SDSB-79-20

Technical Report

1969 Light-Duty Truck Baseline Program and 1983 Emission Standards Development

by

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Table of Contents

I. FOREWORD

The Clean Air Act as amended in 1977 requires the U.S. Environmental Protection Agency (EPA) to develop and promulgate revised hydrocarbon (HC) and carbon monoxide (CO) emission standards for 1983 model year heavy-duty vehicles. These revised standards are to reflect at least a 90 percent reduction from the average emission levels of uncontrolled heavy-duty gasoline-fueled vehicles (1969 model year).

Under a separate test program, EPA measured uncontrolled HC and CO emission levels from heavy-duty vehicles with gross vehicle weight ratings (GVWR) greater than 8,500 pounds. The description and results of this test program are reported in the EPA technical report "1969 Heavy-Duty Engine Baseline Program and 1983 Emission Standards Development." The baseline emission levels (uncontrolled levels) of the vehicles constituting the remainder of the heavy-duty vehicle class1/ (those vehicles from 6,001 to 8,500 pounds (GVWR) also have to be determined.

In response to this need, the Emission Control Technology Division (ECTD) of EPA's Office of Mobile Source Air Pollution Control initiated a testing program to procure and emission test 1969 model year vehicles in the 6,001 to 8,500 pound GVWR range. The primary purposes of this test program were:

1) to determine the HC and CO emission levels from a representative sample of vehicles in the 6,001 to 8,500 pound GVWR range;

2) to derive average baseline HC and CO levels of the test sample; and

3) to calculate HC and CO values that represent 90 percent reductions from the baseline levels.

The HC and CO values that represent 90 percent reductions would be the emission standards that will be proposed for the light-duty truck class effective in the 1983 model year.2/

The purpose of this report is to describe the test program, present the emission results, and explain the methodology used to derive the proposed 1983 HC and CO emission standards for the light-duty truck class.

1/ EPA has established a "subclass" of heavy-duty vehicles which includes those vehicles from 6,001 to 8,500 pounds GVWR. This class of vehicles is referred to as light-duty trucks.

2/ The light-duty truck class includes all trucks in the 0 to 8,500 pound GVWR range. EPA plans to propose these new standards for the entire light-duty truck class.

II. Summary

The Clean Air Act as amended in 1977, directed the U.S. Environmental Protection Agency (EPA) to develop more stringent hydrocarbon and carbon monoxide emission standards for heavy-duty engines used in heavy-duty vehicles and light-duty trucks in the 6,000 to 8,500 lb. GVWR range (hereafter called light-duty trucks). This Congressional mandate required that EPA prescribe standards which by 1983 would require 90 percent reductions in HC and CO emissions. The 90 percent reductions were to be measured from uncontrolled (1969) emission levels.

To comply with the above Congressional requirement, EPA developed and conducted (through contract) an emission testing program that determined baseline emission levels (for HC and CO) for those light-duty trucks in the 6,000 to 8,500 lb. GVWR range. The EPA testing contractor was E G & G Automotive Research, Inc. of San Antonio, Texas and commenced in July, 1978.

The contract called for E G & G to procure and test both 1969 and 1972-73 vehicles for emissions on the 1979 light-duty truck test procedure. (The testing of the 1972-73 vehicles is part of another testing program and was combined with the testing of the 1969 vehicles for expediency and cost savings.) The 1969 baseline portion of the contract has been completed. Eighteen 1969 light-duty trucks, which represents 83.1 percent of all light-duty trucks (6,001 to 8,500 lbs. GVWR) sold were tested. Each vehicle was tested three times for emissions.

Based on the results of these emission tests, the sales-weighted average of the actually measured emissions are:

HC	CO
8.06 g/mile	102.29 g/mile

The corresponding 90 percent reductions from these levels are:

HC	CO
0.8 g/mile	10 g/mile

The above values represent the 1983 proposed emission standards for those light-duty trucks in the 6,000 to 8,500 lb. GVWR range. These standards appear in EPA's recent Notice of Proposed Rulemaking (NPRM) published in the Federal Register on July 12, 1979 (44 FR 40 7849). In this NPRM, EPA also proposes that these same standards apply to light-duty trucks under 6,000 lbs. GVWR as well.

III. Introduction

This technical report describes the test program the Emission Control Technology Division (ECTD) developed to measure hydrocarbons (HC) and carbon monoxide (CO) emissions for 1969 light-duty trucks (LDT). This baseline is being used to set 1983 proposed emission standards for light-duty trucks which have gross vehicle weight ratings (GVWR) of 8,500 pounds or less.

The actual test program was conducted by a contractor. E G & G Automotive Research, Incorporated of San Antonio, Texas was selected to perform the testing work in July, 1978. They were contracted to procure and test for emissions, 30 1969 LDTs and 25 1972-73 LDTs. The 1969 vehicles were tested to determine HC and CO levels for establishing the mandated 90% reduction for the 1983 emission standards. Table 1 lists the vehicles tested to construct the 1969 LDT baseline. The 1972-73 vehicles are currently being tested to determine the oxides of nitrogen (NOx) levels in order to set a 75% reduction for a 1985 NOx emission standard.

The contractor was also required to remove and prepare certain of the engines for dynamometer tests. These engines are found in heavy-duty vehicles (8,500 pounds GVWR and above) and were tested for inclusion in the heavy-duty engine baseline.

This report describes the baseline program formulation for the light-duty truck Contract No. 68-03-2683, the procurement and testing activities performed by E G & G, and the final baseline emission results and standards derived from that baseline.

IV. Discussion

A. LDT Baseline Program Formulation

The Clean Air Act Amendments (CAAA) of 1977 require that HC and CO emissions from heavy-duty vehicles be reduced by 90% from 1969 measured levels for 1983 model year vehicles and that NOx emissions be reduced by 75% from 1973 measured levels for 1985 model year vehicles. EPA has established a "subclass" of heavy-duty vehicles, which includes those vehicles from 6,001 to 8,500 lbs. GVWR, which conform to the current light-duty truck definition in 40 CFR §86.079-2. In order to set emission standards for this subclass for 1983 and 1985 model years, it is necessary to establish baselines for 1969 and 1973 model year light-duty trucks. EPA considers the entire LDT class to include 0<8,500 pounds GVWR trucks and is proposing to apply the new standards to the whole LDT weight class.

EPA in establishing the light-duty truck subclass required that these vehicles be tested for emissions on the applicable light-duty truck test procedure. Since the baselines were to

Table 1

1969 LDT Baseline

Baseline Engine No.	EG&G Vehicle No.	Engine	Mileage	Model	Body Type	Source	Date Procured
1	418	Dodge 318	37,300	D-200	Pick-up	J. W. Stanley San Antonio, Texas	8-24-78
2	444	Dodge 318	51,400	D-200	Pick-up	V. R. Lutes San Antonio, Texas	9-11-78
3	428	Dodge 225	59,200	P-200	Postal Van	Garcia Furniture San Antonio, Texas	12-11-78
4	404	Dodge 225	43,500	P-200	Postal Van	F. Stanish San Antonio, Texas	11-16-78
5	421	Ford 360	81,400	F-250	Pick-up	D. Woollett San Antonio, Texas	10-3-78
6	473	Ford 360	75,800	F-250	Pick-up	G. Tatom San Antonio, Texas	1-5-79
7	425	Ford 360	87,300	F-250	Pick-up	R. Pfluger San Antonio, Texas	11-16-78
8	491	Ford 360	88,200	F-250	Pick-up	B. Hooper San Antonio, Texas	1-19-79
9	610	Ford 360	61,200	F-250	Pick-up	B. A. Knapp San Antonio, Texas	4-5-79
10	613	Ford 360	85,300	F-250	Pick-up	R. Ferber San Antonio, Texas	4-12-79

Table 1 (Cont'd)

1969 LDT Baseline

Baseline Engine No.	EG&G Vehicle No.	Engine	Mileage	Model	Body Type	Source	Date Procured
11	618	Ford 302	107,300	E-300	Van	R. Gomez San Antonio, Texas	4-18-79
12	607	Chev 307	84,200	C-20	Pick-up	A. Rangnow Evero, Texas	3-8-79
13	441	Chev 250	68,900	C-20	Pick-up	P. Lindelow San Antonio, Texas	11-1-78
14	419	Chev 350	68,900	C-20	Pick-up	W. Cornett San Antonio, Texas	9-28-78
15	450	Chev 350	67,500	C-20	Pick-up	S. Smith San Antonio, Texas	12-16-78
16	427	Chev 350	78,800	C-20	Pick-up	W. Fuchs San Antonio, Texas	12-14-78
17	602	GMC 350	77,100	2500	Pick-up	M. Doyle San Antonio, Texas	1-29-79
18	601	IHC 345	102,300	1200D	Pick-up	V. Leos, Jr. San Antonio, Texas	1-26-79

be established using the existing 1979 light-duty truck chassis test procedure, EPA decided that a testing contractor could be utilized for the baseline program.

In the summer of 1977, the Standards Development and Support Branch of the Emission Control Technology Division began work on the contract solicitation to establish the 1969 HC and CO and the 1973 NOx baseline. The contract would require the testing contractor to procure and test thirty 1969 model year and twenty-five 1973 model year light-duty trucks (6,001 to 8,500 lbs. GVWR). The trucks would be tested on the 1979 light-duty truck emission test procedure. The contract solicitation (Request for Proposal No. CI 77-0329) was made available to bidders on December 8, 1977.

