

MASTER

Characteristics of Automotive Fleets in the United States 1966-1977

D. B. Shonka

TRANSPORTATION ENERGY PROGRAM: MONOGRAPH SERIES



OAK RIDGE NATIONAL LABORATORY
OPERATED BY UNION CARBIDE CORPORATION • FOR THE DEPARTMENT OF ENERGY

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Printed in the United States of America. Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road, Springfield, Virginia 22161
Price: Printed Copy ~~\$5.25~~ ^{4.50}; Microfiche \$3.00

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, contractors, subcontractors, or their employees, makes any warranty, express or implied, nor assumes any legal liability or responsibility for any third party's use or the results of such use of any information, apparatus, product or process disclosed in this report, nor represents that its use by such third party would not-infringe privately owned rights.

ORNL/TM-6449
Special

Contract No. W-7405-eng-26

CHARACTERISTICS OF AUTOMOTIVE FLEETS IN THE UNITED STATES

1966-1977

D. B. Shonka

Regional and Urban Studies Section

Energy Division

Prepared for
Data Analysis Branch
Nonhighway Transport Systems and Special Projects
Transportation Energy Conservation Division
Office of Conservation
Department of Energy

Date Published: September 1978

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37830
operated by
UNION CARBIDE CORPORATION
for the
DEPARTMENT OF ENERGY

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

THIS PAGE
WAS INTENTIONALLY
LEFT BLANK

CONTENTS

ACKNOWLEDGMENTS	v
ABSTRACT	vii
1. INTRODUCTION	1
2. DATA	3
2.1 Definitions	3
2.2 Data Sources	5
3. FLEET PROFILE	9
3.1 Historical Trends	9
3.2 Fleet Composition	13
4. COMPARISONS	18
4.1 Fleet vs Total	18
4.2 Fleet Use by Sector	28
5. IMPLICATIONS FOR TRANSPORTATION ENERGY CONSERVATION	30
6. SUMMARY OF PRINCIPAL FINDINGS	35
REFERENCES	37
BIBLIOGRAPHY	39

THIS PAGE
WAS INTENTIONALLY
LEFT BLANK

ACKNOWLEDGMENTS

In spring 1977, ORNL contracted with the Bobit Publishing Company, which publishes *Automotive Fleet* magazine, to produce a report on automotive fleet operations in the United States. Much of the data and definitions used throughout this paper are taken from that subcontract report. In addition, Brookhaven National Laboratory (BNL), under a separate contract with DOE, conducted a fleet study to produce a BNL Fleet Vehicle Data Base. Preliminary results from that study are included herein.

I am also grateful to the persons who provided valuable comments on a draft of this paper: Robert Berke, Executive Director of the National Association of Fleet Administrators, Inc. (NAFA); David Greene of ORNL; Charles Lave of the University of California at Irvine; Philip Patterson of DOE; and Joseph Wagner of Brookhaven National Laboratory.

THIS PAGE
WAS INTENTIONALLY
LEFT BLANK

ABSTRACT

This report covers several major areas pertaining to automobile fleet operations in the United States. First, all known available sources that contain statistics on fleet vehicles are described. Second, fleet operations in the United States are characterized according to stock composition and operational characteristics. Third, properties of fleet cars are compared with those of the total car population, and a comparison is made among fleets used by different sectors. Finally, the significance of fleet operations for transportation energy conservation is discussed.

1. INTRODUCTION

Fleet vehicles are important to the study of transportation energy conservation for primarily two reasons. First, the number of cars purchased for fleet use has been increasing gradually over the years, in spite of recent slumps in total new car sales. In 1977, fleets comprised 13.4% of total new car sales. As fleets become a larger proportion of new cars on the road, they naturally exercise more influence on the characteristics of the total U.S. motor vehicle population. The most important characteristic to consider is fleet influence on total fuel economy. Second, some fleet sectors offer an attractive market potential for new technologies, especially the electric hybrid vehicles now under development. Certain uses of fleets have identifiable user parameters which electric vehicle specifications can satisfy.

This report will cover five major areas pertaining to fleet operations in the United States. First, all known available sources containing statistics on fleet vehicles will be described. Second, fleet operations in the United States will be characterized according to stock composition and operational characteristics. Third, properties of fleet cars will be compared with those of the total car population, which is dominated by cars for personal use. This discussion will cover elements considered in purchase decisions, differences in stock composition (especially size breakdown), and differences in operating characteristics. Fourth, a comparison will be made among fleets used by different sectors, such as business, utility, or police. Oftentimes,

there are more differences among different types of fleets themselves than between fleets as a whole and the total car population. The final section will address fleet operations and their significance for transportation energy conservation.

2. DATA

2.1 Definitions

Ideally, a vehicle could be classified as a member of a fleet if it is:

1. operated in mass by a corporation or institution,
2. operated under unified control, and
3. used for nonpersonal activities.

This ideal definition would serve to delineate fleets from the other group of vehicles which are purchased singularly and operated by individuals or households primarily for personal use.* This distinction needs to be made because of the difference in utilization of vehicles by each subgroup.

The definition of fleet, however, is not consistent throughout the fleet industry. Much of the discrepancy involves a distinction between whether the cars were bought in bulk or whether they are operated in bulk, as well as what number constitutes a fleet (i.e., four cars vs. ten cars).† Also, there is some confusion as to whether a fleet must be homogeneous or whether it may consist of a mixture of different types of vehicles (i.e., passenger cars, trucks, buses, trailers, or off-road vehicles).

*Although 45% of U.S. households owns two or more cars and 10% owns three or more cars, these cars are purchased at separate points in time. (See p. 80, *TEC Data Book*). Also, ORNL estimates that in 1976 82% of total VMTs in the U.S. were for personal use (see p. 41, *Regional Data Book*).

†The rationale favoring a cutoff at ten cars or more is that this would allow a definite distinction between cars purchased for personal use and cars purchased for business.

According to Bobit, statistics on fleet cars in operation include those cars which are operated in groups of ten or more.¹ This definition does not require satisfying the criteria that these cars were bought in groups of ten or more. On the other hand, R. L. Polk and Company deal only with new fleet registrations. They classify a car as a member of a fleet only if it is sold to a customer who buys ten or more cars within a two-year period.²

A fleet vehicle may be leased, rented, or privately owned by either an individual or an institution (government or business). The fleet industry defines rentals as transient, daily, weekly, or monthly use of cars or trucks, generally for less than one year. Leasing refers to long-term periods, usually from one to three years for cars and from two to five years for trucks. Use category of the fleet car is determined by either the identity of the car registrant or, in the case of cars leased by business, their principal use. Use is unspecified for cars that are individually leased. The eight most common categories within the industry are as follows:

1. business/corporate — including company or salesman owned or leased;
2. government — includes state and local governments. Statistics do not usually include federal government vehicles, which are inventoried separately by the General Service Administration;
3. utilities — usually service companies such as electric, telephone, or gas;
4. police — state and local;

5. taxi;
6. daily rental — defined as less than one year and includes such firms as Hertz, Avis, National, and Budget;
7. driver school; and
8. cars for individual lease, which are reported separately with specific use unspecified. They are designated as fleets because they are purchased in mass by a leasing agent and are then leased to individuals.

2.2 Data Sources

Data on fleets are available from several sources. Table 1 provides a list of all known sources with sponsoring organization, location, and contact person. Most of these sources are private organizations that have some association with fleet operators. However, three sources are affiliated with the federal government. Although this report will primarily be restricted to a discussion of car fleets, the sources of data on truck fleets are included in this discussion.

Outlined alphabetically below are the organizations and their activities.

