ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT

EPA-330/1-80-001

MOTOR VEHICLE TAMPERING SURVEY—1979

NATIONAL ENFORCEMENT INVESTIGATIONS CENTER

DENVER, COLORADO

May 1980

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT

EPA-330/1-80-001

MOTOR VEHICLE TAMPERING SURVEY-1979

May 1980

NATIONAL ENFORCEMENT INVESTIGATIONS CENTER - Denver
and
FIELD OPERATIONS AND SUPPORT DIVISION - Washington, D.C.

CONTENTS

Tables

Figure

I. INTRODUCTION

A significant part of the Nation's efforts to achieve clean air standards has been directed toward control of motor vehicle emissions. According to EPA emission estimates, motor vehicles account for nearly three-quarters of the total carbon monoxide, over one-third of the hydrocarbons, and one-third of the oxides of nitrogen emitted to the atmosphere. To reduce these emissions, automotive manufacturers have been required to install control devices on certain classes of new vehicles. Each manufacturer must certify that the control devices will enable its vehicles to meet established emission standards.

Congress has passed laws making it illegal for automobile dealers to disconnect or modify emission control devices. As of August 8, 1977, these laws were broadened to prohibit all automobile service or repair facilities, as well as dealers, from knowingly disconnecting or modifying a vehicle's emission control devices. These laws are contained in the 1977 Amendments to the Clean Air Act under Sections 203(a)(3)(A) and 203(a)(3)(B) [Appendix A]. The Field Operations and Support Division (FOSD) of the EPA is responsible for enforcement of these Sections which are generally referred to as the tampering provisions of the Act.

Prior to 1978, the Mobile Source Enforcement Division (MSED)--(FOSD's predecessor organization) had data showing that tampering was occurring. However, these data were inconclusive due to the variability in inspection procedures and inspectors. Therefore, in early 1978 MSED decided to conduct a tampering survey on a national level that used consistent procedures.

The objectives of the survey were to determine: (1) the rate of tampering on a national level, (2) the common types of tampering, and (3) if a relationship existed between tampering and idle emissions.

The survey was conducted from May through August 1978 under the direction of MSED, by an expert consultant with assistance provided by the National Enforcement Investigations Center (NEIC). Of the 1,953 vehicles inspected, 19% showed tampering, 48% showed arguable tampering,* 2% showed control device malfunctioning, and 31% showed no visible signs of tampering or malfunctioning.

To remain abreast of the tampering rates, MSED requested that the NEIC conduct a second nationwide tampering survey during the summer and fall of 1979. In addition to the objectives of the 1978 survey, the 1979 survey sought to (1) compare the tampering rates in areas with inspection and maintenance regulations (I/M areas) with those having no inspection and maintenance regulations (non-I/M areas), (2) check for sample bias that may have been introduced because participation was voluntary during the survey, and (3) compare the tampering rate for the two years.

---

* The term "arguably tampered" means potential, but not clear-cut tampering.

II. SUMMARY AND CONCLUSIONS

The National Enforcement Investigations Center of EPA's Office of Enforcement conducted the 1979 Motor Vehicle Tampering Survey at the request of the Technical Support Branch of EPA's Mobile Source Enforcement Division. During the period June through November 1979, 2,499 vehicles comprising model years 1973 through 1980 were inspected at eight sites. The sites, Tennessee, Delaware, Minnesota, Vermont, New Jersey, Texas, Virginia, and Arizona, were chosen to represent various geographic areas, duplicate some 1978 sites, and include several with existing or potential I/M regulations.

At each site 100 to 350 vehicles were inspected for tampering with emission control devices. In addition to control device inspection, idle hydrocarbon (HC) and carbon monoxide (CO) emissions were measured and fuel samples were taken from vehicles requiring unleaded gasoline.

All vehicles inspected in the survey were classified into one of four mutually exclusive categories: tampered (at least one control device removed or rendered inoperative), arguably tampered (potential, but not clear-cut tampering), malfunctioning, and OK (all control devices present and apparently operating properly). The results for all four categories for both the 1978 and 1979 surveys are shown below.

TAMPERING SUMMARY

Vehicle Status	1978 Survey (%)	1979 Survey (%)	Change (Percentage Points)
OK	30.7	33.3	+ 2.6
Tampered	18.9	18.0	- 0.9
Arguably Tampered	48.4	46.5	- 1.9
Malfunctioning	2.0	2.2	+ 0.2
Total Number Vehicles	1,953	2,499	

As can be seen, the rates changed only nominally. Averaging these yearly changes, the results of these two national surveys show that almost two-thirds of the vehicles originally equipped with emission control devices are operating without the full benefit of those devices.

Other results of the 1979 survey further substantiate the conclusion reached in the 1978 survey that the tampering rate increases with the age of the vehicle population. The projected tampering rate for the 1979 survey increases to 40% as the vehicle population reaches eight years old. However, this rate of increase is significantly lower than the 1978 projected tampering rate of 48% in eight years.

The results also show the rate of tampering is dependent upon geographic location and vehicle manufacturer. A consistent geographic pattern for tampering has not yet been developed, but a pattern showing vehicles made by foreign manufacturers with lower tampering rates has been developed.

A strong correlation between tampering (including arguable tampering) and high idle emissions has been demonstrated by data from both the 1978 and 1979 surveys. For the 1979 survey overall idle HC and CO emissions, respectively, were two to three and a half times higher for tampered vehicles than for OK vehicles.

The most prevalent form of tampering in the 1978 and 1979 surveys was EGR system tampering. Limiter cap removal remained the most prevalent type of arguable tampering for both survey years.

At 8.9%, the rate of fuel switching for the 1979 survey was more than twice the 4.2% detected during the 1978 survey. The large increase is due to the very high rate found at one site--Vermont. When the Vermont fuel switching data are excluded from the total, the rate falls to 5.3% for 1979. Whether a high rate of fuel switching is peculiar to Vermont or to rural areas in general cannot be said without including other rural areas in future surveys.

The rate of tampering for I/M areas was 6.5% less than the rate for non-I/M areas, but the rate of arguable tampering for I/M areas was 13% higher than the rate for non-I/M areas. Despite the higher arguable tampering rate, idle emission for I/M areas were lower than non-I/M areas. These results indicate that I/M areas should be included in future surveys to obtain additional data.

A comparison study between a voluntary and mandatory survey was made in Vermont to determine if the voluntary nature of the surveys causes a bias in the results. The analysis of this limited data from the survey showed a 48% increase in the tampering rate for the mandatory survey, indicating a potential negative bias on the tampering rate exists in voluntary inspections. However, before concluding a definite result, this comparison should be performed at additional sites.

To determine if drivers may be circumventing I/M regulations by disconnecting emission control devices after I/M inspections, an inspection station and a roadside check inspection were performed in an I/M area. The results showed no statistical differences between the tampering rates and arguable tampering rates for the inspection station and for the roadside check, indicating that circumvention of I/M regulations by disconnecting emission control devices is not a problem.

III. SURVEY DESIGN

The major design considerations for the survey were twofold:

1. A minimum of six locations would be investigated. These locations would represent geographic diversity with at least three of the 1978 locations being repeated.

2. A minimum of 300 vehicles would be the goal to be inspected at each location with at least 1,800 vehicles being inspected during the survey. Inspections would be limited to 1973 and newer light duty vehicles. The mix of vehicles which would come by the inspection sites was assumed equivalent to a random sample. No attempt would be made to approximate the national vehicle mix.

Each vehicle inspection included a thorough check of all emission control systems, recording basic data about the vehicle, measuring idle hydrocarbon (HC) and carbon monoxide (CO) emissions, and obtaining a fuel sample from vehicles requiring unleaded fuel. The inspection procedures required objectively determining and recording the condition of emission controls. A determination whether conditions constituted tampering was not made at the time of inspection. (A detailed explanation of the inspection data required and recording procedures is contained in Appendix B; a list of the equipment used is contained in Appendix C.)

A four member team was used at each site. A designated team leader was responsible for data and sample collection, and implementation of the above-mentioned procedures. The team leader was also responsible for explaining the objectives of the survey to the news media.

All gasoline samples were analyzed by the NEIC using the automated procedure described in Appendix D.

In arranging survey sites, the EPA Regional Office, the state air pollution control agency, the state police and the state department of motor vehicles, or the agency responsible for vehicle safety inspections were contacted. The following states and cities were contacted:

Maine	New Hampshire	Vermont
Delaware	Chattanooga, Tennessee	Illinois
Wisconsin	Minnesota	Texas
New Jersey	Virginia	Maryland
Phoenix, Arizona		

Vermont, Delaware, Chattanooga, Tennessee, Minnesota, Texas, New Jersey, and Phoenix, Arizona agreed to participate. Virginia was included with the aid of the State Air Pollution Control Board. The states that did not wish to participate cited such reasons as manpower shortages, possible unfavorable public reaction, and legal problems associated with roadside checks.

Of the eight sites that were surveyed, three were revisits from the 1978 survey (Wilmington, Delaware; Chattanooga, Tennessee; and Houston, Texas), two were I/M areas (New Jersey and Phoenix, Arizona), four were pre-I/M areas (areas where inspection/maintenance regulations are about to be implemented--Vermont, Delaware, Houston, Texas, and Richmond, Virginia), and one was an area of the country not visited in the 1978 survey (Minneapolis-St. Paul, Minnesota).

The three sites from the 1978 survey were selected so that changes in the tampering rate over the past year could be determined. The two I/M sites were selected to see if the tampering rate differed from non-I/M sites. The four pre-I/M sites were selected to build a data base for comparison with data to be collected from these same sites after I/M regulations go into effect.

Vermont was the site of two inspections during the survey. The first inspection was conducted as a voluntary inspection; the second was a followup mandatory inspection arranged in cooperation with the State Agency of Environmental Conservation. The followup inspection was conducted to determine if a significant difference in the tampering rate exists between a voluntary inspection and a mandatory inspection.

To ensure comparability with the 1978 survey the same expert consultant who supervised the 1978 survey conducted a two-day training course for inspectors at the NEIC and assisted at two sites during the 1979 survey. In addition, many of the inspectors who participated in the 1978 survey also participated in the 1979 survey.

IV. SITE DATA

This section lists the location, dates, inspectors, number of vehicles inspected, number of fuel samples analyzed, and the estimated refusal rate for each site. It also contains a description of the inspection sites and the procedures used to obtain vehicles for inspection.

A. Chattanooga, Tennessee - City-run safety lanes

Dates	June 11 to 15, 1979
Participants	Larry Walz - NEIC Ron Snyder - NEIC Steve Nemec - NEIC Tom Newman - NEIC Jim Caldwell - MSED
Samples	275 Vehicles
Fuel Samples	156 Analyzed
Refusal Rate	Estimated at less than 5%

Chattanooga has a city-wide annual safety inspection at one four-lane site. The tampering inspection was performed in front of an active lane to which 1973 and later model cars were directed by safety inspection personnel.

During the week of the survey a local truckers strike closed most of the city's gasoline stations. Consequently, vehicle flow through the safety lanes was very low and the goal of 300 vehicles was not met.

B. Wilmington, Delaware - State-run safety lanes

Dates	June 18 to 22, 1979
Participants	Larry Walz - NEIC Ron Snyder - NEIC Steve Nemec - NEIC Tom Newman - NEIC Paul Gesalman - MSED Jack Gockel - Private consultant

Samples	330 Vehicles
Fuel Samples	209 Analyzed
Refusal Rate	Daily range of 26 to 38%

Delaware has an annual safety inspection performed at four state-operated sites. The site chosen for the survey was the largest. It was located in a Wilmington suburb near the airport and was set up to do only safety inspections. The inspection team used a vacant lane outside the inspection building and cars were chosen randomly from those waiting in the other lanes. Because those volunteering for the inspection had to leave their place in line and then return to the line after the inspection, the refusal rate was higher than that experienced at the Chattanooga safety lanes.

C. Minneapolis-St. Paul, Minnesota - Roadside check

Dates	July 9 to 13, 1979
Participants	Larry Walz - NEIC John Schmuck - NEIC Tom Newman - NEIC Steven Nemec - NEIC Geri Hilden - NEIC Paul Gesalman - MSED
Samples	300 Vehicles
Fuel Samples	195 Analyzed
Refusal Rate	Estimated at 50%
Sites	Monday - Interstate Hwy I-94, 2 miles east of Rogers, Minnesota Tuesday - Weigh station in Elk River, Minnesota Wednesday - Forest Lakes - Northwest of Minneapolis Thursday - West of Minneapolis Friday - North of St. Paul

One State trooper was assigned to assist with the check. The trooper escorted the inspection team to the sites each morning and supplied the team with a steady flow of cars. The refusal rate was estimated by the trooper.

D. Vermont I - Roadside check

Dates	July 16 to 20, 1979
Participants	Larry Walz - NEIC Jon Dion - NEIC Tom Newman - NEIC John Schmuck - NEIC Paul Gesalman - MSED
Samples	304 Vehicles
Fuel Samples	171 Analyzed
Refusal Rate	Estimated at 40 to 70%
Sites	Monday - Along the roadside of Hwy 14 north of Barre, Vermont
	Tuesday - Parking lot on Hwy 7 north of Milton, Vermont
	Wednesday - Along the roadside of Hwy 117 north of Richmond, Vermont
	Thursday - Along the roadside of Hwy 114 east of Lyndonville, Vermont
	Friday - Along the roadside of Hwy 100B south of Middlesex, Vermont

A roadside check was conducted with the aid of the Vermont Department of Motor Vehicles. The Department inspectors performed a license/ safety check and sent those volunteering for an emissions check to the tampering inspection team. Although exact figures were not kept by the Department inspectors, the refusal rate for the emissions check was estimated to range from 40 to 70%.

E. New Jersey - State Safety Lanes and Roadside Check

Dates	August 20 to 24, 1979
Participants	Jack Gockel - Private Consultant Ron Snyder - NEIC Steve Nemec - NEIC Jim Caldwell - MSED Bob Chatham - New Jersey Department of Environmental Protection Dave West - New Jersey Depratment of Environmental Protection Mark Giallella - New Jersey Department of Environmental Protection

Samples	199 Vehicles -- Safety Lane
	119 Vehicles -- Roadside Check
	318 Total
Fuel Samples	193 Analyzed
Refusal Rate	Daily range of 16 to 20% at Safety Lanes and estimated at 20 to 25% Roadside Check
Sites	Monday and Tuesday - State Safety Lane, Lawrenceville, New Jersey
	Wednesday - State safety lane, Lawrenceville, New Jersey and Roadside at Alt. Rt. #1 and Darrah Lane, Lawrenceville, New Jersey
	Thursday - Alt. Rt. #1 and Meadow Rd., Lawrenceville, New Jersey
	Friday - State Safety Lane, Lawrenceville, New Jersey

New Jersey has an annual safety and emissions inspection performed at State-operated sites. The site chosen for the inspection was the Lawrenceville safety lanes near Trenton, New Jersey. Initially, the inspection team set up at the head of one lane but later moved to the end of the lanes where cars exiting from two lanes could be inspected. Drivers leaving the lanes after completing the State inspection were asked to participate.

Two roadside checks were conducted in the Lawrenceville area with the aid of a State Motor Vehicle Inspector. The inspector stopped vehicles along the highway and directed those drivers who agreed to have their vehicles checked to the inspection team. The roadside check refusal rate for the vehicle inspection was estimated at 20 to 25% by the NEIC inspectors.

F. Houston, Texas - Private garage inspection

Dates	August 27 to 31, 1979
Participants	Ron Snyder - NEIC
	Tom Newman - NEIC
	Jim Kellerstrass - NEIC
	Paul Gesalman - MSED

Samples	236 vehicles
Fuel Samples	138 Analyzed
Refusal Rate	Team 1 - Daily range of 0 to 2%; Team 2 - 0%
Sites	Team 1 - Monday-Friday - Turanos Gulf, 1002 Montrose, Houston, Texas
	Team 2 - Monday-Friday - Walker's Mobil, 13210 Memorial, Houston, Texas

The Texas Department of Public Safety would not agree to assist with a roadside inspection, however, they did agree to assist with a private garage inspection. The Department obtained permission to conduct the survey at the two busiest safety inspection garages and accompanied the tampering inspection teams. Two inspection teams of two inspectors each were sent to Houston so that the sites could be covered simultaneously. Ron Snyder was in charge of Team 1 and Paul Gesalman was in charge of Team 2.

G. Vermont II - Roadside Check

Dates	October 1 to 4, 1979	
Participants	Larry Walz	- NEIC
	Paul Gesalman	- MSED
	Roger Cram	- Vermont Department of Motor Vehicles
	Ted Wills	- Vermont Department of Motor Vehicles
	Charles Pierce	- Vermont Department of Motor Vehicles
	Paul Sambel	- Vermont Department of Motor Vehicles
	Ronald Macie	- Vermont Department of Motor Vehicles
	Harold Garabedian	- Vermont Department of Environmental Conservation
	Larry Miller	- Vermont Department of Environmental Conservation
Samples	312 Vehicles	
Fuel Samples	185 Analyzed	
Refusal Rate	0% - Mandatory Inspection	
Sites	Monday	- State Route 12 near Worchester, Vermont
	Tuesday	- Route 5 at Coventry, Vermont

Wednesday - Route 5 near Bradford, Vermont
Thursday - State Route 116 near Starksborough

A roadside check was conducted with the aid of the Vermont Department of Motor Vehicles and the Vermont Agency of Environmental Conservation. The Department of Motor Vehicles kept the inspection team supplied with a steady flow of vehicles. Participation was mandatory and all vehicles selected from the road traffic were inspected. The Department did not allow a long line to form at the inspection site, but instead directed traffic through when the inspection team had several vehicles waiting.

H. Richmond, Virginia - Private Garage Inspection

Dates	October 29 to November 3, 1979
Participants	Ron Snyder - NEIC Tom Newman - NEIC Steve Nemec - NEIC Jim Kellerstrass - NEIC
Samples	98 Vehicles
Fuel Samples	64 Analyzed
Refusal Rate	Estimated at 15%
Sites	Monday and Tuesday - Team 1 Sears Automotive Center, Cloverleaf Mall Team 2 - Penneys Automotive Center Cloverleaf Mall Wednesday, Thursday, and Saturday - Team 1 - Huguenot Exxon, Rt. 147, Midlothian Pike Team 2 - Buford Road Exxon, Buford Rd. and Midlothian Pike Friday - Teams 1 and 2 - City of Richmond garage

The Virginia Department of State Police declined to assist with a roadside check citing legal problems as the reason. They also declined to obtain permission from the owners of official inspection stations for the tampering inspection team to set up there. However, they did agree to identify the high volume inspection stations. Permission to conduct a voluntary tampering inspection was obtained from six of the nine high volume inspection station managers identified by the State Police.

Two inspection teams were sent to Richmond so that two sites could be covered simultaneously. Ron Snyder was in charge of Team 1 and Tom Newman Team 2.

Peak inspection flow was expected the final week of the month since inspection stickers run out the first of the next month. The actual flow, however, was much lower than predicted by the inspection station managers. At the request of the Virginia Air Pollution Control Board, the inspection teams located at the City of Richmond garage for one day. However, data gathered at this site were not included with the balance of the survey data because data from any one group such as municipal employees can frequently alter general results.

I. Phoenix, Arizona - State-run vehicular emissions inspection station

Dates	November 5 to 8, 1979
Participants	Ron Snyder - NEIC Tom Newman - NEIC Jim Kellerstrass - NEIC Paul Gesalman - MSED
Sample	328 Vehicles
Fuel Samples	180 Analyzed
Refusal Rate	Daily range of 20 to 32%

The State of Arizona has a semi-annual emission inspection performed at State-operated sites in Phoenix. The site chosen for the inspection was the M02 inspection station located at 8802 N. Black Canyon. This station was the most heavily used with a flow of 90 to 110 vehicles per hour.

