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Center for Transportation Analysis
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TRANSPORTATION ENERGY DATA BOOK: EDITION 21

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Transportation Energy Data Book
can be found on the web at:

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FOREWORD

As we endeavor to improve this data book, we find updates and new material to present. Here are some new items you might find interesting.

1. The World Fossil Fuel Potential on p. 1-2 has been updated from a 1997 to a 2000 source.
2. Estimates of the costs of oil dependence to the U.S. are provided on p. 1-8. About $7 trillion in economic costs have been imposed on the U.S. over the last 30 years.
3. Petroleum is the dominant energy source used in OECD and non-OECD countries (p. 2-2).
4. Energy intensity for transit in the U.S. varies greatly from one metropolitan area to another, and for buses it is generally higher than for cars (p. 2-16).
5. To understand the GREET model fuel-cycle comparisons better, the reference car energy use and emissions are provided and the alternative vehicle fuel economies are listed (p. 3-9).
6. The automobile lifetime estimate on p. 6-11 of 16.1 years is two years greater than the estimate in last year's edition of the data book.
7. The heavy truck scrappage and survival estimates on p. 6-15 are a new addition. Heavy trucks are estimated to last 29 years on average.
8. Data from the 2000 Census appears for the first time in Tables 11.14 and 11.15.

I hope you find this data book useful.

ACKNOWLEDGMENTS

I would like to express my gratitude to the many individuals who assisted in the preparation of this document. First, I would like to thank Phil Patterson and the staff of the Office of Transportation Technologies (OTT) for their continued support of the Transportation Energy Data Book project. I would also like to thank Patricia Hu of Oak Ridge National Laboratory (ORNL) for her guidance and mentoring. This document benefits from the criticism and careful review of Phil Patterson, OTT; Alicia Birky, National Renewable Energy Laboratory; Tatyana Gurikova, MacroSys, Inc.; James Moore and William Shadis, TA-Engineering, Inc.; and Margaret Singh, Argonne National Laboratory. I would also like to thank Jamie Payne, ORNL, who designed the cover; Sherry Campbell Gambrell, ORNL, who prepared the title index; and Bob Boundy, Q Systems, who assisted with so many tasks I can't name them all. Finally, this book would not have been possible without the dedication of Debbie Bain, who masterfully prepared the manuscript.

ABSTRACT

The *Transportation Energy Data Book: Edition 21* is a statistical compendium prepared and published by Oak Ridge National Laboratory (ORNL) under contract with the Office of Transportation Technologies in the Department of Energy (DOE). Designed for use as a desk-top reference, the data book represents an assembly and display of statistics and information that characterize transportation activity, and presents data on other factors that influence transportation energy use. The purpose of this document is to present relevant statistical data in the form of tables and graphs. The latest editions of the Data Book are available to a larger audience via the Internet (www-cta.ornl.gov/data/tedb.htm).

This edition of the Data Book has 12 chapters which focus on various aspects of the transportation industry. Chapter 1 focuses on petroleum; Chapter 2 – energy; Chapter 3 – greenhouse gas emissions; Chapter 4 – criteria pollutant emissions; Chapter 5 – transportation and the economy; Chapter 6 – highway vehicles; Chapter 7 – light vehicles; Chapter 8 – heavy vehicles; Chapter 9 – alternative fuel vehicles; Chapter 10 – fleet vehicles; Chapter 11 – household vehicles; and Chapter 12– nonhighway modes. The sources used represent the latest available data. There are also three appendices which include detailed source information for some tables, measures of conversion, and the definition of Census divisions and regions. A glossary of terms and a title index are also included for the readers convenience.

INTRODUCTION

In January 1976, the Transportation Energy Conservation (TEC) Division of the Energy Research and Development Administration contracted with Oak Ridge National Laboratory (ORNL) to prepare a Transportation Energy Conservation Data Book to be used by TEC staff in their evaluation of current and proposed conservation strategies. The major purposes of the data book were to draw together, under one cover, transportation data from diverse sources, to resolve data conflicts and inconsistencies, and to produce a comprehensive document. The first edition of the TEC Data Book was published in October 1976. With the passage of the Department of Energy (DOE) Organization Act, the work being conducted by the former Transportation Energy Conservation Division fell under the purview of the DOE's Office of Transportation Programs (now the Office of Transportation Technologies). DOE, through the Office of Transportation Technologies, has supported the compilation of Editions 3 through 21.

Policymakers and analysts need to be well-informed about activity in the transportation sector. The organization and scope of the data book reflect the need for different kinds of information. For this reason, Edition 21 updates much of the same type of data that is found in previous editions.

In any attempt to compile a comprehensive set of statistics on transportation activity, numerous instances of inadequacies and inaccuracies in the basic data are encountered. Where such problems occur, estimates are developed by ORNL. To minimize the misuse of these statistics, an appendix (Appendix A) is included to document the estimation procedures. The attempt is to provide sufficient information for the conscientious user to evaluate the estimates and to form their own opinions as to their utility. Clearly, the accuracy of the estimates cannot exceed the accuracy of the primary data, an accuracy which in most instances is unknown. In cases where data accuracy is known or substantial errors are strongly suspected in the data, the reader is alerted. In all cases it should be recognized that the estimates are not precise.

The majority of the statistics contained in the data book are taken directly from published sources, although these data may be reformatted for presentation by ORNL. Consequently, neither ORNL nor DOE endorses the validity of these data.

Chapter 1
Petroleum

Summary Statistics from Tables/Figures in this Chapter

Source			
Table 1.2	World Oil Production, 2000		
	U.S. Oil Production (million barrels per day)		*5.8*
	U.S. Share		*8.6%*
Table 1.3	World Oil Consumption, 1999		
	U.S. Oil Consumption (million barrels per day)		*19.5*
	U.S. Share		*26.1%*
Figure 1.2	Average refinery yield, 2000	OECD Europe	North America
	Gasoline	*20.6%*	*40.5%*
	Diesel fuel	*35.4%*	*22.7%*
	Residual fuel	*16.9%*	*7.5%*
	Kerosene	*6.4%*	*9.0%*
	Other	*20.7%*	*20.3%*
Table 1.9	U.S. transportation oil use as a percent of U.S. oil production, 2000		150%
Table 1.9	Net imports as a percentage of U.S. oil consumption, 2000		52%
Table 1.10	Transportation share of oil consumption, 2000		68%

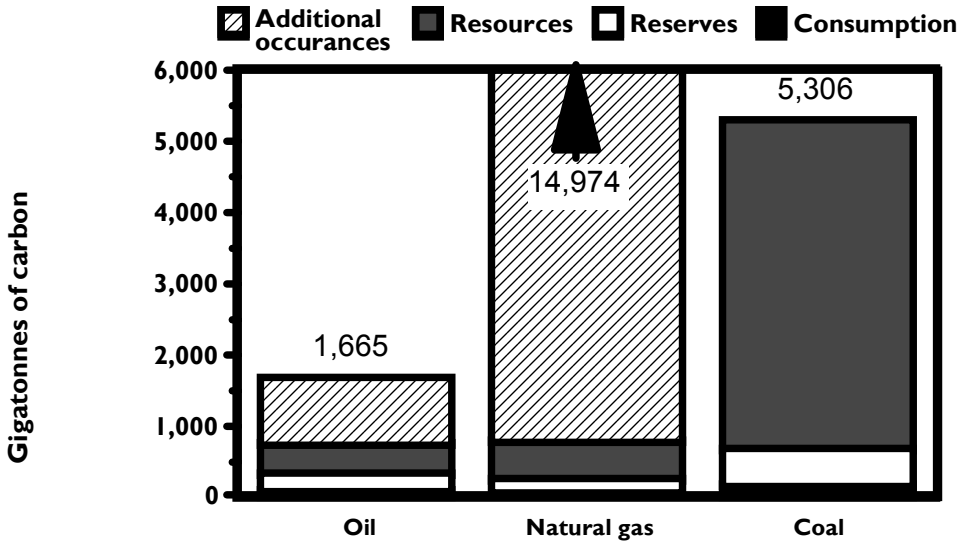
Although the world has consumed about 40% of estimated conventional oil resources, the total fossil fuel potential is huge. Methane hydrates–a potential source of natural gas–are included in the "additional occurrences" of unconventional natural gas, and constitute the largest resource.

Table 1.1
World Fossil Fuel Potential
(gigatonnes of carbon)

	Consumption (1860–1998)	Reserves	Resources	Additional occurrences
Oil				
Conventional	97	120	121	0
Unconventional	6	102	305	914
Natural Gas				
Conventional	36	83	170	0
Unconventional	1	144	364	14,176
Coal	155	533	4,618	[a]

Source:
Rogner, H.H., *World Energy Assessment: Energy and the Challenge of Sustainability, Part II*, Chapter 5, 2000, p. 149.

Figure 1.1. World Fossil Fuel Potential



Source: See Table 1.1.

[a] Data are not available

In 2000, OPEC accounted for 43% of world oil production. Responding to low oil prices early that year, Mexico, Norway, Russia, and Oman joined OPEC in cutting production. This group of oil countries, referred to here as OPEC+, account for 62% of world oil production.

Table 1.2
World Crude Oil Production, 1960-2000[a]
(million barrels per day)

Year	United States	U.S. Share	Total OPEC[b]	OPEC Share	OPEC +[c]	OPEC +[c] Share	Total Non-OPEC	Persian Gulf nations[d]	World
1960	7.04	33.5%	8.70	41.4%	12.25	58.3%	12.29	5.27	20.99
1965	7.80	25.7%	14.35	47.3%	19.83	65.4%	15.98	8.37	30.33
1970	9.64	21.0%	23.30	50.8%	31.16	67.9%	22.59	13.39	45.89
1975	8.37	15.8%	26.77	50.7%	37.56	71.1%	26.06	18.93	52.83
1980	8.60	14.4%	26.61	44.6%	41.07	68.9%	32.99	17.96	59.60
1985	8.97	16.6%	16.18	30.0%	31.81	58.9%	37.80	9.63	53.98
1986	8.68	15.4%	18.28	32.5%	34.05	60.6%	37.95	11.70	56.23
1987	8.35	14.7%	18.52	32.7%	34.72	61.3%	38.15	12.10	56.67
1988	8.14	13.9%	20.32	34.6%	36.66	62.4%	38.42	13.46	58.74
1989	7.61	12.7%	22.07	36.9%	38.50	64.3%	37.79	14.84	59.86
1990	7.36	12.2%	23.20	38.3%	39.12	64.6%	37.37	15.28	60.57
1991	7.42	12.3%	23.27	38.6%	38.53	64.0%	36.94	14.74	60.21
1992	7.17	11.9%	24.40	40.5%	37.67	62.6%	35.81	15.97	60.21
1993	6.85	11.4%	25.12	41.7%	37.65	62.5%	35.12	16.71	60.24
1994	6.66	10.9%	25.51	41.8%	37.67	61.8%	35.48	16.96	60.99
1995	6.56	10.5%	26.00	41.7%	38.24	61.4%	36.33	17.21	62.33
1996	6.46	10.1%	26.46	41.5%	39.15	61.5%	37.25	17.37	63.71
1997	6.45	9.8%	27.71	42.2%	40.69	61.9%	37.98	18.10	65.69
1998	6.25	9.3%	28.77	43.0%	41.61	62.1%	38.19	19.34	66.96
1999	5.88	8.9%	27.58	41.9%	40.48	61.4%	38.29	18.67	65.87
2000	5.83	8.6%	29.11	42.8%	42.74	62.9%	38.87	19.94	67.98
				Average annual percentage change					
1960–2000	-0.5%		3.1%		3.2%		2.9%	3.4%	3.0%
1970–2000	-1.7%		0.7%		1.1%		1.8%	1.3%	1.3%
1990–2000	-2.3%		2.3%		0.9%		0.4%	2.7%	1.2%

Source:
U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2000,* Washington, DC, July 2001, Table 11.4.

[a]Includes lease condensate. Excludes natural gas plant liquids.
[b]Organization of Petroleum Exporting Countries. See Glossary for membership.
[c]OPEC+ includes all OPEC nations plus Russia, Mexico, Norway and Oman.
[d]See Glossary for Persian Gulf nations.

The United States has accounted for approximately one-quarter of the world's oil consumption for the last two decades. These data are the latest available; oil consumption data generally lags behind production data (previous table) by one year.

Table 1.3
World Oil Consumption, 1960–99
(million barrels per day)

Year	United States	U.S. Share	Total OECD[a]	Total Non-OECD	World
1960	9.80	45.9%	15.78	5.56	21.34
1965	11.51	37.0%	22.81	8.33	31.14
1970	14.70	31.4%	34.49	12.32	46.81
1975	16.32	29.0%	38.82	17.38	56.20
1976	17.46	29.3%	41.39	18.28	59.67
1977	18.43	29.8%	42.43	19.40	61.83
1978	18.85	29.4%	43.62	20.54	64.16
1979	18.51	28.4%	44.01	21.21	65.22
1980	17.06	27.0%	41.41	21.66	63.07
1981	16.06	26.4%	39.14	21.76	60.90
1982	15.30	25.7%	37.45	22.05	59.50
1983	15.23	25.9%	36.59	22.15	58.74
1984	15.73	26.3%	37.43	22.41	59.84
1985	15.73	26.2%	37.23	22.87	60.10
1986	16.28	26.4%	38.28	23.48	61.76
1987	16.67	26.5%	38.96	24.04	63.00
1988	17.28	26.7%	40.24	24.58	64.82
1989	17.33	26.3%	40.88	25.04	65.92
1990	16.99	25.8%	40.92	25.05	65.97
1991	16.71	25.1%	41.40	25.16	66.56
1992	17.03	25.5%	42.42	24.34	66.76
1993	17.24	25.7%	42.98	24.02	67.00
1994	17.72	25.9%	44.17	24.12	68.29
1995	17.72	25.4%	44.96	24.92	69.88
1996	18.31	25.6%	46.07	25.34	71.41
1997	18.62	25.5%	46.83	26.23	73.06
1998	18.92	25.7%	46.93	26.71	73.64
1999	19.52	26.1%	47.61	27.30	74.91
		Average annual percentage change			
1960–99	1.8%		2.9%	4.2%	3.3%
1970–99	1.0%		1.1%	2.8%	1.6%
1988–99	1.2%		1.5%	0.9%	1.3%

Source:
U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2000*, Washington, DC, July 2001, Table 11.9.

[a] Organization for Economic Cooperation and Development. See Glossary for membership.

The United States increased its petroleum stocks by 51% from 1973 to 1985; but U.S. stocks remained relatively constant from 1985 to 1998. Data for 1999 and 2000 indicate that U.S. stocks are declining. Petroleum demand, however, continues to increase (see Table 1.3). The Strategic Petroleum Reserve accounted for 37% of total U.S. stocks at the end of 2000.

Table 1.4
Petroleum Stocks in OECD Countries, End of Year 1973–2000[a]
(million barrels)

Year	OECD[b] Europe	Canada	Japan	U.S. Strategic Petroleum Reserve	United States total	Other OECD[c]	OECD[b]	Share of U.S. stocks to U.S. oil consumption	Share of OECD stocks to OECD oil consumption
1973	1,070	140	303	[d]	1,008	67	2,588	16.0%	17.1%
1975	1,154	174	375	[d]	1,133	67	2,903	19.1%	20.5%
1980	1,464	164	495	108	1,392	72	3,587	22.4%	23.8%
1985	1,092	113	494	493	1,519	66	3,284	26.5%	24.2%
1990	1,163	121	590	586	1,621	73	3,568	26.2%	24.0%
1991	1,181	119	606	569	1,617	65	3,588	26.6%	23.8%
1992	1,219	107	603	575	1,592	67	3,588	25.7%	23.2%
1993	1,221	105	618	587	1,647	69	3,661	26.2%	23.4%
1994	1,240	119	645	592	1,653	69	3,726	25.6%	23.2%
1995	1,228	109	630	592	1,563	71	3,601	24.2%	22.0%
1996	1,256	103	651	566	1,507	74	3,591	22.6%	21.4%
1997	1,255	115	685	563	1,560	74	3,689	23.0%	21.7%
1998	1,303	118	649	571	1,647	66	3,784	23.9%	22.2%
1999	1,232	108	629	567	1,493	69	3,530	21.0%	20.4%
2000	1,259	112	634	541	1,468	70	3,542	[e]	[e]
				Average annual percentage change					
1973–2000	0.6%	-0.8%	2.8%	[e]	1.4%	0.2%	1.2%		
1990–2000	0.8%	-0.8%	0.7%	-0.4%	-1.0%	-0.4%	-0.1%		

Source:
Country stocks - U.S. Department of Energy, Energy Information Administration, *International Petroleum Statistics Report*, Washington, DC, July 2001, Table 4.5.
U.S. Strategic Petroleum Reserve - U.S. Department of Energy, Energy Information Administration, *Annual Energy Review, 2000*, Washington, DC, July 2001, Table 5.15.
Oil consumption – See Table 1.3.

[a] Includes crude oil (including strategic reserves), lease condensate, natural gas plant liquids, unfinished oils, and finished petroleum products. Oil stocks include all non-military stocks held by importers, refiners, Governments, major non-importing final consumers and by foreign entities in certain facilities. See *Stocks* in Glossary for details.

[b] Organization for Economic Cooperation and Development (OECD). See Glossary for membership.

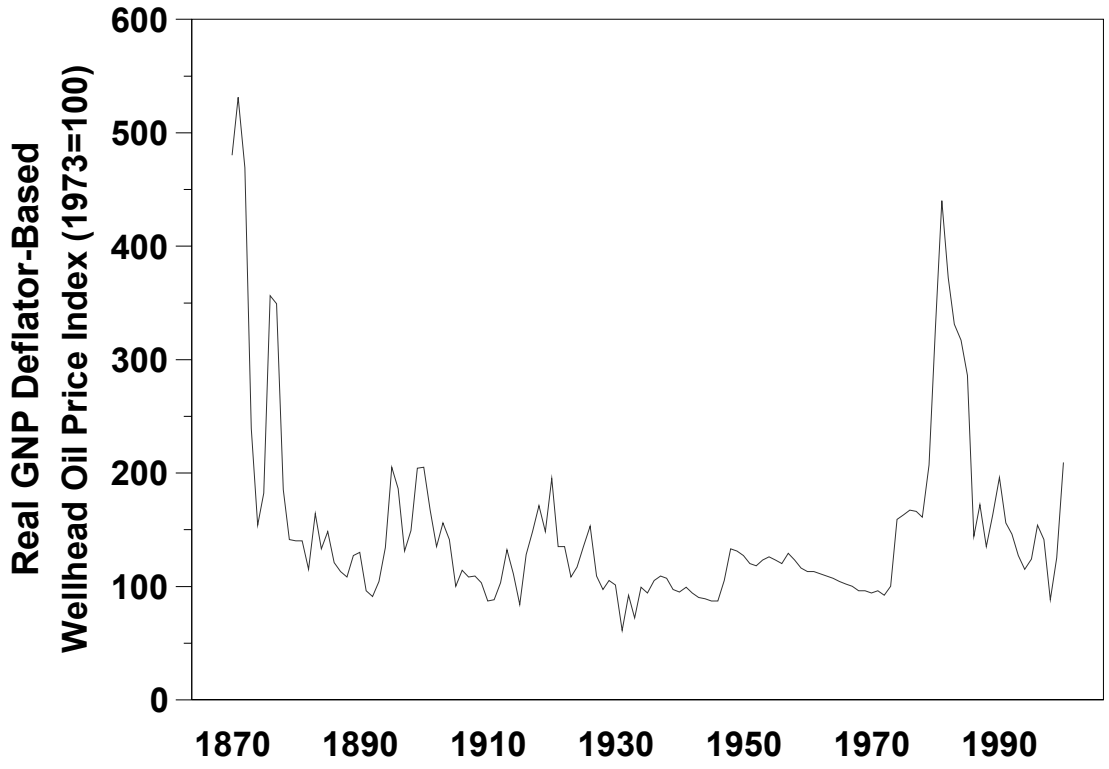
[c] Australia, New Zealand, and United States Territories. Data for Mexico, which joined the OECD on May 18, 1994, are not available.

[d] Data are not available. The Energy Policy and Conservation Act, effective February 1976, authorized the establishment of the U.S. Strategic Petroleum Reserve.

[e] Data are not available.

This chart shows the volatility of crude oil prices since 1870. Given this volatility, it is difficult for anyone to predict future crude oil prices with any certainty.

Figure 1.2. Crude Oil Prices, 1870–2000



Source:
Santini, Danilo J., "An Assessment of Oil Supply and Its Implications for Future Prices," *Nonrenewable Resources*, Vol. 7, No. 2, 1998, pp. 101-121, and 1994–2000 data updates.

The share of petroleum imported to the U.S. can be calculated using total imports or net imports. Net imports, which is the preferred data, rose to 50% of U.S. petroleum consumption for the first time in 1998, while total imports reached 50% for the first time in 1993. OPEC share of net imports has been around 50% for the last five years.

Table 1.5
U.S. Petroleum Imports by World Region of Origin, 1960–2000
(thousand barrels per day)

Year	Net OPEC[a] imports	Net OPEC share	Net Persian Gulf nation[b] imports	Net Persian Gulf share	Net imports	Net imports as a share of U.S. consumption	Total imports
1960	1,311	81.3%	[c]	[c]	1,613	[c]	1,815
1965	1,475	64.7%	[c]	[c]	2,281	[c]	2,468
1970	1,343	42.5%	[c]	[c]	3,161	[c]	3,419
1975	3,599	61.6%	[c]	[c]	5,846	35.8%	6,056
1980	4,293	67.5%	[c]	[c]	6,365	37.3%	6,909
1981	3,315	61.4%	1,215	22.5%	5,401	33.6%	5,996
1982	2,136	49.7%	692	16.1%	4,298	28.1%	5,113
1983	1,843	42.7%	439	10.2%	4,312	28.3%	5,051
1984	2,037	43.2%	502	10.6%	4,715	30.0%	5,437
1985	1,821	42.5%	309	7.2%	4,286	27.3%	5,067
1986	2,828	52.0%	909	16.7%	5,439	33.4%	6,224
1987	3,055	51.7%	1,074	18.2%	5,914	35.5%	6,678
1988	3,513	53.3%	1,529	23.2%	6,587	38.1%	7,402
1989	4,124	57.3%	1,858	25.8%	7,202	41.6%	8,061
1990	4,285	59.8%	1,962	27.4%	7,161	42.2%	8,018
1991	4,065	61.3%	1,833	27.7%	6,626	39.6%	7,627
1992	4,071	58.7%	1,773	25.6%	6,938	40.7%	7,888
1993	4,253	55.8%	1,774	23.3%	7,618	44.2%	8,620
1994	4,233	52.6%	1,723	21.4%	8,054	45.5%	8,996
1995	3,980	50.5%	1,563	19.8%	7,886	44.5%	8,835
1996	4,193	49.3%	1,596	18.8%	8,498	46.4%	9,478
1997	4,542	49.6%	1,747	19.1%	9,158	49.2%	10,162
1998	4,880	50.0%	2,132	21.8%	9,764	51.6%	10,708
1999	4,934	49.8%	2,459	24.8%	9,912	50.8%	10,852
2000	5,115	50.9%	2,463	24.5%	10,053	51.6%	11,093
			Average annual percentage change				
1960–2000	3.5%		[c]		4.7%		4.6%
1970–2000	4.6%		[c]		3.9%		4.0%
1990–2000	1.8%		2.3%		3.5%		3.3%

Source:
U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2000,* Washington, DC, July 2001, Tables 5.4 and 5.7.

[a] Organization of Petroleum Exporting Countries. See Glossary for membership.
[b] See Glossary for Persian Gulf nations.
[c] Data are not available.

The Costs of Oil Dependence

In the *Costs of Oil Dependence: A 2000 Update*, authors Greene and Tishchishyna indicate that the oil market upheavals caused by the OPEC cartel over the last 30 years have cost the U.S. in the vicinity of $7 trillion (present value 1998 dollars) in total economic costs, which is about as large as the sum total of payment on the national debt over the same period.

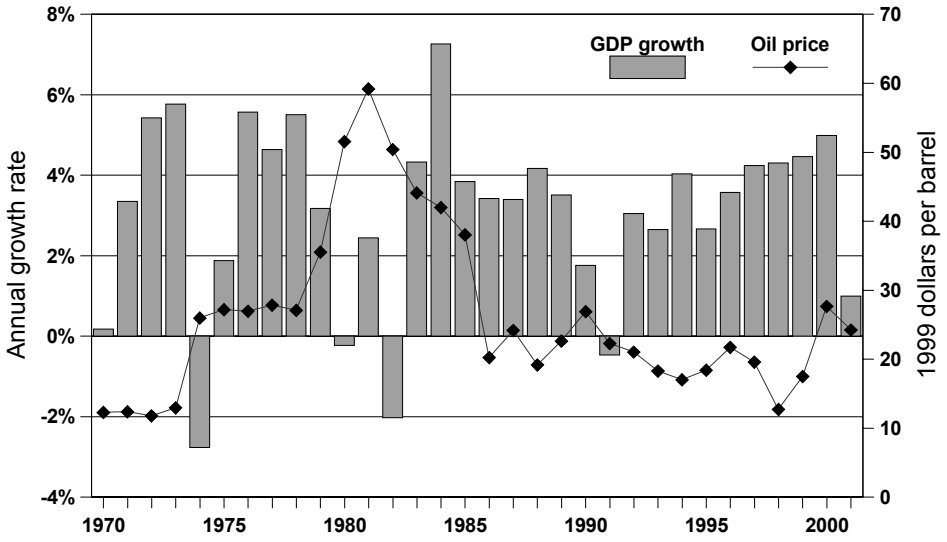
Oil dependence is the product of (1) a noncompetitive world oil market strongly influenced by the OPEC cartel, (2) high levels of U.S. oil imports, (3) oil's critical role in the U.S. economy, and (4) the absence of economical and readily available substitutes for oil. Transportation is key to the problem because transportation vehicles account for 68% of U.S. oil consumption and nearly all of the high-value light products that drive the market.

Oil consuming economies incur three types of costs when monopoly power is used to raise prices above competitive market levels:

- *Loss of potential gross domestic product (GDP)* - the economy's ability to produce is reduced because a key factor of production is more expensive;
- *Macroeconomic Adjustment Costs* - sudden changes in oil prices increase unemployment, further reducing economic output; and
- *Transfer of Wealth* - some of the wealth of oil consuming states is appropriated by foreign oil producers.

Major oil price shocks have disrupted world energy markets four times in the past 30 years (1973-74, 1979-80, 1990-91, 1999-2000). Each of the first three oil price shocks was followed by an economic recession in the U.S.

Figure 1.3. Oil Price and Economic Growth, 1970–2001[a]



Source:
Greene, D.L. and N. I. Tishchishyna, *Costs of Oil Dependence: A 2000 Update*, Oak Ridge National Laboratory, ORNL/TM-2000/152, Oak Ridge, TN, 2000, and data updates, 2001.
(Additional resources: www-cta.ornl.gov/publications)

[a]First two quarters of 2001.

Estimates of 1996 military expenditures for defending oil supplies in the Middle East range from $6 to $60 billion per year. This wide range in estimates reflects the difficulty in assigning a precise figure to the military cost of defending the U.S. interests in the Middle East. The two main reasons for the difficulty are 1) the Department of Defense does not divide the budget into regional defense sectors and 2) it is difficult to determine how much of the cost is attributable to defending Persian Gulf oil.

Table 1.6
Summary of 1996 Military Expenditures for Defending Oil Supplies from the Middle East

Source	Original estimates (billion dollars)	Year of original estimate	1996 estimate (constant 1996 billion dollars)
General Accounting Office [1]	$33	1990	$28[a]
Congressional Research Service [2]	$6.4	1990	$6[a]
Greene and Leiby [3]	$14.3	1990	$12[a]
Ravenal [4]	$50	1992	$60[b]
Kaufmann and Steinbruner [5]	$64.5	1990	$55[b]
Delucchi and Murphy[c] [6]	$20–40	1996	$20–40[b]
Average estimate is $32 billion, with a standard deviation of $22 billion.			

[1] U.S. General Accounting Offices, *Southwest Asia: Cost of Protecting U.S. Interests*, GAO/NSIAD-91-250, Washington, DC, August 1991.

[2] Congressional Research Service, *The External Costs of Oil Used in Transportation*, prepared for the U.S. Alternative Fuels Council, Washington, DC, June 1992.

[3] Greene, D.L., and P. Leiby, *The Social Costs to the U.S. of Monopolization of the World Oil Market*, 1972-1991, ORNL-6744, Oak Ridge National Laboratory, Oak Ridge, TN, March 1993.

[4] Ravenal, E.C., *Designing Defense for a New World Order: The Military Budget in 1992 and Beyond*, Cato Institute, Washington, DC, 1991.

[5] Kaufmann, W.W., and J.D. Steinbruner, *Decisions for Defense: Prospects for a New Order*, The Brookings Institution, Washington, DC, 1991.

[6] Delucchi, M.A., and J. Murphy, *U.S. Military Expenditures to Protect the Use of Persian-Gulf Oil for Motor Vehicles*, UCD-ITS-RR-96-3 (15), University of California, Davis, California, April 1996.

Source:
Hu, P.S., "Estimates of 1996 U.S. Military Expenditures on Defending Oil Supplies from the Middle East: A Literature Review," Oak Ridge National Laboratory, Oak Ridge, TN, March 1996.

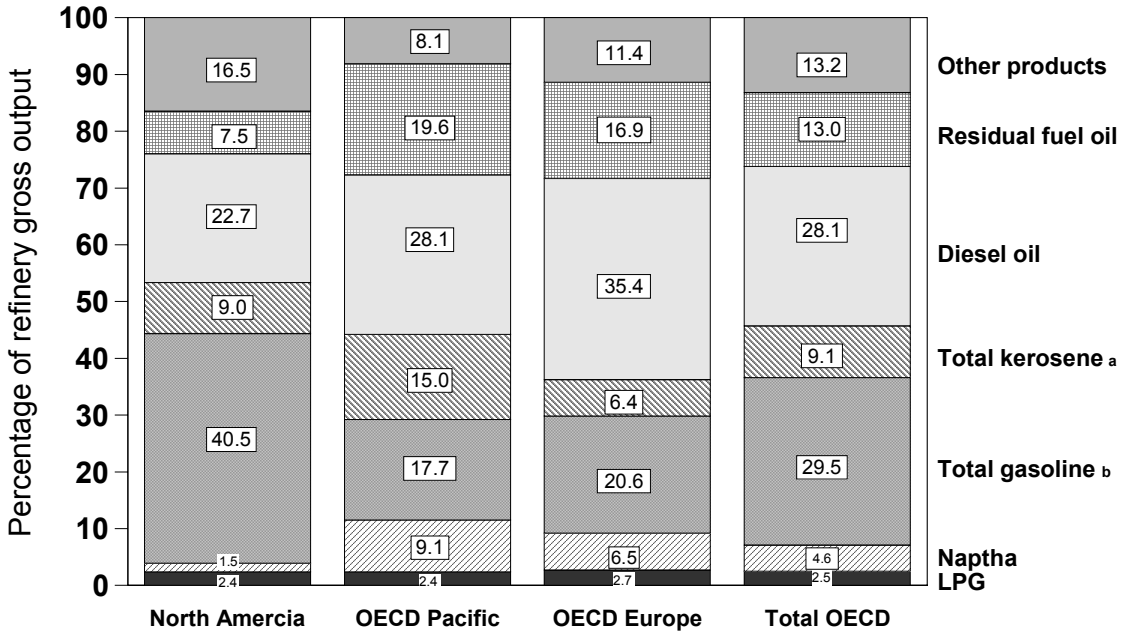
[a]Estimated based on a 3% annual inflation rate and a decrease of 30% in the total Defense budget from 1990 to 1996.

[b]Provided by the author(s); thus, assumptions used for the projection are different from those used in the other estimates.

[c]Annual cost to defend all U.S. interests in the Persian Gulf.

Other parts of the world refine crude oil to produce more diesel fuel and less gasoline than does North America. The OECD Pacific countries produce the lowest share of gasoline.

Figure 1.4. Refinery Gross Output by World Region, 2000



Source:
International Energy Agency, *Monthly Oil Survey*, February 2001, Paris, France, Table 7.

[a] Includes jet kerosene and other kerosene.
[b] Includes motor gasoline, jet gasoline, and aviation gasoline.
[c] Organization for Economic Cooperation and Development. See Glossary for membership.

Oxygenate refinery input increased significantly in 1995, most certainly due to the Clean Air Act Amendments of 1990 which mandated the sale of reformulated gasoline in certain areas beginning in January 1995.

Table 1.7
U.S. Refinery Input of Crude Oil and Petroleum Products, 1987–2000
(thousand barrels)

			Oxygenates						
Year	Crude oil	Natural gas liquids	Fuel ethanol	Methanol	MTBE[a]	Other oxygenates[b]	Other hydrocarbons[c]	Other liquids	Total input to refineries
1987	4,691,783	280,889	[d]	[d]	[d]	[d]	23,304	220,296	5,105,392
1990	4,894,379	170,589	[d]	[d]	[d]	[d]	28,642	231,466	5,325,076
1991	4,855,016	172,306	[d]	[d]	[d]	[d]	31,574	248,691	5,307,587
1992	4,908,603	171,701	[d]	[d]	[d]	[d]	47,918	224,758	5,352,980
1993	4,968,641	179,213	3,351	782	49,393	1,084	15,543	264,531	5,482,538
1994	5,061,111	169,868	3,620	242	52,937	1,676	14,130	179,678	5,483,262
1995	5,100,317	172,026	9,055	246	79,396	3,876	14,668	175,743	5,555,327
1996	5,195,265	164,552	11,156	126	79,407	3,444	20,587	193,695	5,668,232
1997	5,351,466	151,769	11,803	496	86,240	3,750	22,976	178,292	5,806,792
1998	5,434,383	146,921	11,722	675	89,362	3,363	22,759	183,376	5,892,561
1999	5,403,450	135,756	13,735	813	94,784	3,334	21,447	204,332	5,877,651
2000	5,514,395	138,921	15,268	854	90,288	3,151	24,488	176,647	5,964,012
			Average annual percentage change						
1987-2000	1.3%	-5.3%	[e]	[e]	[e]	[e]	0.4%	-1.7%	1.2%
1993-2000	1.5%	-3.6%	24.2%	1.3%	9.0%	16.5%	6.7%	-5.6%	1.2%

Source: U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Annual, 2000*, Vol. 1, June 2001, Table 16, and annual.(Additional resources: www.eia.doe.gov)

[a]Methyl tertiary butyl ether (MTBE).

[b]Includes ethyl tertiary butyl ether (ETBE), tertiary amyl methyl ether (TAME), tertiary butyl alcohol (TBA), and other aliphatic alcohols and ethers intended for motor gasoline blending.

[c]For 1987–92, includes other hydrocarbons/hydrogen/oxygenates. For 1993–on, includes other hydrocarbons/hydrogen.

[d]Reported in "Other hydrocarbons" category in this year.

[e]Data are not available.

When crude oil and other hydrocarbons are processed into products that are, on average, less dense than the input, a processing volume gain occurs. Due to this gain, the product yield from a barrel of crude oil is more than 100%. The processing volume gain has been growing over the years.

Table 1.8
Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978–2000
(percentage)

Year	Motor gasoline	Distillate fuel oil	Jet fuel	Liquified petroleum gas	Other[a]	Total[b]
1978	44.1	21.4	6.6	2.3	29.6	104.0
1979	43.0	21.5	6.9	2.3	30.3	104.0
1980	44.5	19.7	7.4	2.4	30.0	104.0
1981	44.8	20.5	7.6	2.4	28.7	104.0
1982	46.4	21.5	8.1	2.2	26.2	104.4
1983	47.6	20.5	8.5	2.7	24.8	104.1
1984	46.7	21.5	9.1	2.9	24.2	104.4
1985	45.6	21.6	9.6	3.1	24.6	104.5
1986	45.7	21.2	9.8	3.2	24.8	104.7
1987	46.4	20.5	10.0	3.4	24.5	104.8
1988	46.0	20.8	10.0	3.6	24.4	104.8
1989	45.7	20.8	10.1	4.0	24.2	104.8
1990	45.6	20.9	10.7	3.6	24.1	104.9
1991	45.7	21.3	10.3	3.8	24.1	105.2
1992	46.0	21.2	9.9	4.3	24.0	105.4
1993	46.1	21.9	10.0	4.1	23.3	105.4
1994	45.5	22.3	10.1	4.2	23.2	105.3
1995	46.4	21.8	9.7	4.5	22.9	105.3
1996	45.7	22.7	10.4	4.5	22.4	105.7
1997	45.7	22.5	10.3	4.6	22.5	105.6
1998	46.2	22.3	10.4	4.4	22.5	105.8
1999	46.5	22.3	10.2	4.5	22.3	105.8
2000	46.2	23.1	10.3	4.5	22.0	106.1

Source:
Department of Energy, Energy Information Administration, *Petroleum Supply Annual 2000*, Vol. 1, June 2001, Table 19 and annual. (Additional resources: www.eia.doe.gov)

[a] Includes aviation gasoline, kerosene, naphtha and other oils for petrochemical feedstock use, special naphthas, lubricants, waxes, petroleum coke, asphalt and road oil, still gas, and miscellaneous products.
[b] Products sum greater than 100% due to processing gain. The processing gain for years 1978 to 1980 is assumed to be 4%.

The U.S. does not produce enough oil to meet the nation's demand. Since 1998, the net amount of oil imported has been more than half the U.S. consumption. The U.S. does export a small amount of petroleum, mainly to Canada and Mexico.

Table 1.9
United States Petroleum Production and Consumption, 1973–2000
(million barrels per day)

Year	Domestic crude oil production	Net imports			Exports		U.S. petroleum consumption[a]	World petroleum consumption	Net imports as a percentage of U.S. petroleum consumption	U.S. petroleum consumption as a percentage of world consumption	Transportation petroleum use as a percentage of domestic production[b]
		Crude oil	Petroleum products	Total	Crude oil	Petroleum products					
1973	9.21	3.24	2.78	6.03	0.00	0.23	17.31	56.39	34.8%	30.7%	76.7%
1975	8.37	4.10	1.75	5.85	0.00	0.20	16.32	55.48	35.8%	29.4%	82.8%
1980	8.60	4.98	1.39	6.37	0.29	0.26	17.06	63.07	37.3%	27.0%	87.9%
1985	8.97	3.00	1.29	4.29	0.20	0.58	15.73	60.10	27.3%	26.2%	86.6%
1990	7.36	4.79	1.38	7.16	0.11	0.75	16.99	65.98	42.2%	25.8%	114.5%
1991	7.42	5.67	0.96	6.63	0.12	0.89	16.71	66.57	39.6%	25.1%	110.6%
1992	7.17	5.99	0.94	6.94	0.09	0.86	17.03	66.76	40.7%	25.5%	114.5%
1993	6.85	6.69	0.93	7.62	0.10	0.90	17.24	67.00	44.2%	25.7%	118.7%
1994	6.66	6.96	1.09	8.05	0.10	0.84	17.72	68.30	45.5%	25.9%	124.4%
1995	6.56	7.14	0.75	7.89	0.10	0.86	17.73	69.87	44.5%	25.4%	127.0%
1996	6.47	7.40	1.10	8.50	0.11	0.87	18.31	71.40	46.4%	25.6%	130.3%
1997	6.45	8.12	1.04	9.16	0.11	0.90	18.62	73.13	49.2%	25.5%	131.7%
1998	6.25	8.60	1.17	9.76	0.11	0.84	18.92	73.64	51.6%	25.7%	138.7%
1999	5.88	8.47	1.14	9.91	0.12	0.82	19.52	74.91	50.8%	26.1	148.5%
2000	5.83	8.88	1.17	10.05	0.05	0.99	19.48	[c]	51.6%	[c]	150.2%
					Average annual percentage change						
1973–2000	-1.7%	3.8%	-3.2%	1.9%	[c]	5.6%	0.4%	1.1%[d]			
1990–2000	-2.3%	6.4%	-1.6%	2.9%	-7.6%	2.8%	1.4%	1.3%[d]			

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review, March 2001,* Washington, DC, 2001, Table 3.1a.
World petroleum consumption - U.S. Department of Energy, Energy Information Administration, *International Energy Annual 1999*, February 2001, Table1.1.
(Additional resources: www.eia.doe.gov)

[a] Best estimate for U.S. petroleum consumption is the amount of petroleum products supplied to the U.S. in a given year. This is not the sum of crude oil production and net imports due to natural gas plant liquids, refinery processing gains and stock changes.

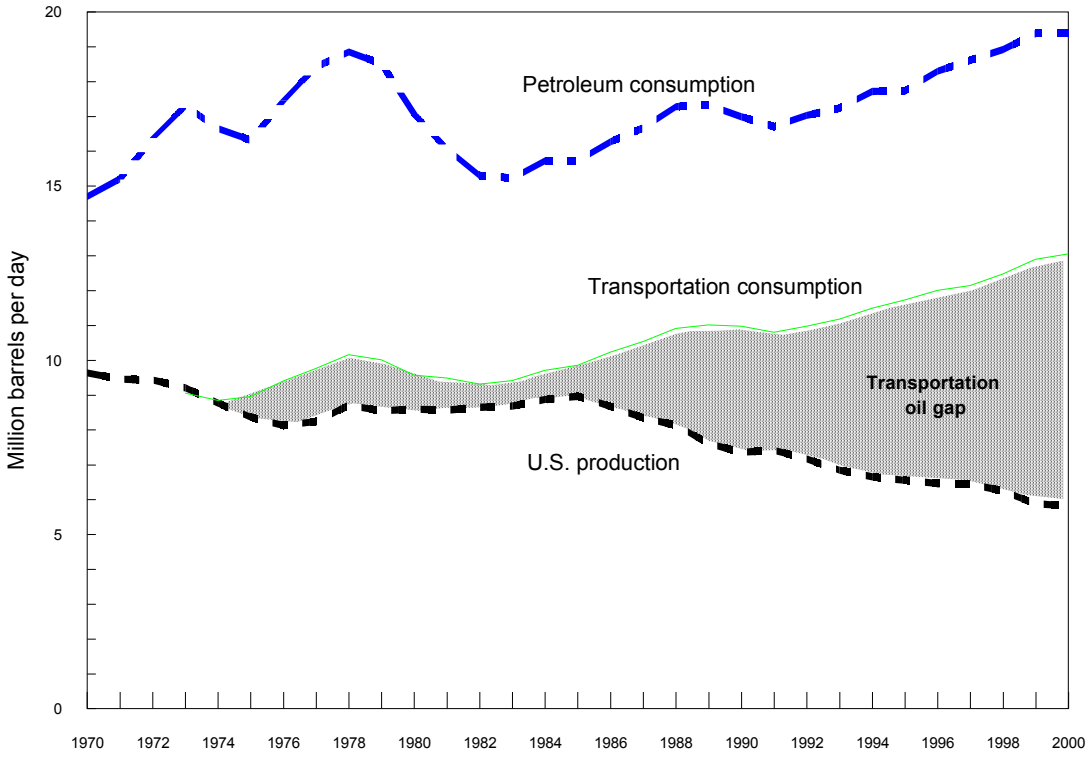
[b] Transportation petroleum use can be found on Table 1.10. This column has been revised to include domestic production of crude oil, natural gas plant liquids, and other hydrocarbons/hydrogen/oxygenates as shown in the *Monthly Energy Review*, Table 3.1a.

[c] Data are not available.

[d] Average annual percentage change is to the latest possible year.

The transportation oil gap is the difference between the amount of oil the U.S. produces and the amount of oil used by the transportation sector. This gap has been getting wider not only due to increasing transportation demand, but also due to decreasing U.S. oil production.

Figure 1.5. United States Petroleum Production and Consumption, 1973–2000



Source: See Tables 1.9 and 1.10.

Transportation accounts for more than two-thirds of the U.S. petroleum use. The residential sector and the commercial sector data which were previously combined are now available separately.

Table 1.10
Consumption of Petroleum by End-Use Sector, 1973–2000
(quadrillion Btu)

Year	Transportation	Percentage	Residential	Commercial	Industrial	Electric utilities	Total
1973	17.83	51.2%	2.83	1.57	9.10	3.52	34.84
1974	17.40	52.0%	2.57	1.42	8.69	3.37	33.46
1975	17.61	53.8%	2.50	1.31	8.15	3.17	32.74
1976	18.51	52.6%	2.72	1.46	9.01	3.48	35.18
1977	19.24	51.8%	2.70	1.51	9.77	3.90	37.12
1978	20.04	52.8%	2.62	1.45	9.87	3.99	37.97
1979	19.83	53.4%	2.11	1.33	10.57	3.28	37.13
1980	19.01	55.6%	1.75	1.29	9.53	2.63	34.21
1981	18.81	58.9%	1.54	1.09	8.29	2.20	31.93
1982	18.42	60.9%	1.44	1.01	7.79	1.57	30.23
1983	18.59	61.9%	1.36	1.14	7.42	1.54	30.05
1984	19.22	61.9%	1.34	1.20	8.01	1.29	31.06
1985	19.50	63.1%	1.48	1.04	7.81	1.09	30.92
1986	20.27	63.0%	1.46	1.10	7.92	1.45	32.20
1987	20.87	63.5%	1.51	1.08	8.15	1.26	32.87
1988	21.63	63.2%	1.56	1.04	8.43	1.56	34.22
1989	21.87	63.9%	1.56	0.97	8.13	1.69	34.22
1990	21.81	65.0%	1.27	0.91	8.32	1.25	33.55
1991	21.46	65.3%	1.29	0.86	8.06	1.18	32.85
1992	21.81	65.0%	1.31	0.81	8.64	0.95	33.53
1993	22.20	65.6%	1.39	0.75	8.45	1.05	33.84
1994	22.76	65.6%	1.34	0.75	8.85	0.97	34.67
1995	23.20	67.1%	1.36	0.72	8.62	0.66	34.56
1996	23.74	66.4%	1.49	0.75	9.06	0.73	35.77
1997	23.99	66.2%	1.45	0.71	9.29	0.82	36.26
1998	24.65	66.7%	1.32	0.67	9.13	1.17	36.94
1999	24.49	67.2%	1.45	0.67	9.40	0.94	37.95
2000	25.84	68.1%	1.48	0.70	9.16	0.78	38.63
			Average annual percentage change				
1973–2000	1.4%		-2.4%	-2.9%	0.0%	-5.4%	0.4%
1990–2000	1.7%		1.5%	-2.6%	1.0%	-4.6%	1.4%

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review, March* 2001, Tables 2.2–2.6. (Additional resources: www.eia.doe.gov)

Pipelines accounted for two-thirds of the domestic movement of crude oil and petroleum products in 1999.

Table 1.11
Ton-Miles of Petroleum and Petroleum Products in the U.S. by Mode, 1975–99

Year	Pipelines[a]	Water carriers	Motor carriers[b]	Railroads	Total
	(percent)				(billion ton-miles)
1975	59.9%	35.2%	3.3%	1.7%	846.7
1976	59.4%	35.4%	3.8%	1.5%	867.7
1977	59.1%	36.1%	3.2%	1.6%	923.4
1978	50.5%	45.7%	2.7%	1.1%	1,160.2
1979	51.8%	44.5%	2.6%	1.2%	1,174.8
1980	47.2%	49.6%	2.2%	1.0%	1,245.3
1981	46.3%	50.7%	2.0%	1.0%	1,218.4
1982	46.4%	50.6%	1.9%	1.1%	1,218.2
1983	45.5%	51.5%	2.1%	1.0%	1,223.5
1984	48.1%	48.4%	2.5%	1.0%	1,180.2
1985	47.2%	49.4%	2.4%	1.0%	1,195.5
1986	48.7%	47.8%	2.5%	1.0%	1,187.8
1987	49.1%	47.4%	2.5%	1.0%	1,195.8
1988	50.6%	45.8%	2.6%	1.1%	1,188.1
1989	53.4%	42.6%	2.8%	1.2%	1,094.2
1990	54.2%	41.7%	2.8%	1.3%	1,076.8
1991	53.3%	42.8%	2.7%	1.3%	1,086.1
1992	53.9%	42.1%	2.6%	1.4%	1,091.7
1993	57.3%	38.8%	2.4%	1.5%	1,034.6
1994	56.5%	39.3%	2.7%	1.5%	1,046.7
1995	57.5%	38.4%	2.5%	1.6%	1,044.9
1996	60.6%	34.9%	2.9%	1.6%	1,022.2
1997	64.5%	30.9%	2.9%	1.8%	956.5
1998	66.7%	28.5%	3.0%	1.8%	929.8
1999	67.7%	27.1%	3.2%	2.1%	912.9
	Average annual percentage change				
1975–99					0.3%
1989–99					-1.8%

Source:
Association of Oil Pipelines, *Shifts in Petroleum Transportation*, Washington, DC, February 2001, Table 1.

[a] The amounts carried by pipeline are based on ton-miles of crude and petroleum products for Federally regulated pipelines (84 percent) plus an estimated breakdown of crude and petroleum products of the ton-miles for pipelines not Federally regulated (16 percent).

[b] The amounts carried by motor carriers are estimated.

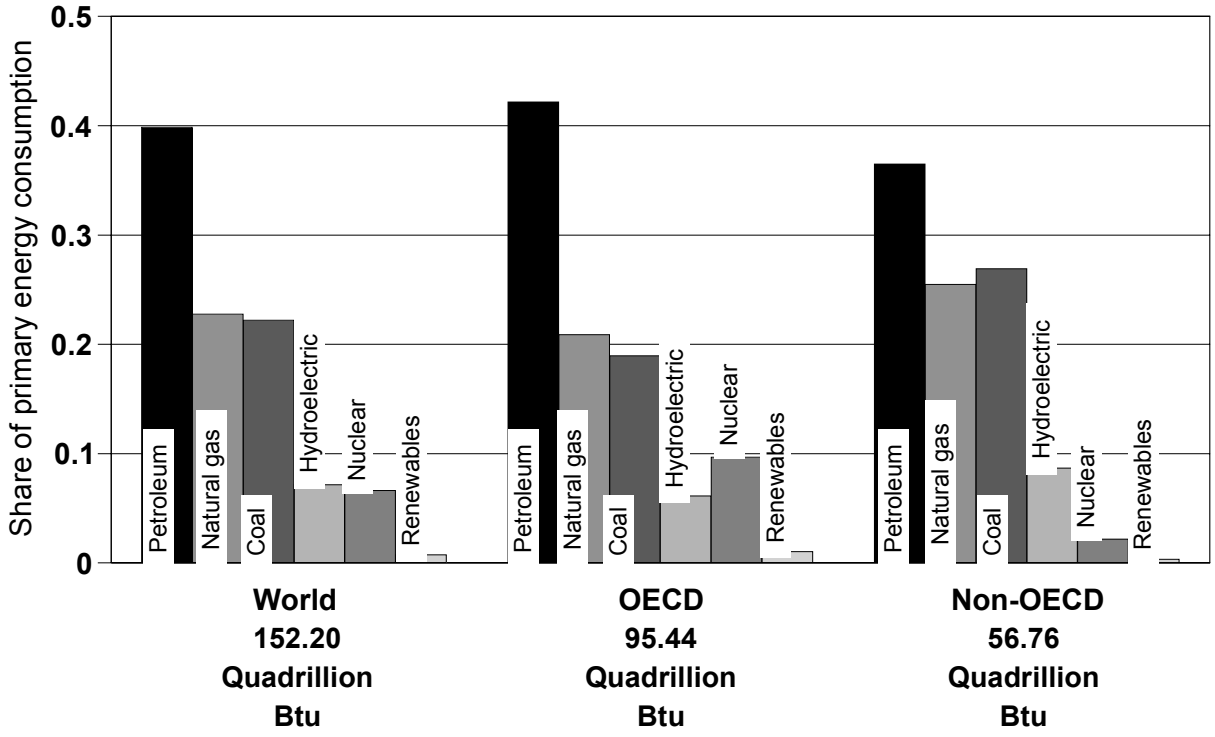
Chapter 2
Energy

Summary Statistics from Tables in this Chapter

Source			
Table 2.1	Transportation share of U.S. energy consumption, 2000	27.0%	
Table 2.2	Petroleum share of transportation energy consumption, 1999	96.4%	
Table 2.3	Alternative fuel and oxygenate consumption, 2000		
		(thousand gasoline equivalent gallons)	(share)
	Liquified petroleum gas	*242,695*	*5.4%*
	Compressed natural gas	*86,286*	*2.2%*
	Liquified natural gas	*6,847*	*0.2%*
	M85/M100	*1,433*	*0.0%*
	E85/E95	*3,398*	*0.1%*
	Electricity	*1,819*	*0.0%*
	MTBE	*3,104,200*	*69.4%*
	Ethanol in gasohol	*1,011,800*	*22.6%*
Table 2.4	Transportation energy use by mode, 1999	(trillion Btu)	(share)
	Automobiles	*9,126*	*34.2%*
	Light trucks	*6,617*	*24.8%*
	Heavy trucks	*4,563*	*17.1%*
	Buses	*208*	*0.8%*
	Air	*2,546*	*9.5%*
	Water	*1,300*	*4.9%*
	Pipeline	*1,009*	*3.8%*
	Rail	*607*	*2.3%*
	Off-highway	*680*	*2.5%*

Petroleum accounted for 40% of the world's energy use in 1999. Though petroleum is the dominant energy source for both OECD countries and non-OECD countries, the non-OECD countries rely on coal, natural gas, and hydroelectric power more than OECD countries do.

Figure 2.1. World Consumption of Primary Energy, 1999



Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Annual 1999*, Washington, DC, February 2001, Table 1.8.

The Energy Information Administration revised the historical energy data series to include renewable energy in each sector. Also, the residential and commercial sector data are now separated. Total energy use was 99 quads in 2000 with transportation using 27%.

Table 2.1
U. S. Consumption of Total Energy by End-Use Sector, 1973–2000[a]
(quadrillion Btu)

Year	Transportation	Percentage transportation of total	Industrial	Commercial	Residential	Total
1973	18.6	24.6%	32.7	9.5	15.0	75.8
1974	18.1	24.5%	31.8	9.4	14.7	74.1
1975	18.2	25.3%	29.4	9.5	14.9	72.0
1976	19.1	25.1%	31.4	10.0	15.5	76.1
1977	19.8	25.4%	32.3	10.2	15.8	78.1
1978	20.6	25.7%	32.8	10.5	16.2	80.1
1979	20.5	25.3%	34.0	10.6	15.9	81.0
1980	19.7	25.1%	32.2	10.6	15.9	78.4
1981	19.5	25.5%	30.9	10.7	15.5	76.6
1982	19.1	26.0%	27.8	10.9	15.7	73.4
1983	19.1	26.1%	27.6	11.0	15.6	73.3
1984	19.8	25.7%	29.7	11.5	15.9	77.0
1985	20.1	26.1%	29.1	11.6	16.1	76.8
1986	20.8	27.0%	28.5	11.7	16.1	77.1
1987	21.5	26.9%	29.7	12.1	16.4	79.6
1988	22.3	26.9%	30.9	12.6	17.2	83.1
1989	22.6	26.7%	31.2	13.1	17.8	84.6
1990	22.5	26.8%	31.7	13.1	16.8	84.2
1991	22.1	26.3%	31.3	13.4	17.4	84.2
1992	22.5	26.3%	32.5	13.3	17.3	85.5
1993	22.9	26.2%	32.7	13.6	18.1	87.3
1994	23.5	26.4%	33.7	13.9	18.1	89.2
1995	24.0	26.4%	34.1	14.4	18.5	90.9
1996	24.5	26.1%	35.0	14.9	19.5	93.9
1997	24.8	26.3%	35.2	15.4	18.9	94.3
1998	25.4	26.8%	34.9	15.5	18.8	94.5
1999	26.3	27.1%	35.7	15.9	19.2	97.1
2000	26.7	27.0%	36.1	16.3	19.7	98.8
		Average annual percentage change				
1973–2000	1.3%		0.4%	2.0%	1.0%	1.0%
1990–2000	1.7%		1.3%	2.2%	1.6%	1.6%

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review, March 2001*, Washington, DC, Table 2.2. (Additional resources: www.eia.doe.gov)

[a]Electrical energy losses have been distributed among the sectors.

The Energy Information Administration revised the historical energy data series to include renewable energy in each sector. Also, the residential and commercial data, which were previously one category, are now separate. In transportation, the alcohol fuels blended into gasoline to make gasohol are now counted under "renewables."

Table 2.2
Distribution of Energy Consumption by Source, 1973 and 2000
(percentage)

Energy source	Transportation		Residential		Commercial		Industrial		Electric utilities	
	1973	2000	1973	2000	1973	2000	1973	2000	1973	2000
Petroleum	95.8	96.4	18.9	7.4	16.4	4.1	27.9	25.4	17.7	2.2
Natural gas[a]	4.0	2.9	33.2	25.2	27.8	20.4	31.8	30.3	18.8	8.6
Coal	0.0	0.0	0.7	2.2	1.6	3.9	12.4	6.4	43.5	55.5
Renewable	0.0	0.5	2.4	2.4	0.1	0.4	3.6	6.3	15.4	11.5
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	22.2
Electricity[b]	0.2	0.2	44.9	62.9	54.1	71.2	24.4	31.6	0.0	0.0
Other[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, *March 200*1, Washington, DC, pp. 27, 29, 31, 33. (Additional resources: www.eia.doe.gov)

[a] Includes supplemental gaseous fuels. Transportation sector includes pipeline fuel and natural gas vehicle use.
[b] Includes electrical system energy losses.
[c] Energy generated from geothermal, wood, waste, wind, photovoltaic, and solar thermal energy sources.

Oxygenates are blended with gasoline to be used in conventional vehicles. The amount of oxygenate use dwarfs the alternative fuel use. Gasoline-equivalent gallons are used in this table to allow comparisons of different fuel types.

Table 2.3
Alternative Fuel and Oxygenate Consumption, 1992–2001
(thousand gasoline–equivalent gallons)

Alternative fuel	1992	1995	1998	1999	2000	2001[a]	2001 Percentage
Liquified petroleum	208,142	232,701	241,583	242,141	242,695	243,196	5.6%
Compressed natural gas	16,823	35,162	73,251	86,286	97,568	107,476	2.5%
Liquified natural gas	585	2,759	5,343	5,828	6,847	7,566	0.2%
M85[b]	1,069	2,023	1,212	1,073	996	918	0.0%
M100	2,547	2,150	449	447	437	406	0.0%
E85[b]	21	190	1,727	2,075	3,344	4,575	0.0%
E95[b]	85	995	59	59	54	51	0.0%
Electricity[c]	359	663	1,202	1,431	1,819	2,143	0.0%
Subtotal	**229,631**	**276,643**	**324,826**	**339,340**	**353,760**	**366,331**	**8.4%**
Oxygenates							
MTBE[d]	1,175,000	2,691,200	2,903,400	3,331,000	3,104,200	2,937,500	67.2%
Ethanol in gasohol	701,000	910,700	889,500	956,900	1,011,800	1,066,000	24.4%
Total	**2,105,631**	**3,878,543**	**4,117,726**	**4,627,240**	**4,469,760**	**4,369,831**	**100.0%**

Source:
U.S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 1999*, Washington, DC, 2000, web site www.eia.doe.gov/cneaf/alternate/page/datatables/atf1-13_00.html, Table 10. (Additional resources: www.eia.doe.gov)

[a]Based on plans or projections.
[b]Consumption includes gasoline portion of the mixture.
[c]Vehicle consumption only; does not include power plant inputs.
[d]Methyl Tertiary Butyl Ether. This category includes a very small amount of other ethers, primarily Tertiary Amyl Methyl Ether (TAME) and Ethyl Tertiary Butyl Ether (ETBE).

As data about alternative fuel use become available, an attempt is made to incorporate them into this table. Sometimes assumptions must be made in order to use the data. Please see Appendix A for a description of the methodology used to develop these data.

Table 2.4
Domestic Consumption of Transportation Energy by Mode and Fuel Type, 1999[a]
(trillion Btu)

	Gasoline	Diesel fuel	Liquified petroleum gas	Jet fuel	Residual fuel oil	Natural gas	Electricity	Methanol
HIGHWAY	**15,958.3**	**4,549.1**	**25.2**			**6.4**	**0.9**	**0.1**
Light vehicles	**15,430.2**	**330.1**	**9.6**			**0.0**		**0.0**
Automobiles	9,044.9[b]	81.2				0.0		0.0
Light trucks[c]	6,358.9	248.9	9.6			0.0		0.0
Motorcycles	26.4							
Buses	**11.0**	**188.5**	**0.5**			**6.4**	**0.9**	**0.1**
Transit	4.1	85.7	0.5			6.4	0.9	0.1
Intercity		33.4						
School	6.9	69.4						0.0
Medium/heavy trucks	**517.1**	**4,030.5**	**15.1**			**0.0**		**0.0**
OFF-HIGHWAY	**110.0**	**570.1** [d]						
Construction	**22.2**	**178.5** [d]						
Agriculture	**87.8**	**391.6** [d]						
NONHIGHWAY	**351.6**	**835.6**		**2,504.1**	**694.6**	**757.9**	**317.0**	
Air	**41.5**			**2,504.1**				
General aviation	41.5			130.6				
Domestic air carriers				2,004.0				
International air				369.5				
Water	**310.1**	**294.8**			**694.6**			
Freight		294.8			694.6			
Recreational	310.1							
Pipeline						**757.9**	**251.3**	
Rail		**540.8**					**65.7**	
Freight (Class I)		520.1						
Passenger		20.7					65.7	
Transit							44.7	
Commuter		10.1					15.5	
Intercity[c]		10.6					5.5	
TOTAL	**16,419.9**	**5,954.8**	**25.2**	**2,504.1**	**694.6**	**764.3**	**317.9**	**0.1**

Source:
See Appendix A for Table 2.4

[a] Civilian consumption only. Totals may not include all possible uses of fuels for transportation (e.g., snowmobiles).
[b] Includes gasohol.
[c] Two-axle, four-tire trucks.
[d] 1985 data.

The 1998 data have been revised to include the latest data available.

Table 2.5
Transportation Energy Use by Mode, 1998–99[a]

	Trillion Btu		Thousand barrels per day crude oil equivalent [b]		Percentage of total	
	1998	1999	1998	1999	1998	1999
HIGHWAY	**19,871.3**	**20,540.0**	**9,996.7**	**10,333.1**	**77.2%**	**77.0%**
Light vehicles	**15296.8**	**15,769.9**	**7,695.4**	**7,933.4**	**59.4%**	**59.1%**
Automobiles	8,943.3	9,126.1	4, 499.1	4,591.1	34.7%	34.2%
Light trucks [c]	6,327.8	6,617.3	3,183.3	3,329.0	24.6%	24.8%
Motorcycles	25.7	26.4	12.9	13.3	0.1%	0.1%
Buses	**201.5**	**207.4**	**101.4**	**104.3**	**0.8%**	**0.8%**
Transit	95.4	97.7	48.0	49.2	0.4%	0.4%
Intercity	30.5	33.4	15.3	16.8	0.1%	0.1%
School	75.6	76.3	38.0	38.4	0.3%	0.3%
Medium/heavy trucks	**4,373.0**	**4,562.7**	**2,199.9**	**2,295.4**	**17.0%**	**17.1%**
OFF-HIGHWAY	**712.7**	**680.1**	**358.5**	**342.1**	**2.8%**	**2.5%**
Construction	**207.8**	**200.7**	**104.5**	**101.1**	**0.8%**	**0.8%**
Agriculture	**504.9**	**479.4**	**254.0**	**241.2**	**2.0%**	**1.8%**
NONHIGHWAY	**5,156.0**	**5,460.8**	**2,593.8**	**2,747.2**	**20.0%**	**20.5%**
Air	**2,370.8**	**2,545.6**	**1,192.7**	**1,280.6**	**9.2%**	**9.5%**
General aviation	147.4	172.1	74.2	86.6	0.6%	0.6%
Domestic air carriers	1,853.4	2,004.0	942.5	1,008.2	7.3%	7.5%
International air	350.0	369.5	176.1	185.9	1.4%	1.4%
Water	**1,295.3**	**1,299.5**	**651.6**	**653.7**	**5.0%**	**4.9%**
Freight	989.4	989.4	497.7	497.7	3.8%	3.7%
Recreational	305.9	310.1	153.9	156.0	1.2%	1.2%
Pipeline	**901.2**	**1,009.2**	**453.4**	**507.7**	**3.5%**	**3.8%**
Rail	**588.7**	**606.5**	**296.2**	**305.1**	**2.3%**	**2.3%**
Freight	502.0	520.1	252.5	261.6	2.0%	1.9%
Passenger	86.7	86.4	43.6	43.5	0.3%	0.3%
Transit	43.1	44.7	21.7	22.5	0.2%	0.2%
Commuter	28.2	25.6	14.2	12.9	0.1%	0.1%
Intercity	15.4	16.1	7.7	8.1	0.1%	0.1%
TOTAL	**25,740.0**	**26,680.9**	**12,949.1**	**13,422.4**	**100%**	**100.0%**

Source: See Appendix A for Table 2.4 (detailed breakdown).

