

Technical Report

**Light-Duty Automotive Technology and
Fuel Economy Trends Through 1988**

by

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June 1988

NOTICE

Technical Reports do not necessarily represent final EPA decisions or positions. They are intended to present technical analysis of issues using data which are currently available. The purpose in the release of such reports is to facilitate the exchange of technical information and to inform the public of technical developments which may form the basis for a final EPA decision, position or regulatory action.

**U. S. Environmental Protection Agency
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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

ANN ARBOR, MICHIGAN 48105

OFFICE OF
AIR AND RADIATION

July 18, 1988

MEMORANDUM

SUBJECT: Exemption From Peer and Administrative Review

FROM: Karl H. Hellman, Chief *WH*
Control Technology and Applications Branch

TO: Charles L. Gray, Jr., Director
Emission Control Technology Division

The attached report entitled "Light-Duty Automotive Technology and Fuel Economy Trends Through 1988," (EPA/AA/CTAB-88-07) examines trends in light-duty vehicle fuel economy and technology usage for model years 1978 through 1988. Comparisons with previous years' data are made for the fleet as a whole and for number of cylinders, vehicle size class, inertia weight class, and market segment (Domestic, European, Asian).

Since this report is concerned only with the presentation of data and its analysis and does not involve matters of policy or regulations, your concurrence is requested to waive administrative review according to the policy outlined in your directive of April 22, 1982.

Concurrence: *Charles L. Gray, Jr.* Date: 7-22
Charles L. Gray, Jr., Dir., ECTD

Nonconcurrence: _____ Date: _____
Charles L. Gray, Jr., Dir., ECTD

cc: E. Burger, ECTD

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I. Abstract

This, the sixteenth in this series of papers and reports, examines trends in light-duty vehicle fuel economy and technology usage for model years 1978 through 1988. Comparisons with previous years' data are made for the fleet as a whole and for number of cylinders, vehicle size class, inertia weight class, and market segment (Domestic, European, and Asian).

II. Introduction

Trends in vehicle technology and fuel economy for light-duty cars and trucks are examined in this report, as in preceding papers in this series [1-18].* Technology usage and vehicle performance are accorded more emphasis in this report than analysis of individual manufacturers.

To the extent possible, the data in this report represent the latest and most complete vehicle technology and fuel economy data available.

For 1978 through 1985, all data are "final CAFE."** For 1986, the data are final CAFE for most, but not all, manufacturers. For 1987, final CAFE data was available for some, but not all manufacturers.

For 1988, fuel economy label data was used. The sales volumes for all 1988 model year data have been adjusted to agree with post-label (but pre-"final") information reported to the Department of Transportation and in reliable trade publications. This same procedure was used for those manufacturers for which "final CAFE" data for 1986 and 1987 were unavailable.

For consistency with the previous reports in this series, the MPG data in this paper have no road or CAFE correction factors. Where only one MPG value is presented, it is 55/45 combined MPG. All vehicle weights presented are inertia weights (nominally curb weight plus 300 lbs).

* Numbers in brackets denote references listed at the end of the text.

** The light truck data in this paper include gross vehicle weights (GVW) up to 8,500 lbs for all model years, although emission standards for light trucks with GVW between 6,000 and 8,500 lbs were not in effect before 1979. For details on how data on 6,001-8,500 lbs light trucks were obtained for model years 1975 to 1979, see Reference 13.

As in previous papers in this series, vehicle classification as to vehicle type, size class and manufacturer generally follows fuel economy label, Gas Mileage Guide and CAFE protocols; exceptions are listed in Table 1.

The truck size classification scheme used in this paper is the same as was first used in Reference 14. In some tables, passenger car market share data is presented as "Large" representing Large Sedans and Wagons, "Midsize" representing Midsize Sedans and Wagons and "Small" representing Compacts, Subcompacts, Minicompacts, and Two-Seaters. Similarly, truck market share data is presented as "Large" representing Large Pickups, Vans and Utility Trucks and "Small" representing Small Pickups, Vans and Utility Trucks.

The database used for this paper was frozen in late May 1988 and may exclude some changes to existing vehicles or new vehicles scheduled for midyear introduction.

Appendix A lists the model year 1988 nameplates and their average MPG as of the data freeze date.

This paper includes an estimate of 0 to 60 MPH acceleration time for cars, calculated as in [16].

III. Car and Truck Trends

Table 2 gives major characteristics of passenger cars, light-duty trucks, and all light-duty vehicles (cars and light trucks) for model years 1975 to 1988. Total sales in model year 1988 are projected to be 11.5 million cars and 4.9 million trucks (16.4 million total).

As shown in Figure 1, unadjusted sales-weighted fuel economy has changed very little the last few years, particularly for light trucks. This year's combined car and truck fleet will average 25.8 MPG. Between 1978 and 1981, 55/45 fuel economy improved about five MPG for both cars and trucks. Since then, 55/45 fuel economy for cars has increased by only three MPG and for trucks by only one MPG.

Average inertia weight for cars dropped 500 lbs between 1978 and 1981 and has varied very little since then. Similarly, average inertia weight for light trucks decreased 350 lbs between 1978 and 1981 and has remained constant since.

Average engine size for both cars and light trucks decreased considerably between 1978 and 1981: 69 CID for cars and 67 for trucks. Since then, automobile engines have decreased another 20 CID. Light truck engines have increased CID two years in a row.

Manual transmission usage for cars peaked in 1980 at 32 percent and has since decreased to about 27 percent. Similarly, manual transmission usage for light trucks peaked at 53 percent in 1980, compared to about 40 percent the last few years. Since 1978, four-wheel drive has been used in 20-30 percent of trucks, but in less than 3 percent of the cars; because of the sales mix of cars and trucks, four-wheel drive accounts for about 10 percent of this year's total light-duty fleet compared to about 5 percent for the period 1975-82.

One major change the last few years is a large increase in the use of fuel-injected engines (Figure 2). More than 80 percent of this year's trucks will have fuel-injected engines as will the cars. By comparison, light trucks were 40 percent fuel-injected in 1986, and 12 percent in 1985. Diesel engine usage peaked in 1981 for cars and a year later for light trucks. Diesels have not been an important part of the U.S. market for the past few years.

Figure 3 shows the percentage of model year 1978 to model year 1988 gasoline-powered automobiles with carbureted, throttle body (TBI) and port fuel-injected engines and a projection of these percentages through model year 1995. Use of TBI engines appears to be at, or possibly just past a peak; conversion to port fuel injection continues. Over half of this year's automobiles have port fuel injection compared to 15 percent in 1984.

IV. MPG Improvement

A. Commercial Fleets vs. Retail

Tables 3 and 4 compare characteristics of retail and commercial fleet passenger cars for model year 1979 to 1986. The data in these tables was derived from registration data supplied by reference [19]. This reference covers more than just "centrally fueled" fleet cars. This registration data is limited to the nameplate level for Domestic manufacturers and to percent imports for the Import segment of the market. This analysis, thus, does not take into account differences below the nameplate level in the usage of transmissions, engines, etc. between retail and commercial automobile users.

As shown in Figure 4, vehicles sold retail have higher average fuel economy (by about an MPG) and are lighter. Figure 5 compares the sales fraction of Large, Midsize and Small cars for consumer and fleet passenger cars. There is little difference in the Large car sales fractions of fleet and consumer vehicles, but commercial fleets consist of a greater percentage of Midsize cars and a smaller percentage of Small cars than consumer vehicles. For example, nearly 60 percent of model year 1984 consumer vehicles were Small vehicles compared to about 40 percent of the commercial fleet vehicles. The sales mix of the vehicles sold to commercial fleet operators thus is reducing the average MPG of the overall (commercial plus retail) fleet (see Figure 5).

B. FFVs

In order to encourage the development of methanol-fueled vehicles, fuel economy credits that could apply toward meeting the fuel economy standards are being proposed. One possibility for M85 flexible-fueled vehicles (FFVs) would be to use only the gasoline content of the fuel blend in calculating fuel economy for the FFVs in a manufacturer's product line.*

Figure 6 shows the impact of such a CAFE credit on the three major Domestic manufacturers for model year 1988, assuming no other CAFE adjustments are made.

GM and Ford would both achieve 27.5 MPG if they were given credit for FFV conversion of 20 percent of their Large Sedans and Wagons. Similarly, all three domestic manufacturers would meet 27.5 MPG if they were given credit for converting 20 percent of their Midsize Sedans and Wagons.

Ford and Chrysler could meet, and GM nearly meet, 27.5 MPG if credited for converting all of their Midsize vehicles sold to commercial fleet operators to FFVs. Ford could also achieve 27.5 MPG if credited for converting all of its Large Sedans and Wagons sold to commercial fleet operators.

V. Technology Usage

A. Catalysts

Tables 5 and 6 give market share, 55/45 MPG and vehicle weight by catalyst type for cars and trucks, respectively. Only a minuscule percentage of the cars built since 1984 have not had feedback control, so we no longer distinguish between vehicles with and without feedback.

Usage of oxidation-only catalysts in passenger cars essentially stopped in 1985. For 1985-87, the only cars with oxidation-only catalysts were vehicles such as Subaru four-wheel-drive sedans and wagons, which were certified as light trucks but classified as "cars" in this report.

* For example: using M85 fuel, 15 percent of the blend is gasoline. If an FFV achieves 15 miles per gallon of M85, it would be credited with a value of 100 miles per gallon of gasoline (15 mpg divided by 15 percent).

Except for some Ford trucks with thermal reactors, all gasoline-fueled trucks built since 1984 have used catalysts. Only 4 percent of this year's trucks use oxidation-only catalysts (Figure 7).

Usage of the three-way-plus-oxidation catalyst continues to drop for cars, but is increasing for light trucks. This combination accounted for 62 percent of the 1984 cars compared to 31 percent last year, and 25 percent this year. Conversely, the three-way-plus-oxidation catalyst combination accounted for 11 percent of the 1983 trucks, 22 percent last year, and 31 percent this year.

B. Transmissions

Tables 7 and 8 show the trend in transmission usage for cars and trucks. For both cars and trucks, conversion from "automatic" to "lockup" transmission continues. In 1978, 73 percent of the cars and 68 percent of the trucks used automatic transmissions. Lockup transmissions are used on 64 percent of this year's cars, and nearly half of the trucks.

Manual transmissions without overdrive accounted for 31.7 percent of the 1978 trucks; for 1987, 33.2 percent of the trucks will have manual transmissions with overdrive.

C. Engines

1. Number of Cylinders

Tables 9 and 10 compare 1978 to 1988 cars and light trucks by number of cylinders. Only 4-, 6-, and 8-cylinder engines are shown in these two tables because vehicles with other numbers of cylinders (e.g., 3-, 5- and 12-) have never accounted for more than a percent or two of the car and truck fleets. The calculation of the sales fractions in these tables, however, include all vehicles, regardless of number of cylinders. Thus, in 1983, cars with 4, 6, or 8 cylinders accounted for 98.4 percent of the car fleet; the remaining 1.6 percent of the fleet consisted of cars with other cylinder counts.

2. Engine Size

Use of 8-cylinder engines continues to drop. In 1978, nearly three-fourths of the light trucks had 8-cylinder engines, compared to about a fourth the last three years. Similarly, the sales fraction of 8-cylinder engines in cars has dropped from 53 percent in 1978 to 12 percent this year. Figure 8 shows the market fraction for passenger cars by number of cylinders. (Similar data for trucks is presented later, in Figure 12.)

Average displacement for 8-cylinder car and light truck engines has remained constant at nominal values of 300 and 320 CID respectively for several years. This year's 8-cylinder cars and trucks are heavier than both last years and those built in 1987.

Figure 8 shows that since 1978, passenger car engine size--at the number of cylinders level--has changed very little compared to the 84 CID reduction in engine size that has occurred for the overall car fleet due to changes in the mix of engines. This year's cars with 4-cylinder engines average 9 CID larger than the 1978s, while the 6- and 8-cylinder engines are smaller by 27 and 37 CID, respectively.

The 6-cylinder market share has remained at about 25 percent for cars, but has more that doubled for trucks since 1978. The market share of 4-cylinder trucks has tripled. At the number of cylinders level of stratification, there has been little if any improvement in fuel economy the last five years for either cars or trucks. Since 1983, the fuel economy of trucks with 4-cylinder engines has dropped nearly 2 MPG, and those trucks are 275 lbs heavier.

3. Performance

Figure 9 shows average engine horsepower for cars with 4-, 6-, and 8-cylinder engines. In 1978, 8-cylinder engines had twice the horsepower of the fours. Between 1978 and 1981, 8-cylinder engine horsepower decreased 21 HP, when use of Diesel engines increased to nearly 17 percent of the 8-cylinder car engines. Since then, as the use of Diesel and carbureted 8-cylinder engines decreased, their horsepower has increased again to 170 HP.

Horsepower of 6-cylinder car engines was constant at a nominal value of 110 HP between 1978 and 1981. Since then, use of port fuel injection in 6-cylinder car engines has increased from 7 to nearly 98 percent; their weight has remained constant, their displacement has decreased from 215 to 193 CID, their horsepower has increased from 110 to 142 HP, and their 0 to 60 acceleration time decreased from 14.1 to 11.5 seconds.

Horsepower of 4-cylinder car engines remained constant through 1982. Since then, weight, engine displacement, and CID of 4-cylinder car engines have all increased.

Figure 10 gives 0 to 60 acceleration time for passenger cars by number of cylinders. Except for 1986 to 1987, cars with 8-cylinder engines always averaged faster 0 to 60 acceleration time than those with 6-cylinder engines. In 1978, cars with 4- and 6-cylinder engines had about the same 0 to 60 acceleration time. Since then, the sixes have reduced their acceleration time by 3.3 seconds and are hard to distinguish from cars with 8-cylinder engines.

4. Fuel Metering

Figure 11 compares fuel metering used in cars with 4-, 6-, and 8-cylinder engines. Nearly all of this year's cars with 6-cylinder engines will have port fuel injection compared to 36 percent of the 4-cylinder and 41 percent of the 8-cylinder engines. This figure also shows an increasing trend for TBI fuel metering for cars with 4-cylinder engines.

Nearly 92 percent of this year's cars with 4-cylinder engines will have front wheel drive, as will 83 percent of the cars with 6-cylinder engines. Conversely, only 20 percent of this year's cars with 8-cylinder engines will have front wheel drive; The other 80 percent will still have rear drive. Similarly, a third of the 8-cylinder car engines built this year will be carbureted. All of these 8-cylinder carbureted engines will be used in cars with rear drive and automatic transmission such as the Chevrolet Caprice, Buick LeSabre and Dodge Diplomat.

Nearly 99 percent of this year's trucks with 6-cylinder engines will be fuel injected, compared to 58 percent in 1986 and 0.5 percent in 1985. Similarly, nearly 95 percent of this year's trucks with 8-cylinder engines will be fuel injected, compared to 24 and 8 percent for the preceding two years. By comparison, only 63 percent of this year's cars with 8-cylinder engines will be fuel injected. Less than half of this year's trucks with 4-cylinder engines will be carbureted. Model year 1988 should be the first for which fuel injection exceeds 50 percent for both cars and trucks.

Figure 12 compares light truck and passenger car MPG by number of cylinders for model years 1978-88. At the number of cylinders level of stratification, there has been little improvement in MPG the last few years for both cars and trucks. MPG for cars with 6-cylinder engines, for example, has increased 1.6 MPG since 1984 compared to a 3.4 MPG increase between 1979 and 1983. The MPG of trucks with 6-cylinder engines is a good estimate of the fleet average for all trucks.

VI. Vehicle Size

A. Truck Size Class

Table 11 gives fuel economy, market fraction, CID and inertia weight for 1978 to 1988 light-duty trucks by size class. In 1978, Large Pickups accounted for nearly 60 percent of all light trucks; Large Vans 19 percent and Small Pickups 10 percent. Since then, the market share of Large Pickups has dropped to about 30 percent (Figure 13). Small Pickups gained in popularity through 1983 when they accounted for 38 percent of all light trucks. Since then, their market share has dropped to about 25 percent while Small Vans and Utility Trucks have increased their shares of the market to 18 and 15 percent, respectively.

Figure 14 shows the changes in 55/45 MPG and inertia weight that have occurred since 1978 for the six truck classes. Small Pickups now get lower MPG than they did in 1978, but are heavier. Small Vans and Utility Trucks both get higher MPG than they did in 1978, and both of these classes are heavier. Small Vans and Small Utility Trucks are now difficult to distinguish on the basis of weight and MPG.

Large Vans, Large Pickups and Large Utility Trucks all get higher MPG than they did in 1978. Large Vans and Utility Trucks are heavier than they were in 1978; Large Pickups are the only truck class to be lighter this year than they were in 1978.

The Light Truck fleet has improved 6.0 MPG since 1978, an amount larger than any of the classes due to mix shifts across classes (Table 12).

B. Car Size Class

Table 13 compares cars by EPA car class. Only Minicompacts and Small Wagons show any significant variation in interior volume: Minicompact volumes have ranged from 76 to 83 cubic feet, Small Wagons 105 to 119 cubic feet. Note that interior volume is undefined for the Two-Seater car class; a value of 50 cubic feet has been assigned to all Two-Seaters, a class which has never accounted for more than about 3 percent of car sales.

On a class-by-class basis, passenger car MPG, inertia weight and engine size have changed very little the last few years. The largest change since last year is the 102 lbs increase in inertia weight for the Large Wagons.

Table 14 gives major characteristics of "Large Cars" (i.e., Large Sedans and Wagons), "Midsize Cars" (Midsize Sedans and Wagons) and "Small Cars" (Compacts, Subcompacts, Minicompacts, Small Wagons and Two Seaters).

Since 1980, Large Sedans and Wagons have accounted for only 11 to 15 percent of the cars. By comparison, they accounted for about 20 percent of the cars in 1978 and 1979. Similarly, the market share of Midsize Cars and Wagons has dropped from a peak of 36 percent in 1981 to less than a fourth this year (see Figure 15).

Figure 16 compares inertia weight and MPG for 1978 to 1988 Small, Midsize and Large cars. Large Sedans and Wagons now achieve higher MPG than both Small and Midsize cars did in 1978 and are lighter than Midsize Cars were then. Similarly, Midsize Cars achieve higher MPG than Small Cars did in 1978, but are heavier.

More than 80 percent of the Small and Midsize cars now have front-wheel drive, but there has been little change in front-wheel drive usage for Large Cars. Front-wheel drive usage for Large cars has been stalled at about the 50 percent mark the past three years.

Use of TBI engines in Large cars peaked at 44 percent in 1985 and has since dropped to 15 percent, while use of port fuel injection increased to 62 percent. Similarly, usage of TBI engines in Midsize Cars peaked at 40 percent in 1986, dropping to 27 percent this year, while port fuel injection increased from 29 percent to 68 percent. Small car usage of TBI engines has remained in the 25-30 percent range the last four years, but Small car usage of port fuel injection has increased from 26 percent in 1985 to 48 percent this year.

C. Vehicle Weight Class

Table 15 presents fuel economy, market fraction, CID, 0 to 60 acceleration time and volume for 1978-88 cars by inertia weight. Table 2 showed that average interior volume of cars changed very little between 1978 and 1988, but inertia weight decreased more than 500 lbs, with most of this decrease coming between 1978 and 1980. This shows up in Table 15 as an increase in volume by weight class. Analysis of cars with inertia weight above 4000 lbs is confounded by the fact that these vehicles accounted for more about a fourth of the cars built in 1978, compared to only about a percent of the cars built each year since 1984. Similarly, vehicles over 3500 lbs accounted for 70 percent of the 1978 fleet, but only 36 percent in 1988.

Since 1979, four weight classes, those from 2500 to 3500 lbs, have accounted for a majority of the cars built each year. The market share of this group of classes has increased each year and now accounts for five out of six cars. Reduction in market share has occurred for those cars below 2500 lbs and also for those above 3500 lbs.

Since last year, MPG has increased for all but two of the weight classes shown (under 2250 and 4000 lbs), but these two classes account for only 10 percent of this year's production.

Table 16 presents fuel economy, average market fraction, and CID by inertia weight class for 1978 to 1988 light trucks. In 1978, two weight classes, 4000 and 4500 lbs, accounted for 70 percent of the light trucks. Since then the market share of these two classes dropped to about 40 percent in 1984-85 and have since increased to 47 percent.

The market share of the 3500 lbs class increased from 3 percent in 1978 to about 25 percent in 1986 where it has remained. Similarly, the 3000 lbs class increased from 4 percent in 1978 to 20 percent in 1982, but it has since dropped to 14 percent.

VII. Market Segments

Table 17 shows major characteristics of the Domestic, European, and Asian car fleets for model years 1978-87. Table 18 presents similar data for light trucks, but the truck fleet is divided into just Domestic and Import segments. As in previous papers, Import production volumes include vehicles assembled in the U.S. by foreign manufacturers.

A. Market Share

As shown in Figure 17, the market share of European cars has stayed at 5 to 7 percent. The Asian share of the car market, on the other hand, has increased from 14 percent in 1978 to the 30 percent level the last two years.

Sales of Import trucks have increased relatively consistently, but their share (27 percent) of the light truck market is not quite as high as it was two years ago when 30 percent of Light Trucks were Imports.

B. Vehicle Size

Figure 18 shows the changes in 55/45 MPG and inertia weight that have occurred for Domestic, European, and Asian cars and also for Domestic and Import trucks.

Domestic cars built this year are 557 lbs lighter, have engines that are 92 CID smaller, and get 8.3 higher 55/45 MPG than their 1978 counterparts. Domestic 1988 trucks are 241 lbs lighter, have engines that are 83 CID smaller, and get 5.8 higher MPG than in 1978. This year's Domestic Cars and Light Trucks, however, are heavier than last year's.

This year's Asian and European cars get higher MPG than in 1978, but are heavier and have larger engines. This year's European cars get 2.7 MPG less than in 1981, primarily because Diesel engines were used in 36 percent of the European cars that year.

This year's Import Trucks get lower average MPG (24.1) than any year since 1979, but also are heavier and do not use Diesel engines.

Since 1978, European and Asian cars have not only increased inertia weight and engine size, they have also increased their interior volumes by 7 and 12 cubic feet respectively (Figure 19). The size (interior volume) of Domestic cars has remained about the same (110 to 115 cubic feet) and their inertia weight has reduced.

Another metric by which Domestic, European, and Asian cars can be compared is interior volume divided by horsepower. The sharp increase in HP/cu. ft. for the Europeans that has occurred since 1980 coincides with the decrease in the use of Diesel engines in European cars (36 percent diesel in 1981 vs. 0.1 percent in 1988).

Since the interior volume of Domestic cars has remained relatively constant, the increase in HP/cu.ft. that has occurred since 1981 is due to the increase in horsepower (130 horsepower in 1988 vs. 106 in 1981-82). A similar increase in horsepower occurred for Asian cars (94 HP this year vs. 77 HP in 1980) but their HP/cu.ft. ratio has also been affected by an increase in volume. About 4 percent of Asian Cars are "Midsize," as are 17 percent of the European Cars. This represents a major change since 1978 when all Asian Cars were small as were 98 percent of the European Cars.

C. Fuel Metering

As mentioned earlier, fuel-injected engines are now used in more than 80 percent of this year's light trucks compared to less than 3 percent just four years ago. Figure 20 compares the use of fuel-injected engines for Domestic and Import trucks for 1978 to 1988. Nearly 95 percent of this year's Domestic trucks are fuel injected, and over half of the Imports are. By comparison, fuel-injected engines were used in 45 percent of the 1986 Domestic and 31 percent of the 1986 Import trucks.

Figure 21 makes a similar comparison for Domestic, European and Asian cars, but also shows only the fraction which uses Diesel, carburetion, TBI or port fuel injection. Nearly 86 percent of this year's European cars use port fuel injection, with the remaining 5 percent almost entirely carbureted. Carbureted engines will be used in 13.5 percent of the European cars this year, the highest level since 1980.

Throttle body injection (TBI) has been used in only a small percentage of Asian cars, but has increased the past few years to 20 percent this year. Less than half the Asian cars still use carbureted engines.

Over 90 percent of this year's Domestic cars will have fuel-injected engines, with nearly two-thirds of these port fuel injection. Use of TBI by the Domestics, however, remained relatively constant at about 43 percent for three years, but has dropped to 33 percent this year. Use of port fuel injection in Domestic cars has increased from 6 percent in 1984 to 59 percent this year.

D. Drive and Transmission

Nearly 80 percent of this year's Domestic cars will use front-wheel drive, as will nearly 90 percent of the Asians and 56 percent of the Europeans. Use of front-wheel drive in European cars, however, is still below the level of 1980-81.

Except for 1983 when 11 percent of the Asian cars used four-wheel drive, it has been used only in a small percentage of the Domestic, European, and Asian cars built each year. Four-wheel-drive usage for light trucks has varied from a maximum of 33 percent in 1984 to a minimum of 18 percent in 1979 for the Domestic. For the Imports, on the other hand, four-wheel-drive usage has increased from 6.5 percent in 1978 to 38.5 percent this year. Since 1985, front-wheel drive has been used in only 8-10 percent of the Domestic trucks and has been used in only as many as 7 percent (in 1982) of the Import trucks each year since 1978.

Use of manual transmissions in Asian cars has dropped from 78 percent in 1978 to about 50 percent the last three years. Similarly, use of manual transmissions peaked at 75 percent in 1980 for the Europeans and decreased to about 50 percent where it has remained since 1983. Manual transmission usage for Domestic cars increased from 8 percent in 1978 to 17 percent in 1980, and has remained in an 11 to 14 percent band since 1983.

