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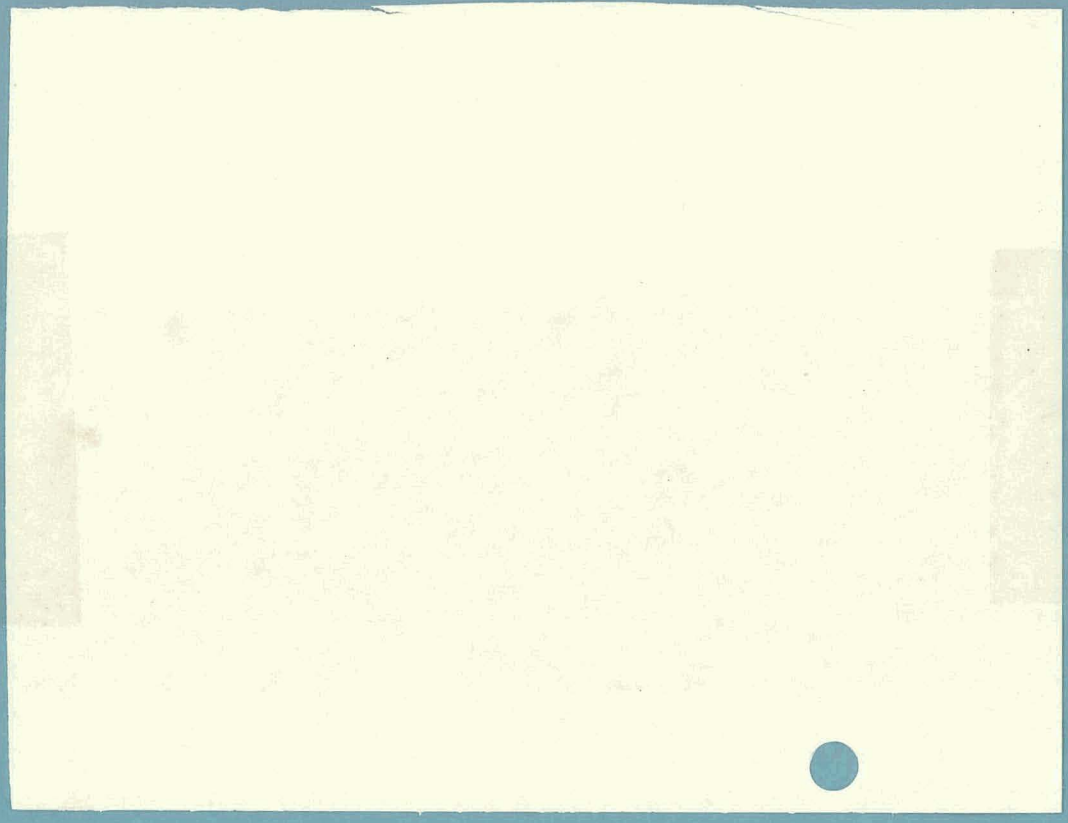

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PROJECTIONS OF AUTOMOBILE, LIGHT TRUCK, AND BUS STOCKS AND SALES, TO THE YEAR 2000

by

Rita Knorr and Marianne Millar

Energy and Environmental Systems Division

November, 1979

prepared for

Office of Transportation Programs
Assistant Secretary for Conservation and Solar Applications
U.S. Department of Energy

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ABSTRACT

Future stocks and sales of automobiles, light trucks, and buses are projected in this document. Automobile projections are developed for fleet and non-fleet sectors. Total auto stock is projected as a function of the number of households and of personal income, with adjustment for present and anticipated shifts from automobiles to light trucks. Automobile stocks and sales are projected to increase steadily through the year 2000 with a slightly larger growth rate associated with fleet autos. Projections of light truck stocks and sales are developed for personal, service/utility, agriculture, manufacturing, government, wholesale/retail, and other uses based on anticipated employment and output for each of the use sectors. Projections anticipate the largest growth area to be that of personal light trucks. Bus stocks and sales are projected as a function of user populations, existing fleet characteristics, and anticipated usage patterns. School, intercity, and transit buses are included in the study. School buses are projected to have the largest percentage of growth in this sector.

1 INTRODUCTION

Automobile, light truck, and bus projections form a major part of Argonne National Laboratory's baseline projection activities for the Department of Energy's (DOE) Office of Transportation Programs. This document presents aggregate projections of automobile stocks and sales for fleet and non-fleet (generally personal use) sectors; personal, commercial and government light truck sectors; and school, transit and intercity bus sectors. These projections are a baseline or business-as-usual estimate of future transportation stocks and sales for use in assessing future transportation activity and energy consumption and in analyzing the impact of potential conservation strategies.

This report compares ANL projections with other available efforts and with data sources. Assumptions are documented in the text and in the attached appendices.

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2 PROJECTIONS OF AUTOMOBILE STOCK AND SALES

2.1 FLEET AUTO TRENDS

Table 2.1 presents historical data on the number of automobiles in use* by sector. According to this table, the total number of automobiles on the road has grown at an average annual rate of 3.5% since 1967. In the past 10 years, the number of automobiles in fleets of 10 or more has grown even more rapidly than the total at an average annual rate of 4.4% for fleet autos vs 3.2% for total autos. Reflecting such trends as the movement of industry from urban to rural and suburban locations (which tends to increase the amount of travel between company facilities, suppliers, or distributors, while reducing the availability of transit for such travel), the growth of "company car" perquisites for middle and upper level executives, and general business expansion, it is anticipated that growth in fleet auto stock probably will continue to exceed that of the total automobile stock.

Unlike larger fleets, small fleets (i.e., 4-9 vehicles) apparently have peaked and have begun to decline at an accelerating rate. This may be attributable to the rise in automotive leasing. Because the maintenance and operating advantages of leasing tend to be particularly appealing to smaller operators who do not have full-time maintenance personnel, it may be inferred that many vehicles previously accounted for in smaller industrial fleets now are included among the larger fleets of leasing agents. This conclusion is supported by recent trends in individual usage segments. Table 2.2 indicates that the fastest growing segments of the fleet market are leased vehicles (both blocks of 10 or more cars and individually leased) followed by daily rentals. The government fleet (excluding military cars) has remained stable, while driving-school and business-owned fleets have declined. Police, taxi, and utility fleets have shown moderate growth.

In 1977 fleet autos (i.e., $\geq$4 vehicles) represented approximately 11.8% of total cars in operation, but they accounted for at least 20% of new car sales [Ref. 2]. This discrepancy is due to differences in fleet vs non-fleet purchase and ownership patterns.** Fleet autos almost always are purchased new and generally are retained for only 3-4 years, after which they enter the used non-fleet auto market. Fleet-auto sales also exhibit unique

---

* Automobiles in use (or on the road) differ significantly from registrations. Registered autos, as reported by FHWA, are the sum of all cars registered by each state at some time during the calendar year. Registration data contains a considerable amount of overcounting of vehicles scrapped early in the year, vehicles with multiple registrations (because of interstate moves), and vehicles that are not registered until very late in the year. By contrast "autos in use" refer to only those automobiles actually in operation on a particular day, usually July 1, of the calendar year.

**Other estimates put nonpersonal auto purchases (i.e., use by fleets, small business, the self employed, salesman, etc.) as high as 52% of domestic new car production, Hertz, Inc., Car and Truck Lease - Rental Spending Nears $20 Billion, Press release (July 1978).

Table 2.1. Automobiles in Use by Sector [Refs. 1-4]
(As of July 1, 1967, through 1977)

Year	Total Automobiles In Use		Fleet Autos[a]				Non-Fleet Autos	
	Number (10^6)	Annual % Change	Number (10^6)		Annual % Change		Number (10^6)	Annual % Increase
1967	73.0	2.4	4.2[b]	(4.6)[c]	-	-	68.8	-
1968	75.4	3.3	4.4	(4.7)	5.3[b]	(2.2)[c]	71.0	3.2
1969	78.5	4.1	4.7	(4.8)	7.2	(2.1)	73.8	3.9
1970	80.4	2.4	5.0	(4.9)	5.2	(2.1)	75.4	2.2
1971	83.1	3.4	5.1	(4.9)	2.6	(-)	78.0	3.4
1972	86.4	4.0	5.3	(4.8)	3.3	(-2.0)	81.1	4.0
1973	89.8	3.9	5.6	(4.6)	5.7	(-4.2)	84.2	3.8
1974	92.6	3.1	5.8	(4.5)	4.2	(-2.2)	86.8	3.1
1975	95.2	2.8	5.9	(4.5)	1.8	(-)	89.3	2.9
1976	97.8	2.7	6.1	(4.3)	3.8	(-4.4)	91.7	2.7
1977	99.9	2.1	6.4	(4.0)	5.3	(-7.0)	93.5	2.0

[a]Year end estimates adjusted to mid-year.

[b]Fleets $\geq$ 10 vehicles.

[c]Fleets of 4-9 vehicles.

size characteristics. These are illustrated in Table 2.3. Unfortunately, data are available only for total sales and fleet sales. Because fleet sales are included within total sales, the magnitude of the differences between fleet and non-fleet sales is somewhat understated. Although there has been some shift over the past decade toward smaller (primarily mid-sized) fleet autos, fleet sales still are highly concentrated in the upper size ranges.

2.2 NON-FLEET AUTO TRENDS

As a residual sector, very little data are available specifically on non-fleet autos. However, because they comprise 93.6% of the total auto stock (89.6% if one counts fleets of 4-9 vehicles) and 86.6% of new auto sales, data on total stock and sales may be applied to the non-fleet sector with some fair degree of certainty. Although ownership and usage patterns for non-fleet autos differ significantly from those for fleet autos, they are probably not far removed from those of the total stock.

Non-fleet autos are used almost exclusively for personal purposes, but they do not comprise all personal autos. The latter category includes those fleet autos, primarily individually leased or in busines fleets (or occasionally government or utility vehicles) that are operated by their users as if they were personal vehicles (i.e., for social-recreational, personal

Table 2.2. Automobiles in Fleets[a] by Type of Use, 1967 - 1977 [Refs. 2,3]

Use	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Avg. Annual % Change
Business Fleets												
Owned (10^3)	1266	1286	1310	1383	1205	1181	1135	1103	1078	1060	1043	
(% Change)	--	1.6	1.9	5.6	-12.9	-2.0	-3.9	-2.8	-2.3	-1.7	-1.6	-1.8
Leased(10^3)	932	1023	1135	1246	1320	1409	1613	1779	1827	1914	2010	
(% Change)	--	9.8	10.9	9.8	5.9	6.7	14.5	10.3	2.7	4.8	5.0	8.0
Individually Leased												
(10^3)	441	530	635	750	818	879	959	1001	1040	1144	1301	
(% Change)	--	20.2	19.8	18.1	9.1	7.5	9.1	4.4	3.9	10.0	13.7	11.6
Government												
(10^3)	693	660	663	669	684	683	678	693	708	721	731	
(% Change)	--	-9.6	0.4	0.9	2.2	-0.1	-0.7	2.2	2.2	1.8	1.4	0.6
Utilities												
(10^3)	380	390	399	410	418	429	452	474	489	502	513	
(% Change)	--	2.6	2.3	2.8	1.9	216	5.4	4.9	3.2	2.7	2.2	3.0
Police												
(10^3)	169	179	188	199	212	227	242	255	269	282	289	
(% Change)	--	5.9	5.0	5.9	6.5	7.1	6.6	5.4	5.5	4.8	2.5	5.5
Taxi												
(10^3)	144	149	161	170	172	175	179	183	189	197	202	
(% Change)	--	3.5	8.0	5.6	1.2	1.7	2.3	2.2	3.3	4.2	2.5	3.5
Daily Rental												
(10^3)	192	222	269	305	316	330	352	363	358	363	379	
(% Change)	--	18.6	21.2	13.4	3.6	4.4	6.7	3.1	-1.4	1.4	4.4	7.3
Driving School												
(10^3)	31	30	28	26	26	28	28	26	26	25	26	
(% Change)	--	-3.2	-6.7	-7.1	--	-7.1	--	-7.1	--	-3.8	4.0	-1.6
TOTAL												
(10^3)	4180	4401	4718	4965	5095	5261	5558	5790	5896	6121	6448	
(% Change)	--	5.3	7.2	5.2	2.6	3.3	5.6	4.2	1.8	3.8	5.3	4.4

[a]Year-end estimates adjusted to mid-year for fleets $\geq$ 10 vehicles.

business, shopping, etc., as well as for business purposes). From survey responses, it appears that between 20-25% of the fleet autos currently in operation are also in personal use [Ref. 5].

As indicated in Table 2.1, the stock of non-fleet autos has been growing, but at a significantly slower rate than that of fleet autos. This growth pattern is attributable to two major factors: (1) the relative maturity of the non-fleet sector; and (2) the growing substitution of light trucks for non-fleet autos.

