General Motors Corporation
Legal Staff

Facsimile
(313) 974-1260

Telephone
(313) 974-1572

September 1, 1998

The Honorable Philip R. Recht
Deputy Administrator
NATIONAL HIGHWAY TRAFFIC
SAFETY ADMINISTRATION
400 Seventh Street, S.W., Room 5220
Washington, DC 20590

Dear Mr. Recht:

Re: **Settlement Agreement**
<u>Section B. Fire Safety Research</u>

Enclosed is the Final Report prepared by Jack L. Jensen and Jeffrey Santrock of General Motors Corporation entitled "Evaluation of Motor Vehicle Fire Initiation and Propagation Part 2: Crash Tests on a Passenger Van."

This report summarizes the crash tests conducted on the Dodge Caravans as part of Project B.3 (Fire Initiation and Propagation Tests).

Sincerely,

David A. Collins
Attorney

Enclosure

MC 482-207-745 - New Center One Building - 3031 West Grand Boulevard, Detroit, Michigan 48202

Evaluation of Motor Vehicle Fire Initiation and Propagation
Part 2: Crash Tests on a Passenger Van

Jack L. Jensen, Jeffrey Santrock

General Motors Corporation

Abstract

This report describes the test conditions and presents the results of four crash tests, each of a passenger van, to study post-collision fire potential. Specialized instrumentation was used to help identify potential ignition sources during the crash. These tests were part of a series of crash and fire propagation tests which General Motors Corporation conducted as part of the GM/Department of Transportation Agreement of March 7, 1995 (Project B.3).

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

List of Figures

List of Figures (continued)

Note: additional figures in Appendices

List of Tables

1. Introduction

Four crash tests were conducted on a passenger van to study post-collision fire potential. These tests were part of a series of crash and fire propagation tests which General Motors Corporation conducted as part of the GM/Department of Transportation Agreement of March 7, 1995 (Project B.3). Part 1 of this report, "Vehicle Crash and Fire Propagation Test Program" documents the overall strategies for this research project and includes the research objectives, testing matrix, test conditions, testing methodology and vehicle selection criteria [1].

This report describes the test conditions and presents the results of four crash tests, each of a new 1996 Dodge Caravan. The four crash conditions used for testing were an offset pole frontal impact at 55 km/h (34 mph), an offset rigid barrier frontal impact at 60 km/h (37 mph), an oblique moving deformable barrier frontal impact at 105 km/h (65 mph), and a repeat of the offset pole test [1]. A repeat test of the offset pole was required to collect information from specialized instrumentation which was either not available or malfunctioned on the first test, and also to evaluate the effects of the hood, which was removed on the first pole impact but left on for the second pole impact.

The results from planned crash tests on other vehicle types including a rear wheel drive passenger car (1997 Chevrolet Camaro), a sport utility vehicle (1997 Ford Explorer), and a front wheel drive passenger car (1998 Honda Accord) [1], will be reported in subsequent technical reports. These additional vehicles will be tested with an additional rear impact test not used for the passenger van series. This test will be a 53 mph impact with a deformable moving barrier using a 70% overlap. The rationale for selecting these vehicle models and crash conditions was also described in Part 1 of this report [1].

A rear impact was not conducted on the passenger van because the National Highway Traffic Safety Administration (NHTSA), through its contractor, Transportation Research Corporation in East Liberty, Ohio, had conducted a similar rear impact crash test on March 2, 1996 using a 1996 Plymouth Voyager. The conditions for the Voyager test differed to some extent from the conditions used in this series of tests. (As an example, the impact speed for the Voyager test was 80 km/h (50 mph), as compared to 85 km/h (53 mph) used for this series.) However, the crash configurations were similar, and it was concluded that little new information about post-collision fire ignition sources would likely have been obtained by conducting a rear impact crash test as described in Part 1 with a Dodge Caravan. The Dodge Caravan and Plymouth Voyager vehicles are similar. Thus the rear impact on the passenger van was dropped and replaced with the repeat of the pole impact.

The four test vehicles were new and similarly equipped 1996 Dodge Caravan Sports. All four vehicles had the following options: 3.3 liter V-6 engine, air conditioning, four speed automatic transmission, a driver's side rear sliding door, and the SE sport package. Standard factory equipped features included lap / shoulder seat belts and dual front air bags. As described in Part 1, the best-selling engine, transmission and air-conditioning options were selected. Based on Ward's 1997 Automotive Yearbook [2], the 3.3 liter engine accounted for 46.6% of model year 1996 Caravan sales compared to 32.4% for the 3.0 liter, 15.3% for the 3.8 liter, and 5.7% for the 2.4 liter engines. Similarly, 62.3% of the Caravans had a 4 speed automatic transmission compared to 37.7% with a 3 speed automatic transmission. Air conditioning was included on all of the Caravans sold. Sales figures were not used to select any other options, however.

2. Passenger Van Offset Pole Frontal Impact, Test C11108

On May 16, 1996 the first passenger van offset pole frontal impact crash test (test #C11108) was conducted at the General Motors Proving Ground in Milford, Michigan. A fire crew was present during and immediately after the test.

A total of 111 channels of data were recorded during the test. This test had less instrumentation than subsequent tests because it was the first test for project B.3 and some of the specialized instrumentation and test conditions were not yet fully developed or fully operational. As examples, only one engine compartment location was monitored for hydrocarbon gas concentration (as compared to five locations on subsequent tests), and no fire detection devices were included on this test. In addition, a learning curve was anticipated for this test series and some of the data channels malfunctioned or exceeded their full-scale dynamic range (10 channels out of 111) and thus did not yield useful information. The second offset pole frontal impact crash test was conducted at the end of the passenger van series and included all of the specialized instrumentation utilized in this series. Following is a description of the test conditions, summary of the test results and conclusions.

2.1. *Test Conditions*

2.1.1. Impact Conditions

This test was an offset pole frontal impact as depicted in Figures 1 and 2. The test vehicle was towed into a 355 mm (14 inch) diameter steel pole. The lateral offset between the vehicle longitudinal centerline and the pole was 305 m (12 inches), with the impact occurring on the right side of the vehicle centerline (U.S. passenger's side). The impact velocity, measured with radar, was 55.2 km/h (34.3 mph).

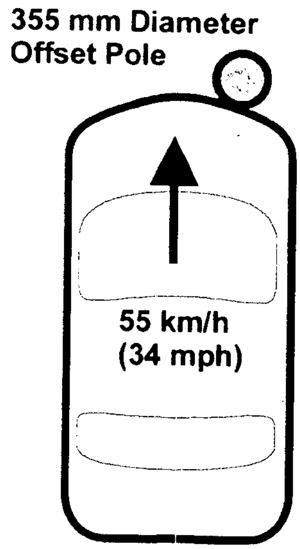


Figure 1.

Crash Test Configuration for Test C11108

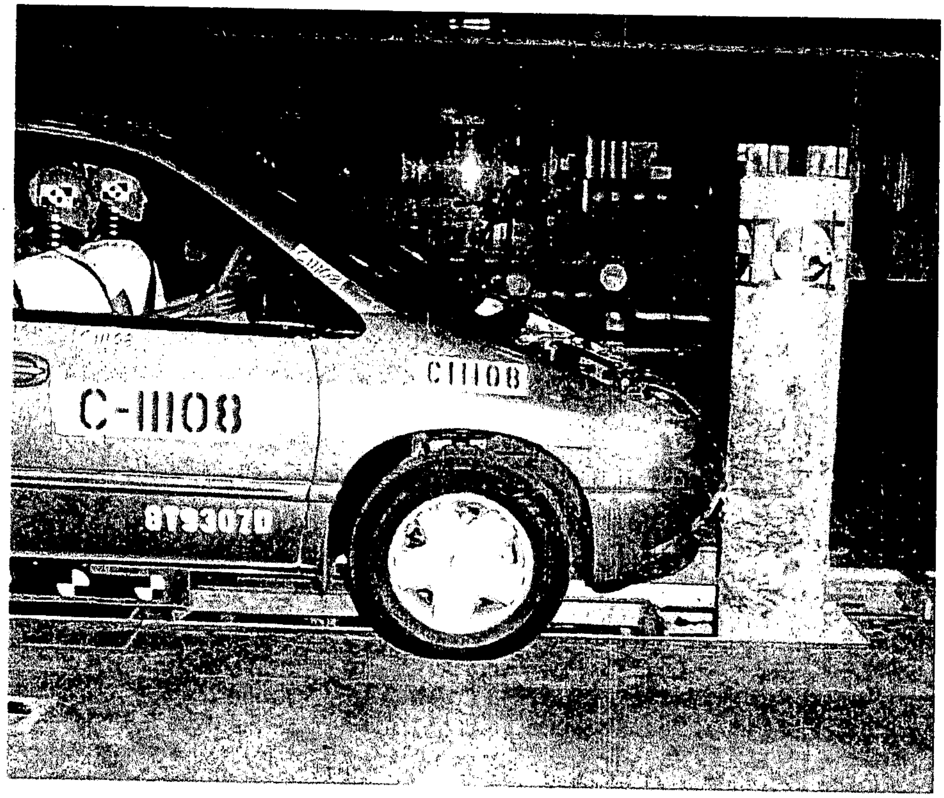


Figure 2.

Pre-Test Photograph of Test C11108

2.1.2. Vehicle Description

The 1996 Dodge Caravan Sport (VIN:1B4GP45R1TB389570) had a test mass of 1977 kg (1142 kg front, 835 kg rear) which included the two Hybrid III Anthropomorphic Test Devices (ATDs), crash test instrumentation, and Stoddard Solvent in the gasoline tank. First, the fuel tank's unusable capacity was filled with Stoddard Solvent, then 71.2 liters of Stoddard were added to usable capacity of the tank. The engine was operating at impact with complete engine compartment fluids, including battery electrolyte. The radio, low beam headlights and air conditioning were all operating at impact.

2.1.3. Pre-test Engine Warm-up Procedure

All frontal crash tests for this project were conducted with the engine operating to provide engine temperatures, fluid temperatures, and fluid pressures that are more representative of an operating engine. Crash test instrumentation precludes the ability to drive the crash test vehicle on the road just prior to impact, therefore, a static (non-driving) engine warm-up protocol was developed for use on all of the frontal crash tests.

To develop this protocol, a series of independent road tests and static idle tests was conducted with one of the vehicles used in the test series (Dodge Caravan, VIN 1B4GP45R9TB377067). The purpose of these additional tests was to determine how actual road load temperatures compare to those temperatures achievable with a high idle static warm-up, which could be conducted prior to a crash test. For these tests, several engine compartment temperatures and fluid pressures were monitored during idle (approximately 900 rpm), high idle (1100 - 1300 rpm), and during road loads at 30, 34 and 40 mph. A subset of this recorded data is shown in Table 1. The objective was to determine which of the engine compartment temperatures and pressures could be elevated to their road load levels using the static high idle procedure. As shown in Table 1, some of the temperatures, namely, the power steering fluid, coolant, transmission fluid, engine oil, manifold surface and under-hood air approached (within 10 °C) the 34mph road load temperature measurements. However, other measurements, including the exhaust gas and converter surface temperatures did not approach their 34mph road load temperatures using the high idle static warm-up.

Table 1.

Temperature and Pressure Measurements From Idle, High Idle and Road Tests.

Measurement	34 mph road test	Idle: 11 min. (approx. 900 rpm)	Idle: 11 min. High idle: 20 min. (1100 - 1300 rpm)	Road temperature achieved with high idle (+/- 10 °C)
Exhaust manifold gas temperature, °C	612	428	542	No
Power steering fluid temperature, °C	86	54	88	Yes
Catalytic converter surface temperature, °C	353	202	295	No
Coolant temperature °C	101	100	106	Yes
Transmission fluid temperature at cooler, °C	110	44	102	Yes
Engine oil temperature, °C	77	36	70	Yes
Front exhaust manifold surface temperature, °C	135	136	139	Yes
Under-hood air temperature, °C	71	56	77	Yes
Transmission fluid pressure at cooler, kPa	276	380	290	N/A
Engine oil pressure, kPa	248	193	220	N/A

Based on these results, a warm-up procedure including 15 - 20 minutes of idle, followed by 20 - 30 minutes of high idle (1100 - 1300 rpm) was established as the protocol. This warm-up procedure was not followed precisely for every test because the crash test instrumentation set-up occurred concurrently, and in some cases, difficulties with instrumentation set-up and calibration required the engine to operate longer than specified in this protocol.

For the first passenger van offset pole frontal impact (test C11108), the engine was started approximately 46 minutes before impact as outlined in Table 2.

Table 2.

Actual Engine Warm-Up Procedure for Test C11108

	Time after initial engine start, (min)	Duration, (min)
Engine started (idle approximately 900 rpm)	0	18
Engine speed increased to 1100 rpm	18	13
Engine turned off for instrumentation set up	31	5
Engine re-started, speed set to 1100 rpm	36	10
Impact	46	

2.1.4. Modifications to Production Vehicle

Because the objective of this test was to conduct basic research on post-collision fire initiation and not to test a production vehicle for compliance with any performance standard, some modifications to the production vehicle were made to facilitate the test objectives. A description of some of the modifications follows.

This vehicle was tested without a hood to improve overhead photographic coverage.

The production fuel tank was filled to 95% of its usable capacity with Stoddard Solvent, however the fuel supply line was plugged downstream from the fuel filter. The engine operated off of gasoline supplied from an auxiliary tank that was rigidly mounted in the passenger compartment. This auxiliary fuel tank had a capacity of approximately 4 gallons and included a new fuel filter (Chrysler part # 4682569) and a new fuel pump (Chrysler part # 04746250). The supply line from this auxiliary fuel pump/filter assembly was connected to the production fuel line to supply gasoline to the engine. The electrical harness was disconnected from the production fuel pump, re-routed, and connected to the auxiliary fuel pump located in the passenger compartment.

The rear seat was removed to facilitate the mounting of the crash test instrumentation. The spare tire was also removed for the test.

The vehicle's rear brake lines were cut and an auxiliary brake machine was installed to abort the test, if necessary, during the tow. The front brakes were manually pre-charged by mechanically locking down the driver brake pedal. The front brake's "banjo bolts" were modified in an attempt to isolate the front calipers from the front brake fluid. This was done so the front brake fluid pressure could be at a steady state but charged condition, while still allowing the front wheels to turn. A steady state pressure condition was desired so changes in the pressure due to leaks could more easily be identified. The modifications to the bolts were unsuccessful at isolating the front calipers, however, and the front wheels were inadvertently locked during the tow. The desired impact speed and pole alignment was achieved even with the front wheels locked.

Pressure transducers, current transducers, and a hydrocarbon vapor sensor were located in the engine compartment. Because of the pole penetration into the engine compartment it is possible that the presence of this added instrumentation could have affected the outcome of the test. Every reasonable effort was made to insure the added instrumentation was as small and non-intrusive as possible, especially in the areas of anticipated vehicle crush. As an example, the cooling system pressure transducer, as well as some of the other pressure transducers, were remotely located and connected to the production fluid system using a braided steel line with a nylon liner. Remotely locating the transducers served two purposes: reducing the likelihood that the transducer would affect the outcome of the test, and also to protect the transducer from damage during the impact, thus improving the reliability of the recorded data.

2.1.5. Vehicle Measurements

Many standard crash test measurements were recorded during this test, including:

- Front left rocker panel acceleration (longitudinal, lateral, and vertical)
- Front right rocker panel acceleration (longitudinal, lateral, and vertical)
- Rear left rocker panel acceleration (longitudinal, lateral, and vertical)
- Rear right rocker panel acceleration (longitudinal, lateral, and vertical)
- Right toepan longitudinal displacement (relative to floorpan, using string potentiometer)
- Driver's and passenger's air bag current (using non-intrusive clamp on current transducers)
- Engine rpm voltage (voltage signal from the production engine speed sending unit)
- Fuel pump current (at auxiliary fuel tank)

2.1.6. Photographic Coverage

High-speed 16 mm movie cameras were used to film the crash test. Cameras were located at various locations around the impact including above, in front of, below, and to both sides of the vehicle.

2.1.7. Anthropomorphic Test Device (ATD) Measurements

Two Hybrid III ATDs (FMVSS reference part 572, Subpart E) [3] were located in the front outboard seating positions. The seats were located in the fore-aft mid position, and the seat backs were at 23 degrees relative to vertical. The ATDs were restrained using the vehicle's production lap / shoulder belts with the adjustable guide loop set in the third position from the top. In addition, the ATDs were restrained by the vehicle's frontal air bags. The ATDs were positioned per FMVSS 208 [4] guidelines and the pelvic angle was measured to be 22.9 degrees from horizontal for the left front occupant and 22.4 degrees for the right front. The head target angle was set to 0 degrees from horizontal for both occupants. Each Hybrid III ATD was instrumented to make the following measurements:

- Head triaxial acceleration
- Head/ neck interface (upper neck) longitudinal shear force (Fx)
- Head/neck interface (upper neck) lateral shear force(Fy)
- Head/neck interface (upper neck) axial force (Fz)
- Head/neck interface (upper neck) moments about longitudinal, lateral and vertical axis (Mx, My, Mz)
- Chest triaxial acceleration
- Sternal deflection
- Pelvic triaxial acceleration
- Femur axial loads, left and right femurs
- Knee clevis loads, left and right, inner and outer
- Upper tibia bending moment, (Mx, right - left), left and right legs
- Upper tibia bending moment, (My, anterior - posterior), left and right legs
- Lower tibia bending moment, (My, anterior - posterior), left and right legs
- Lower tibia shear load, (Fx, anterior - posterior), left and right legs
- Lower tibia axial load, (Fz, vertical), left and right legs
- Tibia/femur displacement, left and right legs
- Lumbar moment (My, anterior - posterior)
- Lumbar shear load (Fx, anterior - posterior)
- Lumbar axial load (Fz, vertical)

Appendix A includes the Injury Assessment Reference Values (IARV) [5] used for the analysis of the recorded ATD measurements. Head Injury Criteria (HIC) computations limited to 15 msec (as described in AGARD 330 [5]), as well as computations limited to 36 msec (as required by FMVSS 208 [4]) are both presented in the test results.

2.1.8. Hydrocarbon Vapor Measurements

As described in detail in Part 1 [1], one of the objectives of these crash tests was to develop a technique to measure flammable vapor from fluids spilled during vehicle crash tests. Before developing this technique, the crashworthiness of sensors that use a tin-oxide element to measure vapor concentration was evaluated during this crash test. One sensor was located on top of the engine under the intake manifold. Concentration measurements were collected; however, the purpose was simply to evaluate its crashworthiness.

2.1.9. Fluid Pressure Measurements

The pressures of several of the vehicle's fluids were measured to help identify fluid leaks and the time during the impact when they occurred. Pressure measurements included:

- Right front brake system pressure (line tapped near power steering rack, transducer remotely located)
- Power steering system pressure (measured near power steering rack)
- Cooling system pressure (measured at thermostat housing, transducer remotely located)
- Auxiliary fuel line pressure (near production fuel tank where auxiliary line was tapped into production line)
- Engine oil pressure (measured at the oil pressure sending unit with a remotely located transducer)
- Transmission cooler fluid pressure (measured at transmission port going to cooler)

In addition to pressure measurements, fluorescent dyes were added to the coolant and engine oil to help identify the locations of these fluids after the impact.

2.1.10. Additional Electrical Measurements

The test was conducted with the engine hot and running to provide possible ignition (heat) sources. Another source of ignition could be electrical events such as shorts, arcs or overheated circuits. Therefore, in addition to standard crash test electrical measurements (such as the air bag currents), electrical measurements were also made on those circuits anticipated to be possible ignition sources during the crash. For this test, most measurements were current measurements, which proved to be quite difficult to analyze following the test. For subsequent tests both currents and voltages were monitored. The list of circuits monitored changed with subsequent tests to reflect the lessons learned from earlier tests, including this one.

Clamp - on current monitoring transducers were used to measure the following currents:

- Right front headlight high beam (measured in right front wheel well)
- Right front headlight low beam (measured in right front wheel well)
- Horn (high tone) current (measured in passenger compartment near the steering column)
- Horn (low tone) current (measured in passenger compartment near the steering column)
- Air conditioning compressor clutch (measured near forward lower engine mount)
- Radiator cooling fan (measured near front left midrail)
- Transmission control module: fused ignition current (measured in right front wheel well)
- Transmission control module: ignition switch current (measured in right front wheel well)
- Transmission control module: fused hot current (measured in right front wheel well)
- Alternator cable (fusible link from battery to alternator, measured near battery)

2.1.11. Evaluation of the Crashworthiness of Potential Fire Detection Technologies

No experimental fire detection devices were included on this crash test.

