

REPORT NO. DOT-TSC-OST-77-6

ENERGY USE AND OTHER  
COMPARISONS BETWEEN DIESEL  
AND GASOLINE PICKUP TRUCKS

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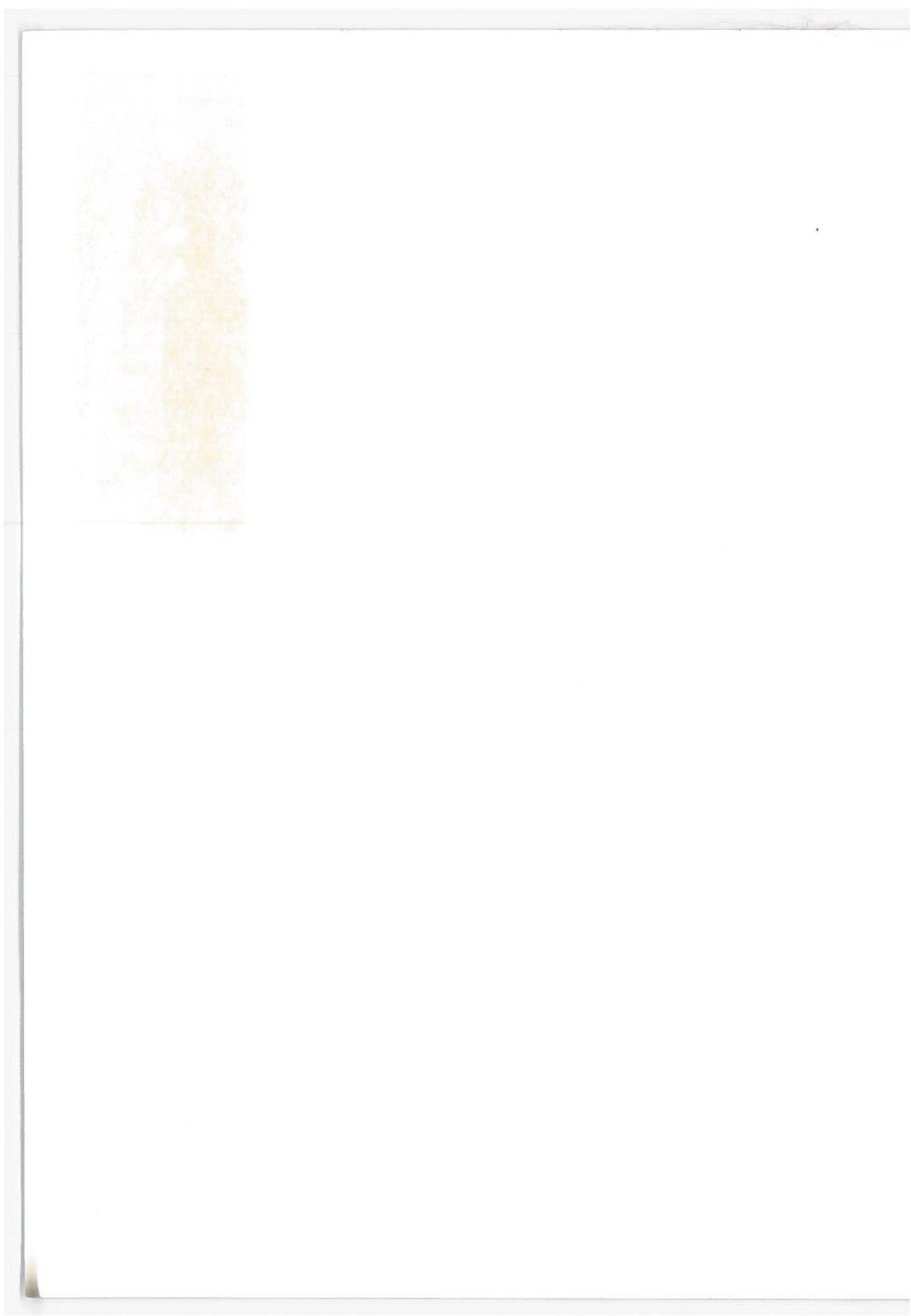


JANUARY 1978

INTERIM REPORT

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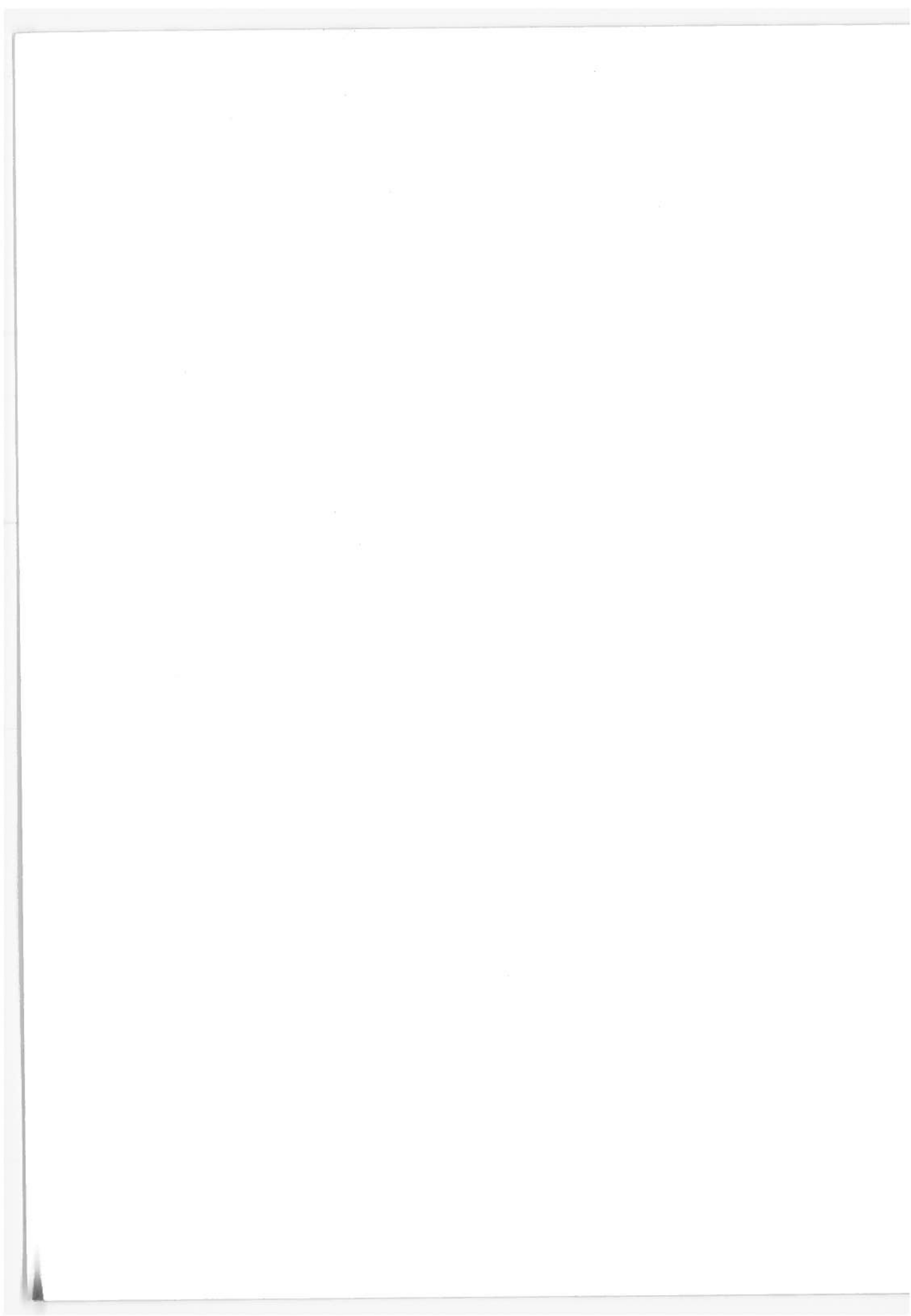