American Automotive Leasing Association (AALA) (private) — Functions as a trade association "to serve the general interests of companies leasing automotive equipment." Membership is open to recognized, commercial motor vehicle leasing companies that operate a minimum of 200 vehicles in interstate service and that have been in business for at least two years. Members receive a monthly newsletter

Table 1. Sources of Fleet Data

Organization	Publication	Location	Contact
American Automotive Leasing Association (AALA)	<i>AALA Newsletter</i> (monthly)	Milwaukee, Wis.	Sidney Rose, Administrative Secretary, (414) 462-0800
Bobit Publishing Company	<i>Automotive Fleet Fact Book</i> (annual)	Redondo Beach, Calif.	Edward Bobit, Editor and Publisher, (213) 376-8788
Brookhaven National Laboratory	Fleet Operator Survey	Upton, N.Y.	Joe Wagner, (516) 345-2251
Car and Truck Renting and Leasing Association	^a		
Census Bureau	<i>Truck Inventory and Use Survey</i>	Washington, D.C.	Carmen Taylor, (301) 763-1744
Commercial Car Journal	<i>Census of the Motor Fleet Market, A Statistical Analysis in 1975</i> (one time)	Radnor, Pa.	Dorothy Denunsus, (215) 687-8200
General Services Administration (GSA)	<i>Federal Motor Fleet Vehicle Report</i> (yearly)	Washington, D.C.	
The Hertz Corporation	<i>Motor Vehicle Operating Costs and Fuel Usage in the U.S.</i> (one time)	New York, N.Y.	Leigh Smith, Public Affairs, (212) 980-2121
McGraw Hill	<i>Fleet Owner Marketing Handbook 1975</i> (periodic) — commercial truck	New York, N.Y.	Paul Kissebe, Sales Manager, (212) 997-6728
National Association of Fleet Administrators, Inc. (NAFA)	<i>NAFA Bulletin</i> (monthly)	New York, N.Y.	Robert Berke, Executive Director, (212) 689-3200

^aMerged with AALA.

containing items of interest to the leasing community. An AALA fleet cost survey is conducted annually. Detailed information is distributed to members, and summaries are available to the public.

Bobit Publishing Company (private) — Publishes a monthly magazine, *Automotive Fleet*, which is billed as a management magazine for car fleet operators. Annually, the April issue is designated as the Fact Book and contains statistics on fleet operations as estimated by the *Automotive Fleet* staff.

Brookhaven National Laboratory (government) — Conducted a fleet study during Summer 1977 at its National Center for the Analysis of Energy Systems. The study was designed to analyze the purchasing behavior of persons who acquire passenger cars and light trucks for use in fleets operated by business organizations or local government units. In specific, BNL's goal was to (1) develop a statistical profile of fleet vehicles, and identify factors affecting technological penetration rates; (2) develop a systematic framework for estimating the rate at which new technologies can penetrate the fleet vehicles market; and (3) generate a formal set of scenarios to illustrate the relationships between technological options, the requirements of fleet vehicles, and technological penetration rates. Questionnaires were distributed to 10,774 readers of *Automotive Fleet* magazine, and 1,147 responses were received.

Bureau of the Census (government) — Conducts a census of transportation every five years. One part of this census involves the Truck Inventory and Use Survey based on a large sample (99,690 in 1972).

Information is presented by truck fleet size (i.e., 1, 2-5, 6-19, 20+). Truck fleet size is based on the number of trucks (single-unit trucks plus truck-tractors) operated by a truck owner from a single base of operation. In this case, 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. Therefore, data in the fleet section are based on the number of trucks found in fleets of specified size and not the number of fleets. Number of trucks, total truck miles, average miles per truck, and major uses are provided by truck fleet size. Data are available at the national and state levels.

Commercial Car Journal (private) — Conducted a one-time study entitled, *Census of the Motor Fleet Market: A Statistical Analysis*, published in December 1975. They surveyed fleet operating locations having ten or more vehicles and gave information on the number of fleets and number of vehicles in fleets at the state level. Their vehicle categories include trucks, truck-tractors, trailers, cars, buses, and off-road vehicles.

General Services Administration (GSA) (government) — Compiles and publishes each fiscal year a report containing statistical data concerning worldwide federal motor vehicle fleet operations.

The Hertz Corporation (private) — One of the largest rental and leasing firms in the United States. In addition to publishing annual figures on cost of operating automobiles, they have also published a report, *Motor Vehicle Operating Costs and Fuel Usage in the United States*, which contains statistics on fleet use.

McGraw-Hill (private) — Publishes a monthly magazine called *Fleet Owner*, which is aimed at the commercial truck market. As a by-product of the research done for *Fleet Owner*, McGraw-Hill maintains a computer file of all available data on commercial trucks. A subset of this information is presented in the *Fleet Marketing Handbook*, which they publish periodically. Also, McGraw-Hill will search their files for additional information upon request from subscribers.

National Association of Fleet Administrators, Inc. (NAFA) (private) — Publishes a monthly bulletin for its membership of fleet administrators. Each year they conduct a new car acquisition survey among the NAFA member fleets. They survey car sizes and options ordered for commercial, government, and public utility fleets. The results are published in the August issue. NAFA also keeps a file on operating characteristics of their member fleets.

3. FLEET PROFILE

3.1 Historical Trends

As has been discussed, fleet statistics vary among sources. For this discussion of historical trends, statistics supplied by the *Automotive Fleet* research staff and published in Bobit's *Automotive Fleet* magazine will be used.

Fleet vehicles represent an increasing share of new vehicle purchases, according to figures from Bobit Publishing Company and, consequently, exercise a growing impact on the characteristics of the national vehicle stock. Although cars remain in fleets for a

relatively short time, they remain in the total U.S. vehicle pool for their lifetimes.

Fleet car retail sales as a percent of total car retail sales were 8.9% in 1966 and stood at 13.4% in 1977 (Table 2 and Fig. 1). Fleet car sales themselves have increased at an annual rate of 3.6% despite a slump in total car sales, which registered minimum increase of 0.1% per year between 1966 and 1977. However, there have been considerable year-to-year fluctuations in fleet car sales. Total new car sales peaked in 1973 with a record high of 11.4 million cars sold. At this point, new car sales were on the increase at 3.0% per year. However, the oil embargo halted this growth. Although fleet sales decreased too, their relative share of the total market increased.

Cars operating in fleets of ten or more as a percent of total cars in operation have shown a gradual increase since 1966, from 5.8% to 6.5% in 1977 (Table 3 and Fig. 2). This percentage has not increased as rapidly as fleets as a percent of new car retail sales because the base population, total cars in operation, has increased at the rate of 3.9% annually since 1966, whereas new car sales have only increased 0.1%. In fact, total new car registrations as a percent of total cars in operation have actually dropped since 1973. Historically, total new car registrations have represented about 11 to 12% of the total car population in any given year; however, this had dropped to 9% in 1977. The number of cars in operation is increasing even though new car sales are decreasing. Cars are remaining in the U.S. stock longer for several reasons, including increased replacement cost. The average age of a

Table 2. New Car Retail Sales, 1966-1977
(in thousands)

	Total ^a	Total new car sales as % of total cars in operation	Fleets 10+ ^b	Fleets 10+ as % of total
1966	9,028	12.7	800	8.9
1967	8,337	11.4	825	9.9
1968	9,656	12.8	985	10.2
1969	9,583	12.2	1,093	11.4
1970	8,405	10.4	1,009	12.0
1971	10,250	12.3	1,098	10.7
1972	10,950	12.7	1,105	10.1
1973	11,439	12.7	1,291	11.3
1974	8,867	9.6	1,083	12.2
1975	8,640	9.1	955	11.0
1976	10,111	10.3	1,154	11.4
1977	9,124	9.1	1,219	13.4
Average annual rate of growth	0.1		3.6	

^a Motor Vehicle Manufacturers Association, *Motor Vehicle Facts & Figures*, '77, Detroit, p. 21 (includes imports and domestic).