The tampering inspection team set up at the end of the lanes and asked for volunteers. As requested by State officials, exhaust gas analyzers were not used. Instead idle emissions were obtained from the State inspection station analyzers. The NEIC inspectors observed the calibration of the State's analyzers.

V. SURVEY RESULTS

This section presents the basic aggregate results of the survey and the rate of tampering by vehicle age, site, and manufacturer. Computer printouts of the data used to produce the tables and the figure in this section are contained in Appendix E.

AGGREGATE RESULTS

The results for all vehicles inspected at all locations are summarized in Table 1 below.

Table 1
1979 AGGREGATE RESULTS

Vehicle Status	Percent	Number
OK	33.3	832
Tampered	18.0	450
Arguably Tampered	46.5	1,162
Malfunctioning	2.2	55
Totals	100	2,499

Because of the hierarchy of classifying vehicles, the above results must be viewed with caution. As the data for each vehicle were processed, the vehicle was classified into one of four categories: OK, tampered, arguably tampered, and malfunctioning. Since each vehicle inspected has various components, each of which could be tampered, the vehicle itself is classified by the worst state of any component in the vehicle. The hierarchy is: tampered, arguably tampered, malfunctioning, and OK. Thus, if any one component is tampered, the entire vehicle is considered tampered. If one component is "arguably tampered" and all the others are functioning properly, the entire vehicle is considered "arguably tampered". Thus an "OK" vehicle must have all observed components functioning properly.

For example, it would be incorrect to conclude that only 2.2% of the vehicles had malfunctioning emission control devices. Many more vehicles had malfunctioning control devices, but if at least one other control device were tampered or arguably tampered, the vehicle as a whole would have been classified in the tampered or arguably tampered state. Thus, as soon as an item like a missing limiter cap (arguably tampered) is noted, the vehicle cannot be classified as malfunctioning, no matter how many other control devices are malfunctioning.

A comparison of the aggregate results from the 1978 Motor Vehicle Tampering survey to the 1979 survey is presented in Table 2.

Table 2

COMPARISON OF 1978 AND 1979 AGGREGATE RESULTS

Vehicle Status	1978 (%)	1978 (%)	Change (Percentage Points)
OK	30.7	33.3	+ 2.6
Tampered	18.9	18.0	- 0.9
Arguably Tampered	48.4	46.5	- 1.9
Malfunctioning	2.0	2.2	+ 0.2

As can be seen the rates changed only nominally with the tampering rate down by 0.9%, and the arguably tampered rate down by 1.9%. These two increases account for most of the 2.6% increase in the OK rate.

The reasons for the redistribution of the above rates are not known. However, the elimination of limiter caps by manufacturers from some models may account for the decrease in the arguable tampering rate since limiter cap removal accounts for most cases of arguable tampering.

Taking these yearly changes into account, the results of these two national surveys still show that almost two-thirds of the vehicles originally equipped with emission control devices are operating without the full benefit of those devices. To better understand this problem, the balance of Section IV identifies those vehicles most likely operated without the full benefit of control devices and Section V analyzes the impact of control devices upon vehicle emissions and the effectiveness of regulations designed to maintain control device operation.

TAMPERING BY VEHICLE AGE

The data from Appendix E show that the tampering rate increases with the age of vehicles and correspondingly, the OK rate decreases with the age of the vehicles. The percentage change by year is given in Table 3.

Table 3

TAMPERING BY VEHICLE AGE

Age	Tampered (%)	OK (%)
0-1	5.5	76.0
1-2	13.8	47.2
2-3	14.9	29.7
3-4	19.0	22.5
4-5	21.7	16.5
5-6	27.4	7.5
6-7	35.6	6.4

In Figure 1 the data from Table 3 have been fit to a straight line to demonstrate the increase in tampering rate over the life of the vehicle

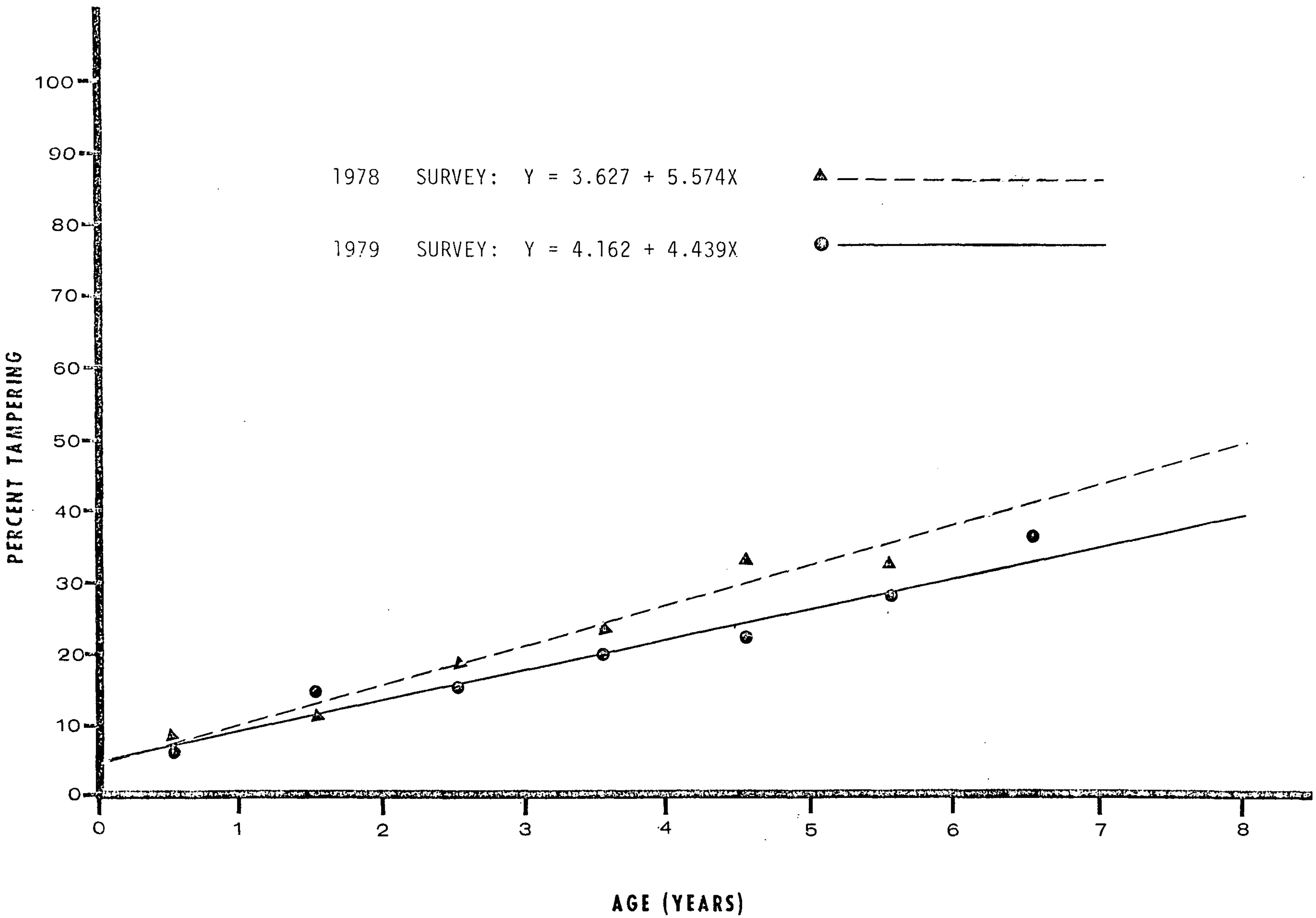


Figure 1.

PLOT OF TAMPERING VS. VEHICLE AGE

population. The figure also shows a straight line plot of the tampering rates vs. vehicle age from the 1978 survey. The 1979 data show that by the end of six years 31% of the vehicle population will be tampered with and after eight years 40% will be in the tampered classification. The 1978 motor vehicle tampering data show the rate of tampering after six years to be 37% and rate after eight years to be 48%.

TAMPERING RATES BY SITE

The tampering rates for each survey site are summarized in Table 4.

Table 4

TAMPERING BY SITE

Site	Number of Vehicles	Tampered %	Arguably Tampered %	Mal-Functioning %	OK%
Arizona[a]	328	15.2	62.2	0	22.6
Delaware	330	14.8	51.2	2.4	31.5
Minnesota	300	13.3	38.7	2.0	46.0
New Jersey[a]	318	11.0	51.6	2.8	34.6
Tennessee	274	22.6	46.7	0.4	30.3
Texas	236	22.5	50.4	1.7	25.4
Virginia	98	17.3	51.0	1.0	30.6
Vermont[b]	616	23.4	34.6	4.2	37.8

a I/M sites.

b Results of both surveys.

The results show a significant difference in the rate of tampering among the sites. To determine if the difference is due to random chance or if there is a difference in the tampering rate by site, a statistical test (Chi-Squared) was run on the data. The test indicated there are less than 5 chances in 1,000 that the differences are due to random chance.

Three of the 1978 sites were again surveyed in 1979. Table 5 lists the sites and compares the tampering rates between years. Of the three sites, Tennessee showed the least change with tampering and arguable tampering up by about 2%. Delaware and Texas showed a significant (8% or more) drop in the tampering and arguable tampering rates, respectively, while the arguable tampering and tampering rates remained essentially unchanged. There are no apparent reasons for the changes in Delaware and Texas.

TAMPERING RATES BY VEHICLE MANUFACTURER

To determine if a difference in the tampering rate exists among vehicle manufacturers, a breakout by manufacturer was examined. For purposes of this evaluation, all foreign manufacturers were grouped as one. The results are shown in Table 6.

A statistical analysis of the 1979 results in Table 6 indicates that there is a difference in the tampering rate among manufacturers. A Chi-Squared test shows less than 5 chances in 1,000 that the differences are due to random chance.

A comparison of the 1978 and 1979 incidence of tampering among manufacturers is also presented in Table 6. The table shows that all manufacturers except Chrysler experienced a decline in tampering from 1978 to 1979. The Table also shows that foreign made vehicles consistently have a significantly lower tampering rate.

Table 5

COMPARISON OF 1978 AND 1979 TAMPERING RATES

Site	Tampered (%)			Arguably Tampered (%)			OK (%)		
	1978	1979	Change (Percentage Pts)	1978	1979	Change (Percentage Pts)	1978	1979	Change (Percentage Pts)
Delaware (Wilmington)	22.8	14.8	- 8.0	51.1	51.2	+ 0.1	24.2	31.5	+ 7.3
Tennessee (Chattanooga)	20.4	22.6	+ 2.2	44.4	46.7	+ 2.3	34.3	30.3	- 4.0
Texas (Houston)	22.2	22.5	+ 0.3	59.7	50.4	- 9.3	16.7	25.4	+ 8.7

Table 6

COMPARISON OF 1978 AND 1979 TAMPERING BY VEHICLE MANUFACTURER

Manufacturer	Tampering (%)		Change
	1978	1979	(Percentage Points)
GMC	20.1	17.3	- 2.8
Ford	20.2	20.1	- 0.1
Chrysler	20.1	24.2	+ 4.1
AMC	31.3	27.5	- 3.8
Foreign	8.5	7.8	- 0.7

VI. DATA ANALYSIS

To gain further insight about the nature of tampering and its effects the following forms and groups of tampering were examined: the most common types of tampering, the effects of tampering on emissions, the rate of fuel-related tampering, the rate of tampering in I/M areas compared to non-I/M areas, the rate of tampering in a voluntary survey compared to a non-voluntary survey, and the rate of tampering at an inspection station compared to a roadside check for an I/M area.

TYPES OF TAMPERING

The rates of tampering and arguable tampering by type are given in Table 7 for both 1978 and 1979 surveys. The figures indicate that EGR system tampering was the most prevalent form of tampering and limiter cap removal the most prevalent form of arguable tampering for both the 1978 and 1979 surveys.

EFFECTS OF TAMPERING ON EMISSIONS

To determine the effect of tampering upon emissions, idle mean HC and CO emissions were calculated for each category of vehicles (OK, tampered, arguably tampered, and malfunctioning) for each model year. Table 8 results show that OK vehicles had lower idle HC and CO emissions than either tampered or arguably tampered vehicles for every model year with only one exception--idle CO emissions for the 1974 model year. The results also show that arguably tampered vehicles usually had slightly lower idle HC and CO emissions than tampered vehicles. These results further substantiate the 1978 motor vehicle tampering survey results which also showed lower idle HC and CO emissions for OK vehicles compared to tampered and arguably tampered vehicles.

Table 7

RATES OF TAMPERING AND ARGUABLE TAMPERING BY TYPE

Tampering	1978 Rate (%)	1979 Rate (%)	Change (Percentage Points)
EGR System	13.0	9.9	- 3.1
EGR Valve	11.9	4.5	- 7.4
EGR Sensor	5.3	7.0	+ 1.7
Air Pump Belt	5.7	4.6	- 1.1
Air Pump Control Valve	2.9	2.1	- 0.8
Air Pump	3.2	2.2	- 1.0
Catalytic Converter	1.2	1.0	- 0.2
Aspirators[a]	-	2.4	-
PCV	3.3	2.7	- 0.6
Vacuum Spark Retard	10.5	1.6	- 8.9
Idle Stop Solenoid	0.7	0.6	- 0.1
Heated Intake	0.8	1.1	+ 0.3
ECS Storage	2.6	2.4	- 0.2
Filler Neck Restrictor	3.4	3.8	- 0.4
<u>Arguable Tampering</u>			
Limiter Cap	65.0	61.9	- 3.1
ECS Tank Cap	0.3	0.6	+ 0.3
Tank Label	5.2	4.2	- 1.0
Dash Label	0.6	0.7	+ 0.1
Heated Intake	8.5	8.0	- 0.5

a Aspirators were not checked during the 1978 survey.

Table 8

1979 MEAN IDLE EMISSIONS OF TAMPERED AND OK VEHICLES

Model Year	Mean Idle HC (ppm)			Mean Idl Idle CO (%)		
	OK	Tampered	Arguably Tampered	OK	Tampered	Arguably Tampered
73	220	279	253	2.66	3.96	3.97
74	195	230	233	3.21	3.09	3.41
75	111	260	261	1.11	2.67	2.23
76	154	218	192	1.00	2.89	2.17
77	138	270	234	0.92	3.47	2.62
78	94	214	141	0.75	1.89	1.67
79	68	89	115	0.59	0.92	1.83
Average	103	239	205	0.85	2.94	2.55

It should be pointed out that the classification OK does not mean that the vehicle is necessarily operating properly; it simply means no tampering or arguable tampering was observed. For example, a spark plug or coil may not be performing satisfactorily resulting in a poorly operating and excessively polluting vehicle. This vehicle would still be classified OK for purposes of this survey.

FUEL RELATED TAMPERING

To determine the rate of fuel switching (vehicles requiring unleaded gas that are being fueled with gas containing greater than 0.05 grams/gallon of lead), fuel samples were taken from vehicles requiring unleaded gas. The percentages of fuel switching detected by inspection site is listed in Table 9.

The 8.9% average fuel switching rate for the 1979 survey was over double the 1978 survey rate which was 4.2%. Most of this increase is due to the very high rates found in the Vermont surveys. When the Vermont fuel switching rates are excluded from the total, the overall rate is 5.3%.

The reason for the high fuel switching rates in Vermont is not known. However, the data from Tables 4 and 9 show a tendency for the fuel switching rate to increase as the tampering rate increases. For example, Tennessee, Texas, and Vermont are the only three states with tampering rates above 20% and they are also the only states with fuel switching rates above 10%.

In the case of New Jersey and Arizona, the low rate of fuel switching may be due in part to the existence of I/M regulations in those states. Although I/M regulations do not address fuel switching directly, their existence may discourage fuel switching because fuel switching normally increase emissions. Another partial explanation of the low rate in New Jersey may be due to the prohibition on self service gasoline stations. The reason for the low rate in Delaware, however, is not apparent.

Table 9

FUEL SWITCHING PERCENTAGES BY STATE

State	% Fuel Switching
Tennessee	10.3
Delaware	1.9
Minnesota	7.2
Vermont I	15.2
New Jersey[a]	2.1
Texas	10.4
Vermont II	25.3
Virginia	6.0
Arizona[a]	2.2
Average for all	8.9

a I/M sites.

TAMPERING RATES FOR I/M AND NON-I/M AREAS

Inspection and maintenance (I/M) areas are those areas that require vehicles to meet specified hot idle emission standards. The 1979 motor vehicle tampering survey included two I/M areas (the State of New Jersey and the City of Phoenix, Arizona) to determine if a difference exists in the tampering rate between I/M and non-I/M areas.

Table 10 compares the rate of tampering in I/M and non-I/M areas.

Table 10

TAMPERING RATES IN I/M AND NON-I/M AREAS

Area	Total Vehicles	Tampering (%)	Arguably Tampered (%)[a]
I/M	645	13.2	56.9
Non-I/M	1,854	19.7	42.9

a This column shows the percent of limiter cap removal for vehicles equipped with limiter caps.

The Table shows a higher incidence of tampering in non-I/M areas which would be expected but it also shows a higher incidence of arguable tampering for I/M areas.

Higher arguable tampering rates in I/M areas are also expected because of the need for more frequent tune-ups and carburetor adjustments that vehicles require to pass emission tests. Although it is not necessary to remove limiter caps to adjust carburetors, some limiter cap removal does occur during adjustment. Therefore, more frequent carburetor adjustments would be expected to result in a higher rate of arguable tampering from limiter cap removal.

A statistical analysis (Chi-Squared Test) of the data in Table 10 indicates that the difference in tampering and arguable tampering rates between I/M and non-I/M areas is not due to random chance and reflects a real difference.

A comparison of idle emissions for all vehicles in I/M areas and non-I/M areas was made to see if the higher incidence of arguable tampering in I/M areas resulted in higher idle emissions for those areas. This comparison is shown in Table 11.

Table 11

IDLE HC AND CO EMISSIONS FOR ALL VEHICLES IN I/M AND NON-I/M AREAS

	Idle HC (ppm)		Idle CO (%)	
Model Year	I/M	Non-I/M	I/M	Non-I/M
73	198	286	2.92	4.23
74	282	207	3.03	3.44
75	133	236	1.58	2.38
76	142	204	1.49	2.21
77	135	238	1.66	2.45
78	94	138	0.97	1.33
79	58	80	0.55	0.87

Table 11 shows that both idle HC and CO emissions were lower in I/M areas for every model year with only one exception--idle HC for the 1974 model year. These results indicate that the higher arguably tampered rate for I/M areas did not adversely affect idle emissions for those areas, and tend to support the explanation suggested above.

For another evaluation of I/M and non-I/M vehicle emissions, the New Jersey I/M idle test criteria* was used to evaluate all vehicles.

* The New Jersey I/M Test has cutpoints of 500 ppm HC and 5.0% CO for model years 1973 and 1974; and 300 ppm HC and 3.0% CO for model years 1975 and later.

The results showed 22% of the I/M vehicles failed the test while 32% of the non-I/M vehicles failed; a statistical test (Chi-Squared) indicates the differences between the two groups did not occur by chance.

TAMPERING RATES IN A NON-VOLUNTARY SURVEY

Both the 1978 and 1979 motor vehicle tampering surveys were voluntary. However, because the inspection arrangements differed from site to site so did the refusal rate (see Section III). During the 1979 survey the refusal rate was documented. A comparison has been made between a voluntary and a mandatory survey to determine the effect of the refusal rate upon the tampering data. The comparison study was done in Vermont where the refusal rate during the voluntary inspection (Vermont I) ranged from 40 to 70%. Table 12 provides a breakdown of tampering rates between the voluntary and mandatory surveys conducted in Vermont.

