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PRELIMINARY REGULATORY ANALYSIS
OF LIGHT TRUCK FUEL ECONOMY STANDARDS
MODEL YEARS 1982-85

DEPARTMENT OF
TRANSPORTATION

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National Highway Traffic Safety Administration
Plans and Programs
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Appendix A

SUMMARY

The effects of the proposed fuel economy levels for Model Years (MYs) 1982-85 light trucks and vans are:

TOTAL CHANGE FOR THE DOMESTIC AUTOMOBILE INDUSTRY FOR MODEL YEARS 1982-85 (BASE YEAR-MODEL YEAR 1981)

	<u>LOW</u>	<u>RANGE</u>	<u>HIGH</u>	
Lifetime Fuel Savings (128,195 miles) for the MYs 1982-85 Fleet	11		17	(Billion gallons)
Cumulative Fuel Savings through 2005	94		142	(Billion) gallons)
Net Consumer Benefits (Lifetime for MYs 1985 vehicle over MY 1981 vehicle)	\$510		\$1,120	(Per vehicle)
Industry Capital Requirements *	\$ 4.2		\$4.8	(Billion)

*Assumes none of the estimated capital investments could be offset through normal business expenditures.

This notice of proposed rulemaking (NPRM) proposes average fuel economy standards for model years (MY) 1982-1985 for two-wheel drive (4x2) and four-wheel drive (4x4) light trucks. Single values of 17.4 miles per gallon (mpg) for 4x2's and 15.6 mpg for 4x4's are proposed for MY 1982, whereas a range of values are proposed for MYs 1983-85. Vehicles subject to this rulemaking include pickup trucks, vans, and general utility vehicles which are 8,500 pounds gross vehicle weight rating (GVWR) or less, have a curb weight of 6,000 pounds or less, and a frontal area of 45 square feet or less.

The proposed fuel economy ranges are estimated to save between 11 and 17 billion gallons of gasoline over the lifetime of the MYs 1982-85 fleets compared to their consumption if the fleet fuel economy had remained at the level of the MY 1981 standards. This amounts to between 900 and 1,390 gallons per vehicle. The cumulative fuel savings due to this proposal between 1982 and 2005 would be in the range of 94 to 142 billion gallons.

Consumer savings from this proposal are significant. The purchaser of the average new truck meeting the fuel economy levels being proposed would save between \$510 and \$1,120 (1979 dollars) over the life of the vehicle. These numbers represent the difference between cost-based price changes (including manufacturer return on investment and dealer profit) and the value of gasoline saved.

This proposal is not anticipated to have any significant impact on sales or employment but instead reflects the Agency's perception of future light truck sales trends. The manufacturers are anticipated to improve their fleet fuel economy by implementing new technologies and introducing new models. Domestic production may rise as captive imports are replaced by domestically produced compact trucks.

If all savings are from imported oil, the Nation could save between \$3.5 billion and \$5.1 billion in 2005 (at the July 1979 price of \$23/barrel).

The capital expenditure necessary to attain the proposed range of fuel economy levels would be between \$4.2 billion and \$4.8 billion. These values do not take into account the distinct possibility that some of these investments may have been made as a part of a company's normal capital investments. The capital spending levels translate into industry investments of from 28-38 cents per gallon of gasoline saved, for the high and low ranges, respectively.

Cash flow analyses for GM and Ford's North American automotive operations show a cash flow deficit of considerable magnitude for 1980-82, while 1983-84 show large cash flow surpluses. Another analysis done by the Department of the Treasury showed large capital requirements for Chrysler for 1980-83. These deficits are subsequently demonstrated to be fairly sensitive to changes in the underlying assumptions.

The outcome of this rulemaking is predicated upon two critical issues:

- 1) The marketability of new models
- 2) The financial capability of the industry to produce these new models.

PART I

BACKGROUND AND INTRODUCTION

I. BACKGROUND AND INTRODUCTION

a. Background

The Energy Policy and Conservation Act, P.L. 94-163, enacted on December 22, 1975, was intended to increase domestic energy supplies and availability, restrain energy demand, and plan for coping with energy emergencies. As part of its provisions for energy conservation, that Act added a new title V, Improving Automotive Efficiency, to the Motor Vehicle Information and Cost Savings Act. Title V requires the Secretary of Transportation to set corporate average fuel economy standards for passenger cars and light trucks. This authority was delegated to the Administrator of the National Highway Traffic Safety Administration (NHTSA) on June 22, 1976 (41 FR 25015).

Title V provides that fuel economy standards are to be set at the maximum feasible level considering the following four criteria:

- o Technological Feasibility: whether fuel economy improving technology could be commercially available in time to meet a particular model year standard.
 - o Economic Practicability: whether the standard is within the financial capability of the industry and would not cause substantial dislocations (major reductions in sales, employment or competition, for example) in the industry or the economy as a whole.
- The Conference Report directs the Secretary to take "industry-wide considerations" into account and not set a standard at the level of

the company "which might have the most difficulty in achieving a given level of fuel economy." At the same time the Report directs that in setting the standard, "appropriate weight" be given to "the small number of domestic automobile manufacturers that currently exist, and the possible implications for the National economy and for the reduced competition association (sic) with a severe strain on any manufacturer."

- o The Effect of Other Federal Motor Vehicle Standards on Fuel Economy: requires an assessment of the potential adverse effects of Federal safety, noise, emissions, and damageability standards on fuel economy.
- o The Need of the Nation to Conserve Energy: requires an assessment of the degree that reliance on imported oil affects the balance of trade, value of dollar, inflation, national security, etc.

Title V required the Secretary to set the first standards for light trucks beginning with model year 1979. Standards must be issued at least 18 months before the beginning of the applicable model year. Separate standards may be issued for different classes of such vehicles as determined by the Secretary.

The penalty for noncompliance with the fleet average standards is \$5 per vehicle for each tenth of a mile that a specific manufacturer's fleet average fuel economy is below the standard. The fleet average

is based on the sales-weighted harmonic average of fuel economy (miles-per-gallon) for all vehicles produced by that manufacturer. Fuel economy values are measured by EPA according to the fuel economy test procedures. Penalties for not achieving the standard may be offset by credits (also \$5 per vehicle for each tenth of a mile per gallon above the standard) attained in the prior or subsequent model year. In its Third Annual Report to the Congress on the Automotive Fuel Economy Program the Department of Transportation has recommended that the period for earning credits be extended to three years, both prior and subsequent to the model year in question.

b. Previous Rulemakings

Model year 1979 was the first model year for which truck standards were established. The standards were issued in March 1977 and covered light duty vehicles with a gross vehicle weight rating (GVWR-weight of the vehicle plus its payload) of 6,000 pounds or less. Manufacturers were required to achieve a corporate average of 15.8 mpg for 4-wheel drive general utility trucks and 17.2 mpg for all other light trucks. At the same time, manufacturers were given the option of meeting a combined standard of 17.2 mpg. Captive imports (vehicles sold by a domestic manufacturer but not produced in the United States or Canada) were allowed to be included to determine manufacturer compliance with the MY 1979 standards.

Standards for MYs 1980-81 light trucks were issued in March 1978. The NHTSA exercised its discretionary authority to set the standards for vehicles with a GVWR up to and including 8,500 pounds. This action more than doubled the number of vehicles subject to fuel economy standards and applied both fuel economy and emission standards to the same class of light trucks. (EPA had extended the vehicle emission standards to MY 1979 light trucks with a GVWR of 8,500 pounds.) The standards then established were 16.0 mpg for 2-wheel drive and 14.0 mpg for 4-wheel drive light trucks in MY 1980, and 18.0 and 15.5 mpg for 2-wheel and 4-wheel light trucks, respectively in MY 1981. Captive imports were no longer permitted to be included for determining compliance. Separate standards were set at 14.0 mpg in MY 1980 and 15.0 mpg in MY 1981 for manufacturers whose trucks were powered exclusively by engines not used in passenger cars. These standards, issued to accommodate any manufacturer lacking experience with passenger car emission control technology, apply only to International Harvester. Each of the 1981 standards would be lowered 0.5 mpg if EPA does not approve the use of improved lubricants in fuel economy testing by January 1, 1980. In response to a petition from Chrysler Corporation, NHTSA reduced the MY 1981 2-wheel drive light truck standard to 17.2 mpg in June 1979. The 4-wheel drive light truck standard was not changed.

The Environmental Protection Agency has recently informed the Department of Transportation that it will not approve the use of improved lubricants by January 1, 1980. Thus, this NPRM also serves notice that the MY 1981 standards will be lowered by 0.5 mpg.

The revised standards are:

	MY 1980	MY 1981
Two-wheel drive vehicles	16.0	16.7
Four-wheel drive vehicles	14.0	15.0
Engine based standards	14.0	14.5

c. Need of the Nation to Conserve Petroleum

The United States imported only 18% of its oil needs at a cost of \$1.5 billion in 1959. Thirteen years later, imported oil accounted for only 20% of total consumption and cost the nation \$4.0 billion. But by 1975, 39% of the domestic demand for oil had to be imported at a cost of \$27.0 billion. This doubling of the amount and a seven fold increase in the cost of imported oil was the result of huge OPEC price increases, falling domestic crude oil production, and continued increase in domestic demand. This trend has continued. By 1978, imported oil, constituting 45% of oil consumed, cost the nation \$42.0 billion*, despite the fact that demand was growing at a slower rate.

*Economic Report of the President, January 1979, p. 296, annualized estimate.

The nation has become increasingly dependent for its oil supplies on the actions and decisions of a few foreign governments. This dependence has been demonstrated in the aftermath of the revolution in Iran when that country's oil production was stopped entirely in December 1978 and, once resumed, only returned to about one-half of its former level. This reduction was felt by all importers because it represented the difference between satisfying current world oil demand and a shortage of supply. OPEC, on whom the U.S. depended for 83% of its 1978 oil imports, has taken advantage of the tight world oil market by doubling prices recently: from \$12.70 per barrel (bbl) on December 31, 1978, to at least \$24.00 per barrel as of December 1979. Currently, prices on the "spot" market are approaching \$40 per barrel. Our total bill for oil imported in 1979 is now expected to be \$60.0 billion. An increase of this magnitude has severe adverse impacts on our trade balance, inflation, economic growth, unemployment, and confidence in the dollar as an international reserve currency.

The rapid transition from a condition of apparent worldwide surplus in 1978 to one of shortage in 1979 has shown the instability of the world oil market. While oil from new sources such as the North Sea, Alaska's North Slope, and Mexico might have been expected to

increase overall supply, it has instead just about matched the decrease in supply from such older sources as the continental United States and Iran. If major supply increases are to be achieved within the next few years they must come from OPEC and especially from Saudi Arabia, OPEC's largest producer. The total U.S. oil supply, and the Nation's economic growth and national security, are being heavily constrained by the decisions of a few foreign countries which control world oil prices and production.

The U.S. can change this situation by increasing its domestic energy production and by reducing demand. The fuel economy standards program helps to reduce demand by motor vehicles. Light trucks account for about 7% of our total oil consumption (20 percent of automobile consumption) and an improvement in their fuel efficiency, beyond the level scheduled to be achieved through the MY 1981 standards, is considered an integral part of the nation's total effort to conserve energy. Increased fuel economy standards would contribute directly to reduced U.S. dependence on foreign oil and help limit foreign oil imports to a level no greater than the amount imported in 1978--in accordance with the President's pledge.

d. Regulatory Analysis

i. Purpose: This document reflects the Agency's analysis of the effects of possible future truck fuel economy standards. It includes a discussion of the possible effects on the automobile industry, on purchasers of light trucks, and on the national economy. Areas covered include the capital investments of the auto industry required by these standards, net consumer benefits, possible retail price increases caused by these standards, employment impacts, and national fuel consumption reductions.

ii. Introduction: The proposed range of fuel economy standards for MYs 1982-85 light trucks are based on a combination of technological improvements, weight reductions, acceleration reductions and introduction of more fuel efficient new models. In this rulemaking, separate fuel economy levels are considered for 2- and 4-wheel drive vehicles. Automobiles which are not passenger automobiles, rated at 8,500 pounds GVWR or less, having a curb weight of 6,000 pounds or less, a frontal area of 45 square feet or less, and manufactured for model years 1982, 1983, 1984, and 1985 would be subject to these standards. This class of vehicles include pickup trucks, vans, and general utility vehicles.

The Agency has decided to continue to use its authority regarding vehicle classification to separate captive imports from domestically produced vehicles for purposes of calculating fleet average fuel economy, but invites comments on Chrysler's request to include up to 80,000 captive imports in its fleet average fuel economy.

iii. Organization: Part II of the Regulatory Analysis states the assumptions used in this analysis. These assumptions provide the basic foundation upon which the analytical framework is built. Part II also includes a discussion of the impact of other government regulations. Part III contains a discussion of the four cases examined in this preliminary analysis, including a description of the technology used, and the rates of new model introduction. This discussion concludes with a presentation of the fuel economy levels resulting from the cases considered. Microeconomic impacts of each case on individual manufacturers and consumers are assessed in Part IV. Part V contains an assessment of the impact on petroleum consumption and other macroeconomic impacts (aggregated national economic impacts) of the proposed cases and Part VI contains a discussion of the sensitivity analysis wherein the impacts of varying some key assumptions are assessed. An analysis of the potential issues is presented in Part VII.

PART II

ASSUMPTIONS

II. ASSUMPTIONS

The following discussion will state the assumptions used in the analysis to assess the economic and other impacts. The contents of this part of the Regulatory Analysis provide the building blocks upon which the analytical structure, presented subsequently, is built.

a. Baseline

Since EPA approval for use of improved lubricants in fuel economy testing will not be given by January 1, 1980, the model year 1981 standards of 16.7 mpg for 2-wheel and 15.0 mpg for 4-wheel drive light trucks are considered to be the base from which fuel economy improvements for MYs 1982-85 will be made. As a result of lowering the standards, lifetime fuel savings of MY 1981 light trucks would be reduced by 770 million gallons. The fuel economy benefits from technological improvements which translate into the fuel economy capabilities of each manufacturer for MY 1981 are described in detail in the Rulemaking Support Paper, Light Truck Fuel Economy Standards, Model Year 1981, July 1979.

Briefly, the fuel economy capability of each manufacturer is assessed by examining the existing fleet of light trucks and then introducing such new technologies as automatic transmissions with torque converter lockup and weight reductions to arrive at a more fuel efficient fleet. The MY 1979 fleet was examined and new technologies

were then applied, the rate of introduction being constrained by each manufacturer's capacity considerations, to arrive at the capabilities for MY 1981. Technological improvements and new model introductions available for MY 1982 are then applied to the MY 1981 fleet; thus establishing a MY 1982 base. The same procedure is followed for subsequent years.

b. Vehicle Miles Travelled

The vehicle miles travelled (VMT) and survival probability by vehicle age used in this analysis are the same as that used in the analysis for the MY 1981 standard.* The sources of these data are: (1) The 1972 Census of Transportation, Truck Inventory and Use Survey, by the U.S. Department of Commerce, Bureau of Census; and (2) A five year average of trucks in operation from 1972-1976 taken from R.L. Polk and Company data. NHTSA is currently examining this information, and if warranted, would modify it especially as the 1977 Census data becomes available. The weighted yearly travel by age as shown in the last column of Table II-1 will be used to determine future savings in petroleum consumption and in operating costs.

c. Discount Rate, 1979 Dollars, and Gasoline Prices

A 10 percent discount rate is used to determine the present value of future costs and savings.**

*Final Regulatory Analysis of Amending the Model Year 1981 Light Truck Fuel Economy Standards, National Highway Traffic Safety Administration, U. S. Department of Transportation, June 1979.

**OMB Circular No. A-94, March 27, 1972.

TABLE II-1
Weighted Vehicle Miles Travelled

Vehicle Age (Years)	Vehicle Miles Travelled	Survival Probability	Weighted Yearly Travel (Miles)
1	14,200	1.000	14,200
2	14,800	.999	14,785
3	13,900	.988	13,735
4	12,200	.966	11,785
5	11,100	.946	10,500
6	9,900	.925	9,155
7	9,300	.897	8,340
8	8,800	.862	7,585
9	8,000	.825	6,600
10	7,600	.771	5,860
11	7,300	.710	5,185
12	6,900	.645	4,450
13	6,000	.573	3,440
14	6,000	.502	3,010
15	5,300	.441	2,335
16	5,000	.38	1,900
17	5,700	.32	1,825
18	5,100	.26	1,325
19	4,600	.20	920
20	4,200	.14	590
21	4,000	.08	320
22	3,700	.05	185
23	3,200	.03	95
24	2,500	.02	50
25	2,000	.01	20
TOTAL			128,195

Manufacturing costs and other price impacts are calculated in 1979 dollars. The Agency believes that 1979 dollars must be used in order to take into account the rapid increase in gasoline and other prices between 1978 and 1979. Because an official Consumer Price Index (CPI) for 1979 is not available, Data Resources' (DRI) projection of 10.9% was used to convert 1978 prices into 1979 prices.

The average price of a gallon of unleaded gasoline is estimated to be \$1.14 in 1980 (in 1979 dollars) and is assumed to then increase at a rate of 3.0 percent per year over and above inflation. The three percent annual real price increases are the same as the Agency used in its June 1979 reanalysis of the MYs 1981-84 passenger car standards. The 1980 price is based on an estimated 20 percent real price increase over the anticipated average 1979 price of \$0.95 per gallon. The 30 percent increase anticipates the effects of further OPEC price increases and domestic oil decontrol. The estimated prices of unleaded gasoline, beginning with 1979, are shown in Table II-2.

TABLE II-2

ESTIMATED AVERAGE PRICE OF UNLEADED GASOLINE
(\$/Gallon in 1979 Dollars)

1979	\$0.95
1980	1.14
1981	1.17
1982	1.21
1983	1.24
1984	1.28
1985	1.32
1986	1.35
1987	1.40
1988	1.44
1989	1.48
1990	1.53
1991	1.57
1992	1.62
1993	1.67
1994	1.72
1995	1.77
1996	1.82
1997	1.88
1998	1.93
1999	1.99
2000	2.05
2001	2.11
2002	2.17
2003	2.24
2004	2.31
2005	2.37
2006	2.45
2007	2.52
2008	2.59
2009	2.67
2010	2.75

d. Sales Projections

Projections of light truck sales provide an estimate of the capacity needs of the manufacturers. For example, if a manufacturer is planning to introduce a new automatic transmission, and use it on 90% of its light truck fleet, then NHTSA can estimate the number of new transmission lines which must be built or modified only if the number of transmissions needed is known. These are important considerations in estimating capital requirements.

Several factors were considered prior to deciding upon the projected sales levels that would be used in this regulatory analysis. The effect of recent gasoline shortages and the resulting rapid price increases in gasoline are two important considerations. The sales projections used in the June 1979 Final Regulatory Analysis for light trucks under 8,500 GVWR for model years 1980 and 1981 were 3.57 million and 3.65 million vehicles, respectively. These projections were made before effects of the most recent gasoline crisis were fully known. The long term effects of this gasoline crisis on domestically produced light truck sales are not clear at this time, although sales have dropped about 21% in the first eight months of 1979. The availability of fuel in the early 1980's will play an important role in determining light truck sales, especially for those purchasers whose main usage will be recreational (about 50%).

In an attempt to project future sales, the results of four regression equations were analyzed, using historical data for 1970-78. The coefficient of correlation (R^2) for these equations was between .77 and .79. However, since sales of light trucks have more than doubled since 1970, the projections from the regression analyses showed extremely high sales estimates (between 4 and 5 million domestic sales alone by 1985). These were deemed too high when the actual sales from 1978 and the first eight months of 1979 were considered. The Agency thus believes that a slowing of the more than 10 percent annual growth rate for light trucks will occur.

Given the various factors of consumer demand for multipurpose vehicle usage and the possible effects of fuel crises, Data Resources, Inc. (DRI) projections of light truck (0-10,000 lbs. GVWR) sales, as shown in the first column of Table II-3, are used in this Regulatory Analysis. The DRI forecast assumes that (a) real consumer spending during 1978-1985 would rise at a slower rate: 3.0% vs. the 4.8% average annual rate recorded for the first quarter of 1975 to the first quarter of 1979; (b) gasoline's share of total consumption expenditures would rise from 3.5% during the period 1950-1973 to 4.3% in 1979 as a result of gasoline price increases and will continue to rise to 4.9% of total consumption by 1990; (c) the rising price of energy, auto loan rates, cost of repair and maintenance, and demographic changes (the population is getting older--the average age is rising; the birth rate

TABLE II-3

Light Truck Sales Projections
(millions of units)

	<u>0-10,000 lbs. GVWR</u>	<u>0-8500 lbs GVWR</u>	<u>0-8500 Domestics</u>	<u>0-8500 Captives</u>	<u>0-8500 Imports</u>
1979	3.07	2.95	2.54	0.20	0.21
1980	2.94	2.56	2.18	0.20	0.18
1981	3.21	2.79	2.39	0.20	0.20
1982	3.34	2.91	2.61	0.10	0.20
1983	3.60	3.13	2.91	-	0.22
1984	3.97	3.45	3.23	-	0.22
1985	4.25	3.70	3.48	-	0.22

NOTES

1. The 0-10,000 lbs., GVWR sales projected are based on DRI TRENDLONG0979.
2. 0-8500 lbs. GVWR trucks are projected to be 87 percent of 0-10,000 lbs. GVWR after 1979 and remain at this level for the entire period of 1979-1985.
3. Imports are estimated to account for 7 percent of 0-8500 lbs. GVWR sales through 1982 and 220,000 units annually in 1983-85. This reflects the Agency assessment that as smaller fuel efficient truck production is switched to domestic plants, the import share, including captive imports, of the light truck market will decline.

has declined and has stabilized at very low levels, the rate of growth of the driving age population is declining, and the total vehicle-market--automobiles and light trucks--is maturing) will cause the annual growth rate for light truck sales to decline from an average of 12.3% during 1970-1978 to an average of 3.1% during 1978-1990; and (d) a mild recession will take place in 1979-80 which would cause sales to decline between 1978 and 1980. A recovery is forecasted beginning with 1981 which would continue through 1985. The manufacturers have mainly provided the Agency with financial planning volumes, which reflect their capacity more than anticipated sales. Thus, comparable manufacturer sales projections are not available.

The DRI projections for 0-10,000 lbs. GVWR are then divided into 0-8,500 lbs. GVWR and 8,500-10,000 lbs. GVWR. Since the regulations apply only to vehicles up to 8,500 lbs. GVWR, manufacturers have the option of rating some of their inefficient vehicles above 8,500 lbs. GVWR, and thus increasing not only the market share of heavier vehicles but also the average fuel efficiency of the lighter fleet. Confidential manufacturer sales projections show that vehicles in the 8,500-10,000 lbs. GVWR range will increase their share of the 0-10,000 lbs. GVWR fleet from 4% in 1978 to roughly 13% by 1981 and continue at this percentage through 1985.

It is also assumed that the domestic manufacturers will continue selling captive imports during 1979-1982 but slowly start the domestic production of compact trucks such that captive imports would decline to

zero beyond 1982. Some of the manufacturers have already announced plans to this effect, but the timing of the phaseout of captive imports is not yet fully known for all the manufacturers. At the same time, because of the domestic production of compact trucks, the total import market share is expected to decline beyond 1982.

The market shares for the domestic manufacturers are assumed to remain stable through 1985, and thus, the NHTSA will use the same projected market shares as those used in the June 1979 Final Regulatory Analysis. The split between 4x2's and 4x4's for domestically produced vehicles is anticipated to level off after 1981 and remain at a steady 67% for 4x2's and 33% for 4x4's. However, if the price and supply of gas become critical factors, this ratio may change to a higher portion of 4x2 light trucks, since they get better fuel economy. The projected domestic market shares are shown below:

Projected 1982-85 Domestic Market Shares

	(%)				
	GM	Ford	Chrysler	AM	IH
4x2	44	41	15	0	0
4x4	38	28	10	19	5

International Harvester's light truck sales are estimated at 40,000 vehicles each year. This estimate reflects the fact that IH's capacity is 45,000 vehicles. Manufacturers' projected sales, as estimated by the Agency, of 4x2 and 4x4 vehicles are shown in Table II-4. These are the projections which will be used in the assessment of capital requirements and manufacturing cost changes, as discussed in Part IV.

While total light truck sales are important to the manufacturers in terms of total capacity needs, revenues, etc., the most important issue in this rulemaking will be the projected mix of light truck sales. That is, how many compact pickup trucks, compact vans, and compact utility vehicles will be demanded by consumers and whether the manufacturers will be able to satisfy or exceed this demand.

The Agency is projecting that a large number of consumers will demand these compact vehicles and it is anticipated that the manufacturers will have the plant capacity to meet the consumer demand. The following discussion shows why it is believed that the increased sales of compact trucks and vans in 1979 is not a one time aberration but the beginning of a long term trend to increased market shares for these vehicles.