VIII. Conclusions

Since 1982 there has been little year-to-year improvement in fuel economy of light-duty vehicles, particularly when compared with the improvements which took place before then.

This year's combined car and light truck fleet will average 25.8 MPG. Since 1981, 55/45 fuel economy has improved 3.3 MPG for cars and 1.1 MPG for light trucks.

There is no evidence of a trend toward larger, heavier, less fuel efficient vehicles.

Average weight for cars has been constant (about 3100 lbs) for the past seven years. There is no trend toward heavier cars.

Average weight for light trucks has been constant (about 3800 lbs) for the past seven years. There is no trend toward heavier trucks.

The market share of Large Sedans and Wagons has remained in a narrow range (11 to 15 percent) since 1980. The market share of Midsize Sedans and Wagons has dropped from 36 percent in 1981 to about 25 percent this year. There is no trend toward larger cars.

Class-by-class, passenger car inertia weight and fuel economy have changed very little since the early 1980s.

There is a trend toward smaller trucks. The market share of Large Pickups has dropped from 60 percent in 1978 to 33 percent this year, with Small Pickups, Vans, and Utility trucks absorbing the shift in market share. Light truck MPG has increased 6.0 MPG since 1978.

At the number of cylinders level of stratification, there has been little year-to-year improvement in fuel economy in the last five years for either cars or trucks. The market share of 6-cylinder engines has remained at about 25 percent for cars over the last several years, but has increased to over 40 percent for trucks. Compared to 1978, this year's 4-cylinder car engines are 21 CID larger, while 6- and 8-cylinder engines are smaller by 27 and 35 CID, respectively. Use of 8-cylinder engines has dropped to 13 percent of this year's cars and 25 percent of this year's trucks. There is no trend toward larger engines.

More than 80 percent of this year's cars will have fuel-injected engines, as will the light trucks.

Use of three-way-plus-oxidation catalysts has decreased for cars, but increased for trucks. This catalyst type is projected to be used on 25 percent of this year's cars and 31 percent of this year's trucks. Oxidation only catalysts will be used on less than 4 percent of this year's trucks.

Sales of Asian cars are projected to exceed three million this year, more than double the number sold in 1978. The market share of European cars has been in a narrow range (5 to 7 percent) since 1978. The market share of Import trucks will be 27 percent this year, compared to a peak of 31 percent in 1980.

Since 1978, engine size, inertia weight, and interior volume have all increased for European and Asian cars. For the Domestic, interior volume has remained the same, but inertia weight and engine size have decreased. Thus, there is no trend toward larger car sizes, increasing weight, or larger engines for Domestic cars.

Since 1978, passenger car 55/45 fuel economy has improved 8.3 MPG for the Domestic, compared to 2.8 MPG for the Europeans and 3.5 for the Asians.

This year's Domestic light trucks get 5.8 MPG higher 55/45 fuel economy than their 1978 counterparts. Import light truck fuel economy has decreased 1.0 MPG since 1978.

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Table 1

Vehicle Classification Convention

<u>Manufacturer/Vehicle</u>	<u>This Trend Analysis</u>
AMC Renault Alliance	All to AMC
AMC Eagle 4WD Car/Wagon	Car/Wagon
Chrysler vehicles by Mitsubishi	Mitsubishi
Colt Vista by Mitsubishi	Mitsubishi Small Van
Mitsubishi Space Wagon	Small Van
Ford vehicles by Mazda	Mazda
Mercury Merkur and Scorpio	Ford European Import
GM vehicles by Isuzu	Isuzu
GM vehicles by Suzuki	Suzuki
1988 Pontiac Lemans	Asian Import
GM/Toyota vehicles	N.U.M.M.I. Assan Import
U.S. built Honda	Honda Import
Honda/Rover/Sterling	Asian Import
Subaru 4WD Car/Wagon	Car/Wagon
Subaru Brat	Small Pickup
U.S. built Volkswagen	VW Group
Audi and German-built Volkswagen	VW Group
Porsche	VW Group through 1984, Porsche after 1984

Table 2 - Characteristics of 1975 - 1988 Light Duty Vehicles

		1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
		----	----	----	----	----	----	----	----	----	----	----	----	----	----
Cars	Sales(000)	8237	9722	11300	11175	10794	9443	8733	7819	8002	10675	10791	11015	10882	11500
	Fraction	.806	.788	.800	.773	.778	.835	.827	.803	.777	.761	.746	.717	.714	.700
	CITY FE	13.7	15.2	16.0	17.2	17.7	20.3	21.7	22.3	22.1	22.4	23.0	23.7	24.0	24.0
	HWY FE	19.5	21.3	22.3	24.5	24.6	29.0	31.1	32.7	32.7	33.3	34.3	35.5	36.2	36.6
	55/45 FE	15.8	17.5	18.3	19.9	20.3	23.5	25.1	26.0	25.9	26.3	27.0	27.9	28.3	28.4
	Wt(lbs)	4058	4059	3944	3588	3485	3101	3076	3054	3112	3099	3093	3041	3033	3069
	Ton-MPG	32.3	35.5	36.4	35.9	35.4	36.6	38.9	40.1	40.7	41.1	41.9	42.6	43.1	43.8
	Disp(CI)	288	287	279	251	238	188	182	175	182	179	177	167	162	162
	Disp/Wt	.068	.068	.068	.067	.065	.058	.057	.055	.056	.056	.055	.053	.052	.051
	% FWD	6.5	5.8	6.8	9.6	11.9	29.7	37.0	45.6	47.3	53.7	61.6	71.1	76.3	80.1
	% 4WD					.3	.9	.7	.8	3.1	1.0	2.1	1.1	1.3	1.7
	% Man.Tr	19.9	17.1	16.8	20.2	22.3	31.9	30.4	29.7	27.4	24.2	23.6	24.8	25.4	27.5
	% Inject	5.1	3.2	4.2	5.1	4.7	6.9	8.8	17.0	28.3	39.4	53.5	65.1	73.1	81.8
	% TBI						.7	2.6	9.8	18.9	24.4	32.0	28.4	29.6	27.2
	% PORT	5.1	3.2	4.2	5.1	4.7	6.2	6.1	7.2	9.5	15.0	21.4	36.7	43.5	54.6
	% Carb	94.6	96.6	95.3	94.0	93.2	88.7	85.3	78.4	69.6	58.9	45.6	34.5	26.6	18.2
	% Diesel	.2	.3	.5	.9	2.1	4.4	5.9	4.7	2.1	1.7	.9	.3	.3	.0
	Eng-HP	136	134	133	124	119	100	99	99	104	106	111	111	113	119
	HP/Disp	.515	.502	.516	.538	.545	.583	.594	.609	.615	.637	.671	.701	.732	.772
	HP/Wt	.033	.032	.033	.034	.034	.032	.032	.032	.033	.034	.035	.036	.037	.038
	O TO 60	14.2	14.4	14.0	13.7	13.8	14.3	14.4	14.4	14.0	13.8	13.3	13.2	13.0	12.6
	% Small	55.4	55.4	51.9	44.7	43.7	54.4	51.5	56.5	53.1	57.4	55.7	59.5	63.0	62.8
	% Mid	23.3	25.2	24.5	34.4	34.2	34.4	36.4	31.0	31.8	29.4	28.9	27.9	24.1	22.3
	% Large	21.3	19.4	23.5	21.0	22.1	11.3	12.2	12.5	15.1	13.2	15.4	12.6	12.9	14.9
Trucks	Sales(000)	1987	2612	2823	3273	3088	1863	1821	1914	2300	3345	3669	4350	4349	4937
	Fraction	.194	.212	.200	.227	.222	.165	.173	.197	.223	.239	.254	.283	.286	.300
	CITY FE	12.1	12.8	14.0	13.8	13.4	16.5	17.8	18.1	18.3	17.9	18.0	18.8	18.7	18.3
	HWY FE	16.2	16.9	18.1	17.5	16.8	21.9	23.9	24.4	25.2	24.8	24.9	25.9	26.2	26.2
	55/45 FE	13.7	14.4	15.6	15.2	14.7	18.6	20.1	20.5	20.9	20.5	20.6	21.4	21.5	21.2
	Wt(lbs)	4072	4155	4135	4151	4252	3869	3806	3806	3763	3782	3795	3738	3755	3853
	Ton-MPG	28.4	30.5	33.0	32.4	32.1	36.3	38.8	39.6	39.9	39.3	39.6	40.4	40.6	41.0
	Disp(CI)	311	319	318	314	298	248	247	243	231	224	224	211	217	225
	Disp/Wt	.076	.076	.076	.075	.069	.062	.063	.062	.060	.058	.058	.055	.056	.057
	% FWD						1.4	2.0	1.7	1.4	4.9	7.1	5.9	7.1	7.7
	% 4WD	17.1	22.9	23.6	29.0	18.0	25.0	20.1	20.0	25.8	31.0	30.6	30.3	29.6	30.0
	% Man.Tr	37.0	34.8	32.0	32.4	35.2	53.0	51.6	45.7	45.9	42.1	37.1	42.7	40.0	36.6
	% Inject	.1	.1	.1	.1	.3	1.7	1.1	.7	.6	2.6	12.3	40.5	70.0	83.1
	% TBI												18.7	31.8	47.2
	% PORT												21.8	38.2	35.8
	% Carb	99.9	99.9	99.9	99.1	97.9	94.9	93.3	90.0	94.7	95.1	86.7	58.7	29.7	16.5
	% Diesel				.8	1.8	3.5	5.6	9.3	4.7	2.3	1.1	.7	.3	.5
	% Small	13.7	11.1	13.5	13.3	18.5	30.3	27.6	33.9	45.5	46.0	49.1	56.3	58.1	54.4
	% Large	86.3	88.9	86.5	86.7	81.5	69.7	72.4	66.1	54.5	54.0	50.9	43.7	41.9	45.6

Table 2 - Characteristics of 1975 - 1988 Light Duty Vehicles (continued)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Both														
Sales(000)	10224	12334	14123	14448	13882	11306	10554	9732	10302	14020	14460	15365	15231	16437
CITY FE	13.4	14.6	15.6	16.3	16.5	19.6	20.9	21.3	21.2	21.2	21.5	22.1	22.2	22.0
HWY FE	18.7	20.2	21.3	22.5	22.3	27.5	29.5	30.7	30.6	30.8	31.3	32.2	32.7	32.7
55/45 FE	15.3	16.7	17.7	18.6	18.7	22.5	24.1	24.7	24.6	24.6	25.0	25.7	25.9	25.8
Wt(lbs)	4060	4079	3982	3715	3655	3228	3202	3202	3257	3262	3271	3238	3239	3304
Ton-MPG	31.6	34.4	35.7	35.1	34.7	36.6	38.9	40.0	40.5	40.7	41.4	42.0	42.4	43.0
Disp(CI)	293	294	287	266	252	198	193	188	193	190	189	180	178	181
Disp/Wt	.069	.069	.070	.069	.066	.059	.058	.056	.057	.056	.056	.054	.053	.053
% FWD	5.3	4.6	5.5	7.4	9.2	25.0	31.0	37.0	37.0	42.1	47.8	52.6	56.5	58.4
% 4WD	3.3	4.8	4.7	6.6	4.3	4.9	4.0	4.6	8.1	8.2	9.3	9.3	9.4	10.2
% Man.Tr	23.2	20.9	19.8	23.0	25.1	35.4	34.1	32.8	31.5	28.5	27.0	29.8	29.6	30.2
% Inject	4.1	2.5	3.4	3.9	3.7	6.0	7.5	13.8	22.1	30.6	43.0	58.2	72.2	82.2
% TBI						.6	2.2	7.9	14.7	18.6	23.9	25.7	30.2	33.2
% PORT	4.1	2.5	3.4	3.9	3.7	5.2	5.1	5.8	7.3	11.4	16.0	32.5	42.0	49.0
% Carb	95.7	97.3	96.2	95.2	94.2	89.7	86.7	80.6	75.2	67.6	56.1	41.4	27.5	17.7
% Diesel	.2	.2	.4	.9	2.0	4.3	5.9	5.6	2.7	1.8	.9	.4	.3	.1

Table 3 - Characteristics of Consumer and Commercial Fleet Passenger Cars

	1979	1980	1981	1982	1983	1984	1985	1986
	----	----	----	----	----	----	----	----
Consumer								
Sales(000)	9281	8212	7473	6726	6945	9055	9157	9180
Fraction	.860	.870	.856	.860	.868	.848	.849	.833
55/45 FE	20.5	23.7	25.3	26.2	26.2	26.5	27.2	28.0
Wt(lbs)	3447	3078	3052	3032	3086	3077	3070	3032
Ton-MPG	35.4	36.6	38.9	40.1	40.8	41.2	41.9	42.6
Disp(CI)	233	185	179	172	178	176	174	166
Disp/Wt	.065	.057	.056	.054	.055	.055	.054	.053
% FWD	12.8	30.5	37.6	46.3	48.5	53.9	62.1	70.8
% 4WD	.4	.9	.8	.9	3.4	1.1	2.4	1.1
% Man.Tr	24.1	33.6	32.3	31.5	29.9	26.2	25.6	25.9
% Inject	5.0	7.3	9.3	17.2	29.0	39.9	52.5	64.3
% TBI		.7	2.6	9.4	18.4	23.6	29.6	26.8
% PORT	5.0	6.7	6.7	7.8	10.6	16.3	22.9	37.5
% Carb	92.8	88.1	84.7	78.1	68.8	58.3	46.5	35.4
% Diesel	2.2	4.5	6.1	4.8	2.2	1.8	1.0	.3
Eng-HP	118	100	98	98	103	105	110	111
HP/Disp	.551	.589	.601	.615	.624	.645	.679	.705
HP/Wt	.034	.032	.032	.032	.033	.034	.035	.036
O TO 60	13.8	14.3	14.4	14.4	14.0	13.8	13.4	13.2
% Small	46.5	57.0	54.2	59.3	57.0	60.4	58.6	61.1
% Mid	33.0	32.1	33.9	28.6	28.1	26.8	26.4	26.3
% Large	20.5	10.8	11.8	12.1	14.9	12.9	14.9	12.6
Cu.Ft	108	103	106	105	108	107	107	107
Cu.Ft MPG	2260	2507	2745	2834	2912	2912	2992	3055
Cu.Ft Ton MPG	3835	3808	4127	4237	4399	4395	4513	4566

Table 3 - Characteristics of Consumer and Commercial Fleet Passenger Cars (continued)

		1979	1980	1981	1982	1983	1984	1985	1986
		----	----	----	----	----	----	----	----
Commercial Fleet	Sales(000)	1513	1231	1260	1093	1057	1620	1634	1835
	Fraction	.140	.130	.144	.140	.132	.152	.151	.167
	55/45 FE	19.1	22.4	24.0	25.0	24.2	25.2	25.9	27.5
	Wt(lbs)	3715	3261	3215	3191	3282	3216	3224	3085
	Ton-MPG	35.6	36.7	38.8	40.1	39.9	40.7	41.9	42.6
	Disp(CI)	269	209	199	193	206	195	195	172
	Disp/Wt	.070	.062	.060	.058	.061	.059	.059	.054
	% FWD	6.3	24.3	33.7	41.3	39.3	53.1	58.6	72.8
	% 4WD	.1	1.0	.4	.5	.8	.3	.4	.7
	% Man.Tr	11.4	20.7	19.3	18.5	10.8	13.1	12.0	19.0
	% Inject	2.7	3.7	5.7	15.6	23.8	36.6	58.7	69.4
	% TBI		.8	2.7	12.0	22.0	28.9	45.7	36.4
	% PORT	2.7	2.9	3.0	3.6	1.8	7.7	13.0	33.0
	% Carb	95.6	92.6	89.0	80.2	74.9	62.2	40.9	30.4
	% Diesel	1.7	3.7	5.3	4.2	1.2	1.2	.4	.2
	Eng-HP	129	106	103	103	109	109	115	112
	HP/Disp	.504	.546	.558	.574	.560	.592	.627	.683
	HP/Wt	.034	.032	.032	.032	.033	.034	.036	.036
	0 TO 60	13.6	14.2	14.3	14.3	14.0	13.8	13.3	13.2
	% Small	26.6	36.8	35.0	39.4	27.7	40.8	39.5	51.3
	% Mid	41.5	49.0	50.8	45.3	55.9	43.9	42.7	36.1
	% Large	31.9	14.1	14.3	15.3	16.5	15.3	17.8	12.5
	Cu.Ft	116	110	112	112	115	113	113	109
	Cu.Ft MPG	2249	2510	2734	2849	2846	2898	2980	3064
	Cu.Ft Ton MPG	4139	4062	4360	4497	4608	4597	4743	4678

Table 4 - Fuel Economy, Market Fraction, Average CID, IW, 0 To 60, and Vol for 1979-86 Cars

	< ----- Consumer ----- >				< ----- Fleet ----- >				< ----- Both ----- >			
	SMALL	MIDSIZE	LARGE	ALL	SMALL	MIDSIZE	LARGE	ALL	SMALL	MIDSIZE	LARGE	ALL
1979	23.6	19.1	17.2	20.5	22.1	19.0	17.1	19.1	23.4	19.1	17.2	20.3
	.465	.330	.205	1.000	.266	.415	.319	1.000	.437	.342	.221	1.000
	161	269	340	233	189	269	334	269	163	269	339	238
	2906	3713	4246	3447	3087	3734	4215	3715	2921	3716	4240	3485
	14.2	13.7	13.0	13.8	14.0	13.9	13.0	13.6	14.2	13.8	13.0	13.8
	90	116	134	108	93	117	134	116	90	117	134	109
1980	26.3	21.6	19.1	23.7	25.3	21.7	19.0	22.4	26.2	21.6	19.1	23.5
	.570	.321	.108	1.000	.368	.490	.141	1.000	.544	.344	.113	1.000
	135	229	315	185	146	226	312	209	136	228	315	188
	2702	3379	4160	3078	2783	3365	4144	3261	2709	3376	4158	3101
	14.6	13.9	14.2	14.3	14.6	14.0	14.1	14.2	14.6	13.9	14.2	14.3
	91	115	134	103	93	116	134	110	91	115	134	104
1981	28.7	22.9	20.4	25.3	27.9	23.0	20.2	24.0	28.6	23.0	20.4	25.1
	.542	.339	.118	1.000	.350	.508	.143	1.000	.515	.364	.122	1.000
	127	218	306	179	135	214	303	199	128	218	305	182
	2631	3346	4140	3052	2694	3320	4122	3215	2637	3341	4137	3076
	14.4	14.3	14.4	14.4	14.4	14.3	14.3	14.3	14.4	14.3	14.4	14.4
	93	116	134	106	96	116	135	112	93	116	134	106
1982	29.2	24.0	20.4	26.2	28.8	24.0	20.4	25.0	29.2	24.0	20.4	26.0
	.593	.286	.121	1.000	.394	.453	.153	1.000	.565	.310	.125	1.000
	128	211	294	172	135	208	296	193	129	211	294	175
	2670	3337	4089	3032	2723	3296	4086	3191	2675	3329	4088	3054
	14.5	14.2	14.0	14.4	14.5	14.3	14.0	14.3	14.5	14.2	14.0	14.4
	94	116	135	105	97	117	136	112	94	116	136	106
1983	29.9	24.0	20.1	26.2	28.3	23.9	20.1	24.2	29.8	24.0	20.1	25.9
	.570	.281	.149	1.000	.277	.559	.165	1.000	.531	.318	.151	1.000
	132	212	294	178	148	209	295	206	133	211	294	182
	2705	3331	4079	3086	2815	3281	4066	3282	2713	3319	4077	3112
	14.2	13.8	13.5	14.0	14.3	13.9	13.6	14.0	14.2	13.8	13.5	14.0
	96	116	134	108	100	117	135	115	97	116	135	109
1984	29.7	24.1	20.5	26.5	28.4	24.6	20.4	25.2	29.6	24.2	20.4	26.3
	.604	.268	.129	1.000	.408	.439	.153	1.000	.574	.294	.132	1.000
	137	207	295	176	151	201	296	195	138	205	296	179
	2756	3327	4067	3077	2833	3277	4061	3216	2765	3315	4066	3089
	13.9	13.7	13.4	13.8	14.1	13.7	13.5	13.8	13.9	13.7	13.4	13.8
	96	116	135	107	100	117	136	113	97	116	135	108
1985	30.1	24.9	22.2	27.2	29.3	25.1	22.0	25.9	30.0	24.9	22.2	27.0
	.588	.263	.149	1.000	.395	.426	.178	1.000	.559	.288	.154	1.000
	134	201	281	174	148	202	284	195	135	201	282	177
	2747	3330	3882	3070	2824	3309	3905	3224	2756	3325	3886	3093
	13.5	13.3	12.8	13.4	13.5	13.4	12.6	13.3	13.5	13.3	12.8	13.3
	97	116	132	107	100	116	133	113	97	116	132	108
1986	30.1	25.8	23.7	28.0	29.7	26.2	23.8	27.5	30.1	25.9	23.8	27.9
	.611	.263	.126	1.000	.513	.361	.125	1.000	.595	.279	.126	1.000
	136	191	264	166	140	185	265	172	136	190	264	167
	2779	3262	3776	3032	2812	3234	3778	3085	2784	3256	3777	3041
	13.4	13.1	12.2	13.2	13.5	13.2	12.2	13.2	13.4	13.1	12.2	13.2
	98	117	130	107	99	117	131	109	98	117	130	107

Table 5 - Market Share, 55/45 MPG and IW of 1978 - 1988 Passenger Cars by Catalyst Type

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	----	----	----	----	----	----	----	----	----	----	----
No Catalyst	.102 27.0 2467	.085 27.2 2408	.046 25.9 2471								
Oxid. Catalyst	.887 19.2 3717	.868 19.6 3587	.790 23.3 3093	.142 30.0 2480	.132 32.6 2413	.124 33.0 2455	.006 27.1 2788	.004 28.0 2722	.005 28.1 2731	.006 27.3 2839	
3-Way Catalyst	.002 22.0 3188	.018 23.5 2982	.096 22.7 3150	.297 26.2 2967	.299 27.1 2977	.243 28.7 2869	.357 30.2 2754	.485 29.3 2837	.540 28.8 2945	.661 29.1 2955	.750 29.4 2970
3-Way + Oxid.		.007 16.8 4082	.025 20.1 3663	.502 23.1 3248	.523 24.0 3210	.612 23.8 3324	.621 24.3 3296	.502 24.9 3339	.452 26.8 3159	.330 26.8 3190	.250 25.9 3364
Diesel	.009 29.4 3498	.021 27.1 3873	.044 30.0 3487	.059 29.9 3589	.047 30.6 3602	.021 30.8 3633	.017 36.3 3202	.009 34.2 3275	.003 40.5 2906	.003 31.2 3531	.000 37.4 3000

Table 6 - Market Share, 55/45 MPG and IW of 1978 - 1988 Light Trucks by Catalyst Type

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	----	----	----	----	----	----	----	----	----	----	----
No Catalyst	.705 14.5 4260	.084 22.8 2821	.107 24.2 2773	.035 27.8 2728	.000 28.8 2750	.022 22.3 3154		.009 21.6 3203			
Oxid. Catalyst	.287 17.3 3878	.898 14.2 4371	.849 17.9 3986	.839 19.4 3913	.795 20.2 3769	.741 20.7 3816	.623 20.2 3851	.530 19.7 3957	.395 19.8 3972	.182 21.0 3752	.038 21.8 3289
3-Way Catalyst			.010 19.2 3622	.032 23.3 3034	.052 23.8 3120	.076 22.0 3372	.122 22.5 3367	.261 24.2 3346	.459 23.1 3514	.592 22.0 3720	.644 22.2 3767
3-Way + Oxid.			.000 13.4 6500	.038 18.6 3925	.060 15.3 4279	.113 19.3 3536	.232 19.8 3764	.189 18.7 3945	.138 21.3 3764	.224 20.5 3840	.313 19.4 4076
Diesel	.008 21.2 4383	.018 21.1 4977	.035 24.3 4437	.056 32.0 3213	.093 27.0 4192	.047 27.0 4388	.023 27.4 4291	.011 26.1 4578	.007 26.7 4550	.003 25.7 4661	.005 22.5 5336

Table 7 - Market Share, 55/45 MPG and IW of 1978 - 1988 Passenger Cars by Transmission Type

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	----	----	----	----	----	----	----	----	----	----	----
Automatic	.731	.697	.516	.362	.189	.168	.175	.185	.172	.155	.083
	18.7	19.0	22.4	24.4	27.3	28.1	28.0	28.3	28.1	27.8	27.4
	3817	3727	3218	2972	2800	2828	2810	2828	2837	2817	2924
Lockup +Auto	.067	.080	.142	.259	.388	.354	.365	.292	.272	.245	.271
	17.2	18.5	19.9	22.4	24.4	24.4	25.4	26.8	27.7	29.0	29.7
	4133	3822	3759	3641	3265	3235	3192	3117	3022	2930	2892
Lockup + Ovdrive			.023	.074	.126	.213	.218	.294	.309	.346	.372
			19.3	19.8	20.2	21.4	22.0	23.2	25.0	25.3	25.4
			3975	4001	4016	3823	3714	3612	3478	3477	3513
Manual	.22	.223	.319	.304	.297	.265	.242	.228	.248	.253	.275
	28.1	26.6	28.5	31.5	31.9	32.4	32.4	32.8	32.7	33.1	32.8
	2575	2604	2558	2492	2531	2555	2609	2607	2657	2660	2685