Table 12

COMPARISON OF TAMPERING RATES FOR VOLUNTARY AND MANDATORY INSPECTIONS IN VERMONT

Type of Inspection	Tampered (%)	Arguably Tampered (%)	Malfunctioning (%)	OK (%)
Voluntary (Vt.I)	18.8	32.9	3.3	45.1
Mandatory (Vt. II)	27.9	36.2	5.1	30.8

The data in Table 12 show a 48% increase in the tampering rate and a 32% decrease in the OK rate for the compulsory survey over the voluntary survey. A statistical analysis (Chi-Squared Test) of the tampering rates indicate that the differences in the voluntary and mandatory surveys did not occur by chance. Hence, the voluntary nature of the survey appears to have a negative bias on the tampering rate. However, before concluding a definite result, this comparison should be performed at more sites.

TAMPERING RATES AT SAFETY LANES VS. ROADSIDE CHECK IN AN I/M AREA

A theoretical weakness in I/M regulations stems from the fact that the inspections are periodic--once or twice a year--and vehicle owners may attempt to circumvent them by connecting pollution control devices only for inspection purposes. The balance of the time the vehicles could be driven without benefit of the control devices under the presumption of obtaining better gas mileage or improved driveability. To determine if a tendency to circumvent I/M regulations exists, tampering inspections in an I/M area (New Jersey) were divided between the safety lanes where I/M inspections are performed and a roadside check where people would not be anticipating an inspection. The results of the tampering inspections are presented in Table 13.

Table 13

TAMPERING RATES AT SAFETY LANES VS. ROADSIDE

Place of Inspection	Total Vehicles	Tampered (%)	Arguably Tampered (%)	Malfunctioning (%)	OK (%)
Roadside	119	10.1	51.3	2.5	36.1
Safety Lanes	199	11.6	51.8	3.0	33.7

A statistical analysis (Chi-Squared Test) of the data presented in Table 13 indicates there is no difference between the tampering rates at the safety lanes and roadside checks for this I/M area.

APPENDICES

APPENDIX A

SECTION 203(a)(3)(A) AND 203(a)(3)(B) OF THE CLEAN AIR ACT

Section 203(a)(3): The following acts and the causing thereof are prohibited --

(A) for any person to remove or render inoperative any device or element of design installed on or in a motor vehicle or motor vehicle engine in compliance with regulations under this title prior to its sale and delivery to the ultimate purchaser, or for any manufacturer or dealer knowingly to remove or render inoperative any such device or element of design after such sale and delivery to the ultimate purchaser; or

(B) for any person engaged in the business of repairing, servicing, selling, leasing, or trading motor vehicles or motor vehicle engines, or who operates a fleet of motor vehicles, knowingly to remove or render inoperative any device or element of design installed on or in a motor vehicle or motor vehicle engine in compliance with regulations under this title following its sale and delivery to the ultimate purchaser.

APPENDIX B

DATA COLLECTION AND RECORDING PROCEDURES

DATA COLLECTION AND RECORDING PROCEDURES

The following data will be recorded on Form 1 [Figure A-1].

a. Date
b. Vehicle identifying survey number - Vehicles shall be numbered sequentially as they are inspected, and this number shall be followed by a site identifying letter.
c. Odometer mileage
d. Model year - obtained from underhood emission label.
e. Make
f. Model
g. Engine family/CID as recorded from the underhood emission label.
h. Carburetor - if the carburetor is original equipment a "P" is used to indicate that it was a production unit. If fuel injection is used then a "F" is recorded. If the carburetor has been replaced with a non-stock unit, then a "6" is recorded.

The following codes, will be used to record data on Form 2 [Figure A-2].

0 - Not equipped
1 - Item is functioning properly
2 - Electrical disconnect
3 - Vacuum disconnect
4 - Mechanical disconnect
5 - Incorrectly routed hose
6 - Non-stock equipment
7 - Missing item
8 - Misadjusted item
9 - Malfunctioning item

The codes are designed so that the inspector can objectively record the condition of the device, and he does not have to make an "on the spot" judgement with respect to tampering.

The following items will be inspected and the results recorded on Form 2.

a. Idle stop solenoid - This solenoid provides an idle stop for maintaining idle speeds to the higher speeds needed to minimize CO emissions. On some vehicles, it is used to close the throttle and thus prevent run-on when the engine ignition is turned off. On vehicles with air conditioning, it is used for increasing engine idle speed to compensate for a decrease in idle speed when the air conditioner is engaged.

   With the air conditioner on, (or in non-air conditioned vehicles) the solenoid should activate and contact the throttle linkage. With the air conditioner turned off, there should be a small gap between the solenoid stop and the throttle linkage.

b. Heated air intake - Provides warm air to the carburetor during cold engine operation.

c. Limiter caps - Plastic caps on idle mixture screws designed to limit carburetor adjustments.

d. Positive crankcase ventilation system - A typical configuration for a V-8 engine consists of the PCV valve connected to a valve cover and then connected to the carburetor by a vacuum line. The other part of the system has a fresh air tube running from the air cleaner to the other valve cover.

The codes are designed so that the inspector can objectively record the condition of the device, and he does not have to make an "on the spot" judgement with respect to tampering.

The following items will be inspected and the results recorded on Form 2.

a. Idle stop solenoid - This solenoid provides an idle stop for maintaining idle speeds to the higher speeds needed to minimize CO emissions. On some vehicles, it is used to close the throttle and thus prevent run-on when the engine ignition is turned off. On vehicles with air conditioning, it is used for increasing engine idle speed to compensate for a decrease in idle speed when the air conditioner is engaged.

   With the air conditioner on, (or in non-air conditioned vehicles) the solenoid should activate and contact the throttle linkage. With the air conditioner turned off, there should be a small gap between the solenoid stop and the throttle linkage.

b. Heated air intake - Provides warm air to the carburetor during cold engine operation.

c. Limiter caps - Plastic caps on idle mixture screws designed to limit carburetor adjustments.

d. Positive crankcase ventilation system - A typical configuration for a V-8 engine consists of the PCV valve connected to a valve cover and then connected to the carburetor by a vacuum line. The other part of the system has a fresh air tube running from the air cleaner to the other valve cover.

e. Evaporative control system - Controls vapors from the fuel tank and carburetor. Some systems have two lines, one from the fuel tank to the canister, and one from the canister to the carburetor or air cleaner to air purge the canister. Other systems have a third line, usually connected to the carburetor.

f. Tank cap - Part of the evaporative system, the tank cap seals with the filler neck to maintain a closed system.

g. Air injection system - Consists of an air pump driven by a crankshaft pulley which pumps air through a control valve and lines connected to the exhaust manifold.

h. Exhaust gas recirculation (EGR) system - The standard configuration consists of a vacuum line from the carburetor to a sensor (used to detect temperature to activiate the EGR valve), and another vacuum line from the sensor to the EGR valve. Some systems have multiple sensors and thus additional vacuum lines. The system directs a portion of the exhaust gases back into the cylinders for the control of oxides of nitrogen. This is one system where a functional check shall be performed.

Non-sealed EGR valve functional check;

1. The system shall be visually inspected to see if the valve, sensor(s) and hoses are in place.

2. If the system is intact the engine shall be revved and EGR valve stem movement checked visually or by touch.

3. If the stem fails to move, the vacuum line to the valve should be pulled off and checked for vacuum while the engine is revved. If vacuum occurs the valve is not functioning and the hose nipple on the valve should be checked for blockage. If vacuum does not occur the line should be checked for blockage. If it is not blocked a hand vacuum pump should be connected to the sensor outlet and the engine revved. If a vaccum is obtained the sensor is functional. If no vacuum is obtained, the line from the sensor to the carburetor should be checked for vacuum while the engine is revved. If this line has vacuum then the sensor is not functioning and should be checked for a plugged port.

4. Some systems have a vacuum delay valve. If the EGR valve is not functioning, the delay valve should be checked for plugs and that it is not installed backwards.

Sealed EGR valve functional check

1. The system shall be visually inspected.

2. The vacuum hose to the EGR valve should be disconnected. The hand vaccum pump should be connected to the valve and vacuum applied with the engine running. If idle speed drops with the application of vacuum, the valve is good. The vacuum pump should then be inserted into the line leading to the valve's vacuum source. The engine should be revved to determine if vacuum is available. If vacuum is not available, the sensors and hosing are checked using the same procedures described for the non-sealed unit.

i. Catalytic converter - Shall be visually checked for its presence and for high temperature discoloration.

j. Dash labels and tank labels - Shall be checked for presence.

k. Filler neck inlet restrictor (unleaded vehicles only) - Shall be checked for presence.

l. Vacuum spark retard - Shall be visually checked for proper connections.

m. Tampering source - When tampering is found the drivers should be asked if they know the origin of the tampering. The following codes shall be used to explain their answers:

The following codes shall be used:

K - Don't know
O - Owner or non-mechanic
D - Dealer
M - Mechanic

n. HC in ppm and CO in percent with the engine at curb idle.

The following is a listing of possible codes that can be observed with each item checked.

Idle stop solenoid

0 - Not equipped
1 - Functioning properly
2 - Electrical disconnect

7 - Missing item

9 - Malfunctioning - If the gap between the solenoid and the throttle plate is incorrect.

Heated intake

0 - Not equipped

1 - Functioning properly

3 - Vacuum disconnect - If the vacuum line to the vacuum override motor is missing or disconnected.

4 - Mechanical disconnect - When the stovepipe is missing, disconnected or deteriorated. Also when the air cleaner has been unsealed i.e., inverted air cleaner lid, oversized filter element, or holes punched into air cleaner.

6 - Non-stock equipment - Custom air cleaner.

7 - Missing item - Missing stovepipe hose

9 - Malfunctioning item - Problems with the vacuum override motor.

Limiter caps

0 - Not equipped

1 - Functioning properly

4 - Mechanical disconnect - Tabs broken or bent

7 - Missing item

PCV system

0 - Not equipped

1 - Functioning properly

3 - Vacuum disconnect - When the line between the PCV valve and the carburetor is disconnected

4 - Mechanical disconnect - When the fresh air tube between the valve cover and the air cleaner is disconnected or removed
6 - Non-Stock equipment - Any add-on device
7 - Missing item - When the entire system has been removed.

Evaporative storage canister

0 - Not equipped
1 - Functioning properly
3 - Vacuum disconnect
4 - Mechanical disconnect
5 - Incorrectly routed hose
7 - Missing item
9 - Malfunctioning item - When the purge line is connected to the air cleaner and the air cleaner is unsealed.

Tank cap

1 - Functioning properly
7 - Missing item
9 - Malfunctioning item - Tank cap not sealing properly

Air pump

0 - Not equipped
1 - Functioning properly
4 - Mechanical disconnect
7 - Missing item
9 - Malfunctioning

Air pump belt

0 - Not equipped
1 - Functioning properly
7 - Missing item
8 - Misadjusted item - Loose pump belt

Air pump control valve

0 - Not equipped
1 - Functioning properly
3 - Vacuum disconnect
4 - Mechanical disconnect
7 - Missing item
9 - Malfunctioning item

EGR control valve

0 - Not equipped
1 - Functioning properly
3 - Vacuum disconnect - Disconnect, removed or plugged vacuum line
7 - Missing item
9 - Malfunctioning item

EGR senser

0 - Not equipped
1 - Functioning properly
3 - Vacuum disconnect
5 - Incorrectly routed hose

7 - Missing item
9 - Malfunctioning item

Catalytic converter

0 - Not equipped
1 - Functioning properly
7 - Missing item
9 - Malfunctioning item - Discolored

Dash label and tank label

0 - Not equipped
1 - Functioning properly
7 - Missing item

Filler neck

0 - Not equipped
1 - Functioning properly
4 - Mechanical disconnect - Widened to fit a leaded filler nozzle
7 - Missing item

Vacuum spark advance

0 - Not equipped
1 - Functioning properly
2 - Electrical disconnect
3 - Vacuum disconnect - Any removed, plugged, or disconnected vacuum line
4 - Mechanical disconnect
5 - Incorrectly routed hose
7 - Missing item
9 - Malfunctioning item

All forms will be numbered and handled according to the NEIC document control procedures.

FIGURE A-1

EPA VEHICLE TAMPERING STUDY

DATE___________

I.D.	ODOMETER	M.Y.	MAKE	MODEL	CID	CARBURETOR MAKE/MODEL	ENGINE FAMILY

Date____________

I.D.	CARB SYSTEM				ECS		AIR SYSTEM			EGR		CATALYST SYSTEM						IDLE EMISSIONS	
	Idle Stop Solenoid	Heated Intake	Limiter Caps	PCV System	Storage	Tank Cap	Pump	Control Valves	Pump Belt	Control Valves	Sensors	Converter	Dash Label	Tank Label	Filler Neck	Vacuum Spark Retard	Tampering Source	CO %	HC ppm

0 - Not Equipped
1 - Functioning Properly
2 - Electrical Disconnect
3 - Vacuum Disconnect
4 - Mechanical Disconnect
5 - Incorrectly Routed Hose
6 - Non-stock Equipment
7 - Missing Item
8 - Misadjusted Item
9 - Malfunctioning Item

562 01

APPENDIX C

SURVEY EQUIPMENT

EQUIPMENT REQUIRED

2 each	HC-CO Gas Analyzers with sample lines, water trap and tailpipe probe
1 each	Calibration Gas ± 2% of listed concentration
	18% CO
	1560 ppm HC (Hexane equivalent)
	4% CO
	827 ppm HC (Hexane equivalent)
	1.6% CO
	320 ppm HC (Hexane equivalent)
3 each	Inspection Mirrors
2 each	Flashlight
2 each	Vacuum Pumps
2 each	Fender Covers
2 each	Fuel Sampling pumps with 3 ft hoses
350 each	Sample Bottles per site
2 each	Power Inverters for sites without power
1 pair	Battery Jumper Cables
2 each	Leaded nozzles
1 each	One Gallon Gasoline Can
1 each	50 ft Extension Cord
2 each	Screwdrivers and pliers
	Sufficient boxes, sample bottles, labels, parking and shipping labels, Chain-of-Custody sheets, and sample tags to label and ship up to 350 fuel samples per site.
	Sufficient data sheets to process up to 500 cars per site.

APPENDIX D

ANALYSIS FOR LEAD IN GASOLINE
(AUTOMATED METHOD)

LEAD IN GASOLINE
(Automated Method)

1. Scope and Application

 1.1 This method covers the determination of the total lead content of gasoline within the concentration range of 0.010 to 0.10 g of lead/U.S. gal. The method compensates for variations in gasoline composition and is independent of lead alkyl type.

2. Summary of Method

 2.1 The gasoline sample is diluted with methyl isobutyl ketone (MIBK) and the alkyl lead compounds are stabilized by reacting with iodine and a quarternary ammonium salt. A Technicon AutoAnalyzer is used to perform the diluting and the chemical reactions and feed the products to the atomic absorption spectrophotometer with an air-acetylene flame.

 2.2 The dilution of the gasoline with MIBK compensates for severe non-atomic absorption, scatter from unburned carbon containing species and matrix effects caused in part by the burning characteristics of gasoline.

 2.2 The in situ reaction of alkyl lead in gasoline with iodine eliminates the problem of variations in response due to different alkyl types by leveling the response of all alkyl lead compounds.

 2.4 The addition of the quarternary ammonium salt improves response and increases the stability of the alkyl iodide complex.

3. Sample Handling and Preservation

3.1 The reception of gasoline samples by laboratory personnel follows NEIC procedures for sample custody.

3.2 All samples are refrigerated until the analysis are performed. The analyses are performed within one week of receipt of the sample when possible.

3.3 The samples are brought to room temperature prior to analysis.

3.4 After the analysis has been completed (see section 8.4), samples are stored in the solvent storage area until written permission for disposal is obtained.

4. Apparatus

4.1 AutoAnalyzer system consisting of:

4.1.1 Sampler 20/hr cam, 30/hr cam

4.1.2 Proportioning pump

4.1.3 Lead in gas manifold

4.1.4 Disposable test tubes

4.1.5 Solvent displacement flasks

4.2 AAS Detector System consisting of:

4.2.1 Perkin-Elmer 403 atomic absorption spectophotometer

4.2.2 10" strip chart recorder

4.2.3 Lead hollow cathode lamp

5. Reagents

5.1 Aliquat 336/MIBK sulution (10% w/v): Dissolve and dilute 100 ml (88.0g) of Aliquot 336 (Aldrich Chemical Co., Milwaukee, Wisconsin) with MIBK (Burdick & Jackson Lab., Inc., Muskegon, Michigan) to one liter.

5.2 Aliquat 336/MIBK working solution (1% v/v): Dissolve and dilute 10 ml (8.8 g) of Aliquat 336 (reagent 5.1) with MIBK to one liter.

5.3 Iodine solution (3% w/v): Dissolve and dilute 3.0 g iodine crystals (ACS) with toluene (Burdick & Jackson Lab. Inc., Muskegon, Michigan) to 100 ml.

5.5 Methyl isobutyl ketone (MIBK) (4-methyl-2-pentanone) (Burdick & Jackson Lab. Inc., Muskegon, Michigan).

5.6 Certified unleaded gasoline (Phillips Chemical Co., Barger, Texas).

6. Standards

6.1 Calibration Standards: Select four concentration levels of alkyl lead in reference fuel ampoule standards (Bob Jungers, U.S. EPA, RTP, N.C.) (see under section 8.3) covering the range 0.010 g/gal to 0.100 g/gal.

6.2 Quality Control Standards: Select one NBS lead in reference fuel ampoule to be utilized as a QC check and one NBS lead in reference fuel at a concentration of approximately 2 g/gal to be utilized for spiking. Obtain two RTP blind check samples from the branch QA officer.

7. AAS Instrumental Conditions

7.1 Lead hollow cathode lamp

7.2 Wavelength: 283.3 nm

7.3 Slit: 4 (0.7mm)

7.4 Range: UV

7.5 Fuel: Acetylene (~20 ml/min at 8 psi)

7.6 Oxidant: Air (~65 ml/min at 31 psi)

7.7 Nebulizer: 5.2 ml/min

7.8 Chart speed: 10 in/hr

7.9 Recorder Full Scale: 0.50 abs

7.10 Digital Readout Button Selection

7.10.1 Absorbance units: in

7.10.2 Repeat mode: in

7.10.3 1 sec integration: in

7.10.4 Damping position: 1

8. Procedures

8.1 AAS startup

8.1.1 Turn the power on to the Perkin Elmer 403 AAS and the strip chart recorder.

8.1.2 Adjust the current to the lead hollow cathode lamp as as specified by the manufacturer.

8.1.3 Adjust all settings indicated in section 7.

8.1.4 Check the wavelength (283.3 nm) by maximizing the energy. This must be rechecked after step 8.1.6.

8.1.5 Check the alignment of the lamp maximizing the energy.

8.1.6 Allow one hour for the AAS to warm up (see section 8.2).

8.1.7 Recheck the instrument optimization.

8.1.8 Check the fuel and air flow rates and ignite the flame. Note: It may be necessary to push the sensor override button.

8.1.9 Check and adjust the aspiration rate to about 5.2 ml/min ($\pm$ 10%).

8.2 AutoAnalyzer Start Up (see figure 1).

8.2.1 Check all pump tubing and replace as necessary. All pump tubing should be replaced after one week of use. Place the platen on the pump.

8.2.2 Withdraw any water from the sample wash cup and fill with certified unleaded gasoline (reagent 5.6).

8.2.3 Fill the 2 liter MIBK dilution displacement Erlenmeyer flask (reagent 5.5) and the 0.5 liter Aliquat 336/MIBK 1% V/V reagent 5.2) displacement flask and place the rubber stopper glass tubing assemblies in their flask.

