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OCTANE REQUIREMENT INCREASE OF 1978 AND 1979 MODEL CARS.(U)
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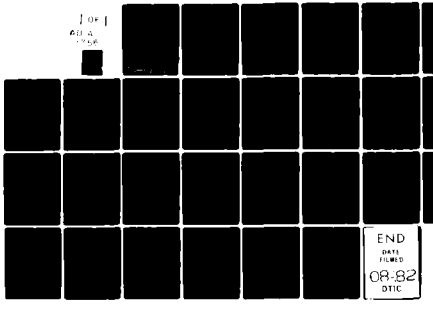

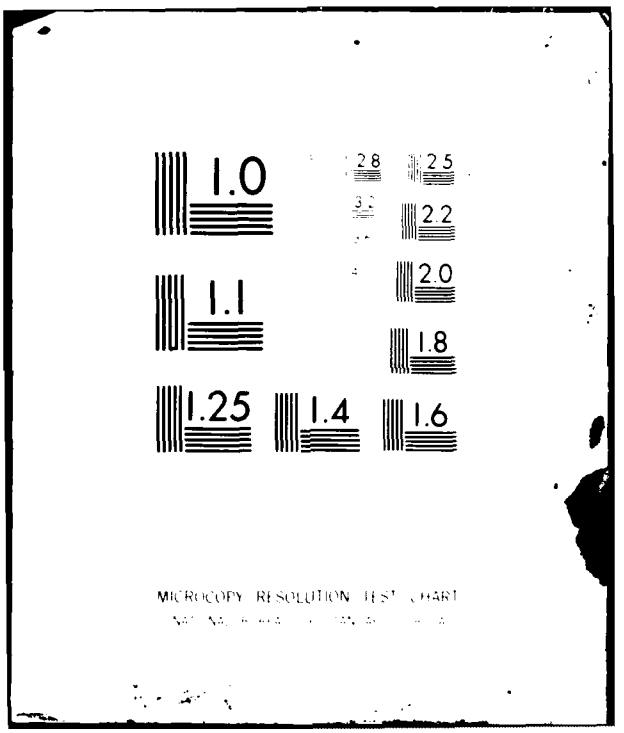
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MICROCOPY RESOLUTION TEST CHART

(12)

CRC Report No. 526

OCTANE REQUIREMENT INCREASE OF 1978 AND 1979 MODEL CARS

Contract DAAK-70-81-C-0128

April 1982

COORDINATING RESEARCH COUNCIL, INC.
219 PERIMETER CENTER PARKWAY, ATLANTA, GEORGIA 30346

COORDINATING RESEARCH COUNCIL
INCORPORATED
219 PERIMETER CENTER PARKWAY
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(404) 396-3400

SUSTAINING MEMBERS
American Petroleum Institute
Society of Automotive Engineers, Inc.

June 30, 1982

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Gentlemen:

In accordance with the requirements stated in Contract Number DAAK70-81-C-0128, enclosed are 12 copies of the following report, which has been approved by the appropriate CRC Committee for transmittal to the Military and release for publication and general distribution by the Sustaining Members:

OCTANE REQUIREMENT INCREASE OF 1978 AND 1979 MODEL CARS (CRC Report No. 526)

Sincerely,

Beth Evan

Beth Evan
Editor

BE:sb

Enclosures

(12)

COORDINATING RESEARCH COUNCIL
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OCTANE REQUIREMENT INCREASE OF 1978 AND 1979 MODEL CARS

(CRC Project No. CM-124-78/79)

Prepared by the

1978/1979 Octane Requirement Increase Analysis Panel

of the

CRC Light-Duty Road Test Group

September 1981

Revised: April 1982

CRC Light-Duty Vehicle Fuel, Lubricant, and Equipment Research Committee

of the

Coordinating Research Council, Inc.

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I. SUMMARY

- Octane requirement increase (ORI) was determined for ninety-two 1978 and one-hundred-nine 1979 model cars operated on unleaded gasoline. All ORI values were determined from the increase in maximum octane requirements irrespective of whether requirements were obtained at full- or part-throttle.

- At 15,000 miles, the mean ORI for all cars with full boiling range unleaded (FBRU) fuels was:

1978 Program (92 cars)	6.0 RON and 4.3 MON
1979 Program (109 cars)	5.4 RON and 3.6 MON

- At 15,000 miles, the mean ORI for all cars with primary reference fuels (PRF) was:

1978 Program	4.2 ON
1979 Program	4.1 ON

- Compared with 1977 models (173 cars), the mean ORI for all cars with FBRU fuels was:

1978 Program	1.1 RON higher and 0.7 MON higher
1979 Program	0.5 RON higher and Not changed on a MON basis

- In general, the mean ORI with FBRU fuels has not changed significantly from the 1975 through 1979 model cars.

- There was no apparent relationship between initial octane requirements and ORI at 15,000 miles for either 1978 or 1979 model cars.

II. INTRODUCTION

The need to study octane requirement increase (ORI) with unleaded fuel became evident in 1970 when manufacturers announced that cars would require catalytic converters and use unleaded gasoline of at least 91 RON quality to meet future emission standards. Since that time, manufacturers have made many engine modifications to meet both exhaust emission and fuel economy standards. Because these engine design changes and the use of unleaded fuel might significantly affect ORI, the Road Test Group of the Coordinating Research Council, Inc. (CRC) initiated a series of ORI programs in 1971.

The ORI data from 1971 and 1973 through 1977 model cars have been reported previously[1,2,3,4,5,6]. This report will summarize ORI data for 1978 and 1979 model cars.

III. EXPERIMENTAL

A. Cars Tested

In the 1978 program, ninety U.S. and two imported cars were used to determine the ORI of 1978 model cars. In a similar program, one-hundred-nine U.S. cars were used to determine the ORI of 1979 model cars. Cars tested were not selected to represent the distribution of vehicles produced in that model year; rather the data base consists of information volunteered by participants. For both programs, data on cars that did not complete 15,000 miles of testing were excluded from the analyses. Participating laboratories are listed in Appendix A.

B. Mileage Accumulation

All test cars were operated in customer-type service using unleaded fuels typical of commercially available gasoline.

C. Unleaded Full-Boiling Range Reference Fuels (FBRU)

In general, octane number requirements of 1978 model cars were defined initially with 1977 FBRU fuels. As mileage increased, the reference fuels were replaced with the 1978 FBRU fuels. The RON-to-MON conversions used in the data analysis for 1978 cars are shown in Appendix C, Tables C-I and C-II.

The octane number requirements of 1979 model cars were defined initially with 1978 FBRU reference fuels. As mileage increased, the reference fuels were replaced with the 1979 FBRU fuels. The RON-to-MON conversions used in the data analysis are shown in Appendix C, Tables C-II and C-III.

D. Primary Reference (PR) Fuels

Standard ASTM PR fuels were used in one octane number increments sufficient to cover the range of car requirements.

E. Test Technique

Octane number requirements were determined at incremental mileages from zero to 15,000 miles by the 1978 and 1979 CRC E-15 technique. Maximum octane number requirements were determined with both FBRU and PR fuels.

IV. DISCUSSION OF RESULTS

A. Data Analyses Method

Octane requirements were to be obtained at initial, 5,000, 10,000, and 15,000 mileage points. Only data from cars that had octane requirement determinations at essentially zero mileage and over a range of at least 14,000 or more miles were included in these analyses. Octane requirements were plotted at the mileage at which they were obtained, and a smooth curve was fitted to the data. Octane requirements at initial, 5,000, 10,000, and 15,000 miles were then determined from the best fit curves for each car. (The raw data are on file at the CRC office.)

Octane requirement increase (ORI) values for each car were determined by subtracting the initial maximum octane requirement from curve values for maximum requirements at each mileage increment.

Initial requirements and ORI data for each car are listed in Appendix D, Table D-I for the 1978 cars, and Table D-II for the 1979 cars.

Distribution of initial RON requirements and RON ORI values for each mileage interval on FBRU and PR fuels are summarized in Tables I and II for the 1978 and 1979 cars, respectively. Similar distributions for MON are summarized in Tables III and IV.

The distribution of 1978 and 1979 initial RON requirements are plotted in Figure 1. Distribution of ORI values at the various mileage increments are plotted in Figures 2 and 3 for the 1978 and 1979 cars, respectively. The ORI distribution for three manufacturers of 1978 model cars are shown in Figures 4, 6, and 8 for FBRU fuels, and in Figures 5, 7, and 9 for PR fuels. Similar 1979 model data are shown in Figures 10 through 15. Members of the Analysis Panel are listed in Appendix B.

B. Comparison of 1975 through 1979 ORI Studies

The mean ORI values for 1975 through 1979 model cars are:

Model Year	Accumulated Miles	Mean ORI	
		FBRU RON	PRF
1975	16,000	5.8	4.4
1976	15,000	5.4	3.6
1977	15,000	4.9	2.3
1978	15,000	6.0	4.2
1979	15,000	5.4	4.1

Except for the 1977 model PR fuel data, the mean ORI value has not changed significantly from 1975 to 1979.

C. ORI Versus Initial Octane Requirements

Initial RON requirements are plotted against ORI at 15,000 miles in Figures 16 and 17 for 1978 and 1979 cars, respectively. No significant trend between initial requirements and ORI was apparent.

REFERENCES

CITED REFERENCES

1. Coordinating Research Council, "Influence of Leaded and Unleaded Fuels on Octane Requirement Increase in 1971 Model Cars," CRC Report No. 445, March, 1971.

2. Coordinating Research Council, "Octane Requirement Increase in 1973 Model Cars," CRC Report No. 476, February, 1975.

3. Coordinating Research Council, "Octane Requirement Increase in 1974 Model Cars," CRC Report No. 485, June, 1976.

4. Coordinating Research Council, "Octane Requirement Increase in 1975 Model Cars," CRC Report No. 498, July, 1978.

5. Octane Requirement Increase in 1976 Model Cars, CRC Road Test Group Informal Study by J. D. Rogers, Jr., October, 1979.

6. Coordinating Research Council, "Octane Requirement Increase in 1977 Model Cars," CRC Report No. 513, April, 1980.

7. Coordinating Research Council, "1978 CRC Octane Number Requirement Survey," CRC Report No. 508, August, 1979.

8. Coordinating Research Council, "1979 CRC Octane Number Requirement Survey," CRC Report No. 515, April, 1980.

TABLES

AND

FIGURES

TABLE I

RESEARCH OCTANE NUMBER INITIAL REQUIREMENTS AND OCTANE REQUIREMENT INCREASES

1978 MODEL CARS

Group	No. Cars	Full-Boiling Range Unleaded Fuels								Primary Reference Fuels							
		Initial Requirement		5,000 Mile ORI		10,000 Mile ORI		15,000 Mile ORI		Initial Requirement		5,000 Mile ORI		10,000 Mile ORI		15,000 Mile ORI	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
All Cars	92	87.7	3.7	3.6	1.4	5.1	1.6	6.0	1.9	86.4	3.2	2.7	1.4	3.7	1.8	4.2	2.0
All Manufacturer A	12	89.6	2.9	4.1	1.5	5.3	1.7	5.8	1.7	88.0	3.1	3.2	1.8	4.1	2.0	4.3	1.9
All Manufacturer B	8	88.8	3.3	3.7	1.4	5.9	1.9	7.0	2.5	86.3	4.4	2.9	1.1	4.8	2.2	5.8	2.9
All Manufacturer C	70	87.4	3.9	3.5	1.4	5.0	1.5	5.9	1.9	86.2	3.1	2.6	1.4	3.5	1.7	4.0	1.8
All Engine A230	5	92.2	1.5	2.9	0.9	4.2	1.5	4.9	2.1	90.6	1.8	1.9	0.7	2.6	0.8	2.8	0.9
All Engine C215	5	87.2	3.1	4.1	1.5	6.0	1.3	6.9	0.9	85.6	2.3	2.6	2.1	3.9	2.5	4.2	2.4
All Engine C220	7	89.3	1.3	3.3	1.7	4.3	2.1	4.7	2.1	88.6	1.1	2.1	1.0	2.7	1.3	3.0	1.4
All Engine C223	15	89.1	4.6	3.5	1.2	4.8	1.5	5.5	2.1	87.6	3.8	2.7	1.0	3.7	1.3	4.2	1.8
All Engine C230	5	90.8	2.6	2.9	1.0	4.5	1.0	5.2	0.9	88.8	0.4	2.1	1.6	3.1	2.1	3.5	2.4
All Engine C231	12	85.3	2.4	3.3	1.6	4.8	1.6	5.9	1.6	84.8	1.9	2.8	1.2	3.9	1.5	4.8	1.2
All Engine C435	8	85.4	3.5	4.5	0.8	6.3	0.7	7.2	1.7	84.3	2.3	2.7	1.4	3.8	1.7	4.2	1.9
All Engine C440	6	89.3	1.6	3.0	1.2	4.9	1.5	6.2	1.9	87.6	0.8	1.6	1.2	2.2	1.4	2.5	1.5

