DRAFT FINAL

Failure Rate Analyses and Development of Fast-Pass, Retest, and CPP Algorithms for IM147 Max CO Cutpoints

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1. SUMMARY

Under the Clean Air Act Amendments of 1990, metropolitan areas with the most serious air quality problems are required to implement so-called "enhanced" I/M programs. Two different test procedures for exhaust emissions testing in enhanced programs have been approved by EPA: the "IM240" test, and the "Acceleration Simulation Mode" (ASM) test. With either procedure, the efficiency of the testing process depends on how quickly accurate decisions can be made as to whether a vehicle should pass or fail.

Inadequate vehicle preconditioning has previously been identified as a cause of false failures in I/M programs. In fact, previous EPA and DEQ analyses estimate that 25% of the vehicles failing the final IM240 standards would pass with further preconditioning, and that these vehicles can be identified through modal analysis. To address this problem, Sierra suggested, in another study, that Phase 1 of the IM240 test be eliminated, instead using only the second hill of the IM240 (i.e., the "IM147") up to three times in succession to ensure adequate preconditioning. Based on this recommendation, and to address the issue of inadequate preconditioning without compromising test throughput excessively, Arizona therefore decided to change its test procedure to the IM147 beginning January 1, 2000. This program upgrade will also include implementation of "Max CO" cutpoints previously developed by Sierra, which are designed to maximize the CO benefits of the program.

Regarding this proposed alternative to the existing IM240 test, several concerns needed to be addressed prior to implementation in Arizona. First of all, how would emissions identification and credit change with the new procedure. Secondly, because the length of the proposed test may be equivalent to that of three IM147 tests, it can use considerably more dynamometer time than the other aforementioned tests, thus increasing the cost of the program. Prior to this study, two other studies have already been conducted to start addressing these issues.

The first study addressed, among other things, reducing test time and projected emission credit levels for the IM147 test. Part of the data analyzed in this study consisted of 101 tests where vehicles were given three back-to-back IM147 tests. These data were used to create "Phase 2b" cutpoints, which are analogous to phase 2 cutpoints for the IM240 test, thus giving vehicles two ways to pass. In addition, fast-pass cutpoints for both the entire IM147 as well as Phase 2b were also developed. The other data used in this study consisted of 2% random sample IM240 test data collected in the Arizona IM240 program. This, in combination with the 101 vehicle data, was used to project emission credits. Unfortunately, since this study did not include back-to-back IM147 to IM240 testing, excess emissions identification rates and SIP credit could not be conclusively established.

In a follow-up work assignment in 1998,[1*] EPA asked Sierra to evaluate 304 triplicate IM147 tests followed by an IM240 test. These data were analyzed to verify the preliminary excess emission identification rates and average test time estimates projected for the Arizona IM program from the Phase 2 and IM240 data sets collected in previous studies. In addition, improved fast-pass and retest algorithms were developed for the IM147 test using the same approach used previously in developing similar IM240 algorithms; however, the cutpoints scenarios evaluated in the study did not include the Max CO cutpoints previously developed for DEQ.

PKE Speed Variation Criteria - In the 1997 IM240-related evaluation for EPA (SR98-02-01),[2] Sierra developed improved speed variation criteria based on the total Positive Kinetic Energy (PKE) change per mile traveled during the IM240 cycle. These criteria were designed to minimize the variation in emissions while still being feasible for use by minimally trained drivers with a reasonable aptitude for dynamometer driving. However, only IM240 drive cycle criteria were developed in the 1997 study. Therefore, further analysis was needed to develop similar speed variation criteria for the IM147.

Scope of Work

To aid in the Arizona IM147 implementation effort, EPA issued a work assignment (#1-08) to Sierra to complete the following tasks:

1. Develop projected IM147 failure rates for the Arizona I/M program;

2. Develop modal IM147 fast-pass standards for the Max CO cutpoints;

3. Develop modal predictive IM147 retest algorithms for the Max CO cutpoints;

4. Develop modal IM147 fast-fail criteria; and

5. Develop fast-pass and full-duration PKE criteria for the IM147 test.

Three distinct data sets were used in this study. The first two sets were the 304 vehicle study, collected for SR99-10-02, and a 543-vehicle sample collected for this study. For both of these sets, randomly selected vehicles were given triplicate IM147 tests followed by an IM240 test. The third data set comprised 2518 vehicles given triplicate IM147 tests and, if they failed the third test, an IM240 test. After removing invalid tests, the test data sets used for this study consisted of 300, 535, and 2512 vehicles respectively (i.e., 3347 vehicles total). All of the data were collected by Gordon-Darby I/M lanes in Phoenix, Arizona.

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* Superscripts denote references listed in Section 8.

Projected IM147 Failure Rates

Prior to projecting failure rates for the IM147 test using each of the four set of emissions standards (Startup, Intermediate, Final, Max CO), Max CO cutpoints developed as part of SR99-10-02 were revised using the combined 300- and 535-vehicle data sets. To this end, IM147 scores were regressed against IM240 scores. The resulting regression equations were then used to derive IM147 cutpoints from the IM240 cutpoints. IM147 phase 2 cutpoints were developed similarly by regressing IM147 composite scores against IM147 phase 2 scores. A scaling factor of 0.9 was multiplied against the predicted phase 2 cutpoint to make the phase 2 cutpoint slightly more stringent than the composite cutpoint, as it is with the IM240 test. Table 4-4 in Section 4 shows the revised Max CO cutpoints.

After revising the Max CO cutpoints, failure rates for the IM147 test using the Startup, Intermediate, final, and Max CO cutpoints were determined using the 3347-vehicle data set. These failure rates, which are shown in Table 1-1, were based upon the results of the third IM147 test.

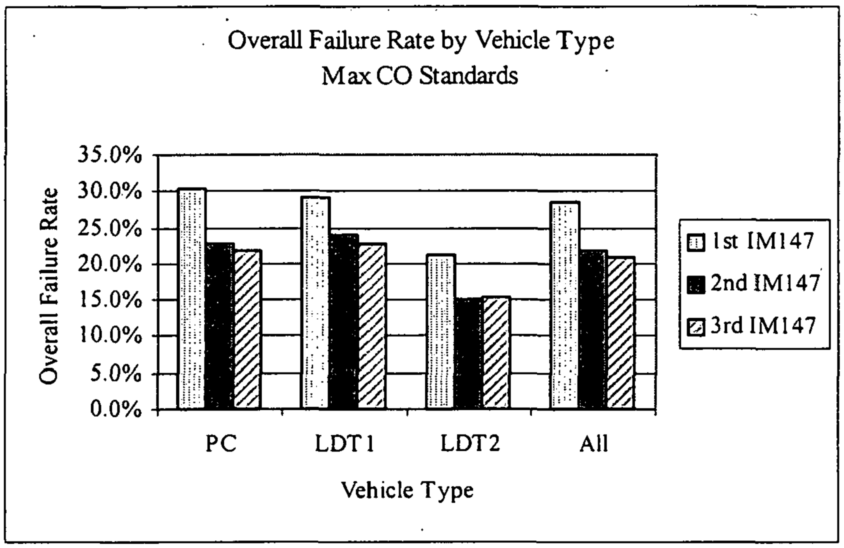
Table 1-1
Failure Rates, Third IM147

	HC			CO			NOx			OVERALL		
Vehicle Type	**Fail**	**Pass**	**% Fail**	**Fail**	**Pass**	**% Fail**	**Fail**	**Pass**	**% Fail**	**Fail**	**Pass**	**% Fail**
Max CO Cutpoints												
LDGV	114	1666	6.4%	250	1530	14.0%	155	1625	8.7%	390	1390	21.9%
LDGT1	49	915	5.1%	156	808	16.2%	70	894	7.3%	219	745	22.7%
LDGT2	25	578	4.1%	63	540	10.4%	30	573	5.0%	93	510	15.4%
All	188	3159	5.6%	469	2878	14.0%	255	3092	7.6%	702	2645	21.0%
Startup Cutpoints												
LDGV	106	1674	6.0%	130	1650	7.3%	141	1639	7.9%	281	1499	15.8%
LDGT1	52	912	5.4%	33	931	3.4%	48	916	5.0%	108	856	11.2%
LDGT2	33	570	5.5%	30	573	5.0%	28	575	4.6%	67	536	11.1%
All	191	3156	5.7%	193	3154	5.8%	217	3130	6.5%	456	2891	13.6%
Intermediate Cutpoints												
LDGV	157	1623	8.8%	161	1619	9.0%	196	1584	11.0%	367	1413	20.6%
LDGT1	80	884	8.3%	53	911	5.5%	73	891	7.6%	165	799	17.1%
LDGT2	40	563	6.6%	42	561	7.0%	42	561	7.0%	93	510	15.4%
All	277	3070	8.3%	256	3091	7.6%	311	3036	9.3%	625	2722	18.7%
Final Cutpoints												
LDGV	280	1500	15.7%	240	1540	13.5%	277	1503	15.6%	507	1273	28.5%
LDGT1	120	844	12.4%	85	879	8.8%	127	837	13.2%	239	725	24.8%
LDGT2	73	530	12.1%	56	547	9.3%	82	521	13.6%	149	454	24.7%
All	473	2874	14.1%	381	2966	11.4%	486	2861	14.5%	895	2452	26.7%

This table helps clarify the relationship between the four sets of cutpoints. The Startup, Intermediate, and Final cutpoints result in nearly equal HC, CO, and NOx failure rates, by vehicle category, which increase as the stringency of the cutpoints increase. The Max CO standards, when compared to the final standards, result in lower HC and NOx failure rates, and higher CO failure rates, especially for light-duty trucks.

Figure 1-1 shows the failure rates for each of the three IM147s, based on the Max CO standards. As the figure shows, most of the decrease in failure rates due to the use of multiple test cycles (i.e., to address the lack of adequate preconditioning) occurs between the first and second IM147s. As a result, it is reasonable to expect that algorithms designed to shorten the test would often end the test prior to the third IM147. This is, in fact, the case, as is shown later in this report.

Figure 1-1



Modal IM147 Fast-Pass Standards

Using the same methodology employed in SR99-10-02, this study developed fast-pass regression standards for the Max CO cutpoints. This methodology requires dividing the IM147 test into a series of short segments over which emission mass is accumulated. By performing multivariate linear regressions of these incremental segments, modal fast-pass coefficients were developed to predict when vehicles would pass without having to complete the entire test. Unlike the previous study, which divided the IM147 test into 14 segments, this study divided the test into 20 segments, thus increasing the frequency of opportunities for fast-pass.

While a fast-pass procedure of this nature has the ability to greatly reduce test time, this reduction has to be balanced against false passes. False passes occur when vehicles that would otherwise fail an inspection are fast-passed out because their emissions over the drive cycle are not appropriately characterized by the regression. For this study, false passes are quantified by measuring excess emissions, which are defined as emissions collected during an IM240 test in excess of the applicable standard for a given vehicle. The IM147 test receives credit for identifying excess emissions if it fails a vehicle that had excess IM240 emissions when using the same emission cutpoints (e.g. Max CO).

In this study, both the regression of the IM147 segments and the analysis of that regression were performed using the combined data sets (3347 vehicles) and the Max CO standards. Table 1-2 details the results of this analysis.

Table 1-2
Modeled Fast-Pass Results
Excess Emissions vs. Average Test Time

	No Fast-Pass*	Fast-Pass Enabled
Excess HC Identified	94.3%	92.7%
Excess CO Identified	98.2%	94.3%
Excess NOx Identified	92.1%	91.2%
Average Test Time**	217 seconds	125 seconds

* While vehicles cannot terminate in the middle of an IM147 without the fast-pass algorithm, the test may end prior to completing three IM147s if the emissions measured at the end of any one of the IM147s meet the applicable standards.
**Test time refers to the time actually required to operate the vehicle on the dynamometer.

Predictive Retest Algorithms

The workplan for the study called for Sierra to refine algorithms originally developed for SR99-10-02 and then to apply them to the total vehicle sample (3347 vehicles) to determine their net effect on test time. In contrast to the fast-pass algorithm, where misidentification results in false-passing vehicles and a loss in excess emissions identification, the retest algorithm errors result in false failures, which can lead to consumer complaints. Like the fast-pass algorithm, decreases in test time need to be weighed against false failures to determine a reasonable compromise.

While the original retest procedure described in SR99-10-02 used a combination of mass and concentration emissions measurements to anticipate whether a vehicle would benefit from additional testing, concerns expressed by Gordon-Darby regarding the complexity of this algorithm led to a different approach for this analysis. Instead, a variation of the fast-pass regression calculation was developed and used to predict emissions improvement over an IM147 test. In short, the emissions result predicted after Segment 7 is compared to the emissions result predicted after Segment 19 to determine whether the vehicle emissions are converging on the applicable standard.

Using this procedure, test time was reduced from 125 seconds (with fast-pass enabled) to 96 seconds. Table 1-3 details further results of the retest analysis.

Table 1-3
Retest Algorithm Results

	LDGV	LDGT1, LDGT2
Total Number of Complete Tests	1567	1780
# of Failures Without Retest Algorithm	327 (20.9% of 1567)	273 (15.3% of 1780)
# of Correctly Identified Failures[a]	245 (74.9% of 327)[b]	180 (65.9% of 273)[b]
# Failing After 1 IM147	94 (38.4% of 245)[c]	97 (53.9% of 180)[c]
# Failing After 2 IM147s	151 (61.6% of 245)[c]	83 (46.1% of 180)[c]
# of Passing Vehicles Falsely Failed by Retest	0 (0% of 1567)	0 (0% of 1780)

[a]"Correctly identified failures" refers to those vehicles that were still failing at the end of the third IM147.
[b]The number shown in parentheses is the number of failures without the retest algorithm.
[c]The number shown in parentheses is the total number of IM147 Cycle 2 and 3 failures.

Modal Fast-Fail Criteria

One of the requirements of this work assignment was to develop modal fast-fail criteria. Unlike the retest procedure, which can terminate the test at the ends of the individual IM147s, the fast-fail algorithm can terminate tests during an IM147 test.

Like the retest algorithm, errors committed by the fast-fail criteria result in false failures. As a result, decreases in test time have to be weighed against false failures. With this in mind, fast-failures cannot be made during the first of the three IM147s. Analysis showed that the results of the first IM147 were too unpredictable relative to the final result to risk false-failing vehicles. The final two IM147s, however, would serve reasonably well for this purpose.

There are two different fast-fail algorithms, one for each of the final two IM147 tests. The fast-fail algorithm for the second IM147 fails vehicles with excessively high predicted emissions after segment 7 of the second IM147. The fast-fail algorithm for the third IM147 test uses a variation of the fast-pass algorithm to predict failing vehicles throughout the test. Both of these algorithms are described more completely in the body of this report.

Table 1-4 shows the results of the fast-fail algorithms when applied to the 3347 vehicle sample. The fast-fail algorithm reduces average test time an additional 2 seconds, from 96 seconds (with fast-pass and retest enabled) to 94 (with fast-pass, retest, and fast-fail enabled).

Table 1-4
Fast-Fail Algorithm

Vehicle Class	Second IM147 Fast-Failures	Third IM147 Fast-Failures	False Failures
LDV	124	211	3
LDT	99	182	3
Total	223	393	6

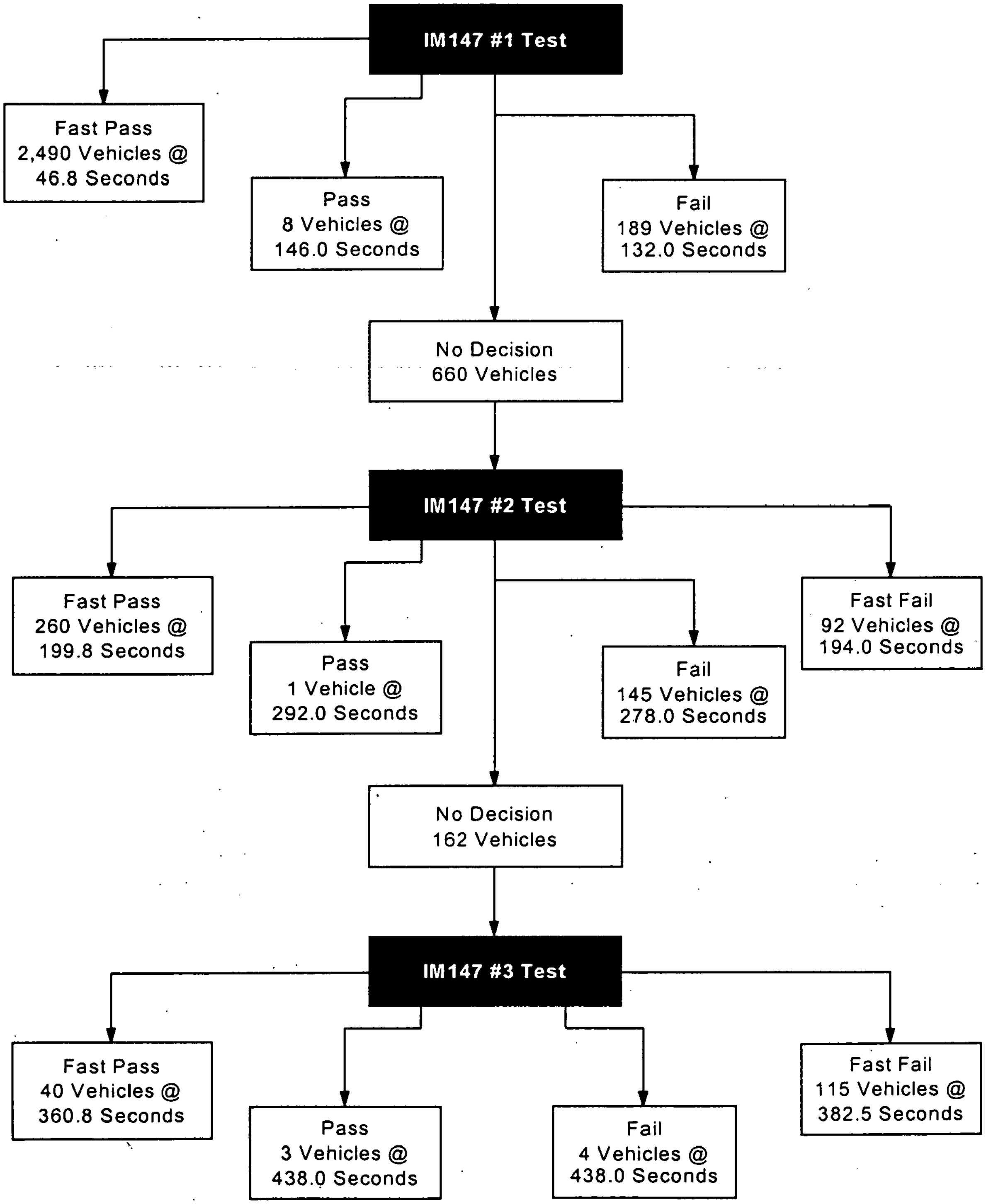
Integrated Fast-Pass, Retest, and Fast-Fail Algorithm Results

This portion of the study combined all of the optimized algorithms to determine their net effect on test time, false failures, and excess emissions while using the Max CO standards with the 3347 vehicle sample. The flow chart contained in Figure 1-2 shows the point at which vehicles concluded the test and the reason they passed or failed. It also indicates the average dynamometer test time for each category of vehicles. Following the flow chart, Table 1-5 shows the net effect of the procedures on test time and excess emissions.

The table shows that excess emission identification using the Max CO cutpoints with the fast-pass, retest, or fail-fail algorithms enabled is 94.4%, 95.4%, and 95.7% for HC, CO, and NOx, respectively. (For comparison, the respective identification rates are 94.3%, 98.2%, and 92.1% <u>without</u> the various test criteria enabled.) This is down from the identification rates developed in SR99-10-02,[1] which identified 99.6% of the HC, 98.2% of the CO, and 99.9% of the NOx with the fast-pass and retest algorithms enabled (fast-fail was not considered). However, direct comparison of the two sets of results may not be relevant for several reasons. First, the previous study measured excess emissions captured against the Final Cutpoints rather than the Max CO cutpoints use for this study. Second, because fast-fail was created for this study, it was not included in the previous study results. Third, the retest algorithm has been modified as part of this study and will therefore have a different effect on the results. Finally, the majority of the data used in this study were collected with the newer model year exemptions in place. As a result, the vehicle distribution was skewed toward older vehicles relative to that in the previous

Figure 1-2

Integrated Test Results
Maximum CO Cutpoints Without CPP Limits



TOTAL PASS = 2,802

TOTAL FAIL = 545

TOTAL FALSE FAILURES = 3

Table 1-5 Comparison of Integrated Algorithms vs. Standard IM147 Impact on Test Time and Excess Emissions Lost*							
Class	Model Year Group	Sample Size**	Mean Test Time Standard**	Mean Test Time w/ Algorithms**	% Excess Emissions Identified***		
					HC	CO	NOx
LDGV	1981-82	105	286.4	140.1	-	87.6%	100.0%
	1983-85	228	311.2	169.4	100.0%	97.4%	100.0%
	1986-89	425	248.4	112.0	99.3%	97.5%	100.0%
	1990-95	952	184.8	78.3	96.9%	85.3%	91.4%
	1996+	70	154.3	37.1	-	-	-
	All	1780	221.0	100.0	98.6%	93.9%	97.6%
LDGT1	1981-85	260	306.6	158.7	75.7%	97.5%	98.4%
	1986-89	222	230.8	101.6	92.4%	91.0%	99.6%
	1990-95	450	173.3	59.2	0.0%	0.0%	100.0%
	1996+	32	155.1	31.6	-	-	100.0%
	All	964	221.9	94.9	79.3%	94.4%	98.7%
LDGT2	1981-85	94	307.5	158.8	100.0%	100.0%	100.0%
	1986-87	64	253.2	101.4	100.0%	100.0%	70.8%
	1988-95	427	166.5	54.2	100.0%	58.0%	39.7%
	1996+	18	146.0	28.0	-	-	-
	All	603	197.1	74.7	100.0%	98.5%	86.0%
Weighted Average		**3347**	**217.0**	**94.0**	**94.4%**	**95.4%**	**95.7%**

* Test time results do <u>not</u> include impact of driver variation limits.
** Mean test time standard refers to the average dynamometer test time without the algorithms enabled. This was determined using the 3347-vehicle sample.
*** Percent of IM240 (Max CO) excess emissions identified with the integrated algorithms enabled. This was determined using the 835-vehicle sample.

study. Less rigorous test criteria were also evaluated as part of this latest study. However, their use yielded relatively little improvement in identification rate at the cost of a large increase in test time. A decision was therefore made not to pursue this latter option.

Segment 2 Revised Integrated Algorithms Results

The original integrated algorithm results were initially determined assuming fast-pass and fast-fail results could not be rendered prior to the fourth segment (i.e., no earlier than Test Time = 28 seconds). This was consistent with the procedure established in SR98-02-01.

Gordon-Darby, wishing to further minimize test time, requested that Sierra explore the feasibility of rendering fast-pass and third IM147 fast-fail decisions after earlier segments without degrading excess emission identification. Further investigation found that decisions could be made as early as the end of segment 2 (i.e., at Test Time = 16 seconds) if the error multiplier used in the fast-pass decision was increased during segments 2 and 3. For segment 2, the error multiplier was 3, while it was 2.5 for segment 3. Using these criteria, average test time was reduced to 91 seconds without sacrificing any excess emissions identification.

Development of IM147 Driver Variation Standards

As will be shown in the body of this report, previous work performed on driver variation limits utilized Positive Kinetic Energy (PKE) limits to evaluate driver performance. Analysis conducted for this study, however, revealed limitations with this metric, which can result in inappropriate driver errors. As a result, a new statistic, Cumulative Positive Power (CPP), was developed to remedy this problem. Designed to be used in conjunction with EPA-specified absolute speed variation limits, CPP produces an improved, more predictable, driver evaluation criteria than PKE.

When applied to the total vehicle sample for this study (minus vehicles with absolute speed violations), the new CPP criteria produced a total abort rate of 3.4%. Since the IM147 test, even without fast-pass, fast-fail, or retest, allows for vehicles to pass the test after a single passing IM147, many of the driver errors in the total sample would not be experienced since they occurred after the vehicle had already passed. Taking this into account, the effective abort rate was 2%.

Integration of CPP Variation Limits

The CPP analysis was conducted on a subset of the 3347-vehicle population, with absolute speed excursion violations (as defined in EPA's IM240 guidance) removed. This resulted in an overall data set of 3006 vehicles. Using the 3006-vehicle sample, the average test time, with the fast-pass, retest, and fast-fail criteria enabled but without the CPP criteria applied, was 89 seconds. Once the CPP criteria were enabled, 87 tests (of the 3006 vehicles) were extended, increasing the average test time by 1 second to 90 seconds. This resulting increase of 1.1% is less than the 2% increase projected at the end of Section 6, which makes sense given that the 2% projection was made without the fast-pass/fail and retest algorithms in place. The overall test time reductions caused by the fast-pass/fail and retest algorithms would mean that fewer errors would be committed.

Table 1-6 summarizes the change in dynamometer test time with each succeeding set of enabled criteria. The overall impact of all the criteria is to reduce the test time by 58%, from 217 to 90 seconds.

Table 1-6
Average Test Time (seconds)
by Test Time Reduction Methodology and CPP

Scenario	Dyno Test Time	Test Time Reduction (%)
Cutpoint only, two possible retests	217	--
Added fast-pass	125	42
Added retest	96	56
Added fast-fail	94	57
Allowed fast-pass at end of Segment 2	91	58
Removed speed excursion violations	89	59
Added CPP limits	90	58

SIP Credit Analysis

The comparison of excess emissions identification between the IM240 and IM147 that is presented above is based on the use of CO Max standards for both test cycles. However, to develop an estimate of the allowable SIP credit that should be allocated to the revised IM147 CO Max standards, it is also necessary to compare excess emissions identification between this scenario and the IM240 with EPA-recommended final cutpoints in place. This is due to the need to establish a link to using MOBILE for SIP modeling purposes. Configuring MOBILE with CO Max standards is not feasible; therefore, a better approach is to run the model with final EPA standards in place and use the excess emissions identification rates developed in this study to adjust the resulting model outputs.

Table 1-7 shows the excess emission identification rates when the IM147 Max CO cutpoints are compared to the IM240 final standards. Pollutant-specific identification rates are shown both without and with the fast-pass, retest, or fail-fail algorithms enabled. (The latter scenario includes fast-passing vehicles as early as at the end of segment 2.) Since Arizona will be implementing the IM147 test procedure with the algorithms

Table 1-7 Comparison of IM147 Max CO Cutpoints to IM240 Final Standards Impact on Excess Emissions Lost*						
Class	% Excess Emission Identified (Without Fast-Pass, Retest, Fast-Fail)			% Excess Emissions Identified (With Integrated Algorithms)		
	HC	CO	NOx	HC	CO	NOx
LDGV	94.1%	96.5%	85.6%	91.7%	95.6%	86.2%
LDGT1	75.6%	100.0%	79.5%	65.0%	98.1%	81.2%
LDGT2	89.0%	100.0%	53.4%	98.5%	100.0%	59.6%
Weighted Average	**86.5%**	**98.8%**	**75.1%**	**85.6%**	**97.9%**	**77.5%**

* Percent of IM240 (Final Standards) excess emissions identified was determined using the 835 vehicle sample.

enabled, the identification rates for this scenario are the ones that should be used to adjust the MOBILE modeling results (based on final IM240 standards) for SIP credit purposes.

As expected, the table shows that HC and NOx identification rates are significantly lower with the IM147 Max CO cutpoints relative to final IM240 standards. This is due to the fact that the Max CO cutpoints are designed to maximize the CO benefits of the program at the expense of HC and NOx benefits, while keeping maximum failure rates in each cutpoint category to acceptable levels. The CO identification rate of 97.9% (with the algorithms enabled) shows that the Arizona program will achieve nearly all of the modeled benefit of the final IM240 standards. Note that this will be substantially more effective than the current phase-in IM240 standards. The table also shows that the addition of the integrated algorithms results in less than a 1% reduction in the excess emissions identification rate for CO. (As noted above, the addition of the algorithms reduce dynamometer test time from 217 to 90 seconds.)

Need for Follow-Up Analysis

As discussed above, the analysis results presented in the report are based on a relatively small sample of IM147 and IM240 data. While the available data are significantly more robust than the previous sample of 300 vehicles, it is clear that these results should be revisited with a much larger sample once IM147 testing is initiated in Arizona. We therefore recommend that as soon as one to two months of IM147 data are collected in the program, they should be used to verify the validity of the cutpoints and algorithms developed in this study. This follow-up analysis would allow for any required fine-tuning of the cutpoints and algorithms.

###

2. INTRODUCTION

Under the Clean Air Act Amendments of 1990, metropolitan areas with the most serious air quality problems are required to implement so-called "enhanced" I/M programs. One element of an enhanced program is a more effective test procedure than the simple idle tests used in "basic" I/M programs. Two different test procedures for exhaust emissions testing in enhanced programs have been approved by EPA: the "IM240" test, and the "Acceleration Simulation Mode" (ASM) test. Both of these procedures have been shown to be capable of separating vehicles with excessive exhaust emissions from other vehicles; however, the accuracy of the test depends on whether tested vehicles have been adequately preconditioned and whether the speed-time profile associated with each test procedure is closely followed. With either procedure, the efficiency of the testing process depends on how quickly accurate decisions can be made as to whether a vehicle should pass or fail.

Inadequate preconditioning of vehicles prior to testing is a potential cause of inaccurate or inconsistent test results because exhaust emission levels depend on how thoroughly a vehicle has been warmed up. Before the vehicle is thoroughly warmed up, high emissions can be caused by air-fuel ratio enrichment or an inactive catalytic converter. In addition, increased emissions due to purging of loaded canisters may also be an issue associated with inadequate preconditioning prior to I/M testing.

Inadequate vehicle preconditioning has previously been identified as a cause of false failures in I/M programs. Under current EPA guidance, IM240 preconditioning procedures are woven into the "two-ways-to-pass" standards. Vehicles that exceed the emissions standards established for the entire 239-second test are passed or failed based on emissions occurring during the last 147 seconds of the test (also called Phase 2 or the IM147). The separate set of standards that applies to Phase 2 is slightly more stringent. For vehicles that initially demonstrate high emissions, the first 93 seconds (Phase 1) of the test are used to precondition the vehicle for the second phase of the test. In addition, EPA calls for a "second-chance" test whenever a vehicle fails the initial test by less than 50% of the standard and was in a queue for more than 20 minutes before being tested.

Previous EPA and DEQ Analyses - Considerable data have already been collected regarding the preconditioning requirements for IM240 testing. During 1996 and 1997, Sierra conducted evaluations of this issue using data obtained from samples of vehicles recruited from IM240 lanes in Phoenix, Arizona, and a laboratory test program at Sierra's facilities in Sacramento. The results of the 1996 analysis were reported in SAE Paper No. 962091.[3] The 1997 evaluation also included an analysis of the effect on test duration of adopting EPA-recommended "final" IM240 cutpoints. Preliminary conclusions from the two evaluations are summarized below.

1. Using the current IM240 test procedures, it is estimated that 25% of the vehicles failing the final IM240 standards would pass with further preconditioning.

2. Vehicles that would benefit from further preconditioning can be identified through modal analysis of the emissions recorded during the IM240 test.

3. Two possible approaches to modifying the current preconditioning procedures would be to:

    a. retain existing IM240 test procedure and two-ways-to-pass standards, with the entire IM240 to be repeated if the Phase 2 emissions failure is marginal, emissions near the end of Phase 2 are relatively low, or emissions during Phase 2 are significantly lower than during Phase 1; or

    b. eliminate Phase 1 and make the initial pass/fail decision based on running only the IM147, with a second-chance test (another IM147) for all vehicles that initially fail, and a third-chance IM147 test if emissions during the second-chance test are significantly lower than emissions during the initial test.

4. Adoption of final cutpoints and more effective preconditioning procedures involving a second full-IM240 (Option 3.a. above) will increase the portion of the test involving dynamometer operation by more than 100%.

The 1997 evaluation also involved the development of improved IM240 fast-pass cutpoints using a modal regression approach originally pioneered by the New York Department of Environmental Conservation (NYDEC).[4] This study also involved the development of modal predictive IM240 retest algorithms designed to minimize the fraction of vehicles either (1) identified as needing a retest when they would still fail, or (2) not identified as needing a retest when they would have passed if retested.

As a follow-up to the 1997 evaluation for EPA, Sierra subsequently conducted an analysis (SR98-05-01)[5] for the Arizona Department of Environmental Quality (DEQ) of the effect on failure rates, I/M program benefits, and test duration of the following changes to the current IM240 procedure: (1) implementation of the Option 3.b preconditioning procedures summarized above; (2) adoption of interim ("Max CO") cutpoints designed to maximize the carbon monoxide emission reduction benefits being achieved by the program; and (3) the exemption of either the first four or first five model years from program requirements.

To analyze the IM147-only preconditioning option, Sierra used a combination of data from the 2% random test sample (consisting entirely of full-duration tests) that is routinely collected in the Arizona IM240 program and a limited number (101 tests) of triplicate (back-to-back-to-back) IM147 tests that were conducted as part of the 1997 EPA evaluation. A key element of the analysis methodology involved the development of "Phase 2b" cutpoints to complement the full IM147-only cutpoints. (The Phase 2b cutpoints were applied in a manner similar to the current IM240 procedure in which vehicles passing in Phase 2 are considered passing for the entire test.) Fast-pass cutpoints for both the entire IM147 and Phase 2b were also developed.

As noted above, while the 1997 EPA study involved the analysis of a considerable amount of IM240 data, only a small subset (101 vehicles) was of use in projecting credit levels and test times for an IM147 test program. An additional concern is that the 101-vehicle study was not specifically designed to determine excess emission identification rates and SIP credit levels. As a result, EPA issued a follow-up work assignment to Sierra in 1998 that involved the collection of test data from triplicate IM147 tests followed immediately by a full-duration IM240. Data were collected from 304 randomly selected light-duty cars and trucks arriving at the test lane during normal queuing conditions. These data were then analyzed to verify the preliminary excess emission identification rates and average test time estimates projected for the Arizona IM program from the Phase 2 and IM240 data sets collected in previous studies.

As part of the 1998 study for EPA, improved fast-pass and retest algorithms for the IM147 were developed using the same approach used previously in developing similar IM240 algorithms; however, the cutpoint scenarios evaluated in the study did not include the Max CO cutpoints previously developed for DEQ. Given Arizona's need for the maximum feasible CO reductions from its I/M program, DEQ has decided to implement this set of cutpoints. A follow-up study is therefore needed to develop improved fast-pass and retest algorithms for the Max CO IM147 cutpoints. Gordon-Darby collected additional test data from roughly 3,000 vehicles in the Phoenix area that can be used in this analysis. Of these vehicles, approximately 2,500 received triplicate IM147s only; the remaining 500 vehicles will receive triplicate IM147s followed by a single full-duration IM240.

<u>PKE Speed Variation Criteria</u> - An additional IM147 implementation issue was the lack of allowable speed variation criteria for the shortened drive trace. In addition to the false failures caused by inadequate preconditioning, inadequate control over vehicle operation during the IM240 test procedure can contribute to inaccurate results. The ability of a driver to follow the IM240 speed-time trace has a significant effect on the emissions recorded during the test. To limit this variation in test results, tolerances are applied to driver performance.

In the 1997 IM240-related evaluation for EPA (SR98-02-01),[2] Sierra developed improved speed variation criteria based on the total Positive Kinetic Energy (PKE) change per mile traveled during the IM240 cycle. These criteria were designed to minimize the variation in emissions while still being feasible for use by minimally trained drivers with a reasonable aptitude for dynamometer driving. However, only IM240 drive cycle criteria were developed in the 1997 study. Therefore, further analysis was needed to develop similar speed variation criteria for the IM147.

Scope

To address the issue of inadequate preconditioning without compromising test throughput excessively, Arizona decided to change its test procedure to the IM147 beginning January 1, 2000. This program upgrade will also include implementation of the Max CO cutpoints previously developed by Sierra, which are designed to maximize the CO benefits of the program.

To aid in this implementation effort, EPA issued a work assignment (#1-08) to Sierra to develop the necessary test criteria. Under Work Assignment 1-08, Sierra is to complete the following tasks:

1. Develop projected IM147 failure rates for the Arizona I/M program using the 3,000-vehicle data set currently being collected by Gordon-Darby. This evaluation is to include start-up, midpoint, Max CO, and final IM147 cutpoint scenarios.

2. Develop modal IM147 fast-pass standards for the Max CO cutpoints using (a) the modal regression technique used in the 1998 EPA study to develop IM147 fast-pass standards, and (b) the 3,000-vehicle data set and the 304-vehicle data set collected in 1998.

3. Develop modal predictive IM147 retest algorithms for the Max CO cutpoints using (a) the same technique used in the 1998 EPA study to develop IM147 retest algorithms, and (b) the 3,000-vehicle data set and the 304-vehicle data set collected in 1998.

4. Develop modal IM147 fast-fail criteria that can be used to terminate retests if emissions performance is not improving during the retest.

5. Develop fast-pass and full-duration PKE criteria for the IM147 start-up, midpoint, Max CO, and final cutpoints using the 3,000-vehicle and 304-vehicle data sets, as well as the 16,581-vehicle data set from the 1997 study of IM240 PKE limits for EPA.

Seven different tasks were proposed to accomplish these objectives.

<u>Task 1, Test Plan Development and Data Collection Assistance</u> - This task covered working with Gordon-Darby in its efforts to collect the test data needed to complete the remaining tasks. Data collection, driver participation incentives, and other program-related details were performed under the guidance of DEQ and Gordon-Darby and were not Sierra's responsibility. Sierra provided assistance on an as-needed basis to resolve

any problems or questions (e.g., regarding test protocols, data record format, etc.) that developed during the data collection process in Arizona.

Task 2, Failure Rates - After completion of the vehicle testing described in Task 1, Sierra analyzed the resulting data. Using the same approach as utilized in the previous EPA and DEQ studies, projected IM147 failure rates were developed for both passenger cars and light-duty trucks. Separate projections were generated for the start-up, midpoint, Max CO, and final IM147 cutpoints developed under the previous analyses.

Task 3, Fast-Pass Cutpoints - Data obtained in Task 1 as well as the 304-vehicle IM147 data set collected in 1998 were analyzed to develop fast-pass cutpoints and algorithms associated with the Max CO cutpoints. The same approach previously used to develop fast-pass cutpoints for the other cutpoint scenarios (i.e., start-up, midpoint, and final) was followed in this analysis.

Sierra developed fast-pass cutpoints and algorithms for the Max CO cutpoints, with minor adjustments to the model year groups when the data indicated that such a change improved accurate emission identification. Separate sets of fast-pass cutpoints were developed for these new model year groups and vehicle classes as contained in EPA's IM240 test guidance.

The impact of the resulting fast-pass cutpoints on average dynamometer test time and excess emissions identified was evaluated using the same techniques as in the previous analyses. Excess emissions identified will be expressed as the percent of excess emissions that are identified relative to those identified on the IM240 test.

Task 4, Retest Algorithms - The same data used in Task 3 were analyzed to develop retest algorithms associated with the Max CO cutpoints. While this task originally charged Sierra with utilizing the same approach previously used to develop retest algorithms for the other cutpoint scenarios (i.e., start-up, midpoint, and final), subsequent comments from Gordon-Darby resulted in an alternate retest algorithms. The impact of the resulting retest algorithms on average dynamometer test time was evaluated using the same technique as in the previous analyses.

Task 5, Fast-Fail Criteria - The same data used in Task 3 were analyzed to develop criteria for evaluating mid-test emissions during IM147s in order to determine whether emissions performance is improving during the retest. The resulting criteria were structured to "fast fail" vehicles that are not benefitting from such retesting. The impact of the resulting fast-fail criteria on average dynamometer test time was evaluated using the same technique as in the previous analyses.

Task 6, Driver Variation Criteria - The same data as used in Task 3 were analyzed to develop fast-pass and full duration driver variation limits for the IM147 start-up, midpoint, Max CO and final cutpoints.* The analytical approach used in the 1997 analysis was initially followed; however, subsequent results led to the development of an improved variation metric, Cumulative Positive Power (CPP). Consistent with the approach used in the previous analysis, the evaluation was structured to develop CPP limits designed to keep the effective abort rate due to drive trace violations to less than 3%. The impact of the resulting criteria on average dynamometer test time was also evaluated.

Organization of the Report

Following this introduction, Section 3 describes data collection and the data sets used throughout this study. Section 4 explains the cutpoint analysis including the revision of the Max CO cutpoints using the larger data sample; it also details failure rates for the Startup, Intermediate, Final, and Max CO standards. Section 5 describes the optimized fast-pass and retest criteria. In addition, it details the new fast-fail algorithm and criteria as well as the net results of optimized criteria when run simultaneously. Section 6 describes the new CPP driver variation limits and Section 7 integrates the CPP limits with the optimized IM147 to show the net effect on test time. Section 8 lists the references cited in the report.

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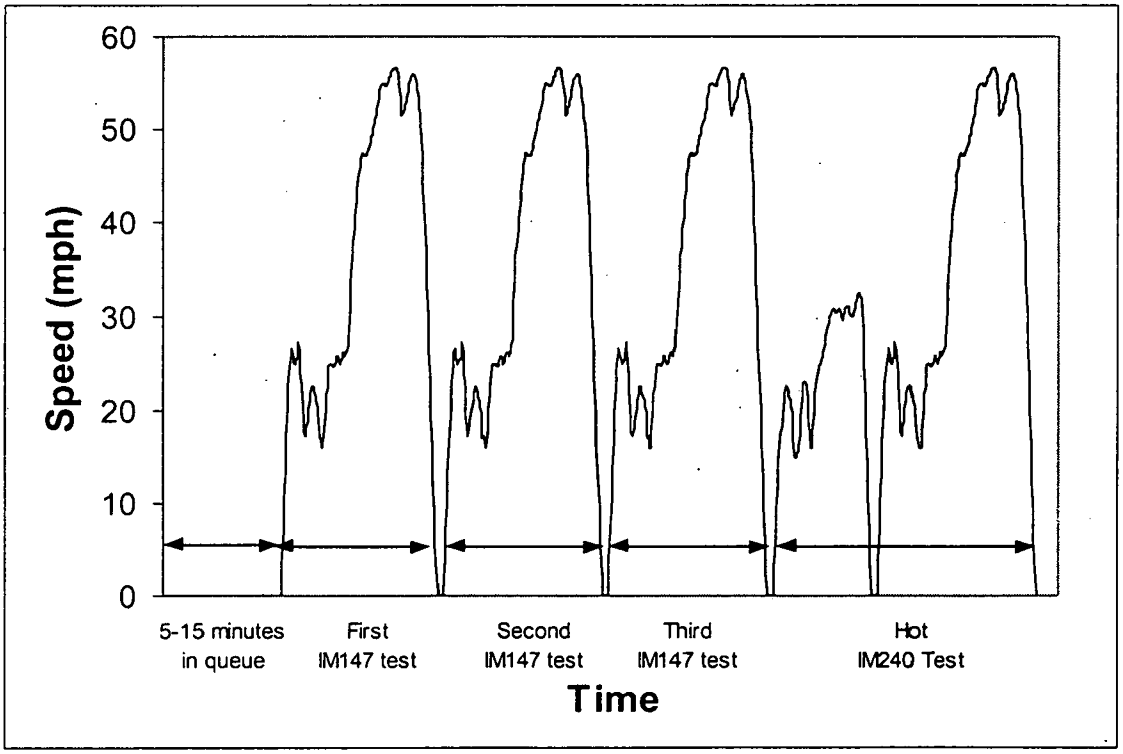
* The original workplan called for the 16,581-vehicle data set from Sierra's 1997 PKE study for EPA (SR98-02-01) to also be used in this latest analysis. However, as discussed in more detail in subsequent sections, a "time realignment" (of emissions versus vehicle speed) was incorporated into the analysis. This made use of the previous data more problematic. It was determined that the effort required to adjust these data could not be justified in terms of a significant increase in the accuracy of the results; therefore, a decision was made not to use these previous data.

3. TEST DATA

Data used in this study are divided into three distinct groups consisting of 304, 543, and 2518 vehicles. Vehicles in each of the groups were given three consecutive IM147 tests regardless of the result.

The 304-vehicle sample was collected by Gordon Darby for Task 1 of Work Assignment SR99-10-02[1] at the Gordon Darby I/M lanes in Phoenix, Arizona, during March 1998. The data included 193 cars and 111 light-duty trucks tested over triplicate IM147 tests followed by a full IM240 test as illustrated in Figure 3-1.

Figure 3-1
Test Sequence Used to Investigate Triplicate IM147 Tests in Arizona Test Lanes



For this set, the study inspector would select vehicles by scanning the queue for the closest white vehicle waiting in the lanes. If there were no white vehicles in the queue, the inspector would look for the palest, closest vehicle waiting in the lanes. The inspector approached the first 1981 or newer vehicle <u>following</u> that vehicle, checked to make sure the vehicle had at least half a tank of gas, and asked the vehicle owner if he or she was interested in participating in a study that would take approximately 30 minutes, for a payment of $50. The selection process resulted in vehicles waiting in a queue for approximately 5 to 15 minutes prior to testing. Most of the vehicles participating in the program were receiving their initial test; however, 12 vehicles in the database were being re-tested after an initial failing score.

As discussed in SR99-10-02, four vehicles were pulled out of the original 304 vehicle data set due to anomalous results. For this study, while Sierra did find some vehicles with anomalous results in the newer data samples (e.g., passing the initial IM147 yet grossly failing the final one), these vehicles were not removed from the sample, with the data set instead being viewed as representative of the in-use fleet. To remain consistent regarding the treatment of data from the older sample, however, the same four vehicles were removed for this analysis. The four vehicles are described below.

- Record 14, a 1988 Pontiac Bonneville, had relatively low CO emissions during the first and second IM147 test (1.35 and 3.42 g/mi, respectively). However, CO emissions during the third IM147 increased substantially (to 55.72 g/mi) and were higher still during the IM240 following the IM147 testing. It is interesting to note that CO was emitted in measurable quantities throughout the test, and the large increases are not attributable to a specific section of the trace. It thus appears that the gradual emissions increase could be attributable to excessive purge as the vehicle warmed up or to some kind of catalyst protection scheme.

- Record 15, a 1989 Dodge Dynasty, had moderate CO emissions during the first three IM147 tests (14 to 18 g/mi), but emissions during the IM240 test were excessive, particularly during the end portion of that test (106 g/mi). Reviewing the modal CO emissions in Figure 3-5, one observes that the vehicle appears to go into open-loop operation at the start of the large hill of the end portion of the test (i.e., beginning at about second 160 of the IM240). Although CO emissions accrue throughout this test, the period from 160 to 230 comprises the bulk of the emissions.

- Record 23, a 1993 Ford Ranger, shows a very similar emissions response throughout the three IM147 tests. As seen in Figure 3-6, most of the CO emissions occur during seconds 62 to 75 of the IM147. During the end portion of the IM240, a similar pattern is observed. In that test, however, substantial CO is also emitted during the high-speed portion of the trace. It is not entirely clear what has caused this, but it appears that the vehicle did not follow the speed-time trace as smoothly during the end portion of the IM240 as it did during the first three IM147 tests.

- Record 24, a 1995 Toyota 4Runner, had decreasing emissions throughout the first three IM147 tests, emitting only 0.72 g/mi CO during the third IM147.

After these vehicles were removed, the remaining sample from the original data set consists of 191 cars and 109 trucks for a total of 300 vehicles.

The 2518- and 543-vehicle data sets were collected for this work assignment by Gordon Darby at the ten I/M lanes in Phoenix, Arizona during June, July, and August 1999. Like the original data set, these tests were conducted at the I/M lanes in Phoenix, Arizona. Unlike the original data set, however, all motorists were asked to participate in the study, rather than simply those following a white-colored vehicle in the queue. The exception to this occurred toward the end of the testing when Gordon Darby staff, based on direction from Sierra, targeted certain vehicle model years and vehicle types to ensure that these groups were adequately represented in the test data.

The main difference between the 2518- and 543-vehicle samples was administration of the IM240 test at the conclusion of the IM147 test. For the 2518-vehicle sample, only failing vehicles were given the IM240 test. In the 543-vehicle sample, all vehicles were given the IM240 test regardless of their IM147 result.

Motorists were not required to participate in this testing. To encourage motorists to participate, inspection fees were waived for these tests. Inspection fees amount to $25 per inspection. Statistics detailing the number of refusals were not kept.

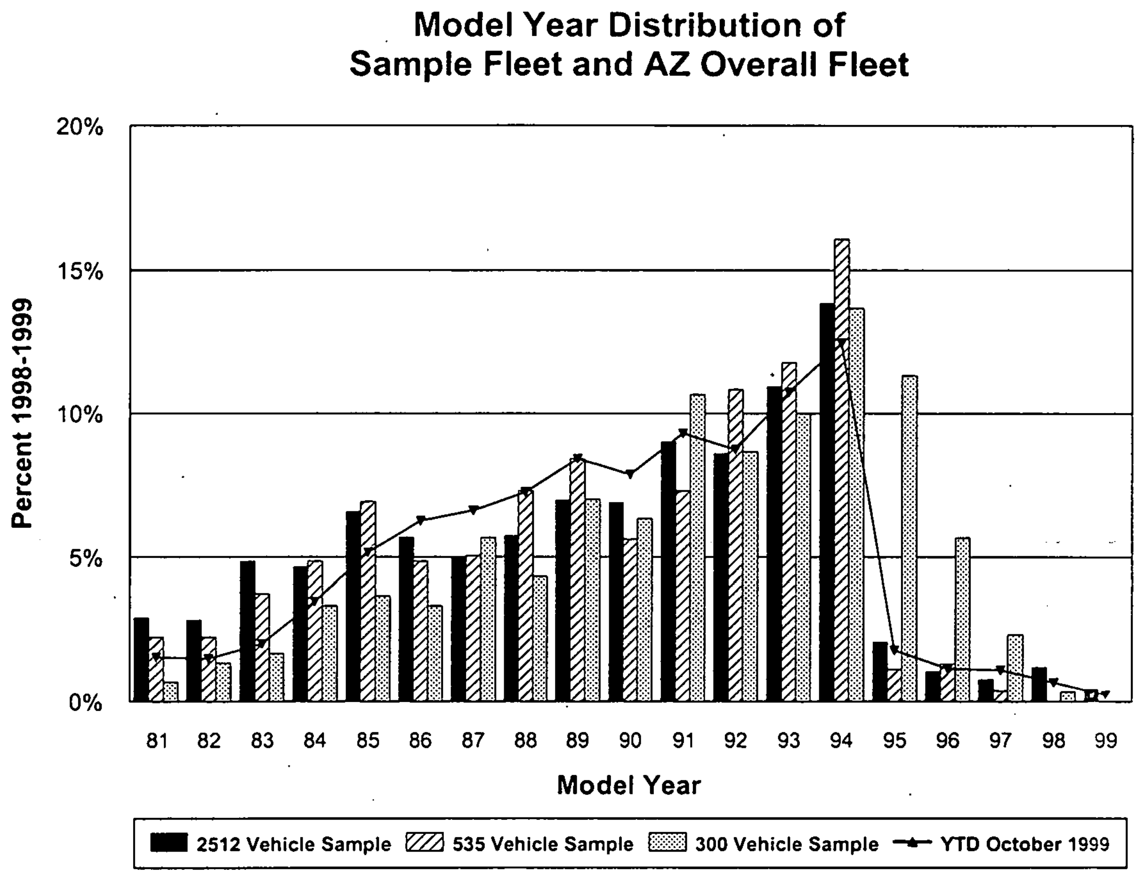
As previously mentioned, anomalous vehicle test data were not thrown out of the latter two samples. There was, however, one vehicle identification number (VIN), "123456," that appeared multiple times with different vehicles. Gordon-Darby staff confirmed that this was a test VIN and should be excluded from analysis, which was done. Once this VIN was removed, the larger sample comprised 2512 vehicles (1360 cars and 1152 trucks) while the smaller sample comprised 535 vehicles (229 cars and 306 trucks).

The model year distribution for each of the samples is shown in Figure 3-2. The YTD (year-to-date) October 1999 line represents the initial test for 2% random sample vehicles tested in 1999 through October. Anomalous vehicles have been removed.

For the most part, the model year distribution of the data samples mirrors the random sample distribution reasonably well. One notable exception can be seen with newer model year vehicles for the 300-vehicle sample. When that data set was collected, model year exemptions for the five newest model years were not in place. As a result, this sample has greater representation throughout these years. The newer data sets were collected with the model year exemptions in place; therefore, they follow the 1999 YTD random sample more closely.