Table 2.4 lists U.S. light duty vehicle sales according to three size classes. Developed from historical data on retail sales by ten inertia weight classes (see Table 2.5), the data are indicative of a general trend toward smaller cars and light trucks. As Table 2.4 indicates, small cars have grown to roughly 40% of total auto sales compared with less than 15% in 1968 while large cars have dropped to roughly 35% compared with nearly 45% in 1968.* Light truck sales have grown significantly, and now account for over 20% of total lightduty vehicle sales. In 1977, light truck sales were nearly 70% as great as large auto sales.

2.3 PROJECTIONS OF AUTOMOBILE STOCK AND SALES

In the absence of major political or social changes, past experience determinants of total auto stock and sales can be assumed to remain basically unchanged. As a result, projecting future stock and sales can be viewed as a relatively straightforward task; however, distributing these totals among vehicle size classes is a far different matter. With the Energy Policy and Conservation Act (EPCA) [Ref. 10], the auto industry became subject to progressively more stringent "corporate-average fuel economy" (CAFE) standards for all new automobiles marketed in this country. As Table 2.5 indicates, these standards have already produced a shift in the inertia weight** classes associated with small-, medium-, and large-sized autos. Between 1976 and 1978 down-sizing (primarily in full and mid-size autos) lowered certain models as much as two inertia weight classes from their previous levels [Ref. 11]. Such shifts in size classes are not unusual in the automobile industry. The ANL staff estimates of historical size classes illustrated in Table 2.5 indicate that a substantial amount of "upsizing", primarily in medium and small classes, occurred during the early 1970s. Such "upsizing" is attributable not only to increased engine size, but also to the addition of air conditioning and other power options which previously were not commonly offered on small and mid-sized cars. Because of such shifts, weight classes historically have not been a reliable measure of vehicle size. However, as weights are forced downward, those weights should equate to the actual size of the vehicle as it relates to passenger and payload capacity and to consumer perceptions of its market niche.

---

*This decline occurs despite a shift in size classes as defined by ANL staff (Table 2.5). Were it not for such a shift, the decline in large auto sales would be more pronounced.

**Defined as curb weight + 300 lbs, representing the weight of two occupants.

Table 2.3. New Car Size Distribution (Percent)[a] 1966 - 1977 [Ref. 6]

	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Fleet Autos[b]												
Small	5	4	3	4	3	4	5	6	5	7	6	8
Medium	-	-	-	-	-	15	19	24	33	40	48	47
Large	95	96	97	96	97	81	76	70	62	53	46	45
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100
Total Autos												
Small	16	16	18	21	30	39	38	43	48	53	48	45
Medium	31	33	32	30	28	20	22	23	24	24	28	29
Large	53	51	51	49	42	41	40	34	27	23	24	27
TOTAL	100	100	101[c]	100	100	100	100	100	99[c]	100	100	101[c]

[a]Car size classifications may not be consistent between the two sources. Although fleet size classes generally conform to Ward's classifications (based on wheelbase and marketing intent) fleet data is derived from surveys in which classes were defined simply as "compact," "intermediate," and "standard" [Ref. 6].

[b]In fleets of 25 or more vehicles.

[c]Does not total 100 because of rounding.

Table 2.4 Estimated U.S. Retail Sales by Inertia Weight Class,[a] 1968-77 (10^3) [Refs. 7-9]

Year	Automobiles				Light Trucks[c]
	Small	Medium	Large	Total[b]	
	10^3 Vehicles				
1968	1207	4210	4249	9656	1429
1969	1466	3804	4302	9581	1431
1970	1857	2538	3395	8404	1251
1971	2583	3239	4428	10249	1603
1972	2620	3592	4741	10950	1931
1973	3752	2803	4884	11439	2438
1974	3582	2057	3236	8867	2158
1975	2964	1763	3491	8640	1891
1976	4146	2609	3347	10112	2574
1977	3568	3277	4340	11185	2955
	Percentage of Sales[d]				
1968	12.5(10.9)	43.6(38.0)	44.0(38.3)	100(87.1)	(12.9)
1969	15.3(13.3)	39.7(34.5)	44.9(39.1)	100(87.0)	(13.0)
1970	22.1(19.2)	30.2(26.3)	40.4(35.2)	100(87.1)	(12.9)
1971	25.2(21.8)	31.6(27.3)	43.2(37.4)	100(86.5)	(13.5)
1972	24.0(20.4)	32.8(27.9)	43.3(36.8)	100(85.0)	(15.0)
1973	32.8(25.7)	24.5(20.2)	42.7(35.2)	100(82.4)	(17.6)
1974	40.4(32.5)	23.2(18.7)	36.5(29.4)	100(80.4)	(19.6)
1975	34.3(28.1)	20.4(16.7)	40.4(33.1)	100(82.0)	(18.0)
1976	41.0(32.7)	25.8(20.6)	33.1(26.4)	100(79.7)	(20.3)
1977[e]	31.9(25.2)	29.3(23.2)	38.8(30.7)	100(79.1)	(20.9)
1978	39.7(N.A.)[f]	24.7(N.A.)	35.5(N.A.)	100(N.A.)	(N.A.)

[a]Inertia weight (i.w.) = curb weight + 300 lbs.
Small: Minicompacts, subcompacts and most compacts. For weight breakdowns see Table 2.5.
Medium: Intermediates and some compacts. (See Table 2.5.)
Large: Full sized autos and station wagons. (See Table 2.5.)

[b]May not add due to rounding.

[c]Trucks $\leq$10,000 lbs Gross Vehicle Weight (GVW). Includes imports by U.S. manufacturers. Excludes other imports.

[d]Percent of total auto sales; numbers in parentheses indicate percent of combined auto and light truck sales.

[e]Size classes not strictly comparable with prior years because of downsizing by some manufacturers.

[f]Not available.

Table 2.5. Automobile Market Share (Percent) by Inertia Weight Class, 1968 - 1978 [Ref. 7]

Model Year	Inertia Weight Class[a]										
	I 2000	II 2250	III 2500	IV 2750	V 3000	VI 3500	VII 4000	VIII 4500	IX 5000	X 5500	Total[b]
1968	0.5	5.4	2.6	0.1	3.8	26.5	17.1	18.7	7.3	0.9	100.0
1969	1.3	5.6	2.2	3.1	3.2	23.5	16.2	33.4	10.6	0.9	100.0
1970	1.3	7.4	3.4	5.0	6.0	12.6	23.9	29.2	9.1	2.1	100.0
1971	1.1	8.8	7.4	2.4	5.5	11.8	19.8	26.6	13.0	3.6	100.0
1972	1.2	4.6	6.6	6.8	4.8	12.5	20.3	24.7	12.4	6.2	100.0
1973	1.6	4.4	5.7	9.4	5.8	5.9	12.2	19.1	16.8	6.8	100.0
1974	0.8	4.9	4.4	7.5	12.8	10.0	11.6	11.6	16.2	8.7	100.0
1975	0.9	4.5	4.2	1.8	10.1	12.7	15.7	9.7	19.2	11.5	100.0
1976	1.0	6.9	3.8	2.2	13.4	13.7	14.2	11.6	14.0	7.5	100.0
1977	1.2	7.6	3.1	3.7	7.8	8.5	29.3	28.4	8.5	1.9	100.0
1978	2.3	7.0	5.5	3.3	7.5	14.1	10.6	19.4	4.4	1.2	100.0
	SMALL[c]					MEDIUM[c]		LARGE[c]			

[a]Inertia weight = Curb weight + 300 lbs. Weight of each class corresponds to midpoint.

[b]May not add due to rounding.

[c]Small, medium, and large size classes - ANL staff estimates. Due to "upsizing" and "downsizing," inertia weight classes corresponding to small, medium, and large sizes shift over time. At times, the breakpoint between vehicle size classes falls within an inertia weight class (e.g., see 1968, 1973, 1974, 1975, 1976, 1978).

Source: Market Shares - J.D. Murrell, *Light Duty Automotive Fuel Trends Through 1978*, SAE Technical Paper #780035 (February 27 - March 3, 1978, Appendix A).

The following projections of future stock and sales by size class assume considerable downsizing between 1978 small, medium, and large cars and their 1985 counterparts. In all cases, future small, medium, and large cars are assumed to have passenger capacities of 2-4, 4-5 and 6, respectively. Table 2.6 presents the major size class assumptions used in this analysis. Additional detail on inertia weight class projections is provided in Appendix A.

2.3.1 Fleet Auto Projections

Fleet travel demand is closely tied to economic activity, both in general, and in the specific sectors that rely most heavily on fleet auto use. Although the fleet auto stock has grown consistently, growth has been greatest during periods of relative economic prosperity and slowest during recessionary periods. In the absence of rapid, unanticipated growth in such large-scale substitutes for fleet auto travel as telecommunications* or vastly improved public transportation networks, and assuming no major shifts in industrial location patterns, future fleet auto demand is expected to be a function of employment levels and industrial output.

Because of certain anomalies associated with the recent trend toward smaller fleets, such as the rise of automotive leasing and its effect on fleet stock (see Section 2.1), this analysis is focused primarily on autos in fleets of 10 or more. Using data generated by the INFORUM input-output

Table 2.6. Automobile Size Class Assumptions, 1975-2000

		1975	1985	1990	1995	2000
New Sales						
	Small (%)	35	40	40	40	40
	Medium (%)	25	25	30	25	25
	Large (%)	40	35	30	35	35
Stocks						
	Small (%)	30	38	40	40	40
	Medium (%)	25	25	25	25	25
	Large (%)	45	37	35	35	35
Passenger Seating Capacities						
	Small	2-4	2-4	2-4	2-4	2-4
	Medium	5	4-5	4-5	4-5	4-5
	Large	6	6	6	6	6

*As with such prior communications improvements as the direct-dial telephone, the conference call, and facsimile transmission, future telecommunications breakthroughs are expected to increase communication, not to replace travel.

model [Ref. 12] with economic inputs from DRI's (Data Resources, Inc.) TRENDLONG forecast [Ref. 13]* autos in fleets of 10 or more were projected out to the year 2000; autos in fleets of 4 to 9 vehicles were extrapolated based on historical trends. Key economic inputs are listed in Appendix A, while fleet auto projections are presented in Fig. 2.1.

As Fig. 2.1 indicates, fleets of 10 or more vehicles are projected to grow fairly rapidly through 1985 at a rate comparable to their 1967-70 pace, and then to taper off slightly through the end of the century. In terms of the split between fleet and non-fleet sectors, fleets of 10 or more are expected to grow from their present share of 6.5% of total autos in operation to 7.8% by 1985, and 9.2% by the year 2000. Due to the projected decline in small fleets, total fleet autos are projected to rise from 11% of total autos in use to 12.3% by 2000.

The trend toward smaller-sized fleet-autos is expected to continue. Based on responses from a recent survey [Ref. 14], it appears that very small (i.e., 2-4 passenger) cars could represent a significant share of new-fleet autos. Assuming that this growth in small vehicles would be accompanied by a similar growth in mid-sized vehicles, new fleet autos were assumed to be 14% small, 40% mid-sized and 46% large. By 2000, this split was projected to be 20% small, 40% medium, and 40% large [Ref. 15].

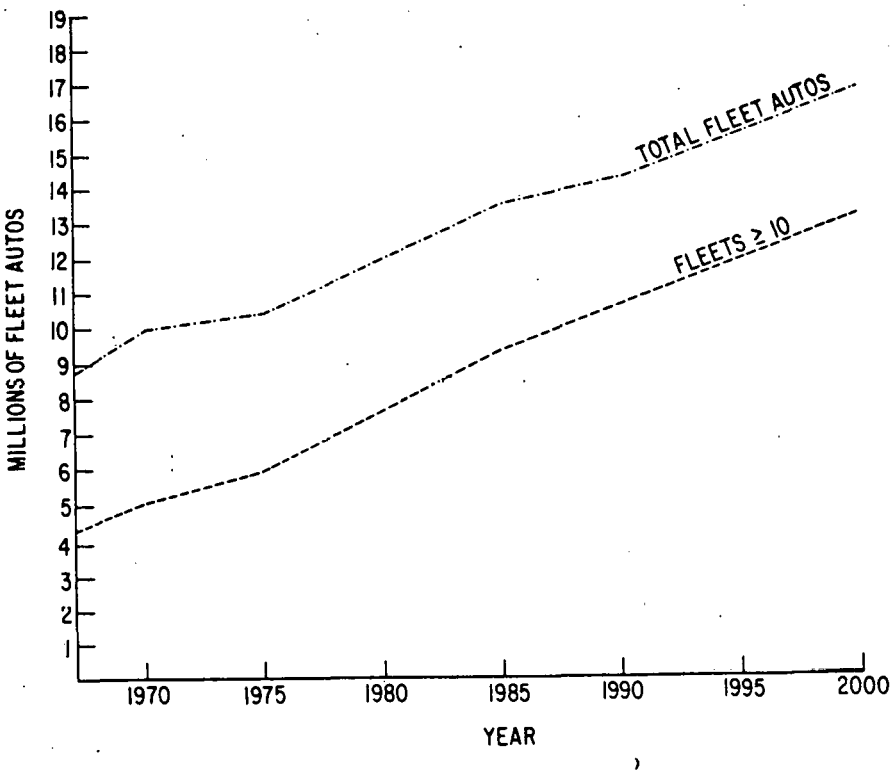

Fig. 2.1. Fleet Autos in Use 1967-2000

*As extrapolated by ANL staff.

