

ORNL-6967
(Edition 22 of ORNL-5198)

Center for Transportation Analysis
Engineering Science & Technology Division

**TRANSPORTATION ENERGY DATA BOOK:
EDITION 22**

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September 2002

Prepared for the
Office of Planning, Budget Formulation and Analysis
Energy Efficiency and Renewable Energy
U.S. Department of Energy

Prepared by the
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831-6073
Managed by
UT-BATTELLE, LLC
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under Contract No. DE-AC05-00OR22725

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FOREWORD

Welcome to this 22nd edition of the Transportation Energy Data Book. I would like to bring to your attention some of the data that is new or of particular interest:

1. Transportation's share of U.S. oil use is at an all-time high of 67.3% (Table 1.12)
2. Transportation's share of U.S. energy use is at an all-time high of 27.9% (Table 2.1)
3. Between 1990 and 2000, light truck energy use grew at a faster rate than for any other mode (Tables 2.6 and 2.7)
4. The price of a new imported car exceeded the price of a new domestic car for the first time in 1982 and is now about 40% higher (Table 5.11)
5. Cars that are 15 years old and older make up 15% of the car population today whereas they made up about 3% of the car population thirty years ago (Table 6.6)
6. Estimated statistics for Class 2b trucks (those between 8,500 and 10,000 pounds gross vehicle weight) show them to use about 30% as much fuel as Class 2a trucks and about 15% as much fuel as Class 1 trucks (Table 7.3) and their percent of light truck sales is not growing (Table 7.4)
7. The optimal speed to attain the best fuel economy has changed over time. In vehicles tested in 1973, the highest mpg was attained at speeds between 30 and 40 mph. In the vehicles tested in 1997, the highest mpg was attained at speeds between 50 and 55 mph (Table 7.24)
8. Annual bicycle sales tend to be greater than light vehicle sales in the U.S. (Table 11.16)

I hope you find value in this data book. We welcome suggestions on how to improve it.



ACKNOWLEDGMENTS

The authors would like to express their gratitude to the many individuals who assisted in the preparation of this document. First, we would like to thank Phil Patterson and the Energy Efficiency and Renewable Energy staff for their continued support of the Transportation Energy Data Book project. We 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; Elyse Steiner, National Renewable Energy Laboratory; James Moore and William Shadis, TA-Engineering, Inc.; and Margaret Singh, Argonne National Laboratory. We 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 we 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 22* is a statistical compendium prepared and published by Oak Ridge National Laboratory (ORNL) under contract with the Office of Planning, Budget Formulation, and Analysis, under the Energy Efficiency and Renewable Energy (EERE) program 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).

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, then to the Office of Transportation Technologies. DOE, through the Office of Transportation Technologies, has supported the compilation of Editions 3 through 21. In the most recent DOE organization, Edition 22 falls under the purview of the Office of Planning, Budget Formulation, and Analysis in the Office of Energy Efficiency and Renewable Energy.

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 22 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.

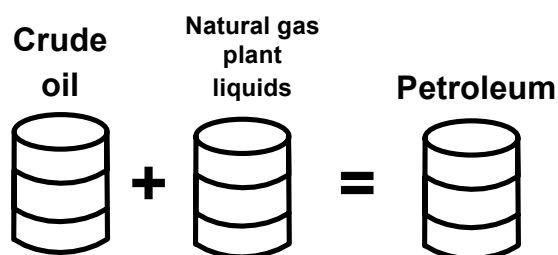
Chapter 1

Petroleum

Summary Statistics from Tables/Figures in this Chapter

| Source | | | |
|------------|---|----------------|------------------|
| Table 1.3 | World Petroleum Production, 2001 (million barrels per day) | | 74.34 |
| | <i>U.S. Production (million barrels per day)</i> | | 7.67 |
| | <i>U.S. Share</i> | | 10.3% |
| Table 1.4 | World Petroleum Consumption, 2001 (million barrels per day) | | 75.96 |
| | <i>U.S. Consumption (million barrels per day)</i> | | 19.65 |
| | <i>U.S. Share</i> | | 25.9% |
| Figure 1.5 | Average refinery yield, 2001 | OECD Europe | North America |
| | <i>Gasoline</i> | 20.4% | 40.6% |
| | <i>Diesel fuel</i> | 35.8% | 23.3% |
| | <i>Residual fuel</i> | 16.7% | 7.7% |
| | <i>Kerosene</i> | 6.2% | 8.5% |
| | <i>Other</i> | 20.9% | 19.9% |
| Table 1.12 | U.S. transportation petroleum use as a percent of U.S. petroleum production, 2001 | | 164.8% |
| Table 1.12 | Net imports as a percentage of U.S. petroleum consumption, 2001 | | 55.5% |
| Table 1.13 | Transportation share of petroleum consumption, 2001 | | 67.3% |

In this document, petroleum is defined as crude oil (including lease condensate) and natural gas plant liquids.



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.

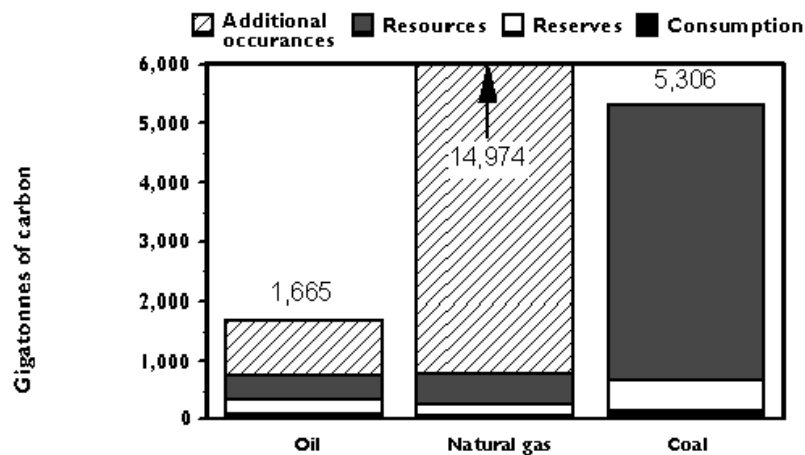
Table 1.1
World Fossil Fuel Potential
(gigatonnes of carbon)

| | Consumption (1860–1998) | Reserves | Resources | Additional occurrences |
|--------------------|----------------------------|----------|-----------|---------------------------|
| <i>Oil</i> | | | | |
| Conventional | 97 | 120 | 121 | 0 |
| Unconventional | 6 | 102 | 305 | 914 |
| <i>Natural Gas</i> | | | | |
| Conventional | 36 | 83 | 170 | 0 |
| Unconventional | 1 | 144 | 364 | 14,176 |
| <i>Coal</i> | 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 2001, OPEC accounted for 42% of world oil production. Responding to low oil prices in early 2000, Mexico, Norway, Russia, and Oman joined OPEC in cutting production. This group of oil countries, referred to here as OPEC+, account for more than 62% of world oil production.

Table 1.2
World Crude Oil Production, 1960-2001^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 | Persian Gulf ^d share | World |
|---|---------------|------------|-------------------------|------------|---------------------|---------------------------|----------------|-----------------------------------|---------------------------------|-------|
| 1960 | 7.04 | 33.5% | 8.70 | 41.4% | 12.25 | 58.3% | 12.29 | 5.27 | 25.1% | 20.99 |
| 1965 | 7.80 | 25.7% | 14.35 | 47.3% | 19.83 | 65.4% | 15.98 | 8.37 | 27.6% | 30.33 |
| 1970 | 9.64 | 21.0% | 23.30 | 50.8% | 31.16 | 67.9% | 22.59 | 13.39 | 29.2% | 45.89 |
| 1975 | 8.37 | 15.8% | 26.77 | 50.7% | 37.56 | 71.1% | 26.06 | 18.93 | 35.8% | 52.83 |
| 1980 | 8.60 | 14.4% | 26.61 | 44.6% | 41.07 | 68.9% | 32.99 | 17.96 | 30.1% | 59.60 |
| 1985 | 8.97 | 16.6% | 16.18 | 30.0% | 31.81 | 58.9% | 37.80 | 9.63 | 17.8% | 53.98 |
| 1986 | 8.68 | 15.4% | 18.28 | 32.5% | 34.05 | 60.6% | 37.95 | 11.70 | 20.8% | 56.23 |
| 1987 | 8.35 | 14.7% | 18.52 | 32.7% | 34.72 | 61.3% | 38.15 | 12.10 | 21.4% | 56.67 |
| 1988 | 8.14 | 13.9% | 20.32 | 34.6% | 36.66 | 62.4% | 38.42 | 13.46 | 22.9% | 58.74 |
| 1989 | 7.61 | 12.7% | 22.07 | 36.9% | 38.50 | 64.3% | 37.79 | 14.84 | 24.8% | 59.86 |
| 1990 | 7.36 | 12.2% | 23.20 | 38.3% | 39.12 | 64.6% | 37.37 | 15.28 | 25.2% | 60.57 |
| 1991 | 7.42 | 12.3% | 23.27 | 38.6% | 38.53 | 64.0% | 36.94 | 14.74 | 24.5% | 60.21 |
| 1992 | 7.17 | 11.9% | 24.40 | 40.5% | 37.67 | 62.6% | 35.81 | 15.97 | 26.5% | 60.21 |
| 1993 | 6.85 | 11.4% | 25.12 | 41.7% | 37.65 | 62.5% | 35.12 | 16.71 | 27.7% | 60.24 |
| 1994 | 6.66 | 10.9% | 25.51 | 41.8% | 37.67 | 61.8% | 35.48 | 16.96 | 27.8% | 60.99 |
| 1995 | 6.56 | 10.5% | 26.00 | 41.7% | 38.24 | 61.4% | 36.33 | 17.21 | 27.6% | 62.33 |
| 1996 | 6.46 | 10.1% | 26.46 | 41.5% | 39.15 | 61.5% | 37.25 | 17.37 | 27.3% | 63.71 |
| 1997 | 6.45 | 9.8% | 27.71 | 42.2% | 40.69 | 61.9% | 37.98 | 18.10 | 27.6% | 65.69 |
| 1998 | 6.25 | 9.3% | 28.77 | 43.0% | 41.61 | 62.1% | 38.19 | 19.34 | 28.9% | 66.96 |
| 1999 | 5.88 | 8.9% | 27.58 | 41.9% | 40.48 | 61.4% | 38.29 | 18.67 | 28.3% | 65.87 |
| 2000 | 5.82 | 8.5% | 29.11 | 42.7% | 42.75 | 62.7% | 39.09 | 19.94 | 29.2% | 68.20 |
| 2001 | 5.80 | 8.5% | 28.31 | 41.7% | 42.57 | 62.6% | 39.64 | 19.21 | 28.3% | 67.96 |
| <i>Average annual percentage change</i> | | | | | | | | | | |
| 1960-2001 | -0.5% | | 2.9% | | 3.1% | | 2.9% | 3.2% | | 2.9% |
| 1970-2001 | -1.6% | | 0.6% | | 1.0% | | 1.8% | 1.2% | | 1.3% |
| 1991-2001 | -2.4% | | 2.0% | | 1.0% | | 0.7% | 2.7% | | 1.2% |

Source:

U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2001*, Washington, DC, July 2002, Table 11.4.

^aIncludes lease condensate. Excludes natural gas plant liquids.

^bOrganization of Petroleum Exporting Countries. See Glossary for membership.

^cOPEC+ includes all OPEC nations plus Russia, Mexico, Norway and Oman.

^dSee Glossary for Persian Gulf nations.



This table shows petroleum production, which includes both crude oil and natural gas plant liquids. The U.S. was responsible for 10.4% of the world's petroleum production in 2001, but only 8.5% of the world's crude oil production (Table 1.2).

Table 1.3
World Petroleum Production, 1973-2001^a
(million barrels per day)

| Year | United States | U.S. share | Total OPEC ^b | OPEC share | Total non-OPEC | Non-OPEC share | Persian Gulf nations ^c | Persian Gulf ^d share | World |
|-----------|---------------|------------|-------------------------|---|----------------|----------------|-----------------------------------|---------------------------------|-------|
| 1973 | 10.95 | 18.7% | 30.95 | 52.9% | 27.51 | 47.1% | 20.86 | 35.7% | 58.47 |
| 1974 | 10.44 | 17.8% | 30.70 | 52.5% | 27.81 | 47.5% | 21.41 | 36.6% | 58.51 |
| 1975 | 10.00 | 18.0% | 27.14 | 48.8% | 28.48 | 51.2% | 19.18 | 34.5% | 55.62 |
| 1976 | 9.73 | 16.2% | 30.77 | 51.1% | 29.43 | 48.9% | 21.80 | 36.2% | 60.21 |
| 1977 | 9.86 | 15.7% | 31.37 | 50.0% | 31.32 | 50.0% | 22.07 | 35.2% | 62.69 |
| 1978 | 10.28 | 16.3% | 30.03 | 47.5% | 33.21 | 52.5% | 21.02 | 33.2% | 63.24 |
| 1979 | 10.13 | 15.4% | 31.22 | 47.3% | 37.74 | 52.7% | 21.53 | 32.6% | 65.96 |
| 1980 | 10.17 | 16.1% | 27.34 | 43.4% | 35.70 | 56.6% | 18.49 | 29.3% | 63.04 |
| 1981 | 10.18 | 17.0% | 23.31 | 39.0% | 36.40 | 61.0% | 15.85 | 26.5% | 59.71 |
| 1982 | 10.20 | 17.9% | 19.62 | 34.4% | 37.48 | 65.6% | 12.77 | 22.4% | 57.11 |
| 1983 | 10.25 | 18.0% | 18.28 | 32.1% | 38.62 | 67.9% | 11.63 | 20.4% | 56.90 |
| 1984 | 10.51 | 18.0% | 18.31 | 31.4% | 40.05 | 68.6% | 11.38 | 19.5% | 58.36 |
| 1985 | 10.58 | 18.3% | 17.07 | 29.5% | 40.85 | 70.5% | 10.28 | 17.7% | 57.92 |
| 1986 | 10.23 | 16.9% | 19.25 | 31.9% | 41.13 | 68.1% | 12.40 | 20.5% | 60.38 |
| 1987 | 9.95 | 16.3% | 19.53 | 32.0% | 41.42 | 68.0% | 12.82 | 21.0% | 60.95 |
| 1988 | 9.77 | 15.4% | 21.40 | 33.8% | 41.82 | 66.2% | 14.27 | 22.6% | 63.22 |
| 1989 | 9.16 | 14.2% | 23.26 | 36.1% | 41.10 | 63.9% | 15.69 | 24.4% | 64.36 |
| 1990 | 8.92 | 13.7% | 24.48 | 37.5% | 40.72 | 62.5% | 16.21 | 24.9% | 65.20 |
| 1991 | 9.08 | 14.0% | 24.57 | 37.8% | 40.47 | 62.2% | 15.67 | 24.1% | 65.04 |
| 1992 | 8.87 | 13.6% | 25.76 | 39.5% | 39.42 | 60.5% | 16.97 | 26.0% | 65.18 |
| 1993 | 8.59 | 13.1% | 26.56 | 40.6% | 38.87 | 59.4% | 17.75 | 27.1% | 65.43 |
| 1994 | 8.39 | 12.7% | 26.98 | 40.7% | 39.31 | 59.3% | 18.03 | 27.2% | 66.29 |
| 1995 | 8.32 | 12.3% | 27.51 | 40.6% | 40.32 | 59.4% | 18.32 | 27.0% | 67.82 |
| 1996 | 8.29 | 12.0% | 27.96 | 40.4% | 41.33 | 59.6% | 18.45 | 26.6% | 69.30 |
| 1997 | 8.27 | 11.6% | 29.30 | 41.0% | 42.12 | 59.0% | 19.25 | 27.0% | 71.42 |
| 1998 | 8.01 | 11.0% | 30.43 | 41.8% | 42.41 | 58.2% | 20.57 | 28.2% | 72.84 |
| 1999 | 7.73 | 10.8% | 29.23 | 40.7% | 42.64 | 59.3% | 19.82 | 27.6% | 71.86 |
| 2000 | 7.73 | 10.4% | 30.87 | 41.5% | 43.58 | 58.5% | 21.19 | 28.5% | 74.45 |
| 2001 | 7.67 | 10.3% | 30.02 | 40.4% | 44.32 | 59.6% | 20.42 | 27.5% | 74.34 |
| | | | | <i>Average annual percentage change</i> | | | | | |
| 1973-2001 | -1.3% | | -0.1% | | 1.7% | | -0.1% | | 0.9% |
| 1991-2001 | -1.7% | | 2.0% | | 0.9% | | 2.7% | | 1.3% |

Source:

U.S. Department of Energy, Energy Information Administration, *International Petroleum Monthly*, Tables 4.1 and 4.3.

^aIncludes natural gas plant liquids, crude oil and lease condensate.

^bOrganization of Petroleum Exporting Countries. See Glossary for membership.

^cSee Glossary for Persian Gulf nations.



The United States has accounted for approximately one-quarter of the world's petroleum consumption for the last two decades.

Table 1.4
World Petroleum Consumption, 1960–2001
(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 | 22.40 | 59.83 | |
| 1985 | 15.73 | 26.2% | 37.23 | 22.86 | 60.09 | |
| 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 | 25.0% | 41.40 | 25.16 | 66.56 | |
| 1992 | 17.03 | 25.4% | 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 | 17.73 | 25.3% | 44.96 | 24.92 | 69.88 | |
| 1996 | 18.31 | 25.6% | 46.07 | 25.34 | 71.41 | |
| 1997 | 18.62 | 25.5% | 46.63 | 26.22 | 72.85 | |
| 1998 | 18.92 | 25.6% | 46.89 | 26.71 | 73.60 | |
| 1999 | 19.52 | 25.9% | 47.69 | 27.29 | 74.98 | |
| 2000 | 19.70 | 25.9% | 47.92 | 27.61 | 75.53 | |
| 2001 | 19.65 | 25.9% | 47.68 | 28.28 | 75.96 | |
| | | <i>Average annual percentage change</i> | | | | |
| 1960–2001 | 1.7% | | 2.7% | 4.0% | 3.1% | |
| 1970–2001 | 0.9% | | 1.1% | 2.7% | 1.6% | |
| 1991–2001 | 1.6% | | 1.4% | 1.2% | 1.3% | |

Source:

U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2001*, Washington, DC, July 2002, Table 11.9 and updates from the *International Petroleum Monthly*, July 2002.

^a Organization for Economic Cooperation and Development. See Glossary for membership.



Figure 1.2. World Oil Reserves, Production and Consumption, 2001

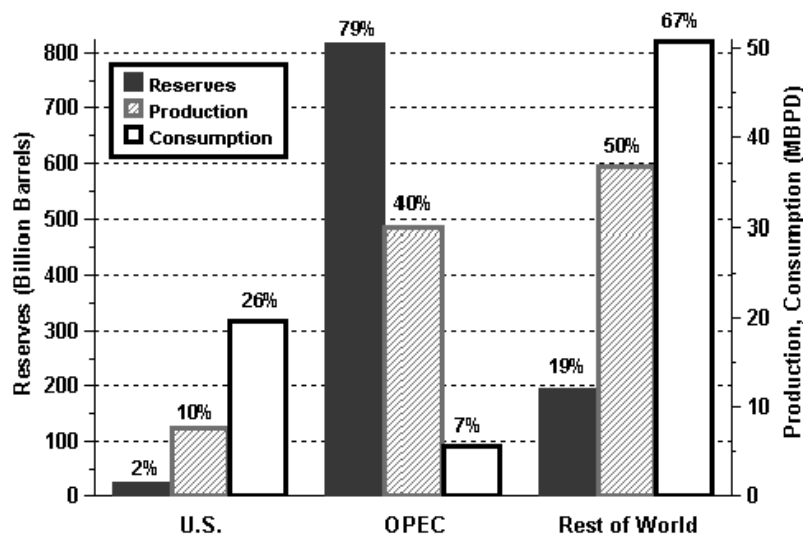


Table 1.5
World Oil Reserves, Production and Consumption, 2001

| | Crude oil reserves (billion barrels) | Reserve share | Petroleum production (million barrels per day) | Production share | Petroleum consumption (million barrels per day) | Consumption share |
|---------------|--------------------------------------|---------------|--|------------------|---|-------------------|
| U.S. | 22.0 | 2% | 7.7 | 10% | 19.6 | 26% |
| OPEC | 814.5 | 79% | 30.0 | 40% | 5.7 | 7% |
| Rest of world | 191.6 | 19% | 36.7 | 50% | 50.7 | 67% |

Source:

Reserves – Energy Information Administration, *International Energy Annual 2000*, Table 8.1.

Production – Energy Information Administration, *International Petroleum Monthly, April 2002*, Tables 4.1a – 4.1c and 4.3

Consumption – Energy Information Administration, *International Petroleum Monthly, April 2002*, Table 4.6.

OPEC consumption (2000 data) – Energy Information Administration, *International Energy Annual 2000*, Table 1.2.

Note:

Total consumption is higher than total production due to refinery gains including alcohol and liquid products produced from coal and other sources.

OPEC countries include Venezuela, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, United Arab Emirates, Algeria, Libya, Nigeria, and Indonesia.

OPEC consumption data are for 2000.



Total OECD government-owned petroleum stocks were slightly lower in 2001 than in 1995. The amount of petroleum held in government stocks is less than one-third that of commercial stocks.

Table 1.6
Petroleum Stocks of OECD Countries by Ownership, 1995–2001
(million barrels)

| Year | OECD Europe | | Japan | | United States ^a | | Total OECD ^b | |
|---|-------------|------------------|------------|------------------|----------------------------|------------------|-------------------------|------------------|
| | Commercial | Government-owned | Commercial | Government-owned | Commercial | Government-owned | Commercial | Government-owned |
| 1995 | 1,153 | 63 | 336 | 295 | 993 | 592 | 2,651 | 950 |
| 1996 | 1,191 | 63 | 351 | 300 | 969 | 566 | 2,659 | 929 |
| 1997 | 1,189 | 63 | 370 | 315 | 1,022 | 563 | 2,744 | 941 |
| 1998 | 1,257 | 63 | 334 | 315 | 1,098 | 571 | 2,851 | 949 |
| 1999 | 1,174 | 63 | 314 | 315 | 939 | 567 | 2,592 | 945 |
| 2000 | 1,196 | 64 | 322 | 312 | 951 | 541 | 2,635 | 917 |
| 2001 | 1,235 | 57 | 341 | 316 | 1,048 | 550 | 2,920 | 923 |
| <i>Average annual percentage change</i> | | | | | | | | |
| 1995–2001 | 1.2% | -1.7% | 0.2% | 1.2% | 0.9% | -1.2% | 1.6% | -0.5% |

Source:

U.S. Department of Energy, Energy Information Administration, *International Petroleum Statistics Report*, April 2002, Table 1.6, and annual.

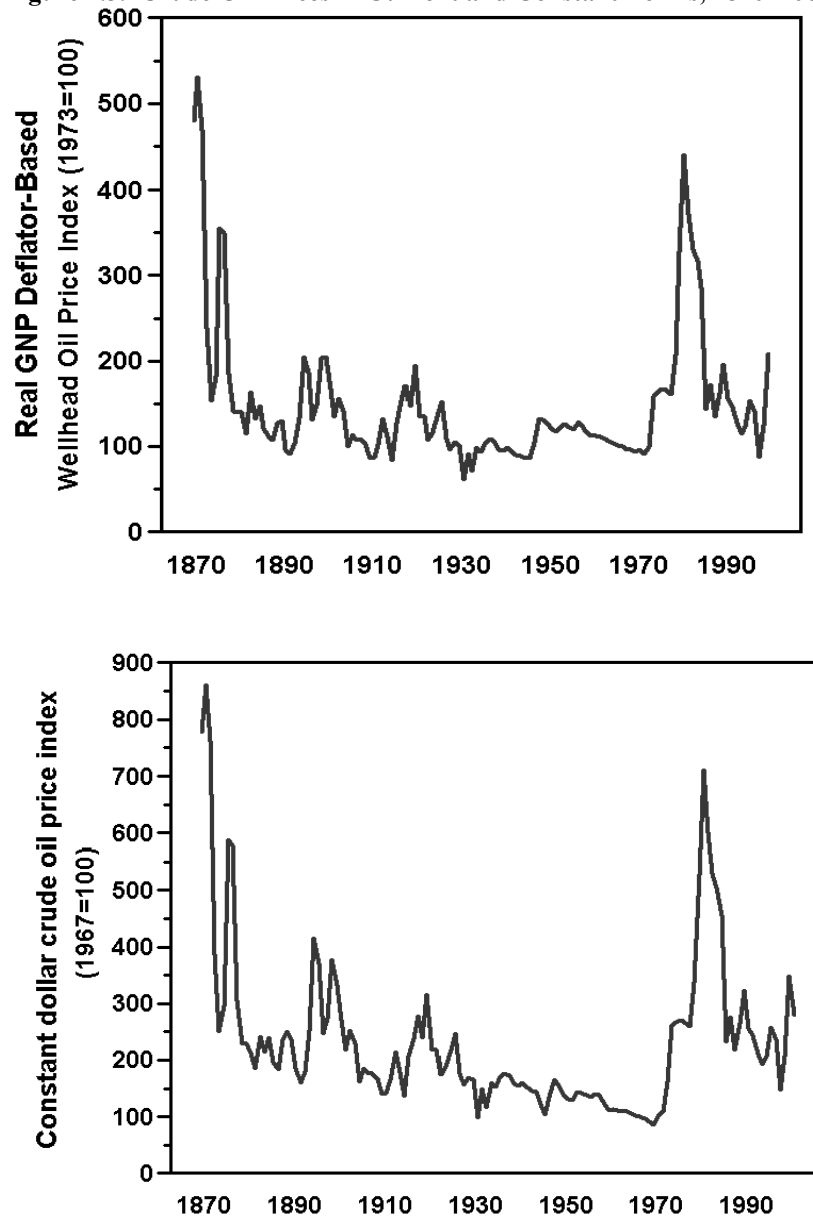
^aIncludes U.S. territories.

^bTotal OECD includes OECD Europe, Japan, United States, and other OECD countries. Look in the Glossary for a complete listing of OECD countries.



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 1.3. Crude Oil Prices in Current and Constant Terms, 1870–2000



Source:

1870–1972 Crude oil prices – American Petroleum Institute, *Basic Petroleum Data Book*, Volume XXI, Number 2, August 2001.

1973–2001 Crude oil prices – U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, April 2002, DOE/EIA-0035(2002/04), Table 9.1, domestic first purchase price.



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 1.7
U.S. Petroleum Imports by World Region of Origin, 1960–2001
 (million 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. products supplied | Total imports |
|---|-------------------------------|----------------|--|------------------------|-------------|--|---------------|
| 1960 | 1.31 | 81.3% | c | c | 1.61 | c | 1.82 |
| 1965 | 1.48 | 64.7% | c | c | 2.28 | c | 2.47 |
| 1970 | 1.34 | 42.5% | c | c | 3.16 | c | 3.42 |
| 1975 | 3.60 | 61.6% | c | c | 5.85 | 35.8% | 6.06 |
| 1980 | 4.29 | 67.5% | c | c | 6.37 | 37.3% | 6.91 |
| 1981 | 3.32 | 61.4% | 1.22 | 22.5% | 5.40 | 33.6% | 6.00 |
| 1982 | 2.14 | 49.7% | 0.69 | 16.1% | 4.30 | 28.1% | 5.11 |
| 1983 | 1.84 | 42.7% | 0.44 | 10.2% | 4.31 | 28.3% | 5.05 |
| 1984 | 2.04 | 43.2% | 0.50 | 10.6% | 4.72 | 30.0% | 5.44 |
| 1985 | 1.82 | 42.5% | 0.31 | 7.2% | 4.29 | 27.3% | 5.07 |
| 1986 | 2.83 | 52.0% | 0.91 | 16.7% | 5.44 | 33.4% | 6.22 |
| 1987 | 3.06 | 51.7% | 1.07 | 18.2% | 5.91 | 35.5% | 6.68 |
| 1988 | 3.51 | 53.3% | 1.53 | 23.2% | 6.59 | 38.1% | 7.40 |
| 1989 | 4.12 | 57.3% | 1.86 | 25.8% | 7.20 | 41.6% | 8.06 |
| 1990 | 4.29 | 59.8% | 1.96 | 27.4% | 7.16 | 42.2% | 8.02 |
| 1991 | 4.07 | 61.3% | 1.83 | 27.7% | 6.63 | 39.6% | 7.63 |
| 1992 | 4.07 | 58.7% | 1.77 | 25.6% | 6.94 | 40.7% | 7.89 |
| 1993 | 4.25 | 55.8% | 1.77 | 23.3% | 7.62 | 44.2% | 8.62 |
| 1994 | 4.23 | 52.6% | 1.72 | 21.4% | 8.05 | 45.5% | 9.00 |
| 1995 | 3.98 | 50.5% | 1.56 | 19.8% | 7.89 | 44.5% | 8.84 |
| 1996 | 4.19 | 49.3% | 1.60 | 18.8% | 8.50 | 46.4% | 9.48 |
| 1997 | 4.54 | 49.6% | 1.75 | 19.1% | 9.16 | 49.2% | 10.16 |
| 1998 | 4.88 | 50.0% | 2.13 | 21.8% | 9.76 | 51.6% | 10.71 |
| 1999 | 4.93 | 49.8% | 2.46 | 24.8% | 9.91 | 50.8% | 10.85 |
| 2000 | 5.18 | 49.7% | 2.48 | 23.8% | 10.42 | 52.9% | 11.46 |
| 2001 | 5.51 | 50.6% | 2.76 | 25.3% | 10.90 | 55.5% | 11.87 |
| <i>Average annual percentage change</i> | | | | | | | |
| 1960–2001 | 3.6% | | c | | 4.8% | | 4.7% |
| 1970–2001 | 4.7% | | c | | 4.1% | | 4.1% |
| 1991–2001 | 3.1% | | 4.2% | | 5.1% | | 4.5% |

Source:

U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2001*, Washington, DC, July 2002, Tables 5.4 and 5.7 and updates from the *International Petroleum Monthly*, July 2002, Table 4.10.

^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.

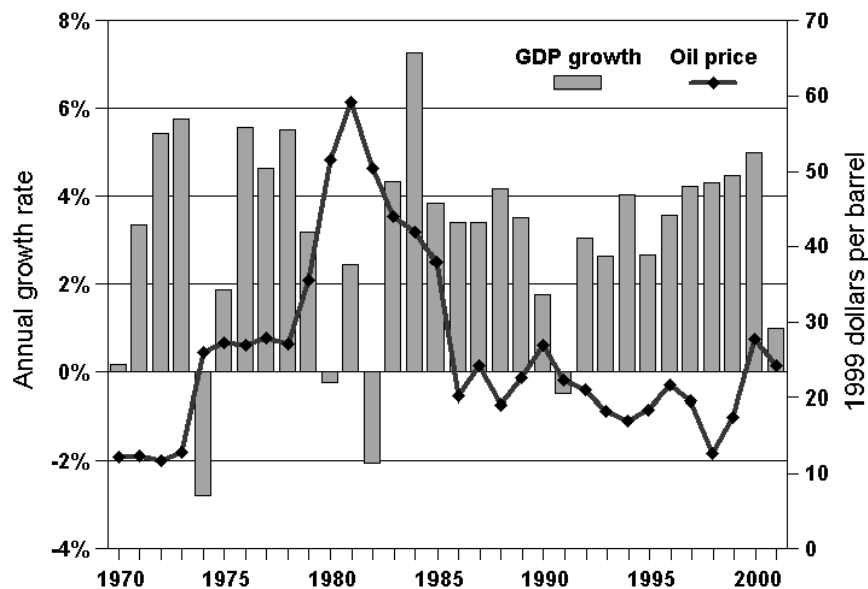
Oil dependence is the product of (1) a noncompetitive world oil market strongly influenced by the OPEC cartel, (2) high levels of U.S. oil imports, (3) oil's critical role in the U.S. economy, and (4) the absence of economical and readily available substitutes for oil. Transportation is key to the problem 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 1.4. 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)

^aFirst 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 1.8
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.

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

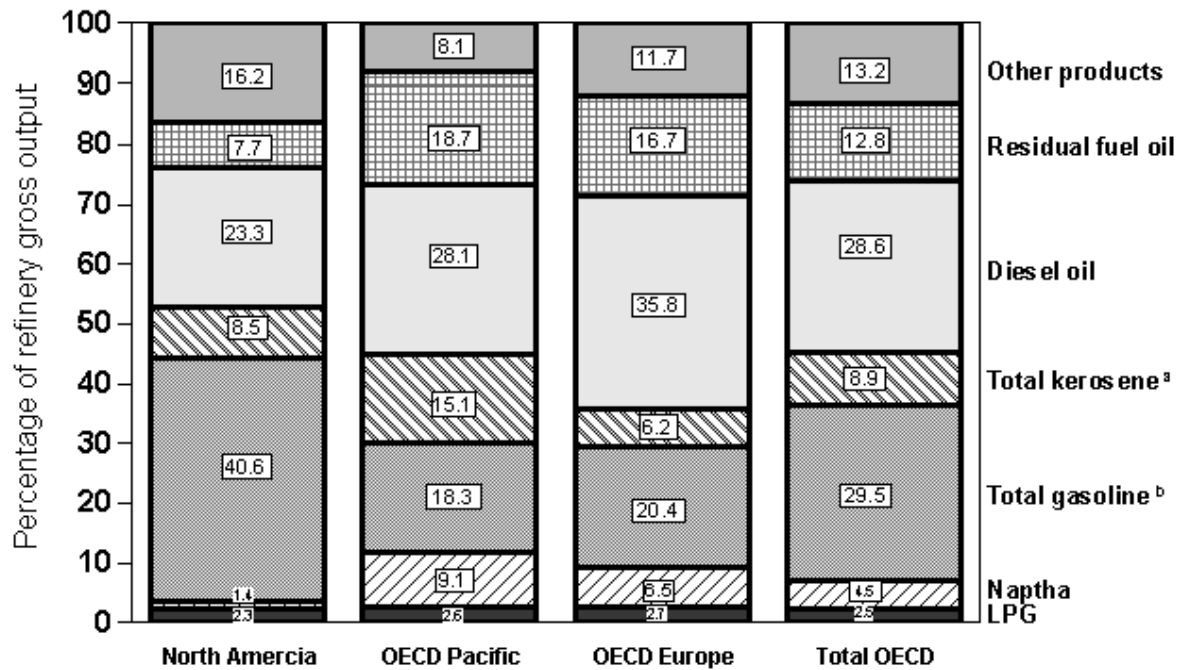
^bProvided by the author(s); thus, assumptions used for the projection are different from those used in the other estimates.

^cAnnual 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 1.5. Refinery Gross Output by World Region, 2001



Source:

International Energy Agency, *Monthly Oil Survey*, January 2002, 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 1.9
U.S. Refinery Input of Crude Oil and Petroleum Products, 1987–2001
 (thousand barrels)

| Year | Crude oil | Natural gas liquids | Oxygenates | | | | Other hydrocarbons ^c | Other liquids | Total input to refineries |
|---|-----------|---------------------|--------------|----------|-------------------|-------------------------------|---------------------------------|---------------|---------------------------|
| | | | Fuel ethanol | Methanol | MTBE ^a | Other oxygenates ^b | | | |
| 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 |
| 2001 | 5,521,637 | 156,479 | 16,929 | 1,431 | 87,116 | 3,113 | 24,903 | 167,729 | 5,979,337 |
| <i>Average annual percentage change</i> | | | | | | | | | |
| 1987-2001 | 1.2% | -4.1% | e | e | e | e | 0.5% | -1.9% | 1.1% |
| 1993-2001 | 1.3% | -1.7% | 22.4% | 7.8% | 7.4% | 14.1% | 6.1% | -5.5% | 1.1% |

Source:

U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Annual, 2001*, Vol. 1, June 2002, Table 16, and annual.
 (Additional resources: www.eia.doe.gov)

^aMethyl tertiary butyl ether (MTBE).

^bIncludes 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.

^cFor 1987–92, includes other hydrocarbons/hydrogen/oxygenates. For 1993–on, includes other hydrocarbons/hydrogen.

^dReported in “Other hydrocarbons” category in this year.

^eData 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 1.10
Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978–2001
(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 |
| 2001 | 46.2 | 23.8 | 9.8 | 4.3 | 21.7 | 105.8 |

Source:

Department of Energy, Energy Information Administration, *Petroleum Supply Annual 2001*, Vol. 1, June 2002, Table 19 and annual. (Additional resources: www.eia.doe.gov)

^a Includes aviation gasoline(0.1%), kerosene (0.5%), naphtha and other oils for petrochemical feedstock use (2.2%), special naphthas (0.3%), lubricants (1.1%), waxes (0.1%), petroleum coke (4.9%), asphalt and road oil (3.1%), still gas (4.3%), and miscellaneous products (0.4%).

^b Products sum greater than 100% due to processing gain. The processing gain for years 1978 to 1980 is assumed to be 4%.



Most of the petroleum imported by the United States is in the form of crude oil. The U.S. does export small amounts of petroleum, mainly refined petroleum products which go to Canada and Mexico.

Table 1.11
United States Petroleum Production, Imports and Exports, 1950–2001
(million barrels per day)

| | Domestic Production | | | Net Imports | | | Exports | | |
|---|---------------------|---------------------------|--------------------|-------------|--------------------|-------|-----------|--------------------|-------|
| | Crude oil | Natural gas plant liquids | Total ^a | Crude oil | Petroleum products | Total | Crude oil | Petroleum products | Total |
| 1950 | 5.41 | 0.50 | 5.91 | 0.39 | 0.15 | 0.55 | 0.10 | 0.21 | 0.30 |
| 1955 | 6.81 | 0.77 | 7.58 | 0.75 | 0.13 | 0.88 | 0.03 | 0.34 | 0.37 |
| 1960 | 7.05 | 0.93 | 7.99 | 1.01 | 0.61 | 1.62 | 0.01 | 0.19 | 0.20 |
| 1965 | 7.80 | 1.21 | 9.01 | 1.24 | 1.05 | 2.28 | 0.00 | 0.18 | 0.19 |
| 1970 | 9.64 | 1.66 | 11.30 | 1.31 | 1.85 | 3.16 | 0.01 | 0.25 | 0.26 |
| 1975 | 8.37 | 1.63 | 10.05 | 4.10 | 1.75 | 5.85 | 0.01 | 0.20 | 0.21 |
| 1980 | 8.62 | 1.58 | 10.24 | 4.99 | 1.39 | 6.38 | 0.29 | 0.26 | 0.55 |
| 1981 | 8.57 | 1.61 | 10.23 | 4.17 | 1.23 | 5.40 | 0.23 | 0.37 | 0.59 |
| 1982 | 8.65 | 1.55 | 10.25 | 3.25 | 1.05 | 4.30 | 0.24 | 0.58 | 0.82 |
| 1983 | 8.69 | 1.56 | 10.30 | 3.17 | 1.15 | 4.31 | 0.16 | 0.58 | 0.74 |
| 1984 | 8.90 | 1.63 | 10.58 | 3.25 | 1.47 | 4.73 | 0.18 | 0.54 | 0.72 |
| 1985 | 8.97 | 1.61 | 10.64 | 3.00 | 1.29 | 4.29 | 0.20 | 0.58 | 0.78 |
| 1986 | 8.68 | 1.55 | 10.29 | 4.02 | 1.41 | 5.44 | 0.15 | 0.63 | 0.78 |
| 1987 | 8.35 | 1.60 | 10.01 | 4.52 | 1.39 | 5.91 | 0.15 | 0.61 | 0.76 |
| 1988 | 8.16 | 1.63 | 9.84 | 4.97 | 1.64 | 6.60 | 0.16 | 0.66 | 0.82 |
| 1989 | 7.61 | 1.55 | 9.22 | 5.70 | 1.50 | 7.20 | 0.14 | 0.72 | 0.86 |
| 1990 | 7.36 | 1.56 | 8.99 | 5.79 | 1.38 | 7.16 | 0.11 | 0.75 | 0.86 |
| 1991 | 7.42 | 1.66 | 9.17 | 5.67 | 0.96 | 6.63 | 0.12 | 0.88 | 1.00 |
| 1992 | 7.19 | 1.70 | 9.02 | 6.01 | 0.95 | 6.96 | 0.09 | 0.86 | 0.95 |
| 1993 | 6.85 | 1.74 | 8.84 | 6.69 | 0.93 | 7.62 | 0.10 | 0.90 | 1.00 |
| 1994 | 6.66 | 1.73 | 8.64 | 6.96 | 1.09 | 8.05 | 0.10 | 0.84 | 0.94 |
| 1995 | 6.56 | 1.76 | 8.63 | 7.14 | 0.75 | 7.89 | 0.09 | 0.85 | 0.95 |
| 1996 | 6.48 | 1.84 | 8.63 | 7.42 | 1.10 | 8.52 | 0.11 | 0.87 | 0.98 |
| 1997 | 6.45 | 1.82 | 8.61 | 8.12 | 1.04 | 9.16 | 0.11 | 0.90 | 1.00 |
| 1998 | 6.25 | 1.76 | 8.39 | 8.60 | 1.17 | 9.76 | 0.11 | 0.83 | 0.94 |
| 1999 | 5.88 | 1.85 | 8.11 | 8.61 | 1.30 | 9.91 | 0.12 | 0.82 | 0.94 |
| 2000 | 5.85 | 1.91 | 8.15 | 8.91 | 1.17 | 10.08 | 0.05 | 0.99 | 1.04 |
| 2001 | 5.85 | 1.86 | 8.10 | 9.12 | 1.51 | 10.64 | 0.02 | 0.96 | 0.98 |
| <i>Average annual percentage change</i> | | | | | | | | | |
| 1950–2001 | 0.2% | 2.6% | 0.6% | 6.4% | 4.6% | 6.0% | -3.1% | 3.0% | 2.3% |
| 1970–2001 | -1.5% | 0.4% | -1.1% | 6.5% | -0.7% | 4.0% | 2.3% | 4.4% | 4.4% |
| 1991–2001 | -2.3% | 1.1% | -1.2% | 4.9% | 4.6% | 4.8% | -16.4% | 0.9% | -0.2% |

Source:

U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2001*, July 2002, Tables 5.1 and 5.5

^aTotal domestic production includes crude oil, natural gas plant liquids and small amounts of other liquids.



The U.S. share of the world's petroleum consumption is approximately one-quarter. The U.S. relies heavily on imported petroleum. Imports accounted for 55% of U.S. petroleum consumption in 2001.

Table 1.12
Petroleum Production and Consumption Ratios, 1950–2001

| | Domestic petroleum production ^a | Net petroleum imports | Transportation petroleum consumption | U.S. petroleum consumption | World petroleum consumption | Net imports as a share of U.S. consumption | U.S. petroleum consumption as a share of world consumption | Transportation petroleum use as a share of domestic production | |
|-----------|--|-----------------------|--------------------------------------|---|-----------------------------|--|--|--|--|
| | (million barrels per day) | | | | | | | | |
| 1950 | 5.91 | 0.55 | 3.36 | 6.46 | b | 8.4% | b | 56.8% | |
| 1955 | 7.58 | 0.88 | 4.46 | 8.46 | b | 10.4% | b | 58.8% | |
| 1960 | 7.99 | 1.62 | 5.15 | 9.82 | 21.34 | 16.5% | 46.0% | 64.5% | |
| 1965 | 9.01 | 2.28 | 6.04 | 11.51 | 31.14 | 19.8% | 37.0% | 67.0% | |
| 1970 | 11.30 | 3.16 | 7.78 | 14.70 | 46.81 | 21.5% | 31.4% | 68.9% | |
| 1975 | 10.05 | 5.85 | 8.95 | 16.32 | 56.20 | 35.8% | 29.0% | 89.1% | |
| 1980 | 10.24 | 6.38 | 9.57 | 17.10 | 63.07 | 37.3% | 27.1% | 93.5% | |
| 1981 | 10.23 | 5.40 | 9.49 | 16.06 | 60.90 | 33.6% | 26.4% | 92.7% | |
| 1982 | 10.25 | 4.30 | 9.31 | 15.30 | 59.50 | 28.1% | 25.7% | 90.8% | |
| 1983 | 10.30 | 4.31 | 9.41 | 15.23 | 58.74 | 28.3% | 25.9% | 91.3% | |
| 1984 | 10.58 | 4.73 | 9.71 | 15.77 | 59.84 | 30.0% | 26.4% | 91.8% | |
| 1985 | 10.64 | 4.29 | 9.85 | 15.73 | 60.10 | 27.3% | 26.2% | 92.6% | |
| 1986 | 10.29 | 5.44 | 10.23 | 16.28 | 61.76 | 33.4% | 26.4% | 99.5% | |
| 1987 | 10.01 | 5.91 | 10.53 | 16.67 | 63.00 | 35.5% | 26.5% | 105.2% | |
| 1988 | 9.84 | 6.60 | 10.90 | 17.33 | 64.82 | 38.1% | 26.7% | 110.8% | |
| 1989 | 9.22 | 7.20 | 11.01 | 17.33 | 65.92 | 41.6% | 26.3% | 119.5% | |
| 1990 | 8.99 | 7.16 | 10.97 | 16.99 | 65.98 | 42.2% | 25.7% | 122.0% | |
| 1991 | 9.17 | 6.63 | 10.80 | 16.71 | 66.73 | 39.6% | 25.0% | 117.8% | |
| 1992 | 9.02 | 6.96 | 10.98 | 17.08 | 66.94 | 40.7% | 25.5% | 121.7% | |
| 1993 | 8.84 | 7.62 | 11.18 | 17.24 | 67.14 | 44.2% | 25.7% | 126.6% | |
| 1994 | 8.64 | 8.05 | 11.49 | 17.72 | 68.44 | 45.5% | 25.9% | 132.9% | |
| 1995 | 8.63 | 7.89 | 11.73 | 17.72 | 70.04 | 44.5% | 25.3% | 136.0% | |
| 1996 | 8.63 | 8.52 | 11.99 | 18.36 | 71.60 | 46.4% | 25.6% | 139.0% | |
| 1997 | 8.61 | 9.16 | 12.13 | 18.62 | 73.06 | 49.2% | 25.5% | 140.9% | |
| 1998 | 8.39 | 9.76 | 12.48 | 18.92 | 73.79 | 51.6% | 25.6% | 148.8% | |
| 1999 | 8.11 | 9.91 | 12.89 | 19.52 | 75.30 | 50.8% | 25.9% | 159.0% | |
| 2000 | 8.11 | 10.42 | 13.25 | 19.70 | 76.02 | 52.9% | 25.9% | 163.4% | |
| 2001 | 8.05 | 10.90 | 13.26 | 19.65 | b | 55.5% | b | 164.8% | |
| | | | | <i>Average annual percentage change</i> | | | | | |
| 1950–2001 | 0.6% | 6.0% | 2.7% | 2.2% | b | | | | |
| 1970–2001 | -1.1% | 4.1% | 1.7% | 0.9% | 1.6% ^c | | | | |
| 1991–2001 | -1.3% | 5.1% | 2.1% | 1.6% | 1.3% ^c | | | | |

Source:

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review 2001*, Tables 2.5, 3.1a, 3.1b, and A3. (Pre-1973 data from the *Annual Energy Review*).

World petroleum consumption - U.S. Department of Energy, Energy Information Administration, *International Energy Annual 2000*, May 2002, Table 1.1, and annual.

^aTotal domestic production includes crude oil, natural gas plant liquids and small amounts of other liquids.

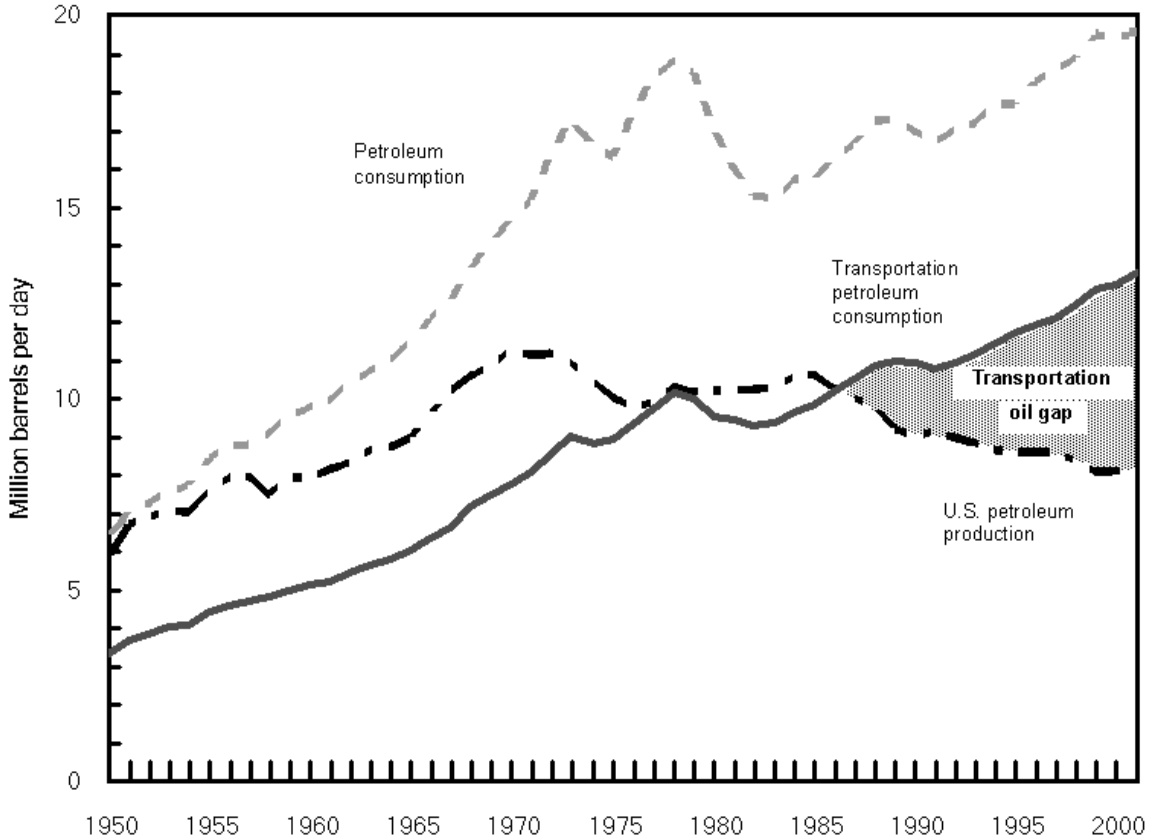
^bData are not available.

^cAverage annual percentage change is to the latest year possible.



The transportation oil gap is the difference between the amount of petroleum the U.S. produces and the amount of petroleum 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. petroleum production.

Figure 1.6. United States Petroleum Production and Consumption, 1950–2001



Source:
See Table 1.11.



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 1.13
Consumption of Petroleum by End-Use Sector, 1973–2001
(million barrels per day)

| Year | Transportation | Percentage | Residential | Commercial | Industrial | Electric utilities | Total | |
|-----------|----------------|---|-------------|------------|------------|--------------------|-------|--|
| 1973 | 9.05 | 52.3% | 1.49 | 0.75 | 4.48 | 1.54 | 17.31 | |
| 1974 | 8.84 | 53.1% | 1.36 | 0.68 | 4.30 | 1.48 | 16.65 | |
| 1975 | 8.95 | 54.8% | 1.32 | 0.63 | 4.04 | 1.39 | 16.32 | |
| 1976 | 9.37 | 53.7% | 1.43 | 0.70 | 4.45 | 1.52 | 17.46 | |
| 1977 | 9.76 | 53.0% | 1.42 | 0.72 | 4.82 | 1.71 | 18.43 | |
| 1978 | 10.16 | 53.9% | 1.38 | 0.69 | 4.87 | 1.75 | 18.85 | |
| 1979 | 10.01 | 54.1% | 1.09 | 0.63 | 5.34 | 1.44 | 18.51 | |
| 1980 | 9.55 | 56.0% | 0.91 | 0.61 | 4.84 | 1.15 | 17.06 | |
| 1981 | 9.49 | 59.1% | 0.81 | 0.52 | 4.27 | 0.96 | 16.06 | |
| 1982 | 9.31 | 60.8% | 0.76 | 0.48 | 4.06 | 0.69 | 15.30 | |
| 1983 | 9.41 | 61.8% | 0.74 | 0.55 | 3.85 | 0.68 | 15.23 | |
| 1984 | 9.68 | 61.5% | 0.71 | 0.57 | 4.19 | 0.56 | 15.73 | |
| 1985 | 9.85 | 62.6% | 0.79 | 0.50 | 4.10 | 0.48 | 15.73 | |
| 1986 | 10.23 | 62.8% | 0.78 | 0.53 | 4.11 | 0.64 | 16.28 | |
| 1987 | 10.53 | 63.2% | 0.81 | 0.52 | 4.25 | 0.55 | 16.67 | |
| 1988 | 10.88 | 63.0% | 0.83 | 0.50 | 4.39 | 0.68 | 17.28 | |
| 1989 | 11.01 | 63.5% | 0.84 | 0.47 | 4.26 | 0.74 | 17.33 | |
| 1990 | 10.97 | 64.6% | 0.70 | 0.44 | 4.32 | 0.55 | 16.99 | |
| 1991 | 10.80 | 64.6% | 0.72 | 0.42 | 4.25 | 0.52 | 16.71 | |
| 1992 | 10.95 | 64.3% | 0.73 | 0.40 | 4.55 | 0.42 | 17.03 | |
| 1993 | 11.18 | 64.8% | 0.77 | 0.37 | 4.45 | 0.46 | 17.24 | |
| 1994 | 11.49 | 64.8% | 0.74 | 0.37 | 4.69 | 0.43 | 17.72 | |
| 1995 | 11.73 | 66.2% | 0.76 | 0.35 | 4.60 | 0.29 | 17.72 | |
| 1996 | 11.96 | 65.3% | 0.84 | 0.37 | 4.82 | 0.32 | 18.31 | |
| 1997 | 12.13 | 65.1% | 0.82 | 0.36 | 4.97 | 0.36 | 18.62 | |
| 1998 | 12.48 | 66.0% | 0.75 | 0.33 | 4.84 | 0.51 | 18.92 | |
| 1999 | 12.89 | 66.0% | 0.84 | 0.34 | 5.03 | 0.42 | 19.52 | |
| 2000 | 13.25 | 67.1% | 0.86 | 0.37 | 4.93 | 0.34 | 19.75 | |
| 2001 | 13.26 | 67.3% | 0.85 | 0.36 | 4.86 | 0.37 | 19.70 | |
| | | <i>Average annual percentage change</i> | | | | | | |
| 1973–2001 | 1.4% | | -2.0% | -2.6% | 0.0% | -5.0% | 0.5% | |
| 1991–2001 | 2.1% | | 1.7% | -1.5% | 1.4% | -3.3% | 1.7% | |

Source:

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2002, Tables 2.2–2.6. Converted to million barrels per day using Table A3. (Additional resources: www.eia.doe.gov)



Pipelines accounted for two-thirds of the domestic movement of petroleum and petroleum products in 2000.

Table 1.14
Ton-Miles of Petroleum and Petroleum Products in the U.S. by Mode, 1975–2000

| 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 |
| 2000 | 66.1% | 28.0% | 3.6% | 2.3% | 873.3 |
| | <i>Average annual percentage change</i> | | | | |
| 1975–2000 | | | | | 0.1% |
| 1990–2000 | | | | | -2.1% |

Source:

Association of Oil Pipelines, *Shifts in Petroleum Transportation*, Washington, DC, February 2002, 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

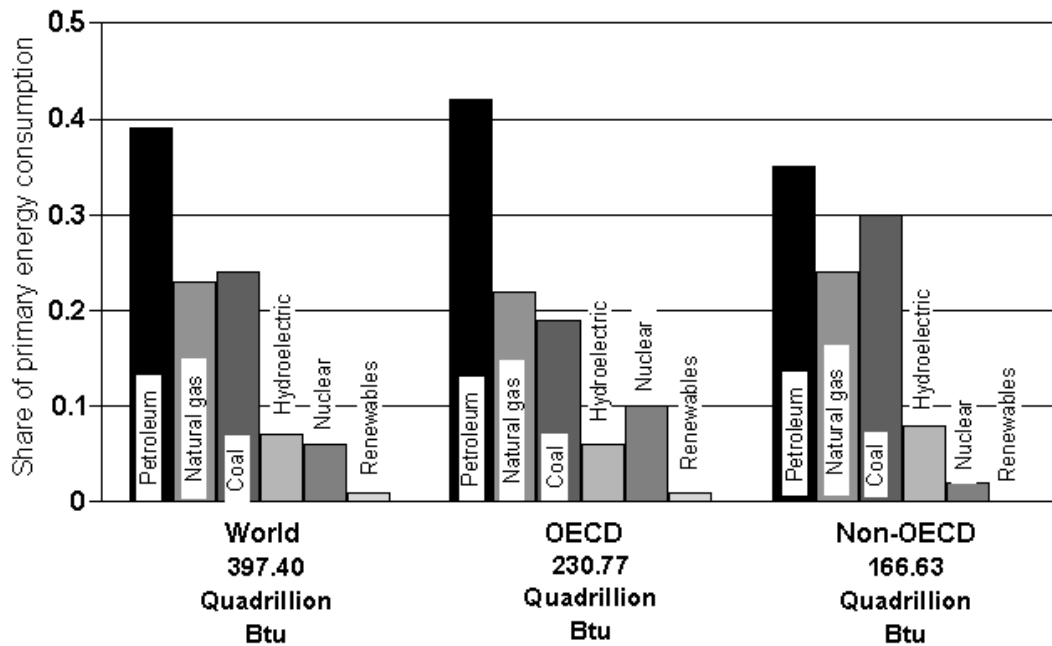
Summary Statistics from Tables in this Chapter

| Source | | | |
|-----------|--|---|---------|
| Table 2.1 | Transportation share of U.S. energy consumption, 2001 | 27.9% | |
| Table 2.2 | Petroleum share of transportation energy consumption, 2001 | 96.9% | |
| Table 2.3 | Alternative fuel and oxygenate consumption, 2001 | | |
| | | (thousand gasoline equivalent gallons) | (share) |
| | <i>MTBE</i> | 2,937,500 | 67.2% |
| | <i>Ethanol in gasohol</i> | 1,066,000 | 24.4% |
| | <i>Liquified petroleum gas</i> | 243,196 | 5.6% |
| | <i>Compressed natural gas</i> | 107,476 | 2.5% |
| | <i>Liquified natural gas</i> | 7,566 | 0.2% |
| | <i>E85/E95</i> | 4,626 | 0.0% |
| | <i>Electricity</i> | 2,143 | 0.0% |
| | <i>M85/M100</i> | 922 | 0.0% |
| Table 2.5 | Transportation energy use by mode, 2000 | (trillion Btu) | (share) |
| | <i>Automobiles</i> | 9,082 | 33.1% |
| | <i>Light trucks</i> | 6,598 | 24.0% |
| | <i>Heavy trucks</i> | 4,813 | 17.5% |
| | <i>Air</i> | 2,549 | 9.3% |
| | <i>Water</i> | 1,720 | 6.3% |
| | <i>Off-highway</i> | 944 | 3.4% |
| | <i>Pipeline</i> | 911 | 3.3% |
| | <i>Rail</i> | 605 | 2.2% |
| | <i>Buses</i> | 211 | 0.8% |



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, 2000



Source:

U.S. Department of Energy, Energy Information Administration, *International Energy Annual 2000*, Washington, DC, February 2002, 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 97 quads in 2001 with transportation using 27.9%.