The contract solicitation included a sampling plan for 1969 model year LDTs which the contractor would use for vehicle procurement. The sampling plan, Table 2, was based on initial engine sales data supplied by the Motor Vehicle Manufacturer's Association (MVMA). This sampling plan, however, was revised when more complete engine sales data were received from the vehicle manufacturers. The sampling plan required revision because 6,000-10,000 pound GVWR vehicles rather than 6,000-8,500 pound GVWR vehicles were included in the sales data. EPA was unable to obtain 6,000-8,500 GVWR sales data in time to include it in the contract solicitation. The revised sampling plan and sales data are shown in Table 3. Although thirty engines were initially included in the proposed test sample , the number of vehicle/engines ultimately tested for the baseline would be based primarily on the trend of the emission results, time, and the availability of the vehicles. The sampling target ranges, which are shown in Table 3, were obtained by multiplying the percent of market sales by 25 and then rounding off.

B. Contract No. 68-03-2683

On July 26, 1978, Contract No. 68-03-2683, Baseline Characterization of Emissions from Medium-Duty Gasoline Vehicles Tested on a Chassis Dynamometer, was awarded to E G & G Automotive Research, Inc. (E G & G) of San Antonio, Texas. The contract originally defined work as:

> The contractor shall procure and test thirty 1969, and twenty-five 1973 model year gasoline medium-duty trucks. These vehicles will be "tuned-up" to manufacturer's specifications and will be tested three times over the 1979 light-duty truck test procedure. (In addition, the 1969 model year vehicles shall be tested three times "as received.") Upon completion of all testing, the engine shall be removed and delivered to EPA, or EPA's contractor for testing.
>
> Vehicles will be tested under the light-duty test proce-

Table 2

1969 Engine Targets

6,000 - 10,000 Pound GVW Breakdown by Manufacturer

Manufacturer	Percent of Sales	Number of Engines in a Sample of 30
Dodge	11.2%	3.4
IHC	5.1%	1.5
Ford	39.3%	11.8
Chev/GMC	44.0%	13.2

Manufacturer	No. of Engines	Percent of Mfr's Engines	Engine	Some Possible Models
Dodge	0-2	~20%	225	D200, W200, P200
	2-3	~80	318	D200, W200
IHC	1-2	61%	V304	1200, 1300
	0-1	18	V345	1200, 1300
	0-1	7	V266	1200, 1300
Ford	1-2	14%	240	E300
	0-2	5	300	F250
	1-3	17	302	E300
	4-8	57	360	F250
	0-2	8	390	F250
Chev/GMC	6-10	61%	307	CE209, CE310
	2-4	21	250	CCS209, CS310
	2-4	17	350-4bbl	CS209
	0-1	2	396	C20, P20

* From Research and Stats Department, Motor Vehicle Manufacturer's Association.

Table 3

Final Sampling Plan and 1969 Sales Data
Based on Sample Size of 25

Manufacturer	Engine	Sales	Percent of Market	Sampling Target Range
Chrysler	318	12,000	3.3	1
(5.5%)	225	8,000	2.2	1
			Total	2
Ford	360	88,700	24.2	6
(42.8%)	302	26,000	7.1	2
	240	21,600	5.9	1-2
	390	12,900	3.5	1-2
	300	7,600	2.1	1
			Total	11
General Motors	307	104,200	28.4	7
(48.0%)	250	34,400	9.4	2-3
	350-4	28,500	7.8	2
	292	6,000	1.6	0-1
	396	3,000	0.8	0-1
			Total	11
IHC	V304	8,610	2.4	1
(3.2%)	V345	2,600	0.7	(any engine)
	V392	400	0.1	
			Total	1
		366,350	99.8	

dure, Title 40 Code of Federal Regulations, Part 86, Subpart B, as applicable to 1979 model year light-duty trucks. Evaporative emissions will not be measured, the vehicle will not undergo a diurnal heat build, and a highway fuel economy test will not be run.

Each 1969 vehicle shall be tested three times in "as received" condition. (1973 vehicles will not be tested prior to adjustment.)

The original Scope of Work is contained in the Appendix. The original contract has since been changed, however, through technical direction and is presently being modified to incorporate the technical directions. These changes were initiated to facilitate an increased vehicle test completion rate. The changes are listed below:

1) 1969 model year vehicles shall not be tested in "as received" condition, but rather shall receive three emission tests, after being tuned-up.

2) Only certain engines designated by the Project Officer shall be removed from the vehicle and prepared for testing on an engine dynamometer.

3) Idle emission tests shall be conducted on all test vehicles.

The period of performance for this contract is 24 months, and the testing of 1973 vehicles is currently underway.

1. Vehicle Procurement

Vehicles were procured initially using the sampling plan in Table 2. Starting in March 1979, the revised sampling plan, Table 3, was utilized. A total of 25 1969 model year vehicles were procured by E G & G. This total includes two vehicles which had to be rejected due to mechanical problems which were discovered during pre-test preparation. The total of available test vehicles is 23; 18 of these vehicles have been tested and comprise the LDT baseline. Table 4 is a summary of vehicles procured by E G & G.

Procurement of the proper test vehicles was a critical element of the light-duty truck baseline program. Vehicles were selected based upon the criteria listed below:

1) Vehicles must be trucks or vans, rated by the manufacturer at 6,001 to 8,500 lbs. GVWR;

2) No emission controlled vehicles shall be included as evidenced by an emission control sticker or external emission control equipment;

Table 4

Vehicles Procured by EG & G

VEHICLE I.D. NO.	INITIAL CONTACT (DATE)	VEHICLE/ ENGINE	OWNER'S NAME	EG & G-AR INSPECTION (DATE)	VEHICLE PURCHASE STATUS (DATE)	PRE-TEST PREP. (DATE)	AS REC'D EMISSIONS (DATE)	ENGINE TUNE-UP (DATE)	EMISSIONS TEST (DATE)	ENGINE REMOVED (DATE)	ENGINE SHIPPED (DATE)	ENGINE RETURN (DATE)	VEHICLE DISPOSED (DATE)
69P200-225-01-404	11-9-78	1969 Dodge (P-200) 225 CID 7200 GVW	Frank Stanish	11-9-78	11-16-78	12-7-78	1-30-79	2-16-79	4-13-79	Pending EPA Decision			
69D200-318-01-418	8-22-78	1969 Dodge (D-200) 318 CID 7500 GVW	James W. Stanley	8-23-78	8-24-78	9-7-78	10-10-78	10-13-78	11-9-78	2-10-79	3-6-79	6-13-79	
69C20-350-01-419	9-20-78	1969 Chev (C-20) 350 CID 7500 GVW	William Cornett	9-21-78	9-28-78	10-3-78	11-10-78	11-16-78	11-29-78	Released by EPA	---	---	12-29-78
69F250-360-01 421	9-15-78	1969 Ford (F-250) 360 CID 7500 GVW	Donald Woollett	10-2-78	10-3-78	10-30-78	11-9-78	11-14-78	12-6-78	12-9-78	1-16-79		
69F250-390-01 424	10-25-78	1969 Ford (F-250) 390 CID 7500 GVW	Charles E. Hubbard	10-30-78	11-1-78	Rejected	---	---	---	---	---	---	12-19-78
69F250-360-02-425	10-25-78	1969 Ford (F-250) 360 CID 6200 GVW	Robert Pfluger	10-30-78	11-16-78	1-12-79	1-24-79	1-26-79	2-15-79	3-7-79	3-16-79	4-26-79	
69F250-360-03-426	12-5-78	1969 Ford (F-250) 360 CID 6800 GVW	Mike King	12-6-78	12-6-78	Rejected	---	---	---	---	---	---	12-29-78

Table 4 (Cont'd)

Vehicles Procured by EG & G

VEHICLE I.D. NO.	INITIAL CONTACT (DATE)	VEHICLE/ ENGINE	OWNER'S NAME	EG & G-AR INSPECTION (DATE)	VEHICLE PURCHASE STATUS (DATE)	PRE-TEST PREP. (DATE)	AS REC'D EMISSIONS (DATE)	ENGINE TUNE-UP (DATE)	EMISSIONS TEST (DATE)	ENGINE REMOVED (DATE)	ENGINE SHIPPED (DATE)	ENGINE RETURN (DATE)	VEHICLE DISPOSED (DATE)
69F250-360-06-610	4-5-79	1969 Ford (F-250) 360 CID 6100 GVW	Brett A. Knapp	4-5-79	4-5-79	5-7-79	Deleted per EPA	5-30-79	6-5-79	Pending EPA Decision			
69F250-360-07-613	4-12-79	1969 Ford (F-250) 360 CID 6900 GVW	Ralph Feber	4-12-79	4-12-79	5-7-79	Deleted per EPA	5-30-79	6-10-79	Pending EPA Decision			
692500-250-02-614	4-13-79	1969 GMC (2500) 250 CID 7500 GVW	Dean Hanes	4-13-79	4-13-79	5-17-79	Deleted per EPA	6-8-79	In Process				
69C20-292-01-617	11-78	1969 Chev (C-20) 292 CID 7500 GVW	Felix A. Sultemeier	4-17-79	4-17-79	5-17-79	Deleted per EPA	In Process					
69E300-302-01-618	4-18-79	1969 Ford (E-300) 302 CID 6200 GVW	Rudy Gomez	4-18-79	4-18-79	5-7-79	Deleted per EPA	5-15-79	In Process				
69F250-307-02-621	11-17-78	1969 Chev. (C-20) 307 CID 7500 GVW	James C. Bradshaw	3-12-79	5-10-79	Awaiting Delivery of Vehicle							
69E300-302-02-622	-	1969 Ford (E-300) 302 CID GVW	John Perackez	Inspected by EPA	5-17-79	6-7-79	Deleted per EPA	In Process					

Table 4 (Cont"d)