TABLE II

RESEARCH OCTANE NUMBER INITIAL REQUIREMENTS AND OCTANE REQUIREMENT INCREASES

1979 MODEL CARS

		Full-Boiling Range Unleaded Fuels								Primary Reference Fuels							
		Initial Requirement		5,000 Mile ORI		10,000 Mile ORI		15,000 Mile ORI		Initial Requirement		5,000 Mile ORI		10,000 Mile ORI		15,000 Mile ORI	
Group	No. Cars	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
All Cars	109	88.4	3.4	3.6	1.9	4.8	2.3	5.4	2.6	86.9	2.8	2.7	1.6	3.6	2.1	4.1	2.4
All Manufacturer A	36	89.0	2.7	3.7	1.7	5.0	2.1	5.6	2.3	87.6	2.5	2.9	1.4	3.9	1.9	4.4	2.2
All Manufacturer B	13	87.8	3.5	3.4	2.3	4.3	2.9	4.6	3.1	86.1	3.5	2.7	1.9	3.5	2.5	3.9	2.6
All Manufacturer C	59	88.4	3.5	3.6	1.9	4.8	2.3	5.4	2.5	86.7	2.5	2.5	1.6	3.4	2.1	3.9	2.4
All Engine A120	5	88.6	3.6	4.5	1.7	5.9	1.9	6.4	1.8	87.1	2.8	3.3	1.2	4.5	1.4	5.0	1.5
All Engine A214	7	89.4	2.8	2.9	1.1	4.0	1.3	4.5	1.5	87.8	3.8	2.5	1.9	3.6	2.5	4.0	3.0
All Engine A230	18	88.7	2.7	3.9	1.9	5.3	2.3	6.1	2.7	87.6	2.1	3.0	1.5	4.1	2.0	4.5	2.3
All Engine A235	6	89.7	2.6	3.1	1.6	4.3	1.9	4.8	2.0	88.0	2.2	2.6	0.9	3.4	1.3	4.0	1.4
All Engine B231	10	88.9	2.5	3.1	2.4	3.8	2.6	4.1	2.7	87.4	1.8	2.6	1.9	3.4	2.4	3.8	2.5
All Engine C223	13	87.4	1.7	4.8	1.8	5.9	2.0	6.6	2.1	86.5	0.6	3.1	1.4	3.9	1.5	4.3	1.7
All Engine C226	11	84.6	2.5	3.5	1.9	4.4	2.3	4.9	2.4	84.0	2.3	2.7	1.8	3.4	2.4	3.9	2.5
All Engine C230	10	90.3	2.1	3.5	1.9	5.2	2.5	6.3	2.8	87.9	1.8	2.2	1.6	3.7	2.9	4.4	3.8
All Engine C231	12	88.0	2.8	3.4	1.8	4.4	2.1	4.9	2.3	87.1	2.5	2.2	1.6	3.0	1.9	3.3	2.0

TABLE III

MOTOR OCTANE NUMBER INITIAL REQUIREMENTS
AND OCTANE REQUIREMENT INCREASES

1978 MODEL CARS

Group	No. Cars	Full-Boiling Range Unleaded Fuels							
		Initial Requirement		5,000 Mile ORI		10,000 Mile ORI		15,000 Mile ORI	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
All Cars	92	80.6	2.8	2.7	1.0	3.9	1.2	4.3	2.3
All Manufacturer A	12	82.0	2.1	3.1	1.0	4.1	1.2	4.4	1.4
All Manufacturer B	8	80.6	2.5	2.8	1.1	4.4	1.4	5.2	1.9
All Manufacturer C	70	80.4	2.9	2.6	1.0	3.8	1.1	4.2	2.5
All Engine A230	5	83.8	1.2	2.4	0.8	3.4	1.4	3.9	1.8
All Engine C215	5	80.2	2.2	3.0	1.0	4.5	0.8	5.2	0.6
All Engine C220	7	81.7	1.3	2.5	1.3	3.2	1.6	3.6	1.6
All Engine C223	15	81.7	3.6	2.5	0.8	3.6	1.1	4.1	1.6
All Engine C230	5	82.9	1.9	2.2	0.7	3.5	0.8	4.0	0.8
All Engine C231	12	78.8	1.8	2.4	1.8	3.6	2.5	4.3	2.4
All Engine C435	8	78.8	2.6	3.4	0.6	4.7	0.7	5.4	1.6
All Engine C440	6	81.8	1.2	2.2	0.9	3.8	1.2	4.8	1.5

TABLE IV

MOTOR OCTANE NUMBER INITIAL REQUIREMENTS
AND OCTANE REQUIREMENT INCREASES

1979 MODEL CARS

Group	No. Cars	Full-Boiling Range Unleaded Fuels							
		Initial Requirement		5,000 Mile ORI		10,000 Mile ORI		15,000 Mile ORI	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
All Cars	109	81.0	2.3	2.5	1.3	3.2	1.6	3.6	1.8
All Manufacturer A	36	81.4	1.8	2.5	1.2	3.3	1.5	3.7	1.6
All Manufacturer B	13	80.6	2.4	2.3	1.6	2.8	2.1	3.0	2.2
All Manufacturer C	59	81.0	2.4	2.4	1.3	3.2	1.6	3.5	1.6
All Engine A120	5	81.2	2.4	2.9	1.4	3.8	1.5	4.2	1.4
All Engine A214	7	81.7	1.8	2.0	0.7	2.5	0.9	2.8	0.8
All Engine A230	18	81.2	1.8	2.7	1.3	3.6	1.6	4.1	1.9
All Engine A235	6	81.9	1.7	2.0	1.1	2.7	1.4	3.0	1.3
All Engine B231	10	81.3	1.6	2.1	1.5	2.5	1.7	2.7	1.7
All Engine C223	13	80.4	1.0	3.1	1.2	3.9	1.3	4.0	1.4
All Engine C226	11	78.4	1.8	2.4	1.4	3.0	1.6	3.3	1.6
All Engine C230	10	82.3	1.4	2.4	1.4	3.8	2.0	4.4	2.0
All Engine C231	12	80.8	1.9	2.3	1.2	2.9	1.4	3.1	1.5

FIGURE 1

DISTRIBUTION OF INITIAL RON
REQUIREMENTS AT LOW MILEAGES

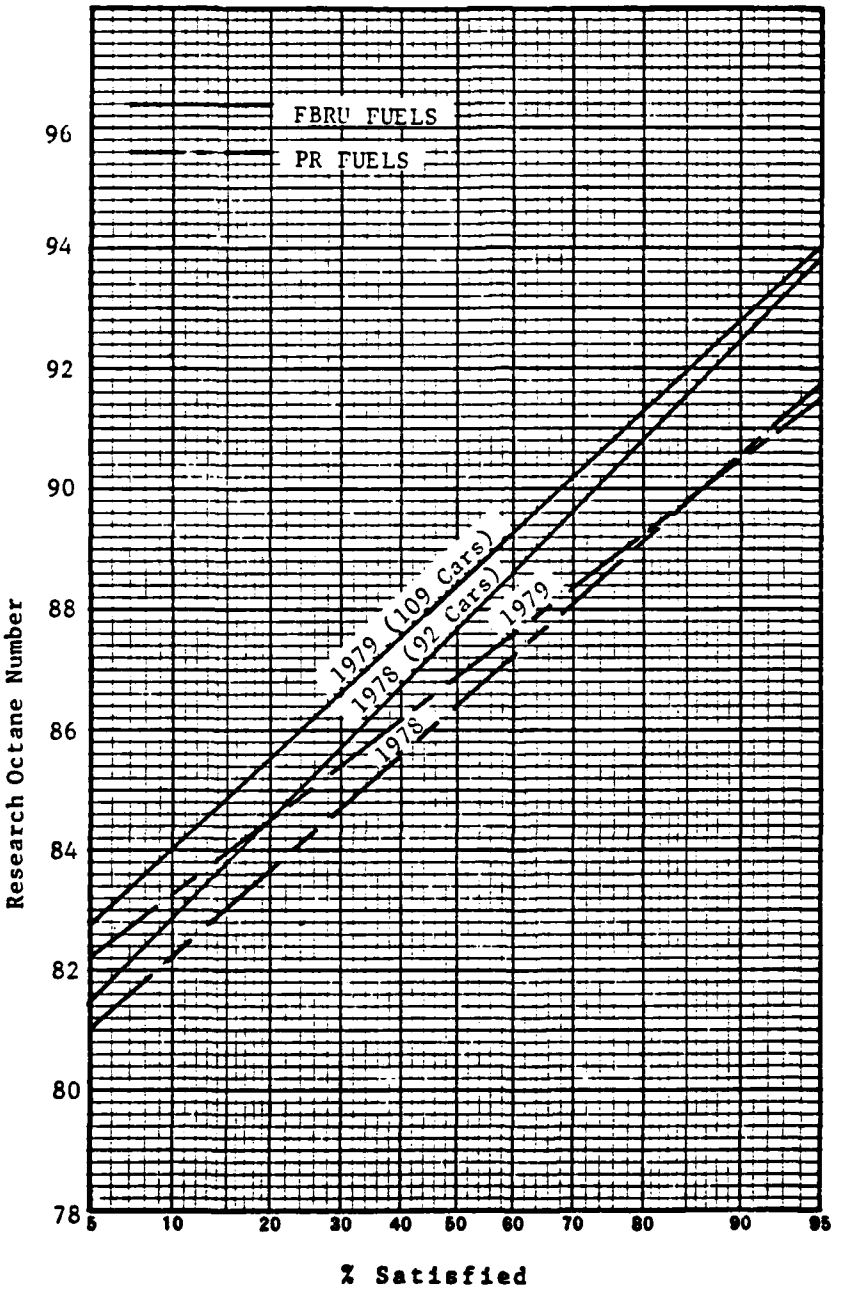


FIGURE 2

DISTRIBUTION OF RON ORI
FOR 1978 MODELS
AT VARIOUS MILEAGES (92 CARS)

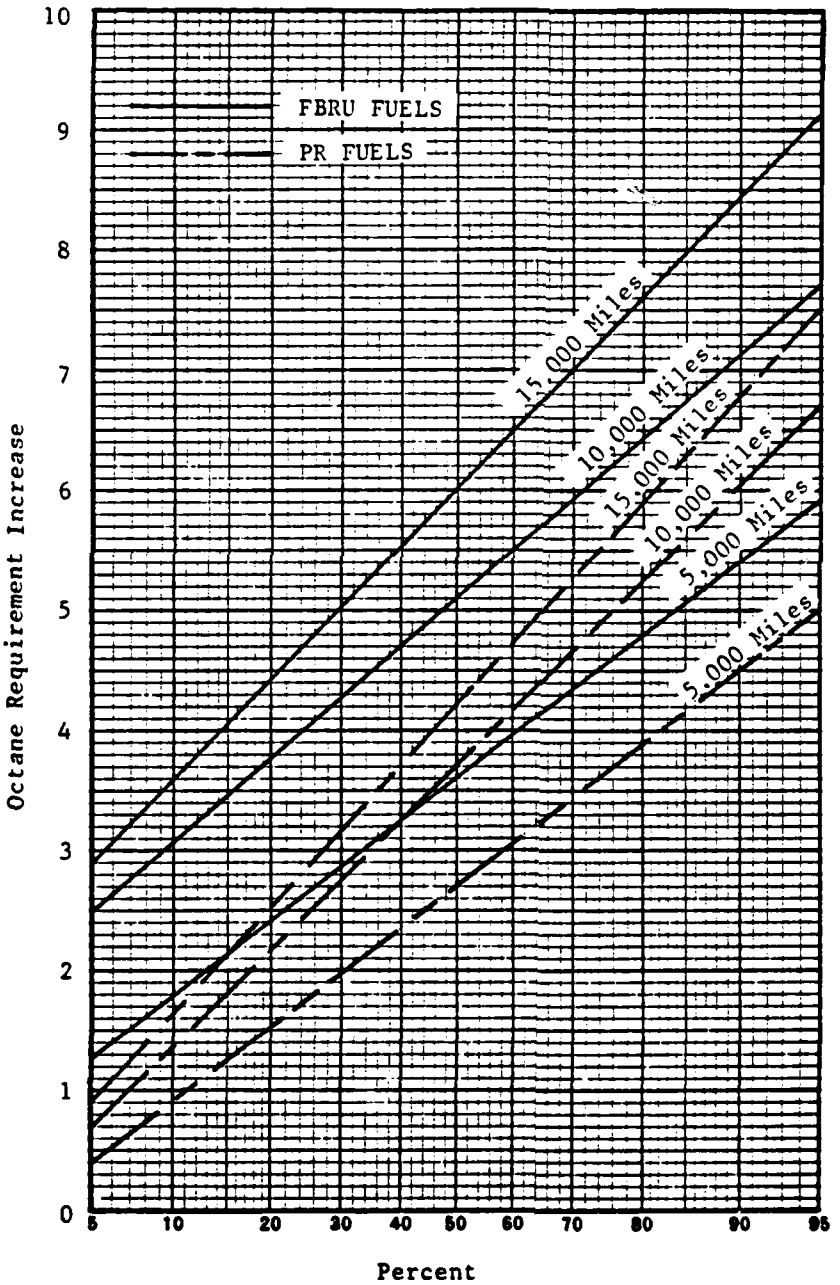


FIGURE 3

DISTRIBUTION OF RON ORI
FOR 1979 MODELS
AT VARIOUS MILEAGES (109 CARS)