One important difference in this study versus previous studies was how time-alignment was handled. For the previous studies, individual channels (HC, CO, etc.) were aligned

Figure 3-2



according to their T90 response times. The T90 response time is the length of time necessary for the analyzer to see 90% of a positive step change in the gas concentration that was introduced at the exhaust collection cone. By correcting for response time, emission events can be linked to the corresponding drive trace event.

The justification for T90 time-alignment centered on the response curve of the gas bench. Typically, the response curve for a bench will appear somewhat asymptotic; as the measured gas value closes in on the actual value, the absolute rate at which the measured value approaches the target value decreases. As a result, the T90 time, which is relatively short, becomes a good approximation to time an event.

Unfortunately, the response time measurement of the analyzer is composed of two elements, gas bench response time and transport time, which is the amount of time necessary for the CVS (Constant Volume Sample) blower to transport the sample from the collection cone to the gas analyzer bench. This second response time element, transport time, obscures the gas bench response curve through gas mixing that occurs during transport.

Noting this effect, Gordon-Darby staff, after reviewing the raw data, suggested that the T90 time alignment overcompensated and thus caused short-duration emission events during a transient cycle to appear to precede the triggering speed event. Given the interaction of the transport time with the bench response time, they suggested that a more appropriate alignment measure is T50 response time, which would be more conservative and alleviate the aforementioned problem.

To accommodate this change, all the existing data, which were previously aligned using T90 alignment by Gordon Darby, had to be realigned to T50 response times. This included data collected specifically for this study. Per Gordon-Darby staff, this change required shifting data for each of the channels (HC, CO, NOx, and CO_2) four seconds later relative to the speed signal. This was accomplished by adding four seconds of data to the front of each test, in which it was assumed that the modal emissions for the entire period were identical to those measured during the "previous first second" (i.e., now second 5) of the test. This assumption is considered reasonable since the vehicle is at idle during this entire period.

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4. IM147 CUTPOINT ANALYSIS

This section of the report discusses the application of the IM147 Max CO cutpoints to the 3347-vehicle data set. Divided into three parts, the section first discusses changes in overall IM147 test time. The second part of the section addresses revising the Max CO cutpoints originally developed in SR99-10-02[1] based on the large data set now available. The third and final part of the section details the failure rate when these revised cutpoints are applied to the 3347-vehicle data set.

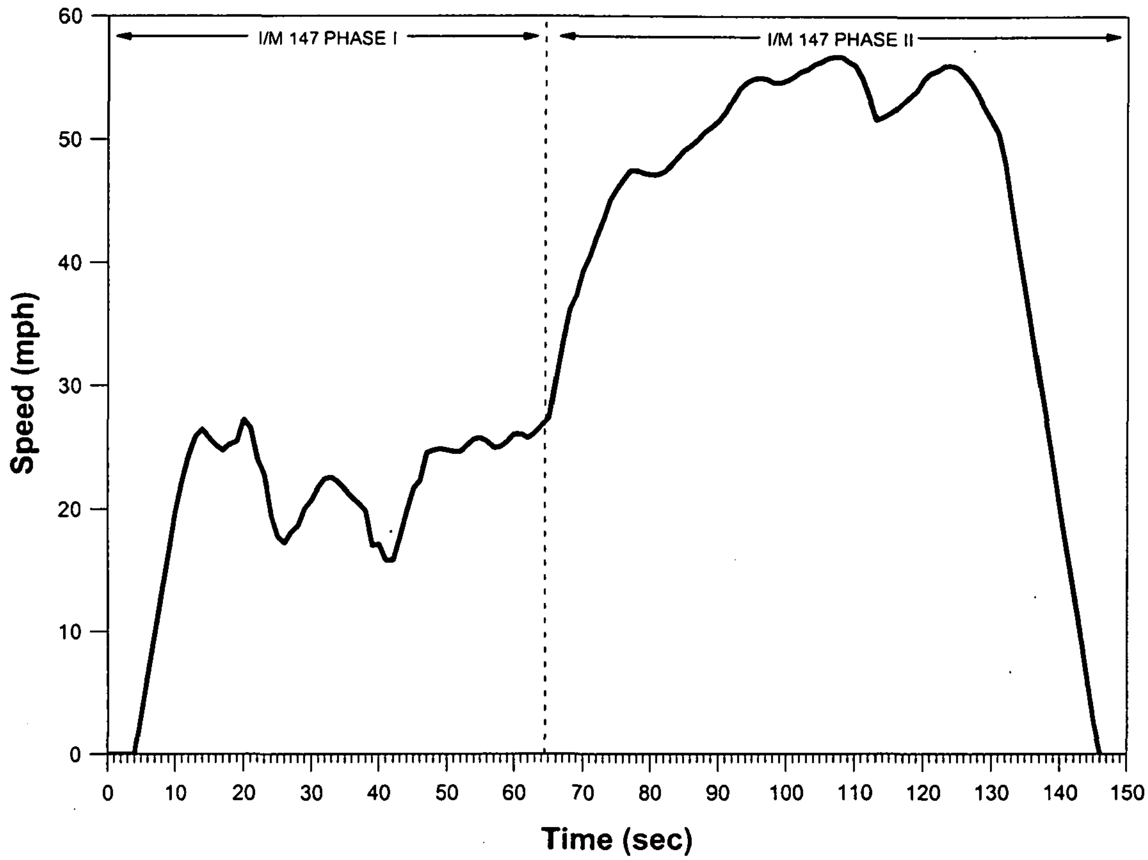
IM147 Test Length

Sierra originally developed the IM147 test cycle based on the last 147 seconds of data from the IM240 drive trace. Following the precedence EPA established with the IM240 drive trace, this meant that the modal results of the IM147 test would have 147 seconds of data. In short, there were no constraints regarding an odd versus even number of seconds in the overall test cycle, nor in Phase 2 of the test cycle.

To simplify implementation of the IM147 test in Arizona, Gordon Darby, and DEQ agreed that modal data would be recorded once every two seconds instead of second-by-second as is done with the IM240. This allows the IM147 cycle data to fit into the same size record format as is currently used for full duration IM240 tests. As a result, having an odd number of seconds in the drive trace creates a problem of what to do with the odd second.

To alleviate the problem, Gordon Darby suggested that the speed/time trace define the boundaries for the test time instead of the actual number of data points reported. In other words, assuming the first speed/time point is labeled zero seconds, the first modal data result would be recorded for second 1 and the last for second 146. Phase 2 of the test would also be revised to start at second 66 (first data reported for second 67) and extend to the end of the test. The net effect of both of these changes is that both the composite results and the Phase 2 results will contain an even number of seconds. Since this addresses the issue of Gordon-Darby's two-second average data collection with no apparent negative consequences, Sierra revised the test length accordingly. Additional information on the drive trace is presented in Section 5.

Figure 4-1
IM147 Trace
Phase 1 and Phase 2



Cutpoint Analysis

Task 1 of the work assignment required projecting failure rates for the Arizona I/M program using the combined (3,347 vehicles) data set collected by Gordon Darby. The projection includes four sets of emission cutpoints: start-up, midpoint, Max CO, and final for the IM147 test. Since the original Max CO cutpoints were developed using the 304-vehicle sample compiled for SR99-10-02, Sierra first revisited these cutpoints and model year groupings to ensure their accuracy against the larger data set.

Accordingly, the model year groupings were modified to avoid anomalously high or low failure rates for any individual model year/vehicle type combination. A second objective in establishing the endpoints of the model year groupings was to ensure that changes in emissions control technology were properly reflected in the various model year groupings. (There is an obvious and direct relationship between the control technology installed on a vehicle and its ability to comply with a given set of cutpoints.)

Once the model year groupings were revised, the IM147 Max CO cutpoints were developed by regressing the final emissions results from the IM240 test against the final emission results from the third IM147 test for each of the three exhaust constituents. For this regression, Sierra used only vehicles from the two of the three data sets where vehicles were automatically given an IM240 test regardless of their IM147 test results (the 300- and 535-vehicle samples). Because the third data set contained IM240 data only for vehicles failing the IM147, this data set would have created a regression bias and was therefore excluded from this part of the analysis. The resulting regression equations were then used to extrapolate IM147 composite cutpoints from the IM240 composite cutpoints developed previously in SR99-10-02. Three linear regression equations were developed for each of three model year groupings. Equation 4-1 illustrates the regression equation.

$$IM147\ Cutpoint = slope * (IM240\ Cutpoint) + Intercept \qquad [4\text{-}1]$$

Table 4-1 details the appropriate model year/emission constituent regression coefficients to be used in the above equation. The model year groupings identified in this table are not the same as the model year groupings used in the emission cutpoint tables, which vary depending upon vehicle type.

Table 4-1
IM240 to IM147 Composite Regression Equation Coefficients

Model Year Group	Emission Constituent	Slope	Intercept
1981-1985	HC	0.896629	0.110694
	CO	1.020463	0.858255
	NOx	1.065128	0.085613
1986-1989	HC	0.933646	0.056509
	CO	0.939067	1.679632
	NOx	1.077932	0.058971
1990+	HC	0.963839	0.026672
	CO	1.037836	0.392486
	NOx	1.102698	0.048771

Phase 2 cutpoints were developed by regressing the IM147 composite test scores against the IM147 Phase 2 scores. Unlike the composite score regressions, however, the equations had to be adjusted to preserve the relationship between composite versus

Phase 2 scores existing in the IM240 test. IM240 Phase 2 cutpoints are more rigorous than the composite cutpoints, presumably to minimize falsely passing vehicles. After studying the IM147 data, a multiplier of 0.9 was used with the regression since it provided additional defense against false failures while maintaining the possibility of a Phase 2 pass. The following Phase 2 regression equation (4-2) was used to extrapolate IM147 Phase 2 cutpoints from the IM147 composite cutpoints.

$$IM147\ Phase\ 2 = 0.9 * (Slope * (IM147\ Composite) + Intercept) \qquad [4\text{-}2]$$

Table 4-2 details the appropriate regression coefficients to be used with the above equation. Unlike the composite regression coefficients shown in Table 4-1, IM147 composite to Phase 2 coefficients were held constant across model years..

Table 4-2
IM147 Composite to Phase 2 Regression Equation Coefficients

Emission Constituent	Slope	Intercept
HC	0.807408	0.012886
CO	0.881965	-0.569281
NOx	0.989412	-0.083696

Table 4-3 shows the revised IM147 Max CO cutpoints developed using both sets of regression equations. In two places, the revised NOx cutpoints seem anomalous because they are actually less stringent for newer vehicles (1989 to 1990 LDGV and 1987 to 1988 LDGT2). As it turns out, these anomalies occurred at or near the regression equation breakpoints.* The slight discontinuity caused by this change created the apparent anomaly.

*To apply the regression equations to the model year groupings, which vary depending upon the vehicle type, cutpoints for some model years were determined using the adjacent regression equation.

Table 4-3 Revised IM147 Max CO Cutpoints (Composite/Phase 2)				
Vehicle Class	Model Years	HC	CO	NOx
LDGV	1981-82	2.80/2.05	26.37/20.42	3.28/2.85
	1983-85	2.08/1.53	17.19/13.13	3.28/2.85
	1986-89	1.46/1.07	15.77/12.00	2.75/2.38
	1990-95	0.99/0.73	12.85/9.68	2.81/2.42
	1996+	0.80/0.59	12.85/9.68	2.25/1.93
LDGT1	1981-85	3.70/2.70	31.47/24.47	5.41/4.74
	1986-89	2.86/2.09	25.16/19.46	4.91/4.30
	1990-95	1.95/1.43	21.15/16.28	4.46/3.90
	1996+	1.57/1.15	21.15/16.28	3.36/2.91
LDGT2	1981-85	4.06/2.96	51.88/40.67	6.48/5.69
	1986-87	3.79/2.77	39.24/30.64	5.99/5.26
	1988-95	2.92/2.13	26.34/20.39	6.11/5.37
	1996+	2.34/1.71	26.34/20.39	4.46/3.90

Comparison of Failure Rates

After revising the Max CO cutpoints using the 835-vehicle sample, the failure rates were evaluated using each of the four sets of IM147 cutpoints (Startup, Intermediate, Final, and Max CO) and the combined vehicle data set (3347 vehicles). While the IM147 Max CO cutpoints were revised for this study, the IM147 Startup, Intermediate, and Final cutpoints were developed as part of SR99-10-02 and are shown in Appendix A.

Table 4-4 shows how the failure rate changed with the different cutpoints for the third and final IM147. The overall failure rate will be slightly less when actually implemented since some vehicles will pass and therefore complete the test after an earlier IM147 even though they would go on to the fail the third one if the test was continued. More detailed information on the failure rates is provided in Appendix B.

This table helps to clarify the relationship between the four sets of cutpoints. The Startup, Intermediate, and Final cutpoints result in nearly equal HC, CO, and NOx failure rates, which increase with increasing cutpoint stringency. The Max CO standards, when compared to the final standards, reduce the HC and NOx failure rates, and instead increase the CO failures, especially for light-duty trucks.

Table 4-4
Failure Rates, Third IM147

Vehicle Type	HC			CO			NOx			OVERALL		
	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
Max CO Cutpoints												
LDGV	114	1666	6.4%	250	1530	14.0%	155	1625	8.7%	390	1390	21.9%
LDGT1	49	915	5.1%	156	808	16.2%	70	894	7.3%	219	745	22.7%
LDGT2	25	578	4.1%	63	540	10.4%	30	573	5.0%	93	510	15.4%
All	188	3159	5.6%	469	2878	14.0%	255	3092	7.6%	702	2645	21.0%
Startup Cutpoints												
LDGV	106	1674	6.0%	130	1650	7.3%	141	1639	7.9%	281	1499	15.8%
LDGT1	52	912	5.4%	33	931	3.4%	48	916	5.0%	108	856	11.2%
LDGT2	33	570	5.5%	30	573	5.0%	28	575	4.6%	67	536	11.1%
All	191	3156	5.7%	193	3154	5.8%	217	3130	6.5%	456	2891	13.6%
Intermediate Cutpoints												
LDGV	157	1623	8.8%	161	1619	9.0%	196	1584	11.0%	367	1413	20.6%
LDGT1	80	884	8.3%	53	911	5.5%	73	891	7.6%	165	799	17.1%
LDGT2	40	563	6.6%	42	561	7.0%	42	561	7.0%	93	510	15.4%
All	277	3070	8.3%	256	3091	7.6%	311	3036	9.3%	625	2722	18.7%
Final Cutpoints												
LDGV	280	1500	15.7%	240	1540	13.5%	277	1503	15.6%	507	1273	28.5%
LDGT1	120	844	12.4%	85	879	8.8%	127	837	13.2%	239	725	24.8%
LDGT2	73	530	12.1%	56	547	9.3%	82	521	13.6%	149	454	24.7%
All	473	2874	14.1%	381	2966	11.4%	486	2861	14.5%	895	2452	26.7%

Figures 4-2 through 4-5 show how the failure rate changes as vehicles progress through the three IM147 tests. Since most of the increase in failures occurs between the first and second IM147 tests, it is reasonable to expect that algorithms designed to shorten the test would end the test prior to the third IM147. As will be shown later in the report, this is indeed the case. Once the fast-pass, retest, and fast-fail criteria are applied, only 162 vehicles out of 3347 (4.8%) are tested beyond the second IM147.

Figure 4-2
Failure Rate by Consecutive IM147
Max CO Cutpoints

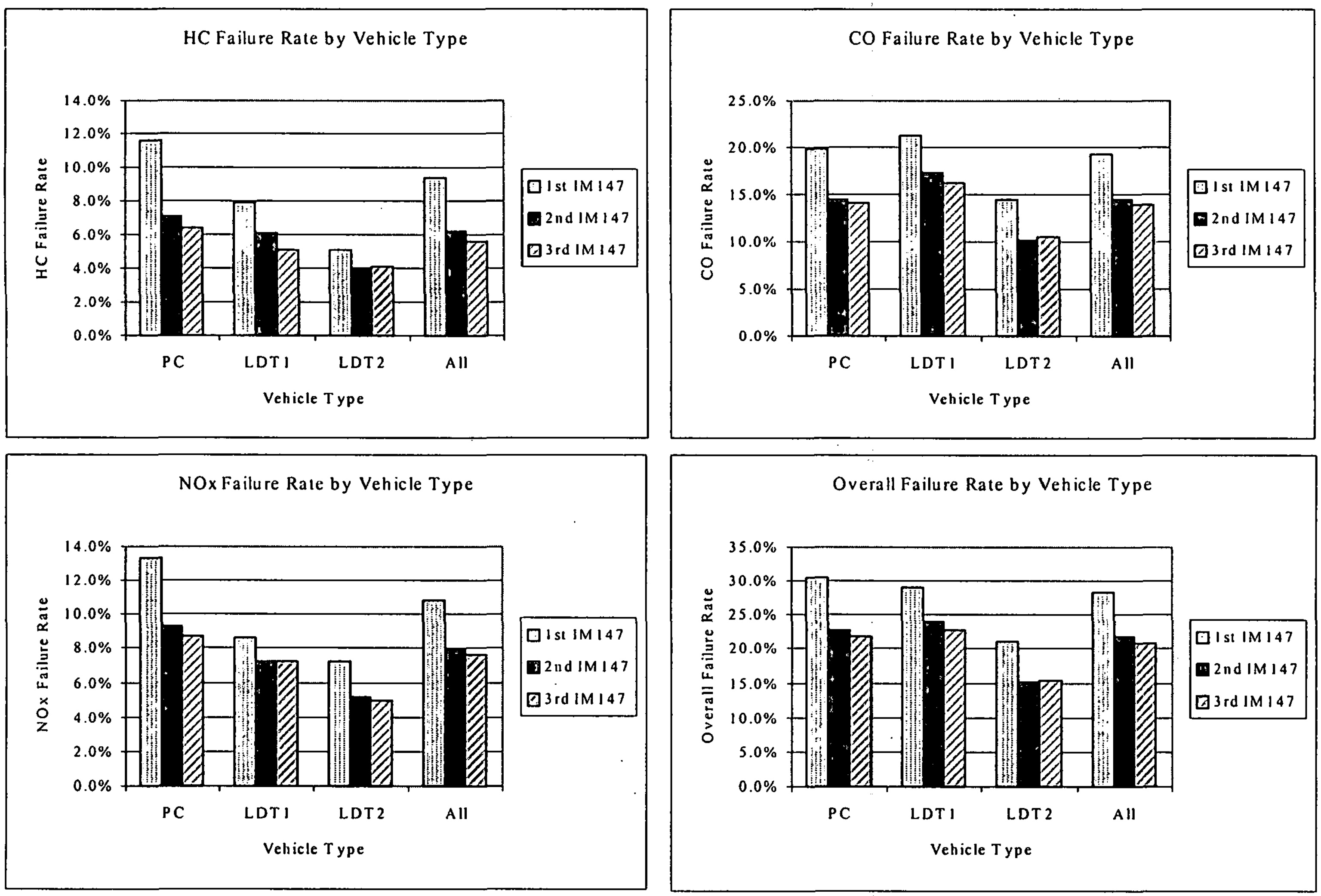


Figure 4-3

Failure Rate by Consecutive IM147

Startup Cutpoints

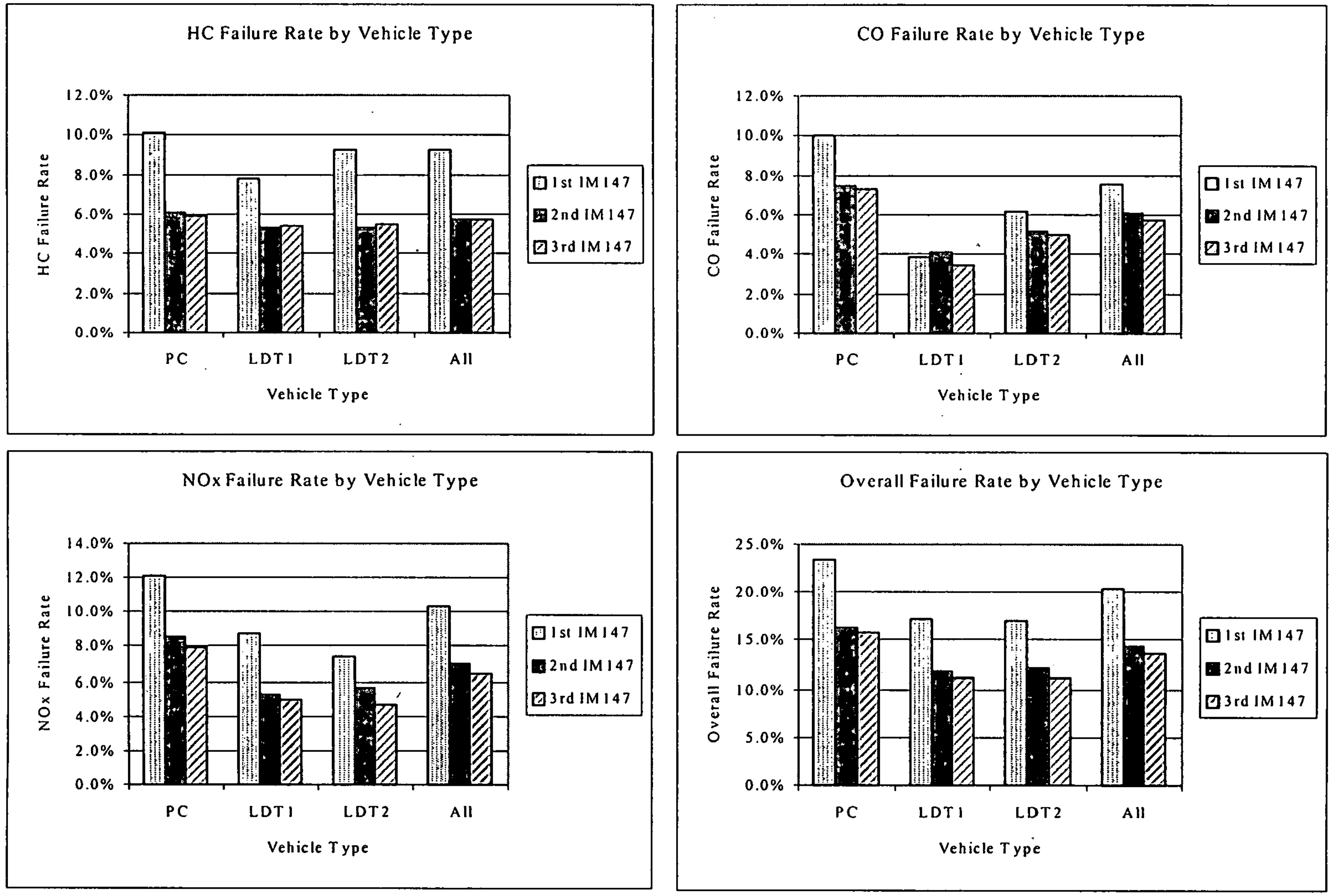


Figure 4-4
Failure Rate by Consecutive IM147
Intermediate Cutpoints

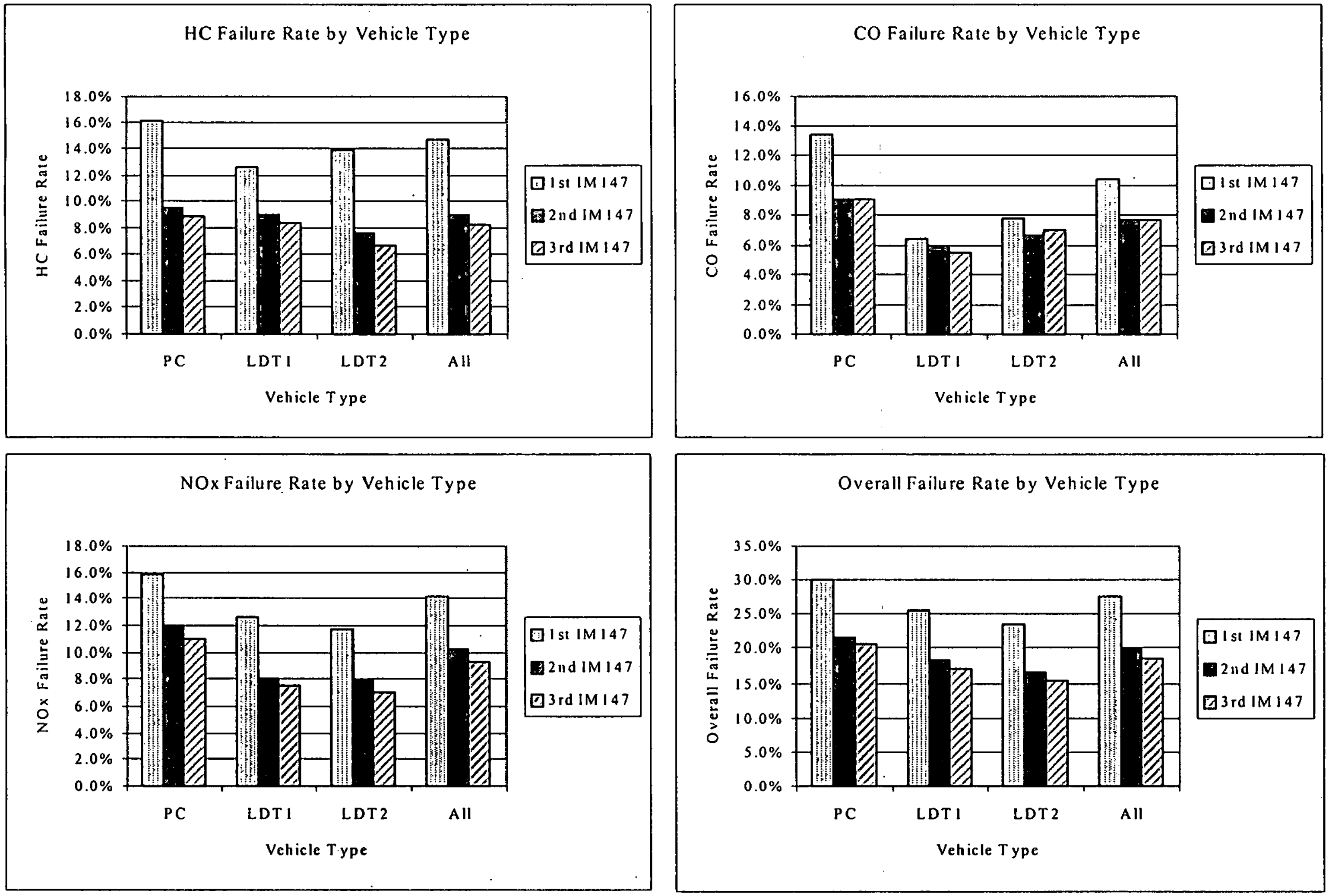
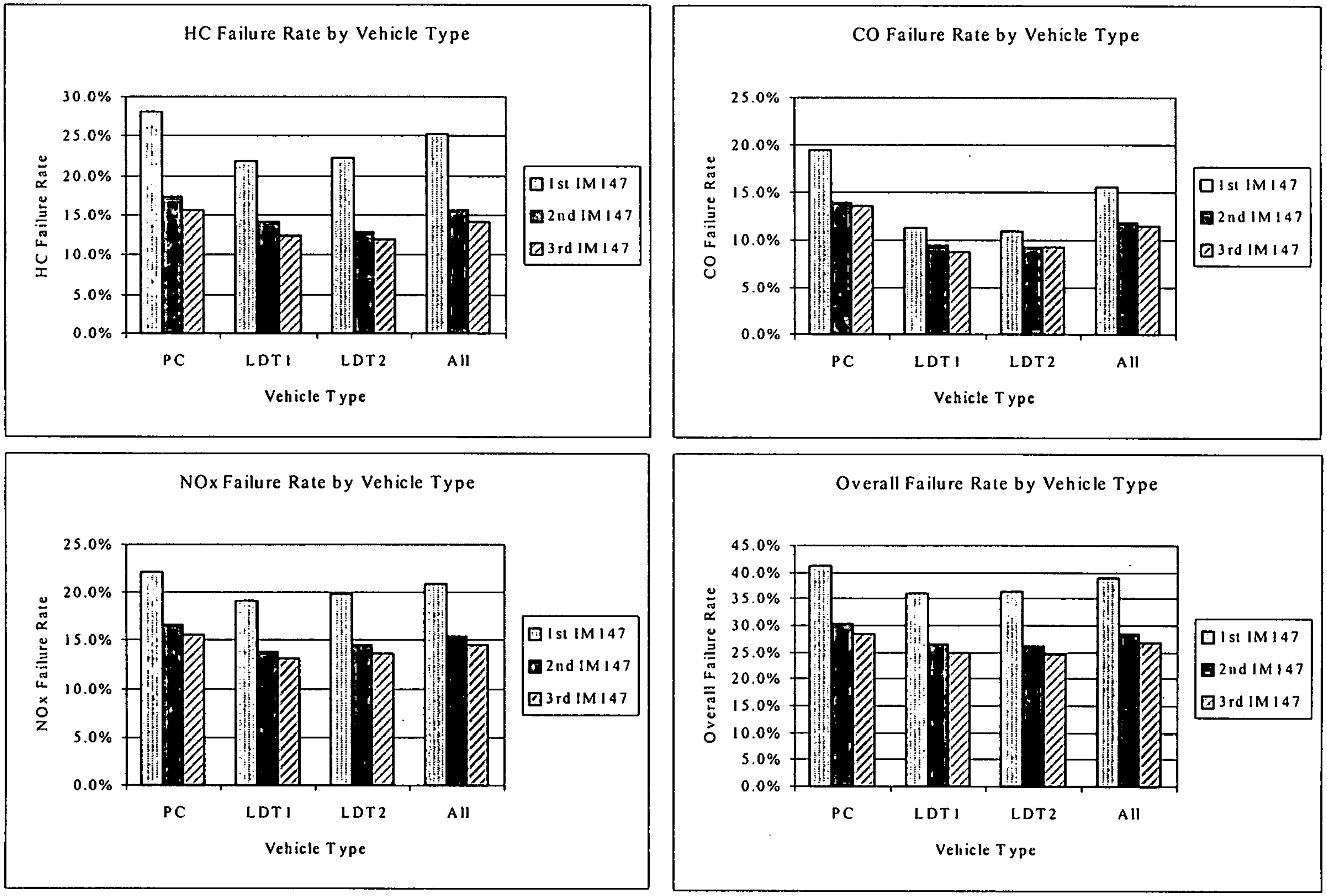


Figure 4-5
Failure Rate by Consecutive IM147
Final Cutpoints



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5. OPTIMIZED IM147 TEST CRITERIA

This section presents the analysis methodology and results used to develop optimized IM147 test criteria. Criteria developed in the study include fast-pass standards, retest algorithms, and fast-fail criteria. As decribed below, each set criteria was evaluated in turn to determine its overall effect on test time and excess emissions identification.

Modal Fast-Pass Standards

IM147 fast-pass standards were originally developed for startup, midpoint, and final standards as part of SR99-10-02.[1] The current study furthered that work by developing fast-pass standards for the Max CO cutpoints. The fast-pass regression coefficients determined for both SR99-10-02 and the current study were developed using the methodology described in Sierra Report No. SR98-02-01,[2] "Additional Study of Preconditioning Effects and Other IM140 Testing Issues." As detailed in that report, the selected drive trace is divided into segments over which mass emissions for HC, CO, and NOx are summed. By performing a multivariate linear regression of the modal mass emissions against the composite emissions result, we can determine the coefficients needed to predict final emissions at mode ends throughout the test. Equation 5-1 illustrates how these coefficients are used to predict emissions.

$$P240_n = C_n + \sum_{m=1}^{n} \{S_{nm} \times X_{nm}\} + (M_e \times E_n) \qquad [5\text{-}1]$$

Where:

	$P240_n$	=	Predicted emissions after completing n segments
	C_n	=	Regression intercept for equation n
	S_{nm}	=	Regression coefficient for segment m in equation n
	X_{nm}	=	Total emissions over a given segment m in equation n
	M_e	=	Error multiplier (usually 2 unless otherwise specified)
	E_n	=	Error in regression equation n
	n	=	Equation number (corresponds to the number of modal segments completed)
	m	=	Segment number

After reviewing the proposed fast-pass and retest procedures described in SR99-10-02, Gordon-Darby staff expressed several concerns regarding actual in-use implementation of that procedure. In response, the workplan developed for the current project indicated that

Sierra would initiate further discussions with Gordon-Darby and evaluate possible changes to the previously developed procedures to address these concerns. Specific concerns that were voiced by Gordon-Darby staff include the following:

1. Insufficient number of fast-pass segments - SR99-10-02 divides the IM147 drive trace into 14 segments. While the segments in the first half of the test usually comprise 8 to 10 seconds, several segments in Phase 2 of the drive trace are considerably longer (up to 19 seconds in duration). Gordon-Darby expressed concern that extended segments may force vehicles to be tested longer than necessary prior to a fast-pass.

2. Fast-pass segments containing an odd number of seconds - To allow the resulting modal test data up to three possible IM147 cycles to fit into the same size record format as currently used for full duration IM240 tests, Gordon-Darby plans to record two-second averages rather than once every second as is presently done. To simplify its lane software, Gordon-Darby requested that Sierra realign the segments to agree with the planned frequency of data storage.

3. Nonalignment of fast-pass segments with proposed retest modes - To further simplify its programming process, Gordon-Darby asked that Sierra try to coincide retest mode breaks with segment breaks.

In addition to simply developing updated fast-pass regression coefficients and retest algorithms based on an expanded data set, this study addresses the above concerns. In response to the first two concerns as well as the test length issue (odd vs. even number or seconds), the fast-pass segments have been revised as shown in Table 5-1.

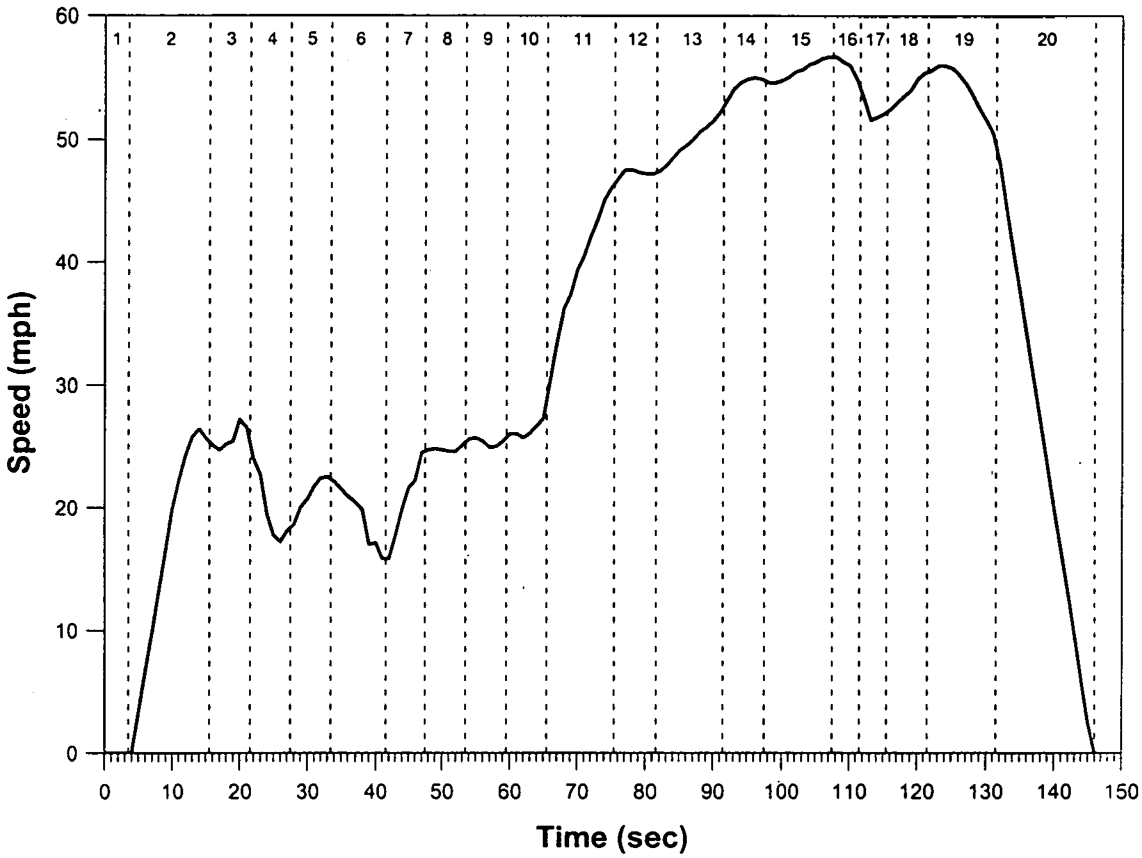
As shown in the table, there are now 20 segments ranging from 4 to 10 seconds in duration. Each segment contains an even number of seconds. Phase 2 of the IM147 now begins at segment 11 and extends through the end of the test. The test includes 146 seconds of data (collected starting at second 0 and ending at second 146).

When the IM240 segments were originally created as part of SR98-02-01, they were divided in such a way that segments characterized different modes of vehicle operation. Some segments were composed of hard accelerations, while others characterize cruises, and everything between, including decelerations. While this study re-aligned the segments with deference to ensuring 4- to 10-second segment lengths divided along even increments, care was taken to preserve the original intent of the segmentation. Figure 5-1 shows the re-aligned segments positioned against the drive trace.

Table 5-1
Revised IM147 Segments

Segment	Initial Second Data	Final Second Data
1	1	4
2	5	16
3	17	22
4	23	28
5	29	34
6	35	42
7	43	48
8	49	54
9	55	60
10	61	66
11	67	76
12	77	82
13	83	92
14	93	98
15	99	108
16	109	112
17	113	116
18	117	122
19	123	132
20	133	146

Figure 5-1
IM147 Test Segments Used for Fast-Pass Cutpoint Development



Using these revised test modes, Sierra applied the aforementioned regression method to the 3,347-vehicle sample supplied by Gordon-Darby. Thirty-nine distinct regression models, shown in Appendix C, were developed from these data. Models were created for each vehicle type (LDGV, LDGT1, and LDGT2), emission constituent (HC, CO, and NOx), and phase (composite and Phase 2 only). There are 20 equations for the composite models and 10 equations for the Phase 2 models.

After revising the regression models, they were applied to the 835-vehicle sample (unbiased IM240 sample) to determine how the models would affect excess emissions identified by the IM147 test. Excess emissions are defined as emissions collected during an IM240 test in excess of the applicable standard for a given vehicle. The IM147 test receives credit for identifying excess emissions if it fails a vehicle that had excess IM240 emissions. Table 5-2 shows the excess emissions versus test time results when the Fast-Pass algorithm was enabled. Max CO standards were used for both the IM147 and the IM240.

As Table 5-2 shows, the IM147 test with the fast-pass criteria enabled still identifies over 91% of the excess emissions for each of the three exhaust constituents and still

Table 5-2 Modeled Fast-Pass Results Excess Emissions vs. Average Test Time	No Fast-Pass	Fast-Pass Enabled
Excess HC Identified	94.3%	92.7%
Excess CO Identified	98.2%	94.3%
Excess NOx Identified	92.1%	91.2%
Average Test Time	217 seconds	125 seconds

significantly reduces average test time.* Without fast-pass enabled, the pass/fail evaluation occurs only after each IM147 is complete. If the vehicle passes the IM147, the test would be complete at that point. If the vehicle fails, another IM147 would be run, with up to three IM147s conducted on any one vehicle. If the vehicle is still failing at the end of the third IM147, it fails the overall test. Since each IM147 lasts 146 seconds, the maximum time a vehicle could be tested is 438 seconds.

Without fast-pass, the average test time for the 3,347-vehicle sample was 217 seconds. Once the fast-pass algorithm was applied, the average test time dropped to 125 seconds, for a reduction of 92 seconds (42%). This is similar to the test time estimate of 121 seconds shown in SR99-10-02[1] for the final standards with fast-pass.

Table 5-3 details excess emissions identification by vehicle type and model year groups. Appendix D provides additional excess emission analysis results. As will be shown later in the report, excess emissions identified increase with the addition of retest and fast-fail algorithms.

*Average test time refers to the estimated time for that portion of the test in which the vehicle is driven on the dynamometer.

Vehicle Class	Model Year	No Fast-Pass: Excess HC Identified	No Fast-Pass: Excess CO Identified	No Fast-Pass: Excess NOx Identified	Fast-Pass Enabled: Excess HC Identified	Fast-Pass Enabled: Excess CO Identified	Fast-Pass Enabled: Excess NOx Identified
LDGV	81-82	75.71%	99.62%	98.42%	N/A	87.6%	100.0%
	83-85	100.00%	98.83%	71.31%	100.0%	97.4%	100.0%
	86-89	100.00%	0.00%	100.00%	99.3%	97.5%	100.0%
	90-95	N/A	N/A	100.00%	96.9%	85.3%	91.4%
	96+	84.26%	99.10%	95.82%	N/A	N/A	N/A
	ALL	92.64%	100.00%	85.50%	98.6%	93.9%	97.6%
LDGT1	81-85	100.00%	100.00%	56.20%	75.7%	92.6%	98.4%
	88-89	100.00%	100.00%	55.88%	92.4%	91.0%	71.3%
	90-95	N/A	N/A	N/A	0.0%	0.0%	100.0%
	96+	95.61%	100.00%	73.26%	N/A	N/A	0.0%
	ALL	N/A	87.65%	100.00%	79.3%	91.7%	94.0%
LDGT2	81-85	100.00%	97.44%	100.00%	92.6%	100.0%	85.5%
	86-87	100.00%	99.81%	100.00%	100.0%	100.0%	56.2%
	88-95	99.00%	86.37%	91.35%	100.0%	58.0%	39.7%
	96+	N/A	N/A	N/A	N/A	N/A	N/A
	ALL	99.65%	95.04%	97.59%	95.6%	98.5%	72.3%
Total	ALL	94.3%	98.2%	92.1%	92.7%	94.3%	91.2%

Table 5-3
Excess Emissions Identified[a]
(With and Without Fast-Pass)

[a] N/A means that no vehicles failed the applicable IM240 cutpoint within this vehicle class/model year grouping.

Predictive Retest Algorithms

As with the fast-pass standards, the predictive retest algorithms were developed as part of SR99-10-02. Retest algorithms are intended to predict whether a vehicle would benefit from additional testing. If the algorithm determines that a vehicle that was failing at the end of the first or second of three IM147 tests would benefit from additional testing, then the next IM147 would begin. If, on the other hand, the algorithm determines that the vehicle would not benefit from additional testing, the test would be terminated at that point and the vehicle would fail the inspection.

In the current study, the workplan called for Sierra to refine the algorithms using the 3,347-vehicle sample and the Max CO cutpoints. The original algorithms used a combination of mass and concentration readings during specific modes of the IM147 test to predict test outcomes.

In conversation with Gordon-Darby staff, however, Sierra learned that the suggested retest logic would be difficult to implement. While gas concentrations could be determined during the test, it would be far less work if all of the retest criteria referred only to mass. Another concern, as previously mentioned, was that the modes did not align with the fast-pass segments. With these issues in mind, Gordon-Darby asked if Sierra could find a more user-friendly retest logic.

While Sierra agreed to explore alternatives to concentration measurement in the retest procedure, it was not clear that any viable alternatives existed since the justification for using both concentration and mass made sense technically. While mass emission measurements are useful to gauge emission performance relative to the actual cutpoint, the concentration measurements provide a measure of emission performance less affected by engine load than mass emissions. As a result, emissions concentration measurements seemed especially relevant for measuring improvements in engine performance during a transient test.

After some experimentation, Sierra settled on a procedure that utilizes the previously determined fast-pass regression coefficients to predict whether a vehicle would benefit from additional testing. In short, if the vehicle has not fast-passed the inspection by the end of the 19th segment and the predicted emissions fall outside a tolerance level allowing automatic retest, the emissions result predicted after segment 7 is compared to the emissions result predicted after segment 19 to determine whether the vehicle emissions are converging on the applicable cutpoint. Equation (5-2), named the convergence ratio for this study, illustrates how emission convergence on the applicable standard is determined.

$$\frac{Segment7 - Comp\_Std}{Segment19 - Comp\_Std} > X \qquad [5\text{-}2]$$

Where:	Segment7	=	Predicted emissions after segment 7 (Composite Regression)
	Segment19	=	Predicted emissions after segment 19 (Composite Regression)
	Comp_Std	=	Composite Cutpoint for the specific emission
	X	=	Empirically determined criteria

According to this equation, the convergence ratio would be greater than one if the emissions are converging on the cutpoint for vehicles where the emissions are above the cutpoint. A convergence ratio less than 1, on the other hand, suggests that the emissions are actually diverging from the cutpoint. With this in mind, it makes sense that a conservative decision threshold for the retest algorithm would utilize a convergence ratio greater than one for the HC and CO channels. In general, emissions of both of these pollutants reduce as a vehicle warms up. NOx, on the other hand, may actually increase the longer a vehicle operates, so the appropriate convergence ratio threshold may be greater than one.

Iterative solutions to this equation using actual vehicle data suggest, however, that both of these assumptions may result in overly stringent application of the retest algorithm, thus creating unacceptable false failure rates. In short, some vehicles failing for either HC or CO during one of the early IM147 tests may go on to pass a later IM147 in spite of the fact that their emissions appeared to be diverging from the cutpoint during the earlier IM147. Therefore, the convergence threshold for HC and CO may have to be greater than one to safely predict convergence. Regarding NOx emissions, modal emissions are even more difficult to predict. As a result, the convergence ratio was not applied to the NOx channel. Instead, the retest algorithm predicts NOx failures by simply comparing segment 7 and 19 NOx readings to the previously mentioned tolerance level. If the readings are greater than the prescribed multiple of the cutpoint, then the vehicle does not receive a retest.

Separate algorithms were developed for LDGVs and LDGTs based upon whether one or two IM147 tests had been completed. In all cases, a predicted emissions score of less than the standard (but that does not trigger a fast-pass) is treated as cause for a retest. This approach avoids the need to deal with negative convergence ratios, while also providing maximum potential for vehicles to pass the test. The flow charts shown in Figures 5-2 through 5-5 show the specifics regarding how these algorithms work.

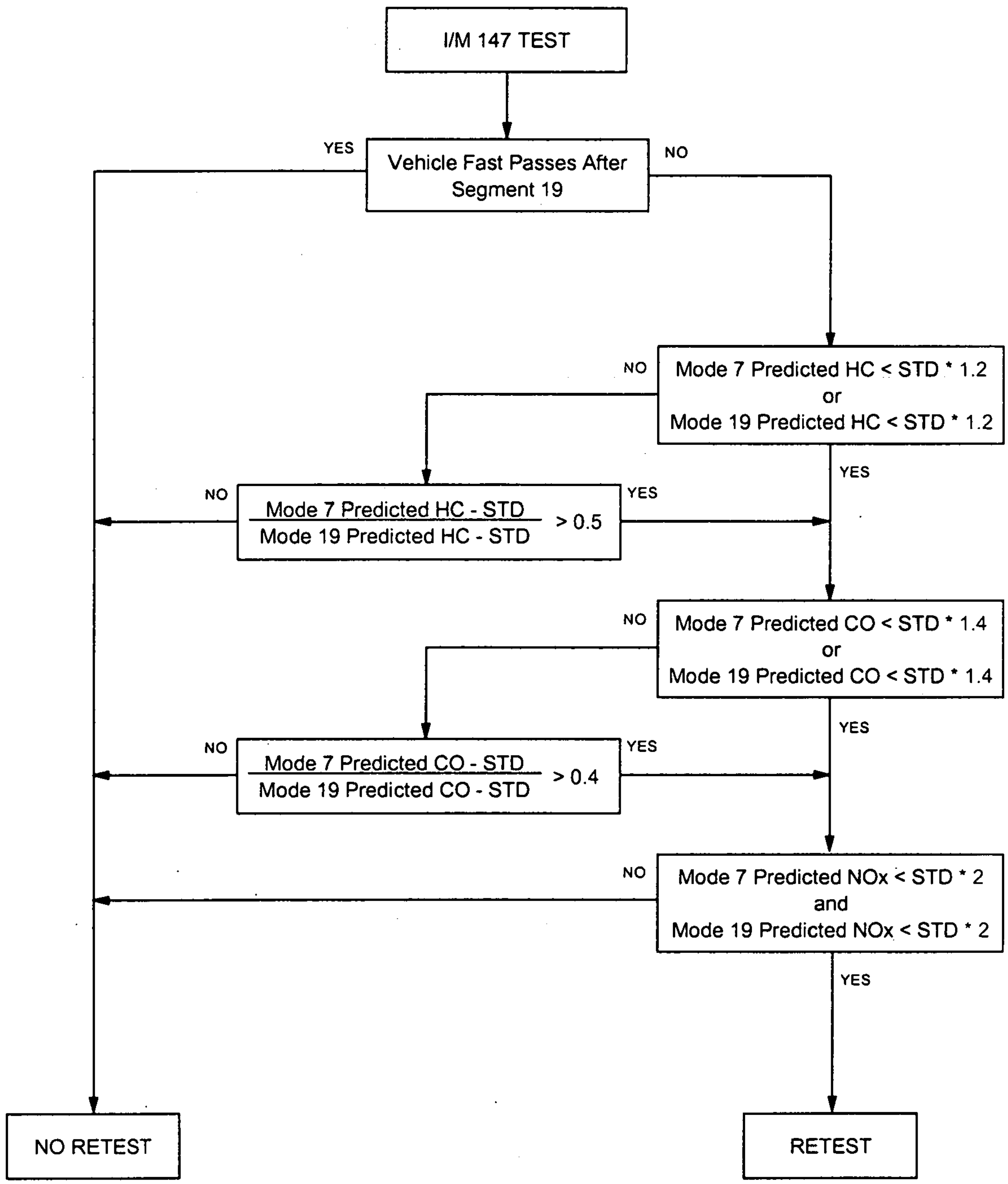
Unlike the fast-pass algorithms, the error term in the fast-pass regression equations is not included when determining predicted emissions for the Segment 7 to Segment 19 comparison. If the error term (which varies between regression models) were included, the retest procedure would need to be refined for specific regression models in addition to vehicle types. Without including the error term, LDGVs can simply be separate from LDGTs while still maintaining acceptable accuracy.

Table 5-4 presents the results of the retest algorithm independent of the fast-pass algorithm. As shown in the table, the retest criteria eliminate more vehicles after the second test than after the first test. This is in contrast to the fast-pass criteria, which pass a disproportionate number of vehicles after the first IM147 when compared to the second IM147. Given the difference between the two criteria, this makes sense. While vehicles can pass the test after early IM147 tests without the fast-pass enabled, the only way a failing vehicle can end the test without the retest algorithm enabled is to run the full duration of the test. As a result, the retest criteria on the first IM147 are judged by their ability to predict emissions on the third IM147 whereas the fast-pass criteria is judged by its ability to predict emissions on the current IM147, an easier task. In turn, the retest criteria must be correspondingly more conservative on the first IM147 than the fast-pass criteria.

