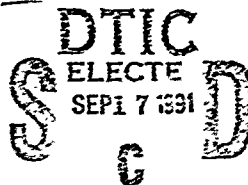


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CRC Report No. 574

(2)



EFFECT OF GASOLINE OCTANE QUALITY ON VEHICLE ACCELERATION PERFORMANCE

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July 1991

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219 PERIMETER CENTER PARKWAY, ATLANTA, GEORGIA 30346

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NOTES

ATLANTA, GEORGIA 30346

(4C4) 396-3400

**EFFECT OF GASOLINE OCTANE QUALITY
ON VEHICLE ACCELERATION PERFORMANCE
(CRC Project No. CM-124-89)**

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of the

CRC Octane Technology and Test Procedures Group

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July 1991

Automotive Vehicle Fuel, Lubricant, and Equipment Research Committee

of the

Coordinating Research Council, Inc.

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ABSTRACT

A study was conducted under the auspices of the Coordinating Research Council, Inc. (CRC) to assess the potential effects of gasoline octane quality on vehicle acceleration performance. Twelve participating laboratories, representing both the oil and the automotive industries, tested a total of 182 vehicles as part of the 1989 CRC Octane Number Requirement Survey. The vehicles consisted of 78 with electronic knock control systems and 104 without. All testing was performed using the 1989/1990 CRC FBRU fuel series. The results showed that acceleration performance of vehicles with knock sensors was significantly affected by gasoline octane quality. Octane effects on acceleration performance were most pronounced at maximum-throttle (detent) conditions and at octane levels below the vehicles' octane requirements; however, some knock-sensor vehicles did show improved acceleration performance with fuels at octane levels above the octane number requirement. Acceleration performance in non-knock-sensor vehicles was unaffected by octane quality.

INTRODUCTION

About 40 percent of new spark-ignition-engines marketed in the US are equipped with electronic knock-control systems. These systems are designed to reduce or prevent audible engine knock by retarding spark timing (and/or reducing boost pressure in certain turbocharged engines). These electronic systems to control engine knock, however, can potentially affect vehicle performance. A preview of the magnitude of the impact of gasoline octane quality on performance was investigated in a pilot program conducted by the Coordinating Research Council (CRC) Octane Technology and Test Procedures Group.⁽¹⁾

The current test program was undertaken to quantify the effect of octane quality on acceleration performance in a large number of vehicles. The goal was to test a large sample of vehicles representing a cross-section of the 1989 vehicle population. Consequently, this study was conducted along with the 1989 Octane Number Requirement Survey (ONRS). About half of the vehicles tested in the 1989 CRC ONRS were also tested as part of this program. Both knock-sensor-equipped (KS) vehicles and vehicles without knock sensors (NKS) were tested.

A list of participating laboratories and membership of the Data Analysis Panel are given in Appendices A and B, respectively.

SUMMARY

One hundred and eighty-two vehicles were tested in conjunction with the 1989 CRC Octane Number Requirement Survey (ONRS) to determine the effect of octane quality on vehicle acceleration performance. Seventy-eight vehicles were knock-sensor-equipped (KS) and 104 were non-knock-sensor-equipped (NKS). The vehicles were tested from the ONRS at random and represented a cross-section of that population. All acceleration testing was done using the 1989/1990 CRC FBRU reference fuel series. The key results of the study are summarized below:

- KS vehicles showed statistically significant differences in acceleration performance with varying octane gasoline. The largest effects were found in the 40-60 mph speed range. Acceleration performance was generally degraded at octane levels below the octane number requirement (ONR); however, 30 percent of KS vehicles showed significant improvement in acceleration performance at octane levels above the ONR.
- Octane effects on acceleration performance of KS vehicles varied considerably among engine types.

(1) Coordinating Research Council, Inc., "CRC Program for Quantifying Performance of Knock-Sensor-Equipped Vehicles with Varying Octane Level," CRC Report No. 571, August 1990.

- Acceleration performance of NKS vehicles was unaffected by gasoline octane quality.
- Vehicle ONR did not influence the octane performance effects in KS vehicles.

TEST VEHICLES

Participants of the 1989 CRC ONRS were requested to conduct acceleration tests on as many of the Survey vehicles as possible. Twelve participating laboratories conducted tests on 182 vehicles, including 155 passenger cars and 27 light trucks. The distribution of vehicles test in this program are compared to the 1989 ONRS below:

	<u>Total Vehicles</u>	<u>Percent of Total Vehicles</u>		<u>% KS</u>
		<u>Passenger Cars</u>	<u>Light Trucks</u>	
1989 CRC ONRS	391	80	20	46
1989 Acceleration Program	182	85	15	43

TEST FUELS

The acceleration tests were conducted with the 1989/1990 CRC ONRS Full-Boiling Range Unleaded (FBRU) fuels with normal sensitivity. This fuel series ranges from 80 to 104 Research octane number (RON) and is blended in two RON increments up to 84, and in one RON increments up to 104 RON from three base fuels. The base fuels are blended from normal refinery gasoline components. Research and Motor octane numbers of the FBRU fuels are shown in Table 1.

TEST PROCEDURE

The acceleration test program was conducted as a voluntary addendum to the 1989 CRC ONRS Program. Participants were requested to test as many vehicles as possible, including both KS and NKS vehicles. The program required that the vehicle maximum-throttle octane number requirement (ONR) be determined with the 1989/1990 FBRU fuel series using the E-15-89 test procedure. Acceleration tests were then conducted with the FBRU fuel 8 RON higher than the maximum-throttle (MT) ONR, with the MT ONR fuel, and with fuels 4 RON above and below the MT ONR.

Participants were asked to obtain acceleration times for 0-30, 0-60, and 0-70 mph wide-open-throttle and for 40-60 mph at maximum throttle (detent). Details of the program and a sample data sheet are included in Appendix C.

DATA ANALYSIS

Analysis Technique - The results from this study were analyzed to determine the effect of octane quality on acceleration performance at octane levels above and below the vehicle full-throttle octane requirements. For consistent comparisons among the test vehicles, individual acceleration times for each test fuel were normalized to the average acceleration time for the octane requirement fuel. Relative acceleration times greater than 1.00 indicate poorer acceleration performance (longer acceleration time compared with the ONR fuel); values less than 1.00 indicate improved acceleration performance (shorter acceleration time compared with the ONR fuel). Results were analyzed for the four test conditions (0 to 30 mph, 0 to 60 mph, and 0 to 70 mph at wide-open-throttle, and 40 to 60 mph at maximum throttle) and the three test fuel comparisons (4 and 8 RON above ONR, and 4 RON below ONR) for both KS and NKS vehicles. Linear regression analyses were conducted using all acceleration data (including replicates) to determine the statistical significance of differences between fuels. Distributions of relative acceleration times were based on average acceleration data for each vehicle and were plotted using the N+1 technique.

Test Repeatability - Triplicate acceleration times were measured in most of the test vehicles for each test fuel at the four test conditions. Average variations in acceleration time are shown in Table 2 as the average coefficient of variation (standard deviation divided by mean). As would be expected, test repeatability was generally poorest for the 0-30 mph wide-open-throttle acceleration (2.3-3.2 percent) due to the short acceleration times. The repeatability of wide-open-throttle acceleration times improved with the 0-60 and 0-70 mph accelerations. Repeatability of the 40-60 mph maximum-throttle accelerations ranged from 2.1 to 2.4 percent. Fuel octane level and knock controls had no effect on test repeatability.

DISCUSSION OF RESULTS

Octane Number Requirements - Octane number requirements were determined at maximum-throttle conditions using FBRU fuels in conjunction with the 1989 CRC ONRS. Distributions of vehicle octane requirements for KS and NKS vehicles are shown in Figure 1.

Average Octane Effects on Acceleration Time - The average effects of octane quality on acceleration time are shown in Figures 2-5 for the wide-open-throttle and maximum-throttle test conditions. Results from regression analysis of all data (including replicates) are shown in Table 3.

The NKS vehicles showed little or no effect of octane quality on acceleration time, with average changes within ± 0.6 percent of the ONR fuel.

The KS vehicles showed statistically significant increases in acceleration time at 4 RON below ONR for all four test conditions. Average acceleration times increased by 1.2 and 2.4 percent at wide-open-throttle and by 3.4 percent at maximum-throttle. At wide-open-throttle conditions, increasing octane quality above the ONR slightly decreased acceleration time; however, the small improvements were not statistically significant. At maximum-throttle conditions, increasing octane quality 4 and 8 RON above the ONR reduced acceleration time by 1.3 percent and 2.2 percent, respectively. The acceleration time reduction at 8 RON above ONR was statistically significant. The performance improvements at octane levels above the ONR for audible knock indicate that the knock-control systems are effectively preventing audible knock through control of spark timing (or boost pressure in turbocharged vehicles), resulting in performance degradations at borderline knock conditions.

Individual Vehicle Results - Acceleration times for individual vehicles were analyzed to determine the relative number of vehicles showing significant effects of octane quality on relative acceleration time and comparing distributions of relative acceleration time for KS and NKS vehicles at the four test conditions. The percent of individual vehicles showing statistically significant effects of octane quality on relative acceleration time is shown in Table 4. Distributions of relative acceleration time are shown in Figures 6-17 for the four acceleration test conditions and three octane quality comparisons.

As shown in Table 4, a significant percentage of KS vehicles showed improved acceleration performance at octanes above ONR (+ 4 and + 8 RON) and degraded performance at octane levels below ONR (- 4 RON), particularly at the 40-60 mph maximum-throttle test condition. For example, 38 percent of KS vehicles showed significantly slower 40-60 mph acceleration times at an octane level 4 RON below ONR, while 25 to 32 percent of KS vehicles showed faster 40-60 mph acceleration times at 4-8 RON above ONR. As previously indicated, the effects of octane quality changes on KS vehicle acceleration performance were more pronounced at octane levels below ONR. The percent of NKS vehicles showing statistically significant effects of octane quality on acceleration performance was generally equally divided between positive and negative effects, indicating an overall random pattern.

Distributions of relative acceleration time, Figure 6-17, were generally similar for the KS and NKS vehicles, except at maximum-throttle conditions and at octane levels below ONR. At octane levels below ONR, the distributions show a higher proportion of KS vehicles with degraded acceleration performance (acceleration time greater than 1.0) compared with NKS vehicles. At maximum-throttle conditions, the distributions show higher proportions of KS vehicles with faster accelerations times (relative acceleration time less than 1.0) at octane levels above ONR (+ 4 and + 8 RON), and slower acceleration times (relative acceleration time greater than 1.0) at octane levels below ONR (- 4 RON).

Select Models - Nine different KS engines were available for analysis as select models. Specifications of the select models are listed in Table 5. The average effect of octane changes on acceleration time for each select model is shown in Table 6. Relative acceleration times for individual vehicles within each select model group are listed in Table 7. The manufacturers recommended regular unleaded gasoline for all select models. Octane quality effects varied considerably among select models and individual vehicles. Most select models showed increased acceleration times at octanes below ONR. One select model (Model E), equipped with an adaptive-learning electronic knock-control system, showed an average decrease of 8.6 percent in acceleration time when octane quality was increased by 8 RON above ONR. The acceleration time decrease was fairly consistent among the three individual vehicles tested, and may indicate the potential for adaptive-learning systems to control audible knock at octane levels well below the engine octane requirement for peak performance.

Effect of Vehicle Octane Requirement - Regression analyses were conducted to determine whether variations in KS vehicle relative acceleration time were related to vehicle octane requirement. The results, summarized in Table 8, showed some small, but statistically significant, effects of vehicle octane requirement on relative acceleration time. For example, at 4 RON below ONR, relative acceleration times tended to be higher in the KS vehicles with lower octane requirements. While statistically significant effects were noted, correlation coefficients (r^2) were very low, indicating that the contribution of vehicle ONR to variations in relative acceleration time was very small.

T A B L E S A N D F I G U R E S

Table 1

OCTANE NUMBERS OF 1939/50 CRC FBRU REFERENCE FUELS

<u>Research Octane Number</u>	<u>Motor Octane Number</u>	<u>Sensitivity</u>
80	75.2	4.6
82	76.7	5.3
84	78.1	5.9
85	78.7	6.3
86	79.4	6.6
87	80.0	7.0
88	80.7	7.3
89	81.3	7.7
90	81.9	8.1
91	82.6	8.4
92	83.3	8.7
93	83.9	9.1
94	84.5	9.5
95	85.2	9.8
96	85.9	10.1
97	86.6	10.4
98	87.3	10.7
99	88.0	11.0
100	88.8	11.2
101	89.6	11.4
102	90.4	11.6
103	91.4	11.6
104	92.6	11.4

Table 2

ACCELERATION TEST REPEATABILITY

Octane Level	Average Coefficient of Variation, %			
	<u>Wide Open Throttle</u>			Max. Throttle
	<u>0-30 MPH</u>	<u>0-60 MPH</u>	<u>0-70 MPH</u>	<u>40-60 MPH</u>
<u>KS Vehicles</u>				
+8 RON	2.8	1.5	1.4	2.0
+4 RON	2.3	1.3	1.0	2.4
ONR	3.2	1.5	1.3	2.4
-4 RON	2.5	1.3	0.9	2.3
<u>NKS Vehicles</u>				
+8 RON	3.2	1.8	1.5	2.1
+4 RON	2.8	1.5	1.3	2.2
ONR	3.0	1.6	1.5	2.1
-4 RON	2.8	1.2	0.7	2.2

Table 3

EFFECT OF OCTANE CHANGES ON RELATIVE ACCELERATION TIME

Octane Change*	<u>Average Change in Acceleration Time per RON, %</u>			
	<u>Wide Open Throttle</u>			<u>Max. Throttle</u>
	<u>0-30 MPH</u>	<u>0-60 MPH</u>	<u>0-70 MPH</u>	<u>40-60 MPH</u>
<u>KS Vehicles</u>				
+8 RON	-0.1	<u>-0.1</u>	<u>-0.1</u>	<u>-0.3</u>
+4 RON	-0.1	0.0	-0.1	<u>-0.4</u>
-4 RON	<u>+0.6</u>	<u>+0.4</u>	<u>+0.3</u>	<u>+0.7</u>
 NKS Vehicles				
+8 RON	0.0	0.0	0.0	<u>0.1</u>
+4 RON	-0.1	0.0	-0.1	0.1
-4 RON	-0.1	0.0	0.0	0.0

* Relative to Vehicle Maximum Throttle Octane Requirement

Underlined values significant at 95% confidence

Table 4

INDIVIDUAL VEHICLE OCTANE EFFECTS ON ACCELERATION TIME

Octane Change*	Effect**	<u>Percent of Vehicles Showing Significant Effect</u>			
		<u>Wide Open Throttle</u>		<u>Max. Throttle</u>	
		<u>0-30 MPH</u>	<u>0-60 MPH</u>	<u>0-70 MPH</u>	<u>40-60 MPH</u>
<u>KS Vehicles</u>					
+8 RON	+	9.5	9.5	5.4	2.6
	-	14.9	24.3	29.7	31.6
+4 RON	+	7.5	11.9	10.4	2.9
	-	4.5	14.9	20.9	24.6
-4 RON	+	21.2	37.9	31.8	38.2
	-	0.0	1.5	1.5	7.4
<u>NKS Vehicles</u>					
+8 RON	+	18.0	13.0	12.4	8.9
	-	7.0	10.0	15.5	7.9
+4 RON	+	9.2	11.2	7.4	13.1
	-	10.2	8.2	10.6	12.1
-4 RON	+	11.5	15.4	15.4	0.0
	-	11.5	7.7	19.2	16.0

* Octane change from vehicle maximum throttle octane requirement.

** Positive effect (+) denotes slower acceleration time with octane change
Negative effect (-) denotes faster acceleration time with octane change.