TABLE II-4

MANUFACTURER SPECIFIC SALES PROJECTIONS - LIGHT TRUCKS UP TO 8,500 LBS. GVWR
(Thousands of Units)

MANUFACTURER	1982			1983			1984			1985		
	4x2	4x4	TOTAL	4x2	4x4	TOTAL	4x2	4x4	TOTAL	4x2	4x4	TOTAL
AM	-	160	160	-	170	170	-	200	200	-	210	210
FORD	720	240	960	800	280	1,080	890	310	1,200	960	330	1,290
CHRYSLER	260	90	350	290	100	390	320	110	430	350	120	470
GM	770	330	1,100	860	370	1,230	950	410	1,360	1,020	450	1,470
IH	-	40	40	-	40	40	-	40	40	-	40	40
SUBTOTAL	1,750	860	2,610	1,950	960	2,910	2,160	1,070	3,230	2,330	1,150	3,480
IMPORTS	280	20	300	200	20	220	200	20	220	200	20	220
TOTAL	2,030	880	2,910	2,150	980	3,130	2,360	1,090	3,450	2,530	1,170	3,700

Historical sales data show that the sales of compact trucks have been rising since 1970 except for a decline between 1973 and 1974 when sales of all light trucks under 10,000 pounds GVWR declined. However, their share of the 0-10,000 lbs. GVWR fleet remained fairly constant. It is anticipated that due to rising fuel prices, sales of compact trucks will now begin to rise. This is supported by the fact that while gasoline prices increased about 50% between 1978 and 1979, compact truck sales rose an estimated 39% while all other light truck sales decreased 20%, as shown in Table II-5 and Figure II-1. The market share of compacts, based on actual data for the first eight months of 1979, is anticipated to grow from 9.0 percent in 1978 to 14.7 percent in 1979.

Sales data for trucks under 6,000 pounds GVWR present a different picture, however. Sales rose between 1970 and 1973, declined between 1975-76, became steady for 1976-78, and have declined between 1978-79. This suggests the vulnerability of these vehicles to higher fuel prices. It should also be noted that a decline in the sales of these trucks in 1974-75 was somewhat offset by a considerable increase in sales of light trucks of over 6,000 pounds GVWR. There are several possible explanations for this change, the most significant being the applicability of emission standards to light trucks under 6,000 pounds GVWR which encouraged manufacturers and consumers to switch to over 6,000 pounds GVWR vehicles to avoid emission control equipment. However, that situation changed when the EPA issued an emission standard applicable to light trucks of up to 8,500 pounds GVWR. Higher

TABLE II-5
HISTORICAL SALES DATA
(000's)

CALENDAR YEARS	Compacts		Under 6,000 lbs. GVWR		6,000-10,000 lbs. GVWR		Total Sales 0-10,000 lbs. GVWR	
	Units	% of Total	Units	%	Units	% of Total	(units)	
1970	130	8.4	1,010	65.2	408	26.4	1548	
1971	148	8.4	1,178	66.4	447	25.2	1773	
1972	191	8.8	1,445	66.4	539	24.8	2175	
1973	275	10.0	1,772	64.1	717	25.9	2764	
1974	205	8.4	1,580	65.2	640	26.4	2425	
1975	249	10.4	1,193	49.8	952	39.8	2394	
1976	255	8.3	1424	46.2	1,401	45.5	3080	
1977	347	9.7	1430	39.9	1,803	50.4	3580	
1978	357	9.0	1468	37.0	2,140	54.0	3965	
1979 (First 8 mos.)	330	14.7	806	35.9	1,109	49.4	2245	

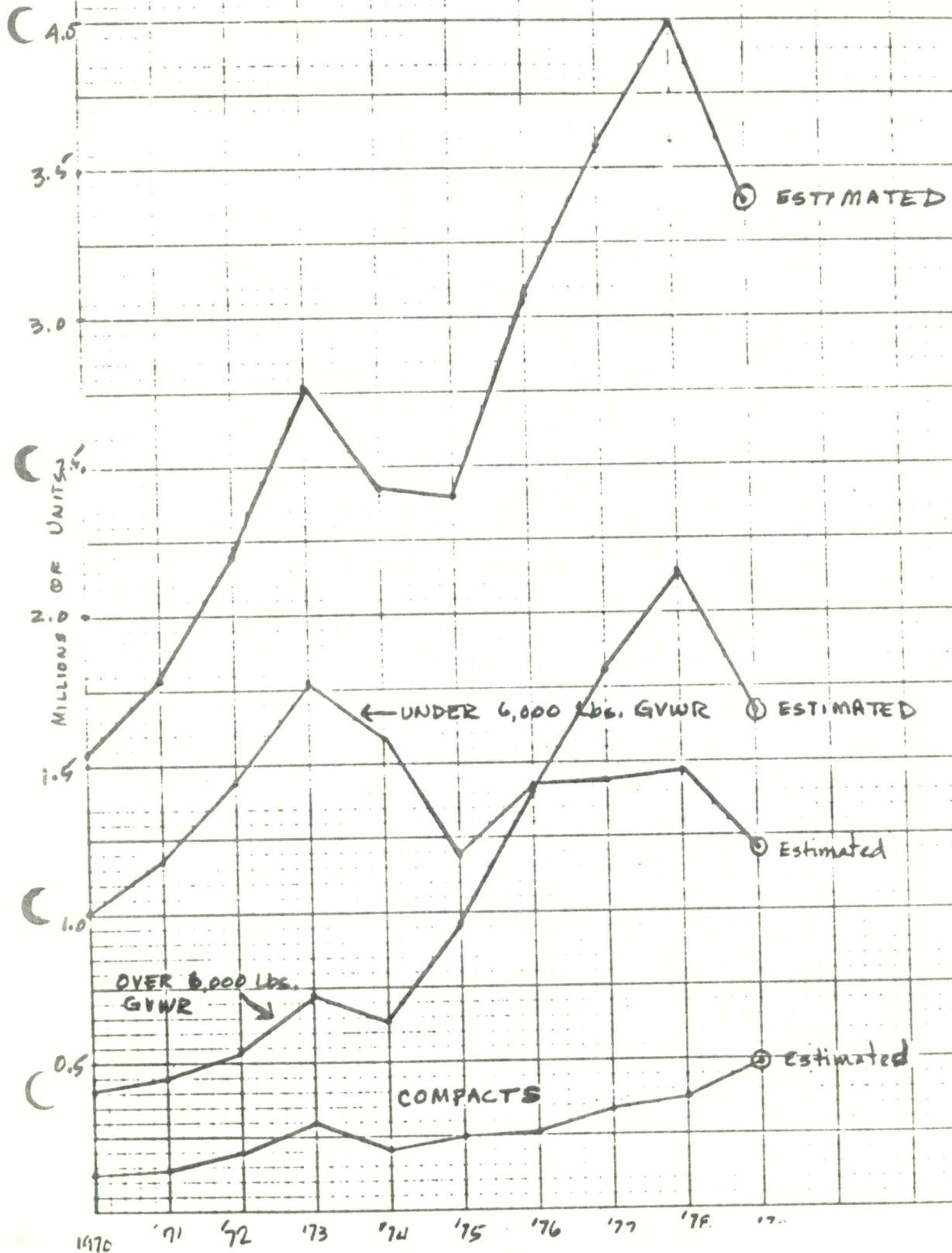
NOTES: Compacts category includes captive imports, imports, and VW van.

Under 6,000 lbs. GVWR category includes light trucks and passenger vans. These are all domestically produced vehicles.

Over 6,000 lbs. GVWR category includes all light trucks over 6,000 pounds GVWR. These are also domestically produced vehicles.

SOURCE: WARD AUTOMOTIVE REPORTS, various Annual Issues; Data for 1979 estimated on the basis of sales data for first eight months of 1979.

HISTORICAL SALES



fuel prices in 1979 have resulted in a sales share decline of the 6-10,000 lbs. GVWR vehicles by 4.6% between 1978-79 and an absolute decline of 22%. Since fuel prices are anticipated to continue to rise, it is estimated that the sales decline of heavier trucks will continue. Another factor which will become important by MY 1982 is the rerating of fuel inefficient vehicles over 8,500 pounds GVWR. When considering the regulated fleet (up to 8,500 lbs. GVWR), the share of compacts and 0-6,000 lbs. GVWR vehicles, shown in Table II-5, will automatically increase and the share of trucks between 6,000 and 8,500 lbs. GVWR will decrease, thus increasing the market share of compact trucks in the 0-8,500 lbs. GVWR light truck fleet.

The 1979 sales data and underlying factors which influenced these changes lead the Agency to believe that these sales changes are not a one time aberration. It is believed that sales of compact trucks will continue to rise, and the sales of heavy trucks will continue to fall. Some of the factors which lead the Agency to the above belief are that: (i) the light truck market is maturing for both consumers and business users; (ii) the demand for trucks will be driven mainly by replacement demand; (iii) replacement truck buyers would assess their needs more carefully and would buy a smaller truck if the currently owned truck is not frequently utilized at its maximum payload capacity; and (iv) the price of

fuel will continue to rise at a rate higher than the rate of inflation forcing consumers to make fuel efficiency a major consideration in their purchasing decision.

e. Truck Usage

i. Fleet Description: Pickup trucks were the first light trucks to evolve from passenger cars. Manufacturers placed short truck beds behind the front seats of their passenger cars, and a pickup truck was born. Pickup beds were lengthened and weight carrying capacity enlarged in response to increasing demand for more bulk and weight carrying capacity and because as long as gasoline was cheap, consumers preferred larger vehicles with more flexibility. Cargo vans were introduced in the 1960's to meet the demand of urban commercial buyers for an enclosed cargo vehicle to limit losses from theft and for vehicles with short front ends to improve maneuvering in city traffic. Cab sizes have grown in response to demand for passenger carrying capacity, to carry a 4-6 man work crew to and from a work site, for example.

Pickups continue to be the most popular light truck type, accounting for more than 65 percent of sales in 1978, or about 2.5 million of the total retail sales of about 3.8 million units in the 0-10,000 lbs. GVWR category. The Agency estimates that about 4 percent of total sales in 1978, about 150,000 units, were in the 8,500-10,000 lbs. GVWR range. Most models are available in a range of wheelbases and load bed sizes; some are available with cabs which seat six passengers, or which have a storage space behind the front seat. Smaller pickups were introduced in the United States market in the late 1960's but did not start to reach significant levels until 1970 when nearly 65,000 units were sold. In 1978, sales had reached 335,000 units, and continuation of the rapid sales growth experienced in the first nine months of 1979 would push small pickup sales to about 480,000 units for the entire calendar year. It is assumed implicitly in this rulemaking that this large increase in small pickup truck sales is not a one time aberration but is a continuing trend brought about by the availability of these vehicles and the rising price of gasoline.

Sales of commercial and passenger vans totaled almost 860,000 units in 1978 or almost 22 percent of total sales. Cargo vans accounted for more than 80 percent of all vans sold in 1978.

The third largest category of light trucks is the general utility vehicle (Jeep, Bronco, Blazer, etc.) with sales of about 355,000 units, equivalent to roughly 9 percent of the 1978 market. More than 90 percent of these vehicles had 4-wheel drive capability for recreational buyers or users needing mobility in snow, ice, mud, etc.

ii. Usage: The uses of light trucks in 1977 are shown in Tables II-6 through II-8. The data in Table II-6 show that personal rather than business use predominates in all truck categories. These range from a low of 54 percent for pickups to a high of 70 percent for sport/utility. However, one should be cognizant of the fact that personal rather than business use does not imply the lack of hauling requirements. Data in Table II-7 show that trucks were frequently used to drive to and from work in 1977--the range being a low of 78 percent for passenger vans to a high of 91 percent for sport/utility vehicles. Ninety percent of pickup owners drove to and from work some or all of the time. When examining their on-the-job usage, it was found that pickups were used about 61 percent of the time, as shown in Table II-8, while the other vehicles were never used even half the time for work purposes.

Thus, data presented in Table II-6 through II-8 clearly show that the primary use of light trucks has been for personal activities rather

TABLE II- 6

Primary Use of 1977 Light Trucks and
Vans Purchased by Early Model Buyers

<u>Vehicle Type</u>	<u>Business</u>	<u>Usage (%)</u> <u>Personal</u>	<u>Both About Equal</u>
Pickup Trucks	22	54	24
Sport/Utility	7	70	23
Suburbans	16	60	25
Vans	24	59	17
Passenger Vans	14	67	19
Compact Pickups	14	65	21

SOURCE: Summary of diagggregated data from Rogers National Research, Inc.;
Disaggregated Data is proprietary.

TABLE II-7

Early Model Buyers of 1977 Light Trucks
and Vans: Used as Transportation to and from Work

<u>Vehicle Type</u>	Usage (%)	
	<u>Some or All of the Time</u>	<u>Never</u>
Pickups	90	10
Sport/Utility	91	9
Suburbans	80	20
Vans	90	10
Passenger Vans	78	22
Compact Pickups	91	9

SOURCE: Summary of disaggregated data from Rogers National Research, Inc.; Disaggregated Data is proprietary.

TABLE II-8

Early Model Buyers of 1977 Light Trucks and Vans
Vehicles Used for On the Job Work

<u>Vehicle Type</u>	Usage (%)	
	<u>Some of All of the Time</u>	<u>Never</u>
Pickups	61	39
Sport/Utility	39	61
Suburbans	49	51
Vans	48	52
Passenger Vans	40	60
Compact Pickups	47	53

SOURCE: Summary of disaggregated data from Rogers National Research, Inc.; Disaggregated Data is proprietary.

than for business. However, this does not obviate the need for these vehicles to carry cargo (heavy and/or bulky) and to pull trailers. Potential usage, even if not the predominant use, plays an important role in a buyer's decision to purchase a particular type of vehicle.

Light trucks are purchased with load carrying needs and plans even though these intentions may never fully be implemented and the load carrying capacity may be overestimated. In December 1977 and January 1978 Ford conducted a study of 1,080 purchasers of 1973 and 1974 model year pickups in an effort to determine how often these vehicles were operated with a load. Table II-9 shows the results for vehicles subject to fuel economy standards. If one looks only at payload, the F 100/150 (1/2 ton) pickup was typically used by 76 percent of the buyers to carry less than 1,000 pounds. Similarly, 55 percent of buyers of the F 250 (3/4 ton) pickup--more likely to be commercial or farm users--typically used their truck to carry less than 1,000 pounds. In other words, it is possible that a small pickup truck may be able to satisfy the load carrying needs of a large number of the standard size pickup buyers.

TABLE II-9

Load Carrying Usage by Weight
For Ford Pickups

Maximum Weight Carried at Least Once or Twice a Week (lbs.)	1973/74 Ford Pickups	
	F 100/150 4x2 / 4x4 (%)	F 250 4x2 / 4x4 (%)
Up to 499	62	42
500 - 999	14	13
1000 - 1499	13	16
1500 - 1999	2	4
2000 and over	<u>9</u> <u>100</u>	<u>25</u> <u>100</u>

Another survey done by Ford in 1976 found that 55% of 3,000 Ford 1/2 ton van owners carried a maximum weight of 900 pounds or less, two or three times a month. A small van with a 1,000 pound payload could be a suitable replacement.

In summary, NHTSA anticipates the demand for more fuel efficient compact pickups, utilities and vans to rise as more realistic assessments of load carrying needs and rising fuel prices are incorporated into consumers' buying decisions. A more detailed discussion of alternatives in Part III will present the rationale for projected increases in market share of compact pickups, utilities and vans.

f. Impact of Other Government Regulations

The Act requires that fuel economy standards be set at the maximum feasible levels after taking into account the following criteria: technological feasibility, economic practicability, the impact of other Federal regulations and the need of the Nation to conserve energy. The following discussion pertains to the impact of other government regulations.

A number of safety, noise, and emission standards, in addition to fuel economy standards, applicable to light trucks may be promulgated or have been promulgated with an effective date which falls between MYs 1982-85. It is appropriate to examine the impact of these standards on the domestic automobile and light truck manufacturers and to account for these impacts in the consideration of fuel economy standards. Each one of the affected areas are discussed below:

(i) Safety Standards:

There are three new safety standards applicable to light trucks in the MY 1982-85 time frame which have been issued. These are: Interior Impact Requirements (Std. 201), Collapsible Steering Columns (Std. 203) and Steering Column Displacement (Std. 204). The effective date for these standards is MY 1982. These standards are not anticipated to

adversely effect the fuel economy of light trucks because changes in weight are estimated to be negligible (8 pounds for pickups and 19 pounds for vans).

The Five Year Rulemaking Plan* indicates that the Agency is planning to propose other safety standards, applicable to light trucks, with an effective date between MYs 1982-85. These are as follows:

<u>MY 1982</u>	<u>MY 1984</u>
Hydraulic Brake Systems	Side Impact Protection
Brake Inspectability	Automatic Restraints
Rearview Mirrors	
Direct Fields of View	
Seat Belt Comfort and Convenience	
<u>MY 1983</u>	<u>MY 1985</u>
Theft Protection	Controls and Displays

* Five Year Plan for Motor Vehicle Safety and Fuel Economy Rulemaking Calendar Years 1980-1984, U.S. Department of Transportation, National Highway Traffic Safety Administration, Washington, D.C., April 20, 1979.

This analysis makes no adjustments to the projected fuel economy to account for these planned rulemakings. When the affect on fuel economy of these planned rulemakings is determined, appropriate adjustments to the fuel economy standards will be made.

(ii) Emission Standards

The Environmental Protection Agency (EPA) has proposed revised emission standards for light trucks for the 1983 and later model years as follows:

(i) The HC and CO standards are to be equal to the 10% of a baseline of 1969 gasoline-fueled light trucks in the 6,000-8,500 lbs. GVWR range.

The resulting 90 percent reduction standards, using this 1969 baseline, are 0.8 g/mi for HC and 10 g/mi for CO.

(ii) The emissions of HC and CO under idle operation are to be equal to 10% of a sales-weighted average of idle emissions of 1969 heavy duty engines. Based on testing the heavy duty engines, the idle standards would be approximately 970 parts per million as carbon, at curb idle of HC and 0.47 percent at curb idle of CO.

(iii) A zero-emissions standards for crankcase emissions (blow-by) for diesel light trucks.

The EPA proposed:

- (i) a revision in the Selective Enforcement Auditing (SEA) procedures including a 10% acceptable quality level to replace the current 40% applicable to light trucks;
- (ii) A Production Compliance Auditing (PCA) procedure for assembly line testing to determine nonconformance penalties for 6,000-8,500 lbs, GVWR vehicles; and
- (iii) a new definition of "useful" life and revised certification requirements for emission control system durability to ensure that in-use emissions are reduced by the same percentages as the numerical levels of the standards.

The EPA proposal, in effect, requires light trucks to be more pollution efficient by reducing emissions. At the same time, the proposal closes some "loopholes" which reduce manufacturer flexibility in complying with the emission standards. The idle operation emission requirement is more stringent and duplicates part of the Federal Test Procedure (FTP) which is used to measure emissions. A zero-emissions standards for crankcase emissions has the same effect as the idle operation standard. The proposed revision of SEA and PCA would require manufacturers to impose not only tighter quality controls but also use improved emission control technology. These changes, when combined with the extension of the useful life, have a direct bearing on the deterioration factors and in effect make the emission standards much more strict than they appear at first glance.

The EPA has estimated that the manufacturers will comply with the proposed standards by installing new emission control systems. Consequently, they claim the fuel economy of the new light truck fleet is not anticipated to be adversely effected. The increase in costs, because of new equipment, development cost and certification testing costs, will be passed on to the consumer. The retail price of a light truck is estimated by EPA to increase by an average of about \$62 per vehicle. The average lifetime operating costs are estimated to rise an additional \$60 due to state inspection fee and maintenance programs anticipated to be necessary, but not required, by EPA.

The automobile manufacturers, however, disagree with EPA's estimate that the fuel economy of light trucks would not be adversely effected. Rather, the manufacturers, in their submissions to EPA, have stated that the proposed emission standards would have an adverse effect on fuel economy. For example, GM estimates that the more stringent exhaust emission standards may cause up to a 7% fuel economy penalty which, at this time cannot be offset by known advanced engine control technology. GM's estimate is based on 1980 emissions and fuel economy certification data, and a comparison of California versus Federal fuel economy at a 40% Acceptable Quality Level (AQL). The additional penalty imposed by a 10% AQL has not yet been measured.

Ford also anticipates a fuel economy penalty due to the proposed emission standards. However, the magnitude of this claimed penalty has not been determined by Ford since they are still conducting tests. In a public hearing held by EPA, other manufacturers made similar statements. The manufacturers' major areas of concern are:

- (i) Acceptable quality level and selective enforcement audit: a greater tightening of these controls of emissions than heretofore provided or practiced;
- (ii) Useful life: A longer useful life raises the deterioration factor, again requiring stricter control of emissions; and
- (iii) Leadtime: Proposed leadtime is not adequate to implement changes (and to develop new control technologies).

An in-house theoretical engine optimization analysis was conducted using these procedures and techniques* which refer

*As described in SAE 790179 and 770076.

to a simulation of the EPA test cycle over a range of engine sizes, axle ratios and inertia weights. The analysis shows that the proposed MY 1983 emission standards need not result in fuel economy degradation provided full electronic engine controls are applied. The Agency does not have any test data to confirm the results of this analysis and solicits test data to facilitate arriving at an independent assessment of the potential emission impacts.

Since there is no test data available, the Agency has decided to handle the emission issue in the following way: Case 1, as will be discussed later, will be the basis for setting the low end of the range for MYs 1983-85, will include a 5% emission penalty (thereby lowering the low end of the range). A 5% penalty was chosen because it appears to be an average of the comments provided by the manufacturers. Cases 2,3, and 4, as will be discussed later, will be used in setting the high end of the range, will include no emission penalty. By taking this approach the Agency can provide itself the most flexibility without making a decision as to the actual fuel economy penalty of the proposed emission standards, if any. Based on future test data, appropriate revisions to the fuel economy capability of light trucks will be made prior to establishing a final rule.

(iii) Noise Standards

The Agency is not aware of any proposed or planned noise standards which would be applicable to light trucks for MYs 1982-85.

PART III

FUEL ECONOMY IMPROVEMENT
CAPABILITIES

III. Fuel Economy Improvement Capabilities

Before assessing the costs and benefits of the proposed alternative fuel economy standards, it is appropriate to briefly discuss the methodology used to estimate the fuel economy capability of each manufacturer. The alternatives examined in this analysis will be discussed, as will the manufacturers' plans, and a basis for the proposed range of mpg numbers selected will also be provided.

a. Methodology

The Agency has identified four methods which the manufacturers can use to improve the fuel economy of their new light truck fleet. The first is the implementation of more fuel efficient technologies in the existing models, including the models introduced through MY 1981. Such fuel efficient technologies as spark ignition engine improvements, alternate engines (stratified charge spark ignition engines, lower displacement engines, and PROCO), improved automatic and manual transmissions, improved accessories, improved lubricants, reduced rolling resistance, aerodynamic drag reduction, weight reduction, and changes in axle ratios were considered. The second method is the introduction of new domestic models which are more fuel efficient than the existing domestic models. The third method is the reduction of payload while maintaining constant acceleration capability. The fourth method is the provision of minimum levels of acceleration capability while

maintaining current payloads. The various cases examined in this proposal are based on these methods. Each of these methods is discussed next, albeit briefly, and will be followed by a discussion of the cases. It should be noted that MY 1981 levels of 16.7 mpg for 2-wheel drive and 15.0 mpg for 4-wheel drive trucks are used as the base standards. Where a manufacturer could already exceed these standards in MY 1981 as estimated by NHTSA, the additional mpg increments were added to its MY 1982 fuel economy potential. (These were 0.2 mpg for Ford's 4x2's and 0.3 mpg for GM's 4x4's).

i. Technology Improvements to Existing Fleets:

Each manufacturer's capability for improving the fuel economy of 4x2 and 4x4 vehicles for MYs 1982-85 was analyzed and fuel economy improvements through improved spark ignition engines, reduction in engine size and rear axle ratios, rolling resistance, etc. are estimated for that portion of the fleet which is not replaced by new models. These technology improvements and related sales fractions for each manufacturer are shown in Tables III-1 through III-4. The estimated miles per gallon of the new models includes the newest technologies, which is why the sales fraction in Tables III-1 through III-4 only include that portion of the fleet that is not replaced by new models.