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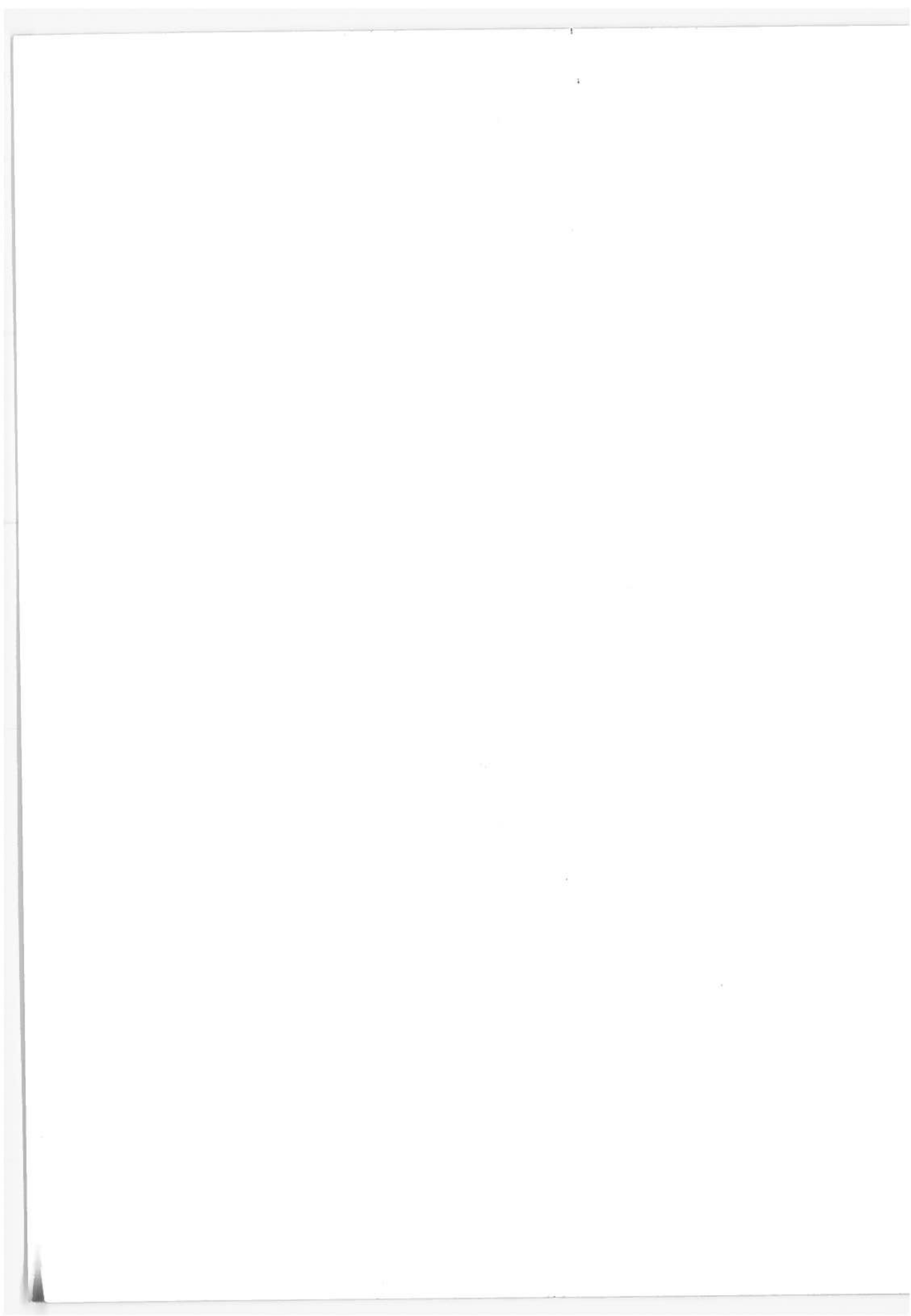
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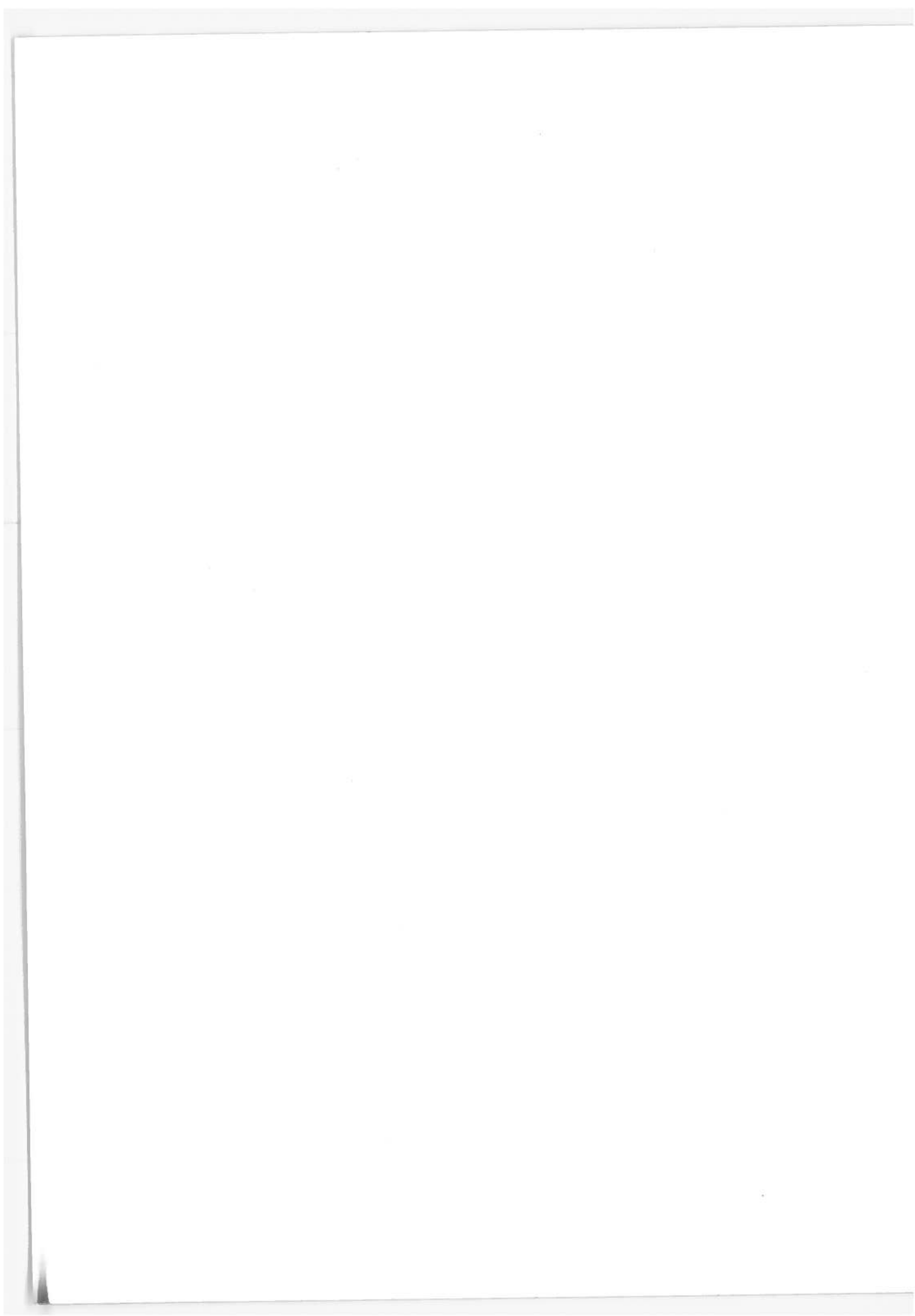
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16. Abstract  The State of Maine Department of Transportation (MDOT) was planning to acquire 28 new pickup trucks in the fall of 1976. When the U.S. Department of Transportation's Transportation Systems Center (TSC) became aware of this, preliminary discussions were initiated relative to the possibility of an energy and cost study being completed on these units. It was believed that if 14 diesel and 14 gasoline units were ordered and monitored it would provide a good base for analyzing these two factors.  Realizing the opportunity to obtain comparative fuel and cost information based on actual experience, the contract #1299 between TSC and MDOT was signed. Thus, 14 diesel and 14 gasoline pickups were delivered in the fall and winter of 1976-77.			
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## PREFACE