Because of the rapid turnover in fleet automobile stock, the projected size distribution of the stock (as shown in Table 2.7) is quite similar to the size distribution of new-fleet autos.

2.3.2 Non-Fleet Auto Projections

As personal vehicles, the non-fleet auto stock grows as a result of household travel demand. Although this category is tied to general economic conditions, most researchers have found demand to be derived largely from lifestyle characteristics (primarily residential and workplace location), population density, and demographics. In the absence of constructing detailed scenarios of household travel behavior, the non-fleet auto stock generally is projected as a function of the number of consuming units (e.g., total population, households, or licensed drivers) available to use the stock and the disposable income that will enable them to purchase and operate it.

Because the licensed driver is the actual user, it may be argued that stock should be projected as a function of licensed drivers. However, because travel generally is household-based, the number of licensed drivers/household seems to be a more appropriate choice. Moreover, trends in this ratio make it particularly well suited to long-range projections. Historically, the number of licensed drivers has grown faster than the number of households and has produced an increasing ratio of drivers/household. However, this ratio was a function of the large population of young people who did not establish their own households until quite recently. Household formation rates have been increasing as the "baby boom" generation ages. Although the driving participation rate is expected to continue growing, household formation will likely keep pace, such that an almost constant ratio of licensed drivers per household should prevail through the year 2000. Table 2.8 illustrates this effect.

Thus, the number of households and household income may be considered the key variables in projecting non-fleet automobile stock. Using anticipated growth rates for these variables (see Appendix A), total auto stock

Table 2.7. Projected Fleet Auto Stocks by Size Class, 1975-2000

	Small		Medium		Large		Total	
Year	Vehicles (10^3)	Share (%)	Vehicles (10^3)	Share (%)	Vehicles (10^3)	Share (%)	Vehicles (10^3)	Share (%)
1975	730	7	3961	38	5734	55	10,425	100
1985	1740	13	5350	40	6290	47	13,380	100
1990	2260	16	5650	40	6215	44	14,125	100
1995	2760	18	6135	40	6445	42	15,340	100
2000	3320	20	6635	40	6635	40	16,590	100

Table 2.8. Population, Households, and Licensed Drivers, 1960-2000 (10^6)

	Population (Series II) [Ref. 16]	Number of Households (Series B) [Ref. 17]	Licensed Drivers [Ref. 18]	Licensed Drivers* per Capita [Ref. 18]	Drivers* per Household [Ref. 18]
1960	180.7	52.8	87.3	0.48	1.65
1965	194.3	57.4	98.6	0.51	1.72
1970	204.9	63.4	111.6	0.54	1.76
1975	213.5	71.7	129.8	0.61	1.81
1985	232.9	87.2	156.3	0.67	1.79
1990	243.5	94.3	166.6[b]	0.68	1.77
1995	252.8	99.9	176.2[b]	0.70	1.76
2000	260.4	104.2	185.4	0.71	1.78

was projected to the year 2000. In the absence of major shifts between autos and trucks, this unadjusted projection would be acceptable. However, because a considerable portion of large auto sales is expected to continue shifting to light trucks (particularly in the near term), the projection was adjusted to reflect this shift. This adjustment was developed from projections of minitruck stock (i.e., trucks $\leq$ 4500 lbs. GVW) and general information on the proportion of personal use vehicles in the current light truck stock [Ref. 19]. (See Section 3.)

Table 2.9 presents adjusted projections of total autos in use, fleet and non-fleet autos, personal-use fleet autos, personal light trucks, and total personal-use vehicles. Table 2.9 also presents selected ratios of projections to total population, households, licensed drivers, employment and GNP. Based on these ratios, the ANL projection seems reasonable. Despite the continued decline in household size (which is expected to begin to level off after 1990), the projections still appear reasonable.

Table 2.10 and Fig. 2.2 compare the adjusted ANL projections of total auto stock (i.e., autos in operation) with comparable projections developed by other researchers.* Although within a reasonable range of these other efforts, the ANL stock projection is somewhat lower than most, reflecting an assumed auto to light truck shift.

*The Data Resources, Inc. (DRI) Model [Ref. 21] projects both autos and light trucks, and a light truck model will supplement the auto forecast in the Wharton Model [Ref. 22] in the near future.

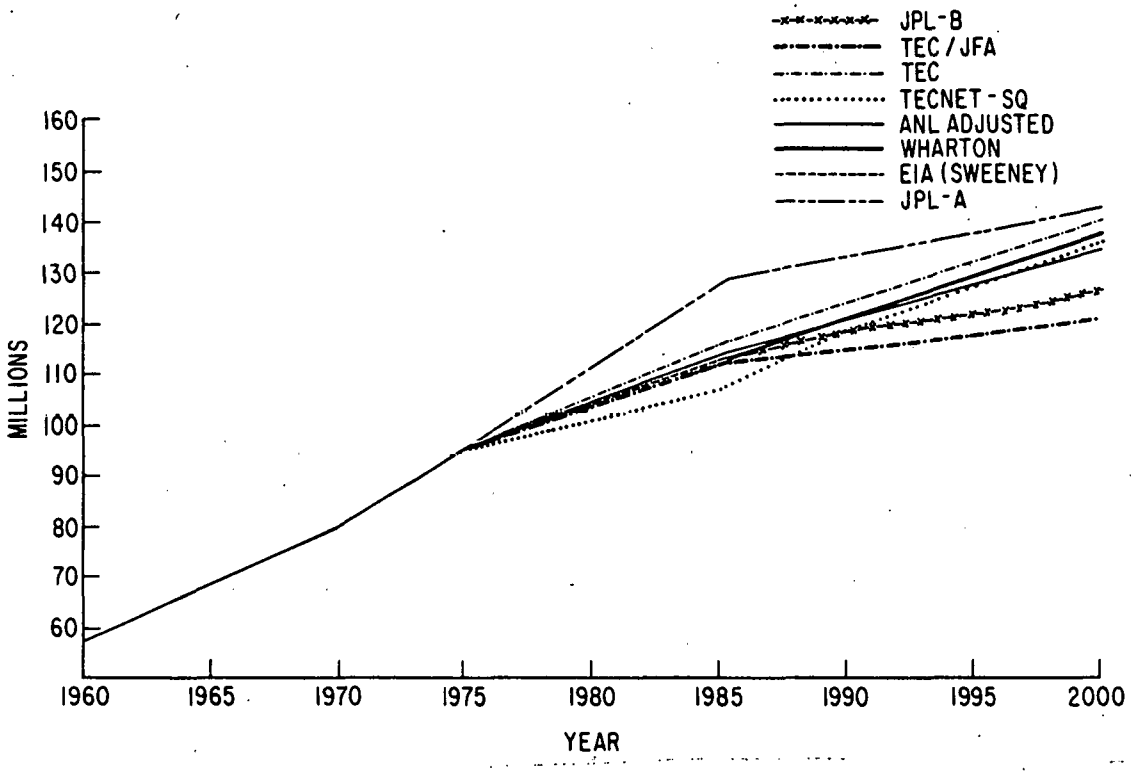

Fig. 2.2. Selected Projections of Autos in Use, 1975-2000

Using the adjusted stock projection and survival rates calculated from historical data, new car sales were projected to the year 2000. Sales were distributed between fleet and non-fleet sectors, small-and large-size classes, and domestic and imported types. Table 2.11 presents these projections and the assumptions used to develop them. Figure 2.3 compares the ANL total sales projection with historical data and comparable Wharton, DRI, ADL, and Aerospace projections. [Refs. 21-24] Historically, new car sales have shown substantial fluctuations from year to year, primarily as a result of economic conditions (actual or perceived, either immediately or following a brief time-lag). Because of this, although sales projections tied to macroeconomic forecasts (e.g., Arthur D. Little) tend to be more variable than trend-derived projections (e.g., Argonne National Laboratory), both types of projections contain a wide margin of error for any single year. Thus, although the ANL projections compare quite favorably with those shown, they should be viewed with caution, recognizing that each point has a different (and unknown) confidence interval associated with it.

2.4 SUMMARY AND CONCLUSIONS

This paper presents projections of total automobile stocks and sales for fleet and non-fleet sectors.* Total auto stock is projected as a func-

*Personal use vehicles are also estimated as the sum of all non-fleet autos and personal light trucks, as well as a fixed portion of all fleet autos (based on current personal use of fleet vehicles).

Table 2.9. Automobile Stock Projections and Ratios, 1975, 1985, and 2000

	1975	1985	2000
Stock (millions)			
Autos in Use (Unadjusted)	95.2	116.7	139.8
Auto Adjustment[a]	-	2.7	4.3
Autos in Use (Adjusted)	95.2	114.0	135.5
Personal Light Trucks	10.3	20.8	26.9
Fleet Autos[b]	10.4	13.4	16.6
Personal-Use Fleet Autos[d]	2.4	3.3	4.1
Non-Fleet Autos	84.7	100.6	118.9
Total Personal Use Vehicles[c]	97.4	124.7	149.9
Ratios			
Autos (Adjusted)/Capita	0.45	0.49	0.52
Autos (Adjusted)/Licensed Driver	0.73	0.73	0.73
Personal Vehicles/Capita	0.46	0.54	0.58
Personal Vehicles/Household	1.36	1.44	1.44
Personal Vehicles/Licensed Driver	0.75	0.80	0.8
Personal Autos/Household	1.21	1.19	1.18
Fleet Autos/Employee	0.13	0.12	0.12
Fleet Autos/$10^3 GNP (1975 dollars)	0.007	0.005	0.005

[a]Estimated shift from autos to light trucks. Assumes peak in early 1980s and gradual decline thereafter.

[b]Fleets $\geq$ 4 vehicles. Fleets $\geq$ 10 vehicles are projected as: 5.9('75), 9.2('85),10.5 ('90), 13.0(2000).

[c]Personal light trucks, non-fleet autos, and fleet autos used for personal purposes.

[d]ANL estimates projected at approximately one-quarter of the fleet stock based on survey data on vehicles available to, but not owned by, household members as reported in Ref. 5.

Table 2.10. Projection of Number of Automobiles in Operation (10^6)

	1950	1955	1960	1965	1970		Annual Growth Rate 1950-75
Historical	35.9	47.4	57.1	68.9	80.4		4.0
Projections	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**Annual Growth Rate (Base Year To Target Year)**
ANL	95		114	121	129	136	1.4
TEC-78	95		117			140	1.6
OTA-B	95		118			148	1.8
OTA-PC	95	109	117			141	1.6
OTA-IM	95		118			148	1.8
Wharton-79[a]	96	105	114	125	134	146	1.7
DOT/TSC	96[b]	100	110	120	129	136	1.6
McNutt/Clulla[a]	99[c]	108	117	126	131		1.5[d]
DRI	94[c]	100	107	117	128	137	1.6
NTPSC-I	95		110			145	1.7
NTPSC-II	95		110			145	1.7
NTPSC-III	95		112			153	1.9
Dupoint	95	107	117	123			1.7[e]
Ratio: High/Low	1.1	1.1	1.1	1.1	1.0	1.1	

[a]Totals are year-end estimates.

[b]1978 estimate.

[c]1976 data.

[d]1976-1995.

[e]1975-1990.

Source: See Appendix A.

Table 2.11. Projections of New Car Sales, 1975-2000 (10^6)

Table 2.11 Projections of New Car Sales, 1975-2000 (10^6)

	1975	1985	1990	1995	2000
Total Auto Stock	95.2	114.0	121.1	128.8	135.5
Survival Rate[a]	0.91	0.91	0.91	0.91	0.91
Total Auto Sales					
Small[b] -Domestic	1.43	3.00	3.14	3.34	3.53
Import[c]	1.59	1.80	1.88	2.00	2.12
Medium	2.16	3.01	3.77	3.34	3.53
Large[d]	3.46	4.21	3.77	4.67	4.95
Total	8.64	12.02	12.56	13.35	14.13
Fleet Auto Sales[e]					
Small	0.29	0.60	0.73	0.91	1.11
Medium	1.30	1.73	1.82	2.02	2.21
Large	1.66	1.99	2.01	2.12	2.21
Total	3.26	4.32	4.56	5.05	5.53

[a]Calculated from Ref. 9, p.34.

[b]Average capacity = 4 passengers.

[c]Assumes imports drop from 18.4% of new car sales (1975) to 15% (1985) and retain that share through 2000. Includes captive imports.

[d]Average capacity = 5 passengers.

[e]Assumes uniform, moderate growth in stock and gradual reduction in average replacement age as business and lease-rental vehicles (with generally lower replacement ages), grow to comprise a larger share of fleet stock.

