010394

THE ADOT ALTERNATIVE FUELS STUDY

October 1, 1988

ARIZONA DEPARTMENT OF TRANSPORTATION

206 South Seventeenth Avenue Phoenix, Arizona 85007

ROSE MOFFORD
Governor

CHARLES L. MILLER
Director

October 1, 1988

Honorable Carl J. Kunasek
President of the Senate
Senate Wing - Room 204
Phoenix, Arizona 85007

and

Honorable Joe Lane
Speaker of the House
House Wing - Room 223
Phoenix, Arizona 85007

Dear Sirs:

The attached alternative fuels study was prepared and is presented in conformance with Senate Bill 1360 and House Bill 2115 passed during the 1987 Legislative Session.

If you have question regarding this report, members of my staff or I will be glad to meet with you at your convenience to go over the data in detail.

Sincerely,

Charles L. Miller

CLM:VN
cc: Senator Pete Corpstein
Representative Jack Jewett

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EXECUTIVE SUMMARY

The Arizona State Legislature in 1987 passed several comprehensive clean air bills. Two of these bills, House Bill 2115 and Senate Bill 1360, mandated that the Arizona Department of Transportation conduct a pilot program on portions of the ADOT fleet. The purpose of this program was to determine the cost of maintaining a vehicle operating on clean-burning fuel, the effect on the miles per gallon of these vehicles, the availability of clean-burning fuels, and the impact of these fuels on motor vehicle emissions.

The department selected ninety vehicles for the pilot program. Three maintenance camp fueling facilities in Phoenix and one in Tucson were converted to dispense an ethanol blend, a methanol blend, and an MTBE blend. In addition, other selected vehicles were converted to compressed natural gas and propane, and contracts were made with appropriate vendors.

In the test period detailed records were kept regarding each of the selected fuel types. Based on this test several findings were determined.

There were no reported cases of vehicle failure, no cases of plugged fuel filters, and no fuel hose deterioration documented as a result of using any of the test fuels. There was no indication in the mileage comparisons that any particular fuel had a significant advantage throughout the entire range of vehicles. No conclusions as to fuel efficiency can be drawn from the data collected.

There were no increased maintenance costs directly related to the use of alternative fuels. While there was no significant difference found in the emissions of the various fuel types, it should be noted that statistical significance is influenced by a number of variables such as vehicle age, vehicle use, maintenance, and variations within fuel types. Thus, this observation is not viewed as unusual in this instance.

The Department of Transportation will continue the current testing program for another year in an effort to broaden the data base in terms of the number of observations available for each of the vehicles in the test program. The increased number of observations may enhance the statistical reliability of future analyses. Based on ADOT's favorable experience with the five clean-burning fuels from both a driveability and maintenance perspective, plans are underway to convert the remainder of the ADOT fleet in both the Tucson and Phoenix metropolitan areas to clean-burning fuels by January 1, 1989.

1. INTRODUCTION

In 1987, during the first regular session of the 38th Legislature, several bills were passed pertaining to the broad subject of clean air.

HOUSE BILL 2115

One of these bills, House Bill 2115, mandated that the Arizona Department of Transportation undertake a pilot program to test certain clean-burning fuels in part of ADOT's fleet. A.R.S. 41-2083.D., Sec. 3 was added and reads as follows:

Sec. 3. Department of transportation pilot project on clean-burning fuels; report; definition
A. The department of transportation shall conduct a pilot project to determine the cost and effect of using clean-burning fuels in motor vehicles. The department shall designate certain department of transportation motor vehicles which will be operated with clean-burning fuels and monitor the motor vehicles to determine, among other things:
1. The cost of maintaining a motor vehicle operated with clean-burning fuel.
2. The effect on the miles per gallon of a motor vehicle operated with clean-burning fuels.
3. The availability of clean-burning fuel.
4. The impact of clean-burning fuels on motor vehicle emissions.
B. The department shall submit a report of its findings to the president of the senate and the speaker of the house of representatives on or before October 1, 1988. The report shall include a recommendation on the feasibility of using clean-burning fuels in public or private motor vehicles on a local or statewide basis.
C. For the purpose of this section, "clean-burning fuels" includes compressed natural gas, liquid propane gas or a blend of gasoline and ethyl alcohol or methyl alcohol.

SENATE BILL 1360

A companion bill to H.B. 2115 was the comprehensive Clean Air legislation contained S.B. 1360. Among other things, this bill mandated that the Department of Transportation carry out certain driveability studies. Section 32 states, in part that:

The state...shall conduct a study of ten percent of their non-diesel...vehicle fleets operating in non-attainment areas...to determine how these vehicles perform in respect to driveability, using clean-burning fuels... Vehicles chosen shall be representative of the entire respective fleet.
Each study shall be conducted for a one-year period beginning October 1, 1987. The department shall submit a report of the findings to the president of the senate and the speaker of the house of representatives on or before November 1, 1988.

The remainder of this report contains information relating to the design of the pilot program, implementation of the program, and the results derived from the tests. Also included are results of the driveability study.

II. PROGRAM DESIGN

The design of the pilot program was established through a series of meetings within various sections of ADOT, with legislators, and with other interested parties in the private sector. Assistance in the development of the program was also obtained through a contract with a statistical consultant. The program was designed in order to minimize the effect on ADOT's normal operations and still provide appropriate data on mileage, maintenance costs, driveability and exhaust emissions.

PILOT STUDY

The following seven points sequentially describe the procedures used in ADOT's program of vehicle testing:

1. The following five types of alternative fuels were selected for the pilot program:

    - Ethanol Blend
    - Methanol Blend
    - Methyl Tertiary Butyl Ether Blend (MTBE)
    - Compressed Natural Gas (CNG)
    - Propane (LPG)

2. Test vehicles were selected so that groups (vehicle make, model and year) could be assigned to each of the five test fuels. Six different groups of vehicles were selected, and three different vehicles of each model were assigned to each fuel. There were 90 test vehicles with 18 vehicles tested on each of the five fuels. (The results of this selection process are shown in Table I.)

3. Three liquid-type fueling stations at ADOT maintenance yards in the metropolitan Phoenix area were selected for dispensing the three liquid alternate fuel blends. Contracts were negotiated with suppliers of propane and compressed natural gas to provide these fuels, because facilities for storing and dispensing the fuels did not exist at ADOT's facilities.

4. Each group of 18 vehicles was assigned to a fueling site and to a type of fuel.

5. Each vehicle used in the test was tuned to factory specifications and operated in normal service for a three-month period. This was done, using unleaded fuel, to establish comparative or baseline data on mileage, emissions and driveability. Monthly emission tests and daily log sheets completed by the vehicles' operators were the primary data sources.

Table I

VEHICLE CLASSIFICATION[1]	FUEL TYPE[1] TYPE I	TYPE II	TYPE III	TYPE IV	TYPE V
TYPE A	B726	B719	B724	B727	B738
	B729	B721	B741	B745	B746
	B759	B735	B747	B750	B749
TYPE B	B773	B793	B792	B768	B823
	B808	B826	B794	B827	B831
	B817	B833	B796	B835	B832
TYPE C	A445	A362	A434	A361	A427
	A446	A431	A439	A364	A432
	A448	A458	A442	A450	A439
TYPE D	BC56	BC32	BC40	BB73	BC51
	B938	BB70	BC41	BB75	B934
	B943	B888	BC65	BB85	B906
TYPE E	B432	B533	B446	B515	B504
	B487	B551	B462	B516	B530
	B641	B625	B543	B517	B549
TYPE F	BC06	BD55	BD12	BD51	BD64
	BD82	BD70	BD57	BD52	BD66
	BD09	BD39	BD08	BD61	BD74
TYPE G	Vehicle ID#s B328, B347, B353, B416, B418 to fuel at a different alternate fuel pump each time.				

[1] Appendix IV

VEHICLE IDENTIFICATION NUMBERS BY FUEL TYPE

6. After the three-month baseline period, the three ADOT fueling sites were converted to clean-burning fuel. Eighteen vehicles were converted to propane, and eighteen vehicles were converted to compressed natural gas.

7. The data on emissions, fuel use, driveability, and maintenance were entered into a computer data base for use in analysis at the end of the study period.

The matrix design of the experiment was such that vehicles could be omitted without impacting the validity of the experiment. Ideally, the data for each cell in the matrix would be available to aid in statistical analysis. However, it was recognized that with 90 operators, an emissions testing lab over which the department had no control, and a number of data entry people, human errors undoubtedly would occur.

The experiment was designed to take advantage of ADOT's fueling facilities and work locations throughout the Phoenix metropolitan area. It should be clearly understood that the experiment was a field test and differs greatly from laboratory experiments within a totally controlled environment. In order to prevent misinterpretations of the study's design or conclusions, it is appropriate to review some things this experiment was <u>not</u> designed to accomplish.

First, the experiment used only vehicles available within the existing ADOT fleet. Therefore, the vehicles are 1980 or newer, of American make, and are maintained under a fleet maintenance program. This group of vehicles should not be viewed as representative of the general fleet of privately-owned vehicles in Arizona.

Second, the ADOT vehicles were used as they normally are in ADOT's everyday work environment. This environment is not the same as that for vehicles used in commuter traffic or in other uses commonly associated with private vehicles in the metropolitan area.

Third, no effort was made to duplicate maintenance practices which might commonly occur to privately-owned vehicles.

Fourth, the experiment was designed as a field test. No laboratory emission tests were performed, and the results of this study should not be interpreted as other than a field evaluation.

Finally, the fuel delivery systems and fuel blending procedures associated with this experiment are not those used in typical vending practices in the private sector.

DRIVEABILITY STUDY

The expanded driveability study basically utilized the same daily log information produced in the more controlled test of the pilot study. In addition, information was obtained from all vehicles using one of the three fueling stations dispensing clean-burning fuel. To obtain an even wider utilization, part of the fueling facility located at the Grant Road maintenance camp in Tucson was converted to clean-burning fuel, and data was collected from all vehicles utilizing this facility.

Fuel usage by this large and diverse group was consistent with expectations of such a field test. Occasionally, operators would use conventional fuel; and conversely, state vehicles from other localities occasionally would be filled with test fuel. This added a dimension to the program which was not designed but which has not been discouraged.

The vehicles were operated during the three-month baseline period on gasoline, and the drivers completed daily log sheets throughout the period. Without this baseline period, no valid comparisons of the vehicles' performance could be made.

III. IMPLEMENTATION

After completion and acceptance of the program's design, work started on the identification of vehicles and fueling sites. In order to minimize the impact on the normal use of vehicles, fueling sites were identified first. Three sites were selected in the Phoenix metropolitan area: Durango, West Georgia, and Recker Road. In addition, the Grant Road maintenance yard was selected in Tucson.

Existing vehicle usage was next analyzed, and vehicles were identified which would use the respective fueling sites throughout the study period. Those vehicles which would be converted to either propane or compressed natural gas were also identified. These vehicles were given a status code identifier to allow their activity to be traced through the computer system located within the ADOT Equipment Section. All fueling, maintenance, and mileage data were traced both through the daily log sheets completed by the drivers and through the Equipment Section's computer records.

When the fueling sites were identified, the baseline testing procedure began. Daily driver's logs were designed and printed, arrangements were made for emissions testing with the Hamilton Test facility on South 7th Street, and meetings were held at various ADOT locations to familiarize drivers and supervisors with the testing program and to solicit their cooperation.

All 90 of the pilot study's vehicles were tuned to factory specifications for the purpose of gathering baseline data on unleaded gasoline. While this process was ongoing, preparations continued for the testing of the clean-burning fuels. Each of the fueling facilities were analyzed to determine the compatibility of the tanks and dispensing equipment with oxygenated fuels. Repairs or alterations were made where necessary, and by mid-December each fueling facility was ready to handle the test fuels.

Next, bid sheets were prepared by ADOT Purchasing to acquire the gasoline blends, and arrangements were made to purchase propane on an as-needed basis from several suppliers. A contract was negotiated with Southwest Gas to obtain the needed compressed natural gas.

The bid process for the gasoline blends proved somewhat disappointing when only three firms responded with offers to sell the ethanol blend, two responded to furnish the MTBE blend, and no one responsed regarding methanol. Because the first bid call specified an oxinol blend for methanol, it was decided to try a second time with specifications for any blend meeting the EPA waiver. Again, no response was received for the methanol blend.

Contracts for delivery of the ethanol and MTBE blends were negotiated while members of the Purchasing Department, the Equipment Section, and the Arizona Transportation Research Center contacted various suppliers and producers of both methanol and blended fuels with methanol. A supply of methanol-blended fuel finally was located in Texas, and arrangements for purchase were concluded. Due to the transportation costs, this fuel was relatively expensive to acquire.

Throughout this same period bidding and contracting was undertaken for the conversion of vehicles to propane and compressed natural gas. Vehicle conversion began in mid-December 1987, and all 36 vehicles had been converted by January 22, 1988.

Delivery of the oxygenated fuel began January 8, 1988 with the receipt of the ethanol shipment. The MTBE blends arrived January 17 and 18. Due to the difficulty in obtaining gasoline blends with methanol, delivery was not made on this fuel type until January 26, 1988. Because of the variance in delivery schedules, it was decided that emissions data for the month of January would not be used in the final analysis.

Using emission test data starting in February ensured that no unusual or "cross-fueled" data was used. Overall accuracy of the results were improved, therefore, through the elimination of possible incorrect data caused by unforeseen confusion during the transition period between baseline and oxygenated fuel.

IV. RESULTS

Based on the data collected in the pilot program, results were determined on driveability, mileage, emissions and cost of operating the test vehicles.

DRIVEABILITY

Data concerning vehicle performance was obtained from daily log sheets completed by drivers. These entries described the frequency and severity of each of nine symptoms commonly associated with fuel-related performance.

These nine symptoms are listed, and a summary of their occurrence is presented for both baseline and test fuel operation in Appendix 1. Note that even on the baseline unleaded fuel, some vehicles consistently reported problems, although drivers did not think the severity of the condition warranted sending the vehicle to the shop for repair. This occurred with some degree of regularity among a fleet of vehicles where no financial liability accrued to the driver if the vehicle was sent to the shop for repair. How often vehicles in the privately-owned fleet might be operated with known performance deficiencies is a matter of conjecture, but due to the financial burden of repair, it is expected that such occurrences would be more frequent and of longer duration than was the case in the ADOT fleet. This hypothesis is supported by looking at the inconvenience associated with vehicle repair in terms lost work time, travel distance, and the uncertainty of vehicle availability as a result of repairs.

During the baseline test period, various performance anomalies were noted for each vehicle being observed for driveability characteristics. These were then compared to any reported problems experienced during operation on clean-burning fuel.

A major finding of the field study was that there were no reported cases of total vehicle failure, no cases of plugged fuel filters, and no hose or elastomer deterioration documented as a result of using any of the test fuels during the nine-month period from January 1988 through September 1988.

The driveability records received for the test vehicles have been summarized by fuel type and vehicle category. This summary is presented in Appendix 1.

In addition to the pilot study's test vehicles, beginning in January 1988 other vehicles operated in the Phoenix area and an additional group in Tucson operated on clean-burning fuels. Vehicles from the Phoenix facility used the same fuel blend that was available in the Tucson facility, and for simplicity of reporting all data is presented together. Ninety-eight vehicles regularly submitted driveability logs.

MILEAGE

During the operation of the pilot study test program, approximately 189,000 miles were driven on gasoline for baseline mileage, and an additional 315,000 miles were driven on the various test fuels. The results of the computation of miles per gallon for each vehicle and for each fuel are illustrated in Table II.

There is no indication in the mileage comparisons that any particular fuel had a significant advantage over the entire range of vehicles. The vehicles reported in this study are operated as part of the ADOT fleet, and any differences in mileage may be attributed to the manner in which they are operated. No conclusions as to fuel efficiency can be drawn from this data, and it is presented to document the experience during this trial.

EMISSIONS

Early in the emissions testing program, even while testing for baseline values, several observations were made by the investigating team. First, successive emissions tests on the same vehicle often gave carbon monoxide or hydrocarbon concentrations which were different from previous readings on the same automobile. While this is not necessarily an unusual situation, it creates the potential for wide variance and would necessitate a much larger sample size for any statistical reliability.

Because the fleet of vehicles used in this study is involved in a major, ongoing construction program, there were instances when the operators were unable to bring the vehicles to the testing facility. Thus, it was fairly certain that all ninety vehicles would not complete the program and that others would be missing observations. Seventy-eight of the 90 test vehicles completed enough testing sequences to be used statistically. Several others had partial data but had sufficient observations to be helpful. This created some problems for statistical comparison, because equal observations were not available for all vehicles.

Only one testing device for nitrogen oxides was available for use. This created a condition of vulnerability; and near the end of the testing sequence, the equipment failed and was out of service for an entire month. This added to the problem of incomplete data.

Analysis of the emission data was an extremely complex undertaking due to the lack of equal cell sizes and the large variance in the data. Improvement in the statistical parameters could be obtained by removing any unusually large or small numbers to reduce the statistical variance. However, if automobiles do occasionally operate in a high pollution mode, then it may be a mistake and give false reliability to arbitrarily remove those observations. Thus, no statistically significant difference was found in the emissions of the various fuel types. Several statistical techniques were attempted, but the results of the comparison of unleaded gasoline to any of the clean-burning fuels were inconclusive.

Since the performance of the alternative fuels, in terms of emissions and based on data availability, seems to vary widely among vehicle types, more data will be required to arrive at more definitive conclusions. Therefore, ADOT will continue the current testing program for another year in an effort to broaden the data base in terms of the number of observations available for each of the vehicles in the test program. The increased number of observations may

Table II

VEHICLE TYPE[1]	FUEL TYPE[1] TYPE I	TYPE II	TYPE III	TYPE IV	TYPE V
TYPE A					
BASELINE	16	14	16	16	17
ALT FUEL	14	13	15	14	12
TYPE B					
BASELINE	16	18	16	13	16
ALT FUEL	15	18	16	12	14
TYPE C					
BASELINE	21	22	17	21	20
ALT FUEL	18	20	16	14	15
TYPE D					
BASELINE	16	14	18	12	12
ALT FUEL	14	14	18	14	10
TYPE E					
BASELINE	11	11	10	7	9
ALT FUEL	10	10	11	6	10
TYPE F					
BASELINE	15	14	19	16	16
ALT FUEL	13	17	18	12	10

[1] Appendix IV

MILEAGE COMPARISONS

enhance the statistical reliability of future analyses, though there is no certainty of more conclusive results within the field evaluation.

In addition, a subset of the test vehicles will be processed through a laboratory test procedure in cooperation with the Department of Environmental Quality. These tests will be done by the Department of Environmental Quality personnel, using newly acquired testing equipment and laboratory facilities. This laboratory testing procedure should enhance the comparative data already available on the five alternative fuels.

Complete details regarding emissions of the five fuels can be found in the Statistician's Report attached as Appendix II.

COST

During the entire course of the Alternate Fuel Study, every repair relating to fuel systems of the test vehicles was identified in the Equipment Section's computer system. These items have been extracted and are attached to the report as Appendix III.

The pilot study did not identify any increased maintenance costs directly related to the use of alternative fuels. The one-time conversion costs of the vehicles to compressed natural gas and propane were not considered maintenance.

Replacement of fuel-related items such as fuel pumps and filters frequently occur as routine maintenance on high-mileage vehicles when a reduced fuel flow is noted in the shop testing procedure. Such a condition in a vehicle with 60,000 to 80,000 miles is not unusual; and in those instances where it did occur, department mechanics could not determine that the cause was related to the type of fuel used.

As a sidelight, ADOT operated five older (1979) vehicles on deliberately co-mingled fuel (fueling on ethanol, then methanol, then MTBE etc.) This was done to simulate conditions similar to those generated when vehicles indiscriminately are fueled with several different types of fuel in succession.

These vehicles operated successfully until the beginning of hot weather. At that point three vehicles refused to operate acceptably on the co-mingled fuel. Carburetors and fuel pumps were changed, but no improvement was noted. Because these vehicles otherwise would operate on unleaded fuel, it is suggested that further study be initiated regarding this phenomenon and caution be used by other experimenters to ensure that fuel mixing purposely occurs in fuel tests. Information on the potential difficulties of co-mingling fuels should be made available to the public along with other advisory information.

Because of ADOT's favorable experience with the five clean-burning fuels from both a driveability and maintenance perspective, plans are underway to convert the remainder of its fleet in both the Tucson and Phoenix metropolitan areas to clean-burning fuels by January 1, 1988.