Table 2.1
U. S. Consumption of Total Energy by End-Use Sector, 1973–2001^a
(quadrillion Btu)

| Year | Transportation | Percentage of total transportation | 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 | 26.2 | 26.8% | 35.5 | 15.8 | 19.2 | 97.8 |
| 2000 | 27.0 | 27.3% | 35.7 | 16.3 | 19.8 | 98.8 |
| 2001 | 27.1 | 27.9% | 34.0 | 16.6 | 19.4 | 97.0 |
| | | <i>Average annual percentage change</i> | | | | |
| 1973–2000 | 1.4% | | 0.1% | 2.1% | 1.0% | 0.9% |
| 1990–2000 | 1.9% | | 0.7% | 2.4% | 1.1% | 1.4% |

Source:

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2002, Washington, DC, Table 2.2. (Additional resources: www.eia.doe.gov)

^aElectrical 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. In transportation, the alcohol fuels blended into gasoline to make gasohol are now counted under “renewables” and have been taken out of petroleum. The petroleum category, however, still contains other blending agents that are not actually petroleum, but are not broken out into a separate category.

Table 2.2
Distribution of Energy Consumption by Source, 1973 and 2001
(percentage)

| Energy source | Transportation | | Residential | | Commercial | | Industrial | | Electric utilities | |
|--------------------------|----------------|-------|-------------|-------|------------|-------|------------|-------|--------------------|-------|
| | 1973 | 2001 | 1973 | 2001 | 1973 | 2001 | 1973 | 2001 | 1973 | 2001 |
| Petroleum ^a | 95.8 | 96.9 | 18.9 | 7.6 | 16.4 | 4.4 | 27.9 | 26.4 | 17.7 | 2.4 |
| Natural gas ^b | 4.0 | 2.3 | 33.2 | 25.5 | 27.8 | 19.9 | 31.8 | 31.0 | 18.8 | 7.8 |
| Coal | 0.0 | 0.0 | 0.7 | 0.2 | 1.6 | 0.4 | 12.4 | 6.5 | 43.5 | 56.6 |
| Renewable | 0.0 | 0.5 | 2.4 | 2.6 | 0.1 | 0.4 | 3.6 | 5.9 | 15.4 | 9.9 |
| Nuclear | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.6 | 23.3 |
| Electricity ^c | 0.2 | 0.2 | 44.9 | 64.1 | 54.1 | 47.9 | 24.4 | 30.2 | 0.0 | 0.0 |
| Other ^d | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 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 2002, Washington, DC, pp. 27, 29, 31, 33. (Additional resources: www.eia.doe.gov)

^a In transportation, the petroleum category contains some blending agents which are not petroleum.

^b Includes supplemental gaseous fuels. Transportation sector includes pipeline fuel and natural gas vehicle use.

^c Includes electrical system energy losses.

^d 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 | 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)

Note:

These data were released in October 1999. Please check the source web site for updates which were not available when this document went to press.

^aBased on plans or projections.

^bConsumption includes gasoline portion of the mixture.

^cVehicle consumption only; does not include power plant inputs.

^dMethyl 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, 2000^a
(trillion Btu)

| | Gasoline | Diesel fuel | Liquified petroleum gas | Jet fuel | Residual fuel oil | Natural gas | Electricity | Methanol | Total |
|---------------------------|----------------------|----------------|-------------------------|----------------|-------------------|--------------|--------------|------------|-----------------|
| <u>HIGHWAY</u> | 15,952.3 | 4,742.2 | 26.1 | | | 8.2 | 0.9 | 0.0 | 20,729.7 |
| Light vehicles | 15,396.2 | 299.7 | 9.6 | | | 0.0 | | 0.0 | 15,705.5 |
| Automobiles | 9,031.1 ^b | 50.6 | | | | 0.0 | | 0.0 | 9,081.7 |
| Light trucks ^c | 6,338.9 ^b | 249.1 | 9.6 | | | 0.0 | | 0.0 | 6,597.6 |
| Motorcycles | 26.2 | | | | | | | | 26.2 |
| Buses | 10.6 | 190.9 | 0.5 | | | 8.2 | 0.9 | 0.0 | 211.1 |
| Transit | 3.7 | 88.1 | 0.5 | | | 8.2 | 0.9 | 0.0 | 101.4 |
| Intercity ^d | | 33.4 | | | | | | | 33.4 |
| School ^d | 6.9 | 69.4 | | | | | | 0.0 | 76.3 |
| Medium/heavy | 545.5 | 4,251.6 | 16.0 | | | | | 0.0 | 4,813.1 |
| <u>OFF-HIGHWAY</u> | 105.4 | 838.3 | | | | | | | 943.7 |
| Construction | 23.9 | 359.1 | | | | | | | 383.0 |
| Agriculture | 81.5 | 479.2 | | | | | | | 560.7 |
| <u>NONHIGHWAY</u> | 351.6 | 825.0 | | 2,508.2 | 1,120.6 | 664.4 | 315.4 | | 5,785.2 |
| Air | 40.4 | | | 2,508.2 | | | | | 2,548.6 |
| General aviation | 40.4 | | | 134.7 | | | | | 175.1 |
| Domestic air | | | | 2,004.0 | | | | | 2,004.0 |
| International air | | | | 369.5 | | | | | 369.5 |
| Water | 311.2 | 288.6 | | | 1,120.6 | | | | 1,720.4 |
| Freight | | 288.6 | | | 1,120.6 | | | | 1,409.2 |
| Recreational | 311.2 | | | | | | | | 311.2 |
| Pipeline | | | | | | 664.4 | 246.5 | | 910.9 |
| Rail | | 536.4 | | | | | 68.9 | | 605.3 |
| Freight (Class I) | | 516.0 | | | | | | | 516.0 |
| Passenger | | 20.4 | | | | | 68.9 | | 89.3 |
| Transit | | | | | | | 47.2 | | 47.2 |
| Commuter | | 9.8 | | | | | 16.1 | | 25.9 |
| Intercity ^c | | 10.6 | | | | | 5.6 | | 16.2 |
| TOTAL | 16,409.3 | 6,405.5 | 26.1 | 2,508.2 | 1,120.6 | 672.6 | 316.3 | 0.0 | 27,457.7 |

Source:

See Appendix A for Energy Use Sources.

^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 1999 data. 2000 data are not yet available.



The 1999 data have been revised to include the latest data available.

Table 2.5
Transportation Energy Use by Mode, 1999–2000^a

| | Trillion Btu | | Percentage of total based on Btus | | Thousand barrels per day crude oil equivalent ^b | |
|----------------------------|-----------------|-----------------|-----------------------------------|---------------|--|-----------------|
| | 1999 | 2000 | 1999 | 2000 | 1999 | 2000 |
| HIGHWAY | 20,609.6 | 20,728.8 | 76.4% | 75.5% | 10,549.0 | 10,607.7 |
| Light vehicles | 15,764.7 | 15,705.5 | 58.5% | 57.2% | 8,242.3 | 8,216.4 |
| Automobiles | 9,133.6 | 9,081.7 | 33.9% | 33.1% | 4,780.4 | 4,756.4 |
| Light trucks ^c | 6,604.6 | 6,597.6 | 24.5% | 24.0% | 3,448.1 | 3,446.3 |
| Motorcycles | 26.5 | 26.2 | 0.1% | 0.1% | 13.8 | 13.7 |
| Buses | 207.4 | 211.1 | 0.8% | 0.8% | 94.7 | 95.6 |
| Transit | 97.7 | 101.4 | 0.4% | 0.4% | 42.8 | 43.7 |
| Intercity | 33.4 | 33.4 | 0.1% | 0.1% | 15.7 | 15.7 |
| School | 76.3 | 76.3 | 0.3% | 0.3% | 36.2 | 36.2 |
| Medium/heavy trucks | 4,637.5 | 4,813.1 | 17.2% | 17.5% | 2,212.0 | 2,295.7 |
| OFF-HIGHWAY | 928.6 | 943.7 | 3.4% | 3.4% | 442.5 | 449.3 |
| Construction | 367.6 | 383.0 | 1.4% | 1.4% | 174.1 | 181.4 |
| Agriculture | 561.0 | 560.7 | 2.1% | 2.0% | 268.4 | 267.9 |
| NONHIGHWAY | 5,423.8 | 5,785.2 | 20.1% | 21.1% | 2,125.1 | 2,283.0 |
| Air | 2,470.8 | 2,548.6 | 9.2% | 9.3% | 1,196.3 | 1,233.9 |
| General aviation | 172.1 | 175.1 | 0.6% | 0.6% | 85.6 | 87.0 |
| Domestic air carriers | 1,944.3 | 2,004.0 | 7.2% | 7.3% | 939.5 | 968.3 |
| International air | 354.4 | 369.5 | 1.3% | 1.3% | 171.2 | 178.6 |
| Water | 1,434.6 | 1,720.4 | 5.3% | 6.3% | 661.7 | 786.4 |
| Freight | 1,124.5 | 1,409.2 | 4.2% | 5.1% | 499.9 | 624.0 |
| Recreational | 310.1 | 311.2 | 1.2% | 1.1% | 161.8 | 162.4 |
| Pipeline | 911.8 | 910.9 | 3.4% | 3.3% | 9.9 | 8.1 |
| Rail | 606.6 | 605.3 | 2.2% | 2.2% | 257.2 | 254.6 |
| Freight | 520.0 | 516.0 | 1.9% | 1.9% | 244.6 | 242.7 |
| Passenger | 86.6 | 89.3 | 0.3% | 0.3% | 12.6 | 11.9 |
| Transit | 44.7 | 47.2 | 0.2% | 0.2% | 1.8 | 1.6 |
| Commuter | 25.7 | 25.9 | 0.1% | 0.1% | 5.4 | 5.1 |
| Intercity | 16.2 | 16.2 | 0.1% | 0.1% | 5.4 | 5.2 |
| TOTAL | 26,962.0 | 27,457.7 | 100.0% | 100.0% | 13,116.6 | 13,340.0 |

Source: See Appendix A for Energy Use Sources.

^a Civilian consumption only. Totals may not include all possible uses of fuels for transportation (e.g., snowmobiles).

^b This year, crude oil equivalent is not a simple conversion from Btu based on the average Btu in a barrel of oil. Each gallon of petroleum product was assumed to equal one gallon of crude oil. The oil used to produce electricity is also estimated. See Appendix A, p. 18 for details.

^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, 1970–2000^a
(trillion Btu)

| Year | Autos | Light trucks | Light vehicles subtotal | Motor-cycles | Buses | Heavy trucks | Highway subtotal | Total transportation ^b | |
|-----------|--------|--------------|---|--------------|-------|--------------|------------------|-----------------------------------|--|
| 1970 | 8,479 | 1,539 | 10,018 | 7 | 129 | 1,553 | 11,707 | 15,320 | |
| 1975 | 9,298 | 2,384 | 11,682 | 14 | 124 | 2,003 | 13,823 | 17,356 | |
| 1976 | 9,826 | 2,602 | 12,428 | 15 | 134 | 2,114 | 14,691 | 18,426 | |
| 1977 | 9,928 | 2,797 | 12,724 | 16 | 137 | 2,344 | 15,222 | 19,179 | |
| 1978 | 10,134 | 3,020 | 13,153 | 18 | 141 | 2,607 | 15,919 | 20,120 | |
| 1979 | 9,629 | 3,055 | 12,685 | 22 | 144 | 2,697 | 15,547 | 20,135 | |
| 1980 | 8,800 | 2,975 | 11,774 | 26 | 143 | 2,686 | 14,629 | 18,982 | |
| 1981 | 8,693 | 2,963 | 11,655 | 27 | 145 | 2,724 | 14,551 | 19,121 | |
| 1982 | 8,673 | 2,837 | 11,510 | 25 | 151 | 2,707 | 14,393 | 18,556 | |
| 1983 | 8,802 | 2,989 | 11,791 | 22 | 152 | 2,770 | 14,735 | 18,687 | |
| 1984 | 8,837 | 3,197 | 12,034 | 22 | 146 | 2,873 | 15,075 | 19,317 | |
| 1985 | 8,932 | 3,413 | 12,345 | 23 | 154 | 2,883 | 15,404 | 19,659 | |
| 1986 | 9,138 | 3,629 | 12,767 | 23 | 160 | 2,958 | 15,908 | 20,278 | |
| 1987 | 9,157 | 3,819 | 12,976 | 24 | 164 | 3,061 | 16,225 | 20,741 | |
| 1988 | 9,158 | 4,077 | 13,235 | 25 | 169 | 3,118 | 16,548 | 21,280 | |
| 1989 | 9,232 | 4,156 | 13,388 | 26 | 169 | 3,199 | 16,782 | 21,579 | |
| 1990 | 8,688 | 4,451 | 13,139 | 24 | 167 | 3,334 | 16,663 | 21,689 | |
| 1991 | 8,029 | 4,774 | 12,803 | 23 | 177 | 3,402 | 16,405 | 21,280 | |
| 1992 | 8,169 | 5,117 | 13,286 | 24 | 184 | 3,468 | 16,963 | 21,939 | |
| 1993 | 8,368 | 5,356 | 13,723 | 25 | 183 | 3,577 | 17,509 | 22,396 | |
| 1994 | 8,470 | 5,515 | 13,984 | 26 | 189 | 3,778 | 17,976 | 22,997 | |
| 1995 | 8,489 | 5,695 | 14,183 | 25 | 189 | 3,937 | 18,334 | 23,536 | |
| 1996 | 8,634 | 5,917 | 14,551 | 24 | 192 | 4,045 | 18,813 | 24,042 | |
| 1997 | 8,710 | 6,168 | 14,879 | 25 | 197 | 4,086 | 19,187 | 24,405 | |
| 1998 | 8,936 | 6,305 | 15,241 | 26 | 202 | 4,218 | 19,686 | 24,839 | |
| 1999 | 9,134 | 6,605 | 15,738 | 26 | 208 | 4,638 | 20,610 | 26,033 | |
| 2000 | 9,082 | 6,598 | 15,679 | 26 | 211 | 4,813 | 20,730 | 26,515 | |
| | | | <i>Average annual percentage change</i> | | | | | | |
| 1970–2000 | 0.2% | 5.0% | 1.5% | 4.5% | 1.7% | 3.8% | 1.9% | 1.8% | |
| 1990–2000 | 0.4% | 4.0% | 1.8% | 0.8% | 2.4% | 3.7% | 2.2% | 2.0% | |

Source:

See Appendix A for Highway Energy Use.

^a These data have been revised slightly. See Appendix A for detailed methodologies.

^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).



About 22% 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, 1970–2000^a
(trillion Btu)

| Year | Air | Water | Pipeline | Rail | Nonhighway subtotal | Total transportation ^b |
|---|-------|-------|----------|------|---------------------|-----------------------------------|
| 1970 | 1,307 | 753 | 995 | 558 | 3,614 | 15,320 |
| 1975 | 1,274 | 851 | 844 | 563 | 3,533 | 17,356 |
| 1976 | 1,333 | 1,010 | 807 | 585 | 3,735 | 18,426 |
| 1977 | 1,372 | 1,200 | 790 | 595 | 3,957 | 19,179 |
| 1978 | 1,417 | 1,405 | 787 | 592 | 4,201 | 20,120 |
| 1979 | 1,488 | 1,626 | 864 | 611 | 4,588 | 20,135 |
| 1980 | 1,437 | 1,424 | 900 | 592 | 4,353 | 18,982 |
| 1981 | 1,455 | 1,642 | 909 | 565 | 4,570 | 19,121 |
| 1982 | 1,442 | 1,378 | 859 | 485 | 4,164 | 18,556 |
| 1983 | 1,450 | 1,277 | 743 | 482 | 3,952 | 18,687 |
| 1984 | 1,603 | 1,315 | 785 | 538 | 4,242 | 19,317 |
| 1985 | 1,677 | 1,316 | 758 | 504 | 4,255 | 19,659 |
| 1986 | 1,823 | 1,314 | 738 | 494 | 4,369 | 20,278 |
| 1987 | 1,899 | 1,338 | 775 | 505 | 4,517 | 20,741 |
| 1988 | 1,978 | 1,358 | 878 | 518 | 4,732 | 21,280 |
| 1989 | 1,981 | 1,399 | 894 | 523 | 4,797 | 21,579 |
| 1990 | 2,077 | 1,508 | 928 | 514 | 5,026 | 21,689 |
| 1991 | 1,940 | 1,586 | 864 | 485 | 4,875 | 21,280 |
| 1992 | 1,971 | 1,659 | 849 | 497 | 4,977 | 21,939 |
| 1993 | 1,990 | 1,497 | 889 | 512 | 4,888 | 22,396 |
| 1994 | 2,070 | 1,449 | 955 | 546 | 5,021 | 22,997 |
| 1995 | 2,141 | 1,523 | 971 | 567 | 5,202 | 23,536 |
| 1996 | 2,206 | 1,460 | 984 | 580 | 5,229 | 24,042 |
| 1997 | 2,300 | 1,309 | 1,027 | 581 | 5,217 | 24,405 |
| 1998 | 2,371 | 1,295 | 901 | 585 | 5,153 | 24,839 |
| 1999 | 2,471 | 1,435 | 912 | 607 | 5,424 | 26,033 |
| 2000 | 2,549 | 1,720 | 911 | 605 | 5,785 | 26,515 |
| <i>Average annual percentage change</i> | | | | | | |
| 1970–2000 | 2.3% | 2.8% | -0.3% | 0.3% | 1.6% | 1.8% |
| 1990–2000 | 2.1% | 1.3% | -0.2% | 1.6% | 1.4% | 2.0% |

Source:

See Appendix A for Nonhighway Energy Use.

^a These data have been revised slightly. See Appendix A for detailed methodologies.

^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).



The use of diesel for off-highway purposes has grown from 1985 to 2000, while the use of gasoline has declined for both agriculture and construction.

Table 2.8
Off-Highway Use of Gasoline and Diesel, 1985–2000
 (trillion btu)

| Year | Agriculture | | Construction | | Total | |
|-----------|---|---------------------|--------------|---------------------|----------|---------------------|
| | Gasoline | Diesel ^a | Gasoline | Diesel ^a | Gasoline | Diesel ^a |
| 1985 | 135 | 430 | 31 | 211 | 166 | 641 |
| 1986 | 121 | 463 | 34 | 230 | 155 | 693 |
| 1987 | 115 | 416 | 35 | 216 | 150 | 632 |
| 1988 | 101 | 439 | 34 | 232 | 135 | 671 |
| 1989 | 103 | 466 | 37 | 234 | 140 | 700 |
| 1990 | 85 | 472 | 40 | 251 | 125 | 723 |
| 1991 | 97 | 438 | 35 | 228 | 132 | 666 |
| 1992 | 101 | 485 | 34 | 244 | 135 | 729 |
| 1993 | 106 | 473 | 31 | 292 | 137 | 765 |
| 1994 | 113 | 454 | 33 | 299 | 146 | 753 |
| 1995 | 116 | 482 | 35 | 301 | 151 | 783 |
| 1996 | 115 | 498 | 35 | 312 | 150 | 810 |
| 1997 | 123 | 492 | 38 | 316 | 161 | 808 |
| 1998 | 113 | 473 | 29 | 344 | 142 | 817 |
| 1999 | 88 | 473 | 22 | 345 | 110 | 818 |
| 2000 | 82 | 479 | 24 | 359 | 106 | 838 |
| | <i>Average annual percentage change</i> | | | | | |
| 1985–2000 | -3.3% | 0.7% | -1.7% | 3.6% | -2.9% | 1.8% |
| 1990–2000 | -0.4% | 0.1% | -5.0% | 3.6% | -1.6% | 1.5% |

Source:

Gasoline: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2000*, Washington, DC, Table MF-24, and annual.

Diesel: U.S. Department of Energy, Energy Information Administration, *Fuel Oil and Kerosene Sales 2000*, Washington, DC, Table 1, and annual.

^a Unadjusted sales of distillate fuel oil.



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 2.9
Highway Usage of Gasoline and Special Fuels, 1973–2000
(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 |
| 2000 | 128.9 | 16.3 | 1.5 | 145.2 | 33.4 | 18.7% | 178.6 |
| <i>Average annual percentage change</i> | | | | | | | |
| 1973–2000 | d | d | d | 1.4% | 4.6% | | 1.8% |
| 1990–2000 | 2.3% | 8.1% | 6.5% | 1.5% | 4.6% | | 3.1% |

Source:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2000*, Washington, DC, 2001, 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.

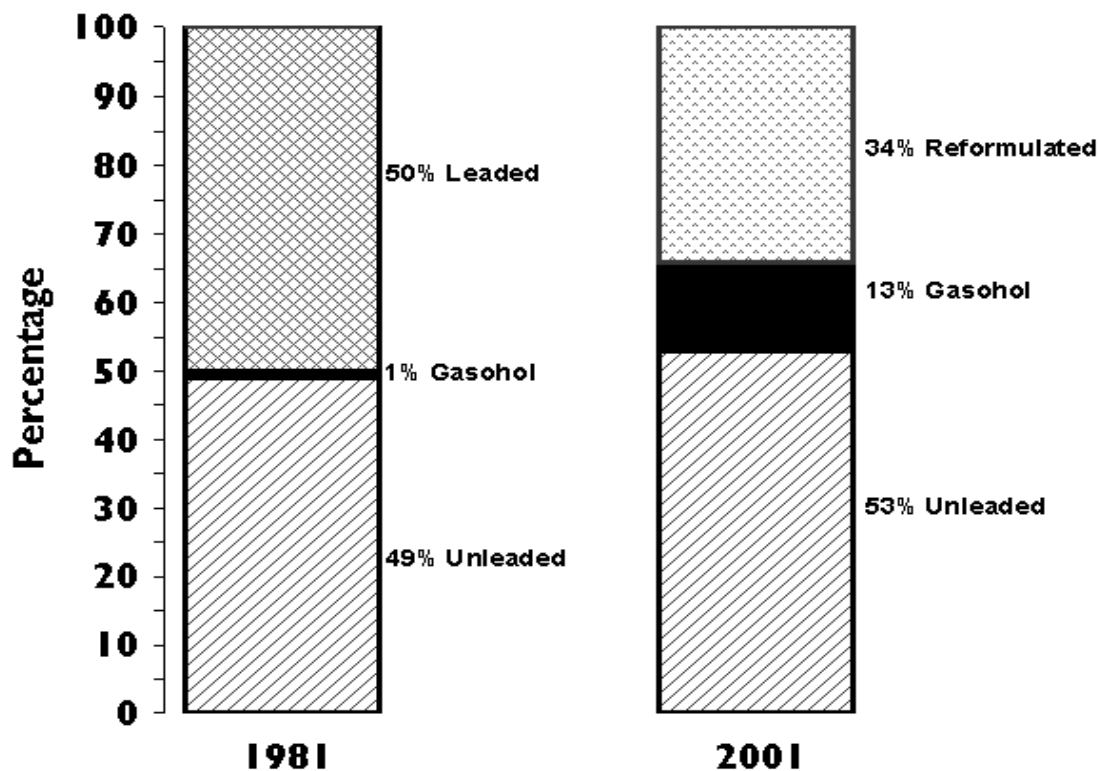
^c Data for gasoline and gasohol cannot be separated in this year.

^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 2001



Source:

U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Annual 2000*, Washington, DC, Tables 17 and 20, June 2002.

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 2000*, 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 2001.

Table 2.10
U.S. Production and Imports of MTBE^a and Fuel Ethanol, 1985–2001
(million gallons)

| Year | Production | | Imports | |
|---|--------------|-------------------|--------------|-------------------|
| | 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 |
| 2001 | 1,765 | 3,257 | 13 | 1,146 |
| <i>Average annual percentage change</i> | | | | |
| 1985–2001 | 5.5% | 17.2% | b | b |
| 1990–2001 | 7.3% | b | b | b |

Source:

Production - 1992–2000 Ethanol and MTBE: U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Monthly*, Washington, DC, January 2002, 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, 2001, Volume 1*, Washington, DC, June 2002, 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 2.11
Passenger Travel and Energy Use, 2000

| | Number of vehicles (thousands) | Vehicle- miles (millions) | Passenger- miles (millions) | Load factor (persons/vehicle) | Energy intensities | | Energy use (trillion Btu) |
|---------------------------|-----------------------------------|---------------------------------|-----------------------------------|----------------------------------|---------------------------|-----------------------------|------------------------------|
| | | | | | (Btu per vehicle-mile) | (Btu per passenger-mile) | |
| Automobiles | 133,621.4 | 1,601,914 | 2,563,062 | 1.6 | 5,669 | 3,543 | 9,081.6 |
| Personal trucks | 60,827.7 | 667,892 | 1,068,627 | 1.6 | 7,033 | 4,396 | 4,697.5 |
| Motorcycles | 4,346.1 | 10,479 | 12,575 | 1.2 | 2,500 | 2,083 | 26.2 |
| Buses | ^a | ^a | ^a | ^a | ^a | ^a | 211.1 |
| Transit | 75.0 | 2,315 | 21,241 | 9.2 | 43,817 | 4,775 | 101.4 |
| Intercity ^b | ^a | ^a | 34,700 | ^a | ^a | 964 | 33.4 |
| School ^b | 606.0 | ^a | ^a | ^a | ^a | ^a | 76.3 |
| Air | ^a | ^a | 529,629 | ^a | ^a | 3,904 | 2,067.5 |
| Certificated route | ^a | 5,664 | 516,129 | 91.1 | 334,086 | 3,666 | 1,892.4 |
| General aviation | 217.5 | ^a | 13,500 | ^a | ^a | 12,975 | 175.2 |
| Recreational boats | 12,782.1 | ^a | ^a | ^a | ^a | ^a | 311.2 |
| Rail | 17.6 | 1,290 | 30,176 | 23.4 | 69,234 | 2,960 | 89.3 |
| Intercity ^c | 0.4 | 371 | 5,574 | 15.0 | 43,581 | 2,902 | 16.2 |
| Transit ^d | 12.2 | 648 | 15,200 | 23.5 | 72,841 | 3,105 | 47.2 |
| Commuter | 5.1 | 271 | 9,402 | 34.7 | 95,757 | 2,759 | 25.9 |

Source:

See Appendix A for Passenger Travel and Energy Use.

^a Data are not available.

^b 1999 energy use data. 2000 data are not available.

^c Amtrak only.

^d 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 2.12
Energy Intensities of Highway Passenger Modes, 1970–2000

| Year | Automobiles | | Light truck ^a (Btu per vehicle-mile) | Buses | | |
|---|---------------------------|-----------------------------|---|---------------------------|-----------------------------|--|
| | (Btu per vehicle-mile) | (Btu per passenger-mile) | | Transit ^b | | Intercity (Btu per passenger-mile) |
| | | | | (Btu per vehicle-mile) | (Btu per passenger-mile) | |
| 1970 | 9,250 | 4,868 | 12,479 | 31,796 | 2,472 | 1,674 |
| 1975 | 8,993 | 4,733 | 11,879 | 33,748 | 2,814 | 988 |
| 1976 | 9,113 | 4,796 | 11,523 | 34,598 | 2,896 | 1,007 |
| 1977 | 8,950 | 4,710 | 11,160 | 35,120 | 2,889 | 970 |
| 1978 | 8,839 | 4,693 | 10,807 | 36,603 | 2,883 | 976 |
| 1979 | 8,647 | 4,632 | 10,467 | 36,597 | 2,795 | 1,028 |
| 1980 | 7,916 | 4,279 | 10,224 | 36,553 | 2,813 | 1,082 |
| 1981 | 7,670 | 4,184 | 9,997 | 37,745 | 3,027 | 1,051 |
| 1982 | 7,465 | 4,109 | 9,268 | 38,766 | 3,237 | 1,172 |
| 1983 | 7,365 | 4,092 | 9,124 | 37,962 | 3,177 | 1,286 |
| 1984 | 7,202 | 4,066 | 8,931 | 38,705 | 3,307 | 954 |
| 1985 | 7,164 | 4,110 | 8,730 | 38,876 | 3,423 | 964 |
| 1986 | 7,194 | 4,197 | 8,560 | 37,889 | 3,545 | 870 |
| 1987 | 6,959 | 4,128 | 8,359 | 36,247 | 3,594 | 940 |
| 1988 | 6,683 | 4,033 | 8,119 | 36,673 | 3,706 | 963 |
| 1989 | 6,589 | 4,046 | 7,746 | 36,754 | 3,732 | 964 |
| 1990 | 6,169 | 3,856 | 7,746 | 37,374 | 3,794 | 962 |
| 1991 | 5,912 | 3,695 | 7,351 | 37,732 | 3,877 | 963 |
| 1992 | 5,956 | 3,723 | 7,239 | 40,243 | 4,310 | 964 |
| 1993 | 6,087 | 3,804 | 7,182 | 39,043 | 4,262 | 962 |
| 1994 | 6,024 | 3,765 | 7,212 | 40,147 | 4,609 | 964 |
| 1995 | 5,902 | 3,689 | 7,208 | 40,004 | 4,643 | 964 |
| 1996 | 5,874 | 3,671 | 7,247 | 40,200 | 4,675 | 963 |
| 1997 | 5,797 | 3,623 | 7,251 | 41,423 | 4,744 | 963 |
| 1998 | 5,767 | 3,604 | 7,261 | 43,880 | 4,688 | 963 |
| 1999 | 5,821 | 3,638 | 7,330 | 42,953 | 4,610 | 964 |
| 2000 | 5,669 | 3,543 | 7,140 | 43,817 | 4,775 | ^c |
| <i>Average annual percentage change</i> | | | | | | |
| 1970–2000 | -1.6% | -1.1% | -1.8% | 1.1% | 2.2% | ^c |
| 1990–2000 | -0.8% | -0.8% | -0.8% | 1.6% | 2.3% | ^c |

Source:

See Appendix A for Highway Passenger Mode Energy Intensities.

Note:

Automobile data series changed historically. See Appendix A for methodology details.

^aAll two-axle, four-tire trucks.

^bSeries not continuous between 1983 and 1984 because of a change in data source by the American Public Transit Association (APTA).

^c2000 data are not yet 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.

Table 2.13
Energy Intensities of Nonhighway Passenger Modes, 1970–2000

| Year | Air | | Rail | | |
|---|---|--|--|--|---|
| | 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) | Commuter rail (Btu per passenger-mile) |
| 1970 | 10,282 | 10,374 | ^a | 2,453 | ^a |
| 1975 | 7,826 | 10,658 | 3,677 | 2,962 | ^a |
| 1976 | 7,511 | 10,769 | 3,397 | 2,971 | ^a |
| 1977 | 6,990 | 11,695 | 3,568 | 2,691 | ^a |
| 1978 | 6,144 | 11,305 | 3,683 | 2,210 | ^a |
| 1979 | 5,607 | 10,787 | 3,472 | 2,794 | ^a |
| 1980 | 5,561 | 11,497 | 3,176 | 3,008 | ^a |
| 1981 | 5,774 | 11,123 | 2,957 | 2,946 | ^a |
| 1982 | 5,412 | 13,015 | 3,156 | 3,069 | ^a |
| 1983 | 5,133 | 11,331 | 2,957 | 3,212 | ^a |
| 1984 | 5,298 | 11,454 | 3,027 | 3,732 | 3,011 |
| 1985 | 5,053 | 11,707 | 2,800 | 3,461 | 3,053 |
| 1986 | 5,011 | 11,935 | 2,574 | 3,531 | 3,174 |
| 1987 | 4,827 | 11,496 | 2,537 | 3,534 | 3,043 |
| 1988 | 4,861 | 11,794 | 2,462 | 3,585 | 3,075 |
| 1989 | 4,844 | 10,229 | 2,731 | 3,397 | 3,120 |
| 1990 | 4,875 | 10,146 | 2,609 | 3,453 | 3,068 |
| 1991 | 4,662 | 9,869 | 2,503 | 3,710 | 3,011 |
| 1992 | 4,516 | 9,785 | 2,610 | 3,575 | 2,848 |
| 1993 | 4,490 | 9,653 | 2,646 | 3,687 | 3,222 |
| 1994 | 4,397 | 9,163 | 2,357 | 3,828 | 2,904 |
| 1995 | 4,349 | 9,870 | 2,590 | 3,818 | 2,849 |
| 1996 | 4,172 | 9,258 | 2,792 | 3,444 | 2,796 |
| 1997 | 4,166 | 9,688 | 2,918 | 3,253 | 2,946 |
| 1998 | 4,146 | 11,252 | 2,900 | 3,216 | 2,859 |
| 1999 | 4,061 | 12,748 | 3,062 | 3,168 | 2,929 |
| 2000 | 3,952 | 12,975 | 2,902 | 3,105 | 2,759 |
| <i>Average annual percentage change</i> | | | | | |
| 1970–2000 | -3.1% | 0.7% | -0.9% ^b | 0.8% | -0.5% ^b |
| 1990–2000 | -2.0% | 2.5% | 1.1% | -1.1% | -1.1% |

Source:

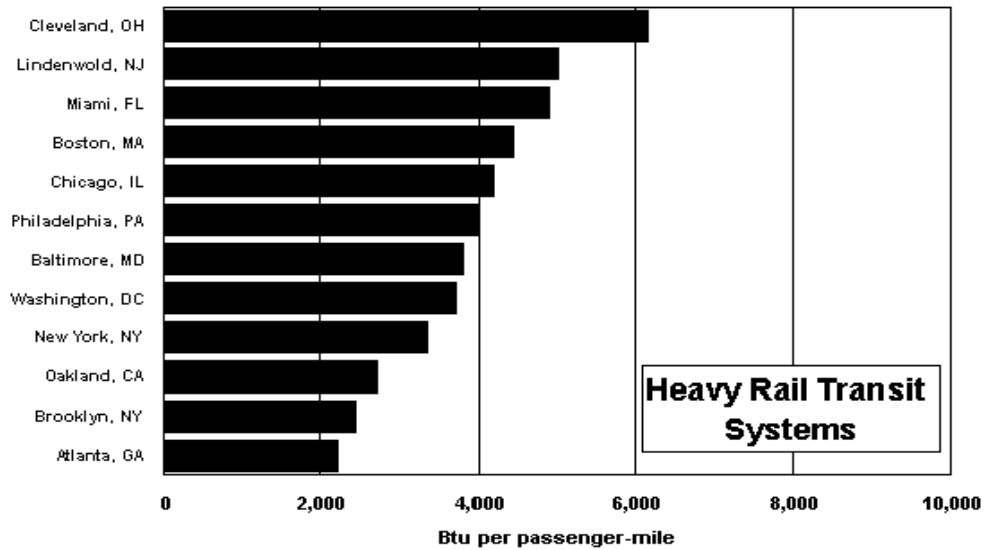
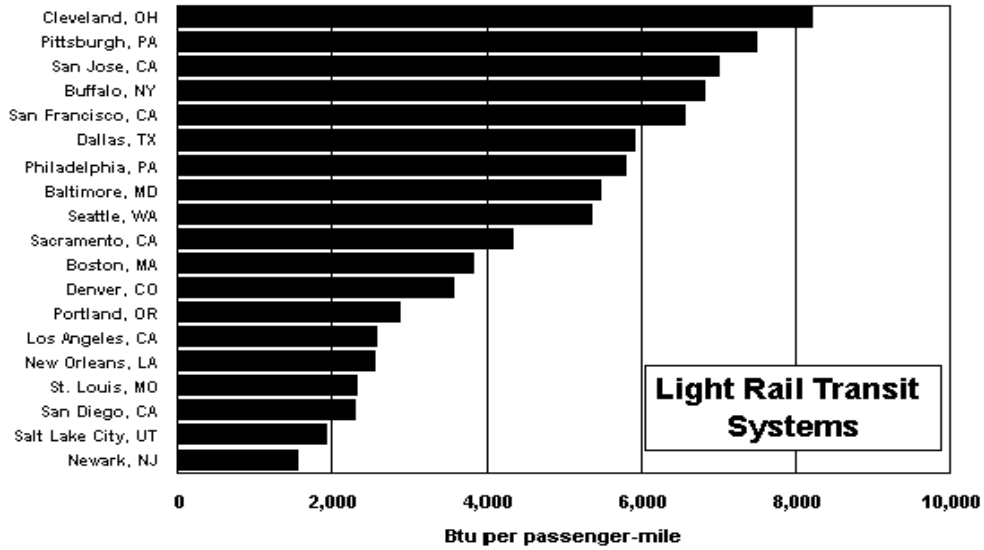
See Appendix A for Nonhighway Passenger Mode Energy Intensities.

^aData are not available.

^bAverage annual percentage change begins with the earliest year possible.



Figure 2.3. Energy Intensities for Transit Rail, 2000



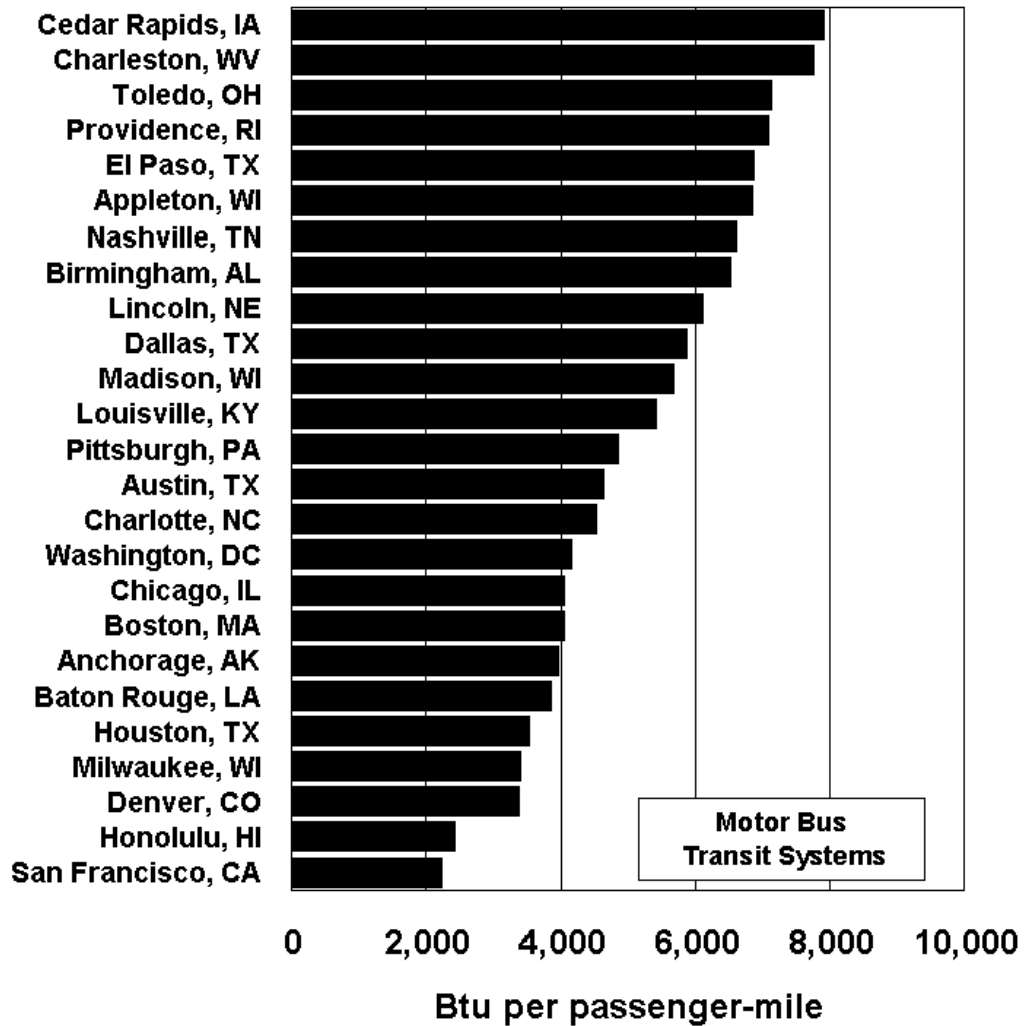
Source:

U.S. Department of Transportation, Federal Transit Administration, 2000 National Transit Databases, Washington, DC.

(Additional resources: www.fta.dot.gov/ntl)



Figure 2.4. Energy Intensities for Selected Transit Bus Systems, 2000

**Source:**

U.S. Department of Transportation, Federal Transit Administration, 2000 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 2.14
Inter-city Freight Movement and Energy Use in the United States, 2000

| | Trucks | Waterborne commerce | Class I railroads |
|---------------------------------|------------------|------------------------|----------------------|
| Number of vehicles (thousands) | 2,643 | 41 | 20 ^a |
| Ton-miles (billions) | 1,093 | 646 | 1,466 |
| Tons shipped (millions) | 4,089 | 1,064 | 1,738 |
| Average length of haul (miles) | 717 ^b | 607 | 843 |
| Energy intensity (Btu/ton-mile) | 3,200 | 508 | 352 |
| Energy use (trillion Btu) | 3,498 | 328 | 516 |

Source:

See Appendix A for Freight Movement and Energy Use.

^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 2.15
Energy Intensities of Freight Modes, 1970–2000

| Year | Heavy single-unit and combination trucks (Btu per vehicle-mile) | Class I freight railroad | | Domestic waterborne commerce (Btu per ton-mile) |
|-----------|---|---|------------------------|---|
| | | (Btu per freight car- mile) | (Btu per ton- mile) | |
| 1970 | 24,960 | 17,669 | 691 | 545 |
| 1971 | 24,485 | 18,171 | 717 | 506 |
| 1972 | 24,668 | 18,291 | 714 | 522 |
| 1973 | 24,777 | 18,468 | 677 | 576 |
| 1974 | 24,784 | 18,852 | 681 | 483 |
| 1975 | 24,631 | 18,739 | 687 | 549 |
| 1976 | 24,566 | 18,938 | 680 | 468 |
| 1977 | 24,669 | 19,226 | 669 | 458 |
| 1978 | 24,655 | 18,928 | 641 | 383 |
| 1979 | 24,745 | 19,188 | 618 | 436 |
| 1980 | 24,757 | 18,742 | 597 | 358 |
| 1981 | 25,058 | 18,629 | 572 | 360 |
| 1982 | 24,296 | 18,404 | 553 | 310 |
| 1983 | 23,852 | 17,864 | 525 | 286 |
| 1984 | 23,585 | 17,795 | 510 | 346 |
| 1985 | 23,343 | 17,500 | 497 | 446 |
| 1986 | 23,352 | 17,265 | 486 | 463 |
| 1987 | 22,922 | 16,790 | 456 | 402 |
| 1988 | 22,596 | 16,758 | 443 | 361 |
| 1989 | 22,411 | 16,894 | 437 | 403 |
| 1990 | 22,795 | 16,619 | 420 | 387 |
| 1991 | 22,749 | 15,835 | 391 | 386 |
| 1992 | 22,608 | 16,043 | 393 | 398 |
| 1993 | 22,373 | 16,056 | 389 | 389 |
| 1994 | 22,193 | 16,340 | 388 | 369 |
| 1995 | 22,096 | 15,992 | 372 | 374 |
| 1996 | 22,109 | 15,747 | 368 | 412 |
| 1997 | 21,340 | 15,784 | 370 | 415 |
| 1998 | 21,514 | 15,372 | 365 | 435 |
| 1999 | 22,880 | 15,363 | 363 | 457 |
| 2000 | 23,388 | 14,917 | 352 | 508 |
| | | <i>Average annual percentage change</i> | | |
| 1970–2000 | -0.2% | -0.6% | -2.2% | -0.2% |
| 1990–2000 | 0.3% | -0.6% | -1.8% | 2.8% |

Source:

See Appendix A for Freight Mode Energy Intensities.



Chapter 3 Greenhouse Gas Emissions

Summary Statistics from Tables in this Chapter

| Source | | 1990 | 1999 |
|-----------|--|-------|----------------|
| Table 3.1 | Carbon emissions (million metric tonnes) | | |
| | <i>United States</i> | 1,352 | 1,517 |
| | <i>China</i> | 617 | 669 |
| | <i>Germany</i> | 271 | 230 |
| | <i>Japan</i> | 269 | 307 |
| | <i>United Kingdom</i> | 164 | 151 |
| | <i>India</i> | 153 | 242 |
| | <i>France</i> | 102 | 109 |
| Table 3.4 | Transportation share of U.S. carbon dioxide emissions from fossil fuel consumption | | |
| | <i>1985</i> | | 30.9% |
| | <i>1990</i> | | 32.0% |
| | <i>2000</i> | | 33.0% |
| Table 3.6 | GREET model greenhouse gas emissions | | |
| | <i>Gasoline baseline</i> | | 469 grams/mile |
| | <i>Natural gas</i> | | -23.1% |
| | <i>E90: corn ethanol</i> | | -31.0% |
| | <i>E90: cellulosic ethanol</i> | | -77.1% |
| | <i>EV: US mix</i> | | -44.5% |
| | <i>Fuel cell: hydrogen, central plant, natural gas</i> | | -48.7% |
| | <i>Fuel cell: hydrogen, central electrolysis, renewables</i> | | -90.7% |
| | <i>Fuel cell: hydrogen, station electrolysis, US mix</i> | | 43.3% |



Table 3.1
World Carbon Emissions, 1990 and 1999

| | 1990 | | 1999 | |
|--------------------------------|---------------------|-----------------------------------|---------------------|-----------------------------------|
| | Million metric tons | Percent of emissions from oil use | Million metric tons | Percent of emissions from oil use |
| Industrialized countries | 2,849 | 49% | 3,129 | 49% |
| United States | 1,352 | 44% | 1,517 | 43% |
| Canada | 126 | 48% | 150 | 45% |
| Mexico | 84 | 77% | 101 | 75% |
| United Kingdom | 164 | 40% | 151 | 42% |
| France | 102 | 66% | 109 | 66% |
| Germany | 271 | 38% | 230 | 45% |
| Italy | 112 | 66% | 121 | 61% |
| Netherlands | 58 | 47% | 64 | 48% |
| Other Western Europe | 223 | 62% | 264 | 66% |
| Japan | 269 | 67% | 307 | 60% |
| Other industrialized countries | 88 | 42% | 115 | 41% |
| Eastern Europe | 1,337 | 30% | 810 | 25% |
| Developing countries | 1,641 | 41% | 2,158 | 45% |
| China | 617 | 15% | 669 | 24% |
| India | 153 | 29% | 242 | 30% |
| Other developing countries | 871 | 61% | 1,247 | 59% |
| Total World | 5,827 | 43% | 6,097 | 44% |

Source:

U.S. Department of Energy, Energy Information Administration, *International Energy Outlook 2001*, Washington, DC, March 2002, 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 | 5-200 ^a | 1 | 1 | 1 |
| Methane | 12 | 62 | 23 | 7 |
| Nitrous Oxide | 114 | 275 | 296 | 156 |
| HFCs ^b , PFCs ^c , and Sulfur Hexafluoride | | | | |
| HFC-23 | 260 | 9,400 | 12,000 | 10,000 |
| HFC-125 | 29 | 5,900 | 3,400 | 1,100 |
| HFC-134a | 14 | 3,300 | 1,300 | 400 |
| HFC-152a | 1 | 410 | 120 | 37 |
| HFC-227ea | 33 | 5,600 | 3,500 | 1,100 |
| Perfluoromethane (CF ₄) | 50,000 | 3,900 | 5,700 | 8,900 |
| Perfluoroethane (C ₂ F ₆) | 10,000 | 8,000 | 11,900 | 18,000 |
| Sulfur hexafluoride (SF ₆) | 3,200 | 15,100 | 22,200 | 32,400 |

Source:

U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2000*, Washington, DC, November 2001, Table 3. 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 ± 35 percent.

^aNo single lifetime can be defined for carbon dioxide due to different rates of uptake by different removal processes.

^bHydrofluorocarbons

^cPerfluorocarbons



Carbon dioxide emissions in 2000 were 17% higher than in 1990. Carbon dioxide accounts for the majority of greenhouse gases.

Table 3.3
Estimated U.S. Emissions of Greenhouse Gases, 1990–2000

| Greenhouse gas | Unit of measure ^a | 1990 | 1995 | 1999 | 2000 |
|--|--|---------|---------|---------|---------|
| Carbon dioxide | million metric tons of gas | 4,969.4 | 5,273.5 | 5,630.7 | 5,805.5 |
| | million metric tons of carbon | 1,355.0 | 1,438.0 | 1,536.0 | 1,583.0 |
| Methane | million metric tons of gas | 31.7 | 31.1 | 28.7 | 28.2 |
| | million metric tons of carbon (gwp) ^b | 199.0 | 195.0 | 180.0 | 177.0 |
| Nitrous oxide | million metric tons of gas | 1.2 | 1.3 | 1.2 | 1.2 |
| | million metric tons of carbon (gwp) ^b | 94.0 | 101.0 | 100.0 | 99.0 |
| HFCs, PFCs, and SF ₆ ^c | million metric tons of carbon (gwp) ^b | 30.0 | 35.0 | 45.0 | 47.0 |

Source:

U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 2000*, Washington, DC, November 2001, Tables ES1 and ES2. (Additional resources: www.eia.doe.gov)

^aGases 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.

^bBased on global warming potential.

^cHFC-hydrofluorocarbons. PFC-perfluorocarbons. SF₆-sulfur hexafluoride.



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, 1985–2000^a
(million metric tons of carbon)

| End use sector | 1985 | 1990 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Residential | 245.8 | 257.0 | 277.9 | 229.9 | 292.8 | 293.7 | 298.8 | 313.4 |
| Commercial | 189.6 | 210.3 | 224.6 | 233.1 | 245.4 | 250.4 | 253.1 | 267.8 |
| Industrial | 424.1 | 452.7 | 461.1 | 476.7 | 481.5 | 469.5 | 465.8 | 465.7 |
| Transportation | 384.4 | 431.8 | 457.8 | 468.9 | 473.6 | 481.5 | 499.4 | 514.8 |
| Percentage | 30.9% | 32.0% | 32.2% | 31.9% | 31.7% | 32.2% | 32.9% | 33.0% |
| Total energy | 1,243.9 | 1,351.7 | 1,421.3 | 1,471.9 | 1,493.3 | 1,495.2 | 1,517.1 | 1,561.7 |

Source:

U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 2000*, Washington, DC, November 2001, Table 5, and annual. (Additional resources: www.eia.doe.gov)

^aIncludes 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, 1980–2000
(million metric tons of carbon)

| Fuel | 1980 | | 1990 | | 2000 | |
|--------------------------|--------------|---------------|--------------|---------------|--------------|---------------|
| | Emissions | Percentage | Emissions | Percentage | Emissions | Percentage |
| Petroleum | | | | | | |
| Motor gasoline | 238.1 | 62.9% | 260.5 | 60.3% | 301.5 | 58.6% |
| LPG ^a | 0.3 | 0.1% | 0.4 | 0.1% | 0.2 | 0.1% |
| Jet fuel | 42.0 | 11.1% | 60.1 | 13.9% | 68.5 | 13.3% |
| Distillate fuel | 55.3 | 14.6% | 75.7 | 17.5% | 106.6 | 20.7% |
| Residual fuel | 30.0 | 7.9% | 21.9 | 5.1% | 23.1 | 4.5% |
| Lubricants | 1.8 | 0.5% | 1.8 | 0.4% | 1.8 | 0.3% |
| Aviation gas | 1.2 | 0.3% | 0.8 | 0.2% | 0.7 | 0.1% |
| Subtotal | 368.7 | 97.4% | 421.2 | 97.5% | 502.5 | 97.6% |
| Other energy | | | | | | |
| Natural gas | 9.4 | 2.5% | 9.8 | 2.3% | 11.4 | 2.2% |
| Electricity ^b | 0.3 | 0.1% | 0.7 | 0.2% | 0.9 | 0.2% |
| Total | 378.4 | 100.0% | 432.8 | 100.0% | 514.8 | 100.0% |

Source:

U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 2000*, Washington, DC, November 2001, Table 8, and annual. (Additional resources: www.eia.doe.gov)

^aLiquified petroleum gas.

^bShare 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/>

A new version of GREET will be available soon. Check the web site for details.



Acronyms and Terms Used on Table 3.6

| | |
|------------------|---|
| BD20 | mixture of 20% biodiesel and 80% conventional diesel (by volume) |
| CA | California |
| CH ₄ | methane |
| CIDI | compression ignition, direct injection |
| CIDIV | compression ignition, direct injection vehicle |
| CNG | compressed natural gas |
| CNGV | compressed natural gas vehicle |
| CO ₂ | 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.H ₂ | 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.H ₂ | liquid hydrogen |
| LS | low-sulfur |
| M90 | mixture of 90% methanol and 10% gasoline by volume |
| MeOH | methanol |
| MeOHV | methanol vehicle |
| N ₂ O | 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
fuelled 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 internal 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 Air Pollutants

Summary Statistics from Tables in this Chapter

| Source | | | |
|------------|--|--------|-----------------|
| Table 4.1 | Transportation's share of U.S. emissions, 1999 | | |
| | <i>CO</i> | | 78.6% |
| | <i>NO_x</i> | | 53.4% |
| | <i>VOC</i> | | 43.5% |
| | <i>PM-10</i> | | 2.1% |
| | <i>PM-2.5</i> | | 7.6% |
| | <i>SO₂</i> | | 6.9% |
| | <i>NH₃</i> | | 5.4% |
| Table 4.12 | Transportation's share of lead emissions | | |
| | <i>1970</i> | | 82.3% |
| | <i>1999</i> | | 12.8% |
| Table 4.13 | GREET model emissions | PM-10 | NO _x |
| | <i>Gasoline baseline (grams per mile)</i> | 0.047 | 0.256 |
| | <i>Natural gas</i> | 190.8% | -41.7% |
| | <i>E90: corn ethanol</i> | 574.3% | 151.2% |
| | <i>E90: cellulosic ethanol</i> | 198.0% | 389.0% |
| | <i>EV: US mix</i> | 24.0% | 11.6% |
| | <i>Fuel cell: hydrogen, central plant, natural gas</i> | -36.7% | -54.4% |
| | <i>Fuel cell: hydrogen, central electrolysis, renewables</i> | -44.8% | -58.8% |
| | <i>Fuel cell: hydrogen, station electrolysis, US mix</i> | 191.2% | 285.4% |



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/chieftrends (Additional resources: www.epa.gov/oar/oaqps)

Note:

Detailed data tabulations for 2000 have not yet been released. Look for the *2000 Air Quality Trends Report* on the EPA website: <http://www.epa.gov/airtrends/reports.html>.

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. SO₂ = Sulfur dioxide. VOC = Volatile organic compounds.

NH₃ = 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/chieftrends (Additional resources: *www.epa.gov/oar/oaqps*)

Note:

Detailed data tabulations for 2000 have not yet been released. Look for the *2000 Air Quality Trends Report* on the EPA website: <http://www.epa.gov/airtrends/reports.html>.

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

^aThe sums of subcategories may not equal total due to rounding.

^bRecreational 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/chieftrends
(Additional resources: www.epa.gov/oar/oaqps)

Note:

Detailed data tabulations for 2000 have not yet been released. Look for the *2000 Air Quality Trends Report* on the EPA website: <http://www.epa.gov/airtrends/reports.html>.

^aThe sums of subcategories may not equal total due to rounding.

^bLess than 8,500 pounds.

^cData are not available.



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

Detailed data tabulations for 2000 have not yet been released. Look for the *2000 Air Quality Trends Report* on the EPA website: <http://www.epa.gov/airtrends/reports.html>.

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

^aThe 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/chieftrends (Additional resources: www.epa.gov/oar/oaqps)

Note:

Detailed data tabulations for 2000 have not yet been released. Look for the *2000 Air Quality Trends Report* on the EPA website: <http://www.epa.gov/airtrends/reports.html>.

^aThe sums of subcategories may not equal total due to rounding.

^bLess than 8,500 pounds.

^cData 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:

Detailed data tabulations for 2000 have not yet been released. Look for the *2000 Air Quality Trends Report* on the EPA website: <http://www.epa.gov/airtrends/reports.html>.

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

^aThe 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/chieftrends (Additional resources: www.epa.gov/oar/oaqps)

Note:

Detailed data tabulations for 2000 have not yet been released. Look for the *2000 Air Quality Trends Report* on the EPA website: <http://www.epa.gov/airtrends/reports.html>.

^aThe sums of subcategories may not equal total due to rounding.

^bLess than 8,500 pounds.

^cData 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/chieftrends (Additional resources: www.epa.gov/oar/oaqps)

Note:

Detailed data tabulations for 2000 have not yet been released. Look for the *2000 Air Quality Trends Report* on the EPA website: <http://www.epa.gov/airtrends/reports.html>.

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

^aFine 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 main source.

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)

Note:

Detailed data tabulations for 2000 have not yet been released. Look for the *2000 Air Quality Trends Report* on the EPA website: <http://www.epa.gov/airtrends/reports.html>.

^aThe sums of subcategories may not equal total due to rounding.

^bLess than 8,500 pounds.

^cData 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)

Note:

Detailed data tabulations for 2000 have not yet been released. Look for the *2000 Air Quality Trends Report* on the EPA website: <http://www.epa.gov/airtrends/reports.html>.



Diesel vehicles are responsible for the majority of highway vehicle PM-2.5 emissions. More than 70% of the highway vehicles' 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/chieftrends (Additional resources: www.epa.gov/oar/oaqps)

Note:

Detailed data tabulations for 2000 have not yet been released. Look for the *2000 Air Quality Trends Report* on the EPA website: <http://www.epa.gov/airtrends/reports.html>.

^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, has 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)

Note:

Detailed data tabulations for 2000 have not yet been released. Look for the *2000 Air Quality Trends Report* on the EPA website: <http://www.epa.gov/airtrends/reports.html>.

^aThe 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 of the GREET model (Beta of Version 1.6) 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;
- 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/>

A new version of GREET will be available soon. Check the web site for details.



Acronyms and Terms Used on Table 4.13

| | |
|------------------|---|
| BD20 | mixture of 20% biodiesel and 80% conventional diesel (by volume) |
| CA | California |
| CH ₄ | methane |
| CIDI | compression ignition, direct injection |
| CIDIV | compression ignition, direct injection vehicle |
| CNG | compressed natural gas |
| CNGV | compressed natural gas vehicle |
| CO ₂ | 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.H ₂ | 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.H ₂ | liquid hydrogen |
| LS | low-sulfur |
| M90 | mixture of 90% methanol and 10% gasoline by volume |
| MeOH | methanol |
| MeOHV | methanol vehicle |
| N ₂ O | 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.



Table 4.14
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 4.14 and 4.15

| | |
|-------|---|
| 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 (8,500–10,000 lbs. GVWR) |
| 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 |

^aSome temporary standards are not shown.

^bBin expires after 2008.

^cNo standard.





Table 4.15
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: | Bins, category, size | 50,000 miles | | | | | | 120,000 miles | | | | |
|--------------|--|--------------|-----|-----------------|---------------|-------|--------------------|---------------|-----|-----------------|---------------|-------|
| | | NMOG | CO | NO _x | PM | HCHO | HC+NO _x | NMOG | CO | NO _x | 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 NO_x 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 4.16
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 | <i>c</i> | 2.2 | 3.4 | | 1.5 | | 0.41 | | | | 0.41 (<i>e</i>) |
| Non-methane hydrocarbons | <i>d</i> | <i>e</i> | | | | | | | | | | 0.25 (0.31) |
| Carbon monoxide | 80 | <i>c</i> | 23 | 39 | | 15 | | 7.0 | 3.4 | | | 3.4 (4.2) |
| Cold-temp. Carbon monoxide ^f | <i>d</i> | <i>e</i> | | | | | | | | | | 10 (<i>e</i>) |
| Nitrogen oxides | 4 | <i>e</i> | | | 3.0 | 3.1 | 2.0 | | 1.0 | | | 0.4 (0.6) |
| Particulates | <i>d</i> | <i>e</i> | | | | | | | | | | 0.08 (0.10) |
| Diesel | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | <i>e</i> | | | | 1.5 | | 0.41 | | | | 0.41 (<i>e</i>) |
| Non-methane hydrocarbons | <i>d</i> | <i>e</i> | | | | | | | | | | 0.25 (0.31) |
| Carbon monoxide | 80 | <i>e</i> | | | | 15 | | 7.0 | 3.4 | | | 3.4 (4.2) |
| Nitrogen oxides | 4 | <i>e</i> | | | | 3.1 | 2.0 | | 1.0 | | | 1.0 (1.25) |
| Particulates | <i>d</i> | <i>e</i> | | | | | | | | 0.60 | 0.20 | 0.08 (0.10) |
| Test Procedure | | 7-mode | | CVS-72 | | CVS-75 | | | | | | |
| Useful Life (intermediate)^b | | <i>e</i> | | | | | | | | | | 5 yrs/50,000 mi |
| (full) | | | | | | | | | | | | 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.