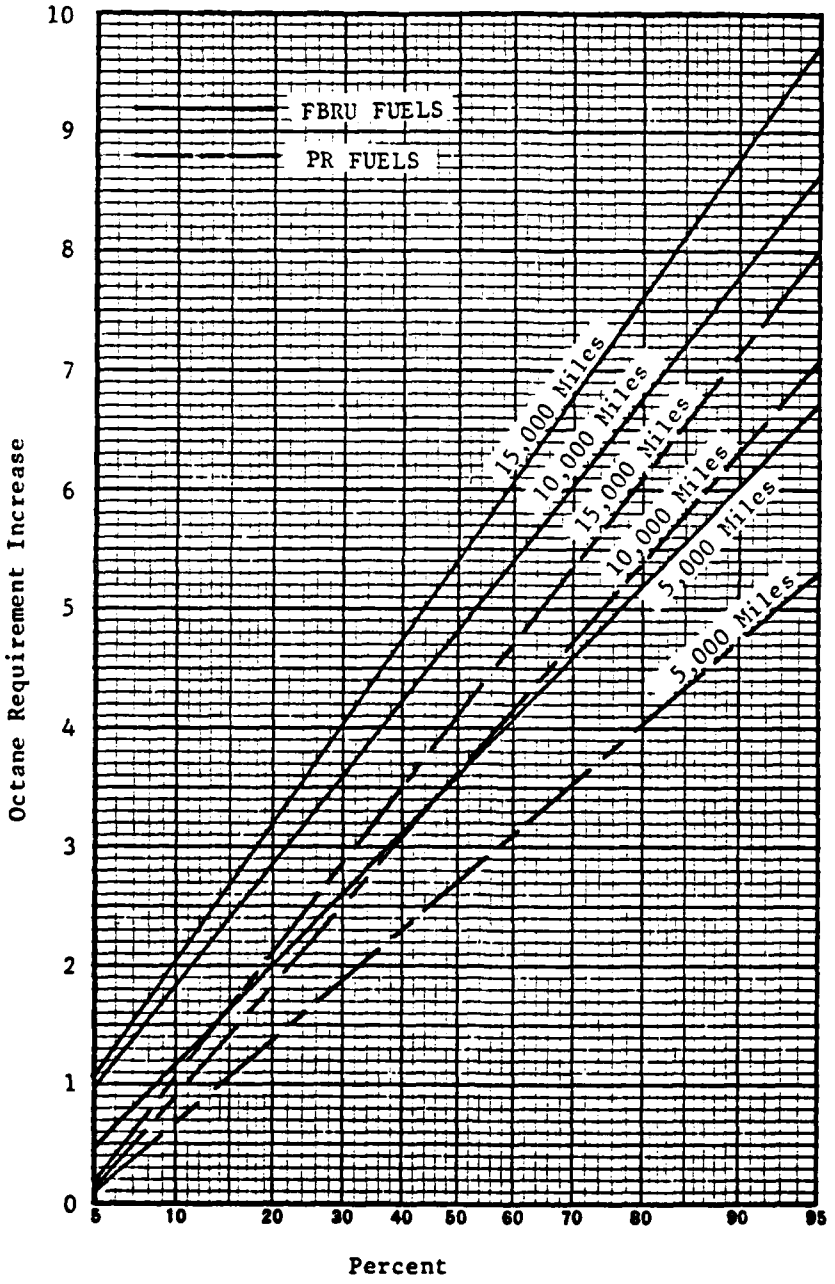


FIGURE 4

RON ORI AT VARIOUS MILEAGES, FBRU,
1978 CARS, MANUFACTURER "A"

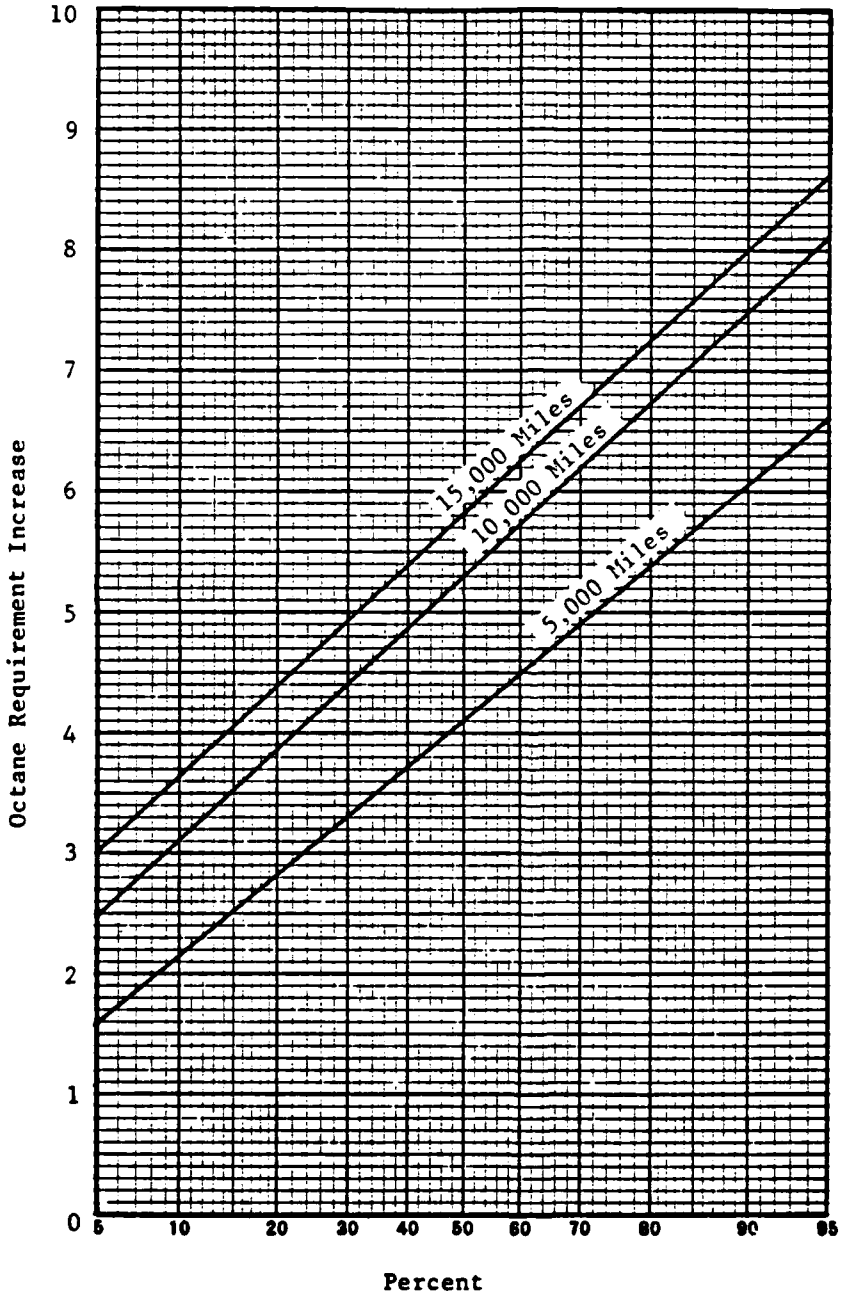


FIGURE 5

ORI AT VARIOUS MILEAGES, PRF,
1978 CARS, MANUFACTURER "A"

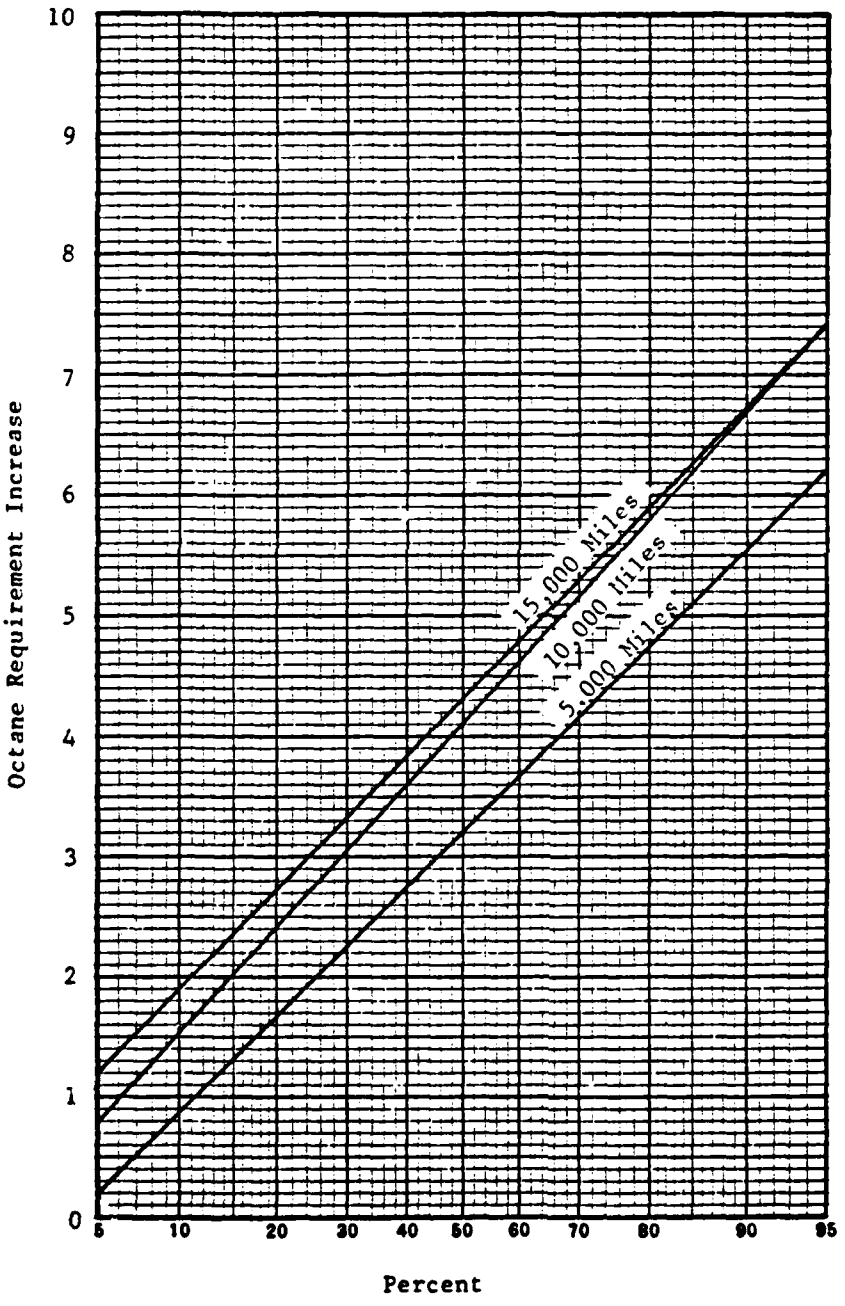


FIGURE 6

RON ORI AT VARIOUS MILEAGES, FBRU,
1978 CARS, MANUFACTURER "B"

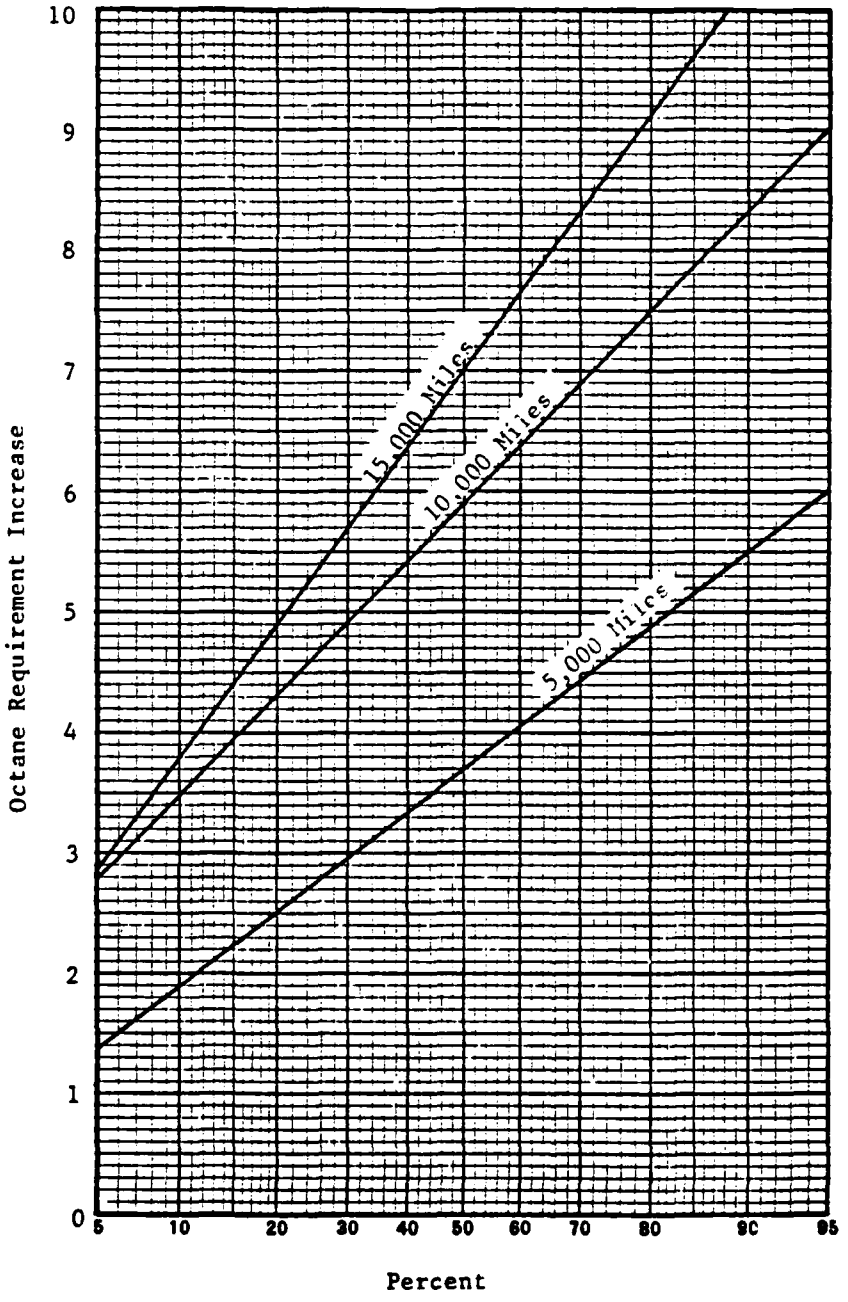


FIGURE 7

ORI AT VARIOUS MILEAGES, PRF, 1978
CARS, MANUFACTURER "B"

