EXHAUST EMISSIONS FROM UNCONTROLLED VEHICLES AND RELATED EQUIPMENT USING INTERNAL COMBUSTION ENGINES

by

Charles T. Hare

Karl J. Springer

FINAL REPORT

PART 3

MOTORCYCLES

Contract No. EHS 70-108

Prepared for

Characterization and Control Development Branch
Mobile Source Pollution Control Program
and
National Air Data Branch
Office of Air Quality Planning and Standards

Office of Air and Water Programs
Environmental Protection Agency

March 1973

SOUTHWEST RESEARCH INSTITUTE
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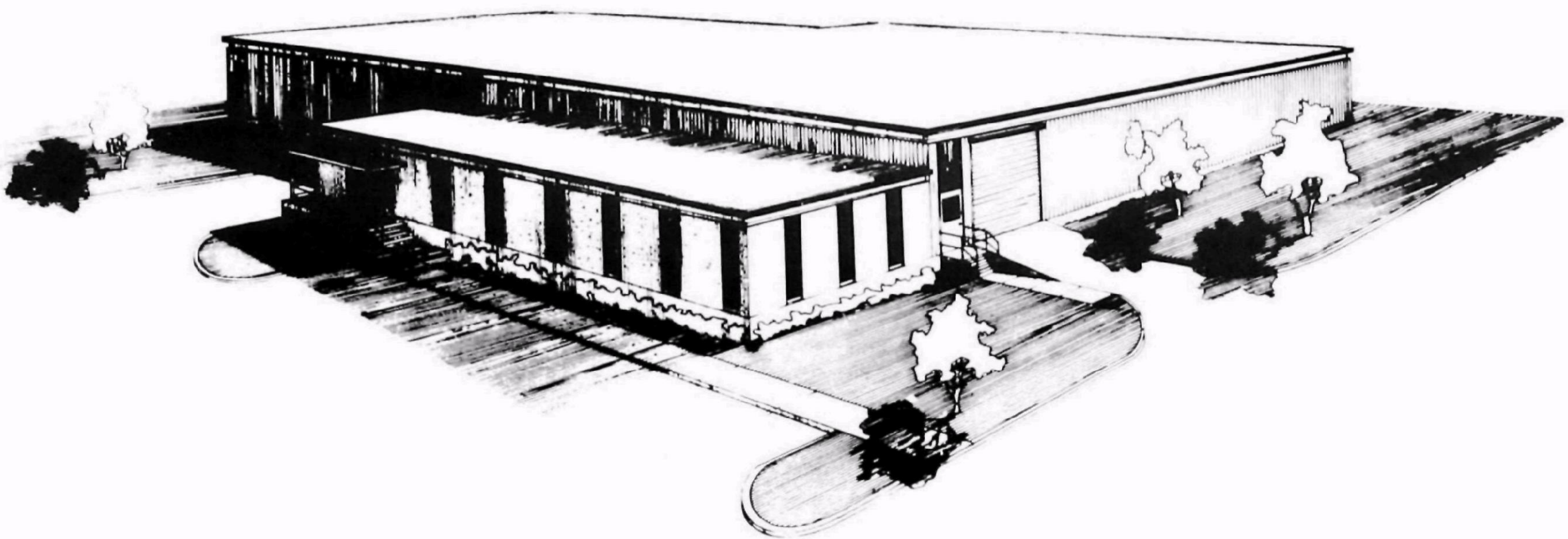

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Approved:

John M. Clark, Jr.
Technical Vice President
Department of Automotive Research

ABSTRACT

This report is Part 3 of the Final Report on Exhaust Emissions from Uncontrolled Vehicles and Related Equipment Using Internal Combustion Engines, Contract EHS 70-108. Exhaust emissions from seven motorcycles were measured using three separate procedures for each bike. The motorcycles tested were a Harley-Davidson FLH (1200cc), a Honda CL350K3, a Honda SL100, a Kawasaki 125F6, a Suzuki T250, a Triumph T120R (650cc), and a Yamaha DT1E (250cc). Although two of the procedures used for testing were based on those specified in Federal Law for automobiles, it should be noted that motorcycles are currently exempt from Federal emissions regulations.

The first procedure used for the motorcycle tests was the Federal "7-mode" direct sampling procedure (applicable to 1970 and 1971 model year light duty vehicles), modified where necessary. The exhaust constituents measured for the 7-mode tests included hydrocarbons, CO, CO_2 and NO, all by NDIR. The motorcycles were also tested on the Federal "LA-4" bag sampling procedure (applicable to 1972 and newer light duty vehicles), modified as necessary. This procedure currently specifies measurement of hydrocarbons by FIA, CO and CO_2 by NDIR, and NO and NO_x by chemiluminescence. The final procedure used was a series of steady-state conditions designed to cover the range of operating conditions experienced by each motorcycle. The exhaust products measured during the steady-state tests included: total hydrocarbons by FIA; light hydrocarbons by gas chromatograph (2 of the 7 machines only); hydrocarbons, (2 of the 7 machines only), CO, CO_2, and NO by NDIR; NO and NO_x by chemiluminescence; O_2 by electrochemical analysis; total aliphatic aldehydes (RCHO) and formaldehyde (HCHO) by the MBTH and chromotropic acid methods, respectively; particulate by an experimental dilution-type sampling device; and exhaust smoke (2-stroke machines only) using a PHS full-flow smokemeter.

The motorcycles were operated on a modified automotive chassis dynamometer, and the emissions results are used in conjunction with statistics on motorcycle population and usage to estimate national emissions impact.

FOREWORD

The project for which this report constitutes part of the end product was initiated jointly on June 29, 1970 by the Division of Motor Vehicle Research and Development and the Division of Air Quality and Emission Data, both divisions of the agency known as NAPCA. Currently, these offices are the Characterization and Control Development Branch of MSPCP and the National Air Data Branch of OAQPS, respectively, Office of Air and Water Programs, Environmental Protection Agency. The contract number is EHS 70-108, and the project is identified within Southwest Research Institute as 11-2869-01.

This report (Part 3) covers the motorcycle portion of the characterization work only, and the other items in the characterization work have been or will be covered by six other parts of the final report. In the order in which the final reports have been or will be submitted, the seven parts of the characterization work include: Locomotives and Marine Counterparts; Outboard Motors; Motorcycles; Small Utility Engines; Farm, Construction and Industrial Engines; Snowmobiles; and Gas Turbine "peaking" Powerplants. Other efforts which have been conducted as separate phases of Contract EHS 70-108, including: measurement of gaseous emissions from a number of aircraft turbine engines; measurement of crankcase drainage from a number of outboard motors; and investigation of emissions control technology for locomotive diesel engines; either have been or will be reported separately.

Cognizant technical personnel for the Environmental Protection Agency are currently Messrs. William Rogers Oliver and David S. Kircher, and past Project Officers include Messrs. J. L. Raney, A. J. Hoffman, B. D. McNutt, and G. J. Kennedy. Project Manager for Southwest Research Institute has been Mr. Karl J. Springer, and Mr. Charles T. Hare has carried the technical responsibility.

The offices of the sponsoring agency (EPA) are located at 2565 Plymouth Road, Ann Arbor, Michigan 48105 and at Research Triangle Park, North Carolina 27711; and the contractor (SwRI) is located at 8500 Culebra Road, San Antonio, Texas 78284.

The assistance of several individuals and groups has contributed to the success of the motorcycle portion of this project. To begin, of course, appreciation is expressed to Harley-Davidson Motor Co.; American Honda Motor Co., Inc.; Kawasaki Motors Corp., U.S.A.; U.S. Suzuki Motor Corp.; Triumph Motorcycle Corp.; and Yamaha International Corp. for supplying motorcycles on a loan basis for test purposes. Individuals within these companies who have provided technical assistance include Messrs. Lance Presnall and Nick Hirsch of Harley-Davidson, Brian Gill and Chet Hale of Honda, Dennis David of Kawasaki, Mike Petler of Suzuki; E. W. "Pete" Colman of Triumph, and Leo Lake, Dennis Stefani, and Isao Shirayanagi of Yamaha. Mr. Roy Kessler of the Motorcycle Industry Council (MIC) has also been very helpful.

Mr. Lake, in his capacity as chairman of the SAE Motorcycle Committee, has also been instrumental in promoting communication by scheduling meetings of his committee at the contractor's facility. These meetings have provided an excellent forum for presentation of progress reports to the motorcycle industry and a good opportunity for exchange of technical information.

The SwRI personnel involved most deeply in preparation for and conduct of the motorcycle tests included Russel T. Mack, lead technician, and Jim Chessher, Gene Hoyt, John T. Jack, Wm. P. Jack, Joyce McBryde, Del Ray O'Neill, and Joyce Winfield. The contributions of all these people were necessary and are sincerely appreciated.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

LIST OF ILLUSTRATIONS

LIST OF TABLES

LIST OF TABLES (Cont.)

LIST OF TABLES (Cont.)

I. INTRODUCTION

The program of research on which this report is based was initiated by the Environmental Protection Agency to (1) characterize emissions from a broad range of internal combustion engines in order to accurately set priorities for future control, as required, and (2) assist in developing more inclusive national and regional air pollution inventories. This document, which is Part 3 of what is planned to be a seven-part final report, concerns emissions from motorcycles and the national impact of these emissions.

Prior to the work reported here, very little well-documented motorcycle emissions research had been made public, although doubtless some unpublished work had been done. The results which were available were also generated by procedures originally developed for passenger cars, some of which were valid for motorcycles and others which were not. Several procedures were used for motorcycle testing in the subject program to gather the most useful results, but little consideration has been given to the potential usefulness of these procedures for anything except research purposes.

Due to arrangements within the contract, the motorcycle testing was performed during three essentially separate time intervals. Some of the 7-mode tests were performed on five motorcycles (all except the Honda SL100 and Kawasaki 125F-6) during April and May 1971. At that point the personnel involved were assigned to on-site testing of aircraft turbine engines until about September 1971, so the remainder of the testing on the same five machines was accomplished from September 1971 through early January, 1972. The third section came after the most recent contract modification, extending from August through October of 1972, and it included all testing on the Honda SL100 and the Kawasaki 125F-6. All the tests were performed in the Emissions Research Laboratory at SwRI except the road tests and noise tests.

II. OBJECTIVES

The objectives of the motorcycle part of this project were to obtain exhaust emission data on a variety of motorcycles, and to use these data along with available information on number of machines in service and annual usage to estimate emission factors and national impact. The emissions to be measured included total hydrocarbons (FIA); CO, CO_2, NO and hydrocarbons (NDIR); NO_x and NO (chemiluminescence); O_2 (electrochemical); light hydrocarbons (gas chromatograph); aldehydes (wet chemistry); particulates (gravimetric analysis); and smoke for 2-stroke machines only (PHS light extinction smokemeter). These exhaust constituents are essentially the same as those measured during all tests on gasoline-fueled engines tested under this contract.

In order to obtain comprehensive data, it became necessary to operate the motorcycles on modified versions of cyclic procedures originally designed for automobiles, as well as steady-state procedures designed specifically for the motorcycles. The modified cyclic procedures gave useful results for constituents which could be analyzed continuously and which did not degrade with time in bag samples, but they could not be used to measure constituents which required relatively lengthy sample collection periods or which decomposed or settled out with time. To meet the objective of obtaining good emissions data, it was necessary to develop representative steady-state procedures which could be weighted by mode to derive composite emissions of difficult-to-measure constituents such as aldehydes and particulates. This development became a secondary objective of the project.

III. INSTRUMENTATION, METHODS, AND CALCULATION TECHNIQUES

This report section covers the conduct of the road tests and dynamometer simulation, all the emission measurements, calculation of unmeasured constituents, and the noise tests. It includes photographic documentation of all the studies as well as descriptions, and is broken into seven major subsections for clarity. In brief, the test procedures were chosen to yield as much useful data and as many comparisons to other emission sources as possible. The steady-state tests permitted acquisition of data on emissions which require an extended sampling period (aldehydes, particulate, and light hydrocarbons), in addition to providing an assessment of the stability of emissions which can be measured continuously. The 7-mode tests were included to attempt comparison to motorcycle work done previously, and they could also be useful in determining emissions variations and average concentrations during transients. The LA-4 (1972 and later Federal) tests were included because this procedure is the current Federal standard for light-duty vehicles, and thus is probably the most reliable way to estimate national emissions impact of motorcycles.

The seven motorcycles tested were chosen to represent a variety of sizes and types, including both 2-stroke and 4-stroke machines. Descriptions of the bikes are given in Table 1, and it should be noted that the five larger machines were 1971 models and that the two smaller ones

TABLE 1. DESCRIPTION OF TEST MOTORCYCLES

Manufacturer	Model	Cyls.	Nom. Disp., cm^3	Wt., lb_f	Engine Type	Chassis Type	Nominal Max hp at rpm
Harley-Davidson	FLH	2	1200	697	4-stroke	street	*57 @ 5,000
Honda	CL350K3	2	350	355	4-stroke	street	33 @ 9,500
Honda	SL100	1	100	220	4-stroke	dual-purpose	11.5 @ 11,000
Kawasaki	125F-6	1	125	248	2-stroke	dual-purpose	*15 @ 7,500
Suzuki	T250	2	250	339	2-stroke	street	32 @ 8,000
Triumph	T120R	2	650	417	4-stroke	street	50 @ 6,500
Yamaha	DT1-E	1	250	279	2-stroke	dual-purpose	23 @ 7,000

*approximate - not from manufacturer's data

were 1972 models. Although the machines tested were some of the most popular types, no attempt was made to correlate exactly with the national population. A much larger number of motorcycles would be necessary to form any kind of statistical sample of the population.

A. Road Testing and Dynamometer Simulation

The reason for conducting road tests on the motorcycles, including accelerations and decelerations, is to make sure that the subsequent dynamometer inertia and road load settings will permit the machines to operate as normally as possible. The same comment applies, of course, to speedometer calibrations. Since the subject work is perhaps the first fairly comprehensive study of motorcycle emissions to be widely circulated, care has been taken to document the process used in setting up the motorcycles for dynamometer operation. Making the dynamometer simulation data available in this manner will allow the process to be judged properly in retrospect, and if errors are found, the emissions data can be corrected for the errors and still be usable.

The dynamometer used was an old Clayton model C-49 unit, having 7-inch diameter rolls about 80 inches long. The actual inertia of the rolls is not known, but they are partially hollowed out rather than being solid. The unit was modified to reduce the roll spacing to 12 inches on centers, preventing the tire of the motorcycle from sinking too far down between the rolls. The inertia system was fabricated especially for motorcycles, consisting of six steel discs which could be selectively coupled to the rolls. For tests on the smaller machines (Honda SL100 and Kawasaki 125F-6), the inertia wheels turned at the same rotational speed as the rolls, but they were driven at twice the roll speed for the five larger machines. The dynamometer and the inertia wheels are shown in Figures 1 and 2, respectively (the inertia system was covered by a guard when in operation). Referring to Figure 2, the three larger wheels were 20 inches in diameter, and were designated numbers 1, 2, and 3 in order of decreasing thickness. The smaller wheels were 16 inches in diameter, and were designated 4, 5, and 6 in order of decreasing thickness. Wheels 1 and 4 were 1/2 inch thick, 2 and 5 were 3/8 inch thick, and 3 and 6 were 1/4 inch thick. The water brake power absorption unit is under the plate at the right end of the dynamometer in Figure 1, and the white console contains speed (mi/hr) and power absorption (hp) readouts.

In the case of the dynamometer as well as some other equipment items used during the subject study, time and financial constraints combined to prevent equipment from being optimized. Another item which was a compromise was the blower used for engine cooling. To simulate the real situation properly, the blower should provide airflow over the engine proportional to road speed, but the blower used for this project was not so controlled. During idles, the blower was shut off, and it was unrestricted during other conditions. The most important function of the

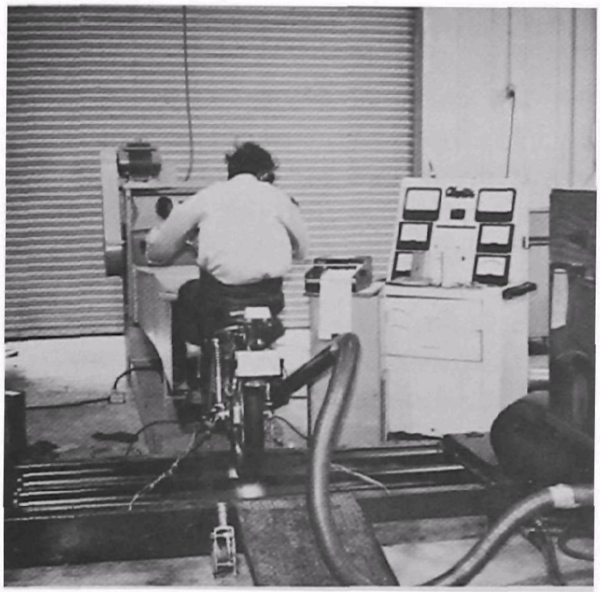


Figure 1. Modified Automobile Chassis Dynamometer Used for Motorcycle Emissions Tests

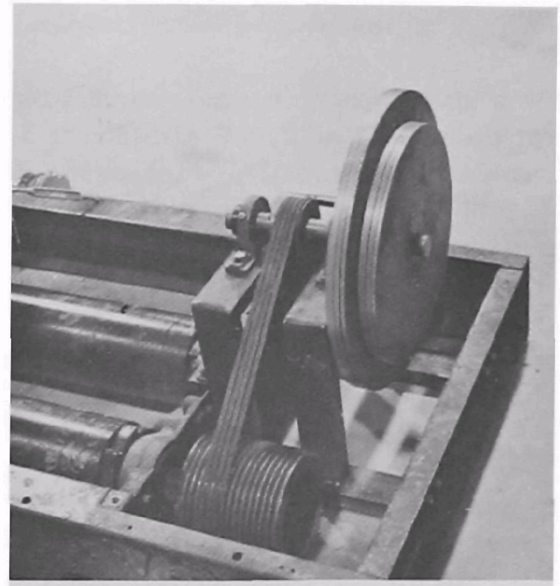


Figure 2. Variable Inertia Simulation System Used for Motorcycle Emissions Tests

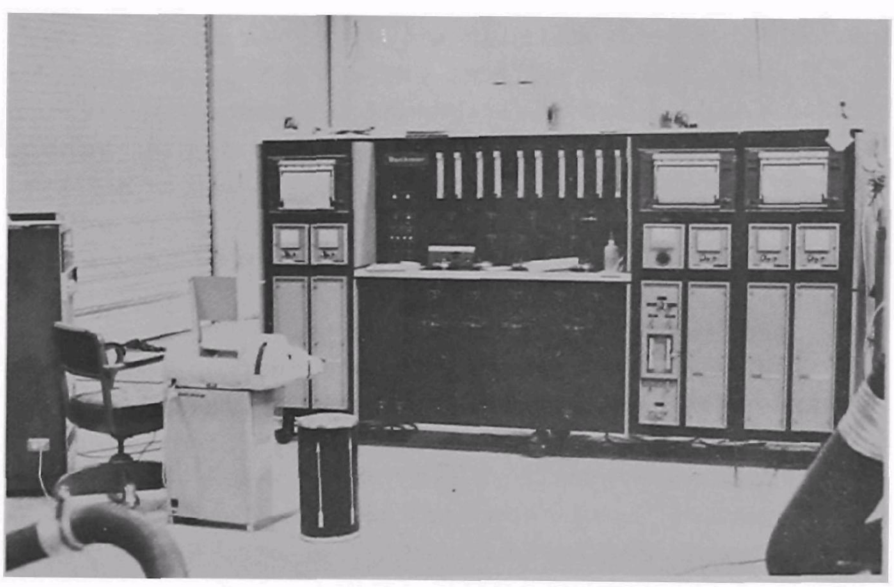


Figure 3. System of NDIR Instruments Used for 7-Mode Tests on Motorcycles

blower during the subject tests was to provide sufficient cooling air to prevent engine damage, and any side-effects on emissions which may have occurred will simply have to be accepted as experimental error until further tests are run using more sophisticated equipment.

Data taken during the road test and dynamometer simulation operation are given in Appendix A, pages A-2 through A-8. The first step for each motorcycle was to calibrate its speedometer. All subsequent work was then performed at true speeds rather than indicated speeds. The motorcycles were weighed with full liquid levels, and these weights (plus an assumed 150 pound rider) were used later to determine power requirements for simulated uphill conditions (steady-state tests). Inlet vacuum was recorded next (five machines only), on a level course in the indicated gears. These data were of limited value, so they were not acquired for the last two bikes tested (Honda SL100 and Kawasaki 125F-6).

The coasting times (or "rundown" times, as they are commonly called) were measured on a flat course, the process requiring two technicians. Taking the data on page A-3 for the Honda CL350K3 as an example, Operator R rode by Operator D (who was standing beside the road) at a true 40 mph and pulled in the clutch in view of Operator D. Operator D started a stopwatch when the clutch was disengaged, and continued watching the motorcycle from the rear. When a true 20 mph was reached, Operator R touched the rear brake pedal, causing the taillight to flash, and Operator D stopped the watch. Operator R turned the bike around and repeated the procedure in the other direction, and then the operators changed places and repeated the two runs. The 20 mph and 40 mph speeds were chosen only as a matter of convenience, because each of the five larger bikes had at least one gear in which it would accelerate well at wide open throttle from 20 mph to 40 mph. It was considered desirable to run the accelerations and the rundowns between the same two speeds. For the two smaller motorcycles, 25 mph and 45 mph proved to be more convenient endpoints. The one-gear accelerations were run in a manner similar to the coasting tests, with the rider beginning the acceleration in view of the stationary observer and tapping the rear brake when the speed reached the true end value. The accelerations were limited to one gear to eliminate the effect of shifting variations.

The data gathered in the road test were used to set up the dynamometer for both constant-speed and transient operation. The inlet vacuum tests were repeated with the bike on the dynamometer and in all cases the vacuum readings indicated that dynamometer friction was just about equal to level road resistance; so it was not necessary to add any additional dynamometer load for the "road load" settings (resulting in the blank columns at the bottom right of the test data sheets). An additional indication of the accuracy of the road load simulation was provided by the acceleration and rundown tests, as will be explained shortly.

The next step was to determine which inertia wheel (or combination of wheels) was necessary to properly simulate road performance during transient conditions. This procedure was of the trial-and-error type, and in all cases the last wheel or combination of wheels listed on the data sheet was the one used during the 7-mode and LA-4 cycles. Looking at the data for the Honda CL350K3 again, wheel number 4 was tried first, resulting in both acceleration and deceleration times which were too short. This outcome meant that the wheel did not have enough inertia, so a wheel having higher inertia (no. 2) was tried. In this second trial, the deceleration time was a little short and the acceleration time was a little bit high. This outcome meant that the inertia was about right, but that the dynamometer friction was a bit greater than road load between 20 mph and 40 mph. If, as an example, the acceleration time had been low and the deceleration time had been high, dynamometer friction would have been lower than road load over the speed range investigated. This reversal occurred markedly only for the Suzuki T250 (although it occurred to a lesser extent for the Honda SL100 and the Kawasaki 125F-6), and it was later discovered that the apparently greater "road load" for the Suzuki had been due to a dragging front brake. A similar but opposite problem seemed to be occurring with the Kawasaki 125F-6, but in this case the restraints were simply snubbed down too tightly, creating an artificial additional amount of dynamometer friction.

Three of the motorcycles tested (Honda SL100, Kawasaki 125F-6, and Yamaha DT1-E) were of the "dual purpose" type, and were fitted with one variety or other of semi-knobby rear tires as standard equipment. These "dirt" tires were replaced with street tires to reduce dynamometer friction and to prevent tire disintegration, so the effective overall gear ratios of the three machines may have been changed slightly as a result.

B. Federal "7-Mode" Cycle Gaseous Emissions Measurement Procedure (Applicable to 1970 and 1971 Model Year Light Duty Vehicles)

The major reasons for running the motorcycles on the 7-mode cycle[1] were to permit correlation with earlier emissions tests and to obtain data on average emission concentrations during certain transient conditions. It was discovered quite early in the tests that use of the empirical equation relating exhaust volume to vehicle mass was not practical because it gave inaccurate (low) results for motorcycles. The effect of this problem was that calculation of emissions on a mass basis from 7-mode results had to be eliminated, which was no great loss since the other measurement procedures gave good results to fill in the gap.

As required by the 7-mode procedure, shift points were standardized for each motorcycle according to what was considered its normal operation. These shift points are outlined on pages B-2 through B-5 of Appendix B, and show considerable variations from one motorcycle to another, as a function of engine size, gearing, and so forth.

The 7-mode procedure (which applied to light-duty vehicles up through the 1971 model year, excluding motorcycles) specified direct exhaust sampling for hydrocarbons, CO, CO_2, and NO (1971 only), so these constituents were the ones measured (all by NDIR analysis). The instrumentation system used is shown in Figure 3, along with a teletype terminal and on-line computer (left) used for processing of information from other types of emissions tests. The system had the high flowrates and fast response required by law for certification work, and data analysis was performed by hand-integrating the strip chart readouts and processing the results by computer from that point (see Appendix B, pages B-6 through B-37 for computer printouts). To help the operator drive the cycle correctly, he watched a strip chart driving aid with a pen to follow the speed-time trace as shown in Figure 4. A similar driving aid was used for the LA-4 runs. The fuel used for the 7-mode tests as well as all the other procedures was standard emissions test fuel(2), similar to the brand-name product "Indolene 30."

C. Federal "LA-4" Cycle Gaseous Emissions Measurement Procedure (Applicable to Light Duty Vehicles of 1972 Model Year and Later)

This newer procedure(2), which uses constant-volume sampling, was much more readily adapted to use in motorcycle testing than was the older 7-mode procedure. Calculations were more direct and less time-consuming, and the composite mass-based results were quite believable. The major drawback of the bag sampling procedure is that it provided no data on individual modes, which made it more useful for determination of impact than for characterization studies. The instrumentation specified for this procedure is NDIR analysis for CO and CO_2, FIA analysis for total hydrocarbons, and chemiluminescent analysis for NO_x. The instrument cart used for the bag analysis is shown in Figure 5, and the constant volume sampler (CVS) is shown in Figure 6 as connected to the Honda SL100 during an LA-4 emissions test. Figure 7 is a more detailed view of the CVS, with the air inlet at upper left, filtration system inside the stainless steel box, and pressure and temperature readouts on the panel and shelf in front of the technician.

For the motorcycle tests, the positive-displacement blower used to pull air/exhaust mixture through the CVS was run more slowly than it would have been for automobile tests to provide reasonable emission concentrations for measurement. The total volume flowrate through the system was about 93 CFM, of which a small fraction was removed to fill the sample bags. The calculation procedure used to arrive at grams per mile from the raw data was essentially that which becomes applicable to light-duty vehicles of 1975 and later model years(3). The

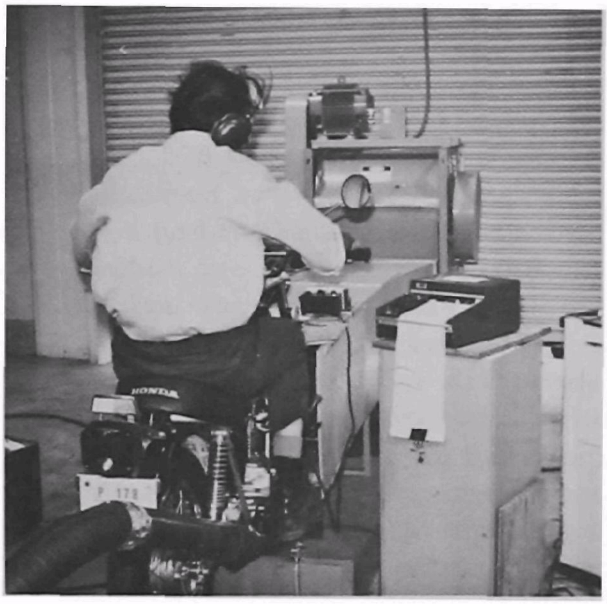


Figure 4. Motorcycle Operator Following Strip Chart Driving Aid During Emission Test

Figure 5. Instrument Cart Used for Analysis of Bag Samples

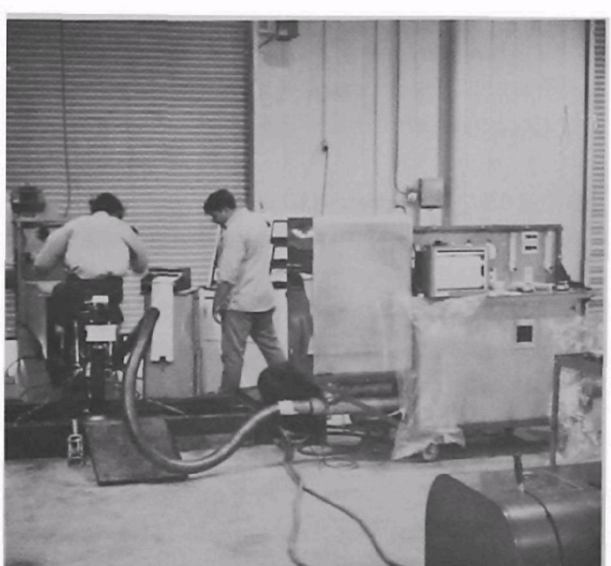


Figure 6. Constant Volume Sampler Connected to Honda SL100 Motorcycle During LA-4 Emissions Test

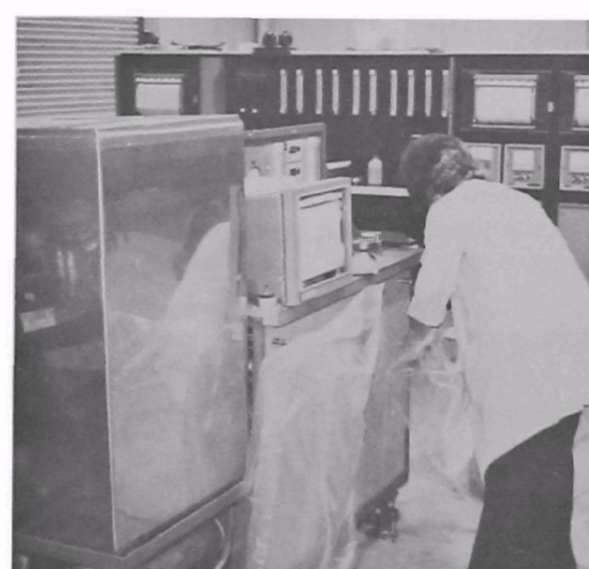


Figure 7. Technician Removing Dilute Sample Bags from Constant Volume Sampler

only exceptions made to the 1975 procedures were that only one background bag was taken during each phase (rather than two), and that the humidity correction factor was assumed to be 1.0 in all cases. The exceptions probably did not have a significant effect on the overall results.

The major difference in calculation procedure between the 1972 and 1975 versions of the Federal light-duty vehicle test procedure is the inclusion of emissions measured during the transient hot phase (bag 3, as noted in the Appendix) in the latter procedure. This change tends to reduce the importance of the cold start to some extent, but since motorcycles warm up rapidly (they have air-cooled engines which are not as bulky as automobile engines) the change probably means little as far as motorcycle emissions are concerned. Both the 1972 and 1975 procedures make use of the same basic principles of measurement, namely; dilution of sample to slow down reactions and prevent condensation of water; determination of volume concentrations of the time-averaged dilute sample; and use of the concentrations with total diluted exhaust volume flowrate to determine mass emitted per mile. This procedure contrasts sharply with the older 7-mode calculations, which required calculation of an "average" concentration based on defined intervals within the cycle, and use of an empirical exhaust volume flowrate to determine mass emitted per mile.

D. Steady State Emissions Measurement Procedures

The inclusion of steady state emissions measurements in addition to the two cyclic procedures was deemed necessary for several reasons. First, the stability of the emissions was of interest, so sampling over a period of time was desirable from that standpoint. In addition, due to the lack of reliable continuous methods for analysis of some exhaust constituents, more or less extended sampling periods were required (aldehydes, light hydrocarbons, and particulate).

Development of reasonable operating conditions for the motorcycles was undertaken with the idea in mind that the resulting procedures should be useful for measurement of gaseous emissions, particulates, and smoke. The dynamometer setup did not include provision for "motoring", or simulation of downhill closed-throttle operation, so the range of operation was limited to level road and uphill conditions. As has already been shown in the discussion on road testing and dynamometer simulation, the dynamometer friction was quite similar to level road resistance, so "road load" conditions were run with no additional power absorption. Uphill conditions were defined in terms of grade, which is normally expressed as a percentage (% grade 100 X tangent of angle with horizontal). The additional power (above road load) required to overcome a grade is given by

$$\text{Power} \quad (\text{speed})(\text{weight of machine + rider}) \sin \left(\arctan \frac{\%\ \text{grade}}{100}\right),$$

and the rider weight is assumed to be 150 lb_f. It was decided that each machine should be run over the range of its gradeability in gears reasonable for the speeds and grades involved, but that the motorcycles should not run at their maximum outputs for long periods of time. The latter consideration led to the arbitrary limit on power absorption of 75% of power available over road load at any speed/gear condition. If, for example, a certain motorcycle would maintain 40 mph in 3rd gear while pulling a maximum indicated power over road load of 10 hp. then the maximum power over road load required for any sampling condition would have been 7.5 hp.

The effect of this limitation on power output was that the number of possible conditions was restricted by available power, especially for the smaller motorcycles. In order to "map" the engines somewhat more broadly, additional conditions were added at higher engine speed and relatively high loads. These latter conditions are thought to represent to some extent the type of usage which motorcycles might undergo in the off-road situation rather than the on-road situation. For the five largest motorcycles, the high speed conditions decided upon were 0.6 and 0.8 times maximum rated rpm with road load, one-third of power available over road load, and two-thirds of power available over road load (total of six conditions). The gear chosen for each engine rpm was that which would bring road speed closest to 30 mph for the given engine speed. These conditions were abbreviated "0.6 Max RL", "0.6 Max 1/3", and so forth.

For the two smaller motorcycles, the conditions chosen were 75% of power available over road load at 20 mph, 30 mph, and 40 mph (abbreviated "20H", "30H", and "40H"). Gears chosen in this instance were the lowest (numerical) gears which could be used without exceeding rated rpm. For the Honda SL100, the "5% grade" conditions could not be achieved at 40 mph or 50 mph in 5th gear (considered normal for highway operation), so the grades corresponding to 75% of power available over road load were substituted (3.0% and 2.4%, respectively). The schedule for the Kawasaki 125F-6 was limited even more than that for the small Honda because the Kawasaki would not pull much power in addition to road load in the higher (numerical) gears. The test conditions used for all the motorcycles are given in Appendix D, pages D-2 through D-28, along with the gaseous emissions data developed during the steady-state runs.

1. Gaseous Emissions

The foregoing discussion applies to all the steady-state emissions measurements, but some additional consideration should be given to each type of analysis. The gaseous emissions measured on a continuous basis during steady-state tests included hydrocarbons by NDIR (last 2 bikes only) and total hydrocarbons by FIA; CO, CO_2, and NO by NDIR;

NO and NO_x by chemiluminescence; and O_2 by electrochemical analysis (6 of the 7 motorcycles). Batch samples were taken over a 3-minute period for aldehyde analysis, (MBTH method[4] for RCHO and chromotropic acid method[5] for HCHO), and bag samples were taken concurrently for light hydrocarbon analysis (last 2 motorcycles only). The chromatograph employed for the light hydrocarbon analysis used a 10 ft by 1/8 inch column packed with a mixture of phenyl isocyanate and Porasil C preceded by a 1 inch by 1/8 inch precolumn packed with 100-120 mesh Porapak N.

The majority of the equipment used for steady-state gaseous emissions tests is shown in Figure 8, with most of the continuous analysis instrumentation at left. The oven in the foreground just to the right of the motorcycle operator contains the FIA detector as well as plumbing for the wet chemistry sampling system. The plastic bag at far right is being filled for subsequent gas chromatograph analysis. Figure 9 is a more detailed view of the continuous analysis/readout system, and the insulated containers in the foreground are water traps.

Figure 10 shows the special exhaust systems fabricated for the test motorcycles to prevent leaks and obtain representative exhaust samples. The pipes were welded to the original muffler shells, and were made with fairly large diameter tubing formed into smooth bends (where necessary) to keep backpressure to a minimum. The systems shown were used for LA-4 and 7-mode tests as well as steady-state tests.

2. Particulate Emissions

The contract under which the subject work was performed calls for measurement of exhaust particulate by "isokinetic sampling probes for either glass fiber filtration or an equivalent level of measurement effort as specified by the Project Officer." The problem with this requirement at the time the project began was that neither a "standard" method for particulate measurements on mobile sources nor a good definition of "particulate" was available. In effect, a certain amount of latitude in particulate measurement was granted to the contractor by default, so an original system was designed to meet project objectives. This system withdrew exhaust "isokinetically" through a probe of 0.305 inch inside diameter, diluted it with a larger flow of prepurified dry (compressed) air, and then filtered the dilute mixture. The term "isokinetic" is qualified because the best that could be hoped for was to match the bulk flow velocity in the exhaust pipe at the probe tip, rather than the instantaneous velocity.

Total exhaust sample flow was obtained by subtracting the known dilution air flow (metered through a critical orifice) from the total flow of dilute mixture (measured by a positive-displacement dry gas meter). Particulate weight was obtained by subtracting the filter's original weight from its weight after sampling. As required by the constraints of the

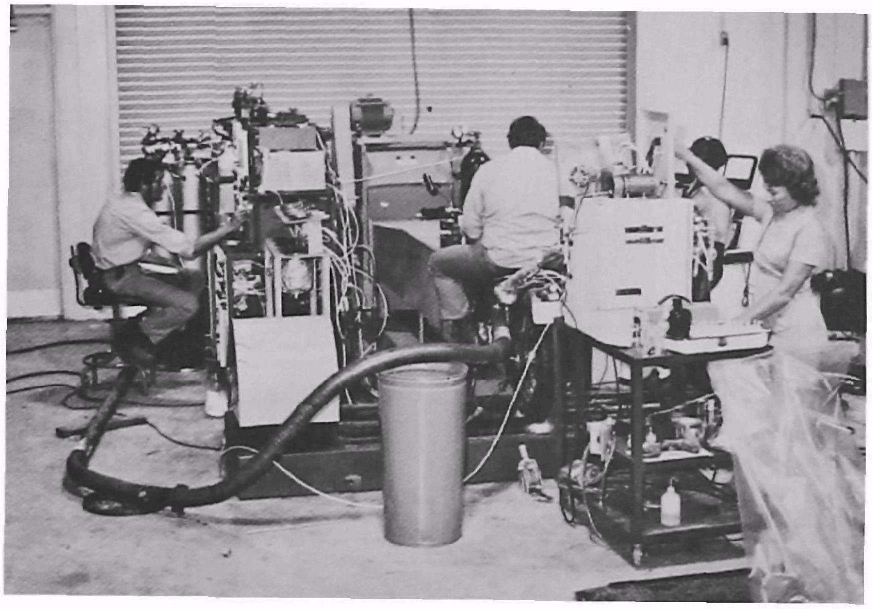


Figure 8. Overall View of Gaseous Emissions Analysis System Used for Steady-State Motorcycle Tests

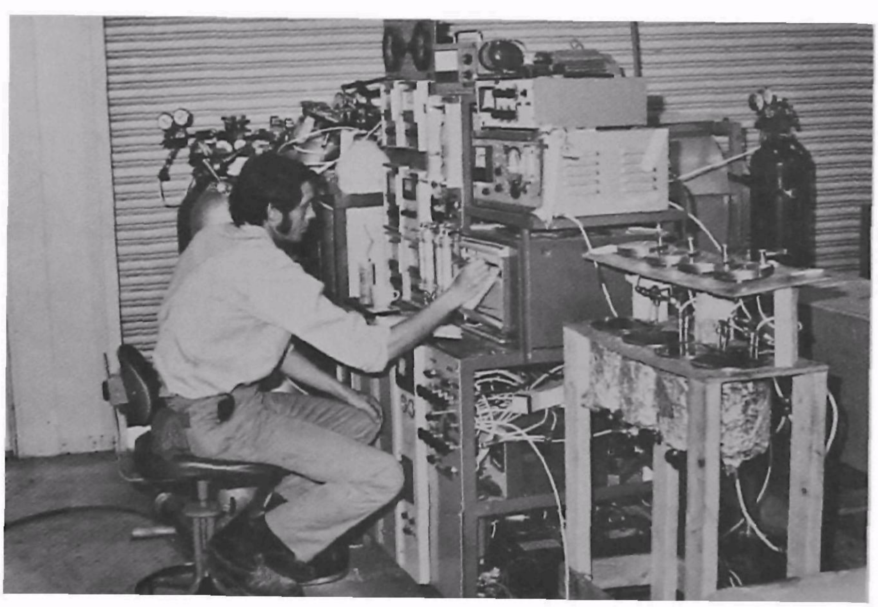
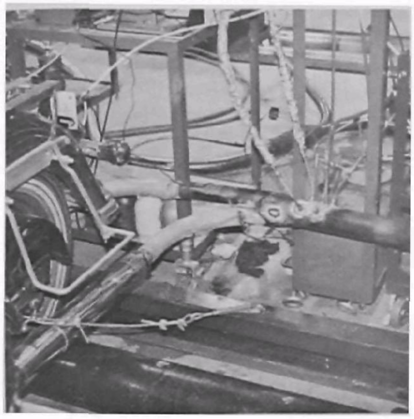


Figure 9. Detailed View of Continuous Analysis/Readout System Used for Steady-State Motorcycle Tests

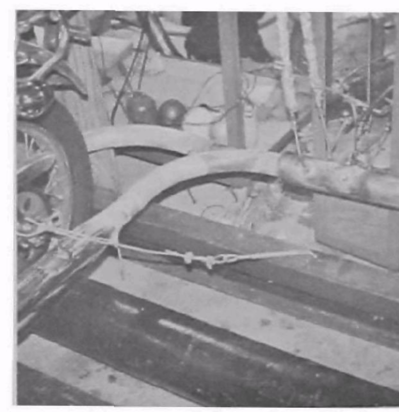


10A. Harley-Davidson FLH

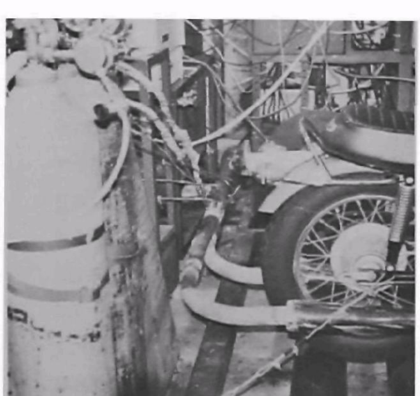
10B. Honda CL350K3

10C. Honda SL100

10D. Kawasaki 125F-6



10E. Suzuki T250



10F. Triumph T120R

10G. Yamaha DT1-E

Figure 10. Configuration of Special Exhaust Systems Used for Motorcycle Gaseous Emissions Tests

sampling system, then, "particulate" was defined for the purposes of this project as everything which was retained at 85 ± 5° F on a filter having 0.45 micron mean flow pore size, exclusive of water and particles obviously not combustion-derived (metal bits, etc.). The extremes in temperature at the filter were 77° F and 92° F, with only some 15 readings of about 200 being outside the 80° F-90° F range.

Particulate was measured during some of the same steady-state conditions which have already been described. Conditions during which samples were taken for all the motorcycles included idle and the four "road load" conditions. Samples were also taken during two of the high load conditions on the Honda SL100 and Kawasaki 125F-6, during the four "10% grade" conditions for the other five machines, and during two of the "20% grade" conditions (in addition) for the Yamaha DT1-E. Most of the samples were taken over a 5-minute period, and each condition was repeated four times or more as necessary to obtain reasonably repeatable results.

Unused filters were kept in a dessicated chamber, and were dried out again following use to establish a stable baseline. The balance used to weigh the filters (nominal weight 500 mg) had an accuracy of ±0.1 mg over the range of measurements taken, and the instrument "zero" was checked between each two independent weighings. The filters were weighed a minimum of four times both before and after use, and the last two weights had to be within 0.2 mg of each other. The last two weights were averaged to obtain the values used in computations. During the sampling period, temperatures and pressures were recorded throughout the system, permitting calculation of exhaust flow rate to 3 significant figures.

The particulate sampler is shown in Figures 11 through 13 with Figure 11 being an overall view showing the dilution air cylinder at left, readouts and controls on the top shelf and back panel, filter holder at back right of the top shelf and pump and dry gas meter on the second and third shelves, respectively. Figure 12 shows more detail of the readouts and controls, with critical flow element upstream pressure gauge at left, rate-setting flowmeters at center, temperature readouts at lower left and gas volume counter, pressure gauges, and timer on the back panel. Figure 13 shows a back view of the sampler as attached to the Kawasaki 125F-6 motorcycle, with heated exhaust and sample lines necessary to prevent condensation of water prior to entering the sampler.

3. Smoke Emissions (2-stroke machines only)

This section on smoke emissions is included under the steady-state measurements heading as a matter of convenience, and not because

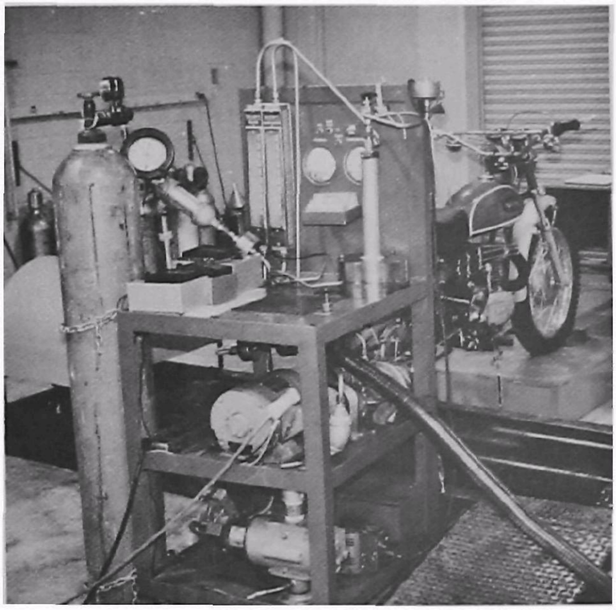


Figure 11. Overall Front View of Particulate Sampler Used for Motorcycle Tests

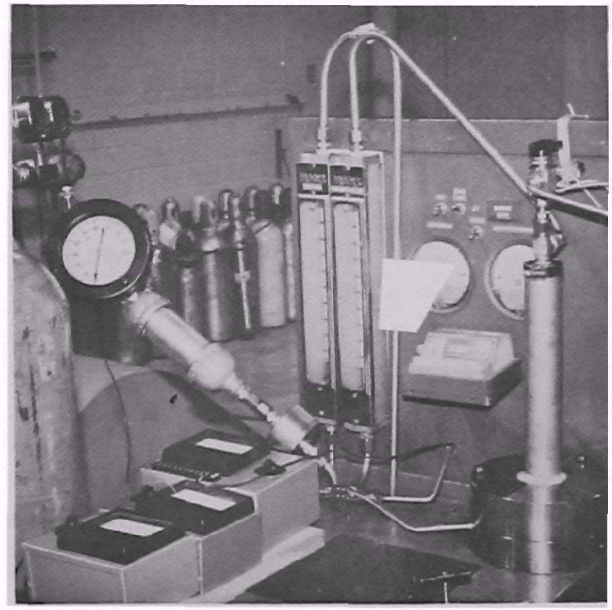


Figure 12. Detail View of Controls and Readouts Used on Particulate Sampler

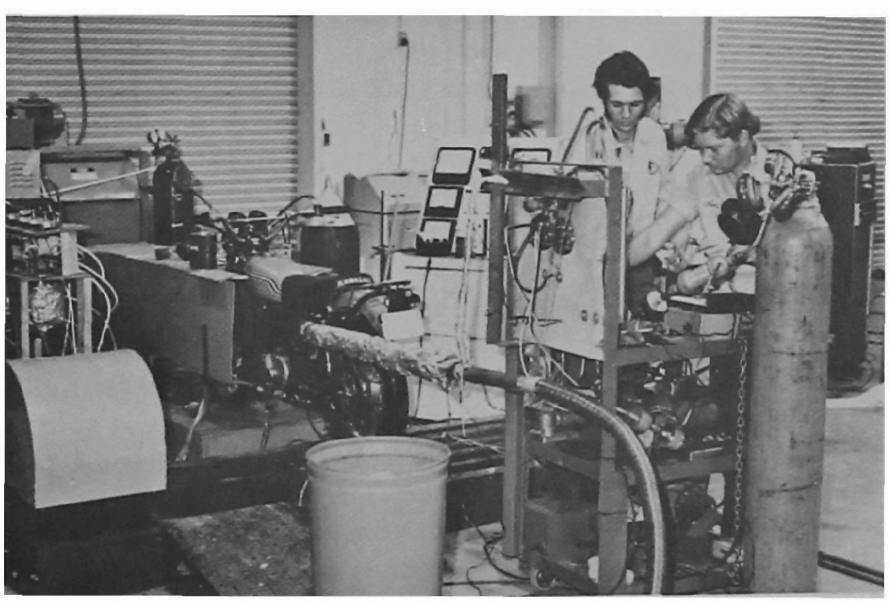


Figure 13. Rear View of Particulate Sampler Set Up for Tests on Kawasaki 125F-6

the smoke measurements were taken during steady-state conditions. The fact is that the smoke tests were conducted by continuous monitoring of smoke opacity on a strip-chart recorder while the motorcycles were being operated over the first 505 seconds of the "LA-4" route. The rationale for this decision was that smoke as seen by the public should be the basis for evaluating the machines, so the LA-4 was adopted as being representative for the purposes of this project.

Actual measurement of the smoke opacity was performed by attaching a PHS full-flow light-extinction smokemeter to the end of a straight section of tailpipe. Figures 14 and 15 are two views of the setup as used on the Kawasaki 125F-6, which was similar to that used for the Yamaha DT1-E. The Suzuki T250 used a slightly different system since it had twin exhausts, and the collector pipe was 3 inches in diameter rather than the 2 inches used for the single-cylinder machines. This difference in diameters means that the opacity readings for the Suzuki are based on a longer optical path length and are therefore not directly comparable to those for the other two machines.

It should also be noted that the PHS smokemeter was used as a research tool only on the motorcycle smoke, not because it is recommended for such use. It probably gives reasonably accurate results on "white" smoke, but some research into the matter would be necessary before it could be recommended as a rigorous quantitative technique.

E. Special Study on Crankcase or "Blowby" Emissions from One 4-Stroke Machine

At the time when the first attempt was made to estimate the national impact of motorcycle emissions under the subject contract[6], one area in which data were totally lacking was crankcase "blowby" emissions. The assumptions were made that only hydrocarbons were emitted from the vent (other than air), and that they amounted to 20% of the exhaust hydrocarbons. This latter figure was developed during studies on automobiles some time ago[7, 8], and it was the best-supported generalization available.

When tests began on the two smaller motorcycles, it was determined that blowby should be investigated from the four-stroke machine in a limited way. This special study was conducted using several complementary measurement techniques, including bag sampling of the blowby gases with subsequent analysis on an instrumentation system designed for low concentrations; continuous sampling with analysis by the same instrumentation used for steady-state exhaust samples; and rerouting the blowby gases into the air cleaner to simulate a "controlled" system with "before and after" measurement of exhaust concentrations. In order to permit computation of blowby emissions on a mass basis, blowby

Figure 14. First View of Smoke Measurements Being Taken on Kawasaki 125F-6 Motorcycle

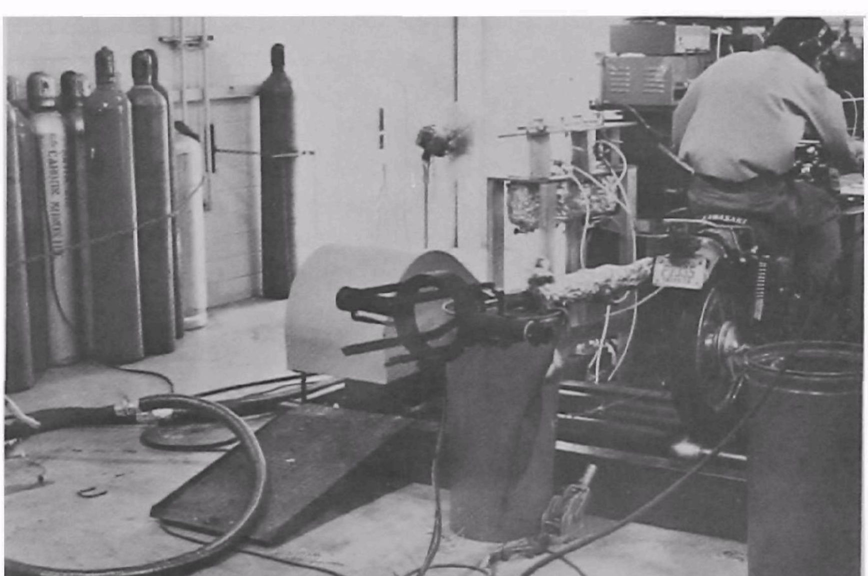


Figure 15. Second View of Smoke Measurements Being Taken on Kawasaki 125F-6 Motorcycle

rate was measured using a wet test meter. To avoid using an inordinate amount of time on this sub-study, sampling was limited to just 3 conditions; idle, 20 mph road load, and 40 mph road load. Figure 16 shows a bag sample being taken during an idle condition and Figure 17 shows the motorcycle set up for continuous sampling. In the latter configuration, the sample line ran up behind the saddle to a tee, one side of which went to the analyzers and the other to the bag at lower right. The sample rate was adjusted so that the bag filled very slowly, providing another check on the backpressure being exerted against the blowby gases in addition to the gauge near the fuel tank which teed into the sample line at the end of the standard vent hose. Data taken during the crankcase emissions study will be presented in section IV. A. 4.

F. Estimation of Unmeasured Emissions

The subject contract was limited by time and financial constraints to measurement of those emissions which were considered most significant and for which reliable techniques were available. According to these criteria, it was decided to estimate emissions of sulfur oxides (SO_x) and evaporative hydrocarbons rather than attempt to measure them.

1. Evaporative Losses of Hydrocarbons

Evaporative losses of hydrocarbons for which motorcycles are responsible include spillage during fueling operations (including mixing of oil and gasoline for 2-stroke machines which do not have injection pumps), losses from the fuel tank and carburetor while running, and losses from the fuel tank and carburetor while the machine is parked. Spillage losses are simply not within the scope of this contract, but other investigations (not specifically on motorcycles) are filling this need. Running losses from the fuel tank and carburetor are quite possibly significant, but no information is available from which they can be estimated intelligently. Evaporation while the machine is not in use is the only category of evaporative loss which can be estimated using available data, so all further discussion here will concern this type of loss alone.

Losses from the carburetor during the cool-down period of an automobile (called the "hot soak") are quite high because the engine is enclosed and has a large heat capacity, and because the carburetor sits on top of the engine. None of these three conditions holds for motorcycles, however, since their carburetors are side-draft and mounted behind the engine, and since the engine is much smaller and less enclosed. Carburetor hot-soak losses are therefore probably small, and the rather small float chambers mean that diurnal breathing losses from the carburetor can probably be neglected, also. Elimination of the other evaporation processes, then, has left diurnal loss from the fuel tank

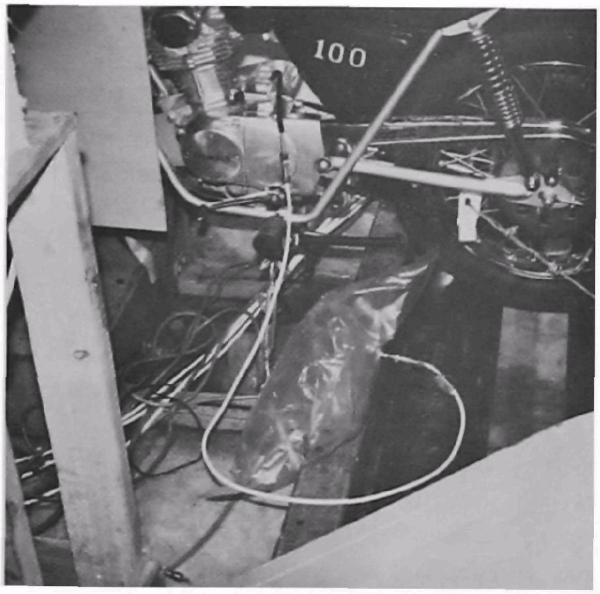


Figure 16. Bag Sample of Blowby Gases Being Taken from Honda SL100 at Idle

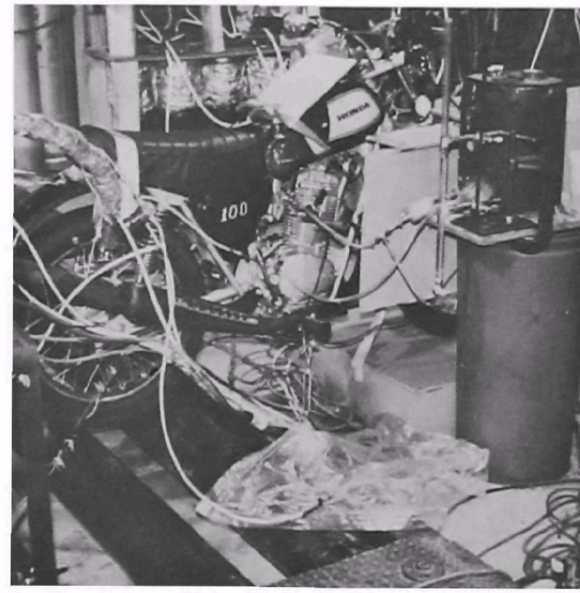


Figure 17. Overflow Bag and Other Parts of Continuous Blowby Analysis System Used on Honda SL100

Figure 18. Noise Measurement on Honda SL100 Motorcycle From Side 1 During Right-to-Left Acceleration Run

Figure 19. Noise Measurement on Honda SL100 Motorcycle from Side 1 During Left-to-Right Acceleration Run

as the only significant evaporation loss which can be estimated from reasonable assumptions.

Diurnal breathing losses are primarily functions of fuel vapor pressure, vapor space in the tank, and the diurnal temperature swing. The standard low and high temperatures for evaporation loss measurements have been pretty well established at 60° F and 84° F, respectively, and several studies have been conducted to determine the effects of fuel Reid vapor pressure (Rvp) and other variables. Reasonably accurate estimates of diurnal losses can be made by assuming a typical Rvp for the fuel and dividing the numbers developed for cars at that Rvp by the applicable ratio of fuel tank volumes. For example, if 30 g/day tank hydrocarbon loss were determined to be representative for a car with a 15 gallon tank, the comparable value for a motorcycle with a 2.5 gallon tank would be (30)/(15/2.5) g/day or 5 g/day if Rvp and the temperature extremes were held constant. Based on the results of investigations directed specifically toward evaporation(9, 10) and the assumption that a summer fuel Rvp of 9.0 psi is typical(11), the factor to be used for motorcycle evaporative emissions is (2.0 g hydrocarbons)/(gallon tank volume day). It might also be noted that the nominal average molecular weight of the hydrocarbons evaporated from standard emissions test fuel with an Rvp of 9.0 is about 58 g/g mole(9), which means that the average molecule evaporated is near butane in structure. The evaporative emission factor developed by this analysis must be considered conservative.

In order to arrive at a usable loss per motorcycle, it is necessary to make some assumption on fuel tank volumes for various sizes of motorcycles. To this end, the data given in Table 2 were developed from available statistics. The actual computation of evaporative emissions factors and impact and the discussion on their seasonal and regional variations is deferred until section V, where all the remaining factor and impact calculations will be done.

TABLE 2. NOMINAL FUEL TANK CAPACITIES FOR VARIOUS SIZES OF MOTORCYCLES

Displacement, cm^3	Nominal Fuel Capacity, gal
under 140	2.0
140 - 199	2.5
200 299	3.0
300 439	3.2
440 699	3.6
700 and over	4.0

2. Oxides of Sulfur (SO_x)

Instrumentation for measurement of sulfur oxides in the exhaust of internal combustion engines has not been developed to the same point as that for other common pollutants, so it has become more or less accepted practice to calculate sulfur oxide emissions based on fuel sulfur content. The assumption is usually made for convenience that all the sulfur oxidizes to SO_2, and thus the mass emission rate of SO_2 is taken to be 2.00 times the rate at which sulfur is entering the engine in the form of fuel (2.00 is the ratio of the molecular weight of SO_2 to the atomic weight of S). This technique is fairly accurate for 4-stroke engines (where substantially all the fuel is being burned), but it should be modified for 2-stroke engines to reflect the fact that a substantial fraction of the fuel is not being burned (that is, some of the fuel sulfur is being emitted without being oxidized). This modification is made by assuming that the fraction of fuel sulfur going to SO_2 is the same as the fraction of the fuel burned, which can be determined from hydrocarbon mass emissions. Emission rates will be calculated and included in section V, based on assumed fuel sulfur contents(11) of 0.043% by weight for the regular fuel used in 2-stroke engines and 0.022% by weight for the premium fuel used in 4-stroke engines.

G. Motorcycle Noise Measurement Procedure

The procedure and instrumentation used for motorcycle noise measurements were basically those specified by SAE Standard J986a(12), although additional measurements not included in J986a were included also. The procedure specifies measurement of peak noise levels during acceleration from 30 mph in the lowest numerical gear such that the vehicle's engine does not overspeed within 50 ft following the onset of the acceleration. This acceleration is intended to be a "worst case" condition, that is, to represent the loudest operation of the vehicle.

In addition to the acceleration test, noise measurements were also taken during a 30 mph constant-speed "driveby" at the same 50 ft distance from the vehicle path, and idle noise was measured all around the motorcycles at a distance of 10 ft. These procedures are documented in Figures 18 through 21, with Figure 18 showing the Honda SL100 leaving the test section after a right-to-left run with measurement on the "first side". Note that the right and left references are from the viewpoint of the person taking the measurements. Figure 19 shows the Honda SL100 entering the test section for a left-to-right run with measure ment on the first side (measurements were taken from both sides of the strip to cancel out directional effects, if present). Figures 20 and 21 show noise measurements being taken at idle on the Kawasaki 125F-6 from the rear and from the left side, respectively (noise measurement at idle is referred to the motorcycle rather than the observer).

Figure 20. Idle Noise Being Measured from the Rear of the Kawasaki 125F-6 Motorcycle

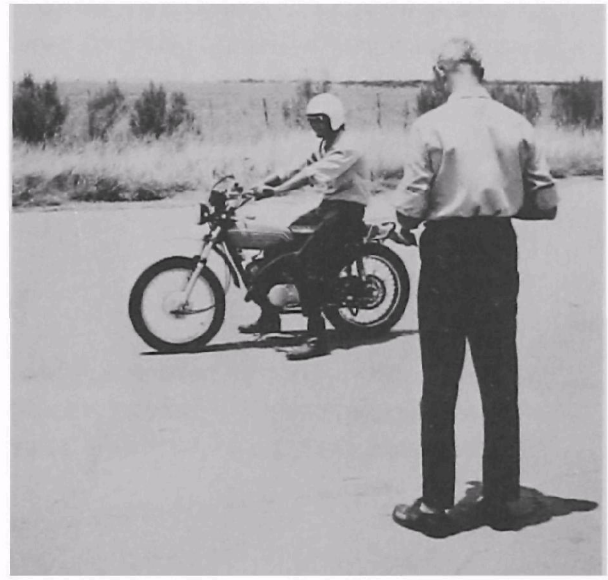


Figure 21. Idle Noise Being Measured from the Left Side of the Kawasaki 125F-6 Motorcycle

The area used for the noise tests was the abandoned airstrip at Hondo, Texas, which the contractor uses on a rental basis as the need arises. The instrumentation used for the tests consisted of a General Radio Type 1565-A sound level meter with windscreen, and a General Radio Type 1562-A sound level calibrator. Ambient noise levels during the tests were in the range of 44 to 48 dbA, and they were also measured on the "C" scale (flat response) as 52 to 74 dbC. The three motorcycles tested were the Honda SL100, the Kawasaki 125F-6, and a privately-owned Yamaha 175 which was included to provide a wider data base. The other motorcycles were not tested for noise because the directive on noise evaluations was added to the contract with the last modification, after the first five motorcycles had been returned to their suppliers.

