CONS/7405-1

TRANSPORTATION ENERGY CONSERVATION DATA BOOK:

EDITION I.5

by

D. B. Shonka, A. S. Loebl, M. C. Ogle,
M. L. Johnson, and E. B. Howard

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37830
Operated by
UNION CARBIDE CORPORATION
for the
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Contract No. W-7405-eng-26

Project Officer

Philip D. Patterson
Energy Research and Development Administration
Washington, D. C. 20545

Prepared for
Data Analysis Branch
Nonhighway Transport Systems and Special Projects
Transportation Energy Conservation Division
Office of Conservation
Energy Research and Development Administration
Washington, D. C. 20545

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402

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Abstract

This document contains statistical information on the major transportation modes, their respective energy consumption patterns, and other pertinent factors influencing performance in the transportation sector. Data relating to past, present, and projected energy use and conservation in the transportation sector are presented under seven chapter headings. These focus on (1) modal transportation characteristics, (2) energy characteristics of the transportation sector, (3) energy conservation alternatives involving the transportation sector, (4) government impacts on the transportation sector, (5) the supply of energy to the transportation sector, (6) characteristics of transportation demand, and (7) miscellaneous reference materials such as energy conversion factors and geographical maps.

References are included for each set of data presented and a more general bibliography is included at the end of the book. In addition, a glossary of key terms and a subject index is provided for the user.

This document is one in a series of documents that are being developed by Oak Ridge National Laboratory for use by the Transportation Energy Conservation Division of the Energy Research and Development Administration. A second edition is scheduled for publication in September 1977.

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FOREWARD

This edition of the TEC Data Book is a modified and integrated version of Edition I (released October 1976) and Supplements I and II (released November 1976 and February 1977, respectively) of the TEC Data Book. Many tables in the earlier editions have been updated; complete sources have been made available for every table and graph; and the index has been substantially improved.

In the process of developing the TEC Data Book, some data inconsistencies have been discovered and resolved. Other inconsistencies still remain. For example, the number of automobiles in the U.S. as shown on pages 8 and 27-30 are taken from Federal Highway Administration (FHWA) registration data. The number of automobiles in use shown on page 33 come from R. L. Polk data. The FHWA yearly totals are about ten percent higher than the Polk totals because they count automobiles during the entire calendar year instead of at mid-year and they do not eliminate some automobiles that are scrapped during the year. For TEC purposes, the Polk autos in use numbers are the appropriate ones to use.

This volume represents the results of about twelve months of effort on the part of the Oak Ridge National Laboratory to develop a comprehensive and useful transportation energy conservation data book. Please contact me or the authors concerning errors, comments, or suggestions on this volume.

Philip D. Patterson

Philip D. Patterson, Chief
(202/376-4616)
Data Analysis Branch
Nonhighway Transport Systems and
Special Projects
Transportation Energy Conservation
Division

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TRANSPORTATION ENERGY CONSERVATION DATA BOOK: EDITION 1.5

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Acknowledgments

The authors would like to express their gratitude to Philip Patterson, the ERDA monitor of the Transportation Energy Conservation Data Book Project, whose many useful suggestions and comments were fundamental in the development of this document. A special acknowledgment is expressed to Judy Arehart for her editorial assistance and a special thanks to Stephanie Davison who diligently typed the contents of this document.

Support for this project is provided by the Division of Transportation Energy Conservation of the Energy Research and Development Administration Office of Conservation.

Introduction

In October 1976, Oak Ridge National Laboratory (ORNL) published the First Edition of the Transportation Energy Conservation Data Book,[1] under contract with the Transportation Energy Conservation (TEC) Division of the Energy Research and Development Administration. The purpose of the TEC Data Book is to provide the TEC staff with a desk-top reference that contains statistics on major transportation modes, their respective energy consumption patterns, and other pertinent factors influencing performance in the transportation sector. Two of the four planned supplements to the annual edition have been published.[2] This document represents a compilation of the materials presented in Edition I and in Supplements I and II. As indicated above, two additional supplements will be issued, and the second edition of the TEC Data Book will be published in September 1977. It will incorporate the information issued in the four supplements with updates to the relevant tables from the first edition.

This document is divided into seven chapters. These focus on (1) modal transportation characteristics, (2) energy characteristics of the transportation sector, (3) energy conservation alternatives involving the transportation sector, (4) government impacts on the transportation

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[1]A. S. Loebl et al., Transportation Energy Conservation Data Book, ORNL-5198, Edition 1, Oak Ridge: Oak Ridge National Laboratory, October 1976.

[2]D. B. Shonka and A. S. Loebl, Transportation Energy Conservation Data Book: Supplement I, ORNL-5232, Oak Ridge National Laboratory, Oak Ridge, Tenn., November 1976. D. B. Shonka, Transportation Energy Conservation Data Book: Supplement II, ORNL-5247, Oak Ridge National Laboratory, Oak Ridge, Tenn., February 1977.

sector, (5) the supply of energy to the transportation sector, (6) characteristics of transportation demand, and (7) miscellaneous reference materials such as energy conversion factors and geographical maps.

Specific chapter contents are described on a chapter-by-chapter basis. The data itself is presented in the form of tables, graphs, and maps. Beginning with Supplement II, descriptive narrative was included in some of the tables and figures themselves and have been reproduced for this edition.

As this document is envisioned as a reference tool, care has been taken to reference the sources utilized. Each individual table or figure includes a reference, and a list of those references appears at the end of each chapter. The bibliographic section includes an annotated bibliography for select publications and the references cited in this document. Also included in this section is a general bibliography for other transportation energy conservation-related publications. Finally there is a glossary of the key concepts and a subject index.

Statistics presented in this compendium have been collected through a review of past and ongoing data activities of many private and public organizations. Time series data are presented for most items, but currently coverage is at the national level only. All major modes of transportation are represented: Highway, Air, Rail, Water, and Pipeline. A profile of total energy consumption and production is presented, but special emphasis is placed on the major transportation fuel--petroleum. The projections of transportation activity and energy use included in this document represent those series available in the fall of 1976.

Naturally, such projections change as our understanding of the current situation broadens and more accurate data will be presented in Edition II. Finally, statistics on the demographic and economic transportation demand determinants are presented in addition to indicators of the transportation sector's influence on the nation's total economy.

The initial effort at ORNL concentrated on reviewing statistical series, and identifying and accumulating data. Inconsistencies exist among the various reporting agencies from which the data presented here were taken. Many of these discrepancies have been resolved, but other differences require more intense study. In an effort to achieve the ultimate goal of producing a document that will be a standard reference in the field, special studies of these issues are currently being conducted. It is planned that by the publication of Edition II of the TEC Data Book, most discrepancies will either be resolved or appropriately documented.

Characteristics of Transportation Modes

Essential to an understanding of transportation energy consumption and conservation is an awareness of the basic characteristics of major transportation modes in the United States. This chapter provides a description of the transportation sector in general and of the individual transportation modes in specific.

This chapter is divided into six sections. Section 1.1 presents summary information on all of the transportation modes and the other five sections present detailed statistics on the individual modes: highway, air, rail, water, and pipe, respectively. In Section I, detailed information is presented on number of vehicle-miles traveled by each mode, passenger-miles traveled and cargo-ton miles traveled.

Section 1.2 provides additional detail for highway vehicles. Initially, information is presented on the motor vehicle capital stock. These include such things as motor vehicle registrations, by type and motor vehicle sales by detailed characteristics. Next, detailed statistics on motor vehicle travel are reviewed. A series of tables from the Nationwide Personal Transportation Study conducted by the Bureau of Census in 1969 is presented and provides insight into the demographics of automobile travel.

Information is included in Section 1.3 on air carrier status and activity for the United States. Information concerning rail transportation is detailed in Section 1.4, including summary statistics for both freight and passenger trains. Section 1.5 presents information on transportation by water, both within the United States and in international activity. Finally, commodity flows through pipelines in the U.S. are reviewed in Section 1.6.

Section 1.1

Overview

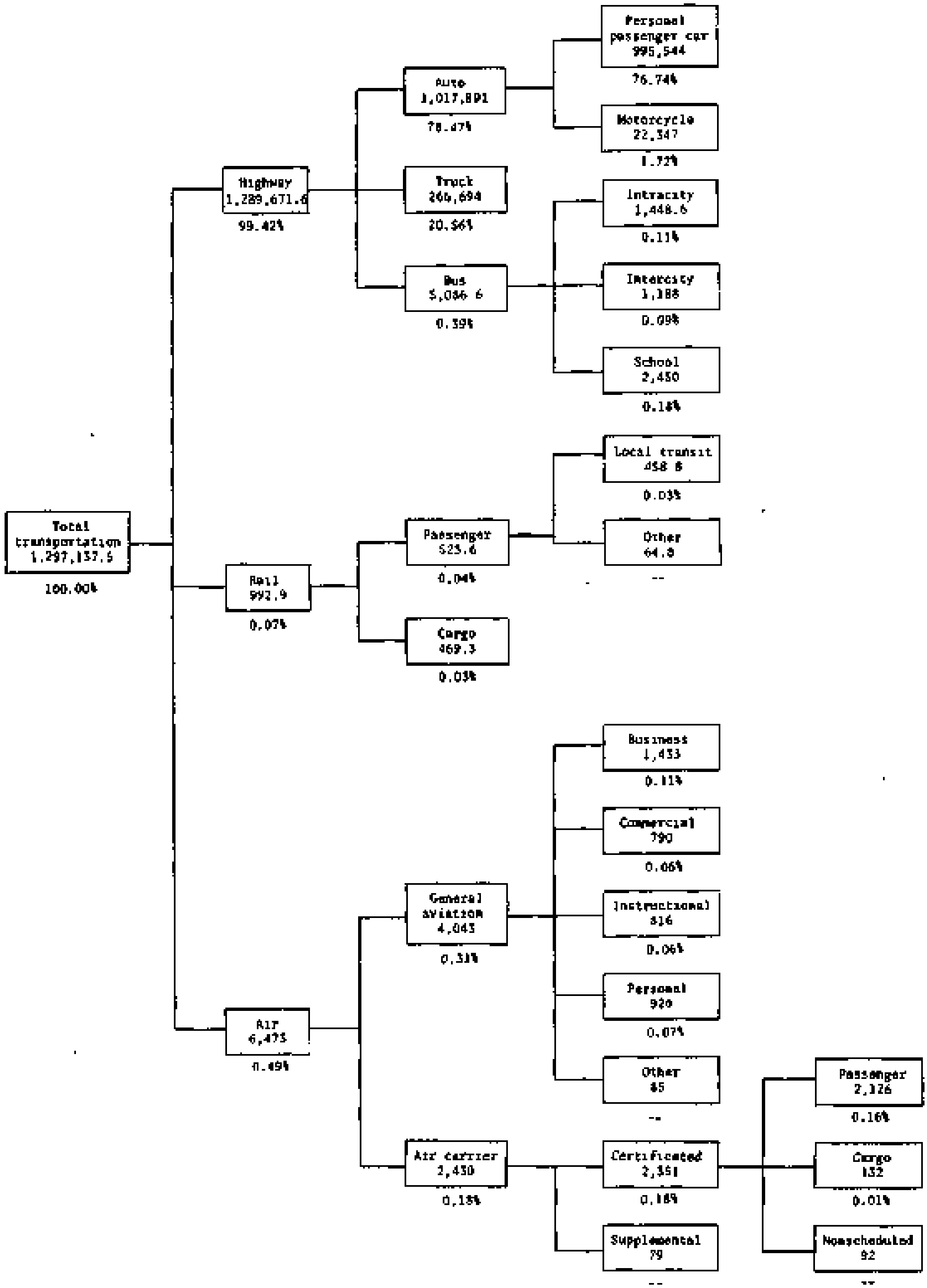
Number of Vehicles: 1960 through 1975

	1960	1965	1970	1971	1972	1973	1974	1975
Highway								
Passenger car and taxi	61,682,304	75,251,386	89,279,864	92,799,052	96,860,000	101,762,477	104,901,066	107,371,000
Motorcycle	575,497	1,381,956	2,814,730	3,345,179	3,774,996	4,332,580	4,936,805	NA
Truck	11,945,000	14,785,795	18,767,294	19,848,344	21,278,946	23,232,872	24,590,178	25,886,000
Intercity bus	20,974	20,600	22,000	21,900	21,400	20,800	20,600	NA
Class I rail								
Passenger cars and pullman	28,305	21,327	11,177	8,670	7,589	7,189	6,848	6,534
Locomotives	29,080	27,816	27,086	27,189	27,364	27,800	28,084	28,524
Freight cars	1,658,292	1,478,005	1,423,921	1,422,411	1,410,568	1,395,105	1,375,265	1,359,459
Local transit	65,292	61,717	61,350	60,737	60,704	59,590	59,889	62,271
Air								
Air carrier[1]	NA	NA	2,679	2,642	2,583	2,599	2,472	2,495
Certified	NA	NA	2,437	2,389	2,361	2,361	2,244	2,267
Supplemental	NA	NA	119	114	100	94	73	74
Commercial	NA	NA	123	139	122	144	155	154
General Aviation	NA	95,442	131,743	131,148	145,010	153,540	161,502	168,475
Water								
Nonself-propelled vessels	16,505	16,789	19,624	20,947	22,117	23,147	25,410	NA
Dry cargo barges and scows	14,058	14,241	16,439	17,527	18,804	19,772	21,876	
Tank barges	2,447	2,548	3,185	3,420	3,313	3,375	3,534	
Towboats and tug	4,052	4,054	4,230	4,278	4,064	4,035	4,100	NA

[1] Includes only those aircraft used during the last quarter.

Sources: W.F. Gay, U.S. Department of Transportation, Summary of National Transportation Statistics, Washington, D.C., June 1976, pp. 57-58; National Association of Motor Bus Owners, Bus Facts-1974 Statistical Supplement, Washington, D.C., June 1975, p. 1; American Public Transit Association, Transit Fact Book, '75-'76 ed., Washington, D.C., March 1976, p. 40; Association of American Railroads, Economics and Finance Department, Yearbook of Railroad Facts, 1976 ed., Washington, D.C., 1976, pp. 50, 51, and 54; Motor Vehicle Manufacturers Association, Motor Vehicle Facts and Figures '76, Detroit, Michigan, 1976, p. 29; B.V. Cayce, U.S. Department of Transportation, Federal Aviation Administration, FAA Statistical Handbook of Aviation, Calendar Year 1975, Washington, D.C., December 1975, pp. 52, 55, 65, 66, and 104.

Total Vehicle-Miles Traveled by Mode, 1974
(in millions)



Note: -- indicates that the percentage is less than 0.01.

Sources: W. F. Gay, Department of Transportation, Summary of National Transportation Statistics, Washington, D.C., June 1976, p. 7; American Public Transit Association, Transit Fact Book, 1975-76 Edition, Washington, D.C., 1976, page 36.

Vehcile-Miles Traveled: 1960 through 1975
(millions)

	1960	1965	1970	1971	1972	1973	1974	1975
Highway								
Personal passenger[1]	NA	711,594	900,992	954,155	1,003,498	1,036,455	1,013,068	1,050,472
Truck	126,409	171,436	214,670	227,037	259,735	267,147	267,519	274,454
Commercial bus	1,092[2]	3,019	2,943	2,885	2,750	2,548	2,610	2,648
School bus	1,481	1,763	2,100	2,212	2,359	2,412	2,450	2,500
Class I rail								
Passenger	209	172	93	53[3]	33[3]	33[3]	35[3]	35[3]
Cargo	404	421	427	430[3]	451[3]	469[3]	469[3]	403[3]
Local transit	2,143	2,008	1,883	1,846	1,756	1,835	1,907	1,990
Air, domestic								
Air carrier								
Certificated	853	1,134	2,065	2,045	2,042	2,194	1,938	1,947
Supplemental	NA	NA	34	36	34	34	31	NA
General aviation	1,769	2,562	3,207	3,143	3,571	3,729	4,043	4,238

NA — Not available.

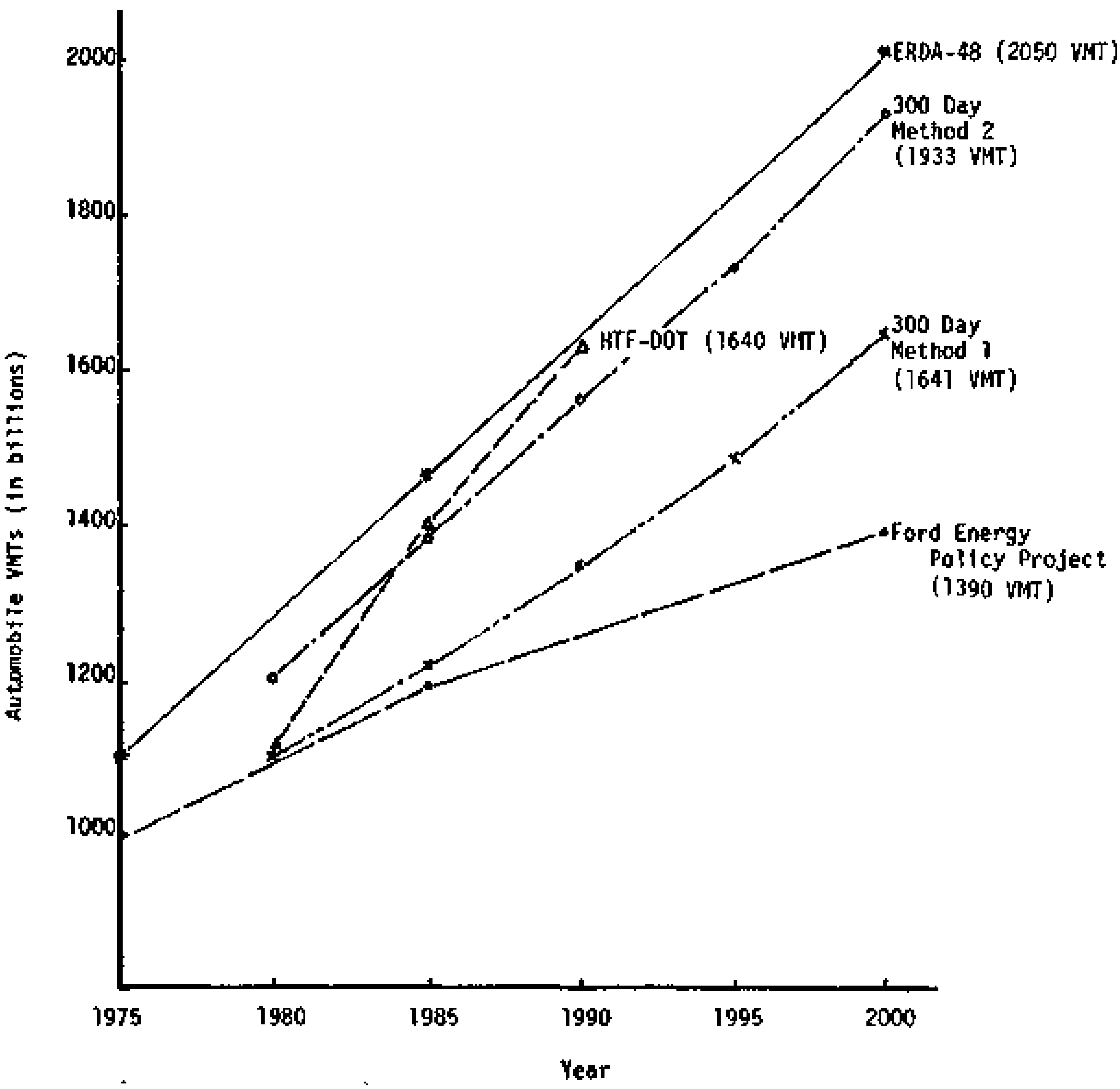
[1]Includes motorcycles.

[2]Intercity buses only.

[3]Excludes AMTRAK operations.

Sources: U.S. Department of Transportation, Department of Transportation News, FWHA 13-77 (March 4, 1977), Washington, D.C., Table VM-1; American Public Transit Association, Transit Fact Book, '75-'76 ed., Washington, D.C., March 1976, p. 36; Association of American Railroads, Economics and Finance Department, Yearbook of Railroad Facts, 1976 ed., Washington, D.C., pp. 37 and 39; B.V. Cayce, U.S. Department of Transportation, Federal Aviation Administration, FAA Statistical Handbook of Aviation, Calendar Year 1975, Washington, D.C., December 1975, pp. 72, 73, and 104.

Comparison of Vehicle-Miles Traveled (VMT)
Forecasts to the Year 2000



Sources: S.D. Freeman, Energy Policy Project of the Ford Foundation, A Time to Choose - America's Energy Future, Ballinger Publishing Company, Cambridge, Mass., 1974; U.S. Department of Transportation, Federal Highway Administration, Highway Travel Forecasts, Washington, D.C., November 1974; Federal Task Force, Motor Vehicle Goals Beyond 1980, U.S. Department of Transportation, Washington, D.C., July 23, 1976 (Draft); Energy Research and Development Administration, A National Plan for Energy Research Development and Demonstration: Creating Energy Choices for the Future, vol. 1: The Plan, Report No. ERDA-48, Washington, D.C., June 1975.

Passenger-Miles Traveled: 1960 through 1975
(millions)

	1960	1965	1970	1971	1972	1973	1974	1975
Highway								
Passenger	NA	1,554,049	1,959,857	2,066,024	2,170,095	2,237,094	2,190,197	NA
Intercity bus	19,300	23,800	25,300	25,500	25,600	26,400	27,600	25,500
Class I rail								
Total	21,201	17,388	10,771	8,901	8,561	9,298	10,332	9,942
Commutation	4,197	4,128	4,592	4,498	4,229	4,245	4,533	4,513
Other than commutation	17,064	13,260	6,179	4,403	4,332	5,053	5,799	5,429
Air domestic								
Air carrier								
Certificated	31,099	53,226	108,451	108,804	121,820	130,450	133,666	135,999
Supplemental	NA	NA	1,057	914	1,281	2,006	1,802	NA
General aviation, intercity	2,300	4,400	9,100	9,300	10,000	10,700	11,000	12,000
Domestic water, intercity	2,700	3,400	4,000	4,100	4,000	4,000	4,000	4,000

NA — Not available.

Sources: Association of American Railroads, Economics and Finance Department, Yearbook of Railroad Facts, 1976 ed., Washington, D.C., 1976, pp. 32 and 36; W.F. Gay, U.S. Department of Transportation, Summary of National Transportation Statistics, Washington, D.C., June 1976, p. 52; Transportation Association of America, Transportation Facts and Trends, Quarterly Supplement, Washington, D.C., January 1977, p. iv; B.V. Cayce, U.S. Department of Transportation, Federal Aviation Administration, FAA Statistical Handbook of Aviation, Calendar Year 1975, December 1975, pp. 72 and 73.

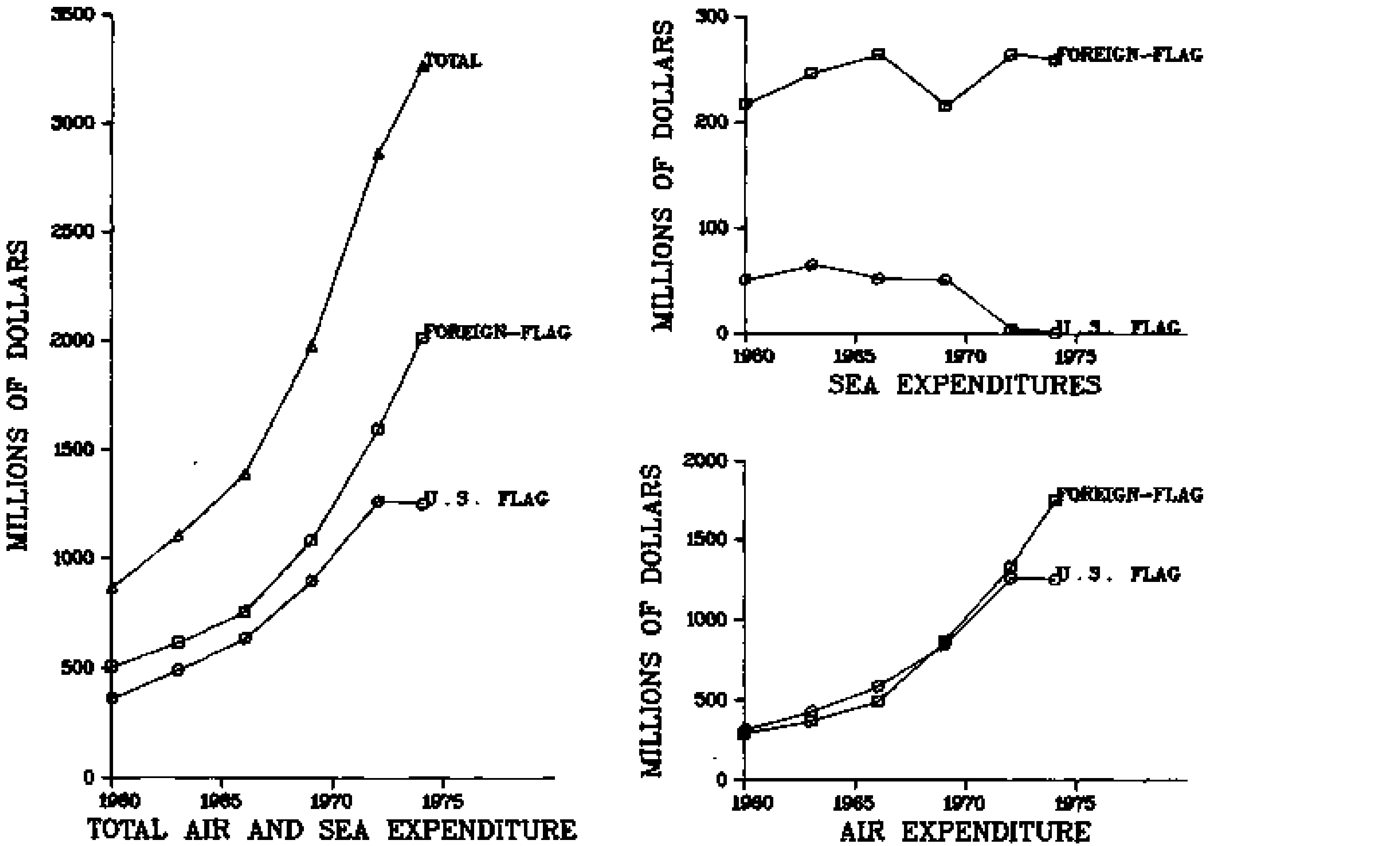
Intercity Passenger Miles by Mode of Travel, 1964-1975

	Automobiles[1]	Motor coaches[1]	Total motor vehicles[1]	Railways revenue passengers	Inland waterways	Airways, domestic revenue services	Total
Passenger miles by mode (in billions)							
1975	1,164.0	25.6	1,189.6	9.7	4.0	148.0	1,351.3
1974	1,143.4	27.6	1,171.0	10.4	4.1	146.2	1,331.7
1973	1,174.0	26.4	1,200.4	9.3	4.0	143.1	1,356.8
1972	1,129.0	25.6	1,154.6	8.7	4.0	133.0	1,300.3
1971	1,071.0	25.5	1,096.5	8.9	4.1	119.9	1,229.4
1970	1,026.0	25.3	1,051.3	10.9	4.0	118.6	1,184.8
1969	977.0	24.9	1,001.9	12.3	3.8	119.9	1,137.9
1968	936.4	24.5	960.9	13.3	3.5	101.2	1,078.9
1967	889.8	24.9	914.7	15.3	3.4	87.2	1,020.6
1966	856.4	24.6	881.0	17.3	3.4	69.4	971.0
1965	817.7	23.8	841.5	17.6	3.1	58.1	920.3
1960	706.1	19.3	725.4	21.6	2.7	34.0	783.7
Passenger miles by mode (percent)							
1975	86.14	1.89	88.03	0.72	0.30	10.95	100
1974	85.86	2.07	87.93	0.78	0.31	10.98	100
1973	86.53	1.95	88.47	0.69	0.30	10.55	100
1972	86.82	1.97	88.79	0.67	0.31	10.23	100
1971	87.12	2.07	89.19	0.73	0.33	9.75	100
1970	86.60	2.14	88.74	0.92	0.33	10.01	100
1969	85.86	2.18	88.04	1.08	0.33	10.54	100
1968	86.80	2.27	89.07	1.23	0.32	9.38	100
1967	87.18	2.44	89.62	1.50	0.33	8.55	100
1966	88.19	2.53	90.72	1.78	0.35	7.15	100
1965	88.85	2.59	91.44	1.91	0.34	6.31	100
1960	90.10	2.46	92.56	2.76	0.34	4.34	100

[1]Includes intra-city portions of intercity trips. Omits rural to rural trips, strictly intra-city trips with both origin and destination confined to same city, local bus or transit movement, nonrevenue school and government bus operations.

Sources: Transportation Association of America, Transportation Facts and Trends, Quarterly Supplement, Washington, D.C., January 1977, p. 18; Transportation Facts and Trends, 12th ed., Washington, D.C., July 1976, p. 18.

EXPENDITURES ON TRANSOCEANIC TRANSPORTATION BY U.S. RESIDENTS



Source: Transportation Association of America, Transportation Facts and Trends, 12th ed., Washington, D.C., July 1976, p. 21.

Freight Ton-Miles, 1960 through 1975
(millions)

	1960	1965	1970	1971	1972	1973	1974	1975
Trucks	285,000	359,000	412,000	445,000	470,000	505,000	495,000	441,000
Class I rail[1]	572,309	697,878	764,809	739,743	776,746	851,809	850,961	752,816
Air carrier								
Certificated[2]	749	1,670	3,010	3,151	3,403	4,759	5,251	5,061
Supplemental[3]	120	298	285	306	259	292	280	262
Water transport								
Inland waterways including Great Lakes	220,253	262,241	318,560	316,030	338,693	358,222	354,882	343,000
Total domestic system	NA	489,803	596,195	593,164	603,542	584,691	586,345	NA
Oil pipeline	228,626	306,393	431,000	444,000	475,800	507,000	506,000	510,000

NA — Not available.

[1]Prior to January 1, 1956, Class I railroads were defined as railroad operating companies (including switching roads and terminal companies) with annual operating revenues above $1,000,000. January 1, 1956, the base was raised to $3,000,000 and effective January 1, 1965, the base for Class I railroad was raised to $5,000,000. These differences in classification have no significant effect on the comparability of the statistics from year to year.

[2]Includes revenue ton-miles of freight, U.S. and foreign mail, and express.

[3]Includes revenue ton-miles of freight and express. Supplemental carriers are not ordinarily authorized to carry mail.

Sources: Association of American Railroads, Economics and Finance Department, Yearbook of Railroad Facts, 1976 ed., Washington, D.C., 1976, pp. 29 and 36; B.V. Cayce, U.S. Department of Transportation, Federal Aviation Administration, FAA Statistical Handbook of Aviation, Calendar Year 1975, Washington, D.C., December 1975, pp. 72 and 73; W.F. Gay, U.S. Department of Transportation, Summary of National Transportation Statistics, Washington, D.C., June 1976, p. 54.

Intercity Freight Movement by Mode, 1950 through 1975

	Motor trucks[a]	Railways[b]	Inland waterways[c]	Pipe lines	Domestic airways	Total
Ton-miles (in billions):						
1975	*441.0*	*761.0*	*354.0*	*510.0*	*4.000*	*2,070.0*
1974	*495.0*	*860.0*	*354.0*	*506.0*	*3.910*	*2,218.9*
1973	505.0	858.0	358.0	507.0	3.940	2,232.0
1972	470.0	784.0	339.0	476.0	3.700	2,073.0
1971	430.0	744.0	315.0	444.0	3.500	1,936.5
1970	412.0	768.0	319.0	431.0	3.400	1,933.4
1969	404.0	774.0	303.0	411.0	3.200	1,895.2
1968	396.3	756.8	291.4	391.3	2.900	1,838.7
1967	388.5	731.2	274.0	361.0	2.592	1,757.3
1966	380.9	750.8	280.5	332.9	2.252	1,747.4
1965	359.2	708.7	262.4	306.4	1.910	1,638.6
1964	356.3	666.2	250.2	268.7	1.504	1,542.8
1963	336.2	629.3	234.2	253.4	1.296	1,454.4
1960[d]	285.5	579.1	220.3	228.6	0.778	1,314.3
1955	223.3	631.4	216.5	203.2	0.481	1,274.9
1950	172.9	596.9	163.3	129.2	0.318	1,062.6
Ton-miles (percent):						
1975	*21.30*	*36.76*	*17.10*	*24.64*	*0.19*	*100*
1974	*22.31*	*38.76*	*15.95*	*22.80*	*0.18*	*100*
1973	22.60	38.50	16.00	22.70	0.18	100
1972	22.70	37.70	16.40	23.00	0.18	100
1971	22.21	38.42	16.27	22.92	0.18	100
1970	21.30	39.72	16.49	22.29	0.17	100
1969	21.31	40.84	15.98	21.68	0.16	100
1968	21.55	41.16	15.85	21.28	0.16	100
1967	22.11	41.61	15.59	20.54	0.15	100
1966	21.80	42.97	16.05	19.05	0.13	100
1965	21.92	43.25	16.01	18.70	0.12	100
1964	23.09	43.18	16.21	17.41	0.10	100
1963	23.11	43.27	16.10	17.43	0.09	100
1960[d]	21.72	44.06	16.76	17.40	0.06	100
1955	17.51	49.53	16.98	15.94	0.04	100
1950	16.27	56.17	15.37	12.16	0.03	100

[a]Ton-miles between cities and between rural and urban areas included, whether private or for hire. Rural-to-rural movements and city deliveries are omitted.

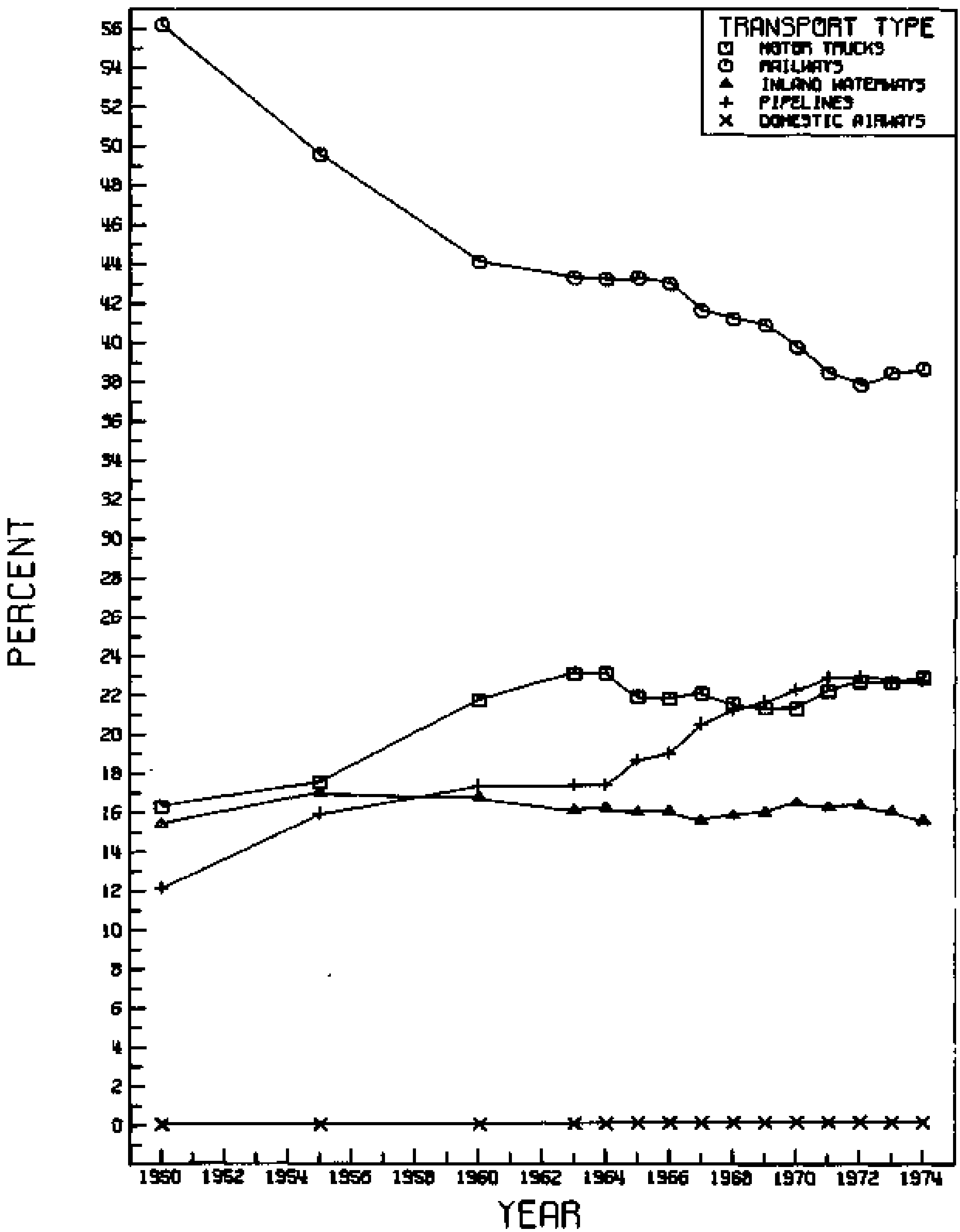
[b]Revenue ton-miles.

[c]Does not include coastwide and intercoastal ton-miles.

[d]1960 and later years include Alaska and Hawaii.

Source: Motor Vehicle Manufacturers Association, Motor Vehicle Facts & Figures '76, Detroit, Michigan, 1976, p. 56.

Distribution of Intercity Freight Movement by
Type of Transport, 1950 to 1974



Source: Motor Vehicle Manufacturers Association, <u>1975 Motor Truck Facts</u>, Detroit, Michigan, 1975, p. 37.

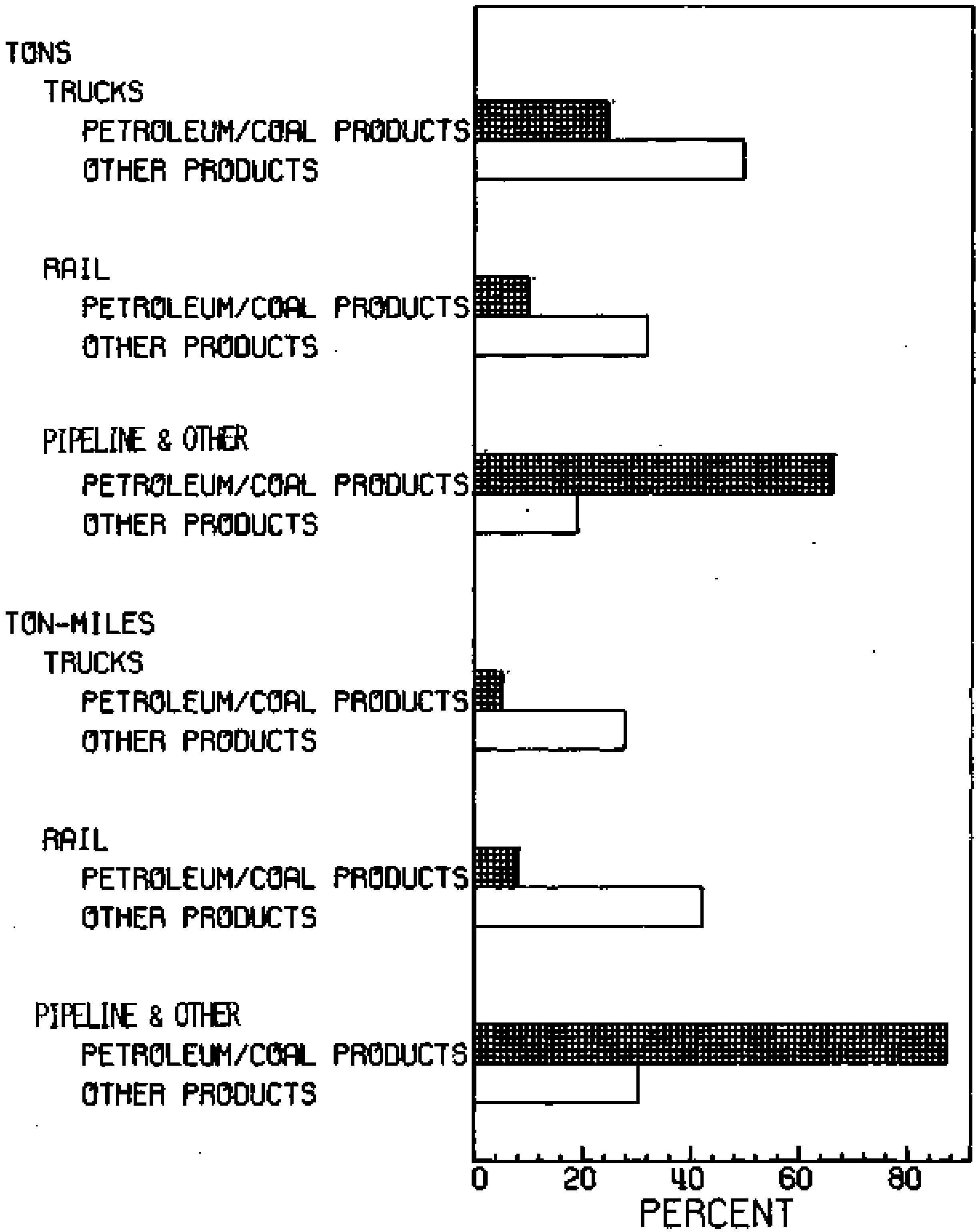
Percent Distribution by Mode of Transportation for Commodities Shipped by Manufacturers, 1972

Group	Tons					Ton-miles				
	Motor carrier	Private truck	Total truck	Rail	Pipeline & Other	Motor carrier	Private truck	Total truck	Rail	Pipeline & Other
Meat & dairy products	41.7%	39.1%	80.8%	18.8%	0.4%	54.3%	17.2%	71.5%	27.8%	0.6%
Canned, frozen & other food products	20.3	23.0	43.3	50.7	6.0	18.3	9.5	27.8	66.8	5.4
Candy, cookies, beverages & tobacco products	25.7	58.4	84.1	15.4	0.4	28.8	25.8	54.6	43.1	2.2
Basic textiles & leather products	61.4	27.7	89.1	9.7	1.2	61.0	21.0	82.0	16.3	1.8
Apparel & related products	69.4	15.6	85.0	8.5	6.5	67.0	9.5	76.5	13.4	10.1
Paper & allied products	28.0	17.9	45.9	51.7	2.3	18.9	5.6	24.5	73.8	1.5
Basic chemicals, plastics, synthetic rubber & fibers	30.1	12.1	42.2	48.6	9.2	21.6	4.7	26.3	63.1	10.5
Drugs, paints & other chemical products	38.6	15.7	54.3	37.8	7.9	32.0	8.4	40.4	44.3	15.2
Petroleum & coal products	16.0	8.4	24.4	9.7	65.8	3.4	1.6	5.0	7.9	87.1
Rubber & plastic products	59.1	15.2	74.3	24.4	1.2	56.8	9.3	66.1	32.1	1.8
Lumber & wood products, except furniture	16.2	36.3	52.5	45.8	1.6	7.6	10.7	18.3	76.8	4.9
Furniture & fixtures	41.4	34.7	76.1	22.0	1.9	39.9	20.5	60.4	37.1	2.5
Stone, clay & glass products	47.2	23.7	70.9	21.9	7.2	36.6	11.3	47.9	45.3	6.7
Primary iron & steel products	44.4	6.7	51.1	43.7	5.2	35.9	4.8	40.7	51.6	7.7
Primary nonferrous metal products	31.4	15.1	46.5	51.6	1.9	23.4	7.7	31.1	67.2	1.6
Fabricated metal products	55.3	25.1	80.4	17.3	2.3	60.1	13.0	73.1	23.3	3.6
Metal cans & misc. metal products	44.1	17.8	61.9	36.8	1.3	40.3	7.1	47.4	50.5	2.1
Industrial machinery, except electrical	59.4	18.8	78.3	19.6	2.0	75.7	8.9	84.6	12.3	3.0
Machinery, except electrical & industrial	53.4	17.7	71.1	26.5	2.3	49.7	8.9	58.6	37.7	3.6
Communication products & parts	64.5	12.4	76.9	13.0	10.0	59.9	5.6	65.5	18.0	16.5
Electrical products & supplies	49.3	14.1	63.4	35.0	1.3	46.0	8.4	54.4	43.2	2.6
Motor vehicles & equipment	37.3	3.0	40.3	59.3	0.4	17.4	1.0	18.4	80.9	0.8
Transportation equipment, except motor vehicles	23.9	54.8	78.7	19.5	1.8	30.3	43.1	73.4	24.0	2.7
Instruments, photo equipment, watches & clocks	63.8	10.9	74.7	20.9	4.4	53.9	5.7	59.6	34.4	6.0
Total all shipper groups	31.1%	18.3%	49.4%	31.7%	18.8%	20.9%	6.8%	27.7%	42.0%	30.3%
Total all shipper groups, except petroleum and coal production	35.7%	21.3%	57.0%	38.4%	4.5%	38.6%	9.1%	37.7%	56.9%	5.4%

Source: U.S. Department of Commerce, Bureau of the Census, Census of Transportation-1972 Commodity Transportation Survey, Washington, D.C.

1.1.3.04

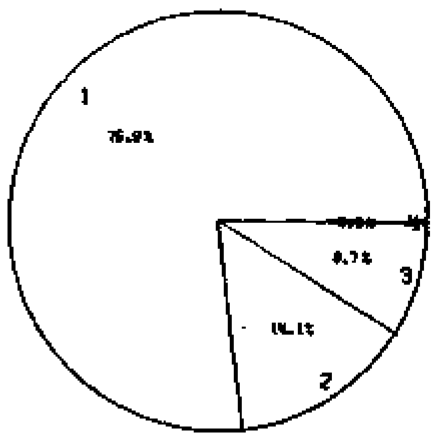
COMMODITIES SHIPPED BY MANUFACTURERS BY MODE, 1972



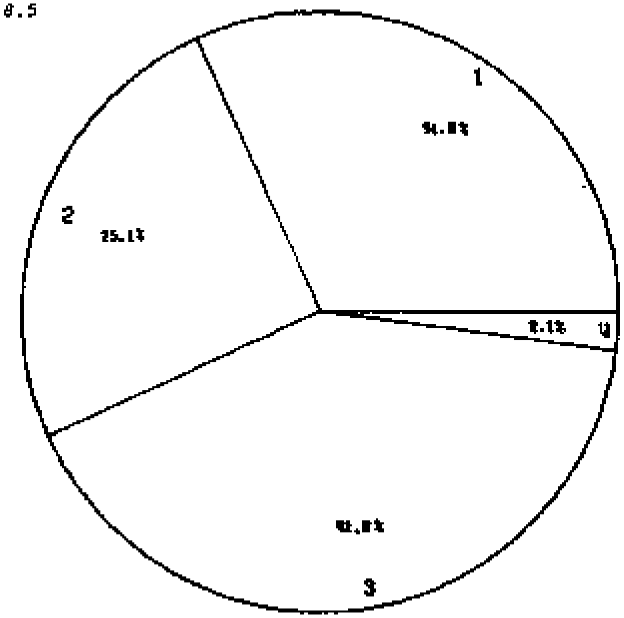
Source: U.S. Department of Commerce, Bureau of the Census, Census of Transportation-1972 Commodity Transportation Survey, Washington, D.C.

METHOD OF TRANSPORTING CRUDE OIL & PETROLEUM PRODUCTS (1973)

TONS IN MILLIONS		MODE
Crude	*Refined*	
492.40	419.80	1. PIPELINES
90.50	330.70	2. WATER CARRIER
55.50	540.20	3. TRUCKS
1.90	27.80	4. RAILROADS
640.30	*1318.5*	



CRUDE OIL



REFINED PRODUCTS

Source: The Aerospace Corporation, Characterization of the U.S. Transportation System — Pipeline Transportation Systems, Los Angeles, Calif., July 1976, pp. 13 and 14. (Draft)

Number of Operating Companies and Employees, 1960 through 1975

	1960	1970	1973	1974	1975
Intercity bus					
Companies	1,150	1,000	1,000	950	950
Employees	45,000	49,600	48,400	49,000	NA
Truck					
Companies	935	1,295	1,442	794	
Employees	302,626	502,021	580,220	492,376	
Local transit					
Companies	1,286	1,096	1,023	946	947
Employees	156,400	138,040	140,700	153,100	159,800
Class I rail					
Companies	NA	71	68	72	NA
Employees	780,494	566,282	520,153	525,177	487,789
Air					
Companies	NA	NA	NA	NA	
Employees	169,872	304,630	317,222	311,688	
Water					
Companies	132	100	97	78	
Employees	30,594	22,656	18,105	18,237	
Oil transport					
Companies	87	99	100	104	
Employees	21,321	15,017	14,745	15,222	
Taxis					
Companies	NA	NA	NA	NA	
Employees	120,700	111,300	97,200	93,300	
Natural gas					
Companies	116 (1964)	NA	1 121	120	
Employees	29,900 (1964)	NA	36,200	36,200	

NA — Not available.

Sources: W.F. Gay, U.S. Department of Transportation, Summary of National Transportation Statistics, Washington, D.C., June 1976, pp. 20, 22, 24, 26, 28, 34, and 35; American Public Transit Association, Transit Fact Book, '75-'75 ed., Washington, D.C., March 1976, p. 38; Association of American Railroads, Economics and Finance Department, Yearbook of Railroad Facts, 1976 ed., Washington, D.C., p. 9; National Association of Motor Bus Owners, Bus Facts - 1974 Statistical Supplement, Washington, D.C., June 1975, p. 1.

Intercity Mileage for Transportation Networks Within the Continental U.S., 1960 through 1975
(statute miles)

	1960	1965	1970	1971	1972	1973	1974	1975
Railroads[1]	217,552	211,925	206,265	205,220	203,299	201,300	200,916	200,000
Oil pipelines[2]	190,944	213,764	218,617	219,899	221,127	222,355	223,353	224,811
Natural-gas pipelines and utility main[3]	239,500	273,000	319,200	323,000	327,300	333,400	NA	NA
Inland waterways[4]	25,253	25,380	25,543	25,543	25,543	25,543	25,543	25,543
Highways[5]	557,729	617,114	665,903	672,838	678,285	679,387	679,934	685,052
Airways[6]	293,003	288,275	291,231	295,301	300,126	304,260	307,783	313,178

NA — Not available.

[1]Data represent aggregate length of roadway of all line-haul railroads, excluding mileage of yard tracks or sidings. Jointly used track is counted only once.

[2]Includes gathering lines.

[3]Includes field and gathering and transmission lines only. Data not adjusted to common diameter equivalent mileage shown as of end of each year.

[4]Includes total length of all commercially navigable inland channels.

[5]Includes paved primary and secondary roads under state control.

[6]1960-1961 airway figures include low/medium frequency routes and very high frequency routes. Only very high frequency routes have been in use since 1962. Jet ranks are included from 1960. Nautical mileage has been counted to statute miles for comparability with the other modes.

Source: W. F. Gay, U.S. Department of Transportation, <u>Summary of National Transportation Statistics</u>, Washington, D.C., June 1976, p. 56; Transportation Association of America, <u>Transportation Facts and Trends</u>, Quarterly Supplement, Washington, D.C., January 1977, p. 31.

TRANSPORTATION ROUTES BETWEEN THE SAME POINTS MAY VARY SIGNIFICANTLY IN TERMS OF TOTAL DISTANCE TRAVELED BY EACH MODE.

Intercity Distances and Circuity Factors
for Selected City Pairs
(distance in statute miles)

Nominal distance	City pair	city center-city center (G.C.D.[1])	Air ATA range	Auto AAA route	Bus	Passenger rail
100	Los Angeles - San Diego	111	190	119	121	128
	Circuity Factor Ratio	1.00	1.71	1.07	1.09	1.15
250	New York - Washington	205	296	224	227	227
	Circuity Factor Ratio	1.00	1.44	1.09	1.10	1.10
750	New York - Chicago	711	828	854	821	907
	Circuity Factor Ratio	1.00	1.16	1.20	1.15	1.27
1,000	New York - Miami	1,094	1,188	1,363	1,362	1,403
	Circuity Factor Ratio	1.00	1.08	1.24	1.24	1.28
1,500	Seattle - Chicago	1,733	1,849	2,107	2,100	2,289
	Circuity Factor Ratio	1.00	1.06	1.21	1.21	1.32
2,000	Atlanta - Los Angeles	1,932	2,053	2,271	2,228	2,561
	Circuity Factor Ratio	1.00	1.06	1.17	1.15	1.32
2,500	Miami - Los Angeles	2,335	2,457	2,838	2,893	3,289
	Circuity Factor Ratio	1.00	1.05	1.21	1.23	1.40

[1] G.C.D. = Great Circle Distance, i.e., the shortest distance between any two terrestrial points.

Source: Boeing Commercial Airplane Company, Intercity Passenger Transportation Data - Energy Comparisons, vol. 1, Seattle, Washington, May 1975, pp. 97 and 141.

THEREFORE, WHEN MAKING COMPARISONS AMONG INTERCITY MODES FOR SUCH VARIABLES AS FUEL EFFICIENCY OR REVENUE PASSENGER MILES, ONE SHOULD CONSIDER CIRCUITY FACTORS: CIRCUITY FACTOR RATIOS EXPRESS THE RELATIONSHIP BETWEEN TOTAL DISTANCE TRAVELED BY A CERTAIN MODE AND THE MINIMUM INTERCITY DISTANCE. FOR EXAMPLE, FOR SHORT DISTANCES BETWEEN CITIES, THE AIR CIRCUITY FACTOR IS HIGHER THAN FOR CAR, BUS OR RAIL BUT FOR GREATER DISTANCES, IT IS MUCH LOWER.

Comparison of Material Inputs to Transportation Equipment Products[1]
(percentage)

Input sector	Truck, bus, and trailer bodies	Motor vehicles and parts	Aircraft	Aircraft engines	Aircraft equipment	Ship and boat building	Railroad equipment
Plastic products	1.5	1.0				1.4	
Rubber products	8.5	3.4					2.4
Glass	1.5	1.9				1.4	
Steel	16.0	14.4	3.4	10.9	6.9	10.4	42.8
Aluminum	7.8	1.4	4.8	2.7	7.7	3.4	4.0
Structural metal products						8.0	
Screw machine products	1.7	1.5	2.3	2.5	5.0		
Other fabricated metal products	1.2	1.3		2.7	1.7	2.0	1.6
Engines and turbines		1.5				18.2	6.7
Other metal working machinery		1.8	3.1	8.6	6.2	2.8	
Power transmission equipment						4.6	2.0
Service industry machinery		2.3					
Machine shop products	2.6	2.2	9.0	14.6	11.5		
Communications equipment			15.3				
Engine electrical equipment				2.6			
Engineering and scientific instruments			5.1				
Trucking	7.7	3.0					
Wholesale trade	4.8	5.3	4.0	3.6	3.3	6.0	4.4
Real estate			3.8	4.0	8.3	1.6	
Business services	11.1	1.0	6.9	7.1	8.3	2.4	1.7
Remainder of 185 input sectors	35.6	58.0	42.3	40.7	41.1	37.8	34.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1]All figures are the share of the total input material bill in value terms, represented by each item — no entries <1% are included. The coefficients to the material bill are derived from the following equation.

$$\frac{A_{ij}}{1-VA_j-A_{ii}}$$

where A_{ij} represents the amount of sales on industry i to industry j per unit of j's output, VA represents value added within sector j, and A_{ii} represents the diagonal term of the input-output matrix.

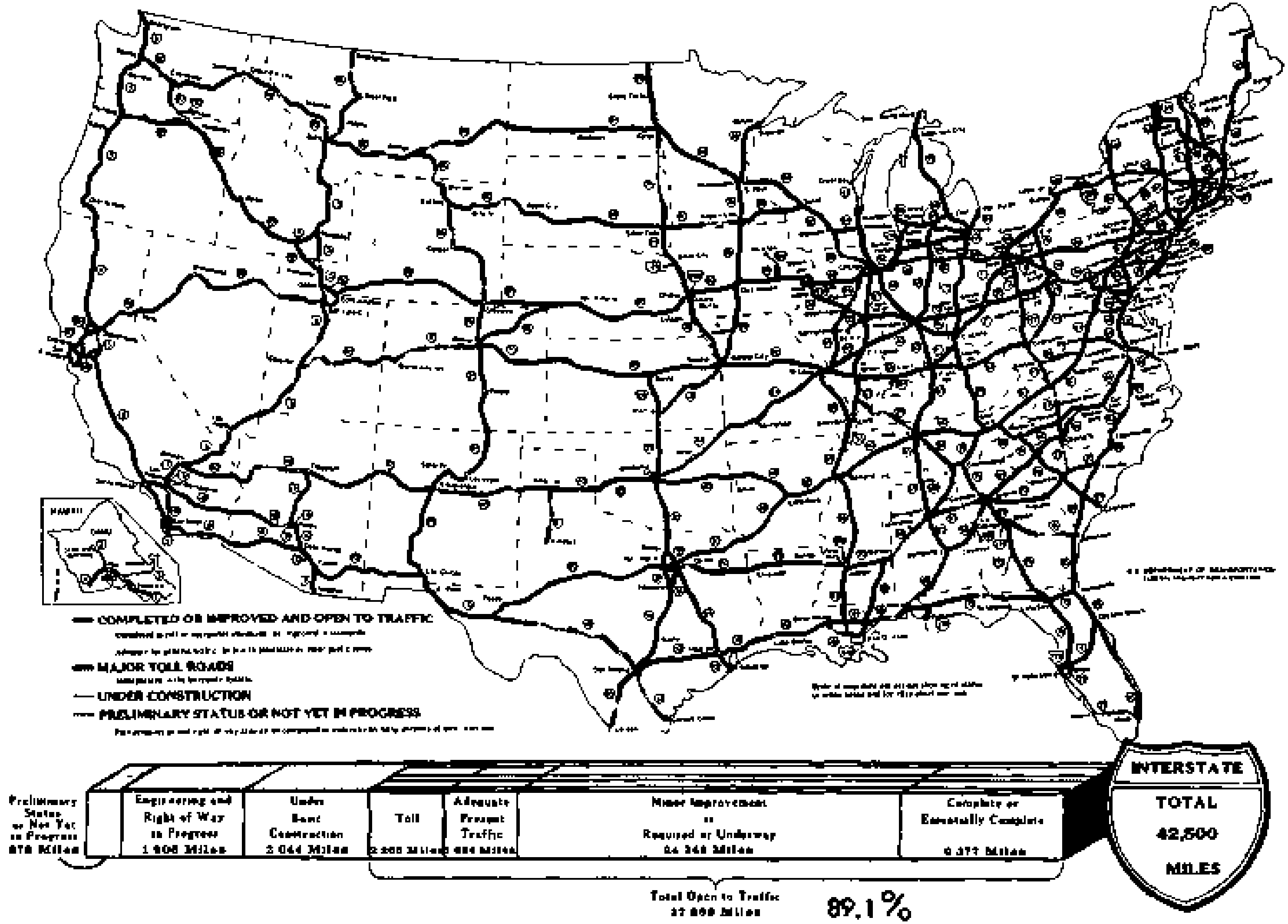
Source: These numbers were generated with the economic forecasting system, INFORUM (Interindustry FORcasting System of the University of Maryland) developed by Professor Clopper Almon, Jr., University of Maryland. The data used is for 1972.

Section 1.2

Highway

The National System of Interstate and Defense Highways

September 30, 1976



Source: U.S. Department of Transportation, Federal Highway Administration, Department of Transportation News, FHWA 72-76 (November 26, 1976), Washington, D.C.

World Motor Vehicle Registrations, 1974

Continent/selected countries	Cars	Trucks and buses	Total motor vehicles	Population		
				Number (in thousands)	Per car	Per motor vehicle
North and Central America	116,691,465	28,199,853	144,891,318	323,846	2.8	2.2
Canada	8,472,224	1,999,900	10,472,124	22,446	2.6	2.1
Mexico	1,947,534	744,738	2,692,272	56,200	29	21
U.S.	104,898,256	25,044,831	129,943,087	209,000	2.0	1.6
South America	8,757,149	3,435,896	12,193,045	206,973	24	17
Argentina	2,160,035	965,868	3,125,903	24,966	12	8.0
Brazil	4,584,142	1,517,681	6,101,823	105,000	23	17
Venezuela	875,714	323,495	1,199,209	11,600	13	9.7
Asia						
China	35,500	670,000	705,500	800,000	22,535	1,134
India	804,561	532,589	1,337,150	547,950	681	410
Iran	410,000	340,000	750,000	32,174	78	43
Japan	15,853,548	10,927,758	26,781,306	110,330	7.0	4.1
Oceania	6,031,474	1,402,932	7,434,406	20,328	3.4	2.8
Australia	4,769,200	1,130,800	5,900,000	13,500	3.0	2.3
New Zealand	1,117,986	202,535	1,320,521	3,000	2.7	2.3
Africa	4,349,969	1,982,189	6,332,158	389,098	89	61
Morocco	287,866	100,419	388,285	16,500	57	42
S.Africa, Rep. of	1,950,347	783,476	2,733,823	24,920	13	9.1
Europe	91,801,053	16,104,090	107,905,143	721,130	7.9	6.7
France	15,100,000	2,334,000	17,434,000	52,000	3.4	3.0
Germany, West	17,356,276	1,302,963	18,659,239	61,990	3.6	3.3
Great Britain	13,947,934	1,916,466	15,864,400	56,900	4.1	3.6
Italy	14,295,040	1,140,923	15,435,963	55,643	3.9	3.6
U.S.S.R.	3,781,700	4,506,500	8,288,200	250,900	66	30
World total	248,609,010	65,725,553	314,334,563	3,739,561	15	12

Source: Motor Vehicle Manufacturers Association, Motor Vehicle Facts and Figures '76, Detroit, Michigan, 1976, pp. 34 and 35.

Number of Highway Motor Vehicles Registered in the United States by Type, 1963 through 1975[1]
(in thousands)

Year	Passenger Vehicles							Cargo vehicles			All motor vehicles
	Personal passenger vehicles			Buses			All passenger vehicles				
	Passenger cars	Motor-cycles	All personal passenger vehicles	Commercial	School	All Buses		Single-unit trucks	Combi-nations	All trucks	
1975	*106,712.6*	*4,966.8*	*111,679.4*	*93.8*	*368.3*	*462.1*	*112,141.5*	*24,644.7*	*1,131.0*	*25,775.7*	*137,917.2*
1974	*104,856.3*	*4,966.4*	*109,822.7*	*90.1*	*356.9*	*447.0*	*110,269.7*	*23,545.2*	*1,085.0*	*24,630.2*	*134,899.9*
1973	101,762.5	4,356.5	106,119.0	89.5	336.0	425.5	106,544.5	22,205.0	1,027.9	23,232.9	129,777.4
1972	96,860	3,798	100,658	88.8	318.2	407.0	101,065	20,249	990	21,239	122,304
1971	92,799	3,345	96,144	90.3	307.3	397.6	96,542	18,828	974	19,802	116,344
1970	89,280	2,815	92,095	90.3	288.7	379.0	92,474	17,788	960	18,748	111,222
1969	86,861	2,295	89,156	90.3	274.0	364.3	89,520	16,942	929	17,871	107,391
1968	83,693	2,100	85,793	89.6	262.2	351.8	86,145	16,124	871	16,995	103,140
1967	80,414	1,953	82,367	90.0	247.9	337.9	82,705	15,363	830	16,193	98,898
1966	78,353	1,753	80,106	84.5	238.7	323.2	80,429	14,694	823	15,517	95,946
1965	75,252	1,382	76,634	85.0	229.3	314.3	76,948	14,008	787	14,795	91,743
1964			72,969[2]	82.3	223.1	305.4	73,274	13,275	738	14,013	87,287
1963			69,842[2]	82.2	215.7	297.9	70,140	12,654	706	13,860	83,500

[1]For the 50 states and District of Columbia.

[2]Only totals are presented for 1963 and 1964, as motorcycles account for less than 1 percent of all travel.

Source: U.S. Department of Transportation, Federal Highway Administration, Department of Transportation News, FHWA 72-76 (November 26, 1976), Washington, D.C., Table VM-1.

Projections of Motor Vehicle Registrations to the Year 1990

Calendar year	Total motor vehicle registrations[1,2] Automobiles (millions)	Trucks and buses (millions)	Total (millions)
Actual			
1940	27.5	5.0	32.5
1950	40.4	8.8	49.2
1960	61.7	12.2	73.9
1965	75.2	15.1	90.3
1970	89.3	19.1	108.4
1972	96.9	21.6	118.5
Estimated			
1975	106.5	25.3	131.8
1980	117.5	28.7	146.2
1985	127.4	31.3	158.7
1990	136.3	33.5	169.8

[1]Recorded figures are shown through 1972.

[2]Estimates of Highway Statistics Division, FHWA, for 1975-1990.

Estimated Distribution of Automobile Registrations by Vehicle Size, 1973-1990

Year	Economy (subcompact) (millions)	Compact (millions)	Regular (standard) (millions)	Total (millions)
1973[1]	13.1	23.0	65.5	101.6
1975	18.1	24.9	63.5	106.5
1980	29.5	30.9	57.1	117.5
1985	50.4	40.2	36.8	127.4
1990	73.8	40.7	21.8	136.3

[1]Actual.

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Travel Forecasts, Washington, D.C., November 1974, pp. 32 and 34.

PRIVATELY AND PUBLICLY OWNED VEHICLES, 1960 TO 1975

Privately and Publicly Owned Vehicles[1]

Year (December 31st)	Passenger cars	Buses	Trucks[2]	Total[2]
1975	107,371,000	470,000	25,886,000	133,727,000
1974	104,901,066	446,558	24,590,178	129,937,802
1973	101,762,477	425,527	23,232,872	125,420,876
1972	97,096,162	406,866	21,278,946	118,781,974
1971	92,741,552	397,075	19,848,344	112,986,971
1970	89,259,341	377,562	18,767,294	108,404,197
1965	75,257,588	314,284	14,785,795	90,357,667
1960	61,671,390	272,129	11,914,249	73,857,768

Publicly Owned Vehicles

Year (December 31st)	Passenger cars	Buses	Trucks[2]	Total[2]
1975	691,000	240,000	1,186,000	2,117,000
1974	628,500	227,869	1,118,710	1,975,079
1973	573,742	207,142	1,057,227	1,838,111
1972	529,143	202,653	1,008,418	1,740,214
1971	497,104	194,948	995,128	1,687,180
1970	468,263	188,477	952,652	1,609,392
1965	348,223	159,227	759,750	1,267,200
1960	251,442	134,557	584,971	970,970

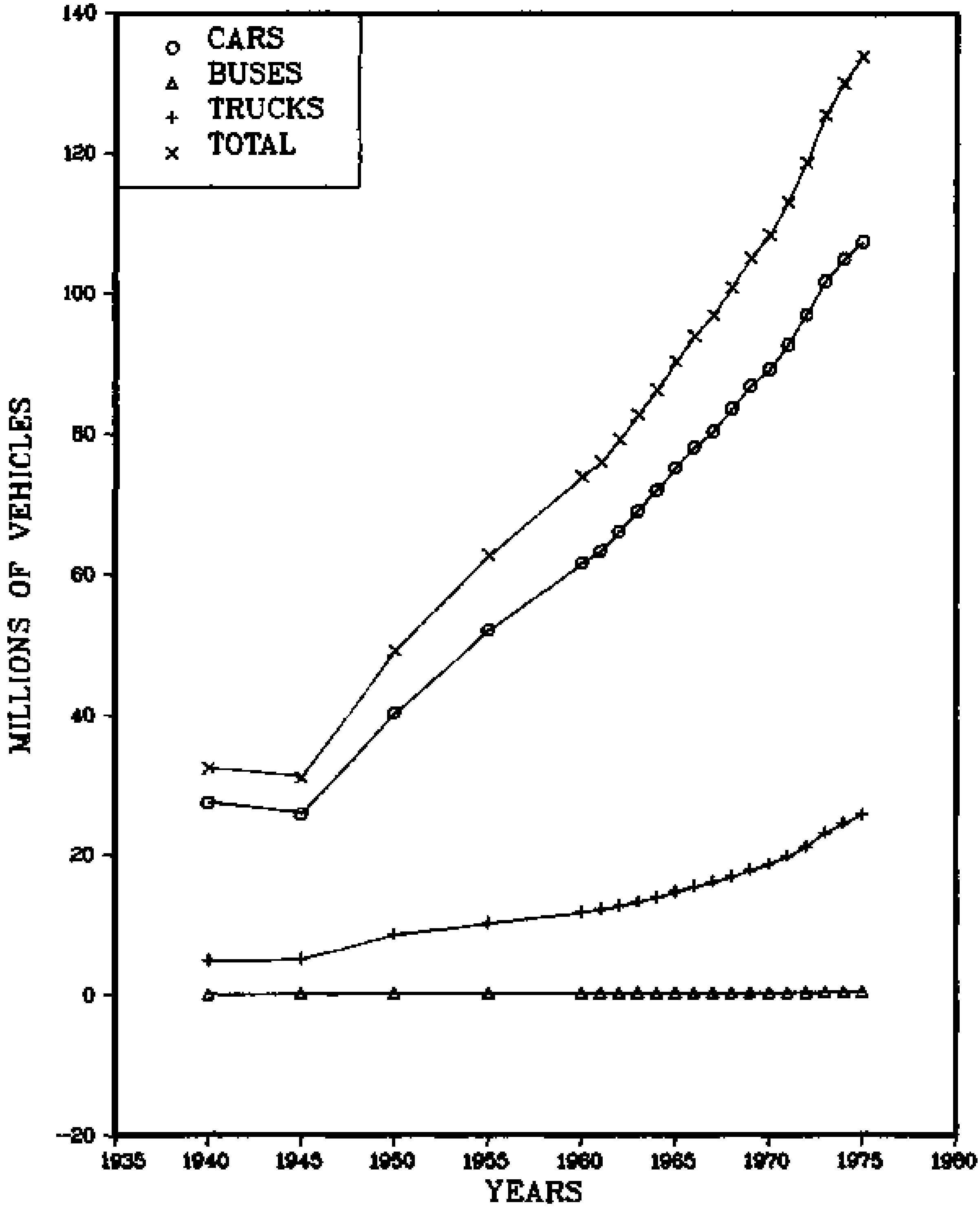
[1]Excludes military vehicles.

[2]Data excludes farm trucks registered at a nominal fee in certain states and restricted to use in the vicinity of the owners farm. In 1974 there was 34,208 such vehicles.

Source: Motor Vehicle Manufacturers Association, Motor Vehicle Facts and Figures '76, Detroit, Michigan, 1976, p. 29.

PRIVATELY AND PUBLICLY OWNED VEHICLES

(EXCLUDES MILITARY VEHICLES)



Source: Motor Vehicle Manufacturers Association, Motor Vehicle Facts & Figures '76, Detroit, Michigan, 1976, p. 29.

Fleet Inventory Summary and Selected Characteristics of Federal Government Motor Vehicles, 1975

	Sedans	Station wagons	Ambulances	Buses	Trucks Less than 12,500 lbs	Trucks 12,500 lbs and over	Total
Total civilian							
Agencies	58,912	6,567	379	2,360	182,276	13,849	264,343
Domestic	57,590	5,871	378	2,301	—	—	259,627
Foreign	1,322	696	1	59	—	—	4,716
Total military[1]							
Agencies	23,691	5,292	3,142	8,920	85,691	29,705	156,441
Domestic	18,717	4,402	2,389	5,763	—	—	122,446
Foreign	4,974	890	753	3,157	—	—	33,995
Total all							
Agencies	82,603	11,859	3,521	11,280	267,967	43,554	420,784
Domestic	76,307	10,273	2,767	8,064	249,142	35,520	382,073
Foreign	6,296	1,586	754	3,216	18,825	8,034	38,711
ERDA (AEC)	1,735	185	55	291	6,159	974	9,399
United States Postal Service	1,191	—[2]	—[2]	—[2]	109,728	4,214	115,113

	1970	1972	1973	1974	1975
Average miles per vehicle year[3]					
Domestic	9,942	9,096	8,625	8,046	7,985
Foreign	10,714	10,528	9,959	9,278	—
ERDA (AEC)[4]	8,873	7,998	8,275	7,457	7,987
United States Postal Service	9,749	6,725	5,988	5,988	5,373
Average miles per gallon of fuel[3]					
Domestic	11.2	10.7	10.6	9.5	9.8
Foreign	11.1	12.6	12.0	9.7	—
ERDA (AEC)[4]	10.0	10.0	9.2	9.8	9.3
United States Postal Service	7.0	7.0	6.6	7.3	7.2
Total cost per mile[3]					
Domestic	0.12681	0.15288	0.16066	0.17946	0.20239
Foreign	0.13505	0.15710	0.16077	0.18585	0.21278
ERDA (AEC)[4]	0.13423	0.15658	0.16142	0.17909	0.20564
United States Postal Service	0.22821	0.27769	0.27726	0.30110	0.32290

[1]Does not include troop-training or tactical vehicles.

[2]These types not separated in USPS data system.

[3]Numbers calculated for agencies holding 2,000 or more reportable vehicles.

[4]Data shows ERDA (AEC) domestic; foreign was not included.

Source: General Services Administration, Federal Motor Vehicle Fleet Report, Washington, D.C., July 1976, pp. 1, 2, 8, 16, 17, 24, and 26; Federal Motor Vehicle Fleet Report, March 1975, April 1974, and March 1973, pp. 14, 16, and 21; Federal Motor Vehicle Fleet Report, March 1971, Table 7, Table 8, and Table 14.

Passenger Cars in Use by Age of Car

Age in years[1]	1965			1970[2]			1974[2]			1975[2]		
	Number (000)	Percent		Number (000)	Percent		Number (000)	Percent		Number (000)	Percent	
		Simple	Cum.		Simple	Cum.		Simple	Cum.		Simple	Cum.
Under 1	6,408	9.3%	100.0%	6,288	7.8%	100.0%	6,433	6.9%	100.0%	4,684	4.9%	100.0%
1-2	7,855	11.4	90.7	9,299	11.6	92.2	11,269	12.2	93.3	9,763	10.3	95.1
2-3	7,315	10.6	79.3	8,816	11.0	80.6	10,147	11.0	81.1	11,332	11.9	84.8
3-4	6,626	9.6	68.7	7,878	9.8	69.6	8,622	9.3	70.1	10,098	10.6	72.9
4-5	5,384	7.8	59.1	8,538	10.6	59.8	8,493	9.2	60.8	8,549	9.0	62.3
5-6	6,002	8.7	51.3	8,506	10.6	49.2	8,615	9.3	51.6	8,341	8.8	53.3
6-7	5,404	7.8	42.6	7,116	8.8	38.6	7,931	8.6	42.3	8,339	8.8	44.5
7-8	3,640	5.3	34.8	6,268	7.8	29.8	6,624	7.2	33.7	7,556	7.9	35.7
8-9	4,527	6.6	29.5	5,058	6.3	22.0	6,531	7.1	26.5	6,113	6.4	27.8
9-10	3,979	5.8	22.9	3,267	4.1	15.7	5,710	6.2	19.4	5,796	6.1	21.4
10-11	3,853	5.6	17.1	2,776	3.5	11.6	3,976	4.3	13.2	4,825	5.1	15.3
11-12	2,030	2.9	11.5	1,692	2.1	8.1	2,824	3.0	8.9	3,234	3.4	10.2
12-13	1,823	2.6	8.6	799	1.0	6.0	1,813	2.0	5.9	2,229	1.5	6.8
13-14	856	1.2	6.0	996	1.2	5.0	901	1.0	3.9	1,407	1.5	4.5
14-15	932	1.4	4.8	794	1.0	3.8	682	.7	2.9	689	.7	3.0
15-16	931	1.4	3.4	753	.9	2.8	391	.4	2.2	523	.5	2.3
16 & Older	1,368	2.0	2.0	1,583	1.9	1.9	1,621	1.8	1.8	1,742	1.8	1.8
Subtotal	68,936	100.0%	—	80,427	100.0%	—	92,583	100.0%	—	95,220	100.0%	—
Year not given	4	—	—	22	—	—	25	—	—	21	—	—
Total	68,940	—	—	80,449	—	—	92,608	—	—	95,241	—	—
Average age	5.90 years			5.55 years			5.72 years			5.99 years		

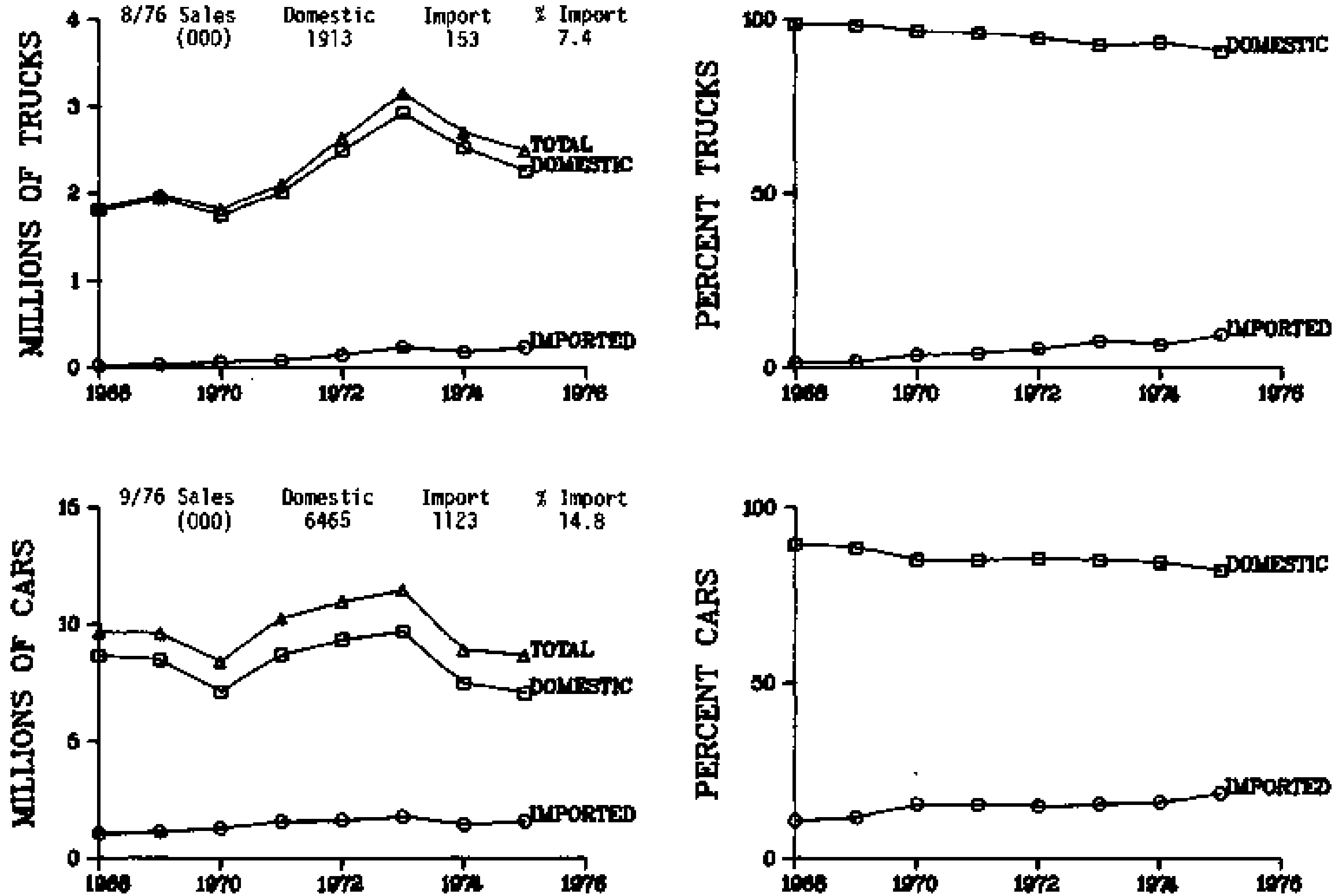
[1]Each class interval includes lower but not higher age.

[2]Beginning in 1966 certain vehicles previously counted as passenger cars have been counted as trucks. The 1966 change involved an estimated 700,000 vehicles.

Note: Data as of July 1 of each year.

Source: R. L. Polk & Co. Further reproduction prohibited.

MOTOR VEHICLE RETAIL SALES
DOMESTIC VS IMPORT



Source: Motor Vehicle Manufacturers Association, Motor Vehicle Facts and Figures '76, Detroit, Michigan, 1976, p. 25.

THE RECREATION VEHICLE INDUSTRY ASSOCIATION (RVIA) FORECASTS SUBSTANTIAL GROWTH IN FACTORY UNIT SHIPMENTS OF RECREATION VEHICLES DESPITE THE UNCERTAINTY OF FUTURE AVAILABILITY OF GASOLINE FOR RECREATIONAL ACTIVITIES.

Factory Unit Shipments of Recreational Vehicles
(thousands)

	Total	Camping trailers	Truck campers	Travel trailers	Motor homes
1961	63	18	16	29	
1965	193	67	44	77	5
1970	380	116	96	138	30
1975	340	48	44	151	97
1980 (Forecast)	726	73	43	263	347[1]
Average 1975 retail price		$2,091	$2,534	$5,901	$12,942

[1]Van camper motor home projection numbers include minimum life support van campers, which have little or no facilities, as well as maximum life support van campers which are equipped with plumbing and electricity.

Source: Recreation Vehicle Industry Association, Recreation Vehicle Industry: Facts and Trends, Chantilly, Va., 1976, pp. 8, 16, and 17.

THESE FORECASTS ARE BASED ON THE INCREASE IN SALES SINCE THE OIL EMBARGO WAS LIFTED AS WELL AS ON BASIC CHANGES IN RECREATION ACTIVITIES PEOPLE HAVE ADOPTED FOR ENERGY CONSERVATION. SURVEYS INDICATE THAT PEOPLE NOW STAY CLOSER TO HOME, BUT TAKE MORE WEEKEND EXCURSIONS AND GENERALLY STAY LONGER THAN THEY DID PRIOR TO THE EMBARGO.

Household Purchases of New and Used Passenger Cars, 1968 through 1974

Year purchased	New cars				Used cars			
	Number purchased (thousands)	Number purchased per 100 households	Average price paid*	Total expend-itures (billions)	Number purchased (thousands)	Number purchased per 100 households	Average price paid*	Total expend-itures (billions)
1974**	8,400	11.9	$3,805	$32.1	13,500	19.1	$1,284	$17.4
1973**	8,700	12.5	3,490	30.2	13,600	18.2	1,287	16.2
1972	8,539	12.8	3,372	28.8	15,021	22.5	1,054	15.8
1971	8,148	12.5	3,294	26.8	14,564	22.4	1,017	14.8
1970	7,051	11.1	3,025	21.3	12,504	19.7	960	12.0
1969	8,069	13.0	3,021	24.4	12,808	20.6	952	12.2
1968	7,960	13.1	2,936	23.4	13,407	22.1	919	12.3

*Net price, after allowance for trade-in.
**Not strictly comparable to previous years, data collected from Fall 1972 to Fall 1973.

Source: Motor Vehicle Manufacturers Association, Motor Vehicle Facts & Figures '76, Detroit, Michigan, 1976, p. 43.

Shares of Sales of Domestic Cars by Two Size Classifications (percentage)

	1973	1974	1975
Wheelbase size			
Short (<112 inches)	32.2	37.2	43.3[1]
Medium (112-120 inches)	29.4	32.4	28.3[1]
Long (>120 inches)	38.4	30.4	28.4[1]
Market class			
Small	32.5	39.7	42.2
Intermediate	27.6	29.0	29.7
Standard	39.6	30.9	28.1

[1]First three quarters of 1975 only.

Sources: U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, 55, No. 11, Washington, D.C., November 1975. Marketing Services Inc., Automotive News Market Data Book, Detroit, Michigan, 1973, 1974, and 1975.

Factory Sales of Motor Vehicles by Body Type, 1969 through 1974

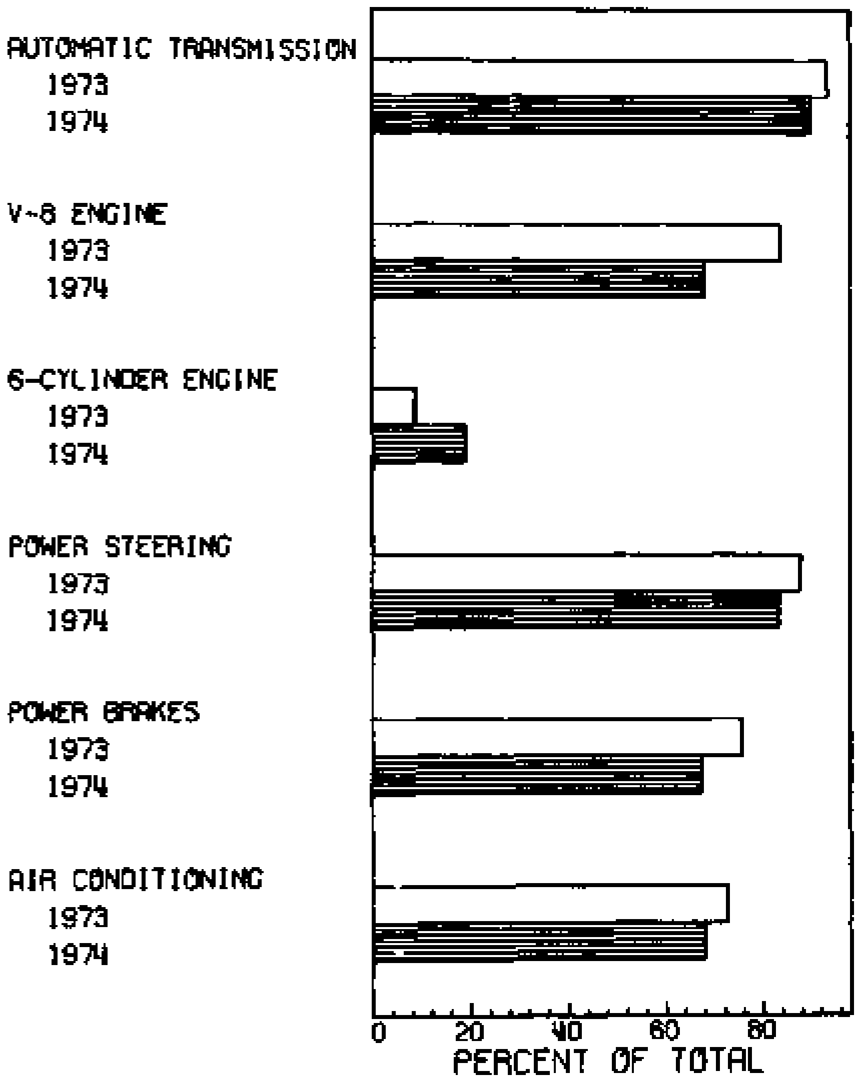
	1969	1970	1971	1972	1973	1974
Passenger cars						
4-door sedans	1,811,218	1,486,329	1,762,520	1,893,869	1,915,302	1,500,537
2-door sedans	603,178	708,572	1,144,302	1,179,773	1,407,389	1,244,617
Convertible coupes	201,997	91,863	87,725	61,655	50,837	27,955
2-door hardtops	3,667,276	2,799,883	3,358,897	3,423,119	4,036,728	3,278,545
4-door hardtops	1,115,083	795,622	1,243,542	1,109,994	1,014,863	494,093
2-door station wagons[1]	287	786	70,525	186,684	250,548	230,714
4-door station wagons[1]	820,877	661,377	913,246	964,893	979,257	552,339
Chassis	3,799	2,385	3,835	3,951	2,723	2,456
Total	8,223,715	6,546,817	8,584,592	8,823,938	9,657,647	7,331,256
Motor truck and bus						
Pickup	1,065,123	898,814	1,130,463	1,334,402	1,711,906	1,430,214
General utility	92,871	95,156	120,660	151,331	183,775	214,766
Panel	8,280	4,809	9,651	4,226	3,281	3,275
Van	173,436	168,081	212,344	298,652	343,423	391,414
Multi-stop	54,230	47,502	72,097	77,539	88,696	42,787
Station wagon (on truck chassis)	45,659	41,898	64,330	69,186	109,718	78,399
Buses (including school bus chassis)	34,400	31,994	33,906	35,298	35,769	38,472
Platform, stake and rack	5,998	6,280	2,734	3,230	3,140	
Other body types	5,755	1,170	761	1,329	37,274	527,986
Chassis with cab	424,468	390,694	400,467	464,590	452,411	
Chassis without cab	12,959	6,042	5,733	7,024	10,295	
Total	1,923,179	1,692,440	2,053,146	2,446,807	2,979,688	2,727,313

[1]Station wagons purchased on commercial vehicle chassis are not included.

Sources: Motor Vehicle Manufacturers Association, 1975 Automobile Facts and Figures, Detroit, Michigan, 1975, p. 13; 1975 Motor Truck Facts, Detroit, Michigan, 1975, p. 14.