8.2.4 Fill a 2-liter Erlenmeyer flask with distilled water. The water will be used to displace the solvents. Therefore, place the appropriate lines in this flask.

8.2.5 Fill the final debubbler reverse displacement 2-liter Erlenmeyer flask with distilled water and place the rubber stopper glass tubing assembly in the flask.

8.2.6 Place the appropriate lines for the iodine reagent (reagent 5.4) and the wash solution (reagent 5.6) in their respective bottles.

8.2.7 Start the pump and connect the aspiration line from the manifold to the AAS.

8.2.8 Some initial check to assure that the reagents are being added are:

a. A good uniform bubble pattern.
b. Yellow color evident due to iodine in the system.
c. No surging in any tubing.

8.3 Calibration

Note: As a means to increase the sample analysis rate, utilize a 30/hr sample rate with a calibration curve from 0.01 to 0.06 g/gal. Any sample resulting in a value $\geq$ 0.05 g/gal should be set aside and analyzed later with a sample rate of 20/hr and a calibrating curve for 0.01 to 0.10 g/gal.

8.3.1 Turn the chart drive on and obtain a steady baseline.

8.3.2 Break the RTP Calibration Standard, NBS check standard, and the RTP blind samples ampoules and pour them into individually labeled telfon lined screw cap test tubes and place them in the sample tray.

8.3.3 Start the sampler and run the above standards (Note: first check the sample probe positioning with an empty test tube).

8.3.4 Check the linearity of calibration standards response and slope by running a least squares fit. Check these results against previously obtained results. They should agree within 10%.

8.3.5 Calculate the found NBS value. It should agree within 10% of the true value.

8.3.6 If the above is in control then start the sample analysis.

8.4 Sample Analysis

8.4.1 To minimize gasoline vapor in the laboratory load the sample tray about 5-10 test tubes ahead of the sampler. Write the sample number on the test tube and maintain the AAS work sheet.

8.4.2 Record the sample number on the strip chart corresponding to the appropriate peak.

8.4.3 Every ten samples run the high calibration standard and a previously analyzed sample (duplicate). Also let the sampler skip to check the baseline.

8.4.4 After an acceptable peak (within the calibration range) is obtained, pour the excess sample from the test tube into the waste gasoline can.

8.4.5 Any sample resulting a peak greater than 0.05 g/gal will be run in duplicate and spiked.

8.5 Shut Down

8.5.1 Replace the solvent displacement flask with flasks filled with distilled water. Also place all other lines in a beaker of distilled water. Rinse the system with distilled water for 15 minutes.

8.5.2 Withdraw the gasoline from the wash cup and fill with water.

8.5.3 Dispose of all solvent waste in waste glass bottles.

8.5.4 Turn the AAS off after extinguishing the flame. Also turn the recorder and pump off. Remove the platen and release the pump tubing.

8.5.5 Shut the acetylene off at the tank and bleed the line.

9. Calculations

9.1 Run a least squares fit or plot of the peak height vs. concentration represented by the working standards and obtain the concentration of the samples. Record the values on the AAS work sheet.

10. Quality Control

10.1 Precision

10.1.1 All duplicate results should be considered suspect if they differ by more than 0.005 g/gal.

10.2 Accuracy

10.2.1 All NBS standard found values should agree within 10% of the true value.

10.2.2 All RPT blind check standards should be reported to the Q.A. officer and the found values should agree within 10% of the true value.

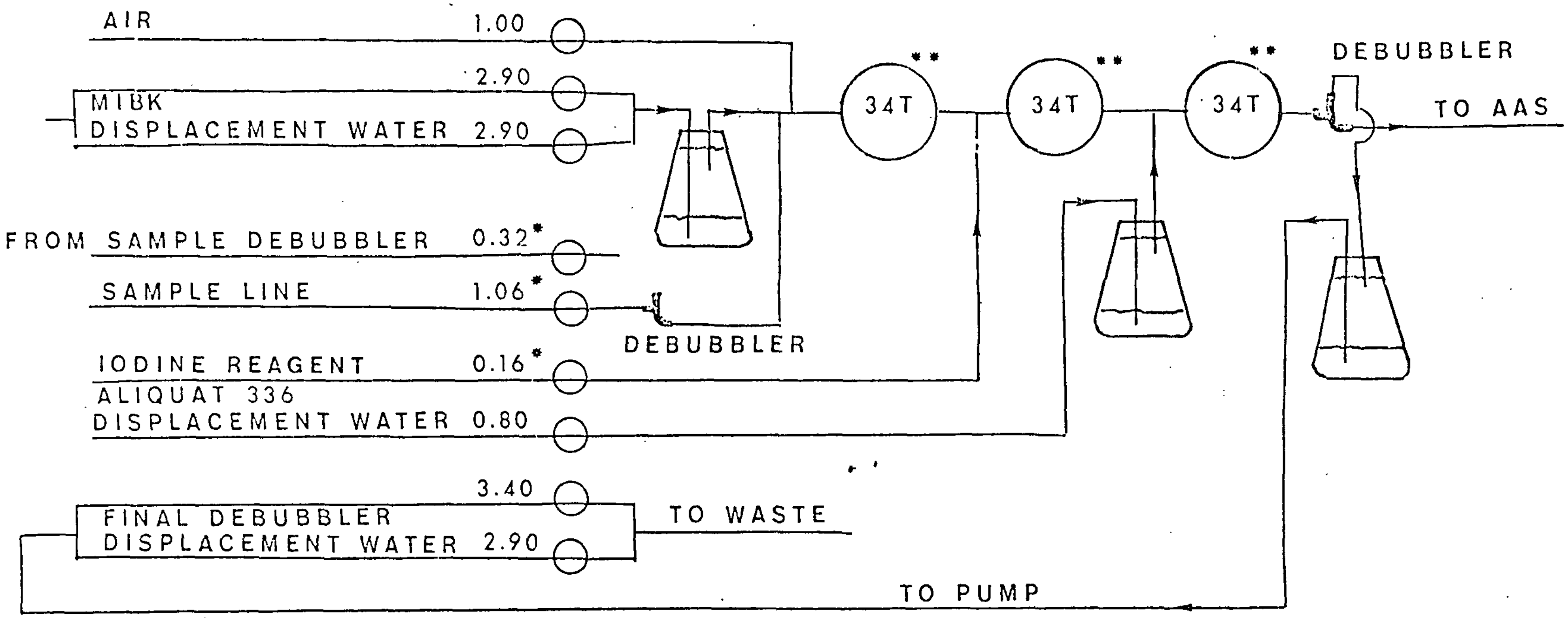
10.2.3 All spikes should agree within 10% of the known addition.

11. Past Quality Control Data

11.1 Duplicate analysis resulted in average difference of 0.003 g/gal with a standard derivation of 0.002 g/gal.

11.2 Replicate analysis (>5) of samples at concentrations of 0.010, 0.048, and 0.085 g/gal resulted in percent relative standard deviations of 4.2% 3.5%, and 3.3%, respectively.

11.3 Analysis of known concentrations of lead in reference fuel has resulted in found values deviating from the true value by 1.7% to 4.8%.



* *SOLVENTFLEX TUBING*

** #157-0225

FIGURE 1

FLOW DIAGRAM

APPENDIX E

COMPUTER PRINTOUTS OF TAMPERING DATA

The following computer printout pages contain the data used in the tables of this report. The tables and the corresponding printout pages that the tables are based on are listed below.

Table	Printout Page Number
1	1
2	1
3	1-3
4	4
5	4
6	5
7	6-23
8	2-3
9*	
10	24-25, 34, 35
11	26-29
12	30-31
13	32-33

*The data for Table 9 were taken from laboratory reports.

FILE [illegible] (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *

STATUS VEHICLE TAMPER STATUS BY MYR

* *

STATUS	MYR: COUNT / ROW PCT / COL PCT / TOT PCT	73.	74.	75.	76.	77.	78.	79.	80.	ROW TOTAL
0.		16	18	44	84	142	237	282	9	832
OK		1.9	2.2	5.3	10.1	17.1	28.5	33.9	1.1	33.3
		6.4	7.4	16.2	22.5	29.8	47.2	76.0	75.0	
		0.6	0.7	1.8	3.4	5.7	9.5	11.3	0.4	
30.		89	67	61	72	71	69	19	2	450
TAMPERED		19.8	14.9	13.6	16.0	15.8	15.3	4.2	0.4	18.0
		35.5	27.7	22.5	19.3	14.9	13.7	5.1	16.7	
		3.6	2.7	2.4	2.9	2.8	2.8	0.8	0.1	
31.		139	154	158	213	249	189	59	1	1162
[illegible]		12.0	13.3	13.6	18.3	21.4	16.3	5.1	0.1	46.5
		55.4	63.6	58.3	57.0	52.3	37.6	15.9	8.3	
		5.6	6.2	6.3	8.5	10.0	7.6	2.4	0.0	
3[illegible].		7	3	8	5	14	7	11	0	55
[illegible]ALECTED		12.7	5.5	14.5	9.1	25.5	12.7	20.0	0.0	2.2
		2.8	1.2	3.0	1.3	2.9	1.4	3.0	0.0	
		0.3	0.1	0.3	0.2	0.6	0.3	0.4	0.0	
COLUMN		251	242	271	374	476	502	371	12	2499
TOTAL		10.0	9.7	10.8	15.0	19.0	20.1	14.8	0.5	100.0

CHI SQUARE = 614.94067 WITH 21 DEGREES OF FREEDOM SIGNIFICANCE = 0.0
CRAMER'S V = 0.25640
CONTINGENCY COEFFICIENT = 0.44439
LAMBDA (ASYMMETRIC) = 0.20868 WITH STATUS DEPENDENT. = 0.06610 WITH MYR DEPENDENT.
LAMBDA (SYMMETRIC) = 0.12328
UNCERTAINTY COEFFICIENT (ASYMMETRIC) = 0.11507 WITH STATUS DEPENDENT. = 0.06651 WITH MYR DEPENDENT.
UNCERTAINTY COEFFICIENT (SYMMETRIC) = 0.08429
KENDALL'S TAU B = -0.30279 SIGNIFICANCE = 0.0000
KENDALL'S TAU C = -0.29737 SIGNIFICANCE = 0.0000
GAMMA = [illegible]
SOMERS'S D (ASYMMETRIC) = -0.26311 WITH STATUS DEPENDENT. = -0.34847 WITH MYR DEPENDENT.
SOMERS'S D (SYMMETRIC) = -0.29983
ETA = 0.47527 WITH STATUS DEPENDENT. = 0.45166 WITH MYR DEPENDENT.
PEARSON'S R = -0.31112 SIGNIFICANCE = 0.0000

NUMBER OF MISSING OBSERVATIONS = 1

TEST OF IMJOPRG 1   03/06/80

FILE NONAME (CREATION DATE = 03/06/80)

- - - - - - - - - - - - - - - - - - D E S C R I P T I O N   O F   S U B P O P U L A T I O N S - - - - - - - - - - - - - - - - - -

CRITERION VARIABLE IHC IDLE HC
BROKEN DOWN BY STATUS VEHICLE TAMPER STATUS
BY YR

VARIABLE	CODE	VALUE LABEL	SUM	MEAN	STD DEV	VARIANCE	N
FOR ENTIRE POPULATION			437235.0000	175.5964	238.5479	56905.1110	(2490)
STATUS	0.	OK	85762.0000	103.3277	162.6264	26447.3376	(830)
YR	73.		3525.0000	220.3125	238.7919	57021.5625	(16)
YR	74.		3507.0000	194.8333	234.1353	54819.3235	(18)
YR	75.		4895.0000	111.2500	132.0418	17435.0291	(44)
YR	76.		12925.0000	153.8690	231.6499	53661.6573	(84)
YR	77.		19390.0000	137.5177	191.9092	36829.1515	(141)
YR	78.		22240.0000	94.2373	137.2994	18851.1179	(236)
YR	79.		19155.0000	67.9255	121.4856	14758.7596	(282)
YR	80.		125.0000	13.8889	22.0479	486.1111	(9)
STATUS	30.	TAMPERED	106690.0000	238.6801	266.1675	70845.1149	(447)
YR	73.		24790.0000	278.5393	283.7545	80516.5922	(89)
YR	74.		15210.0000	230.4545	279.4909	78115.1748	(66)
YR	75.		15580.0000	259.6667	337.9962	114241.4124	(60)
YR	76.		15500.0000	218.3099	189.7817	36017.1026	(71)
YR	77.		19160.0000	** 269.8592	248.1920	61599.2656	(71)
YR	78.		14755.0000	213.8406	265.5739	70529.5183	(69)
YR	79.		1695.0000	89.2105	108.7334	11822.9532	(19)
YR	80.		0.0	0.0	0.0	0.0	(2)
STATUS	31.	ARGUABLE	237033.0000	204.6917	262.1067	68699.8968	(1158)
YR	73.		34885.0000	252.7899	279.3358	78028.4738	(138)
YR	74.		35908.0000	233.1688	310.7445	96562.1412	(154)
YR	75.		33863.0000	215.6879	293.6549	86233.1776	(157)
YR	76.		40992.0000	192.4507	253.2309	64125.8714	(213)
YR	77.		58110.0000	234.3145	272.8655	74455.6011	(248)
YR	78.		26505.0000	140.9840	157.9623	24952.1013	(188)
YR	79.		6770.0000	114.7458	182.1008	33160.7101	(59)
YR	80.		0.0	0.0	0.0	0.0	(1)
STATUS	33.	MALFUNCTN	7750.0000	140.9091	164.9385	27204.7138	(55)
YR	73.		1800.0000	257.1429	196.6989	38690.4762	(7)
YR	74.		600.0000	200.0000	259.8076	67500.0000	(3)
YR	75.		1270.0000	158.7500	119.6946	14326.7857	(8)
YR	76.		700.0000	140.0000	89.4427	8000.0000	(5)
YR	77.		2450.0000	175.0000	221.5244	49073.0769	(14)
YR	78.		620.0000	88.5714	79.0419	6247.6190	(7)
YR	79.		310.0000	28.1818	33.7100	1136.3636	(11)

[illegible] (CREATION DATE = 03/06/80)

\- - - - - - - - - - - - - - - - - D E S C R I P T I O N O F S U B P O P U L A T I O N S - - - - - - - - - - - - - - - - -

[illegible] VARIABLE ICO IDLE CO
[illegible] BY STATUS VEHICLE TAMPER STATUS
BY YR

\- -

[illegible]	CODE	VALUE LABEL	SUM	MEAN	STD DEV	VARIANCE	N
[illegible]			5072.0196	2.0378	2.6593	7.0719	(2489)
[illegible]	0.	OK	706.9199	0.8517	1.7568	3.0865	(830)
YR	73.		42.6000	2.6625	3.3486	11.2132	(16)
YR	74.		57.7000	3.2056	3.4760	12.0829	(18)
YR	75.		48.8000	1.1091	1.9135	3.6613	(44)
YR	76.		84.3500	1.0042	1.8373	3.3756	(84)
YR	77.		129.7000	0.9199	1.6908	2.8587	(141)
YR	78.		177.4000	0.7517	1.6249	2.6404	(236)
YR	79.		166.2700	0.5896	1.3875	1.9252	(282)
YR	80.		0.1000	0.0111	0.0333	0.0011	(9)
[illegible]	30.	TAMPERED	1310.3999	2.9447	2.9891	8.9349	(445)
YR	73.		352.3000	3.9584	3.0921	9.5611	(89)
YR	74.		204.1000	3.0924	2.9312	8.5918	(66)
YR	75.		154.8000	2.6690	2.8086	7.8885	(58)
YR	76.		205.0000	2.8873	2.8338	8.0306	(71)
YR	77.		246.2000	3.4676	3.3575	11.2731	(71)
YR	78.		130.5000	1.8913	2.4400	5.9537	(69)
YR	79.		17.5000	0.9211	2.0112	4.0451	(19)
YR	80.		0.0	0.0	0.0	0.0	(2)
[illegible]	31.	ARGUABLE	2960.6998	2.5545	2.7710	7.6785	(1159)
YR	73.		547.4000	3.9667	2.8076	7.8825	(138)
YR	74.		525.1000	3.4097	2.8526	8.1371	(154)
YR	75.		350.5000	2.2325	2.6126	6.8259	(157)
YR	76.		462.4000	2.1709	2.5217	6.3591	(213)
YR	77.		652.5000	2.6205	2.9832	8.8995	(249)
YR	78.		314.7000	1.6739	2.1812	4.7577	(188)
YR	79.		108.1000	1.8322	2.7463	7.5422	(59)
YR	80.		0.0	0.0	0.0	0.0	(1)
[illegible]	33.	FALF CIND	94.0000	1.7091	2.4663	6.0827	(55)
YR	73.		17.8000	2.5429	2.4724	6.1129	(7)
YR	74.		12.1000	4.0333	5.3482	28.6033	(3)
YR	75.		21.3000	2.6625	3.0128	9.0770	(8)
YR	76.		3.6000	0.7200	1.3918	1.9370	(5)
YR	77.		29.7000	2.1214	2.6030	6.7757	(14)
YR	78.		3.7000	0.5286	0.9123	0.8324	(7)
YR	79.		5.8000	0.5273	0.9737	0.9482	(11)

E-4

FILE NONAME (CREATION DATE = 03/05/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * *
STATUS VEHICLE TAMPER STATUS BY STATE
* PAGE 1 OF 1

STATUS	STATE: COUNT / ROW PCT / COL PCT / TOT PCT	AZ	DE	MA	NJ	TN	TX	VA	VT	ROW TOTAL
OK	0.	74	104	138	110	83	60	30	233	832
		8.9	12.5	16.6	13.2	10.0	7.2	3.6	28.0	33.3
		22.6	31.5	46.0	34.6	30.3	25.4	30.6	37.8	
		3.0	4.2	5.5	4.4	3.3	2.4	1.2	9.3	
TAMPERED	30.	50	49	40	35	62	53	17	144	450
		11.1	10.9	8.9	7.8	13.8	11.8	3.8	32.0	18.0
		15.2	14.8	13.3	11.0	22.6	22.5	17.3	23.4	
		2.0	2.0	1.6	1.4	2.5	2.1	0.7	5.8	
ARGUABLE	31.	204	169	116	164	128	119	50	213	1163
		17.5	14.5	10.0	14.1	11.0	10.2	4.3	18.3	46.5
		62.2	51.2	38.7	51.6	46.7	50.4	51.0	34.6	
		8.2	6.8	4.6	6.6	5.1	4.8	2.0	8.5	
[illegible]	33.	0	8	6	9	1	4	1	26	55
		0.0	14.5	10.9	16.4	1.8	7.3	1.8	47.3	2.2
		0.0	2.4	2.0	2.8	0.4	1.7	1.0	4.2	
		0.0	0.3	0.2	0.4	0.0	0.2	0.0	1.0	
	COLUMN	328	330	300	318	274	236	98	616	2500
	TOTAL	13.1	13.2	12.0	12.7	11.0	9.4	3.9	24.6	100.0

CHI SQUARE = 135.91563 WITH 21 DEGREES OF FREEDOM SIGNIFICANCE = 0.0000
CRAMER'S V = 0.13462
CONTINGENCY COEFFICIENT = 0.22708
LAMBDA (ASYMMETRIC) = 0.03141 WITH STATUS DEPENDENT. = 0.0 WITH STATE DEPENDENT.
LAMBDA (SYMMETRIC) = 0.01304
UNCERTAINTY COEFFICIENT (ASYMMETRIC) = 0.02588 WITH STATUS DEPENDENT. = 0.01452 WITH STATE DEPENDENT.
UNCERTAINTY COEFFICIENT (SYMMETRIC) = 0.01860
KENDALL'S TAU B = -0.06964 SIGNIFICANCE = 0.0000
KENDALL'S TAU C = -0.06655 SIGNIFICANCE = 0.0000
GAMMA = -0.09421
SOMERS'S D (ASYMMETRIC) = -0.06037 WITH STATUS DEPENDENT. = -0.08033 WITH STATE DEPENDENT.
SOMERS'S D (SYMMETRIC) = -0.06893