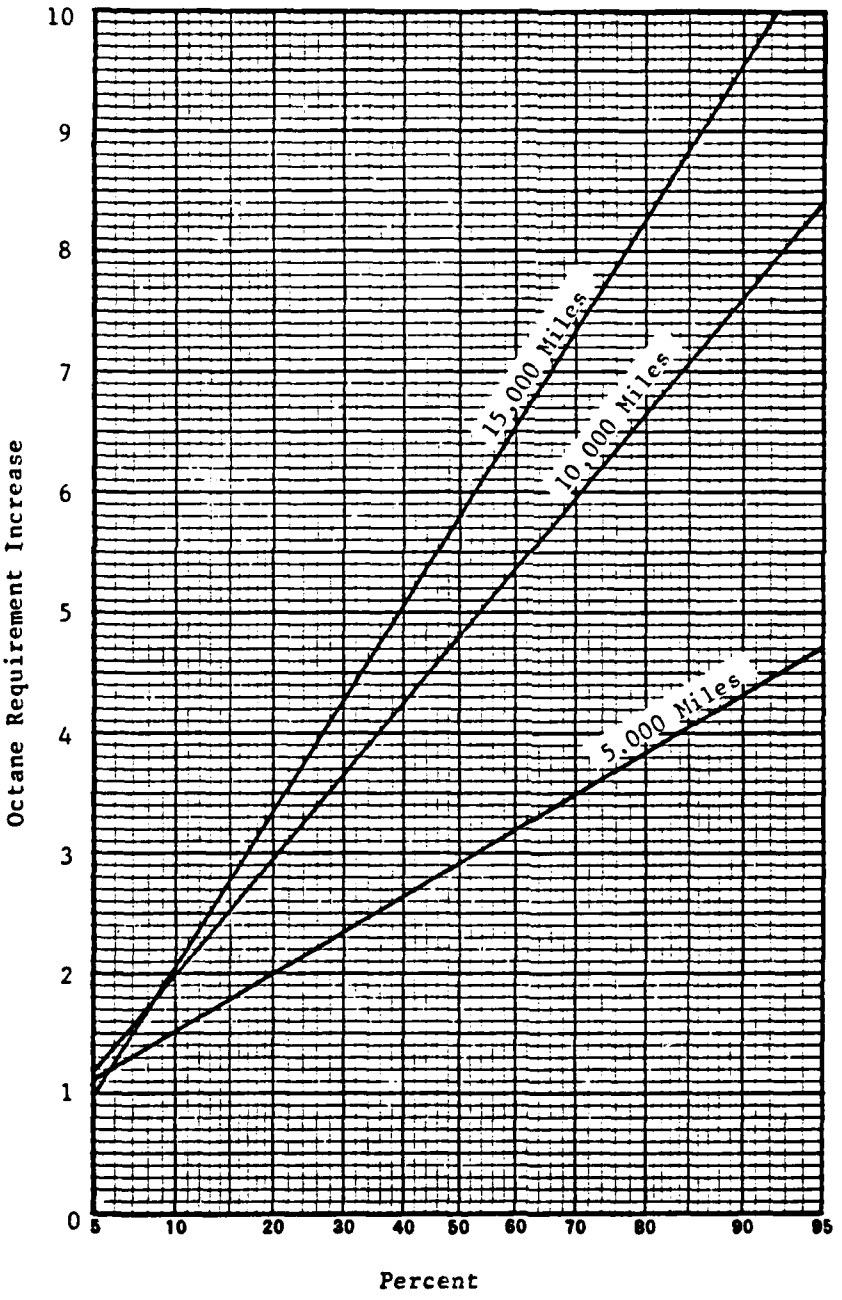


FIGURE 8

RON ORI AT VARIOUS MILEAGES, FBRU,
1978 CARS, MANUFACTURER"C"

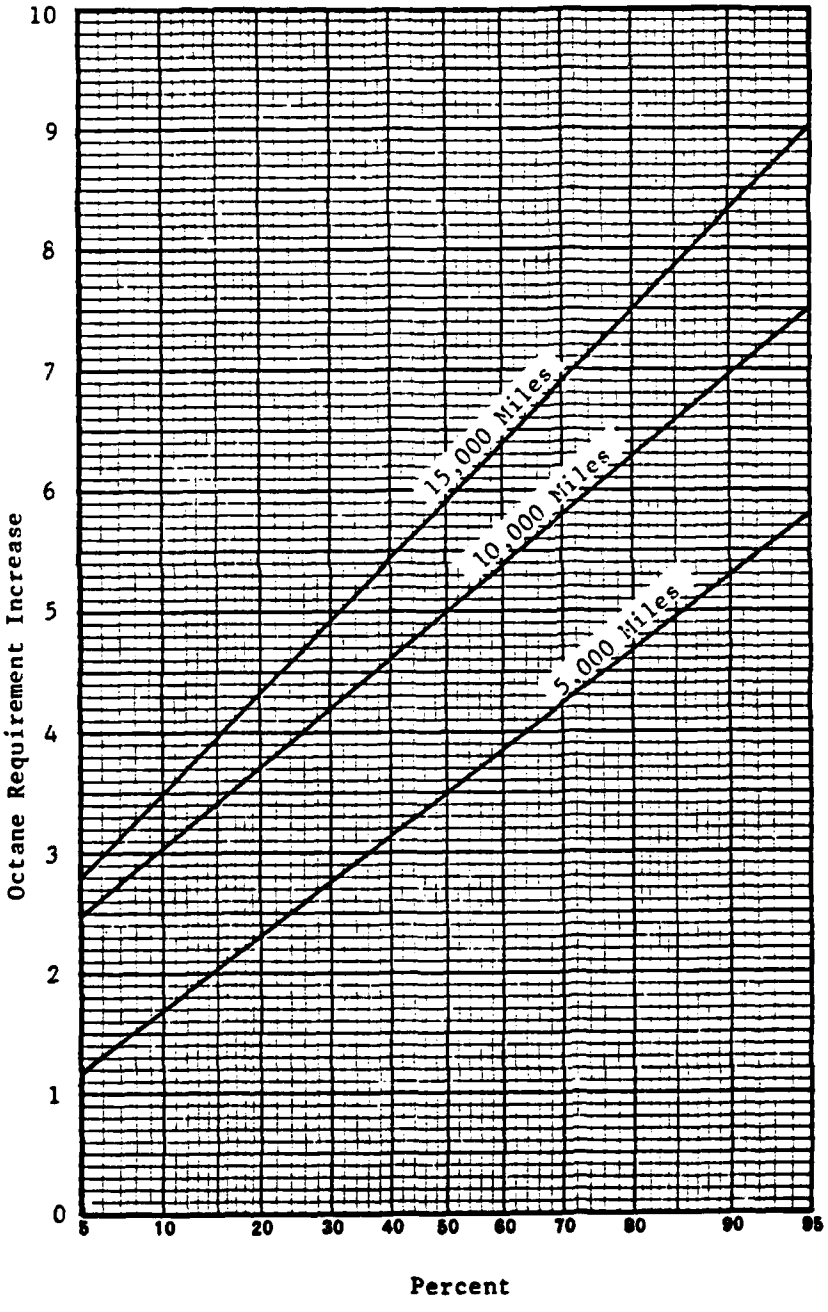


FIGURE 9

ORI AT VARIOUS MILEAGES, PRF, 1978
CARS, MANUFACTURER "C"

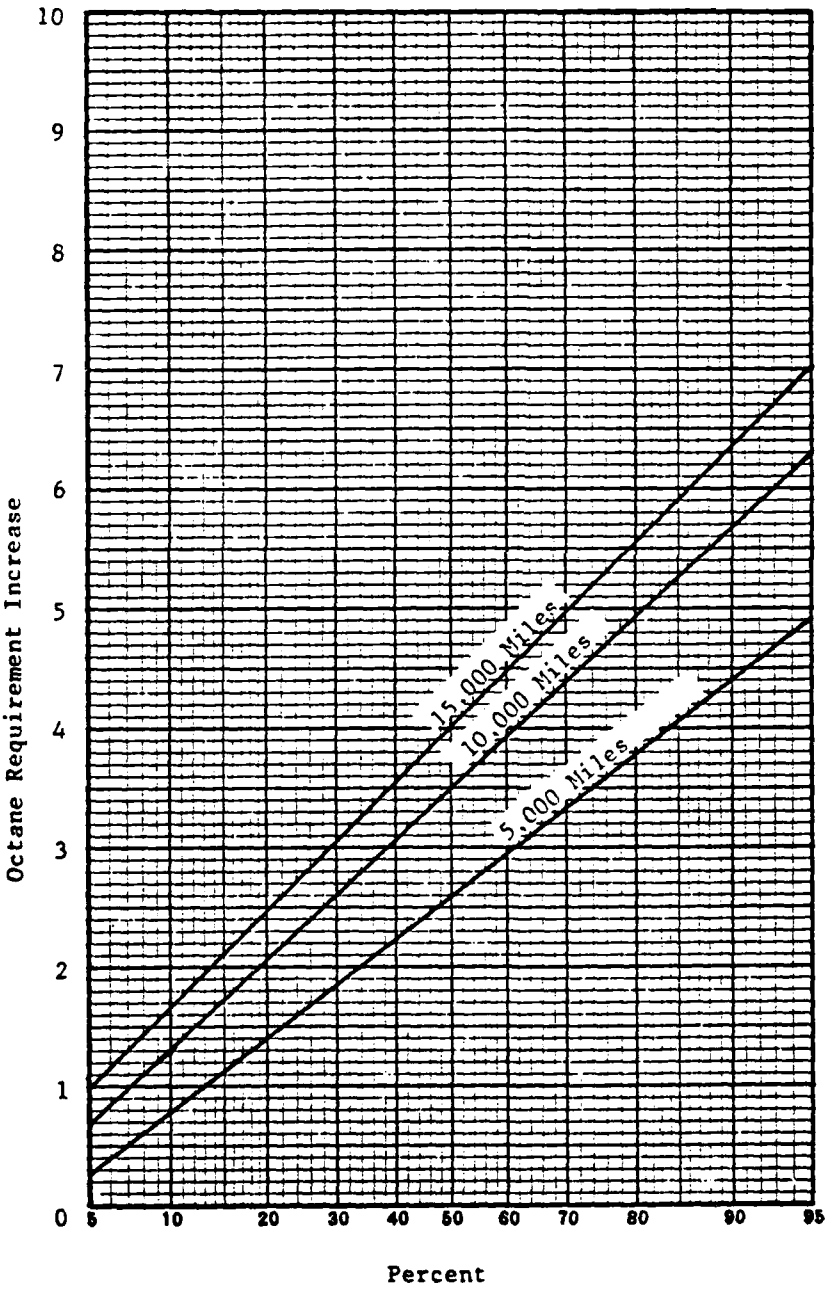


FIGURE 10

RON ORI AT VARIOUS MILEAGES, FBRU,
1979 CARS, MANUFACTURER "A"