Appendix I.
Summary of Problems for Controlled Test Vehicles

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 1 & Vehicle category 1)

Ethanol 1983 S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1			2		44	1	13	1
2			1		37		12	
3			4		11		1	1
4							7	7
5					6		12	1
6			6		14		6	2
7			2		7		1	2
8								
9								
TOTAL	0	0	15	0	158	1	46	8

KEY:		M Mildly Annoying	S Very Troublesome
1)	Cranking required to start engine...	[]	[]
2)	Stalled after starting.....	[]	[]
3)	Stalls in traffic.....	[]	[]
4)	Vapor lock..... (stalls with difficult restart)	[]	[]
5)	Idle roughness.....	[]	[]
6)	Hesitation, bucking or coughing.....	[]	[]
7)	Lack of power.....	[]	[]
8)	Pinging.....	[]	[]
9)	Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 1 & Vehicle category 2)

Ethanol 1984 S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1	1	1						
2	1		2	1				
3	2	1		5				
4								
5	2	4		5				
6	1							
7	1	1						
8	1							
9								
TOTAL	9	8	2	11				

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 1 & Vehicle category 3)

Ethanol & 1985 Chevrolet Celebrity

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1								
2								
3			4		4	1		
4								
5	1							
6								
7			1		2			
8								
9								
TOTAL	1	0	5	0	6	1	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 1 & Vehicle category 4)

Ethanol 1985 Ford Ranger

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1								4
2					1			4
3								
4	10							
5								
6								
7	2							
8								
9								
TOTAL	12	0	0	0	1	0	0	8

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 1 & Vehicle category 5)

Ethanol 1980 C-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1								
2			3					
3								
4								
5			5					
6	2		1					
7								
8								
9								
TOTAL	2	0	9	0		0		0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 1 & Vehicle category 6)

Ethanol 1986 Chevy S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1			24	2	32		13	
2								
3								
4								
5								
6								
7								
8								
9								
TOTAL	0	0	24	20	32	0	130	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 2 & Vehicle category 1)

Methanol 1983 S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1	11	11						
2		10	1					
3								
4								
5	12		2				11	
6	3						1	
7	6		1				6	
8								
9								
TOTAL	32	21	4	0	0	0	18	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 2 & Vehicle category 2)

Methanol 1984 S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1								
2								
3								
4								
5								
6			8		44		28	
7							1	
8								
9								
TOTAL	0	0	84	0	44	0	29	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 2 & Vehicle category 3)

Methanol 1985 Chevy Celebrity

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1					2			
2		1				2		
3	2	2			1			
4								
5								
6								
7								
8								
9								
TOTAL	2	3	0	0	3	2	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 2 & Vehicle category 4)

Methanol 1985 Ford Ranger

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1	2							
2	2		1			1		
3	2		10		13	2		
4								
5	40	1	38		11			
6			38		10	2		
7						11		
8								
9								
TOTAL	46	1	87	0	34	16	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 2 & Vehicle category 5)

Methanol 1980 C-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1							3	3
2					2	1	3	1
3					1	7	2	
4								
5					6		26	5
6					16	4	31	1
7	1		1		6	10	8	
8			1		4	7		6
9								
TOTAL	1	0	2	0	35	29	73	16

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 2 & Vehicle category 6)

Methanol 1986 Chevy S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1	2		1		1			1
2	2							
3								
4								
5								
6	1							
7								
8								
9								
TOTAL	5	0	1	0	1	0	0	1

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 3 & Vehicle category 1)

MTBE 1983 S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1								
2								
3								
4								
5								
6								
7								
8								
9								
TOTAL	0	0	0	0	0	0	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 3 & Vehicle category 2)

MTBE 1984 S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1	4							
2	1						11	11
3								1
4	1							
5								
6			10					
7								
8								
9								
TOTAL	6	0	10	0	0	0	11	12

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 3 & Vehicle category 3)

MTBE 1985 Chevy Celebrity

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1								
2								
3								
4								
5								
6								
7								
8								
9								
TOTAL	0	0	0	0	0	0	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 3 & Vehicle category 4)

MTBE 1985 Ford Ranger

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1								
2								
3								
4								
5					3			
6								
7					4			
8								
9								
TOTAL	0	0	0	0	7	0	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 3 & Vehicle category 5)

MTBE 1980 C-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1	6							
2								
3		1						
4								
5	1	6						
6		6	2	1				
7								
8			2					
9								
TOTAL	7	13	4	1	0	0	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 3 & Vehicle category 6)

MTBE 1986 Chevy S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1		1						
2								
3								
4								
5	1							
6								
7								
8								
9								
TOTAL	1	1	0	0	0	0	0	0

KEY:

		M Mildly Annoying	S Very Troublesome
1)	Cranking required to start engine...	[]	[]
2)	Stalled after starting.....	[]	[]
3)	Stalls in traffic.....	[]	[]
4)	Vapor lock..... (stalls with difficult restart)	[]	[]
5)	Idle roughness.....	[]	[]
6)	Hesitation, bucking or coughing.....	[]	[]
7)	Lack of power.....	[]	[]
8)	Pinging.....	[]	[]
9)	Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 4 & Vehicle category 1)

CNG 1983 S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1	21							
2	4							1
3				1		2		
4	4							
5	1				4	1		
6	8			1				
7								
8								
9								
TOTAL	38	0	0	2	4	3	0	1

KEY:

	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 4 & Vehicle category 2)

CNG 1984 S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1	37							
2						1		1
3						1		2
4						2		
5								2
6							1	2
7					9	7		2
8								
9								
TOTAL	37	0	0	0	9	12	0	9

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 4 & Vehicle category 3)

CNG 1985 Chevy Celebrity

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1								
2								
3								
4								
5								
6								
7								
8								
9								
TOTAL	0	0	0	0	0	0	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 4 & Vehicle category 4)

CNG 1985 Ford Ranger

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1								
2			1		2			
3			1		2	2		
4			1					
5			1		8			
6			4		5			
7			4		6			
8								
9								
TOTAL	0	0	12	0	23	2	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 4 & Vehicle category 5)

CNG 1980 C-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1	2		1	2				
2	5					1		
3	1			1				
4	5							
5								
6	2					1	1	
7	54		3	9		1		
8			3					
9								
TOTAL	69	0	7	12	0	3	1	0

KEY:

	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 4 & Vehicle category 6)

CNG 1986 Chevy S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1			6	2				
2			11	1				
3			5	1				
4								
5			3	3				
6			2	2	1			
7			8	6	1			
8								
9								
TOTAL	0	0	37	15	2	0	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 5 & Vehicle category 1)

Propane 1983 S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1			4		44		20	
2			4		45		20	
3					31		4	11
4								1
5			4		13	31		
6			2	4	14	38		
7								18
8								
9								
TOTAL	0	0	10	4	157	69	44	30

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 5 & Vehicle category 2)

Propane 1984 S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1	4							
2			1					
3								
4	5							
5	1		10			1		
6	25		4					
7	3		4			1		
8			3			1		
9								
TOTAL	38	0	22	0	0	3	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 5 & Vehicle category 3)

Propane 1985 Chevy Celebrity

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1								
2			2	2	1			
3	2		5	2				3
4								
5							3	8
6	1				1		1	8
7			3				1	10
8								5
9								
TOTAL	3	0	10	4	2	0	5	34

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 5 & Vehicle category 4)

Propane 1985 Ford Ranger

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1			3		1			
2								
3			2					
4								
5			1		4			
6								
7					1			
8								
9								
TOTAL	0	0	6	0	6	0	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 5 & Vehicle category 5)

Propane 1980 C-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1				45		3		
2				49		4		
3				46		4		
4	2							
5				52		4		
6								
7								
8								
9								
TOTAL	2	0	192	0	0	15	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 5 & Vehicle category 6)

Propane 1986 Chevy S-10

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1								
2								
3								
4								
5	1							
6	15				3			
7		15			3			
8								
9								
TOTAL	16	15	0	0	6	0	0	0

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

TUCSON

SUMMARY OF PROBLEMS FOR CONTROLLED TEST VEHICLES

(Fuel type 5 & Vehicle category 6)

MTBE Mixed 98 vehicles

	OCT-DEC		JAN-MAR		APR-JUN		JUL-SEP	
	M	S	M	S	M	S	M	S
1	39	2	61	2	13	1	0	4
2	7	1	12	0	2	2	0	2
3	2	3	4	1	1	0	0	0
4	16	1	1	1	22	0	0	1
5	14	7	84	7	26	1	1	4
6	25	15	73	14	59	15	23	11
7	7	0	36	9	36	5	31	5
8	3	1	1	4	0	1	0	0
9	0	0	5	3	0	0	0	0
TOTAL	113	30	277	41	159	25	55	27

KEY:	M Mildly Annoying	S Very Troublesome
1) Cranking required to start engine...	[]	[]
2) Stalled after starting.....	[]	[]
3) Stalls in traffic.....	[]	[]
4) Vapor lock..... (stalls with difficult restart)	[]	[]
5) Idle roughness.....	[]	[]
6) Hesitation, bucking or coughing.....	[]	[]
7) Lack of power.....	[]	[]
8) Pinging.....	[]	[]
9) Dieseling.....	[]	[]

Appendix II.
Analysis of ADOT Emissions Study

ANALYSIS OF ADOT EMISSIONS STUDY

for

ATRC (ADOT)

by

Productivity International
Tempe, Arizona

September 19, 1988

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I. Data Reduction

The tests were conducted using six vehicle classes made up of 78 vehicles and six fuels, one of which was gasoline. All vehicles included in the test were first operated on gasoline fuel to establish baseline emissions data for carbon monoxide (CO), hydrocarbons (HCI), and nitrious oxides. Carbon monoxide was tested at both idle (COI) and load (COL).

At the onset of this study 90 different vehicles were selected for inclusion in the study. Twelve vehicles were excluded from the study in various phases of the study. Vehicles were deleted: for mechanical problems or if no comparisons were available, i.e., gasoline to an alternative fuel.

The data used to conduct the statistical significance tests consists of 548 records. Sixty records were deleted from the study because of: test equipment failures, vehicle problems, transcription errors and lack of comparative data. The records were deleted based upon the fact the data therein were statistical outliers for which ADOT personnel could identify an assignable cause. Each of the 548 records used in the analysis are listed in Table 1.

Table 2, Emissions by Fuel Type within Vehicle, places the data from Table 1 in matrix form "Fuel by Vehicle Type". Fuel types are represented by 0 for gasoline, and the alternative fuels by 1 thru 5. The actual names of the alternative fuels was withheld from the analysis team at their request. Vehicle types are listed as 1 thru 6, which respectively represent 1983 Chevrolet Model S-10s, 1984 Chevrolet Model S-10s, 1985 Chevrolet Celebrities, 1985 Ford Rangers, 1980 Chevrolet C-10s, and 1986 Chevrolet Model S-10s.

II. Analysis of Variance for Baseline Adjusted Data

In order to take into account the fact that a specific vehicle might be a significantly higher emitter of pollution than another vehicle of the same type, each vehicle alternative fuel observation was adjusted back to its gasoline baseline. This was done so that the alternative fuel assigned to this vehicle would not be penalized in its comparisons. The average of all gasoline readings was calculated for COI, COL, HCI, and NOX for each vehicle. Then each alternative fuel observation was subtracted from this gasoline average. These difference readings are given in Table 3. A negative difference means that the alternative fuel did not perform as well as the average for gasoline for that vehicle. Using this data, sums and sums of squares data was generated for use in an analysis of variance (ANOVA) and other statistical procedures. These calculations are presented in Appendix 1. The assumptions for the ANOVA are underlying normality and equality of variances. The most critical of these is the equality of variances. Equal sample sizes will alleviate the necessity of strict equality to some extent. However, due to

problems with control, vehicle and test equipment malfunctions, and transcription errors, there is no longer equal sample sizes as was designed. The sample sizes and standard deviations are given in Table 3. A Bartlett's test for equality of variance was conducted for each of the data sets (COI, COL, HCI, AND NOX). The hypothesis of equal variances was rejected in each case.

Noting that Bartlett's test is sensitive to nonnormality as well as unequal variances, a test for equality of variance suggested by Box was attempted on the COI data to check its feasibility. This test is insensitive to nonnormality, but requires extensive work. To conduct this test, the sample corresponding to each treatment group is partitioned into subsamples of approximately equal size in a random manner. The variance of each subsample is determined and logs of the subsample variances are obtained. Finally, a one-way ANOVA on the logs of the variances is conducted and if the F-statistic is significant, then variance equality is rejected. For the COI data this would require taking the 30 cells and randomly partitioning within to get equal sample sizes. An immediate problem arose here since the smallest sample size in a cell was only 2. That would mean that one would have to randomly choose up to 10 subgroups (for a cell sample size of 20) for each cell. This method was subsequently abandoned as not practical.

Next an attempt was made to find a variance stabilizing transformation, but the variances show no pattern across vehicle types or fuels. That is, as you move across vehicle types, the relationships change. Therefore, a single transformation which would suffice across all vehicle types could not be found.

The ANOVA F-test is still robust for the unequal variances provided that the larger sample sizes correspond to the populations with the larger variances. An inspection of the data shows that this is not true for this data. Thus the usual analysis of variance approach was not deemed appropriate for this analysis.

III. Multiple Comparisons (Baseline)

An inspection of the data shows that there is interaction present in the data between vehicle type and fuel type. That is, the alternative fuel which had the best average difference, changed for different vehicle types. Therefore multiple comparisons were first run within a vehicle type for each emission. Then for each emission type, an overall comparison was made using the averages across all vehicle types.

A multiple comparison procedure known as Bonferroni's Method was used in this analysis. Although this procedure may be the least used, it is often the best. It controls the experimentwise error rate and does not require equal sample sizes.

It was decided to look at all possible pairs for comparison. That is, fuel 1 with fuel 2, fuel 1 with fuel 3, ... , fuel 1 with fuel 5, fuel 2 with fuel 3, ... , and fuel 4 with fuel 5, for a total of 10 comparisons for each vehicle type.

The detail of these analyses are contained in Appendix 1.

The average differences and Bonferroni Baseline results which measured for significant differences at a 0.05 experimentwise error rate reveal the following:

COI Emissions:

Averaged over all vehicles: No significant differences in COI emissions among alternative fuels.

By vehicle type: Significance noted for vehicle type 5. Fuel 4 COI emissions are significantly greater than fuels 1, 2, 3, and 5.

COL Emissions:

Averaged over all vehicles: No significant differences in COL emissions among alternative fuels.

By vehicle type: No significant differences.

HCI Emissions:

Averaged over all vehicles: HCI emissions are significantly greater for fuel 5 than for fuels 1, 2, and 3.

By vehicle type: Fuel 5 HCI emissions for vehicle type 2 are significantly greater than fuels 1, 2, 3, and 4. HCI emissions for vehicle type 6 are significantly greater for fuel 5 than for fuels 1, 2, and 3.

NOX Emissions:

Averaged over all vehicles: No significant differences in NOX emissions among alternative fuels.

By vehicle type: No significant differences.

IV. Multiple Comparisons (Non-adjusted for Gasoline Baseline)

At the request of ADOT another set of multiple comparisons was made without adjustment for the gasoline baseline. Bonferroni's Method was again used with fuels gasoline (0) and the five alternative fuels. All 15 possible comparisons were made: fuel 0 with fuel 1, fuel 0 with fuel 2, ... , fuel 4 with fuel 5. An assumption that is made when using this approach is that all vehicles of the same type are identical in emission performance. In reality however, this is probably not the case in most instances, even when properly tuned.

The detail of these analyses are contained in Appendix 2.

The average differences and Bonferroni results which measured for significant differences at a 0.05 experimentwise error rate reveal the following:

COI Emissions:

Averaged over all vehicles: No significant differences in COI emissions among fuels.

By vehicle type: Significance noted for vehicle type 5. Fuel 4 COI emissions are significantly greater than fuels 0, 1, 2, 3, and 5.

COL Emissions:

Averaged over all vehicles: No significant differences in COL emissions among fuels.

By vehicle type: No significant differences.

HCI Emissions:

Averaged over all vehicles: HCI emissions are significantly greater for fuel 5 than for fuels 0, 1, 2, and 3.

By vehicle type: Fuel 5 HCI emissions for vehicle type 2 are significantly greater than fuels 0, 1, 2, 3, and 4. HCI emissions for vehicle type 6 are significantly greater for fuel 5 than for fuels 0, 1, 2, and 3.

NOX Emissions:

Averaged over all vehicles: No significant differences in NOX emissions among fuels.

By vehicle type: No significant differences.

V. Conclusions

The statistical tests show that only 18 of 280 comparisons (18/280 = 0.06) are statistically significant at the 0.05 experimentwise error rate. With this error rate we would expect 14 such conclusions even when all are not significant. Therefore, the results of this experiment are inconclusive as to whether one or more of these alternative fuels significantly reduce CO, HC, or NOX emissions compared to gasoline or between themselves. The large variances which occur in the measurements, even within the same vehicle, diminish the power of any statistical test to detect significant differences.

The results of this study should be validated by a follow-on study wherein enhanced controls are in place. For example, assure comparative vehicle data, preclude loss of data, machine record all emissions data, and verify data entry at the test center as well as at the computer center.

TABLE 1, Input Data for Statistical Testing

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VEHID	LOG DATE	COI	COL	HCI	NOX	VEH TYPE	FUEL TYPE	MARK
A362	10/21/87	0.01	0.04	19	85	3	0	0
A362	12/17/87	0.04	0.06	27	634	3	0	0
A362	11/19/87	0.02	0.02	0	153	3	2	0
A362	08/26/88	0.03	0.00	5	0	3	2	9
A364	12/14/87	0.42	0.33	142	808	3	0	0
A364	04/25/88	0.03	0.02	8	453	3	4	0
A364	05/11/88	0.03	0.01	5	525	3	4	0
A364	06/13/88	0.03	0.00	211	166	3	4	0
A364	08/18/88	0.04	0.00	26	0	3	4	9
A427	10/23/87	0.64	0.83	177	298	3	0	0
A427	11/10/87	0.40	0.06	139	164	3	0	0
A427	12/10/87	0.11	0.97	34	637	3	0	0
A427	03/02/88	0.04	0.08	98	570	3	5	0
A427	04/27/88	0.03	0.38	73	255	3	5	0
A427	05/16/88	0.03	0.00	20	491	3	5	0
A427	06/20/88	0.03	0.46	60	283	3	5	0
A427	07/15/88	0.32	0.30	152	631	3	5	0
A427	08/05/88	0.03	0.20	7	29	3	5	0
A431	10/30/87	0.01	0.04	15	101	3	0	0
A431	11/25/87	0.05	0.56	69	265	3	0	0
A431	02/26/88	0.21	0.65	68	1058	3	2	0
A431	03/22/88	0.09	0.05	24	662	3	2	0
A431	04/08/88	0.03	0.38	8	628	3	2	0
A431	05/10/88	0.03	0.40	16	855	3	2	0
A431	06/07/88	0.06	0.32	33	348	3	2	0
A431	07/11/88	0.27	0.67	147	987	3	2	0
A431	08/05/88	0.08	0.33	80	1464	3	2	0
A431	08/30/88	0.12	0.00	54	0	3	2	9
A432	12/14/87	0.03	0.07	52	296	3	0	0
A432	05/10/88	0.03	0.01	5	100	3	5	0
A432	06/13/88	0.03	0.01	5	247	3	5	0
A432	08/17/88	0.02	0.00	5	0	3	5	9
A439	10/23/87	0.09	0.25	49	83	3	0	0
A439	11/13/87	0.02	0.35	16	366	3	0	0
A439	12/08/87	0.05	0.04	23	671	3	0	0
A439	03/01/88	0.03	0.19	7	435	3	3	0
A439	04/20/88	0.03	0.01	8	300	3	3	0
A439	05/10/88	0.03	0.01	5	483	3	3	0
A439	05/24/88	0.03	0.93	5	449	3	3	0
A439	06/23/88	0.32	0.34	164	753	3	3	0
A439	07/19/88	0.02	2.70	7	91	3	3	0
A439	08/23/88	0.04	0.00	15	0	3	3	9
A442	12/14/87	0.40	0.34	110	526	3	0	0
A442	05/10/88	0.04	0.02	5	416	3	3	0
A442	06/13/88	0.04	0.30	29	140	3	3	0
A442	08/18/88	0.03	0.00	10	0	3	3	9
A445	10/26/87	0.01	0.04	24	97	3	0	0
A445	11/20/87	0.02	0.01	0	76	3	0	0

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VEHID	LOG DATE	COI	COL	HCI	NOX	VEH TYPE	FUEL TYPE	MARK
A445	03/16/88	0.03	0.02	5	320	3	2	0
A445	04/19/88	0.03	0.01	7	236	3	2	0
A445	06/21/88	0.03	0.30	5	1	3	2	0
A445	07/29/88	0.03	0.01	11	8	3	2	0
A445	08/22/88	0.03	0.00	5	0	3	2	9
A446	11/12/87	0.03	0.41	11	35	3	0	0
A446	12/09/87	0.29	0.88	83	542	3	0	0
A446	02/18/88	0.33	0.04	126	1414	3	1	0
A446	03/21/88	0.28	0.06	104	50	3	1	0
A446	04/15/88	1.87	0.03	106	1739	3	1	0
A446	05/17/88	0.16	0.52	96	1135	3	1	0
A446	06/10/88	0.03	0.00	11	1541	3	1	0
A446	07/19/88	0.12	0.32	52	121	3	1	0
A450	12/14/87	0.32	0.01	115	360	3	0	0
A450	05/11/88	0.02	0.20	1	467	3	4	0
A450	06/14/88	0.03	0.01	5	369	3	4	0
A450	08/18/88	0.04	0.00	5	0	3	4	9
A470	11/17/87	0.03	0.15	24	687	3	0	0
A470	04/15/88	0.03	0.02	5	681	3	1	0
A470	05/10/88	0.03	0.50	34	1178	3	1	0
A470	06/15/88	0.51	0.32	173	1477	3	1	0
A482	11/18/87	0.02	0.01	20	196	3	0	0
A482	02/03/88	0.03	0.05	77	294	3	5	0
A482	05/24/88	0.02	0.00	13	0	3	5	9
A482	06/09/88	0.03	0.00	4	761	3	5	0
A482	07/15/88	0.04	0.01	16	375	3	5	0
A482	08/09/88	0.22	0.17	166	1	3	5	0
B432	11/16/87	0.18	0.03	65	885	5	0	0
B432	12/16/87	0.92	0.03	161	1277	5	0	0
B432	03/25/88	0.03	0.14	49	1994	5	1	0
B432	04/18/88	0.03	0.11	42	1395	5	1	0
B432	05/11/88	0.03	0.18	34	334	5	1	0
B432	06/14/88	0.02	0.11	24	1737	5	1	0
B432	07/07/88	0.03	0.00	32	1675	5	1	0
B476	11/18/87	0.02	0.80	77	195	5	0	0
B476	02/12/88	0.06	0.01	141	416	5	3	0
B476	04/21/88	0.03	0.01	37	102	5	3	0
B476	05/09/88	0.02	0.01	46	280	5	3	4
B476	06/07/88	0.03	0.01	47	277	5	3	0
B476	06/14/88	0.02	0.04	53	318	5	3	0
B498	10/26/87	0.02	0.03	82	185	5	0	0
B498	11/08/87	0.08	0.07	146	206	5	0	0
B498	12/01/87	0.09	0.03	145	216	5	0	0
B498	07/08/88	0.04	0.78	197	468	5	3	0
B504	12/04/87	0.25	0.10	178	249	5	0	0
B504	05/02/88	0.03	0.00	148	230	5	5	0
B516	12/01/87	0.06	0.83	127	690	5	0	0
B516	06/09/88	2.95	2.72	95	166	5	4	0

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VEHID	LOG DATE	COI	COL	HCI	NOX	VEH TYPE	FUEL TYPE	MARK
B516	07/22/88	2.22	0.03	130	162	5	4	0
B530	12/22/87	0.02	0.00	39	1853	5	0	0
B530	06/28/88	0.08	0.03	95	185	5	5	0
B530	08/17/88	0.86	0.00	175	0	5	5	9
B533	10/29/87	0.02	0.01	29	801	5	0	0
B533	11/23/87	0.01	0.01	25	145	5	0	0
B533	12/21/87	0.11	0.07	143	1084	5	0	0
B533	02/19/88	0.03	0.01	173	345	5	2	0
B533	03/15/88	0.03	0.01	38	161	5	2	0
B533	04/20/88	0.02	0.01	33	122	5	2	0
B533	05/16/88	0.03	0.00	46	103	5	2	0
B533	06/21/88	0.02	0.01	33	1	5	2	0
B533	07/15/88	0.02	0.07	33	81	5	2	0
B533	08/17/88	0.02	0.00	14	0	5	2	9
B549	10/23/87	0.01	0.01	30	65	5	0	0
B549	12/01/87	0.05	0.04	134	226	5	0	0
B549	12/22/87	0.02	0.00	12	300	5	0	0
B549	02/28/88	0.03	0.03	169	123	5	5	0
B549	03/25/88	0.06	0.00	149	126	5	5	0
B549	05/18/88	0.03	0.01	213	154	5	5	0
B549	06/29/88	1.16	0.02	218	140	5	5	0
B549	07/20/88	1.50	0.03	270	115	5	5	0
B549	08/15/88	1.64	0.03	261	0	5	5	8
B551	10/30/87	0.01	0.02	34	272	5	0	0
B551	11/17/87	0.05	0.06	101	264	5	0	0
B551	12/09/87	0.03	0.20	50	120	5	0	0
B551	02/19/88	0.02	0.00	79	188	5	2	0
B551	03/15/88	0.03	0.00	41	127	5	2	0
B551	04/20/88	0.03	0.01	29	131	5	2	0
B551	05/16/88	0.06	0.01	42	316	5	2	0
B551	06/17/88	0.03	0.01	23	114	5	2	0
B551	07/15/88	0.06	0.04	20	979	5	2	0
B551	08/15/88	0.04	0.00	29	0	5	2	9
B625	10/29/87	0.62	0.36	194	294	5	0	0
B625	11/16/87	0.99	0.37	155	423	5	0	0
B625	12/21/87	0.20	0.06	198	384	5	0	0
B625	02/26/88	0.06	1.89	123	95	5	2	0
B625	03/15/88	0.03	0.12	34	407	5	2	0
B625	04/22/88	0.03	0.01	22	569	5	2	0
B625	05/17/88	0.04	0.59	59	832	5	2	0
B625	06/22/88	0.03	0.07	23	520	5	2	0
B625	07/29/88	0.02	0.00	23	125	5	2	0
B641	11/16/87	0.03	0.02	78	229	5	0	0
B641	12/09/87	0.02	0.02	54	291	5	0	0
B641	02/19/88	0.11	0.02	93	335	5	1	0
B641	03/16/88	0.03	0.38	56	337	5	1	0
B641	05/12/88	0.03	0.70	33	273	5	1	0
B641	06/14/88	0.04	0.60	48	138	5	1	0