^aThe 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.

^bAll 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.

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

^dNo estimate available.

^eNo standard set.

^fThe 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 4.17
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 | <i>d</i> | 2.2 | 3.4 | | 2.0 | | 1.7 | | 0.80 | | | | <i>f</i> (0.80) | | |
| Non-methane hydrocarbons | <i>e</i> | <i>f</i> | | | | | | | | | | | | 0.25 (0.31) | | |
| Carbon monoxide | 80 | <i>d</i> | 23 | 39 | | 20 | | 18 | | 10 | | | | 3.4 (4.2) | | |
| Cold-temp. carbon monoxide ^g | <i>e</i> | <i>f</i> | | | | | | | | | | | | 10 (<i>f</i>) | | |
| Nitrogen oxides | 4 | <i>f</i> | | | 3.0 | 3.1 | | 2.3 | | | | | 1.2 | 0.4 (0.6) | | |
| Particulates | <i>e</i> | <i>f</i> | | | | | | | | | | | | | 0.08 (0.10) | |
| Diesel | | | | | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | <i>f</i> | | | | | 2.0 | 1.7 | | 0.80 | | | | <i>f</i> (0.80) | | |
| Non-methane hydrocarbons | <i>e</i> | <i>f</i> | | | | | | | | | | | | 0.25 (0.31) | | |
| Carbon monoxide | 80 | <i>f</i> | | | | | 20 | 18 | | 10 | | | | 3.4 (4.2) | | |
| Nitrogen oxides | 4 | <i>f</i> | | | | | 3.1 | 2.3 | | | | | 1.2 | 1.0 (1.25) | | |
| Particulates | <i>e</i> | <i>f</i> | | | | | | | 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 | | <i>f</i> | | | | | | | | | | | | | 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.

^aLight 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.

^bThe 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.

^cEmission 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.

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

^eNo estimate available.

^fNo standard set.

^gThe 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.

^hGross 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 4.18
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 | <i>d</i> | 2.2 | 3.4 | | 2.0 | | 1.7 | | 0.80 | | | | | <i>f</i> (0.80) | | |
| Non-methane hydrocarbons | <i>e</i> | <i>f</i> | | | | | | | | | | | | | 0.32 (0.40) | | |
| Carbon monoxide | 80 | <i>d</i> | 23 | 39 | | 20 | | 18 | | 10 | | | | | 4.4 (5.5) | | |
| Cold-temp. carbon monoxide <i>g</i> | <i>e</i> | <i>f</i> | | | | | | | | | | | | | 12.5 (<i>f</i>) | | |
| Nitrogen oxides | 4 | <i>f</i> | | | 3.0 | 3.1 | | 2.3 | | | | | 1.7 | | 0.7 (0.97) | | |
| Particulates | <i>e</i> | <i>f</i> | | | | | | | | | | | | | | 0.08 (0.10) | |
| Diesel | | | | | | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | <i>f</i> | | | | 2.0 | | 1.7 | | 0.80 | | | | | <i>f</i> (0.80) | | |
| Non-methane hydrocarbons | <i>e</i> | <i>f</i> | | | | | | | | | | | | | 0.32 (0.40) | | |
| Carbon monoxide | 80 | <i>f</i> | | | | 20 | | 18 | | 10 | | | | | 4.4 (5.5) | | |
| Nitrogen oxides | 4 | <i>f</i> | | | | 3.1 | | 2.3 | | | | | 1.7 | | <i>f</i> (0.97) | | |
| Particulates | <i>e</i> | <i>f</i> | | | | | | | 0.60 | | 0.50 | | 0.45 | 0.13 | | 0.08 (0.10) | |
| LDT2 Weight Criteria <i>h</i> | | 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 <i>b</i> | | 7-mode | | CVS-72 | CVS-75 | | | | | | | | | | | | |
| Useful Life (intermediate) <i>c</i> | | <i>f</i> | | | | | | | | | | | | | | 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.

^aLight 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.

^bThe 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.

^cEmission 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.

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

^eNo estimate available.

^fNo standard set.

^gThe 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.

^hGross 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 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 | <i>d</i> | 2.2 | 3.4 | | 2.0 | | 1.7 | | 0.80 | | | | | | <i>f</i> (0.80) |
| Non-methane hydrocarbons | <i>e</i> | <i>f</i> | | | | | | | | | | | | | | 0.32 (0.46) |
| Carbon monoxide | 80 | <i>d</i> | 23 | 39 | | 20 | | 18 | | 10 | | | | | | 4.4 (6.4) |
| Cold-temp. carbon monoxide ^g | <i>e</i> | <i>f</i> | | | | | | | | | | | | | | 12.5 (<i>f</i>) |
| Nitrogen oxides | 4 | <i>f</i> | | | 3.0 | 3.1 | | 2.3 | | | | | 2.3 | 1.7 | | 0.7 (0.98) |
| Particulates | <i>e</i> | <i>f</i> | | | | | | | | | | | | | | <i>f</i> (0.10) |
| Diesel | | | | | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | <i>f</i> | | | | | 2.0 | 1.7 | | 0.80 | | | | | | <i>f</i> (0.80) |
| Non-methane hydrocarbons | <i>e</i> | <i>f</i> | | | | | | | | | | | | | | 0.32 (0.46) |
| Carbon monoxide | 80 | <i>f</i> | | | | | 20 | 18 | | 10 | | | | | | 4.4 (6.4) |
| Nitrogen oxides | 4 | <i>f</i> | | | | | 3.1 | 2.3 | | | | | 2.3 | 1.7 | | (0.98) |
| Particulates | <i>e</i> | <i>f</i> | | | | | | | 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 | | <i>f</i> | | | | | | | | | | | | | | 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.

^aLight 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.

^bThe 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.

^cEmission 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 NO_x 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.

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

^eNo estimate available.

^fNo standard set.

^gThe 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.

^hGross 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 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 | <i>d</i> | 2.2 | 3.4 | | 2.0 | | 1.7 | | 0.80 | | | | | | <i>f</i> (0.80) |
| Non-methane hydrocarbons | <i>e</i> | <i>f</i> | | | | | | | | | | | | | | 0.39 (0.56) |
| Carbon monoxide | 80 | <i>d</i> | 23 | 39 | | 20 | | 18 | | 10 | | | | | | 5.0 (7.3) |
| Cold-temp. carbon monoxide ^g | <i>e</i> | <i>f</i> | | | | | | | | | | | | | | 12.5 (<i>f</i>) |
| Nitrogen oxides | 4 | <i>f</i> | | | 3.0 | 3.1 | | 2.3 | | | | | 2.3 | 1.7 | | 1.1 (1.53) |
| Particulates | <i>e</i> | <i>f</i> | | | | | | | | | | | | | | <i>f</i> (0.12) |
| Diesel | | | | | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | <i>f</i> | | | | | 2.0 | 1.7 | | 0.80 | | | | | | <i>f</i> (0.80) |
| Non-methane hydrocarbons | <i>e</i> | <i>f</i> | | | | | | | | | | | | | | 0.39 (0.56) |
| Carbon monoxide | 80 | <i>f</i> | | | | | 20 | 18 | | 10 | | | | | | 5.0 (7.3) |
| Nitrogen oxides | 4 | <i>f</i> | | | | | 3.1 | 2.3 | | | | | 2.3 | 1.7 | | <i>f</i> (1.53) |
| Particulates | <i>e</i> | <i>f</i> | | | | | | | 0.60 | | | 0.50 | 0.45 | | 0.13 | <i>f</i> (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 | | <i>f</i> | | | | | | | | | | | | | | 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.

^aLight 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.

^bThe 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.

^cEmission 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.

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

^eNo estimate available.

^fNo standard set.

^gThe 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.

^hGross 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 4.21
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) | <i>a</i> | 16 | 10 | <i>a</i> | | | | | | | | |
| Hydrocarbons (HC) | <i>b</i> | <i>a</i> | 1.5 | 1.9 | 1.1 | | | | | | | |
| Nitrogen oxides (NOx) | <i>a</i> | | | 10.6 | | | 6.0 | 5.0 | 4.0 | | | |
| Carbon Monoxide (CO) | <i>b</i> | 40 | 25 | 37.1 | 14.4 | | | | | | | |
| Diesel | | | | | | | | | | | | |
| Hydrocarbons + nitrogen oxides (HC + NOx) | <i>a</i> | 16 | 10 | <i>a</i> | | | | | | | | |
| Hydrocarbons (HC) | <i>b</i> | <i>a</i> | 1.5 | 1.3 | | | | | | | | |
| Nitrogen oxides (NOx) | <i>a</i> | | | 10.7 | | | 6.0 | 5.0 | 4.0 | | | |
| Non-methane hydrocarbons + nitrogen oxides | <i>a</i> | | | | | | | | | | | 2.4 |
| Carbon Monoxide (CO) | <i>b</i> | 40 | 25 | 15.5 | | | | | | | | |
| Particulates | <i>a</i> | | | | | | 0.60 | | 0.25 | 0.10 | | |
| Smoke Opacity (acceleration/lugging/peak) <i>d</i> | 40/20/ <i>a</i> | 20/15/50 | | | | | | | | | | |
| Weight Criteria for Light Heavy Trucks <i>e</i> | GVWR over 6,000 lbs | | | GVWR over 8,500 lbs | | | GVWR 8,501 through 14,000 lbs | | | | | |
| Test Procedure (gasoline) <i>f</i> | 9-mode steady-state | | | | | MVMA transient | | | | | | |
| (diesel) <i>f</i> | 13-mode steady-state | | | EPA transient | | | | | | | | |
| Useful Life (gasoline) <i>g</i> | 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.

^aNo standard set

^bAlthough 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.

^cVehicles 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.

^dSmoke opacity is expressed in percentage for acceleration, lugging, and peak modes (acceleration/lugging/peak). Lugging is when a vehicle is carrying a load.

^eGross vehicle weight rating (GVWR) is the maximum design loaded weight.

^fSeveral 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.

^gEmissions 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 4.22
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) | <i>a</i> | 16 | 10 | <i>a</i> | | | | | | | | |
| Hydrocarbons (HC) | <i>b</i> | <i>a</i> | 1.5 | 1.9 | | | | | | | | |
| Nitrogen oxides (NOx) | <i>a</i> | | | 10.6 | | 6.0 | | 5.0 | | 4.0 | | |
| Carbon Monoxide (CO) | <i>b</i> | 40 | 25 | 37.1 | | | | | | | | |
| Diesel | | | | | | | | | | | | |
| Hydrocarbons + nitrogen oxides (HC + NOx) | <i>a</i> | 16 | 10 | <i>a</i> | | | | | | | | |
| Hydrocarbons (HC) | <i>b</i> | <i>a</i> | 1.5 | 1.3 | | | | | | | | |
| Nitrogen oxides (NOx) | <i>a</i> | | | 10.7 | | 6.0 | | 5.0 | | 4.0 | | |
| Non-methane hydrocarbons + nitrogen oxides | <i>a</i> | | | | | | | | | | | 2.4 ^c |
| Carbon Monoxide (CO) | <i>b</i> | 40 | 25 | 15.5 | | | | | | | | |
| Particulates | <i>a</i> | | | | | | 0.60 | | 0.25 | | 0.10 | |
| Smoke Opacity (acceleration/lugging/peak) <i>d</i> | 40/20/ <i>a</i> | 20/15/50 | | | | | | | | | | |
| Weight Criteria for Heavy Heavy Trucks <i>e</i> | GVWR over 6,000 lbs | | GVWR over 8,500 lbs | | | GVWR over 14,000 lbs | | | | | | |
| Test Procedure (gasoline) <i>f</i> | 13-mode steady-state | | | | MVMA | | | | | | | |
| (diesel) <i>f</i> | 13-mode steady-state | | | EPA transient | | | | | | | | |
| Useful Life (gasoline) <i>g</i> | 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.

^aNo standard set.

^bAlthough 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.

^cVehicles 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.

^dSmoke opacity is expressed in percentage for acceleration, lugging, and peak modes (acceleration/lugging/peak). Lugging is when a vehicle is carrying a load.

^eGross vehicle weight rating (GVWR) is the maximum design loaded weight.

^fSeveral 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.

^gEmissions 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
California Passenger Cars and Light Trucks Emission Certification Standards
 (grams/mile)

| Vehicle Type | Emission Category | Vehicle Useful Life | | | | | | | | | | | | | |
|---------------|-------------------|------------------------|-------------------|-------------------|-----|-----------------|-------------------|--------------------|--------------------------|-------------------|-------------------|-------|-----------------|-------------------|-------|
| | | 5 Years / 50,000 Miles | | | | | | | 10 Years / 100,000 Miles | | | | | | |
| | | THC ^a | NMHC ^b | NMOG ^c | CO | NO _x | PM | HCHO | 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 | 0.000 | 0.00 | 0.00 | 0.000 | 0.0 | 0.0 | 0.00 |
| 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 | 0.000 | 0.00 | 0.00 | 0.000 | 0.0 | 0.0 | 0.00 |
| 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 (6,000 lbs. or less GVWR) up through 3,750 lbs. loaded vehicle weight; LDT2 = light truck (6,000 lbs. or less GVWR) 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 4.24
California Vehicle Emission Reduction for
Passenger Cars and Light Trucks^a**

| | Emission reduction from Tier 1 California standards ^b | | |
|---|---|-------------|-------------|
| | 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.

^aLight trucks less than 6,000 lbs. gross vehicle weight rating.

^bSee 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, 2001 | |
| | <i>Canada</i> | 42% |
| | <i>France</i> | 75% |
| | <i>Germany</i> | 72% |
| | <i>Japan</i> | 55% |
| | <i>United Kingdom</i> | 74% |
| | <i>United States</i> | 23% |
| Table 5.11 | Average price of a new car, 2001 (current dollars) | |
| | <i>Domestic</i> | 21,605 |
| | <i>Import</i> | 19,654 |
| | | 27,477 |
| Table 5.12 | Automobile operating costs, 2001 | |
| | <i>Variable costs (constant 2000 dollars per 10,000 miles)</i> | 1,322 |
| | <i>Fixed costs (constant 2000 dollars per 10,000 miles)</i> | 4,493 |
| Table 5.18 | Transportation sector share of total employment | |
| | <i>1960</i> | 13.5% |
| | <i>1980</i> | 11.4% |
| | <i>1999</i> | 11.0% |





Table 5.1
Gasoline Prices for Selected Countries, 1978–2001

| | Current dollars per gallon | | | | | | | | Average annual percentage change | |
|----------------------------|----------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|----------------------------------|-----------|
| | 1978 ^a | 1982 ^a | 1986 ^a | 1990 ^b | 1994 ^b | 1996 ^b | 2000 ^b | 2001 ^b | 1978–2001 | 1990–2001 |
| China | c | c | c | c | c | 0.93 | 1.21 | c | c | c |
| India | c | c | c | 1.92 | 2.28 | 2.25 | c | c | c | c |
| Japan | 2.00 | 2.60 | 2.79 | 3.05 | 4.14 | 3.77 | 3.65 | 3.80 | 2.8% | 2.0% |
| France | 2.15 | 2.56 | 2.58 | 3.40 | 3.31 | 4.41 | 4.01 | 3.68 | 2.4% | 0.7% |
| United Kingdom | 1.22 | 2.42 | 2.07 | 2.55 | 2.86 | 3.47 | 5.13 | 4.63 | 6.0% | 5.6% |
| Germany | 1.75 | 2.17 | 1.88 | 2.72 | 3.34 | 4.32 | 3.78 | 3.74 | 3.4% | 2.9% |
| Canada | 0.69 | 1.37 | 1.31 | 1.92 | 1.57 | 1.80 | 2.04 | 2.01 | 4.8% | 0.4% |
| United States ^d | 0.66 | 1.32 | 0.93 | 1.04 | 1.24 | 1.28 | 1.47 | 1.63 | 4.0% | 4.2% |

| | Constant 2000 dollars ^c per gallon | | | | | | | | Average annual percentage change | |
|----------------------------|---|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|----------------------------------|-----------|
| | 1978 ^a | 1982 ^a | 1986 ^a | 1990 ^b | 1994 ^b | 1996 ^b | 2000 ^b | 2001 ^b | 1978–2001 | 1990–2001 |
| China | c | c | c | c | c | 1.02 | 1.25 | c | c | c |
| India | c | c | c | 2.53 | 2.56 | 2.47 | c | c | c | c |
| Japan | 5.28 | 4.64 | 4.38 | 4.02 | 4.81 | 4.14 | 3.77 | 3.80 | -1.4% | -0.5% |
| France | 5.68 | 4.57 | 4.05 | 4.48 | 3.85 | 4.84 | 4.14 | 3.68 | -1.9% | -1.8% |
| United Kingdom | 3.22 | 4.32 | 3.25 | 3.36 | 3.32 | 3.81 | 5.30 | 4.63 | 1.6% | 3.0% |
| Germany | 4.62 | 3.87 | 2.95 | 3.58 | 3.38 | 4.74 | 3.91 | 3.74 | -0.9% | 0.4% |
| Canada | 1.82 | 2.44 | 2.06 | 2.53 | 1.82 | 1.98 | 2.11 | 2.01 | 0.4% | -2.1% |
| United States ^d | 1.74 | 2.36 | 1.46 | 1.37 | 1.44 | 1.40 | 1.52 | 1.63 | -0.3% | 1.6% |

Source:

U.S. Department of Energy, Energy Information Administration, *International Energy Annual 2000*, Washington, DC, May 2002, 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 premium leaded gasoline. Prices are representative for each country based on quarterly data averaged for the year.

^b Regular gasoline.

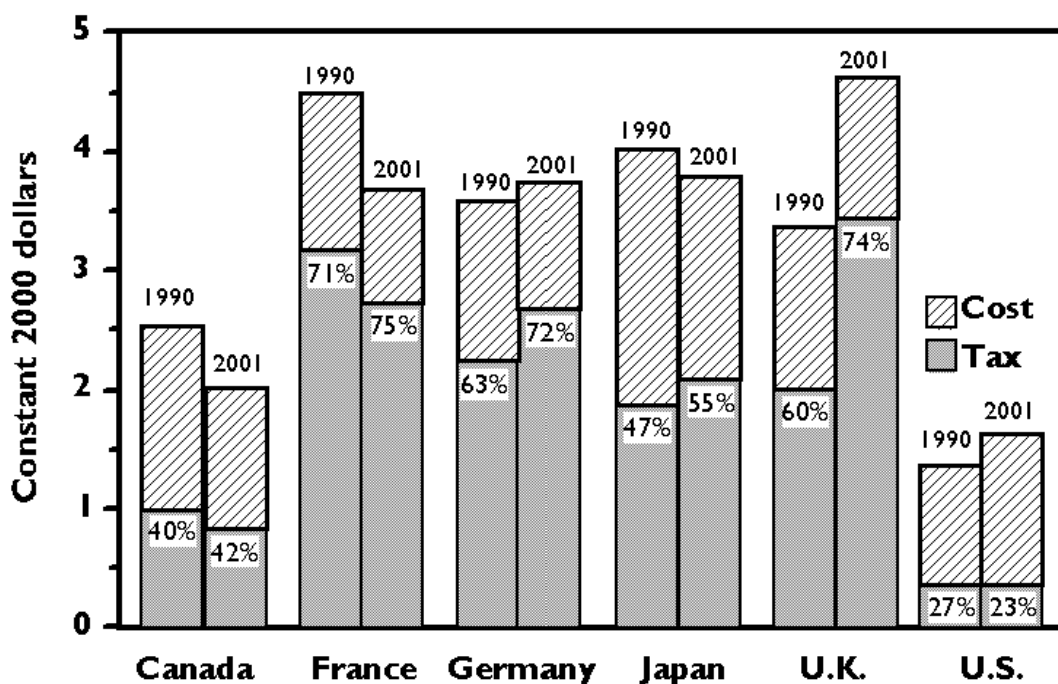
^c Data are not available.

^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 2001 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 2001



Source:

Table 5.1 and International Energy Agency, *Energy Prices and Taxes, Fourth Quarter 2001*, Paris, France, 2002. (Additional resources: www.iea.org)





Table 5.2
Diesel Fuel Prices for Selected Countries, 1978–2001^a

| | Current dollars per gallon | | | | | | | | Average annual percentage change | |
|----------------------------|----------------------------|------|------|------|------|------|------|------|----------------------------------|-----------|
| | 1978 | 1982 | 1986 | 1990 | 1994 | 1996 | 2000 | 2001 | 1978–2001 | 1990–2001 |
| China | b | b | b | b | b | 0.88 | 1.27 | b | b | b |
| India | b | b | b | 0.78 | 0.74 | 0.92 | b | b | b | b |
| Japan | b | 1.78 | 1.90 | 1.75 | 2.48 | 2.51 | 2.89 | 2.70 | b | 4.0% |
| France | 1.30 | 1.88 | 1.69 | 1.78 | 2.10 | 3.10 | 3.05 | 2.80 | 3.4% | 4.2% |
| United Kingdom | 1.24 | 2.05 | 1.71 | 2.04 | 2.46 | 3.26 | 4.77 | 4.42 | 5.7% | 7.3% |
| Germany | 1.48 | 1.81 | 1.51 | 2.72 | 2.16 | 3.02 | 2.90 | 2.91 | 3.0% | 0.6% |
| Canada | b | 1.27 | 1.27 | 1.55 | 1.47 | 1.43 | 1.68 | 1.80 | b | 1.4% |
| United States ^c | 0.54 | 1.16 | 0.94 | 0.99 | 0.96 | 1.15 | 1.36 | 1.52 | 4.6% | 4.0% |

| | Constant 2000 dollars ^d per gallon | | | | | | | | Average annual percentage change | |
|----------------------------|---|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|----------------------------------|-----------|
| | 1978 | 1982 ^a | 1986 ^a | 1990 ^b | 1994 ^b | 1996 ^b | 2000 ^b | 2001 ^b | 1978–2001 | 1990–2001 |
| China | b | b | b | b | b | 0.97 | 1.31 | b | b | b |
| India | b | b | b | 1.03 | 0.86 | 1.01 | b | b | b | b |
| Japan | b | 3.18 | 2.99 | 2.31 | 2.88 | 2.75 | 2.99 | 2.70 | b | 1.4% |
| France | 3.43 | 3.35 | 2.66 | 2.35 | 2.44 | 3.40 | 3.15 | 2.80 | -0.9% | 1.6% |
| United Kingdom | 3.27 | 3.66 | 2.69 | 2.69 | 2.86 | 3.58 | 4.93 | 4.42 | 1.3% | 4.6% |
| Germany | 3.91 | 3.23 | 2.37 | 3.58 | 2.51 | 3.31 | 3.00 | 2.91 | -1.3% | -1.9% |
| Canada | b | 2.27 | 2.00 | 2.04 | 1.71 | 1.57 | 1.74 | 1.80 | b | -1.1% |
| United States ^c | 1.43 | 2.07 | 1.48 | 1.30 | 1.12 | 1.26 | 1.41 | 1.52 | -0.3% | 1.4% |

Source:

U.S. Department of Energy, Energy Information Administration, *International Energy Annual 2000*, Washington, DC, May 2002, 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.

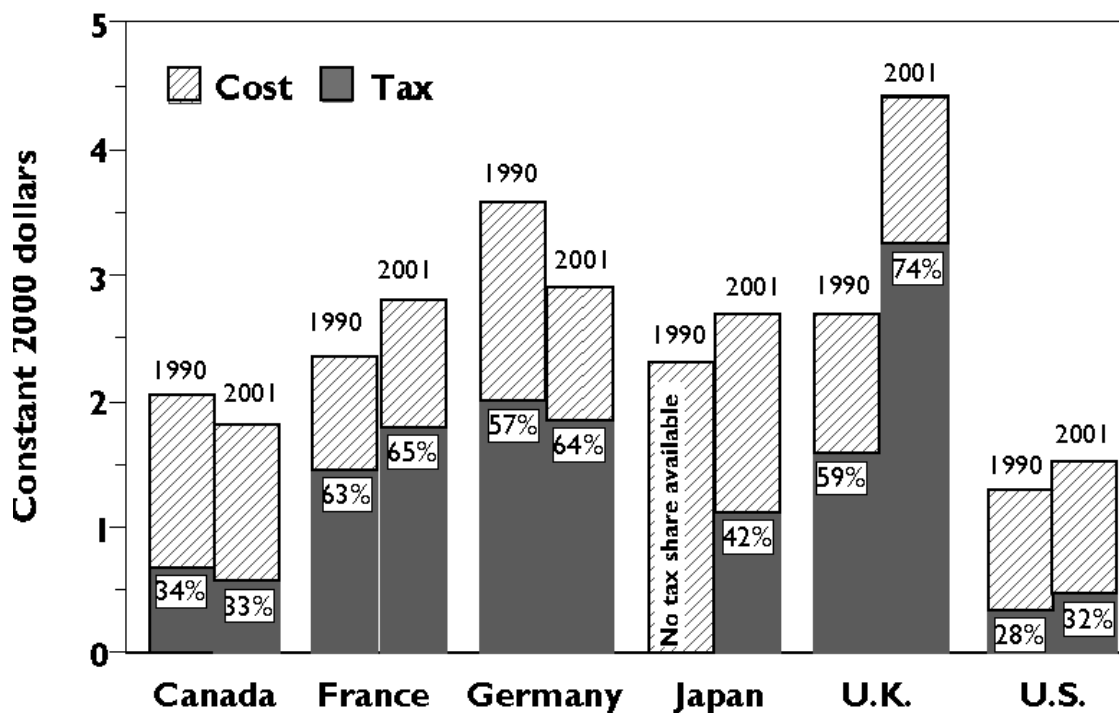
^b Data are not available.

^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 2001



Source:

Table 5.2 and International Energy Agency, *Energy Prices and Taxes, Fourth Quarter 2001*, Paris, France, 2002. (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 2000 dollars) rose by 69% from 1998 to 2001, while the average price of a gallon of gasoline increased only 26% in this same time period.

Table 5.3
Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978–2001

| Year | Crude oil ^a (dollars per barrel) | | Gasoline ^b (cents per gallon) | | Ratio of gasoline to crude oil | |
|-----------|--|---|---|----------------------------|---|--|
| | Current | Constant 2000 ^c | Current | Constant 2000 ^c | | |
| 1978 | 12.5 | 32.9 | 65.2 | 172.2 | 219.8 | |
| 1979 | 17.7 | 42.0 | 88.2 | 209.2 | 209.1 | |
| 1980 | 28.1 | 58.7 | 122.1 | 255.2 | 182.7 | |
| 1981 | 35.2 | 66.8 | 135.3 | 256.3 | 161.3 | |
| 1982 | 31.9 | 56.9 | 128.1 | 228.6 | 168.8 | |
| 1983 | 29.0 | 50.1 | 122.5 | 211.8 | 177.5 | |
| 1984 | 28.6 | 47.5 | 119.8 | 198.6 | 175.7 | |
| 1985 | 26.8 | 42.8 | 119.6 | 191.4 | 187.8 | |
| 1986 | 14.6 | 22.9 | 93.1 | 146.3 | 268.7 | |
| 1987 | 17.9 | 27.1 | 95.7 | 145.1 | 224.5 | |
| 1988 | 14.7 | 21.4 | 96.3 | 140.2 | 275.7 | |
| 1989 | 18.0 | 25.0 | 106.0 | 147.2 | 247.7 | |
| 1990 | 22.2 | 29.3 | 121.7 | 160.3 | 230.0 | |
| 1991 | 19.1 | 24.1 | 119.6 | 151.2 | 263.5 | |
| 1992 | 18.4 | 22.6 | 119.0 | 146.1 | 271.2 | |
| 1993 | 16.4 | 19.6 | 117.3 | 139.8 | 300.2 | |
| 1994 | 15.6 | 18.1 | 117.4 | 136.4 | 316.3 | |
| 1995 | 17.2 | 19.5 | 120.5 | 136.2 | 293.7 | |
| 1996 | 20.7 | 22.7 | 128.8 | 141.2 | 261.2 | |
| 1997 | 19.0 | 20.4 | 129.1 | 138.5 | 284.8 | |
| 1998 | 12.5 | 13.3 | 111.5 | 117.8 | 372.6 | |
| 1999 | 17.5 | 18.0 | 122.1 | 125.2 | 291.3 | |
| 2000 | 28.3 | 28.3 | 156.3 | 156.3 | 232.0 | |
| 2001 | 23.1 | 22.5 | 153.1 | 148.9 | 278.4 | |
| | | <i>Average annual percentage change</i> | | | | |
| 1978–2001 | 2.7% | -1.6% | 3.8% | -0.6% | | |
| 1991–2001 | 1.9% | -0.7% | 2.5% | -0.2% | | |

Sources:

Crude oil - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2002 Washington, DC, Table 9.1.

Gasoline - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2002 Washington, DC, Table 9.4.

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

^aRefiner acquisition cost of composite (domestic and imported) crude oil.

^bAverage 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.

^cAdjusted by the Consumer Price Inflation Index.



Diesel fuel price is generally lower than gasoline; however, in 2001 the price of gasoline and diesel fuel were almost equal.

Table 5.4
Retail Prices for Motor Fuel, 1978–2001
 (cents per gallon, including tax)

| Year | Diesel fuel ^a | | Average for all gasoline types ^b | |
|-----------|---|----------------------------|---|----------------------------|
| | Current | Constant 2000 ^c | Current | Constant 2000 ^c |
| 1978 | ^d | ^d | 65 | 172 |
| 1979 | ^d | ^d | 88 | 209 |
| 1980 | 101 | 211 | 122 | 255 |
| 1981 | 118 | 224 | 135 | 256 |
| 1982 | 116 | 207 | 128 | 229 |
| 1983 | 120 | 207 | 123 | 212 |
| 1984 | 122 | 202 | 120 | 199 |
| 1985 | 122 | 195 | 120 | 191 |
| 1986 | 94 | 148 | 93 | 146 |
| 1987 | 96 | 146 | 96 | 145 |
| 1988 | 95 | 138 | 96 | 140 |
| 1989 | 102 | 142 | 106 | 147 |
| 1990 | 107 | 141 | 122 | 160 |
| 1991 | 91 | 115 | 120 | 151 |
| 1992 | 106 | 130 | 119 | 146 |
| 1993 | 98 | 117 | 117 | 140 |
| 1994 | 96 | 112 | 117 | 136 |
| 1995 | 97 | 110 | 121 | 136 |
| 1996 | 115 | 126 | 129 | 141 |
| 1997 | 129 | 138 | 129 | 139 |
| 1998 | 112 | 118 | 112 | 118 |
| 1999 | 97 | 100 | 122 | 126 |
| 2000 | 136 | 136 | 156 | 156 |
| 2001 | 152 | 148 | 153 | 149 |
| | <i>Average annual percentage change</i> | | | |
| 1978–2001 | 2.0% ^e | -1.7% ^e | 3.8% | -0.6% |
| 1991–2001 | 3.6% | 0.5% | 2.3% | -0.7% |

Source:

Gasoline - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, 2002, Washington, DC, Table 9.4.

Diesel - U.S. Department of Energy, Energy Information Administration, *International Energy Annual 2000*, Washington, DC, May 2002, Table 7.2.

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

^aCollected from a survey of prices on January 1 of the current year.

^bThese 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.

^cAdjusted by the Consumer Price Inflation Index.

^dData are not available.

^eAverage 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, 1978–2001
(cents per gallon, excluding tax)

| Year | Propane ^a | | No. 2 diesel fuel | |
|-----------|----------------------|---|-------------------|----------------------------|
| | Current | Constant 2000 ^b | Current | Constant 2000 ^b |
| 1978 | 33.5 | 88.5 | 37.7 | 99.6 |
| 1979 | 35.7 | 84.7 | 58.5 | 138.8 |
| 1980 | 48.2 | 100.7 | 81.8 | 170.9 |
| 1981 | 56.5 | 107.0 | 99.5 | 188.5 |
| 1982 | 59.2 | 105.6 | 94.2 | 168.1 |
| 1983 | 70.9 | 122.6 | 82.6 | 142.8 |
| 1984 | 73.7 | 122.1 | 82.3 | 136.4 |
| 1985 | 71.7 | 114.7 | 78.9 | 126.3 |
| 1986 | 74.5 | 117.1 | 47.8 | 75.1 |
| 1987 | 70.1 | 106.3 | 55.1 | 83.5 |
| 1988 | 71.4 | 103.9 | 50.0 | 72.8 |
| 1989 | 61.5 | 85.4 | 58.5 | 81.2 |
| 1990 | 74.5 | 98.2 | 72.5 | 95.5 |
| 1991 | 73.0 | 92.3 | 64.8 | 81.9 |
| 1992 | 64.3 | 78.9 | 61.9 | 76.0 |
| 1993 | 67.3 | 80.2 | 60.2 | 71.7 |
| 1994 | 53.0 | 61.6 | 55.4 | 64.4 |
| 1995 | 49.2 | 55.6 | 56.0 | 63.3 |
| 1996 | 60.5 | 66.4 | 68.1 | 74.7 |
| 1997 | 55.2 | 59.2 | 64.2 | 68.9 |
| 1998 | 40.5 | 42.8 | 49.4 | 52.2 |
| 1999 | 45.8 | 47.3 | 58.4 | 60.4 |
| 2000 | 60.3 | 60.3 | 93.5 | 93.5 |
| 2001 | 50.6 | 49.2 | 84.2 | 81.9 |
| | | <i>Average annual percentage change</i> | | |
| 1978–2001 | 1.8% | -2.5% | 3.6% | -0.8% |
| 1991–2001 | -3.6% | -6.1% | 2.7% | 0.0% |

Source:

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2002, Washington, DC, Table 9.7.
 (Additional resources: www.eia.doe.gov)

^aConsumer grade.

^bAdjusted by the Consumer Price Inflation Index.



Average jet fuel prices jumped more than 30 cents per gallon from 1999 to 2000, but lowered again in 2001.

Table 5.6
Refiner Sales Prices for Aviation Gasoline and Jet Fuel, 1978–2001
 (cents per gallon, excluding tax)

| Year | Finished aviation gasoline | | Kerosene-type jet fuel | |
|-----------|----------------------------|---|------------------------|----------------------------|
| | Current | Constant 2000 ^a | Current | Constant 2000 ^a |
| 1978 | 51.6 | 136.3 | 38.7 | 102.2 |
| 1979 | 68.9 | 163.4 | 54.7 | 129.7 |
| 1980 | 108.4 | 226.5 | 86.6 | 181.0 |
| 1981 | 130.3 | 246.8 | 102.4 | 194.0 |
| 1982 | 131.2 | 234.1 | 96.3 | 171.8 |
| 1983 | 125.5 | 217.0 | 87.8 | 151.8 |
| 1984 | 123.4 | 204.5 | 84.2 | 139.5 |
| 1985 | 120.1 | 192.2 | 79.6 | 127.4 |
| 1986 | 101.1 | 158.8 | 52.9 | 83.1 |
| 1987 | 90.7 | 137.5 | 54.3 | 82.3 |
| 1988 | 89.1 | 129.7 | 51.3 | 74.7 |
| 1989 | 99.5 | 138.2 | 59.2 | 82.2 |
| 1990 | 112.0 | 147.6 | 76.6 | 100.9 |
| 1991 | 104.7 | 132.4 | 65.2 | 82.4 |
| 1992 | 102.7 | 126.1 | 61.0 | 74.9 |
| 1993 | 99.0 | 118.0 | 58.0 | 69.1 |
| 1994 | 95.7 | 111.2 | 53.4 | 62.0 |
| 1995 | 100.5 | 113.6 | 54.0 | 61.0 |
| 1996 | 111.6 | 122.5 | 65.1 | 71.4 |
| 1997 | 112.8 | 121.0 | 61.3 | 65.8 |
| 1998 | 97.5 | 103.0 | 45.2 | 47.8 |
| 1999 | 105.9 | 109.5 | 54.3 | 56.1 |
| 2000 | 130.6 | 130.6 | 89.9 | 89.9 |
| 2001 | 132.2 | 128.5 | 77.6 | 75.5 |
| | | <i>Average annual percentage change</i> | | |
| 1978–2001 | 4.2% | -0.3% | 3.1% | -1.3% |
| 1991–2001 | 2.4% | -0.3% | 1.8% | -0.9% |

Source:

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2002, Washington, DC, Table 9.7.
 (Additional resources: www.eia.doe.gov)

^aAdjusted 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 |
| 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 |



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 |
|----------------|----------|-------------|--------------|--------------|-------------------|-------------------|
| 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 ft³.

^d Per therm.

^e Per 120 ft³.

^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 2001, 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, October 2001

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

Source:

U.S. Department of Transportation, Federal Highway Administration, "Monthly Motor Fuel Reported by the States, October 2001," February 2002, Washington, DC, Table MF-121T. (Additional resources: www.fhwa.dot.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 | 15.32 |
| Gasohol | 10% Methanol | 12.40 |
| | 7.7% Methanol | 13.78 |
| | 5.7% Methanol | 14.98 |
| Methanol | Qualified ^b | 12.85 |
| | Partially exempt ^c | 9.20 |
| Ethanol | Qualified ^b | 12.85 |
| | Partially exempt ^c | 9.25 |
| CNG | | 48.54/mcf ^d |
| LNG | | 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.

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

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

^dThousand cubic feet.



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](http://www.fleets.doe.gov/fleet-tool.cgi?$$,benefits,1).
(Additional resources: www.cities.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, 1970–2001

| Year | Domestic ^a | | Import | | Total | | |
|-----------|---|------------------------------------|-----------------|------------------------------------|-----------------|------------------------------------|--|
| | Current dollars | Constant 2000 dollars ^b | Current dollars | Constant 2000 dollars ^b | Current dollars | Constant 2000 dollars ^b | |
| 1970 | 3,708 | 16,457 | 2,648 | 11,752 | 3,542 | 15,720 | |
| 1975 | 5,084 | 16,273 | 4,384 | 14,032 | 4,950 | 15,844 | |
| 1980 | 7,609 | 15,901 | 7,482 | 15,636 | 7,574 | 15,828 | |
| 1981 | 8,912 | 16,883 | 8,896 | 16,852 | 8,910 | 16,879 | |
| 1982 | 9,865 | 17,604 | 9,957 | 17,768 | 9,890 | 17,648 | |
| 1983 | 10,516 | 18,181 | 10,868 | 18,790 | 10,606 | 18,337 | |
| 1984 | 11,079 | 18,362 | 12,336 | 20,445 | 11,375 | 18,853 | |
| 1985 | 11,589 | 18,547 | 12,853 | 20,570 | 11,838 | 18,945 | |
| 1986 | 12,319 | 19,355 | 13,670 | 21,478 | 12,652 | 19,878 | |
| 1987 | 12,922 | 19,588 | 14,470 | 21,934 | 13,386 | 20,291 | |
| 1988 | 13,418 | 19,532 | 15,221 | 22,156 | 13,932 | 20,280 | |
| 1989 | 13,936 | 19,353 | 15,510 | 21,539 | 14,371 | 19,957 | |
| 1990 | 14,489 | 19,090 | 16,640 | 21,924 | 15,042 | 19,818 | |
| 1991 | 15,192 | 19,208 | 16,327 | 20,643 | 15,475 | 19,565 | |
| 1992 | 15,644 | 19,201 | 18,593 | 22,820 | 16,336 | 20,050 | |
| 1993 | 15,976 | 19,039 | 20,261 | 24,145 | 16,871 | 20,105 | |
| 1994 | 16,930 | 19,672 | 21,989 | 25,550 | 17,903 | 20,802 | |
| 1995 | 16,864 | 19,055 | 23,202 | 26,216 | 17,959 | 20,292 | |
| 1996 | 17,468 | 19,171 | 26,205 | 28,760 | 18,777 | 20,608 | |
| 1997 | 17,907 | 19,212 | 27,722 | 29,743 | 19,531 | 20,955 | |
| 1998 | 18,479 | 19,522 | 29,614 | 31,285 | 20,364 | 21,513 | |
| 1999 | 18,630 | 19,256 | 28,931 | 29,903 | 20,658 | 21,352 | |
| 2000 | 18,684 | 18,684 | 27,767 | 27,767 | 20,355 | 20,355 | |
| 2001 | 19,654 | 19,110 | 27,477 | 26,717 | 21,605 | 21,007 | |
| | <i>Average annual percentage change</i> | | | | | | |
| 1970–2001 | 5.5% | 0.5% | 7.8% | 2.7% | 6.0% | 0.9% | |
| 1991–2001 | 2.6% | -0.1% | 5.3% | 2.6% | 3.4% | 0.7% | |

Source:

U.S. Department of Commerce, Bureau of Economic Analysis, *National Income and Product Accounts*, underlying detail estimates for Motor Vehicle Output, Washington, DC, 2002.

(Additional resources: www.stat-usa.gov)

^aIncludes transplants.

^bAdjusted 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. Though the variable cost of operating a car in 2001 was higher than 2000, the total cost declined due to lower fixed costs.

Table 5.12
Automobile Operating Cost per Mile, 1985–2001

| Model year | Constant 2000 dollars per 10,000 miles ^a | | | Total cost per mile ^b (constant 2000 cents ^a) | Percentage gas and oil of total cost |
|------------|---|------------|------------|--|--------------------------------------|
| | Variable cost | Fixed cost | Total cost | | |
| 1985 | 1,187 | 3,298 | 4,486 | 44.86 | 19.9% |
| 1986 | 1,024 | 3,625 | 4,649 | 46.49 | 15.1% |
| 1987 | 1,016 | 3,529 | 4,545 | 45.45 | 14.7% |
| 1988 | 1,150 | 4,411 | 5,560 | 55.60 | 13.6% |
| 1989 | 1,111 | 4,055 | 5,166 | 51.66 | 14.2% |
| 1990 | 1,107 | 4,290 | 5,397 | 53.97 | 13.2% |
| 1991 | 1,226 | 4,509 | 5,735 | 57.35 | 14.6% |
| 1992 | 1,105 | 4,644 | 5,749 | 57.49 | 12.6% |
| 1993 | 1,096 | 4,435 | 5,532 | 55.32 | 12.7% |
| 1994 | 1,057 | 4,457 | 5,515 | 55.15 | 11.8% |
| 1995 | 1,085 | 4,525 | 5,610 | 56.10 | 11.7% |
| 1996 | 1,054 | 4,602 | 5,655 | 56.55 | 10.9% |
| 1997 | 1,159 | 4,665 | 5,834 | 58.34 | 12.1% |
| 1998 | 1,130 | 4,784 | 5,903 | 59.03 | 11.1% |
| 1999 | 1,096 | 4,817 | 5,912 | 59.12 | 9.8% |
| 2000 | 1,220 | 4,724 | 5,944 | 59.44 | 11.6% |
| 2001 | 1,322 | 4,493 | 5,816 | 58.16 | 13.2% |
| | <i>Average annual percentage change</i> | | | | |
| 1985–2001 | 0.7% | 2.0% | 1.6% | 1.6% | |

Source:

American Automobile Association, *Your Driving Costs*, 2001 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 2001 model year autos, the fixed cost is almost \$15 per day.

Table 5.13
Fixed Automobile Operating Costs per Year, 1975–2001
(constant 2000 dollars)^a

| Model year | Fire & theft ^b | Collision ^c | Property damage & liability ^d | License, registration & taxes | Depreciation | Finance charge ^e | Total | Average fixed cost per day |
|---|---------------------------|------------------------|--|-------------------------------|--------------|-----------------------------|-------|----------------------------|
| 1975 | 170 | 451 | 605 | 96 | 2,474 | | 3,796 | 10.40 |
| 1980 | 146 | 359 | 518 | 171 | 2,169 | 884 | 4,249 | 11.64 |
| 1985 | 120 | 283 | 341 | 176 | 2,020 | 855 | 3,794 | 10.40 |
| 1986 | 135 | 300 | 365 | 204 | 2,074 | 1001 | 4,079 | 11.17 |
| 1987 | 132 | 297 | 382 | 194 | 2,265 | 797 | 4,067 | 11.14 |
| 1988 | 125 | 295 | 413 | 202 | 2,597 | 822 | 4,456 | 12.21 |
| 1989 | 142 | 325 | 429 | 200 | 2,802 | 817 | 4,715 | 12.92 |
| 1990 | 145 | 323 | 419 | 217 | 3,105 | 896 | 5,105 | 13.99 |
| 1991 | 137 | 312 | 446 | 212 | 3,166 | 1095 | 4,610 | 12.63 |
| 1992 | 157 | 351 | 458 | 214 | 3,335 | 977 | 5,491 | 15.05 |
| 1993 | 138 | 290 | 459 | 212 | 3,372 | 798 | 5,270 | 14.44 |
| 1994 | 143 | 286 | 465 | 225 | 3,416 | 753 | 5,288 | 14.49 |
| 1995 | 137 | 285 | 463 | 229 | 3,472 | 775 | 5,361 | 14.69 |
| 1996 | 158 | 302 | 468 | 236 | 3,479 | 788 | 5,431 | 14.88 |
| 1997 | 129 | 350 | 430 | 232 | 3,511 | 824 | 5,475 | 15.00 |
| 1998 | 142 | 303 | 506 | 239 | 3,554 | 859 | 5,602 | 15.35 |
| 1999 | 167 | 335 | 500 | 234 | 3,551 | 856 | 5,644 | 15.46 |
| 2000 | 163 | 326 | 481 | 223 | 3,492 | 849 | 5,534 | 15.16 |
| 2001 | 162 | 335 | 466 | 197 | 3,450 | 842 | 5,458 | 14.95 |
| <i>Average annual percentage change</i> | | | | | | | | |
| 1975–2001 | -0.2% | -1.1% | -1.0% | 2.8% | 1.3% | ^e | 1.4% | 1.4% |
| 1991–2001 | 1.7% | 0.7% | 0.4% | -0.7% | 0.9% | 9.6% | 1.7% | 1.7% |

Source:

American Automobile Association, "Your Driving Costs," 2001 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, 1970–2001
(billion dollars)

| Year | Gross National Product | | Total transportation outlays | | Transportation as a percent of GNP |
|------|------------------------|----------------------------|------------------------------|----------------------------|------------------------------------|
| | Current | Constant 2000 ^a | Current | Constant 2000 ^a | |
| 1970 | 1,015.5 | 4,506.9 | 192.8 | 855.7 | 19.0% |
| 1980 | 2,732.0 | 5,709.3 | 533.0 | 1,113.9 | 19.5% |
| 1990 | 5,567.8 | 7,335.7 | 951.0 | 1,253.0 | 17.1% |
| 2000 | 9,860.8 | 9,860.8 | ^b | ^b | ^b |
| 2001 | 10,202.8 | 9,920.5 | ^b | ^b | ^b |

| Year | Personal Consumption Expenditures | | Transportation Personal Consumption Expenditures ^c | | Transportation PCE as a percent of total PCE |
|------|-----------------------------------|----------------------------|---|----------------------------|--|
| | Current | Constant 2000 ^a | Current | Constant 2000 ^a | |
| 1970 | 640.0 | 2,840.4 | 81.5 | 361.7 | 12.7% |
| 1980 | 1,732.6 | 3,620.8 | 238.5 | 498.4 | 13.8% |
| 1990 | 3,761.2 | 4,955.5 | 453.9 | 598.0 | 12.1% |
| 2000 | 6,728.4 | 6,728.4 | 784.9 | 784.9 | 11.7% |
| 2001 | 7,064.5 | 6,869.0 | 816.0 | 793.4 | 11.6% |

Sources:

GNP - U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, April 2002, 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, 1970–2001
(1970 = 1.000)

| Year | Consumer Price Index | Transportation Consumer Price Index ^d | New car Consumer Price Index | Used car Consumer Price Index | Gross National Product Index |
|------|----------------------|--|------------------------------|-------------------------------|------------------------------|
| 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 | 4.438 | 4.088 | 2.694 | 4.994 | 9.710 |
| 2001 | 4.564 | 4.115 | 2.681 | 5.087 | 10.047 |

Source:

Bureau of Labor Statistics, Consumer Price Index Table 1A for 2001, and annual. [GNP—see above.] (Additional resources: stats.bls.gov/cpihome.htm)

^a Adjusted by the implicit GNP price deflator.

^b Data are not available.

^c 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.

^d 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 |
| <i>Average annual percentage change</i> | | | | | |
| 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.

Note:

2000 data were not available from the Eno Foundation when this document went to press.

^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, 1999

| | 1999 Employees | Percent of total motor vehicle | Percent of total U.S. employment |
|---|-------------------|--------------------------------------|--|
| Motor vehicle and equipment manufacturing | 1,313,900 | 14.5% | 1.2% |
| <i>Motor vehicles and equipment</i> | 233,917 | 2.6% | 0.2% |
| <i>Motor vehicle body & trailer</i> | 141,610 | 1.6% | 0.1% |
| <i>Motor vehicle parts</i> | 794,523 | 8.8% | 0.7% |
| <i>Storage batteries</i> | 23,057 | 0.3% | 0.0% |
| <i>Tires</i> | 64,810 | 0.7% | 0.1% |
| <i>Rolled steel shape</i> | 13,268 | 0.1% | 0.0% |
| <i>Other transportation equipment</i> | 42,715 | 0.5% | 0.0% |
| Highway, street, bridge, and tunnel construction | 284,368 | 3.1% | 0.3% |
| Motor freight transportation and related services | 2,331,536 | 25.7% | 2.1% |
| <i>Trucking and courier services, except by air or by the U.S. Postal Service</i> | 1,962,546 | 21.7% | 1.8% |
| Petroleum refining and wholesale distribution | 226,072 | 2.5% | 0.2% |
| Passenger transportation | 965,337 | 10.7% | 0.9% |
| Automotive sales and servicing | 3,938,392 | 43.5% | 3.6% |
| Total of motor vehicle and related industries | 9,059,605 | 100.0% | 8.2% |
| U.S. Total ^a | 110,705,661 | | 100.0% |

Source:

U.S. Department of Commerce, Bureau of the Census, County Business Patterns web site: tier2.census.gov/cbp/, April 2002. (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 |
|---|---------------|---------------|---------------|---------------|---------------|----------------|----------------|----------------|----------------|
| <u>Transportation Service</u> | | | | | | | | | |
| 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 |
| <u>Transportation Equipment Manufacturing</u> | | | | | | | | | |
| 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 |
| <u>Transportation Related Industries</u> | | | | | | | | | |
| 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 |
| <u>Government Transportation Employees</u> | | | | | | | | | |
| 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.

Note:

2000 data were not available from the Eno Foundation when this document went to press.

^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, 2000 | 25.1% |
| Table 6.2 | U.S. share of world truck & bus registrations, 2000 | 44.3% |
| Table 6.3 | Number of automobiles, 2000 (Polk - in thousands) | 127,721 |
| Table 6.3 | Number of trucks, 2000 (Polk - in thousands) | 85,579 |
| Table 6.5 | Vehicle miles traveled, 2000 (million miles) | 2,749,803 |
| | <i>Automobiles</i> | 58.3% |
| | <i>Motorcycles</i> | 0.4% |
| | <i>Two-axle, four-tire trucks</i> | 33.6% |
| | <i>Other single-unit trucks</i> | 2.6% |
| | <i>Combination trucks</i> | 4.9% |
| | <i>Buses</i> | 0.3% |
| Table 6.8 | Average age of vehicles, 2000 | (years) |
| | <i>Automobiles</i> | 9.0 |
| | <i>Trucks</i> | 8.0 |
| | Median lifetime of vehicles | (years) |
| <i>Table 6.9</i> | <i>Automobiles</i> | 16.9 |
| <i>Table 6.10</i> | <i>Light trucks</i> | 15.5 |



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, 1950–2000
(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 | 16,538 | 126,869 | 26.7% | 496,059 |
| 2000 | 3,860 | 5,580 | 52,437 | 28,060 | 27,185 | 43,772 | 16,832 | 127,721 | 25.1% | 508,245 |
| <i>Average annual percentage change</i> | | | | | | | | | | |
| 1950–2000 | ^d | ^d | 15.3% | | ^d 5.1% | ^d | 4.4% | 2.3% | | 4.6% |
| 1970–2000 | ^d | ^d | 6.1% | 2.9% | 2.8% | 3.8% | 3.2% | 1.2% | | 3.3% |
| 1990–2000 | 9.1% | 7.6% | 4.1% | 2.0% | 1.9% | 3.6% | 2.9% | -0.5% | | 1.6% |

Source:

Ward's Communications, *Ward's World Motor Vehicle Data*, 2001 Edition, Southfield, MI, 2001, pp. 232–235 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 and data from 1999 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, 1950–2000
(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 | 722 ^f | 86,640 | 46.9% | 188,367 |
| 2000 | 10,487 | 3,390 | 20,212 | 5,753 | 3,361 | 3,534 | 739 ^f | 85,579 | 44.3% | 192,928 |
| <i>Average annual percentage change</i> | | | | | | | | | | |
| 1950–2000 | ^d | ^d | 9.9% | ^d | 2.3% | ^d | 0.3% | 4.6% | | 4.9% |
| 1970–2000 | ^d | ^d | 2.0% | 3.9% | 2.2% | 3.6% | -2.3% | 5.1% | | 4.4% |
| 1990–2000 | 8.8% | 8.2% | -1.2% | 1.9% | -1.2% | 5.9% | -15.4% | 4.5% | | 2.7% |

Source:

Ward's Communications, *Ward's World Motor Vehicle Data*, 2001 Edition, Southfield, MI, 2001, pp. 232–235 and annual.
(Additional resources: www.wardsauto.com)

^a Data for 1991 and prior include West Germany only. Kraftwagen are included with automobiles. Data from 1999 and later are not comparable to prior data.

^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.

^f Canada

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)

| Year | Automobiles | | | Trucks | | | Total | | |
|------|-------------|------------------|-----------------------|--------|------------------|-----------------------|---------|------------------|-----------------------|
| | FHWA | The Polk Company | Percentage difference | FHWA | The Polk Company | Percentage difference | FHWA | The Polk Company | Percentage difference |
| 1970 | 89,243 | 80,448 | 10.9% | 18,797 | 17,688 | 6.3% | 108,040 | 98,136 | 10.1% |
| 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 | 133,432 | 127,721 | 4.5% | 87,108 | 85,579 | 1.8% | 220,540 | 213,300 | 3.4% |

Source:

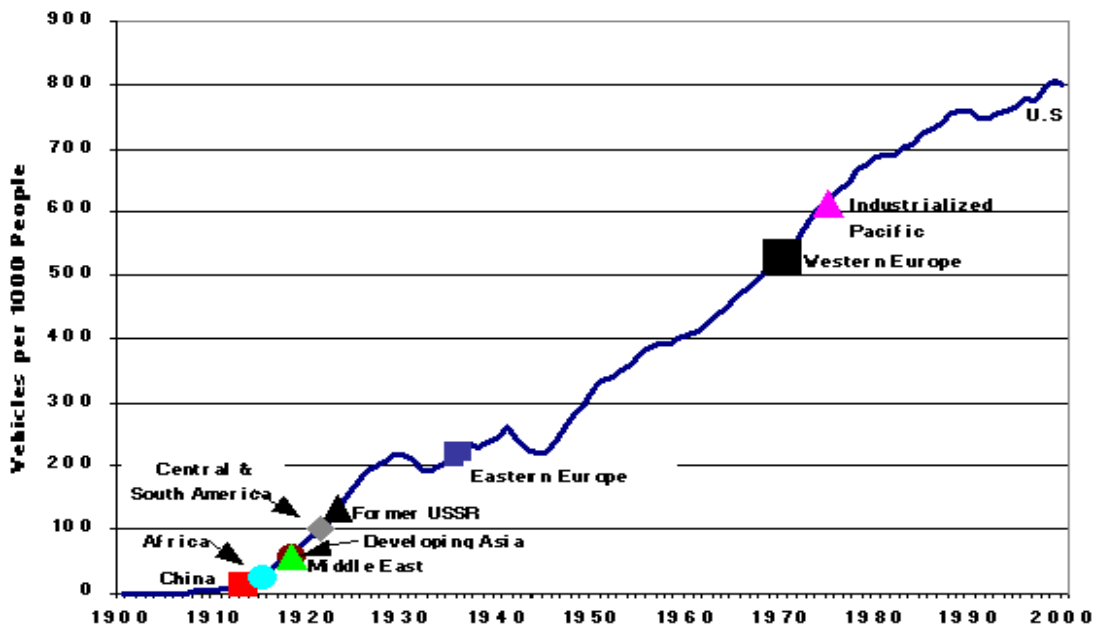
FHWA - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2000*, Washington, DC, 2001, Table VM-1, p. V-50, and annual. (Additional resources: www.fhwa.dot.gov)

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



The line on this graph shows the total vehicles per thousand people in the U.S. from 1900 to 2000. The symbols show the 1998 vehicles per thousand people in other countries/regions of the world. This shows that the Western European nations had the same ratio of vehicles per thousand people in 1998 as the U.S. had in 1970; the former USSR in 1998 had the same ratio of vehicles per thousand people as the U.S. did in 1923; and China in 1998 had the same ratio of vehicles per thousand people as the U.S. did in 1913.

Figure 6.1. Vehicles per Thousand People: U.S. Compared to Other Countries



Source:

United States data –

Vehicles: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics 2000, Table VM-1, and earlier annual editions.

Population: U.S. Department of Commerce, Bureau of the Census web site:

<http://www.census.gov/population/estimates/nation/popclockest.txt>

<http://eire.census.gov/popest/data/national/populartables/files/national01.pdf>

Other countries/regions –

Energy Information Administration, *International Energy Outlook 2002*, DOE/EIA-0484(2002), p. 256.



The data on automobile and light truck 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) and a 2002 report entitled "Investigation of Class 2b Trucks (Vehicles of 8,500 to 10,000 lbs GVWR)."