Vehicles Procured by EG & G

VEHICLE I.D. NO.	INITIAL CONTACT (DATE)	VEHICLE/ ENGINE	OWNER'S NAME	EG & G-AR INSPECTION (DATE)	VEHICLE PURCHASE STATUS (DATE)	PRE-TEST PREP. (DATE)	AS REC'D EMISSIONS (DATE)	ENGINE TUNE-UP (DATE)	EMISSIONS TEST (DATE)	ENGINE REMOVED (DATE)	ENGINE SHIPPED (DATE)	ENGINE RETURN (DATE)	VEHICLE DISPOSED (DATE)
691200D-345-01-601	1-23-79	1969 IH (1200 D) 345 CID 7500 GVW	Victoriano Leos, Jr.	1-24-79	1-26-79	2-3-79	Deleted per EPA	3-16-79	4-17-79	Pending EPA Decision			
692500-350-04-602	1-24-79	1969 GMC (2500) 350 CID 7500 GVW	Mike Doyle	1-26-79	1-29-79	2-20-79	Deleted per EPA	3-16-79	4-17-79	Pending EPA Decision			
69C20-307-01-607	11-22-78	1969 Chev (C-20) 307 CID 7500 GVW	August Rangnow	2-14-79	3-8-79	3-14-79	Deleted per EPA	3-19-79	4-12-79	Pending EPA Decision			
69C20-250-03-623		1969 Chev (C-20) 250 CID 7500 GVW	Robert Kuhn	5-18-79	5-24-79	6-1-79	Deleted per EPA	In Process					
	11-6-78	1969 Ford F-250 390 CID	R. Neil Jenkins	2-14-79	Pending								

Table 4 (Cont'd)

Vehicles Procured by EG & G

VEHICLE I.D. NO.	INITIAL CONTACT (DATE)	VEHICLE/ ENGINE	OWNER'S NAME	EG & G-AR INSPECTION (DATE)	VEHICLE PURCHASE STATUS (DATE)	PRE-TEST PREP. (DATE)	AS REC'D EMISSIONS (DATE)	ENGINE TUNE-UP (DATE)	EMISSIONS TEST (DATE)	ENGINE REMOVED (DATE)	ENGINE SHIPPED (DATE)	ENGINE RETURN (DATE)	VEHICLE DISPOSED (DATE)
69C20-350-02-427	10-10-78	1969 Chev (C-20) 350 CID 7500 GVW	Wm. Gene Fuchs	10-19-78	12-14-78	2-28-79	Deleted per EPA	3-19-79	4-26-79	Pending EPA Decision			
69P200-225-02-428	12-7-78	1969 Dodge (P-200) 225 CID 7500 GVW	Garcia Furniture	12-7-78	12-11-78	12-29-78	1-24-79	1-25-79	2-28-79	Pending EPA Decision			
69C20-250-01-441	10-31-78	1969 Chev (C-20) 250 CID 7500 GVW	Pat Lindelow	10-31-78	11-1-78	12-5-78	12-27-78	1-5-79	1-25-79	Pending EPA Decision			
69D200-318-02-444	8-31-78	1969 Dodge (D-200) 318 CID 7500 GVW	Victor R. Lutes	9-5-78	9-11-78	9-14-78	11-10-78	11-14-78	12-6-78	Released by EPA	---	---	12-29-78
69C20-350-03-450	12-11-78	1969 Chev (C-20) 350 CID 7500 GVW	Steve Smith	12-14-78	12-16-78	12-28-78	1-12-79	1-16-79	2-1-79	Pending EPA Decision			
69F250-360-04-473	1-5-79	1969 Ford (F-250) 360 CID 6900 GVW	Glenn Tatom	1-5-79	1-5-79	1-12-79	1-25-79	1-29-79	2-2-79	Pending EPA Decision			
69F250-360-05-491	1-17-79	1969 Ford (F-250) 360 CID 7500 GVW	Billy D. Hooper	1-17-79	1-19-79	2-2-79	Deleted per EPA	3-16-79	4-17-79	Pending EPA Decision			

3) Potential vehicles shall be inspected to ensure that they do not consume excessive amounts of oil, that they have satisfactory cylinder compression, that they have original carburetors and distributors, and that they have not undergone a major engine overhaul;

4) Every effort must be made to secure low-mileage vehicles (under 80,000 miles) which will not need extensive engine repairs;

5) Higher mileage vehicles, or vehicles requiring more than a minor tune-up may be used if the contractor demonstrates to the Project Officer that the desired test vehicles cannot otherwise be obtained.

2. Identification of Potential Test Vehicles

Finding suitable test vehicles was a significant problem for the contractor. E G & G's approach to vehicle identification was to purchase a list of 1969 light-duty trucks from the R.L. Polk Company. This list was the basis of a letter campaign. It was believed that this method would be the most successful; however, it failed. Only about 10% of the 3,000 letters mailed ever received responses. E G & G found that newspaper and radio advertisements produced the most responses from vehicle owners. This method accounted for most of the vehicles which were later procured.

Once a vehicle was identified as being a potential test vehicle, the selection procedure began. EG&G's vehicle selection procedure consisted of initial screening, physical inspection, vehicle purchase, and diagnostic evaluation.

Initial screening consisted of questioning the vehicle owners as to the vehicle make and GVWR, mileage, engine displacement, past maintenance history, oil consumption, and the general operating condition of the engine. Maintenance records were reviewed when available.

If the initial screening was satisfactory, then a physical inspection of the vehicle was conducted. During this inspection, the general condition of the vehicle and engine were noted, and the vehicle was driven to determine its mechanical condition. Pertinent part numbers for identification of the engine block, distributor, and carburetor were recorded to verify that they were original eqipment. This verification was accomplished by using the appropriate service manuals, or by direct communication with the vehicle manufacturers. Vehicles were checked for correct GVWR rating, engine displacement, and mileage.

When a vehicle had passed the initial screening and the physical inspection satisfactorily, the vehicle was purchased by Jack King Leasing, 5625 San Pedro Street, San Antonio, Texas. The vehicle was then leased to E G & G for a fixed fee for a period of one year.

The final phase of vehicle selection was a diagnostic evaluation. At this time any part numbers which could not be verified during the initial inspection were checked. Any minor non-emission-related defects were repaired to make the vehicle ready for "as received" emission tests.

During the diagnostic evaluation the vehicle was checked for engine oil, fuel, and coolent leaks. A cylinder compression and leak-down test were performed. The transmission, rear axle, engine, electrical system and braking system were inspected. The whole exhaust system was inspected for leaks. Two vehicles, as mentioned earlier, were rejected after diagnostic evaluation when it was determined that a major overhaul would be required before the vehicles could be tested.

3. Maintenance and Tune-Up Procedure

Essential maintenance and a minor tune-up was performed on each test vehicle before emissions testing was begun. Table 5 is a summary of the maintenance each vehicle received at E G & G. A tune-up included replacement of the parts listed below:

Spark Plugs	Distributor Point Set
Distributor Condenser	Distributor Cap
Distributor Rotor	Air Filter Element
PCV Valve	Ignition Wire Set
Carburetor Fuel Filter	

The tune-ups were performed according to recommended tune-up procedures detailed in the manufacturer's service manuals. The distributors were checked on a distributor machine and adjusted as close as possible to original specifications for centrifugal and vacuum advance. The following items were adjusted and set to manufacturer's specifications:

Distributor point gap
Dwell Angle
Spark plug gap
Curb idle speed
Fast idle speed
Choke
Timing

4. Vehicle Testing

Table 5

LDT Baseline Maintenance Summary

	Engine	Vehicle No.	Maintenance
1.	Dodge 318	418	Tune-up; Right Exhaust.
2.	Dodge 225	444	Tune-up; Water Pump Replaced with Rebuilt Unit.
3.	Dodge 225	428	Tune-up; Replaced Exhaust Manifold and Gaskets; Carburetor replaced with OEM Model.
4.	Dodge 225	404	Tune-up; Replaced Ignition Coil; Replaced Exhaust Manifold and Gaskets.
5.	Ford 360	421	Tune-up; Belt Replaced; Left Exhaust Manifold Replaced.
6.	Ford 360	473	Tune-up; Carburetor Rebuilt; Alternator Belt Replaced.
7.	Ford 360	425	Tune-up; Replace Belts, Hoses, Heat Riser Valve.
8.	Ford 360	491	Tune-up; Vacuum Advance Unit Replaced.
9.	Ford 360	610	Tune-up; Vacuum Advance Unit Replaced.
10.	Ford 360	613	Tune-up; Starter Rebuilt.
11.	Ford 302	618	Tune-up.
12.	Chev 307	607	Tune-up; Vacuum Advance Unit Replaced.
13.	Chev 250	441	Tune-up; Exhaust Manifold Replaced; Water Pump Replaced with Rebuilt Water Pump; Distributor Replaced.
14.	Chev 350	419	Tune-up.
15.	Chev 350	450	Tune-up.

Table 5 (Cont'd)

LDT Baseline Maintenance Summary

	Engine	Vehicle No.	Maintenance
16.	Chev 350	427	Tune-up; Distributor Replaced; Exhaust Valve on Cylinder Number 5 Replaced; Left Exhaust Manifold Replaced.
17.	GMC 350	602	Tune-up; Carburetor Replaced
18.	IHC 345	601	Tune-up; Water Pump Belt Replaced.

Vehicle Testing

The vehicles were tested at E G & G using the light-duty test procedure, Title 40 Code of Federal Regulations, Part 86, Subpart B, as applicable to 1979 model year light-duty trucks. Evaporative emissions were not measured, and highway fuel economy tests were not conducted. Each vehicle was required to have three valid "after tune-up" emission tests.