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VEHID	LOG DATE	COI	COL	HCI	NOX	VEH TYPE	FUEL TYPE	MARK
B641	07/19/88	0.08	0.01	68	332	5	1	4
B641	08/12/88	0.04	0.00	30	0	5	1	9
B719	10/21/87	0.01	0.90	23	148	1	0	0
B719	11/19/87	0.02	0.01	32	195	1	0	0
B719	02/28/88	0.02	0.04	5	134	1	2	0
B719	05/26/88	0.02	0.06	1	45	1	2	0
B719	06/24/88	0.02	0.05	4	133	1	2	4
B719	08/11/88	0.47	0.00	66	0	1	2	9
B721	10/26/87	0.01	0.01	19	139	1	0	0
B721	12/01/87	0.02	0.02	28	215	1	0	0
B721	02/16/88	0.02	0.07	12	1053	1	4	0
B721	03/16/88	0.02	0.01	39	1247	1	4	0
B721	04/21/88	0.02	0.01	42	1293	1	4	0
B721	05/24/88	0.12	0.40	144	390	1	4	0
B721	06/28/88	0.02	0.00	37	219	1	4	0
B721	08/16/88	0.35	0.00	92	0	1	4	9
B726	11/12/87	0.02	0.01	9	180	1	0	0
B726	12/09/87	0.02	0.01	16	185	1	0	0
B726	02/12/88	0.02	0.01	12	172	1	1	0
B726	03/16/88	0.02	0.02	20	384	1	1	0
B726	04/11/88	0.02	0.64	12	22	1	1	0
B726	05/11/88	0.02	0.18	5	57	1	1	0
B726	06/14/88	0.03	0.08	8	88	1	1	0
B726	07/19/88	0.03	0.01	8	47	1	1	4
B726	08/12/88	0.02	0.00	5	0	1	1	9
B727	10/29/87	0.02	0.01	9	454	1	0	0
B727	11/24/87	0.02	0.10	16	694	1	0	0
B727	03/10/88	0.02	0.01	77	1191	1	2	0
B727	03/28/88	0.03	0.01	159	972	1	2	0
B727	05/23/88	0.03	0.08	16	1945	1	2	0
B727	06/27/88	0.02	0.01	40	960	1	2	0
B727	07/13/88	0.02	0.01	20	175	1	2	0
B727	08/10/88	0.02	0.00	15	0	1	2	9
B729	12/21/87	0.01	0.00	8	1645	1	0	0
B729	12/04/87	0.02	0.02	29	0	1	1	8
B729	04/27/88	0.02	0.00	84	236	1	1	0
B729	07/15/88	0.02	1.74	54	340	1	1	0
B729	08/23/88	0.02	0.00	81	0	1	1	9
B735	10/29/87	0.01	0.01	15	153	1	0	0
B735	11/17/87	0.02	0.03	15	231	1	0	0
B735	12/21/87	0.02	0.01	12	194	1	0	0
B735	02/19/88	0.02	0.01	33	204	1	2	0
B735	03/15/88	0.03	0.01	53	194	1	2	0
B735	04/20/88	0.02	0.00	11	258	1	2	0
B735	05/16/88	0.02	0.50	22	94	1	2	0
B735	06/17/88	0.02	0.01	8	124	1	2	0
B735	07/13/88	0.02	0.01	8	153	1	2	0
B735	08/15/88	0.02	0.00	8	0	1	2	8

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VEHID	LOG DATE	COI	COL	HCI	NOX	VEH TYPE	FUEL TYPE	MARK
B738	10/23/87	0.01	0.01	22	64	1	0	0
B738	06/24/88	0.02	0.01	33	389	1	5	0
B738	08/30/88	0.02	0.00	5	0	1	5	9
B741	10/23/87	1.48	1.23	135	164	1	0	0
B741	11/09/87	1.67	0.79	93	235	1	0	0
B741	12/16/87	0.67	0.83	65	512	1	0	0
B741	03/21/88	1.06	0.06	118	194	1	3	0
B741	04/18/88	0.26	0.09	92	232	1	3	0
B741	05/10/88	0.21	0.02	81	244	1	3	0
B741	06/09/88	0.27	0.29	133	212	1	3	0
B745	10/23/87	0.01	0.05	18	143	1	0	0
B745	11/18/87	0.02	0.09	17	680	1	0	0
B745	12/28/87	0.02	0.02	10	957	1	0	0
B745	02/19/88	0.02	0.01	8	870	1	5	0
B745	03/29/88	0.08	0.01	100	111	1	5	0
B745	04/21/88	0.02	0.00	14	117	1	5	0
B745	05/24/88	0.02	0.01	19	16	1	5	0
B745	06/28/88	0.02	0.01	41	122	1	5	0
B745	07/27/88	0.02	0.00	23	118	1	5	0
B745	08/16/88	0.02	0.00	15	0	1	5	9
B749	10/29/87	0.57	0.30	101	845	1	0	0
B749	11/17/87	0.11	0.12	153	899	1	0	0
B749	02/03/88	0.17	0.04	135	349	1	5	0
B749	04/29/88	0.20	0.01	179	635	1	5	0
B749	07/08/88	1.13	0.00	191	0	1	5	9
B749	08/19/88	2.57	0.07	175	0	1	5	8
B750	10/29/87	0.01	0.02	27	149	1	0	0
B750	11/17/87	0.02	0.03	16	124	1	0	0
B750	02/03/88	0.02	0.05	45	918	1	4	0
B750	05/04/88	0.02	0.00	53	1174	1	4	0
B750	08/29/88	0.02	0.00	84	0	1	4	9
B759	11/12/87	0.09	0.73	121	752	1	0	0
B759	12/17/87	2.01	0.09	141	810	1	0	0
B759	03/16/88	0.74	0.00	140	1002	1	1	0
B759	05/20/88	0.03	0.09	20	570	1	1	0
B759	06/14/88	0.04	0.01	24	431	1	1	0
B759	07/20/88	0.03	0.01	31	125	1	1	0
B767	10/23/87	0.01	0.01	20	58	2	0	0
B767	11/10/87	0.01	0.01	20	234	2	0	0
B767	12/14/87	0.02	0.03	7	306	2	0	0
B767	03/15/88	0.03	0.01	28	1279	2	3	0
B767	04/13/88	0.02	0.01	20	970	2	3	0
B767	05/13/88	0.03	0.10	11	613	2	3	0
B767	06/15/88	0.02	0.01	14	544	2	3	0
B767	07/20/88	0.02	0.00	28	0	2	3	9
B767	08/05/88	0.03	0.06	31	372	2	3	0
B773	12/17/87	0.02	0.00	18	935	2	0	0
B773	07/11/88	0.03	0.08	18	499	2	1	0

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VEHID	LOG DATE	COI	COL	HCI	NOX	VEH TYPE	FUEL TYPE	MARK
B773	08/19/88	0.03	0.00	22	0	2	1	9
B792	10/23/87	0.01	0.07	19	45	2	0	0
B792	11/18/87	0.02	0.01	20	152	2	0	0
B792	12/30/87	0.02	0.02	28	208	2	0	0
B792	04/28/88	0.08	0.00	35	261	2	3	0
B792	05/24/88	0.02	0.01	11	223	2	3	0
B792	06/28/88	0.20	0.01	73	183	2	3	0
B792	07/29/88	0.03	0.01	15	99	2	3	0
B792	08/17/88	0.03	0.00	8	0	2	3	9
B793	10/23/87	0.01	0.08	30	102	2	0	0
B793	11/17/87	0.02	0.02	13	413	2	0	0
B793	12/21/87	0.02	0.01	9	568	2	0	0
B793	02/18/88	0.02	0.00	8	734	2	2	0
B793	03/18/88	0.03	0.03	13	512	2	2	0
B793	04/19/88	0.02	0.01	7	546	2	2	0
B793	05/24/88	0.02	0.01	11	1320	2	2	0
B793	06/23/88	0.02	0.00	12	19	2	2	0
B793	07/21/88	0.03	0.01	11	124	2	2	0
B793	08/24/88	0.02	0.00	4	0	2	2	9
B794	10/27/87	0.01	0.02	24	123	2	0	0
B794	11/30/87	0.02	0.08	21	168	2	0	0
B794	12/17/87	0.03	0.04	14	175	2	0	0
B794	02/12/88	0.02	0.01	8	160	2	3	0
B808	11/17/87	0.02	0.03	13	196	2	0	0
B808	12/17/87	0.02	0.01	7	294	2	0	0
B808	02/12/88	0.02	0.60	24	117	2	1	0
B808	03/15/88	0.03	0.01	11	211	2	1	0
B808	04/15/88	0.02	0.09	10	196	2	1	0
B808	05/09/88	0.02	0.01	14	264	2	1	0
B808	06/14/88	0.03	0.08	12	7	2	1	0
B808	07/19/88	0.00	0.00	14	8	2	1	7
B808	08/10/88	0.02	0.00	8	0	2	1	9
B815	10/26/87	0.01	0.02	19	775	2	0	0
B815	11/20/87	0.01	0.01	135	499	2	0	0
B815	12/14/87	0.02	0.04	11	1613	2	0	0
B815	02/28/88	0.02	0.08	18	1232	2	2	0
B815	03/23/88	0.02	0.02	8	1419	2	2	0
B815	04/15/88	0.02	0.07	8	1345	2	2	0
B815	05/11/88	0.02	0.01	12	1362	2	2	0
B815	06/15/88	0.02	0.00	4	1457	2	2	0
B815	07/13/88	0.02	0.01	23	152	2	2	0
B815	08/08/88	0.03	0.01	12	1301	2	2	0
B817	10/26/87	0.01	0.00	46	228	2	0	0
B817	12/02/87	0.01	0.00	28	339	2	0	0
B817	02/18/88	0.03	0.05	33	295	2	1	0
B817	05/24/88	0.03	0.02	8	127	2	1	0
B817	06/15/88	0.02	0.12	16	144	2	1	0
B817	08/12/88	0.02	0.00	14	0	2	1	9

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VEHID	LOG DATE	COI	COL	HCI	NOX	VEH TYPE	FUEL TYPE	MARK
B823	12/03/87	0.03	0.02	15	727	2	0	0
B823	07/01/88	0.02	0.01	53	354	2	4	0
B823	07/25/88	0.03	0.00	15	153	2	4	0
B823	08/12/88	0.02	0.00	15	0	2	4	9
B827	10/23/87	0.01	0.04	22	104	2	0	0
B827	10/29/87	0.02	0.02	11	206	2	0	0
B827	12/03/87	0.02	0.09	16	327	2	0	0
B827	02/26/88	0.02	0.03	99	91	2	5	0
B827	03/21/88	0.02	0.00	80	89	2	5	0
B827	04/18/88	0.02	0.01	136	72	2	5	0
B827	05/17/88	0.02	0.01	190	132	2	5	0
B827	06/15/88	0.02	0.00	142	107	2	5	0
B827	07/15/88	0.02	0.03	115	100	2	5	0
B827	08/16/88	0.02	0.00	58	0	2	5	9
B831	12/04/87	0.02	0.10	22	68	2	0	0
B831	02/09/88	0.02	0.01	63	851	2	4	0
B831	03/10/88	0.02	0.00	50	1444	2	4	0
B831	04/28/88	0.02	0.10	60	1124	2	4	0
B831	06/02/88	0.02	0.00	49	90	2	4	0
B831	07/19/88	0.02	0.10	47	26	2	4	0
B831	08/12/88	0.02	0.00	47	0	2	4	9
B833	10/29/87	0.02	0.01	20	139	2	0	0
B833	11/23/87	0.02	0.01	20	179	2	0	0
B833	03/22/88	0.02	0.00	16	571	2	2	0
B833	05/27/88	0.02	0.00	29	428	2	2	0
B833	06/21/88	0.02	0.01	8	10	2	2	0
B833	07/19/88	0.03	0.02	8	323	2	2	4
B833	08/12/88	0.02	0.00	12	0	2	2	9
B835	10/23/87	0.01	0.01	16	55	2	0	0
B835	12/01/87	0.02	0.01	24	305	2	0	0
B835	02/26/88	0.02	0.00	155	79	2	5	0
B835	03/21/88	0.02	0.01	134	113	2	5	0
B835	04/22/88	0.02	0.01	37	119	2	5	0
B835	05/18/88	0.02	0.05	78	145	2	5	0
B835	06/29/88	0.02	0.00	79	135	2	5	0
B835	07/25/88	0.02	0.00	79	131	2	5	0
B887	11/10/87	0.01	0.02	32	525	4	0	0
B887	12/15/87	1.08	0.58	128	1387	4	0	0
B887	02/19/88	0.03	0.07	5	860	4	3	0
B887	03/11/88	0.02	0.01	14	1363	4	3	0
B887	04/20/88	0.03	0.01	29	1362	4	3	0
B887	05/12/88	0.03	0.08	20	1508	4	3	0
B887	06/13/88	0.03	1.00	49	1033	4	3	0
B887	07/19/88	0.09	0.90	27	501	4	3	4
B887	08/09/88	0.02	0.03	18	466	4	3	0
B888	10/23/87	0.01	0.08	36	115	4	0	0
B888	11/19/87	0.02	0.03	16	402	4	0	0
B888	12/17/87	0.02	0.01	11	323	4	0	0

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VEHID	LOG DATE	COI	COL	HCI	NOX	VEH TYPE	FUEL TYPE	MARK
B888	02/19/88	0.02	0.03	12	408	4	2	0
B888	03/18/88	0.02	0.07	18	278	4	2	0
B906	11/20/87	0.02	0.04	0	194	4	0	0
B906	12/21/87	0.02	0.05	32	474	4	0	0
B906	02/16/88	0.01	0.07	88	869	4	4	0
B906	03/15/88	0.02	0.04	351	1100	4	4	0
B934	10/29/87	0.24	0.02	48	503	4	0	0
B934	11/18/87	0.02	0.01	32	347	4	0	0
B934	12/17/87	0.03	0.20	35	815	4	0	0
B934	03/15/88	0.02	0.01	41	215	4	4	0
B934	05/09/88	0.04	0.35	53	705	4	4	0
B938	11/13/87	0.02	0.01	15	404	4	0	0
B938	12/11/87	0.30	0.45	43	486	4	0	0
B938	02/19/88	0.11	0.02	37	241	4	1	0
B938	03/08/88	0.03	0.11	23	685	4	1	0
B938	04/11/88	0.08	0.09	20	891	4	1	0
B938	06/14/88	0.03	0.01	18	461	4	1	0
B938	07/20/88	0.03	0.00	27	230	4	1	7
B938	08/15/88	0.20	0.00	12	0	4	1	9
B943	12/16/87	0.02	0.00	24	287	4	0	0
B943	02/09/88	0.03	0.00	27	249	4	1	7
B943	04/21/88	0.03	0.03	33	516	4	1	0
B943	05/09/88	0.04	0.85	28	1290	4	1	0
B943	05/11/88	0.02	0.00	27	895	4	1	0
B943	06/16/88	0.12	0.40	18	638	4	1	0
BB70	11/09/87	0.03	0.38	45	532	4	0	0
BB70	11/24/87	0.03	0.01	28	224	4	0	0
BB70	02/24/88	0.02	0.04	27	344	4	2	0
BB70	03/28/88	0.02	0.15	11	383	4	2	0
BB70	04/19/88	0.62	0.76	27	393	4	2	0
BB70	05/16/88	0.03	0.03	20	292	4	2	0
BB70	06/24/88	0.07	0.20	29	329	4	2	4
BB70	07/20/88	0.03	0.01	32	467	4	2	0
BB70	08/17/88	0.03	0.00	28	0	4	2	9
BB73	10/22/87	0.02	0.01	45	220	4	0	0
BB73	11/19/87	0.03	0.01	0	181	4	0	0
BB73	12/29/87	0.10	0.03	41	342	4	0	0
BB73	02/25/88	0.02	0.03	514	667	4	5	0
BB73	05/26/88	0.06	0.01	71	749	4	5	0
BB73	06/23/88	0.10	0.01	40	1000	4	5	0
BB75	10/21/87	0.01	0.07	40	592	4	0	0
BB75	11/19/87	0.05	0.03	28	271	4	0	0
BB75	12/21/87	0.28	0.39	50	848	4	0	0
BB75	03/09/88	0.03	0.03	708	305	4	5	0
BB75	05/12/88	0.03	0.02	765	604	4	5	0
BB75	06/10/88	0.02	0.02	135	1179	4	5	0
BB75	07/20/88	0.03	0.03	1379	1414	4	5	0
BB75	08/11/88	0.03	0.03	893	0	4	5	8

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VEHID	LOG DATE	COI	COL	HCI	NOX	VEH TYPE	FUEL TYPE	MARK
BB85	10/22/87	0.01	0.17	39	251	4	0	0
BB85	11/19/87	0.02	0.04	21	265	4	0	0
BB85	12/17/87	0.07	0.00	24	445	4	0	0
BB85	02/24/88	0.02	0.09	73	649	4	5	0
BB85	08/23/88	0.27	0.02	175	0	4	5	8
BC32	10/23/87	0.16	0.01	0	67	4	0	0
BC32	11/19/87	0.14	0.02	13	254	4	0	0
BC32	12/17/87	0.17	0.15	24	324	4	0	0
BC32	02/19/88	0.13	0.01	24	130	4	2	0
BC32	03/15/88	0.07	0.01	39	384	4	2	0
BC32	04/08/88	0.30	0.03	37	680	4	2	0
BC32	05/27/88	0.36	0.01	20	229	4	2	0
BC32	06/23/88	0.03	0.03	26	570	4	2	0
BC32	07/22/88	0.08	0.19	16	48	4	2	0
BC32	08/25/88	1.01	0.00	84	0	4	2	9
BC41	10/23/87	0.01	0.04	31	105	4	0	0
BC41	11/16/87	0.03	0.18	40	209	4	0	0
BC41	12/16/87	0.02	0.08	64	465	4	0	0
BC41	02/11/88	0.30	0.03	16	825	4	3	0
BC41	03/14/88	0.07	0.46	20	142	4	3	0
BC41	04/18/88	0.13	0.00	16	276	4	3	7
BC51	11/20/87	0.97	0.03	344	279	4	0	0
BC51	12/17/87	0.64	0.01	26	256	4	0	0
BC51	02/17/88	0.02	0.00	74	1844	4	4	0
BC51	03/16/88	0.02	0.03	465	730	4	4	0
BC51	04/29/88	0.02	0.02	356	522	4	4	0
BC51	08/18/88	0.65	0.00	48	0	4	4	9
BC56	11/20/87	0.63	0.93	0	382	4	0	0
BC56	12/16/87	0.63	0.92	87	1188	4	0	0
BC56	02/24/88	0.04	0.00	28	693	4	1	7
BC56	04/13/88	0.02	0.03	18	835	4	1	0
BC56	05/16/88	0.02	2.00	18	723	4	1	0
BC56	06/09/88	0.02	0.03	23	480	4	1	0
BC56	07/22/88	0.29	0.86	54	828	4	1	0
BC56	08/22/88	0.02	0.00	22	0	4	1	9
BC65	10/23/87	0.02	0.08	43	259	4	0	0
BC65	11/20/87	0.16	0.09	0	364	4	0	0
BC65	08/18/88	2.85	1.15	97	0	4	3	8
BD06	11/18/87	0.05	0.01	20	228	6	0	0
BD06	12/11/87	0.02	0.08	7	216	6	0	0
BD06	02/12/88	0.03	0.01	1	222	6	1	0
BD06	03/16/88	0.03	0.01	11	186	6	1	0
BD06	04/21/88	0.02	0.01	16	209	6	1	0
BD06	05/19/88	0.02	0.01	14	103	6	1	0
BD06	06/24/88	0.02	0.01	16	257	6	1	0
BD06	07/19/88	0.03	0.05	7	120	6	1	0
BD06	08/12/88	0.02	0.00	8	0	6	1	9
BD08	12/09/87	0.02	0.01	28	251	6	0	0

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VEHID	LOG DATE	COI	COL	HCI	NOX	VEH TYPE	FUEL TYPE	MARK
BD08	12/13/87	0.02	0.01	11	19	6	0	0
BD08	02/16/88	0.02	0.09	18	197	6	3	0
BD08	03/15/88	0.03	0.01	23	269	6	3	0
BD08	04/15/88	0.03	0.01	5	146	6	3	0
BD08	05/16/88	0.02	0.00	5	18	6	3	0
BD08	06/08/88	0.92	0.00	77	123	6	3	0
BD08	07/15/88	0.02	0.01	4	144	6	3	0
BD08	08/16/88	0.02	0.00	5	0	6	3	9
BD09	11/10/87	0.01	0.01	19	139	6	0	0
BD09	12/16/87	0.02	0.00	14	125	6	0	0
BD09	02/18/88	0.02	0.01	14	233	6	1	0
BD09	04/21/88	0.02	0.08	11	214	6	1	0
BD09	05/16/88	0.02	0.10	4	217	6	1	0
BD09	06/14/88	0.03	0.02	4	192	6	1	0
BD09	07/19/88	0.03	0.02	7	152	6	1	0
BD09	08/22/88	0.03	0.00	14	0	6	1	9
BD12	11/10/87	0.02	0.01	19	145	6	0	0
BD12	12/16/87	0.02	0.00	15	268	6	0	0
BD12	02/12/88	0.03	0.00	8	208	6	3	0
BD12	03/07/88	0.03	0.04	8	224	6	3	0
BD12	04/27/88	0.03	0.00	4	176	6	3	0
BD12	07/08/88	0.02	0.00	12	0	6	3	9
BD39	10/29/87	0.02	0.01	15	139	6	0	0
BD39	11/23/87	0.01	0.01	19	245	6	0	0
BD39	02/26/88	0.02	0.07	4	204	6	2	0
BD39	03/25/88	0.03	0.08	5	1928	6	2	0
BD39	04/20/88	0.02	0.01	4	194	6	2	0
BD39	04/27/88	0.03	0.01	12	393	6	2	0
BD39	05/17/88	0.02	0.01	4	250	6	2	0
BD39	06/15/88	0.03	0.00	9	159	6	2	0
BD39	07/13/88	0.02	0.01	4	195	6	2	0
BD39	08/18/88	0.02	0.00	4	0	6	2	9
BD42	11/12/87	0.02	0.00	12	155	6	0	0
BD42	12/16/87	1.06	0.21	78	273	6	0	0
BD42	02/26/88	0.02	0.05	14	165	6	1	0
BD42	03/07/88	0.02	0.03	4	274	6	1	0
BD42	04/08/88	0.02	0.40	8	284	6	1	0
BD42	05/18/88	0.03	0.07	5	277	6	1	0
BD42	06/06/88	0.03	0.00	5	160	6	1	0
BD42	07/20/88	0.03	0.00	4	78	6	1	0
BD42	08/10/88	0.03	0.02	4	0	6	1	8
BD51	10/29/87	0.02	0.00	24	153	6	0	0
BD51	11/25/87	0.01	0.01	20	274	6	0	0
BD51	12/29/87	0.02	0.00	16	366	6	0	0
BD51	02/16/88	0.02	0.06	20	845	6	4	0
BD51	03/07/88	0.02	0.02	26	851	6	4	0
BD51	04/22/88	0.23	0.01	75	801	6	4	0
BD51	05/24/88	0.02	0.01	15	1183	6	4	0