Table 5

SELECT MODEL SPECIFICATIONS

<u>Model</u>	<u>Engine Disp.</u>	<u>Type</u>	<u>Trans.</u>	<u>Fuel System</u>	<u>Knock Control System*</u>
A	2.3L	L4	A3	PFI	AA
B	2.8L	V6	A3	PFI	A
C	2.8L	V6	A4	PFI	A
D	3.0L	V6	A4	PFI	I
E	3.0L	V6	A4/M5	PFI	AAR
F	3.1L	V6	A4	PFI	A
G	3.3L	V6	A3/A4	PFI	A
H	3.8L	V6	A4	PFI	A
I	5.7L	V8	A4	TBI	A

* A - All cylinder spark retard

I - Individual cylinder spark retard

AA - Adaptive learning, all cylinder spark retard

AAR - Adaptive learning, all cylinder advance and retard

Table 6

AVERAGE EFFECT OF OCTANE QUALITY ON ACCELERATION TIME

Select Models

<u>Model</u>	<u>Percent Change in Acceleration Time</u> <u>Versus ONR Fuel</u>		
	<u>- 4 RON</u>	<u>+ 4 RON</u>	<u>+ 8 RON</u>
A	+8.4	-1.7	-1.3
B	+2.7	+0.1	-1.6
C	-0.5	-2.0	-2.5
D	+0.3	0.0	+1.1
E	+1.1	+0.4	-8.6
F	+4.4	-3.7	-5.1
G	+5.2	0.0	+0.6
H	+3.8	-3.6	-4.0
I	+1.0	-5.5	-2.0

Table 7

INDIVIDUAL MODEL RELATIVE ACCELERATION TIME
40-60 MPH AT MAXIMUM THROTTLE

<u>Model</u>	<u>Obs. No.</u>	Relative Acceleration Time at <u>Octane Change from ONR</u>		
		<u>-4 RON</u>	<u>+4 RON</u>	<u>+8 RON</u>
A	05-30	1.044	0.956	0.917
	26-06	1.062	0.997	1.000
	28-27	1.261	0.955	0.963
	28-32	1.102	1.004	1.065
	29-16	1.009	0.988	1.000
	29-18	1.031	0.996	0.977
	Average	1.084	0.983	0.987
B	05-20	1.041	1.016	0.949
	05-25	1.028	0.991	0.984
	08-03	1.027	0.978	1.000
	08-08	0.932	1.000	0.992
	08-21	1.011	0.993	0.975
	26-11	1.007	0.973	1.004
	26-14	1.057	-	0.964
	41-06	1.000	1.010	1.003
	65-12	1.077	1.043	-
	Average	1.027	1.001	0.984
C	05-29	1.056	0.985	0.950
	07-11	0.852	0.882	-
	08-02	0.901	0.927	0.909
	26-10	1.024	1.015	-
	26-17	0.990	1.026	0.987
	28-06	1.031	0.976	1.012
	28-22	1.026	1.026	1.026
	29-04	1.015	1.000	1.007
	29-07	1.015	0.980	0.967
	29-14	1.000	0.995	1.003
	41-09	1.013	0.967	0.964
	47-22	1.012	0.975	0.940
	47-23	1.003	0.987	0.964
	Average	0.995	0.980	0.975

Table 7 (cont.)

INDIVIDUAL MODEL RELATIVE ACCELERATION TIME
40-60 MPH AT MAXIMUM THROTTLE

Model	Obs. No.	Relative Acceleration Time at Octane Change from ONR		
		-4 RON	+4 RON	+8 RON
D	26-07	0.953	0.978	1.004
	26-23	0.991	0.987	1.017
	29-02	1.000	1.004	1.016
	32-17	-	0.994	1.013
	41-23	1.082	1.026	1.027
	65-08	0.987	1.013	0.991
	Average	1.003	1.000	1.011
E	05-14	1.011	1.004	0.902
	06-21	-	-	0.949
	41-04	-	1.005	0.891
	Average	1.011	1.004	0.914
F	08-06	1.113	0.946	0.954
	08-15	1.007	0.955	0.962
	08-19	1.062	0.949	0.930
	21-12	0.995	1.000	-
	Average	1.044	0.963	0.949
G	05-22	1.069	1.021	0.995
	05-28	1.046	0.943	0.966
	26-05	0.991	0.996	1.018
	26-08	1.117	1.025	1.000
	28-24	1.068	1.007	1.024
	29-11	1.019	1.007	1.031
	Average	1.052	1.000	1.006

Table 7 (cont.)

INDIVIDUAL MODEL RELATIVE ACCELERATION TIME
40-60 MPH AT MAXIMUM THROTTLE

<u>Model</u>	<u>Obs. No.</u>	Relative Acceleration Time at Octane Change from ONR		
		<u>-4 RON</u>	<u>+4 RON</u>	<u>+8 RON</u>
H	05-21	1.060	0.979	0.970
	08-04	-	0.909	0.796
	08-24	-	0.952	0.939
	26-21	-	-	0.944
	28-14	0.989	0.946	0.989
	29-17	1.089	0.996	0.984
	29-19	1.017	1.004	0.975
	41-22	0.963	0.929	0.931
	47-18	1.076	0.967	1.022
	47-19	1.071	0.992	0.992
	65-11	-	-	1.018
	Average	1.038	0.964	0.960
I	07-12	0.950	0.953	-
	26-20	0.958	-	0.984
	28-16	1.122	0.936	0.959
	65-28	-	-	0.997
	Average	1.010	0.945	0.980

Table 8

EFFECT OF VEHICLE ONR ON RELATIVE ACCLEPATION TIME
KNOCK SENSOR EQUIPPED VEHICLES

Octane Change*	Stat	<u>Wide Open Throttle</u>			Max Throttle 40-60 MPH
		<u>0-30 MPH</u>	<u>0-60 MPH</u>	<u>0-70 MPH</u>	
+8 RON	Slope	0.001	0.000	0.000	-0.001
	r2	0.007	0.000	0.000	0.007
+4 RON	Slope	<u>0.001</u>	<u>0.001</u>	<u>0.001</u>	0.001
	r2	0.010	0.025	0.031	0.015
-4 RON	Slope	<u>-0.002</u>	<u>-0.001</u>	<u>-0.001</u>	<u>-0.002</u>
	r2	0.042	0.038	0.031	0.035