IV. EMISSIONS TEST RESULTS

The gaseous emissions results which are summarized in this section are given in detail in Appendixes B (7-mode results), C (LA-4 results), and D (steady-state results). Exceptions include results for aldehydes and light hydrocarbons and results of the blowby measurements on one machine, which are presented only in the text. Reproductions of recorder traces showing speed and smoke opacity versus time for the 2-stroke motorcycles operated on the LA-4 route are given in Appendix E. Particulate results are presented in text only.

A. Gaseous Emissions

Due to the variety of tests run on the motorcycles, the gaseous emissions results will be presented in four parts. These parts are 7-mode results, LA-4 results, steady state results, and crankcase or "blowby" results on one motorcycle.

1. Results of 7-Mode Tests

As mentioned earlier, the 7-mode procedure was used for Federal certification of 1970 and 1971 model year light duty vehicles (excluding motorcycles and certain other vehicles). Its primary usefulness in this study is for determining average emission concentrations during transient conditions. The procedure as written(1) includes an empirical equation for exhaust flowrate in ft^3/mile which, it is assumed, was developed from experimental data on automobiles. This equation gives erroneously low values for light vehicles such as motorcycles, so it was not used, and thus the 7-mode results will be reported in concentrations only and not in g/mile. It should be noted that all hydrocarbon concentrations given on the 7-mode printouts (Appendix B) and those given in text are in ppm hexane (ppm C_6), which means they should be multiplied by 6.00 to convert to ppmC if comparison to numbers expressed in that unit is desired. The average test results are presented in Table 3, representing a total of 32 runs on the seven motorcycles. Several features of these data are worthy of note, beginning with the quite reasonable consistency in hydrocarbon concentrations within the 4-stroke group (considering that the Triumph may have had faulty piston rings) and the even better consistency within the 2-stroke group. The perhaps unexpectedly low CO concentrations for the two smallest bikes seem to be due to operation at high rpm for a substantial portion of the cycle, and the high NO concentrations for the same two machines are due to the high average load factor required of the small engines in order to stay up with the speed-time schedule. It can be noted also that hydrocarbon concentrations from the 2-stroke machines were higher than those from the 4-strokes by about a factor of 3, that CO concentrations from the 2-strokes were lower than those from the 4-strokes by about a factor

TABLE 3. SUMMARY OF AVERAGE MOTORCYCLE 7-MODE TRIP COMPOSITE RESULTS

Motorcycle	No. Runs Made	HC, ppm C_6	CO, %	NO (NDIR), ppm
Harley-Davidson FLH	5	1350	8.31	209
Honda CL350K3	6	1330	9.20	164
Honda SL100	3	1520	4.84	711
Kawasaki 125F-6	3	4810	1.67	235
Suzuki T250	5	5940	4.43	90
Triumph T120R	5	2400	9.13	260
Yamaha DT1-E	5	5180	2.92	107

Note: All concentrations on a dry basis

of 2.5, and that NO concentrations from the 2-strokes were lower than those from the 4-strokes by about a factor of 2.3. Care should be taken not to generalize these observations since they stem from such a small sample of machines.

All the concentration data referring to 7-mode tests which are reported in both Appendix B and the text are on a "dry" basis, that is, as measured after the sample had been run through water traps. In terms of effect, measurements on a dry basis are higher than those on a wet basis from perhaps 10 to 20% (carburetted engines only), depending on completeness of combustion and fuel-air ratio.

In order to extract data on concentrations during transients from the computer printouts in Appendix B, it is necessary only to examine the "concentration as measured" columns opposite the particular condition of interest (0-25 mph accel, 30-15 mph decel, 15-30 mph accel, or 50-20 mph decel). Concentrations of CO_2 are included, so the emissions can be converted back to a wet basis, if desired. It should be noted that for research purposes these time-averaged concentrations are really no substitute for continuous recorder traces which actually show concentration as a function of time.

Other data have been developed for a range of motorcycles on the 7-mode procedure[13, 14], and in general the results show reasonable agreement with those of this study. Since the 7-mode results have been included primarily for examination of transients, however, these other data will not be repeated here. As a general conclusion, the 7-mode procedure is much less adaptable to motorcycle testing than the newer "LA-4" procedure.

2. Results of "LA-4" Tests

The procedure called the "LA-4" is so named for the speed-time trace used, which was developed on a driving route called "LA-4" (Los Angeles-4). The main differences between this procedure and the 7-mode are; (1) the LA-4 trace is non-repeating and much more random, containing a number of small accels and decels but very little cruising time, and (2) time-averaged bag samples of diluted exhaust are used to determine mass emissions on the LA-4 rather than mathematical integration of exhaust concentrations during a few parts of the driving schedule. The latter feature, especially, makes the newer procedure quite readily adaptable to testing of a variety of vehicles.

The driving schedule and the type of sampling specified for 1972 procedures and 1975-1976 (and presumably later) procedures are identical, but detail refinements are being made as time progresses. The procedure used for the subject tests is most similar to that currently specified for 1975 certification with minor exceptions as explained in section III. C.

The computer program used to analyze the data gathered in this study printed out results in terms of grams per mile, as shown at the bottom of each table in Appendix C. These data are important to later sections of the report, so they are presented in detail in Table 4. The major features of these data are essentially the same as those already described for the 7-mode data, with the additional variable of exhaust mass flow inherent in the values. From the accuracy standpoint, these LA-4 data are considered to be very good, since there are few opportunities for error in the procedure. Repeatability from run to run for nearly all categories appears to be satisfactory, and the only major deficiency in the data appears to be the size of the sample, which limits analysis for variation in emissions due to engine size and type.

Trends which were perhaps not so obvious in the 7-mode concentration data include a definite size effect on emissions of hydrocarbons and CO (larger machines emitting larger amounts), but a reversal of the downward trend in NO_x from larger to smaller machines somewhere above the 100 to 125cc class represented by the two smallest motorcycles tested. The only available earlier NO_x data(13) simply are not reasonable, but some information obtained from Yamaha Motor Co.(15) on NO_x emissions from 4-stroke motorcycles indicate the same overall trends as data taken in the subject study. The NO_x data from Yamaha are shown in Table 5, and they agree quite well in nominal levels with those taken in the subject study as well as in trends, but it is not known how many individual motorcycles or tests the Yamaha data represent.

The reason for higher NO_x from small motorcycles is probably that they must operate at higher engine speeds and loads than larger machines in order to stay with the speed-time trace. Support for this assertion

TABLE 4. SUMMARY OF RESULTS OF FEDERAL LIGHT-DUTY VEHICLE EMISSIONS TEST PROCEDURE FOR 1972 AND BEYOND AS APPLIED TO MOTORCYCLES

Motorcycle	Run	HC, g/mi	CO, g/mi	NO_x as NO_2, g/mi	Fuel Usage mi/gal
Harley-Davidson FLH	1	4.86	70.6	0.128	-
	2	5.86	80.2	0.120	
	3	5.92	79.9	0.127	-
	Average	5.55	76.9	0.125	24
Honda CL350K3	1	3.86	46.2	0.0643	
	2	4.09	45.7	0.0494	
	3	4.17	47.6	0.0432	-
	Average	4.04	46.5	0.0523	38
Honda SL100	1	2.17	27.3	0.322	-
	4	1.58	15.5	0.384	
	5	2.26	25.8	0.265	-
	6	2.13	19.8	0.353	-
	Average	2.04	22.1	0.331	80
Kawasaki 125F-6	1	12.5	6.76	0.194	-
	3	8.87	8.43	0.149	
	4	8.84	8.22	0.154	
	5	8.91	7.48	0.154	-
	Average	9.78	7.72	0.163	68
Suzuki T250	2	18.7	34.0	0.0364	-
	3	19.7	29.3	0.0334	
	4	23.7	41.0	0.0441	
	Average	20.7	34.8	0.0380	33
Triumph T120R	1	5.36	46.3	0.101	-
	2	5.33	46.5	0.104	
	3	5.57	45.5	0.117	
	Average	5.42	46.1	0.107	34
Yamaha DT1-E	3	16.9	28.5	0.0419	
	4	17.1	27.8	0.0339	-
	5	15.5	22.5	0.0577	-
	Average	16.5	26.3	0.0445	45

TABLE 5. DATA ON NO_x EMISSIONS FROM 4-STROKE MOTORCYCLES SUPPLIED BY YAMAHA MOTOR CO.

Displacement, cm^3	NO_x Emissions	
	g/Km (as supplied)	g/mi (converted)
50	0.33	0.53
125	0.20	0.32
250	0.08	0.13
350	0.06	0.10
500	0.10	0.16
650	0.08	0.13

comes from examination of NO_x data at road load conditions in Tables 6 through 12, where the small machines show a very rapid increase in NO_x with speed and the larger machines show relatively small increases. The higher overall mass rates for the small bikes are confirmed by the steady-state data, also.

The other strong trends appearing in the LA-4 data are considerably higher hydrocarbons for the 2-strokes tested than for the 4-strokes, due to short-circuiting of unburned fuel-air mixture, and slightly lower CO and NO_x for the 2-strokes than for the 4-strokes. The reason for the difference in CO is not clear at this point, but at least part of the difference in NO_x is probably due to dilution of the intake charge by exhaust gas (a form of EGR, or exhaust gas recirculation). To really tie down variation in emissions due to engine size and type, however, a much larger data base would be required.

3. Results of Steady-State Tests

The steady-state gaseous emissions tests were by far the most exhaustive of the three types of tests performed, and they generated an extremely broad spectrum of data. The complete raw data are given in Appendix D, (except those on aldehydes and light hydrocarbons), and they are summarized in more useful form in Tables 6 through 12. For the five largest machines, aldehydes have been calculated in mass units only for those modes which will be used to make up a composite "cycle" for use in developing emission factors.

The mode-by-mode data can be used to "map" emissions from each engine to some extent for research purposes, but such an analysis is really beyond the intended scope of the present effort. A more compact way of analyzing some of the constant-speed data is shown in Figure 22, which consists of "envelopes" for the major emissions. The highest and lowest values at each speed have been plotted separately for 2-strokes and 4-strokes, forming the outlines shown. A greater number of motor-

TABLE 6. SUMMARY OF CONSTANT-SPEED GASEOUS EMISSIONS DATA FOR THE HARLEY-DAVIDSON FLH MOTORCYCLE, AVERAGE VALUES FOR 3 RUNS*

			Mass Emissions, g/hr				Mass Emissions, g/mi				Concentration	
Mode	Condition	Speed mi/hr	HC	CO	NO_x as NO_2	RCHO as HCHO	HC	CO	NO_x as NO_2	RCHO as HCHO	HCHO, ppm	RCHO, ppm
1	Idle	-	136	1190	1.59	1.32	-	-	-	-	26	59
2	20 RL	20	193	3540	3.26	3.24	9.64	177.0	0.16	0.16	47	71
3	30 RL	30	181	3860	3.41	4.45	6.02	129.0	0.11	0.15	55	92
4	40 RL	40	159	3850	3.32	3.40	3.97	96.3	0.08	0.08	46	75
5	50 RL	50	123	3940	4.91	2.76	2.47	78.7	0.10	0.06	38	56
6	20 5%	20	135	4490	4.51	-	6.76	224.0	0.23	-	34	49
7	30 5%	30	91	3660	5.33	-	3.02	122.0	0.18	-	21	34
8	40 5%	40	85	3480	7.77	-	2.13	87.1	0.19	-	13	24
9	50 5%	50	73	2200	14.1	-	1.46	44.1	0.28	-	15	26
10	20 10%	20	121	3790	6.01	2.11	6.06	189.0	0.30	0.10	22	39
11	30 10%	30	67	2570	12.7	1.51	2.25	85.6	0.42	0.05	13	28
12	40 10%	40	46	428	117.	2.10	1.14	10.7	2.92	0.05	18	35
13	50 10%	50	94	4070	22.5	2.20	1.89	81.4	0.45	0.04	16	31
14	20 20%	20	75	2330	23.1	-	3.73	116.0	1.15	-	18	34
15	30 20%	30	99	4010	34.2	-	3.31	134.0	1.14	-	15	32
16	0.6MaxRL	23	211	4300	3.75	-	7.02	144.0	0.12	-	35	65
17	0.6Max1/3	23	84	2250	58.4	-	2.79	74.9	1.95	-	33	59
18	0.6Max2/3	23	203	9590	32.5	-	6.76	320.0	1.08	-	40	64
19	0.8MaxRL	30	93	3900	9.07	-	3.33	110.0	0.32	-	19	33
20	0.8Max1/3	30	199	7630	21.2	-	7.10	273.0	0.76	-	19	35
21	0.8Max2/3	30	306	16300	32.8	-	10.9	581.0	1.17	-	14	32
22	Idle	-	210	1530	0.81	3.08	-	-	-	-	58	150

*2 runs for aldehydes.

TABLE 7. SUMMARY OF CONSTANT-SPEED GASEOUS EMISSIONS DATA FOR THE HONDA CL350K3 MOTORCYCLE, AVERAGE VALUES FOR 2 RUNS

			Mass Emissions, g/hr				Mass Emissions g/mi				Concentration	
Mode	Condition	Speed mi/hr	HC	CO	NO_x as NO2	RCHO as HCHO	HC	CO	NO_x as NO_2	RCHO as HCHO	HCHO, ppm	RCHO, ppm
1	Idle	-	19	211	0.48	0.49	-	-	-	-	31	61
2	20 RL	20	78	1300	1.30	0.98	3.89	65.3	0.07	0.05	29	57
3	30 RL	30	235	2400	1.45	3.45	7.84	80.0	0.05	0.12	64	134
4	40 RL	40	222	2920	2.11	4.86	5.54	73.0	0.05	0.12	64	162
5	50 RL	50	173	2930	4.17	4.77	3.45	58.6	0.08	0.10	86	149
6	20 5%	20	115	2640	1.48	-	5.74	132.0	0.07	-	40	82
7	30 5%	30	129	3500	3.01	-	4.30	117.0	0.10	-	56	109
8	40 5%	40	146	4420	5.59	-	3.65	110.0	0.14	-	34	78
9	50 5%	50	146	4600	26.3	-	2.92	92.0	0.53	-	32	68
10	20 10%	20	123	3690	3.24	1.98	6.16	185.0	0.16	0.10	32	63
11	30 10%	30	135	5630	4.83	2.74	4.49	188.0	0.16	0.09	32	67
12	40 10%	40	162	5160	11.4	3.81	4.05	129.0	0.28	0.10	37	71
13	50 10%	50	186	5900	20.9	3.86	3.72	118.0	0.42	0.08	34	63
14	20 20%	20	204	5020	5.82	-	10.2	251.0	0.29	-	31	67
15	30 20%	30	226	6100	4.59	-	7.54	203.0	0.15	-	37	74
16	0.6MaxRL	30	288	4270	2.46	-	9.59	142.0	0.08	-	47	100
17	0.6Max1/3	30	192	3910	21.5	-	6.40	130.0	0.72	-	64	115
18	0.6Max2/3	30	157	3160	79.3	-	5.24	105.0	2.64	-	45	91
19	0.8MaxRL	28	396	4080	3.71	-	14.2	146.0	0.13	-	75	142
20	0.8Max1/3	28	265	5120	28.6	-	9.47	183.0	1.02	-	78	138
21	0.8Max2/3	28	280	7200	44.3	-	9.99	257.0	1.58	-	59	109
22	Idle	-	14	279	0.73	0.52	-	-	-	-	31	60

TABLE 8. SUMMARY OF CONSTANT-SPEED GASEOUS EMISSIONS DATA FOR THE HONDA SL100 MOTORCYCLE, AVERAGE VALUES FOR 8 RUNS*

			Mass Emissions, g/hr				Mass Emissions, g/mi				Concentration	
Mode	Condition	Speed, mi/hr	HC	CO	NO_x as NO_2	RCHO as HCHO	HC	CO	NO_x as NO_2	RCHO as HCHO	HCHO, ppm	RCHO, ppm
1	Idle	--	23.2	259	0.17	0.16	--	--	--	--	47	53
2	20 RL	20	36.4	674	1.57	0.34	1.82	33.7	0.078	0.017	26	37
3	30 RL	30	33.5	546	6.18	0.67	1.12	18.2	0.206	0.022	35	55
4	40 RL	40	46.8	713	15.3	0.80	1.17	17.8	0.383	0.020	30	48
5	50 RL	50	64.8	576	50.2	1.22	1.30	11.5	1.00	0.024	33	55
6	Idle	--	21.0	273	0.20	--	--	--	--	--	--	--
7	20 5%	20	37.9	609	16.9	1.08	1.89	30.4	0.843	0.054	45	77
8	30 5%	30	52.2	1004	25.3	1.01	1.74	33.5	0.845	0.034	30	49
9	40 3.0%	40	56.4	1069	25.7	1.06	1.41	26.7	0.643	0.026	39	49
10	50 2.4%	50	77.0	1276	46.5	1.38	1.54	25.5	0.930	0.028	29	49
11	Idle	--	16.3	287	0.22	0.18	--	--	--	--	34	56
12	20 H	20	41.7	788	19.4	0.83	2.08	39.4	0.970	0.042	22	46
13	30 H	30	61.5	1219	32.9	1.38	2.05	40.6	1.10	0.046	30	56
14	40 H	40	78.5	1150	40.8	1.97	1.96	28.8	1.02	0.049	44	73
15	Idle	--	17.0	280	0.21	--	--	--	--	--	--	--

* 4 runs for aldehydes.

TABLE 9. SUMMARY OF CONSTANT-SPEED GASEOUS EMISSIONS DATA FOR THE KAWASAKI 125F-6 MOTORCYCLE, AVERAGE VALUES FOR 5 RUNS*

			Mass Emissions, g/hr				Mass Emissions, g/mi				Concentration	
Mode	Conditions	Speed, mi/hr	HC	CO	NO_x as NO_2	RCHO as HCHO	HC	CO	NO_x as NO_2	RCHO as HCHO	HCHO, ppm	RCHO, ppm
1	Idle	--	100	88	0.034	0.49	--	--	--	--	123	175
2	20 RL	20	171	78	0.054	1.71	8.55	3.90	0.027	0.086	103	155
3	30 RL	30	185	200	1.25	2.21	6.17	6.67	0.042	0.074	110	156
4	40 RL	40	364	500	4.48	3.09	9.10	12.5	0.112	0.077	84	148
5	50 RL	50	863	646	28.8	7.71	17.3	12.9	0.577	0.15	142	220
6	Idle	--	106	100	0.066	0.56	--	--	--	--	116	210
7	20 5%	20	507	431	20.4	4.31	25.3	21.6	1.02	0.22	118	195
8	20 H	20	980	768	34.9	6.47	49.0	38.4	1.74	0.32	97	176
9	30 H	30	1612	1492	23.0	9.64	53.7	49.7	0.767	0.32	107	190
10	40 H	40	1640	1588	19.9	8.40	41.0	39.7	0.498	0.21	86	167
11	Idle	--	104	100	0.061	0.57	--	--	--	--	120	213

* 3 runs for aldehydes.

TABLE 10. SUMMARY OF CONSTANT-SPEED GASEOUS EMISSIONS DATA FOR THE SUZUKI T250 MOTORCYCLE, AVERAGE VALUES FOR 4 RUNS*

Mode	Condition	Speed mi/hr	Mass Emissions, g/hr HC	CO	NO_x as NO_2	RCHO as HCHO	Mass Emissions, g/mi HC	CO	NO_x as NO_2	RCHO as HCHO	Concentration HCHO, ppm	RCHO, ppm
1	Idle	-	166	95	0.05	0.60	-	-	-	-	38	125
2	20 RL	20	374	263	0.40	2.24	18.7	13.2	0.020	0.11	48	147
3	30 RL	30	379	510	0.76	2.80	12.6	17.0	0.025	0.09	56	154
4	40 RL	40	478	947	1.08	4.09	11.9	23.7	0.027	0.10	57	165
5	50 RL	50	810	1690	2.16	5.73	16.2	33.8	0.043	0.12	53	132
6	20 5%	20	375	433	0.87	-	18.7	21.6	0.044	-	55	141
7	30 5%	30	522	1030	1.33	-	17.4	34.3	0.044	-	48	123
8	40 5%	40	748	1760	2.01	-	18.7	44.0	0.050	-	42	96
9	50 5%	50	982	2420	1.70	-	19.6	58.3	0.034	-	46	119
10	20 10%	20	524	682	1.36	2.25	26.2	34.1	0.068	0.11	48	96
11	30 10%	30	922	1850	2.26	3.33	30.7	61.8	0.075	0.11	44	87
12	40 10%	40	1540	2820	2.49	5.10	38.6	70.5	0.062	0.13	39	94
13	50 10%	50	1790	3370	3.38	6.02	35.8	67.3	0.068	0.12	52	96
14	20 20%	20	1270	1900	2.12	-	63.2	94.8	0.106	-	45	119
15	30 20%	30	1630	3000	1.96	-	54.5	100.0	0.065	-	44	96
16	0.6MaxRL	28	341	554	0.64	-	12.0	19.4	0.022	-	98	208
17	0.6Max1/3	28	1360	3200	2.18	-	57.8	112.0	0.077	-	74	167
18	0.6Max2/3	28	3240	5540	2.84	-	114.0	194.0	0.100	-	54	138
19	0.8MaxRL	24	231	467	0.53	-	9.4	19.1	0.022	-	84	178
20	0.8Max1/3	24	1560	4420	3.15	-	63.7	181.0	0.129	-	66	150
21	0.8Max2/3	24	4030	6320	12.00	-	164.0	258.0	0.592	-	58	171
22	Idle	-	160	117	0.06	0.76	-	-	-	-	68	163

*2 runs for aldehydes.

TABLE 11. SUMMARY OF CONSTANT-SPEED GASEOUS EMISSIONS DATA FOR THE TRIUMPH T120R MOTORCYCLE, AVERAGE VALUES FOR 3 RUNS*

			Mass Emissions, g/hr				Mass Emissions, g/mi				Concentration	
Mode	Condition	Speed mi/hr	HC	CO	NO_x as NO_2	RCHO as HCHO	HC	CO	NO_x as NO_2	RCHO as HCHO	HCHO, ppm	RCHO, ppm
1	Idle	-	224	799	0.20	0.98	-	-	-	-	34	104
2	20 RL	20	150	2480	0.49	1.45	7.51	124.0	0.02	0.07	42	95
3	30 RL	30	271	2170	2.01	2.37	9.04	71.2	0.07	0.08	44	104
4	40 RL	40	209	2350	2.24	2.33	5.22	58.7	0.06	0.06	43	94
5	50 RL	50	173	2850	4.18	2.31	3.45	57.1	0.08	0.05	36	72
6	20 5%	20	73	1850	4.07	-	3.67	92.6	0.20	-	25	55
7	30 5%	30	100	2620	5.41	-	3.35	87.2	0.18	-	23	49
8	40 5%	40	81	2680	17.90	-	2.03	67.1	0.44	-	26	51
9	50 5%	50	94	2590	43.00	-	1.88	51.8	0.86	-	32	51
10	20 10%	20	64	1950	8.91	1.05	3.20	97.4	0.44	0.05	21	43
11	30 10%	30	78	2910	14.10	1.38	2.60	97.1	0.47	0.05	19	39
12	40 10%	40	77	2520	37.20	1.98	1.92	62.9	0.93	0.05	23	45
13	50 10%	50	85	2220	75.60	1.91	1.69	44.6	1.51	0.04	15	37
14	20 20%	20	58	1960	58.9	-	2.89	97.9	2.94	-	16	39
15	30 20%	30	70	2960	54.6	-	2.34	98.6	1.82	-	21	41
16	0.6MaxRL	-	-	-	-	-	-	-	-	-	-	-
17	0.6Max1/3	-	-	-	-	-	-	-	-	-	-	-
18	0.6Max2/3	-	-	-	-	-	-	-	-	-	-	-
19	0.8MaxRL	-	-	-	-	-	-	-	-	-	-	-
20	0.8Max1/3	-	-	-	-	-	-	-	-	-	-	-
21	0.8Max2/3	-	-	-	-	-	-	-	-	-	-	-
22	Idle	-	238	798	0.22	1.20	-	-	-	-	31	128

*2 runs for aldehydes

TABLE 12. SUMMARY OF CONSTANT-SPEED GASEOUS EMISSIONS DATA FOR THE YAMAHA DT1-E MOTORCYCLE, AVERAGE VALUES FOR 2 RUNS

			Mass Emissions, g/hr				Mass Emissions, g/mi				Concentration	
Mode	Condition	Speed mi/hr	HC	CO	NO_x as NO_2	RCHO as HCHO	HC	CO	NO_x as NO_2	RCHO as HCHO	HCHO, ppm	RCHO, ppm
1	Idle	-	135	137	0.04	0.62	-	-	-	-	35	156
2	20 RL	20	256	144	0.81	2.27	12.8	7.2	0.040	0.11	119	196
3	30 RL	30	139	428	0.66	2.45	4.6	14.3	0.022	0.08	126	190
4	40 RL	40	188	286	1.92	3.25	4.7	7.2	0.048	0.08	102	171
5	50 RL	50	479	1660	2.67	5.87	9.6	33.3	0.053	0.12	124	195
6	20 5%	20	215	255	1.00	-	10.8	12.8	0.050	-	110	180
7	30 5%	30	334	813	2.14	-	11.1	27.1	0.071	-	98	175
8	40 5%	40	628	2340	3.02	-	15.7	58.4	0.076	-	117	183
9	50 5%	50	905	3000	4.37	-	18.1	60.0	0.087	-	126	200
10	20 10%	20	364	897	1.86	4.24	18.2	44.8	0.093	0.21	119	172
11	30 10%	30	499	1610	2.68	5.64	16.6	53.7	0.089	0.19	120	179
12	40 10%	40	892	2970	4.12	9.03	22.3	74.3	0.103	0.23	118	196
13	50 10%	50	1310	3340	10.80	12.1	26.2	66.9	0.217	0.24	122	199
14	20 20%	20	603	2220	3.10	-	30.2	111.0	0.155	-	130	195
15	30 20%	30	1130	3260	6.68	-	37.7	109.0	0.223	-	134	201
16	0.6MaxRL	27	191	262	0.72	-	7.1	9.7	0.027	-	123	193
17	0.6Max1/3	27	419	1400	2.39	-	15.5	51.7	0.088	-	106	173
18	0.6Max2/3	27	852	2410	10.30	-	31.6	89.1	0.381	-	123	198
19	0.8MaxRL	29	137	439	1.08	-	4.7	15.1	0.037	-	118	172
20	0.8Max1/3	29	578	2830	4.48	-	19.9	97.6	0.154	-	98	173
21	0.8Max2/3	29	1030	4160	10.30	-	35.6	143.0	0.356	-	124	197
22	Idle	-	129	152	0.04	0.74	-	-	-	-	103	205

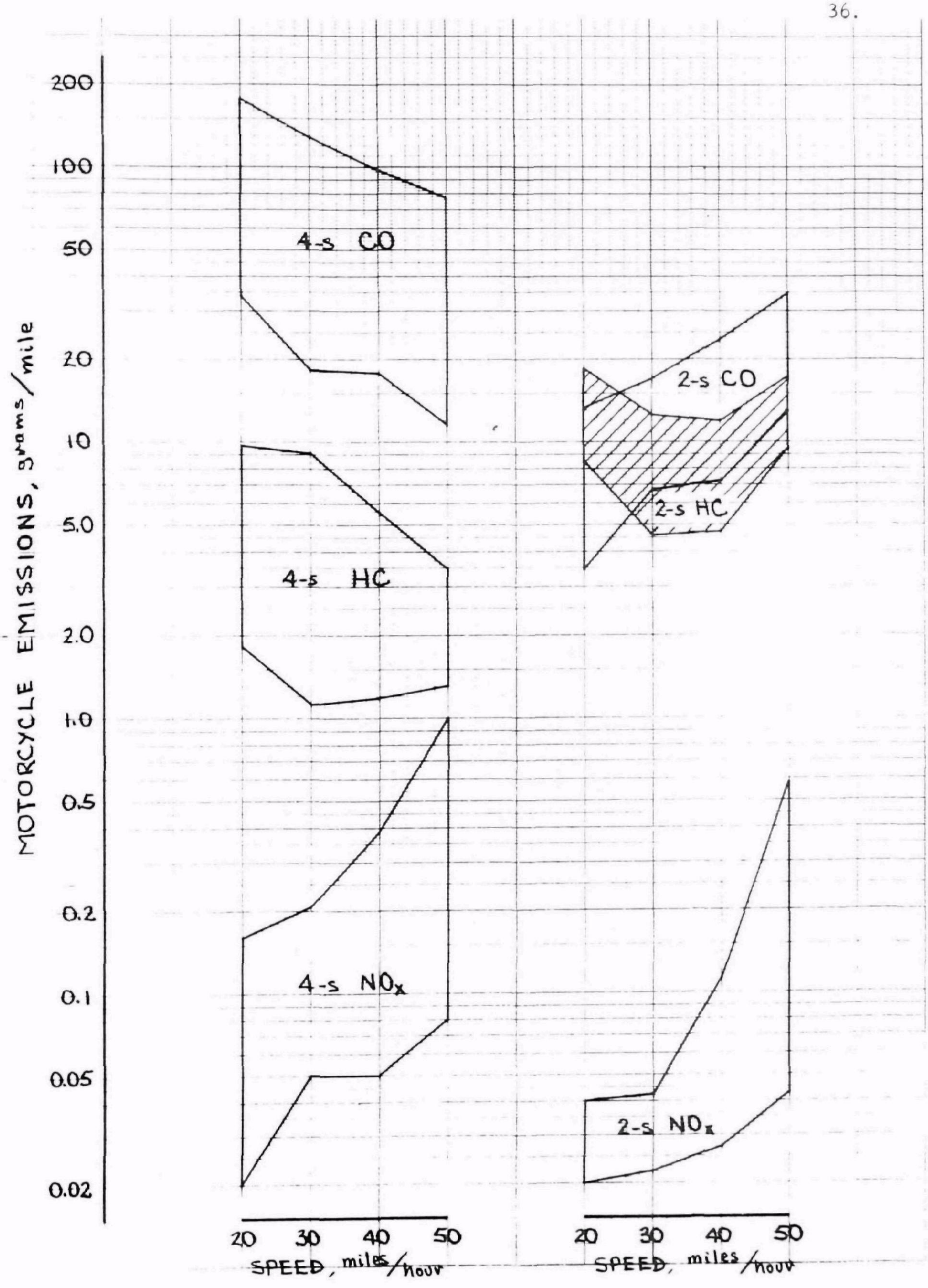


FIGURE 22. ENVELOPES OF ROAD-LOAD EXHAUST EMISSIONS FROM THE SEVEN MOTORCYCLES TESTED (FOUR 4-S AND THREE 2-S)

cycles in each category would doubtless make the ranges even wider (especially the inclusion of larger 2-stroke machines), but even with only a few machines represented, some trends can be observed. Note that although the hydrocarbon and CO envelopes overlap for the 2-stroke machines, the shading of the hydrocarbon envelope prevents ambiguity. The emissions plotted in Figure 22 are those measured during road load conditions only, and while the average emissions from all seven motorcycles do fall within their respective envelopes, all areas of the envelopes should not be construed as having equal weight with respect to the machines tested or the motorcycle population.

To complete the presentation of gaseous emissions concentration data, Table 13 and 14 contain concentrations of light hydrocarbons measured in the exhausts of the Honda SL100 and the Kawasaki 125F-6. Light hydrocarbon data were taken only for these last two machines due to a variety of technical problems encountered when the analysis was attempted earlier on the five larger bikes. Although no comparable data are available on other motorcycles, the concentrations given in Tables 13 and 14 fall into the general ranges which might be expected after examining light hydrocarbon emissions from other engines tested under the subject contract. Propane and butane were omitted from Table 13 because no measurable amount of either compound was found in the exhaust of the Honda SL100.

No attempt will be made to compute light hydrocarbons on a mass basis because the resulting data would be of little significance. Aldehydes, however, are a different matter, since they can be of interest in national impact studies. Aldehydes were measured, of course, only during steady-state conditions, so a method of computing aldehyde mass emissions which approximate those which might be observed during a cyclic procedure like the LA-4 remains to be derived. Individual mode mass emissions of aldehydes are shown in Tables 6 through 12, calculated on the same basis as the other mass emissions, and these mode data can be weighted to make a very rough approximation of a cyclic procedure. The mass data are expressed "as HCHO" (formaldehyde) simply because the assumption of some molecular weight is necessary for calculations and because the importance of the molecule lies in the carbonyl group and not in the remaining structure. The obvious shortcomings of this procedure are that no transients or closed throttle conditions (other than idle) can be included, but emissions on the composite cycles were found to agree fairly well with the LA-4 after some trial-and-error experimentation. Table 15 shows the conditions and weights used in an attempt to simulate road operation. The average speed on both composite cycles is 28 miles per hour, somewhat higher than that for the LA-4 (19.7 mi/hr). Comparison of fuel consumption and hydrocarbon emissions from the composite cycles to the LA-4 (averages) shows fairly good overall agreement, with hydrocarbon emissions a fraction of one percent lower and fuel con-

TABLE 13. DATA ON LIGHT HYDROCARBON EMISSIONS FROM A HONDA SL100 MOTORCYCLE (AVERAGES FOR 3 RUNS)

Mode	Condition	Concentrations of Light Hydrocarbons, ppm				
		CH_4	C_2H_6	C_2H_4	C_2H_2	C_3H_6
1	Idle	1550	57	345	751	164
2	20 RL	440	18	141	156	72
3	30 RL	233	23	115	111	65
4	40 RL	236	22	109	68	71
5	50 RL	221	39	166	49	104
7	20 5%	187	14	85	55	47
8	30 5%	286	19	106	71	59
9	40 3.0%	190	17	93	50	47
10	50 2.4%	289	26	159	72	84
11	20 H	232	26	120	62	78
12	30 H	301	25	137	93	82
13	40 H	352	59	302	205	165
14	Idle	1550	62	336	951	187

TABLE 14. DATA ON LIGHT HYDROCARBON EMISSIONS FROM A KAWASAKI 125F-6 MOTORCYCLE (AVERAGES FOR 3 RUNS)

Mode	Condition	Concentrations of Light Hydrocarbons, ppm						
		CH_4	C_2H_6	C_2H_4	C_3H_8	C_2H_2	C_3H_6	C_4H_{10}
1	Idle	1620	81	446	71	659	143	958
2	20 RL	78	23	97	5	39	41	323
3	30 RL	110	20	87	7	49	51	335
4	40 RL	61	9	71	2	21	41	343
5	50 RL	106	15	76	7	42	63	395
6	Idle	2150	71	556	27	808	126	1010
7	20 5%	127	15	82	6	90	53	441
8	20 H	88	35	82	4	23	65	484
9	30 H	127	13	79	9	40	78	508
10	40 H	160	15	91	6	54	103	714
11	Idle	2470	109	681	21	821	158	1090

TABLE 15. CONDITIONS AND WEIGHTING FACTORS USED FOR CYCLE SIMULATION

Condition	% Time at Condition		Distance (mi)/hr at Condition	
	5 Larger Machines	2 Smaller Machines	5 Larger Machines	2 Smaller Machines
Idle	20	20	0.0	0.0
20 mph road load	15	20	3.0	4.0
30 mph road load	15	20	4.5	6.0
40 mph road load	15	20	6.0	8.0
50 mph road load	15	20	7.5	10.0
20 mph r.l.+ 10% grade	5		1.0	
30 mph r.l.+ 10% grade	5	-	1.5	
40 mph - r.l.+ 10% grade	5	-	2.0	
50 mph - r.l.+ 10% grade	5		2.5	
Total Average Speed -			28 mi/hr	28 mi/hr

sumption about 12% lower on the composite cycles than on the LA-4. This agreement gives a degree of confidence in the data computed over the composite cycles.

Based on the foregoing analysis, composite values for aldehyde emissions from the seven motorcycles have been calculated and are presented in Table 16. Although there is no really accurate way to measure the differences at this point, it appears that aldehyde emissions from 2-strokes are somewhat higher than those from 4-stroke machines of similar size. A weighting procedure similar to the one used for aldehydes will be used later to calculate particulate emissions on a distance-traveled basis.

TABLE 16. CYCLE COMPOSITE ALDEHYDE EMISSIONS FROM MOTORCYCLES

Motorcycle	RCHO as HCHO	
	g/hour	g/mile
Harley-Davidson FLH	2.91	0.104
Honda CL350K3	2.83	0.101
Honda SL100	0.638	0.023
Kawasaki 125F-6	3.04	0.109
Suzuki T250	3.20	0.114
Triumph T120R	1.80	0.064
Yamaha DT1-E	3.76	0.134

4. Results of Special Study on Crankcase "Blowby" Emissions (1 Motorcycle)

The results of the study of blowby emissions (test procedures described in section III. E.) were not surprising, that is, substantial amounts of hydrocarbons were measured, but only negligible amounts of other contaminants. Measurements at the crankcase vent of the Honda SL100 yielded the data shown in Table 17, including both bag samples and continuous samples (no justification could be fonnd for separating the two). These same data expressed on a mass basis are found in Table 18, assuming gas densities as calculated at 29.0 in Hg and 70°F.

TABLE 17. CRANKCASE VENT EMISSIONS FROM A HONDA SL100 MOTORCYCLE (CONCENTRATIONS AS MEASURED)

Condition	Flow ft^3/hr	Run	HC, ppmC	CO, %	CO_2, %	NO, ppm	NO_x, ppm	O_2, %
Idle	4.18	1	42,400	1.24	0.97	5.2	8.8	17.9
	(Avg.)	2	96,500	1.70	0.74	16.5	23.4	16.7
		3	58,400	1.11	1.31	7.4	8.4	18.2
		4	64,500	0.80	1.15	3.8	7.7	18.1
		Avg.	65,400	1.21	1.04	8.2	12.1	17.7
20 RL	7.08	1	60,600	0.96	1.12	8.4	14.2	17.7
		2	85,800	1.32	0.60	10.8	16.8	18.1
		3	76,800	0.86	1.26	9.5	12.9	18.4
		4	47,400	0.63	0.85	14.0	17.8	18.8
		5	68,800	0.95	1.05	4.3	8.0	17.9
		Avg.	69,900	0.94	0.98	9.4	13.9	18.2
40 RL	13.07	1	89,900	0.87	1.15	61.0	71.2	17.3
	(Avg.)	2	80,500	0.50	0.70	22.2	28.3	18.4
		3	80,000	0.20	0.90	43.7	46.7	19.3
		4	77,600	0.25	0.85	36.3	40.2	19.2
		5	59,400	0.30	0.85	29.6	33.8	19.2
		6	57,400	0.22	0.75	26.8	29.7	19.1
		Avg.	60,900	0.39	0.87	36.6	41.6	18.8

In addition to measuring the composition of the blowby gases themselves, measurement of exhaust emissions with and without blowby "recirculation" was also attempted. The results of this sub-study are shown in Table 19, and while they represent independent measurements, they do agree quite well with steady-state exhaust emissions presented in Table 8 and Appendix D. Table 20 summarizes the results given in the preceding parts of this report section, supporting the generalization

TABLE 18. MASS EMISSIONS FROM THE CRANKCASE VENT OF A HONDA SL100 MOTORCYCLE

Condition	Mass Emissions, g/hr HC	CO	NO_x	Mass Emissions, g/mi HC	CO	NO_x
Idle	4.30	1.61	0.00263			
20 RL	7.60	2.47	0.00520	0.380	0.124	0.000260
40 RL	15.5	1.88	0.0292	0.388	0.0469	0.000731
*Composite	10.1	2.06	0.0143	0.421	0.0859	0.000595

*for this purpose only, composite assumed as 20% Idle and 40% at each other condition (time-weighted)

TABLE 19. EXHAUST EMISSIONS FROM A HONDA SL100 MOTORCYCLE WITH AND WITHOUT BLOWBY RECIRCULATION

Condition	Wet Concentrations HC, ppm C	CO, %	CO_2, %	NO, ppm	NO_x, ppm	O_2, %
Idle-stock	12,700	9.40	6.90	31	39	4.3
Idle-recirc.	15,600	9.58	6.71	25	35	4.4
20 RL-stock	7,700	8.37	7.55	89	89	3.4
20 RL-recirc.	8,250	9.12	7.02	71	71	3.7
40 RL-stock	6,100	4.69	9.86	433	433	4.4
40 RL-recirc.	6,250	4.47	9.80	511	511	4.6

Condition	Mass Emissions, g/hr HC	CO	NO_x	Mass Emissions, g/mi HC	CO	NO_x
Idle-stock	18.1	271	0.185	-	-	-
Idle-recirc.	21.9	272	0.163	-		-
20 RL-stock	31.9	700	1.22	1.59	35.0	0.061
20 RL-recirc.	33.6	751	0.964	1.68	37.5	0.048
40 RL-stock	46.7	725	11.0	1.17	18.1	0.275
40 RL-recirc.	48.7	703	13.2	1.22	17.6	0.330

made earlier about the significance of blowby hydrocarbons, CO, and NO_x in the total emissions picture. Using the composite figure for HC

TABLE 20. SUMMARY OF RESULTS OF THE CRANKCASE EMISSIONS (BLOWBY) STUDY CONDUCTED ON THE HONDA SL100 MOTORCYCLE

Condition	*Blowby as % of Exhaust Emissions HC	CO	NO_x	% Control of HC in Blowby by Recirculation
Idle	18.5	0.62	1.55	12
20 RL	20.9	0.37	0.33	76
40 RL	33.1	0.26	0.19	87

*data from Table 18 compared to data from Table 8

from Table 18 (0.421 g/mi) and comparing to the exhaust HC number generated on the LA-4, it appears that crankcase HC from the Honda SL100 tested was about 21% of exhaust HC. This finding supports very well the estimate made in an earlier report(6) that crankcase hydrocarbons could be estimated at "about 20%" of those from 4-stroke motorcycle exhaust.

B. Smoke Emissions (2-stroke engines only) and Particulate Emissions

As described in section III. D. 3., measurements of smoke opacity were taken by continuous recording during the first 505 seconds of the "LA-4" driving route. Figures E-1 through E-3 (Appendix E) are scaled-down reproductions of the recorder traces of speed and smoke opacity for the three 2-stroke bikes. Both speed and opacity were plotted at 3-second intervals except where a smaller interval was necessary to describe the curve properly. Note that the exhaust pipe extension used on the Suzuki was 3 inches in diameter and that those for the other two motorcycles were 2 inches in diameter due to existing exhaust system configurations. This difference in optical path length of the light beam undoubtedly made the Suzuki's smoke density comparatively higher, but it certainly was not the entire cause of the higher density readings for the Suzuki. All the machines tested used automatic oil injection systems, and the oils were supplied by the manufacturers and were those recommended for use in the motorcycles tested. Fresh fuel was used for all runs, because it had been observed earlier that fuel some days old could cause higher-than-normal smoke readings (at least for the Yamaha).

In addition to the measurements taken during the LA-4 runs, a modification of the Federal smoke test procedure for diesel engines was tried on the Suzuki and the Yamaha, consisting of two accelerations and a lug-down (deceleration). Table 21 gives the results of the modified Federal procedure as well as pertinent operating data for each motorcycle. The "a factor" is the average of the 15 highest 1/2-second opacity readings during the two accelerations, and the "b factor" is the average of the 5 highest 1/2-second opacity readings during the decelera-

TABLE 21. MOTORCYCLE SMOKE TEST RESULTS AND SUPPLEMENTARY DATA

SUPPLEMENTARY DATA

SUZUKI T250: Max. Speed 8000 rpm, Inertia wheel 2, road load, 3-inch pipe

1st acceleration: 3000 to 6000 rpm, gear 2, times 6.0 sec and 6.5 sec
2nd acceleration: 2500 to 6000 rpm, gear 2, times 9.0 sec and 8.5 sec
deceleration: 6000 to 3500 rpm, gear 2, times 7.0 sec and 6.5 sec

YAMAHA DT1-E: Max Speed 7000 rpm, Inertia wheel 2, road load, 2-inch pipe

1st acceleration: 2500 to 6000 rpm, gear 3, times 5.5 sec and 6.0 sec
2nd acceleration: 2500 to 6000 rpm, gear 4, times 11.0 sec and 11.0 sec
deceleration: 6000 to 3500 rpm, gear 2, times 6.5 sec and 6.5 sec

RESULTS

SUZUKI T250: "a factor" - 8.69% opacity, "b factor" 20.49% opacity

YAMAHA DT1-E: "a factor" 1.92% opacity, "b factor" = 1.61% opacity

tion. The results in Table 21 are averages of two runs rather than the normal 3 runs (for heavy-duty vehicles). It should again be noted that the opacity values for the two motorcycles are not directly comparable due to the difference in exhaust pipe diameters.

Particulate emissions from the seven motorcycles are summarized in Table 22, generally representing 3 or 4 runs per data point (range 1 to 7, average about 3.2 runs per data point). The interesting features of these data include the fact that the g/mile rates are relatively uniform for the 4-stroke machines over the four road load conditions, while those for the 2-stroke machines tend to increase with increasing speed. The increase in particulate emissions with power level is even more dramatic for 2-strokes (much more so than for 4-strokes), and the most plausible explanation for these observations lies in the oil injection systems used on the 2-stroke engines. These systems meter oil to various points in the engine (depending on the motorcycle) at a rate which increases with both engine speed and throttle opening, and it is apparent that their effects

TABLE 22. PARTICULATE EMISSIONS DATA FROM SEVEN MOTORCYCLES

4-stroke motorcycles

Condition	Average mg/SCF Exhaust				Average Rate, g/hour				Average Rate, g/mi			
	H-D FLH	Honda CL350K3	Honda SL100	Triumph T120R	H-D FLH	Honda CL350K3	Honda SL100	Triumph T120R	H-D FLH	Honda CL350K3	Honda SL100	Triumph T120R
Idle	2.56	1.52	4.23	4.64	1.61	0.344	0.373	1.22	--	--	--	--
20RL	2.69	0.50	2.44	13.4	3.46	0.242	0.632	5.75	0.173	0.012	0.032	0.287
30RL	3.28	0.14	1.69	12.0	4.46	0.101	0.588	7.68	0.149	0.003	0.020	0.256
40RL	4.52	1.67	1.94	30.8	5.75	1.41	0.917	21.4	0.144	0.035	0.023	0.536
50RL	4.44	2.04	3.06	15.2	6.15	1.84	1.93	13.7	0.123	0.037	0.039	0.275
*20 10%	3.05	1.02	3.17	5.74	4.63	0.902	1.63	3.93	0.232	0.045	0.081	0.197
30 10%	3.37	1.88	--	20.0	5.10	2.17	--	19.8	0.170	0.072	--	0.661
*40 10%	2.35	0.94	4.00	12.2	3.96	1.42	3.06	15.1	0.099	0.035	0.077	0.378
50 10%	4.07	4.02	--	13.1	8.11	6.93	--	19.0	0.162	0.139	--	0.380

*These conditions were actually "20H" and "40H" for the Honda SL100

2-stroke motorcycles

Condition	Average mg/SCF Exhaust			Average Rate, g/hour			Average Rate, g/mi		
	Kaw. 125F-6	Suzuki T250	Yamaha DT1-E	Kaw. 125F-6	Suzuki T250	Yamaha DT1-E	Kaw. 125F-6	Suzuki T250	Yamaha DT1-E
Idle	8.54	14.3	2.64	0.664	1.90	0.282	-	-	-
20RL	4.76	5.48	6.24	1.49	2.34	2.04	0.074	0.117	0.102
30RL	7.04	13.2	6.08	2.83	6.72	2.19	0.094	0.224	0.073
40RL	8.18	8.75	10.7	4.85	6.08	5.72	0.121	0.152	0.143
50RL	16.5	19.6	9.57	16.4	23.9	8.10	0.328	0.478	0.162
**20 10%	16.7	12.1	14.0	17.4	7.96	9.68	0.872	0.398	0.484
**30 10%	28.5	27.8	13.2	41.0	29.8	11.7	1.37	0.995	0.389
40 10%	--	44.0	16.3	--	66.8	21.1	--	1.67	0.528
50 10%	--	49.2	19.4	--	86.5	33.1	--	1.73	0.662
20 20%	--	--	20.1	--	--	19.9	--	--	0.993
30 20%	--	--	25.7	--	--	39.0	--	--	1.30

**These conditions were actually "20H" and "30H" for the Kawasaki 125F-6.

on particulate are visible in the data. The filters used for gravimetric analysis (white when unused) turned a light yellow to brownish-yellow after a sample of 2-stroke exhaust had been collected, indicating retention of oil particles. Most filters used for 4-stroke exhaust, however, turned tan to light brown after use. Notable exceptions to the latter rule were some of the filters used to collect samples from the Triumph and the Honda SL100. The Triumph samples were dark brown to black, and this coloring must have been caused by combustion of lubricating oil (it was later shown that the engine had defective rings), although the exhaust did not smoke noticeably. Filters used during higher speed and load conditions on the Honda SL100 turned a distinct reddish color, even when commercial pump gasoline was used in place of emissions test fuel. Filters used during low speed conditions turned a tan color, much like the other 4-stroke bikes.

Overall, the particulate rates in g/mile were somewhat higher for 2-strokes than for 4-strokes (the Triumph, which was probably atypical, maybe an exception). In order to determine particulate rates which represent real operation to at least some extent, it is necessary to use a composite schedule again as was done for aldehydes. The results of this analysis are shown in Table 23, and are considered reasonable except on the Triumph, as explained earlier. Particulate emissions for the 2-stroke bikes seem to be related to the smoke levels discussed earlier, and are probably functions of oil rate.

TABLE 23. SUMMARY OF WEIGHTED PARTICULATE MASS EMISSIONS FROM SEVEN MOTORCYCLES

Motorcycle	Particulate g/hour	Particulate g/mi
Harley-Davidson FLH	4.38	0.157
Honda CL350K3	1.18	0.042
Honda SL100	0.888	0.032
Kawasaki 125F-6	5.25	0.187
Suzuki T250	15.8	0.564
Triumph T120R	10.4	0.372
Yamaha DT1-E	6.54	0.234

C. Results of Noise Tests

Noise tests were conducted on the Honda SL100, the Kawasaki 125F-6 and a privately-owned Yamaha 175 (not included in any other tests). The tests consisted of accelerations patterned after those required in SAE Standard J986a[12], constant-speed "driveby" tests at 30 mph, and measurements at idle with the machines stationary. Procedures and documentation were given in section III. G., and results are summarized in Table 24. Various standards are currently being enforced on

TABLE 24. SUMMARY OF NOISE TEST RESULTS ON THREE MOTORCYCLES
(All noise measurements in dBA except where noted)

	Motorcycle		
	Honda SL100	Kawasaki 125F-6	Yamaha 175
Acceleration Tests			
Ambient before accel.	45 (55dBC)	44 (68dBC)	47 (64dBC)
Gear used for accel.	3	3	3
Acceleration noise left	82.8	86.8	83.2
Acceleration noise right	83.5	84.8	83.2
Ambient after accel.	44 (60dBC)	44 (64dBC)	45 (72dBC)
Driveby Tests			
Ambient before driveby	44 (52dBC)	45 (61dBC)	44dBA, 70dBC
Gear used for driveby	4	4	4 (3)
Driveby noise left	73.0	75.8	74.0 (77.2)
Driveby noise right	72.0	73.5	73.0 (78.8)
Ambient after driveby	44 (55dBC)	44 (55dBC)	44dBA, 60dBC
Idle Tests			
Ambient before idle test	45 (60dBC)	44 (60dBC)	45 (60dBC)
Idle noise left	62.5	69.5	69.5
Idle noise front	63.0	67.2	69.2
Idle noise right	64.8	68.0	69.8
Idle noise rear	65.5	68.2	70.8
Ambient after idle test	44 (55dBC)	44 (65dBC)	45 (63dBC)

motorcycles as well as other vehicles, and the noise levels from the motorcycles tested would be within some limits and not within others. The SAE standard (which has little bearing on regulations) for light-duty vehicles during the acceleration test is 86dBA, to give just one example.

All the measurements are given in dBA (to correlate with human ear response), and in addition, the ambient measurements are also given in dBC (flat response no frequency dependence). The slightly different format for driveby tests on the Yamaha 175 is an attempt to avoid confusion due to the use of two different gears. It is apparent that in this case the use of a lower (numerical) gear, which increased the engine speed, did increase the noise level.

V. ESTIMATION OF EMISSION FACTORS AND NATIONAL IMPACT

To develop reasonable motorcycle emission factors, it is necessary to know the motorcycle population to such an extent that available emissions data can be extrapolated logically. A good description of the population is also necessary to estimation of national impact, because both the number of motorcycles in service and their distribution over the range of available sizes and types are direct inputs to the impact calculation. Consequently, this report section will be broken up into three parts, covering analysis of the motorcycle population, development of emission factors, and estimation of national impact as logically separate items.

A. Analysis of the Motorcycle Population

The population of motorcycles in use in the United States is undergoing rapid changes in both composition and overall size. The tremendous growth of the industry since about 1960 parallels that which has occurred in other recreation-oriented fields, and keeping up with the statistics has been a problem. In that at least some motorcycles are registered for street use, some reliable (if usually outdated) statistics are available. On the other hand, so many bikes are now used exclusively off-road (and unregistered) that total population statistics are largely a matter of speculation.

A summary of some of the more comprehensive registration and sales data is given in Table 25, noting that it comes from several fairly diverse sources. Where possible, data from Alaska and Hawaii

TABLE 25. SUMMARY OF MOTORCYCLE REGISTRATION AND SALES DATA

Year	Total Registrations[16]	Change in Registrations	Industry Sales[17]
1972	3,765,000[a]	439,493	1,800,000[a]
1971	3,325,507	510,807	1,584,800
1970	2,814,700	519,700	1,130,100
1969	2,295,000	195,000	671,700
1968	2,100,000	147,000	481,000[b]
1967	1,953,000	200,000	389,000[b]
1966	1,753,000	-------	342,000[c]

[a] estimate [b] derived from data given in Reference 18
[c] extrapolated

have been excluded from the figures, restricting the analysis to the contiguous states plus the District of Columbia. These exclusions were not possible, however, for the sales data. One note of explanation on the sales data is that they are based on import figures with an allowance added for motorcycles of domestic manufacture.

The outstanding fact in evidence from the data in Table 25 is that motorcycle sales are far outstripping new registrations. The causes of this phenomenon are that many motorcycles are being sold for off-road use only (and are never registered), and that a substantial number of older motorcycles are being retired from service. It remains to make a reasonable estimate of the current (December 31, 1972) motorcycle population using the available facts as basis, proceeding on a more or less trial-and-error basis.

To begin, ranges can be established for quantities which are known to exist, for example, it might be assumed that the percentage of motorcycles in the country which is not registered is between 10% and 30%. It could also be assumed that the average age of a motorcycle in service is between 2 and 5 years, and that the average life of a motorcycle is between 3 and 7 years. In addition, the percentage of motorcycles of a given year which is still in service is probably a function of motorcycle age. A range for this quantity which could be assumed is that 10% to 20% of the motorcycles sold in a given year retire from service in every year that passes. That is, 80% to 90% of sales for year k would still be in service in year k + 1, 60% to 80% would still be serviceable in year k + 2, and so on. Put another way, the percentage of machines sold in any given year still in service would decrease linearly to zero over a period of 5 to 10 years. This longevity function is obviously not entirely correct, but is probably a good enough approximation to yield useful results.

In order to calculate values for all the other quantities, it is really necessary only to assume a value for the constant in the longevity function. The results of calculations performed in this manner are given in Table 26, with the assumption (where necessary) that sales increased linearly from 60,000 in 1960 to 389,000 in 1967. It was also assumed for calculations that as of the end of 1972, the average age of motorcycles sold in 1972 was 0.5 year, the average for those sold in 1971 was 1.5 years, and so forth. Examining the statistics in Table 26, it is at first evident that the last assumption yields an impossible situation, namely that the calculated population is smaller than the number of registrations. Progressing upward from the bottom of the table, the combination of statistics becomes more plausible, at least up to about the third line (assumption of 10% per year retired). Although the number is not presently a known quantity, the percentage of machines currently in the population which are even capable of off-road operation would place some kind of upper limit on the unregistered percentage. The limited amount of information available on this point[19] indicates that the figure may be near 40%, but better information should be available from the Motorcycle Industry Council (MIC) before long.

TABLE 26. MOTORCYCLE POPULATION STATISTICS CALCULATED BY ASSUMING A SERIES OF RETIREMENT RATES

Percent of Original Number Retired per Yr.	Calculated Population 12/31/72	Percent Unregistered	Average Age, yr	Average Life, yr
8.3	5,398,000	30.3	2.31	6.0
9.1	5,223,000	27.9	2.20	5.5
10	5,022,000	25.0	2.07	5.0
11.1	4,796,000	21.5	1.94	4.5
12.5	4,544,000	17.1	1.81	4.0
14.3	4,260,000	11.6	1.66	3.5
16.7	3,931,000	4.2	1.51	3.0
20	3,544,000		1.36	2.5

Having presented the available data, it becomes necessary to make an assumption based on best judgement, and that assumption is that there were 5 million motorcycles in use in the United States as of 12/31/72. If it is shown later that this assumption is erroneous, it should be a relatively simple matter to correct subsequent calculations. It should be noted that this estimate does not include minibikes or bicycles with auxillary engines, but that it does include scaled-down motorcycles intended for use by young people (Yamaha Mini-Enduro, Honda SL70, etc.).

Attention now must be directed toward the composition of the motorcycle population according to size and type of engine used. Data currently available on this point are given in Table 27, although it is anticipated that more comprehensive information will be available shortly from the MIC statistical survey. Since no data to the contrary have been found, it will be assumed for calculation purposes that the current motorcycle population is 60% 4-strokes and 40% 2-strokes. It is not quite so simple to arrive at the compositions of the 2- and 4-stroke populations by size, however, but supplementary information regarding sales trends can be very helpful.

Until the past few years, it has been traditional that street riders prefer 4-stroke machines, since no large, fast 2-stroke machines have been available (except competition bikes). Likewise it has been customary that dirt riders prefer 2-strokes because of their lighter weight and greater simplicity. The market now offers such a variety of machines, however, that these old distinctions are no longer valid. Put another way, there is now more of an equality of offerings among 2-strokes and 4-strokes and there is little justification for supposing that sales breakdowns by engine size should be greatly different for the two engine types. Based on this generalization, some of the data from Table 27, and the population model from Table 26 (10% retirement per year), a distribution of the U.S. motorcycle population by size (both 2-stroke and 4-stroke) has been calculated and is given in Table 28. This distribution will be used in conjunction with emissions test data and motorcycle usage information to develop emission factors and impact estimates in the following report subsections. It would be desirable to use a distribution having a better category breakdown for the larger machines, but the most reliable data simply are not broken down so accurately.

TABLE 27. BREAKDOWN OF U.S. MOTORCYCLE POPULATION ACCORDING TO ENGINE SIZE AND TYPE

1969 Sales Data [20]

Displacement cm^3	% of 2-strokes	% of 4-strokes	% of total
Under 100	16.7	41.9	33.0
100-139	38.8	2.4	15.4
140-199	12.0	9.0	10.1
200-299	21.1	2.2	8.9
300-439	8.2	21.0	16.3
440-699	3.0	15.9	11.4
700 and over	0	7.6	4.9

1971 Sales Data [19]

Displacement, cm^3	% of total
49-100	33
120-250	27
305-360	15
440-750	12
Over 750	3

Displacement cm^3	% of Total Imports for Year [17]			
	1969	1970	1971	1972*
0-50	22.9	15.0	8.2	5.7
51-90	21.4	27.1	24.7	20.0
91-190	22.7	22.1	26.9	31.3
191-290	9.4	6.7	7.2	9.2
over 290	21.9	27.4	30.1	31.0
unclassified	1.7	1.7	2.9	2.8

*January-May

Year	% of Market for 2-strokes	% of Market for 4-strokes
1969 [20]	38	62
1970 [19]	40	60
1971 [17]	40	60

TABLE 28. DISTRIBUTION OF U.S. MOTORCYCLES BY ENGINE SIZE

Displacement, cm^3	% of Population	Number in Service
0-50	10	500,000
51-90	24	1,200,000
91-190	28	1,400,000
191-290	8	400,000
over 290	30	1,500,000

B. Development of Emission Factors

The end products required in this subsection are characteristic emission rates for each of the motorcycle size categories listed in Table 28, which can then be combined to yield characteristic emission rates for the entire motorcycle population. Data acquired during the testing phase of this program indicate that emission rates are not simple functions of engine displacement or motorcycle size, and thus another approach will be used in estimating rates for each category. If composite emission rates from the machines tested (such as LA-4 data and composite aldehydes and particulates) are plotted as functions of engine displacement, envelopes can be drawn indicating the range of values to be expected. Points within these envelopes which are thought to be representative of each category can be chosen, and the emission rates at those points can be assumed as typical for the respective categories. This type of analysis is certainly not rigorous, but is really the only realistic approach to be taken since so few data are available. At some later date, when emissions data on a much larger number of motorcycles (perhaps 100 or more) are available, a good statistical analysis can be made. Mass emissions calculated

TABLE 29. TYPICAL MASS EMISSIONS FROM MOTORCYCLES AS FUNCTIONS OF ENGINE SIZE AND TYPE

Engine Type	Engine Disp., cm^3	Emissions in g/mile					
		*HC	CO	NO_x	RCHO	Particulate	†SO_x
4-stroke	0-50	2.2	19.	0.53	0.015	0.020	0.013
	51-90	2.3	21.	0.35	0.021	0.025	0.015
	91-190	2.6	24.	0.32	0.026	0.030	0.017
	191-290	3.4	32.	0.17	0.044	0.045	0.022
	over 290	4.8	46.	0.11	0.079	0.070	0.031
2-stroke	0-50	5.	5.	0.24	0.095	0.12	0.020
	51-90	7.	7.	0.20	0.10	0.15	0.022
	91-190	10.	12.	0.16	0.11	0.19	0.025
	191-290	18.	30.	0.04	0.13	0.35	0.043
	over 290	25.	50.	0.04	0.14	0.55	0.057

*includes 20% increase for 4-strokes to account for crankcase losses, but does not include evaporative losses
† calculated from fuel consumption

by the process above are given in Table 29, which also includes values for SO_x based on fuel consumption and an allowance for crankcase hydrocarbon emissions from 4-strokes based on test results given in section IV.A.4. The estimates for HC, CO, and NO_x are based on LA-4 results, and those for RCHO and particulate are based on a composite of steady-state conditions. The fuel consumption used to calculate SO_x was that observed in LA-4 runs.

Several items of information are available on distances traveled by motorcycle riders annually, and the averages seem to range from about 3000 to 5000 miles per year. One source(19) estimated about 3900 miles per year for California riders based on a sample corrected for brand-name ownership and preference for street or dirt riding. Data from the Department of Transportation(21) include an estimate of 3605 miles per year for 1970, presumably based on street and highway travel only. An EPA report(22) issued some time ago estimated 5000 miles per year based on 3 references and another source estimated 4700 miles per year based on a survey of magazine subscribers, but it is not known whether this latter sample was corrected for composition or not.

Some of the dynamics of the mileage situation which are presently occurring are that an increasing number of riders are making long tours, which tends to increase average mileage. On the other hand, many riders are entering motorcycling as a second or third sport, and consequently participate at a level lower than that of the real enthusiast. Perhaps the best way of judging the number of miles a rider may cover in a year is to look at the distance capabilities of his motorcycle. It is doubtful that many riders would attempt much of a trip on less than a 350cm^3 machine these days, due to both rider comfort and safety considerations. Almost all street machines of 350 cm^3 displacement or more have performance and comfort which is acceptable for long trips, but as a general rule it would be expected that for street machines annual mileage would still be positively related to motorcycle size.

For the purposes of this report, the annual mileage assumptions which will be used are 2500 mi/yr for the 0-50 cm^3 category, 3000 mi/yr for the 51-90 cm^3 category, and 3500, 4000, and 5000 mi/yr for the other categories in order of increasing displacement. When weighted by the population estimates in Table 28, these assumptions yield an average for all motorcycles of 3770 mi/yr, which is considered a reasonable result. These mileages and the average will be assumed applicable to off-road as well as highway usage.