2.2. *Summary of Test Results*

Post-test photographs of the vehicle are shown in Figures 3 and 4.

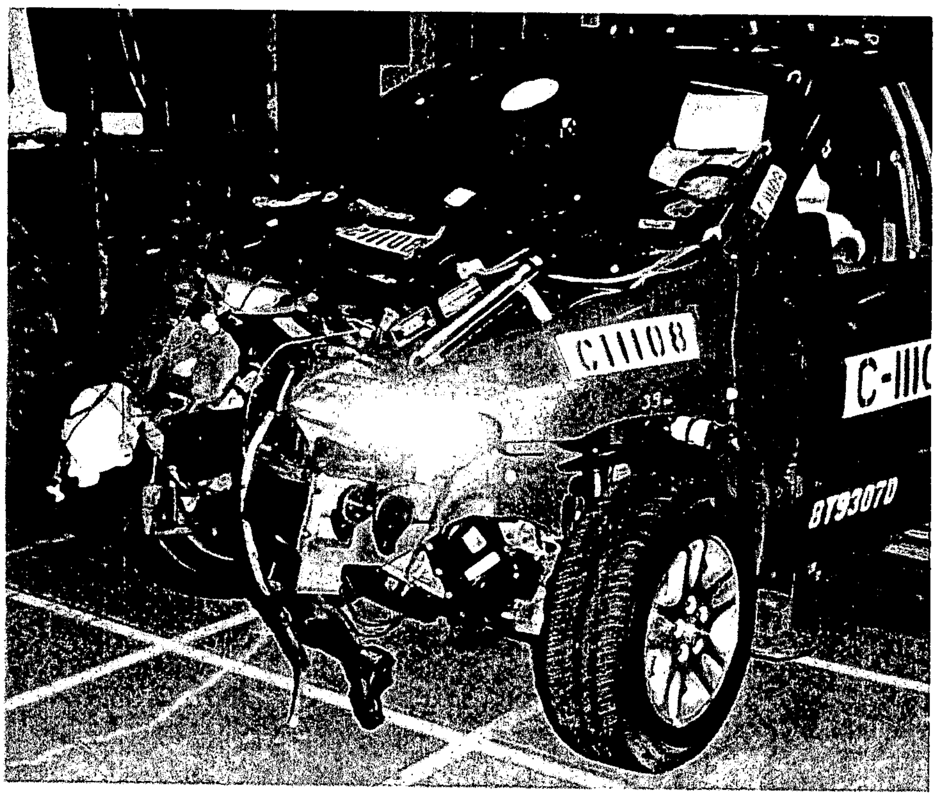


Figure 3.

Post-Test Photograph of Test C11108, Front – Left View

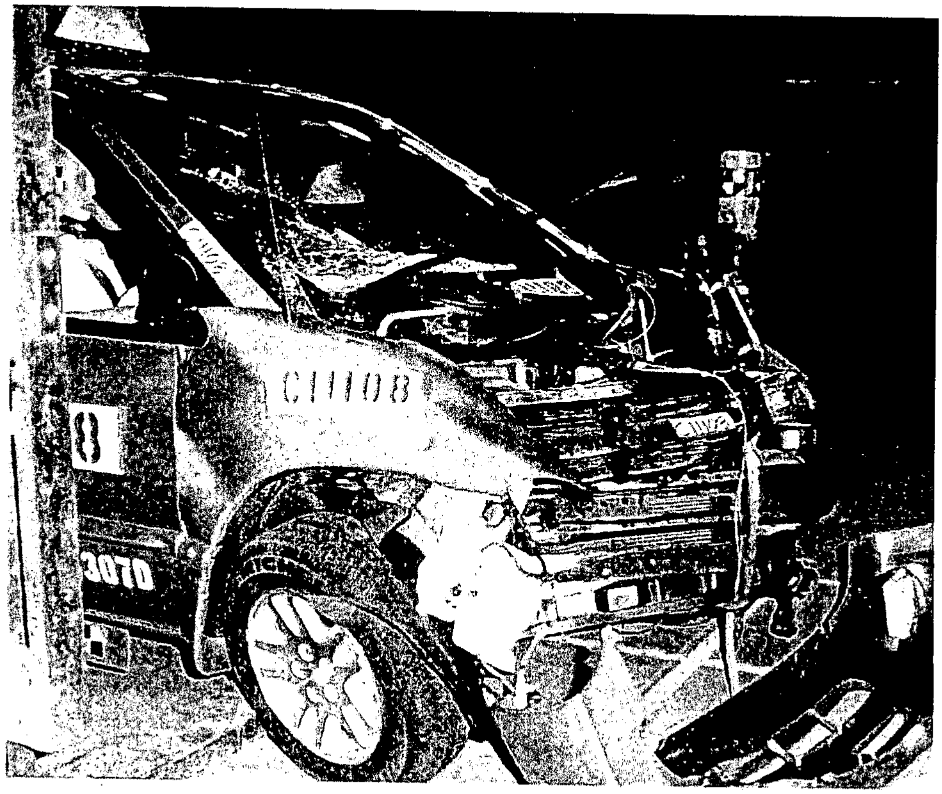


Figure 4.

Post-Test Photograph of Test C11108, Front – Right View

2.2.1 Summary of Standard Vehicle Crash Test Measurements

The complete set of recorded and computed vehicle measurements are included in Appendix B (plots 55 through 114, and 116 through 118).

Accelerations of the vehicle rocker panels can be used as an indication of the passenger compartment acceleration. Many times, the higher frequency acceleration signals would represent localized acceleration at the rocker panels, but the lower frequency signal and first integral of the acceleration are representative of the overall motion of the passenger compartment. The average of the two rear rocker panel longitudinal acceleration measurements (Figure 5) was integrated to compute the change in vehicle velocity (Figure 6). The peak vehicle longitudinal acceleration (after filtering at SAE class 60 [6]), was 22g and the maximum longitudinal change in vehicle velocity was 62 km/h (38.5 mph), with the velocity crossing zero at 120 msec past time zero (impact.)

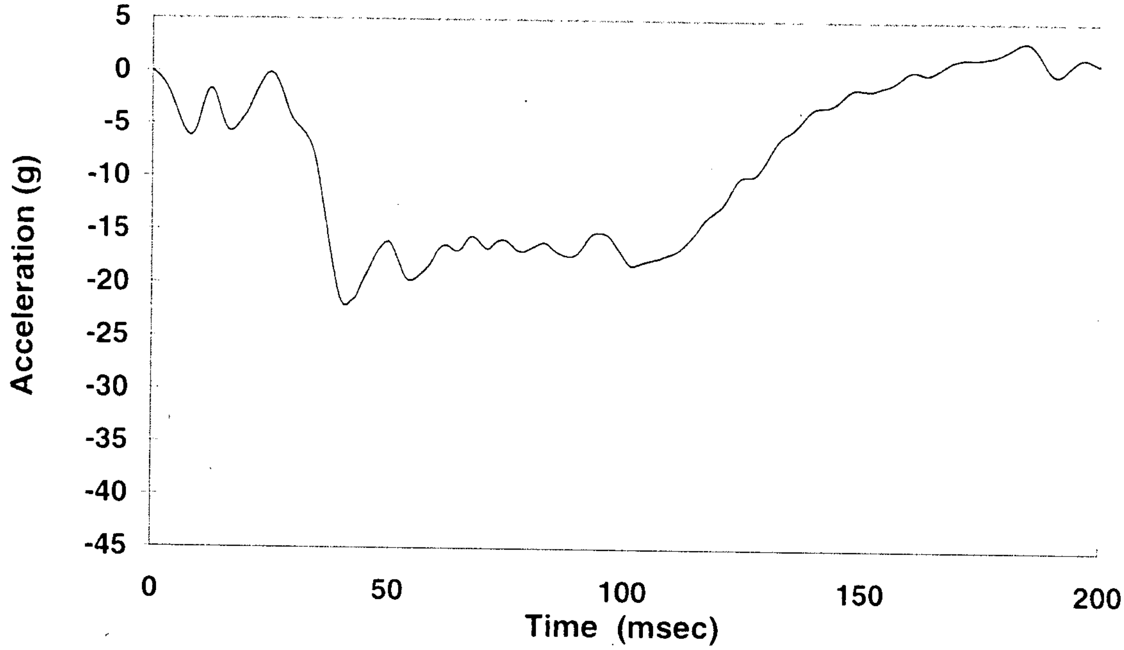


Figure 5

Averaged (Left & Right) Rear Rocker Panel Longitudinal Acceleration, Test C11108, filtered at SAE class 60 [6]

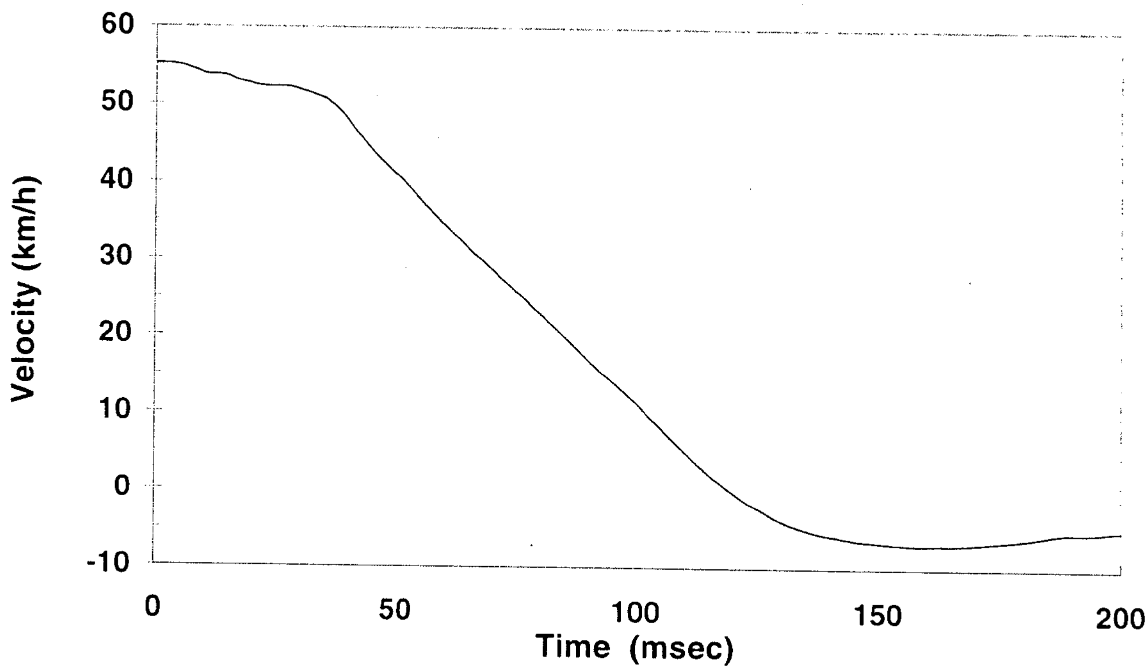


Figure 6

Averaged (Left & Right) Rear Rocker Panel Longitudinal Velocity Test C11108

The displacement of the toe pan on the right (U.S. passenger) side relative to the vehicle's passenger compartment was approximately 255 mm as shown in Figure 7.

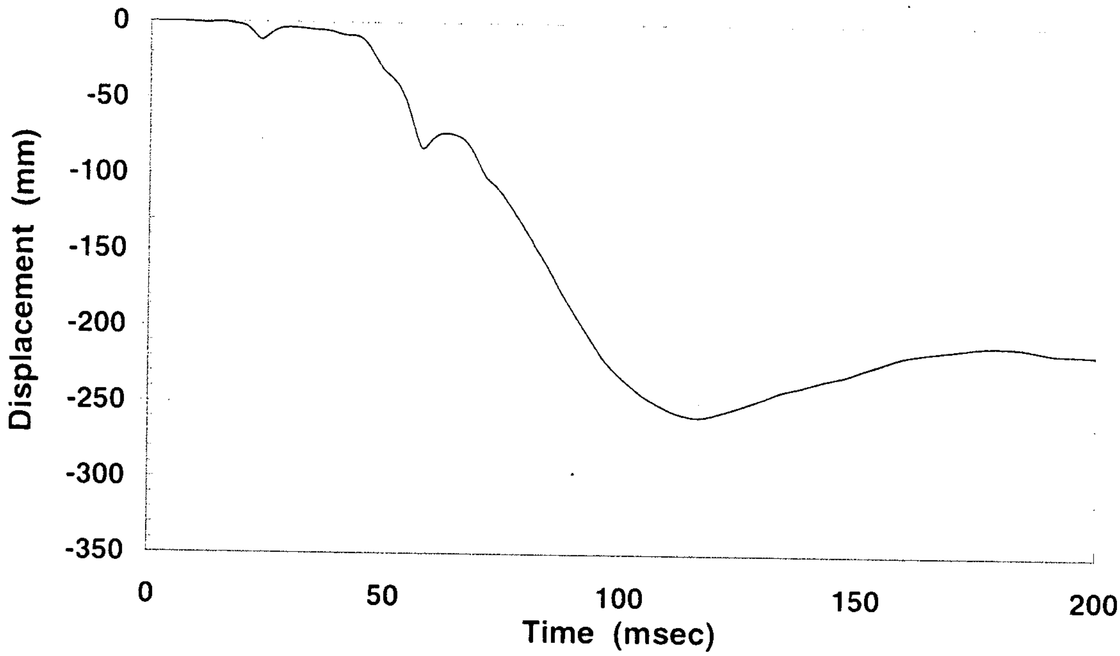


Figure 7

Right Toepan Displacement, Relative to Floorpan

Test C11108, filtered at SAE class 60 [6]

The current measurements of the driver and passenger air bag circuits indicated that both air bags deployed at about 30 msec (Appendix B, plots 116 and 117.)

The voltage measured at the engine speed sending unit indicated that the engine was turning through 47 msec (Appendix B, plot 114). This recorded trace, however, is dependent on the vehicle's overall electrical status, and becomes inconclusive after about 47 msec. Observations of film and other electrical measurements indicated that the vehicle's entire electrical system power was likely lost at about 65 msec when the positive battery cable attached to the power distribution center (PDC) separated near the PDC terminal. The battery moved upwards during the crash, pulling on the positive cable connecting the PDC and eventually causing a separation of the cable from its ring terminal on the PDC. Monitoring the production engine speed sending unit is therefore not a reliable way of measuring engine speed during a crash test because it is dependent on vehicle system power. Later tests in this series beginning with the September 25, 1996 passenger van offset pole test utilized an auxiliary magnetic pickup transducer to measure the motion of the engine. This auxiliary measurement was independent of the vehicle's electrical system.

Figure 8 shows the current measured at the auxiliary fuel pump (the one operating before the impact and supplying gasoline to the engine from the auxiliary fuel tank). The fuel pump drew 8 amps until about 65 msec, when the current dropped to zero. This was due to the loss of the vehicle's electrical power caused by the disconnection of the positive battery cable. Some vehicle fuel pumps are designed to "time out" after a fixed period of engine stoppage (1 or 2 seconds, as an example). Under normal conditions when the engine is turned off, this short period of pump operation pressurizes the fuel systems for the next engine start. However, in the event the engine stops due to a crash, this feature insures that the pump does not continue to operate, possibly supplying a leak with gasoline. For this test, the pump was not required to be "timed-out", instead it shut down early due to the loss of vehicle electrical power.

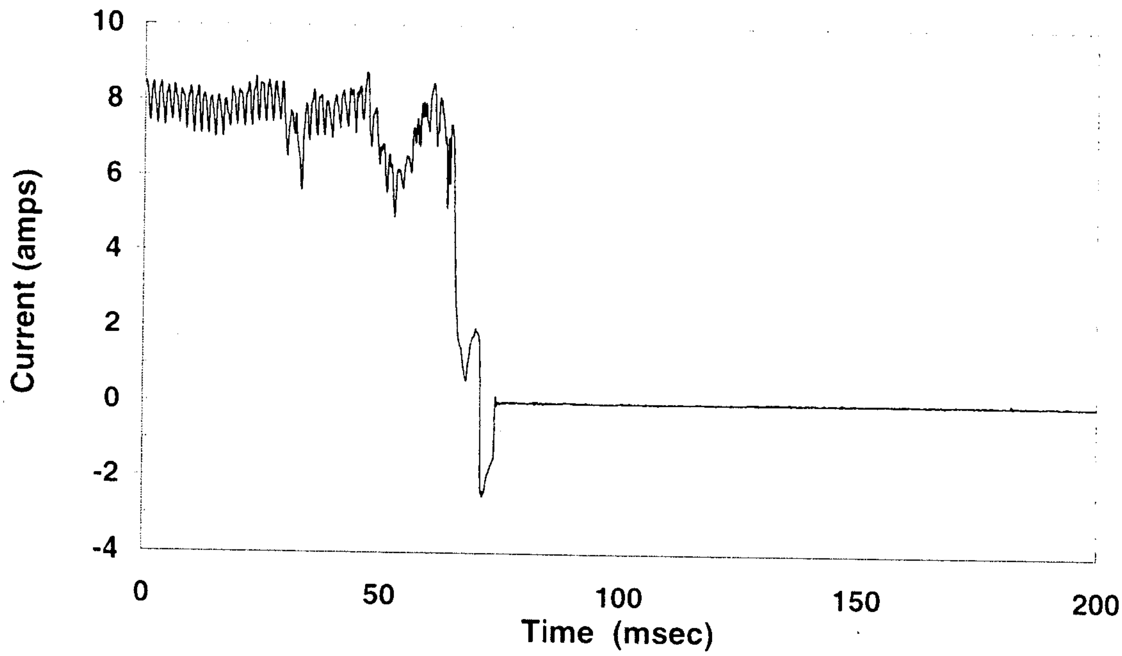


Figure 8

Fuel Pump Current

Test C11108

2.2.2. Summary of Recorded ATD Measurements

The complete set of recorded and computed ATD measurements are included in Appendix B (pages i and ii, and plots 1 through 54).

A comparison of the left front occupant's (driver's) injury measurements to their respective Injury Assessment Reference Values (IARV) (Appendix A), indicates that all measurements were below their respective IARV except the lower tibia bending moment (My) on the left leg. This measurement had a peak value of 407 Nm, which is 181% of its IARV of 225 Nm [5]. This measurement is also used to calculate a tibia index, which in the case of the lower tibia, combines the My and Fz measurements into a normalized leg index with an IARV of 1.0 (as described in Appendix A [5]). This lower left leg index was 1.88 or 188% of IARV.

A similar comparison indicates passenger measurements were above the IARVs for both the lower left and lower right tibias, with all other measurements at or below IARV. The lower tibia bending moment (My) on the left leg had a peak measurement of 286 Nm (127% of 225 Nm), which resulted in a lower tibia index of 1.29 (129%). For the right leg, the lower tibia bending moment channel was overloaded (exceeded the full scale range of the instrumentation.) In this case the full-scale range was set at 400 Nm with 125% over-range (500 Nm) allowed. This leg measurement exceeded 500 Nm at 80 msec.

The head, chest, neck and femur measurements were below the IARV for both ATDs. Except for the lower legs, the risk of severe injury due to crash trauma would have been small for this test, and it could be categorized as a survivable crash for the purposes of this project. The intent here is to subject vehicles to conditions that are severe, but survivable, at least for some occupants.

2.2.3. <u>Summary of Hydrocarbon Vapor Measurements</u>

Plot 115 in Appendix B shows the concentration of hydrocarbon vapor measured above the engine by the gas sensor. These results indicate that this type of gas sensor can survive a vehicle crash test and respond to a fluid spill. Because this sensor functioned in the crash test environment multiple gas sensors were used to measure the concentration of flammable vapor at several locations in the vehicle in all subsequent frontal crash tests. Although this sensor was calibrated with gasoline vapor, the composition and thus the origin of the flammable gas could not be determined from the response of the sensor alone.

2.2.4 <u>Summary of Fluid Pressure Measurements</u>

The dynamic pressure measurements of the engine compartment fluids are shown in Appendix B, plots 129 through 134. All of these measurements exceeded their full-scale dynamic range due to an inadvertent problem with the instrumentation calibration. This problem was corrected for later tests. The brake fluid pressure (plot 129), indicates a rise in brake fluid pressure at 40 msec, and a drop to near zero beginning at 60 msec. The post test inspection of the vehicle revealed that the right front brake line was severed on the right side of the engine block, which was the likely cause of the pressure loss at 60 msec.

The other fluid pressure measurements were inconclusive. However, the post-test vehicle inspection and the high-speed film revealed that the engine oil, transmission fluid, brake fluid, engine coolant, power steering fluid, and washer fluid all leaked in the engine compartment during the test.