[a]Civilian consumption only. Totals may not include all possible uses of fuels for transportation (e.g., snowmobiles).
[b]Thousand barrels per day crude oil equivalents based average on the EIA weighted average of heat content of petroleum products used in transportation.
[c]Two-axle, four-tire trucks.

The highway sector is by far the largest part of transportation energy use. Light truck energy use has increased at the greatest rate, due to the increased use of light trucks as personal passenger vehicles. Light trucks include pick-ups, minivans, sport-utility vehicles, and vans.

Table 2.6
Highway Transportation Energy Consumption by Mode, 1970–99
(trillion Btu)

Year	Autos	Light trucks	Light vehicles subtotal	Motor-cycles	Buses[a]	Heavy trucks	Highway subtotal	Total transportation[b]
1970	8,527	1,540	10,067	7	128	1,503	11,686	15,289
1975	9,321	2,386	11,707	14	124	1,939	13,779	17,302
1976	9,844	2,605	12,449	15	134	2,046	14,639	18,361
1977	9,940	2,799	12,739	16	137	2,268	15,155	19,045
1978	10,140	3,022	13,162	18	141	2,539	15,854	20,002
1979	9,629	3,057	12,686	22	144	2,644	15,489	20,065
1980	8,798	2,976	11,774	26	143	2,651	14,590	19,280
1981	8,695	2,964	11,659	27	145	2,706	14,535	19,016
1982	8,695	2,839	11,534	25	151	2,707	14,412	18,511
1983	8,814	2,995	11,809	22	152	2,757	14,733	18,645
1984	8,857	3,202	12,059	22	144	2,846	15,081	19,268
1985	8,954	3,422	12,376	23	154	2,842	15,402	19,636
1986	9,162	3,636	12,798	23	160	2,903	15,878	20,157
1987	9,179	3,827	13,006	24	163	2,990	16,177	20,657
1988	9,180	4,095	13,275	25	165	3,117	16,577	21,269
1989	9,251	4,173	13,424	26	169	3,196	16,809	21,562
1990	8,707	4,466	13,173	24	166	3,329	16,690	21,656
1991	8,048	4,793	12,841	23	176	3,396	16,434	21,254
1992	8,188	5,133	13,321	24	184	3,460	16,988	21,925
1993	8,389	5,374	13,763	25	183	3,567	17,548	22,419
1994	8,494	5,529	14,023	26	189	3,772	18,024	22,995
1995	8,519	5,717	14,236	25	189	3,950	18,390	23,565
1996	8,622	5,936	14,558	25	192	4,033	18,850	24,068
1997	8,746	6,191	14,937	25	197	4,086	19,244	24,403
1998	8,943	6,328	15,271	26	202	4,373	19,841	24,974
1999	9,126	6,617	15,743	26	208	4563	20,571	26,033
			Average annual percentage change					
1970–99	0.2%	5.2%	1.6%	4.6%	1.7%	3.9%	2.0%	1.9%
1989–99	-0.1%	4.7%	1.6%	0.0%	2.1%	3.6%	2.0%	1.9%

Source: See Appendix A for Table 2.5.

[a] These data have been revised due to revisions of intercity and school bus energy use. Beginning in 1992 data became available on non-diesel fuel use by transit buses.

[b] Total transportation figures do not include military and off-highway energy use and may not include all possible uses of fuel for transportation (e.g. snowmobiles).

Only 20% of transportation energy use is for nonhighway modes. Air travel accounts for nearly half of nonhighway energy use.

Table 2.7
Nonhighway Transportation Energy Consumption by Mode, 1970–99
(trillion Btu)

Year	Air	Water	Pipeline	Rail	Nonhighway subtotal	Total transportation[a]
1970	1,307	753	985	558	3,603	15,289
1975	1,274	851	835	563	3,523	17,302
1976	1,333	1,001	803	585	3,722	18,361
1977	1,411	1,103	781	595	3,890	19,045
1978	1,467	1,311	781	589	4,148	20,002
1979	1,568	1,539	856	613	4,576	20,065
1980	1,528	1,677	889	596	4,690	19,280
1981	1,455	1,562	899	565	4,481	19,016
1982	1,468	1,290	853	488	4,099	18,511
1983	1,505	1,187	738	482	3,912	18,645
1984	1,633	1,251	780	523	4,187	19,268
1985	1,678	1,311	758	487	4,234	19,636
1986	1,823	1,295	738	423	4,279	20,157
1987	1,894	1,326	775	485	4,480	20,657
1988	1,978	1,338	878	498	4,692	21,269
1989	1,981	1,376	895	501	4,753	21,562
1990	2,059	1,487	928	492	4,966	21,656
1991	1,926	1,567	864	463	4,820	21,254
1992	1,971	1,641	849	476	4,937	21,925
1993	1,996	1,473	889	513	4,871	22,419
1994	2,056	1,414	955	546	4,971	22,995
1995	2,117	1,522	971	565	5,175	23,565
1996	2,196	1,460	984	578	5,218	24,068
1997	2,284	1,309	987	579	5,159	24,403
1998	2,351	1,295	901	586	5,133	24,974
1999	2,546	1,300	1,009	607	5,462	26,033
			Average annual percentage change			
1970–99	2.3%	1.9%	0.1%	0.3%	1.4%	1.9%
1989–99	2.5%	-0.6%	1.2%	1.9%	1.4%	1.9%

Source:
See Appendix A for Table 2.5.

[a] Total transportation figures do not include military and off-highway energy use and may not include all possible uses of fuel for transportation (e.g. snowmobiles).

The Federal Highway Administration cautions that data from 1993-on may not be directly comparable to earlier years. Some states have improved reporting procedures in recent years, and the estimation procedures were revised in 1994. Prior to the Energy Policy Act of 1992, gasohol was defined as a blend of gasoline and at least 10%, by volume, alcohol. Effective January 1, 1993, three types of gasohol were defined: 10% gasohol—containing at least 10% alcohol; 7.7% gasohol—containing 7.7% alcohol but less than 10%; and 5.7% gasohol—containing at least 5.7% alcohol but less than 7.7%. See Table 2.3 for details on oxygenate usage.

Table 2.8
Highway Usage of Gasoline and Special Fuels, 1973–99
(billion gallons)

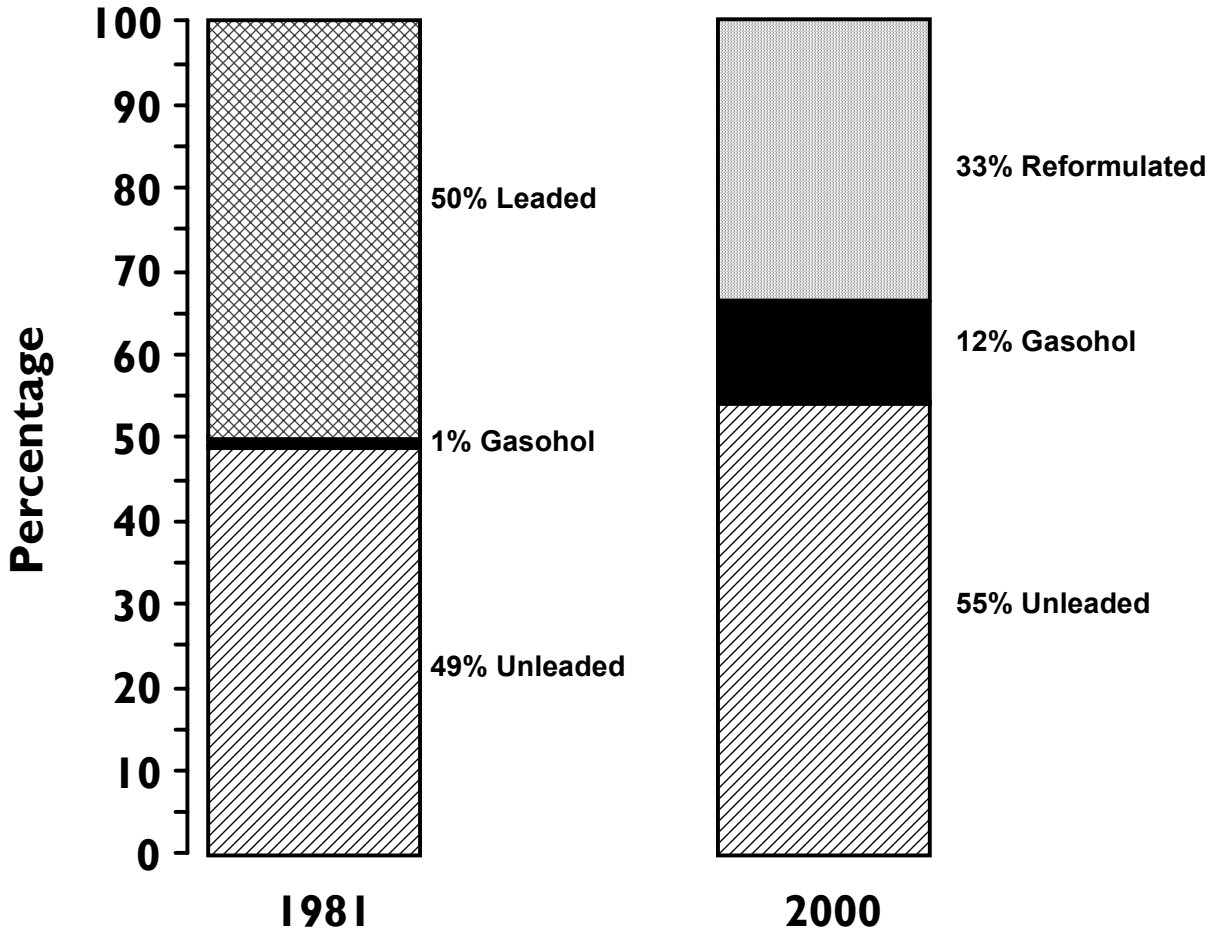
Year	Gasoline	Gasohol	Ethanol used in gasohol[a]	Total gasoline and gasohol	Diesel[b]	Percent diesel	Total highway fuel use
1973	[c]	[c]	[c]	100.6	9.8	8.9%	110.5
1975	[c]	[c]	[c]	99.4	9.6	8.8%	109.0
1980	100.7	0.5	0.0	101.2	13.8	12.0%	115.0
1981	98.9	0.7	0.1	99.6	14.9	13.0%	114.5
1982	96.2	2.3	0.2	98.5	14.9	13.1%	113.4
1983	95.9	4.3	0.4	100.1	16.0	13.8%	116.1
1984	96.0	5.4	0.5	101.4	17.3	14.6%	118.7
1985	95.6	8.0	0.8	103.6	17.8	14.6%	121.3
1986	98.6	8.1	0.8	106.8	18.4	14.7%	125.2
1987	101.8	6.9	0.8	108.7	19.0	14.9%	127.7
1988	101.7	8.1	0.8	109.8	20.1	15.5%	129.9
1989	103.7	6.9	0.7	110.6	21.2	16.1%	131.9
1990	102.6	7.5	0.8	110.2	21.4	16.3%	131.6
1991	99.3	8.6	0.9	107.9	20.7	16.1%	128.6
1992	102.1	8.8	0.9	111.0	22.0	16.5%	132.9
1993	103.4	10.3	1.0	113.7	23.5	17.1%	137.2
1994	104.0	11.0	1.0	115.0	25.1	17.9%	140.1
1995	104.0	13.1	1.2	117.1	26.2	18.3%	143.3
1996	107.4	12.1	1.1	119.5	27.2	18.5%	146.7
1997	106.2	14.7	1.3	120.9	29.4	19.6%	150.3
1998	110.7	14.0	1.3	124.7	30.2	19.5%	154.9
1999	114.6	14.2	1.3	128.7	31.9	19.9%	160.7
			Average annual percentage change				
1973–99	[d]	[d]	[d]	1.0%	4.6%		1.5%
1989–99	1.0%	7.4%	6.4%	1.5%	4.2%		2.0%

Source:
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1999*, Washington, DC, 2000, Tables MF-21 and MF-33E, and annual.
(Additional resources: www.fhwa.dot.gov)

[a] Estimated for 1980–92 as 10% of gasohol consumption.
[b] Consists primarily of diesel fuel, with small quantities of liquified petroleum gas.
[c] Data for gasoline and gasohol cannot be separated in this year.
[d] Data are not available.

The types of gasoline supplied today are significantly different than in 1981, mostly due to air quality mandates. The phase-out of leaded gasoline began in 1978 and the phase-in of reformulated gasoline began in 1995.

Figure 2.2. Motor Gasoline Quantities by Type, 1981 and 2000



Source:

U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Annual 2000*, Washington, DC, Tables 17 and 20, June 2001.

U.S. Department of Energy, Energy Information Administration, *The Motor Gasoline Industry: Past, Present and Future*, Washington, DC, Table 5.

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1999*, Washington, DC, Table MF-33E, and annual.

Note:

Reformulated gasoline has lower concentrations of certain volatile organic compounds in a formulation intended to reduce ozone-forming hydrocarbons and air toxics. It is required in the worst ozone-nonattainment areas.

Gasohol category includes all oxygenate blends except reformulated gasoline.

Unleaded gasoline is now known as conventional gasoline.

Nearly all of the fuel ethanol used in the U.S. is made domestically. One quarter of MTBE was imported in 2000.

Table 2.9
U.S. Production and Imports of MTBE[a] and Fuel Ethanol, 1985–2000
(million gallons)

	Production		Imports	
Year	Fuel ethanol	MTBE[a]	Fuel ethanol	MTBE[a]
1985	793	302	[b]	[b]
1990	756	[b]	[b]	[b]
1991	875	[b]	[b]	[b]
1992	1,080	1,542	[b]	[b]
1993	1,156	2,081	10	306
1994	1,280	2,205	12	595
1995	1,355	2,506	16	692
1996	974	2,846	13	733
1997	1,274	3,011	4	918
1998	1,387	3,151	3	1,040
1999	1,472	3,315	4	1,146
2000	1,633	3,253	5	1,176
		Average annual percentage change		
1985–2000	4.9%	17.2%	[b]	[b]
1989–2000	8.0%	[b]	[b]	[b]

Source:
Production - 1992–2000 Ethanol and MTBE: U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Monthly*, Washington, DC, January 2001, Table D1. 1985–91 Ethanol: Information Resources, Inc., Washington, DC, 1991. 1985 MTBE: EA-Mueller,Inc., Baltimore, MD, 1992.
Imports - U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Annual, 2000, Volume 1,* Washington, DC, June 2001, Table 20, and annual.

Note:
Table 2.3 displays gasoline-equivalent gallons, which differ from these gallons.

[a] Methyl tertiary-butyl ether.
[b] Data are not available.

Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences between the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes. These values are averages, and there is a great deal of variability even within a mode.

Table 2.10
Passenger Travel and Energy Use in the United States, 1999

	Number of vehicles (thousands)	Vehicle-miles (millions)	Passenger-miles (millions)	Load factor (persons/vehicle)	Energy intensities (Btu per vehicle-mile)	Energy intensities (Btu per passenger-mile)	Energy use (trillion Btu)
Automobiles	**132,432.0**	**1,569,270**	**2,510,832**	**1.6**	**5,815**	**3,635**	**9,126.1**
Personal trucks	**57,984.7**	**651,484**	**1,042,374**	**1.6**	**7,217**	**4,511**	**4,701.7**
Motorcycles	**4,152.4**	**10,584**	**12,701**	**1.2**	**2,494**	**2,079**	**26.4**
Buses	**688.1**	[a]	[a]	[a]	[a]	[a]	**207.4**
Transit	74.2	2,276	21,205	8.9	42,955	4,802	97.7
Intercity	21.8	[a]	34,700	[a]	[a]	1,128	33.4
School	592.0	[a]	[a]	[a]	[a]	[a]	76.3
Air	[a]	[a]	**528,867**	[a]	[a]	**4,116**	**2,176.1**
Certificated route	[a]	5,332	515,367	96.6	375,810	3,981	2,004.0
General aviation	219.5	[a]	13,500	[a]	[a]	8,970	172.1
Recreational boats	**12,738.3**	[a]	[a]	[a]	[a]	[a]	**310.1**
Rail	**16.9**	**1,242**	**28,163**	**22.7**	**69,746**	**3,075**	**86.6**
Intercity[b]	0.4[c]	349[d]	5,289[e]	15.1	46,374	3,063	16.2[f]
Transit[g]	11.6	626	14,108	22.5	71,360	3,168	44.7
Commuter	4.9	266	8,766	33.0	96,649	2,932	25.7

Source:
See Appendix A for Table 2.11.

[a]Data are not available.
[b]Amtrak only.
[c]Passenger train cars.
[d]Passenger train car-miles.
[e]Revenue passenger-miles.
[f]Estimated using vehicle travel data.
[g]Light and heavy rail.

Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences between the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes. These values are averages, and there is a great deal of variability even within a mode.

Table 2.11
Energy Intensities of Highway Passenger Modes, 1970–99

	Automobiles		Light truck[a]	Buses		
				Transit[b]		Intercity
Year	(Btu per vehicle-mile)	(Btu per passenger-mile)	(Btu per vehicle-mile)	(Btu per vehicle-mile)	(Btu per passenger-mile)	(Btu per passenger-mile)
1970	9,301	4,896	12,492	31,796	2,472	1,674
1975	9,015	4,745	11,890	33,748	2,814	988
1976	9,130	4,805	11,535	34,598	2,896	1,007
1977	8,961	4,716	11,171	35,120	2,889	970
1978	8,844	4,655	10,815	36,603	2,883	976
1979	8,647	4,551	10,473	36,597	2,795	1,028
1980	7,915	4,166	10,230	36,553	2,813	1,082
1981	7,672	4,038	10,001	37,745	3,027	1,051
1982	7,485	3,939	9,275	38,766	3,237	1,172
1983	7,376	4,098	9,141	37,962	3,177	1,286
1984	7,218	4,010	8,945	37,507	3,204	954
1985	7,182	3,990	8,754	38,862	2,421	964
1986	7,213	4,007	8,578	39,869	3,512	870
1987	6,975	3,875	8,376	38,557	3,542	940
1988	6,700	3,722	8,155	39,121	3,415	963
1989	6,602	3,668	7,778	36,583	3,711	964
1990	6,183	3,864	7,773	36,647	3,735	962
1991	5,925	3,703	7,381	36,939	3,811	963
1992	5,969	3,731	7,262	40,243	4,310	964
1993	6,103	3,814	7,207	39,050	4,262	962
1994	6,041	3,775	7,232	40,147	4,609	964
1995	5,923	3,702	7,236	40,009	4,643	964
1996	5,893	3,683	7,269	40,209	4,675	963
1997	5,821	3,638	7,277	41,431	4,744	963
1998	5,771	3,607	7,288	43,888	4,688	963
1999	5,815	3,635	7,343	42,955	4,610	964
	Average annual percentage change					
1970–99	-1.6%	-1.0%	-1.8%	1.0%	2.2%	-1.9%
1989–99	-1.3%	-0.1%	-0.6%	1.6%	2.2%	0.0%

Source:
See Appendix A for Table 2.12.

[a]All two-axle, four-tire trucks.
[b]Series not continuous between 1983 and 1984 because of a change in data source by the American Public Transit Association (APTA).

Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences between the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes.

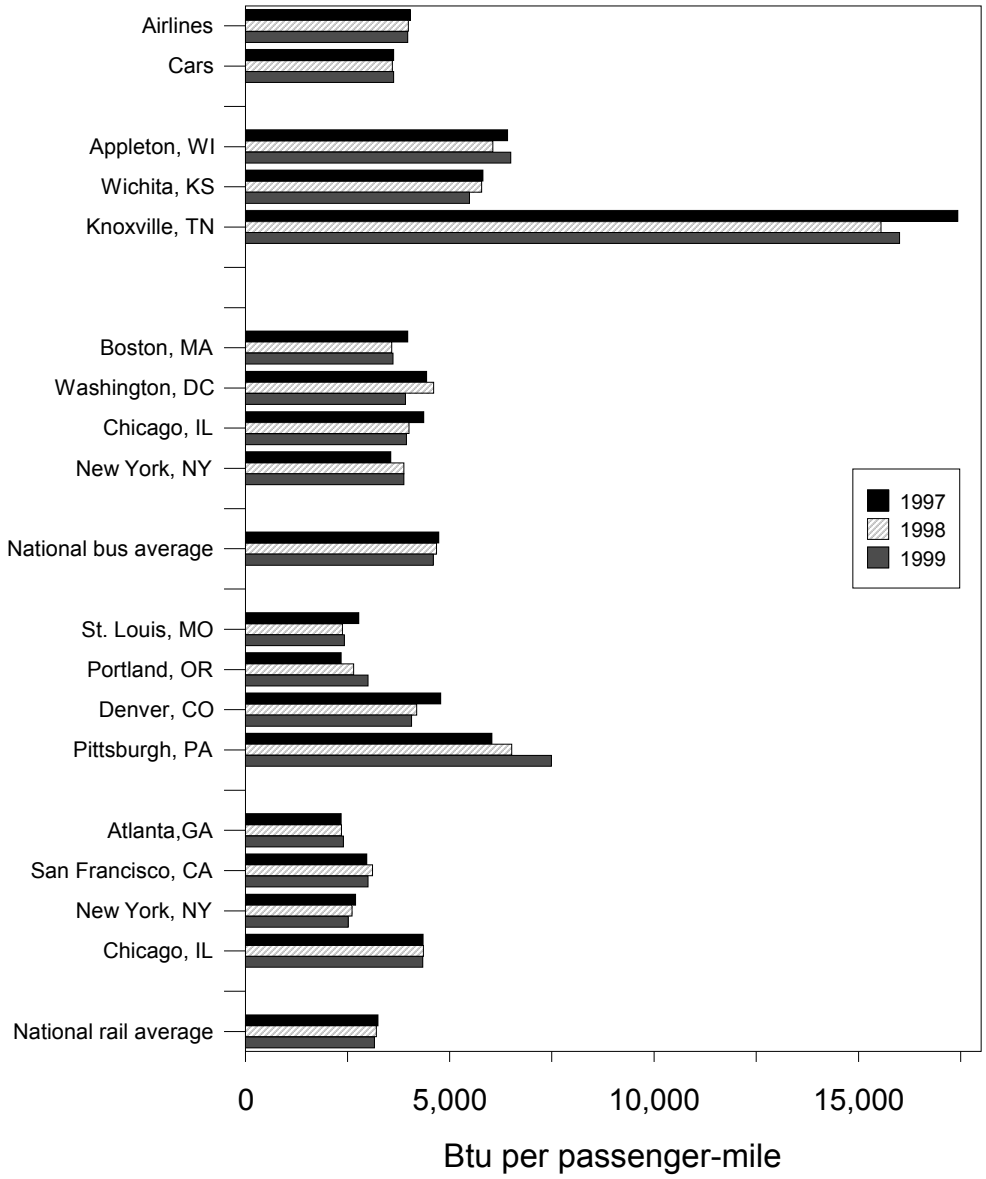
Table 2.12
Energy Intensities of Nonhighway Passenger Modes, 1970–99

	Air		Rail	
Year	Certificated air carriers (Btu per passenger-mile)	General aviation (Btu per passenger-mile)	Intercity Amtrak (Btu per passenger-mile)	Rail transit (Btu per passenger-mile)
1970	10,351	10,374	[a]	2,453
1975	7,883	10,658	3,677	2,962
1976	7,481	10,769	3,397	2,971
1977	7,174	11,695	3,568	2,691
1978	6,333	11,305	3,683	2,210
1979	5,858	10,787	3,472	2,794
1980	5,837	11,497	3,176	3,008
1981	5,743	11,123	2,957	2,946
1982	5,147	13,015	3,156	3,069
1983	5,107	11,331	2,957	3,212
1984	5,031	11,454	3,027	3,732
1985	5,679	11,707	2,800	3,461
1986	5,447	11,935	2,574	3,531
1987	4,751	11,496	2,537	3,534
1988	4,814	11,794	2,462	3,585
1989	4,808	10,229	2,731	3,397
1990	5,006	10,146	2,609	3,453
1991	4,595	9,869	2,503	3,710
1992	4,482	9,785	2,610	3,575
1993	4,558	9,653	2,646	3,687
1994	4,336	9,163	2,351	3,828
1995	4,282	9,870	2,592	3,818
1996	4,096	9,258	2,783	3,444
1997	4,044	9,688	2,923	3,253
1998	3,981	11,252	2,892	3,216
1999	3,889	12,748	3,063	3,168
		Average annual percentage change		
1970–99	-3.3%	0.7%	-0.8%[b]	0.9%
1989–99	-2.1%	2.2%	1.2%	0.7%

Source:
See Appendix A for Table 2.12.

[a]Data are not available.
[b]Average annual percentage change begins with 1975.

Figure 2.3. Energy Intensity for Transit in the U.S., 1997–99



Source:
U.S. Department of Transportation, Federal Transit Administration, 1997–1999 National Transit Databases, Washington, DC.
(Additional resources: www.fta.dot.gov/ntl)

Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences between the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes.

Table 2.13
Intercity Freight Movement and Energy Use in the United States, 1999

	Trucks	Waterborne commerce	Class I railroads
Number of vehicles (thousands)	2,561	42	20[a]
Ton-miles (billions)	1,093,000	656	1,433
Tons shipped (millions)	4,089	1,056	1,717
Average length of haul (miles)	717[b]	621	835
Energy intensity (Btu/ton-mile)	3,037	457	362
Energy use (trillion Btu)	3,319	300	520

Source:
See Appendix A for Table 2.13.

[a] Number of locomotives.

[b] 717 miles is for general freight (less than truckload). Based on data from the Eno Transportation Foundation, the average length of haul for specialized freight (truckload) is 286 miles.

Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences between the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes.

Table 2.14
Energy Intensities of Freight Modes, 1970–99

Year	Heavy single-unit and combination trucks (Btu per vehicle-mile)	Class I freight railroad (Btu per freight car-mile)	Class I freight railroad (Btu per ton-mile)	Domestic waterborne commerce (Btu per ton-mile)
1970	24,154	17,668	691	545
1971	23,694	18,814	717	506
1972	23,871	18,292	714	522
1973	23,977	18,468	677	576
1974	23,983	18,852	681	483
1975	23,836	18,741	687	549
1976	23,773	18,938	680	468
1977	23,873	19,225	669	458
1978	24,013	18,930	641	383
1979	24,260	19,187	618	457
1980	24,431	18,742	597	358
1981	24,892	18,628	572	360
1982	24,296	18,403	553	310
1983	23,740	17,863	525	319
1984	23,363	17,797	510	346
1985	23,015	17,500	497	446
1986	22,917	17,265	486	463
1987	22,391	16,791	456	402
1988	22,586	16,758	443	361
1989	22,391	16,896	437	403
1990	22,765	16,618	420	388
1991	22,710	15,834	391	386
1992	22,559	16,044	393	398
1993	22,308	16,055	389	389
1994	22,159	16,338	388	369
1995	22,172	15,993	372	374
1996	21,964	15,747	368	412
1997	21,340	15,783	370	415
1998	22,268	15,372	365	436
1999	22,510	15,364	362	457
		Average annual percentage change		
1970–99	-0.2%	-0.5%	-2.2%	-0.6%
1989–99	0.1%	-0.9%	-1.9%	1.3%

Source:
See Appendix A for Table 2.14.

Chapter 3
Greenhouse Gas Emissions

Summary Statistics from Tables in this Chapter

Source			
Table 3.1	Carbon emissions (million metric tonnes)	1990	1997
	France	*103*	*102*
	Germany	*267*	*234*
	United Kingdom	*166*	*156*
	Japan	*274*	*297*
	United States	*1,345*	*1,480*
	China	*620*	*822*
	India	*153*	*236*
Table 3.3	Transportation share of U.S. carbon dioxide emissions from fossil fuel consumption		
	1985		*30.9%*
	1990		*32.0%*
	1999		*32.8%*
Table 3.4	Carbon dioxide emissions from U.S. transportation energy use, 1999		
	Motor gasoline		*60.3%*
	Liquified petroleum gas		*0.1%*
	Jet fuel		*13.4%*
	Distillate fuel		*20.2%*
	Residual fuel		*3.5%*
	Lubricants		*0.4%*
	Aviation gas		*0.1%*
	Natural gas		*1.9%*
	Electricity		*0.2%*

Table 3.1
World Carbon Emissions, 1990 and 1997

	1990		1997	
	Million metric tons	Percent of emissions from oil use	Million metric tons	Percent of emissions from oil use
Industrialized countries	2,850	49%	3,039	49%
United States	1,345	44%	1,480	42%
Canada	127	48%	142	46%
Mexico	81	75%	94	74%
United Kingdom	166	40%	156	41%
France	103	65%	102	69%
Germany	267	37%	234	45%
Italy	113	65%	116	66%
Netherlands	60	48%	64	45%
Other Western Europe	224	63%	246	65%
Japan	274	65%	297	63%
Other industrialized countries	90	44%	108	42%
Eastern Europe	1,337	30%	878	25%
Developing countries	1,649	41%	2,258	41%
China	620	16%	822	18%
India	153	29%	236	28%
Other developing countries	876	13%	1,200	3%
Total World	5,836	42%	6,175	43%

Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Outlook 2000*, Washington, DC, March 2000, Tables A10 and A11.

Global Warming Potentials (GWP) were developed to allow comparison of each greenhouse gas' ability to trap heat in the atmosphere relative to carbon dioxide. Extensive research has been performed and it has been discovered that the effects of various gases on global warming are too complex to be precisely summarized by a single number. Further understanding of the subject also causes frequent changes to estimates. Despite that, the scientific community has developed approximations, which are shown below. Most analysts use the 100-year time horizon.

Table 3.2
Numerical Estimates of Global Warming Potentials Compared With Carbon Dioxide
(kilogram of gas per kilogram of carbon dioxide)

Gas	Lifetime (years)	Global warming potential direct effect for time horizons of		
		20 years	100 years	500 years
Carbon Dioxide	Variable	1	1	1
Methane	12 ± 3	56	21	7
Nitrous Oxide	120	280	310	170
HFCs, PFCs, and other gases				
HFC-23	264	9,200	12,100	9,900
HFC-125	33	4,800	3,200	11
HFC-134a	15	3,300	1,300	420
HFC-152a	2	460	140	42
HFC-227ea	37	4,300	2,900	950
Perfluoromethane	50,000	4,400	6,500	10,000
Perfluoroethane	10,000	6,200	9,200	14,000
Sulfur hexafluoride	3,200	16,300	23,900	34,900

Source:
U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States 1999*, Washington, DC, October 2000, p. 8. Original source: Intergovernmental Panel on Climate Change. (Additional resources: www.eia.doe.gov, www.ipcc.ch)

Note:
The typical uncertainty for global warming potentials is estimated by the Intergovernmental Panel on Climate Change at ± 35 percent.

Carbon dioxide emissions in 1999 were 13% higher than in 1990. Carbon dioxide accounts for the majority of greenhouse gases.

Table 3.3
Estimated U.S. Emissions of Greenhouse Gases, 1990–99

Greenhouse gas	Unit of measure[a]	1990	1995	1998	1999
Carbon dioxide	million metric tons of gas	4,951.9	5,260.6	5,527.1	5,598.2
	million metric tons of carbon	1,351.0	1,435.0	1,507.0	1,527.0
Methane	million metric tons of gas	31.7	31.2	29.3	28.8
	million metric tons of carbon (gwp)[b]	182.0	179.0	168.0	165.0
Nitrous oxide	million metric tons of gas	1.2	1.3	1.2	1.2
	million metric tons of carbon (gwp)[b]	99.0	106.0	103.0	103.0
HFCs, PFCs, and SF_6[c]	million metric tons of carbon (gwp)[b]	24.0	29.0	40.0	38.0

Source:
U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 1999*, Washington, DC, October 2000, pp. vii, viii. (Additional resources: www.eia.doe.gov)

[a]Gases that contain carbon can be measured either in terms of the full molecular weight of the gas or just in terms of their carbon content. See Appendix B, Table B.5 for details.

[b]Based on global warming potential.

[c]HFC-hydrofluorocarbons. PFC-perfluorocarbons. SF_6=sulfur hexaflouride.

Gases which contain carbon can be measured in terms of the full molecular weight of the gas or just in terms of their carbon content. This table presents carbon content. The ratio of the weight of carbon to carbon dioxide is 0.2727. The transportation sector accounts for approximately one-third of carbon dioxide emissions.

Table 3.4
U.S. Carbon Dioxide Emissions from Fossil Energy Consumption by End-Use Sector, 1985–99[a]
(million metric tons of carbon)

End use sector	1985	1990	1995	1996	1997	1998	1999
Residential	245.8	254.2	273.4	289.6	288.6	288.8	290.1
Commercial	189.6	207.7	220.6	229.2	241.5	244.5	243.5
Industrial	424.1	454.8	469.2	483.8	489.7	480.2	481.2
Transportation	384.4	431.8	457.8	468.9	473.6	481.9	496.1
Percentage	30.9%	32.0%	32.2%	31.9%	31.7%	32.2%	32.8%
Total energy	**1,243.9**	**1,348.6**	**1,421.0**	**1,471.5**	**1,493.4**	**1,495.4**	**1,510.8**

Source:
U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 1999*, Washington, DC, October 2000, p. 25, and annual. (Additional resources: www.eia.doe.gov)

[a]Includes energy from petroleum, coal, and natural gas. Electric utility emissions are distributed across consumption sectors.

Most U.S. carbon dioxide emissions come from petroleum fuels (98%). Motor gasoline has been responsible for about 60% of U.S. carbon dioxide emissions over the last twenty years.

Table 3.5
U.S. Carbon Dioxide Emissions from Energy Use in the Transportation Sector, 1980–99
(million metric tons of carbon)

	1980		1990		1999	
Fuel	Emissions	Percentage	Emissions	Percentage	Emissions	Percentage
			Petroleum			
Motor gasoline	238.1	62.9%	260.6	60.4%	299.1	60.3%
LPG[a]	0.3	0.1%	0.4	0.1%	0.3	0.1%
Jet fuel	42.0	11.1%	60.1	13.9%	66.3	13.4%
Distillate fuel	55.3	14.6%	75.7	17.5%	100.1	20.2%
Residual fuel	30.0	7.9%	21.9	5.1%	17.5	3.5%
Lubricants	1.8	0.5%	1.8	0.4%	1.8	0.4%
Aviation gas	1.2	0.3%	0.8	0.2%	0.7	0.1%
Total	**368.7**	97.4%	**421.2**	97.5%	**485.8**	97.9%
			Other energy			
Natural gas	9.4	2.5%	9.8	2.3%	9.5	1.9%
Electricity[b]	0.3	0.1%	0.7	0.2%	0.8	0.2%
Total	**378.4**	100.0%	**432.1**	100.0%	**496.1**	100.0%

Source:
U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 1999*, Washington, DC, October 2000, p. 27, and annual. (Additional resources: www.eia.doe.gov)

[a]Liquified petroleum gas.
[b]Share of total electric utility carbon dioxide emissions weighted by sales to the transportation sector.

The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model

The energy in greenhouse gas estimates of the most recent version (Beta Version 1.6) of the GREET model are displayed in the next table. The model estimates the full fuel-cycle emissions and energy use associated with various transportation fuels and advanced transportation technologies for light-duty vehicles. It calculates fuel-cycle emissions of **three greenhouse gases** (carbon dioxide, methane, and nitrous oxide) and five criteria pollutants (volatile organic compounds, carbon monoxide, nitrogen oxides, sulfur oxides, and particulate matter measuring 10 microns or less). **See Chapter 4 for the criteria pollutant data from GREET.** The model also calculates the total fuel-cycle energy consumption, fossil fuel consumption, and petroleum consumption using various transportation fuels. The fuel cycles that are included in the GREET model are:

- petroleum to conventional gasoline, reformulated gasoline, conventional diesel, reformulated diesel, liquefied petroleum gas, and electricity via residual oil;
- natural gas to compressed natural gas, liquefied natural gas, liquefied petroleum gas, methanol, Fischer-Tropsch diesel, dimethyl ether, hydrogen, and electricity;
- coal to electricity;
- uranium to electricity;
- renewable energy (hydropower, solar energy, and wind) to electricity;
- corn, woody biomass, and herbaceous biomass to ethanol;
- soybeans to biodiesel; and
- landfill gases to methanol.

For additional information about the GREET model, see *GREET 1.5 – Transportation Fuel-Cycle Model, Volume 1: Methodology, Development, Use and Results*, ANL/ESD-39, Vol. 1, August 1999, or contact:

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GREET Web Site:
http://www.transportation.anl.gov/ttrdc/greet/

Acronyms and Terms Used on Table 3.6

BD20	mixture of 20% biodiesel and 80% conventional diesel (by volume)
CA	California
CH4	methane
CIDI	compression ignition, direct injection
CIDIV	compression ignition, direct injection vehicle
CNG	compressed natural gas
CNGV	compressed natural gas vehicle
CO2	carbon dioxide
DME	dimethyl ether
E90	mixture of 90% ethanol and 10% gasoline (by volume)
EtOH	ethanol
EtOHV	ethanol vehicle
EV	electric vehicle
FCV	fuel-cell vehicle
FRFG	Federal reformulated gasoline
FT	Fischer-Tropsch
FTD	Fischer-Tropsch diesel
G.H2	gaseous hydrogen
GC	grid-connected (charge depleting)
GGE	gasoline gallon equivalent
GHGs	greenhouse gases
GI	grid-independent (charge sustaining)
GV	gasoline vehicle
HEV	hybrid electric vehicle
L.H2	liquid hydrogen
LS	low-sulfur
M90	mixture of 90% methanol and 10% gasoline by volume
MeOH	methanol
MeOHV	methanol vehicle
N2O	nitrous oxide
NA	North American
NE	northeast
NG	natural gas
NNA	non-North American
SI	spark ignition
urban	Emissions occurring within air quality control regions in the U.S. These regions have emission controls in place in order to meet or maintain air quality standards.
US	United States

Table 3.6
Fuel-Cycle Energy and Greenhouse Gas Emission Changes
of Alternative and Advanced Vehicle/Fuel Systems
(percentage relative to internal combustion engine vehicles
fueled with reformulated gasoline)

	GV: FRFG (btu/mile or grams/mile)	CNGV: NA NG	CNGV: NNA NG	Propane vehicle	M90 MeOHV: NA NG	M90 MeOHV: NNA NG	E90 EtOHV: corn	E90 EtOHV: cellulosic biomass	GI SI HEV: FRFG	GC SI HEV: FRFG
MPG - GGE	24.1	24.1	24.1	25.3	25.3	25.3	25.3	25.3	33.8	54.1
Total energy	5,891	-9.5%	1.2%	-16.2%	14.6%	16.3%	10.4%	53.8%	-28.6%	-40.7%
Fossil fuels	5,872	-9.7%	1.0%	-16.0%	14.9%	16.6%	-45.3%	-79.5%	-28.6%	-43.1%
Petroleum	4,665	-99.5%	-99.5%	-59.1%	-79.1%	-79.9%	-75.0%	-74.9%	-28.6%	-57.7%
CO2	446	-26.8%	-18.5%	-20.1%	-5.7%	-4.3%	-41.0%	-88.9%	-28.6%	-40.1%
CH4	0.684	111.0%	216.8%	-21.9%	-9.5%	8.5%	-27.6%	-63.3%	-25.9%	-39.4%
N2O	0.030	-49.6%	-46.4%	-3.1%	0.5%	1.3%	448.3%	474.8%	-1.6%	-29.2%
GHGs	469	-23.1%	-13.1%	-19.8%	-5.7%	-3.9%	-31.0%	-77.1%	-28.0%	-39.9%

	CIDIV: LS diesel	CIDIV: FTD, NA NG	CIDIV: FTD, NNA NG	CIDIV: BD20	GI CIDI HEV: LS diesel	GC CIDI HEV: LS diesel	EV: US mix	EV: NE US mix	EV: CA mix
MPG - GGE	29.6	29.6	29.6	29.6	41.0	57.7	84.4	84.4	84.4
Total energy	-21.7%	8.7%	10.4%	-19.0%	-43.6%	-47.2%	-45.1%	-46.2%	-50.6%
Fossil fuels	-21.7%	9.0%	10.8%	-19.1%	-43.6%	-49.6%	-52.5%	-55.6%	-61.9%
Petroleum	-10.4%	-99.0%	-98.5%	-25.5%	-35.4%	-59.7%	-98.4%	-97.5%	-99.7%
CO2	-17.1%	-13.4%	-12.1%	-28.4%	-40.2%	-44.6%	-43.5%	-53.4%	-61.5%
CH4	-40.4%	-40.3%	-24.9%	-44.2%	-56.6%	-56.3%	-48.8%	-36.3%	-43.2%
N2O	-42.3%	-44.9%	-30.0%	-34.1%	-43.3%	-57.0%	-84.1%	-87.1%	-88.6%
GHGs	-18.3%	-14.8%	-12.7%	-29.0%	-40.8%	-45.2%	-44.5%	-53.5%	-61.5%

	FCV: G.H2, central plant, NA NG	FCV: G.H2, central plant, NNA NG	FCV: G.H2, refueling station, NA NG	FCV: G.H2, refueling station, NNA NG	FCV: G.H2, central electrolysis, renewables	FCV: G.H2, station electrolysis, US generation mix
MPG - GGE	50.7	50.7	50.7	50.7	50.7	50.7
Total energy	-35.6%	-30.0%	-32.9%	-28.4%	-37.6%	40.5%
Fossil fuels	-36.6%	-31.0%	-33.2%	-28.6%	-91.9%	22.4%
Petroleum	-99.2%	-99.3%	-99.7%	-99.6%	-99.5%	-96.3%
CO2	-47.7%	-42.7%	-46.9%	-43.3%	-90.6%	44.7%
CH4	-50.1%	-4.3%	-36.2%	-3.3%	-89.5%	62.6%
N2O	-94.9%	-93.2%	-94.8%	-93.3%	-97.7%	-64.9%
GHGs	-48.7%	-42.6%	-47.5%	-43.2%	-90.7%	43.3%

(Table continued on next page)

Note:
See page preceding Table 3.6 for acronym definitions.

Table 3.6 (Continued)
Fuel-Cycle Energy and Emission Changes of Alternative and Advanced Vehicle/Fuel Systems
(percentage relative to intenal combustion engine vehicles fueled with reformulated gasoline)

	FCV: L.H2, central plant, NA NG	FCV: L.H2, central plant, NNA NG	FCV: L.H2, refueling station, NA NG	FCV: L.H2, refueling station, NNA NG	FCV: L.H2, central electrolysis, renewables	FCV: L.H2, station electrolysis, US generation mix
MPG - GGE	50.7	50.7	50.7	50.7	50.7	50.7
Total energy	-11.6%	-8.5%	12.4%	19.5%	-44.0%	105.3%
Fossil fuels	-11.4%	-8.4%	6.0%	12.9%	-98.7%	61.7%
Petroleum	-99.3%	-99.0%	-98.4%	-98.4%	-99.4%	-95.2%
CO2	-28.8%	-25.4%	-1.3%	2.4%	-98.8%	91.1%
CH4	-25.1%	-21.6%	6.5%	81.3%	-98.8%	114.7%
N2O	-86.2%	-85.5%	-84.3%	-82.7%	-99.6%	-53.7%
GHGs	-29.7%	-26.4%	-2.5%	2.9%	-98.8%	89.2%

	FCV: MeOH, NA NG	FCV: MeOH, NNA NG	FCV: gasoline	FCV: cellulosic EtOH	FCV: CNG, NA NG	FCV: CNG, NNA NG	FCV: FT naphtha, NNA NG	FCV: crude naphtha
MPG - GGE	42.2	42.2	37.4	39.3	37.4	37.4	37.4	37.4
Total energy	-28.7%	-27.4%	-35.5%	19.9%	-41.6%	-34.7%	-10.3%	-38.6%
Fossil fuels	-28.5%	-27.2%	-35.5%	-96.9%	-41.7%	-34.8%	-10.0%	-38.6%
Petroleum	-98.5%	-98.1%	-35.5%	-94.4%	-99.7%	-99.7%	-98.7%	-36.4%
CO2	-43.5%	-42.5%	-35.5%	-105.1%	-52.7%	-47.4%	-32.7%	-41.3%
CH4	-46.7%	-33.5%	-39.3%	-91.8%	15.0%	85.2%	-38.8%	-41.8%
N2O	-77.4%	-76.7%	-77.4%	338.7%	-79.1%	-77.0%	-79.9%	-78.6%
GHGs	-44.3%	-42.9%	-36.3%	-96.0%	-51.1%	-44.6%	-33.7%	-41.9%

Source:
Wang, Michael, Q., model results of Beta Version of GREET 1.6, Argonne National Laboratory, Argonne, IL, August, 2001.

Note:
See page preceding Table 3.6 for acronym definitions.

Chapter 4
Criteria Pollutants

Summary Statistics from Tables in this Chapter

Source		
Table 4.1	Transportation's share of U.S. emissions, 1999	
	CO	*78.6%*
	NO_X	*53.4%*
	VOC	*43.5%*
	PM-10	*2.1%*
	PM-2.5	*7.6%*
	SO_2	*6.9%*
	NH_3	*5.4%*
Table 4.10	Transportation's share of lead emissions	
	1970	*82.3%*
	1999	*12.8%*

Transportation accounts for the majority of carbon monoxide and nitrogen oxide emissions. Highway vehicles are responsible for the largest share of transportation emissions.

Table 4.1
Total National Emissions of the Criteria Air Pollutants by Sector, 1999
(millions of short tons/percentage)

Sector	CO	NO_x	VOC	PM-10	PM-2.5	SO_2	NH_3
Highway vehicles	**49.99**	**8.59**	**5.30**	**0.30**	**0.23**	**0.36**	**0.26**
	55.9%	*35.1%*	*29.6%*	*0.8%*	*2.7%*	*1.9%*	*5.2%*
Aircraft	**1.00**	**0.16**	**0.18**	**0.04**	**0.03**	**0.01**	**0.00**
	1.1%	*0.7%*	*1.0%*	*0.1%*	*0.3%*	*0.1%*	*0.1%*
Railroads	**0.12**	**0.95**	**0.05**	**0.03**	**0.03**	**0.11**	**0.00**
	0.1%	*3.9%*	*0.3%*	*0.1%*	*0.4%*	*0.6%*	*0.0%*
Vessels	**0.14**	**1.00**	**0.04**	**0.04**	**0.04**	**0.27**	**0.00**
	0.2%	*4.1%*	*0.2%*	*0.1%*	*0.5%*	*1.4%*	*0.0%*
Other off-highway	**18.71**	**3.17**	**2.19**	**0.35**	**0.31**	**0.54**	**0.00**
	20.9%	*13.0%*	*12.2%*	*1.0%*	*3.7%*	*2.9%*	*0.1%*
Transportation total	**70.30**	**13.05**	**7.79**	**0.72**	**0.64**	**1.30**	**0.27**
	78.6%	*53.4%*	*43.5%*	*2.1%*	*7.6%*	*6.9%*	*5.4%*
Stationary source fuel combustion	**5.37**	**10.19**	**0.89**	**1.09**	**0.78**	**16.09**	**0.05**
	6.0%	*41.7%*	*5.0%*	*3.1%*	*9.3%*	*85.3%*	*1.0%*
Industrial processes	**3.71**	**0.80**	**8.02**	**0.71**	**0.38**	**1.43**	**0.20**
	4.1%	*3.3%*	*44.8%*	*2.0%*	*4.6%*	*7.6%*	*4.0%*
Waste disposal and recycling total	**1.15**	**0.10**	**0.43**	**0.31**	**0.24**	**0.04**	**0.09**
	1.3%	*0.4%*	*2.4%*	*0.9%*	*2.8%*	*0.2%*	*1.8%*
Miscellaneous	**8.92**	**0.33**	**0.79**	**31.92**	**6.35**	**0.01**	**4.36**
	10.0%	*1.3%*	*4.4%*	*91.9%*	*75.8%*	*0.1%*	*87.8%*
Total of all sources	**89.45**	**24.45**	**17.92**	**34.74**	**8.38**	**18.87**	**4.96**
	100.0%	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website *www.epa.gov/ttn/chief/trends (Additional resources:* www.epa.gov/oar/oaqps)

Note:
CO = Carbon monoxide. NO_x = Nitrogen oxides. PM-10 = Particulate matter less than 10 microns. PM-2.5 = Particulate matter less than 2.5 microns. SO_2 = Sulfur dioxide. VOC = Volatile organic compounds. NH_3 = Ammonia.

The transportation sector accounted for more than three-fourths of the nation's carbon monoxide (CO) emissions in 1999. Highway vehicles are by far the source of the greatest amount of CO. For details on the highway emissions of CO, see Table 4.3.

Table 4.2
Total National Emissions of Carbon Monoxide, 1970–99[a]
(million short tons)

Source category	1970	1980	1990	1995	1998	1999	Percent of total, 1999
Highway vehicles	88.03	78.05	58.44	54.81	52.36	49.99	51.3%
Aircraft	0.51	0.74	0.90	0.94	1.00	1.00	1.0%
Railroads	0.07	0.10	0.12	0.11	0.12	0.12	0.1%
Vessels[b]	0.02	0.06	0.13	0.13	0.14	0.14	0.1%
Other off-highway	11.38	13.59	17.04	19.04	23.87	23.90	24.5%
Transportation total	100.00	92.54	76.64	75.04	77.48	75.15	77.1%
Stationary fuel combustion total	4.63	7.30	5.51	5.93	5.08	5.32	5.5%
Industrial processes total	9.84	6.95	4.77	4.61	3.81	3.80	3.9%
Waste disposal and recycling total	7.06	2.30	1.08	1.19	1.14	3.79	3.9%
Miscellaneous total	7.91	8.34	11.12	7.30	9.36	9.38	9.6%
Total of all sources	**129.44**	**117.43**	99.12	94.06	96.87	97.44	100.0%

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website *www.epa.gov/ttn/chief/trends (Additional resources:* www.epa.gov/oar/oaqps)

Note:
Emission estimation methodology changes indicated by shaded areas. Transportation methodologies changed in 1970, while all others changed in 1990.

[a]The sums of subcategories may not equal total due to rounding.
[b]Recreational marine vessels.

Though gasoline-powered light vehicles continue to be responsible for the majority of carbon monoxide emissions from highway vehicles, the total pollution from light vehicles in 1999 is less than half what it was in 1970. This is despite the fact that there were many more light vehicles on the road in 1999.

Table 4.3
Emissions of Carbon Monoxide from Highway Vehicles, 1970–99[a]
(million short tons)

Source category	1970	1975	1980	1985	1990	1995	1999	Percent of total, 1999
Gasoline powered								
Light vehicles & motorcycles	64.03	59.28	53.56	49.45	35.00	29.79	27.38	54.8%
Light trucks[b]	16.57	15.77	16.14	18.96	17.12	19.43	16.12	32.2%
Heavy vehicles	6.71	7.14	7.19	7.72	5.03	4.10	4.26	8.5%
Total	87.31	82.19	76.89	76.13	57.14	53.32	47.76	95.5%
Diesel powered								
Light vehicles	[c]	0.03	0.02	0.02	0.02	0.03	0.01	0.0%
Light trucks[b]	[c]	[c]	0.00	0.00	0.05	0.01	0.01	0.0%
Heavy vehicles	0.72	0.92	1.14	1.24	1.22	1.45	2.22	4.4%
Total	0.72	0.95	1.16	1.26	1.30	1.49	2.23	4.5%
Total								
Highway vehicle total	88.03	83.13	78.05	77.39	58.44	54.81	49.99	100.0%
Percent diesel	0.8%	1.1%	1.5%	1.6%	2.2%	2.7%	4.5%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website *www.epa.gov/ttn/chief/trends*
(Additional resources: www.epa.gov/oar/oaqps)

[a]The sums of subcategories may not equal total due to rounding.
[b]Less than 8,500 pounds.
[c]Data are not available.

The transportation sector accounted for over half of the nation's nitrogen oxide (NOx) emissions in 1999, with the majority coming from highway vehicles. For details on the highway emissions of NOx, see Table 4.5.

Table 4.4
Total National Emissions of Nitrogen Oxides, 1970–99[a]
(million short tons)

Source category	1970	1980	1990	1995	1998	1999	Percent of total, 1999
Highway vehicles	7.39	8.62	7.21	7.96	8.82	8.59	33.8%
Railroads	0.50	0.73	0.93	0.99	1.22	1.20	4.7%
Other off-highway	1.44	2.80	3.88	4.14	4.32	4.31	17.0%
Transportation total	9.32	12.15	12.01	13.08	14.36	14.11	55.5%
Stationary fuel combustion total	10.06	11.32	10.89	10.83	10.40	10.03	39.5%
Industrial processes total	0.78	0.56	0.80	0.77	0.85	0.85	3.4%
Waste disposal and recycling total	0.44	0.11	0.09	0.10	0.10	0.09	0.4%
Miscellaneous total	0.33	0.25	0.37	0.27	0.32	0.32	1.3%
Total of all sources	**20.93**	**24.38**	**24.17**	**25.05**	**26.02**	**25.39**	**100.0%**

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website *www.epa.gov/ttn/chief/trends (Additional resources:* www.epa.gov/oar/oaqps)

Note:
Emission estimation methodology changes indicated by shaded areas. Transportation methodologies changed in 1970, while all others changed in 1990.

[a]The sums of subcategories may not equal total due to rounding.

Heavy diesel-powered vehicles were responsible for one-third of highway vehicle nitrogen oxide emissions in 1999, while light gasoline vehicles were responsible for nearly two-thirds.

Table 4.5
Emissions of Nitrogen Oxides from Highway Vehicles, 1970–99[a]
(million short tons)

Source category	1970	1975	1980	1985	1990	1995	1999	Percent of total, 1999
Gasoline powered								
Light vehicles & motorcycles	4.16	4.73	4.42	3.81	3.01	3.04	2.86	33.3%
Light trucks[b]	1.28	1.46	1.41	1.53	1.55	1.99	1.64	19.1%
Heavy vehicles	0.28	0.32	0.30	0.33	0.31	0.33	0.46	5.3%
Total	5.71	6.51	6.13	5.67	4.87	5.36	4.96	57.7%
Diesel powered								
Light vehicles	[c]	0.02	0.03	0.03	0.03	0.03	0.01	0.1%
Light trucks[b]	[c]	[c]	0.01	0.01	0.06	0.01	0.01	0.1%
Heavy vehicles	1.68	2.12	2.46	2.39	2.25	2.54	3.62	42.1%
Total	1.68	2.14	2.49	2.42	2.34	2.59	3.63	42.3%
Total								
Highway vehicle total	**7.39**	**8.65**	**8.62**	**8.09**	**7.21**	**7.96**	**8.59**	**100.0%**
Percent diesel	22.7%	24.8%	28.9%	30.0%	32.4%	32.6%	42.3%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website *www.epa.gov/ttn/chief/trends (Additional resources:* www.epa.gov/oar/oaqps)

[a]The sums of subcategories may not equal total due to rounding.
[b]Less than 8,500 pounds.
[c]Data are not available.

The transportation sector accounted for over 45% of the nation's volatile organic compound (VOC) emissions in 1999, with the majority coming from highway vehicles. For details on the highway emissions of VOC, see Table 4.7.

Table 4.6
Total National Emissions of Volatile Organic Compounds, 1970–99[a]
(million short tons)

Source category	1970	1980	1990	1995	1998	1999	Percent of total, 1999
Highway vehicles	12.97	8.98	6.44	5.82	5.44	5.30	29.2%
Off-highway	1.88	2.31	2.55	2.70	3.30	3.23	17.8%
Transportation total	14.85	11.29	8.99	8.52	8.74	8.53	47.0%
Stationary fuel combustion total	0.72	1.05	1.01	1.07	0.86	0.90	5.0%
Industrial processes total	12.33	12.10	9.01	9.71	7.88	7.41	40.8%
Waste disposal and recycling total	1.98	0.76	0.99	1.07	0.43	0.59	3.2%
Miscellaneous total	1.10	1.13	1.06	0.55	0.71	0.72	3.9%
Total of all sources	**30.98**	**26.34**	**21.05**	**20.92**	**18.61**	**18.15**	**100.0%**

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website *www.epa.gov/ttn/chief/trends (Additional resources:* www.epa.gov/oar/oaqps)

Note:
Emission estimation methodology changes indicated by shaded areas. Transportation methodologies changed in 1970, while all others changed in 1990.

[a]The sum of subcategories may not equal total due to rounding. The EPA's definition of volatile organic compounds excludes methane, ethane, and certain other nonphotochemically reactive organic compounds.

Gasoline-powered vehicles are responsible for 95% of highway vehicle emissions of volatile organic compounds. VOC emissions from highway vehicles in 1999 were less than half the 1970 level.

Table 4.7
Emissions of Volatile Organic Compounds from Highway Vehicles, 1970–99[a]
(thousand short tons)

Source category	1970	1975	1980	1985	1990	1995	1999	Percent of total, 1999
Gasoline powered								
Light vehicles & motorcycles	9,193	7,248	5,907	5,864	3,692	3,029	2,911	55.0%
Light trucks[b]	2,770	2,289	2,059	2,425	2,016	2,135	1,722	32.5%
Heavy vehicles	743	657	611	716	405	325	375	7.1%
Total	12,706	10,194	8,577	9,005	6,113	5,489	5,008	94.5%
Diesel powered								
Light vehicles	[c]	15	8	8	9	12	3	0.1%
Light trucks[b]	[c]	[c]	2	2	24	5	2	0.0%
Heavy vehicles	266	335	392	360	298	309	284	5.4%
Total	266	350	402	370	331	326	289	5.5%
Total								
Highway vehicle total	12,972	10,545	8,979	9,376	6,443	5,816	5,297	100.0%
Percent diesel	2.1%	3.3%	4.5%	3.9%	5.1%	5.6%	5.5%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website *www.epa.gov/ttn/chief/trends (Additional resources:* www.epa.gov/oar/oaqps)

[a]The sums of subcategories may not equal total due to rounding.
[b]Less than 8,500 pounds.
[c]Data are not available.

The transportation sector accounted for only 3% of the nation's particulate matter (PM-10) emissions in 1999. For details on the highway emissions of PM-10, see Table 4.9.

Table 4.8
Total National Emissions of Particulate Matter (PM-10), 1970–99[a]
(million short tons)

Source category	1970	1980	1990	1995	1998	1999	Percent of total, 1999
Highway vehicles	0.44	0.40	0.35	0.30	0.31	0.30	1.2%
Off-highway	0.22	0.40	0.49	0.46	0.47	0.46	1.9%
Transportation total	0.66	0.80	0.84	0.76	0.78	0.75	3.2%
Stationary fuel combustion total	2.87	2.45	1.20	1.18	1.00	1.03	4.3%
Industrial processes total	7.67	2.75	1.04	0.95	0.67	0.68	2.9%
Waste disposal and recycling total	1.00	0.27	0.27	0.29	0.31	0.59	2.5%
Miscellaneous total	0.84	0.85	24.54	22.77	23.28	20.63	87.1%
Total of all sources	**13.04**	**7.12**	**27.88**	**25.93**	**26.04**	**23.68**	**100.0%**

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website *www.epa.gov/ttn/chief/trends (Additional resources:* www.epa.gov/oar/oaqps)

Note:
Emission estimation methodology changes indicated by shaded areas. Transportation methodologies changed in 1970, while all others changed in 1990.

[a]Fine particle matter less than 10 microns. The sums of subcategories may not equal total due to rounding.

Since 1980 diesel-powered vehicles have been responsible for more than half of highway vehicle emissions of particulate matter (PM-10). Heavy vehicles are clearly the cause.

Table 4.9
Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970–99[a]
(thousand short tons)

Source category	1970	1975	1980	1985	1990	1995	1999	Percent of total, 1999
Gasoline powered								
Light vehicles & motorcycles	225	207	120	77	57	55	59	20.0%
Light trucks[b]	70	72	55	43	37	41	36	12.2%
Heavy vehicles	13	15	15	14	10	9	12	4.1%
Total	308	294	190	134	104	105	107	36.3%
Diesel powered								
Light vehicles	[c]	10	12	8	7	7	1	0.3%
Light trucks[b]	[c]	[c]	2	1	13	2	1	0.3%
Heavy vehicles	136	166	194	219	225	185	186	63.1%
Total	136	176	208	228	245	194	188	63.7%
Total								
Highway vehicle total	**443**	**471**	**397**	**363**	**349**	**300**	**295**	**100.0%**
Percent diesel	30.7%	37.4%	52.4%	62.8%	70.2%	64.7%	63.7%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website *www.epa.gov/ttn/chief/trends (Additional resources:* www.epa.gov/oar/oaqps)

[a]The sums of subcategories may not equal total due to rounding.
[b]Less than 8,500 pounds.
[c]Data are not available.

The transportation sector accounted for only 9% of the nation's particulate matter (PM-2.5) emissions in 1998. For details on the highway emissions of PM-2.5, see Table 4.11.

Table 4.10
Total National Emissions of Particulate Matter (PM-2.5), 1990–99
(million short tons)

Source category	1990	1995	1997	1998	1999	Percent of total, 1999
Highway vehicles	0.29	0.24	0.26	0.25	0.23	3.4%
Off-highway	0.43	0.40	0.42	0.42	0.41	6.1%
Transportation total	0.72	0.64	0.69	0.67	0.64	9.4%
Stationary fuel combustion total	0.91	0.90	0.78	0.74	0.77	11.3%
Industrial processes total	0.56	0.50	0.38	0.39	0.39	5.7%
Waste disposal and recycling total	0.23	0.25	0.24	0.24	0.53	7.8%
Miscellaneous total	5.23	4.73	5.19	5.04	4.45	65.8%
Total of all sources	**7.66**	**7.01**	**7.27**	**7.07**	**6.77**	**100.0%**

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website *www.epa.gov/ttn/chief/trends (Additional resources:* www.epa.gov/oar/oaqps)

Diesel vehicles are responsible for the majority of highway vehicle PM-2.5 emissions. More than 70% of the PM-2.5 emissions are from heavy diesel trucks.

Table 4.11
Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990–99[a]
(thousand short tons)

Source category	1990	1995	1997	1998	1999	Percent of total, 1999
Gasoline powered						
Light vehicles & motorcycles	34	32	33	34	34	14.8%
Light trucks[b]	24	26	22	22	22	9.6%
Heavy vehicles	6	6	9	8	8	3.5%
Total	64	64	64	64	64	27.9%
Diesel powered						
Light vehicles	6	6	2	1	1	0.4%
Light trucks[b]	12	2	1	1	1	0.4%
Heavy vehicles	204	165	196	179	164	71.6%
Total	222	173	199	181	166	72.5%
Total						
Highway vehicle total	**286**	**237**	**263**	**246**	**229**	**100.0%**
Percent diesel	77.6%	73.0%	75.7%	73.6%	72.5%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website *www.epa.gov/ttn/chief/trends (Additional resources:* www.epa.gov/oar/oaqps)

[a] The sums of subcategories may not equal total due to rounding.
[b] Less than 8,500 pounds.