^b *Automotive Fleet*, Bobit Publishing Co., Redondo Beach, Calif., April issue annually.

Sources: Motor Vehicle Manufacturers Association, *Motor Vehicle Facts & Figures* '77, Detroit, p. 21 (includes imports and domestic); Bobit Publishing Co., *Automotive Fleet*, April issues.

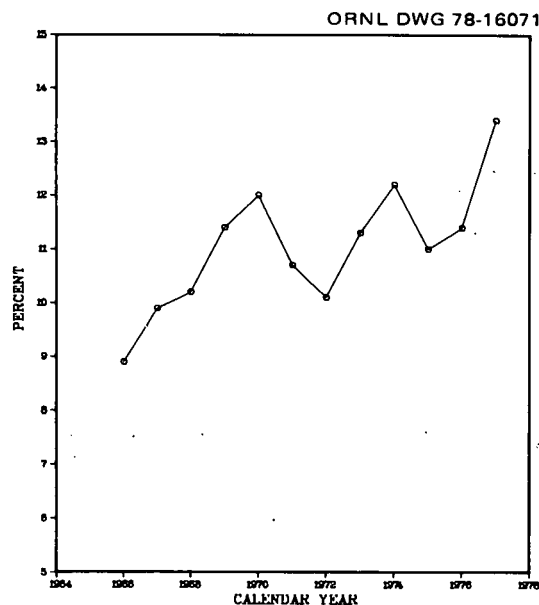


Fig. 1. Fleet Car Retail Sales as a Percent of Total Car Retail Sales.

Table 3. Cars in Operation, 1966-1977
(in thousands)

	Total ^a	Fleets 10+ ^b	Fleets 10+ as % of total	Fleets 4+ ^b	Fleets 4+ as % of total	Fleets 4+ including Federal government as % of total ^c
1966	71,264	4,106	5.8	8,710	12.2	12.3
1967	72,968	4,254	5.8	8,940	12.3	12.3
1968	75,358	4,548	6.0	9,166	12.2	12.3
1969	78,495	4,889	6.2	9,780	12.5	12.5
1970	80,449	5,041	6.3	9,992	12.4	12.5
1971	83,138	5,150	6.2	10,070	12.1	12.2
1972	86,439	5,373	6.2	10,094	11.7	11.8
1973	89,805	5,744	6.4	10,214	11.4	11.5
1974	92,608	5,836	6.3	10,324	11.1	11.2
1975	95,241	5,956	6.3	10,398	10.9	11.0
1976	97,818	6,287	6.4	10,403	10.6	10.7
1977	99,904	6,517	6.5	10,414	10.4	NA
Average annual ratio of growth	2.9	3.9		1.5		

^aCars in operation as estimated by R. L. Polk & Co. taken from Motor Vehicle Manufacturers Association, *Motor Vehicle Facts & Figures '77*, Detroit, p. 34.

^b*Automotive Fleet*, Bobit Publishing Co., Redondo Beach, Calif., April issue annually.

^cGeneral Services Administration, *Federal Motor Vehicle Fleet Report*, for each fiscal year.

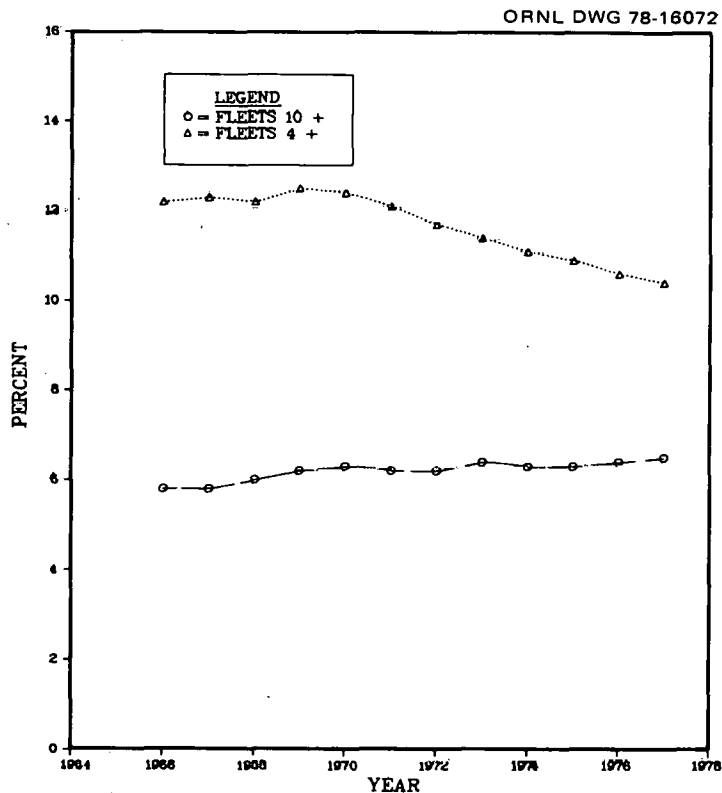


Fig. 2. Fleet Cars in Operation as a Percent of Total Cars in Operation.

U.S. car in 1966 was 68.4 months whereas in 1976 this had increased to 72.4 months (Table 4).

When fleets are defined as cars operating in groups of four or more rather than ten or more, fleets as a percent of total cars in operation doubles. However, the percentage in fleets of four or more has been decreasing over time. This would imply that the smaller fleet operations (i.e., four to nine vehicles) are decreasing relative to the larger fleet operations (i.e., ten or more).

As was indicated earlier, statistics on federal government fleets were not originally included in these fleet statistics. In order to achieve a more complete picture of fleet activity, numbers available from the General Services Administration on cars in the federal government were added to the figure for fleets of four or more. However, this addition increased the percent of fleets of four or more in relation to total cars in operation by only 0.1%. This indicates that cars in federal government fleets do not comprise a significant portion of total car fleets in the United States.

3.2 Fleet Composition

There are many diverse situations for which the fleet concept is suited. These range from a business setting where a company provides transportation for its salesmen to an electric utility that maintains a service fleet.

The eight most common use categories for fleets were defined in Sect. 2. In this section the distribution of the total fleets among

Table 4. Average Age of Cars at Replacement
(in months)

	Average age of all U.S. cars ^a	Average age of AALA fleet cars at trade-in ^b	Average age of <i>Automotive Fleet</i> cars at trade-in ^c	Average age of all U.S. cars at trade-in ^d	Average age of new U.S. cars at trade-in ^e
1966	68.4	21.8	22.9		
1967	67.2	21.2			
1968	67.2	21.6	23.3		
1969	66.0	23.3			
1970	66.0	23.9	23.7		
1971	68.4	23.4			
1972	68.4	24.2	25.2		
1973	68.4	23.6			
1974	68.4	23.9	24.3		
1975	72	24.6			
1976	72.4	26.0	25.9	51.6-54.0	
1977		26.1			42.8

^aMotor Vehicle Manufacturers Association, *Vehicle Facts & Figures '77*, Detroit, p. 32.

^bInformation supplied by American Automotive Leasing Association (AALA) which collects data annually in their AALA Fleet Cost Survey. Summary data appear in each April issue of Eobit's *Automotive Fleet*.

^cData estimated by *Automotive Fleet* Research Department.

^dPersonal communication with the Automotive Information Council, Southfield, Michigan, (313) 358-0290, May 9, 1978.

^eHertz study.

these categories is discussed (Table 5). For purposes of completeness, cars in federal government services have been added to the local and state government category.

Business fleets dominate the fleet stock (Fig. 3). In 1977 46% of fleets in the United States were owned by business corporations. If one considers that a large portion of the cars individually leased are used for business purposes, this figure approaches two-thirds of the total fleet.