TABLE III-1

AMERICAN MOTORS

	2-Wheel Drive				4-Wheel Drive			
	Percent Improvement	1982	Model Years 1983 1984 1985	Percent Sales Change*	Percent Improvement	1982	Model Years 1983 1984 1985	Percent Sales Change*
SI Engine	-	-	-	-	C	C	-	-
Alternative Engines	-	-	-	-	25	C	C	C
4 Speed Auto. Trans. with Lockup Tor. Con.	-	-	-	-	10	-	-	25
3 Speed Auto. Trans. with Lockup Tor. Con.	-	-	-	-	3.5	-	-	-25
Manual Transmission with Overdrive	-	-	-	-	7	5	5	-
Accessories	-	-	-	-	C	C	-	-
Lubricants	-	-	-	-	1.0	100	-	-
Rolling Resistance	-	-	-	-	1.6 ¹	2	25	23
Aerodynamics	-	-	-	-	C	C	C	C
Intermediate Engine (6 cyl.)					15	-	-	82
								-5

¹MY 1982 and 1983²MY 1985

*Percent Sales Change is the additional market share over the preceding year.

C - confidential information

TABLE III-2

Chrysler

	2-Wheel Drive Percent Sales Change*			4-Wheel Drive Percent Sales Change*		
	Percent Improvement	1982	Model Years 1983 1984 1985	Percent Improvement	1982	Model Years 1983 1984 1985
SI Engines	3	100	- - -	3	100	- - -
Alternative Engines	-	-	- - -	-	-	- - -
4 Speed Auto. Trans. with Lockup Tor. Con.	-	-	- - -	-	-	- - -
3 Speed Auto. Trans. with Lockup Tor. Con.	3.5	-	- - -	-	-	- - -
Manual Transmission with Overdrive	5	-	- - -	7	4	- - -
Accessories	1.0	-	- 25 23 ¹ 20 ²	c	-	- 30 25
Lubricants	1.0	100	- - -	1.0	100	- - -
Rolling Resistance	c	-	- 25 23 ¹ 20 ²	c	-	- 30 25
Aerodynamics	-	-	- - -	-	-	- - -

1 Case 1

2 Case 2

*Percent Sales Change is the addition market share over the preceding year.

c - confidential information

TABLE III-3

Ford

	2-Wheel Drive					4-Wheel Drive				
	Percent Sales Change*					Percent Sales Change*				
	Percent Improvement	1982	1983	1984	1985	Percent Improvement	1982	1983	1984	1985
SI Engines	3	100 ¹	85 ²			3	100 ¹	85 ²	-	-
Alternative Engines	10 ³ 25 ⁴	-	2	5	15		-	4	4	15
4 Speed Auto Trans. with Lockup Tor. Con.	10	-	-	-	20	10		25	5	-
3 Speed Auto. Trans. with Lockup Tor. Con.	3.5	c	c	c	c	3.5	c	c	c	c
Manual Transmission with Overdrive	-	-	-	-	-	7	c	c	c	c
Accessories	c	12	-	20	c		50 ¹ 40 ²		43 ¹ 38 ²	40 ¹ 10 ²
Lubricants	1.0	100	-	-	-	1.0	100	-	-	-
Rolling Resistance	c	-	-	30 ¹ 23 ²	30 ¹ 10 ²	c	-	-	43 ¹ 38 ²	40 ¹ 10 ²
Aerodynamics	-	-	-	-	-	-	-	-	-	-

¹Case 1²Case 2³MY 1983 and 1984⁴MY 1985

*Percent Sales Change is the additional market share over the preceding year.

TABLE III-4

General Motors

	Percent Improvement	2-Wheel Drive Percent Sales Changes* Model Years			Percent Improvement	4-Wheel Drive Percent Sales Change* Model Years		
		1982	1983	1984		1982	1983	1984
SI Engines	3	70 ¹	60 ²	-	3	75 ¹	70 ²	-
Alternative Engines	10	c	c	-	10	c	c	-
4 Speed Auto. Trans. with Lockup Tor. Con.	10	c	c	-	10	c	c	-
3 Speed Auto. Trans. with Lockup Tor. Con.	3.5	c	c	-	3.5	c	c	-
Manual Transmission with Overdrive	5	10	-	-	7	-	-	-
Accessories	c	c	33 ¹ 5 ²	51 ¹ 0 ²	c	c	40 ¹ 10 ²	0 ¹ 5 ²
Lubricants	1.0	100	-	-	1.0	100	-	-
Rolling Resistance	c	-	33 ¹ 5 ²	51 ¹ 0 ²	c	-	40 ¹ 10 ²	0 ¹ 5 ²
Aerodynamics	-	-	-	-	-	-	-	-

1 Case 1

2 Case 2

*Percent Sales change is the additional market share over the preceding year.

c - confidential information

The fuel economy mpg improvements associated with implementing these fuel efficient technologies are shown in Tables III-5 through III-8. These are determined by multiplying the percent improvement of the technology times the percent sales change times the previous year's attainable fuel economy. Thus, for American Motors in Table III-5, the MY 1982 improvements are multiplied by 15.0 (the MY 1981 4x4 standard), MY 1983 improvements are multiplied by 16.09, MY 1984 by 16.41, and MY 1985 by 16.89.

ii. New Models:

It is estimated that substantial fuel economy improvements in fleet-wide light truck fuel economy in MY 1982-85 would be obtained as new, lighter weight trucks with high fuel economy are introduced and sold by the domestic manufacturers.

The methodology used to project the capability to design, develop, and produce new models for each of the domestic manufacturers of light trucks is as follows:

- o the types of new vehicles which could be offered by the domestic manufacturers were estimated first;
- o a surrogate for each vehicle type was developed next by estimating sales weighted average test weight and

TABLE III-5

Technology Induced Fleet Average Fuel Economy Levels:
 American Motors
 Case 1: Base Case
 2-Wheel Drive

	2-Wheel Drive			4-Wheel Drive		
	1982	Model Years 1983 1984 1985		1982	Model Years 1983 1984 1985	
Est. MY 1981 MPG						
SI Engine Improvements			15.0			
Alternative Engines						
4 Speed Auto Trans. with Lockup				0.38		
				c	c	c
3 Speed Auto. Trans. with Lockup						
					0.41	
						-0.14
Manual Trans. with Overdrive or Wide Ratio 4 Speed				0.05	0.06	
Accessories				c	c	c
Lubricants				0.14		
Rolling Resistance				0.05	0.06	c
Aerodynamics				c	c	c
Weight Reduction				0.10		
Reduce Engine Size and/or Rear Axle Ratio						
Sales Weight Fuel Economy for Existing Fleet				16.09	16.41	16.89 17.14

TABLE III-6
TECHNOLOGY INDUCED FLEET AVERAGE FUEL ECONOMY LEVELS: CHRYSLER
Case 1: Base Case

	2-WHEEL DRIVE				4-WHEEL DRIVE			
	1982	1983	1984	1985	1982	1983	1984	1985
Est. MY 1981 MPG	16.7				15.0			
Engine Improvements	0.50				0.45			
Alternative Engines								
4-Speed Auto. Trans. with Lockup								
3-Speed Auto. Trans. with Lockup								
Manual Trans. with Overdrive or Wide ratio 4 Speed					0.04			
Accessories		C		C		C		C
Lubricants	0.15				0.13			
Rolling Resistance		C		C		C		C
Aerodynamics								
Weight Reduction								
Reduce Engine Size and/or Rear Axle Ratio			0.40			0.32	0.18	
Sales Weight Fuel Economy for Existing Fleet	17.35	17.35	17.83	17.91	15.62	15.94	16.22	16.30

TABLE III-7
TECHNOLOGY INDUCED FLEET AVERAGE FUEL ECONOMY LEVELS: FORD
Case 1: Base Case

	2-WHEEL DRIVE				4-WHEEL DRIVE			
	1982	1983	1984	1985	1982	1983	1984	1985
Est. MY 1981 MPG	16.7				15.0			
Engine Improvements	0.50				0.45			
Alternative Engines		0.04	0.09	0.68		0.06	0.07	0.63
4-Speed Auto. Trans. with Lockup	0.20			0.36		0.40	0.08	
3-Speed Auto. Trans. with Lockup	C	C	C	C	C	C	C	C
Manual Trans. with Overdrive or Wide ratio 4 Speed					C	C	C	C
Accessories	C		C	C	C		C	C
Lubricants	0.15				0.12			
Rolling Resistance			C	C			C	C
Aerodynamics								
Weight Reduction								
Reduce Engine Size and/or Rear Axle Ratio	0.10							
Sales Weight Fuel Economy for Existing Fleet	17.74	17.83	18.01	19.15	16.02	16.48	16.77	17.54

TABLE III-8
TECHNOLOGY INDUCED FLEET AVERAGE FUEL ECONOMY LEVELS: GENERAL MOTORS
Case 1: Base Case

	2-WHEEL DRIVE				4-WHEEL DRIVE			
	1982	1983	1984	1985	1982	1983	1984	1985
Est. MY 1981 MPG	16.7				15.0			
Engine Improvements	0.35				0.34			
Alternative Engines	C	C			C	C		
4-Speed Auto. Trans. with Lockup	C	C	C		C	C	C	
3-Speed Auto. Trans. with Lockup	C	C	C		C	C	C	
Manual Trans. with Overdrive or Wide ratio 4 Speed	0.08				0.12			
Accessories	C	C	C	C	C	C	C	C
Lubricants	0.14				0.12			
Rolling Resistance			C	C			C	
Aerodynamics								
Weight Reduction								
Reduce Engine Size and/or Rear Axle Ratio								
Sales Weight Fuel Economy for Existing Fleet	17.79	18.22	18.34	18.36	16.58	16.66	16.80	16.80

- associated fuel economy regardless of the number of vehicle configurations which might be offered; and
- o the sales fraction for each surrogate vehicle in each model year where it is projected to be available was estimated last. For more detail see Appendix A and Section VI of the RSP.

Nine types of surrogate new models were established for this purpose: a 2-wheel drive mini-van, 2-wheel and 4-wheel drive small pickups, and 2-wheel and 4-wheel drive "standard size" pickups, 2-wheel and 4-wheel drive small utility vehicles, and 2-wheel and 4-wheel "standard size" utilities. Except for the van, all of these vehicles are based on two vehicle platforms--the small pickup and the "standard size" pickup. The rate of introduction of these surrogate vehicles varied from manufacturer to manufacturer depending upon an assessment of their capabilities. The varying rates of introduction of surrogate new models are discussed in more detail later in Part III. The sales weighted average test weight and associated fuel economy levels for each of the surrogate vehicles are shown in Table III-9.

iii. Payload Reduction:

Assessment of the fuel economy improvement achievable through the reduction of payload is based on the MY 1979 2-wheel and 4-wheel drive fleets. The methodology consisted of replacing the heavier trucks with higher payloads and GVWR, (still under 8,500 lbs. GVWR) with existing lighter trucks from the same

TABLE III-9
SURROGATE VEHICLES
Sales Weighted

	<u>2-Wheel Drive</u>		<u>4-Wheel Drive</u>	
	Average Test Weight (lbs)	Fuel Economy (mpg)	Average Test Weight (lbs)	Fuel Economy (mpg)
Small Pickup/Utility ¹	2,700	25	2,875	23
Mini-van ²	3,200	22	-	-
Standard Pickup/Utility ³	3,750	22	4,250	19

SOURCE: NHTSA estimates; For Details, see Section VI in the RSP, Nov. 1979.

¹The new small pickups are assumed to be larger than the current imported pickups but smaller than the new "standard size" pickup.

²The new mini-vans are projected to be smaller than the current domestic vans but larger than the VW bus sold currently.

³The new standard pickups are lighter than the current domestic 1/2 ton vehicles.

fleet. The assumption underlying this methodology is that most buyers seldom need the payload capacity of the present trucks and thus will accept reduced capacity. The methodology used in this approach is likely to result in a situation whereby relatively few vehicles in the 6,500 to 8,500 lbs. GVWR range would be offered for sale.

The sales weighted average payload capacity of a fleet is determined by subtracting the sales weighted curb weight of the fleet (curb weight plus options) from the sales weighted average GVWR of the fleet. However, it is difficult to accurately determine the relationship between fuel economy improvement and payload reduction for several reasons: (i) sales data by GVWR and total curb weight is not available, (ii) fuel economy of existing trucks, measured by EPA is based on its test weight, i.e., its curb weight plus options plus 300 pounds; and (iii) test weight is generated using a procedure which ascribes an options weight to all vehicles in a truckline if more than 33.3% of the truckline is so equipped.

Thus, the assessment of fuel economy improvement through payload reduction is, at best, a crude attempt to determine the fuel economy improvement attainable by forcing a shift towards smaller trucks. The percent of fleet effected and the mpg improvement for each manufacturer are shown in Table III-10. American Motor's fleet was not analyzed because its current fleet does not have a wide range of GVWR.

TABLE III-10
FUEL ECONOMY IMPROVEMENT
FROM PAYLOAD REDUCTION

<u>Manufacturer</u>	Sales Fraction Affected		MPG Improvement	
	4x2 (%)	4x4 (%)	4x2	4x4
Chrysler	17.1	19.3	0.1	0.0
Ford	28.6	31.6	0.6	0.1
GM	21.6	32.0	0.3	0.0

NOTE: Fuel Economy Improvement is estimated to occur in MY 1982 for all manufacturers.

iv. Acceleration Capability Reduction:

Among other things, fuel economy is inversely related to engine size for a constant inertia weight. Thus, manufacturers can improve the fuel economy of a vehicle by reducing engine size to the minimum displacement consistent with acceptable levels of acceleration capability. For example, larger, 300 CID and over engines can be replaced with smaller, 200 to 250 CID, engines to obtain fuel economy improvements.

Prior to discussing the magnitude of such a change, the resultant fuel economy improvement, and consumer acceptance, a brief discussion of the minimum acceleration criteria used for evaluation of smaller engines is appropriate.

The criteria are:

- a. The vehicle must maintain 45 miles-per-hour (mph) on a 3 percent grade at GVWR,
- b. On level ground, the vehicle must move 90 feet in 5 seconds from a dead stop at GVWR,
- c. The vehicle must start from a dead stop on a 17 percent grade at GVWR, and
- d. On level ground, the vehicle must accelerate from a dead stop to a speed of 50 mpg in 25 seconds at GVWR.

It should be noted that a vehicle capable of meeting these minimum acceleration criteria at sea level may not be able to meet them at higher altitudes or after some normal engine deterioration has occurred.

The fuel economy estimates for the reduced acceleration (low power) fleet starts with the fuel economy values of the vehicles in combination with small engines, test weights typical of "existing fleet" in the 1981 model year, and either a three speed manual or three speed automatic transmission. Usage rates (or sales fractions) for MYs 1982-85 were assumed for engines smaller than 300 CID. Model Year 1979 usages of engines below 300 CID was used as a base for these estimates. The drop in the usage rate for MY 1985 compared with MY 1984 reflects the introduction of new, smaller, more fuel efficient models that replace existing vehicles. What remains of the existing fleet would have engines below 300 CID.

The fleet average fuel economy improvements as a result of acceleration capability reduction for each manufacturer are shown in Table III-11. Data show that there is considerable potential for improving fuel economy by reducing engine sizes. However, a lower powered fleet is accompanied by risks of consumer acceptance and premature deterioration of engines which may adversely affect durability. Sales decline may result if the customer cannot find suitable vehicles for his/her needs. As to engine durability, engine life of smaller engines will be

less than their larger counterparts if the low-power trucks get the same usage as the trucks with larger engines. The reason for this reduction in durability is that engine life is directly related to piston travel and that smaller engines will have greater piston travel for a given distance in miles traveled under the same load.

Light truck users, as they become aware of these problems if not already so, are anticipated to purchase heavier trucks if costs of these heavier trucks are within their budgetary constraints. Alternatively, they may defer or postpone their purchase if they cannot afford a heavier truck. In either case, light truck sales might decline and the fuel saved for the more fuel efficient 0-8,500 lbs. GVWR fleet would be offset by increased fuel consumed by the over 8,500 lbs. GVWR fleet.

The market acceptance of a light truck fleet with a 50-60 percent sales fraction of lower powered vehicles is very difficult to assess. It would mean returning to a level of average acceleration capability that was typical of the early 1950's. Since then, there has been a continual gradual evolution of the new light truck fleet's acceleration capability. Proprietary market studies conducted in 1978 indicate that the potential for a switch to smaller engines may be limited.

TABLE III-11

PROJECTED SALES FRACTIONS FOR MINIMUM POWER
FLEET AND ASSOCIATED FUEL ECONOMY IMPROVEMENTS

Manufacturer	2-WHEEL DRIVE				4-WHEEL DRIVE									
	1982 S.F. (%)	1982 F.E.I. (mpg)	1982 S.F. (%)	1982 F.E.I. (mpg)	1982 S.F. (%)	1982 F.E.I. (mpg)	1983 S.F. (%)	1983 F.E.I. (mpg)	1984 S.F. (%)	1984 F.E.I. (mpg)	1985 S.F. (%)	1985 F.E.I. (mpg)		
American Motors ¹	-	-	-	-	-	-	40	1.43	50	2.49	82	4.08	77	3.94
Chrysler ²	20	.53	40	1.35	60	1.88	50	.59	40	1.36	60	2.08	55	1.90
Ford ²	20	.44	40	1.28	60	2.18	60	.49	40	.85	60	1.36	80	1.47
General Motors ³	20	.40	40	.82	60	1.24	10	.71	40	1.25	60	1.79	20	.69

¹Automatic Transmissions are 70% for MYs 1982-85 and Manual Transmissions are 30% for MYs 1982-85 for 4x4 fleet.

²Automatic Transmissions are 70% and Manual Transmissions are 30% for MYs 1982-85 for both 4x2 and 4x4 fleet.

³Automatic Transmissions are 70% and Manual Transmissions are 30% for MYs 1982-85 for 4x2 fleet. The 4x4 fleet is equipped with 100% manual in 1982, 62.5% automatic and 37.5% manual in 1983, 83% automatic and 17% manual in 1984, and 75% automatic and 25% manual for 1985.

LEGEND: S.F. - Sales Fraction

F.E.I.- Fuel Economy Improvement

Engine size reduction, in addition to the new model introduction, may preclude the availability of large engines on the 0-8,500 lbs. GVWR fleet. If 30 percent of the potential light truck market were to opt for either buying the heavier truck or keeping an existing truck (a 50-50 split), much of the potential fuel savings of this method would be negated. In addition, there could be marketing risks for the manufacturer.

b. Fuel Economy Levels: Various Cases

The various methods to improve fuel economy of the light truck fleet were used to develop alternative fleet-average fuel economy levels attainable for MYs 1982-85. These cases are described below.

i. Case 1: Base Case

The base case shows the Agency's estimate of the fuel economy improvements from the sales of new models as well as technological improvements to the remainder of the fleet.

NHTSA projects new models will constitute an average of 60% of the 0-8,500 lbs. GVWR new light truck fleet in 1985.

The discussion of truck usage in Part II showed that a considerable number of light truck owners do not appear to utilize their vehicles to their maximum rated capacity. Consequently, some of these buyers could switch to a vehicle with a lower payload capability without impairing their current activities. This reason, coupled with the Agency's belief that the increased sales of compact light trucks would continue, underly the derivation of new model introduction rates. A more detailed discussion is included in Case 2.

It should be noted that the fuel economy levels developed in this case correlate well with the manufacturers' confidential projections for MY 1982 with the exception of Chrysler. In most cases, the manufacturers' special order responses indicated the plans for MYs 1983-85 were not firm, and subject to change as warranted by the situation. Thus, an accurate assessment of the manufacturers' plans cannot be made. One trend that stands out is that the Agency's projected introduction rates of new models are somewhat higher than the manufacturers' provided projections, even in Case 1.

The surrogate vehicles in Table III-9 and the mpg numbers on Pages III-5 to III-8 do not include the 5% emission penalty assumed for the low range. These numbers were presented without the penalties because Cases 2,3, and 4 use Case 1 without an emission penalty as a starting point. Table III-12 shows Case 1 with and without the postulated emission penalty.

ii. Case 2: Accelerated New Models

This case is a modification of Case 1 with an accelerated pace of introduction of new models, in terms of model year introduction dates, as well as higher sales percentages. The Agency projects that the new models will constitute an average of 88% of GM, Ford, and Chrysler's 0-8,500 lbs. GVWR new light truck fleet in MY 1985.

Pickups and utility vehicles make up about 74% of the 0-8,500 lbs. GVWR light truck fleet (standard size pickups 50%, utilities 9% and compact pickups 15%). The Agency projects that the compact pickup and utility vehicles' market share would rise to between 29 and 35% by 1985. While Table II-9 showed that 76% of F100/150 pickup owners and 55% of F250 pickup owners typically carry less than 1,000 pounds, it does not show the maximum weight the truck might carry 5 or 10 times a year. The buyer may be willing to forego the better fuel economy to have the capability to carry a few bigger loads per year. Thus, it is difficult to determine how many owners who typically don't carry over 1,000 pounds would purchase a truck with a payload capability of 1,200-1,300

TABLE III-12
CASE 1 WITHOUT EMISSION PENALTY
 (MPG)

			<u>4x2</u>			<u>4x4</u>		
	1982	1983	1984	1985	1982	1983	1984	1985
AM					16.1	16.4	16.9	17.1
CHRYSLER	17.4	19.1	20.1	20.9	15.6	17.9	18.4	18.8
FORD	17.8	18.9	19.8	20.7	16.0	17.2	17.5	18.4
GM	18.6	19.4	19.9	22.2	17.1	17.4	17.8	19.3

CASE 1 WITH 5% EMISSION PENALTY
STARTING IN MY 1983

AM					16.1	15.6	16.1	16.2
CHRYSLER	17.4	18.1	19.1	19.9	15.6	17.0	17.5	17.9
FORD	17.8	18.0	18.8	19.7	16.0	16.3	16.6	17.5
GM	18.6	18.4	18.9	21.1	17.1	16.5	16.9	18.3

pounds or a long-bed model with payload capability of about 1,600-1,700 pounds rather than a standard size pickup. (The Agency projects these new small pickups to be slightly larger than the current Chevy LUV, which has a payload of 1,125-1,600 pounds). Based on the rising price of gasoline, the improved fuel economy of the smaller models, and the apparent under-utilization of current standard size pickup trucks, the Agency is projecting a 14 to 20% shift in the market away from standard size pickups and utilities toward compact pickups and utilities. This is a loss in market of the standard size models of 24% (14÷59) to 34% (20÷59).

In 1978, the van market share of the 0-8,500 lbs. GVWR new light truck fleet was 22%. However, there are no mini-vans for sale except for the Volkswagen bus. Again, if the Ford study of the payload requirements is considered valid (which shows that 58% of 1/2 ton van owners only need a 1,000 pound payload once a month in comparison to the pickup truck survey of once a week)), and if one assumes that this is valid for heavier vans also, then about 12.8% of the 0-8,500 lbs. GVWR fleet could be made up of mini-vans. However, the assumption that the 58% figure is valid for heavier vans is very skeptical. The Agency projects the mini-van market share to be between 11.2% and 16.7% for Case 1 and 2, respectively.

The Agency also projects the "standard size" pickup to be somewhat smaller and more fuel efficient. This will be accomplished through material substitution and by implementing more fuel efficient technologies and efficient utilization of space.

Chrysler Corporation in its "Modification of Loan Guarantee Request," dated October 17, 1979, to the Department of Treasury, projects market segments of light trucks. Small buses, small vans, and small pickups make up about 43% of the 0-10,000 lbs. GVWR truck fleet in 1985. Of this 43%, small pickups make up 28% and mini-vans and small buses comprise 15% of the total 0-10,000 lbs. GVWR fleet. NHTSA projects the small pickup market share of the 0-10,000 lbs. GVWR fleet to be in the range of 25.3% to 30.2% and 9.8% to 14.5% for mini-vans and small buses. Thus, NHTSA's projections are comparable to Chrysler's projections, and seem reasonable. One point that should be brought to the reader's attention is the question "What is Chrysler's definition of small?" If Chrysler's small vehicles are bigger than what NHTSA projects or have larger engines, then NHTSA's fuel economy (mpg) projections would be comparatively optimistic.

iii. Case 3: Payload Reduction

This case is also a modification of Case 1 (Base Case) with a payload reduction for the remaining vehicles (other than new models). The payload reduction is attained by substituting lower GVWR vehicles for high GVWR vehicles.

iv. Case 4: Acceleration Capability Reduction

This case is another modification of Case 1 (Base Case) with reduced acceleration capability through reduced engine size while keeping payload constant.

Case 1 is the Agency's estimate of a reasonable introduction rate of new models based on the assumption that rising gasoline prices will increase the demand for smaller more efficient light trucks. Once again Case 1 includes a 5% emission penalty, whereas, the other cases include no emission penalty.

Case 2 is what the NHTSA would consider as an ambitious introduction rate of new models. Cases 3 and 4 were developed as a way for a manufacturer to improve fuel economy at relatively little investment cost. Reducing payload and reducing engine power must, however, be considered risky in terms of market acceptance. Fuel economy levels attainable for Cases 1 thru 4 are shown in Table III-13.