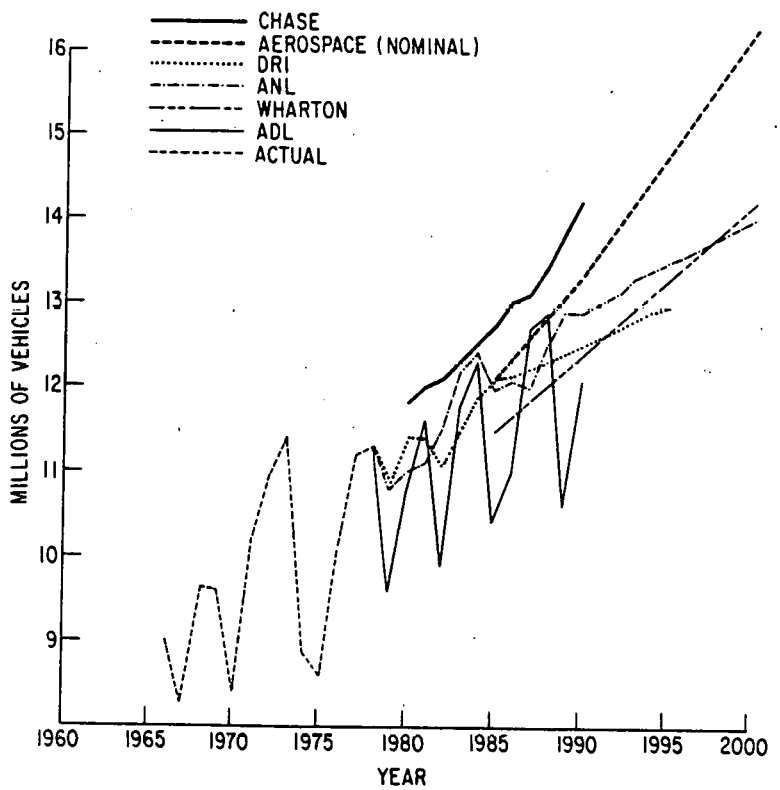

Fig. 2.3 New Car Sales, 1960-2000

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3 PROJECTIONS OF LIGHT TRUCK STOCK AND SALES

3.1 BACKGROUND

Truck sales have shown strong increases in the past decade; from 1966 to 1976, there was a 7% average sales increase. Trucks weighing less than 10,000 pounds gross vehicle weight (commonly referred to as "light" trucks) have experienced the greatest production increases, and are projected to continue the accelerated growth rate seen in the 1970s. By 1990 light trucks are expected to taper off to a growth rate similar to that of the auto market. As light trucks take a greater percentage of the truck fleet, the overall composition has begun to emphasize personal rather than commercial use for tripmaking. Historical use characteristics of light trucks have been examined, and projections have been made of the total light truck stock to the year 2000 by relating trend extrapolation for personal light truck use and sectoral growth in employment and output for nonpersonal use.

3.1.1 Definitions of Terms

For the purposes of this report, light trucks are defined as all trucks having less than 10,000 lbs gross vehicle weight (GVW). GVW includes the vehicle weight plus carrying capacity. Curb weight is the weight of the vehicle unloaded. Truck registrations are determined by a gross vehicle weight rating class; light trucks are divided into Class I ($\leq$ 6,000 lbs GVW) and Class II (6,001 - 10,000 lbs GVW). As a further explanation of light truck classes, some researchers have used the terms "light-light" ans "heavy-light" to describe Class I and Class II, respectively. Table 3.1 presents historical production data of three weight range boundaries. The 0-6,000 lb, 6,001-8,500 lb, and the 8,501-10,000 lb columns include light duty trucks that may fall into two GVW ranges because of suspension characteristics of the vehicle. It has been to the manufacturer's advantage to increase the GVW of some models to avoid emission and fuel economy standards. Table 3.1 shows that there was a sudden increase in 1968 production of 6,001-8,500 lb GVW light trucks. Since federal emissions standards became effective in model year 1968 for trucks $\leq$ 6,000 lbs GVW, this may be an example of manufacturers increasing GVWs on some models to avoid the standards. Beginning with model year 1979, trucks $\geq$ 6,001 lbs GVW will be subject to fuel economy standards; in model years 1980-81, the fuel economy standards will be extended to include trucks up to 8,500 lbs GVW.* Table 3.1 shows that light trucks weighing 8,500-10,000 lbs have historically taken a very small percent of total production; but, that percentage is increasing. New U.S. registrations

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*The National Highway Traffic Safety Administration [Ref. 25] has issued the following average fuel economy standards for light trucks having two- and four-wheel drive:

Model year 1979 ($\leq$ 6,000 lbs. GVW)
- 4 X 2s - 17.2 mpg
- 4 x 4s - 15.8 mpg

Model year 1980 ($\leq$ 8,500 lbs. GVW)
- 4 X 2s - 19.2 mpg
- 4 X 4s - 16.2 mpg

Model year 1981 ($\leq$ 8,500 lbs. GVW)
- 4 X 2s - 20.5 mpg
- 4 X 4s - 17.7 mpg

Table 3.1. New Registration of Light-Duty Trucks by Gross Vehicle Weight Class Range [Ref. 26]
(10^3)

Model Year	Gross Vehicle Weight Range (Pounds)					
	0-6000	0-6000 and 6001-8500	6001-8500	6001-8500 and 8501-10,000	8501-10,000	Total
1967	949	262	4	73	0	1288
1968	1087	37	275	43	45	1877
1969	1191	32	319	83	2	1627
1970	1085	24	324	77	0	1510
1971	1335	0	410	96	0	1841
1972	1133	477	460	149	0	2219
1973	1899	96	564	179	11	2749
1974	1830	84	530	193	0	2637
1975	656	554	730	176	3	2119
1976	769	733	1143	197	9	2851
1977	854	752	1490	267	28	3391

of domestic and imported trucks weighing less than 10,000 lb GVW is totalled for each year in the far right column of Table 3.1.

Light trucks include five body types. The Chilton Company has described light duty truck body classes as follows: [Ref. 27]

- A conventional truck with a two-or four-door cab and an open top cargo-carrying bed.
- A conventional cab vehicle with an extended hood on a light truck chassis providing passenger and cargo capacity within the body. It is a truck version of a passenger station wagon.
- Any vehicle normally referred to as a rough terrain or "Jeep" type. The vehicle design is characterized as having very little front and rear overhang. It is equipped for off- and on-highway use.
- A rectangular vehicle without the traditional long hood of conventional trucks, providing passenger and cargo capacity within the body. It has a relatively high cargo capacity.

- Similar to a van but much higher and with standard seating capacity limited to the driver and one passenger (i.e., the typical bread van or commercial laundry delivery van). The vehicle has none of the qualities of a passenger car, and is primarily intended for low speed intracity deliveries.

3.1.2 Trends

3.1.2.1 Light Truck Sales

Table 3.2 presents motor vehicle manufacturer's 1970-1977 U.S. sales data by body type for light-duty trucks. Total light-truck sales have increased by 42% in the representative seven years. Pickups, utility trucks, and vans have had the most dynamic markets. Pickup sales increased by 46% in 1970-1977, and increased 17% in 1977 alone. Vans captured 7% of the total light-truck market in seven years, and sales are climbing to record highs in the 6,001-10,000 lb GVW range. Utility trucks also have increased sales. The Class II weight range sales for 1978 were about 50% higher than the 1977 sales [Ref. 28]. Figure 3.1 shows sales trends by body type, and Fig. 3.2 shows the distribution of light truck sales by body type for the past seven years. Also shown in Fig. 3.2 are examples of each body type.

3.1.2.2 Light Truck Use

The best available data on light truck use is found in 1963, 1967, and 1972 Truck Inventory and Use Survey (TIUS) [Ref. 29]. Table 3.3 shows total light trucks used in nine major use sectors from 1962, 1967, and 1972 Census of Transportation data. Excepting wholesale and retail trade, which shows a 7% decrease from 1967-1972, the number of light trucks has increased in the other use sectors listed.

Widespread sales of vans, pickups, and utility trucks for personal transportation are the most significant contributors to this growth. Personal use includes those trucks substituted for autos in home-to-work and outdoor-recreation trips. Table 3.3 shows that over one-half of all light trucks were used exclusively for personal transportation in 1972. Appendix B examines light truck use in more detail. The second largest user of light trucks is the service and utility sector including: telephone, electric, gas, and utility uses. Fleets have been down-sized in this sector, and the ratio of employee-to-vehicle has decreased over the years. Trips are being consolidated to such an extent that employees have begun to use the light-duty truck as their offices. Headquarter dispatching services provide continuous job-order updates to employees so that they are not required to report to a centralized distribution headquarters during the workday.

Other sectors, such as for-hire, manufacturing and mining, wholesale and retail trade, and forestry and lumber are taking smaller shares of the market as personal use continues to expand. Heavier, three-axle single-unit

Table 3.2. Light Truck Sales by Body Type, 1970-1977 [Ref. 27]

Body Type	1970	1971	1972	1973	1974	1975	1976	1977
Pickup	898,814	1,130,463	1,334,402	1,711,906	1,430,214	1,190,835	1,660,222	1,937,716
Suburban	41,898	64,330	69,186	109,718	78,399	83,242	114,062	139,903
Utility	95,156	120,660	151,331	183,775	214,766	196,626	254,632	294,633
Van	168,091	215,700	298,652	343,419	391,414	382,813	490,849	526,612
Multi-Stop	47,502	72,097	77,539	88,696	42,787	37,019	54,137	56,258
Total	1,251,451	1,603,250	1,931,110	2,437,514	2,157,580	1,890,535	2,573,902	2,955,122

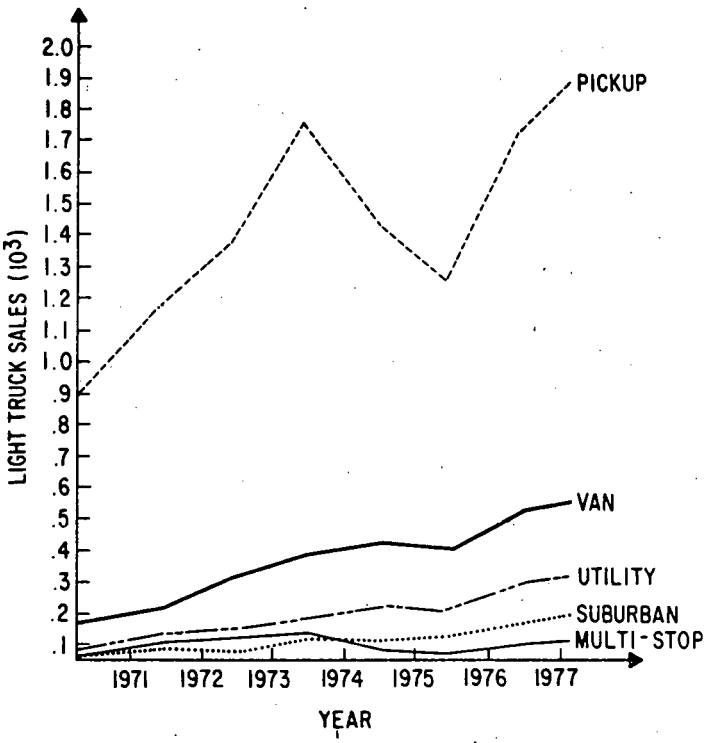

Fig. 3.1. Light Truck Sales by Body Type, 1970 - 1977

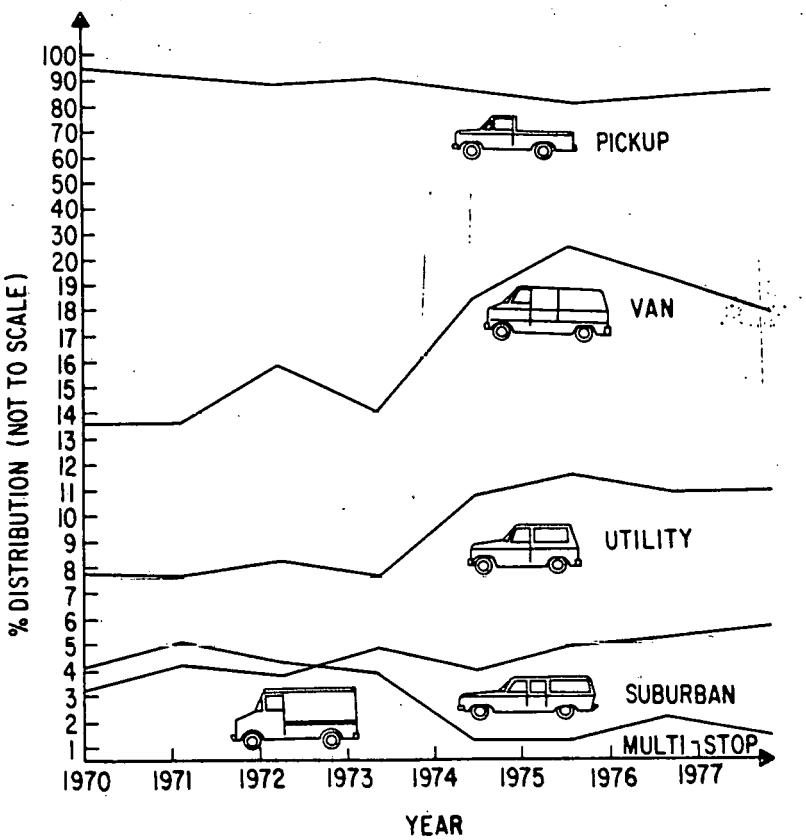

Fig. 3.2. Body Type Sales as a Percent of Total Light Truck Sales, 1970 - 1977

Table 3.3. Distribution of Light Truck Use by Sector 1963, 1967, and 1972 [Ref. 30]

Use Sector	1962 Total (10^3)	1962 % Dist.	1967 Total (10^3)	1967 % Dist.	1972 Total (10^3)	1972 % Dist.	Annual Rate of Growth (%)
Agriculture	2,620	29.6	2,671	23.6	2,934	20.1	1.27
Personal	3,072	34.7	5,070	44.8	7,795	53.4	10.90
For Hire	115	1.3	68	0.6	87	0.6	3.05
Construction	858	9.7	939	8.3	1,007	6.9	1.80
Manufacture & Mining	239	2.7	192	1.7	219	1.5	-0.97
Wholesale & Retail	920	10.4	962	8.5	890	6.1	-0.37
Services & Utilities	796	9.0	962	8.5	1,489	10.2	7.21
Forestry & Lumber	88	1.0	113	1.0	73	0.5	-2.06
Other	141	1.6	407	3.6	175	1.2	2.43
Total	8,853		11,318		14,598		5.71

trucks predominate in these sectors [Ref. 29], so it is not surprising that the light-truck use distribution continues to decline in these sectors.