The fastest growing categories of fleet use are individually leased automobiles and daily rentals. Individually leased automobiles grew at an average annual rate of 12.1% between 1966 and 1977; daily rentals grew 7.2% per year. It appears that companies with larger fleets (25 or more cars) are more likely to lease rather than buy their automobiles, mainly because of the capital investment involved in large fleet inventories.

Such an increase in daily rentals is consistent with the peak demand theory of automobile purchases;^{3,4} that is, as operating and fixed costs for automobiles increase, people will buy cars to meet their normal demands rather than their maximum demands, and will rent cars necessary for their peak demand requirements. For example, a household might purchase a compact car for its everyday use and then rent a standard or luxury car for family vacations, utilize the fly-drive package, or a truck for hauling.

Table 5. U.S. Cars in Fleets by Type of Use
(in thousands)

Use	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Percent distribution 1977	Average annual rate of growth
Business fleets	2,159	2,238	2,381	2,510	2,504	2,546	2,635	2,863	2,902	2,909	3,040	3,057	46.4	3.2
Owned	1,258	1,274	1,299	1,322	1,200	1,210	1,152	1,119	1,088	1,069	1,051	1,036	15.7	-1.8
Leased	901	964	1,082	1,188	1,304	1,336	1,483	1,744	1,814	1,840	1,989	2,031	30.7	7.7
10-24 cars	569	615	664	726	652	668	665	674	674	675	707	716	10.8	2.1
25 or more cars	1,509	1,623	1,717	1,784	1,852	1,878	1,970	2,189	2,228	2,234	2,333	2,351	35.6	4.1
Individually leased	395	487	573	697	803	834	925	994	1,008	1,072	1,217	1,335	21.0	12.1
Government	728	659	662	665	674	695	670	686	701	715	727	735	11.1	-0.3
Utilities	374	386	394	404	416	421	438	467	482	497	508	518	7.8	3.0
Police	165	174	185	191	207	218	236	249	261	278	286	292	4.4	5.3
Taxi	142	146	153	169	171	174	177	182	185	193	202	202	3.0	3.3
Daily rental	180	204	241	297	314	319	341	364	361	354	373	385	5.8	7.2
Driver school	31	31	29	27	25	27	29	27	26	25	26	26	0.4	-1.6
Total 10+	<u>4,106</u>	<u>4,254</u>	<u>4,548</u>	<u>4,889</u>	<u>5,041</u>	<u>5,150</u>	<u>5,373</u>	<u>5,744</u>	<u>5,836</u>	<u>5,956</u>	<u>6,287</u>	<u>6,609</u>	100.0	4.3
Total 4+	<u>8,710</u>	<u>8,940</u>	<u>9,166</u>	<u>9,780</u>	<u>9,992</u>	<u>10,070</u>	<u>10,094</u>	<u>10,214</u>	<u>10,324</u>	<u>10,398</u>	<u>10,403</u>	<u>10,414</u>		1.6

Sources: E. J. Bobit (ed.), *Automotive Fleet*, Vol. 16, No. 6, Bobit Publishing Company, Redondo Beach, Calif., April 1977, p. 22. General Services Administration, *Federal Motor Vehicle Fleet Report*, in each fiscal year.

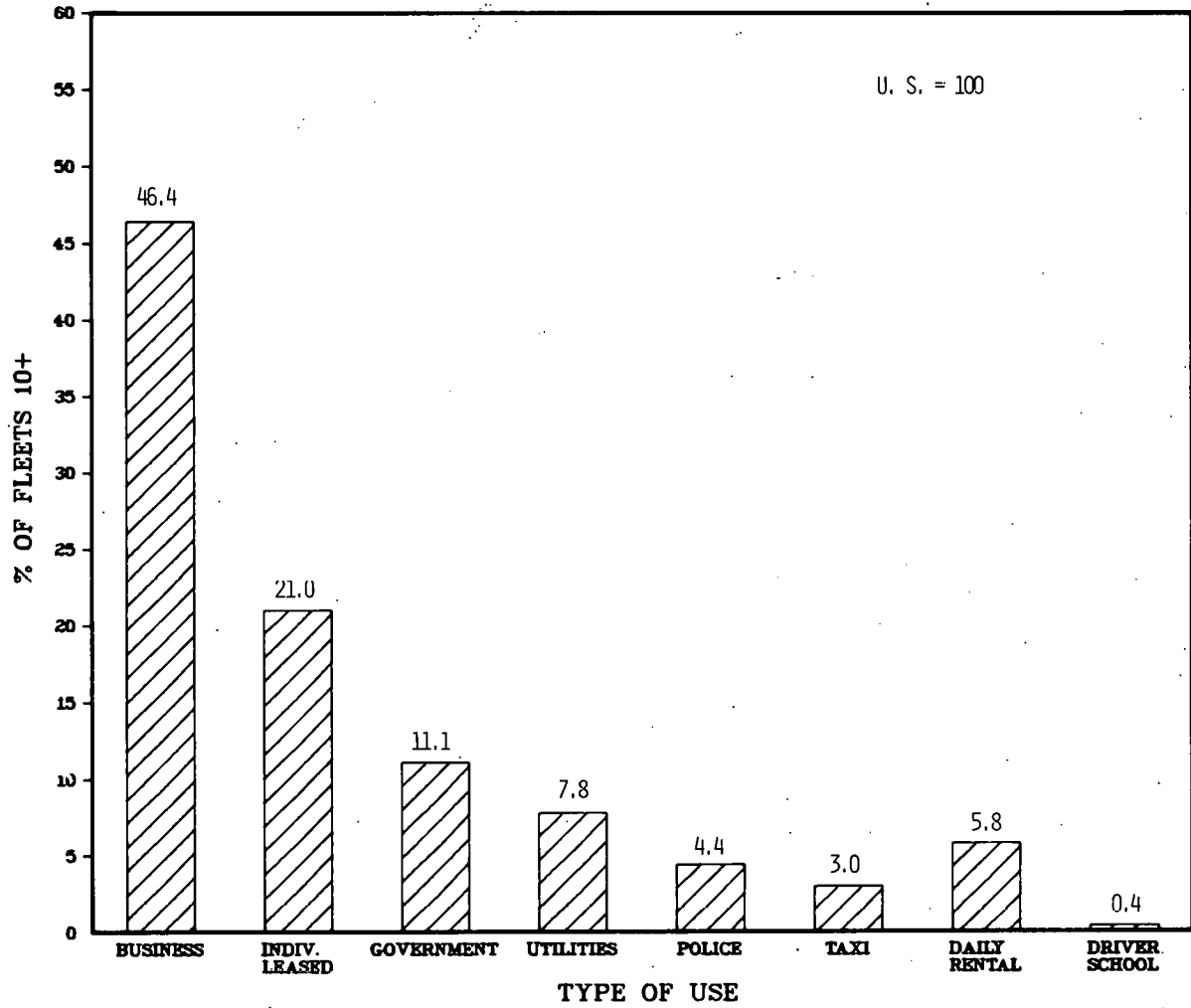


Fig. 3. U.S. Cars in Fleets of Ten or More by Type of Use (%).

4. COMPARISONS

4.1 Fleet vs Total

For the purposes of this report, cars in fleets should be compared with cars used for personal transportation. However, the data is only available for cars in fleets and for total cars in the United States which include fleets. Therefore, this section will provide a comparison between these two groups in terms of purchase decisions, stock composition, and operational characteristics. Most of the information concerning fleet characteristics was provided by the American Automotive Leasing Association⁵ (AALA) or by Brookhaven National Laboratory⁶ (BNL). It should be noted here that the BNL survey attempted to equally weigh all sizes and sectors of fleets. AALA deals only with large leased fleets. Some of the discrepancies between the data reported by each may be attributable to differences in their base populations.