Table 8 - Market Share, 55/45 MPG and IW of 1978 - 1988 Light Trucks by Transmission Type

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	----	----	----	----	----	----	----	----	----	----	----
Automatic	.676	.628	.224	.173	.211	.176	.227	.207	.153	.175	.134
	14.4	13.5	16.3	17.0	16.7	17.2	17.3	17.7	19.2	18.3	17.9
	4330	4534	4162	4138	4137	3919	3921	3988	3921	4103	4313
Lockup +Auto		.021	.246	.311	.332	.361	.351	.422	.420	.424	.476
		15.2	16.6	17.9	19.4	19.3	19.4	19.6	19.7	20.6	20.7
		4141	4491	4264	4236	4296	4196	4075	4089	3971	4054
Manual	.317	.289	.350	.277	.214	.229	.160	.129	.099	.095	.059
	17.3	16.9	19.8	21.7	22.3	23.6	22.3	22.7	23.0	21.9	22.5
	3806	3929	3614	3592	3461	3334	3496	3553	3582	3748	3511
Manual + Ovdrive	.007	.063	.181	.239	.242	.234	.261	.243	.328	.305	.332
	27.2	22.3	23.5	25.3	25.7	25.3	25.0	25.1	25.3	25.3	23.6
	2500	2956	3151	3217	3231	3241	3280	3272	3247	3256	3440

Table 9 - Characteristics of 1978 to 1988 Passenger Cars by Number of Cylinders

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	----	----	----	----	----	----	----	----	----	----	----
FOUR											
Sales(OOO)	2942	3184	4600	4542	4311	4260	5884	6059	6542	6909	6725
Fraction	.263	.295	.487	.520	.551	.532	.551	.562	.594	.635	.585
55/45 FE	28.3	27.0	27.9	29.7	30.8	31.0	31.1	31.3	31.2	31.3	31.9
Wt(lbs)	2519	2571	2579	2560	2607	2630	2664	2676	2720	2718	2728
Ton-MPG	36.1	35.0	36.3	38.4	40.4	41.2	41.8	42.3	42.7	42.9	43.7
Disp(CI)	108	111	116	116	115	119	120	121	122	120	117
Disp/Wt	.043	.043	.045	.045	.044	.045	.045	.045	.045	.044	.043
% FWD	31.6	33.3	44.8	60.3	71.6	74.8	80.7	83.0	88.7	90.9	91.7
% 4WD		1.2	1.0	.9	.9	5.0	1.4	3.7	1.6	2.0	2.7
% Man.Tr	67.1	65.8	60.4	55.3	49.0	47.1	40.0	38.5	36.9	36.8	43.1
% Inject	10.4	7.0	9.5	7.9	18.9	32.3	44.2	51.8	63.6	67.8	76.9
% TBI					11.0	20.5	27.8	32.5	38.5	37.6	40.8
% PORT	10.4	7.0	9.5	7.9	7.9	11.8	16.4	19.3	25.1	30.2	36.2
% Carb	87.4	90.6	86.7	87.8	77.7	66.1	53.9	46.8	36.0	32.1	23.0
% Diesel	2.2	2.4	3.8	4.3	3.4	1.6	1.9	1.3	.4	.1	.0
Eng-HP	78	77	78	79	78	81	86	90	91	93	97
HP/Disp	.726	.707	.682	.693	.686	.695	.719	.753	.755	.778	.830
HP/Wt	.031	.030	.030	.031	.030	.031	.032	.034	.033	.034	.035
O TO 60	14.7	14.9	14.8	14.6	14.9	14.6	14.3	13.9	13.9	13.7	13.4
% Small	97.6	95.8	89.7	82.9	84.1	79.8	84.4	81.3	79.5	81.6	86.8
% Mid	2.4	4.2	10.3	17.1	15.9	20.2	15.6	18.7	20.3	18.2	12.6
% Large								.0	.2	.2	.5
Cu.Ft	89	90	93	97	98	101	100	101	102	102	101
Cu.Ft MPG	2579	2484	2643	2937	3056	3181	3168	3230	3233	3232	3270
Cu.Ft Ton MPG	3216	3163	3376	3734	3963	4147	4190	4291	4373	4365	4422
SIX											
Sales(OOO)	2351	2250	2674	2411	2122	1879	2457	2503	2752	2499	3303
Fraction	.210	.208	.283	.276	.271	.235	.230	.232	.250	.230	.287
55/45 FE	20.2	20.4	21.6	22.6	23.0	23.8	24.1	24.0	24.9	25.1	25.7
Wt(lbs)	3478	3412	3336	3384	3389	3379	3365	3388	3373	3413	3391
Ton-MPG	35.2	34.9	36.1	38.4	39.2	40.4	40.5	40.8	42.0	42.9	43.8
Disp(CI)	220	216	212	215	212	211	205	206	199	199	193
Disp/Wt	.063	.063	.064	.063	.062	.062	.061	.061	.059	.058	.057
% FWD	1.0	1.2	21.7	14.2	19.1	22.3	31.5	48.5	63.9	73.1	83.3
% 4WD			1.5	.8	1.1	1.7	.9	.0	.4	.2	.3
% Man.Tr	9.1	10.4	8.2	5.4	7.0	6.6	6.1	6.3	7.1	8.0	6.3
% Inject	6.2	7.4	4.2	6.8	17.4	12.4	29.9	62.8	80.6	96.7	99.9
% TBI					7.8		8.8	21.6	15.1	8.0	1.6
% PORT	6.2	7.4	4.2	6.8	9.6	12.4	21.1	41.2	65.5	88.7	98.3
% Carb	93.7	91.9	94.6	92.4	79.9	84.7	68.7	36.7	19.2	2.5	.1
% Diesel	.1	.7	1.1	.9	2.7	2.9	1.4	.6	.3	.8	
Eng-HP	107	109	110	110	114	116	117	124	134	143	142
HP/Disp	.498	.516	.530	.523	.551	.567	.586	.617	.687	.733	.747
HP/Wt	.031	.032	.033	.033	.034	.035	.035	.037	.040	.042	.042
O TO 60	14.8	14.4	14.0	14.1	13.8	13.6	13.4	12.9	12.1	11.6	11.5
% Small	54.6	42.1	29.7	23.7	26.3	32.3	30.0	30.2	34.6	37.9	33.6
% Mid	43.4	56.3	66.0	70.0	63.9	63.4	66.9	55.9	44.5	38.2	44.6
% Large	2.1	1.6	4.3	6.3	9.8	4.3	3.1	13.9	21.0	23.9	21.8
Cu.Ft	109	108	111	111	112	111	111	112	112	113	114
Cu.Ft MPG	2204	2211	2408	2528	2591	2659	2682	2695	2799	2843	2938
Cu.Ft Ton MPG	3836	3788	4012	4291	4409	4498	4513	4564	4728	4854	4984

Table 9 - Characteristics of 1978 to 1988 Passenger Cars by Number of Cylinders (continued)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
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EIGHT											
Sales(000)	5882	5361	2169	1780	1386	1863	2334	2229	1721	1474	1472
Fraction	.526	.497	.230	.204	.177	.233	.219	.207	.156	.135	.128
55/45 FE	17.2	17.6	19.1	20.3	20.3	20.1	20.4	21.7	23.1	22.8	22.6
Wt(lbs)	4166	4058	3920	3973	3931	3944	3914	3895	3729	3868	3903
Ton-MPG	36.1	35.9	37.9	40.9	40.4	39.7	40.0	42.3	43.2	44.2	44.2
Disp(CI)	336	324	309	307	304	298	299	296	289	300	301
Disp/Wt	.081	.080	.079	.077	.077	.076	.077	.076	.077	.078	.077
% FWD	2.1	3.7	7.6	8.8	5.4	9.6	9.2	18.2	15.7	13.3	20.3
% 4WD											
% Man.Tr	1.2	1.4	.8	1.0	4.5	3.4	3.2	2.5	6.8	1.3	3.8
% Inject	1.9	2.2	4.4	13.7	10.3	35.3	37.3	47.4	46.4	58.1	63.4
% TBI			3.0	12.9	9.0	34.3	32.2	42.3	11.7	29.1	22.4
% PORT	1.9	2.2	1.4	.8	1.3	1.0	5.1	5.1	34.7	29.0	41.0
% Carb	97.5	95.3	85.8	69.4	78.1	62.5	61.3	52.5	53.6	41.9	36.6
% Diesel	.6	2.6	9.8	16.9	11.6	2.2	1.4	.1			
Eng-HP	154	149	135	133	138	143	144	151	148	155	170
HP/Disp	.460	.461	.439	.440	.459	.482	.484	.509	.521	.519	.568
HP/Wt	.037	.037	.035	.034	.036	.036	.037	.039	.040	.040	.044
O TO 60	12.8	12.9	13.6	14.0	13.4	12.9	12.8	12.4	12.2	12.0	11.4
% Small	14.2	13.4	9.9	8.8	17.3	12.9	18.3	14.9	23.1	18.2	18.4
% Mid	46.8	42.8	46.4	40.0	27.2	26.5	24.5	26.4	30.4	28.3	16.3
% Large	39.0	43.8	43.7	51.2	55.6	60.6	57.3	58.7	46.4	53.5	65.3
Cu.Ft	119	121	121	123	123	125	122	123	119	122	126
Cu.Ft MPG	2085	2144	2343	2540	2528	2516	2497	2670	2799	2792	2852
Cu.Ft Ton MPG	4317	4340	4616	5074	5031	4992	4927	5227	5163	5433	5628

		1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	
		----	----	----	----	----	----	----	----	----	----	----	
FOUR	Sales(000)	342	481	585	522	518	744	1083	1253	1802	1527	1524	
	Fraction	.105	.156	.314	.287	.270	.324	.324	.342	.414	.351	.309	
	55/45 FE	26.2	23.1	24.3	27.3	27.4	27.2	26.4	26.1	26.3	26.6	25.3	
	Wt(lbs)	2849	2850	2842	2861	2897	2924	3064	3157	3159	3123	3199	
	Ton-MPG	37.7	33.6	35.1	39.9	40.4	40.3	40.8	41.5	41.7	41.7	40.6	
	Disp(CI)	121	123	124	130	132	135	135	141	139	139	142	
	Disp/Wt	.042	.043	.044	.046	.046	.046	.044	.045	.044	.045	.045	
	% FWD			4.5	6.4	6.2	4.2	15.1	20.7	14.1	10.5	9.0	
	% 4WD	6.8	20.5	22.2	24.5	23.3	19.2	21.3	21.7	24.7	25.5	26.6	
	% Man.Tr	88.1	86.4	90.0	92.9	88.9	84.8	75.9	65.9	72.6	73.2	74.0	
	% Inject	.8	1.8	5.3	3.9	2.4	2.0	7.9	27.7	34.8	43.9	51.5	
	% TBI									18.5	22.7	39.8	
	% PORT									16.3	21.2	11.8	
	% Carb	99.2	98.2	92.8	80.6	82.0	92.5	88.8	71.1	64.4	55.8	48.5	
	% Diesel			1.9	15.5	15.6	5.6	3.3	1.2	.8	.3		
	% Small	100.0	99.2	89.4	90.4	86.6	92.0	79.6	77.7	81.0	88.7	89.5	
	% Large		.8	10.6	9.6	13.4	8.0	20.4	22.3	19.0	11.3	10.5	
	SIX	Sales(000)	558	515	555	636	642	751	1200	1217	1379	1766	2160
		Fraction	.171	.167	.298	.350	.336	.327	.359	.332	.317	.406	.438
		55/45 FE	17.9	17.2	18.8	19.7	20.9	21.1	20.8	21.5	20.9	21.5	21.6
Wt(lbs)		3973	4066	4016	3956	3693	3754	3730	3704	3793	3791	3838	
Ton-MPG		35.9	35.4	38.0	39.2	38.7	39.7	38.9	39.9	39.7	40.7	41.5	
Disp(CI)		273	264	269	272	243	229	221	216	218	221	225	
Disp/Wt		.069	.066	.067	.069	.066	.061	.059	.058	.057	.058	.059	
% FWD											8.3	11.3	
% 4WD		14.6	19.5	18.3	14.5	12.8	32.4	41.2	43.0	37.8	32.3	34.3	
% Man.Tr		32.0	61.0	61.9	57.3	52.5	48.5	41.4	37.7	33.3	27.1	28.4	
% Inject									.5	58.3	90.2	98.7	
% TBI									.5	34.7	35.0	46.2	
% PORT										23.5	55.3	52.4	
% Carb		99.8	99.3	99.1	100.0	100.0	100.0	100.0	99.5	41.6	9.8	1.3	
% Diesel		.2	.7	.9						.1			
% Small		9.8	10.9	6.4	4.6	31.3	48.0	56.5	67.9	71.8	66.2	61.1	
% Large		90.2	89.1	93.6	95.4	68.7	52.0	43.5	32.1	28.2	33.8	38.9	
EIGHT		Sales(000)	2373	2092	723	662	754	804	1062	1198	1169	1056	1252
		Fraction	.725	.677	.388	.364	.394	.350	.317	.327	.269	.243	.254
		55/45 FE	13.9	13.2	15.4	16.9	17.2	17.0	16.5	16.3	17.1	16.8	17.3
	Wt(lbs)	4381	4620	4585	4405	4526	4547	4573	4555	4563	4609	4675	
	Ton-MPG	30.8	30.9	35.9	37.6	39.9	39.7	38.3	37.5	39.2	38.9	40.8	
	Disp(CI)	352	347	333	315	319	321	320	318	315	322	327	
	Disp/Wt	.081	.075	.073	.072	.071	.071	.070	.070	.069	.070	.070	
	% FWD				.5	.1			.0	.0	.0	.0	
	% 4WD	35.5	17.0	32.5	22.0	24.0	25.6	29.3	27.4	29.9	30.8	26.6	
	% Man.Tr	24.4	17.0	16.3	13.6	10.2	7.4	8.5	6.5	7.6	13.8	5.2	
	% Inject								8.1	28.5	73.9	94.6	
	% TBI									.0	39.5	58.1	
	% PORT									28.4	34.4	36.5	
	% Carb	98.9	97.5	93.4	96.8	87.0	91.7	96.0	89.9	70.2	25.4	3.6	
	% Diesel	1.1	2.5	6.6	3.2	13.0	8.3	4.0	2.0	1.3	.7	1.8	
	% Small	1.6	1.8	1.0	.3						.0	.0	
	% Large	98.4	98.2	99.0	99.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

Table 11 - Fuel Economy, Market Fraction, CID and Inertia Weight for 1978 - 1988 Light-Duty Trucks by Size/Body Class

	Small Pickups	Large Pickups	Small Van	Large Van	Small Utility	Large Utility
1978	26.3 .1037 121 2844	14.7 .5889 339 4326	20.0 .0008 120 3500	14.2 .1902 330 4253	16.7 .0285 275 3026	13.8 .0878 359 4676
1979	23.4 .1486 123 2832	14.3 .5660 330 4486	18.7 .0027 120 3500	13.5 .1529 326 4560	16.7 .0339 261 3196	11.6 .0959 355 4975
1980	25.3 .2625 123 2792	17.4 .5083 294 4227	19.0 .0084 120 3619	16.5 .1213 299 4404	18.8 .0325 227 3083	14.3 .0670 328 4810
1981	28.1 .2468 129 2822	18.9 .5439 286 4069	18.5 .0062 120 3644	17.4 .1283 292 4357	20.4 .0234 225 3054	15.6 .0513 320 4734
1982	27.5 .3091 144 2880	19.0 .4438 287 4151	21.7 .0078 111 3668	17.1 .1545 296 4376	20.5 .0222 207 2922	16.8 .0626 324 4855
1983	26.9 .3805 145 2978	18.4 .3280 289 4197	19.7 .0062 118 3567	17.7 .1599 301 4445	21.9 .0680 189 3512	16.5 .0574 333 4905
1984	26.0 .2707 146 3080	18.8 .3402 271 4048	24.7 .0649 136 3380	17.1 .1371 303 4402	21.9 .1247 175 3546	15.5 .0622 331 4910
1985	25.9 .2273 151 3070	19.2 .3391 269 4026	23.5 .1206 169 3521	16.4 .1124 308 4462	22.1 .1429 168 3643	15.8 .0577 333 4945
1986	25.8 .2829 147 3118	19.7 .2992 262 4005	23.2 .1494 181 3671	17.4 .0906 305 4537	22.2 .1309 163 3550	16.3 .0470 328 4955
1987	27.1 .2472 147 3026	19.2 .2786 272 4092	23.4 .1796 186 3674	17.1 .0959 310 4577	22.6 .1538 172 3519	15.9 .0450 333 5053
1988	25.6 .2216 154 3075	19.4 .3318 278 4166	23.3 .1777 185 3783	17.7 .0818 310 4665	22.2 .1446 182 3573	16.1 .0424 339 5153

Table 12

**Changes In CID, Weight and MPG
of Light-Duty Trucks By Size Class, 1978-88**

<u>Class</u>	<u>CID</u>	<u>Weight</u>	<u>MPG</u>
Small Pickup	+23	+231	-.7
Large Pickup	-61	-160	+4.7
Small Van	+65	+273	+3.3
Large Van	-20	+412	+3.5
Small Utility	-93	+547	+5.5
Large Utility	<u>-20</u>	<u>+477</u>	<u>+2.3</u>
All Trucks	-89	-298	+6.0

Table 13 - Fuel Economy, Market Fraction, CID, IW, 0 To 60, and Volume by Car Size Class

	Two Seater	Mini Compact	Sub Compact	Compact	Midsize	Large	Small Wagon	Midsize Wagon	Large Wagon
1978	19.4 .017 187 3079 11.8 50	27.4 .081 120 2584 14.1 79	24.6 .184 159 2842 14.4 90	20.2 .133 236 3552 14.5 105	18.6 .299 292 3820 13.4 113	16.8 .183 357 4394 12.8 128	24.3 .032 134 2805 14.3 108	18.6 .045 258 3836 14.4 140	15.9 .026 354 4664 13.4 162
1979	20.1 .024 180 3026 12.2 50	27.6 .040 113 2450 14.4 80	24.1 .282 155 2847 14.2 90	19.5 .062 246 3624 14.4 105	19.1 .297 272 3710 13.6 113	17.4 .196 339 4210 12.9 130	25.7 .029 123 2711 15.1 105	19.1 .045 249 3758 14.7 140	16.1 .026 333 4467 13.4 163
1980	20.6 .021 180 2954 12.3 50	28.1 .041 116 2459 14.4 83	27.1 .376 128 2640 14.7 90	22.4 .073 186 3185 14.4 106	21.6 .316 229 3362 13.8 113	19.1 .102 314 4130 14.0 131	28.6 .033 113 2591 15.4 108	21.1 .027 228 3535 15.0 140	19.1 .011 324 4423 15.2 161
1981	21.9 .019 202 3005 10.6 50	34.3 .026 92 2164 14.5 83	29.3 .311 124 2604 14.7 90	26.7 .112 142 2825 14.2 104	22.9 .332 220 3346 14.2 114	20.4 .109 304 4108 14.3 131	30.0 .048 108 2531 14.4 111	23.1 .031 193 3285 14.5 136	19.9 .012 313 4394 15.3 161
1982	25.7 .034 147 2726 13.0 50	35.5 .023 95 2193 14.6 83	29.1 .298 133 2657 14.5 92	29.0 .162 128 2794 14.6 103	24.0 .273 211 3321 14.2 114	20.7 .106 292 4034 13.9 131	30.6 .049 109 2580 15.3 112	23.7 .036 205 3384 14.3 136	19.2 .019 306 4396 14.6 161
1983	23.9 .017 146 2756 11.8 50	35.7 .020 100 2273 14.2 82	30.0 .246 136 2688 14.0 93	28.8 .182 141 2844 14.4 103	23.9 .284 212 3316 13.8 114	20.2 .135 293 4041 13.4 131	32.2 .066 105 2565 15.3 108	24.4 .034 200 3348 14.1 136	19.6 .016 307 4380 14.1 162
1984	26.7 .033 174 2886 12.1 50	25.6 .004 151 2855 10.5 76	29.6 .238 140 2737 13.5 93	29.7 .256 137 2798 14.3 103	24.1 .260 210 3318 13.6 114	20.5 .116 294 4022 13.4 131	31.9 .043 107 2620 15.2 116	25.0 .034 172 3298 14.1 136	19.9 .017 305 4371 13.9 162
1985	26.9 .031 158 2826 11.7 50	36.0 .007 106 2300 13.4 79	30.1 .202 136 2734 13.4 94	29.8 .272 138 2804 13.5 103	24.9 .258 205 3319 13.3 114	22.3 .140 279 3841 12.7 129	32.5 .046 107 2579 15.2 118	25.0 .030 173 3380 13.9 136	20.9 .014 305 4354 13.2 162
1986	28.1 .028 166 2916 11.7 50	30.7 .016 113 2408 12.8 81	30.6 .216 136 2764 13.4 95	29.8 .304 137 2819 13.5 103	25.9 .242 194 3241 13.0 114	23.9 .115 260 3719 12.1 127	31.0 .032 113 2648 14.7 118	26.0 .037 162 3355 13.6 138	22.0 .011 304 4381 13.9 161
1987	27.5 .026 167 2929 11.5 50	31.0 .006 123 2573 11.5 78	31.6 .191 126 2705 13.6 93	29.9 .373 134 2830 13.3 103	26.1 .209 190 3256 12.6 114	24.3 .120 263 3716 11.9 128	31.1 .034 116 2781 14.1 120	25.9 .032 172 3433 13.2 140	22.9 .009 304 4320 13.8 162
1988	27.1 .024 166 2976 10.8 50	32.0 .007 120 2712 12.2 79	32.0 .203 119 2672 13.4 93	29.9 .367 137 2891 12.7 103	26.7 .189 184 3288 12.4 113	24.2 .129 258 3678 11.3 127	31.6 .025 111 2718 13.9 118	26.2 .035 174 3394 12.8 140	22.9 .021 306 4434 14.1 161

Table 14 Characteristics of Small, Midsize and Large Passenger Cars, 1978 to 1988

		1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
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SMALL	Sales(000)	4991	4714	5135	4495	4421	4248	6128	6030	6551	6855	7221
	Fraction	.447	.437	.544	.515	.565	.531	.574	.559	.595	.630	.628
	55/45 FE	23.3	23.4	26.2	28.6	29.2	29.8	29.6	30.0	30.1	30.3	30.5
	Wt(lbs)	3013	2921	2709	2637	2675	2713	2765	2756	2784	2791	2814
	Ton-MPG	35.5	34.6	36.0	38.2	39.6	40.9	41.4	41.8	42.3	42.7	43.3
	Disp(CI)	174	163	136	128	129	133	138	135	136	132	131
	Disp/Wt	.055	.053	.049	.047	.047	.048	.049	.048	.048	.046	.046
	% FWD	20.2	23.7	37.0	49.0	57.3	60.8	64.6	69.8	74.7	80.4	83.3
	% Man.Tr	43.6	49.2	53.6	54.8	51.1	50.6	41.3	41.4	40.2	39.0	42.0
	% Inject	10.1	8.9	10.5	11.4	18.4	33.2	44.9	52.9	60.9	66.4	78.5
	% TBI					6.1	16.2	21.1	26.5	25.8	25.7	30.1
	% PORT	10.1	8.9	10.5	11.4	12.3	17.0	23.8	26.4	35.1	40.7	48.4
	% Carb	88.6	89.0	85.6	83.8	77.8	64.7	52.9	45.8	38.7	33.3	21.5
	% Diesel	1.4	2.1	3.9	4.8	3.8	2.1	2.1	1.3	.4	.3	.0
	Eng-HP	99.2	96.6	85.5	84.7	85.7	89.0	94.2	98.6	99.8	101.1	107.2
	HP/Disp	.631	.644	.659	.687	.684	.695	.707	.746	.753	.782	.832
	HP/Wt	.033	.032	.031	.032	.032	.032	.034	.035	.035	.036	.037
	O TO 60	14.2	14.2	14.6	14.4	14.5	14.2	13.9	13.5	13.4	13.3	12.9
MIDSIZE	Sales(000)	3843	3693	3244	3175	2420	2544	3135	3103	3076	2627	2563
	Fraction	.344	.342	.344	.364	.310	.318	.294	.288	.279	.241	.223
	55/45 FE	18.6	19.1	21.6	23.0	24.0	24.0	24.2	24.9	25.9	26.0	26.6
	Wt(lbs)	3822	3716	3376	3341	3329	3319	3315	3325	3256	3280	3304
	Ton-MPG	35.6	35.7	36.6	38.5	40.2	40.0	40.3	41.6	42.3	42.8	44.1
	Disp(CI)	288	269	228	218	211	211	205	201	190	187	182
	Disp/Wt	.075	.072	.067	.064	.062	.063	.061	.060	.058	.056	.055
	% FWD	1.2	4.5	27.8	32.5	42.8	47.1	56.8	63.1	72.5	77.9	87.0
	% Man.Tr	2.2	2.4	8.0	6.2	2.6	1.7	1.5	1.6	2.8	3.0	4.8
	% Inject	1.6	2.3	2.7	2.8	14.4	16.6	29.5	50.6	69.2	85.6	94.6
	% TBI			1.4	2.1	13.6	15.3	25.0	36.6	40.4	41.2	27.1
	% PORT	1.6	2.3	1.3	.7	.8	1.3	4.5	14.0	28.8	44.4	67.5
	% Carb	98.4	96.1	94.5	93.1	81.5	81.6	69.3	49.0	30.6	14.0	5.4
	% Diesel	.0	1.6	2.8	4.1	4.1	1.7	1.2	.4	.2	.4	
	Eng-HP	133.4	26.4	112.3	107.1	107.5	111.2	112.6	116.8	118.0	123.8	127.1
	HP/Disp	.467	.475	.510	.514	.532	.546	.571	.612	.650	.689	.715
	HP/Wt	.035	.034	.033	.032	.032	.033	.034	.035	.036	.038	.038
	O TO 60	13.5	13.8	13.9	14.3	14.2	13.9	13.7	13.3	13.1	12.7	12.4

