3%	16.5%	35.8%	0.04%
1995	7,129	1,506	8,635	17.4%	18.9%	36.3%	0.04%
1996	7,254	1,273	8,527	14.9%	d	d	0.10%
1997	6,917	1,355	8,272	16.4%	d	d	d
<i>Average annual percentage change</i>							
1970-97	-0.1%	0.2%	-0.1%				
1987-97	-0.2%	-8.2%	-2.1%				

Source:

Domestic and import data - American Automobile Manufacturers Association, *Motor Vehicle Facts and Figures 1997*, Detroit, MI, 1997, p. 15, and annual. 1997 data from *Economic Indicators, 4th Quarter 1997*.

Diesel data - H. A. Stark (ed), Ward's Communications, Inc., *Ward's Automotive Yearbook*, Detroit, MI, 1997, p. 39, and annual.

Transplant data - Oak Ridge National Laboratory, Light-Duty Vehicle MPG and Market Shares Data System, Oak Ridge, TN, 1996. (Additional resources: <http://www.aama.com>, <http://www.wardsauto.com>)

^a North American built.

^b Does not include import tourist deliveries.

^c A transplant is an automobile which was built in the U.S. by a foreign firm. Also included are joint ventures which are built in the U.S.

^d Data are not available.



Table 6.3
Period Sales, Market Shares, and Sales-Weighted Fuel Economies
of New Domestic and Import Automobiles, Selected Sales Periods 1976-97*

	1976	1980	1984	1988	1990	1992	1993	1994	1995	1996	1997
MINICOMPACT											
Total sales, units	428,346	41,368	84,186	76,698	107,634	84,345	57,198	44,752	34,234	39,519	
Market share, %	4.7	0.4	0.8	0.8	1.3	1.0	0.6	0.5	0.4	0.5	
Fuel economy, mpg	29.4	29	37.8	26.4	30.6	29.9	27.8	27.0	27.2	26.3	
SUBCOMPACT											
Total sales, units	2,625,929	3,441,480	2,510,929	1,983,353	2,030,226	2,074,351	1,944,892	2,015,280	1,518,209	1,315,281	1,510,050
Market share, %	27.1	37.8	24.6	19.1	22	25.6	23.2	22.6	17.4	15.2	18.3
Fuel economy, mpg	23.5	27.3	30.5	31.7	31.3	31.8	31.9	31.3	31.7	32.1	32.6
COMPACT											
Total sales, units	2,839,603	599,423	2,768,056	4,199,638	3,156,481	2,451,498	2,655,378	3,077,203	3,289,735	3,492,957	2,937,064
Market share, %	29.3	6.6	27.1	40.5	34.2	30.2	31.7	34.5	37.7	40.4	35.6
Fuel economy, mpg	17.1	22.3	30.6	29.8	28.9	28.7	29.3	29.8	30.2	30.4	30.0
MIDSIZE											
Total sales, units	1,815,505	3,073,103	3,059,647	2,550,964	2,511,503	2,249,553	2,445,842	2,359,898	2,498,521	2,487,880	2,531,196
Market share, %	18.7	33.8	30	24.6	27.2	27.7	29.2	26.5	28.6	28.8	30.6
Fuel economy, mpg	15.3	21.3	24.1	26.9	25.9	25.8	25.7	25.6	25.9	26.4	26.3
LARGE											
Total sales, units	2,206,102	1,336,190	1,502,097	1,368,717	1,279,092	1,140,775	1,186,991	1,339,863	1,320,608	1,259,266	1,162,290
Market share, %	22.8	14.7	14.7	13.2	13.9	14.1	14.2	15.0	15.1	14.6	14.1
Fuel economy, mpg	13.9	19.3	20.2	24.2	23.5	23.7	24.0	24.2	24.1	24.2	24.5
TWO SEATER											
Total sales, units	199,716	215,964	328,968	186,127	170,465	83,192	70,480	67,020	53,045	62,231	80,921
Market share, %	2.1	2.4	3.2	1.8	1.8	1.0	0.8	0.8	0.6	0.7	1.0
Fuel economy, mpg	20.1	21	26.5	27.3	28	25.9	24.8	23.9	24.7	25.4	26.3
TOTAL											
Total sales, units	9,686,855	9,094,506	10,211,06	10,372,98	9,224,465	8,107,003	8,387,928	8,916,462	8,724,870	8,651,849	8,261,040
Market share, %	100	100	100	100	100	100	100	100	100	100	100
Fuel economy, mpg	17.2	23.2	26.3	28.5	27.6	27.7	27.8	27.8	28.0	28.3	28.3

Source:

Oak Ridge National Laboratory, Light-Duty Vehicle MPG and Market Shares System, Oak Ridge, TN, 1998. (Additional resources: <http://www-cta.ornl.gov>)

* These figures represent only those sales that could be matched to corresponding EPA fuel economy values.



Table 6.4
Sales-Weighted Engine Size of New Domestic and Import Automobiles by Size Class,
Sales Periods 1976-97
(liters^a)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
1976	^b	2.67	5.00	5.85	6.79	2.89	4.89
1977	1.98	2.73	4.79	5.47	6.02	2.81	4.56
1978	2.06	2.67	3.95	4.89	6.17	3.01	4.33
1979	1.86	2.39	3.74	4.41	5.56	2.77	3.78
1980	1.90	2.10	3.03	3.90	5.12	2.79	3.22
1981	1.57	2.04	2.20	3.63	5.00	2.49	2.98
1982	1.53	2.08	2.12	3.47	4.73	2.41	2.89
1983	1.60	2.19	2.20	3.45	4.95	2.52	2.98
1984	2.17	2.22	2.21	3.40	4.87	2.50	2.97
1985	1.95	2.29	2.27	3.37	4.65	2.47	2.92
1986	1.45	2.19	2.21	3.19	4.38	2.83	2.76
1987	1.48	2.19	2.20	2.99	4.36	2.57	2.68
1988	1.52	2.05	2.21	3.00	4.32	2.75	2.66
1989	2.54	2.08	2.11	3.01	4.31	2.81	2.68
1990	2.42	1.96	2.25	3.13	4.33	2.57	2.72
1991	2.17	1.97	2.23	3.16	4.40	2.67	2.72
1992	1.89	2.01	2.33	3.16	4.34	3.01	2.76
1993	1.96	2.07	2.28	3.16	4.27	3.47	2.78
1994	2.21	2.27	2.23	3.15	4.17	3.82	2.79
1995	2.42	2.26	2.23	3.12	4.12	3.76	2.79
1996	2.49	2.23	2.19	2.98	4.09	3.67	2.71
1997	2.62	2.13	2.28	3.02	4.03	3.08	2.74
<i>Average annual percentage change</i>							
1976-97	1.4% ^c	-1.1%	-3.7%	-3.1%	-2.5%	0.3%	-2.7%
1987-97	5.9%	0.3%	0.4%	0.1%	-0.8%	1.8%	0.2%

Source:

Oak Ridge National Laboratory, Light-Duty Vehicle MPG and Market Shares System, Oak Ridge, TN, 1998.
 (Additional resources: <http://www-cta.ornl.gov>)

^a 1 liter = 61.02. cubic inches.

^b There were no minicompact automobiles sold in 1976.

^d Average annual percentage change begins with 1977.



Table 6.5
Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class,
Sales Periods 1976-97
(pounds)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
1976	^a	2,577	3,609	4,046	4,562	2,624	3,608
1977	2,228	2,586	3,550	3,900	4,026	2,608	3,424
1978	2,200	2,444	3,138	3,427	3,956	2,763	3,197
1979	2,120	2,367	3,048	3,287	3,763	2,699	3,000
1980	2,154	2,270	2,813	3,081	3,667	2,790	2,790
1981	1,920	2,370	2,382	2,996	3,672	2,744	2,744
1982	2,002	2,302	2,422	2,992	3,703	2,525	2,730
1983	2,072	2,334	2,441	3,027	3,779	2,663	2,788
1984	2,376	2,380	2,454	2,990	3,734	2,559	2,788
1985	2,211	2,392	2,464	2,954	3,575	2,539	2,743
1986	2,120	2,415	2,432	2,857	3,451	2,575	2,675
1987	1,960	2,423	2,474	2,857	3,483	2,602	2,689
1988	1,933	2,346	2,558	2,880	3,487	2,693	2,717
1989	2,576	2,357	2,517	2,985	3,496	2,735	2,760
1990	2,651	2,368	2,637	3,065	3,594	2,656	2,828
1991	2,584	2,406	2,652	3,085	3,650	2,707	2,848
1992	2,395	2,444	2,674	3,131	3,670	2,770	2,879
1993	2,449	2,478	2,659	3,142	3,615	2,967	2,894
1994	2,719	2,571	2,639	3,171	3,657	3,035	2,921
1995	2,831	2,552	2,647	3,179	3,648	2,947	2,937
1996	2,847	2,533	2,667	3,203	3,671	2,985	2,950
1997	2,997	2,489	2,737	3,241	3,653	2,863	2,977
<i>Average annual percentage change</i>							
1976-97	1.5% ^b	-0.2%	-1.3%	-1.1%	-1.1%	0.4%	-0.9%
1987-97	4.3%	0.3%	1.0%	1.3%	0.5%	1.0%	1.0%

Source:

Oak Ridge National Laboratory, Light-Duty Vehicle MPG and Market Shares System, Oak Ridge, TN, 1998.

(Additional resources: <http://www-cta.ornl.gov>)

^a There were no minicompact automobiles sold in 1976.

^c Average annual percentage change begins with 1977.



Table 6.6
Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class,
Sales Periods 1976-97
(cubic feet)

Model year	Minicompact (< 85)	Subcompact (85-99)	Compact (100-109)	Midsized (110-119)	Large (> 120)	Fleet ^a
1977	78.8	89.8	107.1	113.0	128.0	107.9
1978	79.4	89.8	105.3	112.9	128.5	107.9
1979	80.0	90.2	105.8	113.4	130.1	106.9
1980	82.4	89.9	105.4	113.5	130.8	104.9
1981	83.3	90.2	103.6	113.7	130.6	105.5
1982	83.1	91.3	102.9	113.9	130.4	106.0
1983	82.7	93.3	103.0	113.1	131.3	107.3
1984	77.0	93.8	103.0	113.3	130.4	108.0
1985	77.8	94.1	103.1	113.5	129.7	107.9
1986	80.1	94.5	102.8	113.8	127.6	107.0
1987	81.6	93.1	103.0	113.9	127.5	106.9
1988	81.0	93.5	103.3	113.6	127.2	107.0
1989	75.0	93.3	102.7	113.8	127.4	107.5
1990	79.9	93.9	103.2	113.8	127.8	107.3
1991	79.6	94.4	103.2	113.8	128.3	107.1
1992	79.1	94.0	104.2	114.0	129.2	107.5
1993	79.2	94.5	104.0	114.0	128.9	108.0
1994	79.4	94.4	103.8	113.8	128.8	108.0
1995	78.5	93.8	103.9	114.3	128.1	108.7
1996	76.7	94.9	103.4	114.2	128.0	108.8
1997	77.2	95.6	103.2	114.6	128.0	108.7
	<i>Average annual percentage change</i>					
1977-97	-0.1%	0.3%	-0.2%	0.1%	0.0%	0.0%
1987-97	-0.6%	0.3%	0.1%	0.0%	0.0%	0.2%

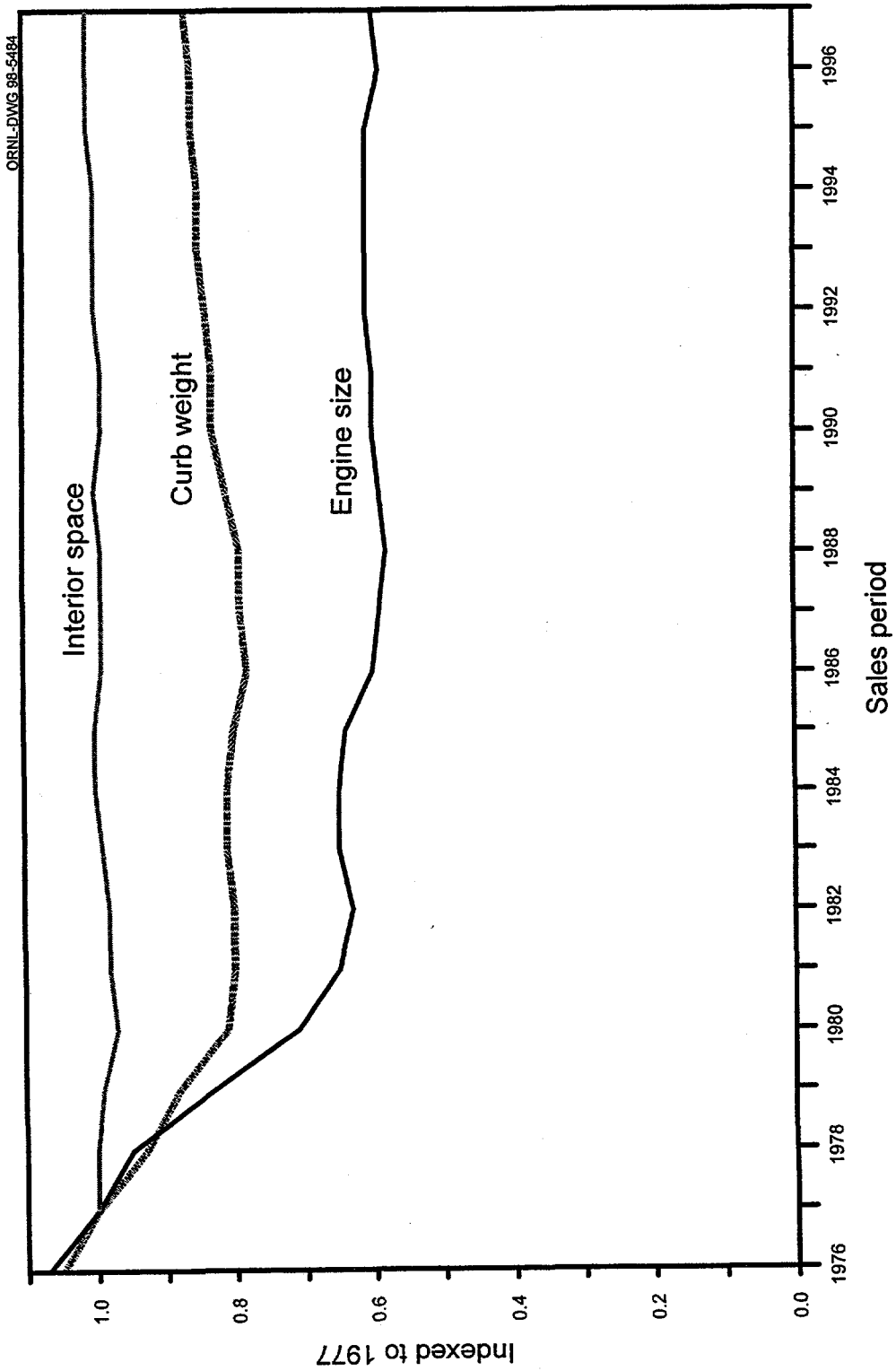
Source:

Oak Ridge National Laboratory, Light-Duty Vehicle MPG and Market Shares System, Oak Ridge, TN, 1998.
 (Additional resources: <http://www-cta.ornl.gov>)

^a Interior volumes of two seaters are not reported to EPA.



Figure 6.1. Engine Size, Curb Weight, and Interior Space of New Domestic and Import Automobiles, 1976-96



Source: See Tables 6.4, 6.5, and 6.6.



The average auto lost over 300 pounds from 1978 to 1985, but gained a few pounds back since then. Much of the weight reduction was due to the declining use of conventional steel and iron and the increasing use of aluminum and plastics. Conventional steel, however, remained the predominant component of automobiles in 1997 with a 43.4% share of total materials. As conventional steel use has been decreasing, use of high-strength steel has increased.

Table 6.7
Average Material Consumption for a Domestic Automobile,
1978, 1985, and 1997

Material	1978		1985		1997	
	Pounds	Percentage	Pounds	Percentage	Pounds	Percentage
Conventional steel ^a	1,880.0	53.8%	1,481.5	46.5%	1,411.0	43.4%
High-strength steel	127.5	3.6%	217.5	6.8%	295.5	9.1%
Stainless steel	25.0	0.7%	29.0	0.9%	47.5	1.5%
Other steels	56.0	1.6%	54.5	1.7%	36.0	1.1%
Iron	503.0	14.4%	468.0	14.7%	378.0	11.6%
Aluminum	112.0	3.2%	138.0	4.3%	206.0	6.3%
Rubber	141.5	4.1%	136.0	4.3%	138.5	4.3%
Plastics/composites	176.0	5.0%	211.5	6.6%	242.0	7.5%
Glass	88.0	2.5%	85.0	2.7%	96.5	3.0%
Copper	39.5	1.1%	44.0	1.4%	46.5	1.4%
Zinc die castings	28.0	0.8%	18.0	0.5%	14.0	0.4%
Powder metal parts	16.0	0.5%	19.0	0.6%	31.0	1.0%
Fluids & lubricants	189.0	5.4%	184.0	5.8%	197.5	6.1%
Other materials	112.5	3.2%	101.5	3.2%	102.0	3.1%
Total	3,494.0	100.0%	3,187.5	100.0%	3,248.0	100.0%

Source:

H. A. Stark (ed.), Ward's Communications, Inc., *Wards Automotive Yearbook*, Detroit, MI, 1997, p. 19, and annual.
(Additional resources: <http://www.wardsauto.com>)

^a Includes cold-rolled and pre-coated steel.



The Federal Highway Administration released revised historical data in 1997 which better reflected two-axle, four-tire trucks. The definition of this category includes vans, pickup trucks, and sport utility vehicles.

Table 6.8
Summary Statistics for Two-Axle, Four-Tire Trucks, 1970-96

Year	Registrations (thousands)	Vehicle travel (million miles)	Fuel use (million gallons)	Fuel economy (miles per gallon)
1970	14,211	123,286	12,313	10.0
1971	15,181	137,870	13,484	10.2
1972	16,428	156,622	15,150	10.3
1973	18,083	176,833	16,828	10.5
1974	19,335	182,757	16,657	11.0
1975	20,418	200,700	19,081	10.5
1976	22,301	225,834	20,828	10.8
1977	23,624	250,591	22,383	11.2
1978	25,476	279,414	24,162	11.6
1979	27,022	291,905	24,445	11.9
1980	27,876	290,935	23,796	12.2
1981	28,928	296,343	23,697	12.5
1982	29,792	306,141	22,702	13.5
1983	31,214	327,643	23,945	13.7
1984	32,106	358,006	25,604	14.0
1985	37,214	390,961	27,363	14.3
1986	39,382	423,915	29,074	14.6
1987	41,107	456,870	30,598	14.9
1988	43,805	502,207	32,653	15.4
1989	45,945	536,475	33,271	16.1
1990	48,275	574,571	35,611	16.1
1991	53,033	649,394	38,217	17.0
1992	57,091	706,863	40,929	17.3
1993	59,994	745,750	42,851	17.4
1994	62,904	764,634	44,112	17.3
1995	65,738	790,029	45,605	17.3
1996	68,934	815,302	47,133	17.3
<i>Average annual percentage change</i>				
1970-96	6.3%	7.5%	5.3%	2.1%
1986-96	5.8%	6.8%	4.9%	1.7%

Source:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1996*, Washington, DC, 1997, Table VM-1, p. V-94, and annual.

(Additional resources: <http://www.fhwa.dot.gov>)



Table 6.9
New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970-96

Calendar year	Light truck sales ^a (thousands)	Percentages					
		Import ^b	Transplants ^c	Diesel	Four-wheel drive of domestic light trucks	Light trucks of light-duty vehicle sales ^d	Light trucks of total truck sales
1970	1,463	4.5%	e	f	e	14.8%	80.4%
1971	1,757	4.8%	e	f	e	14.6%	83.4%
1972	2,239	6.4%	e	f	e	17.0%	83.3%
1973	2,745	8.5%	e	f	e	19.4%	84.2%
1974	2,338	7.5%	e	f	18.0%	20.9%	84.2%
1975	2,281	10.0%	e	f	23.4%	20.9%	87.9%
1976	2,956	8.0%	0.0%	f	23.8%	22.6%	89.8%
1977	3,430	9.4%	0.0%	f	24.6%	23.5%	89.7%
1978	3,808	8.8%	0.0%	1.0%	28.5%	25.2%	89.2%
1979	3,311	14.1%	0.0%	1.0%	29.4%	23.7%	88.7%
1980	2,440	19.7%	0.9%	3.2%	20.7%	21.4%	88.9%
1981	2,189	20.3%	0.0%	3.3%	18.6%	20.4%	89.8%
1982	2,470	16.5%	0.0%	5.0%	16.8%	23.6%	92.8%
1983	2,984	15.6%	0.0%	4.0%	28.5%	24.5%	93.6%
1984	3,863	15.7%	2.0%	3.8%	27.0%	27.1%	93.0%
1985	4,458	17.2%	2.6%	3.3%	29.1%	28.8%	93.6%
1986	4,594	20.1%	2.3%	2.6%	27.0%	28.6%	94.3%
1987	4,610	17.9%	1.7%	2.3%	32.0%	31.0%	93.9%
1988	4,800	12.6%	2.4%	2.0%	32.1%	31.1%	93.2%
1989	4,610	10.9%	2.6%	2.1%	31.4% ^g	31.8%	93.3%
1990	4,548	13.2%	3.4%	2.2% ^g	31.6% ^g	32.8%	93.9%
1991	4,123	12.8%	4.5%	2.2% ^g	34.4% ^g	33.5%	94.5%
1992	4,629	8.6%	5.5%	2.5% ^g	31.6% ^g	36.0%	94.4%
1993	5,351	6.8%	7.1%	2.3% ^g	32.6% ^g	38.6%	94.2%
1994	6,033	6.5%	8.1%	2.7% ^g	34.4% ^g	40.2%	94.0%
1995	6,053	6.5%	7.5%	3.8% ^g	39.1% ^g	41.2%	93.4%
1996	6,519	6.6%	e	3.7% ^g	35.7% ^g	43.3%	94.1%
<i>Average annual percentage change</i>							
1970-96	5.8%						
1985-96	3.6%						

Source:

Four-wheel drive - 1970-88: H. A. Stark (ed.), Ward's Communications, Inc., *Ward's Automotive Yearbook*, Detroit, MI, 1989, p. 168, and annual. 1989-96: H. A. Stark (ed.), Ward's Communications, Inc., *Ward's Automotive Yearbook*, Factory Installation Reports, Detroit, MI, 1997.