Table 6.4
Vehicle Stock and New Sales in the United States, 2000 Calendar Year

| | Vehicle stock ^a | | New sales (in thousands) | | | | | |
|---|----------------------------|--------|--------------------------|----------|---------------------|----------|-------|----------|
| | Thousands | Share | Domestic | | Import ^b | | Total | |
| Autos | 127,721 | 100.0% | 6,830 | (77.2%) | 2,016 | (22.8%) | 8,846 | (100.0%) |
| Two-seaters | 1,948 | 1.5% | 55 | (44.7%) | 69 | (56.1%) | 123 | (100.0%) |
| Minicompact | 1,353 | 1.1% | 0 | (0.0%) | 20 | (100.0%) | 20 | (100.0%) |
| Subcompact | 26,844 | 21.0% | 1,468 | (83.3%) | 294 | (16.7%) | 1,762 | (100.0%) |
| Compact | 40,868 | 32.0% | 1,626 | (68.7%) | 740 | (31.3%) | 2,366 | (100.0%) |
| Midsize | 38,342 | 30.0% | 2,452 | (74.2%) | 854 | (25.8%) | 3,306 | (100.0%) |
| Large | 18,366 | 14.4% | 1,229 | (96.8%) | 40 | (3.2%) | 1,269 | (100.0%) |
| Autos | 127,721 | 100.0% | c | c | c | c | c | c |
| Business fleet autos | 7,346 | 5.8% | c | c | c | c | c | c |
| Personal autos | 120,375 | 94.2% | c | c | c | c | c | c |
| Trucks | 85,579 | 100.0% | 8,092 | (90.3%) | 873 | (9.7%) | 8,965 | (100.0%) |
| Less than 8,500 lbs. | 73,775 | 62.8% | 7,059 | (89.4%) | 841 | (10.6%) | 7,900 | (100.0%) |
| Small pickup | 13,316 | 11.5% | 1,016 | (100.0%) | 0 | (0.0%) | 1,016 | (100.0%) |
| Large pickup | 21,884 | 18.3% | 1,863 | (100.0%) | 0 | (0.0%) | 1,863 | (100.0%) |
| Small van | 12,832 | 11.2% | 1,165 | (96.6%) | 41 | (3.4%) | 1,206 | (100.0%) |
| Large van | 5,718 | 4.8% | 346 | (100.0%) | 0 | (0.0%) | 346 | (100.0%) |
| Small SUV | 5,925 | 5.2% | 416 | (56.6%) | 319 | (43.4%) | 735 | (100.0%) |
| Medium SUV | 11,009 | 9.3% | 1,631 | (78.7%) | 441 | (21.3%) | 2,071 | (100.0%) |
| Large SUV | 3,091 | 2.6% | 628 | (94.0%) | 40 | (6.0%) | 669 | (100.0%) |
| 8,500 – 10,000 lbs. | 6,241 | 30.7% | 487 | (100.0%) | 0 | (0.0%) | 487 | (100.0%) |
| Pickup | 4,600 | 22.6% | 400 | (100.0%) | 0 | (0.0%) | 400 | (100.0%) |
| Van/SUV | 1,641 | 8.1% | 87 | (100.0%) | 0 | (0.0%) | 87 | (100.0%) |
| 10,000 – 26,000 lbs. | 2,567 | 3.0% | 213 | (87.3%) | 31 | (12.7%) | 244 | (100.0%) |
| 26,000 lbs. and over | 2,995 | 3.5% | 333 | (99.7%) | 1 | (0.3%) | 334 | (100.0%) |
| Trucks | 85,579 | 100.0% | c | c | c | c | c | c |
| Business fleet trucks <= 19,500 lbs. GVW ^d | 7,850 | 9.2% | c | c | c | c | c | c |
| Personal trucks <=19,500 lbs. GVW | 73,878 | 86.3% | c | c | c | c | c | c |
| Trucks > 19,500 lbs. GVW | 3,851 | 4.5% | c | c | c | c | c | c |

Source:

See Appendix A Highway Vehicle Stock and New Sales for detailed methodology and sources.
(Additional resources: www.polk.com)

^a Total auto and truck vehicle stocks as of July 1, 2000 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.



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 2000 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, 1970–2000
(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% | 2,691,056 |
| 2000 | 58.3% | 0.4% | 33.6% | 2.6% | 4.9% | 0.3% | 2,749,803 |
| <i>Average annual percentage change</i> | | | | | | | |
| 1970–2000 | | | | | | | 3.1% |
| 1990–2000 | | | | | | | 2.5% |

Source:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2000*, Washington, DC, 2001, Table VM-1, p. V-50, and annual. (Additional resources: www.fhwa.dot.gov)

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



Table 6.6
Automobiles in Operation and Vehicle Travel by Age, 1970 and 2000

| Age (years) | 1970 | | | 2000 | | | 2000 Estimated vehicle travel | | Average annual miles per vehicle |
|----------------------|-------------------------|---------------|--------------------------|-------------------------|------------|--------------------------|----------------------------------|--------------------------|--|
| | Vehicles (thousands) | Percentage | Cumulative percentage | Vehicles (thousands) | Percentage | Cumulative percentage | Percentage | Cumulative percentage | |
| Under 1 ^a | 6,288 | 7.8% | 7.8% | 6,665 | 5.2% | 5.2% | 7.1% | 7.1% | 15,600 |
| 1 | 9,299 | 11.6% | 19.4% | 8,177 | 6.4% | 11.6% | 8.1% | 15.2% | 14,500 |
| 2 | 8,816 | 11.0% | 30.3% | 7,655 | 6.0% | 17.6% | 7.8% | 23.0% | 14,800 |
| 3 | 7,878 | 9.8% | 40.1% | 7,906 | 6.2% | 23.8% | 7.5% | 30.5% | 13,800 |
| 4 | 8,538 | 10.6% | 50.8% | 7,413 | 5.8% | 29.6% | 6.6% | 37.0% | 12,900 |
| 5 | 8,506 | 10.6% | 61.3% | 8,675 | 6.8% | 36.4% | 7.5% | 44.6% | 12,700 |
| 6 | 7,116 | 8.8% | 70.2% | 7,628 | 6.0% | 42.4% | 6.5% | 51.1% | 12,400 |
| 7 | 6,268 | 7.8% | 78.0% | 7,650 | 6.0% | 48.4% | 6.1% | 57.2% | 11,600 |
| 8 | 5,058 | 6.3% | 84.3% | 7,021 | 5.5% | 53.9% | 5.4% | 62.6% | 11,300 |
| 9 | 3,267 | 4.1% | 88.3% | 7,109 | 5.6% | 59.4% | 5.5% | 68.0% | 11,200 |
| 10 | 2,776 | 3.5% | 91.8% | 7,071 | 5.5% | 65.0% | 4.4% | 72.4% | 9,000 |
| 11 | 1,692 | 2.1% | 93.9% | 7,338 | 5.7% | 70.7% | 4.5% | 76.9% | 9,000 |
| 12 | 799 | 1.0% | 94.9% | 6,876 | 5.4% | 76.1% | 4.2% | 81.2% | 9,000 |
| 13 | 996 | 1.2% | 96.1% | 6,084 | 4.8% | 80.9% | 3.8% | 84.9% | 9,000 |
| 14 | 794 | 1.0% | 97.1% | 5,334 | 4.2% | 85.0% | 3.3% | 88.2% | 9,000 |
| 15 and older | 2,336 | 2.9% | 100.0% | 19,119 | 15.0% | 100.0% | 11.8% | 100.0% | 9,000 |
| Subtotal | 80,427 | 100.0% | | 127,721 | | | | | |
| Age not given | 22 | | | 0 | | | | | |
| Total | 80,449 | | | 127,721 | | | | | |
| Average age | | 9.0 | | | 8.9 | | | | |
| Median age | | 8.9 | | | 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)

^aIncludes automobiles from model year 2001 and 2000 which were sold prior to July 1, 2001, 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 2000

| Age (years) | 1970 | | | 2000 | | | 2000 Estimated vehicle travel | | Average annual miles per vehicle |
|----------------------|-------------------------|---------------|--------------------------|-------------------------|------------|--------------------------|----------------------------------|--------------------------|--|
| | Vehicles (thousands) | Percentage | Cumulative percentage | Vehicles (thousands) | Percentage | Cumulative percentage | Percentage | Cumulative percentage | |
| Under 1 ^a | 1,262 | 7.1% | 7.1% | 6,439 | 7.5% | 7.5% | 9.2% | 9.2% | 17,500 |
| 1 | 1,881 | 10.6% | 17.8% | 7,726 | 9.0% | 16.6% | 12.1% | 21.3% | 19,200 |
| 2 | 1,536 | 8.7% | 26.5% | 6,630 | 7.7% | 24.3% | 10.7% | 32.0% | 19,800 |
| 3 | 1,428 | 8.1% | 34.6% | 6,313 | 7.4% | 31.7% | 9.2% | 41.2% | 17,900 |
| 4 | 1,483 | 8.4% | 43.0% | 5,300 | 6.2% | 37.9% | 7.6% | 48.7% | 17,500 |
| 5 | 1,339 | 7.6% | 50.5% | 5,818 | 6.8% | 44.7% | 8.0% | 56.8% | 17,000 |
| 6 | 1,154 | 6.5% | 57.1% | 5,206 | 6.1% | 50.8% | 6.6% | 63.4% | 15,600 |
| 7 | 975 | 5.5% | 62.6% | 4,335 | 5.1% | 55.8% | 5.4% | 68.8% | 15,400 |
| 8 | 826 | 4.7% | 67.3% | 3,547 | 4.1% | 60.0% | 4.4% | 73.2% | 15,100 |
| 9 | 621 | 3.5% | 70.8% | 3,411 | 4.0% | 63.9% | 3.7% | 76.9% | 13,200 |
| 10 | 658 | 3.7% | 74.5% | 3,258 | 3.8% | 67.8% | 2.4% | 79.3% | 9,200 |
| 11 | 583 | 3.3% | 77.8% | 3,665 | 4.3% | 72.0% | 2.7% | 82.0% | 9,200 |
| 12 | 383 | 2.2% | 80.0% | 3,421 | 4.0% | 76.0% | 2.6% | 84.6% | 9,200 |
| 13 | 417 | 2.4% | 82.3% | 2,860 | 3.3% | 79.4% | 2.1% | 86.8% | 9,200 |
| 14 | 414 | 2.3% | 84.7% | 2,812 | 3.3% | 82.7% | 2.1% | 88.9% | 9,200 |
| 15 and older | 2,710 | 15.3% | 100.0% | 14,838 | 17.3% | 100.0% | 11.1% | 100.0% | 9,200 |
| Subtotal | 17,670 | 100.0% | | 85,579 | | | 100.0% | | |
| Age not given | 15 | | | 0 | | | | | |
| Total | 17,685 | | | 85,579 | | | | | |
| Average age | | 7.3 | | | 8.0 | | | | |
| Median age | | 5.9 | | | 6.9 | | | | |

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)

^aIncludes trucks from model year 2001 and 2000 which were sold prior to July 1, 2001, 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, 1970–2000
(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 | 7.6 | 6.5 | 8.0 | 6.5 |
| 1991 | 7.8 | 6.7 | 8.1 | 6.8 |
| 1992 | 7.9 | 7.0 | 8.4 | 7.2 |
| 1993 | 8.1 | 7.3 | 8.6 | 7.5 |
| 1994 | 8.3 | 7.5 | 8.4 | 7.5 |
| 1995 | 8.4 | 7.7 | 8.4 | 7.6 |
| 1996 | 8.5 | 7.9 | 8.3 | 7.7 |
| 1997 | 8.6 | 8.1 | 8.3 | 7.8 |
| 1998 | 8.8 | 8.3 | 8.3 | 7.5 |
| 1999 | 8.9 | 8.3 | 8.2 | 7.2 |
| 2000 | 9.0 | 8.3 | 8.0 | 6.9 |

Source:

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

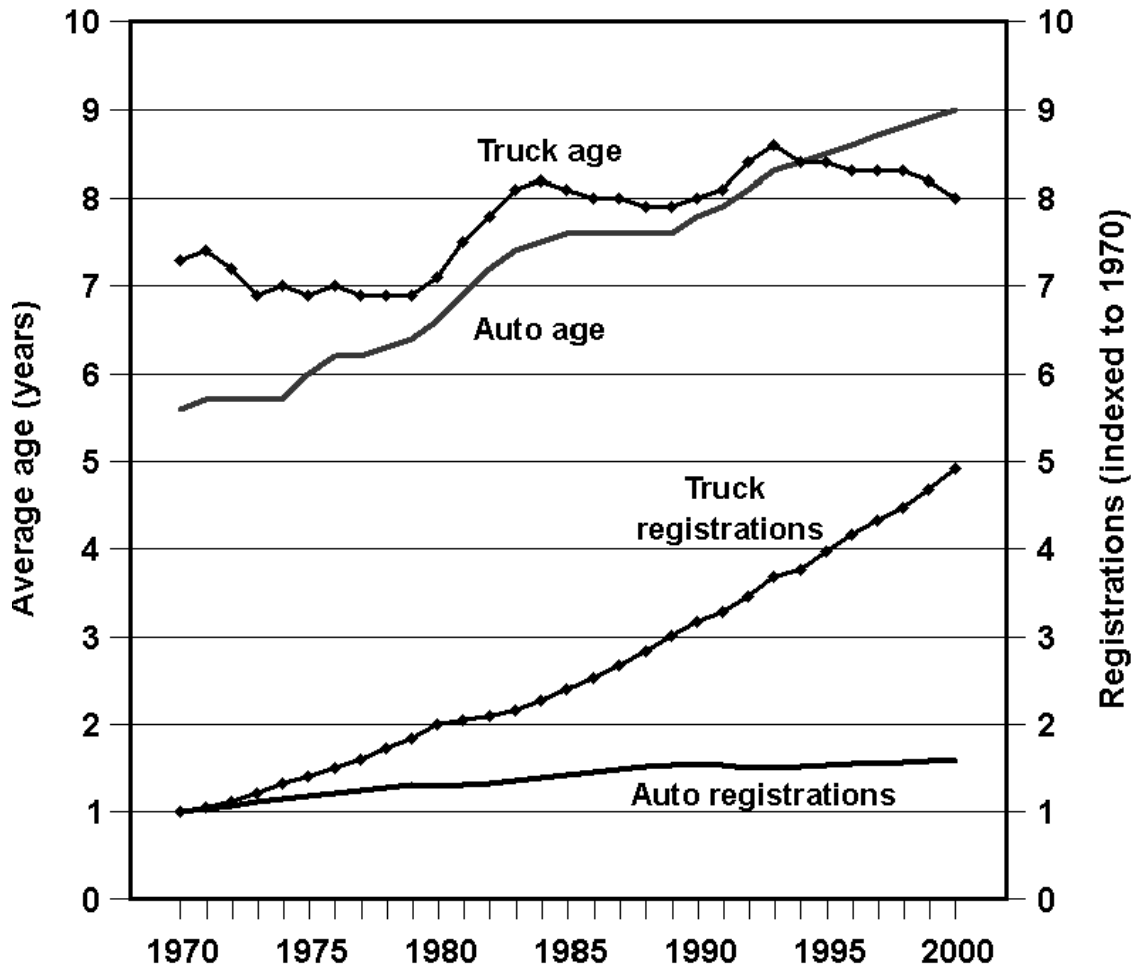
^aMean is the sum of the products of units multiplied by age, divided by the total units.

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



The average age of trucks (classes 1-8) has historically been higher than the average age of automobiles. In 1995, however, this trend reversed, with average automobile age higher than average truck age for the first time. The recent boom in the sales of minivans, sport-utility vehicles, and pick-ups, which are classified as trucks, is influencing the average age of trucks. So many new light trucks are being added into the truck population, that the average age of trucks has been declining since 1993, while the average age of automobiles continues an upward trend.

Figure 6.2. Average Age and Registrations of Automobiles and Trucks, 1970–2000



Source:
See Tables 6.3 and 6.8.



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 16.9 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 | 1.0 | 100.0 | 0.0 | 100.0 | 0.0 |
| 5 | 94.1 | 5.0 | 96.3 | 3.7 | 100.0 | 0.0 |
| 6 | 88.4 | 6.1 | 91.3 | 5.1 | 99.4 | 0.6 |
| 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 years | | 12.5 years | | 16.9 years | |

Source:

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

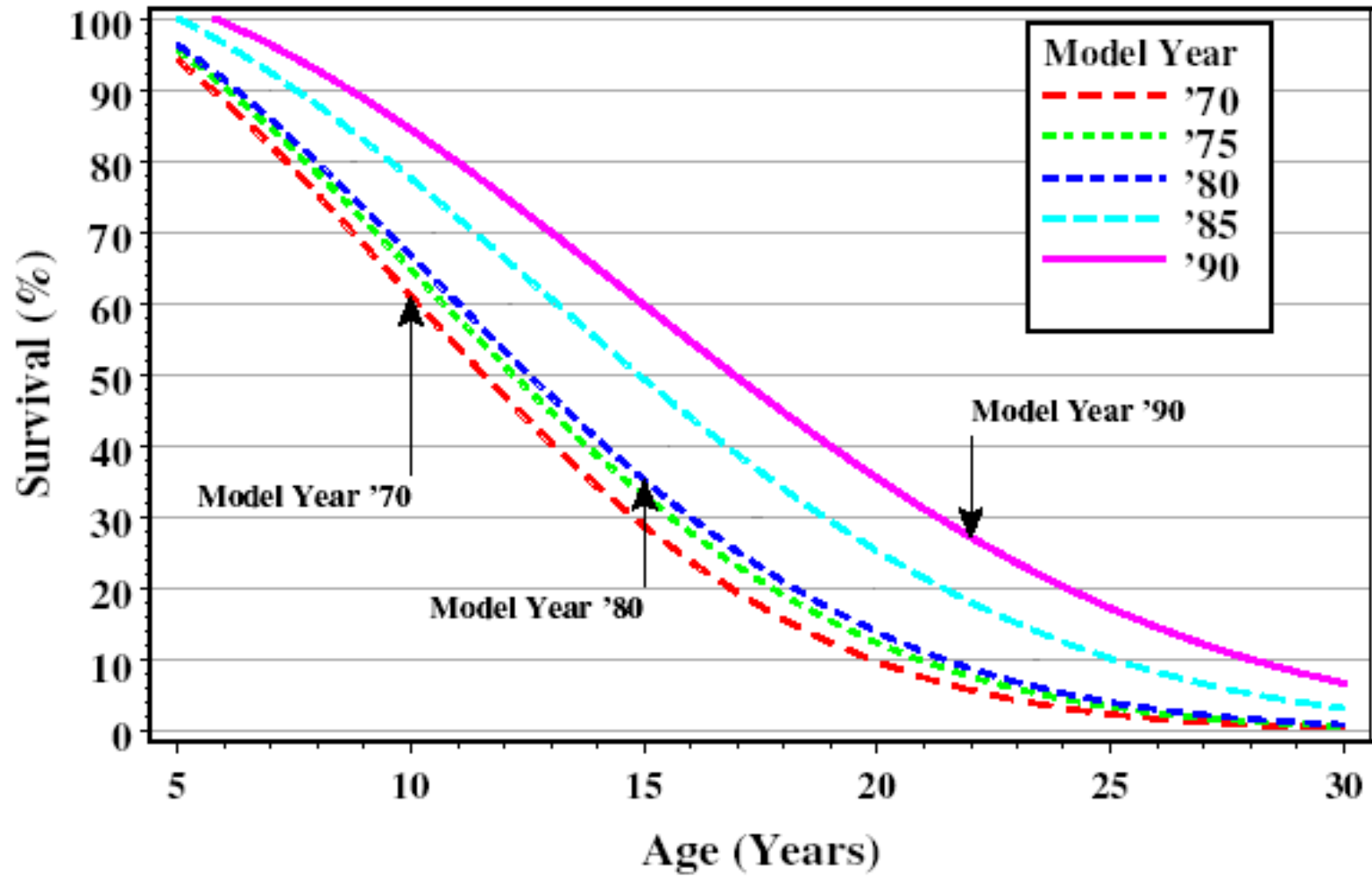
^aIt was assumed that scrappage for vehicles less than 4 years old is 0.

^bThe percentage of automobiles which will be in use at the end of the year.

^cThe percentage of automobiles which will be retired from use during the year.



Figure 6.3. Automobile Survival Rates



Source: See Table 6.9.



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 | 0.3 | 99.1 | 0.9 | 99.3 | 0.7 |
| 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 | 16.2 years | | 15.3 years | | 15.5 years | |

Source:

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

^aLight trucks are trucks less than 10,000 lbs. gross vehicle weight.

^bIt was assumed that scrappage for vehicles less than 4 years old is 0.

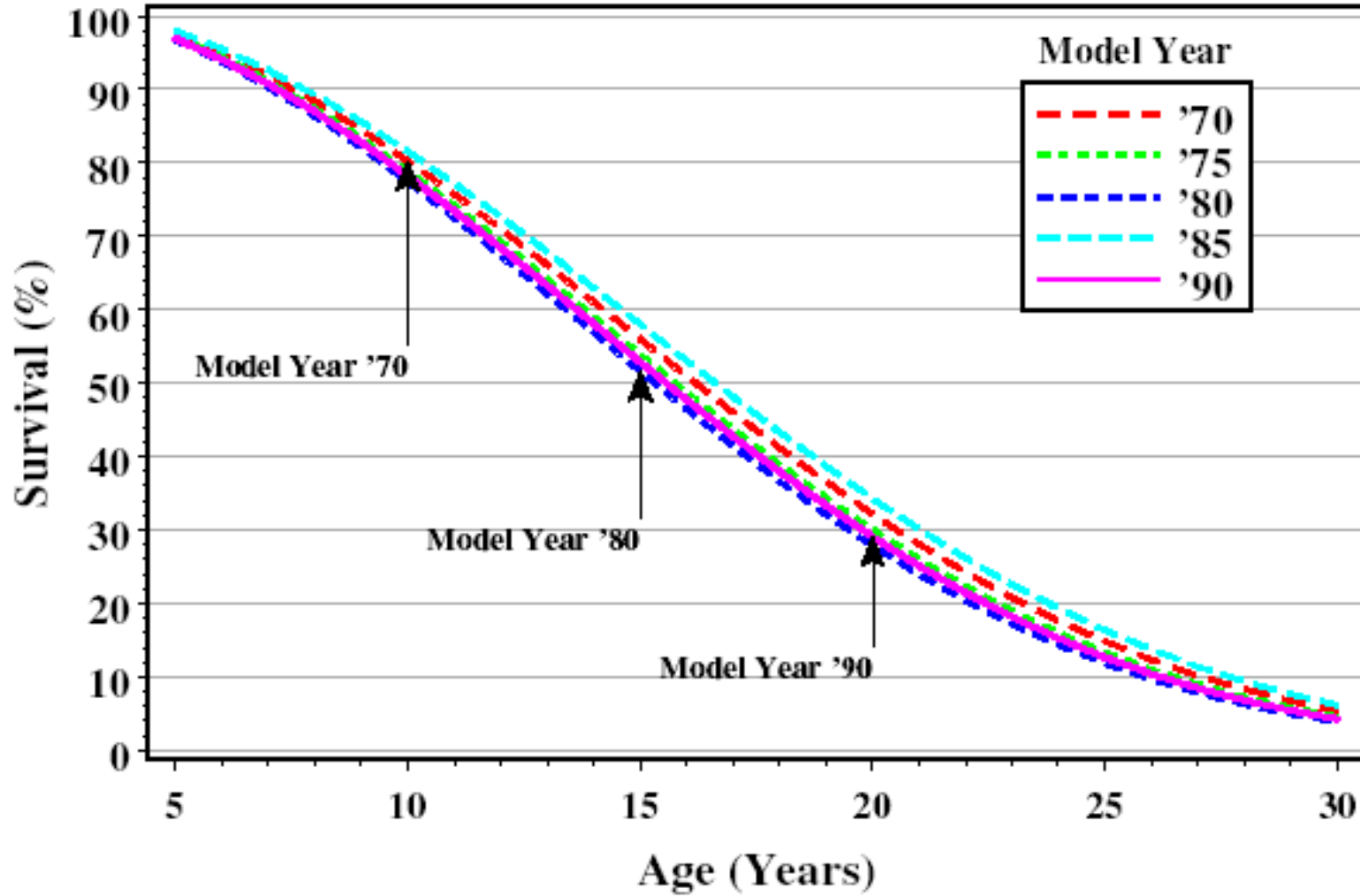
^cThe percentage of light trucks which will be in use at the end of the year.

^dThe percentage of light trucks which will be retired from use during the year.





Figure 6.4. Light Truck Survival Rates



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 26,000 lbs. gross vehicle weight) 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 | 20.0 years | | 18.5 years | | 28.0 years | |

Source:

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

^aHeavy trucks are trucks more than 26,000 lbs. gross vehicle weight.

^bIt was assumed that scrappage for vehicles less than 4 years old is 0.

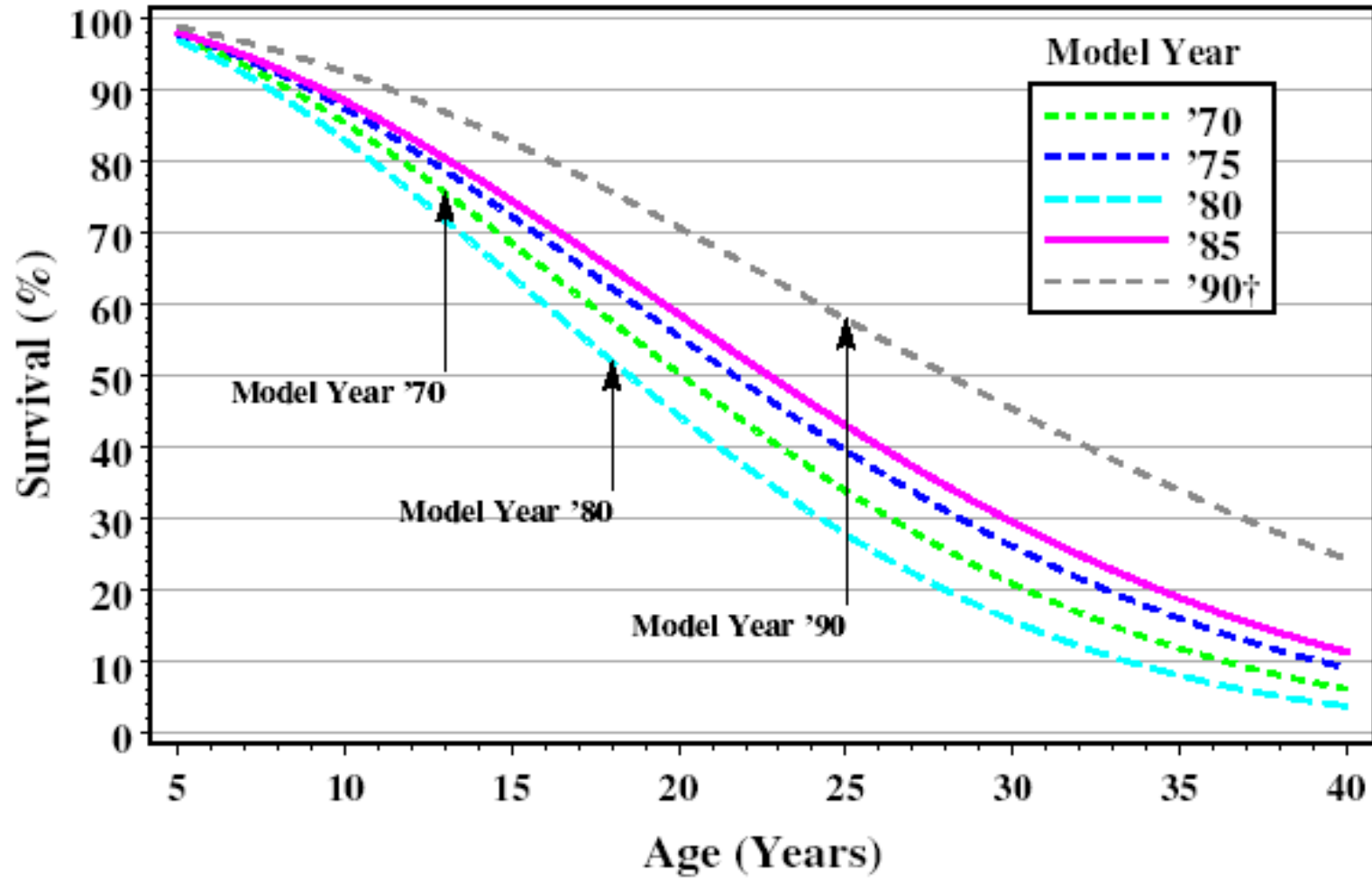
^cThe percentage of heavy trucks which will be in use at the end of the year.

^dThe percentage of heavy trucks which will be retired from use during the year.





Figure 6.5. Heavy Truck Survival Rates



Source: See Table 6.11.

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, 2000 | |
| | <i>Registrations (thousands)</i> | 133,621 |
| | <i>Vehicle miles (million miles)</i> | 1,601,914 |
| | <i>Fuel economy (miles per gallon)</i> | 22.0 |
| Table 7.2 | Two-axle, four-tire trucks, 2000 | |
| | <i>Registrations (thousands)</i> | 79,085 |
| | <i>Vehicle miles (million miles)</i> | 924,018 |
| | <i>Fuel economy (miles per gallon)</i> | 17.5 |
| Table 7.5 | Light truck share of total light vehicle sales | |
| | <i>1970 calendar year</i> | 14.8% |
| | <i>2001 calendar year</i> | 50.5% |
| Table 7.7 | Automobile sales, 2001 sales period | 8,307,985 |
| | <i>Minicompact</i> | 33,206 |
| | <i>Subcompact</i> | 922,287 |
| | <i>Compact</i> | 3,058,389 |
| | <i>Midsized</i> | 2,669,116 |
| | <i>Large</i> | 1,506,890 |
| Table 7.8 | Light truck sales, 2001 sales period | 8,019,518 |
| | <i>Small pickup</i> | 819,033 |
| | <i>Large pickup</i> | 1,987,833 |
| | <i>Small van</i> | 1,050,952 |
| | <i>Large van</i> | 323,806 |
| | <i>Small SUV</i> | 894,788 |
| | <i>Medium SUV</i> | 2,158,012 |
| | <i>Large SUV</i> | 785,094 |
| Tables 7.18 and 7.19 | Corporate average fuel economy | (mpg) |
| | <i>Automobile standard, MY 2002</i> | 27.5 |
| | <i>Automobile fuel economy, MY 2002</i> | 28.8 |
| | <i>Light truck standard, MY 2002</i> | 20.7 |
| | <i>Light truck fuel economy, MY 2002</i> | 21.2 |
| Table 7.24 | 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, 1970–2000

| 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 | 1,569,100 | 73,283 | 21.4 |
| 2000 | 133,621 | 1,601,914 | 72,916 | 22.0 |
| <i>Average annual percentage change</i> | | | | |
| 1970–2000 | 1.4% | 1.9% | 0.2% | 1.6% |
| 1990–2000 | 0.0% | 1.3% | 0.5% | 0.9% |

Source:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2000*, Washington, DC, 2001, Table VM-1, p. V-50, 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, 1970–2000

| 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 | 901,022 | 52,859 | 17.0 |
| 2000 | 79,085 | 924,018 | 52,832 | 17.5 |
| | | <i>Average annual percentage change</i> | | |
| 1970–2000 | 5.9% | 6.9% | 5.0% | 1.9% |
| 1990–2000 | 5.1% | 4.9% | 4.0% | 0.8% |

Source:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2000*, Washington, DC, 2001, Table VM-1, p. V-50, 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.



Because data on Class 2b trucks are scarce, the U.S. DOE funded a study to investigate available sources of data. In the final report, four methodologies are described to estimate the sales of Class 2b trucks.

Table 7.3
Summary Statistics on Class 1, Class 2a, and Class 2b Light Trucks

| | CY 1999 truck sales (millions) | MY 2000 truck population (millions) | Percent diesel trucks in population | Average age (years) | Estimated annual miles ^a (billions) | Estimated fuel use (billion ^a gallons) |
|----------|---|--|--|---------------------------|---|--|
| Class 1 | 5.7 | 49.7 | 0.3% | 7.3 | 672.7 | 37.4 |
| Class 2a | 1.8 | 19.2 | 2.5% | 7.4 | 251.9 | 18.0 |
| Class 2b | 0.5 | 5.8 | 24.0% | 8.6 | 76.7 | 5.5 |

Source: Davis, S.C. and L.F. Truett, *Investigation of Class 2b Trucks (Vehicles of 8,500 to 10,000 lbs GVWR)*, ORNL/TM-2002/49, March 2002, Table 16.

Note: CY - calendar year. MY - model year.

Table 7.4
Sales Estimates of Class 1, Class 2a, and Class 2b Light Trucks, 1989–1999

| Calendar Year | Sales estimates (thousands) | | | Total |
|---------------|-------------------------------------|-----------------------------------|-------------------------------------|-------|
| | Class 1 (6,000 lbs and under) | Class 2a (6,001- 8,500 lbs) | Class 2b (8,5001- 10,000 lbs) | |
| 1989 | 3,313 | 918 | 379 | 4,610 |
| 1990 | 3,451 | 829 | 268 | 4,548 |
| 1991 | 3,246 | 670 | 206 | 4,122 |
| 1992 | 3,608 | 827 | 194 | 4,629 |
| 1993 | 4,119 | 975 | 257 | 5,351 |
| 1994 | 4,527 | 1,241 | 265 | 6,033 |
| 1995 | 4,422 | 1,304 | 327 | 6,053 |
| 1996 | 4,829 | 1,356 | 334 | 6,519 |
| 1997 | 5,085 | 1,315 | 397 | 6,797 |
| 1998 | 5,263 | 1,694 | 342 | 7,299 |
| 1999 | 5,707 | 1,845 | 521 | 8,073 |
| | <i>Percent change</i> | | | |
| 1989–1999 | 72.3% | 101.0% | 37.5% | 75.1% |

Source: Davis, S.C. and L.F. Truett, *Investigation of Class 2b Trucks (Vehicles of 8,500 to 10,000 lbs GVWR)*, ORNL/TM-2002/49, March 2002, Table 1.

Note: These data were calculated using Methodology 4 from the report.

^aEstimates derived using 2000 population data and 1997 usage data. See source for details.



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

Table 7.5
New Retail Automobile Sales in the United States, 1970–2001

| Calendar year | Domestic ^a | Import ^b | Total | Percentage imports | Percentage transplants ^c on model year basis | Percentage imports and transplants | Percentage diesel |
|---|-----------------------|---------------------|--------|--------------------|---|------------------------------------|-------------------|
| | (thousands) | | | | | | |
| 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% |
| 2001 | 6,325 | 2,098 | 8,423 | 24.9% | 26.0% | 50.9% | 0.18% |
| <i>Average annual percentage change</i> | | | | | | | |
| 1970–2001 | -0.4% | 1.6% | 0.0% | | | | |
| 1991–2001 | 0.3% | 0.3% | 0.3% | | | | |

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*. 1998–2001: 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, 2002, p. 52, and annual. Transplant data - Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares Data System, Oak Ridge, TN, 2002. (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 7.6
New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970–2001

| Calendar year | Light truck sales ^a (thousands) | Percentages | | | | | Light trucks of light-duty vehicle sales ^e | Light trucks of total truck sales |
|---|--|---------------------|--------------------------|---------------------|--|-------|---|-----------------------------------|
| | | Import ^b | Transplants ^c | Diesel ^d | Four-wheel drive of domestic light trucks ^d | | | |
| 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% | |
| 2001 | 8,598 | 10.0% | 12.8% | 5.3% | 42.2% | 50.5% | 95.0% | |
| <i>Average annual percentage change</i> | | | | | | | | |
| 1970–2001 | 5.9% | | | | | | | |
| 1991–2001 | 7.6% | | | | | | | |

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 (17.2 mpg) to 1990 (27.6 mpg), but has remained fairly constant since then.

Table 7.7
Period Sales, Market Shares, and Sales-Weighted Fuel Economies
of New Domestic and Import Automobiles, Selected Sales Periods^a 1976–2001

| Sales Period ^a | 1976 | 1980 | 1985 | 1990 | 1995 | 2000 | 2001 |
|---------------------------|-----------|-----------|------------|-----------|-----------|-----------|-----------|
| MINICOMPACT | | | | | | | |
| Total sales, units | – | 428,346 | 52,295 | 76,698 | 44,752 | 19,245 | 33,206 |
| Market share, % | – | 4.7 | 0.5 | 0.8 | 0.5 | 0.2 | 0.4 |
| Fuel economy, mpg | – | 29.4 | 32.7 | 26.4 | 27.0 | 25.6 | 24.6 |
| SUBCOMPACT | | | | | | | |
| Total sales, units | 2,625,929 | 3,441,480 | 2,382,339 | 2,030,226 | 1,518,209 | 1,789,350 | 922,287 |
| Market share, % | 27.1 | 37.8 | 21.7 | 22.0 | 17.4 | 19.9 | 11.1 |
| Fuel economy, mpg | 23.5 | 27.3 | 30.1 | 31.3 | 31.7 | 31.1 | 29.6 |
| COMPACT | | | | | | | |
| Total sales, units | 2,839,603 | 599,423 | 3,526,118 | 3,156,481 | 3,289,735 | 2,397,813 | 3,058,389 |
| Market share, % | 29.3 | 6.6 | 32.1 | 34.2 | 37.7 | 26.7 | 36.8 |
| Fuel economy, mpg | 17.1 | 22.3 | 29.6 | 28.9 | 30.2 | 30.4 | 31.3 |
| MIDSIZE | | | | | | | |
| Total sales, units | 1,815,505 | 3,073,103 | 3,117,817 | 2,511,503 | 2,498,521 | 3,352,198 | 2,669,116 |
| Market share, % | 18.7 | 33.8 | 28.4 | 27.2 | 28.6 | 37.3 | 32.1 |
| Fuel economy, mpg | 15.3 | 21.3 | 24.9 | 25.9 | 25.9 | 26.8 | 27.2 |
| LARGE | | | | | | | |
| Total sales, units | 2,206,102 | 1,336,190 | 1,516,249 | 1,279,092 | 1,320,608 | 1,297,237 | 1,506,890 |
| Market share, % | 22.8 | 14.7 | 13.8 | 13.9 | 15.1 | 14.4 | 18.1 |
| Fuel economy, mpg | 13.9 | 19.3 | 22.3 | 23.5 | 24.1 | 25.3 | 25.4 |
| TWO SEATER | | | | | | | |
| Total sales, units | 199,716 | 215,964 | 373,697 | 170,465 | 53,045 | 122,259 | 118,097 |
| Market share, % | 2.1 | 2.4 | 3.4 | 1.8 | 0.6 | 1.4 | 1.4 |
| Fuel economy, mpg | 20.1 | 21.0 | 27.6 | 28.0 | 24.7 | 25.8 | 26.5 |
| TOTAL | | | | | | | |
| Total sales, units | 9,686,855 | 9,094,506 | 10,968,515 | 9,224,465 | 8,724,870 | 8,978,102 | 8,307,985 |
| Market share, % | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Fuel economy, mpg | 17.2 | 23.2 | 27.0 | 27.6 | 28.0 | 28.2 | 28.5 |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2002.
 (Additional resources: www.cta.ornl.gov)

^a Sales period is October 1 of the previous year through September 30 of the current 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 2001. 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 7.8
Period Sales, Market Shares, and Sales-Weighted Fuel Economies
of New Domestic and Import Light Trucks, Selected Sales Periods^a 1976–2001

| Sales Period ^a | 1976 | 1980 | 1985 | 1990 | 1995 | 2000 | 2001 |
|---------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| SMALL PICKUP | | | | | | | |
| Total sales, units | 170,351 | 516,412 | 863,584 | 1,135,727 | 1,067,764 | 1,071,730 | 819,033 |
| Market share, % | 7.1 | 23.3 | 20.4 | 25.2 | 18.0 | 12.9 | 10.2 |
| Fuel economy, mpg | 23.9 | 25.5 | 26.8 | 24.5 | 24.4 | 22.0 | 21.3 |
| LARGE PICKUP | | | | | | | |
| Total sales, units | 1,586,020 | 1,115,248 | 1,690,931 | 1,116,490 | 1,472,885 | 1,968,710 | 1,987,833 |
| Market share, % | 65.8 | 50.3 | 39.9 | 24.7 | 24.8 | 23.7 | 24.8 |
| Fuel economy, mpg | 15.1 | 17.0 | 19.0 | 17.5 | 17.8 | 18.7 | 19.0 |
| SMALL VAN | | | | | | | |
| Total sales, units | 18,651 | 13,649 | 437,660 | 1,012,141 | 1,330,586 | 1,272,070 | 1,050,952 |
| Market share, % | 0.8 | 0.6 | 10.3 | 22.4 | 22.4 | 15.3 | 13.1 |
| Fuel economy, mpg | 19.5 | 19.6 | 23.9 | 22.3 | 22.4 | 23.0 | 23.1 |
| LARGE VAN | | | | | | | |
| Total sales, units | 574,745 | 328,065 | 536,242 | 319,429 | 327,586 | 368,820 | 323,806 |
| Market share, % | 23.9 | 14.8 | 12.7 | 7.1 | 5.5 | 4.4 | 4.0 |
| Fuel economy, mpg | 15.4 | 16.3 | 16.4 | 17.1 | 17.2 | 18.2 | 18.3 |
| SMALL SUV | | | | | | | |
| Total sales, units | 0 | 51,684 | 441,966 | 402,354 | 509,737 | 756,142 | 894,788 |
| Market share, % | 0.0 | 2.3 | 10.4 | 8.9 | 8.6 | 9.1 | 11.2 |
| Fuel economy, mpg | | 17.7 | 22.1 | 22.5 | 22.0 | 23.8 | 24.3 |
| MEDIUM SUV | | | | | | | |
| Total sales, units | 50,763 | 151,929 | 187,447 | 434,491 | 1,076,686 | 2,167,329 | 2,158,012 |
| Market share, % | 2.1 | 6.9 | 4.4 | 9.6 | 18.1 | 26.1 | 26.9 |
| Fuel economy, mpg | 15.1 | 14.9 | 17.2 | 19.7 | 19.2 | 20.4 | 20.7 |
| LARGE SUV | | | | | | | |
| Total sales, units | 9,228 | 39,550 | 77,535 | 93,993 | 148,622 | 702,152 | 785,094 |
| Market share, % | 0.4 | 1.8 | 1.8 | 2.1 | 2.5 | 8.5 | 9.8 |
| Fuel economy, mpg | 14.2 | 13.7 | 17.1 | 16.5 | 16.1 | 17.5 | 17.6 |
| TOTAL | | | | | | | |
| Total sales, units | 2,409,758 | 2,216,537 | 4,235,365 | 4,514,625 | 5,933,866 | 8,306,953 | 8,019,518 |
| Market share, % | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Fuel economy, mpg | 15.6 | 18.1 | 20.4 | 20.5 | 20.2 | 20.4 | 20.5 |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2002.
 (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 previous year through September 30 of the current 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 7.9
Light Vehicle Market Shares by Size Class, Sales Periods^a 1976–2001

| Sales period ^a | 1976 | 1980 | 1985 | 1990 | 1995 | 2000 | 2001 |
|---------------------------|------------|------------|------------|------------|------------|------------|------------|
| Minicompact | 0.0% | 3.8% | 0.3% | 0.6% | 0.3% | 0.1% | 0.2% |
| Subcompact | 21.7% | 30.4% | 15.7% | 14.8% | 10.4% | 10.4% | 5.6% |
| Compact | 23.5% | 5.3% | 23.2% | 23.0% | 22.4% | 13.9% | 18.7% |
| Midsized | 15.0% | 27.2% | 20.5% | 18.3% | 17.0% | 19.4% | 16.3% |
| Large | 18.2% | 11.8% | 10.0% | 9.3% | 9.0% | 7.5% | 9.2% |
| Two seater | 1.7% | 1.9% | 2.5% | 1.2% | 0.4% | 0.7% | 0.7% |
| Small pickup | 1.4% | 4.6% | 5.7% | 8.3% | 7.3% | 6.2% | 5.0% |
| Large pickup | 13.1% | 9.9% | 11.1% | 8.1% | 10.0% | 11.4% | 12.2% |
| Small van | 0.2% | 0.1% | 2.9% | 7.4% | 8.6% | 7.4% | 6.4% |
| Large van | 4.8% | 2.9% | 3.5% | 2.3% | 9.1% | 2.1% | 2.0% |
| Small utility | 0.0% | 0.5% | 2.9% | 2.9% | 3.5% | 4.4% | 5.5% |
| Medium utility | 0.4% | 1.3% | 1.2% | 3.2% | 7.3% | 12.5% | 13.2% |
| Large utility | 0.1% | 0.3% | 0.5% | 0.7% | 1.0% | 4.1% | 4.8% |
| Total light vehicles sold | 12,096,613 | 11,311,043 | 15,203,880 | 13,739,090 | 14,658,736 | 17,285,055 | 16,327,503 |
| Cars | 80.1% | 80.4% | 72.1% | 67.1% | 59.5% | 51.9% | 50.9% |
| Light trucks | 19.9% | 19.6% | 27.9% | 32.9% | 40.5% | 48.1% | 49.1% |

Source:

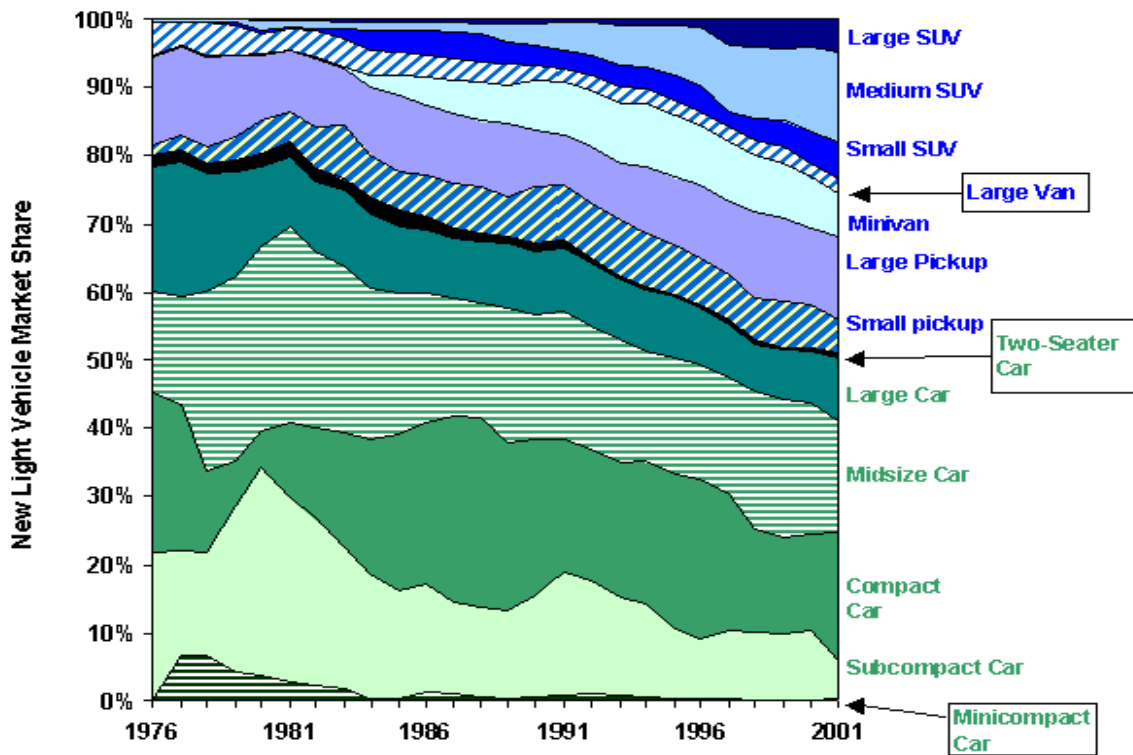
Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2002.
(Additional resources: www-cta.ornl.gov)

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



This graph shows the emergence of the mini-van in the early 1980's and the rising popularity of sport utility vehicles in the 1990's.

Figure 7.1. Light Vehicle Market Shares, Sales Periods 1976–2001



Source:
See Table 7.9



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

Table 7.10
Sales-Weighted Engine Size of New Domestic and Import Automobiles by Size Class,
Sales Periods^a 1976–2001
(liters^b)

| Sales period ^a | Minicompact | Subcompact | Compact | Midsize | Large | Two seater | Fleet |
|---|-------------------|------------|---------|---------|-------|------------|-------|
| 1976 | | 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 |
| 2001 | 3.01 | 2.66 | 2.16 | 2.85 | 3.69 | 3.48 | 2.74 |
| <i>Average annual percentage change</i> | | | | | | | |
| 1976–2001 | 1.1% ^d | 0.0% | -3.3% | -2.8% | -2.4% | 0.7% | -2.3% |
| 1991–2001 | 3.3% | 3.0% | -0.3% | -1.0% | -1.7% | 2.7% | 0.1% |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2002.

(Additional resources: www-cta.ornl.gov)

^a Sales period is October 1 of the previous year through September 30 of the current 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 7.11
Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class
Sales Periods^a 1976–2001
(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 | ^c | 4.21 | 5.74 | 4.18 |
| 1977 | 1.95 | 4.41 | 1.97 | 4.37 | ^c | 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 |
| 2001 | 3.50 | 4.79 | 3.59 | 4.96 | 2.70 | 3.84 | 5.13 | 4.05 |
| | <i>Average annual percentage change</i> | | | | | | | |
| 1976–2001 | 2.4% | 0.3% | 2.4% | 0.6% | ^c | -0.4% | -0.4% | -0.1% |
| 1991–2001 | 1.8% | -0.9% | 0.7% | -0.6% | -2.8% | 0.0% | -0.6% | 0.3% |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2002. (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 previous year through September 30 of the current 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 7.12
Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class,
Sales Periods^a 1976–2001
(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 |
| 2001 | 3,332 | 2,803 | 2,720 | 3,197 | 3,606 | 2,849 | 3,047 |
| | <i>Average annual percentage change</i> | | | | | | |
| 1976–2001 | 1.7% ^c | 0.3% | -1.1% | -0.9% | -0.9% | 0.3% | -0.7% |
| 1991–2001 | 2.6% | 1.5% | 0.3% | 0.4% | 0.1% | 0.5% | 0.7% |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2002.
 (Additional resources: www-cta.ornl.gov)

^a Sales period is October 1 of the previous year through September 30 of the current 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 automobiles over the last two decades, but has increased for subcompact autos and decreased for compact and large autos.

Table 7.13
Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class,
Sales Periods^a 1976–2001
(cubic feet)

| Sales period ^d | 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 |
| 2001 | 78.2 | 94.6 | 103.2 | 113.5 | 125.2 | 109.4 |
| <i>Average annual percentage change</i> | | | | | | |
| 1977–2001 | 0.0% | 0.2% | -0.2% | 0.0% | -0.1% | 0.1% |
| 1991–2001 | -0.2% | 0.0% | 0.0% | 0.0% | -0.2% | 0.0% |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2002.
 (Additional resources: www-cta.ornl.gov)

^a Sales period is October 1 of the previous year through September 30 of the current year.

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



The sales-weighted wheelbase of new automobiles and light trucks (combined) has been rising in the 1990's, but has been declining in this decade.

Table 7.14
Sales-Weighted Wheelbase of New
Automobiles and Light Trucks, Sales Periods^a 1976–2001
(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 |
| 2001 | 105.66 | 113.04 | 109.64 |
| <i>Average annual percentage change</i> | | | |
| 1976–2001 | -0.2% | -0.2% | -0.1% |
| 1991–2001 | 0.2% | 0.2% | 0.4% |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2002.
 (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 7.15
Average Material Consumption for a Domestic Automobile,
1978, 1985, and 2001

| Material | 1978 | | 1985 | | 2001 | |
|---------------------------------|---------|------------|---------|------------|---------|------------|
| | 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 2000 was 774 vehicles per dealer – more than double the 1970 number.

Table 7.16
New Light Vehicle Dealerships and Sales, 1970–2000

| 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 | 748 |
| 2000 | 22,250 | 17,234 | 774 |
| <i>Average annual percentage change</i> | | | |
| 1970–2000 | -1.1% | 1.9% | 3.0% |
| 1990–2000 | -1.1% | 2.2% | 3.3% |

Source:

Number of dealers - National Automobile Dealers Association, *Automotive Executive Magazine*, 2001. (Additional resources: www.nada.org)
Light-duty vehicle sales - See tables 7.5 and 7.6.

^aAs 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 2000, there were 0.82 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 7.17
Conventional and Alternative Fuel Refueling Stations

| Year | Number of retail outlets | Vehicles | Stations per thousand vehicles |
|-------------------------|--------------------------|--------------------------|--------------------------------|
| | | in operation (thousands) | |
| Conventional fuels | | | |
| 1993 | 207,416 | 186,315 | 1.11 |
| 1994 | 202,878 | 188,714 | 1.08 |
| 1995 | 195,455 | 193,441 | 1.01 |
| 1996 | 190,246 | 198,294 | 0.96 |
| 1997 | 187,892 | 201,071 | 0.93 |
| 1998 | 182,596 | 205,043 | 0.89 |
| 1999 | 180,567 | 209,509 | 0.86 |
| 2000 | 175,341 | 213,300 | 0.82 |
| 2001 | 175,132 | 216,683 | 0.81 |
| Alternative fuels, 2001 | | | |
| LPG | 3,403 | 269 | 12.65 |
| CNG | 1,232 | 110 | 11.20 |
| Electricity | 693 | 10 | 69.30 |
| M85/M100 | 0 | 17 | 0.00 |
| LNG | 44 | 2 | 22.00 |
| E85/E95 | 154 | 48 | 3.21 |
| Total | 5,526 | 456 | 12.12 |

Source:

Conventional refueling stations: National Petroleum News Survey, 2001.

Alternative fuel refueling stations: Alternative Fuels Data Center, www.afdc.doe.gov.

Conventional vehicles: The Polk Company, Detroit, MI, FURTHER REPRODUCTION PROHIBITED.

Alternative fuels vehicles: U.S. Department of Energy, Energy Information Administration, Alternatives to Traditional Transportation Fuels web site, www.eia.doe.gov/cneaf/alternate/page/datatables/atf01-13_00.html

Note:

The County Business Patterns (CBP) data published by the Bureau of the Census tells the number of establishments by North American Industry Classification System (NAICS). NAICS is an industry classification system that groups establishments into industries based on the activities in which they are primarily engaged. NAICS 447 represents gasoline stations. However, the CBP gasoline station data differ from the National Petroleum News Survey data; the CBP may not include every gasoline retail outlet due to the classification of the primary activity of the business.



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 7.18
Automobile Corporate Average Fuel Economy (CAFE)
Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2002^a
(miles per gallon)

| Model year ^b | CAFE standards | Automobiles | | | CAFE estimates |
|-------------------------|----------------|-----------------------------|--------|----------|---------------------------------|
| | | 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 | 28.7 | 28.3 | 28.5 | 24.8 |
| 2001 | 27.5 | 28.8 | 28.4 | 28.6 | 24.4 |
| 2002 | 27.5 | 29.1 | 28.5 | 28.8 | 24.5 |

Source:

U.S. Department of Transportation, NHTSA, "Summary of Fuel Economy Performance," Washington, DC, March 2002. (Additional resources: www.nhtsa.dot.gov)

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

^bModel year as determined by the manufacturer on a vehicle by vehicle basis.

^cAll 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 7.19
Light Truck Corporate Average Fuel Economy (CAFE)
Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2002^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 | | | | 20.1 |
| 1980 | e | 17.7 | 20.8 | 18.2 | 20.1 |
| 1981 | e | 16.8 | 24.3 | 18.5 | 23.1 |
| 1982 | 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 | 21.3 | 24.8 |
| 2001 | 20.7 | f | f | 20.9 | 24.4 |
| 2002 | 20.7 | f | f | 21.2 | 24.5 |

Source:

U.S. Department of Transportation, NHTSA, "Summary of Fuel Economy Performance," Washington, DC, March 2002. (Additional resources: www.nhtsa.dot.gov)

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

^bModel year as determined by the manufacturer on a vehicle by vehicle basis.

^cRepresents 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.

^dAll CAFE calculations are sales-weighted.

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

^fData are not available.



Manufacturers of autos and light trucks whose vehicles do not meet the CAFE standards are fined. Data from the National Highway Traffic Safety Administration show that \$32 million was collected from the manufacturers in 2000.

Table 7.20
Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-2000^a
(thousands)

| Model year | Current dollars | 2000 constant dollars ^b |
|------------|-----------------|------------------------------------|
| 1983 | 58 | 100 |
| 1984 | 5,958 | 9,875 |
| 1985 | 15,565 | 24,910 |
| 1986 | 29,872 | 46,934 |
| 1987 | 31,261 | 47,387 |
| 1988 | 44,519 | 64,803 |
| 1989 | 47,381 | 65,798 |
| 1990 | 48,449 | 63,833 |
| 1991 | 42,243 | 53,409 |
| 1992 | 38,287 | 46,992 |
| 1993 | 28,688 | 34,187 |
| 1994 | 31,478 | 36,576 |
| 1995 | 40,788 | 46,087 |
| 1996 | 19,302 | 21,184 |
| 1997 | 36,211 | 38,851 |
| 1998 | 21,740 | 22,967 |
| 1999 | 27,516 | 28,441 |
| 2000 | 32,064 | 32,064 |

Source:

U.S. Department of Transportation, National Highway Traffic Safety Administration, Office of Vehicle Safety Compliance, Washington, DC, January 2002.

(Additional resources: www.nhtsa.dot.gov)

^a These are fines which are actually collected. Fines which are assessed in 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 7.21
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)



Consumers continue to demand gas guzzling automobiles. The IRS collected nearly \$71 million in 2000 from those buying autos with fuel economy less than 22.5 miles per gallon. This tax does not apply to light trucks such as pickups, minivans, sport utility vehicles, and vans.

Table 7.22
Tax Receipts from the Sale of Gas Guzzlers, 1980–2000
(thousands)

| Model year | Current dollars | 2000 constant dollars ^a |
|------------|-----------------|------------------------------------|
| 1980 | 740 | 1,546 |
| 1981 | 780 | 1,478 |
| 1982 | 1,720 | 3,069 |
| 1983 | 4,020 | 6,950 |
| 1984 | 8,820 | 14,618 |
| 1985 | 39,790 | 63,679 |
| 1986 | 147,660 | 231,999 |
| 1987 | 145,900 | 221,162 |
| 1988 | 116,780 | 169,987 |
| 1989 | 109,640 | 152,258 |
| 1990 | 103,200 | 135,968 |
| 1991 | 118,400 | 149,695 |
| 1992 | 144,200 | 176,987 |
| 1993 | 111,600 | 132,993 |
| 1994 | 64,100 | 74,481 |
| 1995 | 73,500 | 83,049 |
| 1996 | 52,600 | 57,729 |
| 1997 | 48,200 | 51,714 |
| 1998 | 47,700 | 50,392 |
| 1999 | 68,300 | 70,596 |
| 2000 | 70,800 | 70,800 |

Source:

Internal Revenue Service, Statistics of Income Bulletin, Summer 2001, Washington, DC, 2001.
(Additional resources: www.irs.gov/tax_stats).

^aAdjusted using the Consumer Price Inflation Index.



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 7.23
Vehicle Specifications for Vehicles Tested in the 1997 Study

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

Source:

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

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



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

Table 7.24
Fuel Economy by Speed, 1973, 1984, and 1997 Studies
(miles per gallon)

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

Source:

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

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

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

^aModel years 1970 and earlier automobiles.

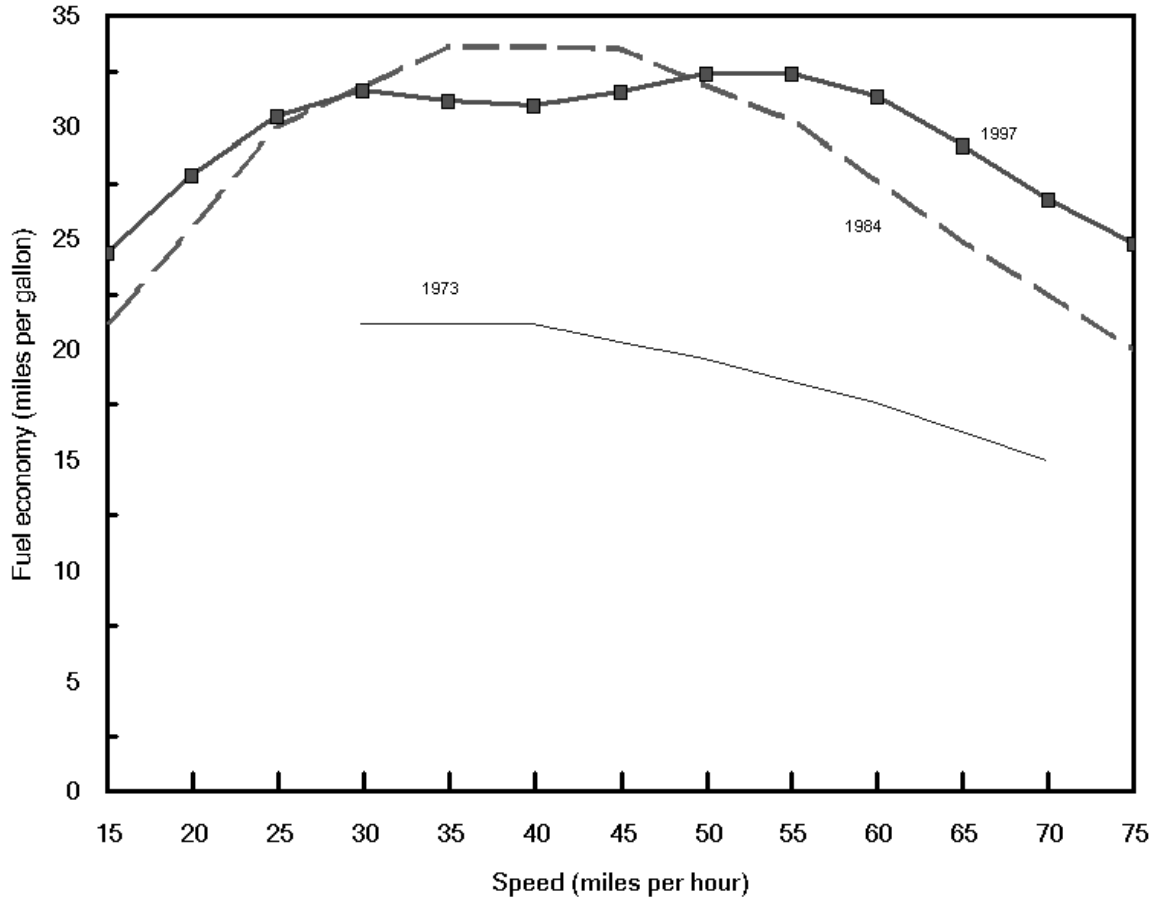
^bModel years 1981–84 automobiles and light trucks.