The 1979 light-duty truck test procedure requires that road load horsepower settings for the dynamometer be a function of vehicle frontal area. ECTD instructed E G & G to use an approximation for frontal area, rather than calculate frontal area for each vehicle individually. The frontal area approximation used was 33 square feet for a pick-up truck, and 37 square feet for a van. This frontal area approximation resulted in an actual road load horsepower setting of 19.0 hp for a pick-up truck and 18.5 hp for a van. EPA allowed this approximation to save time and reduce contract expense. The frontal area approximations which were used, were averages of frontal area measurements performed on pick-ups and vans by EPA personnel. The approximations yield roadload hp settings close to those used for emissions certification testing of LDT's in the 6,000 - 8,500 pound GVWR range for 1979 (19.0-21.5 hp).

Inertia weight settings for the test vehicles was determined by the loaded vehicle weight technique of the EPA test procedure. The vehicle's curb weight was used with the weight of a 40% fuel tank fill included. Three hundred pounds was added to obtain the final weight to be used for determining inertia weight setting.

The test results for each "after tune-up" emission test are contained in Table 6. Table 7 compares the actual engine/vehicles tested to the final sampling plan. The reason more engines are tested for some engine lines than is necessary is because the sampling plan was revised after the procurement process was already in process.

5. Test Equipment and Fuel

A Clayton model ECE50 chassis dynamometer was used for vehicle preconditioning and for the FTP emissions test. A Scott Model 302 CVS was used for the constant volume sampling system. Hydrocarbons were analyzed on a Horiba model F1A-2A FID. The carbon monoxide and carbon dioxide emissions were analyzed on Bechman model 315B analyzers. A Thermoelectron 10A unit was used to analyze oxides of nitrogen. Test fuel used for baseline emission tests was Indolene 30.

6. Audit Procedure

After completion of an emissions test, a test data packet was assembled which contained the following items:

Table 6

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 4500 GVW: 7500

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Dodge 318	418	As received *	01	8.132	68.057	5.249	12.39
		As received *	02	7.899	60.574	5.821	12.28
		As received *	03	7.309	63.582	5.096	12.47
		As received *	04	5.819	33.347	9.060	11.90
		As received *	05	6.918	64.681	5.692	12.46
		After maintenance	06	8.170	84.800	4.283	11.83
		After maintenance	07	7.532	99.605	4.483	11.48
		After maintenance	08	7.865	73.524	4.295	12.13
		Mean		7.856	85.976	4.354	11.81

Note: Tests 01 through 05 run on Indolene HO clear unleaded fuel.
* These tests were not used to determine baseline emissions.

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 18.5
Inertia Weight (lbs): 4500 GVW: 7500

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Dodge 318	444	As received *	01	9.061	132.649	4.146	12.09
		As received *	02	17.434	115.248	4.510	12.60
		As received *	03	15.685	107.980	4.807	13.00
		As received *	04	17.250	118.717	4.271	12.67
		As received *	05	14.826	97.101	4.062	13.59
		As received *	06	16.622	106.254	4.047	12.97
		As received *	07	12.130	93.953	5.929	13.78
		After maintenance *	08	void	test	--	--
		After maintenance	09	void	test	--	--
		After maintenance	10	11.052	95.092	5.236	13.57
		After maintenance	11	10.243	102.993	2.918	13.17
		After maintenance	12	13.145	109.602	3.601	13.04
		Mean		11.480	102.562	3.918	13.26

* These tests were not used to determine baseline emissions.

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 18.5
Inertia Weight (lbs): 5500 GVW: 7500

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Dodge 225	428	As received *	01	3.646	29.952	9.154	13.44
		As received *	02	3.409	28.879	9.843	13.38
		As received *	03	3.571	27.456	9.921	13.94
		After maintenance	04	6.787	57.422	6.564	12.95
		After maintenance *	05	void	test	--	--
		After maintenance *	06	void	test	--	--
		After maintenance	07	6.807	65.002	4.711	14.92
		After maintenance	08	8.600	77.193	5.489	12.76
		After maintenance	09	7.545	68.016	6.263	13.37
		Mean		7.651	70.070	5.488	13.68

* These tests were not used to determine baseline emissions.

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 5500 GVW: 7200

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Dodge 225	404	As received *	01	void	test	--	--
		As received *	02	4.586	167.100	4.070	11.26
		As received *	03	void	test	--	--
		As received *	04	5.075	225.782	3.568	9.51
		As received *	05	5.294	224.276	2.871	9.42
		After maintenance *	06	void	test	--	--
		After maintenance *	07	void	test	--	--
		After maintenance *	08	void	test	--	--
		After maintenance	09	5.980	164.222	2.362	11.82
		After maintenance	10	5.729	157.625	2.282	11.98
		After maintenance *	11	void	test	--	--
		After maintenance	12	5.499	152.791	2.328	11.94
		Mean		5.736	158.213	2.328	11.94

* These tests were not used to determine baseline emissions.

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 5000 GVW: 7500

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Ford 360	421	As received *	01	8.813	98.800	2.933	11.70
		As received *	02	8.929	96.830	3.286	11.36
		As received *	03	9.687	101.743	3.175	11.24
		After maintenance	04	7.741	64.094	2.387	12.40
		After maintenance	05	9.075	65.626	3.073	12.10
		After maintenance	06	7.074	52.408	3.253	12.66
		Mean		7.963	60.709	2.904	12.39

* These tests were not used to determine the baseline emissions.

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 4500 GVW: 6900

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Ford 360	473	As received *	01	8.652	218.441	1.738	9.72
		As received *	02	9.173	219.106	1.841	9.53
		As received *	03	9.035	228.785	1.824	9.17
		After maintenance	04	11.412	232.942	1.596	9.60
		After maintenance	05	10.327	215.766	1.582	9.92
		After maintenance	06	10.251	210.464	1.842	10.00
		Mean		10.663	219.724	1.673	9.84

* These tests were not used to determine the baseline emissions.

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 4500 GVW: 6200

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Ford 360	425	As received *	01	3.316	35.018	3.078	8.92
		As received *	02	5.988	41.268	3.268	8.49
		As received *	03	4.076	38.146	3.660	8.20
		After maintenance	04	2.775	39.874	2.831	7.55
		After maintenance *	05	void	test	--	--
		After maintenance	06	2.864	42.591	2.401	7.78
		After maintenance	07	3.200	51.202	3.070	7.56
		Mean		2.946	44.556	2.767	7.61

* These tests were not used to determine the baseline emissions.

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 5000 GVW: 7500

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Ford 360	491	After maintenance	01	7.390	65.409	5.479	11.36
		After maintenance *	02	void	test	--	--
		After maintenance	03	6.671	62.716	5.028	11.79
		After maintenance	04	6.847	63.229	4.654	11.68
		Mean		6.969	63.785	5.054	11.61

* These tests were not used to determine the baseline emissions.

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 5000 GVW: 6100

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Ford 360	610	After maintenance	01	11.504	178.555	3.017	9.96
		After maintenance	02	11.333	205.661	2.293	9.60
		After maintenance	04	12.163	225.254	1.617	9.30
		Mean		11.667	203.157	2.309	9.62

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 5000 GVW: 6900

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Ford 360	613	After maintenance	04	6.273	116.373	3.819	10.47
		After maintenance	07	4.615	62.553	5.149	10.75
		After maintenance	09	4.644	53.238	5.954	10.90
		Mean		5.177	77.388	4.974	10.71

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 5000 GVW: 6200

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Ford 302	618	After maintenance	01	6.052	92.026	2.335	11.20
		After maintenance	02	5.450	94.274	2.269	11.17
		After maintenance	03	7.431	169.053	1.162	10.17
		After maintenance	04	13.039	211.704	1.165	9.44
		Mean		7.993	141.764	1.733	10.50

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 4500 GVW: 7500

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Chev 307	607	After maintenance	01	9.056	94.916	3.413	12.31
		After maintenance	02	8.957	97.057	3.571	12.37
		After maintenance	03	9.319	94.639	3.869	13.60
		Mean		9.111	95.537	3.618	12.76

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 4500 GVW: 7500

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Chev 250	441	As received *	01	--	--	--	--
		As received *	02	4.330	53.879	5.613	13.60
		As received *	03	4.062	49.023	6.098	13.92
		As received *	04	4.564	57.477	5.015	13.62
		After maintenance	05	4.736	65.135	4.437	13.37
		After maintenance	06	4.408	51.752	4.706	13.69
		After maintenance	07	3.979	54.906	4.496	13.58
		Mean		4.374	57.264	4.546	13.55

* These tests were not used to determine baseline emissions.

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 4500 GVW: 7500

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Chev 350	419	As received *	01	8.473	150.943	1.956	11.80
		As received *	02	7.204	144.308	2.454	11.99
		As received *	03	7.498	142.156	2.722	12.06
		After maintenance	04	7.855	148.609	2.053	12.08
		After maintenance	05	7.702	147.679	2.128	12.12
		After maintenance	06	7.745	151.781	2.240	11.81
		Mean		7.769	149.356	2.140	12.00

* These tests were not used to determine baseline emissions.

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 4500 GVW: 7500

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Chev 350	450	As received *	01	void	test	--	--
		As received *	02	38.704	133.384	4.192	10.15
		As received *	03	38.562	135.833	4.945	10.15
		As received *	04	41.509	144.730	4.591	9.59
		After maintenance	05	14.385	81.131	3.698	11.55
		After maintenance	06	14.655	79.595	3.341	11.61
		After maintenance	07	12.492	110.452	3.128	11.33
		Mean		13.844	90.393	3.389	11.50

* These tests were not used to determine baseline emissions.