Transplants - Oak Ridge National Laboratory, Light-Duty Vehicle MPG and Market Shares System, Oak Ridge, TN, 1996.

All other - American Automobile Manufacturers Association, *Motor Vehicle Facts and Figures 1997*, Detroit, MI, 1997, pp. 8, 19, 20, 21, and annual. (Additional resources: <http://www.aama.com>, <http://www.wardsauto.com>)

^a Includes all trucks of 10,000 pounds gross vehicle weight and less sold in the U.S.

^b Excluding transplants.

^c Based on model year data. A transplant is a light truck which was built in the U.S. by a foreign firm. Also included are joint ventures built in the U.S.

^d Light-duty vehicles include automobiles and light trucks.

^e Data are not available.

^f Indicates less than 1 percent.

^g Based on factory installations or factory sales.



Table 6.10
Period Sales, Market Shares, and Sales-Weighted Fuel Economies
of New Domestic and Import Light Trucks, Selected Sales Periods 1976-97^a

	1976	1980	1984	1988	1990	1992	1993	1994	1995	1996	1997
SMALL PICKUP											
Total sales, units	170,351	516,412	1,012,298	1,026,551	678,488	586,752	332,470	365,322	356,856	574,930 ^b	520,834
Market share, %	7.1	23.3	28.0	21.6	15.0	13.4	6.6	6.4	6.0	9.2	8.0
Fuel economy, mpg	23.9	25.5	27.2	26.1	25.2	25.0	24.9	25.3	25.6	25.6	24.6
LARGE PICKUP											
Total sales, units	1,586,020	1,115,248	1,218,972	1,453,255	1,573,729	1,452,192	1,877,806	2,199,224	2,183,793	2,042,179	2,051,144
Market share, %	66.4	50.3	33.7	30.6	34.9	33.1	37.1	38.4	36.8	32.7	31.4
Fuel economy, mpg	15.1	17	17.5	18.5	18.9	18.9	19.6	20.1	19.4	18.9	19.4
SMALL VAN											
Total sales, units	18,651	13,649	222,798	851,384	932,693	968,361	1,129,459	1,263,933	1,257,116	1,229,650	1,215,776
Market share, %	0.8	0.6	6.2	18.0	20.7	22.0	22.3	22.1	21.2	19.7	18.6
Fuel economy, mpg	19.5	19.6	25.0	22.9	23.1	22.5	22.9	22.1	22.8	22.8	22.9
LARGE VAN											
Total sales, units	574,745	328,065	545,595	486,981	398,877	350,013	388,435	407,737	401,056	370,126	386,563
Market share, %	24.1	14.8	15.1	10.3	8.8	8.0	7.7	7.1	6.8	5.9	5.9
Fuel economy, mpg	15.4	16.3	16.3	17.0	16.9	16.9	17.3	17.4	17.1	17.2	17.8
SMALL UTILITY											
Total sales, units	4,716	75,875	398,000	701,005	738,294	867,934	948,797	1,042,584	1,225,131	1,378,696	1,715,259
Market share, %	0.2	3.4	11.0	14.8	16.4	19.8	18.8	18.2	20.6	22.1	26.3
Fuel economy, mpg	15.5	16.9	23.0	22.4	21.9	20.9	21.3	20.7	20.8	21.1	19.6
LARGE UTILITY											
Total sales, units	32,427	167,288	215,271	223,824	192,544	167,199	378,710	445,601	509,914	641,280	637,140
Market share, %	1.4	7.5	6.0	4.7	4.3	3.8	7.5	7.8	8.6	10.3	9.8
Fuel economy, mpg	14.7	14.6	15.7	16.2	16.1	16.9	17.5	17.8	17.4	18.2	18.2
TOTAL											
Total sales, units	2,386,910	2,216,537	3,612,934	4,743,000	4,514,625	4,392,451	5,055,677	5,724,401	5,933,866	6,236,861	6,526,716
Market share, %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Fuel economy, mpg	15.6	18.1	20.0	20.7	20.5	20.4	20.5	20.4	20.2	20.4	20.1

Source:

Oak Ridge National Laboratory, Light-Duty Vehicle MPG and Market Shares System, Oak Ridge, TN, 1998. (Additional resources: <http://www-cta.ornl.gov>)

^a These figures represent only those sales that could be matched to corresponding EPA fuel economy values.

^b Some four-wheel drive pickups previously classified as large pickups were correctly reclassified as small pickups.



Table 6.11
Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class
Sales Periods 1976-97
(liters^a)

Model year	Small pickup	Large pickup	Small van	Large van	Small utility	Large utility	Fleet
1976	1.91	5.57	1.97	5.39	5.39	4.97	5.23
1977	2.01	5.48	1.97	5.32	5.46	4.95	5.03
1978	2.03	5.45	1.97	5.29	5.09	5.40	5.02
1979	2.05	5.15	1.97	5.13	4.52	5.30	4.62
1980	2.05	5.05	1.97	5.03	4.29	5.39	4.33
1981	2.14	4.82	1.97	4.84	3.94	5.15	4.15
1982	2.34	4.99	1.79	4.92	3.88	5.27	4.24
1983	2.35	4.97	1.87	5.06	3.05	5.34	4.00
1984	2.38	4.95	2.23	5.06	2.81	5.39	3.87
1985	2.38	4.77	2.65	5.12	2.83	5.37	3.77
1986	2.43	4.68	2.78	5.13	2.78	5.55	3.65
1987	2.44	4.69	2.96	5.21	2.80	5.42	3.65
1988	2.56	4.68	3.15	5.21	3.14	5.51	3.82
1989	2.64	4.70	3.11	5.22	3.50	5.45	3.93
1990	2.90	4.49	3.29	5.21	3.38	5.48	3.93
1991	2.91	4.57	3.29	5.23	3.62	5.40	3.94
1992	3.07	4.57	3.32	5.28	3.69	5.47	4.00
1993	3.25	4.32	3.30	5.21	3.80	5.58	4.02
1994	3.10	4.45	3.48	5.31	3.77	5.54	4.10
1995	2.95	4.44	3.40	5.15	3.75	5.49	4.06
1996	2.83	4.72	3.41	5.21	3.68	5.11	4.12
1997	2.90	4.62	3.36	5.04	3.98	4.97	4.14
<i>Average annual percentage change</i>							
1976-97	2.0%	-0.9%	2.6%	-0.3%	-1.4%	0.0%	-1.1%
1987-97	1.7%	-0.2%	1.3%	-0.3%	3.6%	-0.9%	1.3%

Source:

Oak Ridge National Laboratory, Light-Duty Vehicle MPG and Market Shares System, Oak Ridge, TN, 1998.
 (Additional resources: <http://www-cta.ornl.gov>)

^a 1 liter = 61.02 cubic inches.



Table 6.12
Corporate Average Fuel Economy (CAFE)
Standards versus Sales-Weighted Fuel Economy Estimates
for Automobiles and Light Trucks, 1978-98^a
(miles per gallon)

Model Year	Automobiles				Light Trucks ^b			
	CAFE Standards	CAFE Estimates ^c			CAFE Standards	CAFE Estimates ^c		
		Domestic	Import	Combined		Domestic	Import	Combined
1978	18.0	18.7	27.3	19.9	^d	^e	^e	^e
1979	19.0	19.3	26.1	20.3	^d	17.7	20.8	18.2
1980	20.0	22.6	29.6	24.3	^d	16.8	24.3	18.5
1981	22.0	24.2	31.5	25.9	^d	18.3	27.4	20.1
1982	24.0	25.0	31.1	26.6	17.5	19.2	27.0	20.5
1983	26.0	24.4	32.4	26.4	19.0	19.6	27.1	20.7
1984	27.0	25.5	32.0	26.9	20.0	19.3	26.7	20.6
1985	27.5	26.3	31.5	27.6	19.5	19.6	26.5	20.7
1986	26.0	26.9	31.6	28.2	20.0	20.0	25.9	21.5
1987	26.0	27.0	31.2	28.5	20.5	20.5	25.2	21.7
1988	26.0	27.4	31.5	28.8	20.5	20.6	24.6	21.3
1989	26.5	27.2	30.8	28.4	20.5	20.4	23.5	20.9
1990	27.5	26.9	29.9	28.0	20.0	20.3	23.0	20.8
1991	27.5	27.3	30.0	28.4	20.2	20.9	23.0	21.3
1992	27.5	27.0	29.2	27.9	20.2	20.5	22.7	20.8
1993	27.5	27.8	29.6	28.4	20.4	20.7	22.8	21.0
1994	27.5	27.5	29.6	28.3	20.5	20.5	22.0	20.7
1995	27.5	27.7	30.3	28.6	20.6	20.3	21.5	20.5
1996	27.5	28.3	29.7	28.7	20.7	20.5	22.1	20.7
1997	27.5	27.9	29.8	28.6	20.7	20.1	22.1	20.4
1998	27.5	28.1	28.1	28.8	20.7	20.4	23.0	20.8

Source:

U.S. Department of Transportation, NHTSA, "Summary of Fuel Economy Performance," Washington, DC, March 1998. (Additional resources: <http://www.nhtsa.dot.gov>)

^aOnly vehicles with at least 75 percent domestic content can be counted in the average domestic fuel economy for a manufacturer.

^bRepresents two- and four-wheel drive trucks combined. Gross vehicle weight of 0-6,000 pounds for model year 1978-1979 and 0-8,500 pounds for subsequent years.

^cAll CAFE calculations are sales-weighted.

^dStandards were set for two-wheel drive and four-wheel drive light trucks separately, but no combined standard was set in this year.

^eData are not available.



Table 6.13
Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-96^a
 (thousands)

Model year	Current dollars	1990 constant dollars ^b
1983	58	76
1984	5,958	7,496
1985	15,565	18,908
1986	29,872	35,603
1987	31,261	35,945
1988	44,519	49,181
1989	47,381	49,946
1990	48,449	48,449
1991	42,243	40,511
1992	38,287	35,645
1993	28,688	25,963
1994	31,478	27,764
1995	40,788	34,955
1996	^c	^c
Total	404,547	410,442

Source:

U.S. Department of Transportation, National Highway Traffic Safety Administration, Office of Vehicle Safety Compliance, Washington, DC, March, 1998.
 (Additional resources: <http://www.nhtsa.dot.gov>)

Table 6.14
Tax Receipts from the Sale of Gas Guzzlers, 1980-96
 (thousands)

Fiscal year	Current dollars	1990 constant dollars ^b
1980	740	1,174
1981	780	1,121
1982	1,720	2,329
1983	4,020	5,273
1984	8,820	11,097
1985	39,790	48,336
1986	147,660	175,987
1987	145,900	167,759
1988	116,780	129,008
1989	109,640	115,575
1990	103,200	103,200
1991	118,400	113,546
1992	144,200	134,250
1993	111,600	100,998
1994	64,100	56,536
1995	73,500	62,990
1996	52,600	43,816

Source:

Motor Vehicle Manufacturers Association, *Motor Vehicle Facts and Figures 1997*, Detroit, MI, 1997, p. 82.
 (Additional resources: <http://www.aama.com>)

^a These are fines which are actually collected. Fines which are assessed in a certain year may not have been collected in that year.

^b Adjusted using the Consumer Price Inflation Index.

^c No CAFE fines have been collected for MY 1996.



Consumers must pay the Gas Guzzler Tax when purchasing an automobile that has an Environmental Protection Agency (EPA) fuel economy rating less than that stipulated in the table below. The Gas Guzzler Tax doubled in 1991 after remaining constant from 1986 to 1990.

Table 6.15
The Gas Guzzler Tax on New Cars
(dollars per vehicle)

Vehicle fuel economy (mpg)	1980	1981	1982	1983	1984	1985	1986-90	1991+
Over 22.5	0	0	0	0	0	0	0	0
22.0-22.5	0	0	0	0	0	0	500	1,000
21.5-22.0	0	0	0	0	0	0	500	1,000
21.0-21.5	0	0	0	0	0	0	650	1,300
20.5-21.0	0	0	0	0	0	500	650	1,300
20.0-20.5	0	0	0	0	0	500	850	1,700
19.5-20.0	0	0	0	0	0	600	850	1,700
19.0-19.5	0	0	0	0	450	600	1,050	2,100
18.5-19.0	0	0	0	350	450	800	1,050	2,100
18.0-18.5	0	0	200	350	600	800	1,300	2,600
17.5-18.0	0	0	200	500	600	1,000	1,300	2,600
17.0-17.5	0	0	350	500	750	1,000	1,500	3,000
16.5-17.0	0	200	350	650	750	1,200	1,500	3,000
16.0-16.5	0	200	450	650	950	1,200	1,850	3,700
15.5-16.0	0	350	450	800	950	1,500	1,850	3,700
15.0-15.5	0	350	600	800	1,150	1,500	2,250	4,500
14.5-15.0	200	450	600	1,000	1,150	1,800	2,250	4,500
14.0-14.5	200	450	750	1,000	1,450	1,800	2,700	5,400
13.5-14.0	300	550	750	1,250	1,450	2,200	2,700	5,400
13.0-13.5	300	550	950	1,250	1,750	2,200	3,200	6,400
12.5-13.0	550	650	950	1,550	1,750	2,650	3,200	6,400
Under 12.5	550	650	1,200	1,550	2,150	2,650	3,850	7,700

Source:

Internal Revenue Service, Form 6197, (Rev. 1-91), "Gas Guzzler Tax."

(Additional resources: <http://www.irs.ustreas.gov>)



New Data by Vehicle Speed

ORNL has developed fuel consumption and emissions lookup tables for the Federal Highway Administration, for use in their TRAF series of traffic models (NETSIM, CORSIM, FRESIM), although more generic uses are also possible. To develop the data-based models, vehicles are tested both on-road and on a chassis dynamometer. Engine parameters are measured on-road under real-world driving conditions that cover the vehicle's entire operating envelope. Emissions and fuel consumption are then measured on the chassis dynamometer as functions of engine conditions. The two data sets are merged to produce the final three-dimensional maps as functions of vehicle speed and acceleration. Eight well-functioning, late-model vehicles, and one 1997 model vehicle, have been tested thus far in fully warmed-up conditions.

Similar continuing work is planned for the Department of Energy as well as FHWA, which will include more well-functioning, late-model vehicles, pre-control (1960's) vehicles, malfunctioning high-emitter vehicles, light-duty diesel vehicles (cars and pickup trucks), alternative fuel vehicles, and possibly heavy-duty diesel vehicles. ORNL will also be developing cold-start algorithms to enhance the existing models, since emissions and fuel economy generally improve as vehicles warm up to normal operating temperatures.

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Table 6.16
Vehicle Specifications for Tested Vehicles

Vehicle	Curb weight	Engine	Fuel delivery system ^a	Transmission	EPA fuel economy	
					City	Highway
1988 Chevrolet Corsica	2,665	2.8 liter V6	PFI	M5	19	29
1994 Olds Cutlass Supreme	3,290	3.4 liter V6	PFI	L4	17	26
1994 Oldsmobile 88	3,433	3.8 liter V6	PFI	L4	19	29
1994 Mercury Villager	4,020	3.0 liter V6	PFI	L4	17	23
1995 Geo Prizm	2,359	1.6 liter I-4	PFI	L3	26	30
1994 Jeep Grand Cherokee	3,820	4.0 liter I-6	PFI	L4	15	20
1994 Chevrolet Pickup	4,020	5.7 liter V8	TBI	L4	14	18
1993 Subaru Legacy	2,800	2.2 liter H4	PFI	L4	22	29
1997 Toyota Celica	2,395	1.8 liter I4	PFI	L4	27	34

Source:

West, B.H., R.N. McGill, J.W. Hodgson, S.S. Sluder, and D.E. Smith, *Development and Verification of Light-Duty Modal Emissions and Fuel Consumption Values for Traffic Models*, Washington, DC, April 1997 and additional project data, April 1998.

^a PFI = port fuel injection. TBI = throttle-body fuel injection.



The two earlier studies by the Federal Highway Administration (FHWA) indicate maximum fuel efficiency was achieved at speeds of 35 to 40 mph. The recent FHWA study indicates greater fuel efficiency at higher speeds. Note that the 1973 study did not include light trucks.

Table 6.17
Fuel Economy by Speed, 1973, 1984, and 1997
(miles per gallon)

Speed (miles per hour)	1973 ^a (13 vehicles)	1984 ^b (15 vehicles)	1997 ^c (9 vehicles)
15	d	21.1	24.4
20	d	25.5	27.9
25	d	30.0	30.5
30	21.1	31.8	31.7
35	21.1	33.6	31.2
40	21.1	33.6	31.0
45	20.3	33.5	31.6
50	19.5	31.9	32.4
55	18.5	30.3	32.4
60	17.5	27.6	31.4
65	16.2	24.9	29.2
70	14.9	22.5	26.8
75	d	20.0	24.8
<i>Fuel economy loss</i>			
55-65 mph	12.4%	17.8%	9.7%
65-70 mph	8.0%	9.6%	8.2%
55-70 mph	19.5%	25.7%	17.1%

Source:

1973 - U.S. Department of Transportation, Federal Highway Administration, Office of Highway Planning, *The Effect of Speed on Automobile Gasoline Consumption Rates*, Washington, DC, October 1973.

1984 - U.S. Department of Transportation, Federal Highway Administration, *Fuel Consumption and Emission Values for Traffic Models*, Washington, DC, May 1985.

1997 - West, B.H., R.N. McGill, J.W. Hodgson, S.S. Sluder, and D.E. Smith, *Development and Verification of Light-Duty Modal Emissions and Fuel Consumption Values for Traffic Models*, FHWA Report (in press), Washington, DC, April 1997, and additional project data, April 1998.

(Additional resources: <http://www.fhwa-tsis.com>)

^aModel years 1970 and earlier automobiles.

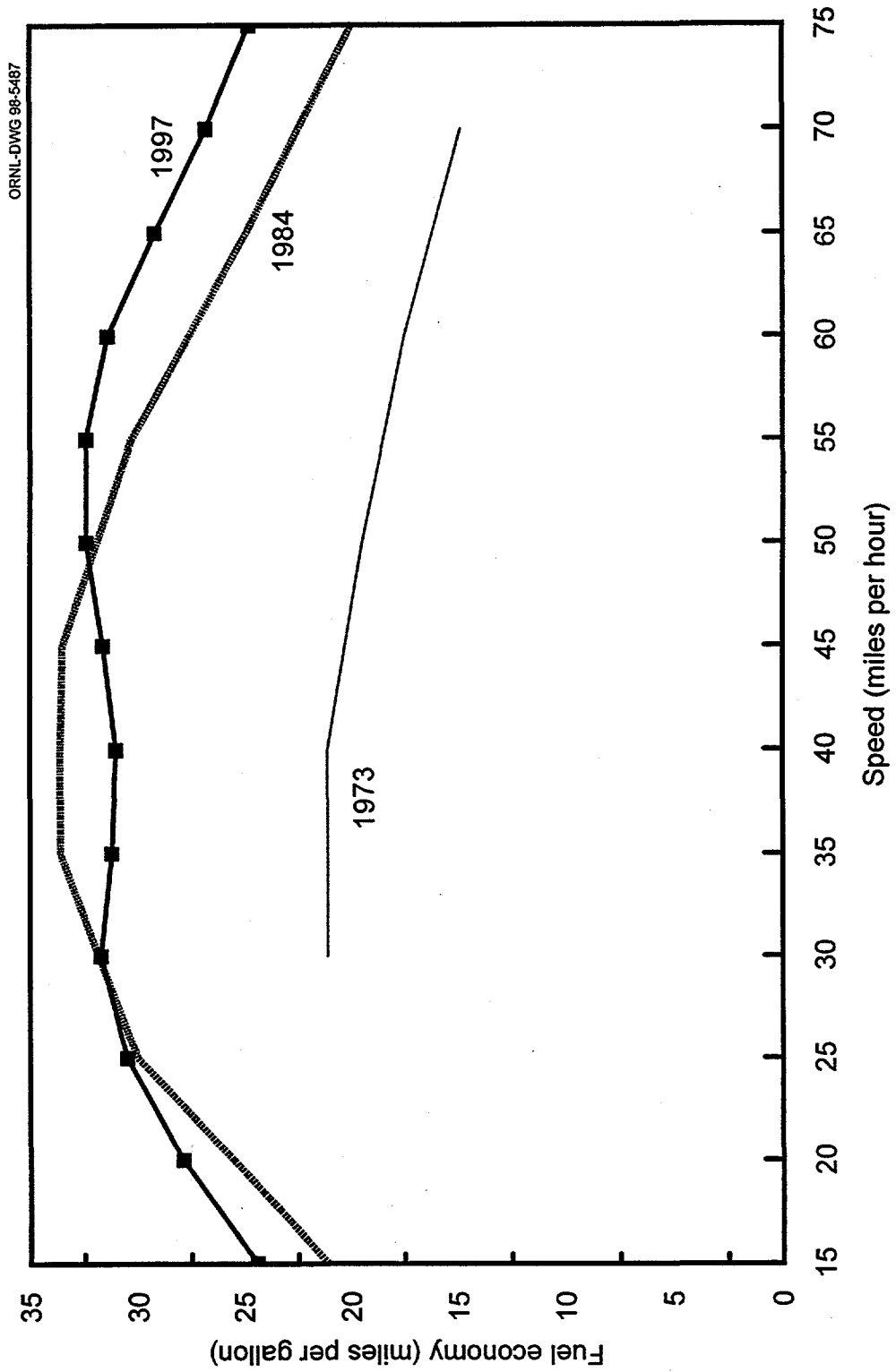
^bModel years 1981-84 automobiles and light trucks.

^cModel years 1988-97 automobiles and light trucks.

^dData are not available.



Figure 6.4. Fuel Economy by Speed, 1973, 1984, and 1997



Source: See Table 6.17.