Table 14 Characteristics of Small, Midsize and Large Passenger Cars, 1978 to 1988 (continued)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
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LARGE											
Sales(000)	2341	2387	1064	1064	978	1209	1412	1657	1388	1400	1717
Fraction	.210	.221	.113	.122	.125	.151	.132	.154	.126	.129	.149
55/45 FE	16.7	17.2	19.1	20.4	20.4	20.1	20.4	22.2	23.8	24.2	24.0
Wt(lbs)	4428	4240	4158	4137	4088	4077	4066	3886	3777	3757	3786
Ton-MPG	37.2	36.7	40.1	42.8	42.2	41.1	41.6	43.1	44.8	45.4	45.4
Disp(CI)	357	339	315	305	294	294	296	282	264	265	265
Disp/Wt	.080	.080	.076	.074	.072	.072	.073	.072	.070	.070	.070
% FWD	1.0							29.1	51.1	52.9	56.5
% Man.Tr									.6	.4	.5
% Inject	.1	.1	1.8	15.3	17.1	35.9	37.3	60.9	76.2	82.2	76.7
% TBI			1.8	15.3	17.1	35.9	37.3	43.6	14.5	26.9	15.1
% PORT	.1	.1						17.4	61.8	55.4	61.6
% Carb	98.5	96.8	86.2	68.4	72.8	61.5	61.8	38.8	23.8	17.8	23.3
% Diesel	1.4	3.1	12.0	16.3	10.1	2.7	.9	.3			
Eng-HP	162.3	53.8	136.3	133.0	135.9	140.4	140.7	143.6	146.9	149.1	157.6
HP/Disp	.457	.456	.438	.442	.466	.480	.478	.511	.569	.574	.607
HP/Wt	.037	.036	.033	.032	.033	.034	.035	.037	.039	.040	.042
O TO 60	12.9	13.0	14.2	14.4	14.0	13.5	13.4	12.8	12.2	12.0	11.7

Table 15 - Fuel Economy, Market Fraction, CID, 0 to 60 Time, and Volume, for 1978 - 1988 Passenger Cars by Weight Class

	Under 2250 -----	2250 -----	2500 -----	2750 -----	3000 -----	3500 -----	4000 -----	Over 4000 -----
1978	34.9 .024 90 14.3 80	31.9 .079 89 15.0 86	27.9 .070 101 15.1 92	24.8 .045 129 13.4 89	22.5 .081 164 13.9 97	20.2 .268 257 13.8 111	18.0 .200 306 13.1 115	15.8 .233 369 13.1 126
1979	32.0 .022 88 14.4 80	31.4 .065 88 15.2 88	27.9 .100 101 15.4 91	24.0 .043 132 13.6 82	22.1 .119 162 13.9 96	20.2 .249 252 13.7 112	17.8 .245 311 13.0 120	16.2 .159 358 13.5 127
1980	33.0 .030 30 14.3 86	32.4 .123 92 15.0 90	28.0 .124 104 15.6 92	26.1 .103 142 13.6 96	23.6 .215 164 13.8 101	20.7 .227 244 14.1 111	18.8 .139 302 13.9 122	18.9 .039 350 15.1 137
1981	38.4 .024 86 14.0 87	34.4 .136 96 14.8 91	29.4 .175 108 14.8 95	27.7 .082 137 13.8 107	24.4 .186 165 13.8 104	22.2 .209 234 14.3 113	20.3 .150 296 14.0 123	20.3 .037 343 16.1 137
1982	40.3 .020 86 14.5 87	35.6 .113 94 15.0 92	31.2 .184 106 15.4 92	28.8 .123 124 14.4 104	25.7 .199 163 13.6 104	22.4 .182 237 14.0 112	20.6 .155 287 13.8 126	20.7 .024 323 16.1 148
1983	43.6 .012 84 14.4 86	36.2 .123 95 14.9 96	32.2 .155 107 15.0 95	30.2 .108 124 14.2 106	25.8 .189 161 13.4 105	22.8 .209 238 13.6 112	20.3 .181 287 13.4 127	19.8 .024 312 14.4 146
1984	44.3 .009 86 13.5 73	37.1 .084 94 14.8 97	32.7 .143 107 14.7 96	30.1 .192 127 14.1 103	26.4 .187 157 13.2 105	22.9 .208 236 13.1 110	20.6 .159 289 13.4 126	20.0 .018 309 14.0 152
1985	48.5 .009 78 14.5 68	37.5 .078 94 14.6 97	32.8 .157 109 14.2 98	30.6 .174 128 13.6 103	27.1 .189 153 13.0 106	23.4 .228 228 12.7 112	21.7 .155 294 12.8 125	20.8 .010 307 13.8 160
1986	45.8 .013 67 15.9 79	38.5 .068 93 14.8 93	33.7 .147 106 14.3 100	30.6 .172 125 13.4 102	27.5 .257 151 13.2 107	24.4 .251 225 12.0 113	22.1 .083 299 12.4 125	21.2 .009 309 14.0 156
1987	45.2 .019 67 16.0 84	39.2 .042 91 14.5 90	33.5 .179 105 14.5 99	30.9 .184 124 13.3 102	28.0 .247 147 12.8 106	24.7 .228 216 11.6 114	22.6 .095 296 12.3 123	22.0 .007 307 14.5 159
1988	42.1 .025 71 15.5 89	39.7 .042 91 13.5 91	34.4 .150 99 14.6 99	31.5 .152 121 13.0 102	28.3 .272 147 12.3 105	25.2 .266 210 11.4 114	22.3 .072 291 11.3 124	22.7 .022 308 14.5 155

Table 16 - Fuel Economy, Market Fraction and CID
for 1978 to 1988 Light Duty Trucks by Weight Class

	Under 2750 -----	2750 -----	3000 -----	3500 -----	4000 -----	4500 -----	5000 -----	Over 5000 -----
1978	27.2 .007 97	23.5 .074 157	25.2 .044 148	18.6 .031 267	15.9 .402 319	13.5 .301 353	12.8 .099 371	12.1 .042 379
1979	27.5 .013 96	22.6 .081 126	21.9 .073 154	16.9 .022 251	15.9 .227 301	13.9 .311 323	12.3 .218 363	11.0 .054 401
1980	28.8 .024 92	25.2 .174 126	22.7 .114 146	18.3 .044 211	18.6 .288 279	15.7 .209 319	15.1 .130 347	13.0 .018 355
1981	33.3 .028 102	27.9 .122 130	25.9 .137 150	20.9 .067 238	19.1 .371 283	16.8 .205 312	15.8 .067 330	13.7 .003 350
1982	29.8 .026 120	28.3 .119 130	25.9 .198 162	22.1 .076 205	18.7 .256 286	16.8 .213 310	17.0 .089 332	21.5 .024 350
1983	28.1 .017 126	28.8 .148 132	25.7 .180 158	23.3 .120 174	19.0 .218 269	17.0 .225 310	17.0 .075 332	20.4 .017 374
1984	28.0 .007 99	28.3 .098 130	26.0 .172 153	22.7 .221 164	18.9 .206 265	16.7 .207 310	16.0 .078 327	18.2 .012 369
1985	29.1 .003 82	29.9 .067 130	26.2 .179 151	23.0 .260 168	19.6 .202 260	16.4 .203 311	15.9 .076 326	17.1 .010 363
1986	32.7 .010 84	29.5 .073 132	26.8 .193 143	23.0 .259 164	20.1 .215 243	17.3 .177 307	16.3 .067 323	16.8 .008 348
1987	33.0 .015 81	29.7 .050 135	27.4 .185 144	23.2 .275 177	20.5 .234 241	17.1 .163 315	15.9 .064 326	16.9 .014 352
1988	33.5 .014 81	27.5 .038 136	26.5 .143 146	22.9 .250 183	21.2 .280 227	18.0 .190 317	16.1 .069 329	17.2 .016 354

Table 17 - Characteristics of 1978 to 1988 Domestic, European and Asian Passenger Cars

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
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Domestic											
Sales(OOO)	9084	8761	6820	6261	5506	5682	8102	7797	7515	6724	7145
Fraction	.813	.812	.722	.717	.704	.710	.759	.723	.682	.618	.621
55/45 FE	18.7	19.3	21.9	23.5	24.5	24.1	25.1	25.8	26.6	26.9	27.0
Wt(lbs)	3828	3696	3323	3291	3247	3310	3233	3246	3199	3209	3271
Ton-MPG	36.0	35.7	36.5	38.7	40.0	40.2	40.8	41.9	42.6	43.2	44.3
Disp(CI)	284	268	218	210	200	208	197	199	191	191	192
Disp/Wt	.073	.071	.064	.062	.059	.061	.059	.059	.058	.058	.057
% FWD	4.6	6.3	23.4	32.4	42.9	42.5	51.3	60.0	68.2	72.6	78.8
% 4WD			.6	.3	.4	.6	.3	.0	.1	.6	.3
% Man.Tr	8.2	9.9	16.8	15.3	15.4	12.3	13.6	11.0	11.7	11.2	12.4
% Inject	1.1	1.1	1.2	3.7	13.9	27.3	38.3	57.5	70.7	84.9	92.4
% TBI			.9	3.7	13.9	26.6	32.0	44.2	41.0	43.5	33.4
% PORT	1.1	1.1	.2			.7	6.3	13.3	29.6	41.5	59.0
% Carb	98.6	97.3	95.7	91.3	82.4	71.5	60.7	42.3	29.2	15.0	7.6
% Diesel	.4	1.6	3.1	5.0	3.7	1.2	.9	.2	.1	.1	
Eng-HP	133	128	109	106	106	111	110	117	117	121	130
HP/Disp	.483	.501	.532	.549	.567	.565	.593	.625	.646	.665	.707
HP/Wt	.035	.035	.033	.032	.032	.033	.034	.036	.036	.037	.040
O TO 60	13.6	13.6	14.1	14.2	14.3	14.0	13.8	13.2	13.0	12.7	12.2
% Small	32.2	31.0	37.3	32.7	38.8	34.7	45.3	40.7	43.6	42.7	44.7
% Mid	42.1	41.8	47.1	50.3	43.4	44.1	37.2	38.0	38.1	36.7	31.7
% Large	25.8	27.2	15.6	17.0	17.8	21.3	17.4	21.3	18.3	20.6	23.6
Cu.Ft	114	114	110	113	112	115	111	113	112	112	114
Cu.Ft MPG	2185	2235	2448	2706	2800	2828	2857	2950	2999	3051	3107
Cu.Ft Ton MPG	4117	4088	4048	4408	4504	4612	4553	4734	4768	4872	5068
European											
Sales(OOO)	582	520	699	525	494	441	640	666	735	734	811
Fraction	.052	.048	.074	.060	.063	.055	.060	.062	.067	.067	.070
55/45 FE	23.9	24.4	28.0	29.4	28.6	27.2	26.7	26.3	26.0	25.9	26.7
Wt(lbs)	2705	2783	2649	2765	2895	3041	2987	3070	3019	3025	2960
Ton-MPG	33.2	35.1	38.5	42.1	42.7	42.0	40.8	41.1	39.8	39.5	39.6
Disp(CI)	115	121	114	121	129	140	139	144	146	145	136
Disp/Wt	.042	.043	.043	.044	.044	.046	.046	.046	.047	.047	.045
% FWD	53.7	47.0	65.3	61.1	54.8	41.9	45.4	45.0	47.0	46.7	55.9
% 4WD						.1	.5	.6	1.2	.9	1.2
% Man.Tr	68.6	69.1	75.2	68.7	61.2	53.5	51.0	46.4	46.9	48.2	52.7
% Inject	65.5	54.9	55.3	61.4	65.6	77.0	84.2	88.8	91.4	90.2	86.4
% TBI											
% PORT	65.5	54.9	55.3	61.4	65.6	77.0	84.2	88.8	91.4	90.2	86.4
% Carb	22.9	27.5	15.5	2.2	6.3	3.6	2.2	.3	5.3	6.6	13.5
% Diesel	11.5	17.6	29.2	36.4	28.1	19.4	13.6	10.9	3.3	3.2	.1
Eng-HP	87	87	80	84	92	107	110	117	124	128	124
HP/Disp	.758	.727	.702	.694	.718	.773	.798	.827	.857	.891	.919
HP/Wt	.032	.031	.030	.030	.031	.035	.037	.038	.040	.041	.041
O TO 60	14.7	15.1	15.4	15.2	14.8	13.5	13.0	12.8	12.2	11.9	12.1
% Small	96.2	93.4	95.4	95.0	93.8	90.5	81.6	79.5	76.3	78.2	79.1
% Mid	3.8	6.6	4.6	5.0	6.2	9.3	18.4	20.5	22.3	19.9	17.4
% Large						.1		.0	1.5	1.9	3.5
Cu.Ft	92	90	90	93	96	99	100	102	103	101	99
Cu.Ft MPG	2335	2354	2699	2928	2923	2784	2772	2818	2788	2712	2729
Cu.Ft Ton MPG	3084	3195	3498	3940	4144	4180	4086	4231	4124	4027	3968

Table 17 - Characteristics of 1978 to 1988 Domestic, European and Asian Passenger Cars (continued)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
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Asian											
Sales(000)	1510	1513	1924	1948	1819	1879	1933	2328	2765	3423	3545
Fraction	.135	.140	.204	.223	.233	.235	.181	.216	.251	.315	.308
55/45 FE	28.7	26.7	29.0	30.9	31.2	32.7	32.7	32.2	32.9	32.2	32.2
Wt(lbs)	2482	2506	2482	2469	2512	2529	2569	2585	2616	2690	2686
Ton-MPG	36.2	33.9	36.4	38.6	39.7	41.9	42.5	42.2	43.5	43.7	43.7
Disp(CI)	106	107	107	109	113	112	114	113	110	111	109
Disp/Wt	.042	.042	.043	.044	.044	.044	.044	.043	.042	.041	.040
% FWD	22.8	32.4	39.2	45.5	51.3	63.2	66.8	71.8	85.3	89.8	88.3
% 4WD		2.5	2.4	2.1	2.2	11.3	4.2	9.4	3.6	2.8	4.6
% Man.Tr	74.1	77.8	69.7	68.7	64.4	67.1	59.4	59.0	54.4	48.4	52.1
% Inject	5.9	8.1	9.4	11.0	13.1	20.2	29.1	29.9	43.2	46.1	59.3
% TBI							.5	.4	1.7	8.7	20.8
% PORT	5.9	8.1	9.4	11.0	13.1	20.2	28.6	29.5	41.4	37.4	38.6
% Carb	94.1	91.9	90.6	88.2	85.6	79.3	70.1	69.9	56.8	53.9	40.7
% Diesel				.8	1.3	.5	.8	.2	.1		
Eng-HP	84	78	77	78	80	83	88	89	90	93	96
HP/Disp	.784	.734	.720	.713	.707	.731	.768	.782	.810	.831	.870
HP/Wt	.033	.031	.031	.031	.032	.032	.034	.034	.034	.034	.035
O TO 60	14.0	14.6	14.6	14.5	14.5	14.2	13.7	13.9	13.8	13.8	13.5
% Small	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.2	98.1	99.5	95.6
% Mid								.8	1.9	.5	4.4
% Large											
Cu.Ft	85	85	89	89	91	93	94	95	97	97	97
Cu.Ft MPG	2531	2356	2647	2816	2924	3160	3174	3175	3287	3227	3239
Cu.Ft Ton MPG	3097	2895	3232	3426	3611	3924	4004	4013	4211	4259	4247

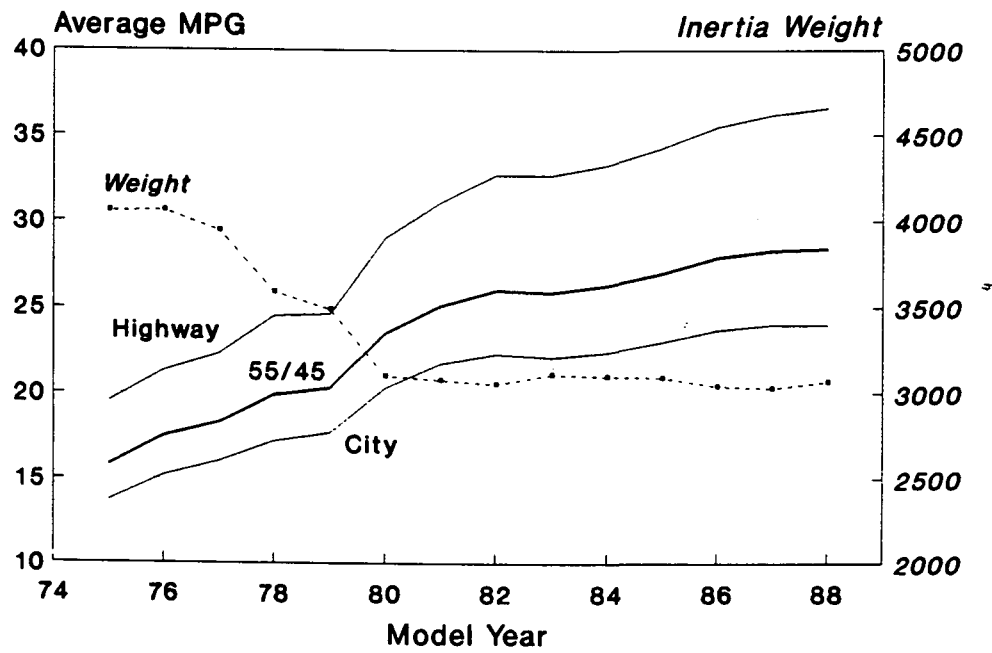
Table 18 - Characteristics of 1978 to 1988 Domestic and Imported Light Trucks

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	----	----	----	----	----	----	----	----	----	----	----
Domestic											
Sales(000)	2915	2616	1293	1310	1459	1806	2608	2938	3055	3274	3626
Fraction	.891	.847	.694	.720	.763	.785	.780	.801	.702	.753	.734
55/45 FE	14.5	13.8	16.8	18.2	19.0	19.6	19.2	19.5	19.9	20.4	20.3
Wt(lbs)	4305	4504	4323	4173	4078	3977	3990	3963	3993	3956	4064
Ton-MPG	31.8	31.8	36.8	38.4	39.3	39.6	38.9	39.2	40.1	40.7	41.6
Disp(CI)	337	330	303	293	277	257	250	245	243	242	254
Disp/Wt	.079	.073	.070	.070	.068	.063	.062	.061	.060	.060	.062
% FWD				.3	.0	.0	5.7	8.2	7.6	8.6	10.2
% 4WD	31.7	17.6	27.1	19.0	18.2	26.1	33.0	30.7	29.9	27.2	26.9
% Man.Tr	25.5	25.6	36.8	35.6	31.2	33.8	30.1	26.5	25.3	28.2	21.9
% Inject								9.5	44.6	80.7	94.8
% TBI									19.8	35.0	51.6
% PORT									24.8	45.7	43.2
% Carb	99.1	97.9	95.9	98.4	93.3	95.9	98.1	89.6	54.8	19.0	4.6
% Diesel	.9	2.1	4.1	1.6	6.7	4.1	1.9	.9	.6	.3	.6
% Small	2.7	3.8	4.3	3.3	18.1	33.8	39.3	45.9	49.1	49.2	43.2
% Large	97.3	96.2	95.7	96.7	81.9	66.2	60.7	54.1	50.9	50.8	56.8
Imports											
Sales(000)	358	473	571	510	454	495	737	730	1296	1075	1311
Fraction	.109	.153	.306	.280	.237	.215	.220	.199	.298	.247	.266
55/45 FE	25.1	23.1	24.3	27.3	27.1	27.1	26.6	26.3	26.1	25.6	24.1
Wt(lbs)	2903	2854	2839	2862	2932	2982	3045	3119	3136	3143	3269
Ton-MPG	37.2	33.7	35.1	39.9	40.6	41.0	40.9	41.4	41.2	40.4	39.4
Disp(CI)	127	124	124	130	135	137	134	139	138	139	146
Disp/Wt	.043	.043	.044	.045	.046	.046	.044	.045	.044	.044	.045
% FWD			4.6	6.5	7.1	6.2	2.0	2.4	1.8	2.4	1.0
% 4WD	6.5	20.1	20.3	22.8	26.1	24.6	23.9	30.0	31.2	36.8	38.5
% Man.Tr	88.6	88.1	89.8	92.8	92.2	90.2	84.5	79.8	83.5	76.1	77.1
% Inject	.8	1.8	5.4	4.0	2.8	3.0	11.6	23.5	30.9	37.5	50.7
% TBI									16.1	21.9	35.2
% PORT									14.8	15.6	15.6
% Carb	99.2	98.2	92.6	80.1	79.5	90.3	84.6	74.9	68.0	62.4	49.3
% Diesel			2.0	15.9	17.7	6.8	3.8	1.6	1.1	.1	
% Small	100.0	100.0	89.3	90.2	84.7	88.0	70.0	61.7	73.4	85.0	85.3
% Large			10.7	9.8	15.3	12.0	30.0	38.3	26.6	15.0	14.7

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19. Interior Volume of Domestic, European and Asian Cars, 1978 To 1988
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Passenger Cars