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VEHID	LOG DATE	COI	COL	HCI	NOX	VEH TYPE	FUEL TYPE	MARK
BD51	06/28/88	0.02	0.00	5	174	6	4	0
BD51	07/27/88	0.03	0.06	11	176	6	4	0
BD51	08/16/88	0.02	0.00	42	0	6	4	9
BD52	10/26/87	1.06	0.01	41	116	6	0	0
BD52	12/09/87	0.02	0.00	7	217	6	0	0
BD52	02/10/88	0.02	0.02	51	1182	6	4	0
BD52	03/02/88	0.02	0.05	75	835	6	4	0
BD52	04/27/88	1.31	0.25	160	159	6	4	0
BD52	07/08/88	0.01	0.00	48	0	6	4	9
BD52	08/19/88	0.02	0.00	35	0	6	4	9
BD55	10/22/87	0.01	0.20	27	145	6	0	0
BD55	11/20/87	0.02	0.10	0	79	6	0	0
BD55	12/17/87	0.02	0.05	19	150	6	0	0
BD55	05/03/88	0.03	0.01	10	204	6	2	0
BD57	10/23/87	0.01	0.01	20	65	6	0	0
BD57	11/09/87	0.02	0.50	35	142	6	0	0
BD57	12/09/87	0.02	0.03	11	381	6	0	0
BD57	02/24/88	0.02	0.00	14	331	6	3	0
BD57	04/20/88	0.02	0.00	11	533	6	3	0
BD57	05/17/88	0.03	0.00	8	469	6	3	0
BD57	06/09/88	0.03	0.00	18	377	6	3	0
BD57	07/15/88	0.03	0.01	19	344	6	3	0
BD57	08/03/88	0.03	0.03	8	180	6	3	0
BD61	10/27/87	0.01	0.01	20	174	6	0	0
BD61	11/25/87	0.02	0.01	23	234	6	0	0
BD61	12/29/87	0.02	0.00	16	277	6	0	0
BD61	02/12/88	0.02	0.40	49	1002	6	4	0
BD61	03/07/88	0.02	0.01	38	981	6	4	0
BD61	04/21/88	0.02	0.06	37	324	6	4	0
BD61	05/24/88	0.02	0.40	39	487	6	4	0
BD61	06/29/88	1.11	1.12	125	138	6	4	0
BD61	07/27/88	0.02	0.02	463	75	6	4	0
BD61	08/16/88	0.02	0.00	42	0	6	4	9
BD64	10/29/87	0.02	0.01	9	124	6	0	0
BD64	11/20/87	0.03	0.09	0	325	6	0	0
BD64	12/28/87	0.02	0.06	5	810	6	0	0
BD64	02/24/88	0.02	0.06	81	139	6	5	0
BD64	04/27/88	0.02	0.01	99	245	6	5	0
BD64	05/18/88	0.02	0.07	219	272	6	5	0
BD64	06/30/88	0.02	0.01	98	187	6	5	0
BD64	07/20/88	0.02	0.00	99	120	6	5	0
BD64	08/15/88	0.02	0.00	98	0	6	5	9
BD66	10/29/87	0.02	0.01	48	183	6	0	0
BD66	11/20/87	0.03	0.01	20	76	6	0	0
BD66	12/17/87	0.02	0.01	5	313	6	0	0
BD66	12/28/87	0.04	0.02	55	262	6	0	0
BD66	02/11/88	0.02	0.01	161	315	6	5	0
BD66	03/07/88	0.02	0.03	123	293	6	5	0

ADOT EMISSIONS STUDY
INPUT DATA FOR ANOVA TESTING
SEPTEMBER 10, 1988

VEHID	LOG DATE	COI	COL	HCI	NOX	VEH TYPE	FUEL TYPE	MARK
BD66	06/30/88	0.02	0.01	135	130	6	5	0
BD66	07/20/88	0.03	0.00	159	161	6	5	0
BD66	08/18/88	0.02	0.00	165	0	6	5	9
BD70	10/29/87	0.03	0.01	24	160	6	0	0
BD70	11/23/87	0.01	0.08	24	275	6	0	0
BD70	02/26/88	0.03	0.00	7	233	6	2	0
BD70	03/22/88	0.03	0.02	8	345	6	2	0
BD70	04/15/88	0.02	0.01	5	272	6	2	0
BD70	05/20/88	0.02	0.01	8	256	6	2	0
BD70	06/16/88	0.03	0.00	4	197	6	2	0
BD70	07/22/88	0.03	0.01	8	135	6	2	0
BD70	08/19/88	0.02	0.00	9	0	6	2	9
BD74	11/20/87	0.68	0.01	0	666	6	0	0
BD74	12/17/87	0.02	0.00	3	17	6	0	0
BD74	02/18/88	0.02	0.06	186	188	6	5	0
BD74	05/02/88	0.02	0.02	112	188	6	5	0
BD74	06/01/88	0.02	0.00	123	174	6	5	0
BD74	07/01/88	0.02	0.01	121	190	6	5	0
BD74	08/26/88	0.02	0.00	120	0	6	5	9
BD74	09/01/88	0.02	0.00	141	0	6	5	9

Table 2, Emissions by Fuel Type within Vehicle

	COI FOR FUEL TYPES					
	0	1	2	3	4	5
1983	0.01	0.02	0.02	1.06	0.02	0.02
CHEVROLET	0.02	0.02	0.02	0.26	0.02	0.02
MODEL S-10	0.01	0.02	0.02	0.21	0.02	0.02
	0.02	0.02	0.47	0.27	0.12	0.08
	0.02	0.03	0.02		0.02	0.02
	0.02	0.03	0.03		0.35	0.02
	0.02	0.02	0.03		0.12	0.02
	0.02	0.02	0.02		0.16	0.02
	0.01	0.02	0.02		0.03	0.02
	0.01	0.02	0.02		0.02	0.17
	0.02	0.02	0.02		0.03	0.20
	0.02	0.74	0.03		0.02	1.13
	0.01	0.03	0.02		0.02	2.57
	1.48	0.04	0.02		0.02	
	1.67	0.03	0.02		0.02	
	0.67		0.02		0.02	
	0.01		0.02			
	0.02					
	0.02					
	0.57					
	0.11					
	0.01					
	0.02					
	0.09					
	2.01					
AVERAGE	0.28	0.07	0.05	0.45	0.06	0.33
MINIMUM	0.01	0.02	0.02	0.21	0.02	0.02
MAXIMUM	2.01	0.74	0.47	1.06	0.35	2.57
SAMPLE (n)	25	15	17	4	16	13

	CO FOR FUEL TYPES					
	0	1	2	3	4	5
1984	0.01	0.03	0.02	0.03	0.02	0.02
CHEVROLET	0.01	0.03	0.03	0.02	0.03	0.02
MODEL S-10	0.02	0.02	0.02	0.03	0.02	0.02
	0.02	0.03	0.02	0.02	0.02	0.02
	0.01	0.02	0.02	0.02	0.02	0.02
	0.02	0.02	0.03	0.03	0.02	0.02
	0.02	0.03	0.02	0.08	0.02	0.02
	0.01	0.00	0.02	0.02	0.02	0.02
	0.02	0.02	0.02	0.20	0.02	0.02
	0.02	0.03	0.02	0.03		0.02
	0.01	0.03	0.02	0.03		0.02
	0.02	0.02	0.02	0.02		0.02
	0.03	0.02	0.02			0.02
	0.02		0.03			
	0.02		0.02			
	0.01		0.02			
	0.01		0.02			
	0.02		0.03			
	0.01		0.02			
	0.01					
	0.03					
	0.01					
	0.02					
	0.02					
	0.02					
	0.02					
	0.02					
	0.01					
	0.02					
AVERAGE	0.02	0.02	0.02	0.04	0.02	0.02
MINIMUM	0.01	0.00	0.02	0.02	0.02	0.02
MAXIMUM	0.03	0.03	0.03	0.20	0.03	0.02
SAMPLE (n)	29	13	19	12	9	13

	COI FOR FUEL TYPES					
	0	1	2	3	4	5
1985	0.01	0.33	0.02	0.03	0.02	0.04
CHEVROLET	0.04	0.28	0.03	0.03	0.02	0.03
CELEBRITY	0.42	1.87	0.21	0.03	1.14	0.03
	0.64	0.16	0.09	0.03	0.03	0.03
	0.40	0.03	0.03	0.32	0.03	0.32
	0.11	0.12	0.03	0.02	0.03	0.03
	0.01	0.03	0.06	0.04	0.04	0.03
	0.05	0.03	0.27	0.04	0.02	0.03
	0.03	0.51	0.08	0.04	0.03	0.02
	0.09		0.12	0.03	0.04	0.03
	0.02		0.03			0.02
	0.05		0.03			0.03
	0.40		0.03			0.04
	0.01		0.03			0.22
	0.02		0.03			
	0.03					
	0.29					
	0.32					
	0.03					
	0.02					
AVERAGE	0.15	0.37	0.07	0.06	0.14	0.06
MINIMUM	0.01	0.03	0.02	0.02	0.02	0.02
MAXIMUM	0.64	1.87	0.27	0.32	1.14	0.32
SAMPLE (n)	20	9	15	10	10	14

	COI FOR FUEL TYPES					
	0	1	2	3	4	5
1985	0.01	0.11	0.02	0.03	0.01	0.02
FORD	1.08	0.03	0.02	0.02	0.02	0.06
RANGERS	0.01	0.08	0.02	0.03	0.02	0.10
	0.02	0.03	0.02	0.03	0.04	0.03
	0.02	0.03	0.62	0.03	0.02	0.03
	0.02	0.20	0.03	0.09	0.02	0.02
	0.02	0.03	0.07	0.02	0.02	0.03
	0.24	0.03	0.03	0.30	0.65	0.03
	0.02	0.04	0.03	0.07		0.02
	0.03	0.02	0.13	0.13		0.27
	0.02	0.12	0.07	2.85		
	0.30	0.04	0.30			
	0.02	0.02	0.36			
	0.03	0.02	0.03			
	0.03	0.02	0.08			
	0.02	0.29	1.01			
	0.03	0.02				
	0.10					
	0.01					
	0.05					
	0.28					
	0.01					
	0.02					
	0.07					
	0.16					
	0.14					
	0.17					
	0.01					
	0.03					
	0.02					
	0.97					
	0.64					
	0.63					
	0.63					
	0.02					
	0.16					
AVERAGE	0.17	0.07	0.18	0.33	0.10	0.06
MINIMUM	0.01	0.02	0.02	0.02	0.01	0.02
MAXIMUM	1.08	0.29	1.01	2.85	0.65	0.27
SAMPLE (n)	36	17	16	11	8	10

	COI FOR FUEL TYPES					
	0	1	2	3	4	5
1980	0.18	0.03	0.03	0.06	2.95	0.03
CHEVROLET	0.92	0.03	0.03	0.03	2.22	0.08
MODEL C-10	0.02	0.03	0.02	0.02		0.86
	0.02	0.02	0.03	0.03		0.03
	0.08	0.03	0.02	0.02		0.06
	0.09	0.11	0.02	0.04		0.03
	0.25	0.03	0.02			1.16
	0.06	0.03	0.02			1.50
	0.02	0.04	0.03			1.64
	0.02	0.08	0.03			
	0.01	0.04	0.06			
	0.11		0.03			
	0.01		0.06			
	0.05		0.04			
	0.02		0.06			
	0.01		0.03			
	0.05		0.03			
	0.03		0.04			
	0.62		0.03			
	0.99		0.02			
	0.20					
	0.03					
	0.02					
AVERAGE	0.17	0.04	0.03	0.03	2.58	0.60
MINIMUM	0.01	0.02	0.02	0.02	2.22	0.03
MAXIMUM	0.99	0.11	0.06	0.06	2.95	1.64
SAMPLE (n)	23	11	20	6	2	9

	COI FOR FUEL TYPES					
	0	1	2	3	4	5
1986	0.05	0.03	0.02	0.02	0.02	0.02
CHEVROLET	0.02	0.03	0.03	0.03	0.02	0.02
MODEL S-10	0.02	0.02	0.02	0.03	0.23	0.02
	0.02	0.02	0.03	0.02	0.02	0.02
	0.01	0.02	0.02	0.92	0.02	0.02
	0.02	0.03	0.03	0.02	0.03	0.02
	0.02	0.02	0.02	0.02	0.02	0.02
	0.02	0.02	0.02	0.03	0.02	0.02
	0.02	0.02	0.03	0.03	0.02	0.02
	0.01	0.02	0.03	0.03	1.31	0.03
	0.02	0.03	0.03	0.02	0.01	0.02
	1.06	0.03	0.02	0.02	0.02	0.02
	0.02	0.03	0.02	0.02	0.02	0.02
	0.01	0.02	0.03	0.03	0.02	0.02
	0.02	0.02	0.03	0.03	0.02	0.02
	1.06	0.02	0.02	0.03	0.02	0.02
	0.02	0.03		0.03	1.11	0.02
	0.01	0.03			0.02	
	0.02	0.03			0.02	
	0.02	0.03				
	0.01					
	0.02					
	0.02					
	0.01					
	0.02					
	0.02					
	0.02					
	0.03					
	0.02					
	0.02					
	0.03					
	0.02					
	0.04					
	0.03					
	0.01					
	0.68					
	0.02					
AVERAGE	0.09	0.03	0.03	0.08	0.16	0.02
MINIMUM	0.01	0.02	0.02	0.02	0.01	0.02
MAXIMUM	1.06	0.03	0.03	0.92	1.31	0.03
SAMPLE (n)	37	20	16	17	19	17

	COL FOR FUEL TYPES					
	0	1	2	3	4	5
1983	0.90	0.01	0.04	0.06	0.07	0.01
CHEVROLET	0.01	0.02	0.06	0.09	0.01	
MODEL S-10	0.01	0.64	0.05	0.02	0.01	0.01
	0.02	0.18		0.29	0.40	0.01
	0.01	0.08	0.01		0.00	0.00
	0.01	0.01	0.01			0.01
	0.01		0.08		0.02	0.01
	0.10	0.02	0.01			0.00
	0.00	0.00	0.01		0.00	
	0.01	1.74			0.00	0.04
	0.03		0.01		0.00	0.01
	0.01	0.00	0.01		0.45	
	0.01	0.09	0.00		0.18	0.07
	1.23	0.01	0.50		0.05	
	0.79	0.01	0.01		0.00	
	0.83		0.01			
	0.05		0.00			
	0.09					
	0.02					
	0.30					
	0.12					
	0.02					
	0.03					
	0.73					
	0.09					
AVERAGE	0.22	0.22	0.05	0.11	0.09	0.02
MINIMUM	0.00	0.00	0.00	0.02	0.00	0.00
MAXIMUM	1.23	1.74	0.50	0.29	0.45	0.07
SAMPLE (n)	25	13	15	4	13	10

	COL FOR FUEL TYPES					
	0	1	2	3	4	5
1984	0.01	0.08	0.00	0.01	0.01	0.03
CHEVROLET	0.01		0.03	0.01	0.00	0.00
MODEL S-10	0.03	0.60	0.01	0.10		0.01
	0.00	0.01	0.01	0.01	0.01	0.01
	0.07	0.09	0.00		0.00	0.00
	0.01	0.01	0.01	0.06	0.10	0.03
	0.02	0.08		0.00	0.00	
	0.08		0.08	0.01	0.10	0.00
	0.02		0.02	0.01		0.01
	0.01	0.05	0.07	0.01		0.01
	0.02	0.02	0.01			0.05
	0.08	0.12	0.00	0.01		0.00
	0.04		0.01			0.00
	0.03		0.01			
	0.01		0.00			
	0.02		0.00			
	0.01		0.01			
	0.04		0.02			
	0.00					
	0.00					
	0.02					
	0.04					
	0.02					
	0.09					
	0.10					
	0.01					
	0.01					
	0.01					
	0.01					
AVERAGE	0.03	0.12	0.02	0.02	0.03	0.01
MINIMUM	0.00	0.01	0.00	0.00	0.00	0.00
MAXIMUM	0.10	0.60	0.08	0.10	0.10	0.05
SAMPLE (n)	29	9	17	10	7	12

	COL FOR FUEL TYPES					
	0	1	2	3	4	5
1985	0.04	0.04	0.02	0.19	0.00	0.08
CHEVROLET	0.06	0.06		0.01	0.00	0.38
CELEBRITY	0.33	0.03	0.65	0.01	0.03	0.00
	0.83	0.52	0.05	0.93	0.02	0.46
	0.06	0.00	0.38	0.34	0.01	0.30
	0.97	0.32	0.40	2.70	0.00	0.20
	0.04	0.02	0.32			0.01
	0.56	0.50	0.67	0.02	0.20	0.01
	0.07	0.32	0.33	0.30	0.01	
	0.25					0.05
	0.35		0.02			
	0.04		0.01			0.00
	0.34		0.30			0.01
	0.04		0.01			0.17
	0.01					
	0.41					
	0.88					
	0.01					
	0.15					
	0.01					
AVERAGE	0.27	0.20	0.26	0.56	0.03	0.14
MINIMUM	0.01	0.00	0.01	0.01	0.00	0.00
MAXIMUM	0.97	0.52	0.67	2.70	0.20	0.46
SAMPLE (n)	20	9	12	8	8	12

	COL FOR FUEL TYPES					
	0	1	2	3	4	5
1985	0.02	0.02	0.03	0.07	0.07	0.03
FORD	0.58	0.11	0.07	0.01	0.04	0.01
RANGERS	0.08	0.09	0.04	0.01	0.01	0.01
	0.03	0.01	0.15	0.08	0.35	0.03
	0.01		0.76	1.00	0.00	0.02
	0.04		0.03	0.90	0.03	0.02
	0.05		0.20	0.03	0.02	0.03
	0.02	0.03	0.01	0.03		0.03
	0.01	0.85		0.46		0.09
	0.20	0.00	0.01			0.02
	0.01	0.40	0.01	1.15		
	0.45		0.03			
	0.00	0.03	0.01			
	0.38	2.00	0.03			
	0.01	0.03	0.19			
	0.01	0.86				
	0.01					
	0.03					
	0.07					
	0.03					
	0.39					
	0.17					
	0.04					
	0.00					
	0.01					
	0.02					
	0.15					
	0.04					
	0.18					
	0.08					
	0.03					
	0.01					
	0.93					
	0.92					
	0.08					
	0.09					
AVERAGE	0.14	0.37	0.11	0.37	0.07	0.03
MINIMUM	0.00	0.00	0.01	0.01	0.00	0.01
MAXIMUM	0.93	2.00	0.76	1.15	0.35	0.09
SAMPLE (n)	36	12	14	10	7	10

	COL FOR FUEL TYPES					
	0	1	2	3	4	5
1980	0.03	0.14	0.01	0.01	2.72	0.00
CHEVROLET	0.03	0.11	0.01	0.01	0.03	0.03
MODEL C-10	0.80	0.18	0.01	0.01		
	0.03	0.11	0.00	0.01		0.03
	0.07	0.00	0.01	0.04		0.00
	0.03	0.02	0.07	0.78		0.01
	0.10	0.38				0.02
	0.83	0.70	0.00			0.03
	0.00	0.60	0.00			0.03
	0.01	0.01	0.01			
	0.01		0.01			
	0.07		0.01			
	0.01		0.04			
	0.04					
	0.00		1.89			
	0.02		0.12			
	0.06		0.01			
	0.20		0.59			
	0.36		0.07			
	0.37		0.00			
	0.06					
	0.02					
	0.02					
AVERAGE	0.14	0.23	0.16	0.14	1.38	0.02
MINIMUM	0.00	0.00	0.00	0.01	0.03	0.00
MAXIMUM	0.83	0.70	1.89	0.78	2.72	0.03
SAMPLE (n)	23	10	18	6	2	8

	COL FOR FUEL TYPES					
	0	1	2	3	4	5
1986	0.01	0.01	0.07	0.09	0.06	0.06
CHEVROLET	0.08	0.01	0.08	0.01	0.02	0.01
MODEL S-10	0.01	0.01	0.01	0.01	0.01	0.07
	0.01	0.01	0.01	0.00	0.01	0.01
	0.01	0.01	0.01	0.00	0.00	0.00
	0.00	0.05	0.00	0.01	0.06	
	0.01		0.01			0.01
	0.00	0.01		0.00	0.02	0.03
	0.01	0.08	0.01	0.04	0.05	0.01
	0.01	0.10	0.00	0.00	0.25	0.00
	0.00	0.02	0.02			
	0.21	0.02	0.01	0.00		0.06
	0.00		0.01	0.00	0.40	0.02
	0.01	0.05	0.00	0.00	0.01	0.00
	0.00	0.03	0.01	0.00	0.06	0.01
	0.01	0.40		0.01	0.40	
	0.00	0.07		0.03	1.12	
	0.20	0.00			0.02	
	0.10	0.00				
	0.05	0.02				
	0.01					
	0.50					
	0.03					
	0.01					
	0.01					
	0.00					
	0.01					
	0.09					
	0.06					
	0.01					
	0.01					
	0.01					
	0.02					
	0.01					
	0.08					
	0.01					
	0.00					
AVERAGE	0.04	0.05	0.02	0.01	0.17	0.02
MINIMUM	0.00	0.00	0.00	0.00	0.00	0.00
MAXIMUM	0.50	0.40	0.08	0.09	1.12	0.07
SAMPLE (n)	37	18	14	15	15	13

	HCI FOR		F U E L	T Y P E S		
	0	1	2	3	4	5
1983	23	12	5	118	12	33
CHEVROLET	32	20	1	92	39	5
MODEL S-10	19	12	4	81	42	8
	28	5	66	133	144	100
	9	8	77		37	14
	16	8	159		92	19
	9	5	16		46	41
	16	29	40		53	23
	8	84	20		76	15
	15	54	15		91	135
	15	81	33		104	179
	12	140	53		78	191
	22	20	11		110	175
	135	24	22		45	
	93	31	8		53	
	65		8		84	
	18		8			
	17					
	10					
	101					
	153					
	27					
	16					
	121					
	141					
AVERAGE	45	36	32	106	69	72
MINIMUM	8	5	1	81	12	5
MAXIMUM	153	140	159	133	144	191
SAMPLE (n)	25	15	17	4	16	13

	HCI FOR FUEL TYPES					
	0	1	2	3	4	5
1984	20	18	8	28	53	99
CHEVROLET	20	22	13	20	15	80
MODEL S-10	7	24	7	11	15	136
	18	11	11	14	63	190
	19	10	12	28	50	142
	20	14	11	31	60	115
	28	12	4	35	49	58
	30	14	18	11	47	155
	13	8	8	73	47	134
	9	33	8	15		37
	24	8	12	8		78
	21	16	4	8		79
	14	14	23			79
	13		12			
	7		16			
	19		29			
	135		8			
	11		8			
	46		12			
	28					
	15					
	22					
	11					
	16					
	22					
	20					
	20					
	16					
	24					
AVERAGE	23	16	12	24	44	106
MINIMUM	7	8	4	8	15	37
MAXIMUM	135	33	29	73	63	190
SAMPLE (n)	29	13	19	12	9	13

	HCI FOR FUEL TYPES					
	0	1	2	3	4	5
1985	19	126	0	7	95	98
CHEVROLET	27	104	5	8	71	73
CELEBRITY	142	106	68	5	133	20
	177	96	24	5	8	60
	139	11	8	164	5	152
	34	52	16	7	211	7
	15	5	33	15	26	5
	69	34	147	5	1	5
	52	173	80	29	5	5
	49		54	10	5	77
	16		5			13
	23		7			4
	110		5			16
	24		11			166
	0		5			
	11					
	83					
	115					
	24					
	20					
AVERAGE	57	79	31	26	56	50
MINIMUM	0	5	0	5	1	4
MAXIMUM	177	173	147	164	211	166
SAMPLE (n)	20	9	15	10	10	14