^cModel years 1988–97 automobiles and light trucks.

^dData are not available.



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



Source: See Table 7.23.



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 7.25
Steady Speed Fuel Economy for Vehicles Tested in the 1997 Study
(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 |
| <i>Fuel economy loss</i> | | | | | | | | | |
| 55-65 mph | 1.4% | 11.4% | 13.3% | 14.1% | 13.1% | 11.3% | 20.2% | 9.5% | -2.4% |
| 65-75 mph | 17.4% | 13.8% | 20.0% | 13.6% | 17.0% | 10.3% | 11.5% | 17.0% | 15.4% |
| 55-75 mph | 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

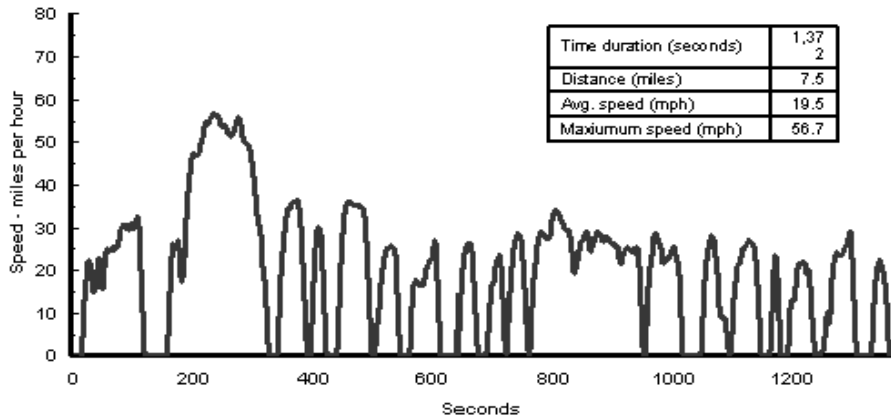
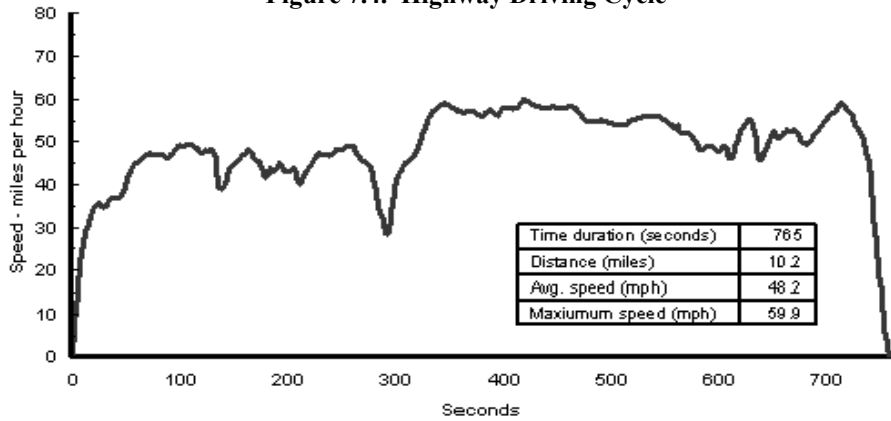


Figure 7.4. Highway Driving Cycle



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

Figure 7.5. New York City Driving Cycle

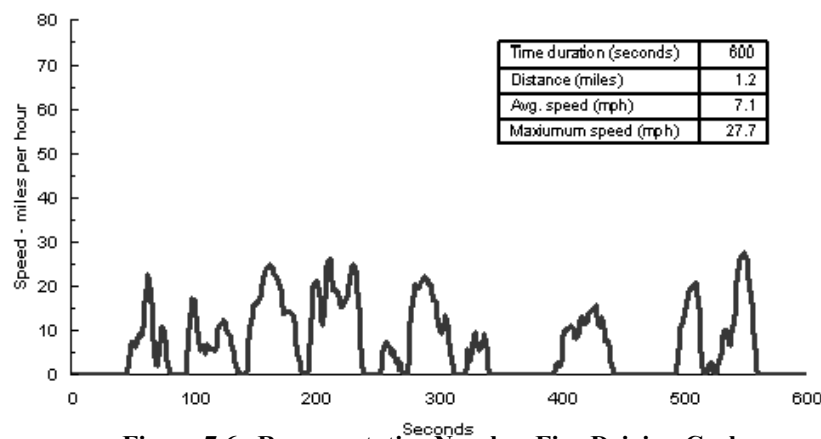
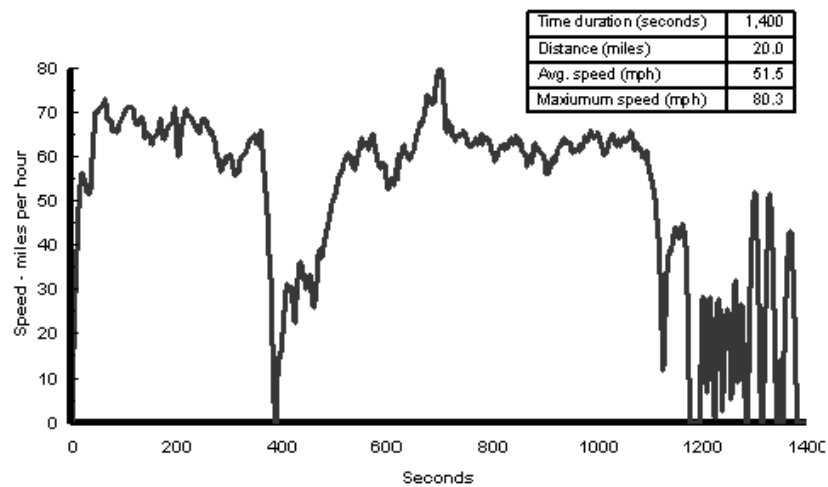


Figure 7.6. Representative Number Five Driving Cycle



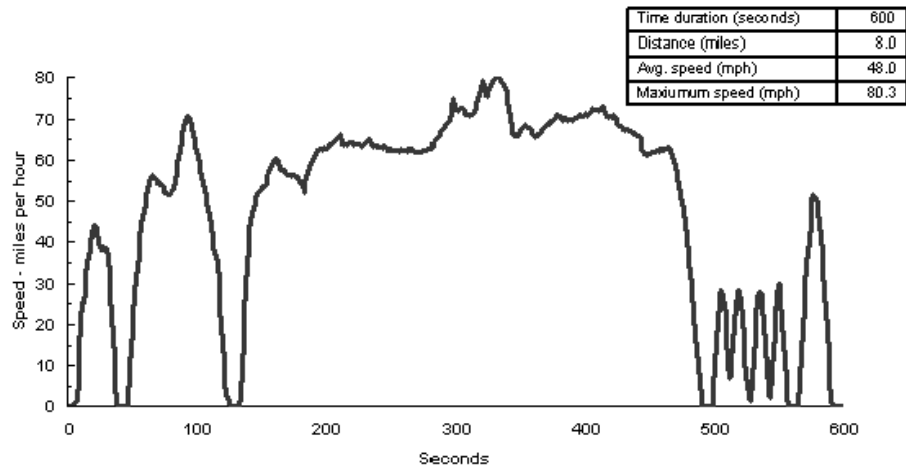
Source:

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.



Researchers at Argonne National Laboratory have estimated the fuel economy of a midsize car using driving cycles from different countries. These results illustrate the difference in fuel economy which can be obtained from the same vehicle using different test cycles.

Table 7.26
Projected Fuel Economies from U.S., European, and Japanese Driving Cycles

| Driving Cycle | Projected fuel economy for a 1995 composite midsize vehicle ^a |
|---|--|
| Japanese 10/15 mode test cycle | 17.5 mpg |
| New European Driving Cycle (NEDC) | 22.0 mpg |
| U.S. EPA city cycle (LA4) | 19.8 mpg |
| U.S. EPA highway cycle | 32.1 mpg |
| U.S. Corporate Average Fuel Economy cycle | 23.9 mpg |

Source:

Santini, D., A. Vyas, J. Anderson, and F. An, *Estimating Trade-Offs along the Path to the PNGV 3X Goal*, presented at the Transportation Research Board 80th Annual Meeting, Washington, DC, January 2001.

^aThe 1995 composite midsize vehicle is an average of a Chevrolet Lumina, Chrysler Concord, and Ford Taurus. The fuel economies were projected using the National Renewable Energy Laboratory's Advanced Vehicle Simulator (ADVISOR) model.



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, $1/\text{fuel economy} = (0.55/\text{city fuel economy}) + (0.45/\text{highway fuel economy})$]. Most vehicles will achieve higher fuel economy on the U.S. test cycle than on the European or Japanese cycles.

Table 7.27
Comparison of U.S., European, and Japanese Driving Cycles

| | Time (seconds) | Percent of time stopped or decelerating | Distance (miles) | Average speed (mph) | Maximum speed (mph) | Maximum acceleration (mph/s) |
|--|-------------------|---|---------------------|---------------------------|---------------------------|------------------------------------|
| Japanese 10/15 mode test cycle | 631 | 52.3 | 2.6 | 14.8 | 43.5 | 1.78 |
| New European Driving Cycle (NEDC) | 1,181 | 24.9 | 6.84 | 20.9 | 74.6 | 2.4 |
| U.S. EPA city cycle (LA4) ^a | 1,372 | 43.2 | 7.5 | 19.5 | 56.7 | 3.3 |
| U.S. EPA highway cycle | 765 | 9.3 | 17.8 | 48.2 | 59.9 | 3.3 |
| U.S. Corporate Average Fuel Economy cycle | 2,137 | 27.9 | 10.3 | 29.9 | 59.9 | 3.3 |

Source:

Santini, D., A. Vyas, J. Anderson, and F. An, *Estimating Trade-Offs along the Path to the PNGV 3X Goal*, presented at the Transportation Research Board 80th Annual Meeting, Washington, DC, January 2001.

^aThe 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.



Total traffic fatalities were lower in 2000 than in 1975. Thirteen percent of traffic fatalities in 2000 were not vehicle occupants (pedestrians, cyclists, etc.).

Table 7.28
Occupant Fatalities by Vehicle Type and Nonoccupant Fatalities, 1975–2000

| | 1975 | 1980 | 1985 | 1990 | 1995 | 1999 | 2000 | 2000 share |
|--|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Vehicle occupant fatalities by vehicle type | | | | | | | | |
| Passenger car | | | | | | | | |
| Subcompact | 3,834 | 7,299 | 7,993 | 8,309 | 6,791 | 4,930 | 4,718 | 11.3% |
| Compact | 614 | 927 | 2,635 | 5,310 | 6,899 | 6,967 | 6,933 | 16.6% |
| Intermediate | 1,869 | 3,878 | 4,391 | 4,849 | 4,666 | 4,743 | 5,131 | 12.3% |
| Full | 10,800 | 11,580 | 6,586 | 4,635 | 3,413 | 2,908 | 2,259 | 5.4% |
| Unknown | 8,812 | 3,765 | 1,607 | 989 | 654 | 1,270 | 1,451 | 3.5% |
| Total | 25,929 | 27,449 | 23,212 | 24,092 | 22,423 | 20,818 | 20,492 | 49.0% |
| Truck | | | | | | | | |
| Light | 4,856 | 7,486 | 7 | 8,601 | 9,568 | 11,243 | 11,418 | 27.3% |
| Large | 961 | 1,262 | 977 | 705 | 648 | 758 | 741 | 1.8% |
| Total | 5,817 | 8,748 | 7,666 | 9,306 | 10,216 | 12,001 | 12,159 | 29.1% |
| Other Vehicles | | | | | | | | |
| Motorcycle | 3,189 | 5,144 | 4,564 | 3,244 | 2,227 | 2,472 | 2,862 | 6.8% |
| Bus | 53 | 46 | 57 | 32 | 33 | 58 | 22 | 0.1% |
| Other/unknown vehicle type | 937 | 540 | 544 | 460 | 392 | 457 | 714 | 1.7% |
| Total | 4,179 | 5,730 | 5,165 | 3,736 | 2,652 | 2,987 | 3,598 | 8.6% |
| TOTAL vehicle occupant fatalities | 35,925 | 41,927 | 36,043 | 37,134 | 35,291 | 35,806 | 36,249 | 86.7% |
| Nonoccupant fatalities | | | | | | | | |
| Pedestrian | 7,516 | 8,070 | 6,808 | 6,482 | 5,584 | 4,906 | 4,739 | 11.3% |
| Pedalcyclist | 1,003 | 965 | 890 | 859 | 833 | 750 | 690 | 1.6% |
| Other | 81 | 129 | 84 | 124 | 109 | 149 | 143 | 0.3% |
| Total | 8,600 | 9,164 | 7,782 | 7,465 | 6,526 | 5,805 | 5,572 | 13.3% |
| TOTAL traffic fatalities | 44,525 | 51,091 | 43,825 | 44,599 | 41,817 | 41,611 | 41,821 | 100.0% |

Source:

Traffic Safety Facts 2000, Washington, DC, December 2001, pp. 18 and 110. (Additional resources: www.nhtsa.dot.gov)



In 2000, 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 (130).

Table 7.29
Light Vehicle Occupant Safety Data, 1975–2000

| | 1975 | 1980 | 1985 | 1990 | 1995 | 1999 | 2000 |
|---------------------------------------|--------------|--------------|--------------|--------|--------|--------|--------|
| Passenger cars | | | | | | | |
| Fatalities | 25,929 | 27,449 | 23,212 | 24,092 | 22,423 | 20,862 | 20,492 |
| Injuries (thousands) | ^a | ^a | ^a | 2,376 | 2,469 | 2,138 | 2,052 |
| Vehicle-miles (billions) ^b | 1,030 | 1,107 | 1,249 | 1,427 | 1,478 | 1,567 | 1,582 |
| Rates per 100 million vehicle miles | | | | | | | |
| Fatalities | 2.5 | 2.5 | 1.9 | 1.7 | 1.5 | 1.3 | 1.3 |
| Injuries | ^a | ^a | ^a | 167 | 167 | 136 | 130 |
| Light trucks (10,000 lbs. or less) | | | | | | | |
| Fatalities | 4,856 | 7,486 | 6,689 | 8,601 | 9,568 | 11,265 | 11,418 |
| Injuries (thousands) | ^a | ^a | ^a | 505 | 722 | 847 | 887 |
| Vehicle-miles (billions) ^b | 204 | 295 | 389 | 556 | 750 | 903 | 944 |
| 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 | 94 | 94 |

Source:

U.S. DOT, National Highway Traffic Safety Administration, *Traffic Safety Facts 2000*, Washington, DC, December 2001, pp. 22, 24.

(Additional resources: www.nhtsa.dot.gov)

^aData are not available.

^bVehicle-miles are estimated by the National Highway Traffic Safety Administration and do not match Federal Highway data.



In 2000, nearly 38% 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 7.30
Crashes by Crash Severity, Crash Type, and Vehicle Type, 2000

| Vehicle type | Fatal | | Injury | | Property damage only | | Total crashes |
|---------------------------|----------------------|------------------------|----------------------|------------------------|----------------------|------------------------|-------------------|
| | Single-vehicle crash | Multiple-vehicle crash | Single-vehicle crash | Multiple-vehicle crash | Single-vehicle crash | Multiple-vehicle crash | |
| Passenger cars | 10,208 | 17,288 | 363,000 | 2,033,000 | 717,000 | 3,750,000 | 6,891,000 |
| Light trucks ^a | 7,934 | 12,361 | 195,000 | 1,015,000 | 447,000 | 2,174,000 | 3,851,000 |
| Large trucks ^b | 802 | 4,128 | 17,000 | 83,000 | 104,000 | 247,000 | 456,000 |
| Buses | 100 | 222 | 1,000 | 12,000 | 7,000 | 35,000 | 56,000 |
| Motorcycles | 1,302 | 1,638 | 26,000 | 27,000 | 3,000 | 11,000 | 70,000 |
| Total | 20,346 | 35,637 | 602,000 | 3,170,000 | 1,278,000 | 6,217,000 | 11,324,000 |
| Share | 0.2% | 0.3% | 5.3% | 28.0% | 11.3% | 54.9% | 100% |

Source:

U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 2000*, Washington, DC, December 2001, pp. 72, 74, 76, 80, 82.

Note:

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

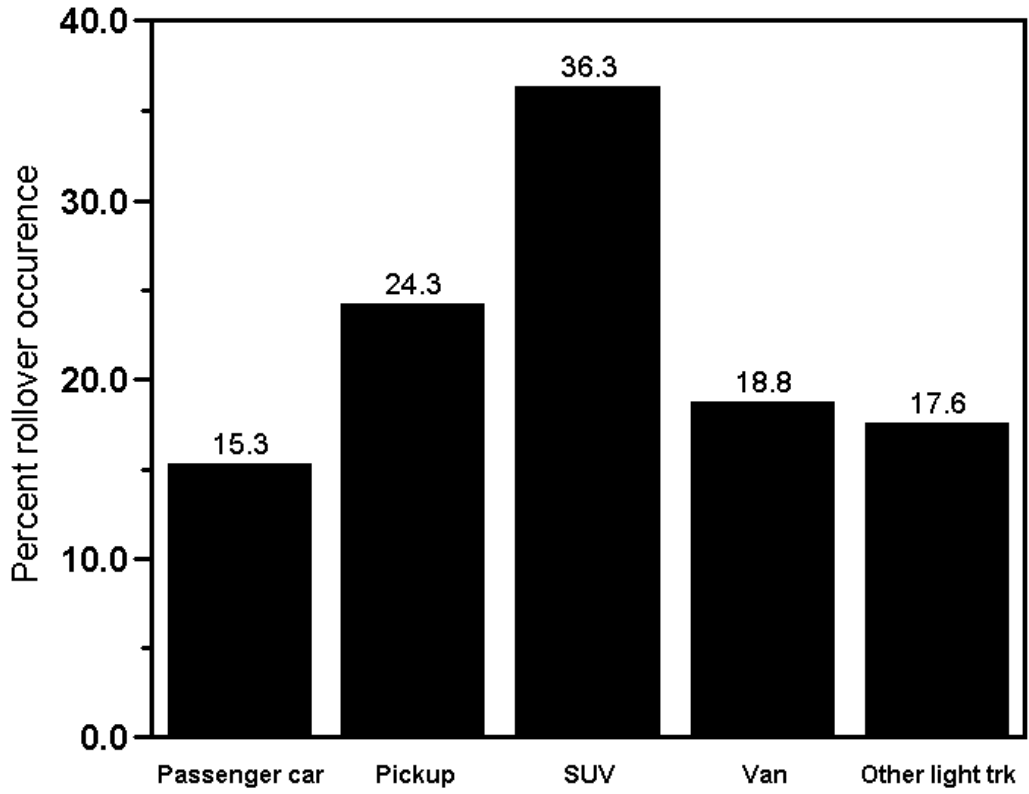
^a Trucks 10,000 lbs. gross vehicle weight rating or less, including pickups, vans, and utility vehicles.

^b Trucks over 10,000 pounds gross vehicle weight rating including single-unit trucks and truck tractors.



For fatal crashes in 2000, sport-utility vehicles (SUVs) had the highest rollover rate (36.3%) while passenger cars had the lowest (15.3%). 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, 2000



Source:

U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 2000*, Washington, DC, December 2001, p. 64.



Chapter 8

Heavy Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

| Source | | |
|-------------------------|---|---------|
| Table 8.1 | Heavy single-unit trucks, 2000 | |
| | <i>Registration (thousands)</i> | 5,926 |
| | <i>Vehicle miles (millions)</i> | 70,583 |
| | <i>Fuel economy (miles per gallon)</i> | 7.4 |
| Table 8.2 | Combination trucks, 2000 | |
| | <i>Registration (thousands)</i> | 2,097 |
| | <i>Vehicle miles (millions)</i> | 135,208 |
| Table 8.6 | Trucks by size, 1997 Vehicle Inventory & Use Survey | |
| | <i>Light (0–10,000 lbs average weight)</i> | 92.88% |
| | <i>Medium (10,001–26,000 lbs average weight)</i> | 3.80% |
| | <i>Heavy (26,001 lbs and over average weight)</i> | 3.32% |
| Tables 8.10 and 8.11 | Freight Shipments, 1997 Commodity Flow Survey | |
| | <i>Value (billion dollars)</i> | 6,944 |
| | <i>Tons (millions)</i> | 11,089 |
| | <i>Ton-miles (billions)</i> | 2,661 |
| Tables 8.12 and 8.13 | Buses in operation, 2000 | |
| | <i>Transit</i> | 75,013 |
| | <i>School</i> | 606,028 |



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, 1970–2000

| Year | Other single-unit trucks | | | |
|------|------------------------------|-----------------------------------|-------------------------------|------------------------------------|
| | Registrations (thousands) | Vehicle travel (million miles) | Fuel use (million gallons) | Fuel economy (miles per gallon) |
| 1970 | 3,681 | 27,081 | 3,968 | 6.8 |
| 1975 | 4,232 | 34,606 | 5,420 | 6.4 |
| 1980 | 4,374 | 39,813 | 6,923 | 5.8 |
| 1981 | 4,455 | 39,568 | 6,867 | 5.8 |
| 1982 | 4,325 | 40,658 | 6,803 | 6.0 |
| 1983 | 4,204 | 42,546 | 6,965 | 6.1 |
| 1984 | 4,061 | 44,419 | 7,240 | 6.1 |
| 1985 | 4,593 | 45,441 | 7,399 | 6.1 |
| 1986 | 4,313 | 45,637 | 7,386 | 6.2 |
| 1987 | 4,188 | 48,022 | 7,523 | 6.4 |
| 1988 | 4,470 | 49,434 | 7,701 | 6.4 |
| 1989 | 4,519 | 50,870 | 7,779 | 6.5 |
| 1990 | 4,487 | 51,901 | 8,357 | 6.2 |
| 1991 | 4,481 | 52,898 | 8,172 | 6.5 |
| 1992 | 4,370 | 53,874 | 8,237 | 6.5 |
| 1993 | 4,408 | 56,772 | 8,488 | 6.7 |
| 1994 | 4,906 | 61,284 | 9,032 | 6.8 |
| 1995 | 5,024 | 62,705 | 9,216 | 6.8 |
| 1996 | 5,266 | 64,072 | 9,409 | 6.8 |
| 1997 | 5,293 | 66,893 | 9,576 | 7.0 |
| 1998 | 5,414 | 67,894 | 9,741 | 7.0 |
| 1999 | 5,763 | 70,304 | 9,372 | 7.5 |
| 2000 | 5,926 | 70,583 | 9,548 | 7.4 |

Source:

U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2000*, Washington, DC, 2001, Table VM1 and annual.

(Additional resources: www.fhwa.dot.gov)

Note:

Highway Statistics 1999 data were not used.



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

Table 8.2
Summary Statistics for Combination Trucks, 1970–2000^a

| Year | Combination trucks ^b | | | |
|------|---------------------------------|-----------------------------------|-------------------------------|------------------------------------|
| | 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 | 1,831 | 128,159 | 21,100 | 6.1 |
| 1999 | 2,029 | 132,384 | 24,537 | 5.4 |
| 2000 | 2,097 | 135,208 | 25,645 | 5.3 |

Source:

U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2000*, Washington, DC, 2001, Table VM1 and annual.
(Additional resources: www.fhwa.dot.gov)

Note:

Highway Statistics 1999 data were not used.

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

^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.





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, 1970–2001^a
 (thousands)

| Calendar year | Class 1 6,000 lbs. or less | Class 2 6,001– 10,000 lbs. | Class 3 10,001– 14,000 lbs. | Class 4 14,001– 16,000 lbs. | Class 5 16,001– 19,500 lbs. | Class 6 19,501– 26,000 lbs. | Class 7 26,001– 33,000 lbs. | Class 8 33,001 lbs. and over | Total |
|---|----------------------------------|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|------------------------------------|-------|
| Domestic sales (import data are not available) | | | | | | | | | |
| 1970 ^b | 1,049 | 408 | 6 | 12 | 58 | 133 | 36 | 89 | 1,791 |
| 1975 | 1,101 | 952 | 23 | 1 | 9 | 159 | 23 | 83 | 2,351 |
| 1980 | 985 | 975 | 4 | c | 2 | 90 | 58 | 117 | 2,231 |
| 1981 | 896 | 850 | 1 | c | 2 | 72 | 51 | 100 | 1,972 |
| 1982 | 1,102 | 961 | 1 | c | 1 | 44 | 62 | 76 | 2,248 |
| 1983 | 1,314 | 1,207 | c | c | 1 | 47 | 59 | 82 | 2,710 |
| 1984 | 2,031 | 1,224 | 6 | c | 5 | 55 | 78 | 138 | 3,538 |
| 1985 | 2,408 | 1,280 | 11 | c | 5 | 48 | 97 | 134 | 3,983 |
| Domestic and import sales | | | | | | | | | |
| 1986 | 3,380 | 1,214 | 12 | c | 6 | 45 | 101 | 113 | 4,870 |
| 1987 | 3,435 | 1,175 | 14 | 2 | 8 | 44 | 103 | 131 | 4,912 |
| 1988 | 3,467 | 1,333 | 14 | 21 | 8 | 54 | 103 | 148 | 5,149 |
| 1989 | 3,313 | 1,297 | 19 | 27 | 7 | 39 | 93 | 145 | 4,942 |
| 1990 | 3,451 | 1,097 | 21 | 27 | 5 | 38 | 85 | 121 | 4,846 |
| 1991 | 3,246 | 876 | 21 | 24 | 3 | 22 | 73 | 99 | 4,365 |
| 1992 | 3,608 | 1,021 | 26 | 26 | 4 | 28 | 73 | 119 | 4,903 |
| 1993 | 4,119 | 1,232 | 27 | 33 | 4 | 27 | 81 | 158 | 5,681 |
| 1994 | 4,527 | 1,506 | 35 | 44 | 4 | 20 | 98 | 186 | 6,421 |
| 1995 | 4,422 | 1,631 | 40 | 53 | 4 | 23 | 107 | 201 | 6,481 |
| 1996 | 4,829 | 1,690 | 52 | 59 | 7 | 19 | 104 | 170 | 6,930 |
| 1997 | 5,085 | 1,712 | 53 | 57 | 9 | 18 | 114 | 179 | 7,226 |
| 1998 | 5,263 | 2,036 | 102 | 43 | 25 | 32 | 115 | 209 | 7,826 |
| 1999 | 5,707 | 2,366 | 122 | 49 | 30 | 48 | 130 | 262 | 8,716 |
| 2000 | 5,965 | 2,421 | 117 | 47 | 29 | 51 | 123 | 212 | 8,965 |
| 2001 | 6,073 | 2,525 | 102 | 52 | 24 | 42 | 92 | 140 | 9,050 |
| <i>Average annual percentage change</i> | | | | | | | | | |
| 1970–1985 | 5.7% | 7.9% | 4.1% | - | -15.1% | -6.6% | 6.8% | 2.8% | 5.5% |
| 1986–2001 | 4.0% | 5.0% | 15.3% | - | 9.7% | -0.5% | -0.6% | 1.4% | 4.2% |

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.

^cData 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. The 2002 VIUS, however, will only include trucks. Data from the 2002 VIUS is expected in 2004. Copies of the 1997 VIUS report or CD may be obtained by contacting the U.S. Bureau of the Census, Transportation Characteristics Surveys Branch (301) 457-2797. Internet site: **www.census.gov/svsd/www/tiusview.html**

Since 1987 the survey has included minivans, vans, station wagons on truck chassis, and sport utility vehicles in addition to the bigger trucks. The 1977 and 1982 surveys did not include those vehicle types. The estimated number of trucks that were within the scope of the 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.



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 Harmonic Mean 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 | 17.2 | 17.1 |
| 2) 6,001–10,000 lbs | 13.0 | 13.6 |
| 3) 10,000–14,000 lbs | 8.8 | 9.4 |
| 4) 14,001–16,000 lbs | 8.8 | 9.3 |
| 5) 16,001–19,500 lbs | 7.4 | 8.7 |
| 6) 19,501–26,000 lbs | 6.9 | 7.3 |
| 7) 26,001–33,000 lbs | 6.5 | 6.4 |
| 8) 33,001 lbs and over | 5.5 | 5.7 |

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:

Based on average fuel economy as reported by respondent.



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

Table 8.6
Truck Statistics by Size, 1997

| | Manufacturer's gross vehicle weight class | | | Total |
|--------------------------|---|-----------------------------------|-------------------------|-------------|
| | Light (< 10,000 lbs) | Medium (10,001– 26,000 lbs) | Heavy (> 26,000 lbs) | |
| Trucks | 67,613,799 | 2,767,784 | 2,418,669 | 72,800,252 |
| Trucks (%) | 92.88% | 3.80% | 3.32% | 100% |
| Miles per truck | 13,204 | 13,712 | 47,022 | 14,347 |
| Total miles (%) | 86.35% | 3.35% | 10.31% | 100% |
| Fuel use (%) | 71.10% | 5.56% | 23.35% | 100% |
| Fuel economy (mpg) | 15.81 | 7.84 | 5.75 | 13.02 |
| | Range of operation | | | |
| Under 50 miles | 75.11% | 64.45% | 39.37% | 73.53% |
| 51–100 miles | 12.83% | 16.53% | 16.44% | 13.09% |
| 101–200 miles | 3.86% | 5.64% | 10.54% | 4.15% |
| 201–500 miles | 2.09% | 4.65% | 12.19% | 2.52% |
| Over 500 miles | 2.31% | 1.25% | 16.80% | 2.75% |
| Off-road | 3.81% | 7.49% | 4.66% | 3.97% |
| Total | 100% | 100% | 100% | 100% |
| | Primary refueling facility | | | |
| Central company-owned | 11.52% | 27.32% | 35.94% | 29.20% |
| Single off-site contract | 3.61% | 5.84% | 7.00% | 6.08% |
| Public station | 82.49% | 61.96% | 53.25% | 60.56% |
| Other | 2.38% | 4.88% | 3.80% | 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 74.56% | Construction 20.19% | For Hire 31.48% |
| 2 | Construction 7.56% | Agriculture 19.54% | Construction 17.56% |
| 3 | Services^a 5.57% | Services^a 11.64% | Agriculture 14.01% |
| 4 | Agriculture 3.82% | Retail 9.28% | Wholesale 7.81% |
| 5 | Retail 2.79% | Wholesale 7.31% | Services^a 7.39% |
| 6 | Not in Use 1.61% | Personal 7.00% | Retail 5.67% |
| 7 | Wholesale 1.33% | For Hire 5.47% | Manufacturing 5.61% |
| 8 | Manufacturing 0.74% | Utilities 4.40% | Forestry 2.56% |
| 9 | Utilities 0.75% | Daily Rental 4.21% | Utilities 2.18% |
| 10 | Daily Rental 0.53% | Manufacturing 3.72% | Mining 2.18% |
| 11 | Forestry 0.26% | Not in Use 3.21% | Daily Rental 2.11% |
| 12 | Mining 0.25% | Forestry 1.64% | Not in Use 1.11% |
| 13 | For Hire 0.21% | One-Way Rental 1.24% | Personal 0.31% |
| 14 | One-Way Rental 0.01% | Mining 1.14% | One-Way Rental 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

| Truck fleet size | Primary refueling facility | | | | Total |
|------------------|--|---|-------------------------|--------------|-------------|
| | Central company-owned fueling facility | Single contract fueling facility located off-site | Public fueling stations | Other | |
| 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

| Major Use | Primary fueling facility | | | Other | Total |
|--|--|---|-------------------------|--------------|-------------|
| | Central company-owned fueling facility | Single contract fueling facility located off-site | Public fueling stations | | |
| 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 for more than six months | 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 | | | | 1,082 | |
| 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 7,700 buses from 1984 to 2000, but the number of passenger-miles in 2000 is nearly identical to the 1984 level.

Table 8.12
Summary Statistics on Transit Buses, 1984–2000

| 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 |
| 2000 | 75,013 | 2,315 | 21,241 | 101.4 |
| | | <i>Average annual percentage change</i> | | |
| 1984–2000 | 0.7% | 1.4% | -0.1% | ^a |
| 1992–2000 | 2.2% | 0.8% | 0.5% | 1.8% |

Source:

American Public Transit Association, *2002 Public Transportation Fact Book*, Washington, DC, 2002, Tables 30, 42, 46, 65, 66 and 67.

^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, 1970–2000

| 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 |
| 2000 | ^a | ^a | 606,028 | ^a |
| <i>Average annual percentage change</i> | | | | |
| 1970–1999 | 1.1% | -0.8% | 2.5% | 2.1% |
| 1989–1999 | 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 Energy Use Sources for detailed methodology on energy use conversion.
School buses - Federal Highway Administration, *Highway Statistics 2000*, Washington, DC, 2001, Table MV-10, and annual.

^aData are not yet available.



Chapter 9

Alternative Fuel and Advanced Technology Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

| Source | | |
|-----------|--|---------|
| Table 9.1 | Alternative fuel vehicles, 2001 | 456,306 |
| | <i>LPG</i> | 269,000 |
| | <i>CNG</i> | 109,730 |
| | <i>LNG</i> | 2,039 |
| | <i>M85</i> | 16,918 |
| | <i>E85^a</i> | 48,022 |
| | <i>Electric</i> | 10,400 |
| Table 9.4 | Number of alternative fuel refuel sites, 2001 | 5,542 |
| | <i>LPG</i> | 3,403 |
| | <i>CNG</i> | 1,232 |
| | <i>Electric</i> | 693 |
| Table 9.5 | U.S. sales of advanced technology vehicles (through June 2002) | |
| | <i>Honda Insight</i> | 9,955 |
| | <i>Toyota Prius</i> | 29,179 |

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

^aDoes 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)

Note:

These data were released in October 1999. Please check the source web site for updates which were not available when this document went to press.

^aBased on plans or projections.

^bDoes 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

| Fuel type | Private | | State and local government | | Federal Government | |
|--------------|----------------|-------------------|----------------------------|-------------------|--------------------|-------------------|
| | 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)

Note:

These data were released in October 1999. Please check the source web site for updates which were not available when this document went to press.

^aBased on plans or projections.



Table 9.3
Alternative Fuel Vehicles Available by Manufacturer, Model Year 2002

| Model | Fuel | Type | Emission class |
|---|-------------------------------------|---------------------------|-------------------------|
| Daimler Chrysler: 1-800-999-FLEET | | | |
| Minivan | E-85 flex fuel | Minivan | LEV |
| Ram Wagon | CNG dedicated | Large wagon | ULEV/ILEV/CA SULEV |
| Ram Van | CNG dedicated | Large van | ULEV/ILEV/SULEV |
| Ford: 1-877-ALT-FUEL | | | |
| Ranger EV | Electric-lead acid | Small pickup | ZEV |
| Ranger FFV | E-85 flex-fuel | Small pickup | LEV |
| Explorer | E-85 flex-fuel | Sport utility vehicle | LEV |
| Crown Victoria | CNG dedicated | Large car | ULEV |
| E-Series | CNG dedicated | Wagon | ULEV/ILEV/SULEV |
| F-Series | CNG dedicated or CNG/LPG bi-fuel | Standard pickup | LEV/ULEV/ILEV/ SULEV |
| E-Series | CNG dedicated | Passenger van | ILEV/ ULEV/SULEV |
| Taurus | E-85 flex-fuel | Sedan & wagon | LEV |
| Think City | Electric | Two-seater | ZEV |
| General Motors: 1-800-25Electric, 313-556-7723 or 1-888-GM-AFT-4U (CNG) | | | |
| Chevy Silverado/GMC Sierra | CNG dedicated or CNG bi-fuel | Small pickup | LEV/ULEV |
| Chevy Express/GMC Savana | CNG bi-fuel | Cargo or passenger van | LEV |
| Chevy Cavalier | CNG bi-fuel | Subcompact | LEV |
| Chevy Tahoe/GMC Yukon | E-85 flex fuel | Sport utility vehicle | LEV |
| Chevy Suburban/GMC Yukon | E-85 flex fuel | Sport utility vehicle | LEV |
| Honda: 1-888-CCHonda | | | |
| Civic GX | CNG dedicated | Subcompact | ILEV/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 |
| Solectria Corporation: 1-508-658-2231 | | | |
| Civitan | Electric-lead acid | Service van | ZEV |
| Toyota: 1-800-331-4331 (Press 3 for Alternative Fuel Information) (Fleet sales only) | | | |
| RAV4-EV (CA fleets only) | Electric-lead acid, NiMH | Sport utility vehicle | ZEV |
| Camry (fleets only) | CNG dedicated | Compact | ULEV |

Source:

U.S. Department of Energy, National Alternative Fuels Data Center, web site, www.afdc.doe.gov/afvehicles.htm, January 2002.
(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.



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, 2001

| State | CNG sites | E85 sites | LPG sites | LNG sites | Electric sites | Biodiesel sites | Total |
|----------------------|--------------|------------|--------------|-----------|----------------|-----------------|--------------|
| Alabama | 14 | 0 | 67 | 2 | 34 | 0 | 117 |
| Alaska | 0 | 0 | 8 | 0 | 0 | 0 | 8 |
| Arizona | 30 | 1 | 108 | 3 | 51 | 2 | 195 |
| Arkansas | 7 | 0 | 73 | 0 | 0 | 0 | 80 |
| California | 213 | 0 | 336 | 9 | 426 | 3 | 987 |
| Colorado | 39 | 7 | 91 | 1 | 2 | 0 | 140 |
| Connecticut | 25 | 0 | 29 | 0 | 1 | 0 | 55 |
| Delaware | 4 | 0 | 4 | 0 | 0 | 0 | 8 |
| District of Columbia | 3 | 0 | 0 | 0 | 1 | 0 | 4 |
| Florida | 40 | 0 | 144 | 1 | 3 | 0 | 188 |
| Georgia | 67 | 0 | 53 | 2 | 82 | 0 | 204 |
| Hawaii | 0 | 0 | 7 | 0 | 3 | 1 | 11 |
| Idaho | 8 | 1 | 33 | 0 | 1 | 0 | 43 |
| Illinois | 22 | 15 | 80 | 0 | 2 | 0 | 119 |
| Indiana | 32 | 1 | 48 | 3 | 1 | 1 | 86 |
| Iowa | 0 | 11 | 42 | 0 | 0 | 0 | 53 |
| Kansas | 5 | 1 | 64 | 1 | 0 | 0 | 71 |
| Kentucky | 6 | 7 | 23 | 0 | 0 | 0 | 36 |
| Louisiana | 14 | 0 | 32 | 0 | 0 | 0 | 46 |
| Maine | 0 | 0 | 19 | 0 | 0 | 1 | 20 |
| Maryland | 30 | 1 | 28 | 2 | 1 | 0 | 62 |
| Massachusetts | 12 | 0 | 37 | 0 | 25 | 0 | 74 |
| Michigan | 31 | 8 | 125 | 1 | 6 | 2 | 173 |
| Minnesota | 11 | 67 | 61 | 1 | 0 | 0 | 140 |
| Mississippi | 3 | 0 | 32 | 0 | 0 | 0 | 35 |
| Missouri | 7 | 5 | 147 | 0 | 0 | 1 | 160 |
| Montana | 9 | 2 | 42 | 1 | 0 | 0 | 54 |
| Nebraska | 5 | 7 | 29 | 0 | 0 | 0 | 41 |
| Nevada | 18 | 0 | 36 | 0 | 0 | 1 | 55 |
| New Hampshire | 1 | 0 | 30 | 0 | 1 | 0 | 32 |
| New Jersey | 30 | 0 | 31 | 0 | 0 | 0 | 61 |
| New Mexico | 15 | 1 | 88 | 1 | 0 | 0 | 105 |
| New York | 62 | 0 | 99 | 0 | 16 | 0 | 177 |
| N. Carolina | 10 | 0 | 77 | 0 | 6 | 0 | 93 |
| N. Dakota | 4 | 2 | 18 | 0 | 0 | 0 | 24 |
| Ohio | 52 | 2 | 73 | 1 | 1 | 1 | 130 |
| Oklahoma | 58 | 0 | 99 | 0 | 0 | 0 | 157 |
| Oregon | 16 | 0 | 50 | 1 | 2 | 0 | 69 |
| Pennsylvania | 55 | 0 | 107 | 1 | 1 | 0 | 164 |
| Rhode Island | 6 | 0 | 7 | 0 | 0 | 0 | 13 |
| S. Carolina | 4 | 1 | 61 | 0 | 1 | 1 | 68 |
| S. Dakota | 2 | 8 | 26 | 0 | 0 | 0 | 36 |
| Tennessee | 2 | 0 | 60 | 0 | 0 | 0 | 62 |
| Texas | 66 | 0 | 442 | 7 | 2 | 1 | 518 |
| Utah | 62 | 2 | 36 | 1 | 0 | 0 | 101 |
| Vermont | 0 | 0 | 17 | 0 | 7 | 0 | 24 |
| Virginia | 24 | 1 | 64 | 3 | 11 | 0 | 103 |
| Washington | 25 | 0 | 89 | 1 | 6 | 1 | 122 |
| W. Virginia | 43 | 0 | 10 | 0 | 0 | 0 | 53 |
| Wisconsin | 22 | 3 | 84 | 0 | 0 | 0 | 109 |
| Wyoming | 18 | 0 | 37 | 1 | 0 | 0 | 56 |
| Total | 1,232 | 154 | 3,403 | 44 | 693 | 16 | 5,542 |

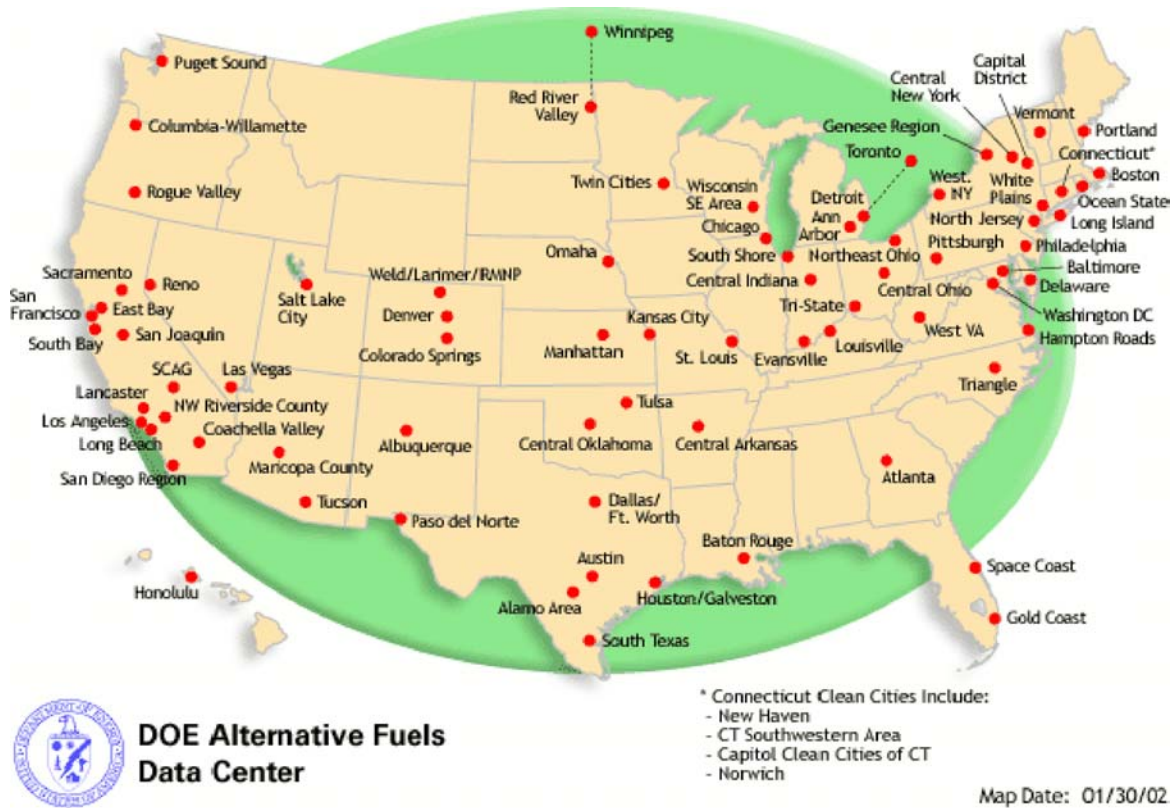
Source:

U.S. Department of Energy, Alternative Fuels Data Center web site, www.afdc.doe.gov/refuel/state_tot.shtml, March 2002.



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.

Figure 9.1. Clean Cities Coalitions



Source:
 U.S. Department of Energy, Alternative Fuel Data Center, July 2002.
 (Additional resources: www.ccities.doe.gov)



The Honda Insight, Civic Hybrid and Toyota Prius are the three advanced technology vehicles which are currently available to the public in the U.S. They are 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 9.5
Sales and Specifications of Available Advanced Technology Vehicles

| | Honda Insight^a | Toyota Prius | Honda Civic Hybrid |
|--|--------------------------------------|-------------------------|-------------------------------|
| Fuel economy (city/hwy) | 57/56 mpg | 52/45 mpg | 46/51 mpg |
| Fuel tank capacity | 10.6 gal. | 11.8 gal. | 13.2 gal. |
| Acceleration (0-60 mph) | 11.3 sec. | 12.8 sec. | 10.9 sec. |
| Emissions | SULEV | SULEV | ULEV |
| Aerodynamics | 0.25 Cd | 0.29 Cd | 0.34 Cd |
| Curb weight | 1,964 lbs. | 2,765 lbs. | 2,732 lbs. |
| Passenger capacity | 2 | 5 | 5 |
| Dimensions: | | | |
| Length | 155.1 in. | 169.6 in. | 174.8 in. |
| Width | 66.7 in. | 66.7 in. | 67.5 in. |
| Cargo Capacity | 16.3 ft ³ | 11.8 ft ³ | 10.1 ft ³ |
| Price | \$21,280 | \$20,480 | \$19,550 |
| Calendar year sales in the U.S. | | | |
| 1999 | 17 | 0 | 0 |
| 2000 | 3,788 | 5,562 | 0 |
| 2001 | 4,853 | 13,568 | 0 |
| 2002 (January–June) | 1,297 | 10,049 | ^b |
| Total | 9,955 | 29,179 | ^b |

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, 2002.

^aSpecifications are for the continuously variable transmission. The Insight is also available with manual transmission.

^bSales for the Civic Hybrid are not shown separately from other Civic models.



Chapter 10 Fleet Vehicles and Characteristics

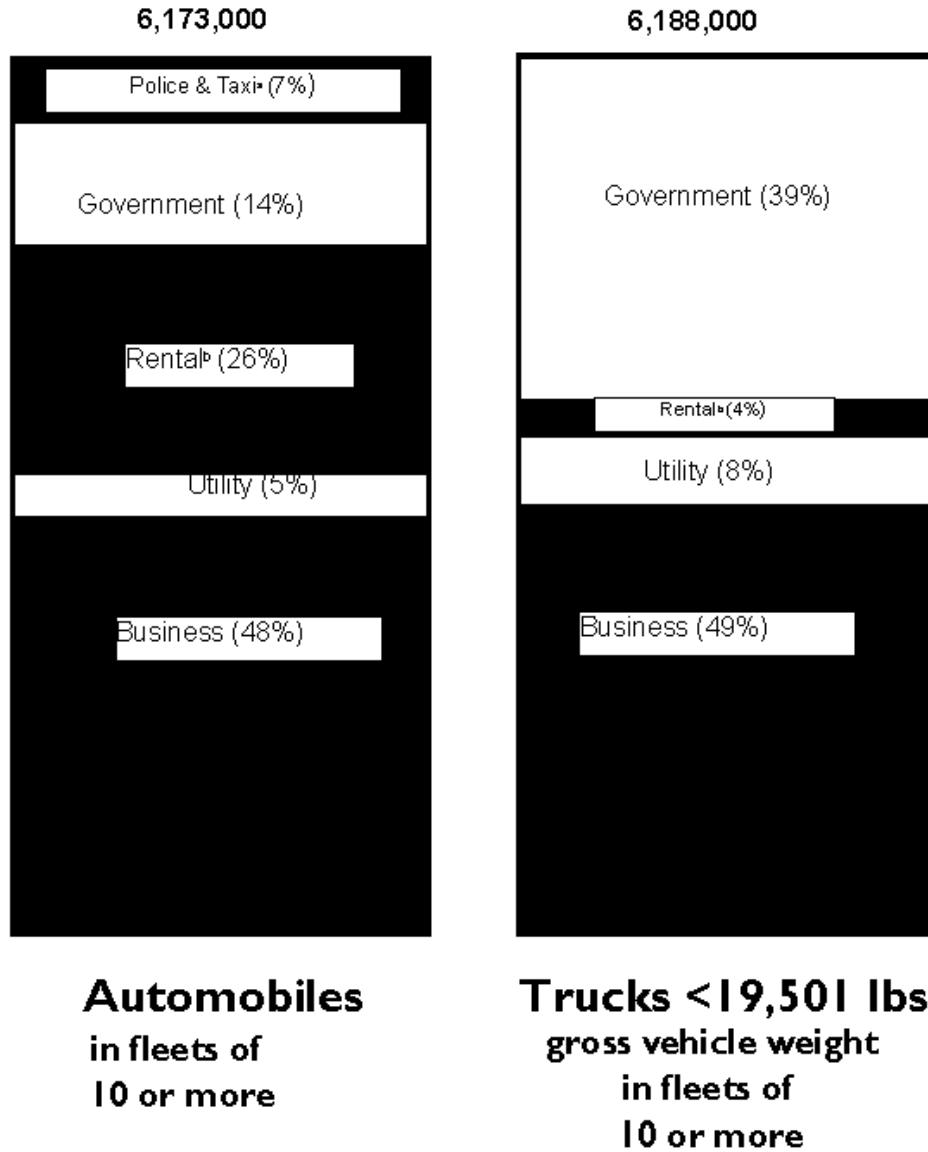
Summary Statistics from Tables/Figures in this Chapter

| Source | | |
|-------------|---|-----------|
| Figure 10.1 | Fleet automobiles, 2001 | 6,173,000 |
| Figure 10.1 | Fleet trucks # 19,500 lbs. GVW, 2000 | 6,188,000 |
| Table 10.3 | Average annual miles per automobile | |
| | <i>Business fleets</i> | 22,780 |
| | <i>Utility fleets</i> | 13,399 |
| | <i>Government fleets</i> | 12,895 |
| Table 10.3 | Average annual miles per light truck (<8,500 lbs. GVW) | |
| | <i>Business fleets</i> | 26,282 |
| | <i>Utility fleets</i> | 12,096 |
| | <i>Government fleets</i> | 6,797 |
| Table 10.4 | Federal government vehicles, FY 2000 | 567,581 |
| | <i>Automobiles</i> | 113,572 |
| | <i>Buses</i> | 5,257 |
| | <i>Light trucks (<8,500 lbs. GVW)</i> | 344,949 |
| | <i>Medium trucks (8,500–26,000 lbs. GVW)</i> | 77,688 |
| | <i>Heavy trucks (>26,000 lbs. GVW)</i> | 26,115 |



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 latest data are presented here.

Figure 10.1. Fleet Vehicles in Service as of February 1, 2001



Source:

Bobit Publishing Company, Automotive Fleet Research Department, *Automotive Fleet Factbook 2002*, Redondo Beach, CA, 2002. (Additional resources: www.fleet-central.com)

^aTaxi category includes vans.

^bRental category includes vans and sports utility vehicles under **automobiles**, not trucks.



According to these estimates of light fleet vehicle population, utility and government fleets have a greater share of light trucks in their light vehicle population than business fleets do. This is also reflected in the new vehicle purchases.

Table 10.1
Light Vehicles in Fleets of 10 or More, 2000

| | Business | Utility | Government |
|------------------------------------|-----------|---------|------------|
| Cars | 60.7% | 41.5% | 37.7% |
| Light trucks ^a and vans | 39.3% | 58.5% | 62.3% |
| Total light vehicles | 7,694,733 | 763,190 | 3,152,831 |

Source:

See Appendix A for Fleet Vehicle Data, Light Fleet Vehicle Population.

Table 10.2
New Light Fleet Vehicle Purchases by Vehicle Type, 2000

| | Business | Utility | Government |
|------------------------------------|-----------|---------|------------|
| Cars | 73.2% | 11.8% | 47.1% |
| Light trucks ^a and vans | 26.8% | 88.2% | 52.9% |
| Total light vehicles | 2,146,351 | 355,989 | 235,085 |

Source:

See Appendix A for Fleet Vehicle Data., Light Fleet Vehicle New Sales.

^aIn this study, light trucks are <10,000 lbs gross vehicle weight.



The average length of service for an intermediate size fleet car is 30 months. Of the light vehicle types, full-size vans have the longest average months in service. Medium trucks are in service for an average of 70 months.

Table 10.3
Average Length of Time Business Fleet
Vehicles are in Service, 2000

| Vehicle type | Average months in service |
|------------------------|------------------------------|
| Compact cars | 33.8 |
| Intermediate cars | 30.0 |
| Pickup trucks | 37.1 |
| Minivans | 32.9 |
| Sport utility vehicles | 30.8 |
| Full-size vans | 59.1 |
| Medium trucks | 70.4 |

Source:

Bobit Publishing Company, *Automotive Fleet Factbook 2001*, pp. 58-67.

Note:

Based on data collected from four leading Fleet Management companies.

Table 10.4
Average Annual Vehicle-Miles of Travel
for Fleet Vehicles, 2000

| Vehicle type | Business | Utility | Government |
|---------------------------|----------|---------|------------|
| Cars | 22,780 | 13,399 | 12,895 |
| Light trucks ^a | 26,282 | 12,096 | 6,797 |
| All light vehicles | 24,158 | 12,583 | 8,328 |

Source:

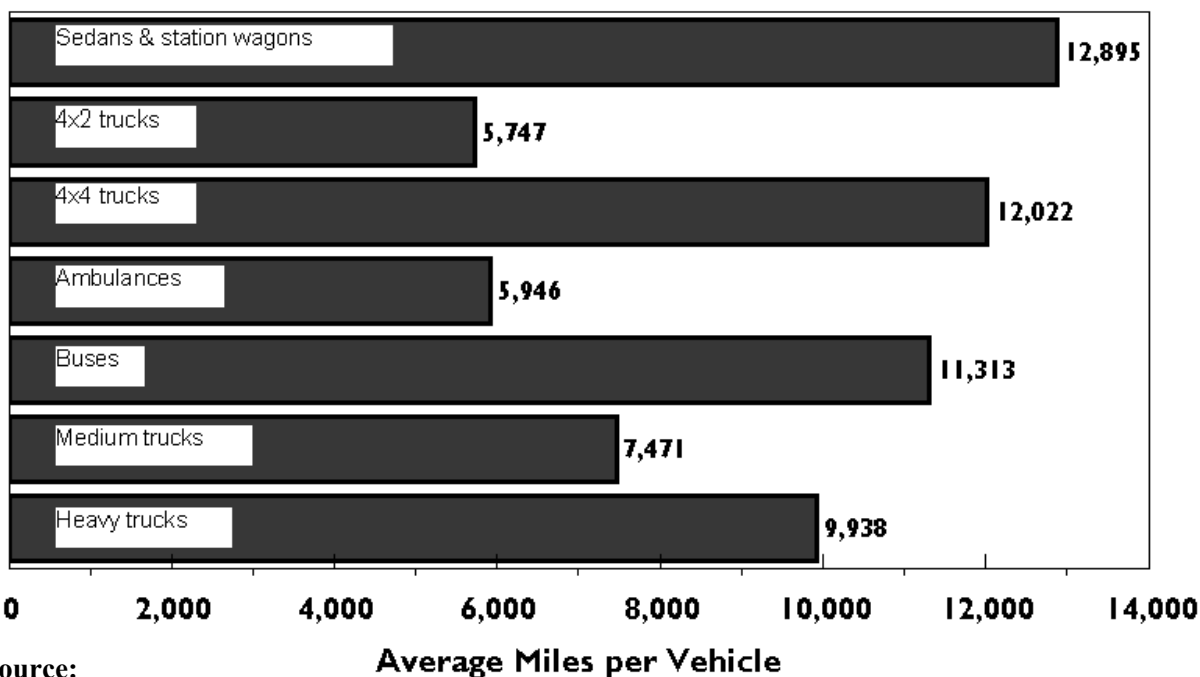
See Appendix A for Fleet Vehicle Data., Light Fleet Vehicle Travel.

^aIn this study, light trucks are <10,000 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 4x4 trucks. There is a 6,000-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, 2000



Source:

U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 2000 Federal Fleet Report*, Washington, DC, 2002, Table 5.