- Personal Light Truck Use. The growth in light trucks for personal use is determined by several factors, but it seems reasonable to associate recent growth of light trucks in this sector to recreational travel growth as well as the required downsizing made in automobiles to achieve fuel economy and emission standards. Personal light-truck sales growth has been largely at the expense of automobile sales. It can be hypothesized that automobile performance reduction because of emissions standards and downsizing have sent auto buyers to the light-truck market.

- Non-Personal Light Truck Use. Table 3.4 compares all non-personal uses for the three TIUS years. Agricultural use dominates in this sector. Wholesale and retail trade has a large share of heavier, three-axle, single-unit trucks because this sector requires vehicles to have greater carrying capacities than others. The government's use of light trucks is largely for service tripmaking where capacity is not a necessary requirement. Table 3.5 gives historical trend data for government ownership from 1960-1975 showing a slow, but constant, average annual rate of growth of 5.75%.

Table 3.4. Distribution of Non-Personal Light Truck Use by Sector, 1963, 1967, and 1972

Use Sector	1962		1967		1972	
	#Lt. Trucks (10^3)	% Dist.	#Lt. Trucks (10^3)	% Dist.	#Lt. Trucks (10^3)	% Dist.
Agricultural	2620	41.2	2671	38.0	2930	37.9
For Hire	115	1.8	68	0.9	87	1.1
Construction	858	13.5	939	13.3	1007	13.
Manufacturing & Mining	239	3.7	192	2.7	219	2.18
Wholesale & Retail	920	14.4	962	13.7	890	11.5
Services & Utilities	796	12.5	962	13.7	1489	19.2
Forestry & Lumber	88	1.4	113	1.6	73	.9
Other	141	2.2	407	5.8	175	2.2
Government	586	9.2	713	10.1	861	11.1
Total	6363		7027		7735	

Table 3.5. Size of Government-Owned Light Truck Fleet, 1960-1975

Year	Total Light Trucks	% Change
1960	497,225	--
1963*	586,362	15.2
1965	645,787	9.2
1967*	713,342	9.4
1970	814,674	12.4
1971	847,591	3.8
1972	861,405	1.6
1973	898,642	4.1
1974	957,609	6.1
1975	992,805	3.5

*Year 1963 and 1967 data are interpolations of the 1960-1965 and 1965-1970 data. All data represents 85% of the total truck fleet and includes federal, state, county, and municipal vehicles. Military service vehicles are not included.

3.1.2.3 Trip Characteristics

Light-truck trips for personal use generally have irregular length and route characteristics, and below average mileage. Conversely, service and utility, manufacturing, and wholesale/retail light-truck trips have more regular characteristics of length, loads, and routes. The Truck Inventory and Use Survey [Ref. 29] defines truck area of operation into three categories:

- Local - mostly in the local area (in or around the city and suburbs, or within a short distance of the farm, factory, mine, or place vehicle is stationed);
- Short range (short haul) - 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 [the] vehicle is stationed;
- Long range (long haul) - mostly over-the-road trips that usually are more than 2000 miles one way to the most distant stop from the place [the] vehicle is stationed.

The 1972 data for pickup, panel, and multi-stop trucks by personal, agriculture, manufacturing, services/utilities, and wholesale/retail trade uses was studied to determine the predominant range of operation by body types. The TIUS data covers only the area of operation data for pickups, panel trucks, and multistop trucks. Panel trucks described in the survey are comparable to vans described in the Motor Vehicle Manufacturer's data [Ref. 27]. Panel trucks are being phased out of domestic productions.

The TIUS area of operation tables show that most light trucks for goods and services are used for local trips close to the central distribution sites. In most cases, 90% of the truck trips in all sectors were local. Manufacturing trips are longer than other sectors. The multi-stop manufacturing trucks are used for the longest trips; 20% are taken beyond the local area (less than 200 miles). The pickup truck is used for an average of 58% of the trips in the four sectors, while the panel truck is used for an average of 35% of all trips in the nonpersonal use sectors considered. Long-haul truck trips are negligible for all sectors, although light truck annual miles are increasing [Ref. 29]. Pickup trucks capture all of the light truck trips for long haul, except for a negligible amount of panel trucks used in services.

Although 59% of the light trucks in 1967 and 1972 were in the mid-range of annual mileage (10-30 thousand), in 1972 more light trucks traveled higher annual mileages (i.e., 5% of 1972 vehicles traveled more than 75,000 miles). Because of the increased sales from 1967-1972, it can be assumed that there was a greater number of newer vehicles in the fleet, which increases the average annual mileage. Light trucks, ten years and older, contributed most significantly to annual mileage category of less than 10,000 for each survey year studied; whereas, newer trucks of less than five years old, added significantly to the higher categories. Personal use pickup trucks have a fairly uniform distribution of annual mileages from 4-20 thousand miles per year, which does not differ from other pickup uses. Because of the large numbers of recreational trips taken with a pickup, it is surprising that this is the case. Most pickups are in the 8000 - 10,000 mi/yr category; this is also true

for services and utilities. Wholesale/retail trade and manufacturing all show the largest percentage of pickups in the 15,000-20,000 mi/yr category.

Multi-stop trucks for service trips are in the highest mileage ranges; 63% of multistop trucks in service industries exceed 10,000 mi/yr and 60 mi/ day (assuming 250 working days and as much as 15,000 mi/yr). Light duty trucks for manufacturing show high annual mileages for all body types, but such trips generally are made by larger vehicles between distribution points. Light trucks in manufacturing usually are heavier (8,501 - 10,000 lb GVW), and have greater carrying capacity than is represented in other sectors.

Interesting variations exist for utility truck tripmaking. Pickup and panel trucks have fairly standard distributions of annual mileage, but multi-stop trucks are primarily in the range of 6,001 to 8,000 mi/yr. This low annual mileage may be attributed to the age of the multi-stop trucks in the utility sector. Only 4.8% of service vehicles are multi-stops, so the data may be distorted because of the low representation rather than the fleet age. Table 3.6 summarizes local tripmaking characteristics of each sector by body type.

3.2 PROJECTIONS OF LIGHT TRUCK STOCK

The burgeoning sales growth of light trucks in the past decade has captured the interest of government and industry for several reasons, especially in the areas of energy and air emissions regulations. Because the light truck sales are becoming largely oriented toward personal use rather than goods and utility use, a great deal of uncertainty exists concerning future use mixes.

Table 3.6. Local Light Truck Trips by Use Sector, 1972 [Refs. 29, 31]

Use	Total (10^3)	Local Total (%)	Percent by Body Type		
			Pickup	Van	Multistop
Personal	7719	90.4	85.2	4.8	0.4
Services/ Utilities	1489	91.3	53.6	32.8	4.9
Agriculture	2934	96.6	95.3	1.1	0.4
Other	--	81.9	67.4	10.3	4.2
Government	--	15.0	--	--	--
Wholesale/ Retail	890	91.0	44.5	28.5	18.0
Manufacturing	219	85.3	60.2	20.3	4.9

The projection presented here represents a "bottoms up" light truck stock projection, aggregating the use sectors to a final stock value. Personal, service/utility, wholesale/retail, manufacturing, agriculture, government, and "other" uses of light trucks were projected separately to determine the aggregate light truck stock in the year 2000, as shown in Table 3.7.

3.2.1 Methodology

Various methods were used to arrive at best estimate projections of light truck stock for the years, 1975-2000. Although the most reliable projections were felt to be trend extrapolation for non-personal and personal use, another projection was calculated on the basis of socio-economic changes such as population, income, households, and employment, and on their resulting impact on the light truck stock for each federal region.

Table 3.8 shows aggregate light truck projections which were obtained in a large part from simple trend extrapolation of 1963, 1967, and 1972 light truck stock data. The linear growth projection with the following light truck stock by five-year increments gives a low growth. Available 1975 light truck stock data indicate that more than 19 million light trucks were registered in 1975. This exceeds the 1980 trend extrapolations in Table 3.8; so, it is assumed that historical trending in this manner will not be adequate, and that the actual future light truck stock will not be similar to 1963, 1967, and 1972 growth. Light truck stock growth by use sector is projected in the remainder of this section.

Table 3.7. Light Truck Stock Projections by Use
(10^6)

Use Sector	1975	1985	1990	1995	2000
Personal	10.3	20.8	22.6	25.4	26.9
Agriculture	3.1	3.6	3.8	3.9	4.0
Manufacture & Mining	0.3	0.6	0.7	0.7	0.8
Wholesale & Retail	0.9	1.0	1.0	1.0	1.0
Services & Utilities	2.2	4.7	6.2	6.8	7.3
Government	1.1	1.2	1.3	1.3	1.4
Other	1.4	1.6	1.6	1.7	1.8
Total	19.3	33.5	37.2	40.8	43.2

Table 3.8. Aggregate Light Truck Projections Using Data from 1963, 1967, and 1972

Projection Year	Light Truck Stock (10^6)
1963	8.8
1967	11.3
1972	14.6
1975	16.5
1985	22.9
1990	26.0
1995	29.8
2000	32.5

3.2.2 Projections of Personal Use

The ratios of personal light trucks per thousand people was used to develop a growth trend that was considered to be the best estimate for the personal use sector. Three projections were developed using the Truck Inventory and Use Survey data and Oak Ridge National Laboratory regional growth estimates [Ref. 32].

As Table 3.9 shows, three methods of trend extrapolation give wide variations for personal use projections. The low estimate extrapolates 1963, 1967, and 1972 personal stocks linearly to project a year 2000 total stock of 22.6 million. This is an artificially low estimate that does not reflect the more recent personal use sales increases. The medium estimate extrapolates 1967 and 1972 stocks to the year 2000 total, and the high estimate extrapolates the 1972 and Oak Ridge National Laboratory 1976 personal truck use estimates [Ref. 32]. The 1972-1976 trends will continue for a portion of the projection period, but not to year 2000. The medium estimate provides the most reasonable projections for total year 2000; whereas, the high estimate provides realistic 1975-1990 projections. Figure 3.3 shows the growth of personal light trucks per thousand people for the high, medium, and low estimates. The final projection shows that the ratio will slow its steady growth in 1985.

The final projection is compared with several other ratios shown in Table 3.10. Compared with personal autos, the ratio of light trucks to autos is expected to rise from .13 to .22 over the next 22 years. This compares to 0.06 in 1963. The calculation assumes that 89% of autos are for personal use.