* Relative to vehicle maximum throttle octane requirement

Underlined slopes statistically significant at 95% confidence

Figure 1

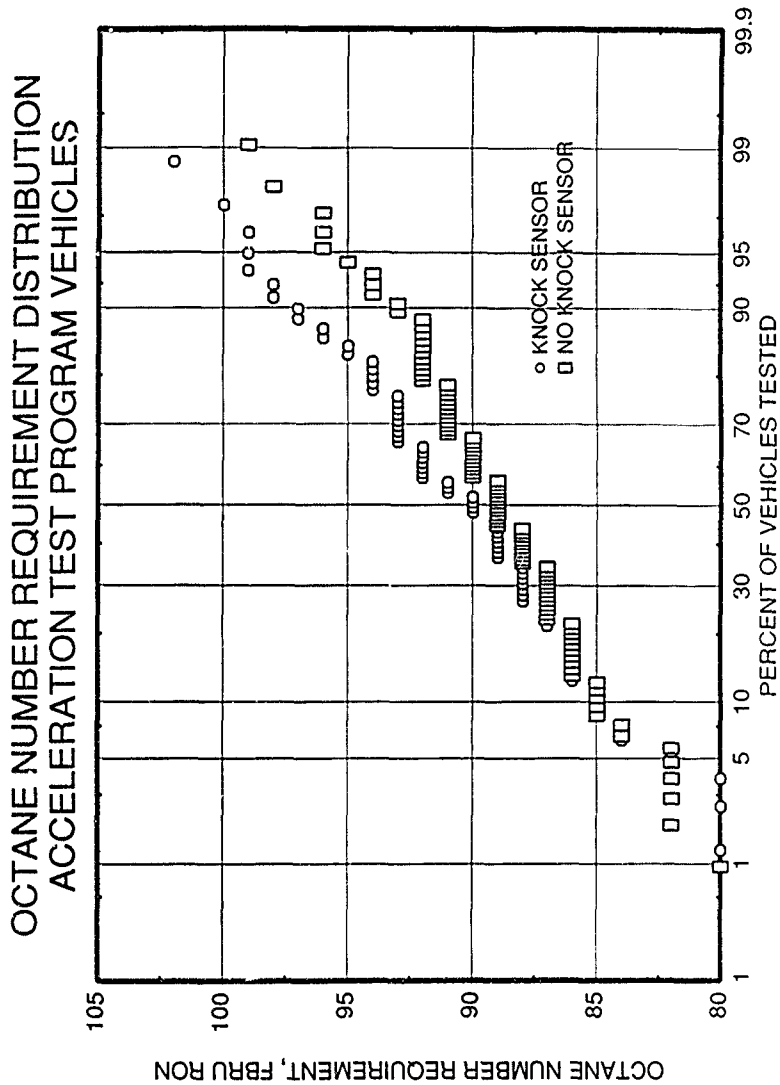


Figure 2
EFFECT OF OCTANE CHANGES ON ACCELERATION TIME
0-30 MPH WIDE OPEN THROTTLE

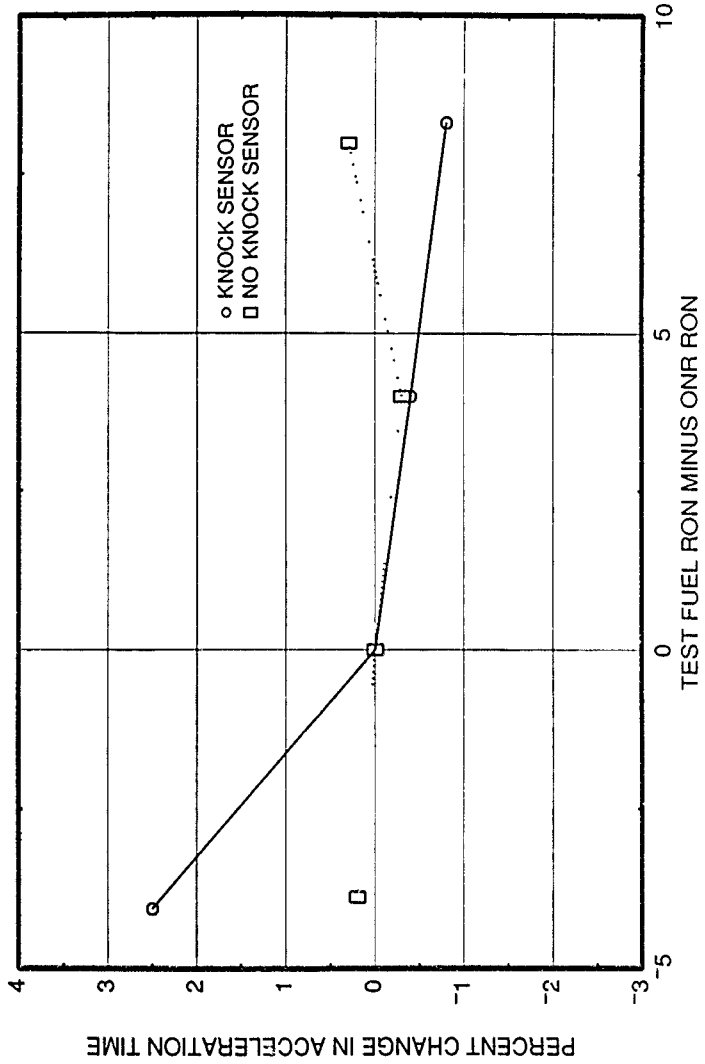


Figure 3

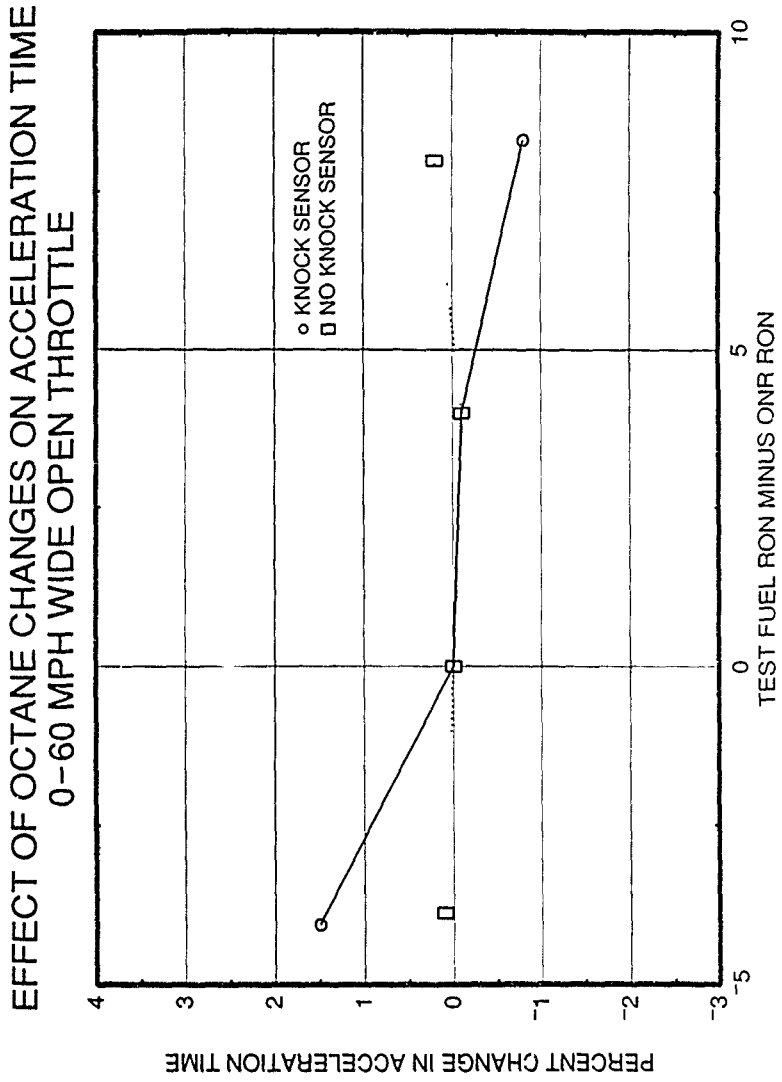


Figure 4
EFFECT OF OCTANE CHANGES ON ACCELERATION TIME
0-70 MPH WIDE OPEN THROTTLE

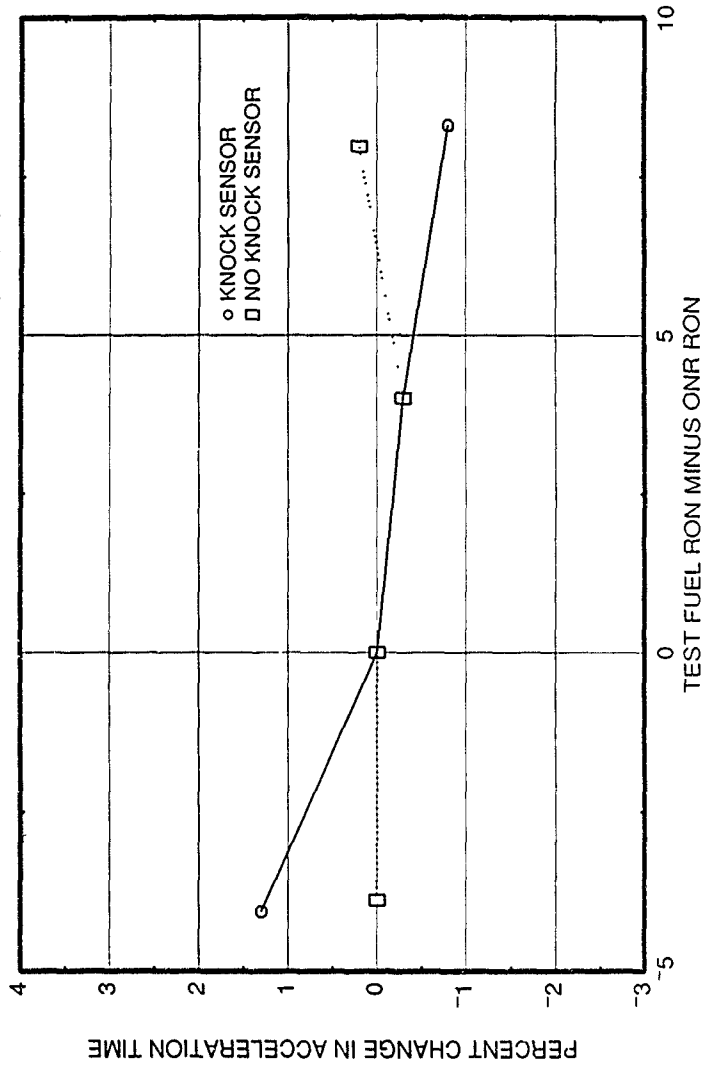


Figure 5
EFFECT OF OCTANE CHANGES ON ACCELERATION TIME
40-60 MPH MAXIMUM THROTTLE

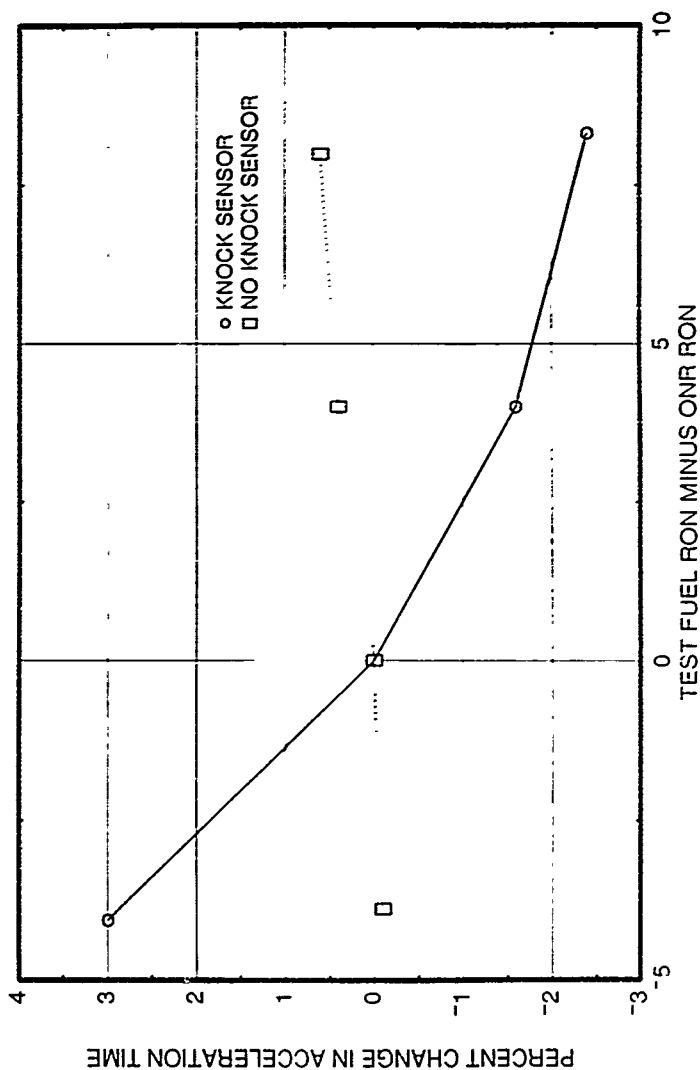


Figure 6

DISTRIBUTION OF RELATIVE ACCELERATION TIME
0-30 MPH WIDE OPEN THROTTLE
BASE VERSUS +8 RON

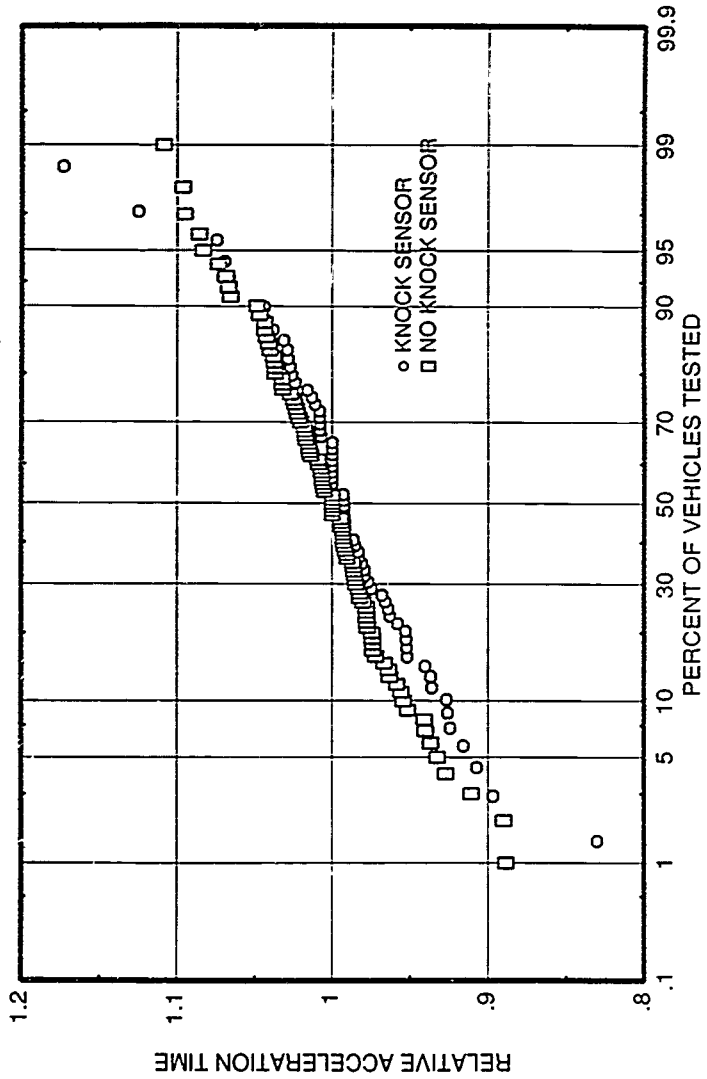


Figure 7
DISTRIBUTION OF RELATIVE ACCELERATION TIME
0-30 MPH WIDE OPEN THROTTLE
BASE VERSUS +4 RON

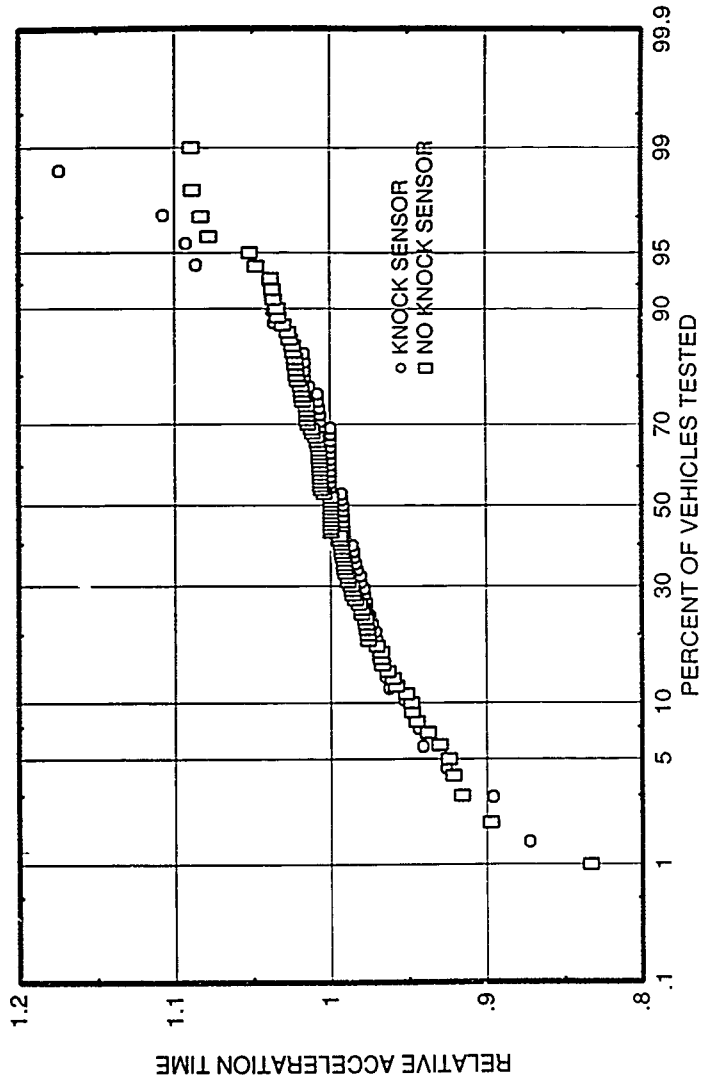


Figure 8
DISTRIBUTION OF RELATIVE ACCELERATION TIME
0-30 MPH WIDE OPEN THROTTLE
BASE VERSUS -4 RON

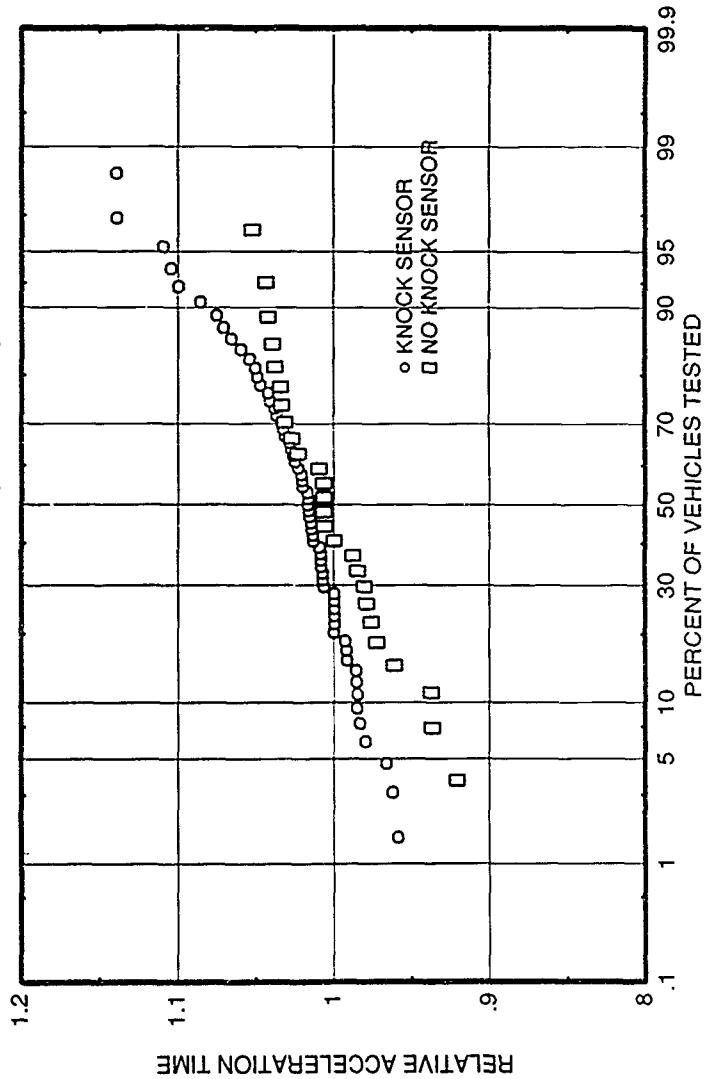


Figure 9
DISTRIBUTION OF RELATIVE ACCELERATION TIME
0-60 MPH WIDE OPEN THROTTLE
BASE VERSUS +8 RON

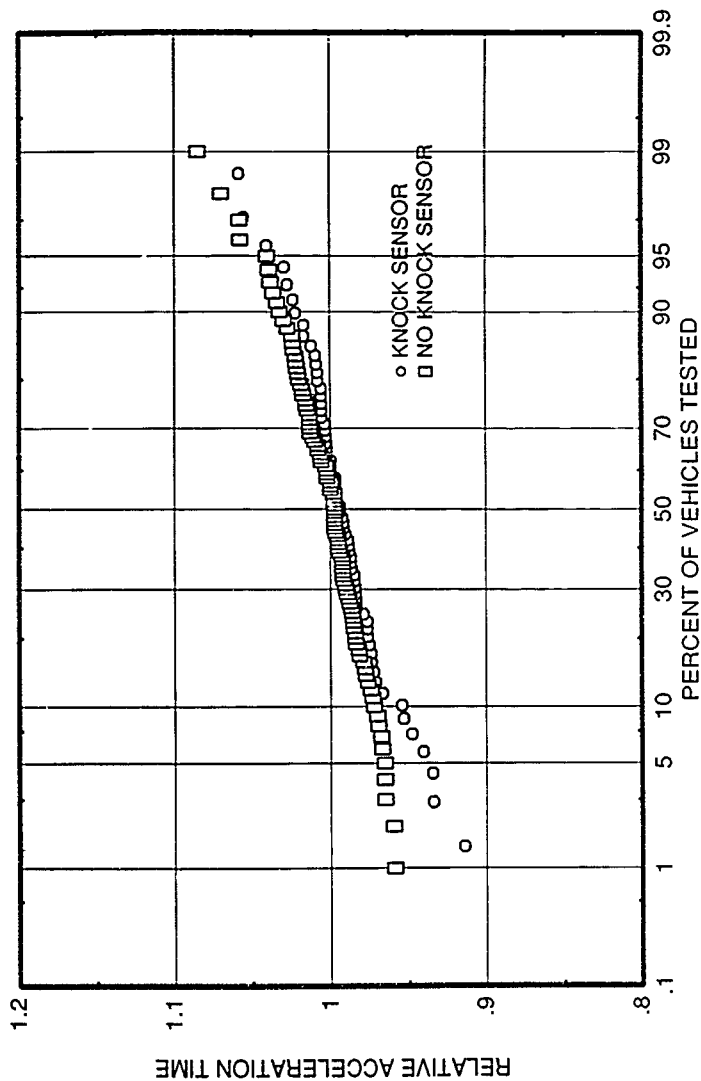


Figure 10
DISTRIBUTION OF RELATIVE ACCELERATION TIME
0-60 MPH WIDE OPEN THROTTLE
BASE VERSUS +4 RON

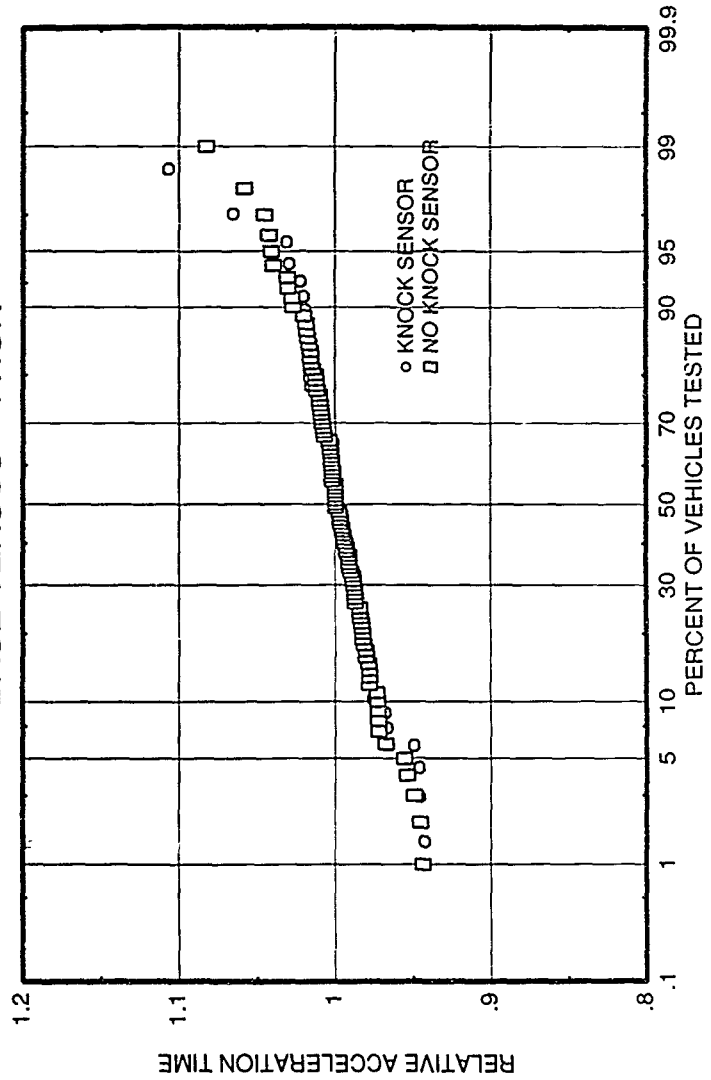


Figure 11

DISTRIBUTION OF RELATIVE ACCELERATION TIME
0-60 MPH WIDE OPEN THROTTLE
BASE VERSUS -4 RON

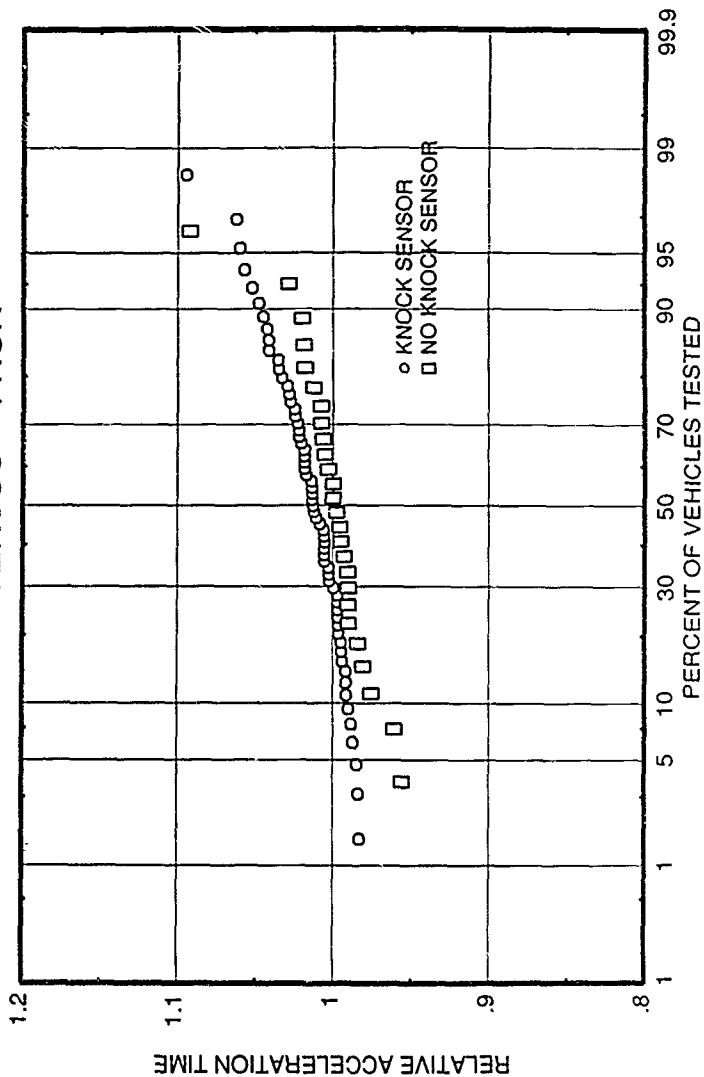


Figure 12
DISTRIBUTION OF RELATIVE ACCELERATION TIME
0-70 MPH WIDE OPEN THROTTLE
BASE VERSUS +8 RON

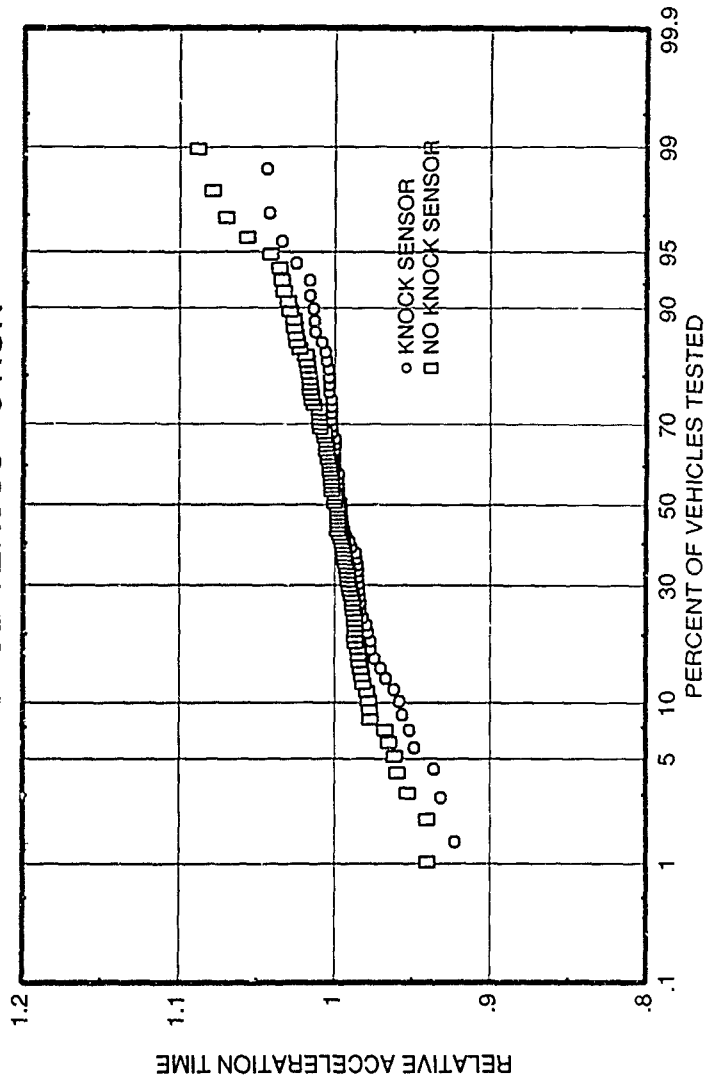


Figure 13

DISTRIBUTION OF RELATIVE ACCELERATION TIME
0-70 MPH WIDE OPEN THROTTLE
BASE VERSUS +4 RON

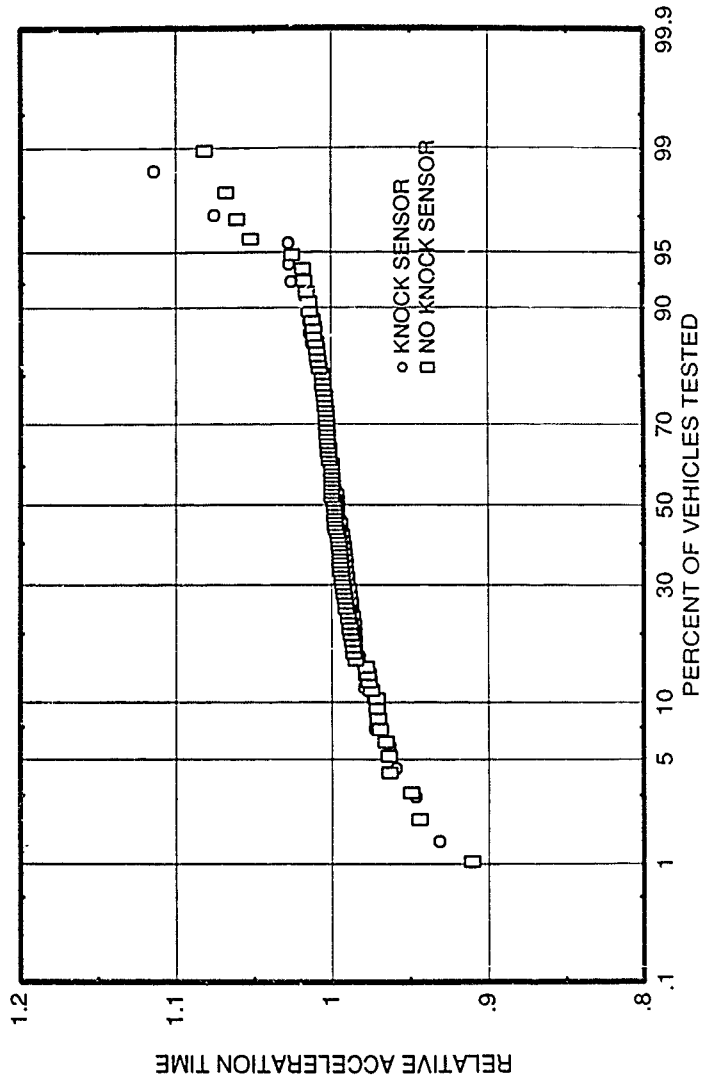


Figure 14
DISTRIBUTION OF RELATIVE ACCELERATION TIME
0-70 MPH WIDE OPEN THROTTLE
BASE VERSUS -4 RON

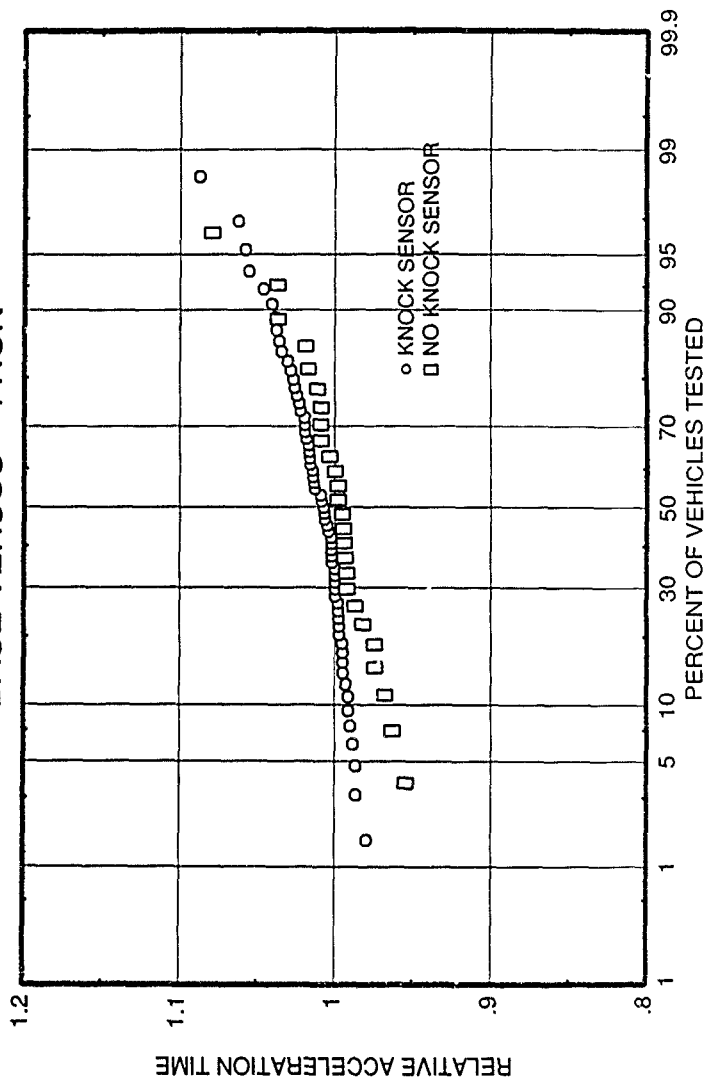


Figure 15
DISTRIBUTION OF RELATIVE ACCELERATION TIME
40-60 MPH MAXIMUM THROTTLE
BASE VERSUS +8 RON

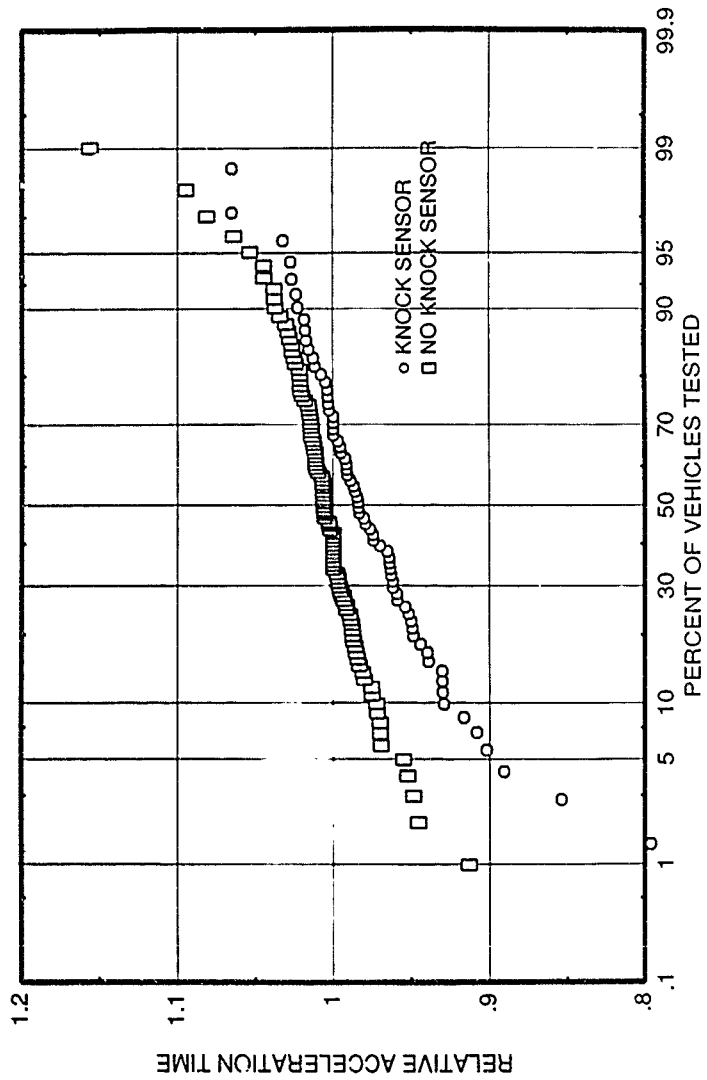


Figure 16
DISTRIBUTION OF RELATIVE ACCELERATION TIME
40-60 MPH MAXIMUM THROTTLE
BASE VERSUS +4 RON

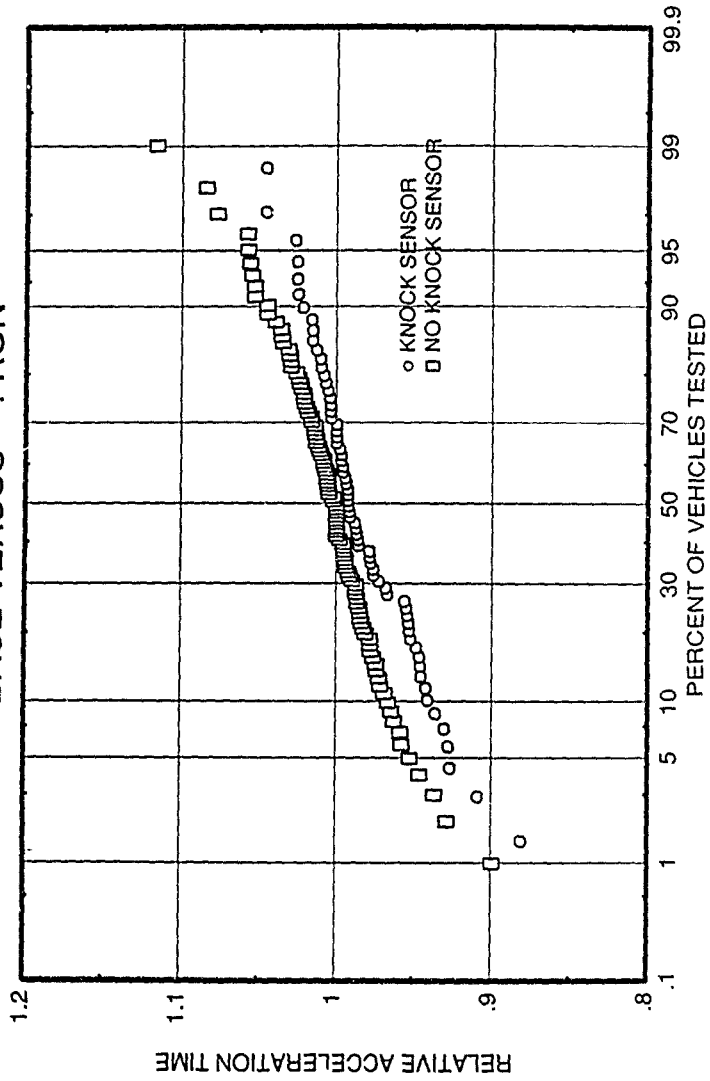
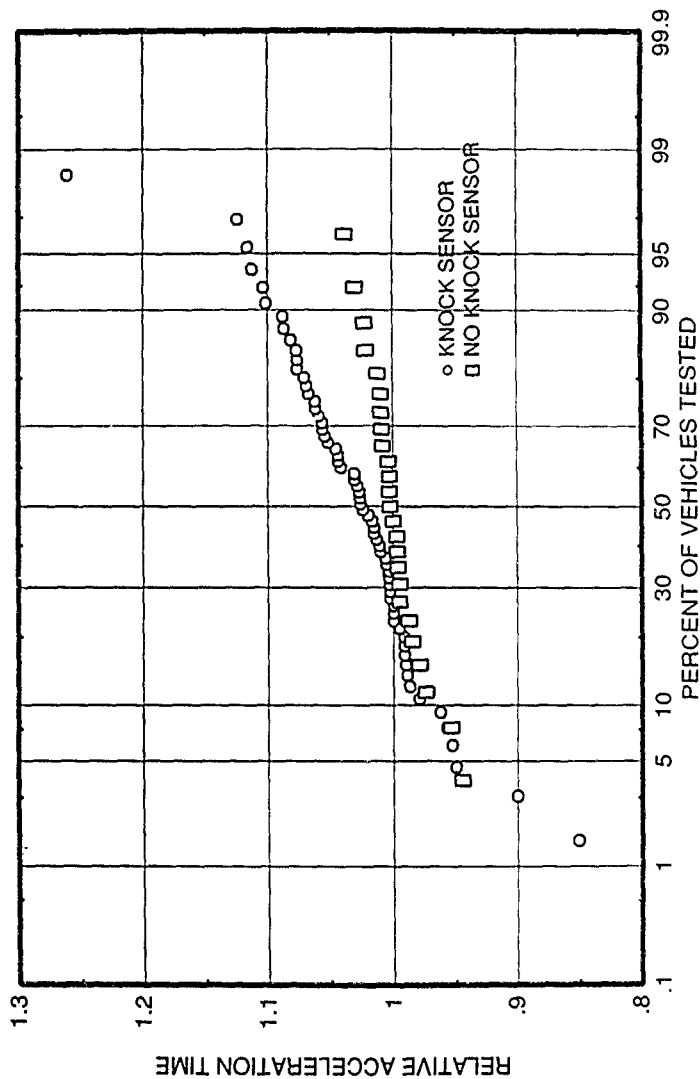


Figure 17
 DISTRIBUTION OF RELATIVE ACCELERATION TIME
 40-60 MPH MAXIMUM THROTTLE