Historically the transportation sector, highway vehicles in particular, have been a major source of lead emissions in the U.S. Regulatory action in 1978 required a gradual reduction of the lead content of all gasoline over a period of many years. The transportation sector accounts for only 13% of lead emissions in 1999, mainly due to off-highway fuel use.

Table 4.12
National Lead Emission Estimates, 1970–99[a]
(thousand short tons per year)

Source category	1970	1975	1980	1985	1990	1995	1999	Percent of total, 1999
Highway vehicles	171.96	130.21	60.50	18.05	0.42	0.02	0.02	0.5%
Off-highway	9.74	6.13	4.21	0.92	0.78	0.54	0.52	12.3%
Transportation total	181.70	136.34	64.71	18.97	1.20	0.56	0.54	12.8%
Stationary source fuel combustion	10.62	10.35	4.30	0.52	0.50	0.49	0.50	11.9%
Industrial processes	26.36	11.38	3.94	2.53	2.48	2.27	2.35	55.9%
Waste disposal and recycling total	2.20	1.60	1.21	0.87	0.80	0.60	0.81	19.4%
Total of all sources	**220.87**	**159.66**	**74.15**	**22.89**	**4.98**	**3.93**	**4.20**	**100.0%**

Source:
U. S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900-1998*, 2000, pp. A-34–A-35, and annual. (Additional resources: www.epa.gov/oar/oaqps)

[a]The sums of subcategories may not equal due to rounding.

The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model

The energy and criteria pollutant estimates of the most recent version (Beta of Version 1.6) of the GREET model are displayed in the next table. The model estimates the full fuel-cycle emissions and energy use associated with various transportation fuels and advanced transportation technologies for light vehicles. It calculates fuel-cycle emissions of **five criteria pollutants** (volatile organic compounds, carbon monoxide, nitrogen oxides, sulfur oxides, and particulate matter measuring 10 microns or less) and three greenhouse gases (carbon dioxide, methane, and nitrous oxide). **See Chapter 3 for the greenhouse gas data from GREET.** The model also calculates the total fuel-cycle energy consumption, fossil fuel consumption, and petroleum consumption using various transportation fuels. The fuel cycles that are included in the GREET model are:

petroleum to conventional gasoline, reformulated gasoline, conventional diesel, reformulated diesel, liquefied petroleum gas, and electricity via residual oil;

1. natural gas to compressed natural gas, liquefied natural gas, liquefied petroleum gas, methanol, Fischer-Tropsch diesel, dimethyl ether, hydrogen, and electricity;
2. coal to electricity;
3. uranium to electricity;
4. renewable energy (hydropower, solar energy, and wind) to electricity;
5. corn, woody biomass, and herbaceous biomass to ethanol;
6. soybeans to biodiesel; and
7. landfill gases to methanol.

For additional information about the GREET model, see *GREET 1.5 – Transportation Fuel-Cycle Model, Volume 1: Methodology, Development, Use and Results*, ANL/ESD-39, Vol. 1, August 1999, or contact:

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GREET Web Site:
http://www.transportation.anl.gov/ttrdc/greet/

Acronyms and Terms Used on Table 4.13

BD20	mixture of 20% biodiesel and 80% conventional diesel (by volume)
CA	California
CH4	methane
CIDI	compression ignition, direct injection
CIDIV	compression ignition, direct injection vehicle
CNG	compressed natural gas
CNGV	compressed natural gas vehicle
CO2	carbon dioxide
DME	dimethyl ether
E90	mixture of 90% ethanol and 10% gasoline (by volume)
EtOH	ethanol
EtOHV	ethanol vehicle
EV	electric vehicle
FCV	fuel-cell vehicle
FRFG	Federal reformulated gasoline
FT	Fischer-Tropsch
FTD	Fischer-Tropsch diesel
G.H2	gaseous hydrogen
GC	grid-connected (charge depleting)
GGE	gasoline gallon equivalent
GHGs	greenhouse gases
GI	grid-independent (charge sustaining)
GV	gasoline vehicle
HEV	hybrid electric vehicle
L.H2	liquid hydrogen
LS	low-sulfur
M90	mixture of 90% methanol and 10% gasoline by volume
MeOH	methanol
MeOHV	methanol vehicle
N2O	nitrous oxide
NA	North American
NE	northeast
NG	natural gas
NNA	non-North American
SI	spark ignition
urban	Emissions occurring within air quality control regions in the U.S. These regions have emission controls in place in order to meet or maintain air quality standards.
US	United States

Table 4. 13
Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative and Advanced Vehicle/Fuel Systems (percentage relative to internal combustion engine vehicles fueled with reformulated gasoline)

	GV: FRFG (btu/mile or grams/mile)	CNGV: NA NG	CNGV: NNA NG	Propane vehicle	M90 MeOHV: NA NG	M90 MeOHV: NNA NG	E90 EtOHV: corn	E90 EtOHV: cellulosic biomass	GI SI HEV: FRFG	GC SI HEV: FRFG
MPG - GGE	24.1	24.1	24.1	25.3	25.3	25.3	25.3	25.3	33.8	54.1
Total energy	5,891	-9.5%	1.2%	-16.2%	14.6%	16.3%	10.4%	53.8%	-28.6%	-40.7%
Fossil fuels	5,872	-9.7%	1.0%	-16.0%	14.9%	16.6%	-45.3%	-79.5%	-28.6%	-43.1%
Petroleum	4,665	-99.5%	-99.5%	-59.1%	-79.1%	-79.9%	-75.0%	-74.9%	-28.6%	-57.7%
VOC: total	0.202	-68.8%	-66.1%	-55.6%	-14.7%	-15.2%	83.9%	1.4%	-20.3%	-45.7%
CO: total	2.838	-40.4%	-32.5%	-40.2%	0.3%	1.2%	5.7%	21.1%	-0.8%	-33.2%
NOx: total	0.256	-41.7%	98.6%	-37.7%	-12.6%	34.2%	151.2%	389.0%	-24.4%	-18.1%
PM10: total	0.047	190.8%	275.5%	-39.3%	-21.5%	-18.8%	574.3%	198.0%	-5.4%	2.1%
SOx: total	0.138	-80.7%	-76.4%	-69.1%	-57.7%	-50.7%	194.0%	-73.6%	-28.6%	94.5%
VOC: urban	0.150	-57.9%	-59.8%	-53.1%	-10.0%	-13.6%	-15.2%	-15.2%	-17.4%	-45.6%
CO: urban	2.775	-38.5%	-37.6%	-40.2%	-0.3%	-0.5%	-0.3%	-0.4%	-0.2%	-33.1%
NOx: urban	0.070	104.5%	111.4%	-33.9%	-30.2%	-40.5%	-25.8%	-33.4%	-13.2%	-36.8%
PM10: urban	0.037	-35.3%	-40.2%	-35.1%	-23.6%	-28.6%	-12.8%	-13.1%	0.5%	-13.5%
SOx: urban	0.073	-92.5%	-91.3%	-83.6%	-81.0%	-80.4%	-82.0%	-83.3%	-28.6%	-44.0%

	CIDIV: LS diesel	CIDIV: FTD, NA NG	CIDIV: FTD, NNA NG	CIDIV: BD20	GI CIDI HEV: LS diesel	GC CIDI HEV: LS diesel	EV: U.S. mix	EV: NE U.S. mix	EV: CA mix
MPG - GGE	29.6	29.6	29.6	29.6	41.0	57.7	84.4	84.4	84.4
Total energy	-21.7%	8.7%	10.4%	-19.0%	-43.6%	-47.2%	-45.1%	-46.2%	-50.6%
Fossil fuels	-21.7%	9.0%	10.8%	-19.1%	-43.6%	-49.6%	-52.5%	-55.6%	-61.9%
Petroleum	-10.4%	-99.0%	-98.5%	-25.5%	-35.4%	-59.7%	-98.4%	-97.5%	-99.7%
VOC: total	-59.9%	-65.3%	-50.9%	-34.6%	-64.4%	-73.4%	-89.7%	-91.4%	-93.5%
CO: total	-0.9%	2.0%	100.1%	0.2%	-1.4%	-33.5%	-98.4%	-97.4%	-97.7%
NOx: total	-15.7%	-22.6%	33.8%	4.9%	-32.0%	-19.9%	11.6%	3.7%	-20.7%
PM10: total	-8.9%	-34.3%	-22.1%	-9.6%	-15.8%	-3.6%	24.0%	4.7%	-9.8%
SOx: total	-27.9%	-83.8%	-78.0%	-43.8%	-48.0%	86.8%	369.2%	233.7%	146.2%
VOC: urban	-61.2%	-65.2%	-47.6%	-61.5%	-62.9%	-75.3%	-99.6%	-99.1%	-99.3%
CO: urban	-0.1%	-0.2%	98.8%	-0.2%	-0.3%	-33.3%	-99.8%	-99.5%	-99.5%
NOx: urban	30.4%	7.6%	62.2%	29.5%	20.3%	-28.1%	-75.5%	-65.5%	-75.1%
PM10: urban	-3.5%	-22.2%	-10.1%	-7.2%	-7.3%	-24.0%	-38.5%	-41.1%	-42.8%
SOx: urban	-26.3%	-99.2%	-98.9%	-57.5%	-46.9%	-78.0%	-44.6%	-53.7%	-71.1%

(Table continued on next page)

Note:
See page preceding Table 4.13 for acronym definitions.

Table 4. 13 (Continued)
Fuel-Cycle Energy and Criteria Pollutant Emission Changes
of Alternative and Advanced Vehicle/Fuel Systems
(percentage relative to internal combustion engine vehicles
fueled with reformulated gasoline)

	FCV: G.H2, central plant, NA NG	FCV: G.H2, central plant, NNA NG	FCV: G.H2, refueling station, NA NG	FCV: G.H2, refueling station, NNA NG	FCV: G.H2, central electrolysis, renewables	FCV: G.H2, station electrolysis, U.S. generation mix
MPG - GGE	50.7	50.7	50.7	50.7	50.7	50.7
Total energy	-35.6%	-30.0%	-32.9%	-28.4%	-37.6%	40.5%
Fossil fuels	-36.6%	-31.0%	-33.2%	-28.6%	-91.9%	22.4%
Petroleum	-99.2%	-99.3%	-99.7%	-99.6%	-99.5%	-96.3%
VOC: total	-97.1%	-93.6%	-94.7%	-91.9%	-97.9%	-68.6%
CO: total	-98.4%	-94.0%	-95.0%	-91.3%	-99.5%	-94.5%
NOx: total	-54.4%	21.6%	-21.5%	42.4%	-58.8%	285.4%
PM10: total	-36.7%	-33.9%	-44.7%	-40.9%	-44.8%	191.2%
SOx: total	-22.4%	5.8%	-58.0%	-55.0%	-5.3%	1390.5%
VOC: urban	-99.6%	-99.5%	-95.3%	-95.5%	-99.9%	-98.6%
CO: urban	-99.7%	-99.6%	-95.9%	-95.9%	-99.9%	-99.3%
NOx: urban	-81.1%	-76.2%	87.6%	86.6%	-83.5%	-22.1%
PM10: urban	-41.5%	-46.1%	-38.3%	-38.4%	-47.9%	-31.4%
SOx: urban	-89.4%	-86.4%	-95.3%	-95.0%	-87.3%	81.8%

	FCV: L.H2, central plant, NA NG	FCV: L.H2, central plant, NNA NG	FCV: L.H2, refueling station, NA NG	FCV: L.H2, refueling station , NNA NG	FCV: L.H2, central electrolysis, renewables	FCV: L.H2, station electrolysis, U.S. generation mix
MPG - GGE	50.7	50.7	50.7	50.7	50.7	50.7
Total energy	-11.6%	-8.5%	12.4%	19.5%	-44.0%	105.3%
Fossil fuels	-11.4%	-8.4%	6.0%	12.9%	-98.7%	61.7%
Petroleum	-99.3%	-99.0%	-98.4%	-98.4%	-99.4%	-95.2%
VOC: total	-96.3%	-95.3%	-86.5%	-83.7%	-98.7%	-76.0%
CO: total	-96.9%	-96.6%	-96.0%	-92.2%	-99.7%	-85.8%
NOx: total	-55.8%	-7.9%	57.3%	121.8%	-46.4%	409.0%
PM10: total	-36.8%	-33.6%	36.1%	39.9%	-57.5%	272.0%
SOx: total	-85.1%	-80.8%	434.0%	437.0%	-94.8%	1868.2%
VOC: urban	-99.5%	-99.5%	-98.3%	-98.5%	-99.9%	-98.2%
CO: urban	-99.7%	-99.7%	-98.8%	-98.8%	-100.0%	-99.1%
NOx: urban	-91.4%	-91.0%	-76.1%	-77.2%	-96.4%	2.8%
PM10: urban	-47.2%	-47.1%	-41.9%	-41.9%	-48.9%	-25.7%
SOx: urban	-99.1%	-99.0%	-99.4%	-99.1%	-99.6%	140.1%

(Table continued on next page)

Note:
See page preceding Table 4.13 for acronym definitions.

Table 4. 13 (Continued)
Fuel-Cycle Energy and Criteria Pollutant Emission Changes
of Alternative and Advanced Vehicle/Fuel Systems
(percentage relative to internal combustion engine vehicles
fueled with reformulated gasoline)

	FCV: MeOH, NA NG	FCV: MeOH, NNA NG	FCV: gasoline	FCV: cellulosic EtOH	FCV: CNG, NA NG	FCV: CNG, NNA NG	FCV: FT naphtha, NNA NG	FCV: crude naphtha
MPG - GGE	42.2	42.2	37.4	39.3	37.4	37.4	37.4	37.4
Total energy	-28.7%	-27.4%	-35.5%	19.9%	-41.6%	-34.7%	-10.3%	-38.6%
Fossil fuels	-28.5%	-27.2%	-35.5%	-96.9%	-41.7%	-34.8%	-10.0%	-38.6%
Petroleum	-98.5%	-98.1%	-35.5%	-94.4%	-99.7%	-99.7%	-98.7%	-36.4%
VOC: total	-69.0%	-67.1%	-45.9%	-49.6%	-91.0%	-87.9%	-81.8%	-78.9%
CO: total	-78.7%	-77.7%	-78.5%	-60.1%	-79.8%	-74.5%	-75.0%	-78.8%
NOx: total	-54.6%	-19.0%	-40.7%	305.7%	-69.0%	22.9%	-25.6%	-48.2%
PM10: total	-44.1%	-43.6%	-33.6%	142.9%	100.8%	153.8%	-53.7%	-42.4%
SOx: total	-81.6%	-76.6%	-36.1%	-91.7%	-88.5%	-85.6%	-82.3%	-57.3%
VOC: urban	-72.1%	-73.0%	-50.4%	-72.4%	-87.8%	-88.1%	-88.1%	-84.8%
CO: urban	-80.0%	-80.0%	-79.6%	-80.0%	-78.9%	-78.3%	-80.1%	-80.1%
NOx: urban	-83.4%	-85.2%	-53.1%	-84.4%	8.0%	15.7%	-89.0%	-88.3%
PM10: urban	-42.9%	-47.9%	-33.1%	-42.7%	-41.8%	-46.6%	-48.9%	-48.8%
SOx: urban	-98.7%	-98.5%	-37.0%	-100.2%	-97.5%	-96.8%	-99.1%	-98.5%

Source:
Wang, Michael, Q., model results of Beta Version of GREET 1.6, Argonne National Laboratory, Argonne, IL, August, 2001.

Note:
See page preceding Table 4.13 for acronym definitions.

The average light truck pollutes 40% more than the average car, according to the American Council for an Energy-Efficient Economy. One reason for the difference is that cars and light trucks have not been held to the same emissions standards. However, that will be changing due to the new Tier 2 standards.

Table 4.14
Pollution from a Typical New Car and Light Truck, 2001 Model Year
(pounds of pollutant per 15,000 miles of travel)

	Car	Light truck
Carbon dioxide	21,900	30,000
Carbon monoxide	195	218
Nitrogen oxide	34	48
Hydrocarbons	29	39
Particulate matter	3.4	4.4

Source:
DeCicco, John and James Kliesch, *Green Guide to Cars and Trucks: Model Year 2001*, American Council for an Energy-Efficient Economy, Washington, DC, 2001, p. 111. (Additional resources: www.aceee.org)

Note:
Includes both tailpipe and fuel-cycle emissions. Assumes 15,000 miles driven per year.

Table 4.15
Tier 2 Emission Standards for Cars and Light Trucks
Effective for 2004–2009 Model Years[a]
(grams/mile)

Bin	NMOG	CO	NOx	PM	HCHO
50,000 miles					
10[b]	0.125	3.4	0.4	[c]	0.015
9[b]	0.075	3.4	0.2	[a]	0.015
8	0.100	3.4	0.14	[a]	0.015
7	0.075	3.4	0.11	[a]	0.015
6	0.075	3.4	0.08	[a]	0.015
5	0.075	3.4	0.05	[a]	0.015
120,000 miles					
MDPV[b]	0.280	7.3	0.9	0.12	0.032
10[b]	0.156	4.2	0.6	0.08	0.018
9[b]	0.090	4.2	0.3	0.06	0.018
8	0.125	4.2	0.2	0.02	0.018
7	0.090	4.2	0.15	0.02	0.018
6	0.090	4.2	0.10	0.01	0.018
5	0.090	4.2	0.07	0.01	0.018
4	0.070	2.1	0.04	0.01	0.011
3	0.055	2.1	0.03	0.01	0.011
2	0.010	2.1	0.02	0.01	0.004
1	0.000	0.0	0.00	0.00	0.000

Source:
Federal Register, Vol. 65, No. 28, Thursday, February 10, 2000, pp. 6822–6870.

Acronyms Used on Tables 4.15 and 4.16

CO	Carbon monoxide
GVW	Gross vehicle weight
HC	Hydrocarbons
HCHO	Formaldehyde
LDT	Light-duty truck
LEV	Low-emission vehicle
LVW	Loaded vehicle weight
MDPV	Medium-duty passenger vehicle
NMOG	Non-methane organic gases
NOx	Nitrogen oxides
PC	Passenger car
PM	Particulate matter
SULEV	Super-ultra-low-emission vehicle
ULEV	Ultra-low-emission vehicle
ZEV	Zero-emission vehicle

[a]Some temporary standards are not shown.
[b]Bin expires after 2008.
[c]No standard.

Table 4.16
Light Vehicle Exhaust Emission Standards in Effect in 2009
When U.S. Tier 2 Standards are Final
(grams/mile)

Vehicle fuels: Gasoline AND diesel unless noted otherwise

Vehicle size: Up to 8,500 lbs GVW unless noted otherwise

Useful life:		50,000 miles						120,000 miles				
	Bins, category, size	NMOG	CO	NOx	PM	HCHO	HC+NOx	NMOG	CO	NOx	PM	HCHO
Government:												
U.S.	Bins											
	8	0.100	3.4	0.14	–	0.015	–	0.125	4.2	0.20	0.02	0.018
	7	0.075	3.4	0.11	–	0.015	–	0.090	4.2	0.15	0.02	0.018
	6	0.075	3.4	0.08	–	0.015	–	0.090	4.2	0.10	0.01	0.018
	5	0.075	3.4	0.05	–	0.015	–	0.090	4.2	0.07	0.01	0.018
	4	–	–	–	–	–	–	0.070	2.1	0.04	0.01	0.011
	3	–	–	–	–	–	–	0.055	2.1	0.03	0.01	0.011
	2	–	–	–	–	–	–	0.010	2.1	0.02	0.01	0.004
	1	–	–	–	–	–	–	0.000	0.0	0.00	0.00	0.000
	Average[a]	–	–	–	–	–	–	–	–	0.07	–	–
California	Category			(Diesel only)						(Diesel only)		
	LEV[b]	0.075	3.4	0.05	–	0.015	–	0.090	4.2	0.07	0.01	0.018
	ULEV	0.04	1.7	0.05	–	0.08	–	0.055	2.1	0.07	0.01	0.011
	SULEV	–	–	–	–	–	–	0.010	1.0	0.02	0.01	0.004
	ZEV[c]	0.00	0.0	0.00	–	0.00	–	0.000	0.0	0.00	0.00	0.000
	Avg. for all PCs + LDTs 0-3750 lbs LVW	0.038	–	–	–	–	–	–	–	–	–	–
	Avg. for LDTs 3751 lbs LVW - 8500 lbs GVW	0.047	–	–	–	–	–	–	–	–	–	–

Source:

U.S.: *Federal Register*, Vol. 65, No. 28, Thursday, February 10, 2000, pp. 6822–6870.

California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles, as of December 1, 1999 (adopted August 5, 1999), incorporated by reference in section 1961(d), title 13, CCR.

Note:

See acronym list on previous page.

[a] Includes medium-duty passenger vehicles which are also required to meet bin standards.

[b] A LEV Option 1 with higher NOx levels also exists for up to 4% of LDTs above 3,750 lbs.

[c] Only apply to PCs and LDTs 0-3750 lbs LVW.

Table 4.17
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Vehicles *a*,*b*
(grams per mile)

Engine Type & Pollutant	Prior to control	1968-69	1970-71	1972	1973-74	1975-76	1977-79	1980	1981	1982-86	1987-93	1994-2004 *b*	
Gasoline													
Hydrocarbons (total)	11	*c*	2.2	3.4		1.5		0.41				0.41	(*e*)
Non-methane hydrocarbons	*d*	*e*										0.25	(0.31)
Carbon monoxide	80	*c*	23	39		15		7.0	3.4			3.4	(4.2)
Cold-temp. Carbon monoxide*f*	*d*	*e*										10	(*e*)
Nitrogen oxides	4	*e*			3.0	3.1	2.0		1.0			0.4	(0.6)
Particulates	*d*	*e*										0.08	(0.10)
Diesel													
Hydrocarbons (total)	11	*e*				1.5		0.41				0.41	(*e*)
Non-methane hydrocarbons	*d*	*e*										0.25	(0.31)
Carbon monoxide	80	*e*				15		7.0	3.4			3.4	(4.2)
Nitrogen oxides	4					3.1	2.0		1.0			1.0	(1.25)
Particulates	*d*	*e*								0.60	0.20	0.08	(0.10)
Test Procedure		7-mode		CVS-72		CVS-75							
Useful Life (intermediate)[b]		*e*										5 yrs/50,000 mi	
(full)		5 yrs/50,000 mi										10 yrs/100,000 mi	

Source:
40 CFR 86.085-2; 40 CFR 86.090-2; 40 CFR 86.090-8; 40 CFR 86.094-8; 40 CFR 86.096-2; 40 CFR 86.096-8; 40 CFR 86.098-8;40 CFR 86.099-8; 40 CFR 86.082-2; 40 CFR 86.000-8.
Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999.

[a]The test procedure for measuring exhaust emissions has changed several times over the course of vehicle emissions regulation. The 7-mode procedure was used through model year 1971 and was replaced by the CVS-72 procedure beginning in model year 1972. The CVS-75 became the test procedure as of model year 1975. While it may appear that the total hydrocarbon and carbon monoxide standards were relaxed in 1972-74, these standards were actually more stringent due to the more stringent nature of the CVS-72 test procedure. Additional standards for carbon monoxide and composite standards for non-methane hydrocarbons and nitrogen oxides tested over the new Supplemental Federal Test Procedure will be phased-in during model years 2000-02; these standards are not shown in this table.

[b]All emission standards must be met for a useful life of 5 years/50,000 miles. Beginning in with model year 1994, a second set of emission standards must also be met for a full useful life of 10 years/100,000 miles (these standards are shown in parentheses). Tier 1 exhaust standards were phased-in during 1994-96 at a rate of 40, 80, and 100 percent, respectively.

[c]In 1968-69, exhaust emission standards were issued in parts per million (ppm) rather than grams per mile and are, therefore, incompatible with this table.

[d]No estimate available.

[e]No standard set.

[f]The cold CO emission standard is measured at 20 degrees F (rather than 75 degrees F) and is applicable for a 5-year/50,000-mile useful life.

Table 4.18
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks (Category LDT1) *a,b,c*
(grams per mile)

Engine Type & Pollutant	Prior to control	1968-69	1970-71	1972	1973-74	1975	1976-78	1979-81	1982-83	1984	1985-86	1987	1988-93	1994	1995–2004
Gasoline															
Hydrocarbons (total)	11	*d*	2.2	3.4		2.0		1.7		0.80				*f* (0.80)	
Non-methane hydrocarbons	*e*	*f*												0.25 (0.31)	
Carbon monoxide	80	*d*	23	39		20		18		10				3.4 (4.2)	
Cold-temp. carbon monoxide *g*	*e*	*f*												10 (*f*)	
Nitrogen oxides	4	*f*			3.0	3.1		2.3					1.2	0.4 (0.6)	
Particulates	*e*	*f*													0.08 (0.10)
Diesel															
Hydrocarbons (total)	11	*f*					2.0	1.7		0.80				*f* (0.80)	
Non-methane hydrocarbons	*e*	*f*												0.25 (0.31)	
Carbon monoxide	80	*f*					20	18		10				3.4 (4.2)	
Nitrogen oxides	4	*f*					3.1	2.3					1.2	1.0 (1.25)	
Particulates	*e*	*f*							0.60			0.26			0.08 (0.10)
LDT1 Weight Criteria *h*		GVWR up through 6,000 lbs						GVWR up through 8,500 lbs					GVWR up through 6,000 lbs; LVW up through 3,750 lbs		
Test Procedure *b*		7-mode		CVS-72		CVS-75									
Useful Life (intermediate) *c*		*f*												5 yrs/50,000 mi	
(full)		5 yrs/50,000 mi									11 yrs/120,000 mi			11 yrs/120,000 mi	

Source:
40 CFR 86.082-2; 40 CFR 86.085-2; 40 CFR 86.090-2; 40 CFR 86.090-9; 40 CFR 86.091-9; 40 CFR 86.094-9; 40 CFR 86.096-2; 40 CFR 86.096-9; 40 CFR 86.099-9; 40 CFR 86.000-9; 40 CFR 86.001-9; 40 CFR 86.004-9. Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication.

[a]Light truck categories LDT1-LDT4 were not actually created until 1994. From 1968 to 1978 all trucks with a Gross Vehicle Weight Rating (GVWR) up to 6,000 lbs were classified as light trucks and were required to meet the same standards. As of 1979, the maximum weight was raised to 8,500 lbs GVWR. During 1988 through 1993, light trucks were divided into two subcategories that coincide with the current LDT1 and LDT2/3/4 categories.

[b]The test procedure for measuring exhaust emissions has changed several times over the course of vehicle emissions regulation. The 7-mode procedure was used through model year 1971 and was replaced by the CVS-72 procedure beginning in model year 1972. The CVS-75 became the test procedure as of model year 1975. While it may appear that the total hydrocarbon and carbon monoxide standards were relaxed in 1972-74, these standards were actually more stringent due to the more stringent nature of the CVS-72 test procedure. Additional standards for carbon monoxide and composite standards for non-methane hydrocarbons and nitrogen oxides tested over the new Supplemental Federal Test Procedure will be phased-in during model years 2000-02; these standards are not shown in this table.

[c]Emission standards had to be met for a useful life of 5 years/50,000 miles through model year 1983, and a full useful life of 11 years 120,000 miles was defined for 1985-93 (several useful life options were available for 1984). Beginning in model year 1994, emission standards were established for an intermediate useful life of 5 years/50,000 miles as well as a full useful life of 11 years/120,000 miles (these standards are shown in parentheses). Hydrocarbon standards, however, were established only for full useful life. Tier 1 exhaust standards, except PM standards, were phased-in during 1994-96 at a rate of 40, 80, and 100 percent, respectively. PM standards were phased-in at a rate of 40, 80, and 100 percent during 1995-97.

[d]In 1968-69, exhaust emission standards were issued in parts per million (ppm) rather than grams per mile and are, therefore, incompatible with this table.

[e]No estimate available.

[f]No standard set.

[g]The cold CO emission standard is measured at 20 degrees F (rather than 75 degrees F) and is applicable for a 5-year/50,000-mile useful life.

[h] Gross vehicle weight rating (GVWR) is the maximum design loaded weight. Loaded vehicle weight (LVW) is the curb weight (nominal vehicle weight) plus 300 lbs.

Table 4.19
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks (Category LDT2) *a,b,c*
(grams per mile)

Engine Type & Pollutant	Prior to control	1968-69	1970-71	1972	1973-74	1975	1976-78	1979-81	1982-83	1984	1985-86	1987	1988-90	1991-93	1994	1995–2004
Gasoline																
Hydrocarbons (total)	11	*d*	2.2	3.4		2.0		1.7		0.80					*f* (0.80)	
Non-methane hydrocarbons	*e*	*f*													0.32 (0.40)	
Carbon monoxide	80	*d*	23	39		20		18		10					4.4 (5.5)	
Cold-temp. carbon monoxide *g*	*e*	*f*													12.5 (*f*)	
Nitrogen oxides	4	*f*			3.0	3.1		2.3					1.7		0.7 (0.97)	
Particulates	*e*	*f*														0.08 (0.10)
Diesel																
Hydrocarbons (total)	11	*f*					2.0	1.7		0.80					*f* (0.80)	
Non-methane hydrocarbons	*e*	*f*													0.32 (0.40)	
Carbon monoxide	80	*f*					20	18		10					4.4 (5.5)	
Nitrogen oxides	4	*f*					3.1	2.3					1.7		*f* (0.97)	
Particulates	*e*	*f*							0.60			0.50	0.45	0.13		0.08 (0.10)
LDT2 Weight Criteria *h*		GVWR up through 6,000 lbs						GVWR up through 8,500 lbs					GVWR up through 5,000 lbs and LVW over 3,750 lbs			
Test Procedure *b*		7-mode		CVS-72		CVS-75										
Useful Life (intermediate) *c*		*f*													5 yrs/50,000 mi	
(full)		5 yrs/50,000 mi									11 yrs/120,000 mi				11 yrs/120,000 mi	

Source:
40 CFR 86.082-2; 40 CFR 86.085-2; 40 CFR 86.090-2; 40 CFR 86.090-9; 40 CFR 86.091-9; 40 CFR 86.094-9; 40 CFR 86.096-2; 40 CFR 86.096-9; 40 CFR 86.099-9; 40 CFR 86.000-9; 40 CFR 86.001-9; 40 CFR 86.004-9. Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999.

[a]Light truck categories LDT1-LDT4 were not actually created until 1994. From 1968 to 1978 all trucks with a Gross Vehicle Weight Rating (GVWR) up to 6,000 lbs were classified as light trucks and were required to meet the same standards. As of 1979, the maximum weight was raised to 8,500 lbs GVWR. During 1988-93, light trucks were divided into two subcategories that coincide with the current LDT1 and LDT2/3/4 categories.

[b]The test procedure for measuring exhaust emissions has changed several times over the course of vehicle emissions regulation. The 7-mode procedure was used through model year 1971 and was replaced by the CVS-72 procedure beginning in model year 1972. The CVS-75 became the test procedure as of model year 1975. While it may appear that the total hydrocarbon and carbon monoxide standards were relaxed in 1972-74, these standards were actually more stringent due to the more stringent nature of the CVS-72 test procedure. Additional standards for carbon monoxide and composite standards for non-methane hydrocarbons and nitrogen oxides tested over the new Supplemental Federal Test Procedure will be phased-in during model years 2000-02; these standards are not shown in this table.

[c]Emission standards had to be met for a useful life of 5 years/50,000 miles through model year 1983, and a full useful life of 11 years 120,000 miles was defined for 1985-93 (several useful life options were available for 1984). Beginning in model year 1994, emission standards were established for an intermediate useful life of 5 years/50,000 miles as well as a full useful life of 11 years/120,000 miles (these standards are shown in parentheses). Hydrocarbon standards, however, were established only for full useful life. Tier 1 exhaust standards, except PM standards, were phased-in during 1994-96 at a rate of 40, 80, and 100 percent, respectively. PM standards were phased-in at a rate of 40, 80, and 100 percent during 1995-97.

[d]In 1968-69, exhaust emission standards were issued in parts per million (ppm) rather than grams per mile and are, therefore, incompatible with this table.

[e]No estimate available.

[f]No standard set.

[g]The cold CO emission standard is measured at 20 degrees F (rather than 75 degrees F) and is applicable for a 5-year/50,000-mile useful life.

[h]Gross vehicle weight rating (GVWR) is the maximum design loaded weight. Loaded vehicle weight (LVW) is the curb weight (nominal vehicle weight) plus 300 lbs.

Table 4.20
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks (Category LDT3) *a,b,c*
(grams per mile)

Engine Type & Pollutant	Prior to control	1968-69	1970-71	1972	1973-74	1975	1976-78	1979-81	1982-83	1984	1985-86	1987	1988-89	1990	1991-95	1996–2004	
Gasoline																	
Hydrocarbons (total)	11	*d*	2.2	3.4		2.0		1.7		0.80						*f*	(0.80)
Non-methane hydrocarbons	*e*	*f*														0.32	(0.46)
Carbon monoxide	80	*d*	23	39		20		18		10						4.4	(6.4)
Cold-temp. carbon monoxide *g*	*e*	*f*														12.5	(*f*)
Nitrogen oxides	4	*f*			3.0	3.1		2.3					2.3	1.7		0.7	(0.98)
Particulates	*e*	*f*														*f*	(0.10)
Diesel																	
Hydrocarbons (total)	11	*f*					2.0	1.7		0.80						*f*	(0.80)
Non-methane hydrocarbons	*e*	*f*														0.32	(0.46)
Carbon monoxide	80	*f*					20	18		10						4.4	(6.4)
Nitrogen oxides	4	*f*					3.1	2.3					2.3	1.7			(0.98)
Particulates	*e*	*f*							0.60			0.50	0.45		0.13		(0.10)
LDT3 Weight Criteria		GVWR up through 6,000 lbs						GVWR up through 8,500 lbs					Any ALW			ALW up through 5,750 lbs	
													GVWR 6,001-8,500 lbs				
Test Procedure *b*		7-mode		CVS-72		CVS-75											
Useful Life (intermediate) *c*		***f***														5 yrs/50,000 mi	
(full)		5 yrs/50,000 mi									11 yrs/120,000 mi					11 yrs/120,000	

Source:
40 CFR 86.082-2; 40 CFR 86.085-2; 40 CFR 86.090-2; 40 CFR 86.090-9; 40 CFR 86.091-9; 40 CFR 86.094-9; 40 CFR 86.096-2; 40 CFR 86.096-9; 40 CFR 86.099-9; 40 CFR 86.000-9; 40 CFR 86.001-9; 40 CFR 86.004-9. Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999.

[a]Light truck categories LDT1-LDT4 were not actually created until 1994. From 1968 to 1978 all trucks with a Gross Vehicle Weight Rating (GVWR) up to 6,000 lbs were classified as light trucks and were required to meet the same standards. As of 1979, the maximum weight was raised to 8,500 lbs GVWR. During 1988-93, light trucks were divided into two subcategories that coincide with the current LDT1 and LDT2/3/4 categories.

[b]The test procedure for measuring exhaust emissions has changed several times over the course of vehicle emissions regulation. The 7-mode procedure was used through model year 1971 and was replaced by the CVS-72 procedure beginning in model year 1972. The CVS-75 became the test procedure as of model year 1975. While it may appear that the total hydrocarbon and carbon monoxide standards were relaxed in 1972-74, these standards were actually more stringent due to the more stringent nature of the CVS-72 test procedure. Additional standards for carbon monoxide and composite standards for non-methane hydrocarbons and nitrogen oxides tested over the new Supplemental Federal Test Procedure will be phased-in during model years 2002-04; these standards are not shown in this table.

[c]Emission standards had to be met for a full useful life of 5 years/50,000 miles through model year 1983, and a full useful life of 11 years 120,000 miles was defined for 1985-93 (several useful life options were available for 1984). Beginning in model year 1996, emission standards were established for an intermediate useful life of 5 years/50,000 miles as well as a full useful life of 11 years/120,000 miles (these standards are shown in parentheses). This applied to all pollutants except hydrocarbons and particulates for all LDT3s and NOx for diesel-powered LDT3s, which were only required to meet full useful life standards. Tier 1 exhaust standards were phased-in during 1996-97 at a rate of 50 and 100 percent, respectively.

[d]In 1968-69, exhaust emission standards were issued in parts per million (ppm) rather than grams per mile and are, therefore, incompatible with this table.

[e]No estimate available.

[f]No standard set.

[g]The cold CO emission standard is measured at 20 degrees F (rather than 75 degrees F) and is applicable for a 5-year/50,000-mile useful life.

[h]Gross vehicle weight rating (GVWR) is the maximum design loaded weight. Loaded vehicle weight (LVW) is the curb weight (nominal vehicle weight) plus 300 lbs.

Table 4.21
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks (Category LDT4) *a,b,c*
(grams per mile)

Engine Type & Pollutant	Prior to control	1968-69	1970-71	1972	1973-74	1975	1976-78	1979-81	1982-83	1984	1985-86	1987	1988-89	1990	1991-95	1996–2004	
Gasoline																	
Hydrocarbons (total)	11	*d*	2.2	3.4		2.0		1.7		0.80						*f*	(0.80)
Non-methane hydrocarbons	*e*	*f*														0.39	(0.56)
Carbon monoxide	80	*d*	23	39		20		18		10						5.0	(7.3)
Cold-temp. carbon monoxide *g*	*e*	*f*														12.5	(*f*)
Nitrogen oxides	4	*f*			3.0	3.1		2.3					2.3	1.7		1.1	(1.53)
Particulates	*e*	*f*														*f*	(0.12)
Diesel																	
Hydrocarbons (total)	11	*f*					2.0	1.7		0.80						*f*	(0.80)
Non-methane hydrocarbons	*e*	*f*														0.39	(0.56)
Carbon monoxide	80	*f*					20	18		10						5.0	(7.3)
Nitrogen oxides	4	*f*					3.1	2.3					2.3	1.7		*f*	(1.53)
Particulates	*e*	*f*							0.60		0.50		0.45		0.13	*f*	(0.12)
LDT4 Weight Criteria *h*		GVWR up through 6,000 lbs						GVWR up through 8,500 lbs					Any ALVW			ALVW over 5,750 lbs	
													GVWR 6,001-8,500 lbs				
Test Procedure *b*		7-mode		CVS-72		CVS-75											
Useful Life (intermediate) *c*		*f*														5 yrs/50,000 mi	
(full)		5 yrs/50,000 mi									11 yrs/120,000 mi					11 yrs/120,000	

Source:
40 CFR 86.082-2; 40 CFR 86.085-2; 40 CFR 86.090-2; 40 CFR 86.090-9; 40 CFR 86.091-9; 40 CFR 86.094-9; 40 CFR 86.096-2; 40 CFR 86.096-9; 40 CFR 86.099-9; 40 CFR 86.000-9; 40 CFR 86.001-9; 40 CFR 86.004-9. Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999.

[a]Light truck categories LDT1-LDT4 were not actually created until 1994. From 1968 to 1978 all trucks with a Gross Vehicle Weight Rating (GVWR) up to 6,000 lbs were classified as light trucks and were required to meet the same standards. As of 1979, the maximum weight was raised to 8,500 lbs GVWR. During 1988-93, light trucks were divided into two subcategories that coincide with the current LDT1 and LDT2/3/4 categories.

[b]The test procedure for measuring exhaust emissions has changed several times over the course of vehicle emissions regulation. The 7-mode procedure was used through model year 1971 and was replaced by the CVS-72 procedure beginning in model year 1972. The CVS-75 became the test procedure as of model year 1975. While it may appear that the total hydrocarbon and carbon monoxide standards were relaxed in 1972-74, these standards were actually more stringent due to the more stringent nature of the CVS-72 test procedure. Additional standards for carbon monoxide and composite standards for non-methane hydrocarbons and nitrogen oxides tested over the new Supplemental Federal Test Procedure will be phased-in during model years 2002-04; these standards are not shown in this table.

[c]Emission standards had to be met for a full useful life of 5 years/50,000 miles through model year 1983, and a full useful life of 11 years 120,000 miles was defined for 1985-93 (several useful life options were available for 1984). Beginning in model year 1996, emission standards were established for an intermediate useful life of 5 years/50,000 miles as well as a full useful life of 11 years/120,000 miles (these standards are shown in parentheses). This applied to all pollutants except hydrocarbons and particulates for all LDT3s and NOx for diesel-powered LDT3s, which were only required to meet full useful life standards. Tier 1 exhaust standards were phased-in during 1996-97 at a rate of 50 and 100 percent, respectively.

[d]In 1968-69, exhaust emission standards were issued in parts per million (ppm) rather than grams per mile and are, therefore, incompatible with this table.

[e]No estimate available.

[f]No standard set.

[g]The cold CO emission standard is measured at 20 degrees F (rather than 75 degrees F) and is applicable for a 5-year/50,000-mile useful life.

[h]Gross vehicle weight rating (GVWR) is the maximum design loaded weight. Adjusted loaded vehicle weight (ALVW) is the numerical average of the GVWR and the curb weight.

Table 4.22
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks
(Grams per brake horsepower-hour)

Engine Type & Pollutant	1970-73	1974-78	1979-83	1984	1985-86	1987	1988-89	1990	1991-93	1994-97	1998-2003	2004+
Gasoline												
Hydrocarbons + nitrogen oxides (HC + NOx)	*a*	16	10		*a*							
Hydrocarbons (HC)	*b*	*a*	1.5		1.9	1.1						
Nitrogen oxides (NOx)	*a*				10.6			6.0	5.0		4.0	
Carbon Monoxide (CO)	*b*	40	25		37.1	14.4						
Diesel												
Hydrocarbons + nitrogen oxides (HC + NOx)	*a*	16	10	*a*								
Hydrocarbons (HC)	*b*	*a*	1.5	1.3								
Nitrogen oxides (NOx)	*a*			10.7				6.0	5.0		4.0	
Non-methane hydrocarbons + nitrogen oxides	*a*											2.4
Carbon Monoxide (CO)	*b*	40	25	15.5								
Particulates	*a*						0.60		0.25	0.10		
Smoke Opacity (acceleration/lugging/peak) *d*	40/20/*a*	20/15/50										
Weight Criteria for Light Heavy Trucks *e*	GVWR over 6,000 lbs		GVWR over 8,500 lbs			GVWR 8,501 through 14,000 lbs						
Test Procedure (gasoline) *f*	9-mode steady-state				MVMA transient							
(diesel) *f*	13-mode steady-state			EPA transient								
Useful Life (gasoline) *g*	5 years/50,000 miles				8 years/110,000 miles							

Sources:

40 CFR 86.082-2; 40 CFR 86.085-2; 40 CFR 86.088-10; 40 CFR 86.090-2; 40 CFR 86.090-10; 40 CFR 86.090-11; 40 CFR 86.091-10; 40 CFR 86.091-11; 40 CFR 86.093-11; 40 CFR 86.094-11; 40 CFR 86.096-2; 40 CFR 86.096-10; 40 CFR 86.096-11; 40 CFR 86.098-10; 40 CFR 86.098-11; 40 CFR 86.099-10; 40 CFR 86.099-11; 40 CFR 86.004-11; 40 CFR 86.004-15. Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999. Rob French, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999.

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[a]No standard set

[b]Although emission standards for hydrocarbons and carbon monoxide were in effect for these years, they were not measured in grams/brake horsepower-hour and are, therefore, incompatible with this table.

[c]Vehicles can meet a composite non-methane hydrocarbons and nitrogen oxides standard of 2.5, if they meet a non-methane hydrocarbon standard of no more than 0.5.

[d]Smoke opacity is expressed in percentage for acceleration, lugging, and peak modes (acceleration/lugging/peak). Lugging is when a vehicle is carrying a load.

[e]Gross vehicle weight rating (GVWR) is the maximum design loaded weight.

[f]Several testing procedures have been used during the course of exhaust emission control. A steady-state 9-mode test procedure (13-mode for diesel) was used for 1970-83 standards. For 1984, either the steady-state tests or the EPA transient test procedure could be used. For diesels, the EPA transient test was required from 1985 to the present. For gasoline-powered vehicles, either either the EPA or MVMA (Motor Vehicle Manufacturers Association) transient test procedure could be used during 1985-86, and the MVMA procedure was required thereafter.

[g]Emissions standards apply to the useful life of the vehicle. Useful life was 5 years/50,000 miles through 1983, and 8 years/110,000 miles for model year 1985 and after. 1984 was a transitional year in which vehicles could meet the older standard (and test procedure) or the newer one. Useful life requirement for gasoline-powered trucks meeting NOx standards for 1998 and after is *10* years/110,000 miles. The useful life requirements for heavy diesel truck standards are more complex and vary by vehicle weight, pollutant, test procedure, and year. Consult the U.S. Code of Federal Regulations for further information.

Table 4.23
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Heavy Heavy Trucks
(Grams per brake horsepower-hour)

Engine Type & Pollutant	1970-73	1974-78	1979-83	1984	1985-86	1987	1988-89	1990	1991-93	1994-97	1998-2003	2004+
Gasoline												
Hydrocarbons + nitrogen oxides (HC + NOx)	*a*	16	10		*a*							
Hydrocarbons (HC)	*b*	*a*	1.5		1.9							
Nitrogen oxides (NOx)	*a*				10.6			6.0	5.0		4.0	
Carbon Monoxide (CO)	*b*	40	25		37.1							
Diesel												
Hydrocarbons + nitrogen oxides (HC + NOx)	*a*	16	10	*a*								
Hydrocarbons (HC)	*b*	*a*	1.5	1.3								
Nitrogen oxides (NOx)	*a*			10.7				6.0	5.0		4.0	
Non-methane hydrocarbons + nitrogen oxides	*a*											2.4*c*
Carbon Monoxide (CO)	*b*	40	25	15.5								
Particulates	*a*						0.60		0.25	0.10		
Smoke Opacity (acceleration/lugging/peak) *d*	40/20/*a*	20/15/50										
Weight Criteria for Heavy Heavy Trucks *e*	GVWR over 6,000 lbs		GVWR over 8,500 lbs			GVWR over 14,000 lbs						
Test Procedure (gasoline) *f*	13-mode steady-state				MVMA							
(diesel) *f*	13-mode steady-state			EPA transient								
Useful Life (gasoline) *g*	5 years/50,000 miles				8 years/110,000 miles							

Sources:
40 CFR 86.082-2; 40 CFR 86.085-2; 40 CFR 86.088-10; 40 CFR 86.090-2; 40 CFR 86.090-10; 40 CFR 86.090-11; 40 CFR 86.091-10; 40 CFR 86.091-11; 40 CFR 86.093-11; 40 CFR 86.094-11; 40 CFR 86.096-2; 40 CFR 86.096-10; 40 CFR 86.096-11; 40 CFR 86.098-10; 40 CFR 86.098-11; 40 CFR 86.099-10; 40 CFR 86.099-11; 40 CFR 86.004-11; 40 CFR 86.004-15. Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999. Rob French, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999.

[a]No standard set.

[b]Although emission standards for hydrocarbons and carbon monoxide were in effect for these years, they were not measured in grams/brake horsepower-hour and are, therefore, incompatible with this table.

[c]Vehicles can meet a composite non-methane hydrocarbons and nitrogen oxides standard of 2.5, if they meet a non-methane hydrocarbon standard of no more than 0.5.

[d]Smoke opacity is expressed in percentage for acceleration, lugging, and peak modes (acceleration/lugging/peak). Lugging is when a vehicle is carrying a load.

[e]Gross vehicle weight rating (GVWR) is the maximum design loaded weight.

[f]Several testing procedures have been used during the course of exhaust emission control. A steady-state 9-mode test procedure (13-mode for diesel) was used for 1970-83 standards. For 1984, either the steady-state tests or the EPA transient test procedure could be used. For diesels, the EPA transient test was required from 1985 to the present. For gasoline-powered vehicles, either either the EPA or MVMA (Motor Vehicle Manufacturers Association) transient test procedure could be used during 1985-86, and the MVMA procedure was required thereafter.

[g]Emissions standards apply to the useful life of the vehicle. Useful life was 5 years/50,000 miles through 1983, and 8 years/110,000 miles for model year 1985 and after. 1984 was a transitional year in which vehicles could meet the older standard (and test procedure) or the newer one. Useful life requirement for gasoline-powered trucks meeting NOx standards for 1998 and after is *10* years/110,000 miles. The useful life requirements for heavy diesel truck standards are more complex and vary by vehicle weight, pollutant, test procedure, and year. Consult the U.S. Code of Federal Regulations for further information.

Table 4.24
***California* Passenger Cars and Light Trucks Emission Certification Standards**
(grams/mile)

Vehicle Type	Emission Category	Vehicle Useful Life: 5 Years / 50,000 Miles THC[a]	NMHC[b]	NMOG[c]	CO	NO_X	PM	HCHO	10 Years / 100,000 Miles THC[a]	NMHC[b]	NMOG[c]	CO	NO_X	PM	HCHO
Passenger car	Tier 0	–	0.39	–	7.0	0.4	0.08[d]	0.015[e]							
	Tier 1	–	0.25	–	3.4	0.4	0.08[d]	0.015[e]	–	0.31	–	4.2	0.6	–	–
	TLEV	–	–	0.125	3.4	0.4	–	0.015	–	–	0.156	4.2	0.6	0.08[d]	0.018
	LEV	–	–	0.075	3.4	0.2	–	0.015	–	–	0.090	4.2	0.3	0.08[d]	0.018
	ULEV	–	–	0.040	1.7	0.2	–	0.008	–	–	0.055	2.1	0.3	0.04[d]	0.011
	ZEV	0.0	0.00	0.000	0.0	0.0	0.00	0.000	0.00	0.00	0.000	0.0	0.0	0.00	0.000
LDT1	Tier 0	–	0.39	–	9.0	0.4	0.08[d]	0.015[e]							
	Tier 1	–	0.25	–	3.4	0.4	0.08[d]	0.015[e]	–	0.31	–	4.2	0.6	–	–
	TLEV	–	–	0.125	3.4	0.4	–	0.015	–	–	0.156	4.2	0.6	0.08[d]	0.018
	LEV	–	–	0.075	3.4	0.2	–	0.015	–	–	0.090	4.2	0.3	0.08[d]	0.018
	ULEV	–	–	0.040	1.7	0.2	–	0.008	–	–	0.055	2.1	0.3	0.04[d]	0.011
	ZEV	0.0	0.00	0.000	0.0	0.0	0.00	0.000	0.00	0.00	0.000	0.0	0.0	0.00	0.000
LDT2	Tier 0	–	0.50	–	9.0	1.0	0.08[d]	0.018[e]							
	Tier 1	–	0.32	–	4.4	0.7	0.08[d]	0.018[e]	–	0.40	–	5.5	0.97	–	–
	TLEV	–	–	0.160	4.4	0.7	–	0.018	–	–	0.200	5.5	0.9	0.10[d]	0.023
	LEV	–	–	0.100	4.4	0.4	–	0.018	–	–	0.130	5.5	0.5	0.10[d]	0.023
	ULEV	–	–	0.050	2.2	0.4	–	0.009	–	–	0.070	2.8	0.5	0.05[d]	0.013

Source:
U.S. Environmental Protection Agency, Office of Transportation and Air Quality, EPA 420-B-00-001. (Additional resources: www.epa.gov/otag)
Note:
LDT1 = light truck up through 3,750 lbs. loaded vehicle weight; LDT2 = light truck greater than 3,750 lbs. loaded vehicle weight.

[a] THCE for methanol vehicles. Does not apply to CNG vehicles.
[b] THCE for Tier 0 methanol vehicles. NMHCE for other alcohol vehicles.
[c] NMHC for diesel-fueled vehicles.
[d] Diesel-fueled vehicles only.
[e] Ethanol- and methanol-fueled vehicles only.

California's Low-Emission Vehicle regulations provide for reduced emission vehicles to be available to consumers. Vehicles meeting these standards have even lower emissions than the basic Tier 1 standards for all new vehicles sold in California. Currently, there is a wide array of TLEVs and LEVs, and a few ULEVs, SULEVs and ZEVs on the market. For a listing of the available low emission vehicles, see the California Air Resources Board web site referenced below.

Table 4.25
California Vehicle Emission Reduction for Passenger Cars and Light Trucks

	Emission reduction from Tier 1 California standards[a]		
	HC	CO	NOx
Transitional Low-Emission Vehicle (TLEV)	50%	=	=
Low-Emission Vehicle (LEV)	70%	=	50%
Ultra-Low-Emission Vehicle (ULEV)	85%	50%	50%
Super-Ultra-Low-Emission Vehicle (SULEV)	96%	70%	95%
Zero-Emission Vehicles (ZEV)	100%	100%	100%

Source:
California Air Resources Board web site, www.arb.ca.gov/msprog/ccbg/ccbg.htm
(Additional resources: www.arb.ca.gov)

Note:
= indicates equivalent emissions to vehicles meeting the Tier 1 California standard.

[a]See Table 4.24.

Chapter 5

Transportation and the Economy

Summary Statistics from Tables/Figures in this Chapter

Source		
Figure 5.1	Share of gasoline cost attributed to taxes, 1999	
	Canada	*49%*
	France	*79%*
	Germany	*76%*
	Japan	*60%*
	United Kingdom	*76%*
	United States	*33%*
Table 5.11	Average price of a new car, 1999 (current dollars)	21,022
	Domestic	*18,725*
	Import	*30,350*
Table 5.12	Automobile operating costs, 2000	
	Variable costs (constant 1999 dollars per 10,000 miles)	*1,219*
	Fixed costs (constant 1999 dollars per 10,000 miles)	*4,376*
Table 5.18	Transportation sector share of total employment	
	1960	*13.5%*
	1980	*11.4%*
	1999	*11.0%*

Table 5.1
Gasoline Prices for Selected Countries, 1978–2000

	Current dollars per gallon								Average annual percentage change	
	1978[a]	1982[a]	1986[a]	1990[b]	1994[b]	1996[b]	1999[b]	2000[b]	1978–2000	1990–2000
China	[c]	[c]	[c]	[c]	[c]	0.93	1.05	1.44	[c]	[c]
India	[c]	[c]	[c]	1.92	2.28	2.25	2.48	[c]	[c]	[c]
Japan	2.00	2.60	2.79	3.05	4.14	3.77	3.13	3.65	2.8%	1.8%
France	2.15	2.56	2.58	3.40	3.31	4.41	3.79	4.01	2.9%	1.7%
United Kingdom	1.22	2.42	2.07	2.55	2.86	3.47	3.97	5.13	6.7%	7.2%
Germany	1.75	2.17	1.88	2.72	3.34	4.32	3.36	3.78	3.6%	3.3%
Canada	0.69	1.37	1.31	1.92	1.57	1.80	1.54	2.04	5.1%	0.6%
United States[d]	0.66	1.32	0.93	1.04	1.24	1.28	1.13	1.47	3.7%	3.5%
	Constant 1999 dollars[e] per gallon								Average annual percentage change	
	1978[a]	1982[a]	1986[a]	1990[b]	1994[b]	1996[b]	1999[b]	2000[b]	1978–2000	1990–2000
China	[c]	[c]	[c]	[c]	[c]	0.99	1.05	1.39	[c]	[c]
India	[c]	[c]	[c]	2.45	2.56	2.39	2.48	[c]	[c]	[c]
Japan	5.11	4.49	4.24	3.89	4.65	4.00	3.13	3.53	-1.7%	-1.0%
France	5.49	4.42	3.92	4.33	3.72	4.68	3.79	3.88	-1.6%	-1.1%
United Kingdom	3.12	4.18	3.15	3.25	3.22	3.68	3.97	4.96	2.1%	4.3%
Germany	4.47	3.75	2.86	3.47	3.75	4.59	3.36	3.66	-0.9%	0.5%
Canada	1.76	2.37	1.99	2.45	1.76	1.91	1.54	1.97	0.5%	-2.2%
United States[d]	1.69	2.28	1.41	1.33	1.39	1.36	1.13	1.42	-0.8%	0.7%

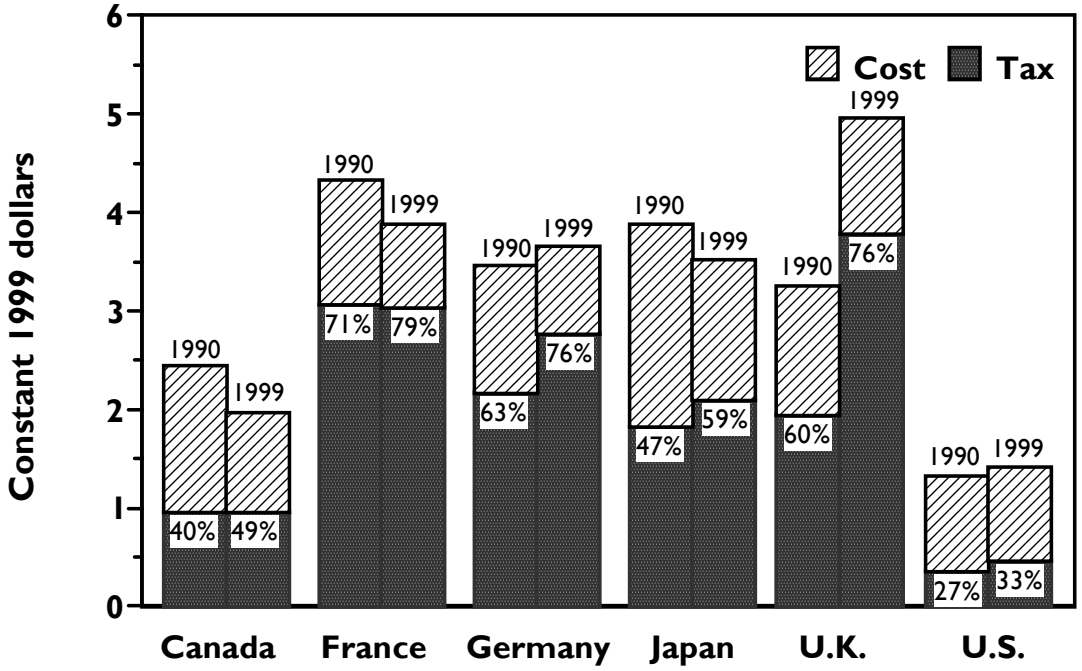
Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Annual 1999*, Washington, DC, February 2001, Table 7.2 and annual.
(Additional resources: ww.eia.doe.gov)

Note:
Comparisons between prices and price trends in different countries require care. They are of limited validity because of fluctuations in exchange rates; differences in product quality, marketing practices, and market structures; and the extent to which the standard categories of sales are representative of total national sales for a given period.

[a] Prices represent the retail prices (including taxes) for premium leaded gasoline. Prices are representative for each country based on quarterly data averaged for the year.
[b] Regular gasoline.
[c] Data are not available.
[d] These estimates are for international comparisons only and do not necessarily correspond to gasoline price estimates in other sections of the book.
[e] Adjusted by the U.S. Consumer Price Inflation Index.

In 1998 more than seventy percent of the cost of gasoline in France, Germany, and the United Kingdom went for taxes. Of these countries, the U.S. has the lowest percentage of taxes.

Figure 5.1. Gasoline Prices for Selected Countries, 1990 and 1999



Source:
Table 5.1 and International Energy Agency, *Energy Prices and Taxes, Fourth Quarter 1999*, Paris, France, 2000. (Additional resources: www.iea.org)

Table 5.2
Diesel Fuel Prices for Selected Countries, 1978–2000[a]

	Current dollars per gallon								Average annual percentage change	
	1978	1982	1986	1990	1994	1996	1999	2000	1978–2000	1990–2000
China	[b]	[b]	[b]	[b]	[b]	0.88	2.73	1.30	[b]	[b]
India	[b]	[b]	[b]	0.78	0.74	0.92	1.15	[b]	[b]	[b]
Japan	[b]	1.78	1.90	1.75	2.48	2.51	1.95	2.89	[b]	5.5%
France	1.30	1.88	1.69	1.78	2.10	3.10	2.23	3.05	4.0%	8.9%
United Kingdom	1.24	2.05	1.71	2.04	2.46	3.26	3.47	4.77	6.3%	0.6%
Germany	1.48	1.81	1.51	2.72	2.16	3.02	2.03	2.90	3.1%	0.8%
Canada	[b]	1.27	1.27	1.55	1.47	1.43	1.32	1.68	[b]	0.8%
United States[c]	0.54	1.16	0.94	0.99	0.96	1.15	0.97	1.36	4.3%	3.2%

	Constant 1999 dollars[d] per gallon								Average annual percentage change	
	1978	1982[a]	1986[a]	1990[b]	1994[b]	1996[b]	1999[b]	2000[b]	1978–2000	1990–2000
China	[b]	[b]	[b]	[b]	[b]	0.93	2.73	1.26	[b]	[b]
India	[b]	[b]	[b]	0.99	0.83	0.98	1.15	[b]	[b]	[b]
Japan	[b]	3.07	2.89	2.23	2.79	2.67	1.95	2.80	[b]	2.3%
France	3.32	3.25	2.57	2.27	2.36	3.29	2.23	2.95	-0.5%	2.7%
United Kingdom	3.17	3.54	2.60	2.60	2.77	3.46	3.47	4.61	1.7%	5.9%
Germany	3.78	3.12	2.30	3.47	2.43	3.21	2.03	2.81	-1.3%	-2.1%
Canada	[b]	2.19	1.93	1.98	1.65	1.52	1.32	1.63	[b]	-1.9%
United States[c]	1.38	2.00	1.43	1.26	1.08	1.22	0.97	1.32	-0.2%	-0.4%

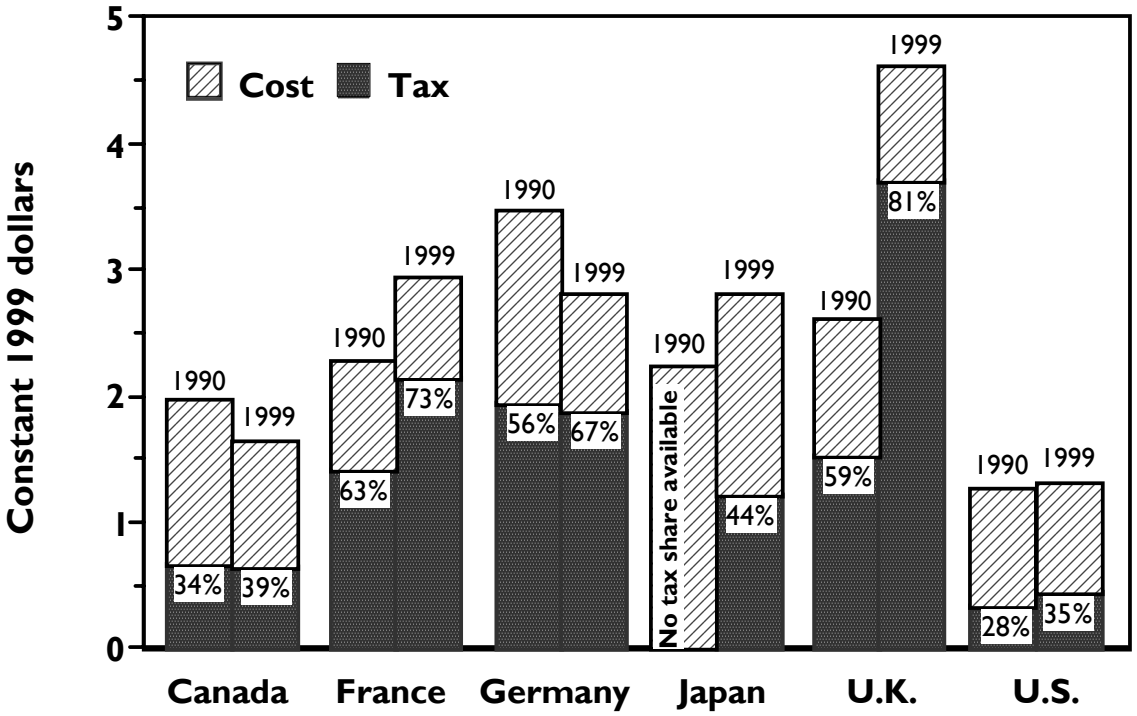
Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Annual 1999*, Washington, DC, February 2001, Table 7.2 and annual.
(Additional resources: www.eia.doe.gov)

Note:
Comparisons between prices and price trends in different countries require care. They are of limited validity because of fluctuations in exchange rates; differences in product quality, marketing practices, and market structures; and the extent to which the standard categories of sales are representative of total national sales for a given period.