Based on all the foregoing analysis and qualifications, emission factors for motorcycles in the United States have been calculated and are presented in Table 30. Evaporative emissions were calculated using the method described in section III. F. 1., assuming that they occurred only during the riding season in each part of the country, and the results are shown in Table 30. For this purpose, it was assumed that the U. S. was divided into three regions. The north region was assumed to be between 49° and 43° north latitude and to have a 6-month riding season, the central region between 43° and 37° and to have an 8-month riding season, and the south region between 37° and 31° and to have a 10-month riding season.

TABLE 30. EMISSION FACTORS FOR MOTORCYCLES (DEC. 31, 1972)

Pollutant	Engine Type	g/mile	g/unit year
Exhaust Hydrocarbons	4-stroke	2.9	10,900
	2-stroke	16.	59,400
Crankcase Hydrocarbons	4-stroke	0.6	2,200
	2-stroke	-	-
Evaporative Hydrocarbons	4-stroke	-	1,360
	2-stroke	-	1,360
Total Hydrocarbons	4-stroke	3.5	14,500
	2-stroke	16.	60,800
CO	4-stroke	33.	123,000
	2-stroke	27.	103,000
NO_x as NO_2	4-stroke	0.24	918
	2-stroke	0.12	434
RCHO as HCHO	4-stroke	0.047	177
	2-stroke	0.11	431
Particulates	4-stroke	0.046	172
	2-stroke	0.33	1,260
SO_x as SO_2	4-stroke	0.022	84
	2-stroke	0.038	145

Based on estimated 1972 registration data(17), about 13% of the motorcycles are in the north region, 46% in the central region, and 41% in the south region. The final units in which the emission factors have been expressed, g/mile and g/motorcycle year, are used because they can be related easily to available population statistics for the purpose of computing national impact. These units are considered more practical than fuel-based units because motorcycle fuel is not easily separated from that sold for use in other vehicles. The factors do depend to some extent on the composition of the motorcycle population, but calculation of new factors based on later population data would be a relatively simple matter.

Note that the g/mile estimates in Table 30 are for the U. S. motorcycle population weighted by size and mileage. In other words, they are the g/unit year estimates divided by 3770 miles (except HC, where the "g/unit year" figure includes evaporation and the "g/mile" figure does not).

If factors or impact on a more limited basis are desired, calculation should start with data given in Table 29, then the size distribution and mileage for the new sample can be used properly in arriving at a new result.

C. Estimation of National Impact

The emission factors from Table 30 need only to be multiplied by the estimated motorcycle population to compute the national impact of motorcycle emissions. This step has been taken and the results appear as Table 31. Placing these results in perspective, Table 32 shows

TABLE 31. NATIONAL IMPACT ESTIMATES FOR MOTORCYCLE EMISSIONS (Dec. 31, 1972)

Engine Type	Units in Service	Pollutant	Total Emissions, ton/yr
4-stroke	3,000,000	Hydrocarbons	47,900
		CO	407,000
		NO_x as NO_2	3,040
		RCHO as HCHO	585
		Particulates	569
		SO_x as SO_2	278
2-stroke	2,000,000	Hydrocarbons	134,000
		CO	227,000
		NO_x as NO_2	957
		RCHO as HCHO	950
		Particulates	2,780
		SO_x as SO_2	320
Total	5,000,000	Hydrocarbons	182,000
		CO	634,000
		NO_x as NO_2	4,000
		RCHO as HCHO	1,540
		Particulates	3,350
		SO_x as SO_2	598

motorcycle emissions as percentages of EPA National Inventory Data, but it should be noted that the inventory data are for 1970, not 1972. The changes foreseen in the near future which affect motorcycle emissions and their importance include the rapidly expanding motorcycle population, reduction of other source emissions due to control programs already in force, and the probable advent of Wankel engines in motorcycles. The first two considerations will tend to emphasize the importance of motorcycles as compared to other sources, but the last will probably have the opposite effect if 2-stroke engines are the type most replaced by the Wankel. The extent to which these factors and others will change the impact of

TABLE 32. COMPARISON OF MOTORCYCLE NATIONAL IMPACT ESTIMATES WITH EPA NATIONWIDE AIR POLLUTANT INVENTORY DATA

Contaminant	1970 EPA Inventory Data 10^6 tons/yr(23): All Sources	1970 EPA Inventory Data 10^6 tons/yr(23): Mobile Sources	Motorcycle Estimates as % of: All Sources	Motorcycle Estimates as % of: Mobile Sources
HC	34.7	19.5	0.524	0.933
CO	147.	111.	0.431	0.571
NO_x	22.7	11.7	0.0176	0.0342
SO_x	33.9	1.0	0.0018	0.060
Particulates	25.4	0.7	0.0132	0.479

motorcycle emissions is difficult to predict, but the overall direction of change expected is toward motorcycles becoming more significant in the nationwide air pollution picture.

As mentioned in the previous subsection, registration figures indicate that about 13% of motorcycles are in the north region, 46% in the central region, and 41% in the south region. It has also been estimated that about 65% of total motorcycle mileage is accumulated in urban/suburban (rather than rural)areas(19, 24). Combining these numbers with the estimates made earlier about length of the riding season in the three regions, mass emissions from motorcycles can be categorized as shown in Table 33. The longer riding season in the south region gives it a little more weight

TABLE 33. SUMMARY OF SEASONAL, REGIONAL, AND URBAN-RURAL VARIATION OF MOTORCYCLE EMISSIONS

	Percentage of Annual Nationwide Emissions by Season								
	Urban/Suburban Areas				Rural Areas				
Region	Dec.-Feb.	Mar.-May	Jun.-Aug.	Sep.-Nov.	Dec.-Feb.	Mar.-May	Jun.-Aug.	Sep.-Nov.	Regional Subtotals
North	0.0	2.0	3.0	1.0	0.0	1.1	1.6	0.5	9.2
Central	0.0	10.5	10.5	7.0	0.0	5.6	5.6	3.8	43.0
South	3.1	9.3	9.3	9.3	1.7	5.0	5.0	5.0	47.7
Seasonal Subtotals	3.1	21.8	22.8	17.3	1.7	11.7	12.2	9.3	
Totals			65.0				34.9		99.9

in the overall emissions picture than is indicated by population statistics alone, and the seasonal effect reduces mass emissions in the other two regions slightly from those which would be expected based on motorcycle distribution. According to this analysis, the midsummer months account for 35% of motorcycle emissions, while spring accounts for about 34%, fall for 27%, and winter for 5%.

VI. SUMMARY

This report is the end product of a study on exhaust emissions from motorcycles, and it is Part 3 of a planned seven-part final report on "Exhaust Emissions from Uncontrolled Vehicles and Related Equipment Using Internal Combustion Engines," Contract No. EHS 70-108. It includes test data, documentation, and discussion on studies which characterized in detail emissions from seven motorcycles (four 4-stroke machines and three 2-strokes), as well as estimated emission factors and national emissions impact. As a part of the final report on the characterization phase of EHS 70-108, this report does not include information on aircraft turbine emissions, outboard motor crankcase drainage, or locomotive emissions control technology. As required by the contract, these three latter areas have been or will be reported on separately.

Emission measurements on the seven motorcycles were performed with the machines operating on a modified automotive chassis dynamometer in the Emissions Research Laboratory. Road tests were conducted both on the Institute grounds and on a nearby test course, and noise measurements were taken at the abandoned Hondo (Texas) airbase which the Institute rents as necessary. Exhaust emissions were measured during the "7-mode" (1970-71 Federal Light Duty Vehicle) Procedure, the "LA-4" (1972 and later Federal L. D. V.) Procedure, and a series of steady-state conditions developed specifically for each motorcycle.

Exhaust constituents measured during one or more of the three procedures were total hydrocarbons by FIA; NO and NO_x by chemiluminescence; hydrocarbons, CO, CO_2, and NO by NDIR: O_2 by electrochemical analyzer; light hydrocarbons by gas chromatograph; aldehydes by wet chemistry; and particulates by an experimental dilution-type sampling device. In addition, crankcase or "blowby" emissions from one motorcycle were characterized, and fuel evaporative losses and SO_x emissions were calculated rather than being measured. Sound level measurements were conducted on 3 motorcycles using fairly standard instrumentation during acceleration, constant-speed operation, and idling. Emission factors and national impact were calculated for hydrocarbons, CO, and NO_x from data developed on the 1975 Federal Procedure (LA-4); for SO_x, particulates, and aldehydes,on the basis of a composite of steady-state conditions. Expressing motorcycle emissions as percentages of 1970 national totals from all sources, motorcycles are estimated to account for about 0.5% of hydrocarbons, 0.4% of CO, 0.02% of NO_x, 0.002% of SO_x, and 0.01% of particulates. As percentages of 1970 national totals from mobile sources only, motorcycles are estimated to be responsible for 0.9% of hydrocarbons, 0.6% of CO, 0.03% of NO_x, 0.06% of SO_x, and 0.5% of particulates. The impact of motorcycle emissions has been estimated for three regions, based on registration data, with the result

that about 9% of motorcycle emissions are estimated to occur in the north region, 43% in the central region, and 48% in the south region.

The air pollution impact of motorcycles on individual metropolitan areas is not known at this time. Nationwide and regional emissions are only rough indicators of the actual air quality impact of any source on an urban area.

It should be recognized that the subject study is only a first step toward a real understanding of motorcycle emissions, and that tests on a great many more machines are needed to obtain an accurate baseline emissions estimate. It has likewise been impossible in the subject study to gain any knowledge at all about emissions variability from one machine to another of the same type or about variation in emission levels with age. Additional attention to possible control technology ideas and the development of a better-suited chassis dynamometer specifically for motorcycle operation are two more items which have been entirely neglected thus far. These comments give some indication of the direction in which future motorcycle emissions work should proceed in order to maintain a reasonably quantitative evaluation of a potentially important emission source.

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APPENDIX A

Motorcycle Road Test and Dynamometer Simulation Data

SOUTHWEST RESEARCH INSTITUTE
DATA SHEET

SHEET NO.____ OF ____ SHEETS
PROJECT 11-2869-01
DATE 4/21/71
BY HARE

SUBJECT MOTORCYCLE ROAD TEST AND DYNAMOMETER SIMULATION DATA

MOTORCYCLE HARLEY-DAVIDSON FLH WEIGHT AS TESTED 697 lb_f

AMBIENT TEMPERATURE 78 °F CORRECTED ATM. PRESS. 28.91 in Hg

SPEEDOMETER CALIBRATION, mi/hr

ACTUAL	INDICATED RUN 1	RUN 2	AVERAGE
10	10	10	10
20	20	20	20
30	31	31	31
40	42	42	42
50	52	53	53

INLET VACUUM, in Hg

TRUE SPEED	GEAR	RUN 1	RUN 2	AVERAGE
20	2	10.3	10.5	10.4
30	3	9.5	9.8	9.6
40	3	9.8	9.9	9.8
50	4	8.2	8.6	8.4

40 mi/hr-TO-20 mi/hr COASTING TIMES

OPERATOR	DIRECTION	TIME, sec
R	A	25.0
R	B	23.5
D	A	25.6
D	B	23.7
	AVERAGE TIME	24.4

20 mi/hr-TO-40 mi/hr ACCELERATION TIMES

OPERATOR	DIRECTION	TIME, sec
R	A	4.1
R	B	3.8
D	A	3.8
D	B	4.0
	AVERAGE TIME	3.9
	GEAR	2

DYNAMOMETER SIMULATION DATA

INERTIA WHEEL(S)	40-20 COASTING TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS	20-40 ACCELERATION TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS
1	17.0	18.5	—	17.8	—	—	—	—
1 AND 2	26.5	27.0	—	26.8	4.0	4.1	—	4.0
1 AND 4	23.7	24.5	—	24.1	3.7	3.5	—	3.6

INLET VACUUM, in Hg

SPEED, mi/hr	GEAR	LOAD = 0 RUN 1	RUN 2	AVG.	LOAD = hp @ mi/hr RUN 1	RUN 2	AVG.	LOAD = hp @ mi/hr RUN 1	RUN 2	AVG.
20	2	10.4	10.2	10.3						
30	3	9.6	9.6	9.6						
40	3	9.6	9.8	9.7						
50	4	8.4	8.4	8.4						

A-2

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SUBJECT MOTORCYCLE ROAD TEST AND DYNAMOMETER SIMULATION DATA

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DATE 4/20/71
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MOTORCYCLE HONDA CL350 K3   WEIGHT AS TESTED 355 lb_f

AMBIENT TEMPERATURE 72 °F   CORRECTED ATM. PRESS. 28.96 in Hg

SPEEDOMETER CALIBRATION, mi/hr

ACTUAL	INDICATED RUN 1	INDICATED RUN 2	INDICATED AVERAGE
10	—	—	—
20	20	20	20
30	32	31	32
40	42	41	42
50	53	52	52

INLET VACUUM, in Hg

TRUE SPEED	GEAR	RUN 1	RUN 2	AVERAGE
20	3	8.9	8.3	8.6
30	4	5.1	7.7	6.4
40	4	6.5	6.5	6.5
50	5	3.0	3.5	3.2

40 mi/hr-TO-20 mi/hr COASTING TIMES

OPERATOR	DIRECTION	TIME, sec
R	A	22.0
R	B	24.8
D	A	21.5
D	B	25.2

AVERAGE TIME 23.4

20 mi/hr-TO-40 mi/hr ACCELERATION TIMES

OPERATOR	DIRECTION	TIME, sec
R	A	5.7
R	B	5.7
D	A	5.9
D	B	5.2

AVERAGE TIME 5.6

GEAR 3

DYNAMOMETER SIMULATION DATA

INERTIA WHEEL(S)	40-20 COASTING TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS	20-40 ACCELERATION TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS
4	17.0	17.5	—	17.2	4.9	5.2	—	5.0
2	20.0	22.5	22.5	22.5	6.0	6.2	—	6.1

INLET VACUUM, in Hg

SPEED, mi/hr	GEAR	LOAD = 0 RUN 1	RUN 2	AVG.	LOAD = hp @ mi/hr RUN 1	RUN 2	AVG.	LOAD = hp @ mi/hr RUN 1	RUN 2	AVG.
20	3	7.0	9.0	8.0						
30	4	5.9	6.2	6.0						
40	4	3.8	4.1	4.0						
50	5	3.5	3.5	3.5						

PC-4

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SUBJECT MOTORCYCLE ROAD TEST AND DYNAMOMETER SIMULATION DATA

SHEET NO.____ OF____ SHEETS
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DATE 6/22/72
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MOTORCYCLE HONDA SL-100 WEIGHT AS TESTED 220 lbf
AMBIENT TEMPERATURE 90 °F CORRECTED ATM. PRESS. 29.20 in Hg

SPEEDOMETER CALIBRATION, mi/hr

ACTUAL	INDICATED RUN 1	RUN 2	AVERAGE
10	10.5	11.0	11.0
20	22.0	22.0	22.0
30	33.0	33.0	33.0
40	44.0	43.5	44.0
50	55.0	55.0	55.0

INLET VACUUM, in Hg

TRUE SPEED	GEAR	RUN 1	RUN 2	AVERAGE
20				
30				
40				
50				

45 mi/hr-TO-25 mi/hr COASTING TIMES

OPERATOR	DIRECTION	TIME, sec
J	A	18.3
J	B	13.7
D	A	17.7
D	B	15.0
	AVERAGE TIME	16.2

25 mi/hr-TO-45 mi/hr ACCELERATION TIMES

OPERATOR	DIRECTION	TIME, sec
J	A	9.4
J	B	10.4
D	A	9.0
D	B	9.8
	AVERAGE TIME	9.6

GEAR 4.

DYNAMOMETER SIMULATION DATA

INERTIA WHEEL(S)	45-25 COASTING TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS	25-45 ACCELERATION TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS
6	12.1	—	—	LOW	8.4	—	—	LOW
4	14.5	14.5	15.1	LOW	9.2	9.1	9.1	LOW
5 & 6	15.6	15.6	14.8	LOW	9.3	9.3	—	LOW
4 & 6	16.9	16.7	17.0	16.9	9.7	9.1	9.4	9.4

INLET VACUUM, in Hg

SPEED mi/hr	GEAR	LOAD=0 RUN 1	RUN 2	AVG.	LOAD= hp@ mi/hr RUN 1	RUN 2	AVG.	LOAD= hp@ mi/hr RUN 1	RUN 2	AVG.
20										
30										
40										
50										

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SHEET NO.____ OF ____ SHEETS
PROJECT 11-2869-01
DATE 6/22/72
BY ____

SUBJECT MOTORCYCLE ROAD TEST AND DYNAMOMETER SIMULATION DATA

MOTORCYCLE KAWASAKI 125F-6 WEIGHT AS TESTED 248 lb_f

AMBIENT TEMPERATURE 90 °F CORRECTED ATM. PRESS. 29.20 in Hg

SPEEDOMETER CALIBRATION, mi/hr

ACTUAL	INDICATED RUN 1	INDICATED RUN 2	INDICATED AVERAGE
10	12.0	12.0	12.0
20	21.0	21.0	21.0
30	30.0	31.0	30.5
40	40.5	41.0	41.0
50	50.0	50.5	50.0

INLET VACUUM, in Hg

TRUE SPEED	GEAR	RUN 1	RUN 2	AVERAGE
20	"			
30				
40				
50				

45 mi/hr-TO-25 mi/hr COASTING TIMES

OPERATOR	DIRECTION	TIME, sec
J	A	18.0
J	B	14.5
D	A	18.0
D	B	15.0
	AVERAGE TIME	16.4

25 mi/hr-TO-45 mi/hr ACCELERATION TIMES

OPERATOR	DIRECTION	TIME, sec	
J	A	10.2	10.0
J	B	12.5	12.5
D	A	10.2	9.8
D	B	10.8	11.2
	AVERAGE TIME	10.9	
	GEAR	4	

DYNAMOMETER SIMULATION DATA

INERTIA WHEEL(S)		45-25 COASTING TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS	25-45 ACCELERATION TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS
RESTRAINED TOO TIGHTLY	4 & 6	11.0	12.8	—	LOW	9.3	9.2	9.0	LOW
	4 & 5	12.3	13.1	—	LOW	9.6	9.5	—	LOW
	2	11.2	12.2	13.0	LOW	9.2	—	—	LOW
	1 & 5	13.8	14.6	—	LOW	11.3	11.8	—	
	1 & 5	16.3	17.0	17.1	16.8	10.5	10.9	11.0	10.8

INLET VACUUM, in Hg

SPEED mi/hr	GEAR	LOAD=0 RUN 1	RUN 2	AVG.	LOAD= hp@ mi/hr RUN 1	RUN 2	AVG.	LOAD= hp@ mi/hr RUN 1	RUN 2	AVG.
20										
30										
40										
50										

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SHEET NO.____ OF ____ SHEETS
PROJECT 11-2869-01
DATE 4/21/71
BY HARE

SUBJECT MOTORCYCLE ROAD TEST AND DYNAMOMETER SIMULATION DATA

MOTORCYCLE SUZUKI T-250R WEIGHT AS TESTED 339 lb_f
AMBIENT TEMPERATURE 78 °F CORRECTED ATM. PRESS. 28.91 in Hg

SPEEDOMETER CALIBRATION, mi/hr

ACTUAL	INDICATED RUN 1	RUN 2	AVERAGE
10	9	11	10
20	19	21	20
30	31	31	31
40	42	42	42
50	52	52	52

INLET VACUUM, in Hg

TRUE SPEED	GEAR	RUN 1	RUN 2	AVERAGE
20	3	1.8	1.8	1.8
30	4	1.5	1.8	1.6
40	4	2.0	2.0	2.0
50	5	2.0	2.0	2.0

40 mi/hr-TO-20 mi/hr COASTING TIMES

OPERATOR	DIRECTION	TIME, sec
R	A	22.1
R	B	22.6
D	A	21.2
D	B	21.9
	AVERAGE TIME	22.0

20 mi/hr-TO-40 mi/hr ACCELERATION TIMES

OPERATOR	DIRECTION	TIME, sec
R	A	5.5
R	B	5.6
D	A	5.6
D	B	5.5
	AVERAGE TIME	5.6
	GEAR	2

DYNAMOMETER SIMULATION DATA

INERTIA WHEEL(S)	40-20 COASTING TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS	20-40 ACCELERATION TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS
2	24.5	24.3	—	24.4	5.2	5.1	—	5.2

INLET VACUUM, in Hg

SPEED, mi/hr	GEAR	LOAD = 0 RUN 1	RUN 2	AVG.	LOAD = hp@ mi/hr RUN 1	RUN 2	AVG.	LOAD = hp@ mi/hr RUN 1	RUN 2	AVG.
20	3	1.6	1.8	1.7						
30	4	1.3	1.5	1.4						
40	4	1.5	1.6	1.6						
50	5	2.0	2.0	2.0						

PC-4

SOUTHWEST RESEARCH INSTITUTE
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SUBJECT MOTORCYCLE ROAD TEST AND DYNAMOMETER SIMULATION DATA

SHEET NO.____ OF____ SHEETS
PROJECT 11-2869-01
DATE 4/30/71
BY HARE

MOTORCYCLE TRIUMPH T120R WEIGHT AS TESTED 417 lb_f
AMBIENT TEMPERATURE 82 °F CORRECTED ATM. PRESS. 29.18 in Hg

SPEEDOMETER CALIBRATION, mi/hr

ACTUAL	INDICATED RUN 1	INDICATED RUN 2	INDICATED AVERAGE
10	11	10	10
20	20	20	20
30	30	31	30
40	41	41	41
50	52	52	52

INLET VACUUM, in Hg

TRUE SPEED	GEAR	RUN 1	RUN 2	AVERAGE
20	2	7.0	6.9	7.0
30	3	5.9	6.4	6.2
40	3	4.6	5.3	5.0
50	4	4.3	3.2	3.8

40 mi/hr-TO-20 mi/hr COASTING TIMES

OPERATOR	DIRECTION	TIME, sec
R	A	20.8
R	B	23.4
D	A	19.4
D	B	23.8
	AVERAGE TIME	21.8

20 mi/hr-TO-40 mi/hr ACCELERATION TIMES

OPERATOR	DIRECTION	TIME, sec
R	A	3.1
R	B	3.2
D	A	3.6
D	B	3.3
	AVERAGE TIME	3.3
	GEAR	2

DYNAMOMETER SIMULATION DATA

INERTIA WHEEL(S)	40-20 COASTING TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS	20-40 ACCELERATION TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS
1	17.0	—	—	17.0	3.0	—	—	3.0
1 AND 5	20.0	21.9	21.1	21.0	4.0	4.0	—	4.0
1 AND 6	21.2	20.2	21.0	20.8	4.0	3.2	3.4	3.5

INLET VACUUM, in Hg

SPEED, mi/hr	GEAR	LOAD = 0 RUN 1	RUN 2	AVG.	LOAD = hp @ mi/hr RUN 1	RUN 2	AVG.	LOAD = hp @ mi/hr RUN 1	RUN 2	AVG.
20	2	7.0	7.0	7.0						
30	3	6.5	6.5	6.5						
40	3	4.5	4.8	4.6						
50	4	3.4	3.6	3.5						

PC-4

SOUTHWEST RESEARCH INSTITUTE
DATA SHEET

SHEET NO.____ OF ____ SHEETS
PROJECT 11-2869-01
DATE 4/20/71
BY HARE

SUBJECT MOTORCYCLE ROAD TEST AND DYNAMOMETER SIMULATION DATA

MOTORCYCLE YAMAHA DT 1-E WEIGHT AS TESTED 279 lbf

AMBIENT TEMPERATURE 72 °F CORRECTED ATM. PRESS. 28.96 in Hg

SPEEDOMETER CALIBRATION, mi/hr

ACTUAL	INDICATED RUN 1	RUN 2	AVERAGE
10	12	11	12
20	22	22	22
30	33	33	33
40	43	44	44
50	53	53	53

INLET VACUUM, in Hg

TRUE SPEED	GEAR	RUN 1	RUN 2	AVERAGE
20	3	2.5	2.5	2.5
30	4	2.2	2.5	2.4
40	4	2.8	3.0	2.9
50	5	2.2	2.5	2.4

40 mi/hr-TO-20 mi/hr COASTING TIMES

OPERATOR	DIRECTION	TIME, sec
R	A	19.8
R	B	19.6
D	A	22.1
D	B	19.9
	AVERAGE TIME	20.4

20 mi/hr-TO-40 mi/hr ACCELERATION TIMES

OPERATOR	DIRECTION	TIME, sec
R	A	5.6
R	B	5.4
D	A	5.5
D	B	5.4
	AVERAGE TIME	5.5

GEAR 3

DYNAMOMETER SIMULATION DATA

INERTIA WHEEL(S)	40-20 COASTING TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS	20-40 ACCELERATION TIMES, sec RUN 1	RUN 2	RUN 3	CONSENSUS
5	11.1	11.6	—	11.4	4.0	—	—	4.0
2	18.2	19.5	20.5	19.4	5.5	5.5	—	5.5

INLET VACUUM, in Hg

SPEED, mi/hr	GEAR	LOAD = 0 RUN 1	RUN 2	AVG.	LOAD= hp@ mi/hr RUN 1	RUN 2	AVG.	LOAD= hp@ mi/hr RUN 1	RUN 2	AVG.
20	3	2.3	2.5	2.4						
30	4	2.4	2.3	2.4						
40	4	2.3	2.2	2.2						
50	5	1.7	1.8	1.8						

APPENDIX B

Shift Points Used for Motorcycle 7-Mode Tests
and Motorcycle 7-Mode Emissions Data
(1970 Federal Light-Duty Vehicle Procedure)

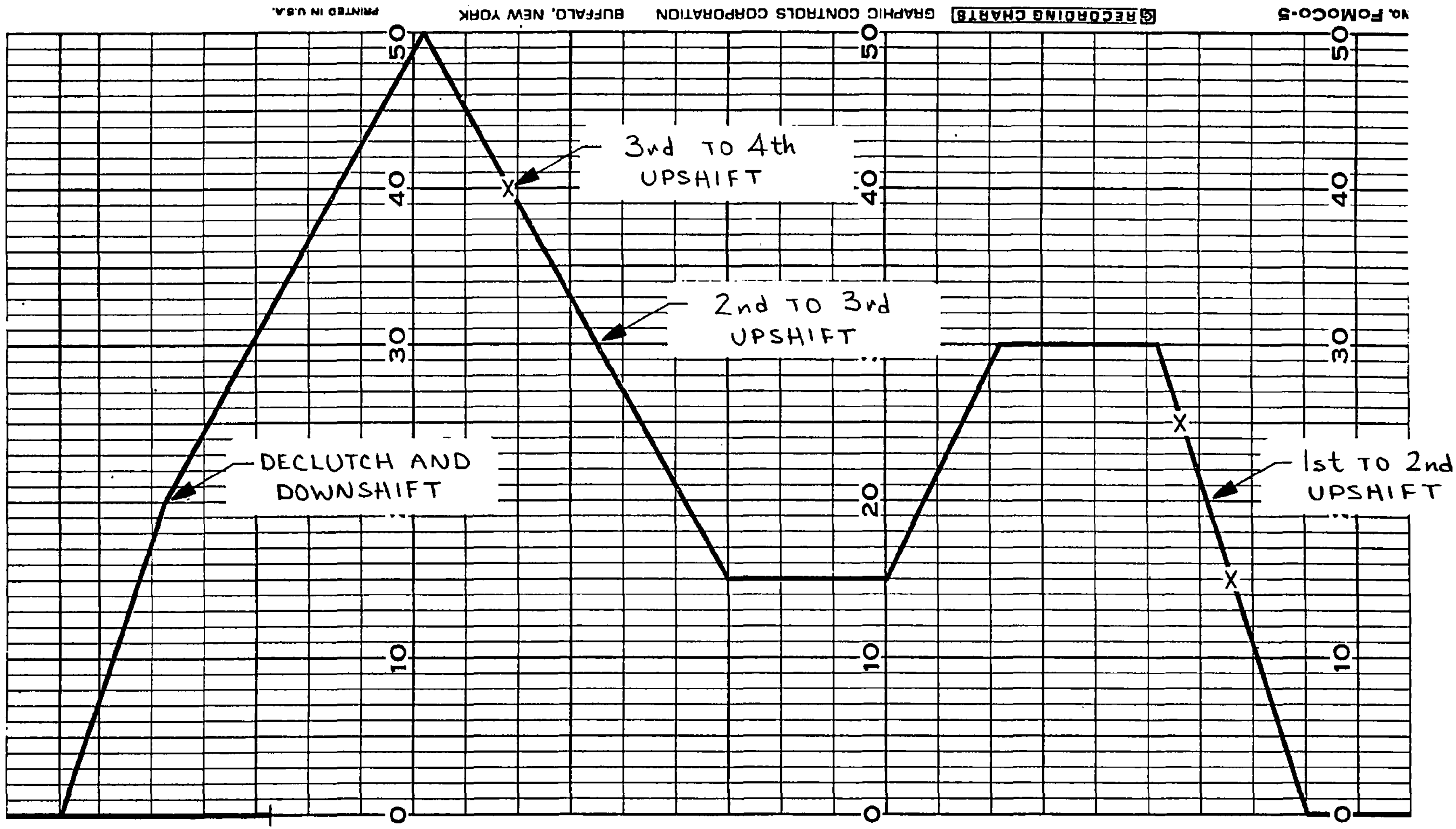

FIGURE B-1. ONE CYCLE OF THE FEDERAL 7-MODE EMISSIONS TEST PROCEDURE SHOWING SHIFT POINTS USED FOR TESTS OF THE SUZUKI T250-R, HARLEY-DAVIDSON FLH, AND TRIUMPH T120R MOTORCYCLES

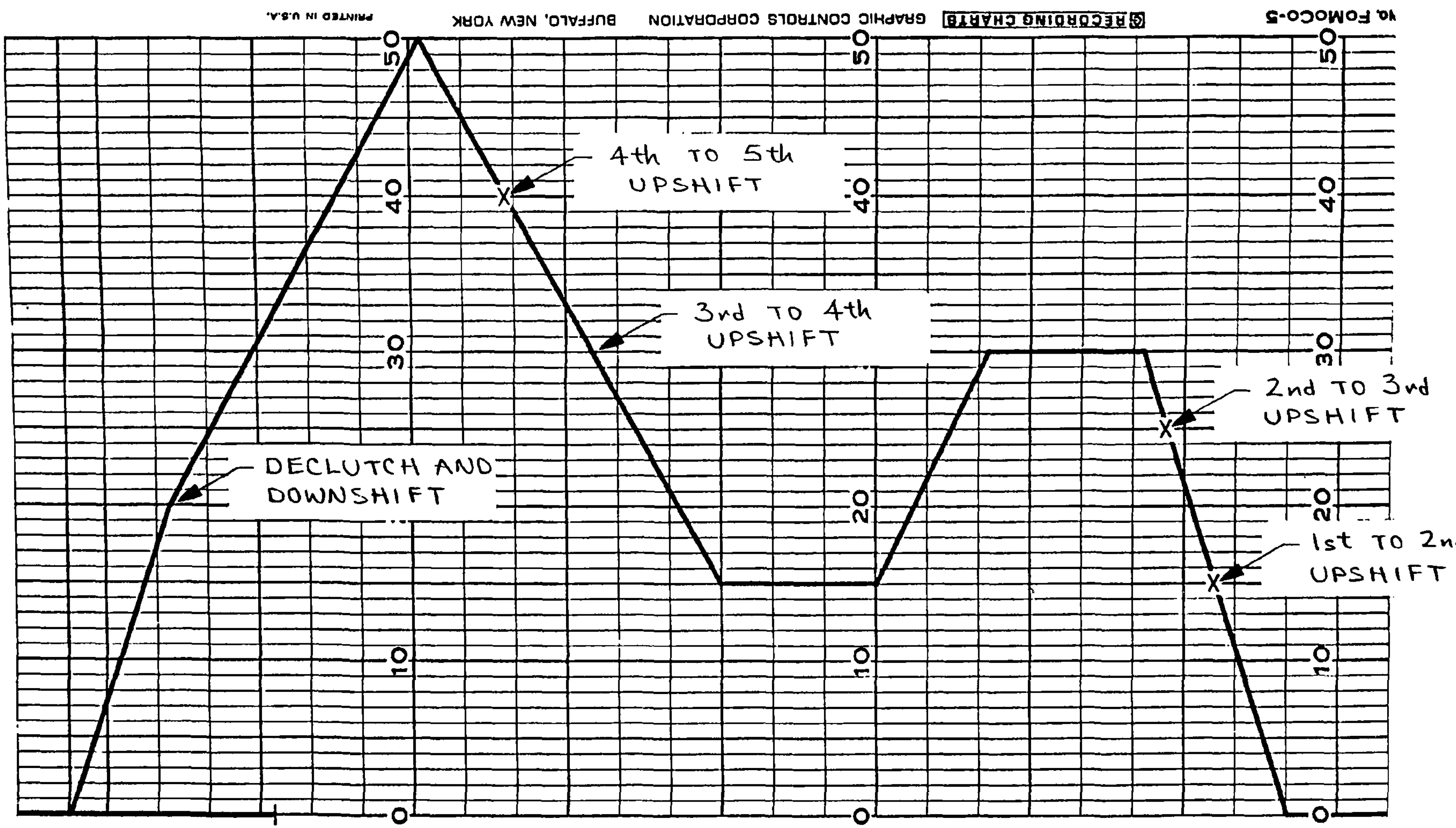

FIGURE B-2. ONE CYCLE OF THE FEDERAL 7-MODE EMISSIONS TEST PROCEDURE SHOWING SHIFT POINTS USED FOR TESTS OF THE HONDA CL350K3 MOTORCYCLE

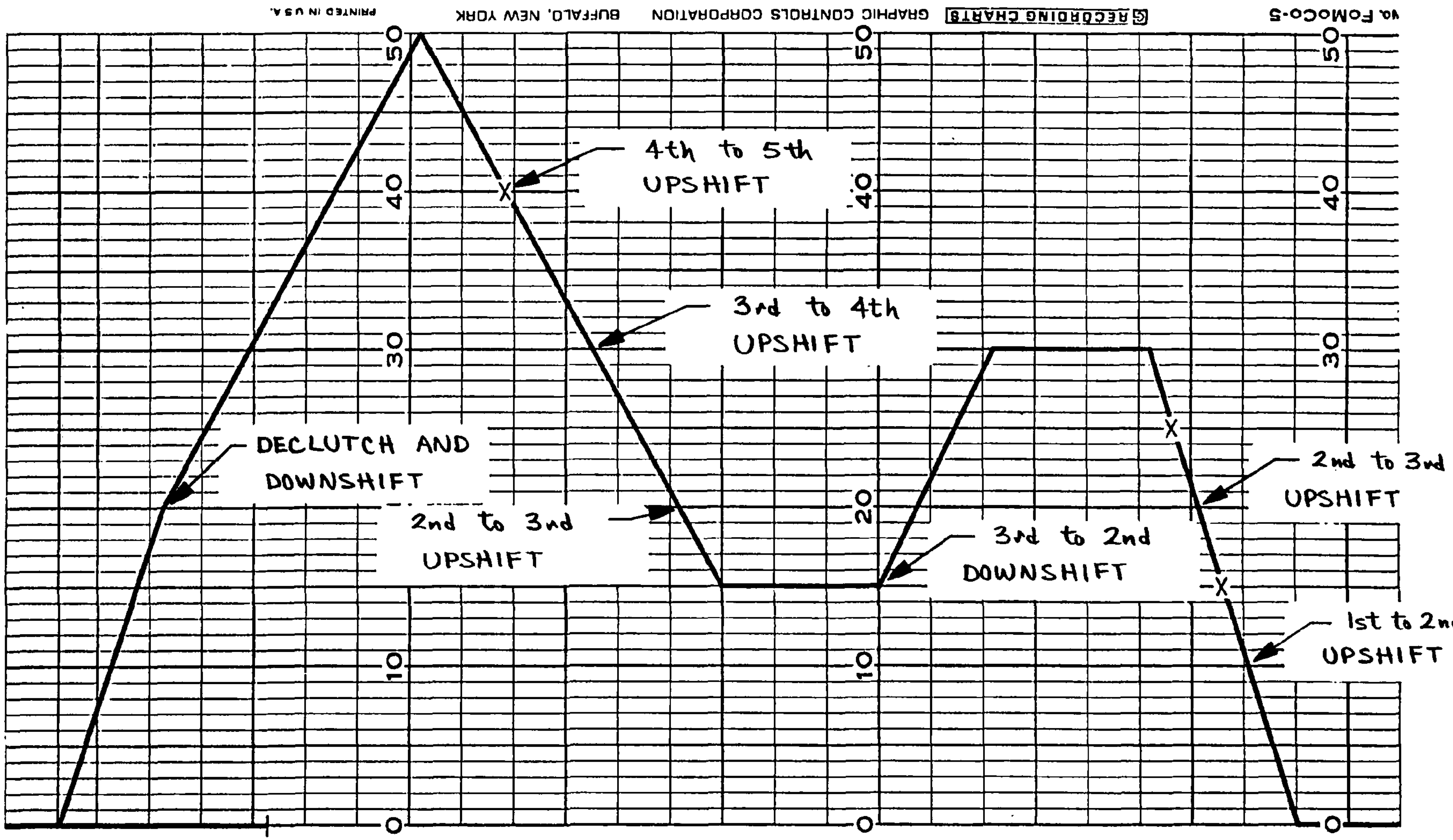

FIGURE B-3. ONE CYCLE OF THE FEDERAL 7-MODE EMISSIONS TEST PROCEDURE SHOWING SHIFT POINTS USED FOR TESTS OF THE HONDA SL-100 AND KAWASAKI 125 F-6 MOTORCYCLES

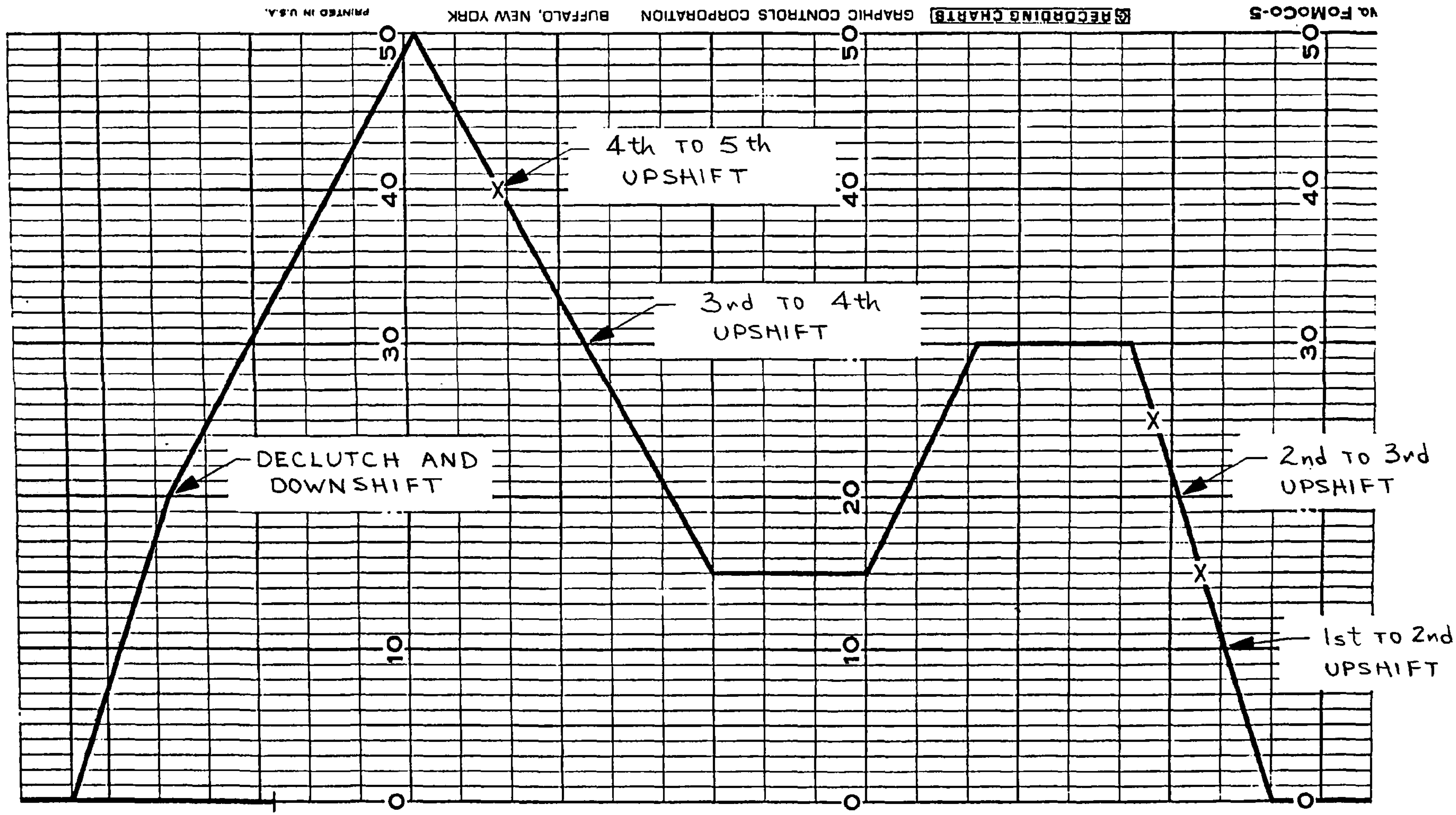

FIGURE B-4. ONE CYCLE OF THE FEDERAL 7-MODE EMISSIONS TEST PROCEDURE SHOWING SHIFT POINTS USED FOR TESTS OF THE YAMAHA DT1-E MOTORCYCLE

HARLEY RUN 1 B - COLD CYCLE K = 1.0000 W = 847.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	1818.	3.720	7.680	189.	1.260	2291.	4.689	238.	0.042	96.246	0.196	10.005
2 0-25	1374.	3.710	8.420	481.	1.233	1694.	4.574	593.	0.244	413.406	1.116	144.722
3 30	329.	3.550	8.720	247.	1.336	439.	4.744	330.	0.118	51.880	0.559	38.949
4 30-15	2810.	3.680	9.240	247.	1.027	2886.	3.780	253.	0.062	178.974	0.234	15.731
5 15	1674.	3.740	7.170	181.	1.336	2237.	4.999	241.	0.050	111.878	0.249	12.096
6 15-30	1100.	3.840	7.740	383.	1.336	1470.	5.132	511.	0.455	668.994	2.335	232.931
7 50-20	4814.	3.610	6.430	141.	1.079	5195.	3.896	152.	0.029	150.682	0.112	4.413
SUM----------(CYCLE COMPOSITE)----------										1672.062	4.805	458.851
CYCLE 2												
1 IDLE	3306.	3.770	6.290	69.	1.234	4081.	4.654	85.	0.042	171.415	0.195	3.577
2 0-25	1704.	3.760	7.070	300.	1.343	2289.	5.052	403.	0.244	558.718	1.232	98.365
3 30	406.	3.720	9.150	93.	1.266	514.	4.711	117.	0.118	60.677	0.555	13.899
4 30-15	2798.	3.860	8.110	82.	1.110	3106.	4.285	91.	0.062	192.576	0.265	5.643
5 15	1516.	3.770	6.680	69.	1.421	2154.	5.358	98.	0.050	107.730	0.267	4.903
6 15-30	1064.	3.830	7.690	277.	1.348	1434.	5.164	373.	0.455	652.748	2.349	169.935
7 50-20	4298.	3.500	6.420	100.	1.131	4864.	3.961	113.	0.029	141.065	0.114	3.282
SUM----------(CYCLE COMPOSITE)----------										1884.932	4.982	299.607
CYCLE 3												
1 IDLE	2632.	3.830	6.290	81.	1.312	3454.	5.026	106.	0.042	145.089	0.211	4.465
2 0-25	1587.	3.560	7.370	118.	1.334	2118.	4.751	157.	0.244	516.828	1.159	38.428
3 30	412.	3.880	7.580	101.	1.455	599.	5.645	146.	0.118	70.741	0.666	17.341
4 30-15	2814.	3.770	6.540	90.	1.264	3559.	4.768	113.	0.062	220.669	0.295	7.057
5 15	1302.	3.880	7.200	93.	1.374	1790.	5.334	127.	0.050	89.506	0.266	6.393
6 15-30	842.	3.860	8.070	115.	1.329	1119.	5.130	152.	0.455	509.204	2.334	69.546
7 50-20	3551.	3.760	5.900	111.	1.248	4432.	4.693	138.	0.029	128.556	0.136	4.018
SUM----------(CYCLE COMPOSITE)----------										1680.597	5.069	147.251
CYCLE 4												
1 IDLE	2874.	3.830	6.200	93.	1.292	3714.	4.950	120.	0.042	156.010	0.207	5.048
2 0-25	1558.	3.870	7.320	163.	1.325	2065.	5.130	216.	0.244	503.966	1.251	52.725
3 30	397.	3.930	7.290	93.	1.497	594.	5.884	139.	0.118	70.144	0.694	16.431
4 30-15	2588.	3.470	6.350	85.	1.332	3449.	4.624	113.	0.062	213.842	0.286	7.023
5 15	1217.	3.880	7.070	93.	1.404	1709.	5.449	130.	0.050	85.460	0.272	6.530
6 15-30	803.	3.830	7.870	148.	1.361	1093.	5.213	201.	0.455	497.340	2.372	91.664
7 50-20	3236.	3.620	5.480	106.	1.344	4350.	4.866	142.	0.029	126.170	0.141	4.132
SUM----------(CYCLE COMPOSITE)----------										1652.935	5.226	183.557
AVERAGE SUM OF CYCLES 1-4 ----------										1722.632	5.021	272.317

PETRO-CHEM COMPUTING INC

HARLEY RUN 1 B - COLD CYCLE K = 1.0000 W = 847.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	2677.	3.830	5.950	69.	1.348	3608.	5.163	93.	0.042	151.568	0.216	3.906
2 0-25	1146.	3.850	6.670	242.	1.474	1689.	5.677	356.	0.244	412.354	1.385	87.076
3 30	485.	3.930	7.350	81.	1.473	714.	5.791	119.	0.118	84.343	0.683	14.086
4 30-15	2546.	3.830	5.110	69.	1.483	3776.	5.681	102.	0.062	234.161	0.352	6.346
5 15	1401.	3.880	7.140	69.	1.368	1917.	5.311	94.	0.050	95.885	0.265	4.722
6 15-30	891.	3.910	7.250	130.	1.426	1270.	5.576	185.	0.455	578.165	2.537	84.356
7 50-20	3726.	3.750	5.860	110.	1.233	4594.	4.624	135.	0.029	133.240	0.134	3.933
SUM----------(CYCLE COMPOSITE)----------										1689.718	5.574	204.427
CYCLE 7												
1 IDLE	3556.	3.830	5.940	93.	1.239	4408.	4.748	115.	0.042	185.165	0.199	4.842
2 0-25	1685.	3.460	7.790	350.	1.278	2154.	4.424	447.	0.244	525.717	1.079	109.199
3 30	872.	3.930	7.490	105.	1.394	1216.	5.481	146.	0.118	143.505	0.646	17.279
4 30-15	3037.	3.810	6.040	93.	1.291	3923.	4.921	120.	0.062	243.231	0.305	7.448
5 15	1573.	3.880	7.490	93.	1.302	2049.	5.055	121.	0.050	102.474	0.252	6.058
6 15-30	939.	3.940	7.090	175.	1.439	1351.	5.670	251.	0.455	614.947	2.580	114.606
7 50-20	3918.	3.810	5.540	91.	1.241	4865.	4.731	113.	0.029	141.097	0.137	3.277
SUM----------(CYCLE COMPOSITE)----------										1956.139	5.201	262.712
AVERAGE SUM OF CYCLES 6-7 ----------										1822.929	5.387	233.570

HARLEY RUN 1 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	1672.062	4.805	458.851	0.0875	146.305	0.420	40.149
2	1884.932	4.982	299.607	0.0875	164.931	0.435	26.215
3	1680.597	5.069	147.251	0.0875	147.052	0.443	12.884
4	1652.935	5.226	183.557	0.0875	144.631	0.457	16.061
6	1689.718	5.574	204.427	0.3250	549.158	1.811	66.439
7	1956.139	5.201	262.712	0.3250	635.745	1.690	85.381
SUM----------(TRIP COMPOSITE)----------					1787.825	5.259	247.131

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING INC

HARLEY RUN 2 - COLD CYCLE K = 1.0000 W = 847.

MODE	CONCENTRATION HC	AS CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 1												
1 IDLE	1953.	6.390	7.710	105.	1.114	2175.	7.119	116.	0.042	91.390	0.299	4.913
2 0-25	1120.	6.600	9.130	190.	1.063	1190.	7.016	201.	0.244	290.518	1.711	49.284
3 30	1050.	5.990	7.950	166.	1.200	1260.	7.190	199.	0.118	148.733	0.848	23.514
4 30-15	3529.	5.620	7.660	149.	1.015	3583.	5.706	151.	0.062	222.148	0.353	9.379
5 15	1035.	7.660	8.500	117.	1.078	1115.	8.259	126.	0.050	55.799	0.412	6.307
6 15-30	868.	6.450	9.720	206.	1.044	906.	6.736	215.	0.455	412.508	3.065	97.899
7 50-20	4442.	6.560	6.030	139.	1.027	4565.	6.742	142.	0.029	132.403	0.195	4.143
SUM----------(CYCLE COMPOSITE)										1353.502	6.887	195.441
CYCLE 2												
1 IDLE	2332.	7.880	7.110	117.	1.068	2492.	8.420	125.	0.042	104.667	0.353	5.251
2 0-25	1049.	8.010	8.310	144.	1.078	1131.	8.636	155.	0.244	275.980	2.107	37.884
3 30	55.	8.120	8.020	121.	1.194	65.	9.698	144.	0.118	7.752	1.144	17.054
4 30-15	3256.	7.260	6.930	127.	1.030	3359.	7.478	130.	0.062	207.945	0.463	8.110
5 15	1359.	8.410	7.980	117.	1.062	1443.	8.931	124.	0.050	72.166	0.446	6.213
6 15-30	723.	7.060	9.430	231.	1.055	762.	7.450	243.	0.455	347.139	3.389	110.911
7 50-20	3639.	7.610	6.290	134.	1.033	3762.	7.867	138.	0.029	109.104	0.228	4.017
SUM----------(CYCLE COMPOSITE)										1124.756	8.133	189.444
CYCLE 3												
1 IDLE	2571.	8.110	6.740	117.	1.068	2746.	8.664	125.	0.042	115.368	0.363	5.250
2 0-25	960.	4.330	10.850	232.	1.031	990.	4.468	239.	0.244	241.711	1.090	58.413
3 30	346.	9.780	7.780	137.	1.111	384.	10.871	152.	0.118	45.386	1.282	17.970
4 30-15	2927.	7.810	6.470	114.	1.071	3135.	8.366	122.	0.062	194.395	0.518	7.571
5 15	1119.	8.350	7.850	121.	1.095	1226.	9.149	132.	0.050	61.304	0.457	6.628
6 15-30	695.	8.390	8.910	118.	1.046	727.	8.780	123.	0.455	330.932	3.994	56.187
7 50-20	3536.	7.900	6.060	131.	1.048	3707.	8.283	137.	0.029	107.520	0.240	3.983
SUM----------(CYCLE COMPOSITE)										1096.618	7.948	156.005
CYCLE 4												
1 IDLE	2768.	8.040	6.800	129.	1.050	2906.	8.442	135.	0.042	122.069	0.354	5.688
2 0-25	1526.	8.160	8.450	133.	1.022	1560.	8.345	136.	0.244	380.798	2.036	33.188
3 30	351.	9.540	7.980	141.	1.104	387.	10.536	155.	0.118	45.742	1.243	18.375
4 30-15	2241.	8.290	7.120	143.	1.059	2374.	8.783	151.	0.062	147.213	0.544	9.393
5 15	951.	8.580	8.010	129.	1.088	1034.	9.335	140.	0.050	51.734	0.466	7.017
6 15-30	833.	8.890	7.650	124.	1.115	929.	9.919	138.	0.455	422.921	4.513	62.955
7 50-20	3971.	7.680	5.470	161.	1.066	4234.	8.189	171.	0.029	122.791	0.237	4.978
SUM----------(CYCLE COMPOSITE)										1293.272	9.396	141.598
AVERAGE SUM OF CYCLES 1-4										1217.037	8.091	170.622

PETRO-CHEM COMPUTING INC

HARLEY RUN 2 - COLD CYCLE K = 1.0000 W = 847.

MODE	CONCENTRATION HC	AS CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 6												
1 IDLE	3462.	7.850	6.320	69.	1.036	3589.	8.139	71.	0.042	150.769	0.341	3.004
2 0-25	1217.	8.100	8.790	138.	1.024	1246.	8.297	141.	0.244	304.199	2.024	34.494
3 30	295.	10.440	7.490	69.	1.112	328.	11.619	76.	0.118	38.741	1.371	9.061
4 30-15	2476.	8.430	6.700	74.	1.067	2641.	8.995	78.	0.062	163.802	0.557	4.895
5 15	1231.	8.870	7.550	81.	1.089	1340.	9.659	88.	0.050	67.030	0.482	4.410
6 15-30	722.	8.730	7.960	104.	1.106	798.	9.659	115.	0.455	363.485	4.395	52.358
7 50-20	2687.	8.210	6.670	87.	1.060	2848.	8.704	92.	0.029	82.612	0.252	2.674
SUM----------(CYCLE COMPOSITE)										1170.641	9.425	110.899
CYCLE 7												
1 IDLE	3556.	7.750	6.470	81.	1.022	3634.	7.921	82.	0.042	152.663	0.332	3.477
2 0-25	1955.	6.470	8.530	448.	1.044	2042.	6.760	468.	0.244	498.457	1.649	114.224
3 30	54.	8.520	8.610	129.	1.121	60.	9.555	144.	0.118	7.146	1.127	17.072
4 30-15	3079.	7.800	6.520	88.	1.054	3248.	8.228	92.	0.062	201.379	0.510	5.755
5 15	1231.	8.870	7.640	93.	1.081	1331.	9.594	100.	0.050	66.580	0.479	5.030
6 15-30	792.	8.970	8.390	119.	1.056	836.	9.472	125.	0.455	380.559	4.310	57.180
7 50-20	3925.	7.940	6.230	105.	1.004	3941.	7.973	105.	0.029	114.305	0.231	3.057
SUM----------(CYCLE COMPOSITE)										1421.092	8.641	205.797
AVERAGE SUM OF CYCLES 6-7										1295.866	9.033	158.348

HARLEY RUN 2 - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
1	1353.502	6.887	195.441	0.0875	118.431	0.602	17.101
2	1124.756	8.133	189.444	0.0875	98.416	0.711	16.576
3	1096.618	7.948	156.005	0.0875	95.954	0.695	13.650
4	1293.272	9.396	141.598	0.0875	113.161	0.822	12.389
6	1170.641	9.425	110.899	0.3250	380.458	3.063	36.042
7	1421.092	8.641	205.797	0.3250	461.854	2.808	66.884
SUM----------(TRIP COMPOSITE)					1268.276	8.703	162.644

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING INC

HARLEY RUN 3 - COLD CYCLE K = 1.0000 W = 847.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	A D J U S T E D HC	CO	NO(K)	WEIGHTING FACTOR	W E I G H T E D HC	CO	NO(K)
CYCLE 1												
1 IDLE	3463.	6.710	7.200	93.	1.014	3512.	6.806	94.	0.042	147.531	0.285	3.962
2 0-25	1314.	6.650	9.690	218.	1.004	1319.	6.680	218.	0.244	322.079	1.630	53.434
3 30	138.	6.880	10.150	141.	1.055	145.	7.261	148.	0.118	17.185	0.856	17.559
4 30-15	3697.	6.680	6.890	102.	1.019	3769.	6.810	103.	0.062	233.681	0.422	6.447
5 15	1317.	8.080	8.670	117.	1.026	1351.	8.290	120.	0.050	67.563	0.414	6.002
6 15-30	820.	6.680	10.610	295.	0.977	801.	6.528	288.	0.455	364.660	2.970	131.188
7 50-20	4769.	7.170	5.970	116.	0.986	4702.	7.069	114.	0.029	136.368	0.205	3.316
SUM----------(CYCLE COMPOSITE)										1289.069	6.785	221.911
CYCLE 2												
1 IDLE	3182.	8.210	6.470	105.	1.034	3292.	8.496	108.	0.042	138.302	0.356	4.563
2 0-25	1848.	9.400	7.600	217.	1.014	1874.	9.534	220.	0.244	457.351	2.326	53.704
3 30	231.	9.090	8.820	117.	1.065	246.	9.681	124.	0.118	29.030	1.142	14.703
4 30-15	2688.	8.350	7.480	97.	0.996	2677.	8.316	96.	0.062	165.991	0.515	5.990
5 15	1345.	8.870	7.880	113.	1.053	1416.	9.341	119.	0.050	70.827	0.467	5.950
6 15-30	807.	9.140	8.520	271.	1.038	838.	9.492	281.	0.455	381.345	4.319	128.060
7 50-20	3353.	7.530	7.000	117.	1.007	3379.	7.589	117.	0.029	98.005	0.220	3.419
SUM----------(CYCLE COMPOSITE)										1340.856	9.347	216.392
CYCLE 3												
1 IDLE	2723.	8.410	6.560	105.	1.057	2880.	8.897	111.	0.042	120.992	0.373	4.665
2 0-25	1731.	8.010	8.570	208.	1.003	1737.	8.040	208.	0.244	423.987	1.961	50.947
3 30	28.	9.540	8.390	117.	1.099	30.	10.487	128.	0.118	3.632	1.237	15.176
4 30-15	2839.	8.310	6.600	108.	1.049	2978.	8.718	113.	0.062	184.663	0.540	7.024
5 15	1231.	8.590	8.180	113.	1.050	1293.	9.022	118.	0.050	64.651	0.451	5.934
6 15-30	833.	8.730	8.680	108.	1.039	866.	9.077	112.	0.455	394.109	4.130	51.097
7 50-20	3133.	8.240	6.250	125.	1.054	3303.	8.687	131.	0.029	95.787	0.251	3.821
SUM----------(CYCLE COMPOSITE)										1287.824	8.947	138.667
CYCLE 4												
1 IDLE	2935.	8.550	6.560	117.	1.035	3038.	8.852	121.	0.042	127.628	0.371	5.087
2 0-25	1674.	8.610	8.570	184.	0.987	1653.	8.502	181.	0.244	403.367	2.074	44.336
3 30	770.	10.400	7.780	129.	1.049	808.	10.918	135.	0.118	95.388	1.288	15.980
4 30-15	2078.	8.140	6.680	111.	1.115	2318.	9.083	123.	0.062	143.765	0.563	7.679
5 15	1601.	9.200	7.290	117.	1.064	1704.	9.795	124.	0.050	85.227	0.489	6.228
6 15-30	914.	8.540	8.880	212.	1.025	937.	8.759	217.	0.455	426.544	3.985	98.935
7 50-20	2649.	8.250	6.180	117.	1.101	2917.	9.085	128.	0.029	84.605	0.263	3.736
SUM----------(CYCLE COMPOSITE)										1366.528	9.036	181.985
AVERAGE SUM OF CYCLES 1-4										1321.069	8.529	189.739

PETRO-CHEM COMPUTING, INC

HARLEY RUN 3 - COLD CYCLE K = 1.0000 W = 847.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	A D J U S T E D HC	CO	NO(K)	WEIGHTING FACTOR	W E I G H T E D HC	CO	NO(K)
CYCLE 6												
1 IDLE	3682.	7.850	6.030	57.	1.040	3832.	8.170	59.	0.042	160.953	0.343	2.491
2 0-25	1743.	6.900	9.460	195.	0.980	1708.	6.763	191.	0.244	416.884	1.650	46.639
3 30	716.	10.660	7.390	81.	1.074	769.	11.455	87.	0.118	90.791	1.351	10.271
4 30-15	2593.	8.290	5.940	63.	1.125	2917.	9.328	70.	0.062	180.910	0.578	4.395
5 15	1515.	9.200	7.200	105.	1.079	1634.	9.928	113.	0.050	81.747	0.496	5.665
6 15-30	842.	7.970	9.100	144.	1.036	872.	8.257	149.	0.455	396.952	3.757	67.887
7 50-20	3512.	8.370	5.930	98.	1.042	3661.	8.726	102.	0.029	106.183	0.253	2.962
SUM----------(CYCLE COMPOSITE)										1434.423	8.430	140.313
CYCLE 7												
1 IDLE	3587.	8.140	6.260	93.	1.020	3661.	8.309	94.	0.042	153.793	0.349	3.987
2 0-25	1488.	8.500	7.670	104.	1.071	1595.	9.111	111.	0.244	389.186	2.223	27.201
3 30	867.	10.400	7.490	105.	1.064	922.	11.066	111.	0.118	108.865	1.305	13.184
4 30-15	2992.	8.110	6.240	98.	1.071	3207.	8.693	105.	0.062	198.856	0.539	6.513
5 15	288.	9.090	7.680	117.	1.156	333.	10.514	135.	0.050	16.655	0.525	6.766
6 15-30	1150.	9.430	8.270	108.	1.019	1172.	9.610	110.	0.455	533.290	4.372	50.082
7 50-20	3139.	8.500	6.090	125.	1.056	3315.	8.976	132.	0.029	96.135	0.260	3.828
SUM----------(CYCLE COMPOSITE)										1496.784	9.576	111.564
AVERAGE SUM OF CYCLES 6-7										1465.603	9.003	125.938

HARLEY RUN 3 - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	W E I G H T E D HC	CO	NO(K)
1	1289.069	6.785	221.911	0.0875	112.793	0.593	19.417
2	1340.856	9.347	216.392	0.0875	117.324	0.817	18.934
3	1287.824	8.947	138.667	0.0875	112.684	0.782	12.133
4	1366.528	9.036	181.985	0.0875	119.571	0.790	15.923
6	1434.423	8.430	140.313	0.3250	466.187	2.739	45.601
7	1496.784	9.576	111.564	0.3250	486.454	3.112	36.258
SUM----------(TRIP COMPOSITE)					1415.016	8.837	148.269

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING, INC.