2.2.5 Summary of Additional Electrical Measurements

The results of the additional electrical measurements made in the engine compartment are shown in Appendix B (plots 119 through 128).

The separation of the positive battery cable from the power distribution center (PDC) at 65 msec resulted in the loss of electrical power on the monitored circuits. A review of high-speed film indicated a large spark that resulted from arcing across the separated battery cable. A still image taken from the high speed film is shown in Figure 9. This could have been an ignition (heat) source, however no fuel source (such as a flammable vapor mixture) was present. This separation also resulted in a shutdown of the vehicle's electrical system at 65 msec.

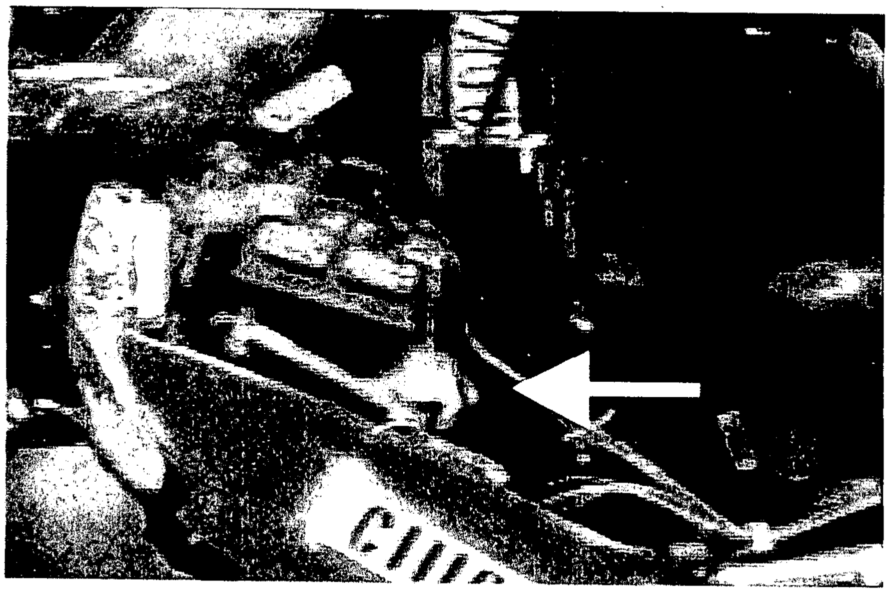


Figure 9
Battery Cable at 65 msec
Test C11108

Hall Effect current transducers with a full scale operating range of 20 amps were utilized on many of the current channels. The 20 amp current transducers are considerably smaller than higher capacity transducers and offered the advantage of being less intrusive. However, exceeding the full-scale range of these transducers was anticipated in some cases, especially if electrical shorts occurred causing high current flow. For cases like this, the current transducer is used to help identify when the short occurred but may not always quantify the amount of current that flowed.

The currents through the two headlight beam circuits are shown in plots 119 and 120. The low beams were drawing 8 amps until about 50 msec, when the current flow dropped to zero, likely due to broken bulbs, or cut wires. No indication of shorts was apparent.

Both horns indicated a short burst of current at about 37 msec (plot 121.) The cause is unknown, but could have been an intermittent short of the circuit or an activation of the horn during the air bag deployment. The current flow lasted about 5 msec.

The air conditioning clutch current indicated no apparent short (plot 123).

The current through the electric cooling fans (plot 124) overloaded the measurement transducers (exceeding 25 amps) at 10 msec. These fan motors where close to the point of impact, thus either electrical shorts, mechanical failure or an instrumentation malfunction of the current transducer could be the cause of the overloaded channel.

The transmission control module circuits indicated little current flow during the test (plots 125 through 127.) These circuits were not monitored on subsequent passenger van crash tests.

The current through the alternator cable (fusible link) (plot 128) also overloaded very early and is generally inconclusive. When space allowed, a larger current transducer (60 or 100 amps) was used for the alternator cable in subsequent tests.

2.2.6. Summary of Numerical Film Analysis

The numeric film analysis plots are included in Appendix C (plots 1 through 7).

The numeric analysis of the high speed film from above the vehicle indicated that the maximum dynamic pole penetration into the engine compartment was approximately 1157 mm at 129 msec after time zero, as shown in Figure 10, and plot 8 in Appendix C. This indicates that this crash configuration is quite severe from a penetration standpoint (by way of comparison many passenger vehicles will exhibit from 400 - 700 mm dynamic crush during a 30 mph rigid barrier test, such as an FMVSS 208 impact.) During a rigid frontal barrier test, the entire front vehicle structure is engaged, resulting in less penetration as compared to a concentrated load like a pole or tree. The fluid and electrical systems in the engine compartment are therefore more severely challenged during an impact of this type.

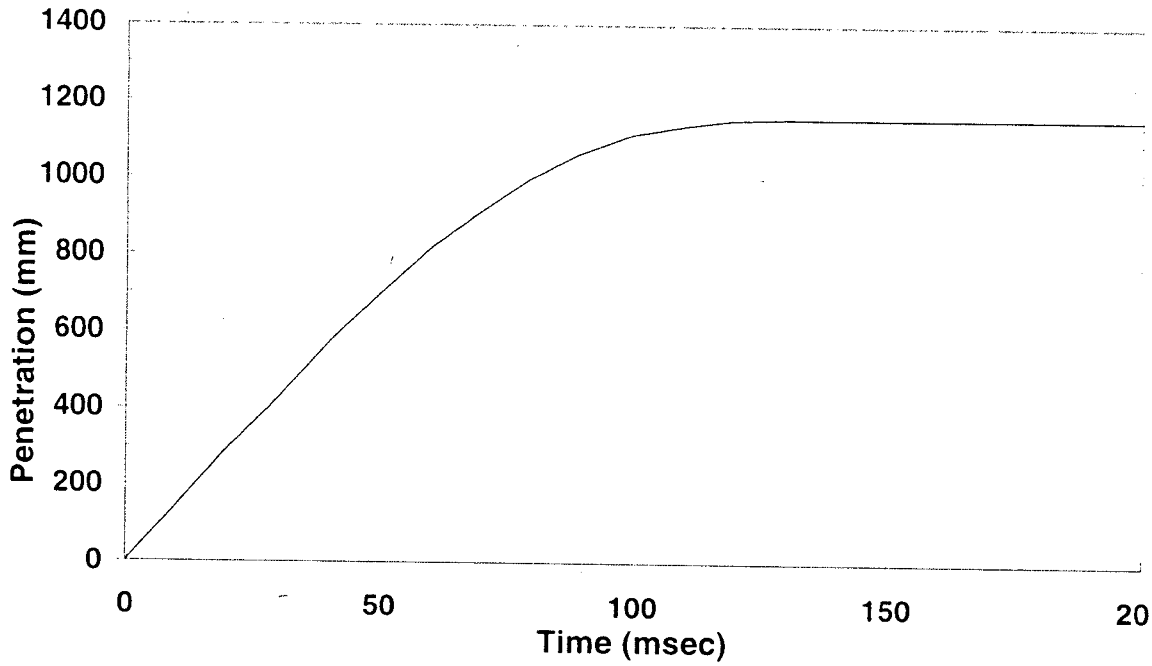


Figure 10.

Pole Penetration

Test C11108, Numerically Measured from High Speed Film

2.2.7 Results of Post-test Static Rollover

This vehicle was rolled on May 17, 1996 using a static roll procedure similar to the roll procedure used for FMVSS 301 [7]. The vehicle was rolled both in the negative direction (filler neck down) and also in the positive direction (filler neck up). There was no gasoline or Stoddard Solvent spillage noted during the static rollover. Many of the other engine compartment fluids, such as engine oil, brake fluid, transmission fluid, and coolant which leaked during the crash test were distributed into the passenger compartment during the roll, contaminating the windshield and fabric materials. These fluids could potentially act as an artificial accelerant in a fire propagation test, and would contribute to fire test variability. Therefore, subsequent frontal crash tests, which resulted in engine compartment fluid leaks, were not rolled.

2.2.8 Results of the Evaluation of the Crashworthiness of Potential Fire Detection Technologies

No fire detection devices were included for this test.

2.2.9 Summary of Post-test Vehicle Inspection

The vehicle was disassembled and inspected for air passages from the engine compartment into the passenger compartment, the locations of any fluid leaks identified during the crash test, the locations of any electrical shorts identified during the crash test, and any contact between combustible materials and hot surfaces. As with any severe frontal crash test, the engine compartment was compromised and the inspection of all components was impossible due to space limitations. Some occurrences or events may not have been identified and noted. However, a reasonable effort was made to complete as thorough an inspection as possible.

Interior components, such as the instrument panel, were removed to identify structural openings in the forward bulkhead. The presence of the interior components, in many cases, would prohibit the free flow of air through the structural openings and so those openings identified would not necessarily permit the free flow of air when all of the interior components are in place. However, many interior components are combustible materials and so openings in the metal forward bulkhead could potentially be fire paths into the passenger compartment. The fire propagation tests (reported separately) identified fire propagation paths using actual fire tests on some vehicles from this crash test series.

Of those openings identified, 2 resulted in opening areas significantly larger than the rest. These openings were not measured for their cross sectional area, however, rough length and width measurements are indicated.

- separation of horizontal lap weld seam near a/c evaporator feed-through
  (Approximately 300 mm long x 40 mm wide at its widest point)
- separation of vertical weld between passenger hinge pillar and forward bulkhead
  (Approximately 400 mm long x 100 mm wide at its widest point)

The remaining smaller openings identified included:

- cracked steering column boot
- separation of heater core line seal and bulkhead
- hole in windshield, near cowl
- separation of shifter cable grommet from bulkhead
- ripped hole in bulkhead near evaporator drain line due to engine penetration
- spot weld separations of driver side toe pan from frame
- separation of oxygen sensor wire grommet from floorpan

The following sources of leaked fluids were located during the post-test inspection:

- engine oil: partial separation of the oil pan from the engine

- transmission fluid: fracture of transmission housing
- brake fluid: severed brake line near right rear corner of engine compartment
- engine coolant: ruptured radiator
- power steering fluid: ruptured pump housing
- washer solvent: ruptured reservoir
- battery electrolyte: vents on the battery top after the battery was turned on its end during the test

No liquid gasoline or Stoddard spills off of the vehicle were noted. However, the hydrocarbon vapor concentration measurement indicated the presence of a hydrocarbon vapor, which was not identified because samples were not collected and analyzed for this test. However, the post-test inspection did reveal leaks in the fuel system when the system was re-pressurized. Those leaks identified were:

- un-sealing of front, right fuel injector from fuel rail
- un-sealing of front, mid fuel injector from fuel rail (due to intake manifold contact)
- un-sealing of front, left fuel injector from fuel rail (due to intake manifold contact)

During the test, the fuel pump shut down early (at 65 msec) during the event so if gasoline was lost, it was likely only residual amounts, that is the leaks were not supplied gasoline by the pump.

No apparent electrical shorts were identified. The following electrical observations were made during the physical inspection:

- disconnection of battery positive cable from PDC ring terminal
  (consistent with the loss of power noted at 65 msec)
- disconnection of alternator charging wire (referred to as fusible link on plots) from alternator ring terminal
- separation of front right headlight from vehicle during impact
  (possibly causing loss of headlight current noted at 50 msec)

The only contact between a hot surface and a possible combustible material noted was between the exhaust manifold and the dash panel silencer pad.

2.3. *Conclusions*

Following are the primary conclusions that can be drawn from the results of test C11108 relative to the objectives of this project.

1. There were no post-collision fires identified during this crash test.

2. There were no electrical shorts noted, however, the separation of the positive battery cable from the PDC at 65 msec after impact resulted in significant arcing at the location of separation. The separation of large current carrying cables during a crash could produce similar arcing which, if present at the same time and location as flammable vapors, could be an ignition source.

3. This separation of the positive battery cable also resulted in the loss of vehicle electrical power, in turn shutting down the fuel pump also at 65 msec. The fuel pump was not required to be "timed out" by the engine control system.

4. No liquid gasoline or Stoddard spills off of the vehicle were noted after the crash or during the static rollover. Two fuel injectors were unsealed from a fuel rail and a third was separated from the rail. Because the fuel pump shut down early, the fuel pump was not operating to supply the leaks with gasoline. Therefore, only residual amounts of gasoline were likely released into the engine compartment.

5. The single hydrocarbon concentration measurement did detect the presence of a hydrocarbon vapor in the engine compartment, however because no vapor samples were taken for this test, the vapor was not identified.

6. Of the other engine compartment fluids, all leaked during the test. None, however, resulted in a fire due to contact with a hot surface.

7. The ATD measurements indicate that a crash condition of this type may be survivable from an occupant trauma standpoint, although there may be a risk of serious lower leg injury as indicated by the lower leg measurements. Lower leg injury could slow the egress of the occupants after an impact. The severity of this test, therefore, is appropriate for this research project. Severe conditions, in which the vehicle's electrical and fluid systems are challenged, but not so severe that occupant fatality would be likely was the goal in developing the crash test conditions.

8. Due to the concentrated loading of the pole, penetration into the engine compartment resulted, severely challenging all of the vehicle's fluid and electrical systems.

9. Due to the severe penetration of the pole, structural openings in the forward bulkhead were identified.

Because this was the first test in the series that used specialized instrumentation not normally included in automotive crash tests, improvements in test methodology were made as the testing progressed. Several conclusions can be drawn from this test relating to improved test methodology for subsequent tests in this series. These conclusions include the following:

10. A static roll should not be done following frontal crashes if the vehicle may be used for a fire propagation test. The static roll may unrealistically contaminate the passenger compartment with engine compartment fluids.

11. Engine compartment electrical measurements should include the larger gage, high current carrying cables such as the starter, main battery positive, and alternator cables. Secondary cables could be selectively monitored if they are in the anticipated crush zone. In addition, voltage measurements should also be made to supplement the current measurements.

12. The number of locations in the engine compartment in which the hydrocarbon vapor measurements are made should be increased to identify the presence of vapors at various locations in the engine compartment. An advantage of multiple location measurements is the ability to follow the dissipation of a vapor cloud through the engine compartment. Another advantage of making measurements at multiple locations is improving the chance of some valid measurements if some of the instruments are destroyed during the test.

13. Measuring the voltage from a vehicle's production engine speed sending unit is an unreliable way to measure engine motion during a frontal crash test. An auxiliary transducer such as a magnetic pickup transducer was used for subsequent tests beginning with the second offset pole frontal impact (test C11279).

14. The full-scale range of the engine compartment fluid pressure measurements was increased for subsequent tests.

15. Although the removal of the vehicle hood improved engine compartment photographic coverage, it also allowed an unrealistic dispersion of fluids or fluid vapors. (This trade-off was evaluated on a test by test basis for subsequent tests.)

3. Passenger Van Oblique Moving Barrier Frontal Impact, Test C11167

On June 25, 1996 a passenger van oblique moving deformable barrier frontal impact crash test (Test #C11167) was conducted at the General Motors Proving Ground in Milford, Michigan. A total of 120 channels of data were recorded during the test, including 114 channels on the test vehicle (including ATDs) and 6 channels on the oblique deformable barrier. Due to the speed of the impact, this test configuration was conducted outdoors, thereby limiting the amount of photographic coverage available. As an example, the indoor tests included high-speed photographic coverage of the vehicle under-body taken from a pit, while the outdoor oblique moving barrier test did not. A fire crew was present during and immediately after the test.

3.1. *Test Conditions*

3.1.1. Impact Conditions

This test was a frontal oblique moving deformable barrier frontal impact as depicted in Figures 11 and 12. The alignment of the barrier and vehicle was set so the center of the moving barrier face impacted the front left corner of the test vehicle. The test vehicle was parked at a 25 degree (+/- 2 degrees) angle relative to the approach velocity vector of the moving barrier. The angle was chosen so the velocity vector of the barrier's center of gravity (CG) at impact passed through the CG of the test vehicle, thus minimizing vehicle rotation and maximizing vehicle crush. The CG of the test vehicle was approximately 1208 mm rearward of the front wheel centerline and laterally in the center of the vehicle.

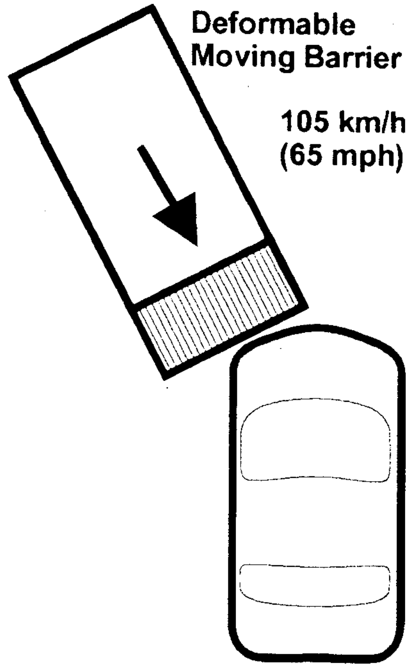


Figure 11.

Crash Test Configuration for Test C11167

Figure 12.

Pre-Test Photograph of Test C11167

The front left corner of the test vehicle was defined by the intersection of two lines. One line was tangent to the most forward part of the vehicle bumper and perpendicular to the vehicle longitudinal centerline. The other line was tangent to the widest part of the vehicle body (excluding mirrors) and parallel to the vehicle longitudinal centerline. This intersection represents a virtual corner of the vehicle, which was not on the vehicle body due to the contours of the body styling. The test configuration was set so the center of the barrier face passed through this virtual corner and in the direction of the vehicle CG at impact, which resulted in the approach angle of 25 degrees. This also resulted in an approximate overlap of 47%. (47% of the Caravan's 1950 mm width was engaged by the moving barrier.)

The mass of the deformable barrier was 1638 kg (3611 lbs.). This mass is greater than what is used for FMVSS214 [8] tests (1367 kg or 3015 lb.) in order to increase the test severity. The height of the center of the simulated bumper form was 470 mm (18.5 in.) above grade. This was set to match the approximate height of the bumper beam centerline on the test vehicle which was 457 mm (18 in.) above grade. The wheels of the moving barrier were oriented in the same direction of the barrier longitudinal axis. The wheelbase, trackwidth, and center of gravity of the moving barrier were all similar to what is specified for FMVSS214 [8] testing. The aluminum honeycomb barrier face was also the same as what is used for FMVSS214 [8] testing except for its vertical location above grade. The brakes of the moving barrier were activated at impact, resulting in an effective brake activation time of about 150 msec after impact. The test vehicle's brakes were on during the impact.

The impact velocity, measured with radar, was 105.7 km/h (65.6 mph).

3.1.2. Vehicle Description

The 1996 Dodge Caravan Sport (VIN:1B4GP45R1TB376396) had a test mass of 1981 kg (1149 kg front, 832 kg rear) which included the two Hybrid III ATDs, crash test instrumentation, and Stoddard Solvent in the gasoline tank. First, the fuel tank's unusable capacity was filled with Stoddard Solvent, then 71.3 liters of Stoddard were added to usable capacity of the tank. The engine was operating at impact with complete engine compartment fluids, including battery electrolyte. The radio, high beam headlights and air conditioning were all operating at impact.

3.1.3. Pre-test Engine Warm-up Procedure

For the passenger van deformable moving barrier frontal impact (Test C11167), the engine was started approximately 1 hour and 46 minutes before impact as outlined in Table 3.

Table 3.

Engine Warm-Up Procedure for Test C11167

	Time after initial engine start (min)	Time after speed increased to 1100 rpm, (min)	Duration, (min)
Engine started (idle approximately 900 rpm)	0	n/a	45 (estimated)*
Engine speed increased to 1100 rpm	45 (estimated)*	0	24
Return to idle speed (approximately 900 rpm)		24	0
Engine turned off for instrumentation set-up		24	22
Engine restarted, set to 1100 rpm		46	14
Impact		60	

The initial 45 minute operation time at 900 rpm was required to operate the vehicle's air conditioning to cool the ATDs to insure that their temperature at impact was within the range specified by FMVSS 208 [4]. Difficulties with the instrumentation set-up and calibration required that the engine be off from 24 minutes to 46 minutes after the initial increase to 1100 rpm.

3.1.4. Modifications to Production Vehicle

As with the other tests, the production vehicle was modified to fulfill the objectives of the project. A description of some of the modifications for test C11167 follows.

This vehicle was tested without a hood to allow overhead photographic coverage of the engine compartment.

Gasoline was supplied to the engine from an auxiliary tank mounted in the passenger compartment similar to test C11108.