In addition to listing the point at which vehicles were denied a retest, Table 5-4 lists the number of vehicles falsely failed as a result of the retest procedure. The criterion for false failing is quite simple; a false failure occurs any time a vehicle, which would go on to

Figure 5-2

Retest Algorithm During First IM147 - LDGV
Max CO Cutpoints



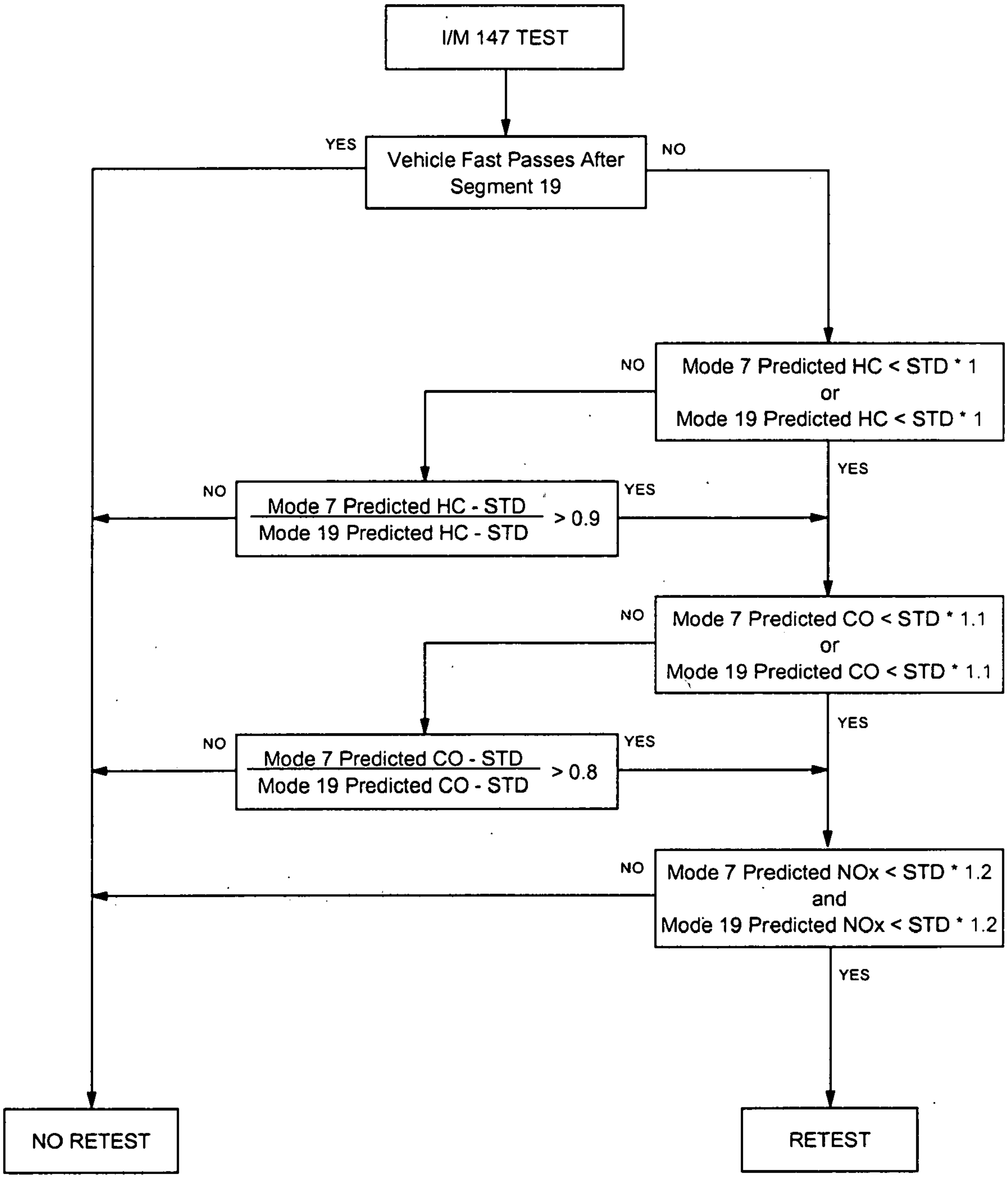
Note: STD = Composite Standard for the specific pollutant.

Mode 7 Predicted = Predicted emissions after 7 segments using the composite regression equations without error term included.

Mode 19 Predicted = Predicted emissions after 19 segments using the composite regression equations without error term included.

Figure 5-3

Retest Algorithm During Second IM147 - LDGV Max CO Cutpoints



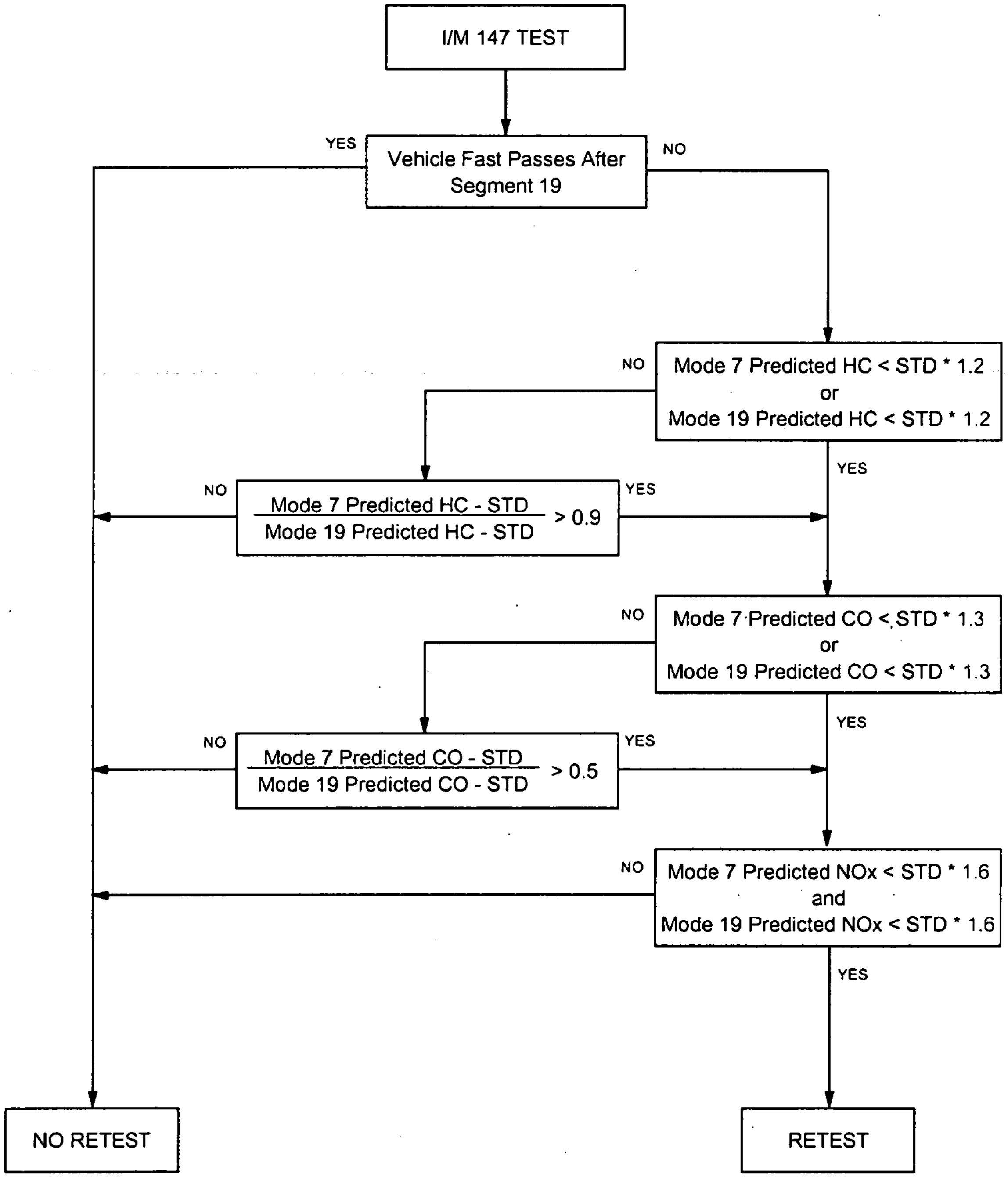
Note: STD = Composite Standard for the specific pollutant.

Mode 7 Predicted = Predicted emissions after 7 segments using the composite regression equations without error term included.

Mode 19 Predicted = Predicted emissions after 19 segments using the composite regression equations without error term included.

Figure 5-4

Retest Algorithm During First IM147 - LDGT1, LDGT2 Max CO Cutpoints



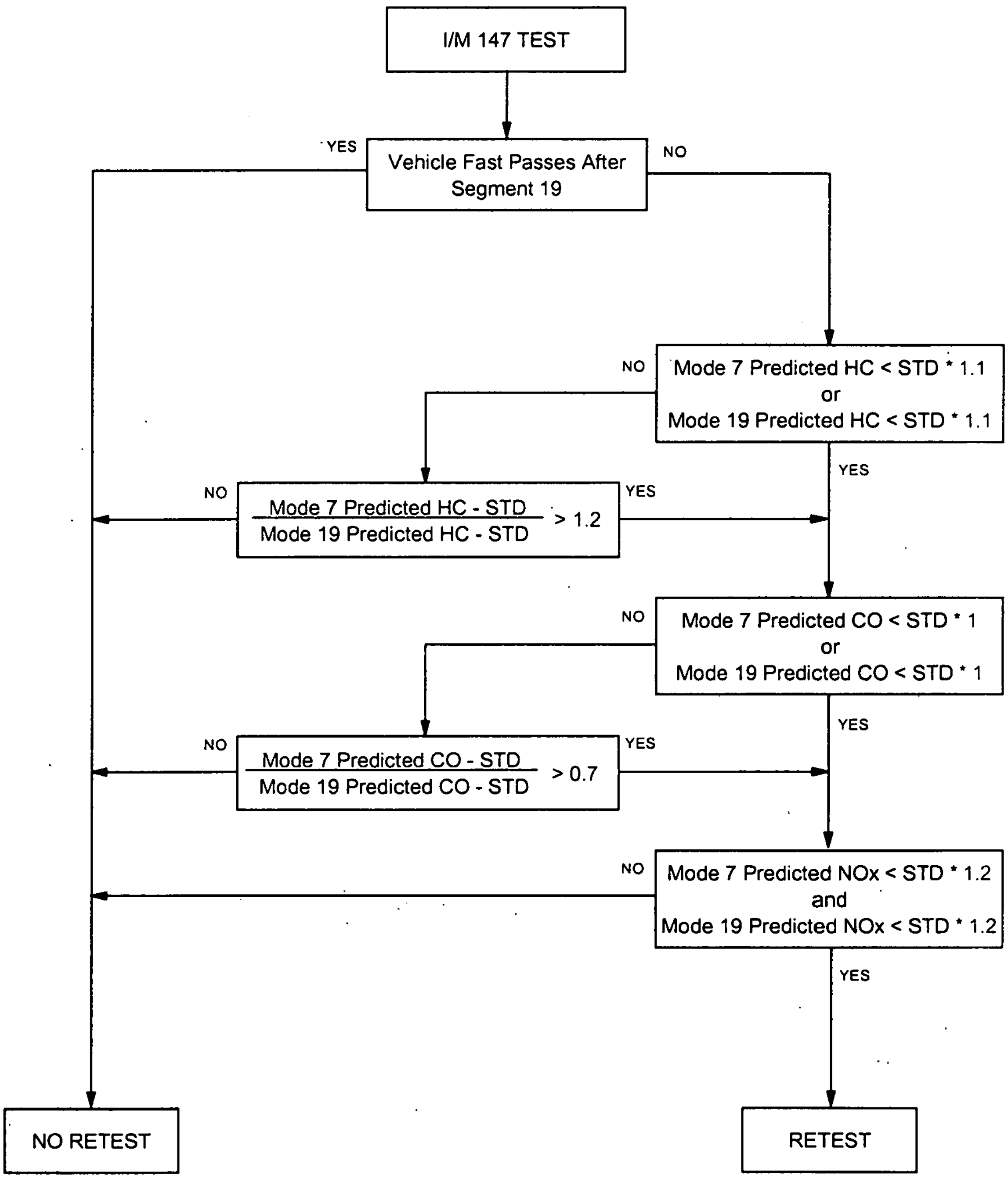
Note: STD = Composite Standard for the specific pollutant.

Mode 7 Predicted = Predicted emissions after 7 segments using the composite regression equations without error term included.

Mode 19 Predicted = Predicted emissions after 19 segments using the composite regression equations without error term included.

Figure 5-5

Retest Algorithm During Second IM147 - LDGT1, LDGT2 Max CO Cutpoints



Note: STD = Composite Standard for the specific pollutant.

Mode 7 Predicted = Predicted emissions after 7 segments using the composite regression equations without error term included.

Mode 19 Predicted = Predicted emissions after 19 segments using the composite regression equations without error term included.

Table 5-4 Retest Algorithm Results	LDGV	LDGT1, LDGT2
Total Number of Complete Tests	1567	1780
# of Failures Without Retest Algorithm	327 (20.9% of 1567)	273 (15.3% of 1780)
# of Correctly Identified Failures[a]	245 (74.9% of 327)[b]	180 (65.9% of 273)[b]
# Failing After 1 IM147	94 (38.4% of 245)[c]	97 (53.9% of 180)[c]
# Failing After 2 IM147s	151 (61.6% of 245)[c]	83 (46.1% of 180)[c]
# of Passing Vehicles Falsely Failed by Retest	0 (0% of 1567)	0 (0% of 1780)

[a]"Correctly identified failures" refers to those vehicles that were still failing at the end of the third IM147.
[b]The number shown in parentheses is the number of failures without the retest algorithm.
[c]The number shown in parentheses is the total number of IM147 Cycle 2 and 3 failures.

pass one of the subsequent IM147 tests, is denied a retest. As shown, there were no false failures. Despite the conservatism evidenced by this result, average test time dropped from 125 seconds to 96 seconds when the retest algorithm was added to the fast-pass criteria.

Modal Fast-Fail Criteria

One of the requirements this work assignment was to develop modal fast-fail criteria. Unlike the retest procedure, which can terminate the test at the ends of the individual IM147 tests, the fast-fail algorithm can terminate tests during an IM147 test.

As with the retest algorithms, the fast-fail algorithm has the potential to falsely fail vehicles that would otherwise pass the inspection in the algorithm's absence. After looking at the test data, it quickly became apparent that the data from the first IM147 were too unpredictable to fast-fail any significant number of vehicles during the first IM147 without also significantly increasing false failure levels. While the retest algorithm utilizes almost all of the first IM147 data before it makes a decision not to retest a vehicle, the fast-fail algorithm must make essentially the same decision in a smaller amount of time. For this reason, it was decided that the fast-fail algorithm would not function before the second IM147.

In order to build on work already completed for the retest procedure, the fast-fail algorithm for the second IM147 trace evaluates predicted emissions after segment 7 of the drive trace. To maintain uniformity for lane software programmers, the error term was not included in the prediction or the mode 7 emissions since it was not in the retest algorithm.

The vehicle fast-fails the second IM147 if any of the following are true:

For LDVs:

Predicted HC after 7 segments > (1.5 x Composite HC standard)

Predicted CO after 7 segments > (2.2 x Composite CO standard)

Predicted NOx after 7 segments > (1.4 x Composite NOx standard)

For LDTs:

Predicted HC after 7 segments > (1.1 x Composite HC standard)

Predicted CO after 7 segments > (1.5 x Composite CO standard)

Predicted NOx after 7 segments > (1.5 x Composite NOx standard)

Using this criteria, 99 trucks and 124 cars are fast-failed after segment 7 of the second IM147, with no false failures when the retest algorithm is disabled.

During the third IM147, the potential for falsely failing vehicles in subsequent IM147 tests is eliminated. As a result, the modal fast-pass algorithm, with a minor modification, can be implemented to predict failing vehicles. Instead of adding the error term to the predicted score as is done with the fast-pass algorithm, the error term is subtracted. This adjustment ensures conservative emission estimates, which will help to minimize false failures when using the algorithm. Equation 5-3 illustrates the third IM147 fast-fail algorithm.

$$P240_n = C_n + \sum_{m=1}^{n} \{S_{nm} \times X_{nm}\} - (M_e \times E_n) \qquad [5\text{-}3]$$

Where:	$P240_n$	=	Predicted emissions after completing n segments
	C_n	=	Regression intercept for equation n
	S_{nm}	=	Regression coefficient for segment m in equation n
	X_{nm}	=	Total emissions over a given segment m in equation n
	M_e	=	Error multiplier (usually 2 unless otherwise specified)

*It is theoretically possible to identify additional fast-fails by using the same or different predictive algorithms at the end of subsequent segments. While Gordon-Darby has expressed interest in this enhancement in order to further reduce average test time, the timing of the study did not allow for the evaluation of this issue.

E_n = Error in regression equation n
n = Equation number (corresponds to the number of modal segments completed)
m = Segment number

Table 5-5 details the results of the fast-fail algorithm for both the second and third IM147 tests. As the number of false failures indicates, the fast-fail criteria was developed with the intention of minimizing false failures. The results shown in the table are also deceptive, since they are based on an analysis of the impact of the fast-fail algorithm in the absence of the other test criteria. While over 600 fast-failures are shown in the table, many of these are also subject to the retest criteria, resulting in a much smaller fast-fail impact when the criteria are combined. In this latter case, the number of fast-fails falls to roughly 200 vehicles. This effect, combined with the fact that such fails occur relatively late in the 3-IM147 test cycle, leads to a fairly small impact on average test me. Once the fast-fail algorithm was enabled with the fast-pass and retest algorithm, average test time was reduced from 96 seconds to 94 seconds.

Table 5-5
Fast-Fail Algorithm

Vehicle Class	Second IM147 Fast-Failures	Third IM147 Fast-Failures	False Failures
LDV	124	211	3
LDT	99	182	3
Total	223	393	6

Integration of Fast-Pass, Retest, and Fast-Fail Algorithms

The next step in the analysis was to integrate the Fast-Pass, Retest, and Fast-Fail criteria to determine their net effect. Table 5-6 shows how average test times and excess emissions identified vary by model year range and vehicle class using the integrated criteria.

As you can see, once the retest and fast-fail algorithms were added to the fast-pass algorithm, excess emissions identification improved. There are two reasons for this: (1) vehicles that would be falsely passed later in the test are now failed prior to that decision being made; and (2) some vehicles that passed according to the IM147 criteria yet would have failed the IM140 are now falsely failed on the IM147, thus increasing IM240 excess emissions identification.

Table 5-6 Comparison of Integrated Algorithms (No CPP) vs. Standard IM147 Impact on Test Time and Excess Emissions Lost							
Class	Model Year Group	Sample Size*	Mean Test Time Standard*	Mean Test Time w/ Algorithms*	% Excess Emissions Identified**		
					HC	CO	NOx
LDGV	1981-82	105	286.4	140.1	-	87.6%	100.0%
	1983-85	228	311.2	169.4	100.0%	97.4%	100.0%
	1986-89	425	248.4	112.0	99.3%	97.5%	100.0%
	1990-95	952	184.8	78.3	96.9%	85.3%	91.4%
	1996+	70	154.3	37.1	-	-	-
	All	1780	221.0	100.0	98.6%	93.9%	97.6%
LDGT1	1981-85	260	306.6	158.7	75.7%	97.5%	98.4%
	1986-89	222	230.8	101.6	92.4%	91.0%	99.6%
	1990-95	450	173.3	59.2	0.0%	0.0%	100.0%
	1996+	32	155.1	31.6	-	-	100.0%
	All	964	221.9	94.9	79.3%	94.4%	98.7%
LDGT2	1981-85	94	307.5	158.8	100.0%	100.0%	100.0%
	1986-87	64	253.2	101.4	100.0%	100.0%	70.8%
	1988-95	427	166.5	54.2	100.0%	58.0%	39.7%
	1996+	18	146.0	28.0	-	-	-
	All	603	197.1	74.7	100.0%	98.5%	86.0%
Weighted Average		**3347**	**217.0**	**94.0**	**94.4%**	**95.4%**	**95.7%**

The excess emissions identification shown in the above table is down from the identification of SR99-10-02[1], which identified 99.6% of the HC emissions, 98.2% of the CO, and 99.9% of the NOx with the fast-pass and retest algorithms enabled. However, direct comparison of these results may not be relevant for several reasons. First, the previous study measured excess emissions captured against the Final Cutpoints rather than the Max CO cutpoints developed for this study. Second, because fast-fail was created for this study, it was not included in the previous study results. Third, since the retest algorithm has been modified as part of this study, it will have a different effect on the results. In the previous study, the retest algorithm improved excess emission identification by 2.7% versus 1.1% for this study. Lastly, most of the vehicle data used in this study were collected with the model year exemptions in place. This skews the model

*Mean test time standard refers to the average dynamometer test time without the algorithms enabled. This was determined using the 3347-vehicle sample.

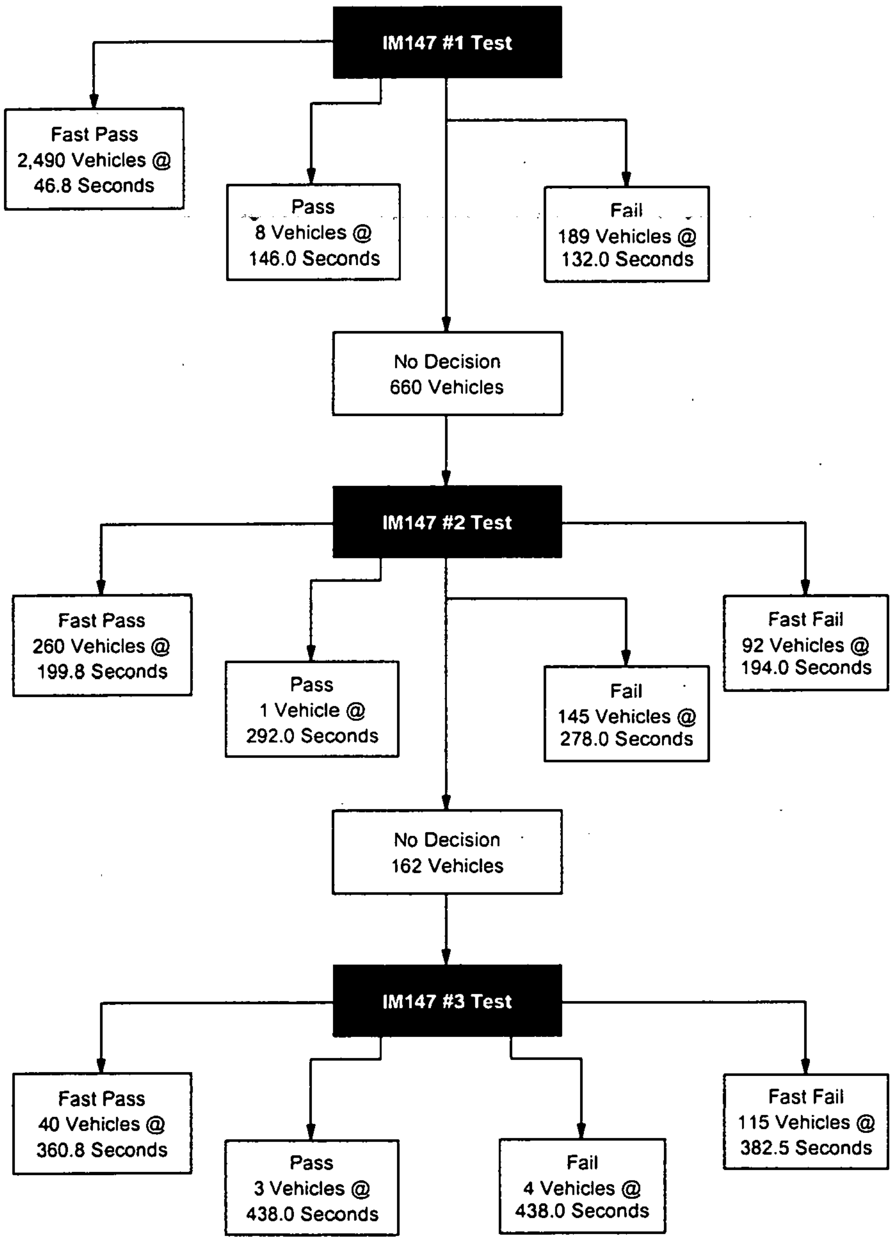
**Percent of IM240 (Max CO) excess emissions identified with the integrated algorithms enabled. This was determined using 835-vehicle sample.

year distribution older when compared to SR99-10-02, which used data unbiased by model year exemptions.

Figure 5-6 illustrates how the integrated criteria combined to produce emission results and final test times. Note that only 5 of the 3347 vehicles were tested the full duration of all three IM147 tests.

Figure 5-5

Integrated Test Results
Maximum CO Cutpoints Without CPP Limits



TOTAL PASS = 2,802

TOTAL FAIL = 545
TOTAL FALSE FAILURES = 3

Segment 2 Revised Integrated Algorithms Results

The original integrated algorithm results were determined assuming fast-pass and fast fail results could not be rendered prior to the fourth segment (i.e., no earlier than Test Time = 28 seconds). This was consistent with the procedure established in SR98-02-01.

Gordon-Darby, wishing to further minimize test time, requested that Sierra explore the feasibility of rendering fast-pass and third IM147 fast-fail decisions after earlier segments without degrading excess emission identification. Unfortunately, simply moving the decision forward with the existing algorithms, while shortening test time, did degrade excess emission identification. To adjust for this change, the error multiplier used in the fast-pass decision needed to be increased to 3 during segment 2 and to 2.5 during segment 3. While the fast-fail algorithm used during the third IM147 also uses an error multiplier, it can be left at 2 during segments 2 and 3 without increasing false-failure incidence. Using these criteria, the earliest possible fast-passes were moved to the end of segment 2 (i.e., Test Time = 16 seconds) and average test time was reduced to 90.5 seconds without sacrificing any excess emissions identification. Excess emissions identification remained at 94.4% for HC, 95.4% for CO, and 95.7% for NOx.

SIP Credit Analysis

The comparison of excess emissions identification between the IM240 and IM147 that is presented above is based on the use of CO Max standards for both test cycles. However, to develop an estimate of the allowable SIP credit that should be allocated to the revised IM147 CO Max standards, it is also necessary to compare excess emissions identification between this scenario and the IM240 with EPA-recommended final cutpoints in place. This is due to the need to establish a link to using MOBILE for SIP modeling purposes. Configuring MOBILE with CO Max standards is not feasible; therefore, a better approach is to run the model with final EPA standards in place and use the excess emissions identification rates developed in this study to adjust the resulting outputs.

Table 5-7 shows the excess emission identification rates when the IM147 Max CO cutpoints are compared to the IM240 final standards. Pollutant-specific identification rates are shown both without and with the fast-pass, retest, or fail-fail algorithms enabled. (The latter scenario includes fast-passing vehicles as early as at the end of segment 2.) Since Arizona will be implementing the IM147 test procedure with the algorithms enabled, the identification rates for this scenario are the ones that should be used to adjust the MOBILE modeling results (based on final IM240 standards) for SIP credit purposes.

As expected, the table shows that HC and NOx identification rates are significantly lower with the IM147 Max CO cutpoints relative to final IM240 standards. This is due to the fact that the Max CO cutpoints are designed to maximize the CO benefits of the program at the expense of HC and NOx benefits, while keeping maximum failure rates in each cutpoint category to acceptable levels. The CO identification rate of 97.9% (with the algorithms enabled) shows that the Arizona program will achieve nearly all of the modeled benefit of the final IM240 standards. Note that this will be substantially more

Table 5-7
Comparison of IM147 Max CO Cutpoints to IM240 Final Standards
Impact on Excess Emissions Lost*

	% Excess Emission Identified (Without Fast-Pass, Retest, Fast-Fail)			% Excess Emissions Identified (With Integrated Algorithms)		
Class	HC	CO	NOx	HC	CO	NOx
LDGV	94.1%	96.5%	85.6%	91.7%	95.6%	86.2%
LDGT1	75.6%	100.0%	79.5%	65.0%	98.1%	81.2%
LDGT2	89.0%	100.0%	53.4%	98.5%	100.0%	59.6%
Weighted Average	**86.5%**	**98.8%**	**75.1%**	**85.6%**	**97.9%**	**77.5%**

* Percent of IM240 (Final Standards) excess emissions identified was determined using the 835 vehicle sample.

effective than the current phase-in IM240 standards. The table also shows that the addition of the integrated algorithms results in less than a 1% reduction in the excess emissions identification rate for CO.

Need for Follow-Up Analysis

As discussed above, the analysis results presented in the report are based on a relatively small sample of IM147 and IM240 data. While the available data are significantly more robust than the previous sample of 300 vehicles, it is clear that these results should be revisited with a much larger sample once IM147 testing is initiated in Arizona. We therefore recommend that as soon as one to two months of IM147 data are collected in the program, they should be used to verify the validity of the cutpoints and algorithms developed in this study. This follow-up analysis would allow for any required fine-tuning of the cutpoints and algorithms.

###

6. DEVELOPMENT OF IM147 VARIATION LIMITS

In addition to fast-pass/fail cutpoints and retest criteria, trace variation limits were also developed for the IM147 test. Under Task 6 of the Work Assignment, an analysis methodology that was used to develop IM240 variation limits under an earlier EPA study[2] was applied to the pilot IM147 data to develop similar limits for the IM147 test.

During the course of the effort, an alternate statistical metric, Cumulative Positive Specific Power (CPP), was identified that resulted in better second-by-second variation limits than the Positive Kinetic Energy (PKE) metric employed in the previous EPA study. This section of the report describes why the new statistic was selected, and how IM147 CPP variation limits were developed and evaluated to ensure they do not produce excessive test abort rates. It also assesses their individual impact on average dynamometer test time. (The combined effect of fast-pass/fail cutpoints, retest criteria and IM147 trace variation limits is discussed in Section 7.)

Before describing the effort performed under the current Work Assignment, a review of the existing IM240 tolerance limits and a summary of the previous evaluation of those limits are presented.

Existing Tolerance Limits

The prescribed driving cycles for the transient IM240 and IM147 tests consist of varying second-by-second speeds ranging from zero (i.e., idle) to 56.7 mph, with maximum speed changes of ±3.3 mph/sec. During actual I/M testing, the driver watches a graphical display of the prescribed or "reference" speed/time trace overlayed with the actual second-by-second trace as it is being driven as an aid to following the reference trace and anticipating upcoming speed changes. (The visual display also indicates prescribed shift points for manual transmission vehicles along the trace.)

Since each vehicle has different performance characteristics, it is impossible, even for highly skilled drivers, to precisely follow the second-by-second reference trace speeds during actual "one-time-only" testing. As a result, EPA originally developed a set of speed-based tolerance limits for the IM240 test that defined the leeway allowed to the driver in trying to follow the reference trace for the test to be considered valid. Those tolerance limits consisted of two components: (1) speed excursion limits; and (2) speed variation limits. Each of these criteria is described below.[6]

Speed Excursion Limits [85.2221 (e) (4)] - *Speed excursion limits shall apply as follows:*

(i). The upper limit is 2 mph higher than the highest point on the trace within 1 second of the given time.

(ii). The lower limit is 2 mph lower than the lowest point on the trace within 1 second of the given time.

(iii). Speed variations greater than the tolerances (e.g., during gear changes) are acceptable provided they occur for no more than 2 seconds on any occasion.

(iv). Speeds lower than those prescribed during accelerations are acceptable provided they occur for no more than 2 seconds on any occasion.

Speed Variation Limits [85.2221 (e) (5)]

(i). A linear regression of feedback value on reference value shall be performed on each transient driving cycle for each speed using the method of least squares, with the best fit equation having the form: $y = mx + b$, *where:*

(A). y = *the feedback (actual) value of speed;*

(B). m = *the slope of the regression line;*

(C). x = *the reference value; and*

(D). b = *the y-intercept of the regression line.*

(ii). The standard error of estimate (SE) of y on x shall be calculated for each regression line. A transient driving cycle lasting the full 240 seconds that exceeds the following criteria shall be void and the test shall be repeated:

(A). SE = 2.0 mph maximum.

(B). $m = 0.96 - 1.01$.

(C). $r^2 = 0.97$ *minimum.*

(D). $b = \pm 2.0$ *mph.*

Simply stated, the speed excursion limits require that vehicles be driven within ±2 mph of the reference trace, accommodating for gear changes and other momentary excursions.

The speed variation limits, though a bit more difficult to comprehend, were intended to ensure that speed differences from the reference trace within the ±2 mph excursion limits "envelope" would not bias the resulting measured emissions.

However, EPA suspended the use of the speed variation limits on November 23, 1993, pending further evaluation.

Previous Analysis of Speed Variation Limits

Inadequacy of Speed Variation Limits - In 1998, Sierra completed a study for EPA[2] that evaluated the ability of the linear regression-based speed variation limits to identify high emissions-producing speed variations. It was found that the linear regression criteria were inadequate in flagging high-emissions speed variations. The reason for this finding was that the standard error (SE) statistic does not give "appropriate" higher weighting to speed deviations occurring at the critical high-emission points along the IM240 trace. Instead, it gives equal weighting to all speed variations and thus (along with the other regression statistics used in the speed variation criteria) is ill-suited to identifying those speed deviations that substantially affect IM240 emissions.

Evaluation of Alternative Statistics - During this study, two alternative statistical measures were evaluated for their ability to better identify IM240 speed variations that significantly affect measured emissions:

1. DPWRSUM[7] - the sum of absolute changes in specific power; and
2. Positive Kinetic Energy (PKE) - the sum of positive differences in kinetic energy per unit distance.

It was found that the PKE statistic provided a better measure than DPWRSUM for identifying those speed variations from the reference trace that produce high emissions. This finding was supported by analysis of modal (i.e., second-by-second) speed and emissions data from a random sample of 16,581 full[*] IM240 tests from the Arizona I/M program. It was determined that the high-emission portions of the IM240 test closely corresponded with periods of acceleration. A examination of both the DPWRSUM and PKE statistics found that DPWRSUM is increased during both decelerations and accelerations. PKE, on the other hand, is increased only during acceleration periods. Thus, the DPWRSUM statistic is "diluted" with speed variations during decelerations that have little effect on emissions. As a result, the PKE statistic was reasoned to provide a better measure of significant emissions-producing speed variations.

Development of PKE-Based IM240 Variation Limits - From this finding, PKE variation limits were then developed as potential replacements to the original regression-based

[*] "Full" tests refer to those run over the entire test duration, regardless of fast-pass or fast-fail status.

speed variation limits. The basic approach used to develop PKE-based speed variation criteria for the IM240 consisted of the following elements:

1. Establishing upper and lower "composite" PKE limits for full 240-second tests from the Arizona data sample; and

2. Scaling these composite limits based on the cumulative PKE at each second of the IM240 reference trace to produce second-by-second PKE variation limits.

Second-by-second PKE variation limits were established to ensure that compliance with the reference trace was maintained throughout the test to minimize emissions bias during fast-pass and fast-fail determinations.

From analysis of the Arizona data, the PKE variation limits were established over a range expected to produce no more than a 3% increase in the test abort rate when applied as a replacement for the speed variation criteria, in conjunction with the existing speed excursion criteria.

Development of Positive Power-Based Variation Limits

Under the current study, the randomly collected triplicate Arizona IM147 tests described in Section 3 were also analyzed to develop IM147 trace variation limits. Similar to the earlier IM240 study, upper and lower composite limits were first established over the full duration of the IM147 test. The composite variation limits were then scaled at each second of the reference trace to produce second-by-second variation limits.

Before discussing the details of how these IM240-developed methodologies were adapted for the IM147 test, an explanation of why positive power was used as a replacement for PKE as the variation limits metric is provided.

Use of Positive Power Instead of PKE - During the course of developing the second-by-second IM147 variation limits, a number of tests were identified for which PKE-based variation limits were being exceeded under periods of deceleration. This was clearly a problem. As discussed earlier, statistical metrics used to establish variation criteria were selected based on their ability to identify high emissions-producing variations that coincide with acceleration events. Although the composite PKE statistic does this well on a cumulative basis over the entire test, it is less-suited when applied on a second-by-second basis.

The reason for this can be seen by first considering how PKE is calculated. Over a traveled driving cycle of distance x, cumulative PKE per unit distance is defined as follows:

$$CPKE(x) = \frac{\sum_{t=0}^{T} PP_t}{\int_0^x dx} \qquad [6\text{-}1]$$

The term PP_t is referred to as the positive specific power at time *t* and is given by the following equation:

$$PP_t = \begin{cases} V_t^2 - (V_{t-1})^2 & when V_t > V_{t-1} \\ 0 & when V_t \leq V_{t-1} \end{cases} \qquad [6\text{-}2]$$

By definition, positive (specific) power* is non-zero during acceleration and zero during cruise and deceleration events. Cumulative positive power (CPP) is defined as the sum of positive power at each second *t* over a transient driving cycle of *T* seconds, or

$$CPP(T) = \sum_{t=0}^{T} PP_t \qquad [6\text{-}3]$$

Thus, CPP increases during accelerations over a transient driving cycle and remains constant during cruise and deceleration.

Conversely, cumulative PKE decreases during cruise and deceleration because the denominator in Equation [6-1], which represents the summed distance driven, still increases while a vehicle is cruising or decelerating. Cumulative PKE becomes constant only during periods of idle (i.e., zero speed).

Figure 6-1 illustrates the different behavior of each metric over the IM147 test. It shows second-by-second speed, CPP, and cumulative PKE over the reference trace. Speed (in mph) is plotted against the left axis. Cumulative positive power and cumulative PKE are plotted against the right axis (in mph^2/sec and $miles/hr^2$, respectively).

As seen in Figure 6-1, CPP either increases or remains constant over the entire duration of the transient IM147 test. On the other hand, cumulative PKE decreases during both deceleration and cruise events, by definition. Furthermore, cumulative PKE can actually decrease during modest accelerations after the initial portion of the IM147 test. For

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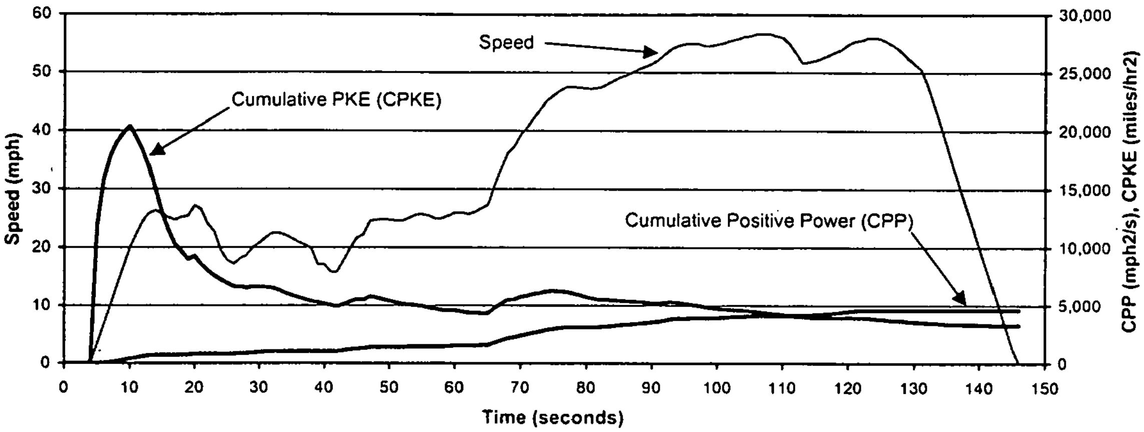
* Power is literally defined as the rate of change in kinetic energy (or work). Strictly speaking, specific power (i.e., power per unit mass) would be calculated by the velocity times the acceleration at time t. When the change in kinetic energy is evaluated on a second-by-second basis as defined in Equation 6-2, instead of as a net change from the beginning to the end of the cycle, PP_t as defined in that equation approaches the strict definition of positive power.

Figure 6-1

Comparison of IM147 Variation Limit Metrics



example, this phenomenon can be seen at Seconds 11-14 in Figure 6-1, where the reference trace exhibits acceleration from Second 5 through Second 14 but cumulative PKE begins dropping beyond Second 11.

Because of this behavior, it was difficult to establish reasonable second-by-second variation limits based upon cumulative PKE differences between the reference and driven traces using a scaling approach similar to that developed under the 1998 IM240 study. That approach basically consisted of scaling the composite PKE interval limits established at the end of the test by the percentage difference of these limits from the composite reference value.

Since the magnitude of critical emissions-affecting deviations during accelerations is difficult to distinguish from the magnitude of deviations that do not substantially affect emissions during deceleration and cruise, this scaling approach fails when based upon cumulative PKE. The result is that cumulative PKE-based second-by-second variation limits of a specific scaled interval width will either falsely flag less important deviations during decelerations or not identify deviations during accelerations that do affect measured emissions.

Thus, two alternate approaches were considered for establishing reasonable second-by-second IM147 variation limits:

1. Use of a better-behaved statistic, such as positive power, in conjunction with the basic scaling approach; and

2. Development of separate variation limits for each second using deviation distributions (reference vs. actual) at each second compiled from a full modal analysis of the test data sample.

Although conceptually appealing since variation limits are established independently for each individual second, the latter approach would require a rigorous modal analysis just to develop initial variation limits for each second. A complex iterative process would then be required to evaluate these limits over the entire trace and "tune" them in a manner that yields an acceptable overall abort rate. This tuning step would also consider the relative impact of trace variations at each second on measured emissions. For example, it would be desirable to apply tighter trace variation limits during acceleration segments that produce high emissions than during less emissions-significant idling segments if the resulting overall abort rates (across all segments) can be kept at acceptable levels.

In addition, it is believed that imposing tighter, independently established second-by-second trace variation limits would result in a much greater degree of "re-learning" by the lane inspectors as they adjust to the impact of these limits. This re-learning process and any necessary re-tuning of the variation limits could best be evaluated through an initial pilot study before being implemented on a program-wide basis. During this pilot study, it is also envisioned that different approaches to providing visual feedback to drivers as they attempt to follow the trace could be evaluated. For example, this could involve providing dynamically updated forward-looking "trace envelopes" or speeds that guide the driver back toward the reference trace when a nominal excursion begins in a manner that complies with the scond-by-second variation limits.

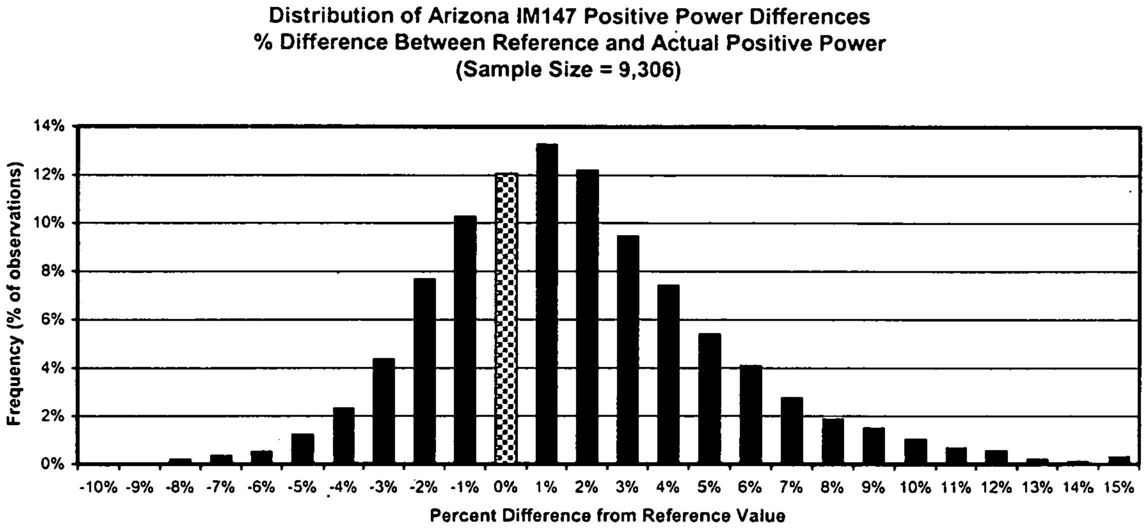
As a result of the scope of the latter approach, the first approach was selected because it was believed to substantially overcome the shortcoming of the PKE-based metric while being less resource-intensive to apply and test than limits developed from a full modal analysis. It should also be noted that using CPP as a replacement for PKE assumes that the existing speed excursion criteria developed by EPA will be applied in conjunction with CPP-based variation limits. This assumption is dictated by the use of a cumulative metric in specifying second-by-second variation limits.

Development of Composite Variation Limits - Composite IM147 variation limits were generated using a similar methodology to that employed in the 1998 IM240 study, except cumulative positive power (CPP), rather than cumulative PKE, was used as the statistical metric.

Figure 6-2 shows the distribution of composite (i.e., 147-second) CPP calculated from the second-by-second actual speeds in the Arizona data sample, expressed as the percent difference between actual and reference IM147 CPP.

As the figure shows, actual CPP appears normally distributed, although the median CPP is approximately 1% higher than the reference value. To determine how far to go along the "tails" of the CPP differences distribution to set composite limits, CPP differences among the test lane drivers in the Arizona data were examined. The basic concept applied in setting the CPP limits was to identify a significant fraction of drivers who, historically, could always (or nearly always) run IM147 tests within the selected CPP limits. Given a mixture of ability among individual drivers to follow the reference trace, Sierra sought to identify the fraction of "competent" drivers who could follow the trace

Figure 6-2



more consistently than others when conducting IM147 tests for a range of vehicles. This subset of competent drivers and tests was used to establish composite CPP limits.

From the Arizona data sample of over 10,000 valid triplicate IM147 tests, records in which speed excursions (over ±2 mph from the reference trace) occurred were discarded, leaving a remaining sample of 9,306 tests. For the purpose of establishing composite CPP variation limits based on the capabilities of "good" drivers, speed excursion tests were removed from this portion of the analysis.

The remaining data sample was then sorted into groups by individual driver. A total of 231 drivers were found in the sample. Driver groups containing fewer than 25 tests were then discarded; this left a total of 112 driver groups, which encompassed 86% of the tests in the total sample (i.e., before discarding small-sample driver groups). Composite CPP was then calculated for each test in the remaining driver groups. The mean and standard deviation of CPP from the tests within each driver group were also computed. The driver groups were then ranked by increasing CPP standard deviation and the top 50% of the drivers (based on lowest CPP standard deviation) were used to compute possible composite CPP cutpoints.

Table 6-1 lists a series of possible CPP cutpoints computed from the percentile CPP variance among the top 50% drivers. For example, the CPP cutpoints shown for the 2% row under the "Top 50% Percentile" column (the third column in Table 6-1) indicates that 96% (100% - 2 x 2%) of the tests from the top 50% drivers had composite CPP within 4,437 and 4,949 mph^2/sec.

* Identified by the four-digit "InspectorID" field in the database.

Table 6-1 Preliminary CPP Cutpoints (mph^2/sec) Based on Top-50% Drivers (Sample Size = 7,962 Tests)					
Top-50% Driver Lower Tail	Top-50% Driver Upper Tail	Top-50% Driver Percentile	Low-End CPP (mph^2/sec)	High-End CPP (mph^2/sec)	Interval Width (mph^2/sec)
0.25%	99.75%	±0.25%	4,348	5,077	728
0.5%	99.5%	±0.5%	4,368	5,039	671
0.75%	99.25%	±0.75%	4,391	5,013	622
1.0%	99.0%	±1.0%	4,403	4,987	584
2.0%	98.0%	±2.0%	4,437	4,949	512
3.0%	97.0%	±3.0%	4,459	4,920	462
4.0%	96.0%	±4.0%	4,475	4,903	428
5.0%	95.0%	±5.0%	4,483	4,882	398

Note that these preliminary cutpoints are not centered about the IM147 reference CPP value of 4,617 mph^2/sec (as evidenced by the shifted CPP distribution shown earlier in Figure 6-2). To generate a series of "final" composite limits for evaluation, Sierra applied the interval widths shown in Table 6-1 to the reference CPP value to produce "centered" limits about the reference value.

Incremental abort test rates for each set of centered cutpoints were then calculated based on both the entire 9,306 test Arizona data sample and the top-50% driver subset. The results are presented in Table 6-2, which lists both "simple" and "effective" abort rates.

Simple abort rates represent the fraction of tests in the sample for which the composite CPP cutpoints would have been exceeded. Effective abort rates were calculated from simple rates by subtracting the fractions of emission-pass tests that exceeded the upper CPP cutpoint and emission-fail tests that exceeded the lower CPP cutpoint. The idea is that tests on vehicles that had passing emission scores but were driven with high CPP should not be aborted. Similarly, tests that failed on emissions despite being driven below the lower CPP cutpoint should also be considered valid tests and not aborted.

Thus, tests should be aborted only when the upper CPP variation limit is exceeded for an emissions failure or the lower CPP variation limit is exceeded during a passing test. The emissions pass/fail determinations used to calculate the effective abort rates shown in Table 6-2 are based upon the "Max CO" cutpoints developed earlier in the study.

In addition to the calculated test abort rates, Table 6-2 also shows the percentage of drivers who are always within the limits of each set of CPP cutpoints.

Table 6-2 Centered CPP Cutpoints and Resulting Test Abort Rates									
	Centered CPP Limits (mph^2/sec)			Abort Rates (%) from All Tests		Abort Rates (%) from Top-50% Driver Tests		Percentage of All Drivers Within Limits	
Top-50% Driver Percentile	Lower CPP Limit	Upper CPP Limit	Interval Half-Width	Simple Abort Rate	Effective Abort Rate	Simple Abort Rate	Effective Abort Rate	> Lower Limit	< Upper Limit
±0.25%	4,253	4,982	364.2	5.8%	1.6%	1.2%	0.2%	95.7%	53.9%
±0.5%	**4,282**	**4,953**	**335.6**	**7.2%**	**2.1%**	**1.9%**	**0.4%**	**93.5%**	**47.4%**
±0.75%	4,307	4,928	310.8	8.7%	2.6%	2.7%	0.6%	91.8%	40.5%
±1.0%	4,325	4,909	292.1	10.5%	3.1%	3.7%	0.9%	88.4%	37.1%
±2.0%	4,361	4,873	255.9	14.1%	4.2%	6.3%	1.6%	81.5%	28.9%
±3.0%	4,386	4,848	230.9	17.3%	5.3%	8.9%	2.6%	77.6%	26.3%
±4.0%	4,403	4,831	214.2	19.9%	6.2%	10.9%	3.1%	74.1%	24.6%
±5.0%	4,418	4,816	199.1	22.6%	7.2%	13.2%	3.9%	67.2%	22.4%
Sample Size	-	-	-	9,306 Tests		7,962 Tests		231 Drivers	

Based on the results given in Table 6-2, Sierra proposes the use of composite lower and upper CPP variation limits of 4,282 and 4,953 mph^2/sec, respectively (shown in the shaded row in Table 6-2). As indicated in the table, these composite CPP limits are expected to increase the (effective) abort test rate by 2.1% relative to that resulting from EPA's recommended speed excursion limits based on available test data. Since the goal of the analysis was to specify variation limits that kept the abort rate due to these variation limit violations to 3%, composite CPP limits resulting in only a 2.1% incremental abort rate were selected. This left some "room" below the 3% target for the impact of also imposing second-by-second CPP variation limits.

If drivers are selected based on their ability to perform as well as the best 50% of the current drivers, then the abort rate would drop to just 0.4%. In practice, it is expected that the abort rate will increase by less than this amount as drivers "adjust" to the new limits.

Development of Second-by-Second Variation Limits - Using the recommended composite CPP limits of 4,282 and 4,953 mph^2/sec, second-by second CPP limits were generated by scaling the percentage difference of these limits from the composite reference value (7.3%) to the CPP calculated at each second from the reference trace. This approach was further modified as described below.

1. To provide drivers with a short period to "learn" to drive each test vehicle, second-by-second CPP limits were not imposed until t=30 seconds; and

2. To further accommodate wider allowable variations (on a percentage basis) in second-by-second CPP at the beginning of the transient IM147 test, a "CPP Multiplier" factor was applied that widened the allowed CPP limits progressively from the end of the test to where limits begin at t=30 seconds. From its maximum value beginning at t=30 seconds, the CPP multiplier factor was linearly decreased to a value of unity (i.e., 1.0) at t=146. In other words, at the end of the test, the CPP limits were set equal to the composite CPP limits. Furthermore, this linear narrowing was applied only over the acceleration sections of the IM147 trace, during which the reference CPP is increasing. During cruise and deceleration periods, the limit widths were held constant (as the reference CPP also remains constant).

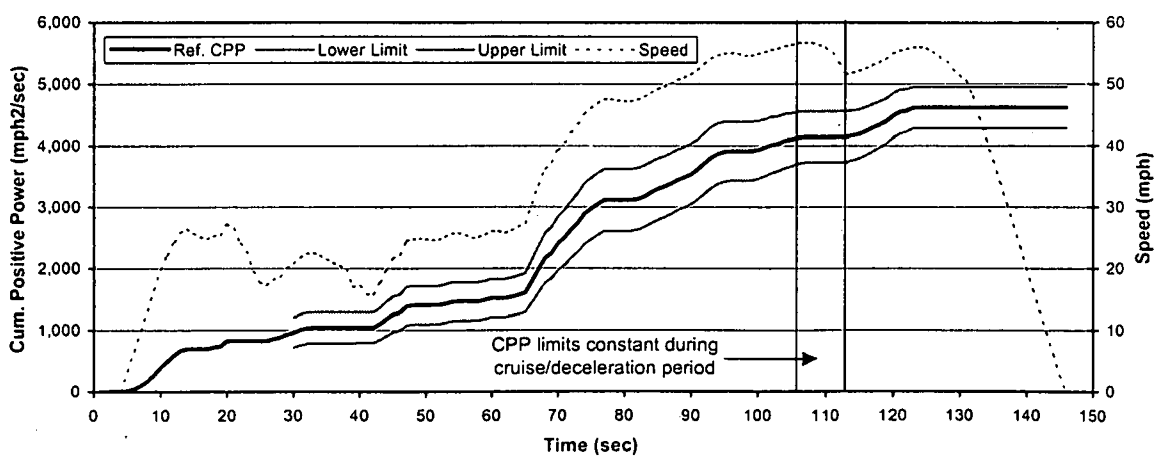
This latter improvement to the methodology employed in the 1998 IM240 study, in conjunction with the use of CPP instead of CPKE, enabled second-by-second IM147 CPP limits to be specified so variation limit aborts were not falsely triggered during deceleration and cruise portions of the transient test. Note that second-by-second CPP variation limits developed in this manner can still be exceeded during cruise and deceleration events, signaling tests that should be aborted. However, falsely triggered "anomalous" exceedances that occur from the use of a PKE-based metric are eliminated under this modified approach.