TABLE III- 13

SUMMARY OF EFFECTS OF CASES 1 THROUGH 4 FUEL ECONOMY CAPABILITY
(MPG's)

MFR	<u>4x2</u>				<u>4x4</u>			
	1982	1983	1984	1985	1982	1983	1984	1985
<u>Case 1</u>								
AM					16.1	15.6	16.1	16.2
CHRY	17.4	18.1	19.1	19.9	15.6	17.0	17.5	17.9
FORD	17.8	18.0	18.8	19.7	16.0	16.3	16.6	17.5
GM	18.6	18.4	18.9	21.1	17.1	16.5	16.9	18.3
<u>Case 2</u>								
AM					16.1	16.4	18.9	19.0
CHRY	17.4	19.8	20.5	22.3	15.6	18.2	18.7	19.1
FORD	18.5	19.5	20.6	22.5	16.7	17.4	17.9	19.7
GM	18.9	19.6	22.2	22.6	17.3	17.6	19.3	19.6
<u>Case 3</u>								
AM					16.1	16.4	16.9	17.1
CHRY	17.5	19.2	20.2	20.9	15.6	17.9	18.4	18.8
FORD	18.4	19.5	20.3	21.1	16.1	17.3	17.6	18.5
GM	18.9	19.6	20.1	22.3	17.1	17.4	17.8	19.3
<u>Case 4</u>								
AM					17.5	18.9	21.0	21.1
CHRY	17.9	20.5	22.0	22.5	16.2	19.2	20.5	20.7
FORD	18.2	20.2	22.0	22.0	16.5	18.1	18.8	19.9
GM	19.0	20.2	21.1	22.5	17.8	18.6	19.6	20.0

c. Proposed Fuel Economy Standards:

From the fuel economy values shown in Table III-13, the proposed fuel economy standards were selected. For MY 1982 a single point was selected for 4x2's and 4x4's, whereas for MYs 1983-85 a range of standards is proposed. A range of standards, instead of a single point is proposed in the later years for a number of reasons:

- 1) The uncertainty in manufacturers' plans
- 2) The uncertainty in the emission standards' effect on fuel economy
- 3) The marketability of the new models projected, and
- 4) The uncertainty in whether the manufacturers have the financial capability to make the investments needed to produce new light trucks as well as introduce new technologies, while at the same time meet new light truck emission standards and passenger car fuel economy standards.

The proposed fuel economy standards shown in Table III-14, were selected as follows:

MY 1982

The lowest mpg level from Case 1 for any manufacturer.

MY 1983-85

Low Range

The low range was selected by taking the lowest mpg level from Case 1 for any manufacturer.

High Range

The high range was selected by averaging all manufacturers' projected mpg levels for Cases 2 and 4. For example in MY 1983 4x2's the projected mpg levels of 19.8, 19.5 and 19.6 (Case 2) and 20.5, 20.2, and 20.2) were added together and divided by 6. Case III was not included in the averaging process because the use of payload reduction does not provide a worthwhile fuel economy improvement.

It should be noted that the fuel economy ranges in Table III-14 have not been modified in any form as a result of cash flow analyses to be presented.

TABLE III-14
 PROPOSED FUEL ECONOMY STANDARDS
 (MPG's)

	<u>4x2</u>		<u>4x4</u>	
MY 1982	17.4		15.6	
	<u>LOWS</u>	<u>HIGHS</u>	<u>LOWS</u>	<u>HIGHS</u>
MY 1983	18.0	20.0	15.6	18.0
MY 1984	18.8	21.4	16.1	19.3
MY 1985	19.7	22.4	16.2	19.9

PART IV

MICROECONOMIC ANALYSIS

PART IV

MICROECONOMIC ANALYSIS

This section of the regulatory analysis examines the costs and benefits to the consumer of the mile per gallon improvement possibilities available to the manufacturers as identified previously. Also, the marginal benefits are examined as well as the overall comparison of operating cost savings to retail price increases.

In addition, the capital requirements of the manufacturers are analyzed in two ways. First, the capital requirements which can be allocated to light trucks to attain the mpg improvement by model year are estimated. This shows the estimated effect of improvements in fuel economy on capital investments. Second, the total capital requirements due to improving fuel economy for both passenger cars and light trucks are estimated by calendar year. These estimates are entered into a cash flow analysis to determine the capability of the manufacturers to finance the needed fuel economy improvements.

A. COST ESTIMATION

Because the proposed standards are given in ranges for each model year, the capital requirements and retail price increases shown in this section are based on the highest achievable mpg for each manufacturer as projected and as shown in Table III-1. Direct comparisons between manufacturers are not valid without taking into

account the mpg level each manufacturer's fleet attains. The costs and benefits of each manufacturer achieving the same standards will be analyzed in the Final Regulatory Analysis which will accompany the Final Rule.

Retail price increases and capital requirements were estimated for each improvement in mpg. These estimates were derived from various sources: manufacturers' confidential submissions to the Agency, contract reports, and in-house analyses. Theoretically, the retail price increases would be estimated by determining the variable cost (direct materials, direct labor, and variable burden) of a certain improvement over and above the variable cost of the equipment it replaces and adding to this a return on the capital investment needed for that particular improvement. However, the manufacturers did not supply the Agency with variable costs for all technologies, and the manufacturers' retail price estimates had to be used where no other information was available. Appendix A provides more information about these estimates.

In the case of new models, it was assumed that there would be no change in variable costs and that the retail price would increase based solely on the return on capital investment (comments on this assumption would be welcomed by the Agency). Capital requirements for new models were estimated by using a data base developed by the

Transportation Systems Center (TSC), an arm of the Research and Special Programs Administration in DOT. TSC has developed a "surrogate plant" analysis which provides estimates of the capital requirements to build various types of plants (assembly, stamping, engine, transmission, etc.) from the ground up, to convert a plant from one model to another new model, and to add capacity to a plant. These capital requirement estimates are based on the knowledge of the types of machinery needed in a "typical" plant and the cost of that machinery, as well as historical costs of plants as found in the news media and other sources.

For a change in engine mix or the introduction of new engines to trucks, the same "surrogate plant" analysis was used with the exception that projected excess capacity, if any, for the particular engine in question was taken into account before determining the needed additional capacity. In all cases where additional capacity was needed, enough capacity was added to fulfill the highest possible sales volume needs--that is, of the MY 1985 fleet.

B. CAPITAL REQUIREMENTS

Capital requirements, estimated in this section, are associated with the fuel economy improvements made to the new light truck fleets for MYs 1982-85 and show the effect these improvements have on capital investments.

Table IV-1 shows the estimated capital requirement for light trucks by model year for Cases 1 and 2 and, in the footnotes, shows the differences between Case 1 and Cases 3 and 4. It is interesting to note that GM shows no change in capital needs between Cases 1 and 2. This results because the difference between the two cases lies only in the percentage introduction of the new models. In this situation, GM has sufficient capacity, regardless of sales volume, and thus additional capital investments for the higher sales levels are unnecessary.

The capital requirements shown in Table IV-1 have no business-as-usual capital subtracted from them. Business-as-usual capital spending is the money the manufacturers would have spent on these fuel economy improvements if there were no average fuel economy standards. Due to present market demand for increased fuel economy, there is no manner in which the effects of fuel economy regulations can be separated from the demands of consumers. The Agency requests comments on the method of handling business-as-usual capital spending.

TABLE IV-1
CAPITAL REQUIREMENTS FOR LIGHT TRUCKS
(MILLIONS OF 1979 DOLLARS)

	MODEL YEARS				
Case 1					
<u>4x2's</u>	1982	1983	1984	1985	TOTAL
CHRYSLER	23	121	76	41	261
FORD	166	353	215 ¹	162	896 ¹
GM	604	485	294 ²	567	1950 ²
 <u>4x4's</u>					
AM	6	0	0	0	6
CHRYSLER	8	53	12	8	81
FORD	34	149	10 ³	36	229 ³
GM	332	86	86 ⁴	240	744 ⁴
 Case 2					
<u>4x2's</u>					
CHRYSLER	23	157	55	234	469
FORD	343	166	189	455	1153
GM	861	322	521	246	1950
 <u>4x4's</u>					
AM	6	0	0	0	6
CHRYSLER	8	58	12	8	86
FORD	100	72	32	207	411
GM	396	64	219	65	744

Case 3: Capital requirements are the same as Case 1.

Case 4: Capital requirements are the same as Case 1, but with the following exceptions:

- 1: Capital expenditures increase by \$65 million in addition to the amount estimated for Case 1.
- 2: Capital expenditures increase by \$165 million in addition to the amount estimated for Case 1.
- 3: Capital expenditures increase by \$35 million in addition to the amount estimated for Case 1.
- 4: Capital expenditures increase by \$85 million in addition to the amount estimated for Case 1.

NOTE: The levels of capital investments required are not directly comparable among manufacturers because different manufacturers incur different levels of expenditures to attain different fuel economy levels.

Comparing the capital requirements in Table IV-1 for MYs 1982-85 light trucks to NHTSA's estimate of capital requirements for both light trucks and passenger cars for MYs 1982-85 (the passenger car capital estimates were those used in the Third Annual Report to Congress on the Automotive Fuel Economy Program) results in the following chart:

CAPITAL REQUIREMENTS OF LIGHT TRUCKS
AS A PERCENTAGE OF TOTAL CAPITAL INVESTMENTS

	<u>CASE 1</u>	<u>CASE 2</u>
	(%)	(%)
Chrysler	19.2	27.8
Ford	21.4	27.5
GM	17.8	17.8

These percentages of light truck to light truck and passenger car capital requirements seem fairly reasonable when one considers that light trucks are projected to make up 25-27% of total light truck and passenger car sales.

The Agency estimates that there would be no difference between the capital requirements of Case 1 and Case 3 (Reduced Payload). A study of the current engine usage of the different models revealed that changing the sales of the heavier trucks to lighter trucks posed no engine capacity problems. No other capital intensive needs for stamping, assembly, or components were foreseen by the Agency.

An analysis of engine usage for Case 4 showed two potential engine capacity problem areas. For Ford it was estimated that for MY 1984 an engine conversion to a smaller engine for both 4x2's and 4x4's would be needed requiring \$100 million of capital. And, for GM in MY 1984, for both 4x2's and 4x4's, the Agency predicts 6-cylinder capacity problems requiring \$250 million of capital. Both of these capital requirements are in addition to Case 1.

C. POTENTIAL RETAIL PRICE CHANGES

The preceding section presented a discussion of manufacturing costs. Equally important is the methodology which is used to transform these cost changes into retail price changes. That is the subject of discussion in this section.

Automobile prices and the pricing policies of the automobile companies have been the subject of considerable interest and discussion over the years because automobile prices are related to a wide range of variables--such as inflation, sales, profits, dealer franchising, imports, marketing, price effects of safety and environmental regulations, and antitrust action. Although list prices receive the publicity in any discussion of auto prices, they are, in fact, only symbolic. Few sales are actually made at list prices; they exist only because they serve as a convenient bench mark for bargaining between dealers and buyers and because of legal requirements.

Wholesale prices are the key prices to the manufacturer; they determine how much revenue a manufacturer receives from each unit sold. The wholesale price plus the retailer's margin determine the actual retail price and, thus, the number sold in the market. It should be noted that the manufacturer influences the retailer's margin because of the power to force cars on dealers and thus reduce their margin. Historically, dealer margins vary from a low of 17 percent for small cars to a high of 26 percent for luxury cars.*

* Task Force on Motor Vehicle Goals Beyond 1980, The Task Force Report, Vol. 2, Ch. 13; the sales weighted dealer margin is about 21 percent.

Similarly, it is estimated that the dealer margin for light trucks varies between 14 percent and 21 percent.* One manufacturer, in its confidential submission, has shown the dealer margin to be over 30 percent for light trucks. Another manufacturer shows this margin to be about 20 percent. Therefore, an industrywide average of 25 percent for the dealer margin is used in this analysis.

As this analysis is concerned only with the transformation of changes in costs into potential changes in retail prices, no attempt is made to duplicate the complex pricing mechanism used by the automobile industry. Rather, potential changes in the retail price of an average light truck are computed to reflect only the cost of making fuel economy related changes. These estimated retail price changes do not represent anticipated actual changes in the retail prices of MYs 1982-85 light trucks; rather, they reflect the cost of improving fuel economy by using the technological options postulated in this analysis.

Title V of the Motor Vehicle Information and Cost Savings Act requires the U.S. Department of Transportation to establish fleet-average fuel economy levels for the automobile industry. The technological changes and their potential fuel economy improvements relate to an average light truck and not any specific model. Similarly, potential retail price changes due to fuel economy related cost changes are also related to the "average" light truck.

* Study of the Effects of Applying Federal Motor Vehicle Safety Standard 201 to Light Trucks and Vans, Department of Transportation (DOT) contract No. DOT-HS-7-01770-Modification No. 2, June 1979. The sales weighted average is about 19%.

Within a manufacturer's new light truck fleet, specific model pricing will be dictated more by competition and consumer demand than by fuel economy related technological improvements.

The following relationship to transform manufacturing cost changes is postulated:

$$RP = (1+D) [(GR \times CE) + VC]$$

where:

RP = Change in the retail price of a car
 D = Dealer margin; assumed to be 25 percent
 GR = Gross rate of return on stockholder's equity
 CE = Change in capital expenditures per car
 VC = Change in variable manufacturing cost per car

The equation postulates that a change in the retail price of an average car is a function of changes both in capital expenditures and variable manufacturing cost per car.

Implicit in the above equation are two relationships: first, capital expenditures are recovered at the gross rate of return; and second, automobile manufacturers recover variable manufacturing costs by passing them through. This enables the manufacturers to recover costs and capital expenditures without lowering the overall rate of return.

Historical data indicate that gross rate of return (gross income as a percent of stockholder's equity) varies considerably among the domestic automobile manufacturers. For General Motors, the gross rate averages 31 percent over the 1971-78 period. For Ford, the gross rate averages 23 percent over the 1971-78 period. The average gross rate

of return for Chrysler Corporation is 17 percent, excluding the 1974-75 period and 1978 when Chrysler incurred losses. Lastly, the gross rate of return for American Motors averaged 15 percent, excluding 1975-76 when losses were incurred. In this analysis, an industrywide average gross rate of return of 27 percent is used to estimate potential retail price changes.

It should be pointed out that the use of an industry average gross rate of return of 27 percent results in an overestimation of the potential price increases for Ford, Chrysler and AM, and a slight underestimation for GM. The use of an industrywide average gross rate reflects several considerations. They are: first, no attempt is made to estimate actual retail price increases. Rather, potential retail price increases driven by capital investment increases are estimated in this analysis. Second, the fuel economy standards are industry average standards. And, third, the industry average gross rate of return reflects GM's domination of the marketplace, and its price leadership position in the domestic automobile industry.

Once again, it should be pointed out that the preceding discussion of the methodology used to estimate the potential price changes due to fuel economy related technological improvements does not represent an attempt to duplicate the complex, model-specific pricing strategies followed by the domestic automobile manufacturers. This is simply an attempt to measure only the impact of fuel economy induced cost changes on the retail prices of an average light truck.

It should also be noted that no business-as-usual capital expenditures have been subtracted out before entering the incremental capital expenditure numbers into the retail price formula. This presents a better analysis of the cost of fuel economy improvements and particularly the marginal cost per mpg without getting into the unanswerable question of what the manufacturers would have done in lieu of the fuel economy standards.

Once a retail price increase is estimated for an mpg improvement, it is multiplied by the percentage increase in usage in the new fleet, resulting in average retail price increase per vehicle.

Table IV-2 shows the average retail price increases per vehicle for Cases 1 and 2. No change in retail price due to Case 3 (Reduction in Payload), which reduces the availability of heavier vehicles, is anticipated. This occurs because in most cases, the same model truck can have a GVW rating of either under 6,000 lbs. or between 6,000 - 8,500 lbs. The difference between the GVWRs can be accounted for by differences in such components as stronger springs, larger tires and larger axles. Changes in these components do not require changes in assembly capacity. Since the same engines can be used, engine capacity would not change and would not impose any additional costs. And, lastly, differences in variable costs, if any, may show a decline due to a reduction in the need for stronger and/or larger components. Thus, the retail price increase for Cases 1 and 3 are estimated to be identical. However, for Case 4 (Acceleration Reduction), which requires smaller engines, capacity restraints for Ford and GM in MY 1984 were found. Conversion of an engine plant for Ford resulted in an estimated increase of \$25/vehicle (4x2 and 4x4), while new capital equipment for a GM plant resulted in an estimated increase of \$56/vehicle (4x2 and 4x4). Both of these are in addition to Case 1's estimated retail price increases.

TABLE IV-2
RETAIL PRICE INCREASES
\$/AVERAGE VEHICLE
(1979 DOLLARS)

		(MODEL YEARS)									
		<u>1982</u>		<u>1983</u>		<u>1984</u>		<u>1985</u>		<u>1982-85</u>	
Case 1											
4x2		RP	RP/MPG	RP	RP/MPG	RP	RP/MPG	RP	RP/MPG	TOTAL RP	TOTAL RP/MPG
CHRYSLER		75	107	120	71	83	83	48	60	326	78
FORD		112	102	88	80	94*	104	144	160	438*	110
GM		233	123	162	203	102**	204	211	92	708**	129
4x4's											
AM		88	80	26	87	39	78	6	30	159	76
CHRYSLER		78	130	140	61	44	88	31	78	293	77
FORD		106	106	114	95	44*	147	133	147	397*	117
GM		260	124	86	287	72**	180	213	142	631**	147
Case 2											
4x2's											
CHRYSLER		75	107	155	65	65	93	229	127	524	94
FORD		174	97	72	72	213	194	276	145	735	127
GM		327	149	114	163	230	88	62	155	733	124
4x4's											
AM		88	80	26	87	131	52	3	30	248	62
CHRYSLER		78	130	157	60	44	88	31	78	310	76
FORD		173	102	91	130	67	134	350	194	681	145
GM		318	138	76	253	215	126	47	157	656	143

Case 3 The retail price increases are the same as Case 1.

Case 4 The retail price increases are the same as Case 1, but with the following exceptions:

* Increases by \$25/vehicle in addition to the amount estimated for Case 1.

** Increases by \$56/vehicle in addition to the amount estimated for Case 1.

Legend:

RP = Retail Price

RP/MPG = Retail Price Increase per 1 MPG improvement

Looking at Table IV-2, one sees that the retail price increases are substantial, being \$700 for GM, \$400 for Ford, \$300 for Chrysler, and \$160 for AM in Case 1. Again, these numbers are not directly comparable because the GM fleet obtains a higher fleet fuel economy.

Table IV-2 also shows the retail price increase per 1 mpg improvement for each model year. This was done under the assumption that there is no emission penalty. As one can see, there are great dissimilarities between manufacturers as well as between model years for any given manufacturer. This comes about because some technologies are more expensive per mpg improvement than others, as are some new models. The technologies with the higher retail price increases per mpg improvement (in this case assumed to be greater than \$125 per one mpg improvement) and their introduction dates into the fleet are as follows:

- 1) Electronic engine controls - introduced by all manufacturers in MY 1982. AMC, however, confidentially provided a higher mpg improvement and thus shows a lower retail price per mpg.
- 2) Weight reduction - AM in MY 1982
- 3) Radial tires (over bias-belted) - AM in MY 1982 and 83
- 4) Proco engine - Ford in MY 1985
- 5) Turbocharged Engines - Ford in MY 1983-84, GM in MY 1982-83
- 6) GM's mini-pickup in MY 1984-85 for 4x2's and MYs 1983-84-85 for 4x4's. The mini-pickup itself in 1982 (4x2) is not that expensive but starting in 1983, additional engine capacity is needed for the van and mini-pickup making the mini-pickup fairly expensive.
- 7) GM's mini-van in MY 1983-84-85 is very expensive because of additional front wheel drive transaxle capacity and new engine capacity.

All of the individual technological improvements, except two, are considered cost-beneficial to the consumer. The two which are not are turbocharged engines and GM's 4x2 mini-van in MY 1983.

Turbocharged engines will continue to be sold based on acceleration attributes rather than improved fuel economy. While GM's mini-van may not be cost-beneficial to the consumer given the various assumptions used, it does add significantly to GM's possible mpg improvements (about .74 mpg). Given the large differences between retail prices and operating cost savings in MY 1982, as shown later, GM can certainly rearrange their pricing strategy to make these vans competitive and cost effective to the consumer.

The use of more costly technologies explains most of the differences in retail price per mpg but there still remains the question of why Chrysler is shown to attain higher fuel economy levels than Ford for MY 1985 in Case 1 and still show a \$100 smaller increase in retail price. The answer lies in the model mix. Chrysler's mini-pickup makes up 50% of their 1985 fleet and improves fuel economy by 2.96 mpg (4x2's) and 2.46 mpg (4x4's) at a relatively low retail price increase, while Ford's new models--20% mini-pickups plus 20% mini-vans for 4x2's only add 1.5 mpg and 20% mini-pickups for 4x4's only add 0.87 mpg through MY 1985, thus resulting in Ford having to use more technology (which is more expensive per mpg) to achieve its 1985 fuel economy.

An average retail price increase associated with the low range and the high range, as opposed to the projected maximum fuel economy level for each manufacturer, is estimated as \$350 to \$615 for a MY 1985 vehicle in comparison to a MY 1981 vehicle.

D. OPERATING COST SAVINGS

Operating cost savings are defined as the present value of dollar savings in gasoline that the vehicle owner would realize over the life of the vehicle from driving a vehicle which gets better fuel economy. The factors used to derive the operating cost savings are the weighted yearly travel by vehicle age (from Table II-1), the price of gasoline (from Table II-2), and a 10 percent discount rate. In addition, a multiplier is used to attempt to take into account the difference between the EPA estimated mpg and actual on-road fuel economy. For passenger cars, it has been estimated that actual on-road fuel economy is 11 percent less than the EPA estimated mpg. Since light trucks are tested unloaded, and are used partially or fully loaded at least some of the time, it is felt that the actual on-road fuel economy of light trucks will be at least 11 percent below EPA estimates. Thus, 0.89 is multiplied by the baseline fuel economy levels as well as the achievable fuel economies for each manufacturer before applying the previously mentioned factors. The operating cost savings presented in Table IV-2 are based on the manufacturers' achievable fuel economy levels and represent incremental savings over the previous model year. Thus, the "Total" column represents the average operating cost savings of a MY 1985 light truck in comparison to a vehicle which just meets the MY 1981 standard.

Table IV-3 shows substantial savings in operating costs for the consumer for all four cases. The noticeable differences between cases are that Case 1 shows a much lower total savings because of the

MY 1983 emission penalty, Cases 2 and 4 are higher than Case 3 for 4x2's, and Case 4 is noticeably higher than the other cases for 4x4's. Naturally, the differences between cases depend on the mpg levels, but a more meaningful examination results when retail prices are balanced with operating cost savings. This is done in the next section.

The price of gasoline that was used to determine the operating cost savings, shown on Table II-2, includes the average Federal and state taxes on gasoline of 12¢ per gallon. One can argue that gasoline taxes should not be included in operating cost savings because they are basically user taxes to keep up highway maintenance and the loss in revenues from a reduction in the sale of gasoline will require the states to increase taxes. Applying this argument, one finds that operating cost savings would be reduced 10 to 11%. However, this does not change the cost effectiveness of the available improvements in fuel economy. On the other hand, since passenger cars and light trucks are getting smaller and losing weight, highway maintenance should be reduced. Thus, the net effect on taxes for highway maintenance is difficult to determine.

TABLE IV-3
OPERATING COST SAVINGS
\$/AVERAGE VEHICLE

IV-20

	MODEL		YEARS		
<u>Case 1*</u>					
<u>4X2's</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>TOTAL</u>
CHRYSLER	266	252	356	259	1133
FORD	392	83	285	304	1064
GM	705	-77	157	704	1489
 <u>4x4's</u>					
AM	482	-321	332	54	547
CHRYSLER	276	600	231	134	1241
FORD	431	153	152	385	1121
GM	907	-235	148	591	1411
 <u>Case 2</u>					
<u>4x2's</u>					
CHRYSLER	266	807	203	493	1769
FORD	667	329	306	516	1818
GM	778	215	755	84	1832
 <u>4x4's</u>					
AM	482	151	972	40	1645
CHRYSLER	276	1072	361	157	1866
FORD	771	273	176	639	1859
GM	994	130	602	74	1800

*Case 1 includes 5% emission penalty starting in MY 1983, this explains the negative number in comparison to a MY 1982 vehicle.