[a] Prices represent the retail prices (including taxes) for diesel fuel. Prices are representative for each country based on quarterly data averaged for the year or on data as of January 1.
[b] Data are not available.
[c] These estimates are for international comparisons only and do not necessarily correspond to gasoline price estimates in other sections of the book.
[d] Adjusted by the U.S. Consumer Price Inflation Index.

Diesel fuel is taxed heavily in the European countries shown here. The U.S. diesel fuel tax share is the lowest of the listed countries.

Figure 5.2. Diesel Prices for Selected Countries, 1990 and 1999



Source:
Table 5.2 and International Energy Agency, *Energy Prices and Taxes, Fourth Quarter 1999*, Paris, France, 2000. (Additional resources: www.iea.org)

Though the cost of crude oil certainly influences the price of gasoline, it is not the only factor which determines the price at the pump. Processing cost, transportation cost, and taxes also play a major part of the cost of a gallon of gasoline. The average price of a barrel of crude oil (in constant 1999 dollars) more than doubled from 1998 to 2000, while the average price of a gallon of gasoline increased only 33% in this same time period.

Table 5.3
Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978–2000

	Crude oil[a] (dollars per barrel)		Gasoline[b] (cents per gallon)		Ratio of gasoline to crude oil
Year	Current	Constant1999[c]	Current	Constant 1999[c]	
1978	12.5	31.8	65.2	166.5	219.8
1979	17.7	40.7	88.2	202.4	209.1
1980	28.1	56.8	122.1	246.9	182.7
1981	35.2	64.6	135.3	247.9	161.3
1982	31.9	55.0	128.1	221.1	168.8
1983	29.0	48.5	122.5	204.9	177.5
1984	28.6	45.9	119.8	192.2	175.7
1985	26.8	41.4	119.6	185.2	187.8
1986	14.6	22.1	93.1	141.5	268.7
1987	17.9	26.2	95.7	140.3	224.5
1988	14.7	20.7	96.3	135.6	275.7
1989	18.0	24.2	106.0	142.5	247.7
1990	22.2	28.3	121.7	155.2	230.0
1991	19.1	23.3	119.6	146.3	263.5
1992	18.4	21.9	119.0	141.3	271.2
1993	16.4	18.9	117.3	135.3	300.2
1994	15.6	17.5	117.4	131.9	316.3
1995	17.2	18.8	120.5	131.7	293.7
1996	20.7	22.0	128.8	136.8	261.2
1997	19.0	19.8	129.1	134.0	284.8
1998	12.5	12.8	111.5	113.9	372.6
1999	17.5	17.5	122.1	121.1	291.3
2000	28.2	27.3	156.3	151.2	232.5
		Average annual percentage change			
1978–2000	3.8%	-0.7%	4.1%	-0.4%	
1990–2000	2.4%	-0.4%	2.5%	-0.3%	

Sources:
Crude oil - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review, March 2001*, Washington, DC, Table 9.1.
Gasoline - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review, March 2001*, Washington, DC, Table 9.4. (Additional resources: www.eia.doe.gov)

[a]Refiner acquisition cost of composite (domestic and imported) crude oil.
[b]Average for all types. These prices were collected from a sample of service stations in 85 urban areas selected to represent all urban consumers. Urban consumers make up about 80% of the total U.S. population.
[c]Adjusted by the Consumer Price Inflation Index.

In constant terms, the price of gasoline and diesel fuel were slightly less expensive in 2000 than in 1990. In current dollars, however, the U.S. is seeing a significant increase in gasoline and diesel prices.

Table 5.4
Retail Prices for Motor Fuel, 1978–2000
(cents per gallon, including tax)

	Diesel fuel [a]		Average for all gasoline types[b]	
Year	Current	Constant 1999[c]	Current	Constant 1999[c]
1978	[d]	[d]	65	167
1979	[d]	[d]	88	202
1980	101	204	122	247
1981	118	216	135	248
1982	116	200	128	221
1983	120	201	123	205
1984	122	196	120	192
1985	122	189	120	185
1986	94	143	93	142
1987	96	141	96	140
1988	95	134	96	136
1989	102	137	106	142
1990	107	136	122	155
1991	91	111	120	146
1992	106	126	119	141
1993	98	113	117	135
1994	96	108	117	132
1995	97	106	121	132
1996	115	122	129	137
1997	129	134	129	134
1998	112	114	112	114
1999	97	97	122	122
2000	136	132	156	151
	Average annual percentage change			
1978–2000	1.5%[e]	1.3%[e]	4.5%	-0.5%
1990–2000	2.4%	-0.3%	2.5%	-0.3%

Source:

Gasoline - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review, 2001*, Washington, DC, Table 9.4.

Diesel - U.S. Department of Energy, Energy Information Administration, *International Energy Annual 1999*, Washington, DC, February 2001, Table 7.2.

(Additional resources: www.eia.doe.gov)

[a]Collected from a survey of prices on January 1 of the current year.

[b]These prices were collected from a sample of service stations in 85 urban areas selected to represent all urban consumers. Urban consumers make up about 80% of the total U.S. population.

[c]Adjusted by the Consumer Price Inflation Index.

[d]Data are not available.

[e]Average annual percentage change is from the earliest year possible to 2000.

*The fuel prices shown here are **refiner sales prices** of transportation fuels to end users, excluding tax. Sales to end users are those made directly to the ultimate consumer, including bulk consumers. Bulk sales to utility, industrial, and commercial accounts previously included in the wholesale category are now counted as sales to end users.*

Table 5.5
Refiner Sales Prices for Propane and No. 2 Diesel, 1978–2000
(cents per gallon, excluding tax)

	Propane[a]		No. 2 diesel fuel	
Year	Current	Constant 1999[b]	Current	Constant 1999[b]
1978	33.5	85.6	37.7	96.3
1979	35.7	81.9	58.5	134.2
1980	48.2	97.5	81.8	165.4
1981	56.5	103.6	99.5	182.4
1982	59.2	102.2	94.2	162.6
1983	70.9	118.6	82.6	138.2
1984	73.7	118.2	82.3	132.0
1985	71.7	111.0	78.9	122.2
1986	74.5	113.2	47.8	72.7
1987	70.1	102.8	55.1	80.8
1988	71.4	100.6	50.0	70.4
1989	61.5	82.6	58.5	78.6
1990	74.5	95.0	72.5	92.4
1991	73.0	89.3	64.8	79.3
1992	64.3	76.4	61.9	73.5
1993	67.3	77.6	60.2	69.4
1994	53.0	59.6	55.4	62.3
1995	49.2	53.8	56.0	61.2
1996	60.5	64.2	68.1	72.3
1997	55.2	57.3	64.2	66.6
1998	40.5	41.4	49.4	50.5
1999	45.8	45.8	58.4	58.4
2000	60.3	58.3	93.5	90.5
		Average annual percentage change		
1978–2000	2.7%	-1.7%	4.2%	-0.3%
1990–2000	-2.1%	-4.8%	2.6%	-0.2%

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review, March 2001*, Washington, DC, Table 9.7.
(Additional resources: www.eia.doe.gov)

[a]Consumer grade.
[b]Adjusted by the Consumer Price Inflation Index.

Jet fuel prices jumped more than 30 cents per gallon from 1999 to 2000.

Table 5.6
Refiner Sales Prices for Aviation Gasoline and Jet Fuel, 1978–2000
(cents per gallon, excluding tax)

	Finished aviation gasoline		Kerosene-type jet fuel	
Year	Current	Constant 1999[a]	Current	Constant 1999[a]
1978	51.6	131.8	38.7	98.9
1979	68.9	158.1	54.7	125.5
1980	108.4	219.2	86.6	175.1
1981	130.3	238.8	102.4	187.7
1982	131.2	226.5	96.3	166.3
1983	125.5	209.9	87.8	146.9
1984	123.4	197.9	84.2	135.0
1985	120.1	186.0	79.6	123.2
1986	101.1	153.7	52.9	80.4
1987	90.7	133.0	54.3	79.6
1988	89.1	125.5	51.3	72.2
1989	99.5	133.7	59.2	79.5
1990	112.0	142.8	76.6	97.6
1991	104.7	128.1	65.2	79.8
1992	102.7	122.0	61.0	72.4
1993	99.0	114.1	58.0	66.9
1994	95.7	107.6	53.4	60.0
1995	100.5	109.9	54.0	59.0
1996	111.6	118.0	65.1	69.1
1997	112.8	117.1	61.3	63.6
1998	97.5	99.7	45.2	46.2
1999	105.9	105.9	54.3	54.3
2000	132.9	128.6	89.8	86.9
	Average annual percentage change			
1978–2000	4.4%	-0.1%	3.9%	-0.6%
1990–2000	1.7%	-1.0%	1.6%	-1.2%

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review, March 2001*, Washington, DC, Table 9.7.
(Additional resources: www.eia.doe.gov)

[a]Adjusted by the Consumer Price Inflation Index.

Table 5.7
State Taxes on Motor Fuels, 2000
(dollars per gallon or gasoline equivalent gallon)
(Footnotes for this table appear on next page)

State	Gasoline	Diesel fuel	CNG	Propane	Methanol	Ethanol
Alabama	0.18	0.19	[a]	[a]	0.16[b]	0.16[b]
Alaska	0.08	0.08	0.08	0.00	0.08[b]	0.04
Arizona	0.18	0.27	0.00	0.00	0.00	0.00
Arkansas	0.186	0.186	0.05[c]	[a]	0.186	0.186
California	0.18	0.18	[a]	[a]	0.09	0.09
Colorado	0.22	0.205	[a]	[a]	0.205	0.17[b]
Connecticut	0.36	0.18	0.18	0.18	0.37[b]	0.35
Delaware	0.23	0.22	0.22	0.22	0.22	0.23
District of Columbia	0.20	0.20	0.20	0.20	0.20	0.20
Florida	0.13	0.25	[a]	[a]	0.04[b]	0.04[b]
Georgia	0.075	0.075	0.075	0.075	0.075	0.075
Hawaii	0.16	0.16	0.16	0.16	0.16	0.16
Idaho	0.25	0.25	0.197[d]	0.181	0.25[b]	0.23[b]
Illinois	0.19	0.215	0.19	0.19	0.19[b]	0.19[b]
Indiana	0.15	0.16	[a]	[a]	0.15	0.15
Iowa	0.20	0.225	0.16[c]	0.20	0.19[b]	0.19[b]
Kansas	0.18	0.20	0.17	0.17	0.20	0.20
Kentucky	0.164	0.134	0.15	0.15	0.15	0.15
Louisiana	0.20	0.20	[a]	[a]	0.20[b]	0.20[b]
Maine	0.19	0.20	0.18	0.18	0.18	0.18
Maryland	0.235	0.2425	0.235	0.235	0.235	0.235
Massachusetts	0.21	0.21	0.10	0.10	0.21	0.21
Michigan	0.19	0.15	0.0	0.15	0.15[b]	0.025[b]
Minnesota	0.20	0.20	0.174	0.15	0.114	0.142
Mississippi	0.184	0.184	0.184[c]	0.17	0.18[b]	0.18[b]
Missouri	0.17	0.17	[a]	[a]	0.17[b]	0.17[b]
Montana	0.27	0.2775	0.07[e]	[a]	0.27	0.27
Nebraska	0.246	0.246	[a]	[a]	[a]	[a]
Nevada	0.2475	0.2775	0.21	0.2475[c]	0.2475	0.2475
New Hampshire	0.195	0.195	0.195	0.195	0.195[b]	0.195[b]
New Jersey	0.105	0.135	0.0525	0.0525	0.105[b]	0.105[b]
New Mexico	0.188	0.198	[a]	[a]	0.22[b]	0.22[b]
New York	0.10[f]	0.10[f]	0.08[f]	0.08[f]	0.08[f]	0.08[f]
North Carolina	0.223	0.223	0.223	0.223	0.223	0.223
North Dakota	0.20	0.20	0.20	0.20	0.20[b]	0.20[b]
Ohio	0.22	0.22	0.22	0.22	0.22[b]	0.21[b]

Table 5.7 (continued)
State Taxes on Motor Fuels, 2000
(dollars per gallon or gasoline equivalent gallon)

State	Gasoline	Diesel fuel	CNG	Propane	Methanol	Ethanol
Oklahoma	0.17	0.14	[a]	[a]	0.16[b]	0.16[b]
Oregon	0.24	0.24	0.24	0.24	0.24	0.24
Pennsylvania	0.12[g]	0.12[g]	0.12[g]	0.12[g]	0.12[g]	0.12[g]
Rhode Island	0.29	0.29	0.0	0.29	0.29	0.29
South Carolina	0.16	0.16	0.16	0.16	0.16	0.16
South Dakota	0.21	0.21	0.06	0.16	0.06	0.19
Tennessee	0.20	0.17	0.13	0.17	0.17	0.17
Texas	0.20	0.20	[a]	[a]	0.20[b]	0.20[b]
Utah	0.245	0.245	0.04	0.04	0.04	0.04
Vermont	0.20	0.17	0.20	[a]	0.20	0.20
Virginia	0.18	0.16	0.10	0.10	0.18[b]	0.18[b]
Washington	0.23	0.23	[a]	[a]	0.23	0.23
West Virginia	0.2535	0.2535	0.2535	0.2535	0.2535	0.2535
Wisconsin	0.238	0.238	0.203	0.186	0.238	0.238
Wyoming	0.09	0.09	0.00	0.00	0.09[b]	0.09[b]

Source:
Energy Futures, Inc., *The Clean Fuels and Electric Vehicles Report*, Boulder, CO, December 2000, pp. 154–155.

[a] Annual flat fee.
[b] Blends with gasoline only.
[c] Per 100 ft^3.
[d] Per therm.
[e] Per 120 ft^3.
[f] Plus a petroleum business tax; the amount varies but is usually in the ballpark of $0.12–$0.14.
[g] Plus 0.1035 oil franchise tax.

As of January 2000, 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 twenty years ago. Still, the Federal Government encourages gasohol use via a difference in the Federal tax rates of gasoline and gasohol.

Table 5.8
State Tax Exemptions for Gasohol, December 1, 2000

State	Exemption (Cents/gallon of gasohol)
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, October 1999," February 2000, Washington, DC, Table MF-121T. (Additional resources: www.fhwa.dat.gov)

Table 5.9
Federal Excise Taxes on Motor Fuels

Fuel		Cents per gallon
Gasoline		18.30
Diesel[a]		24.30
Gasohol	10% Ethanol	13.00
	7.7% Ethanol	14.24
	5.7% Ethanol	12.85
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		18.30
Propane		13.60

Source:
Energy Futures, Inc., *The Clean Fuels and Electric Vehicles Report*, Boulder, CO, December 2000, p. 155.

[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.

[b]Qualified - contains at least 85 percent methanol or ethanol or other alcohol produced from a substance other than petroleum or natural gas.

[c]Partially exempt - 85 percent alcohol and produced from natural gas.

[d]Thousand cubic feet.

These states currently offer extra incentives for ethanol production or consumption. In addition to these tax incentives, many states have regulations in place that State-owned vehicles must fuel with E10 (gasohol) whenever possible.

Table 5.10
States With Ethanol Tax Incentives

State	Ethanol tax incentives
AK	$0.08/ethanol gallon (blender)
AR	Income tax credit for manufacturers of advanced biofuels–ethanol, methanol or any derivatives which are produced through biological means other than direct fermentation of a food crop
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	$0.25 excise tax exemption for ethanol or biodiesel
IN	10% gross income tax deduction for improvements to ethanol producing facilities.
IL	Rebate offer for purchase of E85.
IA	$0.01 (blender)
MN	$0.20 (producer), $0.058 excise tax exemption
MO	$0.20 (producer), $0.02 excise tax exemption
MT	$0.30 (producer)
NE	$0.20 (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), income tax credit for the construction of new fuel ethanol plants
OH	$0.01 (blender), income tax credit
SD	Reduced fuel tax for alternative fuels
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 and updates from www.fleets.doe.gov/fleet-tool.cgi?$$, benefits,1.
(Additional resources: www.ccities.doe.gov)

In current dollars, import cars, on average, were less expensive than domestic cars until 1982. Since then, import prices have nearly tripled, while domestic prices have nearly doubled (current dollars).

Table 5.11
Average Price of a New Car, 1970–99

Year	Domestic[a]		Import		Total	
	Current dollars	Constant 1998 dollars[b]	Current dollars	Constant 1998 dollars[b]	Current dollars	Constant 1998 dollars[b]
1970	3,708	15,568	2,648	11,118	3,542	14,872
1975	5,084	15,400	4,384	13,280	4,950	14,994
1980	7,609	15,055	7,482	14,803	7,574	14,985
1981	8,912	15,976	8,896	15,947	8,910	15,972
1982	9,865	16,662	9,957	16,818	9,890	16,727
1983	10,516	17,208	10,868	17,784	10,606	17,356
1984	11,079	17,390	12,336	19,362	11,375	17,854
1985	11,589	17,563	12,853	19,479	11,838	17,941
1986	12,319	18,317	13,670	20,326	12,652	18,812
1987	12,922	18,536	14,470	20,757	13,386	19,202
1988	13,418	18,493	15,221	20,978	13,932	19,201
1989	13,936	18,327	15,510	20,397	14,371	18,899
1990	14,489	18,076	16,640	20,760	15,042	18,766
1991	15,192	18,182	16,327	19,540	15,475	18,521
1992	15,644	18,175	18,593	21,601	16,336	18,979
1993	15,976	18,029	20,261	22,864	16,871	19,039
1994	16,930	18,619	21,989	24,183	17,903	19,689
1995	16,864	18,035	23,202	24,813	17,959	19,206
1996	17,468	18,152	26,205	27,231	18,777	19,512
1997	17,838	18,116	28,193	28,633	19,551	19,856
1998	18,579	18,579	31,986	31,986	20,849	20,849
1999	18,725	18,323	30,350	29,699	21,022	20,571
	Average annual percentage change					
1970–99	5.7%	0.6%	8.8%	3.4%	6.3%	1.1%
1989–99	3.0%	0.0%	6.9%	3.6%	3.9%	0.9%

Source:
U.S. Department of Commerce, Bureau of Economic Analysis, *National Income and Product Accounts*, underlying detail estimates for Motor Vehicle Output, Washington, DC, 2000.
(Additional resources: www.stat-usa.gov)

[a]Includes transplants.
[b]Adjusted by the Consumer Price Inflation Index.

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 (gas and oil, tires, and maintenance), which is related to the amount of travel. The cost of operating a car in 2000 was lower than 1999 despite rising gasoline prices; the fixed cost was lower.

Table 5.12
Automobile Operating Cost per Mile, 1985–2000

Model year	Constant 1999 dollars per 10,000 miles[a]			Total cost per mile [b] (constant 1999 cents [a])	Percentage gas and oil of total cost
	Variable cost	Fixed cost	Total cost		
1985	1,245	2,967	4,213	42.13	22.6%
1986	991	3,505	4,496	44.96	15.1%
1987	1,055	3,729	4,785	47.85	14.7%
1988	1,113	4,267	5,380	53.80	13.6%
1989	1,062	4,072	5,134	51.34	13.6%
1990	1,071	4,151	5,222	52.22	13.2%
1991	1,199	4,139	5,337	53.37	15.4%
1992	1,080	4,354	5,434	54.34	13.1%
1993	1,072	4,133	5,206	52.06	13.3%
1994	1,034	4,209	5,243	52.43	12.0%
1995	1,093	4,252	5,345	53.45	12.3%
1996	1,073	4,389	5,461	54.61	11.5%
1997	1,121	4,388	5,509	55.09	12.4%
1998	1,104	4,499	5,603	56.03	11.5%
1999	1,070	4,730	5,800	58.00	9.8%
2000	1,219	4,376	5,595	55.95	12.6%
	Average annual percentage change				
1985–2000	-0.1%	2.6%	1.9%	1.9%	

Source:
American Automobile Association, *Your Driving Costs*, 2000 Edition, Heathrow, FL, and annual.
(Additional resources: www.aaa.com, www.runzheimer.com)

[a] Adjusted by the Consumer Price Inflation Index.
[b] Based on 10,000 miles per year.

*While the previous table shows costs per **mile**, this table presents costs per **year** for fixed costs associated with automobile operation. For 2000 model year autos, the fixed cost is more than $14 per day.*

Table 5.13
Fixed Automobile Operating Costs per Year, 1975–2000
(constant 1999 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	164	437	585	93	2,394	[e]	3,673	10.06
1980	142	348	501	166	2,099	855	4,110	11.26
1985	142	307	330	178	1,940	883	3,779	10.36
1986	131	290	353	198	2,006	968	3,946	10.81
1987	128	287	370	205	2,209	881	4,080	11.18
1988	121	286	400	196	2,512	796	4,311	11.82
1989	146	329	415	203	2,813	841	4,748	13.01
1990	140	315	405	210	3,004	867	4,942	13.54
1991	141	316	432	207	3,111	953	5,158	14.13
1992	134	310	443	213	3,301	988	5,389	14.76
1993	123	267	444	211	3,324	802	5,172	14.17
1994	102	232	450	229	3,359	781	5,153	14.12
1995	104	231	448	231	3,388	797	5,198	14.24
1996	116	262	452	243	3,406	826	5,306	14.54
1997	110	313	416	228	3,392	823	5,283	14.48
1998	118	268	490	228	3,367	820	5,289	14.49
1999	123	278	484	223	3,355	812	5,275	14.45
2000	120	271	465	211	3,297	800	5,164	14.14
			Average annual percentage change					
1975–2000	-2.1%	-3.1%	-1.5%	5.6%	2.2%	[e]	2.3%	2.3%
1990–2000	-1.5%	-1.5%	1.4%	0.0%	0.9%	-0.8%	0.4%	0.4%

Source:
American Automobile Association, "Your Driving Costs," 2000 Edition, Heathrow, FL, and annual. (Additional resources: www.aaa.com, 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 – on.
[c] $100 deductible through 1977; $250 deductible 1978 through 1992; $500 deductible for 1993 – on.
[d] Coverage: $100,000/$300,000.
[e] Data are not available.

Table 5.14
Economic Indicators, 1970–2000
(billion dollars)

Year	Gross National Product		Total transportation outlays		Transportation as a percent of GNP
	Current	Constant 1999[a]	Current	Constant 1999[a]	
1970	1,015.5	4,194.0	192.8	809.5	19.0%
1980	2,732.0	5,327.4	533.0	1,054.6	19.5%
1990	5,567.8	6,848.4	951.0	1,186.4	17.1%
1999	9,288.2	9,288.2	1,480.9	1,480.9	15.9%
	Personal Consumption Expenditures		Transportation Personal Consumption Expenditures[b]		Transportation PCE as a percent of total PCE
1970	640.0	2,687.1	81.5	342.2	12.7%
1980	1,732.6	3,428.0	238.5	471.9	13.8%
1990	3,761.2	4,692.4	453.9	566.3	12.1%
2000	6,757.3	6,537.6	775.8	750.6	11.5%

Sources:
GNP - U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, April 2001, Table 1.9, p. D-4, and annual. (Additional resources: www.bea.doc.gov)
Transportation outlays - Eno Transportation Foundation, *Transportation in America 2000*, Eighteenth Edition, Lansdowne, VA, 2001, p. 1.
PCE - U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, April 2001, Table 2.2 and annual. (Additional resources: www.bea.doc.gov/bea/scbinf.html)

Table 5.15
Consumer Price Indices, 1970–2000
(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
2000	4.435	4.088	2.694	4.994	9.807

Source:
Bureau of Labor Statistics, Consumer Price Index Table 1A for 2000, and annual. [GNP—see above.] (Additional resources: 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.

In 1999 there were 7.7 employees for every hundred vehicles sold in the U.S., according to estimates based on domestic light vehicle sales. Using the average domestic automobile price, estimates show 4.1 employees for every million dollars spent on light vehicles. This includes employees of motor vehicle parts manufacturers and tire manufacturers.

Table 5.16
Motor Vehicle Manufacturing Employment Statistics, 1970–99

Year	Motor vehicles, parts and tires manufacturing employees (thousands)	Sales of domestic light vehicles[a] (thousands)	Employees per hundred vehicles sold	Employees per million dollar expenditure (current)	Employees per million dollar expenditure (constant 1999[b])
1970	914	8,516	10.7	28.9	8.0
1975	892	9,106	9.8	19.3	7.4
1980	904	8,540	10.6	13.9	7.6
1981	841	7,954	10.6	11.9	7.1
1982	792	7,821	10.1	10.3	6.5
1983	875	9,313	9.4	8.9	5.9
1984	968	11,209	8.6	7.8	5.3
1985	964	11,896	8.1	7.0	4.9
1986	931	11,886	7.8	6.4	4.6
1987	928	10,866	8.5	6.6	4.9
1988	964	11,721	8.2	6.1	4.7
1989	941	11,181	8.4	6.0	4.8
1990	946	10,845	8.7	6.0	5.0
1991	870	9,732	8.9	5.9	5.0
1992	894	10,510	8.5	5.4	4.8
1993	919	11,729	7.8	4.9	4.4
1994	988	12,893	7.7	4.5	4.2
1995	1,051	12,792	8.2	4.9	4.6
1996	1,047	13,342	7.8	4.5	4.3
1997	1,063	13,143	8.1	4.5	4.4
1998	1,074	13,445	8.0	4.3	4.2
1999	1,098	14,289	7.7	4.1	4.1
		Average annual percentage change			
1970–99	0.6%	1.8%	-1.1%	-6.5%	-2.3%
1989–99	1.6%	2.5%	-0.9%	-3.7%	-1.6%

Source:
Employees - Eno Transportation Foundation, *Transportation in America 2000*, Eighteenth Edition, Lansdowne, VA, 2001, pp. 32-35.
Sales - See Table 6.4. Expenditures - See Table 5.11.

[a] Vehicles produced in North America.
[b] Adjusted by the implicit Gross National Product price deflator.

Employees of motor vehicle and related industries comprise 8.2% of the labor force. For employment in the entire transportation industry, see the next table.

Table 5.17
Employees of Motor Vehicle and Related Industries, 1998

	1998 Employees	Percent of total motor vehicle	Percent of total U.S. employment
Motor vehicle and equipment manufacturing	1,314,317	14.8%	1.2%
Motor vehicles and equipment	*235,483*	*2.7%*	*0.2%*
Motor vehicle body & trailer	128,687	1.5%	0.1%
Motor vehicle parts	*801,461*	*9.0%*	*0.7%*
Storage batteries	*22,745*	*0.3%*	*0.0%*
Tires	*65,298*	*0.7%*	*0.1%*
Rolled steel shape	*14,169*	*0.2%*	*0.0%*
Other transportation equipment	*46,474*	*0.5%*	*0.0%*
Highway, street, bridge, and tunnel construction	267,142	3.0%	0.2%
Motor freight transportation and related services	2,227,195	25.1%	2.1%
Trucking and courier services, except by air or by the U.S. Postal Service	*1,866,637*	*21.1%*	*1.7%*
Petroleum refining and wholesale distribution	227,887	2.6%	0.2%
Passenger transportation	936,025	10.6%	0.9%
Automotive sales and servicing	3,888,265	43.9%	3.6%
Total of motor vehicle and related industries	8,860,831	100.0%	8.2%
U.S. Total[a]	108,117,731		100.0%

Source:
U.S. Department of Commerce, Bureau of the Census, County Business Patterns web site: tier2.census.gov/cbp/, April 2001. (Additional resources: www.census.gov)

[a] Data 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.

Eleven percent of employed civilians in 1999 worked in transportation or transportation-related industries; truck drivers and deliverymen made up 20% of that employment.

Table 5.18
Employment in Transportation and Related Industries, 1960–99
(persons in thousands)

	1960	1965	1970	1975	1980	1985	1990	1995	1999
Transportation Service									
Air transport	191	229	351	362	453	537	968	1,068	1,227
Bus, intercity	41	42	43	39	38	36	26	24	21
Local transport	101	83	77	69	79	90	141	203	240
Railroads	885	735	627	538	532	346	279	238	230
Oil pipeline	23	20	18	17	21	19	19	15	13
Taxi	121	110	107	83	53	38	32	31	31
Trucking & truck materials	770	882	998	996	1,280	1,361	1,395	1,587	1,804
Water	232	230	215	190	211	185	177	175	187
Total	**2,364**	**2,331**	**2,436**	**2,294**	**2,667**	**2,598**	**3,036**	**3,340**	**3,753**
Transportation Equipment Manufacturing									
Aircraft & parts	646	624	669	514	652	647	712	451	495
Motor vehicles, equipment, tires	829	945	914	892	904	964	946	1,051	1,098
Railroad equipment	43	56	51	52	71	34	33	38	38
Ship & boat building & repair	141	160	170	194	221	193	188	160	162
Other transportation equipment	33	57	111	115	149	130	45	53	51
Total	**1,692**	**1,842**	**1,915**	**1,767**	**1,997**	**1,968**	**1,924**	**1,752**	**1,844**
Transportation Related Industries									
Automotive/accessory retail dealers	807	902	996	1,076	1,048	1,185	1,292	1,388	1,377
Automotive wholesalers	215	255	320	367	418	433	456	492	520
Automotive service & garages	251	324	384	400	571	730	926	981	1,341
Gasoline service stations	461	522	614	616	561	611	647	649	675
Highway & street construction	294	324	331	297	268	264	239	228	250
Petroleum[a]	311	292	333	390	533	568	513	429	445
Other industries									
Truck drivers & deliverymen	1,477	1,521	1,565	1,796	1,931	2,050	2,148	2,861	3,116
Freight handlers	365	411	456	613	622	574	504	536	625
Total	**4,181**	**4,551**	**4,999**	**5,545**	**5,952**	**6,415**	**6,725**	**7,564**	**8,349**
Government Transportation Employees									
U.S. Department of Transportation	38	45	66	75	72	61	67	63	64
Highways, state & local	499	550	568	569	532	549	569	560	543
U.S. Postal Service[b]	83	83	103	98	92	104	115	110	113
Other[c]	18	16	12	13	13	11	11	11	12
Total	**638**	**694**	**749**	**755**	**709**	**725**	**762**	**744**	**732**
Total transportation employment	**8,875**	**9,418**	**10,099**	**10,361**	**11,325**	**11,706**	**12,447**	**13,400**	**14,678**
Total employed civilians	**65,778**	**71,088**	**78,627**	**85,783**	**99,303**	**107,150**	**118,793**	**124,900**	**133,488**
Transportation percent of total	13.5%	13.2%	12.8%	12.1%	11.4%	10.9%	10.5%	10.7%	11.0%

Source:
Eno Transportation Foundation, *Transportation in America 2000*, Eighteenth Edition, Lansdowne, VA, 2001, pp. 32-35.

[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 6

Highway Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 6.1	U.S. share of world automobile registrations, 1999	26.9%
Table 6.2	U.S. share of world truck & bus registrations, 1999	43.7%
Table 6.3	Number of automobiles, 1999 (Polk - in thousands)	126,869
Table 6.3	Number of trucks, 1999 (Polk - in thousands)	82,640
Table 6.5	Vehicle miles traveled, 1999 (million miles)	2,691,335
	Automobiles	*58.3%*
	Motorcycles	*0.4%*
	Two-axle, four-tire trucks	*33.5%*
	Other single-unit trucks	*2.6%*
	Combination trucks	*4.9%*
	Buses	*0.3%*
Table 6.8	Average age of vehicles, 1999	(years)
	Automobiles	*8.9*
	Trucks	*8.2*
	Median lifetime of vehicles	(years)
Table 6.9	*Automobiles*	*14.0*
Table 6.10	*Light trucks*	*15.2*

The 1997 data in this series were never published. Use caution comparing historical data because of disconnects in data series, such as China in 1998. Also, the U.S. is unique in how many light trucks (SUVs, minivans, pickups) are used for personal travel. Those light trucks are not included on this table.

Table 6.1
Automobile Registrations for Selected Countries, 1950–99
(thousands)

Year	China	India	Japan	France	United Kingdom	Germany[a]	Canada[b]	United States[c]	U.S. percentage of world[c]	World total
1950	[d]	[d]	43	[d]	2,307	[d]	1,913	40,339	76.0%	53,051
1955	[d]	[d]	153	[d]	360	[d]	2,961	52,145	71.4%	73,036
1960	[d]	[d]	457	4,950	5,650	4,856	4,104	61,671	62.7%	98,305
1965	[d]	[d]	2,181	8,320	9,131	9,719	5,279	75,258	53.8%	139,776
1970	[d]	[d]	8,779	11,860	11,802	14,376	6,602	89,244	46.1%	193,479
1975	[d]	[d]	17,236	15,180	14,061	18,161	8,870	106,706	41.0%	260,201
1980	351	[d]	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
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
1997	Data are not available.									
1998	2,940[e]	4,820	49,896	26,800	22,115	41,674	13,887	131,839	27.5%	478,625
1999	3,400	5,200	51,164	27,480	27,539	42,423	14,143	132,432	26.9%	491,598
	Average annual percentage change									
1950–99	[d]	[d]	15.5%	[d]	5.2%	[d]	4.2%	2.5%		4.6%
1970–99	[d]	[d]	6.3%	2.9%	3.0%	3.8%	2.7%	1.4%		3.3%
1990–99	8.6%	7.6%	4.3%	2.0%	2.3%	3.7%	1.3%	-0.1%		1.4%

Source:
Ward's Communications, *Ward's World Motor Vehicle Data*, 2000 Edition, Southfield, MI, 1998, pp. 218–220 and annual.
(Additional resources: www.wardsauto.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] Data are not available.
[e] Data are not comparable to prior data due to reclassification of autos and trucks.

The 1997 data in this series were never published. Use caution comparing historical data because of disconnects in data series, such as China in 1998. The U.S. totals include SUVs, minivans, and light trucks, many of which are used for personal travel.

Table 6.2
Truck and Bus Registrations for Selected Countries, 1950–99
(thousands)

Year	China	India	Japan	France	United Kingdom	Germany[a]	Canada[b]	United States[c]	U.S. percentage of world[c]	World total
1950	[d]	[d]	183	[d]	1,060	[d]	643	8,823	50.9%	17,349
1955	[d]	[d]	318	[d]	1,244	[d]	952	10,544	46.1%	22,860
1960	[d]	[d]	896	1,540	1,534	786	1,056	12,186	42.6%	28,583
1965	[d]	[d]	4,119	1,770	1,748	1,021	1,232	15,100	39.6%	38,118
1970	[d]	[d]	8,803	1,850	1,769	1,228	1,481	19,175	36.2%	52,899
1975	811	[d]	10,854	2,210	1,934	1,337	2,158	26,243	38.8%	67,698
1980	1,480	[d]	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
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
1997	Data are not available									
1998	8,313[e]	2,610	20,919	5,500	3,169	4,357	3,694	79,062	44.0%	179,498
1999	9,400	3,000	20,559	5,609	3,392	3,370	3,120	83,148	43.7%	190,203
	Average annual percentage change									
1950–99	[d]	[d]	10.0%	[d]	2.4%	[d]	3.3%	4.7%		5.0%
1970–99	[d]	[d]	3.0%	3.9%	2.3%	3.5%	2.6%	5.2%		4.5%
1990–99	8.5%	7.7%	-1.1%	1.9%	-1.2%	6.0%	-2.5%	4.7%		2.8%

Source:
Ward's Communications, *Ward's World Motor Vehicle Data*, 2000 Edition, Southfield, MI, 2000, pp. 218–220 and annual.
(Additional resources: www.wardsauto.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] Data are not available.
[e] Data not comparable to prior data due to reclassification of autos and trucks.

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 6.3
Automobiles and Trucks in Use, 1970–2000
(thousands)

	Automobiles			Trucks			Total		
Year	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%
1975	106,706	95,241	12.0%	25,781	24,813	3.9%	132,487	120,054	10.4%
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%
1997	129,749	124,673	4.1%	77,307	76,398	1.2%	207,056	201,071	3.0%
1998	131,839	125,966	4.7%	79,062	79,077	0.0%	210,901	205,043	2.9%
1999	132,432	126,869	4.4%	83,148	82,640	0.6%	215,580	209,509	2.9%
2000	[a]	127,721	[a]	[a]	85,579	[a]	[a]	213,300	[a]

Source:

FHWA - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1999*, Washington, DC, 2000, Table VM-1, p. V-45, and annual. (Additional resources: www.fhwa.dot.gov)

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

[a]Data are not available.

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 definitions for the size classes are in the Glossary. The data on trucks by weight class are based on estimates from the 1997 Vehicle Inventory and Use Survey (latest available survey). Trucks less than 10,000 lbs. make up 94% of all trucks.

Table 6.4
Vehicle Stock and New Sales in United States, 1999 Calendar Year

	Vehicle stock[a]		New sales		
	Thousands	Percentage	Domestic (thousands)	Import[b] (thousands)	Total (thousands)
Autos	**126,869**	**100.0%**	**6,979 (80.2%)**	**1,719 (19.8%)**	**8,698 (100.0%)**
Two seaters	2,143	1.7%	52 (49.0%)	54 (51.0%)	106 (100.0%)
Minicompact	847	0.7%	0 (0.0%)	14 (100.0%)	14 (100.0%)
Subcompact	26,707	21.1%	1,390 (85.5%)	236 (14.5%)	1,626 (100.0%)
Compact	42,243	33.3%	1,850 (77.5%)	536 (22.5%)	2,386 (100.0%)
Midsize	37,141	29.3%	2,547 (75.1%)	846 (24.9%)	3,393 (100.0%)
Large	17,787	14.0%	1,140 (97.2%)	33 (2.8%)	1,174 (100.0%)
Autos	**126,869**	**100.0%**	[c]	[c]	[c]
Business fleet autos[d]	7,742	6.1%	[c]	[c]	[c]
Personal autos	119,127	93.9%	[c]	[c]	[c]
Motorcycles	**4,152[e]**	**100.0%**	[c]	[c]	[c]
Recreational vehicles	[c]	[c]	**481 (100.0%)**	**0 (0.0%)**	**481 (100.0%)**
Trucks	**82,640**	**100.0%**	7,922 (90.9%)	795 (9.1%)	8,176 (100.0%)
Light (0–10,000 lbs)	77,304	93.5%	7,310 (90.5%)	763 (9.5%)	8,073 (100.0%)
Medium (10,001–26,000 lbs)	2,457	3.0%	220 (87.9%)	30 (12.1%)	250 (100.0%)
Heavy-heavy (26,001 lbs and over)	2,878	3.5%	392 (99.7%)	1 (0.3%)	393 (100.0%)
Trucks	**82,640**	**100.0%**	[c]	[c]	[c]
Business fleet trucks≤19,500 lbs[d]	7,788	9.4%	[c]	[c]	[c]
Personal trucks ≤ 19,500 lbs	71,146	86.1%	[c]	[c]	[c]
Trucks > 19,500 lbs.	3,706	4.5%	[c]	[c]	[c]

Source:
See Appendix A for Table 6.4. (Additional resources: www.polk.com)

[a] Total auto and truck vehicle stock as of July 1,1999 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.

The trend of using two-axle, four-tire trucks, such as pickups, vans, and sport-utility vehicles, for personal travel is evident in these data; two-axle, four-tire trucks account for 22% more travel in 1999 than in 1970, and automobiles account for 24% less travel in that time period.

Table 6.5
Shares of Highway Vehicle-Miles Traveled by Vehicle Type, 1970–99
(million miles)

Year	Automobiles	Motorcycles	Two-axle, four-tire trucks	Other single-unit trucks	Combination trucks	Buses[a]	Total vehicle-miles traveled (million miles)
1970	82.6%	0.3%	11.1%	2.4%	3.2%	0.4%	1,109,724
1975	77.9%	0.4%	15.1%	2.6%	3.5%	0.5%	1,327,664
1980	72.8%	0.7%	19.0%	2.6%	4.5%	0.4%	1,527,295
1981	72.9%	0.7%	19.1%	2.5%	4.4%	0.4%	1,555,308
1982	72.8%	0.6%	19.2%	2.5%	4.4%	0.4%	1,595,010
1983	72.3%	0.5%	19.8%	2.6%	4.5%	0.3%	1,652,788
1984	71.3%	0.5%	20.8%	2.6%	4.5%	0.3%	1,720,269
1985	70.2%	0.5%	22.0%	2.6%	4.4%	0.3%	1,774,826
1986	69.2%	0.5%	23.1%	2.5%	4.4%	0.3%	1,834,872
1987	68.5%	0.5%	23.8%	2.5%	4.5%	0.3%	1,921,204
1988	67.6%	0.5%	24.8%	2.4%	4.4%	0.3%	2,025,962
1989	66.8%	0.5%	25.6%	2.4%	4.4%	0.3%	2,096,487
1990	65.7%	0.4%	26.8%	2.4%	4.4%	0.3%	2,144,362
1991	62.5%	0.4%	29.9%	2.4%	4.4%	0.3%	2,172,050
1992	61.0%	0.4%	31.5%	2.4%	4.4%	0.3%	2,247,151
1993	59.9%	0.4%	32.5%	2.5%	4.5%	0.3%	2,296,378
1994	59.6%	0.4%	32.4%	2.6%	4.6%	0.3%	2,357,588
1995	59.4%	0.4%	32.6%	2.6%	4.8%	0.3%	2,422,696
1996	59.1%	0.4%	32.8%	2.6%	4.8%	0.3%	2,485,848
1997	58.7%	0.4%	33.2%	2.6%	4.9%	0.3%	2,561,695
1998	58.9%	0.4%	33.0%	2.6%	4.9%	0.3%	2,631,522
1999	58.3%	0.4%	33.5%	2.6%	4.9%	0.3%	2,691,335
			Average annual percentage change				
1970–99							3.1%
1989–99							2.5%

Source:
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1999*, Washington, DC, 2000, Table VM-1, p. V-45, and annual. (Additional resources: www.fhwa.dot.gov)

[a]The data do not correspond with vehicle-miles of travel presented in the "Bus" section of this chapter due to differing data sources.

Table 6.6
Automobiles in Operation and Vehicle Travel by Age, 1970 and 1999

Age (years)	1970 Vehicles (thousands)	1970 Percentage	1970 Cumulative percentage	1999 Vehicles (thousands)	1999 Percentage	1999 Cumulative percentage	1999 Estimated vehicle travel Percentage	1999 Estimated vehicle travel Cumulative percentage	Average annual miles per vehicle
Under 1[a]	6,288	7.8%	7.8%	6,219	4.9%	4.9%	6.7%	6.7%	15,600
1	9,299	11.6%	19.4%	7,714	6.1%	11.0%	7.7%	14.4%	14,500
2	8,816	11.0%	30.3%	7,971	6.3%	17.3%	8.1%	22.6%	14,800
3	7,878	9.8%	40.1%	7,488	5.9%	23.2%	7.1%	29.7%	13,800
4	8,538	10.6%	50.8%	8,811	6.9%	30.1%	7.8%	37.5%	12,900
5	8,506	10.6%	61.3%	7,771	6.1%	36.2%	6.8%	44.3%	12,700
6	7,116	8.8%	70.2%	7,826	6.2%	42.4%	6.7%	51.0%	12,400
7	6,268	7.8%	78.0%	7,204	5.7%	48.1%	5.8%	56.8%	11,600
8	5,058	6.3%	84.3%	7,354	5.8%	53.9%	5.7%	62.5%	11,300
9	3,267	4.1%	88.3%	7,387	5.8%	59.7%	5.7%	68.2%	11,200
10	2,776	3.5%	91.8%	7,797	6.1%	65.8%	4.8%	73.1%	9,000
11	1,692	2.1%	93.9%	7,475	5.9%	71.7%	4.6%	77.7%	9,000
12	799	1.0%	94.9%	6,780	5.3%	77.1%	4.2%	81.9%	9,000
13	996	1.2%	96.1%	6,089	4.8%	81.9%	3.8%	85.7%	9,000
14	794	1.0%	97.1%	4,987	3.9%	85.8%	3.1%	88.8%	9,000
15 and older	2,336	2.9%	100.0%	17,996	14.2%	100.0%	11.2%	100.0%	9,000
Subtotal	**80,427**	**100.0%**		**126,869**					
Age not given	**22**			**0**					
Total	**80,449**			**126,869**					
Average age		5.6			8.9				
Median age		4.9			8.3				

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 *Nationwide Personal Transportation Survey* web site: www-cta.ornl.gov/npts.
(Additional resources: www.polk.com, www-cta.ornl.gov/npts)

[a]Includes automobiles from model year 2000 and 1999 which were sold prior to July 1, 1999, and similarly, model years 1971 and 1970 sold prior to July 1, 1970.

Table 6.7
Trucks in Operation and Vehicle Travel by Age, 1970 and 1999

Age (years)	1970 Vehicles (thousands)	1970 Percentage	1970 Cumulative percentage	1999 Vehicles (thousands)	1999 Percentage	1999 Cumulative percentage	1999 Estimated vehicle travel Percentage	1999 Estimated vehicle travel Cumulative percentage	Average annual miles per vehicle
Under 1[a]	1,262	7.1%	7.1%	5,953	7.2%	7.2%	8.8%	8.8%	17,500
1	1,881	10.6%	17.8%	6,750	8.2%	15.4%	11.1%	19.9%	19,200
2	1,536	8.7%	26.5%	6,507	7.9%	23.2%	11.0%	30.9%	19,800
3	1,428	8.1%	34.6%	5,492	6.6%	29.9%	8.4%	39.3%	17,900
4	1,483	8.4%	43.0%	6,063	7.3%	37.2%	9.0%	48.3%	17,500
5	1,339	7.6%	50.5%	5,437	6.6%	43.8%	7.9%	56.2%	17,000
6	1,154	6.5%	57.1%	4,539	5.5%	49.3%	6.0%	62.2%	15,600
7	975	5.5%	62.6%	3,739	4.5%	53.8%	4.9%	67.1%	15,400
8	826	4.7%	67.3%	3,626	4.4%	58.2%	4.7%	71.7%	15,100
9	621	3.5%	70.8%	3,494	4.2%	62.4%	3.9%	75.7%	13,200
10	658	3.7%	74.5%	3,940	4.8%	67.2%	3.1%	78.7%	9,200
11	583	3.3%	77.8%	3,738	4.5%	71.7%	2.9%	81.7%	9,200
12	383	2.2%	80.0%	3,145	3.8%	75.5%	2.5%	84.1%	9,200
13	417	2.4%	82.3%	3,142	3.8%	79.3%	2.5%	86.6%	9,200
14	414	2.3%	84.7%	2,560	3.1%	82.4%	2.0%	88.6%	9,200
15 and older	2,710	15.3%	100.0%	14,515	17.6%	100.0%	11.4%	100.0%	9,200
Subtotal	**17,670**	**100.0%**		**82,640**			**100.0%**		
Age not given	15			0					
Total	**17,685**			**82,640**					
Average age		7.3			8.2				
Median age		5.9			7.2				

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: www.polk.com, www.census.gov)

[a]Includes trucks from model year 2000 and 1999 which were sold prior to July 1, 1999, and similarly, model years 1971 and 1970 sold prior to July 1, 1970.

The average age of automobiles was lower than the average age of trucks until 1994. Since then, the average automobile age continues to grow, while the average truck age has held about the same. The increasing popularity of light trucks as personal passenger vehicles may have had an influence on the average age of trucks.

Table 6.8
Average Age of Automobiles and Trucks in Use, 1970–99
(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
1997	8.7	8.1	8.3	7.8
1998	8.8	8.3	8.3	7.5
1999	8.9	8.3	8.2	7.2

Source:
The Polk Company, Detroit, MI. **FURTHER REPRODUCTION PROHIBITED.**
(Additional resources: www.polk.com)

[a]Mean is the sum of the products of units multiplied by age, divided by the total units.
[b]Median is a value in an ordered set of values below and above which there are an equal number of values.

Using current registration data and a scrappage model by Greenspan and Cohen, [1996 paper: http://www.federalreserve.gov/pubs/feds/1996/199640/199640pap.pdf]*, ORNL calculated new automobile scrappage rates. The expected median lifetime for a 1990 model year automobile is 16 years. These data are fitted model values which assume constant economic conditions.*

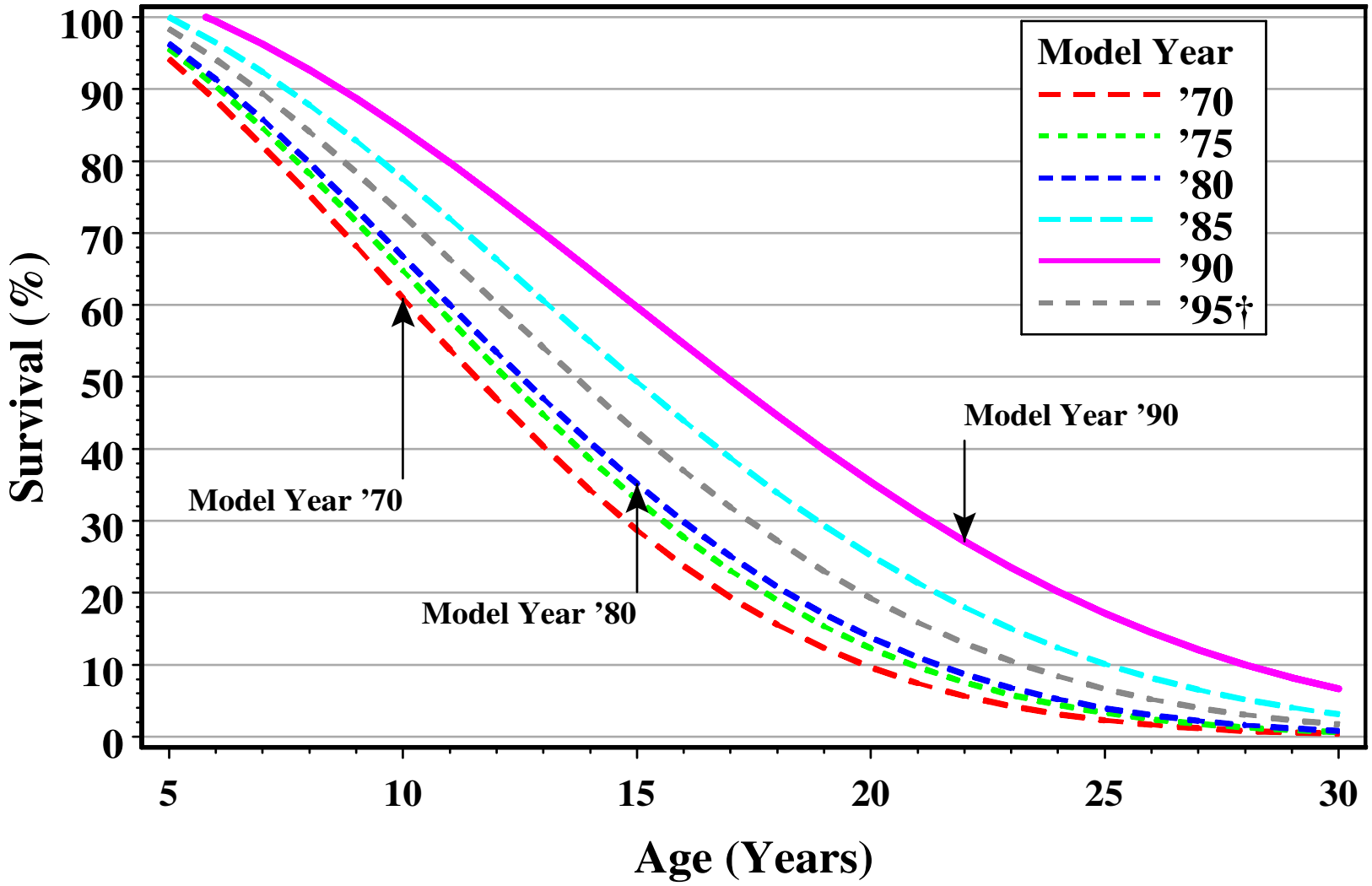
Table 6.9
Automobile Scrappage and Survival Rates
1970, 1980 and 1990 Model Years

Vehicle age[a] (years)	1970 model year		1980 model year		1990 model year	
	Survival rate[b]	Scrappage rate[c]	Survival rate[b]	Scrappage rate[c]	Survival rate[b]	Scrappage rate[c]
4	99.0	3.9	100.0	3.2	100.0	1.6
5	94.1	5.0	96.3	4.2	100.0	2.1
6	88.4	6.1	91.3	5.1	99.4	2.6
7	82.0	7.2	85.7	6.1	96.3	3.2
8	75.2	8.3	79.7	7.1	92.7	3.7
9	68.1	9.5	73.3	8.1	88.7	4.3
10	60.9	10.6	66.6	9.0	84.4	4.9
11	53.8	11.7	60.0	10.0	79.8	5.5
12	46.9	12.8	53.3	11.0	75.0	6.1
13	40.3	14.0	46.9	12.0	70.0	6.7
14	34.2	15.1	40.8	13.0	64.9	7.3
15	28.7	16.2	35.1	14.0	59.7	7.9
16	23.7	17.4	29.8	15.0	54.6	8.6
17	19.3	18.5	25.0	16.1	49.5	9.3
18	15.5	19.6	20.8	17.1	44.6	9.9
19	12.3	20.8	17.0	18.1	39.9	10.6
20	9.6	21.9	13.8	19.1	35.4	11.3
21	7.4	23.0	11.0	20.1	31.1	12.0
22	5.6	24.2	8.7	21.2	27.2	12.7
23	4.2	25.3	6.7	22.2	23.5	13.5
24	3.1	26.4	5.2	23.2	20.2	14.2
25	2.2	27.5	3.9	24.2	17.1	15.0
26	1.6	28.6	2.9	25.3	14.5	15.7
27	1.1	29.7	2.2	26.3	12.1	16.5
28	0.8	30.8	1.6	27.3	10.0	17.2
29	0.5	31.9	1.1	28.4	8.2	18.0
30	0.4	33.0	0.8	29.4	6.6	18.8
Median lifetime	11.5		12.5		16.1	

Source:
Schmoyer, Richard L., unpublished study on scrappage rates, Oak Ridge National Laboratory, Oak Ridge, TN, 2001.

[a]It was assumed that scrappage for vehicles less than 4 years old is 0.
[b]The percentage of 1970/80/90 model year automobiles which will be in use at the end of a given year.
[c]The percentage of 1970/80/90 model year automobiles which will be retired from use within a given year.

Figure 6.1. Automobile Survival Rates*



*Data Source: See Table 6.9.
†Model Year '95 estimates are based on minimal preliminary data.

Using current registration data and a scrappage model by Greenspan and Cohen [1996 paper: http://www.federalreserve.gov/pubs/feds/1996/199640/199640pap.pdf]*, ORNL calculated new light truck scrappage rates. The expected median lifetime for a 1990 model year light truck is 15.5 years. These data are fitted model values which assume constant economic conditions.*

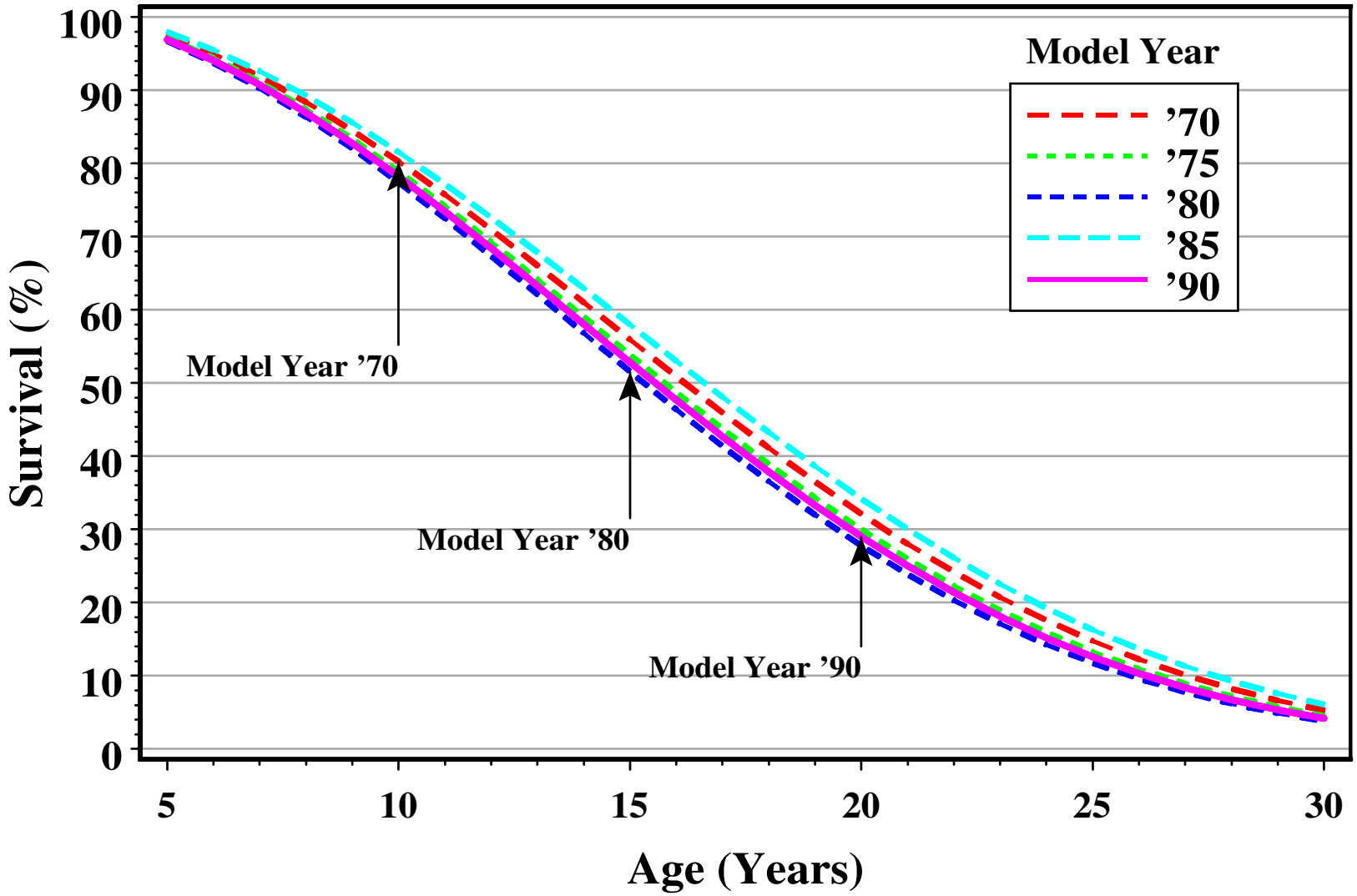
Table 6.10
Light Truck[a] Scrappage and Survival Rates

Vehicle age[b] (years)	1970 model year		1980 model year		1990 model year	
	Survival rate[c]	Scrappage rate[d]	Survival rate[b]	Scrappage rate[c]	Survival rate[b]	Scrappage rate[c]
4	99.7	1.6	99.1	1.9		1.8
5	97.5	2.2	96.6	2.5	96.9	2.4
6	94.9	2.7	93.7	3.1	94.1	3.0
7	91.8	3.2	90.2	3.7	90.7	3.6
8	88.3	3.8	86.3	4.3	86.9	4.2
9	84.4	4.4	82.0	5.0	82.7	4.8
10	80.2	5.0	77.3	5.7	78.2	5.5
11	75.7	5.6	72.4	6.4	73.4	6.1
12	70.9	6.3	67.3	7.1	68.4	6.8
13	66.0	6.9	62.1	7.8	63.3	7.5
14	61.0	7.6	56.8	8.5	58.0	8.2
15	55.9	8.3	51.5	9.3	52.8	9.0
16	50.8	9.0	46.3	10.1	47.7	9.7
17	45.9	9.8	41.3	10.8	42.7	10.5
18	41.1	10.5	36.5	11.6	37.9	11.3
19	36.4	11.3	32.0	12.4	33.3	12.1
20	32.1	12.0	27.7	13.3	29.0	12.9
21	28.0	12.8	23.8	14.1	25.0	13.7
22	24.2	13.6	20.3	14.9	21.4	14.5
23	20.7	14.4	17.1	15.8	18.1	15.4
24	17.5	15.2	14.2	16.7	15.2	16.2
25	14.7	16.1	11.7	17.5	12.6	17.1
26	12.2	16.9	9.6	18.4	10.3	18.0
27	10.1	17.8	7.7	19.3	8.4	18.8
28	8.2	18.6	6.2	20.2	6.7	19.7
29	6.6	19.5	4.9	21.1	5.3	20.6
30	5.2	20.4	3.8	22.1	4.2	21.5
Median lifetime	16.8 years		15.7 years		15.5 years	

Source:
Schmoyer, Richard L., unpublished study on scrappage rates, Oak Ridge National Laboratory, Oak Ridge, TN, 2001.

[a]Light trucks are trucks less than 10,000 lbs. gross vehicle weight.
[b]It was assumed that scrappage for vehicles less than 4 years old is 0.
[c]The percentage of 1970/80/90 model year light trucks which will be in use at the end of a given year.
[d]The percentage of 1970/80/90 model year light trucks which will be retired from use within a given year.

Figure 6.2. Light Truck Survival Rates*



*Data Source: See Table 6.10.