The State of Maine Department of Transportation (MDOT) was planning to acquire 28 new pickup trucks in the fall of 1976. When the U.S. Department of Transportation's Transportation Systems Center (TSC) became aware of this, preliminary discussions were initiated relative to the possibility of an energy and cost study being completed on these units. It was believed that if 14 diesel and 14 gasoline units were ordered and monitored it would provide a good base for analyzing these two factors.

The 14 diesel and 14 gasoline pickups were delivered in the fall and winter of 1976-77; and MDOT was contracted by TSC to obtain comparative fuel and cost information based on actual experience.





# METRIC CONVERSION FACTORS

## Approximate Conversions to Metric Measures

Symbol When You Know Multiply by To Find Symbol

### LENGTH

in 2.5  
ft 30  
yd 0.9  
mi 1.6

cm  
m  
km

### AREA

square inches 6.5  
square feet 0.09  
square yards 0.8  
square miles 2.6  
acres 0.4

cm<sup>2</sup>  
m<sup>2</sup>  
km<sup>2</sup>  
ha

### MASS (weight)

oz 28  
lb 0.45  
(2000 lb) 0.9

g  
kg  
tonnes

### VOLUME

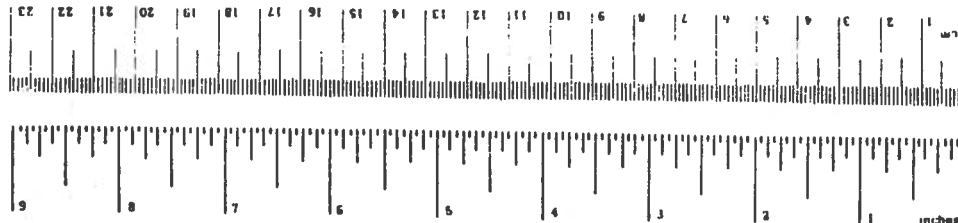
teaspoons 5  
tablespoons 15  
fluid ounces 30  
cups 0.24  
pints 0.47  
quarts 0.95  
gallons 3.8  
cubic feet 0.03  
cubic yards 0.76

ml  
l  
m<sup>3</sup>  
cubic meters

### TEMPERATURE (exact)

Fahrenheit temperature 5/9 (after subtracting 32)

Celsius temperature



## Approximate Conversions from Metric Measures

When You Know Multiply by To Find Symbol

### LENGTH

mm 0.04  
cm 0.4  
m 3.3  
km 0.6

inches  
feet  
yards  
miles

### AREA

square centimeters 0.16  
square meters 1.2  
square kilometers 0.4  
hectares 10,000 m<sup>2</sup> 2.5

square inches  
square yards  
square miles  
acres

### MASS (weight)

grams 0.035  
kilograms 2.2  
tonnes 1000 kg 1.1

oz  
pounds  
short tons

### VOLUME

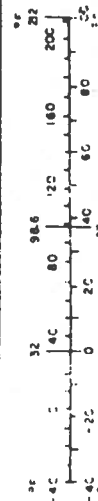
milliliters 0.03  
liters 2.1  
cups 1.06  
quarts 0.26  
gallons 35  
cubic meters 1.3

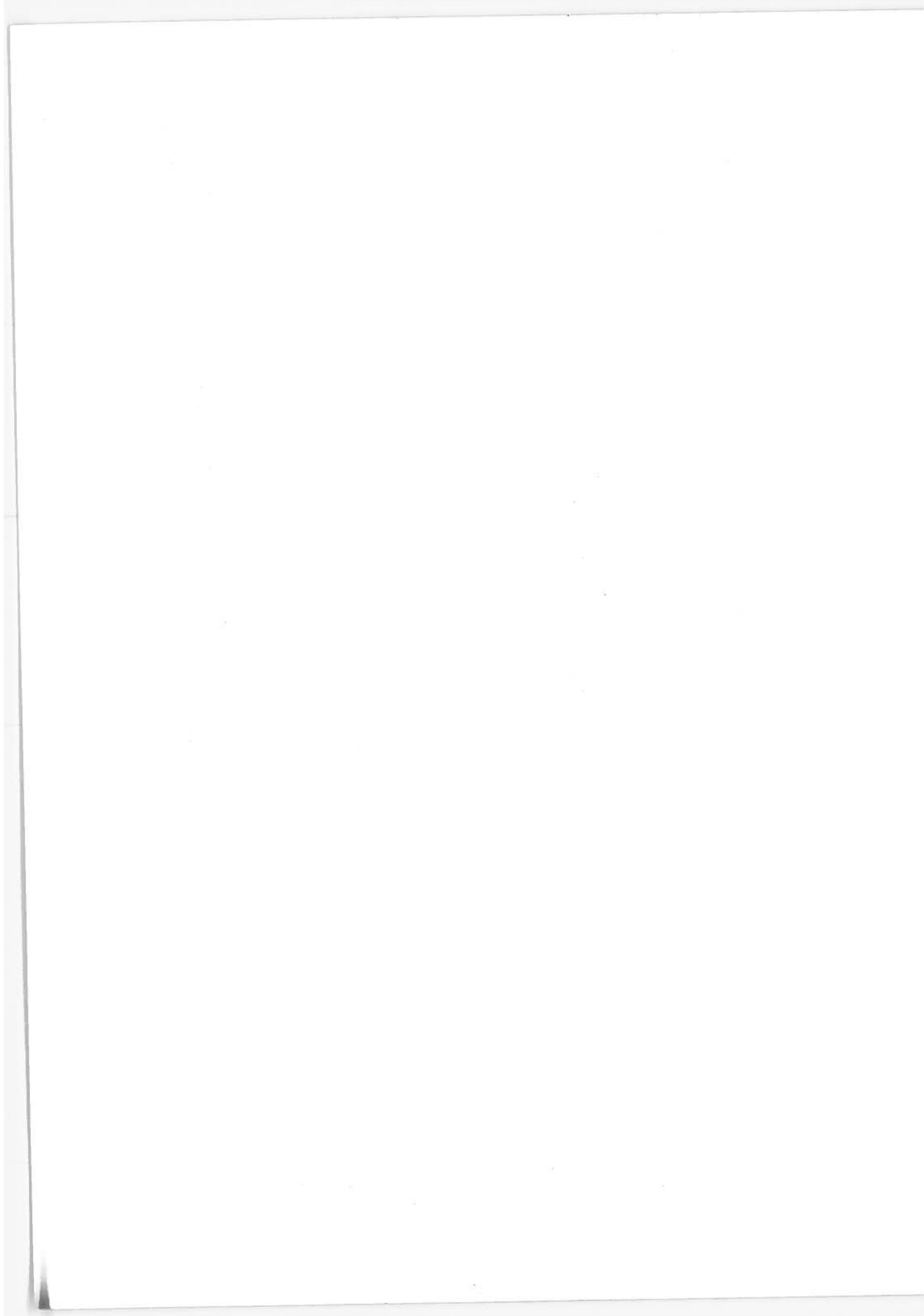
fluid ounces  
pints  
quarts  
gallons  
cubic feet  
cubic yards