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 4500 GVW: 7500

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
Chev 350	427	After maintenance	05	7.595	102.262	2.807	11.40
		After maintenance	06	6.803	100.067	2.699	11.72
		After maintenance	07	7.165	98.833	2.948	11.15
		Mean		7.183	100.387	2.818	11.46

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 4500 GVW: 7500

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
GMC 350	602	After maintenance *	01	void	test	--	--
		After maintenance	02	8.933	110.895	2.802	10.87
		After maintenance *	03	void	test	--	--
		After maintenance *	04	void	test	--	--
		After maintenance	05	8.557	102.058	3.343	11.46
		After maintenance *	06	void	test	--	--
		After maintenance	07	8.378	106.936	3.319	11.29
		Mean		8.623	106.630	3.155	11.21

* These tests were not used to determine baseline emissions.

Table 6 (cont'd)

Summary of Emissions Tests

Roadload HP: 19.0
Inertia Weight (lbs): 5000 GVW: 7500

Manufacturer/ Engine CID	Vehicle Number	Condition	Test Number	HC Grams Per Mile	CO Grams Per Mile	NOx Grams Per Mile	Fuel Economy (mpg)
IHC 345	601	After maintenance	01	19.138	167.662	1.854	10.25
		After maintenance	02	void	test	--	--
		After maintenance	03	void	test	--	--
		After maintenance	04	void	test	--	--
		After maintenance	05	void	test	--	--
		After maintenance	06	void	test	--	--
		After maintenance	07	11.558	129.915	2.063	10.80
		After maintenance	08	void	test	--	--
		After maintenance	09	void	test	--	--
		After maintenance	10	void	test	--	--
		After maintenance	11	13.530	170.184	1.958	9.50
		Mean		14.742	155.92	1.958	10.18

Table 7

Sampling Plan vs. Baseline Engines Tested

Manufacturer	Engine	Sampling Target Range Sample size of 25)	Actual Procured	Actual Tested
Chrysler	318	1	2	2
	225	1	2	2
Total		(2)	4	4
Ford	360	6	6	6
	302	2	2	1
	240	1-2	0	0
	390	1-2	0	0
	300	1	0	0
Total		(11)	8	7
General Motors	307	7	2	1
	250	2-3	3	1
	350-4	2	4	4
	292	0-1	1	0
	396	0-1	0	0
Total		(11)	10	6
IHC	V304	1 (any engine)	1	0
	V345	"		1
	V392	"		0
Total		(1)	1	1

1) Wet bulb-dry bulb temperature trace.
2) Emission results input data tape.
3) Driver's trace - FTP.
4) Test vehicle refueling record.
5) CVS temperature trace.
6) Bag emissions analysis trace.
7) CVS-PDP test data sheet.
8) Driver's FTP check list.
9) Quality control audit sheets.
10) Non-evaporative hot LA-4 precondition checklist.
11) Preconditioning driver's trace.
12) CVS operator's test preparation report.
13) Emission results summary sheet.

The quality control audit consisted of checking the non-evaporative LA-4 precondition check list (item 10 above) and precondition driver's trace, the driver's FTP check list, the FTP driver's trace, the CO/CO_2 instrument traces, and the HC/NOx instrument traces for errors. Using the quality control audit sheets, the quality control technican inspected each item on every operator check list for completeness and accuracy of the particular entry. Errors of omission or misentries were resolved by questioning the individual responsible for the particular data pack item. If any errors or omissions weren's resolved, the test was voided.

Test parameters such as cell temperature, driver's trace speed tolerances, test duration, analyzer calibrations, etc. were checked to ensure that the parameters were within the proper tolerances, as specified in the Federal Register Light-Duty Truck Test Procedure.

7. Baseline Compilation

Audited test data packets were sent to the Project Officer, who compiled the baseline emissions results. Each vehicle's average emission results (the average of three tests) were multiplied by the corrected sales-weighting factor to obtain sales-weighted emissions. The sales-weighted emissions for each vehicle/engine were then added together to yield the baseline sales-weighted emission results. Table 8 contains the final sales-weighted emissions results for each vehicle. Approximately 83% of the sales of LDT's in the 6,000-8,500 pound range are represented in this table (and in the baseline).

In Table 8, the percent LDT sales shown in column four were calculated by dividing the percent LDT market sales (obtained from Table 3) by the number of engines tested for a particular engine line. For example, the Dodge 318 engine line represents 3.3 percent of the LDT market sales, so each of the Dodge 318's tested is considered 1.65% of the market. Column five, corrected percent, is just the percent LDT sales adjusted to 100%. Multiplying the corrected percent by the actual average emissions for each engine

Table 8

1969 L.D.T. BASELINE EMISSION RESULTS

07-06-79 16:4

	VEHICLE	CID	VEHW	% LDT SALES	CORR. %	HC NON-WID	HC SALE-WID	CO NON-WID	CO SALE-WID	NOX NON-WID	NOX SALE-WID
1	DODGE	318	418	1.65	1.99	7.856	0.156	85.976	1.708	4.354	0.086
2	DODGE	318	444	1.65	1.99	11.480	0.228	102.562	2.037	3.918	0.078
3	CHEV	350	419	1.95	2.35	7.767	0.182	149.356	3.506	2.140	0.050
4	FORD	360	421	4.03	4.85	7.963	0.386	60.709	2.945	2.904	0.141
5	CHEV	250	441	9.40	11.31	4.374	0.495	57.264	6.479	4.546	0.514
6	CHEV	350	450	1.95	2.35	13.844	0.325	90.393	2.122	3.389	0.080
7	FORD	360	473	4.03	4.85	10.663	0.517	219.724	10.658	1.673	0.081
8	FORD	360	425	4.03	4.85	2.946	0.143	44.556	2.161	2.767	0.134
9	DODGE	225	428	1.10	1.32	7.651	0.101	70.070	0.928	5.486	0.073
10	DODGE	225	404	1.10	1.32	5.736	0.076	158.213	2.095	2.328	0.031
11	CHEV	350	427	1.95	2.35	7.188	0.169	100.387	2.356	2.818	0.066
12	GMC	350	602	1.95	2.35	8.623	0.202	106.630	2.503	3.155	0.074
13	CHEV	307	607	28.40	34.18	9.111	3.114	95.537	32.658	3.618	1.237
14	IHC	345	601	0.70	0.84	14.742	0.124	155.920	1.314	1.956	0.016
15	FORD	360	491	4.03	4.85	6.969	0.338	63.785	3.094	5.054	0.245
16	FORD	302	618	7.10	8.55	7.993	0.683	141.764	12.115	1.733	0.148
17	FORD	360	610	4.03	4.85	11.667	0.566	203.157	9.855	2.309	0.112
18	FORD	360	613	4.03	4.85	5.177	0.251	77.388	3.754	4.974	0.241
				83.08	100.00		8.058 g/mile		102.286 g/mile		3.408 g/mile

yields the weighted emission results. These are added together to obtain the final baseline emission results.

The sales data used for sales weighting was obtained from the vehicle manufacturers and MVMA. The manufacturers and MVMA were asked to furnish to EPA the sales figures for 1969 truck engines according to engine size and by GVWR of the vehicles in which the engines were placed.

The final baseline sales weighted emissions results from Table 8 are listed below.

HC	CO
8.06 g/mi	102.29 g/mi

D. Standards Computation

The Clean Air Act Amendments require at least a 90% reduction in HC and CO emissions as measured from a 1969 model year baseline. The final baseline sales weighted emissions results of 8.06 g/mile for HC, and 102.29 g/mile for CO, when reduced by 90% yield the following values:

HC	CO
0.81 g/mi	10 g/mi

While the original sample size was chosen to be 30 1969 vehicles, only 18 vehicles were tested to produce the final baseline emissions results. These final results were used to set the final proposed standards. ECTD decided to use the 18 vehicles, based upon the trend of the emission results, the percent of market sales represented by the 18 vehicles tested, and the high correlation with past emissions data on 1969 vehicles. Tables 9 and 10 show the final sales weighted emissions for HC and CO as a function of vehicles tested. It is apparent that after testing 18 engines the final emission results were stable. In ECTD's judgment, these plots indicate that additional test vehiles would not significantly alter the final emission standards. Another consideration was that the baseline using 18 vehicles represented 83.1% of the total light-duty truck sales for the 6,001 to 8,500 lb GVWR subclass.