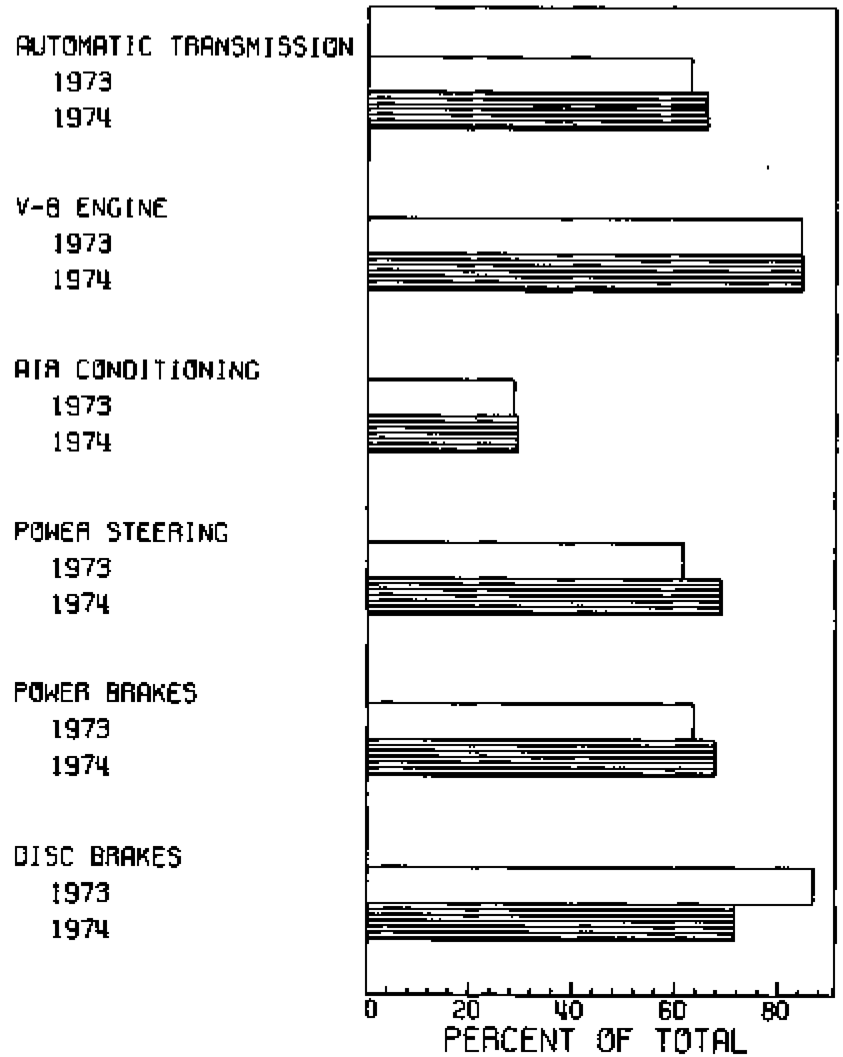
Factory Installation of Energy-Related Equipment

Automobiles



Source: Motor Vehicle Manufacturers Association, 1975 Automobile Facts and Figures, Detroit, Michigan, 1975, p. 19.

Trucks and Buses



Source: Motor Vehicle Manufacturers Association, 1975 Motor Truck Facts, Detroit, Michigan, 1975, p. 18.

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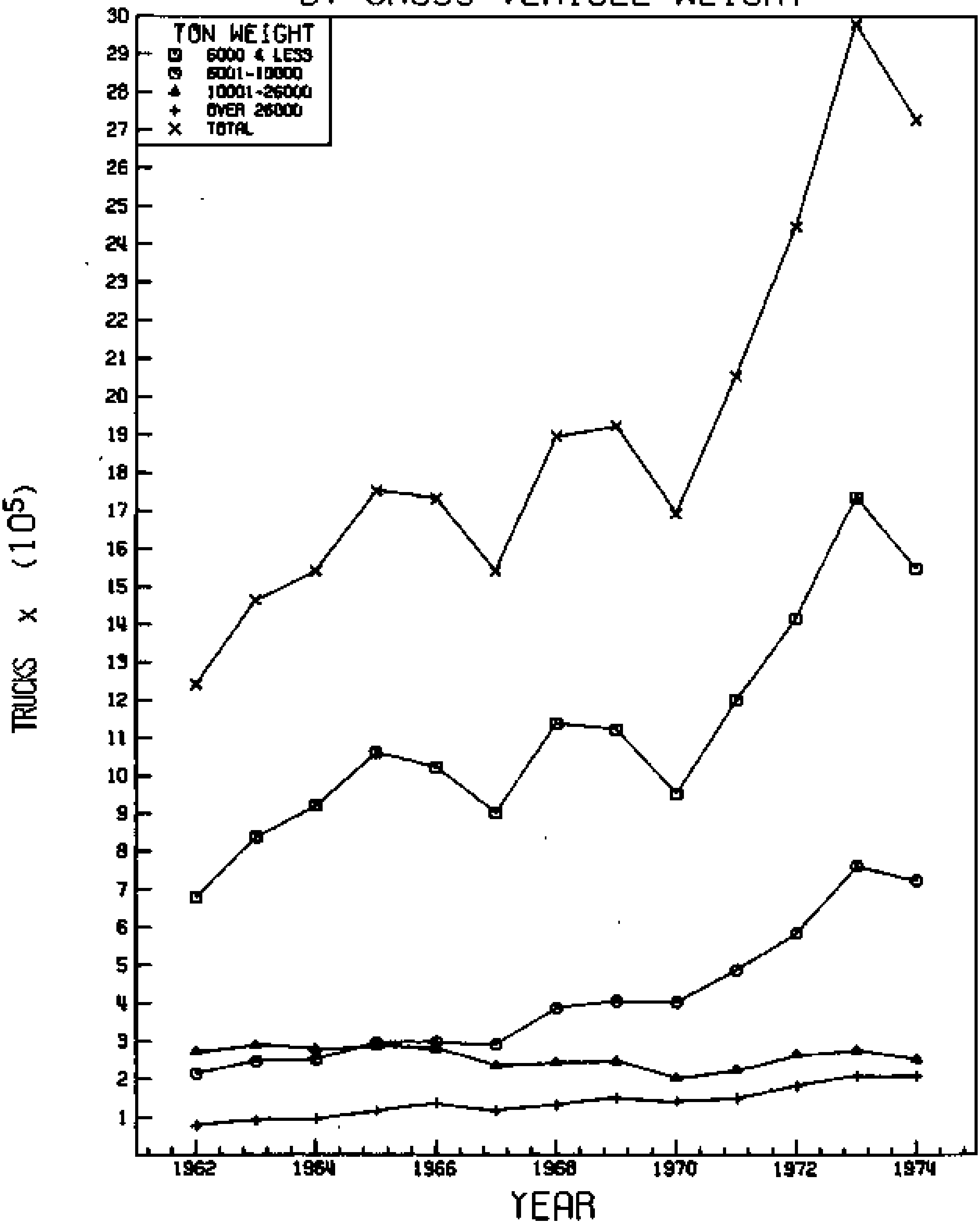
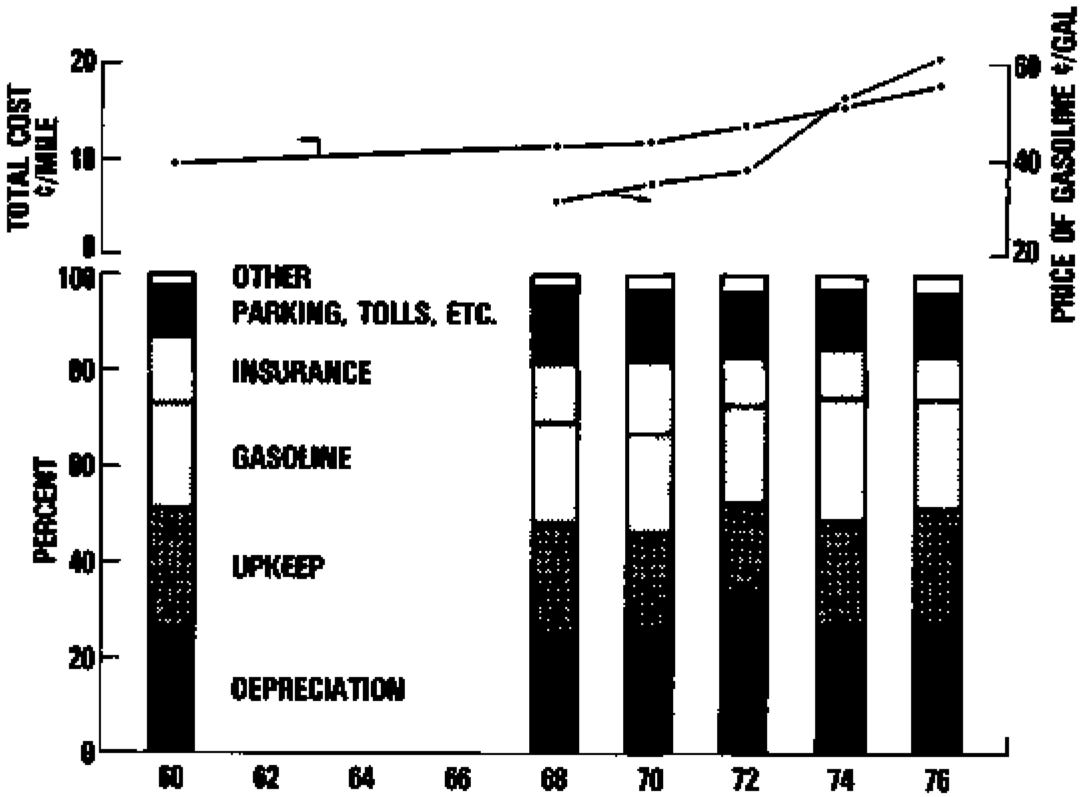
ANNUAL TRUCK AND BUS FACTORY SALES BY GROSS VEHICLE WEIGHT



Source: Motor Vehicle Manufacturers Association, 1975 Motor Truck Facts, Detroit, Michigan, 1975, p. 12.

WHILE THE ABSOLUTE PRICE OF GASOLINE HAS INCREASED OVER THE PAST FIFTEEN YEARS, ITS PROPORTION OF THE TOTAL COST PER VEHICLE MILE HAS REMAINED FAIRLY STABLE.

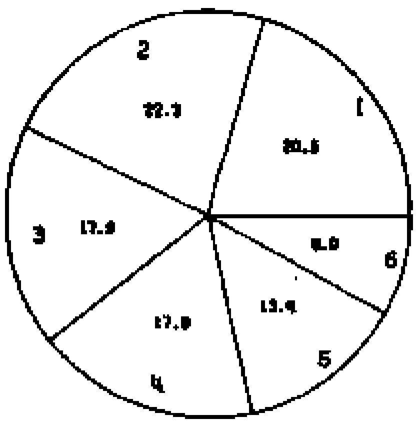


Cost of Operating a Suburban-Based Automobile

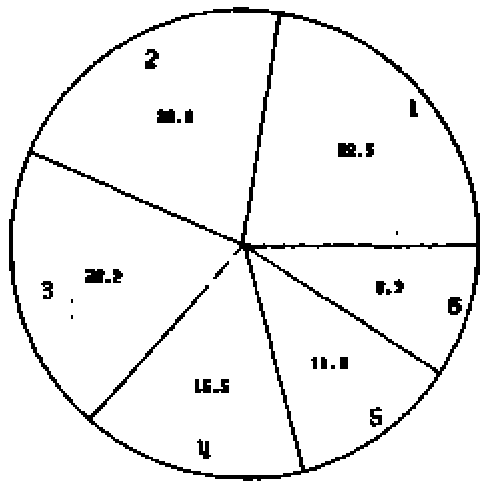
Source: L.L. Liston and C.A. Aiken, U.S. Department of Transportation, Federal Highway Administration, Cost of Owning and Operating an Automobile, Washington, D.C., 1976.

COST OF OPERATING A 1974 AUTOMOBILE
SUBURBAN BASED OPERATION

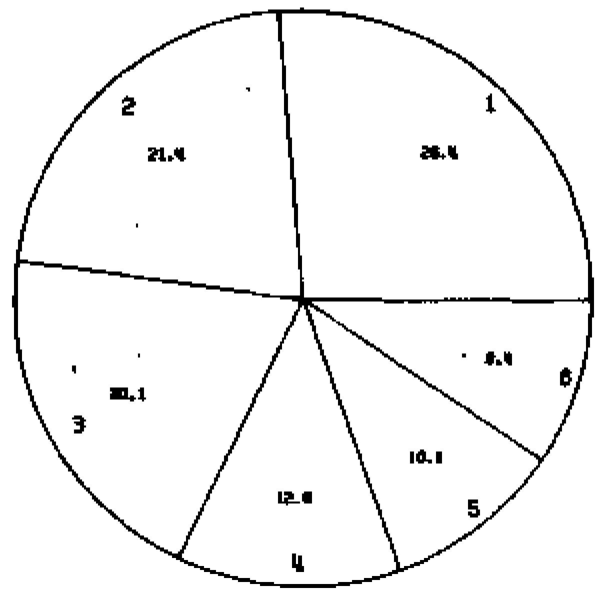
DATA VALUES (CENTS/MILE)			SECTOR
2.30	2.90	4.20	1. ORIGINAL VEHICLE COST DEPRECIATED
2.50	2.70	3.40	2. MAINTENANCE,ACCESSORIES,PARTS & TIRES
2.00	2.60	3.20	3. GAS & OIL (EXCLUDING TAXES)
2.00	2.00	2.00	4. GARAGE, PARKING & TOLLS
1.90	1.50	1.60	5. INSURANCE
0.90	1.20	1.50	6. STATE AND FEDERAL TAXES



SUBCOMPACT SIZED



COMPACT SIZED

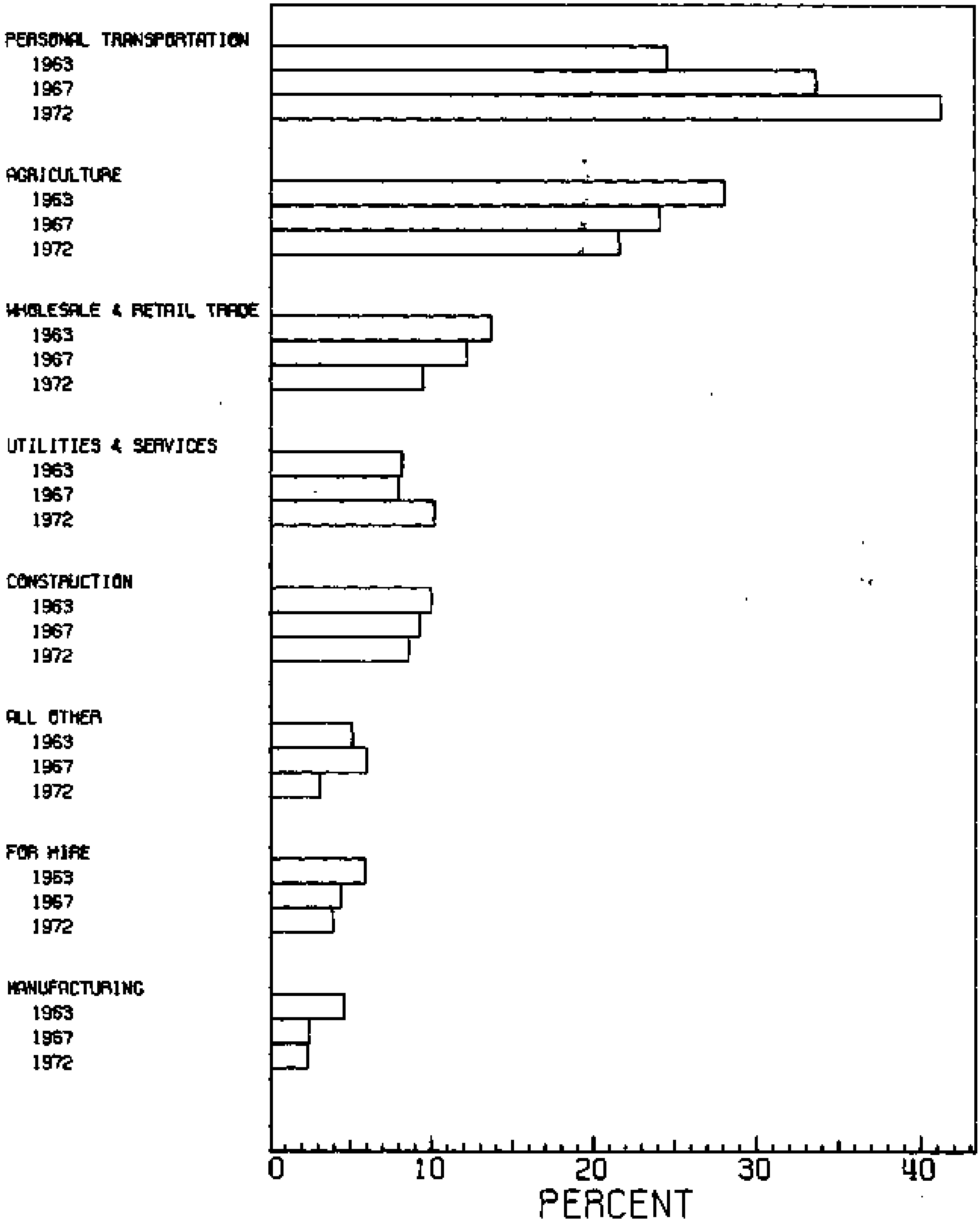


STANDARD SIZED

Source: L.L. Liston and C.A. Aiken, U.S. Department of Transportation, Federal Highway Administration, Cost of Owning and Operating an Automobile, Washington, D.C., 1976.

1.2.2.03

PERCENT DISTRIBUTION OF TRUCKS
BY MAJOR USE



Source: U.S. Department of Commerce, Bureau of the Census, 1972 Census of Transportation, "Truck Inventory and Use Survey-United States Summary," Series TC72-T52, Washington, D.C., 1973, Figure 3.

Percent Distribution by Size of Truck and Major Use, 1972

Major use	Total	Vehicle size class: Light[1]	Medium[2]	Light-heavy[3]	Heavy-heavy[4]
Personal transportation	41.2	53.4	11.0	2.1	1.0
Agriculture	21.6	20.1	32.1	33.2	10.3
Forestry and lumbering	1.0	.5	1.4	2.8	3.6
Mining	.4	.2	.6	.7	1.9
Construction	8.6	6.9	10.2	14.0	19.1
Manufacturing	2.3	1.3	3.3	4.4	8.5
Wholesale and retail trade	9.5	6.1	18.9	23.0	18.3
For hire	3.9	.6	6.0	7.2	30.6
Utilities	2.6	2.5	3.1	3.8	1.9
Services	7.6	7.7	10.5	6.0	2.5
All other	1.7	1.2	3.5	3.4	2.8
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Total trucks number (000)	19,745	14,598	2,822	828	1,500
Total trucks percent	100.0%	73.9%	14.3%	4.2%	7.6%

[1]10,000 lbs Gross Vehicle Weight (G.V.W.) or less.
[2]10,001 to 20,000 lbs G.V.W.
[3]20,001 to 26,000 lbs G.V.W.
[4]Over 26,000 lbs G.V.W.

Source: U.S. Department of Commerce, Bureau of the Census, 1972 Census of Transportation, "Truck Inventory and Use Survey-United States Summary," Series TC72-T52, Washington, D.C., 1973, Table 12.

Selected Characteristics of Truck Stock: 1963, 1967, and 1972
(percentage)

Item	1963	1967	1972
Body type			
Pickup, panel, multistop, or walk-in	65.6	70.3	73.3
Platform and cattlerack	15.9	14.2	12.7
Vans	6.8	5.5	5.9
Beverage truck	*	.5	.5
Utility truck	*	1.1	1.9
Garabge and refuse collector	*	.2	.4
Winch or crane	-	.3	.5
Wrecker	-	.4	.6
Pole or logging	-	.3	.3
Auto transport	-	.1	.2
Dump truck	3.7	2.6	2.4
Tank truck (liquid and dry)	2.3	2.0	1.7
Concrete mixer	-	.3	.4
All other	5.7	2.2	.2
Size class			
Light	69.5	73.6	74.0
Medium	8.9	13.6	14.3
Light-heavy	10.4	5.2	4.2
Heavy-heavy	6.1	7.6	7.6
Miscellaneous sizes	5.1		-
Annual miles[1]			
Less than 5,000 miles	22.7	[2]56.0	23.4
5,000 to 9,999 miles	24.6		28.1
10,000 to 19,999 miles	23.9	30.7	33.5
20,000 to 29,999 miles	6.4	6.9	8.4
30,000 miles and over	6.4	6.4	7.0
Not reported	16.0	-	-

Item	1963	1967	1972
Truck fleet size			
1 truck	70.3	53.3	61.9
2 to 5 trucks	12.9	19.2	22.0
6 to 19 trucks	8.7	8.7	8.8
20 trucks	8.1	7.5	7.6
Not reported	-	11.3	-
Vehicle type[3]			
Single-unit trucks	*	83.4	95.4
2 axle	*	72.1	92.7
3 axle	*	11.3	2.8
Combinations	*	16.6	4.7
3 axle	*	3.3	0.7
4 axles or more	*	13.3	4.1
Range of operations[3]			
Local	72.6	79.0	81.3
Short range	7.7	13.2	8.7
Long range	1.7	4.9	2.4
Not reported	18.0	2.9	7.6
Type of fuel[3]			
Gasoline	97.1	86.2	87.9
Diesel and LPG	2.1	10.9	4.4
Not reported	0.8	2.9	7.9

Note: Percents may not add to total due to rounding. *Indicates no data was obtained. A dash (-) indicates that there were not a significant number of trucks with this characteristic to display.

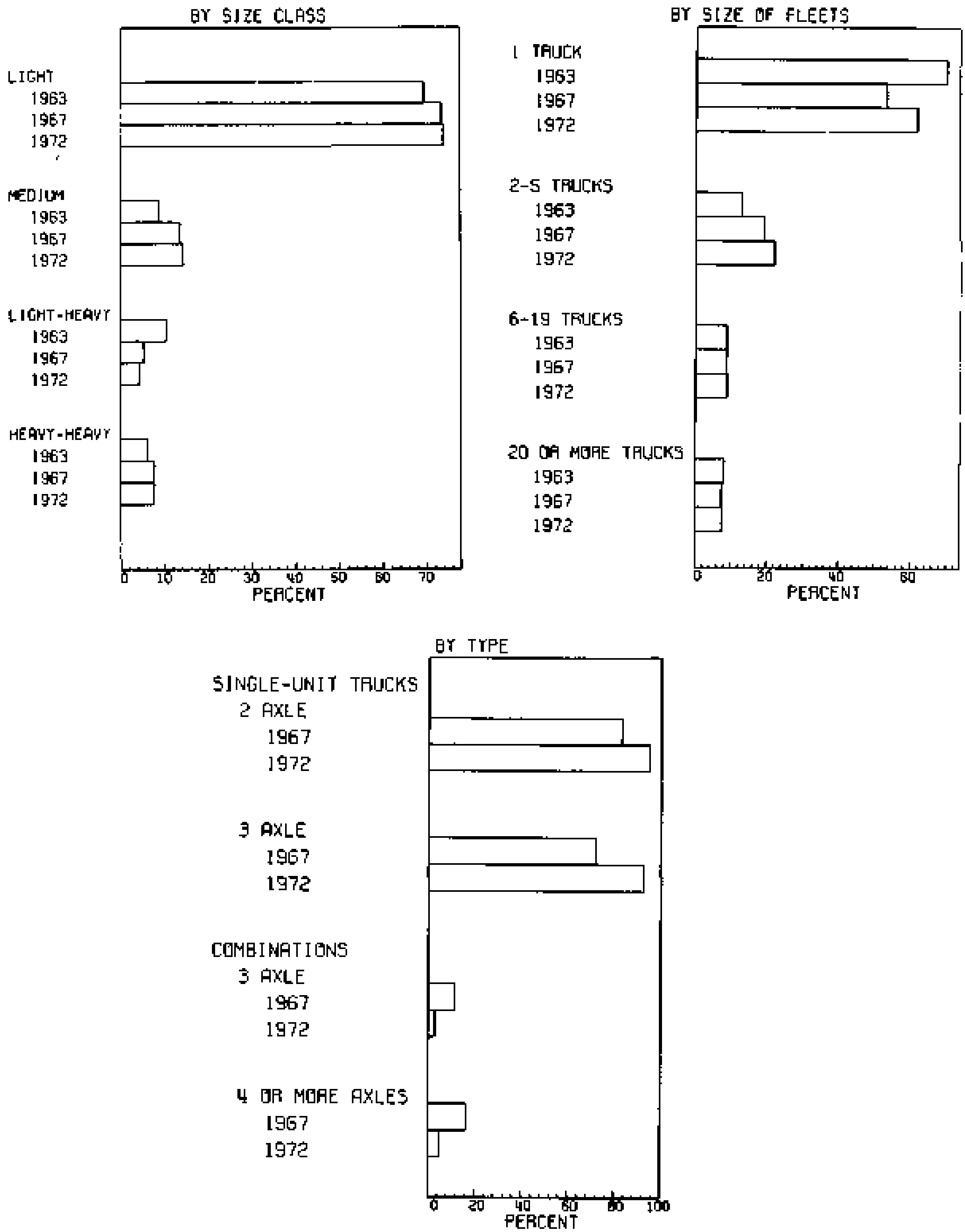
[1]For the 1967 and 1972 surveys, annual miles were imputed if not reported.

[2]For the 1967 survey, data were presented for "Less than 6,000 miles" (36.2 percent) and "6,000 to 9,999 miles" (19.8 percent).

[3]Data for 1967 do not include pickups and panels.

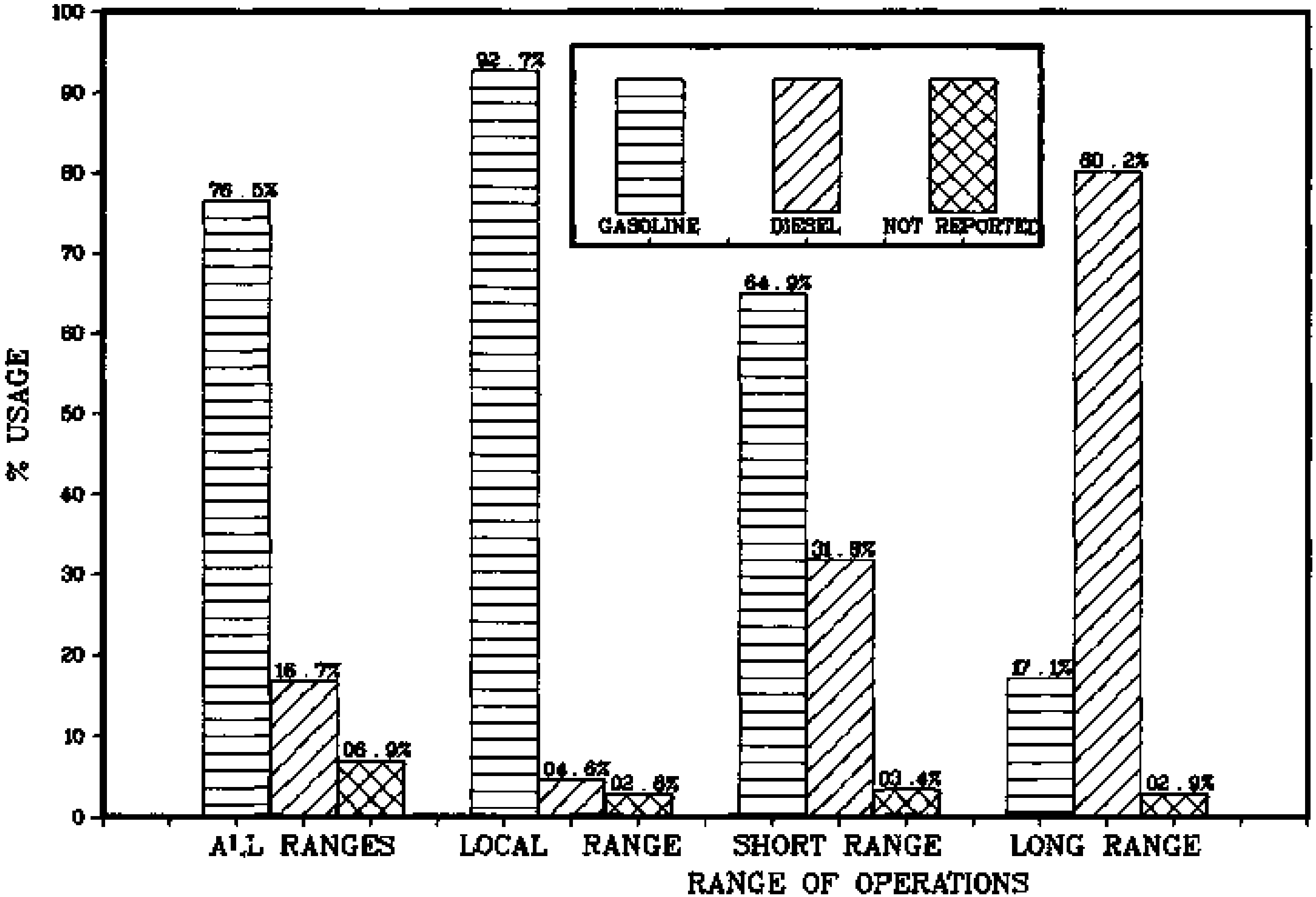
Source: U.S. Department of Commerce, Bureau of the Census, 1972 Census of Transportation, "Truck Inventory and Use Survey-United States Summary," Series TC72-T52, Washington, D.C., 1973, Table 1.

Percent Distribution of Trucks



Source: U.S. Department of Commerce, Bureau of the Census, 1972 Census of Transportation, "Truck Inventory and Use Survey-United States Summary," Series TC72-TS2, Washington, D.C., 1973, Table 1.

TYPE OF FUEL USED BY TRUCKS
BY RANGE OF OPERATION



Source: U.S. Department of Commerce, Bureau of the Census, 1972 Census of Transportation, "Truck Inventory and Use Survey," Series TC72-T52, Washington, D.C., 1973.

Highway Motor Vehicle Travel in the United States, 1963 through 1975[1]
(million vehicle miles)

	Passenger Vehicles							Cargo vehicles			
	Personal passenger vehicles			Buses							
Year	Passenger cars	Motor-cycles	All personal passenger vehicles	Commercial	School	All Buses	All passenger vehicles	Single-unit trucks	Combi-nations	All trucks	All motor vehicles
1975	*1,028,121*	*22,351*	*1,050,472*	*2,648*	*2,500*	*5,148*	*1,055,620*	*218,894*	*55,560*	*274,454*	*1,330,074*
1974	*990,721*	*22,347*	*1,013,068*	*2,610*	*2,450*	*5,060*	*1,018,128*	*211,460*	*56,059*	*267,519*	*1,285,647*
1973	1,016,861	19,594	1,036,455	2,548	2,412	4,960	1,041,415	219,128	48,019	267,147	1,308,562
1972	986,407	17,091	1,003,498	2,750	2,359	5,109	1,008,607	213,122	46,613	259,735	1,268,342
1971	939,102	15,053	954,155	2,885	2,212	5,097	959,252	184,396	42,641	227,037	1,186,289
1970	890,844	10,148	900,992	2,943	2,100	5,043	906,035	174,443	40,227	214,670	1,120,705
1969	849,633	9,225	858,858	3,007	2,030	5,037	863,895	167,241	39,439	206,680	1,070,575
1968	805,693	8,337	814,030	3,031	1,937	4,968	818,998	158,938	37,713	196,651	1,015,649
1967	766,466	7,737	774,203	3,024	1,870	4,894	779,097	147,450	35,006	182,456	961,553
1966	744,844	6,896	751,740	3,008	1,844	4,852	756,592	140,893	33,012	173,905	930,497
1965	706,386	5,208	711,594	3,019	1,763	4,782	716,376	140,117	31,319	171,436	887,812
1964			677,613[2]	2,892	1,724	4,616	682,229	133,711	30,560	164,271	846,500
1963			645,371[2]	2,841	1,642	4,483	649,854	125,753	29,816	155,569	805,423

[1] For the 50 states and District of Columbia.

[2] Only totals are presented for 1963 and 1964 as motorcycles account for less than 1 percent of all travel.

Source: U.S. Department of Transportation, Federal Highway Administration, Department of Transportation News, FHWA 72-76 (November 26, 1976), Washington, D.C., Table VM-1.

Average Miles Traveled by Type of Highway Motor Vehicle
1963 through 1975[1]

Year	Passenger vehicles							Cargo vehicles			All motor vehicles
	Personal passenger vehicles			Buses			All passenger vehicles				
	Passenger cars	Motor-cycles	All personal passenger vehicles	Commercial	School	All buses		Single unit trucks	Combi-nations	All trucks	
1975	9,634	4,500	9,406	28,230	6,788	11,140	9,413	8,882	49,125	10,648	9,644
1974	9,448	4,500	9,225	28,968	6,865	11,320	9,233	8,981	51,667	10,861	9,530
1973	9,992	4,498	9,767	28,469	7,178	11,662	9,774	9,868	46,716	11,538	10,083
1972	10,184	4,500	9,969	30,968	7,414	12,553	9,980	10,525	47,084	12,229	10,370
1971	10,121	4,500[2]	9,926	31,949	7,198	12,819	9,938	9,794	43,779	11,465	10,198
1970	9,978	3,605	9,783	32,591	7,274	13,306	9,798	9,807	41,903	11,450	10,076
1969	9,782	4,020	9,633	33,300	7,409	13,826	9,650	9,871	42,453	11,565	9,969
1968	9,627	3,970	9,488	33,828	7,387	14,122	9,507	9,857	43,299	11,571	9,847
1967	9,531	3,962	9,399	33,600	7,543	14,484	9,420	9,598	42,176	11,268	9,723
1966	9,506	3,930	9,384	35,598	7,725	15,012	9,407	9,588	40,112	11,207	9,698
1965	9,387	3,770	9,286	35,518	7,689	15,215	9,310	10,003	39,795	11,587	9,677
1964			9,286[3]	35,140	7,727	15,115	9,311	10,072	41,409	11,723	9,398
1963			9,240[3]	34,562	7,612	15,049	9,265	9,938	42,232	11,644	9,646

[1]For the 50 states and District of Columbia.

[2]Significant difference in values for 1971 and the corresponding values for 1970 represents a change in the basic assumptions of miles per vehicle and miles per gallon, not a shift in the trend.

[3]Only totals are presented for 1963 and 1964 as motorcycles account for less than 1 percent of all travel.

Source: U.S. Department of Transportation, Federal Highway Administration, Department of Transportation News, Table VM-1, annual.

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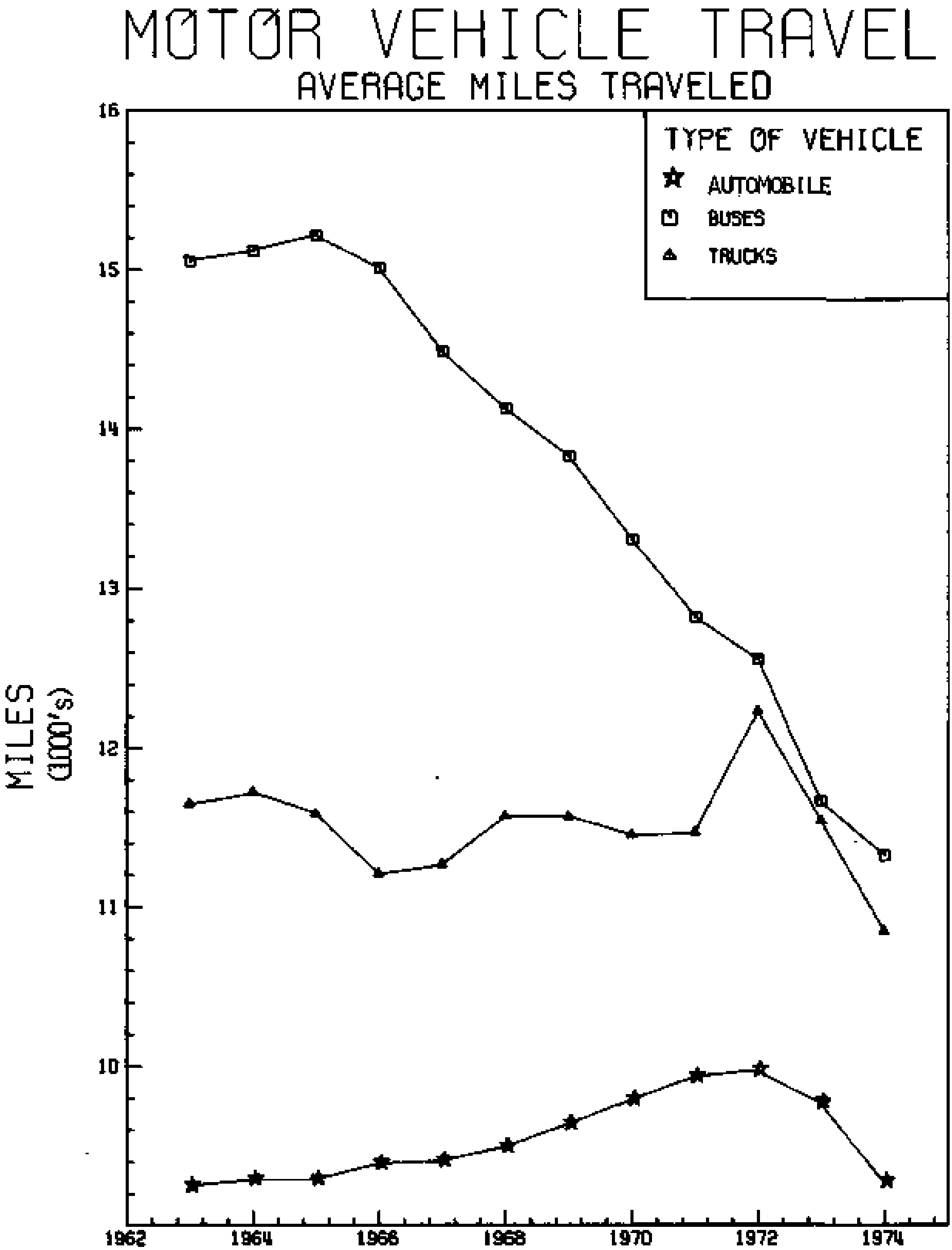


Source: U.S. Department of Transportation, Federal Highway Administration, Department of Transportation News, FHWA 72-76 (November 26, 1976), Washington, D.C., Table VM-I.

ACCORDING TO A 1969 NATIONWIDE STUDY BY THE U.S. FEDERAL HIGHWAY ADMINISTRATION, THE AVERAGE CAR IS DRIVEN 11,600 MILES PER YEAR AND THE AVERAGE TRIP LENGTH IS 8.9 MILES. IN GENERAL, PERSONS IN RURAL AREAS DRIVE THEIR CARS FOR LONGER DISTANCES AND MORE OFTEN THAN PERSONS IN URBAN AREAS.

Summary Statistics from the Nationwide Personal Transportation Study, 1969

	Urban[1]	Rural[1]	Total	1 car household	2 car household	3+ car household
Vehicles						
Number (in millions)	44.2	22.2	66.4[2]	28.2	30.2	8.0
Percent	66.6	33.4	100.0	42.5	45.4	12.1
Average annual miles	11,200	12,600	11,600	10,800	12,000	12,800
1 car household	10,400	11,800	10,800			
2 car household	11,600	13,000	12,000			
3+ car household	12,600	13,200	12,800			
Percent of VMT's	63.9	36.1	100	39.7	47.0	13.3
Average age (years)	5.0	5.3	5.1	5.1	5.1	5.1
Households						
Number (in millions)	43.4	19.1	62.5[3]	30.2	16.5	2.9
Percent	69.4	30.6	100.0	48.3	26.4	4.6
Average number of cars	1.1	1.3	1.2	1.0	2.0	3.0
Trips per household						
Annual	1,300	1,600	1,400	1,219	2,317	3,102
Daily	3.6	4.3	3.8	3.3	6.3	8.5
Average trip length	8.4	9.8	8.9	8.5	9.2	9.6

[1]Urban is defined here as all incorporated places; rural includes all unincorporated places.

[2]This is the number on which the NPTS results are based. The actual number of passenger cars and taxis registered in 1969 was reported as 86.9 million.

[3]12.9 million households have no car.

Sources: H.E. Strate, U.S. Department of Transportation, Federal Highway Administration, <u>Nationwide Personal Transportation Study-Annual Miles of Automobile Travel</u>, Report No. 2, Washington, D.C., April 1972; R.H. Asin and P.V. Svercl, U.S. Department of Transportation, Federal Highway Administration, <u>Nationwide Personal Transportation Study-Automobile Ownership</u>, Report No. 11, Washington, D.C., December 1974; R.H. Asin, U.S. Department of Transportation, Federal Highway Administration, <u>Nationwide Personal Transportation Study-Purposes of Automobile Trips and Travel</u>, Report No. 10, Washington, D.C., May 1974.

ALMOST 40% OF ALL CARS ARE DRIVEN LESS THAN 7000 MILES PER YEAR. THE AVERAGE ANNUAL MILES PER AUTOMOBILE DECREASES AS THE AVERAGE AGE OF VEHICLE INCREASES. THE AVERAGE AGE OF VEHICLE IN EACH MILEAGE CLASS DOES NOT VARY CONSISTENTLY WITH THE NUMBER OF CARS IN THE HOUSEHOLD.

Percent Distribution of Cars by Average Annual Mileage Class and Average Age of Car by Number of Cars in Household and Mileage Class

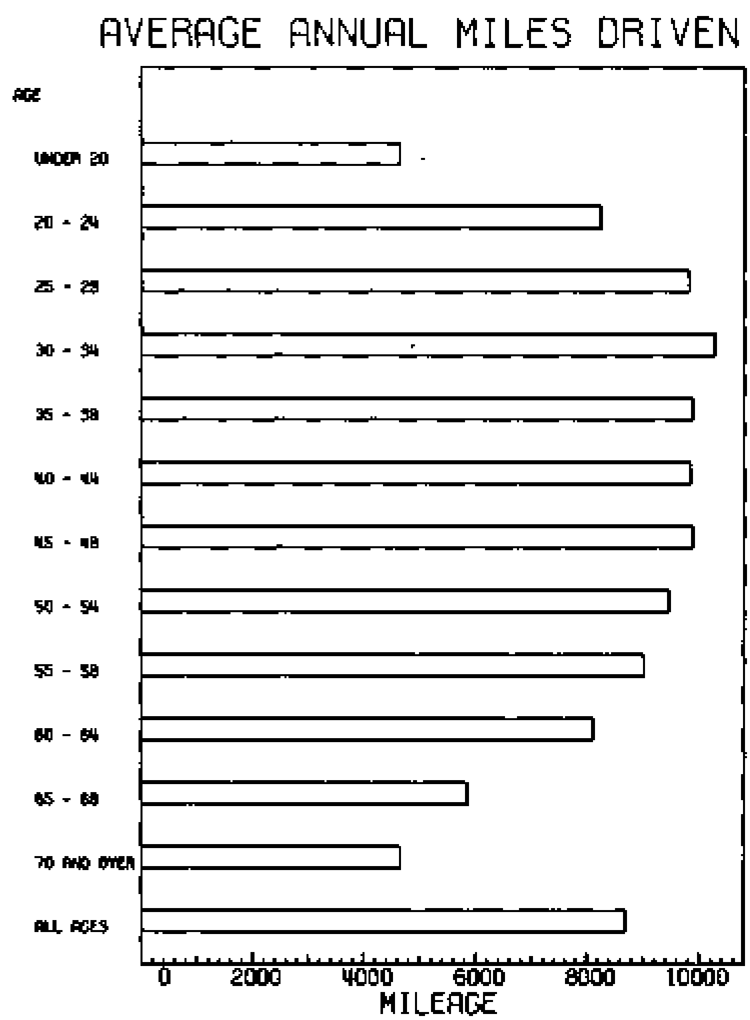
Average annual mileage class (in thousands)	Number of vehicles	Cumulative percent distribution	Average age of car by number of cars in household			
			All households	1 car	2 cars	3 cars
<0.5	1,716,523	2.6	7.8	7.6	7.6	*
1-2	5,592,379	11.0	7.3	7.4	7.2	*
3-7	17,976,302	38.1	5.9	5.7	6.2	5.9
8-12	22,679,764	72.2	4.8	4.9	4.7	4.8
13-17	7,291,626	83.2	4.1	4.2	4.0	3.6
18-22	5,038,421	90.8	3.8	3.6	4.1	3.4
23-27	2,528,521	94.6	3.1	3.3	2.9	*
28+	3,581,320	100.0	3.2	3.3	3.0	3.4
All	66,405,001		5.1	5.1	5.1	5.1

*Data insufficient for analysis. Data were judged to be insufficient when fewer than 50 automobiles were included in the sample in a particular cell.

Source: H.E. Strate, U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Study-Annual Miles of Automobile Travel, Report No. 2, Washington, D.C., April 1972, pp. 10 and 12.

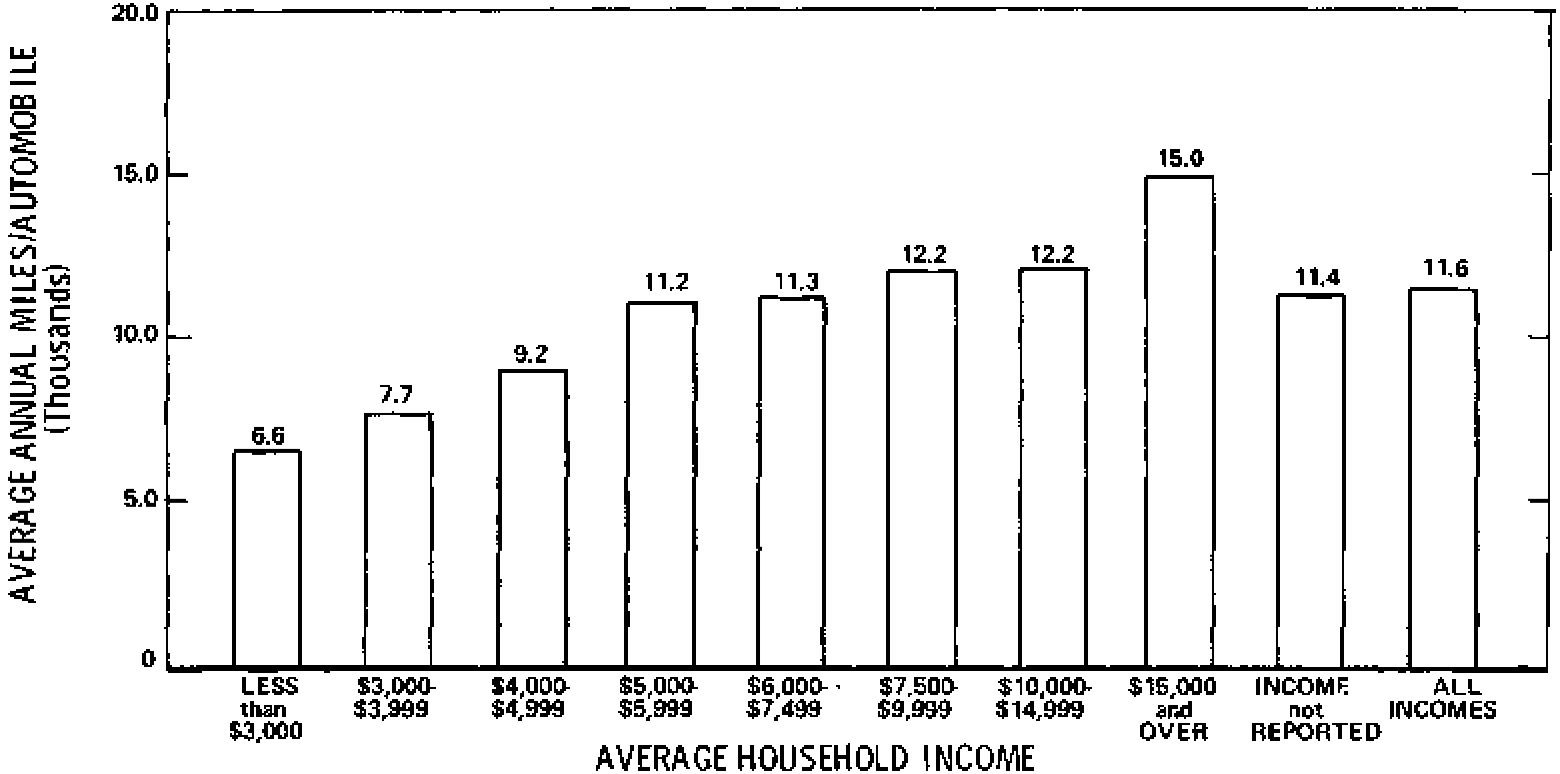
Average Annual Person-Miles Driven by Age and Sex

Age	Male	Female	All
Under 20	5,461	3,586	4,633
20-24	11,425	5,322	8,260
25-29	13,931	5,539	9,814
30-34	14,496	5,752	10,274
35-39	13,035	6,232	9,878
40-44	13,133	5,950	9,833
45-49	12,818	6,271	9,875
50-54	12,345	5,454	9,447
55-59	11,495	5,439	9,009
60-64	9,710	5,291	8,112
65-69	6,915	4,173	5,850
70 and over	5,302	3,183	4,644
All ages	11,352	5,411	8,685



Source: Motor Vehicle Manufacturers Association, 1975 Automobile Facts and Figures, Detroit, Michigan, 1975, p. 35.

Selected Vehicle Usage Characteristics by Annual Income of the Household



Average age of vehicle	7.0	6.1	6.0	6.2	5.6	4.8	4.6	4.2	4.0	5.1
Percent distribution of vehicle-miles traveled	3.5	3.3	7.4	3.8	11.6	18.7	26.4	9.0	16.3	100.0[1]
Percent distribution of vehicles	6.0	4.9	7.6	4.8	11.9	17.8	25.1	9.2	12.7	100.0[1]

[1]Percentages based on a total number of 66,843,567 vehicles and 2,129,860 daily vehicle-miles.

Source: H.E. Strate, U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Study - Annual Miles of Automobile Travel, Report No. 2, Washington, D.C., April 1972, pp. 16 and 17.

RURAL HOUSEHOLDS TRAVEL LONGER DISTANCE BY AUTOMOBILE FOR MOST TRIP PURPOSES.

Distribution of Annual Passenger Car Vehicle Miles per Household and Annual Trips per Household by Individual Purpose and Population Size

Purpose	Urban[2]			Rural[2]			Total		
	Percent vehicle mile	Percent number trips	Average trip size (miles)	Percent vehicle mile	Percent number trips	Average trip size (miles)	Percent vehicle mile	Percent number trips	Average trip size (miles)
Earning a living									
To work	32.68	32.10	8.6	35.36	31.50	11.0	33.67	31.88	9.4
Related business	8.79	4.47	16.5	6.48	4.27	14.9	7.92	4.37	16.1
Total	41.47	36.57	9.5	41.84	35.77	11.5	41.59	36.25	10.2
Family business									
Medical and dental	1.09	1.51	6.1	2.52	2.17	11.4	1.63	1.72	8.4
Shopping	7.10	15.59	3.8	8.13	14.48	5.5	7.47	15.26	4.4
Other Family business	9.81	13.55	6.1	10.90	14.80	7.2	10.22	13.96	6.5
Total	18.00	30.65	4.9	21.55	31.45	6.7	19.32	30.94	5.6
Educational, civic, and religious	4.30	8.94	4.0	5.97	10.02	5.8	4.93	9.32	4.7
Social and recreational									
Vacations	2.66	.16	147.5	2.25	0.13	172.5	2.57	0.14	160.0
Visits friends and relatives	12.95	8.78	12.4	10.59	9.24	11.2	12.05	8.95	12.0
Pleasure rides	3.42	1.43	19.9	2.50	1.28	19.2	3.07	1.36	20.1
Other	16.28	12.49	11.0	13.61	10.77	12.4	15.26	11.89	11.4
Total	35.31	22.86	13.0	28.95	21.42	13.3	32.95	22.34	13.1
Other and unknown	.92	.98	7.8	1.69	1.34	12.4	1.21	1.15	9.4
All purposes (miles)	11,105 (100.0%)	1,321 (100.0%)	8.4	15,387 (100.0%)	1,568 (100.0%)	9.8	12,423 (100.0%)	1,396 (100.0%)	8.9
Earning a living	41.47	36.57	9.5	41.84	35.77	11.5	41.59	36.25	10.2
Other than earning a living	58.53	63.43	7.8	58.16	64.23	8.9	58.41	63.75	8.2

[1]Less than 0.05.

[2]Urban is defined here as all incorporated places; rural includes all unincorporated places.

Source: B.T. Goley, G. Brown, and E. Samson, U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Study - Household Travel in the United States, Report No. 7, Washington, D.C., December 1972, pp. 16 and 17.

MORE THAN THREE-FIFTHS OF ALL AUTOMOBILE TRIPS ARE 5 MILES OR LESS. BUT TRIPS OF OVER 21 MILES ACCOUNT FOR ALMOST HALF OF ALL VMT'S. AVERAGE TRIP LENGTH IS LONGEST IN RURAL AREAS AND IN THE LARGEST URBAN AREAS.

Percent of Automobile Trips for all Trip Purposes
by Trip Length (Miles) and Place of Residence

Place of residence	Trip length - miles: 5 and less	6-10	11-20	21 and over	Total	Trip length (miles)
	Automobile trips					
Rural	55.1	21.6	15.1	8.2	100.0	
Urban						
Under 5,000	61.7	12.5	14.8	11.0	100.0	
5,000-24,999	67.5	14.2	11.0	7.3	100.0	
25,000-49,999	70.9	12.0	10.2	6.9	100.0	
50,000-99,999	70.3	15.1	7.8	6.8	100.0	
100,000-999,999	65.7	18.4	10.8	5.1	100.0	
1,000,000 and over	55.3	21.6	13.4	9.7	100.0	
Total Urban	66.2	15.4	11.1	7.3	100.0	
TOTAL	62.4	16.8	12.5	8.3	100.0	
	Vehicle-miles of travel					
Rural	13.8	16.2	23.5	46.5	100.0	9.8
Urban						
Under 5,000	10.2	9.6	22.1	58.1	100.0	10.4
5,000-24,999	16.8	14.9	21.2	47.1	100.0	7.9
25,000-49,999	19.6	12.3	20.0	48.1	100.0	7.8
50,000-99,999	19.5	15.0	14.7	50.8	100.0	8.1
100,000-999,999	21.2	19.3	21.5	38.0	100.0	7.7
1,000,000 and over	10.6	15.3	17.9	56.2	100.0	11.7
Total Urban	16.8	15.0	20.2	48.0	100.0	8.4
TOTAL	15.7	15.4	21.5	47.4	100.0	8.9

[1]Urban is defined here as all incorporated places; rural includes all unincorporated places.

Source: R.H. Asin, U.S.Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Study - Purposes of Automobile Trips and Travel, Report No. 10, Washington, D.C., May 1974, p. 16.

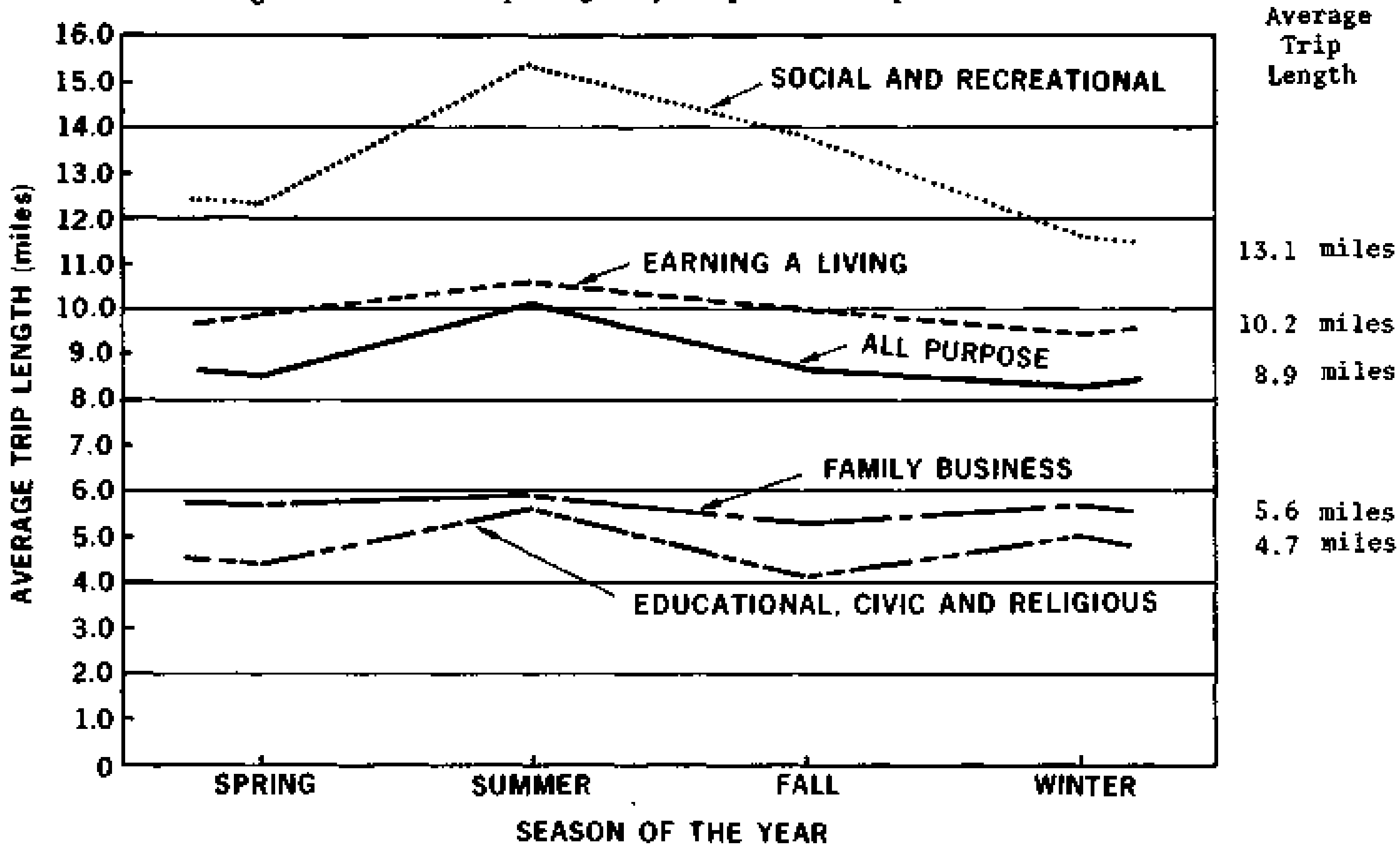
TRIP LENGTH DOES NOT VARY SIGNIFICANTLY BY THE SEASON OF THE YEAR EXCEPT FOR THE SUMMER MONTHS, WHEN TRIPS OF 100 MILES AND LONGER PEAK.

Percentage of Automobile Trips by Season and Trip Length

Season of the year	Length of trip (miles)														
	Less than one-half mile	1	2	3	4	5	6-10	11-20	21-30	31-40	41-50	51-99	100 and over	Total	Daily number of trips (000)
Spring (April)	8.2	16.4	13.0	9.5	6.4	8.8	16.1	13.4	4.1	1.7	0.8	0.9	0.7	100.0	254,445
Summer (July-August)	8.4	14.2	13.1	9.7	6.3	8.8	17.4	12.9	4.1	1.7	0.9	1.3	1.2	100.0	236,971
Fall (October)	8.7	15.2	14.9	10.0	6.6	7.8	17.9	11.1	3.6	1.5	0.9	1.1	0.7	100.0	237,936
Winter (January)	8.8	17.6	13.0	10.6	6.1	7.5	16.4	12.1	4.0	1.3	0.8	0.9	0.7	100.0	222,596

Source: H.E. Strate, U.S. Department of Transportation, Federal Highway Transportation, Nationwide Personal Transportation Study - Seasonal Variations of Automobile Trips and Travel, Report No. 3, Washington, D.C., April 1972, p. 15.

Average Automobile Trip Length by Purpose of Trip and Season



Average trip length (miles)	8.5	10.1	8.7	8.3
Distribution of total trips (percent)	26.9%	24.8	25.0	23.3
Distribution of VMT's (percent)	25.6	28.2	24.4	21.8

Source: H.E. Strate, U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Study - Seasonal Variations of Automobile Trips and Travel, Report No. 3, Washington, D.C., April 1972, pp. 8 and 14.

Percent of Vehicle-Miles of Travel and Vehicle Trips by Household Size, Car Ownership and Place of Residence

Automobile ownership per household	Population size-groups								All areas and places
	Rural	Urban							
		<5000	5,000 24,999	25,000-49,999	50,000-99,999	100,000-999,999	1,000,000 and over	Total	
				Vehicle-miles[1]					
One	39.7	40.0	35.5	33.2	44.7	43.5	62.8	40.9	40.4
Two	46.1	48.0	48.0	52.8	42.8	44.2	26.7	45.1	45.5
Three-or-more	12.2	8.4	15.6	11.6	9.4	8.3	5.5	10.6	11.2
Subtotal	98.0	96.4	97.1	97.6	96.9	96.0	95.0	96.6	97.1
None[3]	2.0	3.6	2.9	2.4	3.1	4.0	5.0	3.4	2.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0[1]
				Vehicle trips[2]					
One	42.8	39.1	39.2	33.2	43.3	46.3	54.5	42.0	42.3
Two	43.6	45.0	45.4	52.8	41.9	42.0	32.8	44.0	43.8
Three-or-more	10.7	12.1	12.1	11.6	10.9	6.5	6.5	10.1	10.3
Subtotal	97.1	96.2	96.7	97.6	96.1	94.8	93.8	96.1	96.4
None[3]	2.9	3.8	3.3	2.4	3.9	5.2	6.2	3.9	3.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1]775.8 billion vehicle miles of travel.
[2]87.3 billion vehicle trips.
[3]This category refers to vehicle miles or vehicle trips taken (as passengers) in passenger automobiles or taxis by persons living in households which have no automobiles.

Source: R.H. Asin and P.V. Svercl, U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Study - Automobile Ownership, Report No. 11, Washington, D.C., December 1974, pp. 37 and 38.

Household Ownership of Motor Vehicles by Selected Characteristics, 1974
(Percent owning in each Household Group)

	Number of households (in millions)	Motor vehicles			One or more cars	One or more pick-ups	One or more vans or recreational vehicles
		One or more	Two or more	Three or more			
All households	70.8	83.8	45.1	10.2	81.5	17.1	3.2
Annual income							
Under $3,000	8.0	46.2	11.0	1.8	43.2	7.8	1.2
$3,000 to $4,999	7.4	64.2	16.1	2.2	60.7	11.0	1.3
$5,000 to $7,499	8.9	79.4	26.2	4.0	76.0	14.3	2.2
$7,500 to $9,999	8.3	88.3	36.2	4.9	85.0	16.8	2.8
$10,000 to $14,999	15.9	93.9	53.5	9.8	91.7	22.2	3.2
$15,000 to $19,999	9.7	96.7	67.9	14.5	95.5	22.7	4.6
$20,000 to $24,999	5.2	97.4	73.1	21.0	96.9	19.2	5.3
$25,000 and over	7.1	97.2	77.6	29.4	96.7	17.2	5.2
Age of head							
Under 25 years	6.1	85.6	34.0	3.4	81.9	10.0	4.3
25 to 29 years	7.5	89.3	45.4	4.4	86.8	17.2	3.7
30 to 34 years	6.9	90.3	49.7	5.3	87.8	18.1	3.5
35 to 44 years	12.3	90.3	59.7	14.6	88.6	22.8	4.2
45 to 54 years	12.6	89.4	61.2	22.3	87.5	21.9	3.9
55 to 64 years	11.6	85.7	46.9	11.8	83.2	18.1	2.6
65 years and over	13.7	64.2	18.2	2.6	61.9	9.4	1.0
Residence							
Central cities	22.3	72.4	32.1	6.6	71.3	7.4	2.3
Suburban rings	26.2	90.1	52.5	12.7	88.3	15.5	3.8
Outside metropolitan areas	22.3	87.8	49.4	10.9	83.8	28.7	3.3
Region							
Northeast	16.6	75.6	36.5	8.1	74.8	7.5	2.5
North central	18.9	86.2	47.5	10.8	84.4	16.4	3.4
South	22.5	85.5	46.9	10.2	82.6	21.1	2.2
West	12.8	87.9	49.6	12.2	84.1	23.6	5.4

Source: U.S. Department of Commerce, Bureau of the Census, Selected Data from the 1973 and 1974 Surveys of Purchases and Ownership, Washington, D.C., July 1976. (Revised)

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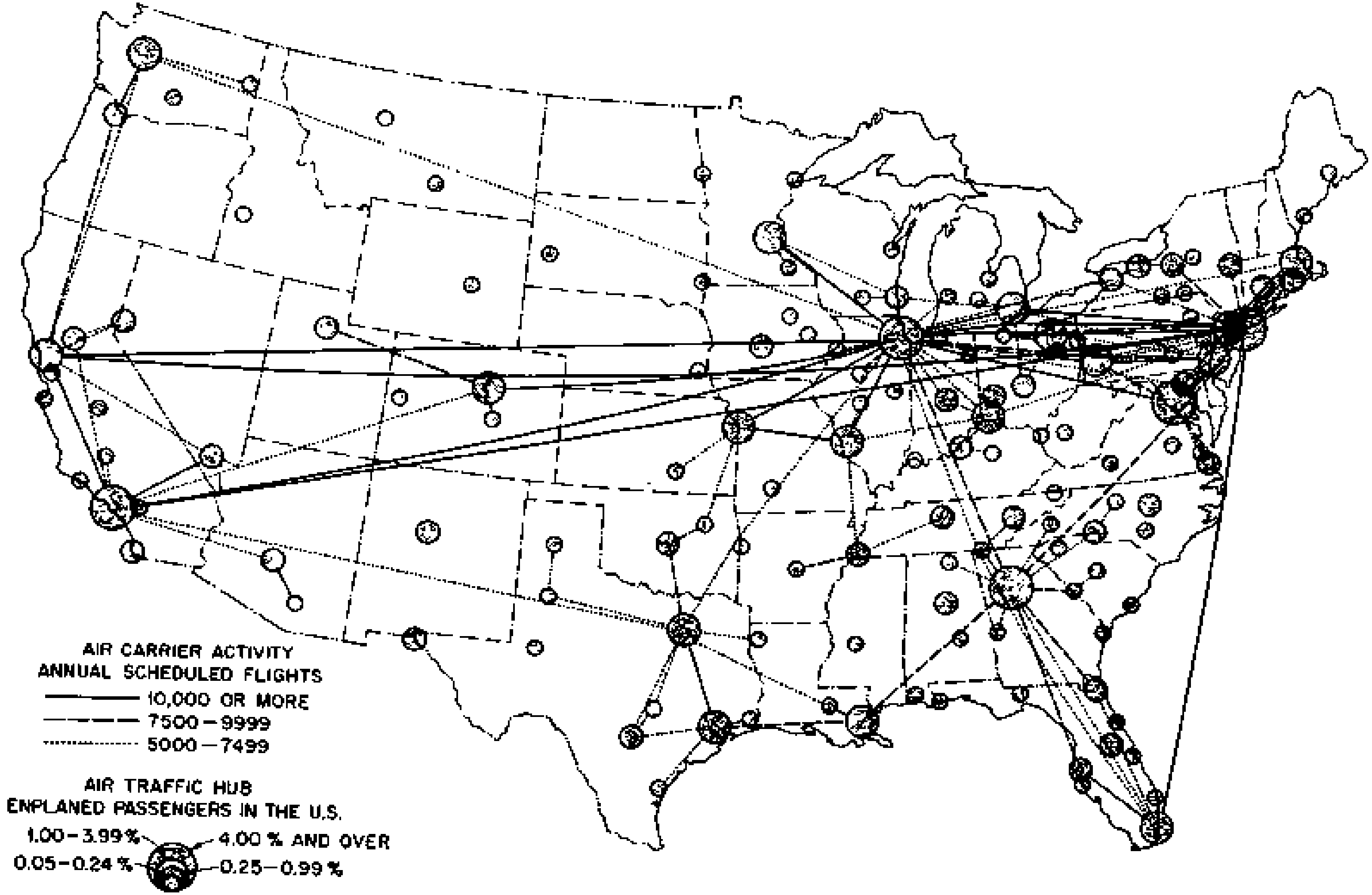
Section 1.3

Air

Air Flights and Facilities: 1965



Source: U.S. Department of the Interior, Geological Survey, The National Atlas of the United States of America, Washington, D.C., 1970.

Airport Statistics and Certificated and Supplemental Air Carriers by Individual Carrier, 1975

Airport facilities	1975
Total — FAA	13,251
Total — U.S.	13,207
Percent public	34.5
Percent private	65.5
Airports	11,224
% paved	36.7
% lighted	31.4
Heliports	1,524
Seaplane bases	468
Stolports	35

Certificated route air carriers by carrier type (35)

Domestic passenger/cargo
- Trunk lines
  - American Airlines
  - Braniff Airways
  - Continental Air Lines
  - Delta Air Lines
  - Eastern Airlines
  - National Airlines
  - Northwest Airlines
  - Trans World Airlines
  - United Air Lines
  - Western Airlines
- Intra-Alaskan Air Lines
  - Alaska Airlines
  - Kodiak-Western Alaska Airlines, Inc.
  - Reeve Aleutian Airways
  - Wien Air Alaska
- Intra-Hawaiian Lines
  - Aloha Airlines
  - Hawaiian Airlines
- Local service
  - Air New England
  - Allegheny Airlines
  - Frontier Airlines
  - Hughes Air West
  - North Central Airlines
  - Ozark Air Lines
  - Piedmont Aviation
  - Southern Airways
  - Texas International

Helicopter
- New York Airways
- S.F.O. Helicopter Airlines, Inc.

International and territorial passenger/cargo
- Air Micronesia
- American Airlines
- Braniff Airways
- Continental Air Lines
- Delta Air Lines
- Eastern Airlines
- National Airlines
- Northwest Airlines
- Pan American World Airways
- Trans World Airlines
- Western Airlines

All cargo
- Flying Tiger Line
- Airlift International
- Seaboard World Airlines

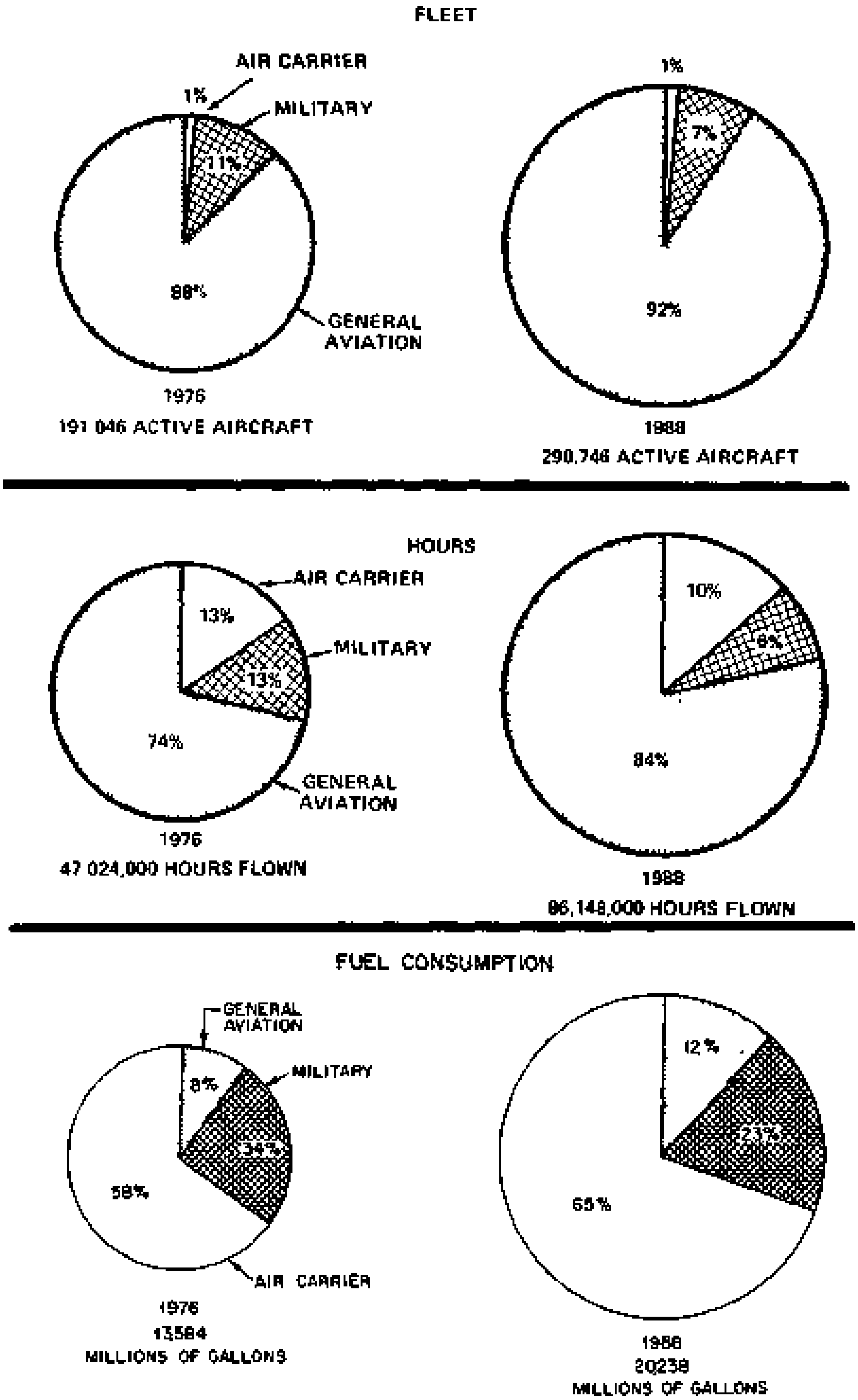
Other
- Aspen Airways
- Wright Air Lines

Supplemental air carriers by individual carrier (8)

- Capitol International Airway, Inc.
- Evergreen International Airlines, Inc.
- McCulloch International Airlines, Inc.
- Modern Air Transport
- Overseas National Airways, Inc.
- Saturn Airways, Inc.
- Trans International Airlines, Inc.
- World Airways, Inc.

Source: U.S. Civil Aeronautics Board, Bureau of Accounts and Statistics, Air Carrier Traffic Statistics, Washington, D.C., December 1975, pp. 91-93; B.V. Cayce, U.S. Department of Transportation, Federal Aviation Administration, FAA Statistical Handbook of Aviation, Washington, D.C., December 1975, Tables 3.1, 3.2, and 4.1.

Comparison of Active Aircraft Fleet to Hours Flown and Fuel Consumed



Source: U.S. Department of Transportation, Federal Aviation Administration, Aviation Forecasts — Fiscal Years 1977-1988, Washington, D.C., December 1976, pp. 22 and 23; William Vance, Defense Energy Information System.

Composition of U.S. Air Carrier Fleet by Type of Aircraft: December 1966 through 1982[1,2]

		Fixed-wing aircraft					Rotary-wing aircraft		
		Total fixed-wing	Turbine				Total rotary-wing		
Year	Total		Total	Turbojet	Turboprop	Piston		Turbine	Piston
1966	2,272	2,251	1,378	1,006	372	873	21	16	5
1970	2,679	2,663	2,510	2,136	374	153	16	13	3
1972	2,583	2,569	2,436	2,118	318	133	14	11	3
1976	2,609	2,599	2,473	2,171	302	126	10	10	
1978	2,762	2,749	2,651	2,361	290	98	13	13	
1980	2,907	2,892	2,832	2,569	263	60	15	15	
1982	3,095	3,078	3,041	2,794	247	37	17	17	

[1] Includes only those aircraft used during the last quarter.

[2] Does not include aircraft operated by Air Taxi operators who hold authority to operate aircraft over 12,500 pounds, or turbojet aircraft under blanket authority, or aircraft operated by Air Travel Clubs.

Note: Included in the forecast are all passenger and cargo aircraft owned or leased by and in the domestic or international service of the U.S. certificated route, supplemental, intrastate, and commercial air carriers. Aircraft used for training and aircraft that have been withdrawn from service and are awaiting disposal are not included here.

Source: B.V. Cayce, U.S. Department of Transportation, Federal Aviation Administration, FAA Statistical Handbook of Aviation, Washington, D.C., 1975, p. 52; U.S. Department of Transportation, Federal Aviation Administration, Aviation Forecasts - Calendar Years 1976-1982, Washington, D.C.

Total Aircraft in Operation and Hours Flown by the United States Air Carrier Fleet by Type of Carrier and by Type of Aircraft: December 1975

Type of aircraft	All air carriers[1]	Certificated route air carriers	Supplemental air carriers	Commercial operators	Hours flown[2]
Total	2,495	2,267	74	154	6,060,734
Fixed-wing — total	2,488	2,260	74	154	6,052,196
Turbine powered — total	2,374	2,215	72	87	5,953,382
Turbojet — total	2,114	2,022	45	47	
4-engine	602	561	33	8	1,770,203
3-engine	994	961	8	25	2,464,673
2-engine	518	500	4	14	1,263,805
Turboprop — total	260	193	27	40	454,701
4-engine	68	16	27	25	116,812
2-engine	192	177	0	15	337,889
Piston-powered — total	114	45	2	67	98,814
4-engine	37	1		36	14,819
2-engine	69	37	2	30	78,698
1-engine	8	7		1	5,297
Rotary-wing — total	7	7	—	—	8,538
Turbine-powered	7	7			8,538
Piston-powered					

[1]Does not include aircraft operated by Air Taxi operators who hold authority to operate aircraft over 12,500 pounds, or turbojet aircraft under blanket authority, or aircraft operated by Air Travel Clubs.

[2]Includes 5,651,262 hours for Certificated Route Air Carriers; 185,955 hours for Supplemental Carriers; 166,496 hours for Commercial Carriers; 52,415 hours for Air Taxi; and 4,606 hours for Travel Clubs.

Source: B.V. Cayce, U.S. Department of Transportation, Federal Aviation Administration, FAA Statistical Handbook of Aviation, Washington, D.C., December 1975, p. 52.

United States Air Carrier Fleet Operations, 1975

Traffic category	Certificated						
	Scheduled		Nonscheduled		Supplemental		
	Total	Domestic	Total	Domestic	Total	Domestic	Total
Revenue passenger miles flown (000)[1]	162,810,057	131,728,389	10,513,699	4,270,764	8,759,279	883,468	182,083,035
Revenue passenger load factor[2]	53.7	54.6	82.0	71.6	88.0	88.3	74.6
Revenue ton-miles flown (000)[1]	22,185,545	16,602,979	1,346,765	466,352	1,947,087[3]	531,533[3]	25,479,397
Passenger	16,281,046	13,172,046	1,051,367	427,074			
Freight	4,766,118	2,718,087	294,875	39,278			
Mail	1,109,191	683,273	519				
Revenue aircraft miles flown (000)[1]	2,240,505	1,909,485	84,126	38,163	65,476	25,585	2,390,107

[1]Details do not add to total due to rounding.

[2]Percent revenue passenger-miles flown of available seat-miles in revenue passenger service representing the proportion of aircraft seating capacity that is actually sold and utilized.

[3]Overall available ton-miles. 34% of total is for military and 66% for civilian.

Source: B.V. Cayce, U.S. Department of Transportation, Federal Aviation Administration, FAA Statistical Handbook of Aviation, Washington, D.C., December 1975.

Active* Registered United States Civil Aircraft as of December 31, 1965-75

			Active registered civil aircraft					
			General aviation aircraft					
				Fixed-wing aircraft				
					Single-engine			
Year	Total	Total air carrier[1]	Total	Multi-engine	4-seat & over	3-seat & less	Rotorcraft[2]	Other[3]
1965	97,741	2,299	95,442	11,977	49,789	31,364	1,503	809
1970	134,539	2,796	131,743	18,291	64,759	44,884	2,555	1,554
1975	171,156	2,681	168,475	24,559	82,621	54,390	4,073	2,832

[1]Includes helicopters.

[2]Includes autogiros; excludes air carrier helicopters.

[3]Includes gliders, blimps, balloons, and dirigibles.

*Prior to 1970 this category was defined as Eligible Aircraft.

Estimated Hours Flown in Active General Aviation by Type of Flying Calendar Years: 1965-75 Actual Use (thousands of hours)

Year	Total estimated hours	Business		Commercial		Instructional		Personal		Other	
		Hours	Percent	Hours	Percent	Hours	Percent	Hours	Percent	Hours	Percent
1965	16,733	5,857	35	3,348	20	3,346	20	4,016	24	166	1
1970	26,030	7,204	28	4,582	18	6,791	26	6,896	26	557	2
1975	34,165	9,545	28	6,480	19	8,174	24	9,244	27	722	2

Note: Business includes business and executive; commercial includes air taxi, aerial application, and industrial/special; and instructional includes training and rental.

Source: B.V. Cayce, U.S. Department of Transportation, Federal Aviation Administration, FAA Statistical Handbook of Aviation, Washington, D.C., December 1975.

Distribution of General Aviation Aircraft and Median Hours Flown by Type of Aircraft and Primary Use of Owner, 1974[1]

Primary Use of General Aviation Aircraft

Aircraft type	Executive	Business	Personal	Aerial application	Instruction	Air taxi	Industrial	Rental	Other	Total Percent	Median number of hours flown
Single-Engine Piston (1-3 seats)	130	5,283	37,139	6,467	7,634	38	489	1,378	2,796	61,355 (37.5%)	91.8
Single-Engine Piston (4 or more seats)	920	25,727	39,432	93	3,721	1,580	600	2,792	2,423	77,298 (47.3%)	106.3
Twin-Engine (Piston) (under 12,500 lbs.)	2,075	8,324	1,865	75	586	1,898	92	721	1,240	16,876 (10.3%)	200.1
Twin/Multi-Engine Piston (12,500 lbs. and over)	188	169	19	172	56	19	39	19	319	1,000 (0.6%)	55.6
Turboprop	934	335	0	0	19	168	0	38	244	1,737 (1.1%)	425.3
Turbojet	978	284	0	0	0	37	0	38	244	1,737 (1.1%)	365.2
Rotorcraft	319	377	766	523	246	542	391	152	418	3,734 (2.3%)	188.5
Other	38	19	0	0	0	0	19	0	19	96 (0.1%)	47.8
Total (Percents)	5,591 (3.4%)	40,519 (24.8%)	79,221 (48.4%)	7,330 (4.5%)	12,262 (7.5%)	4,281 (2.6%)	1,631 (1.0%)	5,119 (3.1%)	7,592 (4.6%)	163,546 (100.0%)	
% Owned by Individuals	10.0%	56.8%	87.8%	49.7%	31.7%	22.9%	32.1%	37.5%	NA	NA	
Median Number of Hours Flown per aircraft	350.8	136.4	77.0	250.2	376.1	409.8	198.0	301.6	86.4		106.3

[1] The General Aviation Survey was developed by the Bureau of the Census and the Federal Aviation Administration (FAA) to obtain information concerning the general aviation fleet; that is, aircraft of individuals who fly primarily for personal or business reasons. By definition, military aircraft and commercial airlines licensed by the Civic Aeronautics Board are not included as part of the general aviation aircraft fleet.

[2] The much larger representation of smaller piston aircraft in the business use fleet serves to form the basis for differentiating the business use fleet from the executive use fleet. 97.0 percent of the business fleet is comprised of twin-engine pistons and smaller aircraft as compared to the executive fleet which has 57.1 percent of its fleet comprised of twin-engine pistons and smaller aircraft.

Source: S. G. Vahovich, U.S. Department of Transportation, Federal Aviation Administration, General Aviation: Aircraft, Owner and Utilization Characteristics, Washington, D.C., November 1976, pp.3-4, 6-11, 8-16, and 8-17.

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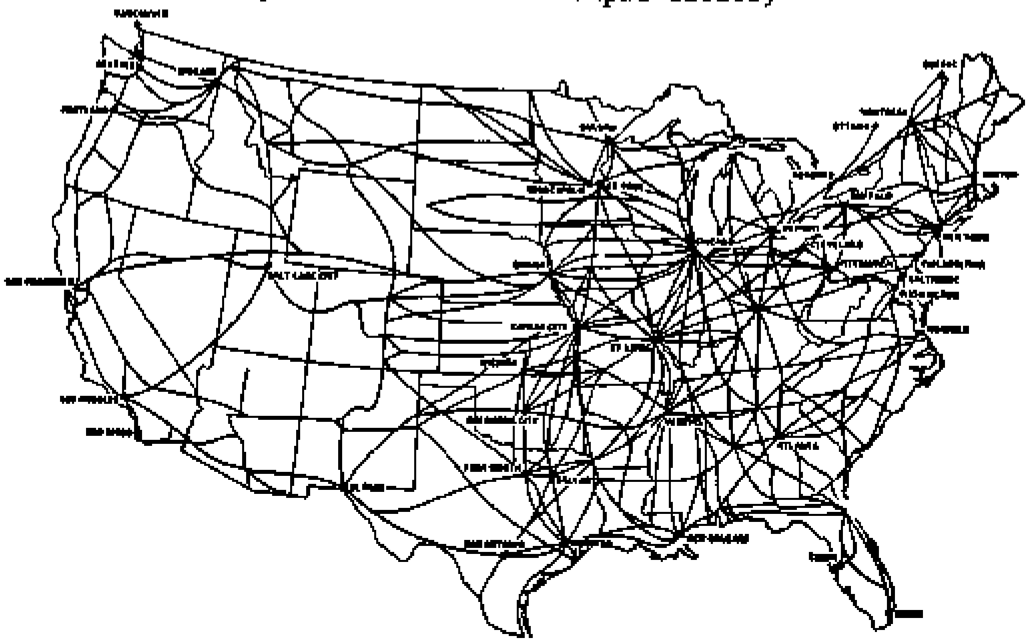
Section 1.4

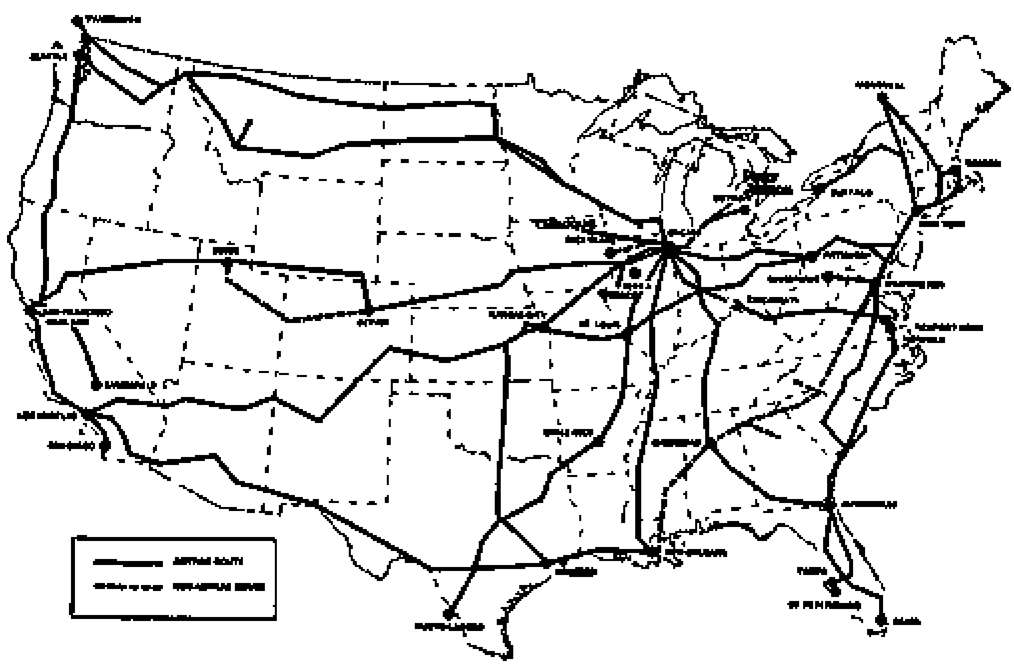
Rail

United States Railroad Mainlines
for Freight and Passenger Operations
(Routes Between Principal Cities)



	Total	Class I	Class II	Other	Electrified
Miles of main track, 1973	201,067	86.3%	3.8%	9.9%	1.02%

Intercity Rail Passenger Routes
(Amtrak and Others)



Source: Boeing Commercial Airplane Company, Intercity Passenger Transportation Data - Service and Economic Comparisons, vol. 1, Seattle, Washington, May 1975, pp. 63 and 65.