Table 3.9. Projections of Personal Light Trucks, 1963-2000 (10^6)

Projection	1963	1967	1972	1976	1985	1990	1995	2000
Low	3.1	5.1	7.8	9.8	14.6	17.3	20.0	22.6
Medium	3.1	5.1	7.8	9.7	15.9	19.6	23.1	26.9
High	3.1	5.1	7.8	11.4	20.8	26.4	32.5	38.9

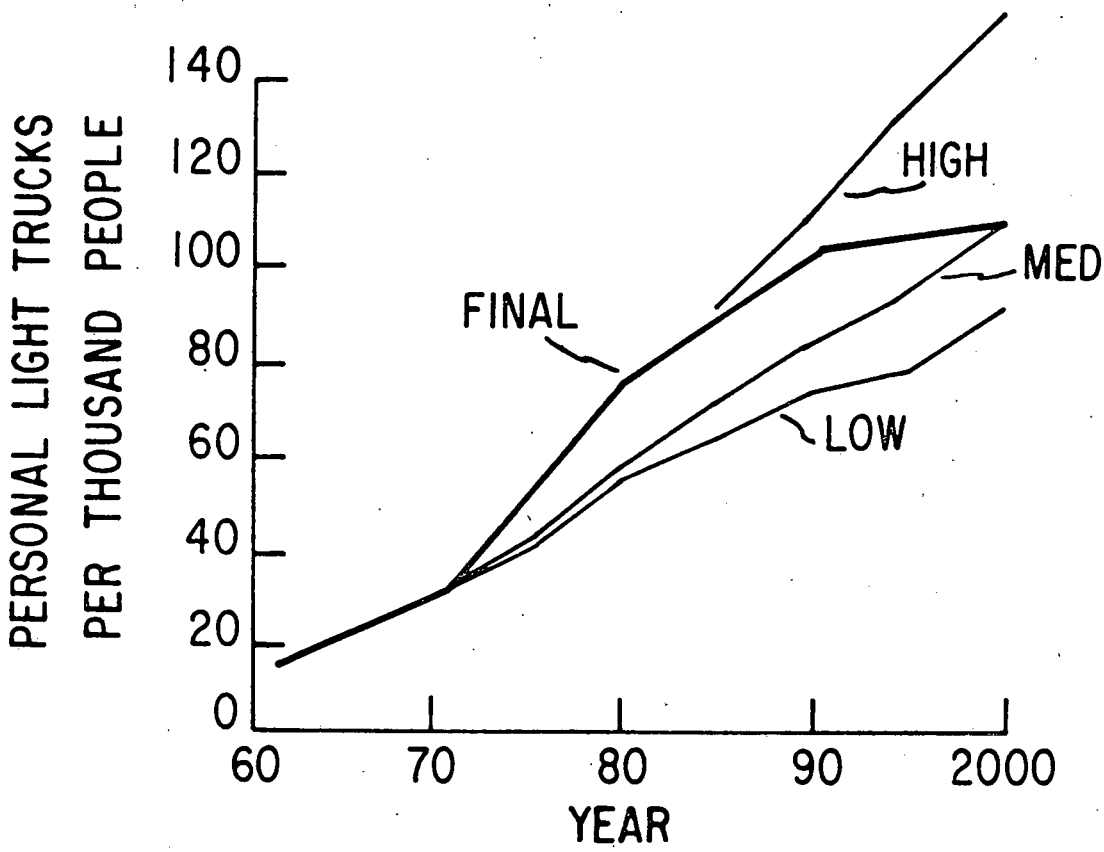

Fig. 3.3. Comparison of Personal Light Truck Projections

Table 3.10. Relation of Projections to Automobiles, Drivers, and Households, 1975, 1985, and 2000

	1975	1985	2000
Projections (10^6)			
Automobiles	95.0	117.0	140.0
Personal autos [Ref. 28]	84.6	104.1	124.6
Light Trucks	19.3	33.5	43.4
Personal Light Trucks	10.3	20.8	27.0
Population	213.0	233.0	260.0
Population 16+ [Ref. 33]	155.7	177.6	199.3
Percent 16+ with Driver's License [Ref. 18]	83.4	88.0	93.0
Licensed Drivers	129.9	156.3	185.3
Ratios			
Personal Light Truck/Auto	0.13	0.15	0.22
Personal Auto & Truck/Capital	0.45	0.52	0.58
Personal Auto & Truck/Licensed Driver	0.74	0.77	0.82
Personal Light Trucks/Capita	0.05	0.07	0.10
Personal Light Trucks/Licensed Driver	0.09	0.10	0.15
Personal Light Trucks/Household [Ref. 32]	0.16	0.18	0.27
Personal Autos/Household	1.18	1.19	1.23
Personal Autos & Light Trucks/Household	1.34	1.37	1.50

Personal autos and personal trucks are expected to increase per capita from 0.45 to 0.58. Personal autos and trucks per licensed driver also are expected to increase from 0.74 to 0.82. The value of 0.82 motor vehicles per licensed driver does not approach a saturation level. Table 3.10 shows that personal trucks, per capita, will double over the next 25 years, but personal trucks per licensed driver will increase only 67%. Households will increase personal auto and light truck ownership by 11% in year 2000.

The calculations in Table 3.10 appear to substantiate the personal light truck projection when the future stock is compared to autos, population, licensed drivers, or households.

3.2.3 Projections of Non-Personal Use

The non-personal light truck projections are based on employment and product growth of agriculture, services and utilities, manufacturing, wholesale and retail trade, government, and "other" uses. The "other" sector includes an aggregate of the for-hire, construction, and forestry and mining use sectors. Employment and product growth was obtained using the INFORUM input/output model developed at the University of Maryland [Ref. 34].

Table 3.11 provides historical information on employment and the ratio of employee to light trucks in each sector. Interesting trends have developed in less than a decade; as agricultural employment decreased, light trucks per farm employee increased. As construction employment increased, light trucks were relatively unaffected; as wholesale and retail trade employment increased by 25%, light truck per employee ratios decreased. In fact, the only industry growth that appears to be directly associated with light truck ownership is services and utilities. Services and utilities employment increased by 25%, while its light-truck-per-employee ratio increased by 30%. Below is a discussion of each sector used to project total non-personal use of light trucks to the year 2000.

3.2.3.1 Projections of Agricultural Use

Agriculture has increased total light truck ownership in the past three truck inventory survey years, despite a decline in agriculture employment during this same period. Agriculture also is contributing to less of the total light truck uses. Although the number of farms is decreasing, single-

Table 3.11. Light Trucks per Employee in Selected Industries for 1962, 1967, and 1972 [Refs. 29, 35]

Industry	1963		1967		1972		Annual Rate of Growth for the Industry
	No. Employed (10^3)	Lt Trucks/ Employee	No. Employed (10^3)	Lt Trucks/ Employee	No. Employed (10^3)	Lt Trucks/ Employee	
Agrucilture	2,027	1.29	1,547	1.73	1,474	1.99	-3.48
Construction	3,012	0.28	3,344	0.28	3,789	0.27	2.58
Manufacture & Mining	17,625	0.01	20,119	0.01	19,672	0.01	1.23
Trucking & Warehousing (for Hire)	900	0.13	1,020	0.07	1,126	0.08	2.52
Wholesale % Retail Trade	11,942	0.08	13,862	0.07	16,013	0.06	3.31
Services & Utilities	11,321	0.07	13,169	0.07	15,065	0.10	3.23

family involvement in weekend farming activities is growing. As totals decrease, single-farm size increases, providing larger employment per farm and a larger output on a per-acre basis. The question of agricultural use projections is complex. The definition of agriculture use for vehicles varies among the states; many vehicles registered for agricultural use often are relegated to other uses. There were problems asociated with projections using declining employment and increasing output; trending agriculture employment, and using INFORUM year 2000 growth rates (see Table 3.12) resulted in unsatisfactorily low light truck stocks. Conversely, using INFORUM agricultural output projections and associating them with high historical output growth gave exceedingly high projections for light trucks in agriculture in the year 2000. Therefore, the projection became a judgmental value, and projected growth is lower than the Oak Ridge projection [Ref. 30], which rises to 6.5 million in the year 2000, and lower than the Lindsey-Kaufman projection [Ref. 35], which rises to 4.0 in year 1995. This is a reasonable projection because the agricultural use will continue to decline as a percent of total uses. Moreover, declining sector employment should not have a noticeable effect on light truck use because the loose method of registering a vehicle for agricultural use will not change.

3.2.3.2 Projections of Service and Utility Use

This sector is assumed to have the largest growth of all the non-personal use sectors. The ratio of light trucks to employee increased from 0.07 to 0.10 in 1973, and that trend is considered to be constant to the year 2000, with 0.265 employees per light truck in the service/utility sector. In 1972, employment in the services, electric, gas, and sanitary sectors is projected to grow acording to INFORUM [Ref. 34] which shows a 43% growth from 1971 to 2000, with the growth slowing in 1990. The light truck projections for this sector follow the INFORUM employment growth.

The year 2000 ratio of employees to light trucks is applied to the total year 2000 employment in services/utilities of 26,482; the total light trucks in 2000 is equal to 7.3 million. Rapid acceleration occurs until 1990 when the sector decreases its growth rate. It is assumed that utilities will be high growth industries throughout the projection time period and that

Table 3.12. Projected Employment in Selected Industries (10^3) [Ref. 34]

Industry	1971	1977	1985	2000
Agriculture	3,744	2,674	2,206	1,807
Mining	340	338	359	337
Construction	4,331	4,327	4,327	4,421
Trucking	1,240	1,497	1,497	1,522
Wholesale & Retail	17,800	20,908	24,092	26,365
Service & Utilities	18,489	23,285	28,390	32,501

business services, repair services, health and educational services, and other professional services also will continue to grow.

3.2.3.3 Projections of Manufacturing Use

As output increases, employment will stabilize in this sector. The ratio of trucks/employee remained stable from 1963 to 1972. Because manufacturing is highly affected by technological changes and productivity, employment was not used as a measure of light truck growth in this sector. Instead, the growth rate of durable and nondurable goods output [Ref. 38] to the year 2000 was used to project manufacturing use. A 3.6 percent annual growth rate occurs from 1971-2000. When this growth rate is applied to 1972 manufacturing employment, light trucks grow from 0.2 to 0.7 million in the year 2000. Light trucks grow rapidly to 1990 in the manufacturing sector, then growth tapers off.

3.2.3.4 Projections of Wholesale and Retail Trade Use

Employment in the wholesale/retail trade sector is expected to grow significantly to the year 2000. However, historical growth trends show that the ratio of trucks per employee decreased from 1963 to 1972. This ratio is assumed to continue to decrease to 0.5 trucks per employee by 1985, and then to stabilize at that ratio to the year 2000. In 1985 there will be one million light trucks used for wholesale/retail trade, and that number is not expected to increase to the year 2000. This is based on the assumption that wholesalers and retailers will continue to rely on the transportation vehicle to move goods as soon as they are produced, and to warehouse the goods until they have reached their destination. Wholesale/retail trade will continue to use heavier trucks to carry the goods, and light trucks to service the sector support needs.

3.2.3.5 Projections of Government Use

Government use of light trucks increased gradually from 1963 to 1967, and from 1967 to 1972. Because employment and products are not applicable for this sector, simple trend extrapolation was used to project the year 2000 government use. In 2000 there will be 1.4 million light trucks in the government fleet.

3.2.3.6 Projections of Other Uses

Other light truck uses include an aggregate of for-hire, construction, and forestry and lumber. The 1963 and 1972 uses were trended to the year 2000. From 1967-1972 the total stock of light trucks in "other" uses declined. The trend extrapolation developed for this projection was based on 1963-1972 stock growth.

3.3 PROJECTIONS OF LIGHT TRUCK SALES

Since the light truck projections are based on the growth of stocks in the personal and non-personal use sectors, no direct estimates of sales were made. Annual sales were estimated by using Jack Faucett Associate's Transportation Energy Conservation (TEC) Model sales as a percent of stock to year 2000 [Ref. 36]. The TEC Model sales percentages were multiplied by the aggregate personal and non-personal 1975-2000 light truck sales, as seen in Table 3.13.

3.4 OTHER LIGHT TRUCK PROJECTIONS

The use sector approach that was designed for the Argonne projection was also used by the Lindsey-Kaufman Company and Gunar Liepins, both for Oak Ridge National Laboratory [Refs. 30, 35]. The Lidsey-Kaufman Company developed five alternative light truck growth assumptions, based on population growth, gross national product, and personal consumption expenditure projections. Personal and non-personal light truck use was projected from total stock estimates. Non-personal use sectors were disaggregated using various industrial growth assumptions. Leipins prepared a monograph which described analytic models that projected the uses of light truck stock. Table 3.14 compares the distribution of various sectors in the light truck market provided in this study, the Lindsey-Kaufman study, and the Leipins study.

The TEC Model output was used to estimate sales. The Model also includes stock, scrappage, annual vehicle miles traveled, and fuel consumption projections. Table 3.15 includes other current projections on light trucks in generation; selected projections are also presented in Fig. 3.4. Continuing research on light truck stock and sales includes estimates by the National Highway Traffic Safety Administration, A.D. Little, Data Resources Incorporated (DRI), TRW, and the Transportation Systems Center [Refs. 23, 25, 36, 37, 38, 39].

Table 3.13. Light Truck Sales Projection

Year	Stock (10^6)	Sales %*	Sales (10^6)
1975	19.2	10.88	2.1
1985	33.5	11.00	3.7
1990	37.2	10.47	3.9
1995	40.8	10.60	4.3
2000	43.2	10.50	4.5

*TEC model sales percentages

Table 3.14. A Comparison of Year 2000 Distributions to Use Sectors [Refs. 30 and 35]

Use Sectors	Argonne	Lindsey-Kaufman	Leipins
Personal	62.2	60.0	60.8
Services/Utilities	16.8	13.3	9.4
Agriculture	9.2	10.0	18.0
Government	3.5	--	--
Wholesale/Retail	2.3	7.0	5.6
Manufacturing	1.8	2.1	1.4
Other	4.2	7.6	4.8

3.5 SUMMARY

This projection of light truck stocks and sales is in the mid-range of others. The projections were made by independently projecting light truck stocks for personal, service/utility, agriculture, manufacturing, government, wholesale/retail, and other uses. A summary for the years 1975 and 2000 is given in Table 3.16.

The projection of personal light trucks was based on trends established from survey data for 1963, 1967, and 1972 personal truck use. [Ref. 29] Personal light trucks make up 62% of the year 2000 total. This compares with 35% in 1963 and 53% in 1972. Personal light trucks per licensed driver was 0.09 in 1975 and is projected to grow to 0.15 by 2000.