Light Trucks

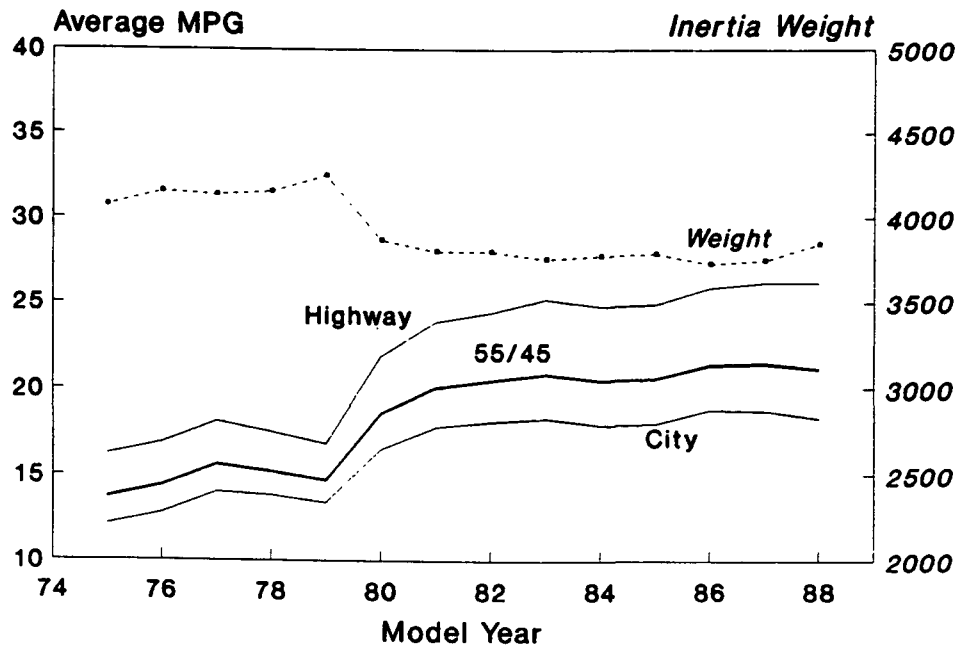


Fig. 1

Fuel Injection Usage *Cars and Light Trucks*

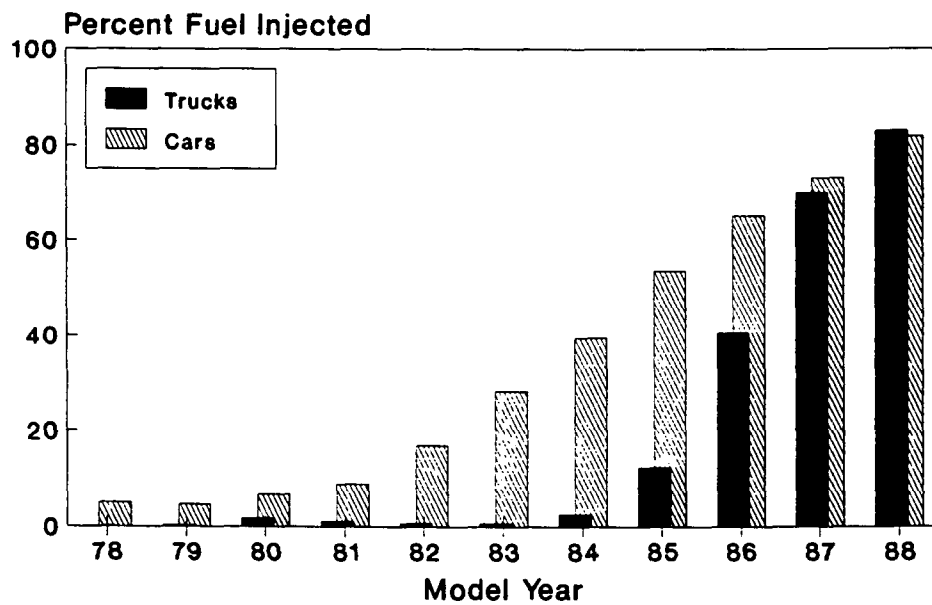


Fig. 2

Fuel Injection Trends *Gasoline Fueled Automobiles*

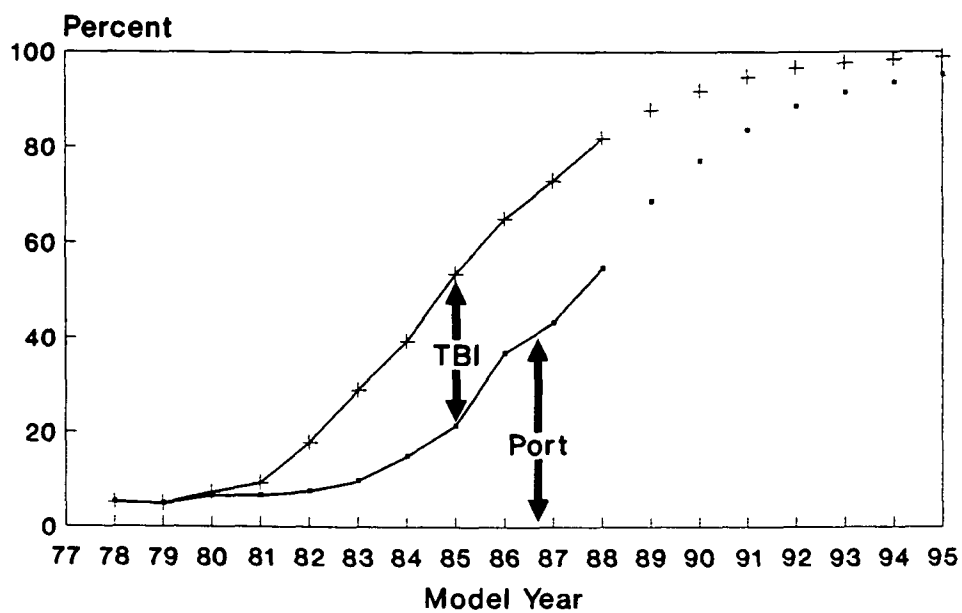
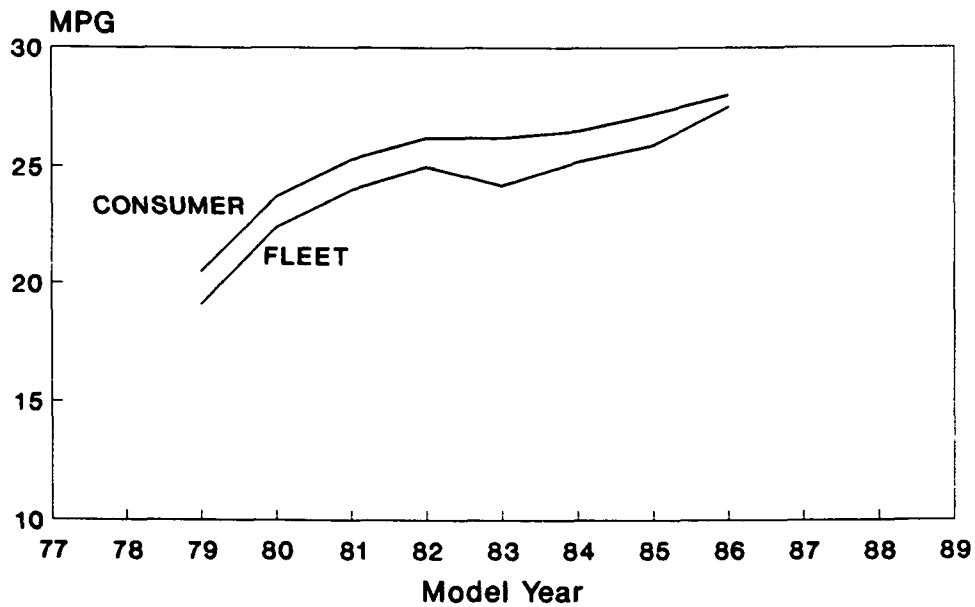


Fig. 3

MPG by Model Year *Consumer & Fleet Cars*



Inertia Weight by Model Year *Consumer & Fleet Cars*

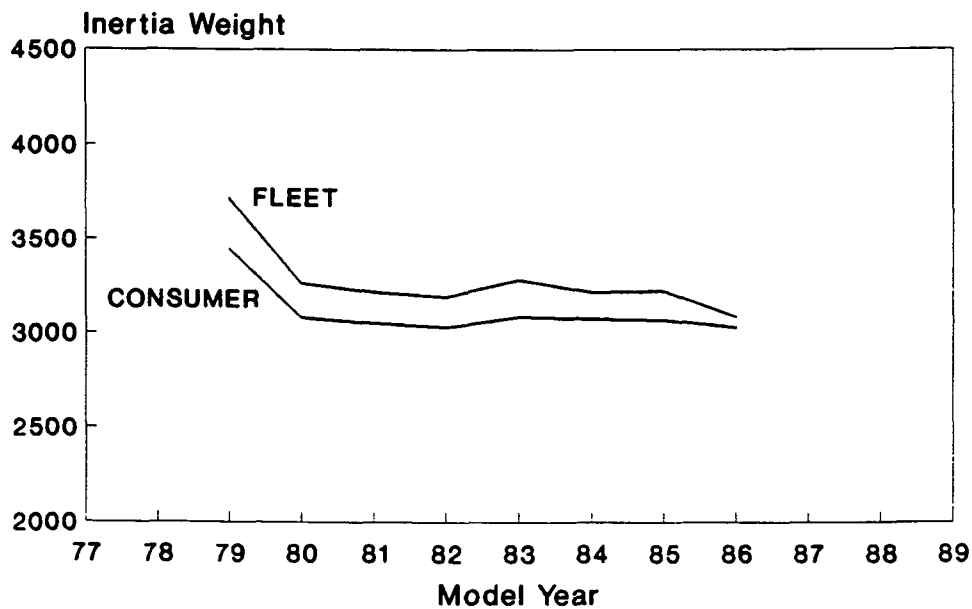
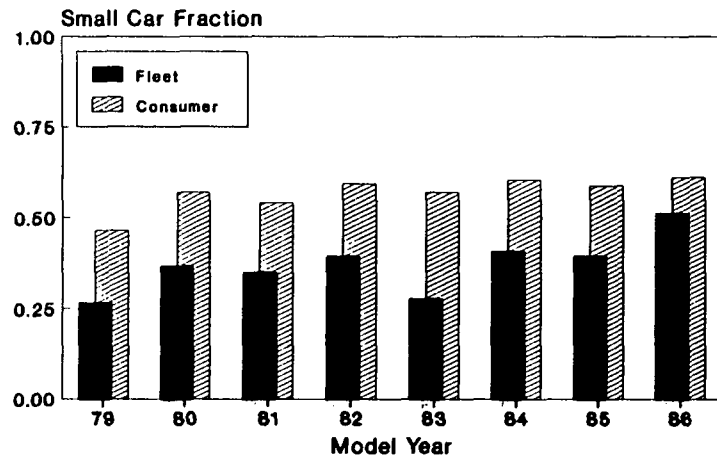
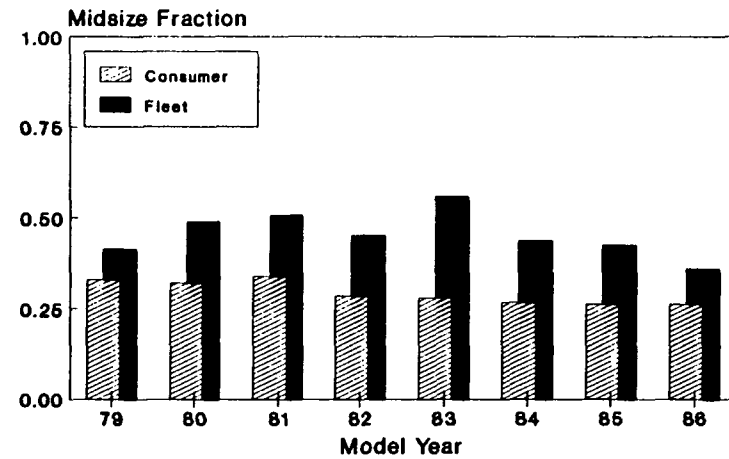


Fig. 4

Small Car Sales Fraction *Consumer vs Fleet*



Midsize Car Sales Fraction *Consumer vs Fleet*



Large Car Sales Fraction *Consumer vs Fleet*

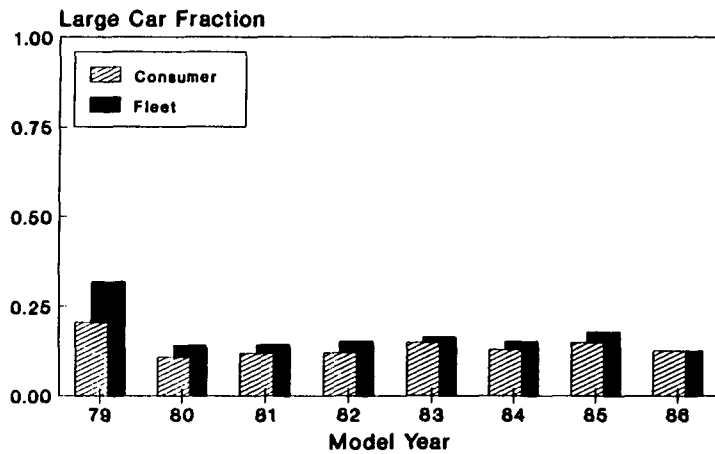
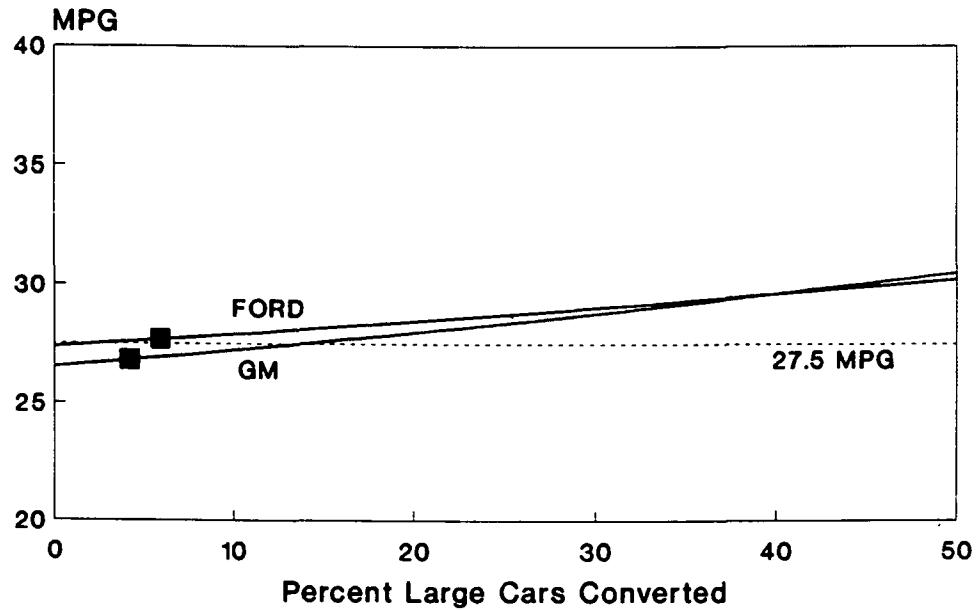


Fig. 5

Effect of FFV Conversion *Model Year 1988 Large Sedans and Wagons*



Effect of FFV Conversion *Model Year 1988 Midsize Sedans & Wagons*

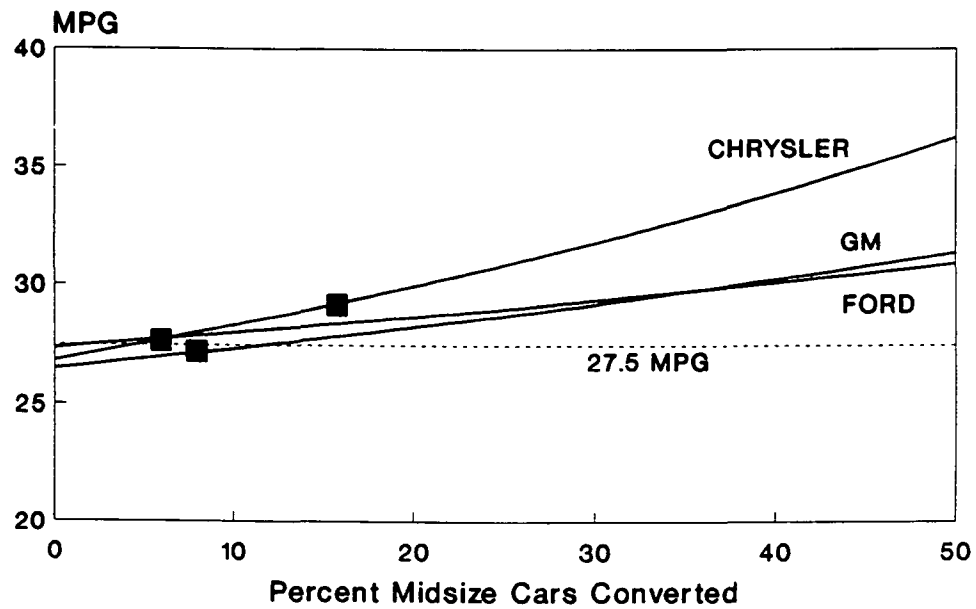
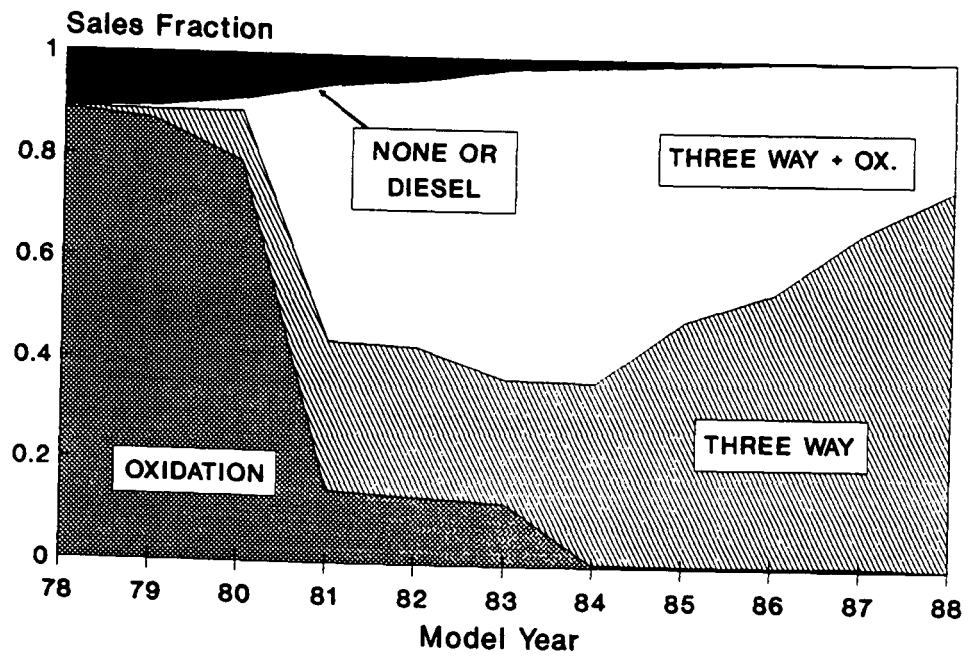


Fig. 6

Catalyst Types Used on Cars



Catalyst Types Used on Light Trucks

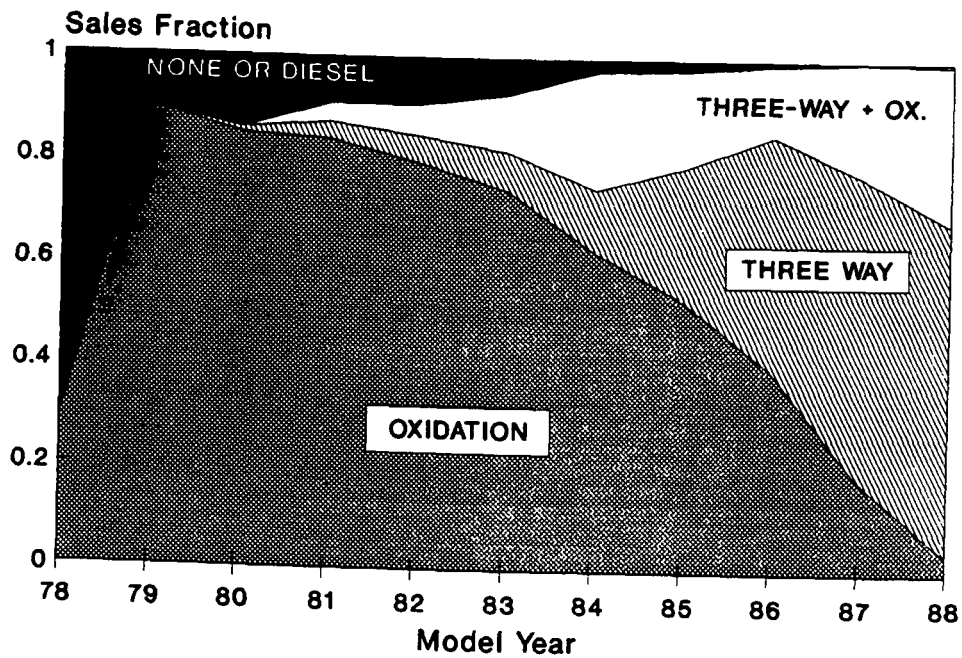
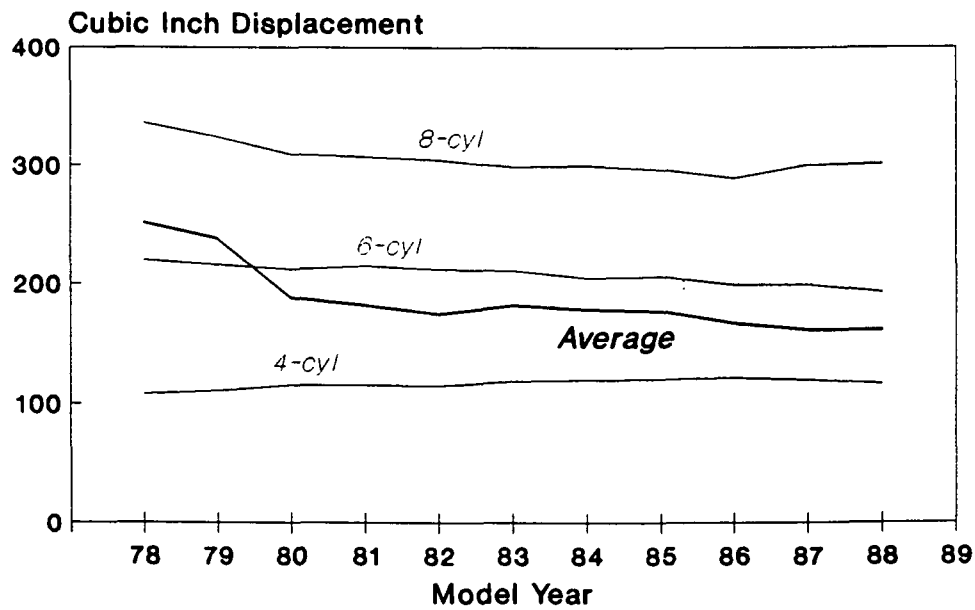


Fig. 7

Average Engine Size Passenger Cars



Average Engine Size Light Trucks

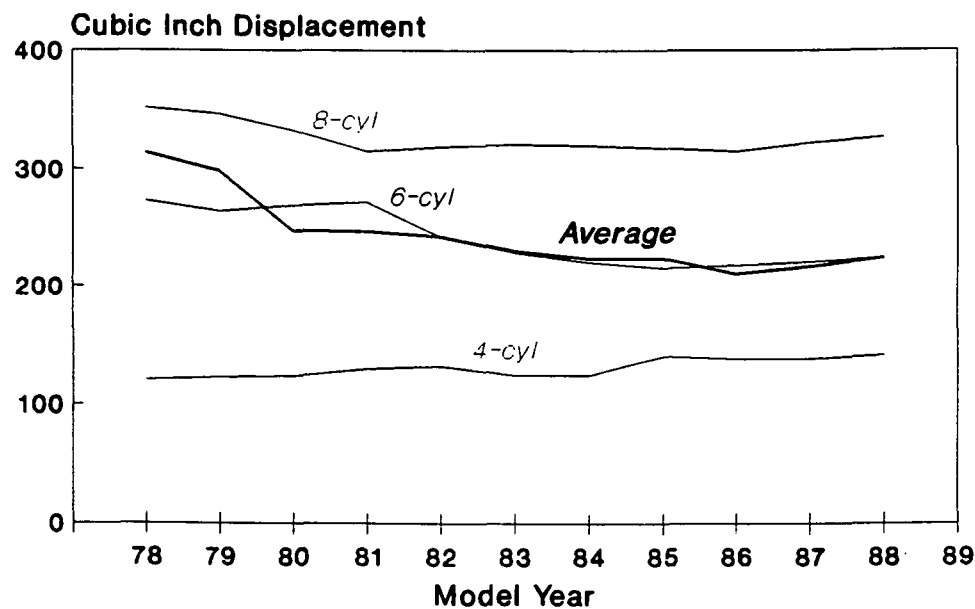


Fig. 8

Average Engine Horsepower *Passenger Cars*

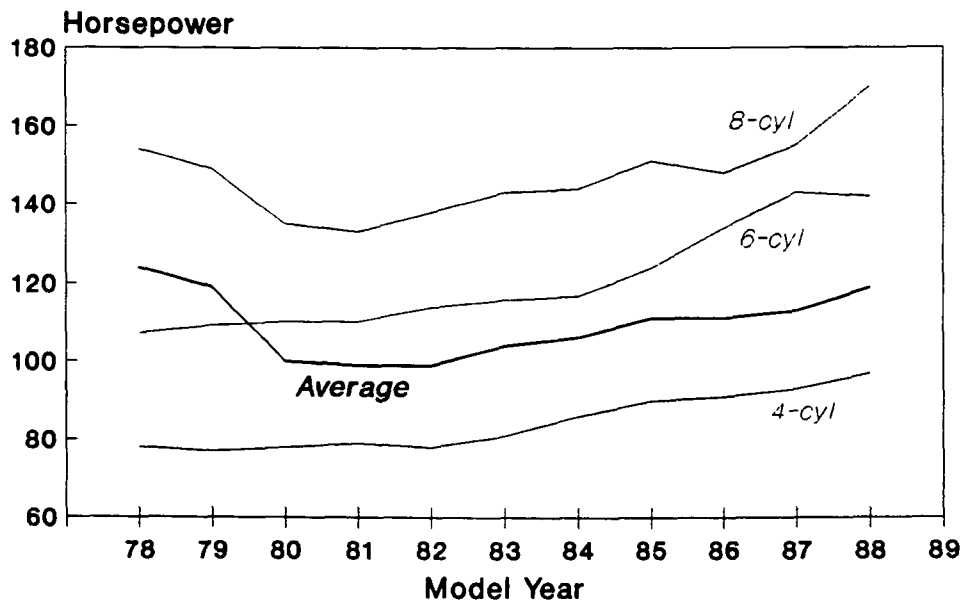


Fig. 9

Average Zero to 60 Acceleration *Passenger Cars*

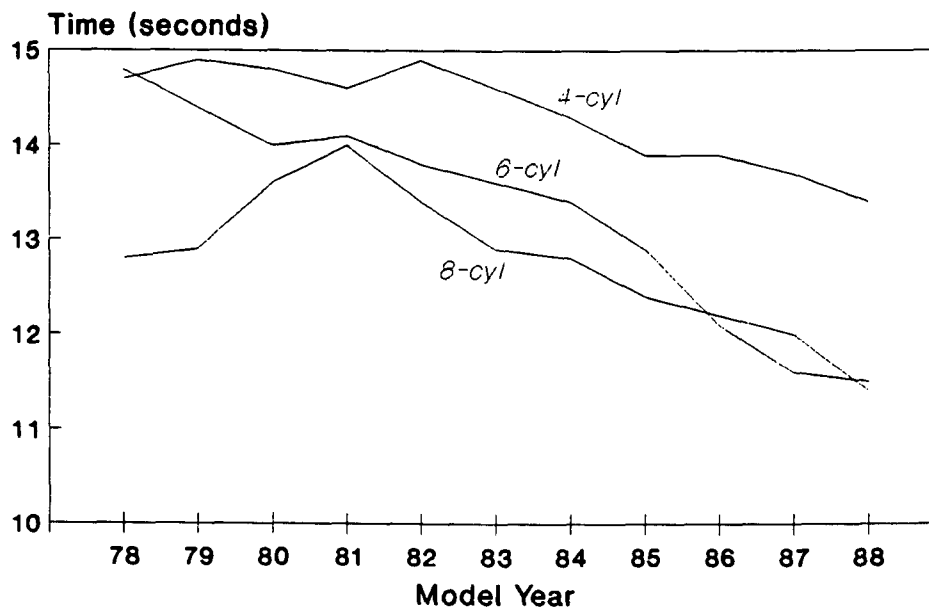
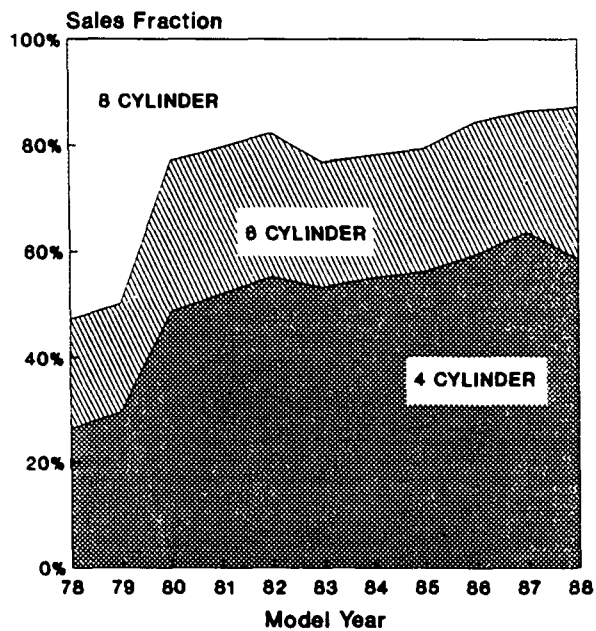
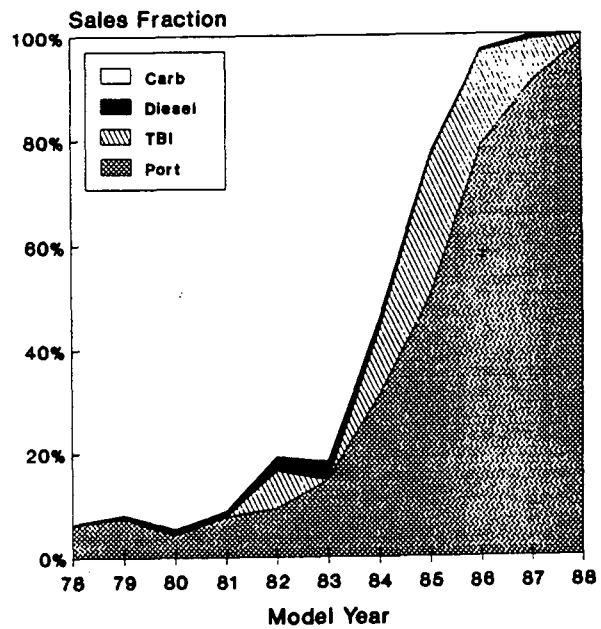