### TEMPERATURE (exact)

Celsius temperature 9/5 (then add 32)

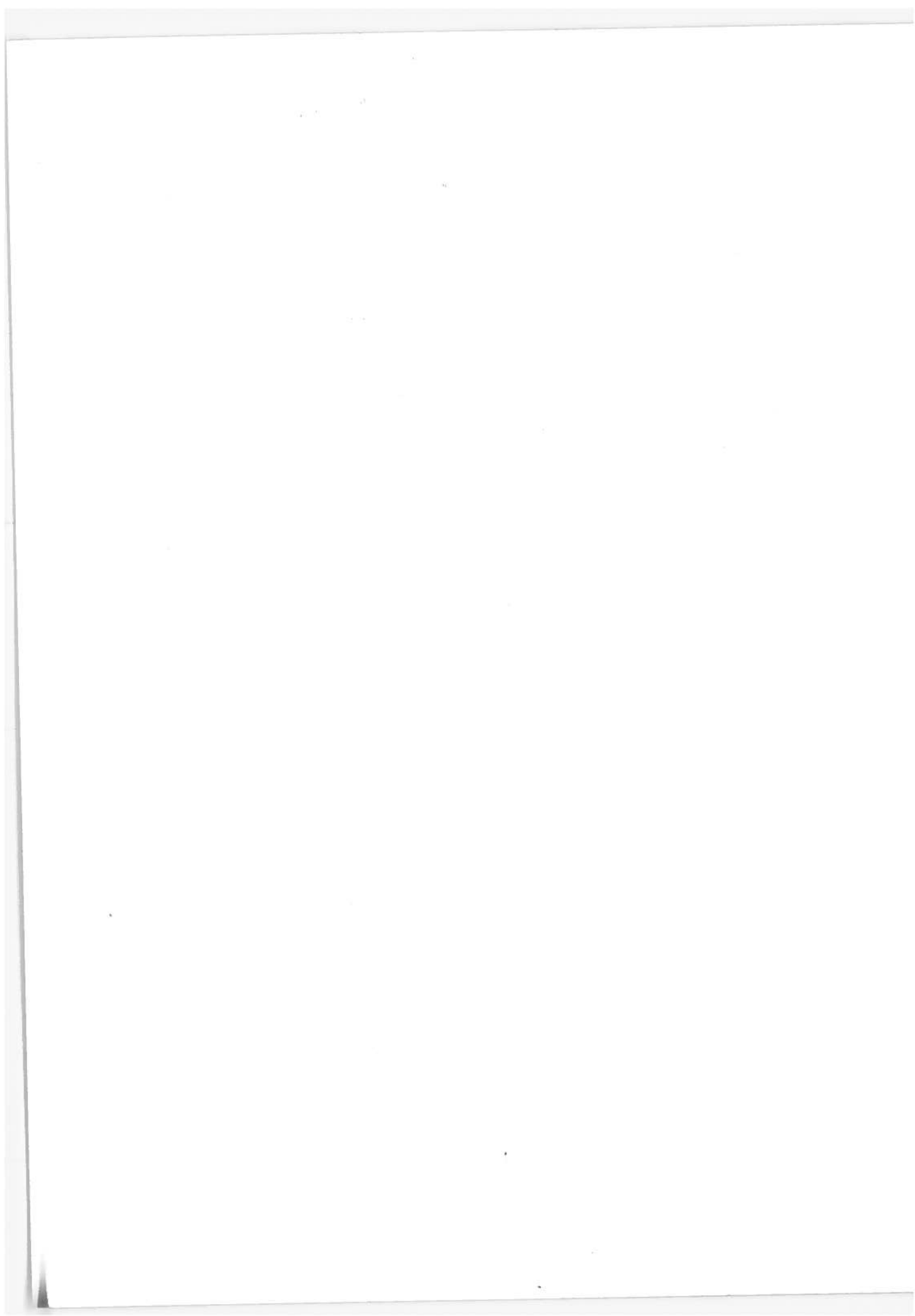
Fahrenheit temperature





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## I. INTRODUCTION

### 1.1 GENERAL

The primary goal of the study was to determine fuel economies, cost economies and reliability differences, if any, between the gasoline and diesel engines used in light duty pickup trucks. These trucks were all identical except for the power source. The power source for the diesel pickups was a six-cylinder Nissan engine which has 198 cubic inch displacement and is rated at 96 horsepower, whereas the power source for the gasoline pickups was a four cylinder International Harvester engine which has a 196 cubic inch displacement and is rated at 86 horsepower. See Table A-1.