ECTD also determined that there was a close correlation between the baseline emission results and other test programs for 1969 light-duty trucks. Table 11 shows emission results for 12 1969 LDT's tested under other programs. These vehicles were selected because the inertia weights and road load horsepowers used were close to current values used for 1979 LDT certification emissions testing. A comparison of the final baseline results to the average of the 12 vehicles in Table 11 is shown below:

Table 9


LDT SALES-WEIGHTED BASELINE
EMISSIONS HC (GRAMS/MI)
HC (GRAMS/MI)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
NO. OF ENGINES

Table 10

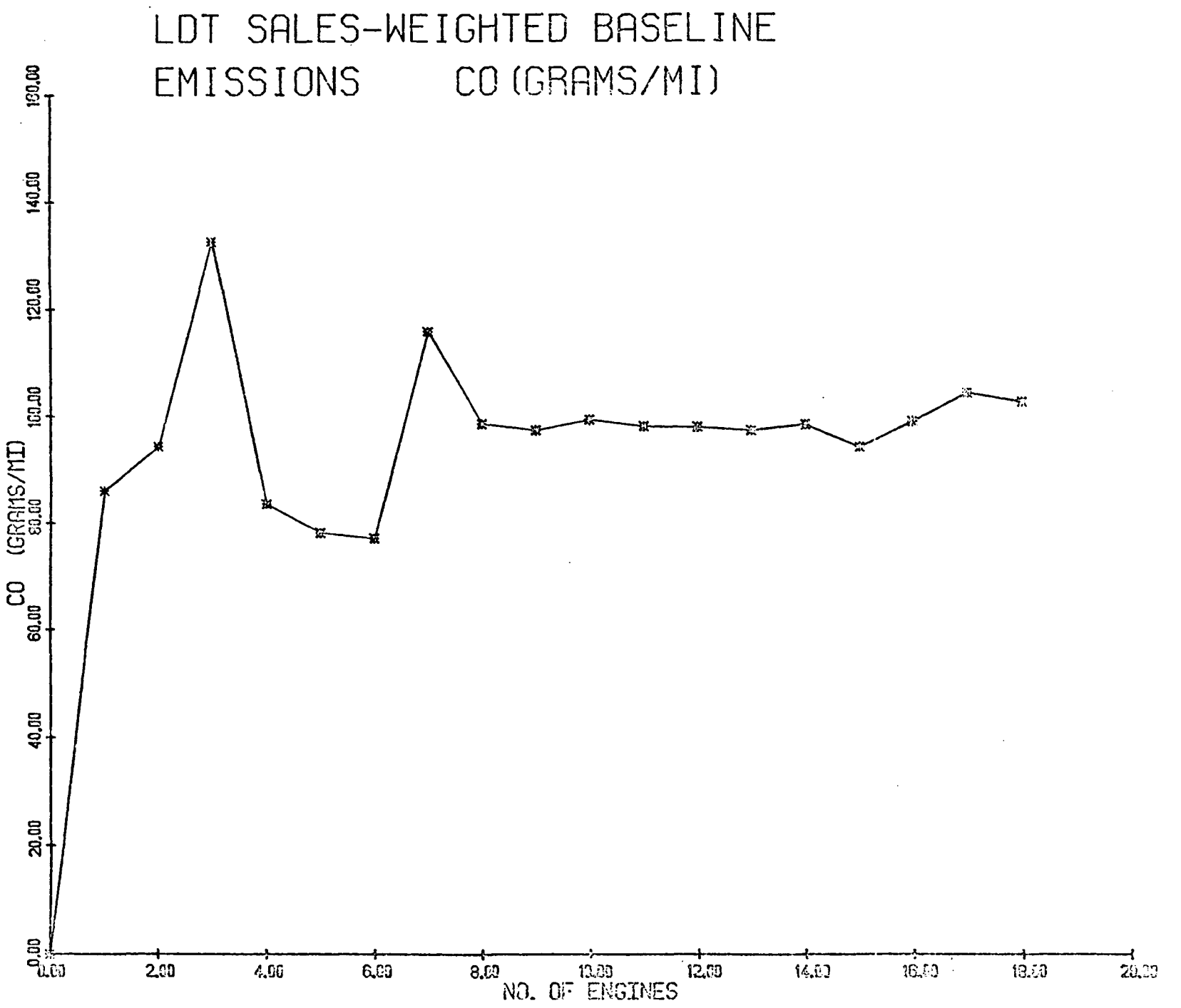

LDT SALES-WEIGHTED BASELINE
EMISSIONS CO (GRAMS/MI)
CO (GRAMS/MI)
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
NO. OF ENGINES

Table 11.

Estimated 1969 Light Duty Truck Baseline

(6,000 - 8,500 GVWR)

No.	Manufacturer	Engine	Inertia	Road Load	Emissions g/mile HC	CO	NOx
1	General Motors	350 in^3	5000 lbs	17.9 hp.	4.94	89.24	7.03
2	General Motors	350 in^3	5000 lbs	17.9 hp	9.00	113.60	5.08
3	Ford	360 in^3	4500 lbs	13.1 hp	4.53	56.00	4.14
4	Ford	390 in^3	5000 lbs	17.9 hp	4.31	54.48	8.46
5	Dodge	383 in^3	5000 lbs	17.9 hp	8.54	149.00	9.12
6	General Motors	292 in^3	5500 lbs	22.7 hp	6.18	68.39	4.81
7	Ford	360 in^3	5000 lbs	17.9 hp	8.04	103.50	2.81
8	Ford	240 in^3	4500 lbs	21.8 hp	6.89	114.97	5.40
9	General Motors	396 in^3	5000 lbs	21.1 hp	7.07	83.44	7.06
10	Ford	360 in^3	5000 lbs	21.1 hp	12.49	106.46	6.96
11	General Motors	350 in^3	5500 lbs	22.7 hp	9.73	152.73	5.49
12	General Motors	307 in^3	5000 lbs	17.9 hp	6.22	31.49	7.24
			Average	19.2	7.33	93.61	6.13
			Metric (g/km)		4.55	58.17	3.81

Sources: A Study of Baseline Emissions on 6,000-14,000 Pound Gross Vehicle Weight Trucks, June 1973, Automotive Environmental Systems, Inc., APTD-1572. (Vehicles 1 to 5)

Baseline Emissions on 6,000 to 14,000 Pounds Gross Vehicle Weight Trucks, June, 1973, Southwest Research Institute, APTD-1571 (Vehicles 6 and 7)

Medium Duty Baseline Tests, Environmental Protection Agency, Unpublished (Vehicles 8 to 12)

	HC	CO
1969 LDT Final Baseline Results	8.06 g/mile	102.19 g/mile
Table 11 (avg. of 12 vehicles)	7.33 g/mile	93.61 g/mile

This data further supports ECTD's judgment to terminate its baseline test program at 18 vehicles.

While the vehicle emissions results from Table 11 correlate well, the vehicles were not included in the baseline because they were tested in an "as received" condition (i.e., no tune-up was performed before testing). Also, the roadload horsepowers and vehicle inertia weights used for the tests were not in exact compliance with the current 1979 light-duty test procedure.

A P P E N D I X

Scope of Work

The contractor shall procure and test thirty 1969 and twenty-five 1973 model year gasoline medium-duty trucks. These vehicles will be "tuned-up" to manufacturers specifications and will be tested three times over the 1979 light-duty truck test procedure. (In addition, the 1969 model year vehicles shall be testing three times "as-received".) Upon completion of all testing, the engine shall be removed and delivered to EPA or EPA's contractor for testing.

Test Facility

The test facility shall be located at less than 550 meters (1800 feet) elevation.

Test Vehicles

Thirty 1969 and twenty-five 1973 test vehicles will be procurred by the contractor. Vehicles must be gasoline-fueled trucks and vans rated by the manufacturer at 6,001 to 8,500 lbs. GVWR. Passenger cars are not acceptable and neither are vehicles which are designed for carrying passengers with a capacity of 12 or fewer passengers. For 1969 vehicles, no emission controlled engines may be included (as evidenced by an emission control sticker or external emission control equipment). For 1973 vehicles, the emission control label must indicate compliance with engine (not vehicle) emission standards. Also for 1973, no California only vehicles may be included; however, vehicles sold nationwide but which meet the California emission standards are acceptable.

A 1969 Medium-Duty Fleet list is attached. The 1973 Medium-Duty Fleet list will be supplied at the time of contract award. (For purposes of bidding, the contractor should assume that the 1973 fleet will be similar to the 1969 fleet, adjusted for engine availability.)

Any deviations from the test fleet must be approved by the Project Officer in advance. While there are no restrictions on optional equipment (transmission type, axle ratio, tires, 4-wheel drive, etc.), the contractor shall attempt to secure, to the extent possible, normal cross section of vehicles.

The contractor shall make a general inspection of the vehicles, ensuring that they do not consume excessive amounts of oil, that they have satisfactory cylinder compression, that they have the original engine and carburetor, and that they have not undergone a major engine overhaul. Every effort must be made to secure low mileage vehicles; under 80,000 miles, which will not need extensive engine repairs. Ideally, the vehicle selected should be able to meet the manufacturers specifications ith only a minor engine tune-up. (It is the goal of this program to test vehicles in the best possible mechanical condition subject to the stated restrictions.) Higher mileage vehicles, or vehicles

requiring more than a minor tune-up, may be used if the contractor demonstrates to the Project Officer that the desired vehicles cannot be obtained.

Test Sequence

Testing of 1969 vehicles must be half completed before 1973 vehicle testing can begin.

Test Procedure

Vehicles will be tested under the light-duty test procedure, Title 40 Code of Federal Regulations, Part 86, Subpart B, as applicable to 1979 model year light-duty trucks. Evaporative emissions will not be measured, the vehicle will not undergo a diurnal heat build, and a highway fuel economy test will not be run.

Each 1969 vehicle shall be tested three times in "as-received" condition. (1973 vehicles will not be tested prior to adjustment.)

Vehicle Adjustment

Each vehicle shall receive a "minor tune-up" replacing filters, PCV valves and ignition parts as necessary. The carburetor, distributor and valves (mechanical tappets) may be adjusted. Manufacturers tune-up specifications (idle speed, mixture, timing, valve lash, etc.) must be met.

If the manufacturers specifications (including compression) cannot be met with a minor tune-up then additional repairs may be authorized by the Project Officer. The type of repairs will be determined by the individual engine's condition as indicated by standard diagnostic techniques. For any repairs performed, extreme care must be taken to insure that original specifications are maintained. Any repairs more extensive than a minor tune-up must be approved by the Project Officer in advance.

Engines requiring more than a minor tune-up may require a break-in (by accumulating a minimum of 1000 miles prior to further emission testing) as determined by the Project Officer.

After adjustment (or repair), all vehicles shall receive 3 emission tests as previously described.