 BASE VERSUS -4 RON



A P P E N D I X A

PARTICIPATING LABORATORIES

Participating Laboratories

Amoco Oil Company

BP Oil Company

Chevron Research & Technology Company

Exxon Research & Engineering Company

Ford Motor Company

Mobil Research & Development Corporation

Petro-Canada Products

Shell Development Company

Shell Canada

Sun Refining & Marketing Company

Texaco, Inc.

Unocal Corporation

A P P E N D I X B

ANALYSIS PANEL MEMBERSHIP

Analysis Panel

<u>Name</u>	<u>Company</u>
M. J. McNally, Leader	Mobil Research & Development Corp.
J. C. Callison	Amoco Oil Company
J. P. Graham	Chevron Research & Technology Company
D. V. Swaynos	Exxon Research & Engineering Company
J. P. Uihlein	BP Oil Company
T. Wusz	Unocal Corporation

A P P E N D I X C

PROGRAM

NOTE: This procedure can be abbreviated by testing only the first two fuels listed.

**PROGRAM FOR QUANTIFYING PERFORMANCE OF VEHICLES
KNOCK-SENSOR EQUIPPED OR NON-KNOCK-SENSOR EQUIPPED
AUTOMATIC TRANSMISSION VEHICLES ONLY**

PROCEDURE

PERFORM STEPS IN ORDER SHOWN

1. Prepare vehicle according to CRC E-15-89 technique.
2. Determine full throttle octane requirement on 1989/90 CRC FBRU fuel series using the CRC E-15-89 Procedure.
3. Cruise at 45 MPH for two minutes.
4. Using the fuel 8 RON above that determined in No. 2 above, perform a Wide-Open-Throttle (WOT) acceleration from zero to 70 mph picking off times at 30, 60, and 70 mph and recording on the data sheet. Also, record if spark knock is observed (N, B, or A). This acceleration should be made similar to a detent acceleration, i.e., ease into the throttle to avoid shocking the tires and creating wheelspin, but go all the way open.
5. Cruise at 45 mph for two minutes.
6. Repeat Nos. 4, 5, and 4, in that sequence.
7. Cruise at 35 mph for two minutes.
8. Perform a 40-60 mph WOT to detent acceleration.* Record time on data sheet as well as knock level observed (N, B, or A).
9. Cruise at 35 mph for two minutes.
10. Repeat Nos. 8, 9, and 8, in that sequence.
11. Repeat sequence 4 through 10 using the following FBRU fuels:
 - a. Fuel equal to full-throttle requirement fuel.
 - b. Fuel 4 RON above full-throttle requirement fuel.
 - c. Fuel 4 RON** below full-throttle requirement fuel (Knock sensor vehicles only).
12. Record all vehicle and test data on the data sheet provided.