Figure 6-3 illustrates this modified second-by-second CPP-based variation limit concept. The thick solid line shows the reference CPP over the IM147 test; the thinner solid lines represent the lower and upper CPP limits established as described above.

These CPP traces are plotted against the left axis. Speed, indicated by the dashed line, is plotted against the right axis. Note that the CPP limits can be held constant during cruise and deceleration periods. Thus, variation limit exceedances in these intervals are real, rather than anomalous artifacts of the statistical metric.

Figure 6-3

Illustration of Second-by-Second IM147 Cumulative Positive Power Variation Limits

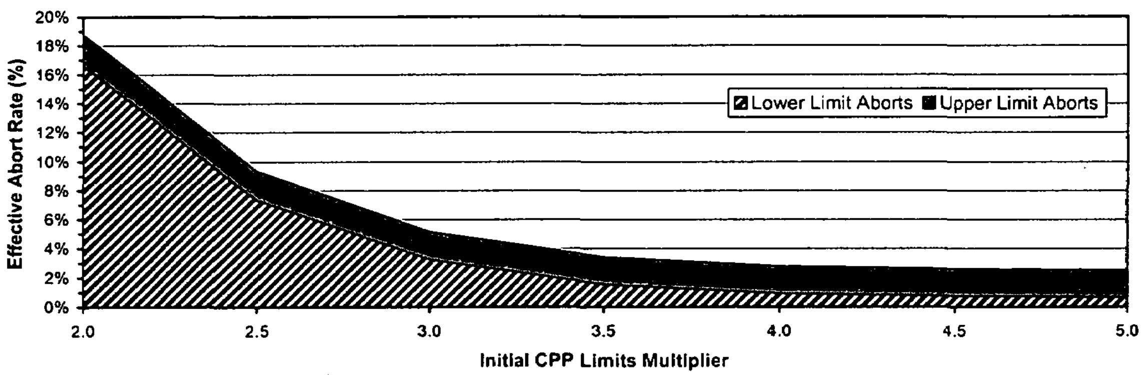


To establish second-by-second CPP variation limits that produced expected test aborts near the 3% target rate, a range of initial CPP multipliers (from 2.0 to 6.0) were evaluated. These initial multipliers specify the width of the variation limits at the starting point (t=30 seconds) relative to the composite interval width at the end of the test. For example, an initial CPP multiplier of 2.0 means that the starting interval width was 14.6% (2.0 x 7.3% composite CPP interval width) of the reference CPP trace at that point.

Figure 6-4 shows the increase in effective abort rate as a function of varying initial CPP multipliers. The diagonally striped region represents lower CPP variation limit aborts, the shaded region above shows upper limit aborts. Since these abort events are mutually exclusive, their sum represents the total expected effective abort rate from implementation of the CPP variation limits.

Figure 6-4

Effect of Initial CPP Limits Multiplier on Effective IM147 Abort Rate (Sample Size = 9,306)



Based on the analysis results, an initial CPP multiplier of 3.5 is recommended for implementation in Arizona. Second-by-second CPP variation limits based on the use of this multiplier are shown in Appendix E.

Evaluation of IM147 Variation Limits on Test Time

Using the second-by-second CPP variation limits described in the preceding section, an analysis was conducted of the impact of these variation limits on average dynamometer test time. This was a simplistic analysis since it addressed only the singular impact of the variation limits. (A more exhaustive analysis of the combined test time impact of CPP variation limits in conjunction with fast-pass, fast-fail and retest decisions is presented in Section 7.)

In this simple analysis, the "without limits" or base average test time was assumed to be 146 seconds, the length of a full IM147 test. This assumption was necessitated by the

Arizona data sample, which contained only full tests. The recommended CPP limits were found to produce a total effective abort rate of 3.4% based on the Arizona IM147 data. The average time at which the aborts occurred under these limits was determined to be 101.6 seconds.

Thus, the "with limits" average test time was then calculated as follows:

With Limits Test Time = Base Test Time + (Abort Rate x Average Abort Time)

= 146 + (3.4% x 101.6 seconds) = 149.5 seconds

It should be noted that this approach also assumes that an aborted test is performed successfully on the subsequent re-test. Under these assumed conditions, the CPP variation limits will increase average test times by approximately 2% [(149.5-146) ÷ 146].

###

7. INTEGRATION OF CPP VARIATION LIMITS

The final phase of this analysis involved integrating the CPP criteria with the other algorithms included in this study to determine net test time.

As shown in Section 6, there are both high-end CPP errors and low-end CPP errors. High-end CPP errors occur when the vehicle is driven too aggressively, whereas low-end CPP errors occur when the vehicle is driven too smoothly, essentially minimizing the peaks and valleys of the trace. Because high-end CPP errors will create additional emissions and in turn make it more difficult for a vehicle to pass the test, a test where a vehicle passed in spite of high-end CPP errors is considered a valid test. If the same vehicle failed because of high emissions, the cause is assumed to be the high-end CPP error; therefore, the test would need to be extended to ensure fairness. Low-end CPP errors, however, would result in lower mass emissions and make it easier for vehicles to pass falsely. In those cases where the vehicle passes with a low-end CPP error, the result would be invalid and the test would need to be extended. If a vehicle fails with a low-end CPP error, the result is valid and the test would terminate. Table 7-1 details which CPP violations affect which decisions.

Table 7-1
End Test Decisions Affected by CPP Errors

Decision Type	Prohibited by:
Fast-Pass	Low-end CPP error
Retest (initiate another IM147 cycle)	High-end CPP error
Fast-Fail	High-end CPP error
End-of-Test Pass	Low-end CPP error
End-of-Test Fail	High-end CPP error

While the above decision types can be prohibited by the corresponding CPP errors, the error must occur while data for that decision were being produced in order to affect the decision. In other words, not all high-end CPP errors occurring during an IM147 test would necessarily invalidate failing results, nor would all low-end CPP errors invalidate passing results. If an applicable power error occurred while data required to make a particular decision were being collected, then the decision would be invalidated and the test would continue. Specifically, this would apply to fast-pass and fast-fail decisions. For example, if the vehicle's emission data were clean enough to permit a fast-pass at second 40, but there was a low power violation at second 34, then the fast-pass decision would be invalidated and the test would continue. On the other hand, if the first power violation occurred after second 40 (e.g., at second 41), then the vehicle could be fast-passed at second 40.

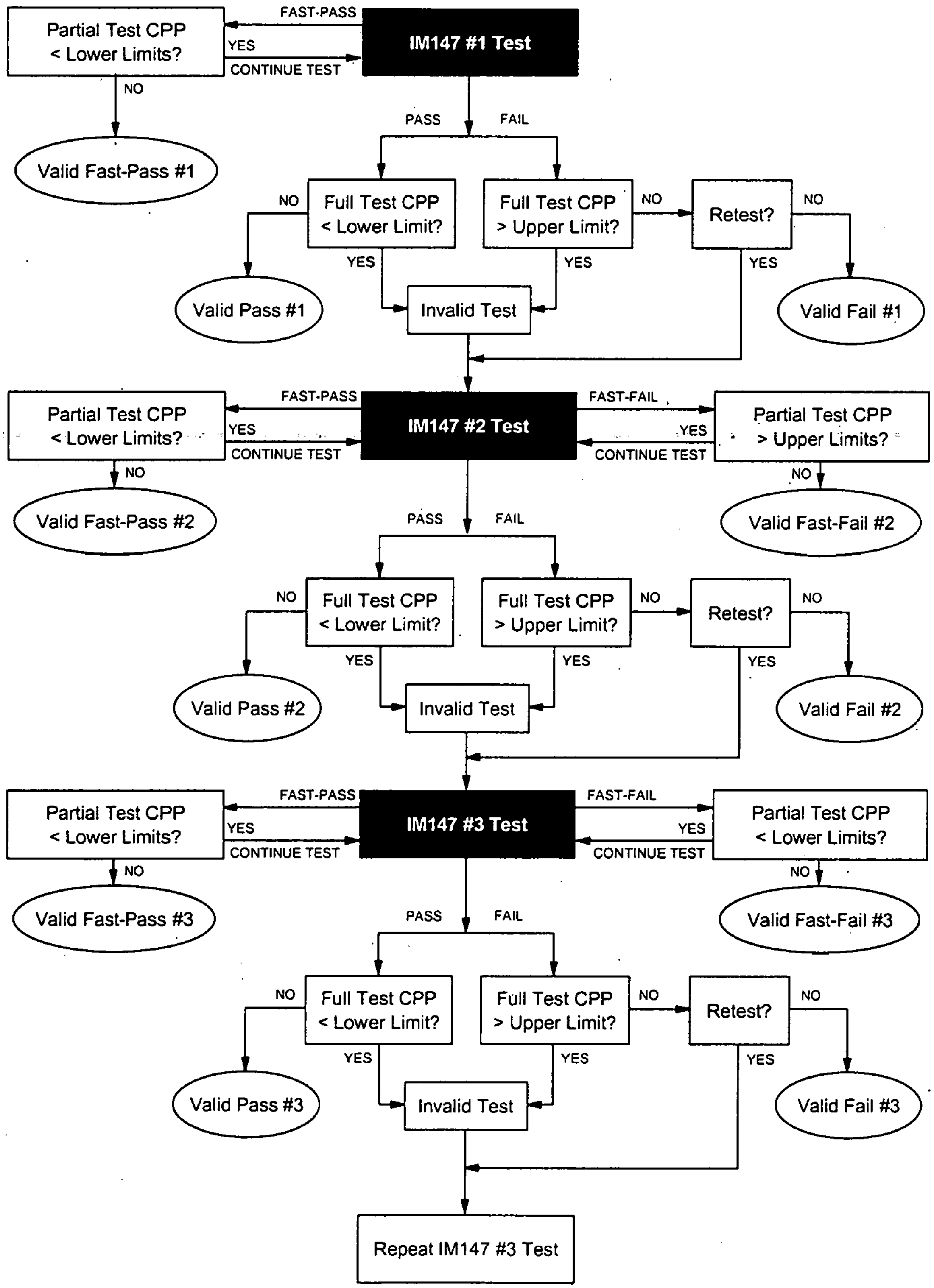
In a related issue, the CPP error is reset at the conclusion of each IM147. As a result, low-end CPP errors occurring during the first IM147 do not prohibit pass-oriented decisions in subsequent IM147 tests. The same is true for high-end CPP errors and fail-oriented decisions.

Using this logical framework, the CPP variation limits were applied to the 3347-vehicle sample to determine how this algorithm would affect test time. Since the CPP variation limits are designed to be imposed in concert with the speed violation limits detailed in the IM240 guidance, vehicles already failing the speed violation limits were eliminated from the sample since they would be aborted regardless of the CPP outcome. Of the original 3347 vehicles, 3006 remained after eliminating vehicles with speed violations from the sample.

The flow chart detailed in Figure 7-1 shows how the CPP decision integrates with the fast-pass/fail and retest algorithms previously discussed in this report. Note that in cases where a CPP violation prevented a decision during the third IM147, the vehicle would, after completing the third IM147, restart the third IM147 again. For the average test time computation, it was assumed that CPP errors during the third IM147 extended the test time 146 seconds.

Given the 3006 vehicle sample, the average test time, with the fast-pass, retest, and fast-fail criteria enabled but without the CPP criteria applied, was 89.07 seconds. Once the CPP criteria were enabled, 87 vehicles' tests (of the 3006 vehicles) were extended, increasing the average test time by 0.98 seconds (or 1.1%) to 90.05 seconds. This is less than the 2% increase projected at the end of Section 6, which makes sense given that the 2% projection was made without the fast-pass/fail and retest algorithms in place. The overall test time reductions caused by the fast-pass/fail and retest algorithms would mean that fewer errors would be committed.

Figure 7-1



IM147 #1 Test
FAST-PASS
Partial Test CPP
< Lower Limits?
YES
CONTINUE TEST
NO
Valid Fast-Pass #1
PASS
FAIL
Full Test CPP
< Lower Limit?
NO
YES
Valid Pass #1
Full Test CPP
> Upper Limit?
NO
YES
Retest?
NO
YES
Valid Fail #1
Invalid Test
IM147 #2 Test
FAST-PASS
Partial Test CPP
< Lower Limits?
YES
CONTINUE TEST
NO
Valid Fast-Pass #2
FAST-FAIL
Partial Test CPP
> Upper Limits?
YES
CONTINUE TEST
NO
Valid Fast-Fail #2
PASS
FAIL
Full Test CPP
< Lower Limit?
NO
YES
Valid Pass #2
Full Test CPP
> Upper Limit?
NO
YES
Retest?
NO
YES
Valid Fail #2
Invalid Test
IM147 #3 Test
FAST-PASS
Partial Test CPP
< Lower Limits?
YES
CONTINUE TEST
NO
Valid Fast-Pass #3
FAST-FAIL
Partial Test CPP
< Lower Limits?
YES
CONTINUE TEST
NO
Valid Fast-Fail #3
PASS
FAIL
Full Test CPP
< Lower Limit?
NO
YES
Valid Pass #3
Full Test CPP
> Upper Limit?
NO
YES
Retest?
NO
YES
Valid Fail #3
Invalid Test
Repeat IM147 #3 Test

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8. REFERENCES

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Appendix A

Startup IM240 Cutpoints and IM147 Cutpoints* (Composite/Phase 2 Cutpoints in g/mi, IM240 - IM147)			
Model Years	**HC**	**CO**	**NOx**
LDGV			
1981-82	2.00/1.25 - 2.00/1.20	60.0/48.0 - 58.0/30.0	3.0 - 3.3/1.2
1983-85	2.00/1.25 - 2.00/1.20	30.0/24.0 - 30.0/15.0	3.0 - 3.3/1.2
1986-90	2.00/1.25 - 2.00/1.00	30.0/24.0 - 30.0/10.0	3.0 - 3.0/1.2
1991-93	1.20/0.75 - 1.30/0.60	20.0/16.0 - 21.0/10.0	2.5 - 2.9/1.0
1994-95	1.20/0.75 - 1.20/0.60	20.0/16.0 - 21.0/10.0	2.5 - 2.7/1.0
1996+ (Tier 1)	0.80/0.50 - 0.80/0.50	15.0/12.0 - 15.0/ 7.0	2.0 - 2.1/0.9
LDGT1			
1981-83	7.50/5.00 - 6.70/4.70	100.0/80.0 - 95.0/50.0	7.0 - 7.6/2.9
1984-85	3.20/2.00 - 2.90/2.00	80.0/64.0 - 76.0/40.0	7.0 - 7.6/2.9
1986-87	3.20/2.00 - 2.90/1.60	80.0/64.0 - 76.0/31.0	7.0 - 7.0/2.7
1988-90	3.20/2.00 - 2.90/1.60	80.0/64.0 - 76.0/31.0	3.5 - 3.6/1.3
1991-93	2.40/1.50 - 2.60/1.20	60.0/48.0 - 61.0/31.0	3.0 - 3.4/1.1
1994-95	2.40/1.50 - 2.40/1.20	60.0/48.0 - 61.0/29.0	3.0 - 3.2/1.1
1996+ (Tier 1)	1.00/0.63 - 1.0/0.60	20.0/16.0 - 21.0/10.0	2.5 - 2.7/1.1
LDGT2			
1981-83	7.50/5.00 - 6.70/4.70	100.0/80.0 - 95.0/50.0	7.0 - 7.6/2.9
1984-86	3.20/2.00 - 2.90/2.00	80.0/64.0 - 76.0/40.0	7.0 - 7.6/2.9
1987	3.20/2.00 - 2.90/1.60	80.0/64.0 - 76.0/31.0	7.0 - 7.6/2.7
1988-90	3.20/2.00 - 2.90/1.60	80.0/64.0 - 76.0/31.0	5.0 - 5.1/1.9
1991-93	2.40/1.50 - 2.60/1.20	60.0/48.0 - 61.0/31.0	4.5 - 5.1/1.9
1994-95	2.40/1.50 - 2.40/1.20	60.0/48.0 - 61.0/29.0	4.5 - 4.8/1.9
1996+ (Tier 1)	2.40/1.50 - 2.40/1.20	60.0/48.0 - 61.0/29.0	4.0 - 4.3/1.7

*Developed for SR99-10-02

Intermediate IM240 Cutpoints and IM147 Cutpoints Developed in This Study (Composite/Phase 2 Cutpoints in g/mi, IM240 - IM147)			
Model Years	**HC**	**CO**	**NOx**
LDGV			
1981-82	1.40/0.88 - 1.40/0.90	45.0/36.0 - 44.0/23.0	2.3 - 2.8/1.0
1983-85	1.40/0.88 - 1.40/0.90	23.0/18.0 - 23.0/12.0	2.3- 2.8/1.0
1986-90	1.40/0.88 - 1.40/0.70	23.0/18.0 - 23.0/9.0	2.3 - 2.6/1.0
1991-93	1.00/0.63 - 1.10/0.50	18.0/14.0 - 18.0/9.0	2.3 - 2.6/0.9
1994-95	1.00/0.63 - 1.00/0.50	18.0/14.0 - 18.0/9.0	2.3 - 2.5/0.9
1996+ (Tier 1)	0.70/0.45 - 0.80/0.40	13.0/10.0 - 15.0/6.0	1.8 - 2.2/0.8
LDGT1			
1981-83	5.50/3.50 - 4.90/3.40	85.0/68.0 - 81.0/43.0	5.8 - 6.3/2.4
1984-85	2.40/1.50 - 2.30/1.50	60.0/48.0 - 60.0/30.0	5.8 - 6.3/2.4
1986-87	2.40/1.50 - 2.30/1.20	60.0/48.0 - 60.0/26.0	5.8 - 5.8/2.2
1988-89	2.40/1.50 - 2.30/1.20	60.0/48.0 - 60.0/26.0	3.0 - 3.3/1.2
1990	2.40/1.50 - 2.30/1.20	60.0/48.0 - 59.0/26.0	3.0 - 3.3/1.2
1991-93	2.00/1.25 - 2.10/1.00	50.0/40.0 - 51.0/26.0	2.8 -3.2/1.1
1994-95	2.00/1.25 - 2.00/1.00	50.0/40.0 - 51.0/25.0	2.8 - 3.0/1.1
1996+ (Tier 1)	0.90/0.57 - 1.30/0.60	17.0/13.0 - 31.0/8.0	2.2 - 2.7/1.0
LDGT2			
1981-83	5.50/3.50 - 4.90/3.40	85.0/68.0 - 81.0/43.0	5.8 - 6.3/2.4
1984-86	2.40/1.50 - 2.30/1.50	60.0/48.0 - 60.0/30.0	5.8 - 6.3/2.4
1987	2.40/1.50 - 2.30/1.20	60.0/48.0 - 60.0/26.0	5.8 - 6.3/2.2
1988-90	2.00/1.50 - 2.30/1.20	60.0/48.0 - 60.0/26.0	4.3 - 4.6/1.6
1991-93	2.00/1.25 - 2.20/1.00	50.0/40.0 - 51.0/26.0	4.0 - 4.6/1.6
1994-95	2.00/1.25 - 2.00/1.00	50.0/40.0 - 51.0/25.0	4.0 - 4.3/1.6
1996+ (Tier 1)	1.60/1.00 - 2.00/0.90	38.0/30.0 - 51.0/18.0	3.0 - 4.1/1.3

Final IM240 Cutpoints and IM147 Cutpoints Developed in This Study (Composite/Phase 2 Cutpoints in g/mi, IM240 - IM147)			
Model Years	**HC**	**CO**	**NOx**
LDGV			
1981-82	0.80/0.50 - 0.80/0.50	30.0/24.0 - 30.0/15.0	2.0 - 2.3/0.8
1983-85	0.80/0.50 - 0.80/0.50	15.0/12.0 - 16.0/8.0	2.0 - 2.3/0.8
1986-89	0.80/0.50 - 0.80/0.40	15.0/12.0 - 16.0/8.0	2.0 - 2.2/0.8
1990-93	0.80/0.50 - 0.80/0.50	15.0/12.0 - 15.0/8.0	2.0 - 2.2/0.7
1994-95	0.80/0.50 - 0.80/0.50	15.0/12.0 - 15.0/7.0	2.0 - 2.2/0.7
1996+ (Tier 1)	0.60/0.40 -0.80/0.30	10.0/8.0 - 15.0/5.0	1.5 - 2.2/0.6
LDGT1			
1981-83	3.40/2.00 - 3.10/2.10	70.0/56.0 - 67.0/35.0	4.5 - 4.9/1.8
1984-85	1.60/1.00 - 1.70/1.00	40.0/32.0 - 43.0/20.0	4.5 - 4.9/1.8
1986-87	1.60/1.00 - 1.70/0.80	40.0/32.0 - 43.0/20.0	4.5 - 4.6/1.7
1988-89	1.60/1.00 - 1.70/0.80	40.0/32.0 - 43.0/20.0	2.5 - 2.9/1.0
1990-93	1.60/1.00 - 1.60/0.80	40.0/32.0 - 41.0/20.0	2.5 - 2.9/1.0
1994-95	1.60/1.00 - 1.60/0.80	40.0/32.0 - 41.0/20.0	2.5 - 2.7/1.0
1996+ (Tier 1)	0.80/0.50 - 1.60/0.50	13.0/10.0 - 41.0/ 6.0	1.8 - 2.7/0.8
LDGT2			
1981-83	3.40/2.00 - 3.10/2.10	70.0/56.0 - 67.0/35.0	4.5 - 4.9/1.8
1984-86	1.60/1.00 - 1.70/1.00	40.0/32.0 - 43.0/20.0	4.5 - 4.9/1.8
1987	1.60/1.00 - 1.70/0.80	40.0/32.0 - 43.0/20.0	4.5 - 4.9/1.7
1988-91	1.60/1.00 - 1.70/0.80	40.0/32.0 -43.0/20.0	3.5 - 4.0/1.3
1992-93	1.60/1.00 - 1.70/0.80	40.0/32.0 - 41.0/20.0	3.5 - 4.0/1.3
1994-95	1.60/1.00 - 1.70/0.80	40.0/32.0 - 41.0/20.0	3.5 - 3.8/1.3
1996+ (Tier 1)	0.80/0.50 - 1.60/0.50	15.0/12.0 - 41.0/ 7.0	2.0 - 3.8/0.9

Appendix B

Failure Rate Max CO Cutpoints												
	HC			CO			NOx			OVERALL		
V Type	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
First IM147												
LDGV	207	1573	11.6%	352	1428	19.8%	236	1544	13.3%	543	1237	30.5%
LDGT1	76	888	7.9%	204	760	21.2%	83	881	8.6%	281	683	29.1%
LDGT2	31	572	5.1%	87	516	14.4%	44	559	7.3%	127	476	21.1%
All	314	3033	9.4%	643	2704	19.2%	363	2984	10.8%	951	2396	28.4%
Second IM147												
LDGV	126	1654	7.1%	256	1524	14.4%	166	1614	9.3%	406	1374	22.8%
LDGT1	59	905	6.1%	167	797	17.3%	70	894	7.3%	231	733	24.0%
LDGT2	24	579	4.0%	61	542	10.1%	31	572	5.1%	91	512	15.1%
All	209	3138	6.2%	484	2863	14.5%	267	3080	8.0%	728	2619	21.8%
Third IM147												
LDGV	114	1666	6.4%	250	1530	14.0%	155	1625	8.7%	390	1390	21.9%
LDGT1	49	915	5.1%	156	808	16.2%	70	894	7.3%	219	745	22.7%
LDGT2	25	578	4.1%	63	540	10.4%	30	573	5.0%	93	510	15.4%
All	188	3159	5.6%	469	2878	14.0%	255	3092	7.6%	702	2645	21.0%

Failure Rate By Model Year Grouping - First IM147 Max CO Cutpoints													
		HC			CO			NOx			OVERALL		
V Type	Year	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
LDGV	81-82	19	86	18.1%	32	73	30.5%	24	81	22.9%	55	50	52.4%
	83-85	48	180	21.1%	108	120	47.4%	53	175	23.2%	144	84	63.2%
	86-89	85	340	20.0%	96	329	22.6%	87	338	20.5%	169	256	39.8%
	90-95	55	897	5.8%	112	840	11.8%	72	880	7.6%	171	781	18.0%
	96+	0	70	0.0%	4	66	5.7%	0	70	0.0%	4	66	5.7%
LDGT1	81-85	38	222	14.6%	109	151	41.9%	54	206	20.8%	152	108	58.5%
	86-89	22	200	9.9%	57	165	25.7%	17	205	7.7%	73	149	32.9%
	90-95	16	434	3.6%	38	412	8.4%	11	439	2.4%	55	395	12.2%
	96+	0	32	0.0%	0	32	0.0%	1	31	3.1%	1	31	3.1%
LDGT2	81-85	18	76	19.1%	44	50	46.8%	16	78	17.0%	55	39	58.5%
	86-89	8	56	12.5%	13	51	20.3%	13	51	20.3%	27	37	42.2%
	88-95	5	422	1.2%	30	397	7.0%	15	412	3.5%	45	382	10.5%
	96+	0	18	0.0%	0	18	0.0%	0	18	0.0%	0	18	0.0%
	ALL	314	3033	9.4%	643	2704	19.2%	363	2984	10.8%	951	2396	28.4%

Failure Rate By Model Year Grouping - Second IM147 Max CO Cutpoints														
		HC			CO			NOx			OVERALL			
V Type	Year	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
LDGV	81-82	13	92	12.4%	29	76	27.6%	18	87	17.1%	49	56	46.7%
	83-85	32	196	14.0%	81	147	35.5%	43	185	18.9%	116	112	50.9%
	86-89	57	368	13.4%	82	343	19.3%	67	358	15.8%	141	284	33.2%
	90-95	24	928	2.5%	64	888	6.7%	38	914	4.0%	100	852	10.5%
	96+	0	70	0.0%	0	70	0.0%	0	70	0.0%	0	70	0.0%
LDGT1	81-85	33	227	12.7%	99	161	38.1%	48	212	18.5%	139	121	53.5%
	86-89	19	203	8.6%	48	174	21.6%	10	212	4.5%	59	163	26.6%
	90-95	7	443	1.6%	20	430	4.4%	11	439	2.4%	32	418	7.1%
	96+	0	32	0.0%	0	32	0.0%	1	31	3.1%	1	31	3.1%
LDGT2	81-85	16	78	17.0%	40	54	42.6%	14	80	14.9%	53	41	56.4%
	86-89	5	59	7.8%	11	53	17.2%	11	53	17.2%	22	42	34.4%
	88-95	3	424	0.7%	10	417	2.3%	6	421	1.4%	16	411	3.7%
	96+	0	18	0.0%	0	18	0.0%	0	18	0.0%	0	18	0.0%
	ALL	209	3138	6.2%	484	2863	14.5%	267	3080	8.0%	728	2619	21.8%

Failure Rate By Model Year Grouping - Third IM147 Max CO Cutpoints													
		HC			CO			NOx			OVERALL		
V Type	Year	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
LDGV	81-82	13	92	12.4%	29	76	27.6%	16	89	15.2%	46	59	43.8%
	83-85	29	199	12.7%	79	149	34.6%	39	189	17.1%	110	118	48.2%
	86-89	48	377	11.3%	77	348	18.1%	65	360	15.3%	137	288	32.2%
	90-95	24	928	2.5%	64	888	6.7%	35	917	3.7%	96	856	10.1%
	96+	0	70	0.0%	1	69	1.4%	0	70	0.0%	1	69	1.4%
LDGT1	81-85	31	229	11.9%	95	165	36.5%	47	213	18.1%	134	126	51.5%
	86-89	15	207	6.8%	43	179	19.4%	12	210	5.4%	56	166	25.2%
	90-95	3	447	0.7%	18	432	4.0%	10	440	2.2%	28	422	6.2%
	96+	0	32	0.0%	0	32	0.0%	1	31	3.1%	1	31	3.1%
LDGT2	81-85	16	78	17.0%	40	54	42.6%	13	81	13.8%	53	41	56.4%
	86-89	6	58	9.4%	13	51	20.3%	10	54	15.6%	23	41	35.9%
	88-95	3	424	0.7%	10	417	2.3%	7	420	1.6%	17	410	4.0%
	96+	0	18	0.0%	0	18	0.0%	0	18	0.0%	0	18	0.0%
	ALL	188	3159	5.6%	469	2878	14.0%	255	3092	7.6%	702	2645	21.0%

Failure Rate Startup Cutpoints												
	HC			CO			NOx			OVERALL		
V Type	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
First IM147												
LDGV	180	1600	10.1%	179	1601	10.1%	216	1564	12.1%	416	1364	23.4%
LDGT1	75	889	7.8%	37	927	3.8%	84	880	8.7%	166	798	17.2%
LDGT2	56	547	9.3%	37	566	6.1%	45	558	7.5%	103	500	17.1%
All	311	3036	9.3%	253	3094	7.6%	345	3002	10.3%	685	2662	20.5%
Second IM147												
LDGV	109	1671	6.1%	133	1647	7.5%	152	1628	8.5%	291	1489	16.3%
LDGT1	51	913	5.3%	40	924	4.1%	51	913	5.3%	115	849	11.9%
LDGT2	32	571	5.3%	31	572	5.1%	34	569	5.6%	74	529	12.3%
All	192	3155	5.7%	204	3143	6.1%	237	3110	7.1%	480	2867	14.3%
Third IM147												
LDGV	106	1674	6.0%	130	1650	7.3%	141	1639	7.9%	281	1499	15.8%
LDGT1	52	912	5.4%	33	931	3.4%	48	916	5.0%	108	856	11.2%
LDGT2	33	570	5.5%	30	573	5.0%	28	575	4.6%	67	536	11.1%
All	191	3156	5.7%	193	3154	5.8%	217	3130	6.5%	456	2891	13.6%

Failure Rate By Model Year Grouping - First IM147 Startup Cutpoints													
		HC			CO			NOx			OVERALL		
V Type	Year	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
LDGV	81-82	30	75	28.6%	13	92	12.4%	24	81	22.9%	48	57	45.7%
	83-85	56	172	24.6%	75	153	32.9%	49	179	21.5%	122	106	53.5%
	86-89	57	368	13.4%	50	375	11.8%	72	353	16.9%	128	297	30.1%
	90-95	36	916	3.8%	37	915	3.9%	71	881	7.5%	114	838	12.0%
	96+	1	69	1.4%	4	66	5.7%	0	70	0.0%	4	66	5.7%
LDGT1	81-85	44	216	16.9%	24	236	9.2%	21	239	8.1%	74	186	28.5%
	86-89	24	198	10.8%	11	211	5.0%	29	193	13.1%	53	169	23.9%
	90-95	7	443	1.6%	2	448	0.4%	32	418	7.1%	37	413	8.2%
	96+	0	32	0.0%	0	32	0.0%	2	30	6.3%	2	30	6.3%
LDGT2	81-85	29	65	30.9%	26	68	27.7%	9	85	9.6%	41	53	43.6%
	86-89	14	50	21.9%	6	58	9.4%	7	57	10.9%	20	44	31.3%
	88-95	13	414	3.0%	5	422	1.2%	29	398	6.8%	42	385	9.8%
	96+	0	18	0.0%	0	18	0.0%	0	18	0.0%	0	18	0.0%
	ALL	311	3036	9.3%	253	3094	7.6%	345	3002	10.3%	685	2662	20.5%

Failure Rate By Model Year Grouping - Second IM147 Startup Cutpoints														
		HC			CO			NOx			OVERALL			
V Type	Year	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	
LDGV	**81-82**	24	81	22.9%	13	92	12.4%	18	87	17.1%	38	67	36.2%	
	83-85	35	193	15.4%	53	175	23.2%	43	185	18.9%	92	136	40.4%	
	86-89	36	389	8.5%	42	383	9.9%	55	370	12.9%	101	324	23.8%	
	90-95	14	938	1.5%	25	927	2.6%	36	916	3.8%	60	892	6.3%	
	96+	0	70	0.0%	0	70	0.0%	0	70	0.0%	0	70	0.0%	
LDGT1	**81-85**	31	229	11.9%	23	237	8.8%	18	242	6.9%	58	202	22.3%	
	86-89	18	204	8.1%	14	208	6.3%	18	204	8.1%	39	183	17.6%	
	90-95	2	448	0.4%	3	447	0.7%	14	436	3.1%	17	433	3.8%	
	96+	0	32	0.0%	0	32	0.0%	1	31	3.1%	1	31	3.1%	
LDGT2	**81-85**	20	74	21.3%	23	71	24.5%	9	85	9.6%	35	59	37.2%	
	86-89	8	56	12.5%	5	59	7.8%	8	56	12.5%	16	48	25.0%	
	88-95	4	423	0.9%	3	424	0.7%	17	410	4.0%	23	404	5.4%	
	96+	0	18	0.0%	0	18	0.0%	0	18	0.0%	0	18	0.0%	
	ALL	192	3155	5.7%	204	3143	6.1%	237	3110	7.1%	480	2867	14.3%	

Failure Rate By Model Year Grouping - Third IM147 Startup Cutpoints													
		HC			CO			NOx			OVERALL		
V Type	Year	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
LDGV	**81-82**	23	82	21.9%	13	92	12.4%	14	91	13.3%	35	70	33.3%
	83-85	33	195	14.5%	56	172	24.6%	39	189	17.1%	90	138	39.5%
	86-89	35	390	8.2%	36	389	8.5%	56	369	13.2%	96	329	22.6%
	90-95	15	937	1.6%	24	928	2.5%	32	920	3.4%	59	893	6.2%
	96+	0	70	0.0%	1	69	1.4%	0	70	0.0%	1	69	1.4%
LDGT1	**81-85**	34	226	13.1%	20	240	7.7%	17	243	6.5%	56	204	21.5%
	86-89	17	205	7.7%	12	210	5.4%	16	206	7.2%	35	187	15.8%
	90-95	1	449	0.2%	1	449	0.2%	14	436	3.1%	16	434	3.6%
	96+	0	32	0.0%	0	32	0.0%	1	31	3.1%	1	31	3.1%
LDGT2	**81-85**	21	73	22.3%	22	72	23.4%	7	87	7.4%	33	61	35.1%
	86-89	9	55	14.1%	6	58	9.4%	7	57	10.9%	16	48	25.0%
	88-95	3	424	0.7%	2	425	0.5%	14	413	3.3%	18	409	4.2%
	96+	0	18	0.0%	0	18	0.0%	0	18	0.0%	0	18	0.0%
	ALL	191	3156	5.7%	193	3154	5.8%	217	3130	6.5%	456	2891	13.6%

Failure Rate Intermediate Cutpoints												
	HC			CO			NOx			OVERALL		
V Type	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
First IM147												
LDGV	286	1494	16.1%	238	1542	13.4%	281	1499	15.8%	533	1247	29.9%
LDGT1	121	843	12.6%	62	902	6.4%	122	842	12.7%	247	717	25.6%
LDGT2	84	519	13.9%	47	556	7.8%	71	532	11.8%	142	461	23.5%
All	491	2856	14.7%	347	3000	10.4%	474	2873	14.2%	922	2425	27.5%
Second IM147												
LDGV	170	1610	9.6%	161	1619	9.0%	214	1566	12.0%	386	1394	21.7%
LDGT1	87	877	9.0%	57	907	5.9%	78	886	8.1%	176	788	18.3%
LDGT2	46	557	7.6%	40	563	6.6%	48	555	8.0%	100	503	16.6%
All	303	3044	9.1%	258	3089	7.7%	340	3007	10.2%	662	2685	19.8%
Third IM147												
LDGV	157	1623	8.8%	161	1619	9.0%	196	1584	11.0%	367	1413	20.6%
LDGT1	80	884	8.3%	53	911	5.5%	73	891	7.6%	165	799	17.1%
LDGT2	40	563	6.6%	42	561	7.0%	42	561	7.0%	93	510	15.4%
All	277	3070	8.3%	256	3091	7.6%	311	3036	9.3%	625	2722	18.7%

Failure Rate By Model Year Grouping - First IM147 Intermediate Cutpoints													
		HC			CO			NOx			OVERALL		
V Type	Year	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
LDGV	81-82	52	53	49.5%	20	85	19.0%	27	78	25.7%	64	41	61.0%
	83-85	88	140	38.6%	91	137	39.9%	64	164	28.1%	146	82	64.0%
	86-89	94	331	22.1%	65	360	15.3%	100	325	23.5%	169	256	39.8%
	90-95	51	901	5.4%	58	894	6.1%	90	862	9.5%	150	802	15.8%
	96+	1	69	1.4%	4	66	5.7%	0	70	0.0%	4	66	5.7%
LDGT1	81-85	71	189	27.3%	42	218	16.2%	37	223	14.2%	117	143	45.0%
	86-89	36	186	16.2%	14	208	6.3%	39	183	17.6%	71	151	32.0%
	90-95	14	436	3.1%	6	444	1.3%	44	406	9.8%	57	393	12.7%
	96+	0	32	0.0%	0	32	0.0%	2	30	6.3%	2	30	6.3%
LDGT2	81-85	37	57	39.4%	32	62	34.0%	17	77	18.1%	53	41	56.4%
	86-89	19	45	29.7%	9	55	14.1%	10	54	15.6%	24	40	37.5%
	88-95	28	399	6.6%	6	421	1.4%	44	383	10.3%	65	362	15.2%
	96+	0	18	0.0%	0	18	0.0%	0	18	0.0%	0	18	0.0%
	ALL	491	2856	14.7%	347	3000	10.4%	474	2873	14.2%	922	2425	27.5%

Failure Rate By Model Year Grouping - Second IM147 Intermediate Cutpoints													
		HC			CO			NOx			OVERALL		
V Type	Year	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
LDGV	81-82	36	69	34.3%	15	90	14.3%	23	82	21.9%	49	56	46.7%
	83-85	51	177	22.4%	66	162	28.9%	60	168	26.3%	118	110	51.8%
	86-89	61	364	14.4%	50	375	11.8%	76	349	17.9%	134	291	31.5%
	90-95	22	930	2.3%	30	922	3.2%	55	897	5.8%	85	867	8.9%
	96+	0	70	0.0%	0	70	0.0%	0	70	0.0%	0	70	0.0%
LDGT1	81-85	57	203	21.9%	34	226	13.1%	31	229	11.9%	95	165	36.5%
	86-89	24	198	10.8%	18	204	8.1%	25	197	11.3%	52	170	23.4%
	90-95	6	444	1.3%	5	445	1.1%	21	429	4.7%	28	422	6.2%
	96+	0	32	0.0%	0	32	0.0%	1	31	3.1%	1	31	3.1%
LDGT2	81-85	29	65	30.9%	32	62	34.0%	15	79	16.0%	50	44	53.2%
	86-89	10	54	15.6%	5	59	7.8%	11	53	17.2%	19	45	29.7%
	88-95	7	420	1.6%	3	424	0.7%	22	405	5.2%	31	396	7.3%
	96+	0	18	0.0%	0	18	0.0%	0	18	0.0%	0	18	0.0%
	ALL	303	3044	9.1%	258	3089	7.7%	340	3007	10.2%	662	2685	19.8%

Failure Rate By Model Year Grouping - Third IM147 Intermediate Cutpoints													
		HC			CO			NOx			OVERALL		
V Type	Year	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
LDGV	81-82	34	71	32.4%	16	89	15.2%	20	85	19.0%	48	57	45.7%
	83-85	48	180	21.1%	66	162	28.9%	58	170	25.4%	113	115	49.6%
	86-89	56	369	13.2%	49	376	11.5%	72	353	16.9%	128	297	30.1%
	90-95	19	933	2.0%	29	923	3.0%	46	906	4.8%	77	875	8.1%
	96+	0	70	0.0%	1	69	1.4%	0	70	0.0%	1	69	1.4%
LDGT1	81-85	56	204	21.5%	34	226	13.1%	29	231	11.2%	92	168	35.4%
	86-89	21	201	9.5%	16	206	7.2%	25	197	11.3%	50	172	22.5%
	90-95	3	447	0.7%	3	447	0.7%	18	432	4.0%	22	428	4.9%
	96+	0	32	0.0%	0	32	0.0%	1	31	3.1%	1	31	3.1%
LDGT2	81-85	25	69	26.6%	31	63	33.0%	14	80	14.9%	47	47	50.0%
	86-89	10	54	15.6%	8	56	12.5%	8	56	12.5%	19	45	29.7%
	88-95	5	422	1.2%	3	424	0.7%	20	407	4.7%	27	400	6.3%
	96+	0	18	0.0%	0	18	0.0%	0	18	0.0%	0	18	0.0%
	ALL	277	3070	8.3%	256	3091	7.6%	311	3036	9.3%	625	2722	18.7%

Failure Rate Final Cutpoints												
	HC			CO			NOx			OVERALL		
V Type	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
First IM147												
LDGV	499	1281	28.0%	346	1434	19.4%	396	1384	22.2%	733	1047	41.2%
LDGT1	210	754	21.8%	109	855	11.3%	184	780	19.1%	348	616	36.1%
LDGT2	135	468	22.4%	66	537	10.9%	120	483	19.9%	219	384	36.3%
All	844	2503	25.2%	521	2826	15.6%	700	2647	20.9%	1300	2047	38.8%
Second IM147												
LDGV	309	1471	17.4%	247	1533	13.9%	296	1484	16.6%	539	1241	30.3%
LDGT1	137	827	14.2%	91	873	9.4%	134	830	13.9%	256	708	26.6%
LDGT2	77	526	12.8%	56	547	9.3%	88	515	14.6%	157	446	26.0%
All	523	2824	15.6%	394	2953	11.8%	518	2829	15.5%	952	2395	28.4%
Third IM147												
LDGV	280	1500	15.7%	240	1540	13.5%	277	1503	15.6%	507	1273	28.5%
LDGT1	120	844	12.4%	85	879	8.8%	127	837	13.2%	239	725	24.8%
LDGT2	73	530	12.1%	56	547	9.3%	82	521	13.6%	149	454	24.7%
All	473	2874	14.1%	381	2966	11.4%	486	2861	14.5%	895	2452	26.7%

Failure Rate By Model Year Grouping - First IM147 Final Cutpoints													
V Type		HC			CO			NOx			OVERALL		
	Year	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
LDGV	81-82	70	35	66.7%	30	75	28.6%	39	66	37.1%	78	27	74.3%
	83-85	148	80	64.9%	120	108	52.6%	81	147	35.5%	183	45	80.3%
	86-89	179	246	42.1%	102	323	24.0%	144	281	33.9%	247	178	58.1%
	90-95	100	852	10.5%	90	862	9.5%	132	820	13.9%	220	732	23.1%
	96+	2	68	2.9%	4	66	5.7%	0	70	0.0%	5	65	7.1%
LDGT1	81-85	116	144	44.6%	69	191	26.5%	70	190	26.9%	165	95	63.5%
	86-89	71	151	32.0%	29	193	13.1%	53	169	23.9%	104	118	46.8%
	90-95	23	427	5.1%	11	439	2.4%	59	391	13.1%	77	373	17.1%
	96+	0	32	0.0%	0	32	0.0%	2	30	6.3%	2	30	6.3%
LDGT2	81-85	50	44	53.2%	41	53	43.6%	32	62	34.0%	73	21	77.7%
	86-89	29	35	45.3%	14	50	21.9%	20	44	31.3%	42	22	65.6%
	88-95	56	371	13.1%	11	416	2.6%	68	359	15.9%	104	323	24.4%
	96+	0	18	0.0%	0	18	0.0%	0	18	0.0%	0	18	0.0%
	ALL	844	2503	25.2%	521	2826	15.6%	700	2647	20.9%	1300	2047	38.8%

Failure Rate By Model Year Grouping - Second IM147 Final Cutpoints													
		HC			CO			NOx			OVERALL		
V Type	Year	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
LDGV	81-82	56	49	53.3%	26	79	24.8%	37	68	35.2%	74	31	70.5%
	83-85	104	124	45.6%	91	137	39.9%	79	149	34.6%	157	71	68.9%
	86-89	110	315	25.9%	83	342	19.5%	101	324	23.8%	181	244	42.6%
	90-95	39	913	4.1%	47	905	4.9%	79	873	8.3%	127	825	13.3%
	96+	0	70	0.0%	0	70	0.0%	0	70	0.0%	0	70	0.0%
LDGT1	81-85	90	170	34.6%	63	197	24.2%	65	195	25.0%	145	115	55.8%
	86-89	36	186	16.2%	22	200	9.9%	39	183	17.6%	69	153	31.1%
	90-95	11	439	2.4%	6	444	1.3%	29	421	6.4%	41	409	9.1%
	96+	0	32	0.0%	0	32	0.0%	1	31	3.1%	1	31	3.1%
LDGT2	81-85	46	48	48.9%	41	53	43.6%	31	63	33.0%	72	22	76.6%
	86-89	14	50	21.9%	12	52	18.8%	18	46	28.1%	33	31	51.6%
	88-95	17	410	4.0%	3	424	0.7%	39	388	9.1%	52	375	12.2%
	96+	0	18	0.0%	0	18	0.0%	0	18	0.0%	0	18	0.0%
	ALL	523	2824	15.6%	394	2953	11.8%	518	2829	15.5%	952	2395	28.4%

Failure Rate By Model Year Grouping - Third IM147 Final Cutpoints													
		HC			CO			NOx			OVERALL		
V Type	Year	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail	Fail	Pass	% Fail
LDGV	81-82	53	52	50.5%	25	80	23.8%	32	73	30.5%	67	38	63.8%
	83-85	91	137	39.9%	88	140	38.6%	81	147	35.5%	156	72	68.4%
	86-89	100	325	23.5%	76	349	17.9%	96	329	22.6%	171	254	40.2%
	90-95	36	916	3.8%	50	902	5.3%	68	884	7.1%	112	840	11.8%
	96+	0	70	0.0%	1	69	1.4%	0	70	0.0%	1	69	1.4%
LDGT1	81-85	83	177	31.9%	57	203	21.9%	61	199	23.5%	137	123	52.7%
	86-89	31	191	14.0%	24	198	10.8%	36	186	16.2%	65	157	29.3%
	90-95	6	444	1.3%	4	446	0.9%	29	421	6.4%	36	414	8.0%
	96+	0	32	0.0%	0	32	0.0%	1	31	3.1%	1	31	3.1%
LDGT2	81-85	44	50	46.8%	41	53	43.6%	31	63	33.0%	73	21	77.7%
	86-89	16	48	25.0%	11	53	17.2%	17	47	26.6%	32	32	50.0%
	88-95	13	414	3.0%	4	423	0.9%	34	393	8.0%	44	383	10.3%
	96+	0	18	0.0%	0	18	0.0%	0	18	0.0%	0	18	0.0%
	ALL	473	2874	14.1%	381	2966	11.4%	486	2861	14.5%	895	2452	26.7%

APPENDIX C

IM147 Composite Regression Coefficients, HC, 1981 to 1985 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT1	81-85	0.73806	0.95039	13.5112	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT1	81-85	0.52814	0.34501	2.7265	5.5143	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT1	81-85	0.40889	0.23152	0.5547	3.2006	6.2124	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT1	81-85	0.38717	0.22535	-1.0106	3.4095	3.2694	3.5979	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT1	81-85	0.36872	0.23976	-0.8175	2.5639	3.1218	2.0148	3.4755	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT1	81-85	0.34978	0.25562	-2.8842	2.7609	1.8633	1.5365	2.3446	3.2626	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT1	81-85	0.33929	0.24395	-2.5969	2.4215	2.0512	1.644	0.5818	2.2896	2.9199	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT1	81-85	0.30707	0.21404	-0.9821	1.8007	1.4784	1.745	0.0989	0.8955	2.4381	4.82	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT1	81-85	0.30661	0.21485	-0.9303	1.7873	1.3395	1.7754	0.0281	0.6238	2.4791	4.5115	0.8987	.	.	.	.	.	.	.	.	.	.
P10	LDGT1	81-85	0.30246	0.21468	-1.189	1.8114	1.1577	2.1188	-0.3285	0.5235	2.6637	4.255	-0.5878	2.1284	.	.	.	.	.	.	.	.	.
P11	LDGT1	81-85	0.25475	0.05761	-0.2293	0.7411	1.0904	1.5866	0.0582	1.3727	1.9974	2.4699	0.822	1.4541	1.8008	.	.	.	.	.	.	.	.
P12	LDGT1	81-85	0.24251	0.05503	-0.1605	0.7753	0.9307	1.635	0.0664	1.336	2.0956	2.1337	0.2754	2.1379	1.2063	1.1106	.	.	.	.	.	.	.
P13	LDGT1	81-85	0.19345	0.05879	1.3617	0.2166	0.9329	1.5508	-0.1316	1.2355	2.3977	1.6874	0.0101	0.9701	0.9488	-0.4982	3.2351	.	.	.	.	.	.
P14	LDGT1	81-85	0.1631	0.04219	1.279	0.1384	1.1759	1.4082	0.0948	1.1156	2.0131	1.2938	0.729	1.1342	0.4477	-0.3274	1.562	4.0745	.	.	.	.	.
P15	LDGT1	81-85	0.13928	0.03346	1.8241	0.0799	1.2164	1.2299	0.2827	0.8749	2.2275	0.6681	0.8755	0.7239	0.5659	0.1723	0.7424	1.1987	2.7671	.	.	.	.
P16	LDGT1	81-85	0.13703	0.03021	1.8786	0.023	1.2823	1.1806	0.305	0.8514	2.2773	0.5758	0.8491	0.7433	0.5775	0.2633	0.6459	1.2728	2.0331	2.1897	.	.	.
P17	LDGT1	81-85	0.09132	0.00475	1.4179	0.434	0.6904	0.7838	1.0571	0.616	1.5938	0.7518	0.2064	0.8618	0.5896	0.4328	0.7951	1.3837	1.3066	0.6628	2.7633	.	.
P18	LDGT1	81-85	0.07314	-0.00235	1.5086	0.5696	0.7494	0.8068	0.8363	0.5804	1.3972	0.5907	0.4057	0.6221	0.5658	0.584	0.7038	0.8587	0.988	0.3277	1.9729	1.7883	.
P19	LDGT1	81-85	0.06979	-0.00621	1.375	0.6281	0.6996	0.852	0.9084	0.5029	1.4414	0.5441	0.3942	0.5659	0.6012	0.6081	0.7093	0.7313	0.6296	0.2443	1.7266	1.5869	0.729

IM147 Phase 2 Regression Coefficients, HC, 1981 to 1985 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT1	81-85	0.5023	0.12381	.	.	.	.	.	.	.	.	.	.	4.4447	.	.	.	.	.	.	.	.
B12	LDGT1	81-85	0.48187	0.11013	.	.	.	.	.	.	.	.	.	.	3.3244	1.9633	.	.	.	.	.	.	.
B13	LDGT1	81-85	0.35264	0.07757	.	.	.	.	.	.	.	.	.	.	1.7904	-1.1796	5.9021	.	.	.	.	.	.
B14	LDGT1	81-85	0.32195	0.06184	.	.	.	.	.	.	.	.	.	.	0.9978	-1.0185	3.8122	5.5161	.	.	.	.	.
B15	LDGT1	81-85	0.2826	0.04064	.	.	.	.	.	.	.	.	.	.	1.0928	0.0499	1.7408	0.7784	4.7049	.	.	.	.
B16	LDGT1	81-85	0.27957	0.0348	.	.	.	.	.	.	.	.	.	.	1.0816	0.2105	1.5379	0.9523	3.4207	3.6479	.	.	.
B17	LDGT1	81-85	0.14692	-0.01627	.	.	.	.	.	.	.	.	.	.	1.0035	0.5208	1.1766	2.2402	1.4703	0.4909	4.6919	.	.
B18	LDGT1	81-85	0.11692	-0.02022	.	.	.	.	.	.	.	.	.	.	0.9177	0.8016	0.9222	1.5324	0.8911	0.0868	3.252	2.7658	.
B19	LDGT1	81-85	0.11286	-0.02299	.	.	.	.	.	.	.	.	.	.	0.9799	0.8216	0.9206	1.4305	0.4043	0.0294	2.8156	2.4898	0.9698