FILE NONAME (CREATION DATE = 03/05/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F *
STATUS VEHICLE TAMPER STATUS BY MAKE
* PAGE 1 OF 1

STATUS	MAKE COUNT ROW PCT COL PCT TOT PCT	AMC	CHRY	FORD	FORE	GMC	ROW TOTAL
OK	0.	15 1.8 21.7 0.6	96 11.5 24.9 3.8	137 16.5 24.2 5.5	138 16.6 41.4 5.5	446 53.6 38.9 17.8	832 33.3
TAMPERED	30.	19 4.2 27.5 0.8	93 20.7 24.2 3.7	114 25.3 20.1 4.6	26 5.8 7.8 1.0	198 44.0 17.3 7.9	450 18.0
ARGUABLE	31.	34 2.9 49.3 1.4	184 15.8 47.8 7.4	310 26.7 54.7 12.4	158 13.6 47.4 6.3	477 41.0 41.6 19.1	1163 46.5
MALFNCTN	33.	1 1.8 1.4 0.0	12 21.8 3.1 0.5	6 10.9 1.1 0.2	11 20.0 3.3 0.4	25 45.5 2.2 1.0	55 2.2
	COLUMN TOTAL	69 2.8	385 15.4	567 22.7	333 13.3	1146 45.8	2500 100.0

CHI SQUARE = 96.30115 WITH 12 DEGREES OF FREEDOM SIGNIFICANCE = 0.0000
CRAMER'S V = 0.11331
CONTINGENCY COEFFICIENT = 0.19259
LAMBDA (ASYMMETRIC) = 0.0 WITH STATUS DEPENDENT. = 0.0 WITH MAKE DEPENDENT.
LAMBDA (SYMMETRIC) = 0.0
UNCERTAINTY COEFFICIENT (ASYMMETRIC) = 0.01831 WITH STATUS DEPENDENT. = 0.01512 WITH MAKE DEPENDENT.
UNCERTAINTY COEFFICIENT (SYMMETRIC) = 0.01656
KENDALL'S TAU B = -0.09520 SIGNIFICANCE = 0.0000
KENDALL'S TAU C = -0.08472 SIGNIFICANCE = 0.0000
GAMMA = -0.14216
SOMERS'S D (ASYMMETRIC) = -0.09127 WITH STATUS DEPENDENT. = -0.09929 WITH MAKE DEPENDENT.
SOMERS'S D (SYMMETRIC) = -0.09511
ETA = 0.15773 WITH STATUS DEPENDENT. = 0.11391 WITH MAKE DEPENDENT.
PEARSON'S R = 0.11219 SIGNIFICANCE = 0.0000

TEST OF IMJOPRG 1 03/11/80

FILE NONAME (CREATION DATE = 03/11/80)

* * * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *
EGRBUBU EGR SYSTEM BY MYR
* *

EGRBUBU	MYR: COUNT / ROW PCT / COL PCT / TOT PCT	73.	74.	75.	76.	77.	78.	79.	80.	ROW TOTAL
0. NOT EQUIPPED	COUNT	47	34	15	29	21	19	13	0	178
	ROW PCT	26.4	19.1	8.4	16.3	11.8	10.7	7.3	0.0	7.1
	COL PCT	13.7	14.0	5.5	7.8	4.4	3.8	3.5	0.0	
	TOT PCT	1.9	1.4	0.6	1.2	0.8	0.8	0.5	0.0	
1. FUNCT PROPERLY	COUNT	106	128	196	290	386	432	341	11	1890
	ROW PCT	5.6	6.8	10.4	15.3	20.4	22.9	18.0	0.6	75.6
	COL PCT	42.2	52.9	72.3	77.5	81.1	86.1	91.9	91.7	
	TOT PCT	4.2	5.1	7.8	11.6	15.4	17.3	13.6	0.4	
11. TAMPERING	COUNT	55	47	34	32	38	30	10	1	247
	ROW PCT	22.3	19.0	13.8	13.0	15.4	12.1	4.0	0.4	9.9
	COL PCT	21.9	19.4	12.5	8.6	8.0	6.0	2.7	8.3	
	TOT PCT	2.2	1.9	1.4	1.3	1.5	1.2	0.4	0.0	
14. MALFUNCTION	COUNT	43	33	26	23	31	21	7	0	184
	ROW PCT	23.4	17.9	14.1	12.5	16.8	11.4	3.8	0.0	7.4
	COL PCT	17.1	13.6	9.6	6.1	6.5	4.2	1.9	0.0	
	TOT PCT	1.7	1.3	1.0	0.9	1.2	0.8	0.3	0.0	
COLUMN TOTAL		251	242	271	374	476	502	371	12	2499
		10.0	9.7	10.8	15.0	19.0	20.1	14.8	0.5	100.0

CHI SQUARE = 323.93237 WITH 21 DEGREES OF FREEDOM SIGNIFICANCE = 0.0
CRAMER'S V = 0.20787
CONTINGENCY COEFFICIENT = 0.33875
LAMBDA (ASYMMETRIC) = 0.0 WITH EGRBUBU DEPENDENT. = 0.03756 WITH MYR DEPENDENT.
LAMBDA (SYMMETRIC) = 0.02878
UNCERTAINTY COEFFICIENT (ASYMMETRIC) = 0.07563 WITH EGRBUBU DEPENDENT. = 0.03215 WITH MYR DEPENDENT.
UNCERTAINTY COEFFICIENT (SYMMETRIC) = 0.04512
KENDALL'S TAU B = -0.11247 SIGNIFICANCE = 0.0000
KENDALL'S TAU C = -0.08817 SIGNIFICANCE = 0.0000
GAMMA = -0.18617
SOMERS'S D (ASYMMETRIC) = -0.07801 WITH EGRBUBU DEPENDENT. = -0.16217 WITH MYR DEPENDENT.
SOMERS'S D (SYMMETRIC) = -0.10534
ETA = 0.26377 WITH EGRBUBU DEPENDENT. = 0.33887 WITH MYR DEPENDENT.
PEARSON'S R =-0.25514 SIGNIFICANCE = 0.0000

NUMBER OF MISSING OBSERVATIONS = 1

TEST OF INJOPRG 1 03/06/80

FILE NOTAPE (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * *
MYR BY EGRCHVL EGR CONTROL VAL
* *

EGRCHVL COUNT / ROW PCT / COL PCT / TOT PCT	NOT EQUIPPED 0.	FUNCT PROPERLY 1.	TAMPERING 11.	MALFUNCT ION 14.	98.	ROW TOTAL
73.	47	114	29	61	0	251
	18.7	45.4	11.6	24.3	0.0	10.0
	28.8	5.9	27.4	20.2	0.0	
	1.9	4.6	1.2	2.4	0.0	
74.	33	130	24	54	1	242
	13.6	53.7	9.9	22.3	0.4	9.7
	20.2	6.8	22.6	17.9	8.3	
	1.3	5.2	1.0	2.2	0.0	
75.	12	199	14	43	3	271
	4.4	73.4	5.2	15.9	1.1	10.8
	7.4	10.4	13.2	14.2	25.0	
	0.5	8.0	0.6	1.7	0.1	
76.	26	298	8	41	1	374
	7.0	79.7	2.1	11.0	0.3	15.0
	16.0	15.6	7.5	13.6	8.3	
	1.0	11.9	0.3	1.6	0.0	
77.	19	388	12	55	2	476
	4.0	81.5	2.5	11.6	0.4	19.0
	11.7	20.3	11.3	18.2	16.7	
	0.8	15.5	0.5	2.2	0.1	
78.	15	434	17	33	3	502
	3.0	86.5	3.4	6.6	0.6	20.1
	9.2	22.7	16.0	10.9	25.0	
	0.6	17.4	0.7	1.3	0.1	
79.	11	342	2	14	2	371
	3.0	92.2	0.5	3.8	0.5	14.8
	6.7	17.8	1.9	4.6	16.7	
	0.4	13.7	0.1	0.6	0.1	
80.	0	11	0	1	0	12
	0.0	91.7	0.0	8.3	0.0	0.5
	0.0	0.6	0.0	0.3	0.0	
	0.0	0.4	0.0	0.0	0.0	
COLUMN TOTAL	163	1916	106	302	12	2499
	6.5	76.7	4.2	12.1	0.5	100.0

FILE NONAME (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *
MYR BY EGRSNSR EGR SENSORS
* *

EGRSNSR COUNT / ROW PCT / COL PCT / TOT PCT	NOT EQUI IPPED 0.	FUNCT PR OPERLY 1.	TAMPERIN G 11.	MALFUNCT ION 14.	98.	ROW TOTAL
MYR 73.	47	123	33	47	1	251
	18.7	49.0	13.1	18.7	0.4	10.0
	28.7	6.2	20.1	25.7	7.1	
	1.9	4.9	1.3	1.9	0.0	
74.	34	136	32	39	1	242
	14.0	56.2	13.2	16.1	0.4	9.7
	20.7	6.9	19.5	21.3	7.1	
	1.4	5.4	1.3	1.6	0.0	
75.	11	205	24	28	3	271
	4.1	75.6	8.9	10.3	1.1	10.8
	6.7	10.4	14.6	15.3	21.4	
	0.4	8.2	1.0	1.1	0.1	
76.	28	299	25	20	2	374
	7.5	79.9	6.7	5.3	0.5	15.0
	17.1	15.1	15.2	10.9	14.3	
	1.1	12.0	1.0	0.8	0.1	
77.	19	403	27	24	3	476
	4.0	84.7	5.7	5.0	0.6	19.0
	11.6	20.4	16.5	13.1	21.4	
	0.8	16.1	1.1	1.0	0.1	
78.	16	451	14	18	3	502
	3.2	89.8	2.8	3.6	0.6	20.1
	9.8	22.8	8.5	9.8	21.4	
	0.6	18.0	0.6	0.7	0.1	
79.	9	346	8	7	1	371
	2.4	93.3	2.2	1.9	0.3	14.8
	5.5	17.5	4.9	3.8	7.1	
	0.4	13.8	0.3	0.3	0.0	
80.	0	11	1	0	0	12
	0.0	91.7	8.3	0.0	0.0	0.5
	0.0	0.6	0.6	0.0	0.0	
	0.0	0.4	0.0	0.0	0.0	
COLUMN TOTAL	164 6.6	1974 79.0	164 6.6	183 7.3	14 0.6	2499 100.0

FILE MONAME (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *
MYR BY APMPBLT AIR PUMP BELT
* *

MYR	APMPBLT: COUNT / ROW PCT / COL PCT / TOT PCT	NOT EQUIPPED 0.	FUNCT PROPERLY 1.	TAMPERING 11.	MALMAINTENANCE 13.	98.	ROW TOTAL
73.		190	47	14	0	0	251
		75.7	18.7	5.6	0.0	0.0	10.0
		10.8	6.7	41.2	0.0	0.0	
		7.6	1.9	0.6	0.0	0.0	
74.		176	57	8	0	1	242
		72.7	23.6	3.3	0.0	0.4	9.7
		10.0	8.1	23.5	0.0	100.0	
		7.0	2.3	0.3	0.0	0.0	
75.		189	79	3	0	0	271
		69.7	29.2	1.1	0.0	0.0	10.8
		10.7	11.3	8.8	0.0	0.0	
		7.6	3.2	0.1	0.0	0.0	
76.		238	132	4	0	0	374
		63.6	35.3	1.1	0.0	0.0	15.0
		13.5	18.9	11.8	0.0	0.0	
		9.5	5.3	0.2	0.0	0.0	
77.		345	127	4	0	0	476
		72.5	26.7	0.8	0.0	0.0	19.0
		19.6	18.1	11.8	0.0	0.0	
		13.8	5.1	0.2	0.0	0.0	
78.		356	144	1	1	0	502
		70.9	28.7	0.2	0.2	0.0	20.1
		20.2	20.6	2.9	100.0	0.0	
		14.2	5.8	0.0	0.0	0.0	
79.		262	109	0	0	0	371
		70.6	29.4	0.0	0.0	0.0	14.8
		14.9	15.6	0.0	0.0	0.0	
		10.5	4.4	0.0	0.0	0.0	
80.		7	5	0	0	0	12
		58.3	41.7	0.0	0.0	0.0	0.5
		0.4	0.7	0.0	0.0	0.0	
		0.3	0.2	0.0	0.0	0.0	
COLUMN TOTAL		1763	700	34	1	1	2499
		70.5	28.0	1.4	0.0	0.0	100.0

FILE NONAME (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *
MYR BY ACHTVL AIR CONTROL VAL
* *

MYR	ACHTVL COUNT / ROW PCT / COL PCT / TOT PCT	NOT EQUIPPED 0.	FUNCT PROPERLY 1.	TAMPERING 11.	MALFUNCTION 14.	98.	ROW TOTAL
73.	COUNT	189	47	7	8	0	251
	ROW PCT	75.3	18.7	2.8	3.2	0.0	10.0
	COL PCT	11.2	6.1	41.2	40.0	0.0	
	TOT PCT	7.6	1.9	0.3	0.3	0.0	
74.	COUNT	176	58	3	4	1	242
	ROW PCT	72.7	24.0	1.2	1.7	0.4	9.7
	COL PCT	10.4	7.5	17.6	20.0	100.0	
	TOT PCT	7.0	2.3	0.1	0.2	0.0	
75.	COUNT	189	79	1	2	0	271
	ROW PCT	69.7	29.2	0.4	0.7	0.0	10.8
	COL PCT	11.2	10.2	5.9	10.0	0.0	
	TOT PCT	7.6	3.2	0.0	0.1	0.0	
76.	COUNT	236	135	0	3	0	374
	ROW PCT	63.1	36.1	0.0	0.8	0.0	15.0
	COL PCT	14.0	17.4	0.0	15.0	0.0	
	TOT PCT	9.4	5.4	0.0	0.1	0.0	
77.	COUNT	322	149	2	3	0	476
	ROW PCT	67.6	31.3	0.4	0.6	0.0	19.0
	COL PCT	19.1	19.3	11.8	15.0	0.0	
	TOT PCT	12.9	6.0	0.1	0.1	0.0	
78.	COUNT	333	165	4	0	0	502
	ROW PCT	66.3	32.9	0.8	0.0	0.0	20.1
	COL PCT	19.7	21.3	23.5	0.0	0.0	
	TOT PCT	13.3	6.6	0.2	0.0	0.0	
79.	COUNT	237	134	0	0	0	371
	ROW PCT	63.9	36.1	0.0	0.0	0.0	14.8
	COL PCT	14.0	17.3	0.0	0.0	0.0	
	TOT PCT	9.5	5.4	0.0	0.0	0.0	
80.	COUNT	5	7	0	0	0	12
	ROW PCT	41.7	58.3	0.0	0.0	0.0	0.5
	COL PCT	0.3	0.9	0.0	0.0	0.0	
	TOT PCT	0.2	0.3	0.0	0.0	0.0	
COLUMN TOTAL		1687	774	17	20	1	2499
		67.5	31.0	0.7	0.8	0.0	100.0

FILE NONAME (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * CROSSTABULATION OF * * * * * * * * * * * * * * * * * *
MYR BY AIRPMP
* *

MYR	AIRPMP COUNT / ROW PCT / COL PCT / TOT PCT	NOT EQUIPPED 0.	FUNCT PROPERLY 1.	TAMPERING 11.	MALFUNCTION 14.	98.	ROW TOTAL
73.	COUNT	188	49	9	5	0	251
	ROW PCT	74.9	19.5	3.6	2.0	0.0	10.0
	COL PCT	11.2	6.3	50.0	29.4	0.0	
	TOT PCT	7.5	2.0	0.4	0.2	0.0	
74.	COUNT	176	58	3	4	1	242
	ROW PCT	72.7	24.0	1.2	1.7	0.4	9.7
	COL PCT	10.5	7.4	16.7	23.5	100.0	
	TOT PCT	7.0	2.3	0.1	0.2	0.0	
75.	COUNT	189	81	1	0	0	271
	ROW PCT	69.7	29.9	0.4	0.0	0.0	10.8
	COL PCT	11.2	10.4	5.6	0.0	0.0	
	TOT PCT	7.6	3.2	0.0	0.0	0.0	
76.	COUNT	237	134	0	3	0	374
	ROW PCT	63.4	35.8	0.0	0.8	0.0	15.0
	COL PCT	14.1	17.2	0.0	17.6	0.0	
	TOT PCT	9.5	5.4	0.0	0.1	0.0	
77.	COUNT	321	149	2	4	0	476
	ROW PCT	67.4	31.3	0.4	0.8	0.0	19.0
	COL PCT	19.1	19.1	11.1	23.5	0.0	
	TOT PCT	12.8	6.0	0.1	0.2	0.0	
78.	COUNT	332	166	3	1	0	502
	ROW PCT	66.1	33.1	0.6	0.2	0.0	20.1
	COL PCT	19.7	21.3	16.7	5.9	0.0	
	TOT PCT	13.3	6.6	0.1	0.0	0.0	
79.	COUNT	236	135	0	0	0	371
	ROW PCT	63.6	36.4	0.0	0.0	0.0	14.8
	COL PCT	14.0	17.3	0.0	0.0	0.0	
	TOT PCT	9.4	5.4	0.0	0.0	0.0	
80.	COUNT	5	7	0	0	0	12
	ROW PCT	41.7	58.3	0.0	0.0	0.0	0.5
	COL PCT	0.3	0.9	0.0	0.0	0.0	
	TOT PCT	0.2	0.3	0.0	0.0	0.0	
COLUMN TOTAL		1684	779	18	17	1	2499
		67.4	31.2	0.7	0.7	0.0	100.0

TEST OF INOUPRG 1 03/06/80

FILE NOLANE (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F *
MYR BY CATCON CATALYTIC CON
* *

MYR	CATCON: COUNT / ROW PCT / COL PCT / TOT PCT	NOT EQUIPPED 0.	EQUI FUNCT PROPERLY 1.	PR CONNECT 4.	MECH DIS G 11.	TAMPERING ION 14.	MALFUNCT 98.	ROW TOTAL
73.	COUNT	250	0	0	1	0	0	251
	ROW PCT	99.6	0.0	0.0	0.4	0.0	0.0	10.0
	COL PCT	32.3	0.0	0.0	5.6	0.0	0.0	
	TOT PCT	10.0	0.0	0.0	0.0	0.0	0.0	
74.	COUNT	240	2	0	0	0	0	242
	ROW PCT	99.2	0.8	0.0	0.0	0.0	0.0	9.7
	COL PCT	31.0	0.1	0.0	0.0	0.0	0.0	
	TOT PCT	9.6	0.1	0.0	0.0	0.0	0.0	
75.	COUNT	45	218	0	4	4	0	271
	ROW PCT	16.6	80.4	0.0	1.5	1.5	0.0	10.8
	COL PCT	5.8	12.9	0.0	22.2	28.6	0.0	
	TOT PCT	1.8	8.7	0.0	0.2	0.2	0.0	
76.	COUNT	66	297	0	7	3	1	374
	ROW PCT	17.6	79.4	0.0	1.9	0.8	0.3	15.0
	COL PCT	8.5	17.6	0.0	38.9	21.4	100.0	
	TOT PCT	2.6	11.9	0.0	0.3	0.1	0.0	
77.	COUNT	66	400	2	4	4	0	476
	ROW PCT	13.9	84.0	0.4	0.8	0.8	0.0	19.0
	COL PCT	8.5	23.7	100.0	22.2	28.6	0.0	
	TOT PCT	2.6	16.0	0.1	0.2	0.2	0.0	
78.	COUNT	66	432	0	2	2	0	502
	ROW PCT	13.1	86.1	0.0	0.4	0.4	0.0	20.1
	COL PCT	8.5	25.6	0.0	11.1	14.3	0.0	
	TOT PCT	2.6	17.3	0.0	0.1	0.1	0.0	
79.	COUNT	41	329	0	0	1	0	371
	ROW PCT	11.1	88.7	0.0	0.0	0.3	0.0	14.8
	COL PCT	5.3	19.5	0.0	0.0	7.1	0.0	
	TOT PCT	1.6	13.2	0.0	0.0	0.0	0.0	
80.	COUNT	0	12	0	0	0	0	12
	ROW PCT	0.0	100.0	0.0	0.0	0.0	0.0	0.5
	COL PCT	0.0	0.7	0.0	0.0	0.0	0.0	
	TOT PCT	0.0	0.5	0.0	0.0	0.0	0.0	
COLUMN TOTAL		774	1690	2	18	14	1	2499
		31.0	67.6	0.1	0.7	0.6	0.0	100.0

FILE NONAME (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F *

STATUS VEHICLE TAMPER STATUS BY AIRPMP

CONTROLLING FOR..