Summary Statistics for Freight and Passenger Trains, 1965-75

	1965	1970	1973	1974	1975
Freight traffic					
Revenue ton miles[1] (in millions)	697,878	764,809	851,809	850,961	752,816
Freight train miles[1] (in thousands)	420,962	427,065	469,122	469,268	402,867
Freight car miles[1] (in millions)	29,336	29,890	31,248	30,719	27,641
Freight cars	1,800,662	1,784,181	1,710,659	1,720,573	1,723,605
% Class I	82.1	79.8	81.6	79.9	78.9
Locomotives (total)	27,816	27,086	27,800	28,084	28,524
% diesel electric units	98.5	98.9	99.1	99.2	99.2
Cars per average train	69.6	70.0	66.6	65.5	68.6
Average carload (in tons)	48.9	54.9	56.7	58.3	61.2
Average car capacity (in tons)	59.7	67.1	70.5	72.8	73.9
Load factor	81.9	81.8	80.4	80.1	82.8
Passenger traffic[2]					
Passenger miles[1] (in millions)	17,388	10,771	9,298	10,332	9,583
% commutation	23.7	42.6	45.7	43.9	47.2
% intercity	76.3	57.4	54.3	56.1	52.8
Passenger train miles (in thousands)	172,338	92,821	60,766	64,771	64,540
Passenger train car miles (in thousands)	1,775,020	689,668	441,708	473,209	439,126
Passenger train cars	21,327	11,177	7,189	6,848	6,534
Amtrak	1,494[3]	---	1,777	1,848	1,883
Average seats per unit	68	70	88	93.0	---
Average passengers per unit	23.2	25.7	31.6	35.0	---
Load factor	34.1	36.7	35.9	37.6	---

[1] Class I railroads.

[2] Includes Amtrak beginning in 1973.

[3] Pullman Company cars.

Source: Association of American Railroads, Yearbook of Railroad Facts, 1976 ed., Washington, D.C., 1976; Transportation Association of America, Transportation Facts and Trends, 12th ed., Washington, D.C., July 1976.

Selected Operating Characteristics of the United States Local Transit Industry in 1975

Total operating transit systems[1]	947
Publicly owned (%)	35%
Motor bus (%)	98%
Total passenger vehicles owned and leased[2]	62,271
Publicly owned (%)	83%
Heavy rail cars	9,608
Publicly owned (%)	100%
Light rail cars	1,061
Publicly owned (%)	93%
Trolley coaches	703
Publicly owned (%)	100%
Cable cars	39
Inclined plane cars	4
Personal rapid transit (PRT) cars	45
Motor buses	50,811
Publicly owned (%)	80%
Total passengers (millions)	6,950
Revenue passengers (%)	81%
Motor bus (%)	73%
Passenger vehicle miles operated (millions)	1,989.7
Average fare, all modes (in cents)	33.07
Light rail	29.99
Heavy rail	36.41
Trolley coach	27.60
Motor bus	32.10

[1]As of December 31, 1975.

[2]As of September 1, 1975.

Source: American Public Transit Association, Transit Fact Book, '75-'76 ed., Washington, D.C., 1976.

Section 1.5

Water

Source: James J. Geraghty, et al., Water Atlas of the United States, Water Information Center, Inc., Port Washington, New York, May 1973.

Number of Vessels Operated for the Transportation of Freight in the United States for the Years 1970 through 1975[1]

Types of vessels	1970	1971	1972	1973	1974	1975
Self-propelled						
Towboats and tugs						
Number of vessels	4,230	4,059	4,064	4,035[2]	4,100[2]	4,240 *(13.7%)*
Total horsepower	3,955,001	4,217,064	4,447,953	4,621,450	5,088,221	
Non-self-propelled						
Dry cargo barges and scows						
Number of vessels	16,439	17,527	18,804	19,772	21,876	23,164
Cargo capacity (net tons)	18,272,014	19,710,605	21,342,522	22,647,076	25,525,996	
Tank barges						
Number of vessels	3,185	3,420	3,313	3,375	3,534	3,623
Cargo capacity (net tons)	6,330,298	7,486,718	7,408,906	7,623,498	8,201,561	
Total non-self-propelled						
Number of vessels	19,624	20,947	22,117	23,147	25,410	26,787 *(86.3%)*
Cargo capacity (net tons)	24,602,312	27,197,323	28,751,428	30,270,574	33,727,557	
Total vessels	23,854	25,006	26,181	27,182	29,510	31,027

[1]From Corps of Engineers, U.S. Army.

[2]U.S. Coast Guard reports 6,095 documented vessels of the United States having a service of towing in 1973, 6,111 in 1974, and 6,430 in 1975. The vessels reported by the Corps of Engineers are those used only in the performance of transportation services.

Source: The American Waterways Operators, 1974 Inland Waterborne Commerce Statistics, Arlington, Va., October 1975, pp. 2 and 3.

Number of Water Vessels Used for Recreation and Length of Exposure by Type, 1973[1]

Boat type	Number	Percent	Million boat-hours	Million passenger-hours
Outboard[2]	4,420,006	53.02%	614.17[2]	1,719.44[2]
Rowboat/jonboat[2]	1,222,434	14.66	88.68	213.03
Motor	---	---	34.56	84.56
No motor	---	---	54.12	128.47
Inboard	560,817	6.73	143.91	515.58
Inboard/outboard	527,317	6.33	87.60	318.30
Sailboat	524,387	6.29	59.91	159.32
Auxiliary	---	---	16.12	57.21
No auxiliary	---	---	43.79	102.11
Canoe	495,535	5.94	61.00	130.18
Motor	---	---	10.52	28.50
No motor	---	---	49.48	102.68
Houseboat	38,552	0.46	8.98	36.92
Inflatable	51,192	0.62	---	---
Kayak	37,481	0.45	---	---
Other	458,622	5.50	125.77	386.94
Total	8,336,343	100.00%	1,189.02	3,480.70

[1]Data contained in this table were taken from the 1973 Nationwide Boating Survey.

[2]Because the questionnaire did not define outboard to exclude rowboats and jonboats, an indeterminate number of motorized rowboats and jonboats may be included in the outboard figures.

Source: U.S. Department of Transportation, Coast Guard, Boating Statistics - 1974, Washington, D.C., May 1975, pp. 28 and 29.

Nonfreight, Nonrecreational Water Vessels Registered with the United States Coast Guard as of July 1, 1975[1]

Service	Number	Service	Number
Cable	10	Pile driving	82
Cod fishing	2	Pilot boat	107
Dredging	488	Police boat	45
Oil exploitation	2,381	Patrol boat	55
Ferry	266	Whale fishing	2
Fire boat	38	Welding	12
Fishing	21,965	Wrecking	24
Ice breaker	2	Miscellaneous	1,311
Lightering	32		
Oystering	837	Total	34,572
Passenger	6,913		

[1]This compilation is of privately owned or corporate vessels which have registered with the U.S. Coast Guard and received a documentation number. The intent of this table is to identify vessels engaged in noncargo and nonrecreational activities; however, some overlap occurs with the tables showing cargo and recreational vehicles.

Source: Statistics compiled by the Information and Analysis Staff, United States Coast Guard, United States Department of Transportation, Washington, D.C.

Waterborne Commerce of the United States: Domestic and Foreign

	Total foreign and domestic	Foreign[1]			Domestic[5]				
		Total	Great Lakes ports	Coastal ports	Total	Coastwise	Lakewise	Internal	Local
Ton-miles (000):									
1965	545,338,544	55,535,589	32,881,964[2]	22,653,625[3]	489,802,955	302,545,509	75,917,920	109,701,156	1,638,370
1970	658,951,768	62,756,357	34,345,283[2]	28,411,074[3]	596,195,411	359,784,103	79,416,394	155,815,888	1,179,026
1974	656,164,337	69,819,094	25,799,993[2]	44,019,101[3]	586,345,243	322,802,209	78,880,393	183,202,577	1,460,064
% distribution									
1974	100	*10.6*	(37.0)	(63.0)	*89.4*	(55.1)	(13.5)	(31.2)	(0.2)
Tons (000):									
1965	1,271,410[4]	443,727	56,732	386,995	827,683	201,508	153,695	369,615	102,865
1970	1,530,066[4]	580,969	62,338	518,631	949,097	238,440	157,059	472,123	81,475
1974	1,742,734[4]	764,089	51,462	712,627	978,645	233,358	146,067	511,022	88,198
% distribution									
1974	100	*43.8*	(6.7)	(93.3)	*56.2*	(23.9)	(14.9)	(52.2)	(9.0)
Average haul (miles per ton):									
1965	428.9	125.2	579.6	58.5[3]	591.8	1,501.8	494.0	296.8	15.9
1970	430.7	108.0	551.0	54.8[3]	628.0	1,508.9	505.6	330.0	14.5
1974	376.5	91.4	501.3	61.8[3]	599.1	1,383.3	540.0	358.5	16.6

[1]All movements of U.S. and foreign ships between the United States and foreign countries and between Puerto Rico and Virgin Islands (U.S.A. part), and foreign countries are classified as foreign traffic. Any traffic with the Panama Canal Zone is treated as foreign commerce. Trade between United States territories and possessions, i.e., Guam, Wake, American Samoa, etc., and foreign countries is excluded. These statistics are compiled by the Bureau of the Census from U.S. Bureau of Customs reports.

[2]Based on distances transported on Great Lakes and St. Lawrence River to International Boundary at St. Regis, Quebec, Canada.

[3]Ton-miles for coastal ports are based on distances transported on United States waterways from entrance channels to ports and waterways only. This results in a deflated value for average haul for foreign commerce.

[4]Excludes intraterritory traffic for which ton-miles were not compiled: 1974, 4,055 thousand tons; 1970, 1,630 thousand tons; 1965, 1,486 thousand tons.

[5]Statistics are for U.S. ships on domestic waters.

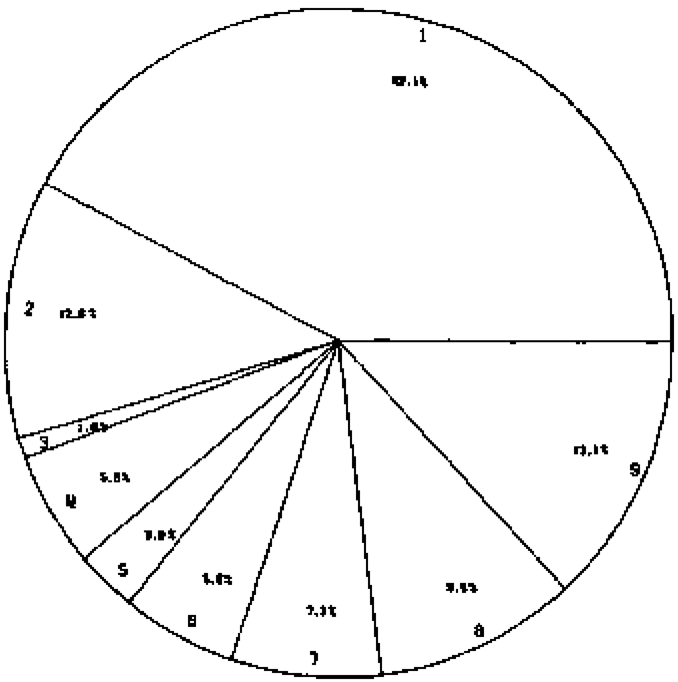
Source: U.S. Department of the Army, Corps of Engineers, Waterborne Commerce of the United States, Part 5 - National Summaries, Vicksburg, Miss., Calendar Year 1974, p. 91.

PRINCIPAL COMMODITIES CARRIED BY WATER

TOTAL COMMERCE 1974

(based on tons)

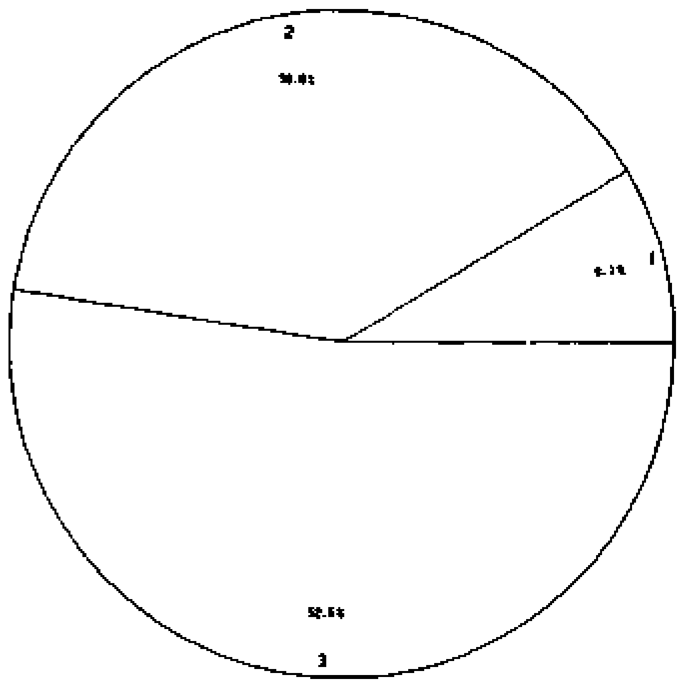
DATA IN PERCENT	SECTOR
42.10	1. PETROLEUM & PRODUCTS
12.60	2. ALL OTHERS
1.00	3. SEASHELLS
5.50	4. CHEMICALS
3.00	5. LOGS & LUMBER
5.60	6. GRAINS
7.30	7. SAND, GRAVEL & STONE
9.80	8. IRON ORE & IRON & STEEL
13.10	9. COAL & COKE



WATER TON-MILES BY TYPE OF SERVICE

DOMESTIC COMMERCE 1974

DATA IN PERCENT	SECTOR
6.70	1. REGULATED
30.80	2. PRIVATE
62.50	3. EXEMPT, FOR HIRE



Source: U.S. Department of the Army, Corps of Engineers, Waterborne Commerce of the United States, Part 5 - National Summaries, Vicksburg, Miss., Calendar Year 1974, pp. 11 and 93.

Section 1.6

Pipe

Pipeline Profiles, 1974

Oil pipeline

Intercity ton-miles (millions)	
ICC-regulated	427,100
Nonregulated	78,900
Total	506,000
Tons transported (millions)	
Crude petroleum	484
Petroleum products	420
Total	904
Intercity ton-miles per capita (regulated plus nonregulated oil pipelines)	2,393.7
Intercity ton-miles per mile of line (regulated plus nonregulated line-millions)	2.3
Tons of Petroleum transported per capita	4.3
Tons of petroleum transported per mile of line	4,050.0
Average length of haul (miles)	
Crude oil	301
Refined products	340
Average flow rate (bbl/day)	
Crude oil	58,800
Refined products	44,500

Natural gas pipeline

Number of interstate natural gas pipeline	120
Companies	120
Number of employees	36,200
Mileage — total	976,700
% field and gathering	6.8
% transmission	27.0
% distributing main	66.2
Natural gas liquids turned into lines (million gal.)	19,626

Water pipelines

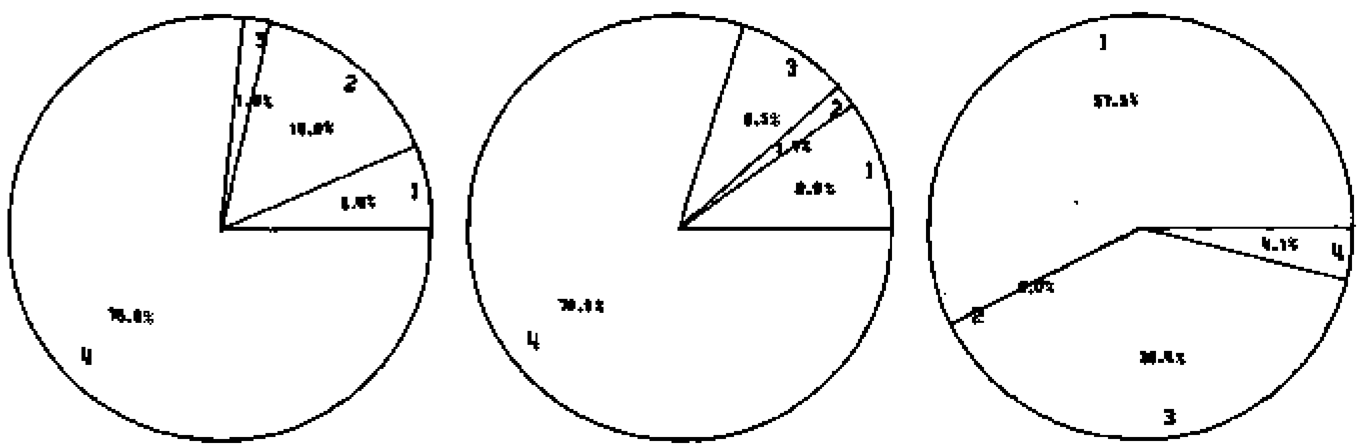
Public water supply	
Number of systems	40,000
% municipal	70
% private	30
Miles of pipe for distribution	12 million
Average per capita usage	150 gal/day
Average per capita residential usage	60 gal/day
Installed horsepower[1]	930,000
% diesel engine	50
% NG engine	50
Energy consumption[1]	43×10^{12} BTU/year
Average power requirement for pumping	$6,110 \times 10^{6}$ hp-hr
Agriculture wells	
Installed horsepower	7,500,000
% diesel engine	100
Energy consumption	184×10^{12} BTU/year
Average power requirement for pumping	$26,280 \times 10^{6}$ hp-hr
California aqueduct	
Installed horsepower	900,000
% electric motor	100
Energy consumption	40×10^{12} BTU/year
Power requirement	$6,700 \times 10^{6}$ hp-hr

[1]Does not include water pumped with electric motors.

Source: W. F. Gay, U.S. Department of Transportation, Summary of National Transportation Statistics, Washington, D.C., June 1976, pp. 34-36 and 32; The Aerospace Corporation, Characterization of the U.S. Transportation System - Pipeline Transportation Systems, Los Angeles, Calif., July 1976. (Draft)

TYPE OF ENGINE/DRIVE USED TO TRANSPORT PETROLEUM & NATURAL GAS BY PIPELINE (1970-1971)

ENERGY (10^{12} BTU'S)			TYPE OF ENGINE/DRIVE
Crude	*Petroleum*	*Natural Gas*	
18.60	8.50	392.50	1. GAS RECIPROCATING *(NG at 7000 BTU/bhp-hr)*
43.50	1.60	0.0	2. DIESEL *(Oil at 7500 BTU/bhp-hr)*
5.40	8.20	262.10	3. GAS TURBINE *(NG at 11,000 BTU/bhp-hr)*
223.80	76.00	27.00	4. ELECTRIC *(From power plant using 8000 BTU/bhp-hr)*
291.3	*96.1*	*682.2*	



CRUDE OIL | PETROLEUM PRODUCTS | NATURAL GAS

Source: The Aerospace Corporation, Characterization of the U.S. Transportation System — Pipeline Transportation Systems, Los Angeles, Calif., July 1976.

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Energy Characteristics

Chapter 2 presents statistics on the consumption of energy in absolute terms and also in terms of efficiency of use. Although the total energy picture is considered, emphasis is centered upon petroleum consumption by the transportation sector.

In Section 2.1, statistics are presented on the total gross consumption of energy by major sources and consuming sectors (see pages 92 and 93). Historical as well as projected data are given. Projections are generally those made by Brookhaven National Laboratory and contained in the ERDA-48 document (see bibliography). Tables giving statistics on petroleum consumption by sector (see page 95) and by mode of transport (see page 98) indicate that the transportation sector consumes over 50% of the petroleum used in the U.S. and that 70% of that is used for travel on our nation's highways.

Section 2.2 contains data which focuses on the intensity of energy use by various modes of transportation. Detailed data is presented for various vehicle types within each of the major transportation modes (see pages 114-121), and also for comparison between the modes (see pages 112 and 113).

Section 2.1

Energy Consumption

United States Total Gross Consumption of Energy Resources by Major Sources and Consuming Sectors[1]
(trillion Btu)

	Coal	Petro-leum	Natural gas	Total fossil fuel	Nuclear power	Geo-hydro-solar power	Total gross energy inputs	Total four sector inputs	Utility electric consumed	Total three sector inputs
1974										
Household and commercial	309	6061	7518	13888			13888	13888	3388	17276
Industrial	4356	6153	10314	20823		37	20860	20860	2425	23285
Transportation	2	17720	685	18407			18407	18407	17	18424
Electrical generation	8540	3480	3512	15532	1202	3253	19987	19987	5830	
Synthetics										
Total	13207	33414	22028	68650	1202	3290	73142	73142		58985
1980										
Household and commercial	156	6403	6137	12696			12696	12696	4662	17358
Industrial	4044	6769	12315	23129			23129	23129	3133	26262
Transportation	3	19413	681	20096			20096	20096	15	20111
Electrical generation	1486	3017	3614	18117	3876	3704	25696	25696	7810-	
Synthetics										
Total	5690	35601	22746	74037	3876	3704	81617	81617		63731
1985										
Household and commercial	114	8232	6440	14787			14787	14787	6432	21219
Industrial	4817	8236	14022	27075			27075	27075	3864	30939
Transportation	2	22367	811	23181			23181	23181	14	23195
Electrical generation	15381	3696	3050	21126	8665	3940	33732	33732	10311	
Synthetics	261		169	92			92			
Total	20575	41532	24154	86261	8665	3940	98866	98774		75353
1990										
Household and commercial	84	10119	6394	16597			16597	16597	8331	24928
Industrial	5803	9753	15602	31158			31158	31158	4823	35981
Transportation	2	24379	932	25313			25313	25313	14	25327
Electrical generation	19569	5731	159	25460	13279	4166	42904	42904	13168	
Synthetics	391		254	137			137			
Total	25850	49982	22833	98665	13279	4166	116109	115972		86236

[1]These figures correspond to the Project Independence Evaluation System (PIES) Reference Case with imported oil price set at $13.

Source: Federal Energy Administration, National Energy Outlook, Washington, D.C., February 1976, pp. G-22 and G-24.

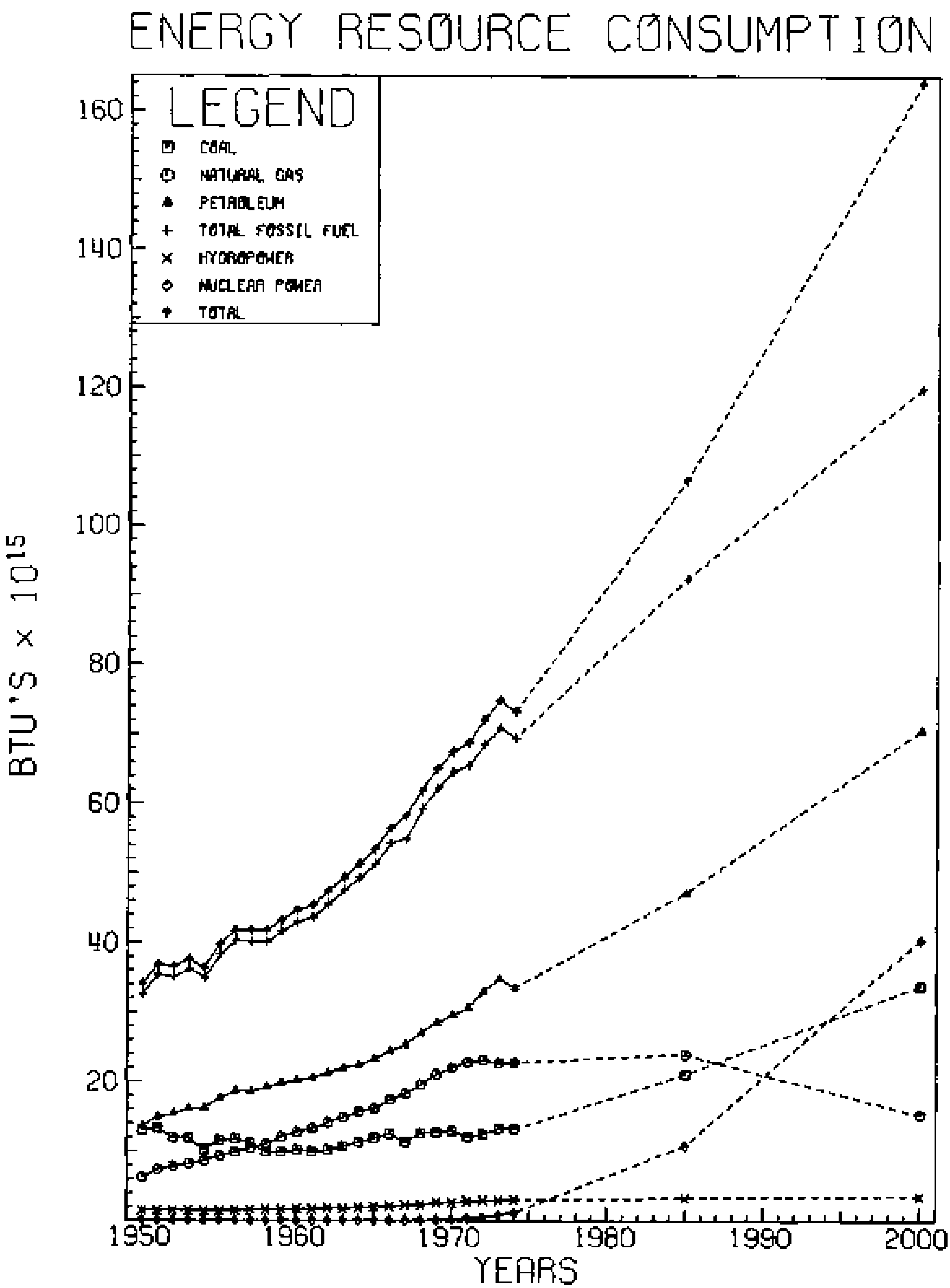
United States Total Gross Consumption of Energy
Resources by Major Source, 1950 through 2000
(trillion Btu)

Year	Coal[1]	Natural gas	Petroleum	Total fossil fuels	Hydro-power	Nuclear power	Total gross energy inputs
1950	12,913	6,150	13,489	32,552	1,440		33,992
1951	13,225	7,248	14,848	35,321	1,454		36,775
1952	11,868	7,760	15,334	34,962	1,496		36,458
1953	11,893	8,136	16,098	36,147	1,439		37,586
1954	10,195	8,548	16,132	34,875	1,388		36,263
1955	11,540	9,232	17,524	38,296	1,407		39,703
1956	11,752	9,834	18,627	40,213	1,487		41,700
1957	11,168	10,416	18,570	40,154	1,551	1	41,706
1958	9,854	10,995	19,214	40,058	1,636	2	41,696
1959	9,810	11,990	19,747	41,547	1,591	2	43,140
1960	10,140	12,699	20,067	42,906	1,657	6	44,569
1961	9,906	13,228	20,487	43,621	1,680	18	45,319
1962	10,189	14,121	21,267	45,577	1,821	24	47,422
1963	10,714	14,843	21,950	47,507	1,767	34	49,308
1964	11,264	15,648	22,386	49,298	1,907	35	51,240
1965	11,908	16,098	23,241	51,247	2,058	38	53,343
1966	12,495	17,393	24,394	54,282	2,073	57	56,412
1967	12,256	18,250	25,835	55,841	2,344	80	58,265
1968	12,659	19,580	27,052	59,291	2,342	130	61,763
1969	12,733	21,020	28,421	62,174	2,659	146	64,979
1970	12,922	22,029	29,614	64,565	2,660	229	67,444
1971	12,023	22,849	30,570	65,462	2,862	404	68,728
1972	12,495	23,125	32,966	68,586	2,946	576	72,108
1973	13,294	22,712	34,851	70,857	2,998	888	74,743
1974	13,169	22,237	33,490	68,896	3,052	1,173	73,121
1985[2]	21,140	24,000	47,140	92,280	3,380	10,850	106,510
2000[2]	33,890	15,400	70,540	119,830	3,650	40,490	163,970

[1]Includes anthracite, bituminous, and lignite.

[2]Projections are based on ERDA's Scenario 0, "No New Initiatives," which portrays future energy demands if there were no changes in the efficiency of energy use.

Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., 1975, p. 102; Energy Research and Development Administration, A National Plan for Energy Research Development and Demonstration: Creating Energy Choices for the Future, Volume 1: The Plan, Report No. ERDA-48, Washington, D.C., June 1975, pp. B-6 and B-8.



Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., 1975, p. 102; Energy Research and Development Administration, A National Plan for Energy Research Development and Demonstration: Creating Energy Choices for the Future, Volume 1: The Plan, Report No. ERDA-48, Washington, D.C., June 1975, pp. B-6 and B-8.

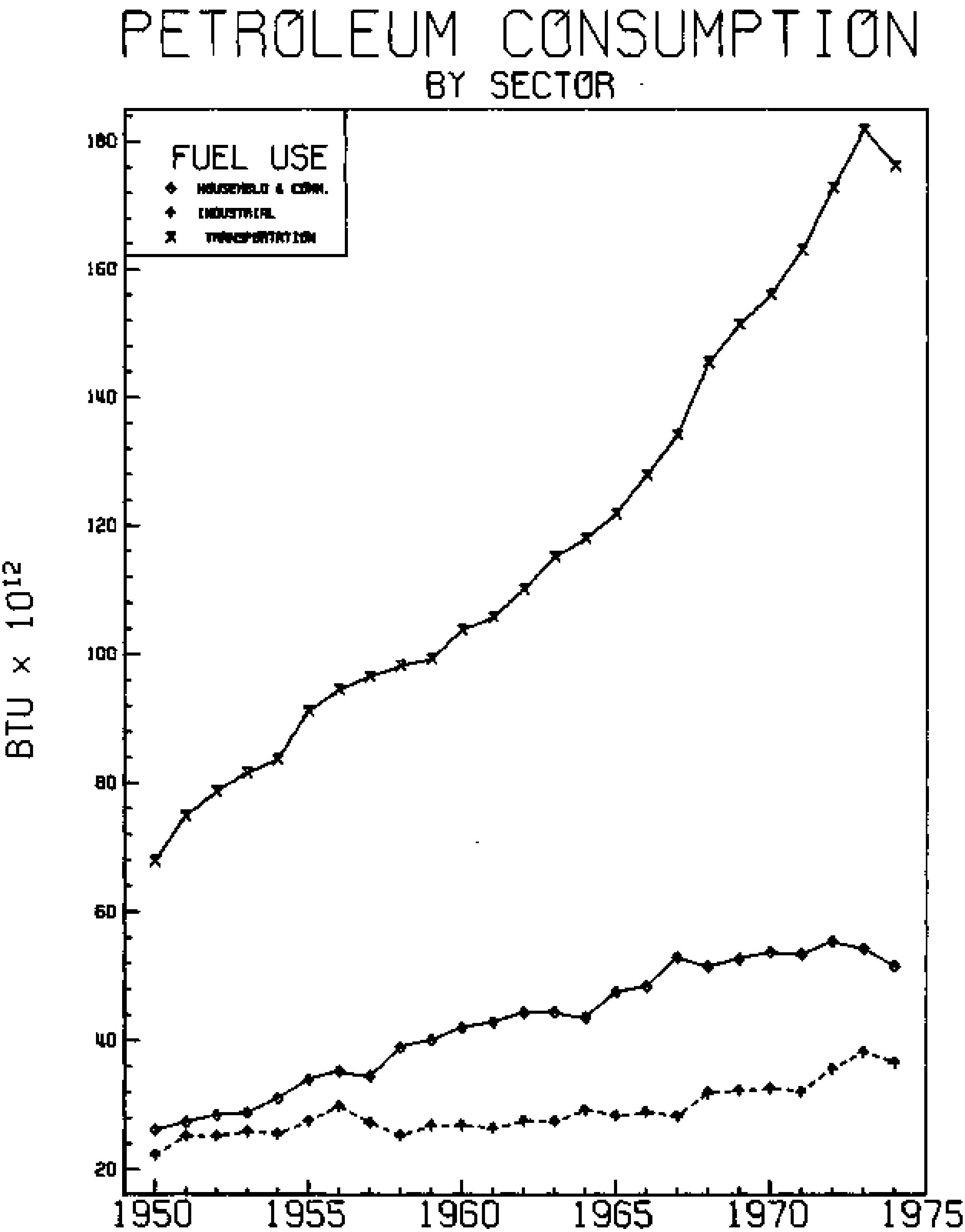
Petroleum[1] Consumption by Sector, 1950 through 1975
(trillion Btu)

Year	Household and commercial			Industrial			Transportation[2]	Transportation as percent of total	Electrical generation	Other	Total input
	Fuel use	Nonfuel use	Total	Fuel use	Nonfuel use	Total					
1950	2,603	435	3,038	2,213	453	2,666	6,785	50.3	662	337	13,488
1951	2,722	480	3,202	2,509	535	3,044	7,482	50.4	499	621	14,848
1952	2,833	517	3,350	2,514	520	3,034	7,868	51.3	492	590	15,334
1953	2,869	522	2,291	2,584	560	3,144	8,158	50.7	577	829	16,099
1954	3,094	556	3,650	2,542	576	3,118	8,358	51.8	480	531	16,137
1955	3,386	615	4,001	2,754	652	3,406	9,109	52.0	512	496	17,524
1956	3,523	660	4,183	2,975	713	3,688	9,448	50.7	497	809	18,625
1957	3,432	637	4,069	2,715	763	3,478	9,649	52.0	512	862	18,570
1958	3,889	679	4,568	2,519	773	3,292	9,819	51.0	515	1,020	19,214
1959	3,997	721	4,718	2,674	915	3,589	9,923	50.3	546	971	19,747
1960	4,189	734	4,923	2,674	1,008	3,682	10,372	51.7	564	526	20,067
1961	4,275	753	5,028	2,634	1,048	3,687	10,575	51.6	577	625	20,487
1962	4,423	804	5,227	2,750	1,130	3,880	11,001	51.7	579	580	21,267
1963	4,434	824	5,258	2,739	1,255	3,994	11,506	52.4	600	592	21,950
1964	4,350	841	5,191	2,922	1,262	4,184	11,791	52.7	636	585	22,387
1965	4,744	891	5,635	2,826	1,313	4,139	12,179	52.4	744	545	23,242
1966	4,830	936	5,766	2,883	1,470	4,353	12,777	52.4	905	594	24,395
1967	5,289	917	6,206	2,820	1,612	4,432	13,408	52.9	1,013	276	25,335
1968	5,145	984	6,129	3,186	1,780	4,966	14,535	53.7	1,180	242	27,052
1969	5,260	1,009	6,269	3,220	1,951	5,171	15,125	53.2	1,628	229	28,422
1970	5,371	1,082	6,453	3,252	2,015	5,267	15,592	52.7	2,087	215	29,614
1971	5,331	1,108	6,439	3,196	1,898	5,094	16,286	53.3	2,543	207	30,570
1972	5,531	1,137	6,668	3,553	2,135	5,668	17,264	52.4	3,114	233	32,966
1973[r]	5,425	1,264	6,689	3,819	2,240	6,059	18,164	52.1	3,656	283	34,851
1974	4,896	1,165	6,061	3,690	2,217	5,907	17,720	53.0	3,480	246	33,414
1975	4,688	1,141	5,829	3,521	2,114	5,635	17,857	54.6	3,312	70	32,701

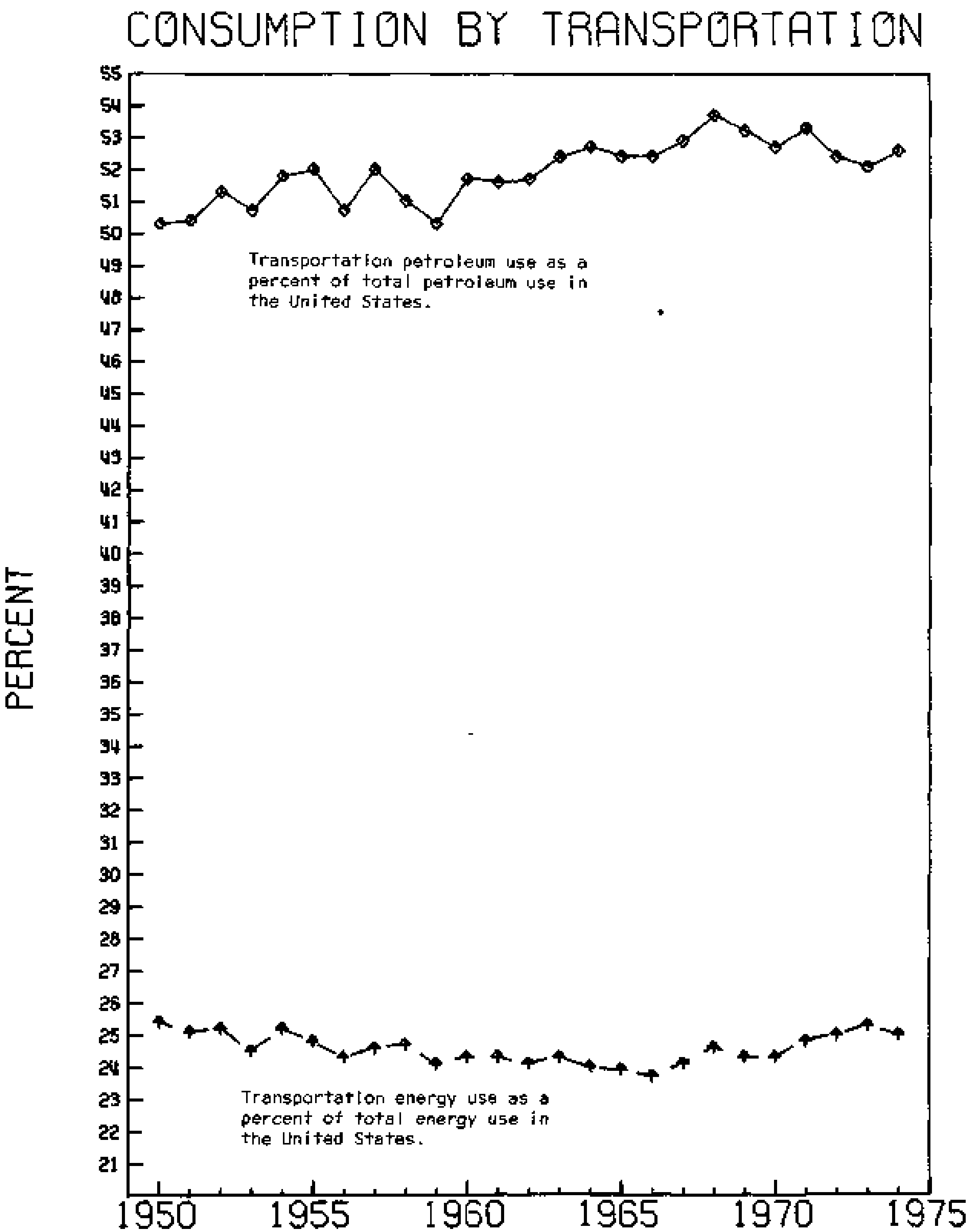
[1]Petroleum products refined and processed from crude oil, including still gas, liquefied refinery gas and natural gas liquids.

[2]Includes bunders and military transportation.

Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., August 1976, p. 108.

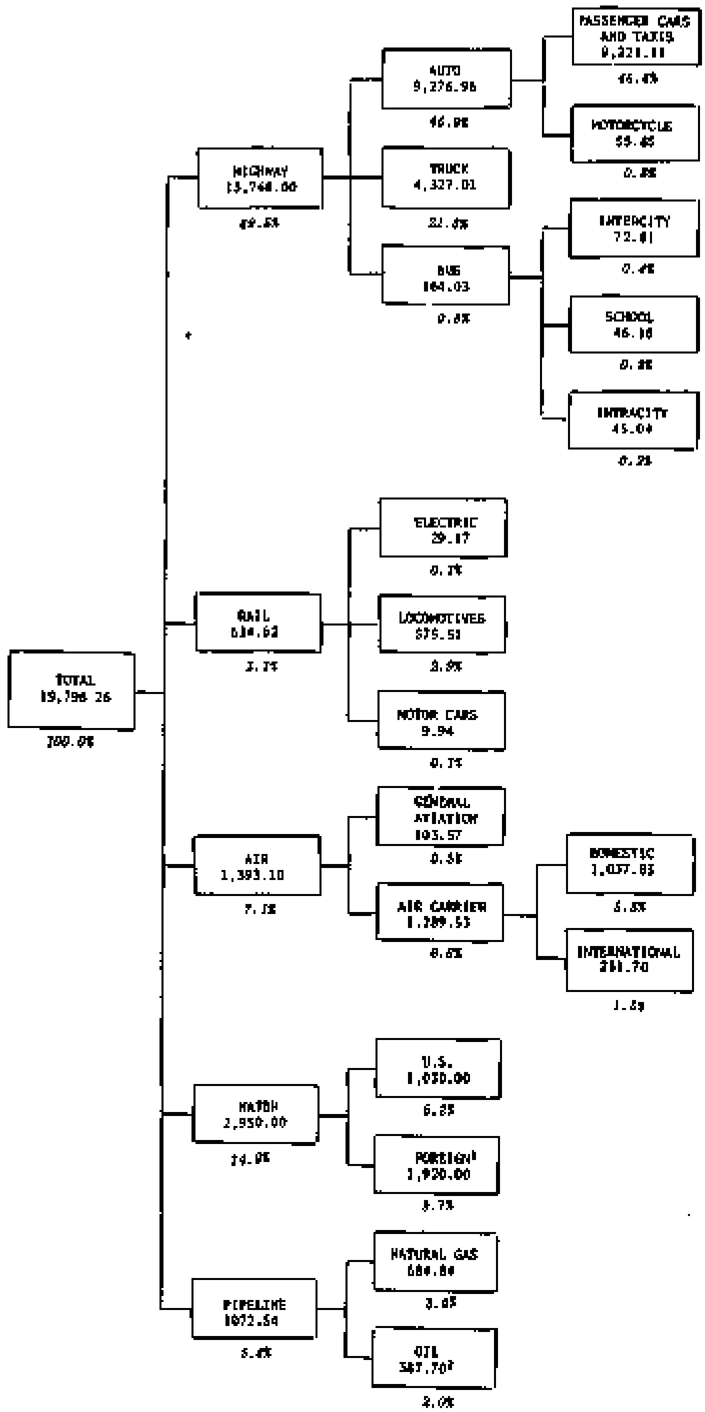


Source: N.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., 1975, p. 106.



Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., 1975, p. 106.

Fuel Consumption by Mode of Transport, 1974
(10^{12} Btu)



[1]Fuel purchased abroad by vessels, both U.S. and foreign flag, engaging in U.S. commerce.

[2]Estimated for 1970-71

Source: Same as page 99.

Fuel Consumption by Mode of Transport[1]
(10^{12} Btu)

	1965	1970	1974
Highway	9,219.04	11,945.72	13,768.00
Passenger cars and taxis	6,273.36	8,203.00	9,221.11
Motorcycles	8.62	16.87	55.85
Buses	172.26	175.37	164.03
Intercity	89.45	89.32	72.81
School	34.53	41.61	46.18
Intracity	48.28	44.44	45.04
Trucks	2,764.80	3,550.48	4,327.01
Single-unit	1,872.88	2,390.61	2,928.59
Combination	891.92	1,159.87	1,398.42
Rail	576.13	572.54	614.62
Electric rail	29.73	28.98	29.17
Locomotive	593.18	533.99	575.51
Motor cars	7.22	9.57	9.94
Air	740.03	1,460.28	1,393.10
General aviation	47.43	96.93	103.57
Air carrier[2]	692.60	1,363.35	1,289.53
Water	553.42	753.24	2,950.00[3]
Pipeline	652.02	929.50	914.84
Natural gas	512.02	739.50	684.84
Oil[4]	236.50	321.79	387.70
Total	11,740.64	15,661.28	19,640.56

[1]Does not include military.

[2]Certificated route air carriers only.

[3]Based on Booz, Allen and Hamilton, Inc. estimates.

[4]Based on Aerospace's estimates.

Sources: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., August 1976, p. 117; B.V. Cayce, U.S. Department of Transportation, Federal Aviation Administration, FAA Statistical Handbook of Aviation, Washington, D.C., December 1974, p. 80; U.S. Department of Transportation, Federal Aviation Administration, Aviation Forecasts - Fiscal Years 1977-1988, Washington, D.C., September 1976, p. 67; Booz, Allen and Hamilton Inc., Energy Use in the Marine Transportation Industry-Task I - Industry Summary, prepared for the Division of Transportation Energy Conservation, Energy Research and Development Administration, January 1977, pp. I-5 and I-10; The Aerospace Corporation, Characterization of the U.S. Transportation System-Pipeline Transportation Systems, Los Angeles, Calif., July 1976, p. 19.

Energy Consumption by Source: Transportation Sector, 1950-1975

Year	Coal[1]		Petroleum[2]			Natural gas[3]		Total fossil fuels	Utility electricity purchased		Total energy input	Percent of total U.S. energy consumption
	Thousand short tons	Trillion Btu	Million barrels	Trillion Btu	Percent of transportation sector	Million cubic feet	Trillion Btu	Trillion Btu	Billion Kilowatt-hours	Trillion Btu	Trillion Btu	
1950	63,783	1,701	1,248.8	6,785	78.5	125,546	130	8,616	7	24	8,640	25.4
1951	56,903	1,525	1,377.5	7,482	81.1	192,486	199	9,206	7	23	9,229	25.1
1952	40,428	1,086	1,451.3	7,868	85.6	207,207	214	9,168	6	22	9,190	25.2
1953	30,074	809	1,511.5	8,158	88.4	230,314	238	9,205	6	20	9,225	24.5
1954	19,060	516	1,551.4	8,358	91.5	230,615	239	9,113	6	18	9,131	25.2
1955	17,429	464	1,691.4	9,109	92.5	245,246	253	9,826	6	19	9,845	24.8
1956	14,187	378	1,756.2	9,448	93.1	295,977	306	10,132	5	17	10,149	24.3
1957	10,126	270	1,832.0	9,649	94.2	299,235	310	10,229	4	15	10,244	24.6
1958	5,015	133	1,825.1	9,819	95.4	312,221	323	10,275	5	16	10,291	24.7
1959	3,861	102	1,849.4	9,923	95.4	349,348	362	10,387	5	17	10,404	24.1
1960	3,294	87	1,934.1	10,372	95.7	347,075	359	10,818	5	18	10,836	24.3
1961	770	21	1,971.9	10,575	96.1	377,607	390	10,986	6	19	11,005	24.3
1962	687	18	2,051.3	11,001	96.2	382,496	396	11,415	5	18	11,433	24.1
1963	670	18	2,146.7	11,506	96.0	423,783	438	11,962	6	19	11,981	24.3
1964	711	19	2,198.8	11,791	96.0	435,570	461	12,261	6	20	12,281	24.0
1965	655	18	2,271.0	12,179	95.6	500,524	517	12,714	5	18	12,732	23.9
1966	609	16	2,382.6	12,777	95.6	535,353	552	13,345	5	16	13,361	23.7
1967	467	13	2,497.1	13,408	95.6	575,752	594	14,015	5	17	14,032	24.1
1968	417	11	2,703.8	14,535	95.8	590,965	610	15,156	5	18	15,174	24.6
1969	313	8	2,815.8	15,125	95.7	630,962	651	15,784	5	17	15,801	24.3
1970	298	8	2,902.8	15,592	95.3	722,166	745	16,345	5	16	16,361	24.3
1971	207	6	3,032.0	16,286	95.4	742,592	766	17,058	5	17	17,075	24.8
1972	163	4	3,213.0	17,264	95.5	766,156	790	18,058	5	17	18,075	25.0
1973	116	3	3,348.8	18,164	96.0	728,177	743	18,910	4	15	18,925	25.5
1974	80	2	3,267.9	17,720	96.2	668,854	685	18,407	6	19	18,426	25.3
1975	26	1	3,297.2	17,857	96.5	620,000	635	18,493	6	19	18,512	26.0

[1]Includes anthracite, bituminous, and lignite coals.

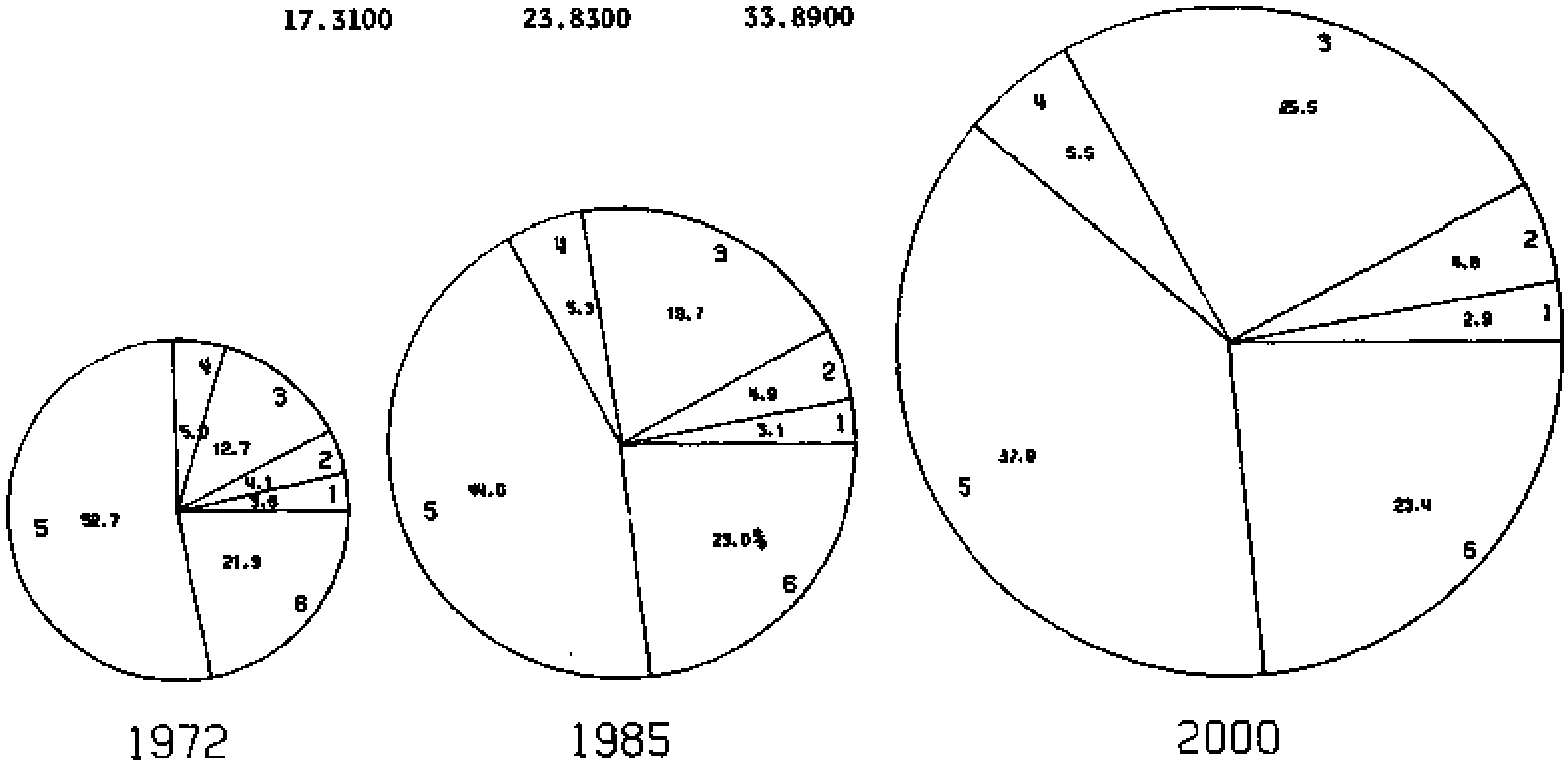
[2]Includes bunkers and military transportation.

[3]Consumption of natural gas by pipelines.

Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., August 1976.

TRANSPORTATION CONSUMPTION OF ENERGY

DATA VALUES-BTU'S × 10^{15} 1972	1985	2000	Mode (SHOWN AS PERCENT)
0.6150	0.7300	0.9900	1. RAIL
0.7130	1.1700	1.6200	2. SHIP
2.2010	4.7000	8.6300	3. AIR
0.8680	1.2600	1.8800	4. PIPELINE
9.1210	10.4800	12.8400	5. AUTO
3.7900	5.4900	7.9300	6. BUS, TRUCK
17.3100	23.8300	33.8900	



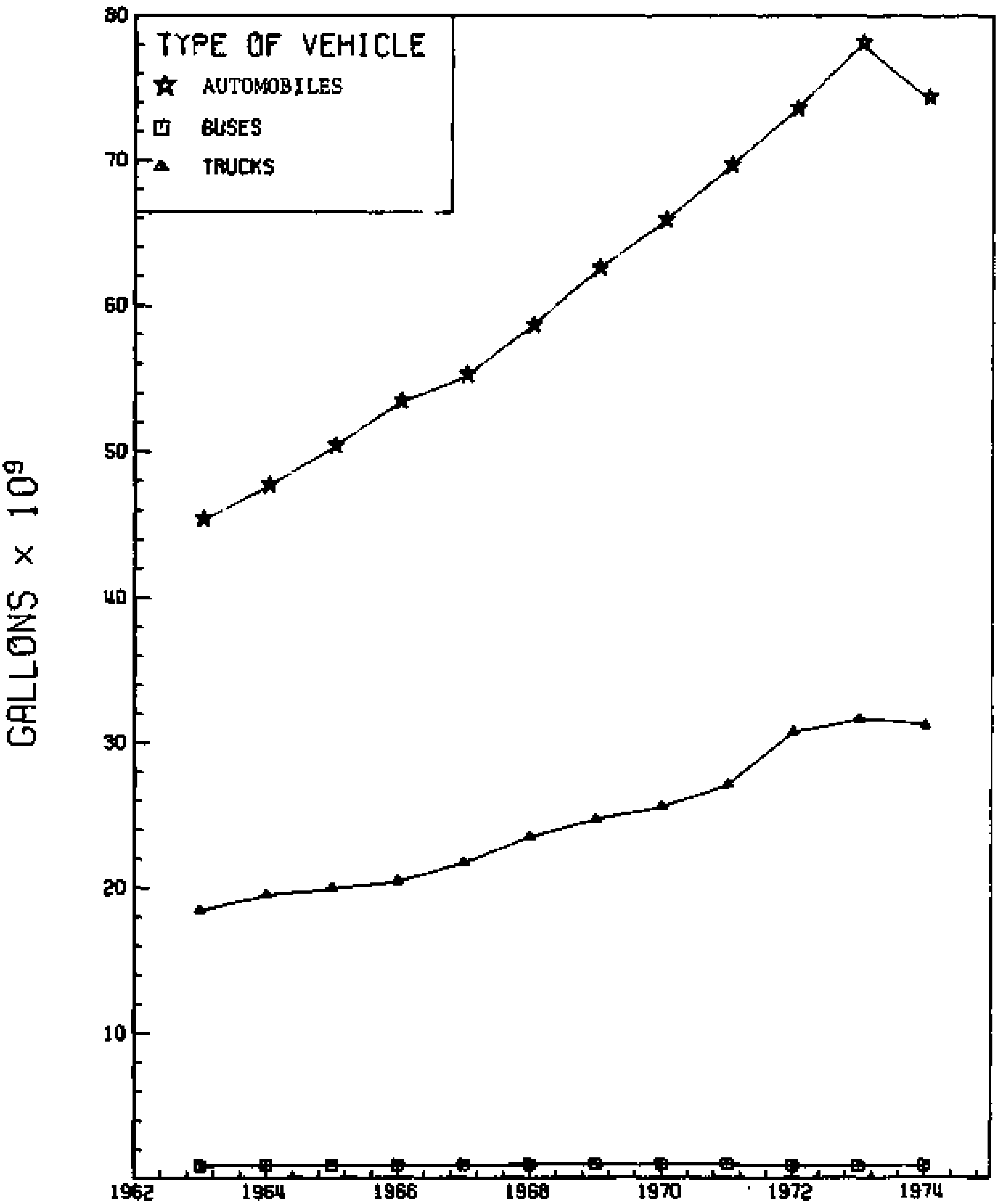
Source: Data Analysis Branch, Transportation Energy Conservation, Energy Research and Development Administration.

Department of Defense Energy Use by Transportation Mode
FY 1973

	Btu × 10^{12}	Percent of total	Percent of transportation
Total	1,824	100.0	
Transportation	1,307	71.7	100.0
Aircraft	917	50.0	69.8
Ship	279	15.3	21.3
Ground	116	6.4	8.9
Other	517	28.3	

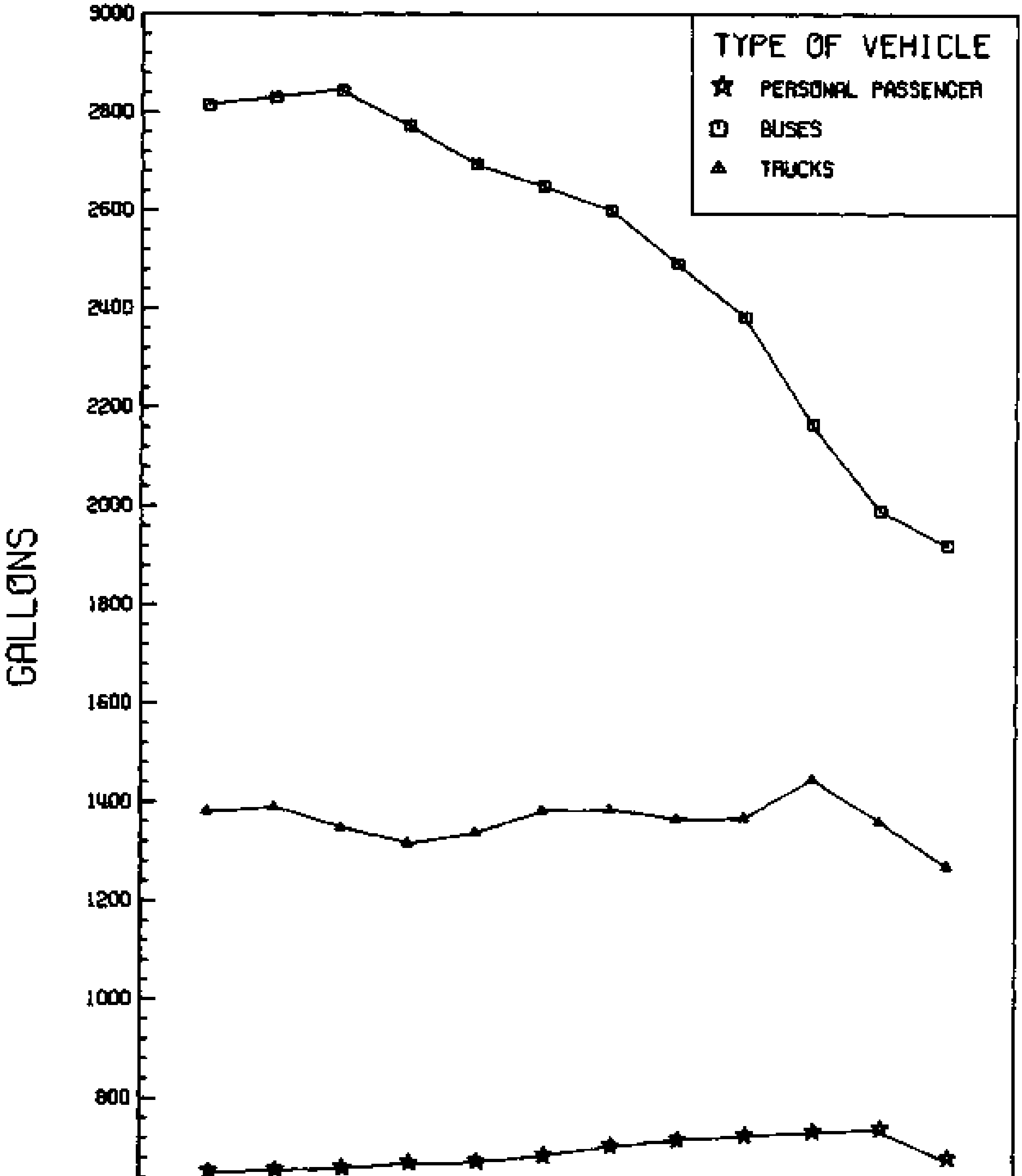
Source: U.S. Department of Defense, Management of Defense Energy Resources — Phase II, Washington, D.C., 1974, p. 2-2.

Total Amount of Fuel Consumed by Type of Highway
Motor Vehicle, 1963 to 1974



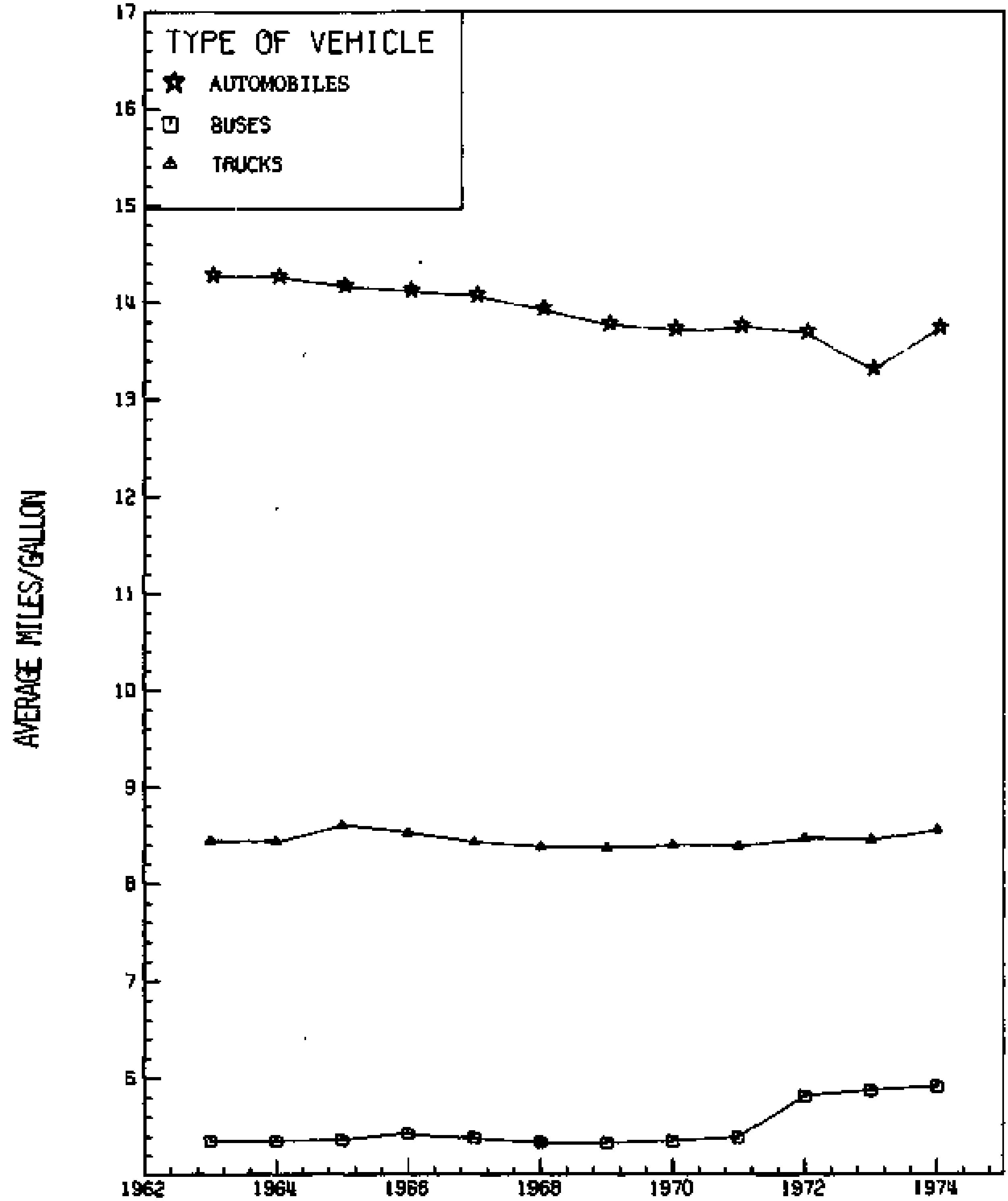
Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics, Table VM-1, annual.

Average Annual Fuel Consumption by Type of Highway Motor Vehicle, 1963 to 1974



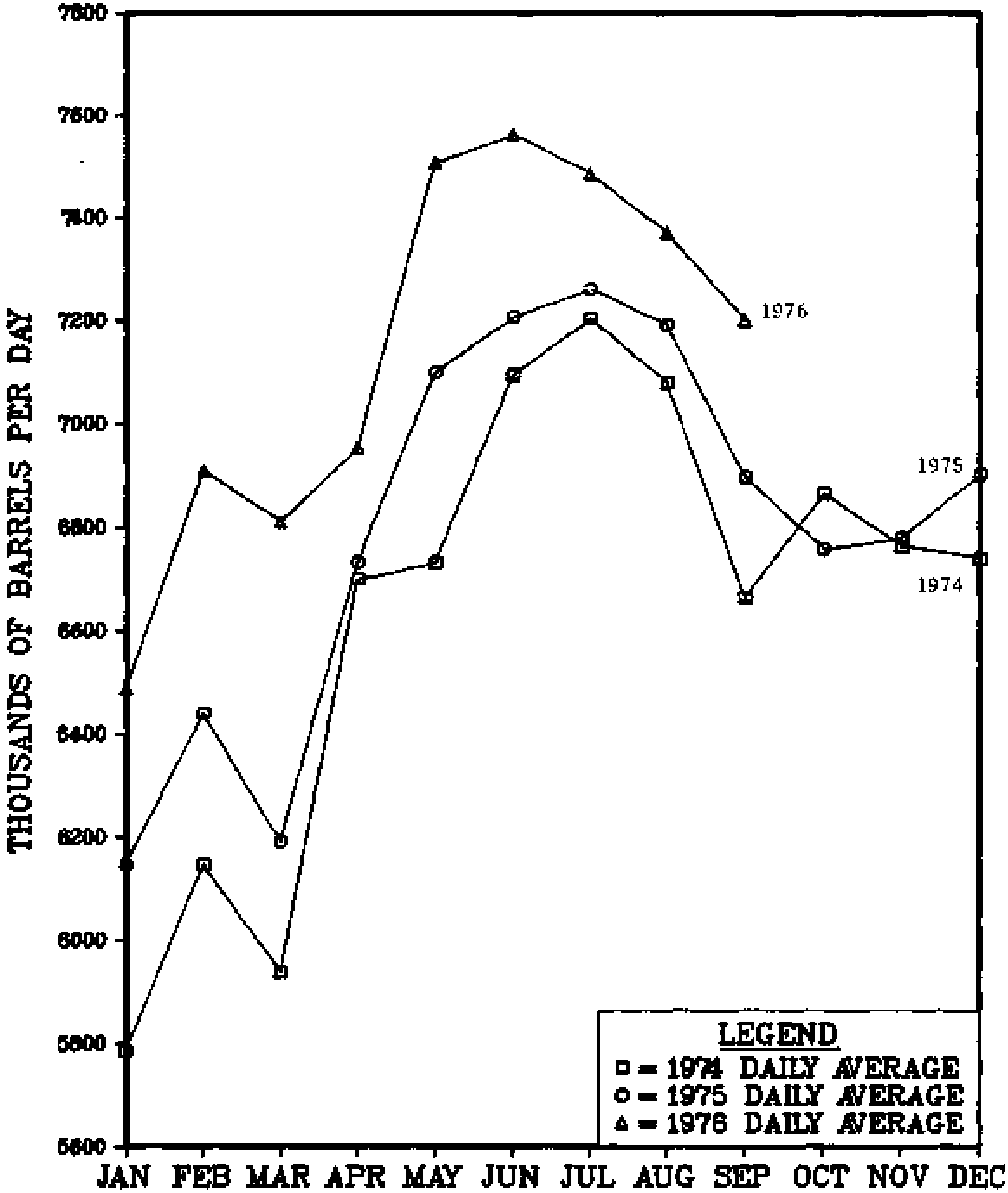
Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics, Table VM-1, annual.

Average Miles Traveled Per Gallon of Fuel Consumed by Type of Highway Motor Vehicle, 1963 to 1974



Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics, Table VM-1, annual.

DAILY AVERAGE CONSUMPTION
OF MOTOR GASOLINE
BY MONTH



Source: U.S. Department of Transportation, Federal Highway Administration, Monthly Motor Gasoline Reported by States, Washington, D.C., monthly.

Estimated Fuel Consumed by United States Domestic Civil Aviation[2]
(In millions of gallons)

Fiscal Year	Total Jet Fuel and Aviation Gasoline		Jet Fuel			Aviation Gasoline		
	Gal × 10^6	BTU × 10^{12}	Total	Air Carrier	General Aviation	Total	Air Carrier	General Aviation
1972	8,724	1173·59	8,311	8,037	274	413	22	391
1973	9,035	1215·38	8,603	8,299	304	432	21	411
1974	8,534	1147·43	8,071	7,714	357	463	20	443
1975	8,795	1182·56	8,321	7,798	523	474	20	454
1976	8,922	1199·25	8,403	7,831	572	519	20	499
1977T[3]	2,294	307·75	2,101	1,995	106	193	5	188
1977[1]	9,268	1245·52	8,705	8,071	634	563	19	544
1978[1]	9,690	1302·18	9,096	8,411	685	594	17	577
1979[1]	10,023	1346·89	9,405	8,676	729	618	15	603
1980[1]	10,532	1415·21	9,875	9,084	791	657	13	644
1981[1]	11,193	1503·84	10,475	9,591	884	718	11	707
1982[1]	11,726	1575·15	10,944	9,962	982	782	10	772
1983[1]	12,318	1654·62	11,491	10,433	1,058	827	9	818
1984[1]	12,939	1738·04	12,071	10,940	1,131	868	9	859
1985[1]	13,572	1823·09	12,664	11,459	1,205	908	8	900
1986[1]	14,145	1900·04	13,197	11,917	1,280	948	8	940
1987[1]	14,831	1992·25	13,843	12,484	1,359	988	7	981
1988[1]	15,576	2092·30	14,535	13,078	1,457	1,041	7	1,034

[1] Forecast.

[2] Note--Domestic civil aviation is defined for purposes of the table to include all civil aircraft flights which originate and terminate within the 50 states. Fuel consumed by airframe and aircraft engine manufacturers, whether for flight testing or ground testing, are not shown here because they are not available for the domestic industry as a whole and cannot be estimated with any assurance of accuracy. Estimates of fuel consumed by the supplemental, contract and intrastate carriers are included in the "Air Carrier" columns. It should also be noted that general aviation fuel consumption is not reported and historical series are estimates.

[3] 1977T represents the transition quarter, July 1, 1976 through September 30, 1976.

Source: U.S. Department of Transportation, Federal Aviation Administration
Aviation Forecasts - Fiscal Years 1977-1988, Washington, D.C
September 1976, p. 57.

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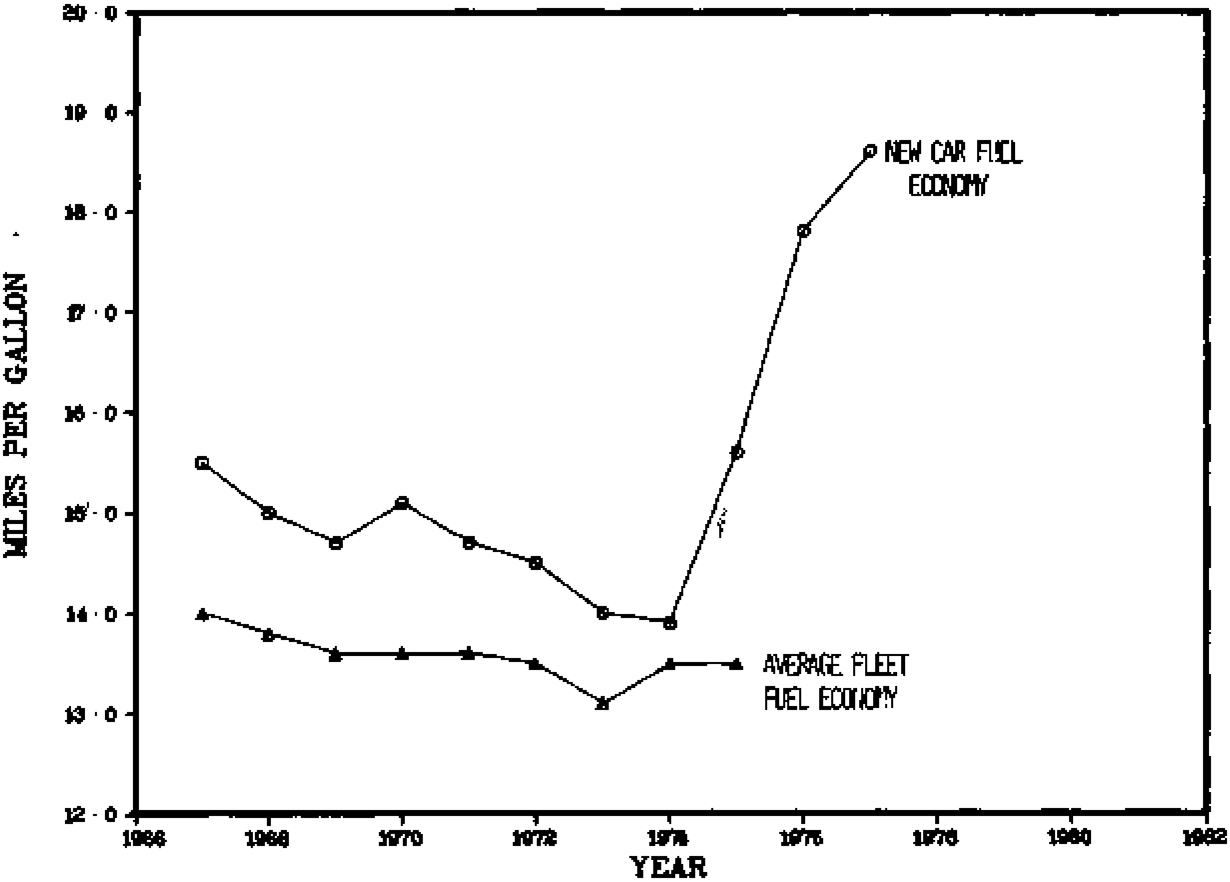
Section 2.2

Energy Efficiency and Intensiveness

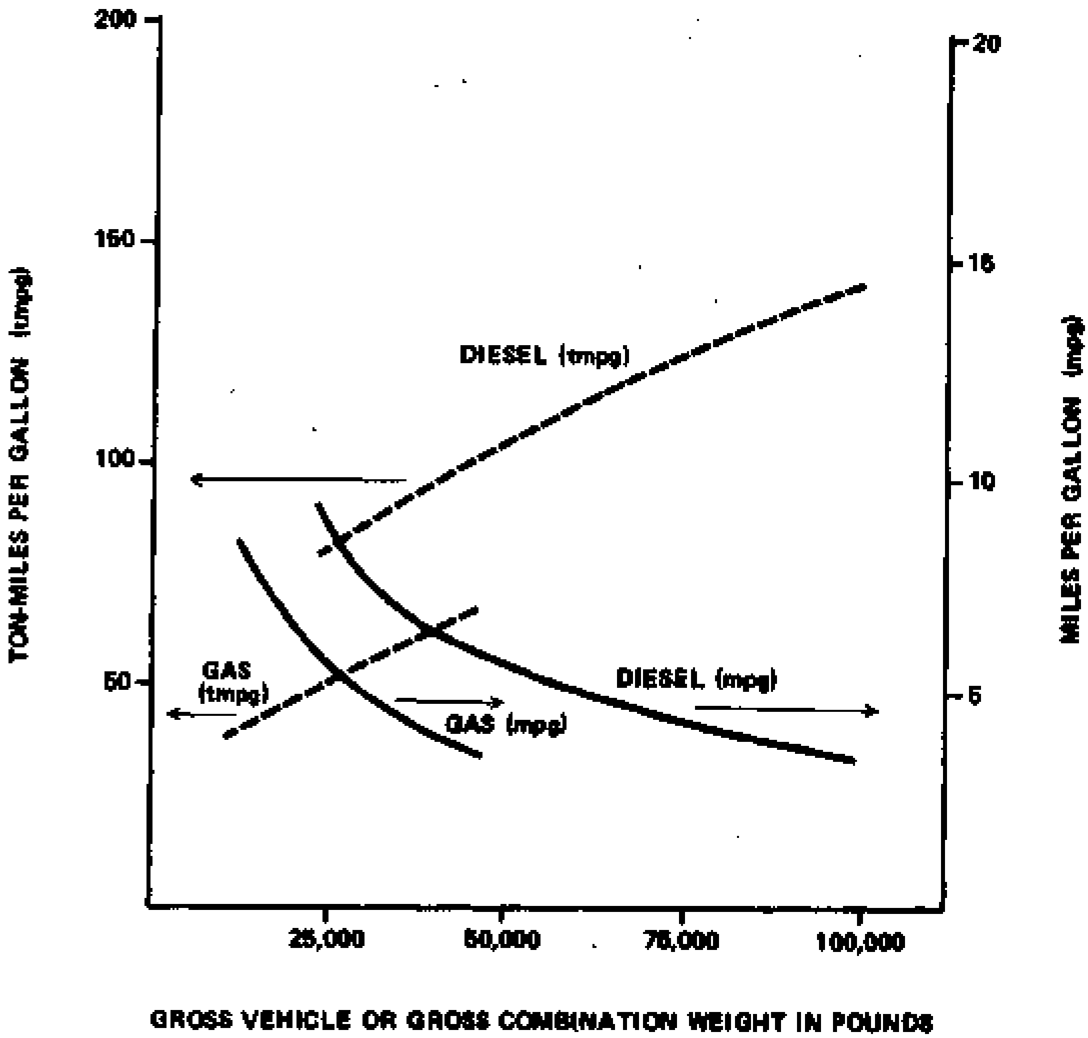
DUE TO AUTOMOBILE MIX, IT WILL TAKE SEVERAL YEARS BEFORE NEW CAR FUEL ECONOMY IMPROVEMENTS SIGNIFICANTLY AFFECT THE AVERAGE FLEET FUEL ECONOMY.

Average Fuel Economy for Automobile Fleet and New Cars



Source: J. D. Murrell et al., Light Duty Automotive Fuel Economy — Trends through 1977, SAE paper 760795, presented at the Automobile Engineering Meeting, Dearborn, Michigan, October 18-22, 1976.

TON-MILES PER GALLON IS A BETTER INDICATOR OF FUEL ECONOMY FOR FREIGHT CARRYING COMMERCIAL VEHICLES THAN IS VEHICLE-MILES PER GALLON.

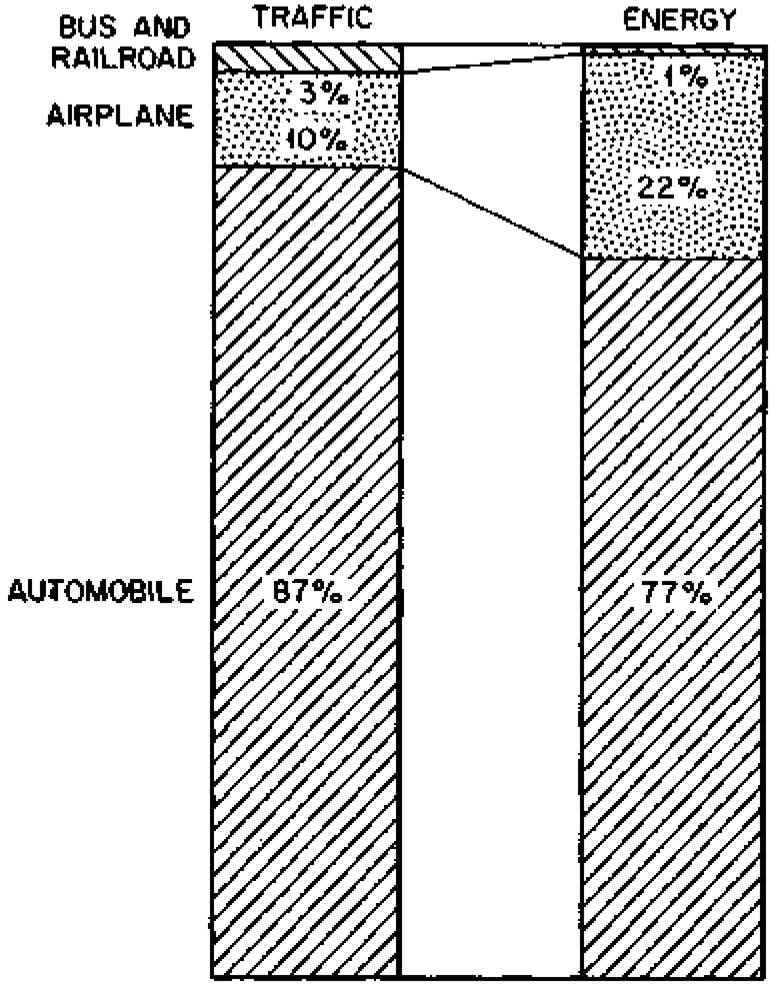


Approximate Productivity in Ton-Miles Per Gallon
Vs. Fuel Economy In Miles Per Gallon

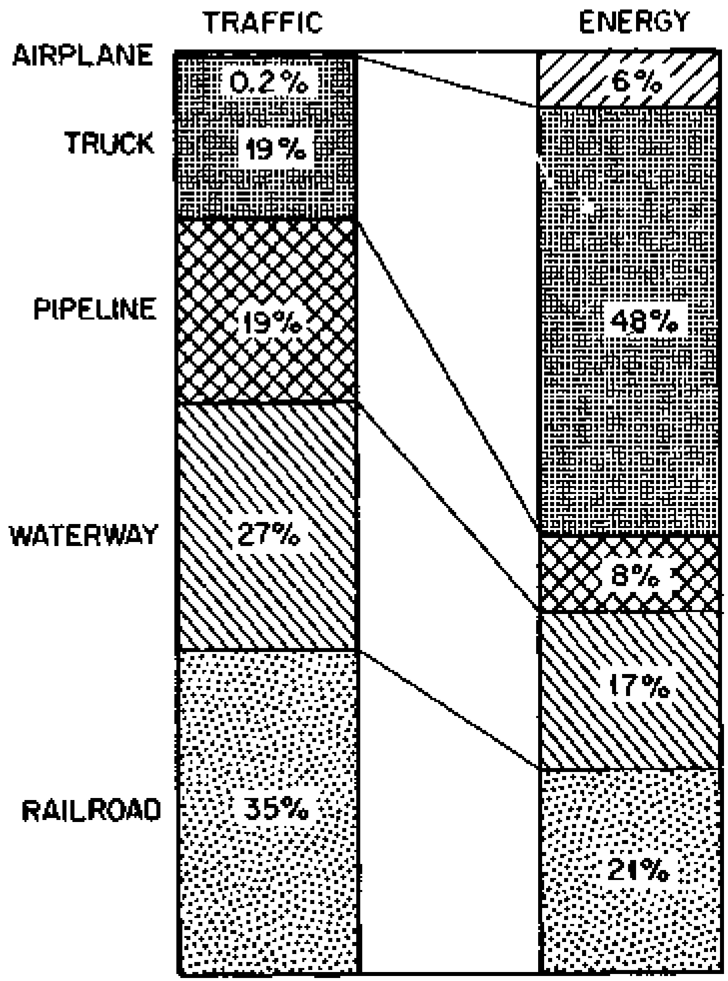
Source: U.S. Department of Transportation et al., Interagency Study of Post-1980 Goals for Commercial Motor Vehicles, Executive Summary, Washington, D.C., July 1976, p. 6.

IT IS EVIDENT FROM THE FIGURE ABOVE THAT ONE WAY OF INCREASING COMMERCIAL VEHICLE PRODUCTIVITY AND DECREASING FUEL USAGE IS TO ENCOURAGE THE CURRENT TREND OF INCREASING THE PROPORTION OF LARGER FREIGHT-CARRYING COMMERCIAL VEHICLES TO THE TOTAL COMMERCIAL FLEET.

1970 Intercity Passenger
Traffic and Energy Distributions



1970 Intercity Freight
Traffic and Energy Distributions



Source: E. Hirst, Energy Intensiveness of Passenger and Freight Transport Modes: 1950-1970, ORNL-NSF-EP-44, Oak Ridge National Laboratory, Oak Ridge, Tenn., April 1973.

Energy Requirements of Passenger Transportation Modes

	Assumed Passenger Loading	Vehicle Miles Per Gallon of Fuel or Equivalent	Passenger Miles Per Gallon of Fuel or Equivalent
Heavy Rail Transit (Subway) Car Peak Load	135	4.00	540
Intercity Passenger Train	540–720	0.50	270–360
Transit Bus Peak Load	75	4.10	307
Intercity Bus	47	6.00	282
Commuter Rail Car, Diesel Powered	125	2.00	250
Heavy Rail Transit (Subway) Car Off-Peak Load	35	4.00	140
Transit Bus, Off-Peak Load	30	4.10	123
Rail Turbine Train	320	0.33	110
Standard Size Automobile Intercity, Maximum Load	6	18.00	108
Standard Size Automobile Urban, Maximum Load	6	14.40	86
Wide-Body Commercial Jet Aircraft, 1,000 Mile Flight	256–385	0.14–0.22	54–60
Twin Jet Commercial Aircraft, 500 Mile Flight	68–106	0.44–0.54	37–47
Average Commuter Automobile	1.4	13.5	19

Source: American Public Transit Association, Transit Fact Book, '75-'76 Edition, Washington, D.C., March 1976, p. 46.

Energy Intensiveness for Automobiles and Buses, 1974-1980

Vehicle type	Gross weight (1000 lbs.)	Trip length (statute miles)	Average trip hrs @ MPH	Fuel type[1]	Vehicle statute miles/gal	Number of seats: Available (full load)	Number of seats: 1972 Actual aver. oper.	Specific energy, stop/start — Seat-miles/gallon: Available (full load)	Seat-miles/gallon: 1972 Actual aver. oper.	BTU's seat-mile: Available (full load)	BTU's seat-mile: 1972 Actual aver. oper.
Urban, subcompact auto	2.0-2.4	10.0	.24/25	Gas	24.0	4.0	1.6	96	38.4	1,302	3,255
Urban, compact auto	2.5-3.4	10.0	.24/25	Gas	18.0	5.0	1.6	90	28.8	1,389	4,340
Urban, standard auto	3.5-4.4	10.0	.24/25	Gas	14.4	6.0	1.6	86.4	23.0	1,447	5,435
Urban, luxury auto	4.5-6.0	10.0	.24/25	Gas	9.0	6.0	1.6	54	14.4	2,315	8,681
Urban, bus	(18.5 empty) 20.3-3-26.0	13.0	1.25/ 10.3	Diesel	3.6-4.0	50	12	180	48	771	2,891
Intercity, bus	(28.7 empty) 45.0	100.0	1.81/55	Diesel	6.0	46	19.4	276	116.4	503	1,192
Intercity, subcompact auto	2.0-2.4	100.0	1.81/55	Gas	30.0	4.0	2.0	120	60	1,042	2,083
Intercity, compact auto	2.5-3.4	100.0	1.81/55	Gas	22.5	5.0	2.2	112.5	49.5	1,111	2,525
Intercity, standard auto	3.5-4.4	100.0	1.81/55	Gas	18.0	6.0	2.6	108	46.8	1,157	2,671
Intercity, luxury auto	4.5-6.0	100.0	1.81/55	Gas	13.0	6.0	3.0	72	36	1,736	3,472

[1]Gasoline = 125 X 10^3 BTU/gal, Diesel = 138.8 X 10^3 BTU/gal.

Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., 1975, p. 137.

Energy Intensiveness for Trucks, 1974 to 1980

Vehicle type	Cargo density (lb/ft^3)	Maximum payload (in tons)	Trip length (statute miles)	Average trip time (hr at MPH)	Type of fuel	Vehicle statute miles/gal.	Specific energy stop/start cycle	
							Ton-miles per gallon	Btu/ton mile
Urban, truck	20-100	8	10	0.4/25	Gas	8	64	1,953
Urban, truck	20-100	8	10	0.4/25	Diesel	12	96	1,446
Urban, truck	10-30	3.1	10	0.4/25	Gas	8	25	5,040
Intercity, truck	20-100	25	100	1.8/55	Diesel	5	125	1,110
Intercity, truck	15	14.3	100	1.8/55	Diesel	4.8	69	2,023

Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., 1975, p. 139.

Energy Intensiveness for Passenger Trains, 1974 to 1980

Vehicle type	Gross weight (1000 lb)	Trip length (statute miles)	Average trip time (hr)	Fuel type	Vehicle statute miles/gal	Number of seats	Specific energy stop/start cycle: Seat-miles/ gallon	Specific energy stop/start cycle: Btu/ seat-mile
Urban train	79	0.75	0.02	Electric	57,600 Btu/mi	50-60	106	1320
Metroliner	1050	75	1.0	Electric	0.83	382	318	440
New Tokaido line	2000	140	1.4	Electric	0.4	1400	305	427
Standard diesel	1200	50	0.75	Diesel	0.66	360	240	583

Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., 1975, p. 139.

Energy Intensiveness for Freight Trains, 1974 to 1980

Vehicles type	Cargo density (lb/ft^3)	Maximum payload in tons	Trip length (statute miles)	Average trip time (hr at MPH)	Type of fuel	Vehicle statute miles/ gallon	Specific energy stop/start cycle: Ton-miles per gallon	Specific energy stop/start cycle: Btu/ton mile
Intercity train I	25	1000	100	2.26/44	Diesel	0.14	273	550
Intercity train II	25	700	100	2.86/35	Diesel	0.17	420	330

Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., 1975, p. 140.