Table 6.18
Steady Speed Fuel Economy for Tested Vehicles
 (miles per gallon)

Speed (mph)	1988		1993		1994		1994		1994		1994		1995		1997	
	Chevrolet Corsica	Subaru Legacy	Oldsmobile Olds 88	Oldsmobile Cutlass	Chevrolet Pickup	1994 Jeep Grand Cherokee	Mercury Villager	Geo Prizm	Toyota Celica							
5	10.0	14.5	10.5	5.1	7.9	8.2	12.3	18.1	19.1							
10	16.8	24.7	14.9	7.9	16.0	11.2	19.0	23.1	34.1							
15	17.7	31.9	22.2	11.4	16.3	17.5	22.4	38.9	41.7							
20	21.7	34.4	26.3	12.5	19.9	24.7	25.8	39.4	46.0							
25	23.9	37.4	28.3	15.6	22.7	21.8	30.8	41.7	52.6							
30	28.7	39.7	29.0	19.0	26.3	21.6	30.3	40.0	50.8							
35	28.6	38.0	30.9	21.2	24.3	25.0	26.1	39.1	47.6							
40	29.2	37.0	33.2	23.0	26.7	25.5	29.0	38.9	36.2							
45	28.8	33.7	32.4	23.0	27.3	25.4	27.8	42.3	44.1							
50	31.2	33.7	34.2	27.3	26.3	24.8	30.1	39.1	44.8							
55	29.1	37.7	34.6	29.1	25.1	24.0	31.7	37.7	42.5							
60	28.2	35.9	32.5	28.2	22.6	23.2	27.3	36.7	48.4							
65	28.7	33.4	30.0	25.0	21.8	21.3	25.3	34.1	43.5							
70	26.1	31.0	26.7	22.9	20.1	20.0	23.9	31.7	39.2							
75	23.7	28.8	24.0	21.6	18.1	19.1	22.4	28.3	36.8							
<i>Fuel economy loss</i>																
55-65 mph	1.4%	11.4%	13.3%	14.1%	13.1%	11.3%	20.2%	9.5%	9.7%							
65-75 mph	17.4%	13.8%	20.0%	13.6%	17.0%	10.3%	11.5%	17.0%	15.3%							
55-75 mph	18.6%	23.6%	30.6%	25.8%	27.9%	20.4%	29.3%	24.9%	23.6%							

Source:

B.H. West, R.N. McGill, J.W. Hodgson, S.S. Sluder, D.E. Smith, *Development and Verification of Light-Duty Modal Emissions and Fuel Consumption Values for Traffic Models*, Washington, DC, April 1997, and additional project data, April 1998.
 (Additional resources: <http://www.fhwa-tsis.com>)

Note:

For specifications of the tested vehicles, please see page 6-21.



The Environmental Protection Agency (EPA) tests new vehicles to determine fuel economy ratings. The city and highway fuel economies that are posted on the windows of new vehicles are determined by testing the vehicle during these driving cycles. The driving cycles simulate the performance of an engine while driving in the city and on the highway. Once the urban cycle is completed, the engine is stopped, then started again for the 8.5 minute hot start cycle.

Figure 6.5. Urban Driving Cycle

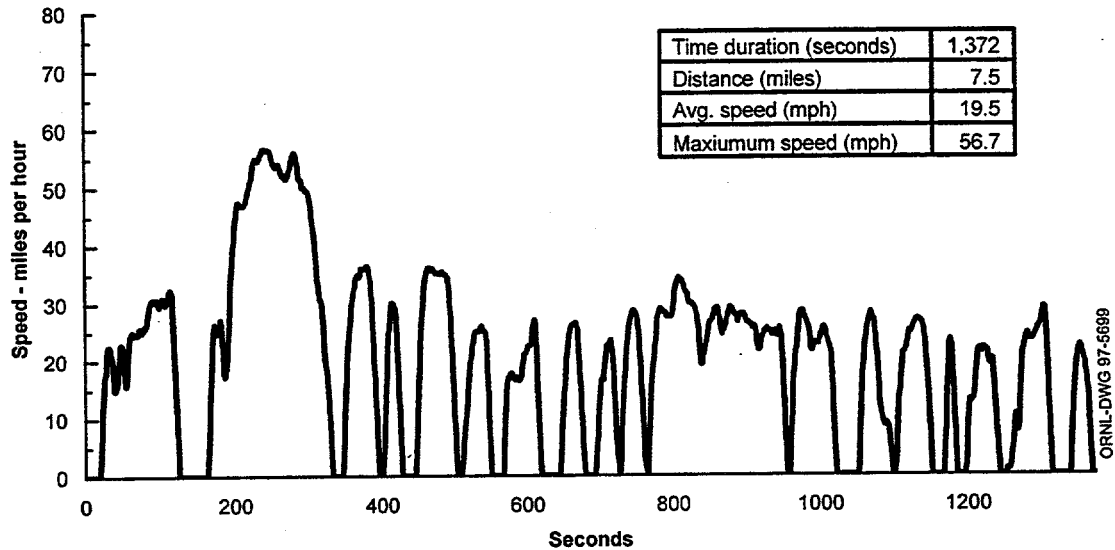
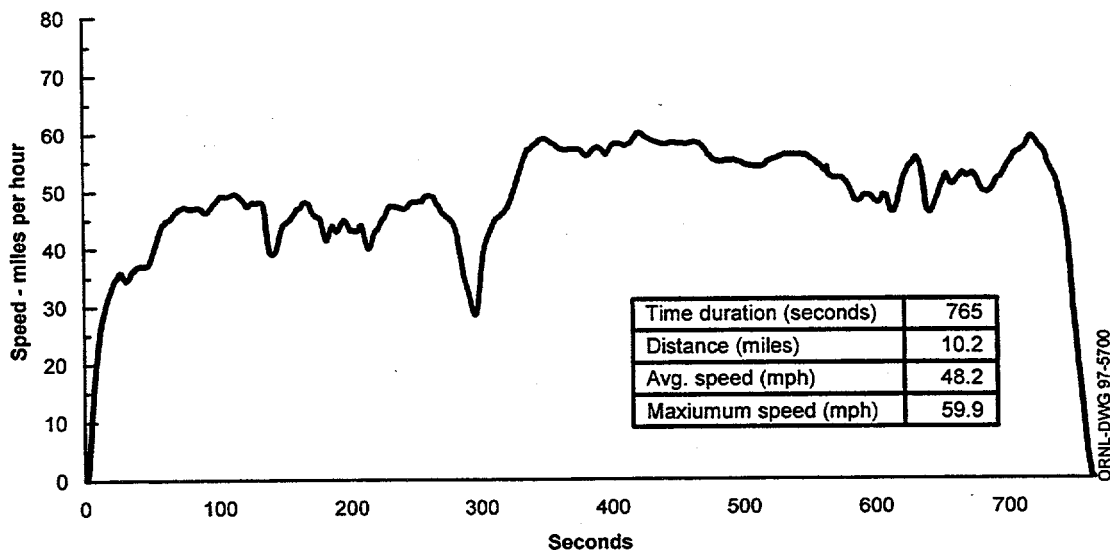


Figure 6.6. Highway Driving Cycle



Source:

Code of Federal Regulations, 40CFR, "Subpart B - Fuel Economy Regulations for 1978 and Later Model Year Automobiles - Test Procedures," July 1, 1988 edition, p. 676.



The New York Test Cycle was developed in the 1970's in order to simulate driving in downtown congested areas. The Representative Number Five Test Cycle was developed recently to better represent actual on-road driving by combining modern urban and freeway driving.

Figure 6.7. New York City Driving Cycle

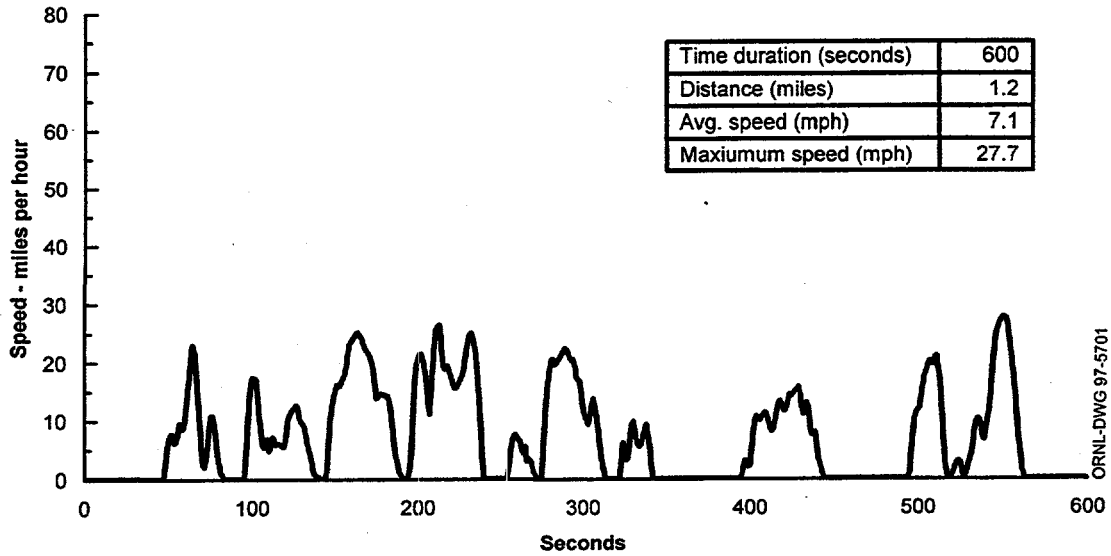
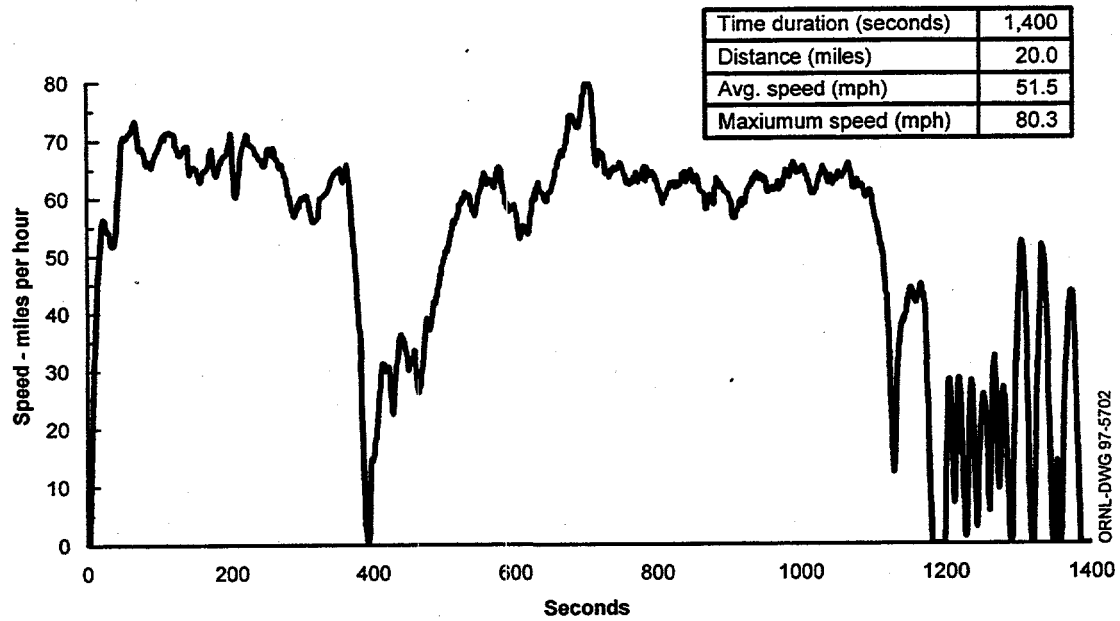


Figure 6.8. Representative Number Five Driving Cycle



Source:

Data obtained from Michael Wang, Argonne National Laboratory, Argonne, IL, 1997.



Chapter 7

Heavy Vehicles and Characteristics

Summary Statistics

Table		
7.1	Heavy single-unit trucks, 1996	
	<i>Registration (thousands)</i>	5,265
	<i>Vehicle miles (millions)</i>	63,967
	<i>Fuel economy (miles per gallon)</i>	6.8
7.1	Combination trucks, 1996	
	<i>Registration (thousands)</i>	1,742
	<i>Vehicle miles (millions)</i>	118,789
	<i>Fuel economy (miles per gallon)</i>	5.9
7.3	Trucks by size, 1992 Truck Inventory & Use Survey	
	<i>Light (0-10,000 lbs)</i>	93.3%
	<i>Medium (10,001-26,000 lbs)</i>	3.4%
	<i>Heavy (26,001 lbs and over)</i>	3.5%
7.11	Freight Shipments, 1993 Commodity Flow Survey	
	<i>Value (million dollars)</i>	6,123,832
	<i>Tons (thousands)</i>	12,157,105
	<i>Ton-miles (millions)</i>	3,627,919
7.13	Bus passenger miles, 1996	(millions)
	<i>Transit</i>	18,860
	<i>Intercity</i>	28,300
	<i>School</i>	99,000



Table 7.1
Summary Statistics for Other Single-Unit and Combination Trucks, 1970-96^a

Year	Other single-unit trucks ^b				Combination trucks ^c			
	Registrations (thousands)	Vehicle use (million miles)	Fuel use (million gallons)	Fuel economy (miles per gallon)	Registrations (thousands)	Vehicle travel (million miles)	Fuel use (million gallons)	Fuel economy (miles per gallon)
1970	3,681	27,081	3,968	6.8	905	35,134	7,348	4.8
1971	3,770	28,985	4,217	6.9	919	37,217	7,595	4.9
1972	3,918	31,414	4,844	6.5	961	40,706	8,120	5.0
1973	4,131	33,661	5,294	6.4	1,029	45,649	9,026	5.1
1974	4,211	33,441	5,261	6.4	1,085	45,966	9,080	5.1
1975	4,232	34,606	5,420	6.4	1,131	46,724	9,177	5.1
1976	4,350	36,390	5,706	6.4	1,225	49,680	9,703	5.1
1977	4,450	39,339	6,268	6.3	1,240	55,682	10,814	5.1
1978	4,518	42,747	6,955	6.1	1,342	62,992	12,165	5.2
1979	4,505	42,012	7,050	6.0	1,386	66,992	12,864	5.2
1980	4,374	39,813	6,923	5.8	1,417	68,678	13,037	5.3
1981	4,455	39,568	6,867	5.8	1,261	69,134	13,509	5.1
1982	4,325	40,658	6,803	6.0	1,265	70,765	13,583	5.2
1983	4,204	42,546	6,965	6.1	1,304	73,586	13,796	5.3
1984	4,061	44,419	7,240	6.1	1,340	77,377	14,188	5.5
1985	4,593	45,441	7,399	6.1	1,403	78,063	14,005	5.6
1986	4,313	45,637	7,386	6.2	1,408	81,038	14,475	5.6
1987	4,188	48,022	7,523	6.4	1,530	85,495	14,990	5.7
1988	4,470	49,434	7,701	6.4	1,667	88,551	15,224	5.8
1989	4,519	50,870	7,779	6.5	1,707	91,879	15,733	5.8
1990	4,487	51,901	8,357	6.2	1,709	94,341	16,133	5.8
1991	4,481	52,898	8,172	6.5	1,691	96,645	16,809	5.7
1992	4,370	53,874	8,237	6.5	1,675	99,510	17,216	5.8
1993	4,408	56,772	8,488	6.7	1,680	103,116	17,748	5.8
1994	4,906	61,284	9,032	6.8	1,681	108,932	18,653	5.8
1995	5,024	62,705	9,216	6.8	1,696	115,451	19,777	5.8
1996	5,265	63,967	9,365	6.8	1,742	118,789	20,098	5.9
1970-96	1.4%	3.4%	3.4%	0.0%	2.6%	4.8%	3.9%	0.8%
1986-96	2.0%	3.4%	2.4%	0.9%	2.2%	3.9%	3.3%	0.5%

Average annual percentage change

Source:

U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1996*, Washington, DC, 1997, Table VM1, p. V-94 and annual. (Additional resources: <http://www.fhwa.dot.gov>)

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

^b Other single-unit trucks are defined as all single-unit trucks with more than two axles or more than four tires.

^c The fuel economy for combination trucks is not the same as the fuel economy for Class 8 trucks. Fuel economy for Class 8 trucks is shown in Table 3.24.



Table 7.2
New Retail Truck Sales by Gross Vehicle Weight, 1970-96^a
(thousands)

Calendar year	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Total
	6,000 lbs. or less	6,001- 10,000 lbs.	10,001- 14,000 lbs.	14,001- 16,000 lbs.	16,001- 19,500 lbs.	19,501- 26,000 lbs.	26,001- 33,000 lbs.	33,001 lbs. and over	
1970 ^b	1,049	408	6	12	58	133	36	89	1,791
1971	1,185	488	6	15	46	140	34	99	2,013
1972	1,498	599	55	11	29	182	35	126	2,535
1973	1,754	758	50	3	16	236	37	155	3,009
1974	1,467	696	21	3	14	207	31	148	2,587
1975	1,101	952	23	1	9	159	23	83	2,351
1976	1,318	1,401	43	c	9	153	22	97	3,043
1977	1,306	1,803	36	3	5	163	28	141	3,485
1978	1,334	2,140	73	6	3	156	41	162	3,915
1979	1,271	1,574	15	3	3	146	50	174	3,236
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	106	201	6,481
1996	4,829	1,690	52	59	7	19	104	170	6,930
1970-85	5.7%	7.9%	4.1%	-	-15.1%	-6.6%	6.8%	2.8%	5.5%
1986-96	3.6%	3.4%	15.8%	-	1.6%	-8.3%	0.3%	4.2%	3.6%
Average annual percentage change									

Source:

American Automobile Manufacturers Association, *Motor Vehicle Facts and Figures 1997*, Detroit, MI, 1997, p. 20, and annual.
(Additional resources: <http://www.aama.com>)

^a Sales include domestic-sponsored imports.

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

^c Less than 500 trucks.



Truck Inventory and Use Survey

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. Data for 1992 have been released in a report, as well as on CD-ROM. Copies may be obtained by contacting the U.S. Bureau of the Census, Transportation Characteristics Surveys Branch (301)457-2797. Internet site <http://www.census.gov/svsd/www/tiusview.html> is the location of the TIUS on-line.

The 1987 and 1992 surveys, in addition to trucks, included minivans, vans, station wagons on truck chassis, and jeep-like vehicles. The 1977 and 1982 surveys did not include those vehicle types. The estimated number of trucks that were within the scope of the 1992 TIUS and registered in the U.S. as of July 1, 1992, was 59.2 million. These trucks were estimated to have been driven a total of 786.3 billion miles during 1992, an increase of 33.7% from 1987. The average annual miles traveled per truck was estimated at 11,900 miles.

In the 1992 TIUS, 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. For illustration of this, see Tables 3.25 and 3.26. The first set of data are based on the average weight as reported by the respondent; the data on Table 3.26 are based on the Gross Vehicle Weight Class of the vehicle when it was manufactured. There is a 22.8% difference in the number of Class 1 trucks. In most tables, the Gross Vehicle Weight Class was used. However, on the tables comparing different survey estimates, average weight must be used, as the older surveys did not include data on the Gross Vehicle Weight rating.



These tables illustrate the difference between two weight variables in the Truck Inventory and Use Survey. The manufacturer's gross vehicle weight class is likely to be a more accurate representation.

Table 7.3
Truck Statistics by Gross Vehicle Weight Class, 1992

Manufacturer's gross vehicle weight class	Number of trucks	Percentage of trucks	Average annual miles per truck	Average fuel economy	Gallons of fuel used (millions)	Percentage of fuel use
6,000 lbs and less	37,068,163	62.61%	12,739	17.23	27,397	44.76%
6,001 – 10,000 lbs	17,519,216	29.59%	11,610	13.00	15,646	25.56%
10,001 – 14,000 lbs	349,301	5.90%	15,814	9.48	583	0.95%
14,001 – 16,000 lbs	127,219	0.21%	14,420	9.19	200	0.33%
16,001 – 19,500 lbs	209,158	0.35%	4,876	8.21	124	0.20%
19,501 – 26,000 lbs	1,859,529	3.14%	11,746	7.26	3,008	4.91%
26,001 – 33,000 lbs	197,985	0.33%	30,074	6.64	897	1.46%
33,001 lbs and up	1,870,183	3.16%	39,832	5.58	13,353	21.82%
Total	59,200,755	100.00%	13,281	12.85	61,206	100.00%

Source:

U.S. Department of Commerce, Bureau of the Census, *1992 Truck Inventory and Use Survey*, Microdata File on CD, 1995. (Additional resources: <http://www.census.gov/svsd/www.tiusview.html>)

Table 7.4
Percentage of Trucks by Size Class, 1977, 1982, 1987, and 1992
(percentage)

Size class	Average weight as reported by respondent	1977 TIUS	1982 TIUS	1987 TIUS	1992 TIUS
Class 1	6,000 lbs and less	66.0%	77.8%	85.4%	85.4%
Class 2	6,001–10,000 lbs	17.9%	11.6%	6.5%	7.9%
Class 3	10,000–14,000 lbs	3.1%	1.6%	1.2%	1.2%
Class 4	14,001–16,000 lbs	1.3%	0.9%	0.5%	0.5%
Class 5	16,001–19,500 lbs	2.1%	1.0%	0.6%	0.5%
Class 6	19,501–26,000 lbs	3.4%	2.4%	1.7%	1.2%
Class 7	26,001–33,000 lbs	1.5%	1.0%	0.8%	0.7%
Class 8	33,001 lbs and over	4.6%	3.8%	3.3%	2.8%

Source:

Estimates are based on data provided on the following public use tapes: U.S. Department of Commerce, Bureau of the Census, 1977 Census of Transportation, *Truck Inventory and Use Survey*, Washington, DC, 1980; U.S. Department of Commerce, Bureau of the Census, 1982 Census of Transportation, *Truck Inventory and Use Survey*, Washington, DC, 1985; U.S. Department of Commerce, Bureau of the Census, 1987 Census of Transportation, *Truck Inventory and Use Survey*, Washington, DC, 1990; and U.S. Department of Commerce, Bureau of the Census, 1992 Census of Transportation, *Truck Inventory and Use Survey*, Washington, DC, 1995. (Additional resources: <http://www.census.gov/svsd/www.tiusview.html>)



Table 7.5
Truck Fuel Economy by Size Class, 1977, 1982, 1987, and 1992
 (miles per gallon)

Size class	Average weight as reported by respondent	1977 TIUS	1982 TIUS	1987 TIUS	1992 TIUS
Class 1	6,000 lbs and less	13.2	14.2	15.0	16.1
Class 2	6,001-10,000 lbs	11.5	11.1	10.9	12.2
Class 3	10,000-14,000 lbs	9.4	8.1	8.1	9.2
Class 4	14,001-16,000 lbs	6.9	7.5	7.5	8.5
Class 5	16,001-19,500 lbs	7.6	7.2	7.1	8.1
Class 6	19,501-26,000 lbs	6.1	6.9	6.4	7.2
Class 7	26,001-33,000 lbs	5.3	6.2	6.1	6.8
Class 8	33,001 lbs and over	4.8	5.2	5.3	5.5

Source:

Estimates are based on data provided on the following public use tapes: U.S. Department of Commerce, Bureau of the Census, 1977 Census of Transportation, *Truck Inventory and Use Survey*, Washington, DC, 1980; U.S. Department of Commerce, Bureau of the Census, 1982 Census of Transportation, *Truck Inventory and Use Survey*, Washington, DC, 1985; U.S. Department of Commerce, Bureau of the Census, 1987 Census of Transportation, *Truck Inventory and Use Survey*, Washington, DC, 1990; and U.S. Department of Commerce, Bureau of the Census, 1992 Census of Transportation, *Truck Inventory and Use Survey*, Washington, DC, 1995. (Additional resources: <http://www.census.gov/svsd/www/tiusview.html>)

Table 7.6
Percentage of Trucks by Fleet Size and Primary Refueling Facility, 1992

Truck fleet size	Primary refueling facility				Total
	Central company-owned fueling facility	Single contract fueling facility located off-site	Public fueling stations	Other	
1	7.91%	2.52%	84.55%	5.02%	100%
2-5	16.41%	4.44%	72.51%	6.64%	100%
6-9	31.40%	7.73%	55.53%	5.33%	100%
10-24	43.90%	9.44%	43.70%	2.96%	100%
25-99	56.98%	7.39%	33.50%	2.13%	100%
100-499	58.34%	7.50%	31.18%	2.98%	100%
500-999	57.93%	7.26%	30.89%	3.92%	100%
1,000-4,999	60.71%	3.28%	32.65%	3.36%	100%
5,000-9,999	58.90%	5.05%	29.09%	6.96%	100%
10,000 & up	59.96%	4.68%	25.69%	9.66%	100%
Total	33.26%	5.76%	56.15%	4.83%	100%

Source:

U.S. Department of Commerce, Bureau of the Census, 1992 *Truck Inventory and Use Survey*, Microdata File on CD, 1995. (Additional resources: <http://www.census.gov/svsd/www/tiusview.html>)



Though diesel engines are generally more efficient than gasoline engines, variations in patterns of use and weight distributions within a weight category can cause the fuel economies to be more similar. Data in the Total row give a good indication that the gasoline trucks are mainly lighter vehicles and diesels are used in heavier applications.