The service/utility use of light trucks is projected to make up 17% of the light truck use in 2000, compared with 9% in 1963 and 10% in 1972. The use of light trucks by this activity is expected to grow with employment increases and to follow the vehicle per employee trend of 1963-1972.

The agricultural share of the use of light trucks is projected to continue its decline. In 1963, 30% of light trucks were used in agriculture. In 1972, it was 20%, and it is projected to decline to 9% by the year 2000. The absolute number of light trucks in agriculture, however, is expected to increase from 2.7 million in 1972 to 4.0 million in 2000.

Light trucks used in manufacturing is expected to grow from 200,000 units in 1972 to about 800,000 in 2000. This fourfold absolute increase amounts to a rise in the manufacturing share of total light trucks from 1.5 to 1.8%.

Table 3.15. Projections of Light Trucks In Operation

Historical	1963	1967	1972	Annual Growth Rate, 1963-72
	8.8	11.3	14.6	5.8 (%)

Projections	10^6 Light Trucks						Average Annual Growth Rate (%)
	1975	1980	1985	1990	1995	2000	1975 - 2000
ANL[a]	19		33	37	41	43	3.3
TEC-78	19		32			39	2.9
DOT/TSC[b]	27[d]	32	46	58	68	77	4.9
McNutt/Dulla[c]	22[e]	32	43	54	60		5.4[f]
ORNL-A	19		26			36	2.6
ORNL-B	19		27			37	2.7
L-K I	19	29	33	37	40	42	3.2
L-K IIA	19	29	32	34	34	35	2.5
DRI	19	27	35	45	57	68	5.2
Dupont	19	27	34	38			4.7[g]
Ratio: High/Low	1.4	1.2	1.8	1.7	2.0	2.2	

[a]Includes all personal, commercial, and government trucks $\leq$ 10,000 lbs GVW.

[b]Includes all registered trucks $\leq$ 10,000 lbs GVW.

[c]Includes all registered domestic and imported trucks $\leq$ 8,500 lbs GVW.

[d]1978 estimate.

[e]1976 data.

[f]1976-1995.

[g]1975-1990.

Source: See Appendix A.

Government (federal, state, and local) use of light trucks is projected to grow 50% from 1 to 1.5 million between 1975 and 2000. Surprisingly, 64% of all Federal motor vehicles are light trucks [Ref. 40] and 21% of state and local light vehicles are light trucks [Ref. 41]. To the extent that government fleets are a viable market for EHVs, light trucks will need to be part of that market.

Wholesale/retail projections of light truck use are based on output growth in this sector. But a declining number of light trucks per unit of output during the 1963-1972 period result in a project that shows an increase of only 100,000 over the next 25 years to 1.0 million in 2000.

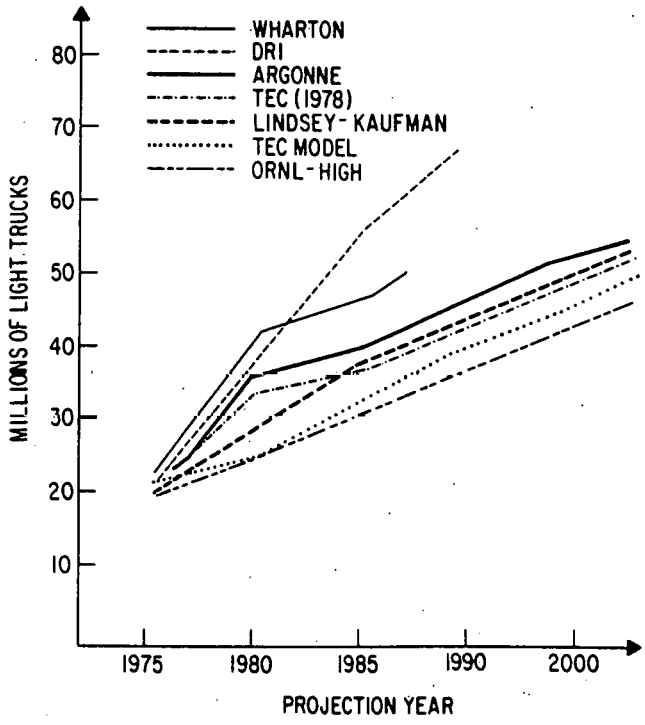

Fig. 3.4. Comparison of Selected Light Truck Stock Projections

Table 3.16. Light Truck Growth Projections, 1975-2000

Use Sector	Projected Light Trucks 10^6 Trucks 1975	2000	Percent Change
Personal	11.3	27.0	139
Service/Utility	2.1	7.3	248
Agriculture	3.0	4.0	33
Manufacturing	0.3	0.8	167
Government	1.0	1.5	50
Wholesale/Retail	0.9	1.9	11
Other	1.4	1.8	29
Total	20.0	43.4	117

The "other" category of light truck use includes for-hire, construction, forestry/lumber, and miscellaneous uses. The growth in this sector's use of light trucks was extrapolated from the 1963 and 1972 data to yield a year 2000 value of 1.8 million light trucks (compared with 1.4 million in 1975).

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4 PROJECTIONS OF BUS STOCK AND SALES

4.1 BACKGROUND

Table 4.1 and Fig. 4.1 present historical data, on the number of registered buses by type. The data show that, school buses are by far the most common type comprising nearly 80 percent of the bus fleet in 1975. With 90 percent of the increase in the total number of buses from 1960 to 1975 occurring in the school-bus fleet, school buses are also the fastest growing segment of the fleet. The number of transit and intercity buses has remained relatively constant over the 15 year period.

4.2 SCHOOL BUSES

Table 4.2 shows historical trends in school-aged population, school buses, and school buses per thousand school-aged persons. Despite the decline in the number of school-aged persons since 1970, the school bus fleet has continued to grow, thereby producing a steady increase in the ratio of school buses to school-aged persons. This continuous rise in the bus/student ratio is attributable to the growing suburban population, the consolidation of many

Table 4.1. Types of Buses, 1960-1975 (10^3)
[Refs. 8 and 41-44]

Bus Type	1960	1965	1970	1971	1972	1973	1974	1975
Transit	49.6	49.6	49.7	49.2	49.1	48.3	48.7	50.8
Intercity	21.0	19.8	22.0	21.9	21.4	20.8	21.0	20.5
Other Commercial[a]	6.2	15.0	15.5	21.9	21.4	20.8	20.6	22.5
School[b]	195.3	229.3	288.8	307.3	316.4	336.0	354.3	366.0
Federal[c]	0	0.6	1.5	1.6	1.8	2.0	2.2	2.3
TOTAL	272.1	314.3	377.6	397.1	406.9	429.9	447.0	462.1

[a]Primarily transit coach (i.e., commercial bus) body types not in urban transit or intercity operation and owned by private industry. In some instances privately owned school buses could not be segregated from commercial buses and are included here.

[b]Primarily publicly owned school bus body types, but does include some privately owned school, institutional, and industrial buses registered free or at a reduced rate.

[c]Either school or transit style body types registered by the federal government.

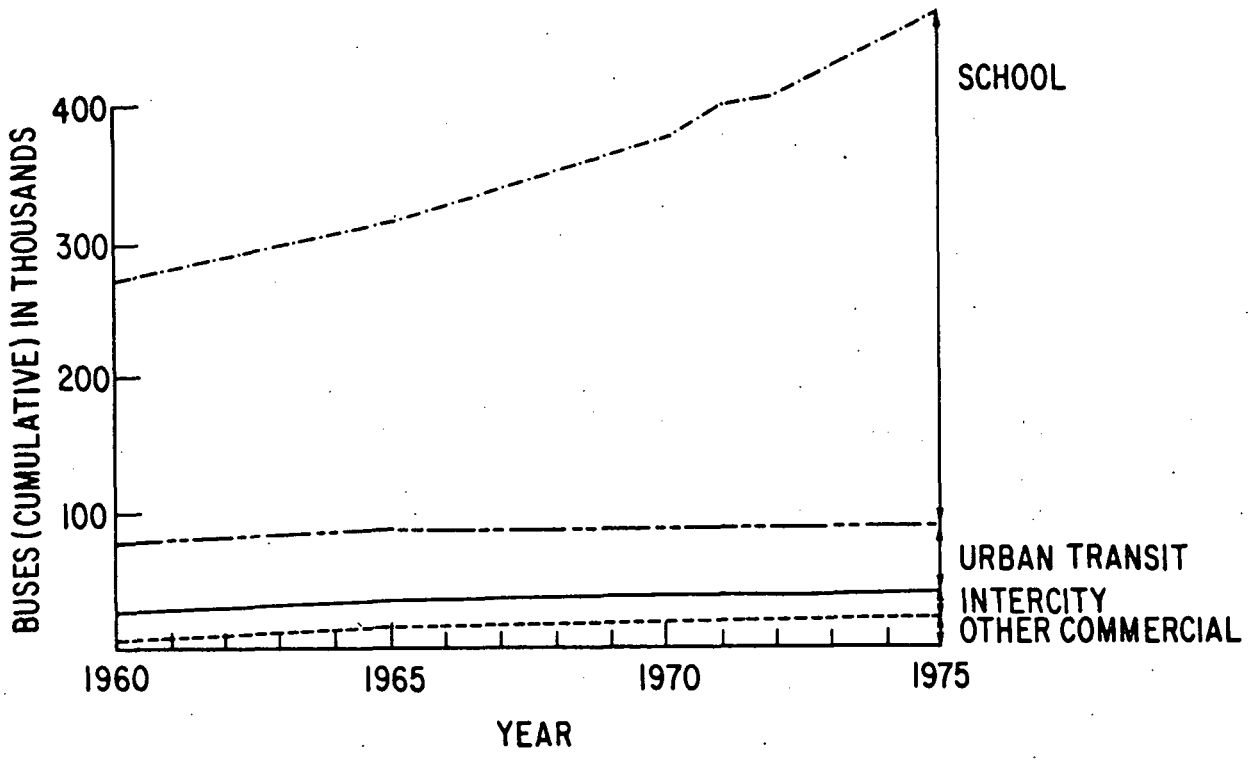

Fig. 4.1. Number of Buses by Type, 1960-1975

Table 4.2. School-Aged Population and School Buses, 1960-1975

Year	Population 5-17 Years (10^6)	Buses/1000 School-Aged Persons	School Buses (10^3)
1960	44.2	4.4	195.3
1965	48.0	4.8	229.3
1970	52.7	5.5	288.8
1975	50.4	7.3	366.0

neighborhood schools because of falling enrollment, the rise in busing for non-traditional purposes (i.e., daycare), and the use of student busing to achieve racial balance in inner-city schools.

Because of these recent and not well-understood factors, projections of future school-bus activities developed by means of statistical projection techniques probably are no more accurate than less sophisticated techniques, such as trend extrapolation. For this reason, this analysis relied on a relatively simple, straightforward method of projecting school bus growth.

The bus/student ratio was assumed to continue increasing at the average annual 1960-1975 level (i.e. 0.18 buses/1000 students) through the year 2000. Ratios thus obtained were applied to Census Bureau Series II projections of the school-aged population. Table 4.3 and Figure 4.2 present these results.