Energy Intensiveness for Passenger Aircraft, 1974-1980

Mode	Number of seats	Gross weight (1000 lbs.)	Specific trip length (S.M.)	Average trip time (Hrs.)[1]	Vehicle statute mi/gal.	Energy available seat-mi. per gal.	Stop/start BTU/avail. seat-mi. (X1000)[2]	Fuel type
Aircraft[3]								
Helicopter[4]	24-26	19	13	0.15	.58-.71	14-18	6.65-8.87	Kero
Gen avia single eng. recip.[5]	4-6	2.3-3.8	100	0.6-0.8	10.5-15.1	42-72	1.49-2.56	Avgas
Gen avia twin eng. recip.[5]	6-11	3.6-8.8	250	1.2-1.5	4.8-10.2	40-61	1.75-2.70	Avgas
Turbo prop	98	113	250	0.8	.38	37	3.32	Kero
Turbo prop	98	113	500	1.3	.47	46	2.68	Kero
Twin eng. turbo fan (NB)	68-106	77.7-116	250	0.8	.34-.44	30-38	3.22-4.15	Kero
Twin eng. turbo fan (NB)	68-106	77.7-116	500	1.3	.44-.54	37-47	2.61-3.35	Kero
Twin eng. turbo fan (NB)	68-106	77.7-116	1000	2.3	.51-.61	41-54	2.30-2.97	Kero
3 & 4 eng. turbo fan (NB)	131-200	177-150	250	0.8	.15-.22	27-30	4.06-4.62	Kero
3 & 4 eng. turbo fan (NB)	131-200	173-350	500	1.3	.21-.29	35-41	3.00-3.48	Kero
3 & 4 eng. turbo fan (NB)	131-200	173-350	1000	2.3	.26-.34	44-51	2.40-2.78	Kero
3 & 4 eng. turbo fan (WB)	256-385	426-775	250	0.8	.09-.15	33-42	2.96-3.75	Kero
3 & 4 eng. turbo fan (WB)	256-385	426-775	500	1.3	.11-.19	44-51	2.40-2.80	Kero
3 & 4 eng. turbo fan (WB)	256-385	426-775	1000	2.3	.14-.22	54-60	2.07-2.30	Kero
3 eng. turbo fan charter (WB)	400	426	250	0.8	.14	57	2.18	Kero
3 eng. turbo fan charter (WB)	400	426	500	1.3	.17	70	1.77	Kero
3 eng. turbo fan charter (WB)	400	426	1000	2.3	.20	79	1.57	Kero

[1]Commercial Transport Trip Times obtained from "Official Airline Guide," January 15, 1974, schedule times plotted versus trip distance.
[2]Kerosene at 18,400 BTU/lb. and 6.7 lb./gal.; Avgas at 18,700 BTU/lb. and 5.75 lb./gal.
[3]With the exception of helicopter and general aviation data, all other fuel consumption data obtained directly from manufacturer.
[4]From CAB "Aircraft Operating Cost and Performance Report," August 1972.
[5]Based on Manufacturer's published performance data for cruise at 75% power, block time and speed estimated at 90% of cruise speed to allow for takeoff and landing.

Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., 1975, p. 138.

Energy Intensiveness for Freight Aircraft, 1974-1980

Mode	Maximum payload (tons	Payload gross density (lb/ft)[3]	Specific trip time (s. mi.)	Average trip time (hrs)[1]	Vehicle statute mi/gal	Specific energy, stop/start cycle per gal	Specific energy, stop/start cycle BTU/ton mi (X1000)[2]	Fuel type
Aircraft								
Turbofan, narrow body	20.6-58.7	8.3-11.6	500	1.3	.19-.44	8.4-11.1	11.1-14.7	Kero
Turbofan, narrow body	20.6-58.7	8.3-11.6	1000	2.3	.22-.53	9.6-12.8	9.6-12.9	Kero
Turbofan, narrow body	46.8-56.7	10.9-11.6	2000	4.4	.23-.27	12.6-13.6	9.1-9.8	Kero
Turbofan, wide body	77.9-126.0	10.0	1000	2.3	.12-.23	13.7-15.0	8.2-9.0	Kero
Turbofan, wide body	77.9-126.0	10.0	2000	4.4	.13-.24	14.2-16.0	7.7-8.7	Kero

[1]Trip times assumed same as passenger schedules obtained from "Official Airline Guide," January 15, 1974, schedule times plotted against trip distance.
[2]Kerosene at 18,400 BTU/lb and 6.7 lb/gallon.
[3]All fuel consumption data obtained directly from aircraft manufacturers for all-freighter or convertible-freighter aircraft models.

Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., 1975, p. 140.

Calculated Energy Intensity of Urban Rail Systems

Heavy Rail

BTU/VEHICLE MILE			BTU/PASSENGER MILE		
Distance Between Stops Miles	Maximum Occupancy Including Standees	All Seats Occupied	Maximum Occupancy Including Standees	All Seats Occupied	30% Seats Occupied
.5	93,000	84,000	669	1,040	3,130
1.0	66,000	60,000	472	750	2,250
1.5	50,000	45,000	351	560	1,670
2.0	39,000	36,000	284	450	1,350
2.5	34,000	30,500	246	390	1,170

Total load: 140 passengers; seats: 80
Maximum load weight: 122,100 lbs
Empty weight: 91,920 lbs
Maximum speed: 55 mph

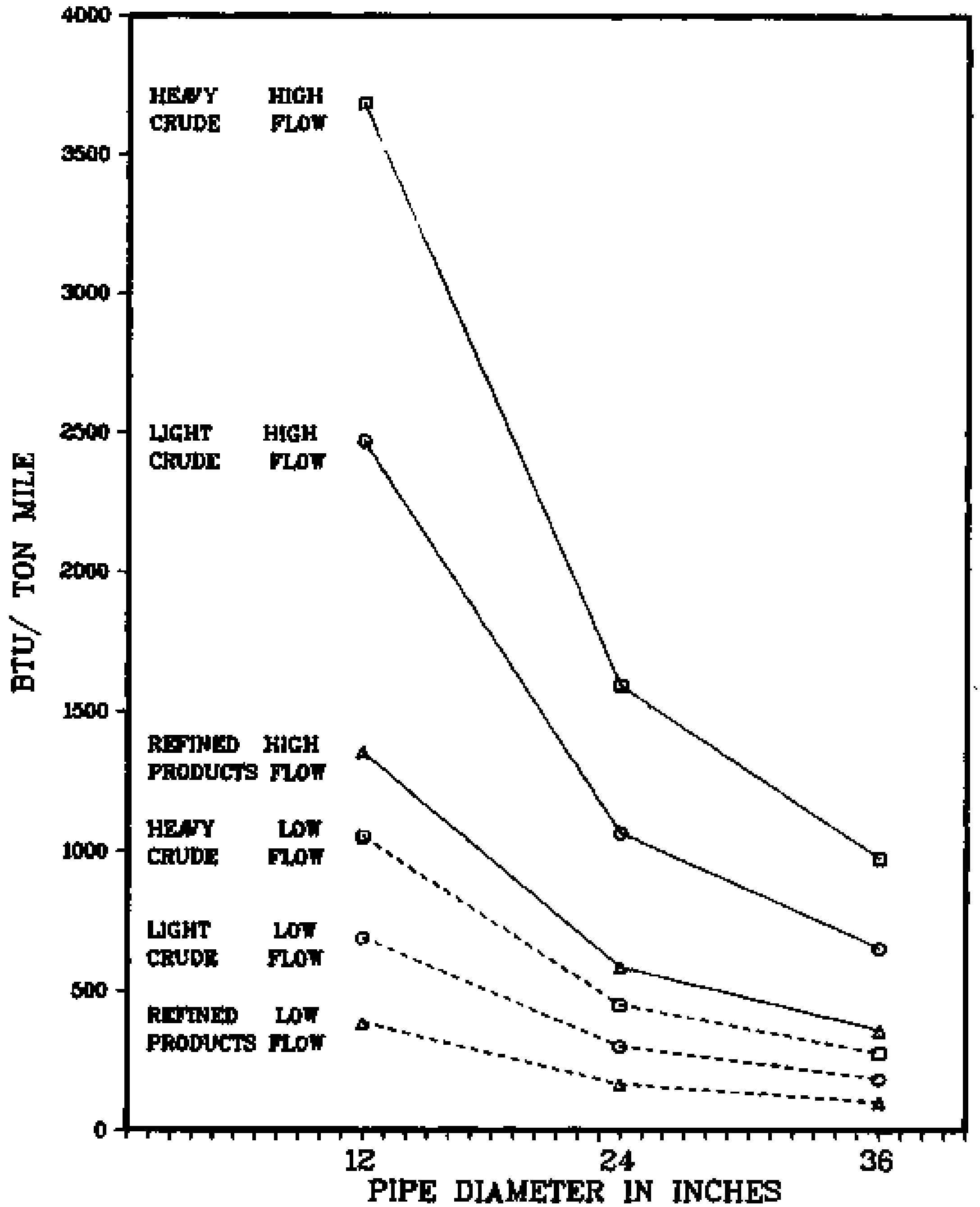
Light Rail

BTU/VEHICLE MILE			BTU/PASSENGER MILE		
Distance Between Stops Miles	Maximum Occupancy Including Standees	All Seats Occupied	Maximum Occupancy Including Standees	All Seats Occupied	30% Seats Occupied
.5	90,000	67,000	309	883	2,652
1.0	61,000	43,000	192	558	1,696
1.5	45,000	32,500	140	429	1,304
2.0	37,500	26,000	114	351	1,087
2.5	31,500	23,000	98	299	913

Total load: 320 passengers; seats: 77
Maximum load weight: 109,400 lbs
Empty weight: 55,815 lbs
Maximum speed: 55 mph

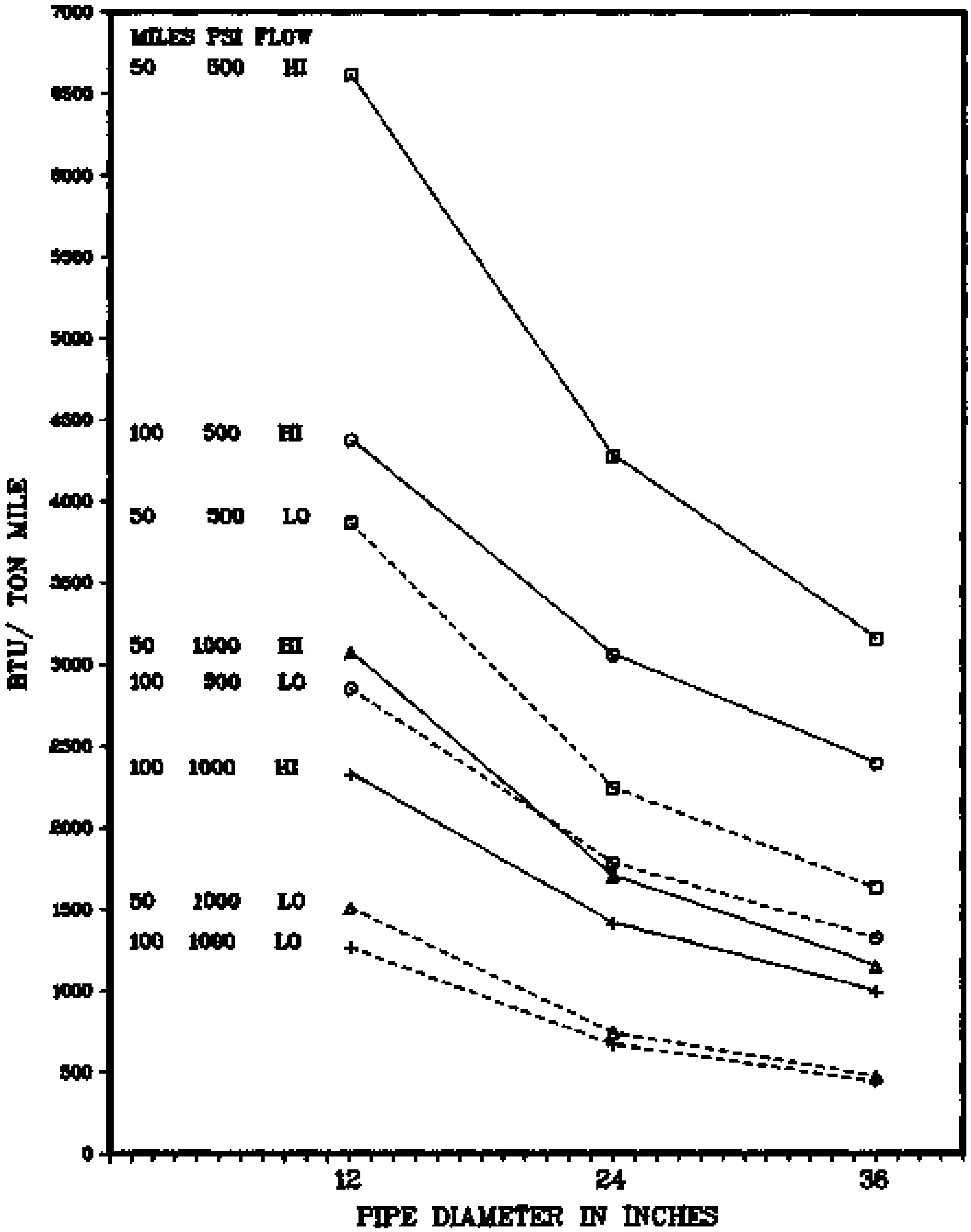
Source: The Aerospace Corporation, Characterization of the U.S. Transportation System - Urban Rail Transit, Los Angeles, Calif., July 1976, p. 21. (Draft)

ENERGY INTENSITY FOR OIL PIPELINES



Source: The Aerospace Corporation, Characterization of the U.S. Transportation System - Pipeline Transportation Systems, Los Angeles, Calif., July 1976. (Draft)

ENERGY INTENSITY FOR NATURAL GAS PIPELINES



Source: The Aerospace Corporation, Characterization of the U.S. Transportation System - Pipeline Transportation Systems, Los Angeles, Calif., July 1976. (Draft)

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U.S. Environmental Protection Agency, A Report on Automotive Fuel Economy, Washington, D.C., October 1973.

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Conservation Alternatives

This chapter summarizes key results from several projections of transportation activity and transportation energy use to the year 2000 and reviews the impact of various conservation alternatives on the total energy consumption by the transportation sector. Section 3.1 deals with the impacts of various parameters on motor vehicle fuel consumption.

Much of this information is taken from a special study on future energy consumption patterns of motor vehicles done in 1976 by the Federal Task Force on Motor Vehicle Goals beyond 1980.[1] On page 131 we see that similar levels of petroleum savings can be achieved by improvement in fuel economy or reduction in total vehicle miles traveled. The diagram on page 132 indicates the sensitivity of new car fleet fuel economy to various auto and fleet characteristics and government regulations. The chart on page 133 deals with the savings in terms of overall fuel consumption associated with material inputs into vehicle fabrication; while the graph on page 134 plots the 1985 new car fleet fuel economy versus vehicle mix and acceleration performance. The table on page 135 indicates the effects of two common conservation techniques — driving without air conditioning and performing regular tune-ups — on average miles per gallon. The other two tables in this section deal with the energy impacts of transportation conservation measures involving means of transportation other than the automobile.

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[1]Federal Task Force, Motor Vehicle Goals Beyond 1980, Vols. 1 and 2, Washington, D.C., U.S. Department of Transportation, September 2, 1976. (Draft)

The first series of scenarios presented in Chapter 3 are a subset of those examined by the Federal Task Force on Motor Vehicle Goals Beyond 1980. The graph on page 142 compares the future fleet fuel consumption for auto design concepts representing a baseline scenario, a weight-conscious Otto engine scenario, a weight-conscious diesel fleet scenario and a scenario based on the introduction of the Stirling engine. Clearly, reduction in automobile weight is a major factor in increasing fleet fuel economy. This was also emphasized in the graphs on page 133 which show the effects of substituting aluminum for steel in vehicle fabrication on total energy needed for production and for operation.

Aggregate transportation energy projections are presented in detail in Section 3.2. These projections are from four major sources: the Jack Faucett Associates study for the Federal Energy Administration's Project Independence Report, the Brookhaven National Laboratory's Reference Energy System, the Ford Foundation's Energy Policy Project, and the Federal Highway Administration. All of these studies were prepared after the 1973 Arab oil embargo; therefore they (either explicitly or implicitly) take account of the recent sharp increases in gasoline, diesel fuel, and jet fuel prices.

The estimates of 1985 transportation energy demand from these projections range from 18 to 26 QBTU (quadrillion BTU or quads). The range for the year 2000 is 17 to 38 QBTU. By comparison, transportation energy use in 1972 was 16 QBTU. Thus, these projections suggest that transportation energy use will continue to grow, although future growth rates may be much lower than historical growth rates.

Differences in energy use for a particular year among the forecasts are due to different assumptions concerning transportation mode choices, vehicle efficiencies, and passenger and freight traffic demands. The low forecasts assume slower growth in transportation demands, greater improvements in technical efficiencies, and larger shifts to less energy-intensive modes.

The FHWA projections cover the 1972-1990 period and deal with automobiles only. Their projections show a range in 1990 gasoline use of 68 to 80 billion gallons (8.5 to 10.0 QBTU). Differences in 1990 gasoline demand among the four FHWA projections are due to different assumptions concerning vehicle fuel economy (mpg), miles traveled per vehicle, and changes in average vehicle type (standard, compact, or economy cars).

Section 3.1

Conservation Measures

Changes in Gallons Consumed by a Vehicle
as a Function of the Percent Improvement in Fuel
Economy and the Number of Miles It is Driven
(savings are in gallons)

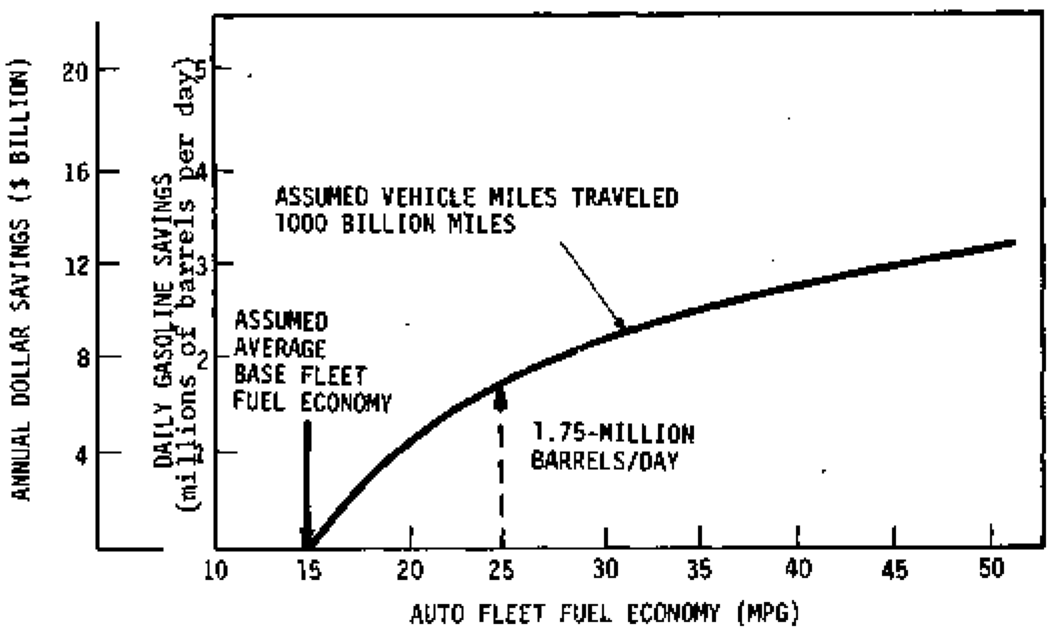
Percent improvement in fuel economy above 27.5 mpg	New mpg	Number of miles traveled 15,000	28,000	40,000	50,000	70,000	100,000
1%	27.8	5	10	14	18	25	36
2	28.1	11	20	29	36	50	71
3	28.3	16	30	42	53	74	106
4	28.6	21	39	56	70	98	140
5	28.9	26	48	69	87	121	173
6	29.2	31	58	82	103	144	206
7	29.4	36	67	95	119	167	238
8	29.7	40	75	108	135	189	269
9	29.9	45	84	120	150	210	300
10	30.2	50	93	132	165	231	331
15	31.6	71	133	190	237	332	474
20	33.0	91	170	242	303	424	606
25	34.4	109	204	290	364	509	727
30	35.8	126	235	336	420	587	839
35	37.1	141	264	377	471	660	943
40	37.5	156	291	416	519	727	1,039
45	39.8	169	316	451	564	790	1,129
50	41.3	182	339	485	606	848	1,212
Total number of gallons consumed at 27.5 mpg		545	1,018	1,455	1,818	2,545	3,636

Savings in this table were derived using the following equation:

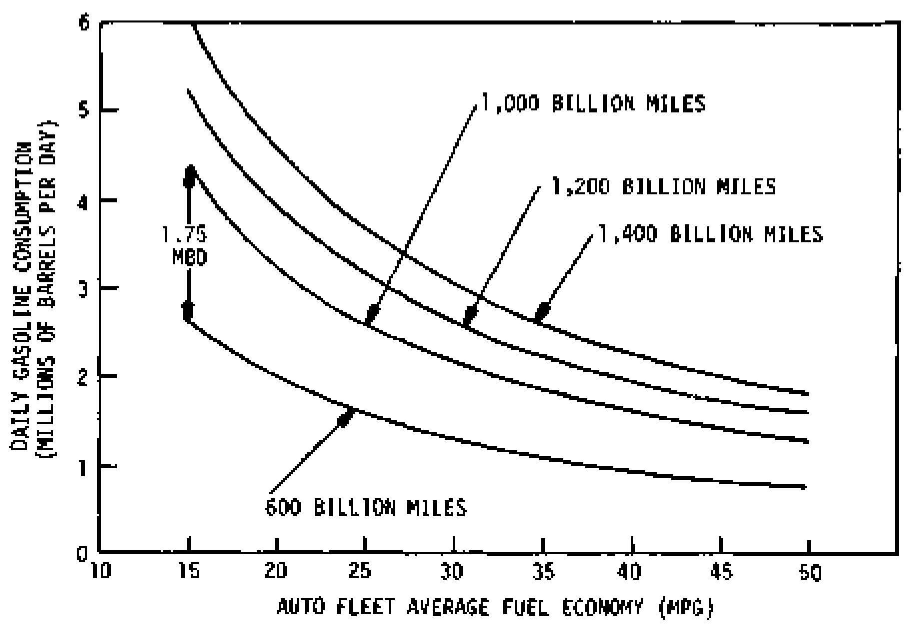
$$\text{Change in gallons consumed} = \frac{(\text{Miles traveled})(\%\ \text{improvement})}{(\text{Baseline FE})(1 + \%\ \text{improvement})}$$

EITHER AN INCREASE IN THE AVERAGE FLEET FUEL ECONOMY OF 10 MPG OR A 40% DECREASE IN THE AVERAGE NUMBER OF VEHICLE MILES TRAVELED WOULD RESULT IN A SAVINGS OF 1.75 MILLION BARRELS OF OIL PER DAY IN TODAY'S AUTOMOBILE FLEET.

Petroleum Conservation through Improvement in Auto Fleet Fuel Economy (MPG)



Petroleum Conservation through Reduction in Motor Vehicle Miles Traveled (VMT)



Source: Federal Task Force, Motor Vehicle Goals Beyond 1980, Volume 2: Task Force Report, U.S. Department of Transportation, Washington, D.C., September 2, 1976, p. 8-2. (Draft)

Sensitivity of New Car Fleet Fuel Economy
to Auto and Fleet Characteristics

BASE 1985 NEW-CAR FLEET FUEL ECONOMY	26.2 MPG
MIX: 50% 6-PASSENGER; 25% 5-PASSENGER; 25% 4-PASSENGER	
PERFORMANCE: HP/WT .03 hp/lb. (0 - 60 MPH IN 15 SEC)	
ENGINE: TOP 75 OTTO	
EMISSION/SAFETY STANDARDS: CURRENT	
INCREMENTAL CHANGES IN FLEET FUEL ECONOMY	
• REDUCE PERFORMANCE TO 17 SEC.	+ 2.4 MPG
• REDUCE PERFORMANCE TO 20 SEC.	+ 5.0 MPG
• REDUCE FRACTION OF 6-PASSENGER CARS FROM 50% TO 40%	+ 0.5 MPG
• REDUCE FRACTION OF 6-PASSENGER CARS FROM 50% TO 30%	+ 1.2 MPG
• ACCELERATE UPGRADED TRANSMISSION TO 100% IN 1985	+ 1.1 MPG
• IMPROVE OTTO ENGINE FUEL ECONOMY BY 10% STARTING IN 1980[1]	+ 1.2 MPG
• DIESELIZE 6-PASSENGER CARS STARTING IN 1980[1,2]	+ 1.3 MPG
• SHIFT TO DIESEL FLEET STARTING IN 1980[1]	+ 1.9 MPG
• ACCELERATE INNOVATIVE STRUCTURE[3]	+ 0.3 MPG
• INTRODUCTION OF SAFETY LEVEL II[6]	− 1.1 MPG
• 6% FUEL ECONOMY PENALTY FOR EMISSIONS II[4,6]	− 1.5 MPG
• 12% FUEL ECONOMY PENALTY FOR EMISSIONS III[4,6]	− 3.1 MPG
• MISCELLANEOUS WEIGHT INCREASES[5]	− 1.5 MPG

[1] PHASE-IN OF UPGRADED OTTO AND DIESELIZATION OF 6-PASSENGER CARS ASSUMED TO PHASE IN AT A RATE OF [illegible]

[2] DIESEL MPG VALUES ARE EXPRESSED AS GASOLINE EQUIVALENT GALLONS. FOR EQUIVALENT GALLONS ON A VOLUME BASIS MULTIPLY INDICATED VALUES BY [illegible]

[3] INNOVATIVE STRUCTURE PHASE-IN AT 10% / YEAR STARTING IN 1980

[4] ESTIMATES OF FUEL ECONOMY PENALTY VARY FROM NEGLIGIBLE TO THOSE SHOWN HERE.

[5] INCREASE OF [illegible] LB IN 4-PASSENGER, [illegible] LB IN 5-PASSENGER CARS TO REFLECT CUSTOMER OPTIONS AND OTHER INCREASES.

[6] *Safety: Level I: 30 MPH Frontal*
Level II: 40 MPH Frontal; 20 MPH Side

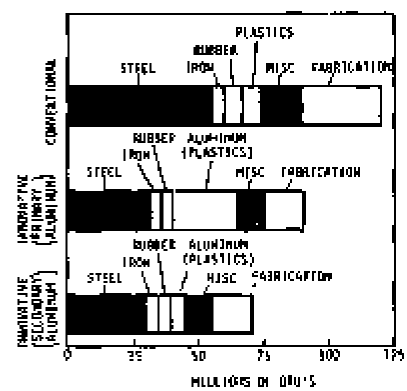
Emissions: Level I: 1.5-HC/15.0-CO/3.1-NO_x (gm/mi)
Level II: 0.41-HC/3.4-CO/2.0-NO_x (gm/mi)
Level III: 0.41-HC/3.4-CO/0.4-NO_x (gm/mi)

Source: Federal Task Force, Motor Vehicle Goals Beyond 1980, Volume 1: Executive Summary, U.S. Department of Transportation, Washington, D.C., September 2, 1976, p. 28. (Draft)

THE SENSITIVITY DATA ABOVE INDICATES THAT THERE IS A WIDE RANGE OF OPTIONS, WITH VARYING MARKETING AND TECHNICAL RISK, AVAILABLE TO ACHIEVE THE SAME FUEL ECONOMY GOALS. FOR EXAMPLE, THE FUEL ECONOMY GAINS ASSOCIATED WITH A REDUCTION IN THE SHARE OF 6-PASSENGER CARS FROM 50% TO 30% (THAT IS, 1/2 MPG), COULD ALTERNATIVELY BE ACHIEVED BY 1) THE DIESELIZATION OF LARGER CARS, 2) ACCELERATED INTRODUCTION OF AN UPGRADED DRIVETRAIN, OR 3) AN IMPROVEMENT IN OTTO ENGINE FUEL ECONOMY OF 10%. HOWEVER, THE LARGEST INCREASES IN MPG IS ASSOCIATED WITH REDUCED ACCELERATION PERFORMANCE.

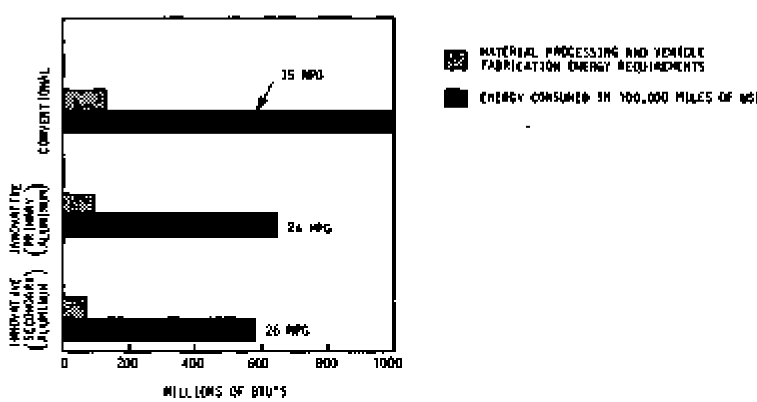
BASIC MATERIAL PROCESSING AND FABRICATION ENERGY REQUIREMENTS FOR CONVENTIAL AND INNOVATIVELY STRUCTURED AUTOMOBILES

THE USE OF PRIMARY OR SECONDARY ALUMINUM HAS A MAJOR IMPACT ON THE TOTAL ENERGY REQUIRED FOR MOTOR VEHICLE MATERIAL PROCESSING. SUBSTITUTION OF PRIMARY ALUMINUM CAN RESULT IN A 25% REDUCTION IN OVERALL ENERGY REQUIREMENTS, AND USE OF SECONDARY ALUMINUM DECREASES THE NUMBER OF BTU NECESSARY TO PRODUCE A CAR BY 42%.



Energy Required for Material Processing
and Vehicle Fabrication

THE ENERGY REQUIRED TO PROCESS AND FABRICATE THE MATERIALS WHICH ARE USED IN AN AUTOMOBILE IS ABOUT 10 TO 15% OF THE PETROLEUM-EQUIVALENT ENERGY THAT THE VEHICLES USES DURING A 100,000 MILE OPERATING LIFE.

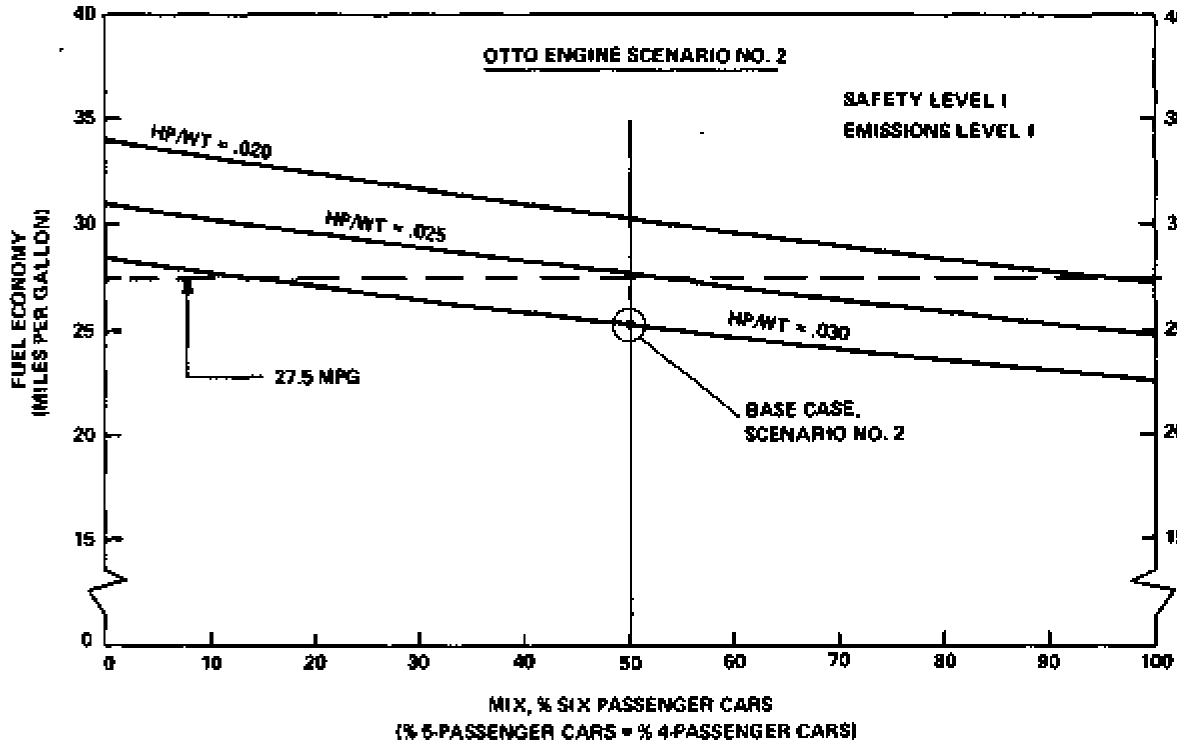


Energy Consumption in Operation of Differently
Structured Automobiles

Source: Federal Task Force, Motor Vehicle Goals Beyond 1980, Volume 2: Task Force Report, U.S. Department of Transportation, Washington, D.C., September 2, 1976, p. 6-11.

THEREFORE, BOTH TOTAL ENERGY NEEDED FOR PRODUCTION AND FOR OPERATION OVER A LIFETIME DECREASE WITH INTRODUCTION OF INNOVATIVELY STRUCTURED AUTOMOBILES.

1985 New Car Fleet Fuel Economy vs Vehicle Mix and Acceleration Performance



Source: Federal Task Force, Motor Vehicle Goals Beyond 1980, Volume 1: Executive Summary, U.S. Department of Transportation, Washington, D.C., September 2, 1976, p. 27. (Draft)

THE 1985 FUEL ECONOMY GOAL OF THE ENERGY POLICY AND CONSERVATION ACT IS INDICATED IN THE FIGURE ABOVE BY THE DASHED LINE AT 27.5 MILES PER GALLON. AT CURRENT MIX (50% 6-PASSENGER, 25% 5-PASSENGER, 25% 4-PASSENGER) AND A POWER-TO-WEIGHT RATIO OF 0.03 HP/LB (0 TO 60 MPH IN 15 SECONDS), 1985 NEW-CAR FLEET FUEL ECONOMY COULD BE 25.2 MILES/GALLON IN ORDER TO MEET THE FUEL ECONOMY STANDARD AT THIS PERFORMANCE LEVEL, THE SHARE OF 6-PASSENGER CARS MUST BE REDUCED TO ABOUT 15%. ON THE OTHER HAND, IF THE POWER-TO-WEIGHT RATIO IS REDUCED TO 0.02 HP/LB (0 TO 60 MPH IN 20 SECONDS), THE FUEL ECONOMY GOAL COULD BE ATTAINED WITH 6-PASSENGER CARS HAVING A 90% MARKET SHARE.

Effect of Common Conservation Techniques
on Vehicle Fuel Efficiency

Air conditioning

Operating speed, miles per hour	Air conditioning in use (Miles per gallon)	Air conditioning not in use (Miles per gallon)	Effect on fuel consumption caused by use of air conditioning: Reduction in miles per gallon	Effect on fuel consumption caused by use of air conditioning: Percent saving with air conditioning "off"
30	18.14	20.25	1.91	10.53
40	17.51	19.71	2.20	12.56
50	16.42	18.29	1.87	11.39
60	15.00	16.25	1.25	8.33
70	13.17	14.18	1.01	7.67

Tune ups

Operating speed miles per hour	Miles per gallon: Before tuning	Miles per gallon: After tuning	Improvement after tuning: Miles per gallon	Improvement after tuning: Percent
30	19.30	21.33	2.03	10.52
40	18.89	21.33	2.44	12.92
50	17.29	18.94	1.65	9.54
60	15.67	17.40	1.73	11.04
70	13.32	15.36	2.04	15.32

[1]All cars included in the averages in this table were equipped with air conditioning in good operating condition.

Source: E.M. Cope, U.S. Department of Transportation, Federal Highway Administration, The Effect of Speed on Automobile Gasoline Consumption Rates, Washington, D.C., October 1973, p. 8.

Energy Impacts of Transportation Conservation Measures*

Policy	Estimated energy savings (thousand barrels per day)	
	1980	1985
Increase percentage of urban travel carried by mass transit from 2.5 percent in 1973 to 5.0 percent in 1980 and 7.5 percent in 1985	52	122
Increase carpooling sufficiently to reduce work-trip auto travel by 10 percent in 1980 and 1985	69	105
Increase gasoline prices by 20 percent starting in 1975	484	700
Increase new car fuel economy from 14 mpg in 1974 to 20 mpg in 1980 and 22 mpg in 1985	568	1327

*Energy savings are calculated relative to a baseline in which auto travel is 1.2×10^{12} vehicle-miles (VM) in 1980 and 1.4×10^{12} VM in 1985, urban travel accounts for 55 percent of this total and average auto fuel economy is 14 mpg for both years and 12 mpg in urban areas. Average automobile occupancy is 2.2 PM/VM and urban occupancy is 1.6 PM/VM (PM = passenger-miles).

Source: E. Hirst, "Transportation Energy Conservation Policies," Science, 192, No. 4234 (2 April 76), p. 16.

Transportation Energy Conservation Strategies

From 1970 situation	To energy-efficient alternative	Energy savings[1] (10^{12} Btu)
	Passenger traffic: modal shifts	
Inter-city auto	Inter-city bus	1.8
Airplane	Inter-city bus	6.8
Urban auto	Mass transit	4.3
	Passenger traffic: load factor increases[2]	
Urban auto (28%)	Urban auto (38%)	2.1
Mass transit (20%)	Mass transit (30%)	1.3
Trains (37%)	Trains (47%)	0.6
	Passenger traffic: technological changes[3]	
Inter-city (auto (3400)	Inter-city auto (2300)	1.1
Urban auto (8100)	Urban auto (5400)	2.7
Airplane (8400)	Airplane (5600)	2.8
Train (2900)	Train (1900)	1.0
	Freight traffic: modal shifts	
Truck	Train	2.1
Airplane	Train	41.3

[1]Energy savings are computed on the basis of a one billion passenger-mile (or ton-mile) effect, about 0.05 percent of 1970 passenger traffic (or inter-city freight traffic).

[2]Energy savings given are for a 10 percentage point increase in load factor; numbers in parentheses are load factors.

[3]Energy savings given are for a 33 percent reduction in vehicle energy intensiveness; numbers in parentheses are energy intensiveness values in Btu's per passenger-mile.

Source: E. Hirst, "Transportation Energy Use and Conservation Potential," Science and Public Affairs, XXIX, No. 9 (November 1973), p. 41.

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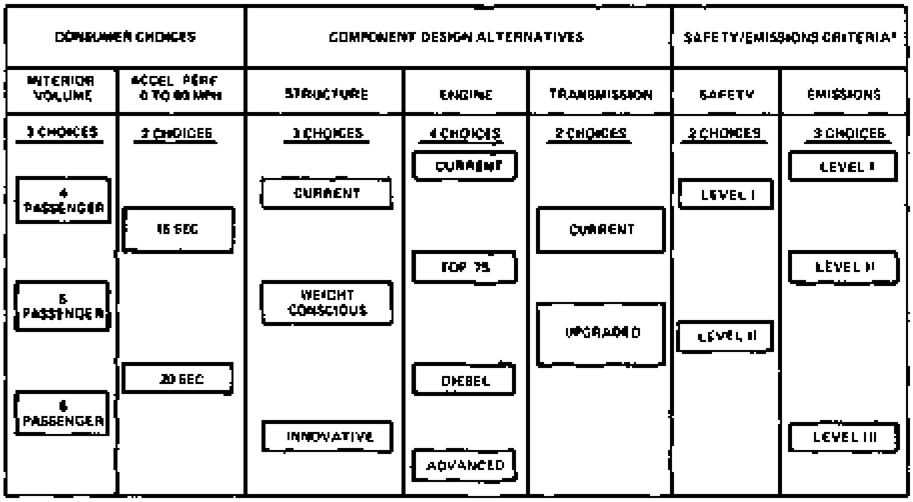
Section 3.2

Penetration Scenarios

Elements Considered in the 864 Auto Design Concepts Analyzed by the Federal Task Force on Motor Vehicle Goals Beyond 1980

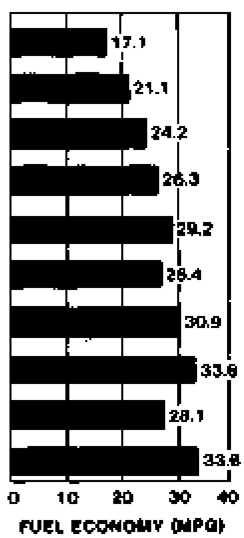


ENGINE	CURRENT AVERAGE FUEL ECONOMY PERFORMANCE FOR 1975 FLEET TOP 75 BEST FUEL ECONOMY PERFORMANCE FOR 1975 FLEET
TRANSMISSION	CURRENT 3 SPEED AUTOMATIC UPGRADED TORQUE CONVERTER 4 SPEED LOCK UP
STRUCTURE	CURRENT AVERAGE 75 WEIGHT CONSCIOUS FIRST STEP IN SIGNIFICANT WEIGHT REDUCTION WITHOUT SACRIFICING INTERIOR SPACE INNOVATIVE SECOND STEP IN WEIGHT REDUCTION UTILIZING 10% TO 15% PLASTIC/ALUMINUM SUBSTITUTION
*SAFETY	LEVEL I 30 MPH FRONTAL LEVEL II 40 MPH FRONTAL, 20 MPH SIDE
EMISSIONS	LEVEL I 1.5 HC/15.0 CO/3.1 NO_x (gm/mi) LEVEL II .41 HC/3.4 CO/2.0 NO_x (gm/mi) LEVEL III .41 HC/3.4 CO/.4 NO_x (gm/mi)

A Comparison of New-Car Fleet Fuel Economy of Ten Selected Auto Concepts

VEHICLE DESCRIPTION [1]

AUTO CONCEPT	STRUCTURE	ENGINE	DRIVETRAIN	FUEL ECONOMY (MPG)
NO. 1	CURRENT	CURRENT	CURRENT	17.1
NO. 2	WEIGHT CONSCIOUS	CURRENT	CURRENT	21.1
NO. 3	WEIGHT CONSCIOUS	TOP '75	CURRENT	24.2
NO. 4	WEIGHT CONSCIOUS	TOP '75	UPGRADED	26.3
NO. 5	INNOVATIVE	TOP '75	UPGRADED	29.2
NO. 6	WEIGHT CONSCIOUS	DIESEL	CURRENT	26.4
NO. 7	WEIGHT CONSCIOUS	DIESEL	UPGRADED	30.9
NO. 8	INNOVATIVE	DIESEL	UPGRADED	33.6
NO. 9	WEIGHT CONSCIOUS	ADVANCED [2]	CURRENT	28.1
NO. 10	INNOVATIVE	ADVANCED [2]	UPGRADED	33.8



1 Current Emission and Safety Levels; 0-60 MPH Acceleration Time - 15 seconds, basic car without special options—*Fleet Mix: 50% 6-Passenger, 25% 5-Passenger, 25% 4-Passenger Autos*
2 Data for Stirling engine have been used to represent future advanced concepts, including Brayton.

Source: Federal Task Force, Motor Vehicle Goals Beyond 1980, Volume 1: Executive Summary, p. 13, and Volume 2: Task Force Report, p. 4-3, U.S. Department of Transportation, Washington, D.C., September 2, 1976. (Draft)

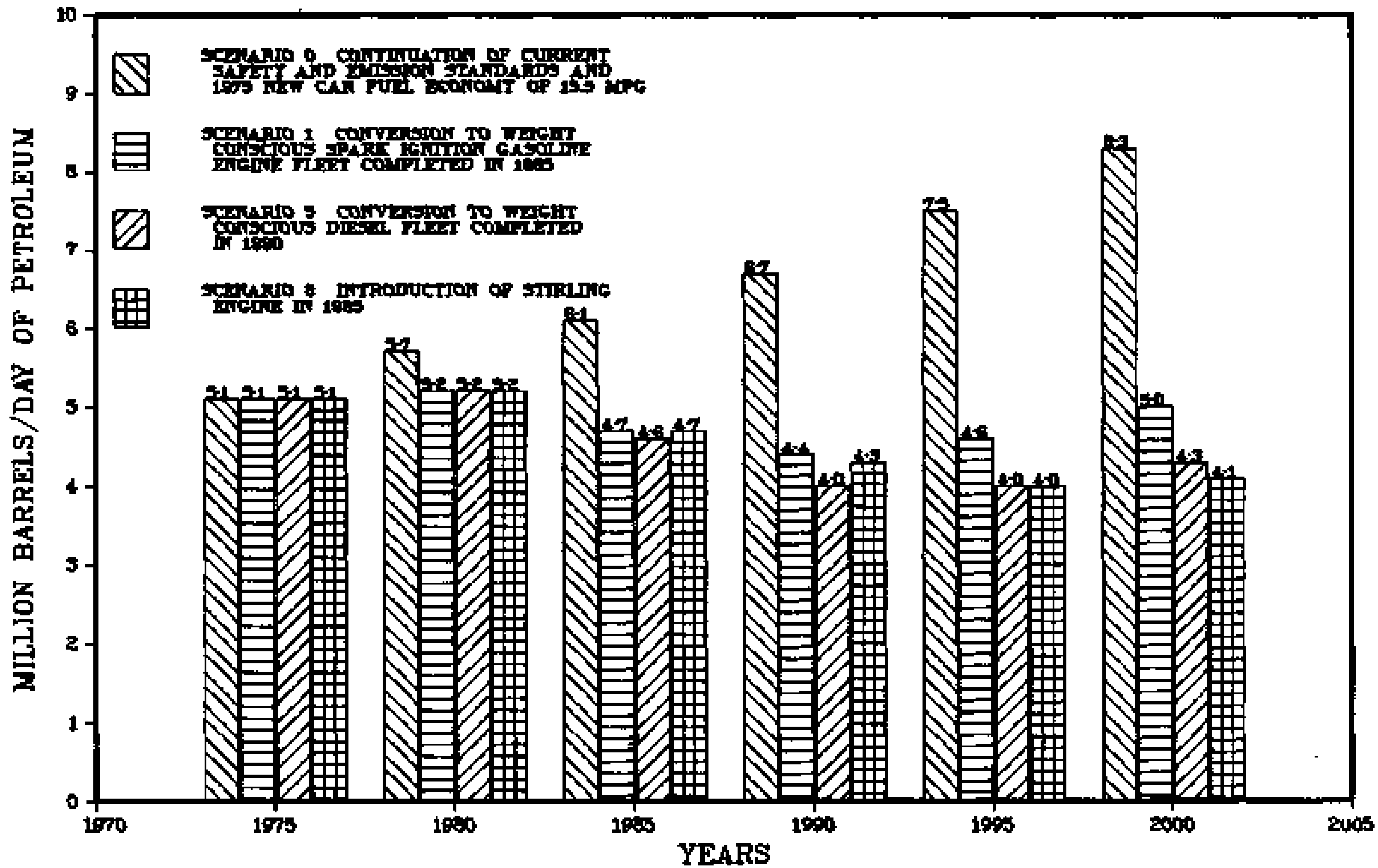
Assumptions and Characteristics for
Baseline Scenario

BASE YEAR - 1975 (APPROXIMATIONS)	BASELINE
● NO. OF AUTOS - 100 MILLION ● AVERAGE MILES/AUTO - 10,000 ● TOTAL NUMBER OF MILES TRAVELED -100,000 ● Fleet Fuel Economy-15.6 MPG ● AUTO SIZE MIX - 50% 6-PASSENGER 25% 5-PASSENGER 25% 4-PASSENGER ● DISTRIBUTION OF 100,000 MILES TRAVEL OVER TEN YEAR LIFE YEAR / MILES: 1 15,000; 2 13,000; 3 12,000; 4 10,000; 5 10,000; 6 10,000; 7 10,000; 8 8,000; 9 7,000; 10 5,000	● ANNUAL RATE OF INTRODUCTION OF CONCEPT "X" (MORE FUEL-ECONOMICAL, ETC) IS NORMALLY ASSUMED AT 10% OF NEW CAR SALES, THUS ACCUMULATING TO 100% OF PRODUCTION IN 10 YEARS ● NEW-CAR SALES INCREASE AT AN ANNUAL RATE OF 2% ● AUTOMOBILE SALES MIX ASSUMED TO REMAIN AT 1975 VALUES (50% 6-PASSENGER, 25% 5-PASSENGER AND 25% 4-PASSENGER CARS) ● DISTRIBUTION OF AUTO USAGE WITH AGE FOLLOWS HISTORIC PATTERN ● VEHICLE MILES TRAVELED (VMT) (FOLLOWING THE DRI LONG-RUN ECONOMIC GROWTH PROJECTIONS) INCREASE AT ABOUT 2% PER YEAR

YEAR	MILES	YEAR	MILES
1	15,000	6	10,000
2	13,000	7	10,000
3	12,000	8	8,000
4	10,000	9	7,000
5	10,000	10	5,000

Source: Federal Task Force, Motor Vehicle Goals Beyond 1980, Volume 2: Task Force Report, U.S. Department of Transportation, Washington, D.C., September 2, 1976, p. 4-5. (Draft)

PROJECTED FLEET FUEL CONSUMPTION FOR SELECTED AUTO DESIGN CONCEPTS



Source: Federal Task Force, Motor Vehicle Goals Beyond 1980, Volume 2: Task Force Report, Chapter 8, U.S. Department of Transportation, Washington, D.C., September 2, 1976. (Draft)

Projecting Energy Demand by the Transportation Sector: A Discussion of Three Methodologies[1]

Project Independence projections[2]

Three projections of transportation energy demand were made by Jack Faucett Associates for the Project Independence study on the alternatives for national energy independence. These projections, or "scenarios" are based on three different prices for crude oil. The $4 per barrel scenario estimates the demand for energy that might result if oil prices were to remain at the pre-embargo level. Projections were also made with the price of crude oil at $7 and $11 per barrel. All three projections are based on detailed analyses of past trends in energy use by the transportation sector and likely changes in the future.

The Project Independence forecasts are made with data compiled by the Federal Highway Administration, the Department of Transportation, and other government offices. Consideration is given to the efficiency with which fuel is used to transport passengers by auto, bus, rail, air and water; and freight by truck, rail, air, water, and pipeline. Changes in fuel use efficiencies are considered explicitly through detailed analyses of vehicle stocks. Future demand is estimated using projections of passenger miles to be traveled and ton miles of freight to be transported by each mode. Distinctions are made between rural (intercity) and urban (local) transportation, and by types of fuel consumed. Project Independence forecasts energy use out to the year 1990.

Reference Energy System projections[3]

The ERDA projections of energy demand were made using the "Reference Energy System" developed by the Brookhaven National Laboratory. The Reference Energy System analyzes energy flows with a link-node network approach. Energy demand by resource type is estimated by process (e.g., extraction, distribution) and end-use category (e.g., space heating and steel making). End-use demand is specified in terms of services, such as passenger miles to be traveled, square feet of floor space to be heated and cooled, tons of steel to be made, etc., and estimated according to assumed technologies. These demand and supply assumptions are developed independently of the model on the basis of engineering, demographic, and economic data. Any domestic energy supply limitations are made up by imports.

A total of six scenarios are presented in the reference cited. The first scenario, titled "No New Initiatives," attempts to portray what future energy demands would be like if there were no change in the efficiency of energy use. Projection number two assumes certain improvements in end-use efficiencies. Synthetic fuels from coal and shale are substituted for conventional fuels in the third scenario. The fourth projection assumes a shift toward increased use of electric power and the fifth projection assumes less use of nuclear power. Finally, scenario number six combines the more favorable aspects of the preceding five projections to portray an optimistic future of slow growth in energy consumption.

Energy Policy Project projections[4]

Three projections of energy demand were made by the Energy Policy Project: a "Historical Growth" projection, a "Technical Fix" projection, and a "Zero Energy Growth" projection. The methodology employed in each projection is similar to that of the Project Independence effort, in that a detailed analysis of future energy demand by end use was made. The Historical Growth projection estimates future energy demands on the basis of past trends in energy consumption and a high growth economy. Increased efficiencies in end-uses are assumed for the Technical Fix projection. The Zero Energy Growth projection places even more emphasis on increased efficiencies, and reflects a declining rate of growth in energy use, which slows to zero by 1990, while GNP continues to increase at respectable rates.

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[1]This discussion is taken from a paper prepared for the Data Analysis Branch in the Transportation Energy Conservation Section of the Energy Research and Development Administration. See Energy Demand by the Transportation Sector in 1985 and 2000: A Comparison of Five Studies by Ralph M. Doggett of the International Research and Technology Corporation.

[2]Project Independence Task Force Report, "Project Independence and Energy Conservation: Transportation Sectors," Federal Energy Administration, November 1974.

[3]"A National Plan for Energy Research, Development, and Demonstration: Creating Energy Choices for the Future," U.S. Energy Research and Development Administration, June 1975.

[4]A Time to Choose, Final Report by the Energy Policy Project of the Ford Foundation, 1974.

Energy Demand by the Transportation Sector in 1985 and 2000:
A Comparison of Three Studies

1985 PROJECTIONS			Project Independence			ERDA-48			Ford Foundation Energy Policy Project		
Line	Description	Units	$4/ bbl oil	$7/ bbl oil	$11/ bbl oil	No new initi- atives	Improved effici- encies	Combina- tion of all tech- nologies	Histor- ical growth	Tech- nical fix	Zero energy growth
1.	Total energy demand	Quadrillion BTU's	118.3	109.6	102.9	105.8	95.5	96.6	116.1	91.3	88.1
2.	Transportation energy demand	Quadrillion BTU's	25.9	23.6	22.8	22.8	20.7	20.6	26.0	19.6	18.4
3.	Transportation as a % of total	%	21.9	21.5	22.2	21.6	21.7	21.3	22.4	21.5	20.9
4.	Passenger trans. energy demand	Quadrillion BTU's	18.0	16.0	15.4				15.7	10.2	9.2
5.	Freight trans. energy demand	Quadrillion BTU's	7.2	6.9	6.6				7.8	7.1	6.8
6.	Other trans. energy demand	Quadrillion BTU's	0.7	0.7	0.7				2.6	2.6	2.4
7.	Passenger as a % of total transport	%	69.5	67.8	67.5				60.2	51.3	50.0
8.	Freight as a % of t.t.	%	27.8	29.2	28.9				29.9	35.7	37.0
9.	Other as a % of t.t.	%	2.7	3.0	3.1				10.0	13.1	13.0
10.	Auto. energy demand	Quadrillion BTU's	13.2	11.7	11.4	10.5	9.8	9.8	12.5	7.5	7.0
11.	Truck energy demand	Quadrillion BTU's	6.3	5.9	5.7				5.3	5.0	5.0
12.	Bus energy demand	Quadrillion BTU's	0.1	0.1	0.1	4.9	4.4	4.4	0.2	0.2	0.5
13.	Rail energy demand	Quadrillion BTU's	0.7	0.7	0.7				1.0	1.0	1.1
14.	Air energy demand	Quadrillion BTU's	3.9	3.4	3.2	6.2	5.3	5.3	4.4	3.3	2.2
15.	Water energy demand	Quadrillion BTU's	0.8	0.8	0.8	1.2	1.2	1.2			
16.	Pipeline energy demand	Quadrillion BTU's	0.1	0.1	0.1	0.1	0.1	0.1	2.6	2.6	2.6
17.	Other energy demand	Quadrillion BTU's	0.7	0.7	0.7						
18.	Auto. as a % of total trans.	%	51.2	50.0	50.2	45.9	47.3	47.6	48.1	38.3	38.0
19.	Truck as a % of t.t.	%	24.4	25.2	25.1				20.4	25.5	27.2
20.	Bus as a % of t.t.	%	0.4	0.4	0.4	21.4	21.3	21.4	0.8	1.0	2.7
21.	Rail as a % of t.t.	%	2.7	3.0	3.1				3.8	5.1	6.0

Energy Demand by the Transportation Sector in 1985 and 2000:
A Comparison of Three Studies (Continued)

Line	1985 PROJECTIONS (continued) Description	Units	Project Independence $4/ bbl oil	$7/ bbl oil	$11/ bbl oil	ERDA-48 No new initi-atives	Improved effici-encies	Combina-tion of all tech-nologies	Ford Foundation Energy Policy Project Histor-ical growth	Tech-nical fix	Zero energy growth
22.	Air as a % of t.t.	%	15.1	14.5	14.1	27.1	25.6	25.7	16.9	16.8	12.0
23.	Water as a % of t.t.	%	3.1	3.4	3.5	5.2	5.8	5.8			
24.	Pipeline as a % of t.t.	%	0.4	0.4	0.4	0.4	0.5	0.5	10.0	13.3	14.1
25.	Other as a % of t.t.	%	2.7	3.0	3.1						
26.	Auto MPG's — Natl. Av.	MPG's	16.1	17.8	17.9	17.5	18.7	18.7	12.5	20.0	
27.	Air MPG's — passenger	MPG's	20.3	21.9	23.8	17.0	19.6	19.6			
28.	Air ton miles per gal.	MPG's				5.2	6.0	6.0			
29.	Trans. demand — residual oil	Quadrillion BTU's	0.8	0.8	0.8						
30.	Trans. demand — distillate oil	Quadrillion BTU's	2.7	2.6	2.5						
31.	Trans. demand — jet fuel	Quadrillion BTU's	4.3	3.8	3.6	22.6	20.5	20.5			
32.	Trans. demand — gasoline	Quadrillion BTU's	18.0	16.2	15.7						
33.	Trans. demand — electricity	Quadrillion BTU's	0.14	0.15	0.16	0.17	0.17	0.17			
34.	Trans. demand — other fuels	Quadrillion BTU's	0.02	0.02	0.02						
35.	Residual oil as a % of total trans.	%	3.1	3.4	3.5						
36.	Distillate oil as a % of total trans.	%	10.4	11.0	11.0						
37.	Jet fuel as a % of total trans.	%	16.6	16.1	15.8	99.3	99.2	99.2			
38.	Gasoline as a % of total trans.	%	69.3	68.7	68.9						
39.	Electricity as a % of total trans.	%	0.5	0.6	0.7	0.7	0.8	0.8			
40.	Other fuels as a % of total trans.	%	0.1	0.1	0.1						

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Energy Demand by the Transportation Sector in 1985 and 2000:
A Comparison of Three Studies (Continued)

Line	Description	Units	Project Independence			ERDA-48			Ford Foundation Energy Policy Project		
1985 PROJECTIONS (continued)			$4/ bbl oil	$7/ bbl oil	$11/ bbl oil	No new initi- atives	Improved effici- encies	Combina- tion of all tech- nologies	Histor- ical growth	Tech- nical fix	Zero energy growth
41.	Total passenger miles	Billion PMT's	3896	3837	3760				2738	2738	2618
42.	Auto passenger miles	Billion PMT's	3517	3461	3387				2159	2159	2063
43.	Bus passenger miles	Billion PMT's	72	72	72	112	112	112	97	97	194
44.	Rail passenger miles	Billion PMT's	32	32	32				19	19	35
45.	Air passenger miles	Billion PMT's	274	272	269	421	421	421	494	494	329
46.	Auto PMT's as a % of total PMT's	%	90.3	90.2	90.1				78.9	78.9	78.8
47.	Bus PMT's as a % of total PMT's	%	1.8	1.9	1.9				3.5	3.5	7.4
48.	Rail PMT's as a % of total PMT's	%	0.8	0.8	0.9				0.7	0.7	1.3
49.	Air PMT's as a % of total PMT's	%	7.0	7.1	7.2				18.0	18.0	12.6
50.	Total freight ton miles	Billion TMT's	3467	3469	3470				2266	2266	2362
51.	Truck freight ton miles	Billion TMT's	757	763	766	724	724	724	895	775	659
52.	Rail freight ton miles	Billion TMT's	1034	1034	1033				1340	1460	1460
53.	Air freight ton miles	Billion TMT's	19	14	11	30	30	30	31	31	27
54.	Water freight ton miles	Billion TMT's	869	802	737						
55.	Pipeline freight ton miles	Billion TMT's	788	856	923						
56.	Truck TMT's as a % of total TMT's	%	21.8	22.0	22.1				39.5	34.2	27.9
57.	Rail TMT's as a % of total TMT's	%	29.8	29.8	29.8				59.1	64.4	61.8
58.	Air TMT's as a % of total TMT's	%	0.5	0.4	0.3				1.4	1.4	0.9
59.	Water TMT's as a % of total TMT's	%	25.1	23.1	21.2						
60.	Pipeline TMT's as a % of total TMT's	%	22.7	24.7	26.6						
61.	GNP	Billions $ (1971)	1842	1842	1842				2064	2030	2031
62.	Total BTU/$	Thousand	64	60	56				56	45	43
63.	Trans BTU/$	Thousand	14	13	12				13	10	9

Con't.

Energy Demand by the Transportation Sector in 1985 and 2000:
A Comparison of Three Studies (Continued)

Line	Description	Units	ERDA-48: No new initiatives	ERDA-48: Improved efficiencies	ERDA-48: Combination of all technologies	Ford Foundation Energy Policy Project: Historical growth	Ford Foundation Energy Policy Project: Technical fix	Ford Foundation Energy Policy Project: Zero energy growth	Row averages
2000 PROJECTIONS									
1.	Total energy demand	Quadrillion BTU's	165.5	122.5	137.0	186.7	124.0	100.0	136.6
2.	Transportation energy demand	Quadrillion BTU's	32.3	25.6	25.3	38.4	24.7	17.2	27.6
3.	Transportation as a % of total	%	19.5	20.9	18.5	20.6	19.9	17.2	20.2
4.	Passenger transportation energy demand	Quadrillion BTU's				21.7	10.5	6.7	
5.	Freight transportation energy demand	Quadrillion BTU's				13.5	11.0	7.6	
6.	Other transportation energy demand	Quadrillion BTU's				3.2	3.2	2.9	
7.	Passenger as a % of total transportation	%				56.5	42.5	40.0	
8.	Freight as a % of total transportation	%				35.2	44.5	44.2	
9.	Other as a % of total transportation	%				8.3	13.0	16.9	
10.	Automobile energy demand	Quadrillion BTU's	12.8	9.2	8.9	15.2	6.8	3.8	9.5
11.	Truck energy demand	Quadrillion BTU's				6.5	4.4	3.7	6.0
12.	Bus energy demand	Quadrillion BTU's	9.1	7.4	7.4	0.2	0.2	1.0	0.4
13.	Rail energy demand	Quadrillion BTU's				1.7	1.9	1.7	1.6
14.	Air energy demand	Quadrillion BTU's	8.6	7.3	7.3	11.6	8.2	4.1	7.3
15.	Water energy demand	Quadrillion BTU's	1.6	1.6	1.6				1.3
16.	Pipeline energy demand	Quadrillion BTU's	0.1	0.1	0.1	3.2	3.2	2.9	0.6
17.	Other energy demand	Quadrillion BTU's							1.8
18.	Automobile as a % of total	%	41.1	35.9	35.2	39.6	27.5	22.1	
19.	Truck as a % of total	%				16.9	17.8	21.5	
20.	Bus as a % of total	%	28.3	28.9	29.2	0.5	0.8	5.8	
21.	Rail as a % of total	%				4.4	7.7	9.9	
22.	Air as a % of total	%	26.7	28.5	28.9	30.2	33.2	23.8	

Con't.

Energy Demand by the Transportation Sector in 1985 and 2000:
A Comparison of Three Studies (Continued)

2000 PROJECTIONS			ERDA-48			Ford Foundation Energy Policy Project			
Line	Description	Units	No new initiatives	Improved efficiencies	Combination of all technologies	Historical growth	Technical fix	Zero energy growth	Row averages
23.	Water as a % of total	%	5.0	6.3	6.3				
24.	Pipeline as a % of total	%	0.3	0.4	0.4	8.3	13.0	16.9	
25.	Other as a % of total	%							
26.	Auto MPG's — national average	MPG's	20.0	28.0	28.0	11.4	25.0	33.0	25.7
27.	Air passenger MPG's — national average	PMPG's	20.0	23.0	23.0				
28.	Air ton miles per gallon	TMPG's	6.8	7.8	7.8				
29.	Transportation demand — residual oil	Quadrillion BTU's							
30.	Transportation demand — distillate oil	Quadrillion BTU's	32.1	25.4	25.1				27.0
31.	Transportation demand — jet fuel	Quadrillion BTU's							
32.	Transportation demand — gasoline	Quadrillion BTU's							
33.	Transportation demand — electricity	Quadrillion BTU's	0.2	0.2	0.2				0.3
34.	Transportation demand — other fuels	Quadrillion BTU's							
35.	Residual oil as a % of total	%							
36.	Distillate oil as a % of total	%	99.4	99.2	99.2				
37.	Jet fuel as a % of total	%							
38.	Gasoline as a % of total	%							
39.	Electricity as a % of total	%	0.6	0.8	0.8				
40.	Other fuels as a % of total	%							
41.	Total passenger miles	Billion PMT's				3676	3676	3014	3805
42.	Auto passenger miles	Billion PMT's				2494	2494	2006	2931
43.	Bus passenger miles	Billion PMT's	161	161	161	39	39	333	128
44.	Rail passenger miles	Billion PMT's				33	108	157	126
45.	Air passenger miles	Billion PMT's	874	874	874	1110	1037	518	715
46.	Auto PMT's as a % of total	%				67.8	67.8	66.6	
47.	Bus PMT's as a % of total	%				1.1	1.1	11.0	

Con't.

Energy Demand by the Transportation Sector in 1985 and 2000:
A Comparison of Three Studies (Continued)

2000 PROJECTIONS			ERDA-48			Ford Foundation Energy Policy Project			
Line	Description	Units	No new initiatives	Improved efficiencies	Combination of all technologies	Historical growth	Technical fix	Zero energy growth	Row averages
48.	Rail PMT's as a % of total	%				0.9	2.9	5.2	
49.	Air PMT's as a % of total	%				30.2	28.2	17.2	
50.	Total freight ton miles	Billion TMT's							
51.	Truck ton miles	Billion TMT's	1040	1040	1040	1121	821	698	987
52.	Rail ton miles	Billion TMT's				2340	2640	2250	2235
53.	Air ton miles	Billion TMT's	99	99	99	105	100	50	71
54.	Water ton miles	Billion TMT's							
55.	Pipeline ton miles	Billion TMT's							
56.	Truck TMT's as a % of total	%							
57.	Rail TMT's as a % of total	%							
58.	Air TMT's as a % of total	%							
59.	Water TMT's as a % of total	%							
60.	Pipeline TMT's as a % of total	%							
61.	GNP	Billion $ ('71)				3345	3219	3227	3025
62.	Total BTU/$	Thousand				56	39	31	44

Source: R. M. Doggett, International Research and Technology Corporation, Energy Demand by the Transportation Sector in 1985 and 2000: A Comparison of Five Studies, Washington, D.C., May 11, 1976, pp. 7-9, 11 and 12. (Draft)

Modal Passenger-Mile Fuel Efficiency Under Three Price Scenarios
(passenger-miles per gallon)

	1972	1980			1985			1990		
		$4	$7	$11	$4	$7	$11	$4	$7	$11
Local										
Auto: Commuting	17.85	19.20	20.10	20.10	20.10	22.50	22.80	20.10	23.25	23.55
Business	20.23	21.76	22.78	22.78	22.78	25.50	25.84	22.78	26.35	26.69
Family	26.18	28.16	29.48	29.48	29.48	33.00	33.44	29.48	34.10	34.54
Social	29.75	32.00	33.50	33.50	33.50	37.50	38.00	33.50	38.75	39.25
Bus transit	78.56	89.50	89.50	89.50	89.50	89.50	89.50	89.50	89.50	89.50
Rail rapid transit[1]	45.23 (3.80)	48.48 (3.80)	48.48 (3.80)	48.48 (3.80)	50.05 (3.80)	50.05 (3.80)	50.05 (3.80)	51.67 (3.80)	51.67 (3.80)	51.67 (3.80)
Commuter rail[1]	36.03 (3,849)	43.17 (3,213)	43.17 (3,213)	43.17 (3,213)	44.59 (3,110)	44.59 (3,110)	44.59 (3,110)	46.57 (2,978)	46.57 (2,978)	46.57 (2,978)
Intercity										
Auto	47.58	51.22	53.30	53.30	54.34	59.54	59.80	53.82	61.88	62.14
Air	15.00	15.30	16.30	17.70	15.50	17.10	18.00	15.80	16.30	18.30
Rail[1]	36.03 (3,849)	43.17 (3,213)	43.17 (3,213)	43.17 (3,213)	44.59 (3,110)	44.59 (3,110)	44.59 (3,110)	46.57 (2,978)	46.57 (2,978)	46.57 (2,978)
Bus	117.97	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00

[1]Passenger-miles per gallon of diesel equivalent. For rail rapid transit, pmpg is calculated from PM/KWH, shown in parentheses. For rail and commuter rail, pmpg is calculated from BTU/PM, shown in parentheses. Conversion for electricity, in BTU/KWH are:

1972:	11,650
1980:	10,872
1985:	10,529
1990:	10,199

Changes in the conversion factor over time reflect estimates of improved efficiency in the heat rates of utility plants. The electricity input BTU measures (i.e., including electricity BTU conversion losses) are used to improve comparability with the energy intensiveness measures of modes which consume fuels directly.

Source: Federal Energy Administration, Project Independence Blueprint: Final Task Report-Inputs to the Project Independence Evaluation System Integration Model for the Transport of Energy Materials, Volume II, Washington, D.C., November 1974, p. S-20.

Energy Consumption for Passenger Travel Under Three Price Scenarios
(10^{12} Btu)

Passenger modes	1972	1980			1985			1990		
		$4	$7	$11	$4	$7	$11	$4	$7	$11
Local										
Auto[1]	6,653.2	8,577.1	8,094.4	7,965.5	9,884.2	8,724.7	8,474.2	11,938.4	10,198.8	9,912.5
Bus transit	39.8	49.5	49.0	48.4	59.8	59.3	58.6	72.3	71.6	70.8
Rail rapid transit[2]	8.3	13.9	13.8	13.8	19.0	19.0	18.9	23.2	23.1	23.1
Commuter rail[2]	12.2	11.8	11.7	11.6	14.0	14.0	13.9	16.5	16.4	16.3
Subtotal, local	6,713.5	8,652.3	8,168.9	8,039.3	9,977.0	8,817.0	8,565.6	12,050.4	10,309.9	10,022.7
Intercity										
Auto	2,423.6	3,002.2	2,831.2	2,761.4	3,326.8	2,981.6	2,895.2	3,950.7	3,374.8	3,281.7
Air carrier (domestic)	1,071.3	1,781.8	1,666.1	1,517.0	2,387.2	2,144.0	2,016.3	3,119.1	2,992.4	2,623.1
Rail[2]	13.3	11.6	11.7	11.8	12.4	12.4	12.5	13.2	13.1	13.1
Bus	29.7	34.7	35.2	35.8	38.8	39.1	39.7	43.7	44.0	44.3
Subtotal, intercity	3,537.9	4,830.3	4,544.2	4,326.0	5,765.2	5,177.1	4,963.7	7,126.7	6,424.3	5,962.2
Other										
General aviation	90.3	123.4	119.6	115.8	150.7	146.4	141.5	186.8	181.6	175.7
International air	240.8	460.4	419.4	377.2	653.7	593.8	535.3	890.4	811.0	730.2
Personal use of trucks	911.0	1,161.7	1,096.3	1,076.2	1,325.4	1,174.5	1,140.7	1,594.2	1,361.9	1,323.7
Motorcycles	42.7	54.5	51.4	50.4	62.1	55.0	53.5	74.7	63.7	62.0
School and other bus	45.8	42.3	42.3	42.3	44.9	44.9	44.9	47.5	47.5	47.5
Subtotal, other	1,330.6	1,842.3	1,729.0	1,661.9	2,236.8	2,014.6	1,915.9	2,793.6	2,465.7	2,339.1
Total Passenger	11,582.0	15,324.9	14,442.1	14,027.2	17,979.0	16,008.7	15,445.2	21,970.7	19,199.9	18,324.0

[1] Includes taxis, which account for approximately 2 percent of local auto energy consumption in 1972.
[2] Electricity converted to BTU's at rate of 3412 BTU/KWH.

Source: Federal Energy Administration, Project Independence Blueprint: Final Task Report-Inputs to the Project Independence Evaluation System Integration Model for the Transport of Energy Materials, Volume II, Washington, D.C., November 1974, p. S-21.

Energy Consumption for Freight Transportation
Under Three Price Scenarios
(10^{12} Btu)

Freight modes	1972	1980			1985			1990		
		$4	$7	$11	$4	$7	$11	$4	$7	$11
Domestic freight										
Railroads	556	587	588	590	650	651	652	720	720	719
Domestic water	300	373	346	319	417	387	358	466	431	396
For-hire truck local	81	107	104	101	125	121	117	147	142	138
For-hire truck intercity	587	792	761	723	910	875	835	1,045	1,004	959
Private truck local	415	584	566	549	693	672	651	817	793	768
Private truck intercity	433	527	501	474	604	573	543	691	657	622
Air - domestic	109	343	234	202	505	374	294	745	606	504
Pipelines	86	101	109	117	116	125	133	132	142	152
Subtotal, domestic freight	2,567	3,414	3,209	3,075	4,020	3,778	3,583	4,763	4,495	4,258
International freight										
Overseas water	303	403	403	403	432	432	432	478	478	478
Air - international	98	142	142	142	182	182	182	224	225	224
Subtotal, international freight	401	545	545	545	614	614	614	702	702	702
Other										
Non-freight trucking	1,375	1,971	1,911	1,852	2,350	2,280	2,209	2,808	2,724	2,640
Government trucking	126	185	179	174	223	216	209	270	262	253
Subtotal, other	1,501	2,156	2,090	2,026	2,573	2,496	2,418	3,078	2,986	2,893
Total Freight	4,469	6,115	5,844	5,646	7,207	6,888	6,615	8,543	8,183	7,853

Source: Federal Energy Administration, _Project Independence Blueprint: Final Task Report-Inputs to the Project Independence Evaluation System Integration Model for the Transport of Energy Materials_, Volume II, Washington, D.C., November 1974, p. S-37.

Projected Energy Consumption by Selected Reference Energy System[1] Scenarios (10^{12} Btu)

	1985	2000	% Change 1985-2000
Scenario 0 no new initiatives			
Energy consumption	22.63	32.10	41.8
Automobile (gasoline engine)	10.48	12.84	22.5
Air transport (gas turbine)	6.22	8.63	38.7
Bus, truck, rail (I-C engine)	4.70	8.91	89.6
Ship	1.17	1.62	38.5
Pipelines	0.06	0.10	66.7
Scenario I improved efficiencies in end use			
Energy consumption	20.55	25.35	23.3
Automobile (gasoline engine)	9.81	9.17	6.5
Air transport (gas turbine)	5.28	7.33	38.8
Bus, truck, rail (I-C engines)	4.23	7.13	68.6
Ship	1.17	1.62	38.5
Pipelines	0.06	0.10	66.7
Scenario III intensive electrification			
Energy consumption	22.25	30.67	37.8
Automobile (gasoline engine)	10.38	11.55	11.3
Automobile (battery)	0.05	0.64	1180.0
Air transport (gas turbine)	6.22	8.63	38.7
Bus, truck, rail (I-C engines)	4.37	8.13	86.0
Ship	1.17	1.62	38.5
Pipelines	0.06	0.10	66.7
Scenario V combination of all technologies			
Energy consumption	20.45	24.43	19.5
Automobile (gasoline engine)	9.71	8.25	15.0
Automobile (battery)	.05	.64	1180.0
Air transport (gas turbine)	5.28	7.33	38.8
Bus, truck, rail (I-C engines)	4.23	7.13	68.6
Ship	1.17	1.62	38.5
Pipelines	0.06	0.10	66.7

[1] Projections made with the Reference Energy System model do not represent forecasts of the future. Rather they provide an indication of the relative impact of various strategies for achieving long-term national energy goals and are valuable in establishing the priorities for technological options.

Source: Energy Research and Development Administration, A National Plan for Energy Research, Development & Demonstration: Creating Energy Choices for the Future, Volume 1: The Plan, Report No. ERDA-48, Washington, D.C., June 1975.

Potential Energy Savings in Transportation:* Zero Energy Growth vs. Technical Fix (TF)
(quadrillion Btu)

	1985	2000	
Transportation energy use in TF scenario	21	27	
Potential savings			Conservative measures
Auto	--	1.9	Improve fuel economy to 33 mpg by 2000
	0.2	0.1	Shift urban traffic to buses: 10% by 1985; 25% by 2000
	--	0.2	Expand new communities
	--	0.3	Shift 10% of urban traffic to walkways and bikeways by 2000
Subtotal	0.2	2.5	
Air	1.2	4.5	Assume slower growth in air transport (3% per year for passenger travel and 6% per year for freight)
Trucks	--	0.8	15% reduction in freight hauling requirements by 2000
Rail	--	0.1	Passenger transport increases at 10% per year after 1975
		0.3	15% reduction in rail freight requirements by 2000
Total savings	1.4	8.0	
Transportation energy use in ZEG scenario	20	19	

* The transportation sector's share of energy processing losses are included in these numbers.

Source: S.D. Freeman, Energy Policy Project of the Ford Foundation, A Time to Choose - America's Energy Future, Ballinger Publishing Company, Cambridge, Mass., 1974, p. 100.

Potential Energy Savings in Transportation:* Technical Fix vs. Historical Growth (quadrillion Btu)

	1985	2000	
Transportation energy use in HG scenario	29	43	
Potential savings			Conservative measures
Auto	5.9	9.9	Improve fuel economy to 20 mpg by 1985 and to 25 mpg by 2000
Air	1.1	2.9	Increase passenger load factor to 67% and ton load factor to 58%
	0.2	0.5	Reduce flight speeds 6%
	--	0.4	Shift short run (less than 400 miles) passenger trips to highspeed rail
	--	0.3	Shift short run (less than 400 miles) freight to truck and rail
Subtotal	1.3	4.1	
Trucks	--	1.6	Shift gasoline fueled trucks to diesel
	0.2	0.6	Shift intercity traffic to rail: 20% in 1985, 40% in 2000
Subtotal	0.2	2.2	
Total savings	7.4	16.2	
Transportation energy use in TF scenario	22	27	

* The transportation sector's share of all energy processing losses are included in these numbers.

Source: S.D. Freeman, Energy Policy Project of the Ford Foundation, A Time to Choose - America's Energy Future, Ballinger Publishing Company, Cambridge, Mass., 1974, p. 58.

Estimated Vehicles, Travel, and Gasoline Consumption Based on Federal Highway Administration's Assumption Number 1[1]

Year and automobile size	Number automobiles	Annual miles per vehicle	Total vehicle-miles (automobiles)	Miles per gallon	Total gasoline consumption	Gallons per vehicle
	(millions)		(billions)		(billion gals)	
1972						
Standard	63.0	10,370	653.3	12.0	54.3	
Compact	22.0	10,000	220.0	16.0	13.7	
Economy	11.9	9,500	113.1	22.0	5.1	
Total	96.9	10,184	986.4	13.49	73.1	755
1980						
Standard	57.1	10,370	592.1	12.0	49.3	
Compact	30.9	10,000	309.0	16.0	19.3	
Economy	29.5	9,500	280.3	22.0	12.7	
Total	117.5	10,054	1,181.4	14.5	81.3	692
1985						
Standard	36.8	10,370	381.6	12.0	31.8	
Compact	40.2	10,000	402.0	16.0	25.1	
Economy	50.4	9,500	478.8	22.0	21.8	
Total	127.4	9,909	1,262.4	16.0	78.7	618
1990						
Standard	21.8	10,370	226.1	12.0	18.8	
Compact	40.1	10,000	407.0	16.0	25.4	
Economy	73.8	9,500	701.1	22.0	31.9	
Total	136.3	9,789	1,334.2	17.5	76.1	558
1990/1972	+40.7%	-3.9%	+35.3% (1.7% compounded annually)	+29.7%	+4.1%	

[1]The average annual vehicle-miles and miles per gallon for each vehicle size that existed in 1972 will remain constant so total vehicle-miles and total fuel consumption will be a function of those factors. The shift in car sizes is in accordance with estimates in Table 1.2.1.04.

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Travel Forecasts, Washington, D.C., November 1974, p. 62.

Estimated Vehicles, Travel, and Gasoline Consumption Based on Federal Highway Administration's Assumption Number 2[1]

Year automobile size	Number automobiles	Annual miles per vehicle	Total vehicle-miles (automobiles)	Miles per gallon	Total gasoline consumption	Gallons per vehicle
	(millions)		(billions)		(billion gals)	
1972						
Standard	63.0	10,370	653.3	12.0	54.3	
Compact	22.0	10,000	220.0	16.0	13.7	
Economy	11.9	9,500	113.1	22.0	5.1	
Total	96.9	10,184	986.4	13.49	73.1	755
1980						
Standard	57.1	10,370	592.1	12.0	49.3	
Compact	30.9	10,300	318.3	16.0	19.9	
Economy	29.5	9,700	286.2	22.0	13.0	
Total	117.5	10,184	1,196.6	14.6	82.2	700
1985						
Standard	36.8	10,405	382.9	12.0	31.9	
Compact	40.2	10,400	418.1	16.0	26.1	
Economy	50.4	9,850	496.4	22.0	22.6	
Total	127.4	10,184	1,297.4	16.1	80.6	633
1990						
Standard	21.8	10,435	227.5	12.0	18.9	
Compact	40.7	10,428	424.4	16.0	26.5	
Economy	73.8	9,975	736.2	22.0	33.5	
Total	136.3	10,184	1,388.1	17.6	78.9	579
1990/1972	+40.7%	0.0%	+40.7% (1.9% compounded annually)	+30.4%	+7.9%	

[1]The average annual vehicle-miles for total automobiles will remain constant but those for individual automobile sizes may vary. The miles per gallon will remain constant at the 1972 level for each automobile size.

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Travel Forecasts, Washington, D.C., November 1974, p. 63.

Estimated Vehicles, Travel, and Gasoline Consumption Based on Federal Highway Administration's Assumption Number 3[1]

Year and automobile size	Number automobiles	Annual miles per vehicle	Total vehicle-miles (automobiles)	Miles per gallon	Total gasoline consumption	Gallons per vehicle
	(millions)		(billions)		(billion gals)	
1972						
Standard	63.0	10,370	653.3	12.0	54.3	
Compact	22.0	10,000	220.0	16.0	13.7	
Economy	11.9	9,500	113.1	22.0	5.1	
Total	96.9	10,184	986.4	13.49	73.1	755
1980						
Standard	57.1	10,370	592.1	13.1	45.2	
Compact	30.9	10,300	318.3	17.0	18.2	
Economy	29.5	9,700	286.2	23.0	12.4	
Total	117.5	10,184	1,196.6	15.7	75.8	649
1985						
Standard	36.8	10,405	382.9	14.5	26.4	
Compact	40.2	10,400	418.1	17.5	23.9	
Economy	50.4	9,850	496.4	24.0	20.7	
Total	127.4	10,184	1,297.4	18.3	71.0	557
1990						
Standard	21.8	10,435	227.5	16.0	14.2	
Compact	40.7	10,428	424.4	18.0	23.6	
Economy	73.8	9,975	736.2	24.5	30.0	
Total	136.3	10,184	1,388.1	20.5	67.8	497
1990/1972	+40.7%	0.0%	+40.7% (1.9% compounded annually)	+51.7%	-7.3%	

[1]The average annual vehicle-miles per automobile will vary as stated in Assumption 2 and the miles per gallon will vary as more efficient cars in each size class are developed.

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Travel Forecasts, Washington, D.C., November 1974, p. 65.

Estimated Vehicles, Travel, and Gasoline Consumption Based on Federal Highway Administration's Assumption Number 4[1]

Year and automobile size	Number automobiles	Annual miles per vehicle	Total vehicle-miles (automobiles)	Miles per gallon	Total gasoline consumption	Gallons per vehicle
	(millions)		(billions)		(billion gals)	
1972						
Standard	63.0	10,370	653.3	12.0	54.3	
Compact	22.0	10,000	220.0	16.0	13.7	
Economy	11.9	9,500	113.1	22.0	5.1	
Total	96.9	10,184	986.4	13.49	73.1	755
1980						
Standard	57.1	9,700	554.1	13.1	42.3	
Compact	30.9	10,100	312.1	17.0	18.4	
Economy	29.5	9,700	286.2	23.0	12.4	
Total	117.5	9,800	1,152.4	15.8	73.1	622
1985						
Standard	36.8	10,950	403.1	14.5	27.8	
Compact	40.2	10,600	426.1	17.5	24.3	
Economy	50.4	10,000	504.0	24.0	21.0	
Total	127.4	10,460	1,333.2	18.2	73.1	574
1990						
Standard	21.8	11,700	255.1	16.0	15.9	
Compact	40.7	11,100	451.8	18.0	25.1	
Economy	73.8	10,650	786.4	24.5	32.1	
Total	136.3	10,950	1,493.3	20.4	73.1	536
1990/1972	+40.7%	+7.5%	+51.4% (2.2% compounded annually)	+51.7%	0.0%	

[1]The total gasoline that can be made available will be that shown for 1972, the base year. Average annual vehicle-miles and miles per gallon may change as demand changes and more efficient cars are developed.

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Travel Forecasts, Washington, D.C., November 1974, p. 66.

Estimated Vehicles, Travel, and Gasoline Consumption Based on Federal Highway Administration's Assumption Number 5[1,2]

Year and automobile size	Number automobiles	Annual miles per vehicle	Total vehicle-miles (automobiles)	Miles per gallon	Total gasoline consumption	Gallons per vehicle
	(millions)		(billions)		(billion gals)	
1972						
Standard	63.0	10,370	653.3	12.0	54.3	
Compact	22.0	10,000	220.0	16.0	13.7	
Economy	11.9	9,500	113.1	22.0	5.1	
Total	96.9	10,184	986.4	13.5	73.1	755
1980						
Standard	57.1	9,700	554.2	13.1	42.3	
Compact	30.9	10,100	312.1	17.0	18.4	
Economy	29.5	9,700	286.2	23.0	12.4	
Total	117.5	9,808	1,152.4	15.8	73.1	622
1985						
Standard	36.8	11,492	422.9	14.5	29.2	
Compact	40.2	11,100	446.2	17.5	25.5	
Economy	50.4	10,490	528.7	24.0	22.1	
Total	127.4	10,972	1,397.8	18.2	76.8	603
1990						
Standard	21.8	12,835	279.8	16.0	17.5	
Compact	40.7	12,194	496.3	18.0	27.6	
Economy	73.8	11,709	864.1	24.5	35.3	
Total	136.3	12,034	1,640.2	20.4	80.4	590
1990/1972	+40.7%	+18.2%	+66.3% (2.9% compounded annually)	+51.1%	+10.0%	

[1]Fuel consumption in 1985 will be 5 percent higher than 1972; and in 1990, 10 percent higher.

[2]This assumption is the same as in 4, except that the total gasoline available will be increased after 1980.

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Travel Forecasts, Washington, D.C., November 1974, p. 67.

CHAPTER 3 - REFERENCES

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Government Impacts

This chapter presents information on the three major areas of government impact in transportation: taxes and expenditures; regulations; and government research, development and demonstration programs. Because of energy problems, government actions have become a focal point regarding policy formulation in areas of transportation and transportation conservation.

Taxes and expenditures associated with the transportation sector comprise the first section of the chapter. Transportation taxes as a percent of total federal taxes collected are shown on page 168. Even though federal transportation related-taxes have increased approximately 400 percent since 1950, their share of total federal tax receipts has declined over the 1950-1973 period from 23 percent to 16 percent. Page 169 shows similar data for state taxes.

As detailed in Section 4.1, excise taxes, user taxes, motor vehicle registration fees and gasoline taxes encompass the sources of government revenue. Federal highway trust fund receipts and disbursements account for a majority of funding of transportation facilities, based upon public transportation dollar outlays (see page 172).

Section 4.2 reviews selected transportation conservation measures mandated by the Energy Policy and Conservation Act of 1975. Also presented are some graphs and tables depicting the interrelationships between enforcement of various emissions and safety standards and energy consumption. Finally, there is a table indicating the federal emissions standards and the emissions reductions achievable through imposition of these standards.

Section 4.3 outlines government research, development and demonstration programs related to transportation energy use. As shown on page 183, outlays for direct energy research and development of the Energy Research and Development Administration are planned to double between 1975 and 1977 fiscal years.