Two basic changes in the total car market have been taking place over the past decade. First, there has been a gradual trend toward small cars.⁷ This has been coupled with a dramatic increase in imports, from 7.3% of total new car registrations in 1966 to 18.3% in 1977. The fleet car market does not necessarily reflect these same trends (Table 6). Only recently have small cars penetrated the fleet car market, and sales of imports for fleet purposes are insignificant. Until 1974, three-fourths of the fleet vehicle stock was standard size or larger. Historically, car ownership in the total fleet was much more evenly

Table 6. New Car-Size Composition^a
(percent)

	Standard	Intermediate	Compact
1966			
U.S. total	53	31	16
AALA fleet	95		5
1967			
U.S. total	51	33	16
AALA fleet	96		4
1968			
U.S. total	15	32	18
AALA fleet	97		3
1969			
U.S. total	49	30	21
AALA fleet	96		4
1970			
U.S. total	42	28	30
AALA fleet	97		3
1971			
U.S. total	41	20	39
AALA fleet	81	15	4
1972			
U.S. total	40	22	38
AALA fleet	76	19	5
1973			
U.S. total ^b	34	23	43
AALA fleet ^c	70	24	6
1974			
U.S. total	27	24	48
AALA fleet	62	33	5
1975			
U.S. total	23	24	53
AALA fleet	53	40	7
1976			
U.S. total	24	28	48
AALA fleet	46	48	6
1977			
U.S. total	27	29	45
AALA fleet	45	47	8

^a Car size classifications may not be consistent between the two sources or with the classifications used in the *TEC Data Book*.

^b Ward's Communications, Inc., *Ward's Automotive Yearbook*, Detroit, table "U.S. New Car Registrations by Market Share," annual editions.

^c Information supplied by American Automotive Leasing Association (AALA), which collects data annually in their AALA Fleet Cost Survey. Summary data appear in the April issue of *Bobit's Automotive Fleet*. This car size breakdown applies to the total fleet.

divided among the three size classifications:* standard, intermediate, and compact. Since 1974, standard-sized fleet cars have been replaced with intermediate-sized cars. In 1977 the stock was about evenly split between standard and intermediate with only 8% compacts; 45% of the total U.S. car population was comprised of compacts in 1977 (Table 6). However, all sources indicate that this downsizing trend for fleet cars will continue as well as the trend toward smaller cars for personal use.⁸

A comparison of car registrations by make (Table 7) indicates that there is more variety in the total U.S. car stock than in the fleet stock. However, both are dominated by Chevrolet and Ford.

The trend has been toward increasing accessories for all cars regardless of purpose.⁹ The use of air conditioning in automobiles deserves monitoring because of its significant effect on energy efficiency.¹⁰ The presence of this option has been increasing for both total new car sales and fleet new car sales, but at a faster rate for fleets (Table 8). In fact, since 1975 air conditioners in fleet cars have been more or less standard equipment. In 1977, 95% of new car fleet sales and 77% of total new car sales had air conditioners. Given the power limitations on new vehicle technologies, specifically electric vehicles, the widespread use of air conditioning has implications for the potential acceptability of these new technologies to fleet operators.

*As noted in Table 6, size classifications used for fleet cars may be inconsistent with those used for the total car stock. Also, the size classifications themselves have downshifted such that a car classified as an intermediate in 1950 may now be classified as a standard, for example.

Table 7. New Car Registrations by Makes, 1966-1977
(percent)

	Chevrolet	Ford	Plymouth	Pontiac	Oldsmobile	Buick	Cadillac	Other ^a
1966								
U.S. total ^b	24	26	7	9	6	6	2	19
AALA fleet ^c	54	23	2	5	2	3	3	8
1967								
U.S. total	24	22	7	10	7	7	2	21
AALA fleet	53	22	4	5	2	4	3	7
1968								
U.S. total	22	24	8	9	7	7	2	22
AALA fleet	46	24	6	4	2	2	2	9
1969								
U.S. total	22	24	7	8	7	7	3	22
AALA fleet	44	28	6	5	3	6	2	6
1970								
U.S. total	20	26	8	6	6	6	2	26
AALA fleet	45	25	4	4	4	6	4	8
1971								
U.S. total	22	25	7	7	7	7	3	23
AALA fleet	41	29	4	3	3	6	2	12
1972								
U.S. total	22	26	7	7	7	6	2	23
AALA fleet	40	31	3	3	3	8	3	9
1973								
U.S. total	22	25	7	7	7	6	3	24
AALA fleet	48	24	2	3	3	6	3	11
1974								
U.S. total	23	26	7	6	6	6	3	25
AALA fleet	43	31	4	3	3	7	2	7
1975								
U.S. total	21	24	5	6	7	6	3	28
AALA fleet	41	26	3	2	7	11	2	8
1976								
U.S. total	21	23	6	7	9	7	3	24
AALA fleet	36	25	3	3	10	10	3	10
1977								
U.S. total								
AALA fleet	38	27	3	3	6	6	3	14

^a"Other" includes Chrysler-Imperial, Dodge, AMC, Studebaker, and imports and others.

^bWard's 1977 *Automotive Yearbook*, Ward's Communications, Inc., Detroit, Table U.S. New Car Registrations by Makers.

^cInformation supplied by American Automotive Leasing Association (AALA), which collects data annually in their AALA Fleet Cost Survey. Summary data appear in each April issue of Bobit's *Automotive Fleet*.

Table 8. Percentage of New Cars with Air Conditioning,
Model Years 1966-1978

Model year	Total car sales ^a	AALA fleet ^b
1966	29	
1967	38	46
1968	45	56
1969	54	67
1970	59	78
1971	63	79
1972	70	83
1973	74	83
1974	68	86
1975	72	94
1976	75	95
1977	77 ^c	95
1978	83 ^c	

^aMarketing Services, Inc., *Automotive News Almanac*, Detroit, annual issues, 1966-1976.

^bInformation supplied by American Automotive Leasing Association (AALA), which collects data annually in their AALA Fleet Cost Survey. Summary data appear in each April issue of Bobit's *Automotive Fleet*.

^cAs of Dec. 31, 1977.

In their study, Brookhaven National Laboratory (BNL) surveyed power options typically ordered on their sample fleet population. According to their results, five of the power options surveyed — automatic transmissions, power steering, power brakes, radio and air conditioning — were more prevalent in fleet cars than on cars in general. However, only 83% of their sample fleet had air conditioning, compared with 95% of the AALA fleet (Table 9). As noted earlier, this discrepancy may be a function of differences in options ordered for strictly large fleets versus options ordered by a combination of large and small fleets.

4.1.1 Operational characteristics

Fleet vehicles are operated differently than cars for personal use. For example, Table 10 gives average annual mileage for the U.S. automobile population as estimated by the Federal Highway Administration and estimates for two fleet subsamples, one drawn from the American Automotive Leasing Association (AALA) Fleet Cost Survey and one estimated by Bobit's *Automotive Fleet** research staff. A direct comparison between these sets of numbers indicates that fleet automobiles register 2 to 3 times the annual mileage of cars in general. However, such a comparison is somewhat misleading for two reasons. First, according to several surveys, the Federal Highway Administration underestimates average annual mileage by 2000 to 3000 miles per year.¹¹ Second, there is considerable controversy over how much of the mileage reported for fleet vehicles by businesses is actually for business purposes. For example, the

*In the BNL sample, the average annual miles travelled by fleet was 24,000, midway between the higher AALA estimate and the lower Bobit estimate.

Table 9. Power Options Typically Ordered for Fleet Cars
in BNL Fleet Study
(percent)

Power option	1976 model year car ^a	BNL fleet, 1977 ^b
Automatic transmission	91	99
Power steering	90	95
Power brakes	81	94
Air conditioning	74	83
Radio	63	79

^aMotor Vehicle Manufacturers Association, *Motor Vehicle Facts & Figures* '77, Detroit, p. 13.