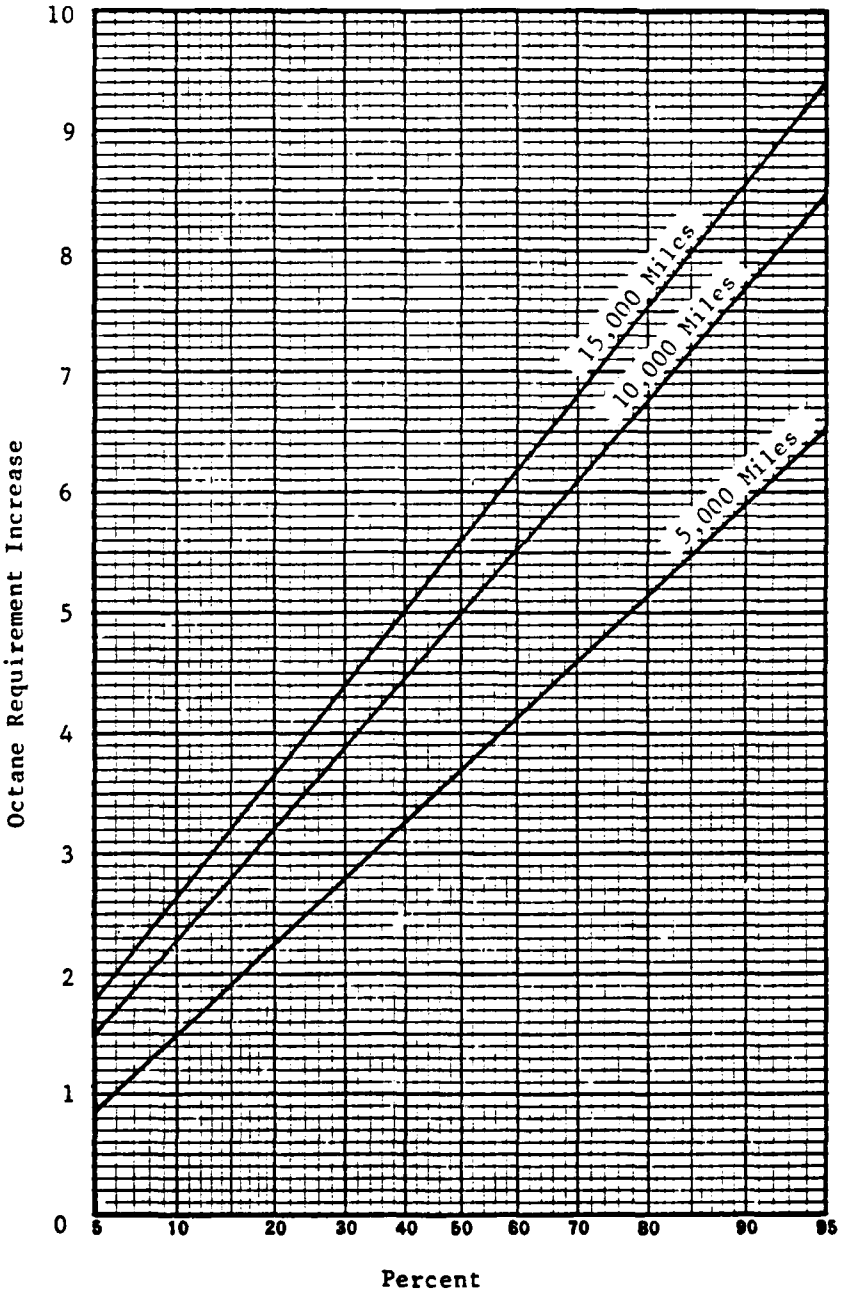


FIGURE 11

ORI AT VARIOUS MILEAGES, PRF, 1979 CARS,
MANUFACTURER "A"

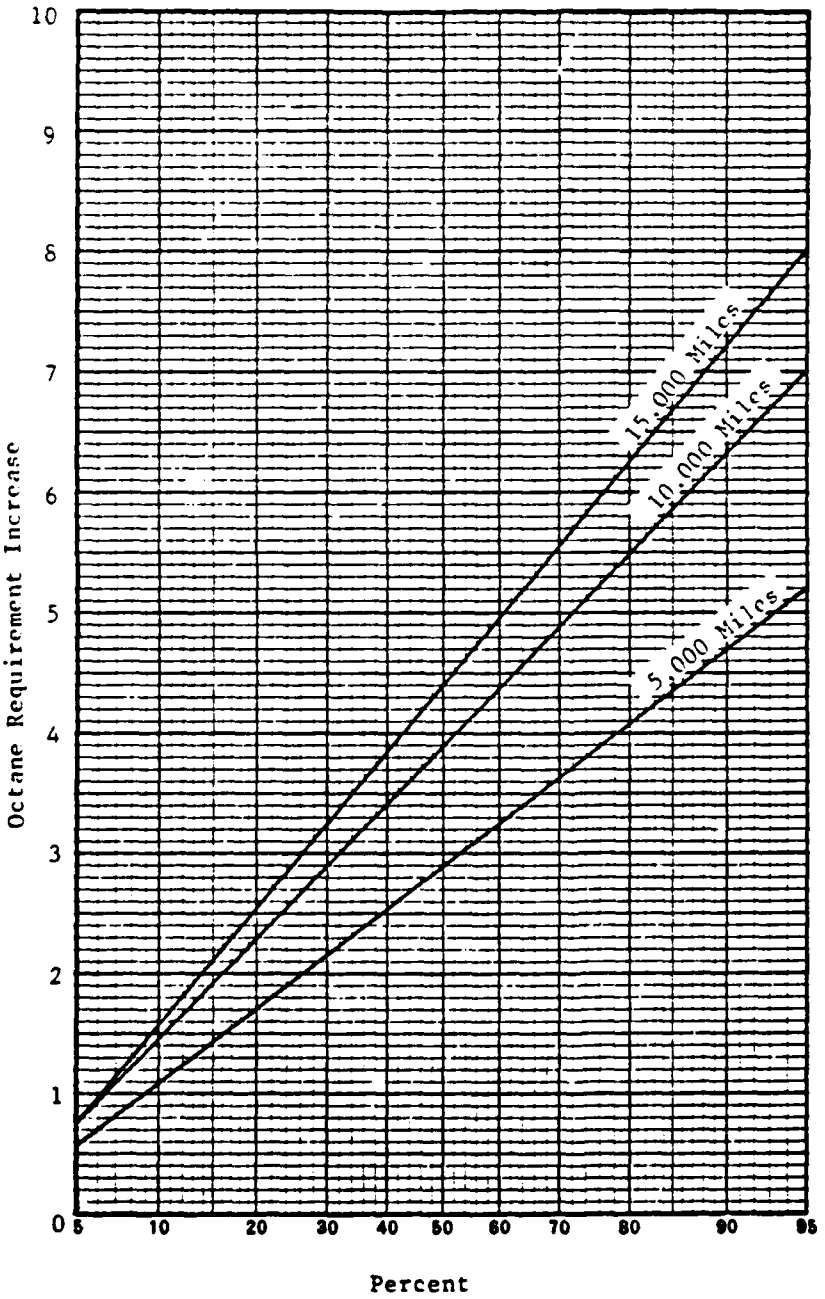


FIGURE 12

RON ORI AT VARIOUS MILEAGES, FBRU,
1979 CARS, MANUFACTURER "B"

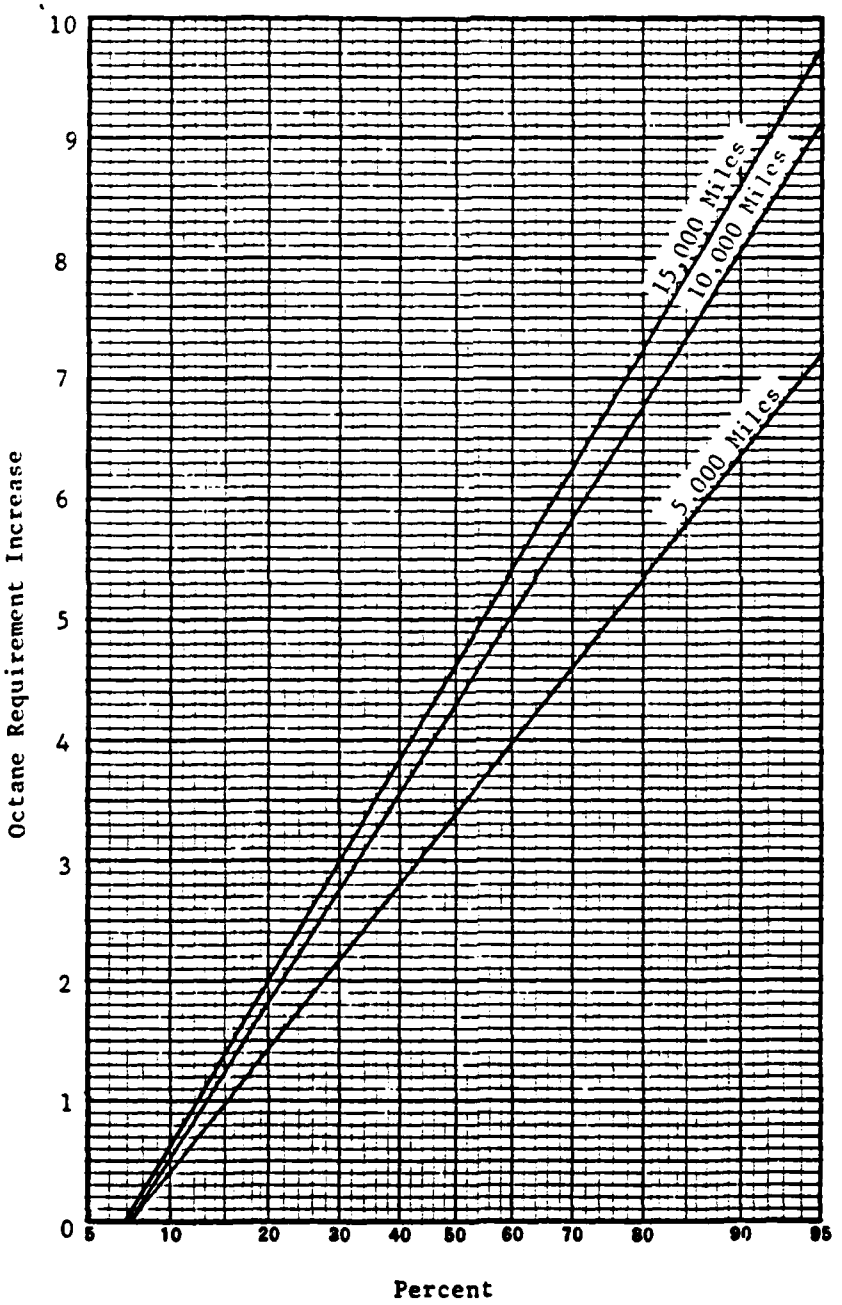


FIGURE 13

ORI AT VARIOUS MILEAGES, PRF, 1979
CARS, MANUFACTURER "B"

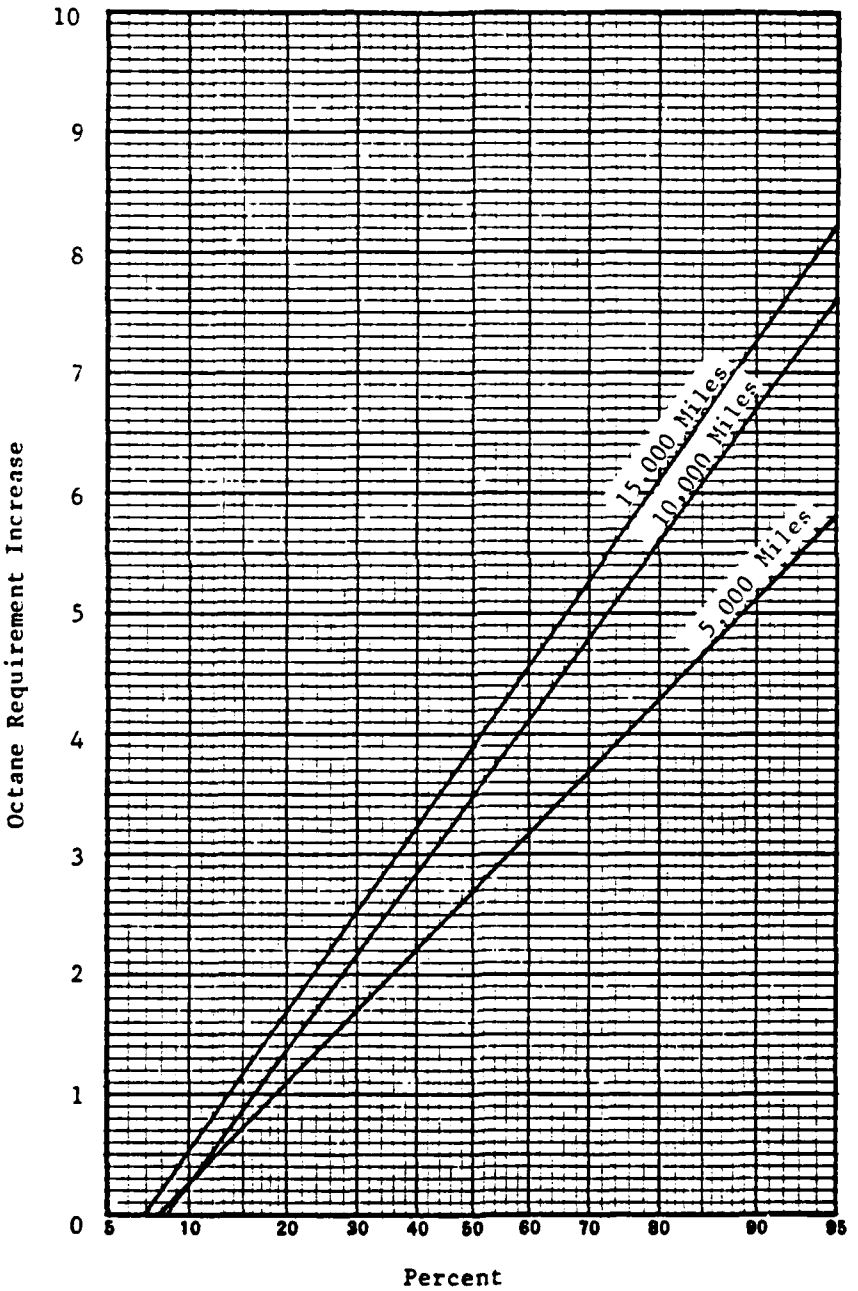


FIGURE 14

RON ORI AT VARIOUS MILEAGES, FBRU,
1979 CARS, MANUFACTURER "C"