Section 4.1

Government Taxes and Expenditures

Federal Taxes Derived from Transportation, 1950-1973
(in million of dollars)

	1950	1955	1960	1965	1970	1971	1972	1973
Corporate income and profits taxes								
Transportation companies	862	809	684	779	788	563	753	980
Transport equipment mfgrs., exc. motor	162	456	322	518	629	454	449	538
Motor vehicle and equipment mfgrs.	1,799	2,434	1,729	2,591	2,927	1,328	3,026	3,438
Automotive sales and services	342	172	214	287	451	393	548	653
Total	3,165	3,871	2,949	4,175	4,795	2,738	4,776	5,609
Excise Taxes[1]								
Gasoline	568	999	2,224	2,627	3,447[r]	3,455[r]	3,674	3,906
Diesel and special motor fuels	- -	25	82	151	265	275	321	358
Use tax on large motor vehicles	- -	- -	45	103	141	152	163	202
Lubricating oil	45	43	47	48	57	53	57	61
Motor vehicles, parts, and accessories	781	1,595	1,781	2,439	2,439	2,742[r]	403[r]	629
Tires, tubes, and tread rubber	184	177	299	458	614	627	696	794
Transportation of property	340	431	2	- -	11	22	29	37
Transportation of people	229	200	261	122	337	423	556[r]	624
Other excise taxes*	831	962	1,235	2,280	2,546	2,685	2,904	2,801
Total	2,978	4,432	5,976	8,228	9,975[r]	10,434[r]	8,803[r]	9,412
Income and employment taxes*	2,673	5,453	7,856	9,199	18,343	18,287	19,837	23,035
Total federal transportation taxes	8,816	13,756	16,781	21,602	33,013[r]	31,459[r]	33,416[r]	38,056
Total federal taxes	38,957	66,289	91,775	114,435	195,722	191,647	209,856	237,787
Transportation taxes as a percent of total	22.6%	20.8%	18.3%	18.9%	16.9%[r]	16.4%[r]	15.0%	16.0%

[1]No adjustments have been made for changes in rates or coverage.
*Paid by people employed in transportation.

Source: Transportation Association of America, Transportation Facts and Trends, 11th ed., Washington, D.C., 1974, p. 27; Transportation Facts and Trends, Quarterly Supplement, Washington, D.C., October 1975.

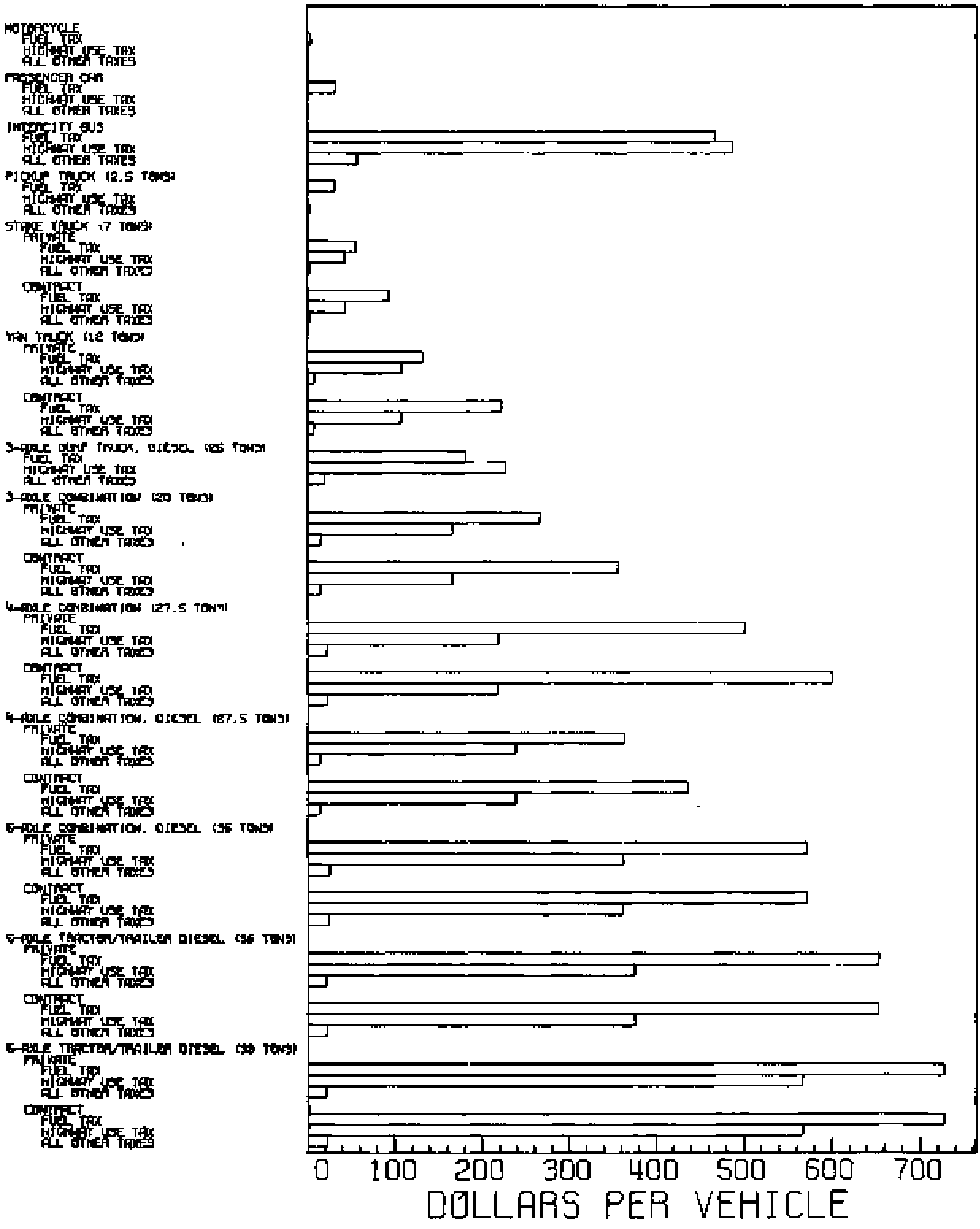
State Taxes Derived from Transportation, 1950-1973
(in millions of dollars)

	1950	1955	1960	1965	1970	1971	1972	1973
Corporate income taxes	171	156	153	308	374	309	601	781
Excise taxes								
Motor fuels	1,544	2,353	3,335	4,300	6,283	6,628	7,216	8,058
Motor vehicle and operator licensing	755	1,184	1,468	2,021	2,955	3,174	3,340	3,636
Other state taxes*	549	847	1,307	1,762	3,239	3,509	4,024	4,471
Total	2,848	4,384	6,110	8,083	12,476	13,311	14,580	16,165
Individual income taxes*	98	158	309	475	1,194	1,320	1,689	2,026
Total state transportation taxes	3,117	4,698	6,572	8,866	14,044	14,940	16,870	18,972
Total states taxes	7,929	11,597	18,036	26,126	47,961	51,541	59,870	68,069
Transportation as a percent total	39.3%	40.5%	36.4%	33.9%	29.3%	29.0%	28.2%	27.0%

*Paid by people employed in transporation.

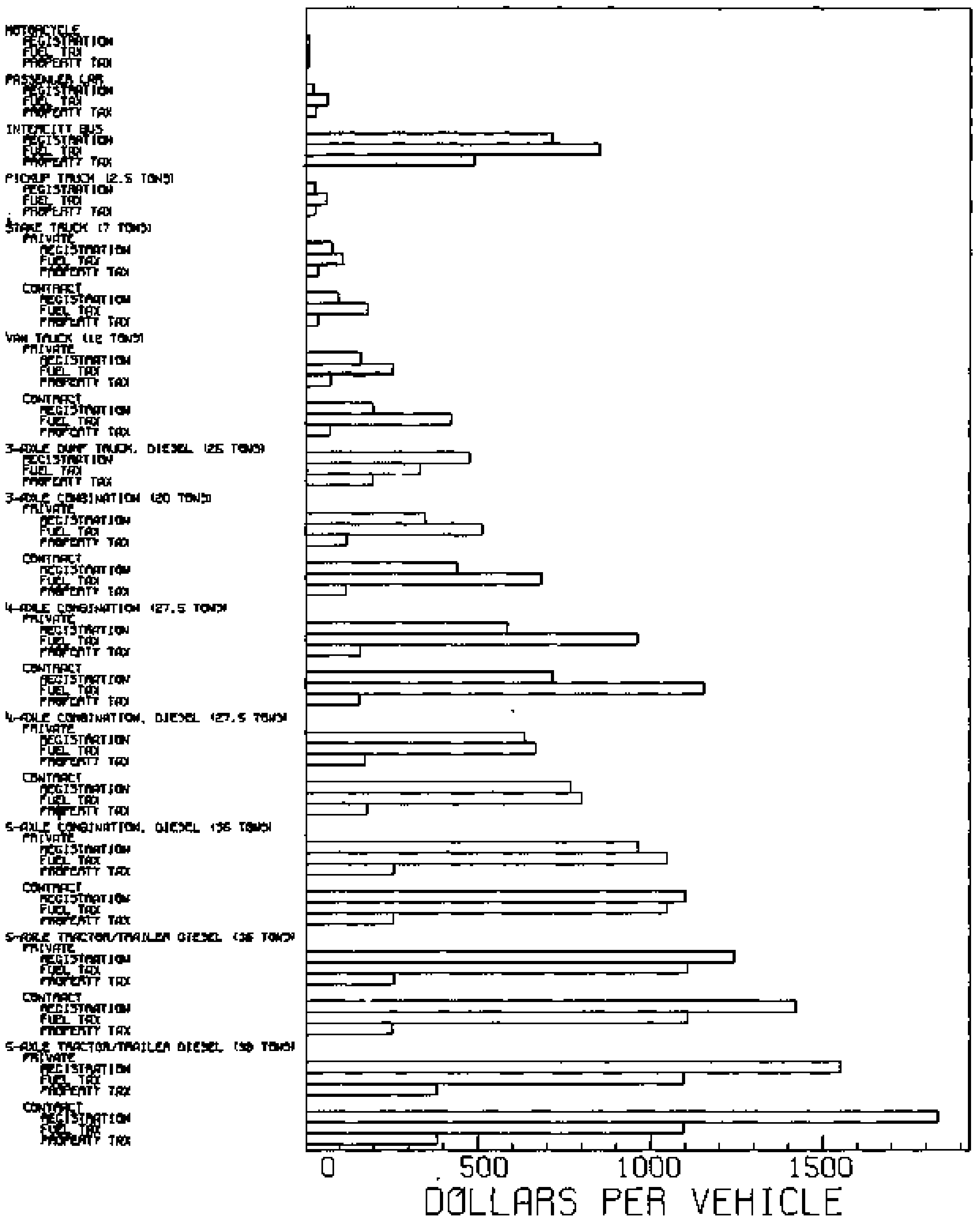
Source: Transportation Association of America, Transportation Facts and Trends, 11th ed., Washington, D.C., 1974, p. 27; Transportation Facts and Trends, Quarterly Supplement, Washington, D.C., October 1975.

Average Annual Federal Taxes Per Vehicle, 1973



Source: Motor Vehicle Manufacturers Association, <u>1975 Motor Truck Facts</u>, Detroit, Michigan, 1975, p. 57.

Average Annual State Taxes Per Vehicle, 1973



Source: Motor Vehicle Manufacturers Association, 1975 Motor Truck Facts, 1975, p. 56.

Highway Trust Fund[3] Receipts and Disbursements (in millions of dollars)

Receipts

Fiscal year	Motor fuel	Tires, tubes & tread rubber	Trucks, buses and trailers	Motor truck use	Oil	Truck & bus parts and accessories	Interest on investment	Total
1974	$4,502	$895	$614	$225	$94	$130	$415	$6,675
1973	4,159	781	380	161	80	104	247	5,912
1972	3,893	682	436[1]	151	73	87	206	5,528[1]
1971	3,934	629	693	148	52	85	184	5,725
1970	3,693	642	700	137	95	87	115	5,469
1969	3,181	609	541	129	83	94	53	4,690
1968	3,096	512	510	98	82	81	33	4,428
1967	3,124	543	525	112	68	69	14	4,455
1966	2,846	497	442	102	23	7	7	3,924
1965	2,736	430	393	99	--	--	11	3,669
1964	2,643	413	357	106	--	--	20	3,539
1963	2,462	409	311	97	--	--	14	3,293
1962	2,374	367	128	80	--	--	7	2,956
1961	2,361	275	115	47	--	--	1	2,799
1960	2,044	315	142	38	--	--	- 3	2,536
1959	1,657	276	107	34	--	--	13	2,087
1958	1,608	274	111	33	--	--	18	2,044
1957	1,326	93	34	26	--	--	3	1,482

Disbursements

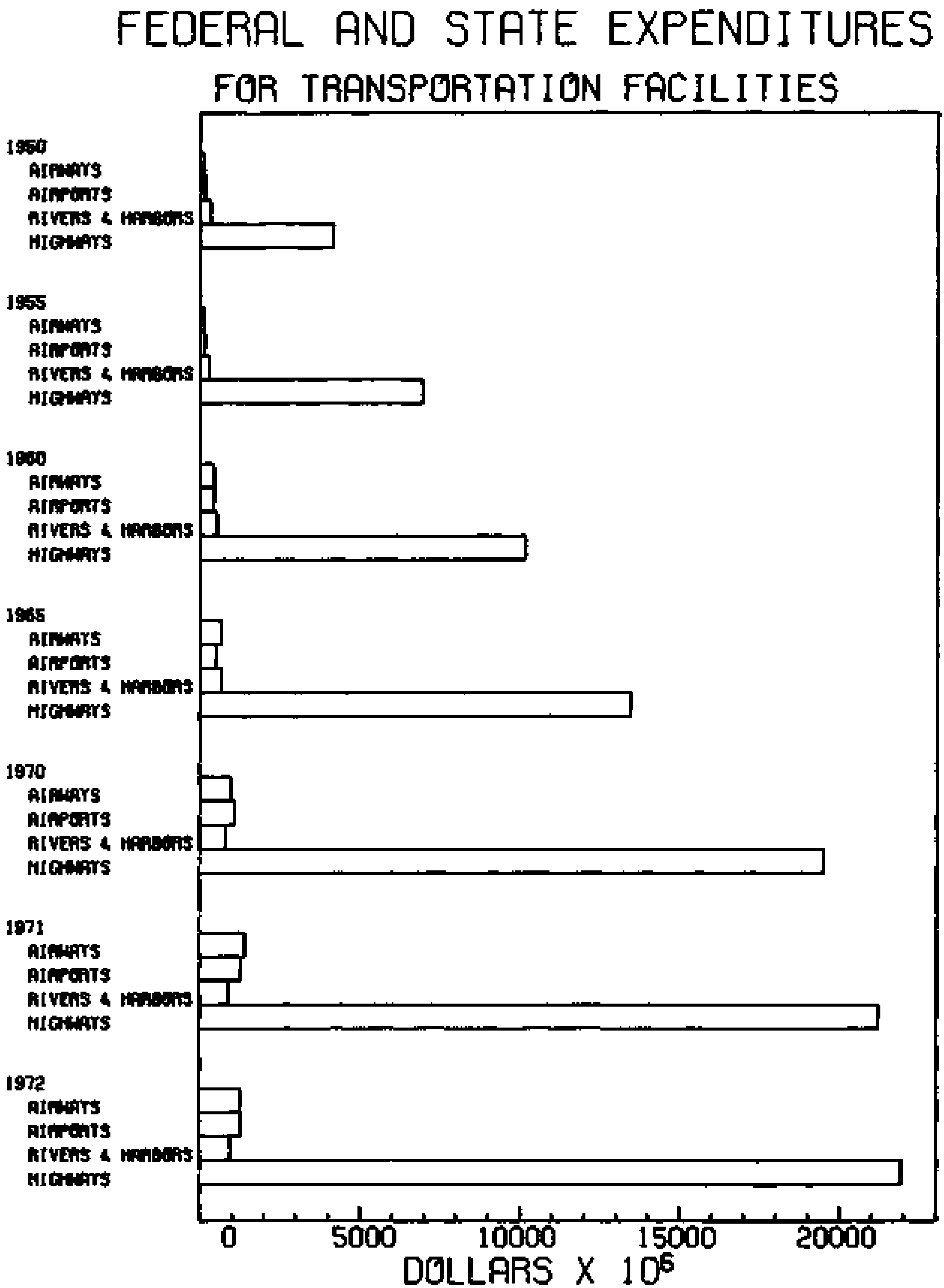
Fiscal year	Receipts	Interstate highway	Other[2]	Total	Balance in the fund	Liability for unpaid obligations	Balance less liability for unpaid obligations
1974	$6,675	NA	NA	$4,576	$7,690	$8,012	$- 322
1973	5,912	$3,400	$1,411	4,811	5,591	7,703	-2,112
1972	5,528	3,468	1,222	4,690	4,490	7,918	-3,428
1971	5,725	3,456	1,229	4,685	3,652	7,512	-3,860
1970	5,469	3,289	1,089	4,378	2,612	7,535	-4,923
1969	4,690	3,149	1,002	4,151	1,521	7,124	-5,603
1968	4,428	3,207	964	4,171	982	6,617	-5,635
1967	4,455	2,976	998	3,974	725	6,556	-5,831
1966	3,924	2,978	987	3,965	244	6,748	-6,504
1965	3,670	3,016	1,010	4,026	285	6,665	-6,380
1964	3,539	2,635	1,010	3,645	641	6,669	-6,028
1963	3,293	2,109	908	3,017	747	6,149	-5,402
1962	2,956	1,914	870	2,784	471	5,239	-4,768
1961	2,799	1,719	900	2,619	299	4,989	-4,690
1960	2,536	1,861	1,079	2,940	119	4,421	-4,302
1959	2,087	1,501	1,112	2,613	523	4,751	-4,228
1958	2,044	675	836	1,511	1,049	3,855	-2,806
1957	1,482	208	758	966	516	2,421	-1,905

[1]The Federal excise tax on light trucks of 10,000 lbs. or less gross vehicle weight was repealed effective September 22, 1971.

[2]Includes expenditures for both primary and secondary urban and rural highways, TOPICS, emergency relief funds, bridge and dam design and construction, forest highways, public land highways, bridge replacement and highway safety research and development.

[3]See "Highway trust fund" in glossary for detailed discussion.

Source: Motor Vehicle Manufacturers Association, <u>1975 Motor Truck Facts</u>, Detroit, Michigan, 1975, p. 60.



Source: Transportation Association of America, Transportation Facts and Trends, 11th ed., Washington, D.C., 1974, p. 26.

Section 4.2

Government Regulations

Selected Transportation Conservation Measures Enacted by the Energy Policy and Conservation Act, Public Law 94-163, December 22, 1975

	Model year	Miles per gallon
Mandatory average fuel economy standards for passenger automobiles	1978	18.0
	1979	19.0
	1980	20.0
	1981-1984	Determined by the Secretary of Transportation[1]
	1985	27.5[2]
Mandatory Federal government fleet average fuel economy	18.0 mpg or the average fuel economy standard described above, whichever is greater.	
Selected eligibility requirements for Federal assistance with state energy conservation plans	1) Programs to promote the availability and use of carpools, vanpools, and public transportation (except that no Federal funds provided under this part shall be used for subsidizing fares for public transportation).	
	2) A traffic law or regulation which, to the maximum extent practicable consistent with safety, permits the operator of a motor vehicle to turn such vehicle right at a red stop light after stopping.	
	3) Transportation controls which can be defined as any plan, procedure, method, or arrangement, or any system of incentives, disincentives, restrictions, and requirements, which is designed to reduce the amount of energy consumed in transportation, except for rationing of gasoline or diesel fuel.	

[1]Not later than July 1, 1977, the Secretary shall prescribe, by rule, average fuel economy standards for passenger automobiles manufactured in each of the model years 1981 through 1984. Any such standard shall apply to each manufacturer and shall be set for each such model year at a level which the Secretary determines (A) is the maximum feasible average fuel economy level, and (B) will result in steady progress toward meeting the average fuel economy standard established by or pursuant to this subsection for model year 1985.

[2]The Secretary may, by rule, amend the average fuel economy standard for model year 1985, or for any subsequent model year, to a level which he determines is the maximum feasible average fuel economy level for such model year, except that any amendment which has the effect of increasing an average fuel economy standard to a level in excess of 27.5 miles per gallon, or of decreasing any such standard to a level below 26.0 miles per gallon, shall be submitted to the Congress in accordance with section 551 of the Energy Policy and Conservation Act and shall not take effect if either House of the Congress disapproves such amendment in accordance with the procedures specified in such section.

Source: Energy Policy and Conservation Act, Public Law 94-163, Ninety-Fourth Congress, December 22, 1975.

Effect of Speed on Fuel Consumption Rates: Cars and Trucks

	Miles per gallon at selected speeds					Percent increase in gasoline consumption caused by increase in speed				
	30	40	50	60	70	30 to 40	40 to 50	50 to 60	60 to 70	50 to 70
Cars without air conditioning	21.05	21.07	19.49	17.51	14.93	0.00	8.11	11.31	17.28	30.53
Cars with air conditioning	18.14	17.51	16.42	15.00	13.17	3.60	6.64	9.47	13.90	24.68
Percent improvement in MPG after tuning	10.52	12.92	9.54	11.04	15.32					
	50	55	60	65		50 to 55	55 to 60	60 to 65	50 to 60	50 to 65
Heavy-duty highway trucks	5.11	4.81	4.54	4.09[1]		6.20	6.66	5.50[1]	12.48	23.30[1]
Percent increase caused by wound-up driving[2]	14.4	8.0	7.6							

[1]Only three of the six test vehicles were operated as the governor setting that controls fuel injection did not permit the other three vehicles to be operated at 65 miles per hour.

[2]Wound-up driving is driving a diesel truck at or near its maximum horsepower. It results in an increase in miles per hour but a decrease in miles per gallon, especially on downgrades.

Source: E.M. Cope, U.S. Department of Transportation, Federal Highway Administration, The Effect of Speed on Automobile Consumption Rates, Washington, D.C., October 1973, pp. 6 and 7; The Effect of Speed on Truck Fuel Consumption Rates, Washington, D.C., August 1974, p. 14.

Emission Reduction from Uncontrolled Levels Achieved through Imposition of Federal Standards[1]
(In Terms of 1975 Federal Test Procedure)

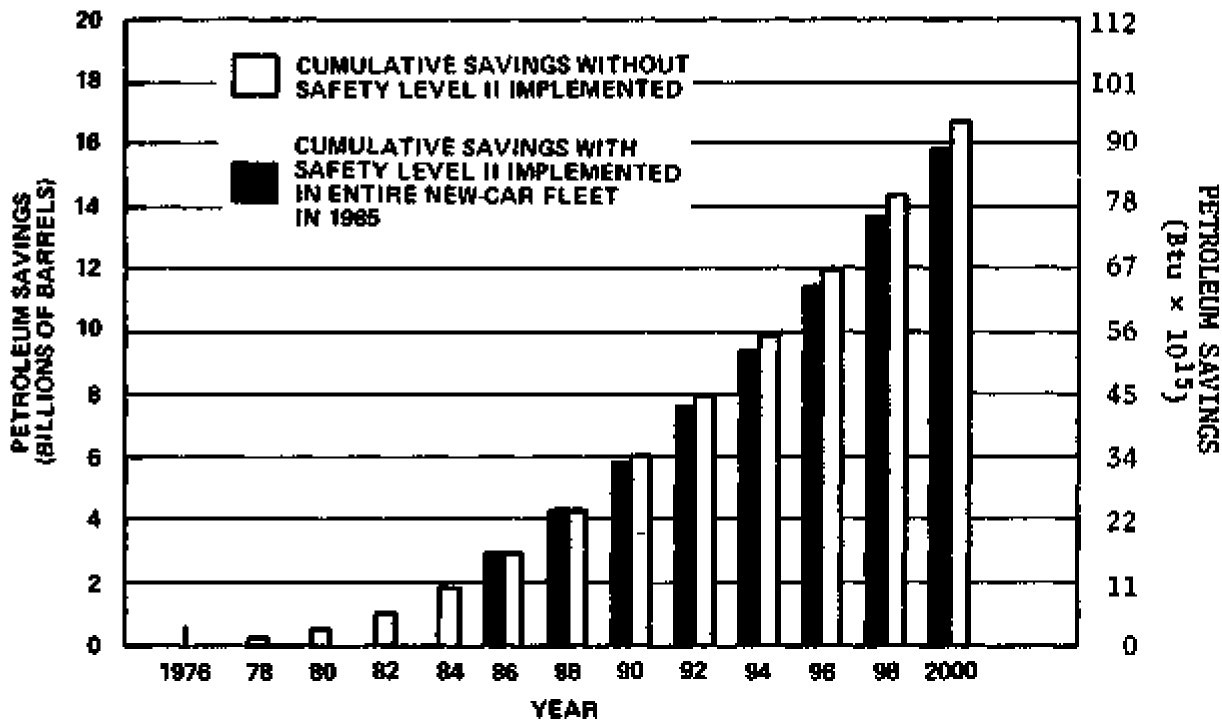
	Hydrocarbons (HC)		Carbon Monoxide (CO)		Oxides of Nitrogen (NO_x)	
	Level (gpm)	% Reduction	Level (gpm)	% Reduction	Level (gpm)	% Reduction
Pre-1968 Vehicles (uncontrolled)	8.7		87		3.5	
1970/71 Standards (NO_x uncontrolled)[2]	4.1	53	34	61	(4.0)	
1973/74 Standards	3.0	66	28	68	3.1	11
National interim standards (1975/76)	1.5	83	15	83	3.1	11
California interim standards (1975/76)	0.9	90	9.0	90	2.0	43
National interim standards (1977)	1.5	83	15	83	2.0	43
Statutory standards (1978) (all states)	0.41	95	3.4	96	0.4	89

[1]Effective September 1976.

[2]No Federal standard for NOx existed in 1970-71. When HC and CO were controlled to the standard in 1970-71, NOx increased slightly from pre-1968 uncontrolled vehicles.

Source: Economic Analysis Division, Office of Planning and Evaluation, U.S. Environmental Protection Agency.

CUMULATIVE FUEL PENALTIES: IMPACTS OF SAFETY REQUIREMENTS



Impact of Implementing Safety Level II Standards[1] in 1985 on Cumulative Fuel Savings

[1]Safety Level II: 40 MPH Frontal; 20 MPH Side.

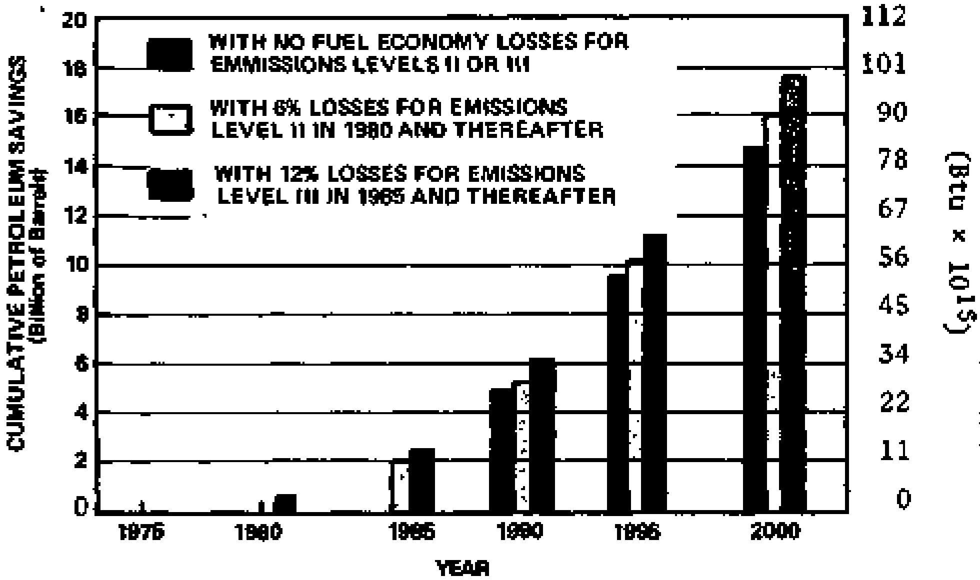
Source: Federal Task Force, Motor Vehicle Goals Beyond 1980, Volume 1: Executive Summary, U.S. Department of Transportation, Washington, D.C., September 2, 1976, p. 20. (Draft)

IMPLEMENTATION IN 1985 OF SAFETY LEVEL II IS ESTIMATED TO INCREASE NEW CAR COSTS BY APPROXIMATELY $300 AND TO INCREASE WEIGHT BY 150 TO 200 POUNDS. THE EFFECTS OF THE ESTIMATED WEIGHT INCREASES ARE SHOWN ABOVE RELATIVE TO THE CUMULATIVE FUEL SAVINGS POTENTIAL OF THE ILLUSTRATIVE OTTO ENGINE SCENARIO.

ESTIMATES VARY AS TO THE FUEL ECONOMY IMPACT OF EMISSIONS CONTROLS

RELATIVE TO NO EMISSION CONTROLS, EMISSIONS STANDARDS APPLICABLE DURING THE 1968-1975 TIMEFRAME AND CHANGES IN FUEL SPECIFICATIONS (E.G. REMOVAL OF LEAD AND CORRESPONDING COMPRESSION RATIO REDUCTION) HAVE INCREASED FUEL CONSUMPTION IN SOME CASES AND, IN ALL CASES, HAVE INCREASED NEW CAR COSTS BY MORE THAN $100 PER CAR ON THE AVERAGE.

Range of Impacts of Implementing Level II and Level III Emissions Standards on Cumulative Petroleum Savings



Note: Emissions: Level II: 0.41 HC/3.4 CO/2.0 NO_x (gm/mi)

Level III: 0.41 HC/3.4 CO/0.4 NO_x (gm/mi)

[1]Estimates are relative to the cumulative savings of the illustrative Otto Engine Scenario No. 2. See page

Source: Federal Task Force, Motor Vehicle Goals Beyond 1980, Volume 1: Executive Summary, U.S. Department of Transportation, Washington, D.C., September 2, 1976, p. 24. (Draft)

FUTHER REDUCTION OF EMISSIONS UNDER CURRENT TECHNOLOGY CAN RESULT IN SUBSTANTIAL INCREASES IN FUEL CONSUMPTION AND COST. HOWEVER, IT IS GENERALLY AGREED THAT, GIVEN CONTINUED DEVELOPMENT OF EMISSIONS CONTROL TECHNOLOGY, WHATEVER FUEL ECONOMY LOSSES MIGHT OCCUR WITH VEHICLES WHEN FIRST MARKETED UNDER VERY STRINGENT STANDARDS WOULD DIMINISH IN SUBSEQUENT MODEL YEARS OF THAT SAME STANDARD.

Section 4.3

Government Research, Development and Demonstration Spending

The Role of Federal Agencies in Dealing with the National Energy Situation

Tasks	Agencies
Recommending comprehensive national energy policy that is in balance with other national policies and priorities.	Energy Resources Council Council of Economic Advisors Council on Environmental Quality Domestic Council Water Resources Council Federal Energy Administration
Managing the expenditure of energy on related RD&D resources.	Energy Research and Development Administration Department of the Interior Environmental Protection Agency Nuclear Regulatory Commission National Science Foundation National Aeronautics and Space Administration
Involved in the regulatory aspects of environmental protection and human health and safety.	Environmental Protection Agency National Institute of Environmental Health Sciences National Institute for Occupational Safety and Health Department of Labor (Occupational Safety and Health Administration) Occupational Safety and Health Review Commission
Involved in setting standards and regulations for energy-related organizations.	Federal Energy Administration Federal Power Commission Nuclear Regulatory Commission Department of Commerce (National Bureau of Standards) Department of Transportation Federal Trade Commission Interstate Commerce Commission Federal Maritime Commission
Work with the private sector to assist the market penetration of key energy technologies.	Department of Housing and Urban Development Department of Commerce Department of the Interior Small Business Administration Department of Transportation General Services Administration
Deal with other areas that have direct energy implications.	Department of State Department of the Treasury Department of Defense Department of Health, Education and Welfare

Source: Energy Research and Development Administration, <u>A National Plan for Energy Research, Development, and Demonstration: Creating Energy Choices for the Future</u>, Volume 1: The Plan Report No. ERDA 76-1, Washington, D.C., April 1976.

Federal Energy Research and Development (R&D) Funding
(in millions of dollars)

	FY 75		FY 76[1]		FY 77	
	Authority	Outlays	Authority	Outlays	Authority	Outlays
Direct energy R&D						
ERDA	1,317.0	1,011.0	1,657.0	1,427.0	2,435.0	2,009.0
DOI	89.9	54.2	104.0	93.3	98.3	96.3
EPA	80.8	18.2	56.8	76.6	55.4	76.6
NRC	58.9	51.7	87.5	76.9	104.0	98.2
NASA	0.8	0.8	1.7	1.0	-0-	0.8
Subtotal	1,547.4	1,135.9	1,907.0	1,674.8	2,692.7	2,280.9
Supporting R&D						
ERDA	362.0	313.0	403.0	373.0	430.0	404.0
DOI	33.2	30.9	59.0	56.7	66.8	65.2
NPA	53.2	5.0	43.2	43.4	41.6	43.4
NRC	2.3	2.1	9.6	9.1	5.3	5.0
NSF	103.2	65.9	114.6	74.2	123.4	106.9
Subtotal	553.9	416.9	629.4	556.4	667.1	624.5
Total Federal Energy R&D	2,101.3	1,551.9	2,536.4	2,231.2	3,359.8	2,905.4

[1]Funds for FY 76 Transition Quarter are not included.

Source: Energy Research and Development Administration, A National Plan for Energy Research, Development and Demonstration: Creating Energy Choices for the Future, Volume 1: The Plan, Report No. ERDA 76-1, Washington, D.C., April 1976, p. 10.

Energy Research and Development Administration (ERDA)
Research and Development (R&D) Budget
(authority and outlays in millions of dollars)

	FY 75		FY 76[1]		FY 77		FY 76 to FY 77 percent change[2]	
	Authority	Outlays	Authority	Outlays	Authority	Outlays	Authority	Outlays
Direct energy R&D								
Nuclear fuel cycle and safeguards	$ 118	$ 120	$ 173	$ 163	$ 347	$ 282	101	73
Conservation	36	21	75	55	120	91	60	64
Geothermal	28	21	31	32	100[3]	50	223	57
Fusion	183	151	250	224	392	304	57	36
Fission	567	538	602	522	823	709	37	36
Solar	42	15	115	86	160	116	39	35
Fossil	335	138	398	333	477	442	20	33
Environmental control tech.	8	7	13	12	16	15	23	24
Subtotal	1,317	1,011	1,657	1,427	2,435	2,009		
Supporting research								
Basic energy sciences	191	165	210	188	227	205	8	9
Environmental research	171	148	193	185	203	199	5	7
Subtotal	362	313	403	373	430	404		
Total ERDA energy RD&D	$1,679	$1,324	$2,060	$1,800	$2,865	$2,413		

[1]Funds for FY 76 Transition Quarter are not included.

[2]Percentage change calculated prior to rounding outlays.

[3]Includes $50 million for Geothermal Loan Guarantee Program.

Source: Energy Research and Development Administration, A National Plan for Energy Research, Development and Demonstration: Creating Energy Choices for the Future, Volume 1: The Plan, Report No. ERDA 76-1, Washington, D.C., April 1976, p. 10.

Estimates of Research and Development (R&D) Funding of the Private Sector, by Industry Group

	Millions of dollars
Oil	660[1]
Oil equipment	50[2]
Natural gas	100[2]
Gas equipment	25[2]
Gas transmission	50[3]
Coal	6[2]
Electric utilities	150[3]
Electric utility equipment suppliers	350[4]
Total	1,391

[1]American Petroleum Institute (API) estimate. This figure includes R&D on synthetic fuels, oil shale, tar sands, coal gasification and liquefaction, and expenditures by the petroleum industry on chemicals.

[2]Oil Information Center, University of Oklahoma.

[3]Federal Power Commission.

[4]Informed Industry source. Includes expenditure on nuclear power.

Source: S.D. Freeman, Energy Policy Project of the Ford Foundation, A Time to Choose - America's Energy Future, Ballinger Publishing Company, Cambridge, Mass., 1974, p. 308.

Major Energy Research, Development and Demonstration (RD&D) in Other Nations

Country	Estimated current budget (in millions of dollars)	Major thrust
France	700	Sixty percent of budget devoted to current and future nuclear technology. Also budgeted are coal mining technology, and oil and gas exploration, storage, and transportation.
West Germany	450	Sixty-five percent devoted to nuclear and twenty-five percent to coal extraction and utilization.
United Kingdom	350	Sixty percent devoted to nuclear power.
Canada	220	Fifty percent devoted to derived fuels mainly in situ conversion of coal and tar sands. Thirty percent devoted to nuclear technology.
Japan	200	Eighty percent devoted to the nuclear option.
USSR	Unknown	All aspects of technology believed to be receiving emphasis in a broadly based program.

Source: Energy Research and Development Administration, A National Plan for Energy Research, Development and Demonstration: Creating Energy Choices for the Future, Volume 1: The Plan, Report No. ERDA-48, Washington, D.C., 1975, p. C-2.

National Energy Technology Goals[1]

Technology	Term of impact[2]	Direct substitution for oil and gas[3]	RD&D status	Impact in year 2000 in quads[4]
Goal I: Expand the domestic supply of economically recoverable energy producing raw materials				
Oil and gas — enhanced recovery	Mid	Yes	Pilot	13.6
Oil shale	Near	Yes	Study/Pilot	7.3
Geothermal	Mid	No	Lab/Pilot	3.1-5.6
Goal II: Increase the use of essentially inexhaustible domestic energy resources				
Solar electric	Long	No	Lab	2.1-4.2
Breeder reactors	Long	No	Pilot/Demo	3.1
Fusion	Long	No	Lab	
Goal III: Efficiently transform fuel resources into more desirable forms				
Coal — direct utilization utility/industry	Near	Yes	Pilot/Demo	24.5
Waste materials to energy	Near	Yes	Comm	4.9
Gaseous & liquid fuels from coal	Mid	Yes	Pilot/Demo	14.0
Fuels from biomass	Long	Yes	Lab	1.4
Goal IV: Increase the efficiency and reliability of the processes used in the energy conversion and delivery systems				
Nuclear converter reactors	Near	No	Demo/Comm	28.0
Electric conversion efficiency	Mid	No	Lab	2.6
Energy storage	Mid	No	Lab	
Electric power transmission and distribution	Long	No	Lab	1.4
Goal V: Transform consumption patterns to improve energy utilization				
Solar heat and cooling	Mid	Yes	Pilot/Demo	5.9
Waste heat utilization	Mid	Yes	Study/Demo	4.9
Electric transport	Long	Yes	Study/Lab	1.3
Hydrogen in energy systems	Long	Yes	Study	
Goal VI: Increase end-use efficiency				
Transportation efficiency	Near	Yes	Study/Lab	9.0
Industrial energy efficiency	Near	Yes	Study/Comm	8.0
Conservation in buildings and consumer products	Near	Yes	Study/Comm	7.1

[1]The last column of this table presents data from ERDA-48. It represents the maximum impact of the technology in any scenario measured in terms of additional oil which would have to be marketed if the technology were not implemented. Basis for the calculation is explained in Appendix B of ERDA-48. These data are being reexamined, and changes will be made when analysis is completed. In a number of cases, revised projections of the impacts will be lower.

[2]Near — now through 1985; mid — 1985 through 2000; long — post-2000.

[3]Assumes no change in end-use device.

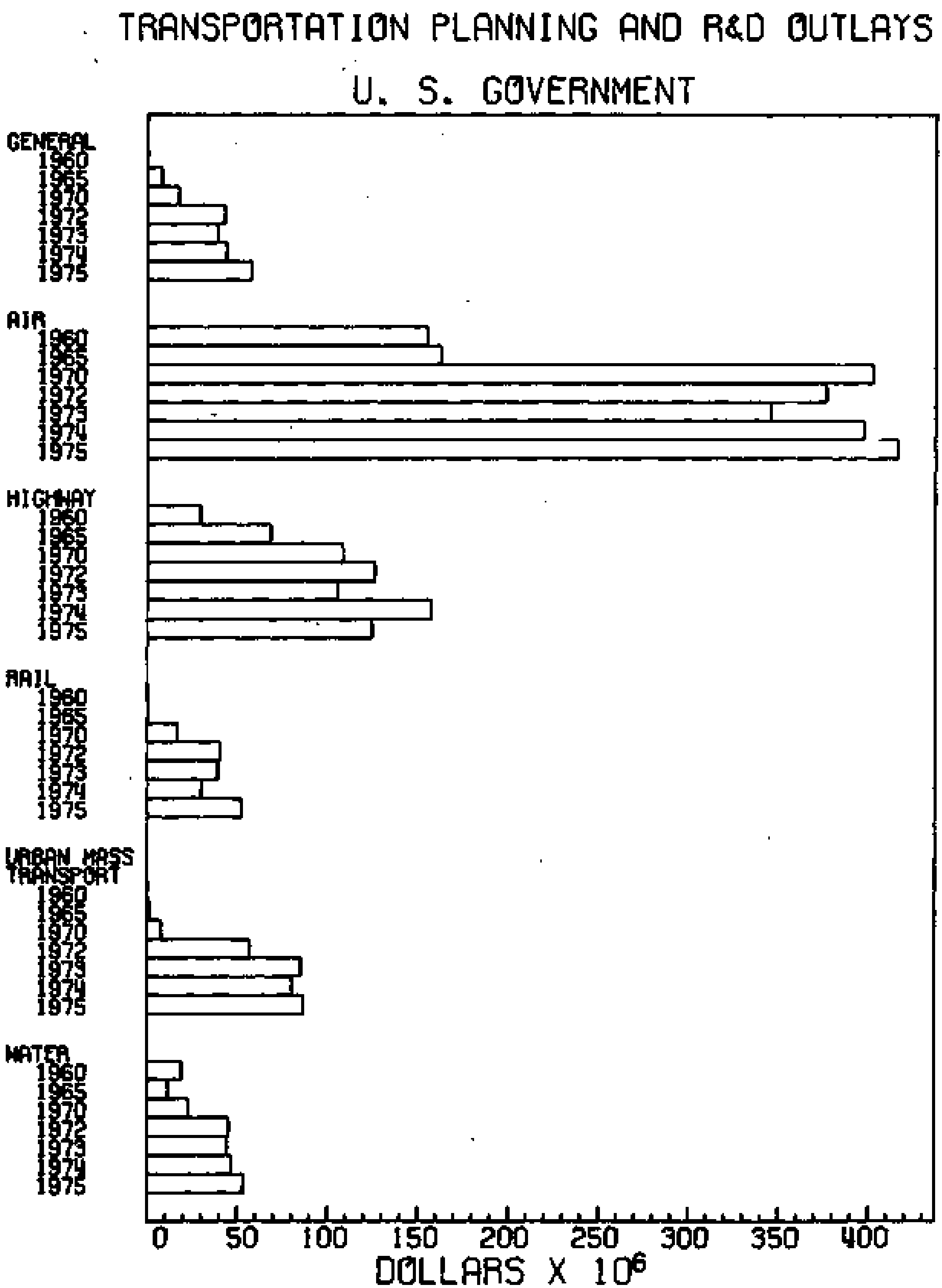
[4]Maximum impact of this technology in any scenario measured in terms of additional oil which would have to be marketed if the technology were not implemented.

Sources: Energy Research and Development Administration, A National Plan for Energy Research Development and Demonstration: Creating Energy Choices for the Future, Report No. ERDA-48, Washington, D.C., 1975, p. VI-2; Energy Research and Development Administration, A National Plan for Energy Research Development and Demonstration: Creating Energy Choices for the Future, Report No. ERDA 76-1, Washington, D.C., April 1976, p. 25.

Proposed National Ranking of Research, Development and Demonstration (RD&D) Technologies[1]

<u>Highest priority demand</u>	
Near-term conservation (efficiency) technologies	* Conservation in buildings and consumer products * Industrial energy efficiency * TRANSPORTATION EFFICIENCY * Waste materials to energy
<u>Highest priority supply</u>	
Near-term major energy systems	* Coal-direct utilization in utility/industry * Nuclear-converter reactors * Oil and gas enhanced recovery
New sources of liquids and gases for the mid term	* Gaseous and liquid fuels from coal * Oil shale
"Inexhaustible" sources for the long term	* Breeder reactors * Fusion * Solar electric
<u>Other important technologies</u>	
Under-used (limited application) mid-term technologies	* Geothermal * Solar heating and cooling * Waste utilization
Technologies supporting intensive electrification	* Electric conversion efficiency * Electric power transmission and distribution * Electric transport * Energy storage
Technologies being explored for the long term	* Fuels from biomass * Hydrogen in energy systems

Source: Energy Research and Development Administration, <u>A National Plan for Energy Research, Development and Demonstration: Creating Energy Choices for the Future</u>, Volume 1: The Plan, Report No. ERDA 76-1, Washington, D.C., April 1976, p. 30.



Source: Transportation Association of America, Transportation Facts and Trends, 11th ed., Washington, D.C., 1974, p. 25.

CHAPTER 4 - REFERENCES

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Energy Supply

This chapter contains five sections dealing with petroleum supply. Section 5.1 is an overview that shows U.S. petroleum production and imports for the 1950-1975 period. An important feature of this summary (pages 196 and 204) is the increasing role played by crude petroleum imports.

Section 5.2 deals with United States and world production of petroleum, United States reserves, and the product mix of United States petroleum refineries for the 1950-1974 period. For example, page 211 shows that motor fuel has had a relatively stable share (43-46 percent) of total refined products and an increasing share of petroleum has gone to jet fuel (0 to 7 percent).

Section 5.3 shows information on petroleum imports and refined petroleum products to the United States by country of origin. The table on imports by country in 1974 (pages 214 and 215) shows the U.S. to be most dependent on Canada, Nigeria, Iran, and Saudi Arabia for crude oil.

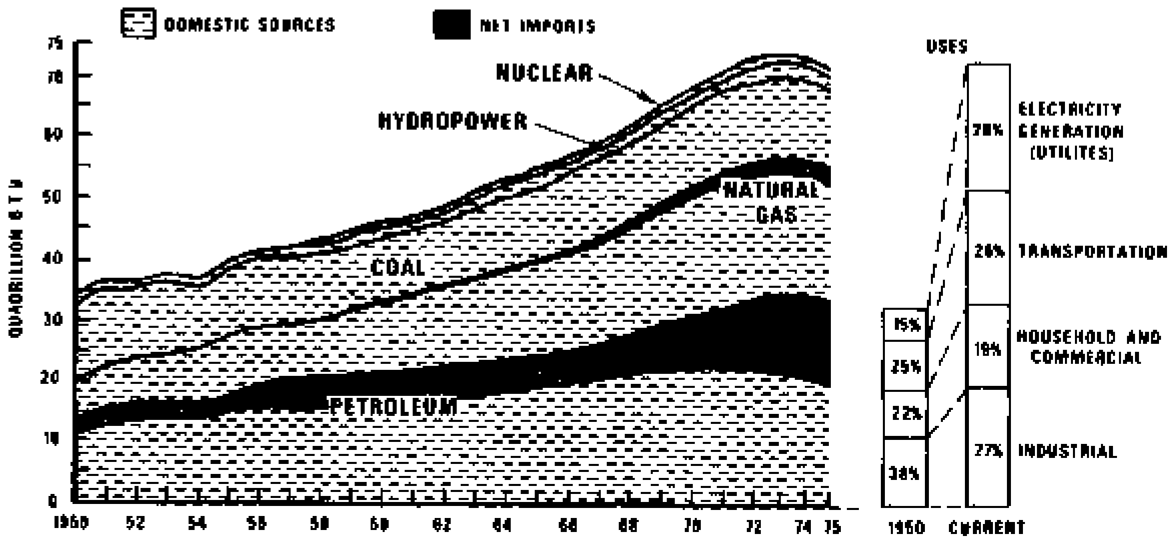
Section 5.4 gives price information over time for domestic crude petroleum by exporting countries, as well as gasoline prices. For example, the graph on page 221 shows the cost of a gallon of crude oil from well to customer.

Section 5.5 provides some projections of United States capacity to produce petroleum products and offers a comparison of estimates of when United States petroleum resources will be exhausted. The graph on page 227 shows that the most pessimistic estimate has the United States running out of petroleum in 1998 while the most optimistic estimate extends the depletion date to 2025.

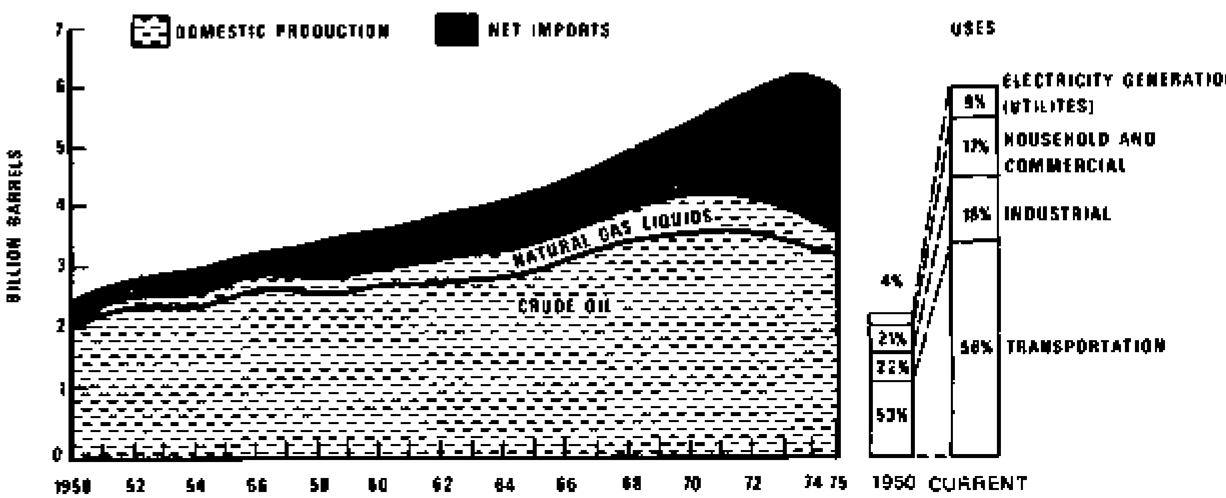
Section 5.1

Overview

U. S. Sources and Uses of Major Energy Sources

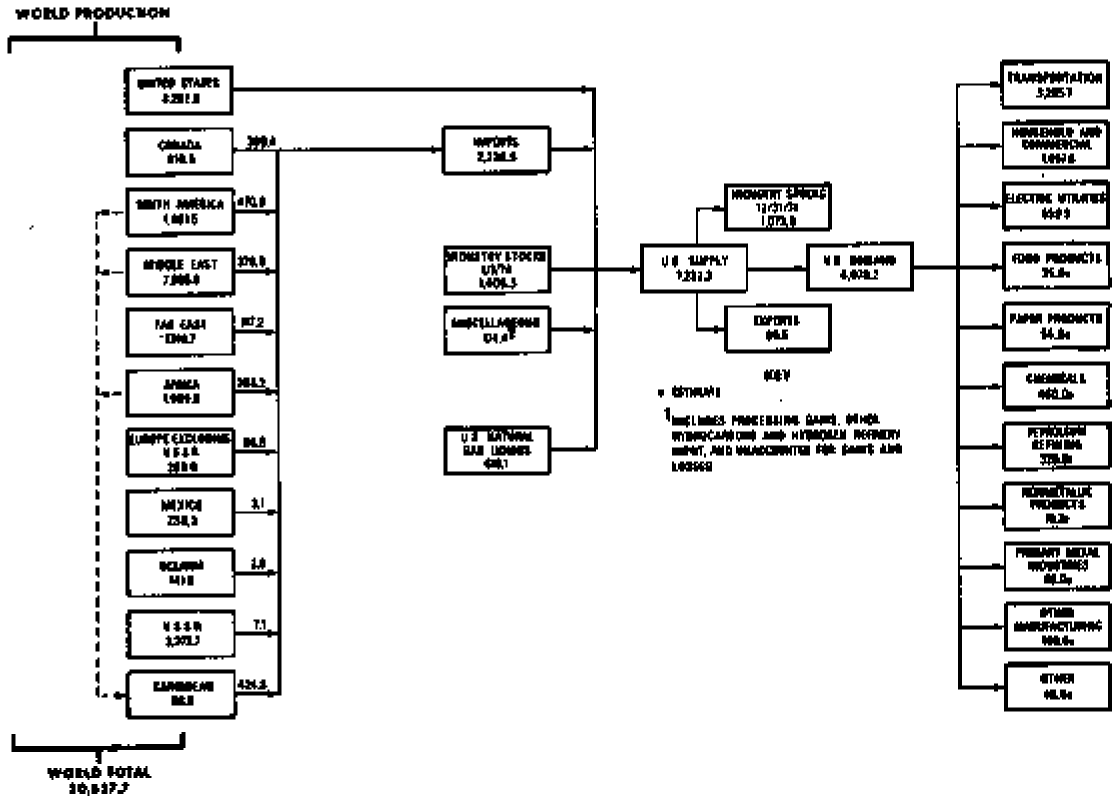


U. S. Sources and Uses of Petroleum



Source: U. S. Department of the Interior, Bureau of Mines, <u>Status of the Mineral Industries 1976</u>, Washington, D.C., 1976, pp. 7 and 8.

Petroleum
Supply-Demand Relationships — 1974
(in million barrels)



Petroleum Supply-Demand Relationships, 1965-74
(percent)

	1965	1970	1974
World production (in million barrels)	11,058.5	16,710.8	20,537.7
United States	25.8	21.0	15.6
Rest of World	74.2	79.0	84.4
Total	100.0	100.0	100.0
Components of United States supply (in million barrels)	5,106.6	6,476.6	7,232.3
Domestic crude oil	55.8	54.5	44.3
Domestic natural gas liquids	8.6	9.4	8.5
Imports	17.6	19.3	30.8
Hydrogen and other hydrocarbon refinery inputs	(1)	0.1	0.2
Processing gain	1.6	2.0	2.4
Industry stocks, Jan. 1	16.4	15.1	13.9
Total	100.0[2]	100.0[2]	100.0[2]
United States demand pattern (in million barrels)	4,202.0	5,364.6	6,078.2
Household and commercial	25.3	21.0	17.4
Industrial	19.4[3]	17.6[3]	18.4
Transportation	54.1	54.5	54.2
Electric utilities	2.8	6.2	9.2
Other	0.4	0.7	0.8
Total	100.0	100.0	100.0

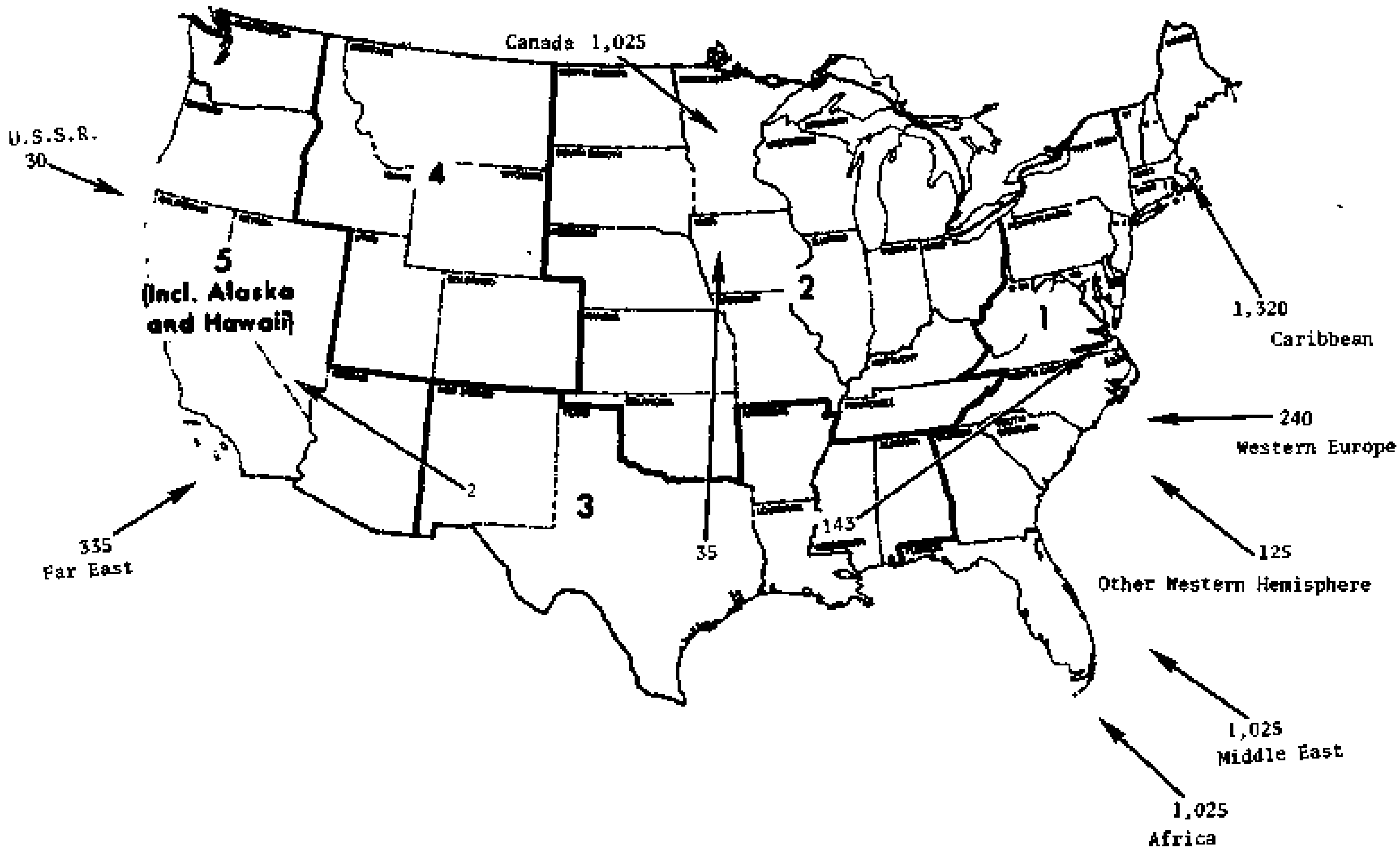
[1]Less than 50,000 barrels.

[2]Percentages may not add to 100.0 due to unaccounted for losses of 3.7 million in barrels in 1965, 11.6 in 1970, and 13.9 in 1974.

[3]Estimate.

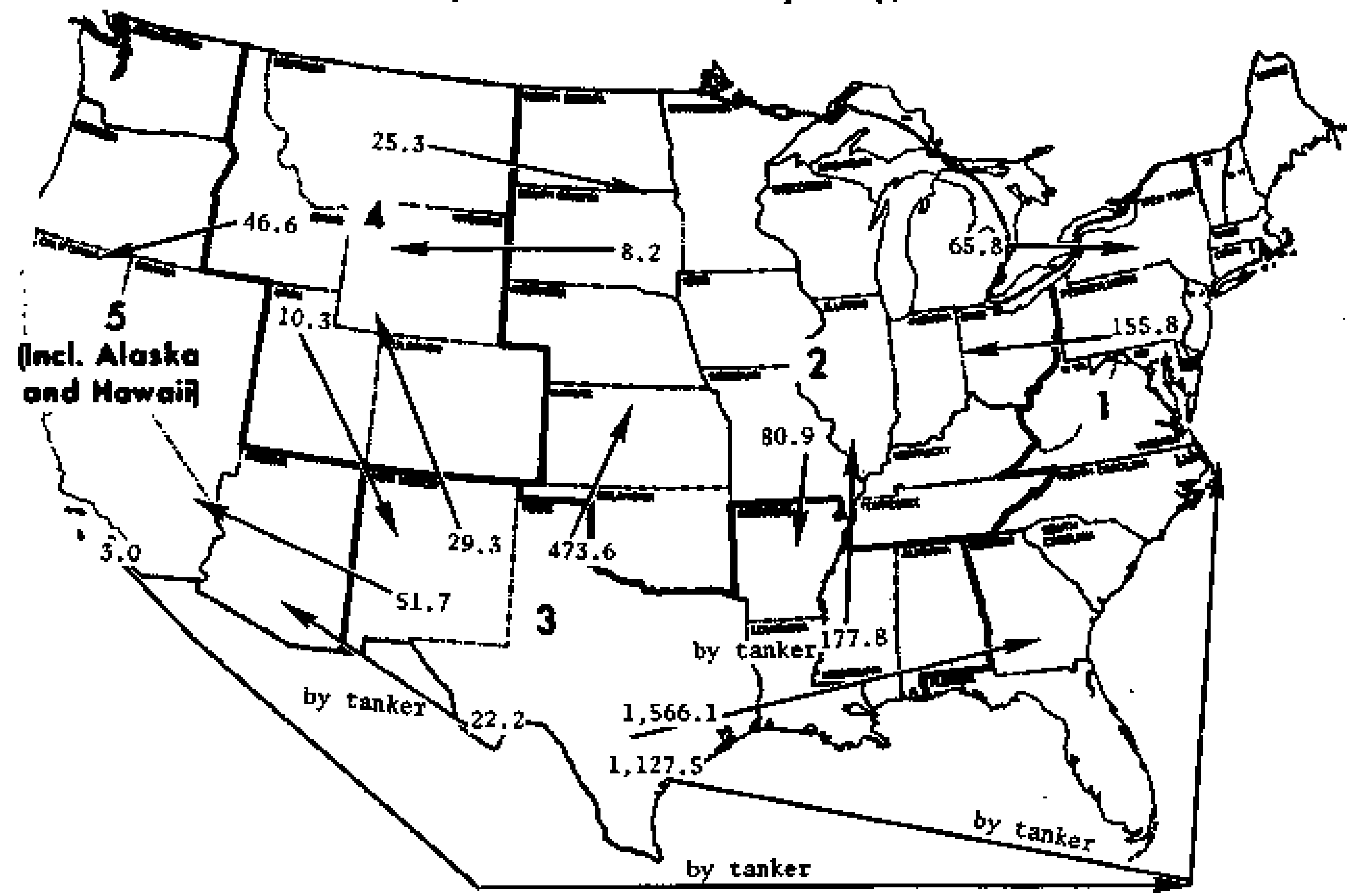
Source: U.S. Department of the Interior, Bureau of Mines, Minerals in the U.S. Economy: Ten Year Supply - Demand Profiles for Mineral and Fuel Commodities (1965-74), Washington, D.C., 1976, p. 64.

Movement of Crude Oil by Pipeline Between Petroleum Administration
for Defense (PAD) Districts — United States, 1974
(thousands of barrels per day)



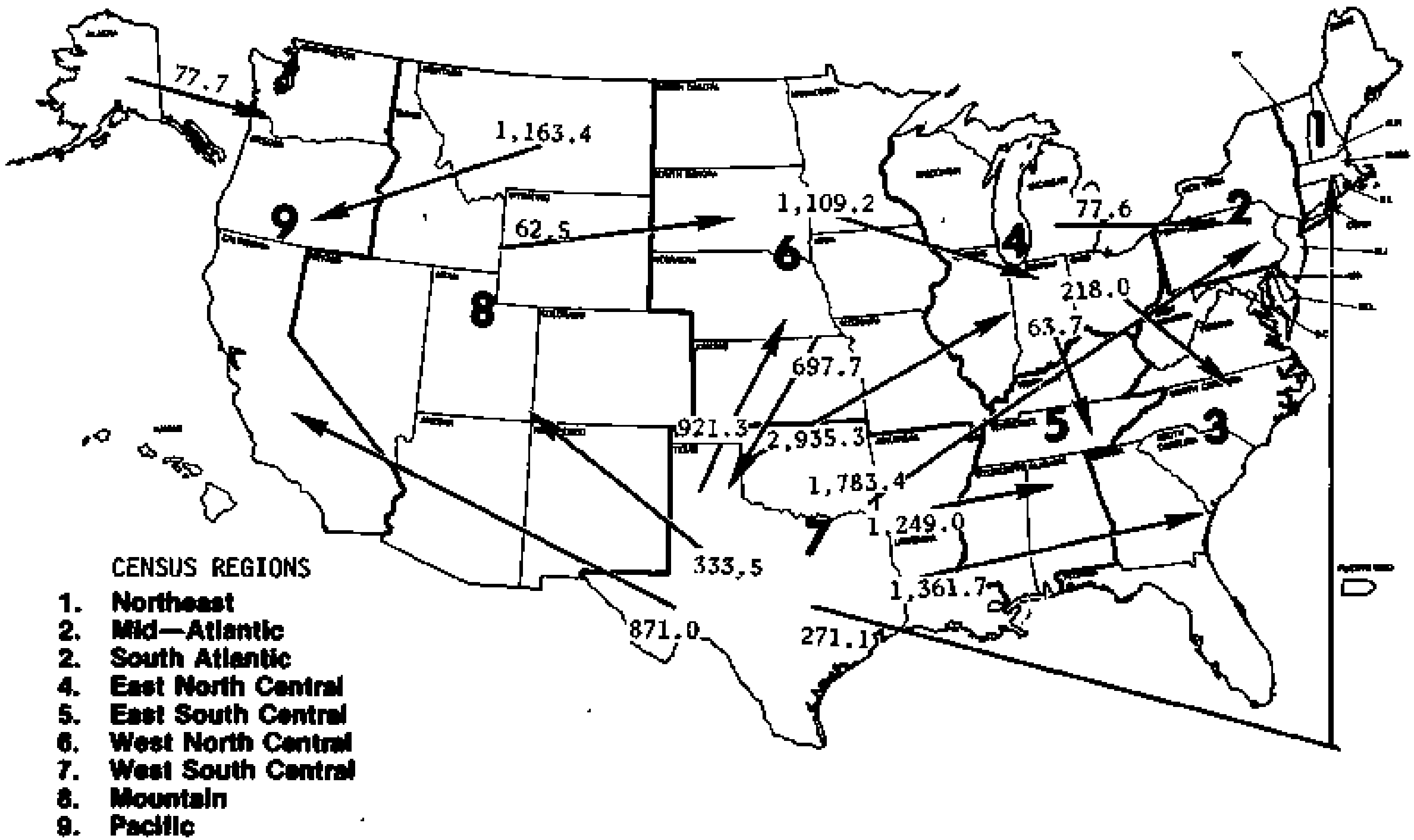
Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., August 1975, Tables 1-15, 1-20, and 1-22.

Movement of Petroleum Products by Pipeline between
Petroleum Administration for Defense (PAD)
Districts — United States, 1974
(thousands of barrels per day)



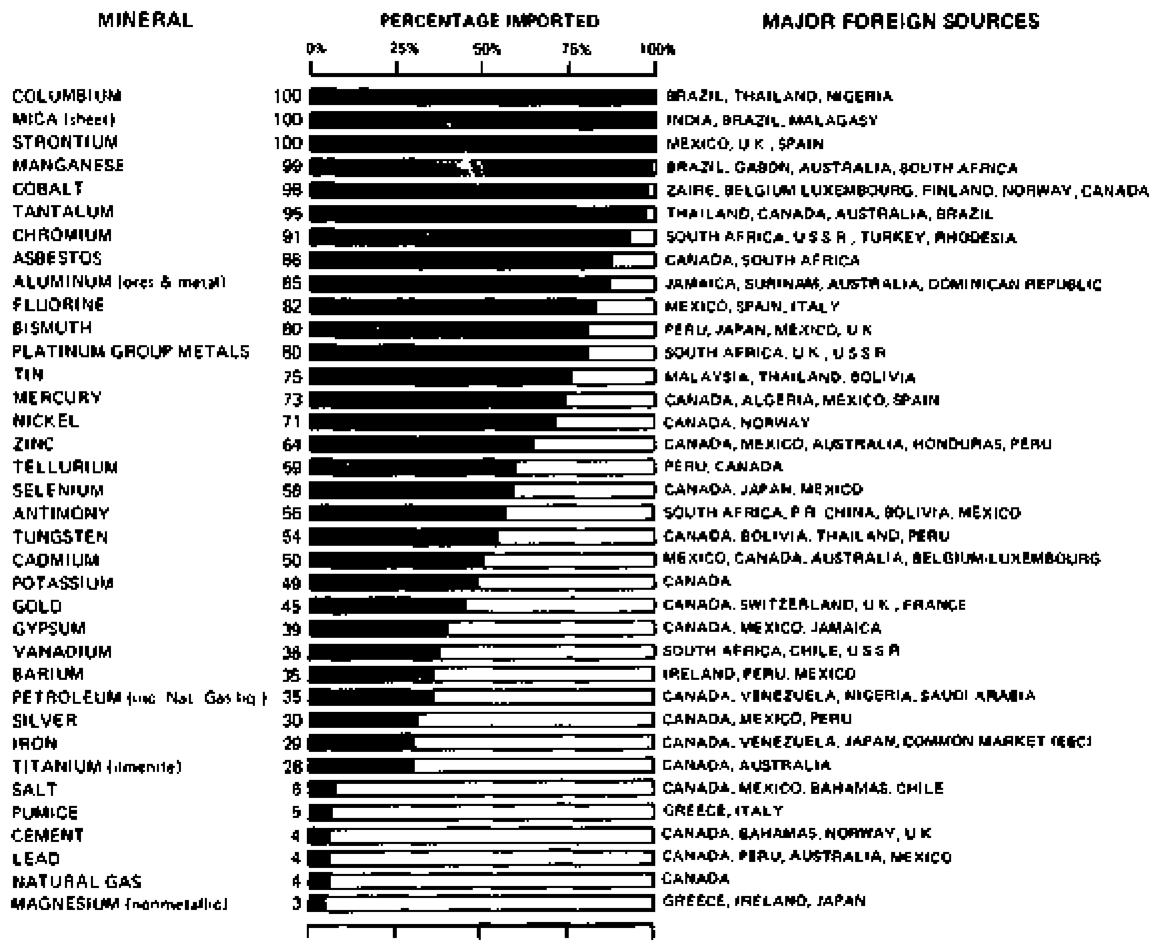
Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., August 1975, Tables 1-15, 1-20, and 1-22.

Natural Gas Shipments by Pipeline
between Demand Regions — 1972
(billions of cubic feet year)



Source: Federal Energy Administration, Project Independence Blueprint Final Task Force Report, Inputs to the Project Independence Evaluation System Integration Model for the Transport of Energy Materials, Volume 2, Washington, D.C., November 1974, Table V-4.

IMPORTS SUPPLIED SIGNIFICANT PERCENTAGE OF MINERALS AND METALS CONSUMPTION IN 1975



Imports of Strategic Materials by the United States in 1975

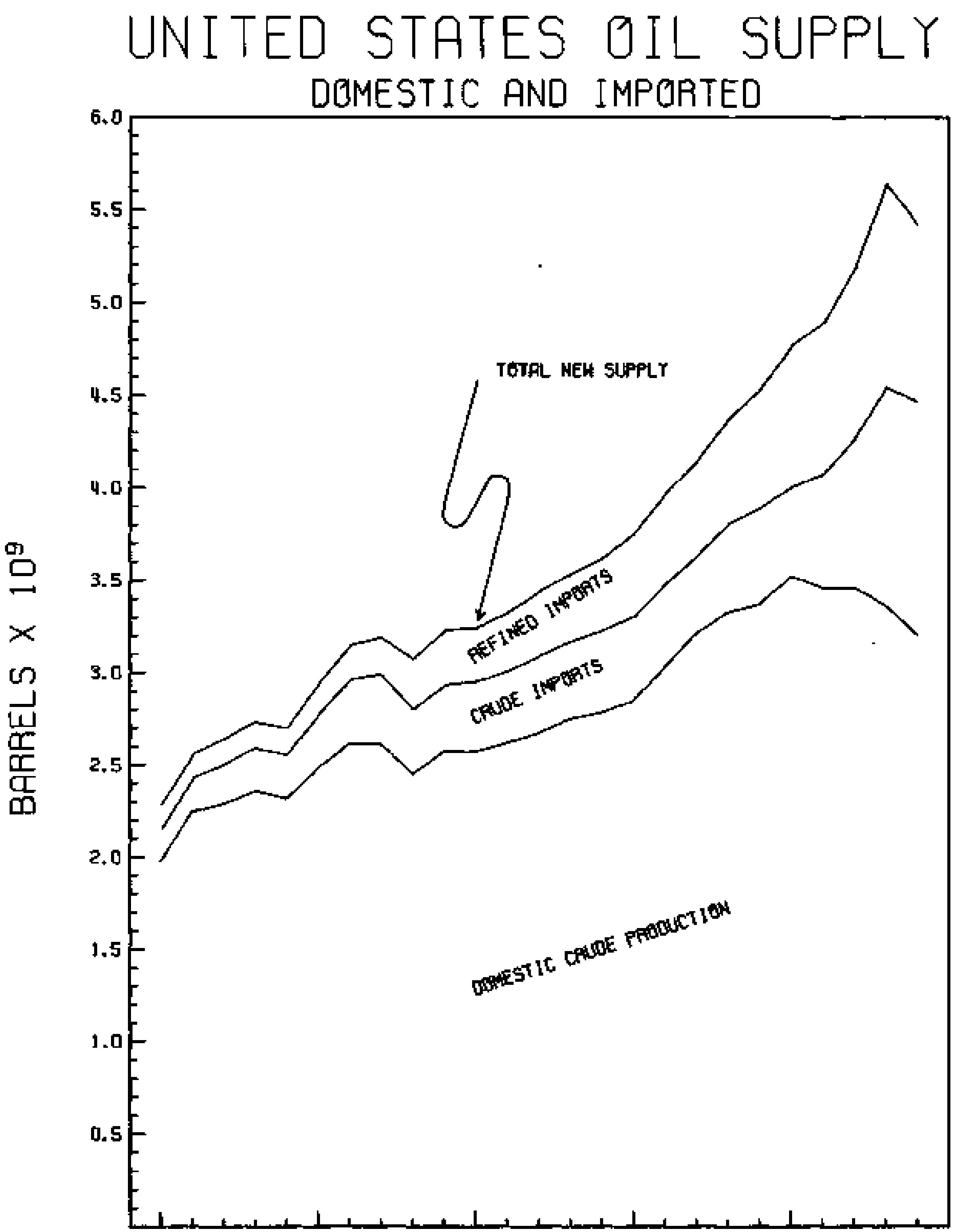
Source: U. S. Department of the Interior, Bureau of the Mines, Status of the Mineral Industries, Washington, D.C., 1976, p.5.

United States Total Production, Imports, and Annual New Supply of Crude Oil
(thousands of barrels)

Year	Total Domestic Crude Oil Production (1)	Crude Oil Imports	Refined Products Imports (2)	Total New Supply (3)	Daily Average of New Supply	Percent Crude Imports to Domestic Production
1950	1,973,574	177,714	132,547	2,283,835	6,257	9.0
1951	2,247,711	179,073	129,121	2,555,905	7,002	8.0
1952	2,289,836	209,591	138,916	2,638,343	7,209	9.2
1953	2,357,082	236,455	141,044	2,734,581	7,492	10.0
1954	2,314,988	239,479	144,476	2,698,943	7,394	10.3
1955	2,484,428	285,421	170,143	2,939,992	8,055	11.5
1956	2,617,283	341,833	183,758	3,142,874	8,578	13.1
1957	2,616,901	373,255	201,344	3,191,490	8,744	14.3
1958	2,448,987	348,007	272,582	3,069,576	8,410	14.2
1959	2,574,590	352,344	297,239	3,224,173	8,833	13.7
1960	2,574,933	371,575	292,536	3,239,044	8,850	14.4
1961	2,621,758	381,548	318,118	3,321,424	9,100	14.6
1962	2,676,189	411,039	348,754	3,435,982	9,414	15.4
1963	2,752,723	412,660	364,922	3,530,305	9,672	15.0
1964	2,786,822	438,643	388,093	3,613,558	9,873	15.7
1965	2,848,514	452,040	448,732	3,749,286	10,272	15.9
1966	3,027,763	447,120	492,042	3,966,925	10,868	14.8
1967	3,215,742	411,649	514,342	4,141,733	11,347	12.8
1968	3,329,042	472,323	567,046	4,368,411	11,935	14.2
1969	3,371,751	514,114	641,437	4,527,302	12,404	15.2
1970	3,517,450	483,293	764,769	4,765,512	13,056	13.7
1971	3,453,914	613,417	819,463	4,886,794	13,388	17.8
1972	3,455,368	811,135	924,179	5,190,682	14,182	23.5
1973	3,360,903	1,183,996	1,099,497	5,644,396	15,464	35.2
1974	3,199,328	1,269,155	953,024	5,421,507	14,853	39.7

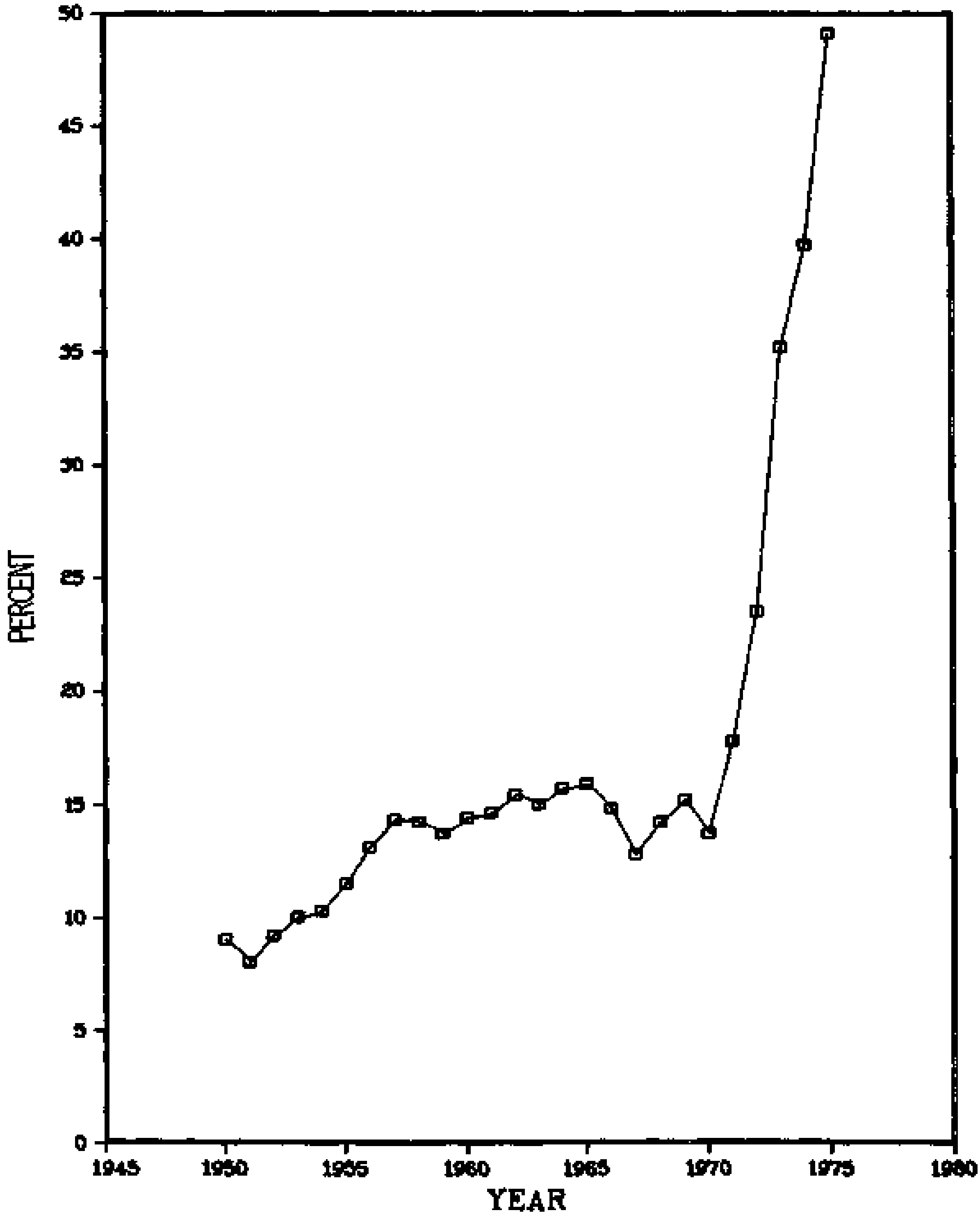
(1) Includes field condensate.
(2) Includes plant condensate and unfinished oils.
(3) Excludes natural gasoline and benzol.

Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 58.



Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 58.

UNITED STATES CRUDE OIL IMPORTS
AS PERCENT OF DOMESTIC PRODUCTION



Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 58.

Section 5.2

Domestic Production

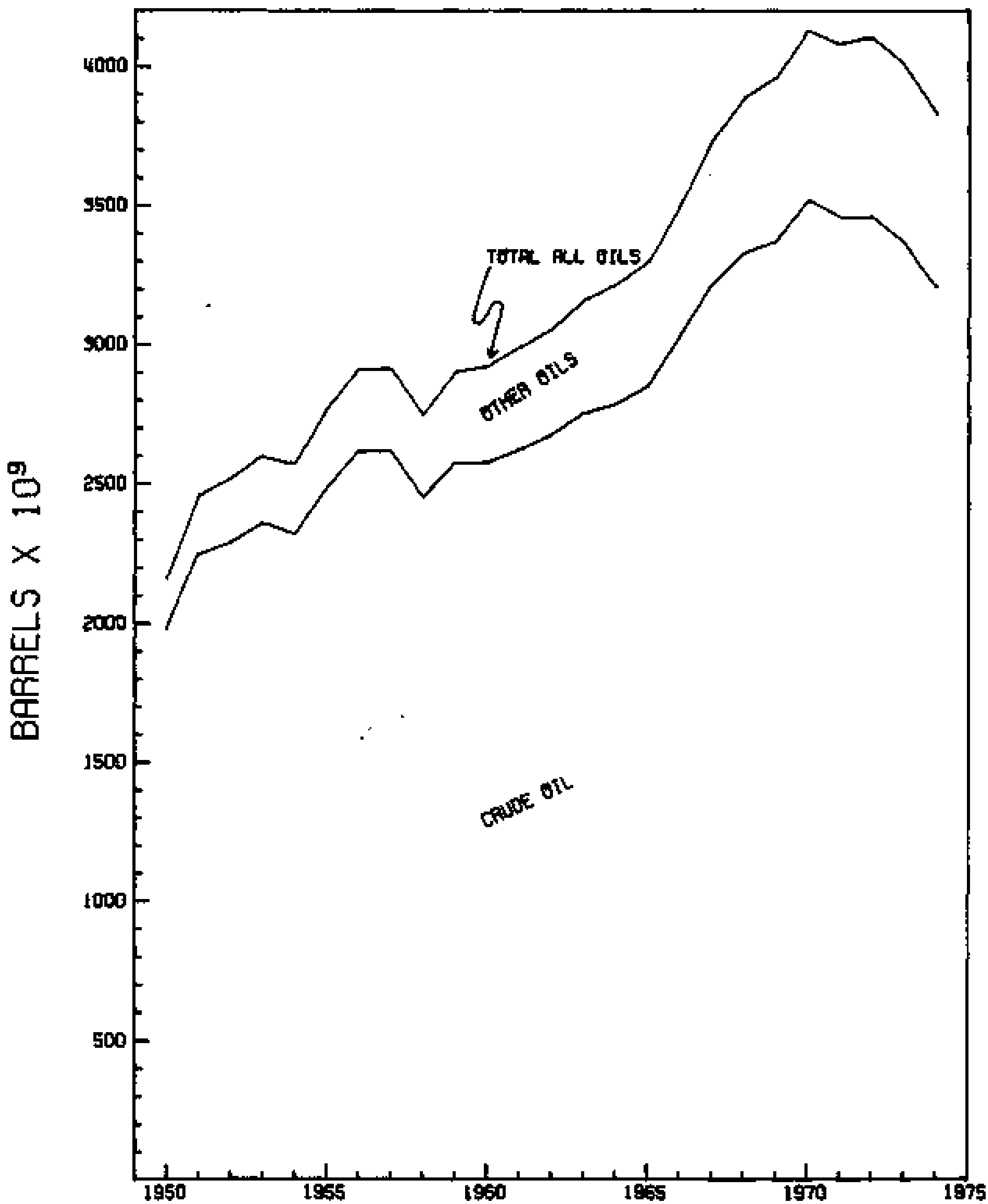
United States Domestic Production of Crude Oil,
Natural Gasoline, and Other Hydrocarbons
(thousands of barrels)

Year	Crude (1)	Daily Average	Natural Gasoline	Other	All Oils Total Production	Daily Average
1950	1,973,574	5,407	181,961	158	2,155,693	5,906
1951	2,247,711	6,158	204,754	211	2,452,676	6,720
1952	2,289,836	6,256	223,515	382	2,513,733	6,868
1953	2,357,082	6,458	238,579	505	2,596,166	7,113
1954	2,314,988	6,342	252,133	507	2,567,628	7,035
1955	2,484,428	6,807	281,371	526	2,766,325	7,579
1956	2,617,283	7,151	292,727	504	2,910,514	7,962
1957	2,616,901	7,170	294,990	252	2,912,143	7,978
1958	2,448,987	6,709	294,749	416	2,744,152	7,518
1959	2,574,590	7,054	320,757	324	2,895,671	7,933
1960	2,574,933	7,035	340,157	275	2,915,365	7,965
1961	2,621,758	7,183	361,689	169	2,983,616	8,174
1962	2,676,189	7,332	372,665	91	3,048,854	8,353
1963	2,752,723	7,542	401,116	80	3,153,919	8,641
1964	2,786,822	7,614	422,471	29	3,209,322	8,769
1965	2,848,514	7,804	441,556	13	3,290,083	9,014
1966	3,027,763	8,295	468,635	30	3,496,428	9,579
1967	3,215,742	8,810	514,456	87	3,730,285	10,220
1968	3,329,042	9,096	550,311	3,377	3,882,730	10,608
1969	3,371,751	9,238	580,241	4,213	3,956,205	10,839
1970	3,517,450	9,637	605,916	6,238	4,129,604	11,314
1971	3,453,914	9,463	617,815	6,074	4,077,803	11,172
1972	3,455,368	9,441	638,216	10,118	4,103,702	11,212
1973	3,360,903	9,208	634,423	10,716	4,006,042	10,975
1974	3,199,328	8,765	616,098	13,057	3,828,483	10,489

(1) Includes field condensate.

Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 27.

UNITED STATES DOMESTIC OIL PRODUCTION



Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 27.

United States Crude Oil Reserves[3] and Production
(thousands of barrels)

Year	Estimated Proved Reserves Beginning of Year	New Reserves Proved During Year (1)	Crude Oil Production During Year	Estimated Proved Reserves End of Year
1950	24,649,489	2,562,685	1,943,776	25,268,398
1951	25,268,398	4,413,954	2,214,321	27,468,031
1952	27,468,031	2,749,288	2,256,765	27,960,554
1953	27,960,554	3,296,130	2,311,856	28,944,828
1954	28,944,828	2,873,037	2,257,119	29,560,746
1955	29,560,746	2,870,724	2,419,300	30,012,170
1956	30,012,170	2,974,336	2,551,857	30,434,649
1957	30,434,649	2,424,800	2,559,044	30,300,405
1958	30,300,405	2,608,242	2,372,730	30,535,917
1959	30,535,917	3,666,745	2,483,315	31,719,347
1960	31,719,347	2,365,328	2,471,464	31,613,211
1961	31,613,211	2,657,567	2,512,273	31,758,505
1962	31,758,505	2,180,896	2,550,178	31,389,223
1963	31,389,223	2,174,110	2,593,343	30,969,990
1964	30,969,990	2,664,767	2,644,247	30,990,510
1965	30,990,510	3,048,079	2,686,198	31,352,391
1966	31,352,391	2,963,978	2,864,242	31,452,127
1967	31,452,127	2,962,122	3,037,579	31,376,670
1968	31,376,670	2,454,635	3,124,188	30,707,117
1969	30,707,117	2,120,036	3,195,291	29,631,862
1970	29,631,862	12,688,918 (2)	3,319,445	39,001,335
1971	39,001,335	2,317,732	3,256,110	38,062,957
1972	38,062,957	1,557,848	3,281,397	36,339,408
1973	36,339,408	2,145,831	3,185,400	35,299,839
1974	35,299,839	1,993,573	3,043,456	34,249,956
1975	34,249,956			

(1) Reflects revisions of earlier estimates based on additional information.

(2) Includes 9.6 billion barrels for Alaska's Prudhoe Bay Field discovered in 1968 and not previously included.

(3) Does not include condensate.