Table 7.7
Truck Fuel Economy by Fuel Type and Size Class, 1992
 (miles per gallon)

Size class	Manufacturer's gross vehicle weight class	Gasoline trucks	Diesel trucks
Class 1	6,000 lbs and less	17.2	18.8
Class 2	6,001-10,000 lbs	12.9	15.0
Class 3	10,001-14,000 lbs	9.3	9.5
Class 4	14,001-16,000 lbs	8.3	10.1
Class 5	16,001-19,500 lbs	7.6	10.0
Class 6	19,501-26,000 lbs	7.3	7.3
Class 7	26,001-33,000 lbs	6.1	6.7
Class 8	33,001 lbs and up	5.5	5.5
Total		15.4	6.5

Source:

U.S. Department of Commerce, Bureau of the Census, *1992 Truck Inventory and Use Survey*, Microdata File on CD, 1995. (Additional resources: <http://www.census.gov/svsd/www/tiusview.html>)



Table 7.8
Truck Statistics by Size, 1992

	Manufacturer's gross vehicle weight class			Total
	Light (< 10,000 lbs)	Medium (10,001- 26,000 lbs)	Heavy (> 26,000 lbs)	
Trucks	54,587,379	685,679	3,927,697	59,200,755
Trucks (%)	92.21%	1.16%	6.63%	100%
Miles per truck	12,377	12,219	26,044	13,281
Total miles (%)	85.92%	1.07%	13.01%	100%
Fuel use (%)	70.32%	1.48%	28.20%	100%
Fuel economy (mpg)	15.70	9.24	5.93	12.85
	Range of operation			
Under 50 miles	75.84%	68.55%	56.47%	74.49%
50-100 miles	11.33%	14.40%	14.55%	11.57%
100-200 miles	3.31%	4.43%	6.53%	3.53%
200-500 miles	2.14%	1.68%	6.33%	2.41%
Over 500 miles	2.17%	1.36%	7.51%	2.51%
Off-road	5.21%	9.59%	8.61%	5.48%
Total	100%	100%	100%	100%
	Primary refueling facility			
Central company-owned	15.83%	23.56%	36.73%	32.06%
Single off-site contract	3.51%	4.34%	6.30%	5.65%
Public station	77.05%	66.72%	51.86%	57.37%
Other	3.61%	5.39%	5.10%	4.93%
Total	100%	100%	100%	100%

Source:

U.S. Department of Commerce, Bureau of the Census, *1992 Truck Inventory and Use Survey*, Microdata File on CD, 1995. (Additional resources: <http://www.census.gov/svsd/www/tiusview.html>)



Table 7.9
 Percentage of Trucks by Major Use and Primary Refueling Facility, 1992

Major Use	Primary refueling facility				Total
	Central company-owned fueling facility	Single contract fueling facility located off-site	Public fueling stations	Other	
Agricultural services	32.66%	2.73%	51.68%	12.93%	100%
Forestry or Lumbering Activities	26.34%	6.43%	63.71%	3.52%	100%
Construction work	35.79%	4.93%	56.71%	2.57%	100%
Contractor Activities or special trades	16.62%	4.93%	77.01%	1.44%	100%
Manufacturing, refining or processing activities	37.54%	11.21%	49.05%	2.20%	100%
Wholesale trade	35.55%	12.72%	49.99%	1.74%	100%
Retail trade	31.35%	8.18%	58.67%	1.81%	100%
Business and Personal services	23.48%	5.94%	68.24%	2.34%	100%
Utilities	58.68%	2.31%	36.42%	2.58%	100%
Mining or quarrying activities	53.75%	5.82%	38.05%	2.38%	100%
Daily rental	49.95%	2.79%	44.75%	2.50%	100%
Not in use	14.42%	3.64%	46.70%	35.24%	100%
For-hire transportation	37.80%	5.22%	53.65%	3.33%	100%
One-way rental	5.28%	0.07%	93.05%	1.60%	100%
Personal transportation	1.51%	0.68%	93.14%	4.67%	100%
Total	32.06%	5.65%	57.37%	4.93%	100%

Source:

U.S. Department of Commerce, Bureau of the Census, *1992 Truck Inventory and Use Survey*, Microdata File on CD, 1995.
 (Additional resources: <http://www.census.gov/svsd/www/tiusview.html>)



Table 7.10
Percentage of Trucks by Size Ranked by Major Use, 1992

Rank	Light (< 10,000 lbs)	Medium (10,001 – 26,000 lbs)	Heavy (> 26,000 lbs)
1	Personal 73.54%	Agriculture 21.12%	For Hire 18.21%
2	Construction 7.57%	Construction 20.59%	Construction 18.17%
3	Services^a 5.12%	Services^a 12.32%	Agriculture 17.42%
4	Agriculture 4.99%	Retail 9.05%	Wholesale 8.73%
5	Retail 2.94%	Utilities 6.44%	Retail 7.22%
6	Not in Use 1.50%	Wholesale 6.04%	Personal 6.56%
7	Wholesale 1.38%	For Hire 5.90%	Services^a 6.20%
8	Manufacturing 1.02%	Personal 5.86%	Manufacturing 5.53%
9	Utilities 0.72%	Manufacturing 3.51%	Not in Use 3.49%
10	Daily Rental 0.40%	Not in Use 3.43%	Utilities 2.66%
11	Forestry 0.31%	Daily Rental 2.89%	Forestry 2.16%
12	Mining 0.27%	Forestry 1.48%	Daily Rental 1.70%
13	For Hire 0.24%	Mining 1.00%	Mining 1.69%
14	One-Way Rental 0.01%	One-Way Rental 0.36%	One-Way Rental 0.26%
15	Other 0.00%	Other 0.00%	Other 0.00%

Source:

U.S. Department of Commerce, Bureau of the Census, *1992 Truck Inventory and Use Survey*, Micro data File on CD, 1995. (Additional resources: <http://www.census.gov/svsd/www/tiusview.html>)

^a Business and personal services.



1993 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 CFS is a continuation of statistics collected in the Commodity Transportation Survey from 1963 through 1977, and includes major improvements in methodology, sample size, and scope. A sample of 200,000 domestic establishments randomly selected from a universe of about 900,000 establishments engaged in mining, manufacturing, wholesale, auxiliary establishments (warehouses) of multi-establishment companies, and some selected activities in retail and service was used. Each selected establishment reported a sample of approximately 30 outbound shipments for a two-week period in each of the four calendar quarters of 1993. This produced a total sample of about 20 million shipments. For each sampled shipment, zip codes of origin and destination, 5-digit Standard Transportation Commodity Classification (STCC) code, weight, value, and modes of transport, were provided. Establishments were also asked to indicate whether the shipment was containerized, a hazardous material, or an export.

The 1993 CFS differs from previous surveys in its greatly expanded coverage of intermodalism. Earlier surveys reported only the principal mode. The 1993 survey reports all modes used for the shipment (for-hire truck, private truck, rail, inland water, deep sea water, pipeline, air, parcel delivery or U.S. Postal Service, other mode, unknown). Route distance for each mode for each shipment as imputed from a mode-distance table developed by Oak Ridge National Laboratory. Distance, in turn, was used to compute ton-mileage by mode of transport.

For more information about the Commodity Flow Survey, contact the Commodity Flow Survey Branch, Department of Commerce, Bureau of the Census, Services Division at (301) 457-2108, or visit the following Internet site: <http://www.bts.gov/cfs/cfs.html>



Table 7.11
1993 Commodity Flow Survey: Shipment Characteristics by Mode of Transportation

Mode	Value (million dollars)	Tons (thousands)	Ton miles (millions)	Value (percent)	Tons (percent)	Ton miles (percent)	Value per ton (dollars)	Value per pound (dollars)	Ton miles per ton
CFS plus ORNL	\$6,123,832	12,157,105	3,627,91	100.0%	100.0%	100.0%	\$503.7	\$0.25	298
Parcel, postal, courier service	\$563,277	18,892	13,151	9.2%	0.2%	0.4%	\$29,815.6	\$14.91	696
Truck (for-hire, private, both)	\$4,403,495	6,385,915	869,536	71.9%	52.5%	24.0%	\$689.6	\$0.34	136
Air (including truck and air)	\$139,087	3,139	4,009	2.3%	0.0%	0.1%	\$44,309.3	\$22.15	1,277
Rail	\$247,394	1,544,148	942,561	4.0%	12.7%	26.0%	\$160.2	\$0.08	610
Water	\$64,077	518,912	271,981	1.0%	4.3%	7.5%	\$123.5	\$0.06	524
Pipeline	\$89,849	483,645	^a	1.5%	4.0%	^a	\$185.8	\$0.09	*
Truck and rail	\$83,082	40,624	37,675	1.4%	0.3%	1.0%	\$2,045.1	\$1.02	927
Other intermodal	\$13,382	148,883	185,030	0.2%	1.2%	5.1%	\$89.9	\$0.04	1,243
Other and unknown	\$242,691	544,335	96,972	4.0%	4.5%	2.7%	\$445.8	\$0.22	178
ORNL estimates:									
Water (not in CFS)	\$187,085	1,609,309	614,104	3.1%	13.2%	16.9%	\$116.3	\$0.06	382
Pipeline (not in CFS)	\$90,413	859,303	592,900	1.5%	7.1%	16.3%	\$105.2	\$0.05	690
Intermodal ^b total	\$659,741	208,399	235,856	10.8%	1.7%	6.5%	\$3,165.8	\$1.58	1,132

Source:

U.S. Department of Commerce, Bureau of the Census, *1993 Commodity Flow Survey: United States, TC92-CF-52*, and Oak Ridge National Laboratory estimates, Washington, DC, 1996, p. 3. (Additional resources: <http://www.bts.gov/cfs/cfs.html>)

^aData do not meet publication standards.

^bIntermodal is a combination of parcel, postal or courier; truck and rail; truck and water, rail and water; and other intermodal. It excludes truck and air which is added to air transportation.



Table 7.12
Value, Tons, and Ton-Miles of Commodity Shipments, 1993

Commodity description ^a	Value (million dollars)	Tons (thousands)	Value per ton (dollars)	Ton-miles (millions)
Energy^b				
Petroleum or coal products	\$359,471	1,885,833	\$191	287,081
Coal	\$23,449	1,129,945	\$21	487,791
Lumber and forest				
Pulp, paper, or allied products	\$195,002	217,233	\$898	100,721
Lumber or wood products, excluding furniture	\$126,662	663,351	\$191	120,669
Forest products	\$1,700	30,520	\$56	3,635
Mining				
Metallic ores	\$20,278	149,562	\$136	36,895
Nonmetallic minerals	\$20,695	1,786,381	\$12	155,417
Farm and food				
Food or kindred products	\$856,884	859,764	\$997	270,984
Farm products	\$142,442	636,630	\$224	276,260
Fresh fish or other marine products	\$11,062	2,995	\$3,693	1,746
Equipment, machinery, and instruments				
Transportation equipment	\$652,474	87,617	\$7,447	49,098
Machinery, excluding electrical	\$442,770	34,180	\$12,954	19,112
Electrical machinery, equipment, or supplies	\$411,030	30,156	\$13,630	19,591
Instruments, photographic goods, optical goods, watches, or clocks	\$198,492	8,600	\$23,080	5,390
Industrial products				
Chemicals or allied products	\$532,907	545,405	\$977	236,856
Fabricated metal products	\$237,316	84,895	\$2,795	30,489
Primary metal products	\$228,610	266,409	\$858	97,266
Rubber or miscellaneous plastics products	\$175,267	52,349	\$3,348	25,528
Clay, concrete, glass, or stone products	\$91,365	799,481	\$114	84,032
Consumer goods				
Apparel or other finished textile products	\$291,203	15,128	\$19,249	9,967
Textile mill products	\$102,189	24,757	\$4,128	11,341
Furniture or fixtures	\$69,471	16,568	\$4,193	9,789
Tobacco products, excluding insecticides	\$60,640	3,225	\$18,803	931
Leather or leather products	\$50,645	2,401	\$21,093	2,182
Waste materials^c				
Waste or scrap materials	\$18,258	130,894	\$139	27,591
Waste hazardous materials or substances	\$558	813	\$686	314
Miscellaneous and other unknown				
Miscellaneous products of manufacturing	\$200,803	20,731	\$9,686	10,992
Miscellaneous freight shipments	\$81,297	20,830	\$3,903	5,038
Ordnance or accessories	\$17,174	663	\$25,903	629
Containers, carriers or devices, shipping, returned empty	\$1,144	702	\$1,630	230
Commodity unknown	\$21,941	7,804	\$2,812	2,522

Source:

U.S. Department of Commerce, Bureau of the Census, *1993 Commodity Flow Survey, United States, TC92-CF-52*, Washington, DC, 1996.

Note:

The sum of the data by commodity groups in this table is not equal to the total in previous table because it includes additional estimates of water and pipeline shipments by ORNL.

^aExcludes data for printed matter because the data do not meet publication standards.

^bExcludes data for pipeline shipments calculated by Oak Ridge National Laboratory (ORNL) that are included in previous table.

^cExcludes data on municipal solid wastes.



Table 7.13
Summary Statistics on Buses by Type, 1970-96

Year	Transit motor bus ^a	Intercity bus	School bus
Number in operation			
1970	49,700	22,000	288,700
1975	50,811	20,500	368,300
1980	59,411	21,400	418,255
1985	64,258	20,200	480,400
1990	58,714	20,680	508,261
1993	64,850	19,119	534,872
1994	68,123	19,146	547,718
1995	67,107	20,138	560,447
1996	67,874	20,649	569,395
Vehicle-miles (millions)			
1970	1,409	1,209	2,100
1975	1,526	1,126	2,500
1980	1,677	1,162	2,900
1985	1,863	933	3,448
1990	2,123	991	3,800
1993	2,210	1,065	4,300
1994	2,162	1,211	4,400
1995	2,178	1,194	5,000
1996	2,165	1,220	5,000
Passenger-miles (millions)			
1970	18,210	25,300	b
1975	18,300	25,400	b
1980	21,790	27,400	b
1985	21,161	23,800	b
1990	20,981	23,000	74,200
1993	20,247	24,700	94,200
1994	18,832	28,100	85,000
1995	18,818	27,700	95,000
1996	18,860	28,300	99,000
Energy use (trillion Btu)			
1970	44.8	26.6	37.5
1975	51.5	24.8	42.6
1980	61.3	29.3	47.5
1985	72.4	31.5	57.0
1990	78.9	21.7	62.2
1993	86.2 ^c	24.0	82.1
1994	86.7	24.7	90.6
1995	87.5	22.6	68.4 ^d
1996	85.1	23.1 ^c	68.4

Source:

See Appendix A for Table 7.13. (Additional resources: <http://www.apta.com>, <http://www.fhwa.dot.gov>, <http://www.schoolbusfleet.com>)

^a Data for transit buses after 1983 are not comparable with prior data. Data for prior years were provided voluntarily and statistically expanded; in 1984 reporting became mandatory.

^b Data are not available.

^c Beginning in 1992, data became available on alternative fuel use by transit buses.

^d Assumptions about fuel type changed in this year. See Appendix for details.

^e Estimated using vehicle-miles.



Chapter 8

Alternative Fuel Vehicles and Characteristics

Summary Statistics

Table		
8.1	Light-duty alternative fuel vehicles, 1996	288,511
	<i>LPG</i>	210,193
	<i>CNG</i>	50,270
	<i>LNG</i>	127
	<i>M85</i>	20,259
	<i>E85</i>	4,536
	<i>Electric</i>	3,126
8.2	Heavy-duty alternative fuel vehicles, 1996	64,105
	<i>LPG</i>	53,002
	<i>CNG</i>	9,874
	<i>LNG</i>	536
	<i>M85/M100</i>	178
	<i>E85</i>	361
	<i>Electric</i>	154
8.5	Number of alternative fuel refuel sites, 1997	6,240
	<i>LPG</i>	4,255
	<i>CNG</i>	1,426
	<i>LNG</i>	71
	<i>M85</i>	106
	<i>E85</i>	71
	<i>Electric</i>	310

Fuel type abbreviations are used throughout this chapter.

<i>LPG</i>	=	<i>liquified petroleum gas</i>
<i>CNG</i>	=	<i>compressed natural gas</i>
<i>M-85</i>	=	<i>85% methanol, 15% gasoline</i>
<i>E-85</i>	=	<i>85% ethanol, 15% gasoline</i>
<i>M-100</i>	=	<i>100% methanol</i>
<i>E-95</i>	=	<i>95% ethanol, 5% gasoline</i>
<i>LNG</i>	=	<i>liquified natural gas</i>



THE ALTERNATIVE FUELS DATA CENTER

The Department of Energy (DOE) has established the Alternative Fuels Data Center (AFDC) in support of its work aimed at fulfilling the Alternative Motor Fuels Act (AMFA) directives. The AFDC is operated and managed by the National Renewable Energy Laboratory (NREL) in Golden, Colorado.

The purposes of the AFDC are:

- to gather and analyze information on the fuel consumption, emissions, operation, and durability of alternative fuel vehicles, and
- to provide unbiased, accurate information on alternative fuels and alternative fuel vehicles to government agencies, private industry, research institutions, and other interested organizations.

The data are collected for three specific vehicle types: (1) light-duty vehicles, including automobiles, light trucks, and mini-vans; (2) heavy-duty vehicles such as tractor-trailers and garbage trucks; and (3) urban transit buses. An Oracle Relational Database Management System is used to manage the data, along with a statistical software package capable of providing statistical, graphic, and textual information to users. Several tables and graphs in this chapter contain statistics which were generated by the AFDC. Future editions of the *Transportation Energy Data Book* will continue to present graphical and statistical information from the AFDC.

The Department of Energy is sponsoring the **National Alternative Fuels Hotline** for Transportation Technologies in order to assist the general public and interested organizations in improving their understanding of alternative transportation fuels. The Hotline can be reached by dialing 1-800-423-1DOE, or on the Internet at <http://www.afdc.nrel.gov>.



Table 8.1
Estimates of Light-Duty Alternative Fuel Vehicles, 1994, 1996, and 1998

Fuel type	Private			State and local government			Federal Government		
	1994	1996	1998 ^a	1994	1996	1998 ^a	1994	1996	1998 ^a
LPG	169,000	167,000	178,000	43,000	43,000	45,000	33	193	380
CNG	21,496	25,020	37,755	7,452	11,305	16,823	7,022	13,945	14,156
LNG	27	10	12	32	45	74	35	72	181
M-85	2,675	6,633	9,302	2,410	5,958	7,329	9,291	7,668	4,733
M-100	0	0	0	0	0	0	0	0	0
E-85	58	793	1,906	408	1,995	4,830	139	1,748	4,136
E-95	1	0	0	1	0	0	0	0	0
Electricity	2,047	2,451	3,398	14	487	764	102	188	400
Total	196,304	201,907	230,373	53,317	62,790	74,820	16,622	23,814	23,986

Source:

U. S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 1996*, Washington, DC, December 1997, pp. 16-18.

(Additional resources: <http://www.eia.doe.gov>)

^aBased on plans or projections.

Table 8.2
Estimates of Heavy-Duty Alternative Fuel Vehicles, 1994, 1996, and 1998

Fuel type	Private			State and local government			Federal government		
	1994	1996	1998 ^a	1994	1996	1998 ^a	1994	1996	1998 ^a
LPG	42,000	43,000	45,000	10,000	10,000	11,000	2	2	2
CNG	2,935	5,485	9,104	2,322	4,389	7,284	0	0	0
LNG	12	77	136	378	453	727	0	6	6
M85	0	0	0	108	6	6	0	0	0
M100	1	0	0	414	172	172	0	0	0
E85	0	0	0	0	0	0	0	0	0
E95	5	4	0	26	357	357	0	0	0
Electricity	8	32	42	53	113	148	0	9	9
Total	44,961	48,598	54,282	13,301	15,490	19,694	2	17	17

Source:

U. S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 1996*, Washington, DC, December 1997, pp. 16-18.

(Additional resources: <http://www.eia.doe.gov>)

^aBased on plans or projections.