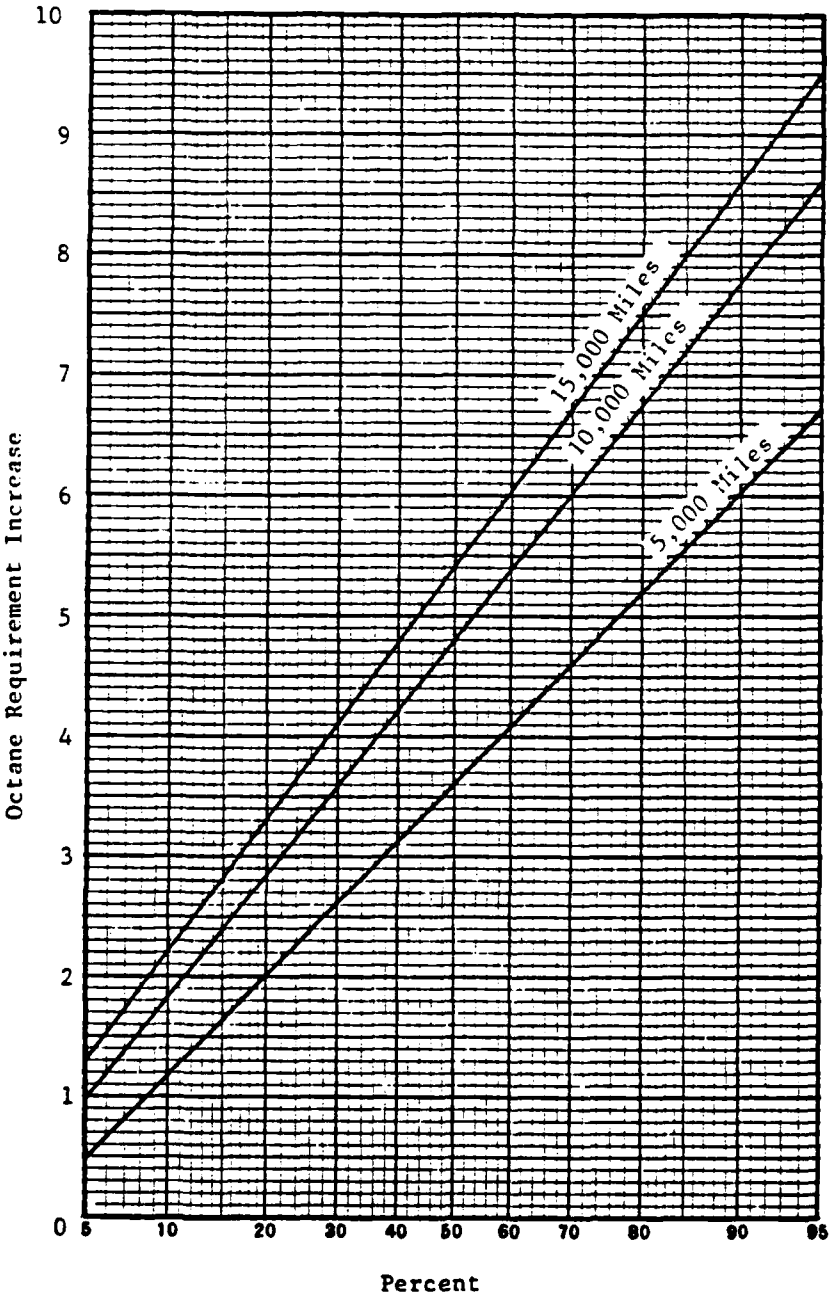


FIGURE 15

ORI AT VARIOUS MILEAGES, PRF, 1979 CARS,
MANUFACTURER "C"

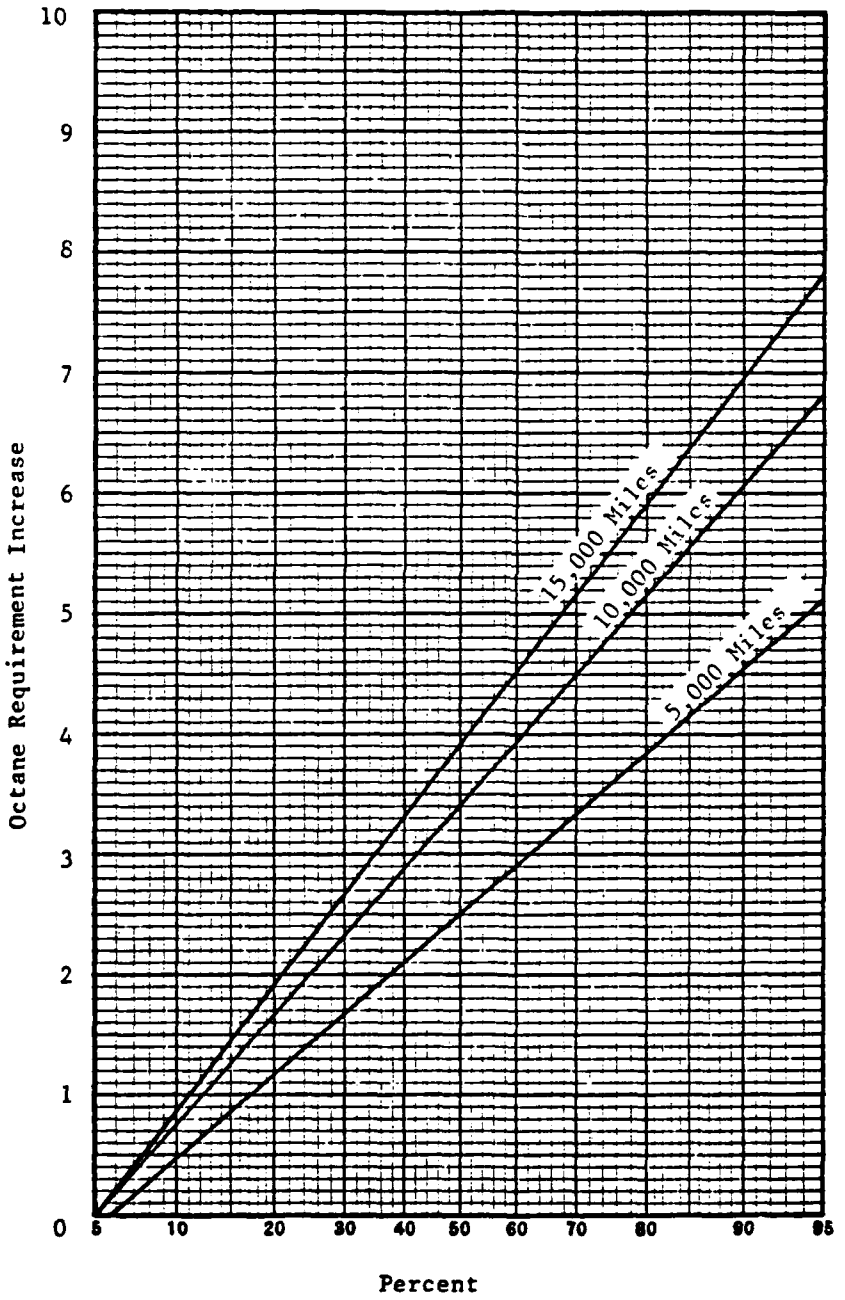
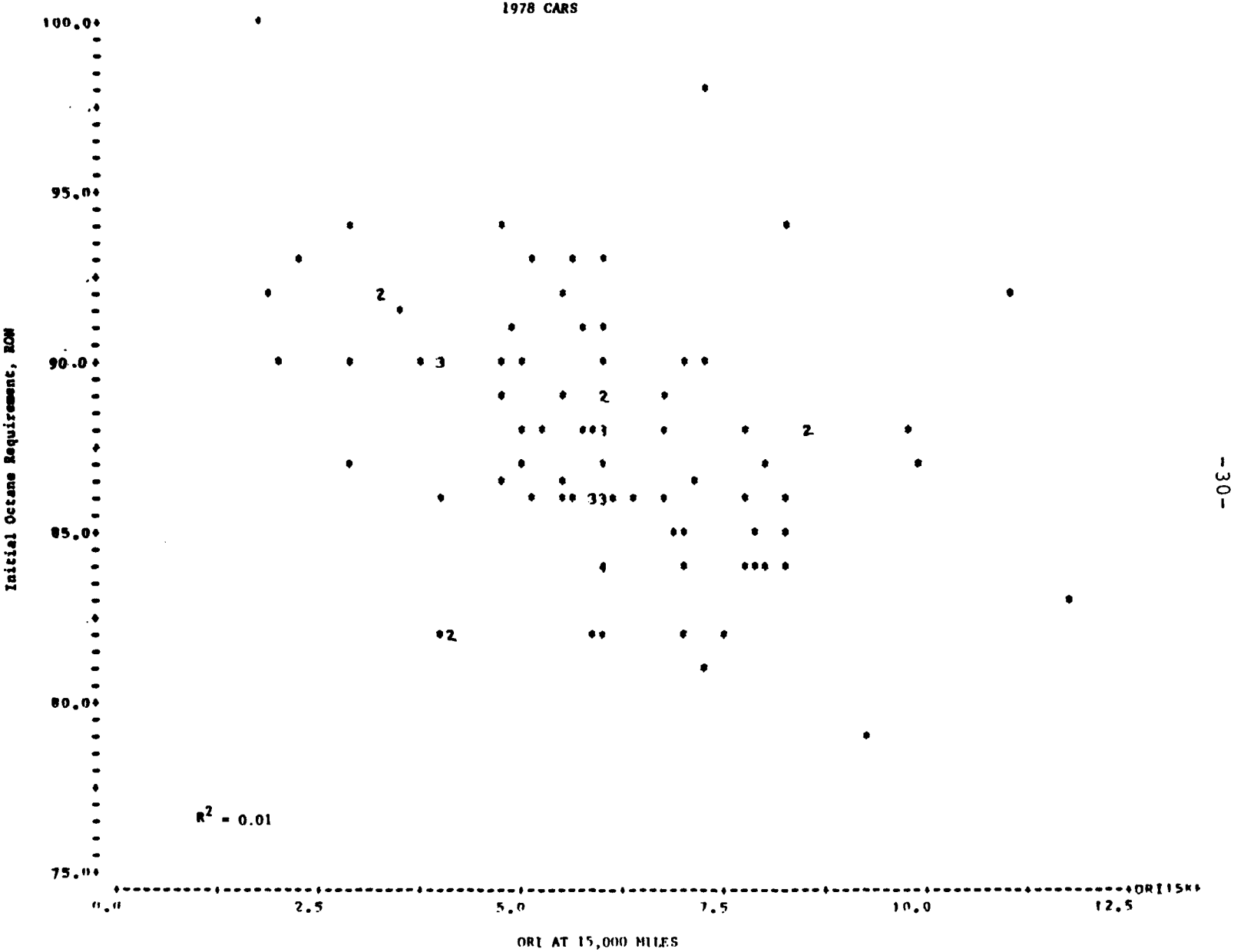


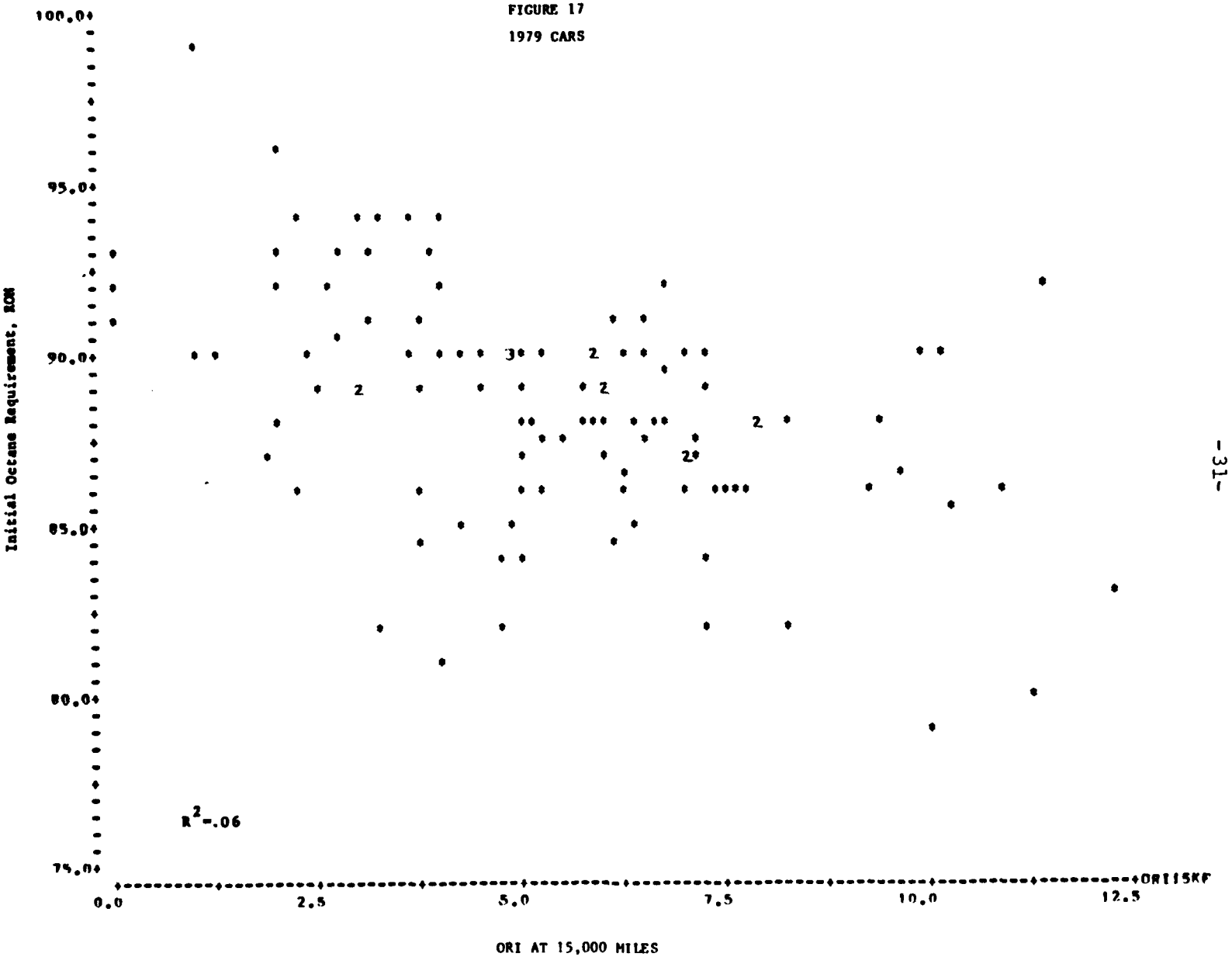
FIGURE 16
1978 CARS



NOTE: Number of replicate points at same location is indicated by numerals.