	HCI FOR FUEL TYPES					
	0	1	2	3	4	5
1985	32	37	12	5	88	514
FORD	128	23	18	14	351	71
RANGERS	36	20	27	29	41	40
	16	18	11	20	53	708
	11	27	27	49	74	765
	0	12	20	27	465	135
	32	27	29	18	356	1379
	48	33	32	16	48	893
	32	28	28	20		73
	35	27	24	16		175
	15	18	39	97		
	43	28	37			
	24	18	20			
	45	18	26			
	28	23	16			
	45	54	84			
	0	22				
	41					
	40					
	28					
	50					
	39					
	21					
	24					
	0					
	13					
	24					
	31					
	40					
	64					
	344					
	26					
	0					
	87					
	43					
	0					
AVERAGE	41	25	28	28	185	475
MINIMUM	0	12	11	5	41	40
MAXIMUM	344	54	84	97	465	1379
SAMPLE (n)	36	17	16	11	8	10

	HCI FOR		F U E L	T Y P E S		
	0	1	2	3	4	5
1980	65	49	173	141	95	148
CHEVROLET	161	42	38	37	130	95
MODEL C-10	77	34	33	46		175
	82	24	46	47		169
	146	32	33	53		149
	145	93	33	197		213
	178	56	14			218
	127	33	79			270
	39	48	41			261
	29	68	29			
	25	30	42			
	143		23			
	30		20			
	134		29			
	12		123			
	34		34			
	101		22			
	50		59			
	194		23			
	155		23			
	198					
	78					
	54					
AVERAGE	98	46	46	87	113	189
MINIMUM	12	24	14	37	95	95
MAXIMUM	198	93	173	197	130	270
SAMPLE (n)	23	11	20	6	2	9

	HCI FOR	FUEL	TYPES			
	0	1	2	3	4	5
1986	20	1	4	18	20	81
CHEVROLET	7	11	5	23	26	99
MODEL S-10	28	16	4	5	75	219
	11	14	12	5	15	98
	19	16	4	77	5	99
	14	7	9	4	11	98
	19	8	4	5	42	161
	15	14	4	8	51	123
	15	11	10	8	75	135
	19	4	7	4	160	159
	12	4	8	12	48	165
	78	7	5	14	35	186
	24	14	8	11	49	112
	20	14	4	8	38	123
	16	4	8	18	37	121
	41	8	9	19	39	120
	7	5		8	125	141
	27	5			463	
	0	4			42	
	19	4				
	20					
	35					
	11					
	20					
	23					
	16					
	9					
	0					
	5					
	48					
	20					
	5					
	55					
	24					
	24					
	0					
	3					
AVERAGE	20	9	7	15	71	132
MINIMUM	0	1	4	4	5	81
MAXIMUM	78	16	12	77	463	219
SAMPLE (n)	37	20	16	17	19	17

	NOX FOR		F U E L	T Y P E S		
	0	1	2	3	4	5
1983	148	172	134	194	1053	389
CHEVROLET	195	384	45	232	1247	
MODEL S-10	139	22	133	244	1293	870
	215	57		212	390	111
	180	88	1191		219	117
	185	47	972			16
	454		1945		1539	122
	694		960		1428	118
	1645	236	175		1355	
	153	340			1119	349
	231		204		1032	635
	194	1002	194		361	
	64	570	258		1	
	164	431	94		918	
	235	125	124		1174	
	512		153			
	143					
	680					
	957					
	845					
	899					
	149					
	124					
	752					
	810					
AVERAGE	431	290	470	221	938	303
MINIMUM	64	22	45	194	1	16
MAXIMUM	1645	1002	1945	244	1539	870
SAMPLE (n)	25	12	14	4	14	9

	NOX FOR FUEL TYPES					
	0	1	2	3	4	5
1984 CHEVROLET MODEL S-10	58	499	734	1279	354	91
	234		512	970	153	89
	306	117	546	613		72
	935	211	1320	544	851	132
	45	196	19		1444	107
	152	264	124	372	1124	100
	208	7		261	90	
	102	8	1232	223	26	79
	413		1419	183		113
	568	295	1345	99		119
	123	127	1362			145
	168	144	1457	160		135
	175		152			131
	196		1301			
	294		571			
	775		428			
	499		10			
	1613		323			
	228					
	339					
	727					
	104					
	206					
	327					
	68					
	139					
	179					
	55					
	305					
AVERAGE	329	187	756	470	577	109
MINIMUM	45	7	10	99	26	72
MAXIMUM	1613	499	1457	1279	1444	145
SAMPLE (n)	29	10	17	10	7	12

	NOX FOR	FUEL	TYPES			
	0	1	2	3	4	5
1985	808	1739	1058	483		491
CHEVROLET	298	1135	662	449	453	283
CELEBRITY	164	1541	628	753	525	631
	637	121	855	91	166	29
	101	681	348			100
	265	1178	987	416	467	247
	296	1477	1464	140	369	
	83	153				294
	366		320	1144	570	
	671		236	787	255	761
	526		1			375
	97		8			1
	76					525
	35		435			1387
	542		300			
	360					
	687					
	196					
	1414					
	50					
AVERAGE	384	1003	562	533	401	427
MINIMUM	35	121	1	91	166	1
MAXIMUM	1414	1739	1464	1144	570	1387
SAMPLE (n)	20	8	13	8	7	12

NOX FOR FUEL TYPES

	0	1	2	3	4	5
1985	115	891	344	1362	215	1000
FORD	402	461	383	1508	705	305
RANGERS	323	230	393	1033	1844	604
	194		292	501	730	1179
	474	249	329	466	522	1414
	503	516	467	825		
	347	1290		142	667	649
	815	895	130	276	749	
	404	638	384			885
	486	693	680	869		1277
	287	835	229	1100		
	532	723	570			
	224	480	48			
	220	828				
	181		860			
	342	408	1363			
	592	278				
	271					
	848					
	251					
	265					
	445					
	67					
	254					
	324					
	105					
	209					
	465					
	279					
	256					
	382					
	1188					
	259					
	364					
	241					
	685					
AVERAGE	378	628	462	808	776	914
MINIMUM	67	230	48	142	215	305
MAXIMUM	1188	1290	1363	1508	1844	1414
SAMPLE (n)	36	15	14	10	7	8

	NOX FOR	F U E L	T Y P E S			
	0	1	2	3	4	5
1980	195	334	122	280	230	
CHEVROLET	185	1737	103	277	185	123
MODEL C-10	206	1675	1	318		126
	216	335	81	468		154
	249	337		166		140
	690	273	188	162		115
	1853	138	127			
	801	332	131			228
	145		316			216
	1084	345	114			
	65	161	979			
	226					
	300		95			
	272		407			
	264		569			
	120		832			
	294		520			
	423		125			
	384		416			
	229		102			
	291					
	1994					
	1395					
AVERAGE	517	567	290	279	208	157
MINIMUM	65	138	1	162	185	115
MAXIMUM	1994	1737	979	468	230	228
SAMPLE (n)	23	10	18	6	2	7

NOX FOR FUEL TYPES

	0	1	2	3	4	5
1986	251	209	194	146	801	272
CHEVROLET	19	103	393	18	1183	187
MODEL S-10	139	257	250	123	174	120
	125	120	159	144	176	
	145		195			315
	268	233		208	1182	293
	139	214	204	224	835	130
	245	217	233	176	159	161
	155	192	345			
	273	152	272	331		188
	153		256	533	1002	188
	274	165	197	469	981	174
	366	274	135	377	324	190
	116	284		344	487	
	217	277	197	180	138	
	145	160	269	845	75	
	79	78		851		
	150				139	
	65	204			245	
	142	1928				
	381					
	174					
	234					
	277					
	124					
	325					
	810					
	183					
	76					
	313					
	262					
	160					
	275					
	666					
	17					
	222					
	186					
AVERAGE	220	298	236	331	527	202
MINIMUM	17	78	135	18	75	120
MAXIMUM	810	1928	393	851	1183	315
SAMPLE (n)	37	17	14	15	15	11

Table 3, Emissions by Fuel Type within Vehicle (Baseline)

	COI FOR	FUEL	TYPES		
	1	2	3	4	5
	0.000	-0.005	0.213	-0.005	-0.010
1983	0.000	-0.005	1.013	-0.005	-0.010
CHEVROLET	0.000	-0.005	1.063	-0.005	-0.003
MODEL S-10	0.000	-0.455	1.003	-0.105	-0.063
	-0.010	0.000		-0.005	-0.003
	-0.010	-0.010		-0.335	-0.003
	0.000	-0.010		-0.005	-0.003
	-0.010	0.000		-0.005	-0.003
	-0.010	0.000		-0.005	-0.003
	-0.010	0.000			0.170
	-0.010	-0.003			0.140
	0.310	-0.013			-0.790
	1.020	-0.003			-2.230
	1.010	-0.003			
	1.020	-0.003			
		-0.003			
		-0.003			

COI-1					
AVERAGE	0.22	-0.03	0.82	-0.05	-0.22
SUM	3.30	-0.52	3.29	-0.48	-2.81
SUM^2	3.20	0.21	3.16	0.12	5.65
SAMPLE (n)	15	17	4	9	13
STD DEV	0.41	0.11	0.35	0.10	0.62

	COI FOR	F U E L	T Y P E S		
	1	2	3	4	5
	COIDIFF	COIDIFF	COIDIFF	COIDIFF	COIDIFF
	-0.010	-0.003	-0.017	0.010	-0.003
1984	-0.010	-0.013	-0.007	0.000	-0.003
CHEVROLET	0.000	-0.003	-0.017	0.010	-0.003
MODEL S-10	-0.010	-0.003	-0.007	0.000	-0.003
	0.000	-0.003	-0.007	0.000	-0.003
	0.000	-0.013	-0.017	0.000	-0.003
	-0.010	-0.003	-0.063	0.000	-0.003
	0.020	-0.007	-0.003	0.000	-0.005
	0.000	-0.007	-0.183	0.000	-0.005
	-0.020	-0.007	-0.013		-0.005
	-0.020	-0.007	-0.013		-0.005
	-0.010	-0.007	0.000		-0.005
	-0.010	-0.007			-0.005
		-0.017			
		0.000			
		0.000			
		0.000			
		-0.010			
		0.000			
COI-2					
AVERAGE	-0.0062	-0.0058	-0.0289	0.0022	-0.0039
SUM	-0.0800	-0.1100	-0.3470	0.0200	-0.0510
SUM^2	0.0018	0.0011	0.0388	0.0002	0.0002
SAMPLE (n)	13	19	12	9	13
STD DEV	0.0100	0.0048	0.0490	0.0042	0.0010

	COI FOR	FUEL	TYPES		
	1	2	3	4	5
	COIDIFF	COIDIFF	COIDIFF	COIDIFF	COIDIFF
	-0.170	0.005	0.023	0.390	0.343
1985	-0.120	-0.005	0.023	0.390	0.353
CHEVROLET	-1.710	-0.180	0.023	0.390	0.353
CELEBRITY	0.000	-0.060	0.023	0.380	0.353
	0.130	0.000	-0.267	0.300	0.063
	0.040	0.000	0.033	0.290	0.353
	0.000	-0.030	0.013	0.280	0.000
	0.000	-0.240	0.360		0.000
	-0.480	-0.050	0.360		0.010
		-0.090	0.370		-0.010
		-0.015			0.000
		-0.015			-0.010
		-0.015			-0.020
		-0.015			-0.200
		-0.015			

COI-3					
AVERAGE	-0.2567	-0.0483	0.0961	0.3457	0.1134
SUM	-2.3100	-0.7250	0.9610	2.4200	1.5880
SUM^2	3.2163	0.1063	0.4708	0.8532	0.6608
SAMPLE (n)	9	15	10	7	14
STD DEV	0.5399	0.0689	0.1945	0.0487	0.1853

	COI FOR	FUEL	TYPES		
	1	2	3	4	5
	COIDIFF	COIDIFF	COIDIFF	COIDIFF	COIDIFF
	0.050	-0.003	0.515	0.010	0.030
1985	0.130	-0.003	0.525	0.000	-0.010
FORD	0.080	0.010	0.515	0.077	-0.050
RANGERS	0.130	0.010	0.515	0.057	0.083
	0.130	-0.590	0.515	0.785	0.083
	-0.040	0.000	0.455	0.785	0.093
	-0.010	-0.040	0.525	0.785	0.083
	-0.010	0.000	-0.280	0.155	0.083
	-0.020	0.000	-0.050		0.013
	0.000	0.027	-0.110		-0.237
	-0.100	0.087	-2.760		
	0.590	-0.143			
	0.610	-0.203			
	0.610	0.127			
	0.610	0.077			
	0.340	-0.853			
	0.610				

COI-4					
AVERAGE	0.2182	-0.0936	0.0332	0.3317	0.0171
SUM	3.7100	-1.4970	0.3650	2.6540	0.1710
SUM^2	2.0239	1.1695	9.5298	1.8820	0.0960
SAMPLE (n)	17	16	11	8	10
STD DEV	0.2673	0.2537	0.9302	0.3538	0.0965

	COI FOR	F U E L	T Y P E S		
	1	2	3	4	5
	COIDIFF	COIDIFF	COIDIFF	COIDIFF	COIDIFF
	0.520	0.017	-0.040	-2.890	0.220
1980	0.520	0.017	-0.010	-2.160	-0.060
CHEVROLET	0.520	0.027	0.000		-0.840
C-10s	0.530	0.017	-0.010		-0.003
	0.520	0.027	0.000		-0.033
	-0.085	0.027	0.023		-0.003
	-0.005	0.027			-1.133
	-0.005	0.010			-1.473
	-0.015	0.000			-1.613
	-0.055	0.000			
	-0.015	-0.030			
		0.000			
		-0.030			
		-0.010			
		0.543			
		0.573			
		0.573			
		0.563			
		0.573			
		0.583			

COI-5					
AVERAGE	0.2209	0.1753	-0.0062	-2.5250	-0.5487
SUM	2.4300	3.5070	-0.0370	-5.0500	-4.9380
SUM^2	1.3733	1.9425	0.0023	13.0177	6.8139
SAMPLE (n)	11	20	6	2	9
STD DEV	0.2758	0.2576	0.0187	0.3650	0.6753

	COL FOR	F U E L	T Y P E S		
	1	2	3	4	5
	COLDIFF	COLDIFF	COLDIFF	COLDIFF	COLDIFF
	0.000	0.415	0.890	-0.055	0.000
1983	-0.010	0.395	0.860	0.005	
CHEVROLET	-0.630	0.405	0.930	0.005	0.043
S-10s	-0.170		0.660	-0.385	0.043
	-0.070	0.045		0.015	0.053
	0.000	0.045			0.043
		-0.025		-0.025	0.043
	-0.020	0.045		0.025	0.053
	0.000	0.045			
	-1.740				0.170
		0.007			0.200
	0.410	0.007			
	0.320	0.017			0.140
	0.400	-0.483			
	0.400	0.007			
		0.007			
		0.017			

COL-1					
AVERAGE	-0.0854	0.0633	0.8350	-0.0593	0.0788
SUM	-1.1100	0.9490	3.3400	-0.4150	0.7880
SUM^2	4.0493	0.7351	2.8322	0.1528	0.1015
SAMPLE (n)	13	15	4	7	10
STD DEV	0.5515	0.2121	0.1040	0.1353	0.0628

	COL FOR	F U E L	T Y P E S		
	1	2	3	4	5
	COLDIFF	COLDIFF	COLDIFF	COLDIFF	COLDIFF
	-0.080	0.037	0.007	0.010	0.020
1984		0.007	0.007	0.020	0.050
CHEVROLET	-0.580	0.027	-0.083		0.040
S-10s	0.010	0.027	0.007	0.090	0.040
	-0.070	0.037		0.100	0.050
	0.010	0.027	-0.043	0.000	0.020
	-0.060		0.033	0.100	
		-0.057	0.023	0.000	0.010
		0.003	0.023		0.000
	-0.050	-0.047	0.023		0.000
	-0.020	0.013			-0.040
	-0.120	0.023	0.037		0.010
		0.013			0.010
		0.013			
		0.010			
		0.010			
		0.000			
		-0.010			
COL-2					
AVERAGE	-0.1067	0.0078	0.0034	0.0457	0.0175
SUM	-0.9600	0.1330	0.0340	0.3200	0.2100
SUM^2	0.3688	0.0118	0.0129	0.0286	0.0109
SAMPLE (n)	9	17	10	7	12
STD DEV	0.1720	0.0251	0.0358	0.0447	0.0245

	COL FOR	F U E L	T Y P E S		
	1	2	3	4	5
	COLDIFF	COLDIFF	COLDIFF	COLDIFF	COLDIFF
	0.605	0.030	0.023	0.310	0.540
1985	0.585		0.203	0.320	0.240
CHEVROLET	0.615	-0.350	0.203	0.330	0.620
CELEBRITY	0.125	0.250	-0.717		0.160
	0.645	-0.080	-0.127	-0.190	0.320
	0.325	-0.100	-2.487	0.000	0.420
	0.130	-0.020			0.060
	-0.350	-0.370	0.320		0.060
	-0.170	-0.030	0.040		
					-0.040
		0.005			
		0.015			0.010
		-0.275			0.000
		0.015			-0.160

COL-3					
AVERAGE	0.2789	-0.0758	-0.3178	0.1540	0.1858
SUM	2.5100	-0.9100	-2.5420	0.7700	2.2300
SUM^2	1.7920	0.4166	6.9023	0.3435	1.0725
SAMPLE (n)	9	12	8	5	12
STD DEV	0.3483	0.1702	0.8728	0.2121	0.2342

	COL FOR	F U E L	T Y P E S		
	1	2	3	4	5
	COLDIFF	COLDIFF	COLDIFF	COLDIFF	COLDIFF
	0.210	0.010	0.230	-0.025	-0.013
1985	0.120	-0.030	0.290	0.005	0.007
FORD	0.140	0.155	0.290	0.067	0.007
RANGERS	0.220	0.045	0.220	-0.273	0.133
		-0.565	-0.700	0.020	0.143
		0.165	-0.600	-0.010	0.143
		-0.005	0.270	0.000	0.133
	-0.030	0.185	0.070		0.133
	-0.850		-0.360		-0.020
	0.000	0.050			0.050
	-0.400	0.050	-1.065		
		0.030			
	0.895	0.050			
	-1.075	0.030			
	0.895	-0.130			
	0.065				

COL-4					
AVERAGE	0.0158	0.0029	-0.1355	-0.0309	0.0716
SUM	0.1900	0.0400	-1.3550	-0.2160	0.7160
SUM^2	3.7718	0.4340	2.4611	0.0802	0.0971
SAMPLE (n)	12	14	10	7	10
STD DEV	0.5604	0.1760	0.4772	0.1025	0.0677

	COL FOR	F U E L	T Y P E S		
	1	2	3	4	5
	COLDIFF	COLDIFF	COLDIFF	COLDIFF	COLDIFF
	-0.110	0.020	0.790	-1.890	0.100
1980	-0.080	0.020	0.790	0.800	-0.030
CHEVROLET	-0.150	0.020	0.790		
C-10s	-0.080	0.030	0.790		-0.013
	0.030	0.020	0.760		0.017
	0.000	-0.040	-0.737		0.007
	-0.360				-0.003
	-0.680	0.093			-0.013
	-0.580	0.093			-0.013
	0.010	0.083			
		0.083			
		0.083			
		0.053			
		-1.627			
		0.143			
		0.253			
		-0.327			
		0.193			
		0.263			

COL-5					
AVERAGE	-0.2000	-0.0302	0.5305	-0.5450	0.0065
SUM	-2.0000	-0.5440	3.1830	-1.0900	0.0520
SUM^2	0.9768	2.9898	3.6172	4.2121	0.0118
SAMPLE (n)	10	18	6	2	8
STD DEV	0.2402	0.4064	0.5669	1.3450	0.0378

	COL FOR	FUEL	TYPES		
	1	2	3	4	5
	COLDIFF	COLDIFF	COLDIFF	COLDIFF	COLDIFF
	0.035	-0.060	-0.080	-0.057	-0.007
1986	0.035	-0.070	0.000	-0.017	0.043
CHEVROLET	0.035	0.000	0.000	-0.007	-0.017
S-10s	0.035	0.000	0.010	-0.007	0.043
	0.035	0.000	0.010	0.003	0.053
	-0.005	0.010	0.000	-0.057	
		0.000			0.003
	-0.005		0.005	-0.015	-0.017
	-0.075	0.107	-0.035	-0.045	0.003
	-0.095	0.045	0.005	-0.245	0.013
	-0.015	0.025			
	-0.015	0.035	0.180		-0.055
		0.035	0.180	-0.393	-0.015
	0.055	0.045	0.180	-0.003	0.005
	0.075	0.035	0.180	-0.053	-0.005
	-0.295		0.170	-0.393	
	0.035		0.150	-1.113	
	0.105			-0.013	
	0.105				
	0.085				
COL-6					
AVERAGE	0.0072	0.0148	0.0637	-0.1610	0.0036
SUM	0.1300	0.2070	0.9550	-2.4150	0.0470
SUM^2	0.1475	0.0284	0.1889	1.6198	0.0106
SAMPLE (n)	18	14	15	15	13
STD DEV	0.0902	0.0425	0.0924	0.2865	0.0284

	HCI FOR	FUEL	TYPES		
	1	2	3	4	5
	HCIDIFF	HCIDIFF	HCIDIFF	HCIDIFF	HCIDIFF
	0	23	-20	12	-11
1983	-8	27	6	-15	17
CHEVROLET	0	24	17	-18	7
S-10s	7	-38	-35	-120	-85
	4	-65		-13	1
	4	-147		-68	-4
	7	-4		-23	-26
	-21	-28		-31	-8
	-76	-8		-62	0
	-46	-3			-8
	-73	-19			-52
	-9	-39			-64
	111	3			-48
	107	-8			
	100	6			
		6			
		6			

HCI-1					
AVERAGE	7	-16	-8	-38	-22
SUM	107	-264	-32	-338	-281
SUM^2	47707	32048	1950	25220	17609
SAMPLE (n)	15	17	4	9	13
STD DEV	55.9427	40.5464	20.5791	37.3069	29.7878

	HCI FOR	F U E L	T Y P E S		
	1	2	3	4	5
	HCIDIFF	HCIDIFF	HCIDIFF	HCIDIFF	HCIDIFF
	0	9	-12	-38	-83
1984	-4	4	-4	0	-64
CHEVROLET	-14	10	5	0	-120
S-10s	-1	6	2	-41	-174
	0	5	-12	-28	-126
	-4	6	-15	-38	-99
	-2	13	-13	-27	-42
	-4	37	11	-25	-135
	2	47	-51	-25	-114
	4	47	7		-17
	29	43	14		-58
	21	51	12		-59
	23	32			-59
		43			
		4			
		-9			
		12			
		12			
		8			
HCI-2					
AVERAGE	4	20	-5	-25	-88
SUM	50	380	-56	-222	-1150
SUM^2	2080	14022	3838	7332	124938
SAMPLE (n)	13	19	12	9	13
STD DEV	12.0502	18.3848	17.2643	14.3604	42.2513