TABLE IV-3 (CONTINUED)

OPERATING COST SAVINGS
\$/AVERAGE VEHICLE

	MODEL	YEARS				
<u>Case 3</u>						
<u>4X2's</u>		<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>TOTAL</u>
CHRYSLER		309	590	317	199	1415
FORD		629	368	241	229	1467
GM		778	215	174	595	1762
<u>4x4's</u>						
AM		482	151	198	97	928
CHRYSLER		276	950	208	122	1556
FORD		482	525	135	343	1485
GM		907	134	133	572	1746
<u>Case 4</u>						
<u>4x2's</u>						
CHRYSLER		433	834	425	113	1805
FORD		552	648	492	0	1692
GM		814	380	257	354	1805
<u>4x4's</u>						
AM		1080	481	656	32	2249
CHRYSLER		532	1151	324	66	2073
FORD		677	621	242	376	1916
GM		1163	320	301	144	1928

D. NET CONSUMER SAVINGS

Table IV-4 presents a comparison of the present value of operating cost savings with retail price increases. Two things stand out in Table IV-4. First, the overall net consumer savings due to these anticipated technological improvements and new models are very large. Second, the overall consumer savings are not spread out very evenly over the model years; that is, the marginal cost-benefit increases and decreases as different technological improvements and new models are introduced.

Table IV-4 basically presents the marginal lifetime consumer benefits; that is, the MY 1984 net consumer savings are over and above those for the MY 1983 vehicles. Thus, if one were to compare the net savings of the MY 1984 vehicle with the MY 1981 standard, one would add the lifetime net consumer savings of MYs 1982, 1983, and 1984.

A comparison of the four cases presents some interesting insights into the assumptions utilized throughout the analysis. These are:

- a) The large differences between Cases 1 and 2, besides the emission penalty in MY 1983, arise when new models are introduced or, in the case of American Motors, when a new engine is introduced. The most notable differences can be seen in MY 1982 introduction of Ford's compact pickup in Case 2, the MY 1985 (Case 1) or MY 1984 (Case 2) introduction of GM's "Standard" size pickup and AM's new engine (for 4x4's) in MY 1984 in Case 2.

TABLE IV-4
LIFETIME NET CONSUMER SAVINGS
\$/AVERAGE VEHICLE

	MODEL	YEARS				
Case 1*						
<u>4x2's</u>		<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>TOTAL</u>
CHRYSLER		191	132	273	211	807
FORD		280	-5	191	160	626
GM		472	-239	55	493	781
<u>4x4's</u>						
AM		394	-347	293	48	388
CHRYSLER		198	460	187	103	948
FORD		325	39	108	252	724
GM		647	-321	76	378	780
Case 2						
<u>4x2's</u>						
CHRYSLER		191	652	138	264	1245
FORD		493	257	93	240	1083
GM		451	101	525	22	1099
<u>4x4's</u>						
AM		394	125	841	37	1397
CHRYSLER		198	915	317	126	1556
FORD		598	182	109	289	1178
GM		676	54	387	27	1144

*Case 1 includes a 5% emission penalty in MY 1983, this explains the negative numbers in comparison to a MY 1982 vehicle.

TABLE IV-4 (CONTINUED)

LIFETIME NET CONSUMER SAVINGS
\$/AVERAGE VEHICLE

MODEL YEARS

Case 34x2's

	1982	1983	1984	1985	TOTAL
CHRYSLER	234	470	234	151	1089
FORD	517	280	147	85	1029
GM	545	53	72	384	1054

4x4's

AM	394	125	159	91	769
CHRYSLER	198	810	164	91	1263
FORD	376	411	91	210	1088
GM	647	48	61	359	1115

Case 44x2's

CHRYSLER	358	714	342	65	1479
FORD	440	560	373	-144	1229
GM	581	218	99	143	1041

4x4's

AM	992	455	617	26	2090
CHRYSLER	454	1011	280	35	1780
FORD	571	507	173	243	1494
GM	903	234	173	-69	1241

b) A comparison of Case 1, with no emission penalty, to Case 3 would show very little change since there is no difference in retail price and very little change in fuel economy resulting from reduced payload.

c) Comparing Case 2 to Case 4 shows that consumers could save large amounts of money by using smaller engines, especially AM purchasers. Interestingly enough though, GM 4x2 purchasers can save some money in MY's 1982-83, but when the new standard pickup is introduced in 1985, it brings the Case 2 up to the same net savings as in Case 4.

The negative numbers in Case 4 in MY 1985 show up in Ford's 4x2's because the smaller engines used in Case 4 in MY 1984 are less expensive than the PROCO engine introduced in the Technology part of Case 4 in MY 1985 while providing the same fuel economy. In the analysis, the smaller engines were deleted in MY 1985 to allow the PROCO to increase its market share of the fleet. The negative number in GM's 4x4's appears because GM's new model in Case 4 is harmonically averaged with a much higher mpg fleet and thus, does not increase the fleet's fuel economy as much.

The operating cost savings of an average MY 1985 vehicle in comparison to an average MY 1981 vehicle for the low range are \$1,013 for 4x2's and \$548 for 4x4--the weighted average being \$860, and for the high range \$1693 for 4x2's and \$1883 for 4x4's--the weighted average being \$1735. Subtracting from this retail price estimates for the low and high range, leaves one with a net consumer savings of \$510-\$1120.

F. ENGINEERING AND LAUNCH COSTS

Engineering and launch costs (launch costs being preproduction setup costs) are expensed items (that is, they are considered expenses and written off in the year they occur), as opposed to capital requirements which are written off over a period of three to five years for special tools or ten to fifteen years for machinery, etc. Thus, they do not have the long term effect of amortization or depreciation. Nevertheless, they are large expenses which become very important in a cash flow analysis. The Agency has been analyzing the manufacturers' responses to its special order in an attempt to determine the magnitude of engineering and launch costs for each manufacturer, the relationship between capital requirements and launch and engineering costs, and the timing of these costs. Unfortunately, only one manufacturer's submission was specific enough to provide an estimate. The Agency is trying to get more information from the other manufacturers, but in the meantime the following estimates will be used: 55% of capital requirements as the average launch and engineering costs for Chrysler and AM, 42% for Ford, and 27% for GM. The basis for these will be given in the assumptions for the cash flow analysis .

Table IV-5 shows the total MY 1982-85 launch and engineering costs.

TABLE IV-5
LAUNCH AND ENGINEERING COSTS
FOR LIGHT TRUCKS
(MILLIONS OF 1979 DOLLARS)

<u>ALTERNATIVE</u>	AM	CHRYSLER	FORD	GM	<u>TOTAL</u>
1	3	188	472	727	1390
2	3	305	657	727	1692
3	3	188	472	727	1390
4	3	188	514	795	1500

G. COMPETITION, PRODUCT RESTRICTION, AND RISK IMPACTS

Competition, product restriction, and risk (in terms of sales volumes, not finances) seem to go hand-in-hand when one is considering new models, new technologies, and the possibility of payload and engine size reductions. While the Agency cannot foresee the future in terms of consumer demand or how the manufacturers may go about improving their fleet fuel economy, some observations can be made about the four cases.

Cases 1 and 2

The differences in these cases lie mainly in model year introduction rates and model years; therefore, they can be discussed together. For technology, the main differences between the manufacturers is the introduction of turbocharged engines by GM and Ford; the 4-speed automatic transmission with lockup torque converters by GM, Ford, and AM; and Ford's PROCO. Turbocharged engines and 4-speed automatic transmissions with lockup torque converters are considered low risk items because they can be advertised as special features and do not change the truck's utility. These items are very expensive, however. Thus, while Chrysler may lag in the introduction of these expensive technologies, it may not be disadvantaged because its vehicles could sell at lower prices. The PROCO must be considered high risk because it has not yet been fully tested.

For new models, NHTSA projects GM to take the lead in all three categories, small pickup, minivan, and standard size pickup. Ford will lag behind GM in model introductions by 6 months to one year, except in Case 2 when both GM and Ford introduces the same pickups in MY 1982. Chrysler may be at a competitive disadvantage by not introducing their minivan until MY 1986 in Case 1 and MY 1985 in Case 2. Thus, Chrysler will have to rely on the commercial and heavier van buyers for three years because GM and Ford will have the advantage of having high mpg vehicles for the recreational/personal light van purchaser.

The Agency's analysis shows that Chrysler may incur another risk by its projection of 50 percent of their sales being minipickup and utility vehicles, in comparison to 20-30 percent for the other manufacturers. If consumer demand for the small pickups is as strong as NHTSA projects it to be, then Chrysler should have a competitive advantage. If consumer demand for small pickups is weak, Chrysler may have trouble meeting a tough fuel economy standard. Meanwhile, in the 4x4 market, American Motors will find increasing competition in the small utility vehicle market. Small utility vehicles off the small pickup chassis by GM, Ford, and Chrysler will challenge AM's CJ models and may force AM to use a smaller engine for these vehicles to improve their fuel economy. A small engine is projected for AM in Case 2.

Cases 3 and 4

Payload and engine power reductions are both product restrictions - one limiting the number of high GVWR vehicles, the other limiting engine size. Both are considered high risk alternatives. Payload

reduction does not appear to be a viable fuel economy alternative because to get a fuel economy benefit of 0.2 mpg requires mix shifts affecting 20-30 percent of the fleet.

Reduced engine power is a viable alternative which can show good fuel economy improvements. Engine size is one factor which may be dealt with better at the dealership level. Depending on the payload to be carried and the steepness of grades that the purchaser must typically encounter, it may be that actual fuel economy would be better with the larger engine. For other purchasers who don't typically travel with heavy loads and travel on fairly flat roads, the smaller engine will improve fuel economy. Thus, individual needs become an important consideration. If a manufacturer must use smaller engines to meet a fuel economy standard, then there is a great risk of consumer unacceptance. However, if a manufacturer can meet the fuel economy standard without the smaller engines, then the consumer can be given an option with little manufacturer risk. In conclusion, in certain cases, reduced engine power has the potential to improve fuel economy. However, the marketability of smaller engines may be much lower than that proposed in Table III-11 (60-80% by 1985). Whether market acceptance would be in the 10-20% range or lower or higher is difficult to predict.

H. Other Manufacturers

Up to this point, the Regulatory Analysis has only discussed the impacts on the four major domestic manufacturers of light trucks. However, there are 5 other manufacturers of light trucks upon

which these standards will have an impact. In the 1982-85 time frame it is possible that other foreign manufacturers may enter the U.S. light truck market. All of these manufacturers must meet the fuel economy standards or be subject to penalties. Each one of the individual manufacturers is discussed below.

International Harvester (IH):

IH is a special case in that a separate classification and lower standards were promulgated for IH for MYs 1980 and 1981, pertaining to fleets which were powered solely by truck engines (whereas all the other manufacturers use passenger car engines). Recently, IH indicated that they would be purchasing engines from another manufacturer making them no longer eligible for the special classification. Thus, IH's vehicles would have to meet the regular 4x4 standard. IH's estimated fuel economy capabilities, assuming no MY 1983 emission penalty are:

MY	With Diesels	Without Diesels
1982	17.2	16.4
1983	17.4	16.5
1984	17.6	16.5
1985	17.7	16.7

Thus, IH will be in the proposed range of fuel economy levels for its MY 1982 4x4 fleet without diesel engines and will be close to the proposed MY 1983 range if diesels are included. Although attention has not been focused on IH in this analysis, the Agency does not want to allow its 40,000 sales to lower the 4x4 fuel economy standard in later years. IH has asked that a separate class be redefined in terms of its market share. The Agency is requesting comments on the desirability and authority for granting IH's request and on the possibility of setting a separate standard based on the number of vehicles a manufacturer produces.

Datsun and Mazda:

Neither Datsun nor Mazda are anticipated to have trouble meeting any fuel economy standard through 1985. This is based on their mid-model year 1979 fuel economy estimated of 23.1 mpg and 30.1 mpg, respectively.

Toyota:

Toyota's 1979 mid-model year report shows an estimated 4x2 fleet at 20.1 mpg and 4x4 fleet at 13.8 mpg. This means that Toyota may have to make some fuel economy improvements in MY 1984 or 1985 for its 4x2 fleet. Probably business-as-usual improvements will make the effect of these standards minimal. For 4x4's, Toyota is anticipated to introduce a 4x4 version of its pickup which should raise its 4x4 fleet fuel economy by a considerable amount. The Agency should have more information when the MY 1980 pre-model year report is submitted.

Volkswagen:

VW's 1979 mid-model year report showed estimated fuel economy of 18.8 mpg. This will meet the proposed MY 1982 4x2 standard. For MY 1983 the Agency projects that VW will introduce a new bus/van using a Rabbit or Dasher front-wheel drive package. This vehicle will exceed the highest alternative fuel economy level under consideration for MY 1985. VW has also introduced a domestic pickup in MY 1980 which should have very high fuel economy.

However, this pickup cannot help the foreign made VW bus meet the fuel economy standards, unless its domestic contents is less than 75%, because the legislation at present requires that both the domestically produced fleet and the imported fleet comply independently with the fuel economy standards.

I. Cash Flow

The next step in assessing the cost impacts of fuel economy improvements is to examine the cash flow of the domestic auto manufacturers. The cash flow analysis shows the effect of changes in capital investments on each manufacturer's sources and uses of funds for each case and the magnitude of these changes. How these cash flow deficits, if any, could be financed will also be discussed.

A cash flow analysis examines the revenues, variable and fixed costs, depreciation and amortization, taxes, dividends, capital expenditures, and debt repayments to arrive at an estimate of the change in net cash for each year. The analyses will focus on North American (U.S. and Canada) Automotive Operations of the domestic manufacturers. In other words, nonautomotive and other worldwide operation related revenues and expenditures have been subtracted. This separation permitted an evaluation of North American automotive capital spending impacts in the proper context of North American automotive financial activity rather than that of total corporate operations. It should be noted that the cash flow analysis is applicable to both passenger car and light truck operations, and is based on NHTSA estimates of the capital requirements for improving the fuel economy of both passenger car and light truck fleets.

Cash flow analyses were prepared for GM and Ford. No cash flow analysis was prepared for AM because of the undisclosed details of their agreements with Renault. Also, no cash flow analysis was developed for Chrysler because of the availability of a Department

of Treasury report* which provides estimated cash requirements for Chrysler over the 1980-83 calendar years. In order to develop this proposed federal loan guarantee package for Chrysler, the Treasury Department has more financial information available to it than the Department of Transportation, and thus, it seems appropriate to use their analysis. It should also be noted that the capital requirements previously estimated in this document for Chrysler's light trucks are fairly similar to those provided in Chrysler's response to the Special Order on MY 1982-85 light trucks. These numbers were also provided to the Treasury Department, and thus, no change in the Treasury Department's analysis is required for consistency.

The Treasury Department presents a number of different analyses based on various assumptions of sales volumes and various financial plans. Taking the lowest and highest cumulative funds required by 1983 and deflating these to 1979 dollars by using the inflation rates assumptions to be presented in Table IV-8 results in the following negative cash flows: \$1,450-\$1,625 million in 1980, \$335-\$885 million in 1981, \$155-780 million in 1982, and \$80-\$680 million in 1983.

*Statement of the Honorable G. William Miller, Secretary of the Treasury, before the Senate Committee on Banking, Housing and Urban Affairs, November 14, 1979.

The discussion that follows will list the assumptions used in conducting the analysis and show the cash flow analysis for GM and Ford for each case including a discussion of the possible courses of action available to a manufacturer to finance cash flow deficits, if any.

A note of caution is in order. The cash flow analyses and sources and uses of funds statements, should not be viewed as forecasts of future financial performance; they are strictly analytic estimates and as such, are sensitive to the underlying assumptions. However, they do provide an indication of what might happen if historical financial performance was to continue into the future. A number of the subsequent assumptions are based upon manufacturer specific 1978 financial data. Comments are invited on the accuracy of the 1978 estimates, the applicability of these estimates to future years, and significant differences between the analytic estimates and manufacturers' own projections of income and changes in financial position statements during the 1980-84 period.

The financial statements are not presented using traditional accounting and cost classifications. Instead of indicating line items for cost of goods sold, selling and administrative expenses, employee retirement plans, etc., costs are classified as being either fixed or variable. This approach facilitated financial impact evaluation of changes in variable margin (revenue per unit less variable cost per unit) and fixed operating costs.

The sensitivity of results to changes in underlying assumptions are presented in Part VI, Sensitivity Analysis.

i. ASSUMPTIONS

- a. Revenue: The calendar year 1978 financial performance of each manufacturer was used to estimate revenue per unit. The process is shown in Table IV-6. Estimated 1978 revenue per unit is \$6,232 for GM and \$6,177 for Ford.

These estimates of revenue per unit have two biases. First, this approach implies that all nonautomotive revenue is derived from North American activity. Some nonautomotive revenue does come from overseas activity and has been subtracted twice in the process of estimating North American Automotive Revenue by subtracting corporate nonautomotive revenue from corporate North American revenue, thus, understating the revenue per unit. Second, since revenue per unit for medium and heavy trucks is included and is higher than for light duty vehicles, an upward bias is added to the per unit revenue projections, even when total North American revenue is divided by total sales (including medium and heavy trucks). The Agency requests comments on these and other assumptions used in the cash-flow analysis.

Revenue per unit is assumed to remain constant in real terms; that is, it increases at the same rate as the rate of inflation. In addition, price increase were included to largely offset the

TABLE IV-6
 CALCULATION OF REVENUE PER UNIT
 (1978 FINANCIAL PERFORMANCE)

	FORD	GM
North American Rev.	\$30,498 M	\$52,412 M
Non-Auto Rev.	<u>2,744</u>	<u>4,236</u>
N.A. Auto Rev.	\$27,754	\$48,176
Units (Passenger Cars and Trucks)	4.493 M	7.731 M
Revenue/Unit	\$ 6,177	\$ 6,232

LEGEND: M-Millions

estimated increases in capital spending. These real price increases for each year were estimated by dividing the incremental capital spending over 1978 levels* by unit sales and multiplying the estimated incremental capital per unit by 0.27 (the estimated gross rate of return and the factor historically used to provide a return on capital investment). The calculated real price increases, estimated for each calendar year in which incremental capital spending exceeded the 1978 spending levels, averaged about 0.3 percent annually for GM and 0.2 percent annually for Ford. The price increases for each year varied slightly for each case.

b. Unit Sales:

North American unit sales are based on the Data Resources' (DRI) U.S. sales projections TRENDLONG0979 for 1980-85. Light duty vehicle sales in Canada, based on 1978 sales data, are added to the U.S. sales projections to obtain North American sales for each manufacturer: GM 8% and Ford 8%. Market shares for each manufacturer are also based on 1978 sales data; 26% for Ford, and 47% for GM. The actual unit sales assumptions used are shown in Table IV-7.

* 1978 annual spending levels for GM and Ford were estimated to be \$3,200 million and \$1,290 million, (1978 economics), respectively. The Automotive Fuel Economy Program, Third Annual Report to the Congress, January 1979.

TABLE IV-7
NORTH AMERICAN PASSENGER CAR AND
LIGHT TRUCK SALES
(MILLIONS OF UNITS)

<u>YEAR</u>	<u>GM</u>	<u>FORD</u>
1980	6.71	3.71
1981	7.04	3.89
1982	7.14	3.95
1983	7.45	4.12
1984	7.95	4.40

c. Inflation Rate

The cash flow analyses for each firm were performed in nominal dollars ("incurred economics") and then deflated to constant 1979 dollars for presentation. This was done to more accurately reflect the behavior of various accounts. The rates of inflation used were based on DRI TRENDLONG0979, and are shown in Table IV-8. They are based on the estimated change in the Consumer Price Index.

d. Fixed and Variable Costs

Fixed and variable costs for 1978 were estimated by fitting a number of industry analysts' estimates to actual 1978 North American operating results. The best fit for each manufacturer is shown in Table IV-9.

Fixed costs do not include depreciation and amortization. Both fixed and variable costs were assumed to increase at the rate of inflation, remaining constant in real terms. Variable cost per unit is anticipated to rise due to fuel economy, safety, and emission standards. However, the Agency is unable to project manufacturers' success in passing these costs on to the consumers. Historically, the industry has claimed that it has been able to recover only 70 to 75 percent of these cost increases.* By using constant real cost per unit and constant real revenue per unit (except for minor price increases mentioned above), this analysis implies that manufacturers will be able to fully pass through

* Ford Motor Company, State of the U.S. Automotive Industry, June 1978.

TABLE IV-8
INFLATION RATES BY CALENDAR YEAR
(CHANGE IN CPI)

<u>YEAR</u>	<u>INFLATION RATE</u>
1980	9.6
1981	8.6
1982	8.2
1983	7.5
1984	7.4

SOURCE: Data Resources Inc., U.S. Long Term Review, Fall 1979.

TABLE IV-9

ESTIMATED 1978 NORTH AMERICAN FIXED AND VARIABLE COSTS

	<u>TOTAL FIXED COST (\$ M)</u>	<u>VARIABLE COST/UNIT</u>
GM	5,444	4,510
FORD	3,911	4,716

NOTE: Variable costs reflect the level of vertical integration, the product mix of each manufacturer, and the percent of options in this product mix. A more appropriate variable to examine is the variable margin (revenue/unit -- variable cost/unit) which provides a better idea of the unit profitability of each manufacturer. The variable margins are: GM - \$1,722 and Ford - \$1,461 in 1978 economics.

e. Dividends

Common stock dividends for GM and Ford are based on the average constant dollar payout per share during 1970-78. Average dividend per share of common stock over this period was estimated to be \$6.57 for GM and \$3.55 for Ford (1979 economics). The number of shares outstanding in 1978 were then multiplied by the estimated dividend per share to obtain total common stock dividends paid by Ford and GM. These amounts were converted into current dollars by applying the rate of inflation for each year. GM is also assumed to pay preferred stock dividends of \$13 million annually.

The dividend assumptions may be considered conservative because they imply that the entire corporate dividend payout is charged to North American automotive operations.

f. Capital Spending

Capital spending estimates were derived from those used in the Third Annual Report to Congress. These estimates are strictly the capital costs of tools, machinery, and facilities put in place to produce more fuel efficient vehicles. Investments for trucks above 10,000 lbs. GVWR are excluded as this is an analysis of North American light duty automotive operations. Also excluded are capital investments in such other areas as plant pollution

any increases in variable manufacturing cost or offset them through productivity improvements, since the base variable margin remains constant in real terms. This analysis also implies that manufacturers will be able to maintain corporate average variable margins although the vehicle mix is shifting toward smaller vehicles, which have historically carried smaller profit margins.*

Incremental launch and engineering expenses for each manufacturer were estimated and added to fixed costs in each year if capital investment exceeded 1978 spending levels. Incremental launch and engineering expenses are shown in Table IV-10. Launch related expenses are attributed to the year in which they are undertaken (year of model introduction). Engineering expenses are assumed to be incurred as follows: 70% one year before introduction and 30% in the year of introduction. For example, launch and engineering expenses for a MY 1979 program would be incurred as follows: launch - 100% in 1978; engineering - 70% in 1977 and 30% in 1978.

* Harold K. Sperlich, Vice President, Product Development, Chrysler Corporation, has indicated that typical passenger car variable margins are: subcompact - \$700, small specialty - \$1,100, compact - \$1,300, mid-size - \$1,500, mid-special - \$2,200, basic large - \$1,900, and luxury - \$5,400. Automotive News, October 15, 1979.

TABLE IV-10

INCREMENTAL LAUNCH AND ENGINEERING EXPENSES
(PERCENT OF CAPITAL INVESTMENT)

<u>MANUFACTURER</u>	<u>LAUNCH</u>	<u>ENGINEERING</u>
GM ¹	14	13
FORD ²	14	28

¹Based on conversations with GM's financial analysis staff.

²Based on Ford's response to 1984-86 Passenger Car questionnaire.

control, capitalized maintenance of existing tools and facilities, and productivity improvements. As a consequence, total spending for light duty operations is understated, although the magnitude is not known. Ford, in its comments in the Third Annual Report to Congress, states that "...NHTSA understated Ford's spending for North American operations by over one-third."* However, Ford did not provide data to support this statement and Ford's actual 1978 North American capital spending provides little insight into the magnitude of the shortfall. For example, NHTSA had estimated Ford's 1978 North American automotive capital spending at \$1,290 million; Ford's 1978 Annual Report indicated spending of \$1,206 million for all North American operations, not just automotive. NHTSA would welcome any data available which documents the amount of non-product related automotive capital spending.

The 1978 dollar capital spending estimates for each calendar year were adjusted by the assumed inflation rate for that year to convert the estimates to nominal (incurred) dollars.

*Ford Motor Company Comments on NHTSA Third Annual Report to Congress on Automotive Fuel Economy Program, April 6, 1979, p.9.