HARLEY-DAVIDSON FLH RUN 4 — S - COLD CYCLE — K = 1.0000 W = 847.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	2516.	7.960	6.970	77.	1.060	2669.	8.444	81.	0.042	112.110	0.354	3.431
2 0-25	1832.	5.810	8.660	84.	1.070	1961.	6.220	89.	0.244	478.575	1.517	21.943
3 30	387.	5.580	9.580	201.	1.133	438.	6.327	227.	0.118	51.779	0.746	26.893
4 30-15	2749.	5.640	8.050	273.	1.047	2880.	5.909	286.	0.062	178.579	0.366	17.734
5 15	1981.	7.740	8.430	90.	1.004	1989.	7.772	90.	0.050	99.465	0.388	4.518
6 15-30	1336.	7.190	9.260	106.	1.014	1354.	7.291	107.	0.455	616.473	3.317	48.911
7 50-20	4550.	6.640	5.910	262.	1.025	4664.	6.807	268.	0.029	135.271	0.197	7.789
SUM----------(CYCLE COMPOSITE)----------										1672.254	6.889	131.222
CYCLE 2												
1 IDLE	1922.	9.060	7.460	103.	1.030	1981.	9.339	106.	0.042	83.216	0.392	4.459
2 0-25	1612.	8.460	8.540	255.	0.999	1610.	8.453	254.	0.244	393.030	2.062	62.173
3 30	281.	9.590	8.630	129.	1.056	296.	10.128	136.	0.118	35.021	1.195	16.077
4 30-15	1479.	7.810	7.390	114.	1.124	1663.	8.783	128.	0.062	103.132	0.544	7.949
5 15	2455.	9.320	8.040	112.	0.944	2318.	8.803	105.	0.050	115.942	0.440	5.289
6 15-30	149.	8.610	8.770	183.	1.095	163.	9.432	200.	0.455	74.269	4.291	91.217
7 50-20	3617.	7.770	6.050	124.	1.047	3789.	8.139	129.	0.029	109.884	0.236	3.767
SUM----------(CYCLE COMPOSITE)----------										914.497	9.162	190.933
CYCLE 3												
1 IDLE	2365.	9.500	6.640	103.	1.039	2459.	9.878	107.	0.042	103.289	0.414	4.498
2 0-25	1966.	9.650	7.540	156.	1.000	1967.	9.657	156.	0.244	480.092	2.356	38.094
3 30	909.	11.200	7.650	99.	1.018	926.	11.411	100.	0.118	109.283	1.346	11.902
4 30-15	1176.	10.230	7.070	99.	1.077	1267.	11.024	106.	0.062	78.574	0.683	6.614
5 15	1588.	9.920	7.720	103.	1.007	1599.	9.992	103.	0.050	79.978	0.499	5.187
6 15-30	1119.	8.720	8.620	343.	1.021	1143.	8.911	350.	0.455	520.322	4.054	159.491
7 50-20	3014.	8.080	6.650	133.	1.039	3133.	8.401	138.	0.029	90.883	0.243	4.010
SUM----------(CYCLE COMPOSITE)----------										1462.424	9.599	229.799
CYCLE 4												
1 IDLE	2231.	9.280	6.820	103.	1.045	2332.	9.701	107.	0.042	97.961	0.407	4.522
2 0-25	1877.	9.250	7.670	222.	1.012	1900.	9.364	224.	0.244	463.674	2.285	54.840
3 30	207.	10.410	8.140	129.	1.068	221.	11.124	137.	0.118	26.102	1.312	16.266
4 30-15	1630.	8.880	6.910	114.	1.105	1802.	9.821	126.	0.062	111.771	0.608	7.817
5 15	1878.	10.030	7.750	117.	0.980	1840.	9.831	114.	0.050	92.038	0.491	5.734
6 15-30	230.	8.270	8.460	287.	1.128	259.	9.336	324.	0.455	118.148	4.248	147.428
7 50-20	3272.	7.830	6.230	141.	1.060	3468.	8.300	149.	0.029	100.584	0.240	4.334
SUM----------(CYCLE COMPOSITE)----------										1010.282	9.594	240.944
AVERAGE SUM OF CYCLES 1-4 ----------										1264.864	8.811	198.224

PETRO-CHEM COMPUTING INC.

HARLEY-DAVIDSON FLH RUN 4 — S - COLD CYCLE — K = 1.0000 W = 847.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	1995.	9.390	6.210	103.	1.110	2215.	10.425	114.	0.042	93.031	0.437	4.803
2 0-25	1863.	9.240	7.540	185.	1.023	1906.	9.453	189.	0.244	465.091	2.306	46.184
3 30	392.	10.560	7.650	129.	1.085	425.	11.466	140.	0.118	50.227	1.353	16.529
4 30-15	1583.	8.680	6.710	126.	1.136	1798.	9.863	143.	0.062	111.532	0.611	8.877
5 15	2322.	10.220	7.560	117.	0.955	2218.	9.763	111.	0.050	110.915	0.488	5.588
6 15-30	97.	9.140	8.390	187.	1.109	107.	10.144	207.	0.455	48.983	4.615	94.432
7 50-20	3761.	7.490	5.820	169.	1.064	4001.	7.969	179.	0.029	116.057	0.231	5.215
SUM----------(CYCLE COMPOSITE)----------										995.840	10.044	181.630
CYCLE 7												
1 IDLE	2865.	9.5[illegible]0	6.410	129.	1.017	2914.	9.663	131.	0.042	122.404	0.405	5.511
2 0-25	2413.	9.960	7.110	195.	0.986	2380.	9.827	192.	0.244	580.917	2.397	46.945
3 30	1105.	10.520	7.850	117.	1.013	1120.	10.664	118.	0.118	132.182	1.258	13.995
4 30-15	1566.	8.860	6.810	137.	1.121	1755.	9.934	153.	0.062	108.870	0.615	9.524
5 15	2683.	9.910	7.870	129.	0.922	2474.	9.139	118.	0.050	123.718	0.456	5.948
6 15-30	87.	8.590	8.660	383.	1.111	96.	9.545	425.	0.455	43.986	4.343	193.643
7 50-20	3797.	7.740	5.650	145.	1.064	4042.	8.239	154.	0.029	117.220	0.238	4.476
SUM----------(CYCLE COMPOSITE)----------										1229.301	9.717	280.044
AVERAGE SUM OF CYCLES 6-7 ----------										1112.570	9.880	230.837

HARLEY-DAVIDSON FLH RUN 4 — S - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	1672.254	6.889	131.222	0.0875	146.322	0.602	11.481
2	914.497	9.162	190.933	0.0875	80.018	0.801	16.706
3	1462.424	9.599	229.799	0.0875	127.962	0.839	20.107
4	1010.282	9.594	240.944	0.0875	88.399	0.839	21.082
6	995.840	10.044	181.630	0.3250	323.648	3.264	59.029
7	1229.301	9.717	280.044	0.3250	399.522	3.158	91.014
SUM----------(TRIP COMPOSITE)----------					1165.873	9.506	219.423

PETRO-CHEM COMPUTING INC.

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

HARLEY DAVIDSON FLH RUN 5 S - COLD CYCLE K = 1.0000 W = 847.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 1												
1 IDLE	1791.	8.490	7.410	77.	1.067	1911.	9.058	82.	0.042	80.263	0.380	3.450
2 0-25	1323.	5.970	9.520	284.	1.040	1376.	6.212	295.	0.244	335.928	1.515	72.111
3 30	465.	7.020	9.370	143.	1.083	503.	7.606	154.	0.118	59.453	0.897	18.283
4 30-15	2034.	5.280	7.540	149.	1.171	2382.	6.185	174.	0.062	147.742	0.383	10.822
5 15	2114.	8.110	8.340	116.	0.987	2088.	8.011	114.	0.050	104.417	0.400	5.729
6 15-30	224.	6.650	9.440	309.	1.114	249.	7.413	344.	0.455	113.619	3.373	156.734
7 50-20	3912.	5.280	6.180	128.	1.111	4348.	5.868	142.	0.029	126.102	0.170	4.126
SUM----------(CYCLE COMPOSITE)----------										967.526	7.121	271.258
CYCLE 2												
1 IDLE	2546.	7.910	7.000	90.	1.058	2693.	8.369	95.	0.042	113.137	0.351	3.999
2 0-25	2250.	6.440	9.060	274.	0.985	2217.	6.348	270.	0.244	541.162	1.548	65.901
3 30	266.	8.950	8.750	117.	1.073	285.	9.604	125.	0.118	33.682	1.133	14.815
4 30-15	1435.	7.490	7.860	105.	1.102	1581.	8.255	115.	0.062	98.068	0.511	7.175
5 15	2276.	8.530	8.480	117.	0.953	2170.	8.135	111.	0.050	108.537	0.406	5.579
6 15-30	1356.	7.010	9.420	283.	1.007	1366.	7.063	285.	0.455	621.718	3.214	129.753
7 50-20	3167.	7.000	6.580	133.	1.074	3401.	7.518	142.	0.029	98.643	0.218	4.142
SUM----------(CYCLE COMPOSITE)----------										1614.949	7.384	231.367
CYCLE 3												
1 IDLE	2172.	8.950	7.090	103.	1.042	2264.	9.329	107.	0.042	95.088	0.391	4.509
2 0-25	1809.	8.440	8.030	200.	1.020	1846.	8.616	204.	0.244	450.603	2.102	49.817
3 30	189.	9.500	8.480	130.	1.079	203.	10.253	140.	0.118	24.071	1.209	16.557
4 30-15	1302.	7.900	7.140	109.	1.160	1510.	9.166	126.	0.062	93.668	0.568	7.841
5 15	1878.	8.840	8.190	90.	0.990	1860.	8.756	89.	0.050	93.013	0.437	4.457
6 15-30	1521.	8.020	8.620	184.	1.015	1545.	8.147	186.	0.455	703.077	3.707	85.053
7 50-20	3093.	7.460	6.460	150.	1.071	3314.	7.994	160.	0.029	96.124	0.231	4.661
SUM----------(CYCLE COMPOSITE)----------										1555.646	8.649	172.898
CYCLE 4												
1 IDLE	2957.	8.630	6.730	103.	1.018	3011.	8.788	104.	0.042	126.474	0.369	4.405
2 0-25	2293.	8.720	7.610	231.	1.003	2301.	8.752	231.	0.244	561.566	2.135	56.572
3 30	281.	9.130	8.070	157.	1.120	314.	10.231	175.	0.118	37.159	1.207	20.761
4 30-15	1552.	7.960	7.230	125.	1.125	1746.	8.956	140.	0.062	108.274	0.555	8.720
5 15	2381.	8.630	8.480	130.	0.943	2246.	8.143	122.	0.050	112.337	0.407	6.133
6 15-30	359.	8.150	8.560	354.	1.113	399.	9.074	394.	0.455	181.874	4.128	179.341
7 50-20	2102.	7.270	6.560	160.	1.163	2445.	8.456	186.	0.029	70.908	0.245	5.397
SUM----------(CYCLE COMPOSITE)----------										1198.595	9.048	281.333
AVERAGE SUM OF CYCLES 1-4 ----------										1334.179	8.050	239.214

PETRO-CHEM COMPUTING, INC

HARLEY DAVIDSON FLH RUN 5 S - COLD CYCLE K = 1.0000 W = 847.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 6												
1 IDLE	2410.	8.740	6.210	130.	1.099	2650.	9.613	142.	0.042	111.333	0.403	6.005
2 0-25	2354.	8.870	6.760	246.	1.055	2484.	9.362	259.	0.244	606.264	2.284	63.356
3 30	606.	9.780	8.040	157.	1.067	646.	10.439	167.	0.118	76.327	1.231	19.774
4 30-15	1264.	8.500	6.740	148.	1.173	1483.	9.975	173.	0.062	91.972	0.618	10.768
5 15	2010.	8.630	8.040	143.	0.998	2006.	8.614	142.	0.050	100.321	0.430	7.137
6 15-30	511.	8.440	7.950	358.	1.139	582.	9.619	408.	0.455	265.001	4.376	185.656
7 50-20	2009.	7.150	6.360	195.	1.197	2406.	8.564	233.	0.029	69.789	0.248	6.774
SUM----------(CYCLE COMPOSITE)----------										1321.011	9.594	299.473
CYCLE 7												
1 IDLE	3173.	7.810	5.960	143.	1.090	3461.	8.519	155.	0.042	145.379	0.357	6.551
2 0-25	213.	8.740	6.910	230.	1.259	268.	11.010	289.	0.244	65.472	2.686	70.698
3 30	225.	10.030	7.940	170.	1.098	247.	11.019	186.	0.118	29.169	1.300	22.038
4 30-15	1495.	8.170	6.630	161.	1.176	1758.	9.608	189.	0.062	109.006	0.595	11.739
5 15	2804.	9.280	7.180	157.	0.976	2738.	9.062	153.	0.050	136.911	0.453	7.665
6 15-30	214.	8.840	8.120	272.	1.135	242.	10.036	308.	0.455	110.551	4.566	140.513
7 50-20	2407.	6.560	5.830	211.	1.238	2980.	8.123	261.	0.029	86.437	0.235	7.577
SUM----------(CYCLE COMPOSITE)----------										682.927	10.195	266.785
AVERAGE SUM OF CYCLES 6-7 ----------										1001.969	9.895	283.129

HARLEY DAVIDSON FLH RUN 5 S - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
1	967.526	7.121	271.258	0.0875	84.658	0.623	23.735
2	1614.949	7.384	231.367	0.0875	141.308	0.646	20.244
3	1555.646	8.649	172.898	0.0875	136.119	0.756	15.128
4	1198.595	9.048	281.333	0.0875	104.877	0.791	24.616
6	1321.011	9.594	299.473	0.3250	429.328	3.118	97.328
7	682.927	10.195	266.785	0.3250	221.951	3.313	86.705
SUM----------(TRIP COMPOSITE)----------					1118.243	9.249	267.759

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING, INC

HONDA CL350K3 RUN-1 B - COLD CYCLE K = 1.0000 W = 505.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	354.	2.810	4.800	46.	2.201	779.	6.185	101.	0.042	32.727	0.259	4.252
2 0-25	430.	4.690	5.220	102.	1.805	776.	8.469	184.	0.244	189.471	2.066	44.944
3 30	332.	2.390	7.580	214.	1.587	527.	3.794	339.	0.118	62.193	0.447	40.088
4 30-15	790.	3.150	3.990	58.	2.259	1784.	7.116	131.	0.062	110.655	0.441	8.124
5 15	387.	4.170	4.040	46.	2.216	857.	9.241	101.	0.050	42.881	0.462	5.097
6 15-30	443.	5.240	4.890	117.	1.815	804.	9.511	212.	0.455	365.865	4.327	96.628
7 50-20	2277.	1.590	1.520	57.	3.037	6915.	4.829	173.	0.029	200.554	0.140	5.020
SUM----------(CYCLE COMPOSITE)----------										1004.349	8.145	204.155
CYCLE 2												
1 IDLE	555.	1.620	4.210	35.	2.580	1432.	4.180	90.	0.042	60.147	0.175	3.793
2 0-25	561.	5.360	4.390	84.	1.889	1059.	10.125	158.	0.244	258.578	2.470	38.717
3 30	463.	6.490	4.090	46.	1.850	856.	12.010	85.	0.118	101.108	1.417	10.045
4 30-15	1936.	2.050	1.480	30.	3.154	6108.	6.467	94.	0.062	378.700	0.401	5.868
5 15	272.	2.600	4.180	50.	2.511	683.	6.529	125.	0.050	34.154	0.326	6.278
6 15-30	387.	5.560	4.470	85.	1.890	731.	10.513	160.	0.455	332.974	4.783	73.133
7 50-20	1887.	1.540	1.810	66.	3.139	5925.	4.835	207.	0.029	171.825	0.140	6.009
SUM----------(CYCLE COMPOSITE)----------										1337.490	9.714	143.846
CYCLE 3												
1 IDLE	379.	2.530	3.700	35.	2.698	1022.	6.825	94.	0.042	42.947	0.286	3.966
2 0-25	493.	5.630	4.250	104.	1.908	940.	10.745	198.	0.244	229.581	2.621	48.431
3 30	571.	7.130	3.620	42.	1.858	1061.	13.251	78.	0.118	125.227	1.563	9.211
4 30-15	1921.	1.870	1.370	37.	3.310	6359.	6.191	122.	0.062	394.316	0.383	7.594
5 15	300.	3.220	4.280	57.	2.333	700.	7.513	133.	0.050	35.001	0.375	6.650
6 15-30	470.	6.170	4.040	76.	1.899	892.	11.721	144.	0.455	406.260	5.333	65.693
7 50-20	1805.	1.470	1.710	66.	3.299	5955.	4.850	217.	0.029	172.720	0.140	6.315
SUM----------(CYCLE COMPOSITE)----------										1406.054	10.705	147.862
CYCLE 4												
1 IDLE	405.	3.020	3.060	35.	2.895	1172.	8.745	101.	0.042	49.256	0.367	4.256
2 0-25	469.	5.440	4.060	82.	1.989	933.	10.825	163.	0.244	227.724	2.641	39.815
3 30	704.	7.040	3.400	46.	1.887	1329.	13.291	86.	0.118	156.835	1.568	10.247
4 30-15	1777.	2.480	1.490	35.	3.118	5542.	7.734	109.	0.062	343.615	0.479	6.767
5 15	235.	2.590	4.480	57.	2.405	565.	6.229	137.	0.050	28.260	0.311	6.854
6 15-30	756.	5.780	4.100	73.	1.857	1404.	10.735	135.	0.455	638.919	4.884	61.694
7 50-20	1795.	1.480	1.840	53.	3.208	5760.	4.749	170.	0.029	167.042	0.137	4.932
SUM----------(CYCLE COMPOSITE)----------										1611.653	10.390	134.569
AVERAGE SUM OF CYCLES 1-4 ----------										1339.887	9.739	157.608

PETRO-CHEM COMPUTING, INC

HONDA CL350K3 RUN-1 B - COLD CYCLE K = 1.0000 W = 505.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	57.	3.020	3.030	34.	3.151	179.	9.516	107.	0.042	7.543	0.399	4.499
2 0-25	838.	5.010	4.200	194.	1.905	1596.	9.545	369.	0.244	389.596	2.329	90.192
3 30	704.	7.130	3.280	46.	1.906	1342.	13.593	87.	0.118	158.381	1.604	10.348
4 30-15	1701.	3.340	1.600	34.	2.839	4829.	9.482	96.	0.062	299.427	0.587	5.985
5 15	757.	3.930	5.490	46.	1.752	1326.	6.888	80.	0.050	66.342	0.344	4.031
6 15-30	437.	5.770	3.940	77.	1.987	868.	11.465	153.	0.455	395.110	5.216	69.619
7 50-20	1701.	1.370	1.640	85.	3.483	5926.	4.772	296.	0.029	171.854	0.138	8.587
SUM----------(CYCLE COMPOSITE)----------										1488.256	10.620	193.264
CYCLE 7												
1 IDLE	457.	3.000	3.230	34.	2.775	1268.	8.327	94.	0.042	53.280	0.349	3.963
2 0-25	509.	5.650	4.030	94.	1.958	996.	11.063	184.	0.244	243.201	2.699	44.913
3 30	680.	6.980	3.340	46.	1.916	1303.	13.379	88.	0.118	153.809	1.578	10.404
4 30-15	1679.	2.130	1.440	34.	3.357	5637.	7.152	114.	0.062	349.538	0.443	7.078
5 15	231.	2.090	4.830	69.	2.367	546.	4.948	163.	0.050	27.345	0.247	8.168
6 15-30	365.	5.840	4.050	87.	1.968	718.	11.498	171.	0.455	326.999	5.231	77.942
7 50-20	6666.	1.470	1.700	71.	1.505	10032.	2.212	106.	0.029	290.945	0.064	3.098
SUM----------(CYCLE COMPOSITE)----------										1445.121	10.615	155.569
AVERAGE SUM OF CYCLES 6-7 ----------										1466.689	10.617	174.417

HONDA CL350K3 RUN-1 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	1004.349	8.145	204.155	0.0875	87.880	0.712	17.863
2	1337.490	9.714	143.846	0.0875	117.030	0.850	12.586
3	1406.054	10.705	147.862	0.0875	123.029	0.936	12.937
4	1611.653	10.390	134.569	0.0875	141.019	0.909	11.774
6	1488.256	10.620	193.264	0.3250	483.683	3.451	62.811
7	1445.121	10.615	155.569	0.3250	469.664	3.449	50.560
SUM----------(TRIP COMPOSITE)----------					1422.308	10.310	168.534

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING, INC

HONDA CL350K3 RUN-2 - COLD CYCLE K = 1.0000 W = 505.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	307.	2.180	9.630	57.	1.312	402.	2.860	74.	0.042	16.917	0.120	3.141
2 0-25	522.	6.550	8.500	320.	1.175	613.	7.697	376.	0.244	149.677	1.878	91.756
3 30	384.	6.680	8.390	125.	1.193	458.	7.975	149.	0.118	54.099	0.941	17.610
4 30-15	3068.	4.030	5.130	65.	1.386	4253.	5.587	90.	0.062	263.723	0.346	5.587
5 15	509.	7.850	7.200	77.	1.241	632.	9.749	95.	0.050	31.608	0.487	4.781
6 15-30	541.	8.350	7.640	178.	1.169	632.	9.764	208.	0.455	287.859	4.442	94.711
7 50-20	4058.	3.610	4.800	78.	1.319	5355.	4.763	102.	0.029	155.300	0.138	2.985
SUM----------(CYCLE COMPOSITE)										959.186	8.354	220.573
CYCLE 2												
1 IDLE	1063.	4.120	8.180	57.	1.273	1353.	5.245	72.	0.042	56.846	0.220	3.048
2 0-25	1025.	8.690	6.940	118.	1.170	1199.	10.168	138.	0.244	292.644	2.481	33.689
3 30	560.	9.740	6.470	69.	1.213	679.	11.823	83.	0.118	80.215	1.395	9.883
4 30-15	2807.	4.770	4.360	55.	1.483	4163.	7.074	81.	0.062	258.116	0.438	5.057
5 15	410.	4.400	8.600	105.	1.289	528.	5.674	135.	0.050	26.439	0.283	6.771
6 15-30	810.	8.810	7.040	123.	1.176	953.	10.369	144.	0.455	433.771	4.717	65.868
7 50-20	3447.	2.970	5.300	101.	1.379	4756.	4.098	139.	0.029	137.942	0.118	4.041
SUM----------(CYCLE COMPOSITE)										1285.975	9.655	128.361
CYCLE 3												
1 IDLE	1021.	3.370	8.600	69.	1.273	1300.	4.291	87.	0.042	54.601	0.180	3.690
2 0-25	969.	8.240	7.140	144.	1.178	1141.	9.708	169.	0.244	278.577	2.368	41.398
3 30	827.	10.800	5.770	53.	1.202	994.	12.981	63.	0.118	117.299	1.531	7.517
4 30-15	2920.	5.130	4.430	49.	1.428	4172.	7.329	70.	0.062	258.664	0.454	4.340
5 15	404.	5.170	8.390	109.	1.270	513.	6.569	138.	0.050	25.667	0.328	6.925
6 15-30	535.	8.960	6.970	132.	1.205	644.	10.801	159.	0.455	293.458	4.914	72.404
7 50-20	2977.	2.530	5.660	149.	1.429	4256.	3.617	213.	0.029	123.452	0.104	6.178
SUM----------(CYCLE COMPOSITE)										1151.721	9.883	142.455
CYCLE 4												
1 IDLE	937.	3.430	8.600	77.	1.280	1199.	4.390	98.	0.042	50.378	0.184	4.139
2 0-25	796.	7.750	6.710	151.	1.266	1008.	9.818	191.	0.244	246.074	2.395	46.680
3 30	1035.	10.930	5.490	57.	1.201	1243.	13.127	68.	0.118	146.683	1.549	8.078
4 30-15	3692.	5.480	4.410	55.	1.301	4806.	7.134	71.	0.062	298.015	0.442	4.439
5 15	385.	4.930	8.470	105.	1.277	491.	6.297	134.	0.050	24.590	0.314	6.706
6 15-30	570.	8.770	7.050	151.	1.203	685.	10.552	181.	0.455	312.065	4.801	82.669
7 50-20	2916.	3.650	5.840	176.	1.340	3909.	4.893	235.	0.029	113.385	0.141	6.843
SUM----------(CYCLE COMPOSITE)										1191.193	9.829	159.557
AVERAGE SUM OF CYCLES 1-4										1147.019	9.430	162.736

PETRO-CHEM COMPUTING, INC

HONDA CL350K3 RUN-2 - COLD CYCLE K = 1.0000 W = 505.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	765.	3.280	8.820	46.	1.284	982.	4.213	59.	0.042	41.279	0.176	2.482
2 0-25	571.	8.050	7.400	196.	1.204	687.	9.693	236.	0.244	167.767	2.365	57.587
3 30	839.	11.350	5.310	46.	1.219	1023.	13.840	56.	0.118	120.722	1.633	6.618
4 30-15	2912.	4.550	4.630	46.	1.442	4201.	6.564	66.	0.062	260.487	0.407	4.114
5 15	316.	4.550	8.710	109.	1.280	404.	5.824	139.	0.050	20.227	0.291	6.977
6 15-30	768.	9.300	6.650	116.	1.195	918.	11.117	138.	0.455	417.734	5.058	63.095
7 50-20	2860.	2.360	5.790	328.	1.441	4122.	3.401	472.	0.029	119.559	0.098	13.711
SUM----------(CYCLE COMPOSITE)										1147.777	10.030	154.587
CYCLE 7												
1 IDLE	965.	3.310	11.540	69.	1.018	982.	3.371	70.	0.042	41.278	0.141	2.951
2 0-25	979.	7.470	7.270	133.	1.202	1176.	8.979	159.	0.244	287.150	2.191	39.010
3 30	979.	11.070	5.400	49.	1.209	1183.	13.384	59.	0.118	139.678	1.579	6.991
4 30-15	2816.	5.110	4.490	53.	1.437	4048.	7.346	76.	0.062	250.992	0.455	4.723
5 15	313.	4.140	8.820	105.	1.291	404.	5.346	135.	0.050	20.210	0.267	6.779
6 15-30	755.	8.750	6.840	130.	1.205	909.	10.546	156.	0.455	414.043	4.798	71.292
7 50-20	2996.	2.870	5.640	146.	1.406	4213.	4.036	205.	0.029	122.185	0.117	5.954
SUM----------(CYCLE COMPOSITE)										1275.540	9.550	137.703
AVERAGE SUM OF CYCLES 6-7										1211.658	9.790	146.145

HONDA CL350K3 RUN-2 - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	959.186	8.354	220.573	0.0875	83.928	0.731	19.300
2	1285.975	9.655	128.361	0.0875	112.522	0.844	11.231
3	1151.721	9.883	142.455	0.0875	100.775	0.864	12.464
4	1191.193	9.829	159.557	0.0875	104.229	0.860	13.961
6	1147.777	10.030	154.587	0.3250	373.027	3.259	50.240
7	1275.540	9.550	137.703	0.3250	414.550	3.103	44.753
SUM----------(TRIP COMPOSITE)					1189.035	9.664	151.952

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM

HONDA CL350K3 RUN-3 B - COLD CYCLE K = 1.0000 W = 505.

MODE	CONCENTRATION HC	AS CO	MEASURED CO2	NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 1												
1 IDLE	3940.	1.610	9.590	46.	0.989	3899.	1.593	45.	0.042	163.783	0.066	1.912
2 0-25	2507.	6.670	8.570	113.	0.992	2487.	6.618	112.	0.244	606.996	1.614	27.359
3 30	1007.	7.480	8.390	141.	1.097	1104.	8.205	154.	0.118	130.355	0.968	18.252
4 30-15	929.	3.920	5.840	79.	1.647	1530.	6.456	130.	0.062	94.870	0.400	8.067
5 15	332.	6.960	8.020	93.	1.222	405.	8.510	113.	0.050	20.297	0.425	5.685
6 15-30	1165.	8.010	8.150	129.	1.081	1259.	8.659	139.	0.455	573.024	3.939	63.450
7 50-20	2876.	3.270	5.340	133.	1.438	4136.	4.703	191.	0.029	119.963	0.136	5.547
SUM-----------(CYCLE COMPOSITE)										1709.289	7.552	130.275
CYCLE 2												
1 IDLE	1245.	2.750	8.080	69.	1.342	1671.	3.692	92.	0.042	70.206	0.155	3.890
2 0-25	7349.	6.970	7.530	137.	0.765	5622.	5.332	104.	0.244	1371.932	1.301	25.575
3 30	2663.	10.270	6.710	69.	0.984	2623.	10.115	67.	0.118	309.515	1.193	8.019
4 30-15	2168.	4.500	5.050	70.	1.503	3260.	6.767	105.	0.062	202.151	0.419	6.527
5 15	2066.	5.080	8.460	97.	1.095	2264.	5.567	106.	0.050	113.205	0.278	5.315
6 15-30	1988.	9.070	8.100	167.	0.980	1950.	8.896	163.	0.455	887.281	4.048	74.535
7 50-20	3766.	2.860	5.680	172.	1.297	4885.	3.710	223.	0.029	141.680	0.107	6.470
SUM-----------(CYCLE COMPOSITE)										3095.974	7.503	130.334
CYCLE 3												
1 IDLE	1461.	2.810	7.850	69.	1.338	1955.	3.761	92.	0.042	82.134	0.157	3.879
2 0-25	7289.	8.300	7.410	169.	0.746	5438.	6.193	126.	0.244	1327.105	1.511	30.769
3 30	2632.	10.890	6.150	69.	1.004	2643.	10.937	69.	0.118	311.919	1.290	8.177
4 30-15	2136.	4.090	4.960	70.	1.557	3326.	6.368	109.	0.062	206.216	0.394	6.758
5 15	1920.	4.560	9.000	121.	1.085	2084.	4.951	131.	0.050	104.241	0.247	6.569
6 15-30	1813.	8.450	7.440	177.	1.064	1929.	8.993	188.	0.455	878.017	4.092	85.719
7 50-20	3756.	2.800	5.710	146.	1.298	4877.	3.635	189.	0.029	141.440	0.105	5.497
SUM-----------(CYCLE COMPOSITE)										3051.075	7.799	147.370
CYCLE 4												
1 IDLE	1431.	2.950	8.040	69.	1.310	1876.	3.867	90.	0.042	78.792	0.162	3.799
2 0-25	6818.	7.890	6.850	234.	0.798	5444.	6.300	186.	0.244	1328.422	1.537	45.592
3 30	2843.	11.350	5.770	69.	0.998	2839.	11.337	68.	0.118	335.117	1.337	8.133
4 30-15	2236.	4.930	4.220	70.	1.593	3562.	7.855	111.	0.062	220.900	0.487	6.915
5 15	1587.	3.680	9.620	121.	1.100	1746.	4.050	133.	0.050	87.337	0.202	6.658
6 15-30	1693.	8.750	6.590	146.	1.133	1918.	9.917	165.	0.455	873.069	4.512	75.291
7 50-20	3794.	2.690	5.910	168.	1.277	4845.	3.435	214.	0.029	140.530	0.099	6.222
SUM-----------(CYCLE COMPOSITE)										3064.169	8.339	152.613
AVERAGE SUM OF CYCLES 1-4										2730.127	7.798	140.148

PETRO-CHEM COMPUTING, INC

HONDA CL350K3 RUN-3 B - COLD CYCLE K = 1.0000 W = 505.

MODE	CONCENTRATION HC	AS CO	MEASURED CO2	NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 6												
1 IDLE	1189.	2.980	7.680	81.	1.387	1649.	4.133	112.	0.042	69.264	0.173	4.718
2 0-25	1345.	8.470	7.240	212.	1.121	1508.	9.500	237.	0.244	368.096	2.318	58.019
3 30	1659.	10.370	5.600	93.	1.152	1912.	11.955	107.	0.118	225.698	1.410	12.652
4 30-15	5390.	4.800	5.000	345.	1.096	5911.	5.264	378.	0.062	366.503	0.326	23.458
5 15	1458.	4.390	9.040	153.	1.131	1650.	4.969	173.	0.050	82.519	0.248	8.659
6 15-30	1408.	8.570	7.290	196.	1.107	1558.	9.489	217.	0.455	709.341	4.317	98.743
7 50-20	4618.	2.990	6.470	207.	1.119	5169.	3.347	231.	0.029	149.923	0.097	6.720
SUM-----------(CYCLE COMPOSITE)										1971.347	8.891	212.972
CYCLE 7												
1 IDLE	1789.	3.150	8.080	105.	1.251	2238.	3.941	131.	0.042	94.026	0.165	5.518
2 0-25	1566.	7.280	7.570	175.	1.123	1760.	8.182	196.	0.244	429.454	1.996	47.991
3 30	1775.	11.640	5.580	105.	1.088	1932.	12.674	114.	0.118	228.056	1.495	13.490
4 30-15	5018.	5.430	4.940	105.	1.109	5565.	6.022	116.	0.062	345.038	0.373	7.219
5 15	1487.	3.170	9.920	177.	1.105	1644.	3.505	195.	0.050	82.227	0.175	9.787
6 15-30	1394.	8.250	7.440	309.	1.109	1546.	9.152	342.	0.455	703.638	4.164	155.971
7 50-20	4925.	3.210	6.330	192.	1.094	5387.	3.511	210.	0.029	156.251	0.101	6.091
SUM-----------(CYCLE COMPOSITE)										2038.692	8.472	246.070
AVERAGE SUM OF CYCLES 6-7										2005.020	8.682	229.521

HONDA CL350K3 RUN-3 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
1	1709.289	7.552	130.275	0.0875	149.562	0.660	11.399
2	3095.974	7.503	130.334	0.0875	270.897	0.656	11.404
3	3051.075	7.799	147.370	0.0875	266.969	0.682	12.894
4	3064.169	8.339	152.613	0.0875	268.114	0.729	13.353
6	1971.347	8.891	212.972	0.3250	640.687	2.889	69.216
7	2038.692	8.472	246.070	0.3250	662.575	2.753	79.973
SUM-----------(TRIP COMPOSITE)					2258.807	8.372	198.241

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING, INC

HONDA CL350K3 RUN-4 B - COLD CYCLE K = 1.0000 W = 505.

MODE	CONCENTRATION AS MEASURED HC	CO	CO2	NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	483.	1.890	8.780	50.	1.415	683.	2.674	70.	0.042	28.706	0.112	2.971
2 0-25	651.	6.270	8.400	125.	1.184	771.	7.428	148.	0.244	188.202	1.812	36.137
3 30	378.	8.310	7.840	93.	1.169	441.	9.714	108.	0.118	52.144	1.146	12.829
4 30-15	3097.	4.610	5.170	62.	1.340	4150.	6.178	83.	0.062	257.325	0.383	5.151
5 15	827.	5.890	8.600	93.	1.165	964.	6.866	108.	0.050	48.204	0.343	5.420
6 15-30	819.	8.150	7.090	172.	1.203	985.	9.807	206.	0.455	448.428	4.462	94.175
7 50-20	3799.	2.520	5.560	96.	1.327	5043.	3.345	127.	0.029	146.250	0.097	3.695
SUM-----------(CYCLE COMPOSITE)										1169.262	8.357	160.381
CYCLE 2												
1 IDLE	1231.	2.610	7.710	46.	1.401	1725.	3.658	64.	0.042	72.471	0.153	2.708
2 0-25	1150.	8.560	7.090	95.	1.149	1322.	9.841	109.	0.244	322.605	2.401	26.650
3 30	868.	8.410	6.350	57.	1.261	1095.	10.610	71.	0.118	129.228	1.252	8.486
4 30-15	2969.	3.710	4.710	49.	1.483	4405.	5.505	72.	0.062	273.154	0.341	4.508
5 15	114.	7.420	7.680	97.	1.259	143.	9.344	122.	0.050	7.178	0.467	6.108
6 15-30	809.	8.640	7.300	119.	1.160	938.	10.027	138.	0.455	427.204	4.562	62.839
7 50-20	3551.	2.890	5.380	119.	1.360	4830.	3.931	161.	0.029	140.073	0.113	4.694
SUM-----------(CYCLE COMPOSITE)										1371.916	9.292	115.994
CYCLE 3												
1 IDLE	979.	2.690	8.080	69.	1.383	1354.	3.721	95.	0.042	56.877	0.156	4.008
2 0-25	1007.	8.150	7.280	158.	1.165	1173.	9.497	184.	0.244	286.337	2.317	44.926
3 30	895.	11.260	6.030	57.	1.148	1027.	12.930	65.	0.118	121.279	1.525	7.723
4 30-15	2868.	5.090	4.550	47.	1.422	4080.	7.241	66.	0.062	252.965	0.448	4.145
5 15	840.	3.160	9.660	112.	1.193	1002.	3.772	133.	0.050	50.135	0.188	6.684
6 15-30	822.	8.670	7.310	134.	1.156	951.	10.030	155.	0.455	432.717	4.564	70.540
7 50-20	3332.	2.790	5.810	74.	1.342	4472.	3.744	99.	0.029	129.689	0.108	2.880
SUM-----------(CYCLE COMPOSITE)										1330.001	9.309	140.910
CYCLE 4												
1 IDLE	1007.	2.950	7.880	54.	1.388	1398.	4.096	74.	0.042	58.727	0.172	3.149
2 0-25	982.	8.100	7.130	413.	1.184	1163.	9.595	489.	0.244	283.836	2.341	119.373
3 30	1021.	1.490	5.770	57.	1.903	1943.	2.836	108.	0.118	229.325	0.334	12.802
4 30-15	2805.	4.920	4.730	57.	1.418	3979.	6.980	80.	0.062	246.755	0.432	5.014
5 15	812.	4.010	9.110	117.	1.209	981.	4.848	141.	0.050	49.091	0.242	7.073
6 15-30	716.	9.110	7.010	925.	1.175	841.	10.706	1087.	0.455	382.858	4.871	494.614
7 50-20	3132.	2.520	5.880	86.	1.377	4315.	3.472	118.	0.029	125.160	0.100	3.436
SUM-----------(CYCLE COMPOSITE)										1375.754	8.495	645.463
AVERAGE SUM OF CYCLES 1-4										1311.733	8.863	265.687

PETRO-CHEM COMPUTING, INC

HONDA CL350K3 RUN-4 B - COLD CYCLE K = 1.0000 W = 505.

MODE	CONCENTRATION AS MEASURED HC	CO	CO2	NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	703.	3.020	8.040	46.	1.406	988.	4.247	64.	0.042	41.528	0.178	2.717
2 0-25	785.	8.760	7.190	91.	1.167	916.	10.228	106.	0.244	223.657	2.495	25.927
3 30	895.	10.530	5.800	46.	1.205	1078.	12.690	55.	0.118	127.276	1.497	6.541
4 30-15	2614.	6.570	5.200	46.	1.282	3351.	8.424	58.	0.062	207.814	0.522	3.657
5 15	513.	2.360	10.370	129.	1.197	614.	2.827	154.	0.050	30.727	0.141	7.726
6 15-30	819.	9.170	6.920	111.	1.170	958.	10.732	129.	0.455	436.122	4.883	59.108
7 50-20	3019.	2.970	5.780	139.	1.377	4158.	4.091	191.	0.029	120.610	0.118	5.553
SUM-----------(CYCLE COMPOSITE)										1187.737	9.837	111.231
CYCLE 7												
1 IDLE	937.	3.140	8.080	57.	1.359	1274.	4.270	77.	0.042	53.520	0.179	3.255
2 0-25	990.	8.520	7.130	141.	1.163	1152.	9.915	164.	0.244	281.127	2.419	40.039
3 30	1396.	11.440	5.770	57.	1.115	1557.	12.762	63.	0.118	183.767	1.505	7.503
4 30-15	3996.	3.020	4.800	51.	1.364	5453.	4.121	69.	0.062	338.086	0.255	4.314
5 15	403.	2.560	10.260	117.	1.210	487.	3.099	141.	0.050	24.398	0.154	7.083
6 15-30	941.	14.000	6.880	106.	0.973	915.	13.627	103.	0.455	416.764	6.200	46.946
7 50-20	3945.	2.700	6.170	144.	1.230	4855.	3.323	177.	0.029	140.813	0.096	5.139
SUM-----------(CYCLE COMPOSITE)										1438.479	10.812	114.283
AVERAGE SUM OF CYCLES 6-7										1313.108	10.324	112.757

HONDA CL350K3 RUN-4 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	1169.262	8.357	160.381	0.0875	102.310	0.731	14.033
2	1371.916	9.292	115.994	0.0875	120.042	0.813	10.149
3	1330.001	9.309	140.910	0.0875	116.375	0.814	12.329
4	1375.754	8.495	645.463	0.0875	120.378	0.743	56.478
6	1187.737	9.837	111.231	0.3250	386.014	3.197	36.150
7	1438.479	10.812	114.283	0.3250	467.505	3.513	37.142
SUM-----------(TRIP COMPOSITE)					1312.627	9.813	166.282

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING, INC

HONDA CL350K3 RUN 5 S - COLD CYCLE K = 1.0000 W = 505.

MODE	CONCENTRATION HC	AS CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 1												
1 IDLE	428.	4.930	7.750	64.	1.358	581.	6.695	86.	0.042	24.411	0.281	3.650
2 0-25	482.	7.040	7.910	138.	1.213	584.	8.541	167.	0.244	142.697	2.084	40.855
3 30	509.	6.640	8.730	170.	1.150	585.	7.641	195.	0.118	69.120	0.901	23.085
4 30-15	1534.	4.930	6.020	108.	1.429	2193.	7.048	154.	0.062	135.979	0.437	9.573
5 15	814.	8.390	7.720	104.	1.133	922.	9.508	117.	0.050	46.126	0.475	5.893
6 15-30	763.	9.380	7.410	148.	1.121	856.	10.523	166.	0.455	389.498	4.788	75.551
7 50-20	3769.	3.840	5.010	128.	1.318	4967.	5.061	168.	0.029	144.071	0.146	4.892
SUM----------(CYCLE COMPOSITE)										951.906	9.114	163.502
CYCLE 2												
1 IDLE	889.	4.850	7.680	77.	1.310	1164.	6.355	100.	0.042	48.928	0.266	4.237
2 0-25	861.	8.480	7.150	109.	1.176	1013.	9.980	128.	0.244	247.260	2.435	31.302
3 30	814.	9.490	7.430	117.	1.110	904.	10.541	129.	0.118	106.690	1.243	15.335
4 30-15	1761.	6.000	5.360	90.	1.412	2488.	8.477	127.	0.062	154.273	0.525	7.884
5 15	874.	7.320	8.270	117.	1.126	984.	8.244	131.	0.050	49.219	0.412	6.588
6 15-30	779.	9.190	7.570	168.	1.114	868.	10.245	187.	0.455	395.150	4.661	85.218
7 50-20	3402.	4.050	5.420	161.	1.304	4436.	5.281	209.	0.029	128.655	0.153	6.088
SUM----------(CYCLE COMPOSITE)										1130.179	9.698	156.656
CYCLE 3												
1 IDLE	1617.	4.740	7.400	90.	1.259	2035.	5.968	113.	0.042	85.509	0.250	4.759
2 0-25	1435.	8.140	7.120	124.	1.138	1633.	9.264	141.	0.244	398.517	2.260	34.436
3 30	728.	9.950	7.400	117.	1.101	802.	10.962	128.	0.118	94.642	1.293	15.210
4 30-15	1560.	6.820	5.210	90.	1.407	2195.	9.596	126.	0.062	136.095	0.594	7.851
5 15	979.	6.070	8.600	130.	1.142	1118.	6.934	148.	0.050	55.921	0.346	7.425
6 15-30	754.	8.590	7.530	154.	1.147	864.	9.854	176.	0.455	393.574	4.483	80.385
7 50-20	3410.	4.330	5.380	136.	1.291	4403.	5.591	175.	0.029	127.710	0.162	5.093
SUM----------(CYCLE COMPOSITE)										1291.970	9.392	155.162
CYCLE 4												
1 IDLE	1176.	4.670	7.370	90.	1.321	1553.	6.169	118.	0.042	65.255	0.259	4.994
2 0-25	1173.	7.980	7.230	147.	1.161	1362.	9.266	170.	0.244	332.355	2.261	41.650
3 30	837.	7.520	7.370	117.	1.204	1008.	9.061	140.	0.118	119.005	1.069	16.635
4 30-15	1543.	7.150	5.400	88.	1.362	2102.	9.742	119.	0.062	130.354	0.604	7.434
5 15	872.	4.960	9.140	143.	1.154	1006.	5.725	165.	0.050	50.327	0.286	8.253
6 15-30	711.	9.110	7.650	178.	1.117	794.	10.182	198.	0.455	361.586	4.632	90.523
7 50-20	3321.	4.190	5.470	163.	1.300	4318.	5.448	211.	0.029	125.226	0.157	6.146
SUM----------(CYCLE COMPOSITE)										1184.111	9.270	175.637
AVERAGE SUM OF CYCLES 1-4										1139.541	9.369	162.739

PETRO-CHEM COMPUTING, INC.

HONDA CL350K3 RUN 5 S - COLD CYCLE K = 1.0000 W = 505.

MODE	CONCENTRATION HC	AS CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 6												
1 IDLE	846.	4.590	11.720	103.	0.971	821.	4.458	100.	0.042	34.511	0.187	4.201
2 0-25	713.	9.330	11.080	149.	0.877	626.	8.191	130.	0.244	152.745	1.998	31.920
3 30	839.	10.400	9.640	117.	0.920	772.	9.576	107.	0.118	91.167	1.130	12.713
4 30-15	2195.	6.710	7.330	99.	1.110	2437.	7.452	109.	0.062	151.146	0.462	6.817
5 15	609.	4.330	15.090	157.	0.809	492.	3.505	127.	0.050	24.648	0.175	6.354
6 15-30	584.	8.550	12.400	171.	0.837	489.	7.163	143.	0.455	222.639	3.259	65.190
7 50-20	3040.	3.900	8.950	218.	1.022	3107.	3.987	222.	0.029	90.129	0.115	6.463
SUM----------(CYCLE COMPOSITE)										766.987	7.328	133.660
CYCLE 7												
1 IDLE	566.	4.260	12.910	103.	0.926	524.	3.946	95.	0.042	22.023	0.165	4.007
2 0-25	632.	8.320	10.890	141.	0.921	582.	7.668	129.	0.244	142.126	1.871	31.708
3 30	993.	10.300	10.830	117.	0.850	844.	8.758	99.	0.118	99.635	1.033	11.739
4 30-15	1987.	6.970	7.630	97.	1.093	2172.	7.621	106.	0.062	134.704	0.472	6.575
5 15	784.	8.270	11.120	153.	0.900	706.	7.447	137.	0.050	35.300	0.372	6.889
6 15-30	636.	8.110	12.550	184.	0.838	533.	6.800	154.	0.455	242.657	3.094	70.202
7 50-20	3045.	4.090	9.200	277.	0.997	3037.	4.080	276.	0.029	88.100	0.118	8.014
SUM----------(CYCLE COMPOSITE)										764.549	7.127	139.138
AVERAGE SUM OF CYCLES 6-7										765.768	7.228	136.399

HONDA CL350K3 RUN 5 S - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
1	951.906	9.114	163.502	0.0875	83.291	0.797	14.306
2	1130.179	9.698	156.656	0.0875	98.890	0.848	13.707
3	1291.970	9.392	155.162	0.0875	113.047	0.821	13.576
4	1184.111	9.270	175.637	0.0875	103.609	0.811	15.368
6	766.987	7.328	133.660	0.3250	249.271	2.381	43.439
7	764.549	7.127	139.138	0.3250	248.478	2.316	45.219
SUM----------(TRIP COMPOSITE)					896.589	7.977	145.618

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING, INC.

HONDA CL350K3 RUN 6 S - COLD CYCLE K = 1.0000 W = 505.

MODE	CONCENTRATION AS MEASURED HC	CO	CO2	NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 ICLE	524.	3.630	9.030	77.	1.270	665.	4.612	97.	0.042	27.965	0.193	4.109
2 0-25	497.	6.270	8.610	176.	1.180	586.	7.402	207.	0.244	143.170	1.806	50.700
3 30	435.	5.860	9.330	197.	1.139	495.	6.674	224.	0.118	58.467	0.787	26.478
4 30-15	1182.	4.750	6.120	88.	1.483	1753.	7.048	130.	0.062	108.745	0.437	8.096
5 15	479.	7.780	8.140	90.	1.155	553.	8.990	104.	0.050	27.677	0.449	5.200
6 15-30	585.	8.790	7.880	163.	1.123	657.	9.875	183.	0.455	299.031	4.493	83.319
7 50-20	3085.	3.780	5.230	133.	1.387	4279.	5.244	184.	0.029	124.116	0.152	5.350
SUM----------(CYCLE COMPOSITE)----										789.175	8.319	183.255
CYCLE 2												
1 IDLE	671.	3.750	8.370	51.	1.321	886.	4.956	67.	0.042	37.251	0.208	2.831
2 0-25	663.	7.140	7.940	137.	1.185	786.	8.467	162.	0.244	191.860	2.066	39.645
3 30	527.	9.060	7.940	103.	1.112	586.	10.075	114.	0.118	69.152	1.188	13.515
4 30-15	1381.	5.940	5.430	64.	1.465	2024.	8.707	93.	0.062	125.513	0.539	5.816
5 15	354.	6.320	8.790	103.	1.175	416.	7.430	121.	0.050	20.811	0.371	6.055
6 15-30	510.	8.700	7.230	152.	1.195	609.	10.399	181.	0.455	277.370	4.731	82.667
7 50-20	2840.	3.870	5.430	120.	1.389	3947.	5.379	166.	0.029	114.474	0.155	4.836
SUM----------(CYCLE COMPOSITE)----										836.435	9.262	155.368
CYCLE 3												
1 IDLE	1791.	3.820	7.180	64.	1.315	2355.	5.024	84.	0.042	98.937	0.211	3.535
2 0-25	406.	6.170	7.430	113.	1.323	537.	8.167	149.	0.244	131.138	1.992	36.499
3 30	694.	9.690	7.530	90.	1.104	766.	10.705	99.	0.118	90.474	1.263	11.733
4 30-15	1585.	6.430	5.370	65.	1.408	2232.	9.054	91.	0.062	138.384	0.561	5.675
5 15	247.	5.940	8.910	103.	1.193	294.	7.090	122.	0.050	14.742	0.354	6.147
6 15-30	461.	8.370	8.050	130.	1.138	524.	9.531	148.	0.455	233.865	4.336	67.359
7 50-20	266.	3.680	5.840	172.	1.819	484.	6.697	313.	0.029	14.039	0.194	9.077
SUM----------(CYCLE COMPOSITE)----										726.582	8.914	140.027
CYCLF 4												
1 IDLF	1834.	4.920	7.650	64.	1.199	2199.	5.900	76.	0.042	92.377	0.247	3.223
2 0-25	221.	7.190	7.790	128.	1.247	275.	8.969	159.	0.244	67.267	2.188	38.960
3 30	846.	9.910	7.270	90.	1.103	933.	10.936	99.	0.118	110.171	1.290	11.720
4 30-15	1752.	5.910	5.120	63.	1.454	2548.	8.597	91.	0.062	158.023	0.533	5.682
5 15	253.	5.860	8.730	103.	1.215	307.	7.120	125.	0.050	15.370	0.356	6.257
6 15-30	409.	8.580	7.890	122.	1.148	469.	9.856	140.	0.455	213.788	4.484	63.770
7 50-20	2518.	4.180	6.010	188.	1.340	3374.	5.601	251.	0.029	97.862	0.162	7.306
SUM----------(CYCLE COMPOSITE)----										754.861	9.263	136.921
AVERAGE SUM OF CYCLES 1-4 ----										776.763	8.939	153.893

PETRO-CHEM COMPUTING, INC

HONDA CL350K3 RUN 6 S - COLD CYCLE K = 1.0000 W = 505.

MODE	CONCENTRATION AS MEASURED HC	CO	CO2	NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	190.	4.500	7.460	64.	1.462	277.	6.580	93.	0.042	11.669	0.276	3.930
2 0-25	721.	7.610	7.410	161.	1.208	871.	9.200	194.	0.244	212.686	2.244	47.493
3 30	1133.	10.320	6.610	77.	1.115	1264.	11.516	85.	0.118	149.193	1.358	10.139
4 30-15	1798.	6.660	4.990	57.	1.413	2540.	9.410	80.	0.062	157.515	0.583	4.993
5 15	1402.	5.120	8.970	103.	1.111	1558.	5.691	114.	0.050	77.923	0.284	5.724
6 15-30	931.	8.770	7.830	162.	1.096	1021.	9.618	177.	0.455	464.602	4.376	80.843
7 50-20	2722.	4.360	5.480	86.	1.367	3723.	5.964	117.	0.029	107.983	0.172	3.411
SUM----------(CYCLE COMPOSITE)----										1181.576	9.297	156.537
CYCLE 7												
1 IDLE	1317.	4.450	7.650	64.	1.283	1690.	5.711	82.	0.042	70.994	0.239	3.450
2 0-25	293.	7.510	7.480	125.	1.255	367.	9.426	156.	0.244	89.740	2.300	38.285
3 30	880.	10.400	6.640	77.	1.133	997.	11.790	87.	0.118	117.719	1.391	10.300
4 30-15	1897.	6.280	4.590	59.	1.482	2812.	9.312	87.	0.062	174.398	0.577	5.424
5 15	1531.	5.190	9.140	103.	1.083	1658.	5.620	111.	0.050	82.905	0.261	5.577
6 15-30	251.	7.590	8.410	154.	1.162	291.	8.821	178.	0.455	132.731	4.013	81.437
7 50-20	2538.	4.010	8.750	131.	1.074	2726.	4.308	140.	0.029	79.077	0.124	4.081
SUM----------(CYCLE COMPOSITE)----										747.567	8.928	148.556
AVERAGE SUM OF CYCLES 6-7 ----										964.571	9.113	152.546

HONDA CL350K3 RUN 6 S - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	789.175	8.319	183.255	0.0875	69.052	0.727	16.034
2	836.435	9.262	155.368	0.0875	73.188	0.810	13.594
3	726.582	8.914	140.027	0.0875	63.576	0.779	12.252
4	754.861	9.263	136.921	0.0875	66.050	0.810	11.980
6	1181.576	9.297	156.537	0.3250	384.012	3.021	50.874
7	747.567	8.928	148.556	0.3250	242.959	2.901	48.280
SUM----------(TRIP COMPOSITE)----					898.839	9.052	153.018

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING, INC

HONDA SL-100 RUN 2 8-23-72 B - COLD CYCLE K = 1.0000 W 0.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	812.	6.870	10.040	70.	1.010	820.	6.940	70.	0.042	34.455	0.291	2.970
2 0-25	709.	3.790	11.690	909.	1.010	716.	3.829	918.	0.244	174.795	0.934	224.103
3 30	2007.	2.160	13.040	832.	0.890	1786.	1.922	740.	0.118	210.834	0.226	87.401
4 30-15	971.	5.990	8.300	239.	1.174	1140.	7.036	280.	0.062	70.718	0.436	17.406
5 15	606.	7.850	9.370	153.	1.039	629.	8.159	159.	0.050	31.495	0.407	7.951
6 15-30	740.	3.360	12.500	1168.	0.968	716.	3.252	1130.	0.455	325.928	1.479	514.438
7 50-20	3679.	7.330	7.400	141.	0.964	3547.	7.067	135.	0.029	102.871	0.204	3.942
SUM-----------(CYCLE COMPOSITE)										951.100	3.981	858.214
CYCLE 2												
1 IDLE	854.	8.240	9.040	70.	1.029	879.	8.484	72.	0.042	36.931	0.356	3.027
2 0-25	735.	4.890	10.990	640.	1.019	749.	4.983	652.	0.244	182.758	1.215	159.136
3 30	3389.	2.780	12.530	698.	0.824	2795.	2.292	575.	0.118	329.837	0.270	67.933
4 30-15	1476.	5.250	6.200	190.	1.391	2054.	7.306	264.	0.062	127.355	0.452	16.393
5 15	771.	8.650	8.930	117.	1.029	793.	8.903	120.	0.050	39.678	0.445	6.021
6 15-30	755.	3.550	11.870	972.	1.002	757.	3.559	974.	0.455	344.465	1.619	443.471
7 50-20	5613.	4.770	4.140	202.	1.151	6466.	5.494	232.	0.029	187.515	0.159	6.748
SUM-----------(CYCLE COMPOSITE)										1248.542	4.519	702.731
CYCLE 3												
1 IDLE	1105.	7.950	9.260	81.	1.004	1110.	7.989	81.	0.042	46.640	0.335	3.418
2 0-25	1052.	6.930	9.330	473.	1.040	1094.	7.212	492.	0.244	267.169	1.759	120.124
3 30	3938.	4.380	11.450	460.	0.810	3191.	3.549	372.	0.118	376.566	0.418	43.986
4 30-15	2245.	5.950	6.230	129.	1.246	2799.	7.418	160.	0.062	173.544	0.459	9.972
5 15	895.	8.980	8.820	141.	1.015	909.	9.120	143.	0.050	45.450	0.456	7.160
6 15-30	896.	4.510	11.700	909.	0.971	870.	4.382	883.	0.455	396.132	1.993	401.880
7 50-20	6552.	4.730	3.900	214.	1.086	7121.	5.140	232.	0.029	206.512	0.149	6.745
SUM-----------(CYCLE COMPOSITE)										1512.015	5.573	593.287
CYCLE 4												
1 IDLE	1105.	8.050	9.150	93.	1.009	1115.	8.123	93.	0.042	46.835	0.341	3.941
2 0-25	1063.	4.940	10.980	626.	0.993	1055.	4.906	621.	0.244	257.630	1.197	151.718
3 30	3182.	4.920	11.000	393.	0.858	2730.	4.222	337.	0.118	322.219	0.498	39.796
4 30-15	2128.	5.560	5.750	141.	1.339	2849.	7.445	188.	0.062	176.674	0.461	11.706
5 15	1021.	9.090	8.710	141.	1.009	1031.	9.180	142.	0.050	51.556	0.459	7.119
6 15-30	925.	3.880	11.050	893.	1.036	958.	4.021	925.	0.455	436.249	1.829	421.157
7 50-20	4398.	4.850	4.490	178.	1.243	5466.	6.028	221.	0.029	158.541	0.174	6.416
SUM-----------(CYCLE COMPOSITE)										1449.705	4.962	641.856
AVERAGE SUM OF CYCLES 1-4										1290.341	4.759	699.022

HONDA SL-100 RUN 2 8-23-72 B - COLD CYCLE K = 1.0000 W = 0.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	979.	8.340	8.930	70.	1.024	1002.	8.541	71.	0.042	42.113	0.358	3.011
2 0-25	933.	6.500	10.260	598.	0.998	931.	6.492	597.	0.244	227.375	1.584	145.734
3 30	3369.	5.370	10.890	315.	0.842	2837.	4.523	265.	0.118	334.873	0.533	31.310
4 30-15	2225.	4.830	5.910	153.	1.351	3007.	6.528	206.	0.062	186.453	0.404	12.821
5 15	1070.	9.310	8.390	117.	1.021	1092.	9.506	119.	0.050	54.627	0.475	5.973
6 15-30	950.	4.770	11.440	924.	0.976	927.	4.657	902.	0.455	422.033	2.119	410.483
7 50-20	6037.	4.440	9.270	227.	0.805	4860.	3.574	182.	0.029	140.953	0.103	5.300
SUM-----------(CYCLE COMPOSITE)										1408.431	5.579	614.634
CYCLE 7												
1 IDLE	1189.	9.310	8.080	81.	1.034	1229.	9.629	83.	0.042	51.650	0.404	3.518
2 0-25	1080.	6.450	10.100	501.	1.000	1080.	6.453	501.	0.244	263.676	1.574	122.316
3 30	4034.	4.920	11.000	420.	0.813	3283.	4.004	341.	0.118	387.398	0.472	40.334
4 30-15	2815.	4.750	6.200	178.	1.248	3514.	5.929	222.	0.062	217.877	0.367	13.776
5 15	1274.	9.430	8.080	117.	1.023	1303.	9.648	119.	0.050	65.179	0.482	5.985
6 15-30	1076.	4.960	11.110	787.	0.982	1057.	4.875	773.	0.455	481.214	2.218	351.966
7 50-20	6234.	4.820	4.720	165.	1.045	6520.	5.041	172.	0.029	189.096	0.146	5.004
SUM-----------(CYCLE COMPOSITE)										1656.093	5.666	542.903
AVERAGE SUM OF CYCLES 6-7										1532.262	5.622	578.768

HONDA SL-100 RUN 2 8-23-72 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	951.100	3.981	859.214	0.0875	83.221	0.348	75.093
2	1248.542	4.519	702.731	0.0875	109.247	0.395	61.489
3	1512.015	5.573	593.287	0.0875	132.301	0.487	51.912
4	1449.705	4.962	641.856	0.0875	126.849	0.434	56.162
6	1408.431	5.579	614.634	0.3250	457.740	1.813	199.756
7	1656.093	5.666	542.903	0.3250	538.230	1.841	176.443
SUM-----------(TRIP COMPOSITE)					1447.589	5.320	620.857

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

HONDA SL-100 RUN 4 8-24-72 B - COLD CYCLE K = 1.0000 W = 0.

MODE	CONCENTRATION AS MEASURED HC	CO	CO2	NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	854.	7.760	9.480	117.	1.015	867.	7.878	118.	0.042	36.414	0.330	4.988
2 0-25	847.	4.190	11.640	678.	0.989	838.	4.147	671.	0.244	204.555	1.011	163.740
3 30	3059.	1.690	13.420	956.	0.825	2524.	1.394	789.	0.118	297.912	0.164	93.103
4 30-15	1849.	2.950	8.140	569.	1.248	2308.	3.683	710.	0.062	143.150	0.228	44.052
5 15	854.	7.480	9.920	193.	0.994	849.	7.437	191.	0.050	42.458	0.371	9.595
6 15-30	934.	3.970	11.920	1031.	0.972	908.	3.859	1002.	0.455	413.180	1.756	456.091
7 50-20	5224.	4.270	4.850	430.	1.148	5998.	4.903	493.	0.029	173.968	0.142	14.319
SUM-----------(CYCLE COMPOSITE)										1311.642	4.006	785.892
CYCLE 2												
1 IDLE	1063.	6.620	10.150	129.	0.992	1055.	6.571	128.	0.042	44.315	0.275	5.377
2 0-25	1021.	4.490	11.450	605.	0.979	1000.	4.399	592.	0.244	244.112	1.073	144.650
3 30	3152.	3.090	12.720	802.	0.820	2586.	2.535	658.	0.118	305.225	0.299	77.661
4 30-15	2148.	5.250	6.780	410.	1.236	2656.	6.492	507.	0.062	164.697	0.402	31.436
5 15	1063.	7.200	9.590	214.	1.011	1075.	7.281	216.	0.050	53.750	0.364	10.820
6 15-30	976.	3.210	12.220	996.	0.974	951.	3.128	970.	0.455	432.766	1.423	441.634
7 50-20	5544.	5.070	4.530	305.	1.110	6158.	5.632	338.	0.029	178.605	0.163	9.825
SUM-----------(CYCLE COMPOSITE)										1423.472	4.002	721.407
CYCLE 3												
1 IDLE	1232.	8.450	9.040	129.	0.993	1223.	8.394	128.	0.042	51.405	0.352	5.382
2 0-25	1066.	5.230	10.990	636.	0.982	1047.	5.139	624.	0.244	255.586	1.253	152.488
3 30	3432.	4.130	11.800	669.	0.825	2832.	3.408	552.	0.118	334.185	0.402	65.142
4 30-15	2504.	4.510	6.010	323.	1.321	3309.	5.961	426.	0.062	205.217	0.369	26.471
5 15	1175.	8.950	9.500	227.	1.017	1196.	9.110	231.	0.050	59.805	0.455	11.553
6 15-30	1031.	4.110	11.950	1117.	0.959	988.	3.941	1071.	0.455	449.914	1.793	487.443
7 50-20	5203.	4.890	4.670	233.	1.138	5924.	5.568	265.	0.029	171.809	0.161	7.693
SUM-----------(CYCLE COMPOSITE)										1527.924	4.788	756.177
CYCLE 4												
1 IDLE	1189.	8.870	8.710	117.	1.004	1194.	8.913	117.	0.042	50.183	0.374	4.938
2 0-25	1144.	5.480	10.820	672.	0.980	1121.	5.370	658.	0.244	273.560	1.310	160.692
3 30	3013.	4.180	11.650	542.	0.853	2570.	3.566	462.	0.118	303.355	0.420	54.569
4 30-15	2203.	4.970	6.760	305.	1.247	2748.	6.199	380.	0.062	170.376	0.384	23.588
5 15	1161.	8.550	9.040	178.	0.995	1155.	8.509	177.	0.050	57.775	0.425	8.857
6 15-30	1050.	3.480	12.280	1024.	0.956	1004.	3.329	979.	0.455	457.131	1.515	445.812
7 50-20	5322.	4.860	4.380	267.	1.154	6145.	5.611	308.	0.029	178.208	0.162	8.940
SUM-----------(CYCLE COMPOSITE)										1490.592	4.593	707.399
AVERAGE SUM OF CYCLES 1-4										1438.407	4.347	742.719

HONDA SL-100 RUN 4 8-24-72 B - COLD CYCLE K = 1.0000 W = 0.