Using current registration data and a scrappage model by Greenspan and Cohen [1996 paper: http://www.federalreserve.gov/pubs/feds/1996/199640/199640pap.pdf]*, ORNL calculated heavy truck (trucks over scrappage rates. The expected median lifetime for a 1990 model year heavy truck is 29 years. These data are fitted model values which assume constant economic conditions.*

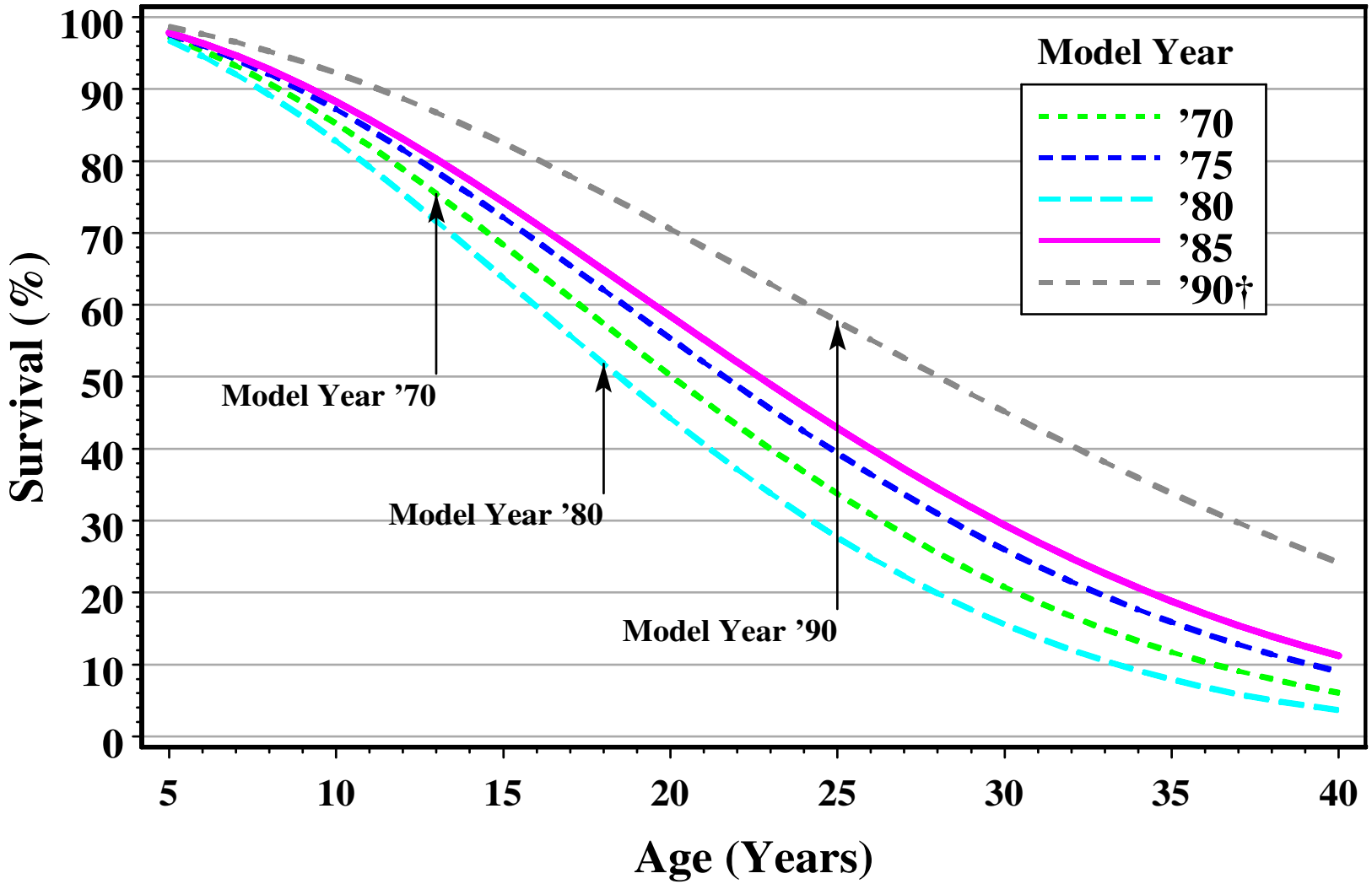
Table 6.11
Heavy Truck[a] Scrappage and Survival Rates

Vehicle age[b] (years)	1970 model year		1980 model year		1990 model year	
	Survival rate[c]	Scrappage rate[d]	Survival rate[b]	Scrappage rate[c]	Survival rate[b]	Scrappage rate[c]
4	98.8	1.2	98.5	1.5	99.4	0.6
5	97.2	1.6	96.7	1.9	98.6	0.8
6	95.3	1.9	94.5	2.3	97.6	1.0
7	93.2	2.3	92.0	2.7	96.5	1.2
8	90.7	2.6	89.1	3.1	95.2	1.3
9	88.1	3.0	86.0	3.5	93.8	1.5
10	85.2	3.3	82.7	3.9	92.2	1.7
11	82.1	3.6	79.1	4.3	90.5	1.9
12	78.8	4.0	75.4	4.7	88.6	2.0
13	75.4	4.3	71.6	5.1	86.7	2.2
14	71.9	4.7	67.7	5.5	84.6	2.4
15	68.3	5.0	63.7	5.9	82.4	2.6
16	64.6	5.3	59.7	6.3	80.2	2.7
17	61.0	5.7	55.7	6.7	77.9	2.9
18	57.3	6.0	51.8	7.1	75.5	3.1
19	53.7	6.3	47.9	7.4	73.0	3.3
20	50.1	6.7	44.2	7.8	70.5	3.4
21	46.6	7.0	40.6	8.2	68.0	3.6
22	43.2	7.3	37.1	8.6	65.4	3.8
23	39.9	7.6	33.7	9.0	62.8	3.9
24	36.7	8.0	30.6	9.4	60.3	4.1
25	33.7	8.3	27.6	9.7	57.7	4.3
26	30.8	8.6	24.8	10.1	55.1	4.5
27	28.0	8.9	22.2	10.5	52.6	4.6
28	25.4	9.3	19.8	10.9	50.0	4.8
29	23.0	9.6	17.6	11.2	47.6	5.0
30	20.7	9.9	15.5	11.6	45.1	5.1
Median lifetime	21.0 years		18.5 years		29.0 years	

Source:
Schmoyer, Richard L., unpublished study on scrappage rates, Oak Ridge National Laboratory, Oak Ridge, TN, 2001.

[a]Heavy trucks are trucks more than 26,000 lbs. gross vehicle weight.
[b]It was assumed that scrappage for vehicles less than 4 years old is 0.
[c]The percentage of 1970/80/90 model year light trucks which will be in use at the end of a given year.
[d]The percentage of 1970/80/90 model year light trucks which will be retired from use within a given year.

Figure 6.3. Heavy Truck Survival Rates*



*Data Source: See Table 6.11. Estimates based on variation of Greenspan-Cohen model for heavy trucks (R. L. Schmoyer, unpublished report).
†Model year '90 estimates are based on minimal preliminary data.

Chapter 7
Light Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 7.1	Passenger cars, 1999	
	Registrations (thousands)	*132,432*
	Vehicle miles (million miles)	*1,569,270*
	Fuel economy (miles per gallon)	*21.6*
Table 7.2	Two-axle, four-tire trucks, 1999	
	Registrations (thousands)	*75,356*
	Vehicle miles (million miles)	*901,121*
	Fuel economy (miles per gallon)	*17.1*
Table 7.5	Automobile sales, 1999 sales period	
	Minicompact	*12,903*
	Subcompact	*1,622,483*
	Compact	*2,367,048*
	Midsize	*3,359,492*
	Large	*1,180,739*
	Two-seater	*103,248*
Table 7.7	Light truck share of total light vehicle sales	
	1976	*19.8%*
	1999	*48.1%*
Table 7.6	Light truck sales, 1999 sales period	
	Small pickup	*302,426*
	Large pickup	*2,830,271*
	Small van	*1,319,398*
	Large van	*416,813*
	Small utility	*942,298*
	Large utility	*2,190,549*
Table 7.16	Corporate average fuel economy	(mpg)
	Automobile standard, MY 1999	*27.5*
	Automobile fuel economy, MY 1999	*28.5*
	Light truck standard, MY 1999	*20.7*
	Light truck fuel economy, MY 1999	*21.2*
Table 7.21	Average fuel economy loss from 55 to 70 mph	17.1%

The Federal Highway Administration released revised historical data back to 1985 in their "Highway Statistics Summary to 1995" report. As a result, the data in this table have been revised. The data in this table from 1985–on ***DO NOT*** *include minivans, pickups, or sport utility vehicles.*

Table 7.1
Summary Statistics for Passenger Cars, 1970–99

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[c]	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	1,469,854	69,221	21.2
1997	129,749	1,502,556	69,892	21.5
1998	131,839	1,549,577	71,695	21.4
1999	132,432	1,569,270	73,160	21.6
		Average annual percentage change		
1970–99	1.4%	1.9%	0.3%	1.6%
1989–99	-0.2%	1.1%	-0.1%	1.3%

Source:
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1999*, Washington, DC, 2001, Table VM-1, p. V-74, and annual.
(Additional resources: www.fhwa.dot.gov)

[a] This number differs from R.L. Polk's estimates of "number of automobiles in use." See Table 6.3.
[b] Fuel economy for automobile population.
[c] Beginning in this year the data were revised to exclude minivans, pickups and sport utility vehicles which may have been previously included.

The Federal Highway Administration released revised historical data back to 1985 which better reflected two-axle, four-tire trucks. The definition of this category includes vans, pickup trucks, and sport utility vehicles.

Table 7.2
Summary Statistics for Two-Axle, Four-Tire Trucks, 1970–99

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[a]	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	69,134	816,540	47,354	17.2
1997	70,224	850,739	49,389	17.2
1998	71,330	868,275	50,462	17.2
1999	75,356	901,121	52,771	17.1
		Average annual percentage change		
1970–99	5.9%	7.1%	5.1%	1.9%
1989–99	5.1%	5.3%	4.7%	0.6%

Source:
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1999*, Washington, DC, 2001, Table VM-1, p. V-74, and annual.
(Additional resources: www.fhwa.dot.gov)

[a] Beginning in this year the data were revised to include all vans (including mini-vans), pickups and sport utility vehicles.

Nearly one-quarter of autos sold in 2000 were transplants–autos built in the U.S. by a foreign firm.

Table 7.3
New Retail Automobile Sales in the United States, 1970–2000

Calendar year	Domestic[a] (thousands)	Import[b] (thousands)	Total (thousands)	Percentage imports	Percentage transplants[c] on model year basis	Percentage imports and transplants	Percentage diesel
1970	7,119	1,285	8,404	15.3%	[d]	[d]	[d]
1975	7,053	1,571	8,624	18.2%	[d]	[d]	0.31%
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	7,255	1,271	8,526	14.9%	22.3%	37.2%	0.10%
1997	6,917	1,355	8,272	16.4%	23.7%	40.1%	0.09%
1998	6,762	1,380	8,142	16.9%	25.1%	42.0%	0.13%
1999	6,979	1,719	8,698	19.8%	24.6%	44.4%	0.16%
2000	6,831	2,016	8,847	22.8%	24.4%	47.2%	0.26%
			Average annual percentage change				
1970–2000	-0.1%	1.5%	0.2%				
1990–2000	-0.1%	-1.7%	-0.5%				

Source:
Domestic and import data - 1970–97: American Automobile Manufacturers Association, *Motor Vehicle Facts and Figures 1998*, Detroit, MI, 1998, p. 15, and annual. 1997 data from *Economic Indicators, 4th Quarter 1997*. 1998–2000: Ward's Communication, *Ward's 2000 Motor Vehicle Facts and Figures*, Detroit, MI, 2000, p. 15.
Diesel data - Ward's Communications, *Ward's Automotive Yearbook*, Detroit, MI, 2001, p. 59, and annual.
Transplant data - Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares Data System, Oak Ridge, TN, 1996. (Additional resources: www.aama.com, 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.

In 2000, light trucks, which include pick-ups, minivans, sport-utility vehicles, and other trucks less than 10,000 pounds gross vehicle weight (GVW), accounted for 48.7% of light vehicle sales.

Table 7.4
New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970–2000

Calendar year	Light truck sales[a] (thousands)	Percentages					
		Import[b]	Transplants[c]	Diesel[d]	Four-wheel drive of domestic light trucks[d]	Light trucks of light-duty vehicle sales[e]	Light trucks of total truck sales
1970	1,463	4.5%	[f]	[g]	[f]	14.8%	80.4%
1975	2,281	10.0%	[f]	[g]	23.4%	20.9%	87.9%
1980	2,440	19.7%	0.9%	3.6%	20.7%	21.4%	88.9%
1981	2,189	20.3%	0.0%	3.1%	18.6%	20.4%	89.8%
1982	2,470	16.5%	0.0%	8.5%	16.8%	23.6%	92.8%
1983	2,984	15.6%	0.0%	6.7%	28.5%	24.5%	93.6%
1984	3,863	15.7%	2.0%	4.8%	27.0%	27.1%	93.0%
1985	4,458	17.2%	2.6%	3.8%	29.1%	28.8%	93.6%
1986	4,594	20.1%	2.3%	3.7%	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%	2.3%	32.1%	31.1%	93.2%
1989	4,610	10.9%	2.6%	2.9%	31.4%	31.8%	93.3%
1990	4,548	13.2%	3.4%	3.1%	31.6%	32.8%	93.9%
1991	4,123	12.8%	4.5%	3.2%	34.4%	33.5%	94.5%
1992	4,629	8.6%	5.5%	3.3%	31.6%	36.0%	94.4%
1993	5,351	6.8%	7.1%	3.7%	32.6%	38.6%	94.2%
1994	6,033	6.5%	8.1%	3.9%	34.4%	40.2%	94.0%
1995	6,053	6.5%	7.5%	4.1%	39.1%	41.2%	93.4%
1996	6,519	6.6%	8.4%	3.7%	35.7%	43.3%	94.1%
1997	6,797	8.4%	7.0%	4.8%	39.6%	46.6%	94.1%
1998	7,299	8.9%	7.6%	1.7%	43.8%	47.3%	93.3%
1999	8,073	9.5%	8.7%	5.9%	43.3%	48.1%	92.6%
2000	8,387	9.9%	11.3%	4.8%	41.7%	48.7%	93.9%
		Average annual percentage change					
1970–2000	6.0%						
1990–2000	6.3%						

Source:
Four-wheel drive - 1970–88: Ward's Communications, *Ward's Automotive Yearbook*, Detroit, MI, 1989, p. 168, and annual. 1989–on: Ward's Communications, *Ward's Automotive Yearbook*, Factory Installation Reports, Detroit, MI, 2001, and annual.
Transplants - Oak Ridge National Laboratory, Light-Duty Vehicle MPG and Market Shares System, Oak Ridge, TN, 1996.
All other - 1970–97: American Automobile Manufacturers Association, *Motor Vehicle Facts and Figures 1998*, Detroit, MI, 1998, pp. 8, 15, 24, and annual. 1998–on: Ward's Communications, *Ward's 2000 Motor Vehicle Facts and Figures*, Detroit, MI, p. 24, and annual.
(Additional resources: www.aama.com, 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] Based on model year factory installations. Column was revised.
[e] Light-duty vehicles include automobiles and light trucks.
[f] Data are not available.
[g] Indicates less than 1 percent.

The sales-weighted fuel economy of automobiles increased dramatically from 1976 (17.3 mpg) to 1990 (27.6 mpg), but has remained fairly constant since then.

Table 7.5
Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Automobiles, Selected Sales Periods[a] 1976–2000

Sales Period[a]	1976	1980	1985	1990	1995	2000
MINICOMPACT						
Total sales, units	–	428,346	52,295	76,698	44,752	19,245
Market share, %	–	4.7	0.5	0.8	0.5	0.2
Fuel economy, mpg	–	29.4	32.7	26.4	27.0	25.6
SUBCOMPACT						
Total sales, units	2,625,929	3,441,480	2,382,339	2,030,226	1,518,209	1,789,350
Market share, %	27.1	37.8	21.7	22.0	17.4	19.9
Fuel economy, mpg	23.5	27.3	30.1	31.3	31.7	31.1
COMPACT						
Total sales, units	2,839,603	599,423	3,526,118	3,156,481	3,289,735	2,397,813
Market share, %	29.3	6.6	32.1	34.2	37.7	26.7
Fuel economy, mpg	17.1	22.3	29.6	28.9	30.2	30.4
MIDSIZE						
Total sales, units	1,815,505	3,073,103	3,117,817	2,511,503	2,498,521	3,352,198
Market share, %	18.7	33.8	28.4	27.2	28.6	37.3
Fuel economy, mpg	15.3	21.3	24.9	25.9	25.9	26.8
LARGE						
Total sales, units	2,206,102	1,336,190	1,516,249	1,279,092	1,320,608	1,297,237
Market share, %	22.8	14.7	13.8	13.9	15.1	14.4
Fuel economy, mpg	13.9	19.3	22.3	23.5	24.1	25.3
TWO SEATER						
Total sales, units	199,716	215,964	373,697	170,465	53,045	122,259
Market share, %	2.1	2.4	3.4	1.8	0.6	1.4
Fuel economy, mpg	20.1	21.0	27.6	28.0	24.7	25.8
TOTAL						
Total sales, units	9,686,855	9,094,506	10,968,515	9,224,465	8,724,870	8,978,102
Market share, %	100	100	100	100	100	100
Fuel economy, mpg	17.2	23.2	27.0	27.6	28.0	28.2

Source:
Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2001.
(Additional resources: www-cta.ornl.gov)

[a] Sales period is October 1 of the current year through September 30 of the next year. These figures represent only those sales that could be matched to corresponding EPA fuel economy values.

Light truck sales have more than tripled from 1976 to 2000. Similar to the automobile trend, the sales-weighted fuel economy of light trucks increased during the late '70's and '80's, but has remained fairly constant in the '90's.

Table 7.6
Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Selected Sales Periods[a] 1976–2000

Sales Period[a]	1976	1980	1985	1990	1995	2000
SMALL PICKUP						
Total sales, units	170,351	516,412	863,584	1,135,727	1,067,764	1,071,730
Market share, %	7.1	23.3	20.4	25.2	18.0	12.9
Fuel economy, mpg	23.9	25.5	26.8	24.5	24.4	22.0
LARGE PICKUP						
Total sales, units	1,586,020	1,115,248	1,690,931	1,116,490	1,472,885	1,968,710
Market share, %	65.8	50.3	39.9	24.7	24.8	23.7
Fuel economy, mpg	15.1	17.0	19.0	17.5	17.8	18.7
SMALL VAN						
Total sales, units	18,651	13,649	437,660	1,012,141	1,330,586	1,272,070
Market share, %	0.8	0.6	10.3	22.4	22.4	15.3
Fuel economy, mpg	19.5	19.6	23.9	22.3	22.4	23.0
LARGE VAN						
Total sales, units	574,745	328,065	536,242	319,429	327,586	368,820
Market share, %	23.9	14.8	12.7	7.1	5.5	4.4
Fuel economy, mpg	15.4	16.3	16.4	17.1	17.2	18.2
SMALL SUV						
Total sales, units	0	51,684	441,966	402,354	509,737	756,142
Market share, %	0.0%	2.3	10.4	8.9	8.6	9.1
Fuel economy, mpg		17.7	22.1	22.5	22.0	23.8
MEDIUM SUV						
Total sales, units	50,763	151,929	187,447	434,491	1,076,686	2,167,329
Market share, %	2.1	6.9	4.4	9.6	18.1	26.1
Fuel economy, mpg	15.1	14.9	17.2	19.7	19.2	20.4
LARGE SUV						
Total sales, units	9,228	39,550	77,535	93,993	148,622	702,152
Market share, %	0.4	1.8	1.8	2.1	2.5	8.5
Fuel economy, mpg	14.2	13.7	17.1	16.5	16.1	17.5
TOTAL						
Total sales, units	2,409,758	2,216,537	4,235,365	4,514,625	5,933,866	8,306,953
Market share, %	100	100	100	100	100	100
Fuel economy, mpg	15.6	18.1	20.4	20.5	20.2	20.4

Source:
Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2001.
(Additional resources: www-cta.ornl.gov)

Note:
Revised definitions of light trucks are based on vehicle **curb weight** as follows:
Small pickup= <3,500 lbs. Large pickup=3,500-8,500 lbs.
Small van = <4,500 lbs. Large van=4,500-8,500 lbs
Small utility= <,3500 lbs. Medium utility=3,500-4,799 lbs. Large utility=4,800-8,500 lbs.

[a] Sales period is October 1 of the current year through September 30 of the next year. These figures represent only those sales that could be matched to corresponding EPA fuel economy values.

Back in 1976 only 20% of new light vehicle sales were light trucks. Because of the boom in sales of minivans, sport utility vehicles, and pick-up trucks, today almost half of light vehicle sales are light trucks.

Table 7.7
Light Vehicle Market Shares by Size Class, Sales Periods[a] 1976–2000

Sales period[a]	1976	1980	1985	1990	1995	2000
Minicompact	0.0%	3.8%	0.3%	0.6%	0.3%	0.1%
Subcompact	21.7%	30.4%	15.7%	14.8%	10.4%	10.4%
Compact	23.5%	5.3%	23.2%	23.0%	22.4%	13.9%
Midsize	15.0%	27.2%	20.5%	18.3%	17.0%	19.4%
Large	18.2%	11.8%	10.0%	9.3%	9.0%	7.5%
Two seater	1.7%	1.9%	2.5%	1.2%	0.4%	0.7%
Small pickup	1.4%	4.6%	5.7%	8.3%	7.3%	6.2%
Large pickup	13.1%	9.9%	11.1%	8.1%	10.0%	11.4%
Small van	0.2%	0.1%	2.9%	7.4%	8.6%	7.4%
Large van	4.8%	2.9%	3.5%	2.3%	9.1%	2.1%
Small utility	0.0%	0.5%	2.9%	2.9%	3.5%	4.4%
Medium utility	0.4%	1.3%	1.2%	3.2%	7.3%	12.5%
Large utility	0.1%	0.3%	0.5%	0.7%	1.0%	4.1%
Total light vehicles sold	12,096,613	11,311,043	15,203,880	13,739,090	14,658,736	17,285,055
Cars	80.1%	80.4%	72.1%	67.1%	59.5%	51.9%
Light trucks	19.9%	19.6%	27.9%	32.9%	40.5%	48.1%

Source:
Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2001.
(Additional resources: www-cta.ornl.gov)

[a] Sales period is October 1 of the current year through September 30 of the next year.

The compact, midsize, and large automobile sales-weighted engine sizes declined dramatically in the late '70's and early '80's.

Table 7.8
Sales-Weighted Engine Size of New Domestic and Import Automobiles by Size Class, Sales Periods[a] 1976–2000
(liters[b])

Sales period[a]	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
1976	[c]	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
1998	3.15	2.29	2.17	2.94	3.98	3.51	2.75
1999	2.86	2.31	2.25	2.91	3.91	3.62	2.76
2000	2.55	2.30	2.23	2.85	3.88	3.45	2.73
			Average annual percentage change				
1976–2000	1.1%[d]	-0.6%	-3.3%	-3.0%	-2.3%	0.7%	-2.4%
1990–2000	0.5%	1.6%	-0.1%	-0.9%	-1.1%	3.0%	0.0%

Source:
Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2001.
(Additional resources: www-cta.ornl.gov)

[a] Sales period is October 1 of the current year through September 30 of the next year.
[b] 1 liter = 61.02. cubic inches.
[c] There were no minicompact automobiles sold in 1976.
[d] Average annual percentage change begins with 1977.

Table 7.9
Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class
Sales Periods[a] 1976–2000
(liters[b])

Sales period[a]	Small pickup	Large pickup	Small van	Large van	Small utility	Medium utility	Large utility	Fleet
1976	1.92	4.41	1.97	4.27	0.00	4.21	5.74	4.18
1977	1.95	4.41	1.97	4.37	0.00	4.21	5.74	4.11
1978	1.96	4.39	1.97	4.25	3.80	4.48	5.74	4.09
1979	2.00	5.15	1.97	4.24	4.23	4.67	5.74	4.41
1980	1.99	4.41	1.97	4.85	2.47	4.51	5.74	3.88
1981	2.08	4.16	1.97	4.34	2.47	4.55	5.00	3.67
1982	2.06	4.02	1.59	4.33	2.47	4.54	5.00	3.55
1983	2.04	4.05	1.59	4.32	2.28	4.84	5.59	3.37
1984	2.05	4.17	2.13	4.33	2.33	4.14	5.65	3.40
1985	2.09	4.02	2.22	4.43	2.60	4.44	4.96	3.38
1986	2.13	3.79	2.29	4.41	2.28	4.33	4.95	3.12
1987	2.17	3.71	2.29	4.46	2.39	3.83	4.95	3.07
1988	2.56	4.68	3.15	5.21	3.23	4.19	5.55	3.82
1989	2.64	4.70	3.11	5.22	3.77	3.77	5.58	3.93
1990	2.90	5.14	3.43	5.24	3.68	3.55	5.56	3.93
1991	2.93	5.22	3.36	5.26	3.60	3.85	5.46	3.92
1992	3.09	5.15	3.43	5.31	3.62	3.94	5.45	4.00
1993	3.15	5.15	3.41	5.24	3.60	4.06	5.58	4.02
1994	3.05	5.26	3.58	5.37	3.53	4.01	5.54	4.10
1995	2.99	5.13	3.50	5.16	3.56	4.04	5.41	4.06
1996	2.93	5.17	3.51	5.25	3.43	4.29	5.35	4.12
1997	3.00	5.05	3.47	5.04	2.75	3.96	5.33	4.09
1998	2.89	5.01	3.45	4.99	2.84	4.15	5.39	4.16
1999	3.36	5.02	3.48	5.05	2.87	4.12	5.46	4.19
2000	3.42	4.94	3.43	5.00	2.78	4.03	5.21	4.11
				Average annual percentage change				
1976–2000	2.4%	0.5%	2.3%	-0.7%	[c]	-0.2%	-0.4%	-0.1%
1990–2000	1.7%	-0.4%	0.0%	-0.5%	-2.8%	1.3%	-0.6%	0.4%

Source:
Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2001. (Additional resources: www-cta.ornl.gov)
Note:
Revised definitions of light trucks are based on vehicle **curb weight** as follows:
Small pickup= <3,500 lbs. Large pickup=3,500-8,500 lbs.
Small van = <4,500 lbs. Large van=4,500-8,500 lbs.
Small utility= <3,500 lbs. Medium utility=3,500-4,799 lbs. Large utility=4,800-8,500 lbs.

[a] Sales period is October 1 of the current year through September 30 of the next year.
[b] 1 liter = 61.02 cubic inches.
[c] Data are not available.

The sales-weighted curb weight of new automobiles has gone up for each size class from 1989 to 2000.

Table 7.10
Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class, Sales Periods[a] 1976–2000
(pounds)

Sales period[a]	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
1976	[b]	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
1998	3,004	2,584	2,703	3,198	3,675	2,956	3,002
1999	2,835	2,626	2,755	3,198	3,689	3,007	3,034
2000	2,906	2,635	2,800	3,215	3,680	2,943	3,052
			Average annual percentage change				
1976–2000	1.2%[c]	0.1%	-1.1%	-1.0%	-0.9%	0.5%	-0.7%
1990–2000	0.9%	1.1%	0.6%	0.5%	0.2%	1.0%	0.8%

Source:
Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2001.
(Additional resources: www-cta.ornl.gov)

[a] Sales period is October 1 of the current year through September 30 of the next year.
[b] There were no minicompact automobiles sold in 1976.
[c] Average annual percentage change begins with 1977.

The sales-weighted interior space has not changed much for midsize and large automobiles over the last two decades, but has increased for subcompact autos.

Table 7.11
Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class, Sales Periods[a] 1976–2000
(cubic feet)

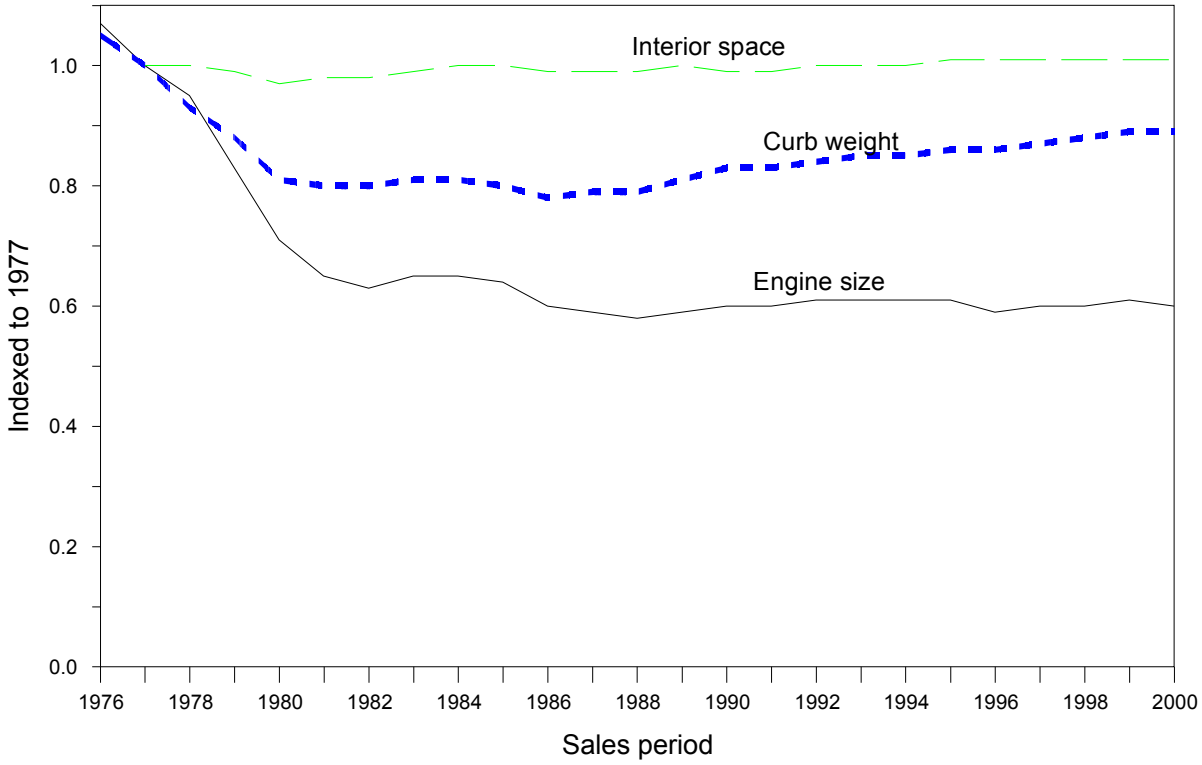
Sales period[a]	Minicompact (< 85)	Subcompact (85–99)	Compact (100–109)	Midsize (110–119)	Large (> 120)	Fleet[b]
1977	78.8	89.8	107.1	113.0	128.0	107.9
1978	79.4	89.8	105.3	112.9	128.5	107.9
1979	80.0	90.2	105.8	113.4	130.1	106.9
1980	82.4	89.9	105.4	113.5	130.8	104.9
1981	83.3	90.2	103.6	113.7	130.6	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
1998	66.9	97.0	102.2	114.4	127.7	109.2
1999	76.3	96.7	103.3	114.1	127.1	109.5
2000	76.3	96.6	103.1	114.2	126.4	109.3
			Average annual percentage change			
1977–2000	-0.1%	0.3%	-0.2%	0.0%	-0.1%	0.1%
1990–2000	-0.5%	0.3%	0.0%	0.0%	-0.1%	0.2%

Source:
Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2001. (Additional resources: www-cta.ornl.gov)

[a] Sales period is October 1 of the current year through September 30 of the next year.
[b] Interior volumes of two-seaters are not reported to EPA.

The sales-weighted curb weight for new automobiles declined in the late 1970s and early 1980s, but has been slowly rising since then. The sales-weighted interior space for new automobiles has not changed much over the last 25 years.

Figure 7.1. Engine Size, Curb Weight, and Interior Space of New Domestic and Import Automobiles, 1976–2000



Source: See Tables 7.8, 7.10, and 7.11.

The sales-weighted wheelbase of new automobiles and light trucks (combined) has been rising since the late 1980s.

Table 7.12
Sales-Weighted Wheelbase of New Automobiles and Light Trucks, Sales Periods[a] 1976–2000
(inches)

Sales period[a]	Automobiles	Light trucks	Automobiles and light trucks combined
1976	110.78	118.87	112.03
1977	109.75	117.79	111.05
1978	107.67	116.23	108.65
1979	105.77	116.27	107.93
1980	103.61	114.54	105.76
1981	102.97	114.86	105.10
1982	103.01	114.87	105.60
1983	103.76	113.73	106.10
1984	103.50	113.87	106.21
1985	102.96	113.98	106.02
1986	102.27	113.40	105.48
1987	102.11	113.27	105.52
1988	102.21	111.79	105.21
1989	102.66	112.23	105.71
1990	103.13	111.41	105.85
1991	103.27	111.09	105.82
1992	103.60	112.68	106.78
1993	104.03	112.57	107.21
1994	104.31	113.23	107.75
1995	104.95	113.37	108.31
1996	105.04	113.36	108.53
1997	105.36	113.36	108.89
1998	105.55	114.53	109.76
1999	105.77	114.70	110.06
2000	105.89	114.05	109.81
	Average annual percentage change		
1976–2000	-0.2%	-0.2%	-0.1%
1990–2000	0.3%	0.2%	0.4%

Source:
Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2001.
(Additional resources: www-cta.ornl.gov)

[a] Sales period is October 1 of the current year through September 30 of the next year.

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 2001 with a 40.8% share of total materials. As conventional steel use has been decreasing, use of high-strength steel has increased.

Table 7.13
Average Material Consumption for a Domestic Automobile, 1978, 1985, and 2001

	1978		1985		2001	
Material	Pounds	Percentage	Pounds	Percentage	Pounds	Percentage
Conventional steel[a]	1,880.0	53.8%	1,481.5	46.5%	1,349.0	40.8%
High-strength steel	127.5	3.6%	217.5	6.8%	351.5	10.6%
Stainless steel	25.0	0.7%	29.0	0.9%	54.5	1.6%
Other steels	56.0	1.6%	54.5	1.7%	25.5	0.8%
Iron	503.0	14.4%	468.0	14.7%	345.0	10.4%
Aluminum	112.0	3.2%	138.0	4.3%	256.5	7.8%
Rubber	141.5	4.1%	136.0	4.3%	145.5	4.4%
Plastics/composites	176.0	5.0%	211.5	6.6%	253.0	7.6%
Glass	88.0	2.5%	85.0	2.7%	98.5	3.0%
Copper	39.5	1.1%	44.0	1.4%	46.0	1.4%
Zinc die castings	28.0	0.8%	18.0	0.5%	11.0	0.3%
Powder metal parts	16.0	0.5%	19.0	0.6%	37.5	1.1%
Fluids & lubricants	189.0	5.4%	184.0	5.8%	196.0	5.9%
Other materials	112.5	3.2%	101.5	3.2%	139.5	4.2%
Total	3,494.0	100.0%	3,187.5	100.0%	3,309.0	100.0%

Source:
American Metal Market, www.amm.com/ref/carmat98.htm, New York, NY, 2000.
(Additional resources: www.amm.com)

[a] Includes cold-rolled and pre-coated steel.

The number of franchised dealerships which sell new light-duty vehicles (cars and light trucks) has declined 27% since 1970, though new vehicle sales have increased. The average number of vehicles sold per dealer in 1999 was 749 vehicles per dealer – more than double the 1970 number.

Table 7.14
New Light Vehicle Dealerships and Sales, 1970–99

Calendar year	Number of franchised new light vehicle dealerships[a]	New light vehicle sales (thousands)	Light vehicle sales per dealer
1970	30,800	9,867	320
1971	30,300	12,006	396
1972	30,100	13,189	438
1973	30,100	14,184	471
1974	30,000	11,191	373
1975	29,600	10,905	368
1976	29,300	13,066	446
1977	29,100	14,613	502
1978	29,000	15,122	521
1979	28,500	13,984	491
1980	27,900	11,419	409
1981	26,350	10,725	407
1982	25,700	10,452	407
1983	24,725	12,166	492
1984	24,725	14,254	577
1985	24,725	15,501	627
1986	24,825	16,047	646
1987	25,150	14,888	592
1988	25,025	15,426	616
1989	25,000	14,508	580
1990	24,825	13,849	558
1991	24,200	12,298	508
1992	23,500	12,842	546
1993	22,950	13,869	604
1994	22,850	15,023	657
1995	22,800	14,688	644
1996	22,750	15,046	661
1997	22,700	15,069	664
1998	22,600	15,441	683
1999	22,400	16,771	749
	Average annual percentage change		
1970–99	-1.1%	1.8%	3.0%
1989–99	-1.1%	1.5%	2.6%

Source:
Number of dealers - National Automobile Dealers Association, *Automotive Executive Magazine*, 2001. (Additional resources: www.nada.org)
Light-duty vehicle sales - See tables 7.3 and 7.4.

[a]As of the beginning of the year.

The number of conventional refueling stations is declining while the number of vehicles fueling at those stations continues to rise. In 1999, there were 0.58 fueling stations per thousand vehicles. Data for alternative fuels in 2000 indicate that there was an average of 12 stations per thousand alternative fuel vehicles.

Table 7.15
Conventional and Alternative Fuel Refueling Stations

Calendar year	Refueling stations[a]	Vehicles in operation (thousands)	Stations per thousand vehicles
	Conventional fuels		
1997	126,889	201,071	0.63
1998	123,894	205,043	0.60
1999	121,095	209,509	0.58
	Alternative fuels, 2000[b]		
LPG	3,268	268	12.19
CNG	1,217	101	12.05
Electricity	558	9	62.00
M85/M100	3	18	0.17
LNG	44	2	22.00
E85/E95	113	35	3.23
Total	5,203	432	12.02

Source:
Refueling stations - Conventional: U.S. Department of Commerce, Bureau of the Census, County Business Patterns for the United States, www.census.gov/epcd/cbp/view/cbpview.html and electronic communication with the County Business Pattern Office, 1998. Alternative Fuel: Alternative Fuels Data Center, www.afdc.doe.gov.
Vehicles - Conventional: The Polk Company, Detroit, MI. FURTHER REPRODUCTION PROHIBITED. Alternative Fuel: Alternative Fuels Data Center, www.afdc.doe.gov.
Note:
The Census Bureau changed in 1998 to use the North American Industry Classification System (NAICS) instead of the Standard Industrial Classification (SIC) System. The NAICS to SIC mapover for gasoline stations is not a one-to-one match. Therefore, data before 1997 are not available.

[a] Includes all convenience stores/refueling stations and truck stops which sell fuel.
[b] Additional data on alternative fuel vehicles and refueling stations are in Chapter 9.

The Corporate Average Fuel Economy standards were established by the U.S. Energy Policy and Conservation Act of 1975 (PL94-163). These standards must be met at the manufacturer level. Though the averages shown here indicate the standards were met in most years, some manufacturers fell short of meeting the standards while others exceeded them.

Table 7.16
Automobile Corporate Average Fuel Economy (CAFE)
Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2000[a]
(miles per gallon)

Model year[b]	Automobiles				CAFE estimates
	CAFE standards	CAFE estimates[c]			Autos and light trucks combined
		Domestic	Import	Combined	
1978	18.0	18.7	27.3	19.9	19.9
1979	19.0	19.3	26.1	20.3	20.1
1980	20.0	22.6	29.6	24.3	23.1
1981	22.0	24.2	31.5	25.9	24.6
1982	24.0	25.0	31.1	26.6	25.1
1983	26.0	24.4	32.4	26.4	24.8
1984	27.0	25.5	32.0	26.9	25.0
1985	27.5	26.3	31.5	27.6	25.4
1986	26.0	26.9	31.6	28.2	25.9
1987	26.0	27.0	31.2	28.4	26.2
1988	26.0	27.4	31.5	28.0	26.0
1989	26.5	27.2	30.8	28.4	25.6
1990	27.5	26.9	29.9	27.9	25.4
1991	27.5	27.3	30.1	28.4	25.6
1992	27.5	27.0	29.2	27.9	25.1
1993	27.5	27.8	29.6	28.4	25.2
1994	27.5	27.5	29.7	28.3	24.7
1995	27.5	27.7	30.3	28.6	24.9
1996	27.5	28.1	29.6	28.5	24.9
1997	27.5	27.8	30.1	28.7	24.6
1998	27.5	28.6	29.2	28.8	24.7
1999	27.5	28.0	29.0	28.3	24.5
2000	27.5	28.5	28.3	28.5	24.7

Source:
U.S. Department of Transportation, NHTSA, "Summary of Fuel Economy Performance," Washington, DC, March 2001.
(Additional resources: www.nhtsa.dot.gov)

[a]Only vehicles with at least 75 percent domestic content can be counted in the average domestic fuel economy for a manufacturer.
[b]Model year as determined by the manufacturer on a vehicle by vehicle basis.
[c]All CAFE calculations are sales-weighted.

The Corporate Average Fuel Economy standards for light trucks are lower than the automobile standards. Light trucks include pickups, minivans, sport utility vehicles and vans.

Table 7.17
Light Truck Corporate Average Fuel Economy (CAFE)
Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2000[a]
(miles per gallon)

Model year[b]	Light trucks[c]				CAFE estimates
	CAFE standards	CAFE estimates[d]			Autos and light trucks combined
		Domestic	Import	Combined	
1978	[e]	[f]	[f]	[g]	19.9
1979	[e]	17.7	20.8	18.2	20.1
1980	[e]	16.8	24.3	18.5	23.1
1981	[e]	18.3	27.4	20.1	24.6
1982	17.5	19.2	27.0	20.5	25.1
1983	19.0	19.6	27.1	20.7	24.8
1984	20.0	19.3	26.7	20.6	25.0
1985	19.5	19.6	26.5	20.7	25.4
1986	20.0	20.0	25.9	21.5	25.9
1987	20.5	20.5	25.2	21.7	26.2
1988	20.5	20.6	24.6	21.3	26.0
1989	20.5	20.4	23.5	21.0	25.6
1990	20.0	20.3	23.0	20.8	25.4
1991	20.2	20.9	23.0	21.3	25.6
1992	20.2	20.5	22.7	20.8	25.1
1993	20.4	20.7	22.8	21.0	25.2
1994	20.5	20.5	22.0	20.8	24.7
1995	20.6	20.3	21.5	20.5	24.9
1996	20.7	20.5	22.1	20.8	24.9
1997	20.7	20.1	22.1	20.6	24.6
1998	20.7	20.4	23.0	21.1	24.7
1999	20.7	[f]	[f]	20.9	24.5
2000	20.7	[f]	[f]	21.2	24.7

Source:
U.S. Department of Transportation, NHTSA, "Summary of Fuel Economy Performance," Washington, DC, March 2001. (Additional resources: www.nhtsa.dot.gov)

[a]Only vehicles with at least 75 percent domestic content can be counted in the average domestic fuel economy for a manufacturer.
[b]Model year as determined by the manufacturer on a vehicle by vehicle basis.
[c]Represents 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.
[d]All CAFE calculations are sales-weighted.
[e]Standards were set for two-wheel drive and four-wheel drive light trucks separately, but no combined standard was set in this year.
[f]Data are not available.

Table 7.18
Corporate Average Fuel Economy (CAFE) Fines Collected, 1983–99[a]
(thousands)

Model year	Current dollars	1999 constant dollars[b]
1983	58	97
1984	5,958	9,557
1985	15,565	24,106
1986	29,872	45,390
1987	31,261	45,826
1988	44,519	62,701
1989	47,381	63,677
1990	48,449	61,768
1991	42,243	51,665
1992	38,287	45,456
1993	28,688	33,084
1994	31,478	35,377
1995	40,788	44,576
1996	19,302	20,497
1997	36,211	37,582
1998	23,354	23,866
1999	27,465	27,465

Source:
U.S. Department of Transportation, National Highway Traffic Safety Administration, Office of Vehicle Safety Compliance, Washington, DC, March, 2001.
(Additional resources: www.nhtsa.dot.gov)

Table 7.19
Tax Receipts from the Sale of Gas Guzzlers, 1980–99
(thousands)

Fiscal year	Current dollars	1999 constant dollars[b]
1980	740	1,496
1981	780	1,429
1982	1,720	2,969
1983	4,020	6,722
1984	8,820	14,147
1985	39,790	61,624
1986	147,660	224,368
1987	145,900	231,878
1988	116,780	164,474
1989	109,640	147,348
1990	103,200	131,571
1991	118,400	144,808
1992	144,200	171,201
1993	111,600	128,700
1994	64,100	72,040
1995	73,500	80,325
1996	52,600	55,857
1997	48,200	50,025
1998	47,700	48,745
1999	68,300	68,300

Source:
Internal Revenue Service, Statistics of Income Bulletin, Summer 2000, Washington, DC, 2000. (Additional resources: www.irs.gov/tax_stats).

[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.

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. The tax has not changed since 1991. This tax does not apply to light trucks such as pickups, minivans, sport utility vehicles, and vans.

Table 7.20
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: www.irs.ustreas.gov)

Fuel Economy 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 7.21
Vehicle Specifications for Tested Vehicles

Vehicle	Curb weight	Engine	Fuel delivery system[a]	Trans-mission	EPA fuel economy	
					City	Highwayy
1988 Chevrolet Corsica	2,665	2.8 liter	PFI	M5	19	29
1994 Olds Cutlass Supreme	3,290	3.4 liter	PFI	L4	17	26
1994 Oldsmobile 88	3,433	3.8	PFI	L4	19	29
1994 Mercury Villager	4,020	3.0 liter	PFI	L4	17	23
1995 Geo Prizm	2,359	1.6 liter I-	PFI	L3	26	30
1994 Jeep Grand Cherokee	3,820	4.0 liter I-	PFI	L4	15	20
1994 Chevrolet Pickup	4,020	5.7 liter	TBI	L4	14	18
1993 Subaru Legacy	2,800	2.2 liter	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.

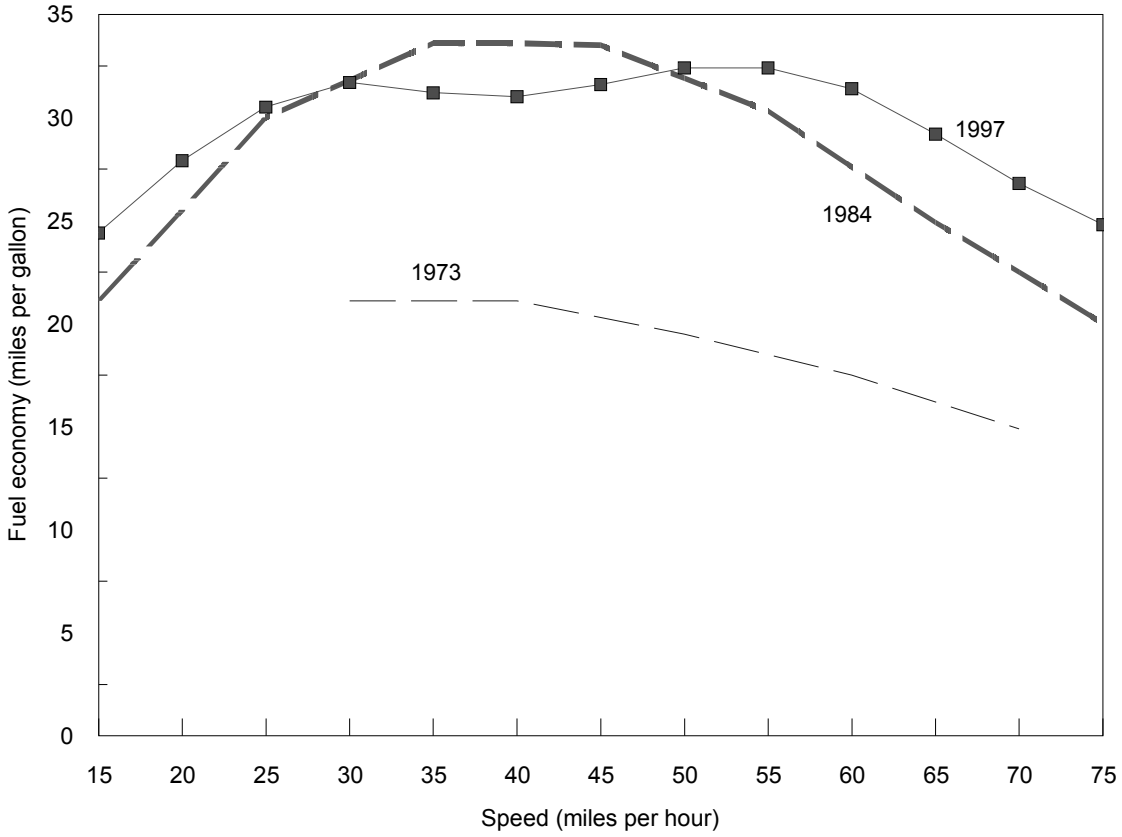
Table 7.22
Fuel Economy by Speed, 1973, 1984, and 1997
(miles per gallon)

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
		Fuel economy loss	
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: www.fhwa-tsis.com)

[a]Model years 1970 and earlier automobiles.
[b]Model years 1981–84 automobiles and light trucks.
[c]Model years 1988–97 automobiles and light trucks.
[d]Data are not available.

Figure 7.2. Fuel Economy by Speed, 1973, 1984, and 1997



Source: See Table 7.21.

Of the tested vehicles, the 1994 Oldsmobile Olds 88 had the greatest fuel economy loss from 55 mph to 75 mpg. The 1997 Toyota Celica tested fuel economy was slightly better at 65 mph than at 55 mph.

Table 7.23
Steady Speed Fuel Economy for Tested Vehicles
(miles per gallon)

Speed (mph)	1988 Chevrolet Corsica	1993 Subaru Legacy	1994 Oldsmobile Olds 88	1994 Oldsmobile Cutlass	1994 Chevrolet Pickup	1994 Jeep Grand Cherokee	1994 Mercury Villager	1995 Geo Prizm	1997 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
				Fuel economy loss					
55–65	1.4%	11.4	13.3%	14.1%	13.1%	11.3%	20.2%	9.5%	-2.4%
65–75	17.4%	13.8	20.0%	13.6%	17.0%	10.3%	11.5%	17.0	15.4%
55–75	18.6%	23.6	30.6%	25.8%	27.9%	20.4%	29.3%	24.9	13.4%

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: www.fhwa-tsis.com)

Note:
For specifications of the tested vehicles, please see Table 7.21.

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 7.3. Urban Driving Cycle

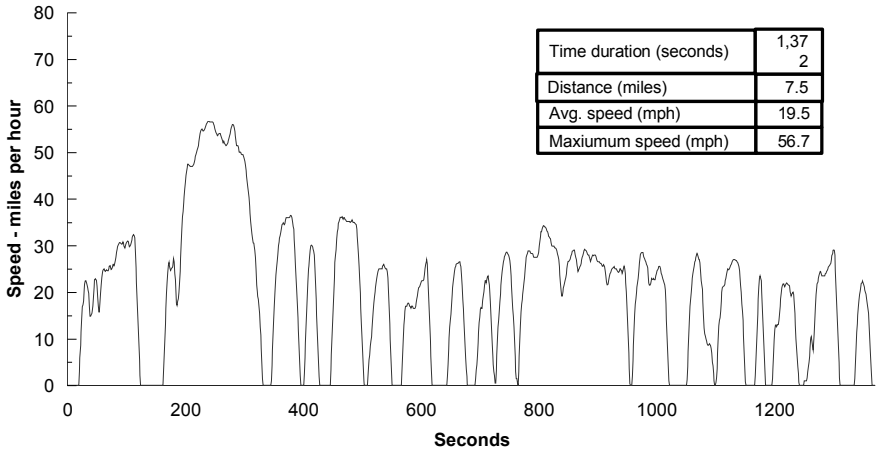
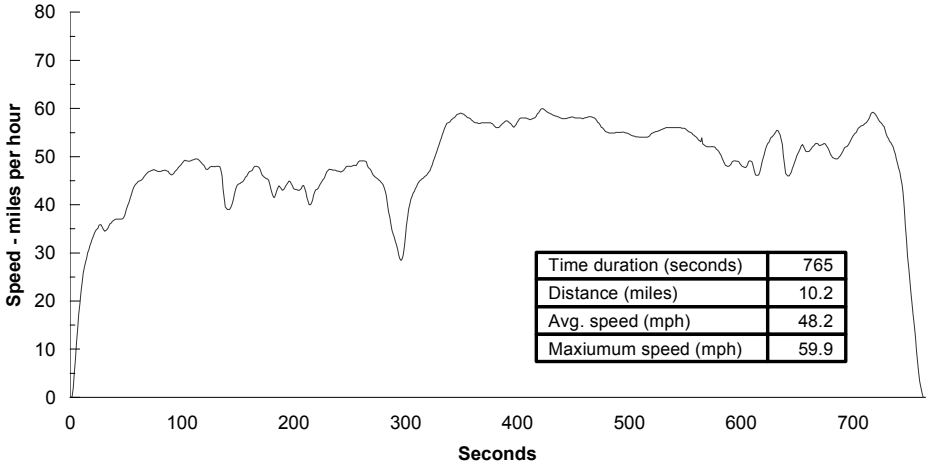


Figure 7.4. Highway Driving Cycle



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 7.5. New York City Driving Cycle

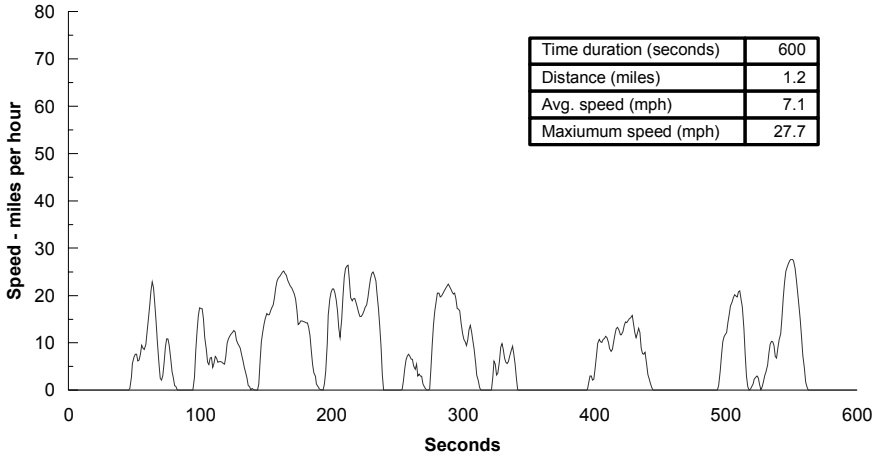
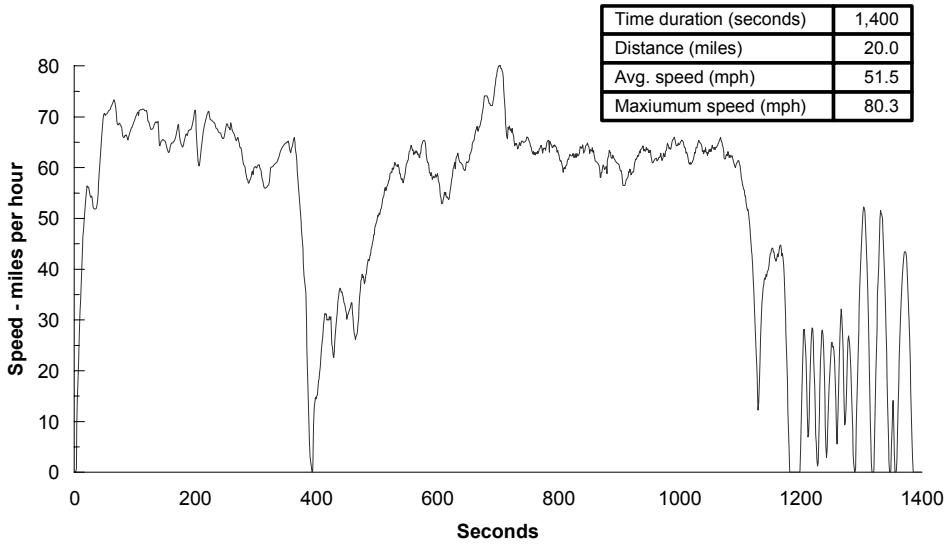


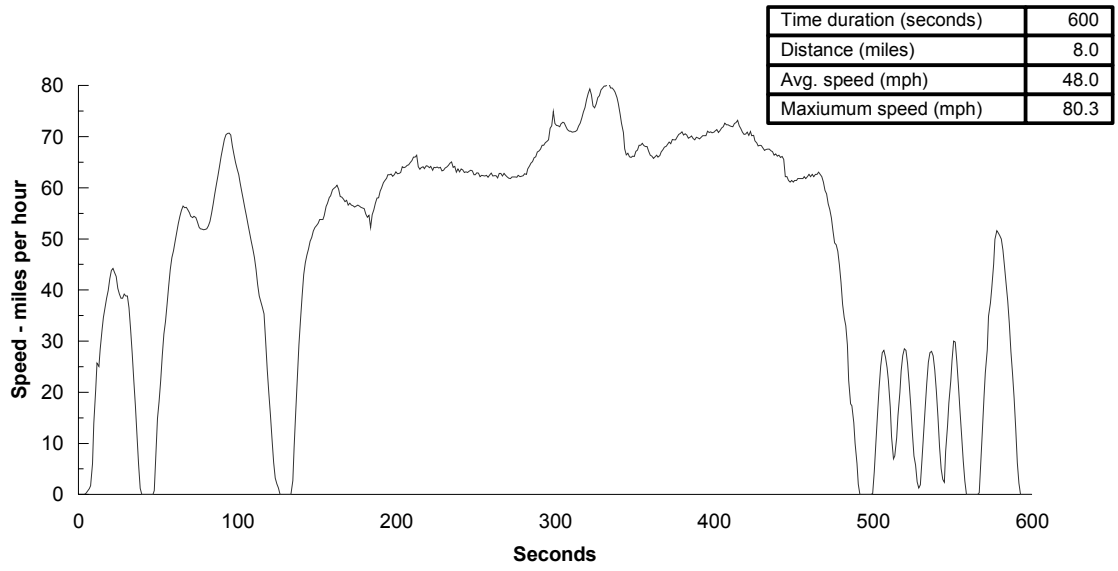
Figure 7.6. Representative Number Five Driving Cycle



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

The US06 driving cycle was developed as a supplement to the Federal Test Procedure. It is a short-duration cycle (600 seconds) which represents hard-acceleration driving.

Figure 7.7. US06 Driving Cycle



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

When comparing data between countries, one must realize that different countries have different testing cycles to determine fuel economy and emissions. This table compares various statistics on the European, Japanese, and U.S. testing cycles [for fuel economy measurements, the U.S. uses the formula, 1/fuel economy = (0.55/urban[a] fuel economy) + (0.45/highway fuel economy)]. Most vehicles will achieve higher fuel economy on the U.S. test cycle than on the European or Japanese cycles.

Table 7.24
Comparison of U.S., European, and Japanese Emission Testing Cycles

Cycle	U.S. urban[a]	U.S. highway	European NEDC[b]	Japan 10.15
Type of driving	urban	highway	mixed	urban
Start condition	cold	hot	cold	hot
Time, seconds	1372	765	1180	680
Distance, miles	7.45	10.2	6.84	2.59
Maximum acceleration, g	0.164	0.146	0.109	0.082
Maximum speed, mph	56.7	59.9	74.6	43.5
Average speed, mph	19.5	48.2	20.9	14.1
Maximum power, kW[c]	31.7	25.9	33.3	18.9
Average power, kW[c]	5.1	9.0	4.8	3.8

Source:
Kenney, T.E., "Partitioning Emissions Tasks Across Engine and Aftertreatment Systems," SAE Paper 1999-01-3475, 1999.

[a] The actual Federal Procedure (FTP), which is also the test for emissions certification, repeats the first 505 seconds of the Federal Urban Driving Simulation cycle, hot started, after a 10 minute hot soak. Starting with Model Year 2001, the emissions test–but not the fuel economy test–incorporates a supplemental cycle that simulates aggressive urban driving, coupled with an added air conditioning load.

[b] New European Driving Cycle.

[c] Simulated Ford Contour (3000 lb., 0.33 Cd, manual transmission, 0.0073 rolling resistance coefficient).

Total traffic fatalities were lower in 1999 than in 1975. Fourteen percent of traffic fatalities in 1999 were not vehicle occupants (pedestrians, cyclists, etc.).

Table 7.25
Occupant Fatalities by Vehicle Type and Nonoccupant Fatalities, 1975–99

	1975	1980	1985	1990	1995	1998	1999	1999 share
Vehicle occupant fatalities by vehicle type								
Passenger car								
Subcompact	3,834	7,299	7,993	8,309	6,791	5,510	4,930	11.8%
Compact	614	927	2,635	5,310	6,899	7,002	6,967	16.7%
Intermediate	1,869	3,878	4,391	4,849	4,666	4,788	4,743	11.4%
Full	10,800	11,580	6,586	4,635	3,413	3,388	2,908	7.0%
Unknown	8,812	3,765	1,607	989	654	476	1,270	3.1%
Total	**25,929**	**27,449**	**23,212**	**24,092**	**22,423**	**21,164**	**20,818**	**50.0%**
Truck								
Light	4,856	7,486	6.689	8,601	9,568	10,647	11,243	27.0%
Large	961	1,262	977	705	648	728	758	1.8%
Total	**5,817**	**8,748**	**7,666**	**9,306**	**10,216**	**11,375**	**12,001**	**28.8%**
Other Vehicles								
Motorcycle	3,189	5,144	4,564	3,244	2,227	2,284	2,472	5.9%
Bus	53	46	57	32	33	36	58	0.1%
Other/unknown vehicle type	937	540	544	460	392	500	457	1.1%
Total	**4,179**	**5,730**	**5,165**	**3,736**	**2,652**	**2,820**	**2,987**	**7.2%**
TOTAL vehicle occupant fatalities	**35,925**	**41,927**	**36,043**	**37,134**	**35,291**	**35,369**	**35,806**	**86.0%**
Nonoccupant fatalities								
Pedestrian	7,516	8,070	6,808	6,482	5,584	5,220	4,906	11.8%
Pedalcyclist	1,003	965	890	859	833	761	750	1.8%
Other	81	129	84	124	109	131	149	0.4%
Total	**8,600**	**9,164**	**7,782**	**7,465**	**6,526**	**6,112**	**5,805**	**14.0%**
TOTAL traffic fatalities	**44,525**	**51,091**	**43,825**	**44,599**	**41,817**	**41,501**	**41,611**	**100.0%**

Source:
Traffic Safety Facts 1999, Washington, DC, December 2000, p. 18. (Additional resources: www.nhtsa.dot.gov)

In 1999, the fatality rate for vehicle occupants per 100 million vehicle miles are surprisingly similar for passenger cars and light trucks—1.3 and 1.2 fatalities per 100 million vehicle miles, respectively. However, the injury rate per 100 million vehicle miles is much lower for light trucks (94) than for passenger cars (136).

Table 7.26
Light Vehicle Occupant Safety Data, 1975–99

	1975	1980	1985	1990	1995	1998	1999
	Passenger cars						
Fatalities	25,929	27,449	23,212	24,092	22,423	21,194	20,818
Injuries (thousands)	[a]	[a]	[a]	2,376	2,469	2,201	2,138
Vehicle-miles (billions)[b]	1,030	1,107	1,249	1,427	1,478	1,556	1,567
Rates per 100 million vehicle miles							
Fatalities	2.5	2.5	1.9	1.7	1.5	1.4	1.3
Injuries	[a]	[a]	[a]	167	167	141	136
	Light trucks (10,000 lbs. or less)						
Fatalities	4,856	7,486	6,689	8,601	9,568	10,705	11,243
Injuries (thousands)	[a]	[a]	[a]	505	722	763	847
Vehicle-miles (billions)[b]	204	295	389	556	750	862	903
Rates per 100 million vehicle-miles							
Fatalities	2.4	2.5	1.7	1.5	1.3	1.2	1.2
Injuries	[a]	[a]	[a]	91	96	88	94

Source:
U.S. DOT, National Highway Traffic Safety Administration, *Traffic Safety Facts 1999*, Washington, DC, December 2000, pp. 22, 24.
(Additional resources: www.nhtsa.dot.gov)

[a]Data are not available.
[b]Vehicle-miles are estimated by the National Highway Traffic Safety Administration and do not match Federal Highway data.

In 1999, nearly 40% of all passenger car and light truck fatal crashes were single-vehicle crashes. Because there are so many passenger cars on the roads compared to the other vehicle types, total passenger car crashes are half of total crashes. Most crashes are multiple-vehicle crashes with property damage only.