IM147 Composite Regression Coefficients, HC, 1986 to 1989 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT1	86-89	0.49429	0.5423	17.2823	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT1	86-89	0.37436	0.2461	2.2738	4.5192	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT1	86-89	0.33313	0.22224	0.5252	2.5885	4.6599	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT1	86-89	0.29595	0.20426	0.5943	2.3293	2.3375	3.7634	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT1	86-89	0.2938	0.19895	0.6763	2.0377	2.3025	2.9749	1.8038	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT1	86-89	0.28058	0.20644	-0.6191	2.2969	1.2069	2.4549	-0.1084	4.2386	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT1	86-89	0.27458	0.19491	-0.0117	2.0167	1.3562	2.7382	-1.5023	2.6456	2.8231	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT1	86-89	0.26273	0.17858	0.9768	1.9562	1.0027	2.2073	-1.5778	1.5977	2.003	3.2606	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT1	86-89	0.25683	0.17484	0.544	2.0132	0.9204	2.1628	-2.2132	0.7045	2.0543	2.3838	3.4294	.	.	.	.	.	.	.	.	.	.
P10	LDGT1	86-89	0.25153	0.17214	0.4457	2.0253	0.8623	1.9864	-2.2523	0.4119	2.2232	1.6726	1.6078	3.6006	.	.	.	.	.	.	.	.	.
P11	LDGT1	86-89	0.19659	0.07478	2.1606	0.6298	1.0463	1.2006	-1.6683	1.7941	1.4349	0.7533	1.4174	2.3957	1.957	.	.	.	.	.	.	.	.
P12	LDGT1	86-89	0.17271	0.05609	2.4645	0.4889	0.5378	1.0905	-0.6636	1.2017	1.3698	1.1634	0.8772	3.332	1.2131	1.5195	.	.	.	.	.	.	.
P13	LDGT1	86-89	0.13816	0.05847	2.1195	0.4529	0.7286	1.2692	-0.7285	1.427	1.284	0.6442	0.4274	2.4657	0.9117	0.2322	2.6432	.	.	.	.	.	.
P14	LDGT1	86-89	0.12661	0.04856	2.2389	0.3811	0.6514	1.4033	-0.4687	1.3427	1.1456	0.9582	0.0864	2.2192	0.7164	0.4248	1.479	2.6071	.	.	.	.	.
P15	LDGT1	86-89	0.11362	0.03727	2.1223	0.3411	0.6537	1.4601	-0.202	1.1529	1.232	0.6887	-0.2172	2.1843	0.7658	0.6133	0.9282	0.7457	2.1404	.	.	.	.
P16	LDGT1	86-89	0.10769	0.03525	1.9852	0.3076	0.7867	1.4374	-0.022	1.1859	1.1329	0.515	-0.1541	2.0989	0.7572	0.7681	0.784	0.499	0.7808	4.7323	.	.	.
P17	LDGT1	86-89	0.05356	0.01318	1.0985	0.6236	0.7621	0.7653	0.5658	1.0327	0.7036	0.4129	0.7975	1.2149	0.7601	0.6019	0.8454	0.937	0.7894	0.9132	3.009	.	.
P18	LDGT1	86-89	0.04127	0.00269	1.2483	0.5985	0.678	0.9508	0.3871	1.095	0.7732	0.6052	0.8039	0.761	0.6892	0.7308	0.7205	0.82	0.9126	0.0726	2.0163	1.4844	.
P19	LDGT1	86-89	0.03395	0.00397	1.0933	0.6168	0.695	0.9028	0.4507	1.0319	0.9511	0.5369	0.7983	0.6339	0.6758	0.6909	0.7183	0.7503	0.7572	-0.3355	1.6677	1.2005	0.8458

IM147 Phase 2 Regression Coefficients, HC, 1986 to 1989 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT1	86-89	0.29834	0.1158	.	.	.	.	.	.	.	.	.	.	3.3457	.	.	.	.	.	.	.	.
B12	LDGT1	86-89	0.26979	0.09053	.	.	.	.	.	.	.	.	.	.	2.3987	1.9564	.	.	.	.	.	.	.
B13	LDGT1	86-89	0.20617	0.08073	.	.	.	.	.	.	.	.	.	.	1.4658	0.0492	4.1671	.	.	.	.	.	.
B14	LDGT1	86-89	0.19052	0.06515	.	.	.	.	.	.	.	.	.	.	1.1799	0.3012	2.4794	3.6519	.	.	.	.	.
B15	LDGT1	86-89	0.16882	0.04542	.	.	.	.	.	.	.	.	.	.	1.1829	0.6531	1.4949	0.6859	3.2881	.	.	.	.
B16	LDGT1	86-89	0.16083	0.04255	.	.	.	.	.	.	.	.	.	.	1.1483	0.9014	1.2632	0.3783	1.3378	6.662	.	.	.
B17	LDGT1	86-89	0.07626	0.01566	.	.	.	.	.	.	.	.	.	.	1.0548	0.7801	1.1751	1.2709	1.2392	0.9683	4.2486	.	.
B18	LDGT1	86-89	0.05999	0.00012	.	.	.	.	.	.	.	.	.	.	0.9466	0.9733	1.0114	1.038	1.3674	-0.1144	2.9584	1.987	.
B19	LDGT1	86-89	0.04869	0.00402	.	.	.	.	.	.	.	.	.	.	0.9313	0.9308	0.9901	0.9768	1.1033	-0.6703	2.4005	1.5697	1.23

IM147 Composite Regression Coefficients, HC, 1990 to 1995 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT1	90-95	0.37406	0.22818	17.1854	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT1	90-95	0.23507	0.05902	-2.145	5.1262	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT1	90-95	0.21189	0.05784	-1.1729	3.3619	3.4597	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT1	90-95	0.20276	0.05212	-2.7245	3.2374	1.6019	3.7987	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT1	90-95	0.19505	0.05057	-3.0392	2.7597	1.1351	2.24	3.8993	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT1	90-95	0.18478	0.05162	-3.3501	2.6388	0.6397	1.4629	1.9249	4.9984	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT1	90-95	0.17282	0.04206	-2.9083	2.3805	0.6434	1.9124	-0.3621	3.0178	4.1577	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT1	90-95	0.16217	0.03882	-1.4065	1.7566	1.0327	1.3221	-0.6046	1.7837	2.9574	4.5516	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT1	90-95	0.15997	0.03954	-1.5284	1.8223	0.7356	1.6157	-0.8447	0.9682	2.5193	3.7565	3.0158	.	.	.	.	.	.	.	.	.	.
P10	LDGT1	90-95	0.15899	0.03962	-1.3222	1.7605	0.8841	1.526	-0.7219	0.6441	2.5385	3.3964	1.3921	2.2962	.	.	.	.	.	.	.	.	.
P11	LDGT1	90-95	0.1242	0.00888	0.4575	0.8942	1.2216	1.078	-0.2219	0.7626	1.9585	1.2513	1.7074	1.5915	1.5461	.	.	.	.	.	.	.	.
P12	LDGT1	90-95	0.108	0.00853	0.5588	0.7543	0.7122	1.489	-0.1897	0.6244	1.9355	0.7067	0.8076	2.4795	0.9978	1.8755	.	.	.	.	.	.	.
P13	LDGT1	90-95	0.08846	0.01744	0.8836	0.5089	0.8095	1.7266	0.0115	0.5537	1.4386	0.4008	0.5776	1.904	0.7549	0.8219	2.3703	.	.	.	.	.	.
P14	LDGT1	90-95	0.07835	0.01772	0.858	0.474	0.6951	1.5244	0.3476	0.7542	1.4394	0.4383	0.7477	2.2305	0.5943	0.9555	0.9132	2.1616	.	.	.	.	.
P15	LDGT1	90-95	0.06853	0.01326	0.7115	0.5394	0.7616	1.4283	0.4159	0.4769	1.3363	0.4071	0.6623	1.647	0.6826	0.8356	0.5762	0.7447	2.2358	.	.	.	.
P16	LDGT1	90-95	0.0593	0.01319	0.6956	0.6235	0.517	1.2912	0.6027	0.5332	1.4561	0.3365	0.4783	1.6692	0.6904	0.8659	0.7576	0.7049	0.1973	5.5813	.	.	.
P17	LDGT1	90-95	0.04054	0.0066	0.721	0.7143	0.508	0.9341	0.7735	0.3397	1.3289	0.8072	0.4656	0.9685	0.6893	0.7801	0.6168	0.8507	0.941	2.2139	2.3062	.	.
P18	LDGT1	90-95	0.03216	0.00497	0.6809	0.6934	0.5834	0.9437	0.759	0.6708	0.9442	0.9559	0.356	0.8599	0.6671	0.8103	0.5884	1.0269	0.3629	1.3443	1.5874	1.5359	.
P19	LDGT1	90-95	0.02955	0.00468	0.7103	0.6964	0.6123	0.9353	0.834	0.5442	0.9229	0.8944	0.4112	0.8891	0.6898	0.7038	0.6909	0.7838	0.3123	0.6669	1.5046	1.3036	0.7468

IM147 Phase 2 Regression Coefficients, HC, 1990 to 1995 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT1	90-95	0.19826	0.0335	.	.	.	.	.	.	.	.	.	.	3.1539	.	.	.	.	.	.	.	.
B12	LDGT1	90-95	0.16235	0.0226	.	.	.	.	.	.	.	.	.	.	1.7885	3.1368	.	.	.	.	.	.	.
B13	LDGT1	90-95	0.12683	0.02868	.	.	.	.	.	.	.	.	.	.	1.1305	1.1678	3.5627	.	.	.	.	.	.
B14	LDGT1	90-95	0.11708	0.02986	.	.	.	.	.	.	.	.	.	.	0.9821	1.3215	2.042	2.4823	.	.	.	.	.
B15	LDGT1	90-95	0.09769	0.0205	.	.	.	.	.	.	.	.	.	.	1.024	1.124	1.0503	0.5065	3.5529	.	.	.	.
B16	LDGT1	90-95	0.08453	0.02072	.	.	.	.	.	.	.	.	.	.	1.0421	1.0995	1.3341	0.4695	0.6556	7.7639	.	.	.
B17	LDGT1	90-95	0.05719	0.01154	.	.	.	.	.	.	.	.	.	.	1.0027	0.9977	1.0045	0.9826	1.4994	2.7725	3.1834	.	.
B18	LDGT1	90-95	0.04461	0.008	.	.	.	.	.	.	.	.	.	.	0.9558	1.0711	0.8811	1.2953	0.5862	1.7403	2.1672	2.144	.
B19	LDGT1	90-95	0.04108	0.00785	.	.	.	.	.	.	.	.	.	.	0.9823	0.9356	1.0185	0.9731	0.499	0.8303	2.0505	1.8394	1.0152

IM147 Composite Regression Coefficients, HC, 1996 and Newer Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT1	96+	0.05316	0.03402	18.1995																		
P2	LDGT1	96+	0.04307	0.02411	0.2121	2.417																	
P3	LDGT1	96+	0.03308	0.02193	2.6279	1.1433	2.9158																
P4	LDGT1	96+	0.0321	0.02215	3.4627	1.1835	1.5689	1.9266															
P5	LDGT1	96+	0.0267	0.01928	1.088	0.5294	2.0247	-3.8687	8.4714														
P6	LDGT1	96+	0.02641	0.01933	0.5547	0.4887	1.8979	-4.0225	7.8031	1.8996													
P7	LDGT1	96+	0.02534	0.01654	0.953	0.3268	2.2496	-3.2672	4.7342	1.2515	3.3211												
P8	LDGT1	96+	0.02524	0.01597	-1.5963	0.6417	2.0178	-4.3447	3.8465	1.9882	2.8209	1.9699											
P9	LDGT1	96+	0.02522	0.0165	-0.9944	0.5289	2.1342	-4.3968	4.6568	1.7412	2.8435	2.4683	-2.6396										
P10	LDGT1	96+	0.02529	0.01642	-1.4673	0.5347	2.3503	-5.1056	4.7009	2.0105	2.7607	2.6563	-1.6108	-0.7547									
P11	LDGT1	96+	0.01755	0.00739	3.4599	0.1081	1.652	-1.1947	3.4359	0.4622	0.6672	0.794	-0.5304	-0.2246	1.7144								
P12	LDGT1	96+	0.0151	0.00659	3.8459	0.4104	0.2567	1.1211	0.4848	0.8471	1.2853	0.5367	1.1122	0.0179	1.1163	1.9287							
P13	LDGT1	96+	0.01241	0.00389	1.7514	0.4378	1.7539	-0.5187	-0.8979	0.5987	2.4378	1.2817	1.9041	-1.2482	0.9844	0.1784	2.6171						
P14	LDGT1	96+	0.01176	0.00367	1.875	0.4721	1.4005	-0.0285	-0.4781	0.4911	2.4771	0.9339	1.5111	-0.5207	0.7769	0.1877	2.2359	1.1134					
P15	LDGT1	96+	0.00769	0.00241	1.0482	0.6074	0.9552	-0.3978	1.4364	1.1394	0.7747	1.4416	0.0533	-0.1206	0.7233	0.4499	1.3519	0.2003	2.2561				
P16	LDGT1	96+	0.00774	0.0024	1.0165	0.6108	0.9582	-0.4078	1.4359	1.1436	0.7653	1.4501	0.0568	-0.1213	0.7218	0.4484	1.3528	0.1992	2.2428	0.0735			
P17	LDGT1	96+	0.00585	0.00306	1.3687	0.5499	1.0977	0.7636	0.4488	0.6346	0.7879	0.6314	0.3617	0.6995	0.7613	0.3632	1.0963	0.709	0.7912	1.2412	3.4916		
P18	LDGT1	96+	0.00432	0.00121	1.569	0.5806	0.9368	0.6842	0.9482	0.5032	0.7086	0.6239	0.5212	0.4646	0.6817	0.6338	0.8277	0.6983	0.744	0.4028	2.2628	1.7838	
P19	LDGT1	96+	0.00416	0.00114	1.2715	0.6218	0.8437	1.0272	0.6835	0.4345	0.8099	0.3982	0.7078	0.75	0.6649	0.7239	0.6761	0.8112	0.5347	0.2273	2.2233	1.3046	0.5973

IM147 Phase 2 Regression Coefficients, HC, 1996 and Newer Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT1	96+	0.02393	0.00865											2.4226								
B12	LDGT1	96+	0.02095	0.00863											1.6528	1.9763							
B13	LDGT1	96+	0.01824	0.00691											1.444	0.667	2.5512						
B14	LDGT1	96+	0.01653	0.00607											1.2007	0.3963	2.3614	1.9099					
B15	LDGT1	96+	0.01077	0.00256											1.0854	0.6091	1.8127	0.4665	3.018				
B16	LDGT1	96+	0.01076	0.00241											1.0549	0.6405	1.7899	0.4709	2.8141	0.9908			
B17	LDGT1	96+	0.00794	0.00414											0.8756	0.7439	1.2805	1.0073	1.458	1.4709	3.9228		
B18	LDGT1	96+	0.00581	0.00161											0.8235	0.9534	1.0124	1.0609	1.0031	0.8433	3.018	2.4016	
B19	LDGT1	96+	0.00549	0.00161											0.823	1.0394	0.8747	1.0551	0.9342	0.2958	2.5227	1.8686	0.7675

IM147 Composite Regression Coefficients, HC, 1981 to 1985 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT2	81-85	0.92959	1.08952	14.1316	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT2	81-85	0.49433	0.24032	2.1062	6.4379	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT2	81-85	0.47471	0.22581	0.921	5.3132	2.7842	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT2	81-85	0.43631	0.17782	-1.7872	5.4763	0.3261	3.8518	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT2	81-85	0.42908	0.2114	-1.5166	4.7372	0.0105	2.9709	2.5245	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT2	81-85	0.41687	0.23473	-3.8569	4.5338	-0.9009	2.7375	1.9498	3.2209	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT2	81-85	0.41066	0.23366	-3.2863	4.2499	-1.1231	2.3552	1.2812	2.4743	2.1991	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT2	81-85	0.3672	0.16688	-1.6179	3.5835	-0.8816	1.6341	-0.5481	3.1967	0.3748	5.7221	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT2	81-85	0.3566	0.18117	-1.9127	3.5055	-0.9418	2.6495	-0.9804	1.9891	0.0338	4.0901	3.7721	.	.	.	.	.	.	.	.	.	.
P10	LDGT2	81-85	0.34151	0.16655	-1.8705	3.3075	-0.9637	3.3159	-1.7891	1.43	-0.0942	4.2235	1.3603	3.899	.	.	.	.	.	.	.	.	.
P11	LDGT2	81-85	0.2931	-0.04548	1.0746	1.8029	-1.2122	2.864	-0.6499	0.7309	0.2679	3.2607	-0.113	4.0698	1.9325	.	.	.	.	.	.	.	.
P12	LDGT2	81-85	0.2758	-0.01823	0.7863	1.8538	-0.984	2.6077	-0.7763	0.9299	0.773	2.1956	-0.3985	4.4575	0.873	2.4503	.	.	.	.	.	.	.
P13	LDGT2	81-85	0.21405	-0.01142	0.4126	1.5075	-0.6583	2.6141	-0.5064	0.917	1.449	-0.2757	1.0903	2.7846	0.8509	0.03	3.3522	.	.	.	.	.	.
P14	LDGT2	81-85	0.17574	-0.01255	0.2502	1.2847	-0.0742	1.733	0.4325	1.3417	1.2187	0.2611	1.1197	1.7719	0.3758	0.7006	0.8312	4.2084	.	.	.	.	.
P15	LDGT2	81-85	0.15062	-0.02221	0.8141	1.325	-0.0587	1.4355	0.2426	1.2996	1.3459	0.694	0.5531	1.836	0.507	0.8254	-0.1245	2.1165	2.3277	.	.	.	.
P16	LDGT2	81-85	0.14738	-0.02755	1.0121	1.3194	-0.0133	1.4206	0.2735	1.0742	1.3679	0.895	0.1188	2.0783	0.5591	0.9525	-0.3444	1.9718	1.5317	2.7401	.	.	.
P17	LDGT2	81-85	0.11644	-0.04735	1.4605	1.1844	0.1561	0.8181	0.2509	0.6122	1.2664	1.4097	-0.3806	2.1461	0.6223	0.997	-0.2513	1.5706	1.3565	1.6797	2.2361	.	.
P18	LDGT2	81-85	0.10411	-0.05875	1.9421	1.2153	0.2284	0.6248	0.1763	0.9731	0.9762	1.0664	-0.3199	1.6679	0.7965	0.7901	0.01	1.0203	0.9553	1.6582	1.5344	1.4185	.
P19	LDGT2	81-85	0.08606	-0.02861	1.9188	1.1185	0.3074	0.5037	0.6515	0.9559	0.5634	1.1722	0.4972	1.0016	0.7179	0.584	0.4013	1.317	0.5551	-0.9186	1.2833	0.9697	1.3485

IM147 Phase 2 Regression Coefficients, HC, 1981 to 1985 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT2	81-85	0.53604	-0.06735	.	.	.	.	.	.	.	.	.	.	4.7635	.	.	.	.	.	.	.	.
B12	LDGT2	81-85	0.50867	-0.03629	.	.	.	.	.	.	.	.	.	.	2.9814	3.9143	.	.	.	.	.	.	.
B13	LDGT2	81-85	0.37516	-0.03573	.	.	.	.	.	.	.	.	.	.	2.2833	-1.1494	5.7782	.	.	.	.	.	.
B14	LDGT2	81-85	0.31715	-0.05881	.	.	.	.	.	.	.	.	.	.	1.5613	0.0866	1.7691	6.5887	.	.	.	.	.
B15	LDGT2	81-85	0.29115	-0.05873	.	.	.	.	.	.	.	.	.	.	1.6798	0.2156	0.484	3.6579	3.2814	.	.	.	.
B16	LDGT2	81-85	0.28504	-0.05551	.	.	.	.	.	.	.	.	.	.	1.6963	0.4373	0.1942	3.4658	1.7593	4.9957	.	.	.
B17	LDGT2	81-85	0.19206	-0.07062	.	.	.	.	.	.	.	.	.	.	1.2418	0.7375	0.4405	2.7184	1.6887	1.1505	4.1633	.	.
B18	LDGT2	81-85	0.17741	-0.07525	.	.	.	.	.	.	.	.	.	.	1.3222	0.5566	0.4852	2.1651	0.9953	1.6325	3.2854	1.6783	.
B19	LDGT2	81-85	0.15121	-0.03936	.	.	.	.	.	.	.	.	.	.	1.1587	0.4814	1.1411	2.1958	0.3955	-1.7449	2.7898	1.0076	1.9981

IM147 Composite Regression Coefficients, HC, 1986 to 1987 Model Year LDGT2's

Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
					Regression Coefficients																		
P1	LDGT2	86-87	0.76767	0.79061	14.82																		
P2	LDGT2	86-87	0.53753	0.28237	1.2627	6.2363																	
P3	LDGT2	86-87	0.38485	0.18393	-0.7945	3.7354	5.7608																
P4	LDGT2	86-87	0.34875	0.16586	-2.6149	3.7629	2.8334	4.1762															
P5	LDGT2	86-87	0.34617	0.17953	-3.6873	3.212	2.761	3.4285	2.4018														
P6	LDGT2	86-87	0.29325	0.20542	-3.5626	3.7025	1.7413	0.4872	1.0679	4.3236													
P7	LDGT2	86-87	0.2934	0.19684	-3.5264	3.6876	1.7296	0.6143	0.2317	4.2624	0.8683												
P8	LDGT2	86-87	0.28213	0.17396	-1.8292	3.3926	1.1562	0.6702	0.0208	3.449	0.3557	2.8062											
P9	LDGT2	86-87	0.27183	0.1983	-1.1117	3.3764	1.0296	0.699	0.2722	2.4556	0.8353	0.6	2.1369										
P10	LDGT2	86-87	0.26655	0.20643	-0.6291	3.3422	0.5757	0.6074	0.6213	2.1855	0.9202	0.0129	1.3566	1.7368									
P11	LDGT2	86-87	0.23982	0.0819	0.4024	2.3049	0.6701	0.0523	1.2179	2.4136	0.3361	0.0779	0.9104	1.6901	1.4014								
P12	LDGT2	86-87	0.21585	0.04628	0.8765	1.6118	0.7539	0.3407	0.9193	1.8565	0.8585	0.4701	0.4832	1.6797	1.0229	2.1489							
P13	LDGT2	86-87	0.17953	0.04669	1.6471	0.9949	0.685	1.0029	0.4324	1.1786	0.7455	0.9956	-0.3607	1.9373	1.0646	0.024	2.6969						
P14	LDGT2	86-87	0.16923	0.01715	2.1778	0.6591	1.0222	0.7528	0.0545	1.7038	0.8256	0.5799	0.1446	1.6426	1.1863	0.1661	1.154	2.4636					
P15	LDGT2	86-87	0.16212	0.02841	2.045	0.4649	0.7435	1.0759	0.3389	1.3816	1.0395	0.9294	0.0477	1.5028	1.0456	0.1781	0.9342	1.5234	1.2274				
P16	LDGT2	86-87	0.15721	0.03244	2.1199	0.4169	0.672	0.9335	0.3563	1.582	1.3979	0.0804	0.2926	1.6162	1.1907	0.4448	0.6092	0.8887	0.3523	3.6537			
P17	LDGT2	86-87	0.08118	-0.01059	0.6472	0.7516	0.3931	0.9394	1.5188	0.882	0.3132	0.5162	0.8422	0.3101	0.8207	0.6645	0.7572	1.2216	0.5723	1.2293	3.38		
P18	LDGT2	86-87	0.06878	-0.02245	0.747	0.8866	0.3561	0.7928	1.5497	0.9638	-0.0777	0.7405	0.8591	0.4782	0.7233	0.7721	0.8208	0.8129	0.6412	0.1007	2.9199	1.2143	
P19	LDGT2	86-87	0.05744	-0.02534	0.8277	0.9324	0.4772	0.6834	1.4838	0.7072	0.6021	0.5295	0.8642	0.1132	0.7642	0.7717	0.5785	0.3706	0.4851	0.0561	2.1533	0.9384	1.4322

IM147 Phase 2 Regression Coefficients, HC, 1986 to 1987 Model Year LDGT2's

Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
					Regression Coefficients																		
B11	LDGT2	86-87	0.42555	0.04924											4.1247								
B12	LDGT2	86-87	0.34262	0.01535											2.3444	4.5554							
B13	LDGT2	86-87	0.26401	0.06727											1.8518	0.0098	4.3001						
B14	LDGT2	86-87	0.26019	0.04305											1.8614	0.0618	3.3888	1.611					
B15	LDGT2	86-87	0.24666	0.06334											1.6413	0.0316	2.594	0.5597	1.9278				
B16	LDGT2	86-87	0.24422	0.06216											1.731	0.2275	2.4543	-0.1869	1.1753	3.2006			
B17	LDGT2	86-87	0.11773	-0.01838											1.1424	0.827	1.1111	1.9999	0.6793	1.223	4.3846		
B18	LDGT2	86-87	0.10087	-0.03741											1.0229	1.0633	1.2587	1.1759	0.8269	0.1785	3.8251	1.6179	
B19	LDGT2	86-87	0.09638	-0.03963											1.0707	1.0296	1.0107	1.2016	0.7069	-0.201	3.2092	1.6709	0.8058

IM147 Composite Regression Coefficients, HC, 1988 to 1995 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT2	88-95	0.48034	0.5235	11.3071																		
P2	LDGT2	88-95	0.33713	0.21906	-2.96	4.9422																	
P3	LDGT2	88-95	0.29651	0.19834	-1.7489	2.8353	4.9489																
P4	LDGT2	88-95	0.28747	0.18089	-1.9477	2.7951	2.9733	3.2647															
P5	LDGT2	88-95	0.27016	0.17705	-2.2098	1.8312	2.2325	1.406	5.8661														
P6	LDGT2	88-95	0.25421	0.19481	-2.5612	2.2441	0.5267	0.4177	3.0039	5.8248													
P7	LDGT2	88-95	0.24477	0.17308	-2.1598	1.867	0.6968	0.5785	0.8635	4.352	4.2662												
P8	LDGT2	88-95	0.22604	0.14292	-1.1587	1.5845	0.5456	0.1762	0.5776	1.9469	3.7472	4.4401											
P9	LDGT2	88-95	0.22226	0.14551	-1.2733	1.703	0.284	0.1479	0.9179	0.6334	3.6501	3.448	2.3522										
P10	LDGT2	88-95	0.21442	0.13617	-0.7091	1.5866	0.3214	0.3077	0.4365	-0.1063	3.9046	2.8806	-0.9464	5.4516									
P11	LDGT2	88-95	0.1654	0.04125	0.6538	0.773	0.5132	0.6898	0.6807	0.4255	2.0621	1.1813	0.4048	2.5588	2.1807								
P12	LDGT2	88-95	0.14608	0.03783	1.0502	0.5966	0.307	0.8399	0.3903	0.6138	1.7604	1.3774	-0.14	2.8081	1.4104	2.3284							
P13	LDGT2	88-95	0.08638	0.03352	1.3017	0.5004	0.8055	0.8896	0.2765	1.4656	0.5695	0.5182	0.3106	1.2433	0.9247	-0.2803	4.1519						
P14	LDGT2	88-95	0.07556	0.02491	1.2979	0.524	0.7653	0.8982	0.3475	1.5181	0.5104	0.7567	0.2981	1.4094	0.6811	0.0851	2.7444	1.9985					
P15	LDGT2	88-95	0.06718	0.02356	1.1938	0.5183	0.8188	0.8118	0.379	1.4304	0.7007	0.8512	0.4013	1.2797	0.6663	0.2996	1.6768	0.8504	1.7815				
P16	LDGT2	88-95	0.06237	0.02258	1.1224	0.5458	0.8938	0.7295	0.4333	1.4798	0.6019	0.7965	0.4454	1.2725	0.6721	0.4389	1.2102	0.7846	1.1152	3.1105			
P17	LDGT2	88-95	0.04421	0.01056	0.9076	0.7137	0.6003	0.6133	0.8089	0.9512	0.7459	0.7414	0.5887	0.9827	0.6061	0.6414	0.972	0.8458	1.1687	1.7368	1.9774		
P18	LDGT2	88-95	0.03718	0.00462	0.9099	0.6818	0.6872	0.6822	0.7561	0.9525	0.6907	0.7852	0.6052	1.0177	0.6169	0.7309	0.6146	0.7739	1.0312	0.9695	1.4043	1.372	
P19	LDGT2	88-95	0.03217	0.00297	0.8825	0.7085	0.7059	0.6951	0.7723	0.8271	0.7424	0.7667	0.703	0.8462	0.6346	0.6886	0.6361	0.6291	0.7448	0.7476	1.2353	1.0716	0.9076

IM147 Phase 2 Regression Coefficients, HC, 1988 to 1995 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT2	88-95	0.23751	0.05786											3.8759								
B12	LDGT2	88-95	0.2067	0.04911											2.4274	3.3621							
B13	LDGT2	88-95	0.1199	0.03897											1.2412	-0.4078	5.5892						
B14	LDGT2	88-95	0.10757	0.02785											1.0283	0.0365	3.9664	2.4645					
B15	LDGT2	88-95	0.09668	0.02657											1.0392	0.3282	2.5887	0.8805	2.4135				
B16	LDGT2	88-95	0.09084	0.02471											1.0542	0.5363	1.9743	0.7835	1.5325	4.1018			
B17	LDGT2	88-95	0.06106	0.01248											0.8883	0.8408	1.4659	1.0499	1.5851	2.3095	2.7427		
B18	LDGT2	88-95	0.05212	0.00425											0.9142	0.9654	1.0256	0.9252	1.4081	1.2094	2.0957	1.7973	
B19	LDGT2	88-95	0.0449	0.00374											0.9299	0.9243	1.0294	0.748	0.9948	0.9323	1.7813	1.4026	1.2714

IM147 Composite Regression Coefficients, HC, 1996 and Newer Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT2	96+	0.07243	0.06002	10.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT2	96+	0.04564	0.0237	-7.2812	4.6718	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT2	96+	0.04313	0.03223	-2.4032	1.3094	6.1404	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT2	96+	0.03729	0.03292	-1.4437	2.1679	-2.2327	9.7739	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT2	96+	0.02887	0.03311	-7.1815	1.5592	3.8084	-6.997	8.5612	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT2	96+	0.02468	0.03246	-5.2125	2.8958	-0.7992	-3.162	2.3757	7.8985	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT2	96+	0.02471	0.03212	-5.6903	2.6269	-0.3486	-3.879	1.8571	6.769	2.1598	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT2	96+	0.02458	0.03221	-5.7203	2.2642	1.1436	-7.0745	3.5654	5.3631	0.5718	2.5776	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT2	96+	0.02153	0.02755	-5.6174	3.2239	-0.1186	-6.6505	2.7679	1.8663	-1.0747	0.5327	8.5733	.	.	.	.	.	.	.	.	.	.
P10	LDGT2	96+	0.02175	0.0276	-5.5557	3.1793	-0.113	-6.663	2.9877	1.5294	-1.4181	0.9223	7.6307	0.9647	.	.	.	.	.	.	.	.	.
P11	LDGT2	96+	0.01561	0.01512	-0.1593	1.3225	0.8979	-3.5644	1.4176	3.2321	-2.661	2.4201	3.7658	1.2056	1.069	.	.	.	.	.	.	.	.
P12	LDGT2	96+	0.01535	0.01155	0.1184	1.3108	0.2317	-1.9686	1.0103	3.2791	-1.9369	2.0526	2.5266	1.346	0.9439	0.9442	.	.	.	.	.	.	.
P13	LDGT2	96+	0.0118	0.00591	0.5316	0.8014	1.3453	-1.5835	1.0716	4.5702	-0.6276	1.6068	1.2052	-0.739	0.9742	-0.8137	3.1462	.	.	.	.	.	.
P14	LDGT2	96+	0.00894	0.00333	0.9294	0.6687	0.8295	0.2036	0.5645	4.0094	0.2628	1.1846	-0.1226	0.2024	0.7931	-0.6864	2.3879	2.3089	.	.	.	.	.
P15	LDGT2	96+	0.00519	0.00298	0.5728	0.3247	2.2863	-2.5268	2.2831	1.4541	-0.658	2.6037	-0.4889	1.5224	0.8251	-0.0309	1.4354	0.4248	1.7293	.	.	.	.
P16	LDGT2	96+	0.00341	0.00091	0.6938	0.6433	0.9494	-0.2435	1.2108	1.9848	0.1134	1.3832	0.4148	0.7129	0.7604	0.2037	1.1446	0.8148	0.7145	4.0429	.	.	.
P17	LDGT2	96+	0.003	0.0006	0.5483	0.8035	0.6446	0.0208	1.0382	2.0883	0.1055	1.0991	0.7076	0.6796	0.7787	0.2756	1.0048	0.7528	0.7994	3.2034	1.1992	.	.
P18	LDGT2	96+	0.00229	0.00034	0.8423	0.7701	0.5405	0.6178	0.7621	1.54	0.2461	0.9463	0.785	0.7135	0.7393	0.5553	0.7347	0.5376	0.9234	2.5586	0.3528	1.0986	.
P19	LDGT2	96+	0.00148	-0.00015	0.5489	0.7737	0.6253	0.5369	0.7319	1.0865	0.7396	0.777	0.8586	0.6472	0.714	0.5043	0.8109	0.8951	0.552	1.6026	0.688	0.6722	0.8733

IM147 Phase 2 Regression Coefficients, HC, 1996 and Newer Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT2	96+	0.02667	0.01375	.	.	.	.	.	.	.	.	.	.	1.9495	.	.	.	.	.	.	.	.
B12	LDGT2	96+	0.02266	0.00456	.	.	.	.	.	.	.	.	.	.	1.3011	3.138	.	.	.	.	.	.	.
B13	LDGT2	96+	0.01837	-0.00086	.	.	.	.	.	.	.	.	.	.	1.3623	0.2518	4.0937	.	.	.	.	.	.
B14	LDGT2	96+	0.015	-0.00298	.	.	.	.	.	.	.	.	.	.	1.1501	0.0589	2.9165	3.3772	.	.	.	.	.
B15	LDGT2	96+	0.01018	-0.00336	.	.	.	.	.	.	.	.	.	.	1.1443	0.9415	1.7337	0.5943	2.5841	.	.	.	.
B16	LDGT2	96+	0.00753	-0.00463	.	.	.	.	.	.	.	.	.	.	1.0828	1.0417	1.2129	0.903	1.0508	6.8124	.	.	.
B17	LDGT2	96+	0.00686	-0.00476	.	.	.	.	.	.	.	.	.	.	1.1331	1.0977	1.0456	0.7683	1.3074	4.7654	2.3941	.	.
B18	LDGT2	96+	0.00371	-0.00109	.	.	.	.	.	.	.	.	.	.	0.9732	1.1893	0.7137	0.4116	1.4972	2.8064	-0.0005	2.4412	.
B19	LDGT2	96+	0.00243	-0.00121	.	.	.	.	.	.	.	.	.	.	0.9785	0.9384	0.9374	1.0534	0.8374	1.4572	0.714	1.4339	1.3705

IM147 Composite Regression Coefficients, HC, 1981 to 1982 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV_	81-82	0.49218	0.57705	15.1354	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGV_	81-82	0.33532	0.27587	2.7958	4.3107	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGV_	81-82	0.28385	0.2387	3.237	1.8573	5.3824	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGV_	81-82	0.26651	0.22287	1.6681	2.0142	3.3342	3.0522	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGV_	81-82	0.25039	0.21722	-0.3542	1.7343	3.0584	-0.4158	5.9309	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGV_	81-82	0.23492	0.22612	-1.1998	1.7931	2.0663	-0.0624	2.4987	4.8232	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGV_	81-82	0.22127	0.21033	-1.4452	1.5589	1.4953	0.1839	1.2039	3.8754	3.5496	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGV_	81-82	0.21552	0.19445	-0.9213	1.4891	1.3035	-0.0672	1.0624	2.967	2.9559	2.5679	.	.	.	.	.	.	.	.	.	.	.
P9	LDGV_	81-82	0.2067	0.18041	-1.0513	1.5796	1.3012	-0.0519	1.564	-0.0917	1.2979	2.0321	6.4454	.	.	.	.	.	.	.	.	.	.
P10	LDGV_	81-82	0.18913	0.16356	-1.3284	1.5978	1.0833	0.3527	0.1824	0.3708	1.1991	2.1788	0.884	7.9922	.	.	.	.	.	.	.	.	.
P11	LDGV_	81-82	0.15452	0.0563	0.0087	0.5393	1.7119	0.1012	0.6423	0.9748	1.0961	0.177	1.9283	6.7153	1.4557	.	.	.	.	.	.	.	.
P12	LDGV_	81-82	0.13848	0.03382	0.3059	0.4616	1.2496	0.2523	0.8742	0.2381	0.6512	1.0074	1.8257	7.1	0.8496	1.7116	.	.	.	.	.	.	.
P13	LDGV_	81-82	0.11063	0.03458	1.1018	0.2871	1.8035	0.9765	-0.5314	0.4907	1.1534	0.6794	1.3477	4.1068	0.6837	0.0626	3.0307	.	.	.	.	.	.
P14	LDGV_	81-82	0.10379	0.02583	0.937	0.3096	1.715	1.0249	-0.5161	0.4784	1.2933	0.6542	1.7892	3.4911	0.4746	0.3833	2.0844	1.8075	.	.	.	.	.
P15	LDGV_	81-82	0.09549	0.02733	1.3271	0.2571	1.7659	0.7304	0.2147	0.1823	1.1956	0.9924	1.0719	2.8131	0.4955	0.6194	1.2124	0.4439	2.0988	.	.	.	.
P16	LDGV_	81-82	0.07932	0.0312	1.0118	0.4766	1.3033	0.8794	0.0472	0.402	1.6192	1.449	-0.2368	2.1792	0.4806	0.6063	1.0279	0.7352	0.5135	5.3144	.	.	.
P17	LDGV_	81-82	0.05521	0.00814	1.2935	0.6849	0.6167	0.5737	0.616	0.8743	0.9448	1.724	0.1427	0.6903	0.6243	0.6678	0.6972	1.4033	0.6874	2.3373	2.2858	.	.
P18	LDGV_	81-82	0.04359	0.00235	1.4765	0.7063	0.5683	0.9993	-0.1434	1.1276	0.8748	1.3533	-0.3586	1.3373	0.6347	0.6998	0.796	0.716	0.6921	1.817	1.4148	1.4078	.
P19	LDGV_	81-82	0.03591	0.00148	1.2991	0.7134	0.6447	0.8407	0.2792	0.9872	0.8646	0.9518	0.1384	1.1208	0.6929	0.6275	0.8021	0.5739	0.7875	-0.2237	1.2967	0.9834	1.1392

IM147 Phase 2 Regression Coefficients, HC, 1981 to 1982 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV_	81-82	0.32813	0.13912	.	.	.	.	.	.	.	.	.	.	3.2894	.	.	.	.	.	.	.	.
B12	LDGV_	81-82	0.29163	0.08753	.	.	.	.	.	.	.	.	.	.	1.8437	3.4587	.	.	.	.	.	.	.
B13	LDGV_	81-82	0.18796	0.06684	.	.	.	.	.	.	.	.	.	.	0.9136	-0.314	6.0599	.	.	.	.	.	.
B14	LDGV_	81-82	0.1799	0.05326	.	.	.	.	.	.	.	.	.	.	0.6172	0.1991	4.6274	2.6027	.	.	.	.	.
B15	LDGV_	81-82	0.15358	0.05277	.	.	.	.	.	.	.	.	.	.	0.6903	0.7618	2.1672	-0.1274	4.2479	.	.	.	.
B16	LDGV_	81-82	0.12174	0.04997	.	.	.	.	.	.	.	.	.	.	0.8196	0.7862	1.6353	0.667	1.0053	8.5142	.	.	.
B17	LDGV_	81-82	0.08162	0.00913	.	.	.	.	.	.	.	.	.	.	1.0095	0.7175	1.2863	1.8724	0.9087	3.3981	3.148	.	.
B18	LDGV_	81-82	0.06421	0.00073	.	.	.	.	.	.	.	.	.	.	0.9515	0.8623	1.1518	0.998	0.9777	2.5859	1.9343	1.9181	.
B19	LDGV_	81-82	0.05142	0.00017	.	.	.	.	.	.	.	.	.	.	0.9854	0.8032	1.1865	0.7374	1.1	-0.3037	1.7543	1.3113	1.6987

IM147 Composite Regression Coefficients, HC, 1983 to 1985 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV_	83-85	0.40712	0.48122	11.2061																		
P2	LDGV_	83-85	0.28584	0.23584	0.3793	4.0312																	
P3	LDGV_	83-85	0.2251	0.18194	0.1504	1.6625	5.8839																
P4	LDGV_	83-85	0.20949	0.1636	-0.6566	1.89	3.4063	3.0941															
P5	LDGV_	83-85	0.19447	0.16094	-1.0863	1.2885	2.6869	2.1291	3.7766														
P6	LDGV_	83-85	0.19153	0.16531	-1.4624	1.3044	2.1907	1.8106	3.1299	2.0652													
P7	LDGV_	83-85	0.18355	0.1542	-1.1191	1.2382	2.1956	1.3759	2.2879	1.3053	2.1756												
P8	LDGV_	83-85	0.1742	0.14505	-1.1029	1.1144	1.7862	0.8889	2.4267	1.2368	1.6895	1.9949											
P9	LDGV_	83-85	0.16499	0.14815	-0.7229	1.073	1.8176	0.7769	1.4795	0.6194	1.4189	0.9084	4.175										
P10	LDGV_	83-85	0.16024	0.14347	-0.7243	1.1373	1.5682	0.8427	0.8657	0.8685	1.1993	0.834	2.645	2.9155									
P11	LDGV_	83-85	0.12238	0.06297	0.38	0.2293	1.7054	0.1938	1.2879	1.6893	0.5856	0.5369	2.6104	1.7875	1.5441								
P12	LDGV_	83-85	0.10785	0.05022	0.4878	0.4094	0.8846	0.5066	1.0774	1.8031	0.7369	0.5491	1.8603	2.2819	1.0196	1.6327							
P13	LDGV_	83-85	0.07961	0.0331	0.7767	0.4332	0.8179	0.9806	1.0015	1.2108	0.561	0.4915	1.5593	1.6272	0.8246	0.3997	2.5228						
P14	LDGV_	83-85	0.068	0.02445	0.861	0.3782	0.9405	0.9692	0.9471	1.0556	0.6664	0.4702	1.5692	1.559	0.6216	0.5139	1.483	2.5758					
P15	LDGV_	83-85	0.05617	0.01633	0.6641	0.3847	0.9494	0.9339	0.8878	1.1718	0.6879	0.3691	1.2553	1.3016	0.7499	0.5579	0.6795	1.1332	2.2871				
P16	LDGV_	83-85	0.05545	0.01675	0.7233	0.393	0.9564	0.9028	0.9463	1.1024	0.7194	0.3887	1.2701	1.1977	0.7436	0.5865	0.627	1.1212	1.8334	1.417			
P17	LDGV_	83-85	0.03879	0.00841	0.893	0.5126	0.7936	0.6136	1.0495	0.8218	0.8047	0.6079	0.984	0.9734	0.7209	0.7276	0.5005	1.2506	1.4269	0.4297	2.417		
P18	LDGV_	83-85	0.02939	-0.0015	0.9063	0.6276	0.7336	0.799	0.8401	0.7909	0.6547	0.6256	1.0592	0.5782	0.7013	0.749	0.5944	0.8615	1.0441	0.6308	1.7952	1.3705	
P19	LDGV_	83-85	0.0284	-0.00036	0.8248	0.6354	0.7403	0.7849	0.8885	0.8016	0.6772	0.6005	1.0662	0.4753	0.7239	0.7376	0.6183	0.7249	0.9182	0.3388	1.7224	1.1415	0.5047

IM147 Phase 2 Regression Coefficients, HC, 1983 to 1985 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV_	83-85	0.2057	0.10209											2.848								
B12	LDGV_	83-85	0.17708	0.0755											1.8316	2.7713							
B13	LDGV_	83-85	0.12398	0.04472											1.2782	0.5298	4.0757						
B14	LDGV_	83-85	0.10965	0.03254											0.9666	0.713	2.5673	3.6248					
B15	LDGV_	83-85	0.08809	0.01872											1.0596	0.7937	1.0694	1.2338	3.6814				
B16	LDGV_	83-85	0.08613	0.02003											1.0528	0.8555	0.9553	1.2083	2.7852	2.7887			
B17	LDGV_	83-85	0.05674	0.00853											0.9868	0.9946	0.7356	1.5594	2.1184	0.6029	3.6309		
B18	LDGV_	83-85	0.04106	-0.0038											0.9461	1.0589	0.7763	1.1008	1.4725	0.8392	2.602	1.9484	
B19	LDGV_	83-85	0.03964	-0.00206											0.9706	1.0465	0.8189	0.9395	1.277	0.41	2.4945	1.6256	0.6907

IM147 Composite Regression Coefficients, HC, 1986 to 1989 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV_	86-89	0.31427	0.27681	15.5205	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGV_	86-89	0.23056	0.12883	1.6181	4.2149	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGV_	86-89	0.19626	0.11002	2.0358	2.3971	3.9903	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGV_	86-89	0.18598	0.09989	0.6425	2.546	1.7035	3.3548	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGV_	86-89	0.17584	0.09767	0.5819	1.852	1.5615	1.555	3.8429	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGV_	86-89	0.16772	0.10204	-0.8376	1.9082	1.0601	1.0965	1.9459	3.8412	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGV_	86-89	0.16444	0.09594	-0.6742	1.6725	0.9995	1.3082	0.7861	3.2631	2.3581	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGV_	86-89	0.15806	0.08909	0.1422	1.5556	0.6844	0.9331	1.0208	2.2001	1.5379	2.5805	.	.	.	.	.	.	.	.	.	.	.
P9	LDGV_	86-89	0.1519	0.08696	-0.1948	1.5757	0.7441	1.0414	0.6635	1.0744	1.3289	1.468	3.5915	.	.	.	.	.	.	.	.	.	.
P10	LDGV_	86-89	0.14467	0.0797	-0.4894	1.5393	0.9657	0.7863	0.5873	1.2938	1.3345	1.1773	-0.2863	4.8853	.	.	.	.	.	.	.	.	.
P11	LDGV_	86-89	0.11095	0.02972	0.2469	0.721	1.1728	0.8987	0.4133	1.9423	0.6973	0.4156	0.9936	2.4194	1.6263	.	.	.	.	.	.	.	.
P12	LDGV_	86-89	0.09318	0.02564	0.8246	0.6275	0.7263	0.7966	0.542	1.6116	0.6663	0.672	0.4503	2.6883	1.1012	1.7602	.	.	.	.	.	.	.
P13	LDGV_	86-89	0.06902	0.02184	1.3196	0.4061	0.8931	0.8959	0.5829	1.0567	0.7867	0.7859	0.5864	1.9088	0.9881	0.291	2.4099	.	.	.	.	.	.
P14	LDGV_	86-89	0.06241	0.01809	1.4552	0.31	1.0344	0.9038	0.6073	1.022	0.7521	0.848	0.6425	1.8254	0.813	0.5647	1.1453	2.4731	.	.	.	.	.
P15	LDGV_	86-89	0.05136	0.01585	1.2694	0.4095	0.9607	0.9108	0.6871	0.8398	0.7304	0.8585	0.5526	1.7815	0.6924	0.6284	0.7316	0.9325	2.1051	.	.	.	.
P16	LDGV_	86-89	0.04861	0.01432	1.1846	0.4732	0.8917	0.9259	0.7055	0.8742	0.7619	0.7564	0.5578	1.5489	0.7021	0.6507	0.7862	0.9721	1.2367	2.5815	.	.	.
P17	LDGV_	86-89	0.03332	0.00699	1.0682	0.673	0.7585	0.7037	0.8742	0.6284	0.7246	0.6208	0.7319	1.1727	0.7152	0.6517	0.7253	1.0692	1.1351	1.0816	2.2316	.	.
P18	LDGV_	86-89	0.02685	0.0032	1.1443	0.6139	0.8508	0.7766	0.7017	0.7447	0.6277	0.623	0.6745	1.0469	0.7238	0.6588	0.7335	0.8575	0.8976	0.668	1.5797	1.3415	.
P19	LDGV_	86-89	0.02176	0.00312	1.0887	0.6218	0.766	0.6703	0.7888	0.6802	0.7991	0.5738	0.7502	0.9406	0.7447	0.674	0.6947	0.6605	0.8184	0.1544	1.3072	0.9142	0.9739

IM147 Phase 2 Regression Coefficients, HC, 1986 to 1989 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV_	86-89	0.17572	0.05913	.	.	.	.	.	.	.	.	.	.	2.9828	.	.	.	.	.	.	.	.
B12	LDGV_	86-89	0.14079	0.04187	.	.	.	.	.	.	.	.	.	.	1.8474	2.837	.	.	.	.	.	.	.
B13	LDGV_	86-89	0.10283	0.03308	.	.	.	.	.	.	.	.	.	.	1.4791	0.4901	3.5664	.	.	.	.	.	.
B14	LDGV_	86-89	0.09666	0.02888	.	.	.	.	.	.	.	.	.	.	1.2557	0.8541	2.0611	2.9206	.	.	.	.	.
B15	LDGV_	86-89	0.07943	0.02543	.	.	.	.	.	.	.	.	.	.	1.0638	0.9286	1.331	0.6468	3.2335	.	.	.	.
B16	LDGV_	86-89	0.07243	0.02198	.	.	.	.	.	.	.	.	.	.	1.0486	0.9587	1.3534	0.8765	1.5227	4.8276	.	.	.
B17	LDGV_	86-89	0.04689	0.01029	.	.	.	.	.	.	.	.	.	.	1.0457	0.8812	1.097	1.3615	1.4856	1.7603	3.2261	.	.
B18	LDGV_	86-89	0.03789	0.00418	.	.	.	.	.	.	.	.	.	.	0.9974	0.9025	1.0724	1.0277	1.1846	1.1391	2.3711	1.8028	.
B19	LDGV_	86-89	0.03036	0.00369	.	.	.	.	.	.	.	.	.	.	1.0225	0.8952	0.9808	0.8231	1.1	0.3076	1.8483	1.2733	1.3385

IM147 Composite Regression Coefficients, HC, 1990 to 1995 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV	90-95	0.2971	0.16705	15.7948																		
P2	LDGV	90-95	0.19863	0.05505	-1.9351	4.8837																	
P3	LDGV	90-95	0.16628	0.03974	-1.5889	2.5546	5.6414																
P4	LDGV	90-95	0.1584	0.03534	-1.9531	2.652	3.0556	3.5632															
P5	LDGV	90-95	0.14861	0.0377	-1.7859	2.1399	2.3054	1.5953	3.8796														
P6	LDGV	90-95	0.1428	0.04157	-2.1978	2.3528	1.3397	1.1611	1.6243	4.1795													
P7	LDGV	90-95	0.13017	0.03906	-1.447	1.8386	1.3743	1.2125	-0.2829	2.1347	4.9626												
P8	LDGV	90-95	0.12213	0.03722	-0.5405	1.6099	1.2031	0.3856	-0.1326	1.4892	3.3678	3.4765											
P9	LDGV	90-95	0.11733	0.03754	-0.7341	1.7237	1.0051	0.4924	-0.9573	0.6324	3.2462	2.3004	3.9191										
P10	LDGV	90-95	0.11526	0.0368	-0.8148	1.6847	1.071	0.425	-1.176	0.876	2.845	2.502	1.4335	2.9572									
P11	LDGV	90-95	0.08741	0.00996	0.6446	0.8311	1.0111	0.5067	-0.4113	1.2288	2.2281	1.2696	1.6991	1.3219	1.5051								
P12	LDGV	90-95	0.07472	0.0105	0.6979	0.7429	0.706	0.5223	-0.0564	1.3101	1.9432	1.288	1.2908	1.3897	0.8836	1.8454							
P13	LDGV	90-95	0.05916	0.0139	1.3045	0.4375	0.9242	0.6499	0.0689	1.2742	1.493	1.04	1.3582	0.4913	0.8544	0.3112	2.5569						
P14	LDGV	90-95	0.05362	0.01549	1.386	0.3479	1.0903	0.5466	0.252	1.3522	1.424	0.6349	1.5658	0.679	0.6813	0.3943	1.6017	2.0376					
P15	LDGV	90-95	0.04337	0.01025	1.2116	0.4485	0.9328	0.7036	0.5038	1.3664	1.1003	0.7903	1.3103	0.2473	0.6803	0.7135	0.7193	0.5976	2.3136				
P16	LDGV	90-95	0.04152	0.00959	1.1338	0.4558	0.9892	0.8217	0.5423	1.2542	0.9416	0.7779	1.3289	0.1879	0.6808	0.7232	0.692	0.6981	1.451	2.8503			
P17	LDGV	90-95	0.0313	0.00573	0.9123	0.6301	0.5621	0.8487	0.6701	1.1772	0.8709	0.7111	1.0362	0.425	0.686	0.7574	0.6663	0.8447	1.2224	1.3549	2.4338		
P18	LDGV	90-95	0.02304	0.004	1.0116	0.6089	0.6873	0.6706	0.6772	1.1438	0.7472	0.6904	0.8929	0.5431	0.6856	0.7093	0.6728	0.682	1.042	0.6819	1.3735	1.591	
P19	LDGV	90-95	0.01929	0.00299	0.874	0.6682	0.6242	0.6993	0.6995	1.2226	0.7716	0.6058	0.6359	0.606	0.6915	0.724	0.6677	0.6623	0.8334	0.1215	1.1562	1.238	0.9297