* On four speed automatic transmission, accelerate in third unlocked.
 On three speed automatic transmissions, accelerate in third unlocked.
 On five speed manual transmissions, accelerate in fourth gear.
 On four speed manual transmissions, accelerate in fourth gear.
 On CVT's, forget it.

** 5 RON below full throttle requirement if 4 RON not available as in bottom end of fuel series

Sheet ____ of ____ Sheets.

**1989 CRC OCTANE NUMBER REQUIREMENT SURVEY - 1989 MODEL VEHICLES
PERFORMANCE QUALIFICATION SHEET**

Company: _____ Date: _____

Vehicle Name: _____ Model: _____

V.I.N.: _____ License No.: _____

TO BE FILLED IN BY CRC: Observation No.: ____ - ____

RUN	E-15 FTR* + 8 RON** RON	Time (Sec) from Zero MPH					
		30	Knock	60	Knock	70	Knock
1							
2							
3							
Avg							

RUN	E-15 FTR* + 8 RON** RON	Time from 40 MPH @ WOT to Detent to 60 MPH.	Knock
1			
2			
3			
Avg			

RUN	E-15 FTR* RON	Time (Sec) from Zero MPH					
		30	Knock	60	Knock	70	Knock
1							
2							
3							
Avg							

RUN	E-15 FTR* RON	Time from 40 MPH @ WOT to Detent to 60 MPH.	Knock
1			
2			
3			
Avg			

* FTR = Full Throttle Requirement.

** If FTR + 8 RON exceeds top fuel in the series, run the highest octane fuel available.

TW/ljg

A P P E N D I X D

INDIVIDUAL VEHICLE RESULTS

APPENDIX D

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs. No.	Vehicle Code	KS	FBRU RON	0-30 MPH WOT			0-60 MPH WOT			0-70 MPH WOT			40-60 MPH MT		
05-14	C76E*2*P30A4	Y	96	3.3	3.7	3.8	10.3	10.6	10.4	13.3	13.3	13.2	8.1	7.9	8.0
			88	4.0	3.9	4.0	10.5	10.6	10.7	13.4	13.3	13.3	8.9	8.7	9.0
			92	4.0	3.9	3.9	10.9	10.5	10.8	13.5	13.2	13.3	9.0	8.9	8.8
			84	3.9	3.7	3.9	11.0	10.7	10.8	13.5	13.1	13.3	8.9	8.9	9.1
05-17	C21RC3*P22A4	N	100	4.8	4.8	4.7	12.7	12.4	12.7	16.5	16.7	16.6	8.7	8.4	8.5
			92	4.6	4.6	4.5	12.6	12.7	12.5	17.0	16.7	16.9	8.4	8.6	8.7
			96	4.6	4.7	4.7	12.8	12.6	13.1	17.0	16.6	16.9	9.0	8.5	8.8
			88	4.8	4.8	4.7	12.6	12.8	12.7	16.7	16.5	16.5	8.5	8.7	8.6
05-18	C31J12*T20A3	N	102	5.1	5.8	5.2	14.2	14.9	14.1	18.0	21.1	17.9	14.4	14.5	14.5
			92	5.1	5.2	5.3	14.1	14.0	14.1	17.5	17.6	17.7	14.1	14.4	14.3
			96	5.1	5.1	4.9	13.8	13.9	13.8	17.5	17.6	17.4	14.5	14.4	14.8
			88	5.0	5.0	5.0	14.0	13.9	13.9	17.7	17.4	17.3	13.8	14.2	13.7
05-20	C32AW2*P28A3	Y	104	4.3	4.2	4.3	10.5	11.0	11.0	14.0	14.0	14.0	9.9	9.9	9.9
			98	4.1	4.2	4.2	10.9	11.1	10.6	14.2	14.4	14.3	10.5	10.4	10.4
			102	4.2	4.3	4.1	10.5	11.1	10.8	14.3	14.6	14.2	10.8	10.5	10.5
			94	4.4	4.2	4.1	11.3	11.0	11.2	14.3	14.3	14.6	10.8	10.9	10.9
05-21	C34HC2*P38A4	Y	100	3.9	3.9	3.9	10.4	10.3	10.3	13.6	13.4	13.5	7.7	7.5	7.6
			92	3.9	4.0	3.9	10.3	10.4	10.4	13.6	13.6	13.4	8.1	7.7	7.7
			96	4.0	4.0	3.9	10.5	10.4	10.5	13.8	13.8	13.6	7.4	7.8	7.8
			88	4.1	4.1	4.1	10.7	10.8	10.7	13.8	13.8	13.7	8.2	8.0	8.7
05-22	C34AN2*P33A4	Y	100	4.8	4.7	4.7	10.5	10.3	10.2	13.7	13.3	13.4	7.5	7.7	7.7
			92	4.5	4.5	4.6	10.1	10.5	10.8	13.6	13.4	13.5	7.4	7.8	7.8
			96	4.4	4.3	4.5	9.9	10.1	10.4	13.2	13.3	13.4	8.0	7.5	8.0
			88	4.3	4.7	4.7	9.9	10.7	10.4	13.3	13.5	13.5	8.2	8.2	8.2
05-23	S36TZ2*T43A4	Y	98	4.2	4.1	4.5	11.6	11.7	11.7	18.5	18.0	19.0	8.5	8.1	8.8
			90	4.6	4.3	4.2	12.6	12.2	12.4	19.8	19.2	19.3	9.1	9.2	9.0
			96	4.2	4.2	4.4	12.1	12.3	12.2	18.8	19.0	19.0	8.3	8.6	8.5
			86	4.5	4.6	4.5	12.7	13.1	12.7	20.1	20.5	20.4	9.3	10.0	9.2
05-24	C22PF2*P50A4	N	100	4.5	4.4	4.3	14.1	13.9	13.7	17.4	16.5	16.9	9.4	9.6	10.0
			92	4.5	4.3	4.3	13.9	13.7	13.5	18.2	18.0	17.8	9.5	9.5	9.4
			96	4.3	4.6	4.4	13.1	14.0	13.3	18.4	17.9	17.7	10.4	9.6	9.9
			86	4.3	4.5	4.6	13.9	13.5	13.4	18.6	18.8	18.6	9.2	8.9	9.0

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs. No.	Vehicle Code	KS	FBRU RON	0-30 MPH WOT	0-60 MPH WOT	0-70 MPH WOT	40-60 MPH MI
06-05	C11BU2*P30A4	Y	97	5.2 5.1 5.0 14.1 13.9 13.9	17.9 17.6 17.9	6.7 6.6 6.7	
			89	5.3 5.2 5.3 14.3 14.2 14.4	18.5 18.4 18.3	6.8 6.6 6.5	
06-06	S15XL2*P40A4	Y	101	7.0 5.8 5.2 16.6 14.6 13.9	22.4 19.8 19.2	7.2 7.2 7.0	
			93	5.6 5.3 5.1 14.6 14.1 13.9	20.0 19.6 19.2	7.3 7.2 7.2	
06-08	C21RL3TP22M5	Y	101	6.9 6.1 5.7 13.0 11.6 10.9	14.8 13.3 12.6	4.3 4.2 4.4	
			82	6.3 5.4 5.7 11.8 11.3 11.8	14.1 13.3 13.9	4.9 5.2 5.0	
06-18	C42A*2*P27A4	N	94	3.6 3.8 3.8 8.7 8.6 8.4	11.0 11.2 11.2	4.8 4.8 5.1	
			86	4.1 3.6 3.7 9.0 8.6 8.4	11.5 11.4 11.0	4.8 4.9 4.7	
06-21	C76E*2*P30M5	Y	94	7.0 5.7 6.2 14.7 13.3 13.6	17.5 16.2 16.5	5.7 5.5 5.7	
			86	5.8 7.5 6.3 15.4 15.2 14.9	18.4 18.2 17.8	6.0 5.9 5.9	
07-11	C31AW2*P28A4	Y	90	2.7 2.5 3.4 9.6 9.5 9.8	13.0 12.8 13.9	11.4 10.3 12.0	
			94	3.4 3.3 3.4 10.4 10.2 10.2	14.2 14.2 14.3	10.7 10.0 9.0	
07-12	P36CK2*T57A4	Y	86	3.4 3.2 3.2 10.3 10.2 10.2	14.0 14.0 14.0	9.2 9.8 9.7	
			92	3.1 3.1 3.1 7.7 8.2 8.1	11.0 10.8 11.4	12.1 10.9 9.0	
07-16	C12PK2*T25A3	N	96	3.0 3.2 2.9 8.2 8.0 7.8	10.7 10.8 10.8	9.4 10.7 10.4	
			88	3.4 3.0 3.6 8.3 7.9 8.8	11.6 11.4 11.4	9.6 10.2 10.6	
07-18	C12PK2*T25A3	N	84	4.2 4.2 4.2 12.3 12.0 12.0	16.8 16.8 16.1	11.2 11.0 11.1	
			88	4.2 4.3 4.1 11.5 12.0 12.0	16.2 15.9 15.8	10.6 10.6 10.7	
07-20	C12PK2*T25A3	N	80	4.1 4.2 4.0 11.8 12.0 11.8	16.0 15.9 16.2	10.8 11.2 10.8	
			84	4.1 4.2 4.0 11.8 12.0 11.8	16.0 15.9 16.2	10.8 11.2 10.8	

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs. No.	Vehicle Code	KS	FBRU RON	0-30 MPH WOT	0-60 MPH WOT	0-70 MPH WOT	40-60 MPH MT									
07-19	C21S42*P38A4	N	-	-	-	-	-									
			92	4.0	3.4	4.0	11.1	10.1	10.5	15.2	14.5	14.0	7.5	8.0	7.8	
			96	3.0	3.1	3.4	9.9	10.0	10.2	13.5	13.1	13.2	7.9	7.8	8.2	
08-01	C31L12*T20A3	N	88	3.4	3.7	3.4	10.1	10.0	10.2	14.1	14.0	14.0	8.4	8.8	7.0	
			94	5.6	5.5	5.5	18.0	17.8	17.8	24.2	24.0	24.0	24.0	19.8	19.0	19.2
			86	5.5	5.4	5.4	17.8	17.7	17.4	23.9	23.8	23.8	23.8	18.9	19.8	20.4
08-02	C33WW2*P28A4	Y	90	5.5	5.4	5.5	17.8	17.8	17.4	23.4	23.2	23.2	21.0	21.1	22.0	
			82	5.3	5.3	5.5	17.0	17.2	17.4	23.2	23.3	23.2	19.4	20.4	19.3	
			96	3.9	3.9	3.9	10.2	10.4	10.2	13.4	14.0	13.9	11.2	11.7	11.8	
08-03	C33AW2*P28A3	Y	88	4.0	3.8	3.9	10.2	10.6	10.5	14.0	13.9	14.0	12.8	13.0	12.4	
			92	4.0	4.0	3.9	10.6	10.8	10.6	13.9	14.2	14.0	12.0	11.6	11.8	
			84	4.2	4.2	4.0	11.0	11.0	10.8	14.5	14.4	14.2	11.2	11.8	11.4	
08-04	C32HC2*P38A4	Y	92	4.1	4.2	4.4	10.9	11.3	11.1	14.5	15.0	14.5	14.8	15.2	15.2	
			84	4.9	4.4	4.4	10.9	10.9	11.2	14.8	14.9	15.1	15.2	14.8	15.2	
			88	4.4	4.2	4.4	10.8	11.2	11.0	14.4	14.9	14.8	14.6	14.8	14.8	
08-05	C60T62*T16A3	N	80	4.6	4.4	4.8	11.2	11.0	11.4	15.0	14.6	15.2	15.6	15.2	15.6	
			88	4.0	4.2	4.0	10.3	10.6	10.4	13.7	13.7	13.6	8.3	8.8	8.3	
			80	4.0	4.0	4.8	11.1	11.0	11.4	14.2	14.1	14.9	10.9	10.8	10.2	
08-06	C32WT2*P31A4	Y	84	4.0	4.2	4.0	10.8	11.2	10.9	13.8	14.0	13.8	9.4	9.8	9.8	
			-	-	-	-	-	-	-	-	-	-	-	-	-	
			98	5.4	5.9	5.9	15.2	15.8	15.8	22.0	22.2	21.9	14.6	13.8	13.8	
08-07	C94BA4*216A3	N	90	5.4	5.6	5.4	15.8	15.6	15.6	22.4	22.1	22.2	13.4	13.0	14.0	
			94	5.6	5.9	5.4	15.4	15.8	15.6	22.0	22.4	22.0	14.4	13.8	13.6	
			86	5.3	5.6	5.6	15.4	15.6	15.8	22.0	22.2	22.2	13.6	13.8	13.4	
08-08	C32WT2*P31A4	Y	97	4.0	4.2	4.0	10.9	10.4	9.8	13.8	13.2	12.9	7.2	7.7	7.9	
			89	4.6	4.2	4.8	10.9	10.2	10.4	13.9	12.8	13.2	7.9	7.8	8.2	
			93	4.1	4.5	4.2	10.0	9.6	10.2	13.2	12.8	13.1	7.4	7.6	7.6	
08-09	C94BA4*216A3	N	85	4.6	4.4	4.4	10.8	10.7	10.2	13.2	13.0	12.9	8.6	9.2	8.8	
			95	4.6	4.9	4.8	13.8	13.2	13.2	17.2	17.1	17.3	13.3	13.6	13.5	
			87	4.4	4.9	4.9	12.8	13.6	13.8	17.4	17.7	17.7	13.2	13.4	13.5	
08-10	C32WT2*P31A4	Y	91	4.8	4.9	4.6	13.6	13.7	13.4	18.0	17.8	17.6	13.7	13.8	13.5	
			82	4.9	5.0	4.9	13.4	13.8	13.3	17.3	17.6	17.5	13.2	13.5	13.2	
			-	-	-	-	-	-	-	-	-	-	-	-	-	

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs. No.	Vehicle Code	KS	FBRU RON	0-30 MPH WOT			0-60 MPH WOT			0-70 MPH WOT			40-60 MPH MT		
08-08	C31AW2*P28A3	Y	96	4.2	4.2	4.1	11.0	11.0	11.0	14.0	14.1	14.1	12.0	12.0	11.9
			88	4.1	4.2	4.2	10.9	11.0	11.1	14.0	14.0	14.1	12.1	12.0	12.1
			92	4.1	4.2	4.1	11.0	11.1	10.9	14.0	14.0	13.9	12.0	12.1	12.1
08-09	C14C32*P30A4	N	84	4.2	4.2	4.1	10.9	11.1	11.1	13.9	14.0	14.0	11.9	12.0	12.0
			90	4.6	4.8	4.4	11.4	11.5	11.4	15.0	14.9	14.9	9.0	9.1	9.0
			82	4.8	4.7	5.0	11.4	11.6	11.8	14.9	15.0	14.9	9.4	9.0	9.1
08-10	C35C52*T45A4	N	86	4.4	4.6	4.6	11.4	11.6	11.8	14.7	14.8	14.9	9.7	9.2	9.1
			80	4.8	4.8	4.6	11.2	11.8	11.8	14.8	14.8	14.9	9.0	9.4	9.0
			94	5.1	4.9	4.9	13.2	13.0	13.0	18.0	17.9	17.8	12.2	11.3	12.2
08-11	C33AR2*T25A3	N	86	4.8	4.9	4.9	12.5	12.9	13.0	17.3	17.8	17.8	12.0	12.3	12.0
			90	4.8	4.9	4.8	13.0	12.9	12.8	17.6	17.6	17.5	10.9	11.4	11.7
			82	5.0	4.8	4.9	13.1	13.2	13.2	17.9	17.8	17.8	10.9	11.6	11.8
08-12	C35C52*T45A4	N	94	4.6	4.9	4.9	12.9	13.0	13.0	16.9	17.2	17.0	10.9	11.2	11.4
			86	4.8	5.0	4.8	12.9	13.1	13.0	17.0	17.1	17.1	11.2	11.2	10.9
			90	5.1	4.8	4.8	13.1	13.1	12.9	17.3	17.1	17.1	10.9	11.2	11.0
08-13	C94BA4*216A3	N	82	4.6	4.8	4.8	12.9	12.9	13.2	17.0	17.1	17.0	10.8	11.4	11.2
			94	4.8	5.0	4.8	13.2	13.6	13.6	19.9	20.4	20.5	13.7	13.8	13.7
			86	4.7	4.9	5.0	13.4	13.7	13.6	20.2	20.6	20.5	13.6	13.8	13.8
08-14	C22C52*P16A3	N	90	4.7	4.9	5.0	13.9	14.0	13.9	20.3	20.2	20.0	13.6	13.8	13.8
			82	4.9	5.2	5.0	13.8	13.9	13.8	20.2	20.2	20.1	13.8	13.7	13.5
			92	4.8	4.6	4.9	13.4	13.0	13.2	17.8	16.8	16.9	11.8	12.0	11.7
08-15	C33WT2*P31A4	Y	84	5.0	4.6	4.9	13.4	13.1	13.4	17.4	16.8	17.0	12.4	11.7	11.9
			88	4.6	4.4	4.8	13.2	13.4	13.6	17.4	17.4	17.7	11.9	12.3	12.1
			80	4.6	4.6	4.4	13.2	13.6	13.6	17.6	17.7	17.8	12.4	12.2	12.5
08-14	C22C52*P16A3	N	94	4.8	4.6	4.9	12.8	12.6	12.5	17.1	17.2	17.0	10.9	11.4	11.1
			86	4.6	4.8	4.9	12.2	12.6	12.6	17.0	17.2	17.2	10.8	10.9	11.3
			90	4.8	4.5	4.8	12.2	12.2	12.4	17.0	17.0	17.2	11.3	11.4	11.1
08-15	C33WT2*P31A4	Y	82	4.6	4.8	4.9	12.1	12.4	12.3	17.0	17.1	17.2	10.8	11.1	11.2
			94	2.9	3.0	2.9	9.6	9.7	9.6	12.9	13.0	13.0	9.4	9.2	9.2
			86	3.4	3.6	3.6	9.7	9.9	10.0	13.1	13.2	13.2	9.5	9.7	9.7
08-15	C33WT2*P31A4	Y	90	3.4	3.1	3.0	9.8	9.8	9.8	13.0	13.1	12.9	9.4	9.0	9.2
			82	3.8	3.6	3.5	10.0	10.1	9.9	13.2	13.2	13.1	9.9	9.4	9.8