Engine Removal/Shipment/Delivery Rate

After completion of all chassis testing, the contractor shall remove the engine from the vehicle. Engines shall be shipped to EPA or EPA's contractor as specified by the Project Officer. The contractor shall ship from two to four engies per month as directed by the Project Officer.

Engines shall be shipped in such a manner that they can be removed using a forklift or overhead crane. The contractor shall take precautions to prevent pilferage of engine parts.

(Previous references to Advisory Circular 22A are deleted.)

Other requirements:

1. Engines shall be shipped on a stand. See Drawing #1 for a suggested stand; others may be used if they permit mounting to the dynamometer.

2. Mounting of gasoline engines shall be 27 and 3/4 inches, as measured from the bedplate to the center of the driveshaft mounting point.

3. Engines shall be equipped with a flywheel and bell-housing.

4. A driveshaft adapter plate shall be installed and shall confrom to the driveshaft flange in Drawing #3.

5. Oil pressure shall terminate in a 1/4 inch female pipe fitting (N.P.T.).

6. All water inlets shall terminate into a single 2 and 1/4 inches O.D. inlet connection.

7. All water outlets shall terminate into a single 2 and 1/4 inches O.D. outlet connection.

8. Fuel inlet connection shall terminate in a 1/2 inch female pipe fitting (N.P.T.).

9. Thermocouples for engine coolant and oil shall be a minimum of 8 feet long and terminate in an iron-constantine male J plug (Honeywell No. 728096-1 or equivalent).

10. An exhasut system and muffler shall be supplied. This system shall be of the same of the same general size and type as on the vehicle. (Exception: For vehicles with dual exhausts, a single system shall be supplied.) The system shall clear the dynamometer. See Drawing's 2 and 2-A.

11. The engine drain cocks shall be operable.

Engine Return

Engines will be tested as quickly as practicable. Upon completion of engine testing they will be made available to the contractor or common carrier, as specified by the contractor. In no case will an engine be retained longer than 6 months.

Information to be Submitted

- Vehicle and Engine description
- Test data, raw and final
- Descriptions of tune-up and repairs made.

Format for these submissions shall be specified by the Project Officer within two months after contract award. A partial data list follows:

Idle RPM (as received/adjusted)

Timing (as received/adjusted)

Dwell (as received/adjusted)

Idle Emissions HC, CO, NOx (as received/adjusted)

Barometric pressure

Ambient temperature

Analyzer calibration curves

CVS Test data, recorded for each segment:

- Inlet air temperature average for wet and dry bulbs
- CVS inlet temperature, PDP only
- Background and Sample bag concentrations of HC, CO, CO_2 and NOx including zero and span readings and gas concentrations
- Distance travelled by segment
- Calculated emissions in grams, grams/km and grams/kg fuel for each segment
- Inertia weight
- Road Load

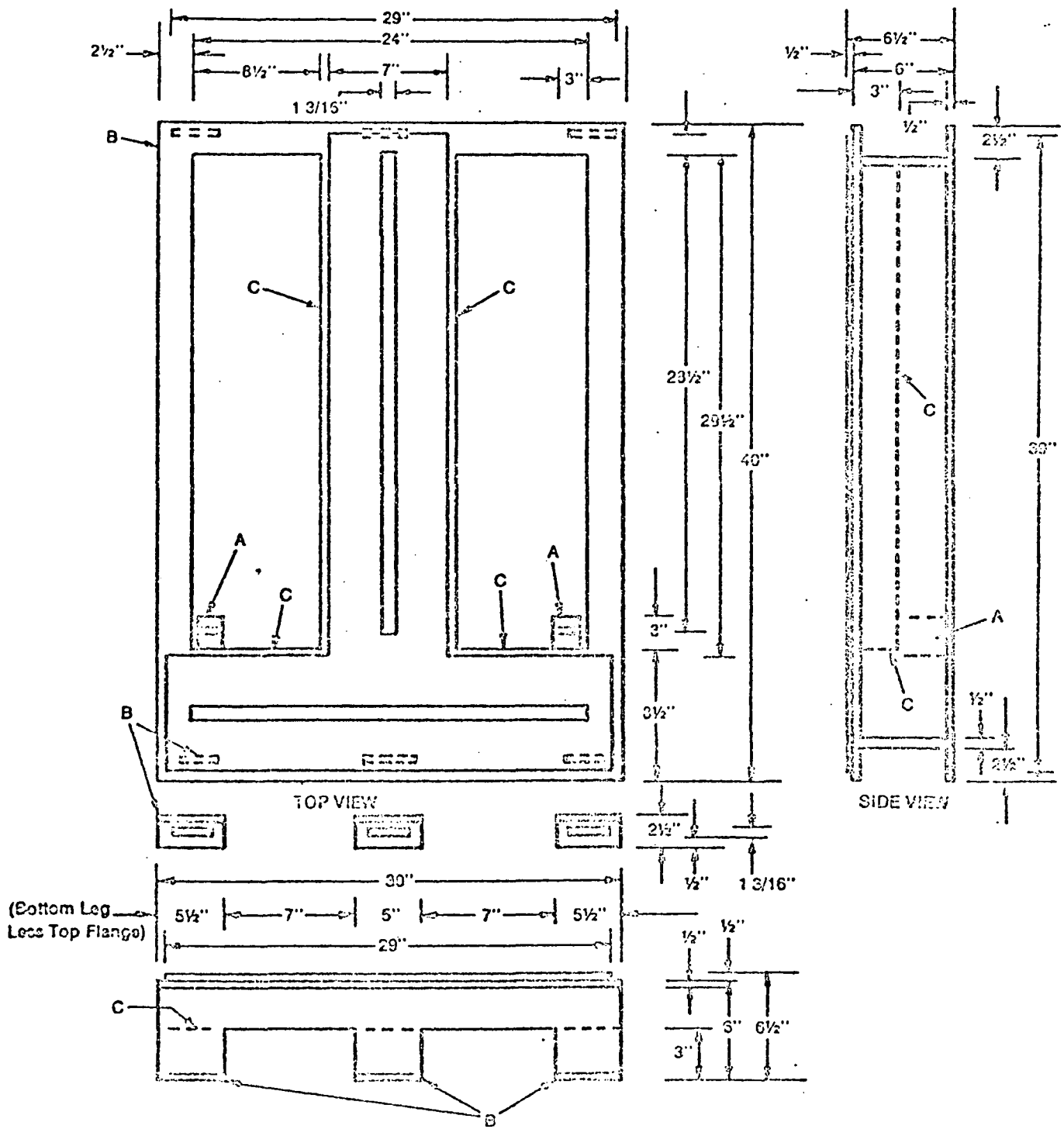
1969 MEDIUM-DUTY FLEET

6001-8500 lbs. GVWR Breakdown by Manufacturer

Mfr.	% of MDV Sales	Number of Engines in a sample of 30
Dodge	11.2%	3.4
IHC	5.1	1.5
Ford	39.3	11.8
Chev/GMC	44.0	13.2

Mfr.	# of Engines	% of Mfr.'s MDV Engines	Engine
Dodge	0-2	∿20%	225
	2-3	∿80	318
IHC	1-2	61%	V304
	0-1	18	V345
	0-1	7	V266
Ford	1-2	14%	240
	0-2	5	300
	1-3	17	302
	4-8	57	360
	0-2	8	390
Chev/GMC	6-10	61%	307
	2-4	21	250
	2-4	17	350-4bbl
	0-1	2	396

SMALL H.D. ENGINE STAND



Note:

A 3" angle with 2½" x 1 3/16" T-slot, 2-places only, bottom of stand

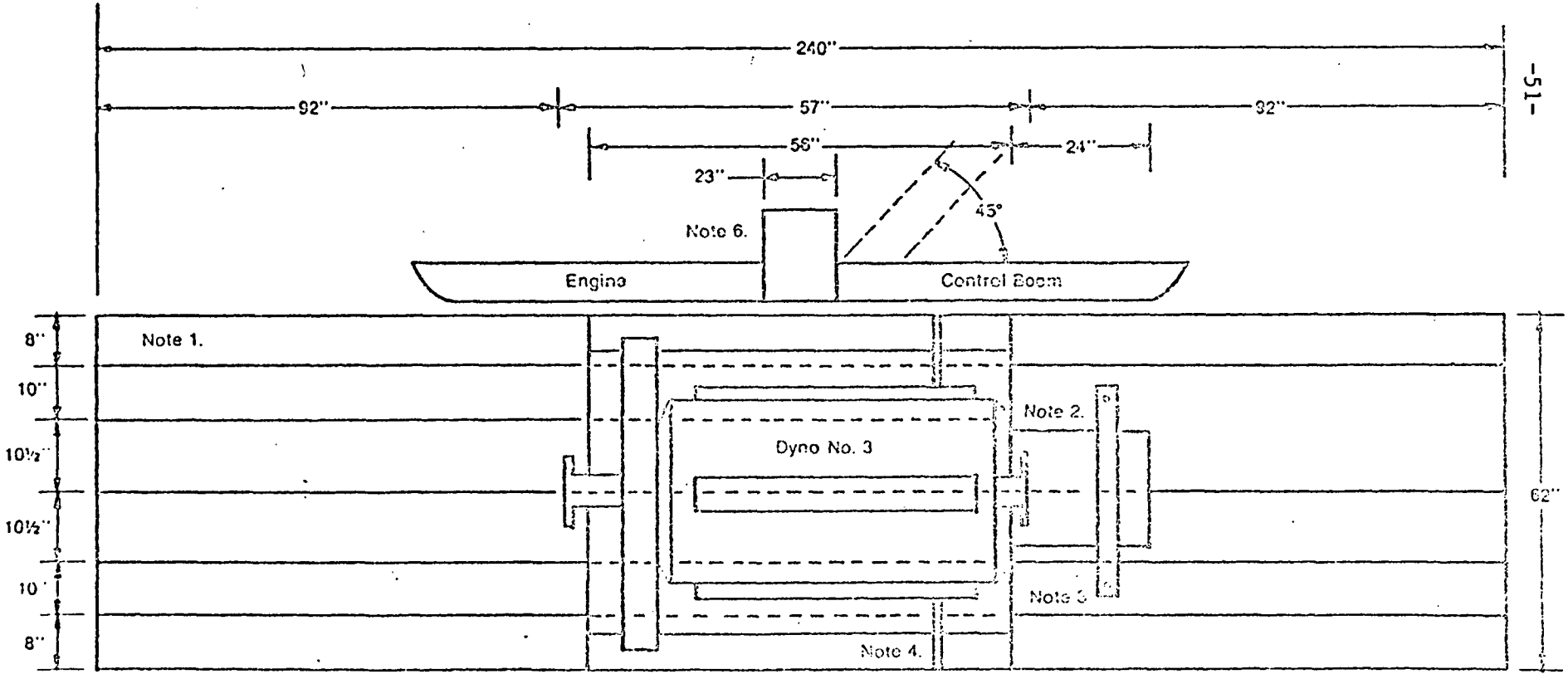
B 2½" x 1 3/16" slot in each leg, both ends, 3-legs each end