The differences between the capital requirements used in the cash flow analysis and the capital requirements shown in Table IV-1 are as follows: although a new model may be introduced in 1983 and its percent of the new fleets' sales is projected to increase in 1984 and 1985, the cash flow analysis will show the total capital requirements for MY 1983, when the new model was introduced (allocated over calendar years 1981 and 1982 when the actual spending will occur), whereas Table IV-1 will show the capital requirements allocated over the percentage introduction rates in MY 1983-MY 1985. The reason for this different treatment is to treat the cash flow analysis in as realistically a fashion as possible whereas in the latter instance, the Agency desires to calculate the effect of capital investments on retail prices, recognizing that not all investments are immediately recouped through price increases.

g. Depreciation and Amortization

Historical data for depreciation, amortization and capital spending covering a period of twenty years were used to develop an

investment write-off approach that best fit the data. For asset classification and investment write-off purposes, the split between Facilities investment and Special Tools investment is assumed to be 50-50 for GM, and 60-40 for Ford.

h. Debt Payments

Debt repayments by calendar years were derived from 1978 annual reports and 10-K statements.

i. Financing or Cost Reduction Actions

Financing or cost reduction actions taken during 1979 (GM's sale of its Frigidaire Division or Ford's \$350 million debt offering; for example) are not considered.

j. Funding of Negative Cash Flows

If a negative cash flow was calculated for a given year, it was not funded through increased debt, stock offerings, reductions in working capital, cost reduction, etc. This has the tendency to make succeeding years results optimistic because if the cash drain was financed through debt, for example, then repayment of the principle and interest would reduce cash in-flows and increase cash out-flows.

ii. RESULTS

The analysis shows that GM and Ford will experience net cash drains from North American automotive operations during 1980-82 because of projected low unit volume sales and increased product-related investments. Higher unit sales volumes and declining investment requirements return both GM and Ford to positive net cash generation positions for 1983 and 1984. The results of the cash flow analysis are summarized in Table IV-11.

The cash flow summary shows that GM and Ford would experience a combined net cash shortfall for Case 1 (base case) of \$2.4 billion in 1980, \$1.3 billion in 1981, \$0.8 billion in 1982, and a net cash surplus of \$1.0 billion in 1983 and \$3.0 billion in 1984. In all cases considered, net cash shortfall is shown for 1980-82 which turns into a positive net cash generating position for 1983 and 1984.

Comparing the four cases shows that Cases 1, 3, and 4 are fairly similar and that the major difference is in Case 2. Case 2 generates higher cash drains for the 1980-81 period for GM and Ford, lower cash drains in 1982, and in 1983-84 generates more cash for GM, but less for Ford in comparison to Case 1. From the manufacturer's perspective, it will be most important to keep the negative cash flows in 1980 and 1981 as low as possible, so that borrowing can be kept to a minimum.

TABLE IV-11

NET CASH SUMMARY

(MILLIONS OF 1979 DOLLARS)

	<u>Calendar Years</u>				
	1980	1981	1982	1983	1984
<u>GM</u>					
Case 1	-1,479	-722	-233	555	2,318
Case 2	-1,618	-903	-204	733	2,394
Case 3	-1,479	-722	-233	555	2,318
Case 4	-1,479	-722	-331	423	2,383
<u>FORD</u>					
Case 1	- 953	-567	-530	479	709
Case 2	-1,150	-691	-202	465	496
Case 3	- 953	-567	-503	479	709
Case 4	- 953	-567	-575	428	724

Tables IV-12 through IV-23, Income Statements and Sources and Uses of Funds, present the derivation of net cash drains and net cash surpluses for each manufacturer and for each case. The Income Statement provides the profit after tax, which is positive in all cases for Ford and GM, as an input to the Sources and Uses of Funds.

The net cash drain estimated in the analysis is not unique to the domestic automobile manufacturers and can be compared with the corporate cash drains experienced in 1974. The net cash shortfall from corporate operations in 1974 was approximately \$1.30 billion for GM and \$0.74 billion for Ford (1979 dollars). The net cash shortfall estimated for 1980 from North American automotive operations for Case 1 is \$1.48 billion for GM and \$0.95 billion for Ford. The magnitude of the shortfall experienced in 1974, thus, is comparable to the level estimated for 1980.

TABLE IV-12

GENERAL MOTORS

Base Case & Case 3
 Income Statement
 North American Automotive Operations
 (Millions of 1979 dollars)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
Sales (million units)	6.71	7.04	7.14	7.45	7.95
Revenue	46603	49097	49935	52199	55692
Variable Cost	33550	35218	35700	37266	39761
Fixed Cost	6296	6212	6193	6152	6037
D & A	2656	2674	3203	3274	2975
PBT	4101	4993	4839	5506	6920
Tax	1846	2247	2177	2477	3114
PAT	2255	2746	2662	3029	3806

Legend: D&A - Depreciation and Amortization

PBT - Profit Before Tax

PAT - Profit After Tax

TABLE IV-13

GENERAL MOTORS

Case 2
Income Statement
North American Automotive Operations
(Millions of 1979 dollars)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
Sales (million units)	6.71	7.04	7.14	7.45	7.95
Revenue	46645	49203	50063	52306	55805
Variable Cost	33550	35218	35700	37266	39761
Fixed Cost	6330	6280	6209	6141	6037
D & A	2684	2744	3280	3327	3007
PBT	4081	4962	4875	5572	7000
Tax	1838	2234	2195	2508	3150
PAT	2243	2728	2680	3065	3850

Legend: D&A - Depreciation and Amortization
PBT - Profit Before Tax
PAT - Profit After Tax

TABLE IV-14

GENERAL MOTORS

Case 4
Income Statement
North American Automotive Operations
(Millions of 1979 dollars)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
Sales (million units)	6.71	7.04	7.14	7.45	7.95
Revenue	46603	49097	49969	52268	55773
Variable Cost	33550	35218	35700	37266	39761
Fixed Cost	6296	6212	6219	6202	6037
D & A	2656	2674	3224	3324	3020
PBT	4101	4993	4825	5476	6955
Tax	1846	2247	2172	2463	3129
PAT	2255	2746	2654	3013	3826

Legend: D&A - Depreciation and Amortization
PBT - Profit Before Tax
PAT - Profit After Tax

TABLE IV-15

GENERAL MOTORS

Base Case & Case 3
 Sources and Uses of Funds
 North American Automotive Operations
 (Millions of 1979 dollars)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
<u>Cash Inflow</u>					
PAT	2255	2746	2662	3029	3806
D & A	2656	2674	3203	3274	2975
<u>Cash Outflow</u>					
Dividend	1886	1886	1884	1884	1883
Capital	4456	4193	4158	3827	2551
Debt	48	63	56	37	29
<u>Net Cash Flow</u>	-1479	-722	-233	555	2318

Legend: D&A - Depreciation and Amortization
 PAT - Profit After Tax

TABLE IV-16

GENERAL MOTORS

Case 2
Sources and Uses of Funds
North American Automotive Operations
(Millions of 1979 dollars)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
<u>Cash Inflow</u>					
PAT	2243	2728	2680	3065	3850
D&A	2684	2744	3280	3327	3007
<u>Cash Outflow</u>					
Dividend	1886	1886	1884	1884	1883
Capital	4611	4426	4224	3738	2551
Debt	48	63	56	37	29
<u>Net Cash Flow</u>					
	-1618	- 903	- 204	733	2394

Legend: D&A - Depreciation and Amortization
PAT - Profit After Tax

TABLE IV-17

GENERAL MOTORS

Case 4
Sources And Uses Of Funds
North American Automotive Operations
(Millions of 1979 dollars)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
<u>Cash Inflow</u>					
PAT	2255	2746	2654	3013	3826
D&A	2656	2674	3224	3324	3020
<u>Cash Outflow</u>					
Dividend	1886	1886	1884	1884	1883
Capital	4456	4193	4269	3993	2551
Debt	48	63	56	37	29
<u>Net Cash Flow</u>					
	-1479	- 722	- 331	423	2383

Legend: D&A - Depreciation and Amortization
PAT - Profit After Tax

TABLE IV-18

FORD

Base Case & Case 3
Income Statement
North American Automotive Operations
(Millions of 1979 dollars)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
Sales (million units)	3.71	3.89	3.95	4.12	4.40
Revenue	25479	26792	27291	28477	30410
Variable Cost	19396	20349	20651	21550	23012
Fixed Cost	4421	4454	4464	4337	4337
D & A	1075	1067	1267	1158	1066
PBT	588	922	909	1432	1995
Tax	266	415	409	645	898
PAT	322	507	500	787	1097

Legend: D&A - Depreciation and Amortization
PBT - Profit Before Tax
PAT - Profit After Tax

TABLE IV-19

FORD

Case 2
Income Statement
North American Automotive Operations
(Millions of 1979 dollars)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
Sales (million units)	3.71	3.89	3.95	4.12	4.40
Revenue	25534	26897	27331	28519	30451
Variable Cost	19396	20349	20651	21550	23012
Fixed Cost	4516	4510	4360	4337	4337
D & A	1107	1126	1278	1176	1109
PBT	514	912	1041	1456	1993
Tax	232	412	468	657	897
PAT	282	501	573	799	1096

Legend: D&A - Depreciation and Amortization
PBT - Profit Before Tax
PAT - Profit After Tax

TABLE IV-20

FORD

Case 4
Income Statement
North American Automotive Operations
(Millions of 1979 dollars)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
Sales (million units)	3.71	3.89	3.95	4.12	4.40
Revenue	25479	26792	27307	28492	30424
Variable Cost	19396	20349	20651	21550	23012
Fixed Cost	4421	4454	4486	4337	4337
D & A	1075	1067	1275	1176	1082
PBT	588	922	894	1429	1993
Tax	266	415	402	644	897
PAT	322	507	492	785	1096

Legend: D&A - Depreciation and Amortization
PBT - Profit Before Tax
PAT - Profit After Tax

TABLE IV-21

FORD

Base Case & Case 3
Sources and Uses of Funds
North American Automotive Operations
(Millions of 1979 dollars)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
<u>Cash Inflow</u>					
PAT	322	507	500	787	1097
D & A	1075	1067	1267	1158	1066
<u>Cash Outflow</u>					
Dividend	422	422	422	422	422
Capital	1707	1653	1807	965	998
Debt	221	66	68	79	34
<u>Net Cash Flow</u>	-953	-567	-530	479	709

Legend: D&A - Depreciation and Amortization
PAT - Profit After Tax

TABLE IV-22

FORD

Case 2
 Sources and Uses of Funds
 North American Automotive Operations
 (Millions of 1979 dollars)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
<u>Cash Inflow</u>					
PAT	282	501	573	799	1096
D & A	1107	1126	1278	1176	1109
<u>Cash Outflow</u>					
Dividend	422	422	422	422	422
Capital	1896	1830	1563	1009	1253
Debt	221	66	68	79	34
<u>Net Cash Flow</u>	-1150	-691	-202	465	496

Legend: D&A - Depreciation and Amortization
 PAT - Profit After Tax

TABLE IV-23

FORD

Case 4
 Sources and Uses of Funds
 North American Automotive Operations
 (Millions of 1979 dollars)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
<u>Cash Inflow</u>					
PAT	322	507	492	785	1096
D & A	1075	1067	1275	1176	1082
<u>Cash Outflow</u>					
Dividend	422	422	422	422	422
Capital	1707	1653	1852	1032	998
Debt	221	66	68	79	34
<u>Net Cash Flow</u>	-953	-567	-575	428	724

Legend: D&A - Depreciation and Amortization
 PAT - Profit After Tax

As a result of 1974 net cash shortfalls, manufacturers reduced dividends and capital spending in 1975 to alleviate pressures on working capital levels. Dividends were reduced an average of 34 percent (in real terms) and capital spending was reduced by an average of 27 percent. The situation after 1980 is expected to be different, however. Assuming that consumers continue to increasingly demand fuel efficient vehicles even in an economic downturn, the manufacturers can choose one of two possible alternatives even in the absence of fuel economy standards. One alternative would be to maintain or increase market share by keeping new product spending at high levels even at the risk of short-term financial problems. Another alternative would be to reduce product spending to improve financial viability at the risk of market share losses which may linger for several years. The nature of the fuel economy regulations which mandate improvements in the fleet-average fuel economy levels preclude the second option, unless the manufacturer is willing to incur civil penalties.

The financial impact of Case 3 is identical to that of Case 1, the Base Case, if sales are assumed to be the same in both cases. Capital spending is essentially equal for either case. However, the increased market risk associated with payload reductions would increase the difficulty of maintaining sales levels. The financial burden of Case 3 relative to Case 1, would be raised by any significant decline in sales.

Aggregate capital spending for Case 2 is not substantially greater than Case 1. However, the timing of the increases in capital spending puts more financial pressure on GM and Ford. Capital spending in Case 2 is moved forward into the low sales years of 1980 and 1981.

Capital spending for Case 2 adds \$139 million to GM's net cash deficit in 1980 and \$181 million for 1981. The associated reductions in capital investment in 1982 and 1983 improve those years' cash flows by \$29 million and \$178 million, respectively. These later year improvements do not negate the additional impacts in 1980-81; however, because Case 2 still requires GM to come up with additional funds during 1980 and 1981.

Ford's financial needs for case 2 increase by \$197 million in 1980 and \$124 million in 1981. The forward shift of investments reduces Ford's 1982 need by \$328 million. During 1983 and 1984, funding needs increase by \$14 million and \$213 million, respectively.

The financial impacts for Case 4, Acceleration Capability Reduction, are only slightly greater than those of Case 1, Base Case. Once again, it should be noted this comparison assumes that sales would remain the same. Since the market risk is considered to be much higher for Case 4 than for Case 1, it is not at all certain that the projected sales levels can be maintained.

The timing of the spending increases in Case 4 places the financial impacts in the 1982-84 period when motor vehicle sales are recovering. Case 4, despite its higher market risk, appears to be a more attractive alternative than Case 2 (Accelerated New Models) if only financial impacts are considered. Of course, the reverse is true from the marketing perspective.

Funding requirements in Case 4, when compared with the Base Case, rise for GM and Ford for 1982 and 1983. GM's funding requirements increase by \$98 million in 1982 and \$132 million in 1983, compared with the Base Case. Ford's cash needs rise by \$45 million in 1982 and \$51 million in 1983.

iii. FUNDING THE NET CASH DEFICITS:

The preceding financial analysis shows significant cash shortfalls for GM and Ford for the 1980-82 period. The discussion in this section is intended to illustrate some possible methods of covering the Base Case funding needs. Chrysler's funding needs are not discussed because of their recent congressionally-approved loan guarantees. However, Chrysler's submissions to the Treasury Department suggest some potential financing opportunities that GM and Ford could use.

There are two possible methods which can be used to eliminate the net cash shortfalls. These are: (1) internal funding by increasing cash in-flows, reducing cash out-flows, and/or working capital adjustments; and (2) external funding by going outside the company for capital.

The internal funding of the shortfall would require an increase in cash in-flow, or a decrease in cash out-flow or working capital adjustments. Cash in-flow can be increased by implementing such actions as improvements in real variable margin and fixed cost reductions. Cash out-flows can be reduced by such actions as reducing dividends and renegotiating debt repayment schedules. Working capital accounts can be adjusted by draining cash

accounts to absolute minimal levels, collecting accounts receivable faster, reducing inventories to absolute minimal levels, and fully utilizing short-term lines of credit.

The alternatives available to fund the shortfall through external sources include sale of company assets (which Chrysler has been doing for well over a year), preferred or common stock offerings, and long-term debt offerings.

A. INTERNAL FUNDING

a. Improve Cash In-Flows

The shortfall estimated earlier can be partially covered by raising cash in-flows. Such actions as warranty cost reductions, increased sales of high profit options, manufacturing and purchasing cost reductions, design cost reductions and real price increases would improve variable margin and thus cash in-flows.

Variable Margin

It is estimated that Chrysler plans to improve its car and light truck real variable margin per unit by about 14 percent between 1979 and 1982.*

* Chrysler Corporation, Analysis of Chrysler Corporation's Situation and Proposal for Government Assistance, September 15, 1979; and Modification of Loan Guarantee Request, October 17, 1979.

If GM and Ford can also improve their variable margins by 7 percent in 1982 (phased in using 2.33 percent increments each year), net cash flow improves substantially and is shown in Table IV-24. GM's net cash in-flow would increase by \$34 million, \$111 million, and \$202 million for 1980, 1981, and 1982, respectively. Similarly, Ford's cash in-flow would increase by \$38 million, \$87 million, and \$118 million for 1980, 1981, and 1982, respectively.

Fixed Cost Reductions

Reduction in fixed costs is another method by which cash in-flows can be improved. For example, in the material submitted to the Treasury Department, Chrysler shows plans to cumulatively reduce North American fixed operating costs: 19 percent in 1980, 23 percent in 1981, and 18 percent in 1982 when compared with 1979.* The reductions are planned to be accomplished through such actions as closing several facilities, reducing the number of salaried employees, cutting the salaries of senior executives, suspending merit pay increases, strict cost control programs, and a 35 percent reduction in advertising budgets.**

* September 15, 1979, Submission, Exhibit IX, p.2.

** September 15, 1979, Submission, pp.7-8.

TABLE IV-24
REDUCTION IN NET CASH DEFICIT DUE TO
VARIABLE MARGIN IMPROVEMENTS
(MILLIONS OF 1979 DOLLARS)

	CALENDAR YEARS		
	1980	1981	1982
GM	34	111	202
FORD	38	87	118

NOTE: These are after-tax estimates which have been adjusted to reflect minor improvements in variable margin already incorporated in the Base Case.

The fixed cost reductions planned by Chrysler are considerable. A major portion of savings (25 percent) is from closing two facilities and reducing operations at others. GM and Ford, on the other hand, have not announced any plans for closing any facilities during the cash shortfall period. Some personnel reductions, however, are anticipated.

If one assumes, for analytical purposes, that GM and Ford are able to achieve half of Chrysler's North American fixed operating cost reductions without affecting future product programs (10% in 1980, 12% in 1981, and 9% in 1982), after tax net cash flow would improve substantially and is shown in Table IV-25. GM's cash in-flow increases by \$351 million in 1980, \$388 million in 1981 and \$303 million in 1982. Similarly, Ford's cash in-flow would increase by \$232 million in 1980, \$281 million in 1981, and \$220 million in 1982.

b. Reduce Cash Out-Flows

The three major components of cash out-flow are dividends, capital spending, and debt repayments. Capital spending cannot be reduced significantly without affecting future product plans.

Renegotiating debt repayment schedules may not be possible without raising the cost of debt to the companies, especially if they seek external financing during the 1980-82 period. Dividend reductions

TABLE IV-25
REDUCTION IN NET CASH DEFICIT DUE TO
FIXED COST REDUCTIONS

(MILLIONS OF 1979 DOLLARS)

	CALENDAR YEARS		
	1980	1981	1982
GM	351	388	303
FORD	232	281	220

are also likely to raise the cost of external financing. However, some short-term dividend reductions should be possible without severely affecting external financing costs.

Dividend Reduction

It should be noted that both GM and Ford have, from time to time, reduced dividends to improve their net cash position. For example, Ford reduced common stock dividends by 21 percent and 20 percent respectively for 1975 and 1976, when compared with the 1970-78 average payout per share. Similarly, GM reduced common stock dividends by 24 and 51 percent respectively for 1974 and 1975 when compared with its 1970-78 average payout per share. On the basis of the above information, it may be possible that Ford could reduce dividends by 20 percent in 1980 and 1981, and GM could reduce dividends by 30 percent during these years.

It should be noted that dividends would have to be raised in the later years to maintain historical average payout rates and to avoid a possible increase in the cost of external financing.

The effects on 1980 and 1981 cash in-flows are shown in Table IV-26. GM's cash in-flow increases by \$562 million for 1980 and again for 1981. Similarly, Ford's cash inflows improve by \$84 million for 1980 and for 1981.

TABLE IV-26

REDUCTION IN NET CASH DEFICIT DUE TO
DIVIDEND REDUCTIONS

(MILLIONS OF 1979 DOLLARS)

CALENDAR YEARS

	1980	1981	1982
GM	562	562	0
Ford	84	84	0

For both GM and Ford, the cash in-flow improvement is zero for 1982 as both manufacturers revert to normal dividend payouts.

Working Capital Adjustments

Working capital adjustments, such as drawing down cash balances, accelerating collection of accounts receivable, and delaying accounts payable would result in an improved net cash position. It is expected, however, that manufacturers would take full advantage of these possibilities during 1979 to offset financial problems caused by unexpected sales declines. Thus, no working capital actions are considered for 1980-82. Short-term lines of credit are also not used here as potential sources of funds because they must be repaid within 1 year.

b. External Funding

The three main sources of external funding are sale of assets, preferred or common stock offerings, and long-term debt. Each method is discussed separately.

Sale of Assets

Sale of assets would provide an infusion of cash into the firm and would improve net cash position. The timing of the infusion would be determined by the terms of sale.

Chrysler is continuing to sell assets to generate capital. In 1979, Chrysler sold two-thirds of its operations in Brazil, assembly facilities in Venezuela and Columbia, one-third of its

operations in Australia, and Chrysler Realty Corporation. General Motors sold its Frigidaire Appliance Division in early 1979. This analysis does not postulate any further asset sales by GM and Ford to meet their financing needs.

New Stock Offerings

Stock sales generated very little in the way of funds for GM during 1970-78; the annual average was about \$4 million in 1979 dollars. GM did not issue new common stock during 1973-75. Common stock dividend reductions, proposed to reduce cash out-flows during 1980 and 1981, would lessen the attractiveness of any new stock offerings. Thus, no new stock offerings were assumed for GM for the 1980-82 period.

Ford generated an annual average of \$35 million, in 1979 dollars, from common stock sales during 1970-78. The company issued \$39 million and \$14 million in common stocks during 1975 and 1976, respectively, even though dividend payouts had been reduced for these years. However, Ford is assumed to not offer new common stocks for the 1980-82 period because of the relatively small amounts involved earlier.

Long-Term Debt

Historically, both GM and Ford have issued long-term debt annually; GM has issued roughly \$280 million and Ford has averaged \$400 million. GM's debt offerings have been considerably more cyclical

than Ford's ranging from negligible in 1970 and 1973 to \$1,015 million (1979 dollars) in 1975. Since then, debt issues have been lower than average; new debt issued has typically been \$140 million annually during 1976-78. GM has not issued any significant new debt during 1979.

The maximum amount of long-term debt that Ford has issued in any one year was about \$850 million (1979 dollars) in 1974. However, long-term debt offerings in successive years have been less than the average amount. During 1975-79, Ford added \$293 million, \$237 million, \$82 million, \$39 million, and \$350 million, respectively.

Although interest rates are at record high levels and third quarter 1979 financial results indicate North American operating losses for GM and Ford, it is assumed that new long-term debt will be issued by both GM and Ford: in 1980, GM would issue new debt for \$750 million and Ford for \$600 million; a \$200 million debt issue in 1981 for Ford; and in 1982, a \$300 million debt issue for Ford.

The prevailing conditions in the capital market could impose additional risk on the two manufacturers because their debt would reach the capital market at the same time. With both firms reducing dividends also, the costs of these issues are expected to be high. However, a combined debt offering of \$1.35 billion in 1980 would not be unprecedented. Both GM and Ford reduced dividends substantially during the 1975 recession and also issued

new long-term debt for \$1.31 billion. It should be noted that a combined debt offering of this magnitude would probably preclude external financing for any of the firms' other operations including expansion plans for non-North American automotive operations. The projected changes in North American automotive net cash flow are shown in Table IV-27.

New debt would provide both GM and Ford with additional cash -- \$750 and \$600 million, respectively, in 1980. However, both companies will show an increase in cash out-flows in 1981 due to repayment of principal and after-tax interest charge. For GM, the cash out-flow would increase for 1982 whereas Ford shows a positive net amount for 1982: a new debt of \$300 million less principal and after-tax interest payment on the 1980 and 1981 debt issues.

c. Summary of Funding Actions

The results of these potential financing actions are summarized in Tables IV-28 and IV-29 for GM and Ford, respectively, and are compared with the net cash deficits of the Base Case. These financing alternatives are not all inclusive; they represent one potential approach to covering the deficits. Some of these alternatives carry more risk than others. For example, the potential variable margin improvements are somewhat speculative and if they did not materialize, further financing actions could be needed.

TABLE IV-27

REDUCTION IN NET CASH DEFICIT DUE TO
NEW LONG-TERM DEBT OFFERINGS*

(MILLIONS OF 1979 DOLLARS)

	CALENDAR YEARS		
	1980	1981	1982
GM	750	-85**	-80
FORD	600	132***	213****

* 10 Year financing, 12 percent interest rate.

** Repayment of principal plus after-tax interest charge.

*** \$200 Million less \$68 million principal repayment and after-tax interest charge for 1980 debt.

**** \$300 million less \$87 million principal repayment and after-tax interest charges for 1980 and 1981 debt.

A combination of these actions, summarized in Table IV-28, show that GM can turn its net cash deficits for the 1980-82 period into positive cash positions for all these years. Similarly, Ford can also take these actions, summarized in Table IV-29, to turn its net cash deficits for the 1980-82 period into positive cash positions for all 3 years.