MODE	CONCENTRATION AS MEASURED HC	CO	CO2	NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	896.	3.650	8.820	93.	1.248	1118.	4.557	116.	0.042	46.988	0.191	4.877
2 0-25	941.	6.730	10.050	464.	1.004	945.	6.762	466.	0.244	230.697	1.649	113.755
3 30	3573.	5.350	10.550	406.	0.848	3032.	4.540	344.	0.118	357.847	0.535	40.662
4 30-15	2286.	5.450	6.080	199.	1.286	2940.	7.009	255.	0.062	182.289	0.434	15.868
5 15	1021.	9.900	7.850	141.	1.042	1064.	10.325	147.	0.050	53.243	0.516	7.352
6 15-30	934.	4.730	11.000	754.	1.008	942.	4.771	760.	0.455	428.703	2.171	346.084
7 50-20	5800.	4.900	4.330	231.	1.111	6447.	5.446	256.	0.029	186.974	0.157	7.446
SUM-----------(CYCLE COMPOSITE)										1486.744	5.657	536.046
CYCLE 7												
1 IDLE	1189.	7.760	9.480	117.	0.990	1177.	7.683	115.	0.042	49.446	0.322	4.865
2 0-25	1098.	5.720	10.370	662.	1.005	1104.	5.753	665.	0.244	269.476	1.403	162.471
3 30	3105.	3.990	11.800	626.	0.845	2625.	3.373	529.	0.118	309.804	0.398	62.459
4 30-15	2322.	4.930	6.290	229.	1.287	2989.	6.347	294.	0.062	185.343	0.393	18.278
5 15	1161.	9.090	8.820	180.	0.991	1151.	9.016	178.	0.050	57.577	0.450	8.926
6 15-30	1047.	3.950	12.090	1203.	0.954	999.	3.769	1147.	0.455	454.573	1.714	522.303
7 50-20	5645.	5.030	4.420	378.	1.112	6281.	5.596	420.	0.029	182.151	0.162	12.197
SUM-----------(CYCLE COMPOSITE)										1508.372	4.846	791.502
AVERAGE SUM OF CYCLES 6-7										1497.558	5.251	663.774

HONDA SL-100 RUN 4 8-24-72 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	1311.642	4.006	785.892	0.0875	114.768	0.350	68.765
2	1423.472	4.002	721.407	0.0875	124.553	0.350	63.123
3	1527.924	4.788	756.177	0.0875	133.693	0.419	66.165
4	1490.592	4.593	707.399	0.0875	130.426	0.401	61.897
6	1486.744	5.657	536.046	0.3250	483.192	1.838	174.215
7	1508.372	4.846	791.502	0.3250	490.221	1.575	257.238
SUM-----------(TRIP COMPOSITE)					1476.855	4.935	691.405

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

HONDA SL-100 RUN 5 8-24-72 B - COLD CYCLE K = 1.0000 W = 0.

MODE	CONCENTRATION AS			MEASURED	DILUTION	A D J U S T E D			WEIGHTING	W E I G H T E D		
	HC	CO	CO2	NO(K)	FACTOR	HC	CO	NO(K)	FACTOR	HC	CO	NO(K)
CYCLE 1												
1 IDLE	1317.	8.760	8.820	70.	0.991	1305.	8.686	69.	0.042	54.851	0.364	2.915
2 0-25	1274.	3.840	11.520	780.	0.978	1246.	3.758	763.	0.244	304.227	0.916	186.261
3 30	2288.	2.320	13.170	982.	0.863	1974.	2.002	847.	0.118	233.007	0.236	100.005
4 30-15	2054.	3.460	7.260	507.	1.293	2657.	4.476	655.	0.062	164.747	0.277	40.665
5 15	1745.	7.760	9.480	178.	0.951	1659.	7.380	169.	0.050	82.988	0.369	8.465
6 15-30	1583.	3.400	12.290	686.	0.923	1462.	3.140	633.	0.455	665.228	1.428	288.279
7 50-20	4257.	5.260	5.110	564.	1.175	5003.	6.181	662.	0.029	145.090	0.179	19.222
SUM-----------(CYCLE COMPOSITE)---										1650.141	3.772	645.816
CYCLE 2												
1 IDLE	2096.	7.480	9.590	141.	0.929	1948.	6.955	131.	0.042	81.857	0.292	5.506
2 0-25	1869.	3.940	11.260	736.	0.950	1777.	3.746	699.	0.244	433.650	0.914	170.768
3 30	2799.	1.590	13.420	1053.	0.841	2354.	1.337	885.	0.118	277.822	0.157	104.518
4 30-15	2200.	4.190	7.130	437.	1.249	2749.	5.237	546.	0.062	170.485	0.324	33.864
5 15	1731.	6.870	10.040	243.	0.944	1635.	6.491	229.	0.050	81.786	0.324	11.481
6 15-30	1487.	2.860	12.670	920.	0.923	1372.	2.640	849.	0.455	624.634	1.201	386.458
7 50-20	4383.	5.280	5.040	609.	1.168	5119.	6.167	711.	0.029	148.469	0.178	20.629
SUM-----------(CYCLE COMPOSITE)---										1818.707	3.393	733.227
CYCLE 3												
1 IDLE	2008.	7.390	9.810	141.	0.925	1857.	6.836	130.	0.042	78.020	0.287	5.478
2 0-25	1822.	4.730	11.000	816.	0.945	1723.	4.473	771.	0.244	420.422	1.091	188.290
3 30	2512.	1.870	13.420	993.	0.849	2134.	1.588	843.	0.118	251.818	0.187	99.544
4 30-15	2064.	4.420	7.360	378.	1.228	2536.	5.431	464.	0.062	157.260	0.336	28.800
5 15	1644.	6.790	10.150	239.	0.946	1555.	6.426	226.	0.050	77.797	0.321	11.309
6 15-30	1494.	2.430	12.740	1282.	0.931	1391.	2.263	1194.	0.455	633.115	1.029	543.275
7 50-20	4470.	5.170	4.770	496.	1.190	5320.	6.153	590.	0.029	154.288	0.178	17.120
SUM-----------(CYCLE COMPOSITE)---										1772.723	3.432	893.819
CYCLE 4												
1 IDLE	2008.	8.240	9.040	133.	0.945	1899.	7.794	125.	0.042	79.776	0.327	5.284
2 0-25	1800.	4.440	11.920	930.	0.901	1622.	4.002	838.	0.244	395.946	0.976	204.572
3 30	2377.	2.910	12.720	659.	0.866	2058.	2.520	570.	0.118	242.922	0.297	67.347
4 30-15	5024.	4.480	7.200	313.	0.975	4900.	4.369	305.	0.062	303.820	0.270	18.928
5 15	1601.	7.130	10.150	315.	0.938	1503.	6.694	295.	0.050	75.156	0.334	14.787
6 15-30	1444.	3.210	12.450	1275.	0.928	1340.	2.980	1183.	0.455	610.123	1.356	538.717
7 50-20	4479.	4.790	4.730	487.	1.212	5429.	5.806	590.	0.029	157.446	0.168	17.119
SUM-----------(CYCLE COMPOSITE)---										1865.192	3.731	866.756
AVERAGE SUM OF CYCLES 1-4 --										1776.691	3.582	784.904

HONDA SL-100 RUN 5 8-24-72 B - COLD CYCLE K = 1.0000 W = 0.

MODE	CONCENTRATION AS			MEASURED	DILUTION	A D J U S T E D			WEIGHTING	W E I G H T E D		
	HC	CO	CO2	NO(K)	FACTOR	HC	CO	NO(K)	FACTOR	HC	CO	NO(K)
CYCLE 6												
1 IDLE	979.	8.140	8.500	93.	1.064	1041.	8.661	98.	0.042	43.751	0.363	4.156
2 0-25	1052.	5.610	10.620	695.	0.995	1047.	5.586	692.	0.244	255.609	1.363	168.867
3 30	2318.	3.790	11.800	565.	0.895	2074.	3.392	505.	0.118	244.844	0.400	59.679
4 30-15	1892.	4.970	6.560	234.	1.307	2474.	6.499	305.	0.062	153.395	0.402	18.971
5 15	1444.	9.200	8.680	165.	0.977	1410.	8.989	161.	0.050	70.548	0.449	8.061
6 15-30	1274.	3.180	11.760	1276.	0.984	1254.	3.131	1256.	0.455	570.776	1.424	571.672
7 50-20	4345.	5.070	5.110	745.	1.175	5106.	5.958	875.	0.029	148.089	0.172	25.391
SUM-----------(CYCLE COMPOSITE)---										1487.016	4.577	856.801
CYCLE 7												
1 IDLE	1703.	7.660	9.700	120.	0.943	1606.	7.226	113.	0.042	67.480	0.303	4.754
2 0-25	1509.	5.500	10.800	811.	0.955	1441.	5.253	774.	0.244	351.708	1.281	189.023
3 30	2437.	3.280	13.300	782.	0.825	2010.	2.706	645.	0.118	237.293	0.319	76.144
4 30-15	2084.	4.170	6.930	431.	1.287	2682.	5.367	554.	0.062	166.302	0.332	34.393
5 15	1487.	7.660	9.700	222.	0.957	1424.	7.338	212.	0.050	71.226	0.366	10.633
6 15-30	1339.	4.730	12.600	1215.	0.883	1183.	4.179	1073.	0.455	538.296	1.901	488.447
7 50-20	4615.	4.290	4.850	682.	1.210	5586.	5.192	825.	0.029	161.998	0.150	23.939
SUM-----------(CYCLE COMPOSITE)---										1594.306	4.656	827.336
AVERAGE SUM OF CYCLES 6-7 --										1540.661	4.616	842.068

HONDA SL-100 RUN 5 8-24-72 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED			WEIGHTING	W E I G H T E D		
	HC	CO	NO(K)	FACTOR	HC	CO	NO(K)
1	1650.141	3.772	645.816	0.0875	144.387	0.330	56.508
2	1818.707	3.393	733.227	0.0875	159.136	0.296	64.157
3	1772.723	3.432	893.819	0.0875	155.113	0.300	78.209
4	1865.192	3.731	866.756	0.0875	163.204	0.326	75.841
6	1487.016	4.577	856.801	0.3250	483.280	1.487	278.460
7	1594.306	4.656	827.336	0.3250	518.149	1.513	268.884
SUM-----------(TRIP COMPOSITE)------------------------------					1623.271	4.254	822.061

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

KAWASAKI 125F-6 RUN 1 8-23-72 B - COLD CYCLE K = 1.0000 W = 0.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	5072.	0.220	4.180	46.	1.484	7529.	0.326	68.	0.042	316.228	0.013	2.868
2 0-25	5257.	1.000	4.840	216.	1.316	6918.	1.316	284.	0.244	1688.147	0.321	69.362
3 30	3089.	1.070	10.370	58.	1.018	3145.	1.089	59.	0.118	371.128	0.128	6.968
4 30-15	4799.	1.910	6.160	50.	1.179	5658.	2.252	58.	0.062	350.815	0.139	3.655
5 15	3699.	0.230	8.500	117.	1.149	4253.	0.264	134.	0.050	212.671	0.013	6.726
6 15-30	3703.	1.760	8.940	219.	1.049	3885.	1.846	229.	0.455	1767.864	0.840	104.553
7 50-20	7340.	3.900	3.080	101.	1.119	8213.	4.364	113.	0.029	238.205	0.126	3.277
SUM-----------(CYCLE COMPOSITE)										4945.061	1.583	197.412
CYCLE 2												
1 IDLE	5739.	2.400	4.400	70.	1.229	7053.	2.949	86.	0.042	296.237	0.123	3.613
2 0-25	4799.	1.080	8.330	277.	1.031	4951.	1.114	285.	0.244	1208.208	0.271	69.738
3 30	3182.	1.560	10.310	93.	0.998	3176.	1.557	92.	0.118	374.789	0.183	10.953
4 30-15	3879.	2.070	5.730	85.	1.323	5134.	2.740	112.	0.062	318.342	0.169	6.975
5 15	4261.	0.470	8.820	70.	1.061	4524.	0.499	74.	0.050	226.202	0.024	3.716
6 15-30	3960.	1.140	9.260	164.	1.027	4070.	1.171	168.	0.455	1852.021	0.533	76.699
7 50-20	8343.	3.310	2.130	142.	1.133	9454.	3.750	160.	0.029	274.178	0.108	4.666
SUM-----------(CYCLE COMPOSITE)										4549.981	1.416	176.363
CYCLE 3												
1 IDLE	6751.	3.610	3.900	93.	1.115	7532.	4.027	103.	0.042	316.353	0.169	4.358
2 0-25	5691.	1.880	7.830	325.	0.972	5532.	1.827	315.	0.244	1349.851	0.445	77.086
3 30	3651.	1.620	10.150	105.	0.972	3552.	1.576	102.	0.118	419.165	0.185	12.054
4 30-15	4160.	2.330	5.790	96.	1.266	5269.	2.951	121.	0.062	326.686	0.182	7.538
5 15	4326.	1.910	8.080	93.	1.057	4576.	2.020	98.	0.050	228.812	0.101	4.918
6 15-30	4098.	1.460	9.120	258.	1.015	4162.	1.482	262.	0.455	1893.867	0.674	119.233
7 50-20	7786.	3.230	2.150	137.	1.191	9273.	3.847	163.	0.029	268.937	0.111	4.732
SUM-----------(CYCLE COMPOSITE)										4803.674	1.871	229.923
CYCLE 4												
1 IDLE	6970.	3.180	4.110	93.	1.096	7640.	3.485	101.	0.042	320.899	0.146	4.281
2 0-25	6005.	1.880	8.090	288.	0.934	5612.	1.756	269.	0.244	1369.329	0.428	65.673
3 30	4083.	1.480	10.260	117.	0.940	3841.	1.392	110.	0.118	453.353	0.164	12.991
4 30-15	4587.	2.730	6.100	97.	1.167	5355.	3.187	113.	0.062	332.049	0.197	7.021
5 15	4424.	1.320	7.580	81.	1.113	4927.	1.470	90.	0.050	246.383	0.073	4.511
6 15-30	4285.	1.860	8.820	218.	1.008	4321.	1.875	219.	0.455	1966.245	0.853	100.033
7 50-20	7607.	3.220	2.090	137.	1.216	9256.	3.918	166.	0.029	268.450	0.113	4.834
SUM-----------(CYCLE COMPOSITE)										4956.711	1.977	199.346
AVERAGE SUM OF CYCLES 1-4										4813.857	1.712	200.761

KAWASAKI 125F-6 RUN 1 8-23-72 B - COLD CYCLE K = 1.0000 W = 0.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	3938.	3.280	3.970	58.	1.470	5789.	4.822	85.	0.042	243.154	0.202	3.581
2 0-25	3870.	1.990	7.760	277.	1.121	4338.	2.230	310.	0.244	1058.560	0.544	75.767
3 30	3416.	1.340	10.260	93.	0.991	3388.	1.329	92.	0.118	399.799	0.156	10.884
4 30-15	4412.	2.820	5.720	86.	1.219	5378.	3.437	104.	0.062	333.451	0.213	6.499
5 15	4309.	1.080	8.500	70.	1.058	4562.	1.143	74.	0.050	228.135	0.057	3.706
6 15-30	4266.	1.830	8.840	268.	1.009	4306.	1.847	270.	0.455	1959.642	0.840	123.109
7 50-20	7662.	3.120	2.000	129.	1.225	9387.	3.822	158.	0.029	272.233	0.110	4.583
SUM-----------(CYCLE COMPOSITE)										4494.977	2.125	228.131
CYCLE 7												
1 IDLE	7043.	3.090	3.970	93.	1.105	7782.	3.414	102.	0.042	326.883	0.143	4.316
2 0-25	6237.	1.760	7.850	304.	0.937	5847.	1.650	285.	0.244	1426.778	0.402	69.543
3 30	4621.	1.450	10.370	105.	0.901	4165.	1.307	94.	0.118	491.526	0.154	11.168
4 30-15	5202.	2.580	6.180	96.	1.107	5763.	2.858	106.	0.062	357.315	0.177	6.594
5 15	4621.	1.420	8.390	70.	1.029	4755.	1.461	72.	0.050	237.761	0.073	3.601
6 15-30	4526.	2.170	8.680	216.	0.989	4478.	2.147	213.	0.455	2037.816	0.977	97.253
7 50-20	7369.	3.150	1.990	130.	1.258	9272.	3.963	163.	0.029	268.899	0.114	4.743
SUM-----------(CYCLE COMPOSITE)										5146.981	2.042	197.220
AVERAGE SUM OF CYCLES 6-7										4820.979	2.084	212.676

KAWASAKI 125F-6 RUN 1 8-23-72 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	4945.061	1.583	197.412	0.0875	432.692	0.138	17.273
2	4549.981	1.416	176.363	0.0875	398.123	0.123	15.431
3	4803.674	1.871	229.923	0.0875	420.321	0.163	20.118
4	4956.711	1.977	199.346	0.0875	433.712	0.173	17.442
6	4494.977	2.125	228.131	0.3250	1460.867	0.690	74.142
7	5146.981	2.042	197.220	0.3250	1672.768	0.663	64.096
SUM-----------(TRIP COMPOSITE)					4818.486	1.953	208.506

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

KAWASAKI 125F-6 RUN 3 8-24-72 B - COLD CYCLE K = 1.0000 W = 0.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	5326.	0.220	4.450	93.	1.406	7488.	0.309	130.	0.042	314.537	0.012	5.492
2 0-25	4877.	1.220	8.020	264.	1.043	5088.	1.272	275.	0.244	1241.608	0.310	67.210
3 30	3182.	1.220	10.480	129.	0.998	3176.	1.217	128.	0.118	374.789	0.143	15.194
4 30-15	4206.	2.250	8.840	108.	0.999	4203.	2.248	107.	0.062	260.637	0.139	6.692
5 15	3954.	0.240	8.520	105.	1.123	4440.	0.269	117.	0.050	222.043	0.013	5.896
6 15-30	3688.	0.490	9.130	237.	1.085	4003.	0.531	257.	0.455	1821.493	0.242	117.053
7 50-20	8352.	3.560	3.170	146.	1.037	8668.	3.695	151.	0.029	251.394	0.107	4.394
SUM----------(CYCLE COMPOSITE)										4486.503	0.969	221.933
CYCLE 2												
1 IDLE	6001.	2.480	4.450	117.	1.191	7149.	2.954	139.	0.042	300.269	0.124	5.854
2 0-25	5087.	1.180	8.020	241.	1.028	5229.	1.213	247.	0.244	1276.081	0.296	60.455
3 30	3369.	1.070	10.480	129.	0.989	3333.	1.058	127.	0.118	393.377	0.124	15.062
4 30-15	4451.	2.070	8.840	122.	0.987	4395.	2.044	120.	0.062	272.539	0.126	7.470
5 15	4212.	0.680	8.520	97.	1.081	4554.	0.735	104.	0.050	227.735	0.036	5.244
6 15-30	4039.	0.820	9.130	196.	1.043	4212.	0.855	204.	0.455	1916.779	0.389	93.015
7 50-20	7799.	3.970	3.170	198.	1.067	8328.	4.239	211.	0.029	241.530	0.122	6.131
SUM----------(CYCLE COMPOSITE)										4628.314	1.220	193.234
CYCLE 3												
1 IDLE	6668.	3.180	3.680	129.	1.162	7752.	3.697	149.	0.042	325.608	0.155	6.299
2 0-25	5711.	1.950	6.720	340.	1.045	5973.	2.039	355.	0.244	1457.526	0.497	86.772
3 30	3922.	1.110	9.960	137.	0.983	3855.	1.091	134.	0.118	454.928	0.128	15.891
4 30-15	4731.	1.840	6.910	136.	1.120	5301.	2.061	152.	0.062	328.697	0.127	9.448
5 15	4260.	1.320	8.520	105.	1.052	4482.	1.388	110.	0.050	224.116	0.069	5.523
6 15-30	4094.	1.690	9.210	187.	1.001	4100.	1.692	187.	0.455	1865.791	0.770	85.223
7 50-20	7824.	3.430	2.390	150.	1.154	9036.	3.961	173.	0.029	262.048	0.114	5.023
SUM----------(CYCLE COMPOSITE)										4918.716	1.864	214.183
CYCLE 4												
1 IDLE	6624.	2.650	4.960	129.	1.078	7147.	2.859	139.	0.042	300.174	0.120	5.845
2 0-25	5958.	1.610	8.780	243.	0.905	5392.	1.457	219.	0.244	1315.847	0.355	53.667
3 30	4277.	1.190	10.890	141.	0.900	3850.	1.071	126.	0.118	454.413	0.126	14.980
4 30-15	5163.	1.280	10.770	136.	0.853	4407.	1.092	116.	0.062	273.255	0.067	7.197
5 15	4424.	1.520	8.820	105.	1.009	4467.	1.535	106.	0.050	223.388	0.076	5.301
6 15-30	4228.	0.910	9.470	273.	1.000	4230.	0.910	273.	0.455	1924.902	0.414	124.290
7 50-20	7558.	3.320	3.440	157.	1.093	8263.	3.629	171.	0.029	239.630	0.105	4.977
SUM----------(CYCLE COMPOSITE)										4731.613	1.266	216.261
AVERAGE SUM OF CYCLES 1-4										4691.286	1.330	211.403

KAWASAKI 125F-6 RUN 3 8-24-72 B - COLD CYCLE K = 1.0000 W = 0.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	3479.	2.860	4.610	153.	1.479	5148.	4.232	226.	0.042	216.254	0.177	9.510
2 0-25	3447.	1.560	8.530	269.	1.112	3835.	1.735	299.	0.244	935.756	0.423	73.025
3 30	3213.	0.650	10.540	235.	1.011	3249.	0.657	237.	0.118	383.496	0.077	28.049
4 30-15	4104.	1.170	8.720	227.	1.055	4331.	1.234	239.	0.062	268.574	0.076	14.855
5 15	4034.	2.510	8.080	190.	1.059	4272.	2.658	201.	0.050	213.607	0.132	10.060
6 15-30	3975.	0.970	8.990	268.	1.053	4186.	1.021	282.	0.455	1904.783	0.464	128.423
7 50-20	7261.	3.820	3.930	288.	1.059	7695.	4.048	305.	0.029	223.160	0.117	8.851
SUM----------(CYCLE COMPOSITE)										4145.632	1.470	272.775
CYCLE 7												
1 IDLE	6642.	2.910	4.560	252.	1.099	7302.	3.199	277.	0.042	306.708	0.134	11.636
2 0-25	6020.	1.670	8.080	533.	0.940	5662.	1.570	501.	0.244	1381.547	0.383	122.319
3 30	4621.	1.200	10.540	277.	0.898	4153.	1.078	248.	0.118	490.154	0.127	29.381
4 30-15	5302.	1.230	8.960	268.	0.947	5024.	1.165	253.	0.062	311.512	0.072	15.745
5 15	4654.	1.290	8.390	239.	1.031	4799.	1.330	246.	0.050	239.959	0.066	12.322
6 15-30	4458.	1.540	8.870	402.	1.003	4471.	1.544	403.	0.455	2034.755	0.702	183.483
7 50-20	7155.	3.360	2.930	297.	1.175	8409.	3.948	349.	0.029	243.866	0.114	10.122
SUM----------(CYCLE COMPOSITE)										5008.503	1.601	385.013
AVERAGE SUM OF CYCLES 6-7										4577.068	1.535	328.894

KAWASAKI 125F-6 RUN 3 8-24-72 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	4486.503	0.969	221.933	0.0875	392.569	0.084	19.419
2	4628.314	1.220	193.234	0.0875	404.977	0.106	16.907
3	4918.716	1.864	214.183	0.0875	430.387	0.163	18.741
4	4731.613	1.266	216.261	0.0875	414.016	0.110	18.922
6	4145.632	1.470	272.775	0.3250	1347.330	0.477	88.652
7	5008.503	1.601	385.013	0.3250	1627.763	0.520	125.129
SUM----------(TRIP COMPOSITE)					4617.044	1.463	287.772

DILUTION FACTOR - 14.5/(CO2+0.5*CO+10.8*HC)

KAWASAKI 125F-6 RUN-6 8-24-72 B - COLD CYCLE K = 1.0000 W = 0.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	5072.	0.450	5.100	58.	1.342	6807.	0.604	77.	0.042	285.931	0.025	3.269
2 0-25	4976.	2.430	6.160	108.	1.137	5659.	2.763	122.	0.244	1380.890	0.674	29.971
3 30	3970.	0.170	9.660	137.	1.033	4102.	0.175	141.	0.118	484.063	0.020	16.704
4 30-15	4577.	1.260	6.360	89.	1.215	5561.	1.531	108.	0.062	344.814	0.094	6.704
5 15	4083.	0.200	7.290	70.	1.228	5017.	0.245	86.	0.050	250.869	0.012	4.300
6 15-30	3990.	0.540	8.750	288.	1.087	4340.	0.587	313.	0.455	1974.914	0.267	142.550
7 50-20	6715.	3.130	2.440	108.	1.288	8649.	4.031	139.	0.029	250.831	0.116	4.034
SUM----------(CYCLE COMPOSITE)										4972.315	1.211	207.535
CYCLE 2												
1 IDLE	6178.	2.310	4.250	81.	1.200	7417.	2.773	97.	0.042	311.528	0.116	4.084
2 0-25	5663.	1.320	7.770	214.	0.996	5645.	1.315	213.	0.244	1377.398	0.321	52.050
3 30	4440.	1.430	9.920	93.	0.939	4172.	1.343	87.	0.118	492.335	0.158	10.312
4 30-15	4712.	1.710	7.550	89.	1.074	5063.	1.837	95.	0.062	313.924	0.113	5.929
5 15	4293.	0.330	8.570	58.	1.084	4655.	0.357	62.	0.050	232.766	0.017	3.144
6 15-30	4191.	0.710	8.850	238.	1.055	4425.	0.749	251.	0.455	2013.659	0.341	114.352
7 50-20	6415.	3.340	2.510	115.	1.305	8373.	4.359	150.	0.029	242.839	0.126	4.353
SUM----------(CYCLE COMPOSITE)										4984.452	1.195	194.227
CYCLE 3												
1 IDLE	6178.	2.400	4.450	93.	1.176	7269.	2.824	109.	0.042	305.334	0.118	4.596
2 0-25	5767.	1.450	7.590	331.	0.997	5749.	1.445	330.	0.244	1402.952	0.352	80.523
3 30	4704.	1.520	9.920	105.	0.920	4327.	1.398	96.	0.118	510.684	0.165	11.399
4 30-15	4714.	1.910	6.870	103.	1.122	5292.	2.144	115.	0.062	328.108	0.132	7.169
5 15	4571.	0.760	8.570	70.	1.044	4772.	0.793	73.	0.050	238.644	0.039	3.654
6 15-30	4349.	0.830	8.910	318.	1.034	4497.	0.858	328.	0.455	2046.262	0.390	149.623
7 50-20	6463.	3.210	2.250	120.	1.338	8649.	4.295	160.	0.029	250.824	0.124	4.657
SUM----------(CYCLE COMPOSITE)										5082.810	1.324	261.622
CYCLE 4												
1 IDLE	6462.	2.680	4.280	105.	1.150	7437.	3.084	120.	0.042	312.355	0.129	5.075
2 0-25	6086.	1.670	7.560	264.	0.968	5895.	1.617	255.	0.244	1438.564	0.394	62.402
3 30	4971.	1.350	10.040	109.	0.901	4481.	1.217	98.	0.118	528.820	0.143	11.595
4 30-15	4789.	1.720	6.850	105.	1.125	5390.	1.936	118.	0.062	334.208	0.120	7.327
5 15	4871.	1.040	8.600	70.	1.008	4911.	1.048	70.	0.050	245.570	0.052	3.529
6 15-30	4591.	1.300	8.730	300.	1.011	4642.	1.314	303.	0.455	2112.465	0.598	138.039
7 50-20	6323.	3.280	2.200	122.	1.359	8593.	4.457	165.	0.029	249.213	0.129	4.808
SUM----------(CYCLE COMPOSITE)										5221.199	1.567	232.778
AVERAGE SUM OF CYCLES 1-4										5065.194	1.324	224.040

KAWASAKI 125F-6 RUN-6 8-24-72 B - COLD CYCLE K = 1.0000 W = 0.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	4671.	2.910	4.060	46.	1.373	6413.	3.995	63.	0.042	269.386	0.167	2.652
2 0-25	4498.	1.660	7.280	302.	1.118	5029.	1.856	337.	0.244	1227.183	0.452	82.394
3 30	3810.	1.440	9.920	97.	0.982	3744.	1.415	95.	0.118	441.816	0.166	11.248
4 30-15	4879.	1.680	6.980	98.	1.107	5404.	1.861	108.	0.062	335.099	0.115	6.730
5 15	4131.	1.510	8.180	62.	1.082	4471.	1.634	67.	0.050	223.564	0.081	3.355
6 15-30	4154.	1.480	8.680	224.	1.042	4331.	1.543	233.	0.455	1970.759	0.702	106.271
7 50-20	7081.	3.220	2.150	116.	1.271	9000.	4.092	147.	0.029	261.018	0.118	4.275
SUM----------(CYCLE COMPOSITE)										4728.828	1.805	216.928
CYCLE 7												
1 IDLE	6054.	2.970	4.040	105.	1.201	7276.	3.569	126.	0.042	305.627	0.149	5.300
2 0-25	5761.	1.570	7.450	261.	1.002	5778.	1.574	261.	0.244	1409.876	0.384	63.873
3 30	4888.	1.120	10.520	109.	0.886	4332.	0.992	96.	0.118	511.238	0.117	11.400
4 30-15	5869.	1.560	7.700	105.	0.978	5742.	1.526	102.	0.062	356.056	0.094	6.370
5 15	4971.	1.430	8.670	70.	0.982	4885.	1.405	68.	0.050	244.276	0.070	3.439
6 15-30	4848.	1.640	9.040	213.	0.960	4656.	1.575	204.	0.455	2118.774	0.716	93.089
7 50-20	7287.	3.500	3.040	117.	1.145	8346.	4.008	134.	0.029	242.037	0.116	3.886
SUM----------(CYCLE COMPOSITE)										5187.887	1.649	187.360
AVERAGE SUM OF CYCLES 6-7										4958.357	1.727	202.144

KAWASAKI 125F-6 RUN-6 8-24-72 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	4972.315	1.211	207.535	0.0875	435.077	0.106	18.159
2	4984.452	1.195	194.227	0.0875	436.139	0.104	16.994
3	5082.810	1.324	261.622	0.0875	444.745	0.115	22.891
4	5221.199	1.567	232.778	0.0875	456.854	0.137	20.368
6	4728.828	1.805	216.928	0.3250	1536.869	0.586	70.501
7	5187.887	1.649	187.360	0.3250	1686.063	0.535	60.892
SUM----------(TRIP COMPOSITE)					4995.750	1.586	209.808

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

SUZUKI RUN 2 B - COLD CYCLE K = 1.0000 W = 489.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	8462.	2.730	3.970	69.	1.001	8477.	2.734	69.	0.042	356.043	0.114	2.903
2 0-25	7047.	4.190	5.460	69.	0.956	6737.	4.006	65.	0.244	1643.985	0.977	16.096
3 30	6969.	5.650	4.720	69.	0.962	6704.	5.435	66.	0.118	791.158	0.641	7.833
4 30-15	8261.	4.080	3.490	81.	1.003	8288.	4.093	81.	0.062	513.887	0.253	5.038
5 15	7172.	3.090	6.180	81.	0.937	6721.	2.896	75.	0.050	336.098	0.144	3.795
6 15-30	6268.	5.630	5.880	81.	0.937	5877.	5.278	75.	0.455	2674.078	2.401	34.556
7 50-20	8186.	3.690	2.880	105.	1.068	8749.	3.944	112.	0.029	253.740	0.114	3.254
SUM----------(CYCLE COMPOSITE)										6568.992	4.648	73.479
CYCLE 2												
1 IDLE	7827.	2.910	4.480	117.	1.007	7887.	2.932	117.	0.042	331.289	0.123	4.952
2 0-25	6714.	3.410	6.790	117.	0.920	6182.	3.140	107.	0.244	1508.570	0.766	26.288
3 30	5429.	4.880	6.740	117.	0.963	5232.	4.703	112.	0.118	617.484	0.555	13.307
4 30-15	5677.	4.120	5.730	117.	1.041	5913.	4.291	121.	0.062	366.609	0.266	7.555
5 15	5949.	2.520	7.080	105.	0.982	5842.	2.474	103.	0.050	292.112	0.123	5.155
6 15-30	5427.	4.560	7.180	117.	0.946	5136.	4.315	110.	0.455	2336.940	1.963	50.381
7 50-20	7173.	4.010	3.950	117.	1.058	7590.	4.243	123.	0.029	220.134	0.123	3.590
SUM----------(CYCLE COMPOSITE)										5673.140	3.920	111.232
CYCLE 3												
1 IDLE	7581.	3.140	4.480	129.	1.018	7720.	3.197	131.	0.042	324.272	0.134	5.517
2 0-25	6615.	4.300	6.390	117.	0.924	6115.	3.975	108.	0.244	1492.194	0.969	26.392
3 30	5566.	5.800	6.530	117.	0.939	5226.	5.446	109.	0.118	616.751	0.642	12.964
4 30-15	5831.	4.010	5.810	117.	1.027	5991.	4.120	120.	0.062	371.449	0.255	7.453
5 15	5739.	2.910	7.040	117.	0.986	5663.	2.871	115.	0.050	283.178	0.143	5.773
6 15-30	5363.	5.150	6.900	117.	0.949	5093.	4.891	111.	0.455	2317.567	2.225	50.560
7 50-20	6724.	4.210	4.200	117.	1.068	7186.	4.499	125.	0.029	208.407	0.130	3.626
SUM----------(CYCLE COMPOSITE)										5613.820	4.502	112.287
CYCLE 4												
1 IDLE	7301.	3.180	4.480	153.	1.039	7586.	3.304	158.	0.042	318.615	0.138	6.676
2 0-25	6008.	3.940	6.480	117.	0.970	5831.	3.824	113.	0.244	1422.907	0.933	27.709
3 30	5704.	5.530	6.650	153.	0.930	5310.	5.148	142.	0.118	626.603	0.607	16.807
4 30-15	5906.	4.090	5.670	153.	1.028	6076.	4.207	157.	0.062	376.734	0.260	9.759
5 15	5756.	3.170	6.920	117.	0.984	5669.	3.122	115.	0.050	283.470	0.156	5.761
6 15-30	5008.	5.290	6.810	117.	0.975	4885.	5.160	114.	0.455	2222.892	2.348	51.932
7 50-20	5490.	4.160	4.460	117.	1.162	6384.	4.837	136.	0.029	185.139	0.140	3.945
SUM----------(CYCLE COMPOSITE)										5436.363	4.584	122.594
AVERAGE SUM OF CYCLES 1-4										5823.079	4.414	104.898

PETRO-CHEM COMPUTING INC

SUZUKI RUN 2 B - COLD CYCLE K = 1.0000 W = 489.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	6969.	3.710	5.360	93.	0.983	6854.	3.649	91.	0.042	287.902	0.153	3.842
2 0-25	6334.	5.330	6.890	93.	0.884	5601.	4.713	82.	0.244	1366.801	1.150	20.068
3 30	5531.	5.130	7.110	117.	0.926	5125.	4.753	108.	0.118	604.757	0.560	12.792
4 30-15	5157.	4.030	6.450	117.	1.033	5328.	4.163	120.	0.062	330.337	0.258	7.494
5 15	5635.	3.250	6.830	93.	0.997	5619.	3.240	92.	0.050	280.959	0.162	4.636
6 15-30	5397.	5.010	6.440	105.	0.981	5296.	4.917	103.	0.455	2410.131	2.237	46.889
7 50-20	6569.	4.270	4.230	129.	1.077	7076.	4.600	138.	0.029	205.227	0.133	4.030
SUM----------(CYCLE COMPOSITE)										5486.118	4.655	99.754
CYCLE 7												
1 IDLE	7134.	3.370	4.560	141.	1.039	7415.	3.502	146.	0.042	311.447	0.147	6.155
2 0-25	6598.	4.520	5.690	144.	0.961	6345.	4.347	138.	0.244	1548.419	1.060	33.793
3 30	5983.	5.910	6.100	141.	0.934	5590.	5.522	131.	0.118	659.737	0.651	15.547
4 30-15	6232.	4.150	5.170	129.	1.037	6465.	4.305	133.	0.062	400.883	0.266	8.298
5 15	5773.	3.520	6.860	117.	0.976	5635.	3.435	114.	0.050	281.754	0.171	5.710
6 15-30	5515.	5.420	6.630	117.	0.947	5227.	5.137	110.	0.455	2378.709	2.337	50.464
7 50-20	6947.	3.750	4.160	125.	1.071	7440.	4.016	133.	0.029	215.782	0.116	3.882
SUM----------(CYCLE COMPOSITE)										5796.734	4.752	123.852
AVERAGE SUM OF CYCLES 6-7										5641.426	4.703	111.803

SUZUKI RUN 2 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	6568.992	4.648	73.479	0.0875	574.786	0.406	6.429
2	5673.140	3.920	111.232	0.0875	496.399	0.343	9.732
3	5613.820	4.502	112.287	0.0875	491.209	0.393	9.825
4	5436.363	4.584	122.594	0.0875	475.681	0.401	10.726
6	5486.118	4.655	99.754	0.3250	1782.988	1.512	32.420
7	5796.734	4.752	123.852	0.3250	1883.938	1.544	40.252
SUM----------(TRIP COMPOSITE)					5705.004	4.602	109.386

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING INC

SUZUKI	RUN-3					B - COLD CYCLE				K = 1.0000	W =	489.
MODE	CONCENTRATION HC	CO	AS CO2	MEASURED NO(K)	DILUTION FACTOR	A D J U S T E D HC	CO	NO(K)	WEIGHTING FACTOR	W E I G H T E D HC	CO	NO(K)
CYCLE 1												
1 IDLE	7676.	2.720	5.050	57.	0.986	7571.	2.682	56.	0.042	318.003	0.112	2.361
2 0-25	6546.	2.320	5.570	57.	1.050	6878.	2.437	59.	0.244	1678.281	0.594	14.613
3 30	6966.	3.400	4.880	57.	1.028	7161.	3.495	58.	0.118	845.110	0.412	6.915
4 30-15	7614.	3.420	4.980	61.	0.972	7403.	3.325	59.	0.062	458.990	0.206	3.677
5 15	6427.	2.650	7.080	69.	0.944	6072.	2.503	65.	0.050	303.631	0.125	3.259
6 15-30	5618.	2.600	7.610	69.	0.968	5438.	2.517	66.	0.455	2474.705	1.145	30.394
7 50-20	7842.	3.340	4.260	72.	1.006	7896.	3.363	72.	0.029	229.007	0.097	2.102
SUM----------(CYCLE COMPOSITE)----------										6307.731	2.694	63.324
CYCLE 2												
1 IDLE	8082.	2.950	4.800	93.	0.966	7810.	2.850	89.	0.042	328.051	0.119	3.774
2 0-25	6695.	2.910	5.040	93.	1.056	7072.	3.074	98.	0.244	1725.746	0.750	23.972
3 30	5583.	3.420	6.200	93.	1.040	5807.	3.557	96.	0.118	685.276	0.419	11.415
4 30-15	6256.	3.370	6.360	93.	0.979	6128.	3.301	91.	0.062	379.971	0.204	5.648
5 15	6053.	3.000	6.830	93.	0.975	5903.	2.925	90.	0.050	295.174	0.146	4.535
6 15-30	5474.	2.750	7.560	93.	0.976	5346.	2.685	90.	0.455	2432.471	1.222	41.326
7 50-20	7077.	3.320	4.520	105.	1.048	7423.	3.482	110.	0.029	215.282	0.100	3.194
SUM----------(CYCLE COMPOSITE)----------										6061.974	2.963	93.866
CYCLE 3												
1 IDLE	7751.	3.040	4.720	117.	0.992	7692.	3.016	116.	0.042	323.067	0.126	4.876
2 0-25	6152.	3.020	5.270	117.	1.080	6645.	3.262	126.	0.244	1621.388	0.795	30.835
3 30	5480.	3.400	6.410	105.	1.033	5664.	3.514	108.	0.118	668.378	0.414	12.806
4 30-15	5770.	3.370	6.870	105.	0.980	5658.	3.304	102.	0.062	350.806	0.204	6.383
5 15	5756.	3.090	6.090	93.	1.046	6025.	3.234	97.	0.050	301.274	0.161	4.867
6 15-30	5395.	2.850	7.340	93.	0.993	5361.	2.832	92.	0.455	2439.315	1.288	42.049
7 50-20	7077.	3.370	4.440	105.	1.053	7453.	3.549	110.	0.029	216.142	0.102	3.206
SUM----------(CYCLE COMPOSITE)----------										5920.371	3.095	105.026
CYCLE 4												
1 IDLE	7581.	3.040	4.690	117.	1.007	7634.	3.061	117.	0.042	320.669	0.128	4.948
2 0-25	6882.	3.010	4.870	117.	1.050	7227.	3.160	122.	0.244	1763.419	0.771	29.979
3 30	5635.	3.500	6.470	105.	1.013	5711.	3.547	106.	0.118	673.956	0.418	12.558
4 30-15	5946.	2.810	6.980	117.	0.979	5822.	2.751	114.	0.062	361.016	0.170	7.103
5 15	5791.	3.230	6.120	105.	1.036	6002.	3.347	108.	0.050	300.120	0.167	5.441
6 15-30	5421.	2.690	7.330	93.	0.997	5409.	2.684	92.	0.455	2461.516	1.221	42.228
7 50-20	6819.	3.340	4.330	105.	1.084	7398.	3.623	113.	0.029	214.552	0.105	3.303
SUM----------(CYCLE COMPOSITE)----------										6095.250	2.983	105.564
AVERAGE SUM OF CYCLES 1-4 ----------										6096.332	2.934	91.945

PETRO-CHEM COMPUTING, INC

SUZUKI	RUN-3					B - COLD CYCLE				K = 1.0000	W =	489.
MODE	CONCENTRATION HC	CO	AS CO2	MEASURED NO(K)	DILUTION FACTOR	A D J U S T E D HC	CO	NO(K)	WEIGHTING FACTOR	W E I G H T E D HC	CO	NO(K)
CYCLE 6												
1 IDLE	5548.	3.140	4.720	46.	1.180	6549.	3.707	54.	0.042	275.099	0.155	2.280
2 0-25	4461.	3.040	4.460	57.	1.342	5990.	4.082	76.	0.244	1461.677	0.996	18.676
3 30	4836.	3.520	6.800	69.	1.052	5087.	3.703	72.	0.118	600.338	0.436	8.565
4 30-15	5450.	3.460	6.990	69.	0.992	5410.	3.434	68.	0.062	335.447	0.212	4.246
5 15	5309.	3.180	6.680	69.	1.035	5497.	3.292	71.	0.050	274.857	0.164	3.572
6 15-30	5079.	2.780	7.320	69.	1.021	5188.	2.839	70.	0.455	2360.545	1.292	32.068
7 50-20	7390.	3.460	3.630	93.	1.086	8031.	3.760	101.	0.029	232.924	0.109	2.931
SUM----------(CYCLE COMPOSITE)----------										5540.891	3.367	72.342
CYCLE 7												
1 IDLE	7525.	3.140	4.640	105.	1.011	7610.	3.175	106.	0.042	319.643	0.133	4.460
2 0-25	6635.	3.120	4.260	93.	1.116	7408.	3.483	103.	0.244	1807.715	0.850	25.337
3 30	5825.	3.670	5.850	105.	1.037	6043.	3.807	108.	0.118	713.120	0.449	12.854
4 30-15	5958.	3.470	6.890	105.	0.962	5736.	3.341	101.	0.062	355.668	0.207	6.268
5 15	5739.	3.040	5.430	81.	1.102	6329.	3.352	89.	0.050	316.453	0.167	4.466
6 15-30	5440.	2.880	7.250	69.	0.995	5415.	2.867	68.	0.455	2464.119	1.304	31.254
7 50-20	6726.	3.360	4.280	93.	1.096	7374.	3.684	101.	0.029	213.873	0.106	2.957
SUM----------(CYCLE COMPOSITE)----------										6190.595	3.218	87.598
AVERAGE SUM OF CYCLES 6-7 ----------										5865.743	3.293	79.970

SUZUKI	RUN-3			B - COLD CYCLE		
CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	W E I G H T E D HC	CO	NO(K)
1	6307.731	2.694	63.324	0.0875	551.926	0.235	5.540
2	6061.974	2.963	93.866	0.0875	530.422	0.259	8.213
3	5920.371	3.095	105.026	0.0875	518.032	0.270	9.189
4	6095.250	2.983	105.564	0.0875	533.334	0.261	9.236
6	5540.891	3.367	72.342	0.3250	1800.789	1.094	23.511
7	6190.595	3.218	87.598	0.3250	2011.943	1.046	28.469
SUM----------(TRIP COMPOSITE)----------					5946.449	3.167	84.161

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING, INC

SUZUKI T250 RUN-4 - COLD CYCLE K = 1.0000 W = 489.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	8526.	2.970	3.500	55.	1.021	8710.	3.034	56.	0.042	365.835	0.127	2.359
2 0-25	8366.	3.200	4.920	51.	0.932	7798.	2.982	47.	0.244	1902.820	0.727	11.599
3 30	7179.	6.110	4.540	60.	0.944	6782.	5.772	56.	0.118	800.300	0.681	6.688
4 30-15	6756.	5.270	4.490	58.	1.005	6792.	5.298	58.	0.062	421.152	0.328	3.615
5 15	8606.	4.120	5.020	64.	0.885	7620.	3.648	56.	0.050	381.041	0.182	2.833
6 15-30	7586.	4.730	5.610	64.	0.896	6803.	4.242	57.	0.455	3095.559	1.930	26.115
7 50-20	8831.	3.800	2.360	77.	1.050	9280.	3.993	80.	0.029	269.138	0.115	2.346
SUM----------(CYCLE COMPOSITE)										7235.848	4.093	55.560
CYCLE 2												
1 IDLE	12016.	3.750	3.050	103.	0.809	9732.	3.037	83.	0.042	408.760	0.127	3.503
2 0-25	10118.	4.600	4.160	87.	0.833	8437.	3.836	72.	0.244	2058.812	0.936	17.702
3 30	8865.	6.020	3.470	86.	0.903	8006.	5.437	77.	0.118	944.800	0.641	9.165
4 30-15	8556.	6.020	3.590	81.	0.915	7831.	5.510	74.	0.062	485.581	0.341	4.597
5 15	8925.	4.160	5.050	77.	0.864	7717.	3.597	66.	0.050	385.868	0.179	3.329
6 15-30	8017.	5.890	5.570	77.	0.844	6769.	4.973	65.	0.455	3079.895	2.262	29.581
7 50-20	8439.	3.710	2.900	87.	1.045	8822.	3.878	90.	0.029	255.863	0.112	2.637
SUM----------(CYCLE COMPOSITE)										7619.582	4.601	70.517
CYCLE 3												
1 IDLE	12711.	3.560	3.100	103.	0.779	9904.	2.774	80.	0.042	416.006	0.116	3.370
2 0-25	10951.	4.760	4.200	95.	0.787	8626.	3.749	74.	0.244	2104.876	0.914	18.259
3 30	8986.	6.640	4.080	90.	0.847	7617.	5.628	76.	0.118	898.868	0.664	9.002
4 30-15	8674.	6.160	3.940	90.	0.884	7674.	5.450	79.	0.062	475.833	0.337	4.937
5 15	9977.	4.400	4.870	77.	0.812	8106.	3.575	62.	0.050	405.338	0.178	3.128
6 15-30	8584.	5.650	5.060	77.	0.845	7255.	4.775	65.	0.455	3301.111	2.172	29.611
7 50-20	8613.	4.230	3.090	89.	0.999	8608.	4.227	88.	0.029	249.655	0.122	2.579
SUM----------(CYCLE COMPOSITE)										7851.691	4.507	70.890
CYCLE 4												
1 IDLE	10039.	3.700	3.200	103.	0.912	9159.	3.375	93.	0.042	384.703	0.141	3.947
2 0-25	9644.	5.000	3.810	91.	0.866	8360.	4.334	78.	0.244	2040.024	1.057	19.249
3 30	8506.	6.620	4.190	90.	0.868	7391.	5.752	78.	0.118	872.189	0.678	9.228
4 30-15	8339.	6.300	4.180	90.	0.887	7401.	5.591	79.	0.062	458.907	0.346	4.952
5 15	9394.	4.360	5.010	90.	0.836	7857.	3.646	75.	0.050	392.872	0.182	3.763
6 15-30	8219.	5.740	5.650	90.	0.833	6850.	4.784	75.	0.455	3116.994	2.176	34.131
7 50-20	8675.	4.350	2.760	90.	1.013	8793.	4.409	91.	0.029	255.022	0.127	2.645
SUM----------(CYCLE COMPOSITE)										7520.713	4.712	77.919
AVERAGE SUM OF CYCLES 1-4										7556.958	4.478	68.721

SUZUKI T250 RUN-4 - COLD CYCLE K - 1.0000 W = 489.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	5161.	4.020	3.230	103.	1.340	6920.	5.390	138.	0.042	290.649	0.226	5.800
2 0-25	5329.	5.140	4.130	90.	1.164	6203.	5.983	104.	0.244	1513.730	1.460	25.564
3 30	5281.	7.180	4.450	103.	1.055	5571.	7.575	108.	0.118	657.460	0.893	12.823
4 30-15	5303.	6.000	4.770	103.	1.074	5696.	6.445	110.	0.062	353.212	0.399	6.860
5 15	6957.	4.540	5.050	103.	0.977	6800.	4.437	100.	0.050	340.027	0.221	5.034
6 15-30	6210.	5.500	5.880	98.	0.945	5871.	5.199	92.	0.455	2671.383	2.365	42.157
7 50-20	7490.	4.530	2.450	95.	1.132	8481.	5.129	107.	0.029	245.977	0.148	3.119
SUM----------(CYCLE COMPOSITE)										6072.442	5.716	101.360
CYCLE 7												
1 IDLE	9046.	3.890	3.130	117.	0.976	8835.	3.799	114.	0.042	371.110	0.159	4.799
2 0-25	8793.	5.160	4.460	107.	0.876	7710.	4.524	93.	0.244	1881.277	1.103	22.892
3 30	7747.	7.150	4.130	103.	0.902	6989.	6.450	92.	0.118	824.745	0.761	10.965
4 30-15	7825.	6.140	4.130	117.	0.926	7249.	5.688	108.	0.062	449.471	0.352	6.720
5 15	8885.	4.790	4.600	103.	0.873	7765.	4.186	90.	0.050	388.264	0.209	4.500
6 15-30	7962.	5.880	5.220	103.	0.865	6888.	5.087	89.	0.455	3134.400	2.314	40.548
7 50-20	8527.	4.740	2.280	98.	1.046	8921.	4.959	102.	0.029	258.717	0.143	2.973
SUM----------(CYCLE COMPOSITE)										7307.987	5.045	93.401
AVERAGE SUM OF CYCLES 6-7										6690.215	5.380	97.380

SUZUKI T250 RUN-4 - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	7235.848	4.093	55.560	0.0875	633.136	0.358	4.861
2	7619.582	4.601	70.517	0.0875	666.713	0.402	6.170
3	7851.691	4.507	70.890	0.0875	687.022	0.394	6.202
4	7520.713	4.712	77.919	0.0875	658.062	0.412	6.817
6	6072.442	5.716	101.360	0.3250	1973.543	1.857	32.942
7	7307.987	5.045	93.401	0.3250	2375.096	1.639	30.355
SUM----------(TRIP COMPOSITE)					6993.575	5.065	87.350

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

SUZUKI T250 RUN-5 S - COLD CYCLE K = 1.0000 W = 489.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	8805.	2.610	3.130	77.	1.039	9155.	2.713	80.	0.042	384.544	0.113	3.362
2 0-25	9011.	2.870	3.870	77.	0.964	8689.	2.767	74.	0.244	2120.181	0.675	18.117
3 30	8152.	5.980	3.300	77.	0.960	7831.	5.744	73.	0.118	924.070	0.677	8.728
4 30-15	7957.	5.610	3.270	77.	0.988	7865.	5.545	76.	0.062	487.664	0.343	4.719
5 15	9712.	3.780	4.450	77.	0.861	8367.	3.256	66.	0.050	418.397	0.162	3.317
6 15-30	7840.	4.840	5.040	77.	0.910	7137.	4.406	70.	0.455	3247.551	2.004	31.895
7 50-20	7440.	4.000	2.690	88.	1.139	8477.	4.557	100.	0.029	245.852	0.132	2.907
SUM----------(CYCLE COMPOSITE)										7828.263	4.110	73.048
CYCLE 2												
1 IDLE	8387.	3.190	2.790	81.	1.078	9046.	3.440	87.	0.042	379.952	0.144	3.669
2 0-25	8057.	3.590	3.630	77.	1.026	8269.	3.684	79.	0.244	2017.877	0.899	19.284
3 30	6993.	5.960	3.560	77.	1.028	7195.	6.132	79.	0.118	849.038	0.723	9.348
4 30-15	6760.	5.100	3.680	77.	1.071	7244.	5.465	82.	0.062	449.141	0.338	5.115
5 15	7518.	3.730	4.840	77.	0.978	7353.	3.648	75.	0.050	367.673	0.182	3.765
6 15-30	6561.	4.180	5.960	77.	0.957	6285.	4.004	73.	0.455	2859.840	1.821	33.563
7 50-20	6452.	4.240	3.370	89.	1.163	7509.	4.934	103.	0.029	217.774	0.143	3.004
SUM----------(CYCLE COMPOSITE)										7141.296	4.253	77.751
CYCLE 3												
1 IDLE	6085.	2.570	3.130	77.	1.319	8030.	3.391	101.	0.042	337.292	0.142	4.268
2 0-25	5983.	3.420	3.900	77.	1.201	7186.	4.107	92.	0.244	1753.519	1.002	22.567
3 30	5419.	5.490	4.840	90.	1.079	5847.	5.924	97.	0.118	690.001	0.699	11.459
4 30-15	5355.	5.430	4.420	89.	1.122	6010.	6.094	99.	0.062	372.657	0.377	6.193
5 15	5610.	3.440	4.910	77.	1.142	6410.	3.931	87.	0.050	320.538	0.196	4.399
6 15-30	5161.	3.750	6.030	77.	1.075	5551.	4.034	82.	0.455	2526.151	1.835	37.689
7 50-20	6092.	4.420	3.160	77.	1.213	7392.	5.363	93.	0.029	214.378	0.155	2.709
SUM----------(CYCLE COMPOSITE)										6214.540	4.409	89.287
CYCLE 4												
1 IDLE	5505.	2.280	3.020	77.	1.434	7898.	3.271	110.	0.042	331.757	0.137	4.640
2 0-25	5409.	2.910	4.090	77.	1.273	6887.	3.705	98.	0.244	1680.645	0.904	23.924
3 30	4991.	5.190	5.500	103.	1.075	5366.	5.580	110.	0.118	633.253	0.658	13.068
4 30-15	4575.	4.900	5.890	89.	1.091	4994.	5.349	97.	0.062	309.684	0.331	6.024
5 15	4923.	2.820	5.750	77.	1.162	5721.	3.277	89.	0.050	286.064	0.163	4.474
6 15-30	4679.	4.010	6.040	77.	1.107	5179.	4.439	85.	0.455	2356.768	2.019	38.784
7 50-20	5819.	4.870	3.350	84.	1.201	6990.	5.850	100.	0.029	202.732	0.169	2.926
SUM----------(CYCLE COMPOSITE)										5800.906	4.385	93.843
AVERAGE SUM OF CYCLES 1-4										6746.251	4.289	83.482

PETRO CHEM COMPUTING INC

SUZUKI T250 RUN-5 S - COLD CYCLE K = 1.0000 W = 489.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	3487.	2.440	3.040	77.	1.806	6299.	4.408	139.	0.042	264.589	0.185	5.842
2 0-25	3926.	3.700	4.910	77.	1.318	5175.	4.877	101.	0.244	1262.735	1.190	24.765
3 30	4291.	5.470	5.800	103.	1.101	4724.	6.022	113.	0.118	557.502	0.710	13.382
4 30-15	4171.	5.010	5.510	89.	1.158	4830.	5.802	103.	0.062	299.506	0.359	6.390
5 15	4428.	2.820	6.050	77.	1.184	5244.	3.340	91.	0.050	262.231	0.167	4.560
6 15-30	4562.	3.960	6.000	77.	1.123	5125.	4.448	86.	0.455	2331.904	2.024	39.359
7 50-20	5920.	4.030	2.660	90.	1.310	7755.	5.279	117.	0.029	224.902	0.153	3.419
SUM----------(CYCLE COMPOSITE)										5203.371	4.789	97.719
CYCLE 7												
1 IDLE	5350.	2.080	3.060	77.	1.467	7853.	3.053	113.	0.042	329.839	0.128	4.747
2 0-25	4861.	3.170	3.460	80.	1.408	6846.	4.464	112.	0.244	1670.560	1.089	27.493
3 30	4991.	5.360	5.500	103.	1.068	5332.	5.727	110.	0.118	629.287	0.675	12.986
4 30-15	4839.	5.120	5.340	99.	1.104	5345.	5.655	109.	0.062	331.420	0.350	6.780
5 15	5123.	3.010	6.310	77.	1.086	5565.	3.269	83.	0.050	278.260	0.163	4.182
6 15-30	4779.	4.180	6.050	77.	1.090	5209.	4.556	83.	0.455	2370.400	2.073	38.192
7 50-20	5967.	3.090	3.090	86.	1.308	7809.	4.044	112.	0.029	226.468	0.117	3.263
SUM----------(CYCLE COMPOSITE)										5836.235	4.598	97.646
AVERAGE SUM OF CYCLES 6-7										5519.803	4.694	97.683

SUZUKI T250 RUN-5 S - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	7828.263	4.110	73.048	0.0875	684.973	0.359	6.391
2	7141.296	4.253	77.751	0.0875	624.863	0.372	6.803
3	6214.540	4.409	89.287	0.0875	543.772	0.385	7.812
4	5800.906	4.385	93.843	0.0875	507.579	0.383	8.211
6	5203.371	4.789	97.719	0.3250	1691.095	1.556	31.758
7	5836.235	4.598	97.646	0.3250	1896.776	1.494	31.735
SUM----------(TRIP COMPOSITE)					5949.060	4.552	92.712

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO CHEM COMPUTING, INC

SUZUKI T250 RUN-6 S - COLD CYCLE K = 1.0000 W 489.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 1												
1 IDLE	6845.	1.990	5.750	51.	1.025	7020.	2.041	52.	0.042	294.859	0.085	2.196
2 0-25	6740.	9.930	6.690	58.	0.765	5161.	7.604	44.	0.244	1259.420	1.855	10.837
3 30	5557.	6.020	5.240	77.	1.017	5653.	6.124	78.	0.118	667.156	0.722	9.244
4 30-15	5248.	5.310	6.050	77.	1.008	5294.	5.356	77.	0.062	328.254	0.332	4.816
5 15	5908.	1.910	7.560	51.	0.973	5751.	1.859	49.	0.050	287.553	0.092	2.462
6 15-30	5331.	3.160	7.960	64.	0.947	5053.	2.995	60.	0.455	2299.154	1.362	27.601
7 50-20	5874.	4.640	4.240	85.	1.123	6600.	5.213	95.	0.029	191.416	0.151	2.769
SUM-----------(CYCLE COMPOSITE)-----										5327.816	4.603	59.949
CYCLE 2												
1 IDLE	6956.	3.380	4.840	77.	1.032	7182.	3.490	79.	0.042	301.670	0.146	3.339
2 0-25	6864.	3.500	5.810	77.	0.968	6647.	3.389	74.	0.244	1621.895	0.827	18.194
3 30	5523.	5.400	6.910	90.	0.930	5141.	5.027	83.	0.118	606.738	0.593	9.887
4 30-15	5140.	5.450	6.820	84.	0.960	4937.	5.234	80.	0.062	306.094	0.324	5.002
5 15	5715.	3.070	7.190	64.	0.973	5562.	2.988	62.	0.050	278.131	0.149	3.114
6 15-30	5318.	4.360	7.440	67.	0.943	5019.	4.114	63.	0.455	2283.701	1.872	28.771
7 50-20	5700.	4.600	4.520	92.	1.117	6369.	5.140	102.	0.029	184.714	0.149	2.981
SUM-----------(CYCLE COMPOSITE)-----										5582.944	4.062	71.290
CYCLE 3												
1 IDLE	6735.	3.330	5.270	77.	1.020	6873.	3.398	78.	0.042	288.667	0.142	3.300
2 0-25	6681.	3.830	6.040	81.	0.955	6385.	3.660	77.	0.244	1558.116	0.893	18.890
3 30	5623.	5.500	7.000	90.	0.916	5152.	5.040	82.	0.118	608.042	0.594	9.732
4 30-15	5126.	5.090	7.600	99.	0.924	4739.	4.706	91.	0.062	293.874	0.291	5.675
5 15	5627.	3.520	7.180	64.	0.965	5433.	3.398	61.	0.050	271.660	0.169	3.089
6 15-30	5152.	4.400	7.630	72.	0.941	4852.	4.144	67.	0.455	2208.000	1.885	30.357
7 50-20	6391.	4.910	3.680	79.	1.112	7108.	5.460	87.	0.029	206.133	0.158	2.548
SUM-----------(CYCLE COMPOSITE)-----										5434.495	4.136	74.093
CYCLE 4												
1 IDLF	6790.	3.660	5.390	77.	0.996	6765.	3.646	76.	0.042	284.137	0.153	3.222
2 0-25	6745.	4.210	6.100	77.	0.936	6314.	3.941	72.	0.244	1540.634	0.961	17.587
3 30	5609.	5.270	7.000	90.	0.923	5182.	4.869	83.	0.118	611.557	0.574	9.812
4 30-15	5239.	5.470	7.530	77.	0.910	4770.	4.981	70.	0.062	295.787	0.308	4.347
5 15	5837.	3.820	7.490	77.	0.923	5389.	3.527	71.	0.050	269.475	0.176	3.554
6 15-30	5438.	4.960	7.500	77.	0.914	4973.	4.536	70.	0.455	2263.111	2.064	32.044
7 50-20	6507.	4.600	3.750	87.	1.108	7214.	5.100	96.	0.029	209.228	0.147	2.797
SUM-----------(CYCLE COMPOSITE)-----										5473.931	4.386	73.367
AVERAGE SUM OF CYCLES 1-4 -----										5454.797	4.297	69.675

SUZUKI T250 RUN-6 S - COLD CYCLE K 1.0000 W 489.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 6												
1 IDLE	3534.	3.290	5.750	77.	1.293	4570.	4.254	99.	0.042	191.960	0.178	4.182
2 0-25	4031.	4.350	5.880	77.	1.168	4710.	5.083	89.	0.244	1149.349	1.240	21.954
3 30	3950.	5.430	7.180	90.	1.023	4044.	5.559	92.	0.118	477.257	0.656	10.874
4 30-15	3748.	4.970	7.930	103.	1.002	3757.	4.982	103.	0.062	232.973	0.308	6.402
5 15	4688.	3.840	7.330	77.	1.013	4749.	3.890	78.	0.050	237.461	0.194	3.900
6 15-30	4489.	5.220	7.330	77.	0.980	4401.	5.118	75.	0.455	2002.700	2.328	34.352
7 50-20	6043.	5.360	3.600	94.	1.132	6842.	6.068	106.	0.029	198.422	0.175	3.086
SUM-----------(CYCLE COMPOSITE)-----										4490.125	5.083	84.753
CYCLE 7												
1 IDLE	6571.	3.890	5.160	90.	1.021	6709.	3.971	91.	0.042	281.779	0.166	3.859
2 0-25	6539.	4.910	5.970	90.	0.936	6122.	4.597	84.	0.244	1493.820	1.121	20.560
3 30	5557.	4.770	8.140	103.	0.877	4875.	4.185	90.	0.118	575.317	0.493	10.663
4 30-15	5153.	4.460	6.980	94.	0.981	5057.	4.376	92.	0.062	313.534	0.271	5.719
5 15	5714.	3.700	7.560	77.	0.930	5317.	3.443	71.	0.050	265.876	0.172	3.582
6 15-30	5465.	6.480	7.130	82.	0.891	4869.	5.774	73.	0.455	2215.762	2.627	33.246
7 50-20	6144.	4.350	4.410	106.	1.096	6738.	4.770	116.	0.029	195.419	0.138	3.371
SUM-----------(CYCLE COMPOSITE)-----										5341.511	4.991	81.003
AVERAGE SUM OF CYCLES 6-7 -----										4915.818	5.037	82.878

SUZUKI T250 RUN-6 S - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
1	5327.816	4.603	59.949	0.0875	466.183	0.402	5.245
2	5582.944	4.062	71.290	0.0875	488.507	0.355	6.237
3	5434.495	4.136	74.093	0.0875	475.518	0.361	6.483
4	5473.931	4.386	73.367	0.0875	478.969	0.383	6.419
6	4490.125	5.083	84.753	0.3250	1459.290	1.652	27.544
7	5341.511	4.991	81.003	0.3250	1735.991	1.622	26.326
SUM-----------(TRIP COMPOSITE)-----					5104.460	4.778	78.257

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING INC

TRIUMPH RUN 1 B - COLD CYCLE K = 1.0000 W = 567.