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



Table 10.5
Federal Government Vehicles by Agency, Fiscal Year 2000^a

| Department or Agency | Autos | Buses | Light trucks ^b | Medium trucks ^c | Heavy trucks ^d | Total |
|--|----------------|--------------|---------------------------|----------------------------|---------------------------|----------------|
| Commodity Futures Trading Commission | 2 | 0 | 2 | 0 | 0 | 4 |
| Consumer Product Safety Commission | 0 | 0 | 0 | 0 | 0 | 0 |
| Defense Logistics Agency | 3 | 0 | 10 | 2 | 11 | 26 |
| Department of Agriculture | 3,304 | 39 | 24,361 | 5,450 | 634 | 33,788 |
| Department of Commerce | 63 | 2 | 242 | 377 | 14 | 698 |
| Department of Education | 1 | 0 | 1 | 0 | 0 | 2 |
| Department of Energy | 507 | 145 | 2,549 | 1,068 | 1,398 | 5,667 |
| Department of Health & Human Services | 52 | 5 | 308 | 108 | 119 | 592 |
| Department of Housing & Urban Development | 47 | 0 | 67 | 1 | 0 | 115 |
| Department of Justice | 21,109 | 342 | 14,554 | 3,396 | 552 | 39,953 |
| Department of Labor | 0 | 0 | 0 | 0 | 0 | 0 |
| Department of State | 135 | 1 | 126 | 6 | 8 | 276 |
| Department of Interior | 1,702 | 315 | 10,735 | 4,829 | 2,286 | 19,867 |
| Department of Treasury | 13,356 | 14 | 6,644 | 871 | 327 | 21,212 |
| Department of Transportation | 68 | 9 | 402 | 96 | 52 | 627 |
| Department of Veterans Affairs | 98 | 72 | 1,084 | 178 | 111 | 1,543 |
| Environmental Protection Agency | 28 | 1 | 143 | 72 | 25 | 269 |
| Equal Employment Opportunity Commission | 1 | 0 | 0 | 0 | 0 | 1 |
| Executive Office of the President | 40 | 0 | 88 | 12 | 0 | 140 |
| Federal Communications Commission | 55 | 0 | 64 | 0 | 0 | 119 |
| Federal Election Commission | 0 | 0 | 0 | 0 | 0 | 0 |
| Federal Emergency Management Agency | 0 | 0 | 0 | 0 | 0 | 0 |
| Federal Mediation and Conciliation Service | 0 | 0 | 0 | 0 | 0 | 0 |
| Federal Trade Commission | 2 | 0 | 2 | 0 | 0 | 4 |
| General Services Administration ^e | 49,502 | 2,445 | 65,222 | 22,729 | 4,050 | 143,948 |
| Government Printing Office | 7 | 0 | 28 | 1 | 16 | 52 |
| Library of Congress | 0 | 0 | 0 | 0 | 0 | 0 |
| National Aeronautics & Space Administration | 112 | 68 | 442 | 176 | 111 | 909 |
| National Gallery of the Arts | 1 | 0 | 0 | 0 | 2 | 3 |
| National Labor Relations Board | 0 | 0 | 0 | 0 | 0 | 0 |
| National Science Foundation | 23 | 8 | 92 | 12 | 25 | 160 |
| Nuclear Regulatory Commission | 0 | 0 | 0 | 0 | 0 | 0 |
| Office of Personnel Management | 4 | 0 | 0 | 0 | 0 | 4 |
| Securities and Exchange Commission | 0 | 0 | 0 | 0 | 0 | 0 |
| Small Business Administration | 0 | 0 | 1 | 0 | 0 | 1 |
| Smithsonian Institution | 13 | 5 | 168 | 21 | 5 | 212 |
| Social Security Administration | 2 | 0 | 0 | 0 | 0 | 2 |
| Tennessee Valley Authority | 582 | 0 | 974 | 922 | 360 | 2,838 |
| U.S. Soldiers' & Airmen Retirement Home | 3 | 2 | 1 | 1 | 2 | 9 |
| CIVILIAN AGENCIES | 90,822 | 3,473 | 128,311 | 40,345 | 10,090 | 273,041 |
| U.S. POSTAL SERVICE | 15,699 | 0 | 189,089 | 11,704 | 4,980 | 221,472 |
| Department of the Navy | 2,508 | 411 | 14,232 | 6,266 | 4,014 | 27,431 |
| Department of the Army | 95 | 33 | 710 | 2,955 | 646 | 4,439 |
| Department of the Air Force | 2,315 | 1,191 | 11,780 | 15,526 | 5,175 | 35,987 |
| Defense Agencies | 2,000 | 0 | 262 | 42 | 28 | 2,332 |
| Corps of Engineers | 0 | 0 | 105 | 180 | 332 | 617 |
| U.S. Marine Corps | 133 | 149 | 460 | 670 | 850 | 2,262 |
| MILITARY AGENCIES | 7,051 | 1,784 | 27,549 | 25,639 | 11,045 | 73,068 |
| TOTAL | 113,572 | 5,257 | 344,949 | 77,688 | 26,115 | 567,581 |

Source:

U.S. General Services Administration, Federal Supply Service, *FY 2000 Federal Fleet Report*, Washington, DC, 2002, 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 10.6
Federal Fleet Vehicle Acquisitions
by Fuel Type, FY 1997–2000^a

| | FY97 | FY98 | FY99 | FY00 |
|---------------|---------------------------|---------------|---------------|---------------|
| Gasoline | 14,097 | 48,338 | 54,625 | 38,561 |
| Diesel | 489 | 2,503 | 3,100 | 1,700 |
| Natural gas | 172 | 1,139 | 1,836 | 1,469 |
| Ethanol/E-85 | 160 | 3,015 | 3,886 | 5,615 |
| Electricity | 139 | 36 | 11 | 620 |
| Other | 12 | 0 | 107 | 0 |
| Methanol/M-85 | 9 | 104 | 33 | 10 |
| LPG | 1 | 91 | 33 | 63 |
| Biodiesel | 0 | 0 | 5 | 0 |
| Hydrogen | 0 | 0 | 0 | 0 |
| Total | 15,079^a | 55,226 | 63,636 | 48,038 |

Source:

U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 2000 Federal Fleet Report*, Washington, DC, 2002, Chart 16.

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

Table 10.7
Fuel Consumed by Federal Government Fleets, FY 1997–2000^a
(thousand gasoline equivalent gallons)

| | FY97 | FY98 | FY99 | FY00 |
|---------------|----------------------------|----------------|----------------|----------------|
| Gasoline | 280,051 | 251,478 | 275,879 | 284,480 |
| Diesel | 64,834 | 55,188 | 63,942 | 70,181 |
| NG | 4,076 | 5,510 | 4,019 | 865 |
| Electricity | 287 | 63 | 25 | 1 |
| Biodiesel | 186 | 11 | 128 | 569 |
| Methanol/M-85 | 289 | 232 | 13 | 14 |
| LPG | 37 | 43 | 26 | 34 |
| Ethanol/E-85 | 19 | 3,708 | 130 | 347 |
| Total | 349,779^a | 316,233 | 344,162 | 356,491 |

Source:

U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 2000 Federal Fleet Report*, Washington, DC, 2002, Charts 8 and 9.

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

^aThese 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 10.8
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)

^aThe 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, 2000 | 1.12 |
| Table 11.3 | Average household transportation expense, 2000 | 18.8% |
| Table 11.4 | Share of households owning 3 or more vehicles | |
| | <i>1960</i> | <i>2.5%</i> |
| | <i>1970</i> | <i>5.5%</i> |
| | <i>1980</i> | <i>17.5%</i> |
| | <i>1990</i> | <i>17.3%</i> |
| | <i>2000</i> | <i>18.3%</i> |
| Figure 11.1 | Average occupancy rates by vehicle type, 1995 | |
| | <i>Automobile</i> | <i>1.6</i> |
| | <i>Pickup truck</i> | <i>1.4</i> |
| | <i>Sports Utility</i> | <i>1.7</i> |
| | <i>Van</i> | <i>2.1</i> |
| Table 11.12 | Average annual miles per household vehicle, 1995 | 11,800 |
| Table 11.14 | Share of workers who car pooled, 2000 | 11.2% |
| Figure 11.4 | Long-distance trips in the U.S., 1995 | |
| | <i>Trips</i> | <i>1,001 million</i> |
| | <i>Person-miles</i> | <i>827 billion</i> |



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, 1950–2000

| 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 | 2,691,056 | 187,170 | 133,488 |
| 2000 | 275,130 | 104,705 | 213,300 | 2,749,803 | 190,625 | 135,208 |
| <i>Average annual percentage change</i> | | | | | | |
| 1950–2000 | 1.2% | 1.8% | 3.2% | 3.6% | 2.3% | 1.7% |
| 1990–2000 | 1.0% | 1.2% | 1.8% | 2.5% | 1.3% | 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—2001*, 121st edition, Washington, DC, 2001, pp. 8, 49, 367, 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 2000*, Tables DL-20 and VM-1, and annual. (Additional resources: www.fhwa.dot.gov)

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



In 2000 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, 1950–2000

| 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 | |
| 2000 | 0.78 | 9,995 | 1.82 | 1.12 | 1.58 | |
| | | <i>Average annual percentage change</i> | | | | |
| 1950–2000 | 2.1% | 2.4% | 0.5% | 0.9% | 1.6% | |
| 1990–2000 | 0.8% | 1.5% | 0.2% | 0.5% | 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–2001*, 121st edition, Washington, DC, 2001, pp. 8, 49, 367, 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 2000*, Tables DL-20 and VM-1, and annual. (Additional resources: www.fhwa.dot.gov)





Transportation (18.8%) is second only to housing (31.1%) as the largest expenditure for the average household. In 2000, approximately 17.4% 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, 2000^a

| | Income before taxes | | | | | | | | | |
|---------------------------------------|---|-------------------|-----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | All households | Less than \$5,000 | \$5,000–\$9,999 | \$10,000–\$14,999 | \$15,000–\$19,999 | \$20,000–\$29,999 | \$30,000–\$39,999 | \$40,000–\$49,999 | \$50,000–\$69,999 | \$70,000 and over |
| Total expenditures | \$40,238 | \$17,946 | \$15,703 | \$21,199 | \$24,331 | \$29,852 | \$35,609 | \$42,323 | \$49,245 | \$75,964 |
| | Percentage of total expenditures ^b | | | | | | | | | |
| Food ^c | 14.6% | 15.9% | 16.7% | 15.1% | 16.2% | 16.1% | 15.4% | 15.6% | 14.4% | 12.4% |
| Housing | 31.1% | 37.2% | 35.4% | 35.7% | 32.9% | 31.4% | 31.2% | 30.4% | 30.3% | 30.2% |
| Apparel and services | 5.0% | 5.0% | 5.4% | 3.8% | 4.8% | 4.7% | 4.7% | 4.7% | 4.8% | 5.3% |
| Transportation | 18.8% | 16.7% | 16.5% | 20.6% | 19.1% | 19.2% | 20.5% | 20.6% | 19.6% | 17.6% |
| Vehicle purchases (net outlay) | 8.6% | 5.3% | 7.5% | 10.7% | 8.7% | 8.5% | 9.5% | 10.1% | 9.0% | 7.9% |
| Gasoline and motor oil | 3.3% | 4.1% | 3.3% | 3.5% | 3.8% | 3.6% | 3.8% | 3.5% | 3.5% | 2.7% |
| Other vehicle expenditures | 5.8% | 5.8% | 4.6% | 5.4% | 5.5% | 6.1% | 6.2% | 6.2% | 6.2% | 5.7% |
| Public transportation | 1.1% | 1.4% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 0.9% | 1.0% | 1.3% |
| Health care | 5.3% | 5.5% | 8.8% | 9.0% | 8.1% | 6.8% | 5.6% | 5.1% | 4.7% | 3.8% |
| Entertainment | 4.9% | 5.5% | 4.1% | 4.7% | 3.7% | 4.7% | 4.7% | 4.7% | 5.1% | 5.1% |
| Personal Insurance & pensions | 10.7% | 1.8% | 2.1% | 2.8% | 4.4% | 6.4% | 8.4% | 10.2% | 12.3% | 15.6% |
| Others ^d | 9.7% | 12.4% | 10.8% | 8.1% | 10.8% | 10.8% | 9.5% | 8.7% | 8.8% | 10.0% |
| Households ^e (thousands) | 81,454 | 3,627 | 7,183 | 8,037 | 6,677 | 12,039 | 9,477 | 7,653 | 11,337 | 15,424 |
| Percentage of households | 100% | 4.5% | 8.8% | 9.9% | 8.2% | 14.8% | 11.6% | 9.4% | 13.9% | 18.9% |
| 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/share/2000/income.txt, February 2002. (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)

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

Source:

U.S. Department of Transportation, Federal Highway Administration, *1990 Nationwide Personal Transportation Survey: Summary of Travel Trends*, FHWA-PL-92-027, Washington, DC, March 1992, Table 7. Data for 1995 were generated from the Internet site 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)

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



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

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

Source:

U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Study, Public Use Tapes, Washington, DC. Data for 1995 were generated from the Internet site 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.

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

^bIncludes trip purposes not shown on this table.



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

| Number of Drivers | Average number of vehicles per household | | Average vehicle-miles traveled per household | |
|-------------------------------|--|------------|--|---------------|
| | 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 |
| All households | 1.8 | 1.8 | 18,300 | 18,700 |

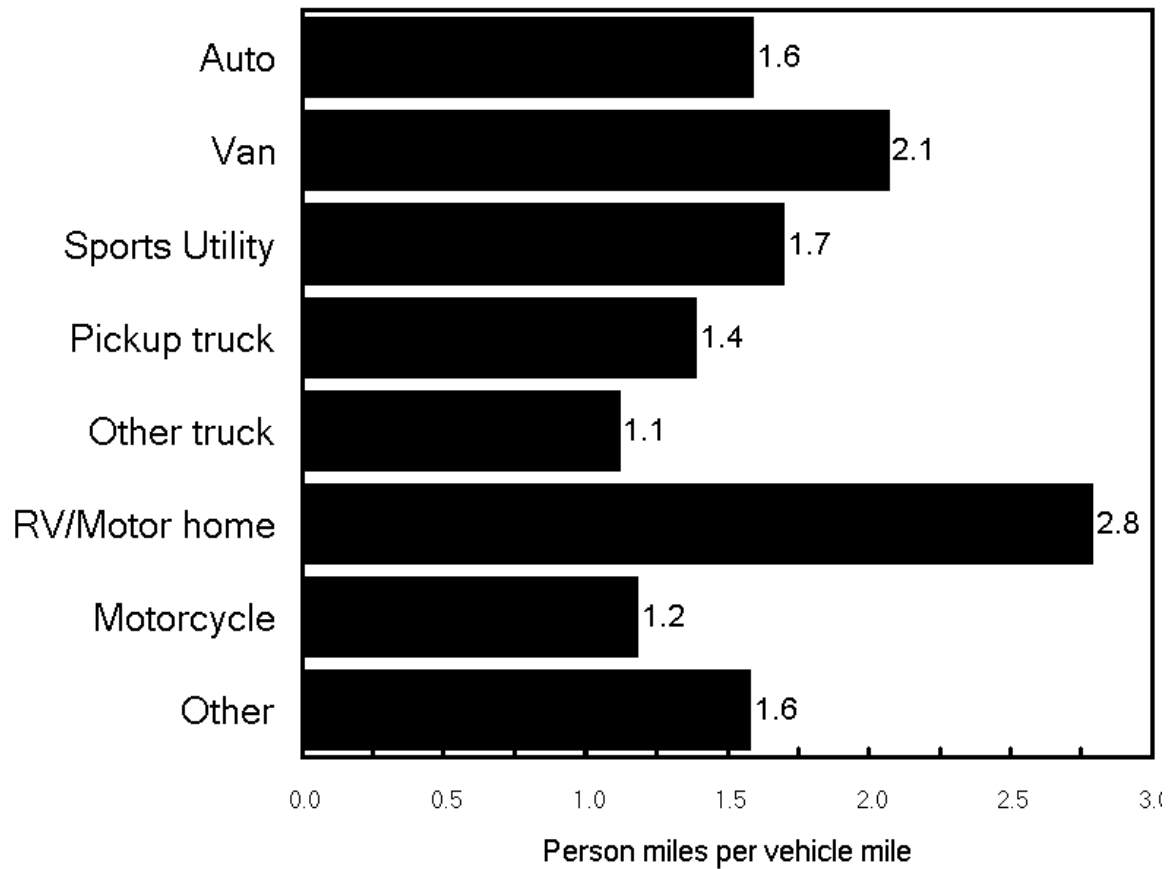
Source:

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:

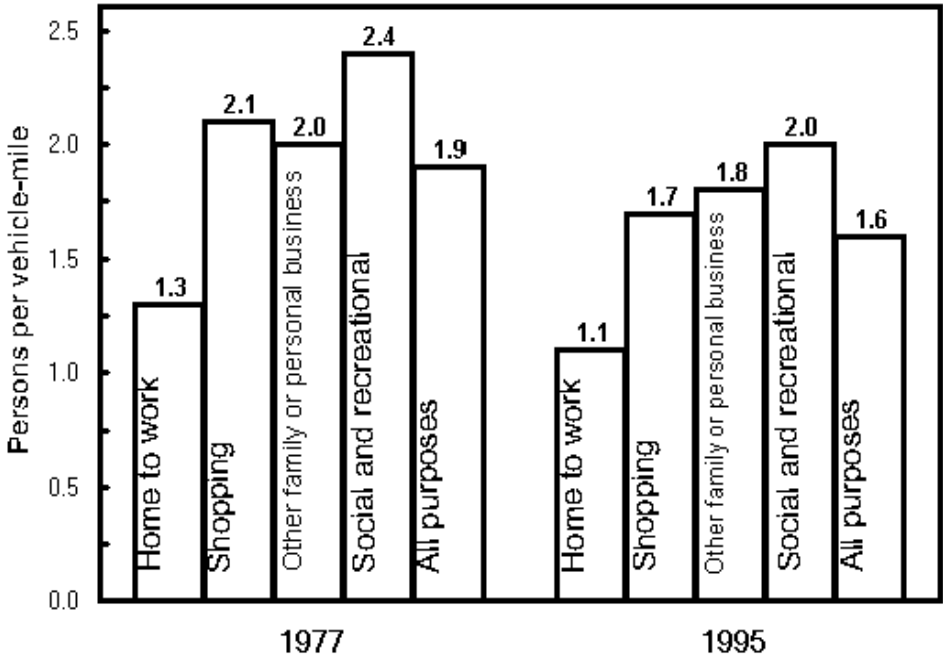
U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Survey, Washington, DC, 1997.

(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)

^aVehicles 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](http://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, 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 |
|---|------------------------|-----------------------|--------------------|-------|
| <i>Average travel time^c (Index: 1983 Private = 1.00)</i> | | | | |
| 1983 | 1.00 | 2.26 | 0.60 | 1.03 |
| 1990 | 1.09 | 2.34 | 0.70 | 1.11 |
| 1995 | 1.14 | 2.39 | 1.07 | 1.18 |
| <i>Average trip length (Index: 1983 Private = 1.00)</i> | | | | |
| 1983 | 1.00 | 1.33 | 0.16 | 0.96 |
| 1990 | 1.24 | 1.44 | 0.25 | 1.20 |
| 1995 | 1.33 | 1.45 | 0.92 | 1.30 |
| <i>Average speed (Index: 1983 Private = 1.00)</i> | | | | |
| 1983 | 1.00 | 0.59 | 0.25 | 0.93 |
| 1990 ^d | 1.15 | 0.60 | 0.25 | 1.10 |
| 1995 ^d | 1.17 | 0.64 | 0.86 | 1.15 |

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)

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

^bIncludes airplane, Amtrak, taxi, bicycle, school bus, moped, walk and other.

^cDoes not include time spent waiting for transportation.

^dDoes 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% |
| <i>Drove alone</i> | 62,193 | 64.4% | 84,215 | 73.2% | 97,247 | 76.3% |
| <i>Car pooled</i> | 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% |
| <i>Bus or trolley bus^a</i> | 3,925 | 4.1% | 3,445 | 3.0% | 3,572 | 2.8% |
| <i>Streetcar or trolley car^a</i> | ^b | ^b | 78 | 0.1% | 88 | 0.1% |
| <i>Subway or elevated</i> | 1,529 | 1.6% | 1,755 | 1.5% | 1,981 | 1.6% |
| <i>Railroad</i> | 554 | 0.6% | 574 | 0.5% | 696 | 0.5% |
| <i>Ferryboat</i> | ^b | ^b | 37 | 0.0% | 43 | 0.0% |
| <i>Taxicab</i> | 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)



Sales of bicycles with wheel sizes of 20-inches and over have grown at an average annual rate of 1.5% from 1981 to 2000. The largest growth in bicycle sales, however, were bicycles with wheel sizes under 20 inches which grew at an average annual rate of 6.7%.

Table 11.16
Bicycle Sales, 1981–2000
(millions)

| | Wheel sizes under 20 inches | Wheel sizes of 20 inches and over | All wheel sizes |
|-----------|---|---|--------------------|
| 1981 | a | 8.9 | a |
| 1982 | a | 6.8 | a |
| 1983 | a | 9.0 | a |
| 1984 | a | 10.1 | a |
| 1985 | a | 11.4 | a |
| 1986 | a | 12.3 | a |
| 1987 | a | 12.6 | a |
| 1988 | a | 9.9 | a |
| 1989 | a | 10.7 | a |
| 1990 | a | 10.8 | a |
| 1991 | a | 11.6 | a |
| 1992 | 3.7 | 11.6 | 15.3 |
| 1993 | 3.8 | 13.0 | 16.8 |
| 1994 | 4.2 | 12.5 | 16.7 |
| 1995 | 4.1 | 12.0 | 16.1 |
| 1996 | 4.5 | 10.9 | 15.4 |
| 1997 | 4.2 | 11.0 | 15.2 |
| 1998 | 4.7 | 11.1 | 15.8 |
| 1999 | 5.9 | 11.6 | 17.5 |
| 2000 | 6.2 | 11.9 | 18.1 |
| | <i>Average annual percentage change</i> | | |
| 1981–2000 | a | 1.5% | a |
| 1992–2000 | 6.7% | 0.3% | 2.1% |

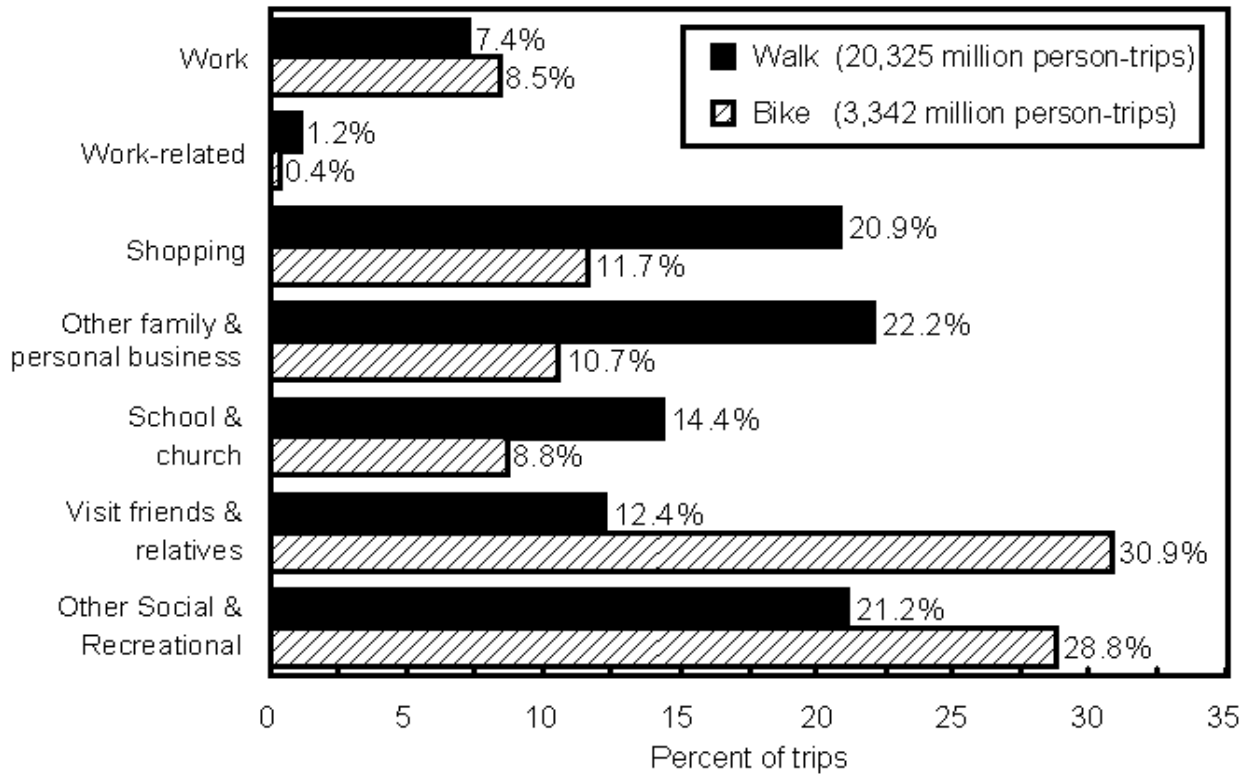
Source:

1981–1996: Bicycle Manufacturers Association. 1997–on: The Bicycle Council.
(Additional resources: www.nbda.com)

^a Data are not available.



Figure 11.3 Walk and Bike Trips by Trip Purpose, 1995 NPTS



Source:

U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Survey web site: www-cta.ornl.gov/npts.

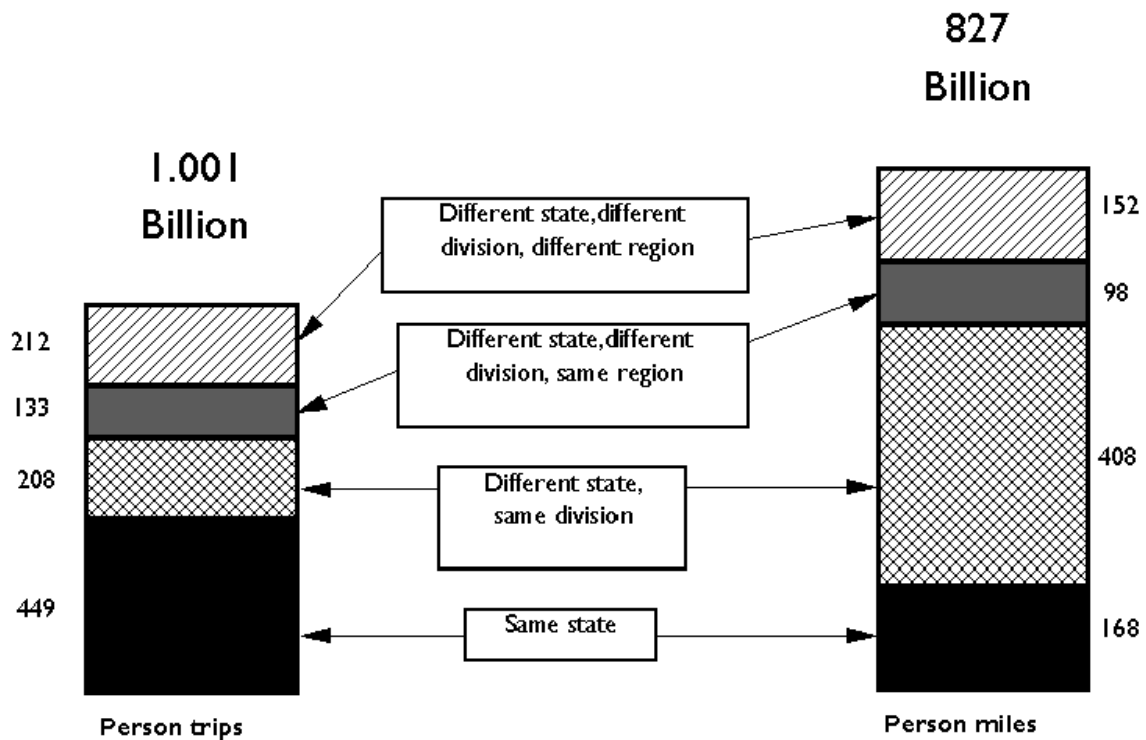


1995 American Travel Survey

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 11.4 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 11.17
Long-Distance Trips^a by Mode and Purpose, 1995

| Principal means of transportation | Main purpose of trip | | | | | |
|-----------------------------------|----------------------|-----------------------------------|----------------|----------------|-------------------|-----------------|
| | Business | Pleasure | | | Personal business | Total |
| | | <i>Visit friends or relatives</i> | <i>Leisure</i> | Total pleasure | | |
| 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 person-trips | 224,835 | 330,755 | 299,355 | 630,110 | 146,338 | 1,001,31 |
| 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:

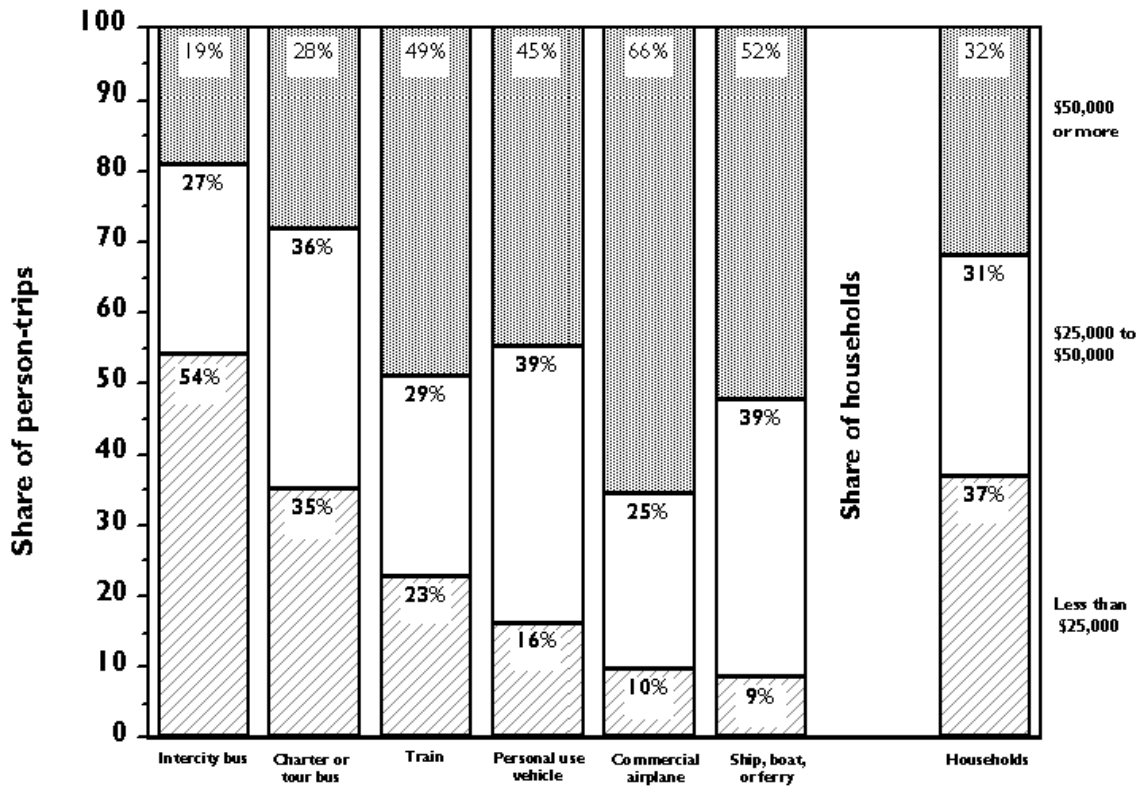
U.S. Department of Transportation, Bureau of Transportation Statistics, *1995 American Travel Survey Profile*, Washington, DC, October 1997, p. 13. (Additional resources: www.bts.gov/ats)

^aA 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 11.5. Shares of Long-Distance Person Trips by Mode and Household Income, 1995



Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *1995 American Travel Survey Profile*, Washington, DC, October 1997, p. 8.

U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, 117th Edition, Washington, DC, 1997, p. 465.

(Additional resources: www.bts.gov/ats, www.census.gov)



Chapter 12 Nonhighway Modes

Summary Statistics from Tables in this Chapter

| Source | | |
|--------------------|---|-----------------|
| | Passenger-miles, 2000 | (millions) |
| <i>Table 12.1</i> | <i>Domestic and international air carrier</i> | 708,419 |
| <i>Table 12.2</i> | <i>General aviation</i> | 14 ^a |
| <i>Table 12.11</i> | <i>Amtrak</i> | 5,574 |
| <i>Table 12.12</i> | <i>Commuter rail</i> | 9,402 |
| <i>Table 12.13</i> | <i>Transit rail</i> | 15,200 |
| | Freight ton-miles, 2000 | (millions) |
| <i>Table 12.4</i> | <i>Domestic waterborne commerce</i> | 646,000 |
| <i>Table 12.8</i> | <i>Class I railroad</i> | 1,465,960 |
| | Passenger energy use, 2000 | (trillion Btus) |
| <i>Table 12.1</i> | <i>Domestic and international air carrier</i> | 2,743.1 |
| <i>Table 12.2</i> | <i>General aviation</i> | 175.2 |
| <i>Table 12.6</i> | <i>Recreational boats</i> | 311.2 |
| <i>Table 12.11</i> | <i>Amtrak</i> | 16.2 |
| <i>Table 12.12</i> | <i>Commuter rail</i> | 25.9 |
| <i>Table 12.13</i> | <i>Transit rail</i> | 47.2 |
| | Freight energy use, 2000 | (trillion Btus) |
| <i>Table 12.4</i> | <i>Domestic waterborne commerce</i> | 327.9 |
| <i>Table 12.8</i> | <i>Class I railroad</i> | 516.0 |

^a 1999 data. The 2000 data are not yet available.





Table 12.1
Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers (Combined Totals), 1970–2001^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 | 6,227 | 812 | 635,517 | 899,851 | 145 | 70.6% | 28,102 | 2,573.4 | 72.8% |
| 1999 | 6,558 | 824 | 668,626 | 942,311 | 144 | 71.0% | 28,984 | 2,653.1 | 73.3% |
| 2000 | 6,944 | 833 | 708,419 | 980,379 | 141 | 72.3% | 30,863 | 2,743.1 | 73.1% |
| 2001 | 6,807 | 842 | 664,841 | 950,530 | 140 | 69.9% | 27,882 | 2,599.4 | 72.8% |
| <i>Average annual percentage change</i> | | | | | | | | | |
| 1970–2001 | 3.4% | 0.7% | 5.4% | 4.2% | 0.8% | | 5.7% | 2.1% | |
| 1991–2001 | 3.9% | 0.4% | 3.7% | 2.6% | -1.2% | | 5.6% | 2.2% | |

Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *Air Carrier Traffic Statistics Monthly*, December 2001/2000, Washington, DC, pp. 1–2, and annual. 1970–76 Energy Use - Department of Transportation, Civil Aeronautics Board, *Fuel Cost and Consumption*, Washington, DC, 1981, and annual. 1977–2001 Energy Use - Department of Transportation, Bureau of Transportation Statistics, "Fuel Cost and Consumption Table," Washington, DC. (Additional resources: www.bts.gov, www.faa.gov)

^aData are for all U.S. air carriers reporting on Form 41.

^bScheduled 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.

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

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

^eEnergy use includes fuel purchased abroad for international flights.

^fScheduled services only.

^gData are not available.

General aviation includes: (1) aircraft operating under general operating and flight rules; (2) not-for-hire airplanes with a seating capacity of 20 or more or a maximum payload capacity of 6,000 lbs. or more; (3) rotocraft external load operations; (4) on-demand and commuter operations not covered under Federal Aviation Regulations Part 121; and (5) agricultural aircraft operations.

Table 12.2
Summary Statistics for General Aviation, 1970–2000

| 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 | 29,862 | 12.1 | 120.4 |
| 1992 | 185,650 | 26,747 | 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 |
| 2000 | 217,533 | 30,975 | ^c | 175.2 |
| <i>Average annual percentage change</i> | | | | |
| 1970–2000 | 1.7% | 0.6% | 1.4% | 2.1% |
| 1990–2000 | 0.9% | -0.4% | 0.3% | 2.9% |

Sources:

Intercity passenger-miles - Eno Foundation for Transportation, *Transportation in America 2001*, Nineteenth edition, Lansdowne, VA, 2002, p. 15, and annual.

All other- U.S. Department of Transportation, Federal Aviation Administration, *General Aviation Activity and Avionics Survey: Calendar Year 2000*, Tables 1.2, 1.5, 5.1, and annual.

(Additional resources: www.faa.gov)

^aActive fixed-wing general aviation aircraft only.

^bIncludes rotocraft.

^cData are not available.



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, 1970–2000
(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 | 2,323 | 1,261 | 1,062 | 45.6% |
| 2000 | 2,462 | 1,392 | 1,070 | 43.5% |
| <i>Average annual percentage change</i> | | | | |
| 1970–2000 | 1.6% | 3.0% | 0.4% | |
| 1990–2000 | 1.3% | 2.9% | -0.5% | |

Source:

U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 2000*, Part 5: National Summaries, New Orleans, Louisiana, 2002, Table 1-1, p. 1-3, and annual. (Additional resources: www.wrc-ndc.usace.army.mil/ndc)

^aAll movements between the U.S. and foreign countries and between Puerto Rico and the Virgin Islands and foreign countries are classified as foreign trade.

^bAll 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, 1970–2000

| 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 |
| 2000 | 41,354 | 646 | 1,064 | 606.8 | 508 | 327.9 |
| <i>Average annual percentage change</i> | | | | | | |
| 1970–2000 | 1.6% | 0.3% | 0.4% | -0.1% | -0.2% | 0.0% |
| 1990–2000 | 0.5% | -2.5% | -0.5% | -2.0% | 2.7% | 0.1% |

Source:

Number of vessels -

1970–92, 1995–2000 - U.S. Department of the Army, Corps of Engineers, "Summary of U.S. Flag Passenger and cargo vessels, 2000," 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 2000* Part 5: National Summaries, New Orleans, LA, 2001, Table 1-4, pp. 1-6, 1-7, and annual.

Energy use - See Appendix A for Water Energy Use.

(Additional resources: www.wrc-ndc.usace.army.mil/ndc)

^aGrand total for self-propelled and non-self-propelled.

^bThese 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-five percent of all domestic marine cargo in 2000 were energy-related products (petroleum, coal, coke). The majority of the energy-related products were shipped internally and locally (66%). Barge traffic accounted for 95.7% of all internal and local waterborne commerce.

Table 12.5
Breakdown of Domestic Marine Cargo by Commodity Class, 2000

| Commodity class | Coastwise | | Lakewise | | Internal and local | | Total domestic ^a | | |
|--------------------------------|-------------------------|-----------------------------------|-------------------------|-----------------------------------|-------------------------|-----------------------------------|-----------------------------|------------|-----------------------------------|
| | 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 | 163 | 1,279 | 2 | 325 | 200 | 194 | 365 | 34.3% | 680 |
| Chemicals and related products | 14 | 1,994 | ^c | 365 | 62 | 498 | 76 | 7.1% | 769 |
| Crude materials | 14 | 553 | 88 | 515 | 133 | 375 | 234 | 22.0% | 438 |
| Coal and coke | 14 | 649 | 20 | 519 | 186 | 328 | 221 | 20.7% | 367 |
| Primary manufactured goods | 7 | 548 | 4 | 311 | 35 | 881 | 46 | 4.3% | 781 |
| Food and farm products | 6 | 1,873 | ^c | 980 | 91 | 1,007 | 97 | 9.1% | 1,059 |
| Manufactured equipment | 9 | 1,822 | ^c | ^c | 12 | 78 | 21 | 2.0% | 790 |
| Waste and scrap | ^c | 0 | 0 | 0 | 4 | 77 | 4 | 0.4% | 77 |
| Unknown | ^c | 2,024 | ^c | ^c | ^c | ^c | ^c | 0.0% | 1,214 |
| Total | 227 | 1,251 | 114 | 506 | 723 | 421 | 1,064 | 100.0% | 607 |
| Barge traffic (million tons) | 104 | | 12 | | 692 | | 808 | | |
| Percentage by barge | 45.9% | | 10.7% | | 95.7% | | 76.0% | | |

Source:

U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 2000*, Part 5: National Summaries, New Orleans, Louisiana, 2002, 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.

^aDoes not include intra-territory tons.

^bCalculated as ton-miles divided by tons shipped.

^cNegligible.

According to the U.S. Coast Guard there are 4,800 more recreational boats in 2000 than in 1977. Even so, recreational boat fatalities are on the decline. There were only 5.5 fatalities per 100,000 boats in 2000.

Table 12.6
Recreational Boating Statistics, 1977–2000

| Year | Number of numbered boats (thousands) | Fatalities | Fatalities per 100,000 numbered boats | Energy use ^a (trillion btu) |
|-----------|--|---|---|---|
| 1977 | 7,976 | 1,312 | 16.5 | 194.2 |
| 1978 | 8,036 | 1,321 | 16.4 | 195.6 |
| 1979 | 8,279 | 1,400 | 16.9 | 201.5 |
| 1980 | 8,578 | 1,360 | 15.9 | 208.8 |
| 1981 | 8,905 | 1,280 | 14.4 | 216.8 |
| 1982 | 9,074 | 1,178 | 13.0 | 220.9 |
| 1983 | 9,165 | 1,241 | 13.5 | 223.1 |
| 1984 | 9,420 | 1,063 | 11.3 | 229.3 |
| 1985 | 9,589 | 1,116 | 11.6 | 233.4 |
| 1986 | 9,876 | 1,066 | 10.8 | 240.4 |
| 1987 | 9,964 | 1,036 | 10.4 | 242.6 |
| 1988 | 10,363 | 946 | 9.1 | 252.3 |
| 1989 | 10,777 | 896 | 8.3 | 262.4 |
| 1990 | 10,996 | 865 | 7.9 | 267.7 |
| 1991 | 11,068 | 924 | 8.3 | 269.4 |
| 1992 | 11,132 | 816 | 7.3 | 271.0 |
| 1993 | 11,283 | 800 | 7.1 | 274.7 |
| 1994 | 11,430 | 784 | 6.9 | 278.2 |
| 1995 | 11,735 | 829 | 7.1 | 285.7 |
| 1996 | 11,878 | 709 | 6.0 | 289.2 |
| 1997 | 12,313 | 821 | 6.7 | 299.7 |
| 1998 | 12,566 | 815 | 6.5 | 305.9 |
| 1999 | 12,738 | 734 | 5.8 | 310.1 |
| 2000 | 12,782 | 701 | 5.5 | 311.2 |
| | | <i>Average annual percentage change</i> | | |
| 1977–2000 | 2.1% | -2.7% | -4.7% | 2.1% |
| 1990–2000 | 1.5% | -2.1% | -3.6% | 1.5% |

Source:

U.S. Department of Transportation, United States Coast Guard, *Boating Statistics - 2000*, pp. 6, 23, and annual.

^aEnergy use estimated using the methodology developed by D.L. Greene in the report *Off-Highway Gasoline in the United States*, (DOT, FHWA, July 1986, p. 3–22) [0.95 x 205 gallons/boat x number of boats].



The Interstate Commerce Commission designates Class I railroads on the basis of annual gross revenues. In 2000, eight 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 12.7
Class I Railroad Freight Systems in the United States
Ranked by Revenue Ton-Miles, 2000

| Railroad | Revenue ton-miles (billions) | Percent |
|--|---------------------------------|---------------|
| Burlington Northern and Sante Fe Railway Company | 492 | 33.6% |
| Union Pacific Railroad Company | 485 | 33.1% |
| CSX Transportation | 212 | 14.5% |
| Norfolk Southern Corporation | 197 | 13.4% |
| Illinois Central Railroad Company | 26 | 1.8% |
| Kansas City Southern Railway Company | 20 | 1.4% |
| Soo Line Railroad Company | 22 | 1.5% |
| Grand Trunk Western Railroad Inc. | 11 | 0.8% |
| Total | 1,465 | 100.0% |

Source:

Association of American Railroads, *Railroad Facts*, 2001 Edition, Washington, DC, October 2001, p. 66. (Additional resources: www.aar.org)



Revenue ton-miles for Class I freight railroads was nearly 1.5 trillion in 2000. Though there are many regional and local freight railroads, the Class I freight railroads accounted for 91% of the railroad industry's freight revenue in 2000 and 71% of the industry's mileage operated..

Table 12.8
Summary Statistics for Class I Freight Railroads, 1970–2000

| 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 | 469.9 |
| 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 | 363 | 520.0 |
| 2000 | 20,028 | 560 | 504 | 34,590 | 1,738 | 843 | 1,465,960 | 352 | 516.0 |
| <i>Average annual percentage change</i> | | | | | | | | | |
| 1970–2000 | -1.0% | -3.1% | 0.6% | 0.5% | 0.5% | 1.7% | 2.2% | -2.2% | -0.1% |
| 1990–2000 | 0.6% | -1.6% | 2.9% | 2.8% | 2.0% | 1.5% | 3.6% | -1.8% | 1.7% |

Source:

Association of American Railroads, *Railroad Facts*, 2001 Edition, Washington, DC, October 2001, pp. 27, 28, 33, 34, 36, 49, 51, 61.
(Additional resources: www.aar.org)

^aDoes 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.

^bDoes not include private or shipper-owned cars.

^cTons originated is a more accurate representation of total tonnage than revenue tons. Revenue tons often produces double-counting of loads switched between rail companies.

^dData 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 158% in carloads from 1974 to 2000. Coal now accounts for one quarter of all carloads.

Table 12.9
Railroad Revenue Carloads by Commodity Group, 1974 and 2000

| Commodity group | Carloads (thousands) | | Percent distribution | | Percentage change 1974-2000 |
|----------------------------------|-------------------------|---------------|----------------------|---------------|-----------------------------------|
| | 1974 | 2000 | 1974 | 2000 | |
| Coal | 4,544 | 6,954 | 17.0% | 25.0% | 53.0% |
| Farm products | 3,021 | 1,437 | 11.3% | 5.2% | -52.4% |
| Chemicals and allied products | 1,464 | 1,844 | 5.5% | 6.6% | 26.0% |
| Nonmetallic minerals | 821 | 1,309 | 3.1% | 4.7% | 59.4% |
| Food and kindred products | 1,777 | 1,377 | 6.6% | 5.0% | -22.5% |
| Lumber and wood products | 1,930 | 648 | 7.2% | 2.3% | -66.4% |
| Metallic ores | 1,910 | 322 | 7.1% | 1.2% | -83.1% |
| Stone, clay and glass | 2,428 | 541 | 9.1% | 1.9% | -77.7% |
| Pulp, paper, and allied products | 1,180 | 633 | 4.4% | 2.3% | -46.4% |
| Petroleum products | 877 | 541 | 3.3% | 1.9% | -38.3% |
| Primary metal products | 1,366 | 753 | 5.1% | 2.7% | -44.9% |
| Waste and scrap material | 889 | 619 | 3.3% | 2.2% | -30.4% |
| Transportation equipment | 1,126 | 1,860 | 4.2% | 6.7% | 65.2% |
| Others | 3,451 | 8,925 | 12.9% | 32.1% | 158.6% |
| Total | 26,784 | 27,763 | 100.0% | 100.0% | 3.7% |

Source:

1974 - Association of American Railroads, *Railroad Facts*, 1976 Edition, Washington, DC, 1975, p. 26.

2000 - Association of American Railroads, *Railroad Facts*, 2001 Edition, Washington, DC,
October 2001, 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 2000. Containerization has increased in recent years, evidenced by the 173% increase in the number of containers from 1988 to 2000. 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 12.10
Intermodal Rail Traffic, 1965–2000

| 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 ^b | 7,936,172 | 3,492,463 | 4,443,709 |
| 1996 ^b | 8,143,258 | 3,302,128 | 4,841,130 |
| 1997 ^b | 8,698,308 | 3,453,907 | 5,244,401 |
| 1998 ^b | 8,772,663 | 3,353,032 | 5,419,631 |
| 1999 ^c | 8,907,626 | 3,207,407 | 5,700,219 |
| 2000 ^c | 9,176,890 | 2,888,630 | 6,288,260 |
| <i>Average annual percentage change</i> | | | |
| 1965–2000 | 5.0% | a | a |
| 1990–2000 | 4.0% | -1.8% | 8.6% |

Source:

Association of American Railroads, *Railroad Facts*,
2001 edition, Washington, DC, October 2001 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.

^c The Illinois Central, Grand Trunk Western Railroad and the Soo Line Railroad Company data are excluded.



The National Railroad Passenger Corporation, known as Amtrak, began operation in 1971. Though Amtrak revenue passenger-miles have grown at an average annual rate of 3.6% from 1971 to 2000, they showed a small decline in annual percentage change from 1990 to 2000.

Table 12.11
Summary Statistics for the National Railroad Passenger Corporation (Amtrak), 1971–2000

| 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 | 2,357 | 13.8 ^b |
| 1995 | 422 | 1,907 | 31,579 | 282,579 | 5,401 | 266 | 2,590 | 14.0 |
| 1996 | 348 | 1,501 | 30,542 | 277,750 | 5,066 | 257 | 2,792 | 14.1 |
| 1997 | 292 | 1,572 | 32,000 | 287,760 | 5,166 | 255 | 2,918 | 15.1 |
| 1998 | 362 | 1,347 | 32,926 | 315,823 | 5,325 | 251 | 2,900 | 15.4 |
| 1999 | 385 | 1,285 | 34,080 | 349,337 | 5,289 | 245 | 3,062 | 16.2 |
| 2000 | 385 | 1,891 | 35,404 | 371,215 | 5,574 | 243 | 2,902 | 16.2 |
| | | | <i>Average annual percentage change</i> | | | | | |
| 1971–2000 | ^a | 1.7% | 2.7% | 3.4% | 3.6% | 0.9% | ^a | ^a |
| 1990–2000 | 1.9% | 0.1% | 0.7% | 2.1% | -0.8% | -1.2% | 1.1% | 0.3% |

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.

1994–2000 - 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*, 2001 Edition, Washington, DC, 2002, p. 77.

Energy use - Personal communication with the Amtrak, Washington, DC.

(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.



Commuter rail, which is also known as regional rail or suburban rail, is long-haul rail passenger service operating between metropolitan and suburban areas, whether within or across state lines. Commuter rail lines usually have reduced fares for multiple rides and commutation tickets for regular, recurring riders.

Table 12.12
Summary Statistics for Commuter Rail Operations, 1984–2000

| Year | Number of passenger vehicles | Vehicle-miles (millions) | Passenger trips (millions) | Passenger-miles (millions) | Average trip length (miles) | Energy intensity (Btu/passenger-mile) | Energy use (trillion Btu) |
|---|------------------------------|--------------------------|----------------------------|----------------------------|-----------------------------|---------------------------------------|---------------------------|
| 1984 | 4,075 | 167.9 | 267 | 6,207 | 23.2 | 3,011 | 18.7 |
| 1985 | 4,035 | 182.7 | 275 | 6,534 | 23.8 | 3,053 | 20.0 |
| 1986 | 4,440 | 188.6 | 306 | 6,723 | 22.0 | 3,174 | 21.3 |
| 1987 | 4,686 | 188.9 | 311 | 6,818 | 21.9 | 3,043 | 20.7 |
| 1988 | 4,649 | 202.2 | 325 | 6,964 | 21.4 | 3,075 | 21.4 |
| 1989 | 4,472 | 209.6 | 330 | 7,211 | 21.9 | 3,120 | 22.5 |
| 1990 | 4,415 | 212.7 | 328 | 7,082 | 21.6 | 3,068 | 21.7 |
| 1991 | 4,370 | 214.9 | 318 | 7,344 | 23.1 | 3,011 | 22.1 |
| 1992 | 4,413 | 218.8 | 314 | 7,320 | 23.3 | 2,848 | 20.8 |
| 1993 | 4,494 | 223.9 | 322 | 6,940 | 21.6 | 3,222 | 22.4 |
| 1994 | 4,517 | 230.8 | 339 | 7,996 | 23.6 | 2,904 | 23.2 |
| 1995 | 4,565 | 237.7 | 344 | 8,244 | 24.0 | 2,849 | 23.5 |
| 1996 | 4,665 | 241.9 | 352 | 8,351 | 23.7 | 2,796 | 23.3 |
| 1997 | 4,943 | 250.7 | 357 | 8,038 | 22.5 | 2,949 | 23.7 |
| 1998 | 4,963 | 259.5 | 381 | 8,704 | 22.8 | 2,859 | 24.9 |
| 1999 | 4,883 | 265.9 | 396 | 8,766 | 22.1 | 2,929 | 25.7 |
| 2000 | 5,073 | 270.9 | 413 | 9,402 | 22.8 | 2,759 | 25.9 |
| <i>Average annual percentage change</i> | | | | | | | |
| 1984–2000 | 1.4% | 3.0% | 2.8% | 2.6% | -0.1% | -0.5% | 2.1% |
| 1990–2000 | 1.4% | 2.4% | 2.3% | 2.9% | 0.5% | -1.1% | -20.8% |

Source:

American Public Transportation Association, *2002 Public Transportation Fact Book*, Washington, DC, February 2002, pp. 66, 70, 78, 83, 112, 114.



This table on transit rail operations includes data on light rail and heavy rail systems. Light rail vehicles are usually single vehicles driven electrically with power drawn from overhead wires. Heavy rail is characterized by high speed and rapid acceleration of rail cars operating on a separate right-of-way.

Table 12.13
Summary Statistics for Rail Transit Operations, 1970–2000^a

| Year | Number of passenger vehicles | Vehicle-miles (millions) | Passenger trips (millions) ^b | 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 | 4.7 | 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 | 554.0 | 2,395 | 11,438 | 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 | 4.7 | 3,828 | 44.0 |
| 1995 | 11,156 | 571.8 | 2,284 | 11,419 | 5.0 | 3,818 | 43.6 |
| 1996 | 11,341 | 580.7 | 2,418 | 12,487 | 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 |
| 2000 | 12,168 | 648.0 | 2,952 | 15,200 | 5.1 | 3,105 | 47.2 |
| <i>Average annual percentage change</i> | | | | | | | |
| 1970–2000 | 0.5% | 1.3% | 1.1% | 0.7% | 0.2% ^g | 0.8% | 1.5% |
| 1990–2000 | 0.7% | 1.5% | 0.6% | 2.4% | 0.6% | -1.1% | 1.3% |

Source:

American Public Transit Association, *2002 Public Transportation Fact Book*, Washington, DC, February 2002, pp. 69, 70, 78, 83.

(Additional resources: www.apta.com)

Energy use - See Appendix A for Rail Transit Energy Use.

^aHeavy 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.

^b1970–79 data represents total passenger rides; after 1979, data represents unlinked passenger trips.

^cEstimated for years 1970–76 based on an average trip length of 5.8 miles.

^dCalculated as the ratio of passenger-miles to passenger trips.

^eLarge system-to-system variations exist within this category.

^fData are not available.

^gAverage annual percentage change is calculated for years 1980–2000.



APPENDIX A

SOURCES & METHODOLOGIES

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 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.

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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 |
| GSA | General Services Administration |
| gvw | gross vehicle weight |
| lpg | liquefied petroleum gas |
| mpg | miles per gallon |
| NHTSA | National Highway Traffic Safety Administration |
| NPTS | Nationwide Personal Transportation Survey |
| NVPP | National Vehicle Population Profile |
| 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 |

Energy Use Sources

Highway energy use

Automobiles

Fuel use in gallons from: DOT, FHWA, *Highway Statistics 2000*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995*. Fuel use was distributed among fuel types using the percentages shown in Table A1.

Table A.1
Automobile Fuel Use and Fuel Type Shares for Calculation of Energy Use

| Year | Fuel use (million gallons) | Source for gasohol shares | Source for gasoline/diesel shares | Shares by fuel type | | |
|--|-------------------------------|------------------------------|--------------------------------------|-----------------------|-----------------------|-----------------------|
| | | | | Gasoline | Gasohol | Diesel |
| 1970 | 67,820 | | 1984 NVPP | 99.8% | 0.0% | 0.2% |
| 1971 | 71,346 | | interpolated | 99.2% | 0.0% | 0.8% |
| 1972 | 75,937 | | interpolated | 98.7% | 0.0% | 1.3% |
| 1973 | 78,233 | | interpolated | 98.1% | 0.0% | 1.9% |
| 1974 | 74,229 | | interpolated | 97.5% | 0.0% | 2.5% |
| 1975 | 74,140 | | interpolated | 97.0% | 0.0% | 3.0% |
| 1976 | 78,297 | | interpolated | 96.4% | 0.0% | 3.6% |
| 1977 | 79,060 | | interpolated | 95.8% | 0.0% | 4.2% |
| 1978 | 80,652 | | interpolated | 95.3% | 0.0% | 4.7% |
| 1979 | 76,588 | | 1979 RTECS | 94.7% | 0.0% | 5.3% |
| 1980 | 69,981 | FHWA, MF-24 | interpolated | 93.9% | 0.5% | 5.6% |
| 1981 | 69,112 | FHWA, MF-24 | 1981 RTECS | 93.4% | 0.7% | 5.9% |
| 1982 | 69,116 | FHWA, MF-24 | interpolated | 93.5% | 2.3% | 4.2% |
| 1983 | 70,322 | FHWA, MF-24 | 1983 RTECS | 93.2% | 4.3% | 2.5% |
| 1984 | 70,663 | FHWA, MF-24 | interpolated | 92.7% | 5.3% | 2.0% |
| 1985 | 71,518 | FHWA, MF-24 | 1985 RTECS | 90.8% | 7.7% | 1.5% |
| 1986 | 73,174 | FHWA, MF-24 | interpolated | 91.0% | 7.6% | 1.4% |
| 1987 | 73,308 | FHWA, MF-24 | interpolated | 92.4% | 6.3% | 1.3% |
| 1988 | 73,345 | FHWA, MF-24 | 1988 RTECS | 91.4% | 7.4% | 1.2% |
| 1989 | 73,913 | FHWA, MF-24 | interpolated | 92.6% | 6.2% | 1.2% |
| 1990 | 69,568 | FHWA, MF-24 | interpolated | 92.0% | 6.8% | 1.2% |
| 1991 | 64,318 | FHWA, MF-24 | 1991 RTECS | 90.8% | 8.0% | 1.2% |
| 1992 | 65,436 | FHWA, MF-24 | interpolated | 90.8% | 7.9% | 1.2% |
| 1993 | 67,047 | FHWA, MF-24 | interpolated | 89.7% | 9.1% | 1.3% |
| 1994 | 67,874 | FHWA, MF-24 | 1994 RTECS | 89.1% | 9.6% | 1.3% |
| 1995 | 68,072 | FHWA, MF-24 | interpolated | 87.6% | 11.2% | 1.2% |
| 1996 | 69,221 | FHWA, MF-24 | interpolated | 88.8% | 10.1% | 1.0% |
| 1997 | 69,892 | FHWA, MF-24 | interpolated | 86.9% | 12.2% | 0.9% |
| 1998 | 71,695 | FHWA, MF-24 | interpolated | 88.0% | 11.2% | 0.8% |
| 1999 | 73,283 | FHWA, MF-24 | interpolated | 88.3% | 11.0% | 0.6% |
| 2000 | 72,916 | FHWA, MF-24 | 2000 NVPP | 86.9% | 12.6% | 0.5% |
| Heat content used for conversion to btu: | | | | 125,000 btu/gallon | 120,900 btu/gallon | 138,700 btu/gallon |

Motorcycles

DOT, FHWA, *Highway Statistics 2000*, Table VM-1, and annual editions.

Table A.2
Motorcycle Fuel Use

| Year | Fuel use (million gallons) | Year | Fuel use (million gallons) |
|--|-------------------------------|--------------------|-------------------------------|
| 1970 | 59580000 | 1986 | 187,940,000 |
| 1971 | 72,140,000 | 1987 | 190,120,000 |
| 1972 | 86,620,000 | 1988 | 200,480,000 |
| 1973 | 103,880,000 | 1989 | 207,420,000 |
| 1974 | 108,900,000 | 1990 | 191,140,000 |
| 1975 | 112,580,000 | 1991 | 183,560,000 |
| 1976 | 120,060,000 | 1992 | 191,140,000 |
| 1977 | 126,980,000 | 1993 | 198,120,000 |
| 1978 | 143,160,000 | 1994 | 204,800,000 |
| 1979 | 172,740,000 | 1995 | 198,262,073 |
| 1980 | 204,280,000 | 1996 | 195,940,000 |
| 1981 | 213,800,000 | 1997 | 201,620,000 |
| 1982 | 198,200,000 | 1998 | 205,660,000 |
| 1983 | 175,200,000 | 1999 | 211,680,000 |
| 1984 | 175,680,000 | 2000 | 209,580,000 |
| 1985 | 181720000 | | |
| Heat content used for conversion to btu: | | 125,000 btu/gallon | |

Buses

Transit:

APTA, *2001 Transit Fact Book*, 2000, Washington, DC. Data are not available for alternative fuels before 1992.