TABLE IV-28
 POTENTIAL FUNDING OF 1980-82
 NET CASH DEFICIT OF GENERAL MOTORS
 SUMMARY
 (MILLIONS OF 1979 DOLLARS)

	CALENDAR YEARS		
	1980	1981	1982
Variable Margin Improvements	34	111	202
Fixed Cost Reductions	351	388	303
Dividend Reductions	562	562	0
Long Term Debt	<u>750</u>	<u>-85</u>	<u>-80</u>
TOTAL	1,697	976	425
Base Case Net Cash Flow	-1,479	-722	-233
Adjusted Net Cash Flow	218	254	192

TABLE IV-29
 POTENTIAL FUNDING OF 1980-82
 NET CASH DEFICIT OF FORD MOTOR COMPANY
 SUMMARY
 (MILLIONS OF 1979 DOLLARS)

	CALENDAR YEARS		
	1980	1981	1982
Variable Margin Improvements	38	87	118
Fixed Cost Reductions	232	281	220
Dividend Reductions	84	84	0
Long Term Debt	<u>600</u>	<u>132</u>	<u>213</u>
TOTAL	954	584	551
Base Case Net Cash Flow	-953	-567	-530
Adjusted Net Cash Flow	1	17	21

PART V

MACROECONOMIC ANALYSIS

PART VMACROECONOMIC ANALYSIS

This section of the analysis discusses the impacts that this proposed rule is anticipated to have on the overall U.S. economy, in general, not just on the specific automobile manufacturers or on the purchasers of these vehicles. It discusses the impact on petroleum consumption, consumption of other materials (steel, aluminum, plastics), the balance of trade, employment impacts, and urban and regional impacts.

A. EFFECT ON PETROLEUM CONSUMPTION

The effect these proposed standards will have on petroleum consumption will be looked at in two different ways. First, the lifetime consumption of gasoline of the MY 1982-85 light trucks affected by the proposal will be analyzed. Second, the yearly effects these proposed fuel economy standards will have on gasoline consumption will be examined.

In order to estimate the actual gasoline savings of these standards, the total domestic and imported 0-8,500 lbs. GVWR light truck fleet was analyzed. Total gasoline consumption was calculated in four ways: Assuming no improvement in fuel economy over MY 1981 vehicles--with and without a 5% emission penalty starting in MY 1983, taking the low range of the proposed standards

for MY's 1982-85, and taking the high range of the proposed standards for MY's 1982-85. The low range is compared with a base fuel consumption which includes a 5% emission penalty, while the high range is compared with a base fuel consumption with no emission penalty.

The basis for comparing the fuel savings of the proposed low and high range standards is that no improvements in fuel economy would be made over the MY 1981 standards. That is, technology improvements would not be implemented and new models would not be introduced by the domestic manufacturers. Using this as a starting point, it is reasonable to assume that the market shares of imports (captive and foreign), as a percent of all 0-8,500 lbs. GVWR light trucks sold in the U.S., would continue at current 1979 levels. Thus, the comparison base for fuel savings assumes that domestic light truck sales are 86 percent and imports 14 percent of the 0-8,500 light truck fleet. For the low and high range of fuel consumption, the sales shown in Table II-3 are used (showing declining import market shares) so that the fuel savings would be consistent with the methodology used to develop the fuel economy ranges.

As was done in the Operating Cost Savings section, an adjustment was made to the EPA estimated mpg to account for the difference between that and actual on-road fuel economy of light trucks. Again, 0.89 was multiplied by the sales weighted EPA test data estimates to provide the fuel economy mpg values in Table V-1. The MY 1979-81 mpg's assume the domestic manufacturers just meet

the promulgated standards and that all foreign and captive imports average 24 mpg on the EPA cycle (21.36 mpg on-road) with no emission penalty.

The total gasoline consumption for each range of standards is calculated by dividing the total lifetime mileage of 128,195 by the estimated on-road mpg of Table V-1 to get a fuel consumed per vehicle and then multiplying this by total 0-8,500 lbs. GVWR sales (projected in Table II-3). This provides the total gasoline consumption figures shown in Table V-2. As one can see, because of increasing sales, the new model's fleet lifetime fuel consumption increases between 1982 and 1985 for the low range and even with the tremendous fuel economy increases of the high range begins to increase after an initial drop in MY 1983. Over the lifetime of the MY 1982-85 light trucks, the low range saves a total of 10.7 billion gallons and the high range 16.5 billion gallons of gasoline. These are average savings for the low range of 9.1 percent of light truck fuel consumption and for the high range of 14.7 percent over MY 1981 fuel economy levels. The differences between the low and the high range are significant; the high range saves 55 percent more fuel than the low range.

TABLE V-1

0-8,500 LBS. GVWR LIGHT TRUCK
ESTIMATED ON-ROAD FUEL ECONOMY OF NEW MODEL FLEET
(MPG)

1979	13.23
1980	14.34
1981	15.03

	<u>No Improvements (with a 5% emission penalty in MY 1983-85)</u>	<u>Lows</u>
1982	15.03	15.38
1983	14.28	15.55
1984	14.28	16.01
1985	14.28	16.50

	<u>No Improvement (No Emission Penalty)</u>	<u>Highs</u>
1982	15.03	15.38
1983	15.03	17.40
1984	15.03	18.48
1985	15.03	19.20

TABLE V-2

TOTAL GASOLINE CONSUMPTION
(128,195 MILES LIFETIME TRAVEL)
(BILLION GALLONS)

MODEL YEAR	NO IMPROVE- MENTS (WITH A 5% EMISSION PENALTY IN MY\$ 1983-1985)	LOW RANGE	GAS SAVINGS BETWEEN LOW RANGE AND NO IMPROVEMENT	% CHANGE	NO IMPROVE- MENTS (WITH NO EMISSION PENALTY)	HIGH RANGE	GAS SAVINGS BETWEEN HIGH RANGE AND NO IMPROVEMENT	% CHANGE
1979		28.585						
1980		22.886						
1981		23.793						
1982	24.819	24.255	.564	2.3	24.819	24.255	.564	2.3
1983	28.099	25.804	2.295	8.2	26.697	23.060	3.637	13.6
1984	30.971	27.625	3.346	10.8	29.426	23.933	5.493	18.7
1985	33.216	28.746	4.470	13.5	31.558	24.704	6.854	21.7
1982- 85 TOTALS	117.105	106.430	10.675	Avg. 9.1	112.500	95.952	16.548	Avg. 14.7

The second way of examining petroleum consumption is by calendar year. Table V-3 shows base case fuel consumption for light trucks, with and without an emission penalty, (assuming no improvement in 0-8,500 lbs. GVWR new fleet fuel economy over MY 1981 standards) and for the combined light truck and passenger car new fleets (assuming no improvement in passenger car fuel economy over 27.5 mpg in MY 1985). Then the fuel savings of the low and high ranges were calculated for each calendar year. Thus, fuel savings in 1985 are estimated to be 1.2-1.9 billion gallons and by the year 2005, rise to 6.3-9.4 billion gallons. These savings are then compared to light truck fuel consumption and total passenger car and light truck fuel consumption for 1982-1990 and selected years thereafter. The fuel savings compared to light truck fuel consumption are 4.3-6.9 percent in 1985 and 14.0-22.0 percent in 2005. Fuel savings compared to all vehicles for which fuel economy standards are applicable, passenger cars and light trucks under 8,500 lbs GVWR, are 1.4-2.2 percent in 1985 and 5.8-8.8 percent in 2005. Since passenger car and light truck fuel consumption accounts for approximately 37 percent of the total U.S. consumption of petroleum annually, the savings will amount to 0.5-0.8 percent of U.S. consumption of petroleum in 1985 and increasing to 2.1-3.3 percent in the year 2005.

TABLE V-3

FUEL SAVINGS BY CALENDAR YEAR
(BILLIONS OF GALLONS)

CALENDAR YEAR	NO IMPROVEMENT FUEL CONSUMPTION					LOW RANGE			HIGH RANGE (NO PENALTY)			
	FOR LT (5% PEN)	FOR LT (NO PEN)	FOR PC & LT (5% PEN)	FOR PC & LT (NO PEN)	FUEL CONS. FOR LT	FUEL SAVINGS	% SAVINGS OF LT CONS.	% SAVINGS OF PC & LT CONS.	FUEL CONS. FOR LT	FUEL SAVINGS	% SAVINGS OF LT CONS.	% SAVINGS OF PC & LT CONS.
1978	25.0	25.0	99.8	99.8	25.0	-			25.0	-		
1979	25.9	25.9	99.4	99.4	25.9	-			25.9	-		
1980	25.9	25.9	96.8	96.8	25.9	-			25.9	-		
1981	25.8	25.8	94.1	94.1	25.8	-			25.8	-		
1982	25.8	25.8	91.1	91.1	25.7	.1	.4	.1	25.7	.1	.4	.1
1983	26.3	26.1	88.9	88.7	26.0	.3	1.1	.3	25.6	.5	1.9	.6
1984	27.0	26.7	87.7	87.4	26.3	.7	2.6	.8	25.6	1.1	4.1	1.3
1985	27.9	27.4	86.8	86.3	26.7	1.2	4.3	1.4	25.5	1.9	6.9	2.2
1986	28.9	28.2	86.4	85.7	27.2	1.7	5.9	2.0	25.6	2.6	9.2	3.0
1987	29.8	29.0	86.0	85.2	27.7	2.1	7.0	2.4	25.7	3.3	11.4	3.9
1988	30.8	29.9	86.1	85.3	28.3	2.5	8.1	2.9	26.0	3.9	13.0	4.6
1989	32.0	30.9	86.9	85.7	29.0	3.0	9.4	3.5	26.4	4.5	14.6	5.2
1990	33.2	31.9	87.9	86.6	29.8	3.4	10.2	3.9	26.8	5.1	16.0	5.9
1991	34.4	33.0	89.1	87.7	30.6	3.8			27.3	5.7		
1992	35.4	33.9	90.4	88.9	31.4	4.0			27.8	6.1		
1993	36.4	34.8	91.8	90.2	32.0	4.4			28.2	6.6		
1994	37.2	35.6	93.1	91.5	32.6	4.6			28.6	7.0		
1995	38.1	36.3	94.6	92.8	33.2	4.9	12.9	5.2	29.0	7.3	20.1	7.9
1996	38.9	37.1	96.0	94.2	33.9	5.0			29.4	7.7		
1997	39.6	37.7	97.4	95.5	34.4	5.2			29.8	7.9		
1998	40.4	38.4	98.9	96.9	35.0	5.4			30.3	8.1		
1999	41.2	39.2	190.4	98.4	35.6	5.6			30.8	8.4		
2000	41.9	39.8	101.8	99.7	36.2	5.7	13.6	5.6	31.2	8.6	21.6	8.6
2001	42.6	40.5	103.3	101.2	36.8	5.8			31.7	8.8		
2002	43.3	41.2	104.7	102.6	37.4	5.9			32.2	9.0		
2003	44.0	41.8	106.2	104.0	37.9	6.1			32.6	9.2		
2004	44.5	42.3	107.4	105.2	38.3	6.2			33.0	9.3		
2005	45.1	42.8	108.7	106.4	38.8	6.3	14.0	5.8	33.4	9.4	22.0	8.8

Comparing the total fuel consumed by calendar year between 1982 and 1990, one finds that the low range saves 15.0 billion gallons and the high range saves 23.0 billion gallons or 0.36-0.55 billion barrels of petroleum. Comparing the total fuel consumed by calendar year between 1982 and 2005, one finds that the low range saves 93.9 billion gallons and the high range saves 142.1 billion gallons or 2.24-3.38 billion barrels of petroleum. These numbers are much higher than those shown in Table V-2 because they include the fuel savings for the new fleets after MY 1985 also, assuming the MY 1985 fuel economy standards remain in effect to the year 2005.

B. IMPACT ON THE U.S. BALANCE OF TRADE

The U.S. balance of trade is comprised of the value of all goods and services exported and imported. There are two major items involved with this rulemaking which will affect the balance of trade. First, is the change in captive import sales of light trucks. Between MY 1981 and 1985, about 200,000 captive imports would be switched to domestic production. If these imports cost \$5,000 to manufacture, U.S. imports could be reduced by \$1 billion. While this rulemaking has little affect on the manufacturers' decisions to stop importing these vehicles, the Agency's previous decision to not allow captive imports to be counted with the domestic vehicles' average fuel economy may have speeded up the manufacturers' decision to change manufacturing sites.

Second, the petroleum savings brought about by these standards will result in a direct reduction in imports. Looking at 1985, savings of 1.2-1.9 billion gallons translates into a savings of 29-45 million barrels of oil (42 gallons per barrel). Multiplying this by the price per barrel (the refinery cost for imported oil in July 1979 was slightly over \$23/barrel*), results in reduced imports of \$0.7-1.0 billion. In 2005, imports would be reduced by \$3.5-5.1 billion. These are impressive figures when one considers the 1978 balance of merchandise trade deficit of \$34 billion.

C. IMPACT ON MATERIAL CONSUMPTION

The impact on material consumption comes about as a result of the manufacturers producing new models which weigh less than their counterparts, as well as substituting lighter weight materials (aluminum and plastic) for steel. NHTSA has estimated the changes in material consumption based on the manufacturers' submissions of their light truck fleet weight over the MY 1982-85 timeframe. These were considered the low range material consumption changes. The high range numbers were developed by using NHTSA's projected new model introduction. The breakdown between the various types of materials is NHTSA's best estimate given the manufacturers' submissions and a fairly extensive knowledge of which parts are under consideration for material substitution. Table V-4 shows the change in material consumption per average vehicle for each

* Based on a quote by the Department of Energy Pricing Office.

TABLE V-4

AVERAGE CHANGE IN MATERIAL CONSUMPTION
PER VEHICLE FOR EACH MODEL YEAR
(POUNDS)

	<u>LOW RANGE</u>	<u>HIGH RANGE</u>
Cast Iron and Steel	-170	-259
Plastics	+ 10	+ 15
Aluminum	+ 27	+ 41
High Strength Steel	+ 32	+ 47
Cross Section (Mix of Other Materials)	<u>- 27</u>	<u>- 39</u>
TOTAL	-128	-195

model year. Thus, by 1985, the total change in weight will be in the range of 512 and 780 pounds.

Comparing the change in material consumption to annual consumption of these materials, one finds that the effect on all of these materials is minimal with the possible exception of aluminum. Aluminum consumption is projected to increase .61-.94 percent per year between 1982-85 using a projected 14 billion pounds annual consumption. By 1985, this is a total of 2.4-3.8 percent. A reduction in cast iron and steel consumption of .2-.3 percent for each model year and an increase of .04-.05% for high strength steel, as compared to a projected annual consumption of 280 billion pounds, are considered to be minimal. Plastics are anticipated to increase only .08-.12 percent for each model year.

D. IMPACT ON EMPLOYMENT

An integral part of an assessment of the various effects of the proposed regulations is the potential changes in employment. The domestic automobile industry would be the primary industry affected by the proposed fuel economy standards. The gasoline distribution industry and the aluminum industry may also be slightly affected.

The proposed fuel economy standards would require manufacturers to increase capital investments to implement new technologies to improve the fuel economy of the existing light trucks and also

introduce more fuel efficient new models. It is also postulated that as these new models are introduced, the domestic manufacturers will stop importing light trucks. These changes have a several-fold effect on the domestic labor force.

i. Increased Capital Expenditures:

An increase in capital expenditures by the domestic light truck manufacturers will have a varied effect on the domestic labor force. Increased capital expenditures could result in an increased demand for labor as more workers are employed to produce a larger number of machines demanded by the auto industry. The magnitude of the increase would depend upon the magnitude of the increase in capital expenditures and also on the relationship between capital expenditures and employment.* Nonetheless, the relationship is positive in that additional capital investments create jobs.

ii. Higher Retail Prices:

Increased capital investments would require manufacturers to raise the retail price of these vehicles not only to recoup additional investments, but also to maintain future profitability and ability to incur additional expenditures in the future. An increase in

* An early Department of Commerce study had estimated a relationship that each \$1 billion of additional capital expenditures create about 42,000 new jobs in the economy. However, changes in the structure and composition of the labor force and inflation render this relationship suspect. Therefore, no attempt is made to estimate the number of new jobs created on the basis of this relationship.

retail price could result in sales losses assuming nothing else changes; the magnitude of the effect would depend upon the magnitude of the price increase and upon the price elasticity of demand for new trucks. Although potential retail price increases due to additional capital investments have been estimated elsewhere in this analysis (Section B, Part IV), a specific amount has not been shown because of the proposed range. One could conceivably use retail price increase per mpg and the percent fuel economy improvement to examine the effect of an increase in retail price on sales, provided a value for the coefficient of the price elasticity of demand for new light trucks is known. Since such a value is not known, no attempt was made to estimate the effect of a price increase on sales.

In general, an increase in price results in a sales decline. However, such a relationship assumes that nothing else changes. That is, such influential factors as incomes of buyers, quality of the products, and tastes have not changed. However, it may not be appropriate to assume that these factors are not changing at the same time prices are rising.

Another factor to consider is that the quality of the product is also changing. A fuel efficient light truck is certainly a different product than a less fuel efficient light truck. This would be even more apparent as new models replace old models. Thus, products are not directly comparable. Yet another factor to consider is that consumer tastes may be changing. Recent gasoline price increases and even more importantly, lines at the gas stations, have played an important role in changing consumer preference for lighter, smaller, more fuel-efficient light trucks. This is clearly shown in the persistent high demand for more fuel efficient vehicles and lagging demand for less fuel efficient vehicles. Finally, consumer perceptions of lifetime operating cost changes, not just initial price changes, may result in faster trade-ins of the less fuel efficient vehicles and higher sales levels. None of these factors can be quantified. Only directional estimates are possible.

iii. Domestic Production of Captive Imports:

Currently, the domestic manufacturers sell about 200,000 light trucks as captive imports. These light trucks are made, by and large, in Japan, and are imported under the manufacturer's nameplate. Some examples are: Ford's Courier, Chevrolet's Luv, and Dodge's D-50. The proposed fuel economy standards would require the domestic manufacturers to implement new fuel efficient technologies and also introduce new models. As these more fuel-efficient new models are introduced, the domestic manufacturers are anticipated to replace their captive imports with domestically produced vehicles.

As a result, domestic production would rise and would generate additional employment. If one assumes that about 115 hours are required to produce a light truck, then an increase in production by 200,000 units would generate 23 million hours of additional work. If one worker works about 2,000 hours per year, then roughly 11,500 new jobs would be created.* These may not be all new jobs, however. Rather, the increase may be in the form of additional overtime for some workers and new jobs for the remainder.

It should be pointed out that the foreign manufacturers may decide to increase their exports when the domestic manufacturers stop importing. In that case, the domestic manufacturers may not be able to capture the total captive import sales and lose some sales to imports. Then, the employment increase would be less than the amount estimated.

iv. New Models:

The proposed fuel economy ranges were developed on the basis of implementing new technologies and by assuming that more fuel efficient new models would be introduced by the domestic manufacturers and would constitute a fairly large portion of the new light truck fleet. This was based on the Agency's belief that the present trend toward more fuel efficient light trucks is not a one time aberration, but is the beginning of a long term trend. This

*For various relationships, see The Task Force Report on Motor Vehicle Goals Beyond 1980, Volume 2, Draft, September, 1978, Ch. 6.

belief is based on an examination of the sales data and an assessment of the gasoline supply situation for both the short and long terms. If the Agency's assumption is valid, then the domestic automobile industry would benefit in the long run because of a switch to the production of more fuel-efficient light trucks over a period of time beginning now. Periodic layoffs, triggered by a decline in sales of less fuel-efficient light trucks, could be prevented.

The industry would face serious repercussions if the Agency's assumption does not materialize. If consumers revert back to their demand for larger light trucks, whereas the domestic manufacturers are producing mostly compact trucks, then the sales of light trucks would decline. If such a change occurs, then an increase in employment (due to increased production of large trucks) would be more than offset by a decrease in employment from lost sales of compact trucks. However, the magnitude of such a change cannot be predicted at this time. What is more important is that one cannot be sure that such a change will or will not occur.

v. U.S. Production by Imports:

As the fuel economy of the domestically produced new light truck fleet rises, the competition between the domestics and the imports would also rise. Prices would then become an increasingly important avenue by which domestic manufacturers and importers would compete. Given the fluctuations in the international currency market,

increases in the cost of transportation, and decreases in the wage differences between the U.S. and the other countries, it is conceivable that more importers may start producing in the United States as evidenced by Volkswagen. If that happens, then employment in the domestic auto industry could rise.

It should be noted, however, that import truck volume is not large enough to encourage production in the United States. Currently, importers sell about 450,000 light trucks in addition to the captive imports sold by the domestic manufacturers. This volume is anticipated to decline as the domestic manufacturers offer more fuel efficient light trucks.

In summary, the impact on employment cannot be precisely assessed at this time. If the Agency's assumptions are proven valid, then employment is anticipated to rise. If the underlying assumptions are proven wrong, then employment in the domestic auto industry would decline.

E. URBAN-REGIONAL IMPACTS*:

The domestic auto manufacturers operate about 50 final assembly plants in the United States. Of these, about 22 plants are used to assemble light trucks. Their locations, for each manufacturer, are shown in Table V-5.

*In accordance with OMB Circular A-116, Preparation of Urban and Community Impact Analyses, August 16, 1978.

TABLE V-5
LIGHT TRUCK ASSEMBLY PLANTS
IN THE UNITED STATES*

General Motors:

Fremont, California
Lakewood, Georgia
Baltimore, Maryland
Detroit, Michigan
Flint, Michigan
Pontiac, Michigan
St. Louis, Missouri
Lordstown, Ohio
Jonesville, Wisconsin

FORD:

Milpitas, California
Louisville, Kentucky
Michigan Truck, Michigan
Twin Cities, Minnesota
Kansas City, Missouri
Lorain, Ohio
Ohio Plant
Norfolk, Virginia

CHRYSLER:

Jefferson Plant, Michigan
Warren, Michigan
St. Louis, Missouri

AMERICAN MOTORS:

Toledo, Ohio

INTERNATIONAL HARVESTER

Fort Wayne, Indiana

VOLKSWAGEN

Westmoreland, Pennsylvania

* Automotive News, November 5, 1979

General Motors operates approximately nine assembly plants to produce light trucks and vans. Some of these plants are also used to assemble passenger cars. These plants are located in many States with three plants located in the State of Michigan. Ford operates eight assembly plants which are located in many parts of the country. Chrysler operates three and AM, IH and VW one each.

A change in employment due to a change in the production and sales of light trucks would change employment in these plants unless manufacturers are planning to produce new models in assembly plants which would be located somewhere else. It is not possible at this time to determine if new plants to produce new models will be established or existing plants will be modified.

Although the discussion on employment in the previous section did not provide an estimate of the actual changes in employment, it did indicate that the proposed fuel economy standards would have a generally positive effect on employment. If one assumes that the new models will be produced in the existing plants, then one can conclude that employment in these plants would be positively affected. However, the magnitude of the impact cannot be precisely determined at this point. Similarly, an accurate assessment of the urban impacts cannot be made in the absence of information regarding the location of the plants where new models will be produced. Comments are invited and more details are sought to facilitate a more detailed, accurate assessment for the final rule.

PART VI

SENSITIVITY ANALYSIS

PART VI

SENSITIVITY ANALYSIS

Manufacturing costs and associated capital investments and cash flow analysis were described in Part IV. Although these calculations are based on the best available data, uncertainty cannot be ruled out. Any prediction of automobile industry performance has associated with it an inherent amount of incertitude due to the external forces impacting on that sector of the economy (e.g., condition of economy, availability of petroleum, consumer reaction, etc.).

The indetermination associated with this analysis arises mainly through estimates of capital investments and the resultant effect on the cash flows of the manufacturers. Only the expected values (most likely values) have been used in the analysis in Part IV. In the discussion that follows, several of the base assumptions will be varied and the sensitivity of the results to changes in assumptions will be examined. It should be noted that these sensitivity analyses are only some of the large number of variations possible. The following analyses entail a wide enough range to gauge the sensitivity of the results in Part IV to most variations.

This part of the regulatory analysis includes Chrysler Corporation and the affect that changes in assumptions would have on Chrysler's cash flow.

A. CHANGES IN MARKET SHARES

Changes in market shares have the same effect as changes in sales. The underlying assumption is that changes in the sales of domestic manufacturers would cause changes in the market share of imports if one assumes that the total projected sales of passenger cars and light trucks do not change. Two cases are examined. In one case, the market shares of the "Big Three" domestic manufacturers are increased. In the second case, the market shares of the "Big Three" domestic manufacturers are lowered.