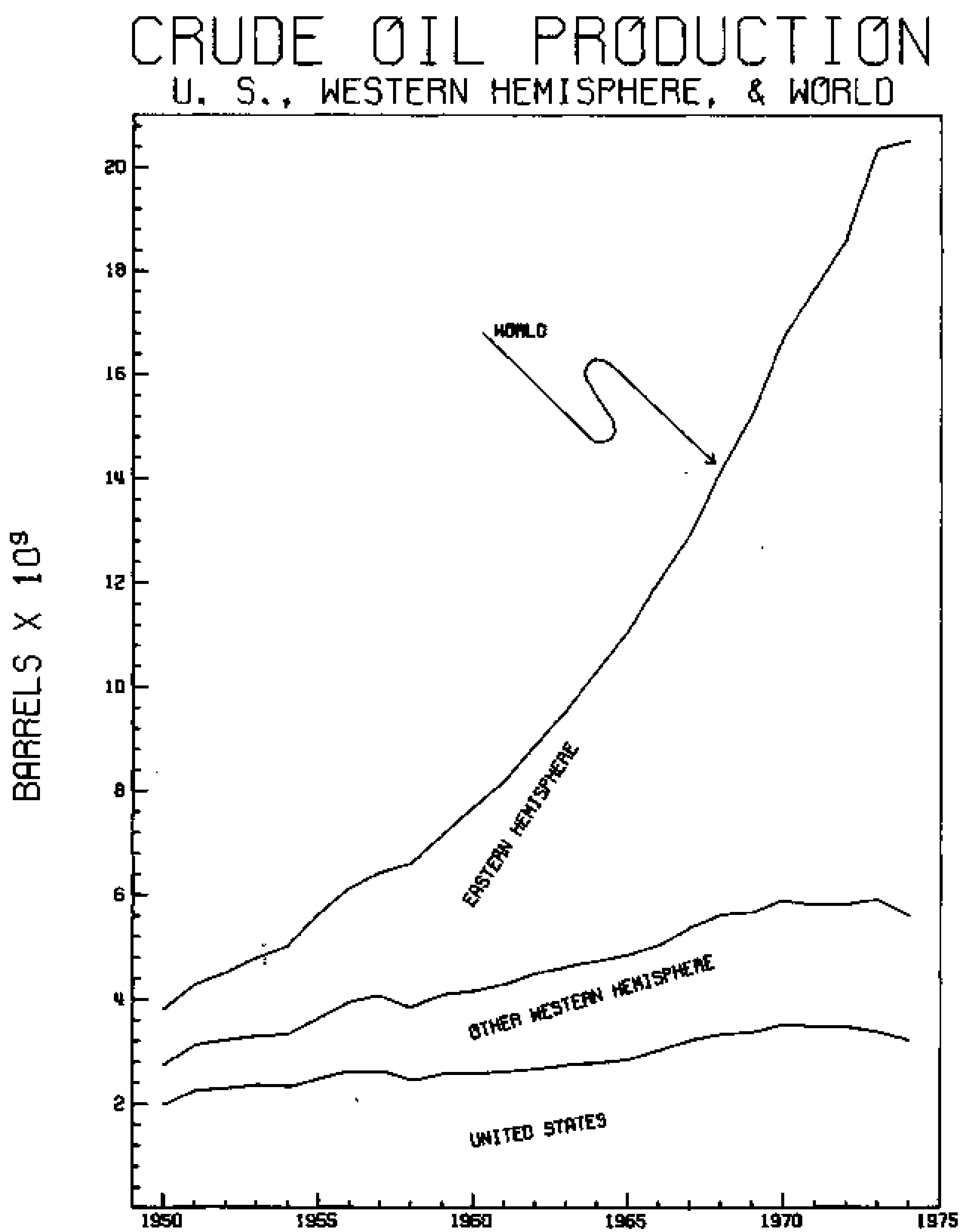
Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 24.

Crude Oil Production in United States, Western Hemisphere and World
(thousands of barrels)

Year	United States Annual Total (1)	United States Daily Average	Western Hemisphere Annual Total	Western Hemisphere Daily Average	World Annual Total	World Daily Average
1950	1,973,574	5,407	2,719,273	7,450	3,802,995	10,419
1951	2,247,711	6,158	3,099,480	8,492	4,282,730	11,733
1952	2,289,836	6.256	3,194,595	8,728	4,504,708	12,308
1953	2,357,082	6,458	3,266,773	8,950	4,798,055	13,145
1954	2,314,988	6,342	3,304,471	9,053	5,016,843	13,745
1955	2,484,428	6.807	3,614,299	9,902	5,625.883	15,413
1956	2,617,283	7,151	3,917,189	10,703	6,124,676	16,734
1957	2,616,901	7,170	4,056,058	11,112	6,438,444	17,640
1958	2,448,987	6,710	3,829,032	10,490	6,607,750	18,103
1959	2,574,590	7,054	4,060,290	11,124	7,133,238	19,543
1960	2,574,933	7,035	4,130,061	11,284	7,674,460	20,968
1961	2,621,758	7,183	4,268,037	11,693	8,186,213	22,428
1962	2,676,189	7,332	4,470,817	12,249	8,881,858	24,334
1963	2,752,723	7,542	4,593,471	12,585	9,538,346	26,132
1964	2,786,822	7,614	4,706,615	12,860	10,309,644	28,168
1965	2,848,514	7,804	4,827,447	13,226	11,062,515	30,308
1966	3,027,763	8,295	5,018,545	13,749	12,021,786	32,936
1967	3,215,742	8,809	5,350,760	14,660	12,914,340	35,382
1968	3,329,042	9,096	5,600,002	15,300	14,146,318	38,651
1969	3,371,751	9,238	5,647,813	15,473	15,222,511	41,706
1970	3,517,450	9,637	5,894,815	16,150	16,718,708	45,805
1971	3,453,914	9,463	5,812,551	15,925	17,662,793	48,391
1972	3,455,368	9,441	5,804,018	15,858	18,600,501	50,821
1973	3,360,903	9,208	5,903,966	16,175	20,367,981	55,803
1974	3,199,328	8,765	5,607,921	15,364	20,518,139	56,214

(1) Includes field condensate.

Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 13



Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 13.

Percentage Yields of the Major Refined Products in United States

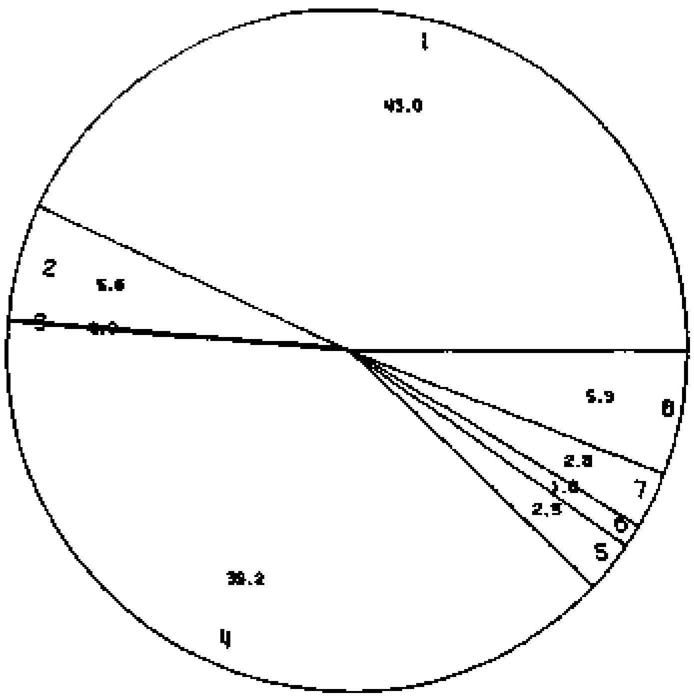
Year	Motor Fuel	Kerosene	Jet Fuel	Distillate and Residual Fuel Oil	Lubricants	Wax	Coke	Asphalt	Other Finished Products & Shortage
1950	43.0	5.6	...	39.2	2.5	0.2	0.8	2.8	5.9
1951	42.4	5.7	...	39.7	2.6	0.2	0.8	2.8	5.8
1952	43.0	5.4	...	39.9	2.3	0.2	0.7	2.9	5.6
1953	43.9	4.8	...	38.3	2.1	0.2	0.8	2.8	7.1
1954	43.9	4.8	1.8	37.7	2.1	0.2	1.0	2.9	5.6
1955	44.0	4.3	2.1	37.3	2.0	0.2	1.0	3.0	6.1
1956	43.4	4.2	2.3	37.6	2.0	0.2	1.1	3.1	6.1
1957	43.8	3.8	2.2	37.5	1.9	0.2	1.2	3.0	6.4
1958	45.2	3.9	2.6	35.3	1.8	0.2	1.3	3.2	6.5
1959	44.9	3.8	3.2	34.9	1.9	0.2	1.4	3.3	6.4
1960	45.2	4.6	3.0	33.6	2.0	0.2	2.0	3.3	6.1
1961	44.7	4.7	3.1	33.6	2.0	0.2	2.5	3.4	5.8
1962	44.8	6.0	3.3	32.8	2.0	0.1	2.6	3.5	5.9
1963	44.1	5.1	3.6	32.6	2.0	0.1	2.6	3.6	6.5
1964	45.2	2.9 (1)	5.6 (1)	30.8	2.0	0.1	2.6	3.5	7.3
1965	44.0	2.8	5.8	31.1	1.9	0.2	2.6	3.7	7.9
1966	44.6	3.0	6.2	30.2	1.9	0.2	2.6	3.8	7.5
1967	44.0	2.7	7.5	29.9	1.8	0.2	2.5	3.5	7.9
1968	44.0	2.6	8.3	29.3	1.7	0.2	2.5	3.6	7.8
1969	44.9	2.6	8.2	28.4	1.7	0.1	2.6	3.5	8.0
1970	45.5	2.4	7.5	28.8	1.6	0.2	2.7	3.7	7.6
1971	46.3	2.1	7.4	28.7	1.6	0.2	2.6	3.8	7.3
1972	46.5	1.8	7.2	29.0	1.5	0.1	2.8	3.6	7.6
1973	45.8	1.7	6.8	30.2	1.5	0.1	2.9	3.7	7.3
1974	46.2	1.3	6.8	30.5	1.6	0.2	2.8	3.7	6.9

(1) Data for commercial jet fuel, previously included with kerosene, now included in total jet fuel.

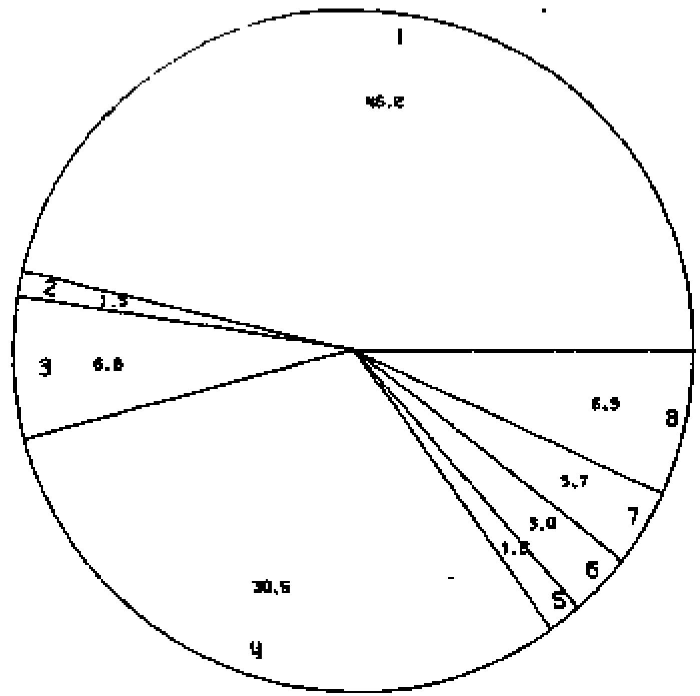
Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 63.

YIELD FROM A BARREL OF CRUDE OIL

	PERCENT	SECTOR
43.00	46.20	1) MOTOR FUEL
5.60	1.30	2) KEROSENE
0.0	6.80	3) JET FUEL
39.20	30.50	4) DISTILLATE & RESIDUAL FUEL OIL
2.50	1.60	5) LUBRICANTS
1.00	3.00	6) WAX & COKE
2.80	3.70	7) ASPHALT
5.90	6.90	8) OTHER PRODUCTS & SHORTAGE



1950



1974

Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 63.

Section 5.3

Imports

United States Imports of Crude Oil by Source Country (1)
(thousands of barrels)

Year	Canada	Mexico	Total North America	Colombia	Venezuela	Total South America	Algeria	Egypt	Libya	Nigeria	Total Africa
1950	...	12,307	12,307	16,159	107,019	123,789	...	...	...	...	...
1951	463	13,862	14,325	16,312	107,437	123,749	...	...	...	...	
1952	1,116	8,483	9,599	16,209	121,963	138,172	...	...	...	...	...
1953	2,527	2,897	5,424	15,860	120,178	136,128	...	...	...	...	...
1954	2,565	3,018	5,583	12,415	128,377	142,427	...	...	...	...	...
1955	16,810	5,510	22,320	8,125	140,754	150,816	...	...	...	...	...
1956	42,739	4,666	47,406	9,009	167,050	177,602	...	...	...	...	...
1957	55,131	2,441	57,572	8,366	193,756	204,166	...	...	...	...	...
1958	30,426	672	31,098	9,411	158,167	168,158	...	...	...	...	...
1959	33,730	112	33,842	12,437	165,883	178,865	...	...	...	...	...
1960	41,349	925	42,274	14,799	172,887	187,965	284	1,167	...	...	1,451
1961	66,614	3,655	70,269	10,050	155,751	167,726	...	1,887	...	...	1,887
1962	85,152	3,644	88,796	8,614	168,993	178,884	1,543	1,543	6,722	...	9,808
1963	90,394	3,657	94,051	8,293	174,537	184,882	380	1,772	7,021	...	9,173
1964	101,607	3,577	105,184	9,606	174,222	183,828	2,249	1,077	14,417	...	17,743
1965	107,762	2,552	110,314	15,211	157,852	173,063	3,256	881	15,152	5,296	24,585
1966	126,712	...	126,712	14,424	147,427	163,088	1,400	852	25,177	4,114	31,543
1967	150,409	...	150,409	11,855	131,089	150,593	1,447	1,318	15,293	1,432	20,151
1968	169,418	...	169,418	11,981	125,737	146,559	1,944	10,795	41,591	3,131	57,461
1969	203,298	...	203,298	15,551	111,722	134,549	358	14,778	48,862	17,958	82,380
1970	245,258	...	245,258	7,313	97,996	106,108	2,093	7,626	17,156	17,490	44,365
1971	263,294	...	263,294	3,175	110,574	114,808	4,685	6,924	19,426	34,826	68,361
1972	312,440	...	312,440	1,695	93,300	109,359	31,753	3,091	40,069	88,887	172,105
1973	365,370	489	365,859	778	125,742	166,379	43,619	5,296	48,585	163,687	285,481
1974	288,763	597	289,360	...	116,437	157,174 (2)	65,764	3,227	1,495	254,358	356,121 (3)

(1) Total may include amounts imported from countries not listed.
(2) Includes 15,225 from Ecuador, 23,045 from Trinidad, and 2,467 from Bolivia.
(3) Includes 17,989 from Angola, 4,519 from Tunisia, 670 from Congo, and 8,552 from Gabon.

Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 75.

United States Imports of Crude Oil by Source Country (1) (Cont'd)
(thousands of barrels)

Year	Abu Dhabi	Iran	Iraq	Kuwait	Neutral Zone	Saudi Arabia	Total Middle East	Indonesia	Others	Total All Countries
1950	...	111	...	26,741	...	14,650	41,618	...	...	177,714
1951	...	...	...	21,601	...	15,900	37,501	...	3,498	179,073
1952	...	...	705	26,444	...	29,407	56,556	3,640	1,624	209,591
1953	...	...	2,287	38,611	...	36,668	80,934	13,969	...	236,455
1954	...	204	2,188	41,046	2,983	27,819	77,764	13,705	...	239,479
1955	...	3,202	6,988	48,954	6,639	29,050	100,344	11,941	...	285,421
1956	...	7,257	9,650	50,953	3,072	27,670	103,517	13,309	...	341,833
1957	...	6,624	4,477	51,389	2,050	21,011	87,798	23,719	...	373,255
1958	...	5,348	8,972	68,098	12,007	27,081	123,019	21,053	4,679	348,007
1959	...	8,961	7,667	59,169	15,091	24,756	115,875	20,023	3,739	352,344
1960	...	13,056	6,363	47,512	16,363	28,232	113,175	26,720	...	371,575
1961	...	21,970	7,362	44,311	19,278	22,501	118,997	22,669	...	381,548
1962	...	17,735	856	40,749	15,837	24,359	109,071	24,480	...	411,039
1963	...	22,717	321	29,680	15,855	28,806	103,214	21,340	...	412,660
1964	1,112	24,143	...	23,263	17,565	35,464	108,841	23,047	...	438,643
1965	5,035	28,633	5,695	20,208	9,756	48,235	121,908	22,170	...	452,040
1966	4,781	30,833	9,447	9,543	7,028	45,771	107,579	18,198	...	447,120
1967	1,936	23,781	1,716	6,859	4,006	29,679	67,977	22,519	...	411,649
1968	5,605	21,154	...	15,863	10,749	18,959	72,330	26,555	...	472,323
1969	5,051	15,306	...	12,539	15,864	12,665	61,616	32,271	...	514,114
1970	23,047	12,184	...	12,123	8,398	6,140	61,892	25,670	...	483,293
1971	29,026	38,576	3,932	10,650	(2)	41,971	124,156	40,232	2,567	613,417
1972	26,873	49,700	1,315	13,205	(2)	63,626	155,982	59,633	1,616	811,135
1973	25,764	78,990	1,529	15,208	(2)	168,525	292,988	73,055	234	1,183,996
1974	25,158	168,956	...	1,820	(2)	159,827	362,186 (3)	103,482	832	1,269,155

(1) Totals may include amounts imported from countries not listed.
(2) Included with Saudi Arabia.
(3) Includes 6,189 from Qatar, and 236 from Oman.

Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, pp. 75 and 76.

United States Imports of Refined Products and Crude Oil
(thousands of barrels)

	REFINED IMPORTS		REFINED AND CRUDE OIL	
Year	Total	Daily Average	From All Countries	Daily Average
1950	132,547	363	310,261	850
1951	129,121	354	308,194	844
1952	138,916	380	348,507	952
1953	141,044	386	377,499	1,034
1954	144,476	396	383,955	1,052
1955	170,143	466	455,564	1,248
1956	183,758	502	525,591	1,436
1957	201,334	552	574,589	1,574
1958	272,582	747	620,589	1,700
1959	297,239	814	649,583	1,780
1960	292,536	804	664,111	1,819
1961	318,118	872	699,666	1,917
1962	348,754	935	759,793	2,082
1963	364,922	1,000	777,582	2,130
1964	388,093	1,060	826,736	2,259
1965	448,732	1,229	900,772	2,468
1966	492,042	1,348	939,162	2,573
1967	514,342	1,409	925,991	2,537
1968	567,046	1,549	1,039,369	2,837
1969	641,437	1,757	1,155,551	3,166
1970	764,769	2,095	1,248,062	3,419
1971	819,463	2,245	1,432,880	3,926
1972	924,179	2,525	1,735,314	4,741
1973	1,099,497	3,012	2,283,493	6,256
1974	953,024	2,611	2,222,179	6,088

Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 77.

Section 5.4

Prices

Wells Drilled and Average Prices of Crude Petroleum in the United States

Year	Total Wells Drilled (1) (Number)	Average Price per Bbl. (Dollars)
1950	43,307	2.51
1951	45,996	2.53
1952	46,509	2.53
1953	49,480	2.68
1954	52,197	2.78
1955	55,879	2.77
1956	58,418	2.79
1957	53,783	3.09
1958	49,101	3.01
1959	50,179	2.90
1960	46,831	2.88
1961	45,644	2.89
1962	45,997	2.90
1963	43,126	2.89
1964	44,149	2.88
1965	40,374	2.86
1966	36,883	2.88
1967	32,473	2.92
1968	30,939	2.94
1969	30,815	3.09
1970	27,408	3.18
1971	26,077	3.39
1972	27,864	3.39
1973	26,081	3.89
1974	33,470	6.85

(1) Includes service wells.

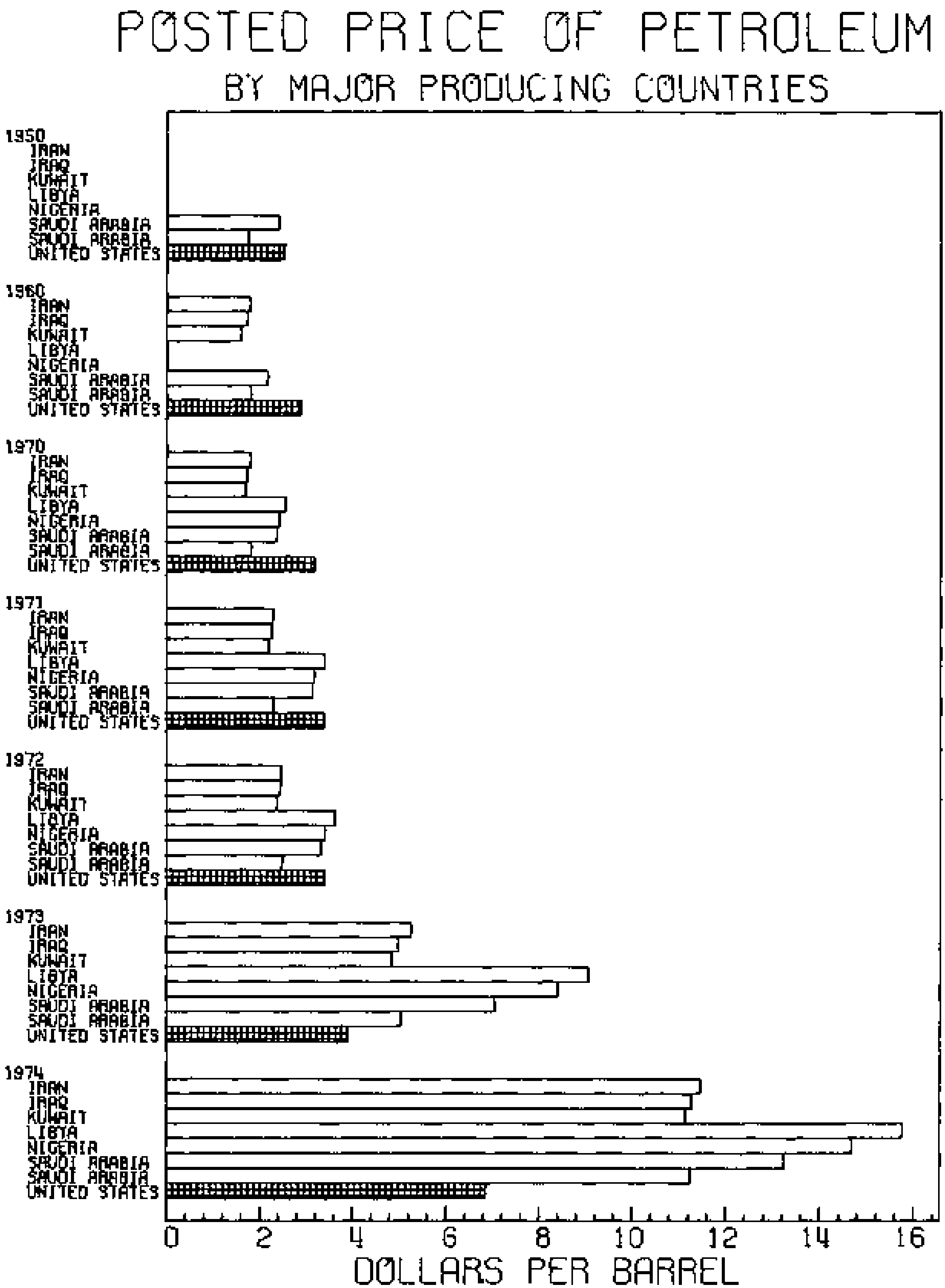
Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 41.

Year End Posted Prices Per Barrel of Petroleum by Major Exporting Countries

YEAR	Iran (1) Light, ex Kharg Is. 34.0°-34.9°	Iraq Basrah, ex Fao 35.0°-35.9°	Kuwait ex Mena al Ahmadi 31.0°-31.9°	Libya Brega ex Marsa el Brega 40.0°-40.9°	Nigeria Light, ex Bonny 34.0°-34.9°	Saudi Arabia (2) ex Sidon 34.0°-34.9°	Saudi Arabia (2) ex Ras Tanura 34.0°-34.9°
1950	$ ...	$ ...	$ ...	$ ...	$ ...	$ 2.410	$ 1.750
1951	...	1.670	...	...	...	2.410	1.750
1952	...	1.670	...	...	...	2.410	1.750
1953	...	1.920	1.720	...	...	2.390	1.970
1954	1.910	1.920	1.720	...	...	2.390	1.970
1955	1.910	1.920	1.720	...	...	2.390	1.970
1956	1.910	1.870	1.720	...	...	2.460	1.970
1957	2.040	1.980	1.850	...	...	2.570	2.080
1958	2.040	1.980	1.850	...	...	2.490	2.080
1959	1.860	1.800	1.670	...	...	2.270	1.900
1960	1.780	1.720	1.590	...	...	2.170	1.800
1961	1.780	1.720	1.590	2.230	...	2.170	1.800
1962	1.780	1.720	1.590	2.230	...	2.170	1.800
1963	1.780	1.720	1.590	2.230	...	2.170	1.800
1964	1.780	1.720	1.590	2.230	...	2.170	1.800
1965	1.780	1.720	1.590	2.230	...	2.170	1.800
1966	1.790	1.720	1.590	2.230	...	2.170	1.800
1967	1.790	1.720	1.590	2.230	2.170	2.170	1.800
1968	1.790	1.720	1.590	2.230	2.170	2.170	1.800
1969	1.790	1.720	1.590	2.230	2.170	2.170	1.800
1970	1.790	1.720	1.680	2.550	2.420	2.370	1.800
1971	2.274	2.259 (3)	2.187	3.399	3.178	3.136	2.285
1972	2.467	2.461 (3)	2.373	3.620	3.409	3.321	2.479
1973	5.254	4.978 (3)	4.822	9.061	8.404	7.034	5.036
1974	11.475	11.272 (3)	11.145	15.768	14.691	13.247	11.251

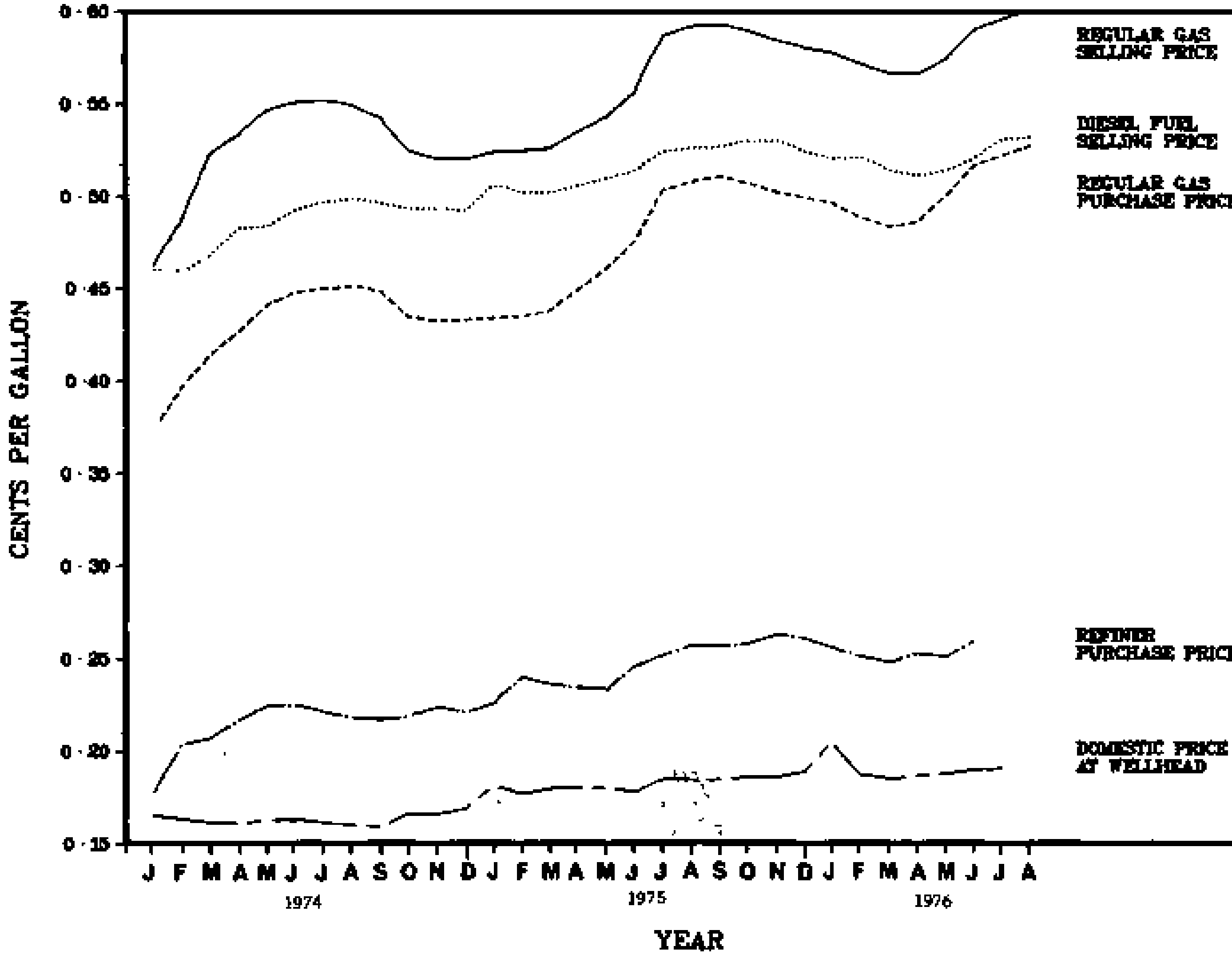
(1) Prior to 1966 port of export was Bandar Mashur.
(2) A.P.I. gravity for crude is 36.0°-36.9° from 1950-1956.
(3) Ex. Khor-al-Amaya.

Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975, p. 15.



Source: DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 31st ed., Dallas, Tex., 1975.

Cost of a Gallon of Crude Oil From Well to Customer



Source: Federal Energy Administration, National Energy Information Center, Monthly Energy Review, Washington, D.C., December 1976, pp. 54, 60, 66 and 69.

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Section 5.5

Projections

United States Capability to Produce Petroleum Products
(MBbls/day)

	Low Demand Case[1]					High Demand Case[2]				
Year	Total Demand	NGL Direct Sales	Net Demand	Refinery Output	Imports	Total Demand	NGL Direct Sales	Net Demand	Refinery Output	Imports
1975	16,600	800	15,800	13,800	2,000	16,000	800	15,800	13,809	2,000
1976	16,600	794	15,800	14,900	900	17,300	794	16,500	14,957	1,500
1977	16,600	783	15,800	15,200	600	18,000	783	17,200	15,945	1,300
1978	17,100	780	16,300	15,500	800	18,800	780	18,000	16,409	1,600
1979	17,600	777	16,800	15,900	900	19,600	777	18,800	17,472	1,300
1980	18,100	775	17,300	16,200	1,100	20,350	775	19,600	17,691	1,900
1981	18,400	769	17,600	16,500	1,100	21,000	769	20,200	18,251	1,900
1982	18,700	763	17,900	16,800	1,100	21,600	763	20,800	18,847	2,000
1983	19,000	757	18,200	17,200	1,000	22,200	757	21,400	19,445	2,000
1984	19,300	752	18,500	17,500	1,000	22,900	752	22,100	20,046	2,100
1985	19,600	747	18,900	17,900	1,000	23,750	747	23,000	20,670	2,300

[1]The Low Demand Case considers a constrained demand as reflected in the President's State of the Union Message. See the White House Fact Sheet, January 15, 1975.

[2]The High Demand Case uses the highest demand projection from Project Independence Blueprint, which assumes unconstrained oil supplies at $7 per barrel. See Project Independence, A Summary, p. 25, Table P-3.

Source: Federal Energy Administration, Office of Policy and Analysis and Office of Energy Resource Development, Initial Report on Oil and Gas Resources, Reserves, and Productive Capacities, Washington, D.C., 1975, p. IX-7.

Projected United States Refinery Capacity and Operations: Low Demand Case*

	Refinery Operations					Major Petroleum Products Produced		
	Refinery Capacity	Crude Runs	NGL and Other	Processing Gain	Total Output	Motor Gasoline	Distillate Fuel Oil	Residual Fuel Oil
1975	14,751	12,538	782	489	12,809	6,462	2,758	1,254
1976	15,070	13,563	777	556	14,896	6,880	2,957	1,424
1977	15,390	13,851	766	596	15,213	6,957	2,992	1,524
1978	15,710	14,139	763	636	15,538	7,041	3,026	1,626
1979	16,030	14,427	760	678	15,865	7,122	3,059	1,731
1980	16,350	14,715	758	721	16,194	7,203	3,090	1,839
1981	16,670	15,003	752	765	16,520	7,278	3,121	1,950
1982	16,990	15,291	756	810	16,847	7,352	3,303	2,064
1983	17,310	15,579	740	857	17,176	7,423	3,178	2,181
1984	17,630	15,867	735	904	17,506	7,494	3,205	2,301
1985	17,950	16,155	730	969	17,854	7,564	3,231	2,423

*From President's State of the Union Message, White House Fact Sheet, January 15, 1975

Source: Federal Energy Administration, Office of Policy and Analysis and Office of Energy Resource Development, Initial Report on Oil and Gas Resources, Reserves, and Productive Capacities, Washington, D.C., 1975, p. IX-8.

Projected United States Refinery Capacity and Operations: High Demand Case*

	Refinery Operations					Major Petroleum Products Produced		
	Refinery Capacity	Crude Runs	NGL and Other	Processing Gain	Total Output	Motor Gasoline	Distillate Fuel Oil	Residual Fuel Oil
1975	14,751	12,538	782	489	13,809	6,462	2,758	1,254
1976	15,136	13,622	777	558	14,957	6,907	2,970	1,430
1977	16,170	14,553	766	626	15,945	7,271	3,143	1,601
1978	16,635	14,972	763	674	16,409	7,411	3,204	1,722
1979	17,735	15,962	760	750	17,472	7,799	3,384	1,915
1980	17,935	16,142	758	791	17,691	7,828	3,390	2,018
1981	18,500	16,650	752	849	18,251	7,995	3,463	2,165
1982	19,100	17,190	756	911	18,847	8,172	3,541	2,321
1983	19,700	17,730	740	975	19,445	8,346	3,617	2,482
1984	20,300	18,270	735	1,041	20,056	8,518	3,691	2,649
1985	20,900	18,810	730	1,130	20,670	8,687	3,762	2,822

*Project Independence - A Summary, Table P-3, P.35

Source: Federal Energy Administration, Office of Policy and Analysis and Office of Energy Resource Development, Initial Report on Oil and Gas Resources, Reserves, and Productive Capacities, Washington, D.C., 1975, p. IX-10.

Number of Drivers by Age and Sex, 1974
(in thousands)

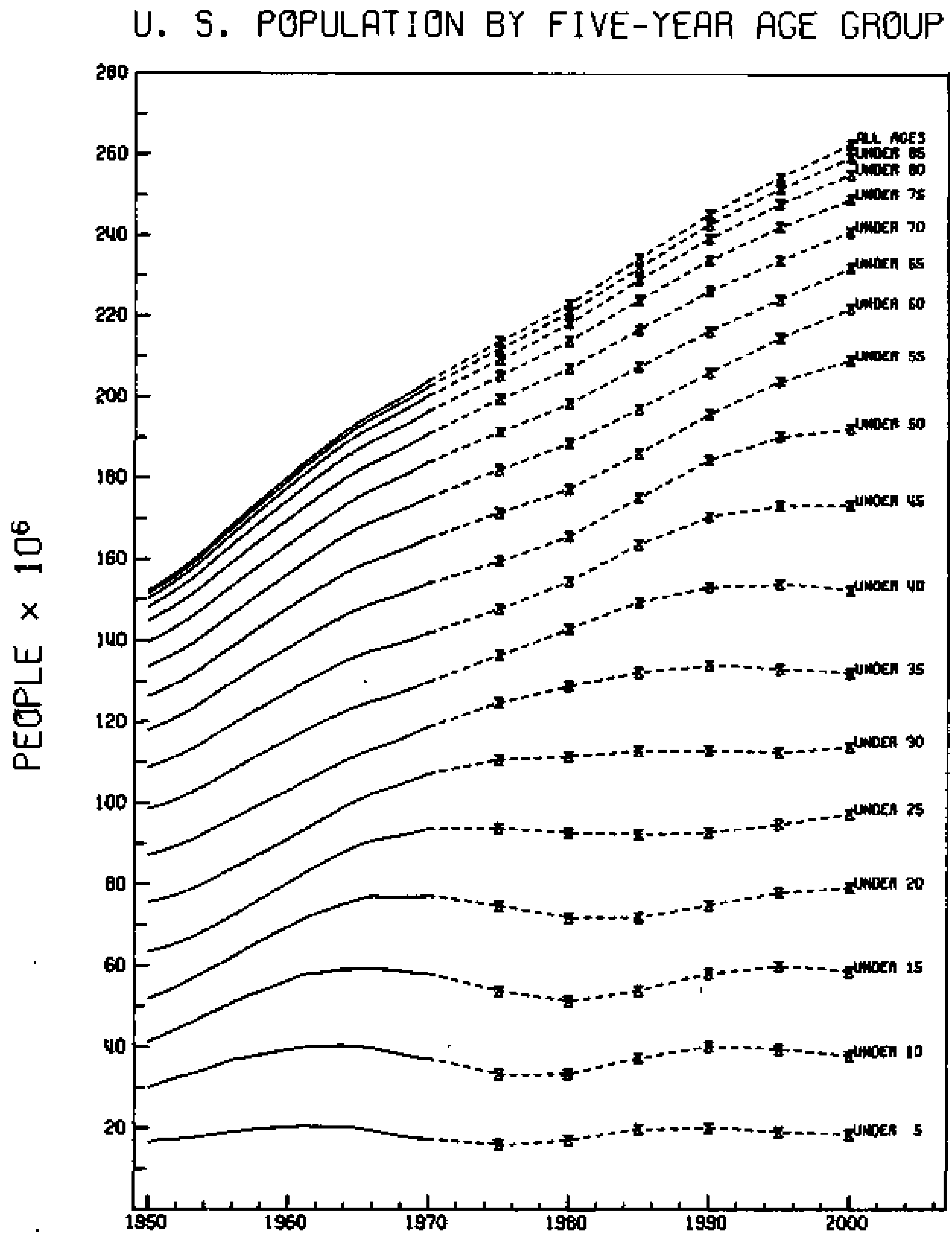
Age	Male	Female	Total	
			Number	Percent
Under 20	6,171	5,066	11,237	9.0
20-24	8,849	7,777	16,626	13.3
25-29	8,068	7,168	15,236	12.2
30-34	6,687	5,963	12,650	10.1
35-39	5,745	5,124	10,869	8.7
40-44	5,707	5,011	10,718	8.6
45-49	5,791	5,002	10,793	8.6
50-54	5,506	4,588	10,094	8.1
55-59	4,750	3,802	8,552	6.8
60-64	4,032	3,036	7,068	5.6
65-69	3,116	2,090	5,206	4.1
70 and over	3,977	2,140	6,117	4.9
Total	68,399	56,767	125,166	100.0

Source: Motor Vehicle Manufacturers Association, 1975 Automobile Facts and Figures, Detroit, Mich., 1975, p. 35.

Projections of Licensed Drivers

Year	Driving age population (15 years and over)	Licensed drivers	Percent of licensed drivers of the forecasted persons of driving age (15 and over)
1975	157.5	126.5	80.3
1980	167.9	137.8	82.1
1985	179.1	149.8	83.6
1990	189.7	161.2	85.0

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Travel Forecasts, Washington, D.C., November 1974, p. 27.



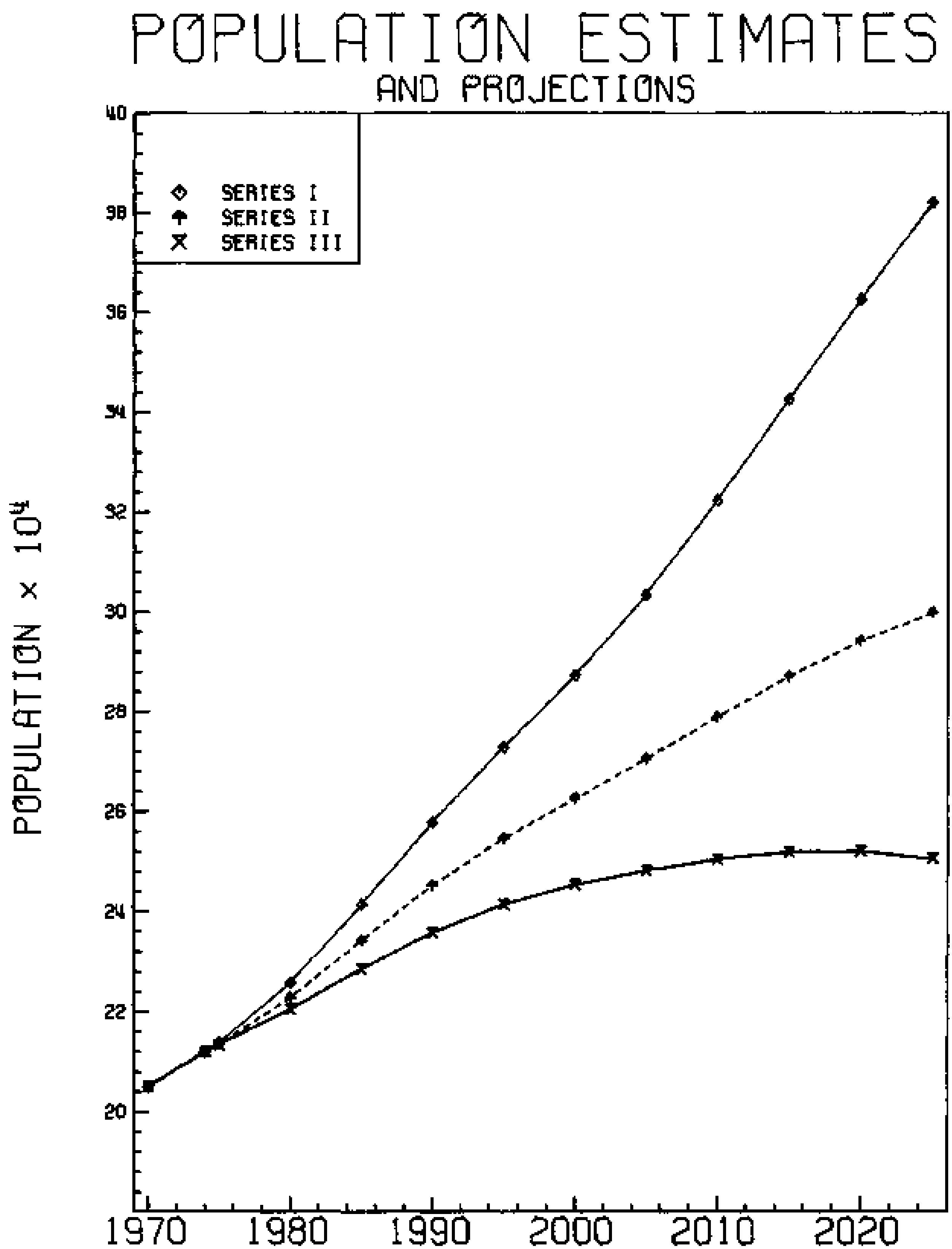
Sources: U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 310, Washington, D.C., 1965, Table 1; Current Population Reports, Series P-25, No. 519, Washington, D.C., 1974, Table 1; Current Population Reports, Series P-25, No. 541, Washington, D.C., 1975, Table 2.

U.S. Population by Five-Year Age Groups, 1950-2000

	<5	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80+	Total	15+
									Numbers in millions										
1950[1]	16.41	13.38	11.21	10.60	11.52	12.29	11.62	11.32	10.28	9.14	8.31	7.29	6.10	5.05	3.44	2.16	1.75	151.87	110.87
1960	20.34	18.81	16.92	13.35	10.87	10.82	11.90	12.48	11.64	10.90	9.66	8.47	7.15	6.28	4.77	3.08	2.54	179.96	123.89
1970	17.16	19.90	20.83	19.21	16.56	13.58	11.49	11.07	11.96	12.13	11.16	10.00	8.67	7.02	5.46	3.86	3.74	203.80	145.91
1980	17.26	16.14	17.80	20.59	20.91	18.93	17.22	14.03	11.68	11.01	11.63	11.30	9.74	8.66	6.75	4.29	4.82	222.76	171.56
1990[2]	20.10	20.02	17.97	16.80	17.95	20.16	20.90	19.25	17.29	13.85	11.36	10.29	10.19	9.86	7.67	5.40	6.00	245.06	186.97
2000[2]	18.36	19.39	20.81	20.71	18.14	16.51	17.99	20.43	20.89	18.95	16.79	12.95	9.99	9.02	8.06	6.22	7.30	262.51	203.95
									Percent distribution										
1950[1]	10.8	8.8	7.4	7.0	7.6	8.1	7.6	7.4	6.8	6.0	5.5	4.8	4.0	3.3	2.3	1.4	1.2	100.0	73.0
1960	11.3	10.4	9.4	7.4	6.0	6.0	6.6	6.9	6.5	6.0	5.4	4.7	4.0	3.5	2.7	1.7	1.4	100.0	68.9
1970	8.4	9.8	10.2	9.4	8.1	6.7	5.6	5.4	5.9	6.0	5.5	4.9	4.3	3.4	2.7	1.9	1.8	100.0	71.6
1980[2]	7.8	7.3	8.0	9.2	9.4	8.5	7.7	6.3	5.2	4.9	5.2	5.1	4.4	3.9	3.1	1.9	2.1	100.0	76.9
1990[2]	8.2	8.2	7.3	6.9	7.3	8.2	8.5	7.9	7.1	5.7	4.6	4.2	4.2	4.0	3.1	2.2	2.4	100.0	76.3
2000[2]	7.0	7.4	7.9	7.9	6.9	6.3	6.8	7.8	8.0	7.2	6.4	4.9	3.8	3.4	3.1	2.4	2.8	100.0	77.7

[1]Figures for 1950 do not include armed forces overseas.
[2]Projections are taken from the Bureau of the Census Projection Series II which assumes a completed cohort fertility rate of 2.1 births per woman.

Source: U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 310, Washington, D.C., 1965, Table 1; Current Population Reports, Series P-25, No. 51[illegible], Washington, D.C., 1974, Table 1; Current Population Reports, Series P-25, No. 541, Washington, D.C., 1975, Table 2.



Source: U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 541, Washington, D.C., 1975, Table A.

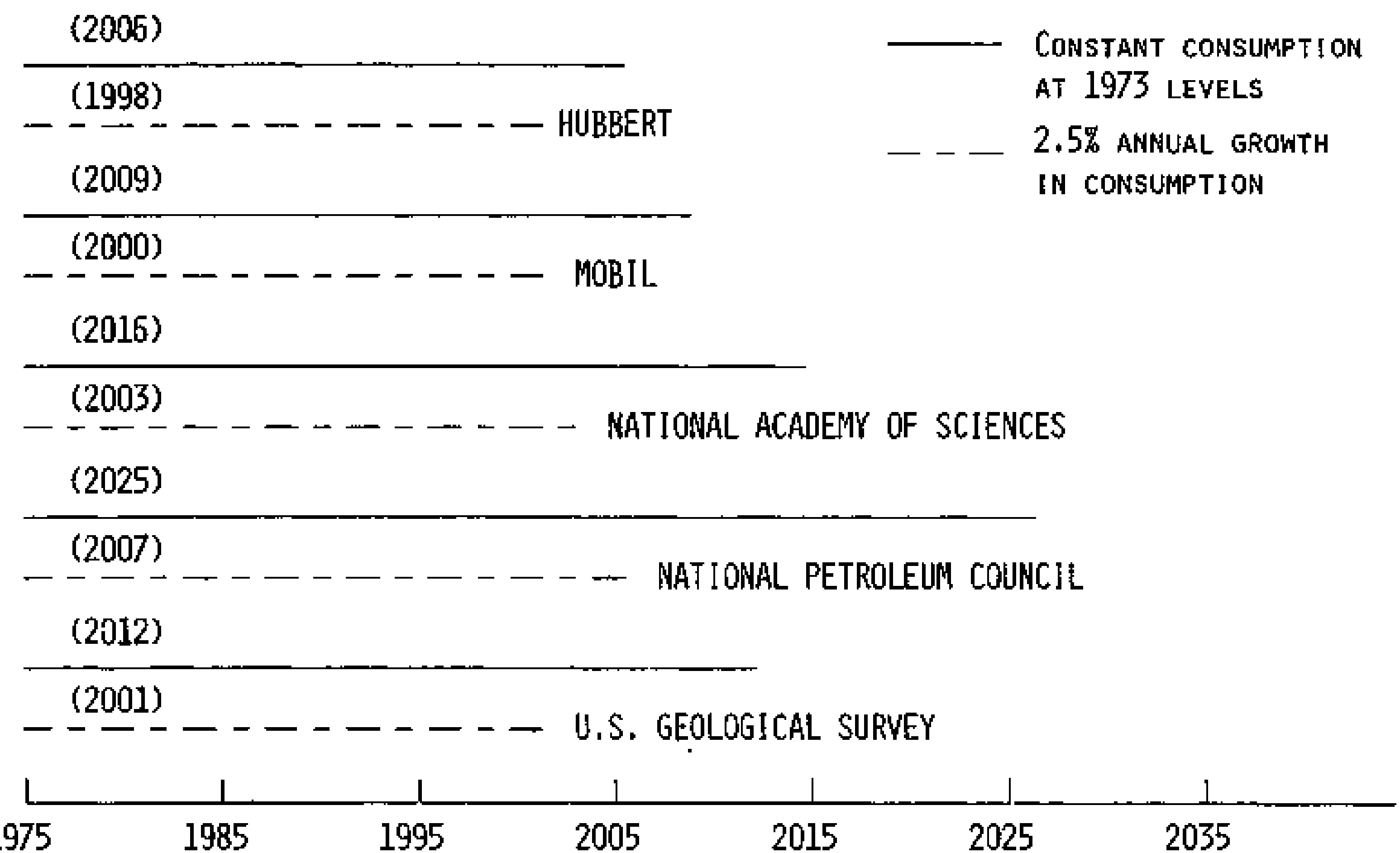
Estimates and Projections[1] of
Total Population: 1970 to 2025
(in thousands)

Year	Series I	Series II	Series III
ESTIMATES			
1970		204,875	
1974		211,909	
PROJECTIONS			
1975	213,641	213,450	213,323
1980	225,705	222,769	220,356
1985	241,274	234,068	228,355
1990	257,663	245,075	235,581
1995	272,685	254,495	241,198
2000	287,007	262,494	245,098
2005	303,144	270,377	247,926
2010	322,049	278,754	250,193
2015	342,340	286,960	251,693
2020	362,348	294,046	251,884
2025	382,011	299,713	250,421

[1]U.S. Bureau of the Census Projection Series I assumes a completed cohort fertility rate of 2.7 births per woman; Series II, 2.1 (replacement level); and Series III, 1.7.

Source: U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 541, Washington, D.C., 1975, Table A.

YEAR OF EXHAUSTION OF DOMESTIC OIL AND NATURAL GAS LIQUID RESOURCES
(ASSUMING 35% IMPORTS)



Source: B.M. Miller et al., U.S. Department of the Interior, Geological Survey, Geological Estimates of Undiscovered Recoverable Oil and Gas Resources in the United States, Geological Survey 725, Washington, D.C., 1975; National Ocean Study, March 1975.

CHAPTER 5 - REFERENCES

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Gay, W.F., U.S. Department of Transportation, Energy Statistics, Washington, D.C., August 1975.

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Transportation Demand

This chapter presents statistics on population characteristics (Section 6.1) and economic determinants (Section 6.2) that influence transportation demand. Statistics are presented in Section 6.1 on current and projected total population distribution by age and for the number of licensed drivers. In Section 6.2, transportation activity in the National Product and Income Accounts shows the influence of transportation on the overall economy and highlights the interdependencies between transportation and other economic activities.

One of the key determinants of transportation demand is population, and more specifically, population of driving age. Data contained in Section 6.1 illustrate past and future trends in population prepared by the U.S. Bureau of the Census. The projection series shows that alternative assumptions regarding fertility can significantly affect population levels, which, in turn, cause differences in driving age populations.

The relationship between transportation activity and other types of economic activity is important because changes in economic activity influence the demand for transportation services, and also because changes in transportation expenditure may influence the overall level of economic activity. That is, transportation energy use may decline substantially as a result of an economic downturn, and policies designed to reduce transportation energy use significantly could affect the level of economic activity.

Data contained in Section 6.2 show that transportation expenditures have remained at a relatively constant fraction of total personal consumption expenditure since 1950, roughly 13 percent, while increasing roughly four-fold in absolute terms (pages 245 and 247).

In terms of employment, the transportation services sector accounted for approximately three percent of total employment in 1974; however, this figure understates the importance of transportation, since it leaves out significant amounts of manufacturing, service, and retail and wholesale trade employment linked directly to transportation (see page 252).

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Section 6.2

Economic Determinants

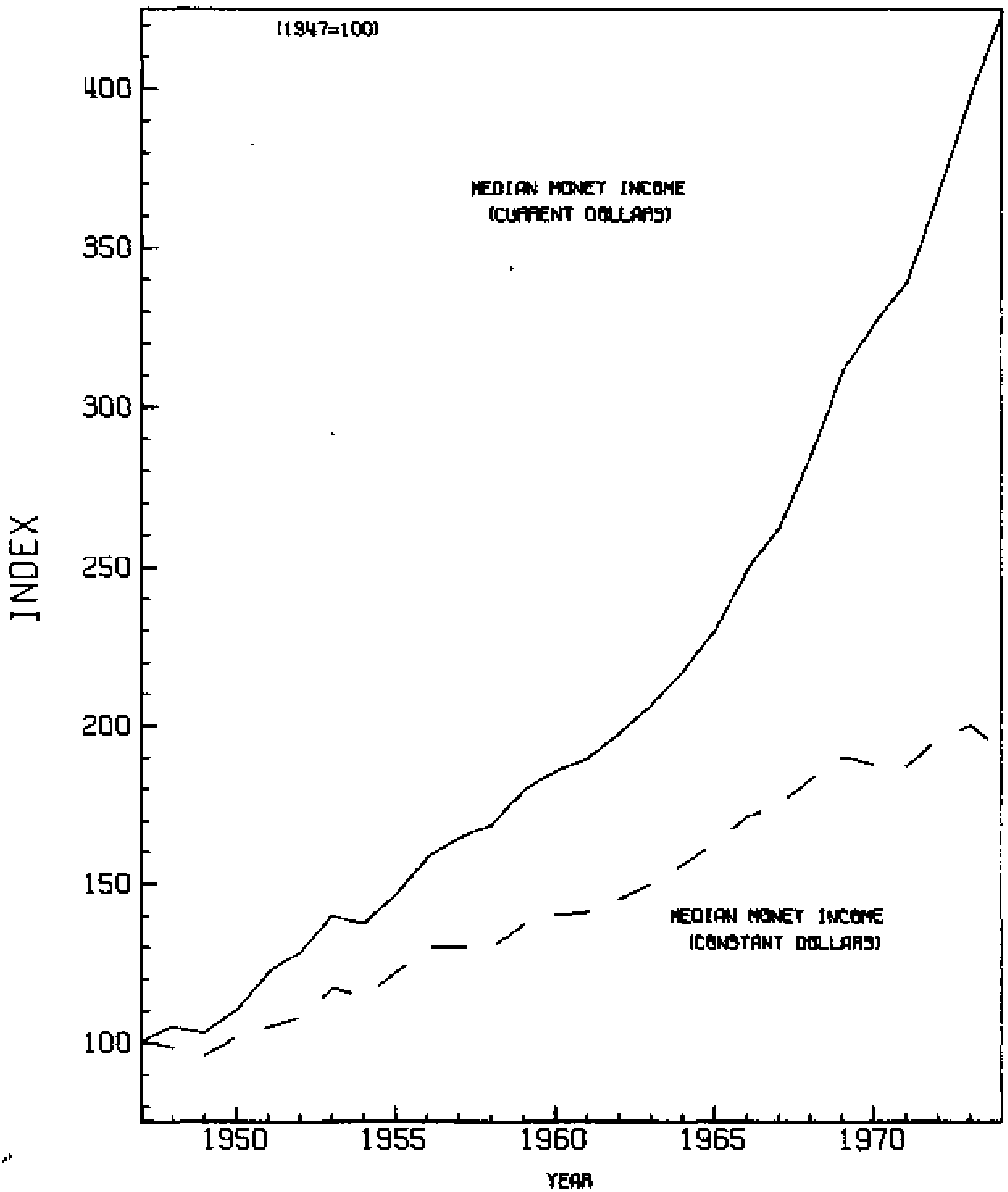
Index of Median Family Income in Current Dollars
and in 1974 Constant Dollars for the United States,
1947 to 1974

Median Income

Year	Current dollars		1974 constant dollars	
	Amount (dollars)	Index (1947 = 100)	Amount (dollars)	Index (1947 = 100)
1974	12,836	424	12,836	192
1973	12,051	398	13,373	200
1972	11,116	367	13,103	196
1971	10,285	339	12,523	187
1970	9,867	326	12,531	167
1969	9,433	311	12,649	190
1968	8,632	285	12,236	183
1967	7,933	262	11,717	175
1966	7,532	249	11,445	171
1965	6,957	230	10,874	163
1964	6,569	217	10,444	156
1963	6,249	206	10,064	150
1962	5,956	197	9,709	145
1961	5,735	189	9,454	141
1960	5,620	185	9,358	140
1959	5,417	179	9,165	137
1958	5,087	168	8,676	130
1957	4,966	164	8,701	130
1956	4,780	158	8,673	130
1955	4,418	146	8,137	122
1954	4,167	137	7,646	114
1953	4,242	140	7,821	117
1952	3,890	128	7,227	108
1951	3,709	122	7,081	105
1950	3,319	110	6,800	102
1949	3,107	103	6,428	96
1948	3,187	105	6,530	98
1947	3,031	100	6,691	100

Source: U.S. Bureau of the Census, Current Population Reports, Series P-60, No. 101, Washington, D.C., 1976, Tables 10 and 11.

INDEX OF MEDIAN FAMILY INCOME
IN CURRENT AND CONSTANT DOLLARS
FOR THE UNITED STATES



Source: U.S. Bureau of the Census, Current Population Reports, Series P-60, No. 101, Washington, D.C., 1976, Tables 10 and 11.

Per Capita Income Projections

	1967 dollars	Relative to 1971
1971	3,544	1.00
1980	4,700	1.33
1985	5,400	1.52
1990	6,100	1.72
2000	8,100	2.29
2020	13,200	3.72

Source: U.S. Water Resources Council, 1972 OBERS Projections, Series E Population, Volume 1, Washington, D.C., April 1974.

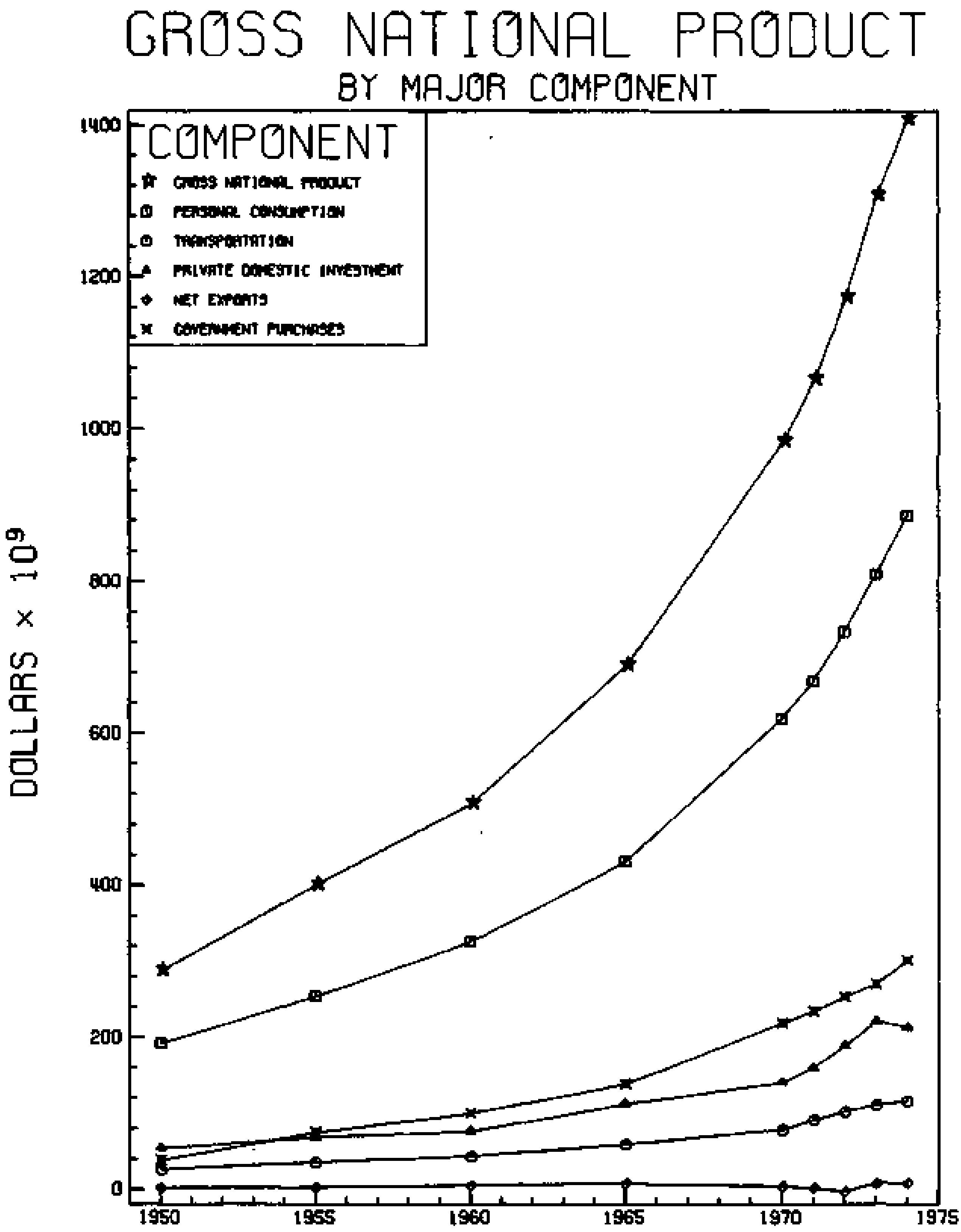
Gross National Product by Major Component, 1950-1976
(million of dollars)

	1960	1965	1970	1971	1972	1973	1974	1975	1976[1]
Gross national product (GNP) (total percent)	505,978 (100.0)	688,110 (100.0)	982,419 (100.0)	1,063,436 (100.0)	1,171,121 (100.0)	1,306,335 (100.0)	1,406,911 (100.0)	1,516,300 (100.0)	1,744,300 (100.0)
Personal consumption expenditures (PCE) (% of GNP)	324,903 (64.2)	430,154 (62.5)	618,796 (63.0)	668,171 (62.8)	733,034 (62.6)	808,549 (61.9)	885,862 (63.0)	973,200 (64.2)	1,122,000 (64.3)
Transportation[2] (% of PCE)	42,400 (13.1)	58,200 (13.5)	78,000 (12.6)	91,000 (13.6)	101,500 (13.8)	110,500 (13.7)	115,300 (13.0)	126,100 (13.0)	155,400 (13.9)
Gross private domestic domestic (% of GNP)	76,444 (15.1)	112,015 (16.3)	140,814 (14.3)	159,969 (15.0)	188,275 (16.1)	220,472 (16.9)	212,218 (15.1)	183,700 (12.1)	242,800 (13.9)
Net exports of goods and services (% of GNP)	4,372 (0.9)	7,591 (1.1)	3,946 (0.4)	1,562 (0.1)	-3,293 (-0.3)	7,368 (0.6)	7,746 (0.6)	20,500 (1.4)	3,300 (0.2)
Government purchases of goods and services (% of GNP)	100,259 (19.8)	138,350 (20.1)	218,863 (22.3)	233,734 (22.0)	253,105 (21.6)	269,946 (20.7)	301,085 (21.4)	339,000 (22.4)	376,200 (21.6)

[1]III Quarter Data.

[2]Includes motor vehicles and parts, gasoline and oil, and transportation.

Sources: U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, 56, No. 1, Part 1 and 2, Washington, D.C., January 1976, Table 1.1 and Table 2.3; Survey of Current Business, 57, No. 1, Washington, D.C., January 1977.

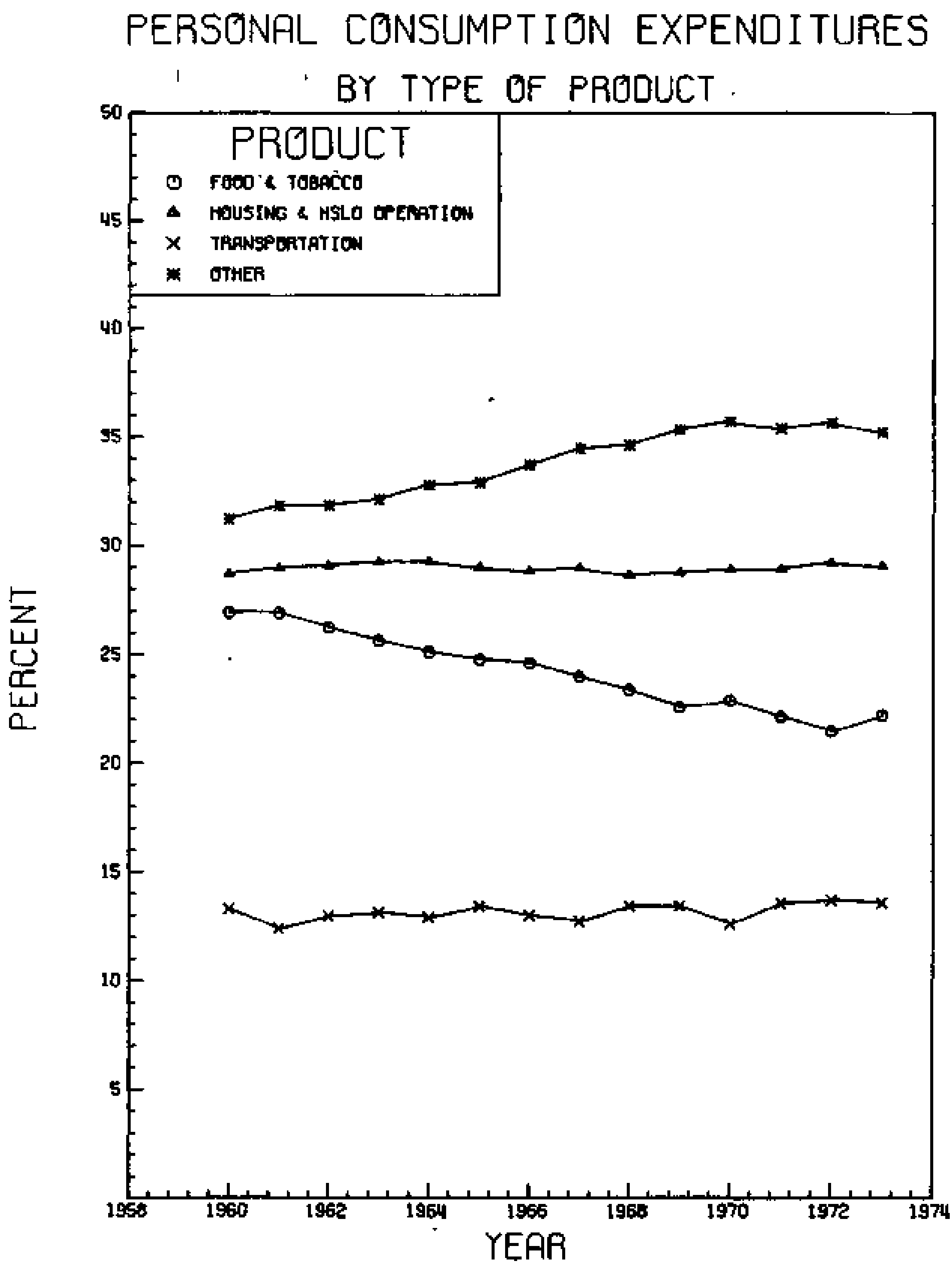


Source: U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, 56, No. 1, Part 1 and 2, Washington, D.C., January 1976, Table 1.1 and Table 2.3.

Personal Consumption Expenditures by Type of Product, 1964 through 1974

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Food and tobacco	100,272	106,966	115,108	118,530	127,704	135,813	147,140	151,933	162,620	181,104	203,131
Clothing accessories and jewelry	38,277	40,304	44,091	46,149	50,276	54,009	55,619	59,618	64,809	71,955	76,365
Personal care	7,106	7,617	8,455	9,082	9,545	10,265	10,920	11,096	11,749	12,616	13,418
Housing	61,394	65,469	69,522	74,144	79,927	86,816	93,986	102,690	112,277	123,097	135,955
Household operation	57,677	61,322	66,468	70,683	76,736	82,842	87,793	94,437	106,155	117,815	130,518
Medical care expenses	28,183	30,053	32,554	35,091	38,766	44,596	49,853	54,671	61,188	67,468	75,771
Personal business	18,049	19,714	21,870	23,999	26,835	29,318	31,336	34.309	37,419	40,595	44,509
Transportation	52,259	58,205	61,008	62,920	71.627	76,942	78,032	90,915	101,438	110,503	115,330
As % of total	*13.0*	*13.5*	*13.1*	*12.8*	*13.4*	*13.3*	*12.6*	*13.6*	*13.8*	*13.6*	*13.0*
Recreation	23,698	25,907	29,794	31,942	35,159	38,130	40,999	43,664	49,100	54,945	60,544
Private education and research	5,073	5,684	6,447	7,109	8,097	8,968	9,874	10,632	11,587	12,572	13,494
Religious and welfare activities	5,825	6,055	6,344	6,921	7,520	7,832	8,539	9,136	10,105	10,652	11,678
Foreign travel by U.S. residents	2,988	3,346	3,606	4,249	4,214	4,749	5,469	5,586	6,954	7,455	8,127
Total	400,801	430,642	465,267	490,821	536,404	580,298	619,560	668,987	734,401	810,777	888,840

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Benchmark Revision of National Income and Product Accounts: Advance Tables, Washington, D.C., February 1976, Table 2.6.



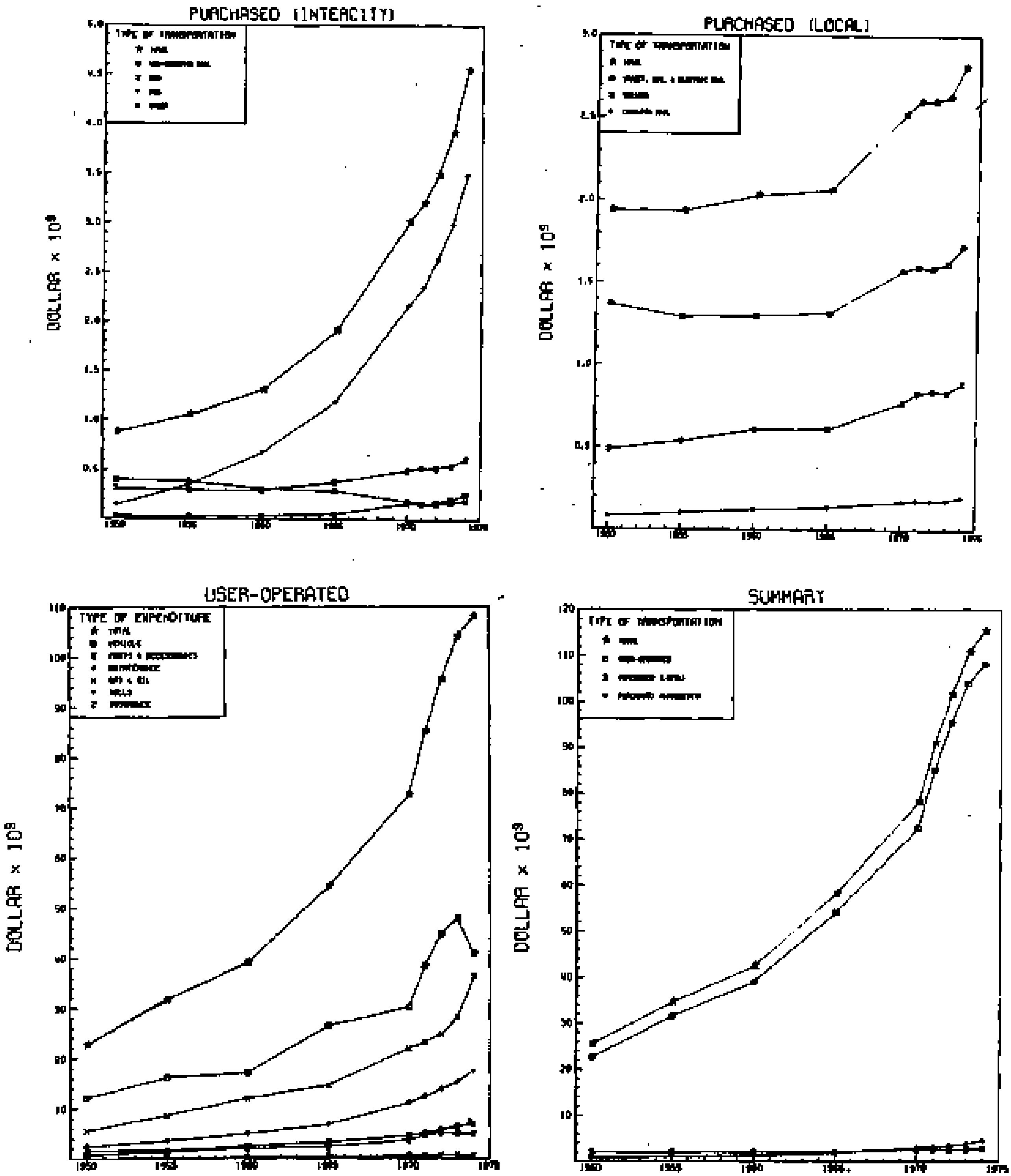
Sources: W. F. Gay, U.S. Department of Transportation, <u>Summary of National Transportation Statistics</u>, Washington, D.C., 1972, p. 53; <u>Summary of National Transportation Statistics</u>, Washington, D.C., 1975, p. 65.

Personal Consumption Expenditures by Transportation Sector, 1950 through 1974
(millions of dollars)

	1950	1955	1960	1965	1970	1971	1972	1973	1974
TRANSPORTATION TOTAL	25,415	34,583	42,391	58,205	78,032	90,915	101,438	110,503	115,330
User-operated Transportation									
Total	22,609	31,598	39,058	54,240	72,503	85,116	95,345	103,959	107,967
New cars and net purchases of used cars	12,173	16,254	17,192	26,578	30,343	38,631	44,860	47,958	41,030
Tires, tubes, accessories and parts	1,545	1,581	2,485	3,223	4,587	5,119	5,691	6,424	6,942
Maintenance	2,509	3,619	5,065	6,901	11,248	12,532	13,922	15,380	17,735
Gasoline and oil	5,522	8,595	11,977	14,696	21,997	23,396	24,879	28,295	36,447
Tolls	97	171	310	463	643	689	745	786	748
Insurance	763	1,378	2,029	2,379	3,685	4,749	5,248	5,116	5,065
Purchased local transportation									
Total	1,934	1,933	2,026	2,061	2,521	2,600	2,604	2,632	2,812
Street, electric, railway and local bus	1,368	1,292	1,295	1,313	1,573	1,596	1,585	1,617	1,720
Taxicab	487	540	609	612	776	828	842	835	892
Railway (commutation)	79	101	122	136	172	176	177	180	200
Purchased intercity transportation									
Total	872	1,052	1,307	1,904	3,008	3,199	3,489	3,912	4,551
Railway (noncommutation)	394	378	306	284	185	155	176	204	259
Intercity bus	309	295	290	375	496	525	523	545	616
Airline	141	349	676	1,191	2,166	2,347	2,637	2,988	3,484
Other	28	30	35	54	161	172	153	175	192

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Benchmark Revision of National Income and Product Accounts: Advance Tables, Washington, D.C., 1976, Table 2.6.

Personal Consumption Expenditure for Transportation



Source: U.S. Department of Commerce, Bureau of Economic Analysis, Benchmark Revision of National Income and Product Accounts: Advance Tables, Washington, D.C., 1976, Table 2.6.

National Income by Industry, 1950-1974

(millions of dollars)

	1950	1955	1960	1965	1970	1971	1972	1973	1974	% 1950	% 1974
Total National Income	239.9	329.2	412.1	460.1	795.9	851.7	940.0	1057.2	1131.1	100.0	100.0
Agriculture	17.6	15.4	16.9	21.0	25.6	26.4	31.2	50.6	45.6	7.3	4.0
Mining	5.2	5.9	5.7	6.1	7.7	7.1	8.3	9.4	11.3	2.2	1.0
Contract construction	11.9	16.6	20.8	29.1	42.8	46.6	51.2	57.1	60.6	5.0	5.3
Manufacturing	76.2	107.9	125.8	172.6	217.5	226.5	253.4	287.2	306.1	31.8	27.1
Transportation	13.4	15.9	18.2	23.2	29.8	32.8	36.6	40.4	43.8	5.6	3.9
(Percent of national income)	(5.6)	(4.8)	(4.4)	(5.0)	(3.7)	(3.8)	(3.9)	(3.8)	(3.9)		
Communication	3.3	5.7	8.2	11.2	16.8	17.6	19.4	21.1	22.6	1.4	2.0
Electric, gas, and utility	3.9	6.2	8.9	11.4	14.7	16.2	17.5	19.1	19.6	1.6	1.7
Wholesale and retail	40.9	52.3	64.4	84.3	121.3	131.2	142.3	155.9	166.1	17.0	14.7
Finance, insurance and real estate	22.0	34.1	45.9	61.9	89.9	99.7	108.8	117.8	127.3	9.2	11.2
Services	21.8	31.1	44.4	64.1	102.9	110.0	120.7	134.6	150.1	9.1	13.3
Government	23.6	38.1	52.9	75.2	126.9	137.6	150.7	164.1	177.9	9.6	15.7

Source: U.S. Bureau of the Census, Statistical Abstract of the United States: 1975, 96th Edition, Washington, D.C., 1975, p. 387.

National Income by Detailed Industrial Breakdown: Manufacturing and Transportation, 1950 through 1974
(in millions of dollars)

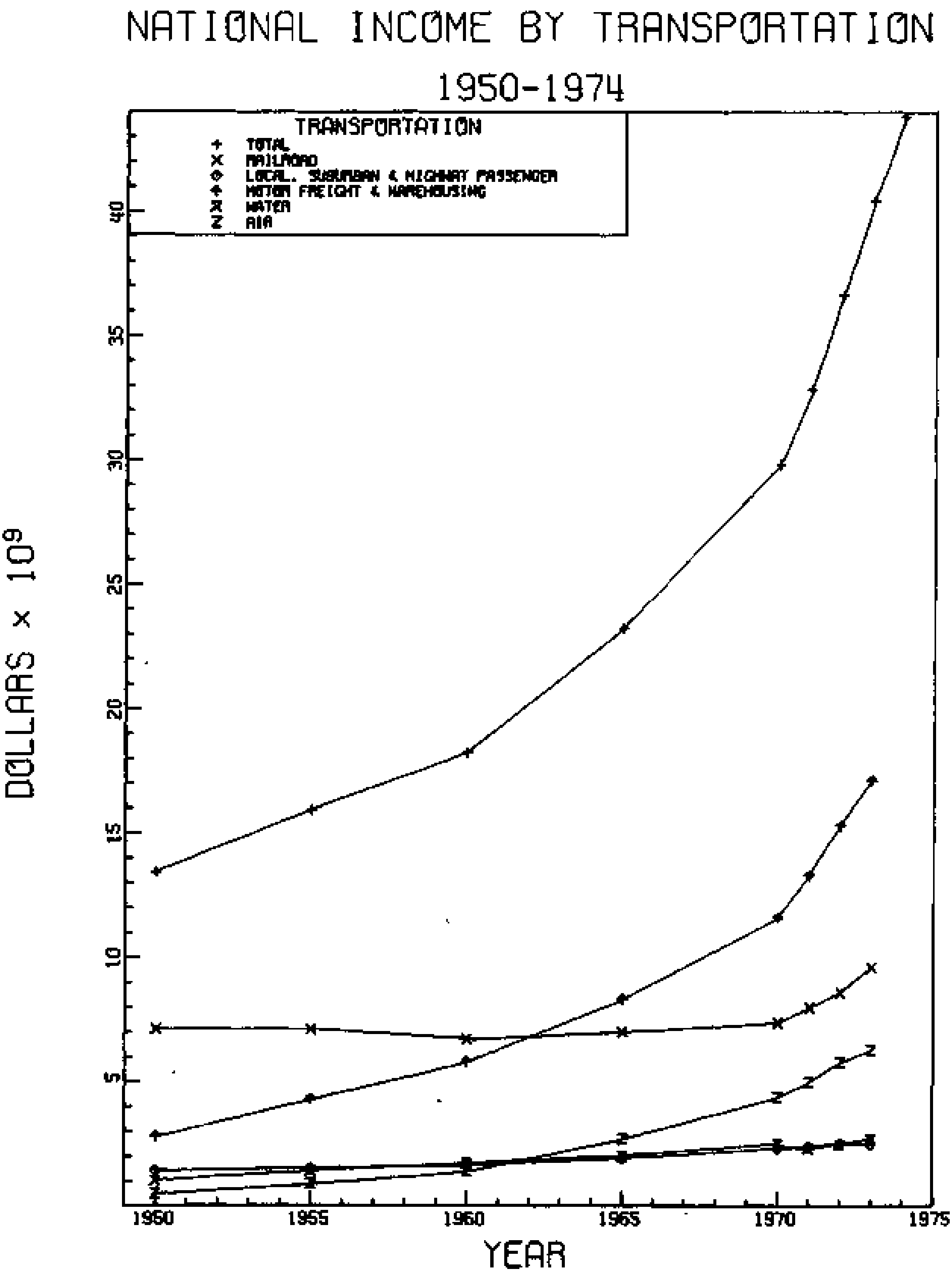
	1950[1]	1955[1]	1960	1965	1970	1971	1972	1973	1974
Manufacturing[2]	76.2	107.9	125.8	172.6	217.5	226.5	253.4	287.2	306.1
(Percent of national income)	(31.8)	(32.8)	(30.5)	(37.5)	(27.3)	(26.6)	(27.0)	(27.1)	(27.1)
Transportation equipment and ordnance	2.3	6.6	8.3	11.4	14.3	13.4	14.6	15.7	NA
(Percent of manufacturing)	(3.0)	(6.1)	(6.6)	(6.6)	(6.6)	(5.9)	(5.8)	(5.5)	
Motor vehicles and motor vehicle equipment	6.6	9.6	8.5	15.4	13.8	19.5	22.3	25.4	NA
(Percent of manufacturing)	(8.7)	(8.9)	(6.7)	(8.9)	(6.3)	(8.6)	(8.8)	(8.8)	
Transportation[1]	13.4	15.9	18.2	23.2	29.8	32.8	36.6	40.4	43.8
(Percent of national income)	(5.6)	(4.8)	(4.4)	(5.0)	(3.7)	(3.8)	(3.9)	(3.8)	(3.9)
Railroad	7.1	7.1	6.7	7.0	7.4	8.0	8.6	9.6	NA
(Percent of transportation)	(53.0)	(44.6)	(36.8)	(30.2	(24.8)	(24.4)	(23.5)	(23.8)	
Local, suburban, and highway passenger	1.4	1.5	1.6	1.9	2.3	2.4	2.5	2.5	NA
(Percent of transportation)	(10.4)	(9.4)	(8.8)	(8.2)	(7.7)	(7.3)	(6.8)	(6.2)	
Motor freight and warehousing	2.8	4.3	5.8	8.3	11.6	13.3	15.3	17.1	NA
(Percent of transportation)	(20.9)	(27.0)	(31.9)	(35.8)	(38.9)	(40.5)	(41.8)	(42.3)	
Water	1.0	1.4	1.7	2.0	2.5	2.3	2.5	2.7	NA
(Percent of transportation)	(7.5)	(8.8)	(9.3)	(8.6)	(8.4)	(7.0)	(6.8)	(6.7)	
Air	0.5	0.9	1.4	2.7	4.4	5.0	5.8	6.3	NA
(Percent of transportation)	(3.7)	(5.7)	(7.7)	(11.6)	(14.8)	(15.2)	(15.8)	(15.6)	

[1]Excludes Alaska and Hawaii.

[2]Includes items not shown separately.

NA = Not available.

Source: U.S. Bureau of the Census, Statistical Abstract of the United States: 1975, 96th Edition, Washington, D.C., 1975, p. 387.



Source: U.S. Bureau of the Census, Statistical Abstract of the United States: 1975, 96th Edition, Washington, D.C., 1975, p. 387.

Employment by Industry, 1950-1974
(thousands)

	1950	1955	1960	1965	1970	1971	1972	1973	1974	% 1950	% 1975
Full- and part-time employees[1]	52,432	59,191	62,743	69,547	79,306	79,170	81,081	84,352	85,661	100.0	100.0
Agriculture	2,495	2,227	2,088	1,756	1,492	1,473	1,474	1,524	1,569	4.7	1.8
Mining	925	803	698	633	627	614	623	635	696	1.8	.8
Contract construction	2,388	2,807	2,889	3,276	3,557	3,614	3,789	4,041	3,980	4.5	4.6
Manufacturing	15,232	16,950	16,755	18,088	19,410	18,583	19,049	20,091	20,075	29.0	23.4
Transportation	2,784	2,752	2,562	2,530	2,696	2,645	2,658	2,750	2,782	5.3	3.2
(Percent of total)	(5.3)	(4.6)	(4.1)	(3.6)	(3.4)	(3.3)	(3.3)	(3.3)	(3.2)		
Communications	727	837	839	880	1,123	1,126	1,144	1,176	1,195	1.4	1.4
Electric, gas and utility	548	587	614	626	691	702	716	734	744	1.0	0.9
Wholesale and retail	9,369	10,429	11,434	12,862	15,266	15,563	16,013	16,742	17,116	17.9	20.0
Finance, insurance and real estate	1,931	2,352	2,705	3,094	3,713	3,830	3,972	4,171	4,292	3.7	5.0
Services	7,149	8,161	9,747	11,497	13,490	13,768	14,349	14,923	15,276	13.6	17.8
Government	8,884	11,286	12,412	14,300	17,241	17,252	17,294	17,565	17,936	16.9	20.9

[1]Employment in domestic industries only.

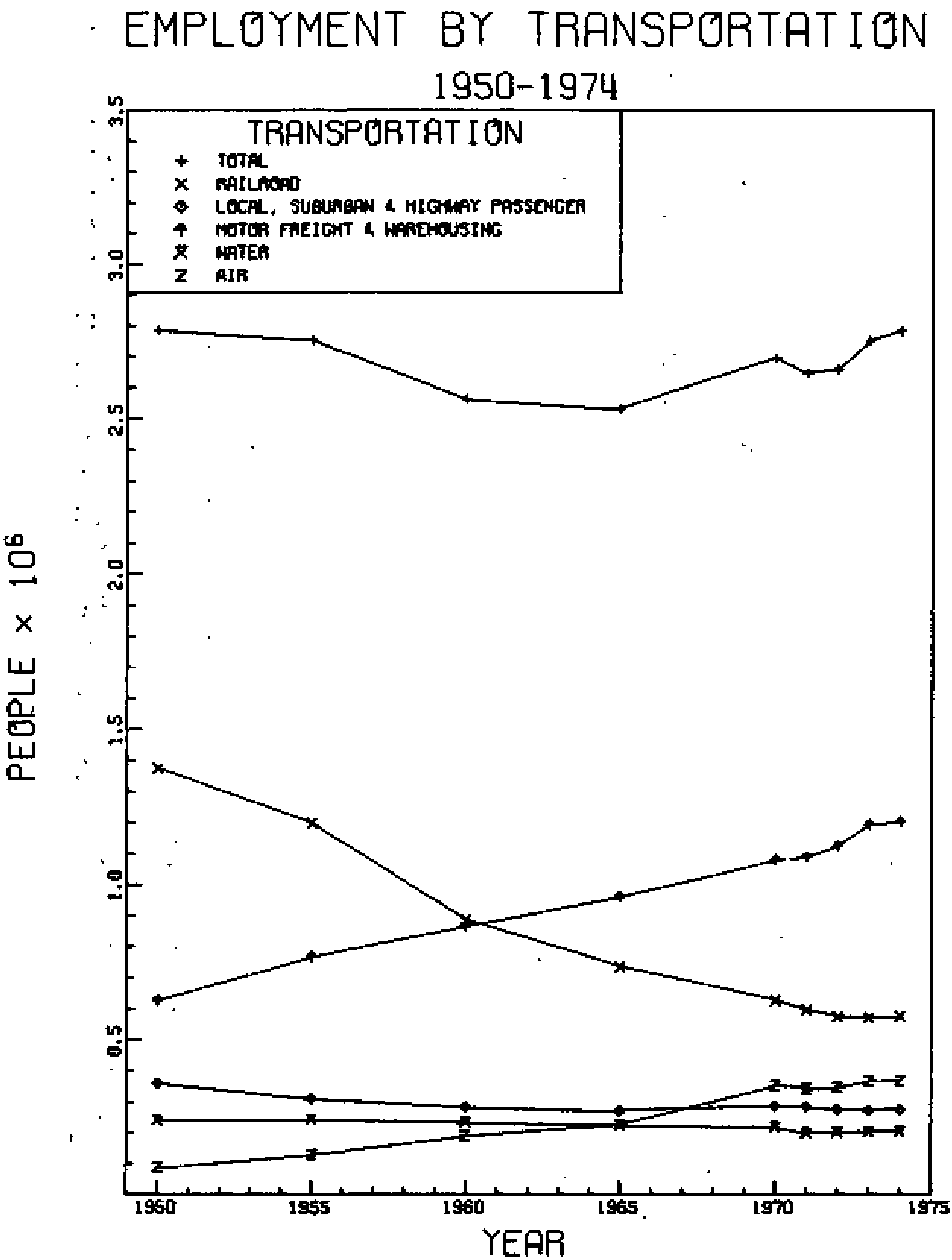
Source: U.S. Department of Commerce, Bureau of Economic Analysis, Benchmark Revision of National Income and Product Accounts: Advance Tables, Washington, D.C., 1976, Table 6.8.