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs No	Vehicle Code	FBRU	KS	RON	0-30 MPH WOT	0-60 MPH WOT	0-70 MPH WOT	40-60 MPH MT								
08-16	C21E92*T19A3	N		101	4.7	4.4	4.7	14.0	14.0	18.9	18.8	11.3	12.1	11.8		
				93	4.4	4.2	4.7	14.1	13.8	14.0	18.9	18.8	18.9	11.2	11.8	
				97	4.4	4.6	4.6	13.9	14.0	14.1	18.7	18.9	18.9	11.4	11.8	
08-17	C31L12*T20A3	N		89	4.6	4.8	4.4	13.8	14.0	14.0	18.8	18.9	18.9	11.5	11.9	
				97	5.2	5.0	5.0	15.1	15.0	14.9	18.5	18.4	18.2	12.8	13.2	13.1
				89	5.1	5.0	5.1	14.7	14.9	14.9	18.4	18.5	18.3	13.2	13.4	13.0
08-18	S13S32*P30A4	N		93	5.1	5.0	5.1	14.8	15.1	15.0	18.1	18.4	18.4	13.2	13.4	
				85	5.2	5.3	5.3	14.9	15.2	15.2	18.4	18.6	18.4	13.3	13.4	
				94	3.4	3.7	3.8	10.2	10.4	10.7	13.4	13.6	13.6	14.9	15.7	
08-19	C32WT2*P31A4	Y		86	3.7	3.7	4.0	10.4	10.5	10.7	13.2	13.6	13.7	15.6	15.2	
				90	4.1	3.8	3.8	10.8	10.6	10.7	13.8	13.6	13.6	15.4	14.8	
				82	4.2	3.8	4.0	10.8	10.6	10.8	13.8	13.7	13.7	15.4	15.6	
08-20	S12SJ2TP25A3	Y		93	3.2	3.6	3.2	9.3	9.4	9.3	12.8	12.7	12.7	8.3	8.6	
				85	3.5	3.6	3.4	9.6	9.6	9.4	13.1	13.0	13.1	8.8	9.1	
				89	3.4	3.5	3.4	9.2	9.4	9.6	12.8	13.0	13.0	8.3	8.7	
08-21	C31LW2*P28A3	Y		80	3.9	3.8	3.9	9.9	10.1	10.1	13.7	13.9	13.8	9.5	9.7	
				92	3.2	3.1	3.2	9.1	9.2	9.5	11.9	11.9	12.2	5.2	5.4	
				84	3.2	3.3	3.2	9.2	9.4	9.4	11.9	12.1	12.0	5.6	5.7	
08-22	C21E92*T19A3	N		88	3.3	3.2	3.2	9.2	9.1	9.2	11.9	11.9	11.8	5.4	5.2	
				80	3.4	3.3	3.4	9.4	9.7	9.6	12.3	12.4	12.2	5.7	5.6	
				100	4.0	4.2	4.0	11.2	11.4	11.1	14.1	14.3	14.1	8.9	9.1	
08-23	C12KD2*T22A3	N		92	4.1	4.0	4.1	11.4	11.6	11.6	14.4	14.3	14.5	9.4	9.3	
				96	4.0	4.1	4.1	11.4	11.2	11.4	14.3	14.3	14.4	9.4	9.1	
				88	4.1	4.1	4.0	11.7	11.3	11.4	14.6	14.3	14.3	9.4	9.2	
08-24	C12KD2*T22A3	N		98	5.1	5.1	4.9	15.2	15.2	15.1	21.8	21.9	21.7	14.2	14.8	
				90	5.2	5.2	4.9	15.6	15.2	15.3	22.1	21.9	21.9	14.8	14.6	
				94	5.2	5.1	5.1	15.4	15.1	15.6	22.1	21.9	22.1	14.6	14.8	
08-25	C12KD2*T22A3	N		86	4.9	5.2	5.3	15.6	15.4	15.4	22.4	22.1	22.0	14.6	14.8	
				97	4.9	5.1	5.1	13.1	13.5	13.4	17.2	17.3	17.3	10.6	10.8	
				89	5.2	5.2	5.1	13.4	13.6	13.4	17.3	17.3	17.5	10.4	10.8	
08-26	C12KD2*T22A3	N		93	5.1	5.3	4.9	13.4	13.6	13.4	17.3	17.5	17.2	10.6	10.7	
				85	5.0	5.1	5.1	13.4	13.4	13.2	17.2	17.2	17.4	10.5	11.0	

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS ACCELERATION TIME, SECONDS

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APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs No.	Vehicle Code	KS	FBRU RON	0-30 MPH WOT	0-60 MPH WOT	0-70 MPH WOT	40-60 MPH MT									
26-22	P21FY2*P49M5	Y	97	1.5	1.4	1.7	9.6	9.7	9.7	14.0	14.2	14.3	8.4	8.3	8.6	
			89	1.5	1.4	1.4	9.7	9.7	9.5	14.4	14.2	14.2	8.9	9.0	8.4	
			93	1.5	1.6	1.6	9.9	9.5	9.6	14.9	14.0	14.1	8.4	8.2	8.3	
26-23	C21DU2*P30A4	Y	85	1.7	1.5	1.7	9.9	9.8	9.9	14.3	14.4	14.2	9.1	8.6	8.7	
			104	4.5	4.3	4.5	11.2	10.9	11.1	15.4	15.3	15.0	7.8	7.7	8.1	
			97	4.3	4.3	4.8	11.0	11.1	10.9	15.3	15.3	15.3	7.6	8.0	7.6	
			101	4.2	4.3	4.4	11.1	11.2	11.3	15.2	15.6	15.7	7.7	7.6	7.6	
			93	4.2	4.4	4.3	11.1	11.2	11.3	15.2	15.6	15.7	7.6	7.6	7.8	
			99	5.9	5.9	6.0	15.9	15.4	15.9	21.8	21.9	22.0	16.0	16.6	16.9	
28-01	C21E92*T19A3	N	91	5.6	5.5	5.6	16.3	15.6	15.8	21.9	21.7	21.8	16.1	16.3	16.4	
			95	5.7	5.6	5.8	16.4	15.8	15.9	21.8	21.7	21.9	16.1	16.4	15.8	
28-02	C94EV4*P25A4	N	-	-	-	-	-	-	-	-	-	-	-	-	-	
			94	5.8	5.4	5.6	12.1	12.4	11.9	15.8	15.5	15.6	13.6	13.9	14.1	
			86	5.5	6.0	6.1	11.9	12.8	12.7	15.5	16.1	15.9	14.8	14.2	13.9	
			90	5.4	5.2	5.2	11.9	11.7	11.7	15.3	15.4	15.4	14.3	13.9	14.0	
			-	-	-	-	-	-	-	-	-	-	-	-	-	-
			97	4.7	4.7	4.4	12.2	11.8	11.3	15.8	15.7	15.7	11.3	11.1	11.5	
28-03	C94EV4*P25A4	N	89	5.5	5.0	5.0	12.3	12.2	12.0	16.1	15.9	16.0	11.0	11.1	11.1	
			93	4.8	4.7	4.7	12.3	11.8	11.6	16.1	15.5	15.9	12.2	11.2	11.7	
			-	-	-	-	-	-	-	-	-	-	-	-	-	-
28-04	V21AU2*P30A4	N	101	4.5	4.5	4.9	12.9	12.7	12.5	17.3	17.3	17.4	11.1	11.2	10.8	
			93	5.2	5.0	4.7	13.0	12.9	12.5	17.6	17.6	17.3	10.9	10.7	10.3	
			97	4.9	5.2	4.9	12.8	12.4	12.6	17.6	17.4	17.2	10.6	10.4	10.5	
28-05	C33AR2*T25A3	N	-	-	-	-	-	-	-	-	-	-	-	-	-	
			97	5.0	4.8	4.8	15.0	15.0	15.0	20.7	20.6	20.6	13.0	13.0	13.2	
			89	5.1	4.8	5.2	15.1	15.0	15.0	20.8	20.6	20.7	13.0	12.9	12.6	
			93	4.6	4.9	5.0	14.5	15.1	15.0	20.6	20.5	20.6	13.1	12.5	12.6	
			-	-	-	-	-	-	-	-	-	-	-	-	-	-
			95	4.6	4.5	4.4	13.3	13.0	13.0	18.5	18.4	18.4	14.2	14.2	14.0	
28-06	C33WW2*P28A4	Y	87	4.5	4.3	4.2	13.5	13.5	12.9	18.4	18.4	18.2	14.4	13.9	13.6	
			91	4.6	4.1	4.8	12.9	13.1	13.2	17.9	18.1	18.4	13.9	13.4	13.6	
			83	4.7	4.2	4.4	13.8	12.8	13.2	18.6	18.7	18.6	14.6	14.6	14.0	

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs No.	Vehicle Code	KS	FBRU RON	0-30 MPH WOT			0-60 MPH WOT			0-70 MPH WOT			40-60 MPH MT		
28-07	V21EN2*P50A3	Y	94	4.6	4.5	4.6	11.7	11.2	11.7	15.3	15.3	15.3	8.5	8.6	8.6
			86	4.7	4.4	4.6	11.4	11.1	11.1	15.2	15.2	15.1	9.0	9.1	8.9
			90	4.5	4.7	4.5	11.6	11.6	11.4	15.2	15.6	15.4	8.9	9.1	8.8
28-08	S21BT2*P29M5	N	100	-	-	-	-	-	-	-	-	-	-	-	
			92	-	-	-	-	-	-	-	-	-	-	-	
			96	-	-	-	-	-	-	-	-	-	-	-	
28-09	C21S42*P38A4	N	98	4.8	4.5	4.7	11.6	11.7	11.8	16.2	16.3	15.8	8.7	8.7	8.7
			90	4.8	5.0	4.6	12.0	12.0	12.1	15.9	16.3	16.3	8.6	8.7	8.5
			94	4.6	4.3	4.5	11.8	11.5	11.8	16.1	16.0	15.9	8.3	8.1	8.6
28-10	C42E*4*P16A4	N	95	5.9	5.6	4.9	14.3	14.3	14.5	20.9	21.8	21.9	11.2	10.5	10.5
			87	5.5	6.3	5.7	14.0	14.7	14.3	21.1	20.7	21.7	10.6	10.7	11.3
			91	6.7	5.4	6.0	15.7	14.7	15.1	22.1	20.2	21.3	10.7	10.6	10.6
28-11	C60E72*215A3	N	93	6.9	6.8	6.7	20.7	20.7	20.8	32.3	32.4	33.1	17.3	18.5	17.6
			85	6.6	6.1	6.3	19.9	19.4	19.5	32.2	30.9	31.9	17.2	17.9	17.7
			89	6.9	6.6	7.2	19.1	19.9	19.4	31.5	32.3	31.6	17.8	17.7	18.4
28-12	V13BX2*T39A3	N	95	5.5	5.6	5.7	16.1	16.1	16.1	24.1	24.2	24.3	15.2	15.4	14.9
			87	5.8	5.4	5.7	16.3	16.2	16.2	24.2	23.9	24.1	14.7	15.3	15.0
			91	5.6	5.8	5.8	16.1	16.1	16.4	23.9	24.3	24.2	14.8	15.2	15.0
28-13	C90C42*T18A3	N	97	6.2	6.3	6.3	17.3	16.3	17.0	26.2	25.5	25.6	14.5	14.6	14.9
			89	6.4	6.5	6.4	16.9	16.8	16.6	25.7	25.6	25.2	14.5	14.2	14.8
			93	6.2	6.4	6.4	16.8	16.8	16.8	25.6	25.8	25.3	14.8	15.1	14.5
28-14	C34HC2*P38A4	Y	93	4.4	4.5	4.5	11.4	11.4	11.4	14.7	15.1	15.0	9.5	9.2	8.8
			85	4.9	4.9	4.5	11.4	11.5	11.7	15.1	15.0	14.9	9.1	9.2	9.5
			89	4.4	4.6	4.5	11.2	11.8	11.3	14.8	15.1	14.7	9.0	8.7	8.6
81	4.8	4.8	5.0	11.9	11.5	11.8	15.3	15.1	14.9	8.9	9.2	9.4			

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs No.	Vehicle Code	KS	FBRU RON	0-30 MPH WOT			0-60 MPH WOT			0-70 MPH WOT			40-60 MPH MT		
28-15	C64AJ2*215A3	N	98	7.9	8.1	7.6	24.3	27.6	23.4	37.5	45.5	37.1	18.9	18.3	20.4
			90	7.6	7.9	7.6	24.0	25.7	24.1	37.1	39.0	41.0	19.3	19.3	19.6
			94	7.7	7.7	7.8	22.7	25.2	23.9	35.6	37.7	39.5	18.8	21.2	20.5
28-16	S36RK2*T57A4	Y	96	-	-	-	-	-	-	-	-	-	-	-	
			88	4.3	4.4	-	10.5	10.5	-	15.2	15.0	-	11.1	11.1	10.9
			92	-	-	-	-	-	-	-	-	-	11.3	10.3	10.7
28-17	C31BE2*T50A4	Y	84	-	-	-	-	-	-	-	-	-	-	-	
			100	4.7	4.7	4.9	11.8	12.2	11.8	15.4	15.9	15.3	13.0	13.1	13.3
			92	4.8	5.2	4.8	12.4	12.6	12.5	16.0	16.4	16.3	13.6	13.0	13.4
28-18	C31L12*T20A3	N	96	5.1	4.7	4.9	12.5	11.7	12.4	16.4	15.5	16.2	13.4	12.8	14.2
			88	5.1	5.1	4.9	13.1	12.9	13.1	16.7	16.6	16.9	14.9	14.4	14.2
			98	5.7	5.6	5.8	16.7	15.9	16.4	23.9	24.1	24.3	17.0	17.6	17.9
28-19	C13C32*P30A4	N	90	5.7	5.2	5.9	16.3	16.6	16.2	23.0	23.3	23.1	15.5	14.7	15.2
			94	5.7	5.2	5.5	17.4	16.4	16.8	25.0	24.6	24.5	16.3	17.0	17.4
			-	-	-	-	-	-	-	-	-	-	-	-	-
28-20	C13PD2*T22A3	N	96	4.2	4.5	4.5	11.5	11.7	11.7	15.6	15.7	15.7	9.1	9.4	9.5
			88	4.8	4.4	4.3	11.8	11.6	11.7	15.9	15.9	15.8	9.5	9.2	9.0
			92	4.8	4.6	4.8	12.5	12.0	12.2	15.7	15.9	15.9	9.4	9.3	9.3
28-21	C98A*2*P23A4	Y	-	-	-	-	-	-	-	-	-	-	-	-	
			95	6.8	6.4	6.6	17.0	17.0	17.4	24.7	24.1	24.3	17.9	19.2	18.3
			87	6.5	6.6	6.6	17.1	17.3	17.4	24.1	24.1	24.2	17.8	18.2	19.1
28-22	C31AW2*P28A4	Y	91	6.6	6.7	6.7	17.4	17.4	17.6	23.8	24.2	24.3	19.2	18.2	17.8
			-	-	-	-	-	-	-	-	-	-	-	-	-
			94	5.6	5.9	5.8	14.8	15.3	14.9	20.3	20.3	20.6	11.6	12.0	11.5
28-22	C31AW2*P28A4	Y	86	5.7	5.9	6.0	15.5	15.4	14.7	21.7	21.3	20.6	12.8	12.0	11.8
			90	5.6	5.6	6.0	14.8	14.2	14.3	20.5	20.1	20.4	11.4	11.3	12.2
			82	6.2	5.8	5.9	16.4	15.6	15.1	22.4	22.2	21.2	12.7	13.1	12.8
28-22	C31AW2*P28A4	Y	101	4.7	4.2	4.2	12.5	12.3	12.4	17.6	17.5	17.6	9.8	10.5	10.5
			93	4.7	4.5	4.4	12.6	12.4	12.3	17.6	17.5	17.4	10.4	9.9	9.7
			97	4.4	4.2	4.6	12.5	12.1	12.3	17.4	17.2	17.1	10.1	10.2	10.5
28-22	C31AW2*P28A4	Y	89	4.5	4.6	4.3	12.4	12.5	12.2	17.1	17.5	17.4	10.8	10.1	9.9
			-	-	-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-	-	-