FIGURE 17

1979 CARS



NOTE: Number of replicate points at same location is indicated by numerals.

A P P E N D I X A

LABORATORIES REPORTING OCTANE REQUIREMENT DATA AT VARIOUS MILEAGES

LABORATORIES REPORTING OCTANE REQUIREMENTS AT VARIOUS MILEAGES

Amoco Oil Company
Naperville, Illinois

Ethyl Corporation
Ferndale, Michigan

General Motors Corporation
Warren, Michigan

Gulf Research and Development Company
Pittsburgh, Pennsylvania

Mobil Research and Development
Paulsboro, N. J.

Phillips Petroleum Company
Bartlesville, Oklahoma

Shell Development Company
Houston, Texas

Standard Oil Company
Cleveland, Ohio

Suntech Group
Marcus Hook, Pennsylvania

Union Oil Company
Brea, California

APPENDIX B

MEMBERSHIP: 1978-1979 OCTANE REQUIREMENT INCREASE ANALYSIS PANEL

1978-1979 OCTANE REQUIREMENT INCREASE

(CRC Project No. CM-124-78/79)

DATA ANALYSIS PANEL

J. B. Smith, Leader	-	Amoco Oil Company
J. B. Baker	-	Shell Development Company
N. D. Esau	-	Amoco Oil Company
J. D. Rogers, Jr.	-	E. I. DuPont de Nemours & Company, Inc.
Tim Wusz	-	Union Oil Company of California

APPENDIX C

REFERENCE FUEL DATA

TABLE C-I

1977 UNLEADED AVERAGE SENSITIVITY FULL-BOILING RANGE REFERENCE FUEL SERIES (FBRU)

Research Octane No.	Motor Octane No.
78	72.9
80	74.6
82	76.2
84	77.9
85	78.7
86	79.4
87	80.1
88	80.8
89	81.5
90	82.2
91	83.0
92	83.7
93	84.5
94	85.3
95	86.1
96	86.9
97	87.8
98	88.7
99	89.5
100	90.4
101	91.3

TABLE C-III

1979 UNLEADED AVERAGE SENSITIVITY FULL-BOILING

RANGE REFERENCE FUEL SERIES (FBRU)

Research Octane No.	Motor Octane No.
78	74.2
80	75.6
82	77.0
84	78.3
85	78.8
86	79.6
87	80.0
88	80.6
89	81.1
90	81.7
91	82.2
92	82.8
93	83.4
94	84.2
95	84.8
96	85.6
97	86.4
98	87.1
99	88.0
100	88.8
101	89.6
102	90.5

APPENDIX D

INITIAL OCTANE REQUIREMENTS AND ORI VALUES

TABLE D-I

INITIAL OCTANE REQUIREMENTS AND ORI VALUES

1978 CARS

Vehicle Code	FBRU Fuels				PR Fuels			
	Initial RON Req.	RON ORI @ Miles			Initial ON Req.	ORI @ Miles		
		5,000	10,000	15,000		5,000	10,000	15,000
NU 230	86.0	2.3	3.7	4.0	86.0	2.3	3.7	4.0
IIH 430	82.0	3.1	4.1	4.1	81.0	4.1	5.1	5.1
IIH 430	82.0	0.0	2.0	7.0	83.0	0.0	1.0	6.0
NL 435	82.0	4.8	6.0	5.9	82.0	3.7	4.8	4.8
NL 435	82.0	4.8	6.0	6.0	83.0	3.8	5.0	5.0
IR 435	92.0	3.8	7.3	11.0	86.0	2.4	4.7	6.5
IR 435	86.0	3.8	6.0	7.8	86.0	2.0	4.4	4.9
IR 435	86.0	3.8	5.6	6.0	86.0	2.0	3.0	3.5
LK 440	88.0	1.9	3.9	6.0	88.0	0.5	1.2	2.0
LK 440	92.0	1.7	3.6	5.5	88.0	0.0	0.2	0.3
LK 440	88.0	4.4	7.4	9.7	86.0	2.8	4.2	5.0
LK 440	90.0	4.3	5.8	6.0	87.9	2.7	3.1	3.1
LK 440	90.0	2.2	3.5	4.0	87.9	2.2	2.2	2.2
LK 440	88.0	3.2	5.3	5.8	88.0	1.3	2.0	2.6
G 442	82.0	2.8	4.0	4.0	82.0	2.2	2.9	2.9
G F12	82.0	3.3	4.2	4.1	83.0	1.0	1.0	0.9
IIU 230	84.0	2.5	5.4	8.3	84.0	0.9	2.1	3.3
OL 214	89.0	4.4	5.9	6.0	86.0	4.8	5.8	6.0
OCA 120	91.0	5.4	6.0	6.0	89.0	4.1	5.0	5.0
OCA 220	85.0	6.8	8.0	7.9	81.0	7.0	7.9	7.9
OCB 225	87.0	5.7	7.5	8.0	86.0	5.0	6.6	6.8
OI 230	94.0	3.9	6.4	8.3	93.0	1.8	2.7	3.1
MI 230	90.0	2.9	4.2	4.8	90.0	1.6	2.6	3.0
MIW 235	86.7	5.0	6.5	7.1	87.0	2.0	4.2	4.4
MIW 235	88.0	3.6	4.8	5.2	87.0	2.9	3.9	4.4
OCB 230	92.0	2.1	2.8	3.2	91.0	1.2	1.7	1.8
OCB 230	92.0	2.0	2.7	3.3	88.0	3.1	3.9	4.0
OI 235	87.0	3.2	4.5	5.0	87.0	1.6	2.4	2.6
OI 230	93.0	3.7	4.7	5.1	91.0	1.8	2.0	2.0
KC 122	89.0	3.7	5.5	6.8	89.0	2.0	3.3	3.2
PC 222	86.0	1.9	6.4	8.3	85.0	2.0	5.6	7.2
PC 122	86.0	4.6	5.7	5.9	82.0	3.1	3.8	4.0
PC 122	86.0	2.0	5.1	6.1	82.0	2.1	4.3	6.6
DC 231	83.0	6.1	9.8	11.8	81.0	5.0	9.3	11.1
DC 231	88.0	4.7	6.1	6.7	88.0	3.2	4.4	4.9
KC 231	94.0	2.9	2.9	2.9	93.0	1.9	1.8	1.8
KC 231	90.0	3.9	5.8	7.3	90.0	3.9	5.8	7.3
E 208	85.0	4.4	6.0	6.9	84.0	2.0	2.0	2.1
OL 209	86.0	3.0	4.7	6.0	86.0	2.4	3.7	4.5
NIU 230	88.0	5.8	7.2	7.7	85.0	3.8	4.7	4.9
NIU 230	87.0	3.4	4.9	6.0	87.0	2.0	2.8	3.3

TABLE D-I

(Continued)

Vehicle Code	FBRU Fuels Initial RON Req.	FBRU Fuels RON ORI @ Miles 5,000	FBRU Fuels RON ORI @ Miles 10,000	FBRU Fuels RON ORI @ Miles 15,000	PR Fuels Initial ON Req.	PR Fuels ORI @ Miles 5,000	PR Fuels ORI @ Miles 10,000	PR Fuels ORI @ Miles 15,000
NU 230	90.0	4.1	5.0	5.0	88.0	3.8	3.9	3.9
HY 230	94.0	3.1	4.2	4.7	89.0	4.8	6.6	7.5
NL 435	85.0	5.9	6.9	7.0	83.0	4.0	4.2	4.2
NIM 220	91.0	4.7	5.1	4.9	89.0	2.8	2.9	2.8
IIF 226	93.0	2.1	4.1	5.6	90.0	1.5	2.0	2.0
NIM 220	90.0	1.9	2.0	2.0	89.0	0.9	1.0	1.1
LA 223	87.0	3.3	6.8	9.9	86.0	3.0	4.2	4.6
LCA 223	93.0	2.1	2.3	2.3	87.5	4.4	5.0	5.0
LCA 223	91.5	3.3	3.5	3.5	87.0	3.0	3.1	3.1
NIA 223	88.0	4.5	6.8	8.5	86.0	2.6	4.0	4.7
NIA 223	86.5	4.4	5.3	5.5	86.0	2.9	3.0	3.0
NLE 109	81.0	4.9	6.6	7.2	80.0	4.9	6.4	6.8
NLE 109	79.0	5.9	8.0	9.2	78.0	5.3	6.3	8.4
NLV 215	85.0	6.3	7.7	8.2	83.0	5.6	7.1	7.4
HCV 215	91.0	3.1	4.7	5.7	88.0	0.9	1.5	1.7
ILV 215	90.0	2.4	4.8	7.0	88.0	0.7	1.3	2.0
NIM 220	88.0	6.0	7.9	8.5	87.0	3.7	5.0	5.2
NIM 220	88.0	1.0	2.6	5.0	87.0	1.2	2.4	3.6
LIA 223	89.0	3.7	5.2	6.0	87.0	2.3	3.3	3.9
LIA 223	89.0	3.3	4.4	4.7	86.0	3.0	4.0	4.3
LA 223	98.0	2.4	5.0	7.2	94.0	3.4	5.6	8.2
NL 435	82.0	5.2	6.8	7.5	81.0	3.5	4.6	5.0
NL 435	88.0	4.2	5.5	6.0	87.0	0.0	0.0	0.0
NU 230	87.0	1.2	2.3	2.9	85.0	2.0	3.0	3.6
LY 230	93.0	3.3	5.0	6.0	89.0	2.1	3.5	4.0
HIW 430	89.0	1.5	3.5	5.5	88.0	0.7	1.4	2.0
LI3 T423	100.0	0.7	1.7	1.7	99.0	0.0	0.2	0.4
HLV 215	86.0	4.3	6.8	6.8	85.0	1.7	4.7	4.9
HLV 215	84.0	4.2	6.2	7.0	84.0	3.9	5.0	5.1
LIC 219	84.0	5.0	6.0	6.0	83.0	5.7	5.3	5.2
LIC 219	86.0	4.7	6.1	6.4	85.0	4.3	5.0	5.7
LIC 219	84.0	1.9	4.2	7.9	82.0	3.5	5.0	5.0
NIM 220	88.0	3.8	5.7	5.9	89.0	2.2	2.8	3.8
NIM 220	90.0	2.5	2.9	2.9	89.0	2.5	3.0	3.0
NIM 220	90.0	3.5	3.7	3.7	90.0	1.5	1.5	1.5
LIA 223	86.0	3.9	5.4	5.5	86.0	3.0	3.9	4.0
LIA 223	86.0	2.0	4.0	5.9	86.0	2.0	4.0	5.9
HIA 223	86.0	3.8	5.3	5.6	86.0	2.8	4.4	4.4
HIA 223	84.0	4.8	6.0	6.0	84.0	4.1	5.1	5.1
HIA 223	86.0	5.4	6.0	6.0	86.0	2.8	3.6	3.6
HIA 223	86.7	4.2	4.7	4.7	87.0	1.6	2.0	2.0
NCD 125	86.0	4.0	5.0	5.1	85.0	3.8	5.0	5.0
IF 226	92.0	1.1	2.1	1.9	89.0	2.4	3.0	3.0
IF 226	90.0	2.0	3.5	4.0	87.0	3.0	3.5	3.9
HY 230	90.0	2.4	3.7	4.0	89.0	1.2	1.8	1.8
HY 230	88.0	4.0	5.9	6.0	89.0	1.7	2.0	2.0
NU 230	84.0	4.5	6.1	8.0	84.0	3.7	5.7	6.0
NU 230	84.0	4.0	5.8	6.0	84.0	3.5	5.2	5.4
NU 230	84.0	2.7	4.9	7.7	84.0	2.8	4.7	7.1
NU 230	86.0	3.9	5.9	5.9	86.0	3.2	5.0	5.0
NU 230	84.0	4.0	5.9	6.0	84.9	2.0	1.9	3.1