Fig. 10

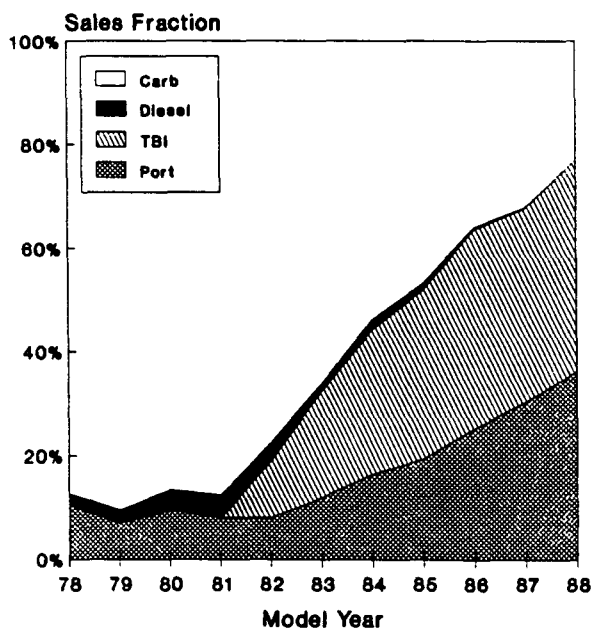
Engine Size Market Shares Passenger Cars



Fuel Metering, Cars 6 Cylinder Engines



Fuel Metering, Cars 4 Cylinder Engines



Fuel Metering, Cars 8 Cylinder Engines

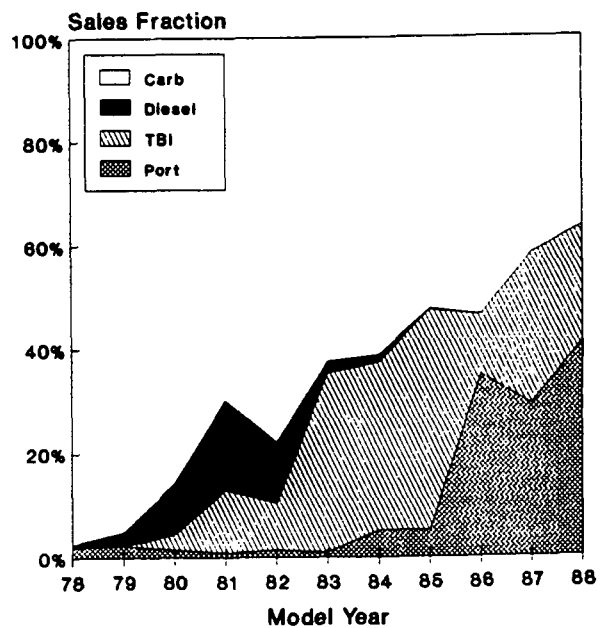
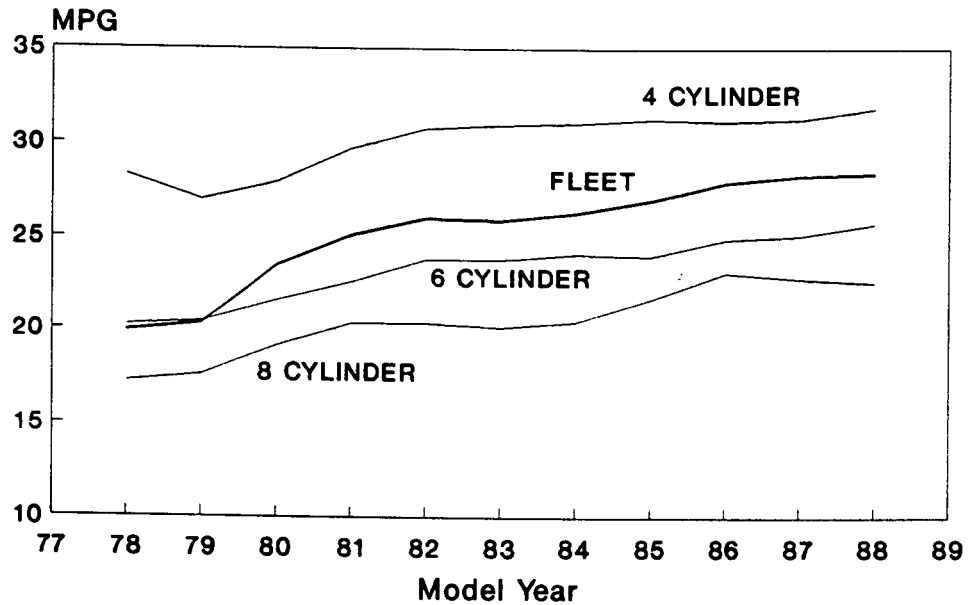