Table 8.3
Alternative Fuel Vehicles Available by Manufacturer^a

Model	Model Year Availability	Fuel	Type	Emission Class
Chrysler Products: 1-800-255-2616				
EPIC	MY 1997 (limited)	Electric lead acid	Minivan	ZEV
Minivan	MY 1998	Ethanol	Minivan	N/A
Ram Wagon	Fall 1998	CNG dedicated	Passenger van	SULEV
Ram Van	Fall 1998	CNG dedicated	Full-size van	SULEV
Ford Products: 1-800-ALT-FUEL				
Ranger	MY 1997 MY 1998	Electric lead acid	Light truck	ZEV
Contour (QVM)	MY 1997 MY 1998	CNG bi-fuel	Compact sedan	Gasoline equivalent
Crown Victoria	MY 1997 MY 1998	CNG dedicated	Full-size sedan	ULEV
Econoline	MY 1997 MY 1998	CNG/LPG dedicated or bi-fuel	Full-size van	Various
F-Series	MY 1997 MY 1998	CNG/LPG dedicated or bi-fuel	Light truck	Various
Taurus	MY 1997 MY 1998	E-85 or M-85 gasoline	Mid-size sedan	TLEV
General Motors Products: 1-800-25Electric, 313-556-7723 or 1-888-GM-AFT-4U (CNG)				
EVI	MY 1997 MY 1998	Electric lead acid Nickel-metal hydride option	Sedan two-seater	ZEV
Chevrolet S-10	MY 1997 MY 1998	Electric lead acid	Light truck	California Certified ZEV
GMC Sierra 2500	MY 1997 MY 1998	CNG bi-fuel	Medium truck	LEV
Honda: 1-888-CCHonda				
Honda EV Plus	MY 1997	Electric-NiMH batteries	Sedan	ZEV
Civic GX	MY 1998	CNG dedicated	Compact sedan	ULEV California ILEV Federal
Nissan: 1-310-771-3422 (Demonstration fleets only)				
Altra EV	MY 1998	Electric lithium batteries	Minivan	ZEV
Toyota: 1-800-331-4331 (Press 3 for Alternative Fuel Information) (Fleet sales only)				
RAV4-EV	MY 1998-US	Electric-lead acid/NiMH	Sports utility vehicle	ZEV

Source:

U.S. Department of Energy, National Alternative Fuels Hotline, "Light-Duty Alternative Fuel Vehicle Resource Guide," January 1998. (Additional resources: <http://www.afdc.nrel.gov>)

Note:

LEV=low emission vehicle. ILEV=inherently low emission vehicle. ULEV=ultra low emission vehicle. ZEV=zero emission vehicle. TLEV=transitional low emission vehicle.

^aIn addition, Mazda (1-800-248-0459) and Volvo (1-800-970-0888) have experimental alternative fuel vehicles which are not yet on the market.



Table 8.4
Number of Onroad Alternative Fuel Vehicles Made Available,^a
by Fuel Type and Vehicle Type, 1996

Fuel type	Automobiles	Passenger vans	Cargo vans/pickups	Other trucks	Buses	Other onroad vehicles	Total
Liquefied Petroleum Gas (LPG)	1,158	238	2,221	3,506	564	28	7,715
Dedicated	390	70	524	3,294	480	18	4,776
Nondedicated	768	168	1,697	212	84	10	2,939
Compressed Natural Gas (CNG)	2,764	599	4,083	2,054	1,125	9	10,634
Dedicated	411	357	600	179	926	9	2,482
Nondedicated	2,353	242	3,483	1,875	199	0	8,152
Liquefied Natural Gas (LNG)	0	0	33	29	12	0	74
Dedicated	0	0	0	26	12	0	38
Nondedicated	0	0	33	3	0	0	36
Methanol, 85 percent ^b (M85)	2,011	0	0	0	0	0	2,011
Dedicated	0	0	0	0	0	0	0
Nondedicated	2,011	0	0	0	0	0	2,011
Methanol, Neat (M100)	0	0	0	0	60	0	60
Dedicated	0	0	0	0	60	0	60
Nondedicated	0	0	0	0	0	0	0
Ethanol, 85 percent ^b (E85)	3,273	0	0	0	0	0	3,273
Dedicated	0	0	0	0	0	0	0
Nondedicated	3,273	0	0	0	0	0	3,273
Ethanol, 95 percent ^b (E95)	0	0	0	0	0	0	0
Dedicated	0	0	0	0	0	0	0
Nondedicated	0	0	0	0	0	0	0
Electricity	370	2	84	62	146	29	693
Nonhybrid	369	2	83	62	144	29	689
Hybrid	1	0	1	0	2	0	4
Other ^c	0	0	0	0	5	0	5
Dedicated	0	0	0	0	0	0	0
Nondedicated	0	0	0	0	5	0	5
Total	9,576	839	6,421	5,651	1,912	66	24,465
Dedicated and Nonhybrid	1,170	429	1,207	3,561	1,622	56	8,045
Nondedicated and Hybrid	8,406	410	5,214	2,090	290	10	16,420

Source:

U.S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 1996*, Washington, DC, December 1997, p. 28.

(Additional resources: <http://www.eia.doe.gov>)

^aVehicles made available are vehicles that are completed and made available for delivery to dealers or users in a given year.

^bThe remaining portion of 85-percent methanol and both ethanol fuels is gasoline.

^cIncludes hydrogen, neat biodiesel, and other alternative fuels.



This list includes public and private refuel sites; therefore, not all of these sites are available to the public.

Table 8.5
Number of Alternative Refuel Sites by State and Fuel Type, 1997

State	M85 sites	CNG sites	E85 sites	LPG sites	LNG sites	Electric sites	Total
Alabama	0	17	0	114	2	0	133
Alaska	0	1	0	9	0	0	10
Arizona	1	31	0	71	3	40	146
Arkansas	0	9	0	156	0	0	165
California	66	203	0	219	18	197	703
Colorado	2	45	1	48	3	0	99
Connecticut	0	22	0	18	0	1	41
Delaware	0	6	0	6	0	0	12
District of Columbia	1	8	1	0	0	2	12
Florida	3	60	0	222	0	4	289
Georgia	1	89	0	80	3	0	173
Hawaii	0	0	0	0	0	3	3
Idaho	0	7	1	20	1	1	30
Illinois	2	24	14	163	0	0	203
Indiana	0	47	2	125	3	1	178
Iowa	0	5	10	107	0	1	123
Kansas	0	18	2	38	1	0	59
Kentucky	0	13	3	35	0	0	51
Louisiana	0	21	0	44	2	0	67
Maine	0	0	0	12	0	0	12
Maryland	2	31	0	21	3	0	57
Massachusetts	0	18	0	42	0	4	64
Michigan	2	39	3	187	2	10	243
Minnesota	0	17	11	125	2	0	155
Mississippi	0	3	0	75	0	0	78
Missouri	0	11	3	83	0	0	97
Montana	0	13	0	48	1	0	62
Nebraska	0	11	6	47	1	0	66
Nevada	0	13	0	20	0	0	33
New Hampshire	0	1	0	31	0	1	33
New Jersey	0	24	0	37	0	0	61
New Mexico	0	18	0	46	1	0	65
New York	18	59	0	100	0	5	182
N. Carolina	0	11	0	72	0	1	84
N. Dakota	0	5	1	17	0	0	23
Ohio	2	70	0	98	1	1	172
Oklahoma	0	56	0	56	0	0	112
Oregon	0	9	0	21	1	0	31
Pennsylvania	1	61	0	141	1	1	205
Rhode Island	0	3	0	6	0	0	9
S. Carolina	0	3	0	67	0	1	71
S. Dakota	0	5	10	30	0	0	45
Tennessee	2	7	0	95	0	2	106
Texas	0	92	0	862	15	0	969
Utah	0	67	0	23	1	0	91
Vermont	0	1	0	40	0	9	50
Virginia	0	30	0	51	3	18	102
Washington	2	32	0	69	1	6	110
W. Virginia	1	42	0	21	0	1	65
Wisconsin	0	29	3	190	0	0	222
Wyoming	0	19	0	47	2	0	68
Total	106	1,426	71	4,255	71	310	6,240

Source:

U.S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 1996*, Washington, DC, December 1997, p. 15.



U.S. ADVANCED BATTERY CONSORTIUM

Electric and hybrid-electric vehicles are the subject of intense research and development because they are required to be sold in California (10% in 2003) under the California Low-Emission Vehicle (LEV) program. Other states, such as New York and Massachusetts, have indicated that they will also enforce the LEV program. One of the greatest advantages in using electric vehicles is that there are no tailpipe emissions. The U.S. Advanced Battery Consortium (USABC) was established in January 1991 to concentrate efforts on battery development for future electric vehicles. The USABC consists of the Big Three U.S. auto manufacturers (Chrysler, Ford, General Motors), the Electric Power Research Institute, and the U.S. Department of Energy. Five major U.S. electric utilities are also direct participants in USABC.

The USABC has established research contracts with several companies for the development of advanced batteries. Also, a series of Cooperative Research and Development Agreements (CRADAs) with several DOE National Laboratories have been established.

Table 8.6
U.S. Advanced Battery Consortium Research Agreements, Phase II

Research contracts	
General Motors-Ovonic Joint Venture	Cost reduction program for nickel-metal hydride battery and testing of nickel-metal hydride pilot production modules
SAFT	Cost reduction program for nickel-metal hydride battery
3M Hydro-Quebec	Phase II development of lithium-polymer battery
Duracell/VARTA	Phase II development of lithium-ion battery
CRADAs for advanced battery testing	
Argonne National Laboratory, Argonne, IL	
Sandia National Laboratory, Albuquerque, NM	
Idaho National Engineering and Environmental Laboratory, Idaho Falls, ID	

Source:

U.S. Advanced Battery Consortium, February, 1998.



Today's lead acid batteries provide 30–40 watt hours per kilogram, cost between \$50–150 per kilowatt hour, and have a two- to three-year lifetime. However, the batteries currently used in electric vehicles do not provide the energy or performance sufficient to make these vehicles competitive with gasoline-fueled vehicles. When attained, the Advanced Battery Technology goals will effectively double the range and performance of electric vehicles compared to the range and performance possible with today's battery technology.

Table 8.7
U.S. Advanced Battery Consortium Goals for Electric Vehicle Batteries

Primary criteria	Mid-term goals (1997)	Long-term goals ^a (2000)
Power density ^b W/L	250	460
Specific power ^b W/kg (80% DOD/30 sec)	150 (200 desired)	300
Energy density ^b Wh/L (C/3 discharge rate)	135	230
Specific energy ^b Wh/kg (C/3 discharge rate)	80 (100 desired)	150
Life (years)	5	10
Cycle life ^b (cycles) (80% DOD)	800	1000 1800 (@ 50% DOD) 2670 (@ 30% DOD)
Power and capacity degradation ^b (% of rated spec)	20%	20%
Ultimate price ^c (\$/kWh) (10,000 units @ 40 kWh)	< \$150	< \$150 (desired to 75)
Operating environment	-30 to 65°C	-30 to 65°C
Recharge time ^b	< 6 hours	< 6 hours
Continuous discharge in 1 hour (no failure)	75% (of rated energy capacity)	75% (of rated energy capacity)
Secondary criteria		
Efficiency (C/3 discharge & C/3 charge) ^d	75%	80%
Self discharge ^b	< 15% in 48 hours	< 20% in 12 days
Maintenance	No maintenance. Service by qualified personnel only.	No maintenance. Service by qualified personnel only.
Thermal loss ^b	3.2 W/kWh; 15% of capacity; 48 hour period	Covered by self discharge
Abuse resistance ^b	Tolerant Minimized by on-board controls	Tolerant Minimized by on-board controls

Source:

U.S. Department of Energy, Office of Transportation Technologies, Washington, DC, February, 1998.

Note:

W=watt; kg=kilogram; L=liter; DOD=depth of discharge; Wh=watt-hour; kWh=kilowatt-hour.

^aFor interim commercialization (Reflects USABC revisions of September 1996).

^bSpecifics on criteria can be found in "USABC Electric Vehicle Battery Test Procedures Manual Revision 2" DOE/ID-10479, Rev. 2, January 1996.

^cCost to the Original Equipment Manufacturers.

^dRoundtrip charge/discharge efficiency.



Hybrid Electric Vehicle Program

The U.S. Department of Energy (DOE) is working closely with other Federal agencies and key auto industry partners to develop hybrid electric vehicles (HEVs) as a practical way of providing clean and efficient transportation for the future that will significantly contribute to reducing our Nation's growing dependence on imported oil. HEV R&D is a key component of DOE's Advanced Automotive Technologies Program and is focused on two strategic goals:

1. Develop a production-feasible hybrid propulsion system by 1998 that will enable subsequent market introduction of a 50-mpg light-duty vehicle.
2. Develop production-feasible hybrid vehicle technologies by 2004 that will enable subsequent market introduction of an 80-mpg light-duty vehicle.

The 50-mpg and 80-mpg fuel economy targets represent two- and three-fold improvements over current six-passenger family sedans. In addition, the HEV technologies must meet Environmental Protection Agency Tier II light-duty emission standards; be acceptable to consumers with respect to performance, range, safety, and cost; and support the introduction of alternative fuels.

The Hybrid Electric Vehicle (HEV) Program is managed by DOE's Office of Transportation Technologies with technical program support from the National Renewable Energy Laboratory. Hybrid Propulsion System Development is focused on systems-driven development, system design, integration, and testing. This is a two-phased effort with the Phase I major milestone of 50-mpg capable hybrid propulsion system by 1998. Phase II, which will be initiated in the near future, will combine further advances in the hybrid propulsion system with other vehicle advances (in materials, etc.) to achieve the 80-mpg goal by 2004. In the first phase of the effort, DOE is supporting three versatile system development teams led by GM, Ford, and Chrysler through 50/50 cost-shared contracts. These teams have successfully mobilized the extensive internal resources of the three major automakers as well as that of key suppliers.

Enabling Technologies Development is focused on technologies that will ensure HEVs will be marketplace-acceptable. The key technologies are:

- Fuel-efficient, low-emission engines (gas turbine and four-stroke, direct-injection engine)
- High-power energy storage (battery, ultra-capacitor, and flywheel)
- Cost-effective, high-efficiency power electronics

To learn more about the DOE HEV Program, visit the Internet site: <http://www.ott.doe.gov>



Chapter 9

Fleet Vehicles and Characteristics

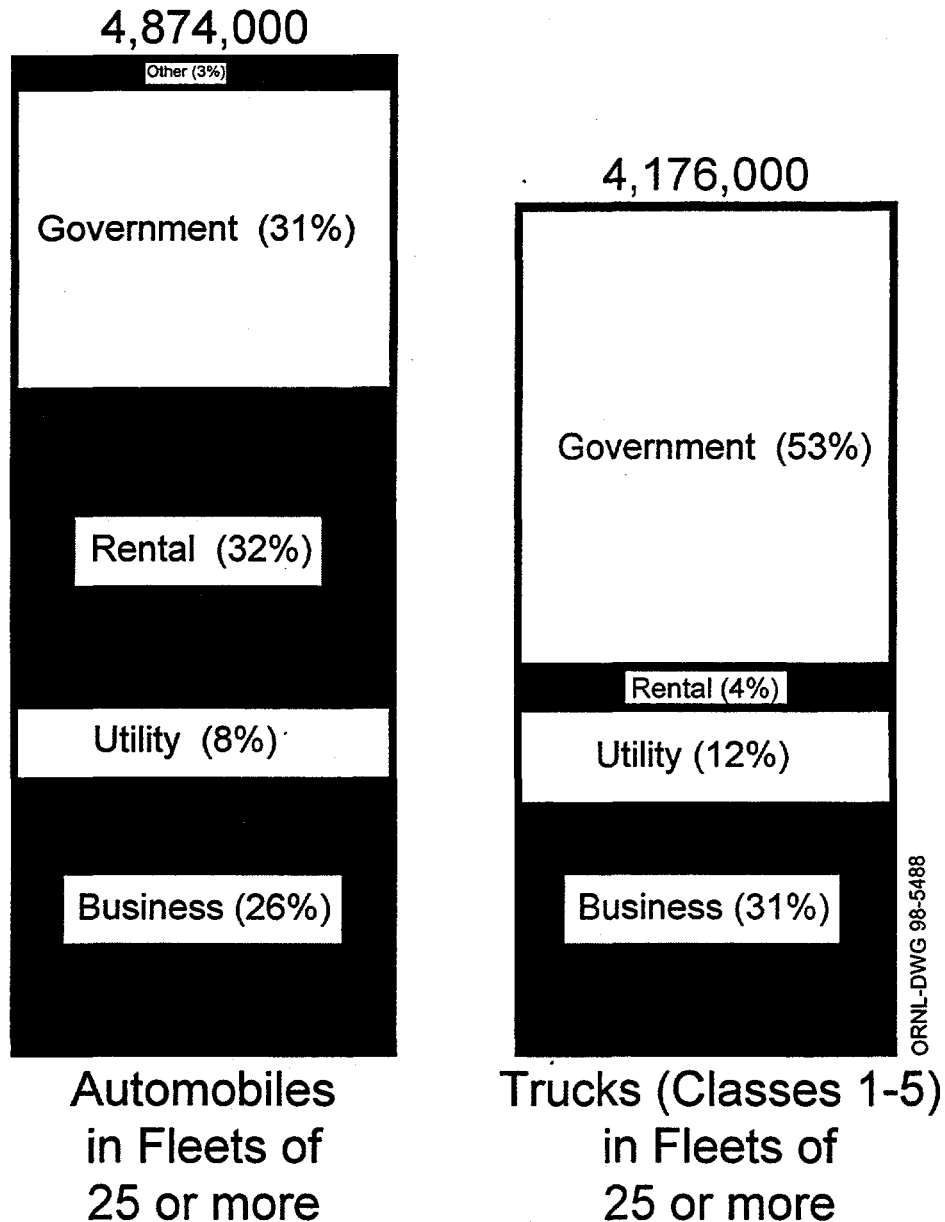
Summary Statistics

Table/Figure		
F 9.1	Fleet automobiles, 1997	4,874,000
F 9.1	Fleet Class 1-5 Trucks, 1997	4,176,000
T 9.3	Average annual miles per automobile	
	<i>Business fleets</i>	29,200
	<i>Utility fleets</i>	14,500
	<i>Government fleets</i>	13,700
T 9.4	Federal Government vehicles, FY 1996	550,373
	<i>Automobiles</i>	113,366
	<i>Buses</i>	6,376
	<i>Light trucks</i>	381,525
	<i>Medium trucks</i>	32,281
	<i>Heavy trucks</i>	16,825



Significant changes have been made in recent years to fleet vehicle estimations. Newly available data improve the accuracy of fleet vehicle estimates but, at the same time, make it impossible to compare the data historically. Therefore, only the 1997 data are presented here.

Figure 9.1. Fleet Vehicles in Service as of January 1, 1997



ORNL-DWG 98-5488

Source:

Bobit Publishing Company, Automotive Fleet Research Department, *Automotive Fleet Factbook 1997*, Redondo Beach, CA, 1997. (Additional resources: <http://www.fleet-central.com>)

Note:

Truck classes 1-5 are 19,500 lbs. and less.



Table 9.1
Fleet Vehicle Composition by Vehicle Type
 (percent)

Fleet type	Cars	Light trucks ^a and vans	Medium trucks ^b	Heavy trucks ^c	Total
Business	24.2%	21.1%	45.8%	8.9%	100%
Utility	22.6%	39.0%	15.0%	23.4%	100%
Government	48.5%	42.8%	6.8%	1.8%	100%

Table 9.2
Average Length of Time Fleet Vehicles are Kept Before Sold to Others
 (months)

	Business	Utility	Government
Cars	35	68	81
Light trucks ^a	56	60	82
Medium trucks ^b	83	86	96
Heavy trucks ^c	103	132	117

Table 9.3
Average Annual and Daily Vehicle-Miles of Travel for Fleet Vehicles

Vehicle type	Business		Utility		Government	
	Miles/year (thousands)	Miles/day @250 days/year	Miles/year (thousands)	Miles/day @250 days/year	Miles/year (thousands)	Miles/day @250 days/year
Cars	29.2	117	14.5	58	13.7	55
Light trucks ^a	26.6	106	17.5	70	13.9	56
Medium trucks ^b	17.5	70	11.8	47	11.9	48
Heavy trucks ^c	64.4	258	13.8	55	10.7	43

Source:

Miaou, S. P., et. al., *Fleet Vehicles in the United States: Composition, Operating Characteristics, and Fueling Practices*, (ORNL-6717), Oak Ridge National Laboratory, Oak Ridge, TN, May 1992.
 (Additional resources: <http://www-cta.ornl.gov>)

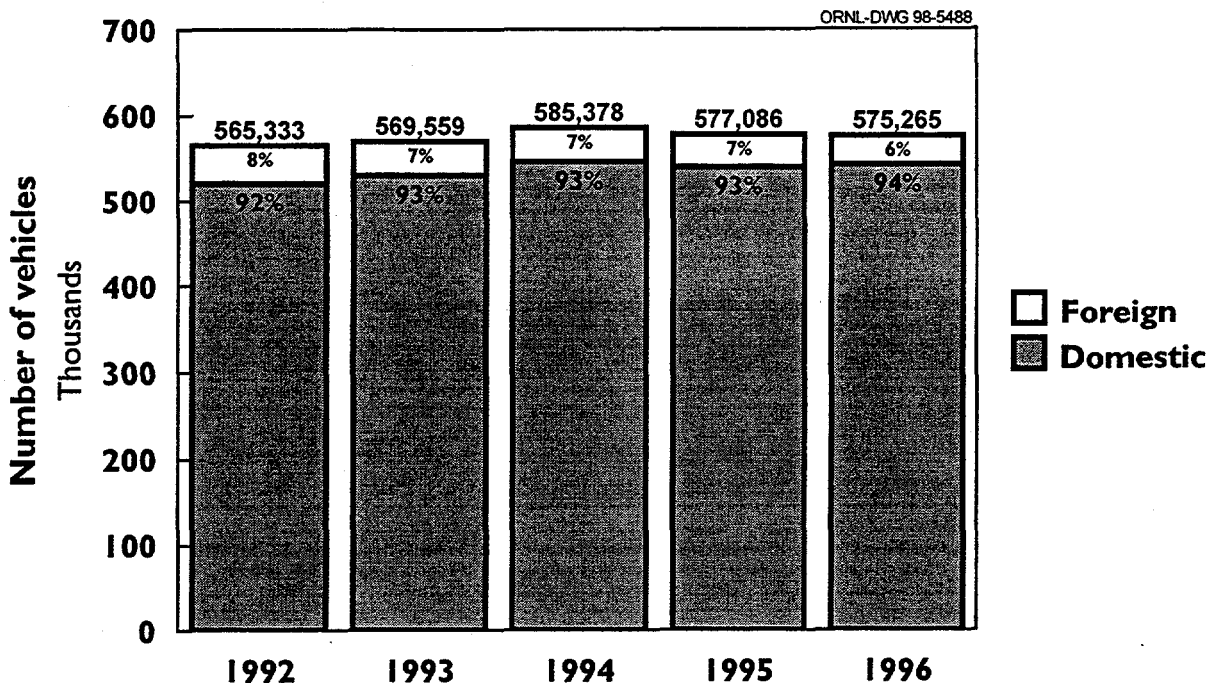
^aIn this study, light trucks are <8,500 lbs gross vehicle weight.