TABLE D-II

INITIAL OCTANE REQUIREMENTS AND ORI VALUES

1979 CARS

Vehicle Code	FBRU Fuels				PR Fuels			
	Initial RON Req.	RON ORI @ Miles			Initial ON Req.	ORI @ Miles		
		5,000	10,000	15,000		5,000	10,000	15,000
NIM 220	90.0	3.2	4.0	4.2	90.0	1.5	2.0	2.0
NG 230	87.0	4.8	5.8	6.0	87.0	4.2	5.0	5.0
OW 235	93.0	2.3	3.0	3.1	91.0	2.0	2.8	3.0
K 231	90.0	2.8	4.2	4.9	88.0	3.3	5.2	6.4
LIC 219	96.0	1.6	2.0	2.0	92.0	1.8	2.7	3.1
NIJ 226	86.5	7.2	9.2	9.6	86.0	5.6	7.4	8.4
OCA 214	90.0	3.5	4.7	5.2	85.0	5.7	6.0	9.6
OW 235	92.0	2.0	3.2	4.0	90.0	1.6	2.3	2.5
K 231	88.0	5.0	5.9	5.9	87.0	4.5	5.7	6.0
LIC 219	92.0	1.3	2.2	2.6	89.0	1.4	2.4	3.0
NIJ 226	88.0	3.4	5.3	6.6	86.0	3.6	5.4	6.5
OCA 214	93.0	2.6	3.6	3.9	94.5	1.5	2.2	2.2
NL 435	99.0	0.8	1.0	1.0	85.5	4.2	5.9	6.8
OCA 120	88.0	6.1	7.5	7.9	87.0	3.9	4.9	5.0
OCA 120	90.0	5.4	6.8	7.2	88.5	4.4	6.0	6.9
O V230	83.0	4.0	8.1	12.2	83.0	3.7	7.0	9.0
PL 210	80.0	6.7	10.4	11.2	77.0	5.5	6.0	8.2
NIJ 226	84.5	2.1	3.1	3.7	84.0	1.6	2.0	2.0
NIH 430	89.0	1.8	2.4	2.5	87.0	1.1	2.4	2.6
NIJ 226	85.0	3.4	4.5	4.9	84.5	2.4	3.1	3.8
NIJ 226	86.0	0.7	1.5	2.3	84.0	2.4	2.8	3.2
NIH 430	86.0	3.8	4.4	5.2	88.0	0.2	0.4	1.0
NIH 430	90.0	0.2	0.6	1.0	89.6	0.0	0.0	0.0
OCA 230	89.0	3.8	4.5	4.5	88.0	3.9	4.7	4.9
OCA 230	89.5	4.0	6.0	6.8	88.0	4.5	5.0	5.0
OCA 230	87.5	2.2	2.9	5.2	86.0	2.2	3.3	4.0
OCA 230	89.0	5.2	6.0	6.0	87.0	4.2	6.1	7.5
OCA 230	90.5	2.0	2.6	2.7	90.0	1.5	2.0	2.0
OCA 230	89.0	4.3	5.6	6.0	88.0	3.2	4.7	5.5
MCA 230	87.5	3.1	4.3	5.5	87.0	2.9	2.7	3.0
MCA 230	93.0	1.5	2.0	2.0	91.0	0.0	0.0	0.0
MCA 230	90.0	3.1	3.8	4.0	88.0	2.9	3.8	4.0
MCA 230	91.0	3.7	3.7	3.7	89.0	2.0	1.9	1.9
MCA 230	87.5	4.6	6.9	7.1	87.0	3.8	5.3	5.3
MCA 230	94.0	0.7	1.5	2.2	90.5	1.7	2.4	2.4
PC 231	86.5	6.3	6.3	6.3	86.0	4.5	4.5	4.5
PC 231	90.0	0.8	1.0	1.3	88.0	0.3	0.8	1.3
PC 231	90.0	2.3	3.6	4.5	88.0	2.6	4.0	4.9
PC 231	89.0	3.0	4.2	5.0	88.0	2.8	3.2	3.6
PC 231	90.9	0.0	0.0	0.0	89.3	0.0	0.1	0.1
PC 231	84.5	5.3	5.7	6.1	84.0	2.6	3.4	4.1

TABLE D-II

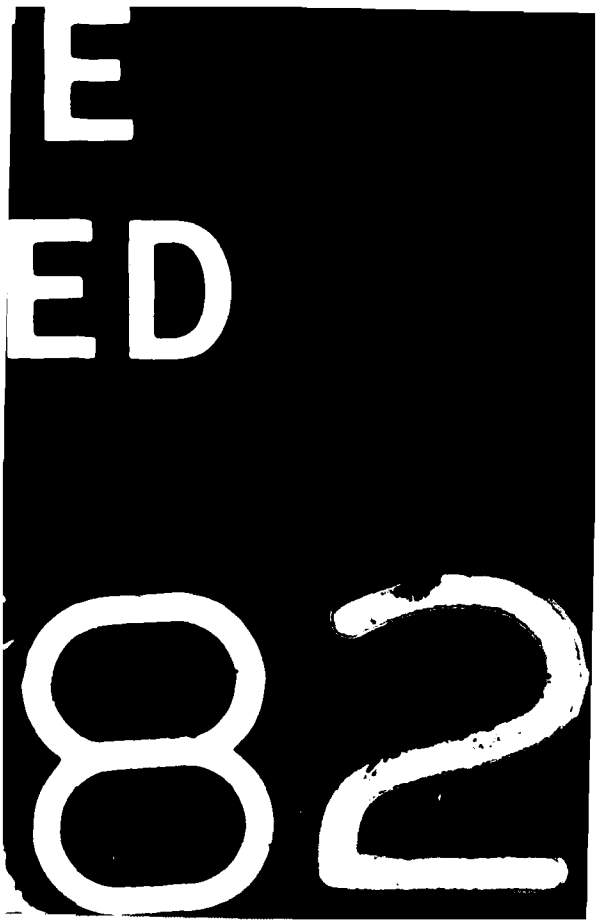
(Continued)

Vehicle Code	FBRU Fuels				PR Fuels			
	Initial RON Req.	RON ORI @ Miles			Initial ON Req.	ORI @ Miles		
		5,000	10,000	15,000		5,000	10,000	15,000
NIJ 226	81.0	2.9	3.5	4.0	82.0	0.0	0.0	0.9
NIJ 226	82.0	4.8	4.8	4.8	81.0	3.9	3.9	3.9
HY 230	91.0	1.8	3.9	6.1	87.0	2.8	5.0	6.7
OCB 230	90.0	8.1	9.5	9.9	88.0	5.3	6.9	7.7
NIG 230	82.0	5.0	6.2	7.3	80.0	4.3	5.7	6.8
NIG 230	87.0	1.0	1.9	1.9	86.0	0.3	0.6	1.0
IR 435	92.0	3.4	5.7	6.7	90.0	1.0	1.2	1.2
LIA 223	86.0	2.4	4.1	7.4	86.0	1.2	2.4	3.6
HY 230	92.0	4.6	8.3	11.4	90.0	4.9	8.8	12.4
HY 230	90.0	7.2	10.0	10.1	89.0	4.6	7.9	8.0
HIA 223	86.0	6.4	7.5	7.6	86.0	3.3	4.1	4.2
HIA 223	88.0	1.7	3.3	5.0	86.5	1.3	3.0	3.7
HIA 223	88.0	4.6	6.0	6.4	87.0	3.1	3.9	4.1
HIA 223	87.0	5.0	5.0	5.0	87.0	3.0	3.0	3.0
HIA 223	86.0	5.0	5.0	5.0	86.0	3.0	3.0	3.0
HIA 223	86.0	8.0	9.9	10.9	86.0	6.9	8.4	9.0
GB F35	86.0	6.2	8.2	9.2	86.0	4.7	5.9	6.2
NG 230	86.0	5.0	6.4	7.5	87.0	2.8	3.9	4.4
NIJ 226	82.0	6.2	7.7	8.3	82.0	5.1	6.4	6.8
NLE 209	86.0	3.0	3.7	3.8	85.0	0.0	0.0	0.0
NIM 220	92.0	0.0	0.0	0.0	85.0	2.6	3.6	4.0
NIJ 226	85.0	4.0	4.0	4.2	85.0	3.0	3.8	4.0
NG 230	90.0	3.5	4.8	5.0	88.0	2.2	2.9	3.0
HLV 215	94.0	2.4	2.9	3.0	92.0	0.9	0.9	1.0
IIF 226	90.0	4.8	6.3	6.5	88.0	2.0	3.1	3.8
LIA 223	88.0	4.6	5.7	6.0	87.0	2.2	2.8	3.0
LY 230	89.0	5.1	6.6	7.2	89.0	2.1	3.0	3.4
OCA 214	89.0	1.9	2.6	3.0	88.0	1.1	2.4	2.8
OCA 120	85.0	4.7	6.0	6.4	84.0	3.8	5.1	5.4
O V230	88.0	3.0	5.5	6.7	88.0	2.2	4.0	4.0
OCA 214	90.0	1.4	2.2	2.4	89.0	0.0	0.0	0.0
OCA 214	84.0	3.3	4.4	5.0	82.0	3.4	4.8	5.0
MW V235	89.0	2.3	3.4	3.8	87.0	2.2	3.0	3.3
PL 210	84.0	3.4	4.4	4.7	82.0	1.4	1.7	1.7
DC 231	87.0	5.6	7.0	7.0	86.0	5.2	6.6	7.0
RC 212	79.0	5.7	8.7	10.0	79.0	4.3	6.8	8.6
IIF 226	90.0	4.0	7.0	7.0	86.0	3.0	4.8	5.0
NIM 220	94.0	2.0	3.0	3.6	91.0	2.6	3.6	4.0
OCA 120	86.0	4.8	6.3	7.0	85.0	3.3	4.4	4.9
MW V235	86.0	4.0	5.5	6.2	85.0	3.9	5.3	6.0
IIH 430	90.0	4.2	5.4	5.9	89.0	3.0	4.0	4.0
NIJ 226	82.0	2.0	2.9	3.3	81.0	1.8	2.8	3.2
O V230	84.0	5.0	6.7	7.2	84.0	5.0	6.5	6.8
D 231	93.0	0.0	0.0	0.0	90.0	0.0	0.0	0.0
LIA 223	90.0	4.8	5.9	5.9	87.0	3.0	3.5	3.6

TABLE D-II

(Continued)

Vehicle Code	FBRU Fuels				PR Fuels			
	Initial RON Req.	RON ORI @ Miles			Initial ON Req.	ORI @ Miles		
		5,000	10,000	15,000		5,000	10,000	15,000
HIY 230	88.0	1.6	3.3	5.1	86.0	1.1	2.7	4.4
HIY 230	87.0	2.9	5.2	7.1	85.0	2.8	4.0	4.0
HIY 230	90.0	4.8	4.8	4.9	89.0	0.0	0.0	0.0
HIY 230	90.0	1.6	3.6	4.9	86.0	2.1	3.0	3.0
HIY 230	92.0	1.5	2.0	2.0	88.0	0.9	1.2	1.2
HIY 230	94.0	3.4	4.0	4.0	90.0	0.9	0.9	1.0
HIA 223	91.0	2.2	2.9	3.1	87.0	3.2	4.0	4.2
OCA 230	88.0	6.9	8.7	9.4	88.5	0.8	1.5	2.3
OCA 230	86.0	5.7	7.2	7.8	85.0	3.9	5.1	5.4
NIA 223	87.5	5.1	6.3	6.5	86.5	2.6	3.0	3.5
NIA 223	85.5	6.0	8.5	10.2	85.0	4.0	4.6	6.5
NIH 430	88.0	4.2	5.4	5.8	88.0	2.3	3.3	3.8
PC 222	89.0	2.3	3.0	3.0	86.0	2.0	2.6	2.9
NIJ 226	88.0	2.0	2.0	2.0	88.0	0.0	0.0	0.0
OCA 120	94.0	1.7	2.7	3.3	91.0	1.3	2.2	2.7
OW 235	90.0	2.2	3.2	3.6	88.0	2.5	2.4	3.7
OCA 214	91.0	4.5	5.9	6.5	88.0	3.6	4.4	4.5
NG 230	88.0	5.9	7.3	7.9	87.0	4.6	5.5	5.5
MW V235	88.0	6.0	7.6	8.2	87.0	3.3	4.8	5.6
NH 430	93.0	1.6	2.5	2.8	89.0	1.9	2.7	3.0
OL 214	89.0	3.3	4.9	5.8	88.0	2.5	3.5	3.9
LIA 223	87.0	6.5	7.0	7.0	87.0	3.7	4.8	5.0
NLC 209	90.0	4.7	6.0	6.3	86.0	3.9	4.8	5.0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