The rear seat was removed to facilitate the mounting of the crash test instrumentation, and the spare tire was removed for the test.

The vehicle's rear brake lines were cut and an auxiliary brake machine was installed to charge the rear brake lines. The purpose of using the brake machine was to help control vehicle kinematics after the impact by isolating the rear brakes to ensure the rear wheels would be locked even if the brake lines were severed towards the front of the vehicle. The front brakes were pre-charged by mechanically locking down the brake pedal, so the front brake fluid pressure would be at a steady state but charged condition so that fluid leaks could be easily identified with the recorded brake pressure measurement.

The instrumentation of the engine compartment was similar to Test C11108 and again every reasonable attempt was made to make the added instrumentation as non-intrusive as possible so as not to affect the outcome of the test.

3.1.5. Vehicle Measurements

Many standard crash test measurements were recorded during this test, including:

- Front left rocker panel acceleration (longitudinal, lateral, and vertical)
- Front right rocker panel acceleration (longitudinal, lateral, and vertical)
- Rear left rocker panel acceleration (longitudinal, lateral, and vertical)
- Rear right rocker panel acceleration (longitudinal, lateral, and vertical)
- Left toepan longitudinal displacement (relative to floorpan, using string potentiometer)
- Driver's and passenger's air bag current (using non-intrusive clamp on current transducers)
- Engine rpm voltage (voltage signal from the production engine speed sending unit)
- Fuel pump current (at auxiliary fuel tank)
- Vehicle yaw angular velocity (measured using rate gyroscope located on the floorpan near the CG)

3.1.6. Photographic Coverage

High-speed 16 mm movie cameras were used to film the crash test. Cameras were located above, in front of, and to both sides of the test vehicle.

3.1.7. Moving Barrier Measurements

The following acceleration measurements were measured on the deformable moving barrier:

- Moving deformable barrier at CG acceleration (longitudinal, lateral, and vertical)
- Moving deformable barrier at rear crossmember acceleration (longitudinal, lateral, and vertical)

3.1.8. Anthropomorphic Test Device (ATD) Measurements

Two Hybrid III ATDs (FMVSS reference part 572, Subpart E)[3] were located in the front outboard seating positions. The seats were located in the fore-aft mid position, and the seat backs were at 25 degrees relative to vertical. The ATDs were restrained using the vehicle's lap / shoulder belts with the adjustable guide loop set in the third position from the top. In addition, the ATDs were restrained by the vehicle's frontal air bags. The ATDs were positioned per FMVSS 208 [4] guidelines and the pelvic angles were measured to be 23.9 degrees from horizontal for the left front ATD and 23.7 degrees for the right front ATD. The head target angle was at 0 degrees from horizontal for both ATDs.

Each Hybrid III ATD was instrumented to make the same measurements as on test C11108.

3.1.9. Hydrocarbon Vapor Measurements

Hydrocarbon gas vapors were measured at the five following locations in the engine compartment:

- left upper engine (location #1)
- right upper engine (location #2)
- left lower engine (location #3)
- right lower engine (location #4)
- exhaust manifold (location #5)

At each location the concentration of hydrocarbon vapors was measured using tin oxide sensors described in a previous report [1], and similar to the single sensor used for test C11108. Gas sampled from each of these locations was collected in sorbent tubes for subsequent analysis by gas chromatography / mass spectrometry (GC/MS) [1].

3.1.10. Fluid Pressure Measurements

The pressures of several of the vehicle's fluids were measured to help identify fluid leaks and the time during the impact when they occurred. Pressure measurements included:

- Left front brake system pressure (brake line tapped near ABS junction box)
- Power steering system pressure (measured near power steering rack)
- Cooling system pressure (measured at thermostat housing, transducer remotely located)
- Auxiliary fuel line pressure (near production fuel tank where auxiliary line was tapped into production line)
- Engine oil pressure (measured at the oil pressure sending unit with a remotely located transducer)
- Transmission cooler fluid pressure (measured at transmission port going to cooler)

In addition to pressure measurements, fluorescent dyes were added to the coolant and engine oil to help visually identify the location of these fluids after the impact.

3.1.11. Additional Electrical Measurements

Similar to test C11108, the test was conducted with the engine hot and running to provide additional ignition (heat) sources. Additional electrical measurements were also made to identify possible shorts, arcing or overheated circuits. Those measurements are listed below.

Clamp - on current monitoring transducers were used to measure the following currents:

- Horn (low tone) current (measured in passenger compartment near the steering column)
- Air conditioning compressor clutch (measured near forward lower engine mount)
- Radiator cooling fan (measured near front left midrail)
- Alternator cable (fusible link from battery to alternator), (measured near battery)
- Battery main (B+) (measured near battery)

Direct voltage measurements were also made of the following circuits:

- Ignition
- Left front headlight high beam
- Left front headlight low beam

3.1.12. Evaluation of the Crashworthiness of Potential Fire Detection Technologies

An experimental thermal wire fire detector (supplied by Dual Spectrum, Goleta, CA) was located in the engine compartment and ran the full width of the van's engine compartment under the wiper tray near the cowl. This detector included two wires separated by an insulating material, which is designed to melt at 356 degrees F, thus allowing the wires to contact each other; completing an electrical circuit. Devices of this type could be used with an active fire suppression system but for this test, it was only monitored to evaluate its crashworthiness. This thermal wire was electrically monitored for contact closure between the wires during the test.

3.2. *Summary of Test Results*

Post-test photographs of the vehicle are shown in Figures 13 and 14.

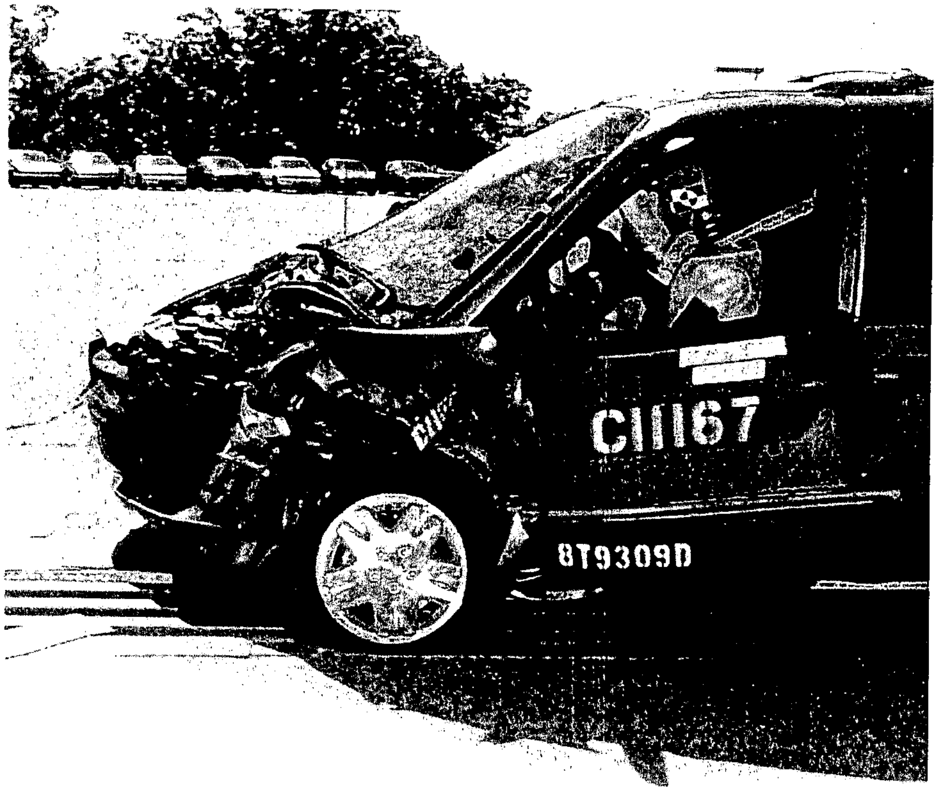


Figure 13.

Post-Test Photograph of Test C11167, Left Side

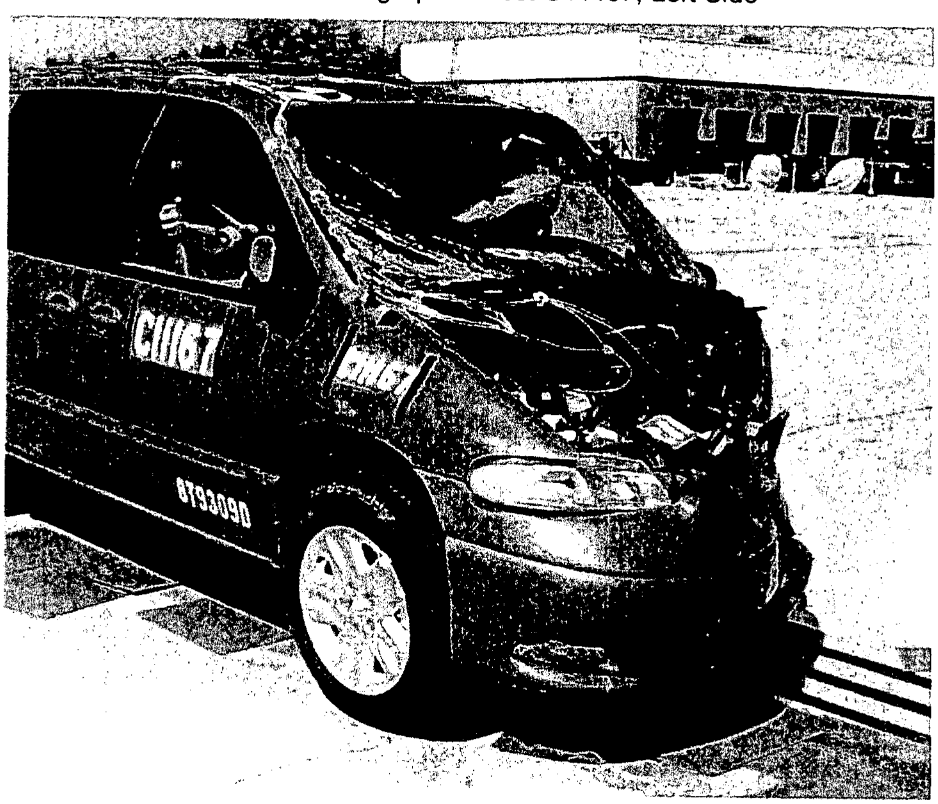


Figure 14.

Post-Test Photograph of Test C11167, Front – Right View

3.2.1. Summary of Standard Vehicle Crash Test Measurements

The complete set of recorded and computed vehicle measurements are included in Appendix D (plots 55 through 112, 116, 122 through 124, and 137).

Because this vehicle was impacted at a 25 degree angle, it experiences both longitudinal (relative to the vehicle) and lateral accelerations early during the crash event. The accelerations and velocity changes of the vehicle's rocker panels translated to a new coordinate system aligned with the initial motion of the moving barrier may be an appropriate measurement to estimate crash severity. This measurement could be compared to the vehicle's longitudinal acceleration and change in velocity in pure longitudinal crashes, such as the pole impacts, in which vehicle yaw is minimal. The axis of the vehicle and barrier are shown in Figure 15. a_o is the acceleration in the vehicle's longitudinal direction, a_a is the acceleration in the vehicle's lateral direction, and a_b is the acceleration in the barrier's initial longitudinal direction.

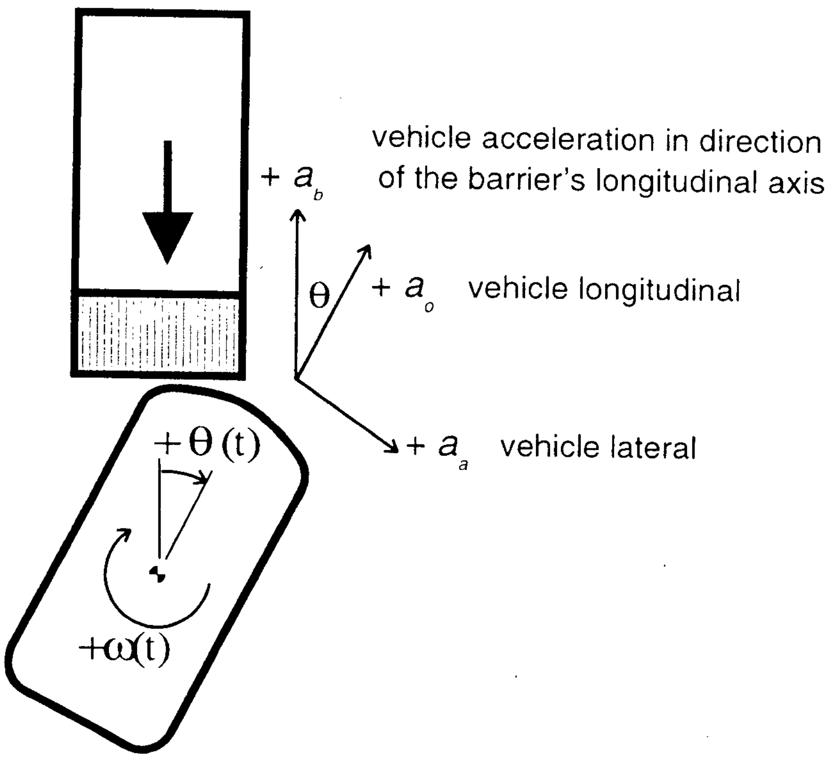


Figure 15.

Vehicle and Barrier Axis

Test C11167

The translated measurement was calculated using the following steps.

The yaw velocity rate, $\omega(t)$ (which was measured and is shown in plot 137, Appendix D) was integrated using a constant of 25° to yield the vehicle's angle $\theta(t)$. This angle, $\theta(t)$, is relative to the barrier's initial longitudinal axis and is shown in Figure 16.

$$\theta(t) = \int \omega(t)\, dt + 25^\circ$$

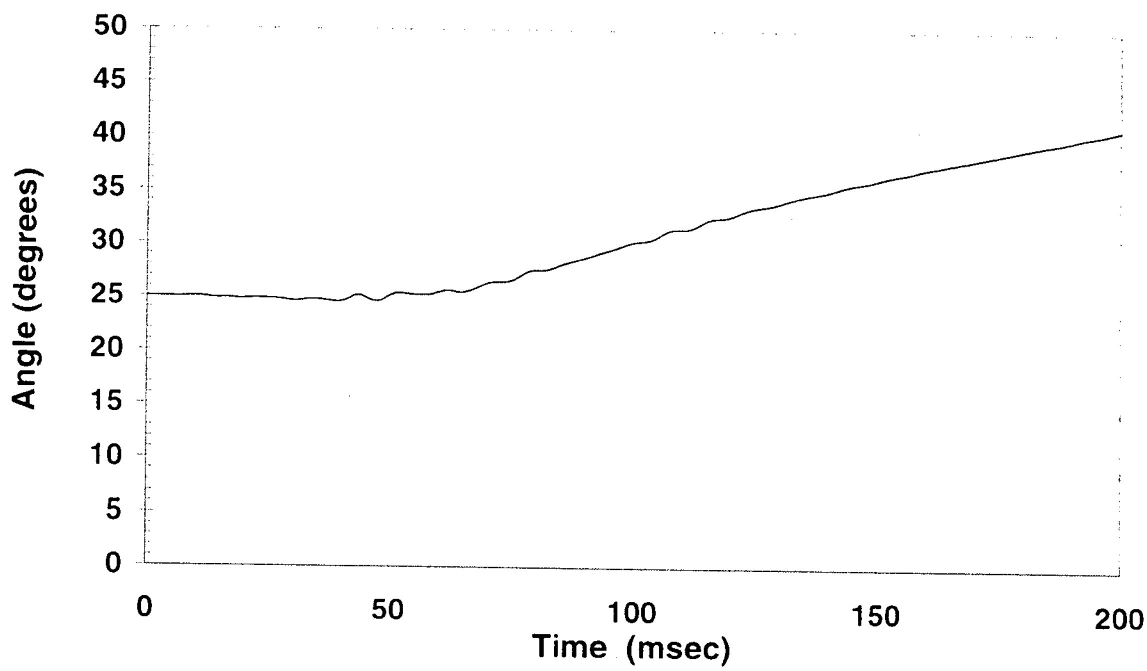


Figure 16.

Vehicle's Yaw Angle, $\theta(T)$

Test C11167

Next, the following measured channels were filtered at SAE class 60 [6] :

Right front rocker panel longitudinal acceleration, $a_{rfo}(t)$, (plot 58, Appendix D)

Right front rocker panel lateral acceleration, $a_{rfa}(t)$, (plot 67, Appendix D)

Left rear rocker panel longitudinal acceleration, $a_{lro}(t)$, (plot 83, Appendix D)

Left rear rocker panel lateral acceleration, $a_{lra}(t)$, (plot 94, Appendix D)

Next, the right front rocker resultant acceleration in the direction of the barrier's initial longitudinal axis, $a_{rfb}(t)$, was calculated using the following formula, and is depicted in Figure 17:

$$a_{rfb}(t) = a_{rfo}(t) \cos\theta(t) - a_{rfa}(t) \cos(90° - \theta(t))$$

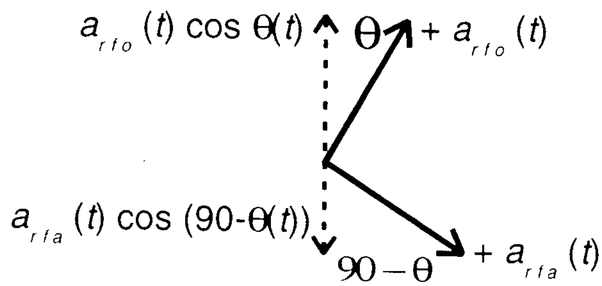


Figure 17.

Translation of Accelerations to the Barrier's Initial Axes

In a similar fashion, the left rear rocker resultant acceleration in the direction of the barrier's initial longitudinal axis, $a_{lrb}(t)$, was calculated:

$$a_{lrb}(t) = a_{lro}(t) \cos\theta(t) - a_{lra}(t) \cos(90° - \theta(t))$$

The two locations were averaged to yield $a_{avgb}(t)$, the averaged vehicle acceleration in the direction of the barrier's initial longitudinal axis, which is shown in Figure 18.

$a_{avgb}(t) = [a_{rfb}(t) + a_{lrb}(t)] / 2$

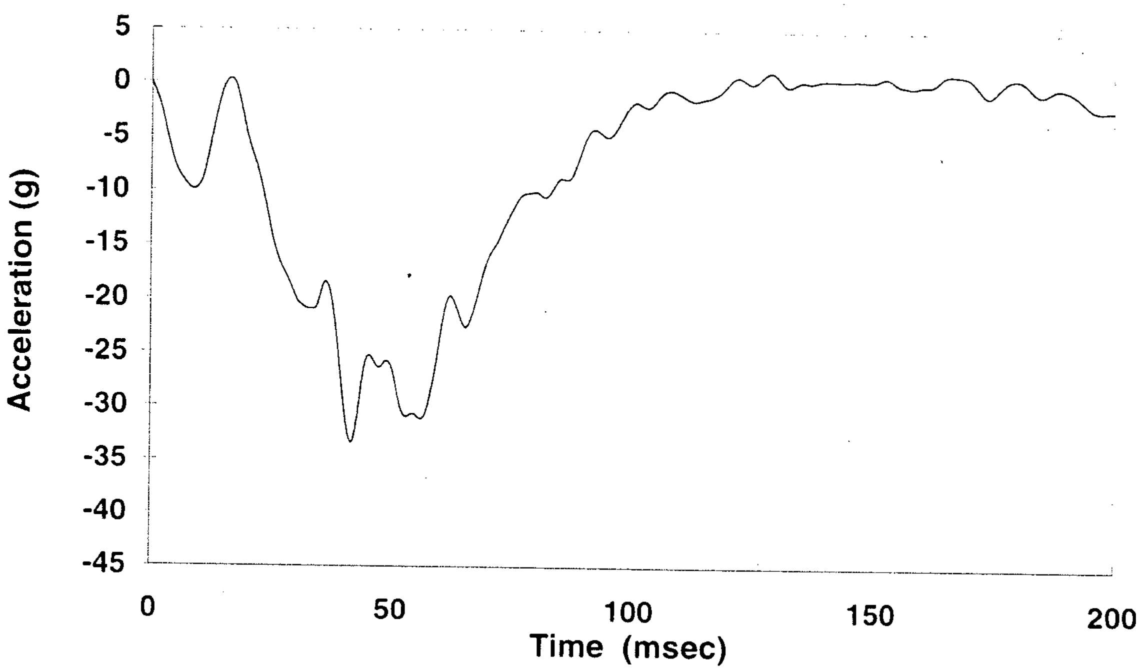


Figure 18.