Fig. 11

Passenger Car MPG by Model Year and Number of Cylinders



Light Truck MPG by Model Year and Number of Cylinders

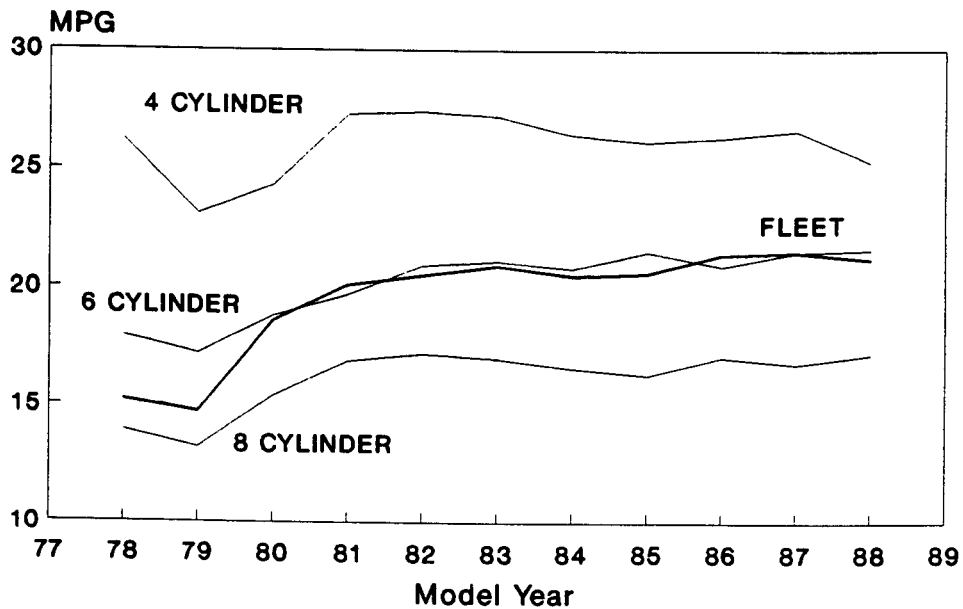


Fig. 12

Truck Class Market Shares

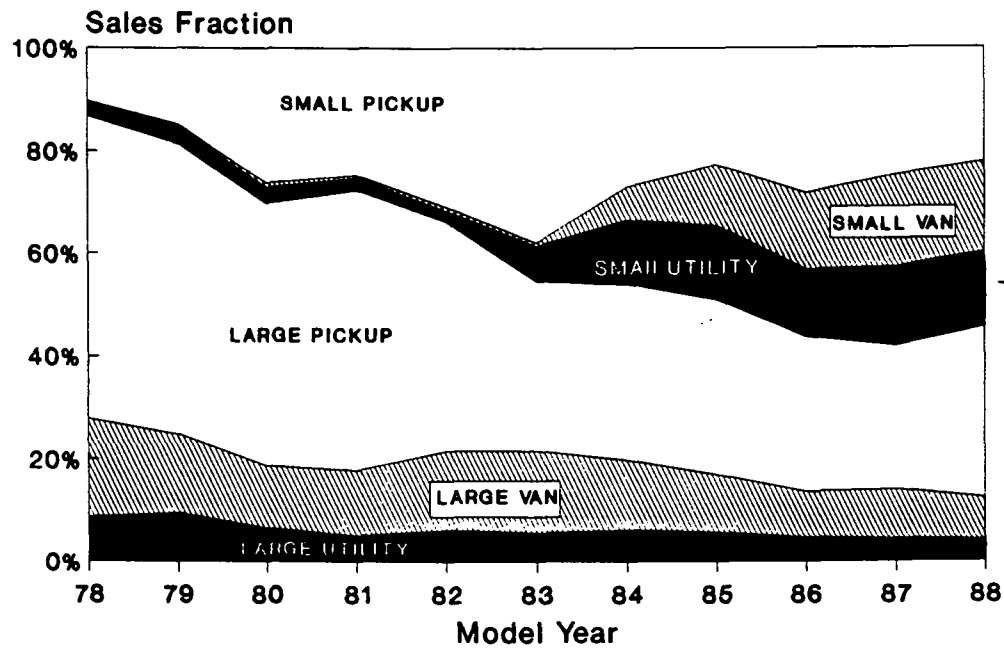


Fig. 13

MPG vs Inertia Weight by Truck Size

Model Year 1978 to 1988 Light Trucks

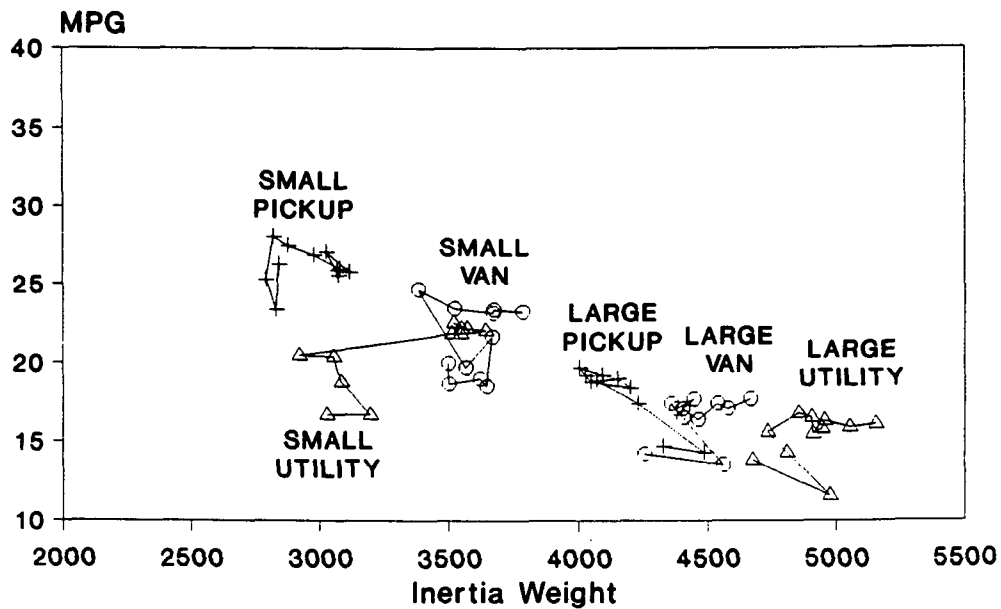


Fig. 14

Car Size Market Shares

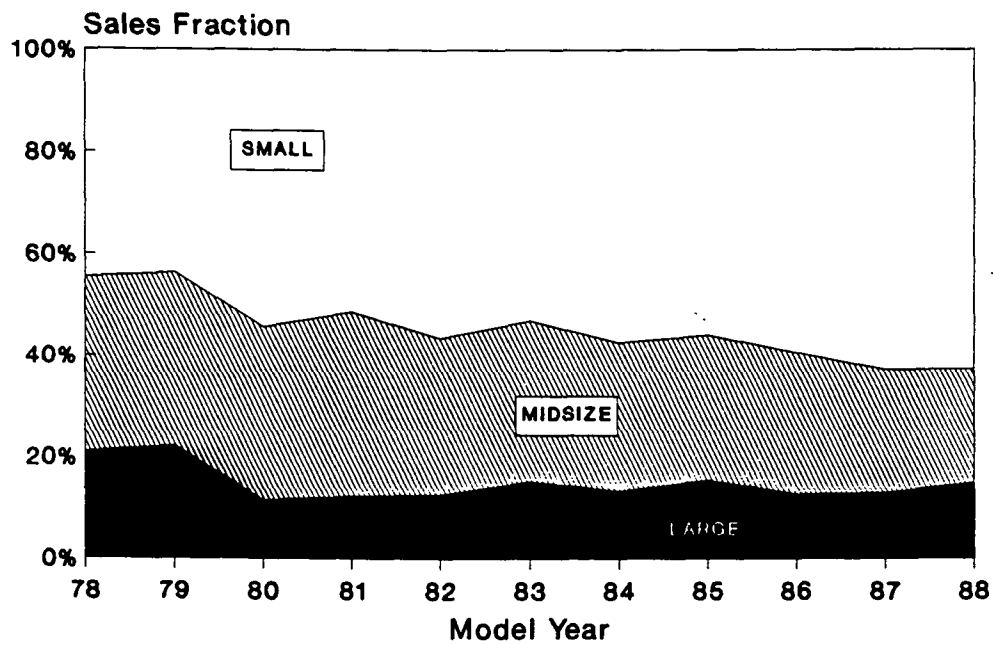


Fig. 15

MPG vs Inertia Weight by Size Class

Model Year 1978 to 1988 Passenger Cars

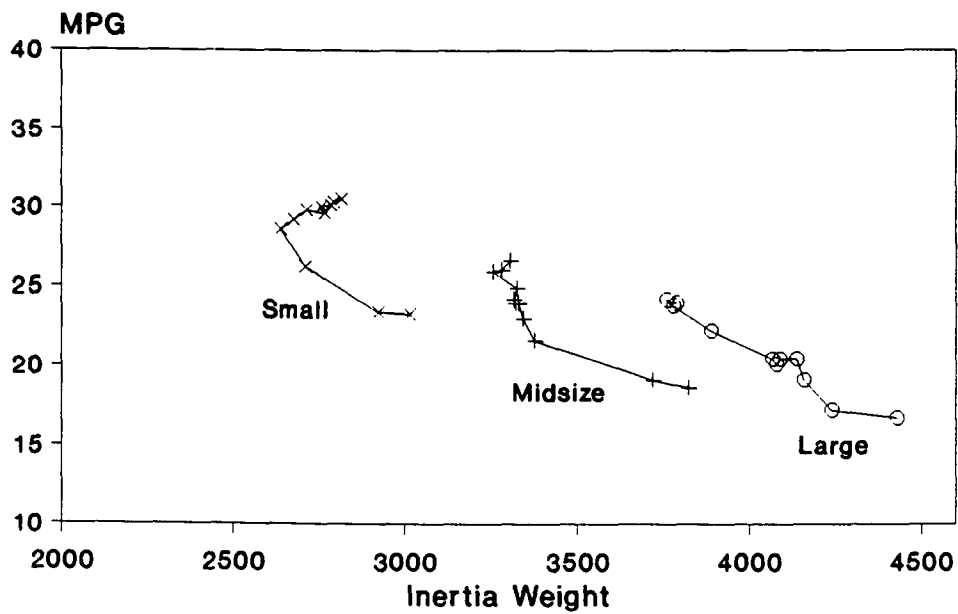


Fig. 16

Vehicle Sales by Vehicle Type *Cars and Light Trucks*

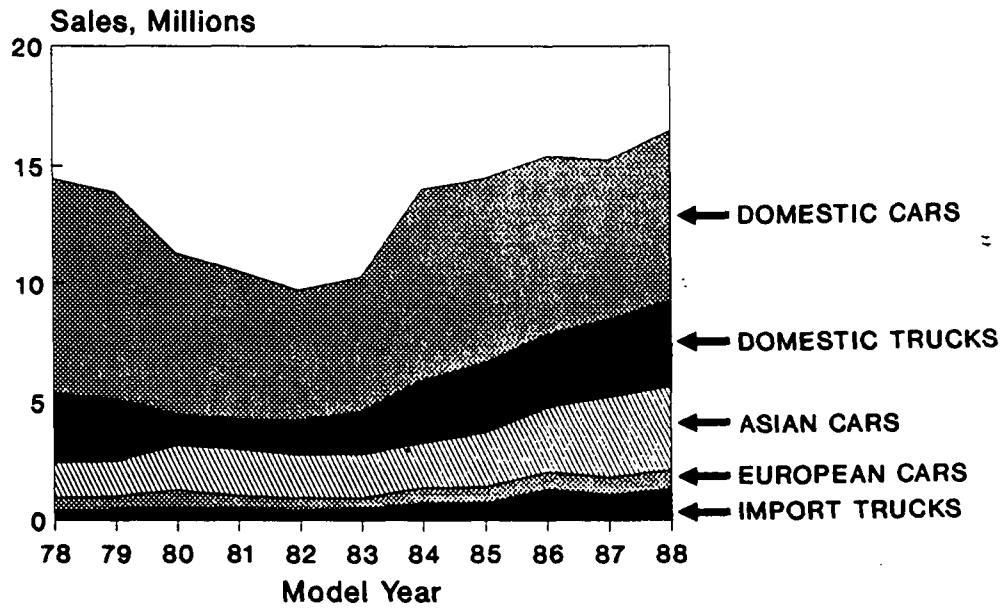


Fig. 17

MPG vs Inertia Weight by Vehicle Type

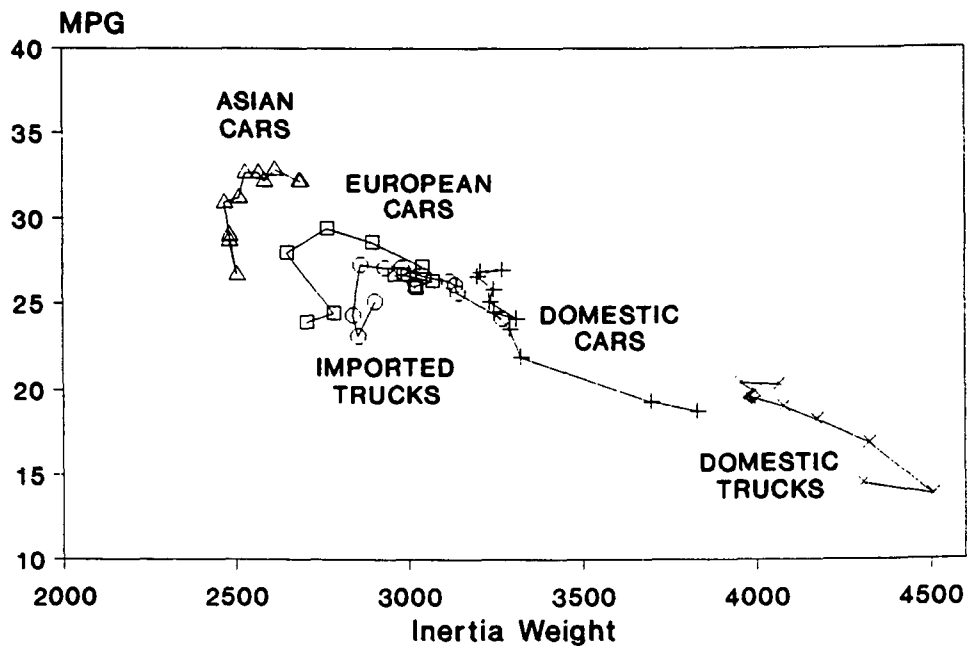


Fig. 18

Interior Volume of Cars

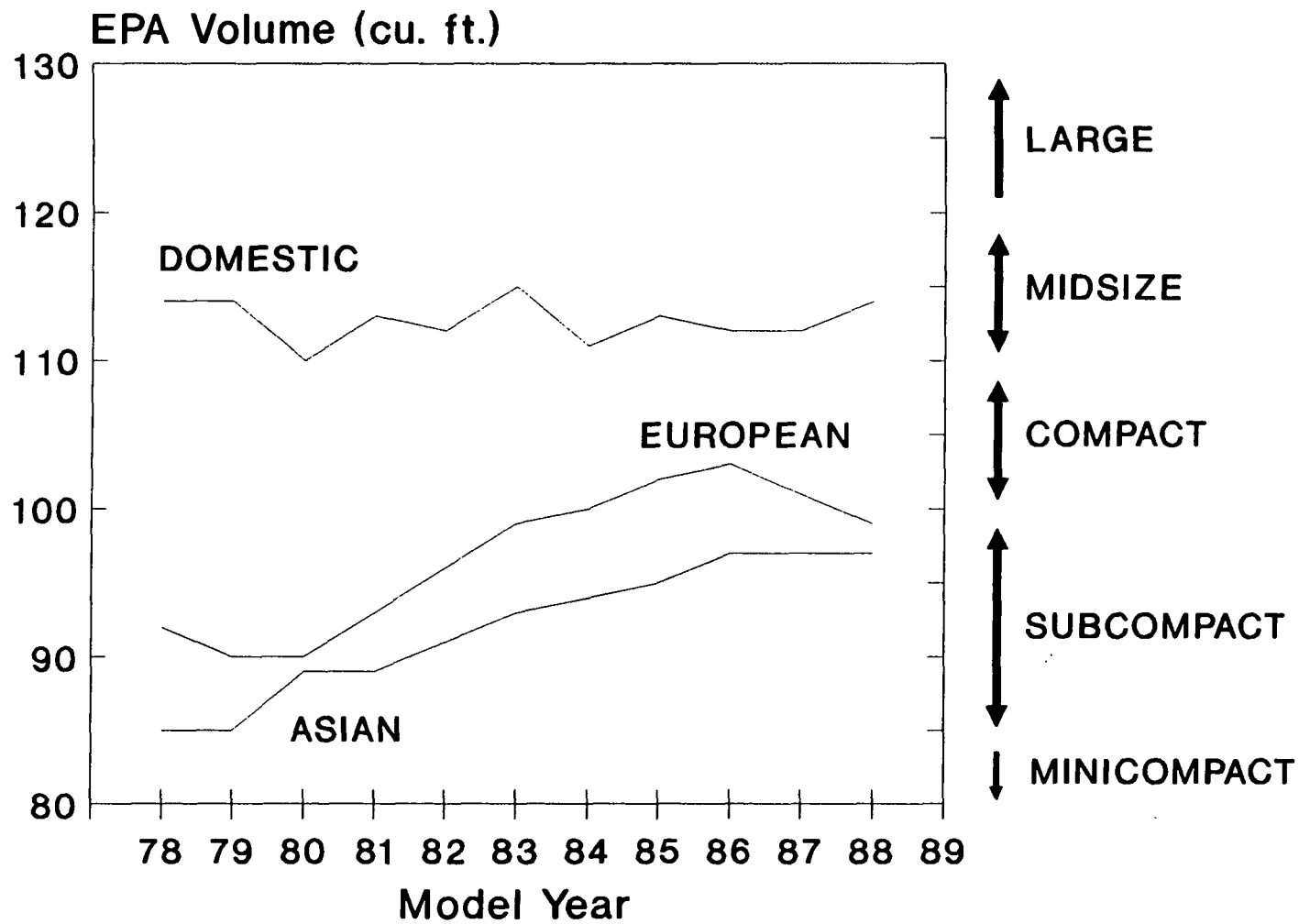


Fig. 19

Fuel Injection Usage *Light Trucks*

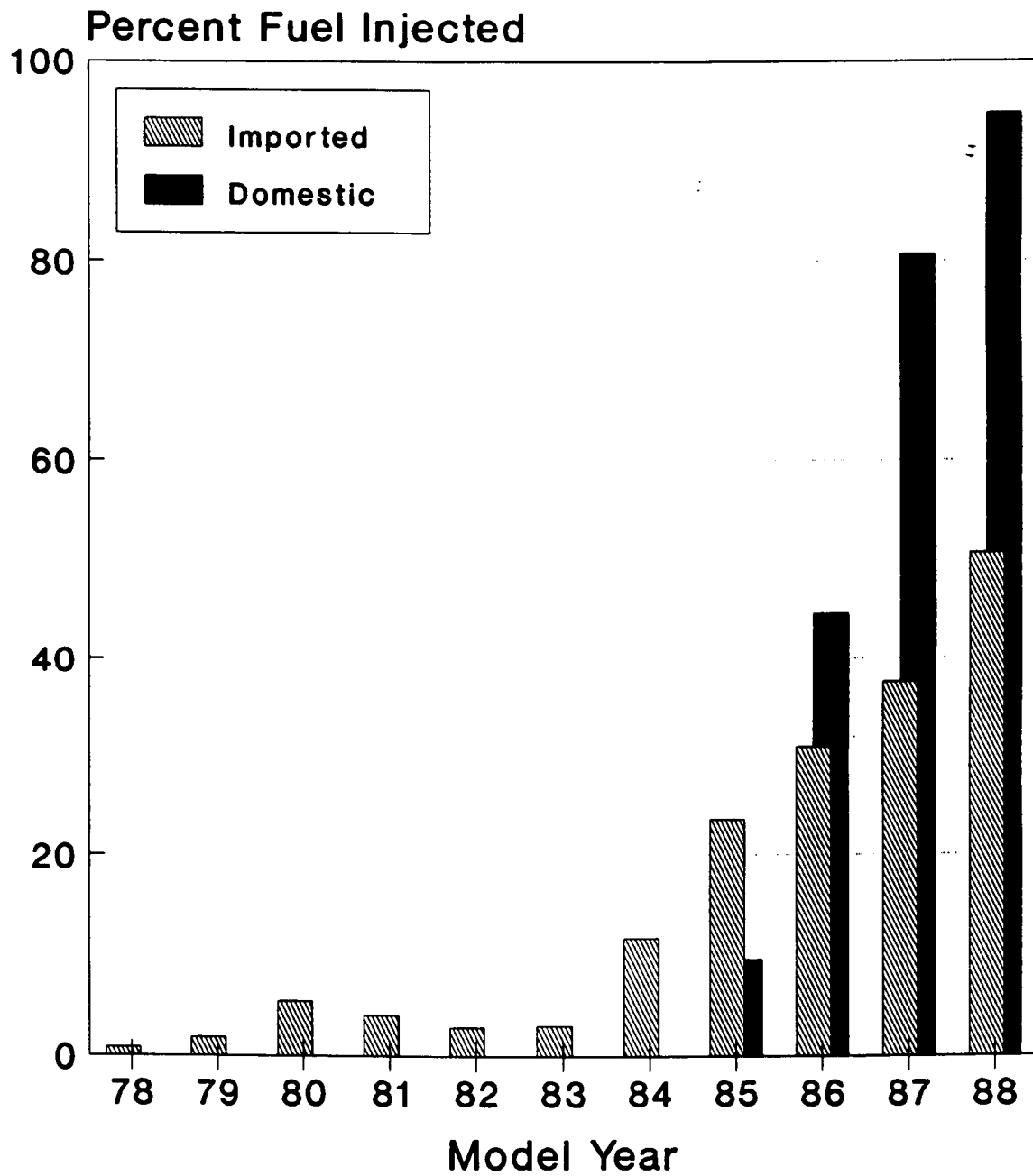
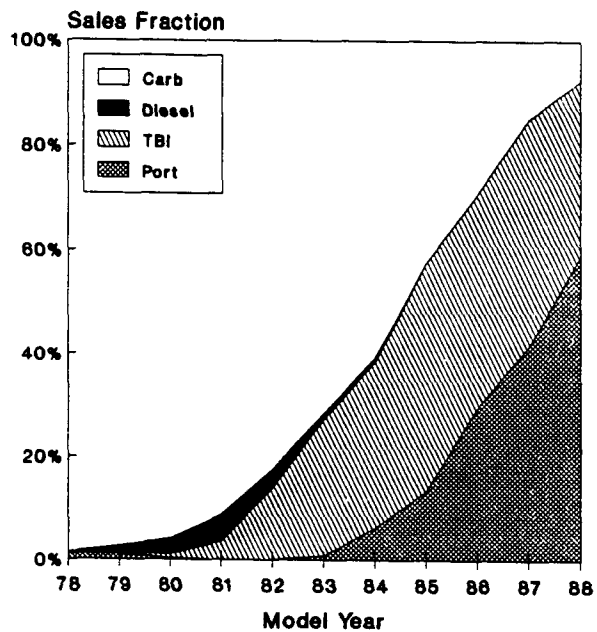
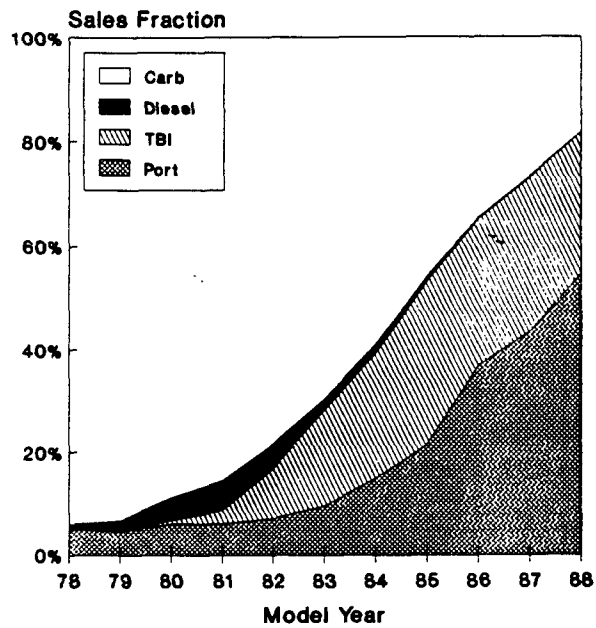


Fig. 20

Fuel Metering *Domestic Cars*



Fuel Metering *Asian Cars*



Fuel Metering *European Cars*

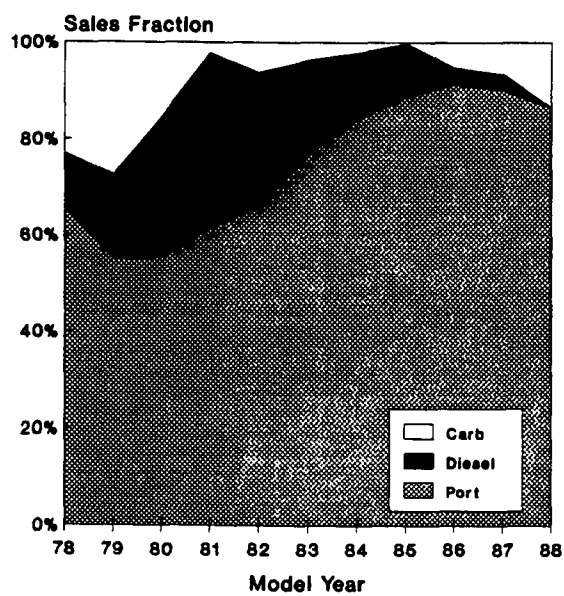


Fig. 21

APPENDICES

APPENDIX A lists the sales-weighted average nameplate MPG values for model year 1988 cars and trucks, by size class.

APPENDIX B gives major characteristics of model year 1988 trucks by weight class.

APPENDIX C gives major characteristics of model year 1988 trucks by size class.

APPENDIX D gives major characteristics of model year 1988 cars by weight class.

APPENDIX E gives major characteristics of model year 1988 cars by size class.

APPENDIX F compares model year 1988 Domestic, European, and Asian passenger cars by transmission type, drive type, and engine type.

APPENDIX G compares model year 1988 Domestic and Import trucks by transmission type, drive type, and engine type.

A-1

Appendix A - Nameplate Average Fuel Economy

***** UNADJ TWO SEATERS *****	***** UNADJ MINICOMPACT SEDANS *****	***** UNADJ SUBCOMPACT SEDANS *****
55/45 MPG	55/45 MPG	55/45 MPG
HONDA CIVIC CRX HF 60.7	SUZUKI SPRINT METRO 65.6	SUZUKI SPRINT 50.9
		SUZUKI FIREFLY 50.6
	SUZUKI FORSA TURBO 46.0	SUZUKI FORSA 50.6
	SUZUKI TURBO SPRINT 46.0	FORD FESTIVA 46.8
	SUZUKI TURBO FIREFLY 46.0	DAIHATSU CHARADE 46.5
HONDA CIVIC CRX 38.5		TOYOTA TERCEL EZ 44.6
		SUBARU JUSTY 44.3
		ISUZU SPECTRUM 41.0
		HONDA CIVIC 38.9
		DAIHATSU COLT 38.6
		ISUZU SUNBURST 38.4
		ISUZU I-MARK 38.0
		SUBARU JUSTY 4WD 37.6
		MERCEDES-BENZ 190D2.5 37.4
		NISSAN SENTRA HONEYBEE 37.3
		TOYOTA TERCEL 36.6
		MITSUBISHI MIRAGE 36.1
		ISUZU SPECTRUM TURBO 36.1
		MITSUBISHI PRECIS 35.2
		HYUNDAI EXCEL 34.9
		NISSAN SENTRA COUPE 34.7
FORD EXP 34.4	TOYOTA CELICA CONVERTIB 34.3	YUGO GV 33.9
		NUMMI COROLLA FX 33.5
		HONDA INTEGRA 32.6
TOYOTA MR2 32.4		VW/AUDI FOX 31.9
SUBARU XT-DL 32.3		SUBARU HATCHBAC 31.7
		TOYOTA COROLLA 31.3
		NISSAN PULSAR NX 31.2
	DAZIA COUPE 30.7	
	DAZIA SEDAN 30.7	
DELTA 204T 29.9		SUBARU XT 30.4
		GM SUNBIRD CONVERTIB 30.0
BERTONE X1/9 29.2		MITSUBISHI TREDIA 29.3
		MITSUBISHI CORDIA 29.3
	VW/AUDI CABRIOLET 29.0	
		SUBARU SEDAN/3DOOR 29.0
		VW/AUDI SCIROCCO 16V 28.8
		CHRYSLER DAYTONA 28.5
		VW/AUDI 80/90 28.1
		HONDA PRELUDE 28.0
		CHRYSLER LEBARON CONVERTIB 27.8
		NISSAN 200SX 27.8
ALFA ROMEO SPIDER 27.7		TOYOTA CELICA 27.4
GM FIERO 27.5		
PANTHER KALLISTA 26.9	PORSCHE 924 S 26.5	ISUZU IMPULSE 26.5
		FORD MUSTANG 26.3
		GM CAVALIER CONVERTIB 26.3
		MERCEDES-BENZ 190E2.3 26.1
GM REATTA 26.2	PORSCHE 944 26.0	SUBARU XT 4WD 25.6
	PORSCHE 944 S 25.8	SAAB 900 CONVERTIB 25.5
	PORSCHE 944 TURBO 25.7	MERCEDES-BENZ 190E2.6 24.9
MASERATI Q 24.7		
MASERATI QC CAR 24.1	PORSCHE 911 CARRERA 24.4	NISSAN 300ZX 2+2 24.1
		BMW 3-SERIES 24.0
		VW/AUDI 80/90 QUATTRO 23.9
		GM CAMARO 23.8
NISSAN 300ZX 23.7		GM FIREBIRD/TRANS 23.6
LOTUS ESPRIT TU 23.4	PORSCHE 911 23.3	TOYOTA SUPRA 23.3
		MITSUBISHI CONQUEST 23.3
		ALFA ROMEO MILANO 23.2
		MITSUBISHI STARION 23.1
		MERCEDES-BENZ 300CE 23.0
MAZDA RX-7 22.7	PORSCHE 911 TURBO 21.4	
GM CORVETTE 22.6	PORSCHE 928 S4 20.7	BMW 6-SERIES 17.6
GM CORVETTE CONVERTIB 22.6		
GM ALLANTE 22.4		
		JAGUAR XJ-S 16.5
AURORA 19.1		
MERCEDES-BENZ 560SL 17.5	FERRARI 3.2 MONDIAL/CAB 17.2	
FERRARI 328 GTS/GTB 17.2		
RUF 17.0		
JAGUAR XJ-SC 16.5		
FERRARI TESTAROSSA 13.4		
		ROLLS-ROYCE BENTLEY 11.8
LAMBORGHINI COUNTACH 8.7		ROLLS-ROYCE CORNICHE II 11.8
		ASTON MARTIN LAGONDA 10.9
		ASTON MARTIN SALOON/VANTAGE 10.9

Appendix A - Nameplate Average Fuel Economy (Continued)

..... UNADJ UNADJ UNADJ
COMPACT SEDANS 55/45	MIDSIZE SEDANS 55/45	LARGE SEDANS 55/45
..... MPG MPG MPG
GM LEMANS 35.7		
TOYOTA COROLLA 35.0		
NISSAN SENTRA 34.8		
NUMMI NOVA 34.7		
FORD ESCORT 33.6		
FORD TRACER 33.2		
GM FIRENZA 33.2		
GM SKYHAWK 32.9		
GM SUNBIRD 32.6		
MAZDA 323 32.5		
CHRYSLER OMNI 32.2		
CHRYSLER HORIZON 32.2		
VW/AUDI JETTA 31.7		
VW/AUDI GOLF 31.7		
GM CAVALIER 31.6		
GM SKYLARK 31.5		
HONDA ACCORD 31.4		
GM GRAND AM 31.2		
MAZDA LASER 31.0		
GM CUTLASS CALAIS 30.9		
SUBARU SEDAN/3DOOR 30.3		
CHRYSLER SHADOW 29.4	CHRYSLER ARIES 30.3	
CHRYSLER SUNDANCE 29.2	CHRYSLER RELIANT 30.3	
VW/AUDI JETTA GLI 16V 28.8	CHRYSLER CARAVELLE 28.9	
VW/AUDI GTI 16V 28.8	CHRYSLER 600 28.8	
FORD TOPAZ 28.7	MAZDA 626/MX-6 28.8	
FORD TEMPO 28.7	GM 6000 28.7	
GM CORSICA 28.3	CHRYSLER LANCER 28.6	
GM BERETTA 28.3	GM CELEBRITY 28.1	
CHRYSLER LEBARON 28.3	CHRYSLER LEBARON GTS 28.1	
NISSAN STANZA 28.0	MITSUBISHI MEDALLION SEDAN ... 28.0	
GM CIMARRON 26.4	GM CUTLASS CIERA 28.0	
VOLVO 240DL/240GL 26.3	GM CENTURY 27.6	
	GM REGAL 27.3	
	GM GRAND PRIX 27.2	
	FORD SABLE 27.2	
	FORD TAURUS 27.0	
	GM CUTLASS SUPREME 26.4	
FORD COUGAR 26.0	GM RIVIERA 26.2	GM BONNEVILLE 26.2
SAAB 900 25.9	GM TORONADO 26.2	GM LESABRE 26.2
FORD THUNDERBIRD 25.6	VOLVO 740/760 26.0	GM DELTA 88 26.2
McEVoy 240 DL/240 GL S 25.3	CHRYSLER NEW YORKER TURBO 25.9	GM NINETY-EIGHT 26.2
GM SOMERSET/SKYLAR 25.3	CHRYSLER DYNASTY 25.4	GM ELECTRA 26.2
MERCEDES-BENZ 260E 24.8	CHRYSLER NEW YORKER/5TH 25.1	CHRYSLER PREMIER 25.3
TOYOTA CAMRY 24.6		SAAB 9000 25.2
FORD TOPAZ ALL WHEEL 24.4	MAZDA 929 24.2	
FORD TEMPO ALL WHEEL 24.4	VW/AUDI 5000S 23.8	
NISSAN MAXIMA 23.9	VW/AUDI 5000S QUATTRO 23.7	
TOYOTA CRESSIDA 23.6	GM MONTE CARLO 23.6	
HONDA LEGEND 23.6	VW/AUDI 5000CS TURBO 23.4	
VW/AUDI QUANTUM 23.5	VW/AUDI 5000CS QUATTRO 23.3	
STERLING AUSTIN ROVER ST 23.4	FORD MARK VII 23.0	
FORD XR4TI 23.4	CHRYSLER NEWPORT/FIFTH A 22.8	FORD CONTINENTAL 23.2
JAGUAR XJ6 23.3	FORD SCORPIO 22.6	FORD GRAND MARQUIS 23.0
PEUGEOT 505 SEDAN 23.3	GM SEVILLE 22.4	FORD TOWN CAR 23.0
MITSUBISHI GALANT SIGMA 23.2	GM ELDOURO 22.4	GM BROUGHAM 22.9
MERCEDES-BENZ 300E 23.0	VOLVO 740/760 21.1	GM CAPRICE 22.5
BMW 5-SERIES 22.4	CX 25GTI 21.0	FORD LTD CROWN VICTORIA 22.4
VOLVO 780 21.1	MERCEDES-BENZ 300SEL 20.6	GM DEVILLE 22.4
MERCEDES-BENZ 300SE 20.6	CHRYSLER GRAN FURY 20.1	GM FLEETWOOD 22.4
MERCEDES-BENZ 560SEC 17.0	CHRYSLER DIPLOMAT 19.5	DUTOV GT 19.6
	BMW 7-SERIES 18.9	
	MERCEDES-BENZ 420SEL 18.8	
	MERCEDES-BENZ 580SEL 17.0	
	ROLLS-ROYCE SILVER SPIRIT ... 12.0	BMW 750 SERIES 16.2
	ROLLS-ROYCE BENTLEY EIGHT 12.0	ROLLS-ROYCE SILVER SPUR 11.8

Appendix A - Nameplate Average Fuel Economy (Continued)

***** UNADJ	***** UNADJ	***** UNADJ
SMALL WAGONS 55/45	MIDSIZE WAGONS 55/45	LARGE WAGONS 55/45
***** MPG	***** MPG	***** MPG
HONDA CIVIC 37.0		
MITSUBISHI COLT 35.8		
MITSUBISHI MIRAGE 35.4		
NISSAN SENTRA 33.7		
FORD ESCORT 33.5		
MAZDA 323 33.3		
GM SUNBIRD 33.3		
GM FIRENZA CRUISER 33.2		
FORD TRACER 32.0		
GM SKYHAWK 32.0		
VW/AUDI FOX 31.9		
TOYOTA TERCEL 31.6		
GM CAVALIER 31.5		
NISSAN SENTRA 4WD 31.3		
SUBARU 30.7		
DACIA STATION WAGON 30.7		
HONDA CIVIC 4WD 30.2		
	CHRYSLER RELIANT 29.3	
TOYOTA COROLLA ALL-TRACK 29.2	CHRYSLER ARIES 29.3	
SUBARU 4WD 28.7		
	CHRYSLER TOWN & COUNTRY 28.3	
	GM CELEBRITY 28.1	
	GM 6000 28.1	
	FORD SABLE 27.7	
	GM CUTLASS CRUISER 27.6	
	GM CENTURY 27.3	
	FORD TAURUS 27.2	
	NISSAN STANZA 2WD 27.1	
	VOLVO 240DL/240GL WAG 27.0	
	MITSUBISHI MEDALLION 26.0	
	McEVoy 240 DL/240 GL WAG 25.3	
	VOLVO 740/760 WAGON 25.3	
TOYOTA CAMRY 24.6	FORD TAURUS V6 24.4	
NISSAN STANZA 4WD 24.4		
NISSAN MAXIMA 23.8	FORD SABLE V6 23.6	
	VW/AUDI 5000S 23.4	
VW/AUDI QUANTUM 23.4	PEUGEOT 505 STATION WAG 23.4	
	VW/AUDI 5000CS QUATTRO 23.3	
	CHRYSLER TOWN & COUNTRY 23.2	
		FORD GRAND MARQUIS WAG 23.1
		FORD LTD CROWN VICTORIA 23.1
		GM CUSTOM CRUISER 22.9
		GM CAPRICE 22.9
		GM SAFARI 22.9
		GM LESABRE/ELECTRA 22.9
VW/AUDI QUANTUM SYNCRO 22.1	MERCEDES-BENZ 300TE 21.1	
CHRYSLER EAGLE-4WD 20.3	CX ESTATE 21.0	

Appendix A - Nameplate Average Fuel Economy (Continued)

***** UNADJ	***** UNADJ	***** UNADJ
LARGE PICKUPS 55/45	LARGE VANS 55/45	LARGE UTILITY 55/45
***** MPG	***** MPG	***** MPG
CHRYSLER COMANCHE-2WD 24.1		
GM CABALLERO PICKUP 24.0		
GM EL CAMINO PICKUP 24.0		
MINI TRUCK 4WD 23.5		
GM T10 PICKUP 4WD 23.0		
GM T15 PICKUP 4WD 23.0		
MINI POWER RAM50 4WD 23.0		
CHRYSLER DAKOTA 2WD 22.8		
CHRYSLER COMANCHE-4WD 22.7		
ISUZU PICKUP TRUCK 2WD 22.6		
	GM G30 VAN 2WD 20.7	
	GM G35 VANDURA 2WD 20.7	
CHRYSLER DAKOTA 4WD 20.7		
TOYOTA TRUCK 4WD 20.7		
NISSAN TRUCK 4WD 20.6		
ISUZU PICKUP TRUCK 4WD 20.6		
GM C10 PICKUP 2WD 20.2		
GM C15 PICKUP 2WD 20.2		
	GM G15/25 VANDURA 19.4	
GM C25 PICKUP 2WD 18.8	GM G10/20 VAN 2WD 19.3	
GM C20 PICKUP 2WD 18.8		
FORD F150 PICKUP 2WD 18.6		
CHRYSLER DAKOTA CAB CHAS 18.3		
	GM G15/25 RALLY 2WD 17.7	
	GM G10/20 SPORTVAN 17.7	
FORD F250 PICKUP 2WD 17.4		GM R10 SUBURBAN 2WD 17.5
		GM R15 SUBURBAN 2WD 17.5
CHRYSLER D100/D150 PICKUP 17.3	FORD E150 ECONOLINE 17.4	
FORD F150 PICKUP 4WD 17.2	CHRYSLER B150/B250 VAN 2 17.4	
GM K25 PICKUP 4WD 17.2		
GM K20 PICKUP 4WD 17.2		
	GM G30 SPORTVAN 2WD 17.1	
	GM G35 RALLY 2WD 17.1	
GM K15 PICKUP 4WD 17.0		GM V15 SUBURBAN 4WD 17.1
GM K10 PICKUP 4WD 17.0		GM V10 SUBURBAN 4WD 17.1
		GM V15 JIMMY 4WD 17.0
	FORD E150 CLUB 16.8	GM V10 BLAZER 4WD 17.0
	CHRYSLER B150/B250 16.7	RANGE ROVER 16.8
FORD F250 PICKUP 4WD 16.3		CHRYSLER AD150 RAMCHARGE 16.3
CHRYSLER D250 PICKUP 2WD 15.6	FORD E250 ECONOLINE 16.1	
	CHRYSLER B350 VAN 2WD 15.5	TOYOTA LAND CRUISER 15.4
CHRYSLER J-10 STD PICKUP 14.6		FORD BRONCO 4WD 15.3
CHRYSLER W100/W150 PICKUP 14.2	CHRYSLER B350 2WD 13.9	CHRYSLER AW150 RAMCHARGE 14.3
CHRYSLER J-20 STD PICKUP 13.9		CHRYSLER GRAND WAGONEER 13.9
CHRYSLER W250 PICKUP 4WD 13.6		
CHRYSLER D250 CAB CHASSI 13.4		

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Appendix A - Nameplate Average Fuel Economy (Continued)

***** UNADJ SMALL PICKUPS 55/45 ***** MPG	***** UNADJ SMALL VANS 55/45 ***** MPG	***** UNADJ SMALL UTILITY 55/45 ***** MPG
		SUZUKI SAMURAI CONVERT 33.5 SUZUKI SAMURAI HARDTOP 33.5
MITSUBISHI TRUCK 2WD 27.8 MITSUBISHI RAM50 2WD 26.9 TOYOTA TRUCK 2WD 26.6 MAZDA FORD COURIER 26.5 MAZDA B2200/B2600 26.4 FORD RANGER PICKUP 2WD 26.3 ISUZU PICKUP TRUCK 2WD 26.2 NISSAN TRUCK 2WD 26.1 GM S10 PICKUP 2WD 24.7 GM S15 PICKUP 2WD 24.7	MITSUBISHI COLT VISTA 28.0 MITSUBISHI SPACE 27.4 TOYOTA VAN 2WD (PASS) 26.1 TOYOTA VAN 2WD (CARGO) 26.1 TOYOTA VAN 4WD (CARGO) 24.2 CHRYSLER CARAVAN/RAM VAN 24.2 TOYOTA VAN 4WD (PASS) 24.1 CHRYSLER VOYAGER 2WD 24.0 MITSUBISHI VAN 23.8 FORD AEROSTAR VAN 22.9 GM SAFARI 2WD (CARGO) 22.7 GM ASTRO 2WD (CARGO) 22.7 NISSAN VAN(CARGO) 22.6 GM ASTRO 2WD (PASS) 22.4 GM SAFARI 2WD (PASS) 22.4 MITSUBISHI 22.4 NISSAN VAN(PASSENGER) 22.4 FORD AEROSTAR 22.2	MITSUBISHI COLT VISTA 4WD 26.8 GM S10 BLAZER 2WD 23.5 GM S15 JIMMY 2WD 23.5 CHRYSLER CHEROKEE-2WD 23.2 FORD BRONCO II 2WD 22.5 CHRYSLER CHEROKEE/WAGONEER ... 22.4 GRUMMAN-OLSON LLV 22.3 FORD BRONCO II 4WD 21.9 GM T10 BLAZER 4WD 21.6 GM T15 JIMMY 4WD 21.6 CHRYSLER WRANGLER-4WD 21.2 MITSUBISHI MONTERO 20.5 MITSUBISHI RAIDER 20.3 TOYOTA 4-RUNNER 4WD 20.0 ISUZU TROOPER 19.9 NISSAN PATHFINDER 4WD 19.3
FORD RANGER PICKUP 4WD 22.6 MAZDA COURIER PICKUP 21.9 MAZDA B2600 4X4 21.7 N OHIO COMMERCIAL CHAS 21.4	VOLKSWAGEN VANAGON 2WD 19.7 VOLKSWAGEN VANAGON SYNCRO 18.4	
GM S15 CAB CHASSIS 17.8 GM S10 CAB CHASSIS 17.8 NISSAN TRUCK CAB CHASS 16.6		