IM147 Phase 2 Regression Coefficients, HC, 1990 to 1995 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV	90-95	0.13911	0.0203											2.9778								
B12	LDGV	90-95	0.11712	0.01783											1.7491	2.9654							
B13	LDGV	90-95	0.08624	0.01945											1.2881	0.3333	3.9332						
B14	LDGV	90-95	0.08064	0.02126											1.0669	0.4262	2.8321	2.3928					
B15	LDGV	90-95	0.06433	0.0142											1.0083	0.9588	1.2508	0.4227	3.4379				
B16	LDGV	90-95	0.06126	0.01375											0.9905	0.9989	1.1536	0.6257	2.0703	4.3157			
B17	LDGV	90-95	0.04442	0.00749											0.9692	0.997	1.0495	1.0206	1.6198	2.0719	3.5584		
B18	LDGV	90-95	0.03245	0.00457											0.9306	0.9602	0.9645	0.8007	1.3774	1.0699	1.9911	2.2266	
B19	LDGV	90-95	0.02708	0.00366											0.9309	0.9723	0.9484	0.8169	1.0622	0.3307	1.6177	1.7198	1.2796

IM147 Composite Regression Coefficients, HC, 1996 and Newer Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV_	96+	0.10038	0.04026	29.2462	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGV_	96+	0.07371	0.01788	5.9182	4.0658	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGV_	96+	0.06844	0.01874	2.9638	1.9584	5.5186	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGV_	96+	0.06132	0.01973	2.7332	1.6433	3.0543	4.4161	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGV_	96+	0.06046	0.02162	2.8327	1.3424	2.314	3.7839	1.694	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGV_	96+	0.05435	0.02387	1.2378	1.2522	0.457	3.4931	-1.2143	7.4758	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGV_	96+	0.05447	0.0241	1.0091	1.2788	0.4429	3.4792	-1.2783	7.8471	-0.2285	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGV_	96+	0.05359	0.02337	0.9941	0.7729	0.7794	3.2658	-2.1201	7.6602	-0.5933	3.1409	.	.	.	.	.	.	.	.	.	.	.
P9	LDGV_	96+	0.05279	0.02482	2.6229	0.6273	0.6458	3.3195	-1.1123	4.6464	-0.1966	0.788	4.1995	.	.	.	.	.	.	.	.	.	.
P10	LDGV_	96+	0.05143	0.02476	1.0359	0.4556	1.1796	3.0156	-1.3707	3.8218	0.108	0.823	-0.5809	6.8862	.	.	.	.	.	.	.	.	.
P11	LDGV_	96+	0.03867	0.00936	5.4115	-0.1934	1.9861	0.9553	-0.8572	0.8886	0.8704	-0.1062	0.029	6.6498	1.6503	.	.	.	.	.	.	.	.
P12	LDGV_	96+	0.02114	0.009	3.1864	0.1934	1.3914	1.1882	0.032	-0.1178	0.7255	1.0187	0.0701	4.5106	0.6495	2.1154	.	.	.	.	.	.	.
P13	LDGV_	96+	0.01901	0.00675	3.9129	0.3208	1.0647	0.8952	0.4296	0.6088	0.9736	0.1471	-0.7025	3.5491	0.6163	1.6571	1.3153	.	.	.	.	.	.
P14	LDGV_	96+	0.01746	0.00454	4.3463	0.3067	1.0782	1.0439	0.3355	1.3018	1.0886	-0.2129	-0.7694	2.9793	0.5207	1.3494	1.2261	1.5726	.	.	.	.	.
P15	LDGV_	96+	0.01604	0.00595	4.6859	0.2669	0.8615	0.9562	0.5265	1.8859	0.9556	-0.0501	-1.2322	2.431	0.5884	1.2496	1.3707	-0.6015	1.5225	.	.	.	.
P16	LDGV_	96+	0.01579	0.00648	4.6016	0.2309	0.8473	0.9826	0.3155	2.3189	0.8167	0.4521	-1.291	2.0816	0.5345	1.4982	1.0515	-0.1967	2.1338	-2.9193	.	.	.
P17	LDGV_	96+	0.01236	0.00351	2.9817	0.5075	0.6011	1.1216	0.3319	1.6187	0.8518	0.5096	0.0325	1.425	0.5667	1.2205	0.6224	1.0067	1.5045	-2.3679	2.3031	.	.
P18	LDGV_	96+	0.00892	0.00122	2.9957	0.5568	0.7792	0.788	0.2152	1.8089	0.6335	0.4301	0.2697	0.9495	0.5389	1.1609	0.7993	0.5202	1.4602	-1.9165	1.033	1.7225	.
P19	LDGV_	96+	0.00643	0.00092	1.469	0.8076	0.4864	0.7865	0.6192	1.1938	0.534	0.2013	0.8084	1.3759	0.6416	0.824	0.4897	0.7037	0.7724	0.0797	0.3811	1.5812	0.8653

IM147 Phase 2 Regression Coefficients, HC, 1996 and Newer Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV_	96+	0.06231	0.01367	.	.	.	.	.	.	.	.	.	.	2.7246	.	.	.	.	.	.	.	.
B12	LDGV_	96+	0.03471	0.01289	.	.	.	.	.	.	.	.	.	.	1.0956	3.2189	.	.	.	.	.	.	.
B13	LDGV_	96+	0.02909	0.00972	.	.	.	.	.	.	.	.	.	.	0.7958	2.4462	2.013	.	.	.	.	.	.
B14	LDGV_	96+	0.02839	0.00805	.	.	.	.	.	.	.	.	.	.	0.7353	2.2615	1.8431	1.2834	.	.	.	.	.
B15	LDGV_	96+	0.02692	0.00988	.	.	.	.	.	.	.	.	.	.	0.8024	2.2022	1.7552	-1.4225	1.8689	.	.	.	.
B16	LDGV_	96+	0.02668	0.01042	.	.	.	.	.	.	.	.	.	.	0.7459	2.4894	1.4031	-0.8725	2.5744	-3.5714	.	.	.
B17	LDGV_	96+	0.0192	0.00442	.	.	.	.	.	.	.	.	.	.	0.8885	1.711	0.9711	0.9804	1.8655	-2.5604	3.883	.	.
B18	LDGV_	96+	0.01449	0.00185	.	.	.	.	.	.	.	.	.	.	0.7232	1.6635	1.0171	0.5616	1.7084	-1.9289	2.0901	2.3918	.
B19	LDGV_	96+	0.01043	0.00074	.	.	.	.	.	.	.	.	.	.	0.92	1.1468	0.7967	0.6882	1.2025	-0.0572	0.6503	2.302	1.1734

IM147 Composite Regression Coefficients, CO, 1981 to 1985 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT1	81-85	10.1754	14.5276	12.5442	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT1	81-85	7.53286	8.22078	5.3429	3.5563	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT1	81-85	6.63268	6.60978	2.7905	2.1525	5.3312	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT1	81-85	6.52317	6.63083	1.5125	2.2786	3.2782	3.8618	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT1	81-85	6.508	6.69361	1.2349	2.1748	2.865	3.4811	1.0432	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT1	81-85	6.43582	6.71221	0.1813	2.3646	2.9243	1.5307	0.1722	2.7427	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT1	81-85	6.19445	6.37324	0.5635	1.9693	2.7172	0.6361	-1.561	3.2843	2.9955	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT1	81-85	5.94027	5.98064	1.2119	1.6393	2.7167	0.5356	-1.4442	1.3759	1.7876	3.6004	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT1	81-85	5.9353	5.97383	1.0059	1.6737	2.5314	0.6549	-1.7102	0.8508	1.7967	3.4358	1.1942	.	.	.	.	.	.	.	.	.	.
P10	LDGT1	81-85	5.85738	6.02848	1.177	1.7285	2.0533	0.7067	-2.0802	1.0202	1.2427	3.6953	-1.2444	3.1472	.	.	.	.	.	.	.	.	.
P11	LDGT1	81-85	4.17486	2.67355	0.0251	1.2531	0.5349	0.8814	-0.4647	2.1824	0.0334	2.27	1.2267	2.243	1.0397	.	.	.	.	.	.	.	.
P12	LDGT1	81-85	3.65635	1.97698	-0.5472	1.2512	-0.2635	2.0162	-0.5276	2.225	0.3841	1.8143	0.5359	2.6593	0.7892	1.1045	.	.	.	.	.	.	.
P13	LDGT1	81-85	2.30258	0.92158	0.7798	0.5868	0.3445	2.2218	0.3028	1.3536	0.523	1.1833	0.7632	1.2554	0.7979	0.6638	2.4441	.	.	.	.	.	.
P14	LDGT1	81-85	1.68789	0.51912	1.7468	0.429	0.6515	1.5816	0.7182	0.8416	0.48	1.2506	1.093	1.1172	0.6993	0.5859	1.7776	1.5319	.	.	.	.	.
P15	LDGT1	81-85	1.13559	0.36037	1.4986	0.481	0.5203	1.5061	0.696	0.646	0.8751	0.9462	0.7302	1.215	0.6963	0.7448	0.985	0.9478	1.4391	.	.	.	.
P16	LDGT1	81-85	1.03437	0.37532	1.4149	0.5205	0.4715	1.4258	0.7753	0.6646	0.8775	0.7646	0.5543	1.4051	0.6989	0.7734	0.9487	0.9689	0.8955	1.6125	.	.	.
P17	LDGT1	81-85	0.96568	0.20115	1.2423	0.5923	0.2634	1.3236	0.9825	0.7034	0.7693	0.7682	0.1979	1.3783	0.7136	0.7407	0.9773	0.9693	0.8911	1.2362	1.2653	.	.
P18	LDGT1	81-85	0.75949	0.06889	1.1529	0.5685	0.4385	1.1423	0.7942	0.9943	0.7711	0.6846	0.5815	1.031	0.7017	0.7499	0.8098	0.8097	0.847	0.846	1.2494	0.9829	.
P19	LDGT1	81-85	0.34973	-0.06051	1.1508	0.6559	0.4115	1.1472	0.7599	0.9619	0.799	0.6744	0.5327	0.985	0.7106	0.7294	0.7378	0.6891	0.6385	0.7063	1.0232	0.6907	0.8306

IM147 Phase 2 Regression Coefficients, CO, 1981 to 1985 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT1	81-85	9.2129	9.11082	.	.	.	.	.	.	.	.	.	.	1.5105	.	.	.	.	.	.	.	.
B12	LDGT1	81-85	5.96613	4.72873	.	.	.	.	.	.	.	.	.	.	1.1535	1.7914	.	.	.	.	.	.	.
B13	LDGT1	81-85	3.55873	1.89825	.	.	.	.	.	.	.	.	.	.	1.0491	0.955	3.6598	.	.	.	.	.	.
B14	LDGT1	81-85	2.92833	1.4436	.	.	.	.	.	.	.	.	.	.	0.9077	0.9194	2.7661	1.929	.	.	.	.	.
B15	LDGT1	81-85	1.93926	0.86159	.	.	.	.	.	.	.	.	.	.	0.9453	1.0943	1.32	1.0292	2.3486	.	.	.	.
B16	LDGT1	81-85	1.76086	0.83361	.	.	.	.	.	.	.	.	.	.	0.9517	1.1151	1.2896	1.1023	1.3595	2.6847	.	.	.
B17	LDGT1	81-85	1.44658	0.21699	.	.	.	.	.	.	.	.	.	.	0.9768	0.9803	1.3491	1.2314	1.27	1.5265	2.526	.	.
B18	LDGT1	81-85	1.172	0.01644	.	.	.	.	.	.	.	.	.	.	0.9407	1.0108	1.0591	1.0119	1.2102	1.0895	2.58	1.3347	.
B19	LDGT1	81-85	0.69787	-0.12536	.	.	.	.	.	.	.	.	.	.	0.9656	0.9797	0.9936	0.8578	0.9082	0.8798	2.1293	0.9645	1.1513

IM147 Composite Regression Coefficients, CO, 1986 to 1989 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT1	86-89	7.18532	10.8086	9.9102																		
P2	LDGT1	86-89	5.68789	7.0459	1.8741	2.6779																	
P3	LDGT1	86-89	5.04319	5.5558	1.7455	1.371	5.3393																
P4	LDGT1	86-89	4.88921	5.13459	1.4696	1.5629	2.9026	5.3333															
P5	LDGT1	86-89	4.78915	5.08892	1.6656	1.4035	2.0371	4.1723	2.0022														
P6	LDGT1	86-89	4.74332	5.11226	1.0229	1.4755	1.9866	3.8059	1.0898	2.4375													
P7	LDGT1	86-89	4.65225	4.91955	1.7462	1.3554	1.7097	3.8418	-0.0053	1.9673	1.6899												
P8	LDGT1	86-89	4.48557	4.61047	2.0142	1.3439	1.7523	2.7365	-0.09	0.1646	0.9526	2.9249											
P9	LDGT1	86-89	4.44811	4.5639	2.1382	1.316	1.6099	2.7676	-0.2399	-0.7903	0.9655	2.4766	2.079										
P10	LDGT1	86-89	4.41872	4.48084	2.0022	1.3046	1.5957	2.4537	-0.4021	-0.7631	0.7899	2.5819	0.8104	2.0187									
P11	LDGT1	86-89	3.05161	2.26609	2.8544	0.9359	0.8115	1.4536	0.41	0.3277	0.4047	2.1497	-0.2782	2.0562	0.9911								
P12	LDGT1	86-89	2.51613	1.51088	2.8342	0.7464	0.9245	1.9441	0.5707	-0.2141	0.4114	2.0168	0.2073	1.9253	0.7438	1.2083							
P13	LDGT1	86-89	1.68355	0.8064	2.1795	0.6233	0.8001	1.3103	0.4715	0.7177	0.6871	0.7545	0.7656	1.1501	0.7503	0.8943	2.2692						
P14	LDGT1	86-89	1.31741	0.68081	2.1784	0.5849	0.6912	1.3598	0.4357	0.9373	0.6956	0.8278	0.6331	1.2087	0.7057	0.7686	1.824	1.1207					
P15	LDGT1	86-89	0.93911	0.47	1.8779	0.6014	0.6301	1.3592	0.4395	0.8121	0.876	0.6638	0.7005	0.9787	0.7117	0.7437	1.0888	0.8731	1.3809				
P16	LDGT1	86-89	0.88497	0.41787	1.6764	0.5971	0.6595	1.3638	0.5037	0.8323	0.8426	0.6198	0.6814	1.0802	0.7147	0.7671	1.022	0.8818	0.9654	1.3933			
P17	LDGT1	86-89	0.76094	0.28167	1.1884	0.633	0.6369	1.0655	0.6729	0.7423	0.7527	0.7112	0.7965	0.8042	0.7055	0.7447	0.9245	0.8862	1.048	0.6815	1.7386		
P18	LDGT1	86-89	0.51513	0.11517	1.107	0.6616	0.6251	1.1599	0.7126	0.7927	0.5228	0.8379	0.7639	0.7464	0.7046	0.7204	0.7302	0.7811	1.0809	0.4756	1.39	0.889	
P19	LDGT1	86-89	0.22775	0.06824	0.9804	0.6792	0.6446	1.0212	0.6645	0.7468	0.6847	0.7006	0.7495	0.7734	0.7063	0.7111	0.7207	0.7067	0.7928	0.5475	0.9726	0.7062	0.7346

IM147 Phase 2 Regression Coefficients, CO, 1986 to 1989 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT1	86-89	5.73419	6.44585											1.4889								
B12	LDGT1	86-89	3.83261	3.46613											1.1555	1.6694							
B13	LDGT1	86-89	2.36328	1.33398											1.0419	1.1807	3.2911						
B14	LDGT1	86-89	1.90917	1.13186											0.9737	1.0107	2.6834	1.4946					
B15	LDGT1	86-89	1.36531	0.75413											0.976	0.9839	1.5355	1.1464	1.973				
B16	LDGT1	86-89	1.28845	0.69885											0.9841	1.0114	1.4453	1.1588	1.3867	1.9667			
B17	LDGT1	86-89	1.04812	0.39116											0.9599	0.9873	1.256	1.1763	1.4736	0.8337	2.6609		
B18	LDGT1	86-89	0.7463	0.14799											0.9544	0.9576	1.0029	1.0365	1.5243	0.6229	2.1332	1.1447	
B19	LDGT1	86-89	0.33544	0.07788											0.9581	0.9522	0.9677	0.9398	1.0857	0.7154	1.4816	0.9344	1.0357

IM147 Composite Regression Coefficients, CO, 1990 to 1995 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT1	90-95	7.96708	6.47319	8.6737	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT1	90-95	5.93561	3.60059	0.3029	2.9243	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT1	90-95	5.49867	2.58569	0.1967	1.6676	5.73	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT1	90-95	5.47555	2.41839	0.0472	1.683	4.5333	2.9942	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT1	90-95	5.34097	2.4681	0.3008	1.3842	2.8744	1.4949	3.7142	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT1	90-95	5.23567	2.50459	-0.4457	1.3784	2.6883	0.8341	2.2673	4.9505	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT1	90-95	5.12065	2.31146	-0.3312	1.2837	1.873	-0.1146	0.7803	4.7671	3.2802	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT1	90-95	4.93002	2.15394	-0.1308	1.2614	1.6587	-0.7666	0.4112	1.9844	1.3783	5.3488	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT1	90-95	4.92436	2.15209	-0.2521	1.2934	1.4663	-0.6767	0.1855	1.6357	1.4433	4.9503	1.3627	.	.	.	.	.	.	.	.	.	.
P10	LDGT1	90-95	4.83877	2.07448	-0.0883	1.3418	1.2572	-0.6746	-0.0356	1.4432	1.0559	4.4422	-1.7507	4.57	.	.	.	.	.	.	.	.	.
P11	LDGT1	90-95	3.05447	0.67888	0.7448	0.9163	0.7304	-1.1973	0.6625	1.9991	1.1363	2.2194	-0.3005	2.3958	1.1499	.	.	.	.	.	.	.	.
P12	LDGT1	90-95	2.59434	0.35922	0.8716	0.834	-0.2278	-0.1746	0.685	1.603	1.4913	1.7526	-0.5786	2.4993	0.9124	1.5835	.	.	.	.	.	.	.
P13	LDGT1	90-95	1.69051	0.3538	0.7846	0.7978	0.2453	0.7291	0.7109	0.6836	0.9317	0.9732	0.7569	0.3609	0.8116	0.8909	2.4633	.	.	.	.	.	.
P14	LDGT1	90-95	1.25118	0.29289	0.7084	0.7156	0.4878	0.5609	0.6826	0.8354	0.9735	1.1145	0.55	0.9761	0.7373	0.7493	1.6233	1.1532	.	.	.	.	.
P15	LDGT1	90-95	0.88666	0.17653	0.6832	0.7443	0.6247	0.7585	0.551	0.8411	0.8994	0.6594	0.516	0.6847	0.7688	0.6805	1.0955	0.8841	1.4675	.	.	.	.
P16	LDGT1	90-95	0.83688	0.14342	0.6546	0.7325	0.6626	0.7804	0.6	0.754	0.9659	0.5296	0.6743	0.5828	0.7741	0.6855	0.9886	0.964	1.0266	1.788	.	.	.
P17	LDGT1	90-95	0.75939	0.03084	0.6751	0.7626	0.4984	0.7727	0.6819	0.6512	0.8746	0.5588	0.7025	0.4405	0.774	0.6594	0.9682	0.9724	1.0041	1.3254	2.054	.	.
P18	LDGT1	90-95	0.48016	0.02847	0.6665	0.7378	0.5678	0.7356	0.81	0.7878	0.6105	0.7172	0.7969	0.5663	0.7101	0.721	0.8057	0.915	0.6348	1.2367	1.3997	1.0199	.
P19	LDGT1	90-95	0.16891	-0.00569	0.7401	0.7243	0.6471	0.7729	0.6775	0.7704	0.7643	0.6818	0.7573	0.6839	0.7157	0.7187	0.7375	0.6868	0.717	0.6511	1.1384	0.7248	0.7498

IM147 Phase 2 Regression Coefficients, CO, 1990 to 1995 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT1	90-95	5.48884	2.92303	.	.	.	.	.	.	.	.	.	.	1.7403	.	.	.	.	.	.	.	.
B12	LDGT1	90-95	3.74619	0.83254	.	.	.	.	.	.	.	.	.	.	1.3383	2.3792	.	.	.	.	.	.	.
B13	LDGT1	90-95	2.29939	0.47273	.	.	.	.	.	.	.	.	.	.	1.1019	1.1903	3.3532	.	.	.	.	.	.
B14	LDGT1	90-95	1.7181	0.48708	.	.	.	.	.	.	.	.	.	.	1.0162	1.02	2.3871	1.5186	.	.	.	.	.
B15	LDGT1	90-95	1.20254	0.23609	.	.	.	.	.	.	.	.	.	.	1.0388	0.9035	1.4703	1.2205	1.9615	.	.	.	.
B16	LDGT1	90-95	1.13572	0.20105	.	.	.	.	.	.	.	.	.	.	1.0447	0.9125	1.3168	1.3287	1.3674	2.3837	.	.	.
B17	LDGT1	90-95	1.04495	0.01286	.	.	.	.	.	.	.	.	.	.	1.0374	0.8678	1.2457	1.3709	1.2968	1.8468	2.5009	.	.
B18	LDGT1	90-95	0.65189	0.0106	.	.	.	.	.	.	.	.	.	.	0.9551	0.9717	1.0606	1.2615	0.8351	1.7471	1.7371	1.3845	.
B19	LDGT1	90-95	0.219	0.00146	.	.	.	.	.	.	.	.	.	.	0.968	0.9695	0.9969	0.9364	0.9681	0.9047	1.5264	0.9898	1.012

IM147 Composite Regression Coefficients, CO, 1996 and Newer Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT1	96+	1.82409	1.39419	5.531	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT1	96+	1.63165	0.95561	-5.9413	3.0869	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT1	96+	1.57733	0.85422	-1.5783	1.5971	3.8856	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT1	96+	1.57696	0.84862	-1.5432	1.758	1.4232	4.1058	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT1	96+	1.55655	0.77387	-1.8497	1.5252	1.4375	1.5669	3.3072	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT1	96+	1.48358	0.83228	-5.5406	1.6396	-0.2011	-2.3153	2.1554	10.6111	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT1	96+	1.47504	0.7148	-5.2472	1.8872	-0.9914	-0.8568	0.4965	7.7306	2.5842	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT1	96+	1.48311	0.71859	-5.1507	1.8553	-0.9277	-0.9266	0.671	8.0227	2.621	-0.2793	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT1	96+	1.49155	0.72084	-5.0954	1.8331	-1.0008	-0.6946	0.7565	7.9469	2.63	-0.1935	-0.3333	.	.	.	.	.	.	.	.	.	.
P10	LDGT1	96+	1.48528	0.70223	-3.9278	1.5364	-0.9574	-0.075	1.1515	8.3687	2.439	-0.1927	-2.1271	1.4542	.	.	.	.	.	.	.	.	.
P11	LDGT1	96+	0.71796	0.22242	-1.2984	1.4739	0.5359	-1.1903	0.4023	2.2155	2.7505	0.2649	0.6008	1.0433	0.8928	.	.	.	.	.	.	.	.
P12	LDGT1	96+	0.54429	0.13226	1.524	1.022	0.7868	-1.432	0.1372	2.482	1.6269	-0.3682	2.2202	0.4979	0.8781	1.6265	.	.	.	.	.	.	.
P13	LDGT1	96+	0.43766	0.08336	1.4971	0.7999	1.0816	-1.4102	0.8701	2.4778	1.5114	-0.0111	0.8915	0.5019	0.8812	0.3603	3.2131	.	.	.	.	.	.
P14	LDGT1	96+	0.27254	0.0707	1.3293	0.9437	0.7684	-0.6826	0.5074	1.8189	1.5858	0.2076	0.9221	0.5798	0.729	0.6284	2.4591	0.7018	.	.	.	.	.
P15	LDGT1	96+	0.19651	0.03007	1.3733	0.8799	0.3876	0.2025	0.6389	2.4824	0.9733	0.4929	0.3408	0.8102	0.7261	0.7297	1.4475	0.6703	1.466	.	.	.	.
P16	LDGT1	96+	0.17615	0.02979	1.0484	0.8101	0.7323	-0.205	0.5366	2.4872	0.7994	0.4735	0.5618	0.7865	0.7275	0.7712	1.4017	0.6818	0.9833	2.2195	.	.	.
P17	LDGT1	96+	0.13011	0.05988	1.062	0.6811	0.3816	0.7616	0.4795	2.2042	0.9584	0.5832	0.1538	0.8447	0.7233	0.7198	1.1616	0.6987	1.0372	0.2683	1.8782	.	.
P18	LDGT1	96+	0.08591	0.02837	1.3696	0.6559	0.7295	0.2618	0.8191	1.2599	0.5828	0.7744	0.6755	0.6858	0.712	0.7269	0.7236	0.7111	0.9386	0.4881	1.7121	1.0654	.
P19	LDGT1	96+	0.03308	0.00956	0.6181	0.7187	0.7481	0.61	0.6377	0.8223	0.7051	0.6935	0.8481	0.6648	0.7101	0.7232	0.6944	0.7189	0.8125	0.226	1.1367	0.7471	0.7019

IM147 Phase 2 Regression Coefficients, CO, 1996 and Newer Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT1	96+	1.23604	0.96823	.	.	.	.	.	.	.	.	.	.	0.9526	.	.	.	.	.	.	.	.
B12	LDGT1	96+	0.74363	0.24386	.	.	.	.	.	.	.	.	.	.	1.1933	2.1843	.	.	.	.	.	.	.
B13	LDGT1	96+	0.60473	0.1527	.	.	.	.	.	.	.	.	.	.	1.2056	0.5562	4.3384	.	.	.	.	.	.
B14	LDGT1	96+	0.40405	0.15643	.	.	.	.	.	.	.	.	.	.	0.9921	0.9282	3.3758	0.9673	.	.	.	.	.
B15	LDGT1	96+	0.30462	0.06538	.	.	.	.	.	.	.	.	.	.	0.9969	1.0801	1.9431	0.914	2.0105	.	.	.	.
B16	LDGT1	96+	0.26097	0.03614	.	.	.	.	.	.	.	.	.	.	0.9954	1.08	1.8842	0.9365	1.1866	3.7438	.	.	.
B17	LDGT1	96+	0.2048	0.0653	.	.	.	.	.	.	.	.	.	.	0.9914	1.0331	1.5352	0.9586	1.2475	1.026	2.448	.	.
B18	LDGT1	96+	0.12661	0.03391	.	.	.	.	.	.	.	.	.	.	0.9631	0.9575	0.9469	0.9698	1.2044	0.8083	2.4102	1.4239	.
B19	LDGT1	96+	0.04352	0.01126	.	.	.	.	.	.	.	.	.	.	0.9604	0.9595	0.9395	0.9708	1.1345	0.2607	1.4873	1.0202	0.9453

IM147 Composite Regression Coefficients, CO, 1981 to 1985 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT2	81-85	18.0705	25.7173	7.5612																		
P2	LDGT2	81-85	12.3795	12.9451	3.4376	3.6374																	
P3	LDGT2	81-85	11.5598	10.6148	1.0212	2.3546	5.6508																
P4	LDGT2	81-85	11.1259	9.72659	-0.5375	2.5842	2.5322	5.5716															
P5	LDGT2	81-85	11.1623	9.79162	-0.516	2.5693	2.415	5.44	0.2344														
P6	LDGT2	81-85	10.5815	10.5149	-5.1729	2.5377	2.4642	3.5854	-2.439	9.5373													
P7	LDGT2	81-85	10.5066	9.63447	-5.1298	2.3487	2.1758	3.1663	-2.7919	8.8001	1.9586												
P8	LDGT2	81-85	10.4986	9.46232	-4.5397	2.2916	2.2264	2.9027	-2.935	8.1749	1.56	1.182											
P9	LDGT2	81-85	10.534	9.45853	-4.6546	2.2745	2.3176	2.9007	-2.96	8.3683	1.5537	1.2902	-0.3956										
P10	LDGT2	81-85	10.5104	9.14764	-4.0569	2.3269	1.7791	3.0871	-3.3367	7.9403	1.0377	1.7694	-1.8655	2.3687									
P11	LDGT2	81-85	6.70683	1.00692	-0.9625	0.8295	2.9212	0.599	-1.3472	6.2535	1.0658	1.6592	-0.2765	1.4949	1.0962								
P12	LDGT2	81-85	5.84441	1.64077	-0.9579	0.8376	2.0719	1.2901	-1.7228	6.1373	1.3423	1.3993	-0.7286	1.7599	0.6956	1.5499							
P13	LDGT2	81-85	3.26892	0.61651	1.3225	0.6113	0.8575	1.1276	0.3105	2.4597	0.7224	0.0984	0.8037	1.0488	0.8185	0.7462	2.8417						
P14	LDGT2	81-85	2.22826	0.53462	1.2795	0.6654	0.9477	1.2845	0.5586	1.7615	0.7222	0.4197	1.0753	0.8413	0.6372	0.838	1.8815	1.2908					
P15	LDGT2	81-85	1.43068	0.16253	1.4763	0.6916	0.8805	1.0498	0.7614	1.593	0.6161	0.2931	0.9481	0.6408	0.759	0.6649	1.0119	0.9471	1.4604				
P16	LDGT2	81-85	1.39761	0.09202	1.4913	0.6618	0.9629	0.9832	0.8115	1.4561	0.5963	0.4052	0.7374	0.7242	0.7696	0.6414	0.9815	0.9546	1.1597	1.2077			
P17	LDGT2	81-85	1.30226	-0.04105	1.2639	0.683	0.8813	0.8942	0.7966	1.641	0.6092	0.4611	0.6586	0.3214	0.791	0.5936	0.982	0.9715	0.9473	1.1888	1.5709		
P18	LDGT2	81-85	0.98169	-0.23459	1.3573	0.7081	0.8658	0.8401	0.6551	1.4524	0.5751	0.6074	0.7206	0.4241	0.7757	0.6063	0.7425	0.8257	0.8673	1.0036	1.3323	0.8645	
P19	LDGT2	81-85	0.50955	-0.1442	1.2761	0.7138	0.6615	0.8723	0.6415	1.4442	0.6884	0.5997	0.8506	0.4704	0.7392	0.6704	0.7048	0.6711	0.7256	0.4192	1.1487	0.8223	0.7477

IM147 Phase 2 Regression Coefficients, CO, 1981 to 1985 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT2	81-85	13.6662	10.3119											1.5327								
B12	LDGT2	81-85	9.5454	6.3219											0.9685	2.6838							
B13	LDGT2	81-85	4.74433	1.25606											1.0757	0.9968	4.0692						
B14	LDGT2	81-85	3.50162	1.57213											0.8395	1.1681	2.9369	1.7248					
B15	LDGT2	81-85	2.41832	0.59238											1.0109	0.918	1.4255	1.2686	2.1564				
B16	LDGT2	81-85	2.31489	0.51543											1.0284	0.8761	1.3639	1.2777	1.5125	2.5385			
B17	LDGT2	81-85	2.02742	-0.13816											1.0611	0.7865	1.3133	1.3648	1.0331	2.4287	2.7411		
B18	LDGT2	81-85	1.59498	-0.3696											1.0435	0.8038	0.976	1.1376	0.9439	2.1064	2.2992	1.2758	
B19	LDGT2	81-85	1.13333	-0.2565											1	0.8755	0.9246	0.9223	0.7526	1.3895	2.0596	1.205	1.0168

IM147 Composite Regression Coefficients, CO, 1986 to 1987 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT2	86-87	10.9444	12.9835	9.9921	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT2	86-87	7.55854	7.97406	5.9552	2.7507	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT2	86-87	6.99501	6.13276	4.0152	1.8868	4.4945	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT2	86-87	6.97238	5.95324	3.4929	1.8483	3.4182	2.3575	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT2	86-87	6.96833	6.05169	3.0277	1.6681	2.9579	1.9105	1.5754	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT2	86-87	6.92215	5.98054	2.189	1.8432	2.2804	1.5316	0.9365	3.0663	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT2	86-87	6.94695	5.96146	2.2344	1.7997	2.1735	1.5149	0.7182	3.2075	0.349	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT2	86-87	6.86254	5.92929	3.5275	1.4609	2.7997	0.5921	0.3135	2.0879	-0.2127	2.0942	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT2	86-87	6.87158	5.95327	3.8626	1.5007	2.5734	0.597	0.1327	1.6367	-0.0355	1.5977	1.3024	.	.	.	.	.	.	.	.	.	.
P10	LDGT2	86-87	6.8465	5.84494	3.819	1.5958	2.1327	0.6932	0.2752	1.0075	-0.5524	1.789	-0.4389	2.5615	.	.	.	.	.	.	.	.	.
P11	LDGT2	86-87	4.00509	1.79665	1.9731	0.449	2.1242	-1.7461	2.0304	1.3946	-0.7103	1.246	1.7513	2.4635	1.0775	.	.	.	.	.	.	.	.
P12	LDGT2	86-87	3.20981	1.45021	1.8521	0.2977	1.3666	1.06	2.0745	-0.8491	0.2216	1.3232	1.1353	1.6136	0.6802	1.8785	.	.	.	.	.	.	.
P13	LDGT2	86-87	2.18993	0.93828	1.6364	0.6089	1.2938	1.9515	0.3685	-0.5328	-0.0587	1.2006	0.4256	1.2367	0.6922	1.2207	2.0554	.	.	.	.	.	.
P14	LDGT2	86-87	1.37534	0.49488	1.2757	0.6254	1.0665	0.9774	0.576	0.938	0.198	1.1141	0.5629	1.3587	0.6742	0.7466	1.5811	1.3798	.	.	.	.	.
P15	LDGT2	86-87	0.82014	0.15633	1.0946	0.6111	0.9745	0.7593	0.7578	1.1728	0.4226	1.0261	0.3048	1.0888	0.7145	0.6425	0.9896	1.02	1.5309	.	.	.	.
P16	LDGT2	86-87	0.69514	-0.03757	1.0745	0.6025	1.0009	0.7342	0.6475	1.2043	0.645	0.9395	0.3972	0.8668	0.7284	0.6071	0.9474	1.1426	0.9553	2.2245	.	.	.
P17	LDGT2	86-87	0.60214	-0.0821	1.1799	0.6279	0.8864	0.6465	0.8573	0.9847	0.4956	1.0034	0.4603	0.6907	0.7232	0.6711	0.8613	1.1323	0.9966	1.4224	1.7537	.	.
P18	LDGT2	86-87	0.44333	-0.03364	1.1598	0.6606	0.7253	0.5353	0.9864	1.1754	0.4065	0.9965	0.5489	0.8032	0.7002	0.7326	0.6569	1.0226	0.9838	0.6221	1.7755	0.6944	.
P19	LDGT2	86-87	0.18065	-0.04526	1.0637	0.7123	0.7409	0.8109	0.662	0.9665	0.652	0.7498	0.6309	0.6545	0.715	0.7245	0.7123	0.6921	0.7437	0.6817	1.153	0.6878	0.7348

IM147 Phase 2 Regression Coefficients, CO, 1986 to 1987 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT2	86-87	7.78582	5.80047	.	.	.	.	.	.	.	.	.	.	1.4386	.	.	.	.	.	.	.	.
B12	LDGT2	86-87	4.68466	3.16394	.	.	.	.	.	.	.	.	.	.	0.9308	2.6872	.	.	.	.	.	.	.
B13	LDGT2	86-87	3.05474	1.67487	.	.	.	.	.	.	.	.	.	.	0.9606	1.5982	2.7862	.	.	.	.	.	.
B14	LDGT2	86-87	2.02059	1.1291	.	.	.	.	.	.	.	.	.	.	0.8908	1.1326	2.3405	1.8259	.	.	.	.	.
B15	LDGT2	86-87	1.24999	0.47151	.	.	.	.	.	.	.	.	.	.	0.9544	0.9442	1.4229	1.3063	2.1977	.	.	.	.
B16	LDGT2	86-87	1.06317	0.16747	.	.	.	.	.	.	.	.	.	.	0.9833	0.8605	1.3578	1.508	1.2803	3.3341	.	.	.
B17	LDGT2	86-87	0.90457	-0.06369	.	.	.	.	.	.	.	.	.	.	0.9757	0.9354	1.2019	1.5292	1.2917	2.1953	2.4754	.	.
B18	LDGT2	86-87	0.76129	-0.02736	.	.	.	.	.	.	.	.	.	.	0.9433	1.0434	0.9962	1.3721	1.2582	1.4319	2.4588	0.8181	.
B19	LDGT2	86-87	0.34719	-0.0285	.	.	.	.	.	.	.	.	.	.	0.9787	0.9885	0.9663	0.8916	0.9566	0.9606	1.5579	0.947	1.0918

IM147 Composite Regression Coefficients, CO, 1988 to 1995 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT2	88-95	7.29843	8.32241	9.6375	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT2	88-95	5.72678	5.74122	-0.9189	2.3772	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT2	88-95	5.24439	4.67052	-1.3811	1.1541	5.5635	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT2	88-95	5.14826	4.26813	-1.2272	1.0883	3.6162	4.9841	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT2	88-95	5.09801	4.25023	-1.2746	0.9561	3.0791	3.914	1.7536	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT2	88-95	5.03227	4.30487	-2.116	1.045	2.75	2.5651	1.1445	4.8242	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT2	88-95	4.94785	3.9903	-1.6248	0.9734	2.2915	2.261	0.0539	4.0718	2.4087	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT2	88-95	4.89866	3.89264	-1.7403	1.0233	1.931	1.7839	0.2408	2.7207	1.5017	2.1928	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT2	88-95	4.85108	3.81187	-1.2151	1.0106	1.7096	1.9917	-0.0267	1.4417	1.4322	1.6155	3.0089	.	.	.	.	.	.	.	.	.	.
P10	LDGT2	88-95	4.82605	3.68452	-1.0168	1.0461	1.7253	1.7644	-0.2401	1.2295	1.1312	1.6015	1.909	2.3455	.	.	.	.	.	.	.	.	.
P11	LDGT2	88-95	3.00685	1.74476	1.0382	0.6435	2.2076	0.8361	0.297	0.8814	1.2011	-0.12	2.4158	1.0536	1.0849	.	.	.	.	.	.	.	.
P12	LDGT2	88-95	2.71202	1.40261	1.3589	0.5437	1.8138	1.0668	0.3264	0.7761	1.4578	0.0633	1.6352	0.8125	0.9029	1.3647	.	.	.	.	.	.	.
P13	LDGT2	88-95	1.9294	0.60523	1.2096	0.6003	1.3401	0.909	0.5644	1.2411	0.8508	0.3162	0.575	0.1662	0.8851	0.7097	2.7113	.	.	.	.	.	.
P14	LDGT2	88-95	1.26478	0.42753	1.2507	0.6101	1.151	0.906	0.608	1.707	0.8161	0.593	0.3194	0.7475	0.7497	0.8072	1.7136	1.2385	.	.	.	.	.
P15	LDGT2	88-95	0.8779	0.28841	0.9697	0.6415	1.0695	0.7999	0.5885	1.284	0.8121	0.5778	0.5467	0.957	0.7335	0.8178	1.057	0.8384	1.2288	.	.	.	.
P16	LDGT2	88-95	0.79251	0.18425	1.0108	0.6516	1.0689	0.8061	0.5356	1.3495	0.8301	0.6371	0.4534	0.9417	0.7116	0.8113	1.0192	0.8943	0.9962	1.2531	.	.	.
P17	LDGT2	88-95	0.69731	0.07985	0.8509	0.7135	0.8792	0.7703	0.5294	1.3068	0.6755	0.6246	0.4121	0.958	0.7118	0.8086	0.9187	0.9121	0.9794	0.751	2.056	.	.
P18	LDGT2	88-95	0.52944	-0.00314	0.7855	0.7161	0.8485	0.6381	0.64	1.2114	0.5735	0.7301	0.4666	0.8616	0.7036	0.7599	0.6897	0.8686	0.9015	0.8581	1.2682	1.0027	.
P19	LDGT2	88-95	0.18228	-0.02029	1.0068	0.7103	0.7155	0.8232	0.7148	0.8349	0.6247	0.8302	0.6614	0.7366	0.7094	0.724	0.6921	0.7083	0.7232	0.6986	1.0875	0.7309	0.7311

IM147 Phase 2 Regression Coefficients, CO, 1988 to 1995 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT2	88-95	5.55431	4.86126	.	.	.	.	.	.	.	.	.	.	1.4596	.	.	.	.	.	.	.	.
B12	LDGT2	88-95	3.81315	2.54349	.	.	.	.	.	.	.	.	.	.	1.2451	2.0945	.	.	.	.	.	.	.
B13	LDGT2	88-95	2.63707	0.83295	.	.	.	.	.	.	.	.	.	.	1.1848	0.9524	3.6628	.	.	.	.	.	.
B14	LDGT2	88-95	1.77124	0.72633	.	.	.	.	.	.	.	.	.	.	1.0256	1.1004	2.4663	1.6377	.	.	.	.	.
B15	LDGT2	88-95	1.22283	0.50627	.	.	.	.	.	.	.	.	.	.	1.0014	1.1189	1.5439	1.0872	1.7128	.	.	.	.
B16	LDGT2	88-95	1.11757	0.38075	.	.	.	.	.	.	.	.	.	.	0.9754	1.1094	1.4934	1.1553	1.4158	1.6429	.	.	.
B17	LDGT2	88-95	0.95396	0.13503	.	.	.	.	.	.	.	.	.	.	0.9673	1.1001	1.2482	1.2114	1.3643	0.9484	2.9337	.	.
B18	LDGT2	88-95	0.72512	-0.00576	.	.	.	.	.	.	.	.	.	.	0.9541	1.0331	0.9195	1.158	1.2511	1.1276	1.7748	1.3609	.
B19	LDGT2	88-95	0.28372	0.00704	.	.	.	.	.	.	.	.	.	.	0.9656	0.9834	0.9474	0.9412	1.0187	0.8827	1.65	0.9988	0.9646

IM147 Composite Regression Coefficients, CO, 1996 and Newer Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT2	96+	1.3088	1.42622	17.1995																		
P2	LDGT2	96+	1.1479	1.00342	-1.078	3.0953																	
P3	LDGT2	96+	0.98949	0.98019	-2.6776	0.7119	4.3482																
P4	LDGT2	96+	0.82952	0.97186	-4.3164	0.4586	-0.0693	9.4052															
P5	LDGT2	96+	0.82272	0.92541	-6.1685	0.6234	0.0838	7.9052	1.1172														
P6	LDGT2	96+	0.80854	0.93687	-2.5537	0.4345	0.9927	5.0074	0.2744	5.1496													
P7	LDGT2	96+	0.78612	0.93219	-0.8299	0.1902	0.867	2.2463	-0.6382	7.4747	1.8026												
P8	LDGT2	96+	0.7922	0.9145	-0.5421	0.3098	1.1613	-0.1172	-0.5476	8.6914	1.4725	1.1768											
P9	LDGT2	96+	0.79439	0.90764	0.4323	0.2804	1.57	-1.9801	-0.584	8.2734	1.281	1.4763	1.8463										
P10	LDGT2	96+	0.80176	0.89411	0.6291	0.4422	1.1925	-2.1872	-0.6255	7.6689	1.3637	1.6415	0.9728	1.2038									
P11	LDGT2	96+	0.45829	0.43587	2.7438	0.9615	1.1761	-4.6902	-0.051	7.5376	0.5427	2.8889	0.9224	1.6589	0.7053								
P12	LDGT2	96+	0.43361	0.27262	1.6129	0.8974	1.1808	-3.2179	0.1827	6.7307	0.6851	2.4296	1.0559	0.404	0.7027	1.0882							
P13	LDGT2	96+	0.35545	0.13528	-0.1926	1.1224	-0.5669	2.979	0.8935	3.5882	0.4381	0.8157	-0.0928	0.4589	0.7161	0.668	1.9197						
P14	LDGT2	96+	0.30207	0.07328	-2.5856	1.3224	-0.4318	1.9157	1.1728	1.7862	0.501	0.7493	0.097	1.2673	0.6916	0.617	1.1886	1.8756					
P15	LDGT2	96+	0.11959	0.01946	0.8675	0.9676	-0.1805	1.423	0.6812	2.4687	0.9513	0.6769	0.0759	1.097	0.7126	0.6574	1.1486	0.3594	1.6893				
P16	LDGT2	96+	0.09136	0.01277	-0.0995	0.9293	-0.1463	2.0115	0.7771	2.1495	0.9056	0.4482	0.4595	0.6343	0.7138	0.6364	1.0287	0.625	1.3436	1.1992			
P17	LDGT2	96+	0.08571	0.00815	0.3122	0.914	0.0235	1.495	0.8462	2.28	0.6668	0.6935	0.6686	0.5081	0.7115	0.6609	0.9459	0.5995	1.3506	0.864	1.1952		
P18	LDGT2	96+	0.07115	-0.00155	0.1596	0.9576	0.1434	1.207	0.8318	1.7452	0.5467	0.8902	0.2782	0.9571	0.7097	0.6328	0.8136	0.7233	1.1938	0.7903	0.6252	0.8195	
P19	LDGT2	96+	0.02689	-0.00249	-0.2617	0.9243	0.5171	0.6083	0.8825	1.183	0.5554	0.926	0.5734	0.7532	0.715	0.657	0.7458	0.7682	0.6645	0.7015	0.8289	0.6613	0.7521

IM147 Phase 2 Regression Coefficients, CO, 1996 and Newer Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT2	96+	1.20408	1.12226											0.7609								
B12	LDGT2	96+	0.62558	0.40305											0.9685	2.1567							
B13	LDGT2	96+	0.54186	0.23919											0.9716	1.5278	2.1489						
B14	LDGT2	96+	0.44605	0.15037											0.9303	1.3986	1.0695	2.924					
B15	LDGT2	96+	0.24307	0.03103											0.9646	1.2679	1.1889	0.9274	2.4187				
B16	LDGT2	96+	0.21899	0.02112											0.9694	1.1748	0.9741	1.2313	1.9455	1.756			
B17	LDGT2	96+	0.19501	0.00313											0.9536	1.2274	0.7628	1.1104	1.9911	0.8779	2.8529		
B18	LDGT2	96+	0.14188	-0.00797											0.9522	1.0935	0.6831	1.2308	1.578	1.0698	0.7732	1.802	
B19	LDGT2	96+	0.06636	0.01816											0.9663	0.9491	0.8971	1.0203	0.7701	0.8901	1.1191	1.0268	1.2815

IM147 Composite Regression Coefficients, CO, 1981 to 1982 Model Year LDGV's

Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
					Regression Coefficients																		
P1	LDGV_	81-82	7.99839	11.8892	10.2939	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGV_	81-82	6.58035	8.47137	3.9709	2.1482	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGV_	81-82	5.95523	7.35499	2.3706	1.1885	4.3273	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGV_	81-82	5.84107	6.94384	0.9352	1.4	2.5147	4.4184	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGV_	81-82	5.67429	6.92733	-0.9051	1.3052	1.0082	3.8467	3.2208	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGV_	81-82	5.60045	7.2234	-1.4742	1.4463	-0.1894	3.6997	2.3343	2.4304	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGV_	81-82	5.42769	6.90375	-1.2377	1.0873	0.2076	2.5448	1.0667	3.0396	2.007	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGV_	81-82	5.17703	6.82475	-1.395	0.841	-0.567	2.793	1.0784	2.1889	0.6894	3.583	.	.	.	.	.	.	.	.	.	.	.
P9	LDGV_	81-82	5.11543	6.5602	-1.8042	0.9128	-0.049	1.6424	0.3327	1.1075	0.5581	3.277	3.6636	.	.	.	.	.	.	.	.	.	.
P10	LDGV_	81-82	5.09166	6.36664	-1.8837	0.9302	-0.4412	1.7282	0.1522	1.3964	0.1539	3.943	1.4796	2.6588	.	.	.	.	.	.	.	.	.
P11	LDGV_	81-82	3.36176	2.42133	-1.7143	0.9431	0.3844	-1.067	0.3333	1.7489	0.1534	1.8436	3.6102	2.5886	0.995	.	.	.	.	.	.	.	.
P12	LDGV_	81-82	2.45131	1.51191	-0.6053	0.8264	0.3739	0.1848	0.3965	1.281	0.4926	1.5431	2.6906	2.8681	0.6782	1.3748	.	.	.	.	.	.	.
P13	LDGV_	81-82	1.84222	0.81857	0.547	0.7456	0.5366	1.486	-0.1283	1.4627	0.5971	1.0752	1.2221	2.1211	0.6873	0.8834	2.0965	.	.	.	.	.	.
P14	LDGV_	81-82	1.30098	0.6002	0.761	0.7639	0.4632	0.8416	-0.3448	2.0537	0.7512	1.0435	0.8919	2.1412	0.6644	0.6957	1.6479	1.2133	.	.	.	.	.
P15	LDGV_	81-82	0.99586	0.48274	1.4122	0.6691	0.5819	1.4446	-0.1117	1.6713	0.9146	0.8677	0.8203	0.9725	0.6913	0.6885	1.0384	0.8235	1.3336	.	.	.	.
P16	LDGV_	81-82	0.92334	0.37973	1.5086	0.6203	0.6059	1.5811	0.0371	1.4292	1.0143	0.8284	0.7229	0.8179	0.6963	0.6941	0.9588	0.9625	0.9091	1.8136	.	.	.
P17	LDGV_	81-82	0.84728	0.19448	1.3677	0.6505	0.544	1.2293	0.3115	1.4583	0.9885	0.8554	0.4817	0.4999	0.7063	0.6726	0.9648	0.9625	0.9546	1.1516	2.0177	.	.
P18	LDGV_	81-82	0.52289	0.04744	1.1672	0.7297	0.3484	1.2653	0.3087	1.1707	0.6643	0.8253	0.7848	0.8903	0.6988	0.7311	0.7096	0.8592	0.8362	1.0156	1.7867	0.8424	.
P19	LDGV_	81-82	0.31963	-0.00493	1.0652	0.7221	0.5675	1.1578	0.3797	0.9834	0.7238	0.6876	0.994	0.7578	0.7005	0.7001	0.7374	0.7792	0.7058	0.244	1.232	0.646	0.9011

IM147 Phase 2 Regression Coefficients, CO, 1981 to 1982 Model Year LDGV's

Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
					Regression Coefficients																		
B11	LDGV_	81-82	7.87561	8.04896	.	.	.	.	.	.	.	.	.	.	1.2099	.	.	.	.	.	.	.	.
B12	LDGV_	81-82	4.28681	4.12849	.	.	.	.	.	.	.	.	.	.	0.9421	1.967	.	.	.	.	.	.	.
B13	LDGV_	81-82	2.91132	1.85708	.	.	.	.	.	.	.	.	.	.	0.9717	1.0199	3.5026	.	.	.	.	.	.
B14	LDGV_	81-82	2.35783	1.43426	.	.	.	.	.	.	.	.	.	.	0.9278	0.7999	2.9182	1.5911	.	.	.	.	.
B15	LDGV_	81-82	1.81322	0.97781	.	.	.	.	.	.	.	.	.	.	0.9942	0.8184	1.529	0.995	2.1475	.	.	.	.
B16	LDGV_	81-82	1.64673	0.74808	.	.	.	.	.	.	.	.	.	.	1.0076	0.8215	1.3625	1.3316	1.1639	3.4285	.	.	.
B17	LDGV_	81-82	1.35105	0.12268	.	.	.	.	.	.	.	.	.	.	1.0045	0.858	1.3822	1.29	1.2026	1.7464	4.1093	.	.
B18	LDGV_	81-82	0.83894	-0.09966	.	.	.	.	.	.	.	.	.		0.9679	0.9648	0.9202	1.1549	1.0845	1.5149	3.5169	1.2191	.
B19	LDGV_	81-82	0.57427	-0.10409	.	.	.	.	.	.	.	.	.	.	0.9662	0.9148	0.9743	1.0447	0.9099	0.3112	2.66	0.9357	1.318