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs No	Vehicle Code	KS	FBRU RON	0-30 MPH WOT			0-60 MPH WOT			0-70 MPH WOT			40-60 MPH MT		
28-23	C21RC3*P22A4	N	93	5.5	5.0	5.3	13.9	14.2	14.3	19.6	19.4	19.6	10.7	10.3	10.5
			85	5.3	5.2	5.9	14.6	14.1	14.0	20.1	19.5	19.7	10.4	10.2	10.7
			89	5.3	5.7	5.8	14.2	14.6	14.2	19.7	19.9	19.4	10.7	10.4	10.7
28-24	C33AN2*P33A4	Y	96	4.9	4.8	4.7	11.7	11.6	11.8	15.3	15.4	15.3	10.3	9.9	10.0
			88	4.6	4.6	4.8	11.8	11.6	11.8	15.5	15.2	15.4	10.1	9.5	9.9
			92	4.7	4.4	4.5	11.8	11.4	11.5	15.4	15.2	15.2	9.3	10.1	10.3
28-25	C52SY2*P16A4	N	84	5.0	4.9	5.3	12.0	12.0	12.2	15.8	15.5	15.7	10.3	11.1	10.1
			95	5.9	6.1	5.8	14.8	14.7	15.4	19.6	20.2	20.4	13.7	14.0	13.9
			87	6.2	6.2	5.8	15.9	15.9	14.7	21.3	21.0	20.3	12.5	12.4	13.1
28-26	P21RA2*P23M5	N	91	6.2	6.4	6.1	15.9	14.9	15.8	21.4	20.6	21.3	12.8	14.1	13.1
			99	4.2	4.4	4.1	15.4	15.7	15.5	-	-	-	-	-	-
			91	4.0	4.2	4.2	14.9	15.6	15.3	-	-	-	12.3	12.2	12.1
28-27	C33ND4*P23A3	Y	95	4.8	4.4	4.3	15.5	15.5	15.5	-	-	-	12.3	12.3	12.3
			95	4.8	4.4	4.3	15.5	15.5	15.5	-	-	-	12.4	12.6	12.5
			95	4.9	4.8	5.0	11.6	11.4	11.4	15.5	15.3	15.6	11.8	10.8	11.3
28-28	C21TX2*P23A3	N	87	5.3	5.2	5.2	12.4	12.2	12.2	16.7	16.2	16.9	11.8	11.6	11.8
			91	4.5	4.5	4.7	11.8	11.5	11.4	15.6	15.3	15.5	11.6	11.1	10.9
			83	5.6	5.1	5.0	12.4	12.4	12.1	16.6	16.5	16.7	14.7	14.9	14.8
28-28	C21TX2*P23A3	N	100	5.8	5.8	5.9	15.4	15.7	15.5	21.3	21.7	21.3	13.7	14.6	14.3
			92	5.7	5.8	5.7	15.5	15.5	15.5	21.5	21.4	21.1	13.7	13.4	14.1
			96	5.8	5.7	5.9	15.5	15.5	15.5	21.5	21.4	21.3	13.2	14.3	13.7
28-30	C76A*3*T16A3	N	95	6.1	6.1	6.4	18.8	16.7	18.3	27.3	24.0	26.2	13.8	14.9	13.7
			87	6.5	6.1	6.1	18.2	16.5	17.0	26.7	23.2	25.0	14.4	15.1	14.2
			91	6.4	6.5	6.5	17.0	18.4	18.5	24.5	27.5	26.8	15.2	14.3	14.8
28-31	C21RC3*P22A4	N	95	5.1	5.3	5.5	13.9	14.0	14.2	19.6	19.2	19.8	15.0	15.4	14.8
			87	5.1	5.3	5.6	14.4	14.3	14.3	20.0	19.3	19.8	14.8	15.1	15.2
			91	5.3	5.6	5.4	13.9	14.4	13.3	19.8	20.0	19.4	15.5	15.8	15.2
			-	-	-	-	-	-	-	-	-	-	-	-	

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs No.	Vehicle Code	KS	FBRU RON	0-30 MPH WOT		0-60 MPH WOT		0-70 MPH WOT		40-60 MPH MT					
28-32	C33ND4*P23A3	Y	97	4.6	4.7	4.6	11.2	11.2	11.3	14.9	14.9	15.0	9.9	9.7	9.7
			89	4.6	5.1	4.9	11.8	11.4	11.5	15.3	15.1	15.1	9.1	9.3	9.1
			93	4.6	4.8	4.7	11.9	11.8	11.6	14.8	15.0	14.8	9.0	9.4	9.2
			85	5.3	5.5	5.4	11.5	12.0	11.5	15.4	15.9	15.4	10.2	10.1	10.0
29-01	C21S42*P38A4	N	99	4.2	4.2	4.0	10.1	10.0	10.1	12.4	12.0	12.3	7.3	7.1	7.3
			91	4.0	3.8	3.8	10.0	9.9	9.9	12.1	12.0	12.0	7.3	6.8	7.3
			95	3.8	4.0	3.9	9.8	10.0	10.1	11.9	12.0	12.1	7.2	7.2	7.3
			-	-	-	-	-	-	-	-	-	-	-	-	-
29-02	C21DU2*P30A4	Y	101	4.0	4.0	4.1	11.8	11.8	11.9	15.8	15.8	15.9	8.5	8.8	8.5
			93	4.0	4.0	4.1	11.9	11.9	11.5	15.8	15.8	15.8	8.5	8.4	8.5
			97	4.1	4.1	4.1	11.8	11.8	11.6	15.8	15.8	15.8	8.5	8.4	8.6
			89	4.1	4.0	4.1	11.8	11.5	11.9	15.9	15.8	15.9	8.5	8.4	8.5
29-03	C34AR2*T25A3	N	95	5.0	5.1	5.1	13.9	14.1	14.0	18.9	19.2	19.0	11.8	11.6	11.7
			87	5.2	5.2	5.2	14.0	14.0	14.2	19.0	19.2	19.2	11.8	12.0	12.0
			91	4.9	5.1	5.1	13.9	14.0	14.0	18.9	19.0	19.0	11.4	11.5	11.2
			-	-	-	-	-	-	-	-	-	-	-	-	-
29-04	C32WW2*P28A4	Y	102	3.5	3.8	4.0	10.9	11.1	11.1	14.9	14.6	14.9	8.4	8.4	8.6
			94	4.2	4.0	4.0	11.2	11.0	11.1	15.0	15.0	15.1	8.3	8.5	8.4
			98	3.6	3.8	3.9	10.7	11.0	10.9	14.8	15.0	14.7	8.6	8.3	8.3
			90	3.8	3.9	4.0	10.8	11.0	11.0	15.0	14.8	14.7	8.5	8.8	8.3
29-05	C21TX2*P23A3	N	97	4.4	4.4	4.5	12.4	12.3	12.5	16.6	16.8	16.8	9.2	9.2	9.4
			89	4.3	4.5	4.3	12.0	12.2	12.2	16.1	16.4	16.4	9.7	9.6	9.8
			93	4.4	4.5	4.5	12.4	12.6	12.5	16.6	16.6	16.6	9.2	9.4	9.3
			-	-	-	-	-	-	-	-	-	-	-	-	-
29-06	C31L12*T20A3	N	97	5.6	5.6	5.6	16.1	16.4	16.4	20.6	21.0	20.8	14.1	14.2	14.2
			89	5.8	5.7	5.6	16.5	16.3	16.2	21.2	21.1	20.8	14.5	14.7	14.6
			93	5.6	5.6	5.4	16.4	16.5	16.1	21.0	21.0	21.0	14.6	14.4	14.6
			-	-	-	-	-	-	-	-	-	-	-	-	-
29-07	C32AW2*P28A4	Y	104	4.2	4.2	4.2	11.7	11.7	11.6	15.6	15.7	15.7	8.5	8.4	8.3
			96	4.3	4.2	4.2	11.7	11.5	11.6	15.7	15.5	15.6	8.7	8.5	8.5
			100	4.3	4.4	4.3	11.7	11.7	11.6	15.5	15.6	15.6	8.6	8.4	8.5
			92	4.3	4.1	4.2	11.7	11.6	11.7	15.4	15.6	15.4	8.9	8.8	8.7

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs. No.	Vehicle Code	KS	FBRU FON	0-30 MPH WOT			0-60 MPH WOT			0-70 MPH WOT			40-60 MPH MT		
29-11	C34AN2*P39A4	Y	101	4.9	5.1	4.9	11.4	11.3	11.4	14.4	14.2	14.4	8.5	8.3	8.8
			93	4.2	4.2	4.3	10.7	10.8	10.8	14.4	14.3	14.5	8.4	8.3	8.1
			97	4.4	4.7	4.7	10.9	11.1	10.9	14.2	14.2	14.4	8.3	8.5	8.2
29-14	C33AW2*P28A4	Y	101	4.2	4.2	4.2	12.5	12.3	12.6	17.6	17.4	17.5	12.0	12.1	12.1
			93	4.1	4.2	4.2	12.7	12.5	12.5	17.5	17.5	17.4	12.0	12.0	12.1
			97	4.2	4.1	4.2	12.5	12.4	12.5	17.6	17.5	17.5	11.9	12.0	12.0
29-16	C32ND4*P23A3	Y	101	4.0	4.0	4.0	10.2	10.2	10.2	13.5	13.4	13.4	8.6	8.5	8.4
			93	4.0	4.0	3.9	10.2	10.3	10.1	13.4	13.5	13.4	8.6	8.4	8.5
			97	4.0	4.0	3.9	10.5	10.3	10.1	13.5	13.6	13.3	8.4	8.3	8.5
29-17	C32HC2*P38A4	Y	89	4.2	4.3	4.0	10.5	10.5	10.5	13.5	13.5	13.5	8.6	8.4	8.6
			96	4.3	4.4	4.4	11.5	11.4	11.3	14.6	14.7	14.7	8.1	8.2	8.3
			86	4.9	4.7	4.7	11.9	11.6	11.6	15.0	15.0	14.9	8.2	8.5	8.3
29-18	C32ND4*P23A3	Y	90	4.6	4.7	4.5	11.5	11.5	11.4	14.7	14.7	14.7	8.3	8.4	8.2
			82	4.7	4.7	4.7	11.7	11.5	11.5	14.9	14.9	14.9	9.0	9.1	9.1
			97	4.0	3.9	3.9	10.2	10.2	10.2	13.2	13.3	13.2	8.4	8.3	8.3
29-19	C32HC2*P38A4	Y	89	4.0	4.0	4.0	10.4	10.3	10.4	13.4	13.5	13.4	8.5	8.5	8.6
			93	4.0	4.0	4.0	10.4	10.3	10.3	13.6	13.3	13.4	8.5	8.6	8.4
			85	4.1	4.1	4.0	10.5	10.5	10.5	13.8	13.6	13.7	8.8	8.8	8.8
32-01	C21RC3*P22A4	N	100	4.1	4.0	3.9	10.1	10.0	10.0	13.0	13.1	13.0	7.8	7.6	7.6
			92	4.0	3.9	4.0	9.9	10.0	10.1	13.0	13.0	13.1	8.0	7.8	7.8
			96	3.9	4.0	4.0	9.9	10.0	10.0	13.0	13.1	13.0	8.1	7.8	7.8
32-02	C21RC3*P22A4	N	88	4.0	4.0	4.0	10.0	10.0	10.0	13.0	13.0	13.0	7.9	8.0	8.1
			90	4.1	4.0	4.1	11.0	11.4	11.5	14.5	15.0	15.2	5.3	5.5	5.6
			82	3.9	4.0	4.0	11.0	11.0	11.1	15.0	14.6	15.0	5.4	5.2	5.4
32-02	C21RC3*P22A4	N	86	4.1	4.1	4.1	11.0	11.1	11.4	14.6	14.7	15.3	5.2	5.3	5.5
			80	4.1	4.1	4.1	11.2	11.0	11.0	15.1	15.0	14.9	5.5	5.2	5.1
			90	3.9	4.0	3.9	11.1	11.3	11.3	14.8	15.4	15.4	5.4	5.6	5.6
32-02	C21RC3*P22A4	N	82	4.0	4.0	3.9	11.5	11.4	11.3	15.6	15.2	15.4	5.6	5.6	5.6
			86	4.0	3.9	3.9	11.2	11.3	11.3	14.9	15.3	15.3	5.4	5.5	5.5

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs No.	Vehicle Code	KS	FBRU RON	0-30 MPH WOT			0-60 MPH WOT			0-70 MPH WOT			40-60 MPH MT		
32-03	C24N42*P38A4	N	90	3.8	3.4	3.5	10.8	10.4	10.5	14.7	14.3	14.4	5.1	5.1	5.1
			82	3.6	3.5	3.5	10.7	10.5	10.6	14.5	14.4	14.4	5.1	5.1	5.1
			86	3.6	3.4	3.5	10.6	10.3	10.4	14.4	14.1	14.3	5.1	5.1	5.1
32-05	C21D42*P38A4	N	95	3.5	4.3	4.1	10.5	11.0	10.9	14.3	14.6	14.5	5.0	4.9	5.0
			87	3.8	4.0	3.9	10.5	10.7	10.7	14.2	14.4	14.5	5.0	5.0	5.0
			91	4.1	3.9	3.7	10.8	10.5	10.5	14.3	14.2	14.1	5.0	4.9	4.9
32-07	C21PF2*P50A4	N	95	4.7	4.8	4.4	12.4	12.0	12.0	16.9	16.4	16.4	5.7	5.8	5.7
			87	4.2	4.2	4.4	11.7	11.9	12.0	15.8	16.1	16.2	5.7	5.7	5.7
			91	4.1	4.4	4.3	11.7	12.0	12.0	16.0	16.3	16.2	5.7	5.5	5.6
32-08	C22PF2*P50A4	N	96	3.8	3.6	3.6	10.3	10.2	10.2	13.5	13.4	13.4	4.9	4.8	4.8
			88	3.7	3.6	3.6	10.2	10.0	10.1	13.4	13.2	13.3	4.8	4.8	4.8
			92	3.8	3.7	3.6	10.3	10.2	10.1	13.6	13.4	13.3	4.9	4.8	4.9
32-09	C22PF2*P50A4	N	100	4.1	3.8	3.6	11.7	11.4	11.2	15.6	15.3	15.1	5.7	5.6	5.7
			92	3.5	3.5	3.5	11.0	11.0	11.0	14.8	14.8	14.8	5.6	5.5	5.5
			96	3.6	3.6	3.5	11.1	11.1	11.1	14.9	14.9	15.0	5.6	5.6	5.4
32-10	C21BH2*P13A3	N	88	4.3	4.3	4.2	10.7	10.7	10.6	14.1	14.1	14.0	4.8	4.7	4.7
			80	4.7	4.5	4.4	11.0	10.8	10.8	14.2	14.1	14.1	4.6	4.7	4.6
			84	4.4	4.3	4.2	10.9	10.7	10.6	14.3	14.2	13.9	5.0	4.7	4.7
32-11	C21S42*P38A4	N	99	3.9	3.7	3.7	11.0	10.7	10.8	14.4	14.4	14.0	5.3	5.1	5.2
			91	3.7	3.6	3.7	10.7	10.6	10.6	14.3	14.3	14.2	5.2	5.1	5.1
			95	3.6	3.7	3.7	10.7	10.8	10.8	14.4	14.5	14.5	5.1	5.3	5.2
32-12	V21AU2*P30A4	N	97	4.6	4.6	4.5	12.5	12.6	12.5	16.5	16.4	16.4	6.3	6.4	6.3
			89	4.5	4.5	4.5	12.4	12.5	12.4	16.5	16.4	16.4	6.2	6.3	6.2
			93	4.5	4.5	4.6	12.3	12.4	12.4	0.0	0.0	0.0	6.2	6.3	6.3