	HCI FOR	F U E L	T Y P E S		
	1	2	3	4	5
	HCIDIFF	HCIDIFF	HCIDIFF	HCIDIFF	HCIDIFF
	-79	23	22	134	19
1985	-57	18	21	137	44
CHEVROLET	-59	-26	24	-69	97
CELEBRITY	-49	18	24	116	57
	36	34	-135	114	-35
	-5	26	22	110	110
	19	9	14	110	47
	-10	-105	105		47
	-149	-38	81		47
		-12	100		-57
		7			7
		5			16
		7			4
		1			-146
		7			
HCI-3					
AVERAGE	-39	-2	28	93	18
SUM	-353	-26	278	652	257
SUM^2	39355	16552	48568	92138	59793
SAMPLE (n)	9	15	10	7	14
STD DEV	53.2390	33.1732	63.9059	66.9849	62.7212

	HCI FOR	FUEL	TYPES		
	1	2	3	4	5
	HCIDIFF	HCIDIFF	HCIDIFF	HCIDIFF	HCIDIFF
	-8	9	75	-72	-485
1985	6	3	66	-335	-42
FORD	9	9	51	-3	-11
RANGERS	11	25	60	-15	-669
	2	9	31	111	-726
	17	16	53	-280	-96
	-3	7	62	-171	-1340
	-9	4	29	137	-854
	-4	8	25		-45
	-3	-12	29		-147
	6	-27	-75		
	16	-25			
	26	-8			
	26	-14			
	21	-4			
	-10	-72			
	22				

HCI-4					
AVERAGE	7	-5	37	-79	-442
SUM	125	-72	406	-628	-4415
SUM^2	3379	8220	31728	256374	3769513
SAMPLE (n)	17	16	11	8	10
STD DEV	12.0291	22.2149	39.0139	160.8866	426.6486

	HCI FOR	F U E L	T Y P E S		
	1	2	3	4	5
	HCIDIFF	HCIDIFF	HCIDIFF	HCIDIFF	HCIDIFF
	64	-107	-64	32	30
1980	71	28	40	-3	-56
CHEVROLET	79	33	31		-136
C-10s	89	20	30		-110
	81	33	24		-90
	-27	33	-73		-154
	10	52			-159
	33	-17			-211
	18	21			-202
	-2	33			
	36	20			
		39			
		42			
		33			
		59			
		148			
		160			
		123			
		159			
		159			
HCI-5					
AVERAGE	41	54	-2	15	-121
SUM	452	1071	-12	29	-1088
SUM^2	33402	141873	13462	1033	177054
SAMPLE (n)	11	20	6	2	9
STD DEV	36.7162	65.0081	47.3251	17.5000	71.1234

	HCI FOR	F U E L	T Y P E S		
	1	2	3	4	5
	HCIDIFF	HCIDIFF	HCIDIFF	HCIDIFF	HCIDIFF
	13	13	2	0	-76
1986	3	12	-3	-6	-94
CHEVROLET	-2	13	15	-55	-214
S-10s	0	5	15	5	-93
	-2	13	-57	15	-94
	7	8	16	9	-93
	6	13	15	-22	-129
	2	13	9	-27	-91
	5	5	9	-51	-103
	12	17	13	-136	-127
	12	16	5	-24	-133
	9	19	8	-11	-184
	2	16	11	-29	-110
	31	20	14	-18	-121
	41	16	4	-17	-119
	37	15	3	-19	-118
	40		14	-105	-139
	40			-443	
	41			-22	
	41				
HCI-6					
AVERAGE	17	13	5	-50	-120
SUM	338	214	93	-956	-2038
SUM^2	11246	3146	5151	235972	263894
SAMPLE (n)	20	16	17	19	17
STD DEV	16.6340	4.2112	16.5249	99.4379	33.9323

	NOX FOR	F U E L	T Y P E S		
	1	2	3	4	5
	NOXDIFF	NOXDIFF	NOXDIFF	NOXDIFF	NOXDIFF
	10	38	110	-876	-325
1983	-202	127	72	-1070	
CHEVROLET	160	39	60	-1116	-277
S-10s	125		92	-213	482
	94	-617		-42	476
	135	-398			577
		-1371		-782	471
		-386		-1038	475
	1409	399			
	1305				523
		-11			237
	-221	-1			
	211	-65			
	350	99			
	656	69			
		40			

NOX-1					
AVERAGE	336	-146	84	-734	293
SUM	4032	-2038	334	-5137	2639
SUM^2	4443694	2766534	29348	4893833	1751347
SAMPLE (n)	12	14	4	7	9
STD DEV	507	420	19	401	330

	NOX FOR	F U E L	T Y P E S		
	1	2	3	4	5
	NOXDIFF	NOXDIFF	NOXDIFF	NOXDIFF	NOXDIFF
	436	-373	-1080	373	121
1984		-151	-771	574	123
CHEVROLET	128	-185	-414		140
S-10s	34	-959	-345	-783	80
	49	342		-1376	105
	-19	237	-173	-1056	112
	238		-126	-22	
	237	-270	-88	42	101
		-457	-48		67
	-11	-383	36		61
	157	-400			35
	140	-495	-5		45
		810			49
		-339			
		-412			
		-269			
		149			
		-164			
NOX-2					
AVERAGE	139	-195	-301	-321	87
SUM	1389	-3319	-3014	-2248	1039
SUM^2	367581	3184655	2108436	4092454	103401
SAMPLE (n)	10	17	10	7	12
STD DEV	132	386	346	694	33

	NOX FOR	F U E L	T Y P E S		
	1	2	3	4	5
	NOXDIFF	NOXDIFF	NOXDIFF	NOXDIFF	NOXDIFF
	-1126	207	-62	355	-204
1985	238		73	283	111
CHEVROLET	-1451	-875	-110	642	-125
CELEBRITY	-847	-479	-76		83
	-1253	-445	-380	-107	-265
	167	-672	282	-9	337
	6	-165			196
	-491	-804	110		49
	-790	-1281	386		
					-98
		-234			
		-150			-565
		85			-179
		78			195

NOX-3					
AVERAGE	-616	-395	28	233	-39
SUM	-5547	-4735	223	1164	-465
SUM^2	6610445	4092691	412069	629808	699957
SAMPLE (n)	9	12	8	5	12
STD DEV	596	431	225	268	238

	NOX FOR	F U E L	T Y P E S		
	1	2	3	4	5
	NOXDIFF	NOXDIFF	NOXDIFF	NOXDIFF	NOXDIFF
	204	-128	96	-535	-419
1985	-240	2	-407	-766	-501
FORD	-446	34	-406	340	-752
RANGERS	-16	-5	-552	-150	265
	215	-15	-77	-1576	-34
		86	455	-462	-609
	38	49	490	-254	-844
	-229	-89	-565		
	-1003		118		-329
	-608	85	-16		
	-351	-169			
	92	-465			
	-50	-14			
	62	-355			
	305	167			
	-43				

NOX-4					
AVERAGE	-138	-58	-86	-486	-403
SUM	-2070	-817	-864	-3403	-3223
SUM^2	2007054	441633	1430864	3772817	2254905
SAMPLE (n)	15	14	10	7	8
STD DEV	339	168	368	550	346

	NOX FOR	F U E L	T Y P E S		
	1	2	3	4	5
	NOXDIFF	NOXDIFF	NOXDIFF	NOXDIFF	NOXDIFF
	-913	332	-221	524	19
1980	-314	516	93	528	1668
CHEVROLET	747	555	-85		
C-10s	-656	574	-82		74
	-594	676	-123		71
	-75	596	-266		43
	-77				57
	-13	31			82
	122	92			
	-72	88			
		-97			
		105			
		-760			
		272			
		-40			
		-202			
		-465			
		-153			
		242			
NOX-5					
AVERAGE	-185	131	-114	526	288
SUM	-1845	2362	-684	1052	2014
SUM^2	2305137	2855962	157324	553360	2804924
SAMPLE (n)	10	18	6	2	7
STD DEV	443	376	115	2	564

	NOX FOR	F U E L	T Y P E S		
	1	2	3	4	5
	NOXDIFF	NOXDIFF	NOXDIFF	NOXDIFF	NOXDIFF
	0	-12	-62	-581	281
1986	36	-1736	-134	-587	175
CHEVROLET	13	-2	-11	-537	148
S-10s	119	-201	117	-919	233
	-35	-58	12	90	300
	102	33	-9	88	
		-3			-107
	-101		-2	-1016	-85
	-82	-79	-18	-669	78
	-85	-15	30	7	47
	-60	-127			
	-20	-54	-135		154
		-38	-337	-774	154
	49	21	-273	-753	168
	-60	83	-181	-96	152
	-70		-148	-259	
	-63		16	90	
	54			153	
	136				

NOX-6					
AVERAGE	-4	-156	-76	-384	131
SUM	-67	-2188	-1135	-5763	1698
SUM^2	91687	3092992	298307	4584661	401506
SAMPLE (n)	17	14	15	15	13
STD DEV	73	443	119	398	118

Appendix 1. Multiple Comparisons (Baseline)

ADOT ADMISSIONS STUDY-Average Differences & Bonferroni Results (Baseline)

	COI FOR FUEL TYPES 1	2	3	4	5	SUM	TABLE VAL CALCs
COI-1							
AVERAGE	0.2200	-0.0300	0.8200	-0.0500	-0.2200		
SUM	3.3000	-0.5200	3.2900	-0.4800	-2.8100	2.7800	
SUM^2	3.2000	0.2100	3.1600	0.1200	5.6500	12.3400	
SAMPLE (n)	15	17	4	9	13	58	
STD. DEV.	0.4204	0.1101	0.3890	0.1086	0.6482		
SIGMA^	2.474	0.194	0.454	0.094	5.043	0.395	0.0025
BMULT,DF	0.067	0.059	0.250	0.111	0.077	1.062	53
DIFF,TV		0.250	-0.600	0.270	0.440	0.419	2.9375
			-0.850	0.020	0.190	1.231	<-Critval
				0.870	1.040		
					0.170		
COI-2							
AVERAGE	-0.0062	-0.0058	-0.0289	0.0022	-0.0039		
SUM	-0.0800	-0.1100	-0.3470	0.0200	-0.0510	-0.5680	
SUM^2	0.0018	0.0011	0.0388	0.0002	0.0002	0.0421	
SAMPLE (n)	13	19	12	9	13	66	
STD. DEV.	0.0104	0.0049	0.0512	0.0044	0.0010		
SIGMA^	0.001	0.000	0.029	0.000	0.000	0.022	0.0025
BMULT,DF	0.077	0.053	0.083	0.111	0.077	0.895	61
DIFF,TV		-0.000	0.023	-0.008	-0.002	0.020	2.919
			0.023	-0.008	-0.002	0.059	<-Critval
				-0.031	-0.025		
					0.006		
COI-3							
AVERAGE	-0.2567	-0.0483	0.0961	0.3457	0.1134		
SUM	-2.3100	-0.7250	0.9610	2.4200	1.5880	1.9340	
SUM^2	3.2163	0.1063	0.4708	0.8532	0.6608	5.3073	
SAMPLE (n)	9	15	10	7	14	55	
STD. DEV.	0.5726	0.0713	0.2051	0.0526	0.1923		
SIGMA^	2.623	0.071	0.378	0.017	0.481	0.267	0.0025
BMULT,DF	0.111	0.067	0.100	0.143	0.071	0.992	50
DIFF,TV		-0.208	-0.353	-0.602	-0.370	0.265	2.945
			-0.144	-0.394	-0.162	0.781	<-Critval
				-0.250	-0.017		
					0.232		

ADOT ADMISSIONS STUDY-Average Differences & Bonferroni Results (Baseline)

	COI FOR FUEL TYPES						
	1	2	3	4	5	SUM	TABLE VAL CALCs
COI-4							
AVERAGE	0.2182	-0.0936	0.0332	0.3317	0.0171		
SUM	3.7100	-1.4970	0.3650	2.6540	0.1710	5.4030	
SUM^2	2.0239	1.1695	9.5298	1.8820	0.0960	14.7012	
SAMPLE (n)	17	16	11	8	10	62	
STD. DEV.	0.2755	0.2620	0.9756	0.3783	0.1017		
SIGMA^	1.214	1.029	9.518	1.002	0.093	0.475	0.0025
BMULT,DF	0.059	0.063	0.091	0.125	0.100	0.935	57
DIFF,TV		0.312	0.185	-0.114	0.201	0.444	2.9275
			-0.127	-0.425	-0.111	1.300	<-Critval
				-0.299	0.016		
					0.315		
COI-5							
AVERAGE	0.2209	0.1753	-0.0062	-2.5250	-0.5487		
SUM	2.4300	3.5070	-0.0370	-5.0500	-4.9380	-4.0880	
SUM^2	1.3733	1.9425	0.0023	13.0177	6.8139	23.1497	
SAMPLE (n)	11	20	6	2	9	48	
STD. DEV.	0.2892	0.2643	0.0205	0.5162	0.7163		
SIGMA^	0.836	1.328	0.002	0.266	4.105	0.390	0.0025
BMULT,DF	0.091	0.050	0.167	0.500	0.111	1.355	43
DIFF,TV		0.046	0.227	2.746	0.770	0.529	2.9625
			0.182	2.700	0.724	1.566	<-Critval
				2.519	0.543		
					-1.976		

ADOT ADMISSIONS STUDY-Average Differences & Bonferroni Results (Baseline)

	COI FOR FUEL TYPES						
	1	2	3	4	5	SUM	TABLE VAL CALCs
COI-6							
AVERAGE	0.1807	-0.0077	-0.0593	-0.0017	0.1193		
SUM	3.6150	-0.1230	-1.0080	-0.0320	2.0280	4.4800	
SUM^2	1.8533	0.0014	0.8112	2.9253	0.6537	6.2449	
SAMPLE (n)	20	16	17	19	17	89	
STD. DEV.	0.2513	0.0053	0.2167	0.4031	0.1604		
SIGMA^	1.200	0.000	0.751	2.925	0.412	0.252	0.001667
BMULT,DF	0.050	0.063	0.059	0.053	0.059	0.752	83
DIFF,TV		0.188	0.240	0.182	0.061	0.190	2.897
			0.052	-0.006	-0.127	0.550	<-Critval
				-0.058	-0.179		
					-0.121		
SUM COI							
AVERAGE	0.1255	0.0052	0.0537	-0.0087	-0.0528		
SUM	10.6650	0.5320	3.2240	-0.4680	-4.0120	9.9410	
SUM^2	11.6686	3.4307	14.0129	18.7984	13.8746	61.7852	
SAMPLE (n)	85	103	60	54	76	378	
STD. DEV.	0.3507	0.1833	0.4843	0.5955	0.4268		
SIGMA^	10.330	3.428	13.840	18.794	13.663	0.401	0.0025
BMULT,DF	0.012	0.010	0.017	0.019	0.013	0.374	373
DIFF,TV		0.120	0.072	0.134	0.178	0.150	2.81
			-0.049	0.014	0.058	0.421	<-Critval
				0.062	0.107		
					0.044		

ADOT ADMISSIONS STUDY-Average Differences & Bonferroni Results (Baseline)

	COL FOR F U E L T Y P E S 1	2	3	4	5	SUM	TABLE VAL CALCs
COL-1							
AVERAGE	-0.0854	0.0633	0.8350	-0.0593	0.0788		
SUM	-1.1100	0.9490	3.3400	-0.4150	0.7880	3.5520	
SUM^2	4.0493	0.7351	2.8322	0.1528	0.1015	7.8709	
SAMPLE (n)	13	15	4	7	10	49	
STD. DEV.	0.5741	0.2196	0.1201	0.1462	0.0662		
SIGMA^	3.955	0.675	0.043	0.128	0.039	0.332	0.0025
BMULT,DF	0.077	0.067	0.250	0.143	0.100	1.128	44
DIFF,TV		-0.149	-0.920	-0.026	-0.164	0.374	2.96
			-0.772	0.123	-0.016	1.108	<-Critval
				0.894	0.756		
					-0.138		
COL-2							
AVERAGE	-0.1067	0.0078	0.0034	0.0457	0.0175		
SUM	-0.9600	0.1330	0.0340	0.3200	0.2100	-0.2630	
SUM^2	0.3688	0.0118	0.0129	0.0286	0.0109	0.4330	
SAMPLE (n)	9	17	10	7	12	55	
STD. DEV.	0.1825	0.0259	0.0377	0.0483	0.0256		
SIGMA^	0.266	0.011	0.013	0.014	0.007	0.079	0.0025
BMULT,DF	0.111	0.059	0.100	0.143	0.083	0.996	50
DIFF,TV		-0.114	-0.110	-0.152	-0.124	0.079	2.945
			0.004	-0.038	-0.010	0.231	<-Critval
				-0.042	-0.014		
					0.028		
COL-3							
AVERAGE	0.2789	-0.0758	-0.3178	0.1540	0.1858		
SUM	2.5100	-0.9100	-2.5420	0.7700	2.2300	2.0580	
SUM^2	1.7920	0.4166	6.9023	0.3435	1.0725	10.5270	
SAMPLE (n)	9	12	8	5	12	46	
STD. DEV.	0.3695	0.1778	0.9331	0.2371	0.2446		
SIGMA^	1.092	0.348	6.095	0.225	0.658	0.453	0.0025
BMULT,DF	0.111	0.083	0.125	0.200	0.083	1.098	41
DIFF,TV		0.355	0.597	0.125	0.093	0.497	2.9675
			0.242	-0.230	-0.262	1.476	<-Critval
				-0.472	-0.504		
					-0.032		

ADOT ADMISSIONS STUDY-Average Differences & Bonferroni Results (Baseline)

	COL FOR FUEL TYPES						
	1	2	3	4	5	SUM	TABLE VAL CALCs
COL-4							
AVERAGE	0.0158	0.0029	-0.1355	-0.0309	0.0716		
SUM	0.1900	0.0400	-1.3550	-0.2160	0.7160	-0.6250	
SUM^2	3.7718	0.4340	2.4611	0.0802	0.0971	6.8442	
SAMPLE (n)	12	14	10	7	10	53	
STD. DEV.	0.5853	0.1827	0.5030	0.1107	0.0714		
SIGMA^	3.769	0.434	2.278	0.074	0.046	0.371	0.0025
BMULT,DF	0.083	0.071	0.100	0.143	0.100	0.998	48
DIFF,TV		0.013	0.151	0.047	-0.056	0.370	2.95
			0.138	0.034	-0.069	1.091	<-Critval
				-0.105	-0.207		
					-0.102		
COL-5							
AVERAGE	-0.2000	-0.0302	0.5305	-0.5450	0.0065		
SUM	-2.0000	-0.5440	3.1830	-1.0900	0.0520	-0.3990	
SUM^2	0.9768	2.9898	3.6172	4.2121	0.0118	11.8076	
SAMPLE (n)	10	18	6	2	8	44	
STD. DEV.	0.2532	0.4182	0.6211	1.9021	0.0404		
SIGMA^	0.577	2.973	1.929	3.618	0.011	0.483	0.0025
BMULT,DF	0.100	0.056	0.167	0.500	0.125	1.376	39
DIFF,TV		-0.170	-0.731	0.345	-0.207	0.665	2.9725
			-0.561	0.515	-0.037	1.977	<-Critval
				1.075	0.524		
					-0.551		

ADOT ADMISSIONS STUDY-Average Differences & Bonferroni Results (Baseline)

	COL FOR F U E L T Y P E S 1	2	3	4	5	SUM	TABLE VAL CALCs
COL-6							
AVERAGE	0.0072	0.0148	0.0637	-0.1610	0.0036		
SUM	0.1300	0.2070	0.9550	-2.4150	0.0470	-1.0760	
SUM^2	0.1475	0.0284	0.1889	1.6198	0.0106	1.9952	
SAMPLE (n)	18	14	15	15	13	75	
STD. DEV.	0.0928	0.0441	0.0956	0.2965	0.0295		
SIGMA^	0.147	0.025	0.128	1.231	0.010	0.149	0.001667
BMULT,DF	0.056	0.071	0.067	0.067	0.077	0.821	69
DIFF,TV		-0.008	-0.056	0.168	0.004	0.123	2.911
			-0.049	0.176	0.011	0.357	<-Critval
				0.225	0.060		
					-0.165		
SUM COL							
AVERAGE	-0.0175	-0.0014	0.0682	-0.0708	0.0622		
SUM	-1.2400	-0.1250	3.6150	-3.0460	4.0430	3.2470	
SUM^2	11.1062	4.6156	16.0146	6.4370	1.3044	39.4778	
SAMPLE (n)	71	90	53	43	65	322	
STD. DEV.	0.3979	0.2277	0.5507	0.3849	0.1283		
SIGMA^	11.085	4.615	15.768	6.221	1.053	0.350	0.0025
BMULT,DF	0.014	0.011	0.019	0.023	0.015	0.407	317
DIFF,TV		-0.016	-0.086	0.053	-0.080	0.142	2.81
			-0.070	0.069	-0.064	0.400	<-Critval
				0.139	0.006		
					-0.133		

ADOT ADMISSIONS STUDY-Average Differences & Bonferroni Results (Baseline)

	HCI FOR FUEL TYPES 1	2	3	4	5	SUM	TABLE VAL CALCs
HCI-1							
AVERAGE	7	-16	-8	-38	-22		
SUM	107	-264	-32	-338	-281	-808	
SUM^2	47707	32048	1950	25220	17609	124534	
SAMPLE (n)	15	17	4	9	13	58	
STD. DEV.	58	42	24	40	31		
SIGMA^	46944	27948	1694	12526	11535	44	0.0025
BMULT,DF	0.067	0.059	0.250	0.111	0.077	1.062	53
DIFF,TV		23	15	45	29	46	2.9375
			-8	22	6	136	<-Critval
				30	14		
					-16		
HCI-2							
AVERAGE	4	20	-5	-25	-88		
SUM	50	380	-56	-222	-1150	-998	
SUM^2	2080	14022	3838	7332	124938	152210	
SAMPLE (n)	13	19	12	9	13	66	
STD. DEV.	13	19	18	15	44		
SIGMA^	1888	6422	3577	1856	23207	25	0.0025
BMULT,DF	0.077	0.053	0.083	0.111	0.077	0.895	61
DIFF,TV		-16	9	29	92	22	2.919
			25	45	108	64	<-Critval
				20	84		
					64		
HCI-3							
AVERAGE	-39	-2	28	93	18		
SUM	-353	-26	278	652	257	808	
SUM^2	39355	16552	48568	92138	59793	256406	
SAMPLE (n)	9	15	10	7	14	55	
STD. DEV.	56	34	67	72	65		
SIGMA^	25510	16507	40840	31409	55075	58	0.0025
BMULT,DF	0.111	0.067	0.100	0.143	0.071	0.992	50
DIFF,TV		-37	-67	-132	-58	58	2.945
			-30	-95	-20	170	<-Critval
				-65	9		
					75		

ADOT ADMISSIONS STUDY-Average Differences & Bonferroni Results (Baseline)

	HCI FOR FUEL TYPES 1	2	3	4	5	SUM	TABLE VAL CALCs
HCI-4							
AVERAGE	7	-5	37	-79	-442		
SUM	125	-72	406	-628	-4415	-4584	
SUM^2	3379	8220	31728	256374	3769513	4069214	
SAMPLE (n)	17	16	11	8	10	62	
STD. DEV.	12	23	41	172	450		
SIGMA^	2460	7896	16743	207076	1820291	190	0.0025
BMULT,DF	0.059	0.063	0.091	0.125	0.100	0.935	57
DIFF,TV		12	-30	86	449	178	2.9275
			-41	74	437	520	<-Critval
				115	478		
					363		
HCI-5							
AVERAGE	41	54	-2	15	-121		
SUM	452	1071	-12	29	-1088	452	
SUM^2	33402	141873	13462	1033	177054	366824	
SAMPLE (n)	11	20	6	2	9	48	
STD. DEV.	39	67	52	25	75		
SIGMA^	14829	84521	13438	613	45527	61	0.0025
BMULT,DF	0.091	0.050	0.167	0.500	0.111	1.355	43
DIFF,TV		-12	43	27	162	82	2.9625
			56	39	174	244	<-Critval
				-17	119		
					135		