Table 7.27
Crashes by Crash Severity, Crash Type, and Vehicle Type, 1999

	Fatal		Injury		Property damage only		
Vehicle type	Single-vehicle crash	Multiple-vehicle crash	Single-vehicle crash	Multiple-vehicle crash	Single-vehicle crash	Multiple-vehicle crash	Total crashes
Passenger cars	10,387	17,566	366,000	2,071,000	670,000	3,799,000	6,935,000
Light trucks[a]	7,847	12,048	183,000	982,000	398,000	2,094,000	3,677,000
Large trucks[b]	808	4,090	17,000	84,000	98,000	271,000	475,000
Buses	90	228	2,000	12,000	7,000	42,000	63,000
Motorcycles	1,132	1,387	21,000	25,000	3,000	8,000	59,000
Total	**20,264**	**35,319**	**589,000**	**3,174,000**	**1,176,000**	**6,214,000**	**11,209,000**
Share	0.2%	0.3%	5.3%	28.3%	10.5%	55%	100%

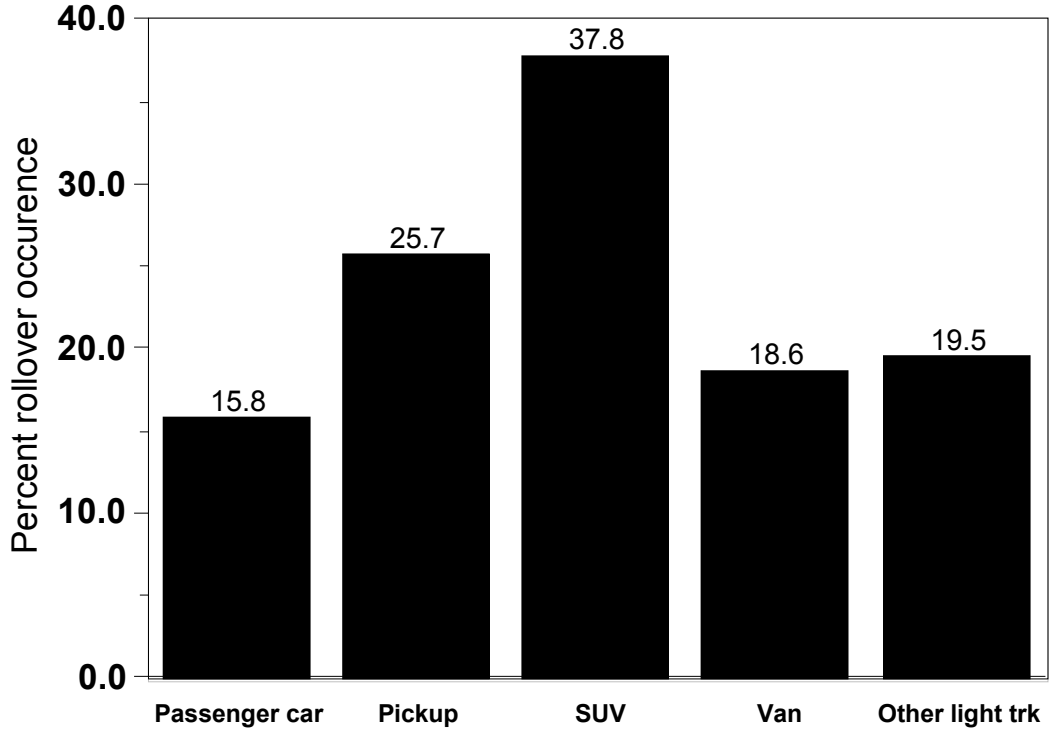
Source:
U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 1999*, Washington, DC, December 2000, pp. 72, 74, 76, 80, 82.

Note:
Multiple-vehicle crashes cannot be totaled over vehicle type due to duplication of accidents between vehicle types.

[a] Trucks 10,000 lbs. gross vehicle weight rating or less, including pickups, vans, and utility vehicles.
[b] Trucks over 10,000 pounds gross vehicle weight rating including single-unit trucks and truck tractors.

For fatal crashes in 1999, sport-utility vehicles (SUVs) had the highest rollover rate (37.8%) while passenger cars had the lowest (15.8%). This does not mean that the rollover caused the fatality, just that a vehicle in the crash rolled over.

Figure 7.8. Percent Rollover Occurrence in Fatal Crashes by Vehicle Type, 1999



Source:
U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 1999*, Washington, DC, December 2000, p. 64.

Chapter 8
Heavy Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 8.1	Heavy single-unit trucks, 1999	
	Registration (thousands)	*5,763*
	Vehicle miles (millions)	*70,311*
	Fuel economy (miles per gallon)	*9.9*
Table 8.1	Combination trucks, 1998	
	Registration (thousands)	*2,029*
	Vehicle miles (millions)	*132,386*
	Fuel economy (miles per gallon)	*5.0*
Table 8.5	Trucks by size, 1997 Vehicle Inventory & Use Survey	
	Light (0–10,000 lbs average weight)	*93.5%*
	Medium (10,001–26,000 lbs average weight)	*3.0%*
	Heavy (26,001 lbs and over average weight)	*3.5%*
Tables 8.11	Freight Shipments,1997 Commodity Flow Survey	
and 8.12	*Value (billion dollars)*	*8,567*
	Tons (millions)	*14,800*
	Ton-miles (billions)	*3,851*
Tables 8.13	Buses in operation, 1999	
and 8.14	*Transit*	*74,228*
	School	*592,029*

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

Table 8.1
Summary Statistics for Other Single-Unit Trucks, 1970–99

	Other single-unit trucks			
Year	Registrations (thousands)	Vehicle travel (million miles)	Fuel use (million gallons)	Fuel economy (miles per gallon)
1970	3,681	27,081	3,968	6.8
1975	4,232	34,606	5,420	6.4
1980	4,374	39,813	6,923	5.8
1981	4,455	39,568	6,867	5.8
1982	4,325	40,658	6,803	6.0
1983	4,204	42,546	6,965	6.1
1984	4,061	44,419	7,240	6.1
1985	4,593	45,441	7,399	6.1
1986	4,313	45,637	7,386	6.2
1987	4,188	48,022	7,523	6.4
1988	4,470	49,434	7,701	6.4
1989	4,519	50,870	7,779	6.5
1990	4,487	51,901	8,357	6.2
1991	4,481	52,898	8,172	6.5
1992	4,370	53,874	8,237	6.5
1993	4,408	56,772	8,488	6.7
1994	4,906	61,284	9,032	6.8
1995	5,024	62,705	9,216	6.8
1996	5,266	64,072	9,409	6.8
1997	5,293	66,893	9,576	7.0
1998[a]	5,735[a]	68,021[a]	6,817[a]	10.0[a]
1999	5,763	70,311	7,122	9.9

Source:
U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1999*, Washington, DC, 2001, Table VM1 and annual.
(Additional resources: www.fhwa.dot.gov)

[a] Change in data series due to newly available source data. This change affected both other single-unit trucks and combination trucks (see Table 8.2).

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

Table 8.2
Summary Statistics for Combination Trucks, 1970–99[a]

	Combination trucks[b]			
Year	Registrations (thousands)	Vehicle travel (million miles)	Fuel use (million gallons)	Fuel economy (miles per gallon)
1970	905	35,134	7,348	4.8
1975	1,131	46,724	9,177	5.1
1980	1,417	68,678	13,037	5.3
1981	1,261	69,134	13,509	5.1
1982	1,265	70,765	13,583	5.2
1983	1,304	73,586	13,796	5.3
1984	1,340	77,377	14,188	5.5
1985	1,403	78,063	14,005	5.6
1986	1,408	81,038	14,475	5.6
1987	1,530	85,495	14,990	5.7
1988	1,667	88,551	15,224	5.8
1989	1,707	91,879	15,733	5.8
1990	1,709	94,341	16,133	5.8
1991	1,691	96,645	16,809	5.7
1992	1,675	99,510	17,216	5.8
1993	1,680	103,116	17,748	5.8
1994	1,681	108,932	18,653	5.8
1995	1,696	115,451	19,777	5.8
1996	1,747	118,899	20,192	5.9
1997	1,790	124,584	20,302	6.1
1998[c]	1,997[c]	128,359[c]	25,157[c]	5.1[c]
1999	2,029	132,386	26,240	5.0

Source:
U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1999*, Washington, DC, 2001, Table VM1 and annual.
(Additional resources: www.fhwa.dot.gov)

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

[b] 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 8.5.

[c] Change in data series due to newly available source data. This change affected both combination and other single-unit trucks (see Table 8.1).

Sales of the medium trucks, classes 3–6 rose substantially in 1998. Light trucks, under 10,000 lbs., continue to dominate truck sales.

Table 8.3
New Retail Truck Sales by Gross Vehicle Weight, 1970–2000[a]
(thousands)

Calendar year	Class 1 6,000 lbs. or less	Class 2 6,001–10,000 lbs.	Class 3 10,001–14,000 lbs.	Class 4 14,001–16,000 lbs.	Class 5 16,001–19,500 lbs.	Class 6 19,501–26,000 lbs.	Class 7 26,001–33,000 lbs.	Class 8 33,001 lbs. and over	Total
Domestic sales (import data are not available)									
1970[b]	1,049	408	6	12	58	133	36	89	1,791
1975	1,101	952	23	1	9	159	23	83	2,351
1980	985	975	4	[c]	2	90	58	117	2,231
1981	896	850	1	[c]	2	72	51	100	1,972
1982	1,102	961	1	[c]	1	44	62	76	2,248
1983	1,314	1,207	[c]	[c]	1	47	59	82	2,710
1984	2,031	1,224	6	[c]	5	55	78	138	3,538
1985	2,408	1,280	11	[c]	5	48	97	134	3,983
Domestic and import sales									
1986	3,380	1,214	12	[c]	6	45	101	113	4,870
1987	3,435	1,175	14	2	8	44	103	131	4,912
1988	3,467	1,333	14	21	8	54	103	148	5,149
1989	3,313	1,297	19	27	7	39	93	145	4,942
1990	3,451	1,097	21	27	5	38	85	121	4,846
1991	3,246	876	21	24	3	22	73	99	4,365
1992	3,608	1,021	26	26	4	28	73	119	4,903
1993	4,119	1,232	27	33	4	27	81	158	5,681
1994	4,527	1,506	35	44	4	20	98	186	6,421
1995	4,422	1,631	40	53	4	23	106	201	6,481
1996	4,829	1,690	52	59	7	19	104	170	6,930
1997	5,085	1,712	53	57	9	18	114	178	7,226
1998	5,263	2,036	102	43	25	32	115	209	7,825
1999	5,707	2,366	122	49	30	48	130	262	8,716
2000	5,965	2,421	117	47	29	51	123	212	8,965
				Average annual percentage change					
1970–1985	5.7%	7.9%	4.1%	-	-15.1%	-6.6%	6.8%	2.8%	5.5%
1986–2000	4.1%	5.1%	17.7%	-	11.9%	0.9%	1.4%	4.6%	4.5%

Source:
Ward's Communication's, *Motor Vehicle Facts and Figures 2000*, Southfield, MI, 2000, p. 24, and annual. (Additional resources: www.wardsauto.com)

[a] Sales include domestic-sponsored imports.
[b] Data for 1970 is based on new truck registrations.
[c] Data are not available.

Vehicle Inventory and Use Survey

The Vehicle Inventory and Use Survey (VIUS), which was formerly the Truck Inventory and Use Survey (TIUS), provides data on the physical and operational characteristics of the Nation's truck population. It is based on a probability sample of private and commercial trucks registered (or licensed) in each state. The name of the 1997 survey was changed to the Vehicle Inventory and Use Survey due to future possibilities of including additional vehicle types. Data for 1997 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 **www. census.gov/svsd/www/tiusview.html** is the location of the VIUS on-line.

Since 1987 the survey has included minivans, vans, station wagons on truck chassis, and sport utility vehicles in addition to the bigger trucks. The 1977 and 1982 surveys did not include those vehicle types. The estimated number of trucks that were within the scope of the 1997 VIUS and registered in the U.S. as of July 1, 1997, was 72.8 million. These trucks were estimated to have been driven a total of 1,044 billion miles during 1997, an increase of 32.8% from 1992. The average annual miles traveled per truck was estimated at 14,300 miles.

In the 1997 VIUS, there are several ways to classify a truck by weight. The survey respondent was asked the average weight of the vehicle or vehicle-trailer combination when carrying a typical payload; the empty weight (truck minus cargo) of the vehicle as it was usually operated; and the maximum gross weight at which the vehicle or vehicle-trailer combination was operated. The Census Bureau also collected information on the Gross Vehicle Weight Class of the vehicles (decoded from the vehicle identification number) and the registered weight of the vehicles from the State registration files. Some of these weights are only provided in categories, while others are exact weights. Since all these weights could be quite different for a single truck, the tabulations by weight can be quite confusing. For illustration of this, see Tables 8.3 and 8.4. The first set of data are based on the Gross Vehicle Weight Class of the vehicle when it was manufactured; the data on Table 8.5 are based on the average weight as reported by the respondent. There is a 24% difference in the number of Class 1 trucks (6,000 lbs. and less). 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 Vehicle Inventory and Use Survey. The manufacturer's gross vehicle weight class is likely to be more accurate than the average weight provided by the respondent.

Table 8.4
Truck Statistics by Gross Vehicle Weight Class, 1997

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
1) 6,000 lbs and less	45,240,632	62.14%	13,328	17.82	35,184	44.34%
2) 6,001 – 10,000 lbs	22,373,167	30.73%	12,952	14.11	21,226	26.75%
3) 10,001 – 14,000	510,476	0.70%	15,650	10.83	771	0.97%
4) 14,001 – 16,000	194,951	0.27%	16,390	10.11	320	0.40%
5) 16,001 – 19,500	178,111	0.24%	6,016	8.69	117	0.15%
6) 19,501 – 26,000	1,884,246	2.59%	13,637	8.21	3,202	4.04%
7) 26,001 – 33,000	207,386	0.28%	35,588	7.07	1,096	1.38%
8) 33,001 lbs and up	2,211,283	3.04%	48,095	6.69	17,427	21.96%
Total	**72,800,252**	**100.00%**	**14,347**	**16.02**	**79,344**	**100.00%**

Source:
U.S. Department of Commerce, Bureau of the Census, *1997 Vehicle Inventory and Use Survey*, Microdata File on CD, 2000. (Additional resources: www.census.gov/svsd/www.tiusview.html)

Table 8.5
Truck Fuel Economy by Size Class, 1992 and 1997
(miles per gallon)

Manufacturer's gross vehicle weight class	1992 TIUS	1997 VIUS
1) 6,000 lbs and less	17.9	17.8
2) 6,001–10,000 lbs	13.6	14.1
3) 10,000–14,000 lbs	10.4	10.8
4) 14,001–16,000 lbs	9.7	10.1
5) 16,001–19,500 lbs	7.9	8.7
6) 19,501–26,000 lbs	7.9	8.2
7) 26,001–33,000 lbs	7.2	7.1
8) 33,001 lbs and over	7.0	6.7

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

As expected, most light trucks travel within 50 miles of their home base and refuel at public stations. Sixty percent of heavy trucks travel over 50 miles from their home base and 40% of them refuel at central company-owned refueling stations.

Table 8.6
Truck Statistics by Size, 1997

	Manufacturer's gross vehicle weight class			
	Light (< 10,000 lbs)	Medium (10,001–26,000 lbs)	Heavy (> 26,000 lbs)	Total
Trucks	68,099,912	2,164,791	2,535,549	72,800,252
Trucks (%)	93.54%	2.97%	3.48%	100%
Miles per truck	13,165	13,837	46,513	14,347
Total miles (%)	85.84%	2.87%	11.29%	100%
Fuel use (%)	71.61%	3.99%	24.40%	100%
Fuel economy (mpg)	16.55	9.37	6.20	16.02
	Range of operation			
Under 50 miles	75.15%	62.50%	39.55%	73.53%
51–100 miles	12.84%	16.60%	16.73%	13.09%
101–200 miles	3.85%	5.60%	10.82%	4.15%
201–500 miles	2.05%	5.74%	12.18%	2.52%
Over 500 miles	2.28%	20.04%	16.00%	2.75%
Off-road	3.83%	7.52%	4.74%	3.97%
Total	100%	100%	100%	100%
	Primary refueling facility			
Central company-owned	14.55%	24.68%	39.13%	29.20%
Single off-site contract	4.27%	6.11%	6.89%	6.08%
Pubic station	77.71%	64.62%	49.83%	60.56%
Other	3.47%	4.59%	4.16%	4.16%
Total	100%	100%	100%	100%

Source:
U.S. Department of Commerce, Bureau of the Census, *1997 Vehicle Inventory and Use Survey*, Microdata File on CD, 2000. (Additional resources: www.census.gov/svsd/www/tiusview.html)

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

Table 8.7
Percentage of Trucks by Size Ranked by Major Use, 1997

Rank	Light (< 10,000 lbs average weight)	Medium (10,001 – 26,000 lbs average weight)	Heavy (> 26,000 lbs average weight)
1	**Personal**	**Construction**	**For Hire**
	74.56%	20.19%	31.48%
2	**Construction**	**Agriculture**	**Construction**
	7.56%	19.54%	17.56%
3	**Services**[a]	**Services**[a]	**Agriculture**
	5.57%	11.64%	14.01%
4	**Agriculture**	**Retail**	**Wholesale**
	3.82%	9.28%	7.81%
5	**Retail**	**Wholesale**	**Services**[a]
	2.79%	7.31%	7.39%
6	**Not in Use**	**Personal**	**Retail**
	1.61%	7.00%	5.67%
7	**Wholesale**	**For Hire**	**Manufacturing**
	1.33%	5.47%	5.61%
8	**Manufacturing**	**Utilities**	**Forestry**
	0.74%	4.40%	2.56%
9	**Utilities**	**Daily Rental**	**Utilities**
	0.75%	4.21%	2.18%
10	**Daily Rental**	**Manufacturing**	**Mining**
	0.53%	3.72%	2.18%
11	**Forestry**	**Not in Use**	**Daily Rental**
	0.26%	3.21%	2.11%
12	**Mining**	**Forestry**	**Not in Use**
	0.25%	1.64%	1.11%
13	**For Hire**	**One-Way Rental**	**Personal**
	0.21%	1.24%	0.31%
14	**One-Way Rental**	**Mining**	**One-Way Rental**
	0.01%	1.14%	0.01%

Source:
U.S. Department of Commerce, Bureau of the Census, *1997 Vehicle Inventory and Use Survey*, Micro data File on CD, 2000. (Additional resources: www.census.gov/svsd/www/tiusview.html)

[a] Business and personal services.

In 1997 nearly 60% of all truck fleets use public fueling stations as their primary refueling facility. As expected, larger fleets use central company-owned facilities more than smaller fleets. Mid-size fleets (10–500 vehicles) use off-site contract facilities more than the smaller or larger fleets.

Table 8.8
Percentage of Trucks by Fleet Size and Primary Fueling Facility, 1997

	Primary refueling facility				
Truck fleet size	Central company-owned fueling facility	Single contract fueling facility located off-site	Public fueling stations	Other	Total
1	5.94%	2.70%	87.26%	4.09%	100%
2–5	13.80%	4.56%	76.12%	5.52%	100%
6–9	25.77%	7.32%	62.02%	4.88%	100%
10–24	37.08%	10.43%	49.70%	2.79%	100%
25–99	48.48%	9.65%	39.29%	2.59%	100%
100–499	48.76%	10.62%	38.40%	2.22%	100%
500–999	46.39%	7.46%	44.38%	1.77%	100%
1,000–4,999	45.24%	4.93%	45.94%	3.89%	100%
5,000–9,999	35.77%	6.01%	53.36%	4.87%	100%
10,000 & up	71.72%	2.56%	19.27%	6.45%	100%
Overall	**30.08%**	**6.39%**	**59.37%**	**4.16%**	**100%**

Source:
U.S. Department of Commerce, Bureau of the Census, *1997 Vehicle Inventory and Use Survey*, Microdata File on CD, 2000. (Additional resources: www.census.gov/svsd/www/tiusview.html)

Most trucks are fueled at public fueling stations but one-way rental trucks are more often fueled at company-owned central fueling facilities or contract fueling facilities than at public stations. Mining and quarrying activities use central fueling facilities more than 40% of the time.

Table 8.9
Percentage of Trucks by Major Use and Primary Fueling Facility, 1997

	Primary fueling facility				
Major Use	Central company-owned fueling facility	Single contract fueling facility located off-site	Public fueling stations	Other	Total
Agricultural services	32.09%	2.99%	53.92%	11.00%	100%
Forestry or lumbering activities	22.49%	4.50%	70.33%	2.68%	100%
Construction work	33.40%	5.39%	58.79%	2.42%	100%
Contractor activities or special trades	12.09%	4.38%	81.18%	2.36%	100%
Manufacturing, refining or processing activities	35.47%	9.48%	53.69%	1.36%	100%
Wholesale trade	32.56%	11.90%	53.62%	1.92%	100%
Retail trade	28.21%	10.25%	59.41%	2.12%	100%
Business and personal services	26.40%	6.33%	65.42%	1.85%	100%
Utilities	40.56%	5.09%	52.25%	2.09%	100%
Mining or quarrying activities	43.82%	9.32%	44.44%	2.42%	100%
Daily rental	39.42%	13.29%	45.12%	2.17%	100%
Not in use	10.56%	2.37%	53.12%	33.94%	100%
For-hire transportation	32.87%	4.90%	59.53%	2.70%	100%
One-way rental	48.47%	3.10%	48.43%	0.00%	100%
Personal transportation	2.02%	0.56%	94.46%	2.96%	100%
Overall	**29.20%**	**6.08%**	**60.56%**	**4.16%**	**100%**

Source:
U.S. Department of Commerce, Bureau of the Census, *1997 Vehicle Inventory and Use Survey*, Microdata File on CD, 2000.
(Additional resources: www.census.gov/svsd/www/tiusview.html)

Commodity Flow Survey

The Commodity Flow Survey (CFS) is designed to provide data on the flow of goods and materials by mode of transport. The 1993 and 1997 CFS are a continuation of statistics collected in the Commodity Transportation Survey from 1963 through 1977, and include major improvements in methodology, sample size, and scope. In 1997, CFS used a sample of 100,000 domestic establishments randomly selected from a universe of about 800,000 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 25 outbound shipments for a one-week period in each of the four calendar quarters of 1997. This produced a total sample of over 5 million shipments. For each sampled shipment, zip codes of origin and destination, 5-digit Standard Classification of Transported Goods (SCTG) code, weight, value, and modes of transport, were provided. Establishments also reported whether the shipment was containerized, a hazardous material, or an export.

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

For more information about the CFS, 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: **www.bts.gov/cfs** .

Industries covered by the 1997 Commodity Flow Survey (CFS) shipped over 11 billion tons of goods worth almost $7 trillion. Compared to the 1993 CFS, the value of shipments is up 9.2% and ton shipped are up 14.5%. By value, intermodal shipments increased 31.2% over 1993.

Table 8.10
Growth of Freight in the United States: Comparison of the 1997 and 1993 Commodity Flow Surveys
(Detail may not add to total because of rounding)

Mode of Transportation	Value			Tons		
	1997 (billion 1997 dollars)	1993 (billion 1997 dollars)	Percent change	1997 (millions)	1993 (millions)	Percent change
All modes	6,944.0	6,360.8	9.2%	11,089.7	9,688.5	14.5%
Single modes	5,719.6	5,376.3	6.4%	10,436.5	8,922.3	17.0%
Truck[a]	4981.5	4791.0	4.0%	7700.7	6385.9	20.6%
For-hire truck	2901.3	2856.1	1.6%	3402.6	2808.3	21.2%
Private truck	2036.5	1910.4	6.6%	4137.3	3543.5	16.8%
Rail	319.6	269.2	18.7%	1,549.8	1,544.1	0.4%
Water	75.8	67.1	13.1%	563.4	505.4	11.5%
Shallow draft	53.9	44.3	21.7%	414.8	362.5	14.4%
Great Lakes	1.5	[c]	[c]	38.4	33.0	[c]
Deep draft	20.4	21.5	-4.9%	110.2	109.9	0.2%
Air (includes truck and air)	229.1	151.3	51.4%	4.5	3.1	42.6%
Pipeline[b]	113.5	97.8	16.1%	618.2	483.6	27.8%
Multiple modes	945.9	720.9	31.2%	216.7	225.7	-4.0%
Parcel, U.S. Postal Service or courier	855.9	612.8	39.7%	23.7	18.9	25.4%
Truck and rail	75.7	90.4	-16.3%	54.2	40.6	33.5%
Truck and water	8.2	10.2	-19.4%	33.2	68.0	-51.2%
Rail and water	1.8	4.0	-55.2%	79.3	79.2	0.1%
Other multiple modes	4.3	3.5	22.0%	26.2	18.9	38.6%
Other and unknown modes	278.6	263.6	5.7%	436.5	540.5	-19.2%

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics, *Freight USA*, Washington, DC, 2000. (Additional resources: www.bts.gov/cfs)

[a] "Truck" as a single mode includes shipments which went by private truck only, for-hire truck only, or a combination of private truck and for-hire truck.
[b] CFS data for pipeline lack most shipments of crude oil.
[c] Denotes data do not meet publication standards because of high sampling variability or other reasons. Some unpublished estimates can be derived from other data published in this table. However, figures obtained in this manner are subject to these same limitations.

Industries covered by the 1997 Commodity Flow Survey (CFS) accounted for about 2.7 trillion ton-miles on the nation's highways, railways, waterways, pipelines, and aviation system. Ton-miles increased 9.9% from 1993 to 1997.

Table 8.11
Growth of Freight Miles in the United States: Comparison of the 1997 and 1993 Commodity Flow Surveys
(Detail may not add to total because of rounding)

Mode of Transportation	Ton-miles			Average miles per shipment		
	1997 (billions)	1993 (billions)	Percent change	1997	1993	Percent change
All modes	2,661.4	2,420.9	9.9%	472	424	11.4%
Single modes	2,383.5	2,136.9	11.5%	184	197	-6.4%
Truck[a]	1023.5	869.5	17.7%	144	144	-0.1%
For-hire truck	741.1	629.0	17.8%	485	472	2.9%
Private truck	268.6	235.9	13.9%	53	52	2.1%
Rail	1,022.5	942.6	8.5%	769	766	3.0%
Water	261.7	272.0	-3.8%	482	[c]	[c]
Shallow draft	189.3	164.4	15.2%	177	[c]	[c]
Great Lakes	13.4	12.4	8.2%	204	534	-61.8%
Deep draft	59.0	95.2	-38.0%	1,024	1,861	-45.0%
Air (includes truck and air)	6.2	4.0	55.5%	1,380	1,415	-2.5%
Pipeline[b]	[c]	[c]	[c]	[c]	[c]	[c]
Multiple modes	204.5	191.5	6.8%	813	736	10.5%
Parcel, U.S. Postal Service or courier	18.0	13.2	36.8%	813	734	10.7%
Truck and rail	55.6	37.7	47.5%	1,347	1,403	-3.9%
Truck and water	34.8	40.6	-14.4%	1,265	1,417	-10.7%
Rail and water	77.6	70.2	10.5%	1,092	627	74.1%
Other multiple modes	18.6	[c]	[c]	[c]	1,082	[c]
Other and unknown modes	73.4	92.6	-20.7%	122	229	-46.9%

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics, *Freight USA*, Washington, DC, 2000. (Additional resources: www.bts.gov/cfs)

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

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

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

The number of active transit buses has increased by nearly 7,000 buses from 1984 to 1999, but the number of passenger-miles in 1999 is nearly identical to the 1984 level.

Table 8.12
Summary Statistics on Transit Buses, 1984–99

Year	Number of active buses	Vehicle-miles (millions)	Passenger-miles (millions)	Energy use (trillion Btu)
1984	67,294	1,845	21,595	69.2
1985	64,258	1,863	21,161	72.4
1986	66,218	2,002	21,395	75.6
1987	63,017	2,079	20,970	74.3
1988	62,572	2,097	20,753	73.0
1989	58,919	2,109	20,768	77.3
1990	58,714	2,130	20,981	78.9
1991	60,377	2,167	21,090	80.6
1992	63,080	2,178	20,336	87.7[a]
1993	64,850	2,210	20,247	86.3
1994	68,123	2,162	18,832	86.8
1995	67,107	2,184	18,818	87.4
1996	71,678	2,221	19,096	89.3
1997	72,770	2,245	19,604	93.0
1998	72,142	2,175	20,360	95.4
1999	74,228	2,276	21,205	97.8
		Average annual percentage change		
1984–99	0.7%	1.4%	-0.1%	[a]
1992–99	2.4%	0.6%	0.6%	1.6%

Source:
American Public Transit Association, *Public Transportation Fact Book*, Washington, DC, 2001, Tables 30, 42, 46, 65, and 66.

[a] Comparisons cannot be made with data before 1992. Beginning in 1992, data were available on non-diesel fuel consumption (i.e. propane, compressed natural gas, methanol).

There are currently not many sources of data on intercity and school buses. The Eno Foundation for Transportation publishes petroleum use for intercity and school buses, and passenger-miles for intercity buses. The Federal Highway Administration publishes an estimate of the total number of school buses. School Bus Fleet magazine also contains statistics on school buses (www.schoolbusfleet.com/stats.cfm).

Table 8.13
Summary Statistics on Intercity and School Buses, 1970–99

Year	Intercity bus passenger-miles (billions)	Intercity bus energy use (trillion Btu)	Number of school buses	School bus energy use (trillion Btu)
1970	25.3	42.4	288,700	41.18
1975	25.4	25.1	368,300	46.95
1980	27.4	29.7	418,255	52.14
1981	27.1	28.5	432,813	53.12
1982	26.9	31.5	442,133	54.74
1983	25.6	32.9	470,727	55.03
1984	24.6	23.5	471,461	51.51
1985	23.8	23.0	480,400	58.37
1986	23.7	20.6	479,076	63.50
1987	23.0	21.6	486,753	66.91
1988	23.1	22.3	498,907	70.19
1989	24.0	23.1	507,628	68.41
1990	23.0	22.1	508,261	64.83
1991	23.1	22.3	513,227	73.25
1992	22.6	21.8	525,838	74.98
1993	24.7	23.8	534,872	73.25
1994	28.1	27.1	547,718	74.98
1995	28.1	27.1	560,447	74.87
1996	28.8	27.7	569,395	74.87
1997	30.6	29.5	568,113	74.81
1998	31.7	30.5	582,470	75.56
1999	34.7	33.4	592,029	76.31
		Average annual percentage change		
1970–99	1.1%	-0.8%	2.5%	2.1%
1989–99	3.8%	3.8%	1.5%	1.1%

Source:
Intercity bus data and school bus energy use - Eno Foundation for Transportation, *Transportation in America 2000*, Eighteenth edition, Washington, DC, pp. 15, 20–23. See Appendix A for Table 2.6 for detailed methodology on energy use conversion.
School buses - Federal Highway Administration, *Highway Statistics 1999*, Washington, DC, 2001, Table MV-10, and annual.

Chapter 9
Alternative Fuel and Advanced Technology Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 9.1	Alternative fuel vehicles, 2000	432,344
	LPG	*268,000*
	CNG	*100,530*
	LNG	*1,900*
	M85	*18,365*
	E85[a]	*34,680*
	Electric	*8,661*
Table 9.4	Number of alternative fuel refuel sites, 2000	5,205
	LPG	*3,268*
	CNG	*1,217*
	Electric	*558*
Table 9.6	U.S. sales of advanced technology vehicles (calendar year 2000)	
	Honda Insight	*3,788*
	Toyota Prius	*5,562*

Fuel type abbreviations are used throughout this chapter.

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

[a]Does not include flex-fuel vehicles.

Alternative Fuels

The U.S. Department of Energy (DOE) defines alternative fuels as fuels which are substantially non-petroleum and yield energy security and environmental benefits. DOE currently recognizes the following as alternative fuels:

- methanol and denatured ethanol as alcohol fuels (alcohol mixtures that contain no less than 70% of the alcohol fuel),
- natural gas (compressed or liquefied),
- liquefied petroleum gas,
- hydrogen,
- coal-derived liquid fuels
- fuels derived from biological materials, and
- electricity (including solar 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 vehicles, including automobiles, light trucks, and mini-vans; (2) heavy vehicles such as tractor-trailers and garbage trucks; and (3) urban transit buses. Much of the AFDC data can be obtained through their web site: **www.afdc.doe.gov**. Several tables and graphs in this chapter contain statistics which were generated by the AFDC.

DOE 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 **www.afdc.doe.gov/hotline.html**.

There are more LPG vehicles in use than any other alternative fuel vehicle. The population of E85 vehicles, however, has grown the most since 1992. For details on alternative fuel use by fuel type, see Table 2.3.

Table 9.1
Estimates of Alternative Fuel Vehicles in Use, 1992–2001

Fuel type	1992	1995	1998	1999	2000[a]	2001[a]	Average annual percentage change 1992–2001
LPG	221,000	259,000	266,000	267,000	268,000	269,000	2.2%
CNG	23,191	50,218	78,782	89,556	100,530	109,730	18.9%
LNG	90	603	1,172	1,681	1,900	2,039	41.4%
M85	4,850	18,319	19,648	18,964	18,365	16,918	14.9%
M100	404	386	200	198	195	184	-8.4%
E85[b]	172	1,527	12,788	22,464	34,680	48,022	87.0%
E95	38	136	14	14	13	13	-11.2%
Electricity	1,607	2,860	5,243	6,964	8,661	10,400	23.1%
Total	**251,352**	**333,049**	**383,847**	**406,841**	**432,344**	**456,306**	**6.9%**

Source:
U. S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels,1999*, Washington, DC, 2000, web site www.eia.doe.gov/cneaf/alternate/page/datatables/atf1-13_00.html.
(Additional resources: www.eia.doe.gov)

[a]Based on plans or projections.
[b]Does not include flex-fuel vehicles.

Nearly 90% of private alternative fuel vehicles are fueled by LPG and CNG. The Federal Government does not own many LPG vehicles; its alternative fuel vehicle fleet is split almost 50/50 between CNG and E-85 vehicles in 2001.

Table 9.2
Estimates of Alternative Fuel Vehicles by Ownership, 1996 and 2001

	Private		State and local government		Federal Government	
Fuel type	1996	2001[a]	1996	2001[a]	1996	2001[a]
LPG	167,000	215,000	43,000	54,000	193	229
CNG	25,020	57,481	11,305	35,335	13,945	16,914
LNG	10	472	45	1,514	72	53
M-85	6,633	8,898	5,958	7,848	7,668	172
M-100	0	0	0	184	0	0
E-85	793	18,697	1,995	12,471	1,748	16,854
E-95	0	0	0	13	0	0
Electricity	2,451	4,643	487	4,977	188	780
Total	**201,907**	**305,191**	**62,790**	**116,342**	**23,814**	**35,002**

Source:
U. S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 1999*, Washington, DC, 2000, web site www.eia.doe.gov/cneaf/alternate/page/datatables/atf1-13_00.html.
(Additional resources: www.eia.doe.gov)

[a]Based on plans or projections.

Table 9.3
Alternative Fuel Vehicles Available by Manufacturer, Model Year 2001

Model	Fuel	Type	Emission class
Daimler Chrysler: 1-800-999-FLEET			
Minivan	E-85 flex fuel	Minivan	LEV
Ram Wagon	CNG dedicated	Large van	ULEV/ILEV/SULEV
Ram Van	CNG dedicated	Large van	ULEV/ILEV/SULEV
Ford: 1-877-ALT-FUEL			
Ranger	Electric-lead acid	Standard pickup	ZEV
Explorer Sport	E-85 flex-fuel	Sport utility vehicle	N/A
Crown Victoria	CNG dedicated	Large car	ULEV
Econoline	CNG dedicated	Full-size van	ULEV/ILEV/SULEV
F-Series	CNG dedicated or CNG/LPG bi-fuel	Standard pickup	LEV/ULEV/ILEV/ SULEV
E-Series Cutaway	CNG dedicated	Passenger van	ULEV
Taurus	E-85 flex-fuel	Large car	LEV
General Motors: 1-800-25Electric, 313-556-7723 or 1-888-GM-AFT-4U (CNG)			
EV1 (CA and AZ only)	Electric-lead acid or NiMH	Two-seater	ZEV
Chevrolet S-10	Electric-lead acid or NiMH	Small pickup	ILEV/ZEV
Chevrolet S-10	E85 flex-fuel	Small pickup	LEV
Chevrolet Cavalier	CNG bi-fuel	Subcompact	LEV
Honda: 1-888-CCHonda			
Insight[a]	Hybrid EV-NiMH	Two-seater	LEV/ULEV
Civic GX (CA, NY fleets only)	CNG dedicated	Subcompact	ILEV/ULEV/SULEV
Mazda: 1-800-222-5500			
B3000	E85 flex fuel	Standard pickup	LEV
Nissan: 1-310-771-3422			
Altra EV (CA fleets only)	Electric lithium-ion	Mid-size wagon	ZEV
Hypermini	Electric-lithium ion	Two-seater	ZEV
Solectria Corporation: 1-508-658-2231			
Civitan	Electric-lead acid	Service van	ZEV
Flash	Electric-lead acid	Small pickup truck	ZEV
Force	Electric-lead acid, NiMH, NiCd	Compact	ZEV
Toyota: 1-800-331-4331 (Press 3 for Alternative Fuel Information) (Fleet sales only)			
RAV4-EV (fleets only)	Electric-lead acid, NiMH	Sport utility vehicle	ZEV
Camry (fleets only)	CNG dedicated	Compact	ULEV
Prius[a]	Hybrid EV	Compact	SULEV

Source:
U.S. Department of Energy, National Alternative Fuels Data Center, web site, www.afdc.doe.gov/afvehicles.htm, January 2001. (Additional resources: 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. SULEV=super ultra low emission vehicle.

[a]The Honda Insight and the Toyota Prius are considered advanced technology vehicles, not alternative fuel vehicles.

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

Table 9.4
Number of Alternative Refuel Sites by State and Fuel Type, 2000

State	M85 sites	CNG sites	E85 sites	LPG sites	LNG sites	Electric sites	Biodiesel sites	Total
Alabama	0	15	0	75	2	35	0	127
Alaska	0	0	0	9	0	0	0	9
Arizona	0	28	1	105	3	52	1	190
Arkansas	0	7	0	68	0	0	0	75
California	3	207	0	342	9	335	0	896
Colorado	0	44	1	68	1	0	0	114
Connecticut	0	25	0	33	0	1	0	59
Delaware	0	6	0	4	0	0	0	10
District of Columbia	0	3	0	0	0	1	0	4
Florida	0	39	0	149	1	3	0	192
Georgia	0	67	0	55	2	73	0	197
Hawaii	0	0	0	7	0	3	1	11
Idaho	0	8	1	34	0	1	0	44
Illinois	0	21	13	56	0	2	0	92
Indiana	0	34	2	45	3	1	0	85
Iowa	0	5	8	40	0	0	0	53
Kansas	0	5	1	68	1	0	0	75
Kentucky	0	6	1	25	0	0	0	32
Louisiana	0	14	0	33	0	0	0	47
Maine	0	0	0	20	0	0	0	20
Maryland	0	25	0	29	2	1	0	57
Massachusetts	0	15	0	37	0	3	0	55
Michigan	0	31	6	132	1	6	0	176
Minnesota	0	12	54	61	1	0	0	128
Mississippi	0	3	0	32	0	0	0	35
Missouri	0	7	5	130	0	0	0	142
Montana	0	10	1	42	1	0	0	54
Nebraska	0	5	7	29	0	0	0	41
Nevada	0	18	0	32	0	0	0	50
New Hampshire	0	1	0	29	0	1	0	31
New Jersey	0	22	0	28	0	0	0	50
New Mexico	0	14	1	88	1	0	0	104
New York	0	59	0	98	0	6	0	163
N. Carolina	0	9	0	77	0	8	0	94
N. Dakota	0	4	2	14	0	0	0	20
Ohio	0	47	0	75	1	1	0	124
Oklahoma	0	53	0	39	0	0	0	92
Oregon	0	14	0	50	1	0	0	65
Pennsylvania	0	53	0	106	1	1	0	161
Rhode Island	0	6	0	7	0	0	0	13
S. Carolina	0	4	0	60	0	1	0	65
S. Dakota	0	4	7	26	0	0	0	37
Tennessee	0	4	0	59	0	0	0	63
Texas	0	69	0	442	7	2	0	520
Utah	0	62	0	18	1	0	0	81
Vermont	0	0	0	17	0	7	0	24
Virginia	0	27	1	63	3	8	0	102
Washington	0	26	0	88	1	6	0	121
W. Virginia	0	39	0	10	0	0	0	49
Wisconsin	0	22	1	82	0	0	0	105
Wyoming	0	18	0	32	1	0	0	51
Total	**3**	**1,217**	**113**	**3,268**	**44**	**558**	**2**	**5,205**

Source:
U.S. Department of Energy, Alternative Fuels Data Center web site, www.afdc.doe.gov/refuel/state_tot.shtml, March 2001.

Clean Cities is a locally-based government/industry partnership, coordinated by the U.S. Department of Energy to expand the use of alternatives to gasoline and diesel fuel. By combining the decision-making with voluntary action by partners, the "grass-roots" approach of Clean Cities departs from traditional "top-down" Federal programs. It establishes a plan, carried out at the local level, for creating a sustainable, nationwide alternative fuels market.

Table 9.5
List of Clean Cities as of August 2001 by Designation

1. Atlanta, GA - 9/8/93
2. Denver, CO - 9/13/93
3. Philadelphia, PA - 9/22/93
4. State of Delaware - 10/12/93
5. Las Vegas, NV - 10/18/93
6. Washington, DC - 10/21/93
7. Boston, MA - 3/18/94
8. Austin, TX - 4/18/94
9. Florida Gold Coast - 5/3/94
10. Chicago, IL - 5/13/94
11. Land of Enchantment, NM - 6/1/94
12. Wisconsin - SE Area - 6/30/94
13. Colorado Springs, CO - 7/13/94
14. Long Beach, CA - 8/31/94
15. Lancaster, CA - 9/22/94
16. Salt Lake City, UT - 10/3/94
17. White Plains, NY - 10/4/94
18. Baltimore, MD - 10/7/94
19. Commonwealth CC Partnership, KY - 10/18/94
20. Rogue Valley, OR - 11/10/94
21. State of WV - 10/18/94
22. Sacramento, CA - 10/21/94
23. East Bay, CA - 10/21/94
24. San Joaquin Valley, CA - 10/21/94
25. San Francisco, CA - 10/21/94
26. South Bay (San Jose), CA - 10/21/94
27. Western New York - 11/4/94
28. Columbia-Willamette, OR - 11/10/94
29. St. Louis, MO - 11/18/94
30. Connecticut SW Area, - 11/21/94
31. Waterbury, CT - 11/21/94
32. Norwich, CT - 11/22/94
33. New London, CT - 11/22/94
34. Peoria, IL - 11/22/94
35. Kansas - SW Area - 3/30/95
36. Central New York - 6/15/95
37. Dallas/Ft. Worth, TX - 7/25/95
38. Honolulu, HI - 8/29/95
39. Missoula, MT - 9/21/95
40. New Haven, CT - 10/5/95
41. Central Arkansas - 10/25/95
42. Paso Del Norte, TX - 11/17/95
43. Pittsburgh, PA - 12/5/95
44. S. California Assn. Gov. - 3/1/96
45. Los Angeles, CA - 3/22/96
46. Coachella Valley, CA - 4/22/96
47. Weld/Larimer/Rocky Mountain National Park - 5/21/96
48. Central Oklahoma - 5/29/96
49. Hampton Roads, VA -10/4/96
50. San Diego, CA 12/12/96
51. Long Island, NY -10/18/96
52. Detroit, MI/Toronto, ON -12/18/96
53. Cincinnati, OH - 1/29/97
54. Evansville, IN - 1/30/97
55. Houston-Galveston, TX - 9/4/97
56. Portland, ME - 9/4/97
57. Tulsa, OK - 9/22/97
58. Maricopa Assn. of Govts. - 10/8/97
59. NW Riverside County, CA - 10/24/97
60. North Jersey, NJ - 10/31/97
61. Texas Coastal (Corpus Christi), TX - 3/30/98
62. Genesee Region (Rochester), NY - 5/28/98
63. Red River Valley/Grand Forks, ND - 8/10/98
64. Puget Sound, WA - 8/13/98
65. RI - Ocean States - 9/14/98
66. Omaha, NE - 9/18/98
67. Kansas City, KS/MO - 11/18/98
68. Central Indiana CC Alliance, IN - 3/4/99
69. Ann Arbor, MI - 4/19/99
70. Capital District (Albany), NY - 4/26/99
71. South Shore, IN - 6/15/99
72. Capital Clean Cities of CT - 6/21/99
73. Tuscon, AZ - 8/24/99
74. NE Clean Fuels Coalition (Cleveland) - 9/14/99
75. Florida Space Coast - 10/1/99
76. Manhattan Area, KS - 10/4//99
77. The Alamo Area (San Antonio) - 11/10/99
78. Baton Rouge, LA - 4/12/00
79. Truckee Meadows - 6/28/00
80. Raleigh, Durham, Chapel Hill, NC - 3/19/01
81. Twin Cities, MN - 5/31/01
82. State of Vermont - 6/25/01

For more information, contact the Clean Cities Hotline at (800) CCITIES, or write to: U.S. Department of Energy, EE-33, Clean Cities Program, 1000 Independence Avenue SW, Washington, DC 20585.

Source:
U.S. Department of Energy, Alternative Fuel Information, *Clean Cities: Guide to Alternative Fuel Vehicle Incentives & Laws*, Washington, DC, November 1996, and updates from web site, August 2001. (Additional resources: www.ccities.doe.gov)

The Honda Insight and Toyota Prius are the two advanced technology vehicles which are currently available to the public in the U.S. They are both hybrid vehicles, using both electricity (from batteries) and mechanical power (from a small internal combustion engine). Learn more about DOE's hybrid vehicle program at: www.ott.doe.gov/hev.

Table 9.6
Sales and Specifications of Available Advanced Technology Vehicles

	Honda Insight[a]	Toyota Prius
Fuel economy (city/hwy)	61/68 mpg	52/45 mpg
Fuel tank capacity	10.6 gal.	11.8 gal.
Acceleration (0-60 mph)	12.0 sec.	12.69 sec.
Emissions	ULEV/LEV	SULEV
Aerodynamics	0.25 Cd	0.29 Cd
Curb weight	1,856 lbs.	2,765 lbs.
Passenger capacity	2	5
Dimensions:		
Length	155.1 in.	169.6 in.
Width	66.7 in.	66.7 in.
Cargo Capacity	16.3 ft^3	11.8 ft^3
Price	$18,980	$20,450
	Calendar year sales in the U.S.	
1999	17	0
2000	3,788	5,562
2001 (January - July)	3,296	8,443
Total as of July 31, 2001	7,101	14,005

Source:
Manufacturer's web sites: www.honda2001.com/models/insight and prius.toyota.com. Sales data - Ward's Communications, Inc., *Wards Automotive Reports*, Southfield, MI, 2001.

[a]Specifications are for the base model. The Insight is also available with continuously variable transmission.

Hybrid-electric vehicles were chosen by DaimlerChrysler, Ford and General Motors in their efforts to develop environmentally friendly cars with up to triple the fuel efficiency of today's midsize cars--without sacrificing affordability, performance, or safety. The manufacturers are hoping to significantly improve national competitiveness in automotive manufacturing and to apply commercially viable innovation to conventional vehicles with these vehicles, which are currently only at the concept stage.

Table 9. 7
Comparative Specifications of Concept Hybrid-Electric Vehicles

Parameter	Dodge ESX3	Ford Prodigy	GM Precept
Fuel economy	72 mpg gas equiv. 80 mpg diesel[a]	72 mpg gas equiv. 80 mpg diesel[a]	80 mpg gas equiv. 90 mpg diesel[a]
Range	400 miles	660 miles	380 miles
Acceleration (0–60 mph)	11.0 seconds	12.0 seconds	11.5 seconds
Emissions	Target is Tier 2	Target is Tier 2	Target is Tier 2
Areodynamics	0.22 Cd	0.199 Cd	0.163 Cd
Curb weight	2,250 lbs.	2,387 lbs.	2,592 lbs.
Passenger capacity	5	5	5
Dimensions: Length Width	192.8 in. 74.2 in.	186.9 in. 69.1 in.	193.2 in. 67.9 in.
Cargo Capacity	16.0 ft^3	14.6 ft^3	4.4 ft^3
Safety	Meet FMVSS[b]	Meet FMVSS[b]	Meet FMVSS[b]

Source:
Media Information, 2000.

[a]Fuel economy for Dodge using "Designer" diesel (0 ppm sulfur); Ford using Swedish clean diesel (<10 ppm sulfur); GM using California low-sulfur diesel (<30 ppm sulfur).

The U.S. Advanced Battery Consortium (USABC)

Electric and hybrid-electric vehicles are required to be sold in California under the California Low-Emission Vehicle (LEV) program. Other states, such as New York, Texas, and Massachusetts, have indicated that they will also enforce the LEV program. The USABC was established in 1991 to concentrate efforts on battery development for future electric vehicles. The USABC consists of the Big Three U.S. auto manufacturers (Daimler-Chrysler, Ford, General Motors), the Electric Power Research Institute, and the U.S. Department of Energy.

A cooperative agreement between USABC and DOE was signed in September 1991 to develop advanced electric vehicle batteries. Under this agreement, Phase 1 of the USABC Electric Vehicle Battery Program ran from 1991 through 1996. A follow-on Phase 2 effort (1996–2000) was undertaken by a second cooperative agreement signed in August 1996 to continue the development of advanced electric vehicle batteries. An additional Phase 3 effort (2000–2004) is being undertaken by a third cooperative agreement signed in January 2000 to continue development of advanced lithium-based batteries. Similar to these three cooperative agreements between USABC and DOE to develop advanced batteries for electric vehicles, a fourth cooperative agreement (1995–2002) was entered into during September 1995 between USABC and DOE to develop high-power battery storage devices for hybrid vehicles.

Since its inception, the DOE-USABC Cooperative Program has worked to promote the convergence of advanced battery technologies and focus R&D resources on the most promising battery candidates for EV applications. Nickel-metal hydride batteries, developed by the USABC from 1992 through 1998, are being utilized in current-model EVs. USABC continues to work on lithium-based batteries with goals as shown below.

Table 9.8
U.S. Advanced Battery Consortium Goals for Electric Vehicle Batteries

Primary criteria	Long-term goals[a] (beyond 2002)
Power density[b] W/L	460
Specific power[b] W/kg [80% depth of discharge (DOD)/30 sec]	300
Energy density[b] Wh/L (C/3 discharge rate)	230
Specific energy[b] Wh/kg (C/3 discharge rate)	150
Life (years)	10
Cycle life[b] (cycles) (80% DOD)	1000 1600 (@ 50% DOD) 2670 (@ 30% DOD)
Power and capacity degradation[b] (% of rated spec)	20%
Ultimate price[c] ($/kWh) (10,000 units @ 40 kWh)	<$150 (desired to 75)
Operating environment	–30 to 65°C
Recharge time[b]	< 6 hours
Continuous discharge in 1 hour (no failure)	75% (of rated energy capacity)
Secondary criteria	**Long-term goals (2002)**
Efficiency[b] (C/3 discharge and C/6 charge)[d]	80%
Self-discharge[b]	< 20% in 12 days
Maintenance	No maintenance. Service by qualified personnel only.
Thermal loss[b]	Covered by self-discharge
Abuse resistance[b]	Tolerant Minimized by on-board controls

Source:
U.S. Department of Energy, Office of Transportation Technologies, Washington, DC, March 2001.

[a]For interim commercialization (reflects USABC revisions of September 1996).
[b]Specifics on criteria can be found in *USABC Electric Vehicle Battery Test Procedures Manual, Rev. 2*, DOE/ID-10479, January 1996.
[c]Cost to the original equipment manufacturers.
[d]Roundtrip charge/discharge efficiency.

The purpose of the Vehicle High-Power Energy Storage Program is to develop a low-cost, high-power energy storage device that meets or exceeds the energy storage requirements for the power-assist and the dual-mode hybrid vehicles by 2008, as shown in this table. Advanced high-power batteries were selected as the technology that has the potential to meet or exceed these requirements.

Table 9.9
Energy Storage Requirements for Hybrid Vehicles

Characteristics	Units	Power-assist hybrid	Dual-mode hybrid
Pulse discharge power[a] [at minimum operating state of change (SOC)]	kW	25 (constant for 18-sec pulse)	45 (constant for 12-sec pulse)
Peak regenerative pulse power[a] (2-second pulse at maximum operating SOC)	kW	30 (50-Wh pulse)	35 (97-Wh pulse)
Total available energy[a] (within operating SOC range)	kWh	0.3 (at C/1 rate)	1.5 (at 6-kW continuous power)
Minimum round-trip efficiency[a] on reference cycle	%	>90	>88
Cycle life,[a] for specified SOC increments:	cycles	300K power-assist cycles[a] (7.5 MWh)	3,750 dual-mode cycles[a] (22.5 MWh)
Cold-cranking power[a] at –30°C (three 2-sec pulses, 10-sec rest between pulses)	kW	5	5
Calendar life	year	15	15
Maximum weight	kg	40	100
Maximum volume	l	32	75
Production cost,[b] at 100,000 units per year	$	300	500
Maximum operating voltage	Vdc	≤440	≤440
Minimum operating voltage	Vdc	$\geq 0.55 \times V_{max}$	$\geq 0.5 \times V_{max}$
Maximum dc current	A	≤217	≤217
Maximum allowable self-discharge rate[a]	Wh/day	50	50
Temperature range:	°C		
Equipment operation		–40 to +52	–40 to +52
Equipment survival		–46 to +66	–46 to +66

Source:
U.S. Department of Energy, Office of Transportation Technologies, Washington, DC, March 2001.

[a]Specifics on characteristics and cycle life protocols can be found in *PNGV Battery Test Manual Rev.* 3, DOE/ID-10597, November 2000.
[b]Selling price to the vehicle manufacturers.
Note: The energy storage subsystem is recharged only by the on-board prime power source and regenerative power from braking. Nominal SOC must permit discharge or regenerative recharge without degradation in the performance of the energy storage subsystem. Power and energy values are as delivered/received at the dc terminals of the subsystem. Discharge pulse energy and power requirements are sufficient for the vehicle to reach top speed in 18 sec for the power-assist hybrid and 12 sec for the dual-mode hybrid.

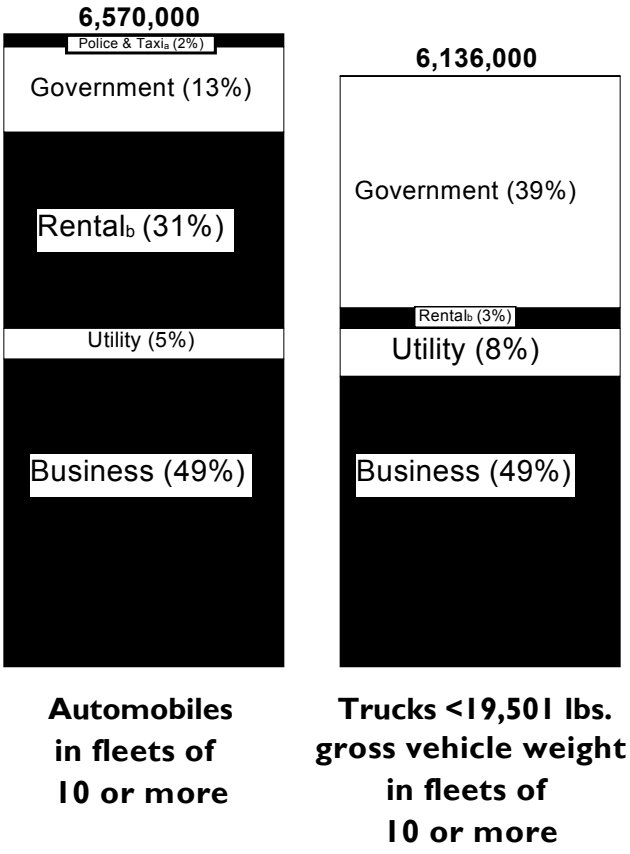
Chapter 10
Fleet Vehicles and Characteristics

Summary Statistics from Tables/Figures in this Chapter

Source		
Figure 10.1	Fleet automobiles, 2000	6,570,000
Figure 10.1	Fleet trucks ≤ 19,500 lbs. GVW, 2000	6,136,000
Table 10.3	Average annual miles per automobile	
	Business fleets	*29,200*
	Utility fleets	*14,500*
	Government fleets	*13,700*
Table 10.3	Average annual miles per light truck (<8,500 lbs. GVW)	
	Business fleets	*26,600*
	Utility fleets	*17,500*
	Government fleets	*13,900*
Table 10.4	Federal government vehicles, FY 1998	547,534
	Automobiles	*111,990*
	Buses	*6,051*
	Light trucks (<8,500 lbs. GVW)	*357,592*
	Medium trucks (8,500–26,000 lbs. GVW)	*54,033*
	Heavy trucks (>26,000 lbs. GVW)	*17,898*

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 2000 data are presented here.

Figure 10.1. Fleet Vehicles in Service as of February 1, 2000



Source:
Bobit Publishing Company, Automotive Fleet Research Department, *Automotive Fleet Factbook 2001*, Redondo Beach, CA, 2001. (Additional resources: www.fleet-central.com)

[a]Taxi category includes vans.
[b]Rental category includes vans and sports utility vehicles under **automobiles**, not trucks.

These fleet data, which were generated from a 1991–92 ORNL study, are still the latest available data of this kind.

Table 10 .1
Fleet Vehicle Composition by Vehicle Type, 1991
(percent)

	Business	Utility	Government
Cars	24.2%	22.6%	48.5%
Light trucks[a] and vans	21.1%	39.0%	42.8%
Medium trucks[b]	45.8%	15.0%	6.8%
Heavy trucks[c]	8.9%	23.4%	1.8%
Total	100.0%	100.0%	100.0%

Table 10.2
Average Length of Time Fleet Vehicles are Kept Before Sold to Others, 1991
(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 10.3
Average Annual and Daily Vehicle-Miles of Travel for Fleet Vehicles, 1991

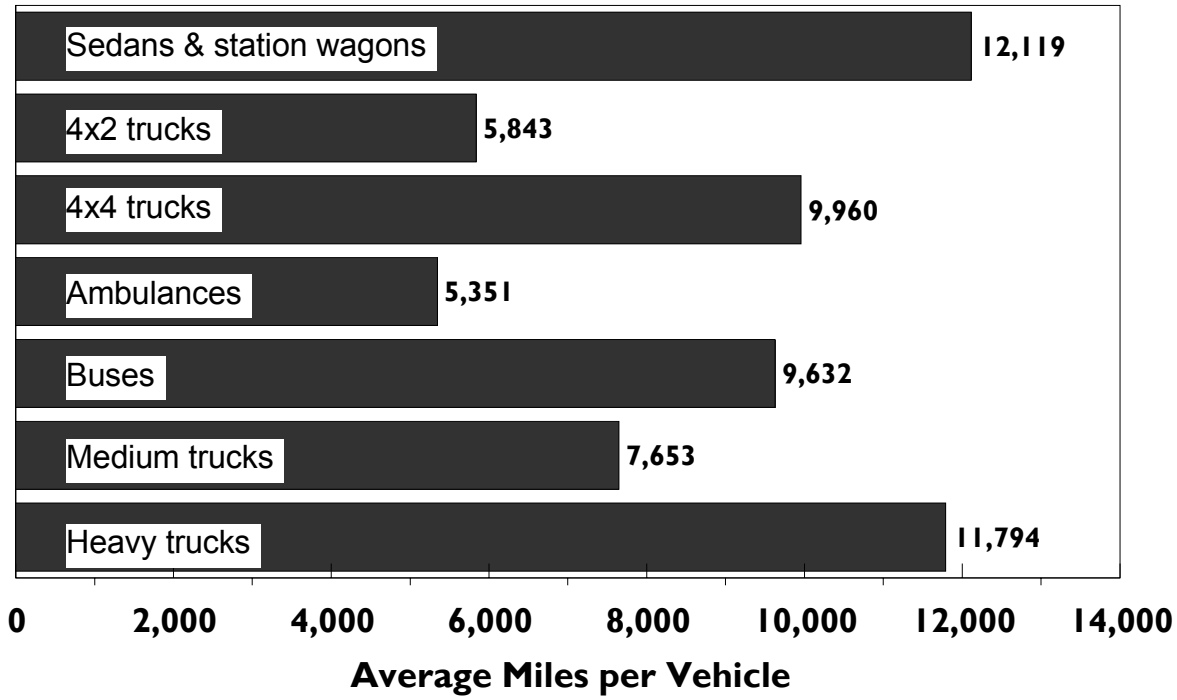
	Business		Utility		Government	
Vehicle type	Miles/year (thousands)	Miles/day @250 days/year	Miles/year (thousands)	Miles/day @250 days/year	Miles/year (thousands)	Miles/day @250 days/year
Cars	29.2	117	14.5	58	13.7	55
Light trucks[a]	26.6	106	17.5	70	13.9	56
Medium trucks[b]	17.5	70	11.8	47	11.9	48
Heavy 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: www-cta.ornl.gov)

[a]In this study, light trucks are <8,500 lbs gross vehicle weight.
[b]In this study, medium trucks are between 8,500–26,000 lbs gross vehicle weight.
[c]In this study, heavy trucks are >26,000 lbs gross vehicle weight.

These data, which apply to domestic Federal fleet vehicles, indicate that sedans and station wagons have the highest average annual miles per vehicle, followed closely by heavy trucks. There is a 4000-mile difference in the average for 4x2 light trucks as opposed to 4x4 light trucks.

Figure 10.2. Average Miles per Domestic Federal Vehicle by Vehicle Type, 1998



Source:

U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 1998 Federal Fleet Report*, Washington, DC, 2000, Table 5.
(Additional resources: policyworks.gov/org/main/mt/homepage/mtv/mtvhp.htm)

Table 10.4
Federal Government Vehicles by Agency, Fiscal Year 1998[a]

Department or Agency	Autos	Buses	Light trucks[b]	Medium trucks[c]	Heavy trucks[d]	Total
Appalachian Regional Commission	1	0	0	0	0	1
Commodity Futures Trading Commission	1	0	1	0	0	2
Consumer Product Safety Commission	1	0	1	0	0	2
Department of Agriculture	3,211	41	24,433	5,235	614	33,534
Department of Commerce	162	2	419	216	14	813
Department of Education	1	0	2	0	0	3
Department of Energy	761	156	3,496	832	492	5,737
Department of Health & Human Services	83	7	366	115	108	679
Department of Housing & Urban Development	3	0	1	0	0	4
Department of Justice	21,170	360	13,823	1,056	273	36,682
Department of Labor	27	1	144	15	3	190
Department of State	103	0	84	0	11	198
Department of Interior	1,324	73	9,513	3,535	1,766	16,211
Department of Treasury	11,205	15	4,393	249	89	15,951
Department of Transportation	50	18	362	120	76	626
Department of Veterans Affairs	257	86	1,310	218	93	1,964
Environmental Protection Agency	16	2	156	64	7	245
Equal Employment Opportunity Commission	1	0	0	0	0	1
Executive Office of the President	53	0	2	16	0	71
Federal Communications Commission	60	0	64	1	0	125
Federal Election Commission	0	0	1	0	0	1
Federal Emergency Management Agency	27	6	135	3	24	195
Federal Mediation and Conciliation Service	1	0	0	0	0	1
General Services Administration[e]	55,227	3,100	68,566	28,824	3,743	159,460
Government Printing Office	7	0	49	0	0	56
International Boundary & Water Commission	3	0	19	5	35	62
Library of Congress	1	0	0	0	0	1
National Aeronautics & Space Administration	96	9	394	196	54	749
National Gallery of the Arts	1	0	0	0	2	3
National Labor Relations Board	1	0	0	0	0	1
National Science Foundation	1	7	33	7	20	68
Nuclear Regulatory Commission	6	0	0	0	0	6
Office of Personnel Management	4	0	0	0	0	4
Securities and Exchange Commission	1	0	1	0	0	2
Small Business Administration	108	0	0	0	0	108
Smithsonian Institution	14	3	149	0	13	179
Social Security Administration	2	0	1	0	1	4
Tennessee Valley Authority	647	0	1,053	931	279	2,910
United States Information Agency	6	0	16	3	2	27
United States International Trade Commission	1	0	0	0	0	1
U.S. Soldiers' & Airmen Retirement Home	3	2	1	4	2	12
CIVILIAN AGENCIES	**94,647**	**3,888**	**128,988**	**41,645**	**7,721**	**276,889**
U.S. POSTAL SERVICE	**9,396**	**5**	**178,725**	**8,779**	**4,774**	**201,679**
Department of the Navy	3,049	629	20,516	974	2,090	27,258
Department of the Army	87	44	2,053	623	302	3,109
Department of the Air Force	2,490	1,184	23,027	1,004	2,304	30,009
Defense Agencies	1,975	13	691	114	145	2,938
Corps of Engineers	81	2	1,358	379	210	2,030
U.S. Marine Corps	265	286	2,234	515	322	3,622
MILITARY AGENCIES	**7,947**	**2,158**	**49,879**	**3,609**	**5,373**	**68,966**
TOTAL	**111,990**	**6,051**	**357,592**	**54,033**	**17,868**	**547,534**

Source:
U.S. General Services Administration, Federal Supply Service, *FY 1998 Federal Fleet Report*, Washington, DC, 2000, Table 14. (Additional resources: policyworks.gov/org/main/mt/homepage/mtv/mtvhp.htm)

[a] Federally-owned and commercially-leased domestic vehicles.
[b] Less than 8,500 lbs GVWR. Includes ambulances.
[c] 8,501–23,999 lbs GVWR.
[d] 24,000 lbs. or more GVWR.
[e] GSA Fleet vehicles. Some of these are foreign-based; most are leased by other Federal agencies.