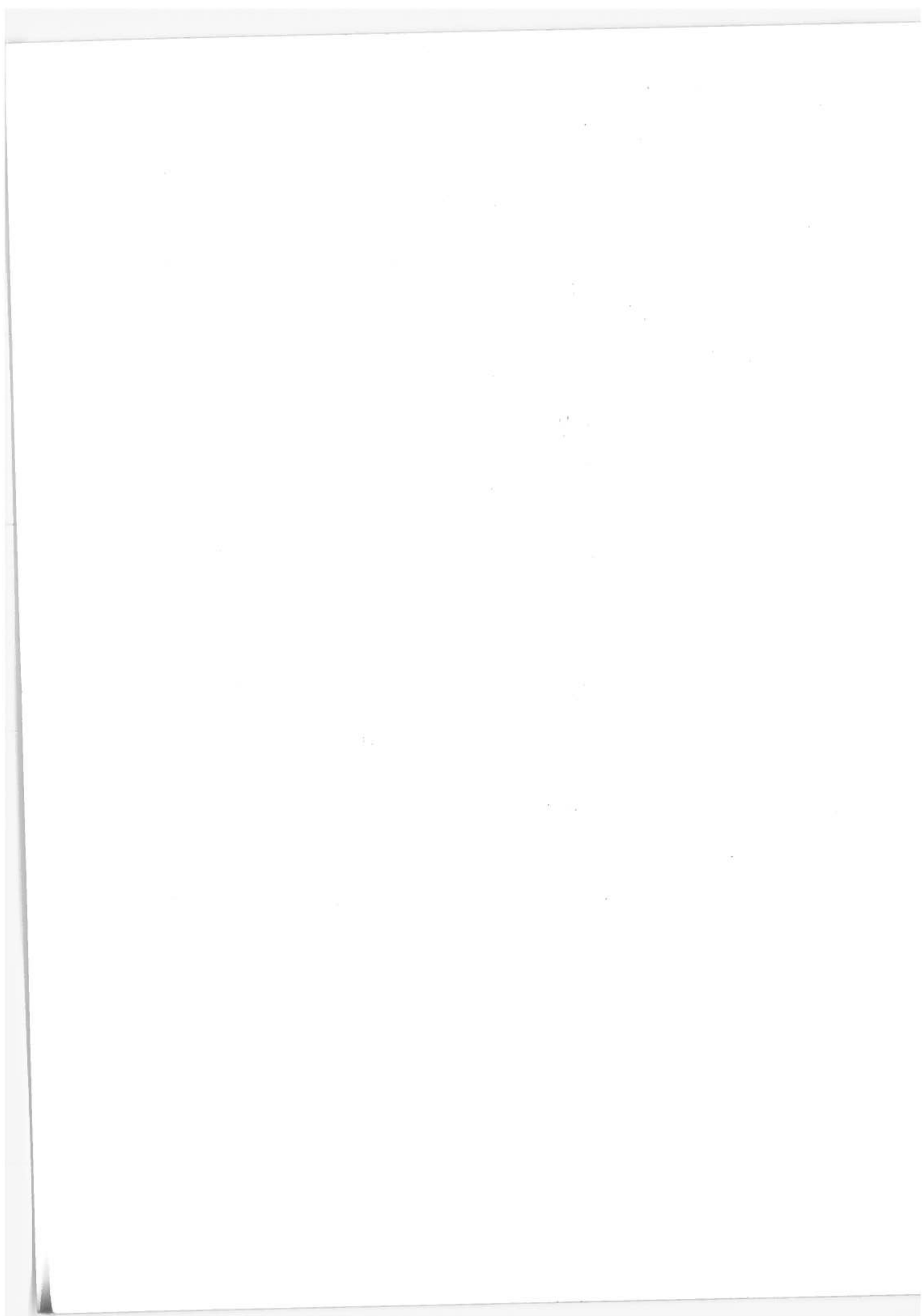
In each of the seven Maintenance Divisions, four vehicles were assigned, two diesel and two gasoline. It was believed that with this geographical distribution the sample bias would be minimized.

### 1.2 SCOPE

The data base for the study was as follows:

- A. 28 pickup trucks, 1977 models.
- B. 14 gasoline pickup trucks 86 horsepower.
- C. 14 diesel pickup trucks 96 horsepower.

General specifications for the trucks, fuels, and lubes, as well as a preventive maintenance schedule, are shown in Tables A-2 and A-3.





## 2. METHODOLOGY

The operational records of the department, which are stored on magnetic tape, provided a good source for developing fuel consumption comparisons between the two fuel types. The records also provide information for the comparison of parts, labor and depreciation costs for the two engine types. The analysis of data for this interim report covers the period from December 1976 through May 1977. The statistical analyses were made using an IBM 270 computer and the statistical package for Social Sciences, a system of computer programs.

The variables tabulated were miles and hours of operation, gallons of fuel, quarts of engine oil, pints of transmission oil, and parts and labor costs. These variables were tabulated on what would be considered, primarily, winter months, thus, the analyses may be based on biased data. Total maintenance and operational costs were tabulated; i.e., parts, labor, total gas, oil, and grease costs.

In addition to the statistical work completed by using the Department's equipment file layout, personal interviews with at least two drivers from each of the seven divisions were completed during April and May. A questionnaire form similar to that shown in Table A-4 was used. It was thought that comments of the personnel who drove these vehicles would provide beneficial insight to those who make an overall evaluation between the diesel and gasoline units.



### 3. ANALYSIS OF DATA

#### 3.1 FUEL ECONOMY

The analysis of fuel economy was based on two dependent variables: miles per gallon and gallons per hour. The means of the miles per gallon (MPG) and gallons per hour (GPH) comparisons between the diesel and gasoline are shown in Table 3-1. In Table 3-1, the means are based on total miles divided by total gallons and total gallons divided by total hours. For the six month time frame, the 14 diesel-powered pickups logged 248,186 miles and used 11,973 gallons of fuel, and the 14 gasoline-powered pickups logged 189,590 miles and used 12,571 gallons of fuel. Also, the average MPG and GPH were based on the means of the individual units and are shown in Table 3-1.

TABLE 3-1. AVERAGE FUEL ECONOMY BY FUEL TYPE

	DIESEL	GASOLINE
MPG, Total Miles divided by total gallons	20.73	15.08
MPG, Average based on means of unit averages	21.16 S= + 1.83	15.12 S= 1.83
MPG Range, minimum maximum	18.06 24.34	13.01 18.52
-----		
GPH, Total gallons divided by total hours	1.02* 1.02*	1.51* 1.51*
GPH, Average based on means of unit average	0.02* S= 0.17	1.62* S= 0.25
GPH, Range minimum maximum	0.69* 1.07*	1.16* 1.89*

\*Based on less than 14 units

Based on total miles and total gallons for the five month period, the miles per gallon for the diesel units was found to be 20.73 miles per gallon and the miles per gallon for the

gasoline units was found to be 15.08 miles per gallon. Based on these two consumption rates, the diesel units were found to provide approximately 37 percent more miles per gallon than their gasoline counterparts. Equipment number 03610, a diesel, had been driven the most miles (43,800), and the average miles per gallon for this vehicle was 19.70. Of gasoline units, equipment number 03627 had been driven the most miles (23,394), and the average miles per gallon for this vehicle was 16.69.

During the subzero weather, it was thought that the diesel pickups were getting moisture in the fuel tank, and that this was causing the engines to die out; thus, approximately one hundred plus gallons of fuel were dumped. If this fuel had not been dumped, the overall MPG would have increased to approximately 20.91 MPG instead of the 20.73 MPG shown in Table 3-1.

The problem of the engine die-out was caused by the diesel fuel congealing on the filter in the fuel tank and in the fuel line. Also, kerosene was blended with the diesel fuel during the winter months; thus, the BTU for the blended fuel was less which may have lowered the MPG figure.

### 3.2 ENGINE OIL REQUIRED

The average engine oil required for the diesel units was found to be 12.30 quarts per 3000 miles which was the mileage when the engine oil was changed. The average engine oil used for the gasoline units was found to be 5.71 quarts per 3000 miles. Thus, the engine oil required was 115 percent more for the diesel pickups than for the gasoline pickups.