ADOT ADMISSIONS STUDY-Average Differences & Bonferroni Results (Baseline)

	HCI FOR FUEL TYPES						
	1	2	3	4	5	SUM	TABLE VAL CALCs
HCI-6							
AVERAGE	17	13	5	-50	-120		
SUM	338	214	93	-956	-2038	-2349	
SUM^2	11246	3146	5151	235972	263894	519409	
SAMPLE (n)	20	16	17	19	17	89	
STD. DEV.	17	4	17	102	35		
SIGMA^	5534	284	4642	187870	19574	51	0.001667
BMULT,DF	0.050	0.063	0.059	0.053	0.059	0.752	83
DIFF,TV		4	11	67	137	39	2.897
			8	64	133	112	<-Critval
				56	125		
					70		
SUM HCI							
AVERAGE	8	13	11	-27	-115		
SUM	719	1303	677	-1463	-8715	-7479	
SUM^2	137169	215861	104697	618069	4412801	5488597	
SAMPLE (n)	85	103	60	54	76	378	
STD. DEV.	40	44	41	104	213		
SIGMA^	131087	199377	97058	578433	3413443	109	0.0025
BMULT,DF	0.012	0.010	0.017	0.019	0.013	0.374	373
DIFF,TV		-4	-3	36	123	41	2.81
			1	40	127	114	<-Critval
				38	126		
					88		

ADOT ADMISSIONS STUDY-Average Differences & Bonferroni Results (Baseline)

	NOX FOR F U E L T Y P E S						
	1	2	3	4	5	SUM	TABLE VAL CALCs
NOX-1							
AVERAGE	336	-146	84	-734	293		
SUM	4032	-2038	334	-5137	2639	-170	
SUM^2	4443694	2766534	29348	4893833	1751347	13884756	
SAMPLE (n)	12	14	4	7	9	46	
STD. DEV.	530	436	22	433	350		
SIGMA^	3088942	2469859	1459	1124009	977534	432	0.0025
BMULT,DF	0.083	0.071	0.250	0.143	0.111	1.148	41
DIFF,TV		482	253	1070	43	496	2.9675
			-229	588	-439	1472	<-Critval
				817	-210		
					-1027		
NOX-2							
AVERAGE	139	-195	-301	-321	87		
SUM	1389	-3319	-3014	-2248	1039	-6153	
SUM^2	367581	3184655	2108436	4092454	103401	9856527	
SAMPLE (n)	10	17	10	7	12	56	
STD. DEV.	139	398	365	750	35		
SIGMA^	174649	2536669	1200016	3370525	13441	378	0.0025
BMULT,DF	0.100	0.059	0.100	0.143	0.083	0.985	51
DIFF,TV		334	440	460	52	373	2.9425
			106	126	-282	1096	<-Critval
				20	-388		
					-408		
NOX-3							
AVERAGE	-616	-395	28	233	-39		
SUM	-5547	-4735	223	1164	-465	-9360	
SUM^2	6610445	4092691	412069	629808	699957	12444970	
SAMPLE (n)	9	12	8	5	12	46	
STD. DEV.	632	450	241	300	249		
SIGMA^	3191644	2224339	405853	358829	681938	409	0.0025
BMULT,DF	0.111	0.083	0.125	0.200	0.083	1.098	41
DIFF,TV		-222	-644	-849	-578	449	2.9675
			-422	-627	-356	1333	<-Critval
				-205	67		
					272		

ADOT ADMISSIONS STUDY-Average Differences & Bonferroni Results (Baseline)

	NOX FOR FUEL TYPES						
	1	2	3	4	5	SUM	TABLE VAL CALCs
NOX-4							
AVERAGE	-138	-58	-86	-486	-403		
SUM	-2070	-817	-864	-3403	-3223	-10377	
SUM^2	2007054	441633	1430864	3772817	2254905	9907273	
SAMPLE (n)	15	14	10	7	8	54	
STD. DEV.	351	174	388	594	370		
SIGMA^	1721394	393955	1356214	2118473	956439	366	0.0025
BMULT,DF	0.067	0.071	0.100	0.143	0.125	1.006	49
DIFF,TV		-80	-52	348	265	368	2.9475
			28	428	345	1084	<-Critval
				400	316		
					-83		
NOX-5							
AVERAGE	-185	131	-114	526	288		
SUM	-1845	2362	-684	1052	2014	2899	
SUM^2	2305137	2855962	157324	553360	2804924	8676707	
SAMPLE (n)	10	18	6	2	7	43	
STD. DEV.	467	387	126	3	609		
SIGMA^	1964735	2546015	79348	8	2225467	424	0.0025
BMULT,DF	0.100	0.056	0.167	0.500	0.143	1.389	38
DIFF,TV		-316	-71	-711	-472	588	2.982
			245	-395	-156	1755	<-Critval
				-640	-402		
					238		

ADOT ADMISSIONS STUDY-Average Differences & Bonferroni Results (Baseline)

	NOX FOR FUEL TYPES						
	1	2	3	4	5	SUM	TABLE VAL CALCs
NOX-6							
AVERAGE	-4	-156	-76	-384	131		
SUM	-67	-2188	-1135	-5763	1698	-7455	
SUM^2	91687	3092992	298307	4584661	401506	8469153	
SAMPLE (n)	17	14	15	15	13	74	
STD. DEV.	76	460	123	411	122		
SIGMA^	91423	2751039	212425	2370516	179721	287	0.001667
BMULT,DF	0.059	0.071	0.067	0.067	0.077	0.825	68
DIFF,TV		152	72	380	-135	237	2.912
			-81	228	-287	690	<-Critval
				309	-206		
					-515		
SUM NOX							
AVERAGE	-56	-121	-97	-333	61		
SUM	-4108	-10735	-5140	-14335	3702	-30616	
SUM^2	15825598	16434467	4436348	18526933	8016040	63239386	
SAMPLE (n)	73	89	53	43	61	319	
STD. DEV.	465	415	275	572	360		
SIGMA^	15594425	15139633	3937865	13748044	7791371	423	0.0025
BMULT,DF	0.014	0.011	0.019	0.023	0.016	0.409	314
DIFF,TV		64	41	277	-117	173	2.81
			-24	213	-181	486	<-Critval
				236	-158		
					-394		

Appendix 2, Multiple Comparisons (Nonadjusted Baseline)

ADOT EMISSIONS STUDY - Average Differences and Bonferoni Results

	COI FOR		F U E L	T Y P E S				TABLE VAL
	0	1	2	3	4	5	SUMS	CALCs
COI - 1								
AVERAGE	0.276	0.072	0.048	0.450	0.063	0.332		
SUM	6.890	1.080	0.820	1.800	1.010	4.310	15.91	
SUM^2	9.818	0.556	0.229	1.308	0.183	7.960	20.0549	
SAMPLE (n)	25	15	17	4	16	13	90	
STD. DEV.	0.574	0.185	0.109	0.408	0.089	0.738		
SIGMA^	7.920	0.479	0.189	0.498	0.119	6.531	0.433	0.001667
BMULT,DF	0.040	0.067	0.059	0.250	0.063	0.077	1.053	84
DIFF,TV		0.204	0.227	-0.174	0.212	-0.056	0.456	3.032
			0.024	-0.378	0.009	-0.260	1.382	<-Critval
				-0.402	-0.015	-0.283		
					0.387	0.118		
						-0.268		
COI - 2								
AVERAGE	0.017	0.023	0.022	0.044	0.021	0.020		
SUM	0.490	0.300	0.420	0.530	0.190	0.260	2.19	
SUM^2	0.009	0.008	0.010	0.053	0.004	0.005	0.0876	
SAMPLE (n)	29	13	19	12	9	13	95	
STD.DEV.	0.006	0.009	0.004	0.052	0.003	0.000		
SIGMA^	0.001	0.001	0.000	0.029	0.000	0.000	0.019	0.001667
BMULT,DF	0.034	0.077	0.053	0.083	0.111	0.077	0.933	89
DIFF,TV		-0.006	-0.005	-0.027	-0.004	-0.003	0.018	3.026167
			0.001	-0.021	0.002	0.003	0.053	<-CRITVAL
				-0.022	0.001	0.002		
					0.023	0.024		
						0.001		
COI - 3								
AVERAGE	0.149	0.373	0.073	0.061	0.140	0.064		
SUM	2.990	3.360	1.090	0.610	1.400	0.900	10.35	
SUM^2	1.124	3.987	0.157	0.112	1.308	0.162	6.8493	
SAMPLE (n)	20	9	15	10	10	14	78	
STD.DEV.	0.189	0.584	0.075	0.091	0.351	0.090		
SIGMA^	0.676	2.733	0.078	0.075	1.112	0.104	0.258	0.001667
BMULT,DF	0.050	0.111	0.067	0.100	0.100	0.071	0.999	72
DIFF,TV		-0.224	0.077	0.088	0.010	0.085	0.257	3.046
			0.301	0.312	0.233	0.309	0.784	
				0.012	-0.067	0.008		
					-0.079	-0.003		
						0.076		

ADOT EMISSIONS STUDY - Average Differences and Bonferoni Results

	COI FOR	FUEL	TYPES					TABLE VAL
	0	1	2	3	4	5	SUMS	CALCs
COI - 4								
AVERAGE	0.168	0.066	0.177	0.327	0.100	0.061		
SUM	6.040	1.130	2.840	3.600	0.800	0.610	15.02	
SUM^2	3.663	0.167	1.662	8.247	0.426	0.091	14.2566	
SAMPLE (n)	36	17	16	11	8	10	98	
STD.DEV.	0.275	0.076	0.278	0.841	0.222	0.078		
SIGMA^	2.650	0.092	1.158	7.069	0.346	0.054	0.352	0.001667
BMULT,DF	0.028	0.059	0.063	0.091	0.125	0.100	0.964	92
DIFF,TV		0.101	-0.010	-0.159	0.068	0.107	0.339	3.022667
			-0.111	-0.261	-0.034	0.005	1.025	
				-0.150	0.077	0.116		
					0.227	0.266		
						0.039		
COI - 5								
AVERAGE	0.166	0.043	0.033	0.033	2.585	0.599		
SUM	3.810	0.470	0.650	0.200	5.170	5.390	15.69	
SUM^2	2.385	0.028	0.025	0.008	13.631	7.037	23.1137	
SAMPLE (n)	23	11	20	6	2	9	71	
STD.DEV.	0.282	0.027	0.013	0.015	0.516	0.690		
SIGMA^	1.754	0.007	0.003	0.001	0.266	3.809	0.300	0.001667
BMULT,DF	0.043	0.091	0.050	0.167	0.500	0.111	1.387	65
DIFF,TV		0.123	0.133	0.132	-2.419	-0.433	0.416	3.054167
			0.010	0.009	-2.542	-0.556	1.270	
				-0.001	-2.553	-0.566		
					-2.552	-0.566		
						1.986		

ADOT EMISSIONS STUDY - Average Differences and Bonferoni Results

	COI FOR		FUEL	TYPES				TABLE VAL
	0	1	2	3	4	5	SUMS	CALCs
COI - 6								
AVERAGE	0.094	0.025	0.025	0.078	0.156	0.021		
SUM	3.490	0.500	0.400	1.330	2.970	0.350	9.04	
SUM^2	2.726	0.013	0.010	0.857	3.008	0.007	6.6216	
SAMPLE (n)	37	20	16	17	19	17	126	
STD.DEV.	0.258	0.005	0.005	0.217	0.376	0.002		
SIGMA^	2.397	0.000	0.000	0.753	2.543	0.000	0.218	0.001667
BMULT,DF	0.027	0.050	0.063	0.059	0.053	0.059	0.787	120
DIFF,TV		0.069	0.069	0.016	-0.062	0.074	0.171	2.99
			0.000	-0.053	-0.131	0.004	0.513	
				-0.053	-0.131	0.004		
					-0.078	0.058		
						0.136		
SUM COI								
AVERAGE	0.139	0.080	0.060	0.135	0.180	0.156		
SUM	23.710	6.840	6.220	8.070	11.540	11.820	68.20	
SUM^2	19.726	4.758	2.093	10.585	18.559	15.264	70.9850	
SAMPLE (n)	170	85	103	60	64	76	558	
STD.DEV.	0.312	0.224	0.130	0.401	0.511	0.423		
SIGMA^	16.419	4.208	1.717	9.500	16.478	13.425	0.334	0.001667
BMULT,DF	0.006	0.012	0.010	0.017	0.016	0.013	0.382	552
DIFF,TV		0.059	0.079	0.005	-0.041	-0.016	0.128	2.94
			0.020	-0.054	-0.100	-0.075	0.375	
				-0.074	-0.120	-0.095		
					-0.046	-0.021		
						0.025		

ADOT EMISSIONS STUDY - Average Differences and Bonferoni Results

	COL FOR		F U E L	T Y P E S				TABLE VAL
	0	1	2	3	4	5	SUMS	CALCs
COL - 1								
AVERAGE	0.217	0.216	0.054	0.115	0.092	0.017		
SUM	5.430	2.810	0.810	0.460	1.190	0.170	10.87	
SUM^2	4.306	3.485	0.265	0.096	0.403	0.007	8.5621	
SAMPLE (n)	25	13	15	4	13	10	80	
STD. DEV.	0.361	0.490	0.126	0.120	0.157	0.022		
SIGMA^	3.126	2.878	0.221	0.043	0.294	0.004	0.298	0.001667
BMULT,DF	0.040	0.077	0.067	0.250	0.077	0.100	1.105	74
DIFF,TV		0.001	0.163	0.102	0.126	0.200	0.329	3.044
			0.162	0.101	0.125	0.199	1.002	
				-0.061	-0.038	0.037		
					0.023	0.098		
						0.075		
COL - 2								
AVERAGE	0.028	0.118	0.017	0.023	0.031	0.013		
SUM	0.820	1.060	0.290	0.230	0.220	0.150	2.77	
SUM^2	0.045	0.398	0.014	0.014	0.020	0.005	0.4967	
SAMPLE (n)	29	9	17	10	7	12	84	
STD.DEV.	0.028	0.185	0.023	0.032	0.047	0.016		
SIGMA^	0.022	0.274	0.009	0.009	0.013	0.003	0.065	0.001667
BMULT,DF	0.034	0.111	0.059	0.100	0.143	0.083	1.030	78
DIFF,TV		-0.090	0.011	0.005	-0.003	0.016	0.067	3.039
			0.101	0.095	0.086	0.105	0.204	
				-0.006	-0.014	0.005		
					-0.008	0.010		
						0.019		
COL - 3								
AVERAGE	0.273	0.201	0.263	0.563	0.034	0.139		
SUM	5.450	1.810	3.160	4.500	0.270	1.670	16.86	
SUM^2	3.337	0.732	1.481	8.397	0.042	0.524	14.5118	
SAMPLE (n)	20	9	12	8	8	12	69	
STD.DEV.	0.312	0.214	0.243	0.915	0.068	0.163		
SIGMA^	1.852	0.368	0.648	5.866	0.032	0.292	0.379	0.001667
BMULT,DF	0.050	0.111	0.083	0.125	0.125	0.083	1.075	63
DIFF,TV		0.071	0.009	-0.290	0.239	0.133	0.408	3.057
			-0.062	-0.361	0.167	0.062	1.246	
				-0.299	0.230	0.124		
					0.529	0.423		
						-0.105		

ADOT EMISSIONS STUDY - Average Differences and Bonferoni Results

	COL FOR		F U E L	T Y P E S				TABLE VAL
	0	1	2	3	4	5	SUMS	CALCs
COL - 4								
AVERAGE	0.144	0.369	0.112	0.374	0.074	0.029		
SUM	5.180	4.430	1.570	3.740	0.520	0.290	15.73	
SUM^2	2.716	5.646	0.687	3.357	0.130	0.013	12.5487	
SAMPLE (n)	36	12	14	10	7	10	89	
STD. DEV.	0.237	0.604	0.198	0.467	0.124	0.023		
SIGMA^	1.970	4.010	0.511	1.959	0.092	0.005	0.321	0.001667
BMULT,DF	0.028	0.083	0.071	0.100	0.143	0.100	1.025	83
DIFF,TV		-0.225	0.032	-0.230	0.070	0.115	0.329	3.033
			0.257	-0.005	0.295	0.340	0.998	
				-0.262	0.038	0.083		
					0.300	0.345		
						0.045		
COL - 5								
AVERAGE	0.138	0.225	0.159	0.143	1.375	0.019		
SUM	3.170	2.250	2.860	0.860	2.750	0.150	12.04	
SUM^2	1.669	1.071	3.947	0.610	7.399	0.004	14.7008	
SAMPLE (n)	23	10	18	6	2	8	67	
STD. DEV.	0.237	0.251	0.453	0.312	1.902	0.014		
SIGMA^	1.232	0.565	3.492	0.487	3.618	0.001	0.392	0.001667
BMULT,DF	0.043	0.100	0.056	0.167	0.500	0.125	1.408	61
DIFF,TV		-0.087	-0.021	-0.006	-1.237	0.119	0.552	3.059
			0.066	0.082	-1.150	0.206	1.690	
				0.016	-1.216	0.140		
					-1.232	0.125		
						1.356		

ADOT EMISSIONS STUDY - Average Differences and Bonferoni Results

	COL FOR		F U E L	T Y P E S				TABLE VAL
	0	1	2	3	4	5	SUMS	CALCs
COL - 6								
AVERAGE	0.043	0.050	0.018	0.013	0.166	0.022		
SUM	1.600	0.900	0.250	0.200	2.490	0.290	5.73	
SUM^2	0.374	0.189	0.013	0.011	1.652	0.014	2.2523	
SAMPLE (n)	37	18	14	15	15	13	112	
STD. DEV.	0.092	0.092	0.025	0.024	0.297	0.025		
SIGMA^	0.305	0.144	0.008	0.008	1.238	0.007	0.127	0.001667
BMULT,DF	0.027	0.056	0.071	0.067	0.067	0.077	0.854	106
DIFF,TV		-0.007	0.025	0.030	-0.123	0.021	0.108	3.006
			0.032	0.037	-0.116	0.028	0.326	
				0.005	-0.148	-0.004		
					-0.153	-0.009		
						0.144		
SUM COL								
AVERAGE	0.127	0.187	0.099	0.188	0.143	0.042		
SUM	21.650	13.260	8.940	9.990	7.440	2.720	64.00	
SUM^2	12.447	11.521	6.405	12.487	9.646	0.567	53.0724	
SAMPLE (n)	170	71	90	53	52	65	501	
STD.DEV.	0.239	0.359	0.249	0.452	0.410	0.084		
SIGMA^	9.690	9.045	5.517	10.603	8.582	0.453	0.298	0.001667
BMULT,DF	0.006	0.014	0.011	0.019	0.019	0.015	0.411	495
DIFF,TV		-0.059	0.028	-0.061	-0.016	0.086	0.122	2.940
			0.087	-0.002	0.044	0.145	0.360	
				-0.089	-0.044	0.057		
					0.045	0.147		
						0.101		

ADOT EMISSIONS STUDY - Average Differences and Bonferoni Results

	HCI FOR		F U E L	T Y P E S				TABLE VAL
	0	1	2	3	4	5	SUMS	CALCs
HCI - 1								
AVERAGE	45	36	32	106	69	72		
SUM	1121	533	546	424	1106	938	4668	
SUM^2	105443	39777	42784	46638	93870	131542	460054	
SAMPLE (n)	25	15	17	4	16	13	90	
STD. DEV.	48	39	40	24	34	73		
SIGMA^	55177	20838	25248	1694	17418	63862	47	0.001667
BMULT,DF	0.040	0.067	0.059	0.250	0.063	0.077	1.053	84
DIFF,TV		9.307	12.722	-61.160	-24.285	-27.314	49.337	3.032
			3.416	-70.467	-33.592	-36.621	149.591	
				-73.882	-37.007	-40.036		
					36.875	33.846		
						-3.029		
HCI -2								
AVERAGE	23	16	12	24	44	106		
SUM	668	204	224	282	399	1382	3159	
SUM^2	30108	3810	3338	10274	20147	169466	237143	
SAMPLE (n)	29	13	19	12	9	13	95	
STD.DEV.	23	7	6	18	18	43		
SIGMA^	14721	609	697	3647	2458	22549	22	0.001667
BMULT,DF	0.034	0.077	0.053	0.083	0.111	0.077	0.933	89
DIFF,TV		7.342	11.245	-0.466	-21.299	-83.273	20.909	3.026
			3.903	-7.808	-28.641	-90.615	63.273	
				-11.711	-32.544	-94.518		
					-20.833	-82.808		
						-61.974		
HCI - 3								
AVERAGE	57	79	31	26	56	50		
SUM	1149	707	468	255	560	701	3840	
SUM^2	117823	81079	37804	28299	77092	76087	418184	
SAMPLE (n)	20	9	15	10	10	14	78	
STD.DEV.	52	57	41	49	71	56		
SIGMA^	51813	25540	23202	21797	45732	40987	54	0.001667
BMULT,DF	0.050	0.111	0.067	0.100	0.100	0.071	0.999	72
DIFF,TV		-21.106	26.250	31.950	1.450	7.379	53.844	3.046
			47.356	53.056	22.556	28.484	164.008	
				5.700	-24.800	-18.871		
					-30.500	-24.571		
						5.929		

ADOT EMISSIONS STUDY - Average Differences and Bonferoni Results

	HCI FOR		F U E L	T Y P E S				TABLE VAL
	0	1	2	3	4	5	SUMS	CALCs
HCI - 4								
AVERAGE	41	25	28	28	185	475		
SUM	1485	433	450	311	1476	4753	8908	
SUM^2	177077	12511	16950	15237	486176	4110595	4818546	
SAMPLE (n)	36	17	16	11	8	10	98	
STD. DEV.	58	10	17	25	175	454		
SIGMA^	115821	1482	4294	6444	213854	1851494	154	0.001667
BMULT,DF	0.028	0.059	0.063	0.091	0.125	0.100	0.964	92
DIFF,TV		15.779	13.125	12.977	-143.250	-434.050	148.905	3.023
			-2.654	-2.802	-159.029	-449.829	450.091	
				-0.148	-156.375	-447.175		
					-156.227	-447.027		
						-290.800		
HCI - 5								
AVERAGE	98	46	46	87	113	189		
SUM	2257	509	917	521	225	1698	6127	
SUM^2	299111	27623	70557	67193	25925	346230	836639	
SAMPLE (n)	23	11	20	6	2	9	71	
STD.DEV.	59	20	39	66	25	57		
SIGMA^	77631	4070	28513	21953	613	25874	49	0.001667
BMULT,DF	0.043	0.091	0.050	0.167	0.500	0.111	1.387	65
DIFF,TV		51.858	52.280	11.297	-14.370	-90.536	68.534	3.054
			0.423	-40.561	-66.227	-142.394	209.315	
				-40.983	-66.650	-142.817		
					-25.667	-101.833		
						-76.167		