The market shares and the resultant unit volume for each manufacturer are shown in Tables VI-1 through VI-3. The base case unit sales volume is the volume used in the base case, analyzed in Part IV. Changes in the cash flows due to changes in sales are measured against the base case. The market share rises from a low of 10 percent to a high of 12 percent for Chrysler, from a low of 24 percent to a high of 27 percent for Ford, and from a low of 45 percent to a high of 48 percent for GM. While these changes may not appear to be large, historical data indicate that large fluctuations do not occur and even changes of these magnitudes affect cash flows. The low and the high market share or sales volume cases are discussed below.

TABLE VI-1
NORTH AMERICAN UNIT SALES VOLUMES
CHRYSLER CORPORATION
(MILLIONS OF UNITS)

<u>YEARS</u>	<u>SALES VOLUME</u>		
	<u>BASE CASE</u> <u>(11% Mkt Share)</u>	<u>LOW SALES</u> <u>(10% Mkt Share)</u>	<u>HIGH SALES</u> <u>(12% Mkt Share)</u>
1980	1.64	1.49	1.79
1981	1.72	1.57	1.88
1982	1.75	1.59	1.91
1983	1.82	1.66	1.99
1984	1.95	1.77	2.12

NOTE: Sales volumes include Canadian sales which are 13 percent of the U.S. sales -- based on historical sales data.

TABLE VI-2
NORTH AMERICAN UNIT SALES VOLUMES
FORD MOTOR COMPANY
(MILLIONS OF UNITS)

<u>YEARS</u>	SALES VOLUME		
	<u>BASE CASE</u> <u>(26% Mkt Share)</u>	<u>LOW SALES</u> <u>(24% Mkt Share)</u>	<u>HIGH SALES</u> <u>(27% Mkt Share)</u>
1980	3.71	3.42	3.85
1981	3.89	3.59	4.04
1982	3.95	3.65	4.10
1983	4.12	3.81	4.28
1984	4.40	4.06	4.57

NOTE: Sales volumes include Canadian sales which are 8 percent of the U.S. sales -- based on historical sales data.

TABLE VI-3

NORTH AMERICAN UNIT SALES VOLUMES

GENERAL MOTORS

(MILLIONS OF UNITS)

YEARS	SALES VOLUME		
	BASE CASE (47% Mkt Share)	LOW SALES (45% Mkt Share)	HIGH SALES (48% Mkt Share)
1980	6.71	6.42	6.85
1981	7.04	6.74	7.19
1982	7.14	6.84	7.29
1983	7.45	7.13	7.61
1984	7.95	7.62	8.12

NOTE: Sales volumes include Canadian sales which are 8 percent of the U.S. sales -- based on historical sales data.

i. High Sales Volumes:

An increase in sales volume would raise both total revenues and total variable costs. However, the magnitude of the increase in revenues would be greater than the increase in variable costs. Thus, the total contribution would increase. Depreciation and amortization and fixed costs would not change in the short run; profits before taxes and taxes would both rise and so would profit after taxes. The net result would be an increase in cash in-flow. Since the cash out-flow does not change as a result of increased sales volume, the cash flow deficits for 1980-82 would decrease and cash flow surpluses for 1983-84 would increase for both GM and Ford. The results for Cases 1 and 3 are summarized in Tables VI-4 and VI-5 for GM and Ford, respectively.

The analysis shows that even a one percent increase in the market share of GM decreases its cash flow deficits by about 10 percent for 1980, 22 percent for 1981, and 71 percent for 1982 when compared with the base case cash flow deficits. Cash flow surpluses for 1983 and 1984 rise by 32 percent and 8 percent, respectively. A larger increase in GM's market share would decrease its cash flow deficits for the 1980-82 period even more, and raise its cash flow surpluses for 1983-84.

Similarly, a one percent increase in the market share of Ford reduces its cash flow deficits for the period of 1980-82 by a considerable amount: 13 percent for 1980, 24 percent for 1981,

TABLE VI-4

CHANGES IN CASH FLOW: HIGH SALES VOLUMES

GENERAL MOTORS: CASE 1

(MILLIONS OF 1979 DOLLARS)

	CALENDAR YEARS				
	1980	1981	1982	1983	1984
D&A	2,655	2,673	3,189	3,271	2,977
PAT	2,404	2,908	2,814	3,202	3,996
TOTAL CASH IN	5,059	5,581	6,003	6,473	6,973
TOTAL CASH OUT	6,388	6,141	6,071	5,742	4,467
NET CASH FLOW	-1,329	-560	-68	731	2,506
BASE CASE NET CASH FLOW	-1,479	-722	-233	555	2,318

LEGEND: D&A = Depreciation and Amortization

PAT = Profits After Taxes

TABLE VI-5
 CHANGES IN CASH FLOW: HIGH SALES VOLUMES
FORD: CASE 1
 (MILLIONS OF 1979 DOLLARS)

	CALENDAR YEARS				
	1980	1981	1982	1983	1984
D&A	1,074	1,067	1,266	1,157	1,065
PAT	449	643	639	935	1,253
TOTAL CASH IN	1,523	1,710	1,905	2,092	2,318
TOTAL CASH OUT	2,350	2,140	2,296	1,465	1,452
NET CASH FLOW	-827	-430	-391	627	866
BASE CASE NET CASH FLOW	-953	-567	-530	479	709

LEGEND: D&A = Depreciation and Amortization

PAT = Profits After Taxes

and 26 percent for 1982. The cash flow surplus rises by 31 percent for 1983 and 22 percent for 1984. Once again, a larger increase in Ford's market share would decrease its cash flow deficits for 1980-82 even more and raise its cash flow surpluses for 1983-84.

ii. Low Market Shares:

A decline in the market shares for GM and Ford and its consequences on cash flows are examined in this section. A decline in the market share translates into a decline in sales which, in turn, translates into a decline in revenues if the revenue per unit does not change.

Data in Table VI-6 show the effect of a decline in sales on cash flows for Case 1 for GM. Cash flow deficits for the 1980-82 period have increased and the cash flow surpluses for the 1983-84 period have declined as a result of a 2 percentage point decline in sales. Cash flow deficits have risen: 21 percent for 1980, 45 percent for 1981, and 141 percent for 1982. Similarly, cash flow surpluses have declined: 64 percent for 1983 and 16 percent for 1984, when compared with the Base Case.

Similar results are obtained for Ford when its market share declines 2 percentage points -- from 26 percent to 24 percent, and are shown in Table VI-7. Cash flow deficits increase: 27 percent for 1980, 48 percent for 1981, and 52 percent for 1982. Cash flow surpluses decline: 60 percent for 1983 and 44 percent for 1984, when compared with the Base Case.

The affect that a one percentage point increase or decrease in market share would have on Chrysler's cash flow situation is shown in Table VI-8. These numbers were developed by using assumptions similar to those used for GM and Ford. A one percentage point change in market share generally makes a difference of \$220 to \$266 million in cash flow. This affects Chrysler's cash flow even more than a 1 percentage point change shown in the high sales cases for GM and Ford, which changes their cash flow by \$130 - \$180 million. This results because a one percentage point change is a bigger percentage change in sales for Chrysler than for GM or Ford.

In summary, the cash flow analysis is fairly sensitive to changes in sales volumes.

TABLE VI-6
 CHANGES IN CASH FLOW: LOW SALES
GENERAL MOTORS: CASE 1
 (MILLIONS OF 1979 DOLLARS)

	CALENDAR YEARS				
	1980	1981	1982	1983	1984
D&A	2,655	2,673	3,202	3,267	2,977
PAT	1,944	2,420	2,331	2,670	3,445
TOTAL CASH IN	4,599	5,093	5,533	5,937	6,422
TOTAL CASH OUT	6,388	6,140	6,095	5,735	4,467
NET CASH FLOW	1,789	-1,047	-562	202	1,955
BASE CASE NET CASH FLOW	-1,479	-722	-233	555	2,318

LEGEND: D&A = Depreciation and Amortization

PAT = Profits After Taxes

TABLE VI-7
 CHANGES IN CASH FLOW: LOW SALES
FORD: CASE 1
 (MILLIONS OF 1979 DOLLARS)

	CALENDAR YEARS				
	1980	1981	1982	1983	1984
D&A	1,074	1,067	1,266	1,157	1,067
PAT	62	233	223	500	783
TOTAL CASH IN	1,136	1,300	1,489	1,657	1,850
TOTAL CASH OUT	2,350	2,140	2,296	1,465	1,455
NET CASH FLOW	-1,214	-840	-807	192	395
BASE CASE NET CASH FLOW	-953	-567	-530	479	709

LEGEND: D&A = Depreciation and Amortization

PAT = Profits After Taxes

TABLE VI-8

CHANGES IN CASH FLOW: HIGH AND LOW SALES

CHRYSLER: CASE 1

(MILLIONS OF 1979 DOLLARS)

CALENDAR YEAR	CHANGES IN CASH FLOW	CHANGES IN CASH FLOW
	RESULTING FROM DIFFERENCES	RESULTING FROM DIFFERENCES
	IN HIGH SALES AND BASE	IN LOW SALES AND BASE
	CASE SALES	CASE SALES
1980	220	-220
1981	239	-222
1982	243	-243
1983	248	-244
1984	142	-266

B. CHANGE IN CAPITAL INVESTMENTS:

The cash flow analysis contained in Part IV shows large cash flow deficits for GM and Ford for 1980-82. These deficits are precipitated by poor sales and the estimates of capital investments for both current passenger car fuel economy standards and proposed light truck fuel economy standards. It would be interesting, therefore, to examine how the light truck fuel economy related capital expenditures affect the cash flows of the manufacturers. In the analysis that follows, cash flow changes are examined but without light truck fuel economy-related capital spending beyond MY 1981 and assuming that sales remain at the base case sales levels. The cash flow deficits change considerably for all three manufacturers.

TABLE VI-9
 CHANGES IN CASH FLOW: NO POST-MY 1981 TRUCK SPENDING
GENERAL MOTORS
 (MILLIONS OF 1979 DOLLARS)

	CALENDAR YEARS				
	1980	1981	1982	1983	1984
D&A	2,546	2,371	2,844	2,897	2,695
PAT	2,315	2,911	2,856	3,232	3,964
TOTAL CASH IN	4,861	5,282	5,700	6,129	6,659
TOTAL CASH OUT	5,814	5,047	5,646	5,482	4,468
NET CASH FLOW	-953	235	54	647	2,191
BASE CASE NET CASH FLOW	-1,479	-722	-233	555	2,318

LEGEND: D&A = Depreciation and Amortization

PAT = Profits After Taxes

TABLE VI-10

CHANGES IN CASH FLOW: NO POST-MY 1981 TRUCK SPENDING

FORD

(MILLIONS OF 1979 DOLLARS)

	CALENDAR YEARS				
	1980	1981	1982	1983	1984
D&A	1,066	1,010	1,142	1,035	942
PAT	327	538	565	854	1,166
TOTAL CASH IN	1,393	1,548	1,707	1,889	2,108
TOTAL CASH OUT	2,299	1,846	1,875	1,388	1,349
NET CASH FLOW	-906	-298	-168	501	759
BASE CASE NET CASH FLOW	-953	-567	-530	479	709

LEGEND: D&A = Depreciation and Amortization

PAT = Profits After Taxes

The cash flow position of GM, when no post-MY 1981 light trucks capital spending is included, changes dramatically when compared with the cash flows associated with the Base Case. and is shown in Table VI-9. The cash flow declines by 36 percent in 1980 and turns positive for 1981-84. The improvement in the cash flow position is roughly 133 percent in 1981, 123 percent in 1982, and 17 percent in 1983. The cash flow position deteriorates in 1984 by 5 percent -- this occurs because depreciation and amortization (a cash inflow) is lowered more than the reduction in capital requirements (a cash outflow).

Ford's cash flow position also improves but not quite as dramatically as GM's. The results, summarized in Table VI-10, show that the cash flow deficit declines by 5 percent in 1980, 47 percent in 1981, and 68 percent in 1982. The cash flow surpluses rise by 5 percent in 1984 and 7 percent in 1985.

The cash flow position of Chrysler without post-MY 1981 light truck fuel economy capital spending improves in comparison with the Base Case. However, the improvements are not so dramatic, only improving Chrysler's cash flow by about \$320 million over the 5 years. The results of the analysis are summarized in Table VI-11.

TABLE VI-11

CHANGES IN CASH FLOW: NO POST-MY 1981 TRUCK SPENDING

CHRYSLER

(MILLIONS OF 1979 DOLLARS)

CALENDAR YEAR	CHANGES IN CASH FLOW
	RESULTING IN DIFFERENCES IN NO TRUCK SPENDING AND CASE 1 TRUCK SPENDING
1980	28
1981	150
1982	161
1983	0
1984	-20

To summarize, cash flows are also sensitive to capital spending requirements. Some manufacturers are more sensitive than others, however. GM's cash flow improvement is also aided by the fact that capital investment reductions for GM were quite large during these years. Ford's position also improves but the magnitude of the improvement is smaller than GM's. Chrysler's position improves least as a result of excluding post-MY 1981 light truck spending. The primary reason being that Chrysler wasn't anticipated to incur large amounts of capital investments to improve their new light truck fleet fuel economy.

PART VII

ISSUES

ISSUES

The preceding sections describe the various effects of the proposed fuel economy standards for the new light truck and van fleets for MYs 1982-85. The analysis shows that the cases presented have a varying influence just as they result in different levels of fuel economy improvements. Because of a wide divergence among both the fuel economy levels attainable among the different manufacturers and the magnitude of the capital expenditures necessary to make these fuel economy improvements, the Agency is proposing a range of fuel economy levels for MYs 1983-85.

The analysis underlying the development of the proposed ranges of fuel economy levels indicates two significant issues arising from this proposal: One, the marketability of the new models; and two, the financial capabilities of the manufacturers to improve the fuel economy of both the new car fleet and the light truck fleet in light of the estimated capital expenditures necessary to make these improvements. Each of the issues is discussed below.

I. MARKETABILITY OF NEW MODELS:

The technical analysis conducted by the Agency indicated that the fuel economy of the new light truck fleet cannot be substantially improved solely by implementing new technologies but it can be by introducing new models. Thus, the Agency developed 9 surrogate new

models which were incorporated into the projection of fuel economy levels attainable in Cases 1 and 2; the difference between the two cases depended upon the rate of introduction of new models.

The introduction of new models in estimating potential fuel economy improvements is precipitated by several events: domestic manufacturers of light trucks are planning to introduce new models at various times; the recent gasoline shortage and concomitant gasoline price increases have changed the buying behavior of the light truck buyers such that more compact light trucks are being bought while the sales of their larger counterparts have declined; the Agency belief that the new buying behavior is not a one time aberration but a long term trend; and the need for long lead times for the auto manufacturers to switch production from large to compact light trucks.

The surrogate new models developed by the Agency are based on publicly available information regarding the weight and the fuel economy of various sizes of trucks. The smaller trucks postulated by the Agency are anticipated to perform the tasks for which these trucks are used at present. However, the new models will be more evenly matched with the needs of the buyers. Marketing studies, discussed earlier in this report, indicate that a large number of buyers do not frequently utilize their trucks to the maximum rated capacity. Conceivably, these buyers can purchase smaller trucks without affecting their load carrying needs.

The projected introduction of new models has several consequences for the manufacturers. A switch to the production of smaller, more fuel efficient light trucks requires both long leadtimes and large capital expenditures. If these new models are not accepted by the buyers, then their sales would decline. Thus, manufacturers would not be able to recover their investments. Also, their ability to improve the fuel economy of their light truck fleet, in the absence of new models or declining sales, would be very limited.

On the other hand, if the current strong demand for fuel efficient light trucks continues and the domestic manufacturers cannot satisfy this consumer demand, then they would continue to lose sales to the more fuel efficient imports. A loss in sales and the resultant cash flow limitations would hamper the domestic manufacturers' ability to improve their fleet average fuel economy.

The preceding discussion indicates that there is considerable risk associated with projecting not only the number of new models which would be introduced by the domestic manufacturers, but also their rate of introduction. However, given the current sales pattern (a very strong demand for more fuel efficient light trucks) and a perception of the future availability and price of gasoline (while gasoline may be available, its price is anticipated to continue to rise at a real rate of three percent per year, at a minimum), the Agency believes that the strong demand for more fuel efficient light trucks will prevail and continue in the future.

II. FINANCIAL CAPABILITY

Whether the domestic manufacturers can generate sufficient cash to finance fuel economy improvements to their North American passenger car and light truck fleet is another issue raised by this proposal. The domestic automobile manufacturers are now investing in new technologies to meet the MYs 1981-85 passenger car fuel economy standards. Since passenger car operations generate a large portion of total revenues, they are also anticipated to require a large portion of expenditures. The proposal to improve the fuel economy of the light truck fleet would require that these manufacturers make additional efforts and incur additional expenditures.

In the preceding part of this analysis, (Part IV) capital investments necessary to improve the fleet average fuel economy of the new light truck fleet for each of the four cases was estimated. The capital investments associated with each model year were then converted to calendar year expenditures, and additional expenditures such as launch and engineering were estimated. The process and the underlying assumptions are described in detail in Part IV. A cash flow analysis was conducted for each case assessed in this analysis. The sources of funds were estimated from revenues, variable and fixed costs, depreciation and amortization, and taxes.

The uses of funds were estimated from such factors as dividends, capital spending, and debt repayment. The cash flow analysis for calendar years 1980-84 shows that the manufacturers would incur substantial cash flow deficits: Both GM and Ford, however, return to a positive cash flow generation position for 1983-84. The magnitude of the surplus depends upon the case considered.

An examination of the potential methods of funding these deficits revealed that both GM and Ford could conceivably finance these deficits by such means as lowered fixed cost or reduced dividend payments, increased long term debt, and improvements in variable margin. Chrysler is currently seeking Federal loan guarantees and the full consequences of this course of action cannot be determined until final legislative action occurs.

The above analysis, however, is based on several assumptions and other considerations which should be pointed out. One consideration is that the estimates of total capital spending for North American automotive operations do not include capital investment requirements for such areas as plant improvements, and plant pollution control. In that sense, capital investments may be underestimated. Another consideration would be the sensitivity of the cash flow deficits to changes in assumptions. A sensitivity analysis, contained in

Part VI, shows that the cash flow results are very sensitive to changes in the assumptions used in this Regulatory Analysis. An increase in sales or an increase in revenue through a retail price increase would reduce cash flow deficits; the magnitude of the decrease would depend upon the magnitude of the increase in revenues either due to higher sales or higher prices or both. It is also possible that sales may decline in these years and may worsen the cash flow position of the manufacturers. However, it is extremely difficult to accurately forecast the conditions of the economy which would exist for these years.

There is yet another consideration which strongly leads the Agency to believe that the manufacturers must make significant improvements in the fuel economy of their both passenger car and light truck fleets. Once again, it is the Agency's perception that the current strong demand for more fuel efficient passenger cars and light trucks would continue in the future. The domestic auto manufacturers have also recognized that currently consumers are demanding more fuel economy than they can supply and are making efforts to satisfy current consumer demand for higher fuel efficiency.

The Agency, however, also believes that the current trend will continue for a long time. The reason is the recent increases in the price of oil by the oil producing nations. As the price of oil is expected to continue to rise, faster than the rate of inflation, the cost of driving will also rise, and influence consumer buying

behavior. This is evident today and is anticipated to continue in the future.

In summary, both issues--the marketability of new light trucks and the financial capability of the domestic manufacturers--are areas of great concern. Comments are invited on the assumptions and discussion presented in this analysis.

APPENDIX A

The figures shown below are estimates derived from manufacturer provided data, contract reports and NHTSA analyses. The numbers are rounded. Such factors as excess capacity, volume, and production capacity were considered in deciding whether a conversion of an existing facility or installation of new equipment is appropriate.

APPENDIX A

TECHNOLOGY COSTS

(all in 1978 Dollars unless noted)

A) Electronic Engine Controls

Pioneer Contract
DOT-HS-7-01789, p.4-2

Capital Cost: \$20 million/350,000 units
Consumer Cost: \$68/unit

B) Transmissions

1) 4-speed auto w/lockup

Capital Cost: \$110 million for 200,000 units
Consumer Cost: \$(C) for GM and Ford \$(C) for AM

GM estimate: \$ (C)
Ford PA estimates: \$ (C)
Ford LT estimate: \$ (C)
(difference between PA and LT estimates
is dealer markup and inflation)

2) 3-speed auto w/lockup

Capital Cost: \$40 million/300,000 units (GM- \$ (C)
(Ford- \$ (C))
Consumer Cost: \$50/unit

GM estimate: \$ (C)
Ford PA estimate: \$ (C)
Ford LT estimate: \$ (C)

3) Manual Overdrive

Capital Cost: \$55 million for 200,000 units
Consumer Cost: \$ (C)

Ford PA: \$ (C)
Ford LT: \$ (C)

4) Transaxles for GM's Front Wheel Drive Van

Capital Cost: \$165 million for 257,000 units
Consumer Cost: \$217/unit

LEGEND:

(C) - Confidential Information
PA - Passenger Automobile
LT - Light Truck

C) Radial Tires

No Capital Cost

Consumer Cost:

\$6 for P-metric over radials
\$10 for "advanced" over P-metric
no estimates by manufacturers
\$69 for radials over bias ply
AMC - \$ (C)
Rord - \$(C)

D) Accessories

Negligible Capital Cost

1) Viscous Fans

Consumer Cost:

\$20
AMC estimate \$ (C)
IH estimate \$ (C)
Ford PA \$ (C)

2) Variable Speed Accessory Drive

Consumer Cost:

\$20

E) Aerodynamics

Hood Revisions for AM

Negligible Capital Cost

Consumer Cost

\$5
No manufacturer estimate

F) Weight Reduction

100 lbs. Fleet Average Reduction AM

Capital Cost:

\$5 million face lift/200,000 units

Consumer Cost:

\$21

10¢/lb. variable cost

G) Turbocharged Engines:

No Capital Cost
Consumer Cost:

\$500/unit
GM PA estimate \$ (C)
Ford PA estimate \$ (C)
Ford LT \$ (C)

H) Proco Engine

Capital Cost:

\$50 million for 200,000 units
Ford LT \$(C)

Consumer Cost:

\$600/unit
Ford PA estimate \$(C)
Ford LT \$(C)

I) Engines

1) *AMC 151 L4 Engine	Consumer Cost: \$69
* AMC 173 replace 258	: \$106
*Chrysler 260 replace 318	: \$106

*Developed from June 30, 1978, Pioneer report, p.4-3.

2) Ford Expansion of 2.3L capacity:

Capital Cost:	\$125 million for 250,000 units
Consumer Cost:	\$32 per vehicle over entire fleet

3) GM Increase: 2.8L Capacity:

Capital Cost:	\$375 million for 600,000 units
Consumer Cost:	\$84 per vehicle over entire fleet

4) Ford Alternative 4 255 Engine (conversion) (400,000 units)

Capital Cost	\$100 million
Consumer Cost	\$25 per vehicle over entire fleet

5) GM Alternative 4 250 L6 (new capital) (400,000 units)

Capital Cost:	\$250 million
Consumer Cost:	\$56 per vehicle over entire fleet

J) New Models

1) Chrysler New Pickup/Utility (250,000 units)

Capital Costs	Assembly: \$45 million
	Stamping: \$100 million
	Components: <u>\$100 million</u>
	<u>\$245 million</u>

Consumer Costs: \$330/vehicle

2) Chrysler Compact Van (110,000 units)

Capital Costs	Assembly: \$ 45million
	Stamping: \$ 50million
	Components: <u>\$100million</u>
	<u>\$195million</u>

Consumer Costs: \$600/vehicle

3) Ford Mini Pickup (400,000 units)

Capital Costs	Assembly \$ 90 million
	Stamping \$100 million
	Components <u>\$125 million</u>
	<u>\$315 million</u>

Consumer Costs \$265/unit

4) Ford Van (300,000 units)

Capital Costs	Assembly \$ 45 million
	Stamping \$ 50 million
	Components <u>\$100 million</u>
	<u>\$195 million</u>

Consumer Costs \$220/unit

5) Ford New Standard Pickup (500,000 units)

Capital Costs	Assembly \$ 90 million
	Stamping \$100 million
	Components <u>\$200 million</u>
	<u>\$390 million</u>

Consumer Costs \$370/unit

6) GM Mini Pickup (455,000 units)

New Capital Equipment for Dayton Plant

Capital Costs	Assembly \$360 million
	Stamping \$100 million
	Components <u>\$165 million</u>
	<u>\$625 million</u>

Consumer Cost \$465/unit

7) GM Mini Van (225,000 units)

Capital Costs	Assembly \$ 45 million
	Stamping \$ 50 million
	Components <u>\$120 million</u>
	<u>\$215 million</u>

Consumer Cost \$325 unit

8) GM Standard Size Pickup (550,000 units)

Capital Costs	Assembly \$ 90 million
	Stamping \$100 million
	Components <u>\$200 million</u>
	<u>\$390 million</u>

Consumer Costs: \$240/unit

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