^bWagner, Naughton, Brooks, *Light Duty Highway Fleets*, draft briefing paper prepared by Brookhaven National Laboratory for DOE, Apr. 18, 1978.

Table 10. Average Annual Mileage, 1966-1977

	Total all U.S. cars ^a	AALA fleet cars ^b	Automotive Fleet cars ^c
1966	9,506	21,932	22,761
1967	9,531	21,430	
1968	9,627	23,800	21,698
1969	9,782	24,200	
1970	9,978	24,600	22,170
1971	10,121	24,787	
1972	10,184	24,322	22,244
1973	9,992	24,350	
1974	9,448	26,384	20,901
1975	9,634	31,185	
1976	9,733	26,000	21,563
1977		28,568	

^aU.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, Table VM-1 annual. These averages tend to underestimate average mileages. See *Transportation Energy Conservation Data Book: Edition 2*, ORNL-5320, p. 96, for comparison of estimates.

^bInformation supplied by American Automotive Leasing Association (AALA) which collects data annually in their AALA Fleet Cost Survey. Summary data appear in each April issue of Bobit's *Automotive Fleet*.

^cData estimated by *Automotive Fleet* Research Department.

Internal Revenue Service contends that company cars used for personal transportation should be counted as additional income. If this were actually reported, almost \$1.8 million of additional wages would be subject to taxation, according to the IRS.¹² This works out to about 12 million vehicle miles of personal travel. Also, according to the National Association of Fleet Administration, the best estimate, personal use accounts for about 15% of total fleet mileage. However, even when these two qualifiers are added, fleet cars are driven more than the average car.

It is often claimed that fleet automobiles are replaced at a much faster rate than cars for personal use. Table 4 gives the data that is most often used for comparing average age of cars at replacement for fleets with replacement time for cars in general. This indicates that in 1976 personal automobiles were kept almost three times as long as fleet vehicles (72.4 months vs 26.0 months). Once again, this comparison is misleading. The figures quoted for fleet automobiles are actually the average months that a car is retained in fleet service. However, the figures often given for all cars are actually the average ages of automobiles in the United States for various calendar years. That is, according to this data, the average car on the road in 1976 was 6.2 years old. This is not the same as the average time an individual keeps his new car before trading it in, which would be the appropriate figure for such a comparison.

A study done by the Hertz Corporation found that the average new domestic model car is kept 3.57 years (42.8 months) and run nearly

53,000 miles before it is first traded (i.e., 14,846 miles per year).¹³ According to the Ford and General Motors (GM) marketing research departments, an individual keeps a car between 4.3 and 4.5 years (51.6 to 54.0 months) before trading it in for a different car.¹⁴ These figures are not necessarily the absolute age of the car itself but rather how long any one car is kept by an individual for his own service (new cars specifically in the Hertz study and any car according to figures provided by Ford and GM).*

Given that the majority of fleet cars are purchased new, the most appropriate comparison of retention rates would be between the figures estimated by the Hertz Corporation and the Bobit fleet estimates. Such a comparison indicates that new cars in general are kept by their owner about 1.6 times as long as fleet automobiles (42.8 months vs 26 months). Therefore, fleets are replaced at a faster rate than cars in general. However, the differences in the rates of turnover diminish significantly when fleet disposal time is compared with turnover of new cars only.

4.1.2 Purchase decisions

Many factors are considered by individuals or households when choosing automobiles for personal use. Until the 1973 oil embargo, style, capacity, performance, and automobile cost were the major choice criteria.^{15,16} However, since that period automobile operating cost per mile (which implies fuel efficiency) has become one of the more important variables. Potential trade-in value is always ranked low

*Given that the Hertz figure and the GM/Ford figure are accurate, one can infer that used cars are kept much longer than new cars.

in terms of relative importance of factors influencing the individual car choice decision.

According to several experts,¹⁷⁻¹⁹ the anticipated value at liquidation (resale) of the used fleet vehicle is the single most important factor considered by fleet managers in selection of new fleet cars as depreciation accounts for approximately 40% of the total vehicle expense over two years.* Supposedly, the ultimate resale value of the cars substantially determines the overall cost of operating a fleet whether leased or company-owned. Thus administrators strive to minimize depreciation, or the holding cost of a vehicle in an effort to minimize total cost. The contention so far has been that fleet administrators will only opt for more fuel efficient cars if this will not affect the resale value of the car in relation to the purchase price.

Apparently, the situation now is such that fleet executives are encouraging their associates to buy the new smaller intermediates (105- to 112-in. wheelbase cars) with downsized engines. The primary reasoning behind this is that these types of cars will fare better in the used car markets a few years hence. According to Bennett A. Bilshi of Donlen Leasing, "The used car marketplace is already penalizing oversized optional V8s in standard two-year-old sedans. . . . The emphasis on four- or six-cylinder engines in the new cars will be a must for these vehicles that will be recycled in 1981 or 1982 when mandatory mileage of 21 to 23 mpg will be required. . . . Looking to model years 1979 and 1980, we will probably see our recommendations

*A study by BNL does not support this. See discussion, p. 28.

continue to stress smaller but practical vehicles. The job of the lessor to sell large, V8-engine vehicles with high mileage will be even more difficult than in 1977."

The results of the BNL fleet study did not support the idea that resale value is the single most important factor considered in the purchase decision. According to the fleet administrators they surveyed, resale value ranked lowest along with tradition. Purchase price was the number one consideration followed by reliability and gas mileage, maintenance, life-cycle cost (as defined by recipient), and running lifetime. However, once again these discrepancies may be a function of the size of fleet or fleet sector surveyed in each study.

4.2 Fleet Use by Sector

Oftentimes there is as much variation among the different applications of the fleet concept as between fleets and the total car population. Very little data is available on fleets by sector. However, the Brookhaven study did survey fleets by sector type. The following discussion is based on their sample results.

Size composition of a fleet is somewhat dependent on its use (Table 11). For example, both police and taxi operators require predominantly large cars. The majority of cars in small business fleets (4 to 24 vehicles) are also large, whereas large business fleets (25+ vehicles) have more medium-sized cars. This probably results from the fact that companies with larger fleets can accommodate more specialized cars, whereas companies with smaller fleets have to purchase cars that will satisfy their maximum demands.

Table 11. Size Composition of BNL Sample
(percent)

Sector	Small ^a	Medium ^a	Large ^a	All vehicles
Police		8	91	41,528
Government ^b	10	38	52	25,698
Utility	10	59	31	37,343
Taxi		18	81	2,071
Auto rental	20	30	50	12,482
Business 25+	2	32	66	126,246
Business 4-24	2	10	88	3,579
All sectors	5	32	63	248,947

^aSmall is defined as 3059 lb; medium, 3050-3500 lb; large, 3500 lb or more.

^bState and local nonpolice.

Source: Wagner, Naughton, Brooks, *Light Duty Highway Fleet*, draft briefing paper prepared by Brookhaven National Laboratory for DOE, Apr. 18, 1978.

Annual miles of travel — and consequently daily miles of travel — vary substantially according to type of use (Table 12). Taxis register the highest annual mileage — 57,000 miles/year or about 160 miles/day. Police fleets, as a result of their patrolling activities, register 33,000 miles/year. Cars in business fleets travel 26,000 to 27,000 miles/year. Surprisingly, auto rental cars are only driven about 18,000 miles/year. State and local government fleets, while having the largest average size of fleet (1428 cars per fleet), drive each car only about 17,000 miles/year.*

Cars in utility fleets are driven the least of all fleets — 12,000 miles/year. Therefore, within the fleet market itself, the highest average annual miles travelled by a fleet car is 4.75 times the miles by the lowest mileage car. Miles driven by fleets as a whole is only 2.7 times that of miles driven by the average car in the United States.