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs. No.	Vehicle Code	KS	FBRU RON	0-30 MPH WOT			0-60 MPH WOT			0-70 MPH WOT			40-60 MPH MT			
32-13	V21AU2*P30A4	N	97	5.4	5.3	5.4	10.6	10.7	10.6	14.8	14.9	14.9	5.4	5.3	5.4	
			89	5.6	5.5	5.6	11.0	11.0	10.9	14.9	15.0	15.0	5.6	5.6	5.7	
			93	5.5	5.5	5.6	10.7	10.7	10.6	14.9	15.0	14.9	5.5	5.4	5.4	
32-14	C21D42*P38A4	N	96	3.4	3.3	3.4	9.5	9.5	9.6	12.6	12.6	12.6	4.4	4.3	4.4	
			88	3.2	3.3	3.2	9.2	9.2	9.3	12.2	12.4	12.2	4.3	4.3	4.3	
			92	3.3	3.2	3.2	9.2	9.2	9.3	12.3	12.4	12.3	4.3	4.4	4.3	
32-16	C21PF2*P50A4	N	97	3.6	3.5	3.4	10.7	10.6	10.5	14.6	14.5	14.3	5.3	5.3	5.3	
			89	3.5	3.6	3.5	10.6	10.6	10.5	14.6	14.7	14.6	5.2	5.3	5.3	
			93	3.6	3.5	3.6	10.7	10.7	10.6	14.7	14.6	14.6	5.3	5.2	5.3	
32-17	C22DU2*P30A4	Y	96	4.1	3.9	4.0	11.2	10.8	11.0	14.4	14.0	14.0	5.2	5.3	5.2	
			88	3.8	3.9	3.8	10.9	10.9	10.8	13.9	14.0	13.9	5.2	5.1	5.2	
			92	3.9	3.9	4.0	10.8	10.9	10.9	14.0	14.0	14.0	5.1	5.1	5.2	
40-03	C22S42*P38A4	N	100	4.5	4.0	4.2	11.8	11.4	11.3	15.8	15.3	15.5	5.5	5.2	5.4	
			92	4.0	4.1	4.2	11.0	10.9	10.7	14.3	14.4	14.1	5.2	5.4	5.5	
			96	4.2	4.3	3.9	11.3	11.4	11.2	14.9	16.0	14.5	5.1	5.3	5.1	
40-05	C64AJ2*215A3	N	97	6.1	6.2	6.1	16.2	16.5	16.2	-	-	-	-	-	-	
			89	6.2	6.0	6.1	17.0	16.3	16.4	-	-	-	-	8.1	8.4	8.2
			93	6.1	6.0	6.0	17.1	16.6	16.9	-	-	-	-	8.8	8.0	8.6
40-06	C31J12*T20A3	N	96	4.8	4.9	4.8	13.3	14.1	14.5	-	-	-	-	-	-	
			88	5.1	4.8	4.4	14.9	14.1	14.4	-	-	-	-	8.4	7.8	7.8
			92	5.0	4.8	4.8	15.2	14.4	15.0	-	-	-	-	7.9	7.5	7.8
41-01	C13KD2*T22A3	N	98	6.0	6.1	6.1	15.1	15.2	15.1	20.3	20.6	20.6	13.7	13.6	13.5	
			90	5.4	5.7	5.5	14.4	14.8	14.6	19.7	20.2	20.2	13.6	13.2	13.4	
			94	6.0	5.8	6.1	15.1	15.2	15.3	20.0	19.8	20.0	14.0	14.2	13.8	

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs No	Vehicle Code	KS	FBRU RON	0-30 MPH WOT	0-60 MPH WOT	0-70 MPH WOT	40-60 MPH MT								
41-02	C62A*4*P15M5	N	90	6.2	6.1	5.4	16.0	15.9	22.1	21.5	21.3	12.7	12.6	13.1	
			82	5.8	5.7	5.8	16.9	16.7	15.9	22.9	23.0	22.2	13.9	13.9	12.8
			86	5.6	5.4	5.4	15.9	15.4	15.5	21.6	21.1	21.6	13.9	13.5	13.4
41-03	C21S42*P38A4	N	99	5.4	5.1	5.3	12.7	12.7	12.5	16.3	16.3	16.1	18.3	18.9	18.8
			91	5.3	5.2	4.8	12.8	12.4	12.4	16.5	16.4	16.1	18.6	18.7	18.7
			95	5.2	4.8	5.0	12.7	12.5	12.5	16.1	16.3	16.0	17.9	19.0	19.0
41-04	C76E*2*P30A4	Y	95	4.9	4.6	4.6	13.4	13.0	13.0	17.2	17.0	16.9	16.5	16.6	16.8
			87	4.9	4.9	5.0	13.4	13.5	13.5	17.4	17.4	17.5	18.5	18.5	19.0
			91	5.1	4.9	4.9	13.6	13.5	13.5	17.5	17.5	17.6	18.6	18.8	18.9
41-05	V21AU2*P30A4	N	96	4.9	4.2	4.8	12.6	12.9	12.5	16.9	17.1	16.8	13.9	12.8	14.0
			88	5.0	4.3	5.3	12.6	12.5	13.0	16.8	16.9	17.0	13.4	13.5	12.7
			92	4.8	5.0	5.1	12.8	12.8	13.1	16.7	17.0	17.1	13.7	13.9	13.4
41-06	C33AW2*P28A3	Y	98	5.0	4.7	4.6	12.0	11.9	11.8	15.1	15.1	14.7	9.8	9.9	9.6
			90	5.1	4.8	4.7	12.2	11.6	11.6	15.5	15.1	14.9	9.9	9.6	9.7
			94	5.0	5.1	4.7	12.1	11.7	11.9	15.3	15.1	14.9	9.7	9.7	10.1
41-07	C62C*4*P20A4	N	86	5.2	4.9	4.8	11.9	11.5	11.4	15.2	14.9	14.9	10.0	9.4	9.8
			98	4.4	4.4	4.5	12.1	12.0	12.1	17.1	16.9	16.7	18.0	17.8	17.7
			90	4.9	4.8	4.9	12.5	12.5	12.5	17.8	17.3	17.3	17.7	17.6	17.9
94	4.5	4.6	4.7	12.1	12.4	12.2	17.0	16.8	17.1	17.8	18.1	17.6	17.6		
41-08	C21RC3*P22M5	N	99	4.8	4.4	4.7	12.7	12.6	13.0	16.8	16.6	16.9	13.1	12.9	13.0
			91	4.8	5.1	4.6	13.3	13.5	13.1	17.5	17.7	17.2	13.2	12.9	12.9
			95	4.9	5.0	4.7	12.9	12.8	13.1	17.0	16.8	16.8	13.0	13.3	12.9
41-09	C32WW2*P28A4	Y	99	4.7	4.8	4.6	12.2	12.2	12.2	15.9	16.2	16.0	11.6	11.6	12.0
			91	4.8	4.8	4.5	12.5	12.3	12.2	16.3	16.0	15.9	12.6	11.8	12.1
			95	4.8	4.6	4.6	12.2	12.4	12.5	15.7	16.0	16.1	11.7	11.6	12.0
87	4.7	4.6	4.6	12.3	12.1	12.0	16.2	16.0	15.9	12.8	12.2	12.0	12.0		

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs. No.	Vehicle Code	FBRU KS RON	0-30 MPH WOT	0-60 MPH WOT	0-70 MPH WOT	40-60 MPH MT
41-10	C32JK2*T20A3	N	5.8	5.8	5.8	16.8
			6.0	14.5	14.9	16.3
			5.8	6.0	15.1	16.3
			5.8	14.8	14.6	16.1
			6.1	5.8	15.2	16.4
41-11	C42E*4*P16M5	N	-	-	-	-
			4.8	5.5	15.1	14.0
			5.4	5.9	15.3	13.0
			5.1	5.4	15.2	13.7
			5.6	15.2	14.9	14.1
41-12	C11BU2*P30A4	Y	-	-	-	-
			4.5	4.6	12.2	15.5
			4.6	4.6	12.4	16.3
			4.6	4.6	12.4	16.2
			4.6	12.4	12.3	17.0
			4.6	12.4	12.1	15.8
			4.7	4.6	12.5	16.6
			4.7	4.6	12.3	15.4
			4.7	12.3	15.5	16.5
41-13	P94IR2*P24M5	Y	-	-	-	-
			4.1	4.3	12.3	16.5
			4.3	4.4	12.3	15.5
			4.4	12.1	17.5	16.0
			4.5	11.9	17.3	11.3
			4.5	12.2	17.0	11.0
			4.5	12.0	17.3	11.4
			4.5	12.1	17.1	11.5
			4.4	11.8	17.2	11.5
			4.5	12.4	17.1	10.9
41-14	C21D42*P38A4	N	-	-	-	-
			3.5	3.6	10.2	14.6
			3.2	10.0	14.2	12.4
			3.6	10.5	14.9	12.0
			3.6	9.9	13.7	11.8
			3.7	10.5	14.1	12.2
			3.9	9.9	14.2	12.5
			3.2	10.4	14.4	11.7
			3.5	10.2	14.2	12.0
41-15	C33ND4*P23M5	Y	-	-	-	-
			3.7	10.4	14.0	12.6
			4.4	10.2	13.7	12.1
			4.4	10.0	14.2	12.0
41-16	S13S32*P30A4	N	-	-	-	-
			4.4	11.3	15.8	11.3
			4.4	11.2	15.7	11.5
			4.4	12.0	15.6	11.3
			4.3	12.2	15.5	11.0
			4.4	12.0	15.6	11.4
			4.1	11.9	15.8	11.4
41-17	C78S62*P16A3	N	-	-	-	-
			5.0	13.2	17.3	13.0
			4.9	13.3	17.4	12.6
			4.9	13.2	17.3	12.7
			4.8	13.4	17.2	12.9
			5.1	13.3	17.2	13.0

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs. No.	Vehicle Code	FBRU KS RDN	0-30 MPH WOT	0-60 MPH WOT	0-70 MPH WOT	40-60 MPH MT
41-18	C76A*3*T16M5	N	4.2 4.7 4.2 4.4 4.6 4.1	12.3 13.0 12.4	16.6 17.1 16.7 17.1 16.7 12.1 11.9 11.8	12.1 12.3 12.0 13.1
41-19	C96GA2*P18A3	Y	- - - - -	- - - - -	- - - - -	- - - - -
41-20	C68A*2*P36A4	N	98 4.7 4.6 4.3 4.8 4.1	10.9 10.8 10.9 11.0 10.6 10.9 14.0 14.3 10.1 10.1 9.5	14.7 14.5 14.1 8.7 8.8 8.5	14.2 14.3 8.6 8.9 9.3
41-21	C94AE3*115M4	N	99 4.4 4.2 4.3 4.3 4.5 4.2	13.4 13.6 13.6 13.6 13.6 13.6 18.9 19.0 18.9 10.4 10.2 10.4	18.9 19.0 18.8 10.2 10.3 10.3	18.9 18.7 19.0 10.3 10.3 10.6
41-22	C33HC2*P38A4	Y	95 3.8 3.8 3.9 10.7 10.8 10.8	14.2 14.3 14.4 12.5 12.6 12.4	14.6 14.9 14.7 13.3 13.4 13.6	14.4 14.2 12.4 12.8 12.2 12.8
41-23	C21DU2*P30A4	Y	97 4.1 4.1 4.1 11.7 11.8 11.9	11.9 16.2 16.3 20.3 20.4 19.5	15.4 15.8 15.6 19.6 20.6 18.4	15.4 15.5 15.5 19.1 22.1 22.2
41-24	C21PF2*P50A4	N	96 3.8 3.7 3.8 11.0 10.9 11.0	15.1 15.0 15.2 16.3 16.7 16.2	15.4 15.4 15.4 16.7 16.4 16.1	15.4 15.4 15.4 16.7 16.4 16.1
41-25	V36M22*T43A4	Y	101 3.8 4.0 3.9 11.6 12.0 12.0	16.9 16.7 17.3 18.2 17.4 18.2	16.6 17.1 16.0 17.2 17.3	16.6 17.1 16.0 17.2 17.3
98			3.8 3.7 3.9 12.5 11.8 12.3	17.5 16.6 17.1 16.0 17.2 17.3	16.8 17.2 18.0 17.6	16.8 17.2 18.0 17.6
90			3.7 11.9 12.1 12.1 12.1 12.1	17.5 17.9 17.0 17.9 18.1 18.4	17.5 17.9 17.0 17.9 18.1 18.4	17.5 17.9 17.0 17.9 18.1 18.4

APPENDIX D (cont.)

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs No.	Vehicle Code	KS	FBRU RON	0-30 MPH WOI	0-60 MPH WOI	0-70 MPH WOI	40-60 MPH MT
41-26	P36SE2*T25M5	N	102	4.4	4.6	4.6	13.1
			94	5.6	4.7	5.0	12.1
			98	4.7	4.8	4.6	12.2
41-27	C21RC3*P22A4	N	99	4.6	4.4	4.5	19.5
			91	4.4	4.5	4.3	19.0
			95	4.5	4.6	4.3	19.2
41-28	C72B*2*P30A4	N	99	6.1	5.7	6.3	10.4
			91	6.4	6.1	6.0	9.9
			95	5.8	6.4	6.1	10.7
41-29	P21RT2*P29M5	N	104	5.3	4.9	5.4	19.4
			96	4.8	4.7	4.9	19.3
			100	5.1	5.0	5.5	18.8
41-30	S15XL2*P40A4	Y	-	-	-	-	-
			102	3.6	3.5	3.6	16.8
			104	3.4	3.5	3.6	17.2
47-08	C21TX2*P23A3	N	98	4.3	4.5	4.4	11.5
			90	4.5	4.4	4.5	11.6
			-	-	-	-	-
47-09	C21E92*T19A3	N	102	5.0	5.4	5.1	12.5
			94	5.2	5.4	5.3	12.8
			98	5.3	5.3	5.3	12.7
47-18	C33HC2*P38A4	Y	93	3.3	3.6	3.5	7.3
			85	3.6	3.6	3.4	7.3
			89	3.6	3.7	3.7	7.4
			80	3.8	3.7	3.8	7.8

INDIVIDUAL VEHICLE RESULTS
ACCELERATION TIME, SECONDS

Obs No	Vehicle Code	KS	FBRU RON	0-30 MPH WOT			0-60 MPH WOT			0-70 MPH WOT			40-60 MPH MT		
47-19	C32HC2*P38A4	Y	99	3.8	3.9	4.0	11.9	11.9	11.9	15.8	15.9	16.0	9.1	8.6	8.8
			91	4.0	4.0	4.0	12.1	12.0	12.2	16.0	16.3	16.2	9.1	8.9	0.7
			95	4.0	4.0	4.0	12.3	12.4	12.3	16.3	16.4	16.3	9.1	8.6	0.8
			87	4.0	4.2	4.0	12.1	12.5	12.5	16.4	16.4	16.5	9.4	9.5	0.7
47-21	C21RC3*P22A4	N	93	4.5	4.5	4.5	13.4	13.5	13.6	18.6	18.6	18.7	19.6	19.0	17.8
			85	4.5	4.5	4.8	13.5	13.6	13.5	18.3	18.7	18.7	19.2	18.3	17.5
			89	4.5	4.5	4.5	12.8	13.5	13.5	17.8	18.0	18.5	18.5	18.7	18.4
47-22	C31AW2*P28A4	Y	104	4.2	4.2	4.3	11.3	11.4	11.4	16.0	16.2	16.2	7.8	7.0	0.1
			96	4.3	4.1	4.4	11.3	11.3	11.3	15.9	16.1	16.2	8.2	8.3	0.5
			100	4.2	4.3	4.3	11.5	11.4	11.3	16.4	16.3	16.2	8.0	8.3	0.1
			92	4.3	4.5	4.4	11.4	11.6	11.6	16.2	16.5	16.6	8.6	8.3	0.5
47-23	C31AW2*P28A4	Y	94	4.8	4.9	4.9	13.0	13.1	13.2	17.5	17.8	18.0	11.5	11.7	11.8
			86	4.9	4.9	5.0	13.0	13.1	13.2	18.0	17.9	17.9	12.0	12.0	12.1
			90	4.8	4.8	5.0	13.0	13.0	13.2	17.5	17.5	17.7	12.1	11.8	11.7
			82	5.0	5.0	5.0	13.5	13.4	13.3	18.0	18.0	18.0	12.0	12.1	12.1
65-08	C21D'J2*P30A4	Y	103	5.0	4.8	4.8	12.6	12.2	12.2	16.5	15.9	16.0	8.0	7.5	7.7
			95	4.4	4.6	4.7	12.1	11.8	12.1	16.0	15.4	15.8	7.7	8.2	7.5
			96	4.8	4.7	4.7	12.3	12.2	12.1	16.3	16.1	16.1	7.8	8.0	7.9
			91	4.7	4.6	4.6	12.0	12.0	12.2	16.1	15.9	16.0	7.9	7.6	7.6
65-11	C34HC2*P38A4	Y	99	4.8	4.8	4.9	13.1	13.3	13.0	15.4	15.9	15.2	13.4	12.3	12.7
			91	4.9	4.8	4.8	12.9	13.5	12.9	15.2	15.8	15.3	12.8	12.9	12.0
65-12	C32AW2*P28A3	Y													
			99	5.1	4.7	4.9	13.0	12.6	13.3	15.1	15.0	15.9	11.6	11.7	11.8
			104	5.0	4.9	4.9	13.3	13.2	13.1	15.9	15.8	15.5	12.1	12.9	11.7
			95	5.1	5.0	4.8	13.1	13.0	12.6	15.1	15.5	14.8	13.7	12.3	11.8
			97	4.7	4.6	4.7	13.7	13.8	13.3	16.7	16.5	16.0	12.4	12.8	12.7
65-13	C32NU2*T25A3	N	89	4.6	4.5	4.4	13.6	13.9	13.4	16.4	16.9	16.3	13.2	12.0	12.6
			93	4.5	4.7	4.6	13.7	14.1	13.5	16.5	17.0	16.3	12.3	12.5	12.0