MODE	CONCENTRATION HC	AS CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 1												
1 IDLE	1063.	7.480	6.950	153.	1.224	1302.	9.161	187.	0.042	54.685	0.384	7.870
2 0-25	720.	5.220	9.520	532.	1.123	808.	5.863	597.	0.244	197.353	1.430	145.822
3 30	416.	7.760	9.300	227.	1.063	442.	8.255	241.	0.118	52.224	0.974	28.497
4 30-15	4781.	5.700	6.090	203.	1.029	4902.	5.869	209.	0.062	303.946	0.363	12.959
5 15	730.	8.620	8.080	198.	1.100	803.	9.484	217.	0.050	40.160	0.474	10.892
6 15-30	672.	6.310	9.890	610.	1.052	707.	6.644	642.	0.455	321.951	3.023	292.247
7 50-20	7521.	3.520	4.740	485.	0.991	7457.	3.490	480.	0.029	216.279	0.101	13.946
SUM-----------(CYCLE COMPOSITE)										1186.600	6.752	512.237
CYCLE 2												
1 IDLE	3283.	8.830	4.880	215.	1.129	3707.	9.971	242.	0.042	155.704	0.418	10.196
2 0-25	1436.	7.740	8.610	598.	1.033	1484.	7.998	617.	0.244	362.099	1.951	150.790
3 30	1009.	8.910	8.530	239.	1.030	1039.	9.179	246.	0.118	122.659	1.083	29.054
4 30-15	5904.	6.520	5.300	231.	0.970	5731.	6.329	224.	0.062	355.355	0.392	13.903
5 15	1105.	9.540	7.580	210.	1.070	1183.	10.213	224.	0.050	59.152	0.510	11.241
6 15-30	937.	6.790	9.580	724.	1.036	971.	7.039	750.	0.455	441.972	3.202	341.503
7 50-20	7634.	4.020	4.640	448.	0.973	7431.	3.913	436.	0.029	215.519	0.113	12.647
SUM-----------(CYCLE COMPOSITE)										1712.462	7.673	569.337
CYCLE 3												
1 IDLE	3852.	9.090	4.880	239.	1.067	4111.	9.702	255.	0.042	172.678	0.407	10.713
2 0-25	1752.	7.620	9.030	551.	0.984	1724.	7.499	542.	0.244	420.751	1.829	132.325
3 30	937.	9.660	8.110	264.	1.039	973.	10.039	274.	0.118	114.909	1.184	32.375
4 30-15	5361.	6.920	4.990	242.	1.018	5458.	7.046	246.	0.062	338.453	0.436	15.278
5 15	1317.	9.540	7.390	215.	1.067	1405.	10.184	229.	0.050	70.298	0.509	11.476
6 15-30	1024.	8.170	8.810	433.	1.035	1060.	8.461	448.	0.455	482.528	3.849	204.037
7 50-20	7042.	5.630	3.710	283.	1.026	7226.	5.777	290.	0.029	209.560	0.167	8.421
SUM-----------(CYCLE COMPOSITE)										1809.180	8.385	414.628
CYCLE 4												
1 IDLE	2335.	9.270	6.470	239.	1.064	2484.	9.864	254.	0.042	104.354	0.414	10.681
2 0-25	1537.	8.330	7.480	440.	1.089	1675.	9.078	479.	0.244	408.712	2.215	117.002
3 30	1063.	9.700	7.750	239.	1.054	1121.	10.230	252.	0.118	132.294	1.207	29.744
4 30-15	4777.	7.690	5.500	239.	0.999	4775.	7.687	238.	0.062	296.089	0.476	14.813
5 15	1601.	9.900	7.230	226.	1.042	1669.	10.320	235.	0.050	83.450	0.516	11.780
6 15-30	1147.	8.940	8.280	399.	1.036	1188.	9.266	413.	0.455	540.958	4.216	188.179
7 50-20	8199.	5.190	3.540	290.	0.967	7931.	5.020	280.	0.029	229.999	0.145	8.135
SUM-----------(CYCLE COMPOSITE)										1795.859	9.191	380.337
AVERAGE SUM OF CYCLES 1-4										1626.025	8.000	469.135

PETRO-CHEM COMPUTING INC

TRIUMPH RUN 1 B - COLD CYCLE K = 1.0000 W = 567.

MODE	CONCENTRATION HC	AS CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 6												
1 IDLE	2333.	9.780	5.890	165.	1.090	2543.	10.662	179.	0.042	106.829	0.447	7.555
2 0-25	1130.	8.430	8.500	425.	1.040	1175.	8.771	442.	0.244	286.890	2.140	107.901
3 30	647.	9.900	8.080	202.	1.056	683.	10.456	213.	0.118	80.634	1.233	25.175
4 30-15	4875.	6.890	4.960	192.	1.060	5170.	7.308	203.	0.062	320.601	0.453	12.626
5 15	1316.	10.530	6.950	177.	1.063	1399.	11.196	188.	0.050	69.967	0.559	9.410
6 15-30	892.	9.330	8.200	386.	1.048	935.	9.783	404.	0.455	425.572	4.451	184.160
7 50-20	8248.	5.040	3.260	238.	0.987	8142.	4.975	234.	0.029	236.133	0.144	6.813
SUM-----------(CYCLE COMPOSITE)										1526.630	9.430	353.643
CYCLE 7												
1 IDLE	2458.	9.660	6.200	302.	1.059	2604.	10.235	319.	0.042	109.387	0.429	13.439
2 0-25	1607.	9.070	7.660	361.	1.040	1672.	9.440	375.	0.244	408.136	2.303	91.684
3 30	895.	10.200	7.290	214.	1.085	971.	11.073	232.	0.118	114.650	1.306	27.413
4 30-15	5267.	7.020	5.280	206.	1.001	5274.	7.030	206.	0.062	327.042	0.435	12.791
5 15	1746.	10.710	6.740	202.	1.037	1810.	11.107	209.	0.050	90.542	0.555	10.475
6 15-30	1157.	9.850	7.880	318.	1.031	1193.	10.162	328.	0.455	543.119	4.623	149.275
7 50-20	7547.	5.610	3.550	257.	0.999	7544.	5.607	256.	0.029	218.776	0.162	7.450
SUM-----------(CYCLE COMPOSITE)										1811.654	9.817	312.530
AVERAGE SUM OF CYCLES 6-7										1669.142	9.624	333.086

TRIUMPH RUN 1 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
1	1186.600	6.752	512.237	0.0875	103.827	0.590	44.820
2	1712.462	7.673	569.337	0.0875	149.840	0.671	49.817
3	1809.180	8.385	414.628	0.0875	158.303	0.733	36.280
4	1795.859	9.191	380.337	0.0875	157.137	0.804	33.279
6	1526.630	9.430	353.643	0.3250	496.154	3.064	114.934
7	1811.654	9.817	312.530	0.3250	588.787	3.190	101.572
SUM-----------(TRIP COMPOSITE)					1654.051	9.055	380.703

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING, INC

TRIUMPH RUN 2 B - COLD CYCLE K = 1.0000 W = 567.

MODE	CONCENTRATION HC	CO	AS CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	895.	5.700	4.880	69.	1.667	1492.	9.503	115.	0.042	62.674	0.399	4.831
2 0-25	1109.	6.080	5.130	267.	1.547	1716.	9.411	413.	0.244	418.847	2.296	100.840
3 30	375.	4.730	5.770	141.	1.697	636.	8.031	239.	0.118	75.131	0.947	28.249
4 30-15	3257.	4.370	4.730	124.	1.389	4526.	6.073	172.	0.062	280.663	0.376	10.685
5 15	1147.	6.410	5.490	93.	1.459	1674.	9.356	135.	0.050	83.712	0.467	6.787
6 15-30	848.	5.400	5.700	429.	1.556	1319.	8.405	667.	0.455	600.555	3.824	303.818
7 50-20	7469.	2.270	3.450	364.	1.146	8560.	2.601	417.	0.029	248.247	0.075	12.098
SUM----------(CYCLE COMPOSITE)										1769.832	8.387	467.311
CYCLE 2												
1 IDLE	4905.	6.260	3.360	141.	1.230	6033.	7.700	173.	0.042	253.418	0.323	7.284
2 0-25	2203.	5.710	5.130	451.	1.399	3082.	7.988	630.	0.244	752.029	1.949	153.956
3 30	979.	5.370	5.220	165.	1.617	1583.	8.688	266.	0.118	186.901	1.025	31.500
4 30-15	4899.	4.870	4.340	145.	1.201	5887.	5.852	174.	0.062	365.011	0.362	10.803
5 15	1659.	6.420	3.510	121.	1.703	2826.	10.936	206.	0.050	141.308	0.546	10.306
6 15-30	1128.	5.540	5.820	357.	1.478	1667.	8.190	527.	0.455	758.747	3.726	240.135
7 50-20	7425.	2.770	3.480	310.	1.125	8356.	3.117	348.	0.029	242.332	0.090	10.117
SUM----------(CYCLE COMPOSITE)										2699.749	8.024	464.104
CYCLE 3												
1 IDLE	5580.	6.010	3.070	153.	1.198	6686.	7.201	183.	0.042	280.812	0.302	7.699
2 0-25	3023.	5.910	4.690	371.	1.329	4017.	7.854	493.	0.244	980.341	1.916	120.313
3 30	1105.	6.710	5.340	157.	1.466	1620.	9.839	230.	0.118	191.199	1.161	27.165
4 30-15	4727.	4.800	3.840	157.	1.278	6041.	6.134	200.	0.062	374.571	0.380	12.440
5 15	2300.	6.870	4.880	141.	1.342	3088.	9.224	189.	0.050	154.412	0.461	9.466
6 15-30	1407.	5.960	5.760	316.	1.413	1988.	8.423	446.	0.455	904.783	3.832	203.206
7 50-20	7176.	3.380	2.730	193.	1.191	8549.	4.027	229.	0.029	247.944	0.116	6.668
SUM----------(CYCLE COMPOSITE)										3134.065	8.171	386.960
CYCLE 4												
1 IDLE	5298.	6.280	3.120	177.	1.210	6411.	7.599	214.	0.042	269.281	0.319	8.996
2 0-25	2744.	5.950	4.790	460.	1.351	3708.	8.041	621.	0.244	904.903	1.962	151.696
3 30	1231.	6.630	5.310	165.	1.456	1793.	9.657	240.	0.118	211.587	1.139	28.360
4 30-15	4719.	5.290	4.050	169.	1.229	5802.	6.505	207.	0.062	359.782	0.403	12.884
5 15	2541.	6.930	4.640	165.	1.336	3396.	9.261	220.	0.050	169.801	0.463	11.026
6 15-30	1941.	6.340	5.450	335.	1.353	2626.	8.578	453.	0.455	1194.980	3.903	206.243
7 50-20	7179.	2.660	3.400	371.	1.161	8338.	3.089	430.	0.029	241.824	0.089	12.497
SUM----------(CYCLE COMPOSITE)										3352.160	8.280	431.704
AVERAGE SUM OF CYCLES 1-4										2738.952	8.215	437.520

PETRO-CHEM COMPUTING INC

TRIUMPH RUN 2 B - COLD CYCLE K = 1.0000 W = 567.

MODE	CONCENTRATION HC	CO	AS CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	5004.	6.160	3.280	93.	1.232	6167.	7.592	114.	0.042	259.040	0.318	4.814
2 0-25	2434.	6.370	5.270	308.	1.308	3184.	8.333	402.	0.244	776.949	2.033	98.315
3 30	1021.	6.540	4.640	93.	1.608	1642.	10.521	149.	0.118	193.830	1.241	17.655
4 30-15	3458.	4.740	3.400	81.	1.525	5275.	7.231	123.	0.062	327.076	0.448	7.661
5 15	2481.	7.300	4.820	141.	1.300	3226.	9.493	183.	0.050	161.328	0.474	9.168
6 15-30	1535.	6.010	5.720	377.	1.396	2143.	8.393	526.	0.455	975.378	3.818	239.555
7 50-20	6941.	3.590	2.230	134.	1.258	8735.	4.518	168.	0.029	253.330	0.131	4.890
SUM----------(CYCLE COMPOSITE)										2946.934	8.466	382.061
CYCLE 7												
1 IDLE	4854.	6.620	3.580	141.	1.195	5801.	7.911	168.	0.042	243.653	0.332	7.077
2 0-25	3000.	6.250	5.100	323.	1.264	3794.	7.904	408.	0.244	925.774	1.928	99.675
3 30	1359.	7.210	5.020	141.	1.436	1952.	10.358	202.	0.118	230.388	1.222	23.903
4 30-15	4389.	5.080	3.030	133.	1.406	6172.	7.144	187.	0.062	382.702	0.442	11.597
5 15	3043.	7.570	4.480	129.	1.255	3819.	9.502	161.	0.050	190.987	0.475	8.096
6 15-30	2063.	6.520	5.400	267.	1.331	2747.	8.682	355.	0.455	1250.054	3.950	161.786
7 50-20	6390.	2.790	2.970	340.	1.287	8224.	3.590	437.	0.029	238.500	0.104	12.690
SUM----------(CYCLE COMPOSITE)										3462.061	8.456	324.825
AVERAGE SUM OF CYCLES 6-7										3204.497	8.461	353.443

TRIUMPH RUN 2 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	1769.832	8.387	467.311	0.0875	154.860	0.733	40.889
2	2699.749	8.024	464.104	0.0875	236.228	0.702	40.609
3	3134.065	8.171	386.960	0.0875	274.230	0.714	33.859
4	3352.160	8.280	431.704	0.0875	293.314	0.724	37.774
6	2946.934	8.466	382.061	0.3250	957.753	2.751	124.170
7	3462.061	8.456	324.825	0.3250	1125.169	2.748	105.568
SUM----------(TRIP COMPOSITE)					3041.556	8.375	382.870

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING INC

TRIUMPH RUN 3 B - COLD CYCLE K = 1.0000 W = 567.

MODE	CONCENTRATION HC	AS CO	MEASURED CO2	NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	2317.	7.790	6.920	69.	1.088	2522.	8.481	75.	0.042	105.955	0.356	3.155
2 0-25	1032.	7.990	8.200	378.	1.089	1124.	8.704	411.	0.244	274.330	2.123	100.481
3 30	374.	6.760	9.410	165.	1.098	411.	7.429	181.	0.118	48.500	0.876	21.397
4 30-15	3536.	7.760	7.790	132.	0.936	3310.	7.264	123.	0.062	205.235	0.450	7.661
5 15	1487.	8.760	6.830	85.	1.131	1682.	9.911	96.	0.050	84.119	0.495	4.808
6 15-30	999.	8.510	8.450	410.	1.051	1050.	8.952	431.	0.455	478.158	4.073	196.241
7 50-20	8600.	4.920	4.760	184.	0.878	7553.	4.321	161.	0.029	219.063	0.125	4.686
SUM----------(CYCLE COMPOSITE)										1415.364	8.501	338.432
CYCLE 2												
1 IDLE	2066.	9.540	6.150	113.	1.102	2277.	10.518	124.	0.042	95.670	0.441	5.232
2 0-25	1406.	9.200	7.260	166.	1.083	1523.	9.971	179.	0.244	371.823	2.432	43.899
3 30	895.	8.870	8.390	129.	1.051	940.	9.325	135.	0.118	111.034	1.100	16.003
4 30-15	5741.	8.560	7.230	113.	0.818	4700.	7.008	92.	0.062	291.421	0.434	5.736
5 15	1503.	10.020	7.170	113.	1.050	1578.	10.525	118.	0.050	78.943	0.526	5.935
6 15-30	1086.	9.000	8.190	230.	1.045	1135.	9.413	240.	0.455	516.839	4.283	109.459
7 50-20	7606.	5.740	5.250	179.	0.887	6751.	5.095	158.	0.029	195.801	0.147	4.608
SUM----------(CYCLE COMPOSITE)										1661.535	9.366	190.874
CYCLE 3												
1 IDLE	3937.	9.430	5.860	141.	0.977	3850.	9.222	137.	0.042	161.707	0.387	5.791
2 0-25	2195.	9.090	6.600	444.	1.072	2354.	9.752	476.	0.244	574.588	2.379	116.226
3 30	1147.	9.620	8.190	141.	1.018	1168.	9.796	143.	0.118	137.829	1.155	16.943
4 30-15	5351.	9.530	7.430	124.	0.806	4316.	7.688	100.	0.062	267.638	0.476	6.202
5 15	2362.	10.320	6.410	117.	1.026	2425.	10.597	120.	0.050	121.270	0.529	6.007
6 15-30	1573.	9.310	7.440	211.	1.051	1653.	9.786	221.	0.455	752.355	4.452	100.919
7 50-20	7881.	6.140	5.220	180.	0.863	6801.	5.298	155.	0.029	197.242	0.153	4.504
SUM----------(CYCLE COMPOSITE)										2212.631	9.535	256.595
CYCLE 4												
1 IDLE	3607.	9.660	5.950	141.	0.988	3563.	9.544	139.	0.042	149.681	0.400	5.851
2 0-25	2146.	12.190	7.700	257.	0.899	1931.	10.969	231.	0.244	471.215	2.676	56.431
3 30	1189.	9.900	8.180	141.	1.005	1196.	9.958	141.	0.118	141.137	1.175	16.737
4 30-15	5150.	9.290	6.580	132.	0.863	4448.	8.024	114.	0.062	275.799	0.497	7.069
5 15	2707.	10.340	7.010	117.	0.960	2598.	9.926	112.	0.050	129.941	0.496	5.616
6 15-30	1711.	9.580	8.490	203.	0.958	1639.	9.182	194.	0.455	746.193	4.177	88.531
7 50-20	8759.	8.260	4.980	187.	0.780	6839.	6.449	146.	0.029	198.342	0.187	4.234
SUM----------(CYCLE COMPOSITE)										2112.311	9.611	184.471
AVERAGE SUM OF CYCLES 1-4										1850.460	9.253	242.593

PETRO-CHEM COMPUTING INC

TRIUMPH RUN 3 B - COLD CYCLE K = 1.0000 W = 567.

MODE	CONCENTRATION HC	AS CO	MEASURED CO2	NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	3089.	9.540	5.580	93.	1.059	3272.	10.107	98.	0.042	137.453	0.424	4.138
2 0-25	1754.	9.690	6.680	127.	1.080	1895.	10.470	137.	0.244	462.441	2.554	33.483
3 30	812.	10.230	7.940	133.	1.040	845.	10.647	138.	0.118	99.722	1.256	16.333
4 30-15	4942.	9.090	7.110	124.	0.853	4217.	7.756	105.	0.062	261.462	0.480	6.560
5 15	3091.	10.400	6.950	105.	0.936	2893.	9.736	98.	0.050	144.688	0.486	4.915
6 15-30	1528.	9.870	7.600	157.	1.022	1561.	10.089	160.	0.455	710.666	4.590	73.020
7 50-20	8243.	7.970	4.480	219.	0.834	6882.	6.654	182.	0.029	199.579	0.192	5.302
SUM----------(CYCLE COMPOSITE)										2016.014	9.986	143.753
CYCLE 7												
1 IDLE	3228.	9.780	6.200	129.	0.994	3211.	9.728	128.	0.042	134.866	0.408	5.389
2 0-25	2104.	9.950	6.280	154.	1.071	2255.	10.665	165.	0.244	550.290	2.602	40.277
3 30	1189.	9.480	7.840	161.	1.045	1243.	9.914	168.	0.118	146.736	1.169	19.869
4 30-15	3965.	10.240	7.580	118.	0.853	3385.	8.743	100.	0.062	209.898	0.542	6.246
5 15	3135.	9.560	5.820	117.	1.036	3250.	9.911	121.	0.050	162.513	0.495	6.065
6 15-30	1971.	10.540	6.980	126.	1.008	1987.	10.628	127.	0.455	904.371	4.836	57.813
7 50-20	8215.	7.860	4.890	213.	0.819	6732.	6.441	174.	0.029	195.250	0.186	5.062
SUM----------(CYCLE COMPOSITE)										2303.927	10.241	140.724
AVERAGE SUM OF CYCLES 6-7										2159.970	10.114	142.239

TRIUMPH RUN 3 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	1415.364	8.501	338.432	0.0875	123.844	0.743	29.612
2	1661.535	9.366	190.874	0.0875	145.384	0.819	16.701
3	2212.631	9.535	256.595	0.0875	193.605	0.834	22.452
4	2112.311	9.611	184.471	0.0875	184.827	0.841	16.141
6	2016.014	9.986	143.753	0.3250	655.204	3.245	46.719
7	2303.927	10.241	140.724	0.3250	748.776	3.328	45.735
SUM----------(TRIP COMPOSITE)					2051.642	9.813	177.363

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING INC

TRIUMPH T120R RUN-4 S COLD CYCLE K - 1.0000 W = 567.

MODE	CONCENTRATION HC	CO	AS CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	966.	9.780	7.000	68.	1.121	1083.	10.964	76.	0.042	45.486	0.460	3.201
2 0-25	1078.	8.650	8.050	141.	1.070	1154.	9.263	151.	0.244	281.697	2.260	36.845
3 30	391.	7.620	9.370	157.	1.065	416.	8.122	167.	0.118	49.183	0.958	19.748
4 30-15	416.	6.600	7.820	116.	1.253	521.	8.271	145.	0.062	32.325	0.512	9.013
5 15	3666.	9.540	7.940	77.	0.869	3188.	8.298	66.	0.050	159.445	0.414	3.348
6 15-30	304.	7.900	8.780	222.	1.110	337.	8.772	246.	0.455	153.590	3.991	112.161
7 50-20	4502.	5.370	4.840	144.	1.170	5269.	6.285	168.	0.029	152.826	0.182	4.889
SUM----------(CYCLE COMPOSITE)										874.556	8.780	189.208
CYCLE 2												
1 IDLE	6015.	8.950	4.640	103.	0.928	5586.	8.312	95.	0.042	234.647	0.349	4.018
2 0-25	4943.	8.640	6.550	192.	0.894	4421.	7.729	171.	0.244	1078.964	1.885	41.910
3 30	281.	8.810	8.850	138.	1.069	300.	9.421	147.	0.118	35.460	1.111	17.414
4 30-15	1169.	7.850	7.710	121.	1.124	1314.	8.825	136.	0.062	81.483	0.547	8.434
5 15	4443.	9.910	7.690	77.	0.831	3693.	8.237	64.	0.050	184.663	0.411	3.200
6 15-30	2200.	8.960	8.310	217.	0.956	2103.	8.566	207.	0.455	957.042	3.897	94.399
7 50-20	4847.	6.160	4.710	113.	1.113	5395.	6.857	125.	0.029	156.483	0.198	3.648
SUM----------(CYCLE COMPOSITE)										2728.746	8.402	173.024
CYCLE 3												
1 IDLE	6068.	8.950	4.770	103.	0.917	5569.	8.214	94.	0.042	233.909	0.345	3.970
2 0-25	5079.	8.160	7.160	303.	0.866	4403.	7.074	262.	0.244	1074.389	1.726	64.095
3 30	1488.	9.950	8.340	143.	0.971	1445.	9.668	138.	0.118	170.617	1.140	16.396
4 30-15	1346.	8.560	7.430	114.	1.101	1482.	9.428	125.	0.062	91.923	0.584	7.785
5 15	5081.	10.220	7.250	86.	0.812	4128.	8.303	69.	0.050	206.400	0.415	3.493
6 15-30	2902.	9.410	8.700	222.	0.876	2544.	8.249	194.	0.455	1157.612	3.753	88.556
7 50-20	4842.	4.170	5.960	350.	1.092	5289.	4.555	382.	0.029	153.382	0.132	11.087
SUM----------(CYCLE COMPOSITE)										3088.236	8.097	195.384
CYCLE 4												
1 IDLE	7291.	9.280	4.110	129.	0.872	6359.	8.094	112.	0.042	267.092	0.339	4.725
2 0-25	6047.	8.290	6.850	225.	0.827	5003.	6.858	186.	0.244	1220.733	1.673	45.421
3 30	2083.	10.290	8.230	134.	0.928	1933.	9.549	124.	0.118	228.102	1.126	14.673
4 30-15	1787.	8.830	6.970	114.	1.089	1946.	9.615	124.	0.062	120.654	0.596	7.697
5 15	4881.	10.450	6.820	81.	0.837	4087.	8.750	67.	0.050	204.355	0.437	3.391
6 15-30	2852.	8.810	8.360	222.	0.915	2609.	8.062	203.	0.455	1187.496	3.668	92.434
7 50-20	4421.	4.010	5.660	469.	1.165	5153.	4.674	546.	0.029	149.443	0.135	15.853
SUM----------(CYCLE COMPOSITE)										3377.878	7.977	184.198
AVERAGE SUM OF CYCLES 1-4										2517.354	8.314	185.454

PETRO-CHEM COMPUTING INC

TRIUMPH T120R RUN-4 S - COLD CYCLE K - 1.0000 W = 567.

MODE	CONCENTRATION HC	CO	AS CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	5229.	8.780	3.250	129.	1.091	5706.	9.581	140.	0.042	239.661	0.402	5.912
2 0-25	4328.	9.410	6.060	187.	0.939	4064.	8.837	175.	0.244	991.788	2.156	42.852
3 30	1431.	9.390	7.940	134.	1.022	1463.	9.601	137.	0.118	172.662	1.132	16.168
4 30-15	1347.	8.980	6.680	117.	1.148	1547.	10.313	134.	0.062	95.918	0.639	8.331
5 15	4824.	10.630	6.050	103.	0.874	4220.	9.299	90.	0.050	211.005	0.464	4.505
6 15-30	3497.	10.620	6.690	190.	0.919	3213.	9.760	174.	0.455	1462.369	4.441	79.453
7 50-20	4368.	4.400	6.140	367.	1.110	4850.	4.886	407.	0.029	140.666	0.141	11.818
SUM----------(CYCLE COMPOSITE)										3314.073	9.378	169.042
CYCLE 7												
1 IDLE	4607.	10.480	5.500	117.	0.922	4250.	9.669	107.	0.042	178.527	0.406	4.533
2 0-25	3742.	9.910	6.620	218.	0.928	3474.	9.201	202.	0.244	847.777	2.245	49.389
3 30	1681.	10.510	8.310	143.	0.942	1584.	9.908	134.	0.118	187.002	1.169	15.908
4 30-15	1585.	9.240	6.170	143.	1.159	1838.	10.716	165.	0.062	113.976	0.664	10.283
5 15	5336.	11.060	6.320	103.	0.823	4392.	9.105	84.	0.050	219.646	0.455	4.239
6 15-30	3250.	10.410	7.370	206.	0.901	2929.	9.384	185.	0.455	1333.035	4.269	84.493
7 50-20	4460.	6.100	4.720	178.	1.152	5137.	7.027	205.	0.029	148.999	0.203	5.946
SUM----------(CYCLE COMPOSITE)										3028.965	9.413	174.794
AVERAGE SUM OF CYCLES 6-7										3171.519	9.396	171.918

TRIUMPH T120R RUN-4 S - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	874.556	8.780	189.208	0.0875	76.523	0.768	16.555
2	2728.746	8.402	173.024	0.0875	238.765	0.735	15.139
3	3088.236	8.097	195.384	0.0875	270.220	0.708	17.096
4	3377.878	7.977	184.198	0.0875	295.564	0.698	16.117
6	3314.073	9.378	169.042	0.3250	1077.074	3.048	54.938
7	3028.965	9.413	174.794	0.3250	984.413	3.059	56.808
SUM----------(TRIP COMPOSITE)					2942.561	9.017	176.656

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING INC

TRIUMPH T120R RUN 5 S - COLD CYCLE K = 1.0000 W = 567.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	1415.	8.220	7.430	51.	1.109	1570.	9.120	56.	0.042	65.941	0.383	2.376
2 0-25	1271.	7.830	7.880	152.	1.101	1399.	8.622	167.	0.244	341.502	2.103	40.840
3 30	261.	6.860	9.980	143.	1.059	276.	7.264	151.	0.118	32.615	0.857	17.869
4 30-15	362.	6.550	9.170	112.	1.129	408.	7.399	126.	0.062	25.353	0.458	7.844
5 15	2915.	8.420	8.540	77.	0.912	2658.	7.679	70.	0.050	132.931	0.383	3.511
6 15-30	387.	7.770	9.010	184.	1.089	421.	8.462	200.	0.455	191.785	3.850	91.184
7 50-20	4999.	5.100	5.120	155.	1.109	5546.	5.658	171.	0.029	160.845	0.164	4.987
SUM-----------(CYCLE COMPOSITE)										950.976	8.201	168.614
CYCLE 2												
1 IDLE	2789.	10.030	6.670	77.	0.986	2751.	9.895	75.	0.042	115.566	0.415	3.190
2 0-25	2315.	9.210	7.400	168.	0.999	2314.	9.206	167.	0.244	564.657	2.246	40.977
3 30	285.	9.060	8.840	117.	1.060	302.	9.604	124.	0.118	35.651	1.133	14.635
4 30-15	855.	8.370	8.410	105.	1.072	917.	8.977	112.	0.062	56.859	0.556	6.982
5 15	4675.	9.910	7.560	77.	0.825	3859.	8.181	63.	0.050	192.972	0.409	3.178
6 15-30	2427.	8.830	8.570	228.	0.929	2254.	8.204	211.	0.455	1026.013	3.732	96.386
7 50-20	4625.	5.200	5.460	147.	1.110	5136.	5.775	163.	0.029	148.970	0.167	4.734
SUM-----------(CYCLE COMPOSITE)										2140.692	8.661	170.086
CYCLE 3												
1 IDLE	4358.	10.470	6.530	77.	0.880	3836.	9.216	67.	0.042	161.126	0.387	2.846
2 0-25	3249.	9.760	7.240	153.	0.927	3014.	9.055	141.	0.244	735.493	2.209	34.635
3 30	1161.	9.630	8.680	130.	0.983	1141.	9.467	127.	0.118	134.686	1.117	15.081
4 30-15	1032.	5.790	7.870	106.	1.220	1259.	7.067	129.	0.062	78.097	0.438	8.021
5 15	4358.	10.430	7.180	77.	0.847	3695.	8.843	65.	0.050	184.751	0.442	3.264
6 15-30	2758.	9.240	8.190	239.	0.918	2532.	8.485	219.	0.455	1152.468	3.861	99.869
7 50-20	3602.	5.970	5.060	121.	1.214	4376.	7.252	147.	0.029	126.905	0.210	4.263
SUM-----------(CYCLE COMPOSITE)										2573.529	8.665	167.981
CYCLE 4												
1 IDLE	3798.	10.400	6.300	77.	0.929	3529.	9.665	71.	0.042	148.250	0.405	3.005
2 0-25	3112.	9.720	7.380	195.	0.929	2892.	9.034	181.	0.244	705.742	2.204	44.222
3 30	239.	10.050	8.480	129.	1.053	251.	10.588	135.	0.118	29.711	1.249	16.036
4 30-15	1201.	8.750	7.670	113.	1.086	1305.	9.509	122.	0.062	80.924	0.589	7.614
5 15	4542.	10.400	7.000	77.	0.847	3850.	8.815	65.	0.050	192.509	0.440	3.263
6 15-30	2849.	8.480	8.080	235.	0.941	2683.	7.986	221.	0.455	1220.781	3.633	100.696
7 50-20	4255.	4.300	4.210	112.	1.323	5631.	5.691	148.	0.029	163.319	0.165	4.298
SUM-----------(CYCLE COMPOSITE)										2541.239	8.688	179.137
AVERAGE SUM OF CYCLES 1-4										2051.609	8.554	171.455

PETRO-CHEM COMPUTING, INC

TRIUMPH T120R RUN 5 S - COLD CYCLE K = 1.0000 W = 567.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	1776.	11.000	5.500	90.	1.122	1993.	12.347	101.	0.042	83.726	0.518	4.242
2 0-25	1869.	9.590	6.350	235.	1.101	2058.	10.563	258.	0.244	502.336	2.577	63.161
3 30	1317.	10.200	8.240	134.	0.982	1293.	10.018	131.	0.118	152.644	1.182	15.530
4 30-15	822.	8.790	6.440	119.	1.236	1016.	10.872	147.	0.062	63.037	0.674	9.125
5 15	2824.	11.100	6.670	90.	0.949	2681.	10.540	85.	0.050	134.080	0.527	4.273
6 15-30	2831.	10.430	6.990	181.	0.950	2689.	9.908	171.	0.455	1223.754	4.508	78.240
7 50-20	3682.	4.850	5.400	262.	1.228	4523.	5.958	321.	0.029	131.192	0.172	9.335
SUM-----------(CYCLE COMPOSITE)										2290.772	10.160	183.910
CYCLE 7												
1 IDLE	4124.	10.450	6.050	103.	0.921	3801.	9.633	94.	0.042	159.675	0.404	3.988
2 0-25	3409.	9.940	7.050	203.	0.923	3148.	9.179	187.	0.244	768.135	2.239	45.741
3 30	265.	11.160	7.850	130.	1.057	280.	11.797	137.	0.118	33.056	1.392	16.216
4 30-15	1388.	9.830	7.090	125.	1.073	1490.	10.554	134.	0.062	92.402	0.654	8.321
5 15	4309.	10.840	6.300	103.	0.885	3815.	9.599	91.	0.050	190.795	0.479	4.560
6 15-30	2965.	9.970	7.660	252.	0.914	2712.	9.122	230.	0.455	1234.387	4.150	104.912
7 50-20	4962.	5.960	4.980	179.	1.088	5401.	6.488	194.	0.029	156.657	0.188	5.651
SUM-----------(CYCLE COMPOSITE)										2635.110	9.509	189.391
AVERAGE SUM OF CYCLES 6-7										2462.941	9.835	186.651

TRIUMPH T120R RUN 5 S - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	950.976	8.201	168.614	0.0875	83.210	0.717	14.753
2	2140.692	8.661	170.086	0.0875	187.310	0.757	14.882
3	2573.529	8.665	167.981	0.0875	225.183	0.758	14.698
4	2541.239	8.688	179.137	0.0875	222.358	0.760	15.674
6	2290.772	10.160	183.910	0.3250	744.501	3.302	59.770
7	2635.110	9.509	189.391	0.3250	856.410	3.090	61.552
SUM-----------(TRIP COMPOSITE)					2318.975	9.386	181.332

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO CHEM COMPUTING, INC.

YAMAHA RUN 2 - COLD CYCLE K = 1.0000 W = 429.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	7612.	2.010	5.310	81.	0.997	7593.	2.005	80.	0.042	318.913	0.084	3.393
2 0-25	5762.	0.790	7.120	85.	1.055	6081.	0.833	89.	0.244	1483.914	0.203	21.890
3 30	3028.	1.880	10.420	141.	0.991	3001.	1.863	139.	0.118	354.123	0.219	16.489
4 30-15	6471.	2.360	5.520	113.	1.059	6854.	2.499	119.	0.062	424.981	0.154	7.421
5 15	7885.	4.100	4.700	93.	0.949	7489.	3.894	88.	0.050	374.472	0.194	4.416
6 15-30	5015.	4.160	7.290	111.	0.980	4917.	4.079	108.	0.455	2237.658	1.856	49.527
7 50-20	9129.	4.380	3.030	113.	0.961	8778.	4.211	108.	0.029	254.570	0.122	3.151
SUM----------(CYCLE COMPOSITE)										5448.632	2.835	106.290
CYCLE 2												
1 IDLE	8469.	3.640	3.970	141.	0.970	8221.	3.533	136.	0.042	345.302	0.148	5.748
2 0-25	6391.	3.200	6.630	171.	0.958	6123.	3.066	163.	0.244	1494.246	0.748	39.980
3 30	3368.	1.550	10.830	161.	0.951	3203.	1.474	153.	0.118	378.065	0.173	18.072
4 30-15	6530.	1.320	6.930	160.	0.990	6466.	1.307	158.	0.062	400.922	0.081	9.823
5 15	5652.	0.450	7.780	117.	1.027	5808.	0.462	120.	0.050	290.428	0.023	6.012
6 15-30	4528.	2.120	8.130	158.	1.029	4662.	2.183	162.	0.455	2121.659	0.993	74.033
7 50-20	8732.	4.320	3.080	156.	0.988	8630.	4.269	154.	0.029	250.283	0.123	4.471
SUM----------(CYCLE COMPOSITE)										5280.910	2.291	158.142
CYCLE 3												
1 IDLE	8742.	4.010	3.770	165.	0.952	8330.	3.821	157.	0.042	349.878	0.160	6.603
2 0-25	7317.	3.940	6.650	176.	0.877	6421.	3.457	154.	0.244	1566.818	0.843	37.687
3 30	3794.	1.430	10.890	153.	0.923	3503.	1.320	141.	0.118	413.407	0.155	16.671
4 30-15	6003.	2.360	6.620	139.	1.015	6094.	2.395	141.	0.062	377.834	0.148	8.748
5 15	5566.	0.880	8.080	117.	0.997	5554.	0.878	116.	0.050	277.700	0.043	5.837
6 15-30	4779.	2.680	8.540	142.	0.964	4607.	2.583	136.	0.455	2096.189	1.175	62.284
7 50-20	8315.	4.680	2.860	138.	1.022	8502.	4.785	141.	0.029	246.573	0.138	4.092
SUM----------(CYCLE COMPOSITE)										5328.402	2.666	141.925
CYCLE 4												
1 IDLE	8780.	4.210	3.700	157.	0.948	8327.	3.993	148.	0.042	349.766	0.167	6.254
2 0-25	6401.	3.140	6.720	166.	0.953	6104.	2.994	158.	0.244	1489.615	0.730	38.630
3 30	4605.	2.420	10.480	169.	0.870	4007.	2.105	147.	0.118	472.841	0.248	17.352
4 30-15	5480.	2.250	7.280	150.	1.012	5547.	2.277	151.	0.062	343.949	0.141	9.414
5 15	5617.	0.510	8.180	129.	0.999	5616.	0.509	128.	0.050	280.823	0.025	6.449
6 15-30	4579.	2.550	7.500	148.	1.056	4839.	2.694	156.	0.455	2201.840	1.226	71.166
7 50-20	7860.	4.450	3.250	147.	1.038	8161.	4.620	152.	0.029	236.692	0.134	4.426
SUM----------(CYCLE COMPOSITE)										5375.529	2.673	153.695
AVERAGE SUM OF CYCLES 1-4										5358.368	2.617	140.013

PETRO-CHEM COMPUTING INC

YAMAHA RUN 2 - COLD CYCLE K = 1.0000 W = 429.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	6162.	4.430	3.700	81.	1.153	7108.	5.110	93.	0.042	298.541	0.214	3.924
2 0-25	4455.	3.540	7.290	140.	1.045	4656.	3.700	146.	0.244	1136.279	0.902	35.708
3 30	3493.	2.140	10.790	117.	0.927	3239.	1.984	108.	0.118	382.315	0.234	12.805
4 30-15	5944.	2.950	5.930	117.	1.048	6234.	3.094	122.	0.062	386.534	0.191	7.608
5 15	4817.	1.250	8.080	105.	1.042	5022.	1.303	109.	0.050	251.113	0.065	5.473
6 15-30	4652.	3.260	8.500	127.	0.956	4451.	3.119	121.	0.455	2025.290	1.419	55.290
7 50-20	6941.	4.580	3.130	127.	1.122	7792.	5.141	142.	0.029	225.969	0.149	4.134
SUM----------(CYCLE COMPOSITE)										4706.044	3.177	124.945
CYCLE 7												
1 IDLE	8677.	4.550	3.700	141.	0.944	8198.	4.299	133.	0.042	344.339	0.180	5.595
2 0-25	6982.	3.210	6.400	166.	0.932	6512.	2.994	154.	0.244	1589.027	0.730	37.779
3 30	4820.	1.790	10.170	153.	0.891	4295.	1.595	136.	0.118	506.866	0.188	16.089
4 30-15	6530.	2.640	8.090	139.	0.880	5751.	2.325	122.	0.062	356.598	0.144	7.590
5 15	5583.	1.160	8.290	117.	0.973	5433.	1.128	113.	0.050	271.662	0.056	5.693
6 15-30	4940.	2.780	8.480	132.	0.953	4710.	2.651	125.	0.455	2143.454	1.206	57.274
7 50-20	7569.	4.620	5.840	132.	0.888	6723.	4.103	117.	0.029	194.968	0.119	3.400
SUM----------(CYCLE COMPOSITE)										5406.917	2.625	133.423
AVERAGE SUM OF CYCLES 6-7										5056.481	2.901	129.184

YAMAHA RUN 2 - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	5448.632	2.835	106.290	0.0875	476.755	0.248	9.300
2	5280.910	2.291	158.142	0.0875	462.079	0.200	13.837
3	5328.402	2.666	141.925	0.0875	466.235	0.233	12.418
4	5375.529	2.673	153.695	0.0875	470.358	0.233	13.448
6	4706.044	3.177	124.945	0.3250	1529.464	1.032	40.607
7	5406.917	2.625	133.423	0.3250	1757.248	0.853	43.362
SUM----------(TRIP COMPOSITE)					5162.141	2.801	132.974

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING INC

YAMAHA RUN 3 B - COLD CYCLE K = 1.0000 W = 429.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	A D J U S T E D HC	CO	NO(K)	WEIGHTING FACTOR	W E I G H T E D HC	CO	NO(K)
CYCLE 1												
1 IDLE	7490.	2.150	5.610	189.	0.981	7350.	2.110	185.	0.042	308.741	0.088	7.790
2 0-25	5440.	1.420	7.420	183.	1.035	5632.	1.470	189.	0.244	1374.255	0.358	46.229
3 30	3229.	1.880	10.600	190.	0.964	3115.	1.814	183.	0.118	367.651	0.214	21.633
4 30-15	6613.	2.740	4.290	76.	1.132	7490.	3.103	86.	0.062	464.385	0.192	5.336
5 15	5949.	1.000	7.810	23.	0.984	5854.	0.984	22.	0.050	292.707	0.049	1.131
6 15-30	4380.	2.550	8.250	45.	1.017	4455.	2.593	45.	0.455	2027.094	1.180	20.826
7 50-20	9220.	3.190	2.790	64.	1.010	9321.	3.225	64.	0.029	270.314	0.093	1.876
SUM----------(CYCLE COMPOSITE)										5105.151	2.176	104.824
CYCLE 2												
1 IDLE	9296.	3.140	3.880	93.	0.936	8702.	2.939	87.	0.042	365.486	0.123	3.656
2 0-25	7051.	2.740	7.340	104.	0.888	6262.	2.433	92.	0.244	1528.105	0.593	22.539
3 30	3651.	1.800	13.040	105.	0.810	2960.	1.459	85.	0.118	349.316	0.172	10.046
4 30-15	6172.	2.600	5.640	94.	1.065	6577.	2.770	100.	0.062	407.814	0.171	6.211
5 15	5808.	0.730	8.080	69.	0.985	5722.	0.719	67.	0.050	286.105	0.035	3.398
6 15-30	4996.	2.260	8.570	96.	0.960	4798.	2.170	92.	0.455	2183.479	0.987	41.956
7 50-20	8562.	3.250	2.950	106.	1.049	8982.	3.409	111.	0.029	260.478	0.098	3.224
SUM----------(CYCLE COMPOSITE)										5380.786	2.183	91.032
CYCLE 3												
1 IDLE	8823.	3.180	3.640	129.	0.982	8668.	3.124	126.	0.042	364.067	0.131	5.322
2 0-25	7132.	2.160	7.640	151.	0.882	6297.	1.907	133.	0.244	1536.484	0.465	32.530
3 30	4524.	1.780	11.560	117.	0.836	3783.	1.488	97.	0.118	446.504	0.175	11.547
4 30-15	6741.	2.530	5.580	229.	1.026	6919.	2.597	235.	0.062	429.029	0.161	14.574
5 15	5756.	1.000	8.500	105.	0.952	5484.	0.952	100.	0.050	274.248	0.047	5.002
6 15-30	5189.	2.570	8.220	63.	0.959	4979.	2.466	60.	0.455	2265.812	1.122	27.509
7 50-20	8213.	3.130	3.150	127.	1.067	8766.	3.340	135.	0.029	254.218	0.096	3.931
SUM----------(CYCLE COMPOSITE)										5570.364	2.199	100.419
CYCLE 4												
1 IDLE	9395.	3.230	3.580	129.	0.945	8879.	3.052	121.	0.042	372.943	0.128	5.120
2 0-25	7316.	2.750	7.630	139.	0.857	6274.	2.358	119.	0.244	1531.029	0.575	29.088
3 30	4920.	2.490	11.000	117.	0.825	4062.	2.056	96.	0.118	479.430	0.242	11.401
4 30-15	6911.	2.810	5.360	117.	1.019	7042.	2.863	119.	0.062	436.646	0.177	7.392
5 15	5896.	1.890	8.390	93.	0.923	5444.	1.745	85.	0.050	272.221	0.087	4.293
6 15-30	5362.	2.700	8.610	117.	0.920	4936.	2.485	107.	0.455	2245.945	1.130	49.007
7 50-20	6855.	3.250	2.860	105.	1.219	8360.	3.963	128.	0.029	242.465	0.114	3.713
SUM----------(CYCLE COMPOSITE)										5580.681	2.457	110.017
AVERAGE SUM OF CYCLES 1-4										5409.246	2.254	101.573

PETRO-CHEM COMPUTING INC

YAMAHA RUN 3 B - COLD CYCLE K = 1.0000 W = 429.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	A D J U S T E D HC	CO	NO(K)	WEIGHTING FACTOR	W E I G H T E D HC	CO	NO(K)
CYCLE 6												
1 IDLE	5847.	3.370	3.640	141.	1.245	7283.	4.198	175.	0.042	305.918	0.176	7.377
2 0-25	5139.	2.740	7.560	150.	1.001	5146.	2.743	150.	0.244	1255.637	0.669	36.650
3 30	4330.	2.730	10.700	129.	0.866	3750.	2.364	111.	0.118	442.533	0.279	13.184
4 30-15	6251.	2.990	5.400	176.	1.062	6642.	3.177	187.	0.062	411.814	0.196	11.594
5 15	5122.	2.320	8.180	105.	0.975	4993.	2.262	102.	0.050	249.698	0.113	5.118
6 15-30	4751.	2.660	8.230	64.	0.986	4689.	2.625	63.	0.455	2133.588	1.194	28.741
7 50-20	7709.	3.370	2.990	121.	1.115	8598.	3.758	134.	0.029	249.342	0.109	3.913
SUM----------(CYCLE COMPOSITE)										5048.533	2.738	106.579
CYCLE 7												
1 IDLE	9886.	3.370	3.700	129.	0.902	8924.	3.042	116.	0.042	374.836	0.127	4.891
2 0-25	7124.	2.760	7.310	138.	0.885	6304.	2.442	122.	0.244	1538.381	0.596	29.800
3 30	5004.	2.740	10.770	129.	0.826	4135.	2.264	106.	0.118	488.012	0.267	12.580
4 30-15	7022.	2.860	5.650	140.	0.988	6943.	2.828	138.	0.062	430.501	0.175	8.583
5 15	5904.	2.520	7.780	105.	0.940	5553.	2.370	98.	0.050	277.653	0.118	4.937
6 15-30	5127.	2.960	8.170	85.	0.954	4895.	2.826	81.	0.455	2227.235	1.285	36.925
7 50-20	7334.	3.540	3.050	104.	1.138	8346.	4.028	118.	0.029	242.054	0.116	3.432
SUM----------(CYCLE COMPOSITE)										5578.675	2.687	101.150
AVERAGE SUM OF CYCLES 6-7										5313.604	2.712	103.865

YAMAHA RUN 3 B - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	W E I G H T E D HC	CO	NO(K)
1	5105.151	2.176	104.824	0.0875	446.700	0.190	9.172
2	5380.786	2.183	91.032	0.0875	470.818	0.191	7.965
3	5570.364	2.199	100.419	0.0875	487.406	0.192	8.786
4	5580.681	2.457	110.017	0.0875	488.309	0.214	9.626
6	5048.533	2.738	106.579	0.3250	1640.773	0.889	34.638
7	5578.675	2.687	101.150	0.3250	1813.069	0.873	32.873
SUM----------(TRIP COMPOSITE)					5347.078	2.552	103.063

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING, INC

YAMAHA DTIE RUN 4 - COLD CYCLE K 1.0000 W 429.

MODE	CONCENTRATION HC	AS CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 1												
1 IDLE	6462.	1.360	5.630	51.	1.091	7050.	1.483	55.	0.042	296.137	0.062	2.337
2 0-25	6210.	0.930	6.950	77.	1.026	6376.	0.954	79.	0.244	1555.820	0.232	19.291
3 30	3950.	3.820	9.420	125.	0.929	3672.	3.551	116.	0.118	433.345	0.419	13.713
4 30-15	3501.	2.410	8.680	88.	1.061	3714.	2.557	93.	0.062	230.307	0.158	5.788
5 15	5593.	0.430	8.140	77.	1.007	5633.	0.433	77.	0.050	281.681	0.021	3.877
6 15-30	4873.	2.360	8.570	85.	0.965	4706.	2.279	82.	0.455	2141.474	1.037	37.353
7 50-20	6881.	5.250	3.530	82.	1.067	7343.	5.602	87.	0.029	212.966	0.162	2.537
SUM----------(CYCLE COMPOSITE)										5151.732	2.094	84.900
CYCLE 2												
1 IDLE	8685.	3.990	3.700	90.	0.961	8353.	3.837	86.	0.042	350.861	0.161	3.635
2 0-25	8223.	3.320	6.000	102.	0.876	7208.	2.910	89.	0.244	1758.857	0.710	21.817
3 30	5043.	2.260	10.970	103.	0.826	4167.	1.867	85.	0.118	491.756	0.220	10.043
4 30-15	4384.	2.040	9.440	84.	0.954	4183.	1.946	80.	0.062	259.380	0.120	4.969
5 15	5980.	0.700	8.480	77.	0.948	5671.	0.663	73.	0.050	283.581	0.033	3.651
6 15-30	5260.	2.310	8.750	90.	0.930	4893.	2.149	83.	0.455	2226.568	0.977	38.097
7 50-20	6889.	5.360	3.490	88.	1.065	7339.	5.710	93.	0.029	212.843	0.165	2.718
SUM----------(CYCLE COMPOSITE)										5583.848	2.389	84.934
CYCLE 3												
1 IDLE	8407.	4.350	3.580	91.	0.977	8217.	4.251	88.	0.042	345.130	0.178	3.735
2 0-25	7871.	3.870	6.650	113.	0.848	6679.	3.284	95.	0.244	1629.879	0.801	23.399
3 30	5776.	1.850	11.440	117.	0.779	4502.	1.441	91.	0.118	531.241	0.170	10.760
4 30-15	4741.	2.560	8.510	98.	0.972	4610.	2.489	95.	0.062	285.853	0.154	5.908
5 15	5873.	0.550	8.500	90.	0.959	5632.	0.527	86.	0.050	281.649	0.026	4.316
6 15-30	5275.	2.980	8.390	107.	0.930	4910.	2.773	99.	0.455	2234.179	1.262	45.318
7 50-20	6497.	5.250	3.540	95.	1.100	7146.	5.775	104.	0.029	207.255	0.167	3.030
SUM----------(CYCLE COMPOSITE)										5515.189	2.760	96.470
CYCLE 4												
1 IDLE	8211.	4.400	3.620	103.	0.987	8105.	4.343	101.	0.042	340.450	0.182	4.270
2 0-25	7386.	4.230	6.610	118.	0.868	6412.	3.672	102.	0.244	1564.594	0.896	24.996
3 30	5212.	2.000	11.720	117.	0.790	4118.	1.580	92.	0.118	486.007	0.186	10.909
4 30-15	4993.	2.680	8.900	103.	0.927	4631.	2.485	95.	0.062	287.140	0.154	5.923
5 15	6300.	1.150	8.680	90.	0.902	5688.	1.038	81.	0.050	284.419	0.051	4.063
6 15-30	5510.	3.430	8.460	113.	0.899	4954.	3.084	101.	0.455	2254.289	1.403	46.231
7 50-20	6490.	5.120	4.800	100.	1.009	6549.	5.166	100.	0.029	189.923	0.149	2.926
SUM----------(CYCLE COMPOSITE)										5406.826	3.024	99.321
AVERAGE SUM OF CYCLES 1-4										5414.398	2.566	91.406

YAMAHA DTIE RUN 4 - COLD CYCLE K = 1.0000 W = 429.

MODE	CONCENTRATION HC	AS CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	ADJUSTED CO	ADJUSTED NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
CYCLE 6												
1 IDLE	4423.	4.400	3.560	51.	1.376	6086.	6.054	70.	0.042	255.637	0.254	2.947
2 0-25	4702.	3.990	5.830	76.	1.123	5283.	4.483	85.	0.244	1289.271	1.094	20.838
3 30	3189.	2.140	11.480	103.	0.906	2891.	1.940	93.	0.118	341.149	0.228	11.018
4 30-15	3208.	2.560	8.910	98.	1.061	3406.	2.718	104.	0.062	211.209	0.168	6.452
5 15	4924.	0.970	8.750	90.	0.996	4906.	0.966	89.	0.050	245.304	0.048	4.483
6 15-30	4364.	3.200	8.690	105.	0.966	4217.	3.092	101.	0.455	1919.033	1.407	46.172
7 50-20	5961.	5.320	4.800	96.	1.043	6219.	5.550	100.	0.029	180.358	0.160	2.904
SUM----------(CYCLE COMPOSITE)										4441.963	3.362	94.818
CYCLE 7												
1 IDLE	7575.	4.120	4.390	103.	0.991	7507.	4.083	102.	0.042	315.301	0.171	4.287
2 0-25	7111.	3.330	6.330	136.	0.925	6578.	3.080	125.	0.244	1605.034	0.751	30.696
3 30	5001.	2.250	11.480	103.	0.805	4027.	1.811	82.	0.118	475.212	0.213	9.787
4 30-15	4933.	2.500	9.450	103.	0.904	4462.	2.261	93.	0.062	276.694	0.140	5.777
5 15	5996.	1.130	8.680	90.	0.922	5530.	1.042	83.	0.050	276.521	0.052	4.150
6 15-30	5383.	3.020	8.620	110.	0.909	4895.	2.746	100.	0.455	2227.492	1.249	45.518
7 50-20	6420.	5.410	3.560	100.	1.098	7053.	5.943	109.	0.029	204.537	0.172	3.185
SUM----------(CYCLE COMPOSITE)										5380.794	2.751	103.403
AVERAGE SUM OF CYCLES 6-7										4911.379	3.056	99.110

YAMAHA DTIE RUN 4 - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	WEIGHTED CO	WEIGHTED NO(K)
1	5151.732	2.094	84.900	0.0875	450.776	0.183	7.428
2	5583.848	2.389	84.934	0.0875	488.586	0.209	7.431
3	5515.189	2.760	96.470	0.0875	482.579	0.241	8.441
4	5406.826	3.024	99.321	0.0875	473.097	0.264	8.690
6	4441.963	3.362	94.818	0.3250	1443.638	1.092	30.816
7	5380.794	2.751	103.403	0.3250	1748.758	0.894	33.606
SUM----------(TRIP COMPOSITE)					5087.436	2.885	96.414

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

YAMAHA DTIE RUN 5 - COLD CYCLE K = 1.0000 W = 429.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	7997.	2.600	4.640	51.	0.994	7954.	2.586	50.	0.042	334.105	0.108	2.130
2 0-25	7332.	2.070	6.750	67.	0.923	6770.	1.911	61.	0.244	1651.893	0.466	15.095
3 30	3503.	2.230	10.410	103.	0.947	3318.	2.112	97.	0.118	391.529	0.249	11.512
4 30-15	3443.	1.910	8.410	94.	1.108	3815.	2.116	104.	0.062	236.578	0.131	6.459
5 15	7090.	0.450	7.680	157.	0.931	6606.	0.419	146.	0.050	330.303	0.020	7.314
6 15-30	5080.	2.800	8.410	77.	0.947	4815.	2.654	72.	0.455	2191.058	1.207	33.210
7 50-20	8562.	4.990	3.210	74.	0.969	8303.	4.839	71.	0.029	240.792	0.140	2.081
SUM----------(CYCLE COMPOSITE)										5376.261	2.324	77.803
CYCLE 2												
1 IDLE	9434.	4.070	3.560	77.	0.918	8666.	3.738	70.	0.042	364.002	0.157	2.970
2 0-25	8813.	3.540	5.750	92.	0.851	7500.	3.012	78.	0.244	1830.045	0.735	19.104
3 30	3567.	1.500	11.580	103.	0.890	3176.	1.335	91.	0.118	374.831	0.157	10.823
4 30-15	3708.	2.200	8.890	96.	1.036	3841.	2.279	99.	0.062	238.197	0.141	6.166
5 15	7521.	1.080	7.910	77.	0.874	6580.	0.944	67.	0.050	329.018	0.047	3.368
6 15-30	5545.	2.880	8.580	96.	0.905	5022.	2.608	86.	0.455	2285.217	1.186	39.563
7 50-20	8087.	5.050	3.380	81.	0.990	8010.	5.002	80.	0.029	232.296	0.145	2.326
SUM----------(CYCLE COMPOSITE)										5653.610	2.570	84.324
CYCLE 3												
1 IDLE	9833.	4.400	3.350	90.	0.896	8817.	3.945	80.	0.042	370.342	0.165	3.389
2 0-25	9323.	4.290	5.640	113.	0.812	7571.	3.484	91.	0.244	1847.489	0.850	22.392
3 30	4226.	1.900	11.440	99.	0.855	3614.	1.624	84.	0.118	426.486	0.191	9.991
4 30-15	3801.	2.170	8.720	108.	1.042	3962.	2.262	112.	0.062	245.656	0.140	6.979
5 15	7764.	1.380	8.200	77.	0.839	6516.	1.158	64.	0.050	325.838	0.057	3.231
6 15-30	6081.	3.250	8.400	96.	0.873	5314.	2.840	83.	0.455	2417.926	1.292	38.171
7 50-20	7430.	5.210	3.650	92.	1.015	7544.	5.290	93.	0.029	218.798	0.153	2.709
SUM----------(CYCLE COMPOSITE)										5852.537	2.851	86.865
CYCLE 4												
1 IDLE	9662.	4.600	3.370	103.	0.900	8699.	4.141	92.	0.042	365.363	0.173	3.894
2 0-25	8854.	4.330	6.060	115.	0.815	7217.	3.529	93.	0.244	1761.111	0.861	22.874
3 30	4226.	2.160	11.480	117.	0.846	3578.	1.829	99.	0.118	422.252	0.215	11.690
4 30-15	3780.	2.580	9.390	99.	0.982	3712.	2.534	97.	0.062	230.194	0.157	6.028
5 15	8199.	1.560	7.990	90.	0.822	6745.	1.283	74.	0.050	337.265	0.064	3.702
6 15-30	5807.	3.020	8.620	104.	0.884	5133.	2.669	91.	0.455	2335.856	1.214	41.833
7 50-20	7533.	4.330	3.580	98.	1.044	7869.	4.523	102.	0.029	228.204	0.131	2.968
SUM----------(CYCLE COMPOSITE)										5680.247	2.818	92.993
AVERAGE SUM OF CYCLES 1-4										5640.664	2.641	85.496

PETRO-CHEM COMPUTING INC.

YAMAHA DTIE RUN 5 - COLD CYCLE K = 1.0000 W = 429.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	8289.	4.690	3.200	90.	1.000	8290.	4.690	90.	0.042	348.207	0.197	3.780
2 0-25	7296.	3.790	6.820	105.	0.873	6375.	3.311	91.	0.244	1555.513	0.808	22.386
3 30	3127.	2.020	11.400	103.	0.918	2872.	1.855	94.	0.118	338.901	0.218	11.163
4 30-15	3344.	2.710	8.550	103.	1.072	3587.	2.907	110.	0.062	222.413	0.180	6.850
5 15	6995.	1.760	8.270	103.	0.868	6071.	1.527	89.	0.050	303.591	0.076	4.470
6 15-30	5166.	3.490	8.450	111.	0.919	4748.	3.208	102.	0.455	2160.649	1.459	46.425
7 50-20	7360.	5.040	3.490	113.	1.038	7645.	5.235	117.	0.029	221.715	0.151	3.404
SUM----------(CYCLE COMPOSITE)										5150.991	3.092	98.480
CYCLE 7												
1 IDLE	9475.	4.540	3.450	129.	0.908	8612.	4.126	117.	0.042	361.704	0.173	4.924
2 0-25	8687.	4.730	5.970	115.	0.818	7109.	3.871	94.	0.244	1734.756	0.944	22.965
3 30	3536.	2.300	11.360	129.	0.887	3139.	2.042	114.	0.118	370.515	0.241	13.517
4 30-15	3651.	2.820	8.450	127.	1.050	3835.	2.962	133.	0.062	237.791	0.183	8.271
5 15	7067.	2.480	7.850	117.	0.867	6127.	2.150	101.	0.050	306.390	0.107	5.072
6 15-30	5681.	4.020	8.270	133.	0.883	5018.	3.550	117.	0.455	2283.234	1.615	53.453
7 50-20	7658.	5.410	3.470	124.	1.003	7686.	5.430	124.	0.029	222.917	0.157	3.609
SUM----------(CYCLE COMPOSITE)										5517.310	3.423	111.813
AVERAGE SUM OF CYCLES 6-7										5334.151	3.257	105.146

YAMAHA DTIE RUN 5 - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	5376.261	2.324	77.803	0.0875	470.422	0.203	6.807
2	5653.610	2.570	84.324	0.0875	494.690	0.224	7.378
3	5852.537	2.851	86.865	0.0875	512.097	0.249	7.600
4	5680.247	2.818	92.993	0.0875	497.021	0.246	8.136
6	5150.991	3.092	98.480	0.3250	1674.072	1.004	32.006
7	5517.310	3.423	111.813	0.3250	1793.125	1.112	36.339
SUM----------(TRIP COMPOSITE)					5441.430	3.041	98.269

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

PETRO-CHEM COMPUTING INC.