Table A.3
Transit Bus Fuel Use

| Year | Methanol (thousand gallons) | LNG (thousand gallons) | LPG (thousand gallons) | CNG (thousand gallons) | Gasoline (thousand gallons) | Diesel fuel (thousand gallons) | Electricity (million kilowatt hours) |
|--|-----------------------------------|------------------------------|------------------------------|------------------------------|-----------------------------------|--------------------------------------|---|
| 1992 | 1,583 | 191 | 2,487 | 1,009 | 32,906 | 592,049 | 80,000 |
| 1993 | 4,975 | 474 | 2,098 | 1,579 | 37,928 | 575,740 | 79,000 |
| 1994 | 12,269 | 1,450 | 1,871 | 4,835 | 43,921 | 565,064 | 103,000 |
| 1995 | 11,174 | 2,236 | 3,686 | 10,740 | 42,769 | 563,767 | 100,000 |
| 1996 | 7,268 | 2,862 | 5,235 | 15,092 | 41,495 | 577,680 | 69,000 |
| 1997 | 965 | 4,030 | 5,150 | 23,906 | 41,547 | 597,636 | 78,000 |
| 1998 | 958 | 5,331 | 6,631 | 37,268 | 35,645 | 606,631 | 74,000 |
| 1999 | 1,433 | 7,672 | 5,604 | 44,398 | 32,699 | 618,204 | 75,000 |
| 2000 | 131 | 12,567 | 4,988 | 54,794 | 29,908 | 635,160 | 77,000 |
| Heat content used for conversion to btu: | 64,600 btu/gallon | 90,800 btu/gallon | 91,300 btu/gallon | 129,400 btu/gallon | 125,000 btu/gallon | 138,700 btu/gallon | 11,765 btu/kWhr |

Intercity and School:

Eno Transportation Foundation, *Transportation in America 2000*, Eighteenth Edition, 2001, Washington, DC, pp. 20–23. School bus fuel was assumed to be 90% diesel fuel and 10% gasoline based on estimates from the National Association of State Directors of Pupil Transportation Services. Intercity bus fuel was assumed to be 100% diesel. Because the 2000 data were not available at the time this report went to press, the 1999 data were used again for 2000.

Table A.4
Intercity and School Bus Fuel Use

| Year | Intercity (million gallons) | School (million gallons) |
|--|--------------------------------|--|
| 1970 | 305.34 | 299.88 |
| 1971 | 296.73 | 309.75 |
| 1972 | 288.12 | 319.62 |
| 1973 | 252.42 | 327.04 |
| 1974 | 216.72 | 334.46 |
| 1975 | 181.02 | 341.88 |
| 1976 | 182.28 | 389.76 |
| 1977 | 181.86 | 401.52 |
| 1978 | 180.18 | 406.98 |
| 1979 | 205.38 | 404.88 |
| 1980 | 213.78 | 379.68 |
| 1981 | 205.38 | 386.82 |
| 1982 | 227.22 | 398.58 |
| 1983 | 237.30 | 400.68 |
| 1984 | 169.26 | 375.06 |
| 1985 | 165.48 | 425.04 |
| 1986 | 148.68 | 462.42 |
| 1987 | 155.82 | 487.20 |
| 1988 | 160.44 | 511.14 |
| 1989 | 166.74 | 498.12 |
| 1990 | 159.60 | 472.08 |
| 1991 | 160.44 | 533.40 |
| 1992 | 157.08 | 546.00 |
| 1993 | 171.36 | 533.40 |
| 1994 | 195.30 | 546.00 |
| 1995 | 195.30 | 545.16 |
| 1996 | 199.92 | 545.16 |
| 1997 | 212.52 | 544.74 |
| 1998 | 220.08 | 550.20 |
| 1999 | 241.08 | 555.66 |
| 2000 | Not available | Not available |
| Fuel type shares | 100% diesel | 90% diesel 10% gasoline |
| Heat content used for conversion to btu: | 138,700 btu/gallon | 138,700 btu/gallon 125,000 btu/gallon |

Trucks

*Light Trucks:*DOT, FHWA, *Highway Statistics 2000*, Table VM-1 and annual editions back to 1996;DOT, FHWA, *Highway Statistics Summary to 1995*.

Table A.5
Light Truck Fuel Use and Fuel Type Shares for Calculation of Energy Use

| Year | Fuel use (million gallons) | Source for gasohol shares | Source for gasoline/diesel /lpg shares | Shares by fuel type | | | |
|--|----------------------------------|------------------------------|--|-----------------------|-----------------------|-----------------------|----------------------|
| | | | | Gasoline | Gasohol | Diesel | Lpg |
| 1970 | 12,313 | | 1977 TIUS | 97.6% | 0.0% | 1.6% | 0.8% |
| 1971 | 13,484 | | 1977 TIUS | 97.6% | 0.0% | 1.6% | 0.8% |
| 1972 | 15,150 | | 1977 TIUS | 97.6% | 0.0% | 1.6% | 0.8% |
| 1973 | 16,828 | | 1977 TIUS | 97.6% | 0.0% | 1.6% | 0.8% |
| 1974 | 16,657 | | 1977 TIUS | 97.6% | 0.0% | 1.6% | 0.8% |
| 1975 | 19,081 | | 1977 TIUS | 97.6% | 0.0% | 1.6% | 0.8% |
| 1976 | 20,828 | | 1977 TIUS | 97.6% | 0.0% | 1.6% | 0.8% |
| 1977 | 22,383 | | 1977 TIUS | 97.6% | 0.0% | 1.6% | 0.8% |
| 1978 | 24,162 | | Interpolated | 97.1% | 0.0% | 2.0% | 0.9% |
| 1979 | 24,445 | | Interpolated | 96.7% | 0.0% | 2.4% | 1.0% |
| 1980 | 23,796 | FHWA, MF-24 | Interpolated | 95.7% | 0.5% | 2.7% | 1.0% |
| 1981 | 23,697 | FHWA, MF-24 | Interpolated | 95.1% | 0.7% | 3.1% | 1.1% |
| 1982 | 22,702 | FHWA, MF-24 | 1982 TIUS | 93.0% | 2.3% | 3.5% | 1.2% |
| 1983 | 23,945 | FHWA, MF-24 | Interpolated | 91.0% | 4.3% | 3.5% | 1.2% |
| 1984 | 25,604 | FHWA, MF-24 | Interpolated | 90.0% | 5.3% | 3.5% | 1.2% |
| 1985 | 27,363 | FHWA, MF-24 | Interpolated | 87.6% | 7.7% | 3.5% | 1.2% |
| 1986 | 29,074 | FHWA, MF-24 | Interpolated | 87.7% | 7.6% | 3.5% | 1.2% |
| 1987 | 30,598 | FHWA, MF-24 | 1987 TIUS | 89.0% | 6.3% | 3.5% | 1.2% |
| 1988 | 32,653 | FHWA, MF-24 | Interpolated | 88.2% | 7.4% | 3.5% | 1.0% |
| 1989 | 33,271 | FHWA, MF-24 | Interpolated | 89.5% | 6.2% | 3.4% | 0.8% |
| 1990 | 35,611 | FHWA, MF-24 | Interpolated | 89.2% | 6.8% | 3.4% | 0.7% |
| 1991 | 38,217 | FHWA, MF-24 | Interpolated | 88.1% | 8.0% | 3.3% | 0.5% |
| 1992 | 40,929 | FHWA, MF-24 | 1992 TIUS | 88.5% | 7.9% | 3.3% | 0.3% |
| 1993 | 42,851 | FHWA, MF-24 | Interpolated | 87.3% | 9.1% | 3.3% | 0.3% |
| 1994 | 44,112 | FHWA, MF-24 | Interpolated | 86.8% | 9.6% | 3.3% | 0.3% |
| 1995 | 45,605 | FHWA, MF-24 | Interpolated | 85.1% | 11.2% | 3.4% | 0.3% |
| 1996 | 47,354 | FHWA, MF-24 | Interpolated | 86.2% | 10.1% | 3.4% | 0.3% |
| 1997 | 49,388 | FHWA, MF-24 | 1997 VIUS | 84.2% | 12.2% | 3.4% | 0.2% |
| 1998 | 50,462 | FHWA, MF-24 | 1997 VIUS | 85.2% | 11.2% | 3.4% | 0.2% |
| 1999 | 52,859 | FHWA, MF-24 | 1997 VIUS | 85.4% | 11.0% | 3.4% | 0.2% |
| 2000 | 52,832 | FHWA, MF-24 | 1997 VIUS | 83.8% | 12.6% | 3.4% | 0.2% |
| Heat content used for conversion to btu: | | | | 125,000 btu/gallon | 120,900 btu/gallon | 138,700 btu/gallon | 90,800 btu/gallon |

Medium/Heavy Trucks:

DOT, FHWA, *Highway Statistics 1999*, Table VM-1 and annual editions back to 1996;
 DOT, FHWA, *Highway Statistics Summary to 1995*. Total gallons for other
 trucks was the difference between total and 2-axle, 4-tire trucks.

Table A.6
Medium/Heavy Truck Fuel Use and Fuel Type Shares
for Calculation of Energy Use

| Year | Fuel use (million gallons) | Source for gasoline/diesel /lpg shares | Shares by fuel type | | |
|--|-------------------------------|--|---------------------|------------|------------|
| | | | Gasoline | Diesel | Lpg |
| 1970 | 11,316 | 1977 TIUS | 10.4% | 89.5% | 0.1% |
| 1971 | 11,812 | 1977 TIUS | 10.4% | 89.5% | 0.1% |
| 1972 | 12,964 | 1977 TIUS | 10.4% | 89.5% | 0.1% |
| 1973 | 14,320 | 1977 TIUS | 10.4% | 89.5% | 0.1% |
| 1974 | 14,341 | 1977 TIUS | 10.4% | 89.5% | 0.1% |
| 1975 | 14,598 | 1977 TIUS | 10.4% | 89.5% | 0.1% |
| 1976 | 15,408 | 1977 TIUS | 10.4% | 89.5% | 0.1% |
| 1977 | 17,082 | 1977 TIUS | 10.4% | 89.5% | 0.1% |
| 1978 | 19,121 | Interpolated | 16.2% | 83.5% | 0.3% |
| 1979 | 19,913 | Interpolated | 22.1% | 77.5% | 0.5% |
| 1980 | 19,960 | Interpolated | 27.9% | 71.4% | 0.6% |
| 1981 | 20,376 | Interpolated | 33.8% | 65.4% | 0.8% |
| 1982 | 20,386 | 1982 TIUS | 39.6% | 59.4% | 1.0% |
| 1983 | 20,761 | Interpolated | 35.6% | 63.6% | 0.8% |
| 1984 | 21,428 | Interpolated | 31.5% | 67.8% | 0.7% |
| 1985 | 21,405 | Interpolated | 27.5% | 72.0% | 0.5% |
| 1986 | 21,861 | Interpolated | 23.4% | 76.2% | 0.4% |
| 1987 | 22,513 | 1987 TIUS | 19.4% | 80.4% | 0.2% |
| 1988 | 22,925 | Interpolated | 18.8% | 81.0% | 0.3% |
| 1989 | 23,512 | Interpolated | 18.1% | 81.6% | 0.3% |
| 1990 | 24,490 | Interpolated | 17.5% | 82.1% | 0.4% |
| 1991 | 24,981 | Interpolated | 16.8% | 82.7% | 0.4% |
| 1992 | 25,453 | 1992 TIUS | 16.2% | 83.3% | 0.5% |
| 1993 | 26,236 | Interpolated | 15.4% | 84.1% | 0.5% |
| 1994 | 27,685 | Interpolated | 14.7% | 84.8% | 0.5% |
| 1995 | 28,828 | Interpolated | 13.9% | 85.6% | 0.5% |
| 1996 | 29,601 | Interpolated | 13.2% | 86.3% | 0.5% |
| 1997 | 29,878 | 1997 VIUS | 12.4% | 87.1% | 0.5% |
| 1998 | 30,841 | 1997 VIUS | 12.4% | 87.1% | 0.5% |
| 1999 | 33,909 | 1997 VIUS | 12.4% | 87.1% | 0.5% |
| 2000 | 35,193 | 1997 VIUS | 12.4% | 87.1% | 0.5% |
| Heat content used for conversion to btu: | | | 125,000 | 138,700 | 90,800 |
| | | | btu/gallon | btu/gallon | btu/gallon |

Off-highway energy use

Diesel:

DOE, EIA, *Fuel Oil and Kerosene Sales 2000*, Table 1. Unadjusted sales of distillate.

Gasoline:

DOT, FHWA, *Highway Statistics 1999*, Table MF-24.

Table A.7
Off-Highway Fuel Use

| Year | Gasoline (thousand gallons) | | Diesel (thousand gallons) | |
|--|--------------------------------|-----------------------|------------------------------|-----------------------|
| | Agriculture | Construction | Agriculture | Construction |
| 1985 | 1,080,677 | 250,935 | 3,102,106 | 1,522,041 |
| 1986 | 964,226 | 275,997 | 3,340,813 | 1,659,365 |
| 1987 | 921,692 | 278,767 | 2,998,681 | 1,559,873 |
| 1988 | 806,097 | 275,927 | 3,162,575 | 1,671,387 |
| 1989 | 821,612 | 297,577 | 3,360,092 | 1,689,651 |
| 1990 | 681,220 | 318,184 | 3,403,400 | 1,808,646 |
| 1991 | 776,217 | 278,237 | 3,158,477 | 1,641,560 |
| 1992 | 805,511 | 272,896 | 3,499,518 | 1,757,788 |
| 1993 | 845,320 | 245,299 | 3,410,827 | 2,104,299 |
| 1994 | 903,682 | 266,560 | 3,270,227 | 2,153,153 |
| 1995 | 926,732 | 280,046 | 3,476,472 | 2,173,054 |
| 1996 | 918,085 | 283,911 | 3,591,383 | 2,245,922 |
| 1997 | 984,450 | 300,491 | 3,547,699 | 2,276,548 |
| 1998 | 906,941 | 234,705 | 3,410,801 | 2,477,199 |
| 1999 | 702,700 | 177,758 | 3,411,623 | 2,490,492 |
| 2000 | 652,256 | 191,516 | 3,454,861 | 2,589,383 |
| Heat content used for conversion to btu: | 125,000 btu/gallon | 125,000 btu/gallon | 138,700 btu/gallon | 138,700 btu/gallon |

Nonhighway energy use

Air

General Aviation:

DOT, FAA, *General Aviation Activity and Avionics Survey: Annual Summary Report Calendar Year 2000*, Table 5.1, and annual.

Table A.8
General Aviation Fuel Use

| Year | Jet fuel (million gallons) | Aviation gasoline (million gallons) |
|---|-------------------------------|--|
| 1970 | 208.0 | 551.0 |
| 1971 | 226.0 | 508.0 |
| 1972 | 245.0 | 584.0 |
| 1973 | 304.0 | 411.0 |
| 1974 | 357.0 | 443.0 |
| 1975 | 453.0 | 412.0 |
| 1976 | 495.0 | 432.0 |
| 1977 | 536.0 | 456.0 |
| 1978 | 763.0 | 518.0 |
| 1979 | 736.0 | 570.0 |
| 1980 | 766.0 | 520.0 |
| 1981 | 759.0 | 489.0 |
| 1982 | 887.0 | 448.0 |
| 1983 | 613.0 | 428.0 |
| 1984 | 738.9 | 462.4 |
| 1985 | 691.0 | 421.0 |
| 1986 | 732.1 | 408.6 |
| 1987 | 672.7 | 401.8 |
| 1988 | 746.0 | 398.0 |
| 1989 | 688.0 | 342.8 |
| 1990 | 662.0 | 353.0 |
| 1991 | 579.0 | 348.0 |
| 1992 | 496.0 | 306.0 |
| 1993 | 454.1 | 268.4 |
| 1994 | 470.8 | 264.1 |
| 1995 | 544.0 | 276.0 |
| 1996 | 567.5 | 286.5 |
| 1997 | 639.4 | 289.7 |
| 1998 | 814.6 | 311.4 |
| 1999 | 967.2 | 345.4 |
| 2000 | 998.1 | 336.3 |
| Heat content used for conversion to btu: | 135,000 btu/gallon | 120,200 btu/gallon |

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.

Table A.9
Air Carrier Fuel Use

| Year | Domestic (thousand gallons) | International (thousand gallons) | Total (thousand gallons) |
|---|--------------------------------------|-------------------------------------|-----------------------------|
| 1970 | | | 10,085,000 |
| 1971 | | | 10,140,000 |
| 1972 | Separate estimates for domestic and | | 10,302,000 |
| 1973 | international are not available from | | 10,671,000 |
| 1974 | 1970-1976. | | 10,417,260 |
| 1975 | | | 10,412,640 |
| 1976 | | | 10,400,040 |
| 1977 | 8,202,051 | 1,708,376 | 9,910,427 |
| 1978 | 8,446,117 | 1,741,918 | 10,188,035 |
| 1979 | 8,865,885 | 1,828,435 | 10,694,320 |
| 1980 | 8,519,233 | 1,747,306 | 10,266,539 |
| 1981 | 8,555,249 | 2,032,520 | 10,587,769 |
| 1982 | 8,432,465 | 1,967,733 | 10,400,198 |
| 1983 | 8,672,574 | 1,998,289 | 10,670,863 |
| 1984 | 9,625,958 | 2,286,407 | 11,912,365 |
| 1985 | 10,115,007 | 2,487,929 | 12,602,936 |
| 1986 | 11,137,331 | 2,544,996 | 13,682,327 |
| 1987 | 11,586,838 | 2,893,617 | 14,480,455 |
| 1988 | 11,917,904 | 3,262,824 | 15,180,728 |
| 1989 | 11,905,144 | 3,557,294 | 15,462,438 |
| 1990 | 12,429,305 | 3,963,081 | 16,392,386 |
| 1991 | 11,506,477 | 3,939,666 | 15,446,144 |
| 1992 | 11,762,852 | 4,120,132 | 15,882,983 |
| 1993 | 11,958,663 | 4,113,321 | 16,071,984 |
| 1994 | 12,475,549 | 4,310,879 | 16,786,428 |
| 1995 | 12,811,717 | 4,511,418 | 17,323,135 |
| 1996 | 13,187,305 | 4,658,093 | 17,845,398 |
| 1997 | 13,659,581 | 4,964,181 | 18,623,762 |
| 1998 | 13,876,971 | 5,185,562 | 19,062,533 |
| 1999 | 14,402,127 | 5,250,492 | 19,652,619 |
| 2000 | 14,844,592 | 5,474,685 | 20,319,277 |
| 2001 | 14,017,461 | 5,237,487 | 19,254,948 |
| Heat content used for conversion to btu: | 135,000 btu/gallon | 135,000 btu/gallon | 135,000 btu/gallon |

Water

Freight:

Total - DOE, EIA, *Fuel Oil and Kerosene Sales 2000*, 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.)

Table A.10
Diesel and Residual Fuel Oil for Vessel Bunkering

| Year | Distillate fuel oil (thousand gallons) | Residual fuel oil (thousand gallons) |
|---|---|---|
| 1970 | 819,000 | 3,774,120 |
| 1971 | 880,000 | 3,307,000 |
| 1972 | 1,013,000 | 3,273,000 |
| 1973 | 1,125,000 | 3,859,000 |
| 1974 | 1,018,920 | 3,827,040 |
| 1975 | 1,097,880 | 4,060,140 |
| 1976 | 1,220,100 | 4,977,000 |
| 1977 | 1,407,420 | 5,416,740 |
| 1978 | 1,578,822 | 6,614,790 |
| 1979 | 1,630,858 | 8,002,672 |
| 1980 | 717,376 | 7,454,242 |
| 1981 | 1,723,143 | 7,922,512 |
| 1982 | 1,423,216 | 6,408,818 |
| 1983 | 1,418,890 | 5,724,115 |
| 1984 | 1,692,141 | 5,687,375 |
| 1985 | 1,894,016 | 5,473,614 |
| 1986 | 2,034,215 | 5,287,347 |
| 1987 | 2,223,258 | 5,259,272 |
| 1988 | 2,310,367 | 5,248,981 |
| 1989 | 2,356,444 | 5,410,263 |
| 1990 | 2,197,004 | 6,248,095 |
| 1991 | 2,167,640 | 6,786,055 |
| 1992 | 2,240,170 | 7,199,078 |
| 1993 | 2,043,745 | 6,269,882 |
| 1994 | 2,026,899 | 5,944,383 |
| 1995 | 1,978,105 | 6,431,238 |
| 1996 | 2,177,608 | 5,804,977 |
| 1997 | 2,107,561 | 4,789,861 |
| 1998 | 2,125,568 | 4,640,153 |
| 1999 | 2,064,590 | 5,598,630 |
| 2000 | 2,080,599 | 7,485,487 |
| Heat content used for conversion to btu: | 138,700 btu/gallon | btu/gallon |

Recreational Boating:

Fuel use by recreational boating from 1977-on 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). Fuel use for recreational boating from 1970 to 1976 was from FHWA, *Highway Statistics, 1976*, Table MF-24, and annual editions 1970-75.

Table A11
Recreational Boating Fuel Use

| Year | Number of numbered boats | Source | Estimated gasoline use (thousand gallons) |
|--|-----------------------------|------------------|---|
| 1970 | | FHWA, MF-24 | 598,000 |
| 1971 | | FHWA, MF-24 | 645,000 |
| 1972 | | FHWA, MF-24 | 687,000 |
| 1973 | | FHWA, MF-24 | 717,000 |
| 1974 | | FHWA, MF-24 | 696,780 |
| 1975 | | FHWA, MF-24 | 729,540 |
| 1976 | | FHWA, MF-24 | 763,980 |
| 1977 | 7,975,587 | | 1,553,246 |
| 1978 | 8,035,905 | | 1,564,992 |
| 1979 | 8,278,723 | | 1,612,281 |
| 1980 | 8,577,857 | | 1,670,538 |
| 1981 | 8,905,097 | | 1,734,268 |
| 1982 | 9,073,972 | Multiply by: | 1,767,156 |
| 1983 | 9,165,094 | 0.95 × | 1,784,902 |
| 1984 | 9,420,011 | 205 gallons/boat | 1,834,547 |
| 1985 | 9,589,483 | | 1,867,552 |
| 1986 | 9,876,197 | | 1,923,389 |
| 1987 | 9,963,696 | | 1,940,430 |
| 1988 | 10,362,613 | | 2,018,119 |
| 1989 | 10,777,370 | | 2,098,893 |
| 1990 | 10,996,253 | | 2,141,520 |
| 1991 | 11,068,440 | | 2,155,579 |
| 1992 | 11,132,386 | | 2,168,032 |
| 1993 | 11,282,736 | | 2,197,313 |
| 1994 | 11,429,585 | | 2,225,912 |
| 1995 | 11,734,710 | | 2,285,335 |
| 1996 | 11,877,938 | | 2,313,228 |
| 1997 | 12,312,982 | | 2,397,953 |
| 1998 | 12,565,930 | | 2,447,215 |
| 1999 | 12,738,271 | | 2,480,778 |
| 2000 | 12,782,143 | | 2,489,322 |
| Heat content used for conversion to btu: | | | 125,000 |
| | | | btu/gallon |

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 2000*, Table 1. Cubic feet were converted to Btu using 1,031 Btu/ft³. 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 29.305×10^{-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. (Data held constant; Latest available data.)

Coal slurry and water:

W. F. Banks, Systems, Science and Software, *Energy Consumption in the Pipeline Industry*, LaJolla, CA, October 1977. (Data held constant; Latest available data.)

Table A.12
Pipeline Fuel Use

| Year | Natural gas (million cubic feet) | Formula for estimating electricity use | Estimated electricity use (million kWhr) | Electricity constant (btu) |
|---|--|---|--|----------------------------------|
| 1970 | 722,166 | | 3,272.9 | 212.1 |
| 1971 | 742,592 | | 3,365.4 | 212.1 |
| 1972 | 766,156 | Multiply natural gas by | 3,472.2 | 212.1 |
| 1973 | 728,177 | heat content to get btu | 3,300.1 | 212.1 |
| 1974 | 668,792 | × 0.015 | 3,031.0 | 212.1 |
| 1975 | 582,963 | × (29.305 × 10 ⁻⁵ kWhr/btu) | 2,642.0 | 212.1 |
| 1976 | 548,323 | | 2,485.0 | 212.1 |
| 1977 | 532,669 | | 2,414.1 | 212.1 |
| 1978 | 530,451 | | 2,404.0 | 212.1 |
| 1979 | 600,964 | | 2,723.6 | 212.1 |
| 1980 | 634,622 | | 2,876.1 | 212.1 |
| 1981 | 642,325 | | 2,911.0 | 212.1 |
| 1982 | 596,411 | | 2,703.0 | 212.1 |
| 1983 | 490,042 | | 2,220.9 | 212.1 |
| 1984 | 528,754 | | 2,396.3 | 212.1 |
| 1985 | 503,766 | | 2,283.1 | 212.1 |
| 1986 | 485,041 | | 2,198.2 | 212.1 |
| 1987 | 519,170 | | 2,352.9 | 212.1 |
| 1988 | 613,912 | | 2,782.3 | 212.1 |
| 1989 | 629,308 | | 2,852.0 | 212.1 |
| 1990 | 659,816 | | 2,990.3 | 212.1 |
| 1991 | 601,305 | | 2,725.1 | 212.1 |
| 1992 | 587,710 | | 2,663.5 | 212.1 |
| 1993 | 624,308 | | 2,829.4 | 212.1 |
| 1994 | 685,362 | | 3,106.1 | 212.1 |
| 1995 | 700,335 | | 3,173.9 | 212.1 |
| 1996 | 711,446 | | 3,224.3 | 212.1 |
| 1997 | 751,470 | | 3,405.7 | 212.1 |
| 1998 | 635,477 | | 2,880.0 | 212.1 |
| 1999 | 645,319 | | 2,924.6 | 212.1 |
| 2000 | 644,444 | | 2,920.6 | 212.1 |
| Heat content used for conversion to btu: | 1,031 btu/cubic foot | | 11,765 Btu/kWhr | |

Rail

Freight:AAR, *Railroad Facts*, 2001 Edition, Washington, DC, 2001.

Table A.13
Class I Freight Railroad
Fuel Use

| Year | Diesel fuel (thousand gallons) |
|---|-----------------------------------|
| 1970 | 3,807,663 |
| 1971 | 3,822,907 |
| 1972 | 3,996,985 |
| 1973 | 4,160,730 |
| 1974 | 4,175,375 |
| 1975 | 3,736,484 |
| 1976 | 3,895,542 |
| 1977 | 3,985,069 |
| 1978 | 3,968,007 |
| 1979 | 4,072,187 |
| 1980 | 3,955,996 |
| 1981 | 3,756,439 |
| 1982 | 3,178,116 |
| 1983 | 3,137,295 |
| 1984 | 3,388,173 |
| 1985 | 3,144,190 |
| 1986 | 3,039,069 |
| 1987 | 3,102,227 |
| 1988 | 3,182,267 |
| 1989 | 3,190,815 |
| 1990 | 3,134,446 |
| 1991 | 2,925,970 |
| 1992 | 3,022,108 |
| 1993 | 3,111,981 |
| 1994 | 3,355,802 |
| 1995 | 3,503,096 |
| 1996 | 3,600,649 |
| 1997 | 3,602,793 |
| 1998 | 3,619,341 |
| 1999 | 3,749,428 |
| 2000 | 3,720,107 |
| Heat content used for conversion to btu: | 138,700 Btu/gallon |

Passenger:

Commuter - APTA, 2002 Transit Fact Book, Washington, DC, 2002.

Table A.14
Commuter Rail Fuel Use

| Year | Diesel (thousand gallons) | Electricity (million kWhr) |
|---|------------------------------|-------------------------------|
| 1984 | 58,320 | 901 |
| 1985 | 55,372 | 1,043 |
| 1986 | 54,608 | 1,170 |
| 1987 | 51,594 | 1,155 |
| 1988 | 53,054 | 1,195 |
| 1989 | 52,516 | 1,293 |
| 1990 | 52,681 | 1,226 |
| 1991 | 54,315 | 1,239 |
| 1992 | 54,951 | 1,124 |
| 1993 | 59,766 | 1,196 |
| 1994 | 61,900 | 1,244 |
| 1995 | 63,064 | 1,253 |
| 1996 | 61,888 | 1,255 |
| 1997 | 63,195 | 1,270 |
| 1998 | 69,200 | 1,299 |
| 1999 | 73,005 | 1,322 |
| 2000 | 70,818 | 1,370 |
| Heat content used for conversion to btu: | 138,700 Btu/gallon | 11,765 Btu/kWhr |

Transit - APTA, 2002 Transit Fact Book, Washington, DC, 2002. Includes light rail and heavy rail.

Table A.15
Transit Rail Fuel Use

| Year | Electricity (million kWhr) | | Total |
|--|------------------------------------|--------------------|--------------------|
| | Light rail | Heavy rail | |
| 1970 | | | 2,561 |
| 1971 | | | 2,556 |
| 1972 | | | 2,428 |
| 1973 | | | 2,331 |
| 1974 | | | 2,630 |
| 1975 | | | 2,646 |
| 1976 | Light rail and heavy rail data are | | 2,576 |
| 1977 | not available separately from | | 2,303 |
| 1978 | 1970 to 1985. | | 2,223 |
| 1979 | | | 2,473 |
| 1980 | | | 2,446 |
| 1981 | | | 2,655 |
| 1982 | | | 2,722 |
| 1983 | | | 2,930 |
| 1984 | | | 3,092 |
| 1985 | | | 2,928 |
| 1986 | 173 | 3,066 | 3,239 |
| 1987 | 191 | 3,219 | 3,410 |
| 1988 | 243 | 3,256 | 3,499 |
| 1989 | 242 | 3,286 | 3,528 |
| 1990 | 239 | 3,284 | 3,523 |
| 1991 | 274 | 3,248 | 3,522 |
| 1992 | 297 | 3,193 | 3,490 |
| 1993 | 281 | 3,287 | 3,568 |
| 1994 | 282 | 3,431 | 3,713 |
| 1995 | 288 | 3,401 | 3,689 |
| 1996 | 321 | 3,322 | 3,643 |
| 1997 | 361 | 3,253 | 3,614 |
| 1998 | 381 | 3,280 | 3,661 |
| 1999 | 416 | 3,385 | 3,801 |
| 2000 | 463 | 3,549 | 4,012 |
| Heat content used for conversion to btu: | 11,765 Btu/kWhr | 11,765 Btu/kWhr | 11,765 Btu/kWhr |

Intercity - Personal communication with Amtrak, Washington, DC.

Table A.16
Intercity Rail Fuel Use

| Year | Diesel fuel (thousand gallons) | Electricity (thousand kWhr) |
|---|-----------------------------------|---------------------------------|
| 1994 | 73,516 | 308,948 |
| 1995 | 72,371 | 335,818 |
| 1996 | 71,226 | 362,689 |
| 1997 | 75,656 | 389,559 |
| 1998 | 75,999 | 416,429 |
| 1999 | 79,173 | 443,300 |
| 2000 | 76,759 | 470,170 |
| Heat content used for conversion to btu: | 138,700 Btu/gallon | 11,765 Btu/kWhr |

Calculation of Million Barrels per Day Crude Oil Equivalent

One gallon of gasoline, diesel fuel, or lpg is estimated to be the equivalent of one gallon of crude oil. Petroleum used for electricity was calculated using the following formula:

$$(\{[(BTU*S)/G]/P \}/365)/1000$$

- BTU = Btus of electricity from Table 2.4
 S = Share of petroleum used in making primary electricity (Calculated from Table 2.6 from the EIA, *Monthly Energy Review*)
 G = Electricity generation and distribution (assumed 29%)
 P = Btus per barrel of petroleum product (Table A3 from the EIA, *Monthly Energy Review*).

Passenger Travel and Energy Use

Automobiles

Number of vehicles, vehicle-miles - DOT, FHWA, *Highway Statistics, 2000*, Table VM-1. Data series shown in Table 7.1.

Passenger-miles - Vehicle-miles multiplied by an average load factor.

Load factor - 1995 NPTS shows automobile load factor as 1.6 persons per vehicle.

Energy intensities -

Btu per vehicle-mile - Automobile energy use divided by vehicle-miles.

Btu per passenger-mile - Automobile energy use divided by passenger-miles.

Energy use - See Energy Use Sources, p. A-3. Data series shown in Table 2.6.

Light trucks

Number of vehicles, vehicle-miles - DOT, FHWA, *Highway Statistics 2000*, Table VM-1. Data by truck type were multiplied by the shares of trucks/truck travel which are for personal use (Table A16).

Passenger-miles - Vehicle-miles multiplied by an average load factor.

Load factor - 1995 NPTS shows personal light truck load factor as 1.6 persons per vehicle.

Energy intensities -

Btu per vehicle-mile - Personal light truck energy use divided by personal light truck vehicle-miles.

Btu per passenger-mile - Personal light truck energy use divided by personal light truck passenger-miles.

Energy use - See Energy Use Sources, p. A-6, A-7 (light trucks, medium/heavy trucks). Data by truck type were multiplied by the shares of truck fuel use which are for personal use (Table A17) which were derived by ORNL from the 1997 VIUS Micro Data File on CD.

Table A.17
Share of Trucks, Truck Travel,
and Fuel Use for Personal Travel

| | |
|--------------------------------|--|
| Personal trucks | |
| 75.2% | 2-axle, 4-tire trucks |
| 16.9% | Other single-unit and combination trucks |
| Personal truck travel | |
| 70.7% | 2-axle, 4-tire trucks |
| 7.1% | Other single-unit and combination trucks |
| Personal truck fuel use | |
| 68.5% | 2-axle, 4-tire trucks |
| 3.7% | Other single-unit and combination trucks |

Motorcycles

Number of vehicles, vehicle-miles - DOT, FHWA, *Highway Statistics 2000*, Table VM-1.

Passenger-miles - Vehicle-miles multiplied by an average load factor.

Load factor - 1995 NPTS shows motorcycle load factor as 1.2 persons per vehicle.

Energy intensities -

Btu per vehicle-mile - Motorcycle energy use divided by vehicle-miles.

Btu per passenger-mile - Motorcycle energy use divided by passenger-miles.

Energy use - See Energy Use Sources, p. A-4. Data series shown in Table 2.6.

Buses

Transit

Number of vehicles, vehicle miles, passenger miles - APTA, *2002 Public Transportation Fact Book*, Washington, DC, 2002. Data series shown on Table 8.12.

Load factor - Passenger-miles divided by vehicle-miles.

Energy intensities -

Btu per vehicle-mile - Transit bus energy use divided by transit bus vehicle-miles.

Btu per passenger-mile - Transit bus energy use divided by transit bus passenger-miles.

Energy use - See Energy Use Sources, p. A-4. Data series shown in Table 8.12.

Intercity

Passenger-miles - Eno Foundation for Transportation, *Transportation in America 2000*, Eighteenth edition, Washington, DC. Data series shown in Table 8.13. Because the 2000 data were not available at the time this report went to press, the 1999 data were used again for 2000.

Energy intensities -

Btu per passenger-mile - Intercity bus energy use divided by intercity bus passenger-miles.

Energy use - See Energy Use Sources, p. A-5. Data series shown in Table 8.13. Because the 2000 data were not available at the time this report went to press, the 1999 data were used again for 2000.

School

Number of vehicles - DOT, FHWA, *Highway Statistics 2000*, Table MV-10. Data series shown in Table 8.13.

Energy use - See Energy Use Sources, p. A-5. Data series shown in Table 8.13. Because the 2000 data were not available at the time this report went to press, the 1999 data were used again for 2000.

Air

Certificated air carriers

Aircraft-miles, passenger-miles - DOT, BTS, *Air Carrier Traffic Statistics Monthly, December 2001/2000*, Washington, DC.

Load factor - Passenger-miles divided by aircraft-miles.

Energy intensities -

Btu per passenger-mile - Certificated air carrier energy use divided by passenger-miles.

Energy use - See Energy Use Sources, p. A-10. All of domestic fuel use and half of international fuel use was considered to be domestic use.

Note: These data differ from the data in Table 12.1 because that table contains data on ALL domestic AND international air carrier energy use and passenger-miles.

General aviation

Number of vehicles - DOT, FAA, *General Aviation Activity and Avionics Survey: Calendar Year 2000*. Data series shown in Table 12.2.

Passenger-miles - Eno Foundation for Transportation, *Transportation in America 2000*, Eighteenth edition, Washington, DC. Data series shown in Table 12.2.

Energy intensities -

Btu per passenger-mile - General aviation energy use divided by passenger-miles.

Energy use - See Energy Use Sources, p. A-9. Data series shown in Table 12.2.

Recreational boating

Number of vehicles - DOT, U.S. Coast Guard, Office of Boating Safety, Washington, DC, 2002.

Energy use - See Energy Use Sources, p. A-12.

Rail

Intercity

Number of vehicles, vehicle-miles, passenger-miles - AAR, *Railroad Facts, 2001 Edition*, Washington, DC, 2001.

Load factor - Passenger-miles divided by vehicle-miles.

Energy Intensities -

Btu per vehicle-mile - Intercity rail energy use divided by vehicle-miles.

Btu per passenger-mile - Intercity rail energy use divided by passenger-miles.

Energy use - See Energy Use Sources, p. A-18. Data series shown in Table 12.11.

Transit

Number of vehicles, vehicle-miles, passenger-miles - APTA, *2002 Public Transportation Fact Book*, Washington, DC, 2002. Sum of light and heavy rail transit. Data series shown on Table 12.13.

Load factor - Passenger-miles divided by vehicle-miles.

Energy intensities -

Btu per vehicle-mile - Light and heavy transit rail energy use divided by vehicle-miles.

Btu per passenger-mile - Light and heavy transit rail energy use divided by passenger-miles.

Energy use - See Energy Use Sources, p. A-17. Data series shown in Table 12.13.

Commuter

Number of vehicles, vehicle-miles, passenger-miles - APTA, *2002 Public Transportation Fact Book*, Washington, DC, 2002. Data series shown on Table 12.12.

Load factor - Passenger-miles divided by vehicle-miles.

Energy intensities -

Btu per vehicle-mile - Commuter rail energy use divided by vehicle-miles.

Btu per passenger-mile - Commuter rail energy use divided by passenger-miles.

Energy use - See Energy Use Sources, p. A-16. Data series shown in Table 12.12.

Highway Passenger Mode Energy Intensities

Automobiles

Btu per vehicle-mile - Automobile energy use divided by automobile vehicle miles of travel.

Energy use - See Energy Use Sources, p. A-3. Data series shown in Table 2.6.

Vehicle miles - DOT, FHWA, *Highway Statistics 2000*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995*. Data series shown in Table 7.1.

Btu per passenger-mile - Automobile energy use divided by automobile passenger-miles.

Energy use - See Energy Use Sources, p. A-3. Data series shown in Table 2.6.

Passenger miles - Vehicle miles multiplied by an average load factor.

Vehicle miles - DOT, FHWA, *Highway Statistics 2000*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995*. Data series shown in Table 7.1.

Load factor - NPTS 1969, 1977, 1983/84, 1990, and 1995.

Table A.18
Automobile Load Factor used to calculate Passenger-Miles

| Year | Source | Load Factor |
|------|--------------|-------------|
| 1970 | 1969 NPTS | 1.90 |
| 1971 | Interpolated | 1.90 |
| 1972 | Interpolated | 1.90 |
| 1973 | Interpolated | 1.90 |
| 1974 | Interpolated | 1.90 |
| 1975 | Interpolated | 1.90 |
| 1976 | Interpolated | 1.90 |
| 1977 | 1977 NPTS | 1.90 |
| 1978 | Interpolated | 1.88 |
| 1979 | Interpolated | 1.87 |
| 1980 | Interpolated | 1.85 |
| 1981 | Interpolated | 1.83 |
| 1982 | Interpolated | 1.82 |
| 1983 | 1983/84 NPTS | 1.80 |
| 1984 | Interpolated | 1.77 |
| 1985 | Interpolated | 1.74 |
| 1986 | Interpolated | 1.71 |
| 1987 | Interpolated | 1.69 |
| 1988 | Interpolated | 1.66 |
| 1989 | Interpolated | 1.63 |
| 1990 | 1990 NPTS | 1.60 |
| 1991 | Interpolated | 1.60 |
| 1992 | Interpolated | 1.60 |
| 1993 | Interpolated | 1.60 |
| 1994 | Interpolated | 1.60 |
| 1995 | 1995 NPTS | 1.60 |
| 1996 | 1995 NPTS | 1.60 |
| 1997 | 1995 NPTS | 1.60 |
| 1998 | 1995 NPTS | 1.60 |
| 1999 | 1995 NPTS | 1.60 |
| 2000 | 1995 NPTS | 1.60 |

Light trucks

Btu per vehicle-mile - Light truck energy use divided by light truck vehicle miles of travel.

Energy use - See Energy Use Sources, p. A-6. Data series shown in Table 2.6.

Vehicle miles - DOT, FHWA, *Highway Statistics 2000*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995*. Data series shown in Table 7.2.

Buses

Transit

Btu per vehicle-mile - Transit bus energy use divided by transit bus vehicle-miles.

Energy use - See Energy Use Sources, p. A-4. Data series shown in Table 8.12.

Vehicle miles - APTA, *2002 Public Transportation Fact Book*, Washington, DC, 2002. Data series shown on Table 8.12.

Btu per passenger-mile - Transit bus energy use divided by transit bus passenger-miles.

Energy use - See Energy Use Sources, p. A-4. Data series shown in Table 8.12.

Passenger miles - APTA, *2002 Public Transportation Fact Book*, Washington, DC, 2002. Data series shown on Table 8.12.

Intercity

Btu per passenger-mile - Intercity bus energy use divided by intercity bus passenger-miles.

Energy use - See Energy Use Sources, p. A-5. Data series shown in Table 8.13. Because the 2000 data were not available at the time this report went to press, the 1999 data were used again for 2000.

Passenger-miles - Eno Foundation for Transportation, *Transportation in America 2000*, Eighteenth edition, Washington, DC. Data series shown in Table 8.13. Because the 2000 data were not available at the time this report went to press, the 1999 data were used again for 2000.

Nonhighway Mode Energy Intensities

Air

Certificated air carriers

Btu per passenger-mile - Certificated air carrier energy use divided by passenger-miles.

Energy use - See Energy Use Sources, p. A-10. All of domestic fuel use and half of international fuel use was considered to be domestic use.

Passenger-miles - DOT, BTS, *Air Carrier Traffic Statistics Monthly, December 2001/2000*, Washington, DC, and annual editions back to 1994. Pre-1994 data are from various editions of the *FAA Statistical Handbook of Aviation* (no longer published). Scheduled service passenger-miles of domestic air carriers and half of international air carriers were used to coincide with fuel use.

Note: These data differ from the data in Table 12.1 because that table contains data on ALL domestic AND international air carrier energy use and passenger-miles.

General aviation

Btu per passenger-mile - General aviation energy use divided by passenger-miles.

Energy use - See Energy Use Sources, p. A-9. Data series shown in Table 12.2.

Passenger-miles - Eno Foundation for Transportation, *Transportation in America 2000*, Eighteenth edition, Washington, DC. Data series shown in Table 12.2.

Rail

Intercity

Btu per passenger-mile - Intercity rail energy use divided by passenger-miles.

Energy use - See Energy Use Sources, p. A-18. Data series shown in Table 12.11.

Passenger-miles - AAR, *Railroad Facts, 2001 Edition*, and previous annual editions.

Transit

Btu per passenger-mile - Transit rail energy use divided by passenger-miles.

Energy use - See Energy Use Sources, p. A-17. Data series shown in Table 12.13.

Passenger-miles - APTA, *2002 Public Transportation Fact Book*, Washington, DC, 2002. Data series shown on Table 12.13.

Commuter

Btu per passenger-mile - Commuter rail energy use divided by passenger-miles.

Energy use - See Energy Use Sources, p. A-16. Data series shown in Table 12.12.

Passenger-miles - APTA, *2002 Public Transportation Fact Book*, Washington, DC, 2002. Data series shown on Table 12.12.

Freight Movement and Energy Use

Truck

Number of vehicles - DOT, FHWA, *Highway Statistics 2000*, Table VM-1. Data by truck type were multiplied by the shares of trucks engaged in intercity freight movement (Table A19).

Ton miles, tons shipped and average length of haul - Eno Transportation Foundation, *Transportation in America 2000*, Eighteenth Edition, Washington, DC, 2001.

Energy intensity - Freight truck energy use divided by ton-miles.

Energy use - See Energy Use Sources (light trucks, medium/heavy trucks), pp. A-6, A-7. Data by truck type were multiplied by the shares of trucks engaged in intercity freight movement (Table A19).

Table A.19
Share of Trucks and Truck Fuel Use
for Trucks Engaged in Intercity Freight Movement

| Intercity freight trucks | |
|----------------------------------|--|
| 0.4% | 2-axle, 4-tire trucks |
| 29.0% | Other single-unit and combination trucks |
| Intercity freight truck fuel use | |
| 1.0% | 2-axle, 4-tire trucks |
| 71.3% | Other single-unit and combination trucks |

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.

Rail

Number of locomotives, ton-miles, tons shipped, average length of haul - AAR, *Railroad Facts, 2001 Edition*, Washington, DC, 2001. Data series shown in Table 12.8.

Energy intensity - Class I rail energy use divided by freight car-miles.

Energy use - See Energy Use Sources, p. A-15. Data series shown in Table 12.8.

Water

Number of vehicles - U.S. Department of the Army, Army Corps of Engineers, "Summary of U.S. Flag Passenger and Cargo Vessels, 2000," New Orleans, LA, 2001.

Ton-miles, tons shipped, average length of haul - U.S. Department of the Army, Army Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 2000*, Part 5: National Summaries, New Orleans, LA, 2001. Data series shown in Table 12.4.

Btu per ton-mile - Domestic waterborne commerce energy use divided by ton-miles.

Energy use - See Energy Use Sources, p. A-11. Data series shown in Table 12.4.

Freight Mode Energy Intensities

Truck

Btu per vehicle-mile - Heavy single-unit and combination truck energy use divided by vehicle miles

Energy use - See Energy Use Sources (medium/heavy trucks), p. A-7.

Vehicle-miles - DOT, FHWA, *Highway Statistics 2000*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995*. Data series is the total of vehicle travel data on Tables 8.1 and 8.2.

Rail

Btu per freight car-mile - Class I rail energy use divided by freight car-miles.

Energy use - See Energy Use Sources, p. A-15. Data series shown in Table 12.8.

Freight car miles - AAR, *Railroad Facts, 2001 Edition*, Washington, DC, 2001. Data series shown in Table 12.8.

Btu per ton-mile - Class I rail energy use divided by ton-miles.

Energy use - See Energy Use Sources, p. A-15. Data series shown in Table 12.8.

Ton-miles - AAR, *Railroad Facts, 2001 Edition*, Washington, DC, 2001. Data series shown in Table 12.8.

Water

Btu per ton-mile - Domestic waterborne commerce energy use divided by ton-miles.

Energy use - See Energy Use Sources, p. A-11. Data series shown in Table 12.4.

Ton-miles - U.S. Department of the Army, Army Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 2000*, Part 5: National Summaries, New Orleans, LA, 2001. Data series shown in Table 12.4.

Highway Vehicle Stock and New Sales 2000 Calendar Year

Automobiles

Stock - Vehicle registrations by model year are from The Polk Company's National Vehicle Population Profile. Vehicles were distributed into size classes using the percentages in Table A.20. This method assumed that all vehicles, large and small, were scrapped at the same rate. Shares were generated from the ORNL MPG and Market Shares Database, 2002.

Table A.20
Shares by Automobile Size Class and Model Year

| Year | Minicompact | Subcompact | Compact | Midsize | Large | Two-seater | Total |
|----------|-------------|------------|---------|---------|-------|------------|--------|
| Pre-1977 | 7.1% | 22.0% | 16.4% | 29.5% | 23.0% | 2.0% | 100.0% |
| 1977 | 7.2% | 16.2% | 25.7% | 21.7% | 27.4% | 1.8% | 100.0% |
| 1978 | 8.5% | 19.0% | 15.2% | 33.0% | 22.3% | 2.0% | 100.0% |
| 1979 | 5.5% | 30.7% | 8.4% | 33.8% | 19.4% | 2.2% | 100.0% |
| 1980 | 4.7% | 37.8% | 6.6% | 33.8% | 14.7% | 2.4% | 100.0% |
| 1981 | 3.3% | 33.0% | 13.4% | 35.1% | 12.5% | 2.7% | 100.0% |
| 1982 | 2.9% | 31.4% | 17.0% | 33.1% | 13.0% | 2.6% | 100.0% |
| 1983 | 2.6% | 26.8% | 22.0% | 31.7% | 14.5% | 2.4% | 100.0% |
| 1984 | 0.4% | 24.6% | 27.1% | 30.0% | 14.7% | 3.2% | 100.0% |
| 1985 | 0.6% | 21.7% | 32.1% | 28.4% | 13.8% | 3.4% | 100.0% |
| 1986 | 1.8% | 22.4% | 33.2% | 26.9% | 13.2% | 2.5% | 100.0% |
| 1987 | 1.4% | 19.5% | 39.1% | 25.2% | 12.5% | 2.3% | 100.0% |
| 1988 | 0.8% | 19.1% | 40.5% | 24.6% | 13.2% | 1.8% | 100.0% |
| 1989 | 0.2% | 19.3% | 36.2% | 28.9% | 13.8% | 1.6% | 100.0% |
| 1990 | 0.9% | 22.0% | 34.2% | 27.2% | 13.9% | 1.8% | 100.0% |
| 1991 | 0.9% | 26.1% | 29.5% | 27.9% | 13.9% | 1.7% | 100.0% |
| 1992 | 1.2% | 25.3% | 30.6% | 27.7% | 14.1% | 1.1% | 100.0% |
| 1993 | 0.9% | 22.6% | 32.3% | 29.1% | 14.2% | 0.9% | 100.0% |
| 1994 | 0.5% | 22.1% | 35.2% | 26.5% | 14.9% | 0.8% | 100.0% |
| 1995 | 0.5% | 17.4% | 37.8% | 28.6% | 15.1% | 0.6% | 100.0% |
| 1996 | 0.4% | 15.2% | 40.3% | 28.8% | 14.6% | 0.7% | 100.0% |
| 1997 | 0.5% | 18.3% | 35.5% | 30.6% | 14.1% | 1.0% | 100.0% |
| 1998 | 0.2% | 18.5% | 28.6% | 38.4% | 13.0% | 1.3% | 100.0% |
| 1999 | 0.1% | 18.8% | 27.4% | 38.8% | 13.7% | 1.2% | 100.0% |
| 2000 | 0.2% | 19.9% | 26.7% | 37.4% | 14.4% | 1.4% | 100.0% |

Business fleet autos - Bobit Publishing Company, Automotive Fleet Research Department,
Automotive Fleet Factbook 2001, Redondo Beach, CA, 2000.

Personal autos - Difference between total vehicle stock and business fleet autos.

Sales - Domestic and import totals are from *Ward's Motor Vehicle Facts and Figures 2001*. Domestic-sponsored imports (captive imports) were included in the import figure only. Domestic and import sales were distributed into size classes using the percentages in Table A21 from the ORNL MPG and Market Shares Database, 2002.

Table A.21
Automobile Sales Shares by Size Class, 2000

| Size class | Domestic | Import |
|-------------|----------|--------|
| Two-seaters | 0.8% | 3.4% |
| Minicompact | 0.0% | 1.0% |
| Subcompact | 21.5% | 14.6% |
| Compact | 23.8% | 36.7% |
| Midsize | 35.9% | 42.4% |
| Large | 18.0% | 2.0% |

See Glossary for definition of Automobile Size Classifications.

Trucks

Stock - Total truck population from The Polk Company, 2001. The trucks were distributed using shares of trucks by standard weight classes from VIUS 1997 (Table A22).

Table A.22
Share of Trucks by Weight Class

| Weight classes | Share of trucks in the population |
|---------------------|-----------------------------------|
| 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% |
| Total | 100.0% |

Then, the number of trucks in Class 2b were split from Classes 1 and 2 by model year (Polk NVPP data) using shares from ORNL's Class 2b study (Table A23).

Table A.23
Share of Class 1 and 2 Trucks
that are Class 2b Trucks (8,500-10,000 lbs)

| Model Year | Share of class 2b trucks |
|------------|--------------------------|
| Pre-1974 | 7.35% |
| 1974 | 15.64% |
| 1975 | 17.15% |
| 1976 | 18.29% |
| 1977 | 14.60% |
| 1978 | 17.90% |
| 1979 | 17.79% |
| 1980 | 18.20% |
| 1981 | 13.87% |
| 1982 | 14.05% |
| 1983 | 8.13% |
| 1984 | 9.74% |
| 1985 | 9.56% |
| 1986 | 8.77% |
| 1987 | 8.91% |
| 1988 | 6.90% |
| 1989 | 8.34% |
| 1990 | 6.73% |
| 1991 | 4.91% |
| 1992 | 5.04% |
| 1993 | 5.60% |
| 1994 | 5.60% |
| 1995 | 7.05% |
| 1996 | 6.71% |
| 1997 | 7.86% |
| 1998 | 5.01% |
| 1999 | 9.36% |
| 2000 | 8.94% |
| 2001 | 8.61% |

Trucks less than 8,500 lbs (Classes 1 and 2a) were distributed into size classes using the percentages in Table A24. This method assumed that all vehicles, large and small, were scrapped at the same rate. Shares were generated from the ORNL MPG and Market Shares Database, 2002.

Table A.24
Shares by Light Truck Size Class and Model Year for Trucks under 8,500 lbs

| Sales period | Small pickup | Large pickup | Small van | Large van | Small utility | Medium utility | Large utility | Total |
|--------------|--------------|--------------|-----------|-----------|---------------|----------------|---------------|--------|
| Pre-1976 | 9.5% | 66.1% | 0.9% | 21.1% | 0.0% | 2.0% | 0.4% | 100.0% |
| 1976 | 7.1% | 65.7% | 0.8% | 23.9% | 0.0% | 2.1% | 0.4% | 100.0% |
| 1977 | 11.0% | 68.5% | 1.0% | 16.6% | 0.0% | 2.5% | 0.4% | 100.0% |
| 1978 | 10.5% | 64.0% | 0.8% | 22.8% | 0.1% | 1.4% | 0.4% | 100.0% |
| 1979 | 16.1% | 58.5% | 0.6% | 20.7% | 1.8% | 1.9% | 0.4% | 100.0% |
| 1980 | 23.3% | 50.3% | 0.6% | 14.8% | 2.3% | 6.9% | 1.8% | 100.0% |
| 1981 | 24.4% | 50.0% | 0.6% | 16.9% | 2.0% | 4.7% | 1.4% | 100.0% |
| 1982 | 27.2% | 46.8% | 0.6% | 17.8% | 1.3% | 4.8% | 1.5% | 100.0% |
| 1983 | 33.3% | 35.7% | 0.5% | 18.0% | 6.3% | 4.5% | 1.7% | 100.0% |
| 1984 | 23.7% | 38.1% | 6.2% | 15.1% | 10.6% | 4.4% | 1.9% | 100.0% |
| 1985 | 20.4% | 40.0% | 10.3% | 12.7% | 10.4% | 4.4% | 1.8% | 100.0% |
| 1986 | 21.7% | 35.2% | 14.1% | 11.3% | 11.7% | 4.1% | 1.9% | 100.0% |
| 1987 | 21.2% | 33.7% | 16.0% | 10.3% | 12.3% | 4.8% | 1.7% | 100.0% |
| 1988 | 21.6% | 30.6% | 18.0% | 10.3% | 12.5% | 4.9% | 2.1% | 100.0% |
| 1989 | 18.4% | 33.2% | 18.0% | 9.9% | 9.8% | 8.6% | 2.1% | 100.0% |
| 1990 | 25.2% | 24.7% | 22.4% | 7.1% | 8.9% | 9.6% | 2.1% | 100.0% |
| 1991 | 24.8% | 23.1% | 23.4% | 6.1% | 8.6% | 12.2% | 1.8% | 100.0% |
| 1992 | 22.8% | 23.6% | 23.6% | 6.4% | 8.7% | 13.3% | 1.6% | 100.0% |
| 1993 | 21.6% | 22.2% | 23.8% | 6.2% | 8.2% | 15.5% | 2.5% | 100.0% |
| 1994 | 20.3% | 24.5% | 23.6% | 5.6% | 7.6% | 16.0% | 2.4% | 100.0% |
| 1995 | 18.0% | 24.9% | 22.4% | 5.5% | 8.6% | 18.1% | 2.5% | 100.0% |
| 1996 | 16.2% | 25.7% | 21.0% | 4.7% | 9.3% | 20.4% | 2.7% | 100.0% |
| 1997 | 15.0% | 24.3% | 19.9% | 4.7% | 5.4% | 22.2% | 8.5% | 100.0% |
| 1998 | 12.5% | 27.4% | 17.8% | 4.6% | 6.8% | 22.2% | 8.7% | 100.0% |
| 1999 | 13.9% | 25.3% | 17.1% | 4.5% | 8.3% | 22.0% | 8.9% | 100.0% |
| 2000 | 12.9% | 23.7% | 15.3% | 4.4% | 9.1% | 26.1% | 8.5% | 100.0% |

The Class 2b trucks were split into two truck types - pickups and van/SUV using shares from the report *Investigation of Class 2b Trucks*, ORNL/TM-2002/49, Table 11, which are shown here in Table A25.

Table A.25
Shares of Class 2b Trucks by Truck Type

| Truck types | Shares of class 2b truck population |
|-------------|-------------------------------------|
| Pickup | 73.7% |
| Van/SUV | 26.3% |

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.

Sales - Domestic and import totals are from *Ward's Motor Vehicle Facts and Figures 2001*. Domestic-sponsored imports (captive imports) were included in the import figure only.

According to the *Investigation of Class 2b Trucks*, ORNL/TM-2002/49, 6.5% of all classes 1 and 2 truck sales were Class 2b trucks. Also, there were no class 2b trucks which were imported into the U.S. in 2000.

Domestic and import sales of trucks less than 8,500 lbs were distributed into size classes using the percentages in Table A26 from the ORNL MPG and Market Shares Database, 2002.

Table A.26
Light Truck Sales Shares by Size Class, 2000
for Trucks less than 8,500 lbs

| Size class | Domestic | Import |
|--------------|----------|--------|
| Small pickup | 14.4% | 0.0% |
| Large pickup | 26.4% | 0.0% |
| Small van | 16.5% | 4.9% |
| Large van | 4.9% | 0.0% |
| Small SUV | 5.9% | 37.9% |
| Medium SUV | 23.1% | 52.4% |
| Large SUV | 8.9% | 4.8% |

The Class 2b truck sales were split into two truck types - pickups and van/SUV using shares from the report *Investigation of Class 2b Trucks*, ORNL/TM-2002/49, Table 6, which are shown here in Table A27.

Table A.27
Shares of Class 2b Truck Sales
by Truck Type, 2000

| Truck types | Shares of class 2b truck population |
|-------------|-------------------------------------|
| Pickup | 82.1% |
| Van/SUV | 17.9% |

Fleet Vehicle Data

Light Fleet Vehicle Population

Automobiles - Bobit Publishing Company, *Automotive Fleet Factbook 2001*, Redondo Beach, CA, 2002, p. 12. Fleets of 10 or more units. Taxi and Rental categories were considered Business fleets.

Light trucks - Bobit Publishing Company, *Automotive Fleet Factbook 2001*, Redondo Beach, CA, 2002, p. 12. Trucks under 19,501 lbs GVW in fleets of 10 or more units. Light trucks were split from the total using shares from the 1997 VIUS (business, rental, and utility) and the GSA *Federal Fleet Factbook* (government) shown in Table A28.

Table A.28
Light Truck Share of Fleet Trucks
Less than 19,501 lbs GVW

| Vehicles in Fleets of 10 or more | |
|---|-------|
| Business | 92.1% |
| Utility | 89.6% |
| Rental | 97.3% |
| Federal Government | 81.6% |

Light Fleet Vehicle New Sales

Automobiles - Bobit Publishing Company, *Automotive Fleet Factbook 2001*, Redondo Beach, CA, 2002, p. 40-48, Fleet 2000 Model Year registrations. New registrations are considered a proxy for new vehicle sales. Commercial and rental categories were considered Business fleets. Utility fleets were estimated as share of business fleet purchases based on data from the National Association of Fleet Administrators shown in Table A29.

Light trucks - Bobit Publishing Company, *Automotive Fleet Factbook 2001*, Redondo Beach, CA, 2002, p. 48-52, Fleet 2000 Model Year registrations. New registrations are considered a proxy for new vehicle sales. Commercial and rental categories were considered Business fleets. Utility fleets were estimated as a share of business fleet purchases based on data from the National Association of Fleet Administrators shown in Table A29.