IM147 Composite Regression Coefficients, CO, 1983 to 1985 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV_	83-85	5.65667	8.71977	10.0773	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGV_	83-85	4.39498	6.05704	2.7834	2.4038	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGV_	83-85	3.79704	5.05452	2.132	1.2291	4.6404	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGV_	83-85	3.62371	4.67806	0.5952	1.3042	2.354	5.4862	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGV_	83-85	3.59484	4.60345	0.0971	1.2134	2.0391	4.9125	1.269	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGV_	83-85	3.59268	4.59476	-0.3543	1.2106	2.0275	4.62	1.1146	1.0934	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGV_	83-85	3.44031	4.32493	-0.5781	1.2446	0.8896	4.3893	0.6174	1.6598	1.5993	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGV_	83-85	3.36343	4.2564	0.0459	1.093	0.9849	3.5699	0.5789	0.9952	1.2147	1.5455	.	.	.	.	.	.	.	.	.	.	.
P9	LDGV_	83-85	3.33029	4.1852	-0.1659	1.1245	0.9751	3.3158	0.1104	0.6868	1.2398	1.3047	2.0264	.	.	.	.	.	.	.	.	.	.
P10	LDGV_	83-85	3.29987	4.12599	0.0405	1.1476	0.8196	3.3153	-0.2824	0.8442	1.1246	1.22	1.1895	1.552	.	.	.	.	.	.	.	.	.
P11	LDGV_	83-85	2.20291	2.25511	0.3918	0.6788	0.9189	1.6168	0.932	1.9937	0.5168	0.7853	1.9632	1.1107	0.7316	.	.	.	.	.	.	.	.
P12	LDGV_	83-85	1.87972	1.58471	0.5439	0.7415	0.8536	1.6537	0.727	1.925	0.7033	0.7588	1.3654	1.0997	0.6415	1.1026	.	.	.	.	.	.	.
P13	LDGV_	83-85	1.28242	0.91688	0.7111	0.7088	0.7627	1.8183	0.2958	1.6032	0.6711	0.6173	1.5002	0.6472	0.6692	0.8018	1.9269	.	.	.	.	.	.
P14	LDGV_	83-85	1.03127	0.58797	0.6489	0.7423	0.3578	1.9308	0.4662	1.5147	0.8643	0.6344	1.5828	0.5435	0.6488	0.7632	1.5457	1.1794	.	.	.	.	.
P15	LDGV_	83-85	0.69673	0.34058	0.7164	0.7324	0.354	1.9052	0.5776	1.1365	0.8592	0.5437	1.0426	0.8335	0.6765	0.708	0.9536	0.8489	1.4982	.	.	.	.
P16	LDGV_	83-85	0.6836	0.3288	0.6397	0.7348	0.4045	1.8616	0.5991	1.1119	0.8675	0.5275	0.9881	0.8608	0.6754	0.7075	0.9317	0.828	1.269	0.931	.	.	.
P17	LDGV_	83-85	0.61016	0.1403	0.7783	0.7181	0.5497	1.5209	0.4902	1.1225	0.8292	0.592	0.9313	0.8148	0.6905	0.7307	0.9393	0.8363	1.1503	0.6464	1.6992	.	.
P18	LDGV_	83-85	0.35809	0.01542	1.0268	0.6988	0.5932	1.2395	0.5512	1.1677	0.6596	0.7122	0.8022	0.6293	0.6933	0.7668	0.6573	0.8294	1.0268	0.6176	1.4839	0.9529	.
P19	LDGV_	83-85	0.25947	-0.01001	1.0127	0.7023	0.6463	1.1344	0.5259	1.0927	0.704	0.6265	0.7924	0.6521	0.7068	0.755	0.7028	0.7409	0.743	0.4739	1.3579	0.7294	0.7327

IM147 Phase 2 Regression Coefficients, CO, 1983 to 1985 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV_	83-85	4.69212	5.7524	.	.	.	.	.	.	.	.	.	.	1.0243	.	.	.	.	.	.	.	.
B12	LDGV_	83-85	2.83315	3.12116	.	.	.	.	.	.	.	.	.	.	0.9251	1.6564	.	.	.	.	.	.	.
B13	LDGV_	83-85	1.86354	1.56942	.	.	.	.	.	.	.	.	.	.	0.9295	1.1338	2.8182	.	.	.	.	.	.
B14	LDGV_	83-85	1.55825	1.15742	.	.	.	.	.	.	.	.	.	.	0.9063	1.0736	2.325	1.5629	.	.	.	.	.
B15	LDGV_	83-85	1.07233	0.69467	.	.	.	.	.	.	.	.	.	.	0.943	0.9688	1.4054	1.0868	2.1751	.	.	.	.
B16	LDGV_	83-85	1.05389	0.68187	.	.	.	.	.	.	.	.	.	.	0.9437	0.9647	1.3864	1.0625	1.8313	1.3471	.	.	.
B17	LDGV_	83-85	0.89995	0.27297	.	.	.	.	.	.	.	.	.	.	0.9612	0.9964	1.3316	1.1059	1.5922	0.8992	2.8516	.	.
B18	LDGV_	83-85	0.54856	0.0412	.	.	.	.	.	.	.	.	.	.	0.9415	1.0459	0.8624	1.115	1.3817	1.1042	2.1846	1.3008	.
B19	LDGV_	83-85	0.4078	-0.005	.	.	.	.	.	.	.	.	.	.	0.9594	1.0223	0.9206	0.9952	0.9616	0.8242	1.9266	0.9809	1.0636

IM147 Composite Regression Coefficients, CO, 1986 to 1989 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV_	86-89	4.67926	5.71778	10.6405	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGV_	86-89	3.51709	3.81788	0.1364	2.695	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGV_	86-89	3.15842	3.11069	1.0124	1.6189	3.9459	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGV_	86-89	3.14894	3.04972	0.8613	1.649	3.2671	1.3569	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGV_	86-89	3.10204	3.03267	0.7486	1.4903	2.3894	0.8299	1.8322	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGV_	86-89	3.09685	3.08465	0.6252	1.4634	2.3373	0.5195	1.5731	0.9056	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGV_	86-89	3.02573	2.86107	1.1098	1.2652	1.9531	0.4921	0.7359	0.8227	2.1087	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGV_	86-89	2.94297	2.68329	0.7801	1.2178	1.8801	0.8138	0.7593	-0.8902	1.5027	2.0203	.	.	.	.	.	.	.	.	.	.	.
P9	LDGV_	86-89	2.87652	2.54621	-0.0543	1.2924	1.523	1.0828	0.2369	-1.106	1.5137	1.3545	3.0417	.	.	.	.	.	.	.	.	.	.
P10	LDGV_	86-89	2.74734	2.37808	-0.6515	1.4027	1.4393	1.1934	-0.1403	-0.5027	1.2073	0.9038	-0.333	4.4623	.	.	.	.	.	.	.	.	.
P11	LDGV_	86-89	1.80566	1.04515	0.0874	0.8282	1.4645	1.1894	0.8248	-0.2838	0.6291	1.0042	1.4625	2.0759	0.8639	.	.	.	.	.	.	.	.
P12	LDGV_	86-89	1.49356	0.71931	0.2804	0.7493	0.9793	1.513	0.8296	-0.0469	0.689	1.0787	0.769	1.9598	0.7434	1.2423	.	.	.	.	.	.	.
P13	LDGV_	86-89	1.06067	0.36461	0.8207	0.6529	0.9226	1.272	0.8321	0.1223	0.6425	0.8893	0.7679	1.6076	0.7379	0.7345	2.1093	.	.	.	.	.	.
P14	LDGV_	86-89	0.82231	0.26307	0.8376	0.5953	0.933	1.0658	0.8038	0.4366	0.672	0.8768	0.8378	1.4217	0.7134	0.7172	1.4718	1.4518	.	.	.	.	.
P15	LDGV_	86-89	0.57486	0.17901	0.8519	0.6644	0.7016	1.0893	0.6865	0.5537	0.8363	0.7844	0.7334	1.1584	0.7057	0.7004	0.9553	0.9039	1.5623	.	.	.	.
P16	LDGV_	86-89	0.54701	0.18097	0.946	0.6657	0.6984	0.9951	0.7165	0.6267	0.8323	0.7529	0.6652	1.0979	0.7051	0.7127	0.9675	0.8974	1.1743	1.3482	.	.	.
P17	LDGV_	86-89	0.49266	0.13124	0.9156	0.6933	0.6436	0.974	0.7016	0.686	0.7814	0.7572	0.5724	0.9245	0.7053	0.7153	0.9399	0.8866	1.0881	0.9489	1.6484	.	.
P18	LDGV_	86-89	0.29132	0.05317	0.9002	0.685	0.7018	0.9872	0.6206	0.7756	0.6789	0.7453	0.7249	0.7506	0.7065	0.7322	0.7884	0.697	0.8566	1.1084	1.3762	0.8805	.
P19	LDGV_	86-89	0.1491	0.02273	0.8668	0.6976	0.726	0.8685	0.6806	0.7684	0.7148	0.6669	0.6743	0.7484	0.7087	0.7177	0.7096	0.7249	0.7202	0.6852	0.9434	0.7022	0.8271

IM147 Phase 2 Regression Coefficients, CO, 1986 to 1989 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV_	86-89	4.18172	3.9913	.	.	.	.	.	.	.	.	.	.	1.1684	.	.	.	.	.	.	.	.
B12	LDGV_	86-89	2.21032	1.63478	.	.	.	.	.	.	.	.	.	.	1.0475	1.964	.	.	.	.	.	.	.
B13	LDGV_	86-89	1.5326	0.82575	.	.	.	.	.	.	.	.	.	.	1.0148	1.0859	3.0948	.	.	.	.	.	.
B14	LDGV_	86-89	1.21271	0.6268	.	.	.	.	.	.	.	.	.	.	0.9705	1.0461	2.17	2.0218	.	.	.	.	.
B15	LDGV_	86-89	0.82448	0.40601	.	.	.	.	.	.	.	.	.	.	0.9653	0.9766	1.3403	1.2022	2.2818	.	.	.	.
B16	LDGV_	86-89	0.77323	0.3766	.	.	.	.	.	.	.	.	.	.	0.9636	0.9888	1.3495	1.1956	1.6328	2.1301	.	.	.
B17	LDGV_	86-89	0.67252	0.23667	.	.	.	.	.	.	.	.	.	.	0.9624	0.9661	1.2888	1.1945	1.4722	1.3414	2.4799	.	.
B18	LDGV_	86-89	0.40383	0.10653	.	.	.	.	.	.	.	.	.	.	0.9566	0.984	1.0723	0.9316	1.1674	1.5464	1.9865	1.1802	.
B19	LDGV_	86-89	0.20724	0.05209	.	.	.	.	.	.	.	.	.	.	0.9611	0.965	0.9597	0.9776	0.9801	0.9182	1.3409	0.9424	1.1303

IM147 Composite Regression Coefficients, CO, 1990 to 1995 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV_	90-95	5.5829	4.52493	10.561	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGV_	90-95	4.19016	2.55934	-2.4176	3.5176	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGV_	90-95	3.59909	1.7089	-2.0167	1.8381	5.8658	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGV_	90-95	3.52751	1.57279	-2.1878	1.7555	4.1493	4.0887	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGV_	90-95	3.35967	1.52742	-1.8847	1.3658	3.0822	2.7595	3.0615	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGV_	90-95	3.30911	1.53896	-2.1747	1.433	2.5763	2.1518	2.309	3.2307	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGV_	90-95	3.20465	1.37753	-1.7351	1.2677	2.4869	1.7618	0.6153	2.8007	3.0019	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGV_	90-95	3.08075	1.25584	-0.8703	1.3157	1.5808	1.0639	0.6544	1.6621	1.8801	3.4334	.	.	.	.	.	.	.	.	.	.	.
P9	LDGV_	90-95	3.03308	1.28742	-0.9409	1.3472	1.2629	1.2814	0.1146	0.9574	2.0383	2.5679	2.6687	.	.	.	.	.	.	.	.	.	.
P10	LDGV_	90-95	2.99284	1.29175	-0.6667	1.2906	1.1937	1.4946	-0.2007	0.8633	1.7797	2.4995	0.7394	2.5847	.	.	.	.	.	.	.	.	.
P11	LDGV_	90-95	1.79334	0.39573	0.8907	0.875	0.9738	0.6525	0.6724	1.4441	0.9505	1.8704	1.0336	1.2774	0.946	.	.	.	.	.	.	.	.
P12	LDGV_	90-95	1.48201	0.27031	0.8772	0.7905	0.9191	0.8699	0.6683	0.8288	0.9734	1.6847	0.9938	1.2059	0.7634	1.2265	.	.	.	.	.	.	.
P13	LDGV_	90-95	1.22124	0.18956	0.9352	0.7049	1.1123	0.7943	0.6333	0.6174	0.819	1.3469	0.8633	0.9048	0.7518	0.8615	1.6924	.	.	.	.	.	.
P14	LDGV_	90-95	0.96232	0.19909	1.2249	0.6231	0.8871	0.5243	0.6879	1.0339	0.9491	1.0285	1.2323	0.735	0.7153	0.7873	1.2566	1.1834	.	.	.	.	.
P15	LDGV_	90-95	0.67059	0.09713	1.1865	0.6235	0.8229	0.6645	0.7023	0.9149	0.9983	0.9575	1.0487	0.5318	0.7254	0.7636	0.8921	0.7821	1.3034	.	.	.	.
P16	LDGV_	90-95	0.61862	0.0845	1.1157	0.6363	0.8291	0.672	0.6393	0.9358	0.9492	0.8718	1.0229	0.6422	0.7279	0.7605	0.8704	0.8116	0.9084	1.6959	.	.	.
P17	LDGV_	90-95	0.56789	0.04406	1.1034	0.6685	0.6934	0.7551	0.6966	0.8027	0.9189	0.7923	0.9078	0.6476	0.7299	0.7393	0.8716	0.8032	0.8822	1.1592	1.9586	.	.
P18	LDGV_	90-95	0.38985	0.01218	1.0107	0.6685	0.7981	0.7109	0.6672	0.9253	0.6833	0.8064	0.9037	0.6447	0.7163	0.726	0.7487	0.7691	0.7468	1.0451	1.2236	0.9766	.
P19	LDGV_	90-95	0.13949	0.01779	0.7784	0.7029	0.7108	0.7886	0.6798	0.8583	0.733	0.6745	0.7331	0.685	0.7139	0.7148	0.711	0.7002	0.7152	0.6362	0.9674	0.7322	0.7843

IM147 Phase 2 Regression Coefficients, CO, 1990 to 1995 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV_	90-95	4.103	2.35754	.	.	.	.	.	.	.	.	.	.	1.4957	.	.	.	.	.	.	.	.
B12	LDGV_	90-95	2.32229	0.91944	.	.	.	.	.	.	.	.	.	.	1.1523	2.0251	.	.	.	.	.	.	.
B13	LDGV_	90-95	1.76794	0.5229	.	.	.	.	.	.	.	.	.	.	1.0723	1.2322	2.7642	.	.	.	.	.	.
B14	LDGV_	90-95	1.40264	0.44364	.	.	.	.	.	.	.	.	.	.	0.9979	1.1201	2.0763	1.6438	.	.	.	.	.
B15	LDGV_	90-95	0.97281	0.25022	.	.	.	.	.	.	.	.	.	.	1.0003	1.0639	1.4071	1.0512	1.8686	.	.	.	.
B16	LDGV_	90-95	0.88873	0.20771	.	.	.	.	.	.	.	.	.	.	1.0023	1.0561	1.3449	1.0929	1.2656	2.5533	.	.	.
B17	LDGV_	90-95	0.79003	0.10796	.	.	.	.	.	.	.	.	.	.	0.9981	1.009	1.2809	1.0795	1.1947	1.6393	3.0349	.	.
B18	LDGV_	90-95	0.54771	0.04247	.	.	.	.	.	.	.	.	.	.	0.9734	0.9933	1.0674	1.0348	1.0249	1.4049	2.0212	1.3189	.
B19	LDGV_	90-95	0.19036	0.03127	.	.	.	.	.	.	.	.	.	.	0.9671	0.9711	0.9708	0.9442	0.9644	0.8618	1.3588	0.9845	1.0769

IM147 Composite Regression Coefficients, CO, 1996 and Newer Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV	96+	4.2502	1.81884	53.0314	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGV	96+	2.79375	0.86889	-6.9133	5.3642	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGV	96+	2.31951	0.49886	-22.4698	2.9121	7.8787	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGV	96+	2.30066	0.48852	-20.2357	2.6582	5.7046	6.7489	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGV	96+	2.29856	0.4874	-19.0504	2.2906	4.9636	7.0228	1.4214	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGV	96+	2.17485	0.36586	-18.1249	2.1863	5.4292	5.3931	-0.6432	6.8037	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGV	96+	2.17872	0.34724	-17.6869	2.1129	5.4618	5.4355	-0.8956	6.7245	0.3983	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGV	96+	2.17729	0.32839	-15.8387	1.9759	5.2235	5.2769	-1.1683	6.4131	0.2201	1.4309	.	.	.	.	.	.	.	.	.	.	.
P9	LDGV	96+	2.16612	0.4024	-11.8473	1.4566	4.5337	6.4172	-1.2079	5.4459	0.3128	0.4287	3.2042	.	.	.	.	.	.	.	.	.	.
P10	LDGV	96+	2.17081	0.40258	-11.4985	1.3861	4.5521	6.4182	-1.1694	5.5108	0.2871	0.3698	2.6985	0.5987	.	.	.	.	.	.	.	.	.
P11	LDGV	96+	1.3457	-0.04872	-1.5411	1.3212	1.6098	6.5928	-0.785	3.2891	0.7158	-0.2278	1.3044	1.2284	1.1171	.	.	.	.	.	.	.	.
P12	LDGV	96+	0.94601	0.03677	0.1569	1.1325	0.7478	7.1762	-2.7331	2.8294	0.8581	0.5253	-0.3667	2.4476	0.8375	1.6915	.	.	.	.	.	.	.
P13	LDGV	96+	0.83127	0.04161	6.5433	0.7725	0.7897	2.3429	-1.2999	2.5769	0.8026	1.0385	-0.6814	0.7591	0.8719	1.3576	1.4743	.	.	.	.	.	.
P14	LDGV	96+	0.36237	0.07318	-1.7846	0.7477	1.0289	0.323	0.8116	2.2639	0.6876	0.4145	1.1104	0.4144	0.6973	0.7747	0.877	1.8748	.	.	.	.	.
P15	LDGV	96+	0.29315	0.05053	-0.3484	0.5009	0.8684	2.0337	0.8189	2.1406	0.8321	0.2796	-0.0113	0.3684	0.7271	0.7433	1.1116	1.0359	0.8817	.	.	.	.
P16	LDGV	96+	0.29205	0.04924	0.0274	0.4967	0.8209	2.0574	0.8019	2.0106	0.8654	0.1479	0.1851	0.3987	0.7276	0.7477	1.1209	1.0535	0.7862	0.5132	.	.	.
P17	LDGV	96+	0.23867	0.02554	-0.2222	0.7177	0.3166	1.7918	0.9891	1.2672	0.7007	0.7511	0.1642	0.6983	0.7129	0.7751	0.8196	1.3698	0.5666	0.1481	2.2487	.	.
P18	LDGV	96+	0.211	0.02076	1.8186	0.5321	0.4849	0.8707	1.2541	1.116	0.6247	0.9096	-0.3981	0.9301	0.7173	0.7777	0.8774	0.7931	1.0214	-0.0389	1.7607	0.6392	.
P19	LDGV_	96+	0.05419	0.00995	0.7814	0.7041	0.7989	0.4985	0.7204	0.9434	0.6972	0.728	0.6052	0.6829	0.7065	0.7486	0.7235	0.6863	0.7334	0.6843	0.7333	0.7391	0.7203

IM147 Phase 2 Regression Coefficients, CO, 1996 and Newer Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV	96+	2.8132	0.6365	.	.	.	.	.	.	.	.	.	.	1.9389	.	.	.	.	.	.	.	.
B12	LDGV	96+	1.55476	0.22139	.	.	.	.	.	.	.	.	.	.	1.2687	2.444	.	.	.	.	.	.	.
B13	LDGV	96+	1.21697	0.12297	.	.	.	.	.	.	.	.	.	.	1.1955	1.6069	1.8026	.	.	.	.	.	.
B14	LDGV	96+	0.54556	0.13004	.	.	.	.	.	.	.	.	.	.	0.9864	1.1698	1.3748	2.3969	.	.	.	.	.
B15	LDGV	96+	0.4806	0.1147	.	.	.	.	.	.	.	.	.	.	0.9893	1.0617	1.3564	1.8394	0.7573	.	.	.	.
B16	LDGV	96+	0.4633	0.09077	.	.	.	.	.	.	.	.	.	.	0.985	1.0604	1.4116	1.8485	0.4981	1.6802	.	.	.
B17	LDGV	96+	0.33866	0.04766	.	.	.	.	.	.	.	.	.	.	0.968	1.0626	1.1629	1.9325	0.5734	0.8152	3.1735	.	.
B18	LDGV	96+	0.30627	0.03898	.	.	.	.	.	.	.	.	.	.	0.9596	1.0743	1.0207	1.4501	0.9473	0.6378	2.7247	0.6646	.
B19	LDGV_	96+	0.07437	0.01481	.	.	.	.	.	.	.	.	.	.	0.9598	1.0096	0.9451	0.966	0.9371	1.0884	1.159	0.9807	0.9897

IM147 Composite Regression Coefficients, NOx, 1981 to 1985 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT1	81-85	1.62529	2.96654	22.8751	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT1	81-85	0.82038	0.84089	-0.5552	5.7627	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT1	81-85	0.76521	0.73117	-1.5829	4.5821	7.1986	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT1	81-85	0.75286	0.70493	-1.1236	4.4969	4.9474	8.0174	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT1	81-85	0.74049	0.73769	-3.3308	4.0049	3.8497	6.663	3.702	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT1	81-85	0.73674	0.71486	-3.9127	4.0869	3.8046	3.6966	3.0011	4.8137	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT1	81-85	0.71739	0.69385	-3.0212	3.5234	3.5081	3.9937	-0.1792	6.3496	3.9431	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT1	81-85	0.70652	0.67353	-2.6651	3.5435	2.1822	2.6706	0.0115	3.2904	2.8238	3.9683	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT1	81-85	0.70505	0.67708	-1.8358	3.4819	2.4475	3.1809	0.6337	3.7784	2.952	4.1428	-2.2115	.	.	.	.	.	.	.	.	.	.
P10	LDGT1	81-85	0.70227	0.66689	-2.4177	3.494	2.3056	3.6942	0.2591	3.8357	2.4151	4.2563	-4.019	2.4819	.	.	.	.	.	.	.	.	.
P11	LDGT1	81-85	0.61346	0.34129	-0.06	2.6963	1.5535	2.4383	1.5201	5.655	0.7401	2.8173	-2.4441	1.0401	1.3101	.	.	.	.	.	.	.	.
P12	LDGT1	81-85	0.59022	0.30932	-0.6809	2.658	1.3697	1.2656	1.4801	3.8951	1.356	2.1592	-2.7018	1.3911	0.8585	1.6633	.	.	.	.	.	.	.
P13	LDGT1	81-85	0.27799	0.12998	-0.1294	0.9449	1.4979	2.9854	0.7785	0.1823	-0.313	0.9976	0.5738	0.4624	0.694	1.076	2.7355	.	.	.	.	.	.
P14	LDGT1	81-85	0.19309	0.05416	0.6065	0.856	0.9251	1.6344	0.8251	-0.094	0.4201	1.4703	0.998	0.7742	0.5699	0.79	1.6886	1.7582	.	.	.	.	.
P15	LDGT1	81-85	0.10887	0.02502	0.5161	0.6742	1.1768	1.4558	0.2902	1.3526	0.7996	0.8754	0.732	0.6248	0.6617	0.8183	0.8141	1.2315	1.3505	.	.	.	.
P16	LDGT1	81-85	0.09725	0.01363	0.4935	0.6784	1.1208	1.1307	0.3923	0.9511	0.8969	0.5086	0.7311	0.6773	0.699	0.7813	0.8355	1.1375	1.1283	1.0972	.	.	.
P17	LDGT1	81-85	0.09344	0.01174	0.5252	0.7346	0.9639	1.1015	0.6838	0.7005	0.7356	0.6406	0.6359	0.4841	0.6953	0.7762	0.8511	1.1597	1.0383	1.0222	1.0523	.	.
P18	LDGT1	81-85	0.05721	0.00436	0.6442	0.6817	1.0499	1.0725	0.6056	1.15	0.5722	0.7474	0.8465	0.5131	0.6842	0.8341	0.6429	0.922	0.8319	1.1396	0.7657	0.8484	.
P19	LDGT1	81-85	0.0165	0.00076	0.7099	0.6986	0.7653	0.7747	0.7168	0.9007	0.7285	0.7007	0.7342	0.6359	0.7093	0.736	0.7337	0.6964	0.7033	0.7238	0.7471	0.7212	0.7201

IM147 Phase 2 Regression Coefficients, NOx, 1981 to 1985 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT1	81-85	1.076	0.85959	.	.	.	.	.	.	.	.	.	.	3.4954	.	.	.	.	.	.	.	.
B12	LDGT1	81-85	1.00048	0.67351	.	.	.	.	.	.	.	.	.	.	2.4254	3.4463	.	.	.	.	.	.	.
B13	LDGT1	81-85	0.38989	0.20314	.	.	.	.	.	.	.	.	.	.	0.8889	1.8075	3.7573	.	.	.	.	.	.
B14	LDGT1	81-85	0.27037	0.0891	.	.	.	.	.	.	.	.	.	.	0.8213	1.2937	2.454	2.3704	.	.	.	.	.
B15	LDGT1	81-85	0.15297	0.04337	.	.	.	.	.	.	.	.	.	.	0.8745	1.292	1.0958	1.7178	1.8359	.	.	.	.
B16	LDGT1	81-85	0.13123	0.01886	.	.	.	.	.	.	.	.	.	.	0.9513	1.0861	1.1153	1.5763	1.4991	1.5837	.	.	.
B17	LDGT1	81-85	0.12525	0.01412	.	.	.	.	.	.	.	.	.	.	0.9423	1.0698	1.128	1.6173	1.4024	1.4526	1.3599	.	.
B18	LDGT1	81-85	0.08127	0.0094	.	.	.	.	.	.	.	.	.	.	0.8966	1.2134	0.8469	1.3163	1.0875	1.7522	1.1639	1.0764	.
B19	LDGT1	81-85	0.01759	0.00132	.	.	.	.	.	.	.	.	.	.	0.9552	1.0089	0.9919	0.9568	0.9493	1.0003	1.0401	0.9479	1

IM147 Composite Regression Coefficients, NOx, 1986 to 1989 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT1	86-89	1.23043	2.06694	23.5015	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT1	86-89	0.70187	0.74907	1.2554	4.6182	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT1	86-89	0.65788	0.66459	1.9511	3.4741	6.6849	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT1	86-89	0.65847	0.6622	2.0121	3.4718	6.5638	0.4801	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT1	86-89	0.60304	0.65314	0.8979	2.5888	3.7778	0.693	7.82	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT1	86-89	0.60221	0.64909	0.8986	2.5939	3.729	-0.3487	7.391	2.7912	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT1	86-89	0.58554	0.63588	-0.2658	2.2631	2.7626	-0.2519	4.6311	4.814	3.3278	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT1	86-89	0.57068	0.60583	0.1372	2.1042	2.0549	-1.463	4.181	1.0084	2.9915	4.4107	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT1	86-89	0.57122	0.60597	0.1342	2.1057	2.0299	-1.4503	4.1619	0.9698	2.989	4.3952	0.1053	.	.	.	.	.	.	.	.	.	.
P10	LDGT1	86-89	0.56454	0.59282	-0.9316	2.1076	1.5254	-0.8557	3.4898	1.6834	2.3002	4.575	-1.5419	3.1754	.	.	.	.	.	.	.	.	.
P11	LDGT1	86-89	0.44918	0.31619	0.8774	1.547	0.3721	-1.2258	3.7047	1.8503	0.299	3.4571	-0.7772	1.6757	1.4183	.	.	.	.	.	.	.	.
P12	LDGT1	86-89	0.39015	0.23116	2.1899	1.3771	-0.3977	-1.386	2.7841	0.6668	0.7794	1.8436	-0.1039	1.861	0.955	2.7651	.	.	.	.	.	.	.
P13	LDGT1	86-89	0.21107	0.11066	-0.9618	0.6673	1.0909	0.613	1.2202	0.9175	0.3457	1.1499	1.3016	-0.1198	0.8075	1.3691	2.4303	.	.	.	.	.	.
P14	LDGT1	86-89	0.15824	0.06623	-0.4774	0.6974	0.7145	0.8449	1.214	0.9814	0.6256	0.7295	1.5692	0.6474	0.6399	0.8685	1.8063	1.4835	.	.	.	.	.
P15	LDGT1	86-89	0.10582	0.03533	0.0217	0.6721	0.9237	0.9185	0.462	1.2051	0.9519	0.6397	1.0663	0.5564	0.7033	0.8047	0.8872	1.1532	1.2727	.	.	.	.
P16	LDGT1	86-89	0.09624	0.03427	0.4994	0.6974	0.6351	1.2145	0.5601	0.5254	1.017	0.3771	0.9662	0.7977	0.7267	0.8275	0.9401	1.0394	0.9564	1.2214	.	.	.
P17	LDGT1	86-89	0.09019	0.02973	0.3688	0.7491	0.5027	1.1374	0.7202	0.7519	0.9628	0.4449	0.9374	0.4114	0.7103	0.847	0.8964	1.087	0.896	1.1054	1.2517	.	.
P18	LDGT1	86-89	0.05194	0.01155	0.561	0.6874	0.7247	0.8944	0.4555	1.1866	0.7413	1.03	0.6717	0.4644	0.7014	0.8099	0.637	0.8736	0.8444	0.9947	0.7536	0.9298	.
P19	LDGT1	86-89	0.01448	0.0007	0.522	0.7051	0.7802	0.7612	0.7043	0.8674	0.7473	0.7107	0.6734	0.7097	0.7081	0.7257	0.7131	0.7176	0.7067	0.7115	0.6881	0.7158	0.7428

IM147 Phase 2 Regression Coefficients, NOx, 1986 to 1989 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT1	86-89	0.71447	0.56214	.	.	.	.	.	.	.	.	.	.	2.9488	.	.	.	.	.	.	.	.
B12	LDGT1	86-89	0.58562	0.33666	.	.	.	.	.	.	.	.	.	.	1.7796	4.5068	.	.	.	.	.	.	.
B13	LDGT1	86-89	0.29253	0.15935	.	.	.	.	.	.	.	.	.	.	1.0449	2.1599	3.1651	.	.	.	.	.	.
B14	LDGT1	86-89	0.22004	0.08924	.	.	.	.	.	.	.	.	.	.	0.9001	1.3657	2.486	1.9841	.	.	.	.	.
B15	LDGT1	86-89	0.14504	0.05	.	.	.	.	.	.	.	.	.	.	0.9776	1.164	1.1562	1.5604	1.7468	.	.	.	.
B16	LDGT1	86-89	0.13142	0.04594	.	.	.	.	.	.	.	.	.	.	1.0201	1.0708	1.2975	1.3785	1.3303	1.5302	.	.	.
B17	LDGT1	86-89	0.12255	0.04125	.	.	.	.	.	.	.	.	.	.	0.977	1.1131	1.218	1.4703	1.2356	1.4639	1.602	.	.
B18	LDGT1	86-89	0.0715	0.02293	.	.	.	.	.	.	.	.	.	.	0.937	1.1335	0.8403	1.2196	1.0929	1.5766	0.9306	1.2015	.
B19	LDGT1	86-89	0.01559	0.00168	.	.	.	.	.	.	.	.	.	.	0.9648	0.9858	0.9551	0.9715	0.9562	1.0147	0.9809	0.9807	0.9956

IM147 Composite Regression Coefficients, NOx, 1990 to 1995 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT1	90-95	1.15989	1.24128	32.9634	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT1	90-95	0.72181	0.40146	0.679	4.5914	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT1	90-95	0.69216	0.32475	2.1542	3.4912	6.7253	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT1	90-95	0.68749	0.3123	2.1371	3.4737	5.023	5.8563	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT1	90-95	0.62455	0.33205	3.4043	2.3634	1.7239	5.0562	8.7446	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT1	90-95	0.61978	0.33046	2.2722	2.3005	1.5599	2.9584	8.2913	6.1514	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT1	90-95	0.58792	0.29749	2.0622	1.8473	0.0555	3.6238	4.2818	7.9809	5.3164	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT1	90-95	0.55746	0.26129	5.9179	1.7445	-0.5662	1.235	4.3563	0.782	3.7446	7.1976	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT1	90-95	0.54008	0.24653	4.1085	1.8313	-1.1591	2.0187	2.9278	-0.7348	3.4121	5.4986	7.8688	.	.	.	.	.	.	.	.	.	.
P10	LDGT1	90-95	0.53603	0.2342	2.929	1.8441	-1.4993	2.6412	2.6552	0.0076	2.7177	5.458	6.0386	2.7176	.	.	.	.	.	.	.	.	.
P11	LDGT1	90-95	0.45579	0.05778	3.2806	1.051	-0.2096	0.7143	2.8133	1.4291	0.9583	2.9071	6.0179	0.9428	1.4469	.	.	.	.	.	.	.	.
P12	LDGT1	90-95	0.36036	0.0273	4.3485	0.9563	-0.635	-0.3902	2.43	0.4675	1.7444	0.5941	4.1616	1.3325	0.6814	3.9706	.	.	.	.	.	.	.
P13	LDGT1	90-95	0.17758	0.04529	0.6553	0.7331	0.4798	1.1424	1.2661	0.9419	0.3362	0.8	1.2658	0.277	0.7426	1.2309	2.6602	.	.	.	.	.	.
P14	LDGT1	90-95	0.12741	0.02345	0.6061	0.7033	0.6424	1.2708	1.124	1.4838	0.5682	0.7251	0.9404	0.6888	0.6431	0.8253	1.6054	1.8253	.	.	.	.	.
P15	LDGT1	90-95	0.07822	0.01761	1.1782	0.6831	0.7996	1.3552	0.7806	0.9482	0.6863	0.8429	1.0081	0.3774	0.6949	0.7428	0.8865	1.0954	1.3651	.	.	.	.
P16	LDGT1	90-95	0.06969	0.01628	1.367	0.7128	0.824	1.0691	0.8406	0.6506	0.711	0.7051	0.914	0.6359	0.7085	0.724	0.8452	1.0797	1.0435	1.2099	.	.	.
P17	LDGT1	90-95	0.06569	0.00712	1.0171	0.713	0.7449	0.9912	0.8383	0.5662	0.7047	0.7856	0.8682	0.5184	0.7126	0.7606	0.8503	1.0453	1.0145	1.1224	1.218	.	.
P18	LDGT1	90-95	0.03909	0.0008	0.7599	0.7108	0.6532	1.2612	0.7148	1.122	0.5737	0.837	0.7408	0.6827	0.6897	0.8094	0.6826	0.8525	0.8302	1.1087	0.8134	0.8578	.
P19	LDGT1	90-95	0.01086	0.00079	0.757	0.7	0.7412	0.7991	0.7237	0.854	0.7206	0.6726	0.7413	0.7075	0.7135	0.7264	0.7129	0.729	0.7202	0.7122	0.7434	0.6941	0.73

IM147 Phase 2 Regression Coefficients, NOx, 1990 to 1995 Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT1	90-95	0.70725	0.11508	.	.	.	.	.	.	.	.	.	.	3.158	.	.	.	.	.	.	.	.
B12	LDGT1	90-95	0.54083	0.02981	.	.	.	.	.	.	.	.	.	.	1.5474	5.8806	.	.	.	.	.	.	.
B13	LDGT1	90-95	0.24246	0.06072	.	.	.	.	.	.	.	.	.	.	0.9747	1.7935	3.6	.	.	.	.	.	.
B14	LDGT1	90-95	0.1753	0.03555	.	.	.	.	.	.	.	.	.	.	0.8927	1.2292	2.2351	2.4522	.	.	.	.	.
B15	LDGT1	90-95	0.10866	0.02903	.	.	.	.	.	.	.	.	.	.	0.9331	1.1278	1.1969	1.4839	1.8483	.	.	.	.
B16	LDGT1	90-95	0.09571	0.02747	.	.	.	.	.	.	.	.	.	.	0.9823	1.0076	1.1844	1.4428	1.4242	1.6458	.	.	.
B17	LDGT1	90-95	0.08918	0.01127	.	.	.	.	.	.	.	.	.	.	0.9705	1.0641	1.1573	1.415	1.3597	1.5734	1.7341	.	.
B18	LDGT1	90-95	0.05491	0.00454	.	.	.	.	.	.	.	.	.	.	0.9276	1.1839	0.9094	1.1571	1.0953	1.6597	1.2012	1.1201	.
B19	LDGT1	90-95	0.01259	0.0022	.	.	.	.	.	.	.	.	.	.	0.9623	0.9896	0.9651	0.9817	0.9732	0.9769	1.063	0.9406	0.9926

IM147 Composite Regression Coefficients, NOx, 1996 and Newer Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT1	96+	0.75598	0.48362	23.6975																		
P2	LDGT1	96+	0.46673	0.18401	12.1233	3.0933																	
P3	LDGT1	96+	0.46374	0.16288	12.749	2.6461	3.1462																
P4	LDGT1	96+	0.46514	0.16338	12.1028	2.534	2.3048	4.9422															
P5	LDGT1	96+	0.3791	0.14765	18.1804	1.5554	-1.8687	0.8812	12.6955														
P6	LDGT1	96+	0.38121	0.14804	18.193	1.5564	-1.9029	1.0072	12.8058	-0.5274													
P7	LDGT1	96+	0.3284	0.12947	19.8606	1.0854	-0.0898	-8.9504	5.5367	-2.3077	9.8773												
P8	LDGT1	96+	0.31982	0.14076	18.8826	0.9749	1.2061	-5.4908	2.7593	-4.5733	4.9464	8.5778											
P9	LDGT1	96+	0.32062	0.15138	18.5988	0.8971	1.8707	-4.2693	2.4773	-3.9369	4.9682	9.0399	-2.7492										
P10	LDGT1	96+	0.24391	0.13494	9.3292	0.7629	2.6156	-11.0979	1.3803	2.9882	1.7874	11.2329	-6.1993	8.6929									
P11	LDGT1	96+	0.18099	0.10785	0.7068	0.5528	3.4731	-8.9995	-0.2732	4.7615	0.0782	7.2458	-2.3664	2.4504	1.28								
P12	LDGT1	96+	0.17159	0.09436	-0.6219	0.5365	2.5353	-3.0512	-0.8472	1.9087	-0.1596	6.9805	-2.7139	3.1761	0.9818	1.8863							
P13	LDGT1	96+	0.12899	0.07087	1.7268	0.3591	2.536	1.5628	0.5764	-2.7771	1.4626	2.9783	-1.5186	1.4469	0.7662	1.0775	1.7081						
P14	LDGT1	96+	0.10789	0.06233	-1.0403	0.4537	1.9505	0.0036	0.7498	1.6955	0.3857	3.6594	-0.8929	0.9085	0.7212	0.4779	1.0256	1.5265					
P15	LDGT1	96+	0.06499	0.02733	-0.039	0.6102	1.5778	0.9818	0.0528	0.1089	1.1186	2.0576	-0.9366	1.0631	0.7396	0.86	0.6974	0.7671	1.3416				
P16	LDGT1	96+	0.05153	0.02183	0.4719	0.5741	2.1518	-0.4167	0.1408	-0.69	0.7472	2.1867	0.0185	0.9315	0.8149	0.7897	0.797	0.6681	0.6861	2.2482			
P17	LDGT1	96+	0.04794	0.01483	0.175	0.6024	1.5796	0.5006	0.714	-1.1578	0.8449	2.0981	-0.6903	1.1098	0.7149	0.9709	0.8288	0.7074	0.7195	1.7387	1.6876		
P18	LDGT1	96+	0.02782	0.00211	0.6747	0.6416	1.5148	-0.1218	0.5752	0.4924	0.7534	1.8426	-0.2848	0.9695	0.7007	0.83	0.7552	0.7376	0.7664	1.1279	0.8032	0.758	
P19	LDGT1	96+	0.00403	0.00098	0.7432	0.7168	0.7163	0.6233	0.7292	1.0286	0.6325	0.9521	0.6402	0.7217	0.7125	0.7112	0.7066	0.7343	0.6734	0.7676	0.7274	0.7239	0.7481

IM147 Phase 2 Regression Coefficients, NOx, 1996 and Newer Model Year LDGT1's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT1	96+	0.28558	0.12907											2.2171								
B12	LDGT1	96+	0.24779	0.09313											1.6406	3.4138							
B13	LDGT1	96+	0.18123	0.08816											1.252	1.6471	2.2975						
B14	LDGT1	96+	0.15739	0.06574											0.9727	1.3922	1.7725	1.7148					
B15	LDGT1	96+	0.09057	0.02458											1.0721	1.1839	0.9796	1.028	1.925				
B16	LDGT1	96+	0.07613	0.02379											1.1061	1.2115	1.0191	0.9869	1.1519	2.6649			
B17	LDGT1	96+	0.07139	0.00843											1.0352	1.3901	1.1173	0.956	1.1159	2.3796	2.0104		
B18	LDGT1	96+	0.04333	-0.00582											0.9841	1.2998	1.0418	0.9729	1.1585	1.4094	0.9684	1.1153	
B19	LDGT1	96+	0.00565	0.00178											0.9761	0.9749	0.9793	0.9737	0.9206	1.0687	0.9432	0.9717	1.0089

IM147 Composite Regression Coefficients, NOx, 1981 to 1985 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT2	81-85	1.99804	3.69101	10.2569	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGT2	81-85	0.87409	0.91821	-7.9377	6.5305	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGT2	81-85	0.84122	0.83444	-8.613	5.4145	7.2247	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGT2	81-85	0.82892	0.89342	-10.2897	5.4633	2.5096	8.8657	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGT2	81-85	0.80333	0.89081	-9.4068	4.7319	0.276	9.1558	5.3418	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGT2	81-85	0.7983	0.87735	-13.437	4.8675	-0.2244	7.2171	4.8373	4.2644	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGT2	81-85	0.79972	0.89425	-13.7206	4.6923	-0.887	7.62	4.3577	4.6628	1.0456	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGT2	81-85	0.79473	0.84415	-11.4499	4.5789	-1.4261	5.7988	3.4916	2.7174	1.1653	3.2995	.	.	.	.	.	.	.	.	.	.	.
P9	LDGT2	81-85	0.79705	0.83069	-11.6615	4.6051	-1.4956	5.8933	3.2922	2.8161	1.1255	3.028	0.9261	.	.	.	.	.	.	.	.	.	.
P10	LDGT2	81-85	0.79648	0.81111	-11.8131	4.561	-1.2986	5.9935	2.4713	3.4666	0.516	3.1827	-0.4726	2.7254	.	.	.	.	.	.	.	.	.
P11	LDGT2	81-85	0.6659	0.51142	-7.4827	3.0898	-1.5249	6.9352	3.5295	2.9385	1.4316	3.7346	1.3238	-2.5498	1.2169	.	.	.	.	.	.	.	.
P12	LDGT2	81-85	0.54957	0.33422	-8.1307	2.4318	-0.7549	0.1755	1.141	5.7388	3.1487	2.2295	0.7669	0.0157	0.6425	3.1201	.	.	.	.	.	.	.
P13	LDGT2	81-85	0.26368	0.1926	-3.0729	0.495	1.2524	2.9861	-0.2928	2.9259	1.4715	0.5835	2.0376	-0.4876	0.712	1.7639	2.5466	.	.	.	.	.	.
P14	LDGT2	81-85	0.17079	0.09831	-1.9366	0.7267	0.5707	1.4814	-0.6512	2.8236	1.4133	1.5048	1.8051	0.7881	0.6265	1.0991	1.5732	1.6465	.	.	.	.	.
P15	LDGT2	81-85	0.13538	0.05816	-1.2593	0.6843	0.9631	1.699	-1.1762	2.6604	1.5116	1.2555	1.0619	1.1308	0.6644	0.9993	0.9615	1.3864	0.9139	.	.	.	.
P16	LDGT2	81-85	0.12927	0.04855	-0.6587	0.6411	0.9878	1.2005	-0.6445	2.468	1.4956	0.99	1.0154	1.2544	0.6922	0.8896	1.0162	1.349	0.717	0.6881	.	.	.
P17	LDGT2	81-85	0.12798	0.04485	-0.3609	0.6627	0.916	1.0272	-0.4442	2.2519	1.3213	1.1276	1.0486	1.1459	0.6823	0.8485	0.9897	1.3779	0.7091	0.682	0.6099	.	.
P18	LDGT2	81-85	0.08606	0.02155	0.3328	0.587	1.0724	1.0072	0.5742	1.9792	0.4674	1.4066	1.3569	-0.0211	0.6682	0.8649	0.7604	0.9339	0.6473	0.8806	1.1799	0.9731	.
P19	LDGT2	81-85	0.02488	0.0013	1.1429	0.6401	0.9555	0.8446	0.5989	0.8719	0.8311	0.6923	0.5888	0.7318	0.7118	0.6787	0.7213	0.7279	0.7365	0.6649	0.7072	0.679	0.7799

IM147 Phase 2 Regression Coefficients, NOx, 1981 to 1985 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT2	81-85	1.42447	1.55851	.	.	.	.	.	.	.	.	.	.	3.2137	.	.	.	.	.	.	.	.
B12	LDGT2	81-85	1.03629	0.77984	.	.	.	.	.	.	.	.	.	.	1.5673	6.4951	.	.	.	.	.	.	.
B13	LDGT2	81-85	0.38433	0.27378	.	.	.	.	.	.	.	.	.	.	0.8325	2.718	3.5162	.	.	.	.	.	.
B14	LDGT2	81-85	0.26921	0.18815	.	.	.	.	.	.	.	.	.	.	0.8123	1.6716	2.4085	2.1998	.	.	.	.	.
B15	LDGT2	81-85	0.22469	0.11816	.	.	.	.	.	.	.	.	.	.	0.8718	1.4697	1.4685	1.8766	1.2618	.	.	.	.
B16	LDGT2	81-85	0.19939	0.09578	.	.	.	.	.	.	.	.	.	.	0.9679	1.128	1.6012	1.7461	0.8574	1.4532	.	.	.
B17	LDGT2	81-85	0.19039	0.09229	.	.	.	.	.	.	.	.	.	.	0.9221	1.0819	1.4847	1.7994	0.8974	1.351	1.5644	.	.
B18	LDGT2	81-85	0.15301	0.07095	.	.	.	.	.	.	.	.	.	.	0.8347	1.2468	1.0994	1.3645	0.8676	1.6334	1.4952	1.0081	.
B19	LDGT2	81-85	0.03621	0.00936	.	.	.	.	.	.	.	.	.	.	0.943	0.9237	0.9993	0.9988	0.978	0.8541	1.0342	0.8947	1.1014

IM147 Composite Regression Coefficients, NOx, 1986 to 1987 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT2	86-87	1.61179	3.13663	31.3453																		
P2	LDGT2	86-87	0.97795	1.10882	-3.0631	5.8632																	
P3	LDGT2	86-87	0.94502	0.9839	-5.0759	4.548	8.9192																
P4	LDGT2	86-87	0.93501	0.93053	-3.3825	4.4591	5.2516	12.419															
P5	LDGT2	86-87	0.85394	0.96285	-4.4203	3.6091	-1.7208	11.4179	9.1873														
P6	LDGT2	86-87	0.84757	0.91259	-4.4095	3.6676	-1.5513	6.2687	8.3678	9.6507													
P7	LDGT2	86-87	0.85029	0.91803	-4.0853	3.616	-2.1286	6.0176	7.8929	10.0878	0.7099												
P8	LDGT2	86-87	0.85275	0.92194	-3.8044	3.5415	-2.4148	4.8872	7.7612	9.5053	0.6261	1.3726											
P9	LDGT2	86-87	0.83178	0.86005	-3.778	4.3986	-6.3555	9.9437	4.6162	8.3808	-0.6741	-0.2851	9.9702										
P10	LDGT2	86-87	0.80985	0.90764	-7.0196	4.1229	-5.9089	8.2497	2.6936	10.9511	-1.1815	0.3123	3.2549	6.8821									
P11	LDGT2	86-87	0.76148	0.62189	-8.9566	3.094	-4.9268	6.2947	5.15	9.9243	-2.4765	-0.213	3.9969	6.4604	0.8842								
P12	LDGT2	86-87	0.59003	0.3735	-2.4217	2.087	-2.6617	4.0616	2.224	1.9821	-1.3263	-2	4.7639	5.4191	0.2795	5.406							
P13	LDGT2	86-87	0.33385	0.19007	0.2814	1.1386	0.5118	3.255	-0.1077	2.4058	0.5387	-1.7814	4.2622	-0.1798	0.5687	0.4608	3.2021						
P14	LDGT2	86-87	0.20099	0.13811	1.8759	0.6935	0.5775	3.0589	0.9302	1.5194	0.7032	-0.6974	2.2407	0.0121	0.4793	0.2025	1.9049	2.1646					
P15	LDGT2	86-87	0.1038	0.0461	0.3765	0.6236	1.678	0.8805	1.0648	1.097	0.2424	-0.0264	1.7158	0.0601	0.6449	0.9194	1.0397	1.1878	1.3178				
P16	LDGT2	86-87	0.09657	0.03819	0.6854	0.5604	1.7082	0.6146	0.6222	1.3221	0.5089	-0.0753	1.3097	0.8115	0.675	0.9002	0.9782	1.1823	1.0924	0.8604			
P17	LDGT2	86-87	0.08202	0.02243	0.7341	0.6449	1.3141	-0.1109	0.6071	1.3461	0.4166	0.5635	1.6121	-0.0273	0.695	0.8997	0.9541	1.1481	1.0157	0.8336	1.7925		
P18	LDGT2	86-87	0.05719	0.02206	0.9248	0.6705	1.2239	-0.0494	0.6674	1.7312	0.3068	0.8156	1.3908	0.0199	0.6845	0.9323	0.8095	0.9223	0.7808	0.9324	1.241	0.7403	
P19	LDGT2	86-87	0.01482	0.00786	0.6527	0.6745	0.6642	0.6799	0.7944	0.7706	0.6813	0.8969	0.6883	0.6733	0.71	0.7009	0.7385	0.7569	0.6679	0.7207	0.8026	0.7243	0.7208

IM147 Phase 2 Regression Coefficients, NOx, 1986 to 1987 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT2	86-87	1.44862	1.6677											2.507								
B12	LDGT2	86-87	0.92821	0.61792											0.4543	9.8299							
B13	LDGT2	86-87	0.45405	0.32299											0.7862	0.5919	4.3588						
B14	LDGT2	86-87	0.27745	0.22123											0.6178	0.2412	2.551	2.9603					
B15	LDGT2	86-87	0.14699	0.0967											0.8032	1.2698	1.2876	1.6105	1.8179				
B16	LDGT2	86-87	0.1382	0.07565											0.859	1.1449	1.2732	1.5831	1.6009	0.9193			
B17	LDGT2	86-87	0.1172	0.05283											0.8945	1.2281	1.135	1.5637	1.3545	1.3493	2.1364		
B18	LDGT2	86-87	0.08824	0.05293											0.8887	1.3239	0.9624	1.2543	1.0381	1.5212	1.2998	0.9849	
B19	LDGT2	86-87	0.0176	0.00876											0.958	0.9848	0.9632	0.9799	0.9647	0.9458	1.1217	0.9723	0.9846