YAMAHA DTIE RUN-6 S - COLD CYCLE K = 1.0000 W = 429.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 1												
1 IDLE	5093.	1.380	5.630	51.	1.226	6247.	1.692	62.	0.042	262.396	0.071	2.627
2 0-25	5082.	1.240	7.290	30.	1.082	5499.	1.341	32.	0.244	1341.943	0.327	7.921
3 30	4047.	1.380	11.240	104.	0.889	3599.	1.227	92.	0.118	424.791	0.144	10.916
4 30-15	3742.	1.540	8.730	90.	1.070	4006.	1.649	96.	0.062	248.428	0.102	5.975
5 15	4975.	0.360	8.000	64.	1.069	5322.	0.385	68.	0.050	266.131	0.019	3.423
6 15-30	4361.	2.830	8.690	90.	0.978	4268.	2.769	88.	0.455	1942.081	1.260	40.079
7 50-20	5741.	5.030	3.560	73.	1.181	6781.	5.941	86.	0.029	196.662	0.172	2.500
SUM----------(CYCLE COMPOSITE)										4682.434	2.097	73.444
CYCLE 2												
1 IDLE	7030.	3.750	4.190	77.	1.061	7463.	3.981	81.	0.042	313.476	0.167	3.433
2 0-25	6982.	3.150	6.350	93.	0.937	6546.	2.953	87.	0.244	1597.246	0.720	21.275
3 30	4821.	1.810	11.860	104.	0.806	3889.	1.460	83.	0.118	458.984	0.172	9.901
4 30-15	4470.	2.040	9.420	98.	0.949	4245.	1.937	93.	0.062	263.206	0.120	5.770
5 15	5862.	0.600	8.520	77.	0.957	5610.	0.574	73.	0.050	280.506	0.028	3.684
6 15-30	4984.	2.230	8.860	89.	0.944	4705.	2.105	84.	0.455	2141.069	0.957	38.233
7 50-20	5909.	5.170	2.810	85.	1.231	7275.	6.365	104.	0.029	210.986	0.184	3.035
SUM----------(CYCLE COMPOSITE)										5265.477	2.351	85.333
CYCLE 3												
1 IDLE	7302.	4.160	3.810	90.	1.052	7685.	4.378	94.	0.042	322.798	0.183	3.978
2 0-25	6966.	4.220	6.040	120.	0.925	6444.	3.904	111.	0.244	1572.466	0.952	27.088
3 30	4770.	1.420	12.090	117.	0.807	3852.	1.146	94.	0.118	454.637	0.135	11.151
4 30-15	4756.	1.930	9.890	93.	0.906	4312.	1.749	84.	0.062	267.373	0.108	5.228
5 15	5879.	1.070	8.700	77.	0.930	5469.	0.995	71.	0.050	273.497	0.049	3.582
6 15-30	5229.	3.530	8.480	105.	0.912	4770.	3.220	95.	0.455	2170.754	1.465	43.589
7 50-20	6243.	5.330	3.750	85.	1.102	6880.	5.873	93.	0.029	199.520	0.170	2.716
SUM----------(CYCLE COMPOSITE)										5261.045	3.065	97.334
CYCLE 4												
1 IDLE	7310.	4.350	3.740	90.	1.049	7675.	4.567	94.	0.042	322.364	0.191	3.968
2 0-25	7140.	4.580	6.270	127.	0.891	6362.	4.081	113.	0.244	1552.517	0.995	27.614
3 30	4890.	0.820	12.510	117.	0.796	3895.	0.653	93.	0.118	459.683	0.077	10.999
4 30-15	4842.	2.370	8.300	100.	0.985	4771.	2.335	98.	0.062	295.830	0.144	6.109
5 15	6477.	0.890	9.000	90.	0.881	5712.	0.784	79.	0.050	285.631	0.039	3.968
6 15-30	5395.	3.980	8.440	100.	0.891	4812.	3.549	89.	0.455	2189.480	1.615	40.583
7 50-20	6320.	5.210	3.610	91.	1.111	7027.	5.793	101.	0.029	203.791	0.167	2.934
SUM----------(CYCLE COMPOSITE)										5309.299	3.232	96.178
AVERAGE SUM OF CYCLES 1-4										5129.564	2.686	88.072

PETRO-CHEM COMPUTING, INC

YAMAHA DTIE RUN-6 S - COLD CYCLE K = 1.0000 W = 429.

MODE	CONCENTRATION AS HC	CO	CO2	MEASURED NO(K)	DILUTION FACTOR	ADJUSTED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
CYCLE 6												
1 IDLE	4096.	4.500	3.560	77.	1.416	5803.	6.376	109.	0.042	243.750	0.267	4.582
2 0-25	4217.	3.560	6.610	123.	1.120	4723.	3.987	137.	0.244	1152.605	0.973	33.619
3 30	2682.	2.690	11.130	112.	0.943	2529.	2.537	105.	0.118	298.531	0.299	12.466
4 30-15	2706.	2.580	8.570	100.	1.134	3069.	2.926	113.	0.062	190.314	0.191	7.033
5 15	4890.	1.840	8.600	103.	0.979	4790.	1.802	100.	0.050	239.524	0.090	5.045
6 15-30	4063.	4.150	8.270	126.	0.984	3998.	4.084	124.	0.455	1819.423	1.858	56.423
7 50-20	5545.	5.320	3.640	110.	1.179	6542.	6.277	129.	0.029	189.742	0.182	3.764
SUM----------(CYCLE COMPOSITE)										4133.893	3.852	122.933
CYCLE 7												
1 IDLE	7011.	4.640	3.500	103.	1.082	7591.	5.023	111.	0.042	318.827	0.211	4.663
2 0-25	6706.	3.930	6.550	132.	0.920	6170.	3.616	121.	0.244	1505.686	0.882	29.637
3 30	4689.	2.930	11.200	117.	0.817	3834.	2.396	95.	0.118	452.525	0.282	11.291
4 30-15	4521.	2.700	8.570	119.	0.979	4428.	2.644	116.	0.062	274.570	0.163	7.227
5 15	6192.	1.230	8.500	103.	0.917	5681.	1.128	94.	0.050	284.084	0.056	4.725
6 15-30	5377.	4.280	8.250	114.	0.895	4813.	3.831	102.	0.455	2190.183	1.743	46.434
7 50-20	6290.	5.380	3.440	108.	1.122	7057.	6.036	121.	0.029	204.666	0.175	3.514
SUM----------(CYCLE COMPOSITE)										5230.544	3.514	107.514
AVERAGE SUM OF CYCLES 6-7										4682.219	3.683	115.224

YAMAHA DTIE RUN-6 S - COLD CYCLE

CYCLE NUMBER	CONCENTRATION AS DETERMINED HC	CO	NO(K)	WEIGHTING FACTOR	WEIGHTED HC	CO	NO(K)
1	4682.434	2.097	73.444	0.0875	409.713	0.183	6.426
2	5265.477	2.351	85.333	0.0875	460.729	0.205	7.466
3	5261.045	3.065	97.334	0.0875	460.341	0.268	8.516
4	5309.299	3.232	96.178	0.0875	464.563	0.282	8.415
6	4133.893	3.852	122.933	0.3250	1343.515	1.251	39.953
7	5230.544	3.514	107.514	0.3250	1699.926	1.142	34.942
SUM----------(TRIP COMPOSITE)					4838.789	3.334	105.721

PETRO CHEM COMPUTING, INC

DILUTION FACTOR = 14.5/(CO2+0.5*CO+10.8*HC)

APPENDIX C

Motorcycle LA-4 Emissions Data
(1975 Federal Light-Duty Vehicle Procedure)

HARLEY-DAVIDSØN FLH MØTØRCYCLE
RUN 1 10/29/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	48	HCE	1500
CØDM	41.46	CØEM	9888.11
NOD	1.4	NØE	16
NØXD	1.8	NØXE	17.5
CØ2D	.05	CØ2M	1.18
RPM	11293	T	110
P	1	H	104
R	90		
VMIX	704.736	K	1.15781
CØD	40.2548	CØE	9376.05
DF	5.90932		
HC-C	1460.12	HC-MASS	16.8036
NØX-C	16.0046	NØX-MASS	.707273
CØ-C	9342.61	CØ-MASS	217.077

INPUTS AND RESULTS FØR BAG 3

HCD	56	HCE	1150
CØDM	193.77	CØEM	10047.
NOD	1.5	NØE	13.5
NØXD	1.8	NØXE	15
CØ2D	.05	CØ2M	1.12
RPM	11017	T	114
P	1	H	104
R	90		
VMIX	682.721	K	1.15781
CØD	188.137	CØE	9538.28
DF	6.122		
HC-C	1103.15	HC-MASS	12.2988
NØX-C	13.494	NØX-MASS	.577697
CØ-C	9380.88	CØ-MASS	211.157

INPUTS AND RESULTS FØR BAG 2

HCD	48	HCE	1200
CØDM	41.46	CØEM	8566.6
NOD	1.4	NØE	5
NØXD	1.8	NØXE	6
CØ2D	.05	CØ2M	.7
RPM	18872	T	112
P	1	H	104
R	90		
VMIX	1173.58	K	1.15781
CØD	40.2548	CØE	8202.13
DF	8.16967		
HC-C	1157.88	HC-MASS	22.1902
NØX-C	4.42033	NØX-MASS	.3253
CØ-C	8166.81	CØ-MASS	315.998

HC-WM	4.85681
NØX-WM	.127829
CØ-WM	70.6268

HARLEY-DAVIDSØN FLH MØTØRCYCLE
RUN 2 10/30/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	43	HCE	1450
CØDM	117.01	CØEM	10539.5
NOD	1	NØE	16.5
NØXD	1.5	NØXE	17.5
CØ2D	.05	CØ2M	1.22
RPM	11140	T	110
P	1	H	77
R	59		
VMIX	694.472	K	1.00949
CØD	114.78	CØE	10091.2
DF	5.6442		
HC-C	1414.62	HC-MASS	16.0428
NØX-C	16.2658	NØX-MASS	.617603
CØ-C	9996.72	CØ-MASS	228.892

INPUTS AND RESULTS FØR BAG 3

HCD	43	HCE	1400
CØDM	74.89	CØEM	9426.65
NOD	1	NØE	14
NØXD	1.5	NØXE	15
CØ2D	.04	CØ2M	1.1
RPM	11304	T	113
P	1	H	77
R	59		
VMIX	701.006	K	1.00949
CØD	73.4628	CØE	9047.4
DF	6.24784		
HC-C	1363.88	HC-MASS	15.6129
NØX-C	13.7401	NØX-MASS	.526613
CØ-C	8985.69	CØ-MASS	207.679

INPUTS AND RESULTS FØR BAG 2

HCD	43	HCE	1500
CØDM	117.01	CØEM	10372.6
NOD	1	NØE	5
NØXD	1.5	NØXE	6.5
CØ2D	.05	CØ2M	.84
RPM	18935	T	111
P	1	H	77
R	59		
VMIX	1178.35	K	1.00949
CØD	114.78	CØE	10007.2
DF	6.73122		
HC-C	1463.39	HC-MASS	28.1591
NØX-C	5.22284	NØX-MASS	.336481
CØ-C	9909.5	CØ-MASS	384.985

HC-WM	5.86092
NØX-WM	.120296
CØ-WM	80.2381

HARLEY-DAVIDSØN MØTØRCYCLE
RUN 3 11/1/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	30	HCE	1600
CØDM	49.8	CØEM	11418.1
NOD	.4	NØE	16
NØXD	.6	NØXE	18
CØ2D	.06	CØ2M	1.36
RPM	11003	T	110
P	1	H	73
R	65		
VMIX	684.045	K	.990688
CØD	48.7544	CØE	10879.4
DF	5.13815		
HC-C	1575.84	HC-MASS	17.6028
NØX-C	17.5168	NØX-MASS	.642916
CØ-C	10840.1	CØ-MASS	244.477

INPUTS AND RESULTS FØR BAG 3

HCD	28	HCE	1500
CØDM	66.51	CØEM	11236.3
NOD	.2	NØE	15
NØXD	.4	NØXE	16.5
CØ2D	.05	CØ2M	1.31
RPM	11229	T	111
P	1	H	73
R	65		
VMIX	696.873	K	.990688
CØD	65.1136	CØE	10717.
DF	5.29289		
HC-C	1477.29	HC-MASS	16.8115
NØX-C	16.1756	NØX-MASS	.604823
CØ-C	10664.2	CØ-MASS	245.019

INPUTS AND RESULTS FØR BAG 2

HCD	30	HCE	1450
CØDM	49.8	CØEM	9578.01
NOD	.4	NØE	4.5
NØXD	.6	NØXE	5.8
CØ2D	.06	CØ2M	.83
RPM	18905	T	112
P	1	H	73
R	65		
VMIX	1171.19	K	.990688
CØD	48.7544	CØE	9223.89
DF	7.06234		
HC-C	1424.25	HC-MASS	27.2396
NØX-C	5.28496	NØX-MASS	.332113
CØ-C	9182.04	CØ-MASS	354.558

HC-WM	5.91885
NØX-WM	.127109
CØ-WM	79.9125

HØNDA CL350K3 MØTØRCYCLE
RUN 1 10/29/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	40	HCE	1100
CØDM	33.14	CØEM	7534.46
NOD	.8	NØE	6.4
NØXD	1	NØXE	7.6
CØ2D	.04	CØ2M	.66
RPM	11446	T	115
P	1	H	104
R	90		
VMIX	708.072	K	1.15781
CØD	32.1766	CØE	7219.71
DF	8.98141		
HC-C	1064.45	HC-MASS	12.3081
NØX-C	6.71134	NØX-MASS	.297991
CØ-C	7191.11	CØ-MASS	167.878

INPUTS AND RESULTS FØR BAG 3

HCD	43	HCE	1030
CØDM	41.46	CØEM	6834.52
NOD	1	NØE	6.8
NØXD	1.2	NØXE	8
CØ2D	.03	CØ2M	.63
RPM	11384	T	117
P	1	H	104
R	90		
VMIX	701.796	K	1.15781
CØD	40.2548	CØE	6552.95
DF	9.65212		
HC-C	991.455	HC-MASS	11.3624
NØX-C	6.92432	NØX-MASS	.304722
CØ-C	6516.87	CØ-MASS	150.789

INPUTS AND RESULTS FØR BAG 2

HCD	40	HCE	940
CØDM	33.14	CØEM	5131
NOD	.8	NØE	2.6
NØXD	1	NØXE	3.4
CØ2D	.04	CØ2M	.45
RPM	18858	T	117
P	1	H	104
R	90		
VMIX	1162.55	K	1.15781
CØD	32.1766	CØE	4937.39
DF	12.9127		
HC-C	903.098	HC-MASS	17.1448
NØX-C	2.47744	NØX-MASS	.180606
CØ-C	4907.71	CØ-MASS	188.109

HC-WM	3.85518
NØX-WM	6.43244 E-2
CØ-WM	46.1661

HØNDA CL350K3 MØTØRCYCLE
RUN 2 10/30/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	30	HCE	1250
CØDM	66.51	CØEM	7907.4
NOD	1.5	NØE	7.5
NØXD	2	NØXE	8.5
CØ2D	.04	CØ2M	.69
RPM	10701	T	112
P	1	H	77
R	59		
VMIX	664.772	K	1.00949
CØD	65.2425	CØE	7651.68
DF	8.48011		
HC-C	1223.54	HC-MASS	13.2824
NØX-C	6.73585	NØX-MASS	.244819
CØ-C	7594.13	CØ-MASS	166.445

INPUTS AND RESULTS FØR BAG 3

HCD	25	HCE	1150
CØDM	41.46	CØEM	6947.16
NOD	1.5	NØE	7.5
NØXD	3.5	NØXE	9
CØ2D	.06	CØ2M	.64
RPM	11237	T	112
P	1	H	77
R	59		
VMIX	698.069	K	1.00949
CØD	40.6699	CØE	6729.18
DF	9.38429		
HC-C	1127.66	HC-MASS	12.8548
NØX-C	5.87296	NØX-MASS	.224149
CØ-C	6692.84	CØ-MASS	154.038

INPUTS AND RESULTS FØR BAG 2

HCD	30	HCE	950
CØDM	66.51	CØEM	4953.65
NOD	1.5	NØE	3
NØXD	2	NØXE	4
CØ2D	.04	CØ2M	.44
RPM	18813	T	112
P	1	H	77
R	59		
VMIX	1168.71	K	1.00949
CØD	65.2425	CØE	4817.29
DF	13.1795		
HC-C	922.276	HC-MASS	17.6017
NØX-C	2.15175	NØX-MASS	.137492
CØ-C	4757.	CØ-MASS	183.298

HC-WM	4.08537
NØX-WM	4.94039 E-2
CØ-WM	45.6895

HØNDA CL350K3 MØTØRCYCLE
RUN 3 11/1/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	57	HCE	1200
CØDM	117.01	CØEM	7413.67
NOD	.2	NØE	5.3
NØXD	.5	NØXE	6.5
CØ2D	.05	CØ2M	.68
RPM	11142	T	109
P	1	H	74
R	65		
VMIX	693.904	K	.995322
CØD	114.553	CØE	7160.98
DF	8.83848		
HC-C	1149.45	HC-MASS	13.0249
NØX-C	6.05657	NØX-MASS	.226552
CØ-C	7059.38	CØ-MASS	161.505

INPUTS AND RESULTS FØR BAG 3

HCD	45	HCE	1200
CØDM	100.12	CØEM	7413.67
NOD	.5	NØE	4.2
NØXD	.7	NØXE	5.2
CØ2D	.05	CØ2M	.59
RPM	11206	T	115
P	1	H	74
R	65		
VMIX	690.607	K	.995322
CØD	98.018	CØE	7173.82
DF	9.38782		
HC-C	1159.79	HC-MASS	13.0797
NØX-C	4.57456	NØX-MASS	.170303
CØ-C	7086.24	CØ-MASS	161.349

INPUTS AND RESULTS FØR BAG 2

HCD	57	HCE	1000
CØDM	117.01	CØEM	5312.75
NOD	.2	NØE	1.6
NØXD	.5	NØXE	2.5
CØ2D	.05	CØ2M	.45
RPM	18877	T	109
P	1	H	74
R	65		
VMIX	1175.63	K	.995322
CØD	114.553	CØE	5155.19
DF	12.576		
HC-C	947.532	HC-MASS	18.1907
NØX-C	2.03976	NØX-MASS	.129268
CØ-C	5049.74	CØ-MASS	195.73

HC-WM	4.16625
NØX-WM	4.31677 E-2
CØ-WM	47.6195

HØNDA SL-100 MØTØRCYCLE
RUN 1 8/15/72

VO IS 7.55355E-2

INPUTS AND RESULTS FØR BAG 1

HCD	30	HCE	638
CØDM	3	CØEM	3487
NOD	0	NØE	32
NØXD	.1	NØXE	39
CØ2D	.05	CØ2M	.66
RPM	11925	T	106
P	3.8	H	70
R	57		
VMIX	814.429	K	.97704
CØD	2.94477	CØE	3378.5
DF	12.6219		
HC-C	610.377	HC-MASS	8.11778
NØX-C	38.9079	NØX-MASS	1.6768
CØ-C	3375.79	CØ-MASS	90.6457

INPUTS AND RESULTS FØR BAG 3

HCD	25	HCE	536
CØDM	8	CØEM	2465
NOD	.1	NØE	32.3
NØXD	.3	NØXE	43.5
CØ2D	.03	CØ2M	.6
RPM	12182	T	114
P	3.8	H	70
R	57		
VMIX	820.385	K	.97704
CØD	7.85271	CØE	2391.15
DF	15.0104		
HC-C	512.666	HC-MASS	6.86812
NØX-C	43.22	NØX-MASS	1.87626
CØ-C	2383.82	CØ-MASS	64.4777

INPUTS AND RESULTS FØR BAG 2

HCD	30	HCE	466
CØDM	3	CØEM	3246
NOD	0	NØE	8.4
NØXD	.1	NØXE	9.6
CØ2D	.05	CØ2M	.37
RPM	18187	T	108
P	3.8	H	70
R	57		
VMIX	1237.72	K	.97704
CØD	2.94477	CØE	3163.12
DF	18.2832		
HC-C	437.641	HC-MASS	8.84561
NØX-C	9.50547	NØX-MASS	.62257
CØ-C	3160.33	CØ-MASS	128.966

HC-WM	2.16681
NØX-WM	.321742
CØ-WM	27.2928

HØNDA SL-100 MØTØRCYCLE
RUN 4 8/18/72

VO IS 7.55355E-2

INPUTS AND RESULTS FØR BAG 1

HCD	36	HCE	523
CØDM	2	CØEM	2004
NOD	.4	NØE	18.8
NØXD	1.2	NØXE	46.1
CØ2D	.04	CØ2M	.57
RPM	11430	T	120
P	3.8	H	70
R	52		
VMIX	758.627	K	.97704
CØD	1.96641	CØE	1948.35
DF	16.3988		
HC-C	489.195	HC-MASS	6.06034
NØX-C	44.9732	NØX-MASS	1.8054
CØ-C	1946.51	CØ-MASS	48.6859

INPUTS AND RESULTS FØR BAG 3

HCD	31	HCE	418
CØDM	2	CØEM	1691
NOD	.3	NØE	23.9
NØXD	1	NØXE	49.8
CØ2D	.04	CØ2M	.53
RPM	10855	T	120
P	3.8	H	70
R	52		
VMIX	720.464	K	.97704
CØD	1.96641	CØE	1645.35
DF	18.1982		
HC-C	388.703	HC-MASS	4.57316
NØX-C	48.855	NØX-MASS	1.86257
CØ-C	1643.49	CØ-MASS	39.0389

INPUTS AND RESULTS FØR BAG 2

HCD	36	HCE	356
CØDM	2	CØEM	1794
NOD	.4	NØE	10.8
NØXD	1.2	NØXE	16.8
CØ2D	.04	CØ2M	.33
RPM	18987	T	119
P	3.8	H	70
R	52		
VMIX	1262.37	K	.97704
CØD	1.96641	CØE	1752.47
DF	24.7759		
HC-C	321.453	HC-MASS	6.62662
NØX-C	15.6484	NØX-MASS	1.04532
CØ-C	1750.58	CØ-MASS	72.8602

HC-WM	1.57857
NØX-WM	.384441
CØ-WM	15.473

HONDA SL-100 MØTØRCYCLE
RUN 5 8/21/72

VO IS 7.55355E-2

INPUTS AND RESULTS FØR BAG 1

HCD	40	HCE	685
CØDM	25	CØEM	2654
NOD	.6	NØE	20.1
NØXD	1.4	NØXE	36.2
CØ2D	.03	CØ2M	.55
RPM	11386	T	121
P	3.8	H	93
R	62		
VMIX	753.361	K	1.09242
CØD	24.4993	CØE	2572.75
DF	15.3007		
HC-C	647.614	HC-MASS	7.9672
NØX-C	34.8915	NØX-MASS	1.55522
CØ-C	2549.85	CØ-MASS	63.3341

INPUTS AND RESULTS FØR BAG 3

HCD	30	HCE	616
CØDM	31	CØEM	3452
NOD	.3	NØE	19.3
NØXD	1.3	NØXE	27.8
CØ2D	.03	CØ2M	.53
RPM	11260	T	121
P	3.8	H	93
R	62		
VMIX	745.025	K	1.09242
CØD	30.3792	CØE	3347.65
DF	14.4651		
HC-C	588.074	HC-MASS	7.15466
NØX-C	26.5899	NØX-MASS	1.17207
CØ-C	3319.37	CØ-MASS	81.5353

INPUTS AND RESULTS FØR BAG 2

HCD	40	HCE	500
CØDM	25	CØEM	2993
NOD	.6	NØE	7.9
NØXD	1.4	NØXE	10.1
CØ2D	.03	CØ2M	.34
RPM	18890	T	119
P	3.8	H	93
R	62		
VMIX	1254.19	K	1.09242
CØD	24.4993	CØE	2913.47
DF	19.6669		
HC-C	462.034	HC-MASS	9.46285
NØX-C	8.77119	NØX-MASS	.65036
CØ-C	2890.22	CØ-MASS	119.512

HC-WM	2.26225
NØX-WM	.265025
CØ-WM	25.7628

HØNDA SL-100 MØTØRCYCLE
RUN 6 8/22/72

VO IS 7.55355E-2

INPUTS AND RESULTS FØR BAG 1

HCD	34	HCE	781
CØDM	0	CØEM	2288
NOD	0	NØE	19.6
NØXD	.3	NØXE	42.5
CØ2D	.05	CØ2M	.64
RPM	11717	T	120
P	3.8	H	81
R	63		
VMIX	776.868	K	1.02902
CØD	0	CØE	2213.25
DF	14.264		
HC-C	749.384	HC-MASS	9.50687
NØX-C	42.221	NØX-MASS	1.82801
CØ-C	2213.25	CØ-MASS	56.6888

INPUTS AND RESULTS FØR BAG 3

HCD	36	HCE	548
CØDM	2	CØEM	2350
NOD	0	NØE	22.1
NØXD	.4	NØXE	37.4
CØ2D	.04	CØ2M	.55
RPM	11600	T	121
P	3.8	H	81
R	63		
VMIX	767.787	K	1.02902
CØD	1.9593	CØE	2277.3
DF	16.0955		
HC-C	514.237	HC-MASS	6.44748
NØX-C	37.0249	NØX-MASS	1.58429
CØ-C	2275.46	CØ-MASS	57.6009

INPUTS AND RESULTS FØR BAG 2

HCD	34	HCE	433
CØDM	0	CØEM	2260
NOD	0	NØE	10.2
NØXD	.3	NØXE	14
CØ2D	.05	CØ2M	.39
RPM	18953	T	119
P	3.8	H	81
R	63		
VMIX	1258.8	K	1.02902
CØD	0	CØE	2197.04
DF	20.5205		
HC-C	400.657	HC-MASS	8.23601
NØX-C	13.7146	NØX-MASS	.962152
CØ-C	2197.04	CØ-MASS	91.1835

HC-WM	2.1332
NØX-WM	.353499
CØ-WM	19.7856

KAWASAKI 125F-6 MØTØRCYCLE
RUN 1 8/15/72

VO IS 7.55355E-2

INPUTS AND RESULTS FØR BAG 1

HCD	24	HCE	3400
CØDM	5	CØEM	1089
NOD	0	NØE	8.4
NØXD	.9	NØXE	20.1
CØ2D	.06	CØ2M	.6
RPM	13145	T	100
P	3.8	H	70
R	57		
VMIX	907.368	K	.97704
CØD	4.90794	CØE	1056.37
DF	12.8152		
HC-C	3377.87	HC-MASS	50.051
NØX-C	19.2702	NØX-MASS	.925255
CØ-C	1051.85	CØ-MASS	31.467

INPUTS AND RESULTS FØR BAG 3

HCD	32	HCE	3800
CØDM	5	CØEM	1685
NOD	.1	NØE	14.1
NØXD	.9	NØXE	23.3
CØ2D	.06	CØ2M	.6
RPM	11796	T	117
P	3.8	H	70
R	57		
VMIX	790.26	K	.97704
CØD	4.90794	CØE	1634.52
DF	11.7189		
HC-C	3770.73	HC-MASS	48.6611
NØX-C	22.4768	NØX-MASS	.939929
CØ-C	1630.03	CØ-MASS	42.4701

INPUTS AND RESULTS FØR BAG 2

HCD	24	HCE	2040
CØDM	5	CØEM	304
NOD	0	NØE	4.2
NØXD	.9	NØXE	8.1
CØ2D	.06	CØ2M	.45
RPM	19726	T	104
P	3.8	H	70
R	57		
VMIX	1351.98	K	.97704
CØD	4.90794	CØE	295.77
DF	19.6028		
HC-C	2017.22	HC-MASS	44.536
NØX-C	7.24591	NØX-MASS	.518388
CØ-C	291.112	CØ-MASS	12.9763

HC-WM	12.506
NØX-WM	.193601
CØ-WM	6.76201

KAWASAKI 125F-6 MØTØRCYCLE
RUN 3 8/17/72

VO IS 7.55355E-2

INPUTS AND RESULTS FØR BAG 1

HCD	24	HCE	2950
CØDM	3	CØEM	1532
NOD	.2	NØE	11.8
NØXD	1.9	NØXE	17.5
CØ2D	.03	CØ2M	.5
RPM	11449	T	120
P	3.8	H	80
R	66		
VMIX	761.73	K	1.02407
CØD	2.93605	CØE	1484.6
DF	14.203		
HC-C	2927.69	HC-MASS	36.4177
NØX-C	15.7338	NØX-MASS	.664723
CØ-C	1481.87	CØ-MASS	37.2159

INPUTS AND RESULTS FØR BAG 3

HCD	25	HCE	2810
CØDM	2	CØEM	1632
NOD	.7	NØE	12.8
NØXD	5.1	NØXE	19.7
CØ2D	.05	CØ2M	.48
RPM	11387	T	120
P	3.8	H	80
R	66		
VMIX	757.605	K	1.02407
CØD	1.95736	CØE	1582.13
DF	14.5777		
HC-C	2786.71	HC-MASS	34.4764
NØX-C	14.9498	NØX-MASS	.628183
CØ-C	1580.31	CØ-MASS	39.4733

INPUTS AND RESULTS FØR BAG 2

HCD	24	HCE	1530
CØDM	3	CØEM	610
NOD	.2	NØE	5.7
NØXD	1.9	NØXE	8.6
CØ2D	.03	CØ2M	.35
RPM	19043	T	119
P	3.8	H	80
R	66		
VMIX	1269.17	K	1.02407
CØD	2.93605	CØE	592.886
DF	23.8312		
HC-C	1507.01	HC-MASS	31.2334
NØX-C	6.77973	NØX-MASS	.47724
CØ-C	590.073	CØ-MASS	24.6913

HC-WM	8.87261
NØX-WM	.149485
CØ-WM	8.42585

KAWASAKI 125F-6 MØTØRCYCLE
RUN 4 8/18/72

VO IS 7.55355E-2

INPUTS AND RESULTS FØR BAG 1

HCD	41	HCE	3000
CØDM	9	CØEM	1564
NOD	0	NØE	10.3
NØXD	.6	NØXE	17.7
CØ2D	.04	CØ2M	.54
RPM	11305	T	120
P	3.8	H	79
R	61		
VMIX	751.63	K	1.01916
CØD	8.82267	CØE	1516.93
DF	13.5123		
HC-C	2962.03	HC-MASS	36.3564
NØX-C	17.1444	NØX-MASS	.711291
CØ-C	1508.76	CØ-MASS	37.3889

INPUTS AND RESULTS FØR BAG 3

HCD	26	HCE	2910
CØDM	2	CØEM	1487
NOD	.4	NØE	12.7
NØXD	2	NØXE	18.3
CØ2D	.03	CØ2M	.5
RPM	11285	T	120
P	3.8	H	79
R	61		
VMIX	750.3	K	1.01916
CØD	1.96059	CØE	1443.39
DF	14.3264		
HC-C	2885.81	HC-MASS	35.3582
NØX-C	16.4396	NØX-MASS	.680844
CØ-C	1441.57	CØ-MASS	35.6606

INPUTS AND RESULTS FØR BAG 2

HCD	41	HCE	1520
CØDM	9	CØEM	632
NOD	0	NØE	4.7
NØXD	.6	NØXE	7.2
CØ2D	.04	CØ2M	.35
RPM	18954	T	119
P	3.8	H	79
R	61		
VMIX	1262.36	K	1.01916
CØD	8.82267	CØE	615.29
DF	23.7787		
HC-C	1480.72	HC-MASS	30.5242
NØX-C	6.62523	NØX-MASS	.461643
CØ-C	606.838	CØ-MASS	25.2566

HC-WM	8.84154
NØX-WM	.154077
CØ-WM	8.22138

KAWASAKI 125F-6 MØTØRCYCLE
RUN 5 8/21/72

VO IS 7.55355E-2

INPUTS AND RESULTS FØR BAG 1

HCD	26	HCE	3010
CØDM	11	CØEM	1461
NOD	0	NØE	10.1
NØXD	.4	NØXE	15.8
CØ2D	.05	CØ2M	.57
RPM	11258	T	120
P	3.8	H	83
R	66		
VMIX	749.023	K	1.03907
CØD	10.7655	CØE	1413.82
DF	13.2361		
HC-C	2985.96	HC-MASS	36.5229
NØX-C	15.4302	NØX-MASS	.650414
CØ-C	1403.87	CØ-MASS	34.669

INPUTS AND RESULTS FØR BAG 3

HCD	35	HCE	2750
CØDM	44	CØEM	1451
NOD	0	NOE	11.7
NØXD	.4	NØXE	16.6
CØ2D	.04	CØ2M	.53
RPM	11137	T	120
P	3.8	H	83
R	66		
VMIX	740.972	K	1.03907
CØD	43.062	CØE	1405.26
DF	14.172		
HC-C	2717.47	HC-MASS	32.8816
NØX-C	16.2282	NØX-MASS	.6767
CØ-C	1365.24	CØ-MASS	33.3526

INPUTS AND RESULTS FØR BAG 2

HCD	26	HCE	1590
CØDM	11	CØEM	559
NOD	0	NØE	4.9
NØXD	.4	NØXE	7.3
CØ2D	.05	CØ2M	.41
RPM	18990	T	119
P	3.8	H	83
R	66		
VMIX	1265.63	K	1.03907
CØD	10.7655	CØE	542.671
DF	21.4996		
HC-C	1565.21	HC-MASS	32.3494
NØX-C	6.9186	NØX-MASS	.492776
CØ-C	532.407	CØ-MASS	22.2162

HC-WM	8.90624
NØX-WM	.154423
CØ-WM	7.48465

SUZUKI T250 MØTØRCYCLE
RUN 2 11/16/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	12	HCE	6250
CØDM	8	CØEM	7177
NOD	.2	NØE	1.9
NØXD	.4	NØXE	4.4
CØ2D	.03	CØ2M	.77
RPM	11147	T	111
P	1	H	75
R	62		
VMIX	692.261	K	1
CØD	7.83979	CØE	6926.89
DF	6.41858		
HC-C	6239.87	HC-MASS	70.5393
NØX-C	4.06232	NØX-MASS	.152308
CØ-C	6920.27	CØ-MASS	157.947

INPUTS AND RESULTS FØR BAG 3

HCD	13.5	HCE	6550
CØDM	8	CØEM	7657
NOD	.1	NØE	1.7
NØXD	.4	NØXE	4.6
CØ2D	.04	CØ2M	.71
RPM	11133	T	111
P	1	H	75
R	62		
VMIX	691.391	K	1
CØD	7.83979	CØE	7399.01
DF	6.3661		
HC-C	6538.62	HC-MASS	73.8238
NØX-C	4.26283	NØX-MASS	.159625
CØ-C	7392.4	CØ-MASS	168.511

INPUTS AND RESULTS FØR BAG 2

HCD	12	HCE	3550
CØDM	8	CØEM	2438
NOD	.2	NØE	.9
NØXD	.4	NØXE	2.2
CØ2D	.03	CØ2M	.51
RPM	18865	T	111
P	1	H	75
R	62		
VMIX	1171.57	K	1
CØD	7.83979	CØE	2365.24
DF	12.165		
HC-C	3538.99	HC-MASS	67.707
NØX-C	1.83288	NØX-MASS	.1163
CØ-C	2358.05	CØ-MASS	91.0835

HC-WM	18.6825
NØX-WM	3.63705 E-2
CØ-WM	34.0069

SUZUKI T250 MØTØRCYCLE
RUN 3 11/17/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	63	HCE	6700
CØDM	50	CØEM	6294
NOD	.1	NØE	1.5
NØXD	.4	NØXE	4.1
CØ2D	.05	CØ2M	.67
RPM	11200	T	117
P	1	H	75
R	56		
VMIX	685.475	K	1
CØD	49.0956	CØE	6098.98
DF	6.87216		
HC-C	6646.17	HC-MASS	74.3959
NØX-C	3.75821	NØX-MASS	.139525
CØ-C	6057.03	CØ-MASS	136.889

INPUTS AND RESULTS FØR BAG 3

HCD	21.5	HCE	7000
CØDM	17	CØEM	6614
NOD	.1	NØE	1.7
NØXD	.4	NØXE	4.2
CØ2D	.02	CØ2M	.66
RPM	11068	T	113
P	1	H	75
R	56		
VMIX	682.125	K	1
CØD	16.6925	CØE	6410.34
DF	6.69654		
HC-C	6981.71	HC-MASS	77.7699
NØX-C	3.85973	NØX-MASS	.142593
CØ-C	6396.14	CØ-MASS	143.847

INPUTS AND RESULTS FØR BAG 2

HCD	63	HCE	3800
CØDM	50	CØEM	2151
NOD	.1	NØE	1.6
NØXD	.4	NØXE	2.1
CØ2D	.05	CØ2M	.46
RPM	19024	T	115
P	1	H	75
R	56		
VMIX	1168.38	K	1
CØD	49.0956	CØE	2093.05
DF	12.7704		
HC-C	3741.93	HC-MASS	71.3946
NØX-C	1.73132	NØX-MASS	.109557
CØ-C	2047.79	CØ-MASS	78.8839

HC-WM	19.6952
NØX-WM	3.34441 E-2
CØ-WM	29.2985

SUZUKI T250 MØTØRCYCLE
RUN 4 11/18/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	30	HCE	8100
CØDM	8	CØEM	8165
NOD	.1	NØE	2.5
NØXD	.5	NØXE	5.7
CØ2D	.03	CØ2M	.8
RPM	11338	T	112
P	1	H	55
R	52		
VMIX	703.617	K	.914077
CØD	7.86563	CØE	7902.12
DF	5.58284		
HC-C	8075.37	HC-MASS	92.7866
NØX-C	5.28956	NØX-MASS	.184254
CØ-C	7895.66	CØ-MASS	183.166

INPUTS AND RESULTS FØR BAG 3

HCD	30	HCE	8400
CØDM	17	CØEM	9131
NOD	.1	NØE	2.4
NØXD	.6	NØXE	6.4
CØ2D	.06	CØ2M	.77
RPM	11159	T	112
P	1	H	55
R	52		
VMIX	692.509	K	.914077
CØD	16.7145	CØE	8842.29
DF	5.3724		
HC-C	8375.58	HC-MASS	94.7167
NØX-C	5.91168	NØX-MASS	.202674
CØ-C	8828.69	CØ-MASS	201.577

INPUTS AND RESULTS FØR BAG 2

HCD	30	HCE	4400
CØDM	8	CØEM	3029
NOD	.1	NØE	1.2
NØXD	.5	NØXE	2.8
CØ2D	.03	CØ2M	.53
RPM	18923	T	113
P	1	H	55
R	52		
VMIX	1172.28	K	.914077
CØD	7.86563	CØE	2947.22
DF	10.5952		
HC-C	4372.83	HC-MASS	83.7106
NØX-C	2.34719	NØX-MASS	.13622
CØ-C	2940.1	CØ-MASS	113.635

HC-WM	23.6797
NØX-WM	4.41298 E-2
CØ-WM	40.9727

TRIUMPH T120R MØTØRCYCLE
RUN 1 11/3/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	12	HCE	1300
CØDM	17	CØEM	6835
NOD	.2	NØE	12
NØXD	.4	NØXE	13.5
CØ2D	.04	CØ2M	.68
RPM	11264	T	104
P	1	H	60
R	53		
VMIX	716.257	K	.934143
CØD	16.709	CØE	6628.52
DF	9.09799		
HC-C	1289.32	HC-MASS	15.0805
NØX-C	13.144	NØX-MASS	.476308
CØ-C	6613.65	CØ-MASS	156.181

INPUTS AND RESULTS FØR BAG 3

HCD	13	HCE	1400
CØDM	25	CØEM	6506
NOD	.8	NØE	11.5
NØXD	1	NØXE	12.5
CØ2D	.05	CØ2M	.63
RPM	11424	T	103
P	1	H	60
R	53		
VMIX	727.722	K	.934143
CØD	24.572	CØE	6315.72
DF	9.56069		
HC-C	1388.36	HC-MASS	16.4988
NØX-C	11.6046	NØX-MASS	.427255
CØ-C	6293.72	CØ-MASS	151.005

INPUTS AND RESULTS FØR BAG 2

HCD	12	HCE	1250
CØDM	17	CØEM	5042
NOD	.2	NØE	4.7
NØXD	.4	NØXE	5.4
CØ2D	.04	CØ2M	.47
RPM	18849	T	103
P	1	H	60
R	53		
VMIX	1200.7	K	.934143
CØD	16.709	CØE	4910.07
DF	12.3388		
HC-C	1238.97	HC-MASS	24.2931
NØX-C	5.03242	NØX-MASS	.305706
CØ-C	4894.71	CØ-MASS	193.768

HC-WM	5.35761
NØX-WM	.100541
CØ-WM	46.2665

TRIUMPH T120R MØTØRCYCLE
RUN 2 11/4/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	14	HCE	1300
CØDM	33	CØEM	6190
NOD	.1	NØE	13.5
NØXD	.4	NØXE	15
CØ2D	.05	CØ2M	.74
RPM	11265	T	103
P	1	H	43
R	45		
VMIX	719.548	K	.869263
CØD	32.5203	CØE	6011.85
DF	9.1083		
HC-C	1287.54	HC-MASS	15.1288
NØX-C	14.6439	NØX-MASS	.496075
CØ-C	5982.9	CØ-MASS	141.935

INPUTS AND RESULTS FØR BAG 3

HCD	18	HCE	1500
CØDM	58	CØEM	6506
NOD	.2	NØE	13
NØXD	.3	NØXE	14
CØ2D	.05	CØ2M	.66
RPM	11410	T	103
P	1	H	43
R	45		
VMIX	728.81	K	.869263
CØD	57.157	CØE	6328.78
DF	9.287		
HC-C	1483.94	HC-MASS	17.661
NØX-C	13.7323	NØX-MASS	.471181
CØ-C	6277.77	CØ-MASS	150.848

INPUTS AND RESULTS FØR BAG 2

HCD	14	HCE	1200
CØDM	33	CØEM	5221
NOD	.1	NØE	4.7
NØXD	.4	NØXE	5.6
CØ2D	.05	CØ2M	.51
RPM	18887	T	103
P	1	H	43
R	45		
VMIX	1206.4	K	.869263
CØD	32.5203	CØE	5093.86
DF	11.7607		
HC-C	1187.19	HC-MASS	23.3883
NØX-C	5.23401	NØX-MASS	.297273
CØ-C	5064.1	CØ-MASS	201.425

HC-WM	5.32806
NØX-WM	.103888
CØ-WM	46.4587

TRIUMPH T120R MØTØRCYCLE
RUN 3 11/5/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	9.5	HCE	1450
CØDM	17	CØEM	6506
NOD	.2	NØE	13.5
NØXD	.3	NØXE	15
CØ2D	.04	CØ2M	.75
RPM	11310	T	110
P	1	H	64
R	57		
VMIX	707.493	K	.950841
CØD	16.687	CØE	6292.29
DF	8.79133		
HC-C	1441.58	HC-MASS	16.6551
NØX-C	14.7341	NØX-MASS	.536825
CØ-C	6277.5	CØ-MASS	146.429

INPUTS AND RESULTS FØR BAG 3

HCD	11	HCE	1450
CØDM	25	CØEM	6190
NOD	.2	NØE	12
NØXD	.4	NØXE	14.5
CØ2D	.04	CØ2M	.73
RPM	11447	T	109
P	1	H	64
R	57		
VMIX	719.778	K	.950841
CØD	24.5397	CØE	5989.05
DF	9.09149		
HC-C	1440.21	HC-MASS	16.9282
NØX-C	14.144	NØX-MASS	.524273
CØ-C	5967.21	CØ-MASS	141.608

INPUTS AND RESULTS FØR BAG 2

HCD	9.5	HCE	1300
CØDM	17	CØEM	5221
NOD	.2	NØE	5.4
NØXD	.3	NØXE	6
CØ2D	.04	CØ2M	.53
RPM	18887	T	110
P	1	H	64
R	57		
VMIX	1185.52	K	.950841
CØD	16.687	CØE	5071.61
DF	11.4809		
HC-C	1291.33	HC-MASS	24.9994
NØX-C	5.72613	NØX-MASS	.349587
CØ-C	5056.38	CØ-MASS	197.636

HC-WM	5.57469
NØX-WM	.117234
CØ-WM	45.5089

YAMAHA DT1-E MØTØRCYCLE
RUN 3 11/18/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	28.5	HCE	5900
CØDM	17	CØEM	5690
NOD	.1	NØE	2.4
NØXD	.6	NØXE	4.4
CØ2D	.06	CØ2M	.9
RPM	11157	T	109
P	1	H	61
R	50		
VMIX	695.317	K	.938262
CØD	16.7254	CØE	5499.53
DF	6.56878		
HC-C	5875.84	HC-MASS	66.7174
NØX-C	3.89134	NØX-MASS	.137494
CØ-C	5485.35	CØ-MASS	125.749

INPUTS AND RESULTS FØR BAG 3

HCD	20	HCE	5800
CØDM	25	CØEM	6190
NOD	.1	NØE	2.5
NØXD	.5	NØXE	4
CØ2D	.04	CØ2M	.82
RPM	11160	T	109
P	1	H	61
R	50		
VMIX	695.504	K	.938262
CØD	24.5962	CØE	5992.32
DF	6.70257		
HC-C	5782.98	HC-MASS	65.6807
NØX-C	3.5746	NØX-MASS	.126337
CØ-C	5971.4	CØ-MASS	136.929

INPUTS AND RESULTS FØR BAG 2

HCD	28.5	HCE	3150
CØDM	17	CØEM	2174
NOD	.1	NØE	1.9
NØXD	.6	NØXE	3.6
CØ2D	.06	CØ2M	.56
RPM	18993	T	109
P	1	H	61
R	50		
VMIX	1183.67	K	.938262
CØD	16.7254	CØE	2115.45
DF	12.3327		
HC-C	3123.81	HC-MASS	60.3809
NØX-C	3.04865	NØX-MASS	.183375
CØ-C	2100.08	CØ-MASS	81.9568

HC-WM	16.8677
NØX-WM	4.19346 E-2
CØ-WM	28.5438

YAMAHA DT1-E MØTØRCYCLE
RUN 4 11/18/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	31	HCE	6200
CØDM	17	CØEM	5788
NOD	.2	NØE	2.4
NØXD	.8	NØXE	4.4
CØ2D	.03	CØ2M	.86
RPM	11124	T	106
P	1	H	62
R	63		
VMIX	698.855	K	.942418
CØD	16.6541	CØE	5574.4
DF	6.57688		
HC-C	6173.71	HC-MASS	70.4563
NØX-C	3.72164	NØX-MASS	.132753
CØ-C	5560.28	CØ-MASS	128.116

INPUTS AND RESULTS FØR BAG 3

HCD	32	HCE	5300
CØDM	8	CØEM	5886
NOD	.2	NØE	2.8
NØXD	.6	NØXE	4.6
CØ2D	.04	CØ2M	.8
RPM	11159	T	109
P	1	H	62
R	63		
VMIX	697.358	K	.942418
CØD	7.83721	CØE	5675.58
DF	7.06171		
HC-C	5272.53	HC-MASS	60.0428
NØX-C	4.08497	NØX-MASS	.145401
CØ-C	5668.85	CØ-MASS	130.338

INPUTS AND RESULTS FØR BAG 2

HCD	31	HCE	3300
CØDM	17	CØEM	2081
NOD	.2	NØE	2.1
NØXD	.8	NØXE	2.6
CØ2D	.03	CØ2M	.51
RPM	19126	T	107
P	1	H	62
R	63		
VMIX	1199.45	K	.942418
CØD	16.6541	CØE	2018.22
DF	12.8621		
HC-C	3271.41	HC-MASS	64.0774
NØX-C	1.8622	NØX-MASS	.114007
CØ-C	2002.86	CØ-MASS	79.2053

HC-WM	17.1464
NØX-WM	3.38626 E-2
CØ-WM	27.8117

YAMAHA DT1-E MØTØRCYCLE
RUN 5 11/19/71

VO IS .069207

INPUTS AND RESULTS FØR BAG 1

HCD	8.5	HCE	5100
CØDM	8	CØEM	4507
NOD	.4	NØE	7.8
NØXD	.8	NØXE	4.7
CØ2D	.05	CØ2M	.84
RPM	11139	T	106
P	1	H	41
R	37		
VMIX	704.604	K	.862218
CØD	7.90439	CØE	4380.26
DF	7.4943		
HC-C	5092.63	HC-MASS	58.5968
NØX-C	4.00675	NØX-MASS	.131836
CØ-C	4373.41	CØ-MASS	101.598

INPUTS AND RESULTS FØR BAG 3

HCD	7.5	HCE	4600
CØDM	8	CØEM	5221
NOD	.2	NØE	6.4
NØXD	.4	NØXE	9.6
CØ2D	.05	CØ2M	.77
RPM	11055	T	107
P	1	H	41
R	37		
VMIX	698.058	K	.862218
CØD	7.90439	CØE	5081.22
DF	7.70947		
HC-C	4593.47	HC-MASS	52.3623
NØX-C	9.25188	NØX-MASS	.30159
CØ-C	5074.34	CØ-MASS	116.786

INPUTS AND RESULTS FØR BAG 2

HCD	8.5	HCE	3150
CØDM	8	CØEM	1523
NOD	.4	NØE	2.7
NØXD	.8	NØXE	4.4
CØ2D	.05	CØ2M	.51
RPM	18862	T	106
P	1	H	41
R	37		
VMIX	1193.13	K	.862218
CØD	7.90439	CØE	1489.85
DF	13.7579		
HC-C	3142.12	HC-MASS	61.2203
NØX-C	3.65815	NØX-MASS	.203819
CØ-C	1482.52	CØ-MASS	58.3184

HC-WM	15.5018
NØX-WM	5.76552 E-2
CØ-WM	22.4764

APPENDIX D

Gaseous Emissions Data from Steady-State Tests on Motorcycles

CONSTANT-SPEED EMISSIONS TEST DATA HARLEY-DAVIDSON FLH Motorcycle

Date 10/4/71 Atmospheric Pressure 29.24 in Hg Wet Bulb Temp. 64 °F Dry Bulb Temp. 72 °F

RUN No. 2

Mode	Condition	Gear	Engine rpm	Dyno hp	FIA HC, ppm C	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	C.L. NO_x, ppm	C.L. NO, ppm	Polar. O_2, %	Temperatures, °F Inlet	Temperatures, °F Exhaust	Fuel Rate, lbm/hr
1	Idle	—	—	—	12,000	4.96	5.60	57	78	28	6.6	76	125	2.72
2	20 RL	1	2970	—	9,200	7.48	6.65	60	50	37	3.2	76	240	4.94
3	30 RL	2	2690	—	8,400	8.25	6.50	60	45	32	3.2	77	300	7.53
4	40 RL	3	2420	—	7,400	9.02	6.35	63	52	39	3.4	77	325	7.10
5	50 RL	4	2460	—	5,400	8.39	6.81	85	67	56	3.2	77	340	7.90
6	20 5%	1	2970	4.1	8,000	8.71	6.50	74	54	45	3.2	77	310	8.75
7	30 5%	2	2690	6.0	5,600	8.55	6.81	82	62	51	3.2	77	345	7.42
8	40 5%	3	2420	8.3	4,200	7.17	7.63	121	93	87	3.0	77	350	7.65
9	50 5%	4	2460	10.1	3,400	5.25	9.06	202	190	185	2.9	77	400	7.31
10	20 10%	1	2970	6.3	9,000	8.71	6.65	63	51	42	3.0	76	250	7.77
11	30 10%	2	2690	9.3	3,600	6.13	8.33	150	120	116	2.9	75	350	7.90
12	40 10%	3	2420	12.8	2,000	0.51	11.75	—	1459	1375	3.1	75	430	6.80
13	50 10%	4	2460	15.7	3,200	6.27	8.69	240	269	269	2.5	75	460	10.65
14	20 20%	1	2970	10.7	3,200	5.40	9.44	187	185	185	2.6	75	445	8.16
15	30 20%	2	2690	15.9	3,200	5.69	9.44	278	306	278	2.3	75	475	10.20
16	0.6Max. RL	1	3360	—	10,800	9.50	6.35	67	48	35	2.9	75	425	8.30
17	0.6Max. 1/3	1	3360	13.9	1,600	0.38	12.68	—	927	890	2.1	75	†500+	10.88
18	0.6Max. 2/3	1	3360	25.8	3,700	9.02	7.80	92	153	139	1.8	75	†500+	23.33
19	0.8Max. RL	1	4480	—	2,500	4.68	9.83	49	91	88	2.1	75	450	12.89
20	0.8Max. 1/3	1	4480	17.8	3,300	7.02	8.50	63	120	116	1.6	75	†500+	20.41
21	0.8Max. 2/3	1	4480	33.1	3,100	9.66	7.30	57	107	97	1.4	75	†500+	30.62
22	Idle	—	—	—	24,400	8.09	5.18	28	23	12	5.1	75	220	3.16

† over 500°F, out of range of pyrometer

CONSTANT-SPEED EMISSIONS TEST DATA HARLEY-DAVIDSON FLH Motorcycle

Date 10/5/71 Atmospheric Pressure 29.30 in Hg Wet Bulb Temp. 64 °F Dry Bulb Temp. 73 °F

RUN No. 3

Mode	Condition	Gear	Engine rpm	Dyno hp	FIA HC, ppm C	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	C.L. NO_x, ppm	C.L. NO, ppm	Polar. O_2, %	Temperatures, °F Inlet	Temperatures, °F Exhaust	Fuel Rate, lbm/hr
1	Idle	—	—	—	9,800	4.81	5.88	53	35	33	7.2	75	135	2.57
2	20 RL	1	2970	—	7,400	8.22	6.49	56	45	34	3.9	75	145	8.44
3	30 RL	2	2690	—	7,000	8.37	6.18	49	45	32	4.2	75	185	7.42
4	40 RL	3	2420	—	7,200	9.15	6.33	49	45	31	3.9	78	235	7.10
5	50 RL	4	2460	—	5,400	8.53	6.63	67	66	58	3.8	78	290	7.31
6	20 5%	1	2970	4.1	6,200	8.53	6.79	42	48	38	3.8	75	245	8.75
7	30 5%	2	2690	6.0	3,200	7.30	7.78	78	75	69	3.7	74	325	8.03
8	40 5%	3	2420	8.3	3,400	7.46	7.95	81	91	88	3.4	74	335	8.16
9	50 5%	4	2460	10.1	2,800	4.67	9.61	187	199	194	3.4	74	350	7.53
10	20 10%	1	2970	6.3	2,750	6.71	7.95	78	88	85	3.3	74	285	8.30
11	30 10%	2	2690	9.3	2,400	4.81	7.45	179	180	176	3.3	74	390	8.03
12	40 10%	3	2420	12.8	1,600	1.15	11.48	1061	1109	1081	3.1	74	400	7.10
13	50 10%	4	2460	15.7	2,750	7.60	8.31	179	166	162	2.7	74	410	10.20
14	20 20%	1	2970	10.7	2,100	3.14	10.41	162	277	259	3.2	74	380	8.44
15	30 20%	2	2690	15.9	2,900	5.67	9.22	346	323	314	2.8	74	485	11.13
16	0.6 Max. RL	1	3360	—	8,500	9.00	6.49	56	51	39	3.6	73	390	8.59
17	0.6 Max. 1/3	1	3360	13.9	2,900	4.81	10.21	277	259	240	2.3	73	500	10.88
18	0.6 Max. 2/3	1	3360	25.8	3,500	7.76	8.13	194	171	166	2.0	73	†500+	16.89
19	0.8 Max. RL	1	4480	—	3,600	7.30	8.48	78	78	74	2.1	74	440	9.07
20	0.8 Max. 1/3	1	4480	17.8	4,100	8.06	8.31	114	106	102	1.8	74	†500+	18.14
21	0.8 Max. 2/3	1	4480	33.1	4,500	9.64	7.95	164	148	129	1.7	74	†500+	28.82
22	Idle	—	—	—	22,000	7.60	5.45	42	25	14	6.0	74	305	3.28

† over 500°F, out of range of pyrometer

CONSTANT - SPEED EMISSIONS TEST DATA HARLEY-DAVIDSON FLH Motorcycle

Date 10/6/71 Atmospheric Pressure 29.34 in Hg Wet Bulb Temp. 63 °F Dry Bulb Temp. 69 °F

RUN No. 4

Mode	Condition	Gear	Engine rpm	Dyno hp	FIA	NDIR			C. L.		Polar.	Temperatures, °F		Fuel Rate,
					HC, ppm C	CO, %	CO_2, %	NO, ppm	NO_x, ppm	NO, ppm	O_2, %	Inlet	Exhaust	lbm/hr
1	Idle	——	——	——	17,400	7.17	5.47	49	28	15	7.8	74	135	3.16
2	20 RL	1	2970	——	11,000	8.87	6.51	56	46	30	5.1	74	230	7.53
3	30 RL	2	2690	——	8,900	9.03	6.42	63	48	33	4.8	73	290	7.65
4	40 RL	3	2420	——	8,200	9.19	6.35	60	47	34	2.8	73	315	7.77
5	50 RL	4	2460	——	5,500	8.80	6.81	74	62	50	3.2	74	325	7.53
6	20 5%	1	2970	4.1	5,300	9.19	7.47	70	60	51	3.0	74	275	8.16
7	30 5%	2	2690	6.0	3,150	7.79	7.81	99	71	67	3.1	74	350	7.42
8	40 5%	3	2420	8.3	3,000	6.73	8.70	139	107	104	3.1	74	380	7.65
9	50 5%	4	2460	10.1	2,850	6.14	9.25	165	134	131	3.0	74	380	7.31
10	20 10%	1	2970	6.3	3,600	7.32	7.98	88	75	70	2.6	74	300	8.90
11	30 10%	2	2690	9.3	2,150	4.40	9.45	191	162	158	2.9	74	425	7.42
12	40 10%	3	2420	12.8	1,400	0.64	11.98	1248	1251	1251	2.7	74	435	7.90
13	50 10%	4	2460	15.7	2,700	6.57	8.33	209	185	185	2.9	74	450	10.88
14	20 20%	1	2970	10.7	2,700	3.84	10.87	232	269	269	2.4	74	325	8.59
15	30 20%	2	2690	15.9	2,500	5.70	9.44	202	259	259	2.5	74	490	11.66
16	0.6 Max. RL	1	3360	——	8,000	9.03	6.65	63	47	36	3.2	74	400	8.03
17	0.6 Max. $\frac{1}{3}$	1	3360	13.9	3,100	5.40	9.64	247	232	222	2.7	74	480	9.60
18	0.6 Max. $\frac{2}{3}$	1	3360	25.8	3,500	8.09	8.33	180	195	185	2.1	75	†500+	19.60
19	0.8 Max. RL	1	4480	——	2,700	6.42	8.70	110	79	74	2.1	75	†500+	9.60
20	0.8 Max. $\frac{1}{3}$	1	4480	17.8	3,500	7.93	8.33	135	121	116	2.9	75	†500+	18.41
21	0.8 Max. $\frac{2}{3}$	1	4480	33.1	3,600	9.98	7.64	121	107	102	1.8	75	†500+	32.66
22	Idle	——	——	——	20,400	8.25	5.76	63	29	18	5.6	75	320	3.33

† over 500°F, out of range of pyrometer

CONSTANT - SPEED EMISSIONS TEST DATA HONDA CL350 K3 Motorcycle

Date 10/13/71 Atmospheric Pressure 29.26 in Hg Wet Bulb Temp. 62 °F Dry Bulb Temp. 72 °F

RUN No. 7

Mode	Condition	Gear	Engine rpm	Dyno hp	FIA HC, ppm C	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	C.L. NO_x, ppm	C.L. NO, ppm	Polar. O_2, %	Temperatures, °F Inlet	Temperatures, °F Exhaust	Fuel Rate, lbm/hr
1	Idle	—	1200	—	4,600	2.52	8.95	61	37	37	4.5	74	110	0.88
2	20 RL	2	3800	—	8,800	7.63	7.51	48	58	50	2.7	74	125	2.59
3	30 RL	3	4300	—	14,000	9.78	6.32	56	44	37	2.9	74	135	3.85
4	40 RL	4	4800	—	14,000	10.76	6.18	70	51	37	2.6	74	150	5.26
5	50 RL	5	5200	—	8,200	9.87	6.90	119	103	96	2.3	74	225	5.00
6	20 5%	2	3800	3.1	9,000	10.73	6.47	41	38	32	2.3	74	125	4.29
7	30 5%	3	4300	4.6	8,200	10.41	6.47	70	60	53	2.3	74	200	5.97
8	40 5%	4	4800	6.5	7,200	10.73	6.47	99	74	64	1.9	74	300	8.03
9	50 5%	5	5200	7.9	6,600	8.37	7.98	302	272	227	1.6	74	375	8.30
10	20 10%	2	3800	4.5	8,600	11.60	6.18	78	65	62	1.8	74	315	5.05
11	30 10%	3	4300	6.6	6,700	10.54	6.75	91	78	75	1.8	74	260	7.31
12	40 10%	4	4800	9.2	6,500	10.70	6.75	134	110	92	1.5	74	390	8.90
13	50 10%	5	5200	*11.0	7,200	11.56	6.47	142	120	101	1.5	74	485	10.65
14	20 20%	2	3800	7.1	7,400	11.39	6.47	170	101	101	1.9	74	380	7.10
15	30 20%	3	4300	*9.0	10,400	13.94	5.36	57	38	35	1.9	74	400	10.00
16	0.6 Max. RL	2	5700	—	28,000	10.00	5.76	99	46	35	4.7	74	150	5.26
17	0.6 Max. $\frac{1}{3}$	2	5700	7.4	10,000	9.14	7.98	325	317	317	2.7	74	375	7.77
18	0.6 Max. $\frac{2}{3}$	2	5700	12.1	6,000	5.75	9.64	—	1002	957	1.8	74	†500+	8.30
19	0.8 Max. RL	1	7600	—	16,000	11.45	6.04	70	60	51	2.4	74	490	6.71
20	0.8 Max. $\frac{1}{3}$	1	7600	9.6	8,400	8.18	8.29	503	425	407	2.6	74	335	9.42
21	0.8 Max. $\frac{2}{3}$	1	7600	16.7	6,800	9.12	8.14	424	389	326	1.9	74	†500+	12.89
22	Idle	—	1300	—	3,400	4.01	8.46	76	58	56	4.6	74	200	1.20

* Motorcycle would not pull calculated load, so maximum load consistent with smooth operation was recorded † over 500°F, out of range of pyrometer

CONSTANT - SPEED EMISSIONS TEST DATA HONDA CL350 K3 Motorcycle

Date 10/15/71 Atmospheric Pressure 29.08 in Hg Wet Bulb Temp. 64 °F Dry Bulb Temp. 73 °F

RUN No. 8

Mode	Condition	Gear	Engine rpm	Dyno hp	FIA	NDIR			C.L.		Polar.	Temperatures, °F		Fuel Rate, lbm/hr
					HC, ppm C	CO, %	CO_2, %	NO, ppm	NO_x, ppm	NO, ppm	O_2, %	Inlet	Exhaust	
1	Idle	—	1200	—	5,600	3.06	8.44	55	40	39	4.5	76	110	1.01
2	20 RL	2	3800	—	10,800	8.62	6.74	41	41	28	2.6	76	125	2.80
3	30 RL	3	4300	—	24,800	10.19	5.35	35	30	15	2.9	76	110	4.80
4	40 RL	4	4800	—	18,000	10.14	5.75	35	42	26	2.3	76	150	5.21
5	50 RL	5	5200	—	14,800	9.76	6.31	77	69	51	2.0	76	200	5.76
6	20 5%	2	3800	3.1	10,800	11.77	5.89	56	39	31	1.8	76	125	4.54
7	30 5%	3	4300	4.6	8,200	11.57	6.17	63	55	51	1.9	76	175	5.90
8	40 5%	4	4800	6.5	6,800	10.68	6.74	105	92	82	1.7	76	200	7.31
9	50 5%	5	5200	7.9	6,000	7.41	8.44	399	414	351	1.3	76	375	7.77
10	20 10%	2	3800	4.5	8,400	7.26	10.34	67	69	56	2.2	78	150	5.16
11	30 10%	3	4300	6.6	7,600	11.56	6.31	70	76	74	1.9	78	260	7.00
12	40 10%	4	4800	9.2	6,600	9.97	7.34	184	164	146	1.7	78	390	9.61
13	50 10%	5	5200	*11.0	6,000	9.16	7.49	325	318	291	1.5	78	460	10.65
14	20 20%	2	3800	7.1	10,200	10.69	6.59	70	61	58	2.0	78	200	10.00
15	30 20%	3	4300	*9.0	8,800	11.74	6.17	70	81	74	1.9	78	350	8.91
16	0.6 Max. RL	2	5700	—	10,600	9.39	6.74	77	62	46	2.8	78	285	4.19
17	0.6 Max. 1/3	2	5700	7.4	7,400	8.46	8.44	322	270	270	1.8	78	275	7.31
18	0.6 Max. 2/3	2	5700	12.1	6,000	6.16	9.62	761	822	755	1.3	77	460	8.03
19	0.8 Max. RL	1	7600	—	25,200	9.95	6.03	85	58	42	1.8	77	365	7.54
20	0.8 Max. 1/3	1	7600	9.6	9,400	8.83	7.80	169	163	147	1.6	77	285	11.14
21	0.8 Max. 2/3	1	7600	16.7	7,200	8.77	8.44	322	288	270	1.3	77	†500+	15.31
22	Idle	—	1200	—	3,600	2.77	9.45	54	52	49	3.5	77	250	0.92

* Motorcycle would not pull calculated load, so maximum load consistent with smooth operation was recorded. † over 500°F, out of range of pyrometer