### 3.3 COST OF FUEL, LUBRICANTS, PARTS, AND LABOR

Fuel, lubricants, parts and labor costs per mile were found to be approximately 4 3/4 cents per mile for the gasoline-powered vehicles and 3 3/4 cents per mile for the diesel pickups. When considering these costs per mile, it is well to remember that these are new pickups, and, in the case of the diesel

pickups, some modifications were necessary. Due to cold weather, modifications such as changing fuel lines and placing heavier duty batteries in the diesel units were necessary. Also, these costs reflect claims which come under the company's warranty of the vehicle. As of March 14, 1977, the warranty claims were \$1,209.24 for the diesel vehicles and \$218.85 for the gasoline vehicles. The primary reason the diesel warranty claims were higher than the gasoline claims was the modification of the fuel distribution system for the diesel.

### 3.4 COMMENTS OF DRIVERS

The comments of the drivers were collected and classified as to the best feature of the vehicle, next best feature, worst feature, and next to worst feature. For the 14 diesel pickups, 11 drivers were interviewed, and for the 14 gasoline pickups, 6 drivers were interviewed. The comments were as follows:

#### DIESEL - 11 INTERVIEWED

##### (1) Best Feature

- 5 - fuel economy
- 2 - handles well on snow and slush
- 1 - doesn't die out in wet weather
- 3 - had no comment

##### (2) Next Best Feature

- 4 - fuel economy
- 2 - rode well
- 1 - no engine flooding
- 4 - had no comment

##### (3) Worst Feature

- 6 - hard steering
- 2 - poor seat - too close to steering wheel
- 2 - poor ride (hard riding)
- 1 - had no comment

(4) Next to Worst Feature

- 3 - seat did not have enough throw for taller person
- 2 - hard starting in the winter
- 2 - box too short (6-ft. box)
- 1 - hard ride
- 1 - noise level too high
- 2 - had no comment

GASOLINE - 6 INTERVIEWED

(1) Best Feature

- 2 - adjustable steering wheel
- 2 - had no comment
- 1 - large fuel tank
- 1 - has enough power

(2) Next Best Feature

- 2 - had enough power
- 2 - had no comment
- 1 - good ride
- 1 - handling

(3) Worst Feature

- 3 - hard steering
- 1 - underpowered
- 1 - hard handling
- 1 - had no comment

(4) Next to Worst Feature

- 2 - hard steering
- 1 - hard ride
- 1 - hard handling
- 2 - had no comment

The most common remark provided by the drivers was that the units should have had power steering.

Generally speaking, the only problem was the fuel line and fuel filter of the diesel pickups, which were not properly designed for subzero weather.

### 3.5 CAPITAL COST OF UNIT

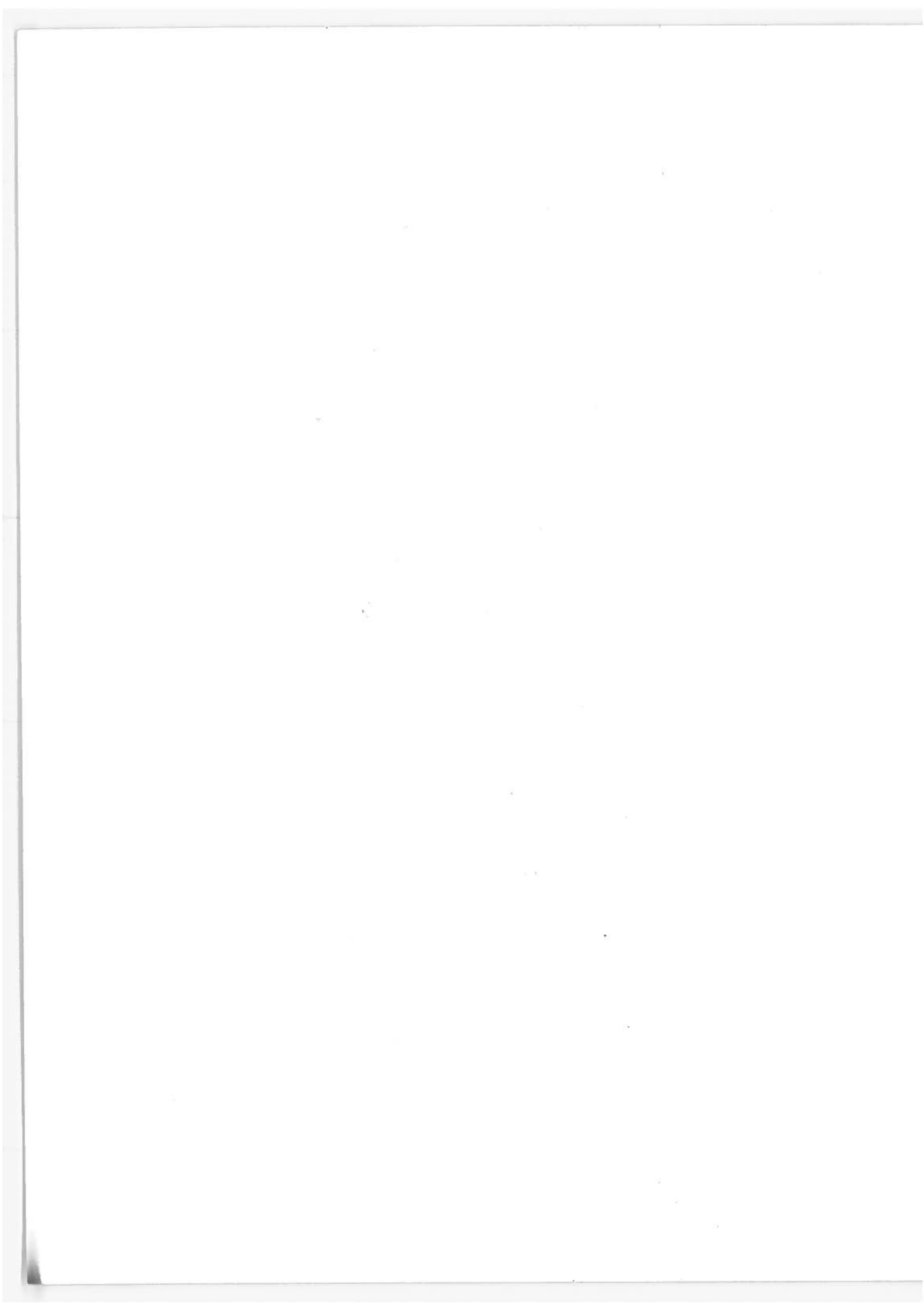
The capital cost difference between the diesel and gasoline pickups was \$1928.70. The gasoline pickups cost \$4628.19 each, the diesels, \$6556.89.

8



#### 4. DISCUSSION OF RESULTS

It should be remembered that this data is preliminary and may be biased in that the time was relatively short and primarily covered winter months. However, it is believed that the data provides a good indication of relative fuel economy in winter operation.



APPENDIX A  
SUPPLEMENTAL DATA

TABLE A-1. INTERNATIONAL HARVESTER CO. SPECIFICATION (SHEET 1)

DIESEL & GASOLINE PICKUPS  
6200 lbs. GVWR, MINIMUM

NOTE: Answer all questions and attach to bid.  
(Please use typewriter for maximum legibility.)

Bidder International Harvester Company - Portland, Maine  
 Make International Model Scout Year 1977  
 Manufacturer's Certified GVWR 6200 lbs.