Table 10.5
Federal Fleet Vehicle Acquisitions
by Fuel Type, FY 1997–98[a]

	FY97	FY98
Gasoline	14,097	48,338
Diesel	489	2,503
Natural gas	172	1,139
Ethanol/E-85	160	3,015
Electricity	139	36
Other	12	0
Methanol/M-85	9	104
LPG	1	91
Biodiesel	0	0
Hydrogen	0	0
Total	15,079[a]	55,226

Source:
U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 1998 Federal Fleet Report*, Washington, DC, 2000, Table 18.
(Additional resources: policyworks.gov/org/main/mt/homepage/mtv/mtvhp.htm)

Table 10.6
Fuel Consumed by Federal Government Fleets, FY 1997–98[a]
(thousand gasoline equivalent gallons)

	FY97	FY98
Gasoline	280,051	261,541
Diesel	64,834	58,272
NG	4,076	5,671
Electricity	287	83
Biodiesel	186	11
Methanol/M-85	289	251
LPG	37	43
Ethanol/E-85	19	3,708
Total	349,780[a]	329,775

Source:
U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 1998 Federal Fleet Report*, Washington, DC, 2000, Table 6.
(Additional resources: policyworks.gov/org/main/mt/homepage/mtv/mtvhp.htm)

[a]These data are reported under new requirements for FY 1997. Data for some agencies are missing or incomplete.

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

Table 10.7
Energy Policy Act Purchase Requirements of Light Alternative Fuel Vehicles

Year	Federal	State	Alternative 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. (www.ott.doe.gov/credits)

[a]The Department of Energy is presently considering implementation of private and municipal fleet rule making.

Chapter 11
Household Vehicles and Characteristics

Summary Statistics from Tables/Figures in this Chapter

Source		
Table 11.2	Vehicles per licensed driver, 1999	1.12
Table 11.3	Average household transportation expense, 1999	18.4%
Table 11.4	Share of households owning 3 or more vehicles	
	1960	*2.5%*
	1970	*5.5%*
	1980	*17.5%*
	1990	*17.3%*
	2000	*18.3%*
Table 11.12	Average annual miles per household vehicle, 1995	11,800
Figure 11.1	Average occupancy rates by vehicle type, 1995	
	Automobile	*1.6*
	Pickup truck	*1.4*
	Sports Utility	*1.7*
	Van	*2.1*
Table 11.14	Share of workers who car pooled, 2000	11.2%
Figure 11.3	Long-distance trips in the U.S., 1995	
	Trips	*1,001 million*
	Person-miles	*827 billion*

Vehicle-miles are growing at a faster rate than vehicles and more than twice the rate of population. See Table 11.2 for vehicles per capita and vehicle-miles per capita.

Table 11.1
Population and Vehicle Profile, 1950–99

Year	Resident population[a] (thousands)	Total households (thousands)	Number of vehicles in operation (thousands)	Total vehicle-miles (millions)	Number of licensed drivers (thousands)	Number of civilian employed persons (thousands)
1950	151,868	43,554	43,256	458,246	62,194	58,918
1955	165,069	47,874	55,804	605,646	74,686	62,170
1960	179,979	52,799	66,582	718,762	87,253	65,778
1965	193,526	57,251	82,067	887,812	98,502	71,088
1970	203,984	63,401	98,136	1,109,724	111,543	78,678
1975	215,465	71,120	120,054	1,327,664	129,791	85,846
1980	227,225	80,776	139,832	1,527,295	145,295	99,303
1985	237,924	86,789	157,048	1,774,826	156,868	107,150
1986	240,133	88,458	162,094	1,834,872	159,487	109,597
1987	242,289	89,479	167,193	1,921,204	161,975	112,440
1988	244,499	91,061	171,741	2,025,962	162,853	114,968
1989	246,819	92,830	175,960	2,096,487	165,555	117,342
1990	249,464	93,347	179,299	2,144,362	167,015	118,793
1991	252,153	94,312	181,438	2,172,050	168,995	117,718
1992	255,030	95,689	181,519	2,247,151	173,125	118,492
1993	257,783	96,391	186,315	2,296,378	173,149	120,259
1994	260,327	97,107	188,714	2,357,588	175,403	123,060
1995	262,803	98,990	193,441	2,422,696	176,628	124,900
1996	265,229	99,627	198,294	2,485,848	179,539	126,708
1997	267,784	101,018	201,071	2,561,695	182,709	129,558
1998	270,248	102,528	205,043	2,631,522	184,980	131,463
1999	272,691	103,874	209,509	2,691,335	187,170	133,488
			Average annual percentage change			
1950–99	1.2%	1.8%	3.3%	3.7%	2.3%	1.7%
1989–99	1.0%	1.1%	1.8%	2.5%	1.2%	1.3%

Source:
Resident population, total households, and civilian employed persons - U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States–2000*, 120th edition, Washington, DC, 2000, pp. 7, 54, 403, and annual. (Additional resources: www.census.gov)
Vehicles in operation - The Polk Company. **FURTHER REPRODUCTION PROHIBITED**. (Additional resources: www.polk.com)
Licensed drivers and vehicle-miles - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1999*, Tables DL-20 and VM-1, and annual.
(Additional resources: www.fhwa.dot.gov)

[a]Estimates as of July 1. Includes Armed Forces stationed in the United States.

In 1999 there were 1.12 vehicles for every licensed driver in the U.S. Vehicle-miles per capita have nearly reached 10,000 miles.

Table 11.2
Population and Vehicle Ratios, 1950–99

Year	Vehicles per capita	Vehicle-miles per capita	Licensed drivers per household	Vehicles per licensed driver	Vehicles per civilian employed persons
1950	0.28	3,029	1.43	0.70	0.73
1955	0.34	3,656	1.56	0.75	0.90
1960	0.37	3,994	1.65	0.76	1.01
1965	0.42	4,587	1.72	0.83	1.15
1970	0.48	5,440	1.76	0.88	1.25
1975	0.56	6,162	1.82	0.92	1.40
1980	0.62	6,722	1.80	0.96	1.41
1985	0.66	7,460	1.81	1.00	1.47
1986	0.68	7,641	1.80	1.02	1.48
1987	0.69	7,929	1.81	1.03	1.49
1988	0.70	8,286	1.79	1.05	1.49
1989	0.71	8,494	1.78	1.06	1.50
1990	0.72	8,596	1.79	1.07	1.51
1991	0.72	8,614	1.79	1.07	1.54
1992	0.71	8,811	1.81	1.05	1.53
1993	0.72	8,908	1.80	1.08	1.55
1994	0.72	9,056	1.81	1.08	1.53
1995	0.74	9,219	1.78	1.10	1.55
1996	0.75	9,372	1.80	1.10	1.56
1997	0.75	9,566	1.81	1.10	1.55
1998	0.76	9,737	1.80	1.11	1.56
1999	0.77	9,870	1.80	1.12	1.57
		Average annual percentage change			
1950–99	2.1%	2.4%	0.5%	1.0%	1.6%
1989–99	0.8%	1.5%	0.1%	0.6%	0.5%

Source:

Resident population, total households, and civilian employed persons - U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States–2000*, 120th edition, Washington, DC, 2000, pp. 7, 54, 403, and annual. (Additional resources: www.census.gov)

Vehicles in operation - The Polk Company. **FURTHER REPRODUCTION PROHIBITED**. (Additional resources: www.polk.com)

Licensed drivers and vehicle-miles - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1999*, Tables DL-20 and VM-1, and annual.
(Additional resources: www.fhwa.dot.gov)

Transportation (18.4%) is second only to housing (31.4%) as the largest expenditure for the average household. In 1999, approximately 15% of transportation expenditures were for purchasing gasoline and motor oil. There is an average of two vehicles per household.

Table 11.3
Average Annual Expenditures of Households by Income, 1999[a]

		Income before taxes								
	All households	Less than $5,000	$5,000–$9999	$10,000–$14999	$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	$39,174	$18,015	$14,926	$19,722	$24,366	$28,963	$35,077	$40,868	$49,615	$76,812
						Percentage of total expenditures[b]				
Food[c]	14.2%	17.5%	17.9%	15.7%	16.5%	15.9%	15.3%	15.1%	14.0%	12.3%
Housing	31.5%	35.6%	38.5%	36.1%	34.2%	32.6%	31.0%	31.0%	30.0%	30.1%
Apparel and services	4.8%	5.5%	4.7%	4.5%	5.6%	5.4%	5.4%	4.1%	4.3%	4.7%
Transportation	18.4%	17.3%	15.0%	18.8%	18.8%	19.0%	19.9%	20.5%	18.9%	17.4%
Vehicle purchases (net outlay)	**8.7%**	**8.1%**	**6.3%**	**9.1%**	**8.7%**	**8.6%**	**9.2%**	**10.1%**	**8.7%**	**8.4%**
Gasoline and motor oil	**2.7%**	**3.1%**	**2.8%**	**3.1%**	**3.0%**	**3.2%**	**3.2%**	**3.0%**	**2.9%**	**2.2%**
Other vehicle expenditures	**6.0%**	**5.3%**	**4.7%**	**5.7%**	**6.1%**	**6.1%**	**6.5%**	**6.4%**	**6.3%**	**5.6%**
Public transportation	**1.0%**	**0.9%**	**1.1%**	**0.9%**	**1.0%**	**1.0%**	**0.9%**	**0.9%**	**0.9%**	**1.2%**
Health care	5.2%	5.2%	7.8%	8.3%	7.9%	7.0%	5.6%	5.0%	4.8%	3.7%
Entertainment	5.1%	5.0%	4.3%	4.9%	4.2%	4.6%	4.8%	4.6%	5.6%	5.4%
Personal Insurance & pensions	11.1%	2.2%	2.1%	3.0%	4.2%	6.4%	8.8%	11.1%	12.9%	15.9%
Others[d]	9.7%	11.6%	9.8%	8.7%	8.8%	9.4%	9.3%	8.7%	9.4%	10.6%
Households[e] (thousands)	81,692	3,909	7,588	8,639	6,995	11,560	9,453	7,381	10,999	15,168
Percentage of households	100%	4.8%	9.3%	10.6%	8.6%	14.2%	11.6%	9.0%	13.5%	18.6%
Average number of vehicles in HH	2.0	1.0	0.9	1.3	1.5	1.8	2.1	2.3	2.5	2.8

Source:
U.S. Department of Labor, Bureau of Labor Statistics, web site: www.bls.gov/pub/special.requests/ce/standard/1999/income.txt, February 2001. (Additional resources: www.bls.gov)

[a] Public assistance monies are included in reported income. Data for those reporting 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.

[e] The term household refers to a "consumer unit," which is defined differently than households on Table 11.1.

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 11.4
Household Vehicle Ownership, 1960–2000 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
2000	9.35%	33.79%	38.55%	18.31%	179,417,526

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.
2000 data - U.S. Bureau of the Census, American Fact Finder, factfinder.census.gov, Table QT-04, August 2001.
(Additional resources: www.census.gov)

[a]Estimates using Census Bureau data; these data on the total number of vehicles do not match the figures on Table 11.1. The figures on Table 11.1, from R.L. Polk and Company, are the preferred data.

1995 Nationwide Personal Transportation 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: **www-cta.ornl.gov/npts**.

Table 11.5
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 *www-cta.ornl.gov/npts*.
(Additional resources: 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 11.6
Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household
1969, 1977, 1983, 1990, and 1995 NPTS

	Journey-to-work[a]	All trips
Average annual vehicle-miles per household		
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
Average annual vehicle trips per household		
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
Average vehicle trip length (miles)		
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 *www-cta.ornl.gov/npts*. 1990 adjusted data - Oak Ridge National Laboratory, Oak Ridge, TN, August 1998. (Additional resources: www.fhwa.dot.gov, www-cta.ornl.gov/npts)

[a]It 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 11.7
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]
Average annual PMT per household				
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
Average annual person trips per household				
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
Average person trip length (miles)				
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 *www-cta.ornl.gov/npts*. 1990 adjusted data - Oak Ridge National Laboratory, Oak Ridge, TN, August 1998. (Additional resources: www.fhwa.dot.gov, 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.

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

[b]Includes trip purposes not shown on this table.

In 1995 vehicle-miles traveled (vmt) for a three-person household is nearly 25,000 miles. The number of drivers in a household makes a big difference in vmt, as does the presence of children in the household. Households with children have 46% more vmt than households without children.

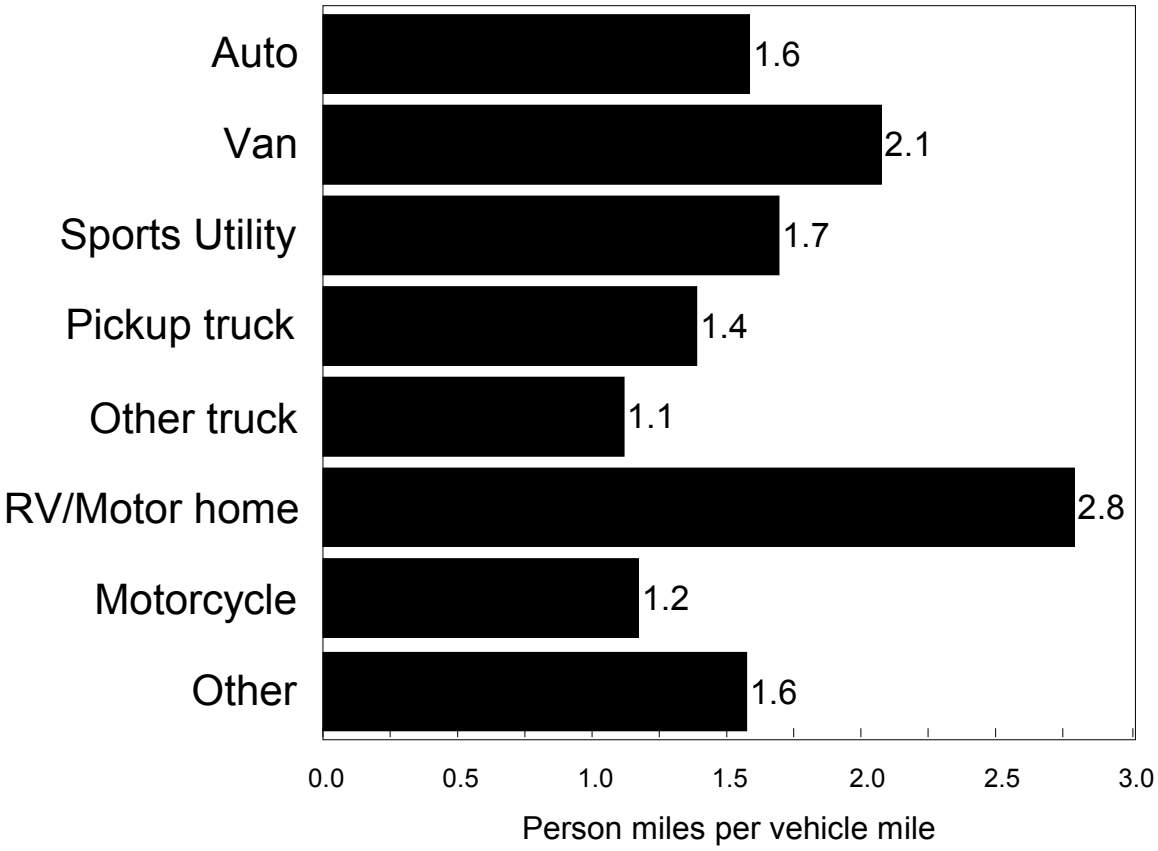
Table 11.8
Average Number of Vehicles and Vehicle Travel per Household, 1990 and 1995 NPTS

	Average number of vehicles per household		Average vehicle-miles traveled per household	
Number of Drivers	**1990**	**1995**	**1990**	**1995**
1	1.5	1.2	15,200	11,000
2	2.1	2.1	22,900	22,600
3	2.9	2.8	29,400	30,100
4 or more	3.8	3.6	40,500	39,600
Household size				
1 person	1.2	1.2	11,400	10,800
2 persons	1.9	1.9	19,300	19,400
3 persons	2.2	2.2	23,700	24,800
4 persons	2.4	2.3	25,300	25,600
5 persons	2.4	2.3	24,900	27,200
6 or more persons	2.7	2.5	29,200	27,900
Household urban status				
Urban	1.9	1.6	19,000	16,500
Rural	2.1	2.0	22,200	22,600
Household composition				
With children	2.2	2.2	24,100	25,000
Without children	1.8	1.8	17,600	17,100
Total	**1.8**	**1.8**	**18,300**	**18,700**

Source:
Generated from the Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Survey Public Use Files, Washington, DC, 2000. (Additional resources: www-cta.ornl.gov/npts)

Vans and sport utility vehicles have higher vehicle occupancies than automobiles. RV's and motor homes have the highest vehicle occupancy.

Figure 11.1. Average Vehicle Occupancy by Vehicle Type, 1995 NPTS

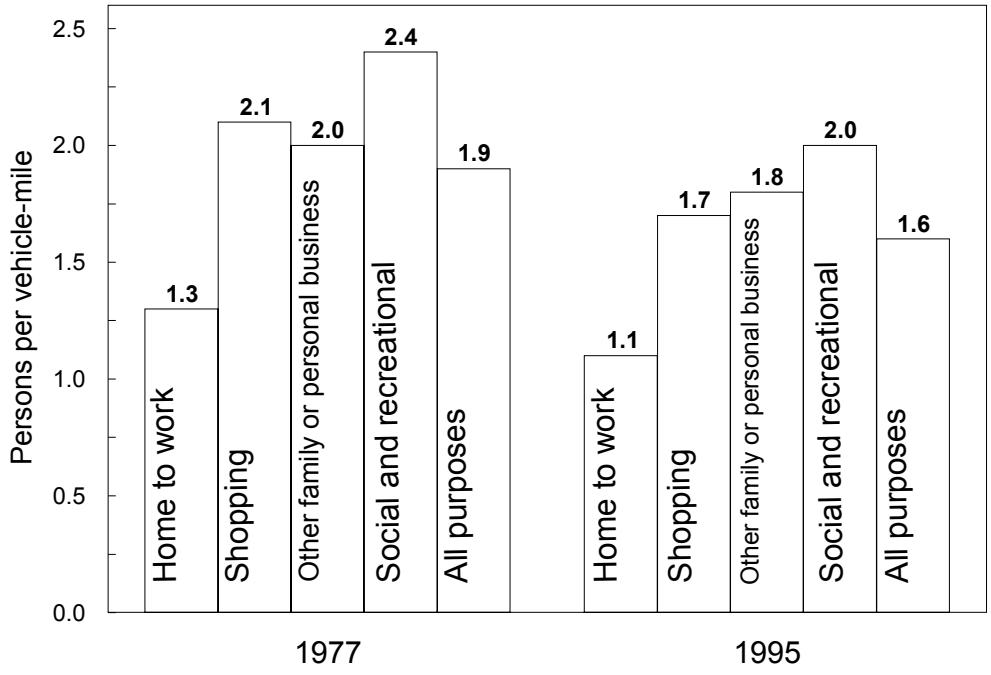


Source:

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

The average vehicle occupancy, calculated as person-miles per vehicle-mile, is highest for social and recreational purposes. The highest vehicle occupancy levels for all purposes were in 1977. The increase in number of vehicles per household and the decrease in average household size could have contributed to the decline since then.

Figure 11.2. Average Vehicle Occupancy by Trip Purpose
1977 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: www.fhwa.dot.gov, www-cta.ornl.gov/npts)

Less than 27% of all household vehicle-miles are trips to or from work. Errands such as family and personal business and shopping (combined) make up almost a third of vehicle travel. One quarter of all trips 75 miles or longer (one way) were for the purpose of visiting friends or relatives.

Table 11.9
Vehicle-Miles by Trip Purpose, 1995 NPTS

Purpose of trip	Daily trip vehicle-miles (<75 miles one-way)	Long trip vehicle-miles (≥75 miles one-way)	Total trip vehicle-miles
To or from work	31.1%	4.2%	26.8%
Work-related business	6.7%	14.7%	7.9%
Shopping	13.4%	3.5%	11.9%
Other family or personal business	20.6%	14.2%	19.6%
School/church	3.8%	3.1%	3.7%
Doctor/dentist	1.5%	1.3%	1.5%
Vacation	1.0%	10.0%	2.4%
Visit friends or relatives	9.4%	25.7%	12.0%
Other social or recreational	12.4%	22.3%	13.9%
Other	0.1%	1.1%	0.3%
Not ascertained	0.0%	0.0%	0.0%
All (millions)	2,068,368	385,997	2,454,365

Source:
U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Survey web site: www-cta.ornl.gov/npts.

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 26% more per year than the one in two-vehicle households (21,177 miles vs. 16,804 miles).

Table 11.10
Average Annual Miles per Vehicle by Household Vehicle Ownership, 1995 NPTS

Vehicle [a]	One-vehicle household	Two-vehicle household	Three-vehicle household	Four-vehicle household	Five-vehicle household
#1	12,379	16,804	18,853	20,724	21,177
#2	-	8,322	9,806	11,311	12,880
#3	-	-	4,555	6,395	7,319
#4	-	-	-	3,218	4,177
#5	-	-	-	-	2,321
Average	**12,379**	**12,855**	**11,604**	**11,100**	**10,372**

Source:
Generated from the Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Survey Public Use Files, Washington, DC, 1998. (Additional resources: www-cta.ornl.gov/npts)

Table 11.11
Average Age of Vehicles by Household Vehicle Ownership, 1995 NPTS

Vehicle[a]	One-vehicle household	Two-vehicle household	Three-vehicle household	Four-vehicle household	Five-vehicle household
#1	7.48	6.45	6.74	7.01	7.35
#2	-	8.54	8.55	8.68	9.54
#3	-	-	12.25	11.36	11.89
#4	-	-	-	14.52	14.60
#5	-	-	-	-	17.81
Average	**7.48**	**7.42**	**8.93**	**10.03**	**11.62**

Source:
Generated from the Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Survey Public Use Files, Washington, DC, 1998. (Additional resources: www-cta.ornl.gov/npts)

[a]Vehicles are ranked by descending annual miles driven.

Historically, the data from the Nationwide Personal Transportation Survey (NPTS) are based on estimates reported by survey respondents. For the 1995 survey, odometer data was also collected. These data indicate that respondents overestimate the number of miles driven in a year.

Table 11.12
Average Annual Miles Per Household Vehicle by Vehicle Age

Vehicle age (years)	1983 self-reported	1990 self-reported	1995 self-reported	**1995 odometer**
Under 1	8,200	19,600	15,900	**15,600**
1	15,200	16,800	16,800	**14,500**
2	16,800	16,600	15,500	**14,800**
3	14,500	14,700	14,400	**13,800**
4	13,000	13,600	14,100	**12,900**
5	12,100	12,900	13,500	**12,700**
6	11,300	13,200	13,200	**12,400**
7	10,000	12,400	12,800	**11,600**
8	9,800	12,600	12,200	**11,300**
9	9,000	11,500	12,200	**11,200**
10 and older	7,300	9,200	8,900	**9,000**
All household vehicles	**10,400**	**12,500**	**12,200**	**11,800**

Source:
Nationwide Personal Transportation Study—1983: D. Klinger and J. Richard Kuzmyak, 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: www-cta.ornl.gov/npts.
(Additional resources: www.fhwa.dot.gov, www.eia.doe.gov)

Note:
Data include all household vehicles, and have been rounded to the nearest hundred.

In 1995 the average journey-to-work speed was faster (miles per hour increased to 34.6), but the travel time still increased, 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 11.13
Journey-to-Work Statistics
1983, 1990, and 1995 NPTS[a]

Year	Private transportation	Public transportation	Other[b]	Total
Average travel time (minutes)[c]				
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
Average trip length (miles)				
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
Average speed (miles per hour)				
1983	30.2	17.8	7.6	28.2
1990[d]	34.7	18.2	7.6	33.3
1995[d]	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 *www-cta.ornl.gov/npts*. (Additional resources: www.fhwa.dot.gov, www-cta.ornl.gov/npts)

[a]It is believed that the methodology changes in the 1995 NPTS did not affect journey-to-work trips; therefore, no adjustment is necessary.
[b]Includes airplane, Amtrak, taxi, bicycle, school bus, moped, walk and other.
[c]Does not include time spent waiting for transportation.
[d]Does 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 11.2% in 2000. The percent of workers using public transit declined from 6.4% to 5.3% in the ten year period between 1980 and 1990, but stayed relatively the same from 1990 to 2000 (5.2%). The average travel time increased by 2.6 minutes from 1980 to 2000.

Table 11.14
Means of Transportation to Work, 1980, 1990 and 2000 Census

Means of transportation	1980 Census		1990 Census		2000 Census	
	Number of workers (thousands)	Share	Number of workers (thousands)	Share	Number of workers (thousands)	Share
Private vehicle	81,258	84.1%	99,593	86.5%	111,554	87.5%
Drove alone	*62,193*	*64.4%*	*84,215*	*73.2%*	*97,247*	*76.3%*
Car pooled	*19,065*	*19.7%*	*15,378*	*13.4%*	*14,307*	*11.2%*
Public transportation	6,175	6.4%	6,070	5.3%	6,575	5.2%
Bus or trolley bus[a]	*3,925*	*4.1%*	*3,445*	*3.0%*	*3,572*	*2.8%*
Streetcar or trolley car[a]	[b]	[b]	*78*	*0.1%*	*88*	*0.1%*
Subway or elevated	*1,529*	*1.6%*	*1,755*	*1.5%*	*1,981*	*1.6%*
Railroad	*554*	*0.6%*	*574*	*0.5%*	*696*	*0.5%*
Ferryboat	[b]	[b]	*37*	*0.0%*	*43*	*0.0%*
Taxicab	*167*	*0.2%*	*179*	*0.2%*	*194*	*0.2%*
Motorcycle	419	0.4%	237	0.2%	158	0.1%
Bicycle	468	0.5%	467	0.4%	563	0.4%
Walked only	5,413	5.6%	4,489	3.9%	3,413	2.7%
Other means	703	0.7%	809	0.7%	1,099	0.9%
Worked at home	2,180	2.3%	3,406	3.0%	4,075	3.2%
Total workers	96,617	100.0%	115,070	100.0%	127,437	100.0%
Average travel time (minutes)	21.7		22.4		24.3	

Source:
1980-1990 data - Provided by the Journey-to-Work and Migration Statistics Branch, Population Division, U.S. Bureau of the Census
2000 data - U.S. Bureau of the Census, American Fact Finder, factfinder.census.gov, Tables QT-03 and P047, August 2001. (Additional resources: www.census.gov)

[a] This category was "Bus or streetcar" in 1980.
[b] Data are not available.

More than half of workers had 15-29 minute commutes in 1990, but that dropped to 35% by 2000. The share of workers commuting less than 15 minutes increased the most in the ten-year period (14 percentage points), but the share of workers commuting 30 minutes or more also saw small increases.

Table 11.15
Workers by Commute Time, 1990 and 2000 Census

Commute time	1990	2000
Less than 15 minutes	15.9%	30.1%
15–29 minutes	51.6%	36.3%
30–39 minutes	14.7%	15.7%
40–59 minutes	9.0%	10.7%
60 minutes or more	5.9%	7.3%
Average travel time (minutes)	22.4	24.3

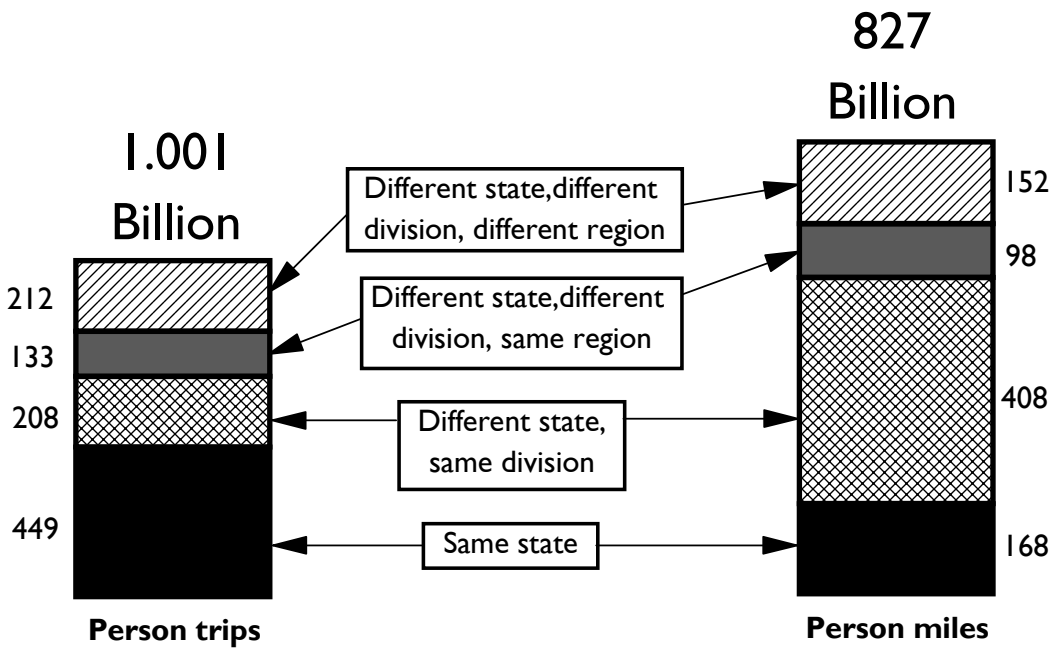
Source:
1990 - U. S. Department of Transportation, Volpe National Transportation Systems Center, *Journey-to-Work Trends in the United States and its Major Metropolitan Area, 1960–1990*, FHWA-PL-94-012, Cambridge, MA, 1994, p. 2-6.
2000 - U.S. Bureau of the Census, American Fact Finder, factfinder.census.gov, Tables QT-03 and P048, August 2001.
(Additional resources: www.census.gov)

1995 American Travel Survey

The American Travel Survey (ATS) was conducted by the Bureau of Transportation Statistics, U.S. Department of Transportation, 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: www.bts.gov/ats

Figure 11.3 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: www.bts.gov/ats)
Note:
Definitions of divisions and regions are in Appendix C.

Personal-use vehicles are by far the most predominant means of transportation on long-distance trips (100 miles or more, one way); two-thirds of those personal vehicle trips are pleasure trips.

Table 11.16
Long-Distance Trips[a] by Mode and Purpose, 1995

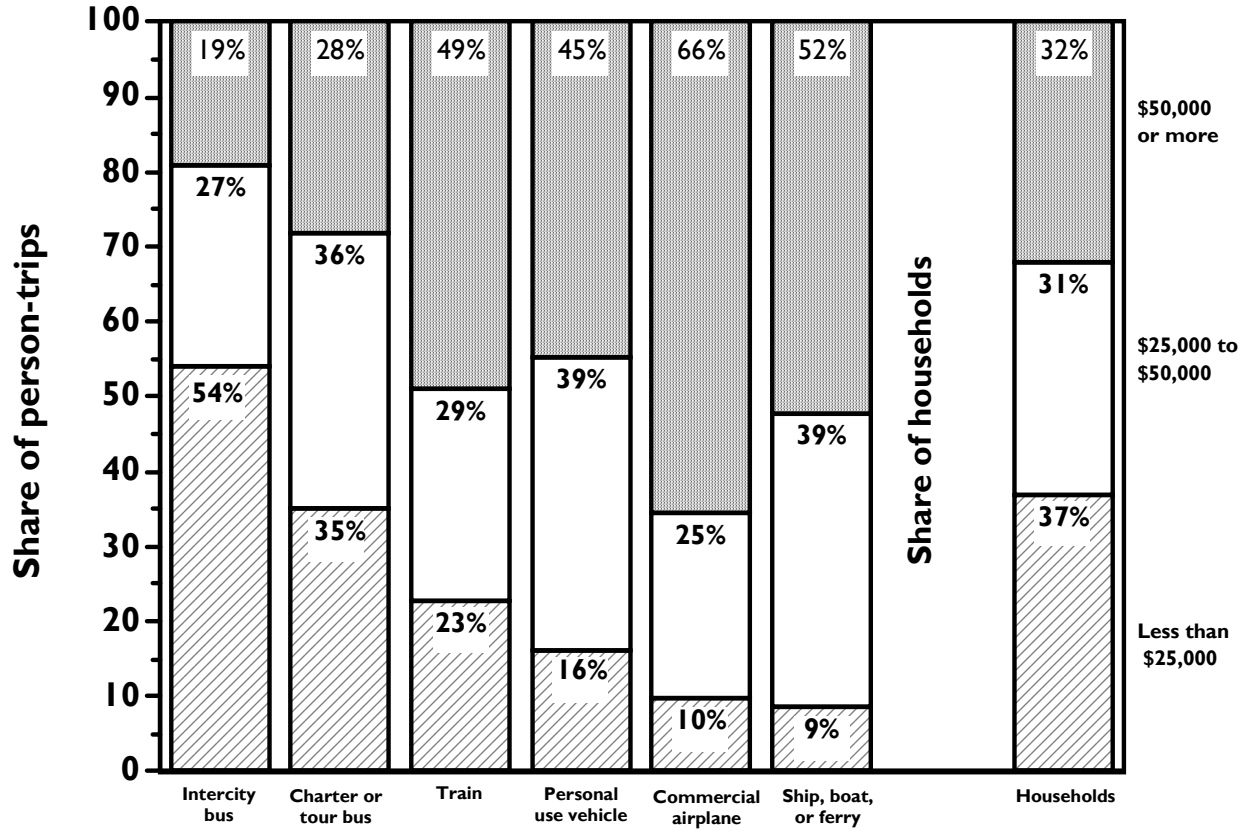
Principal means of transportation	Main purpose of trip					
		Pleasure				
	Business	*Visit friends or relatives*	*Leisure*	Total	Personal business	Total
	Person trips (thousands)					
Personal use vehicle	151,697	*283,153*	*254,186*	537,339	124,791	813,858
Commercial airplane	67,083	*41,881*	*31,581*	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: www.bts.gov/ats)

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

Those with a household income of less than $25,000 account for more than half (54%) of intercity bus person-trips. Those with a household income of $50,000 or more account for two-thirds (66%) of commercial airplane person-trips.

Figure 11.4. 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: www.bts.gov/ats, www.census.gov)

Chapter 12
Nonhighway Modes

Summary Statistics from Tables in this Chapter

Source		
	Passenger-miles, 1999	(millions)
Table 12.1	*Domestic and international air carrier*	*668,626*
Table 12.2	*General aviation*	*13,500*
Table 12.10	*Amtrak*	*5,289*
Table 12.11	*Transit rail*	*14,108*
	Freight ton-miles, 1999	(millions)
Table 12.4	*Domestic waterborne commerce*	*656,000*
Table 12.7	*Class I railroad*	*1,433,461*
	Passenger energy use, 1999	(trillion Btus)
Table 12.1	*Domestic and international air carrier*	*2,653.1*
Table 12.2	*General aviation*	*172.1*
Table 12.10	*Amtrak energy use*	*16.2*
Table 12.11	*Transit rail*	*44.7*
	Freight energy use, 1999	(trillion Btus)
Table 12.4	*Domestic waterborne commerce*	*299.9*
Table 12.7	*Class I railroad*	*520.1*

Table 12.1
Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers (Combined Totals), 1970–2000[a]

Year	Revenue aircraft-miles (millions)	Average passenger trip length[b] (miles)	Revenue passenger-miles (millions)	Available seat-miles (millions)	Available seats per aircraft[c]	Passenger load factor (percentage)[d]	Revenue cargo ton-miles (millions)	Energy use (trillion Btu)[e]	Percent domestic of total energy use (percentage)
1970	2,383	678	131,719 [f]	264,904 [f]	111	49.7%[f]	4,994	1,363.4	[g]
1975	2,241	698	173,324	315,823	135	54.9%	5,944	1,283.4	[g]
1980	2,924	736	267,722	448,479	148	59.7%	7,515	1,386.0	83.0%
1985	3,462	758	351,073	565,677	163	62.1%	9,048	1,701.4	80.3%
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	1,945.9	80.0%
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	2,213.0	75.8%
1991	4,661	806	463,296	738,030	158	62.8%	16,149	2,085.2	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	2,169.7	74.4%
1994	5,360	787	537,506	809,240	151	66.4%	21,773	2,266.2	74.3%
1995	5,627	791	558,757	845,012	150	66.1%	23,375	2,338.6	74.0%
1996	5,855	802	596,164	859,720	147	69.3%	24,892	2,409.1	73.9%
1997	6,025	814	619,969	880,607	146	70.4%	27,610	2,514.2	73.3%
1998	6,222	813	636,410	899,115	145	70.8%	28,015	2,573.4	72.8%
1999	6,558	824	668,626	942,311	144	71.0%	28,984	2,653.1	73.3%
2000	6,919	833	707,979	979,779	142	72.3%	30,221	2,743.1	73.1%
				Average annual percentage change					
1970–2000	3.4%	0.7%	5.6%	4.3%	0.9%		6.0%	2.2%	
1990–2000	3.3%	0.3%	3.5%	2.3%	-1.0%		5.9%	1.8%	

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics, *Air Carrier Traffic Statistics Monthly*, December 1998/1997, 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.
1982–99 Energy Use - Department of Transportation, Bureau of Transportation Statistics, "Fuel Cost and Consumption Tables," Washington, DC, monthly. Annual totals are derived by summing monthly totals for domestic and international air carriers. (Additional resources: www.bts.gov, www.faa.gov)

[a]Data are for all U.S. air carriers reporting on Form 41.
[b]Scheduled 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.
[c]Available seats per aircraft is calculated as the ratio of available seat-miles to revenue aircraft-miles.
[d]Passenger load factor is calculated as the ratio of revenue passenger-miles to available seat-miles for scheduled and nonscheduled services.
[e]Energy use includes fuel purchased abroad for international flights.
[f]Scheduled services only.
[g]Data are not available.

Table 12.2
Summary Statistics for General Aviation, 1970–99

Calendar year	Total number of aircraft	Aircraft hours flown (thousands)	Intercity passenger travel (billion passenger-miles)	Energy use (trillion btu)
1970	131,700[a]	26,030[b]	9.1	94.4
1975	168,475	30,298	11.4	121.5
1976	177,964	31,950	12.1	130.3
1977	184,294	33,679	12.8	149.7
1978	199,178	36,844	14.1	159.4
1979	210,339	40,432	15.5	167.2
1980	211,045	41,016	14.7	169.0
1981	213,226	40,704	14.6	162.4
1982	209,779	36,457	13.1	170.5
1983	213,293	35,249	12.7	143.9
1984	220,943	36,119	13.0	148.9
1985	196,500	31,456	12.3	144.0
1986	205,300	31,782	12.4	148.0
1987	202,700	30,883	12.1	139.1
1988	196,200	31,114	12.6	148.6
1989	205,000	32,332	13.1	134.0
1990	198,000	32,096	13.0	131.9
1991	196,874	30,490	12.1	120.4
1992	185,650	27,471	10.8	104.7
1993	177,120	24,455	9.9	97.5
1994	172,935	24,092	9.8	95.3
1995	188,089	26,612	10.8	106.6
1996	191,129	26,909	12.0	111.1
1997	192,414	27,713	12.5	121.1
1998	204,710	28,100	13.1	147.4
1999	219,464	31,756	13.5	172.1
		Average annual percentage change		
1970–99	1.8%	0.7%	1.4%	2.1%
1989–99	0.7%	-0.2%	0.3%	2.5%

Sources:
Intercity passenger-miles - Eno Foundation for Transportation, *Transportation in America 2000*, Eighteenth edition, Lansdowne, VA, 2001, p. 15, and annual.
All other- U.S. Department of Transportation, Federal Aviation Administration, *General Aviation Activity and Avionics Survey: Calendar Year 1999*, Tables 1.2, 1.5, 5.1, and annual. (Additional resources: www.faa.gov)

[a]Active fixed-wing general aviation aircraft only.
[b]Includes rotocraft.

In the early seventies, domestic waterborne commerce accounted for over 60% of total tonnage, but by 1994 foreign tonnage grew to more than half of all waterborne tonnage and has continued to grow each year since.

Table 12.3
Tonnage Statistics for Domestic and International Waterborne Commerce, 1970–99
(million tons shipped)

Year	Foreign and domestic total	Foreign total[a]	Domestic total[b]	Percent domestic of total
1970	1,532	581	951	62.1%
1975	1,695	749	946	55.8%
1976	1,835	856	979	53.4%
1977	1,908	935	973	51.0%
1978	2,021	946	1,075	53.2%
1979	2,073	993	1,080	52.1%
1980	1,999	921	1,077	53.9%
1981	1,942	887	1,054	54.3%
1982	1,777	820	957	53.9%
1983	1,708	751	957	56.0%
1984	1,836	803	1,033	56.3%
1985	1,788	774	1,014	56.7%
1986	1,874	837	1,037	55.3%
1987	1,967	891	1,076	54.7%
1988	2,088	976	1,112	53.3%
1989	2,140	1,038	1,103	51.5%
1990	2,164	1,042	1,122	51.8%
1991	2,092	1,014	1,079	51.6%
1992	2,132	1,037	1,095	51.4%
1993	2,128	1,060	1,068	50.2%
1994	2,215	1,116	1,099	49.6%
1995	2,240	1,147	1,093	48.8%
1996	2,284	1,183	1,101	48.2%
1997	2,334	1,221	1,113	47.7%
1998	2,339	1,245	1,094	46.8%
1999	2,333	1,261	1,062	45.5%
	Average annual percentage change			
1970–99	1.5%	2.7%	0.4%	
1989–99	0.9%	2.0%	-0.4%	

Source:
U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 1999*, Part 5: National Summaries, New Orleans, Louisiana, 2001, Table 1-1, p. 1-3, and annual. (Additional resources: www.wrc-ndc.usace.army.mil/ndc)

[a]All movements between the U.S. and foreign countries and between Puerto Rico and the Virgin Islands and foreign countries are classified as foreign trade.

[b]All movements between U.S. ports, continental and noncontiguous, and on the inland rivers, canals, and connecting channels of the U.S., Puerto Rico, and the Virgin Islands, excluding the Panama Canal. Beginning in 1996, fish was excluded for internal and intra port domestic traffic.

Table 12.4
Summary Statistics for Domestic Waterborne Commerce, 1970–99

Year	Number of vessels[a]	Ton-miles (billions)	Tons shipped[b] (millions)	Average length of haul (miles)	Energy intensity (Btu/ton-mile)	Energy use (trillion Btu)
1970	25,832	596	949	628.2	545	324.8
1975	31,666	566	944	599.9	549	311.0
1976	33,204	592	976	606.3	468	277.3
1977	35,333	599	969	618.0	458	274.3
1978	35,723	827	1,072	771.6	383	316.6
1979	36,264	829	1,076	770.0	457	378.7
1980	38,792	922	1,074	856.4	358	329.8
1981	42,079	929	1,051	884.0	360	334.5
1982	42,079	886	954	929.0	310	274.9
1983	41,784	920	953	964.6	319	293.7
1984	41,784	888	1,029	862.5	346	307.3
1985	41,672	893	1,011	883.5	446	398.6
1986	40,308	873	1,033	845.3	463	404.0
1987	40,000	895	1,072	835.0	402	370.7
1988	39,192	890	1,106	804.3	361	321.3
1989	39,209	816	1,097	743.2	403	328.6
1990	39,233	834	1,118	745.7	388	323.2
1991	39,233	848	1,074	789.9	386	327.5
1992	39,210	857	1,090	785.7	398	341.0
1993	39,064	790	1,063	742.7	389	307.0
1994	39,064	815	1,093	745.5	369	300.7
1995	39,641	808	1,086	743.6	374	302.2
1996	41,104	765	1,093	699.4	412	314.9
1997	41,419	707	1,106	639.5	415	293.2
1998	42,032	673	1,087	619.0	436	293.1
1999	41,766	656	1,056	621.1	457	299.9
			Average annual percentage change			
1970–99	1.7%	0.3%	0.4%	0.0%	-0.6%	-0.3%
1989–99	0.6%	-2.2%	-0.4%	-1.8%	1.3%	-0.9%

Source:
Number of vessels -
1970–92, 1995–99 - U.S. Department of the Army, Corps of Engineers, "Summary of U.S. Flag Passenger and cargo vessels, 1999," New Orleans, LA, 2001, and annual.
1993–94 - U.S. Dept of the Army, Corps of Engineers, *The U.S. Waterway System-Facts*, Navigation Data Center, New Orleans, Louisiana, January 1996.
Ton-miles, tons shipped, average length of haul - U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 1999* Part 5: National Summaries, New Orleans, LA, 2001, Table 1-4, pp. 1-6, 1-7, and annual.
Energy use - See Appendix A for Table 2.5.
(Additional resources: www.wrc-ndc.usace.army.mil/ndc)

[a]Grand total for self-propelled and non-self-propelled.
[b]These figures are not consistent with the figures on Table 6.4 because intra-territory tons are not included in this table. Intra-territory traffic is traffic between ports in Puerto Rico and the Virgin Islands.

Fifty-four percent of all domestic marine cargo in 1999 were energy-related products (petroleum, coal, coke). The majority of the energy-related products were shipped internally and locally (66%). Barge traffic accounted for 96% of all internal and local waterborne commerce.

Table 12.5
Breakdown of Domestic Marine Cargo by Commodity Class, 1999

	Coastwise		Lakewise		Internal and local		Total domestic[a]		
Commodity class	Tons shipped (millions)	Average haul[b] (miles)	Tons shipped (millions)	Average haul[b] (miles)	Tons shipped (millions)	Average haul[b] (miles)	Tons shipped (millions)	Percentage	Average haul[b] (miles)
Petroleum and products	162	1,316	2	305	192	203	356	33.7%	710
Chemicals and related products	14	2,060	[c]	336	61	492	75	7.1%	790
Crude materials	17	606	87	508	136	364	239	22.7%	433
Coal and coke	13	650	21	528	185	340	219	20.7%	396
Primary manufactured goods	8	612	4	295	34	833	45	4.3%	752
Food and farm products	7	1,862	[c]	978	93	1,032	100	9.5%	1,091
Manufactured equipment	8	1,698	[c]	[c]	10	90	18	1.7%	814
Waste and scrap	[c]	1,000	0	0	4	60	4	0.4%	60
Unknown	[c]	2,022	[c]	[c]	[c]	[c]	[c]	0.0%	1,292
Total	229	1,279	114	501	713	429	1,056	100.0%	621
Barge traffic (million tons)	107		12		685		804		
Percentage by barge	46.8%		10.3%		96.0%		76.1%		

Source:
U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 1999*, Part 5: National Summaries, New Orleans, Louisiana, 2001, Tables 2-1, 2-2, and 2-3, pp. 2-1—2-8, and annual.
(Additional resources: www.wrc-ndc.usace.army.mil/ndc)

Note:
Coastwise applies to domestic traffic receiving a carriage over the ocean or between the Great Lakes ports and seacoast ports when having a carriage over the ocean. Lakewise applies to traffic between United States ports on the Great Lakes. Internal applies to traffic between ports or landings wherein the entire movement takes place on inland waterways. Local applies to movements of freight within the confines of a port.

[a]Does not include intra-territory tons.
[b]Calculated as ton-miles divided by tons shipped.
[c]Negligible.

The Interstate Commerce Commission designates Class I railroads on the basis of annual gross revenues. In 1999, nine railroads were given this designation. The number of railroads designated as Class I has changed considerably in the last 25 years; in 1976 there were 52 railroads given Class I designation.

Table 12.6
Class I Railroad Freight Systems in the United States
Ranked by Revenue Ton-Miles, 1999

Railroad	Revenue ton-miles (billions)	Percent
Burlington Northern and Sante Fe Railway Company	488	34.0%
Union Pacific Railroad Company	473	33.0%
CSX Transportation	189	13.2%
Norfolk Southern Corporation	166	11.6%
Consolidated Rail Corporation (Conrail)	40	2.8%
Illinois Central Railroad Company	25	1.7%
Kansas City Southern Railway Company	22	1.5%
Soo Line Railroad Company	21	1.5%
Grand Trunk Western Railroad Inc.	11	0.8%
Total	**1,435**	**100.0%**

Source:
Association of American Railroads, *Railroad Facts*, 2000 Edition, Washington, DC, October 2000, p. 66. (Additional resources: www.aar.org)

Table 12.7
Summary Statistics for Class I Freight Railroads, 1970–99

Year	Number of locomotives in service[a]	Number of freight cars (thousands)[b]	Train-miles (millions)	Car-miles (millions)	Tons originated[c] (millions)	Average length of haul (miles)	Revenue ton-miles (millions)	Energy intensity (Btu/ton-mile)	Energy use (trillion Btu)
1970	27,077[d]	1,424	427	29,890	1,485	515	764,809	691	528.1
1975	27,855	1,359	403	27,656	1,395	541	754,252	687	518.3
1980	28,094	1,168	428	29,277	1,492	616	918,621	597	548.7
1981	27,421	1,111	408	27,968	1,453	626	910,169	572	521.0
1982	26,795	1,039	345	23,952	1,269	629	797,759	553	440.8
1983	25,448	1,007	346	24,358	1,293	641	828,275	525	435.1
1984	24,117	948	369	26,409	1,429	645	921,542	510	470.0
1985	22,548	867	347	24,920	1,320	664	876,984	497	436.1
1986	20,790	799	347	24,414	1,306	664	867,722	486	421.5
1987	19,647	749	361	25,627	1,372	688	943,747	456	430.3
1988	19,364	725	379	26,339	1,430	697	996,182	443	441.4
1989	19,015	682	383	26,196	1,403	723	1,013,841	437	442.6
1990	18,835	659	380	26,159	1,425	726	1,033,969	420	434.7
1991	18,344	633	375	25,628	1,383	751	1,038,875	391	405.8
1992	18,004	605	390	26,128	1,399	763	1,066,781	393	419.2
1993	18,161	587	405	26,883	1,397	794	1,109,309	389	431.6
1994	18,505	591	441	28,485	1,470	817	1,200,701	388	465.4
1995	18,812	583	458	30,383	1,550	843	1,305,688	372	485.9
1996	19,269	571	469	31,715	1,611	842	1,355,975	368	499.4
1997	19,684	568	475	31,660	1,585	851	1,348,926	370	499.7
1998	20,261	576	475	32,657	1,649	835	1,376,802	365	502.0
1999	20,256	579	490	33,851	1,717	835	1,433,461	362	520.1
				Average annual percentage change					
1970–99	-1.0%	-3.1%	0.5%	0.4%	0.5%	1.7%	2.2%	-2.2%	-0.1%
1989–99	0.6%	-1.6%	2.5%	2.6%	2.0%	1.5%	3.5%	-1.9%	1.6%

Source:
Association of American Railroads, *Railroad Facts*, 2000 Edition, Washington, DC, October 2000, pp. 27, 28, 33, 34, 36, 48, 50, 60.
(Additional resources: www.aar.org)

[a]Does not include self-powered units. From 1972 to 1979, the number of locomotives used in Amtrak passenger operations are subtracted from the total locomotives used in passenger and freight service to calculate the number of Class I locomotives in service.

[b]Does not include private or shipper-owned cars.

[c]Tons originated is a more accurate representation of total tonnage than revenue tons. Revenue tons often produces double-counting of loads switched between rail companies.

[d]Data represent total locomotives used in freight and passenger service. Separate estimates are not available.

The "other" category, which consists primarily of intermodal traffic, has grown 126% in carloads from 1974 to 1998. Coal now accounts for one quarter of all carloads.

Table 12.8
Railroad Revenue Carloads by Commodity Group, 1974 and 1999

Commodity group	Carloads (thousands) 1974	Carloads (thousands) 1999	Percent distribution 1974	Percent distribution 1999	Percentage change 1974–99
Coal	4,544	6,965	17.0%	25.7%	53.3%
Farm products	3,021	1,477	11.3%	5.5%	-51.1%
Chemicals and allied products	1,464	1,844	5.5%	6.8%	26.0%
Nonmetallic minerals	821	1,306	3.1%	4.8%	59.1%
Food and kindred products	1,777	1,354	6.6%	5.0%	-23.8%
Lumber and wood products	1,930	673	7.2%	2.5%	-65.1%
Metallic ores	1,910	295	7.1%	1.1%	-84.6%
Stone, clay and glass	2,428	538	9.1%	2.0%	-77.8%
Pulp, paper, and allied products	1,180	612	4.4%	2.3%	-48.1%
Petroleum products	877	514	3.3%	1.9%	-41.4%
Primary metal products	1,366	709	5.1%	2.6%	-48.1%
Waste and scrap material	889	624	3.3%	2.3%	-29.8%
Transportation equipment	1,126	1,764	4.2%	6.5%	56.7%
Others	3,451	8,422	12.9%	31.1%	144.0%
Total	26,784	27,097	100.0%	100.0%	1.2%

Source:
1974 - Association of American Railroads, *Railroad Facts*, 1976 Edition, Washington, DC, 1975, p. 26.
1999 - Association of American Railroads, *Railroad Facts*, 2000 Edition, Washington, DC, October 2000, p. 25.
(Additional resources: www.aar.org)

The number of trailers and containers moved by railroads has increased more than four-fold from 1965 to 1999. Containerization has increased in recent years, evidenced by the 150% increase in the number of containers from 1988 to 1999. According to the 1997 Commodity Flow Survey, 5% of all freight ton-miles are rail intermodal shipments (truck/rail or rail/water). See Table 8.11 for details.

Table 12.9
Intermodal Rail Traffic, 1965–99

Year	Trailers & containers	Trailers	Containers
1965	1,664,929	[a]	[a]
1970	2,363,200	[a]	[a]
1975	2,238,117	[a]	[a]
1980	3,059,402	[a]	[a]
1985	4,590,952	[a]	[a]
1986	4,997,229	[a]	[a]
1987	5,503,819	[a]	[a]
1988	5,779,547	3,481,020	2,298,527
1989	5,987,355	3,496,262	2,491,093
1990	6,206,782	3,451,953	2,754,829
1991	6,246,134	3,201,560	3,044,574
1992	6,627,841	3,264,597	3,363,244
1993	7,156,628	3,464,126	3,692,502
1994	8,128,228	3,752,502	4,375,726
1995	8,070,309	3,519,664	4,550,645
1996[b]	8,153,942	3,320,312	4,833,630
1997[b]	8,695,860	3,453,081	5,242,779
1998[b]	8,772,663	3,353,032	5,419,631
1999[b]	9,041,771	3,298,024	5,743,747
Average annual percentage change			
1965–99	5.2%	[a]	[a]
1989–99	4.3%	-0.4%	9.0%

Source:
Association of American Railroads, *Railroad Facts*, 2000 edition, Washington, DC, October 2000 p. 26. (Additional resources: www.aar.org**)**

[a] Data are not available.
[b] The Grand Trunk Western Railroad and the Soo Line Railroad Company data are excluded.

Table 12.10
Summary Statistics for the National Railroad Passenger Corporation (Amtrak), 1971–99

Year	Number of locomotives in service	Number of passenger cars	Train-miles (thousands)	Car-miles (thousands)	Revenue passenger-miles (millions)	Average trip length (miles)	Energy intensity (Btu per revenue passenger-mile)	Energy use (trillion Btu)
1971	[a]	1,165	16,537	140,147	1,993	188	[a]	[a]
1975	355	1,913	30,166	253,898	3,753	224	3,677	13.8
1980	448	2,128	29,487	235,235	4,503	217	3,176	14.3
1981	398	1,830	30,380	222,753	4,397	226	2,979	13.1
1982	396	1,929	28,833	217,385	3,993	220	3,156	12.6
1983	388	1,880	28,805	223,509	4,227	223	2,957	12.5
1984	387	1,844	29,133	234,557	4,427	227	3,027	13.4
1985	382	1,818	30,038	250,642	4,785	238	2,800	13.4
1986	369	1,793	28,604	249,665	5,011	249	2,574	12.9
1987	381	1,850	29,515	261,054	5,361	259	2,537	13.6
1988	391	1,845	30,221	277,774	5,686	265	2,462	14.0
1989	312	1,742	31,000	285,255	5,859	274	2,731	16.0
1990	318	1,863	33,000	300,996	6,057	273	2,609	15.8
1991	316	1,786	34,000	312,484	6,273	285	2,503	15.7
1992	336	1,796	34,000	307,282	6,091	286	2,610	15.9
1993	360	1,853	34,936	302,739	6,199	280	2,646	16.4
1994	411	1,874	34,940	305,600	5,869	276	2,351	13.8[b]
1995	422	1,907	31,579	282,579	5,401	266	2,592	14.0
1996	348	1,501	30,542	277,750	5,066	257	2,783	14.1
1997	292	1,572	32,000	287,760	5,166	255	2,923	15.1
1998	362	1,347	32,926	315,823	5,325	251	2,892	15.4
1999	385	1,285	34,080	349,337	5,289	245	3,063	16.2
				Average annual percentage change				
1971–99	[a]	0.4%	2.6%	3.3%	3.5%	1.0%	[a]	[a]
1989–99	2.1%	-3.0%	1.0%	2.0%	-1.0%	-1.1%	1.2%	-0.1%

Source:
1971–83- Association of American Railroads, Economics and Finance Department, *Statistics of Class I Railroads*, Washington, DC, and annual.
1984–88- Association of American Railroads, *Railroad Facts*, 1988 Edition, Washington, DC, December 1989, p. 61, and annual.
1989–93- Personal communication with the Corporate Accounting Office of Amtrak, Washington, D.C.
1994–99- Number of locomotives in service, number of passenger cars, train-miles, car-miles, revenue passenger-miles, and average trip length - Association of American Railroads, *Railroad Facts*, 1999 Edition, Washington, DC, 2000, p. 77.
Energy use - Personal communication with the Amtrak, Washington, DC, and estimates thereafter based on train-miles.
(Additional resources: www.amtrak.com, www.aar.org)

[a] Data are not available.
[b] Energy use for 1994 on is not directly comparable to earlier years. Some commuter rail energy use may have been inadvertently included in earlier years.

Table 12.11
Summary Statistics for Rail Transit Operations, 1970–99[a]

Year	Number of passenger vehicles	Vehicle-miles (millions)	Passenger trips (millions)[b]	Estimated passenger-miles (millions)[c]	Average trip length (miles)[d]	Energy intensity (Btu/passenger-mile)[e]	Energy use (trillion Btu)
1970	10,548	440.8	2,116	12,273	[f]	2,453	30.1
1975	10,617	446.9	1,797	10,423	[f]	2,962	31.1
1980	10,654	402.2	2,241	10,939	4.9	3,008	32.9
1981	10,824	436.6	2,217	10,590	4.8	2,946	31.2
1982	10,831	445.2	2,201	10,428	4.6	3,069	32.0
1983	10,904	423.5	2,304	10,741	4.7	3,212	34.5
1984	10,848	452.7	2,388	10,531	4.4	3,732	39.3
1985	11,109	467.8	2,422	10,777	4.4	3,461	37.3
1986	11,083	492.8	2,467	11,018	4.5	3,531	38.9
1987	10,934	508.6	2,535	11,603	4.6	3,534	41.0
1988	11,370	538.3	2,462	11,836	4.8	3,565	42.2
1989	11,261	553.4	2,704	12,539	4.6	3,397	42.6
1990	11,332	560.9	2,521	12,046	4.8	3,453	41.6
1991	11,426	554.8	2,356	11,190	4.7	3,727	41.7
1992	11,303	554.1	2,396	11,441	4.8	3,575	40.9
1993	11,286	549.8	2,234	10,936	4.9	3,687	42.2
1994	11,192	565.8	2,453	11,501	4.8	3,828	44.0
1995	11,156	571.8	2,284	11,419	5.0	3,818	43.6
1996	11,341	580.7	2,417	12,484	5.2	3,444	43.0
1997	11,471	598.9	2,692	13,091	4.9	3,253	42.6
1998	11,521	609.5	2,669	13,412	5.0	3,216	43.1
1999	11,603	626.4	2,813	14,108	5.0	3,168	44.7
				Average annual percentage change			
1970–99	0.3%	1.2%	1.0%	0.5%	-0.7%[g]	0.9%	1.4%
1989–99	0.3%	1.2%	0.4%	1.2%	0.8%	-0.7%	0.5%

Source:
American Public Transit Association, *2000 Transit Fact Book*, Washington, DC, March 2000, pp. 69, 70, 78, 83. (Additional resources: www.apta.com)
Energy use - See Appendix A for Table 2.5.

[a]Heavy rail and light rail. Series not continuous between 1983 and 1984 because of a change in data source by the American Public Transit Association (APTA). Beginning in 1984, data provided by APTA are taken from mandatory reports filed with the Urban Mass Transit Administration (UMTA). Data for prior years were provided on a voluntary basis by APTA members and expanded statistically.
[b]1970–79 data represents total passenger rides; after 1979, data represents unlinked passenger trips.
[c]Estimated for years 1970–76 based on an average trip length of 5.8 miles.
[d]Calculated as the ratio of passenger-miles to passenger trips.
[e]Large system-to-system variations exist within this category.
[f]Data are not available.
[g]Average annual percentage change is calculated for years 1977-98.

APPENDIX A

SOURCES

This appendix contains documentation of the estimation procedures used by ORNL. The reader can examine the methodology behind the estimates and form an opinion as to their utility. The appendix is arranged by table number and subject heading. Only tables which contain ORNL estimations are documented in Appendix A; all other tables have sources listed at the bottom of the table. Since abbreviations are used throughout the appendix, a list of abbreviations is also included.

List of Abbreviations Used in Appendix A

AAMA	American Automobile Manufacturers Association
AAR	Association of American Railroads
APTA	American Public Transit Association
Amtrak	National Railroad Passenger Corporation
Btu	British thermal unit
DOC	Department of Commerce
DOE	Department of Energy
DOT	Department of Transportation
EIA	Energy Information Administration
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
gvw	gross vehicle weight
lpg	liquefied petroleum gas
mpg	miles per gallon
NHTSA	National Highway Traffic Safety Administration
NPTS	Nationwide Personal Transportation Survey
ORNL	Oak Ridge National Laboratory
pmt	passenger-miles traveled
RECS	Residential Energy Consumption Survey
RTECS	Residential Transportation Energy Consumption Survey
TIUS	Truck Inventory and Use Survey
TSC	Transportation Systems Center
VIUS	Vehicle Inventory and Use Survey
vmt	vehicle-miles traveled

Table 2.4
Domestic Consumption of Transportation Energy by Mode and Fuel Type, 1999

Most of the source data were given in gallons. Fuel use was converted to Btu using the conversion factors in Appendix B.

Highway

Automobiles

Total gallons of fuel taken from DOT, FHWA, *Highway Statistics 1999*, Table VM-1. These were distributed as follows: 90.2% gasoline, 9.0% gasohol, and 0.8% diesel.

Motorcycles

DOT, FHWA, *Highway Statistics 1999,* Table VM-1. For conversion purposes, fuel for all motorcycles was assumed to be gasoline.

Buses

Transit:

APTA, *2001 Transit Fact Book,* 2000, Washington, DC.
Non-diesel fossil fuel consumption was assumed to be used by motor buses.

Intercity:

Eno Transportation Foundation, *Transportation in America 2000*, Eighteenth Edition, 2001, Washington, DC, pp. 20–23. For conversion purposes, fuel for all intercity buses was assumed to be diesel fuel.

School:

Gasoline and Diesel - Eno Transportation Foundation, *Transportation in America 2000,* Eighteenth Edition, 2001, Washington, DC, pp. 20–23. For conversion purposes, fuel for school buses was assumed to be 90% diesel fuel and 10% gasoline based on estimates from the National Association of State Directors of Pupil Transportation Services.