Appendix B - Characteristics of 1988 Light Duty Trucks by Weight Class

	Under 2750 ----	2750 ----	3000 ----	3500 ----	4000 ----	4500 ----	5000 ----	Over 5000 ----
Domestic								
Sales(000)		37	223	880	1134	929	343	81
Fraction		.196	.317	.713	.821	.988	1.000	1.000
55/45 FE		28.0	26.7	23.1	21.5	18.0	16.1	17.2
Wt(lbs)		2750	3000	3500	4000	4500	5000	5662
Ton-MPG		38.4	40.4	40.6	43.1	40.8	40.6	49.3
Disp(CI)		122	153	195	241	318	329	354
Disp/Wt		.044	.051	.056	.060	.071	.066	.063
% FWD				21.8	15.6			
% 4WD			4.3	44.8	16.3	19.3	52.8	32.7
% Man.Tr		100.0	72.4	30.5	20.9	8.5	3.9	.1
% Inject			74.8	96.7	99.9	96.1	94.6	84.3
% TBI			40.6	49.7	55.5	56.8	35.5	79.3
% PORT			34.2	47.0	44.4	39.3	59.1	5.0
% Carb		100.0	25.2	3.3	.1	3.3	3.8	.9
% Diesel						.6	1.6	14.8
Imports								
Sales(000)	68	149	481	354	248	11		
Fraction	1.000	.804	.683	.287	.179	.012		
55/45 FE	33.5	27.4	26.4	22.5	20.0	15.8		
Wt(lbs)	2250	2750	3000	3500	4000	4500		
Ton-MPG	37.7	37.8	39.7	39.6	40.1	35.6		
Disp(CI)	81	139	143	153	162	233		
Disp/Wt	.036	.050	.048	.044	.040	.052		
% FWD			2.6		.1			
% 4WD	100.0		.6	56.8	89.3	100.0		
% Man.Tr	100.0	100.0	85.0	60.5	68.7			
% Inject			42.0	57.8	100.0	100.0		
% TBI			36.9	34.9	64.5			
% PORT			5.1	22.9	35.5	100.0		
% Carb	100.0	100.0	58.0	42.2				
% Diesel								
Fleet								
Sales(000)	68	186	704	1234	1382	940	343	81
55/45 FE	33.5	27.5	26.5	22.9	21.2	18.0	16.1	17.2
Wt(lbs)	2250	2750	3000	3500	4000	4500	5000	5662
Ton-MPG	37.7	37.9	39.9	40.3	42.6	40.8	40.6	49.3
Disp(CI)	81	136	146	183	227	317	329	354
Disp/Wt	.036	.049	.049	.052	.057	.071	.066	.063
% FWD			1.8	15.6	12.8			
% 4WD	100.0		1.8	48.3	29.4	20.3	52.8	32.7
% Man.Tr	100.0	100.0	81.0	39.1	29.4	8.4	3.9	.1
% Inject			52.4	85.5	99.9	96.2	94.6	84.3
% TBI			38.1	45.5	57.1	56.2	35.5	79.3
% PORT			14.3	40.1	42.8	40.0	59.1	5.0
% Carb	100.0	100.0	47.6	14.5	.1	3.3	3.8	.9
% Diesel						.6	1.6	14.8

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Appendix C - Characteristics of 1988 Light Duty Trucks by Size Class

	Small Pickups	Large Pickups	Small Van	Large Van	Small Utility	Large Utility
<hr/>						
Domestic						
Sales(000)	401	1456	699	404	468	198
Fraction	.366	.889	.796	1.000	.655	.947
55/45 FE	25.0	19.2	23.3	17.7	22.1	16.1
Wt(lbs)	3189	4229	3843	4665	3636	5190
Ton-MPG	40.1	40.8	44.8	41.6	40.3	42.6
Disp(CI)	171	292	196	310	204	345
Disp/Wt	.053	.069	.051	.067	.056	.067
% FWD			52.8			
% 4WD	16.6	27.0			79.9	71.6
% Man.Tr	56.2	23.6	8.5	3.1	31.9	2.3
% Inject	81.4	96.8	100.0	97.5	93.8	85.2
% TBI	37.7	59.2	43.6	50.4	49.5	59.9
% PORT	43.8	37.6	56.4	47.1	44.3	25.3
% Carb	18.6	2.5		2.1	6.2	9.7
% Diesel		.8		.4		5.1
Imports						
Sales(000)	693	182	179		246	11
Fraction	.634	.111	.204		.345	.053
55/45 FE	26.0	21.5	23.4		22.3	15.8
Wt(lbs)	3009	3664	3548		3454	4500
Ton-MPG	39.1	39.5	41.7		38.5	35.6
Disp(CI)	144	162	141		140	233
Disp/Wt	.048	.044	.040		.040	.052
% FWD	.0		7.0			
% 4WD	8.1	99.1	5.9		100.0	100.0
% Man.Tr	88.2	83.4	25.4		82.0	
% Inject	29.8	62.7	100.0		63.0	100.0
% TBI	29.0	40.9	57.9		33.2	
% PORT	.7	21.8	42.1		29.8	100.0
% Carb	70.2	37.3			37.0	
% Diesel						
Fleet						
Sales(000)	1094	1638	877	404	714	209
55/45 FE	25.6	19.4	23.3	17.7	22.2	16.1
Wt(lbs)	3075	4166	3783	4665	3573	5153
Ton-MPG	39.5	40.7	44.2	41.6	39.7	42.2
Disp(CI)	154	278	185	310	182	339
Disp/Wt	.050	.066	.049	.067	.051	.066
% FWD	.0		43.4			
% 4WD	11.2	35.0	1.2		86.9	73.2
% Man.Tr	76.5	30.3	12.0	3.1	49.2	2.2
% Inject	48.7	93.0	100.0	97.5	83.2	86.0
% TBI	32.2	57.1	46.5	50.4	43.9	56.7
% PORT	16.5	35.9	53.5	47.1	39.3	29.3
% Carb	51.3	6.3		2.1	16.8	9.2
% Diesel		.7		.4		4.8

Appendix D - Characteristics of 1988 Passenger Cars by Weight Class

	Under 2250 -----	2250 -----	2500 -----	2750 -----	3000 -----	3500 -----	4000 -----	Over 4000 -----
Domestic								
Sales(000)			256	1059	2387	2483	712	248
Fraction			.149	.608	.762	.812	.859	.980
55/45 FE			34.6	31.8	28.5	25.5	22.6	22.9
Wt(lbs)			2500	2750	3000	3500	4000	4500
Ton-MPG			43.9	43.9	43.0	44.8	45.4	51.5
Disp(CI)			116	128	153	222	301	307
Disp/Wt			.047	.047	.051	.063	.075	.068
% FWD			100.0	99.8	95.6	80.4	5.6	
% 4WD					.8		.3	
% Man.Tr			55.5	33.2	12.6	3.8		
% Inject			100.0	100.0	100.0	99.8	59.4	
% TBI			100.0	82.7	35.6	15.5	2.8	
% PORT				17.3	64.4	84.3	56.7	
% Carb						.2	40.6	100.0
% Diesel								
Eng-HP			88	96	116	149	172	140
HP/Disp			.756	.759	.769	.685	.572	.456
HP/Wt			.035	.035	.039	.043	.043	.031
O TO 60			13.1	13.2	12.5	11.5	11.5	14.6
Cu.Ft			102	103	107	117	129	156
Cu.Ft MPG			3588	3292	3079	3009	2937	3572
Cu.Ft Ton MPG			4485	4526	4618	5265	5874	8037
European								
Sales(000)	99	10	121	143	184	172	76	5
Fraction	.347	.020	.070	.082	.059	.056	.092	.020
55/45 FE	34.2	32.0	31.2	30.6	25.6	24.0	19.5	14.8
Wt(lbs)	2000	2250	2500	2750	3000	3500	4000	4716
Ton-MPG	34.2	35.9	39.1	42.3	38.6	42.3	39.5	35.1
Disp(CI)	71	79	107	111	143	151	253	333
Disp/Wt	.036	.035	.043	.040	.048	.043	.063	.070
% FWD	100.0	100.0	98.2	97.4	26.5	21.2		
% 4WD					3.0	2.3		
% Man.Tr	100.0	100.0	97.2	67.6	36.8	20.3	1.9	.3
% Inject			99.9	100.0	99.6	100.0	100.0	100.0
% TBI								
% PORT			99.9	100.0	99.6	100.0	100.0	100.0
% Carb	100.0	100.0	.1					
% Diesel					.4			
Eng-HP	56	61	88	108	135	152	207	270
HP/Disp	.788	.772	.828	.980	.948	1.020	.843	.842
HP/Wt	.028	.027	.035	.039	.045	.044	.052	.058
O TO 60	15.5	15.8	13.3	11.9	11.1	11.3	9.8	9.1
Cu.Ft	86	86	92	102	98	112	99	111
Cu.Ft MPG	2952	2760	2890	3141	2533	2714	1979	1682
Cu.Ft Ton MPG	2952	3106	3613	4318	3800	4750	3958	3922

Appendix D - Characteristics of 1988 Passenger Cars by Weight Class (continued)

	Under 2250 ----	2250 ----	2500 ----	2750 ----	3000 ----	3500 ----	4000 ----	Over 4000 ----
Asian								
Sales(000)	187	468	1345	541	562	402	41	
Fraction	.653	.980	.781	.310	.179	.131	.049	
55/45 FE	48.1	39.9	34.7	31.2	28.4	23.9	23.3	
Wt(lbs)	1959	2250	2500	2750	3000	3500	4000	
Ton-MPG	47.4	45.2	43.6	43.1	42.9	41.9	46.7	
Disp(CI)	70	91	95	111	124	166	180	
Disp/Wt	.036	.040	.038	.040	.041	.048	.045	
% FWD	96.6	100.0	98.6	92.7	74.0	59.7		
% 4WD	3.4		1.4	6.8	11.6	9.0		
% Man.Tr	89.8	66.6	49.2	45.3	54.9	31.7	59.7	
% Inject	19.1	40.2	43.4	53.9	100.0	100.0	100.0	
% TBI		34.8	29.5	23.2	6.0	4.4		
% PORT	19.1	5.3	13.9	30.7	94.0	95.6	100.0	
% Carb	80.9	59.8	56.6	46.1				
% Diesel								
Eng-HP	55	77	75	100	118	162	207	
HP/Disp	.792	.853	.792	.913	.947	.991	1.153	
HP/Wt	.028	.034	.030	.036	.039	.046	.052	
0 TO 60	15.5	13.4	15.0	12.9	12.2	10.6	9.6	
Cu.Ft	90	91	100	98	99	98	85	
Cu.Ft MPG	4362	3653	3473	3077	2853	2338	1989	
Cu.Ft Ton MPG	4264	4110	4341	4230	4280	4092	3979	
Fleet								
Sales(000)	286	478	1722	1743	3133	3057	829	253
55/45 FE	42.1	39.7	34.4	31.5	28.3	25.2	22.3	22.7
Wt(lbs)	1973	2250	2500	2750	3000	3500	4000	4504
Ton-MPG	42.8	45.0	43.3	43.5	42.7	44.3	44.9	51.2
Disp(CI)	71	91	99	121	147	210	291	308
Disp/Wt	.036	.040	.040	.044	.049	.060	.073	.068
% FWD	97.8	100.0	98.7	97.4	87.7	74.4	4.8	
% 4WD	2.2		1.1	2.1	2.8	1.3	.2	
% Man.Tr	93.3	67.3	53.5	39.8	21.6	8.4	3.1	.0
% Inject	12.5	39.3	55.8	85.7	100.0	99.9	65.2	2.0
% TBI		34.1	37.9	57.4	28.2	13.2	2.4	
% PORT	12.5	5.2	17.9	28.3	71.8	86.7	62.8	2.0
% Carb	87.5	60.7	44.2	14.3		.1	34.8	98.0
% Diesel					.0			
Eng-HP	56	77	78	98	118	151	177	143
HP/Disp	.790	.851	.789	.825	.811	.744	.626	.464
HP/Wt	.028	.034	.031	.036	.039	.043	.044	.032
0 TO 60	15.5	13.5	14.6	13.0	12.3	11.4	11.3	14.5
Cu.Ft	89	91	99	102	105	114	124	155
Cu.Ft MPG	3872	3635	3449	3213	3006	2904	2802	3534
Cu.Ft Ton MPG	3808	4089	4311	4417	4509	5082	5604	7954

Appendix E - Characteristics of 1988 Cars by EPA Car Class

		Passenger		Cars			Station Wagons			
		Two Seater	Mini Compact	Sub Compact	Compact	Midsize	Large	Small	Midsize	Large
Domestic										
Sales(000)	87		388	2604	1917	1443	112	348	245	
Fraction	.322		.166	.621	.887	.980	.332	.866	1.000	
55/45 FE	27.1		25.6	29.8	26.9	24.2	32.4	26.2	22.9	
Wt(lbs)	3110		3296	2928	3291	3679	2720	3394	4434	
Ton-MPG	42.7		42.5	43.9	44.3	44.6	44.3	44.6	50.8	
Disp(CI)	210		214	147	187	261	122	180	306	
Disp/Wt	.065		.064	.050	.056	.071	.045	.053	.069	
% FWD	39.0		26.2	90.3	90.9	65.5	98.2	100.0		
% 4WD				.7			1.8			
% Man.Tr	42.9		35.4	24.8	1.6	.1	26.8	1.1		
% Inject	100.0		100.0	100.0	92.8	87.0	98.2	100.0	13.2	
% TBI	29.0		22.7	46.7	29.9	18.0	92.7	34.5	7	
% PORT	71.0		77.3	53.3	62.9	69.0	5.5	65.5	13.2	
% Carb					7.2	13.0	1.8		86.8	
% Diesel										
Eng-HP	151		144	114	126	160	92	127	145	
HP/Disp	.743		.699	.788	.690	.619	.757	.707	.475	
HP/Wt	.047		.043	.039	.038	.043	.034	.037	.033	
0 TO 60	11.0		11.6	12.5	12.5	11.3	13.6	12.7	14.1	
Cu.Ft	50		95	104	114	127	119	140	161	
Cu.Ft MPG	1399		2480	3127	3079	3081	3888	3694	3688	
Cu.Ft Ton MPG	2137		4056	4555	5035	5661	5257	6260	8172	
European										
Sales(000)	31	38	277	267	102	29	27	39		
Fraction	.113	.472	.119	.064	.047	.020	.081	.097		
55/45 FE	20.7	26.9	29.0	27.4	22.4	23.4	31.2	25.5		
Wt(lbs)	3543	2771	2568	3012	3495	3635	2523	3538		
Ton-MPG	37.5	37.3	37.2	41.5	39.5	43.2	39.4	45.3		
Disp(CI)	225	138	112	134	178	147	108	144		
Disp/Wt	.061	.049	.042	.044	.050	.039	.043	.041		
% FWD	27.4	53.4	69.7	62.1	11.9	86.0	98.0	2.9		
% 4WD			1.8		3.6		2.0	.8		
% Man.Tr	27.5	83.8	77.1	45.7	9.5	25.9	98.4	17.7		
% Inject	99.5	100.0	60.3	100.0	100.0	100.0	100.0	100.0		
% TBI										
% PORT	99.5	100.0	60.3	100.0	100.0	100.0	100.0	100.0		
% Carb	.5		39.4							
% Diesel			.3							
Eng-HP	200	140	99	127	155	165	80	130		
HP/Disp	1.056	.967	.861	.957	.899	1.164	.745	.905		
HP/Wt	.057	.049	.037	.042	.044	.045	.032	.037		
0 TO 60	9.3	11.3	13.1	11.5	11.1	11.1	14.1	12.9		
Cu.Ft	50	74	90	104	112	125	110	134		
Cu.Ft MPG	1090	2034	2674	2920	2577	3025	3451	3444		
Cu.Ft Ton MPG	1875	2775	3353	4333	4439	5420	4347	6083		

Appendix E - Characteristics of 1988 Cars by EPA Car Class (continued)

	Passenger Cars						-- Station Wagons --		
	Two Seater	Mini Compact	Sub Compact	Compact	Midsize	Large	Small	Midsize	Large
Asian									
Sales(000)	153	43	1669	1324	142		199	15	
Fraction	.565	.528	.715	.316	.066		.587	.036	
55/45 FE	29.0	38.5	34.6	30.7	27.6		30.3	26.8	
Wt(lbs)	2787	2659	2542	2793	3091		2806	3000	
Ton-MPG	41.4	51.4	44.3	43.1	42.8		42.7	40.4	
Disp(CI)	129	103	98	118	143		107	123	
Disp/Wt	.046	.038	.038	.042	.046		.038	.041	
% FWD	50.9	100.0	89.0	98.2	78.0		50.1	100.0	
% 4WD			3.9				49.9		
% Man.Tr	75.9	61.3	62.7	35.9	46.3		55.8	36.4	
% Inject	100.0	85.8	43.8	63.6	100.0		92.1	100.0	
% TBI	22.6		18.2	21.8			54.3		
% PORT	77.4	85.8	25.5	41.8	100.0		37.8	100.0	
% Carb		14.2	56.2	36.4			7.9		
% Diesel									
Eng-HP	126	98	89	100	126		91	99	
HP/Disp	.984	.949	.886	.836	.878		.850	.801	
HP/Wt	.045	.036	.034	.035	.041		.032	.033	
O TO 60	11.0	12.9	13.8	13.4	11.8		14.2	13.8	
Cu.Ft	50	82	93	103	113		119	136	
Cu.Ft MPG	1556	3353	3346	3238	3149		3659	3662	
Cu.Ft Ton MPG	2072	4237	4134	4439	4844		5089	5493	
Fleet									
Sales(000)	271	81	2334	4195	2161	1472	339	402	245
55/45 FE	27.1	32.0	32.0	29.9	26.7	24.2	31.0	26.2	22.9
Wt(lbs)	2976	2712	2670	2891	3288	3678	2754	3394	4434
Ton-MPG	41.4	44.8	43.1	43.5	44.0	44.5	43.0	44.5	50.8
Disp(CI)	166	120	119	137	184	258	112	174	306
Disp/Wt	.054	.043	.043	.047	.055	.070	.041	.051	.069
% FWD	44.4	78.0	76.2	91.0	86.4	65.9	70.0	90.5	
% 4WD			3.0	.4	.2		30.0	.1	
% Man.Tr	59.8	71.9	59.9	29.6	4.9	.6	49.6	4.0	
% Inject	99.9	92.5	55.1	88.5	93.6	87.3	94.8	100.0	13.2
% TBI	22.1		16.8	35.9	26.5	17.6	62.6	29.9	
% PORT	77.8	92.5	38.3	52.6	67.1	69.6	32.1	70.1	13.2
% Carb	.1	7.5	44.9	11.5	6.4	12.7	5.2		86.8
% Diesel			.0						
Eng-HP	143	118	99	110	127	160	91	126	145
HP/Disp	.914	.958	.852	.814	.713	.629	.811	.730	.475
HP/Wt	.047	.042	.036	.038	.039	.043	.033	.037	.033
O TO 60	10.8	12.2	13.4	12.7	12.4	11.3	14.0	12.8	14.1
Cu.Ft	50	79	93	103	113	127	118	140	161
Cu.Ft MPG	1453	2730	3122	3149	3060	3080	3718	3669	3688
Cu.Ft Ton MPG	2071	3546	4028	4504	4994	5656	5085	6215	8172

Appendix F - Market Fraction, MPG, Weight, CID, 0 to 60, and Volume of 1988 Cars

		Front	Rear	4Wheel	Total	Auto	Manual	Total
		-----	-----	-----	-----	-----	-----	-----
Domestic	Mkt Fraction	.490	.130	.002	.621	.544	.077	.621
	55/45 FE	28.1	23.6	24.0	27.0	26.5	31.2	27.0
	Weight	3115	3861	3099	3271	3327	2874	3271
	Displacement	169.	280.	152.	192.	199.	142.	192.
	0 to 60	12.4	11.7	14.0	12.2	12.2	12.4	12.2
	Volume	112	121	103	114	116	101	114
European	Mkt Fraction	.039	.030	.001	.070	.033	.037	.070
	55/45 FE	30.3	23.1	23.6	26.7	23.7	30.1	26.7
	Weight	2596	3427	3209	2960	3362	2600	2960
	Displacement	103.	177.	140.	136.	165.	109.	136.
	0 to 60	13.1	10.8	11.3	12.1	11.2	12.8	12.1
	Volume	97	102	104	99	105	94	99
Asian	Mkt Fraction	.272	.022	.014	.308	.148	.161	.308
	55/45 FE	33.3	24.2	28.5	32.2	30.3	34.2	32.2
	Weight	2614	3412	2956	2686	2766	2614	2686
	Displacement	105.	163.	110.	109.	114.	105.	109.
	0 to 60	13.7	10.6	13.3	13.5	13.6	13.4	13.5
	Volume	98	81	109	97	100	95	97
All Mfrs	Mkt Fraction	.801	.182	.017	1.000	.725	.275	1.000
	55/45 FE	29.8	23.6	27.7	28.4	27.1	32.7	28.4
	Weight	2919	3735	2983	3069	3214	2685	3069
	Displacement	144.	249.	115.	162.	180.	116.	325.
	0 to 60	12.9	11.4	13.2	12.6	12.4	13.1	12.6
	Volume	107	113	108	108	112	97	108

		Fuel Inj	Carb	Diesel	Total
		-----	-----	-----	-----
Domestic	Mkt Fraction	.574	.047		.621
	55/45 FE	27.5	22.4		27.0
	Weight	3192	4225		3271
	Displacement	182.	309.		192.
	0 to 60	12.1	13.4		12.2
	Volume	112	138		114
European	Mkt Fraction	.071	.010	.000	.080
	55/45 FE	27.0	33.9	37.4	27.7
	Weight	3003	2023	3000	2887
	Displacement	138.	72.	152.	130.
	0 to 60	12.0	15.5	14.6	12.4
	Volume	102	86	96	100
Asian	Mkt Fraction	.173	.125		.298
	55/45 FE	29.7	36.1		32.1
	Weight	2886	2437		2697
	Displacement	121.	95.		110.
	0 to 60	12.5	14.8		13.4
	Volume	97	97		97
All Mfrs	Mkt Fraction	.818	.182	.000	1.000
	55/45 FE	27.9	31.1	37.4	28.4
	Weight	3111	2878	3000	3069
	Displacement	165.	149.	152.	162.
	0 to 60	12.2	14.5	14.6	12.6
	Volume	108	107	96	108

Appendix G - Market Fraction, MPG, Weight, CID, and 0 to 60 of 1988 Trucks

		Front -----	Rear -----	4Wheel -----	Total -----	Auto -----	Manual -----	Total -----
Domestic	Mkt Fraction	.075	.462	.198	.734	.573	.161	.734
	55/45 FE	24.1	20.3	19.4	20.3	19.7	22.9	20.3
	Weight	3740	4094	4117	4064	4184	3638	4064
	Displacement	171.	266.	255.	254.	264.	216.	254.
Imports	Mkt Fraction	.003	.161	.102	.266	.061	.205	.266
	55/45 FE	27.8	25.7	21.8	24.1	22.2	24.7	24.1
	Weight	3023	3082	3570	3269	3547	3187	3269
	Displacement	126.	143.	151.	146.	154.	144.	146.
All Mfrs	Mkt Fraction	.077	.623	.300	1.000	.634	.366	1.000
	55/45 FE	24.2	21.4	20.1	21.2	19.9	23.9	21.2
	Weight	3716	3833	3931	3853	4123	3385	3853
	Displacement	170.	235.	220.	225.	254.	176.	451.

		Fuel Inj -----	Carb -----	Diesel -----	Total -----
Domestic	Mkt Fraction	.696	.034	.005	.734
	55/45 FE	20.3	20.7	22.5	20.3
	Weight	4084	3479	5336	4064
	Displacement	255.	211.	379.	254.
	0 to 60	12.7	15.1	16.9	12.8
Imports	Mkt Fraction	.135	.131		.266
	55/45 FE	22.4	26.0		24.1
	Weight	3551	2979		3269
	Displacement	154.	138.		146.
	0 to 60	14.0	14.0		14.0
All Mfrs	Mkt Fraction	.831	.165	.005	1.000
	55/45 FE	20.6	24.7	22.5	21.2
	Weight	3998	3082	5336	3853
	Displacement	239.	153.	379.	225.
	0 to 60	12.9	14.2	16.9	13.1