Table 4.3. Projections of School-Aged Population and School Buses, 1975-2000

Year	Population 5-17 Years (10^6)	Buses/1000 School-Aged Persons	School Buses (10^3)
1975	50.4	7.3	366.0
1985	43.5	9.1	398.0
1990	45.3	10.1	457.5
2000	51.1	12.0	613.2

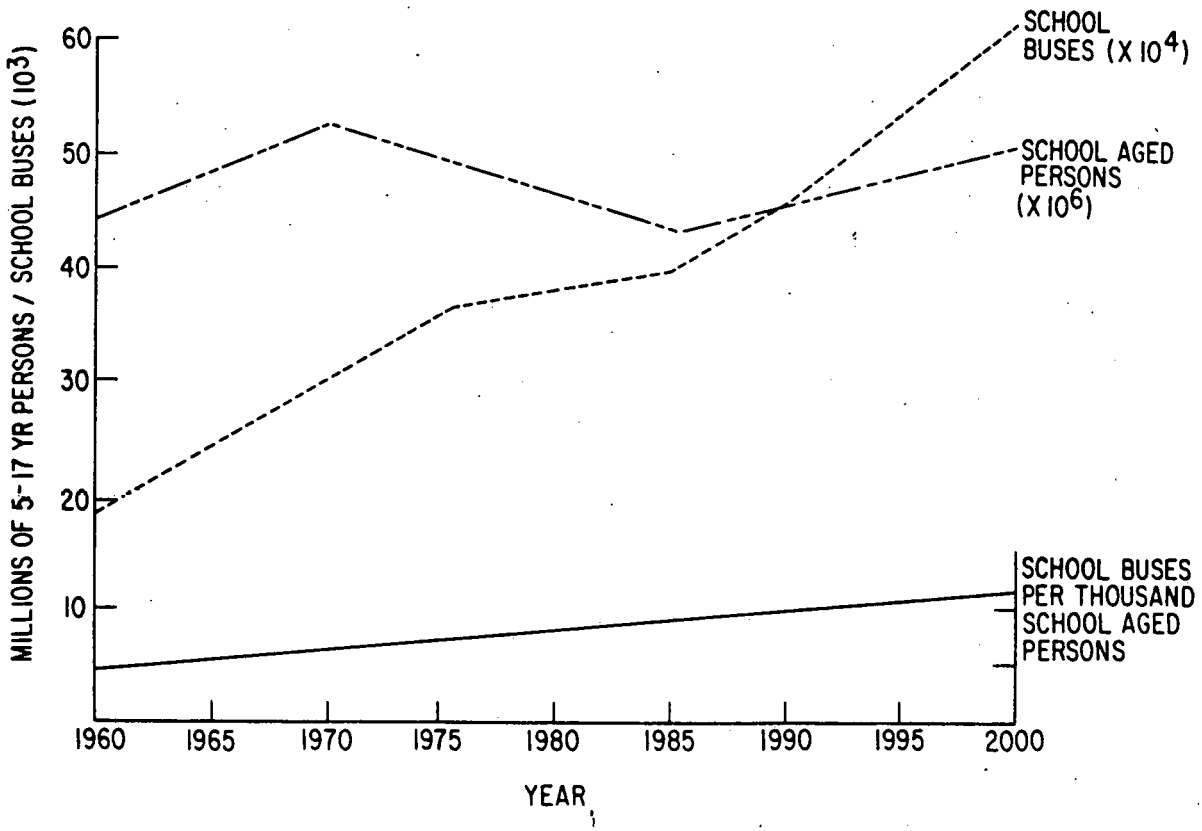

Fig. 4.2. Historical and Projected School Buses and School-Age Population, 1960-2000

Annual sales required to support the projected increase in the school-bus fleet were projected by adding the projected annual increase in school buses to the number of buses scrapped each year. Because data on the age distribution within the school-bus fleet were not available, the generally accepted norm for publicly owned school bus life expectancy, (i.e., 9-11 years) was used [Ref. 45]. Assuming that publicly operated school buses tend to be retired somewhat earlier than privately operated buses, a fleet-wide average of 11 years (or an annual rate of .091) was used for this analysis. Table 4.4 presents the annual school bus sales (for selected years) implied by the above fleet projection and scrappage rates.

With a growing fleet, scrappage would probably not be a linear function. However, because of the unavailability of any age information on the school-bus fleet, linearity had to be assumed; therefore, projections of annual sales should be viewed as average figures subject to considerable fluctuation.

4.3 TRANSIT AND INTERCITY BUSES

As was noted in Table 4.1 the number of transit and intercity buses remained essentially unchanged during the period from 1960-1975. It may be assumed that some expansion will occur as ridership increases, but it will level off by the mid-1980s and remain essentially unchanged from the mid-1980s to the year 2000. Although Tables 4.5 and 4.6 indicate substantial increases in transit bus purchase projections from 1979 to 2000 over actual purchases in the early 1979s, much of this increase is expected to be cylical. As large stocks of older vehicles are retired and the federally

Table 4.4. Projected School Bus Stock, Scrappage, and Sales 1975-2000

Year	Stock at Beginning of Year (10^3)	Scrappage (10^3)	Expansion (10^3)	Total Sales[a] (10^3)	Stock at End of Year (10^3)
1975	354.3	32.2	11.7	43.9	366.0
1985	393.9	35.8	4.1	39.9	398.0
1990	445.6	40.5	11.9	52.4	457.5
1995	519.8	47.3	15.6	62.9	535.4
2000	597.6	54.4	15.6	70.0	613.2

[a]Assumes all sales are new vehicles.

accepted vehicle life of 12 years becomes standard, transit bus purchases are expected to peak, decline, and then increase as the new vehicles of the late 1970s near retirement in the early 1990s.*

No market force similar to the Urban Mass Transportation Administration (UMTA) appears likely in the area of intercity bus transportation. Thus, the stock of intercity buses is assumed to remain unchanged through the year 2000. Using the industry-wide standard-life expectancy of ten years for an intercity bus [Ref. 48], the intercity bus stock and annual sales were projected as shown in Table 4.7. Because no age information on the intercity fleet was available, a uniform distribution was assumed.

4.4 OTHER COMMERCIAL BUSES

"Other commercial" buses consist primarily of transit style coaches, but also include a residual category of non-transit and non-intercity buses engaged in various activities. Because of their variety of uses and related life expectancies, and the lack of information about them, their numbers cannot be projected with any degree of accuracy. Moreover, because many of these vehicles are actually retired buses that had been purchased "used," an estimate of annual sales would include both new and used sales, and would, therefore, be greater than an estimate of new sales.

Table 4.5. Projections of Transit Bus Stock and Sales for Selected Years

Year	Transit Bus Stock (10^3)	Scrappage[a] (10^3)	Expansion (10^3)	Total Sales (10^3)
1975	50.8	-	-	-
1985	54.7	4.2	0.3	4.5
1990	55.4	4.4	0.1	4.5
1995	55.4	5.2	-	5.2
2000	55.4	4.4	-	4.4

[a]Because the transit fleet is not uniformly distributed with respect to age, a constant scrappage rate could not be applied. Projections are based on fleet age information obtained from Ref. 47.

*Before the advent of the UMTA program, transit operators generally lacked the capital needed to maintain industry norms for bus replacement. Therefore, when assistance first became available there was a large stock of 12-20-year old vehicles which are just now in the process of being retired.

4.5 SUMMARY

Tables 4.8 and 4.9 summarize the preceding projections. Federal bus ownership and sales were not projected because of the limited data and the small number of buses involved.

Table 4.6. Actual Transit Bus Purchases, 1970-1979 [Ref. 47]

Actual (10^3)								Projected (10^3)	
1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1.4	2.5	2.9	3.2	4.8	5.3	4.7	2.4a	5.8	5.8

[a]In 1976-77 UMTA witheld a large portion of capital grant funds pending the outcome of litigation. The downturn in those years and the subsequent sharp increase is due to that action.

Table 4.7. Projected of Intercity Bus Stock and Annual Sales, 1975 and 2000

Year	Intercity Buses (10^3)	Annual Scrappage (10^3)	Annual Sales (10^3)
1975	20.5	2.05	2.05
2000	20.3	2.03	2.03

Table 4.8. Projected Bus Stock by Type for Selected Years (10^3)

Year	School	Transit	Intercity	Total[a]
1975	366.0	50.8	20.5	437.3
1980	377.7	53.4	20.3	451.4
1985	398.0	54.7	20.3	473.0
1990	457.5	55.4	20.3	533.2
2000	613.2	55.4	20.3	688.9

[a]Excluding "other commercial"

Table 4.9. Projected Bus Sales by Type for Selected Years

Year	School	Transit	Intercity	Total[a]
Sales (10^3)				
1980	21.4	5.7	2.0	29.1
1985	24.2	4.5	2.0	30.7
1990	34.6	4.5	2.0	41.1
2000	46.1	4.4	2.0	52.5
Percent of Total				
1980	73.5	19.6	6.9	100.0
1985	78.8	14.7	6.5	100.0
1990	84.2	10.9	4.9	100.0
2000	87.8	8.4	3.8	100.0

[a]Excluding "other commercial."

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5 SUMMARY AND CONCLUSIONS

5.1 AUTOMOBILE STOCKS AND SALES

Total automobile stock projected as a function of the number of households and personal income, with adjustment for present and anticipated shifts from autos to light trucks. Larger fleets (i.e., $\geq$ 10 vehicles) are projected as a function of economic activity and employment; whereas, smaller fleets (4-9 vehicles) are extrapolated from historical trends.

By the year 2000, total automobile stocks are anticipated to number 135.5 million, of which 16.6 million will be in fleets of four or more. Total personal vehicles are expected to number 149.9 million (including 118.9 million non-fleet autos, 26.9 million personal light trucks, and 4.1 million personal use fleet autos). New car sales are expected to rise to 14.1 million units (5.5 million fleet sales vs 8.6 million non-fleet sales).

5.2 LIGHT TRUCK STOCK

The light truck stock is expected to continue growing to the year 2000, but not as rapidly as in the past ten years. The most significant growth is expected to occur before 1985. The ANL projection is based on trend analysis of personal and non-personal light truck use sectors. Historical trend extrapolations, emplofyee per vehicle growth rates, and industrial output growth rates were all applied to use sectors shown in data from the Truck Inventory and Use Survey [Ref. 29]. Personal use will account for the largest stock growth, with an average annual growth rate of 3.9% to year 2000. Non-personal use includes a disaggregation of stock associated with various industry types. The most rapid growth in the non-personal use sector is for services and utilities, where the light truck stock is expected to grow at an average annual growth rate of 4.9% during the projection period.

5.3 BUS STOCKS AND SALES

Based on historical growth rates, school buses are expected to be the primary source of growth in the bus fleet and to comprise nearly 90% of the total vehicle stock by the year 2000.

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APPENDIX A

ECONOMIC AND DEMOGRAPHIC ASSUMPTIONS

Table A.1. Economic and Demographic Assumptions, 1975-2000

Variable	1975	1985	1990	1995	2000	Source
Population (Millions)	213.5	232.9	243.5	252.8	260.4	U.S. Dept. of Commerce, Bureau of the Census, Projections of the Population of the United States: 1977-2050, Series P-25 No. 704 (July 1977-Series II)
Households (Millions)	71.7	87.2	94.3	99.9	104.2	U.S. Dept. of Commerce, Bureau of the Census, Projections of the Number of Households and Families: 1975 to 1990, Series P-25, No. 607 (August 1975-Series B).[a]
Number of persons in household	2.92	2.64	2.58	2.53	2.50	
Licensed Drivers (Millions)	129.8	156.3	--	--	185.4	Institute for Energy Analysis, The Future of the Personal Automobile in the United States, Oak Ridge Associated Universities (July 1978).
Unemployment Rate (%)	8.4	5.0	4.7	4.6	4.6	Energy Information Administration, Preliminary data from 1978 Annual Report to Congress based on Data Resources Inc. (DRI) TRENDLONG economic forecast.[a]
Employment (Millions)[b]	82.6	106.8	114.0	120.7	123.8	Ibid.
Consumer Prices (Annual % Change)	--	6.2	5.3	5.3	5.3	Ibid.
Gross National Product (Billions 1975 dollars)	1527.9	2280.2	2650.0	3061.1	3522.9	Ibid.
Personal Income (Billions 1975 dollars)	1253.6	1890.2	2222.0	2603.1	3042.7	Ibid.
Disposable Personal Income (Billions 1975 dollars)	1084.5	1596.4	1863.2	2170.1	2524.3	Ibid.

[a]With ANL staff extrapolations to 2000.

[b]Excluding military.

APPENDIX B

AUTOMOBILE SIZE CLASSES

It should be noted that automobile size class projections for 1985 and beyond assume a considerably downsized version of the classes which existed in 1975. At present, there is considerable variation in estimates of the future inertia weights* of small, medium and large autos. Table A.2 illustrates these differences. Both the 300 Day Study (Interagency Task Force on Motor Vehicle Goals Beyond 1980) and industry projections assume only moderate downsizing by 1985, and little (if any) additional downsizing beyond 1985. The National Highway Traffic Safety Administration (NHTSA) and The Jet Propulsion Laboratory (JPL) assume somewhat more radical downsizing** and continued (though decelerated) weight reduction beyond 1985. These sources are far more conservative than comparable estimates made by the Lawrence Livermore Panel. According to the latter source, 1985 average inertia weights could be a least 600 lbs less than other estimates for small autos, at least 700 lbs less for mid-sized autos, and at least 450 lbs less for large autos.

In this analysis, no attempt was made to quantify the inertia weights of future small, medium and large autos. Assumptions regarding the size mix of future stocks and sales were intended to simulate the consumer's past purchase behavior and his likely response to future auto production, whatever the actual vehicle weight. Size classes were defined relatively - even though future large or mid-sized autos may be equivalent in size to present small autos, they would still be large or mid-sized relative to other vehicles on the road. Assumed changes in size shares thus reflect size shifts, not vehicle downsizing.

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* Curb weight + 300 lbs

**Primarily NHTSA

Table B.1. Inertia Weights by Automobile Size Class, 1975-2000 (lbs)

	1975	1985	2000
Small			
Industry & 3000 Day Study	<4000	<3050	<3050
JPL[a,b]	3300	2650	2450
NHTSA[b]	----	----	----
LLL[c]	----	2000	1900
Medium			
Industry & 300 Day Study	4000-4500	3050-3500	3050-3500
JPL[b]	4350	3375	3075
NHTSA[b]	----	3125	----
LLL[b,d]	----	2400	2300
Large			
Industry & 300 Day Study	>4500	>3500	>3500
JPL[b]	5200	4050	3700
NHTSA[b]	----	3450	----
LLL[b,e]	----	3000	2800

[a]Includes compacts, subcompacts and minicompacts.

[b]Average weight, largest subclass in class.

[c]4-passenger

[d]5-passenger

[e]6-passenger

Sources:

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