Vehicle's Averaged Acceleration In The Direction Of The Barrier's Longitudinal Axis, $A_{avgb}(T)$

Test C11167

This averaged acceleration was integrated to give $v_{avgb}(t)$, the vehicle's velocity in the direction of the barrier's initial longitudinal axis, which is shown in Figure 19. The vehicle experienced a change in velocity of 53 km/h in the direction of the barrier's initial longitudinal axis.

$v_{avgb}(t) = \int a_{avgb}(t)\, dt + 0$ (the vehicle's initial velocity was 0)

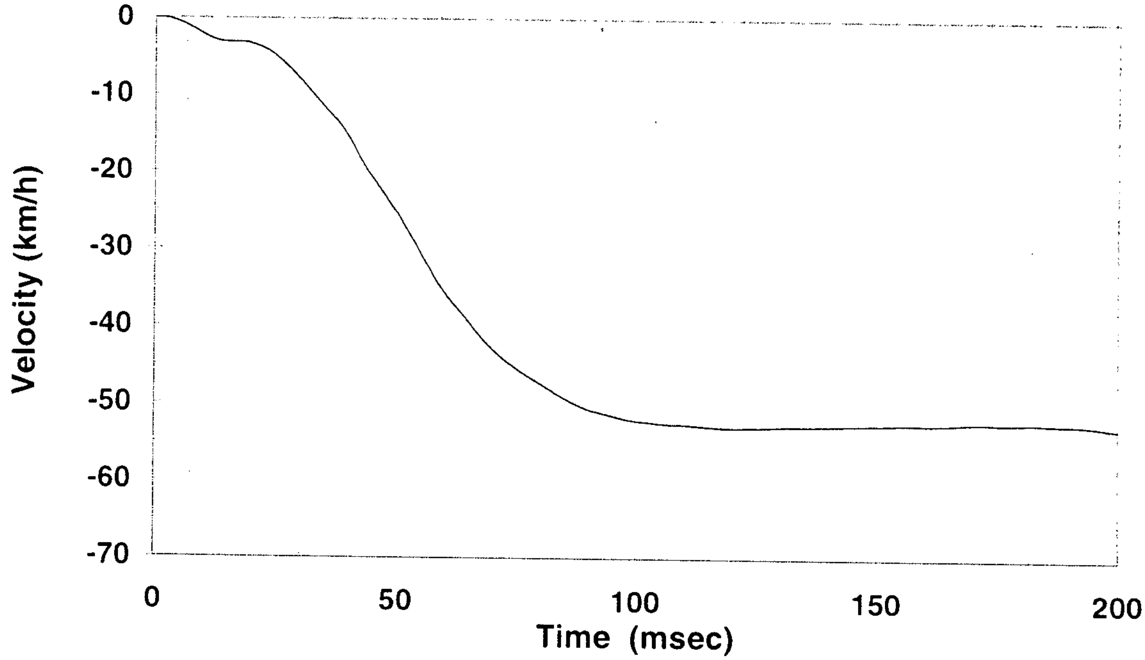


Figure 19.

Vehicle's Averaged Velocity in the Direction of the Barrier's Longitudinal Axis, $V_{avgb}(T)$

Test C11167

The displacement of the driver's side toe pan was approximately 130 mm as shown in Figure 20 and plot 112 Appendix D. This is roughly half of the displacement measured on passenger's side toe pan during the first pole impact test (test #C11108). This oblique moving deformable barrier resulted in less toe pan penetration because the pole subjects the vehicle to a more concentrated load than does the deformable barrier and also because the longitudinal change in velocity of the test vehicle for the pole impact (62 km/h) was greater than for the oblique moving barrier (53 km/h).

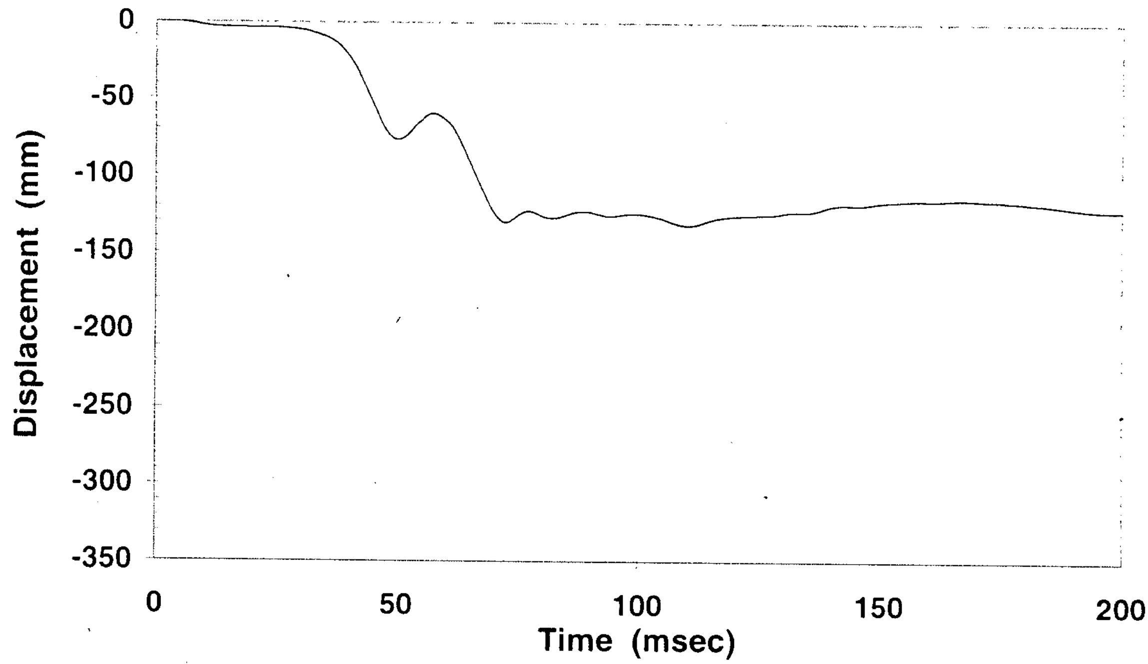


Figure 20

Left Toepan Displacement, Relative To Floorpan

Test C11167, filtered at SAE class 60 [6]

The current measurements of the driver and passenger air bag circuits indicated that both air bags deployed at 13 msec (Appendix D, plots 122 and 123.)

The voltage measured at the engine speed sending unit indicated that the engine was still turning at least through 40 msec (Appendix D, plot 116). This recorded trace, however, becomes inconclusive after about 40 msec. Similar to Test C11108, the vehicle's electrical system temporarily lost voltage at about 40 msec, thus affecting this recorded measurement. Several of the recorded voltage traces verified that electrical power was lost at about 40 msec. The auxiliary transducers to make this measurement independent of the vehicle power were not yet available for this test. The temporary loss of vehicle (ignition) voltage (shown in Figure 21 and plot 113, Appendix D) was due to the negative battery terminal separating from the negative battery plates as the top of the battery moved upwards, partially separating from the battery during the test. Note that Figures 21 and 22 display the recorded measurements for a duration of 1800 msec (1.8 seconds), unlike previous figures which have displayed 240 msec of data. This displacement of the battery top was observed in the high speed film of the crash test. The re-establishment of ignition voltage at 120 msec is described in later sections.

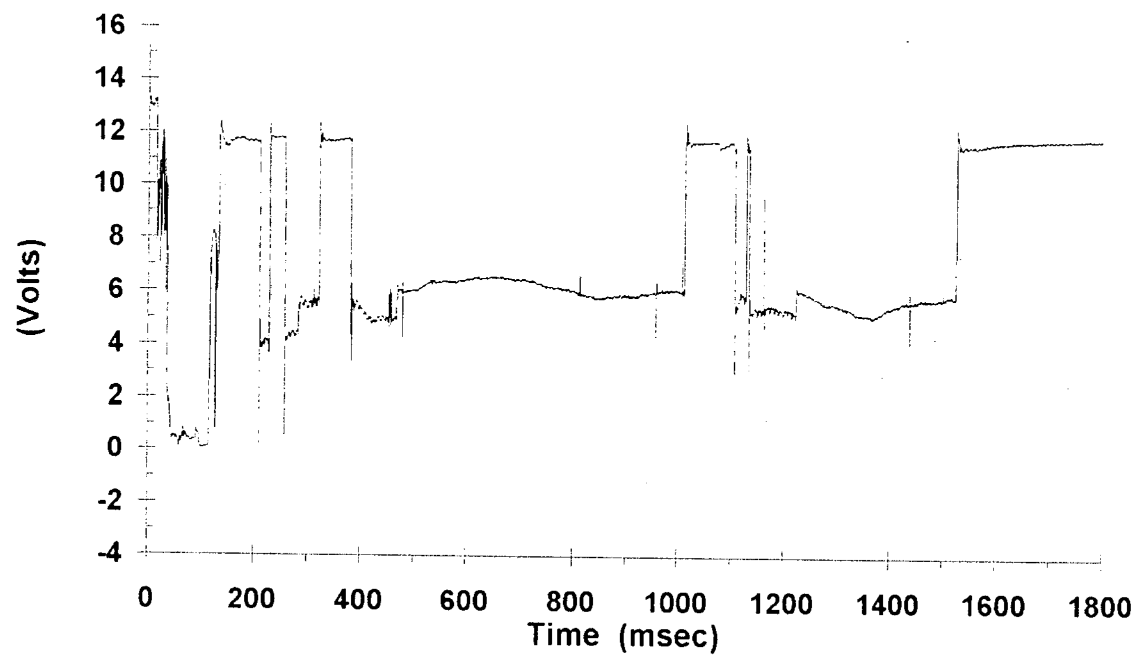


Figure 21

Ignition Voltage

Test C11167

Figure 22 and plot 124 (Appendix D) show the current measurement at the auxiliary fuel pump (the one operating before the impact and supplying gasoline to the engine from the auxiliary fuel tank). The fuel pump drew about 7 amps until about 37 msec, when the current dropped to zero. This is also likely due to the temporary loss of the vehicle's electrical power as shown in Figure 21. The fuel pump did not re-start at 120 msec when the ignition (system) voltage was temporarily re-established. Similar to test C11108, this pump did not require to be "timed out" after a fixed period of engine stoppage (as described in section 2.2.1).

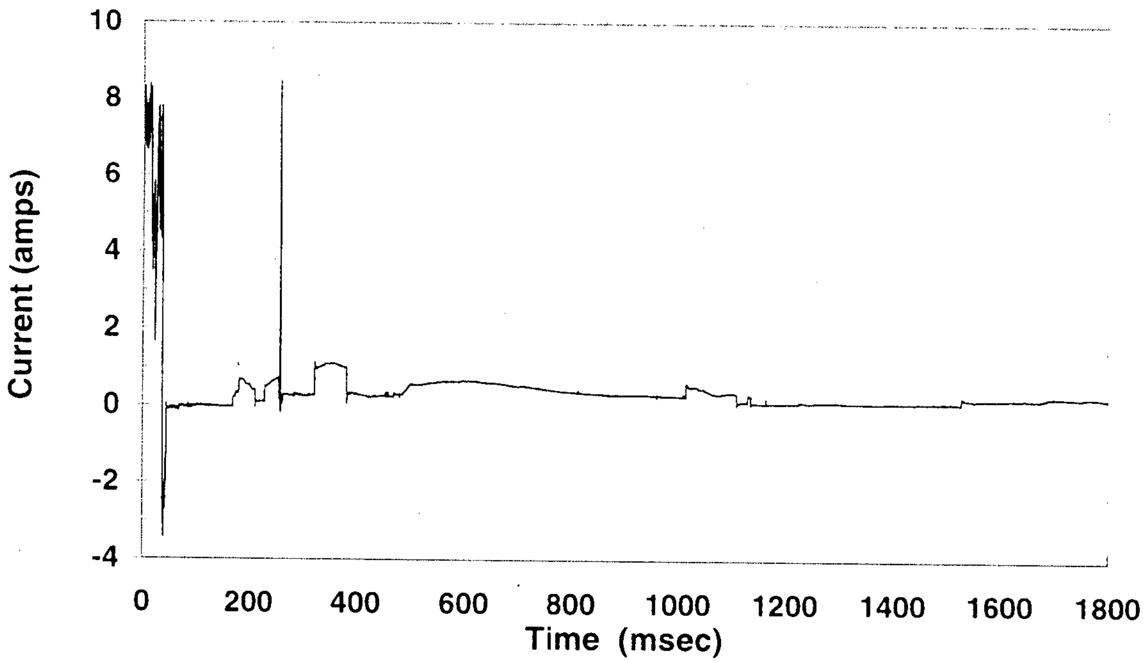


Figure 22

Fuel Pump Current

Test C11167

3.2.2. Summary of Recorded Barrier Measurements

The acceleration measurements and related computed values from the moving barrier are included in Appendix D (plots 139 through 156).

The longitudinal velocity of the barrier's CG is re-created here as Figure 23. The barrier sustained a velocity change of about 65 km/h (40 mph) in 120 msec.

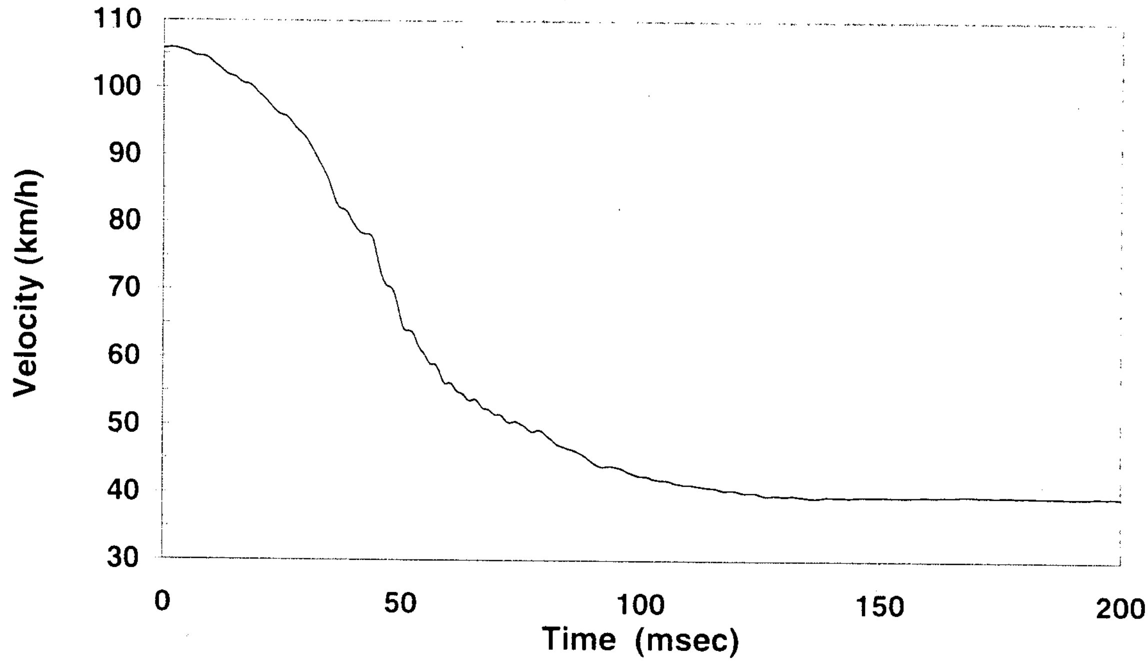


Figure 23

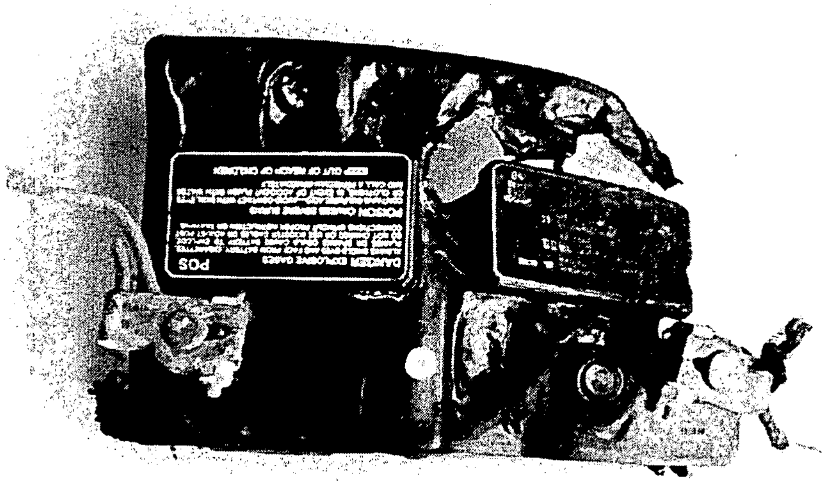
Moving Deformable Barrier Longitudinal Velocity at CG

Test C11167

3.2.3. Analysis of Post-Impact Fire

A fire was observed on the vehicle at the crash test facility approximately five minutes after impact.

The fire was first observed as blistering paint on the upper radiator tie bar near the front of the deformed battery. Approximately 30 seconds later, flames were then observed near the battery and the fire was allowed to propagate to verify that it was a self-propagating flame front. Approximately five minutes after the first observation of fire (ten minutes after impact) the fire was extinguished using a carbon dioxide fire extinguisher. At that time the damage caused by the fire was limited to the plastic components around the battery compartment including the plastic battery housing, battery top, plastic housing of the power distribution center, miscellaneous electrical connectors and harnesses, and some plastic components of the left front headlight assembly. A photograph of the battery top, removed after the test is shown in Figure 24.



C-11167

Figure 24

Post-test Photograph of the Battery Top, Removed from the Vehicle

Test C11167

After analyzing the recorded information and disassembling the battery, it was determined that the fire was electrical in nature, caused by a series of electrical events during the crash and consumed only solid components. None of the fluid systems (including gasoline) contributed to the ignition or propagation of the fire. Similarly, none of the normally hot surfaces, such as the exhaust manifolds or catalytic converter contributed to the fire.

There were three separate electrical occurrences caused by the collision, which, in combination, caused the post-impact fire.

One event was the pinching and partially severing of a wiring harness between the front edge of the left frame rail and the transaxle housing as shown in Figure 25. Several wires in this harness, including the starter cable, were shorted to chassis. The insulation on the starter cable showed signs of melt/flow and there was evidence of corrosion caused by electrical arcing at the tips of the copper wire. Also, electrical arcing eroded a small area of the frame rail. An inspection of the ignition voltage (Figure 21) indicates a drop in ignition voltage from 13 volts to about 10 volts beginning at 15 msec. It is likely, but impossible to verify, that this was the time at which the wiring harness was severed, causing additional load on the battery due to the starter cable short. The physical inspection of the starter cable short also revealed some possible cross shorting of the starter cable to other wires in the wiring harness including the headlight low-beam circuit. An inspection of the headlight low-beam voltage (Figure 26 and plot 115, Appendix D) also suggests that this cross shorting started at about 15 msec. This voltage was initially at zero (because the low beam lights were not on for the test) but intermittently raised beginning at about 15 msec. This suggests that the wiring harness was physically crushed at about 15 msec and both the starter cable short to chassis and the cross shorting between cables in the bundle likely occurred at about this time.