Table A.29
Share of Business Fleet Vehicles
which are Utility Fleet Vehicles

| Vehicle type | |
|------------------------|-------|
| Automobiles | 2.6% |
| Passenger vans | 7.3% |
| Cargo vans | 64.3% |
| Sport utility vehicles | 14.8% |
| Pickup trucks | 66.2% |

Light Fleet Vehicle Travel

Automobiles

Business

Bobit Publishing Company, *Automotive Fleet Factbook 2001*, Redondo Beach, CA, 2002, p.58-67. Average annual miles of compact and intermediate size automobiles were based on data from four leading fleet management companies. Weighted average of automobile travel was derived based on the estimated share of vehicles in the population from The Polk Company. Compact autos and smaller were assumed to travel as compact cars. Intermediate autos and larger were assumed to travel like intermediate autos. Average annual miles and weights are shown in Table A30.

Government

The only source of data on government fleet travel was for the Federal Government fleet vehicles. Data on sedans and station wagons from the GSA *Federal Fleet Factbook* was used for government fleet travel and is shown in Table A30.

Utility

The only source of data available on utility fleet vehicle travel was for the fleets of the Tennessee Valley Authority (TVA). Data on the TVA automobile fleet from the GSA *Federal Fleet Factbook* was used for utility fleet travel and is shown in Table A30.

Table A.30
Average Annual Miles and Population Shares
of Fleet Automobiles

| | Average annual miles, 2000 | Estimated share of vehicles in the population, 2000 |
|-------------------------------|-------------------------------|---|
| Business automobiles | | |
| Compact | 22,689 | 55.6% |
| Intermediate | 22,893 | 44.4% |
| Government automobiles | | |
| Sedans and station wagons | 12,895 | |
| Utility automobiles | | |
| Sedans and station wagons | 13,399 | |

Light trucks

Business

Bobit Publishing Company, *Automotive Fleet Factbook 2001*, Redondo Beach, CA, 2002, p.58-67. Average annual miles of pickups, minivans, sport utility vehicles and full-size vans were based on data from four leading fleet management companies. Weighted average of light truck travel was derived based on the estimated share of vehicles in the population from The Polk Company. Average annual miles and weights are shown in Table A31.

Government

The only source of data on government fleet travel was for the Federal Government fleet vehicles. Data on ambulances, 2x4 trucks, and 4x4 trucks from the GSA *Federal Fleet Factbook* were used for government fleet travel. Weighted average of light truck travel was derived based on the estimated share of vehicles in the population from the same GSA report. Average annual miles and weights are shown in Table A31.

Utility

The only source of data available on utility fleet vehicle travel was for the fleets of the Tennessee Valley Authority (TVA). Data on the 2x4 trucks and 4x4 trucks in the TVA fleet from the GSA *Federal Fleet Factbook* were used for utility fleet travel. The weighted average of travel was derived based on the share of vehicles in the population from the same GSA report. Average annual miles and weights are shown in Table A31.

Table A.31
Average Annual Miles and Population Shares
of Fleet Light Trucks

| | Average annual miles, 2000 | Estimated share of vehicles in the population, 2000 |
|--------------------------------|-------------------------------|---|
| Business light trucks | | |
| Pickup trucks | 28,515 | 48.8% |
| Minivans | 25,677 | 17.1% |
| Sport utility vehicles | 24,003 | 28.4% |
| Full-size vans | 20,412 | 5.8% |
| Government light trucks | | |
| Ambulances | 5,946 | 0.5% |
| 2x4 trucks | 5,747 | 82.8% |
| 4x4 trucks | 12,022 | 16.7% |
| Utility light trucks | | |
| 2x4 trucks | 10,405 | 55.5% |
| 4x4 trucks | 14,208 | 44.5% |

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) |
| Biodiesel | 126,206 Btu/gal (gross) = 117,093 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 | = 0.365 billion bbl crude oil/year = 2.117 quadrillion Btu/year = 100.465 million short tons coal/year = 91.142 million metric tons coal/year = 2.065 trillion ft ³ natural gas/year = 2,233.435 petajoules/year |
| 1 billion bbl crude oil/year | = 2.740 million bbl crude oil/day = 5.800 quadrillion Btu/year = 275.247 million short tons coal/year = 249.704 million metric tons coal/year = 5.659 trillion ft ³ natural gas/year = 6,119 petajoules/year |
| 1 quadrillion Btu/year | = 0.472 million bbl crude oil/day = 172.414 million bbl crude oil/year = 47.456 million short tons coal/year = 43.052 million metric tons coal/year = 975.610 billion ft ³ natural gas/year = 1,055 petajoules/year |
| 1 billion short tons coal/year | = 0.907 billion metric tons coal/year = 9.954 million bbl crude oil/day = 3.633 billion bbl crude oil/year = 21.072 quadrillion Btu/year = 20.558 trillion ft ³ natural gas/year = 22,230.960 petajoules/year |
| 1 billion metric tons coal/year | = 1.102 billion short tons coal/year = 9.030 million bbl crude oil/day = 3.296 billion bbl crude oil/year = 19.117 quadrillion Btu/year = 18.650 trillion ft ³ natural gas/year = 20,167.927 petajoules/year |
| 1 trillion ft ³ natural gas/year | = 0.484 million bbl crude oil/day = 0.177 billion bbl crude oil/year = 1.025 quadrillion Btu/year = 48.643 million short tons coal/year = 44.129 million metric tons coal/year = 1,081.375 petajoules/year |
| 1 petajoule/year | = 447.741 bbl crude oil/day = 163.425 thousand bbl crude oil/year = 0.948 trillion Btu/year = 44.982 thousand short tons coal/year = 40.808 thousand metric tons coal/year = 0.925 billion ft ³ natural gas/year |

Table B.3
Energy Unit Conversions

| | | | |
|--------|--|---------------|---|
| 1 Btu | = 778.2 ft-lb = 107.6 kg-m = 1055 J = 39.30×10^{-5} hp-h = 39.85×10^{-5} metric hp-h = 29.31×10^{-5} kWhr | 1 kWhr | = 3412 Btu ^a = 2.655×10^6 ft-lb = 3.671×10^5 kg-m = 3.600×10^6 J = 1.341 hp-h = 1.360 metric hp-h |
| 1 kg-m | = 92.95×10^{-4} Btu = 7.233 ft-lb = 9.806 J = 36.53×10^{-7} hp-h = 37.04×10^{-7} metric hp-h = 27.24×10^{-7} kWhr | 1 Joule | = 94.78×10^{-5} Btu = 0.7376 ft-lb = 0.1020 kg-m = 37.25×10^{-8} hp-h = 37.77×10^{-8} metric hp-h = 27.78×10^{-8} kWhr |
| 1 hp-h | = 2544 Btu = 1.98×10^6 ft-lb = 2.738×10^6 kgm = 2.685×10^6 J = 1.014 metric hp-h = 0.7475 kWhr | 1 metric hp-h | = 2510 Btu = 1.953×10^6 ft-lb = 27.00×10^4 kg-m = 2.648×10^6 J = 0.9863 hp-h = 0.7355 kWhr |

^aThis 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: | <i>multiply by:</i> | | | | |
| Terajoules | 1 | 238.8 | 2.388×10^{-5} | 947.8 | 0.2778 |
| Gigacalories | 4.1868×10^{-3} | 1 | 10^{-7} | 3.968 | 1.163×10^{-3} |
| Million tonnes of oil equivalent | 4.1868×10^4 | 10^7 | 1 | 3.968×10^7 | 11,630 |
| Million Btu | 1.0551×10^{-3} | 0.252 | 2.52×10^{-8} | 1 | 2.931×10^{-4} |
| Gigawatt-hours | 3.6 | 860 | 8.6×10^{-5} | 3412 | 1 |

Table B.5
Distance and Velocity Conversions

| | |
|---|---|
| 1 in. = 83.33 x 10 ⁻³ ft = 27.78 x 10 ⁻³ yd = 15.78 x 10 ⁻⁶ mile = 25.40 x 10 ⁻³ m = 0.2540 x 10 ⁻⁶ km | 1 ft = 12.0 in. = 0.33 yd = 189.4 x 10 ⁻³ mile = 0.3048 m = 0.3048 x 10 ⁻³ km |
| 1 mile = 63360 in. = 5280 ft = 1760 yd = 1609 m = 1.609 km | 1 km = 39370 in. = 3281 ft = 1093.6 yd = 0.6214 mile = 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 ₂ O-N) | = | 1.571 pounds nitrous oxide, measured at full molecular weight (N ₂ O) |

Table B.7
Volume and Flow Rate Conversions^a

| | |
|--|---|
| 1 U.S. gal = 231 in. ³ = 0.1337 ft ³ = 3.785 liters = 0.8321 imperial gal = 0.0238 bbl = 0.003785 m ³ | 1 liter = 61.02 in. ³ = 3.531 x 10 ⁻² ft ³ = 0.2624 U.S. gal = 0.2200 imperial gal = 6.29 x 10 ⁻³ bbl = 0.001 m ³ |
| A U.S. gallon of gasoline weighs 6.2 pounds | |
| 1 imperial gal = 277.4 in. ³ = 0.1606 ft ³ = 4.545 liters = 1.201 U.S. gal = 0.0286 bbl = 0.004546 m ³ | 1 bbl = 9702 in. ³ = 5.615 ft ³ = 158.97 liters = 42 U.S. gal = 34.97 imperial gal = 0.15897 m ³ |
| 1 U.S. gal/hr = 3.209 ft ³ /day = 90.84 liter/day = 19.97 imperial gal/day = 0.5712 bbl/day | = 1171 ft ³ /year = 33157 liter/year = 7289 imperial gal/year = 207.92 bbl/year |
| For Imperial gallons, multiply above values by 1.201 | |
| 1 liter/hr = 0.8474 ft ³ /day = 6.298 U.S. gal/day = 5.28 imperial gal/day = 0.1510 bbl/day | = 309.3 ft ³ /year = 2299 U.S. gal/year = 1927 imperial gal/year = 55.10 bbl/year |
| 1 bbl/hr = 137.8 ft ³ /year = 1008 U.S. gal/day = 839.3 imperial gal/day = 3815 liter/day | = 49187 ft ³ year = 3.679 x 10 ⁵ U.S. gal/year = 3.063 x 10 ⁵ imperial gal/year = 1.393 x 10 ⁶ liter/day |

^aThe 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

| FROM | TO | | | | |
|------------|-------|----------|-------------------------|-------------------------|-------------------------|
| | 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 | : |
| 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 |

^aCare 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 | 2001 |
| 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 | 3.20 | 3.37 | 3.51 | 3.62 | 3.72 | 3.82 | 3.93 | 4.04 | 4.14 | 4.20 | 4.29 | 4.44 | 4.56 |
| 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 | 2.69 | 2.75 | 2.83 | 2.92 | 2.98 | 3.03 | 3.10 | 3.20 | 3.29 |
| 1976 | 0.68 | 0.95 | 1.00 | 1.07 | 1.15 | 1.28 | 1.45 | 1.60 | 1.70 | 1.75 | 1.83 | 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 | 3.11 |
| 1977 | 0.64 | 0.89 | 0.94 | 1.00 | 1.08 | 1.20 | 1.36 | 1.50 | 1.59 | 1.64 | 1.71 | 1.78 | 1.81 | 1.87 | 1.95 | 2.05 | 2.16 | 2.25 | 2.32 | 2.38 | 2.45 | 2.51 | 2.59 | 2.65 | 2.69 | 2.75 | 2.84 | 2.92 |
| 1978 | 0.60 | 0.83 | 0.87 | 0.93 | 1.00 | 1.11 | 1.26 | 1.39 | 1.48 | 1.53 | 1.59 | 1.65 | 1.68 | 1.74 | 1.81 | 1.90 | 2.00 | 2.09 | 2.15 | 2.22 | 2.27 | 2.34 | 2.41 | 2.46 | 2.50 | 2.56 | 2.64 | 2.72 |
| 1979 | 0.53 | 0.74 | 0.78 | 0.83 | 0.90 | 1.00 | 1.13 | 1.25 | 1.33 | 1.37 | 1.43 | 1.48 | 1.51 | 1.56 | 1.63 | 1.71 | 1.80 | 1.88 | 1.93 | 1.99 | 2.04 | 2.10 | 2.16 | 2.21 | 2.25 | 2.29 | 2.37 | 2.44 |
| 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 | 2.15 |
| 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 | 1.95 |
| 1982 | 0.40 | 0.56 | 0.59 | 0.63 | 0.68 | 0.75 | 0.85 | 0.94 | 1.00 | 1.03 | 1.08 | 1.12 | 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 | 1.84 |
| 1983 | 0.39 | 0.54 | 0.57 | 0.61 | 0.65 | 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 | 1.58 | 1.61 | 1.64 | 1.67 | 1.73 | 1.78 |
| 1984 | 0.37 | 0.52 | 0.55 | 0.58 | 0.63 | 0.70 | 0.79 | 0.87 | 0.93 | 0.96 | 1.00 | 1.04 | 1.05 | 1.09 | 1.14 | 1.19 | 1.26 | 1.31 | 1.35 | 1.39 | 1.43 | 1.47 | 1.51 | 1.54 | 1.57 | 1.60 | 1.66 | 1.70 |
| 1985 | 0.36 | 0.50 | 0.53 | 0.56 | 0.61 | 0.67 | 0.77 | 0.84 | 0.90 | 0.93 | 0.97 | 1.00 | 1.02 | 1.06 | 1.10 | 1.15 | 1.21 | 1.27 | 1.30 | 1.34 | 1.38 | 1.42 | 1.46 | 1.49 | 1.51 | 1.55 | 1.60 | 1.65 |
| 1986 | 0.35 | 0.49 | 0.52 | 0.55 | 0.59 | 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 | 1.62 |
| 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 | 1.56 |
| 1988 | 0.33 | 0.45 | 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 | 1.10 | 1.15 | 1.19 | 1.22 | 1.25 | 1.29 | 1.33 | 1.36 | 1.38 | 1.41 | 1.46 | 1.50 |
| 1989 | 0.31 | 0.43 | 0.46 | 0.49 | 0.53 | 0.59 | 0.66 | 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 | 1.31 | 1.34 | 1.39 | 1.43 |
| 1990 | 0.30 | 0.41 | 0.44 | 0.46 | 0.50 | 0.56 | 0.63 | 0.70 | 0.74 | 0.76 | 0.79 | 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 | 1.36 |
| 1991 | 0.28 | 0.40 | 0.42 | 0.44 | 0.48 | 0.53 | 0.60 | 0.67 | 0.71 | 0.73 | 0.76 | 0.79 | 0.80 | 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 | 1.30 |
| 1992 | 0.28 | 0.38 | 0.41 | 0.43 | 0.46 | 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 | 1.26 |
| 1993 | 0.27 | 0.37 | 0.39 | 0.42 | 0.45 | 0.50 | 0.57 | 0.63 | 0.67 | 0.69 | 0.72 | 0.74 | 0.76 | 0.79 | 0.82 | 0.86 | 0.90 | 0.94 | 0.97 | 1.00 | 1.03 | 1.05 | 1.09 | 1.11 | 1.13 | 1.15 | 1.19 | 1.23 |
| 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 | 1.20 |
| 1995 | 0.25 | 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 | 1.16 |
| 1996 | 0.25 | 0.34 | 0.36 | 0.39 | 0.42 | 0.46 | 0.53 | 0.58 | 0.62 | 0.63 | 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 | 1.13 |
| 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 | 1.00 | 1.02 | 1.04 | 1.07 | 1.10 |
| 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 | 0.93 | 0.96 | 0.98 | 1.00 | 1.02 | 1.06 | 1.09 |
| 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 | 0.91 | 0.94 | 0.96 | 0.98 | 1.00 | 1.03 | 1.06 |
| 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 | 1.03 |
| 2001 | 0.22 | 0.30 | 0.32 | 0.34 | 0.37 | 0.41 | 0.47 | 0.51 | 0.54 | 0.56 | 0.59 | 0.61 | 0.62 | 0.64 | 0.67 | 0.70 | 0.74 | 0.77 | 0.79 | 0.82 | 0.84 | 0.86 | 0.89 | 0.91 | 0.92 | 0.94 | 0.97 | 1.00 |

Source:

U.S. Bureau of Labor Statistics.

Table B.14
Gross National Product 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 | 2001 |
| 1970 | 1.00 | 1.38 | 1.46 | 1.55 | 1.66 | 1.80 | 1.96 | 2.15 | 2.28 | 2.37 | 2.46 | 2.54 | 2.59 | 2.67 | 2.87 | 2.87 | 2.98 | 3.09 | 3.16 | 3.24 | 3.31 | 3.38 | 3.44 | 3.51 | 3.55 | 3.60 | 3.68 | 3.76 |
| 1975 | 0.73 | 1.00 | 1.06 | 1.12 | 1.21 | 1.31 | 1.43 | 1.56 | 1.66 | 1.72 | 1.78 | 1.84 | 1.88 | 1.94 | 2.08 | 2.08 | 2.16 | 2.24 | 2.29 | 2.35 | 2.40 | 2.45 | 2.50 | 2.55 | 2.58 | 2.61 | 2.67 | 2.73 |
| 1976 | 0.69 | 0.95 | 1.00 | 1.06 | 1.14 | 1.24 | 1.35 | 1.47 | 1.57 | 1.63 | 1.69 | 1.74 | 1.78 | 1.83 | 1.97 | 1.97 | 2.05 | 2.12 | 2.17 | 2.22 | 2.27 | 2.32 | 2.36 | 2.41 | 2.44 | 2.47 | 2.53 | 2.58 |
| 1977 | 0.65 | 0.89 | 0.94 | 1.00 | 1.07 | 1.16 | 1.27 | 1.39 | 1.47 | 1.53 | 1.59 | 1.64 | 1.67 | 1.72 | 1.85 | 1.85 | 1.92 | 1.99 | 2.04 | 2.09 | 2.13 | 2.18 | 2.22 | 2.26 | 2.29 | 2.32 | 2.38 | 2.43 |
| 1978 | 0.60 | 0.83 | 0.88 | 0.93 | 1.00 | 1.08 | 1.18 | 1.29 | 1.37 | 1.43 | 1.48 | 1.53 | 1.56 | 1.61 | 1.73 | 1.73 | 1.79 | 1.86 | 1.90 | 1.95 | 1.99 | 2.03 | 2.07 | 2.11 | 2.14 | 2.17 | 2.22 | 2.27 |
| 1979 | 0.56 | 0.77 | 0.81 | 0.86 | 0.92 | 1.00 | 1.09 | 1.19 | 1.27 | 1.32 | 1.37 | 1.41 | 1.44 | 1.48 | 1.59 | 1.59 | 1.66 | 1.72 | 1.76 | 1.80 | 1.84 | 1.88 | 1.91 | 1.95 | 1.97 | 2.00 | 2.05 | 2.09 |
| 1980 | 0.51 | 0.70 | 0.74 | 0.79 | 0.85 | 0.92 | 1.00 | 1.09 | 1.16 | 1.21 | 1.25 | 1.29 | 1.32 | 1.36 | 1.46 | 1.46 | 1.52 | 1.57 | 1.61 | 1.65 | 1.68 | 1.72 | 1.75 | 1.79 | 1.81 | 1.83 | 1.88 | 1.92 |
| 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 | 1.24 | 1.34 | 1.34 | 1.39 | 1.44 | 1.47 | 1.51 | 1.54 | 1.57 | 1.60 | 1.63 | 1.65 | 1.68 | 1.72 | 1.75 |
| 1982 | 0.44 | 0.60 | 0.64 | 0.68 | 0.73 | 0.79 | 0.86 | 0.94 | 1.00 | 1.04 | 1.08 | 1.11 | 1.14 | 1.17 | 1.26 | 1.26 | 1.31 | 1.35 | 1.39 | 1.42 | 1.45 | 1.48 | 1.51 | 1.54 | 1.56 | 1.58 | 1.61 | 1.65 |
| 1983 | 0.42 | 0.58 | 0.61 | 0.65 | 0.70 | 0.76 | 0.83 | 0.91 | 0.96 | 1.00 | 1.04 | 1.07 | 1.09 | 1.13 | 1.21 | 1.21 | 1.26 | 1.30 | 1.33 | 1.37 | 1.39 | 1.42 | 1.45 | 1.48 | 1.50 | 1.52 | 1.55 | 1.59 |
| 1984 | 0.41 | 0.56 | 0.59 | 0.63 | 0.68 | 0.73 | 0.80 | 0.87 | 0.93 | 0.96 | 1.00 | 1.03 | 1.05 | 1.09 | 1.17 | 1.17 | 1.21 | 1.26 | 1.29 | 1.32 | 1.34 | 1.37 | 1.40 | 1.43 | 1.44 | 1.46 | 1.50 | 1.53 |
| 1985 | 0.39 | 0.54 | 0.57 | 0.61 | 0.65 | 0.71 | 0.77 | 0.85 | 0.90 | 0.93 | 0.97 | 1.00 | 1.02 | 1.05 | 1.13 | 1.13 | 1.17 | 1.22 | 1.25 | 1.28 | 1.30 | 1.33 | 1.36 | 1.38 | 1.40 | 1.42 | 1.45 | 1.48 |
| 1986 | 0.39 | 0.53 | 0.56 | 0.60 | 0.64 | 0.69 | 0.76 | 0.83 | 0.88 | 0.91 | 0.95 | 0.98 | 1.00 | 1.03 | 1.11 | 1.11 | 1.15 | 1.19 | 1.22 | 1.25 | 1.27 | 1.30 | 1.33 | 1.35 | 1.37 | 1.39 | 1.42 | 1.45 |
| 1987 | 0.37 | 0.52 | 0.55 | 0.58 | 0.62 | 0.67 | 0.74 | 0.80 | 0.85 | 0.89 | 0.92 | 0.95 | 0.97 | 1.00 | 1.07 | 1.07 | 1.12 | 1.16 | 1.18 | 1.21 | 1.24 | 1.26 | 1.29 | 1.31 | 1.33 | 1.35 | 1.38 | 1.41 |
| 1988 | 0.36 | 0.50 | 0.53 | 0.56 | 0.60 | 0.65 | 0.71 | 0.78 | 0.83 | 0.86 | 0.89 | 0.92 | 0.94 | 0.97 | 1.04 | 1.04 | 1.08 | 1.12 | 1.14 | 1.17 | 1.20 | 1.22 | 1.25 | 1.27 | 1.29 | 1.30 | 1.33 | 1.36 |
| 1989 | 0.35 | 0.48 | 0.51 | 0.54 | 0.58 | 0.63 | 0.69 | 0.75 | 0.80 | 0.83 | 0.86 | 0.88 | 0.90 | 0.93 | 1.00 | 1.00 | 1.04 | 1.08 | 1.10 | 1.13 | 1.15 | 1.18 | 1.20 | 1.22 | 1.24 | 1.26 | 1.28 | 1.31 |
| 1990 | 0.34 | 0.46 | 0.49 | 0.52 | 0.56 | 0.60 | 0.66 | 0.72 | 0.77 | 0.80 | 0.83 | 0.85 | 0.87 | 0.90 | 0.96 | 0.96 | 1.00 | 1.04 | 1.06 | 1.09 | 1.11 | 1.13 | 1.16 | 1.18 | 1.19 | 1.21 | 1.24 | 1.26 |
| 1991 | 0.32 | 0.45 | 0.47 | 0.50 | 0.54 | 0.58 | 0.64 | 0.70 | 0.74 | 0.77 | 0.80 | 0.82 | 0.84 | 0.87 | 0.93 | 0.93 | 0.96 | 1.00 | 1.02 | 1.05 | 1.07 | 1.09 | 1.12 | 1.14 | 1.15 | 1.17 | 1.19 | 1.22 |
| 1992 | 0.32 | 0.44 | 0.46 | 0.49 | 0.53 | 0.57 | 0.62 | 0.68 | 0.72 | 0.75 | 0.78 | 0.80 | 0.82 | 0.84 | 0.91 | 0.91 | 0.94 | 0.98 | 1.00 | 1.02 | 1.05 | 1.07 | 1.09 | 1.11 | 1.12 | 1.14 | 1.16 | 1.19 |
| 1993 | 0.31 | 0.43 | 0.45 | 0.48 | 0.51 | 0.56 | 0.61 | 0.66 | 0.70 | 0.73 | 0.76 | 0.78 | 0.80 | 0.82 | 0.89 | 0.89 | 0.92 | 0.95 | 0.98 | 1.00 | 1.02 | 1.04 | 1.06 | 1.08 | 1.10 | 1.11 | 1.14 | 1.16 |
| 1994 | 0.30 | 0.42 | 0.44 | 0.47 | 0.50 | 0.54 | 0.59 | 0.65 | 0.69 | 0.72 | 0.74 | 0.77 | 0.78 | 0.81 | 0.87 | 0.87 | 0.90 | 0.93 | 0.96 | 0.98 | 1.00 | 1.02 | 1.04 | 1.06 | 1.07 | 1.09 | 1.11 | 1.14 |
| 1995 | 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 | 0.85 | 0.85 | 0.88 | 0.91 | 0.94 | 0.96 | 0.98 | 1.00 | 1.02 | 1.04 | 1.05 | 1.07 | 1.09 | 1.11 |
| 1996 | 0.29 | 0.40 | 0.42 | 0.45 | 0.48 | 0.52 | 0.57 | 0.62 | 0.66 | 0.69 | 0.71 | 0.74 | 0.75 | 0.78 | 0.83 | 0.83 | 0.87 | 0.90 | 0.92 | 0.94 | 0.96 | 0.98 | 1.00 | 1.02 | 1.03 | 1.05 | 1.07 | 1.09 |
| 1997 | 0.28 | 0.39 | 0.42 | 0.44 | 0.47 | 0.51 | 0.56 | 0.61 | 0.65 | 0.68 | 0.70 | 0.72 | 0.74 | 0.76 | 0.82 | 0.82 | 0.85 | 0.88 | 0.90 | 0.92 | 0.94 | 0.96 | 0.98 | 1.00 | 1.01 | 1.03 | 1.05 | 1.07 |
| 1998 | 0.28 | 0.39 | 0.41 | 0.44 | 0.47 | 0.51 | 0.55 | 0.60 | 0.64 | 0.67 | 0.69 | 0.71 | 0.73 | 0.75 | 0.81 | 0.81 | 0.84 | 0.87 | 0.89 | 0.91 | 0.93 | 0.95 | 0.97 | 0.99 | 1.00 | 1.01 | 1.04 | 1.06 |
| 1999 | 0.28 | 0.38 | 0.40 | 0.43 | 0.46 | 0.50 | 0.55 | 0.60 | 0.63 | 0.66 | 0.68 | 0.70 | 0.72 | 0.74 | 0.80 | 0.80 | 0.83 | 0.86 | 0.88 | 0.90 | 0.92 | 0.94 | 0.96 | 0.97 | 0.99 | 1.00 | 1.02 | 1.04 |
| 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 | 0.78 | 0.78 | 0.81 | 0.84 | 0.86 | 0.88 | 0.90 | 0.92 | 0.93 | 0.95 | 0.96 | 0.98 | 1.00 | 1.02 |
| 2001 | 0.27 | 0.37 | 0.39 | 0.41 | 0.44 | 0.48 | 0.52 | 0.57 | 0.61 | 0.63 | 0.65 | 0.67 | 0.69 | 0.71 | 0.76 | 0.76 | 0.79 | 0.82 | 0.84 | 0.86 | 0.88 | 0.90 | 0.91 | 0.93 | 0.94 | 0.96 | 0.98 | 1.00 |

Source:

U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, Washington, DC, monthly.

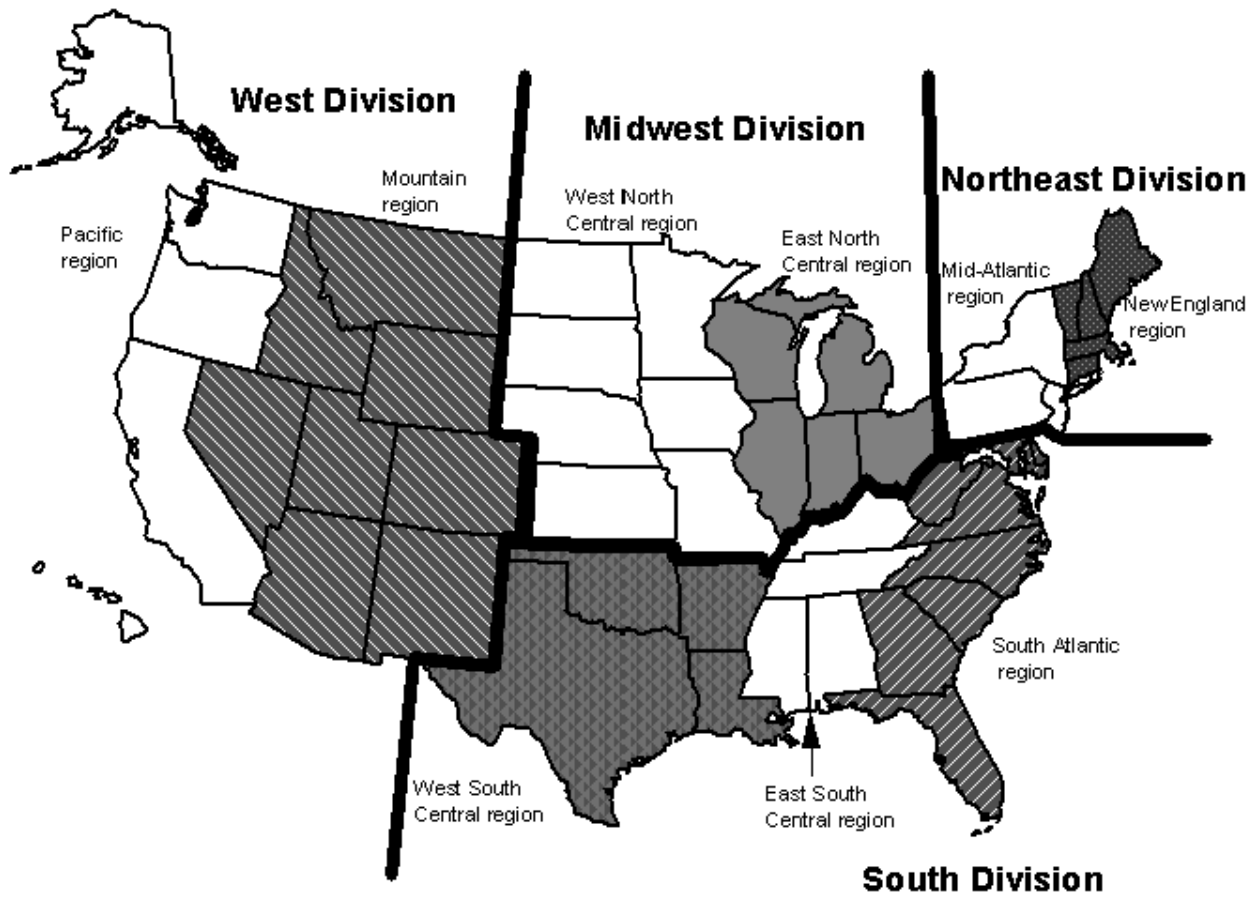
APPENDIX C

CENSUS DIVISIONS AND REGIONS

**Table C.1
Census Divisions and Regions**

| | | | |
|--|---|--|---|
| Northeast Division | | | |
| Mid-Atlantic region | | New England region | |
| New Jersey New York | Pennsylvania | Connecticut Maine Massachusetts | New Hampshire Rhode Island Vermont |
| South Division | | | |
| West South Central region | East South Central region | South Atlantic region | |
| Arkansas Louisiana Oklahoma Texas | Alabama Kentucky Mississippi Tennessee | Delaware Florida Georgia Maryland North Carolina | South Carolina Virginia Washington, DC West Virginia |
| West Division | | | |
| Pacific region | | Mountain region | |
| Alaska California Hawaii | Oregon Washington | Arizona Colorado Idaho Montana | Nevada New Mexico Utah Wyoming |
| Midwest Division | | | |
| West North Central region | | East North Central region | |
| Iowa Kansas Minnesota Missouri | Nebraska North Dakota South Dakota | Illinois Indiana Michigan | Ohio Wisconsin |

Census Divisions and Regions



GLOSSARY

Acceleration power - Measured in kilowatts. Pulse power obtainable from a battery used to accelerate a vehicle. This is based on a constant current pulse for 30 seconds at no less than 2/3 of the maximum open-circuit-voltage, at 80% depth-of-discharge relative to the battery's rated capacity and at 20° C ambient temperature.

Air Carrier - The commercial system of air transportation consisting of certificated air carriers, air taxis (including commuters), supplemental air carriers, commercial operators of large aircraft, and air travel clubs.

Certificated route air carrier: An air carrier holding a Certificate of Public Convenience and Necessity issued by the Department of Transportation to conduct scheduled interstate services. Nonscheduled or charter operations may also be conducted by these carriers. These carriers operate large aircraft (30 seats or more, or a maximum payload capacity of 7,500 pounds or more) in accordance with Federal Aviation Regulation part 121.

Domestic air operator: Commercial air transportation within and between the 50 States and the District of Columbia. Includes operations of certificated route air carriers, Pan American, local service, helicopter, intra-Alaska, intra-Hawaii, all-cargo carriers and other carriers. Also included are transborder operations conducted on the domestic route segments of U.S. air carriers. Domestic operators are classified based on their operating revenue as follows:

- Majors - over \$1 billion
- Nationals - \$100-1,000 million
- Large Regionals - \$10-99.9 million
- Medium Regionals - \$0-9.99 million

International air operator: Commercial air transportation outside the territory of the United States, including operations between the U.S. and foreign countries and between the U.S. and its territories and possessions.

Supplemental air carrier: A class of air carriers which hold certificates authorizing them to perform passenger and cargo charter services supplementing the scheduled service of the certificated route air carriers. Supplemental air carriers are often referred to as nonscheduled air carriers or "nonskeds."

Alcohol - The family name of a group of organic chemical compounds composed of carbon, hydrogen, and oxygen. The molecules in the series vary in chain length and are composed of a hydrocarbon plus a hydroxyl group. Alcohol includes methanol and ethanol.

Amtrak - See *Rail*.

Anthropogenic - Human made. Usually used in the context of emissions that are produced as the result of human activities.

Automobile size classifications - Size classifications of automobiles are established by the Environmental Protection Agency (EPA) as follows:

Minicompact - less than 85 cubic feet of passenger and luggage volume.

Subcompact - between 85 to 100 cubic feet of passenger and luggage volume.

Compact - between 100 to 110 cubic feet of passenger and luggage volume.

Midsize - between 110 to 120 cubic feet of passenger and luggage volume.

Large - more than 120 cubic feet of passenger and luggage volume.

Two seater - automobiles designed primarily to seat only two adults.

Station wagons are included with the size class for the sedan of the same name.

Aviation - See *General aviation*.

Aviation gasoline - All special grades of gasoline for use in aviation reciprocating engines, as given in the American Society for Testing and Materials (ASTM) Specification D 910. Includes all refinery products within the gasoline range that are to be marketed straight or in blends as aviation gasoline without further processing (any refinery operation except mechanical blending). Also included are finished components in the gasoline range which will be used for blending or compounding into aviation gasoline.

Barges - Shallow, nonself-propelled vessels used to carry bulk commodities on the rivers and the Great Lakes.

Battery efficiency - Measured in percentage. Net DC energy delivered on discharge, as a percentage of the total DC energy required to restore the initial state-of-charge. The efficiency value must include energy losses resulting from self-discharge, cell equalization, thermal loss compensation, and all battery-specific auxiliary equipment.

Btu - British thermal unit. The amount of energy required to raise the temperature of 1 pound of water 1 degree Fahrenheit at or near 39.2 degrees Fahrenheit. An average Btu content of fuel is the heat value per quantity of fuel as determined from tests of fuel samples.

Bunker - A storage tank.

Bunkering fuels - Fuels stored in ship bunkers.

Bus -

Intercity bus: A standard size bus equipped with front doors only, high backed seats, luggage compartments separate from the passenger compartment and usually with restroom facilities, for high-speed long distance service.

Motor bus: Rubber-tired, self-propelled, manually-steered bus with fuel supply on board the vehicle. Motor bus types include intercity, school, and transit.

School and other nonrevenue bus: Bus services for which passengers are not directly charged for transportation, either on a per passenger or per vehicle basis.

Transit bus: A bus designed for frequent stop service with front and center doors, normally with a rear-mounted diesel engine, low-back seating, and without luggage storage compartments or restroom facilities.

Trolley coach: Rubber-tired electric transit vehicle, manually-steered, propelled by a motor drawing current, normally through overhead wires, from a central power source not on board the vehicle.

Calendar year - The period of time between January 1 and December 31 of any given year.

Captive imports - Products produced overseas specifically for domestic manufacturers.

Carbon dioxide (CO₂) - A colorless, odorless, non-poisonous gas that is a normal part of the ambient air. Carbon dioxide is a product of fossil fuel combustion.

Carbon monoxide (CO) - A colorless, odorless, highly toxic gas that is a by-product of incomplete fossil fuel combustion. Carbon monoxide, one of the major air pollutants, can be harmful in small amounts if breathed over a certain period of time.

Car-mile (railroad) - A single railroad car moved a distance of one mile.

Cargo ton-mile - See *Ton-mile*.

Certificated route air carriers - See *Air carriers*.

Class I freight railroad - See *Rail*.

Coal slurry - Finely crushed coal mixed with sufficient water to form a fluid.

Combination trucks - Consist of a power unit (a truck tractor) and one or more trailing units (a semi-trailer or trailer). The most frequently used combination is popularly referred to as a "tractor-semitrailer" or "tractor trailer".

Commercial sector - An energy-consuming sector that consists of service-providing facilities of: businesses; Federal, State, and local governments; and other private and public organizations, such as religious, social or fraternal groups. Includes institutional living quarters.

Commuter railroad - See *Rail*.

Compact car - See *Automobile size classifications*.

Constant dollars - A time series of monetary figures is expressed in constant dollars when the effect of change over time in the purchasing power of the dollar has been removed. Usually the data are expressed in terms of dollars of a selected year or the average of a set of years.

Consumer Price Index (CPI) - An index issued by the U.S. Department of Labor, Bureau of Labor Statistics. The CPI is designed to measure changes in the prices of goods and services bought by wage earners and clerical workers in urban areas. It represents the cost of a typical consumption bundle at current prices as a ratio to its cost at a base year.

Continuous discharge capacity - Measured as percent of rated energy capacity. Energy delivered in a constant power discharge required by an electric vehicle for hill climbing and/or high-speed cruise, specified as the percent of its rated energy capacity delivered in a one hour constant-power discharge.

Corporate Average Fuel Economy (CAFE) standards - CAFE standards were originally established by Congress for new automobiles, and later for light trucks, in Title V of the Motor Vehicle Information and Cost Savings Act (15 U.S.C.1901, et seq.) with subsequent amendments. Under CAFE, automobile manufacturers are required by law to produce vehicle fleets with a composite sales-weighted fuel economy which cannot be lower than the CAFE standards in a given year, or for every vehicle which does not meet the standard, a fine of \$5.00 is paid for every one-tenth of a mpg below the standard.

Crude oil - A mixture of hydrocarbons that exists in the liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities. Crude oil production is measured at the wellhead and includes lease condensate.

Crude oil imports - The volume of crude oil imported into the 50 States and the District of Columbia, including imports from U.S. territories, but excluding imports of crude oil into the Hawaiian Foreign Trade Zone.

Curb weight - The weight of a vehicle including all standard equipment, spare tire and wheel, all fluids and lubricants to capacity, full tank of fuel, and the weight of major optional accessories normally found on the vehicle.

Current dollars - Represents dollars current at the time designated or at the time of the transaction. In most contexts, the same meaning would be conveyed by the use of the term "dollars." See also constant dollars.

Diesel fuel - See distillate fuel oil.

Disposable personal income - See *Income*.

Distillate fuel oil - The lighter fuel oils distilled off during the refining process. Included are products known as ASTM grades numbers 1 and 2 heating oils, diesel fuels, and number 4 fuel oil. The major uses of distillate fuel oils include heating, fuel for on-and off-highway diesel engines, and railroad diesel fuel.

Domestic air operator - See *Air carrier*.

Domestic water transportation - See *Internal water transportation*.

Electric utilities sector - Consists of privately and publicly owned establishments which generate electricity primarily for resale.

Emission standards - Standards for the levels of pollutants emitted from automobiles and trucks. Congress established the first standards in the Clean Air Act of 1963. Currently, standards are set for four vehicle classes - automobiles, light trucks, heavy-duty gasoline trucks, and heavy-duty diesel trucks.

Energy capacity - Measured in kilowatt hours. The energy delivered by the battery, when tested at C/3 discharge rate, up to termination of discharge specified by the battery manufacturer. The required acceleration power must be delivered by the battery at any point up to 80% of the battery's energy capacity rating.

Energy efficiency - In reference to transportation, the inverse of energy intensiveness: the ratio of outputs from a process to the energy inputs; for example, miles traveled per gallon of fuel (mpg).

Energy intensity - In reference to transportation, the ratio of energy inputs to a process to the useful outputs from that process; for example, gallons of fuel per passenger-mile or Btu per ton-mile.

Ethanol (C₂H₅OH) - Otherwise known as ethyl alcohol, alcohol, or grain-spirit. A clear, colorless, flammable oxygenated hydrocarbon with a boiling point of 78.5 degrees Celsius in the anhydrous state. In transportation, ethanol is used as a vehicle fuel by itself (E100 – 100% ethanol by volume), blended with gasoline (E85 – 85% ethanol by volume), or as a gasoline octane enhancer and oxygenate (10% by volume).

Fixed operating cost - See *Operating cost*.

Fleet vehicles -

Private fleet vehicles: Ideally, a vehicle could be classified as a member of a fleet if it is:

- a) operated in mass by a corporation or institution,
- b) operated under unified control, or
- c) used for non-personal activities.

However, the definition of a fleet is not consistent throughout the fleet industry. Some companies make a distinction between cars that were bought in bulk rather than singularly, or whether they are operated in bulk, as well as the minimum number of vehicles that constitute a fleet (i.e. 4 or 10).

Government fleet vehicles: Includes vehicles owned by all Federal, state, county, city, and metro units of government, including toll road operations.

Foreign freight - Movements between the United States and foreign countries and between Puerto Rico, the Virgin Islands, and foreign countries. Trade between U.S. territories and possessions (e.g. Guam, Wake, American Samoa) and foreign countries is excluded. Traffic to or from the Panama Canal Zone is included.

Gas Guzzler Tax - Originates from the 1978 Energy Tax Act (Public Law 95-618). A new car purchaser is required to pay the tax if the car purchased has a combined city/highway fuel economy rating that is below the standard for that year. For model years 1986 and later, the standard is 22.5 mpg.

Gasohol - A mixture of 10% anhydrous ethanol and 90% gasoline by volume. There are other fuels that contain methanol and gasoline, but these fuels are not referred to as gasohol.

Gasoline - See *Motor gasoline*.

General aviation - That portion of civil aviation which encompasses all facets of aviation except air carriers. It includes any air taxis, commuter air carriers, and air travel clubs which do not hold Certificates of Public Convenience and Necessity.

Gross National Product - A measure of monetary value of the goods and services becoming available to the nation from economic activity. Total value at market prices of all goods and services produced by the nation's economy. Calculated quarterly by the Department of Commerce, the Gross National Product is the broadest available measure of the level of economic activity.

Gross vehicle weight (gvw) - The weight of the empty truck plus the maximum anticipated load weight.

Gross vehicle weight rating (gvwr) - The gross vehicle weight which is assigned to each new truck by the manufacturer. This rating may be different for trucks of the same model because of certain features, such as heavy-duty suspension. Passenger cars do not have gross vehicle weight ratings.

Heavy-heavy truck - See *Truck size classifications*.

Household - Consists of all persons who occupy a housing unit, including the related family members and all unrelated persons, if any, who share the housing unit.

Housing unit - A house, apartment, a group of rooms, or a single room occupied or intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants do not live and eat with any other persons in the structure and which have either (1) direct access from the outside of the building or through a common hallway intended to be used by the occupants of another unit or by the general public, or (2) complete kitchen facilities for the exclusive use of the occupants. The occupants may be a single family, one person living alone, two or more families living together, or any other group of related or unrelated persons who share living arrangements.

Hydrocarbon (HC) - A compound that contains only hydrogen and carbon. The simplest and lightest forms of hydrocarbon are gaseous. With greater molecular weights they are liquid, while the heaviest are solids.

Income -

Disposable personal income: Personal income less personal tax and non-tax payments.

National income: The aggregate earnings of labor and property which arise in the current production of goods and services by the nation's economy.

Personal income: The current income received by persons from all sources, net of contributions for social insurance.

Industrial sector - Construction, manufacturing, agricultural and mining establishments.

Inertia weight - The curb weight of a vehicle plus 300 pounds.

Intercity bus - See *Bus*.

Internal water transportation - Includes all local (intraport) traffic and traffic between ports or landings wherein the entire movement takes place on inland waterways. Also termed internal are movements involving carriage on both inland waterways and the water of the Great Lakes, and inland movements that cross short stretches of open water that link inland systems.

International air operator - See *Air carrier*.

International freight - See *Foreign freight*.

Jet fuel - Includes both naphtha-type and kerosene-type fuels meeting standards for use in aircraft turbine engines. Although most jet fuel is used in aircraft, some is used for other purposes such as generating electricity in gas turbines.

Kerosene-type jet fuel: A quality kerosene product with an average gravity of 40.7 degrees API and 10% to 90% distillation temperatures of 217 to 261 degrees centigrade. Used primarily as fuel for commercial turbojet and turboprop aircraft engines. It is a relatively low freezing point distillate of the kerosene type.

Naphtha-type jet fuel: A fuel in the heavy naphtha boiling range with an average gravity of 52.8 degrees API and 10% to 90% distillation temperatures of 117 to 233 degrees centigrade used for turbojet and turboprop aircraft engines, primarily by the military. Excludes ramjet and petroleum.

Kerosene - A petroleum distillate in the 300 to 500 degrees Fahrenheit boiling range and generally having a flash point higher than 100 degrees Fahrenheit by the American Society of Testing and Material (ASTM) Method D56, a gravity range from 40 to 46 degrees API, and a burning point in the range of 150 to 175 degrees Fahrenheit. It is a clean-burning product suitable for use as an illuminant when burned in wick lamps. Includes grades of kerosene called range oil having properties similar to Number 1 fuel oil, but with a gravity of about 43 degrees API and an end point of 625 degrees Fahrenheit. Used in space heaters, cooking stoves, and water heaters.

Kerosene-type jet fuel - See *Jet fuel*.

Large car - See *Automobile size classifications*.

Lease Condensate - A liquid recovered from natural gas at the well or at small gas/oil separators in the field. Consists primarily of pentanes and heavier hydrocarbons (also called field condensate).

Light duty vehicles - Automobiles and light trucks combined.

Light truck - Unless otherwise noted, light trucks are defined in this publication as two-axle, four-tire trucks. The U.S. Bureau of Census classifies all trucks with a gross vehicle weight less than 10,000 pounds as light trucks (See *Truck size classifications*).

Light-heavy truck - See *Truck size classifications*.

Liquefied petroleum gas (lpg) - Consists of propane and butane and is usually derived from natural gas. In locations where there is no natural gas and the gasoline consumption is low, naphtha is converted to lpg by catalytic reforming.

Load factor - Total passenger miles divided by total vehicle miles.

Low emission vehicle - Any vehicle certified to the low emission standards which are set by the Federal government and/or the state of California.

Medium truck - See *Truck size classifications*.

Methanol (CH₃OH) - A colorless highly toxic liquid with essentially no odor and very little taste. It is the simplest alcohol and boils at 64.7 degrees Celsius. In transportation, methanol is used as a vehicle fuel by itself (M100), or blended with gasoline (M85).

Midsized car - See *Automobile size classifications*.

Minicompact car - See *Automobile size classifications*.

Model year - In this publication, model year is referring to the "sales" model year, the period from October 1 to the next September 31.

Motor bus - See *Bus*.

Motor Gasoline - A mixture of volatile hydrocarbons suitable for operation of an internal combustion engine whose major components are hydrocarbons with boiling points ranging from 78 to 217 degrees centigrade and whose source is distillation of petroleum and cracking, polymerization, and other chemical reactions by which the naturally occurring petroleum hydrocarbons are converted into those that have superior fuel properties.

Naphtha-type jet fuel - See *Jet fuel*.

National income - See *Income*.

Nationwide Personal Transportation Survey (NPTS) - A nationwide survey of households that provides information on the characteristics and personal travel patterns of the U.S. population. Surveys were conducted in 1969, 1977, 1983, 1990, and 1995 by the U.S. Bureau of Census for the U.S. Department of Transportation.

Natural gas - A mixture of hydrocarbon compounds and small quantities of various nonhydrocarbons existing in the gaseous phase or in solution with crude oil in natural underground reservoirs at reservoir conditions.

Natural gas, dry: Natural gas which remains after: 1) the liquefiable hydrocarbon portion has been removed from the gas stream; and 2) any volumes of nonhydrocarbon gases have been removed where they occur in sufficient quantity to render the gas unmarketable. Dry natural gas is also known as consumer-grade natural gas. The parameters for measurement are cubic feet at 60 degrees Fahrenheit and 14.73 pounds per square inch absolute.

Natural gas, wet: The volume of natural gas remaining after removal of lease condensate in lease and/or field separation facilities, if any, and after exclusion of nonhydrocarbon gases where they occur in sufficient quantity to render the gas unmarketable. Natural gas liquids may be recovered from volumes of natural gas, wet after lease separation, at natural gas processing plants.

Natural gas plant liquids - Natural gas liquids recovered from natural gas in processing plants and from natural gas field facilities and fractionators. Products obtained include

ethane, propane, normal butane, isobutane, pentanes plus, and other products from natural gas processing plants.

Nitrogen oxides (NO_x) - A product of combustion of fossil fuels whose production increases with the temperature of the process. It can become an air pollutant if concentrations are excessive.

Oil Stocks - Oil stocks include crude oil (including strategic reserves), unfinished oils, natural gas plant liquids, and refined petroleum products.

Operating cost -

Fixed operating cost: In reference to passenger car operating cost, refers to those expenditures that are independent of the amount of use of the car, such as insurance costs, fees for license and registration, depreciation and finance charges.

Variable operating cost: In reference to passenger car operating cost, expenditures which are dependent on the amount of use of the car, such as the cost of gas and oil, tires, and other maintenance.

Organization for Economic Cooperation and Development (OECD) - Consists of Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States. Total OECD includes the United States Territories (Guam, Puerto Rico, and the U.S. Virgin Islands). Total OECD excludes data for Czech Republic, Hungary, Mexico, Poland, and South Korea which are not yet available.

OECD Europe: Consists of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, and United Kingdom. OECD Europe excludes data for Czech Republic, Hungary, and Poland which are not yet available.

OECD Pacific: Consists of Australia, Japan, and New Zealand.

Organization for Petroleum Exporting Countries (OPEC) - Includes Saudi Arabia, Iran, Venezuela, Libya, Indonesia, United Arab Emirates, Algeria, Nigeria, Ecuador, Gabon, Iraq, Kuwait, and Qatar. Data for Saudi Arabia and Kuwait include their shares from the Partitioned Zone (formerly the Neutral Zone).

Arab OPEC - Consists of Algeria, Iraq, Kuwait, Libya, Qatar, Saudi Arabia and the United Arab Emirates.

Other single-unit truck - See *Single-unit truck*.

Oxygenate - A substance which, when added to gasoline, increases the amount of oxygen in that gasoline blend. Includes fuel ethanol, methanol, and methyl tertiary butyl ether (MTBE).

Particulates - Carbon particles formed by partial oxidation and reduction of the hydrocarbon fuel. Also included are trace quantities of metal oxides and nitrides, originating from engine wear, component degradation, and inorganic fuel additives. In the transportation sector, particulates are emitted mainly from diesel engines.

Passenger-miles traveled (PMT) - One person traveling the distance of one mile. Total passenger-miles traveled, thus, give the total mileage traveled by all persons.

Passenger rail - See *Rail, "Amtrak" and "Transit Railroad"*.

Persian Gulf countries: Consists of Bahrain, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, and the United Emirates.

Personal Consumption Expenditures (PCE) - As used in the national accounts, the market value of purchases of goods and services by individuals and nonprofit institutions and the value of food, clothing, housing, and financial services received by them as income in kind. It includes the rental value of owner-occupied houses but excludes purchases of dwellings, which are classified as capital goods (investment).

Personal income - See *Income*.

Petroleum - A generic term applied to oil and oil products in all forms, such as crude oil, lease condensate, unfinished oil, refined petroleum products, natural gas plant liquids, and non-hydrocarbon compounds blended into finished petroleum products.

Petroleum consumption: A calculated demand for petroleum products obtained by summing domestic production, imports of crude petroleum and natural gas liquids, imports of petroleum products, and the primary stocks at the beginning of the period and then subtracting the exports and the primary stocks at the end of the period.

Petroleum exports: Shipments of petroleum products from the 50 States and the District of Columbia to foreign countries, Puerto Rico, the Virgin Islands, and other U.S. possessions and territories.

Petroleum imports: All imports of crude petroleum, natural gas liquids, and petroleum products from foreign countries and receipts from Guam, Puerto Rico, the Virgin Islands, and the Hawaiian Trade Zone. The commodities included are crude oil, unfinished oils, plant condensate, and refined petroleum products.

Petroleum inventories: The amounts of crude oil, unfinished oil, petroleum products, and natural gas liquids held at refineries, at natural gas processing plants, in pipelines, at bulk terminals operated by refining and pipeline companies, and at independent bulk terminals. Crude oil held in storage on leases is also included; these stocks are known as primary stocks. Secondary stocks - those held by jobbers dealers, service station operators, and consumers - are excluded. Prior to 1975, stock held at independent bulk terminals were classified as secondary stocks.

Petroleum products supplied: For each petroleum product, the amount supplied is calculated by summing production, crude oil burned directly, imports, and net withdrawals from primary stocks and subtracting exports.

Processing Gain - The amount by which the total volume of refinery output is greater than the volume of input for given period of time. The processing gain arises when crude oil and other hydrocarbons are processed into products that are, on average, less dense than the input.

Processing Loss - The amount by which the total volume of refinery output is less than the volume of input for given period of time. The processing loss arises when crude oil and other hydrocarbons are processed into products that are, on average, more dense than the input.

Proved Reserves of Crude Oil - The estimated quantities of all liquids defined as crude oil, which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions.

Quad - Quadrillion, 10^{15} . In this publication, a Quad refers to Quadrillion Btu.

Rail -

Amtrak (American Railroad Tracks): Operated by the National Railroad Passenger Corporation of Washington, DC. This rail system was created by President Nixon in 1970, and was given the responsibility for the operation of intercity, as distinct from suburban, passenger trains between points designated by the Secretary of Transportation.

Class I freight railroad: Defined by the Interstate Commerce Commission each year based on annual operating revenue. A railroad is dropped from the Class I list if it fails to meet the annual earnings threshold for three consecutive years.

Commuter railroad: Those portions of mainline railroad (not electric railway) transportation operations which encompass urban passenger train service for local travel between a central city and adjacent suburbs. Commuter railroad service - using both locomotive-hauled and self-propelled railroad passenger cars - is characterized by multi-trip tickets, specific station-to-station fares, and usually only one or two stations in the central business district. Also known as suburban railroad.

Transit railroad: Includes "heavy" and "light" transit rail. **Heavy transit rail** is characterized by exclusive rights-of-way, multi-car trains, high speed rapid acceleration, sophisticated signaling, and high platform loading. Also known as subway, elevated railway, or metropolitan railway (metro). **Light transit rail** may be on exclusive or shared rights-of-way, high or low platform loading, multi-car trains or single cars, automated or manually operated. In generic usage, light rail includes streetcars, trolley cars, and tramways.

Residential sector - An energy consuming sector that consists of living quarters for private households. Excludes institutional living quarters.

Residential Transportation Energy Consumption Survey (RTECS) - This survey was designed by the Energy Information Administration of the Department of Energy to provide information on how energy is used by households for personal vehicles. It has been conducted five times since 1979, the most recent being 1991.

Residual fuel oil - The heavier oils that remain after the distillate fuel oils and lighter hydrocarbons are boiled off in refinery operations. Included are products know as ASTM grade numbers 5 and 6 oil, heavy diesel oil, Navy Special Fuel Oil, Bunker C oil, and acid sludge and pitch used as refinery fuels. Residual fuel oil is used for the production of electric power, for heating, and for various industrial purposes.

Rural - Usually refers to areas with population less than 5,000.

Sales period - October 1 of the previous year to September 30 of the given year. Approximately the same as a model year.

Sales-weighted miles per gallon (mpg) - Calculation of a composite vehicle fuel economy based on the distribution of vehicle sales.

Scrappage rate - As applied to motor vehicles, it is usually expressed as the percentage of vehicles of a certain type in a given age class that are retired from use (lacking registration) in a given year.

School and other nonrevenue bus - See *Bus*.

Single-unit truck - Includes two-axle, four-tire trucks and other single-unit trucks.

Two-axle, four-tire truck: A motor vehicle consisting primarily of a single motorized device with two axles and four tires.

Other single-unit truck: A motor vehicle consisting primarily of a single motorized device with more than two axles or more than four tires.

Special fuels - Consist primarily of diesel fuel with small amount of liquified petroleum gas, as defined by the Federal Highway Administration.

Specific acceleration power - Measured in watts per kilogram. Acceleration power divided by the battery system weight. Weight must include the total battery system.

Specific energy - Measured in watt hours per kilogram. The rated energy capacity of the battery divided by the total battery system weight.

Subcompact car - See *Automobile size classifications*.

Supplemental air carrier - See *Air carrier*.

Test weight - The weight setting at which a vehicle is tested on a dynamometer by the U.S. Environmental Protection Agency (EPA). This weight is determined by the EPA using the inertia weight of the vehicle.

Ton-mile - The movement of one ton of freight the distance of one mile. Ton-miles are computed by multiplying the weight in tons of each shipment transported by the distance hauled.

Transmission types -

A3 - Automatic three speed

A4 - Automatic four speed

A5 - Automatic five speed

L4 - Automatic lockup four speed

M5 - Manual five speed

Transit bus - See *Bus*.

Transit railroad - See *Rail*.

Transportation sector - Consists of both private and public passenger and freight transportation, as well as government transportation, including military operations.

Truck Inventory and Use Survey (TIUS) - Survey designed to collect data on the characteristics and operational use of the nation's truck population. It is conducted every five years by the U.S. Bureau of the Census. Surveys were conducted in 1963, 1967, 1972, 1977, 1982, 1987, and 1992. For the 1997 survey, it was renamed the Vehicle Inventory and Use Survey in anticipation of including additional vehicle types. However, no additional vehicle types were added to the 1997 survey.

Trolley coach - See *Bus*.

Truck size classifications - U.S. Bureau of the Census has categorized trucks by gross vehicle weight (gvw) as follows:

Light - Less than 10,000 pounds gvw (Also see *Light Truck*.)

Medium - 10,001 to 20,000 pounds gvw

Light-heavy - 20,001 to 26,000 pounds gvw

Heavy-heavy - 26,001 pounds gvw or more.

Two-axle, four-tire truck - See *Single-unit truck*.

Two seater car - See *Automobile size classifications*.

Ultra-low emission vehicle - Any vehicle certified to the ultra-low emission standards which are set by the Federal government and/or the state of California.

Urban - Usually refers to areas with population of 5,000 or greater.

Variable operating cost - See *Operating cost*.

Vehicle Inventory and Use Survey - See *Truck Inventory and Use Survey*.

Vehicle-miles traveled (vmt) - One vehicle traveling the distance of one mile. Total vehicle miles, thus, is the total mileage traveled by all vehicles.

Zero-emission vehicle - Any vehicle certified to the zero emission standards which are set by the Federal government and/or the state of California. These standards apply to the vehicle emissions only.

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