^bIn this study, medium trucks are between 8,500–26,000 lbs gross vehicle weight.

^cIn this study, heavy trucks are >26,000 lbs gross vehicle weight.

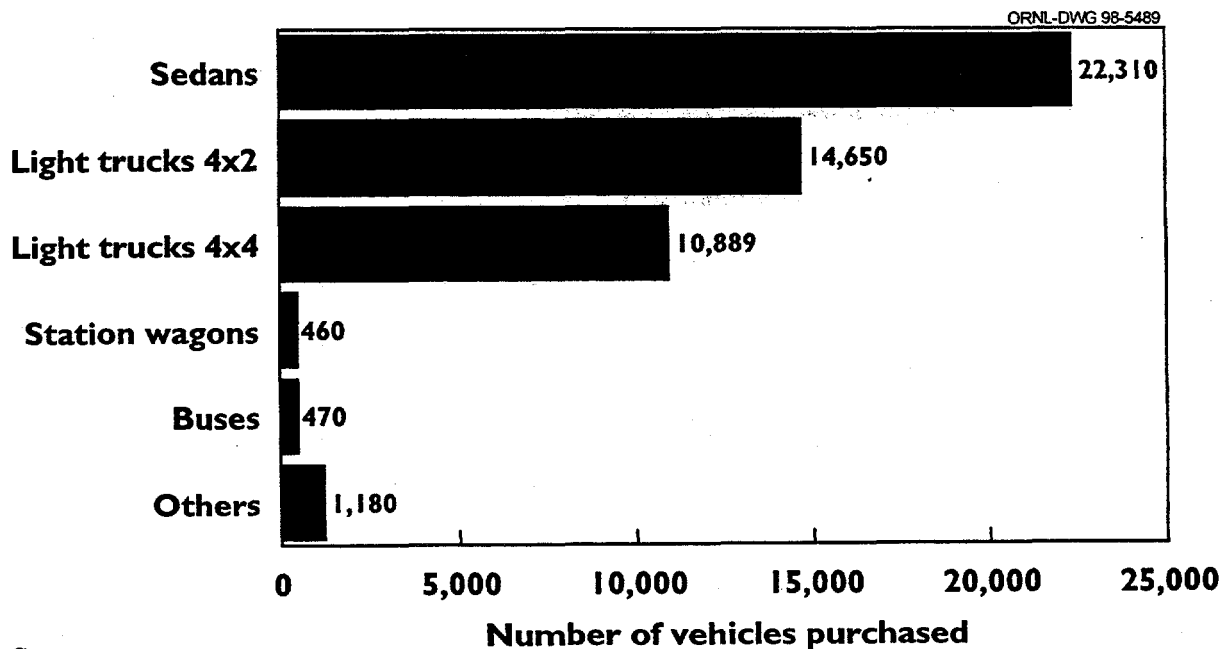


Figure 9.2. Worldwide Federal Inventory, 1991-96



Source:
 U.S. General Services Administrations, Federal Supply Service, Federal Motor Fleet Report, Washington, DC, 1998. (Additional resources: <http://policyworks.gov/main/mt/homepage/mtv/mtvhp.htm>)

Figure 9.3. Federal Vehicle Purchases by Vehicle Type, 1996



Source:
 U.S. General Services Administrations, Federal Supply Service, Federal Motor Fleet Report, Washington, DC, 1998. (Additional resources: <http://policyworks.gov/main/mt/homepage/mtv/mtvhp.htm>)



Table 9.4
Federal Government Vehicles by Agency, Fiscal Year 1996^a

Department or Agency	Autos	Buses	Light trucks ^b	Medium trucks ^c	Heavy trucks ^d	Total
Department of Agriculture	3,292	91	24,477	5,280	601	33,741
Department of Commerce	133	2	399	205	29	768
Department of Education	1	0	1	0	0	2
Department of Energy	807	209	3,447	1,001	402	5,866
Department of Health & Human	84	8	300	113	54	559
Department of Housing & Urban Dev.	3	0	1	0	0	4
Department of Justice	19,473	294	10,152	1,239	0	31,158
Department of Labor	19	1	151	14	3	188
Department of State	112	0	63	3	8	186
Department of Interior	1,553	126	9,605	4,283	1,911	17,478
Department of Treasury	11,148	21	3,661	388	26	15,244
Department of Transportation	42	17	385	80	38	562
Department of Veterans Affairs	452	122	1,152	223	102	2,051
Environmental Protection Agency	108	0	262	193	2	565
Federal Communications Comm	62	0	62	2	0	126
Federal Emergency Mgmt Agency	28	5	261	25	0	319
General Services Administration	53,127	2,856	87,983	3,635	3,745	151,346
Natl Aeronautics & Space Admin.	92	18	636	237	52	1,035
Small Business Administration	137	0	0	0	0	137
Tennessee Valley Authority	1,535	2	1,125	1,067	232	3,961
Others	91	17	540	79	38	765
CIVILIAN AGENCIES	92,299	3,789	144,663	18,067	7,243	266,061
U.S. POSTAL SERVICE	10,708	11	176,888	8,179	4,874	200,660
Department of the Air Force	3,582	1,342	25,896	2,242	1,688	34,750
Department of the Army	414	102	1,209	418	255	2,398
Department of the Navy	3,424	733	24,393	1,999	2,124	32,673
Other Defense Agencies	2,056	3	639	78	98	2,874
Corps of Engineers	268	4	3,342	697	221	4,532
U.S. Marine Corps	615	392	4,495	601	322	6,425
MILITARY AGENCIES	10,359	2,576	59,974	6,035	4,708	83,652
TOTAL	113,366	6,376	381,525	32,281	16,825	550,373

Source:

U.S. General Services Administration, Federal Supply Service, *Federal Motor Fleet Report*, Washington, DC, 1998.

(Additional resources: <http://policyworks.gov/org/main/mt/homepage/mtv/mtvhp.htm>)

^a Federally-owned and commercially-leased vehicles.

^b Less than 8,500 lbs GVWR. Includes ambulances.

^c 8,501–23,999 lbs GVWR.

^d 24,000 lbs. Or more GVWR.



Table 9.5
Operating and Cost Data for Large Domestic Federal Fleets, 1986-96^a

Fiscal year	Number of vehicles	Miles operated (thousands)	Average annual miles per vehicle	Fleet average cost per mile (dollars)
Sedans				
1986	86,069	1,130,843	13,139	\$0.21
1987	89,894	1,069,124	11,893	\$0.20
1988	85,928	1,119,343	13,027	\$0.19
1989	90,254	1,170,370	12,968	\$0.20
1990	93,510	1,226,674	13,118	\$0.22
1991	98,259	1,297,651	13,206	\$0.23
1992	97,680	1,261,954	12,940	\$0.20
1993	98,144	1,251,348	12,750	\$0.23
1994	96,386	1,216,385	12,620	\$0.18
1995	97,777	1,214,877	12,425	\$0.21
1996	97,588	1,214,579	12,446	\$0.23
Trucks				
1986	292,256	2,095,079	7,168	\$0.43
1987	303,275	2,195,017	8,238	\$0.45
1988	316,443	2,242,075	7,085	\$0.44
1989	336,617	2,292,593	6,811	\$0.43
1990	354,392	2,423,131	6,837	\$0.44
1991	366,471	2,498,190	6,818	\$0.45
1992	381,721	2,645,979	6,932	\$0.40
1993	392,796	2,627,759	6,690	\$0.41
1994	400,564	2,659,631	6,640	\$0.40
1995	413,328	2,754,750	6,665	\$0.37
1996	413,704	2,713,467	6,566	\$0.44
All Vehicles^b				
1986	403,855	3,477,730	8,611	\$0.36
1987	414,575	3,461,332	8,349	\$0.37
1988	424,286	3,576,421	8,429	\$0.36
1989	448,836	3,681,314	8,202	\$0.35
1990	467,678	3,855,984	8,245	\$0.38
1991	484,552	3,984,175	8,222	\$0.38
1992	495,257	4,061,255	8,200	\$0.35
1993	504,877	4,010,354	7,943	\$0.36
1994	509,483	3,995,161	7,842	\$0.34
1995	522,959	4,076,990	7,796	\$0.34
1996	523,600	4,032,247	7,701	\$0.38

Source:

U.S. General Services Administrations, Federal Supply Service, *Federal Motor Fleet Report*, Washington, DC, 1998. (Additional resources: <http://policyworks.gov/main/mt/homepage/mtv/mtvhp.htm>)

^aAgencies or bureaus with 2,000 or more vehicles.

^bIncludes sedans, station wagons, ambulances, buses, and all trucks.



The Energy Policy Act of 1992 (EPACT) set alternative fuel vehicle purchase requirements for Federal and State Governments, fuel providers and the private sector. Additional rule making has adjusted the original purchase requirements. State government and fuel providers requirements begin in 1997.

Table 9.6
Energy Policy Act Purchase Requirements of Light-Duty Alternative Fuel Vehicles

Year	Federal	State	Fuel providers	Private ^a
1993	5,000	-	-	-
1994	7,500	-	-	-
1995	10,000	-	-	-
1996	25%	-	-	-
1997	33%	10%	30%	-
1998	50%	15%	50%	-
1999	75%	25%	70%	-
2000	75%	50%	90%	-
2001	75%	75%	90%	-
2002	75%	75%	90%	20%
2003	75%	75%	90%	40%
2004	75%	75%	90%	60%
2005	75%	75%	90%	70%
2006-on	75%	75%	90%	70%

Source:

Final rule for the alternative fuels transportation programs, *Federal Register*, Vol. 61, p. 10622, March 14, 1996.

Private alternative fueled vehicle acquisition requirements for private and local government fleets, *Federal Register*, vol. 62, p. 19701, April 23, 1997.

Note:

The Department of Energy has provided an Alternative Fuel Vehicles Acquisitions and Credits Database on the Internet to provide fleet managers with a convenient way to report their compliance with this mandate. (<http://www.ott.doe.gov/credits>)

^aAdditional rule making is required by January 1, 2000, for private AFV requirements to take effect.



"Section 501 of the Energy Policy Act mandates that certain percentages of new light-duty vehicles acquired by alternative fuel providers be alternative fuel vehicles (AFV). The first step in estimating the effects of these mandates entails identifying affected fleets that are covered by the Act. This assessment concludes that a limited number of companies in the methanol, ethanol, propane, and hydrogen industries are likely to be covered by this mandate. On the other hand, many of the large crude oil producers, petroleum refiners, natural gas producers and transporters, and natural gas and electric utilities are likely to be subject to this mandate."

Table 9.7
Summary of EPACT Section 501 Coverage by Industry, 1994

Fuel	Percentage of companies likely to be "covered"	Estimated number of light-duty vehicles "covered"	Current AFV percentage of total "covered" light-duty vehicles
Methanol	10%	60	0%
Ethanol	0%	0	0%
Natural gas	23%	73,000 ^a	20%
Propane ^b	8%	420	78%
Electricity	5%	59,000	2%
Petroleum ^c	30%	11,000	0.4%
Hydrogen	0%	0	0%

Source:

P. Hu, M. Wang, A. Vyas, M. Mintz, and S. Davis, *Transportation Research Record No. 1520*, Washington, DC, 1996, p. 155.

^aAmong these vehicles, 30,000 are owned/operated by gas-only companies, 33,000 by dual utilities and 10,000 by gas producers and transporters.

^bOf the top 35 propane providers only.

^cThose with production capability of at least 50,000 barrels per day.



Chapter 10

Household Vehicles and Characteristics

Summary Statistics

Table/Figure		
T 10.1	Vehicles per licensed driver, 1996	1.10
T 10.2	Average household transportation expense, 1995	18.2%
T 10.8	Share of households owning 3 or more vehicles	
	1960	2.5%
	1970	5.5%
	1980	17.5%
	1990	17.3%
T 10.12	Average annual miles per household vehicle, 1995	11,800
F 10.1	Average occupancy rates by vehicle type, 1995	
	<i>Automobile</i>	1.6
	<i>Pickup truck</i>	1.4
	<i>Sports Utility</i>	1.7
	<i>Van</i>	2.1
T 10.14	Share of workers who car pooled, 1990	13.4%
F 10.3	Long-distance trips in the U.S., 1995	
	<i>Trips</i>	1,001 million
	<i>Person-miles</i>	827 billion



Table 10.1
Population and Vehicle Profile, 1950-96

Year	Resident population ^a (thousands)	Total households (thousands)	Number of vehicles in operation (thousands)	Number of licensed drivers (thousands)	Number of civilian employed persons (thousands)	Vehicles per capita	Vehicle-miles per capita	Licensed drivers per household	Vehicles per licensed driver	Vehicles per civilian employed persons
1950	151,868	43,554	43,256	62,194	58,918	0.29	3,029	1.43	0.70	0.73
1955	165,069	47,874	55,804	74,686	62,170	0.34	3,656	1.56	0.75	0.90
1960	179,979	52,799	66,582	87,253	65,778	0.36	3,994	1.65	0.76	1.01
1965	193,526	57,251	82,067	98,502	71,088	0.42	4,587	1.72	0.83	1.15
1970	203,984	63,401	98,136	111,543	78,678	0.48	5,440	1.76	0.88	1.25
1975	215,465	71,120	120,054	129,791	85,846	0.56	6,162	1.82	0.92	1.40
1980	227,225	80,776	139,832	145,295	99,303	0.62	6,722	1.80	0.96	1.41
1981	229,466	82,368	141,908	147,075	100,397	0.62	6,767	1.79	0.96	1.41
1982	231,664	83,527	143,854	150,234	99,526	0.62	6,885	1.80	0.96	1.45
1983	233,792	83,918	147,104	154,389	100,834	0.63	7,069	1.83	0.95	1.46
1984	235,825	85,407	152,162	155,424	105,005	0.65	7,295	1.82	0.98	1.45
1985	237,924	86,789	157,048	156,868	107,150	0.66	7,457	1.81	1.00	1.47
1986	240,133	88,458	162,094	159,487	109,597	0.68	7,655	1.80	1.02	1.48
1987	242,289	89,479	167,193	161,975	112,440	0.69	7,929	1.81	1.03	1.49
1988	244,499	91,061	171,741	162,853	114,968	0.70	8,286	1.79	1.05	1.49
1989	246,819	92,830	175,960	165,555	117,342	0.71	8,494	1.78	1.06	1.50
1990	249,398	93,347	179,299	167,015	118,793	0.72	8,598	1.79	1.07	1.51
1991	252,106	94,312	181,438	168,995	117,718	0.72	8,614	1.79	1.07	1.54
1992	255,011	95,689	181,519	173,125	118,492	0.71	8,781	1.81	1.05	1.53
1993	257,795	96,391	186,315	173,149	120,259	0.72	8,909	1.80	1.08	1.55
1994	260,372	97,107	188,714	175,403	123,060 ^b	0.72	9,055	1.81	1.08	1.53
1995	262,890	98,990	193,441	176,628	124,900 ^b	0.74	9,216	1.78	1.10	1.55
1996	265,284	99,627	198,294	179,539	126,708 ^b	0.75	9,357	1.80	1.10	1.56
1950-96	1.2%	1.8%	3.4%	2.3%	1.7%	2.1%	2.5%	0.5%	1.0%	1.7%
1986-96	1.0%	1.2%	2.0%	1.2%	1.5%	1.0%	2.0%	0.0%	0.8%	0.5%

Average annual percentage change

Source:

Resident population, total households, and civilian employed persons - U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, 117th edition, Washington, DC, 1997, pp. 8, 59, 397, and annual. (Additional resources: <http://www.census.gov>)
 Vehicles in operation - The Polk Company. **FURTHER REPRODUCTION PROHIBITED.** (Additional resources: <http://www.polk.com>)
 Licensed drivers and vehicle-miles - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1996*, Tables DL-1C and VM-1, and annual. (Additional resources: <http://www.fhwa.dot.gov>)

^aEstimates as of July 1. Includes Armed Forces stationed in the United States.

^bData are not comparable to earlier years due to changes in definitions and methodology. See original source for more details.



Transportation (18.2%) is second only to housing (31.5%) as the largest expenditure for the average household. In 1995, approximately 17% of transportation expenditures were for purchasing gasoline and motor oil. There is an average of two vehicles per household.

Table 10.2
Average Annual Expenditures of Households by Income, 1995^a

	All households	Income before taxes									
		Less than \$5,000	\$5,000-\$9,999	\$10,000-\$14,999	\$15,000-\$19,999	\$20,000-\$29,999	\$30,000-\$39,999	\$40,000-\$49,999	\$50,000-\$69,999	\$70,000 and over	
Total expenditures	\$33,610	\$14,718	\$14,156	\$18,911	\$22,619	\$26,732	\$33,324	\$38,496	\$48,844	\$69,303	
		Percentage of total expenditures ^b									
Food ^c	14.9%	17.6%	17.6%	17.3%	17.9%	16.0%	14.9%	15.3%	13.7%	12.6%	
Housing	31.5%	38.6%	38.5%	35.7%	32.8%	31.5%	31.4%	29.2%	29.6%	30.6%	
Apparel and services	5.3%	4.6%	5.3%	4.9%	5.2%	5.5%	5.0%	5.4%	5.0%	5.5%	
Transportation	18.2%	13.3%	14.3%	17.6%	17.8%	19.8%	19.2%	19.5%	19.7%	17.0%	
Vehicle purchases (net outlay)	8.0%	3.6%	5.2%	7.5%	7.5%	9.3%	8.4%	9.0%	8.8%	7.4%	
Gasoline and motor oil	3.0%	3.2%	3.2%	3.3%	3.3%	3.4%	3.4%	3.2%	3.1%	2.4%	
Other vehicle expenditures	6.1%	5.6%	4.9%	5.8%	6.1%	6.2%	6.4%	6.4%	6.8%	5.8%	
Public transportation	1.1%	1.0%	1.0%	1.0%	0.9%	0.9%	1.0%	0.8%	1.0%	1.5%	
Health care	5.2%	5.7%	8.5%	7.9%	7.1%	6.5%	5.0%	5.1%	4.4%	3.6%	
Entertainment	5.0%	4.9%	4.7%	4.7%	4.0%	4.5%	5.3%	5.0%	5.1%	5.4%	
Personal insurance & pensions	1.3%	1.3%	1.3%	1.4%	1.3%	1.4%	1.4%	1.4%	1.2%	1.1%	
Others ^d	18.7%	14.0%	9.9%	10.6%	13.9%	14.9%	17.9%	19.2%	21.3%	24.1%	
Households (thousands)	83,364	4,687	9,787	8,725	7,724	12,643	10,648	8,191	10,378	10,582	
Percentage of households	100%	5.6%	11.6%	11.5%	9.2%	15.0%	12.6%	9.7%	12.3%	12.5%	
Average number of vehicles in HH	2.0	1.0	0.9	1.3	1.6	1.9	2.3	2.5	2.7	2.8	

Source:

U.S. Department of Labor, Bureau of Labor Statistics, *Consumer Expenditure Survey: Interview Survey, 1995*. Washington, DC, 1997. (Additional resources: <http://www.bls.gov>)

^a Public assistance monies are included in reported income.

^b Percentages may not sum to totals due to rounding.

^c Includes alcoholic beverages.

^d Includes personal care, reading, education, tobacco and smoking supplies, cash contributions, and miscellaneous items.



Table 10.3
Average Number of Vehicles and Vehicle Travel per Household,
1991 and 1994 RTECS

Number of Drivers	Average number of vehicles per household		Average vehicle-miles traveled per household	
	1991	1994	1991	1994
1	1.2	1.2	10,900	12,300
2	2.0	2.0	21,400	23,200
3	2.6	2.8	30,700	33,100
4 or more	3.1	3.4	36,700	43,000
Household size				
1 person	1.2	1.2	10,600	11,600
2 persons	1.8	1.8	17,700	20,000
3 persons	2.0	2.1	22,300	25,200
4 persons	2.2	2.2	26,200	26,600
5 persons	2.1	2.2	23,600	26,300
6 or more persons	1.9	2.3	22,600	30,900
Household urban status				
Urban	1.8	1.8	18,800	20,700
Central city	1.6	1.7	15,900	18,000
Suburban	1.9	1.9	20,400	22,300
Rural	1.9	1.9	19,500	22,500
Household composition				
With children	2.0	2.0	22,800	24,800
Without children	1.7	1.7	16,500	18,900
Total	1.8	1.8	18,900	21,100

Source:

1991-U.S. Department of Energy, Energy Information Administration, *Household Vehicles Energy Consumption 1994*, Washington, DC, 1996, pp. 48, 49.

1994-Personal Communication, U.S. Department of Energy, Energy Information Administration, Office of Markets and End Use, Energy End Use Division.

(Additional resources: <http://www.eia.doe.gov>)



Table 10.4
 Statistics for Household Vehicles by Vehicle Type, 1985, 1988, 1991, and 1994 RTECS

Type of vehicle	Number of vehicles ^a (millions)				Average annual miles per vehicle (thousands)				Average fuel economy (mpg)			
	1985	1988	1991	1994	1985	1988	1991	1994	1985 ^b	1988	1991	1994
Passenger car	106.6	109.3	108.3	106.4	9.9	10.4	10.6	11.3	17.2	19.7	21.1	21.9
Pickup truck	21.2	25.9	25.9	28.8	9.4	9.4	10.0	11.1	13.5	15.3	15.8	16.3
Mini van	°	2.2	5.1	8.1	°	12.7	12.7	13.4	°	19.4	19.6	19.7
Large van	4.7	4.7	2.6	3.4	10.5	9.8	10.1	11.7	13.2	13.1	13.7	13.8
Utility vehicle	3.7	4.8	7.3	9.5	10.6	11.8	11.6	12.7	12.7	15.4	16.2	16.3
Other ^d	1.1	0.7	°	°	6.0	4.9	°	°	9.6	8.3	°	°

Source:

1985 and 1988 estimates are based on data provided on the following public use tapes: U.S. Department of Energy, Energy Information Administration, 1985 *Residential Transportation Energy Consumption Survey*, and 1988 *Residential Transportation Energy Consumption Survey*, Washington, DC, 1987 and 1990. 1991 estimates: U.S. Department of Energy, Energy Information Administration, *Household Vehicles Energy Consumption 1991*, Washington, DC, 1993, pp. 29, 46, 52.