5. IMPLICATIONS FOR TRANSPORTATION ENERGY CONSERVATION

The Department of Energy is sponsoring a separate project to examine in more detail the applicability of new technology vehicles for fleet use, specifically electric vehicles.⁶ Section 6 of this report attempts to discuss, in general, why the fleet concept can be instrumental in achieving transportation energy conservation in the United States. Most of the following discussion relates to the characteristics of fleets that have been identified in the previous sections.

*According to the *Federal Motor Vehicle Fleet Report*, federal government cars are driven an average of less than 10,000 miles per year.

Table 12. Selected Characteristics of BNL Fleet Sample

Sector	Annual miles	Daily miles ^b	Average size of fleet
Police	33,000	132	506
Government ^a	17,000	68	1,428
Utilities	12,000	48	137
Taxi	57,000	228	31
Auto rental	18,000	72	1,040
Business 25+	27,000	108	
Business 4-24	26,000	104	205
All sectors	24,000	96	230

^a State and local nonpolice.

^b Estimated by ORNL assuming the average working year is no more than 250 working days.

Source: Wagner, Naughton, Brooks, *Light Duty Highway Fleet*, Draft briefing paper prepared by Brookhaven National Laboratory for DOE, Apr. 18, 1978.

Since fleets comprise only 6 to 10%* of the total automobile population and this percentage is only gradually increasing, why should much effort be expended to achieve energy conservation in this small segment? On the surface, it would appear that the federal government would receive only minimum payoffs from such an effort. However, the payoffs may be higher than the absolute fleet numbers themselves suggest.

First, fleet automobiles are turned over at a much faster rate than personal automobiles. Automobiles remain in fleet service for only about 26 months, whereas the typical new car bought for personal use is kept an average of 43 months. Once automobiles are retired from fleet use, they reenter the national vehicle stock as used cars for personal use (Table 13). Given that over 60% of all cars purchased by households in the United States are used cars (Table 14), the potential impact of selection of fuel efficient cars at the fleet administrators level is obvious. Therefore, the payoff from influencing the purchase decisions of fleet administrators in terms of overall fuel efficiency in the United States is much greater than the number of cars currently in fleets would suggest. The implication of this is that fleet cars are purchased at a faster rate than cars in general. Therefore, the efficiency improvements on new cars are introduced more quickly into the fleets, and filter to the general public sooner.

The second reason that fleets offer a favorable opportunity for implementing energy conservation measures involves their operating

*Depending on whether one considers fleets to be comprised of four or more or ten or more cars.

Table 13. Disposition of Used Cars in Fleets, 1972-1977
(percent)

	New car dealer	Used car dealer	Auctions	Lessee employees	Other
1972	10	41	27	8	14
1973	10	55	17	8	10
1974	9	54	16	9	12
1975	13	55	14	12	6
1976	7	55	15	16	7
1977	11	48	14	18	9

Source: Information supplied by American Automotive Leasing Association (AALA), which collects data annually in their AALA Fleet Cost Survey. Summary data appear in each April issue of Bobit's *Automotive Fleet*.

Table 14. Household Purchases of New and Used Passenger Cars,
1968-1974

	New cars purchased (thousands)	Used cars purchased (thousands)	Total cars purchased (thousands)	Used cars as % of total cars
1968	7,960	13,407	21,367	63
1969	8,069	12,808	20,877	61
1970	7,051	12,504	19,555	64
1971	8,148	14,564	22,712	64
1972	8,539	15,021	23,560	64
1973 ^u	8,700	12,600	21,300	59
1974 ^a	8,500	13,700	22,200	62

^aNot strictly comparable to data prior to 1973.

Source: Motor Vehicle Manufacturers Association, *Motor Vehicle Facts & Figures '77*, p. 39 (taken from U.S. Bureau of the Census, *Consumer Buying Indicators*, January 1974, and unpublished data from 1973 and 1974 *Surveys of Purchases and Ownership*).

characteristics. Fleets are generally bought and operated in mass. The purchase decision is usually made by a well-informed fleet administrator, who is more likely to consider life-cycle costs than a private individual. Not only is it easier to persuade this individual to purchase fuel efficient cars from an economical standpoint, but it also has more fuel conservation ramifications because it directly impacts on a larger number of cars.

Oftentimes cars in fleets (other than business) are housed at one location overnight. This would allow for, on a cost efficient basis, any special maintenance that a new technology vehicle might require. An example would be the battery recharging necessary for electric-hybrid vehicles.

Except for cars in daily rental fleets, the operating demands for a fleet car are generally clearly defined; that is, the maximum range and capacity of the vehicle can be sufficiently identified. The fleet administrator is less likely to have to deal with peak demand services than an individual who is purchasing a personal vehicle. A fleet administrator can be more comfortable with choosing a vehicle with somewhat limited capacity but still sufficient to fulfill his company's demands. Therefore, fleets offer some special opportunities for new or unified performance vehicles.

For example, a battery-powered delivery van has been tested in a program conducted by a large Chicago bank and Willett National lease as an alternative to conventional gasoline-powered vehicles for city use.²⁰ The fleet delivers bank mail, provides messenger service and

transports personnel between the bank's facilities. The vehicles operate on regularly scheduled routes between the bank's various facilities and are involved in heavy stop-and-go traffic and perform at an average speed of 10 miles per hour. The test was conducted over a nine-day period with one vehicle in operation for more than 70 hours. According to Commonwealth Edison, who studied results of this test along with data from similar studies, "energy costs for electric vehicles are about half that of the presently used vans. . . . Electric vehicles are expected to have a much lower maintenance cost than conventional types." However, additional operation and maintenance data is needed to evaluate electric vehicles.

Finally, government-owned vehicles — federal, state and local — which comprise almost 8% of total fleets are more vulnerable to legislation or Presidential mandate. For example, the federal government has ordered its member agencies and departments to purchase no passenger car which gets less than a combined 20 mpg in 1978. In fact, between now and 1985 the government fleet average is mandated to be 4 mpg higher than the manufactured sales-weighted averages are required to be.²¹

6. SUMMARY OF PRINCIPAL FINDINGS

- There is no universal definition of fleet. However, most of the statistics collected are based on ten or more cars operated together or registered to the same entity.
- Cars sold for fleet use represent 13% of total new car retail sales.

- Cars in fleet service of ten or more cars represent 6.5% of the total car stock in the United States.
- Business fleets dominate the fleet stock (46%).
- Individually leased and daily rental fleet categories are growing at the fastest rates — 12% and 8% per year respectively.
- Historically, most fleet cars have been standard size. However, fleet administrators are now buying the new smaller intermediate (105- to 112-in. wheelbase) with downsized engine because of their low depreciation rate (i.e., these cars will fare better in the used car market a few years hence).
- On the average, fleet cars are driven more miles per year than cars in general. This is very sector specific, however.
- The principal impact of fleets on the energy efficiency of the total vehicle population may be higher than the absolute fleet numbers themselves suggest. Cars are maintained as fleets for only about 26 months out of their total lifetime. After their fleet service, they are filtered to the general public, usually through the used car market. Given that fleet cars are purchased at a faster rate than cars in general, the efficiency improvements on new cars are implemented in fleets more quickly and filter to the general public faster.
- Given their specific operating demands, fleets offer some special opportunities for new or limited performance vehicles.