ADOT EMISSIONS STUDY - Average Differences and Bonferoni Results

	HCI FOR		F U E L	T Y P E S				TABLE VAL
	0	1	2	3	4	5	SUMS	CALCs
HCI - 6								
AVERAGE	20	9	7	15	71	132		
SUM	729	171	105	247	1356	2240	4848	
SUM^2	23315	1895	793	8291	284684	316304	635282	
SAMPLE (n)	37	20	16	17	19	17	126	
STD.DEV.	16	5	3	17	102	36		
SIGMA^	8952	433	104	4702	187908	21151	43	0.001667
BMULT,DF	0.027	0.050	0.063	0.059	0.053	0.059	0.787	120
DIFF,TV		11.153	13.140	5.173	-51.666	-112.062	33.952	2.990
			1.988	-5.979	-62.818	-123.215	101.516	
				-7.967	-64.806	-125.202		
					-56.839	-117.235		
						-60.396		
SUM HCI								
AVERAGE	44	30	26	34	80	154		
SUM	7409	2557	2710	2040	5122	11712	31550	
SUM^2	752877	166695	172226	175932	987894	5150224	7405848	
SAMPLE (n)	170	85	103	60	64	76	558	
STD.DEV.	50	33	31	43	96	211		
SIGMA^	429975	89774	100924	106572	577974	3345343	92	0.001667
BMULT,DF	0.006	0.012	0.010	0.017	0.016	0.013	0.382	552
DIFF,TV		13.500	17.272	9.582	-36.449	-110.523	35.025	2.940
			3.772	-3.918	-49.949	-124.023	102.974	
				-7.689	-53.721	-127.795		
					-46.031	-120.105		
						-74.074		

ADOT EMISSIONS STUDY - Average Differences and Bonferoni Results

	NOX FOR		F U E L	T Y P E S				TABLE VAL
	0	1	2	3	4	5	SUMS	CALC
NOX - 1								
AVERAGE	431	290	470	221	938	303		
SUM	10767	3474	6582	882	13129	2727	37561	
SUM^2	8228749	1892312	7329622	195940	15447965	1488321	34582909	
SAMPLE (n)	25	12	14	4	14	9	78	
STD. DEV.	387	284	571	22	491	288		
SIGMA^	3591617	886589	4235142	1459	3135776	662040	417	0.001667
BMULT,DF	0.040	0.083	0.071	0.250	0.071	0.111	1.120	72
DIFF,TV		141.180	-39.463	210.180	-507.106	127.680	466.940	3.046
			-180.643	69.000	-648.286	-13.500	1422.299	
				249.643	-467.643	167.143		
					-717.286	-82.500		
						634.786		
NOX - 2								
AVERAGE	329	187	756	470	577	109		
SUM	9541	1868	12855	4704	4042	1313	34323	
SUM^2	6108435	539326	14504815	3573570	4230214	149841	29106201	
SAMPLE (n)	29	10	17	10	7	12	85	
STD.DEV.	326	145	547	389	562	24		
SIGMA^	2969446	190384	4784166	1360808	1896248	6177	377	0.001667
BMULT,DF	0.034	0.100	0.059	0.100	0.143	0.083	1.019	79
DIFF,TV		142.200	-427.176	-141.400	-248.429	219.583	383.921	3.038
			-569.376	-283.600	-390.629	77.383	1166.288	
				285.776	178.748	646.760		
					-107.029	360.983		
						468.012		
NOX - 3								
AVERAGE	384	1003	562	533	401	427		
SUM	7672	8025	7302	4263	2805	5124	35191	
SUM^2	5162192	10758051	6358972	3130941	1252565	3796758	30459479	
SAMPLE (n)	20	8	13	8	7	12	68	
STD.DEV.	342	622	434	350	146	382		
SIGMA^	2219213	2707973	2257495	859295	128561	1608810	397	0.001667
BMULT,DF	0.050	0.125	0.077	0.125	0.143	0.083	1.098	62
DIFF,TV		-619.525	-178.092	-149.275	-17.114	-43.400	436.233	3.058
			441.433	470.250	602.411	576.125	1333.854	
				28.817	160.978	134.692		
					132.161	105.875		
						-26.286		

ADOT EMISSIONS STUDY - Average Differences and Bonferoni Results

	NOX FOR		F U E L	T Y P E S				TABLE VAL
	0	1	2	3	4	5	SUMS	CALC
NOX - 4								
AVERAGE	378	628	462	808	776	914		
SUM	13599	9415	6472	8082	5432	7313	50313	
SUM^2	6938919	7119663	4434838	8406480	5754860	7682433	40337193	
SAMPLE (n)	36	15	14	10	7	8	90	
STD.DEV.	227	294	333	456	507	377		
SIGMA^	1801897	1210181	1442925	1874608	1539628	997437	325	0.001667
BMULT,DF	0.028	0.067	0.071	0.100	0.143	0.125	1.033	84
DIFF,TV		-249.917	-84.536	-430.450	-398.250	-536.375	335.673	3.032
			165.381	-180.533	-148.333	-286.458	1017.761	
				-345.914	-313.714	-451.839		
					32.200	-105.925		
						-138.125		
NOX - 5								
AVERAGE	517	567	290	279	208	157		
SUM	11881	5667	5228	1671	415	1102	25964	
SUM^2	12746119	6508887	2832126	529077	87125	186186	22889520	
SAMPLE (n)	23	10	18	6	2	7	66	
STD.DEV.	548	605	278	113	32	46		
SIGMA^	6608808	3297398	1313682	63704	1013	12700	434	0.001667
BMULT,DF	0.043	0.100	0.056	0.167	0.500	0.143	1.420	60
DIFF,TV		-50.135	226.121	238.065	309.065	359.137	616.279	3.060
			276.256	288.200	359.200	409.271	1885.813	
				11.944	82.944	133.016		
					71.000	121.071		
						50.071		

ADOT EMISSIONS STUDY - Average Differences and Bonferoni Results

	NOX FOR		F U E L	T Y P E S				TABLE VAL
	0	1	2	3	4	5	SUMS	CALC
NOX - 6								
AVERAGE	220	298	236	331	527	202		
SUM	8151	5067	3299	4969	7901	2218	31605	
SUM^2	2655049	4392051	840545	2526623	6634497	488312	17537077	
SAMPLE (n)	37	17	14	15	15	11	109	
STD.DEV.	155	424	70	251	420	64		
SIGMA^	859406	2881787	63159	880559	2472777	41083	264	0.001667
BMULT,DF	0.027	0.059	0.071	0.067	0.067	0.091	0.874	103
DIFF,TV		-77.762	-15.346	-110.969	-306.436	18.661	230.933	3.010
			62.416	-33.208	-228.675	96.422	695.068	
				-95.624	-291.090	34.006		
					-195.467	129.630		
						325.097		
SUM NOX								
AVERAGE	362	466	464	464	649	336		
SUM	61611	33516	41738	24571	33724	19797	214957	
SUM^2	41839463	31210290	36300918	18362631	33407226	13791851	174912379	
SAMPLE (n)	170	72	90	53	52	59	496	
STD.DEV.	340	469	436	366	476	351		
SIGMA^	19510549	15608592	16944689	6971423	11535915	7149119	398	0.001667
BMULT,DF	0.006	0.014	0.011	0.019	0.019	0.017	0.415	490
DIFF,TV		-103.082	-101.338	-101.186	-286.121	26.875	165.104	2.940
			1.744	1.896	-183.038	129.958	485.405	
				0.152	-184.783	128.213		
					-184.935	128.061		
						312.996		

Appendix III.
Repair History

09/14/88

ADOT EQUIPMENT MANAGEMENT SYSTEM

FUEL TEST VEHICLES
FUEL SYSTEM (05) TASK CODES FROM REPAIR HISTORY
FEB.1988 THRU JUNE 1988

VEH. NO.	JULIAN DATE	CURR. METER	REPAIR ORDER #	REPR CAUSE	REPR CODE	RPR CODE DESCRIPTION	LABOR COST	PARTS COST
A361	88043	41,194	M93200	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,423
A361							500	1,423
A362	88054	31,061	X23927	C	05A	DIAGNOSIS/INSPECT	29	
	88054	31,061	X23927	C	05G	PRI. FUEL FILTER ELEMENT - R&R		14
	88147	33,282	X24605	C	05A	DIAGNOSIS/INSPECT	26	
	88147	33,282	X24605	C	05E	CHOKE CONTROL - MISC. REPAIR		8
	88147	33,282	X24605	C	05F	INLINE FUEL FILTER - R&R	7	
	88147	33,282	X24605	C	05P	FUEL PUMP- PRESSURE & FLOW CHECK	15	
	88147	33,282	X24605	C	05Z	MISC. FUEL SYSTEM REPAIRS	13	
A362							90	22
A364	88042	28,052	M93201	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,423
	88173	30,437	X20698	C	05A	DIAGNOSIS/INSPECT	11	
A364							511	1,423
A427	88042	23,096	M93220	Z	05*	COMMERCIAL FUEL SYSTEM	350	1,431
A427							350	1,431
A432	88042	30,172	M93221	Z	05*	COMMERCIAL FUEL SYSTEM	350	1,431
	88057	30,614	X23945	C	05A	DIAGNOSIS/INSPECT	41	
	88139	32,751	X23764	C	05F	INLINE FUEL FILTER - R&R	7	7
A432							398	1,438
A445	88134	31,473	X23413	C	05*	COMMERCIAL FUEL SYSTEM		19
A445								19
A450	88042	26,968	M93202	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,423
A450							500	1,423
A482	88042	15,619	M93222	Z	05*	COMMERCIAL FUEL SYSTEM	350	1,431
A482							350	1,431
BB73	88042	16,235	M93224	Z	05*	COMMERCIAL FUEL SYSTEM	200	732
BB73							200	732
BB75	88042	23,399	M93225	Z	05*	COMMERCIAL FUEL SYSTEM	200	132
BB75							200	132
BBB6	88042	28,450	M93226	Z	05*	COMMERCIAL FUEL SYSTEM	200	732

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VEH. NO.	JULIAN DATE	CURR. METER	REPAIR ORDER #	REPR CAUSE	REPR CODE	RPR CODE DESCRIPTION	LABOR COST	PARTS COST
BB85								
							200	132
BC32	88167	23,179	X20219	C	05A	DIAGNOSIS/INSPECT	7	2
	88167	23,179	X20219	C	05C	CARBURETOR, AND/OR GASKET - R&R	24	
	88167	23,179	X20219	C	05D	CARBURETOR - O/H	17	19
	88167	23,179	X20219	C	05G	PRI. FUEL FILTER ELEMENT - R&R		2
	88167	23,179	X20219	C	05Z	MISC. FUEL SYSTEM REPAIRS	27	
BC32								
							75	23
BC51	88042	20,946	M93203	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,709
	88133	24,540	X23550	C	05A	DIAGNOSIS/INSPECT	16	
	88133	24,540	X23550	C	05C	CARBURETOR, AND/OR GASKET - R&R	11	
	88133	24,540	X23550	C	05F	INLINE FUEL FILTER - R&R	11	2
	88133	24,540	X23550	C	05Z	MISC. FUEL SYSTEM REPAIRS	11	7
BC51								
							549	1,718
BC65	88182	73,522	X20372	C	05B	CARBURETOR, ADJUST PER MFG. PROCEDURE	11	
	88182	73,522	X20372	C	05C	CARBURETOR, AND/OR GASKET - R&R	15	
	88182	73,522	X20372	C	05K	FUEL LINE(S) - R&R	9	
	88182	73,522	X20372	C	05Z	MISC. FUEL SYSTEM REPAIRS	11	
BC65								
							46	
BD07	88036	42,988	M93042	Z	05*	COMMERCIAL FUEL SYSTEM	275	1,134
	88063	46,466	X23905	C	05Z	MISC. FUEL SYSTEM REPAIRS	23	39
BD07								
							298	1,173
BD12	88176	16,525	X20135	C	05*	COMMERCIAL FUEL SYSTEM		19
BD12								
								19
BD39	88119	14,983	X22760	C	05F	INLINE FUEL FILTER - R&R	7	8
BD39								
							7	8
BD42	88134	15,995	X23041	C	05F	INLINE FUEL FILTER - R&R	11	7
	88134	15,995	X23041	C	05Z	MISC. FUEL SYSTEM REPAIRS		3
BD42								
							11	10
BD51	88042	20,116	M93204	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,775
BD51								
							500	1,775
BD52	88042	21,210	M93205	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,775
	88153	26,238	X25053	C	05A	DIAGNOSIS/INSPECT	13	

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VEH. NO.	JULIAN DATE	CURR. METER	REPAIR ORDER #	REPR CAUSE	REPR CODE	RPR CODE DESCRIPTION	LABOR COST	PARTS COST
8052								
8056	88036	9,889	M93043	Z	05*	COMMERCIAL FUEL SYSTEM	513	1,775
8056							275	1,134
8061	88042	19,113	M93206	Z	05*	COMMERCIAL FUEL SYSTEM	275	1,134
8061							500	1,775
8064	88043	20,925	M93235	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,775
8064							200	932
8066	88042	19,306	M93236	Z	05*	COMMERCIAL FUEL SYSTEM	200	932
	88132	24,169	X23470	B	05A	DIAGNOSIS/INSPECT	200	932
8066							47	
8074	88042	17,702	M93237	Z	05*	COMMERCIAL FUEL SYSTEM	247	932
8074							200	932
8331	88169	68,178	X25278	C	05A	DIAGNOSIS/INSPECT	200	932
	88169	68,178	X25278	C	05B	CARBURETOR, ADJUST PER MFG. PROCEDURE	77	
	88169	68,178	X25278	C	05C	CARBURETOR, AND/OR GASKET - R&R	91	
	88169	68,178	X25278	C	05D	CARBURETOR - O/H	67	161
	88169	68,178	X25278	C	05F	INLINE FUEL FILTER - R&R	58	16
	88169	68,178	X25278	C	05K	FUEL LINE(S) - R&R		1
	88169	68,178	X25278	C	05T	GOVERNOR - O/H	13	1
	88169	68,178	X25278	C	05Z	MISC. FUEL SYSTEM REPAIRS		3
8331							65	3
8432	88134	70,465	X23867	B	05Z	MISC. FUEL SYSTEM REPAIRS	371	185
8432							4	3
8498	88116	85,160	X22383	B	05A	DIAGNOSIS/INSPECT	4	3
	88116	85,160	X22383	B	05B	CARBURETOR, ADJUST PER MFG. PROCEDURE	22	
	88116	85,160	X22383	B	05C	CARBURETOR, AND/OR GASKET - R&R	11	
	88116	85,160	X22383	B	05D	CARBURETOR - O/H	43	
8498								21
8504	88042	79,498	M93238	Z	05*	COMMERCIAL FUEL SYSTEM	76	21
8504							200	852
							200	852

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VEH. NO.	JULIAN DATE	CURR. METER	REPAIR ORDER #	REPR CAUSE	REPR CODE	RPR CODE DESCRIPTION	LABOR COST	PARTS COST
8516	88042	77,415	M93207	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,775
8516							500	1,775
8530	88042	92,513	M93239	Z	05*	COMMERCIAL FUEL SYSTEM	200	852
	88106	94,932	X21540	C	05A	DIAGNOSIS/INSPECT	6	
	88106	94,932	X21540	C	05B	CARBURETOR, ADJUST PER MFG. PROCEDURE	4	
8530							210	852
8545	88042	58,580	M93209	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,775
8545							500	1,775
8549	88042	55,904	M93240	Z	05*	COMMERCIAL FUEL SYSTEM	200	852
8549							200	852
8551	88090	47,080	X25569	C	05*	COMMERCIAL FUEL SYSTEM	20	1
8551							20	1
8641	88033	81,698	X22704	C	05A	DIAGNOSIS/INSPECT	16	
	88033	81,698	X22704	C	05Z	MISC. FUEL SYSTEM REPAIRS	14	
8641							30	
8719	88096	48,905	X25482	C	05F	INLINE FUEL FILTER - R&R	7	1
	88096	48,905	X25482	C	05K	FUEL LINE(S) - R&R	13	
8719							20	1
8721	88042	47,800	M93210	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,775
8721							500	1,775
8726	88102	33,149	X21055	C	05A	DIAGNOSIS/INSPECT	13	
8726							13	
8727	88068	57,484	X24758	C	05A	DIAGNOSIS/INSPECT	7	
	88068	57,484	X24758	C	05B	CARBURETOR, ADJUST PER MFG. PROCEDURE	7	
	88068	57,484	X24758	C	05Z	MISC. FUEL SYSTEM REPAIRS	5	
	88141	58,670	X23072	C	05F	INLINE FUEL FILTER - R&R	7	1
	88141	58,670	X23072	C	05R	FUEL PUMP- R&R	20	
	88141	58,670	X23072	C	05Z	MISC. FUEL SYSTEM REPAIRS	22	
8727							68	1
8735	88126	26,341	X22470	C	05F	INLINE FUEL FILTER - R&R	15	

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VEH. NO.	JULIAN DATE	CURR. METER	REPAIR ORDER #	REPR CAUSE	REPR CODE	RPR CODE DESCRIPTION	LABOR COST	PARTS COST
B735							15	
B738	88042	53,502	M93241	Z	05*	COMMERCIAL FUEL SYSTEM	200	732
B738							200	732
B745	88035	43,439	X22628	C	05A	DIAGNOSIS/INSPECT	28	
	88042	43,439	M93242	Z	05*	COMMERCIAL FUEL SYSTEM	200	732
	88132	44,592	X23049	C	05F	INLINE FUEL FILTER - R&R		
B745							228	732
B746	88042	64,746	M93211	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,775
	88097	65,534	X25303	C	05A	DIAGNOSIS/INSPECT	307	
	88097	65,534	X25303	C	05B	CARBURETOR, ADJUST PER MFG. PROCEDURE	139	
	88097	65,534	X25303	C	05C	CARBURETOR, AND/OR GASKET - R&R	80	474
	88097	65,534	X25303	C	05D	CARBURETOR - O/H	27	
	88097	65,534	X25303	C	05H	SEC. FUEL FILTER ELEMENT - R&R	9	
	88097	65,534	X25303	C	05Z	MISC. FUEL SYSTEM REPAIRS	256	85
	88141	61,551	X23154	M	05A	DIAGNOSIS/INSPECT	15	
	88141	61,551	X23154	M	05B	CARBURETOR, ADJUST PER MFG. PROCEDURE	34	
	88141	61,551	X23154	M	05C	CARBURETOR, AND/OR GASKET - R&R	23	
	88141	61,551	X23154	M	05D	CARBURETOR - O/H	75	3
	88141	61,551	X23154	M	05F	INLINE FUEL FILTER - R&R	9	4
	88153	66,133	X24907	C	05A	DIAGNOSIS/INSPECT	42	
	88153	66,133	X24907	C	05Z	MISC. FUEL SYSTEM REPAIRS	16	
	88173	66,259	X20324	C	05A	DIAGNOSIS/INSPECT	51	
B746							1,583	2,341
B747	88147	70,436	X24464	C	05A	DIAGNOSIS/INSPECT	15	
	88147	70,436	X24464	C	05E	CHOKE CONTROL - MISC. REPAIR	15	
B747							30	
B749	88042	36,606	M93243	Z	05*	COMMERCIAL FUEL SYSTEM	200	732
B749							200	732
B750	88042	55,533	M93212	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,775
B750							500	1,775
B759	88134	42,873	X21542	B	05B	CARBURETOR, ADJUST PER MFG. PROCEDURE	9	
	88134	42,873	X21542	B	05C	CARBURETOR, AND/OR GASKET - R&R	35	
	88134	42,873	X21542	B	05F	INLINE FUEL FILTER - R&R	7	1
	88134	42,873	X21542	B	05K	FUEL LINE(S) - R&R	11	
	88134	42,873	X21542	B	05R	FUEL PUMP- R&R	13	
	88134	42,873	X21542	B	05Z	MISC. FUEL SYSTEM REPAIRS		60

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VEH. NO.	JULIAN DATE	CURR. METER	REPAIR ORDER #	REPR CAUSE	REPR CODE	RPR CODE DESCRIPTION	LABOR COST	PARTS COST
8759							75	61
8767	88064	23,028	X23690	C	05B	CARBURETOR, ADJUST PER MFG. PROCEDURE	11	
	88064	23,028	X23690	C	05F	INLINE FUEL FILTER - R&R	11	1
8767							22	1
8768	88042	37,569	M93245	Z	05*	COMMERCIAL FUEL SYSTEM	200	732
8768							200	732
8773	88036	45,079	X22865	C	05A	DIAGNOSIS/INSPECT	11	
	88036	45,079	X22865	C	05G	PRI. FUEL FILTER ELEMENT - R&R		2
	88036	45,079	X22865	C	05R	FUEL PUMP- R&R	24	19
	88036	45,079	X22865	C	05Z	MISC. FUEL SYSTEM REPAIRS	13	
	88053	45,085	X23119	B	05A	DIAGNOSIS/INSPECT	9	
	88053	45,085	X23119	B	05Z	MISC. FUEL SYSTEM REPAIRS		4
8773							57	25
8793	88137	59,643	X22980	C	05F	INLINE FUEL FILTER - R&R	9	1
8793							9	1
8794	88070	49,633	X25283	C	05A	DIAGNOSIS/INSPECT	11	
	88070	49,633	X25283	C	05K	FUEL LINE(S) - R&R	15	1
	88070	49,633	X25283	C	05M	FUEL INJECTION PUMP - R&R		19
	88070	49,633	X25283	C	05R	FUEL PUMP- R&R	33	
	88134	45,678	X23109	C	05E	CHOKE CONTROL - MISC. REPAIR	4	
	88134	45,678	X23109	C	05F	INLINE FUEL FILTER - R&R	7	7
	88134	45,678	X23109	C	05Z	MISC. FUEL SYSTEM REPAIRS		4
8794							70	31
8796	88036	43,427	M93044	Z	05*	COMMERCIAL FUEL SYSTEM	275	956
8796							275	956
8823	88042	39,485	M93213	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,775
8823							500	1,775
8827	88042	30,015	M93247	Z	05*	COMMERCIAL FUEL SYSTEM	200	732
8827							200	732
8831	88042	32,421	M93214	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,775
	88078	33,836	X25484	B	05A	DIAGNOSIS/INSPECT	11	
	88099	34,101	X20804	B	05A	DIAGNOSIS/INSPECT	13	

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B831	88099	34,101	X20804	B	05Z	MISC. FUEL SYSTEM REPAIRS	9	
	88111	37,750	X22184	C	05A	DIAGNOSIS/INSPECT	20	
	88111	37,750	X22184	C	05Z	MISC. FUEL SYSTEM REPAIRS	28	
B831							581	1,775
B832	88042	36,096	M93215	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,775
B832							500	1,775
B835	88042	27,334	M93248	Z	05*	COMMERCIAL FUEL SYSTEM	200	732
B835							200	732
B906	88042	28,287	M93216	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,709
B906							500	1,709
B934	88042	35,960	M93217	A	05	FUEL SYSTEM		
	88042	35,960	M93217	Z	05*	COMMERCIAL FUEL SYSTEM	500	1,709
B934							500	1,709
							15,877	48,831

Appendix IV.
Vehicle and Fuel Type

VEHICLE TYPE

TYPE A	83 Chev S-10
TYPE B	84 Chev S-10
TYPE C	85 Chev Celebrity
TYPE D	85 Ford Ranger
TYPE E	80 Chev C-10
TYPE F	86 Chev S-10
TYPE G	79 Chev C-10

FUEL TYPE

TYPE I	Ethanol Blend
TYPE II	Methanol Blend
TYPE III	MTBE Blend
TYPE IV	Compressed Natural Gas
TYPE V	Propane