Employment by Detailed Industrial Breakdown: Manufacturing and Transportation, 1950 through 1974 (thousands)

	1950	1955	1960	1965	1970	1971	1972	1973	1974
Manufacturing[1]	15,232	16,950	16,755	18,088	19,410	18,583	19,049	20,091	20,075
Transportation equipment and ordnance	487	1,102	1,078	1,137	1,251	1,085	1,095	1,127	1,100
Motor vehicles and motor vehicle equipment	801	888	717	843	813	846	885	958	908
Petroleum	217	236	207	181	189	187	184	185	190
Transportation[1]	2,784	2,752	2,562	2,530	2,696	2,645	2,658	2,750	2,782
Railroad	1,373	1,197	885	735	626	597	575	572	577
Local, suburban, and highway passenger	359	309	282	270	285	283	274	271	275
Motor freight and warehousing	626	768	866	962	1,080	1,090	1,126	1,194	1,204
Water	239	242	233	225	218	199	201	202	204
Air	87	129	191	228	353	342	346	367	369
Services									
Auto repair, services, and garage	206	207	268	327	386	400	415	445	450

[1]Includes items not shown separately.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Benchmark Revision of National Income and Product Accounts: Advance Tables, Washington, D.C., 1976, Table 6.8.



Source: U.S. Department of Commerce, Bureau of Economic Analysis, Benchmark Revision of National Income and Product Accounts: Advance Tables, Washington, D.C., 1976, Table 6.8.

Employment and Establishments for Selected Motor Vehicle-Related Businesses: 1967 and 1972

Kind of business	Establishments[1] (1,000)		Paid employees[2] (1,000)	
	1967	1972	1967	1972
Retail trade				
Automotive dealers	105.5	131.8	906.8	1,073.0
Motor vehicle dealers — new and used cars			696.3	765.6
Motor vehicle dealers — used cars only	62.0	64.2	38.6	39.4
Tire, battery, and accessory dealers	29.2	37.5	129.6	167.7
Misc. automotive dealers	14.3	30.1	42.2	100.3
Gasoline service stations	213.1	226.5	575.2	747.7
Wholesale trade				
Motor vehicles and auto equipment	31.2	35.6	341.1	391.8
Automobiles and other motor vehicles	4.8	5.6	91.9	102.3
Automotive equipment	23.3	27.0	214.1	246.1
Tires and tubes	3.1	3.0	35.1	43.4
Services				
Auto repairs, services, and garages	139.2	169.0	316.2	392.5
Automobile repair shops	109.9	127.2	187.9	237.9
Automobile parking	10.6	10.5	33.5	37.3
Car and truck rental and leasing; other services	18.7	31.3	95.0	117.3
Manufacturing				
Motor vehicles and equipment	2.7	3.4	739.4	806.6
Motor vehicles	0.2	0.2	321.2	339.2
Motor vehicle parts and accessories	1.7	2.1	364.9	399.9
Truck and bus bodies	0.6	0.8	30.4	42.8
Truck trailers	0.2	0.3	22.9	24.7

[1]As of Dec. 31, represents all establishments (except for wholesale trade and manufacturing which represent only establishments employing one or more workers at any time during the year).

[2]Workweek including Mar. 12, except quarterly average for manufacturing.

Source: U.S. Bureau of the Census, Statistical Abstract of the United States: 1975, 96th Edition, Washington, D.C., 1975, p. 574.

Wages and Salaries by Industry, 1950-1974
(millions of dollars)

	1950	1955	1960	1965	1970	1971	1972	1973	1974
Wages and salaries[1]	146,948	211,739	272,074	361,982	546,380	579,946	633,720	700,887	763,043
Agriculture	3,157	3,013	3,500	4,224	5,319	5,462	5,798	6,602	7,603
Mining	3,200	3,763	3,955	4,297	5,799	6,026	6,625	7,289	8,847
Contract construction	7,959	12,317	15,725	21,665	33,161	35,965	38,857	43,339	45,965
Manufacturing	50,288	73,830	89,671	115,506	158,173	160,462	175,249	196,184	211,240
Transportation	9,848	12,448	14,578	17,190	24,350	26,049	28,027	31,568	33,695
(% of total)	(6.7)	(5.9)	(5.3)	(4.7)	(4.4)	(4.5)	(4.4)	(4.5)	(4.4)
Communication	2,280	3,518	4,463	5,756	9,329	10,141	11,488	12,686	14,008
Electric, gas and utility	1,938	2,759	3,688	4,560	6,685	7,247	7,908	8,633	9,376
Wholesale and retail	25,778	34,656	45,512	59,716	89,747	96,107	104,332	115,217	127,231
Finance, Insurance and Real Estate	5,829	8,850	12,553	17,178	27,403	30,202	33,198	36,471	39,793
Services	14,053	20,011	29,279	42,030	70,442	76,503	84,649	94,300	105,228
Government	22,618	36,574	49,150	69,860	115,972	125,782	137,589	148,598	160,057

[1]Wages and salaries for domestic industries only.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Benchmark Revision of National Income and Product Accounts: Advance Tables, Washington, D.C., 1976, Table 6.6.

Wages and Salaries by Detailed Industrial Breakdown: Manufacturing and Transportation, 1950-1974

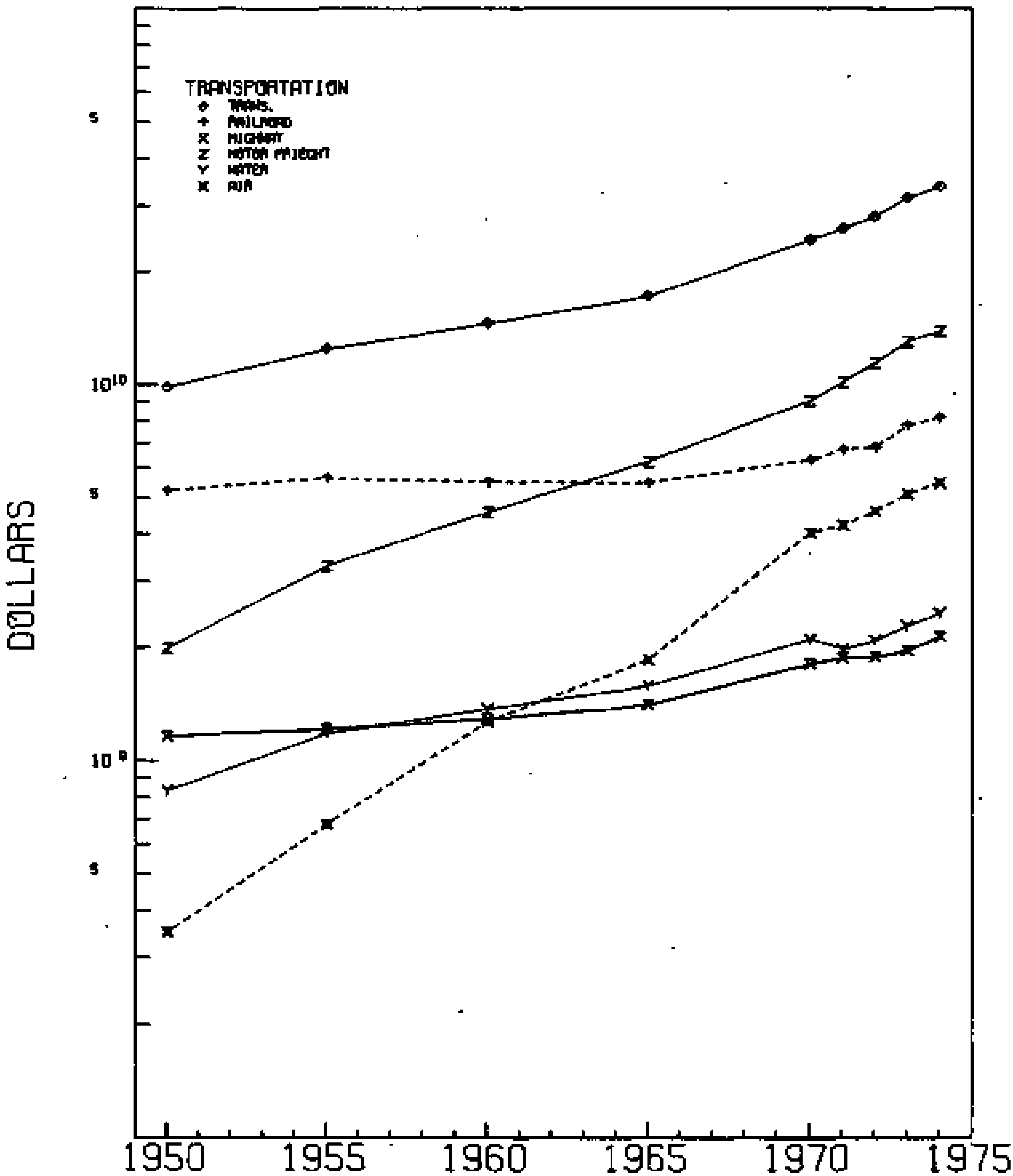
(millions)

	1950	1955	1960	1965	1970	1971	1972	1973	1974
Manufacturing[1]	50,288	73,830	89,671	115,506	158,173	160,462	175,249	196,184	211,240
Transportation equipment and ordnance	1,817	5,582	7,158	9,075	12,425	11,189	11,945	12,930	13,734
Motor vehicles and motor equipment	3,221	4,870	4,730	6,955	8,128	9,553	11,026	13,029	12,520
Petroleum	961	1,329	1,462	1,500	2,015	2,140	2,271	2,420	2,728
Transportation[1]	9,848	12,448	14,578	17,190	24,350	26,049	28,027	31,568	33,695
Railroad	5,187	5,622	5,499	5,447	6,269	6,691	6,799	7,782	8,147
Local, suburban and highway passenger	1,159	1,213	1,293	1,404	1,808	1,878	1,885	1,962	2,138
Motor freight and warehousing	1,984	3,280	4,558	6,207	9,036	10,133	11,422	13,032	13,866
Water	832	1,183	1,377	1,581	2,108	1,978	2,089	2,281	2,470
Air	350	677	1,268	1,852	4,029	4,208	4,588	5,114	5,481
Services									
Auto repair, services and garage	516	647	1,009	1,452	2,321	2,522	2,782	3,161	3,426

[1]Include items not shown separately.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Benchmark Revision of National Income and Product Accounts: Advance Tables, Washington, D.C., 1976, Table 6.6.

WAGES AND SALARIES
FOR TRANSPORATION



Source: U.S. Department of Commerce, Bureau of Economic Analysis, Benchmark Revision of National Income and Product Accounts: Advance Tables, Washington, D.C., 1976, Table 6.6.

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Conversion Factors

BTU values of energy sources[1]

Source	BTU
Coal (per 2,000 lb. ton)	
Anthracite	25.4×10^6
Bituminous	26.2×10^6
Sub-bituminous	19.0×10^6
Lignite	13.4×10^6
Natural gas (per cubic foot)	
Dry	1,031
Wet	1,103
Liquid (avg.)	4,100
Electricity — 1 kwh	3,413
Petroleum (per barrel)	
Crude oil	5.60×10^6
Residual fuel oil	6.29×10^6
Distillate fuel oil	5.83×10^6
Gasoline (including av. gas)	5.25×10^6
Jet fuel (kerosene)	5.67×10^6
Jet fuel (naphtha)	5.36×10^6
Kerosene	5.67×10^6
Nuclear	
1 gram of fissioned U-235	74,000

[1]These are conventional or average values, not precise equivalents.

Other conversion factors

Electricity — 1 kwh	= 0.88 lbs. of coal = 0.076 gallons of oil = 10.4 cu. ft. of natural gas
Natural Gas — 1 tcf (trillion cubic feet)	= 39,300 tons of coal = 184,000 barrels of oil
Coal — 1 mtce (million tons of coal equivalent)	= 4.48×10^6 barrels of oil = 67 tons of oil = 25.19×10^{12} cu. ft. of natural gas
Oil — 1 million tons (6.65×10^6 barrels)	= 4×10^9 kwh of electricity (when used to generate power) = 12×10^9 kwh unconverted = 1.5×10^6 tons of coal = 41.2×10^9 cu. ft. of natural gas

Approximate conversion factors for oils[1]

To convert —	Barrels to metric tons	Metric tons to barrels	Barrels/day to tons/year	Tons/year to barrels/day
		Multiply by —		
Crude oil	0.136	7.33	49.8	0.0201
Gasoline	0.118	8.45	43.2	0.0232
Kerosene	0.128	7.80	46.8	0.0214
Diesel fuel	0.133	7.50	48.7	0.0205
Fuel oil	0.149	6.70	54.5	0.0184

[1]Based on world average gravity (excluding natural gas liquids).

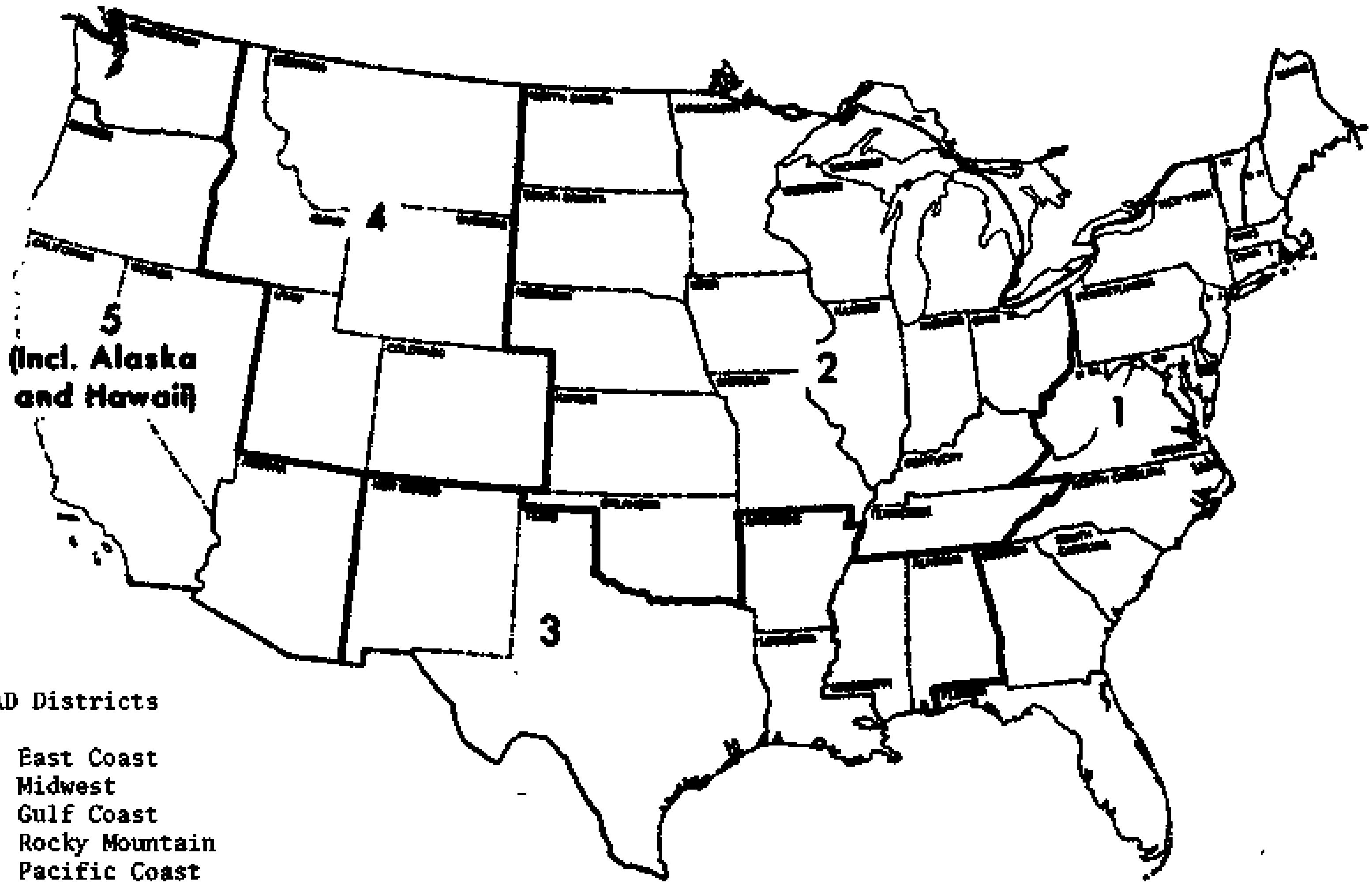
Source: G.E. Delury (ed.), Newspaper Enterprise Association, Inc., The World Almanac and Book of Facts, New York, annual, p. 100.

Consumer Price Indexes for New and Used Cars Purchased by
Urban Wage Earners and Clerical Workers, 1950-1975
(1967 = 100)

Year	New cars	Used cars	Year and month		New cars	Used cars
1950	83.4	---	1974:	Jan	112.9	107.0
1951	87.4	---		Feb	112.7	103.0
1952	94.9	---		Mar	112.8	102.2
1953	95.8	89.2		Apr	113.3	107.0
1954	94.3	75.9		May	114.6	114.4
1955	90.9	71.8		June	116.4	122.2
1956	93.5	69.1				
1957	98.4	77.4		July	118.0	127.9
1958	101.5	80.2		Aug	118.1	132.0
1959	105.9	89.5		Sept	118.4	135.9
				Oct	123.7	139.4
1960	104.5	83.6		Nov	124.5	141.6
1961	104.5	86.9		Dec	124.9	138.4
1962	104.1	94.8				
1963	103.5	96.0	1975:	Jan	123.4	134.9
1964	103.2	100.1		Feb	124.5	133.5
1965	100.9	99.4		Mar	127.3	135.3
1966	99.1	97.0		Apr	127.5	138.1
1967	100.0	100.0		May	126.8	142.2
1968	102.8	NA		June	127.0	147.5
1969	104.4	103.1				
				July	126.6	153.2
1970	107.6	104.3		Aug	126.8	156.1
1971	112.0	110.2		Sept	126.5	156.6
1972	111.0	110.5		Oct	129.9	156.5
1973	111.1	117.6		Nov	131.3	153.7
1974	117.5	122.6		Dec	134.0	149.6
1975	127.6	146.4				

Source: Department of Labor, Bureau of Labor Statistics.

Petroleum Administration for Defense (PAD) Districts

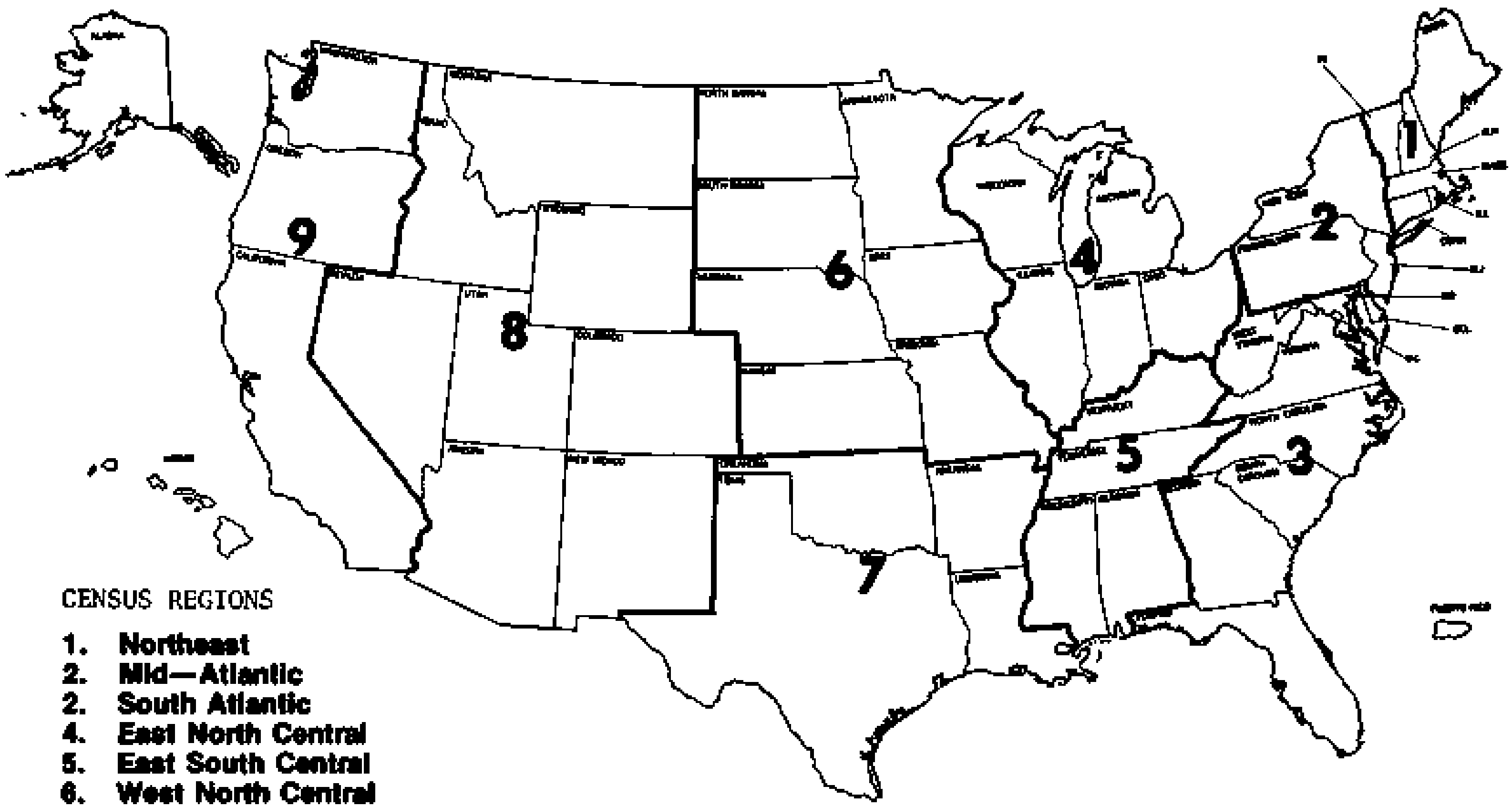


PAD Districts

1. East Coast
2. Midwest
3. Gulf Coast
4. Rocky Mountain
5. Pacific Coast

Source: W.F. Gay, U.S. Department of Transportation, Energy Statistics, Washington, D.C., August 1975.

Demand Regions of the United States Used by the
Federal Energy Administration (FEA)

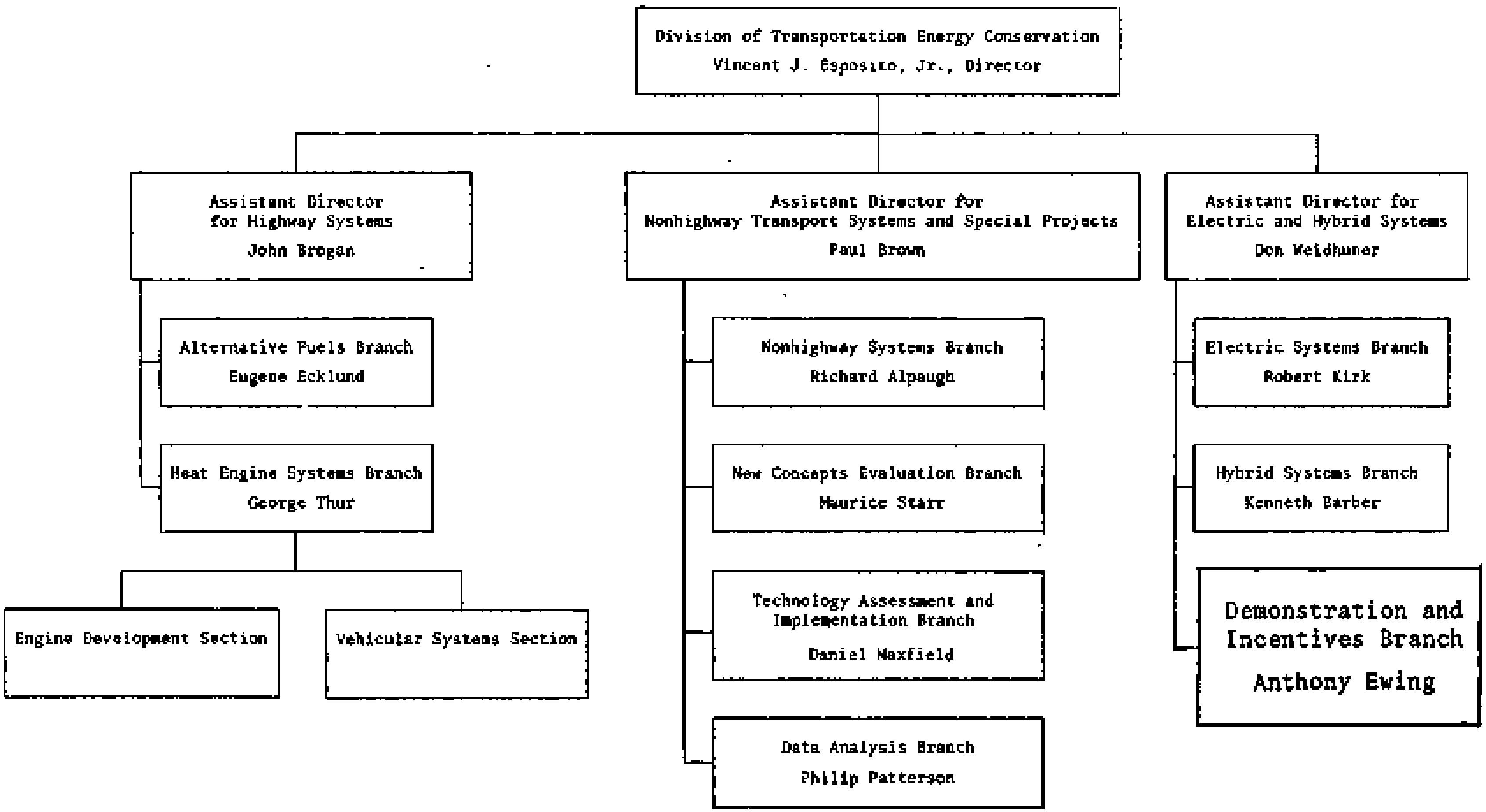


CENSUS REGIONS

1. **Northeast**
2. **Mid—Atlantic**
2. **South Atlantic**
4. **East North Central**
5. **East South Central**
6. **West North Central**
7. **West South Central**
8. **Mountain**
9. **Pacific**

Source: Federal Energy Administration, National Energy Outlook, Washington, D.C., Feb. 1976, p. A-2.

Transportation Energy Conservation Division Organization Chart
October 1976



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Aerospace Corp., Environment and Energy Conservation Division, Mobile Systems Group, Los Angeles, CA
<u>Characterization of the U.S. Transportation System: Domestic Air Transportation (Passengers and Cargo), Highway Transportation (Autos, Trucks, Buses, Motorcycles, Bicycles), Pipeline Transportation Systems (Petroleum, Natural Gas, Water), Railroads (Freight and Passenger), Urban Rail Transit, and Water Transportation of Freight</u>
Rough Drafts, bound in 6 separate documents, 987 p.
Jul 1976
Abstract: These internal working papers provide data on the physical state, use, economics, and energy consumption and intensity of the U.S. transportation system, including these modes of transportation: air transportation, highway transportation, pipeline transportation, railroads, urban rail transit, and water transportation. (71 references) (NTB)

American Gas Association, Dept. of Statistics, 1515 Wilson Blvd., Arlington, VA 22209
<u>Gas Facts, a Statistical Record of the Gas Utility Industry in 1969; 1970; 1971; 1972; 1973</u>
Approximately 205 p.
1970; 1971; 1972; 1973; 1974
Abstract: These publications contain both current and historical information and related data about the gas utility industry. The gas utility industry includes all regulated distribution and transmission companies and excludes producers. Statistics for the given year and summary data for earlier years are shown. Five year summary data from 1945 to 1965 (to 1970 for 1971, 1972, and 1973 Data) are also included for comparative analysis.---These issues of Gas Facts are comprised of at least twelve sections and a glossary of terms relative to the gas industry. The sections are arranged to follow the standard sequence of the industry's operations. The first section serves as an overall review of the year and those events affecting the gas industry most importantly. The subsequent sections detail current and historical data pertinent to the industry and encompasses reserves, production, transmission and distribution, storage, customers, sales and revenues. The remaining sections pertain to financial information, construction, labor, prices, and appliance data trends.----All data are relevant to the operations of a segment of the gas utility industry as it existed during any year in question. Accordingly, time series analysis is not completely valid for comparison with individual company statistics over a period of years. The number and size of companies included in a given segment of the industry has varied from one year to another, according to A.G.A. definitions as explained in the Glossary. (Auth. from Introduction)
Availability: American Gas Association, Catalog No. F10171 for 1970 data, Catalog No. F11171 for 1971 data ($4.00); Catalog No. F10172 for 1972 data; Catalog No. F10173 for 1973 data

American Public Transit Association, Statistical Dept., 1100 17th Street NW, Suite 1200, Washington, DC 20036
<u>Transit Fact Book</u>
1975-1976 Edition, ISSN 0082-5913, 47 p.
Mar 1976
Abstract: Trends in U.S. urban mass transportation are summarized in this annual publication. During the period from 1940 to 1975 total U.S. vehicle miles traveled by railroad, trolley, or motor bus declined, while operating revenue nearly tripled and passenger revenue increased by a factor of two and a half. Total rail vehicle miles were cut to a third of the 1940 1.3 billion miles, with almost all the cut in the light rail category. Heavy and light rail reversed positions in terms of passenger and operating revenue. Trolley coach travel, which declined from 86 to 14.3 million miles, had substantial cuts in revenues. Motor buses increased 20% to 1.5 billion miles with corresponding increases in revenue. Comparisons of fuel requirements show the average commuter automobile at 19 passenger miles (PM) per gallon ranging to a peak hour subway rate of 590 PM/gallon of fuel (or equivalent). Efficiency of subways drops to 140 PM/gallon at off-peak times. Intercity buses range from 202 to 123 PM/gallon, and intercity passenger trains from 360 to 270 PM/gallon. Lowest ratings were for short flights of twin jets (37-47) and automobiles. Glossaries of transit industry terms and financial terms and a short history of U.S. transit are included. (DCK)

American Trucking Associations Inc., Dept. of Research and Transport Economics; American Trucking Associations Inc., Public Relations Dept., 1616 P Street NW, Washington, DC 20036
<u>American Trucking Trends 1975</u>
38 p.
1975
Abstract: Truck use in the United States has grown every year from 1905, when there were 1,400 registered, to 1974, when there were an estimated 23.5 million. Statistics are given for all phases of the trucking industry, including freight, revenue and costs, taxes, safety, and truck characteristics. Trucks represented more than 18% of the ton-miles of regulated intercity freight transportation in 1974 and earned 55% ($22.4 billion) of freight transportation revenues. The industry paid an estimated $7.1 billion in taxes and used 95.2% of its revenues for operating expenses. Wages, which average 6.7% higher than the total transportation industry, account for 53.1% of the revenue. Trucks covered 250 billion miles and had an accident rate per million vehicle-miles of 13.85 compared with 22.92 for passenger cars. Trends in various phases of the industry are shown in graphs. (DCK)
Availability: American Trucking Associations, Inc., Public Relations Dept. Free

American Waterways Operators Inc., 1600 Wilson Boulevard, Suite 1101, Arlington, VA 22209
Inland Waterborne Commerce Statistics, 1974
41 p.
Oct 1975
Abstract: The barge and towing industry's share of the nation's transportation output totalled 599,219,554 net tons in 1974, nearly 16% of the nation's U.S. domestic commerce. Data in this report graphically illustrate the importance of the industry to the nation's economy and well-being. They also illustrate the dependence of production industry and the consuming public on low-cost, efficient, energy-saving, safe, reliable barge transportation. In spite of inflationary pressures which have lead to spiraling operating costs and a low margin of profit, the industry managed to hold the line on the overall cost of barge transportation. (The average cost remained at four to five mills per ton-mile). Included in this report on inland waterborne commerce statistics are total tonnages moved and total ton-miles of service performed nationally, and by individual waterways. The report also shows the total number of vessels in operation and a comparison of transport services performed by the various modes. The data are compiled from the latest reports issued by the Waterborne Commerce Statistics Center of the Army Corps of Engineers. The compilations and comparisons are published annually as a public information service. (Auth)

Asin, R.H.
Nationwide Personal Transportation Study: Purposes of Automobile Trips and Travel
U.S. Dept. of Transportation, Federal Highway Administration, Office of Highway Planning, Program Management Division, 400 Seventh St. SW, Washington, DC 20590
Report No. 10, 59 p.
May 1974
Abstract: This report presents data on automobile trips (one-way) and travel according to the purpose for which the trip was made. The distribution of automobile trips and associated travel is related to four major trip purposes: earning a living, family business, educational, civic and religious, and social and re-reational. The first part of the report discusses distribution of automobile trips and vehicle-miles of travel by trip purpose as related to population size-groups in incorporated places and unincorporated areas, as well as Standard Metropolitan Statistical Areas (SMSA's); trip length, age of driver, occupation, household income, hour of the day trip started, day of the week, season of the year, and the number of occupants per trip. The second part of the report examines the relationship of the number of cars owned per household to the distribution of automobile trips and vehicle-miles of travel by trip purpose and trip length. In addition, daily and annual tripmaking rates are included. (From Description of Data)

Asin, R.H.; Svercl, P.V.
Nationwide Personal Transportation Study: Automobile Ownership
U.S. Dept. of Transportation, Federal Highway Administration, Office of Highway Planning, Program Management Division, 400 Seventh St. SW, Washington, DC 20590
Report No. 11, 74 p.
Dec 1974
Abstract: Data collected in this survey were used to study the effect of selected variables on car ownership. The first part of the report relates car ownership to such household characteristics as place of residence of principal driver by incorporated places and unincorporated areas and size of the standard metropolitan statistical areas (SMSA's), income, and household composition including number of occupants and number of licensed drivers. The second part of the report relates car ownership to characteristics of the automobile including age of the automobile and automobile ownership rates by place of residence and household income. The third part of the report relates car ownership to characteristics of vehicle trips and vehicle-miles of travel and person trips and person-miles of travel. Daily trip generation rates and miles of travel per household are included. (From Description of Data)

Association of American Railroads, Economics and Finance Dept., 1920 L Street NW, Washington, DC 20036
Yearbook of Railroad Facts: 1975, 1976 Editions
Approximately 65 p.
1975; 1976
Abstract: These annual reports present summaries of railroad operations in 1975, 1976 and prior years for the U.S. as a whole and for the Eastern, Southern, and Western Districts. Data are included on financial results; traffic; train-miles and car-miles; operating averages; plant and equipment; capital expenditures; employment and wages; indexes of charge-out prices and wage rates; and Amtrak and the Auto-Train. (ETD)

Association of Oil Pipe Lines, Suite 1208, 1725 K St. NW, Washington, DC 20006
Shifts in Petroleum Transportation
10 p.
1975
Abstract: Pipeline transportation of crude petroleum and petroleum products in 1973 totaled 47.44% of the 1.9 billion net tons transported domestically. This represents a 4.10% increase over 1972. In ton-mileage pipelines transported 60.29% of the 880.9 billion ton-miles, compared to 35.3% by water, 2.97% by truck, and 1.44% by rail carriers. Tables show the shift in transportation modes since 1938, with an increase for pipelines and motor carriers and a decrease for water and rail carriers. (8 references) (DCK)
Availability: Association of Oil Pipe Lines, Suite 1208, 1725 K Street, NW, Washington, DC 20006

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Beschen, D.A. Jr.
Nationwide Personal Transportation Study: Transportation Characteristics of School Children
U.S. Dept. of Transportation, Federal Highway Administration, Office of Highway Planning, Program Management Division, 400 Seventh St. SW, Washington, DC 20590
Report No. 4, 32 p.
Jul 1972
Abstract: This report presents data on travel patterns to school of students between 5 and 18 years of age in kindergarten through grade 12. Only students living at home at the time of the survey were included in the data. These data were collected in section 7 of form NPT-2 used in the Nationwide Personal Transportation Survey conducted by the Bureau of the Census for the Federal Highway Administration in 1969-1970. For the analysis in this report, students were classified according to three grade levels: elementary (kindergarten through sixth); intermediate (seventh and eighth), and senior (ninth through twelfth). For each grade level, home-to-school travel by various modes of transportation is analyzed in terms of distance to school (miles) and time from home-to-school (minutes). These comparisons are shown separately for residents of all areas and places, all unincorporated areas, and all incorporated places. Limited data are also shown separately for students attending public and private schools, by grade level and distance from home-to-school. (from Introduction)

Boeing Commercial Airplane Co., P.O. Box 3707, Seattle, WA 98124
Intercity Passenger Transportation Data. Volume 1: Service and Economic Comparisons. Volume 2: Energy Comparisons
Report No. D6-41814, 254 p. in Volume 1, 250 p. in Volume 2
May 1975
Abstract: These reports are the first two volumes of a series that compares measures of performance of public and private transportation modes providing intercity passenger transportation in the U.S. The purpose of these studies is to obtain comprehensive information on these transportation modes in order to understand the position of each mode within the U.S. transportation system and to evaluate how well each mode provides passenger travel service. Intercity passenger transportation is defined as travel between two cities located at least 100 miles apart. The first volume compares the service and economic performance of the modes on a national basis and in 42 city pairs. "Energy Comparison," Volume Two of the study, presents statistics of transportation energy consumption and details main energy efficiency comparisons. Modal source data and a city pair study provide a basis for the findings and are included in this volume. Inadequacies of available transportation energy data and the limitations of the city pair study are identified. The transportation sector accounts for about 2.5% of total U.S. energy consumption and 50% of the petroleum consumption. From 1968 to 1973 petroleum consumption by the transportation sector increased 22%; 96% of this increase is attributed to highway transportation. The energy analysis shows that buses are the most fuel efficient mode at all ranges, and that airplanes, automobiles, and trains have comparable efficiency levels, except at short distances where trains can be more efficient. (BTB)

Broderick, A.J.
Fuel Consumption of Tractor-Trailer Trucks as Affected by Speed Limit and Payload Weight
U.S. Dept. of Transportation, Transportation Systems Center, Kendall Square, Cambridge, MA 02142
Report No. DOT-TSC-OST-75-3, PB-248953, 34 p.
Nov 1975
Abstract: The effect of speed limit and payload weight on fuel consumption was determined in tests of tractor-trailer rigs. Two virtually identical vehicles were used, one loaded with a 28,000 lb payload and the other carrying 42,000 lbs; each was driven over two different sets of terrain on the Massachusetts Turnpike at simulated speed limits of 50, 55, and 60 mph. Onboard observers recorded data on tank-measured fuel consumption, trip average speed, etc. An analysis of the data led to the following conclusions: (1) increased fuel consumption results from higher speed limits in the range of 50 to 60 mph; (2) terrain is an important factor in determining the effect of speed limit on fuel consumption; and (3) a payload increase from 28,000 lbs to 42,000 lbs is carried at no detectable increase in fuel consumption for the "hilly" route, and less than a 7% increase in fuel consumption for the route including a crossing of the Berkshire Mountains. (Summary)
Availability: NTIS

Cayce, D.V.
FAA Statistical Handbook of Aviation: Calendar Year 1975
U.S. Dept. of Transportation, Federal Aviation Administration, Office of Management Systems, 800 Independence Ave. SW, Washington, DC
Annual report, 162 p.
31 Dec 1975
Abstract: Statistical data on air transportation in 1974 is presented in 155 tables, which cover personnel, airport traffic and control, domestic and international flight service stations, civil and joint-use airports, various types of air carriers, operations, and financial information. The mission and activities of the Federal Aviation Administration and the National Airspace System are outlined. Information on airmen covers pilot and non-pilot personnel for all types of aircraft. Safety data reports 47 aircraft accidents, nine of which resulted in a total of 467 fatalities. (DCK)
Availability: GPO $2.80; NTIS

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Civil Aeronautics Board, Bureau of Accounts and Statistics, Statistical Data Division, Financial and Traffic Data Section, Washington, DC 20428
<u>Air Carrier Traffic Statistics</u>
Monthly report, approximately 95 p.
Monthly
Abstract: In this monthly report, monthly and twelve-month traffic data of 35 air carriers are presented, including information on: revenue passenger-miles, available seat-miles, revenue passenger load factor, revenue passenger enplanements, revenue ton-miles, overall capacity and load factor, aircraft revenue miles and hours, overall performance factor and departures, and averages. The data are grouped into two broad operational categories: domestic and international. Domestic includes operations of the trunk and all-cargo carriers, the local service, helicopter, Alaskan, Hawaiian, and other carriers; the international category comprises operations for both the international trunks and all-cargo carriers. The data include both basic figures from the carriers' reports and derived figures computed from the basic data. Statistics are presented on category totals and individual carriers for all services, scheduled services, and non-scheduled services. (BTB)

Compton, R.H. (Chairman)
<u>Safety: Report of a Panel of the Interagency Task Force on Motor Vehicle Goals Beyond 1980</u>
U.S. Dept. of Transportation, National Highway Traffic Safety Administration, Motor Vehicles Programs, Washington, DC
Interim Report, 166 p.
Mar 1976
Abstract: Long-range goals for the government motor vehicle fleet are examined in terms of environmental protection, safety, and economy. A baseline safety standard is set to determine areas where design trade-offs could be made and still provide crashworthiness and crash avoidance for the car and damage protection for the occupants. Passenger safety is examined at two levels: (1) three point belt restraints, and (2) air-cushion plus lap belt restraint and anti-lock brakes. A 1975 baseline of 29,800 deaths for car occupants not using restraints is used in determining incremental benefits of safety features. Compliance tests were performed to check vehicles for crash avoidance and damageability. Statistical data on damage, injuries, and repair costs are presented along with background information on safety research and regulations. Recommendations include further studies of highway user and highway environment safety. (57 references) (DCK)
Availability: Office of the Secretary of Transportation, Publications Section, TAD-443.1, Washington, DC 20590

Cope, E.M.
<u>The Effect of Speed on Automobile Gasoline Consumption Rates</u>
U.S. Dept. of Transportation, Federal Highway Administration, Office of Highway Planning, Highway Statistics Division, 400 Seventh St. SW, Washington, DC 20591
8 p. report
Oct 1973
Abstract: The purpose of this study was to measure, under practical operating conditions, the effect of automobile speed on gasoline consumption. Twelve cars with weights varying from 2050 lbs. to 5250 lbs. were used for the tests. The testing methods and equipment are described, and data are presented for each car on miles per gallon at 30, 40, 50, 60, and 70 miles per hour, and the percent increase in gasoline consumption caused by increases in speed from 30 to 40, 40 to 50, 50 to 60, 60 to 70, and 50 to 70 miles per hour. Measurements were made with and without the use of air conditioning, and the fuel consumption of one car was measured before and after tuning. When the results from the 12 cars were averaged, it was found that fuel economy decreased from 21.05 miles per gallon at 30 mph to 14.03 at 70 mpg without the use of air conditioning, and from 18.34 to 13.17 with air conditioning. The use of air conditioning reduced the average car's mileage by as much as 2 miles per gallon, and a tune up improved the mileage of one car by better than 2 miles per gallon. (MPG)
Availability: U.S. Dept. of Transportation (no charge)

Cope, E.M.
<u>The Effect of Speed on Truck Fuel Consumption Rates</u>
U.S. Dept. of Transportation, Federal Highway Administration, Office of Highway Planning, Highway Statistics Division, Washington, DC
15 p.
Aug 1974
Abstract: The basic objective of the study was to obtain information on the effect of speed on the rates of fuel consumption of heavy-duty highway trucks. The tests were not designed to elicit the maximum fuel economy from the trucks used; and the trucks were not necessarily representative of optimized combinations of engines, power train and load. No effort was made to compare the advantages or disadvantages of one vehicle versus another. Differences in engine horsepower, transmissions, and other optional equipment offered to the purchaser by the manufacturer and in fact used on the test vehicles would make such comparison unwarranted. For this reason and because of other factors, such as original cost, longevity, frequency and type of maintenance and repairs, resale value, dependability, employee relations (driver satisfaction), suitability for particular performance (trip travel time), type of service, or other factors, the information in this report should not be interpreted as implying an advantage or disadvantage of one vehicle over another. (auth)

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DeGolyer and MacNaughton, One Energy Square, Dallas, TX 75206
Twentieth Century Petroleum Statistics
Annual publication, approximately 115 p.
Annual
Abstract: Over 100 tables, accompanied by graphs, present statistics on production, reserves, transportation, imports, exploration, and consumption of crude oil, petroleum products, and natural gas. This handbook utilizes information published by the American Petroleum Institute, U.S. Bureau of Mines, and other government agencies as well as data in "The Oil and Gas Journal" and "World Oil." (BTB)

Delury, G.E. (ed.)
The World Almanac and Book of Facts
Newspaper Enterprise Association Inc., 230 Park Avenue, New York, NY 10017
ISBN 0-385-12555-0, 976 p. for 1977 Almanac
Annual
Abstract: This annual publication provides a compendium of useful facts relating to countries of the world, sports, travel, money, news and events, business, health, history, science, celebrities, astronomy, politics, nature, etc. Energy conversion tables are included. (BTB)
Availability: Newspaper Enterprise Association, Inc. $3.25 for 1977 Almanac

Doggett, R.M.
Energy Demand by the Transportation Sector in 1985 and 2000: A Comparison of Five Studies
International Research and Technology Corp., Washington, DC
Report No. IRT 427-R, draft copy, 14 p.
11 May 1976
Abstract: Numerous studies of transportation energy use have been conducted in an effort to estimate the extent to which future demand might be reduced through conservation initiatives and behavioral and institutional changes. Resources for the Future, Inc. (RFF), through a contract with the National Institute of Health, adopted EPA's Strategic Environmental Assessment System (SEAS) to project energy demand out to the year 2025. The purpose of this paper is to compare and contrast two RFF projections with ten other projections; three by the Federal Energy Administration's Project Independence effort, three by the Energy Research and Development Administration (ERDA), three by the Ford Foundation Energy Policy Project (EPP), and a preliminary projection by the recently developed SEAS transportation energy demand module. Particular attention will be given to the basic methodology and underlying assumptions used in making each projection. (from Introduction)

Dupree, W.G. Jr.; Corsentino, J.S.
United States Energy Through the Year 2000 (Revised)
U.S. Dept. of Interior, Bureau of Mines, Washington, DC
72 p.
1975
Abstract: Earlier energy consumption and supply forecasts of the Bureau of Mines are updated in this report, which is based mainly on evaluation of Bureau of Mines fuels data. Net energy consumption is expected to increase from 59,855 trillion Btu in 1974 to 110,230 trillion Btu in 2000. The present trend toward increased use of secondary energy sources will continue. Conversion losses in the electrical, synthetic gas, and synthetic liquids sectors will increase as will the total gross energy inputs. Both net and gross energy inputs per capita are forecast to rise. The difference between net and gross energy inputs will increase over time due to increased dependence on secondary energy sources. In 1974 the energy consumed by the electrical sector represented 26.7% of total gross consumption of energy. By 2000 this sector is expected to consume 48.1% of total gross energy inputs. It is anticipated that the U.S. will continue to rely on conventional fossil fuels (i.e., coal, petroleum and natural gas). Coal resources appear adequate through 2000. However, domestic natural gas and petroleum will have to be supplemented by synthetic fuels and imports. (BTB)
Availability: Bureau of Mines, Publications Distribution Branch, 4800 Forbes Ave., Pittsburgh, PA 15213

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Energy Research and Development Administration
A National Plan for Energy Research, Development & Demonstration: Creating Energy Choices for the Future, Volume 1: The Plan
Report No. ERDA-48, v.p.
Jun 1975
Abstract: Five national policy goals are recognized as a focus for energy policy: maintain the security and policy independence of the U.S.; maintain a strong and healthy economy; provide for future needs so that life styles are not limited by the unavailability of energy; contribute to world stability through cooperative international efforts in energy; and protect and improve the Nation's environmental quality. The present energy problem is one of limited choices. This plan is designed to create options for the future and delineates innovations in technologies required to overcome energy problems. Individual chapters are devoted to: The Problem: Limited Choice; National Energy Technology Goals; Establishing a Strategic Framework for the Plan; Technology Priorities; Roles of Key Participants in Achieving National Goals; Summary of Federal Program Implementation; Potential Constraints of Implementation; and Future Evolution of the Plan. Eight national energy technology goals are outlined, all of which must be pursued together. Priorities are set for research, development, and demonstration technologies, and broad and specific supporting technologies are also outlined. Five major changes are needed in the nature and scope of the Nation's energy R,D & D program: emphasis on overcoming the technical problems inhibiting expansion of high leverage existing systems - notably coal and light water reactors; immediate focus on conservation efforts; acceleration of commercial capability to extract gaseous and liquid fuels from coal and shale; high priority to the solar electric approach; and increased attention to under-used new technologies that can be rapidly developed, e.g. solar heating and cooling and use of geothermal power. (HPG)
Availability: GPO $1.70

Energy Research and Development Administration, Washington, DC
A National Plan for Energy Research, Development & Demonstration: Creating Energy Choices for the Future. Volume 2. Program Implementation
Report No. ERDA-48, Vol. 2 of 2, 176 p.
1975
Abstract: Volume I introduced a proposed National Plan for energy research, development, and demonstration covering programs now underway and supported by the Federal Government, and others which will be considered in the future for Federal support. Volume II is limited to activities supported in whole or part by the Federal Government. It does not cover energy R and D underway in industry or elsewhere unless Federal funds are involved. Together these volumes comprise the first ERDA effort to collect the Federal Government's diverse R,D and D. Within this scope, emphasis is on ERDA's programs. Information on energy programs being conducted by other Government agencies is limited to general descriptions of fields of activity. It reflects the best data that could be assembled in the time available. The coverage of other Federal programs will be increased to make future editions of Program Implementation more comprehensive. ... (from Introduction)
Availability: GPO $2.45

Energy Research and Development Administration, Washington, DC
A National Plan for Energy Research, Development & Demonstration: Creating Energy Choices for the Future 1976. Volume 1: The Plan
Report No. ERDA 76-1, 130 p.
1976
Abstract: The first annual update of ERDA's Plan summarizes the agency's current views on the energy technologies needed to accomplish energy independence. Chapter One reviews the energy problem and requirements for its solution. The relative roles of participants in the solution are described. The revised Plan is presented in Chapter Two; the most important change involves increased emphasis on energy conservation. A summary of the Federal energy research, development, and demonstration (RD&D) program is provided in Chapter Three. The next two chapters deal with the institutional mechanics needed to implement the RD&D Program. Factors that have influenced the formulation of the Plan (e.g., events, public comments, and new analytical results) are discussed in Chapter Six. The final chapter examines priority matters to be treated further in the next Plan update. Also included in this document are two appendixes: Perspective on World Resources, and Net Energy Analysis of Nuclear Power Production; a glossary; and a selected bibliography. (STB)
Availability: GPO $2.00, Stock No. 052-010-00478-6

Energy Research and Development Administration, Washington, D.C.
A National Plan for Energy Research, Development & Demonstration: Creating Energy Choices for the Future--1976: Volume 2: Program Implementation
Report No. ERDA 76-1, 433 p.
1976
Abstract: As a companion to Volume 1 (The Plan), Volume 2 describes programs now in progress which are supported by the Federal government, including Federally funded research done by industries and private institutions. In conjunction with Volume 1, this volume describes technologies being examined as well as current and future efforts in Federal energy research, development, and demonstration (RD&D) programs. Seventy-six program descriptions or "Building Blocks" are presented; each building block corresponds to a line item in the ERDA budget and represents the energy RD&D activities of one or more Federal agencies. Part I, Energy Technology Programs, presents 62 Building Blocks explaining Federal program activities oriented toward a single energy technology. These building blocks are grouped into nine major program areas: Fossil Energy, Solar Energy, Geothermal Energy, Conservation, Fusion Power, Nuclear Fuel Cycle R & D and Safeguards, Fission Power, Environmental Control Technology, and Synthetic Fuels Commercial Demonstration. Parts II and III of the Program Implementation Volume include Building Blocks describing supportive programs that tend to cut across several energy technologies. Part II is divided into two major program areas: Environmental Research and Safety, and Basic Energy Sciences. Part III lists six activities which are not unique to energy RD&D, but which are essential to such research. Three tables containing cross-referencing data make up Part III, which permits examination of the Building Blocks from the different perspectives of the National Energy Technology Goals, Volume I Technologies, and Federal Agency Involvement. A glossary of acronyms and abbreviations is included in the appendix (Part V). (BYB)
Availability: GPO $3.45, Stock No. 052-010-00492-1

Fawcett (Jack) Associates Inc.; Council on Environmental Quality; Federal Energy Administration; Interagency Task Force on Energy Conservation
Project Independence Blueprint: Final Task Force Report - Energy Conservation, Volume 2, Project Independence and Energy Conservation: Transportation Sectors
318 p.
Nov 1974
Abstract: Energy conservation data in the transportation sector were compiled for a scenario with petroleum prices under $4 per barrel and for scenarios with petroleum prices under $7 and under $11 per barrel. Projections were made of passenger modes and freight and trucking modes. Fuel transportation demands and impacts on demands for transportation of products sensitive to petroleum prices are discussed in an overview. Information presented in five appendices include summary tables of passenger travel projections by purpose and distance interval; summary tables of total passenger travel trip costs by mode; fuel consumption by type of fuel and mode of passenger travel; auto fuel efficiencies considering vehicle-miles and alternative energy projections; and energy consumption for military transportation. (TIC)
Availability: GPO $4.20, Stock No. 4118-00039

Federal Energy Administration; U.S. Dept. of Transportation; Interagency Task Force Transportation Crosscut Group
Project Independence Blueprint: Final Task Force Report - Inputs to the Project Independence Evaluation System Integration Model for the Transport of Energy Materials, Volume II
v.p.
Nov 1974
Abstract: This technical analysis by the Project Independence Transportation Crosscut Task Force was chaired by the Department of Transportation. The Task Force was formed to determine the degree to which the transportation system of the U.S. will be able to accommodate potential increases in energy production. After an introductory chapter, other chapters are: Methodology in Developing Transport Data for the Federal Energy Administration Model; Transportation of Coal by Rail; Coal Transport Via Waterways; Transport of Oil and Gas by Pipeline; Inland and Coastal Transport of Petroleum; Methodology in Developing Coal Slurry Pipeline Data; and Standard Input Tables for the F.E.A. Model. (TIC)
Availability: GPO $3.00, Stock No. 4118-00030

Federal Energy Administration, Washington, DC 20461
<u>Initial Report on Oil and Gas Resources, Reserves, and Productive Capacities. Submitted in Compliance with Public Law 93-275, Section 15(b). Executive Summary</u>
9 p. report
1975
Abstract: U.S. proved reserves of crude oil and natural gas are estimated to be 38.2 billion barrels of oil and 237 trillion cubic feet of natural gas. These estimates are compared with estimates from the American Gas Association, the U.S. Geological Survey, the American Association of Petroleum Geologists, the National Petroleum Council, and the Potential Gas Committee. Proved reserves are defined as those oil and natural gas resources that have been discovered and can be produced under current economic and technological conditions. Four conclusions are reached: 1) annual additions to reserves must be greater than in recent years if domestic producing rates are to be sustained; 2) remaining volumes of recoverable oil and gas are large enough to justify increasing efforts to explore and produce them; 3) the limits of recoverable oil and gas resources may be approached in the next fifty years; and 4) there is a need for a) intensified exploration to define those limits, b) advancement of recovery technology, c) development of alternative energy sources, d) energy conservation, and e) economic incentives to facilitate exploration, recovery, development, and conservation. (ETB)

Federal Energy Administration, Policy and Analysis, Office of Data and Analysis; Federal Energy Administration, National Energy Information Center, Washington, DC 20461
<u>Energy Information in the Federal Government. A Directory of Energy Sources Identified by the Interagency Task Force on Energy Information</u>
Report No. PB-246703, FEA/B-75/375, 1038 p.
1975
Abstract: The Federal Energy Information Locator System (FEILS), which contains information on most of the sources of energy data in the Federal Government, is described and illustrated in this directory. FEILS is the beginning of a comprehensive inventory of existing data sources; eventually FEILS will include all government energy data sources. Using this Directory, Federal agencies collecting specific kinds of energy data can be identified rapidly. The following information on the energy data sources are included in FEILS: the energy source for which data is collected (e.g., coal, natural gas); major functions associated with that energy source (e.g., exploration, reserves, or extraction); more refined characteristics associated with specific energy data sources, such as geographical location, bed thickness of anthracite coal reserves; identification and description of 84 separate Federal agencies, bureaus, and administrations associated with 261 different programs; and program summaries identifying 200 data collection forms, 600 publications, and 98 computerized data bases or major files. The National Energy Information Center of the Federal Energy Administration will have the responsibility of maintaining and enhancing FEILS. An updated Directory will be published annually. (ETB)
Availability: NTIS

Federal Energy Administration, Washington, DC 20461
<u>National Energy Outlook</u>
Report No. FEA/N-75/713, 593 p., also Executive Summary FEA/N-76/100, 14 p.
Feb 1976
Abstract: This report is an update of last year's Project Independence Report. It concludes that the U.S. can achieve energy independence by 1985 without sacrificing its economic objectives. The study states that the U.S. oil imports, which are currently 6.1 million barrels per day (MMB/D), will continue to increase in the next two years, until Alaskan production begins. However, with gradual deregulation of oil and gas prices, intensive efforts to increase domestic production, and continuation of current world oil prices, 1985 imports could drop to 5.9 MMB/D, slightly below today's level. With accelerated production and increased conservation efforts, imports could decline to 1 to 2 MMB/D in 1985. If domestic oil and gas prices are regulated at low levels, however, imports could reach 13.5 MMB/D that year. The report points out that even if imports decline by 1985, they could increase again by 1990 as production from older oil fields declines. This decline will need to be offset by the use of nuclear power, coal, synthetic fuels, and emerging energy sources such as solar power. (GRL)
Availability: GPO $7.30, Stock No. 041-018-00097-6, Executive Summary $0.60, Stock No. 041-018-00102-6

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Federal Task Force on Motor Vehicle Goals Beyond 1980, Washington, DC
<u>The Report by the Federal Task Force on Motor Vehicle Goals Beyond 1980. Volume 1, Executive Summary. Volume 2. Task Force Report</u>
Draft report, 30 p. in Volume 1; 279 p. in Volume 2
2 Sep 1976
Abstract: Written by a task force with representatives from several Federal departments and agencies, this draft report examines motor vehicle fuel economy goals beyond 1980 which are compatible with environmental, safety, and economic objectives. Decisions on the automobile beyond 1980 involve balancing such factors as consumer preferences, government regulation, and manufacturing and finance requirements. It is concluded that, with adequate industry involvement and reasonable government regulation, the U.S. can save four million barrels of oil per day by 1995. This fuel savings would represent a 40 to 50% reduction in projected automobile fuel consumption, a 25 to 40% reduction in projected light truck fuel consumption, and a 30% reduction in projected commercial vehicle fuel consumption. The actual fuel savings are dependent on the rate of introduction of new fuel-economical cars. A move toward more compact, properly-designed, lighter-weight automobiles is not expected to increase automobile occupant fatalities and injuries. However, implementation of a higher safety level would increase car weight and cost. The impact of emissions controls on fuel economy is estimated. The average cost per mile of automobile transportation will decrease with the transition to lighter, more fuel-economical cars. An earlier draft report was published in July 1976. (DTS)

Fraize, W.E.; Dukowicz, J.K.
<u>Transportation Energy and Environmental Issues</u>
Mitre Corp., McLean, VA 22101
M72-25, 40 p.
Feb 1972
Abstract: The role of transportation in air pollution and petroleum energy consumption is reviewed, with emphasis on the U.S. situation. Both technological and regulatory solutions for each problem area are discussed. Technological solutions focus on the auto, electric and petroleum-fueled, and on the use of non-petroleum fuels. Regulatory measures seek to reduce transportation energy consumption via improved transportation efficiency or restricted private vehicle use. Future R&D efforts are emphasized. (Auth)

Fraize, W.E.; Dyson, P.; Gouse, S.W., Jr.
<u>Energy and Environmental Aspects of U.S. Transportation</u>
Mitre Corp., Westgate Research Park, McLean, VA 22101
Report No. MTP-391, 76 p., 45 ref.
Feb 1974
Abstract: U.S. transportation's impact on energy, economy, and environment is briefly reviewed, and the near and long term factors, including national energy and environmental policy, relevant to transportation's future are discussed. A selected statistical profile of the market, energy, and emissions characteristics of U.S. transportation, according to mode, is presented as a background from which the opportunities for transportation energy conservation are analyzed. Transportation energy conservation in the near term is seen to be best effected by pricing measures and more efficient use of existing systems, especially the automobile. Long term transportation energy conservation will rely heavily on technological changes, mode shifts, and improved land use. (Auth)

Freeman, S.D.
<u>A Time to Choose: America's Energy Future</u>
Energy Policy Project, 1755 Massachusetts Avenue NW, Washington, DC 20036
Ballinger Publishing Co., Cambridge, MA, 511 p.
1974
Abstract: This book is the final report of the Ford Foundation Energy Policy Project, a two and one-half year research effort on the nation's energy crisis. The principal conclusion is that it is desirable and technically and economically feasible to reduce the rate of energy growth. The U.S. can lessen energy growth from the current 4.5% to about 2% per year without harm to jobs, incomes, or quality of life. After 1985 it appears feasible to sustain growth in the economy without any further increases in the annual consumption of energy. The largest savings in energy consumption can be achieved by "technical fixes" in three areas: construction and operation of buildings to reduce energy consumed for heating and cooling; better mileage for automobiles; and greater energy efficiency in industrial plants through new technology and use of waste heat. The book contains six appendixes with the following titles: Energy requirements for scenarios; Capital requirements for conservation; Technical Fix vs. Historical Growth; Energy supply notes; Major energy resources; Government organization and re-organization for energy; and Economic analysis of alternative energy growth patterns, 1975-2000, a report by E. A. Hudson and D. W. Jorgenson, Data Resources, Inc. (NPG)
Availability: Ballinger Publishing Co., Cambridge, MA

Gay, W.F.
Summary of National Transportation Statistics
U.S. Dept. of Transportation, Transportation Systems Center, Kendall Square, Cambridge, MA 02142
Annual report, Report No. PB-252410, DOT-TSC-OST-75-18, 160 p. for June 1975 report; Report No. DOT-TSC-OST-76-11, 120 p. for June 1976 report
Jun 1975; Jun 1976
Abstract: These periodic reports are compendiums of selected national-level transportation statistics. Included are cost, inventory, and performance data describing the passenger and cargo operations of the following modes: air carrier, general aviation, automobile, bus, truck, local transit, rail, water, and oil pipeline. The report includes basic descriptors of U.S. transportation, such as operating revenues and expenses, number of vehicles and employees, vehicle-miles and passenger miles, etc. As the name implies, these reports are summaries of a larger data base, consisting of time-series collected from a variety of government and private statistical handbooks. In the 1975 and 1976 editions, the selected data cover the periods 1963 through 1973 and 1964 through 1974, respectively. (GRA)
Availability: GPO $5.05, Stock No. 050-003-00220-6 for 1975 report; GPO $1.85, Stock No. 050-000-00118-1 for 1976 report

Gay, W.F.
Energy Statistics - A Supplement to The Summary of National Transportation Statistics
U.S. Dept. of Transportation, Transportation Systems Center, Kendall Square, Cambridge, MA 02142
Annual reports, Report No. PB-238767, DOT-TSC-OST-74-12, 156 p. for Aug 1974 report; Report No. PB-252612, DOT-TSC-OST-75-33, 168 p. for Aug 1975 report; DOT-TSC-OST-76-30, 194 p. for Aug 1976 report
Aug 1974; Aug 1975; Aug 1976
Abstract: These reports are compendiums of selected time-series data describing the transportation, production, processing, and consumption of energy. The statistics have been assembled from a wide variety of sources, such as the U.S. Department of the Interior, the Interstate Commerce Commission, and the American Petroleum Institute. These reports are divided into three main sections. The first, entitled "Energy Transport", contains such items as the revenues and expenses of oil pipeline companies, number and capacities of U.S. tank ships, and the total crude oil transported in the U.S. by method of transportation. The second section, entitled "Reserves, Production, and Refining", reveals the growth over time of the U.S. oil and natural gas reserves, refinery capacity, and yields. Trends in the demand for fuel and power are displayed in the third section, entitled "Energy Consumption". Throughout this part, the transportation sector is emphasized. Included are the gasoline and oil costs of automobiles of different sizes, the consumption of petroleum by type of product, the energy intensiveness of the air carriers, the electrical energy consumed by the local transit industry, and other important statistics describing the supply and demand for energy. (Auth)
Availability: NTIS for Aug 1974 and Aug 1975 Supplements; GPO $2.00, Stock No. 050-000-00122-9 for Aug 1976 Supplement

General Services Administration, Federal Supply Service, Office of Transportation and Public Utilities, Motor Equipment Management Division, Washington, DC 20406
Federal Motor Vehicle Fleet Report
Annual reports for fiscal years ending June 30, 1962 through June 30, 1975. Report No. FPMR 101-38.9 for 1972 through 1975 reports; Report No. FPMR 101-38.101 for 1964 through 1971 reports; reports prior to 1972 report are entitled "Annual Motor Vehicle Report"
Jan 1963; Feb 1964; Feb 1965; Feb 1966; Feb 1967; Feb 1968; Feb 1969; Mar 1970; Mar 1971; Mar 1972; Mar 1973; Apr 1974; Mar 1975; Jul 1976
Abstract: The Federal Motor Vehicle Fleet Report is compiled and published each fiscal year by the General Services Administration (GSA). Issued for more than 30 years, the report is designed to provide essential statistical data concerning worldwide Federal motor vehicle fleet operations. The data reported was supplied to GSA by all Federal agencies operating motor vehicles in the United States and overseas. ... Statistical data on fleet changes, acquisition costs, rental vehicles, and operating and maintenance costs, have been summarized for the 420,784 vehicles of the Federal fleet. For the purposes of this report, the following types of vehicles are classified as fleet vehicles: sedans of all types, station wagons, ambulances, buses, trucks, and truck tractors. The report does not include data on trailers, trailer-vans, motorcycles, firetrucks, trucks with permanently mounted special equipment, special purpose vehicles, or military (tactical) design motor vehicles. Review of the data in this report will assist Government agencies in evaluating the effectiveness of the operation and management of their individual vehicle fleets. (from Foreword to 1975 Report)

Geraghty, J.J.; Miller, D.W.; Van Der Leeden, F.; Troise, F.L.
Water Atlas of the United States
Geraghty & Miller Inc.
ISBN 0-912394-03-X, a Water Information Center Publication, v.p.
1973
Abstract: The Water Atlas is the only publication available which provides a comprehensive visual guide to the water situation in the U.S. This expanded second edition contains a total of 122 maps, including material on water resources and water use, water pollution and water quality, water conservation, water law, and water-based recreation. The primary purpose of this Atlas is to display complex national water data in easily understandable form. (BTB)
Availability: Water Information Center, Inc., Water Research Building, Manhasset Isle, Port Washington, NY 11050 $28.00

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Gish, P.E.
Nationwide Personal Transportation Study: Characteristics of Licensed Drivers
U.S. Dept. of Transportation, Federal Highway Administration, Office of Highway Planning, Program Management Division, 400 Seventh St. SW, Washington, DC 20590
Report No. 6, 36 p.
Apr 1973
Abstract: Data collected in this study for motor-vehicle drivers are examined within three parameters. These parameters are (1) geographic distribution of the resident non-institutionalized driving-age population 16 years of age and older with driver licenses in unincorporated areas, and by population size-group of place of residence in incorporated places and Standard Metropolitan Statistical Areas (SMSA's); (2) population distribution of licensed drivers by age-groups and sex; and (3) travel distribution of licensed drivers by age-groups, sex, and estimated annual miles of driving. The population data shown in this report are based on the 1970 census and include members of the Armed Forces in the United States living off post or with their families on post. Population data for all other reports in this series were based on estimates of 1969 population expanded from the 1960 census and excluded members of the Armed Forces. The percentage contribution of the Armed Forces to the different age-sex population levels necessitated this revision. (from Description of Data)

Goley, B.T.; Brown, G.; Samson, E.
Nationwide Personal Transportation Study: Household Travel in the United States
U.S. Dept. of Transportation, Federal Highway Administration, Office of Program and Policy Planning, Socio-Economics Studies Division, Economic and Demographic Forecasting Team, 400 Seventh St. SW, Washington, DC 20590
Report No. 7, 80 p.
Dec 1972
Abstract: Residents of households make 87 billion automobile or taxi trips in one year, accounting for 776 billion vehicle-miles of travel. Each household averages 1.4 thousand trips and 12.4 thousand vehicle-miles annually, or 3.8 trips and 34 vehicles-miles per day. The trip rate and vehicle-miles are analyzed by purpose of trip (i.e., earning a living, conducting family business, and engaging in social and recreational activities). Data indicate that household tripmaking by passenger cars increases as the level of household income increases. The number of trips by passenger cars and the vehicle-miles traveled also vary among incorporated places according to the population size. (BTB)

Grad, F.P.; Rosenthal, A.J.; Rockett, L.R.; Fay, J.A.; Heywood, J.; Kain, J.F.; Ingram, G.K.; Harrison, D., Jr.; Tietenberg, T.
The Automobile and the Regulation of Its Impact on the Environment
Columbia University, Legislative Drafting Research Fund; Massachusetts Institute of Technology; Harvard University, Dept. of Economics; Williams College, CU, New York, NY; MIT, Cambridge, MA; HU, Cambridge, MA; WC, Williamstown, MA
Report No. NSF/RA/X-74-023, ISBN 0-8061-1278-0, University of Oklahoma Press, Norman, 495 p.
1975
Abstract: This book deals systematically with problems of regulating automotive air pollution and with other aspects of environmental pollution caused by the automobile--noise, water pollution from used crankcase oil, and solid waste problems caused by junked cars. Its assessments are offered from legal and economic, as well as technological, perspectives. In this study, the authors examine in great detail a number of alternative strategies for contending with automotive pollution. These include a rollback strategy relying on emission controls, mandatory inspection and repair strategies, traffic control, and legislative action. In each of these areas, careful consideration is given to the legislative history of pollution control and to the current and projected impact of the Clean Air Amendments of 1970. (from publisher's description)
Availability: University of Oklahoma Press, Norman, OK $19.95

Harris, R.A.; Bacon, R.F.; McCabe, W.L.; Winslow, E.H.; Braket, C.A.
U.S. Transportation: A Summary Appraisal
Mitre Corp., Westgate Research Park, McLean, VA 22101
Report No. M75-22, Rev. 1, 66 p.
1975
Abstract: A summary of the findings and recommendations of a MITRE report, "Transportation in the U.S.: An Appraisal," is presented in this document. This report analyzed and evaluated problems and issues that need to be resolved before developing government policies on transportation. Presently, the Federal government transportation policies seem to be inadequately coordinated, causing substantial diseconomies and other misallocations. This report purports that a reassessment of existing government policies is needed and would be demanded if the public were better informed on the options available. The Summary is organized under these sections: Institutional and Economic Considerations; Urban Transportation; Air Transportation; Intercity Freight; Intercity Ground Passenger Transportation; and Energy and Environmental Considerations. (BTB)
Availability: MITRE Corp., Westgate Research Park, McLean, VA 22101

Batley, R.H.
Nationwide Personal Transportation Study: Availability of Public Transportation and Shopping Characteristics of SMSA Households
U.S. Dept. of Transportation, Federal Highway Administration, Office of Highway Planning, Program Management Division, 400 Seventh St. SW, Washington, DC 20590
Report No. 5, 36 p.
Jul 1972
Abstract: This report presents data on the availability of public transportation to the main business district of the central city for households located in Standard Metropolitan Statistical Areas (SMSA's) and information on shopping characteristics of SMSA residents. These data were collected in the Nationwide Personal Transportation Study, conducted by the Bureau of the Census for the Federal Highway Administration in 1969-1970. The first part of this report relates size of the SMSA and income of the households by race of household head and by the nearness of the households to public transportation to the main business district of the central city. The second part of the report discusses the frequency with which the heads of SMSA households shop in the main business district of the central city, including reasons for not shopping downtown. No attempts, however, have been made to relate the two parts of this report. (from Introduction)

Heywood, J.B.; Jacoby, H.D.; Linden, L.H.
The Role for Federal R & D on Alternative Automotive Power Systems
Massachusetts Institute of Technology, Energy Laboratory, Cambridge, MA 02139
Report No. MIT-EL-74-013, 174 p., 54 references
Nov 1974
Abstract: This question is examined: Is it appropriate for the Federal Government to support R & D on alternative automotive power systems? Potential alternatives to the ICE include the stratified charge, Wankel, diesel, Rankine cycle, Stirling cycle, gas turbine, electric and hybrid systems. These engines may offer advantages over the ICE but considerable development would be required, and Federal support has been proposed. The five sections of the report are: a description of the central issue and a set of underlying issues, a review of the relevant technology, an exploration of the role for Federal R & D in overall Federal policy concerning the automobile, an analysis of present programs in industry and government, and conclusions. Appendices review the history of Federal programs and describe the content of present industry and government programs. The principal conclusions of the report are that it cannot now be forecast whether the ICE or any of the alternatives will be the dominant engine later in this century, that it is important that economically justifiable research and development efforts in this area be carried out, that the automobile industry has active programs underway which reflect a reasonable distribution of internal investments, and that a moderately funded Federally supported effort is well justified. (auth)
Availability: NTIS

Hirst, E.
Energy Consumption for Transportation in the U.S.
Oak Ridge National Laboratory, ORNL-NSF Environmental Program
ORNL-NSF-EP-15, 34 p.
Mar 1972
Abstract: Historical, present, and possible future patterns of energy consumption in the transportation sector are examined for inter-city freight and passenger traffic and for urban passenger traffic. The energy-efficiencies among the various transport modes are quite variable. Airplanes are relatively inefficient; cars and trucks are slightly more efficient; and railroads, waterways, pipelines, and buses are quite efficient. The energy implications of changes in the modal mixes for freight and passenger transport are explored using two hypothetical futures. The energy required, directly and indirectly, for automobiles in American society is also computed. This includes the energy needed to produce gasoline; to manufacture and sell cars; to repair, maintain, and insure cars; to provide replacement equipment; and to build and power cars. When total automotive energy consumption is considered the automobile accounts for about 25 percent of total U.S. energy consumption. This is equivalent to 7.1 miles per gallon for the average American car. (Auth)
Availability: NTIS

Hirst, E.
Energy Intensiveness of Passenger and Freight Transport Modes: 1950-1970
Oak Ridge National Laboratory, ORNL-NSF Environmental Program, P.O. Box Y, Oak Ridge, TN 37830
Report No. ORNL-NSF-EP-44, 39 p.
Apr 1973
Abstract: Previous work at ORNL evaluated the energy consequences of changes in freight and passenger traffic levels and shifts in modal mix for the period 1950 to 1970. The research reported here extends this work to include an analysis of changes in energy intensiveness for individual modes during this period. Examination of individual modes shows that airplanes are energy-intensive and that cars and trucks are less so. Buses, mass transit, railroads, pipelines, and boats are relatively energy-efficient. Railroad energy intensiveness dropped sharply during this 20-year period because of the shift from steam engines to diesel engines. On the other hand, airplane energy intensiveness increased rapidly because of increased speed. Other modes generally showed slight increases in energy intensiveness. Energy intensiveness of inter-city freight declined during this period because of the large drop in railroad energy intensiveness. However, passenger transport became more energy intensive because of shifts to airplanes and autos and because of a general increase in energy intensiveness for all passenger modes. Results derived here are summarized in a number of ways to highlight important shifts in energy use patterns for transportation. (Auth)
Availability: NTIS

Hirst, E.
Transportation Energy Use and Conservation Potential
Oak Ridge National Laboratory, ORNL-NSF Environmental Program, P.O. Box X, Oak Ridge, TN 37830
Paper presented at NSF/RANN Conference on Energy: Demand, Conservation, and Institutional Problems, held at MIT, Cambridge, MA, February 12-14, 1973, published in Science and Public Affairs, p. 36-42, November 1973
Feb 1973

Abstract: Historical, present and possible future energy use patterns for transportation in the U.S. are examined. Between 1950 and 1970, annual energy consumption for transportation increased 89% to 16,500 trillion Btu, a per capita growth of 40%. During this period, energy use for inter-city freight fell slightly in spite of an increase in freight traffic. This reflects the large increase in railroad energy efficiency. However, energy consumption for passenger transport grew more rapidly than did passenger traffic levels. This reflects the shift to less energy-efficient modes and a decline in efficiency for most modes. Various strategies for increasing energy efficiency of transportation are briefly discussed. These include: shifts from energy intensive transport modes (airplanes, automobiles, trucks) to more efficient modes (mass transit, trains, buses); increased utilization of existing equipment; reduced speeds; and use of advanced transport technologies. Finally, possible ways to implement these energy conservation schemes are described. (Auth)

Availability: MIT Press, Cambridge, MA $25.00 for entire proceedings

Hirst, E.
Transportation Energy Conservation Policies
Oak Ridge National Laboratory, Energy Division, Oak Ridge, TN 37830
Science, Vol. 192, pp. 15-20
2 Apr 1976

Abstract: Economic factors and government policies may alter the energy intensiveness and energy use of the transportation sector. Historical trends in passenger transportation and energy consumption are examined for the period 1950 to 1972. The energy efficiencies of different urban and intercity passenger systems are compared. Four policies for reducing transportation fuel consumption are discussed, evaluated, and compared--improving mass transit, increasing carpooling, raising gasoline prices, and imposing new car fuel economy standards. Policies which have a direct impact on car ownership and use (gasoline taxes and fuel economy standards) are considered far more effective than policies aimed at shifting travelers from individual cars to mass transit and carpools. These recommendations are made: (1) technological development to reduce fuel consumption should be pursued; and (2) the public should be informed about energy problems and the need for and attractiveness of energy conservation. Models and data currently used in this type of policy analysis are not completely satisfactory. (18 references) (DYB)

Interstate Commerce Commission, Washington, DC
89th Annual Report of the Interstate Commerce Commission, Fiscal Year Ending June 30, 1975
143 p.
1975

Abstract: This is a report on the manner in which the Interstate Commerce Commission carried out its responsibilities, with an analysis of the condition of the industries regulated. As such, it is hoped that the report illuminates the need for regulation, under present statutory criteria--or under refined, yet reasonably similar, standards. This is a report to the Congress and it is the Congress that must decide whether new policies should be established for protection of the public interest in surface interstate transportation transactions, or whether controversies surrounding such transactions should be left for resolution in the market place or in the courts. It is difficult to conceive of modern commerce without modern transportation, yet, transportation's basic controversies have changed little through the ages. Who can provide service? What is a fair price to charge? What protection does the shipper have? What are the obligations of the carrier? How will differences of opinion be resolved? This report documents the manner in which the present system of regulation addressed these issues during fiscal year 1975. (from Introduction)

Availability: GPO $1.65, Stock No. 026-000-01015-2

Interstate Commerce Commission, Bureau of Accounts, Washington, DC

Transport Statistics in the United States for the Year Ended December 31, 1974. Part 1: Railroads, Their Lessors and Proprietary Companies, REA Express, Inc., and Electric Railroads. Part 2: Motor Carriers. Part 3: Freight Forwarders. Part 4: Private Car Lines. Part 5: Carriers by Water. Part 6: Pipe Lines

Annual Reports, Part 1, 190 p.; Part 2, 28 p.; Part 3, 12 p.; Part 4, 7 p.; Part 5, 60 p.; Part 6, 30 p.

1975

Abstract: These annual statistics provide data on Railroads (Part One), Motor Carriers (Part Two), Freight Forwarders (Part Three), Private Car Lines (Part Four), Carriers by Water (Part 5), and Pipelines (Part 6). Part One presents data on income, total assets and liabilities, operating expenses, capital improvement, and freight revenues. Detailed financial statements are given, including operating and revenue data for freight and passenger service by geographic area. Part Two on motor carriers provides financial data, statistics on employees, and operating statistics. Three tables are found in Part Three on Freight Forwarders: summary of operating revenues and expenses; selected balance sheet data and number of motor vehicles owned, by individual freight forwarders; selected income statement data, number and compensation of employees, and selected operating statistics, by individual freight forwarders. Part Four, Private Car Lines, presents the following data in tabular form: selected statistics; financial and operating statistics--refrigerator car lines owned or controlled by railroads; selected data--owners of 1,000 or more cars (excluding refrigerator car lines owned or controlled by railroads). Statistics on carriers by inland and coastal waterways are given in Part Five, including financial and operating data, number of carriers, tons of freight carried, and passengers carried. Part Six contains data reported by 103 pipeline companies in tables, which summarize financial and operating data, pipeline mileage, number of barrels of oil transported and barrel miles, a condensed balance sheet, a condensed income statement, operating revenues and expenses, number of employees and their compensation, and corporate changes. (DTB)

Availability: GPO $2.50, Stock No. 026-000-01032-2, Superintendent of Documents No. IC1.25:974/pt.1 for Part 1; $0.60, Stock No. 026-000-01039-0, Superintendent of Documents No. IC1.25:974/pt.2 for Part 2; $0.55, Stock No. 026-000-01027-6, Superintendent of Documents No. IC1.25:974/pt.3 for Part 3; $0.50, Stock No. 026-000-01026-8, Superintendent of Documents No. IC1.25:974/pt.4 for Part 4; Superintendent of Documents No. IC1.25:974/pt. 5 for Part 5; $0.70, Stock No. 026-000-01031-4, Superintendent of Documents No. IC1.25:974/pt.6 for Part 6

Kirby, R.F.; Bhatt, K.U.; Kemp, M.A.; McGillivray, R.G.; Wohl, M.

Para-Transit: Neglected Options for Urban Mobility

Urban Institute, 2100 M Street NW, Washington, DC 20037

Report No. UMTA-CA-06-0045-74-2, PB-234320, 443 p.