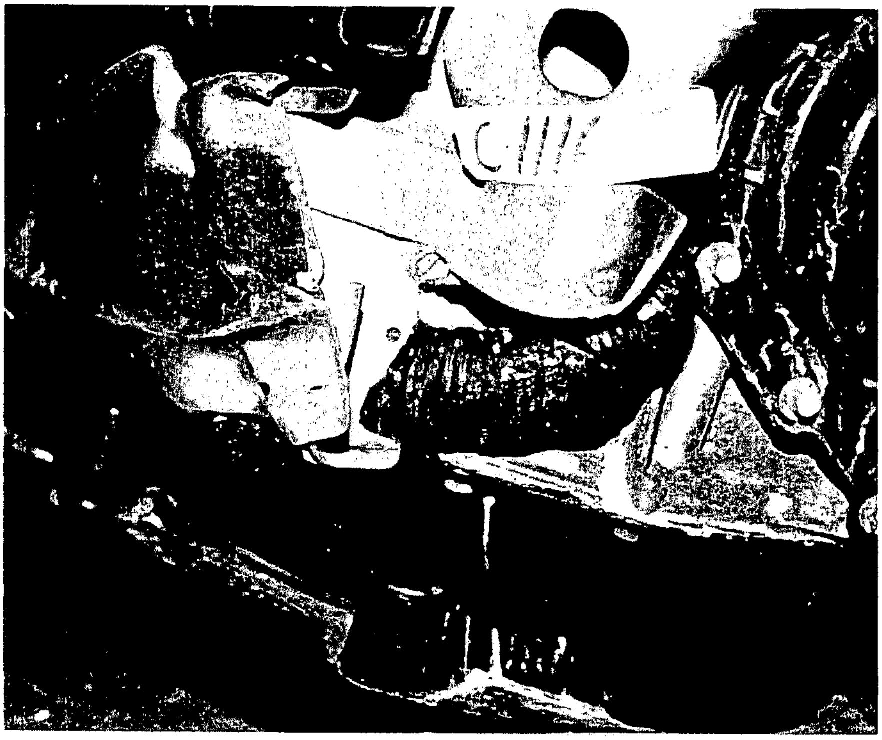


Figure 25

Post-test Photograph of Wiring Harness Pinched by Transaxle Housing

C11167

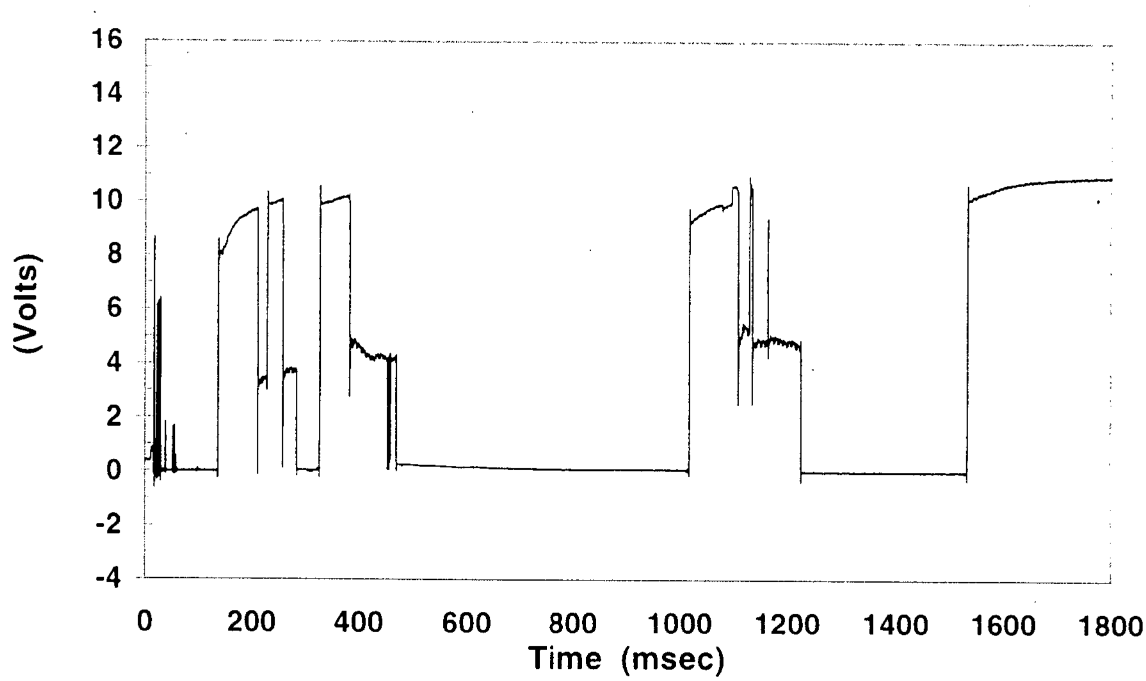


Figure 26

Headlight Low-Beam Voltage

Test C11167

A second electrical event noted during the test was the disconnection of the negative terminal from the internal plates of the battery (which was identified during the post-test inspection of the battery.) The disconnection was caused by the motion of the battery top and terminals upwards during the impact (which was observed in the high-speed film.) The entire electrical system will not operate and current will not flow without a battery ground. Again, the timing of this occurrence is difficult to determine with complete certainty.

A third electrical event that was noted was the penetration of a self-tapping screw into the battery contacting the negative (and possibly positive) plates inside the forward cell of the battery. The screw was identified during the disassembly of the battery and the penetration was noted from inside of the battery housing. This screw initially mounted the metal bracket holding the power distribution center housing.

The penetration of the screw into the battery resulted in local resistive heating of both the screw and the surrounding steel structure to which it was mounted. The current flow for this local resistive heating could have been from two different sources:

1) The contact of the screw (which was attached to the chassis) with the negative plates of the battery would re-connect the battery ground to chassis thus restoring electrical power to the vehicle. Although the negative battery terminal had been separated from the battery plates, some of the vehicle's exterior lights, including the

brake lights were observed to be on following the impact. This confirms that there was an alternate ground being supplied to the battery. If the screw were the only connection to ground, then all of the current flowing on the vehicle would be flowing through this screw. The intermittent starter cable short to ground could have been a source of high current flow through the screw.

2) The screw shorted the battery by contacting both positive and negative plates in cell 6 (forward cell) of the battery. This caused high current flow through the screw, probably for a short period of time until the connection was opened due to the continued crush or localized melting of the screw or plates. Subsequent removal of the screw and comparison to an intact screw taken from another vehicle indicated that approximately 5 mm of material was melted off the tip of the screw. This internal shorting of the battery would be independent of other electrical occurrences external to the battery such as the starter cable short to chassis.

From the available data, it is impossible to quantify how much each of the above two current sources contributed to the heating of the screw and surrounding steel components which, in turn, led to the ignition of the post-impact fire.

An additional observation during the battery inspection is worth noting, although it probably did not contribute to the fire. The inter-cell connection between cells 3 and 4 (the 2 middle cells) was severed when the battery was crushed, but the broken ends were held tightly together, maintaining electrical contact after the crash.

The shorting of the starter cable, the disconnection of the negative battery terminal, and the penetration of the screw into the battery, in combination, were the causes of the electrical fire. However, in drawing conclusions on how post-impact fires might start, the specific outcome of this test should not be regarded as determinative. It is impossible to determine the repeatability of these specific occurrences, or whether they were affected by the modifications made to the production vehicle in this specific test. As an example, the removal of the hood could have increased the vertical displacement of the battery contributing the separation of the negative battery cable.

It is more useful to use this test to draw generic lessons about electrical fires and how they may start in real world occurrences. As an example, this test demonstrates the following: 1) electrical fires unrelated to fluids such as gasoline are possible and may propagate by igniting solid combustibles in the engine compartment, 2) objects grounded to chassis which penetrate the side of the battery housing could contribute to increased electrical activity by providing parallel ground paths and also by internally shorting the battery, and 3) shorts between heavy gage non-fused cables (such as starter cables) and chassis ground can also contribute by increasing the overall current flow.

3.2.4. Summary of Recorded ATD Measurements

The complete set of recorded and computed ATD measurements are included in Appendix D (pages i and ii, and plots 1 through 54).

The following injury measurements from the left front occupant (driver) were above their respective Injury Assessment Reference Values (IARV): left femur compression, right upper tibia moment (Mx, My resultant), right lower tibia moment (My), and left lower tibia moment (My), and the corresponding computed values associated with these measurements (such as lower leg indices.) The left femur compression was 12,454 N, which is 125% of the IARV of 10,000 N. The right upper tibia moment was 274 Nm, which is 122% of the IARV of 225 Nm. The right lower tibia moment was 461 Nm, which is 205% of the IARV of 225 Nm. The left lower tibia moment was 338 Nm, which is 150% of the IARV of 225 Nm. All other measurements on the left front ATD were below their respective IARVs.

The right front occupant's (passenger's) injury measurements indicated only the left, lower tibia moment (My) was above the IARV with a measurement of 249 Nm (110% of 225 Nm). All other measurements for this occupant were less than their respective IARVs.

For both ATDs, the head, chest, and neck measurements were below their respective IARVs for the passenger van oblique moving deformable barrier frontal impact (test C11167.)

3.2.5. Summary of Hydrocarbon Vapor Measurements

A complete set of the recorded measurements is included in Appendix E, Figures E1 through EE5, and also Appendix D, plots 117 through 121.

Of the five locations monitored, location #1 (left upper engine) and location #3 (left lower engine) had the highest concentrations of hydrocarbon vapors.

The concentration at the left upper engine (#1) approached 0.3 % concentration from shortly after impact through about 25 seconds as shown in Figure E1, Appendix E. The concentration at this location then decayed to less than 0.1% by 50 seconds after impact. The concentration at the left lower engine (#3) exceeded 1.0 % concentration at approximately 20 seconds after impact and remained above 0.2% through about 100 seconds after impact. The concentration measurement at the left lower engine (#3) is shown in Figure E3 (Appendix E) and is also recreated here as Figure 27. It is possible that these two measurements are simply two different locations in the same cloud of gas, and that the source of the gas could be the same for both measurements. The remaining three locations remained below a concentration of 0.1% for the measurement duration.

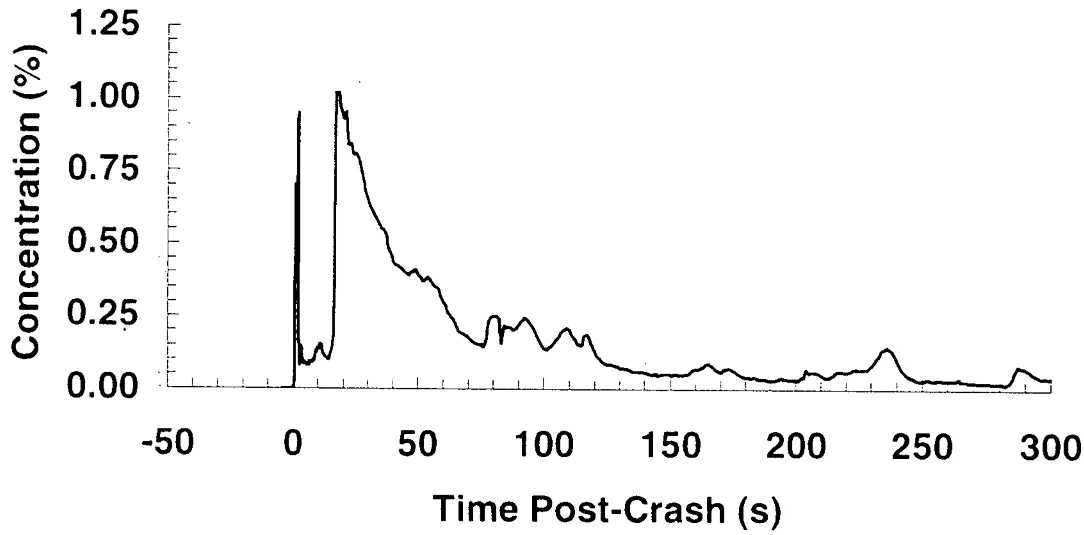


Figure 27

Concentration of Hydrocarbon Vapor Measured from Left Lower Engine (Location #3)
Test C11167

A gas chromatography / mass spectrometry (GC/MS) analysis was performed on 10 samples collected during the test. Background samples from each of the five locations were collected for a 10 minute period during the vehicle warm-up. Test samples from each of the five locations were collected for a 20 minute period starting approximately 5 minutes before the impact and ending about 15 minutes after the impact. Both the background and test chromatograms are shown in Figures EE1 through EE5 in Appendix E. Note that the abscissa in all of the GC/MS figures refers to the retention time of the analysis and not the time following the impact, as other figures do. Figure EE3 in Appendix E includes the background and test chromatograms for location #3 which are recreated here as Figure 28 and 29.

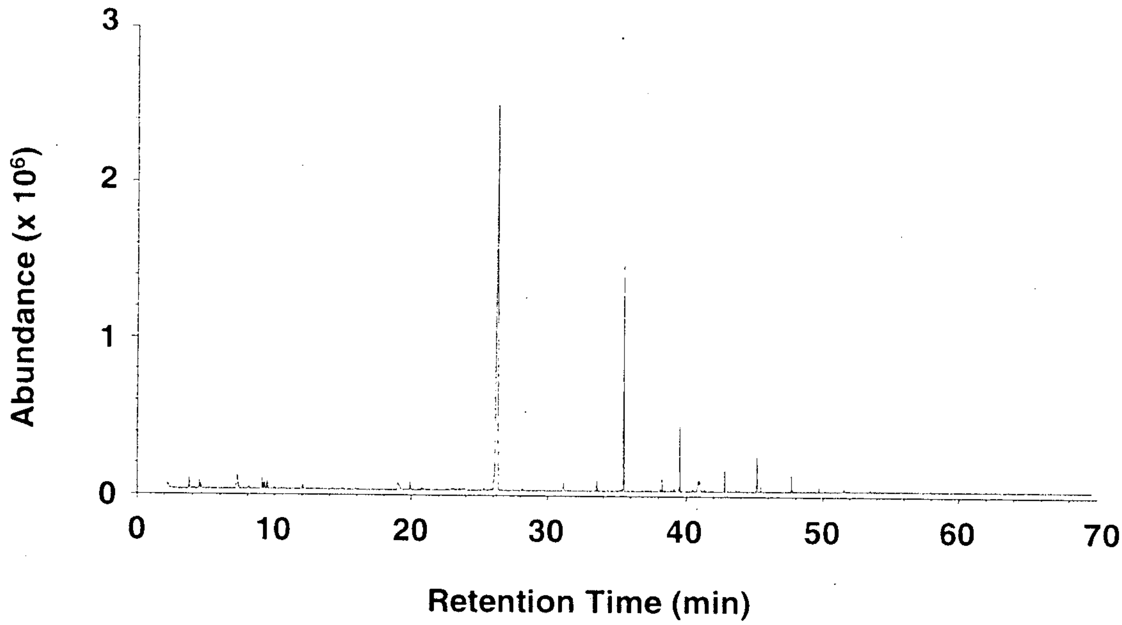


Figure 28

Background Chromatogram from GC/MS Analysis from Left Lower Engine (Location #3)

Test C11167

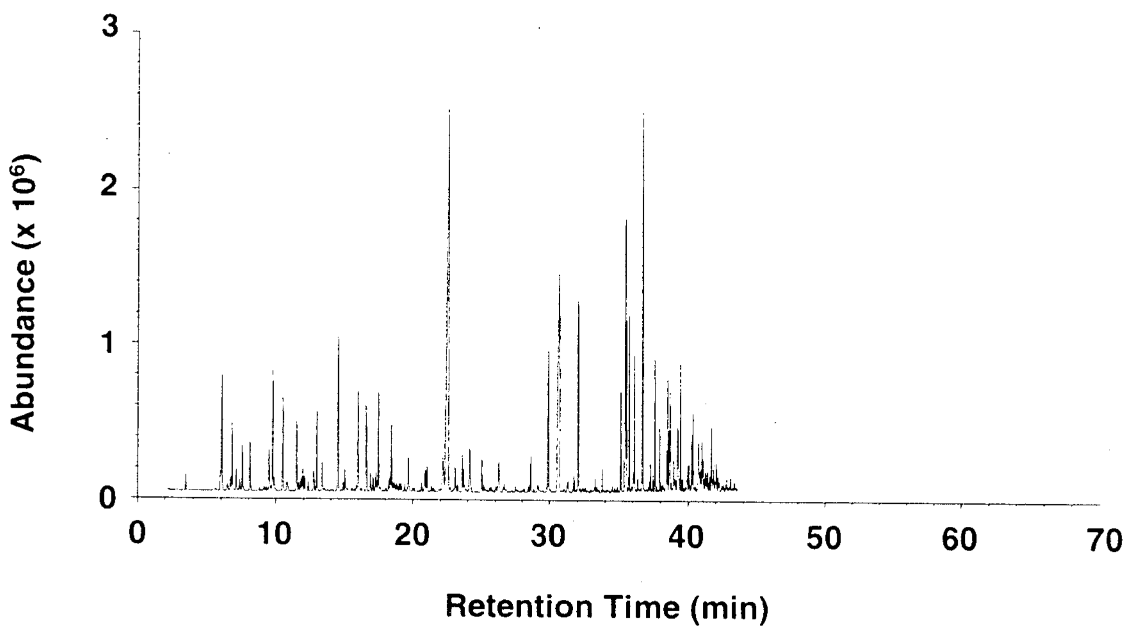


Figure 29

Test Chromatogram from GC/MS Analysis from Left Lower Engine (Location #3)

Test C11167

The peaks in the mass chromatogram of the background from the left lower engine (location #3) were identified as a homologous series of cyclic poly(dimethyl siloxanes). These compounds were produced during the GC/MS analysis by thermal decomposition of reagent used to deactivate the glass surfaces in the sorbent tubes. None of the engine compartment fluids was siloxane-based. The peaks in the mass chromatogram of the test sample were identified as a mixture of aliphatic and aromatic hydrocarbons in the range of C5 to C10. Higher molecular weight hydrocarbons were not detected. Gasoline was the only fluid in the test vehicle that contains hydrocarbons in this molecular weight range. The mass chromatograms of samples from the other locations where a hydrocarbon vapor was detected were similar to that shown in Figure 29. The abundances of the each hydrocarbon species were lower, however.

It is apparent that gasoline vapor was present in the left side of the engine compartment for about 1 minute after the impact. This is consistent with leaks in the fuel system identified during the post-test inspection (reported in section 3.2.11.) as well as the recorded drop in fuel pressure (reported in section 3.2.6.). However, the concentration at the left upper engine (location #1) barely exceeded the lower limit of flammability (approximately 0.8%) and the concentration at the left lower engine (location #3) never exceeded the lower limit of flammability. No apparent ignition sources were identified at these locations during the post-test analysis and vehicle inspection.

3.2.6. Summary of Fluid Pressure Measurements

The dynamic pressure measurements of the engine compartment fluids are shown in Appendix D, plots 130 through 135.

Although the brake pressure measurement (plot 130) indicates a significant drop in brake pressure, no leak was identified in the pressurized brake system during the post-test inspection. The loss in pressure could be due to deformation of the brake line or release of the brake pedal, during the impact. The post-test inspection (Section 3.2.11.) did reveal, however, that the brake fluid reservoir was separated from the master cylinder which released brake fluid (non-pressurized) into the engine compartment during the crash.

The auxiliary fuel line pressure (plot 13) also dropped to near zero at around 120 msec, which was likely caused by the leaks at the fuel injectors as reported under post-test inspection. No other pressure measurements conclusively identified the time of any fluid leaks. However, the post-test vehicle inspection revealed that battery electrolyte, engine coolant, brake fluid, power steering fluid and washer fluid all were released into the engine compartment during the impact.

3.2.7. Summary of Additional Electrical Measurements

The results of the electrical measurements made in the engine compartment are shown in Appendix D (plots 113 through 115, and 125 through 129).

A description of several electrical events were reported in the analysis of the post-test fire. Those events, namely the broken inter-cell connection in the battery, the separation of the negative battery cable, the pinching of the wiring harness containing the starter cable, and the penetration of the screw into the battery housing likely were the causes of the ignition voltage drops (as shown in plot 113 and Figure 21). Heavy currents caused by shorts to chassis typically will cause drops in ignition voltage due to additional loading on the battery.

No other electrical shorts were apparent on the recorded data.

3.2.8. Summary of Numerical Film Analysis

High speed film and video was used to document this crash test, however, no numerical analysis of the film was done. Only for the pole impacts, in which film analysis can accurately measure the dynamic pole penetration, was film analysis deemed necessary.

3.2.9. Results of Post-test Static Rollover

No static rollover was conducted on this vehicle following the crash test for reasons described in the results of the first offset pole frontal impact on the passenger van (Test C11108).

3.2.10. Results of the Evaluation of the Crashworthiness of Potential Fire Detection Technologies

The thermal wire fire detection device located under the wiper tray indicated a contact closure at 42 msec lasting about 15 msec as shown in Appendix D, plot 136. This closure was due to the physical pinching of the wire during the crash and not because of overheating. During the post-test inspection, the continuity of this device was measured to be open. However, it closed upon movement of the cable at the location where it was pinched. The purpose of including this device was to evaluate the crashworthiness of not only the device but also its mounting location. For subsequent tests the mounting location was moved to enable evaluation of alternate locations.

3.2.11. Summary of Post-test Vehicle and Barrier Inspection

An inspection of the moving barrier immediately following the impact revealed that the mounting plate for the deformable honeycomb face fractured during the impact. This mounting plate was a 50 mm thick aluminum plate mounted on the front of the moving barrier but just rearward of the honeycomb face. A review of the high-speed film revealed the fracture likely occurred late during the event at approximately 42 msec. The fracture of the mounting plate may have reduced the severity of the impact on the test vehicle slightly, because it allowed further penetration of the honeycomb into the barrier and also because there was some energy absorption associated with the fracture, which normally would not have been present. In addition, the fracture of the mounting plate reduced the ability to precisely repeat this crash test.