APPPBLT AIR PUMP BELT VALUE = 0. NOT EQUIPPED

* *

STATUS	AIRPMP: COUNT / ROW PCT / COL PCT / TOT PCT	NOT EQUIPPED 0.	FUNCT PROPERLY 1.	TAMPERING 11.	ROW TOTAL
OK	0.	593	29	0	622
		95.3	4.7	0.0	35.3
		35.3	35.8	0.0	
		33.6	1.6	0.0	
TAMPERED	30.	293	12	2	307
		95.4	3.9	0.7	17.4
		17.4	14.8	100.0	
		16.6	0.7	0.1	
NEGLIGENT	31.	753	39	0	792
		95.1	4.9	0.0	44.9
		44.8	48.1	0.0	
		42.7	2.2	0.0	
MALFUNCTN	33.	42	1	0	43
		97.7	2.3	0.0	2.4
		2.5	1.2	0.0	
		2.4	0.1	0.0	
COLUMN TOTAL		1681	81	2	1764
		95.3	4.6	0.1	100.0

CHI SQUARE = 10.51236 WITH 6 DEGREES OF FREEDOM SIGNIFICANCE = 0.1047
CRAMER'S V = 0.05459
CONTINGENCY COEFFICIENT = 0.07697
LAMBDA (ASYMMETRIC) = 0.00206 WITH STATUS DEPENDENT. = 0.0 WITH AIRPMP DEPENDENT.
LAMBDA (SYMMETRIC) = 0.00190
UNCERTAINTY COEFFICIENT (ASYMMETRIC) = 0.00206 WITH STATUS DEPENDENT. = 0.01162 WITH AIRPMP DEPENDENT.
UNCERTAINTY COEFFICIENT (SYMMETRIC) = 0.00350
KENDALL'S TAU B = 0.00041 SIGNIFICANCE = 0.4927
KENDALL'S TAU C = 0.00015 SIGNIFICANCE = 0.4927
GAMMA = 0.00172
SOMERS'S D (ASYMMETRIC) = 0.00110 WITH STATUS DEPENDENT. = 0.00015 WITH AIRPMP DEPENDENT.
SOMERS'S D (SYMMETRIC) = 0.00027
ETA = 0.02312 WITH STATUS DEPENDENT. = 0.05749 WITH AIRPMP DEPENDENT.
PEARSON'S R = 0.01487 SIGNIFICANCE = 0.2142

FILE NONAME (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * *
MYR BY PCV
* *

MYR / PCV: COUNT, ROW PCT, COL PCT, TOT PCT	NOT EQUIPPED 0.	FUNCT PROPERLY 1.	NON STOCK EQUIP 6.	TAMPERING 11.	MALFUNCTION 14.	98.	ROW TOTAL
73.	3	228	0	16	4	0	251
	1.2	90.8	0.0	6.4	1.6	0.0	10.0
	37.5	9.5	0.0	23.5	40.0	0.0	
	0.1	9.1	0.0	0.6	0.2	0.0	
74.	0	229	0	11	1	1	242
	0.0	94.6	0.0	4.5	0.4	0.4	9.7
	0.0	9.5	0.0	16.2	10.0	50.0	
	0.0	9.2	0.0	0.4	0.0	0.0	
75.	1	258	1	8	3	0	271
	0.4	95.2	0.4	3.0	1.1	0.0	10.8
	12.5	10.7	33.3	11.8	30.0	0.0	
	0.0	10.3	0.0	0.3	0.1	0.0	
76.	0	364	0	9	1	0	374
	0.0	97.3	0.0	2.4	0.3	0.0	15.0
	0.0	15.1	0.0	13.2	10.0	0.0	
	0.0	14.6	0.0	0.4	0.0	0.0	
77.	3	463	1	8	1	0	476
	0.6	97.3	0.2	1.7	0.2	0.0	19.0
	37.5	19.2	33.3	11.8	10.0	0.0	
	0.1	18.5	0.0	0.3	0.0	0.0	
78.	0	490	1	11	0	0	502
	0.0	97.6	0.2	2.2	0.0	0.0	20.1
	0.0	20.3	33.3	16.2	0.0	0.0	
	0.0	19.6	0.0	0.4	0.0	0.0	
79.	1	365	0	4	0	1	371
	0.3	98.4	0.0	1.1	0.0	0.3	14.8
	12.5	15.2	0.0	5.9	0.0	50.0	
	0.0	14.6	0.0	0.2	0.0	0.0	
80.	0	11	0	1	0	0	12
	0.0	91.7	0.0	8.3	0.0	0.0	0.5
	0.0	0.5	0.0	1.5	0.0	0.0	
	0.0	0.4	0.0	0.0	0.0	0.0	
COLUMN TOTAL	8	2408	3	68	10	2	2499
	0.3	96.4	0.1	2.7	0.4	0.1	100.0

FILE NONAME (CREATION DATE = 03/06/80)

* * * * * C R O S S T A B U L A T I O N O F * * * * *
SYR BY VCSPKRT VAC SPRK RETRD

SYR	COUNT / ROW PCT / COL PCT / TOT PCT	VCSPKRT: NOT EQUIPPED 0.	FUNCT PROPERLY 1.	TAMPERING 11.	MALFUNCTION 14.	98.	ROW TOTAL
73.	COUNT	188	62	0	0	1	251
	ROW PCT	74.9	24.7	0.0	0.0	0.4	10.0
	COL PCT	10.5	9.0	0.0	0.0	20.0	
	TOT PCT	7.5	2.5	0.0	0.0	0.0	
74.	COUNT	194	47	1	0	0	242
	ROW PCT	80.2	19.4	0.4	0.0	0.0	9.7
	COL PCT	10.8	6.8	9.1	0.0	0.0	
	TOT PCT	7.8	1.9	0.0	0.0	0.0	
75.	COUNT	212	55	4	0	0	271
	ROW PCT	78.2	20.3	1.5	0.0	0.0	10.8
	COL PCT	11.8	8.0	36.4	0.0	0.0	
	TOT PCT	8.5	2.2	0.2	0.0	0.0	
76.	COUNT	303	67	4	0	0	374
	ROW PCT	81.0	17.9	1.1	0.0	0.0	15.0
	COL PCT	16.9	9.7	36.4	0.0	0.0	
	TOT PCT	12.1	2.7	0.2	0.0	0.0	
77.	COUNT	358	116	1	0	1	476
	ROW PCT	75.2	24.4	0.2	0.0	0.2	19.0
	COL PCT	20.0	16.9	9.1	0.0	20.0	
	TOT PCT	14.3	4.6	0.0	0.0	0.0	
78.	COUNT	345	153	1	0	3	502
	ROW PCT	68.7	30.5	0.2	0.0	0.6	20.1
	COL PCT	19.2	22.2	9.1	0.0	60.0	
	TOT PCT	13.8	6.1	0.0	0.0	0.1	
79.	COUNT	187	183	0	1	0	371
	ROW PCT	50.4	49.3	0.0	0.3	0.0	14.8
	COL PCT	10.4	26.6	0.0	100.0	0.0	
	TOT PCT	7.5	7.3	0.0	0.0	0.0	
80.	COUNT	7	5	0	0	0	12
	ROW PCT	58.3	41.7	0.0	0.0	0.0	0.5
	COL PCT	0.4	0.7	0.0	0.0	0.0	
	TOT PCT	0.3	0.2	0.0	0.0	0.0	
COLUMN TOTAL		1794	688	11	1	5	2499
		71.8	27.5	0.4	0.0	0.2	100.0

FILE NONAME (CREATION DATE = 03/06/80)

* * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * *
YR BY ISOLSTP IDLE STOP SOL

YR	COUNT / ROW PCT / COL PCT / TOT PCT	NOT EQUIPPED 0.	FUNCT PROPERLY 1.	TAMPERING 11.	MALFUNCTION 14.	98.	ROW TOTAL
73.	COUNT	136	112	1	2	0	251
	ROW PCT	54.2	44.6	0.4	0.8	0.0	10.0
	COL PCT	9.1	11.4	16.7	20.0	0.0	
	TOT PCT	5.4	4.5	0.0	0.1	0.0	
74.	COUNT	138	102	1	0	1	242
	ROW PCT	57.0	42.1	0.4	0.0	0.4	9.7
	COL PCT	9.2	10.4	16.7	0.0	20.0	
	TOT PCT	5.5	4.1	0.0	0.0	0.0	
75.	COUNT	174	94	2	0	1	271
	ROW PCT	64.2	34.7	0.7	0.0	0.4	10.8
	COL PCT	11.6	9.6	33.3	0.0	20.0	
	TOT PCT	7.0	3.8	0.1	0.0	0.0	
76.	COUNT	288	85	0	1	0	374
	ROW PCT	77.0	22.7	0.0	0.3	0.0	15.0
	COL PCT	19.3	8.6	0.0	10.0	0.0	
	TOT PCT	11.5	3.4	0.0	0.0	0.0	
77.	COUNT	296	175	2	2	1	476
	ROW PCT	62.2	36.8	0.4	0.4	0.2	19.0
	COL PCT	19.8	17.8	33.3	20.0	20.0	
	TOT PCT	11.8	7.0	0.1	0.1	0.0	
78.	COUNT	284	217	0	0	1	502
	ROW PCT	56.6	43.2	0.0	0.0	0.2	20.1
	COL PCT	19.0	22.1	0.0	0.0	20.0	
	TOT PCT	11.4	8.7	0.0	0.0	0.0	
79.	COUNT	173	192	0	5	1	371
	ROW PCT	46.6	51.8	0.0	1.3	0.3	14.8
	COL PCT	11.6	19.5	0.0	50.0	20.0	
	TOT PCT	6.9	7.7	0.0	0.2	0.0	
80.	COUNT	6	6	0	0	0	12
	ROW PCT	50.0	50.0	0.0	0.0	0.0	0.5
	COL PCT	0.4	0.6	0.0	0.0	0.0	
	TOT PCT	0.2	0.2	0.0	0.0	0.0	
COLUMN TOTAL		1495	983	6	10	5	2499
		59.8	39.3	0.2	0.4	0.2	100.0

FILE NOLAME (CREATION DATE = 03/06/80)

E-18

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F *
NYR BY HEATIN - HEATED INTAKE
* *

HEATIN

YR / COUNT / ROW PCT / COL PCT / TOT PCT	NOT EQUIPPED 0.	FUNCT PROPERLY 1.	TAMPERING 11.	ARGUABLE TAMPERING 12.	MALFUNCTION 14.	ROW TOTAL
73.	6	181	3	58	3	251
	2.4	72.1	1.2	23.1	1.2	10.0
	13.6	8.2	10.7	29.6	23.1	
	0.2	7.2	0.1	2.3	0.1	
74.	5	194	1	37	5	242
	2.1	80.2	0.4	15.3	2.1	9.7
	11.4	8.7	3.6	18.9	38.5	
	0.2	7.8	0.0	1.5	0.2	
75.	6	237	1	24	3	271
	2.2	87.5	0.4	8.9	1.1	10.8
	13.6	10.7	3.6	12.2	23.1	
	0.2	9.5	0.0	1.0	0.1	
76.	5	335	6	27	1	374
	1.3	89.6	1.6	7.2	0.3	15.0
	11.4	15.1	21.4	13.8	7.7	
	0.2	13.4	0.2	1.1	0.0	
77.	12	425	7	31	1	476
	2.5	89.3	1.5	6.5	0.2	19.0
	27.3	19.2	25.0	15.8	7.7	
	0.5	17.0	0.3	1.2	0.0	
78.	3	480	8	11	0	502
	0.6	95.6	1.6	2.2	0.0	20.1
	6.8	21.6	28.6	5.6	0.0	
	0.1	19.2	0.3	0.4	0.0	
79.	7	354	2	8	0	371
	1.9	95.4	0.5	2.2	0.0	14.8
	15.9	16.0	7.1	4.1	0.0	
	0.3	14.2	0.1	0.3	0.0	
80.	0	12	0	0	0	12
	0.0	100.0	0.0	0.0	0.0	0.5
	0.0	0.5	0.0	0.0	0.0	
	0.0	0.5	0.0	0.0	0.0	
COLUMN TOTAL	44	2218	28	196	13	2499
	1.8	88.8	1.1	7.8	0.5	100.0

TEST OF [illegible] 1 03/06/80

FILE [illegible] (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * *
SYR BY STOR ECS STORAGE

SYR	COUNT / ROW PCT / COL PCT / TOT PCT	NOT EQUIPPED 0.	FUNCT.PROPERLY 1.	TAMPERING 11.	MALFUNCTION 14.	98.	ROW TOTAL
73.	COUNT	4	228	15	3	1	251
	ROW PCT	1.6	90.8	6.0	1.2	0.4	10.0
	COL PCT	19.0	9.5	25.0	30.0	11.1	
	TOT PCT	0.2	9.1	0.6	0.1	0.0	
74.	COUNT	6	219	13	2	2	242
	ROW PCT	2.5	90.5	5.4	0.8	0.8	9.7
	COL PCT	28.6	9.1	21.7	20.0	22.2	
	TOT PCT	0.2	8.8	0.5	0.1	0.1	
75.	COUNT	2	263	3	2	1	271
	ROW PCT	0.7	97.0	1.1	0.7	0.4	10.8
	COL PCT	9.5	11.0	5.0	20.0	11.1	
	TOT PCT	0.1	10.5	0.1	0.1	0.0	
76.	COUNT	2	364	7	1	0	374
	ROW PCT	0.5	97.3	1.9	0.3	0.0	15.0
	COL PCT	9.5	15.2	11.7	10.0	0.0	
	TOT PCT	0.1	14.6	0.3	0.0	0.0	
77.	COUNT	1	464	9	2	0	476
	ROW PCT	0.2	97.5	1.9	0.4	0.0	19.0
	COL PCT	4.8	19.3	15.0	20.0	0.0	
	TOT PCT	0.0	18.6	0.4	0.1	0.0	
78.	COUNT	5	485	9	0	3	502
	ROW PCT	1.0	96.6	1.8	0.0	0.6	20.1
	COL PCT	23.8	20.2	15.0	0.0	33.3	
	TOT PCT	0.2	19.4	0.4	0.0	0.1	
79.	COUNT	1	365	3	0	2	371
	ROW PCT	0.3	98.4	0.8	0.0	0.5	14.8
	COL PCT	4.8	15.2	5.0	0.0	22.2	
	TOT PCT	0.0	14.6	0.1	0.0	0.1	
80.	COUNT	0	11	1	0	0	12
	ROW PCT	0.0	91.7	8.3	0.0	0.0	0.5
	COL PCT	0.0	0.5	1.7	0.0	0.0	
	TOT PCT	0.0	0.4	0.0	0.0	0.0	
COLUMN TOTAL		21	2399	60	10	9	2499
		0.8	96.0	2.4	0.4	0.4	100.0

FILE NONAME (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * *

YR BY FILNEK FILLER NECK

* *

FILNEK COUNT / ROW PCT / COL PCT / TOT PCT	NOT EQUIPPED 0.	FUNCT PROPERLY 1.	NON STOCK EQUIP 6.	PARTS MALFUNCTIO 9.	TAMPERING 11.	98.	ROW TOTAL
YR 73.	249	2	0	0	0	0	251
	99.2	0.8	0.0	0.0	0.0	0.0	10.0
	33.2	0.1	0.0	0.0	0.0	0.0	
	10.0	0.1	0.0	0.0	0.0	0.0	
74.	242	0	0	0	0	0	242
	100.0	0.0	0.0	0.0	0.0	0.0	9.7
	32.3	0.0	0.0	0.0	0.0	0.0	
	9.7	0.0	0.0	0.0	0.0	0.0	
75.	36	216	0	1	18	0	271
	13.3	79.7	0.0	0.4	6.6	0.0	10.8
	4.8	12.9	0.0	100.0	27.3	0.0	
	1.4	8.6	0.0	0.0	0.7	0.0	
76.	65	287	1	0	20	1	374
	17.4	76.7	0.3	0.0	5.3	0.3	15.0
	8.7	17.1	100.0	0.0	30.3	50.0	
	2.6	11.5	0.0	0.0	0.8	0.0	
77.	56	406	0	0	14	0	476
	11.8	85.3	0.0	0.0	2.9	0.0	19.0
	7.5	24.2	0.0	0.0	21.2	0.0	
	2.2	16.2	0.0	0.0	0.6	0.0	
78.	61	427	0	0	13	1	502
	12.2	85.1	0.0	0.0	2.6	0.2	20.1
	8.1	25.4	0.0	0.0	19.7	50.0	
	2.4	17.1	0.0	0.0	0.5	0.0	
79.	40	330	0	0	1	0	371
	10.8	88.9	0.0	0.0	0.3	0.0	14.8
	5.3	19.6	0.0	0.0	1.5	0.0	
	1.6	13.2	0.0	0.0	0.0	0.0	
80.	0	12	0	0	0	0	12
	0.0	100.0	0.0	0.0	0.0	0.0	0.5
	0.0	0.7	0.0	0.0	0.0	0.0	
	0.0	0.5	0.0	0.0	0.0	0.0	
COLUMN TOTAL	749	1680	1	1	66	2	2499
	30.0	67.2	0.0	0.0	2.6	0.1	100.0

TEST OF IHOPPRG 1 03/06/80

FILE NONAME (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *
PYR BY LIMCAP LIMITER CAPS

PYR	LIMCAP COUNT ROW PCT COL PCT TOT PCT	NOT EQUIPPED 0.	FUNCT PROPERLY 1.	ARGUABLE TAMPERED 12.	98.	ROW TOTAL
73.		9 3.6 6.8 0.4	29 11.6 3.2 1.2	213 84.9 14.5 8.5	0 0.0 0.0 0.0	251 10.0
74.		3 1.2 2.3 0.1	23 9.5 2.6 0.9	214 88.4 14.6 8.6	2 0.8 25.0 0.1	242 9.7
75.		4 1.5 3.0 0.2	61 22.5 6.8 2.4	206 76.0 14.1 8.2	0 0.0 0.0 0.0	271 10.8
76.		10 2.7 7.6 0.4	105 28.1 11.8 4.2	259 69.3 17.7 10.4	0 0.0 0.0 0.0	374 15.0
77.		21 4.4 15.9 0.8	158 33.2 17.7 6.3	296 62.2 20.2 11.8	1 0.2 12.5 0.0	476 19.0
78.		16 3.2 12.1 0.6	261 52.0 29.2 10.4	222 44.2 15.1 8.9	3 0.6 37.5 0.1	502 20.1
79.		64 17.3 48.5 2.6	249 67.1 27.9 10.0	56 15.1 3.8 2.2	2 0.5 25.0 0.1	371 14.8
80.		5 41.7 3.8 0.2	7 58.3 0.8 0.3	0 0.0 0.0 0.0	0 0.0 0.0 0.0	12 0.5
	COLUMN TOTAL	132 5.3	893 35.7	1466 58.7	8 0.3	2499 100.0