IM147 Composite Regression Coefficients, NOx, 1988 to 1995 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT2	88-95	1.24878	2.35108	23.5648																		
P2	LDGT2	88-95	0.82176	0.87411	0.1479	4.6355																	
P3	LDGT2	88-95	0.77845	0.71657	-1.7162	3.425	8.1364																
P4	LDGT2	88-95	0.7742	0.70093	-1.8478	3.4367	6.2476	5.1308															
P5	LDGT2	88-95	0.73556	0.71294	-1.4757	2.6692	3.7613	3.2899	6.2663														
P6	LDGT2	88-95	0.72738	0.72398	-2.5889	2.6139	3.8661	-0.5835	5.6306	6.8957													
P7	LDGT2	88-95	0.70212	0.63963	-1.6939	2.0359	3.1437	0.5064	1.7183	8.4446	5.0667												
P8	LDGT2	88-95	0.68022	0.60531	-0.4848	1.8702	2.347	-1.174	1.1716	2.9882	4.0341	6.3227											
P9	LDGT2	88-95	0.67704	0.59719	-1.6152	1.9533	1.922	-0.993	0.5073	2.3082	3.7294	5.9607	3.1202										
P10	LDGT2	88-95	0.66525	0.59249	-1.2143	1.9942	1.1629	0.3777	-0.1791	2.4339	2.4689	6.3272	-0.1222	4.5356									
P11	LDGT2	88-95	0.49566	0.16456	-1.995	0.9652	1.6003	1.6143	0.2178	0.8508	-0.2399	3.1105	1.8601	2.7668	1.9044								
P12	LDGT2	88-95	0.39011	0.13915	-0.5048	0.8942	0.6646	0.7011	0.5649	-0.3036	0.9763	0.3149	0.4631	3.3575	0.9895	3.9381							
P13	LDGT2	88-95	0.22071	0.13586	0.1295	0.5892	1.2326	1.6722	0.4435	0.7176	0.4615	0.651	1.5772	0.5428	0.7152	1.6198	2.5117						
P14	LDGT2	88-95	0.16814	0.08085	0.4177	0.6242	1.2076	1.54	0.4306	1.0374	0.8469	0.7753	1.5915	0.5229	0.5567	1.0483	1.735	1.6545					
P15	LDGT2	88-95	0.09792	0.04274	1.2914	0.6299	0.932	1.5301	0.7496	0.6925	0.7213	0.5876	1.3142	0.4284	0.6686	0.9379	0.8221	1.0317	1.4681				
P16	LDGT2	88-95	0.08515	0.04	1.3815	0.6274	0.8992	1.2443	0.777	0.5902	0.9112	0.3659	1.1635	0.6339	0.6996	0.8562	0.8431	0.9855	1.1161	1.2384			
P17	LDGT2	88-95	0.0793	0.03	1.1604	0.6609	0.7332	1.166	0.8211	0.5607	0.8664	0.4784	1.1288	0.4527	0.7155	0.8591	0.8406	0.9915	1.0422	1.1105	1.2887		
P18	LDGT2	88-95	0.04482	0.00528	1.0205	0.6891	0.8472	0.9762	0.6666	1.0589	0.5961	0.8411	0.7658	0.5158	0.703	0.8891	0.6603	0.8286	0.8216	1.0348	0.9346	0.8792	
P19	LDGT2	88-95	0.0136	-0.00252	0.7213	0.711	0.747	0.8258	0.7089	0.7055	0.696	0.744	0.7329	0.7233	0.715	0.7382	0.7138	0.716	0.7117	0.7363	0.7333	0.6995	0.7243

IM147 Phase 2 Regression Coefficients, NOx, 1988 to 1995 Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT2	88-95	0.71642	0.34014											3.1858								
B12	LDGT2	88-95	0.55127	0.22451											1.6945	5.1988							
B13	LDGT2	88-95	0.30245	0.20374											0.8854	2.4317	3.3283						
B14	LDGT2	88-95	0.23377	0.14045											0.7529	1.6901	2.356	2.1936					
B15	LDGT2	88-95	0.13683	0.07379											0.881	1.4099	1.0647	1.3754	2.0165				
B16	LDGT2	88-95	0.11912	0.06757											0.9498	1.1559	1.1515	1.31	1.5401	1.6409			
B17	LDGT2	88-95	0.10918	0.04812											0.9645	1.1668	1.1296	1.3343	1.4075	1.494	1.8722		
B18	LDGT2	88-95	0.0635	0.01509											0.9291	1.3099	0.8518	1.1259	1.093	1.5612	1.2713	1.1432	
B19	LDGT2	88-95	0.01423	0.0016											0.9672	1.0052	0.9647	0.96	0.9599	1.0009	1.0227	0.9483	1.0006

IM147 Composite Regression Coefficients, NOx, 1996 and Newer Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGT2	96+	0.578	0.71379	15.4654																		
P2	LDGT2	96+	0.33821	0.37061	-21.218	3.256																	
P3	LDGT2	96+	0.33307	0.33021	-17.4893	2.5344	3.8906																
P4	LDGT2	96+	0.30416	0.30038	-14.5682	2.2242	11.6872	-12.2279															
P5	LDGT2	96+	0.29072	0.28842	-17.6088	1.8185	9.3908	-10.8536	4.734														
P6	LDGT2	96+	0.2883	0.30337	-11.6965	1.745	9.8903	-10.7171	5.8457	-7.1022													
P7	LDGT2	96+	0.24718	0.25136	-20.0849	1.7221	5.3396	-2.4287	-0.5675	-9.9875	8.4455												
P8	LDGT2	96+	0.23492	0.2519	-22.4763	1.5623	5.2794	-3.3995	-2.4191	-8.9711	6.8514	7.9536											
P9	LDGT2	96+	0.23608	0.24316	-22.27	1.5055	5.3167	-3.4781	-3.0309	-9.6937	6.8514	8.1317	3.1882										
P10	LDGT2	96+	0.2359	0.23077	-20.9734	1.5584	5.6716	-3.4051	-4.2894	-8.7832	6.8235	6.3126	1.8606	3.9221									
P11	LDGT2	96+	0.18371	0.16444	-10.5542	0.5675	3.1636	-1.1457	-3.3023	0.5825	3.4287	3.1947	4.4137	2.9738	1.3085								
P12	LDGT2	96+	0.18578	0.16354	-9.9999	0.6169	2.8048	-0.7267	-3.2312	0.1935	3.5982	3.0439	4.2462	2.9303	1.2191	0.2662							
P13	LDGT2	96+	0.12127	0.05817	-4.2485	0.6116	4.4173	-3.0746	-1.9566	-5.1095	2.1593	3.236	5.8951	2.3221	1.0537	-0.1452	1.6328						
P14	LDGT2	96+	0.06953	0.0183	4.3668	0.7373	2.7372	0.575	-1.3744	-3.22	2.844	-0.5548	1.4212	3.1253	0.6404	1.0543	0.791	1.4102					
P15	LDGT2	96+	0.05854	0.01128	2.8175	0.7837	1.5804	1.7698	-0.6221	-2.7325	2.4484	0.2815	-0.0086	2.3246	0.5592	1.0307	0.7388	1.1608	0.7986				
P16	LDGT2	96+	0.05584	0.00873	1.9819	0.7799	1.6432	1.5678	-0.4135	-2.4395	2.0557	0.0994	0.2982	1.9349	0.6182	0.9336	0.7441	1.0662	0.7148	1.3475			
P17	LDGT2	96+	0.05251	0.00847	0.351	0.7816	1.4739	1.5467	-0.3431	-2.0093	2.0146	-0.208	0.4812	1.4451	0.723	0.6611	0.7379	1.0331	0.6536	1.3684	2.1742		
P18	LDGT2	96+	0.01918	0.00064	1.8364	0.7759	1.0399	1.1145	0.2474	-0.0511	0.6696	0.6814	0.6723	1.4583	0.5956	0.9049	0.7647	0.8482	0.6884	1.3503	-0.5973	0.8893	
P19	LDGT2	96+	0.00325	0.00226	0.7097	0.7313	0.8044	0.6612	0.6632	0.833	0.6804	0.6611	0.5647	0.8016	0.72	0.6732	0.7118	0.7105	0.7272	0.7857	0.7169	0.7106	0.6983

IM147 Phase 2 Regression Coefficients, NOx, 1996 and Newer Model Year LDGT2's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGT2	96+	0.25624	0.28161											2.2649								
B12	LDGT2	96+	0.25427	0.26879											1.8738	1.3389							
B13	LDGT2	96+	0.18429	0.10134											1.6678	0.8038	2.0982						
B14	LDGT2	96+	0.11213	0.05754											1.2535	1.3129	1.0561	1.9394					
B15	LDGT2	96+	0.08972	0.02934											1.1523	0.9849	1.0364	1.4467	1.3152				
B16	LDGT2	96+	0.08172	0.02161											1.1412	0.9687	1.0064	1.2969	1.0936	2.5063			
B17	LDGT2	96+	0.07624	0.01744											1.1996	0.6743	0.9948	1.295	1.0153	2.0425	3.1694		
B18	LDGT2	96+	0.03345	0.0095											0.929	1.0616	1.0355	1.1034	0.9077	1.821	-0.1023	1.2122	
B19	LDGT2	96+	0.00415	0.0038											0.9821	0.9175	0.9698	0.9467	0.9808	1.0103	1.1121	0.9437	0.9983

IM147 Composite Regression Coefficients, NOx, 1981 to 1982 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV_	81-82	0.91799	1.65041	42.7692	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGV_	81-82	0.63601	0.72708	17.5251	4.1787	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGV_	81-82	0.52331	0.58513	-4.6789	2.4424	11.7817	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGV_	81-82	0.52237	0.58386	-6.215	2.4752	10.4671	3.1134	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGV_	81-82	0.50775	0.50405	-4.2723	2.2111	9.2772	2.5761	3.9991	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGV_	81-82	0.50352	0.48347	-3.9075	2.1456	8.9952	1.1125	3.4211	5.3989	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGV_	81-82	0.49839	0.48687	-4.3121	2.0136	8.6708	0.9449	1.0442	5.8614	2.4035	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGV_	81-82	0.46669	0.46683	1.6928	1.6175	7.9174	-2.5315	1.6902	0.2702	0.6553	7.5772	.	.	.	.	.	.	.	.	.	.	.
P9	LDGV_	81-82	0.46311	0.452	-0.8119	1.7211	7.5725	-2.1824	0.4138	-2.0068	0.7582	7.4243	3.9487	.	.	.	.	.	.	.	.	.	.
P10	LDGV_	81-82	0.46376	0.44782	-1.0048	1.7433	7.4758	-2.0726	0.0943	-1.7963	0.4584	7.4711	3.3527	1.0886	.	.	.	.	.	.	.	.	.
P11	LDGV_	81-82	0.35194	0.23815	-8.5826	0.7688	4.8431	-0.79	0.1979	2.4979	0.684	4.4696	3.7564	0.8973	1.4384	.	.	.	.	.	.	.	.
P12	LDGV_	81-82	0.2927	0.17049	-9.8733	0.9681	2.776	-2.0862	0.4024	1.4025	2.1207	3.7386	2.3379	1.5715	0.6911	2.5825	.	.	.	.	.	.	.
P13	LDGV_	81-82	0.18109	0.07569	-4.5202	0.7632	1.5888	1.3953	0.0498	2.8038	-0.6444	2.0452	0.4039	1.7917	0.6671	1.3367	2.4626	.	.	.	.	.	.
P14	LDGV_	81-82	0.14099	0.02431	-4.1674	0.7506	1.6956	1.9641	0.1583	1.4761	-0.6375	1.7248	-0.4851	2.7419	0.5236	0.9627	1.8418	1.5633	.	.	.	.	.
P15	LDGV_	81-82	0.08737	0.01811	-1.382	0.8401	1.3947	1.6138	-0.2041	1.0019	0.7778	0.8836	1.2699	0.6037	0.6393	0.8763	0.6065	0.8832	1.7403	.	.	.	.
P16	LDGV_	81-82	0.07312	0.0041	-1.1445	0.8151	1.058	1.5224	0.0582	0.8216	1.2094	0.5747	1.1231	0.8514	0.7173	0.8313	0.6082	0.7402	1.2902	1.5334	.	.	.
P17	LDGV_	81-82	0.07264	0.00367	-0.9811	0.8032	1.0413	1.4118	0.1444	0.848	1.1681	0.6401	1.1443	0.7002	0.7202	0.816	0.6414	0.7463	1.2653	1.4284	0.5328	.	.
P18	LDGV_	81-82	0.04243	0.00563	0.017	0.7339	0.8526	1.377	0.2716	1.0442	0.6919	0.8178	0.9258	0.5464	0.7223	0.7683	0.6426	0.8313	0.8107	1.4947	0.4033	0.8387	.
P19	LDGV_	81-82	0.01342	0.00395	0.7869	0.7185	0.788	0.8447	0.6524	0.7441	0.6472	0.857	0.6045	0.7562	0.6997	0.7449	0.6929	0.7279	0.7185	0.7737	0.6197	0.7165	0.6907

IM147 Phase 2 Regression Coefficients, NOx, 1981 to 1982 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV_	81-82	0.59924	0.60079	.	.	.	.	.	.	.	.	.	.	2.8438	.	.	.	.	.	.	.	.
B12	LDGV_	81-82	0.50466	0.48014	.	.	.	.	.	.	.	.	.	.	1.6	3.6643	.	.	.	.	.	.	.
B13	LDGV_	81-82	0.2646	0.11652	.	.	.	.	.	.	.	.	.	.	0.8595	2.316	3.4315	.	.	.	.	.	.
B14	LDGV_	81-82	0.21288	0.04456	.	.	.	.	.	.	.	.	.	.	0.7104	1.676	2.6006	2.1072	.	.	.	.	.
B15	LDGV_	81-82	0.13034	0.02244	.	.	.	.	.	.	.	.	.	.	0.8971	1.4034	0.8839	1.2572	2.3849	.	.	.	.
B16	LDGV_	81-82	0.1083	0.01418	.	.	.	.	.	.	.	.	.	.	1.0311	1.1362	1.0575	0.9885	1.7362	2.0954	.	.	.
B17	LDGV_	81-82	0.10478	0.0082	.	.	.	.	.	.	.	.	.	.	1.0248	1.1015	1.1113	1.0374	1.6264	1.8908	1.4012	.	.
B18	LDGV_	81-82	0.06108	-0.00004	.	.	.	.	.	.	.	.	.	.	0.9845	1.139	0.8671	1.145	0.9874	2.2913	0.654	1.1584	.
B19	LDGV_	81-82	0.01536	0.00328	.	.	.	.	.	.	.	.	.	.	0.9626	1.0202	0.9556	0.9706	0.9459	1.0635	0.9025	0.9818	0.9686

IM147 Composite Regression Coefficients, NOx, 1983 to 1985 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV_	83-85	0.96463	1.88521	18.7418																		
P2	LDGV_	83-85	0.58177	0.74711	0.782	4.5182																	
P3	LDGV_	83-85	0.57164	0.69924	1.7395	3.8215	3.9404																
P4	LDGV_	83-85	0.56866	0.69182	2.2485	3.7307	2.712	4.1135															
P5	LDGV_	83-85	0.54912	0.68329	0.0309	3.6538	-0.5552	2.7207	4.4539														
P6	LDGV_	83-85	0.54056	0.65766	-0.2605	3.6825	-0.6893	0.2755	3.3123	6.9261													
P7	LDGV_	83-85	0.52478	0.64771	-1.2424	3.0981	-0.7131	-0.3096	1.2743	8.0479	3.3901												
P8	LDGV_	83-85	0.49039	0.64355	-0.2025	2.5593	-0.8873	-2.2555	0.9327	0.9917	2.648	6.9554											
P9	LDGV_	83-85	0.49081	0.6366	-0.2479	2.5692	-0.9586	-2.1078	0.7709	0.8195	2.6479	6.804	0.8258										
P10	LDGV_	83-85	0.48198	0.62502	-0.6852	2.5126	-1.7481	-0.7564	0.3327	1.3097	1.8572	6.9911	-1.6919	3.7996									
P11	LDGV_	83-85	0.43238	0.38649	0.6471	1.837	-1.1074	0.237	1.3594	1.4974	0.1122	6.1798	0.33	1.9052	1.0346								
P12	LDGV_	83-85	0.35372	0.24907	1.0365	1.599	-1.5529	1.0484	1.5953	-0.2612	1.2403	3.835	-0.566	1.7683	0.4528	3.3405							
P13	LDGV_	83-85	0.22239	0.11604	1.4435	0.8789	1.1136	3.1005	0.6475	1.7479	0.451	1.0221	0.5773	0.455	0.4514	1.7854	2.2469						
P14	LDGV_	83-85	0.16685	0.04792	1.1199	0.8083	0.993	2.3512	0.3301	2.1868	0.9638	0.6226	1.2885	1.0545	0.5328	0.7862	1.2774	2.0142					
P15	LDGV_	83-85	0.09344	0.00442	0.6972	0.724	1.0561	1.1547	0.647	1.6301	0.8766	0.4133	1.7045	0.185	0.7132	0.6701	0.6719	1.0248	1.5987				
P16	LDGV_	83-85	0.07618	0.01155	1.4799	0.6974	0.9307	0.8525	0.7603	0.9115	1.0175	0.3596	1.3353	0.4874	0.7501	0.6536	0.7419	0.8969	1.1713	1.4857			
P17	LDGV_	83-85	0.07136	0.00873	1.0722	0.7157	0.74	1.0551	0.6004	0.9688	0.8579	0.6022	0.9517	0.6109	0.7611	0.5992	0.7747	0.9329	1.1217	1.2072	1.6127		
P18	LDGV_	83-85	0.03952	0.0055	0.6259	0.6692	0.8058	1.0136	0.6208	1.1765	0.512	0.9231	0.7662	0.5965	0.7047	0.7879	0.6504	0.8038	0.8335	1.1663	1.2587	0.9322	
P19	LDGV_	83-85	0.01224	-0.00128	0.8422	0.7007	0.7898	0.724	0.7372	0.8013	0.7199	0.7142	0.6943	0.7149	0.7141	0.7285	0.7042	0.7381	0.7145	0.6689	0.7795	0.691	0.7508

IM147 Phase 2 Regression Coefficients, NOx, 1983 to 1985 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV_	83-85	0.73374	0.81776											2.4382								
B12	LDGV_	83-85	0.54834	0.39309											1.1577	5.767							
B13	LDGV_	83-85	0.31629	0.20822											0.6375	2.8068	3.1803						
B14	LDGV_	83-85	0.24412	0.1176											0.8028	1.3747	1.9218	2.6998					
B15	LDGV_	83-85	0.13375	0.03665											0.9668	1.0509	0.9033	1.3245	2.2612				
B16	LDGV_	83-85	0.10708	0.03554											1.0501	0.8984	1.0487	1.1265	1.6402	2.0329			
B17	LDGV_	83-85	0.09639	0.02013											1.0496	0.8104	1.0655	1.2345	1.5252	1.6719	2.3989		
B18	LDGV_	83-85	0.05614	0.0163											0.9253	1.1246	0.8614	1.096	1.1113	1.8248	1.4559	1.1912	
B19	LDGV_	83-85	0.01369	0.0022											0.9686	0.9844	0.9642	0.9894	0.962	0.9116	1.1138	0.9386	1.0241

IM147 Composite Regression Coefficients, NOx, 1986 to 1989 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV	86-89	0.78565	1.40846	22.9983	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGV_	86-89	0.57844	0.77237	9.21	3.0925	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGV_	86-89	0.53576	0.63136	9.1703	2.0307	7.0173	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGV_	86-89	0.52985	0.61276	9.5621	2.0154	5.1612	5.5354	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGV_	86-89	0.48733	0.58411	7.6422	1.5437	3.1981	4.1123	5.8762	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGV_	86-89	0.469	0.58	4.0676	1.525	2.9935	0.4973	4.8986	10.1283	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGV_	86-89	0.44452	0.51948	2.5722	1.2222	2.2925	1.1125	2.3363	11.7286	3.4574	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGV_	86-89	0.42664	0.46953	3.5526	1.2073	1.7483	-0.3064	2.0313	6.7259	2.6637	5.3318	.	.	.	.	.	.	.	.	.	.	.
P9	LDGV_	86-89	0.42322	0.45426	3.3018	1.301	1.139	0.1369	1.5033	5.9904	2.5273	4.8613	3.2834	.	.	.	.	.	.	.	.	.	.
P10	LDGV_	86-89	0.42048	0.44434	2.7682	1.279	0.8669	0.8265	1.1624	5.9839	1.9554	4.9824	2.1016	2.3949	.	.	.	.	.	.	.	.	.
P11	LDGV_	86-89	0.3185	0.16273	1.6969	0.9234	0.2926	1.5843	1.5047	5.7857	0.6453	3.2517	2.4719	1.4771	1.3713	.	.	.	.	.	.	.	.
P12	LDGV_	86-89	0.28211	0.13132	0.4472	0.9805	-0.3268	1.5058	1.3641	3.9271	1.2167	1.5887	1.8636	1.9637	0.9702	2.2297	.	.	.	.	.	.	.
P13	LDGV_	86-89	0.17181	0.05351	1.5839	0.7587	0.7909	1.2166	0.7145	1.5691	0.9527	1.0643	1.0876	0.6012	0.7526	1.15	2.3208	.	.	.	.	.	.
P14	LDGV_	86-89	0.13065	0.04173	0.3316	0.7154	1.0709	0.6518	0.7486	1.2646	0.8718	0.8749	0.8522	0.9529	0.6065	0.9816	1.5163	1.6439	.	.	.	.	.
P15	LDGV_	86-89	0.08069	0.01822	0.1209	0.6879	0.733	1.0408	0.7212	1.5437	0.8545	0.957	0.2801	0.7471	0.6975	0.8112	0.8905	1.0278	1.3107	.	.	.	.
P16	LDGV_	86-89	0.06908	0.01317	0.5535	0.7013	0.7623	0.918	0.6392	1.068	0.9735	0.7864	0.2568	0.9626	0.7416	0.7472	0.8532	0.8939	1.013	1.487	.	.	.
P17	LDGV_	86-89	0.06367	0.01125	0.3901	0.7232	0.6166	0.8153	0.6598	1.0147	0.8687	0.8487	0.2077	0.8136	0.7444	0.7667	0.847	0.9405	0.9462	1.3241	1.4006	.	.
P18	LDGV_	86-89	0.03823	0.00394	0.7351	0.6866	0.7439	1.0847	0.6838	1.2044	0.6292	0.8002	0.5291	0.672	0.6852	0.8818	0.7191	0.82	0.7757	1.2183	0.9059	0.8386	.
P19	LDGV_	86-89	0.01005	0.00003	0.7593	0.7055	0.7238	0.7901	0.6814	0.9355	0.7038	0.7211	0.6966	0.7005	0.7134	0.7342	0.7231	0.7021	0.7072	0.7254	0.7597	0.7156	0.7326

IM147 Phase 2 Regression Coefficients, NOx, 1986 to 1989 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV_	86-89	0.52925	0.42098	.	.	.	.	.	.	.	.	.	.	2.5542	.	.	.	.	.	.	.	.
B12	LDGV_	86-89	0.43224	0.27635	.	.	.	.	.	.	.	.	.	.	1.6545	3.9022	.	.	.	.	.	.	.
B13	LDGV_	86-89	0.23852	0.0957	.	.	.	.	.	.	.	.	.	.	1.0646	1.7542	3.3487	.	.	.	.	.	.
B14	LDGV_	86-89	0.18118	0.07257	.	.	.	.	.	.	.	.	.	.	0.867	1.4108	2.1959	2.261	.	.	.	.	.
B15	LDGV_	86-89	0.11203	0.02849	.	.	.	.	.	.	.	.	.	.	0.9505	1.1788	1.2539	1.4295	1.7812	.	.	.	.
B16	LDGV_	86-89	0.0963	0.02351	.	.	.	.	.	.	.	.	.	.	1.0428	0.9898	1.2047	1.2246	1.4141	1.9452	.	.	.
B17	LDGV_	86-89	0.08734	0.01558	.	.	.	.	.	.	.	.	.	.	1.0275	1.0114	1.167	1.2958	1.2756	1.7751	1.9705	.	.
B18	LDGV_	86-89	0.05354	0.0073	.	.	.	.	.	.	.	.	.	.	0.9133	1.2514	0.967	1.1377	1.0194	1.8001	1.2499	1.0893	.
B19	LDGV_	86-89	0.01153	0.00104	.	.	.	.	.	.	.	.	.	.	0.964	0.9967	0.973	0.9592	0.9531	0.9973	1.0544	0.9572	1.0152

IM147 Composite Regression Coefficients, NOx, 1990 to 1995 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV_	90-95	0.85265	0.98234	27.2602																		
P2	LDGV	90-95	0.55676	0.37911	3.4685	3.9198																	
P3	LDGV	90-95	0.5187	0.31019	2.4287	2.702	6.9157																
P4	LDGV	90-95	0.51364	0.29256	2.566	2.669	5.4346	4.5289															
P5	LDGV	90-95	0.47026	0.27475	0.7261	2.0325	3.4764	2.5823	7.1639														
P6	LDGV	90-95	0.46835	0.27776	0.0795	2.0153	3.3673	1.5718	6.6904	3.6255													
P7	LDGV	90-95	0.43598	0.24653	-0.2787	1.6476	1.7967	2.607	2.986	4.5264	4.7362												
P8	LDGV	90-95	0.42397	0.22613	0.8668	1.576	1.4199	1.0315	2.7698	1.4176	3.8634	4.4221											
P9	LDGV	90-95	0.41414	0.21779	0.4251	1.6155	0.9945	0.7619	2.1999	0.108	3.4947	3.5743	5.7316										
P10	LDGV	90-95	0.40712	0.2139	-0.4251	1.6685	0.371	1.1081	1.7587	0.4377	2.6567	3.7398	4.0116	3.1506									
P11	LDGV	90-95	0.32541	0.07608	0.4951	1.01	0.8419	0.3247	2.3515	0.3887	1.0667	2.0267	3.9523	1.1292	1.4038								
P12	LDGV	90-95	0.27382	0.05866	1.1507	0.9457	0.7041	-0.1603	1.9823	-0.7329	1.4374	0.757	2.5555	1.2857	0.8276	3.2666							
P13	LDGV	90-95	0.1552	0.0465	1.245	0.7538	1.2793	0.8753	0.6342	0.2174	0.6015	0.6589	2.2733	-0.1902	0.7277	1.3434	2.4018						
P14	LDGV	90-95	0.11701	0.02975	1.1371	0.7436	0.97	0.8665	0.7991	0.5198	0.7343	0.5517	1.7367	0.4654	0.6168	1.0241	1.4687	1.7969					
P15	LDGV	90-95	0.07219	0.00927	0.8725	0.7153	0.8392	0.9635	0.7945	0.6765	0.7708	0.6798	1.0226	0.5631	0.7013	0.8864	0.8237	1.0439	1.3295				
P16	LDGV	90-95	0.06398	0.00808	1.0798	0.7045	0.8792	0.8433	0.7229	0.5834	0.8931	0.5466	0.9541	0.7035	0.7254	0.8265	0.8134	0.9715	1.0589	1.191			
P17	LDGV	90-95	0.05809	0.00266	0.7561	0.7292	0.6974	0.8682	0.8458	0.6179	0.8355	0.681	0.8312	0.5502	0.7239	0.822	0.8206	0.9771	0.9638	1.1024	1.5163		
P18	LDGV	90-95	0.03251	0.00233	0.6937	0.7144	0.6856	0.9367	0.7529	0.9301	0.619	0.8318	0.7798	0.5858	0.6898	0.8309	0.7014	0.849	0.7786	1.1002	0.83	0.8865	
P19	LDGV_	90-95	0.00903	0.00112	0.8195	0.7065	0.733	0.7558	0.7072	0.8124	0.7212	0.7331	0.7165	0.7193	0.7121	0.7215	0.7187	0.7075	0.7149	0.7316	0.7374	0.7123	0.7172

IM147 Phase 2 Regression Coefficients, NOx, 1990 to 1995 Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV	90-95	0.4955	0.16783											2.7648								
B12	LDGV	90-95	0.39806	0.10265											1.5279	4.9874							
B13	LDGV	90-95	0.21598	0.0764											0.9775	2.036	3.2274						
B14	LDGV	90-95	0.16191	0.04867											0.8655	1.4947	2.0303	2.4727					
B15	LDGV	90-95	0.09916	0.01709											0.9685	1.262	1.1221	1.4177	1.8321				
B16	LDGV	90-95	0.08828	0.01425											1.0137	1.1226	1.1413	1.3001	1.4762	1.565			
B17	LDGV	90-95	0.07957	0.00619											0.9986	1.1256	1.132	1.322	1.3198	1.5162	2.0499		
B18	LDGV	90-95	0.04511	0.00552											0.9273	1.1868	0.9219	1.1679	1.0538	1.5928	1.0608	1.1805	
B19	LDGV_	90-95	0.01076	0.00217											0.9663	0.9854	0.9735	0.9568	0.9719	1.0002	1.022	0.9682	0.9807

IM147 Composite Regression Coefficients, NOx, 1996 and Newer Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
P1	LDGV_	96+	0.29865	0.37011	11.7736	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P2	LDGV_	96+	0.22677	0.24297	-3.0327	2.4026	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P3	LDGV_	96+	0.21591	0.222	-0.4545	1.4421	5.448	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P4	LDGV_	96+	0.21456	0.2173	-0.7302	1.4606	4.3233	3.1071	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P5	LDGV_	96+	0.20702	0.21364	1.0698	1.2242	3.8494	-0.6109	4.3718	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P6	LDGV_	96+	0.20746	0.2141	0.6213	1.2154	3.841	-0.6842	4.2145	0.9383	.	.	.	.	.	.	.	.	.	.	.	.	.
P7	LDGV_	96+	0.20382	0.20285	2.5242	1.0207	3.6971	-1.4265	3.1047	0.3945	2.683	.	.	.	.	.	.	.	.	.	.	.	.
P8	LDGV_	96+	0.19807	0.19482	4.1563	0.9074	3.4911	-2.0343	2.3803	-0.0536	2.1013	3.3361	.	.	.	.	.	.	.	.	.	.	.
P9	LDGV_	96+	0.19619	0.19096	1.8739	1.0364	2.2721	-1.119	2.141	-0.5391	2.1297	2.5845	3.318	.	.	.	.	.	.	.	.	.	.
P10	LDGV_	96+	0.1935	0.18673	1.493	0.998	2.3525	-1.4944	2.0734	0.242	1.6938	2.8999	1.2192	1.9845	.	.	.	.	.	.	.	.	.
P11	LDGV_	96+	0.15206	0.11563	6.6686	0.3811	2.506	-1.1883	0.7057	-0.2193	2.4209	0.8267	1.5013	0.5498	1.1615	.	.	.	.	.	.	.	.
P12	LDGV_	96+	0.14242	0.09025	7.3264	0.4696	2.0937	-0.2105	0.3797	-0.6436	2.1032	0.8737	0.8521	0.6422	0.984	1.8962	.	.	.	.	.	.	.
P13	LDGV_	96+	0.1117	0.0621	4.8271	0.6696	2.0895	-2.2591	0.9164	-0.565	1.4492	-0.1321	0.1274	0.7773	0.8735	0.8257	2.0634	.	.	.	.	.	.
P14	LDGV_	96+	0.0781	0.04141	3.4134	0.5916	1.3165	-0.2995	1.3675	-0.2089	1.4165	0.0989	0.2565	0.3993	0.7549	0.6841	1.288	1.631	.	.	.	.	.
P15	LDGV_	96+	0.05148	0.02187	2.4596	0.6558	1.17	0.6931	0.7565	0.2435	0.7215	0.5341	0.5256	0.6843	0.7209	0.6775	1.1075	0.9069	1.122	.	.	.	.
P16	LDGV_	96+	0.04778	0.01987	3.1395	0.6091	1.203	0.5425	0.9077	0.4201	0.7848	0.5764	0.1403	0.7957	0.7431	0.6929	1.0516	0.9276	0.7894	1.4029	.	.	.
P17	LDGV_	96+	0.04525	0.01326	3.3943	0.6187	0.8612	0.7678	1.1673	0.4078	0.7682	0.5486	0.2441	0.6409	0.7404	0.726	0.935	1.0264	0.7278	1.3847	1.368	.	.
P18	LDGV_	96+	0.02353	0.00022	1.5178	0.6979	0.7651	0.9288	0.6991	0.3426	0.7998	0.6796	0.6094	0.5847	0.7147	0.8429	0.6623	0.895	0.6746	0.9795	0.7813	1.0686	.
P19	LDGV_	96+	0.004	0.00038	0.7846	0.7189	0.7176	0.7276	0.6851	0.7511	0.7279	0.6879	0.7681	0.6817	0.7174	0.7317	0.7291	0.7203	0.7125	0.7336	0.7584	0.7113	0.7181

IM147 Phase 2 Regression Coefficients, NOx, 1996 and Newer Model Year LDGV's

					Regression Coefficients																		
Segment Number			RMS Error	Reg. Constant	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
B11	LDGV_	96+	0.20953	0.18322	.	.	.	.	.	.	.	.	.	.	1.6724	.	.	.	.	.	.	.	.
B12	LDGV_	96+	0.19448	0.14434	.	.	.	.	.	.	.	.	.	.	1.3687	2.7382	.	.	.	.	.	.	.
B13	LDGV_	96+	0.155	0.09509	.	.	.	.	.	.	.	.	.	.	1.1262	1.2948	2.6037	.	.	.	.	.	.
B14	LDGV_	96+	0.10659	0.06065	.	.	.	.	.	.	.	.	.	.	0.9685	0.9898	1.6977	2.2378	.	.	.	.	.
B15	LDGV_	96+	0.06912	0.03298	.	.	.	.	.	.	.	.	.	.	0.9526	0.8932	1.4872	1.252	1.5305	.	.	.	.
B16	LDGV_	96+	0.0649	0.03049	.	.	.	.	.	.	.	.	.	.	0.9772	0.9069	1.4267	1.2614	1.1325	1.7334	.	.	.
B17	LDGV_	96+	0.06203	0.02204	.	.	.	.	.	.	.	.	.	.	0.9694	0.9325	1.3118	1.3384	1.0793	1.6717	1.6273	.	.
B18	LDGV_	96+	0.03172	0.00214	.	.	.	.	.	.	.	.	.	.	0.9508	1.1071	0.9089	1.1952	0.9329	1.2914	1.0022	1.4675	.
B19	LDGV_	96+	0.00523	0.00111	.	.	.	.	.	.	.	.	.	.	0.9672	0.9874	0.9855	0.9791	0.9675	0.9838	1.0369	0.9689	0.9757

Appendix D

Excess Emissions with Fast-pass, Retest, Fast-Fail Enabled

Max CO Cutpoints

Vehicle Class	Model Year Range	Excess IM240 HC (grams)	Excess HC with fast-pass (grams)	Excess HC Identified	Excess IM240 CO (grams)	Excess CO with fast-pass (grams)	Excess CO Identified	Excess IM240 NOx (grams)	Excess NO with fast-pass (grams)	Excess NOx Identified
LDGV	81-82	0	0	N/A	56.74	49.73	87.6%	3.61	3.61	100.0%
	83-85	6.13	6.13	100.0%	243.24	237.02	97.4%	3.49	3.49	100.0%
	86-89	10.72	10.65	99.3%	301.8	294.27	97.5%	9.92	9.92	100.0%
	90-95	8.96	8.68	96.9%	185.26	157.96	85.3%	6.59	6.02	91.4%
	96+	0	0	N/A	0	0	N/A	0	0	N/A
	ALL	25.81	25.46	98.6%	787.04	738.98	93.9%	23.61	23.04	97.6%
LDGT1	81-85	10.99	8.32	75.7%	605.55	590.71	97.5%	19.02	18.72	98.4%
	88-89	5.55	5.13	92.4%	533.37	485.61	91.0%	2.37	2.36	99.6%
	90-95	0.42	0	0.0%	1.77	0	0.0%	1.65	1.65	100.0%
	96+	0	0	N/A	0	0	N/A	0.43	0.43	100.0%
	ALL	16.96	13.45	79.3%	1140.69	1076.32	94.4%	23.47	23.16	98.7%
LDGT2	81-85	15.62	15.62	100.0%	441.44	441.44	100.0%	6.69	6.69	100.0%
	86-87	10.39	10.39	100.0%	285.54	285.54	100.0%	4.11	2.91	70.8%
	88-95	0.21	0.21	100.0%	26.15	15.16	58.0%	0.68	0.27	39.7%
	96+	0	0	N/A	0	0	N/A	0	0	N/A
	ALL	26.22	26.22	100.0%	753.13	742.14	98.5%	11.48	9.87	86.0%
Total	ALL	68.99	65.13	**94.4%**	2680.86	2557.44	**95.4%**	58.56	56.07	**95.7%**

Excess Emissions with Fast-pass Enabled

Max CO Cutpoints

Vehicle Class	Model Year Range	Excess IM240 HC (grams)	Excess HC with fast-pass (grams)	Excess HC Identified	Excess IM240 CO (grams)	Excess CO with fast-pass (grams)	Excess CO Identified	Excess IM240 Nox (grams)	Excess NO with fast-pass (grams)	Excess NOx Identified
LDGV	81-82	0	0	N/A	56.74	49.73	87.6%	3.61	3.61	100.0%
	83-85	6.13	6.13	100.0%	243.24	237.02	97.4%	3.49	3.49	100.0%
	86-89	10.72	10.65	99.3%	301.8	294.27	97.5%	9.92	9.92	100.0%
	90-95	8.96	8.68	96.9%	185.26	157.96	85.3%	6.59	6.02	91.4%
	96+	0	0	N/A	0	0	N/A	0	0	N/A
	ALL	25.81	25.46	98.6%	787.04	738.98	93.9%	23.61	23.04	97.6%
LDGT1	81-85	10.99	8.32	75.7%	605.55	560.92	92.6%	19.02	18.72	98.4%
	88-89	5.55	5.13	92.4%	533.37	485.61	91.0%	2.37	1.69	71.3%
	90-95	0.42	0	0.0%	1.77	0	0.0%	1.65	1.65	100.0%
	96+	0	0	N/A	0	0	N/A	0.43	0	0.0%
	ALL	16.96	13.45	79.3%	1140.69	1046.53	91.7%	23.47	22.06	94.0%
LDGT2	81-85	15.62	14.47	92.6%	441.44	441.44	100.0%	6.69	5.72	85.5%
	86-87	10.39	10.39	100.0%	285.54	285.54	100.0%	4.11	2.31	56.2%
	88-95	0.21	0.21	100.0%	26.15	15.16	58.0%	0.68	0.27	39.7%
	96+	0	0	N/A	0	0	N/A	0	0	N/A
	ALL	26.22	25.07	95.6%	753.13	742.14	98.5%	11.48	8.3	72.3%
Total	ALL	68.99	63.98	**92.7%**	2680.86	2527.65	**94.3%**	58.56	53.4	**91.2%**

Excess Emissions with Fast-pass Disabled

Max CO Cutpoints

Vehicle Class	Model Year Range	Excess IM240 HC (grams)	Excess HC w/o fast-pass (grams)	Excess HC Identified	Excess IM240 CO (grams)	Excess CO w/o fast-pass (grams)	Excess CO Identified	Excess IM240 Nox (grams)	Excess NO w/o fast-pass (grams)	Excess NOx Identified
LDGV	81-82	10.99	8.32	75.7%	605.55	603.26	99.6%	19.02	18.72	98.4%
	83-85	5.55	5.55	100.0%	533.37	527.14	98.8%	2.37	1.69	71.3%
	86-89	0.42	0.42	100.0%	1.77	0	0.0%	1.65	1.65	100.0%
	90-95	0	0	N/A	0	0	N/A	0.43	0.43	100.0%
	96+	16.96	14.29	84.3%	1140.69	1130.4	99.1%	23.47	22.49	95.8%
	ALL	15.62	14.47	92.6%	441.44	441.44	100.0%	6.69	5.72	85.5%
LDGT1	81-85	10.39	10.39	100.0%	285.54	285.54	100.0%	4.11	2.31	56.2%
	88-89	0.21	0.21	100.0%	26.15	26.15	100.0%	0.68	0.38	55.9%
	90-95	0	0	N/A	0	0	N/A	0	0	N/A
	96+	26.22	25.07	95.6%	753.13	753.13	100.0%	11.48	8.41	73.3%
	ALL	0	0	N/A	56.74	49.73	87.6%	3.61	3.61	100.0%
LDGT2	81-85	6.13	6.13	100.0%	243.24	237.02	97.4%	3.49	3.49	100.0%
	86-87	10.72	10.72	100.0%	301.8	301.22	99.8%	9.92	9.92	100.0%
	88-95	8.96	8.87	99.0%	185.26	160	86.4%	6.59	6.02	91.4%
	96+	0	0	N/A	0	0	N/A	0	0	N/A
	ALL	25.81	25.72	99.7%	787.04	747.97	95.0%	23.61	23.04	97.6%
Total	ALL	68.99	65.08	**94.3%**	2680.86	2631.5	**98.2%**	58.56	53.94	**92.1%**

IM147 CUMULATIVE POSITIVE POWER (CPP) VARIATION CUTPOINTS

IM147 REFERENCE DATA			POWER VARIATION CUTPOINTS (mph2/sec)				
TIME (sec)	SPEED (mph)	CPP (mph2/sec)	"BASE" DELTA	MULT. FACTOR	VARYING DELTA	CPP LIMITS LOW	CPP LIMITS HIGH
0	0.0	0.00	.	.	.	.	.
1	0.0	0.00	.	.	.	.	.
2	0.0	0.00	.	.	.	.	.
3	0.0	0.00	.	.	.	.	.
4	0.0	0.00	.	.	.	.	.
5	3.3	10.89	.	.	.	.	.
6	6.6	43.56	.	.	.	.	.
7	9.9	98.01	.	.	.	.	.
8	13.2	174.24	.	.	.	.	.
9	16.5	272.25	.	.	.	.	.
10	19.8	392.04	.	.	.	.	.
11	22.2	492.84	.	.	.	.	.
12	24.3	590.49	.	.	.	.	.
13	25.8	665.64	.	.	.	.	.
14	26.4	696.96	.	.	.	.	.
15	25.7	696.96	.	.	.	.	.
16	25.1	696.96	.	.	.	.	.
17	24.7	696.96	.	.	.	.	.
18	25.2	721.91	.	.	.	.	.
19	25.4	732.03	.	.	.	.	.
20	27.2	826.71	.	.	.	.	.
21	26.5	826.71	.	.	.	.	.
22	24.0	826.71	.	.	.	.	.
23	22.7	826.71	.	.	.	.	.
24	19.4	826.71	.	.	.	.	.
25	17.7	826.71	.	.	.	.	.
26	17.2	826.71	.	.	.	.	.
27	18.1	858.48	.	.	.	.	.
28	18.6	876.83	.	.	.	.	.
29	20.0	930.87	.	.	.	.	.
30	20.7	959.36	69.7	3.500	244.0	715.31	1,203.41
31	21.7	1001.76	72.8	3.424	249.3	752.44	1,251.08
32	22.4	1032.63	75.1	3.386	254.2	778.47	1,286.79
33	22.5	1037.12	75.4	3.348	252.4	784.71	1,289.53
34	22.1	1037.12	75.4	3.348	252.4	784.71	1,289.53
35	21.5	1037.12	75.4	3.348	252.4	784.71	1,289.53
36	20.9	1037.12	75.4	3.348	252.4	784.71	1,289.53
37	20.4	1037.12	75.4	3.348	252.4	784.71	1,289.53
38	19.8	1037.12	75.4	3.348	252.4	784.71	1,289.53
39	17.0	1037.12	75.4	3.348	252.4	784.71	1,289.53
40	17.1	1040.53	75.6	3.311	250.4	790.16	1,290.90
41	15.8	1040.53	75.6	3.311	250.4	790.16	1,290.90
42	15.8	1040.53	75.6	3.311	250.4	790.16	1,290.90
43	17.7	1104.18	80.3	3.273	262.7	841.53	1,366.83
44	19.8	1182.93	86.0	3.235	278.1	904.80	1,461.06
45	21.6	1257.45	91.4	3.197	292.2	965.27	1,549.63

IM147 CUMULATIVE POSITIVE POWER (CPP) VARIATION CUTPOINTS

IM147 REFERENCE DATA			POWER VARIATION CUTPOINTS (mph2/sec)				
TIME	SPEED	CPP	"BASE"	MULT.	VARYING	CPP LIMITS	
(sec)	(mph)	(mph2/sec)	DELTA	FACTOR	DELTA	LOW	HIGH
46	22.2	1283.73	93.3	3.159	294.8	988.97	1,578.49
47	24.5	1391.14	101.1	3.121	315.6	1,075.55	1,706.73
48	24.7	1400.98	101.8	3.083	314.0	1,087.02	1,714.94
49	24.8	1405.93	102.2	3.045	311.2	1,094.73	1,717.13
50	24.7	1405.93	102.2	3.045	311.2	1,094.73	1,717.13
51	24.6	1405.93	102.2	3.045	311.2	1,094.73	1,717.13
52	24.6	1405.93	102.2	3.045	311.2	1,094.73	1,717.13
53	25.1	1430.78	104.0	3.008	312.8	1,118.02	1,743.54
54	25.6	1456.13	105.8	2.970	314.3	1,141.83	1,770.43
55	25.7	1461.26	106.2	2.932	311.4	1,149.88	1,772.64
56	25.4	1461.26	106.2	2.932	311.4	1,149.88	1,772.64
57	24.9	1461.26	106.2	2.932	311.4	1,149.88	1,772.64
58	25.0	1466.25	106.6	2.894	308.4	1,157.84	1,774.66
59	25.4	1486.41	108.0	2.856	308.6	1,177.85	1,794.97
60	26.0	1517.25	110.3	2.818	310.8	1,206.47	1,828.03
61	26.0	1517.25	110.3	2.818	310.8	1,206.47	1,828.03
62	25.7	1517.25	110.3	2.818	310.8	1,206.47	1,828.03
63	26.1	1537.97	111.8	2.780	310.8	1,227.18	1,848.76
64	26.7	1569.65	114.1	2.742	312.9	1,256.78	1,882.52
65	27.3	1602.05	116.4	2.705	314.9	1,287.13	1,916.97
66	30.5	1787.01	129.9	2.667	346.4	1,440.65	2,133.37
67	33.5	1979.01	143.8	2.629	378.1	1,600.89	2,357.13
68	36.2	2167.20	157.5	2.591	408.1	1,759.09	2,575.31
69	37.3	2248.05	163.4	2.553	417.1	1,830.90	2,665.20
70	39.3	2401.25	174.5	2.515	439.0	1,962.29	2,840.21
71	40.5	2497.01	181.5	2.477	449.6	2,047.41	2,946.61
72	42.1	2629.17	191.1	2.439	466.2	2,163.02	3,095.32
73	43.5	2749.01	199.8	2.402	479.8	2,269.18	3,228.84
74	45.1	2890.77	210.1	2.364	496.6	2,394.15	3,387.39
75	46.0	2972.76	216.1	2.326	502.5	2,470.24	3,475.28
76	46.8	3047.00	221.5	2.288	506.7	2,540.32	3,553.68
77	47.5	3113.01	226.3	2.250	509.1	2,603.92	3,622.10
78	47.5	3113.01	226.3	2.250	509.1	2,603.92	3,622.10
79	47.3	3113.01	226.3	2.250	509.1	2,603.92	3,622.10
80	47.2	3113.01	226.3	2.250	509.1	2,603.92	3,622.10
81	47.2	3113.01	226.3	2.250	509.1	2,603.92	3,622.10
82	47.4	3131.93	227.6	2.212	503.6	2,628.37	3,635.49
83	47.9	3179.58	231.1	2.174	502.5	2,677.11	3,682.05
84	48.5	3237.42	235.3	2.136	502.7	2,734.73	3,740.11
85	49.1	3295.98	239.6	2.098	502.7	2,793.27	3,798.69
86	49.5	3335.42	242.4	2.061	499.5	2,835.88	3,834.96
87	50.0	3385.17	246.0	2.023	497.7	2,887.49	3,882.85
88	50.6	3445.53	250.4	1.985	497.1	2,948.47	3,942.59
89	51.0	3486.17	253.4	1.947	493.3	2,992.84	3,979.50
90	51.5	3537.42	257.1	1.909	490.8	3,046.58	4,028.26
91	52.2	3610.01	262.4	1.871	491.0	3,119.03	4,100.99

IM147 CUMULATIVE POSITIVE POWER (CPP) VARIATION CUTPOINTS

IM147 REFERENCE DATA			POWER VARIATION CUTPOINTS (mph2/sec)				
TIME	SPEED	CPP	"BASE"	MULT.	VARYING	CPP LIMITS	
(sec)	(mph)	(mph2/sec)	DELTA	FACTOR	DELTA	LOW	HIGH
92	53.2	3715.41	270.0	1.833	495.1	3,220.33	4,210.49
93	54.1	3811.98	277.1	1.795	497.5	3,314.53	4,309.43
94	54.6	3866.33	281.0	1.758	493.9	3,372.43	4,360.23
95	54.9	3899.18	283.4	1.720	487.4	3,411.82	4,386.54
96	55.0	3910.17	284.2	1.682	478.0	3,432.20	4,388.14
97	54.9	3910.17	284.2	1.682	478.0	3,432.20	4,388.14
98	54.6	3910.17	284.2	1.682	478.0	3,432.20	4,388.14
99	54.6	3910.17	284.2	1.682	478.0	3,432.20	4,388.14
100	54.8	3932.05	285.8	1.644	469.8	3,462.23	4,401.87
101	55.1	3965.02	288.2	1.606	462.8	3,502.17	4,427.87
102	55.5	4009.26	291.4	1.568	457.0	3,552.29	4,466.23
103	55.7	4031.50	293.0	1.530	448.4	3,583.09	4,479.91
104	56.1	4076.22	296.3	1.492	442.2	3,634.06	4,518.38
105	56.3	4098.70	297.9	1.455	433.3	3,665.39	4,532.01
106	56.6	4132.57	300.4	1.417	425.5	3,707.05	4,558.09
107	56.7	4143.90	301.2	1.379	415.3	3,728.63	4,559.17
108	56.7	4143.90	301.2	1.379	415.3	3,728.63	4,559.17
109	56.3	4143.90	301.2	1.379	415.3	3,728.63	4,559.17
110	56.0	4143.90	301.2	1.379	415.3	3,728.63	4,559.17
111	55.0	4143.90	301.2	1.379	415.3	3,728.63	4,559.17
112	53.4	4143.90	301.2	1.379	415.3	3,728.63	4,559.17
113	51.6	4143.90	301.2	1.379	415.3	3,728.63	4,559.17
114	51.8	4164.58	302.7	1.341	405.9	3,758.70	4,570.46
115	52.1	4195.75	305.0	1.303	397.4	3,798.38	4,593.12
116	52.5	4237.59	308.0	1.265	389.7	3,847.93	4,627.25
117	53.0	4290.34	311.8	1.227	382.7	3,907.64	4,673.04
118	53.5	4343.59	315.7	1.189	375.5	3,968.10	4,719.08
119	54.0	4397.34	319.6	1.152	368.0	4,029.31	4,765.37
120	54.9	4495.35	326.7	1.114	363.9	4,131.49	4,859.21
121	55.4	4550.50	330.7	1.076	355.8	4,194.70	4,906.30
122	55.6	4572.70	332.4	1.038	344.9	4,227.76	4,917.64
123	56.0	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
124	56.0	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
125	55.8	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
126	55.2	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
127	54.5	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
128	53.6	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
129	52.5	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
130	51.5	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
131	50.5	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
132	48.0	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
133	44.5	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
134	41.0	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
135	37.5	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
136	34.0	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
137	30.5	4617.34	335.6	1.000	335.6	4,281.74	4,952.94

IM147 CUMULATIVE POSITIVE POWER (CPP) VARIATION CUTPOINTS

IM147 REFERENCE DATA			POWER VARIATION CUTPOINTS (mph2/sec)				
TIME (sec)	SPEED (mph)	CPP (mph2/sec)	"BASE" DELTA	MULT. FACTOR	VARYING DELTA	CPP LIMITS LOW	CPP LIMITS HIGH
138	27.0	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
139	23.5	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
140	20.0	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
141	16.5	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
142	13.0	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
143	9.5	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
144	6.0	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
145	2.5	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
146	0.0	4617.34	335.6	1.000	335.6	4,281.74	4,952.94
Cycle Sums		4617.34		1.000		4,281.74	4,952.94