Jun 1974

Abstract: Increasing concern over pollution, congestion, and fuel consumption accompanying the use of the private auto in urban areas, together with greater emphasis on needs of those without access to autos, has led to major efforts to upgrade scheduled bus and rapid rail transit service in the U.S. cities. Other forms of transportation which are available to the public and use the streets and highways of urban areas, referred to as "para-transit," are now under consideration as transportation alternatives. This study was designed to review the experience to date with para-transit services, to assess their potential for servicing urban transportation demand, and to design an R D & D program as needed to identify and demonstrate innovations in the provisions of para-transit services which would be beneficial. Services studied were grouped into 3 categories: (1) "hire and drive" - daily car rentals and forms of short-term car rentals that have been proposed including Minicar and Public Automobile System; (2) "hail or phone" - taxi, dial-a-ride, jitney and related services; and (3) pre-arranged ride-sharing - forms of car pool, van pool, and subscription bus services. Four major applications of para-transit services are identified. Chapters include comparative study of para-transit modes, innovations in para-transit regulations, and case studies. A para-transit bibliography is furnished. Tables and figures complement the text. A summary of this report is "Para-Transit: A Summary Assessment of Experience and Potential." (GRA)

Availability: NTIS

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Linden, L.H.; Heywood, J.B.; Jacoby, H.D.; Margolis, H.
__Federal Support for the Development of Alternative Automotive Power Systems: The General Issue and the Stirling, Diesel, and Electric Cases__
Massachusetts Institute of Technology, Energy Laboratory, Cambridge, MA 02139
Report No. MIT-EL 76-003WP (Working Paper), 405 p.
Mar 1976
Abstract: Massive Federal support for the development of alternative automobile powerplants has been called for because the major companies have not done so. Analysis of the Stirling and diesel engines and electric vehicles is made in the context of the present market for automobiles and the present level of government intervention. Conclusions include: (1) the Big Three will continue to control domestic markets; (2) major technological changes are risky because of an unpredictable market; (3) the manufacturers can take steps to lower initial investments for innovations; (4) the industry perceives Federal intervention as having added to the uncertainties; and (5) it will take a 15 to 20 year research and development program to result in significant changes in the overall automobile fleet. Federal involvement should set goals for life cycle cost, emission and cost-benefit standards, and should be responsive to the long-term nature of technology, demonstration, and production when funding is set for alternative systems. (DCK)
Availability: Energy Laboratory, Headquarters, Room E40-139, MIT, Cambridge, MA 02139

Liston, L.L.; Aiken, C.A.
__Cost of Owning and Operating an Automobile__
U.S. Dept. of Transportation, Federal Highway Administration, Office of Highway Planning, Highway Statistics Division, Vehicles, Drivers, and Fuels Branch, Washington, DC
Superintendent of Documents No. TD2.2:Au8/976, 15 p.
1976
Abstract: This biennial report examines the factors affecting the costs of automobile ownership and operation and pinpoints opportunities to save on these costs. Four tables provide cost estimates of owning and operating standard, compact, and subcompact size cars, per year and per mile, from the first to the tenth years. These costs include: depreciation, repairs and maintenance, tire replacement, accessories, gasoline and oil, insurance, parking and tolls, and state and Federal taxes and fees. Total cost per mile to own and operate a standard sized car is 17.9 cents; 14.6 cents for a compact car; and 12.6 cents for a subcompact. The following suggestions are made to keep car costs to a minimum: use radial tires rather than bias ply tires, join a carpool, shop for money to finance a car, keep the car properly tuned, make sure that the car insurance is suited to the particular use patterns, buy small cars without automatic transmission, air conditioning, and power steering, be sure to read and make full use of a new car warranty, and make minor repairs and replacements instead of paying a mechanic to have them done. (BYB)

Marketing Services Inc., 965 E. Jefferson, Detroit, MI 48207
__Automotive News Market Data Book (Formerly Almanac)__
Annual publication, v.p.
1973; 1974; 1975; 1976
Abstract: These annual reference issues of Automotive News contain statistics and information on the automotive industry. Data are included on U.S. new cars and trucks sales, registration, imports, retail prices, specifications, and equipment and options. U.S. and Canadian automobile production is covered as is used cars sales and used cars in operation. Financial data on the automobile industry are provided, and U.S. and foreign top executives in the industry are listed. A section is included in the 1976 issue on the industry government policies affecting car manufacture. (BYB)
Availability: Marketing Services Inc., 1973 $9.00, 1974 $7.00, 1975 $9.00, 1976 $10.00

Miller, B.M.; Thomsen, H.L.; Dolton, G.L.; Coury, A.B.; Hendricks, T.A.; Lennartz, F.E.; Powers, R.B.; Sable, E.G.; Varnes, K.L.
__Geological Estimates of Undiscovered Recoverable Oil and Gas Resources in the United States__
U.S. Dept. of Interior, Geological Survey, National Center, Reston, VA 22092
Geological Survey Circular 725, 82 p., 77 references
1975
Abstract: The primary purpose of this study was to estimate the amount of oil and gas available for discovery and recovery under conditions representing a continuation of historical trends of technology and economics; no attempt has been made to predict how much will be discovered, nor when discoveries will be made. The uncertainties involved are emphasized by reporting undiscovered recoverable resource estimates in terms of ranges of values. ... Thus, the current appraisals indicate that the estimated statistical mean of undiscovered recoverable resources of crude oil in the United States, onshore and offshore, amounts to 82 billion barrels, but this value lies within a range of 50 to 127 billion barrels. The corresponding figures for gas are: a statistical mean of 484 trillion cubic feet, within a range of 322 to 655 trillion cubic feet. In each case the mean value of the undiscovered recoverable quantity is on the order of one-half the amount which has been identified and produced to date. The results also suggest that nearly one-half of the undiscovered recoverable oil resources and more than one-quarter of the undiscovered recoverable gas resources may occur in offshore regions of the United States and in the onshore frontier provinces of the State of Alaska. It is important to note that these resources are located in regions of difficult and costly operations--particularly in the hostile physical environment of the Arctic--and require long lead times for exploration and development. (auth, from Conclusions)

Miller, J.C., III (ed.)
<u>Perspectives on Federal Transportation Policy</u>
Texas A & M University, College Station, TX
ISBN 0-8447-2055-0, proceedings of a conference held in Washington, DC, February 14-15, 1974, 224 p.
1975
Abstract: At the time of the conference, transportation problems were in the news due to the proposal of the Transportation Improvement Act, seven bankrupt railroads being reorganized, and the energy crisis again focusing on mass transportation. Economists who have studied the various modes of transportation are critical of the effects of government regulation on the nation's transportation system. They have raised the question of whether the consumer is better served with existing government regulation of the various modes of transportation than he would be with less regulation, but transportation specialists still maintain that government regulation of transportation is necessary for the public's interest to be safeguarded. The first two sections analyze government regulation of surface and air transportation; the third deals with different approaches to problem solving among economists and government officials; the fourth analyzes four Federal transportation programs; and the fifth and sixth present the responses of transportation policy makers to the questions raised. (TIC)
Availability: American Enterprise Institute for Public Policy Research, 1150 17th St. NW, Washington, D.C. 20036 $4.00

Morris, R.J.
<u>A Comparative Analysis of Trip Distribution and Traffic Assignment Models for Transportation Planning in Developing Regions</u>
Stanford University, Dept. of Industrial Engineering, Stanford, CA 94305
Report No. UMTA-CA-11-0008-73-9, PB-232325, 405 p.
Dec 1973
Abstract: Comparisons of planning models indicate that trip distribution factors are more sensitive than traffic assignment factors in modeling transportation systems. In this study, trip distribution (matching of trip origins and destinations), traffic assignment (determining the specific route to be followed), trip generation (determining how trips will originate) and modal split (allocating trips among available modes of travel) are examined, with emphasis on the first two. Other modeling processes should be explored in order to determine which components of the modeling process will have significance in regard to investment decisions. Techniques developed in setting up these models could be extended to allow better travel forecasts and more efficient transportation systems. Many factors, including political, financial, and environmental, affect the planning of proposed transport facilities. The interactions of these forces have not been satisfactorily modeled yet. (88 references) (DCR)
Availability: NTIS

Motor Vehicle Manufacturers Association of the U.S. Inc., 320 New Center Bldg., Detroit, MI 48202
<u>Automobile Facts & Figures</u>
Annual Report, 72 p.
1975
Abstract: The motor vehicle industry, along with the entire national economy, has been adversely affected by the recession, inflation, energy shortages, and ecological problems during 1974 and 1975. In response to the public's demand for less fuel-intensive cars in the winter of 1973, the automobile industry switched from producing large cars to manufacturing smaller models. However, the public demand has now turned back to large cars, leaving automobile manufacturers with increasing inventories of unsold compact and subcompact cars. Price increases due to inflation and to the costs of complying with federal controls also hurt car sales. Industry reported that profits for 1974 were the lowest since the Great Depression of the 1930's. The rebate program in early 1975 stimulated sales, but cars were sold with little, if any, profit. In order for the automobile industry to obtain a 40% fuel economy improvement on all cars by 1980, Congress is asked to freeze emission standards. These pollution regulations also increase the cost of production, increase prices, and, therefore, have an adverse impact of the economy. A shift from individualized transportation to mass transit is considered improbable. Automobile manufacturers are continuing research on alternate power sources and on variations in the conventional gasoline system. Industry and government are called upon to work together in resolving the automobile industry's problems. Statistical data are presented on production and registration, and use and ownership of automobiles, and on the economic impact of the automobile industry. (STB)
Availability: Statistics Dept., Motor Vehicle Manufacturers Association, 320 New Center Bldg., Detroit, MI 48202

Motor Vehicle Manufacturers Association of the U.S., Inc., 320 New Center Building, Detroit, MI 48202
<u>Motor Truck Facts</u>
Annual report, 64 p.
1974; 1975
Abstract: These annual reports describe the truck industry situation in 1973 and in 1974. In 1973 new records were reached in U.S. motor truck production and use. Even with the economic downturn at the end of 1973, the use of light trucks for personal transportation and recreation increased. Inflation, recession, energy shortages, and government safety and emission regulations contributed to a substantial decline in truck sales during late 1974 and 1975. However, with the expected increase in tonnage shipped by trucks, more and better trucks will be in demand. Progress that U.S. truck manufacturers are making in environmental protection, highway safety, and energy conservation is discussed. Statistical data are presented on production and registration, and use and ownership of trucks, and on the economic impact of the trucking industry. (BTB)
Availability: Statistics Dept., Motor Vehicle Manufacturers Association, 320 New Center Bldg., Detroit, MI 48202

Motor Vehicle Manufacturers Association of the United States Inc., 320 New Center Bldg., Detroit, MI 48202
<u>Motor Vehicle Facts & Figures '76</u>
104 p.
1976
Abstract: Two annual publications, "Automobile Facts and Figures" and "Motor Truck Facts," are combined into this single annual publication, which presents all of the data contained in both predecessor publications. An overview of the activities of the U.S. motor vehicle industry in 1975 is provided. The bulk of the report consists of statistics on: 1) Production/Registration, with tables on facilities of motor vehicle manufacturers, factory sales, optional equipment installations, production, recreational vehicles, registrations, retail sales, and retirement; 2) Use and Owners, including information on driver, emissions, energy consumption, farm vehicles, fleets, government ownership, highway fatalities, highways, intercity travel, personal transportation, purchasers, purpose of usage, school bus transportation, shipments of goods, and vehicle miles of travel; and 3) Economic Impact, providing statistical data on businesses, employment, exports and imports, financing, gross national product contribution, highway trust fund, materials consumption, payrolls, personal consumption expenditures, sales, sizes and weights, and taxes. (BTB)
Availability: Statistics Dept., Motor Vehicle Manufacturers Association, 320 New Center Building, Detroit, MI 48202

Mutch, J.J.
<u>Transportation Energy Use in the United States: A Statistical History, 1955-1971</u>
Rand Corp., Santa Monica, CA 90406
Report No. R-1391-NSF, 44 p., 25 references
Dec 1973
Abstract: Although most of the data contained in this report have been published elsewhere, as far as we know this is the only compilation of historical energy consumption statistics from 1955 through 1971 for all major transportation modes. As such, it should conserve time and effort for researchers, students, legislators, policymakers, and others concerned with transportation and energy consumption. An effort has been made to provide the latest information and to include the following: Data for all major passenger and freight transport modes; Data for both domestic and international operations; Tabular time-series data from 1955 to 1971 (1972 where available) in both energy units (trillion Btu) and physical quantities (gallons, barrels, etc.); Discussions of each mode, explaining trends and causes, the data, their source, and any cautions needed in their interpretation; Careful estimation of otherwise unavailable data; and Reference to all primary and secondary sources to aid in updating the statistics in the future. (Auth, from Reasons for This Study)

National Academy of Sciences - National Research Council, Transportation Research Board, Washington, DC
<u>Transportation Energy Conservation and Demand</u>
Transportation Research Record 561, 71 p.
1976
Abstract: Six reports from the Transportation Research Board's 54th annual meeting are reproduced. While conclusions in the reports vary, some principal observations are that (1) neither the energy shortage nor high gasoline prices significantly changed driving habits; (2) legislative benefits might improve public transit systems to a point of public acceptance; (3) states and local agencies could acquire railroad rights of way to reinstate transportation systems to rural areas; (4) policies in New Jersey should give top priority to the use of smaller, economical cars, then to the development of public transit in selected areas, the reduction of unnecessary travel, and finally to the development of a state-wide transportation system; (5) a profile can be made of driver characteristics in relation to gasoline consumption, car purchases, and driving habits; (6) the environment will benefit in the long term from cost-benefit economic analyses; and (7) structured citizen involvement is evolving in the area of complex planning problems. (49 references) (DCK)
Availability: Transportation Research Board, National Academy of Sciences, 2101 Constitution Ave. NW, Washington, DC 20418 $5.00

National Academy of Sciences - National Research Council, Transportation Research Board, 2101 Constitution Ave NW, Washington, D.C. 20418
Inland Waterway Transportation
ISBN 0-309-02450-1, Transportation Research Board 545, 8 reports prepared for the 54th Annual Meeting of the Transportation Research Board, 40 p.
1975
Abstract: Eight reports examine the nature of inland waterways as a significant part of the national transportation system. Water transportation offers the advantages of fuel economy, low cost, and the capacity of expanding and increasing service. The role of various Federal agencies is examined, and the conclusion is reached that a relatively unregulated environment can result in an efficient, competitive system. The papers cover economic policies, statistical data on tonnage and market shares, trends in shipping on the Great Lakes, multi-purpose water resource projects on the Tennessee River, and information on the planning, operation, personnel levels, and maintenance of the waterways. (DCK)
Availability: NTIS; also available from the Transportation Research Board, National Academy of Sciences, 2101 Constitution Ave. NW, Washington, DC 20418

National Association of Motor Bus Owners, 1025 Connecticut Ave., Washington, DC 20036
Bus Facts. 1974 Statistical Supplement
5 p.
Jun 1975
Abstract: Final bus industry operating and financial data are presented for years through 1973, and preliminary results are provided for 1974. Tables are included on the following: Intercity Bus Industry in the United States; Scope of Class 1 Intercity Bus Operations; Income and Expenses of Class 1 Carriers; Passenger Traffic and Vehicle-miles; Taxes of Class 1 Carriers; Employees and Their Compensation; Revenue and Operating Averages; Expense and Labor Cost Averages; and Accident Death Rates in Passenger Transportation. (BYB)

National Safety Council, 425 N. Michigan Ave., Chicago, IL 60611
Accident Facts - 1975 Edition
Annual publication. 96 p.
1975
Abstract: This yearly publication on accidental deaths and injuries provides numerous charts and tables along with an analysis of the data. Statistics are included for all types of accidents--work, motor vehicle, home, public, railway, aviation, school, and farm. The report displays many details, such as city and state records, types of accidents and age groupings, work injury rates, and accident costs. (BYB)
Availability: National Safety Council $3.35, Stock No. 021.55

Randill, A.; Greenbaigh, R.; Samson, E.
Nationwide Personal Transportation Study: Mode of Transportation and Personal Characteristics of Tripmakers
U.S. Dept. of Transportation, Federal Highway Administration, 400 Seventh St. SW, Washington, DC 20590
Report No. 9, 49 p.
Nov 1973
Abstract: This report of the 1969-1970 Nationwide Personal Transportation Survey presents personal characteristics of all individuals 5 years old and over who reported making a one-way trip ("person trip") by a motorized vehicle. The survey data were expanded to represent travel habits on an annual basis for the entire U.S. population. The percentage distributions of these trips by mode are related to age, sex, race, and place of residence. Trips are aggregated to show personal travel for all purposes. The age-groupings have been selected to provide data for a variety of transportation planning needs; for example, to furnish information about school children (5-13), teenagers (14-20), young adults (21-25), persons normally included in the work force (21-59), and several usual break points for classifying older persons: 60-64, 65-69, and 70 and over. (from Introduction)

Recreation Vehicle Industry Association, Marketing and Public Relations Departments, P.O. Box 204, 14650 Lee Road, Chantilly, VA 22021
Recreation Vehicle Industry: Facts and Trends
17 p.
1976
Abstract: Information on the recreation vehicle industry is provided in this report, including data on travel trailers, camping trailers, motor homes, truck campers, and pickup covers. The market share by type of vehicle is depicted. Trends in unit shipments and retail sales are shown in graphs and tables from the year 1962 through 1975. Tables are also provided on monthly factory shipments for each type of vehicle for 1969 through 1975, 1975 unit production by state, percent of 1975 shipments to states, and average retail prices for 1975. The Recreation Vehicle Industry Association's five year forecast is presented. A final section on industry progress and highlights sums up the economic development of the recreation vehicle industry. (BYB)

Rice, R.A.
System Energy and Future Transportation
Carnegie-Mellon University, Pittsburgh, PA 15213
Technology Review, 74(3), pp. 31-37 (Jan 1972)
Jan 1972
Abstract: The importance of transportation in energy consumption is discussed. A breakdown is given of the amount of fuel used by each type of transportation and the passenger miles or cargo miles moved. The energy efficiencies of the various transport modes are compared. The human being and bicycle are shown to be very efficient means of transportation, and recently developed transport modes, such as jet airplanes and the SST, are very inefficient. The report suggests that some changes should be made in intercity transport development, and drastic changes should be considered for urban transportation. (BEG)

Stephenson, R.R.
Should We Have a New Engine? An Automobile Power Systems Evaluation. Volume I. Summary. Volume II. Technical Reports
California Institute of Technology, Jet Propulsion Laboratory; California Institute of Technology, Environmental Quality Laboratory, Pasadena, CA 91103
Report No. JPL SP 43-17, v.p.
Aug 1975
Abstract: Alternative automotive power plants were examined for possible introduction during the 1980-1990 time period. Technical analyses were made of the Stratified-Charge Otto, Diesel, Rankine (steam), Brayton (gas turbine), Stirling, Electric, and Hybrid power plants as alternatives to the conventional Otto-cycle engine with its likely improvements. These alternatives were evaluated from a societal point of view in terms of energy consumption, urban air quality, cost to the consumer, materials availability, safety, and industry impact. The results show that goals for emission reduction and energy conservation for the automobile over the next 5-10 years can be met by improvements to the Otto-cycle engine and to the vehicle. This provides time for the necessary development work on the Brayton and Stirling engines, which offer the promise of eliminating the automobile as a significant source of urban air pollution, dramatically reducing fuel consumption, and being saleable at a price differential which can be recovered in fuel savings by the first owner. Specifically, the Brayton and Stirling engines require intensive component, system, and manufacturing process development at a funding level considerably higher than at present. (auth)
Availability: Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr., Pasadena, CA 91103 $3.50 (Vol. I) $10.50 (Vol. II) $16.50 (Combined Set)

Strate, H.E.
Nationwide Personal Transportation Study: Automobile Occupancy
U.S. Dept. of Transportation, Federal Highway Administration, Office of Highway Planning, Program Management Division, 400 Seventh St. SW, Washington, DC 20590
Report No. 1, 32 p.
Apr 1972
Abstract: Data collected in this survey included automobile trips, number of occupants on each trip, passenger-miles, and vehicle-miles, all from which average occupancy rates were computed and primarily grouped according to the major purpose of the trip. There were four primary groupings from which more specific secondary groupings were taken. The four primary categories for purpose were: (1) earning a living; (2) family business; (3) educational, civic, and religious; and (4) social and recreational. In addition to the classification of trips, etc., by purpose, further analyses were made for five selected variables. The variables examined were residence of principal operator of the vehicle, both for incorporated places and unincorporated areas; population groupings of the standard metropolitan statistical areas; day of the week; the length of the trip; and, finally, time of day by hour that the trip was started. (from Description of Data)

Strate, H.E.
Nationwide Personal Transportation Study: Annual Miles of Automobile Travel
U.S. Dept. of Transportation, Federal Highway Administration, Office of Highway Planning, Program Management Division, 400 Seventh St SW, Washington, DC 20590
Report No. 2, 32 p.
Apr 1972
Abstract: Data collected in this survey were used to study the effect of seven selected variables on automobile use expressed in average annual miles per vehicle. These seven variables were: number of cars in the household, age of the automobile by year model, cars purchased new or used, annual income of the household, occupation of the principal operator of the automobile, place of residence of principal operator by incorporated places and unincorporated areas, and size of the Standard Metropolitan Statistical Area. (from Description of Data)

Strate, H.E.
Nationwide Personal Transportation Study: Seasonal Variations of Automobile Trips and Travel
U.S. Dept. of Transportation, Federal Highway Administration, Office of Highway Planning, Program Management Division, 400 Seventh St. SW, Washington, DC 20590
Report No. 3, 28 p.
Apr 1972
Abstract: Seasonal patterns of automobile trips and vehicle-miles of travel were examined within four selected parameters. These parameters were: (1) place of residence by unincorporated areas and incorporated places; (2) purpose of the trip; (3) length of the trip; and (4) day of the week that the trip was started. Four points concerning the data should be noted. First, except for the summer season, the data which represent a season of the year were collected during nine days of one month (hereafter referred to as one week) of that season. On the tables of the report the data months are shown in parentheses. Secondly, Secondly, only the data for the summer season were collected during one week in July and one week in August, then factored and averaged for tabulation. Significantly, the data for these two summer weeks were quite consistent. Thirdly, as explained above, the data were collected from the same households for four of the five data months. Only the August data were collected from a separate, independent national sample of households. Finally, the tabulations actually present estimates of national values for the average day in each data week. Because the data weeks were distributed among the four seasons, the resulting distributions are considered to provide reliable indications of seasonal patterns and are so treated in this analysis. (from Description of Data)

Svercl, P.V.; Asin, R.H.
Nationwide Personal Transportation Study: Home-to-Work Trips and Travel
U.S. Dept. of Transportation, Federal Highway Administration, Office of Highway Planning, Program Management Division, 400 Seventh St. SW, Washington, DC 20590
Report No. 8, 104 p.
Aug 1973
Abstract: This report presents characteristics of home-to-work travel (in both directions) by various modes of transportation and by population size-group of the workers' place of residence. The first part of the report presents characteristics of workers, including the distribution of workers by place of residence and by place of employment, the characteristics of travel such as distance, time and daily home-to-work person trips, miles of travel and trip lengths by mode, by place of residence and by SMSA (Standard Metropolitan Statistical Areas) population groups. The second part of the report discusses the modes of transportation used by workers for their home-to-work journey and how income, occupation and age of workers affect choice of mode of transportation. The third part of the report stresses the role of the automobile (defined as passenger cars, station wagons and similar-type vehicles) as the predominant mode of transportation used by more than three-fourths of the workers. Automobile trips, vehicle-miles of travel and average trip length by day of the week, hour of the day, and place of residence are discussed. In addition, car ownership and automobile occupancy for home-to-work purposes are discussed. (From Description of Data)

Transportation Association of America, 1101 17th St., N.W., Washington, DC 20036
Transportation Facts and Trends
Published annually, with quarterly supplements, Twelfth Edition (1975)
Jul 1976
Abstract: The purpose of these annual booklets is to illustrate the importance of transportation to the U.S. and to discuss transportation trends. The reports consist of a compilation of tables and graphs presenting data on all phases of transportation, including freight and passenger bills for the nation, shipments by manufacturing establishments, intercity and overseas travel, employment, earnings, taxes, investments, expenditures, demand, and government agencies. (MPC)

Toerk, E. (Chairman)
Air Quality, Noise and Health. Report of a Panel of the Interagency Task Force on Motor Vehicle Goals Beyond 1980. Interim Report
U.S. Environmental Protection Agency, Panel on Air Quality, Noise and Health, Washington, DC
v.p.
Mar 1976
Abstract: Carbon monoxide, photochemical oxidants, and nitrogen dioxide levels are summarized in this projection of air quality during the 1980 to 2000 year time span. Carbon monoxide effects are projected to range from a 9% to a 39% reduction based on emission standards of 9 grams per mile for the first to 3.4 g/mi. If the current standard of 15 g/mi is relaxed to 25 g/mi there may be a 45% increase in adverse health consequences. Photochemical effects on heart and lung disease and asthma and cough symptoms could be reduced 24% by lowering the present standard from 1.5 g/mi to 0.4 g/mi. The effect of such a reduction would be a 45% lowering of these adverse effects by 2000. Respiratory attacks caused by nitrogen dioxide can be reduced 53% by lowering the current 3.1 g/mi standard to 0.4 g/mi, which would further lower effects to 69% by 2000. Sources of carbon monoxide emission, which are confined to roadways and urban areas generally, are easily monitored, but photochemical oxidants originating from scattered small plants as well as cars are believed to be spread over rural areas as well. Monitors show that 90% of areas exceed a 1-hour oxidant standard. NOx emissions will exceed acceptable limits in eleven areas by 1975. A long-range goal of lower decibel standards for all surface vehicles is in the range of 71 to 75 dB for automobile acceleration. Eliminating automobile noise will result in a 78% noise reduction for the whole population and an 88% reduction in areas with a mix of cars, trucks, buses, and motorcycles. (24 references) (DCK)
Availability: Office of the Secretary of Transportation, Publications Section, TAD-443.1, Washington, DC 20590

U.S. Congress
Energy Policy and Conservation Act, Public Law 94-163
94th Congress, S.622, 99 p.
22 Dec 1975
Abstract: The purposes of the Act are: (1) to grant standby authority to the President to impose rationing, to reduce energy demand through conservation plans, and to fulfill obligations under the international energy program; (2) to create a Strategic Petroleum Reserve capable of reducing the impact of severe energy supply interruptions; (3) to increase domestic fossil fuel supplies through price incentives and production requirements; (4) to conserve energy supplies through conservation programs and through regulations, where necessary; (5) to improve energy efficiency of vehicles, major appliances, and certain other consumer commodities; (6) to decrease demand for petroleum products and natural gas by providing for greater use of coal resources; and (7) to assure reliability of energy data. (DTB)
Availability: GPO $1.20

U.S. Congress, Office of Technology Assessment, Washington, DC
<u>A Review of National Railroad Issues</u>
Report No. OTA-T-14, 103 p.
Dec 1975
Abstract: Congress, in its deliberations on funding and reorganization of the Northeastern railroads, will use this review of national railroad issues that were considered when CONRAIL was organized. Appropriate legislation will respond to both a projected cash shortfall of $500 million at the industry level and problems of the individual weak railroads. Solutions will cover the areas of (1) rehabilitating railroad fixed plant through direct grants or low cost loans, (2) restructuring to deal with the short-term bankruptcy problem, (3) rate structuring that provides more flexibility to rail management and avoids disruptive effects, (4) subsidizing low-density lines which meet public needs, and (5) eliminating discriminatory taxation. Inappropriate legislation could lead to rehabilitation efforts of questionable public value and such stringent financial terms that available capital would be constrained. Other potential dangers could result in unsuitable mergers, disruption of railroad traffic, and widespread cost increases. Background information on each of the proposals includes current status, available options, and probable impacts. (DCK)
Availability: GPO $1.70

U.S. Dept. of Commerce, Bureau of the Census, Washington, DC
<u>Statistical Abstract of the United States, 1975</u>
Annual publication, National Data Book and Guide to Sources, 96th Annual Edition, 1050 p.
1975
Abstract: Statistical data is included in the following categories: population; vital statistics, health, and nutrition; immigration and naturalization; education; law enforcement, federal courts, and prisons; area, geography, and climate; public lands, parks, recreation, and travel; labor force, employment, and earnings; national defense and veterans affairs; social insurance and welfare services; income, expenditures, and wealth; prices; elections; federal government finances and employment; state and local government finances and employment; banking, finance, and insurance; business enterprise; communications; power; science; transportation - land; transportation - air and water; agriculture; forests and forest products; fisheries; mining and mineral products; construction and housing; manufactures; distribution and services; foreign commerce and aid; outlying areas under the jurisdiction of the United States; comparative international statistics; and metropolitan area statistics. (DCK)
Availability: GPO $10.50 (cloth), Stock No. 0324-01049-6; $8.00 (paper), Stock No. 0324-01050-0 for 1975 Edition

U.S. Dept. of Commerce, Bureau of the Census, Transportation Division, Room 2526, Building #3, Washington, DC 20233
<u>1972 Census of Transportation, Truck Inventory and Use Survey, U.S. Summary</u>
Report No. TC72-T52, an annual publication, 62 p.
Oct 1973
Abstract: Summary data on the characteristics and uses of private and commercial trucks are contained in these surveys. A stratified probability sample drawn from registrations in all states was used to establish current inventories and uses of trucks. Tables arranged by regions and states show total numbers of trucks, truck-miles, average miles per truck, and percentages of national trucks and truck-miles. (DCK)
Availability: GPO $1.00

U.S. Dept. of Commerce, Bureau of Economic Analysis, Washington, DC 20402
<u>The National Income and Product Accounts of the United States: Revised Estimates, 1929-74</u>
Survey of Current Business, 56(1) (Jan 1976), Part 2
1976
Abstract: Revised benchmark tables are presented for Personal Consumption and Expenditures by Type, Product, Income, and Employment by Industry. Personal income and outlay tables by type of expenditure and by product cover 1929-1974. Product, income, and employment by industry tables are presented annually from approximately 1947 through 1974. Included are Gross National Product by industry, compensation of employees by industry, employer contributions, nonfarm proprietors' income, corporate profits and undistributed corporate taxes. (BBM)
Availability: GPO $48.30 for annual subscription, $3.00 for single copy

U.S. Dept. of Commerce, Bureau of the Census, Washington, DC
Current Population Reports: Population Estimates and Projections. Estimates of the Population of the United States and Components of Change, by Age, Color, and Sex. 1950 to 1960
P-25 Series, No. 310, 56 p.
30 Jun 1965
Abstract: This report presents revised estimates of the population of the United States by age, color, and sex, for July 1 of each year, 1950 to 1959. These estimates take account of the census counts of 1950 and 1960 as well as final data on births, deaths, and immigration for this decade. Estimates are presented according to three definitions of population: the total population including Armed Forces overseas, the total resident population, and the civilian resident population. The third of these excludes all members of the Armed Forces and the second excludes only those overseas. None of the three series includes American citizens living abroad as civilians. Estimates are presented both for the United States, that is, the 50 States and the District of Columbia, and for conterminous United States, that is, the United States exclusive of Alaska and Hawaii (the area of the United States prior to the admission of these two States to the Union in 1959). Additional tables present some of the basic data employed in preparing the population estimates, for each year and for the decade. (from Introduction)
Availability: GPO $1.55. Annual subscription series P-20, P-23, P-25, P-27, P-28, P-60, P-65 $56. Individual copies priced separately

U.S. Dept. of Commerce, Bureau of the Census, Washington, DC
Current Population Reports: Population Estimates and Projections. Estimates of the Population of the United States, by Age, Sex, and Race. April 1, 1960 to July 1, 1973
P-25 Series, No. 519, 79 p.
Jan 1974
Abstract: This report presents estimates of the population of the United States by single years of age, sex, and race for July 1, 1960 to 1973 and for April 1, 1960 and 1970, the dates of the two most recent censuses of population. Estimates are shown for the total population including Armed Forces overseas, the resident population, and the civilian population. The estimates in this report were prepared using a variant of the cohort-component method which takes account of estimated net census undercount by age, sex, and race. This procedure is referred to in this report as the "inflation-deflation" method. The inflation-deflation method has been used previously in the preparation of intercensal age estimates, but not in the preparation of postcensal estimates. (from Introduction)
Availability: GPO Annual Subscription Series P-20, P-23, P-25, P-26, P-27, P-28, P-60 and P-65 $56. Individual copies priced separately

U.S. Dept. of Commerce, Bureau of Economic Analysis, Washington, DC
Survey of Current Business
v.p.
Monthly
Abstract: Each monthly report provides comprehensive coverage of business and economic conditions including national income and balance of payment statements. In-depth articles on various economic subjects are also included. Weekly supplements provide advance information on selected data. (EBH)
Availability: GPO $46.30 annual subscription including weekly supplements

U.S. Dept. of Commerce, Bureau of the Census, Washington, DC
Current Population Reports: Population Estimates and Projections. Projections of the Population of the United States, by Age and Sex. 1975 to 2000 with Extensions of Total Population to 2025
P-25 Series, No. 541, 16 p.
Feb 1975
Abstract: This advance report presents annual projections of the population of the United States by age and sex for the period 1975 to 2000, with projections of total population to 2025. The general approach, methodology, and assumptions are discussed here. In addition to the use of an updated population base (July 1, 1974) and revised projections of mortality and net immigration, these projections differ from previous Census Bureau projections with respect to assumptions about future fertility. This report includes projection series reflecting three different assumptions about the ultimate level of completed cohort fertility (average number of lifetime births per woman) instead of four assumptions as used in Census Bureau projections during the past two decades. Because the present approach is not directly comparable with that used in past reports, the new projection series have been labeled numerically instead of alphabetically as was done in previous reports presenting national population projections. (from Introduction)
Availability: GPO $0.35. Annual subscription series P-20, P-23, P-25, P-26, P-27, P-28, P-60 and P-65 $56. Individual copies priced separately

U.S. Dept. of Commerce, Bureau of the Census, Washington DC
Current Population Reports: Consumer Income. Monthly Income in 1974 of Families and Persons in the U.S.
P-60 Series, No. 101, 180 p.
Jan 1976
Abstract: In-depth data are presented on social and economic areas by total money income for persons and families. Tables indicate type of income, class of worker, and source of income. Family types, size, and trends in income are also covered. (EBH)
Availability: GPO $3.30

U.S. Dept. of Commerce, Bureau of the Census, Washington, DC
Current Population Reports: Consumer Buying Indicators
P-65 Series, Supt. Docs. Series C56.218:P-65/(nos.), v.p.
Abstract: There are two types of reports issued presenting information gathered from the Survey of Consumer Buying Expectations, part of the Quarterly Survey of Households, 1966-1973. Actual and anticipated purchases of houses, cars, and durable goods are issued as quarterly reports. Ownership and expenditures of items in the quarterly reports are given in special reports. (EBH)
Availability: GPO Subscription with series P-20, P-23, P-25 to P-28, P-60 and P-65 $56 per year. Individual reports priced separately

U.S. Dept. of Commerce, Bureau of the Census, Transportation Division, Washington, DC
1972 Census of Transportation. Commodity Transportation Survey - Commodity Series: Transportation Equipment
Report No. TC72C1-13, 39 p.
Apr 1975
Abstract: Published every five years, this report is one of fourteen reports (TC72C1-1 to 14) in the Commodity Series of the Commodity Transportation Survey of the Census of Transportation. The entire Series provides statistics on the shipments of commodities for about 80 three-digit Transportation Commodities Classification (TCC) groups. In this report, tables are presented which indicate the flow of transportation equipment for tons and ton-miles of shipment by means of transport, distance and weight of shipment, and origin and destination. (BTB)
Availability: GPO $1.20

U.S. Dept. of Commerce, Bureau of the Census, Transportation Division, Washington, DC
1972 Census of Transportation. Commodity Transportation Survey - Commodity Series: Petroleum and Coal Products
Report No. TC72C1-8, 42 p.
May 1975
Abstract: As one of the fourteen reports (TC72C1-1 to 14) in the Commodity Series of the Commodity Transportation Survey of the Census of Transportation, this report provides data on the shipments of petroleum and coal products from manufacturers. The entire Series contains information on the shipments of commodities for about 80 three-digit Transportation Commodities Classification (TCC) groups. This report presents tables showing the flow of petroleum and coal products for tons and ton-miles of shipment by means of transport, distance and weight of shipment, and origin and destination. (BTB)
Availability: GPO $1.20

U.S. Dept. of Commerce, Bureau of Census, Washington, DC
Selected Data from the 1973 and 1974 Surveys of Purchases and Ownership
62 p.
Jul 1976
Abstract: The Surveys of Purchases and Ownership were conducted in the fall of 1973 and 1974 as supplements to the Annual Housing Survey. Data are presented on consumer ownership, availability, and purchases of automobiles and major household items. Socio-economic factors affecting ownership and purchases of cars and appliances are surveyed (e.g., income, age of head of household, race and Spanish origin, location of residence, and tenure of housing unit). Data collected from the 1973 and 1974 Surveys of Purchases and Ownership are to be published in an issue of "Consumer Buying Indicators," Series P-65 in the Current Population Report Series. (BTB)

U.S. Dept. of Defense, Washington, DC
Management of Defense Energy Resources. Phase II Report
Report No. AD-A013 554, 165 p.
22 Jul 1974
Abstract: This report summarizes the progress made in carrying out the recommendations of the Defense Energy Task Group and analyzes the evolving character of the DoD energy management program. Further, it examines the current directions of DoD energy policy and makes new recommendations in selected energy management areas. Chapters of the report cover: World, U.S. and DoD energy situation and DoD energy management; Defense energy requirements and budget impact; petroleum storage and distribution; flexibility in fuel selection; naval petroleum and oil shale reserves; Defense energy conservation; energy research and development; and organization and management. (GRA)
Availability: NTIS

U.S. Dept. of Defense, Army Corps of Engineers, P.O. Box 60267, New Orleans, LA 70160
Waterborne Commerce of the United States Calendar Year 1974. Part 1: Waterways and Harbors - Atlantic Coast. Part 2: Waterways and Harbors - Gulf Coast, Mississippi River System and Antilles. Part 3: Waterways and Harbors - Great Lakes. Part 4: Waterways and Harbors - Pacific Coast, Alaska and Hawaii. Part 5: National Summaries
215 p. in Part 1; 109 p. in Part 2; 106 p. in Part 3; 133 p. in Part 4; 118 p. in Part 5
1975
Abstract: Statistics on the waterborne commerce of the U.S. in 1974 are presented in this 5-part publication. The first four volumes contain information on both commodities and vessels for regional waterways and canals. The fifth volume covers the country as a whole. Statistical data include foreign and domestic freight traffic and the trips and drafts of self- and nonself-propelled vessels. The national summary shows that petroleum and petroleum products accounted for over 40% of waterborne commodities. Tonnage in 1974 was 1,746.8 million tons, a decline of 14.8 million tons from the peak year in 1973. Tonnage moved by barges was 63.3% of the total, which represented a slight increase. Domestic inland traffic information covers area of origin and destination of six groups of commodities. Ton-mileage data are given for type of service (regulated, private, and exempt) and type of traffic (coast, lake, and internal). (DCK)
Availability: U.S. Army Engineer Division, P.O. Box 60267, New Orleans, LA 70160 $2.75 for Part 1; $3.50 for Part 2; $3.25 for Part 3; $2.00 for Part 4; $2.00 for Part 5

U.S. Dept. of Interior, Bureau of Mines, Mineral and Materials Supply/Demand Analysis, Washington, DC
Minerals in the U.S. Economy: Ten-Year Supply-Demand Profiles for Mineral and Fuel Commodities
100 p.
1975
Abstract: Supply/demand diagrams and tables are presented to highlight the flow of minerals through the U.S. economy. The data cover a ten-year period ending with 1973. A total of 96 tables and diagrams present data on metals, minerals, and fuel commodities. An update of this report covers the ten-year period ending with 1974 and is entitled "Minerals in the U.S. Economy: Ten-year Supply-Demand Profiles for Mineral and Fuel Commodities (1965-74)." (MLH)
Availability: Publications Distribution Branch, Bureau of Mines, 4800 Forbes Ave., Pittsburgh, PA 15213 free

U.S. Dept. of Interior, Bureau of Mines, Washington, DC
Annual U.S. Energy Use Drops Again
Report No. MP-21000, 13 p.
5 Apr 1976
Abstract: Industry, which used substantially less energy in 1975, helped to lower total U.S. energy use for the second year. Electric utilities, for the first time, exceeded the industrial sector in energy use. Anthracite coal and natural gas had the largest drop in consumption (7.8 and 7.2%), with smaller drops in hydropower (4%) and petroleum products (1.9%). Bituminous coal and lignite consumption increased 1.7% and nuclear power 37.5%. Imports of all fuels decreased, and coal exports increased. Petroleum was the largest energy source, followed by natural gas, coal and lignite, and nuclear. Trends in ratio of gross energy use to gross national product indicate that the economy may be using energy more efficiently, although the end use may not be thermodynamically more efficient. Tables show percentage change of all fuel consumption by major source and consuming sector, domestic supply and demand for individual fuels, U.S. trade in mineral fuels, and selected economic, demographic, and energy indicators since 1947. (DCK)
Availability: TIC

U.S. Dept. of Interior, Bureau of Mines, Washington, DC
Status of the Mineral Industries: 1976
21 p.
1976
Abstract: Viable domestic mineral industries are essential to the economic health of the United States and the well-being of its citizens. The charts in this publication reflect developments significant to the Nation's mineral industries during 1975, which was a year of reduced activity for the nation's mineral industries. Although the value of the country's total mineral output rose, for example, the overall production and use of many minerals fell. At the same time, the industry experienced lower profits and higher debt/equity ratios. These and other adverse effects on many segments of the nation's mineral industries resulted from the overall decline in domestic and international economic activity. Production figures for energy sources were also mixed. Domestic oil and gas output continued their downward trends, with domestic oil production dropping far below demand, thus necessitating greater oil imports. At the same time, domestic output of coal and nuclear power increased. Bituminous coal and lignite production rose 6.1 percent to an all-time high of 640 million tons in 1975, while nuclear power generation jumped 37.5 percent to 155 billion kilowatt hours. Coal supplied 19 percent of total energy demand and nuclear power supplied 2.3 percent. Despite fluctuations in the production of individual energy sources, total domestic energy use in 1975 dropped for the second consecutive year to 71,078 trillion British Thermal Units (Btu)--down 2.5 percent from the 1974 total. U.S. imports of raw and processed minerals in 1975 were valued at $40 billion, $26 billion of which went for fuels. Coal exports worth $3.3 billion accounted for over 18 percent of the nation's total minerals exports, valued at $18 billion. Mineral imports exceeded exports by $22 billion; much of the deficit was caused by increased prices for crude and refined petroleum. Such price hikes, and other actions by foreign producers, have renewed concern about possible political and economic actions that could affect the supply of other imported mineral commodities. (from Introduction)

U.S. Dept. of Interior, Geological Survey, Washington, DC
The National Atlas of the United States of America
430 p.
1970
Abstract: The National Atlas of the United States of America was designed to be of practical use to decision makers in government and business, planners, research scholars, and others needing to visualize country-wide distributional patterns and relationships between environmental phenomena and human activities. Consequently, the 765 maps in this volume constitute a scientific presentation, in cartographic format, of the principal characteristics of the country, including its physical features, historical evolution, economic activities, socio-cultural conditions, administrative subdivisions, and place in world affairs. (from Introduction)
Availability: U.S. Geological Survey $100.00

U.S. Dept. of Transportation, Washington, DC 20590
1972 National Transportation Report, Present Status - Future Alternatives
437 p., also Executive Summary, 25 p.
Jul 1972
Abstract: The 1972 National Transportation Report is the first in a series of periodic reports on the status of the Nation's transportation system and alternative plans aimed at improving that system. This first report is focused on transportation needs and plans for investment in capital improvements as seen by State and local governments and on the Federal role in supporting transportation expenditure programs carried out at the State and metropolitan level. In addition, this report provides estimates of private sector capital investment needs and describes the results of special studies of investment and operational alternatives in specific problem areas. (From Chapter I. -Introduction)
Availability: GPO $3.25, Stock No. 5000-00058

U.S. Dept. of Transportation, Coast Guard, 400 Seventh Street SW, Washington, DC 20590
Boating Statistics - 1974
Report No. CG-357, 42 p.
1 May 1975
Abstract: This sixteenth annual report contains data on boat accidents and casualties, boat numbering registration, and related Coast Guard activities. Most boating accidents occur in mid-summer during good weather because of operator error. A national survey, by state, of boat owners estimates 8.5 million numbered boats (some states are still in the process of numbering water craft) and 3,440.7 million passenger hours. Accidents were at the rate of 16.9 per 100,000 and accounted for 1,446 fatalities. Boat accidents took place in non-tidal, calm waters, on clear July-August days, with little or no wind, and good visibility. Outboard motor boats, involving 53% of the accidents, had one passenger and were the fault of a 26 to 50 year old operator. The U.S. Coast Guard Auxiliary has begun a volunteer program to promote recreational boating safety through education, courtesy boat inspection, and rescue operations. In 1974 the Auxiliary assisted 31,412 persons and saved 403 lives. (DCK)

U.S. Dept. of Transportation, Federal Highway Administration, Washington, DC
Highway Statistics: 1974; 1975
Report No. PB-255090, annual publication, 268 p. for 1974 Statistics
1976
Abstract: This annual publication brings together selected statistical tabulations relating to highway transportation in three major areas: 1) highway uses--the ownership and operation of motor vehicles; 2) highway finance--the receipts and expenditures for highways by public agencies; and 3) the highway plant--the extent and changing characteristics of the mileage of public highways, roads, and streets in the Nation. Beginning in 1975, this report is being released in several sections in order to make the information available earlier. Section One of the 1975 Statistics, subtitled "Vehicles, Drivers, and Fuels," contains data on Motor Fuel; Motor Vehicles and Driver Licensing; Highway Usage Characteristics; Federal Fuel and Automotive Taxes, and the Highway Trust Fund; Highway Finance Summaries; Federal Highway Finance and Programs; State Highway Finance; Local Road and Street Finance; Roadway; and U.S. Territories. (ERB)
Availability: GPO $3.90, Stock No. 050-001-00107-1 or NTIS $2.25 for 1974 Statistics

U.S. Dept. of Transportation, Washington, DC
Cost of Operating an Automobile
11 p.
Apr 1974
Abstract: This report indicates cost of owning and operating standard, compact, and subcompact cars over a ten-year period. Data are given for gasoline, oil, depreciation, maintenance, taxes, tire replacement, parking, and tolls. (ERB)
Availability: U.S. Dept. of Transportation

U.S. Dept. of Transportation, Federal Highway Administration
<u>Highway Travel Forecasts</u>
67 p.
Nov 1974
Abstract: This report is the result of a Federal Highway Administration study to reevaluate national highway travel forecasts in light of such factors as declining birth rates, possible saturation of vehicle ownership, and fuel constraints. Results indicate that highway travel is expected to increase at an annual compound rate of 2 to 3 percent per year to 1990 as compared to an average annual growth of 4.6 percent for the last 20 years. The travel projections are based on anticipated increases in population, licensed drivers, vehicles, and personal income. The reduced growth rate in travel would have occurred even without the fuel shortage due to the decreasing rate of persons entering the driving age population. This has resulted from the decline in births since the late 1950's. Even with fairly severe constraints on fuel the travel projections appear reasonable, assuming continued increases in the fuel efficiency of the vehicle fleet using presently available technology. Although this was a national assessment, review and application of these analyses at the State and local level are encouraged. Comments will be useful in updating the report. (GRA)
Availability: NTIS

U.S. Dept. of Transportation, Washington, DC
<u>1974 National Transportation Report: Current Performance and Future Prospects</u>
720 p.
1975
Abstract: The U.S. transportation system is assessed, and options for improving transportation performance are detailed. Information includes plans and priorities for transportation for each state as received from the Governors in cooperation with local officials, and data and analyses on National transportation problems and issues. The report is divided into four parts: 1) Introduction and National Overview; 2) Urban Transportation Developments; 3) Intercity and Rural Transportation Development; and 4) National Issues Affecting Plans and Programs. An appendix, "Profiles of Public Transportation Plans and Programs," presents a detailed analysis of the public transportation information on the 52 largest urban areas in the U.S. It seems probable that during the next 15 years, transportation activity, especially passenger transportation, will experience a lower rate of growth than in the past. The rate of energy consumption per unit of transportation activity is also likely to decrease. The States' plans for transportation as contained in this report were developed prior to realization of the fuel supply problem. Many of the long-range plans call for large amounts of public investment in transportation. Opportunities for reducing investment requirements are demonstrated through more intensive use of present capacity while allowing for growth with some improvement in service. (DTB)
Availability: GPO $7.50, Stock No. 050-000-00105-9

U.S. Dept. of Transportation, Federal Highway Administration, Washington, DC
<u>Monthly Motor Gasoline Reported by States</u>
Monthly report, approximately 5 p.
Monthly
Abstract: The Federal Highway Administration issues each month a cumulated tabulation of gross gallons of motor gasoline reported in each state during the most recent months for which substantial information is available. State taxation reports at the wholesale level are the source of the data, with time lags of up to 6 weeks between the wholesale level and retail sales. The data include highway use, nonhighway use, and losses. Thus, there is not necessarily a close correlation between these data and those shown in the Federal Highway Administration's monthly "Traffic Volume Trends" report; also the traffic counts reflect travel by all vehicles, not limited to only those powered by gasoline. Large monthly changes sometimes result from delays in processing reports from a few large distributors, exceptional weather conditions, or variations in the timing of holidays, as well as from changes in trend. (auth)
Availability: Federal Highway Administration, Office of Public Affairs, Room 4208, 400 7th St., SW, Washington, DC 20590

U.S. Dept. of Transportation, Federal Aviation Administration, Office of Aviation Policy, Washington, DC 20591
<u>Aviation Forecasts - Fiscal Years 1975-1986; Fiscal Years 1977-1988</u>
Report No. AD/A-002 618, 48 p. for Sep 1974 report; Report No. FAA-AVP-76-17, 103 p. for Sep 1976 report
Sep 1974; Sep 1976
Abstract: These reports contain the latest Federal Aviation Administration forecast of measures of workload and activity at towered airports, air route traffic control centers, and flight service stations for Fiscal Years 1975 to 1986 and 1977 to 1988. The forecasts were made for the four major users of the system: air carriers, air taxi, general aviation and the military. The report has been prepared to meet the budget and planning needs of the various offices and services of FAA for data concerning future trends in aviation activity. (GRA)
Availability: NTIS

U.S. Dept. of Transportation; Federal Energy Administration; U.S. Environmental Protection Agency; Energy Research and Development Administration; Interstate Commerce Commission; National Science Foundation; U.S. Postal Service, Washington, DC
Interagency Study of Post-1980 Goals for Commercial Motor Vehicles. Executive Summary
Draft report, 23 p.
Jul 1976
Abstract: The aim of this study was to set commercial motor vehicle fuel economy goals that are compatible with environmental, safety, and economic objectives. This report summarizes the work done on commercial motor vehicles, trucks, and buses with gross vehicle weight ratings of over 10,000 pounds. Commercial vehicles used approximately 19.2 billion gallons of gasoline and diesel fuels in 1975, or about 13% of the petroleum consumed by all transportation and 6.6% of total U.S. petroleum consumption. Projections are made of the number of trucks, truck-tractors, and buses (by year, type, and fuel consumed) that will be in use during the period 1975 to 1990. Goals and projections for improving the fuel economy, environmental impact, noise control, and safety of commercial vehicles are presented, and means to achieve these goals are discussed. With a well-coordinated industry and government effort, it is thought that even with increased sizes and weights, commercial vehicles in 1990 can be quieter, emit less pollutants, and can maintain the good safety record of the mid-seventies. (RTB)

U.S. Dept. of Transportation, Federal Highway Administration, Washington, DC 20590
Department of Transportation News, Federal Highway Administration
Irregularly published news release
Abstract: These news releases from the Federal Highway Administration provide information on highway transportation in the U.S. Tables are included on such subjects as highway construction, fuel consumption, motor vehicle registrations, motor vehicle travel, motor fuel taxes, and gasoline sales. (RTB).
Availability: Federal Highway Administration free

U.S. Environmental Protection Agency, Office of Air and Water Programs, Office of Mobile Source Air Pollution Control, 401 M Street SW, Washington, DC 20460
A Report on Automotive Fuel Economy
39 p. report, 5 references (annotated)
Oct 1973
Abstract: This report presents a detailed analysis of each of the factors which affect the fuel economy of an automobile. Tables and graphs are presented to show trends in these factors from 1967 through 1973. A brief section describes possible future developments. (JBC)

U.S. Senate, Committee on Finance, Washington, DC
Energy Conservation and Conversion Act of 1975. Hearings Before the Committee on Finance, United States Senate, Ninety-Fourth Congress, First Session on H.R. 6860. Part 2 of 2 Parts
Hearings held July 15,16,17, and 18, 1975. pp. 461-1002
1975
Abstract: Testimony was recorded from legislators and from organizations who represented practically all phases of energy production, use, and conservation. With the exception of the sponsoring legislators, the consensus of the testimony seemed to be that restrictions on expenditure of energy imposed by H.R. 6860 are not stringent enough, and that the Bill deals inadequately with the problems of increasing energy supplies. The proposals of the Bill relating to allocations, import tariffs, and import quotas provoked much comment--often criticism. The gas and petroleum industries presented strong arguments for deregulation of prices as an energy production incentive. The inadequacy of provision for domestic energy resources was a concern of many witnesses. A panel of witnesses presented reforms of electric rate structure that would encourage energy conservation. Also, the removal of the recycling tax incentive from H.R. 6860 by the Senate was considered to be an anti-conservative action. The testimony also pointed out that conservation alone cannot solve the energy shortage, but that at best conservation could reduce energy growth to 2% annually. Communications received by the Committee expressing an interest in these hearings are appended. (BLH)
Availability: GPO $4.60

U.S. Water Resources Council, Washington, DC
1972 OBERS Projections. Regional Economic Activity in the U.S. Series E - Population. V. 1 Concepts, Methodology and Summary Data
Supt. Doc. Is. Y29: 20 B2/972/Ser. E/V.1, 205 p.
Apr 1974
Abstract: This report presents projections of economic activity for the Nation, functional economic areas, water resources regions and subareas and the 50 States by decade intervals from 1980 to 2020. Included are projections of population, personal income, employment earnings of persons and output, with the last three items shown by industry. Also included are projections of land use by broad categories for the same period. The historical information from which the projections were derived is included in essentially the same geographic and industrial detail as the projections. ... Volume 1 includes an introduction, a discussion of concepts and methodology in three parts, the national and summary tables, and four appendices relating to the measures and terms used. (from Introduction)
Availability: GPO $3.05

Urban Systems Research and Engineering, 1218 Massachusetts Ave., Cambridge, MA 02138
Baseline Energy Forecasts and Analysis of Alternative Strategies for Airline Fuel Conservation
Report No. FEA/D-76-026, Conservation Paper No. 48, 181 p.
Jul 1976
Abstract: The objectives of this study were to identify measures to reduce airline fuel consumption and to evaluate the impact of these alternatives on fuel consumption through 1990. To evaluate the impact of fuel conservation strategies, baseline forecasts of airline activity and energy consumption to 1990 were developed. Alternative policy options to reduce fuel consumption were identified and analyzed for three baseline levels of aviation activity within the framework of an aviation activity/energy consumption model. By combining the identified policy options, a strategy was developed to provide incentives for airline fuel conservation. Strategies and policy options were evaluated in terms of their impact on airline fuel conservation and the functioning of the airline industry as well as the associated social, environmental, and economic costs. (66 references) (GRA)
Availability: NTIS

Vahovich, S.G.
General Aviation: Aircraft, Owner and Utilization Characteristics (1974 Data)
U.S. Dept. of Transportation, Federal Aviation Administration, Office of Aviation Policy, Washington, DC 20591
Report No. FAA-AVP-76-9, 203 p.
Nov 1976
Abstract: The staff study presents and analyzes 1974 data obtained from a scientifically selected sample of general aviation (GA) aircraft owners. Statistics dealing with the distribution of the GA fleet by type of aircraft, nine primary use categories, regional representation, type of ownership, and age of aircraft are presented and discussed. Average and median family income statistics of GA aircraft owners are presented by the above criteria. The distribution of aircraft across the occupation of individual owners and the industry category for company owners is also presented. Cruising speed and avionics equipage data are analyzed across type of aircraft, primary use categories, and type of owner. Utilization statistics include mean and median total hours flown, local and itinerant flight hours, and instrument and visual hours flown. These utilization criteria are analyzed across type of aircraft, family income, primary use categories, and across regions. (GRA)
Availability: NTIS

Wager, A. (ed.)
Platt's Oil Price Handbook and Oilmanac
McGraw-Hill Publications Co., 1221 Avenue of the Americas, New York, NY 10020
Annual Publication, McGraw-Hill, Inc., approximately 185 p.
Annual
Abstract: Statistical data on petroleum sales and prices and on happenings that affect petroleum and related markets are contained in these annual Handbooks. Information is organized into these sections: Products Prices in United States (motor gasoline, liquefied petroleum gas, distillates and residual fuel oils, and lubes); U.S. Statistics, including retail gasoline prices in 55 cities, U.S. Bureau of Labor Statistics wholesale price index, and the Independent Petroleum Association of America's average wholesale prices; Crude Oil Prices for U.S. and Canada, Middle East, Africa, Argentina, and Venezuela; and World Products Prices (Other than United States) -"AFM" (Aussenhandelsverband Fur Mineralol E.V.) Barge Quotations; European Bulk Prices and Averages, Cargo Prices, Tanker Rates, and Average Freight Rate Assessments. In addition to a subject index two other indexes are included: Refinery and Terminal Prices Index, which indicates pages on which prices are shown for principal products in specific cities or regions of the U.S.; and Crude Oil Prices Index (U.S. and other). (STB)
Availability: $75.00 for 51st (1974 Prices) and 52nd (1975 Prices) Editions

Wright, D.G.; Davis, E.S.
Census Bureau Guide to Transportation Statistics
U.S. Dept. of Commerce, Bureau of the Census, Washington, DC
90 p.
Mar 1976
Abstract: Transportation statistics based primarily on 1972 data from the National Travel Survey, Truck Inventory and Use Survey, and the Commodity Transportation Survey provide information on the types of trips travelers made, the movement of goods from manufacturing plants, and trucking resources. Selected production and market areas from four census geographic regions were used for survey sampling. Trip characteristics indicate that the most used means of transport was the automobile, and that most trips were taken to visit friends and relatives 200 to 400 miles away, lasted one to two nights, and involved one person. Most overnight accomodations were either with friends or relatives or in commercial establishments. Light trucks represented 74% of truck use, which was primarily for agriculture, construction, wholesale and retail trade, and services. Heavy trucks of 13 tons or more represented 60% of the "for hire" transportation. Ton and ton-mile statistics were gathered for 79 categories of commodities. Other surveys examined were on domestic origins and destinations of commodities involved in U.S. foreign trade using vessel and air shipment and a public use computer tape system (PICADAD) designed for geographic coding of transportation statistics. As part of the economic census program of the Bureau of Census, the census of transportation is conducted every 5 years (the census was taken first in 1963 and again in 1967).
Availability: GPO $2.00

GENERAL BIBLIOGRAPHY

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AVAILABILITY OF REPORTS

GPO For sale by the Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

NTIS For sale by the National Technical Information Service
U.S. Department of Commerce
Springfield, Virginia 22161

NTIS has adopted a single price schedule for its printed reports. The new price schedule, effective January 1, 1977, covers reports now in the collection and those yet to be acquired. A few reports will continue to be specially priced. The exceptions are publications of Special Technology Groups and organizations for which NTIS acts as a sales agent and must honor that organization's price schedule.

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TIC Information Available from the USERDA
Technical Information Center
P.O. Box 62
Oak Ridge, Tennessee 37830

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An Economic Analysis of the Junk Automobile Problem
U.S. Dept. of Interior, Bureau of Mines, Office of Economic Analysis, Arlington, VA
Information Circular 8596, 168 p.
1973
Availability: GPO $2.35, Catalog No. I28.27:8596, Stock No. 2404-01406

Alexander, A.D., III
United States Transportation Fuel Economics (1975-1995)
National Aeronautics and Space Administration, Ames Research Center, Moffett Field, CA 94035
Report No. NASA-TM X-3197, N75-21154, 30 p.
Apr 1975
Availability: GPO $3.75

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Highway Robbery: An Analysis of the Gasoline Crisis
ISBN 0-253-13750-0, Indiana University Press, Bloomington, IN, 273 p.
1974
Availability: Indiana University Press, Bloomington, IN $10.00

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Fuel Economy of the 1975 Models
U.S. Environmental Protection Agency, Washington, DC
Paper presented at the Automobile Engineering Meeting held in Toronto, Canada, October 21-25, 1974, 24 p.

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Resources for the Future, Inc.; International Research and Technology, Inc.
Johns Hopkins University Press, Baltimore, MD, 324 p.
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Monitoring Report - Automobile Voluntary Fuel Economy Improvement Program
U.S. Dept. of Transportation, Transportation Systems Center, Kendall Square, Cambridge, MA 02142
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Increased Fuel Economy in Transportation Systems by Use of Energy Management. Volume I. General Results and Discussion. Volume II. Digital Automotive Propulsion Simulator Programs and Description. Volume III. Real-Time (Hybrid Computer) Simulation Program Set
University of Wisconsin, Engineering Experiment Station, 1500 Johnson Dr., Madison, WI 53706
Report No. PB-240220, DOT-TST-75-2, 172 p. for Volume I; Report No. PB-248777, DOT-TST-75-2, 335 p. for Volume II; Report No. PB-248778, DOT-TST-75-2, 57 p. for Volume III
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The Production and Consumption of Automobiles, an Energy Analysis of the Manufacture, Discard and Reuse of the Automobile and its Component Materials
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National Academy of Sciences - National Research Council, Commission on Sociotechnical Systems, Committee on Motor Vehicle Emissions, Washington, DC
84 p.
Sep 1974

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Supply of Liquefied Natural Gas to the Northeast
Science Applications Inc.; Brookhaven National Laboratory, National Center for Analysis of Energy Systems, Policy Analysis Division, SAI, McLean, VA; BNL, Upton, NY 11973
Report No. BNL-50556, 110 p.
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Availability: NTIS

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U.S. Environmental Protection Agency, Advanced Automotive Power Systems Development Division
Paper 730519, 6 p.
May 1973
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Future Oil Supply to the Northeast United States
Brookhaven National Laboratory, National Center for Analysis of Energy Systems, Policy Analysis Division, Upton, NY 11973
Report No. BNL-50557, 87 p.
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Systems Consultants Inc., 3255 Wing St., San Diego, CA
Report No. AD/A-024429, FAA-AVP-76-7, SCI-75-4069, 113 p.
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Radian Corp., 8500 Shoal Creek Boulevard, P.O. Box 9948, Austin, TX 78766
Report No. PB-246088, EPA-450/3-75-046-a, 218 p. for Volume I; Report No. PB-246358, EPA-450/3-75-046-b, 265 p. for Volume II
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Peat, Marwick, Mitchell & Co.; Metropolitan Transportation Commission, MTC, 1777 Murchison Dr., Burlingame, CA 94010; MTC, Hotel Claremont, Berkeley, CA 94705
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Glossary

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AIR CARRIER DOMESTIC OPERATIONS: Operations within and between the 50 states and the District of Columbia. Includes domestic operations of the certificated trunk carriers and Pan American and the local service, helicopter, intra-Alaska, intra-Hawaii, domestic all-cargo and other carriers. It also includes transborder operations conducted on the domestic route segments of U.S. air carriers.

AIR CARRIER INTERNATIONAL OPERATIONS: Operations outside the territory of the United States, including operations between the United States and foreign countries and between the United States and its territories and possessions. Includes both the combination passenger/cargo carriers and all-cargo carriers engaged in international and territorial operations.

AIR TRAFFIC HUB: Air traffic hubs are not airports; they are the cities and Standard Metropolitan Statistical Areas requiring aviation services. Communities fall into four classes as determined by each community's percentage of the total enplaned passengers in scheduled service of the fixed-wing operations of the domestic certificated route air carriers in the 50 states, the District of Columbia, and other U.S. areas designated by the Federal Aviation Administration.

ALL-CARGO CARRIER: One of a class of air carriers holding certificates of public convenience and necessity, issued by the Civil Aeronautics Board, authorizing the performance of scheduled air freight, express, and mail transportation over specified routes, as well as the conduct of non-scheduled operations, which may include passengers.

AVAILABLE SEAT-MILES (AIRCRAFT): The product of aircraft miles and number of available seats on each flight stage, representing the total passenger-carrying capacity offered.

AVAILABLE TON-MILES (AIRCRAFT): The aircraft miles flown on each inter-airport hop multiplied by the available aircraft capacity (tons) for that hop, representing the traffic-carrying capacity offered.

BARGES: Shallow, non-self propelled vessels used to carry bulk commodities on the rivers and the Great Lakes.

BTU — BRITISH THERMAL UNIT: The amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

BUSES (INCLUDING SCHOOL BUSES): A motor vehicle with a long body equipped with seats or benches for passengers, usually operating as part of a scheduled service line.

CAR-MILE (RAILROAD): A car-mile is a single car moved through one mile.

CARGO TON-MILE: The transportation of one ton of freight a distance of one mile.

CARGO VEHICLE: A truck which carries goods or merchandise (freight).

CERTIFICATED CARRIER: One of a class of air carriers holding certificates of public convenience and necessity issued by the Civil Aeronautics Board, authorizing the performance of scheduled air transportation over specified routes and a limited amount of nonscheduled operations. This general carrier grouping includes the all-purpose carriers (i.e., the so-called passenger/cargo carriers) and the all-cargo carriers, and comprises all of the airlines certificated by the Board, except the supplemental air carriers. Certificated route air carriers are often referred to as "scheduled airlines," although they also perform nonscheduled service.

CHASSIS: The frame, wheels, and machinery of a motor vehicle, on which the body is supported.

CHASSIS WITHOUT CAB: These are units where a body or other equipment is installed after the chassis is shipped from the assembly plant.

CIRCUITY FACTOR RATIO: Expresses the relationship between total distance traveled and the minimum intercity distance.

CLASS A CARRIERS BY INLAND AND COASTAL WATERWAYS: A class A carrier by water is one with an average annual operating revenue that exceeds $500,000.

CLASS B CARRIERS BY INLAND AND COASTAL WATERWAYS: A class B carrier by water is one with an average annual operating revenue greater than $100,000 but less than $500,000.

CLASS I RAILROAD: A railroad with an annual operating revenue of greater than $5,000,000. These operating companies represent about 99 percent of the railroad industry in terms of traffic, operate 96 percent of rail mileage and account for 94 percent of the workers employed by all railroad companies.

CLASS II RAILROAD: A railroad with an annual operating revenue from $100,000 to $1,000,000.

CLASS III RAILROAD: A railroad with an annual operating revenue below $100,000.

COMMERCIAL BUS: Any bus used to carry passengers at rates specified in tariffs; charges may be computed per passenger (as in regular route service) or per vehicle (as in charter service).

COMMUTATION: In reference to Class I rail, passenger traffic handled between designated points at less than the basic fare per trip. It does not include traffic moving on basic rates of round trip, half rates, clergy, charity, military, special excursions, and other special-rated traffic.

COMPACT SIZE CAR: An automobile industry designation usually consisting of cars with a wheelbase between 101 and 111 inches. After 1975 these are included in the SMALL category.

CONSERVATION IN BUILDINGS AND CONSUMER PRODUCTS: The development, design, construction, and operation of buildings and consumer products that minimize energy consumption. The technology includes types of insulation and arrangement, proportioning, and design of windows and doors and systems of control to minimize energy requirements, as well as consumer products such as appliances, televisions, and heating, cooling, and ventilating systems that use less energy, or energy more efficiently.

CONSTANT DOLLARS: A series is said to be expressed in "constant dollars" when the effect of change in the purchasing power of the dollar has been removed. Usually the data are expressed in terms of dollars of some selected year or the average of some set of years.

CONVERSION EFFICIENCY FACTOR: The percent of total gross energy going into the final consuming sector.

CRUDE OIL TRUNK LINES (PIPELINE SYSTEMS): One of three types of pipeline network that is used to transport crude oil to the refineries for processing.

CURRENT DOLLARS: Dollars current at the time designated or at the time the transaction listed took place. In most contexts, the same meaning would be conveyed by the simple term "dollars."

CURRENT POPULATION SURVEY (CPS): This is a monthly nationwide survey conducted by the Bureau of the Census. The primary purpose of the CPS is to obtain monthly labor force statistics for the U.S. Department of Labor. However, to obtain current demographic data between the decennial census of population, the Census Bureau adds supplementary questions to the CPS in March each year. This yearly survey is the major source of demographic data issued in the Census' Current Population Reports series.

CYCLE DUTY OR LOAD FACTOR (PIPELINE): The fraction of the time that the pumps are operated at rated horsepower capacity and/or the pipeline throughput is at design peak levels.

DIESEL ENGINE: An internal combustion engine in which the fuel is sprayed directly into the combustion chamber and ignited by the high temperature to which the air in the combustion chamber has been heated during the compression process. There are 400 different variations in size, number of cylinders, and power output of diesel engines. The engines are relatively costly, but they operate with high efficiency combined with a long-life span that needs service infrequently.

DISTILLATE OIL: Fuel which may be used in diesel engines, i.e., water vessels, railroads, trucks, etc.

DOMESTIC FREIGHT: All waterborne commercial movements between points in the United States, Puerto Rico and the Virgin Islands, excluding traffic with the Panama Canal Zone. Cargo moved for the military in commercial vessels is reported as ordinary commercial cargo; military cargo moved in military vessels is omitted.

DOMESTIC SYSTEM TRUNKS: This group of carriers operates primarily within and between the 50 states of the United States over routes serving primarily the larger communities. Included in this group are carriers such as: American, Delta, Eastern, National, Pan Am, TWA, United, Western, etc.

DRIVETRAIN (AUTOMOBILE): Current drivetrains are understood to be primarily the 3-speed automatic transmissions, encountered in current fleets, and the 3- and 4-speed manual transmission used in some of the smaller automobiles. The drivetrain also consists of the drive shaft, differential gear and rear axles.

DRY CARGO BARGES AND SCOWS: Both are large, flat-bottomed boats used to transport dry bulk materials; the scow is chiefly used for transporting sand, gravel, or refuse.

ELECTRIFIED ROADWAY (RAILROAD): Electrified roadway is track along which a locomotive or rail motor car can receive electrical power generated at a remote location.

EMISSION STANDARDS: Emission standards are federally established under control of the U.S. Congress. The current national emission standards for new automobiles and light trucks are set at 1.5 grams of hydrocarbon (HC) per mile, 1.5 grams of carbon monoxide (CO) per mile and 3.1 grams of nitrogen oxides (NOx) per mile (effective September 1976).

ENERGY CONSUMPTION (OIL TRANSPORT): The pumps needed to move the oil through the pipeline network are driven by heat engines or electric motors. The energy consumed for pumping is the product of the installed pumping horsepower (hp-hr) and the specific energy consumption of the engine/motor (BUT/bhp-hr) driving the pumps.

ENERGY EFFICIENCY: In reference to transportation, energy efficiency is defined as the inverse of energy intensiveness, i.e., the ratio of outputs from a process to the energy inputs; for example, passenger miles traveled (PMT).

ENERGY INTENSITY (PIPELINE): The energy intensity of oil transport via pipelines can be expressed as BTU/ton-mile, and the fraction of the through-put energy needed to pump the oil a specified distance.

ENERGY INTENSITY (RAILROADS): This term is defined as energy consumed per unit of service provided. The operating energy intensity is determined from actual fuel use by the railroads and actual service provided, and includes the effect of operating inefficiences. The calculated energy intensity is determined analytically, using a model of the railroad system, and often does not include system inefficiencies.

ENERGY INTENSITY (WATER TRANSPORTATION): Fuel energy required per ton-mile of freight carriage (BTU/ton-mile).

ENERGY INTENSIVENESS: In reference to transportation, energy intensiveness is defined as the ratio of energy inputs to a process to the useful outputs from that process; for example, gallons of gasoline per passenger mile or BTU per ton mile.

FIELD AND GATHERLINE LINES (PIPELINE SYSTEMS): One of three types of pipeline network that is used to gather crude oil from individual wells and feed it to trunk lines.

FIXED-WING AIRCRAFT: Aircraft having wings fixed to the airplane fuselage and outspread in flight, i.e., nonrotating wings.

FLEET: A group of motor vehicles operating under unified control as by a commercial or military organization.

FLEET SIZE (TRUCK): Based on the number of trucks (single-unit trucks plus truck-tractors) operated by a truck owner from a single "base of operation," the fleet is an operational unit and is necessarily smaller than the total fleet that an owner has, if he operates from more than one base. The data shown in the fleet section of the tables are based on the number of trucks found in fleets of specified size and not the number of fleets.

GENERAL AVIATION: This field of aviation employs light planes to work for air taxi services, business firms and other organizations. Flying light planes for commercial purposes requires a commercial pilot license. Included in this field are planes employed for personal use.

GENERAL AVIATION SURVEY: The Federal Aviation Administration (FAA) requested the Bureau of Census in 1975 to conduct a scientifically delineated selected sample of general aviation (GA) owners in the United States. There were 9,860 GA aircraft owners interviewed. The universe of aircraft from which the sample was drawn consisted of 177,641 aircraft. Telephone interviews were the primary method of data collection (accounting for some 94 percent of the responses), personal visits and mail follow-up were used for the telephone nonrespondents - resulting in an overall 96.5 percent response rate. The survey was conducted because of the FAA's Aviation Forecast Branch need to know more about important aspects of general aviation such as:

- What are the socioeconomic characteristics of the average or "typical" GA owner;

- What types of plane does he fly;
- How is he using his planes; and,
- How are his planes equipped with avionics.

These data were used in order that the FAA's Aviation Forecast Branch could improve its forecasts of aviation activity and contribute to improve planning of future airspace systems.

GREAT CIRCLE PATH: The shortest distance between any two terrestrial points.

GREAT LAKES — LAKEWISE (WATER TRANSPORTATION): Traffic between United States ports on the Great Lakes system.

GROSS ENERGY: The total of inputs into the economy of the primary fuels (petroleum, natural gas, and coal, including imports) or their derivatives, plus the generation of hydro and nuclear power converted to equivalent energy inputs.

GROSS NATIONAL PRODUCT: Total value at market prices of all goods and services produced by the nation's economy. As calculated quarterly by the Department of Commerce, gross national product is the broadest available measure of the level of economic activity.

GROSS VEHICLE WEIGHT: The empty weight of the vehicle plus the maximum anticipated load weight.

HEAVY-HEAVY: In reference to truck size class, a gross vehicle weight of 26,001 pounds or more.

HEAVY RAIL: Subway-type transit vehicle railway constructed on exclusive private right-of-way with high-level platform stations.

HIGHWAY TRUST FUND: In 1956, Congress established the Highway Trust Fund to finance construction of the National System of Interstate and Defense Highways. Eighty-nine percent of the proposed 42,500 mile system is open to traffic with work underway on an additional 11%. Completion is expected in the early 1980's. The Trust Fund has been expanded to support mass transit development in urban areas. Programs funded by the Trust Fund include: Highway safety grants to the states and local governments for highway safety programs, including support of the Federal highway safety program standards; highway safety research by the Department of Transportation; highway mass transit facilities such as reserved lanes, special roadways, shelters, loading platforms, and parking areas; research, development and initial testing of advanced transportation systems and concept for all modes of urban transportation; pilot programs designated to alleviate urban traffic congestion through improved highways and highway-related systems.

ICC-REGULATED CARRIER: A motor common carrier operating in interstate commerce under a grant of authority from the Interstate Commerce Commission and subject to its economic regulation.

ICC-REGULATED PIPELINE: A pipeline company operating in interstate commerce under a grant of authorization from the Interstate Commerce Commission, and subject to economic regulation by the Commission. Such a pipeline company is required to report relevant statistics to the ICC. Petroleum companies and pipelines are regulated while only natural gas companies are regulated.

INBOARD-DIESEL: As pertaining to boats, where the primary propulsion is a diesel engine located within and permanently attached to the hull.

INBOARD-GASOLINE: A boat designed such that the primary propulsion is a gasoline engined located within and permanently attached to the hull.

INBOARD-OUTBOARD: Also referred to as inboard/outdrive. Regarded as inboard because the power unit is located inside the boat.

INDUSTRY ENERGY EFFICIENCY: The development, design, construction, and operation of industrial processes and equipment to minimize the energy requirements of fabricating, forming, converting, or producing industrial or agricultural products.

INLAND AND COASTAL WATERWAYS, INLAND AND COASTAL CHANNELS: These terms include the Atlantic Coast Waterways, the Atlantic Intracoastal Waterway, the New York State Barge Canal System, the Gulf Coast Waterways, the Gulf Coast Waterways, the Gulf Intracoastal Waterway, the Mississippi River System (including the Illinois Waterway), Pacific Coast Waterways, the Great Lakes, and all other channels (waterways) of the United States, exclusive of Alaska, that are usable for commercial navigation.

INLAND-INTERNAL (WATER TRANSPORTATION): 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 waters of the Great Lakes: inland movement that cross short stretches of open water which link inland systems.

INSTALLED HORSEPOWER (PIPELINE): The aggregate horsepower of the pumps installed at pumping stations throughout the pipeline network. The pumps are driven by engines/motors of various types (diesel, electric, etc.).

INTERCITY BUS — CLASS I: An interstate motor carrier of passengers with an average annual gross revenue of at least $1,000,000 is defined by the ICC as a Class I carrier.

INTERCITY BUS — TOTAL: This figure includes Class I, II, and III interstate carriers, all of which report to the Interstate Commerce Commission, and intrastate carriers.

INTERMEDIATE SIZE CAR: An automobile industry designation usually consisting of cars with a wheelbase between 112 and 118 inches.

INTERNATIONAL AND TERRITORIAL OPERATIONS (AIRCRAFT): In general, operations outside the territory of the United States, including operations between the United States and foreign countries and the United States and its territories or possessions. Includes both the combination passenger/cargo carriers and the all-cargo carriers engaged in international and territorial operations.

INTERNATIONAL (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 (i.e., Guam, Wake, American Samoa, etc.) and foreign countries is excluded. Traffic to or from the Panama Canal Zone is included.

INTRACOASTAL-COASTWISE (WATER TRANSPORTATION): Domestic traffic receiving a carriage over the ocean or the Gulf of Mexico. Traffic between Great Lakes ports and seacoast ports, when having a carriage over the ocean is also termed coastwise.

LIGHT: In reference to truck size class, a gross vehicle weight of 10,000 pounds or less.

LIGHT-HEAVY: In reference to truck size class, a gross vehicle weight of 20,001 to 26,000 pounds.

LIGHT RAIL: Streetcar-type transit vehicle railway constructed on city streets, semi-private right-of-way, and exclusive private right-of-way.

LINE MILEAGE: The aggregate length of roadway of all line-haul railroads. It does not include the mileage of yard tracks or sidings, nor does it reflect the fact that a mile of railroad may include two or more parallel tracks. Jointly-used track is counted only once.

LOAD FACTOR: A term relating the potential capacity of a system relative to its actual performance.

LOAD FACTOR (AIRCRAFT): See REVENUE PASSENGER MILE.

LOCAL: In reference to area of operation of trucks, mostly in the local area i.e., in or around the city and suburbs, or within a short distance of the farm, factory, mine, or place vehicle is stationed.

LOCAL: In reference to water traffic, movements of freight within the confines of a port, whether the port has only one or several arms or channels, except by car-ferry and general ferry, are termed "local."

LOCAL RURAL ROADS: Streets outside urban boundaries other than principal arteries of travel.

LOCAL SERVICE CARRIERS: Certificated domestic route air carriers, such as Allegheny, Ozark, Piedmont, Southern, Texas International, etc., operating routes of lesser density between the smaller traffic centers and between those centers and principal centers.

LOCOMOTIVES: Self-propelled units of equipment designed solely for moving other equipment.

LONG RANGE: In reference to area of operation of trucks, mostly over-the-road trips that usually are more than 200 miles one way to the most distant stop from the place vehicle is stationed.

MAIN RURAL ROADS: Streets outside urban boundaries that are generally recognized as principal arteries of travel.

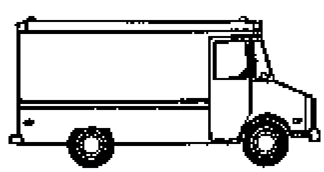
MEDIUM: In reference to truck size class, a gross vehicle weight of 10,001 to 20,000 pounds.

MILE (STATUTE): 5,280 feet.

MILES OF TRACK (RAILROAD): Miles of track is the total miles of railroad track in the United States, including multiple main tracks, yard tracks and sidings, owned by both line-haul and switching and terminal companies.

MOTORBUS: Rubber tired, self-propelled transit vehicle with fuel supply carried on board the vehicle.

MULTI-STOP TRUCK: Arrangement of this vehicle is such that the driver can stand at the wheel and get in and out easily, for door-to-door deliveries.



MUNICIPAL MILEAGE: Roads inside city, municipal district, or urban boundaries; includes extensions of the state primary system, and state secondary roads within delimited incorporated and unincorporated places, and mileage under local control, e.g., local city streets, roads, and public ways not under State control within such places.

NATIONAL SYSTEM OF INTERSTATE AND DEFENSE HIGHWAYS: The Interstate system was originally established in 1944. In 1956 changes were made in the extent of the system and increased funding was established. The system is limited to 42,500 miles and is intended to serve as a direct connection between the nations principal metropolitan areas, cities and industrial centers.

NATIONWIDE BOATING SURVEY (1973): A survey of 1973 boating activity was conducted by the U.S. Coast Guard during the months of April and May 1974. Over 25,000 households were contacted and screened; those households which contained boat owners or boat operators were interviewed. At the completion of the interviewing period, the responses from each geographical area were appropriately weighted, resulting in state, regional (the United States was divided into 7 geographical regions) and national estimates. Results of the survey revealed the number of boats and their characteristics and activities, and information on emergency situations and boating safety education.

NATIONWIDE PERSONAL TRANSPORTATION SURVEY: Data for the Nationwide Personal Transportation Survey (NPTS) were collected in 1969-1970 by the Bureau of the Census of the Department of Commerce for the Federal Highway Administration of the Department of Transportation. The NPTS was designed to obtain information on national patterns of travel. The survey was based on a multi-stage probability sample of housing units located in 235 sample areas, comprising 485 counties and independent cities, representing every State and the District of Columbia. Experienced field staff of the Bureau of the Census conducted the interviews. Data obtained included characteristics of the household such as income, automobile ownership, and age and sex of persons in the household. The survey produced statistics on vehicle travel as well as household and person travel.

NET ENERGY: Net energy is the total of the sector inputs (i.e. household, commercial, transportation, and industrial), and consists of direct fuels and purchased electricity.

NON-ICC-REGULATED CARRIER: A motor carrier not subject to the economic regulation of the ICC. The category includes intrastate carriers, private carriers hauling only the goods of their owners, and carriers of commodities, the transportation of which is exempt from ICC economic regulation.

NON-REGULATED PIPELINE: A pipeline company not operating as a common carrier in interstate commerce, hence neither required to secure a grant of operating authority from the Commission nor to report to it.

NONSCHEDULED SERVICE (AIRCRAFT): Revenue flights, such as charter flights, that are not operated in regular scheduled service, and all nonrevenue flights incident to such flights.

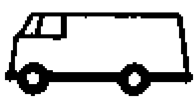
NON-SELF-PROPELLED: This term applies to vessels not containing within themselves the means for their own propulsion.

OTHER THAN COMMUTATION: In reference to Class I rail, passenger traffic other than that handled between designated points at less than the basic fare per trip. It does include traffic moving on basic rates of round trip, half rates, clergy, charity, military, special excursions, and other special-rated traffic.

OTTO ENGINE: An internal combustion engine conceived by Beau de Rochas and built by Otto. Large numbers of engines were built and sold at the end of the 19th century; the principal changes since then include: much higher speed, lighter weight, smaller bulk, and greater efficiency. The engine operates on an OTTO CYCLE, which essentially requires four strokes of the piston for a cycle.

OUTBOARDS: As pertaining to boats, this classification includes "portable: engines." Some are so large as to preclude portability in its true sense, but they are considered "outboard" because they are not permanently affixed to the structure of the craft. Also includes all "outboard" motors regardless of the method or location used to mount the engine, i.e., motor wells, "kicker pits," motor pockets, etc.

PANEL TRUCK: A small fully enclosed vehicle, such as many stores use for delivery.



PASSENGER/CARGO AIR CARRIER: One of a class of air carriers holding certificates of public convenience and necessity issued by the Civil Aeronautics Board, authorizing the performance of scheduled air transportation of passengers and property over specified routes.

PASSENGER ENPLANEMENTS: The count of the total number of passengers boarding aircraft, including originating, stopover, and transfer passengers.

PASSENGER-MILE (AIRCRAFT): One passenger transported one mile. Passenger-miles are computed by summation of the products of the aircraft miles flown on each inter-airport flight stage multiplied by the number of passengers carried on that flight stage.

PASSENGER-MILE: One passenger traveling one mile.

PASSENGER REVENUE TON-MILE (AIRCRAFT): One ton of revenue passenger weight (including all baggage) transported one mile. Effective 1/1/70, passenger weight standard for both "Domestic" and "International" operations is 200 pounds.

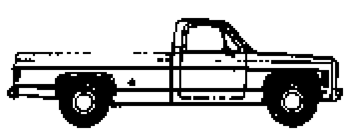
PASSENGER TRAIN CARS: Cars typically found in passenger trains include coaches, sleeping cars (formerly called Pullman cars), parlor cars, dining cars, lounge cars, baggage cars, crew-dormitory cars, and observation cars.

PERFORMANCE (AUTOMOBILE): Capability of the automobile to accelerate, to perform passing maneuvers, and to climb grades. It is specified as the time required to accelerate from 0 to 60 miles per hour.

PERSONAL CONSUMPTION EXPENDITURES: 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).

PETROLEUM ADMINISTRATION FOR DEFENSE (PAD) DISTRICTS: Five geographical areas of the United States used by the Bureau of Mines in presenting petroleum production, storage, and marketing statistics.

PICK-UP TRUCK: A vehicle with an enclosed cab for the driver and an open-topped metal box over the rear wheels.



PISTON-POWERED AIRCRAFT: An aircraft operated by engines in which pistons moving back and forth work upon a crank shaft or other device to create rotational movement.

PLATFORM CAR: A railroad freight car without permanently raised sides, ends, or covering.

PSI: Pounds per square inch.

RACK: A spreading framework set on a vehicle for carrying hay, straw, or the like in large loads.

RAIL MOTOR CARS: Self-propelled passenger rail cars which are driven by electric motors energized from an electrified roadway or by a generator driven by a diesel or gas turbine engine.

RAILROAD LINE: Railroad line is the aggregate length of roadway of all line-haul railroads. A mile of line may include two or more parallel tracks and be used by two or more railroad companies.

REFINED PRODUCT TRUNK LINES (PIPELINE SYSTEMS): One of three types of pipeline network that is used to transport refined petroleum products (i.e., gasoline, kerosene, residual oil, etc.) from the refineries to local distribution centers near large market areas.

REGULATED WATER CARRIER: A common and contract carrier subject to economic regulation by the Interstate Commerce Commission. Carriers for reporting purposes are divided into three classes based on their average annual operating revenues in accordance with the following definitions: Class A companies are those having annual revenue exceeding $500,000; Class B companies are those having annual revenue between $100,000 and $500,000; Class C companies have annual operating revenues less than $100,000.

RESIDUAL OIL: Oil which remains after the simple distillation of crude oil. It is used as fuel for ships and steam locomotives and for industrial heating and power.

REVENUE HOURS FLOWN (AIRCRAFT): The aircraft hours of flights inclusive of all-cargo flights performed in revenue service. Aircraft hours are the airborne hours computed from the moment an aircraft leaves the ground until it touches the ground at the end of the flight.

REVENUE PASSENGER LOAD FACTOR (AIRCRAFT): Revenue passenger-miles as a percentage of available seat-miles in revenue passenger services, representing the proportion of aircraft seating capacity that is actually sold and utilized.

REVENUE PASSENGER-MILE (AIRCRAFT): One revenue passenger transported one mile in revenue service. Revenue passenger-miles are computed by summation of the products of the revenue aircraft miles flown on each inter-airport hop multiplied by the number of revenue passengers carried on that hop.

REVENUE PASSENGER-MILE (BUS): One revenue passenger carried one mile generates one passenger-mile. The revenue passenger miles reported thus represent the total distance traveled by all bus passengers.

REVENUE PASSENGER-MILE (RAILROAD): One revenue passenger traveling one mile generates one revenue passenger-mile. The revenue passenger-miles reported thus represent the total distance traveled by all railroad passengers.

REVENUE TON-MILES (RAILROAD): The product of weight of the contents of a freight car in tons and the distance transported in miles; i.e., $\underline{n}$ tons moving $\underline{m}$ miles generate $\underline{n} \times \underline{m}$ ton-miles.

REVENUE TON-MILE OF FREIGHT (AIRCRAFT): One short ton of freight transported one statute mile. Ton-miles are computed by summation of the products of the aircraft-miles flown on each interairport flight stage multiplied by the number of tons carried on that flight stage.

REVENUE VEHICLE-MILES (LOCAL TRANSIT): One vehicle (bus, trolley car, subway car, etc.) traveling one mile while revenue passengers are on board generates one revenue vehicle-mile. The revenue vehicle-miles reported thus represent the total mileage traveled by vehicles in scheduled or unscheduled revenue-producing services.

ROWBOAT OR CANOE: Crafts of open construction designed primarily to be propelled manually. Includes "dugouts," but not "kayaks."

RURAL MILEAGE: Roads outside city, municipal district, or urban boundaries.

SAILBOAT OR AUXILIARY: Crafts intended to be propelled primarily by sail, regardless of size or type.

SCHEDULED SERVICE (AIRCRAFT): Transport service operated over an air carrier's certificated routes, based on published flight schedules, including extra sections and related nonrevenue flights.

SCOW: A large flat-bottomed boat with broad square ends used chiefly for transporting sand, gravel, or refuse.

SELF-PROPELLED TOWBOATS AND TUGS: This towboat is a compact shallow-draft boat with squared bow and towing knees for pushing tows of barges on inland waterways; and a tug is a strongly built boat used for towing and pushing, also termed as towboat. Both of these vessels have within their structure the means for their own propulsion.

SHORT RANGE: In reference to area of operation of trucks, mostly over-the-road (beyond the local area) but usually not more than 200 miles one way to the most distant stop from the place vehicle is stationed.

SIZE OF ROOMINESS (AUTOMOBILE): Refers to the volumetric capacity of the automobile for passengers and luggage and is specified by a combination of interior dimensions.

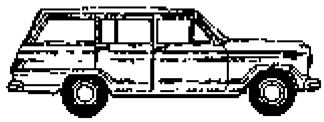
STAKE: One of a number of vertical posts fitting into sockets or staples on the edge of the platform of a vehicle, as to retain the load. This type vehicle is used mainly in the transport of pulpwood and timber.

STANDARD SIZE CAR: An automobile industry designation which usually consists of cars with a wheelbase of greater than or equal to 119 inches.

STATE PRIMARY SYSTEM: This refers to highways that have been so officially designated by States. They encompass the principal intercounty, intercity and interstate roads of all states.

STATE SECONDARY ROADS: This mileage is reported in the tables for the states (taken from the Highway Statistics 1970 Bulletin) that have designated both a primary and a secondary system.

STATION WAGON (ON TRUCK CHASSIS): A truck having an enclosed body of paneled design with several rows of folding or removable seats behind the driver, similar to an automobile station wagon.



STIRLING ENGINE: An external-combustion engine that has pistons that move up and down in cylinders. It uses a fixed volume of a working fluid that constantly flows back and forth between a hot top space and a cold bottom space in a cylinder, and relies on continuous external combustion of a fuel that supplies heat to the working fluid through the upper wall of a cylinder. The theoretical efficiency of the Stirling engine is substantially higher than that of diesel and other internal-combustion engines. These engines have a lower emission of harmful exhaust gases, noise level, and fuel consumption than that of gasoline engines, and no oil consumption; however, the cost of the engine is the major factor in its use at present.

SUBCOMPACT SIZE CAR: An automobile industry designation usually consisting of cars with a wheelbase of less than or equal to a hundred inches. After 1975 these are included in the SMALL category.

SUPPLEMENTAL AIR CARRIER: One of a class of air carriers now holding certificates, issued by the Civil Aeronautics Board (CAB), 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 "nonskeds," i.e., nonscheduled carriers.

TANK BARGES: This term applies to flat barges that travel on inland waterways, have no engines, and must be pulled by a towboat. They usually carry fluid such as oil.

TON-MILE (AIRCRAFT): One short ton (2,000 pounds) transported one statute mile (5,280 feet). Ton-miles are computed by multiplying the aircraft miles flown on each inter-airport hop by the number of tons carried on that hop.

TON-MILES (TRUCK): The transportation of one short ton (2,000 lbs.) of freight a distance of one mile generates a one ton-mile.

TOTAL ENERGY: See gross energy.

TOTAL VEHICLE MILES OPERATED: Sum of all passenger vehicle miles operated in line (regular) service, special (charter) service, and nonrevenue service. When vehicles are operated in trains, each vehicle is counted separately, e.g., an eight-vehicle train operating for one mile equals eight vehicle-miles.

TOWBOATS: Diesel powered vessels used in inland waterways to push flotilla of barges.

TRAIN-MILE (RAILROAD): A train-mile is a complete train moved one mile.

TRANSPORTATION EFFICIENCY: The development, design, construction, and operation of more efficient transport systems. The technology focuses on autos, trucks, planes, trains, pipelines, and ships, as well as the power systems involved.

TURBINE-POWERED AIRCRAFT: Includes aircraft with either turbojet, turbofan, turboprop, or turboshaft engines.

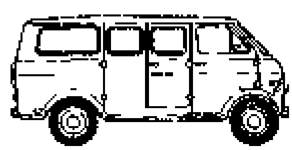
TURBOJET: Aircraft operated by jet engines incorporating a turbine-driven air compressor to take in and compress the air for the combustion of fuel, the gases of combustion (or the heated air) being used both to rotate the turbine and to create a thrust-producing jet.

TURBOPROP: Aircraft in which the main propulsive force is supplied by a gas turbine driven conventional propeller. Additional propulsive force may be supplied from the discharged turbine exhaust gas.

URBAN STREETS: Streets within urban boundaries.

U.S. CIVIL AIR CARRIER FLEET: Three types of aircraft, certificated, supplemental, and commercial, operating under certificates of public convenience and necessity. These certificates, issued by the Civil Aeronautics Board, authorize the performance of scheduled air transportation over specified routes and a limited amount of nonscheduled operations.

VAN: A vehicle used to carry bulky loads that must be sheltered from the weather. Used of late as recreational vehicles and for van pooling in commuting.



VEHICLE-MILE (ALSO REFERRED TO AS VEHICLE-MILES TRAVELED): One vehicle traveling one mile generates one vehicle-mile. Total vehicle-miles, thus, gives the total mileage traveled by all vehicles.

Subject Index

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