C 3" Gusset (welded) to support T-slot plates

Mat'l— "C" channel, ½" THK, 2½" wide, 6" HIGH; T-slot Plate is ½" THK, welded on. T-slots are 1 3/16" wide, MILD STL.

Note: Not to Scale

Note
1. Bed Plate "T-slots" -2" wide at bottom, 1" wide at top, full length of bed plate.
2. Drive shaft guard - 24" long x 7½" wide.
3. Accelerator Actuator Stand - 7" x 27½"; Height adjustable from 40½", min.
4. Exhaust Pipe(s) must be at an angle that will clear drive shaft guard, accelerator actuator stand, Dynamometer base, and torque arm.
5. Drive shaft length - 26" min. - 29" max.
6. Dyno test cell no. 4 is identical to No. 3 except engine control boom is on the opposite side.
7. Overhead exhaust stack not shown.



Not to Scale

Gasoline Dyno Test Cell No. 3 & 4

TOP VIEW

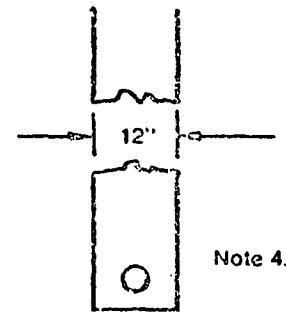
Drawing # 2

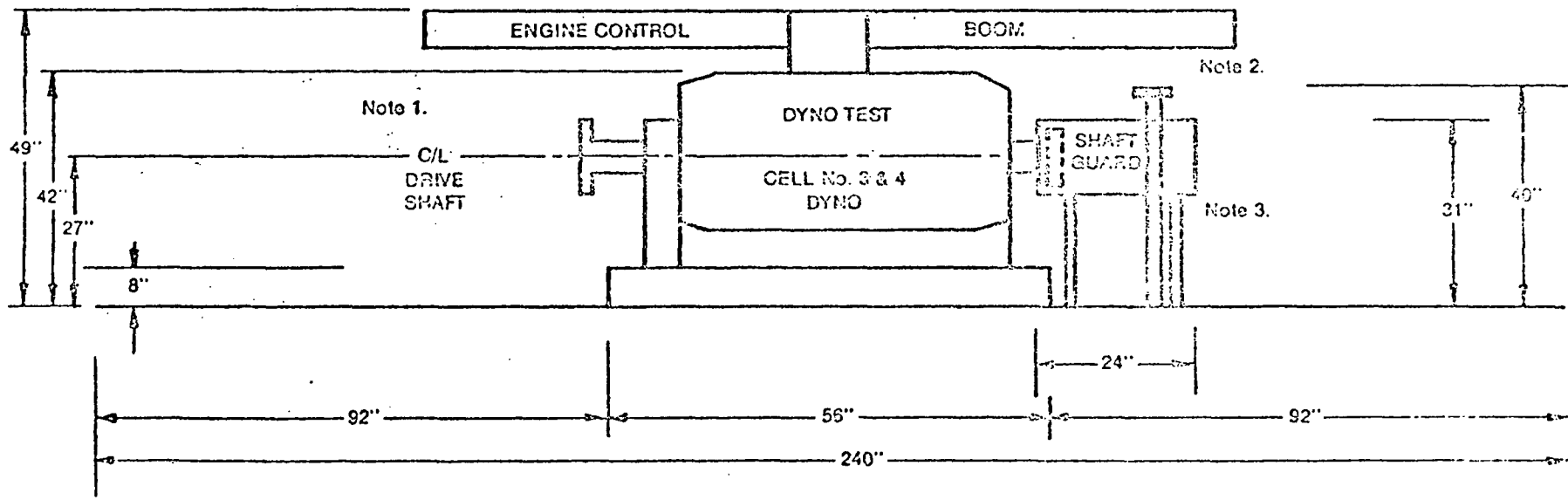
GASOLINE DYNO TEST CELL NO 3 & 4

SIDE VIEW

Note

1. C/L of Drive Shaft - 27" above Bed Plate.
2. Accelerator Actuator Stand can be on either end of engine.
3. Drive shaft guard is only 12" long when clutch bell housing is affixed to engine (with or without clutch).
4. Overhead exhaust stacks fitted with (2) exhaust ports to connect to 3" I.D. Marmon clamps.

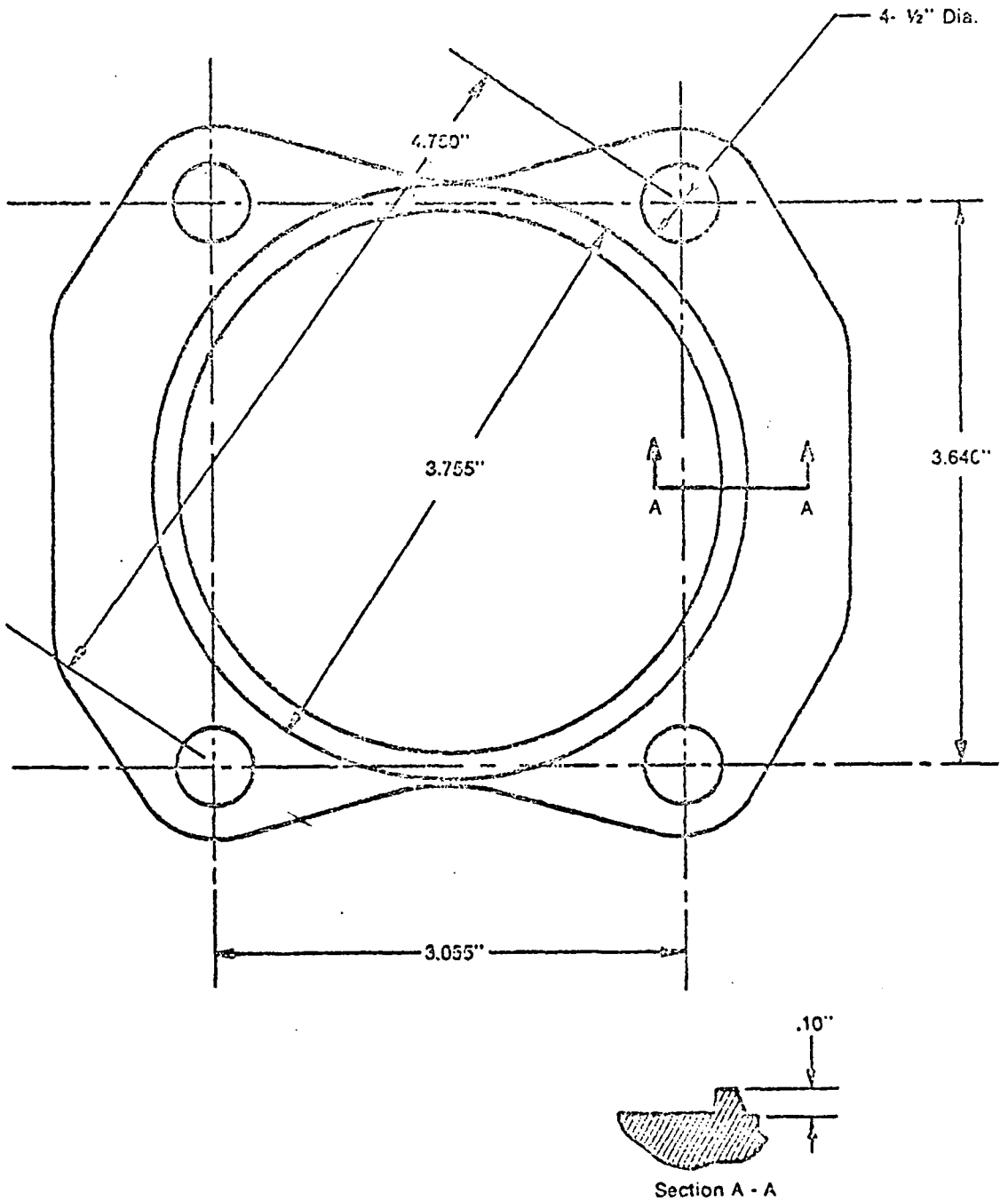




Not to Scale

Drawing # 2 - A

DYNAMOMETER DRIVE SHAFT BOLT PATTERN



Drawing # 3
Gasoline Engine