			ENGINE	DYNO	FIA HC,	NDIR				CL		O_2,	FUEL RATE	
						HC,	CO,	CO_2,	NO,	NO,	NO_x,			
MODE	CONDITION	GEAR	RPM	hp	ppmC	ppmC_6	%	%	ppm	ppm	ppm	%	lbm/hr	g/hr
1	IDLE	—	1100	—	18,600	300	9.03	6.74	17	24	31	—	0.355	161
2	20 RL	3	4400	—	9350	413	9.38	6.89	52	71	82	—	1.48	672
3	30 RL	4	5500	—	6300	314	5.76	9.23	180	219	228	—	1.74	791
4	40 RL	5	5600	—	5500	259	4.98	9.74	407	449	483	—	2.26	1030
5	50 RL	5	6900	—	6700	295	3.21	10.82	1070	1150	1180	—	3.38	1530
6	IDLE	—	1200	—	20,000	774	10.44	6.03	17	23	32	—	0.639	290
7	20-5%	3	4250	1.0	6100	363	4.45	10.05	617	679	722	—	1.94	879
8	30-5%	4	5500	2.0	5850	348	6.49	8.91	491	521	521	—	3.10	1410
9	40-3.0%*	5	5800	1.2	7300	406	7.79	8.02	308	344	344	—	3.71	1680
10	50-2.4%*	5	6900	1.2	6050	315	4.56	10.13	990	1060	1060	—	5.54	2510
11	IDLE	—	1200	—	16,800	479	10.17	6.39	12	26	32	—	0.692	314
12	20 H	2	6000	2.2	5300	291	5.15	9.79	575	591	599	—	2.66	1210
13	30 H	3	6600	2.5	5500	291	5.76	9.32	645	675	675	—	3.73	1690
14	40 H	4	7000	2.1	5580	282	4.12	10.34	938	1020	1020	—	4.01	1820
15	IDLE	—	1200	—	12,600	439	9.90	6.68	46	32	39	—	0.719	326

*about 75% of power available over road load

HONDA SL-100 MOTORCYCLE CONSTANT-SPEED EMISSIONS TEST DATA

RUN 3
DATE 8/30/72

WET BULB TEMPERATURE, °F 69
DRY BULB TEMPERATURE, °F 80
ATMOSPHERIC PRESSURE, in Hg 29.10

						NDIR				CL			FUEL RATE	
MODE	CONDITION	GEAR	ENGINE RPM	DYNO hp	FIA HC, ppmC	HC, ppm C_6	CO, %	CO_2, %	NO, ppm	NO, ppm	NO_x, ppm	O_2, %	lbm/hr	g/hr
1	IDLE	—	1200	—	24,400	848	9.49	6.36	58	22	34	—	0.719	326
2	20 RL	3	4300	—	8850	432	7.60	7.70	117	112	116	—	1.44	652
3	30 RL	4	5400	—	6480	292	4.57	9.75	284	284	288	—	1.78	809
4	40 RL	5	5600	—	6020	293	4.57	9.75	473	492	496	—	2.20	997
5	50 RL	5	6800	—	7100	330	2.66	10.85	1250	1260	1270	—	2.82	1280
6	IDLE	—	1200	—	18,300	648	10.18	6.26	40	27	36	—	0.701	318
7	20-5%	3	4300	1.0	6970	411	5.25	9.18	495	509	522	—	2.07	941
8	30-5%	4	5200	2.0	5920	351	5.24	9.35	753	690	690	—	3.10	1410
9	40-3.0%*	5	5500	1.2	5800	339	5.43	9.17	761	868	868	—	3.43	1560
10	50-2.4%*	5	6800	1.2	5910	294	3.92	10.08	1230	1740	1740	—	3.86	1750
11	IDLE	—	1200	—	11,800	428	9.44	6.70	40	38	47	—	0.736	334
12	20 H	2	5800	2.2	5250	304	5.37	9.17	436	449	500	—	2.64	1200
13	30 H	3	6400	2.5	5810	270	5.43	9.08	728	796	796	—	3.79	1720
14	40 H	4	7000	2.1	6200	272	3.88	10.00	1132	1220	1220	—	3.87	1760
15	IDLE	—	1200	—	10,600	404	9.44	6.70	40	38	43	—	0.602	273

*about 75% of power available over road load

HONDA SL-100 MOTORCYCLE CONSTANT-SPEED EMISSIONS TEST DATA

RUN 4

DATE 8/31/72

WET BULB TEMPERATURE, °F 68

DRY BULB TEMPERATURE, °F 76

ATMOSPHERIC PRESSURE, in Hg 29.13

						NDIR				CL				
			ENGINE	DYNO	FIA HC,	HC,	CO,	CO_2,	NO,	NO,	NO_x,	O_2,	FUEL RATE	
MODE	CONDITION	GEAR	RPM	hp	ppmC	ppm C_6	%	%	ppm	ppm	ppm	%	lbm/hr	g/hr
1	IDLE	—	1200	—	16,600	537	9.39	6.68	40	29	38	—	0.639	290
2	20 RL	3	4300	—	9000	408	8.23	7.48	105	100	105	—	1.49	676
3	30 RL	4	5400	—	7280	327	6.16	8.81	218	220	224	—	1.90	862
4	40 RL	5	5600	—	5900	272	4.71	9.80	542	511	515	—	2.45	1110
5	50 RL	5	6800	—	6800	274	2.92	10.78	1350	1320	1330	—	2.99	1360
6	IDLE	—	1200	—	13,400	431	9.16	6.98	40	38	45	—	0.626	284
7	20-5%	3	4300	1.0	6150	317	4.72	9.61	826	810	815	—	2.23	1010
8	30-5%	4	5300	2.0	5900	282	5.67	9.02	571	595	595	—	3.05	1380
9	40-3.0%*	5	5500	1.2	6500	316	5.80	9.01	730	743	764	—	3.55	1610
10	50-2.4%*	5	6800	1.2	6100	272	4.48	9.82	1100	1240	1240	—	4.21	1910
11	IDLE	—	1200	—	10,400	346	9.26	6.90	40	38	46	—	0.602	273
12	20 H	2	5700	2.2	5250	272	4.78	9.61	644	631	640	—	2.75	1250
13	30 H	3	6400	2.5	5800	250	5.68	8.77	659	703	703	—	3.90	1770
14	40 H	4	7000	2.1	6300	251	4.11	9.85	1100	1180	1180	—	3.98	1800
15	IDLE	—	1200	—	10,900	457	9.50	6.75	40	39	46	—	0.613	278

*about 75% of power available over road load

HONDA SL-100 MOTORCYCLE CONSTANT-SPEED EMISSIONS TEST DATA

RUN 5

DATE 8/31/72

WET BULB TEMPERATURE, °F 62

DRY BULB TEMPERATURE, °F 71

ATMOSPHERIC PRESSURE, in Hg 29.07

MODE	CONDITION	GEAR	ENGINE RPM	DYNO hp	FIA HC, ppmC	NDIR HC, ppmC6	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	FUEL RATE lbm/hr	FUEL RATE g/hr
1	IDLE	—	1200	—	15,100	566	9.27	6.45	81	24	36	—	0.553	251
2	20 RL	3	4100	—	9200	395	8.61	6.91	99	91	97	—	1.51	685
3	30 RL	4	5100	—	7000	281	5.58	9.17	324	288	292	—	1.96	890
4	40 RL	5	5400	—	5600	248	5.24	9.37	488	500	500	—	2.68	1210
5	50 RL	5	6500	—	7400	285	2.87	10.66	1540	1540	1540	—	3.17	1440
6	IDLE	—	1100	—	14,700	591	9.59	6.57	28	30	40	—	0.545	247
7	20-5%	3	4100	1.0	6800	365	5.41	8.69	490	512	520	—	1.99	902
8	30-5%	4	5100	2.0	5800	328	5.06	9.39	790	807	807	—	3.21	1460
9	40-3.0%*	5	5300	1.2	5400	248	5.12	9.46	805	869	869	—	3.17	1440
10	50-2.4%*	5	6500	1.2	5800	261	4.04	10.09	1240	1170	1180	—	3.80	1720
11	IDLE	—	1100	—	11,100	548	9.46	6.64	28	38	41	—	0.536	243
12	20 H	2	5700	2.2	4950	299	4.32	8.29	830	823	823	—	2.78	1260
13	30 H	3	6100	2.5	5350	126	5.05	9.55	901	890	901	—	3.84	1740
14	40 H	4	6800	2.1	6500	238	4.99	9.65	973	1020	1020	—	4.09	1860
15	IDLE	—	1200	—	11,800	507	9.68	6.78	12	33	40	—	0.545	247

*about 75% of power available over road load

HONDA SL-100 MOTORCYCLE CONSTANT-SPEED EMISSIONS TEST DATA

RUN 6
DATE 9/5/72

WET BULB TEMPERATURE, °F 66
DRY BULB TEMPERATURE, °F 74
ATMOSPHERIC PRESSURE, in Hg 29.16

			ENGINE	DYNO	FIA HC,	NDIR				CL		O₂,	FUEL RATE	
						HC,	CO,	CO_2,	NO,	NO,	NO_x,	O_2,		
MODE	CONDITION	GEAR	RPM	hp	ppmC	ppm C_6	%	%	ppm	ppm	ppm	%	lbm/hr	g/hr
1	IDLE	—	1100	—	14,600	467	9.10	7.01	57	28	38	—	0.507	230
2	20 RL	3	4200	—	8400	436	6.61	8.19	155	133	140	—	1.59	722
3	30 RL	4	5200	—	6150	362	4.62	9.93	436	390	394	—	2.00	905
4	40 RL	5	5400	—	5100	281	4.51	10.04	745	695	700	—	2.63	1190
5	50 RL	5	6500	—	5950	261	2.98	11.00	1510	1540	1540	—	3.38	1530
6	IDLE	—	1100	—	11,200	635	8.99	7.17	69	42	49	—	0.516	230
7	20-5%	3	4100	1.0	4850	412	4.02	10.35	1000	1060	1060	—	2.05	928
8	30-5%	4	5100	2.0	5100	303	5.04	9.81	951	845	856	—	3.27	1480
9	40-3.0%*	5	5300	1.2	5560	292	4.92	9.74	1010	995	995	—	3.17	1440
10	50-2.4%*	5	6500	1.2	5920	270	4.50	10.12	1050	1060	1060	—	3.99	1810
11	IDLE	—	1100	—	11,000	650	9.22	6.94	69	42	50	—	0.525	238
12	20 H	2	5600	2.2	5300	351	4.74	9.93	632	635	643	—	2.78	1260
13	30 H	3	6100	2.5	5400	316	4.94	9.77	1060	1060	1060	—	3.84	1740
14	40 H	4	6700	2.1	6200	333	4.04	9.85	955	936	957	—	3.87	1760
15	IDLE	—	1100	—	11,100	521	9.34	6.86	63	39	44	—	0.516	234

* about 75% of power available over road load

HONDA SL-100 MOTORCYCLE CONSTANT-SPEED EMISSIONS TEST DATA

RUN 7

DATE 9/5/72

WET BULB TEMPERATURE, °F 69

DRY BULB TEMPERATURE, °F 77

ATMOSPHERIC PRESSURE, in Hg 29.09

MODE	CONDITION	GEAR	ENGINE RPM	DYNO hp	FIA HC, ppmC	NDIR HC, ppmC6	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	FUEL RATE lbm/hr	FUEL RATE g/hr
1	IDLE	—	1200	—	14,600	576	8.88	7.33	57	27	37	—	0.492	223
2	20 RL	3	4100	—	8500	508	8.26	7.75	117	90	96	—	1.59	722
3	30 RL	4	5100	—	6300	164	4.54	10.58	371	379	383	—	1.90	862
4	40 RL	5	5300	—	5200	270	4.01	10.73	662	635	639	—	2.83	1280
5	50 RL	5	6500	—	5600	249	2.37	11.87	1680	1700	1710	—	3.49	1580
6	IDLE	—	1200	—	12,500	336	8.31	7.23	58	39	47	—	0.492	223
7	20-5%	3	4200	1.0	5300	280	4.26	10.70	933	918	939	—	2.73	1240
8	30-5%	4	5000	2.0	5200	269	4.78	10.28	1020	1010	1020	—	3.27	1480
9	40-3.0%*	5	5300	1.2	5200	248	4.23	10.34	1070	1100	1100	—	3.22	1460
10	50-2.4%*	5	6400	1.2	5300	258	5.29	9.71	933	886	897	—	4.13	1880
11	IDLE	—	1100	—	11,100	416	9.44	6.93	57	37	46	—	0.525	238
12	20 H	2	5500	2.2	4600	248	4.22	10.60	863	824	824	—	2.75	1250
13	30 H	3	6100	2.5	5100	259	4.56	10.13	1190	1190	1200	—	3.73	1690
14	40 H	4	6700	2.1	6300	315	4.80	9.92	1050	994	1000	—	4.39	1990
15	IDLE	—	1100	—	12,440	589	9.43	7.00	57	36	44	—	0.492	223

*about 75% of power available over road load

HONDA SL-100 MOTORCYCLE CONSTANT-SPEED EMISSIONS TEST DATA

RUN 8

DATE 9/6/72

WET BULB TEMPERATURE, °F 68

DRY BULB TEMPERATURE, °F 77

ATMOSPHERIC PRESSURE, in Hg 29.06

MODE	CONDITION	GEAR	ENGINE RPM	DYNO hp	FIA HC, ppmC	NDIR HC, ppmC6	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	FUEL RATE lbm/hr	FUEL RATE g/hr
1	IDLE	—	1100	—	14,600	432	8.82	7.21	58	29	36	—	0.578	262
2	20 RL	3	4300	—	8150	384	7.09	8.40	161	143	152	—	1.55	703
3	30 RL	4	5100	—	6000	271	4.25	10.37	572	553	570	—	2.07	937
4	40 RL	5	5300	—	5050	228	4.25	10.37	886	851	862	—	2.83	1280
5	50 RL	5	6500	—	5900	262	2.91	11.06	1620	1670	1680	—	3.55	1610
6	IDLE	—	1100	—	12,400	418	9.14	7.04	58	37	46	—	0.461	209
7	20-5%	3	4000	1.0	5850	316	4.70	9.97	764	829	850	—	2.10	954
8	30-5%	4	5100	2.0	5500	270	4.93	9.86	956	976	987	—	3.46	1570
9	40-3.0%*	5	5300	1.2	5000	239	4.25	10.19	1320	1360	1360	—	3.27	1480
10	50-2.4%*	5	6500	1.2	6350	146	5.78	9.17	778	847	847	—	4.62	2100
11	IDLE	—	1200	—	11,000	539	9.56	7.09	46	39	48	—	0.545	247
12	20 H	2	5600	2.2	5050	271	4.36	10.18	723	851	862	—	2.75	1250
13	30 H	3	6100	2.5	5520	196	5.38	9.64	865	900	910	—	3.73	1690
14	40 H	4	6700	2.1	6800	249	5.19	9.66	849	849	860	—	4.39	1990
15	IDLE	—	1100	—	12,200	535	9.35	7.02	57	38	47	—	0.536	243

*about 75% of power available over road load

HONDA SL-100 MOTORCYCLE CONSTANT-SPEED EMISSIONS TEST DATA

RUN 9

DATE 9/6/72

WET BULB TEMPERATURE, °F 65

DRY BULB TEMPERATURE, °F 76

ATMOSPHERIC PRESSURE, in Hg 29.00

MODE	CONDITION	GEAR	ENGINE RPM	DYNO hp	FIA HC, ppmC	NDIR HC, ppmC$_6$	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	FUEL RATE lbm/hr	FUEL RATE g/hr
1	IDLE	—	1100	—	12,600	468	9.01	6.73	58	21	37	—	0.507	230
2	20 RL	3	4100	—	7800	419	7.88	7.53	123	100	105	—	1.53	694
3	30 RL	4	5100	—	5350	293	4.13	10.05	352	306	310	—	1.90	862
4	40 RL	5	5300	—	4650	259	4.56	9.93	616	550	555	—	2.58	1170
5	50 RL	5	6300	—	5300	273	2.43	11.06	1600	1520	1520	—	3.27	1480
6	IDLE	—	1100	—	12,200	480	9.21	6.86	75	35	44	—	0.483	219
7	20-5%	3	4000	1.0	4950	327	4.51	9.75	889	822	831	—	2.10	954
8	30-5%	4	5000	2.0	4800	292	4.80	9.64	943	889	900	—	3.21	1460
9	40-3.0%*	5	5200	1.2	4420	270	4.80	9.74	881	847	858	—	3.17	1440
10	50-2.4%*	5	6300	1.2	6000	338	6.29	8.60	792	675	696	—	4.53	2060
11	IDLE	—	1100	—	10,400	548	9.22	6.79	69	37	45	—	0.439	199
12	20 H	2	5400	2.2	4300	315	4.57	9.75	779	646	678	—	2.68	1210
13	30 H	3	6100	2.5	4950	291	5.77	8.79	845	739	760	—	3.90	1770
14	40 H	4	6700	2.1	6600	327	5.44	9.08	770	678	689	—	4.27	1940
15	IDLE	—	1100	—	11,800	520	9.44	6.70	57	33	40	—	0.467	212

*about 75% of power available over road load

HONDA SL-100 MOTORCYCLE CONSTANT-SPEED EMISSIONS TEST DATA

RUN 10

DATE 9/7/72

WET BULB TEMPERATURE, °F 70

DRY BULB TEMPERATURE, °F 77

ATMOSPHERIC PRESSURE, in Hg 29.10

MODE	CONDITION	GEAR	ENGINE RPM	DYNO hp	FIA HC, ppmC	NDIR HC, $ppmC_6$	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	FUEL RATE lbm/hr	FUEL RATE g/hr
1	IDLE	—	2000	—	77,100	8730	3.46	3.84	64	4.7	7.5	9.7	0.452	205
2	20 RL	3	4500	—	32,700	4210	0.79	9.36	31	23	26	5.4	1.52	691
3	30 RL	4	6400	—	26,800	2920	1.31	9.93	68	52	58	4.0	2.00	905
4	40 RL	5	6500	—	39,200	3570	3.44	7.80	70	54	60	5.1	3.21	1460
5	50 RL	5	6100	—	52,000	6140	1.74	8.99	542	—	—	6.8	5.64	2560
6	IDLE	—	2000	—	82,900	10,800	4.00	3.65	100	9.0	24	10.3	0.452	205
7	20 - 5%	3	4500	1.1	44,200	6380	1.79	7.86	448	—	—	6.3	3.13	1420
8	20 H	2	6000	3.5	63,200	6400	2.52	6.75	471	—	—	7.7	5.89	2670
9	30 H	3	6500	3.3	70,400	7290	3.14	5.69	311	234	255	8.4	7.82	3540
10	40 H	4	6500	2.2	73,600	9110	3.88	5.17	220	108	162	8.3	9.04	4100
11	IDLE	—	2000	—	82,100	11,100	3.99	3.57	100	5.5	13	10.1	0.445	202
12														
13														
14														
15														

KAWASAKI 125F-6 MOTORCYCLE CONSTANT-SPEED EMISSIONS TEST DATA

RUN 1

DATE 9/19/72

WET BULB TEMPERATURE, °F 69

DRY BULB TEMPERATURE, °F 79

ATMOSPHERIC PRESSURE, in Hg 29.21

MODE	CONDITION	GEAR	ENGINE RPM	DYNO hp	FIA HC, ppmC	NDIR HC, ppmC6	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	FUEL RATE lbm/hr	FUEL RATE g/hr
1	IDLE	—	2000	—	72,200	—	3.63	3.79	68	2.4	5.9	10.5	0.439	199
2	20 RL	3	4500	—	31,300	—	0.53	9.41	80	27	33	5.2	1.50	679
3	30 RL	4	5000	—	26,400	—	1.43	9.54	101	45	50	4.1	1.90	862
4	40 RL	5	5100	—	33,800	—	3.00	8.30	109	105	118	4.5	2.99	1360
5	50 RL	5	6100	—	43,800	—	1.53	7.58	399	278	296	6.6	4.82	2190
6	IDLE	—	2000	—	81,000	—	4.06	3.57	95	3.6	10	10.2	0.445	202
7	20-5%	3	4500	1.1	48,400	—	2.08	7.44	607	491	527	6.4	3.13	1420
8	20 H	2	6100	3.5	61,000	—	2.71	6.16	526	440	467	7.5	6.01	2730
9	30 H	3	6500	3.3	64,200	—	3.31	5.75	314	231	257	7.8	8.66	3930
10	40 H	4	6500	2.2	69,000	—	3.75	5.40	224	119	141	7.9	9.46	4290
11	IDLE	—	2000	—	83,000	—	4.08	3.66	114	4.4	10	9.7	0.461	209
12														
13														
14														
15														

KAWASAKI 125F-6 MOTORCYCLE CONSTANT-SPEED EMISSIONS TEST DATA

RUN 2

DATE 9/19/72

WET BULB TEMPERATURE, °F 69

DRY BULB TEMPERATURE, °F 79

ATMOSPHERIC PRESSURE, in Hg 29.34

MODE	CONDITION	GEAR	ENGINE RPM	DYNO hp	FIA HC, ppmC	NDIR HC, ppm C_6	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	FUEL RATE lbm/hr	FUEL RATE g/hr
1	IDLE	—	2000	—	75,800	8560	3.63	3.71	59	2.7	8.9	11.1	0.439	199
2	20 RL	3	4500	—	30,300	5090	0.40	9.35	76	25	30	5.6	1.42	646
3	30 RL	4	5100	—	24,800	3280	1.52	9.55	93	40	47	4.2	1.84	835
4	40 RL	5	5200	—	31,400	3000	2.42	8.59	137	79	81	4.7	2.72	1230
5	50 RL	5	6200	—	47,200	4510	1.73	7.88	555	447	461	6.9	4.73	2150
6	IDLE	—	2000	—	84,200	7720	4.13	3.69	105	5.1	13	10.7	0.452	205
7	20 - 5%	3	4400	1.1	47,800	6510	2.62	7.20	442	384	402	6.6	3.68	1670
8	20 H	2	6300	3.5	48,800	6200	2.63	6.60	530	404	418	8.9	6.01	2730
9	30 H	3	6500	3.3	69,300	7250	3.92	5.25	225	126	159	8.4	9.01	4090
10	40 H	4	6700	2.2	63,800	6440	3.26	7.54	270	228	260	8.1	7.79	3540
11	IDLE	—	2000	—	77,600	8670	3.91	3.85	96	5.0	12	10.6	0.452	205
12														
13														
14														
15														

KAWASAKI 125F-6 MOTORCYCLE CONSTANT-SPEED EMISSIONS TEST DATA

RUN 3

DATE 9/19/72

WET BULB TEMPERATURE, °F 66

DRY BULB TEMPERATURE, °F 76

ATMOSPHERIC PRESSURE, in Hg 29.33

MODE	CONDITION	GEAR	ENGINE RPM	DYNO hp	FIA HC, ppmC	NDIR HC, ppmC6	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	FUEL RATE lbm/hr	FUEL RATE g/hr
1	IDLE	—	2000	—	84,100	7890	3.25	4.26	64	4.1	7.8	10.7	0.410	186
2	20 RL	3	4500	—	35,400	4310	0.43	9.67	62	30	34	5.5	1.50	679
3	30 RL	4	5200	—	30,700	3070	1.60	9.51	66	48	51	4.3	2.10	954
4	40 RL	5	5200	—	40,000	3920	3.18	7.90	141	124	132	5.2	3.33	1510
5	50 RL	5	6200	—	60,300	4940	2.72	7.02	354	315	347	7.2	5.64	2560
6	IDLE	—	2000	—	87,000	9140	4.00	3.82	59	6.4	16	10.3	0.439	199
7	20 - 5%	3	4500	1.1	53,500	5240	1.54	7.69	706	612	632	7.3	3.21	1460
8	20 H	2	6100	3.5	59,900	5970	1.61	7.34	840	722	731	7.8	5.31	2410
9	30 H	3	6500	3.3	69,200	7240	2.82	6.13	456	370	397	8.5	7.60	3450
10	40 H	4	6200	2.2	74,300	8670	3.07	5.90	474	361	384	8.8	8.15	3700
11	IDLE	—	2000	—	81,100	10,100	3.87	5.20	113	6.4	19	10.2	0.439	199
12														
13														
14														
15														

KAWASAKI 125F-6 MOTORCYCLE CONSTANT-SPEED EMISSIONS TEST DATA

RUN 4

DATE 9/20/72

WET BULB TEMPERATURE, °F 64

DRY BULB TEMPERATURE, °F 75

ATMOSPHERIC PRESSURE, in Hg 29.27

MODE	CONDITION	GEAR	ENGINE RPM	DYNO hp	FIA HC, ppmC	NDIR HC, ppm C_6	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	CL NO, ppm	CL NO_x, ppm	O_2, %	FUEL RATE lbm/hr	FUEL RATE g/hr
1	IDLE	—	2000	—	76,800	9820	2.81	4.53	95	5.0	10	11.5	0.421	191
2	20 RL	3	4500	—	38,400	6420	1.64	9.54	92	30	38	5.8	1.67	756
3	30 RL	4	5000	—	32,800	4280	1.73	9.71	129	70	81	4.4	2.22	1010
4	40 RL	5	5000	—	43,200	4960	0.93	9.15	300	240	290	6.2	3.33	1510
5	50 RL	5	6200	—	63,200	7070	2.16	7.08	572	548	584	8.0	5.89	2670
6	IDLE	—	4400	—	97,600	11,900	4.08	3.93	101	8.6	18	10.6	0.428	194
7	20-5%	3	2100	1.1	55,200	7200	2.37	7.68	715	491	602	7.0	3.27	1480
8	20 H	2	6000	3.5	56,800	4760	1.48	7.75	638	720	792	7.6	4.63	2100
9	30 H	3	6100	3.3	72,400	9430	2.46	5.93	562	363	443	9.2	7.60	3450
10	40 H	4	6200	3.2	72,000	11,800	2.81	6.18	450	350	384	8.9	7.57	3430
11	IDLE	—	2000	—	99,200	16,300	4.19	4.04	127	6.8	22	10.5	0.439	199
12														
13														
14														
15														

KAWASAKI 125F-6 MOTORCYCLE CONSTANT-SPEED EMISSIONS TEST DATA

RUN 6

DATE 9/25/72

WET BULB TEMPERATURE, °F 64

DRY BULB TEMPERATURE, °F 73

ATMOSPHERIC PRESSURE, in Hg 29.04

CONSTANT - SPEED EMISSIONS TEST DATA SUZUKI T250 Motorcycle

Date 9/28/71 Atmospheric Pressure 29.18 in Hg Wet Bulb Temp. 63 °F Dry Bulb Temp. 70 °F

RUN No. 1

			Engine	Dyno	FIA	NDIR			C.L.		Polar.	Temperatures, °F		Fuel Rate,
Mode	Condition	Gear	rpm	hp	HC, ppm C	CO, %	CO_2, %	NO, ppm	NO_x, ppm	NO, ppm	O_2, %	Inlet	Exhaust	lbm/hr
1	Idle	—	1400	—	75,200	1.83	5.45	78	6	4	9.9	78	90	0.81
2	20 RL	2	3800	—	54,400	1.59	7.56	31	15	9	7.2	78	123	2.27
3	30 RL	3	4400	—	48,000	2.86	7.72	61	24	14	5.5	78	126	3.50
4	40 RL	4	4600	—	44,800	4.36	6.97	83	29	17	4.8	78	140	4.01
5	50 RL	5	5000	—	42,400	5.34	6.68	73	29	19	4.3	79	180	4.94
6	20 5%	2	3800	3.1	41,600	2.20	6.54	56	30	21	5.5	79	125	2.67
7	30 5%	3	4400	4.6	42,400	4.45	7.12	72	31	22	5.1	79	148	3.95
8	40 5%	4	4600	6.4	44,800	5.48	6.13	98	33	25	5.0	79	198	6.04
9	50 5%	5	5000	7.8	50,400	6.43	5.32	114	23	15	5.2	79	245	7.10
10	20 10%	2	3800	4.4	49,600	3.48	6.97	72	36	30	5.9	80	140	3.98
11	30 10%	3	4400	6.5	52,800	5.31	5.85	52	36	28	5.9	80	200	6.62
12	40 10%	4	4600	9.0	61,600	5.76	4.93	86	28	23	6.9	80	275	9.80
13	50 10%	5	5000	11.0	60,000	5.87	4.93	125	33	28	6.7	80	315	10.65
14	20 20%	2	3800	6.9	57,600	5.03	5.45	85	28	18	7.1	80	165	6.53
15	30 20%	3	4400	*8.5	61,600	6.19	4.55	28	21	11	7.2	80	260	10.00
16	0.6 Max. RL	2	5400	—	41,600	3.56	7.42	83	21	15	4.9	80	185	2.70
17	0.6 Max. 1/3	2	5400	8.6	49,600	6.63	5.18	85	24	13	4.7	79	225	10.42
18	0.6 Max. 2/3	2	5400	*12.0	72,000	5.43	4.06	86	20	10	7.8	79	290	18.14
19	0.8 Max. RL	1	7200	—	29,600	2.99	8.97	81	22	14	4.8	79	240	3.00
20	0.8 Max. 1/3	1	7200	11.1	45,600	5.78	4.67	57	27	10	7.5	79	200	14.00
21	0.8 Max. 2/3	1	7200	*15.5	66,400	4.13	3.82	108	48	33	10.8	81	†500+	20.41
22	Idle	—	1400	—	68,000	2.67	4.42	86	7	4	11.7	81	250	—

* Motorcycle would not pull calculated load, so maximum load consistent with smooth operation was recorded. † over 500°F, out of range of pyrometer

CONSTANT-SPEED EMISSIONS TEST DATA SUZUKI T250 Motorcycle

Date 9/29/71 Atmospheric Pressure 29.21 in Hg Wet Bulb Temp. 66 °F Dry Bulb Temp. 73 °F

RUN No. 2

			Engine	Dyno	FIA	NDIR			C.L.		Polar.	Temperatures, °F		Fuel Rate,
Mode	Condition	Gear	rpm	hp	HC, ppm C	CO, %	CO_2, %	NO, ppm	NO_x, ppm	NO, ppm	O_2, %	Inlet	Exhaust	lbm/hr
1	Idle	—	1400	—	72,800	2.03	5.44	66	6	5	9.6	78	85	0.71
2	20 RL	2	3800	—	52,800	1.97	7.55	72	18	12	6.5	78	85	2.33
3	30 RL	3	4400	—	45,600	3.14	7.77	88	28	19	4.9	78	95	2.93
4	40 RL	4	4600	—	41,600	4.13	7.33	96	33	24	4.3	78	115	4.29
5	50 RL	5	5000	—	40,800	4.81	7.25	58	30	21	4.0	78	165	7.00
6	20 5%	2	3800	3.1	41,600	2.14	8.48	74	29	23	5.2	78	165	3.00
7	30 5%	3	4400	4.6	40,000	3.72	7.70	106	38	28	4.5	78	155	3.92
8	40 5%	4	4600	6.4	49,800	4.94	6.67	73	40	31	4.7	78	190	5.83
9	50 5%	5	5000	7.8	49,600	6.11	5.44	70	29	19	4.5	78	200	7.90
10	20 10%	2	3800	4.4	47,600	3.28	6.82	90	43	32	5.8	78	200	3.57
11	30 10%	3	4400	6.5	52,000	5.22	5.57	102	42	30	5.4	78	200	7.10
12	40 10%	4	4600	9.0	62,400	5.44	5.05	128	34	27	6.1	78	295	10.00
13	50 10%	5	5000	11.0	59,200	5.73	5.17	99	36	29	5.7	78	210	10.88
14	20 20%	2	3800	*6.0	64,800	4.74	5.17	114	37	23	6.9	77	250	7.58
15	30 20%	3	4400	*8.0	64,800	5.97	4.66	103	27	15	6.2	77	270	9.60
16	0.6 Max. RL	2	5400	—	43,200	3.64	7.25	111	22	16	4.7	77	215	2.80
17	0.6 Max. 1/3	2	5400	8.6	61,600	5.16	4.92	85	28	18	6.5	77	145	10.88
18	0.6 Max. 2/3	2	5410	*12.0	75,200	6.63	3.81	71	19	8	7.3	77	350	20.41
19	0.8 Max. RL	1	7200	—	31,200	3.22	8.01	110	20	16	4.9	77	320	2.11
20	0.8 Max. 1/3	1	7200	11.1	47,200	6.88	5.05	56	28	12	4.3	77	185	12.25
21	0.8 Max. 2/3	1	7200	*18.0	71,200	5.09	4.29	115	58	35	7.9	77	495	27.22
22	Idle	—	1400	—	75,200	2.75	5.05	114	7	6	9.5	77	160	0.71

* Motorcycle would not pull calculated load, so maximum load consistent with smooth operation was recorded.

CONSTANT-SPEED EMISSIONS TEST DATA SUZUKI T250 Motorcycle

Date 9/29/71 Atmospheric Pressure 29.19 in Hg Wet Bulb Temp. 64 °F Dry Bulb Temp. 72 °F

RUN No. 3

Mode	Condition	Gear	Engine rpm	Dyno hp	FIA HC, ppm C	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	C.L. NO_x, ppm	C.L. NO, ppm	Polar. O_2, %	Temperatures, °F Inlet	Temperatures, °F Exhaust	Fuel Rate, lbm/hr
1	Idle	—	1400	—	75,200	2.34	5.18	74	7	6	10.7	77	90	0.71
2	20 RL	2	3800	—	52,800	1.87	7.79	75	17	13	6.7	77	115	2.37
3	30 RL	3	4400	—	43,200	2.75	8.02	95	29	21	5.4	77	125	2.25
4	40 RL	4	4600	—	39,200	3.43	7.87	61	36	29	4.8	77	155	3.88
5	50 RL	5	5000	—	36,000	2.55	8.17	95	40	36	5.3	77	130	6.80
6	20 5%	2	3800	3.1	44,000	2.66	7.71	82	32	23	5.6	77	160	2.95
7	30 5%	3	4400	4.6	42,400	4.34	7.12	93	34	24	4.8	77	160	4.01
8	40 5%	4	4600	6.4	49,600	5.51	5.78	102	37	27	5.4	77	210	5.97
9	50 5%	5	5000	7.8	49,600	5.70	5.71	41	24	17	4.8	77	140	7.90
10	20 10%	2	3800	4.4	48,000	2.68	7.27	61	35	28	6.0	77	185	3.57
11	30 10%	3	4400	6.5	52,000	5.01	5.71	70	36	26	5.6	77	205	6.62
12	40 10%	4	4600	9.0	62,400	5.54	5.32	81	27	17	6.7	77	255	9.60
13	50 10%	5	5000	11.0	62,400	5.24	5.32	56	35	25	6.4	77	225	10.65
14	20 20%	2	3800	6.9	64,800	4.75	5.18	88	31	19	7.2	77	240	7.53
15	30 20%	3	4400	*8.5	68,000	6.00	4.42	86	18	9	7.0	77	260	10.00
16	0.6 Max. RL	2	5400	—	44,000	3.37	7.12	104	31	14	5.4	77	225	2.67
17	0.6 Max. 1/3	2	5400	8.6	48,800	6.43	5.32	42	23	11	4.8	77	125	10.42
18	0.6 Max. 2/3	2	5400	*12.0	73,600	6.38	3.93	68	18	8	7.1	77	375	18.84
19	0.8 Max. RL	1	7200	—	34,400	3.24	7.87	89	21	18	4.3	77	320	2.12
20	0.8 Max. 1/3	1	7200	11.1	45,600	6.93	5.18	21	30	10	4.5	77	175	12.56
21	0.8 Max. 2/3	1	7200	19.1	56,800	5.45	5.06	92	59	55	7.0	77	440	22.27
22	Idle	—	1400	—	77,600	2.96	5.06	92	11	6	9.6	77	260	0.78

* Motorcycle would not pull calculated load, so maximum load consistent with smooth operation was recorded.

CONSTANT-SPEED EMISSIONS TEST DATA SUZUKI T250 Motorcycle

Date 9/30/71 Atmospheric Pressure 29.20 in Hg Wet Bulb Temp. 63 °F Dry Bulb Temp. 73 °F

RUN No. 4

Mode	Condition	Gear	Engine rpm	Dyno hp	FIA HC, ppm C	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	C.L. NO_x, ppm	C.L. NO, ppm	Polar. O_2, %	Temperatures, °F Inlet	Temperatures, °F Exhaust	Fuel Rate, lbm/hr
1	Idle	—	1400	—	77,600	2.34	5.32	74	9	6	9.3	78	90	0.69
2	20 RL	2	3800	—	52,800	1.97	7.73	65	19	12	5.8	78	115	2.33
3	30 RL	3	4400	—	43,200	3.26	7.57	85	29	17	4.9	78	130	3.02
4	40 RL	4	4600	—	41,600	4.46	6.98	83	33	19	4.4	77	145	4.08
5	50 RL	5	5000	—	49,800	5.28	6.41	48	27	16	4.4	77	165	7.65
6	20 5%	2	3800	3.1	44,000	2.77	7.57	68	29	21	5.8	77	150	2.80
7	30 5%	3	4400	4.6	43,200	4.67	6.69	76	32	23	4.9	77	160	4.62
8	40 5%	4	4600	6.4	46,200	5.61	5.86	91	40	28	6.0	77	200	6.20
9	50 5%	5	5000	7.8	50,400	6.12	5.58	31	28	14	5.4	77	195	8.90
10	20 10%	2	3800	4.4	48,800	2.98	6.98	83	38	30	6.6	77	200	3.76
11	30 10%	3	4400	6.5	52,000	5.21	5.86	91	40	28	6.0	77	225	6.36
12	40 10%	4	4600	9.0	60,800	5.56	5.06	99	31	17	6.7	77	300	9.60
13	50 10%	5	5000	11.0	65,600	6.10	4.43	111	37	19	6.8	77	340	12.56
14	20 20%	2	3800	6.9	64,000	4.26	5.18	63	31	19	7.4	80	125	8.59
15	30 20%	3	4400	*8.5	64,800	5.39	4.80	82	28	14	6.9	80	275	10.42
16	0.6 Max. RL	2	5400	—	44,800	3.37	7.13	119	24	16	6.0	81	235	2.70
17	0.6 Max. 1/3	2	5400	8.6	52,000	6.56	4.93	86	28	10	5.3	81	250	9.24
18	0.6 Max. 2/3	2	5400	*12.0	74,400	6.53	4.06	64	21	8	7.1	79	290	15.31
19	0.8 Max. RL	1	7200	—	32,000	3.25	7.73	92	25	19	4.3	79	300	2.40
20	0.8 Max. 1/3	1	7200	11.1	47,200	6.53	5.32	49	28	13	4.4	79	295	12.25
21	0.8 Max. 2/3	1	7200	*18.0	60,800	5.27	5.06	125	67	46	6.6	79	†500+	19.60
22	Idle	—	1400	—	69,600	2.34	5.45	56	7	6	9.7	79	95	0.71

* Motorcycle would not pull calculated load, so maximum load consistent with smooth operation was recorded † over 500°F, out of range of pyrometer

CONSTANT-SPEED EMISSIONS TEST DATA TRIUMPH T120R Motorcycle

Date 10/19/71 Atmospheric Pressure 29.14 in Hg Wet Bulb Temp. 65 °F Dry Bulb Temp. 72 °F

RUN No. 2

			Engine	Dyno	FIA	NDIR			C.L.		Polar.	Temperatures, °F		Fuel Rate,
Mode	Condition	Gear	rpm	hp	HC, ppmC	CO, %	CO_2, %	NO, ppm	NO_x, ppm	NO, ppm	O_2, %	Inlet	Exhaust	lbm/hr
1	Idle	—	1200	—	64,800	7.53	5.09	86	15	11	5.6	77	100	1.38
2	20 RL	2	2450	—	15,200	9.42	7.87	71	19.	14	2.3	78	125	2.54
3	30 RL	2	3600	—	13,600	9.74	7.70	111	26	21	1.8	78	175	4.15
4	40 RL	3	3500	—	10,400	10.72	7.03	89	70	56	1.7	78	190	4.90
5	50 RL	3	4200	—	11,600	8.94	8.40	159	112	105	1.3	78	225	5.21
6	20 5%	2	2450	3.3	6,000	8.15	8.57	148	189	177	1.7	76	130	3.58
7	30 5%	2	3600	4.9	6,400	8.94	8.22	174	151	131	1.5	76	215	5.10
8	40 5%	3	3500	6.8	4,800	8.46	8.58	334	350	318	1.4	76	250	6.12
9	50 5%	3	4200	8.3	3,000	6.93	9.72	605	589	541	1.1	76	415	7.21
10	20 10%	2	2450	4.8	3,800	7.38	9.14	233	355	346	1.3	77	170	4.12
11	30 10%	2	3600	7.1	3,600	9.58	8.76	304	355	318	1.4	77	270	6.05
12	40 10%	3	3500	9.8	3,000	5.45	10.43	—	411	355	1.2	77	350	7.21
13	50 10%	3	4200	12.0	2,800	4.87	10.74	—	467	439	1.0	77	480	8.60
14	20 20%	2	2450	7.7	3,200	4.44	10.74	—	1495	1425	1.4	76	200	5.38
15	30 20%	2	3600	11.5	2,800	6.03	9.82	674	1004	958	1.2	76	375	7.42
16														
17														
18														
19														
20														
21														
22	Idle	—	1200	—	33,600	7.98	6.40	78	19	14	2.8	76	190	1.68

CONSTANT-SPEED EMISSIONS TEST DATA TRIUMPH T120R Motorcycle

Date 11/4/71 Atmospheric Pressure 29.24 in Hg Wet Bulb Temp. 59 °F Dry Bulb Temp. 72 °F

RUN No. 7

Mode	Condition	Gear	Engine rpm	Dyno hp	FIA HC, ppmC	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	C.L. NO_x, ppm	C.L. NO, ppm	Polar. O_2, %	Temperatures, °F Inlet	Temperatures, °F Exhaust	Fuel Rate, lbm/hr
1	Idle	—	1200	—	54,400	9.15	4.84	86	15	13	4.7	78	100	2.20
2	20 RL	2	2450	—	26,400	11.11	6.28	64	23	17	1.3	76	135	3.02
3	30 RL	2	3600	—	32,800	10.44	6.43	108	50	40	1.9	76	175	4.41
4	40 RL	3	3500	—	24,000	9.31	6.59	116	52	51	0.9	78	200	4.49
5	50 RL	3	4200	—	12,800	9.98	7.57	145	39	33	0.8	78	250	5.57
6	20 5%	2	2450	3.3	9,400	10.12	8.09	101	88	84	0.7	76	140	3.63
7	30 5%	2	3600	4.9	9,000	9.96	7.57	137	99	94	0.8	76	245	5.21
8	40 5%	3	3500	6.8	5,400	8.36	8.62	282	225	211	0.6	76	205	5.97
9	50 5%	3	4200	8.3	5,600	6.66	9.77	566	498	488	0.5	78	355	6.71
10	20 10%	2	2450	4.8	7,200	9.31	8.09	220	169	164	0.8	78	220	4.26
11	30 10%	2	3600	7.1	5,800	8.67	8.44	282	207	216	0.7	78	325	6.13
12	40 10%	3	3500	9.8	4,800	6.22	9.77	714	686	658	0.7	80	320	7.00
13	50 10%	3	4200	12.0	4,200	4.46	11.02	—	1292	1245	0.6	78	485	7.78
14	20 20%	2	2450	7.7	4,200	6.22	9.97	—	845	775	0.8	78	330	5.27
15	30 20%	2	3600	11.5	3,400	7.42	9.37	626	540	493	0.6	78	390	7.31
16														
17														
18														
19														
20														
21														
22	Idle	—	1300	—	60,800	10.78	4.57	123	16	12	3.6	79	150	2.03

CONSTANT-SPEED EMISSIONS TEST DATA TRIUMPH T120R Motorcycle

Date 11/8/71 Atmospheric Pressure 29.33 in Hg Wet Bulb Temp. 58 °F Dry Bulb Temp. 70 °F

RUN No. 8

			Engine	Dyno	FIA	NDIR			C.L.		Polar.	Temperatures, °F		Fuel Rate,
Mode	Condition	Gear	rpm	hp	HC, ppm C	CO, %	CO_2, %	NO, ppm	NO_x, ppm	NO, ppm	O_2, %	Inlet	Exhaust	lbm/hr
1	Idle	—	1300	—	40,000	10.17	5.92	85	11	5	2.7	70	130	2.12
2	20 RL	2	2450	—	22,400	10.74	6.52	71	20	15	1.1	72	125	3.31
3	30 RL	2	3600	—	31,600	10.00	6.44	99	42	36	2.0	72	160	4.62
4	40 RL	3	3500	—	21,600	10.33	6.99	92	51	46	0.9	72	200	5.00
5	50 RL	3	4200	—	10,800	9.61	7.82	128	98	93	0.6	72	255	6.20
6	20 5%	2	2450	3.3	8,000	10.82	6.99	114	100	98	0.7	72	225	3.80
7	30 5%	2	3600	4.9	7,600	10.17	7.49	151	116	110	0.6	72	250	5.27
8	40 5%	3	3500	6.8	5,000	7.95	8.72	452	418	390	0.5	73	330	5.98
9	50 5%	3	4200	8.3	5,400	5.37	7.82	832	782	759	0.6	74	375	7.42
10	20 10%	2	2450	4.8	6,200	9.07	5.77	167	172	126	0.6	74	380	4.45
11	30 10%	2	3600	7.1	5,000	8.33	6.06	223	206	195	0.6	74	320	6.36
12	40 10%	3	3500	9.8	3,600	6.81	6.99	467	526	503	0.6	74	375	7.00
13	50 10%	3	4200	12.0	3,800	4.49	7.82	—	1098	963	0.6	75	475	8.03
14	20 20%	2	2450	7.7	4,000	6.46	10.27	738	1108	1080	0.4	75	230	5.33
15	30 20%	2	3600	11.5	4,000	7.76	9.86	762	775	748	0.4	77	390	7.31
16														
17														
18														
19														
20														
21														
22	Idle	—	1200	—	69,600	8.58	5.02	132	10	7	4.7	77	170	2.03

CONSTANT-SPEED EMISSIONS TEST DATA YAMAHA DT1-E Motorcycle

Date 10/7/71 Atmospheric Pressure 29.31 in Hg Wet Bulb Temp. 62 °F Dry Bulb Temp. 68 °F

RUN No. 1

Mode	Condition	Gear	Engine rpm	Dyno hp	FIA HC, ppm C	NDIR CO, %	NDIR CO_2, %	NDIR NO, ppm	C.L. NO_x, ppm	C.L. NO, ppm	Polar. O_2, %	Temperatures, °F Inlet	Temperatures, °F Exhaust	Fuel Rate, lbm/hr
1	Idle	—	1300	—	70,400	3.89	4.31	50	7	6	11.7	74	150	0.56
2	20 RL	2	4100	—	44,000	2.01	8.44	76	40	40	3.5	74	125	1.88
3	30 RL	3	5000	—	25,600	3.60	8.11	61	32	30	3.3	74	150	1.92
4	40 RL	4	5300	—	22,400	1.97	10.70	114	66	66	3.0	74	175	2.53
5	50 RL	5	4900	—	36,000	6.62	7.18	112	57	46	4.7	74	280	5.32
6	20 5%	2	4100	2.9	27,200	1.21	10.52	77	38	32	3.5	74	160	2.17
7	30 5%	3	5000	4.3	32,000	4.12	8.85	96	54	45	4.5	74	235	4.04
8	40 5%	4	5300	6.1	34,400	6.77	7.03	98	50	39	4.8	74	375	6.53
9	50 5%	5	4900	7.4	41,600	6.78	6.89	116	69	50	5.1	74	500	8.30
10	20 10%	2	4100	4.1	32,000	3.14	9.97	78	50	42	4.6	74	200	3.35
11	30 10%	3	5000	5.2	35,200	5.84	7.95	97	54	46	5.0	74	325	5.05
12	40 10%	4	5300	8.4	41,600	6.65	6.73	98	57	44	5.5	74	465	8.59
13	50 10%	5	4900	10.2	47,200	5.89	7.11	162	114	96	6.4	74	†500+	10.20
14	20 20%	2	4100	6.3	35,200	7.48	7.49	119	62	54	5.0	74	410	5.90
15	30 20%	3	5000	9.3	44,800	6.78	6.89	148	87	73	6.1	74	500	8.90
16	0.6 Max. RL	3	4500	—	32,000	0.49	9.44	85	36	33	5.1	74	140	2.27
17	0.6 Max. 1/3	3	4500	5.8	33,600	5.12	8.11	97	53	46	4.2	74	225	4.62
18	0.6 Max. 2/3	3	4500	9.2	40,000	5.59	7.26	199	123	118	3.9	74	425	8.03
19	0.8 Max. RL	2	6000	—	20,800	2.52	10.52	105	66	57	2.7	74	410	2.26
20	0.8 Max. 1/3	2	6000	7.7	28,000	5.72	7.49	97	73	68	3.4	74	425	6.80
21	0.8 Max. 2/3	2	6000	12.9	35,200	6.62	7.18	151	96	82	3.9	74	†500+	10.65
22	Idle	—	1300	—	75,200	4.19	4.19	40	8	5	10.7	74	175	0.58

† over 500°F, out of range of pyrometer

CONSTANT-SPEED EMISSIONS TEST DATA YAMAHA DT1-E Motorcycle

Date 10/7/71 Atmospheric Pressure 29.27 in Hg Wet Bulb Temp. 64 °F Dry Bulb Temp. 72 °F

RUN No. 2

			Engine	Dyno	FIA	NDIR			C.L.		Polar.	Temperatures, °F		Fuel Rate,
Mode	Condition	Gear	rpm	hp	HC, ppm C	CO, %	CO_2, %	NO, ppm	NO_x, ppm	NO, ppm	O_2, %	Inlet	Exhaust	lbm/hr
1	Idle	—	1300	—	76,000	3.48	4.19	61	7	5	9.9	74	110	0.65
2	20 RL	2	4100	—	51,000	0.74	8.27	111	50	50	6.2	74	125	1.95
3	30 RL	3	5000	—	21,600	3.54	9.80	74	35	27	2.6	74	145	2.02
4	40 RL	4	5300	—	20,800	1.34	10.62	108	66	59	2.7	74	160	3.08
5	50 RL	5	4900	—	32,800	5.15	7.49	119	59	53	2.7	74	250	5.00
6	20 5%	2	4100	2.9	26,400	1.85	10.16	78	37	30	3.4	74	210	2.06
7	30 5%	3	5000	4.3	26,800	2.90	9.27	113	61	54	3.4	74	240	3.38
8	40 5%	4	5300	6.1	36,000	6.14	7.64	90	52	42	4.3	74	325	6.36
9	50 5%	5	4900	7.4	44,000	7.24	6.73	105	55	46	4.8	74	450	7.90
10	20 10%	2	4100	4.1	32,000	4.51	9.10	110	49	45	3.7	74	300	4.33
11	30 10%	3	5000	5.2	33,600	5.12	8.12	125	57	48	4.1	74	340	5.00
12	40 10%	4	5300	8.4	42,400	7.24	6.73	120	60	52	4.5	74	360	7.20
13	50 10%	5	4900	10.2	46,400	5.91	6.89	192	119	110	5.3	74	†500+	10.00
14	20 20%	2	4100	6.3	39,200	6.03	7.34	69	53	43	4.1	74	305	5.98
15	30 20%	3	5000	9.3	46,400	6.21	6.59	84	75	66	5.0	74	480	9.42
16	0.6 Max. RL	3	4500	—	25,600	4.29	8.93	55	29	23	3.1	74	375	1.75
17	0.6 Max. 1/3	3	4500	5.8	30,400	5.43	7.64	76	57	51	3.9	74	250	4.53
18	0.6 Max. 2/3	3	4500	9.2	39,200	5.47	6.89	199	165	160	4.6	74	380	7.78
19	0.8 Max. RL	2	6000	—	23,200	4.66	8.93	40	33	27	2.6	74	350	1.91
20	0.8 Max. 1/3	2	6000	7.7	28,000	7.67	7.03	98	59	50	3.0	74	410	8.60
21	0.8 Max. 2/3	2	6000	12.9	32,000	6.76	7.26	162	105	100	3.6	74	†500+	12.25
22	Idle	—	1300	—	78,400	4.77	3.83	61	7	5	9.4	74	210	0.61

† over 500°F, out of range of pyrometer

APPENDIX E

Reproductions of Speed and Smoke Opacity
Traces for the 2-Stroke Motorcycles
Operated on the LA-4 Route

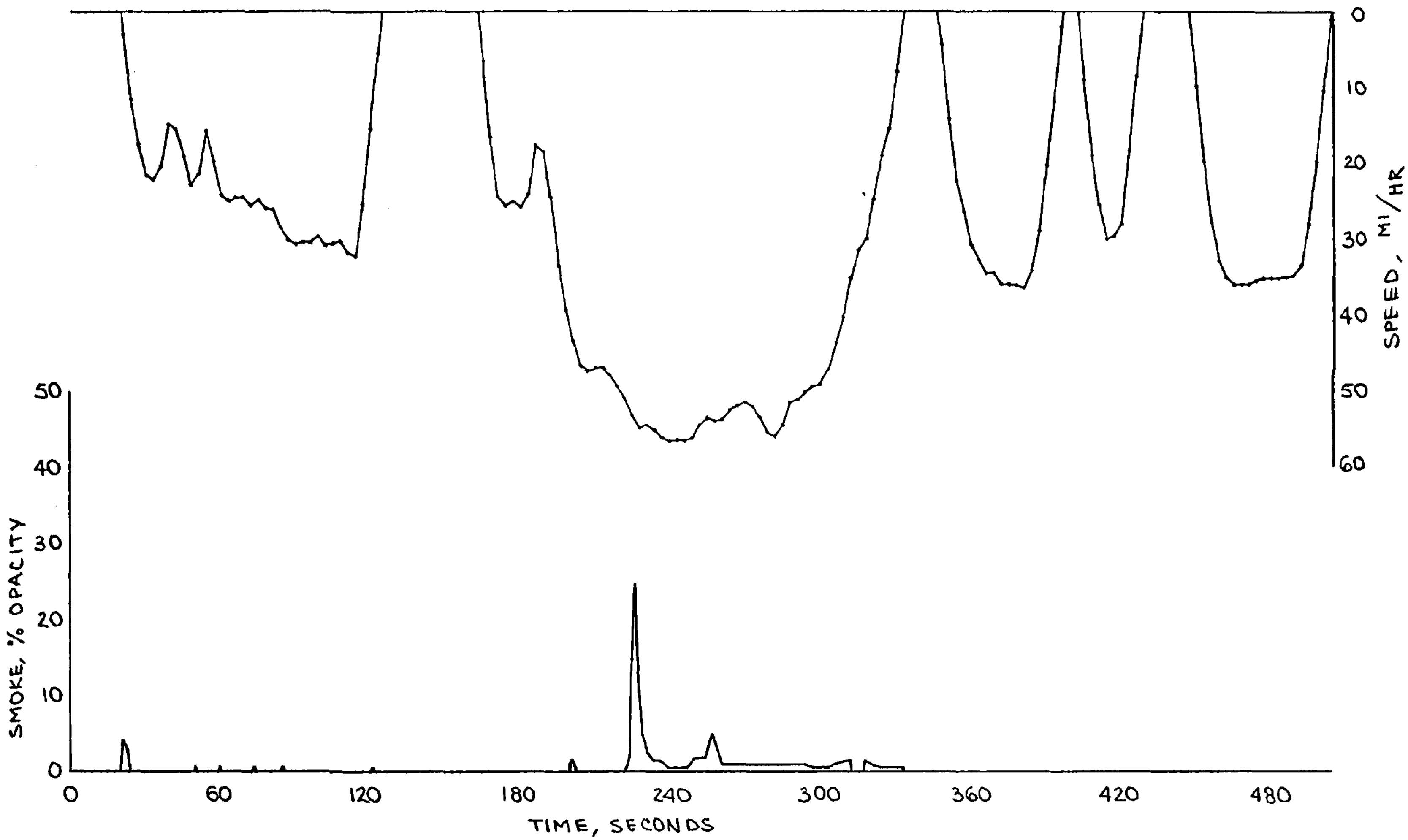

FIGURE E-1. SMOKE OPACITY AND SPEED AS A FUNCTION OF TIME FOR THE KAWASAKI 125F-6 MOTORCYCLE OPERATED OVER THE FIRST 505 SECONDS OF THE LA-4 ROUTE (2-INCH PIPE)

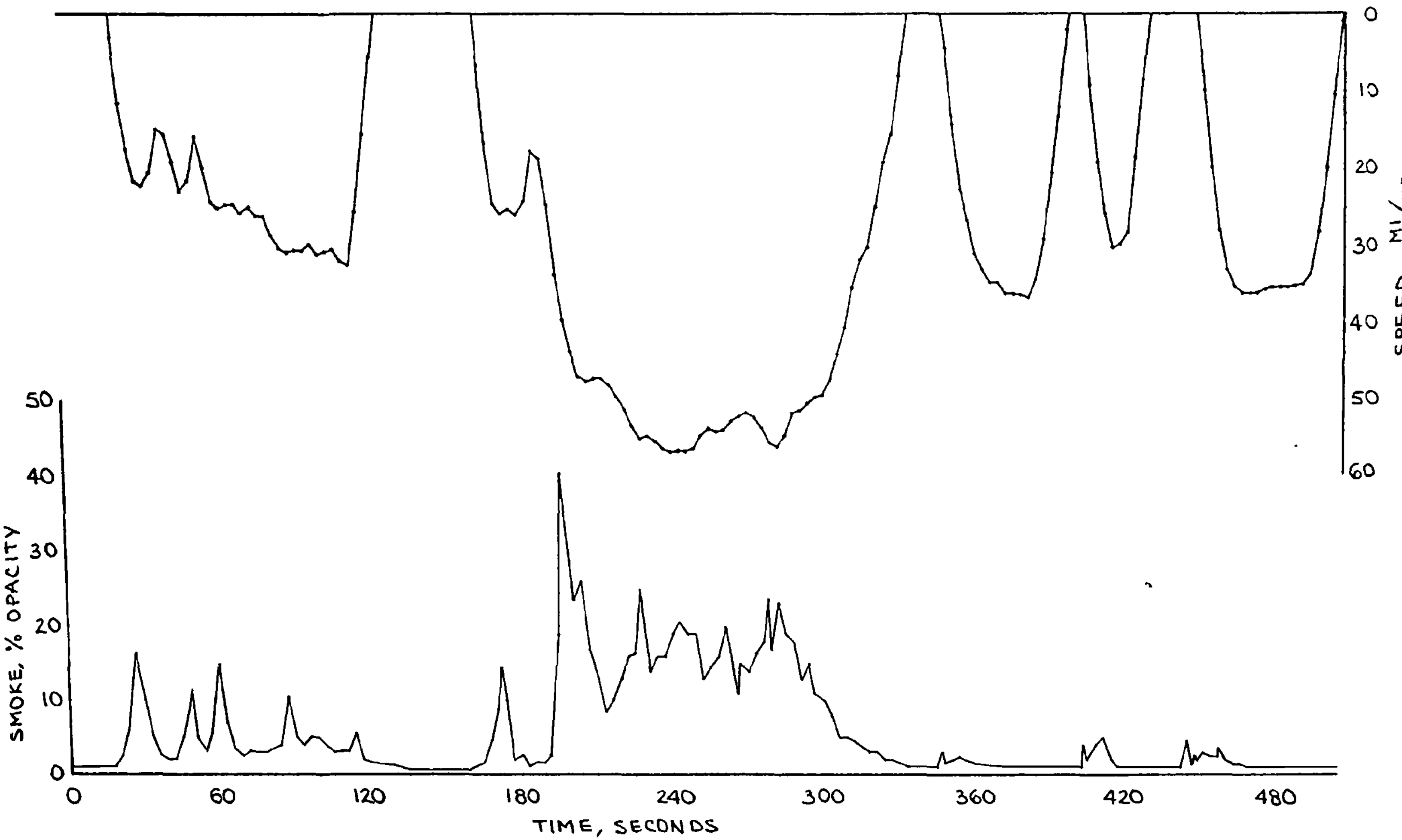

FIGURE E-2. SMOKE OPACITY AND SPEED AS A FUNCTION OF TIME FOR THE SUZUKI T250 MOTORCYCLE OPERATED OVER THE FIRST 505 SECONDS OF THE LA-4 ROUTE (3-INCH PIPE)

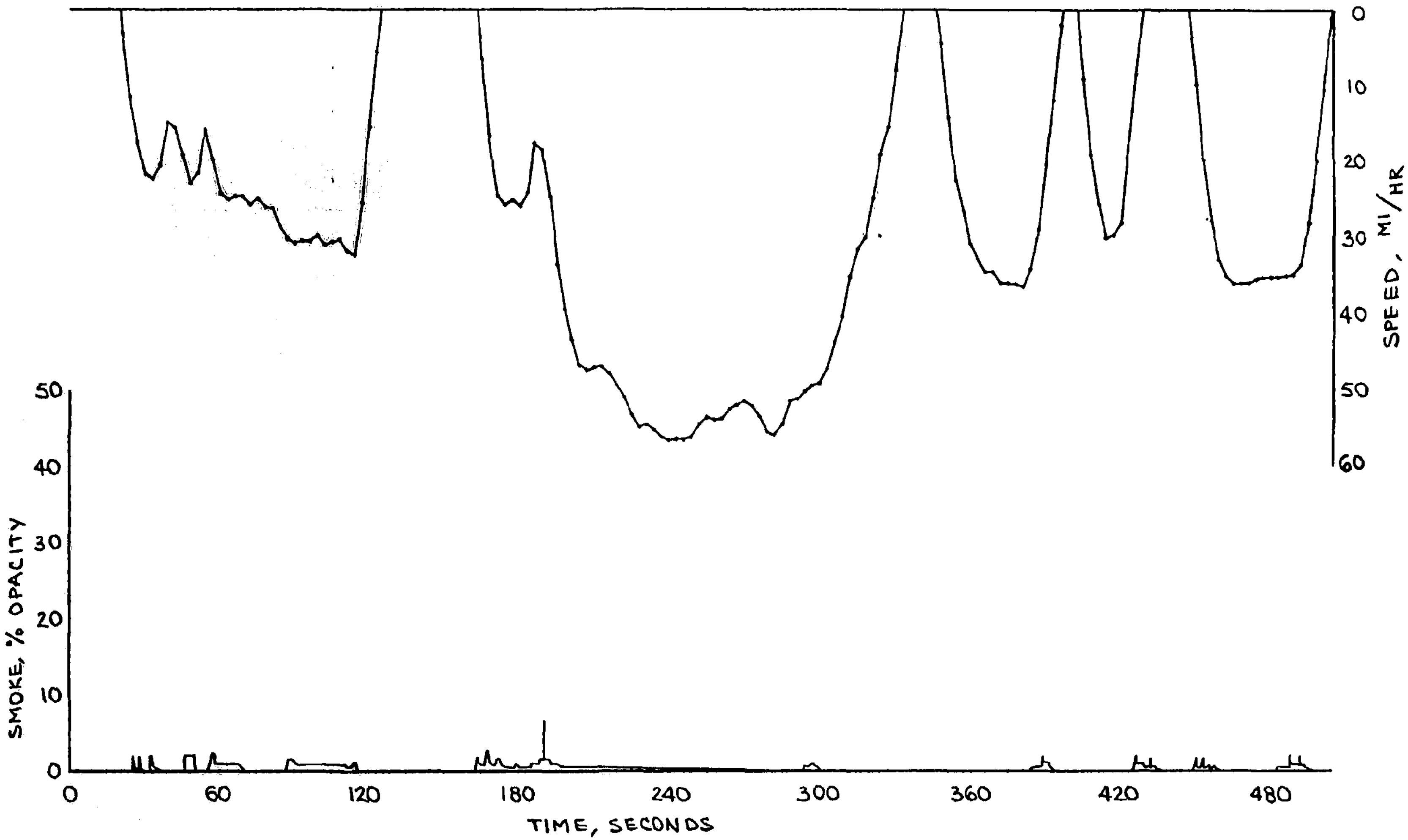

FIGURE E-3. SMOKE OPACITY AND SPEED AS A FUNCTION OF TIME FOR THE YAMAHA DT1-E MOTORCYCLE OPERATED OVER THE FIRST 505 SECONDS OF THE LA-4 ROUTE (2-INCH PIPE)