1994 estimates: Personal Communication, U.S. Department of Energy, Energy Information Administration, Office of Markets and End Use, Energy End Use Division.

(Additional resources: <http://www.eia.doe.gov>)

^aThese data are survey estimates; data are not the same as R. L. Polk estimates of the number of vehicles.

^bFuel economy data from the 1985 RTECS is not directly comparable to data from later years because of a change in methodology.

^cData are not available.

^dIncludes motor homes.



As households owned more vehicles, the average annual miles for the most frequently driven vehicle increased. For example, the most frequently driven vehicle in five-vehicle households was driven 9% more per year than the one in two-vehicle households (16,542 miles vs. 15,172 miles).

Table 10.5
Average Annual Miles per Vehicle by Household Vehicle Ownership, 1994 RTECS

Vehicle ^a	One-vehicle household	Two-vehicle household	Three-vehicle household	Four-vehicle household	Five-vehicle household
#1	11,284	15,172	15,599	17,410	16,542
#2	-	7,694	9,057	10,270	10,160
#3	-	-	5,188	6,693	7,620
#4	-	-	-	5,036	5,219
#5	-	-	-	-	3,609
Average	11,284	12,014	11,329	11,728	11,144

Source:

Generated from the Department of Energy, Energy Information Administration, 1994 Residential Transportation Energy Consumption Survey Public Use Files, Washington, DC, May 1997.
(Additional resources: <http://www.eia.doe.gov>)

Table 10.6
Average Age of Vehicles by Household Vehicle Ownership, 1994 RTECS

Vehicle ^a	One-vehicle household	Two-vehicle household	Three-vehicle household	Four-vehicle household	Five-vehicle household
#1	7.63	6.67	7.16	6.33	6.76
#2	-	8.75	8.52	7.76	7.92
#3	-	-	10.80	10.61	10.68
#4	-	-	-	11.68	15.86
#5	-	-	-	-	24.64
Average	7.63	7.55	8.29	8.15	9.29

Source:

Generated from the Department of Energy, Energy Information Administration, 1994 Residential Transportation Energy Consumption Survey Public Use Files, Washington, DC, May 1997.
(Additional resources: <http://www.eia.doe.gov>)

^aVehicles are ranked by descending annual miles driven.



Table 10.7
Distribution of Vehicles by Vehicle Age and Household Vehicle Ownership, 1994 RTECS

Vehicle age	One-vehicle households	Two-vehicle households	Three-vehicle households	Four-vehicle households	Five-vehicle households	Total households
Vehicle 1						
New	1.45%	2.28%	0.76%	0.56%	0.14%	5.23%
2-5	5.81%	8.18%	3.97%	1.34%	0.56%	20.10%
6-10	7.02%	8.49%	4.06%	1.69%	0.44%	21.84%
11-15	2.54%	2.58%	1.46%	0.42%	0.12%	7.17%
16-20	1.20%	0.98%	0.57%	0.17%	0.14%	3.09%
21+	0.46%	0.35%	0.16%	0.03%	0.02%	1.05%
Vehicle 2						
New		1.11%	0.35%	0.25%	0.05%	1.84%
2-5		4.45%	2.88%	1.05%	0.26%	8.80%
6-10		6.29%	3.72%	1.79%	0.61%	12.46%
11-15		2.55%	1.59%	0.51%	0.19%	4.96%
16-20		1.28%	0.62%	0.20%	0.08%	2.19%
21+		1.02%	0.42%	0.10%	0.00%	1.60%
Vehicle 3						
New			0.13%	0.06%	0.02%	0.21%
2-5			1.06%	0.47%	0.21%	1.82%
6-10			1.00%	0.97%	0.34%	2.45%
11-15			0.85%	0.49%	0.10%	1.47%
16-20			0.66%	0.21%	0.14%	1.01%
21+			0.40%	0.26%	0.10%	0.85%
Vehicle 4						
New				0.02%	0.00%	0.02%
2-5				0.28%	0.02%	0.36%
6-10				0.14%	0.05%	0.29%
11-15				0.15%	0.23%	0.42%
16-20				0.12%	0.12%	0.30%
21+				0.15%	0.08%	0.27%
Vehicle 5						
New					0.00%	0.03%
6-10					0.02%	0.05%
11-15					0.00%	0.05%
21+					0.03%	0.07%
Total	18.47%	39.57%	24.65%	11.44%	4.07%	100.00%

Source:

Generated from the Department of Energy, Energy Information Administration, 1994 Residential Transportation Energy Consumption Survey Public Use Files, Washington, DC, May 1997.

(Additional resources: <http://www.eia.doe.gov>)



Household vehicle ownership shows a dramatic increase from 1960 to 1990. In 1960, nearly 79% of households owned less than two vehicles; by 1990, it declined to 45%. Census data prior to 1990 indicated that the majority of households owned one vehicle; in 1990 that changed to two vehicles.

Table 10.8
Household Vehicle Ownership, 1960-90 Census
 (percentage)

	No vehicles	One vehicle	Two vehicles	Three or more vehicles	Total vehicles ^a
1960	21.53%	56.94%	19.00%	2.53%	54,766,718
1970	17.47%	47.71%	29.32%	5.51%	79,002,052
1980	12.92%	35.53%	34.02%	17.52%	129,747,911
1990	11.53%	33.74%	37.35%	17.33%	152,380,479

Source:

U. S. Department of Transportation, Volpe National Transportation Systems Center, *Journey-to-Work Trends in the United States and its Major Metropolitan Area, 1960-1990*, Cambridge, MA, 1994, p. 2-2. (Additional resources: <http://www.census.gov>)

^aCompiled by the Census Bureau, these data on the total number of vehicles do not match the figures on Table 4.1. The figures on Table 4.1, from R.L. Polk and Company, are the preferred data.



1995 Nationwide Personal Travel Survey

The 1995 Nationwide Personal Travel Survey (NPTS) is a national survey designed to collect data on the nature and characteristics of personal travel. The definition of a trip in the NPTS is "any one-way travel from one address to another by private motor vehicle, public transportation, bicycle, or walking." Excluded from the survey are jogging and walking for exercise, as is all bicycling and walking for individuals under 5 years of age. The survey collects detailed data on household trips, their purposes and the transportation modes used. The NPTS is sponsored by several agencies of the U.S. Department of Transportation and is conducted approximately every seven years. Since each of the surveys differ somewhat in terminology, survey procedure, and target population, one should be cautious when comparing statistics from one survey to the next. Improved methodologies used in the collection of the trip information in the 1995 NPTS make it impossible to compare these data with past NPTS survey data. Thus, the 1990 NPTS trip data have been adjusted to make it comparable with the latest survey. Both the original 1990 data and the adjusted 1990 data are shown in tables comparing trip information. The 1995 trip data should only be compared to the adjusted 1990 trip data, and the original trip 1990 data should be compared with previous surveys. Additional analyses can be done on the 1995 NPTS data through the Internet site: <http://www-cta.ornl.gov/npts>.

Table 10.9
Demographic Statistics
1969, 1977, 1983, 1990, and 1995 NPTS

	1969	1977	1983	1990	1995	Percent change 1969-95
Persons per household	3.16	2.83	2.69	2.56	2.63	-17%
Vehicles per household	1.16	1.59	1.68	1.77	1.78	53%
Workers per household	1.21	1.23	1.21	1.27	1.33	10%
Vehicles per worker	0.96	1.29	1.39	1.40	1.34	40%
Average vehicle trip length (miles)	8.89	8.34	7.90	8.98	9.06	2%

Source:

U.S. Department of Transportation, Federal Highway Administration, *1990 Nationwide Personal Transportation Survey: Summary of Travel Trends*, FHWA-PL-92-027, Washington, DC, March 1992, Table 2. Data for 1995 were generated from the Internet site <http://www-cta.ornl.gov/npts>.
(Additional resources: <http://www.fhwa.dot.gov>)

Note:

Average vehicle trip length for 1990 and 1995 is calculated using only those records with trip mileage information present. The 1969 survey does not include pickups and other light trucks as household vehicles.



The 1995 NPTS data should be compared only to the 1990 adjusted data due to survey methodology improvements in collecting trip information. The original 1990 data are comparable to all previous surveys; however, comparisons should always be made with caution because of differing survey methodologies.

Table 10.10
Average Annual Vehicle-Miles, Vehicle Trips and
Trip Length per Household
1969, 1977, 1983, 1990, and 1995 NPTS

	Journey-to-work ^a	All trips
<i>Average annual vehicle-miles per household</i>		
1969	4,183	12,423
1977	3,815	12,036
1983	3,538	11,739
1990 original	4,853	15,100
1990 adjusted	4,853	18,161
1995	6,492	20,895
<i>Average annual vehicle trips per household</i>		
1969	445	1,396
1977	423	1,442
1983	414	1,486
1990 original	448	1,702
1990 adjusted	448	2,077
1995	553	2,321
<i>Average vehicle trip length (miles)</i>		
1969	9.4	8.9
1977	9.0	8.4
1983	8.5	7.9
1990 original	11.0	9.0
1990 adjusted	11.0	8.9
1995	11.8	9.1

Source:

U.S. Department of Transportation, Federal Highway Administration, *1990 Nationwide Personal Transportation Survey: Summary of Travel Trends*, FHWA-PL-92-027, Washington, DC, March 1992, Table 7. Data for 1995 were generated from the Internet site <http://www-cta.ornl.gov/npts>. 1990 adjusted data - Oak Ridge National Laboratory, Oak Ridge, TN, August 1998. (Additional resources: <http://www.fhwa.dot.gov>, <http://www-cta.ornl.gov/npts>)

^aIt is believed that the methodology changes in the 1995 NPTS did not affect journey-to-work trips; therefore, no adjustment is necessary.



The 1995 NPTS data should be compared only to the 1990 adjusted data due to survey methodology improvements in collecting trip information. The original 1990 data are comparable to all previous surveys; however, comparisons should always be made with caution because of differing survey methodologies.

Table 10.11
Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length
per Household by Selected Trip Purposes
1983, 1990, and 1995 NPTS

	Journey-to-work ^a	Shopping	Social and recreational	All purposes ^b
<i>Average annual PMT per household</i>				
1983	4,586	2,567	8,964	22,802
1990 original	5,637	2,674	8,567	24,803
1990 adjusted	5,637	3,343	11,308	30,316
1995	7,740	4,659	10,571	34,459
<i>Average annual person trips per household</i>				
1983	537	474	728	2,628
1990 original	539	504	662	2,673
1990 adjusted	539	630	874	3,262
1995	676	775	953	3,828
<i>Average person trip length (miles)</i>				
1983	8.5	5.4	12.3	8.7
1990 original	10.7	5.4	13.2	9.5
1990 adjusted	10.7	5.4	13.2	9.5
1995	11.6	6.1	11.3	9.1

Source:

U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Study, Public Use Tapes, Washington, DC. Data for 1995 were generated from the Internet site <http://www-cta.ornl.gov/npts>. 1990 adjusted data - Oak Ridge National Laboratory, Oak Ridge, TN, August 1998. (Additional resources: <http://www.fhwa.dot.gov>, <http://www-cta.ornl.gov/npts>)

Note:

Average person trip length for 1990 and 1995 is calculated using only those records with trip mileage information present. "All purposes" includes unreported trip purposes.

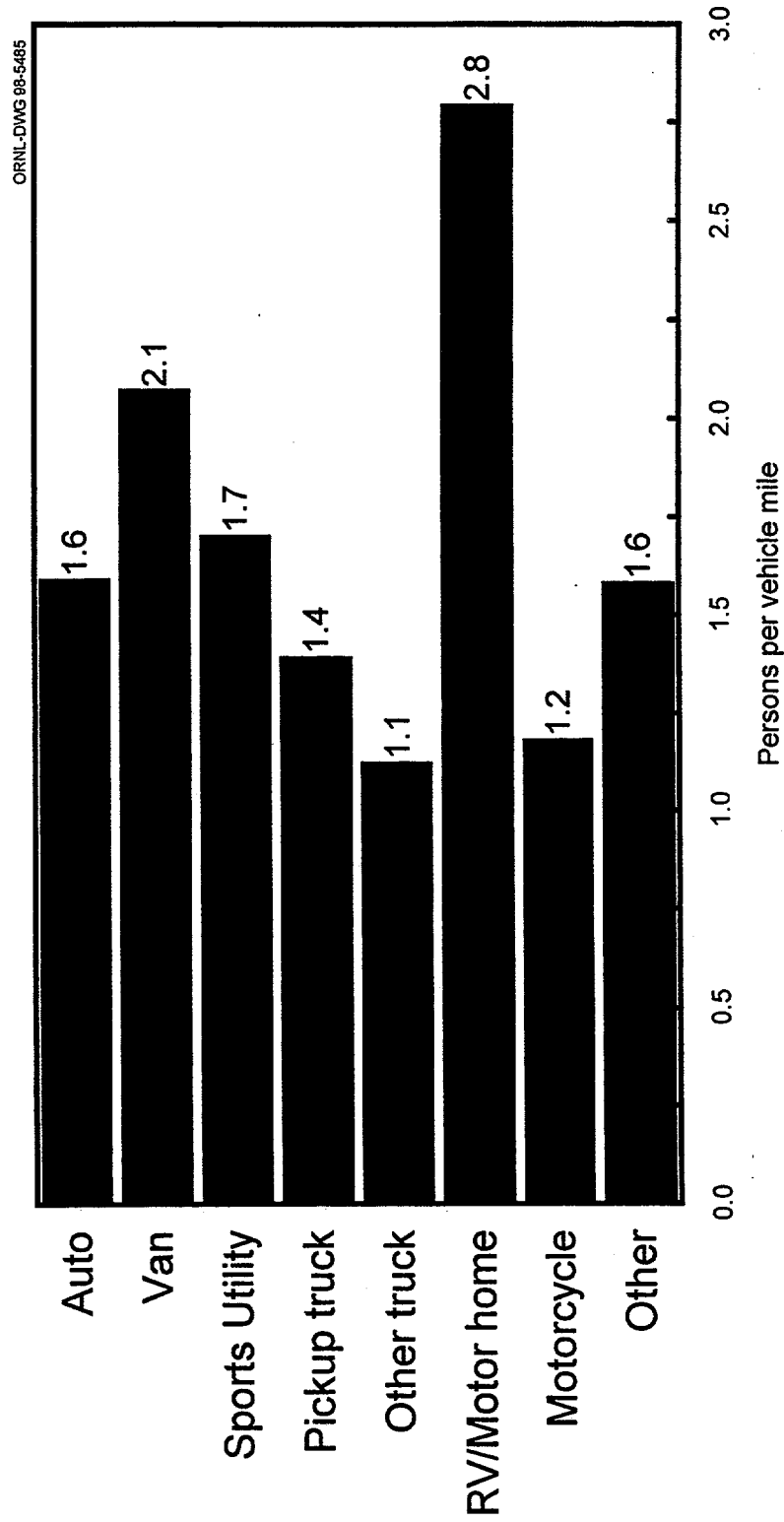
^aIt is believed that the methodology changes in the 1995 NPTS did not affect journey-to-work trips; therefore, no adjustment is necessary.

^bIncludes trip purposes not shown on this table.





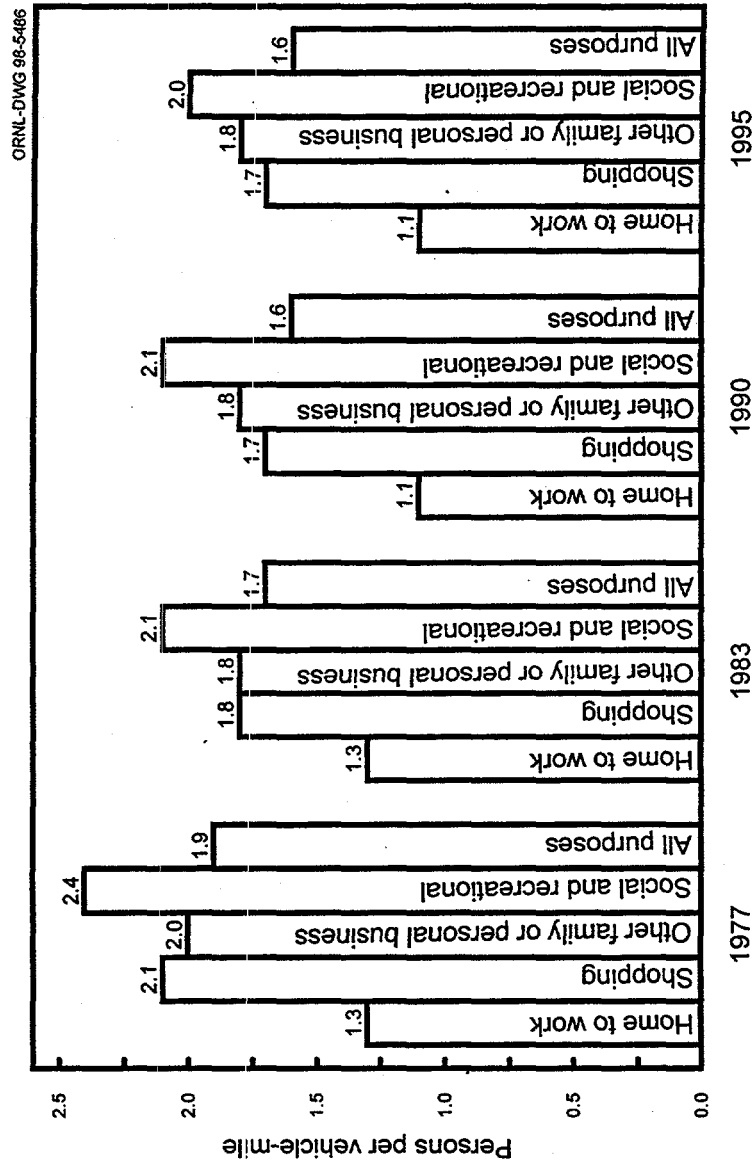
Figure 10.1. Average Vehicle Occupancy by Vehicle Type, 1995 NPTS



Source:
U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Survey, Washington, DC, 1997.
(Additional resources: <http://www.fhwa.dot.gov>, <http://www-cia.ornl.gov/npts>)

The average vehicle occupancy, calculated as person-miles per vehicle-mile, was nearly identical in 1990 and 1995 for every trip purpose. The highest vehicle occupancy levels were in 1977. The increased number of vehicles per household and the decrease in average household size could have contributed to the decline since then.

**Figure 10.2. Average Vehicle Occupancy by Trip Purpose
1977, 1983, 1990, and 1995 NPTS**



Source:

U.S. Department of Transportation, Federal Highway Administration, 1990 Nationwide Personal Transportation Survey: Summary of Travel Trends, FHWA-PL-92027, Washington, DC, March 1992, Figure 6. Data from 1995 were generated from the public use file.
(Additional resources: <http://www.fhwa.dot.gov>, <http://www.cta.ornl.gov/npts>)



Historically, the data from the Nationwide Personal Transportation Study (NPTS) are based on estimates reported by survey respondents. For the 1995 survey, odometer data was also collected. The Residential Transportation Energy Consumption Survey (RTECS) data has always been collected from odometer readings. These data indicate that respondents may overestimate the number of miles driven in a year.

Table 10.12
Average Annual Miles Per Household Vehicle by Vehicle Age

Vehicle age (years)	National Personal Transportation Study			Residential Transportation Energy Consumption Survey					
	1983 self-reported	1990 self-reported	1995 self-reported	1995 odometer	1983 odometer	1985 odometer	1988 odometer	1991 odometer	1994 odometer
Under 1	8,200	19,600	15,900	15,600	13,400	12,700	12,900	13,400	15,220
1	15,200	16,800	12,200	11,200	13,000	13,000	13,400	14,100	14,250
2	16,800	16,600	12,200	11,300	12,700	12,600	12,600	12,600	13,740
3	14,500	14,700	12,800	11,600	12,100	12,400	12,100	13,200	13,080
4	13,000	13,600	13,200	12,400	11,300	11,100	11,500	13,300	12,500
5	12,100	12,900	13,500	12,700	9,700	10,600	10,600	12,200	12,560
6	11,300	13,200	14,100	12,900	9,700	10,000	10,800	11,200	12,290
7	10,000	12,400	14,400	13,800	9,500	9,700	10,000	10,700	12,030
8	9,800	12,600	15,500	14,800	8,700	8,900	10,300	11,400	10,915
9	9,000	11,500	16,800	14,500	8,400	8,600	8,900	10,000	10,950
10 and older	7,300	9,200	8,900	9,000	8,700	8,400	7,500	7,200	9,780
All vehicles	10,400	12,500	12,200	11,800	9,400	9,900	10,200	10,600	11,400

Source:

Nationwide Personal Transportation Study—1983: D. Klinger and J. Richard Kuznyak, COMSIS Corporation, Personal Travel in the United States, Volume 1: 1983-84 Nationwide Personal Travel Study, prepared for the U.S. Department of Transportation, Washington, DC, August 1986, Table 4-22, p.4-21.
1990: Generated from the 1990 Nationwide Personal Transportation Study Public Use Tape, March 1992. 1995: Generated from the Internet site: <http://www.cta.ornl.gov/npts>.

Residential Transportation Energy Consumption Survey—Personal communication with Energy Information Agency, Office of Markets and End Use, Energy End Use Division.

(Additional resources: <http://www.fhwa.dot.gov>, <http://www.eia.doe.gov>)

Note:

Data include all household vehicles. Data have been rounded to the nearest hundredth.



In 1995 the average journey-to-work was faster (miles per hour increased to 34.6), but the travel time still increased, probably due to an increase in the average travel distance. Journeys-to-work using public transportation continued to take twice as long as private transportation, though there is only a slight difference in travel distance.