As with the previous test, the vehicle was disassembled and inspected to identify air passages from the engine compartment into the passenger compartment, the locations of any fluid leaks identified during the crash test, locations of any electrical shorts identified during the crash test, and any contact between combustible materials and hot surfaces.

Interior components, such as the instrument panel, were removed to identify structural openings between the engine compartment and the passenger compartment. The presence of the interior components, in many cases, would prohibit the free flow of air through the structural openings.

In general, the deformation and damage to the forward bulkhead was less severe than that caused by the offset pole. Following are the locations of openings identified during the inspection of the test vehicle:

- separation of engine coolant pass-through grommet from forward bulkhead
- air conditioning refrigerant pass-through
- separation of steering column boot from forward bulkhead
- smaller holes (less than 15 mm dia.) in the left wheel well where left frame rail spot welds pulled through
- smaller holes (less than 15 mm dia.) in the right wheel well where right frame rail spot welds pulled through
- opening in windshield near right A - pillar

The following sources of fluid leaks were located during the post-test inspection:

- transmission fluid: approximately 6 mm diameter hole in differential cover identified
- brake fluid: reservoir separated from master cylinder
- engine coolant: crushed radiator with loss of coolant, however coolant reservoir was intact
- power steering fluid: reservoir empty following test
- washer solvent: reservoir empty after test, washer pump was pulled out of reservoir
- battery electrolyte: partial loss of electrolyte

No liquid gasoline or Stoddard spills off of the vehicle were noted. However, the hydrocarbon vapor sampling identified the presence of gasoline vapors. The post-test inspection revealed the likely source of those vapors to be from the following locations:

- un-sealing of front, right fuel injector from fuel rail
- un-sealing of front, mid fuel injector from fuel rail

Similar to test C11108, these leaks were not supplied gasoline continuously from the pump, which had shut down at 35 msec.

No additional electrical shorts were identified other than previously reported as contributing to the post-impact fire.

No contact between normally hot surfaces and possible combustible materials was identified during the post-test vehicle inspection.

3.3. *Conclusions*

1. There was a post-collision electrical fire identified near the battery, demonstrating that electrically induced fires that consume only solid combustibles are possible in collision situations. This fire was unrelated to engine compartment fluids. It was also unrelated to any normally hot surfaces, such as exhaust manifolds or catalytic converters.

2. Three specific electrical occurrences were identified which contributed to the ignition of the fire. Namely, the separation of the negative battery cable from the battery, the penetration of a chassis-mounted self tapping screw into the battery housing, and the shorting of the starter cable to chassis. The repeatability of these three events occurring concurrently during a crash is unknown. Also, the effect on these events caused by the modifications made to the production vehicle, such as the removal of the hood, is also unknown.

3. The electric fuel pump shut down at about 35 msec past time zero due to the intermittent drops in the supply voltage caused by several impact-related electrical occurrences. The ignition voltage temporarily recovered back to 12 volts at about 120 msec. The fuel pump did not recover and remained off after 35 msec.

4. No liquid gasoline or Stoddard spills off of the vehicle were identified. However, the hydrocarbon vapor sampling devices identified the presence of gasoline vapors at the left-lower and left-upper engine compartment locations. During the post-test vehicle inspection, two of the six fuel injectors were unseated (un-sealed) from the fuel rail. Because the fuel pump shut down early (35 msec) only residual amounts of

gasoline were likely released from these leaks. This release of small amounts of gasoline from the fuel rail near the injectors, was likely the source of the gasoline vapors measured by the hydrocarbon vapor measurement devices.

5. Other engine compartment fluids (liquids) which were released included: transmission fluid, brake fluid, coolant, power steering fluid, washer solvent, and battery electrolyte. None of the fluids contributed to the fire.

6. As with the offset pole impact, the ATD measurements indicate that a crash condition of this type may be survivable from an occupant trauma standpoint, although there may be a risk of lower leg injury as indicated by the lower leg measurements. Lower leg injuries could slow the egress of the occupants after an impact. Thus the severity of this test is appropriate for post-collision fire research.

7. The thermal wire fire detector, which was located under the wiper tray in the engine compartment, was pinched and inadvertently closed due the impact. Alternate locations were investigated on subsequent tests.

8. The toe pan intrusion into the passenger compartment was less for this oblique moving barrier test, as compared to the offset pole impact.

9. The damage to the forward bulkhead was less for this test, as compared to the offset pole impact. Fewer openings from the engine compartment into the passenger compartment were identified.

Following are conclusions relating to test methodology useful for subsequent crash tests:

10. The mounting plate used to support the deformable honeycomb barrier face on the moving barrier fractured during the impact. This plate required reinforcement for subsequent crash tests.

11. The bumper height was set to match the test vehicle's bumper height for this test (457 mm or 18 in.). After analyzing the results of this test, the 25 mm difference from the FMVSS214 [8] height of 432 mm (17 in) was judged to have only minor effects on the test outcome. Therefore, to improve test consistency, subsequent tests will be conducted at the standard FMVSS 214 height of 432 mm (17 in.)

4. Passenger Van Offset Rigid Barrier Frontal Impact, Test C11226

On August 14, 1996 a passenger van offset rigid barrier frontal impact crash test (Test #C11226) was conducted also at the General Motors Proving Ground in Milford, Michigan. A total of 129 channels of data were recorded during the test.

4.1. *Test Conditions*

4.1.1. Impact Conditions

This test was a 50% overlap offset angled rigid frontal barrier impact as depicted in Figures 30 and 31. The rigid barrier overlapped 50% of the lateral width of the vehicle (the edge of the barrier was aligned with the longitudinal centerline of the vehicle.) The rigid barrier's face had anti-skid bars and was oriented at a 15 degree angle from the lateral vertical plane of the test vehicle. The inside edge of the barrier face had a 146 mm (5.75 in.) radius. The impact velocity, measured with radar, was 60.0 km/h (37.36 mph).

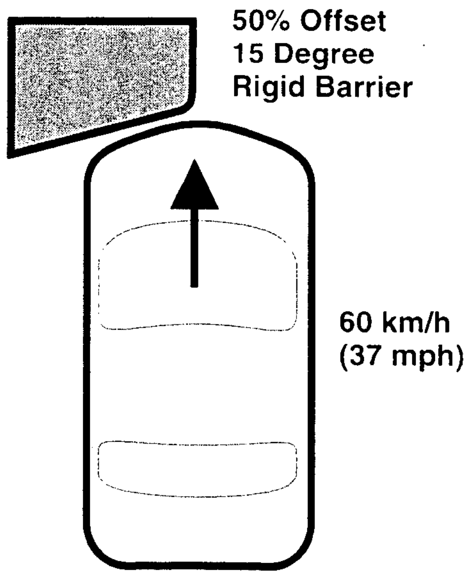


Figure 30.
Crash Test Configuration for Test C11226

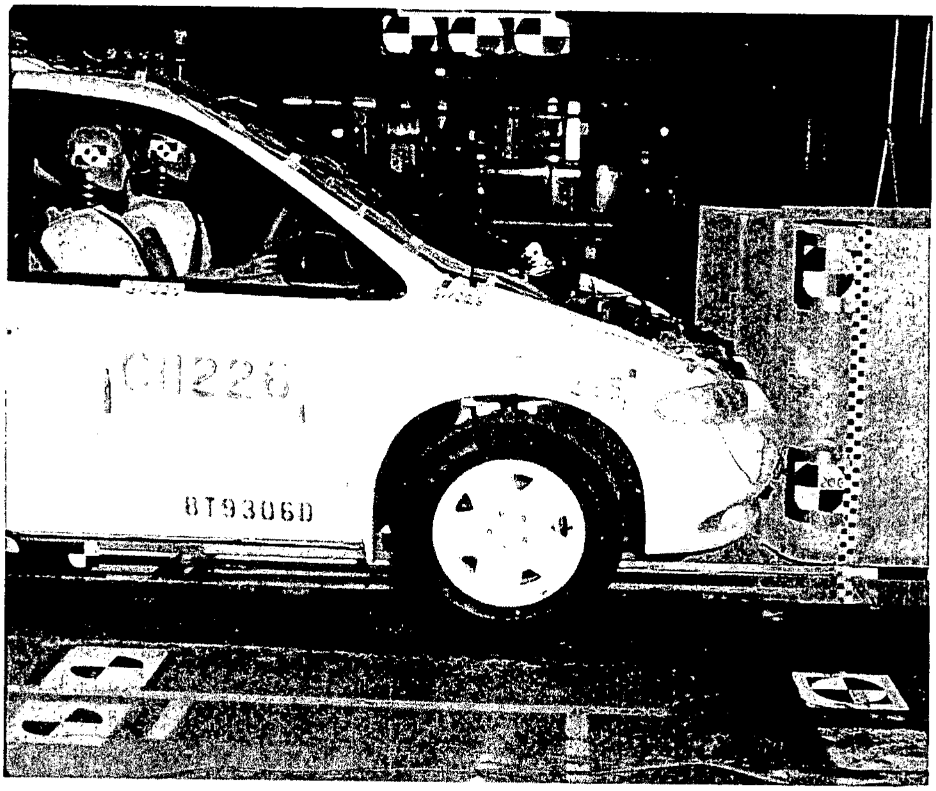


Figure 31.

Pre-Test Photograph of Test C11226

4.1.2. Vehicle Description

The 1996 Dodge Caravan Sport (VIN:1B4GP45R9TB377067) had a test mass of 2003 kg (1143 kg front, 860 kg rear) which included the two Hybrid III ATDs, crash test instrumentation, and Stoddard Solvent in the gasoline tank. First, the fuel tank's unusable capacity was filled with Stoddard Solvent, then 71.3 liters of Stoddard were added to the usable capacity of the tank. The engine was operating at impact with complete engine compartment fluids, including battery electrolyte. The radio, high beam headlights and air conditioning were operating at impact. The transmission was in neutral during the vehicle tow.

4.1.3. Pre-test Engine Warm-up Procedure

For the passenger van offset rigid barrier frontal impact (Test C11226), the engine was started approximately 46 minutes before impact as outlined in Table 4.

Table 4.

Engine Warm-Up Procedure for Test C11226

	Time after initial engine start (min)	Duration (min)
Engine started (idle approximately 900 rpm)	0	14
Engine speed increased to 1100 rpm	14	11
Engine turned off for instrumentation set-up	25	6
Engine restarted, set to 1100 rpm	31	15
Impact	46	

4.1.4. Modifications to Production Vehicle

As with the other tests, modifications to the production vehicle were done to fulfill the objectives of the project. A description of some of the modifications for test C11226 follows.

This vehicle was tested without a hood to improve overhead photographic coverage.

Gasoline was supplied to the engine from an auxiliary tank mounted in the passenger compartment similar to test C11108.

The rear seat was removed to facilitate the mounting of the crash test instrumentation, and the spare tire was removed for the test.

The vehicle's rear brake lines were cut and an auxiliary brake machine was installed to abort the test, if necessary, during the tow. The front brakes were manually pre-charged by mechanically locking down the driver brake pedal. The pistons were removed from the front calipers and the brake fluid inlet port was welded shut. This allowed the front brake pressure to be pre-charged and at a steady state pressure, while still allowing the front wheels to rotate during tow. Unlike test C11108, this modification was successful in allowing the front wheels to rotate.

The instrumentation of the engine compartment was similar to Test C11167 and again every reasonable attempt was made to make the added instrumentation as non-intrusive as possible so as not to affect the outcome of the test.

4.1.5. Vehicle Measurements

Many standard crash test measurements were recorded during this test, including:

- Front left rocker panel acceleration (longitudinal, lateral, and vertical)
- Front right rocker panel acceleration (longitudinal, lateral, and vertical)
- Rear left rocker panel acceleration (longitudinal, lateral, and vertical)
- Rear right rocker panel acceleration (longitudinal, lateral, and vertical)
- Left toepan longitudinal displacement (relative to floorpan, using string potentiometer)
- Driver's and passenger's air bag current (using non-intrusive clamp on current transducers)
- Engine rpm voltage (voltage signal from the production engine speed sending unit)
- Fuel pump current (at auxiliary fuel tank)

4.1.6. Photographic Coverage

High-speed 16 mm movie cameras were used to film the crash test. Cameras were located at various locations around the impact including above, below, and to both sides of the vehicle, as well as above the barrier face in front of the vehicle.

4.1.7. Anthropomorphic Test Device (ATD) Measurements

Similar to the previous frontal crash tests, two Hybrid III ATDs (FMVSS reference part 572, Subpart E)[3] were located in the front outboard seating positions. The seats were located in the fore-aft mid position, and the seat backs were at 28 degrees relative to vertical. The ATDs were restrained using the vehicle's lap / shoulder belts with the adjustable guide loop set in the third position from the top. In addition, the ATDs were restrained by the vehicle's frontal air bags. The ATDs were positioned per FMVSS 208 [4] guidelines and the pelvic angles were measured to be 24.1 degrees from horizontal for the left front ATD and 24.3 degrees for the right front ATD. The head target angle was at 0 degrees from horizontal for both ATDs.

Each Hybrid III ATD was instrumented to make the same measurements as on test C11108. In addition, the left front (driver) ATD only was also instrumented to make the following measurements.

- Upper tibia triaxial acceleration, left and right legs
- Lower tibia triaxial acceleration, left and right legs

4.1.8. Hydrocarbon Vapor Measurements

Hydrocarbon gas vapors were measured at the five following locations in the engine compartment:

- left upper engine (location #1)
- right upper engine (location #2)
- left lower engine (location #3)
- right lower engine (location #4)
- exhaust manifold (location #5)

At each location the concentration of hydrocarbon vapors was measured using tin oxide sensors described in a previous report [1], and similar to test C11167. Gas sampled from each of these locations was collected in sorbent tubes for subsequent analysis by gas chromatography / mass spectrometry (GC/MS) [1].

4.1.9. Fluid Pressure Measurements

The pressures of several of the vehicle's fluids were measured to help identify fluid leaks and the time during the impact when they occurred. Pressure measurements included:

- Left front brake system pressure (brake line tapped near ABS junction box)
- Power steering system pressure (measured near power steering rack)
- Cooling system pressure (measured at thermostat housing, transducer remotely located)
- Auxiliary fuel line pressure (near production fuel tank where auxiliary line was tapped into production line)
- Engine oil pressure (measured at the oil pressure sending unit with a remotely located transducer)
- Transmission cooler fluid pressure (measured at transmission port going to cooler)

In addition to pressure measurements, a fluorescent dye was added to the cooling system to help visually identify the presence of fluid leaks and the location of fluids after the impact. Unlike the previous tests, dye was not added to the engine oil because the dye was found not to significantly increase the ability to distinguish the oil from other spilled fluids.

4.1.10. Additional Electrical Measurements

Similar to previous tests, additional electrical measurements were made to identify possible shorts, arcing or overheated circuits. Those measurements are listed below.

Clamp - on current monitoring transducers were used to measure the following currents:

- Horn (low tone) current (measured in passenger compartment near the steering column)
- Air conditioning compressor clutch (measured near forward lower engine mount)
- Radiator cooling fan (measured near front left midrail)
- Alternator cable (fusible link from battery to alternator), (measured near battery)
- Battery main (B+) (measured near battery)
- Starter cable

Voltage measurements were also made of the following circuits:

- Ignition
- Left front headlight high beam
- Left front headlight low beam
- Starter

4.1.11. Evaluation of the Crashworthiness of Potential Fire Detection Technologies

An experimental thermal wire fire detector was located in the rear portion of the engine compartment and ran the full width of the van forward of the wiper tray. Its location was more forward in the vehicle than for Test C11167. This detection wire was the same type as for Test C11167, and was designed to close when heated to 356 degrees Fahrenheit. This thermal wire was monitored for contact closure between the wires during the test.

In addition to the thermal wire, a pneumatic fire detector was also included and was also located forward of the wiper tray. The pneumatic detector, however, did not span the entire lateral width of the van but was looped over on itself and spanned only approximately 300 mm. It was positioned laterally in the center of the vehicle. Two channels were monitored on the pneumatic device, one normally open activation circuit and a normally closed fault circuit.

Both of these devices were supplied by Dual Spectrum (Goleta, CA). Devices of this type could be used with an active fire suppression system but for this test were only monitored to evaluate their crashworthiness.

4.2. *Summary of Test Results*

Post-test photographs of the vehicle are shown in Figures 32 and 33.

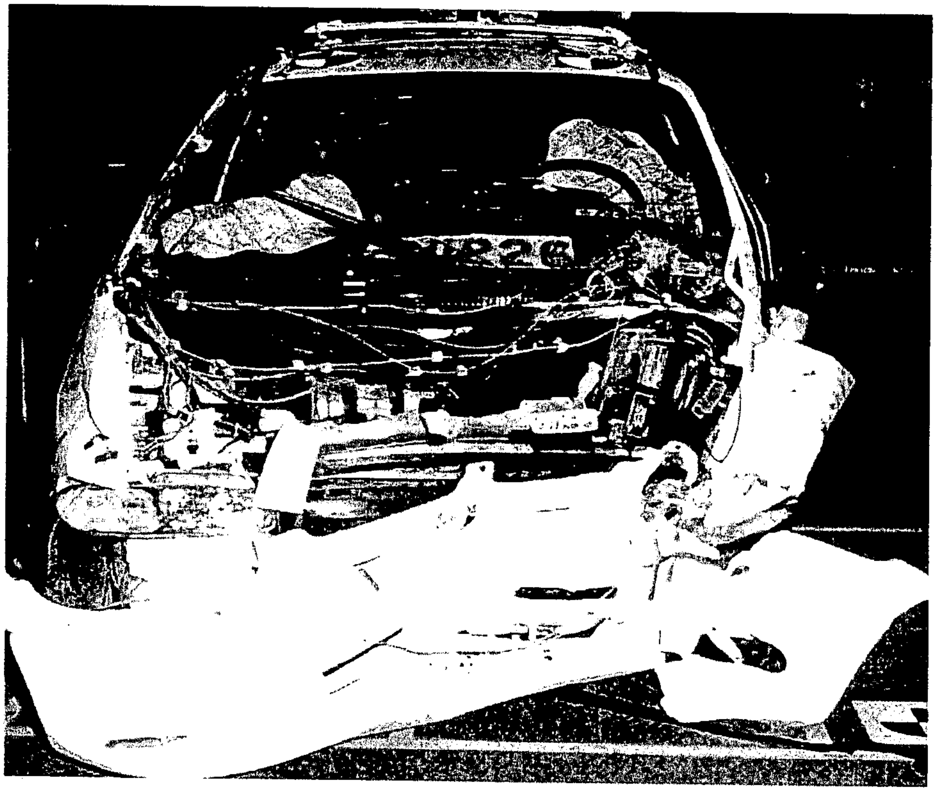


Figure 32.

Post-Test Photograph of Test C11226, Front View

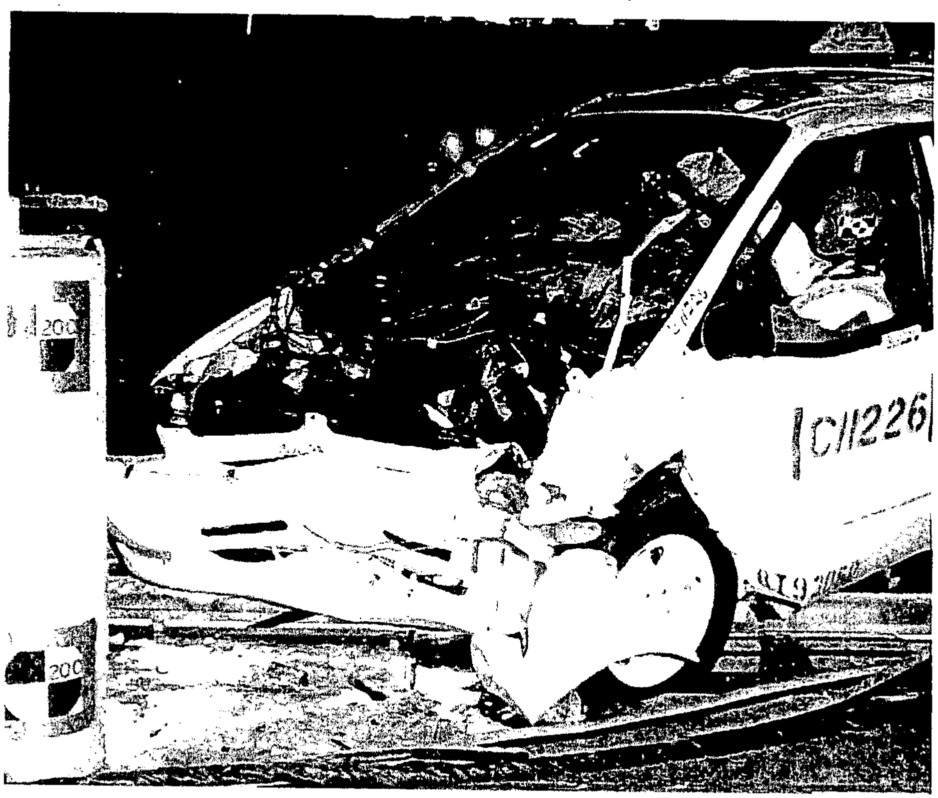


Figure 33.