FILE NONAME (CREATION DATE = 03/06/80)

E-22

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * *
RYR BY TNKCAP ECS TANK CAP
* *

RYR / TNKCAP (COUNT, ROW PCT, COL PCT, TOT PCT)	NOT EQUIPPED 0	FUNCT PROPERLY 1	VAC DISCONNECT 3	NON STD K EQUIP 6	ARGUABLE TAMPERING 12	MALFUNCTION 14	98	ROW TOTAL
73.	2	240	0	0	2	6	1	251
	0.8	95.6	0.0	0.0	0.8	2.4	0.4	10.0
	14.3	9.8	0.0	0.0	14.3	42.9	16.7	
	0.1	9.6	0.0	0.0	0.1	0.2	0.0	
74.	3	234	0	0	3	1	1	242
	1.2	96.7	0.0	0.0	1.2	0.4	0.4	9.7
	21.4	9.6	0.0	0.0	21.4	7.1	16.7	
	0.1	9.4	0.0	0.0	0.1	0.0	0.0	
75.	1	266	0	1	1	2	0	271
	0.4	98.2	0.0	0.4	0.4	0.7	0.0	10.8
	7.1	10.9	0.0	50.0	7.1	14.3	0.0	
	0.0	10.6	0.0	0.0	0.0	0.1	0.0	
76.	2	368	0	1	2	1	0	374
	0.5	98.4	0.0	0.3	0.5	0.3	0.0	15.0
	14.3	15.0	0.0	50.0	14.3	7.1	0.0	
	0.1	14.7	0.0	0.0	0.1	0.0	0.0	
77.	0	470	1	0	2	3	0	476
	0.0	98.7	0.2	0.0	0.4	0.6	0.0	19.0
	0.0	19.2	100.0	0.0	14.3	21.4	0.0	
	0.0	18.8	0.0	0.0	0.1	0.1	0.0	
78.	5	491	0	0	3	1	2	502
	1.0	97.8	0.0	0.0	0.6	0.2	0.4	20.1
	35.7	20.1	0.0	0.0	21.4	7.1	33.3	
	0.2	19.6	0.0	0.0	0.1	0.0	0.1	
79.	1	368	0	0	0	0	2	371
	0.3	99.2	0.0	0.0	0.0	0.0	0.5	14.8
	7.1	15.0	0.0	0.0	0.0	0.0	33.3	
	0.0	14.7	0.0	0.0	0.0	0.0	0.1	
80.	0	11	0	0	1	0	0	12
	0.0	91.7	0.0	0.0	8.3	0.0	0.0	0.5
	0.0	0.4	0.0	0.0	7.1	0.0	0.0	
	0.0	0.4	0.0	0.0	0.0	0.0	0.0	
COLUMN TOTAL	14	2448	1	2	14	14	6	2499
	0.6	98.0	0.0	0.1	0.6	0.6	0.2	100.0

TEST OF MAJORRG 1 03/06/80

FILE NONAME (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * *
NYR BY TLABEL TANK LABEL
* *

NYR \ TLABEL (COUNT / ROW PCT / COL PCT / TOT PCT)	NOT EQUIPPED 0.	FUNCT PROPERLY 1.	ARGUABLE TAMPERED 12.	ROW TOTAL
73.	249	2	0	251
	99.2	0.8	0.0	10.0
	33.3	0.1	0.0	
	10.0	0.1	0.0	
74.	242	0	0	242
	100.0	0.0	0.0	9.7
	32.4	0.0	0.0	
	9.7	0.0	0.0	
75.	36	220	15	271
	13.3	81.2	5.5	10.8
	4.8	13.1	20.3	
	1.4	8.8	0.6	
76.	63	287	24	374
	16.8	76.7	6.4	15.0
	8.4	17.1	32.4	
	2.5	11.5	1.0	
77.	57	400	19	476
	12.0	84.0	4.0	19.0
	7.6	23.8	25.7	
	2.3	16.0	0.8	
78.	60	429	13	502
	12.0	85.5	2.6	20.1
	8.0	25.6	17.6	
	2.4	17.2	0.5	
79.	40	328	3	371
	10.8	88.4	0.8	14.8
	5.4	19.5	4.1	
	1.6	13.1	0.1	
80.	0	12	0	12
	0.0	100.0	0.0	0.5
	0.0	0.7	0.0	
	0.0	0.5	0.0	
COLUMN TOTAL	747	1678	74	2499
	29.9	67.1	3.0	100.0

FILE NOHAME (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *

GYR BY DLABEL DASH LABEL

* *

GYR	DLABEL: COUNT / ROW PCT / COL PCT / TOT PCT	NOT EQUIPPED 0.	FUNCT PROPERLY 1.	ARGUABLE TAMPERED 12.	ROW TOTAL
73.	COUNT	249	2	0	251
	ROW PCT	99.2	0.8	0.0	10.0
	COL PCT	33.1	0.1	0.0	
	TOT PCT	10.0	0.1	0.0	
74.	COUNT	242	0	0	242
	ROW PCT	100.0	0.0	0.0	9.7
	COL PCT	32.2	0.0	0.0	
	TOT PCT	9.7	0.0	0.0	
75.	COUNT	37	232	2	271
	ROW PCT	13.7	85.6	0.7	10.8
	COL PCT	4.9	13.4	16.7	
	TOT PCT	1.5	9.3	0.1	
76.	COUNT	65	304	5	374
	ROW PCT	17.4	81.3	1.3	15.0
	COL PCT	8.6	17.5	41.7	
	TOT PCT	2.6	12.2	0.2	
77.	COUNT	57	417	2	476
	ROW PCT	12.0	87.6	0.4	19.0
	COL PCT	7.6	24.0	16.7	
	TOT PCT	2.3	16.7	0.1	
78.	COUNT	61	439	2	502
	ROW PCT	12.2	87.5	0.4	20.1
	COL PCT	8.1	25.3	16.7	
	TOT PCT	2.4	17.6	0.1	
79.	COUNT	41	329	1	371
	ROW PCT	11.1	88.7	0.3	14.8
	COL PCT	5.5	19.0	8.3	
	TOT PCT	1.6	13.2	0.0	
80.	COUNT	0	12	0	12
	ROW PCT	0.0	100.0	0.0	0.5
	COL PCT	0.0	0.7	0.0	
	TOT PCT	0.0	0.5	0.0	
COLUMN TOTAL		752	1735	12	2499
		30.1	69.4	0.5	100.0

FILE [illegible] (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *

STATUS VEHICLE TAMPER STATUS BY MYR

CONTROLLING FOR..

STATO VALUE = 40.

STATUS	MYR → COUNT / ROW PCT / COL PCT / TOT PCT	73.	74.	75.	76.	77.	78.	79.	80.	ROW TOTAL
[illegible]	0.	5	4	12	19	36	44	63	1	184
		2.7	2.2	6.5	10.3	19.6	23.9	34.2	0.5	28.5
		6.7	5.6	15.8	19.6	26.9	39.3	79.7	50.0	
		0.8	0.6	1.9	2.9	5.6	6.8	9.8	0.2	
[illegible]	30.	21	15	12	6	17	12	2	0	85
		24.7	17.6	14.1	7.1	20.0	14.1	2.4	0.0	13.2
		28.0	21.1	15.8	6.3	12.7	10.7	2.5	0.0	
		3.3	2.3	1.9	0.9	2.6	1.9	0.3	0.0	
[illegible]	31.	48	51	51	71	77	55	13	1	367
		13.1	13.9	13.9	19.3	21.0	15.0	3.5	0.3	56.9
		64.0	71.8	67.1	74.0	57.5	49.1	16.5	50.0	
		7.4	7.9	7.9	11.0	11.9	8.5	2.0	0.2	
[illegible]	33.	1	1	1	0	4	1	1	0	9
		11.1	11.1	11.1	0.0	44.4	11.1	11.1	0.0	1.4
		1.3	1.4	1.3	0.0	3.0	0.9	1.3	0.0	
		0.2	0.2	0.2	0.0	0.6	0.2	0.2	0.0	
	COLUMN TOTAL	75	71	76	96	134	112	79	2	645
		11.6	11.0	11.8	14.9	20.8	17.4	12.2	0.3	100.0

CHI SQUARE = 175.23196 WITH 21 DEGREES OF FREEDOM SIGNIFICANCE = 0.0
CRAMER'S V = 0.30093
CONTINGENCY COEFFICIENT = 0.46221
LAMBDA (ASYMMETRIC) = 0.17966 WITH STATUS DEPENDENT. = 0.06067 WITH MYR DEPENDENT.
LAMBDA (SYMMETRIC) = 0.10266
UNCERTAINTY COEFFICIENT (ASYMMETRIC) = 0.13414 WITH STATUS DEPENDENT. = 0.06973 WITH MYR DEPENDENT.
UNCERTAINTY COEFFICIENT (SYMMETRIC) = 0.09176
KENDALL'S TAU B = -0.26485 SIGNIFICANCE = 0.0000
KENDALL'S TAU C = -0.25505 SIGNIFICANCE = 0.0000
GAMMA = -0.39616
SOMERS'S D (ASYMMETRIC) = -0.23475 WITH STATUS DEPENDENT. = -0.34564 WITH MYR DEPENDENT.
SOMERS'S D (SYMMETRIC) = -0.27960
ETA = 0.46497 WITH STATUS DEPENDENT. = 0.43787 WITH MYR DEPENDENT.
PEARSON'S R = -0.42463 SIGNIFICANCE = 0.0000

FILE FONAME (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F *
STATUS VEHICLE TAMPER STATUS BY MYR
CONTROLLING FOR..
I-STATO VALUE = 50.
* *

STATUS	COUNT / ROW PCT / COL PCT / TOT PCT	MYR 73.	74.	75.	76.	77.	78.	79.	80.	ROW TOTAL
OK	0.	11	14	32	65	106	193	219	8	648
		1.7	2.2	4.9	10.0	16.4	29.8	33.8	1.2	35.0
		6.3	8.2	16.4	23.4	31.0	49.5	75.0	80.0	
		0.6	0.8	1.7	3.5	5.7	10.4	11.8	0.4	
TAMPERED	30.	68	52	49	66	54	57	17	2	365
		18.6	14.2	13.4	18.1	14.8	15.6	4.7	0.5	19.7
		38.6	30.4	25.1	23.7	15.8	14.6	5.8	20.0	
		3.7	2.8	2.6	3.6	2.9	3.1	0.9	0.1	
[illegible]	31.	91	103	107	142	172	134	46	0	795
		11.4	13.0	13.5	17.9	21.6	16.9	5.8	0.0	42.9
		51.7	60.2	54.9	51.1	50.3	34.4	15.8	0.0	
		4.9	5.6	5.8	7.7	9.3	7.2	2.5	0.0	
[illegible]	33.	6	2	7	5	10	6	10	0	46
		13.0	4.3	15.2	10.9	21.7	13.0	21.7	0.0	2.5
		3.4	1.2	3.6	1.8	2.9	1.5	3.4	0.0	
		0.3	0.1	0.4	0.3	0.5	0.3	0.5	0.0	
COLUMN TOTAL		176	171	195	278	342	390	292	10	1854
		9.5	9.2	10.5	15.0	18.4	21.0	15.7	0.5	100.0

CHI SQUARE = 457.58521 WITH 21 DEGREES OF FREEDOM SIGNIFICANCE = 0.0
CRAMER'S V = 0.28526
CONTINGENCY COEFFICIENT = 0.44296
LAMBDA (ASYMMETRIC) = 0.22663 WITH STATUS DEPENDENT. = 0.05396 WITH MYR DEPENDENT.
LAMBDA (SYMMETRIC) = 0.12644
UNCERTAINTY COEFFICIENT (ASYMMETRIC) = 0.11341 WITH STATUS DEPENDENT. = 0.06734 WITH MYR DEPENDENT.
UNCERTAINTY COEFFICIENT (SYMMETRIC) = 0.08450
KENDALL'S TAU B = -0.30536 SIGNIFICANCE = 0.0000
KENDALL'S TAU C = -0.30290 SIGNIFICANCE = 0.0000
GAMMA = -0.40184
SOMERS'S D (ASYMMETRIC) = -0.26856 WITH STATUS DEPENDENT. = -0.34705 WITH MYR DEPENDENT.
SOMERS'S D (SYMMETRIC) = -0.30281
ETA = 0.47145 WITH STATUS DEPENDENT. = 0.45480 WITH MYR DEPENDENT.
PEARSON'S R = -0.45366 SIGNIFICANCE = 0.0000

NUMBER OF MISSING OBSERVATIONS = 1

TEST OF IMJDPRG 1 03/17/80

FILE NONAME (CREATION DATE = 03/17/80)

- - - - - - - - - - - - - - - - - - D E S C R I P T I O N O F S U B P O P U L A T I O N S - - - - - - - - - - - - - - - - - -

CRITERION VARIABLE IHC IDLE HC
BROKEN DOWN BY MYR
BY IMSTATU

VARIABLE	CODE	VALUE LABEL	SUM	MEAN	STD DEV	VARIANCE	N
FOR ENTIRE POPULATION			437235.0000	175.5964	238.5479	56905.1110	(2490)
MYR	73.		65000.0000	260.0000	275.6944	76007.4297	(250)
IMSTATU	40.		14640.0000	197.8378	244.3654	59714.4391	(74)
IMSTATU	50.		50360.0000	286.1364	284.4596	80917.2727	(176)
MYR	74.		55225.0000	229.1494	295.4147	87269.8693	(241)
IMSTATU	40.		19990.0000	281.5493	372.2255	138551.8511	(71)
IMSTATU	50.		35235.0000	207.2647	254.7742	64909.8881	(170)
MYR	75.		55608.0000	206.7212	284.1778	80757.0451	(269)
IMSTATU	40.		10112.0000	133.0526	120.9896	14638.4772	(76)
IMSTATU	50.		45496.0000	235.7306	322.5075	104011.0833	(193)
MYR	76.		70117.0000	187.9812	236.3512	55861.8787	(373)
IMSTATU	40.		13620.0000	141.8750	166.2611	27642.7632	(96)
IMSTATU	50.		56497.0000	203.9603	254.5225	64781.7194	(277)
MYR	77.		99110.0000	209.0928	250.3911	62695.6869	(474)
IMSTATU	40.		17915.0000	134.6992	140.2835	19679.4543	(133)
IMSTATU	50.		81195.0000	238.1085	276.7150	76571.1911	(341)
MYR	78.		64120.0000	128.2400	171.9250	29558.2188	(500)
IMSTATU	40.		10530.0000	94.0179	98.0757	9618.8465	(112)
IMSTATU	50.		53590.0000	138.1186	186.8605	34916.8645	(388)
MYR	79.		27930.0000	75.2830	131.8265	17378.2305	(371)
IMSTATU	40.		4580.0000	57.9747	108.9269	11865.0763	(79)
IMSTATU	50.		23350.0000	79.9658	137.1582	18812.3700	(292)
MYR	80.		125.0000	10.4167	19.8240	392.9924	(12)
IMSTATU	40.		0.0	0.0	0.0	0.0	(2)
IMSTATU	50.		125.0000	12.5000	21.2459	451.3889	(10)

TOTAL CASES = 2500
MISSING CASES = 10 OR 0.4 PCT.

CRITERION VARIABLE IHC

ANALYSIS OF VARIANCE

VARIABLE	CODE	VALUE LABEL	SUM	MEAN	STD DEV	SUM OF SQ	N
MYR	73.		65000.0000	260.0000	275.6944	18925850.0000	(250)
MYR	74.		55225.0000	229.1494	295.4147	20944768.6224	(241)
MYR	75.		55608.0000	206.7212	284.1778	21642888.0892	(269)
MYR	76.		70117.0000	187.9812	236.3512	20780618.8686	(373)
MYR	77.		99110.0000	209.0928	250.3911	29655059.9156	(474)
MYR	78.		64120.0000	128.2400	171.9250	14749551.2000	(500)
MYR	79.		27930.0000	75.2830	131.8265	6429945.2830	(371)
MYR	80.		125.0000	10.4167	19.8240	4322.9167	(12)
	WITHIN GROUPS TOTAL		437235.0000	175.5964	231.6018	133133004.8956	(2490)

ANALYSIS OF VARIANCE

SOURCE	SUM OF SQUARES	D.F.	MEAN SQUARE	F	SIG.
BETWEEN GROUPS	8503816.472	7	**********	22.648	0.0
LINEARITY	6885572.417	1	**********	128.368	0.0000
DEV. FROM LINEARITY	1618244.055	6	269707.342	5.028	0.0000
	R =-0.2205	R SQUARED = 0.0486			
WITHIN GROUPS	133133004.896	2482	53639.406		
	ETA = 0.2450	ETA SQUARED = 0.0600			

TEST OF IMJDPRG 1 03/17/80

FILE NONAME (CREATION DATE = 03/17/80)

\- - - - - - - - - - - D E S C R I P T I O N O F S U B P O P U L A T I O N S - - - - - - - - - - -

CRITERION VARIABLE ICO IDLE CO
BROKEN DOWN BY MYR
BY IMSTATU

VARIABLE	CODE	VALUE LABEL	SUM	MEAN	STD DEV	VARIANCE	N
FOR ENTIRE POPULATION			5072.0196	2.0378	2.6593	7.0719	(2489)
MYR	73.		960.0999	3.8404	2.9477	8.6891	(250)
IMSTATU	40.		216.2000	2.9216	2.6958	7.2672	(74)
IMSTATU	50.		743.9000	4.2267	2.9707	8.8248	(176)
MYR	74.		798.9999	3.3154	2.9386	8.6353	(241)
IMSTATU	40.		215.0000	3.0282	3.0464	9.2803	(71)
IMSTATU	50.		584.0000	3.4353	2.8931	8.3701	(170)
MYR	75.		575.4000	2.1551	2.6027	6.7741	(267)
IMSTATU	40.		120.0000	1.5789	2.1595	4.6633	(76)
IMSTATU	50.		455.4000	2.3843	2.7308	7.4574	(191)
MYR	76.		755.3499	2.0251	2.5142	6.3214	(373)
IMSTATU	40.		142.7000	1.4865	1.9625	3.8515	(96)
IMSTATU	50.		612.6500	2.2117	2.6568	7.0586	(277)
MYR	77.		1058.0999	2.2276	2.8586	8.1717	(475)
IMSTATU	40.		220.9000	1.6609	2.3788	5.6588	(133)
IMSTATU	50.		837.1999	2.4480	2.9991	8.9945	(342)
MYR	78.		626.2999	1.2526	2.0241	4.0970	(500)
IMSTATU	40.		109.0000	0.9732	1.6185	2.6196	(112)
IMSTATU	50.		517.3000	1.3332	2.1219	4.5023	(388)
MYR	79.		297.6700	0.8023	1.7531	3.0734	(371)
IMSTATU	40.		43.5000	0.5506	1.5099	2.2797	(79)
IMSTATU	50.		254.1700	0.8704	1.8096	3.2748	(292)
MYR	80.		0.1000	0.0083	0.0289	0.0008	(12)
IMSTATU	40.		0.0	0.0	0.0	0.0	(2)
IMSTATU	50.		0.1000	0.0100	0.0316	0.0010	(10)

TOTAL CASES = 2500
MISSING CASES = 11 OR 0.4 PCT.