REFERENCES

1. E. J. Bobit, Editor of *Automotive Fleet*, personal communication, May 1978.
2. Patricia Tesolin, Account Service Representative, R. L. Polk and Company, personal communication, May 1978.
3. J. P. Leape, *The Demand for Automobiles: An Analysis*, Harvard University, Cambridge, Mass., April 1977, p. 117.
4. A. S. Morton et al., *Study of Automobile Market Dynamics, vol. 1: Description*, prepared by Arthur D. Little, Inc., for the U.S. Department of Transportation, August 1977, p. 3-3; *Travel Market Yearbook 1977/1978*.
5. AALA Annual Fleet Cost Survey, as reported in *Automotive Fleet*, a Bobit publication.
6. Wagner, Naughton, and Brooks, *Light Duty Highway Fleets*, draft briefing paper prepared by Brookhaven National Laboratory for the Department of Energy, Apr. 18, 1978.
7. D. B. Shonka et al., *Transportation Energy Conservation Data Book: Edition 2*, ORNL-5320, Oak Ridge National Laboratory, October 1977, p. 61.
8. E. J. Bobit, Ed., *Automotive Fleet* 16(12): 61 (1977).
9. Motor Vehicle Manufacturers Association, *Facts and Figures '77*, Detroit, Mich., p. 13.
10. Ref. 7, p. 214.
11. Ref. 7, p. 96.
12. E. J. Bobit, Ed., *Automotive Fleet* 17(1): 43 (1977).
13. "Used car sales top \$21 billion," *Automotive News*, Crain Publishing Co., Detroit, Mich., May 15, 1978, p. 46.
14. Automotive Information Council, Southfield, Mich., (313) 358-0290, personal communication, May 9, 1978.
15. Charles A. Lave and Kenneth Travis, "A Disaggregate Model of Auto-type Choice," Economics Department, University of California.
16. James P. Leape, *The Demand for Automobiles: An Analysis*, Harvard University, Cambridge, Mass., April 1977.

17. "More fleets switch to smaller cars," *Automotive News*, Crain Publishing Co., Detroit, Mich., Mar. 7, 1977.
18. Robert Berke, Executive Director, National Association of Fleet Administrators, Inc., personal communication, July 7, 1978.
19. "Intermediates Recommended for Fleet Car Use in 1978," *Automotive Fleet* 17(1): 16 (1977).
20. "Electric Vehicle Tested for Downtown Deliveries," *Automotive Fleet*, February 1978, p. 42.
21. "U.S. orders 20 mpg for cars it purchases," *Automotive News*, Crain Publishing Co., Detroit, Mich., Dec. 5, 1977, p. 9.

BIBLIOGRAPHY

- Automotive News*. Dec. 5, 1977, p. 9.
- Bobit, E. J., Ed. *Automotive Fleet*. 17(6).
- Bobit, E. J.; Hornhohl, C.; and Dunlap, J. R. "Report on the Aspects of Automotive Fleet Operations on Transportation Energy Conservation," ORNL/Sub-77/14246/1. Oak Ridge National Laboratory, Aug. 8, 1977.
- General Services Administration. *Federal Motor Vehicle Fleet Report, for Fiscal Year Ending June 30, 1976*. Washington, D.C.: General Services Administration, June 1977.
- D. L. Greene, et al. *Regional Transportation Energy Conservation Data Book: Edition I*, ORNL, August 1978.
- The Hertz Corporation. *Motor Vehicle Operating Costs and Fuel Usage in the United States*. New York: Public Affairs Department of the Hertz Corporation, 1976.
- Lave, Charles A. and Travis, Kenneth, "A Disaggregate Means of Autotype Choice," Economics Department, University of California.
- Leape, James P. "An Analysis of the Demand for Automobiles: Multicar Households and Electric Vehicles." Undergraduate thesis funded by the Department of Energy (formerly ERDA), August 1977.
- Leyburn, Robert L. *The Fleetowner Fleet Marketing Handbook*, No. 4. New York: McGraw-Hill.
- Morton, A. S., et al. *Study of Automobile Market Dynamics Vol. 1 - Description*. Cambridge: Arthur D. Little, Inc., August 1977.
- Motor Vehicle Manufacturers Association of the United States, Inc. *Motor Vehicle Facts & Figures '77*. Detroit: MVMA, 1977.
- National Association of Fleet Administrators, Inc. "NAFA's 1978 New Car Survey." *NAFA Bulletin*, August 1977.
- Shonka, D. B.; Loebl, A. S.; and Patterson, P. D. *Transportation Energy Conservation Data Book: Edition 2*, ORNL-5320. Oak Ridge National Laboratory, October 1977.
- U.S. Bureau of the Census, Census of Transportation, 1972. *Truck Inventory and Use Survey: U.S. Summary*, TC72-T52. Washington, D.C.: U.S. Government Printing Office, 1973.
- Wagner, Naughton, Brooks, *Light Duty Highway Fleets*, draft briefing paper prepared by Brookhaven National Laboratory for the Department of Energy, Apr. 18, 1978.

White, Lawrence J. *The Automobile Industry Since 1945*, Harvard University Press, Cambridge, Mass., 1971.

INTERNAL DISTRIBUTION

- | | | | |
|------|--------------------------|----------|----------------------------|
| 1. | J. T. Arehart | 10-193. | Data Management and |
| 2. | R. M. Davis | | Analysis Group |
| 3-4. | Energy and Environmental | 194. | H. Postma |
| | Response Center | 195. | A. B. Rose |
| 5. | W. Fulkerson | 196-207. | D. B. Shonka |
| 6. | D. L. Greene | 208. | Central Research Library |
| 7. | R. F. Hibbs | 209. | Document Reference Section |
| 8. | J. L. Hills | 210-212. | Laboratory Records |
| 9. | D. Jared | 213. | Laboratory Records - RC |
| | | 214. | ORNL Patent Office |

EXTERNAL DISTRIBUTION

215. American Automotive Leasing Association, 5635 West Douglas Avenue, Milwaukee, Wis. 53218.
216. Dave Arbogast, Congressional Information Service, 7101 Wisconsin Avenue, N.W., Washington, D.C. 20014.
217. Robert Berke, National Association of Fleet Administrators, Inc., 295 Madison Avenue, New York, N.Y. 10017.
218. Marty Bernard, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Ill. 60439.
219. Edward J. Bobit, Bobit Publishing Co., 2500 Artesia Boulevard, Redondo Beach, Calif. 90278.
220. Commercial Car Journal, Chilton Co., Rador, Pa. 19089.
- 221-348. Data Management and Analysis Group, Energy Division, Transportation Energy Conservation Distribution.
349. Director, Research and Technical Support Division, DOE-ORO.
350. Fleet Owner, McGraw-Hill Publishing Co., New York, N.Y. 10020.
351. Charles Lave, University of California, Irvine, School of Social Sciences, Irvine, Calif. 92717.
352. Maureen McDonald, Automotive Information Council, 2833 Telegraph Rd., Southfield, Mich. 48034.
353. Maryanne Millar, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Ill. 60439.
- 354-428. Philip D. Patterson, Chief, Data Analysis Branch, Division of Transportation Energy Conservation, Department of Energy.
- 429-545. Regional and Urban Studies Distribution, Energy Division.
546. Harry A. Stark, Editor, Ward's Automotive Reports, 28 W. Adams Street, Detroit, Mich. 48226.
- 547-573. Technical Information Center, Box 62, Oak Ridge, Tenn. 37830.
574. Transportation Association of America, Suite 1107, 1100 17th Street, N.W., Washington, D.C. 20036.
575. Joseph R. Wagner, Brookhaven National Laboratory, Building 475, Associated Universities, Ind., Upton, Long Island, N.Y. 11973.
576. Fred Westbrook, TERA, Suite 888, 1901 N. Ft. Myer Drive, Arlington, Va. 22209.
- 577-578. U.S. Department of Transportation, Library Acquisitions M-491.1, 400 7th Street S.W., Washington, D.C. 20590.