Chassis wgt., front axle 2032 lbs. Rear Axle 1569 lbs. Total wgt. 4001 lbs. -Diesel  
 Front: 1957 lbs. rear: 1569; Total Weight lbs. - Gas 3526 lbs.

<u>COMPONENT</u>	<u>DIESEL</u>	<u>GASOLINE</u>
<u>1. Engine</u>		
1.1 Make	Nissan	IH
Model	IN - 633	4 - 196
Cubic Inch Displacement	198	196
1.2 Rated hrs:power @ RPM	96 @ 4000	86 @ 3500
1.3 Rated torque @ RPM	137.5 @ 2000	157 @ 2200
Fuel grade octane	-	-
<u>2. Clutch</u>		
2.1 Size	11"	11"
2.2 Type	Angle Link	Angle Link
<u>3. Transmission</u>		
3.1 Make	Warner	Warner
Model	T-19A	T-19A
3.2 Forward speeds	Four	Four
3.3 Type	Synchronesh	Synchronesh
<u>4. Front Axle</u>		
4.1 Make	IH	IH
Model	FA-3	FA-3
Rated capacity	3200#	3200#
Type	"I" Beam	"I" Beam
<u>5. Rear Axle</u>		
5.1 Make	Dana	Dana
5.2 Model	#44	#44
5.3 Type	Semi-Floating	Semi-Floating
5.4 Gear ratio	4.09	4.09

TABLE A-1. CONT'D (SHEET 2)

COMPONENT	DIESEL	GASOLINE
<b>6. Suspension System</b>		
6.1 Spring type, front	Steel Leaf	Steel Leaf
Spring capacity, front	3200	3200
6.2 Spring type, rear	Steel Leaf	Steel Leaf
Spring capacity, rear	3200	3200
6.3 Shock absorbers, front	Heavy-Duty	Heavy-Duty
6.4 Shock absorbers, rear	Heavy-Duty	Heavy-Duty
<b>7. Frame</b>		
Type	Box	Box
Section modulus	1.87 per side	1.87 per side
<b>8. Wheels &amp; Tires</b>		
8.1 Size & Ply tires	HR-78 LR "B"	HR-78 LR "B"
8.2 Mounted spare furnished?	Yes	Yes
8.3 Wheel type	Disc	Disc
8.4 Rim size	6.00 JK	6.00JK
8.5 Wheel covers furnished?	Yes	Yes
<b>9. Steering system</b>		
Manual or power-furnished? See attached letter on options	Manual	Manual
<b>10. Brake System</b>		
Optional power furnished?	Power Brakes furnished	Power Brakes furnished
<b>11. Cooling System</b>		
Optional or standard furnished?	Standard only is available	Standard only is available
<b>12. Electrical System</b>		
12.1 Voltage	12	12
12.2 Alternator capacity	45	37
12.3 Battery capacity	85	55
12.4 Make battery	Prestolite	Prestolite
Model battery	Group 24	Group 24
Maintenance-free type?	Not available at this time	-
12.5 Standard accessories furnished?	Yes	Yes
<b>13. Fuel Tank</b>		
Capacity	19 gallon	19 gallon
Location	rear of body	rear of body
<b>14. Filtration System</b>		
Primary fuel filter type	canister type	in-line
Secondary fuel filter type	in-line, element type	none
Primary Oil filter type	full flow	full flow
Secondary Oil filter type	-	-
Cooling system filter type	None	None
Air inlet filter type	Paper element	Paper element
<b>15. Starting Assist</b>		
Type	Glow plug	None

TABLE A-1. CONT'D (SHEET 3)

COMPONENT	DIESEL	GASOLINE
	Standard	Standard
16. Cab & Body		
16.1 Type Cab	All gauges	All gauges
16.2 Standard instruments?	Std fresh air	Std fresh air
16.3 Heater/defroster optional cap?	4x6	4x6
16.4 Size rearview mirrors	6 feet	6 feet
16.5 Size pickup body		
17. Color	White cab top w/ #6772 Glacier Blue	Dark Brown Cab top w/ #6772 Glacier Blue
17.1 Color chart included w/bid?	Yes	Yes
	Balance of unit See attached letter	
18. Manuals:		
18.1 No. Shop Manuals furnished	8	8
18.2 No. Parts Books furnished	8	8
18.3 No. Operator's Manuals furnished	30	30
19. Legal Compliance		
19.1 Vehicle complies w/Federal laws?	Yes	Yes
Vehicle complies w/State of Maine laws?	Yes	Yes
20. Delivery & Final Inspection		
20.1 Vehicles completely serviced?	Yes	Yes
Tires balanced?	Yes	Yes
Steering geometry checked?	Yes	Yes
Documented proof of services performed furnished at delivery?	Yes	Yes
<u>APPLICABLE WARRANTIES</u>	12 months, unlimited mileage	12 months - 12,000 miles whichever comes first
(a) Engine		
(b) Transmission 12 mos. 12000 miles, whichever is first	" " " "	" " " "
(c) Front Axle " " " "	" " " "	" " " "
(d) Rear Axle " " " "	" " " "	" " " "
(e) Electrical System " " " "	" " " "	" " " "
(f) Injection System 12 months, unlimited mileage	-	-
(g) Steering System 12 months, 12000 miles whichever is first	" " " "	" " " "
(h) Brake System " " " "	" " " "	" " " "
	Please note attached warranty	
<u>FUEL CONSUMPTION</u>		
Approximate MPG at normal speed and usage.	Estimate only: 22-28	16- 20

Date: August 9, 1976 Signed: International Harvester Co. - Portland  
 Signature of person authorized to sign bid: R. F. Carmichael  
 R. F. Carmichael  
 Fleet Account Executive

RFV/NTS  
7/15/76

TABLE A-2. INSPECTION, LUBRICATION AND MAINTENANCE SCHEDULE, GASOLINE ENGINE (SHEET 1)

Equipment: IHC Scout II      Type: 1/2 Ton Pickup      Model: Scout Terra Gasoline Engine

KEEP YOUR EQUIPMENT CLEAN

INTERVAL	ITEM	SERVICES TO BE PERFORMED BY DRIVER	LUBRICANT
DAILY	1	Check engine oil level.	15W-40
	2	Check coolant level.	Antifreeze
	3	Check windshield washer fluid level.	Washer fluid
	4	Visual inspection of battery, terminals, cables, and fan belt(s).	
	5	Visual inspection of tires for under-inflation, cuts and/or bruises.	
	6	Check & clean all lights & cab glass.	
	7	Check all instruments & gauges.	
	8	Report all defects and/or malfunctions to Serviceman or MTS Garage.	
INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
EACH 3000 MILES	9	Change engine oil.	15W-40
	10	Check electrolyte level in battery.	
	11	Check fluid level in brake master cylinder.	Brake Fluid "DOT3"
	12	Check lubricant level in transmission	#90 Gear oil
	13	Check lubricant level in rear differential.	#90 Gear oil
	14	Lubricate clutch pedal relay & release fork shaft.	MP Grease
	15	Lubricate propeller shaft slip joint.	MP Grease
	16	Lubricate drag link ends.	MP Grease
	17	Check tire pressures w/gauge 28 lbs.	
	18	Check operation of all lights.	
	19	Check state inspection sticker date.	
INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
EACH 6000 MILES		<u>Perform the 3000 mile inspection &amp; services</u>	
	20	Change engine oil filter.	
	21	Clean air cleaner.	
	22	Check lubricant level in steering gear box.	#90 Gear oil
	23	Lubricate manifold heat control valve.	Penetrating oil
	24	Lubricate accelerator linkage	Engine oil
	25	Lubricate hood catch & hinges	Engine oil
	26	Lubricate door check & door hinges	Engine oil
	27	Lubricate door latch & striker plate	Stick lubricant
	28	Lubricate door lock cylinders	Lock oil