CRITERION VARIABLE ICO

ANALYSIS OF VARIANCE

VARIABLE	CODE	VALUE LABEL	SUM	MEAN	STD DEV	SUM OF SQ	N
MYR	73.		960.0999	3.8404	2.9477	2163.5819	(250)
MYR	74.		798.9999	3.3154	2.9386	2072.4731	(241)
MYR	75.		575.4000	2.1551	2.6027	1801.9205	(267)
MYR	76.		755.3499	2.0251	2.5142	2351.5579	(373)
MYR	77.		1058.0999	2.2276	2.8586	3873.3884	(475)
MYR	78.		626.2999	1.2526	2.0241	2044.4264	(500)
MYR	79.		297.6700	0.8023	1.7531	1137.1507	(371)
MYR	80.		0.1000	0.0083	0.0289	0.0092	(12)
WITHIN GROUPS TOTAL.			5072.0196	2.0378	2.4950	15444.5082	(2489)

ANALYSIS OF VARIANCE

SOURCE	SUM OF SQUARES	D.F.	MEAN SQUARE	F	SIG.
BETWEEN GROUPS	2150.496	7	307.214	49.351	0.0
LINEARITY	1935.862	1	1935.862	310.976	0.0
DEV. FROM LINEARITY	214.635	6	35.772	5.746	0.0000
WITHIN GROUPS	15444.508	2481	6.225		

R =-0.3317 R SQUARED = 0.1100

ETA = 0.3496 ETA SQUARED = 0.1222

FILE NONAME (CREATION DATE = 03/07/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *

YR BY STATUS VEHICLE TAMPER STATUS

CONTROLLING FOR..

STATE VALUE = VT1

* *

YR / STATUS (COUNT / ROW PCT / COL PCT / TOT PCT)	OK 0.	TAMPERED 30.	ARGUABLE 31.	MALFUNCTIONED 33.	ROW TOTAL
73.	1	5	8	1	15
	6.7	33.3	53.3	6.7	4.9
	0.7	8.8	8.0	10.0	
	0.3	1.6	2.6	0.3	
74.	1	3	8	0	12
	8.3	25.0	66.7	0.0	3.9
	0.7	5.3	8.0	0.0	
	0.3	1.0	2.6	0.0	
75.	6	2	13	2	23
	26.1	8.7	56.5	8.7	7.6
	4.4	3.5	13.0	20.0	
	2.0	0.7	4.3	0.7	
76.	16	17	24	0	57
	28.1	29.8	42.1	0.0	18.8
	11.7	29.8	24.0	0.0	
	5.3	5.6	7.9	0.0	
77.	19	10	13	1	43
	44.2	23.3	30.2	2.3	14.1
	13.9	17.5	13.0	10.0	
	6.3	3.3	4.3	0.3	
78.	36	13	25	2	76
	47.4	17.1	32.9	2.6	25.0
	26.3	22.8	25.0	20.0	
	11.8	4.3	8.2	0.7	
79.	57	6	9	4	76
	75.0	7.9	11.8	5.3	25.0
	41.6	10.5	9.0	40.0	
	18.8	2.0	3.0	1.3	
80.	1	1	0	0	2
	50.0	50.0	0.0	0.0	0.7
	0.7	1.8	0.0	0.0	
	0.3	0.3	0.0	0.0	
COLUMN TOTAL	137	57	100	10	304
	45.1	18.8	32.9	3.3	100.0

TEST OF [illegible] 1 03/07/80

FILE [illegible] (CREATION DATE = 03/07/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * *

[illegible] BY STATUS VEHICLE TAMPER STATUS

CONTROLLING FOR..

STATE VALUE = V12

* *

EYR	STATUS COUNT ROW PCT COL PCT TOT PCT	OK 0.	TAMPERED 30.	ARGUABLE 31.	[illegible] 33.	ROW TOTAL
73.		3	13	10	0	26
		11.5	50.0	38.5	0.0	8.3
		3.1	14.9	8.8	0.0	
		1.0	4.2	3.2	0.0	
74.		2	11	12	1	26
		7.7	42.3	46.2	3.8	8.3
		2.1	12.6	10.6	6.3	
		0.6	3.5	3.8	0.3	
75.		1	12	5	0	18
		5.6	66.7	27.8	0.0	5.8
		1.0	13.8	4.4	0.0	
		0.3	3.8	1.6	0.0	
76.		7	15	22	4	48
		14.6	31.3	45.8	8.3	15.4
		7.3	17.2	19.5	25.0	
		2.2	4.8	7.1	1.3	
77.		15	18	19	5	57
		26.3	31.6	33.3	8.8	18.3
		15.6	20.7	16.8	31.3	
		4.8	5.8	6.1	1.6	
78.		25	14	31	3	73
		34.2	19.2	42.5	4.1	23.4
		26.0	16.1	27.4	18.8	
		8.0	4.5	9.9	1.0	
79.		40	3	14	3	60
		66.7	5.0	23.3	5.0	19.2
		41.7	3.4	12.4	18.8	
		12.8	1.0	4.5	1.0	
80.		3	1	0	0	4
		75.0	25.0	0.0	0.0	1.3
		3.1	1.1	0.0	0.0	
		1.0	0.3	0.0	0.0	
COLUMN		96	87	113	16	312
TOTAL		30.8	27.9	36.2	5.1	100.0

FILE [illegible] (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *

STATUS VEHICLE TAMPER STATUS BY MYR

[illegible]

VALUE = **********

* *

STATUS	MYR: COUNT / ROW PCT / COL PCT / TOT PCT	73.	74.	75.	76.	77.	78.	79.	80.	ROW TOTAL
[illegible]	0.	4	2	6	11	17	17	9	1	67
		6.0	3.0	9.0	16.4	25.4	25.4	13.4	1.5	33.7
		15.4	10.0	18.8	28.9	34.7	73.9	90.0	100.0	
		2.0	1.0	3.0	5.5	8.5	8.5	4.5	0.5	
[illegible]	30.	3	3	6	4	5	2	0	0	23
		13.0	13.0	26.1	17.4	21.7	8.7	0.0	0.0	11.6
		11.5	15.0	18.8	10.5	10.2	8.7	0.0	0.0	
		1.5	1.5	3.0	2.0	2.5	1.0	0.0	0.0	
[illegible]	31.	19	15	19	23	23	3	1	0	103
		18.4	14.6	18.4	22.3	22.3	2.9	1.0	0.0	51.8
		73.1	75.0	59.4	60.5	46.9	13.0	10.0	0.0	
		9.5	7.5	9.5	11.6	11.6	1.5	0.5	0.0	
[illegible]	33.	0	0	1	0	4	1	0	0	6
		0.0	0.0	16.7	0.0	66.7	16.7	0.0	0.0	3.0
		0.0	0.0	3.1	0.0	8.2	4.3	0.0	0.0	
		0.0	0.0	0.5	0.0	2.0	0.5	0.0	0.0	
	COLUMN TOTAL	26	20	32	38	49	23	10	1	199
		13.1	10.1	16.1	19.1	24.6	11.6	5.0	0.5	100.0

CHI SQUARE = [illegible].64027 WITH 21 DEGREES OF FREEDOM SIGNIFICANCE = 0.0000
CRAMER'S V = 0.31602
CONTINGENCY COEFFICIENT = 0.47070
LAMBDA (ASYMMETRIC) = 0.23958 WITH STATUS DEPENDENT. = 0.00667 WITH MYR DEPENDENT.
LAMBDA (SYMMETRIC) = 0.09756
UNCERTAINTY COEFFICIENT (ASYMMETRIC) = 0.14133 WITH STATUS DEPENDENT. = 0.07994 WITH MYR DEPENDENT.
UNCERTAINTY COEFFICIENT (SYMMETRIC) = 0.10212
KENDALL'S TAU B = -0.29505 SIGNIFICANCE = 0.0000
KENDALL'S TAU C = -0.28026 SIGNIFICANCE = 0.0000
GAMMA = -0.40940
SOMERS'S D (ASYMMETRIC) = -0.25204 WITH STATUS DEPENDENT. = -0.34773 WITH MYR DEPENDENT.
SOMERS'S D (SYMMETRIC) = -0.29225
ETA = 0.47531 WITH STATUS DEPENDENT. = 0.44155 WITH MYR DEPENDENT.
PEARSON'S R =-0.4[illegible] SIGNIFICANCE = 0.0000

FILE NONAME (CREATION DATE = 03/06/80)

* * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *

STATUS VEHICLE TAMPER STATUS BY MYR

CONTROLLING FOR..

[illegible] VALUE = *********

STATUS	COUNT / ROW PCT / COL PCT / TOT PCT	73.	74.	75.	76.	77.	78.	79.	80.	ROW TOTAL
0. OK	COUNT	0	0	4	1	10	8	20	0	43
	ROW PCT	0.0	0.0	9.3	2.3	23.3	18.6	46.5	0.0	36.1
	COL PCT	0.0	0.0	30.8	8.3	38.5	40.0	80.0	0.0	
	TOT PCT	0.0	0.0	3.4	0.8	8.4	6.7	16.8	0.0	
30. [illegible]	COUNT	2	2	0	1	3	3	1	0	12
	ROW PCT	16.7	16.7	0.0	8.3	25.0	25.0	8.3	0.0	10.1
	COL PCT	25.0	14.3	0.0	8.3	11.5	15.0	4.0	0.0	
	TOT PCT	1.7	1.7	0.0	0.8	2.5	2.5	0.8	0.0	
31. [illegible]	COUNT	5	11	9	10	13	9	3	1	61
	ROW PCT	8.2	18.0	14.8	16.4	21.3	14.8	4.9	1.6	51.3
	COL PCT	62.5	78.6	69.2	83.3	50.0	45.0	12.0	100.0	
	TOT PCT	4.2	9.2	7.6	8.4	10.9	7.6	2.5	0.8	
33. [illegible]	COUNT	1	1	0	0	0	0	1	0	3
	ROW PCT	33.3	33.3	0.0	0.0	0.0	0.0	33.3	0.0	2.5
	COL PCT	12.5	7.1	0.0	0.0	0.0	0.0	4.0	0.0	
	TOT PCT	0.8	0.8	0.0	0.0	0.0	0.0	0.8	0.0	
COLUMN TOTAL		8	14	13	12	26	20	25	1	119
		6.7	11.8	10.9	10.1	21.8	16.8	21.0	0.8	100.0

CHI SQUARE = [illegible] WITH 21 DEGREES OF FREEDOM SIGNIFICANCE = 0.0005
CRAMER'S V = 0.37164
CONTINGENCY COEFFICIENT = 0.54126
LAMBDA (ASYMMETRIC) = 0.?9310 WITH STATUS DEPENDENT. = 0.11828 WITH MYR DEPENDENT.
LAMBDA (SYMMETRIC) = 0.16543
UNCERTAINTY COEFFICIENT (ASYMMETRIC) = 0.23874 WITH STATUS DEPENDENT. = 0.12954 WITH MYR DEPENDENT.
UNCERTAINTY COEFFICIENT (SYMMETRIC) = 0.16795
KENDALL'S TAU B = -0.40[illegible] SIGNIFICANCE = 0.0000
KENDALL'S TAU C = -0.36597 SIGNIFICANCE = 0.0000
GAMMA = -0.55[illegible]
SOMERS'S D (ASYMMETRIC) = -0.34444 WITH STATUS DEPENDENT. = -0.48519 WITH MYR DEPENDENT.
SOMERS'S D (SYMMETRIC) = -0.40287
ETA = 0.5[illegible] WITH STATUS DEPENDENT. = 0.48987 WITH MYR DEPENDENT.
PEARSON'S R = -0.48[illegible] SIGNIFICANCE = 0.0000

TEST OF IMJDPRG 1 05/01/80

FILE NONAME (CREATION DATE = 05/01/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *

LIMCAP LIMITER CAPS BY MYR

CONTROLLING FOR..

I/STATU VALUE = 40.

* *

LIMCAP	MYR: COUNT / ROW PCT / COL PCT / TOT PCT	73.	74.	75.	76.	77.	78.	79.	80.	ROW TOTAL
0. NOT EQUIPPED	COUNT	1	2	2	2	5	3	28	1	44
	ROW PCT	2.3	4.5	4.5	4.5	11.4	6.8	63.6	2.3	6.8
	COL PCT	1.3	2.8	2.6	2.1	3.7	2.7	35.4	50.0	
	TOT PCT	0.2	0.3	0.3	0.3	0.8	0.5	4.3	0.2	
1. FUNCT PROPERLY	COUNT	6	5	14	19	39	45	40	1	169
	ROW PCT	3.6	3.0	8.3	11.2	23.1	26.6	23.7	0.6	26.2
	COL PCT	8.0	7.0	18.4	19.8	29.1	40.2	50.6	50.0	
	TOT PCT	0.9	0.8	2.2	2.9	6.0	7.0	6.2	0.2	
12. ARGUABLE TAMPERI	COUNT	68	63	60	75	90	63	11	0	430
	ROW PCT	15.8	14.7	14.0	17.4	20.9	14.7	2.6	0.0	66.7
	COL PCT	90.7	88.7	78.9	78.1	67.2	56.3	13.9	0.0	
	TOT PCT	10.5	9.8	9.3	11.6	14.0	9.8	1.7	0.0	
99.	COUNT	0	1	0	0	0	1	0	0	2
	ROW PCT	0.0	50.0	0.0	0.0	0.0	50.0	0.0	0.0	0.3
	COL PCT	0.0	1.4	0.0	0.0	0.0	0.9	0.0	0.0	
	TOT PCT	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	
COLUMN TOTAL		75	71	76	96	134	112	79	2	645
		11.6	11.0	11.8	14.9	20.8	17.4	12.2	0.3	100.0

CHI SQUARE = 223.64787 WITH 21 DEGREES OF FREEDOM SIGNIFICANCE = 0.0
CRAMER'S V = 0.33860
CONTINGENCY COEFFICIENT = 0.50589
LAMBDA (ASYMMETRIC) = 0.13953 WITH LIMCAP DEPENDENT. = 0.05871 WITH MYR DEPENDENT.
LAMBDA (SYMMETRIC) = 0.08264
UNCERTAINTY COEFFICIENT (ASYMMETRIC) = 0.18343 WITH LIMCAP DEPENDENT. = 0.07798 WITH MYR DEPENDENT.
UNCERTAINTY COEFFICIENT (SYMMETRIC) = 0.10944
KENDALL'S TAU B = -0.38901 SIGNIFICANCE = 0.0000
KENDALL'S TAU C = -0.33208 SIGNIFICANCE = 0.0000
GAMMA = -0.59267
SOMERS'S D (ASYMMETRIC) = -0.29301 WITH LIMCAP DEPENDENT. = -0.51647 WITH MYR DEPENDENT.
SOMERS'S D (SYMMETRIC) = -0.37390
ETA = 0.37969 WITH LIMCAP DEPENDENT. = 0.44227 WITH MYR DEPENDENT.
PEARSON'S R =-0.32112 SIGNIFICANCE = 0.0000

FILE NONAME (CREATION DATE = 05/01/80)

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *

LIMCAP LIMITER CAPS BY MYR

CONTROLLING FOR..

INSTATU VALUE = 50.

* *

LIMCAP	MYR: COUNT / ROW PCT / COL PCT / TOT PCT	73.1	74.1	75.1	76.1	77.1	78.1	79.1	80.1	ROW TOTAL
0. NOT EQUIPPED	COUNT	8	1	2	8	16	13	36	4	88
	ROW PCT	9.1	1.1	2.3	9.1	18.2	14.8	40.9	4.5	4.7
	COL PCT	4.5	0.6	1.0	2.9	4.7	3.3	12.3	40.0	
	TOT PCT	0.4	0.1	0.1	0.4	0.9	0.7	1.9	0.2	
1. FUNCI PROPERLY	COUNT	23	18	47	86	119	216	209	6	724
	ROW PCT	3.2	2.5	6.5	11.9	16.4	29.8	28.9	0.8	39.1
	COL PCT	13.1	10.5	24.1	30.9	34.8	55.4	71.6	60.0	
	TOT PCT	1.2	1.0	2.5	4.6	6.4	11.7	11.3	0.3	
12. ARGUABLE TAMPERI	COUNT	145	151	146	184	206	159	45	0	1036
	ROW PCT	14.0	14.6	14.1	17.8	19.9	15.3	4.3	0.0	55.9
	COL PCT	82.4	88.3	74.9	66.2	60.2	40.8	15.4	0.0	
	TOT PCT	7.8	8.1	7.9	9.9	11.1	8.6	2.4	0.0	
99.	COUNT	0	1	0	0	1	2	2	0	6
	ROW PCT	0.0	16.7	0.0	0.0	16.7	33.3	33.3	0.0	0.3
	COL PCT	0.0	0.6	0.0	0.0	0.3	0.5	0.7	0.0	
	TOT PCT	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.0	
COLUMN TOTAL		176	171	195	278	342	390	292	10	1854
		9.5	9.2	10.5	15.0	18.4	21.0	15.7	0.5	100.0

CHI SQUARE = 452.09033 WITH 21 DEGREES OF FREEDOM SIGNIFICANCE = 0.0
CRAMER'S V = 0.28510
CONTINGENCY COEFFICIENT = 0.44277
LAMBDA (ASYMMETRIC) = 0.27751 WITH LIMCAP DEPENDENT. = 0.04781 WITH MYR DEPENDENT.
LAMBDA (SYMMETRIC) = 0.13015
UNCERTAINTY COEFFICIENT (ASYMMETRIC) = 0.14976 WITH LIMCAP DEPENDENT. = 0.06661 WITH MYR DEPENDENT.
UNCERTAINTY COEFFICIENT (SYMMETRIC) = 0.09221
KENDALL'S TAU B = -0.38386 SIGNIFICANCE = 0.0000
KENDALL'S TAU C = -0.34364 SIGNIFICANCE = 0.0000
GAMMA = -0.55798
SOMERS'S D (ASYMMETRIC) = -0.30471 WITH LIMCAP DEPENDENT. = -0.48356 WITH MYR DEPENDENT.
SOMERS'S D (SYMMETRIC) = -0.37385
ETA = 0.32332 WITH LIMCAP DEPENDENT. = 0.44069 WITH MYR DEPENDENT.
PEARSON'S R = -0.30073 SIGNIFICANCE = 0.0000

NUMBER OF MISSING OBSERVATIONS = 1

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.
EPA-330/1-80-001

2.

3. RECIPIENT'S ACCESSION NO.

4. TITLE AND SUBTITLE
Motor Vehicle Tampering Survey-1979

5. REPORT DATE
May 1980-date of preparat

6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)
National Enforcement Investigations Center
Field Operations and Support Division

8. PERFORMING ORGANIZATION REPORT NO.

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Office of Enforcement
U.S. Environmental Protection Agency

12. SPONSORING AGENCY NAME AND ADDRESS
U.S. Environmental Protection Agency
401 M Street S.W.
Washington, D.C. 20460

15. SUPPLEMENTARY NOTES

16. ABSTRACT

The National Enforcement Investigatic
2,499 vehicles for tampering with emi
All vehicles inspected were classifie
mutually exclusive categories: tamper
device removed or rendered inoperativ
(potential, but not clear-cut tamperi
and OK (all control devices present a
properly). The results were: tampere
46.5%, malfunctioning-2.2%, and OK-3

17. KEY WORDS AND DOCUMEN

a. DESCRIPTORS	b. IDEN	
Survey Investigation	Automotive Tampering	

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
Unlimited	Unclassified	101
	20. SECURITY CLASS *(This page)*	22. PRICE
	Unclassified	

EPA Form 2220-1 (9-73)