Table 10.13
Journey-to-Work Statistics
1983, 1990, and 1995 NPTS^a

Year	Private transportation	Public transportation	Other	Total
<i>Average travel time (minutes)^b</i>				
1983	17.6	39.8	10.6	18.2
1990	19.1	41.1	12.4	19.6
1995	20.1	42.0	18.8	20.7
<i>Average trip length (miles)</i>				
1983	8.9	11.8	1.4	8.5
1990	11.0	12.8	2.2	10.7
1995	11.8	12.9	8.2	11.6
<i>Average speed (miles per hour)</i>				
1983	30.2	17.8	7.6	28.2
1990 ^c	34.7	18.2	7.6	33.3
1995 ^c	35.4	19.3	25.9	34.6

Source:

U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Study, Public Use Tapes, Washington, DC. Data for 1995 were generated from the Internet site <http://www-cta.ornl.gov/npts>. (Additional resources: <http://www.fhwa.dot.gov>, <http://www-cta.ornl.gov/npts>)

^aIt is believed that the methodology changes in the 1995 NPTS did not affect journey-to-work trips; therefore, no adjustment is necessary.

^bDoes not include time spent waiting for transportation.

^cDoes not include segmented trips.



According to the U.S. Census data, the percentage of workers who car pooled has dropped from 19.7% in 1980 to 13.4% in 1990. The percent of workers using public transit declined from 6.4% to 5.3% during the same time period. The average travel time increased by 0.7 minutes from 1980 to 1990.

Table 10.14
Means of Transportation to Work, 1980 and 1990 Census

Means of transportation	1980 Census		1990 Census	
	Number of workers	Percentage	Number of workers	Percentage
Private vehicle	81,258,496	84.1%	99,592,932	86.5%
Drove alone	62,193,449	64.4%	84,215,298	73.2%
Car pooled	19,065,047	19.7%	15,377,634	13.4%
Public transportation	6,175,061	6.4%	6,069,589	5.3%
Bus or trolley bus ^a	3,924,787	4.1%	3,445,000	3.0%
Streetcar or trolley car ^a	b	b	78,130	0.1%
Subway or elevated	1,528,852	1.6%	1,755,476	1.5%
Railroad	554,089	0.6%	574,052	0.5%
Ferryboat	b	b	37,497	0.0%
Taxicab	167,133	0.2%	179,434	0.2%
Other means	703,273	0.7%	808,582	0.7%
Motorcycle	419,007	0.4%	237,404	0.2%
Bicycle	468,348	0.5%	466,856	0.4%
Walked only	5,413,248	5.6%	4,488,886	3.9%
Worked at home	2,179,863	2.3%	3,406,025	3.0%
Total workers	96,617,296	100.0%	115,070,274	100.0%
Average travel time (minutes)	21.7		22.4	

Source:

Data provided by the Journey-to-Work and Migration Statistics Branch, Population Division, U.S. Bureau of the Census. (Additional resources: <http://www.census.gov>)

^aThis category was "Bus or streetcar" in 1980.

^bData are not available.



Table 10.15
National and Metropolitan Area Comparisons of Journey-to-Work Statistics, 1990 Census

	National	Metropolitan areas ^a
Workers per household	1.25	1.31
Workers per vehicle	0.76	0.82
Average travel time (minutes)	22.38	25.20
Commute length (percentage)		
Less than 15 minutes	15.87%	11.45%
15-29 minutes	51.64%	49.22%
30-39 minutes	14.66%	17.48%
40-59 minutes	9.01%	11.77%
60 minutes or more	5.86%	7.52%
Mode (percentage)		
Drive alone	73.19%	70.75%
Percentage car pooled	13.36%	12.69%
Public transit	5.27%	8.98%
Motorcycle	0.21%	0.21%
Walk	3.90%	3.76%
Bicycle	0.41%	0.43%
Other	0.70%	0.62%
Work at home	2.96%	2.57%
Time workers leave home (percentage)		
5:00 AM-6:59 AM	26.04%	25.49%
7:00 AM-8:29 AM	41.87%	42.44%
8:30 AM-9:59 AM	10.28%	11.57%
All other departures	18.85%	17.93%

Source:

U. S. Department of Transportation, Volpe National Transportation Systems Center, *Journey-to-Work Trends in the United States and its Major Metropolitan Area, 1960-1990*, FHWA-PL-94-012, Cambridge, MA, 1994, p. 2-6. (Additional resources: <http://www.census.gov>)

^aMetropolitan areas over 1 million population. There were 39 such areas in the 1990 Census.

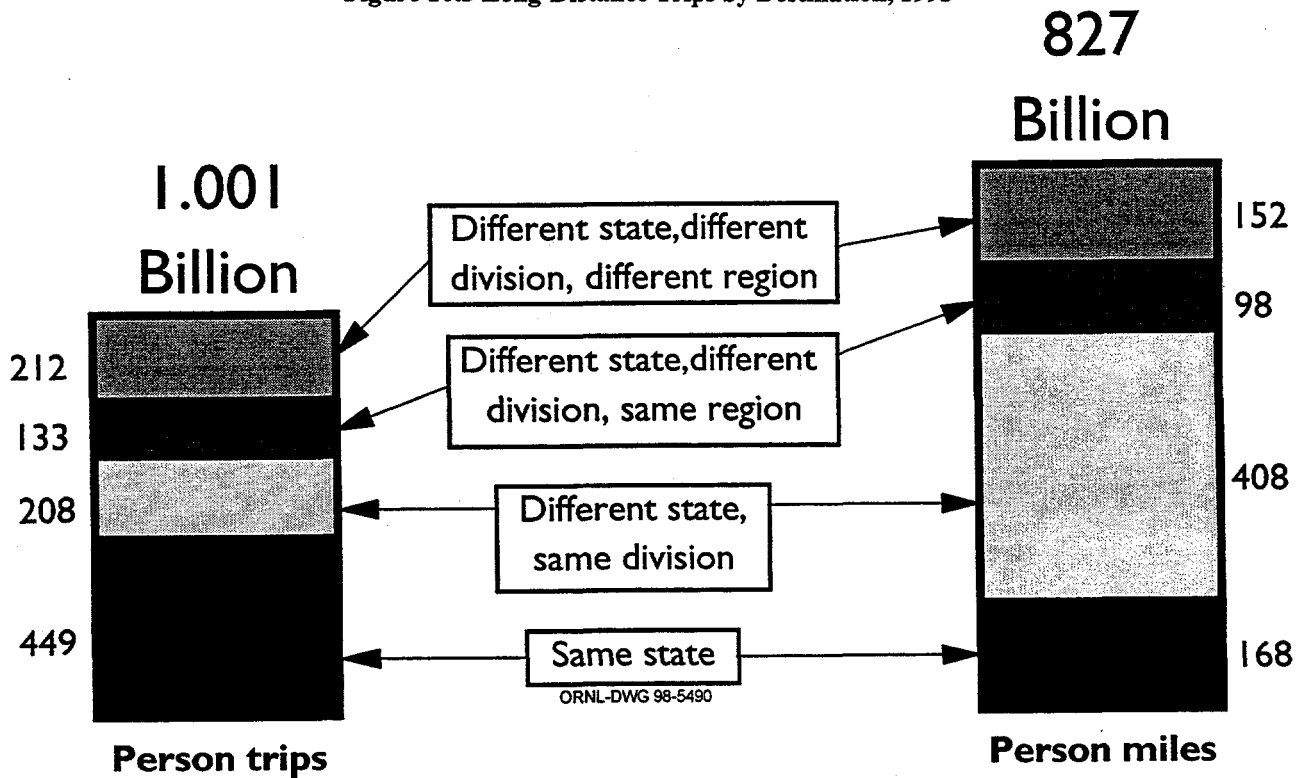


1995 American Travel Survey

The American Travel Survey (ATS) was conducted by the Bureau of Transportation Statistics to obtain information about the long-distance travel of persons living in the United States. Approximately 80,000 randomly selected households were interviewed for the survey, which collected information about all trips of 100 miles or more, one-way, taken by household members in 1995. The ATS data provide detailed information on state-to-state travel, as well as travel to and from metropolitan areas by mode of transportation.

For additional information about the American Travel Survey, contact the Bureau of Transportation Statistics at (202) 366-3282 or visit the following Internet site: <http://www.bts.gov/ats>

Figure 10.3 Long-Distance Trips by Destination, 1995



Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *1995 American Travel Survey Profile*, Washington, DC, October 1997, p. 2. (Additional resources: <http://www.bts.gov/ats>)

Note:

Definitions of divisions and regions are in Appendix C.



Table 10.16
Long-Distance Trips* by Mode and Purpose

Principal means of transportation	Main purpose of trip						Total
	Pleasure			Personal business		Total	
	Business	Visit friends or relatives	Leisure	Total	Personal business		
	Person trips (thousands)						
Personal use vehicle	151,697	283,153	254,186	537,339	124,791	813,858	
Commercial airplane	67,083	41,881	31,581	73,462	15,386	155,936	
Intercity bus	286	1,830	690	2,519	439	3,244	
Charter or tour bus	1,281	1,198	9,253	10,451	2,514	14,247	
Train	1,342	2,004	944	2,948	704	4,994	
Ship, boat, or ferry	68	43	483	525	20	614	
Total	224,835	330,755	299,355	630,110	146,338	1,001,319	
	Percentage						
Personal use vehicle	18.6	34.8	31.2	66.0	15.3	100.0	
Commercial airplane	43.0	26.9	20.3	47.1	9.9	100.0	
Intercity bus	8.8	56.4	21.3	77.7	13.5	100.0	
Charter or tour bus	9.0	8.4	64.9	73.4	17.6	100.0	
Train	26.9	40.1	18.9	59.0	14.1	100.0	
Ship, boat, or ferry	11.1	7.0	78.7	85.5	3.3	100.0	
Total	22.5	33.0	29.9	62.9	14.6	100.0	

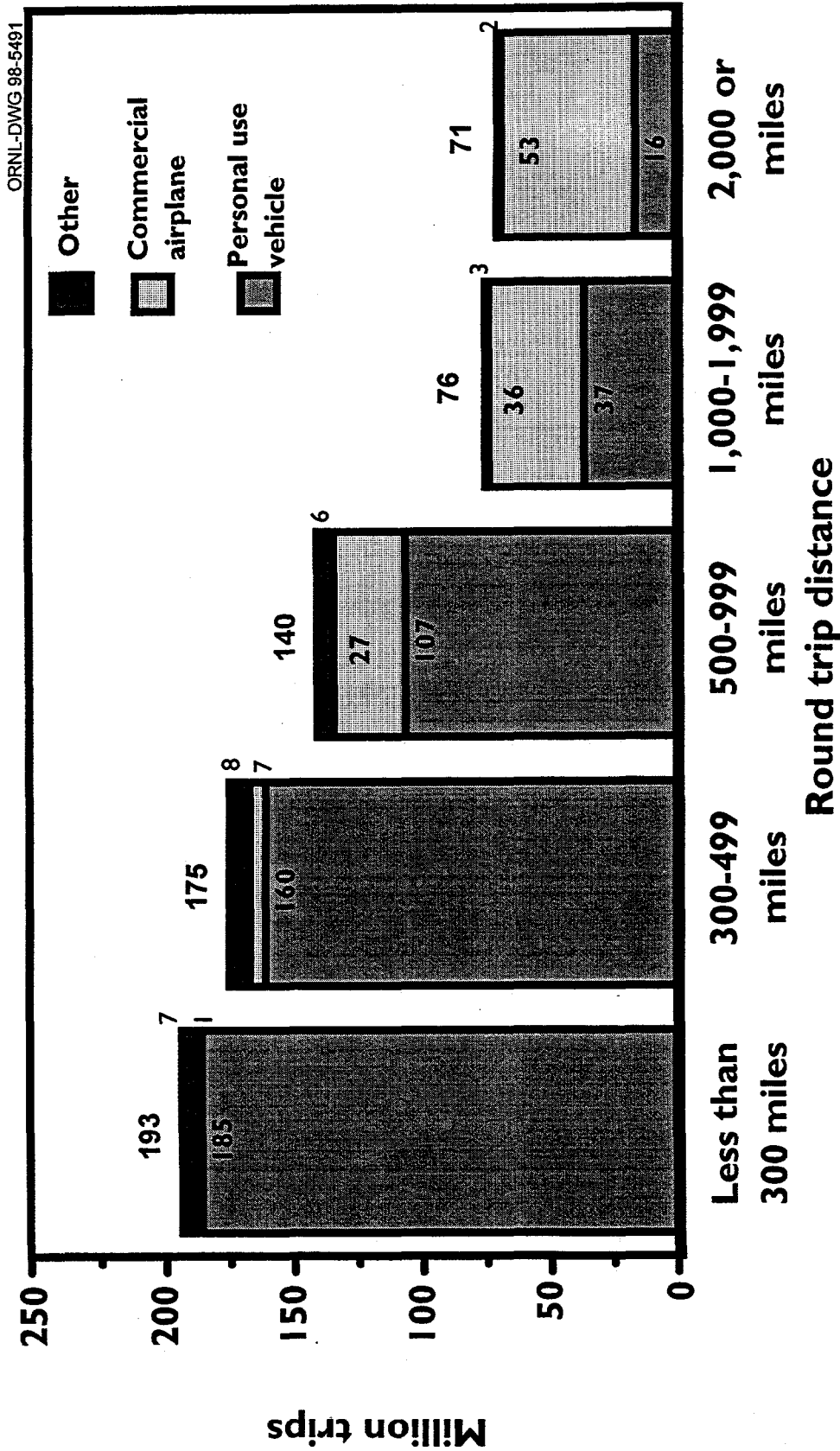
Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *1995 American Travel Survey Profile*, Washington, DC, October 1997, p. 13.
(Additional resources: <http://www.bts.gov/ats>)

*A long-distance trip is any trip of 100 miles or more, one way.



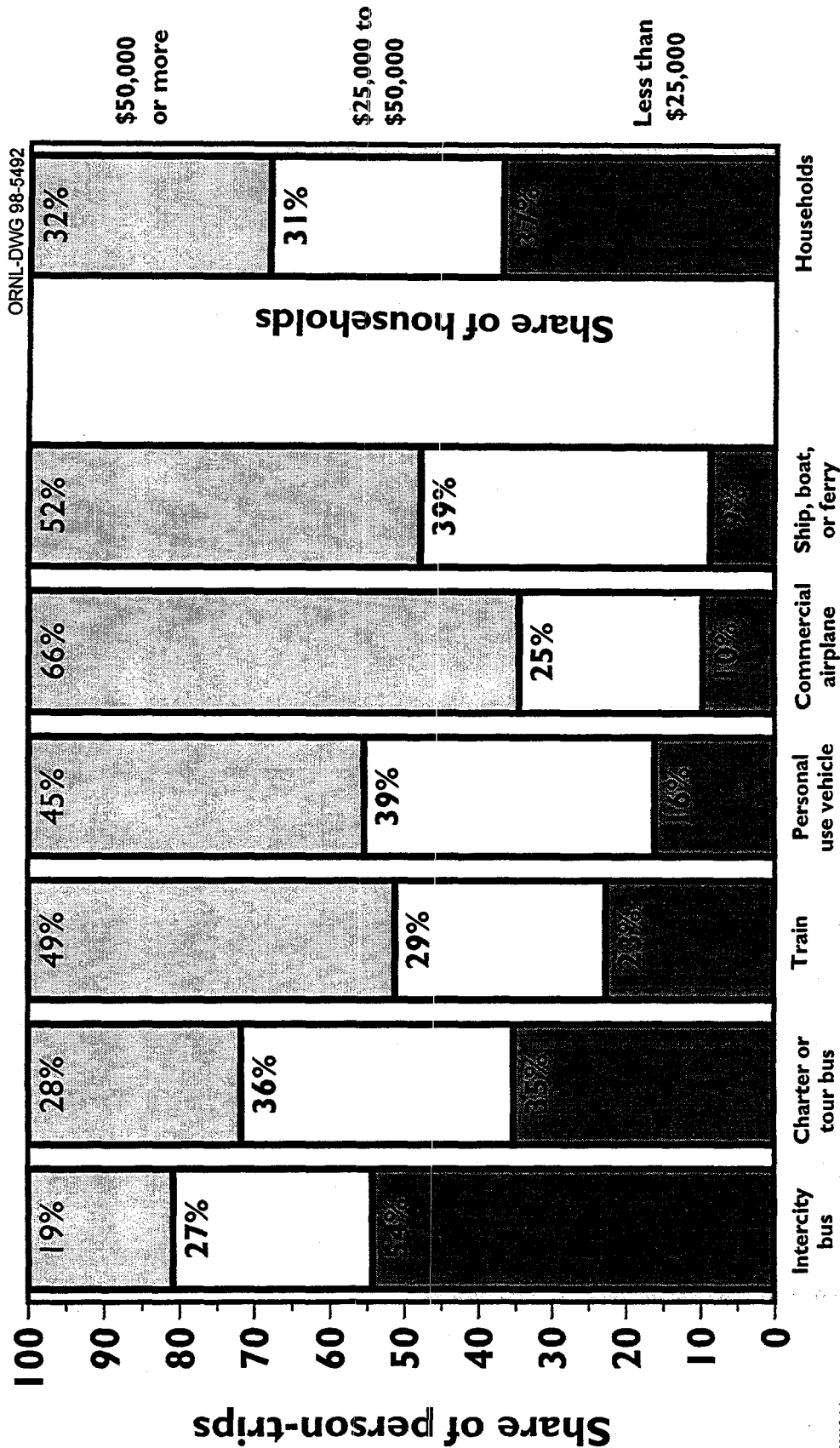
Figure 10.4. Long-Distance Household Trips by Mode and Trip Distance, 1995



Source: U.S. Department of Transportation, Bureau of Transportation Statistics, *1995 American Travel Survey Profile*, Washington, DC, October 1997, p. 3. (Additional resources: <http://www.bts.gov/ats>)



Figure 10.5. Shares of Long-Distance Person Trips by Mode and Household Income, 1995



Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *1995 American Travel Survey Profile*, Washington, DC, October 1997, p. 8.
 U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, 117th Edition, Washington, DC, 1997, p. 465.
 (Additional resources: <http://www.bts.gov/ats>, <http://www.census.gov>)



Chapter 11

Nonhighway Modes

Summary Statistics

Table		
	Passenger-miles, 1996	(millions)
11.1	<i>Domestic and international air carrier</i>	595,784
11.2	<i>General aviation</i>	10,600
11.10	<i>Amtrak</i>	5,066
11.11	<i>Transit rail</i>	12,484
	Freight ton-miles, 1996	(millions)
11.4	<i>Domestic waterborne commerce</i>	765,000
11.7	<i>Class I railroad</i>	1,355,975
	Passenger energy use, 1996	(trillion Btus)
11.1	<i>Domestic and international air carrier</i>	2,396.6
11.2	<i>General aviation</i>	111.1
11.10	<i>Amtrak energy use</i>	43.0
11.11	<i>Transit rail</i>	12.1
	Freight energy use, 1996	(trillion Btus)
11.4	<i>Domestic waterborne commerce</i>	1,171.0
11.7	<i>Class I railroad</i>	499.4



Table 11.1
Summary Statistics for Domestic and International Certificated Route Air Carriers (Combined Totals), 1970-96

Year	Revenue aircraft-miles (millions)	Average passenger trip length ^a (miles)	Revenue passenger-miles (millions)	Available seat-miles (millions)	Available seats per aircraft ^b	Passenger load factor (percentage) ^c	Revenue cargo ton-miles (millions)	Energy use (trillion Btu) ^d	Percent domestic of total energy use (percentage)
1970	2,383	678	131,719 ^e	264,904 ^e	111	49.7% ^e	4,994	1,363.4	f
1975	2,241	698	173,324	315,823	135	54.9%	5,944	1,283.4	f
1976	2,320	704	191,823	338,349	139	56.7%	6,222	1,324.1	f
1977	2,418	704	206,082	361,172	143	57.1%	6,587	1,386.2	f
1978	2,608	719	236,998	381,113	147	62.2%	7,395	1,436.3	82.0%
1979	2,859	714	269,719	425,411	146	63.4%	7,580	1,534.8	82.5%
1980	2,924	736	267,722	448,479	148	59.7%	7,515	1,489.6	82.4%
1981	2,703	749	260,063	438,778	157	59.3%	7,917	1,429.3	f
1982	2,804	766	272,435	455,938	157	59.8%	7,807	1,406.6	81.1%
1983	2,923	765	295,144	480,977	159	61.4%	8,497	1,439.2	84.4%
1984	3,264	759	319,504	534,104	164	59.8%	9,328	1,607.4	f
1985	3,462	758	351,073	565,677	163	62.1%	9,048	1,701.5	f
1986	3,873	767	378,923	623,073	161	60.8%	10,987	1,847.1	81.4%
1987	4,182	779	417,830	670,871	160	62.3%	13,130	1,945.4	80.4%
1988	4,355	786	437,649	696,337	160	62.9%	14,633	2,049.4	78.5%
1989	4,442	792	447,480	703,888	158	63.6%	16,347	2,087.4	77.0%
1990	4,724	803	472,236	753,211	159	62.7%	16,411	2,191.3	75.9%
1991	4,661	806	463,296	738,030	158	62.8%	16,149	2,069.2	74.5%
1992	4,899	806	493,715	772,869	158	63.9%	17,306	2,144.2	74.1%
1993	5,118	799	505,996	793,959	155	63.7%	19,083	2,168.8	74.4%
1994	5,360	787	537,506	809,240	151	66.4%	21,773	2,249.5	74.3%
1995	5,627	791	558,757	845,012	150	66.1%	23,375	2,310.4	74.0%
1996	5,850	802	595,784	859,077	147	69.4%	24,810	2,396.6	74.0%
<i>Average annual percentage change</i>									
1970-96	3.5%	0.6%	6.0%	4.6%	1.1%		6.4%	2.2%	
1986-96	4.2%	0.4%	4.6%	3.3%	-0.9%		8.5%	2.6%	

Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *Air Carrier Traffic Statistics Monthly*, December 1996/1995, Washington, DC, pp. 1-2, and annual. 1970-81 Energy Use - Department of Transportation, Civil Aeronautics Board, *Fuel Cost and Consumption*, Washington, DC, 1981, and annual.

1982-96 Energy Use - Department of Transportation, Research and Special Programs Administration, "Fuel Cost and Consumption Tables," Washington, DC, monthly. Annual totals are derived by summing monthly totals for domestic and international air carriers. (Additional resources: <http://www.bts.gov>, <http://www.faa.gov>)

^aScheduled services of domestic operations only. The average passenger trip length for international operations is more than three and a half times longer than for domestic operations.

^bAvailable seats per aircraft is calculated as the ratio of available seat-miles to revenue aircraft-miles.

^cPassenger load factor is calculated as the ratio of revenue passenger-miles to available seat-miles for scheduled and nonscheduled services.

^dEnergy use includes fuel purchased abroad for international flights.

^eScheduled services only.

^fData are not available.