Trucks

Total:

Sum of light trucks and other trucks.

Light Trucks:

DOT, FHWA, *Highway Statistics 1999*, Table VM-1, for single-unit, 2-axle, 4-tire trucks. 96.3% of fuel assumed to be gasoline, 3.4% diesel, 0.2% lpg; percentages were generated from the 1997 VIUS Public Use CD.

Other Trucks:

DOT, FHWA, *Highway Statistics 1999*, Table VM-1. Total gallons for other trucks was the difference between total and 2-axle, 4-tire trucks. These gallons were distributed as follows based on data from the 1997 VIUS Public Use CD: 12.4% of fuel assumed to be gasoline, 87.1% diesel, and 0.5% lpg.

Off-Highway

Diesel:

Data supplied by Marianne Mintz, Argonne National Laboratory, from the Public Use Data Base, *National Energy Accounts,* DOC, OBA-NEA-10, August 1988.

Gasoline:

DOT, FHWA, *Highway Statistics 1999,* Table MF-24. Agriculture and Construction totals.

Nonhighway

Air

General Aviation:

DOT, FAA, *General Aviation Activity and Avionics Survey: Annual Summary Report Calendar Year 1999,* Table 5.1. Jet fuel was converted from gallons to Btu using 135,000 Btu/gallon (kerosene-type jet fuel).

Domestic and International Air Carrier:

DOT, Bureau of Transportation Statistics, "Fuel Cost and Consumption Tables." Because the data for international included fuel purchased abroad, the international total was divided in half to estimate domestic fuel use for international flights.

Water

Freight:

Total - DOE, EIA, *Fuel Oil and Kerosene Sales 1999*, Table 23. Adjusted sales of distillate and residual fuel oil for vessel bunkering. (This may include some amounts of bunker fuels used for recreational purposes.)

Recreational Boating:

Fuel use by recreational boating was calculated using the methodology developed by D. L. Greene in the report, *Off-Highway Use of Gasoline in the United States* (DOT, FHWA, July 1986, p. 3-22). Results from Model 1 in the report indicated an average annual consumption of 205 gallons per boat. Total consumption in gallons was then calculated using the following equation: Total = 0.95 (Gal/boat) (number of boats). An estimate of number of recreational boats in operation is from the U.S. Coast Guard (numbered boats).

Pipeline

The sum of natural gas, crude petroleum and petroleum product, and coal slurry and water.

Natural Gas:

The amount of natural gas used to transport natural gas was defined as "pipeline fuel" as reported in DOE, EIA, *Natural Gas Annual 1999*, Table 1. Cubic feet were converted to Btu using 1,031 Btu/ft^3. Electricity use was estimated using the following procedure as reported on p. 5-110 of J. N. Hooker et al., *End Use Energy Consumption DataBase: Transportation Sector*. The energy consumption of a natural gas pipeline was taken to be the energy content of the fuel used to drive the pumps. Some 94% of the installed pumping horsepower was supplied by natural gas. The remaining 6% of the horse power was generated more efficiently, mostly by electric motors. The energy consumed by natural gas pipeline pumps that were electrically powered was not known. In order to estimate the electricity consumed, the Btu of natural gas pipeline fuel consumed was multiplied by a factor of 0.015. From this computed value, electricity efficiency and generation loss must be taken into account. The electricity energy use in Btu must be converted to kWhr, using the conversion factor 29.305 x 10^{-5} kWhr/Btu. Electricity generation and distribution efficiency was 29%. When generation and distribution efficiency are taken into account, 1 kWhr equals 11,765 Btu.

Crude petroleum and petroleum product:

J. N. Hooker, *Oil Pipeline Energy Consumption and Efficiency*, ORNL-5697, ORNL, Oak Ridge, TN, 1981. (Latest available data.)

Coal slurry and water:

W. F. Banks, Systems, Science and Software, *Energy Consumption in the Pipeline Industry*, LaJolla, CA, October 1977. (Latest available data.)

Rail

Total:

Sum of freight and passenger rail.

Freight:

AAR, *Railroad Facts*, 2000 Edition, Washington, DC, 2000.

Passenger:

Transit and Commuter - APTA, *2001 Transit Fact Book*, Washington, DC, 2001. Transit was defined as the sum of "heavy rail," "light rail," and "other."

Intercity - Personal communication with Amtrak, Washington, DC.

Table 2.6
Highway Energy Consumption by Mode, 1970–99

Automobiles

Total gallons of fuel for automobiles was taken from DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A; and Table VM-1 in the 1996–1999 annual editions. Fuel for automobiles was distributed between fuel types for conversion into Btu's as follows:

1970–80 - 94.7% gasoline, 5.3% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Residential Energy Consumption Survey: Consumption Patterns of Household Vehicles, June 1979 to December 1980*, p. 10.

1981–82 - 94.1% gasoline, 5.9% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Residential Energy Consumption Survey: Consumption Patterns of Household Vehicles, Supplement: January 1981 to September 1981*, pp. 11, 13.

1983–84 - 97.5% gasoline, 2.5% diesel as reported in the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Residential Transportation Energy Consumption Survey: Consumption Patterns of Household Vehicles, 1983*, Jan., 1985, pp. 7, 9.

1985–87 - 98.5% gasoline, 1.5% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Residential Transportation Energy Consumption Survey: Consumption Patterns of Household Vehicles 1985*, April 1987, pp. 25, 27.

1988–90 - 98.8% gasoline and 1.2% diesel as reported in the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Household Vehicles Energy Consumption 1988*, March 1990, p. 65.

1991–93 - 97.8% gasoline, 1.0% gasohol, and 1.2% diesel as reported in the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Household Vehicles Energy Consumption 1991*, December 1993, p. 46.

1994–97 - 97.7% gasoline, 1.0% gasohol, 1.3% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Household Vehicles Energy Consumption, 1994*, Washington, DC, August 1997, p. 46.

1998–99 - 90.8% gasoline, 9.0% gasohol, 0.8% diesel.

Motorcycles

Department of Transportation, Federal Highway Administration, *Highway Statistics Summary to 1995*, Table VM-201A; and Table VM-1 in the 1996–99 annual editions. For conversion purposes, fuel for all motorcycles was assumed to be gasoline.

Buses

Sum of transit, intercity and school.

Transit:

APTA, *2001 Transit Fact Book*, 2001, Washington, DC, and annual.

Non-diesel fossil fuel consumption was assumed to be used by motor buses. For the years 1988–92, motor bus gasoline use was estimated as 5% of "other" fuels, based on personal communication with the APTA Research and Statistics Department.

Intercity: Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, 2000, Washington, DC, pp.20–23. For conversion purposes, fuel for all intercity buses was assumed to be diesel fuel.

School: Eno Transportation Foundation, *Transportation in America 2000* , Eighteenth Edition, 2000, Washington, DC, pp.20–23. For conversion purposes, fuel for school buses was assumed to be 90% diesel fuel and 10% gasoline based on estimates from the National Association of State Directors of Pupil Transportation Services.

Trucks

Light Trucks:

Defined as 2-axle, 4-tire trucks. Total gallons of fuel was taken from DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–99 annual editions. Based on data from the 1982 TIUS Public Use Tape, fuel use for 1970–87 was distributed among fuel types as follows: 95.3% gasoline; 3.5% diesel; and 1.2% lpg. Fuel use for 1988–93 was distributed based on the 1987 TIUS: 96.6% gasoline; 3.3% diesel; and 0.1% lpg. Fuel use for 1994–97 was distributed based on the 1992 TIUS: 96.4% gasoline; 3.3% diesel; 0.3% lpg. Fuel use for 1998–99 was based on the 1997 VIUS: 96.3% gasoline, 3.4% diesel, 0.2% lpg.

Other Trucks:

Defined as the difference between total trucks and 2-axle, 4-tire trucks. Total gallons of fuel was taken from DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–99 annual editions. Based on data from the 1982 TIUS Public Use Tape, fuel use for 1970–87 was distributed among fuel types as follows: 39.6% gasoline; 59.4% diesel; and 1.0% lpg. Fuel use for 1988–93 was distributed based on the 1987 TIUS: 19.4% gasoline; 80.4% diesel; and 0.2% lpg. Fuel use for 1994–96 was distributed based on the 1992 TIUS: 16.2% gasoline; 83.3% diesel; and 0.5% lpg. Fuel use for 1997-99 was distributed as follows based on data from the 1997 VIUS Public Use CD: 12.4% of fuel assumed to be gasoline, 87.1% diesel, and 0.5% lpg.

Total Highway

Sum of autos, motorcycles, buses, light trucks, and other trucks.

Table 2.7
Nonhighway Energy Consumption by Mode, 1970–99

Air

Sum of fuel use by General Aviation and Certificated Route Air Carrier.

General Aviation:

1970–74 - DOT, TSC, *National Transportation Statistics*, Cambridge, MA, 1981.
1975–85 - DOT, FAA, *FAA Aviation Forecasts*, Washington, DC, annual.
1985–97 - DOT, FAA, *General Aviation Activity and Avionics Survey: Annual Summary Report, Calendar Year 1999*, Table 5.1. Jet fuel was converted from gallons to Btu using 135,000 Btu/gallon (kerosene-type jet fuel).

Certificated Route Air Carrier:

1970–81 - DOT, Civil Aeronautics Board, *Fuel Cost and Consumption*, Washington, DC, annual.
1982–99- DOT, Bureau of Transportation Statistics, "Fuel Cost and Consumption Tables." These data are for domestic carriers, but include the international operations of those domestic carriers. The international operations total was divided in half to estimate domestic fuel use for international flights.

Water

Sum of vessel bunkering fuel (i.e., freight) and fuel used by recreational boats.

Freight:

Total - DOE, EIA, *Fuel Oil and Kerosene Sales 1999*, Table 23. Adjusted sales of distillate and residual fuel oil for vessel bunkering. (This may include some amounts of bunker fuels used for recreational purposes.)

Recreational Boating:

1970–84 - DOT, FHWA, *Highway Statistics*, Washington, DC, Table MF-24, annual.
1985–98 - Fuel use by recreational boating was calculated using the methodology developed by D. L. Greene in the report, *Off-Highway Use of Gasoline in the United States* (DOT, FHWA, July 1986, p. 3-22). Results from Model 1 in the report indicated an average annual consumption of 205 gallons per boat. Total consumption in gallons was then calculated using the following equation: Total = 0.95 (Gal/boat) (number of boats). An estimate of number of recreational boats in operation is from the U.S. Coast Guard (numbered boats).

Pipeline

The sum of natural gas, crude petroleum and petroleum product, and coal slurry and water.

Natural Gas:

The amount of natural gas used to transport natural gas was defined as "pipeline fuel" as reported in DOE, EIA, *Natural Gas Annual 1999*, Table 1. Cubic feet were converted to Btu using 1,031 Btu/ft^3. Electricity use was estimated using the following procedure as reported on

p. 5-110 of J. N. Hooker et al., *End Use Energy Consumption DataBase: Transportation Sector*. The energy consumption of a natural gas pipeline was taken to be the energy content of the fuel used to drive the pumps. Some 94% of the installed pumping horsepower was supplied by natural gas. The remaining 6% of the horse power was generated more efficiently, mostly by electric motors. The energy consumed by natural gas pipeline pumps that were electrically powered was not known. In order to estimate the electricity consumed, the Btu of natural gas pipeline fuel consumed was multiplied by a factor of 0.015. From this computed value, electricity efficiency and generation loss must be taken into account. The electricity energy use in Btu must be converted to kWhr, using the conversion factor 29.305 x 10^{-5} kWhr/Btu. Electricity generation and distribution efficiency was 29%. When generation and distribution efficiency are taken into account, 1 kWhr equals 11,765 Btu.

Crude petroleum and petroleum product:

J. N. Hooker, *Oil Pipeline Energy Consumption and Efficiency*, ORNL-5697, ORNL, Oak Ridge, Tennessee, 1981. (Latest available data.)

Coal slurry and water:

W. F. Banks, Systems, Science and Software, *Energy Consumption in the Pipeline Industry*, LaJolla, California, October 1977. (Latest available data.)

Rail

Total:

Sum of freight and passenger rail.

Freight:

AAR, *Railroad Facts*, 2000 Edition, Washington, DC.

Passenger:

Transit and Commuter - APTA, *2001 Transit Fact Book*, 2001, Washington, DC , annual. Transit was defined as the sum of "heavy rail," "light rail," and "other."

Intercity - Personal communication with Amtrak, Washington, DC.

Table 2.10
Passenger Travel and Energy Use in the United States, 1999

Highway

Automobiles

Number of Vehicles - DOT, FHWA, *Highway Statistics 1999* Table VM-1.
Vmt - DOT, FHWA, *Highway Statistics 1999*, Table VM-1.
Pmt - Calculated by ORNL (load factor times vmt).
Load Factor - DOT, FHWA, Office of Highway Information Management, 1995 NPTS, Public Use Tape, 1997.
Energy Use - Total gallons of fuel taken from DOT, FHWA, *Highway Statistics 1998*, Table VM-1. These were distributed as follows: 90.2% gasoline, 9.0% gasohol, and 0.8% diesel.

Personal Trucks

Number of Vehicles - Based on the 1997 TIUS, 75.2% of total 2-axle, 4-tire trucks and 16.9% of total other trucks were for personal use. Therefore, 75.2% of total 2-axle, 4-tire trucks (as reported by DOT, FHWA in *Highway Statistics 1999*, Table VM-1) and 16.9% of total other trucks were estimated to be for personal use.
Vmt - 70.7% of total vehicle miles traveled by 2-axle, 4-tire trucks (as reported by DOT, FHWA in *Highway Statistics 1999*, Table VM-1) and 7.1% of total vehicle miles traveled by other trucks were for personal use. The percentages were derived by ORNL from the 1997 VIUS Micro Data File on CD.
Pmt - Calculated by ORNL as vmt multiplied by load factor.
Load Factor - DOT, FHWA, Office of Highway Information Management, 1995 NPTS, Public Use Tape, 1997.
Energy Use- Assuming that there is no difference in fuel economy (measured in miles per gallon) between personal-use trucks and non-personal use trucks, 68.5% of total fuel consumption by 2-axle, 4-tire trucks (as reported by DOT, FHWA in *Highway Statistics 1998*, Table VM-1) and 3.7% of total other truck fuel consumption was for personal use. These percentages were derived by ORNL from the 1997 VIUS Public Use tape. Total truck energy use was the sum of light truck and other truck energy use.
Light Trucks: DOT, FHWA, *Highway Statistics 1999*, Table VM-1, for single-unit, 2-axle, 4-tire trucks. 96.3% of fuel assumed to be gasoline, 3.4% diesel, 0.2% lpg; percentages were generated from the 1997 VIUS Public Use CD.

Other Trucks: DOT, FHWA, *Highway Statistics 1999*, Table VM-1. Total gallons for other trucks was the difference between total and 2-axle, 4-tire trucks. These gallons were distributed as follows based on data from the 1997 VIUS Public Use CD: 12.4% of fuel assumed to be gasoline, 87.1% diesel, and 0.5% lpg.

Motorcycles

Number of Vehicles and Vmt - DOT, FHWA, *Highway Statistics 1999*, Table VM-1.
Pmt - Calculated by ORNL as vmt multiplied by load factor.

Load Factor - DOT, FHWA, Office of Highway Information Management, 1995 NPTS, Public Use Tape, 1997.

Energy Use - DOT, FHWA, *Highway Statistics 1999*, Table VM-1. For conversion purposes, fuel for all motorcycles was assumed to be gasoline.

Buses

Transit:

Number of Vehicles, Vmt, Pmt, and Energy Use - Motor bus only. APTA, *2001 Transit Fact Book*, 2001, Washington, DC.

Load Factor - Calculated by ORNL as pmt/vmt.

Intercity:

Number of Vehicles - Estimated by ORNL as 18% of commercial bus registrations, DOT, FHWA, *Highway Statistics 1999*, Table MV-10.

Pmt - Eno Transportation Foundation, *Transportation in America, 2000*, Eighteenth Edition, Washington, DC, 2001, pp. 14–15.

Vmt - Estimated using passenger travel and an average load factor of 23.2 persons/vehicle.

Load Factor -Estimated as 23.2 based on historical data.

Energy Use - Eno Transportation Foundation, *Transportation in America 2000*, Eighteenth Edition, 2001, Washington, DC, p. 56. For conversion purposes, fuel for all intercity buses was assumed to be diesel fuel.

School:

Number of Vehicles - School and other nonrevenue as reported in DOT, FHWA, *Highway Statistics 1999*, Table MV-10.

Energy Use - Eno Transportation Foundation, *Transportation in America 2001*, Eighteenth Edition, 2001, Washington, DC, pp. 20–23. For conversion purposes, fuel for school buses was assumed to be 90% diesel fuel and 10% gasoline based on estimates from the National Association of State Directors of Pupil Transportation Services.

Nonhighway

Air

Large Certified Route Air Carriers:

Vmt, Pmt - DOT, Bureau of Transportation Statistics, *Air Carrier Traffic Statistics Monthly*, December 1999/2000, Washington, DC, p. 2.

Load Factor - Calculated by ORNL as pmt/vmt.

Energy Use - DOT, Bureau of Transportation Statistics, "Fuel Cost and Consumption Tables."

General Aviation:

Number of Vehicles, Vmt, Energy Use - DOT, FAA, *General Aviation Activity and Avionics, Survey: Calendar Year 1999*, Tables 1.2, 1.5, and 5.1.

Pmt - Eno Transportation Foundation, *Transportation in America 2000*, Eighteenth Edition, Washington, DC, 2001, pp. 14–15.

Load Factor - Calculated by ORNL as pmt/vmt.

Recreational Boating

Number of Vehicles - U.S. Coast Guard, Office of Boating Safety, Washington, DC, 2001.
Energy Use - Fuel use by recreational boating was calculated using the methodology developed by D. L. Greene in the report, *Off-Highway Use of Gasoline in the United States* (DOT, FHWA, July 1986, p. 3-22). Results from Model 1 in the report indicated an average annual consumption of 205 gallons per boat. Total consumption in gallons was then calculated using the following equation: Total = 0.95 (Gal/boat) (number of boats). An estimate of number of recreational boats in operation is from the U.S. Coast Guard (numbered boats).

Rail

Intercity:

Number of Vehicles, Vmt and Pmt -AAR, *Railroad Facts*, 2000 Edition, Washington, DC, p. 77.
Load Factor - Calculated by ORNL as pmt/vmt.
Energy Use - Personal communication with Amtrak, Washington, DC.

Transit and Commuter:

Number of Vehicles, Vmt and Pmt - APTA, *2001 Transit Fact Book*, Washington, DC, 2001.
Load Factor - Calculated by ORNL as pmt/vmt.
Energy Use - APTA, *2001 Transit Fact Book*, 2001,Washington, DC. Transit was defined as the sum of "heavy rail," "light rail," and "other."

Table 2.11
Energy Intensities of HighwayPassenger Modes, 1970–99

In reference to transportation, the energy intensity of a mode is the ratio of the energy inputs to a process to a measure of the useful outputs from that process; for example, Btu per pmt or Btu per ton-mile. The energy intensity ratios were calculated for each passenger mode using the following data sources:

Automobiles

Vmt - DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–99 editions.

Pmt - vmt multiplied by the load factor.

Energy Use - Total gallons of fuel for automobiles was taken from DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A; and Table VM-1 in the 1996–99 annual editions. Fuel for automobiles was distributed between fuel types for conversion into Btu's as follows:

1970–80 - 94.7% gasoline, 5.3% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Residential Energy Consumption Survey: Consumption Patterns of Household Vehicles, June 1979 to December 1980*, p. 10.

1981–82 - 94.1% gasoline, 5.9% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Residential Energy Consumption Survey: Consumption Patterns of Household Vehicles, Supplement: January 1981 to September 1981*, pp. 11, 13.

1983–84 - 97.5% gasoline, 2.5% diesel as reported in the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Residential Transportation Energy Consumption Survey: Consumption Patterns of Household Vehicles, 1983*, Jan., 1985, pp. 7, 9.

1985–87 - 98.5% gasoline, 1.5% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Residential Transportation Energy Consumption Survey: Consumption Patterns of Household Vehicles 1985*, April 1987, pp. 25, 27.

1988–90 - 98.8% gasoline and 1.2% diesel as reported in the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Household Vehicles Energy Consumption 1988*, March 1990, p. 65.

1991–93 - 97.8% gasoline, 1.0% gasohol, and 1.2% diesel as reported in the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Household Vehicles Energy Consumption 1991*, December 1993, p. 46.

1994–97 - 97.7% gasoline, 1.0% gasohol, 1.3% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Household Vehicles Energy Consumption 1994*, Washington, DC, August 1997, p. 46.

1998–99 - 90.2% gasoline, 9.0% gasohol, 0.8% diesel.

1993–99 - Methanol use was estimated using data from DOE, EIA, Alternatives to *Traditional Transportation Fuels 1999*, Washington, DC, 1998, Table 12.

Light Trucks

Vmt - DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–99 editions. Light trucks were defined as 2-axle, 4-tire trucks.

Energy Use - Defined as 2-axle, 4-tire trucks. Total gallons of fuel was taken from DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–99 annual

editions. Based on data from the 1982 TIUS Public Use Tape, fuel use for 1970–87 was distributed among fuel types as follows: 95.3% gasoline; 3.5% diesel; and 1.2% lpg. Fuel use for 1988–93 was distributed based on the 1987 TIUS: 96.6% gasoline; 3.3% diesel; and 0.1% lpg. Fuel use for 1994–96 was distributed based on the 1992 TIUS: 96.4% gasoline; 3.3% diesel; 0.3% lpg. Fuel use for 1997–99 was based on the 1997 VIUS: 96.3% gasoline, 3.4% diesel, 0.2% lpg.

Buses

Transit:

Vmt, Pmt, Energy Use - APTA, *2001 Transit Fact Book*, Washington, DC, 2001, and annual.

Non-diesel fossil fuel consumption was assumed to be used by motor buses. For the years 1988–91, motor bus gasoline use was estimated as 5% of "other" fuels, based on personal communication with the APTA Research and Statistics Department. In 1992 data became available on non-diesel fuels.

Intercity:

Pmt - 1970–84 - American Bus Association, *Annual Report*, Washington, DC, and annual.

1985–99 - Eno Transportation Foundation, *Transportation in America 2000,* Eighteenth Edition, Washington, DC, 2001, pp. 14–15.

Vmt - 1990–99 - Estimated using passenger travel and an average load factor of 23.2.

Energy Use - Eno Transportation Foundation, *Transportation in America 2000*, Eighteenth Edition, Washington, DC, pp. 20–23. For conversion purposes, fuel for all intercity buses was assumed to be diesel fuel.

School:

Vmt - 1970–84 - DOT, FHWA, *Highway Statistics 1984*, Washington, DC, Table VM-1, p. 175, and annual.

1985–87 - DOT, TSC, *National Transportation Statistics*, 1989, Figure 2, p. 7, and annual.

1988–98- National Safety Council, *Accident Facts*, 1999 Edition , Chicago, IL, and annual. These data are no longer available.

Energy Use - Eno Transportation Foundation, *Transportation in America 2000*, Eighteenth Edition, Washington, DC, pp. 20–23. For conversion purposes, fuel for school buses was assumed to be 90% diesel fuel and 10% gasoline based on estimates from the National Association of State Directors of Pupil Transportation Services.

Table 2.12
Energy Intensities of Nonhighway Passenger Modes, 1970–99

In reference to transportation, the energy intensity of a mode is the ratio of the energy inputs to a process to a measure of the useful outputs from that process; for example, Btu per pmt or Btu per ton-mile. The energy intensity ratios were calculated for each passenger mode using the following data sources:

Air

Certificated Air Carriers:

Pmt - DOT, Bureau of Transportation Statistics, *Air Carrier Traffic Statistics Monthly*, December 1999/2000, Washington, DC, p. 2.

Energy Use - 1970–76 - DOT, Civil Aeronautics Board, *Fuel Cost and Consumption*, Washington, DC, annual.

1977–99 - DOT, Bureau of Transportation Statistics, "Fuel Cost and Consumption Tables."

General Aviation:

Pmt - Eno Transportation Foundation, *Transportation In America 2000*, Eighteenth Edition, Washington, DC, 2001, pp. 14-15.

Energy Use - 1970–74 - DOT, TSC, *National Transportation Statistics*, Cambridge, MA, 1981.

1975–85 - DOT, FAA, *FAA Aviation Forecasts*, Washington, DC, annual.

1985–99 - DOT, FAA, *General Aviation Activity and Avionics Survey: Calendar Year 1999*, Table 5.1. Jet fuel was converted from gallons to Btu using 135,000 Btu/gallon (kerosene-type jet fuel).

Rail

Passenger (Amtrak):

Pmt - 1971–83 - AAR, *Statistics of Class I Railroads*, Washington, DC, annual.

1984–88, 1995–96 - AAR, *Railroad Facts*, 1987 Edition, Washington, DC, December 1987, p. 78, and annual.

1989–94 - Personal communication with Amtrak.

1995–99 - AAR, *Railroad Facts*, 2000 Edition, Washington, DC, 2000, p. 77, and annual.

Energy Use - Personal communication with Amtrak.

Transit:

Pmt and Energy Use - APTA, *2001 Transit Fact Book*, Washington, DC, 2001.

Transit was defined as the sum of "heavy rail," "light rail."

Table 2.13
Intercity Freight Movement and Energy Use in the United States, 1999

Highway

Trucks

Vehicles - 0.4% of total 2-axle, 4-tire trucks (as reported by DOT, FHWA in *Highway Statistics 1999*, Table VM-1) and 29% of total other trucks were engaged in intercity freight movement. These percentages were derived by ORNL from the 1997 VIUS Micro Data File on CD. Intercity freight trucks were defined as any truck whose:

- greatest share of miles were traveled more than 50 miles away from the vehicle's home base; **and**
- principal use was not personal or passenger transportation; **and**
- body type was not pickup, minivan, or utility vehicle.

Ton Miles, Tons Shipped and Average Length of Haul - Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, Washington, DC, 2000, pp. 44, 46, 71.

Energy Intensity - Energy use divided by ton-miles.

Energy Use - 1.0% of total fuel consumption by 2-axle, 4-tire trucks (as reported by DOT, FHWA in *Highway Statistics 1999*, Table VM-1) and 71.3% of total other truck fuel consumption were used in intercity freight movement. These percentages were derived by ORNL from the 1997 VIUS Micro Data File on CD.

Nonhighway

Waterborne Commerce

Vehicles - U.S. Department of the Army, Army Corps of Engineers, "Summary of U.S. Flag Passenger and Cargo Vessels, 1998," New Orleans, LA, 2000.

Ton Miles, Tons Shipped, and Average Length of Haul - U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 1998, Part 5: National Summaries*, New Orleans, LA, 2000, pp. 1-6, 1-7.

Energy Intensity - Energy use divided by ton miles.

Energy Use - DOE, EIA, *Fuel Oil and Kerosene Sales 1999* Table 23. Adjusted sales of distillate and residual fuel oil for vessel bunkering. (This may include some amounts of bunker fuels used for recreational purposes.)

Domestic freight energy use was calculated as:

Distillate fuel - 77.5% domestic
Residual fuel - 9.3% domestic.

Percentages were derived from the DOC, U.S. Foreign Trade, *Bunker Fuels*, "Oil and Coal Laden in the U.S. on Vessels Engaged in Foreign Trade," 1988.

Rail

Vehicles, Tons, Ton Miles, Average Length of Haul and Energy Use - AAR, *Railroad Facts*, 2000 Edition, Washington, DC, 2000.

Table 2.14
Energy Intensities of Freight Modes, 1970–99

In reference to transportation, the energy intensity of a mode is the ratio of the energy inputs to a process to a measure of the useful outputs from that process; for example, Btu per pmt or Btu per ton-mile. The energy intensity ratios were calculated for each freight mode using the following data sources:

Highway

Heavy Single-Unit and Combination Trucks

Vmt - DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–99 editions. Heavy single-unit and combination trucks were defined as the difference between total trucks and 2-axle, 4-tire trucks.

Energy Use - Defined as the difference between total trucks and 2-axle, 4-tire trucks. Total gallons of fuel was taken from DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–99 annual editions. Based on data from the 1982 TIUS Public Use Tape, fuel use for 1970–87 was distributed among fuel types as follows: 39.6% gasoline; 59.4% diesel; and 1.0% lpg. Fuel use for 1988–93 was distributed based on the 1987 TIUS: 19.4% gasoline; 80.4% diesel; and 0.2% lpg. Fuel use for 1994–96 was distributed based on the 1992 TIUS: 16.2% gasoline; 83.3% diesel; and 0.5% lpg. Fuel use for 1997-99 was distributed as follows based on data from the 1997 VIUS Public Use CD: 12.4% of fuel assumed to be gasoline, 87.1% diesel, and 0.5% lpg.

Nonhighway

Water

Ton Miles - U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 1999*, *Part 5: National Summaries*, New Orleans, LA, 2001, p. 1-6, and annual.

Energy Use - Calculated as the difference between total water freight energy use and foreign water freight energy use.

Total - DOE, EIA, *Fuel Oil and Kerosene Sales 1999,* Table 23. Adjusted sales of distillate and residual fuel oil for vessel bunkering. (This may include some amounts of bunker fuels used for recreational purposes.)

Rail

Freight Car Miles, Ton Miles and Energy Use - AAR, *Railroad Facts*, 2000 Edition, Washington, DC, 2000, and annual.

Table 6.4
Vehicle Stock and New Sales in the
United States, 1999 Calendar Year

Highway

Automobiles

Stock -The number of vehicles in use by EPA size class were derived as follows: Market Shares by EPA size class for new car sales from 1970–75 were taken from the DOT, NHTSA, *Automotive Characteristics Historical DataBase*, Washington, DC. Market shares for the years 1976–90 were found in Linda S. Williams and Patricia S. Hu, *Highway Vehicle MPG and Market Shares Report: Model Year 1990*, ORNL-6672, April 1991, and Table 7 and the ORNL MPG and Market Shares Database, thereafter. These data were assumed to represent the number of cars registered in each size class for each year. These percentages were applied to the automobiles in operation for that year as reported by The Polk Company (FURTHER REPRODUCTION PROHIBITED) and summed to calculate the total mix. This method assumed that all vehicles, large and small, were scrapped at the same rate.

Sales - Domestic, import, and total sales were from *Ward's Motor Vehicle Facts and Figures 2000* , p. 15. The domestic sales were distributed by size class according to the following percentages: Two seater, 0.7%; Minicompact, 0.0%; Subcompact, 19.9%; Compact 26.5%; Midsize, 36.5%; and Large, 16.3%. The import sales were distributed by size class according to the following percentages: Two-seater, 3.2%; Minicompact, 0.8%; Subcompact, 13.7%; Compact, 31.2%; Midsize, 49.2; and Large, 1.9%. These percentages were derived from the ORNL MPG and Market Shares Database. Domestic-sponsored imports (captive imports) were included in the import figure only.

Business fleet autos - Bobit Publishing Company, Automotive Fleet Research Department, *Automotive Fleet Factbook 2000*, Redondo Beach, CA, 2000.

Personal autos - Difference between total vehicle stock and business fleet autos.

See Glossary for definition of Automobile Size Classifications.

Motorcycles

Stock - DOT, FHWA, *Highway Statistics 1999*, Table VM-1, 2001.

Recreational Vehicles

Sales - *Ward's Automotive Yearbook 2000*, U.S. Recreation Vehicle Shipments by Type, "Total," p. 242.

Trucks

Stock - Vehicles in use by weight class were determined by applying the percentage in use by weight class as reported in DOC, Bureau of the Census, 1997 VIUS, (0–10,000 lbs, 93.5%; 10,001–19,500 lbs, 2.0%; 19,501–26,000 lbs, 1.0%; 26,001 lbs and over, 3.5%) to the total number of trucks in use as reported by R. L. Polk and Company (FURTHER REPRODUCTION PROHIBITED).

Sales -Ward's Motor Vehicle Facts and Figures 2000, p. 24.

Business fleet trucks - Bobit Publishing Company, Automotive Fleet Research Department, *Automotive Fleet Factbook 2000*, Redondo Beach, CA, 2001.

Personal trucks - Difference between total stock and business fleet trucks.

APPENDIX B
CONVERSIONS

A Note About Heating Values

The heat content of a fuel is the quantity of energy released by burning a unit amount of that fuel. However, this value is not absolute and can vary according to several factors. For example, empirical formulae for determining the heating value of liquid fuels depend on the fuels' American Petroleum Institute (API) gravity. The API gravity varies depending on the percent by weight of the chemical constituents and impurities in the fuel, both of which are affected by the combination of raw materials used to produce the fuel and by the type of manufacturing process. Temperature and climatic conditions are also factors.

Because of these variations, the heating values in Table B.1 may differ from values in other publications. The figures in this report are representative or average values, not absolute ones. The gross heating values used here agree with those used by the Energy Information Administration (EIA).

Heating values fall into two categories, gross and net. If the products of fuel combustion are cooled back to the initial fuel-air or fuel-oxidizer mixture temperature and the water formed during combustion is condensed, the energy released by the process is the higher (gross) heating value. If the products of combustion are cooled to the initial fuel-air temperature, but the water is considered to remain as a vapor, the energy released by the process is lower (net) heating value. Usually the difference between the gross and net heating values for fuels used in transportation is around 5 to 8 percent; however, it is important to be consistent in their use.

Table B.1
Approximate Heat Content for Various Fuels

Automotive gasoline		125,000 Btu/gal(gross) = 115,400 Btu/gal(net)
Diesel motor fuel		138,700 Btu/gal (gross) = 128,700 Btu/gal (net)
Methanol		64,600 Btu/gal (gross) = 56,560 Btu/gal (net)
Ethanol		84,600 Btu/gal (gross) = 75,670 Btu/gal (net)
Gasohol		120,900 Btu/gal (gross) = 112,417 Btu/gal (net)
Aviation gasoline		120,200 Btu/gal (gross) = 112,000 Btu/gal (net)
Propane		91,300 Btu/gal (gross) = 83,500 Btu/gal (net)
Butane		103,000 Btu/gal (gross) = 93,000 Btu/gal (net)
Jet fuel (naphtha)		127,500 Btu/gal (gross) = 118,700 Btu/gal (net)
Jet fuel (kerosene)		135,000 Btu/gal (gross) = 128,100 Btu/gal (net)
Lubricants		144,400 Btu/gal (gross) = 130,900 Btu/gal (net)
Waxes		131,800 Btu/gal (gross) = 120,200 Btu/gal (net)
Asphalt and road oil		158,000 Btu/gal (gross) = 157,700 Btu/gal (net)
Petroleum coke		143,400 Btu/gal (gross) = 168,300 Btu/gal (net)
Natural gas		
	Wet	1,109 Btu/ft^3
	Dry	1,027 Btu/ft^3
	Compressed	20,551 Btu/pound
		960 Btu/cubic foot
	Liquid	90,800 Btu/gal (gross) = 87,600 Btu/gal (net)
Crude petroleum		138,100 Btu/gal (gross) = 131,800 Btu/gal (net)
Fuel Oils		
	Residual	149,700 Btu/gal (gross) = 138,400 Btu/gal (net)
	Distillate	138,700 Btu/gal (gross) = 131,800 Btu/gal (net)
Coal		
	Anthracite - Consumption	21.711 x 10^6 Btu/short ton
	Bituminous and lignite - Consumption	21.012 x 10^6 Btu/short ton
	Production average	21.352 x 10^6 Btu/short ton
	Consumption average	21.015 x 10^6 Btu/short ton

Table B.2
Fuel Equivalents

1 million bbl crude oil/day	= 0.3650 billion bbl crude oil/year = 2.117 quadrillion Btu/year = 99.45 million short tons coal/year = 90.22 million metric tons coal/year = 2.061 trillion ft^3 natural gas/year = 2,233 petajoule/year
1 billion bbl crude oil/year	= 2.740 million bbl crude oil/day = 5.800 quadrillion Btu/year = 272.5 million short tons coal/year = 247.2 million metric tons coal/year = 5.648 trillion ft^3 natural gas/year = 6,119 petajoule/year
1 quadrillion Btu/year	= 0.4724 million bbl crude oil/day = 172.4 million bbl crude oil/year = 46.98 million short tons coal/year = 42.62 million metric tons coal/year = 973.7 billion ft^3 natural gas/year = 1.055 petajoule/year
1 billion short tons coal/year	= 0.9072 billion metric tons coal/year = 10.06 million bbl crude oil/day = 3.670 billion bbl crude oil/year = 21.29 quadrillion Btu/year = 20.73 trillion ft^3 natural gas/year = 22,468 petajoule/year
1 billion metric tons coal/year	= 1.102 billion short tons coal/year = 9.122 million bbl crude oi l/day = 3.330 billion bbl crude oil/year = 19.31 quadrillion btu/year = 18.80 trillion ft^3 natural gas/year = 20.37 exajoules/year
1 trillion ft^3 natural gas/year	= 0.4851 million bbl crude oil/day = 0.1771 billion bbl crude oil/year = 1.027 quadrillion Btu/year = 48.25 million short tons coal/year = 43.77 million metric tons coal/year = 1.083 petajoules/year
1 petajoule/year	= 447.7 bbl crude oil/day = 163.4 thousand bbl crude oil/year = 0.947 trillion Btu/year = 44.53 thousand short tons coal/year = 40.40 thousand metric tons coal/year = 0.9229 billion ft^3 natural gas/year

Table B.3
Energy Unit Conversions

1 Btu	= 778.2 ft-lb	1 kWhr	= 3412 Btu[a]
	= 107.6 kg-m		= 2.655 x 10^{6} ft-lb
	= 1055 J		= 3.671 x 10^{5} kg-m
	= 39.30 x 10^{-5} hp-h		= 3.600 x 10^{6} J
	= 39.85 x 10^{-5} metric hp-h		= 1.341 hp-h
	= 29.31 x 10^{-5} kWhr		= 1.360 metric hp-h
1 kg-m	= 92.95 x 10^{-4} Btu	1 Joule	= 94.78 x 10^{-5} Btu
	= 7.233 ft-lb		= 0.7376 ft-lb
	= 9.806 J		= 0.1020 kg-m
	= 36.53 x 10^{-7} hp-h		= 37.25 x 10^{-8} hp-h
	= 37.04 x 10^{-7} metric hp-h		= 37.77 x 10^{-8} metric hp-h
	= 27.24 x 10^{-7} kWhr		= 27.78 x 10^{-8} kWhr
1 hp-h	= 2544 Btu	1 metric hp-h	= 2510 Btu
	= 1.98 x 10^{6} ft-lb		= 1.953 x 10^{6} ft-lb
	= 2.738 x 10^{6} kgm		= 27.00 x 10^{4} kg-m
	= 2.685 x 10^{6} J		= 2.648 x 10^{6} J
	= 1.014 metric hp-h		= 0.9863 hp-h
	= 0.7475 kWhr		= 0.7355 kWhr

[a]This figure does not take into account the fact that electricity generation and distribution efficiency is approximately 29%. If generation and distribution efficiency are taken into account, 1 kWhr = 11,765 Btu.

Table B.4
International Energy Conversions

To:	**Terajoules**	**Giga-calories**	**Million tonnes of oil equivalent**	**Million Btu**	**Gigawatt-hours**
From:	*multiply by:*				
Terajoules	1	238.8	2.388 x 10^{-5}	947.8	0.2778
Gigacalories	4.1868 x 10^{-3}	1	10^{-7}	3.968	1.163 x 10^{-3}
Million tonnes of oil equivalent	4.1868 x 10^{4}	10^{7}	1	3.968 x 10^{7}	11,630
Million Btu	1.0551 x 10^{-3}	0.252	2.52 X 10^{-8}	1	2.931 x 10^{-4}
Gigawatthours	3.6	860	8.6 x 10^{-5}	3412	1

Table B.5
Distance and Velocity Conversions

1 in.	= 83.33 x 10^{-3} ft	1 ft	= 12.0 in.
	= 27.78 x 10^{-3} yd		= 0.33 yd
	= 15.78 x 10^{-6} mile		= 189.4 x 10^{-3} mile
	= 25.40 x 10^{-3} m		= 0.3048 m
	= 0.2540 x 10^{-6} km		= 0.3048 x 10^{-3} km
1 mile	= 63360 in.	1 km	= 39370 in.
	= 5280 ft		= 3281 ft
	= 1760 yd		= 1093.6 yd
	= 1609 m		= 0.6214 mile
	= 1.609 km		= 1000 m

1 ft/sec = 0.3048 m/s = 0.6818 mph = 1.0972 km/h
1 m/sec = 3.281 ft/s = 2.237 mph = 3.600 km/h
1 km/h = 0.9114 ft/s = 0.2778 m/s = 0.6214 mph
1 mph = 1.467 ft/s = 0.4469 m/s = 1.609 km/h

Table B.6
Alternative Measures of Greenhouse Gases

1 pound methane, measured in carbon units (CH_4)	=	1.333 pounds methane, measured at full molecular weight (CH_4)
1 pound carbon dioxide, measured in carbon units (CO_2-C)	=	3.6667 pounds carbon dioxide, measured at full molecular weight (CO_2)
1 pound carbon monoxide, measured in carbon units (CO-C)	=	2.333 pounds carbon monoxide, measured at full molecular weight (CO)
1 pound nitrous oxide, measured in nitrogen units (N_2O-N)	=	1.571 pounds nitrous oxide, measured at full molecular weight (N_2O)

Table B.7
Volume and Flow Rate Conversions[a]

1 U.S. gal	= 231 $in.^3$	1 liter	= 61.02 $in.^3$
	= 0.1337 ft^3		= 3.531 x 10^{-2} ft^3
	= 3.785 liters		= 0.2624 U.S. gal
	= 0.8321 imperial gal		= 0.2200 imperial gal
	= 0.0238 bbl		= 6.29 x 10^{-3} bbl
	= 0.003785 m^3		= 0.001 m^3
	A U.S. gallon of gasoline weighs 6.2 pounds		
1 imperial gal	= 277.4 $in.^3$	1 bbl	= 9702 $in.^3$
	= 0.1606 ft^3		= 5.615 ft^3
	= 4.545 liters		= 158.97 liters
	= 1.201 U.S. gal		= 42 U.S. gal
	= 0.0286 bbl		= 34.97 imperial gal
	= 0.004546 m^3		= 0.15897 m^3
1 U.S. gal/hr	= 3.209 ft^3/day		= 1171 ft^3/year
	= 90.84 liter/day		= 33157 liter/year
	= 19.97 imperial gal/day		= 7289 imperial gal/year
	= 0.5712 bbl/day		= 207.92 bbl/year
	For Imperial gallons, multiply above values by 1.201		
1 liter/hr	= 0.8474 ft^3/day		= 309.3 ft^3/year
	= 6.298 U.S. gal/day		= 2299 U.S. gal/year
	= 5.28 imperial gal/day		= 1927 imperial gal/year
	= 0.1510 bbl/day		= 55.10 bbl/year
1 bbl/hr	= 137.8 ft^3/year		= 49187 ft^3 year
	= 1008 U.S. gal/day		= 3.679 x 10^5 U.S. gal/year
	= 839.3 imperial gal/day		= 3.063 x 10^5 imperial gal/year
	= 3815 liter/day		= 1.393 x 10^6 liter/day

[a]The conversions for flow rates are identical to those for volume measures, if the time units are identical.

Table B.8
Power Conversions

FROM	TO					
	Horsepower	Kilowatts	Metric horsepower	Ft-lb per sec	Kilocalories per sec	Btu per sec
Horsepower	1.000	0.7457	1.014	550	0.1781	0.7068
Kilowatts	1.341	1.000	1.360	737.6	0.239	0.9478
Metric horsepower	0.9863	0.7355	1.000	542.5	0.1757	0.6971
Ft-lb per sec	1.36×10^{-3}	1.356×10^{-3}	1.84×10^{-3}	1.000	0.3238×10^{-3}	1.285×10^{-3}
Kilocalories per sec	5.615	4.184	5.692	3088	1.000	3.968
Btu per sec	1.415	1.055	1.434	778.2	0.2520	1.000

Table B.9
Mass Conversions

	TO				
FROM	Pound	Kilogram	Short ton	Long ton	Metric ton
Pound	1	0.4536	5.0×10^{-4}	4.4643×10^{-4}	4.5362×10^{-4}
Kilogram	2.205	1	1.1023×10^{-3}	9.8425×10^{-4}	1.0×10^{-3}
Short ton	2000	907.2	1	0.8929	0.9072
Long ton	2240	1016	1.12	1	1.016
Metric ton	2205	1000	1.102	0.9842	1

Table B.10
Fuel Efficiency Conversions[a]

MPG	Miles/liter	Kilometers/L	L/100 kilometers
10	2.64	4.25	23.52
15	3.96	6.38	15.68
20	5.28	8.50	11.76
25	6.60	10.63	9.41
30	7.92	12.75	7.84
35	9.25	14.88	6.72
40	10.57	17.00	5.88
45	11.89	19.13	5.23
50	13.21	21.25	4.70
55	14.53	23.38	4.28
60	15.85	25.51	3.92
65	17.17	27.63	3.62
70	18.49	29.76	3.36
75	19.81	31.88	3.14
80	21.13	34.01	2.94
85	22.45	36.13	2.77
90	23.77	38.26	2.61
95	25.09	40.38	2.48
100	26.42	42.51	2.35
105	27.74	44.64	2.24
110	29.06	46.76	2.14
115	30.38	48.89	2.05
120	31.70	51.01	1.96
125	33.02	53.14	1.88
130	34.34	55.26	1.81
135	35.66	57.39	1.74
140	36.98	59.51	1.68
145	38.30	61.64	1.62
150	39.62	63.76	1.57
Formula	MPG/3.785	MPG/[3.785/1.609]	235.24/MPG

Table B.11
SI Prefixes and Their Values

	Value	Prefix	Symbol
One million million millionth	10^{-18}	atto	a
One thousand million millionth	10^{-15}	femto	f
One million millionth	10^{-12}	pico	p
One thousand millionth	10^{-9}	nano	n
One millionth	10^{-6}	micro	μ
One thousandth	10^{-3}	milli	m
One hundredth	10^{-2}	centi	c
One tenth	10^{-1}	deci	
One	10^{0}		
Ten	10^{1}	deca	
One hundred	10^{2}	hecto	
One thousand	10^{3}	kilo	k
One million	10^{6}	mega	M
One billion[a]	10^{9}	giga	G
One trillion[a]	10^{12}	tera	T
One quadrillion[a]	10^{15}	peta	P
One quintillion[a]	10^{18}	exa	E

[a]Care should be exercised in the use of this nomenclature, especially in foreign correspondence, as it is either unknown or carries a different value in other countries. A "billion," for example, signifies a value of 10^{12} in most other countries.

Table B.12
Metric Units and Abbreviations

Quantity	Unit name	Symbol
Energy	joule	J
Specific energy	joule/kilogram	J/kg
Specific energy consumption	joule/kilogram•kilometer	J/(kg•km)
Energy consumption	joule/kilometer	J/km
Energy economy	kilometer/kilojoule	km/kJ
Power	kilowatt	Kw
Specific power	watt/kilogram	W/kg
Power density	watt/meter^3	W/m^3
Speed	kilometer/hour	km/h
Acceleration	meter/second^2	m/s^2
Range (distance)	kilometer	km
Weight	kilogram	kg
Torque	newton•meter	N•m
Volume	meter^3	m^3
Mass; payload	kilogram	kg
Length; width	meter	m
Brake specific fuel consumption	kilogram/joule	kg/J
Fuel economy (heat engine)	liters/100 km	L/100 km

Conversion of Constant Dollar Values

Many types of information in this data book are expressed in dollars. Generally, constant dollars are used--that is, dollars of a fixed value for a specific year, such as 1990 dollars. Converting current dollars to constant dollars, or converting constant dollars for one year to constant dollars for another year, requires conversion factors (Table B.13 and B.14). Table B.13 shows conversion factors for the Consumer Price Index inflation factors. Table B.14 shows conversion factors using the Gross National Product inflation factors.

Due to the size of the tables, the data in Tables B.13 and B.14 were changed to two decimal places starting with Edition 17 and data for years 1971–74 were taken off in Edition 21. However, three decimal places were used to calculate all constant dollar values.

Table B.13
Consumer Price Inflation (CPI) Index

From	To																										
	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1970	1.00	1.39	1.47	1.56	1.68	1.87	2.12	2.34	2.49	2.57	2.68	2.77	2.82	2.93	3.05	3.19	3.37	3.51	3.61	3.72	3.82	3.93	4.04	4.13	4.20	4.29	4.44
1975	0.72	1.00	1.06	1.13	1.21	1.35	1.53	1.69	1.79	1.85	1.93	2.00	2.04	2.11	2.20	2.30	2.43	2.53	2.61	2.68	2.75	2.83	2.92	2.98	3.03	3.10	3.20
1976	0.68	0.95	1.00	1.07	1.15	1.28	1.45	1.60	1.70	1.75	1.82	1.89	1.93	2.00	2.08	2.18	2.30	2.39	2.47	2.54	2.60	2.68	2.76	2.82	2.86	2.93	3.03
1977	0.64	0.89	0.94	1.00	1.08	1.20	1.36	1.50	1.59	1.65	1.72	1.78	1.81	1.88	1.95	2.05	2.16	2.25	2.32	2.38	2.45	2.52	2.59	2.65	2.69	2.75	2.84
1978	0.60	0.83	0.87	0.93	1.00	1.11	1.27	1.40	1.48	1.53	1.59	1.65	1.68	1.74	1.81	1.90	2.00	2.09	2.15	2.21	2.27	2.34	2.40	2.46	2.50	2.55	2.64
1979	0.54	0.74	0.78	0.84	0.90	1.00	1.14	1.25	1.33	1.37	1.43	1.48	1.51	1.57	1.63	1.71	1.80	1.88	1.93	1.99	2.04	2.10	2.16	2.21	2.25	2.30	2.37
1980	0.47	0.65	0.69	0.74	0.79	0.88	1.00	1.10	1.17	1.21	1.26	1.31	1.33	1.38	1.44	1.50	1.59	1.65	1.70	1.75	1.80	1.85	1.90	1.95	1.98	2.02	2.09
1981	0.43	0.59	0.63	0.67	0.72	0.80	0.91	1.00	1.06	1.10	1.14	1.18	1.21	1.25	1.30	1.36	1.44	1.50	1.54	1.59	1.63	1.68	1.73	1.77	1.79	1.83	1.89
1982	0.40	0.56	0.59	0.63	0.68	0.75	0.85	0.94	1.00	1.03	1.08	1.11	1.14	1.18	1.23	1.28	1.35	1.41	1.45	1.50	1.54	1.58	1.63	1.66	1.69	1.73	1.78
1983	0.39	0.54	0.57	0.61	0.66	0.73	0.83	0.91	0.97	1.00	1.04	1.08	1.10	1.14	1.19	1.24	1.31	1.37	1.41	1.45	1.49	1.53	1.57	1.61	1.64	1.67	1.73
1984	0.37	0.52	0.55	0.58	0.63	0.70	0.79	0.88	0.93	0.96	1.00	1.04	1.06	1.09	1.14	1.19	1.26	1.31	1.35	1.39	1.43	1.47	1.51	1.55	1.57	1.60	1.66
1985	0.36	0.50	0.53	0.56	0.61	0.68	0.77	0.85	0.90	0.93	0.97	1.00	1.02	1.06	1.10	1.15	1.22	1.27	1.30	1.34	1.38	1.42	1.46	1.49	1.52	1.55	1.60
1986	0.35	0.49	0.52	0.55	0.60	0.66	0.75	0.83	0.88	0.91	0.95	0.98	1.00	1.04	1.08	1.13	1.19	1.24	1.28	1.32	1.35	1.39	1.43	1.46	1.49	1.52	1.57
1987	0.34	0.47	0.50	0.53	0.57	0.64	0.73	0.80	0.85	0.88	0.91	0.95	0.96	1.00	1.04	1.09	1.15	1.20	1.24	1.27	1.30	1.34	1.38	1.41	1.43	1.47	1.52
1988	0.33	0.46	0.48	0.51	0.55	0.61	0.70	0.77	0.82	0.84	0.88	0.91	0.93	0.96	1.00	1.05	1.11	1.15	1.19	1.22	1.25	1.29	1.33	1.36	1.38	1.41	1.46
1989	0.31	0.43	0.46	0.49	0.53	0.59	0.67	0.73	0.78	0.80	0.84	0.87	0.88	0.92	0.95	1.00	1.05	1.10	1.13	1.17	1.20	1.23	1.27	1.29	1.32	1.34	1.39
1990	0.30	0.41	0.44	0.46	0.50	0.56	0.63	0.70	0.74	0.76	0.80	0.82	0.84	0.87	0.91	0.95	1.00	1.04	1.07	1.11	1.13	1.17	1.20	1.23	1.25	1.27	1.32
1991	0.29	0.40	0.42	0.45	0.48	0.53	0.61	0.67	0.71	0.73	0.76	0.79	0.81	0.83	0.87	0.91	0.96	1.00	1.03	1.06	1.09	1.12	1.15	1.18	1.20	1.22	1.26
1992	0.28	0.38	0.41	0.43	0.47	0.52	0.59	0.65	0.69	0.71	0.74	0.77	0.78	0.81	0.84	0.88	0.93	0.97	1.00	1.03	1.06	1.09	1.12	1.14	1.16	1.19	1.23
1993	0.27	0.37	0.39	0.42	0.45	0.50	0.57	0.63	0.67	0.69	0.72	0.75	0.76	0.79	0.82	0.86	0.91	0.94	0.97	1.00	1.03	1.06	1.09	1.11	1.13	1.15	1.19
1994	0.26	0.36	0.38	0.41	0.44	0.49	0.56	0.61	0.65	0.67	0.70	0.73	0.74	0.77	0.80	0.84	0.88	0.92	0.95	0.98	1.00	1.03	1.06	1.08	1.10	1.12	1.16
1995	0.26	0.35	0.37	0.40	0.43	0.48	0.54	0.60	0.63	0.65	0.68	0.71	0.72	0.75	0.78	0.81	0.86	0.89	0.92	0.95	0.97	1.00	1.03	1.05	1.07	1.09	1.13
1996	0.25	0.34	0.36	0.39	0.42	0.46	0.53	0.58	0.62	0.64	0.66	0.69	0.70	0.72	0.75	0.79	0.83	0.87	0.89	0.92	0.94	0.97	1.00	1.02	1.04	1.06	1.10
1997	0.24	0.34	0.35	0.38	0.41	0.45	0.51	0.57	0.60	0.62	0.65	0.67	0.68	0.71	0.74	0.77	0.81	0.85	0.87	0.90	0.92	0.95	0.98	1.000	1.02	1.04	1.07
1998	0.24	0.33	0.35	0.37	0.40	0.45	0.51	0.56	0.59	0.61	0.64	0.66	0.67	0.70	0.73	0.76	0.80	0.84	0.86	0.89	0.91	0.94	0.96	0.980	1.00	1.02	1.06
1999	0.23	0.32	0.34	0.36	0.39	0.44	0.49	0.55	0.58	0.60	0.62	0.65	0.66	0.68	0.71	0.74	0.78	0.82	0.84	0.87	0.89	0.92	0.94	0.960	0.98	1.00	1.03
2000	0.23	0.31	0.33	0.35	0.38	0.42	0.48	0.53	0.56	0.58	0.60	0.62	0.64	0.66	0.69	0.72	0.76	0.79	0.81	0.84	0.86	0.89	0.91	0.93	0.95	0.97	1.00

Source:
U.S. Bureau of Labor Statistics.

Table B.14
Gross National Product (GNP) Implicit Price Deflator

From	To																										
	1970	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
1970	1.00	1.38	1.45	1.53	1.65	1.79	1.95	2.14	2.27	2.36	2.45	2.53	2.60	2.67	2.76	2.87	2.99	3.12	3.23	3.29	3.36	3.47	3.54	3.63	3.64	3.71	3.68
1975	0.73	1.00	1.05	1.11	1.20	1.30	1.42	1.55	1.65	1.71	1.78	1.84	1.89	1.94	2.01	2.08	2.17	2.27	2.34	2.39	2.44	2.52	2.57	2.63	2.64	2.69	2.67
1976	0.69	0.95	1.00	1.06	1.14	1.24	1.35	1.48	1.57	1.63	1.70	1.75	1.80	1.84	1.91	1.98	2.06	2.15	2.23	2.27	2.32	2.40	2.44	2.50	2.51	2.56	2.53
1977	0.65	0.90	0.95	1.00	1.07	1.17	1.27	1.40	1.48	1.54	1.60	1.65	1.70	1.74	1.80	1.87	1.95	2.03	2.11	2.15	2.19	2.26	2.31	2.37	2.37	2.42	2.37
1978	0.61	0.84	0.88	0.93	1.00	1.09	1.19	1.30	1.38	1.43	1.49	1.54	1.58	1.62	1.68	1.74	1.81	1.89	1.96	2.00	2.04	2.11	2.15	2.20	2.21	2.25	2.22
1979	0.56	0.77	0.81	0.86	0.92	1.00	1.09	1.20	1.27	1.32	1.37	1.42	1.45	1.49	1.54	1.60	1.67	1.74	1.80	1.84	1.88	1.94	1.98	2.03	2.03	2.07	2.05
1980	0.51	0.71	0.74	0.78	0.84	0.92	1.00	1.10	1.16	1.21	1.26	1.30	1.33	1.36	1.41	1.47	1.53	1.60	1.65	1.68	1.72	1.78	1.81	1.86	1.86	1.90	1.87
1981	0.47	0.64	0.68	0.72	0.77	0.84	0.91	1.00	1.06	1.10	1.15	1.18	1.21	1.25	1.29	1.34	1.40	1.46	1.51	1.54	1.57	1.62	1.66	1.70	1.70	1.74	1.71
1982	0.44	0.61	0.64	0.68	0.73	0.79	0.86	0.94	1.00	1.04	1.08	1.12	1.15	1.18	1.22	1.26	1.32	1.38	1.42	1.45	1.48	1.53	1.56	1.60	1.60	1.64	1.61
1983	0.42	0.58	0.61	0.65	0.70	0.76	0.83	0.91	0.96	1.00	1.04	1.08	1.10	1.13	1.17	1.22	1.27	1.32	1.37	1.40	1.42	1.47	1.50	1.54	1.54	1.57	1.55
1984	0.41	0.56	0.59	0.62	0.67	0.73	0.80	0.87	0.92	0.96	1.00	1.04	1.06	1.08	1.12	1.16	1.21	1.27	1.31	1.34	1.37	1.41	1.44	1.47	1.48	1.51	1.50
1985	0.40	0.54	0.57	0.61	0.65	0.71	0.77	0.85	0.90	0.93	0.94	1.00	1.03	1.05	1.09	1.13	1.18	1.23	1.28	1.30	1.33	1.37	1.40	1.43	1.44	1.47	1.45
1986	0.39	0.53	0.56	0.59	0.63	0.69	0.75	0.82	0.87	0.91	0.94	0.97	1.00	1.03	1.06	1.10	1.15	1.20	1.24	1.27	1.29	1.34	1.36	1.40	1.40	1.43	1.42
1987	0.38	0.52	0.54	0.58	0.62	0.67	0.73	0.80	0.85	0.89	0.92	0.95	0.98	1.00	1.04	1.08	1.12	1.17	1.21	1.24	1.26	1.30	1.33	1.36	1.36	1.39	1.38
1988	0.36	0.50	0.53	0.56	0.60	0.65	0.71	0.77	0.82	0.85	0.89	0.92	0.94	0.97	1.00	1.04	1.08	1.13	1.17	1.19	1.22	1.26	1.28	1.31	1.32	1.34	1.33
1989	0.35	0.48	0.51	0.54	0.58	0.62	0.68	0.75	0.79	0.82	0.86	0.88	0.91	0.93	0.96	1.00	1.04	1.09	1.13	1.15	1.17	1.21	1.24	1.27	1.27	1.29	1.28
1990	0.34	0.46	0.49	0.51	0.55	0.60	0.66	0.72	0.76	0.79	0.83	0.85	0.87	0.89	0.93	0.96	1.00	1.05	1.08	1.10	1.13	1.16	1.19	1.22	1.22	1.24	1.24
1991	0.32	0.44	0.47	0.49	0.53	0.57	0.63	0.69	0.73	0.76	0.79	0.81	0.83	0.86	0.89	0.92	0.96	1.00	1.04	1.06	1.08	1.11	1.14	1.16	1.17	1.19	1.19
1992	0.31	0.43	0.45	0.48	0.51	0.55	0.61	0.66	0.70	0.73	0.76	0.78	0.81	0.83	0.86	0.89	0.92	0.97	1.00	1.02	1.04	1.08	1.10	1.12	1.13	1.15	1.16
1993	0.30	0.42	0.44	0.47	0.50	0.54	0.59	0.65	0.69	0.72	0.75	0.77	0.79	0.81	0.84	0.87	0.91	0.95	0.98	1.00	1.02	1.05	1.08	1.10	1.10	1.13	1.14
1994	0.30	0.41	0.43	0.46	0.49	0.53	0.58	0.64	0.68	0.70	0.73	0.75	0.77	0.79	0.82	0.85	0.89	0.93	0.96	0.98	1.00	1.03	1.05	1.08	1.08	1.10	1.11
1995	0.29	0.40	0.42	0.44	0.47	0.52	0.56	0.62	0.65	0.68	0.71	0.73	0.75	0.77	0.80	0.83	0.86	0.90	0.93	0.95	0.97	1.00	1.02	1.05	1.05	1.07	1.09
1996	0.28	0.39	0.41	0.43	0.46	0.51	0.55	0.60	0.64	0.67	0.69	0.71	0.73	0.75	0.78	0.81	0.84	0.88	0.91	0.93	0.95	0.98	1.00	1.02	1.03	1.05	1.07
1997	0.26	0.38	0.40	0.42	0.45	0.49	0.54	0.59	0.63	0.65	0.68	0.70	0.72	0.74	0.76	0.79	0.82	0.86	0.89	0.91	0.93	0.96	0.98	1.00	1.00	1.02	1.05
1998	0.27	0.38	0.40	0.42	0.45	0.49	0.54	0.59	0.62	0.65	0.68	0.70	0.71	0.73	0.76	0.79	0.82	0.86	0.89	0.91	0.92	0.95	0.97	1.00	1.00	1.02	1.04
1999	0.270	0.37	0.39	0.41	0.44	0.48	0.53	0.58	0.61	0.64	0.66	0.68	0.70	0.72	0.74	0.77	0.80	0.84	0.87	0.89	0.91	0.94	0.96	0.98	0.98	1.00	1.02
2000	0.27	0.37	0.40	0.42	0.45	0.49	0.53	0.58	0.62	0.64	0.67	0.69	0.70	0.73	0.75	0.78	0.81	0.84	0.86	0.88	0.90	0.92	0.94	0.95	0.97	0.98	1.00

Source:

U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, Washington, DC, monthly.

APPENDIX C

CENSUS DIVISIONS AND REGIONS

Table C.1
Census Divisions and Regions

Northeast Division			
Mid-Atlantic region		New England region	
New Jersey	Pennsylvania	Connecticut	New Hampshire
New York		Maine	Rhode Island
		Massachusetts	Vermont
South Division			
West South Central region	East South Central region	South Atlantic region	
Arkansas	Alabama	Delaware	South Carolina
Louisiana	Kentucky	Florida	Virginia
Oklahoma	Mississippi	Georgia	Washington, DC
Texas	Tennessee	Maryland	West Virginia
		North Carolina	
West Division			
Pacific region		Mountain region	
Alaska	Oregon	Arizona	Nevada
California	Washington	Colorado	New Mexico
Hawaii		Idaho	Utah
		Montana	Wyoming
Midwest Division			
West North Central region		East North Central region	
Iowa	Nebraska	Illinois	Ohio
Kansas	North Dakota	Indiana	Wisconsin
Minnesota	South Dakota	Michigan	
Missouri			

Census Divisions and Regions