TABLE A-2. CONT'D (SHEET 2)

INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
EACH 17,000 MILES		<u>Perform the 6000 mile inspection &amp; services</u>	
	29	Replace air cleaner.	
	30	Replace fuel filter.	
	31	Replace crankcase ventilation valve & service ventilation system.	
	32	Tune up engine: (a) Clean & re-gap spark plugs (replace if required) (b) Check & adjust ignition timing. (c) Check ignition wiring, dist. cap, etc. (d) Adjust carb. idle mixture. (e) Check choke operation. (f) Check operation of emission control system. (g) Check radiator pressure cap.	
INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
EACH 18,000 MILES		<u>Perform the 6000 mile inspection &amp; services</u>	
	33	Change lubricant in transmission. Cap. 7 pts.	#90 Gear oil
	34	Lubricate brake linkage	Engine oil
	35	Lubricate clutch release fork.	MP Grease
INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
EACH 24,000 MILES		<u>Perform the 12000 mile inspection &amp; services</u>	
	36	Change lubricant in rear differential. Cap. 3pts.	#90 Gear oil
	37	Check & repack front wheel bearings.	MP Grease
	38	Lubricate seat adjuster slides.	MP Grease
	39	Repack propeller shaft U-joints without fittings.	MP Grease
INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
EACH 48,000 MILES	40	<u>Perform the 24,000 mile inspection &amp; services</u> Repack rear wheel bearings.	MP Grease

TABLE A-3. INSPECTION, LUBRICATION AND MAINTENANCE SCHEDULE, DIESEL ENGINE (SHEET 1)

Equipment: IHC Scout II Type: 1/2 Ton Pickup Model: Scout Terra Diesel Engine

KEEP YOUR EQUIPMENT CLEAN

INTERVAL	ITEM	SERVICES TO BE PERFORMED BY DRIVER	LUBRICANT
DAILY	1	Check engine oil level.	15 W-40 Antifreeze Washer fluid
	2	Check coolant level.	
	3	Check windshield washer fluid level	
	4	Visual inspection of battery, terminals, cables and fan belt(s).	
	5	Visual inspection of tires for under-inflation cuts and/or bruises.	
	6	Check & clean all lights & cab glass.	
	7	Check all instruments and gauges.	
	8	With engine at normal operating temperature, observe color of exhaust gases from tailpipe. (Excessive white or black smoke conditions should be reported)	
	9	Report all defects and/or malfunctions to Serviceman or MTS Garage,.....	
INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
FIRST 2500 MILES	10	Replace primary fuel filter element.	
	11	Replace secondary fuel filter element.	
	12	Clean fuel strainer,.....	
INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
EACH 3000 MILES	13	Change engine oil. Cap. 10 qts. - 11 qts. w/filter	15 W-40  Brake fluid "DOT 3" #90 Gear oil #90 Gear oil  MP Grease MP Grease MP Grease
	14	Clean air filter element.	
	15	Check electrolyte level in battery.	
	16	Check fluid level in brake master cylinder.	
	17	Check lubricant level in transmission.	
	18	Check lubricant level in rear differential	
	19	Lubricate clutch pedal relay & release fork shaft.	
	20	Lubricate propeller shaft slip joint.	
	21	Lubricate drag link ends.	
	22	Check tire pressure w/gauge. 28 lbs.	
	23	Check operation of all lights.	
	24	Check state inspection sticker date.	
NOTE: Check valve lash & adjust if necessary at <u>First</u> 3000 miles.			



TABLE A-3. CONT'D (SHEET 2)

INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
EACH 5000 MILES		<u>Perform the 3000 mile inspection &amp; services</u>	
	25	Change engine oil filter.	
	26	Check lubricant level in steering box.	#90 Gear Oil
	27	Lubricate accelerator linkage.	Engine oil
	28	Lubricate hood catch & hinges.	Engine oil
	29	Lubricate door check & door hinges.	Engine oil
	30	Lubricate door latch & striker plate..	Stick lubricant
31	Lubricate door lock cylinders.	Lock oil	
INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
EACH 12000 MILES		<u>Perform the 6000 mile inspection &amp; services</u>	
	32	Replace air cleaner element.	
	33	Replace primary fuel filter element.	
	34	Replace secondary fuel filter element.	
	35	Clean fuel strainer.	
	36	Check valve lash and adjust if necessary.	
	37	Check radiator pressure cap.	
INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
EACH 18000 MILES		<u>Perform the 6000 mile inspection &amp; services</u>	
	38	Change lubricant in transmission. Cap 7 pts.	#90 Gear oil
	39	Lubricate brake linkage.	Engine oil
	40	Lubricate clutch release fork.	MP Grease
INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
EACH 24000 MILES		<u>Perform the 12000 mile inspection &amp; services</u>	
	41	Change lubricant in rear differential. Cap. 3pts.	#90 Gear oil
	42	Check & repack front wheel bearings	MP Grease
	43	Lubricate seat adjuster slides	MP Grease
	44	Repack propeller shaft U-joints without fittings	MP Grease
INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
EACH 36000 MILES	45	Check Fuel injection pump timing, adjust if required.	
	46	Check engine idle speed, adjust if required..	
	47	Check engine no load speed, adjust if required.	
INTERVAL	ITEM	SERVICES TO BE PERFORMED BY MTS	LUBRICANT
EACH 48000 MILES		<u>Perform the 24000 mile inspection &amp; services</u>	
	48	Repack rear wheel bearings.	

TABLE A-4. QUESTIONNAIRE FORM

DIESEL & GASOLINE PICKUPS FUEL USE

EQUIPMENT NO. \_\_\_\_\_ DATE \_\_\_\_\_

FUEL TYPE \_\_\_\_\_ LOCATION \_\_\_\_\_

DIESEL  DIVISION \_\_\_\_\_

GAS.

NUMBER OF MILES \_\_\_\_\_

NUMBER OF HOURS \_\_\_\_\_

BEST FEATURE \_\_\_\_\_

NEXT BEST FEATURE \_\_\_\_\_

WORST FEATURE \_\_\_\_\_

NEXT TO WORST FEATURE \_\_\_\_\_

WHAT IMPROVEMENT SHOULD BE MADE \_\_\_\_\_

\_\_\_\_\_

WHAT REPAIRS OR MODIFICATIONS HAVE BEEN MADE \_\_\_\_\_

\_\_\_\_\_

REMARKS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## APPENDIX B

### REPORT OF INVENTIONS

This report provides a brief energy and cost comparison between diesel and gasoline pickup trucks. Although no innovations, discoveries or inventions have accrued, it is believed this report substantially improves the data base for comparison of diesel and gasoline engines in light-duty trucks.

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