Post-Test Photograph of Test C11226, Front – Left View

4.2.1. Summary of Standard Vehicle Crash Test Measurements

The complete set of recorded and computed vehicle measurements are included in Appendix F (plots 59 through 117, 121, and 128 through 130).

The two rear rocker panel longitudinal acceleration measurements were averaged and integrated to compute the change in vehicle velocity. The average vehicle velocity was integrated to compute vehicle displacement. The peak vehicle longitudinal acceleration (after filtering at SAE class 60 [6]), was 41 g and the maximum longitudinal change in vehicle velocity was 68 km/h (42.2 mph), with the velocity crossing zero at 97 msec past time zero (impact.) The averaged rear rocker longitudinal acceleration and velocity is shown in Figures 34 and 35, and plots 95 and 96, Appendix F.

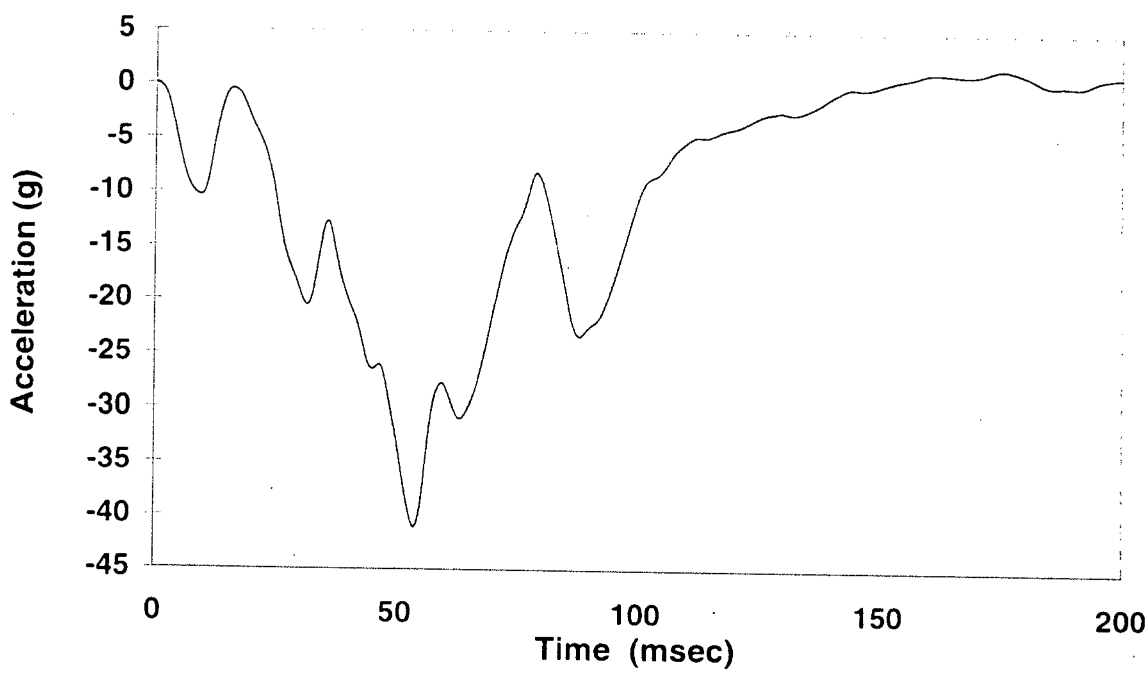


Figure 34

Averaged (Left & Right) Rear Rocker Panel Longitudinal Acceleration, Test C11226, filtered at SAE class 60 [6]

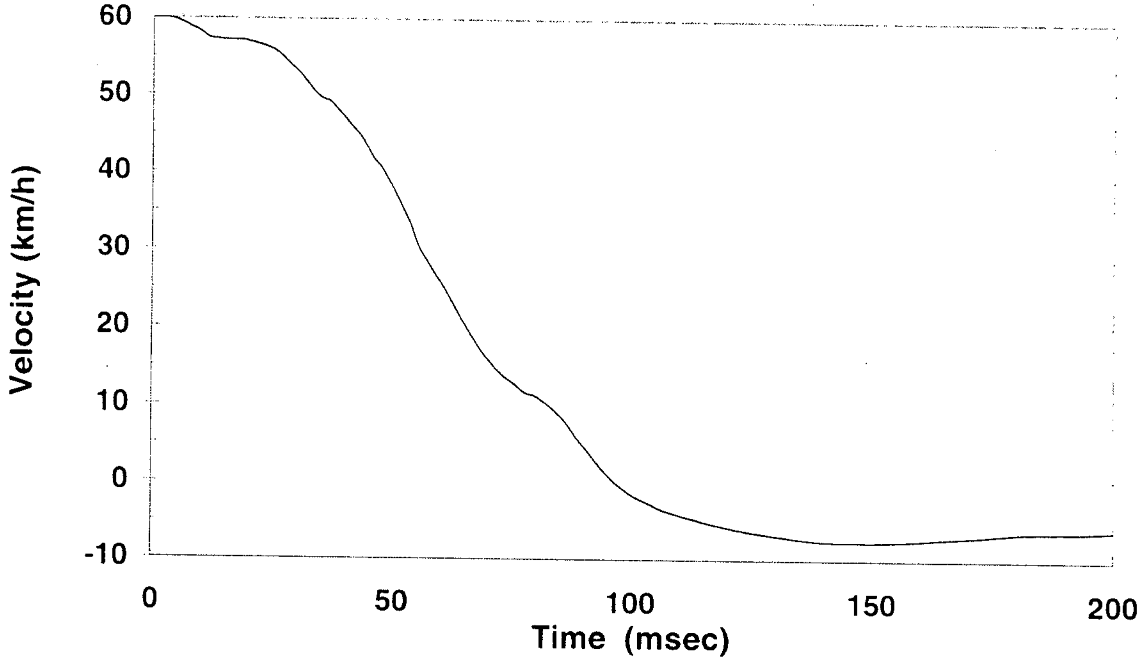


Figure 35

Averaged (Left & Right) Rear Rocker Panel Longitudinal Velocity

Test C11226

The displacement of the left toe pan, which indicated approximately 350 mm toe pan intrusion is shown in Figure 36 and plot 117 (Appendix F).

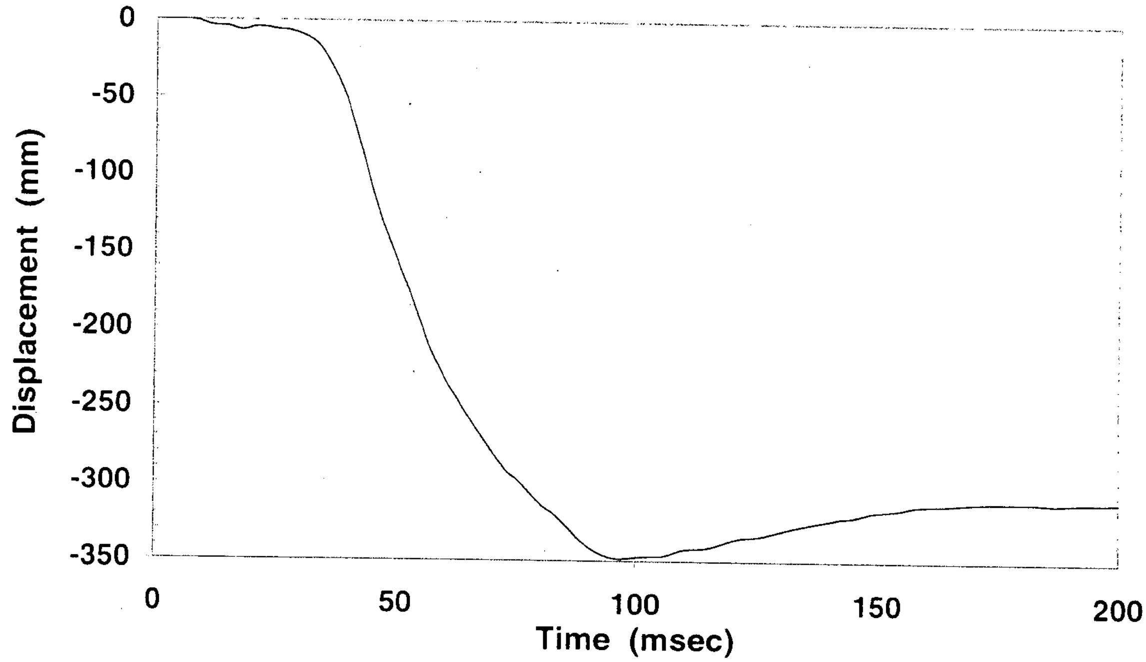


Figure 36

Left Toepan Displacement, Relative to Floorpan

Test C11226, filtered at SAE class 60 [6]

The driver and passenger air bag current indicated that both air bags deployed at about 14 msec (Appendix F, plots 128 and 129.)

The voltage measured at the engine speed sending unit indicated that the engine was still turning at least through 10 msec (Appendix F, plot 121). Similar to previous tests, however, this measurement becomes inconclusive after 10 msec due to the crash-induced damage to the vehicle's electrical power.

Figure 37 and plot 130 (Appendix F) show the current measurement at the auxiliary fuel pump (the one operating before the impact and supplying gasoline to the engine from the auxiliary fuel tank). The fuel pump drew 7.5 amps until about 20 msec, when the current dropped to zero. It quickly recovered to 7.5 amps before dropping back to zero at about 30 msec. The ignition voltage, which is shown in Figure 38 and plot 120 (Appendix F), also follows a similar waveform. These changes in ignition voltage are the likely cause of the changes in the fuel pump current. Unlike test C11167, the ignition voltage never recovered and remained at or near zero for the duration of the data acquisition period.

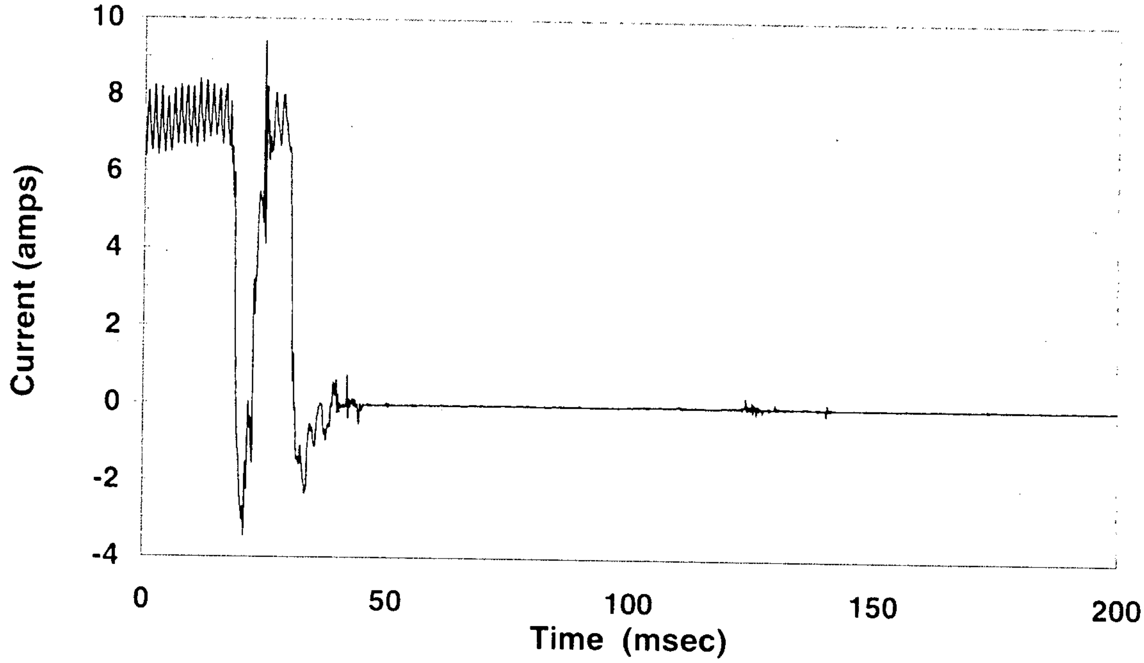


Figure 37

Fuel Pump Current

Test C11226

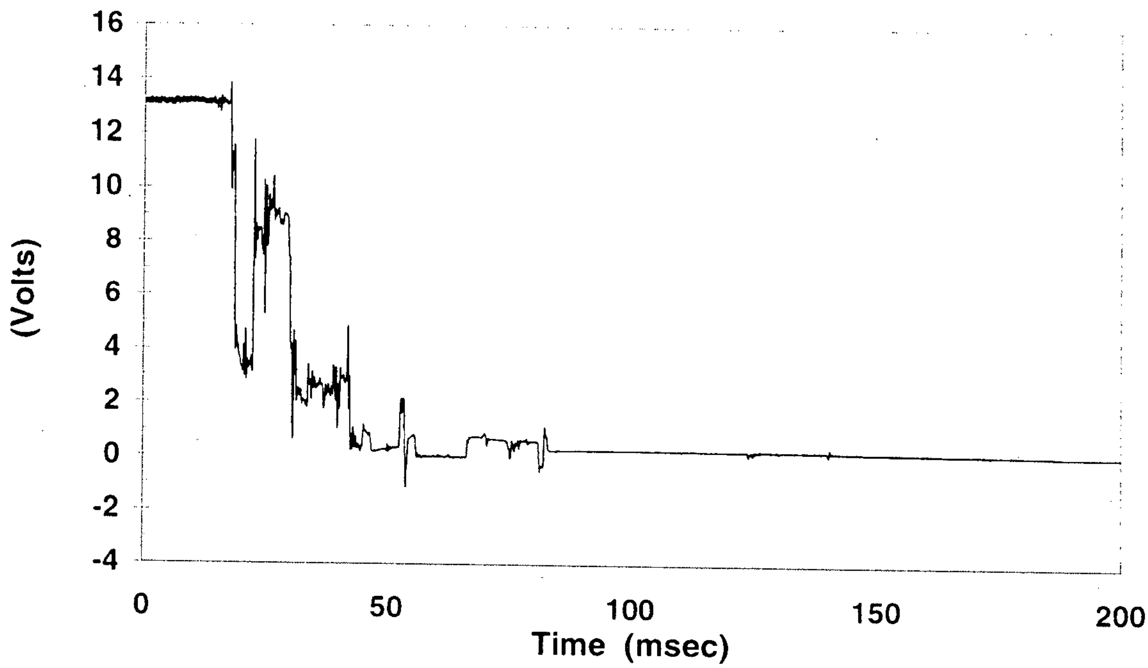


Figure 38

Ignition Voltage

Test C11226

4.2.2. Summary of Recorded ATD Measurements

The complete set of recorded and computed ATD measurements are included in Appendix F (pages i and ii, and plots 1 through 58).

The following injury measurements from the left front occupant (driver) were above their respective Injury Assessment Reference Values (IARV): Head Injury Criteria (HIC, limited to 36 msec duration), upper neck moment about the lateral axis (extension, -My), upper neck axial force (tension, +Fz), left upper tibia moment (resultant of Mx and My), right upper tibia moment (resultant of Mx and My), left lower tibia moment (My), right lower tibia moment (My), and the corresponding computed values associated with these measurements such as all of the lower leg indices. The 36 msec HIC value was 1110, or 110% of the IARV. However, the HIC recalculated with a duration of 15 msec, which is recommended for air bag interactions by the AGARD report [5], was less than the IARV. The neck extension was 65 Nm, which is 114% of the IARV of 57 Nm. The upper neck tension time duration computation was 130% of the IARV. The left upper tibia moment was 342 Nm which is 152% of the IARV of 225 Nm. The right upper tibia moment was 306 Nm which is 136% of the IARV of 225 Nm. The left lower tibia moment exceeded the full-scale range that was established for the test. The right lower tibia moment was 372 Nm which is 165% of the IARV of 225 Nm. The left upper, right upper, and right lower leg indices were 155%, 146%, and 176% of their respective IARV. The left lower leg index could not be calculated due to the overloaded moment channel. All other measurements on the left front ATD, including the HIC calculated using a 15 msec duration, were below their respective IARV.

The right front occupant's (passenger's) injury measurements indicated only the left upper leg index exceeded its IARV at 113%. All other measurements were less than IARV for the right front occupant.

4.2.3. Summary of Hydrocarbon Vapor Measurements

A complete set of the recorded measurements is included in Appendix F, plots 123 through 127, and Appendix G, Figures G1 through GG5.

All of the concentration measurements begin at about 5 seconds after impact as shown in Figures G1 through G5, Appendix G. This was due to an instrumentation malfunction resulting in the loss of the first 5 seconds of data. None of the measured concentrations at the five locations exceeded 0.2% at any time for the duration of the recording. All of these measurements were below the measured concentrations at locations #1 and #3 for test C11167.

Similar to test C11167, GC/MS analyses were conducted on both background samples (collected before the impact) and test samples (collected after the impact) at each of the five locations. Unfortunately, at location #2 (right upper engine) the tube in which the air samples were drawn through to the collection cartridges was severed during the crash. Therefore, no test chromatogram is available for this location. The chromatograms from the remaining 9 analyses are shown in Figures GG1 through GG5 in Appendix G. The background and test chromatograms from the left lower engine (locations #3), right lower engine (#4) and the exhaust manifold (#5) indicate a match with heavy oil headspace chromatograms. (The control analyses on the different heavy oils all result in similar chromatograms.) It is possible that the engine was leaking oil during the static engine warm up prior to the impact, or that oil was spilled on the engine surface(s) during the test preparation. The oil likely was in contact with a hot surface causing it to vaporize and be collected in the sorbent tubes.

None of the test chromatograms matched the gasoline control sample, indicating there was no apparent gasoline leak during the impact. This is consistent with the post test inspection, in which no fuel system leaks were identified (reported in Section 4.2.9.)

4.2.4. Summary of Fluid Pressure Measurements

The dynamic pressure measurements of the engine compartment fluids are shown in Appendix F, plots 137 through 142.

Although the brake pressure measurement (plot 137) indicates a gradual drop in left front brake pressure, no leak was identified in the pressurized fuel system during the post-test inspection. The loss in pressure could have been due to deformation of the brake line or release of the brake pedal, during the impact, as with test C11167. The post-test inspection revealed that the non-pressurized brake fluid reservoir was cracked but still full of brake fluid.

The power steering fluid pressure measurement (plot 138) indicated a loss of pressure during the test. However, no leaks were identified during the post-test disassembly and inspection. The pressure loss was likely due to the pump stopping when the engine stopped during the impact.

The engine coolant pressure measurement (plot 139) indicated sustained pressure through 240 msec. However, most of the coolant from the radiator was lost during the impact. The sustained pressure is likely only in a short section of the cooling system from the thermostat to a pinch in the upper radiator hose, where the pressure transducer was located. The pinch was caused by the impact and was identified during the post-test inspection.

There was no indication of pressure loss in the auxiliary fuel line pressure (plot 140).

The engine oil pressure measurement (plot 141) indicated a gradual decline in pressure but this is not indicative of a leak because the pressure never dropped to zero. The post-test inspection did not reveal any leaks in the engine oil system.

The transmission fluid pressure measurement (plot142) indicated sustained pressure during the impact. The post-test inspection did reveal a cracked transmission case with nearly all of the fluid gone in the case. The sustained pressure measurement is likely an artifact of the test instrumentation. A hose added to connect the transmission fluid to the remote pressure transducer was pinched during the impact. This pinch was identified during the post-test inspection.

4.2.5. Summary of Additional Electrical Measurements

The results of the electrical measurements made in the engine compartment are shown in Appendix F (plots 118 through 120, 122, and 131 through 136).

The ignition voltage (plot 120 and also Figure 38) dropped beginning at about 20 msec and continued to near zero at 40 msec. The battery was inspected following the test and an internal short was identified through a continuity test. The drop in ignition voltage is due to internal shorting of the battery and possibly also due to electrical shorts external of the battery, although none were identified during the post-test inspection.

The starter voltage (plot 122) followed a similar waveform as the ignition voltage as would be expected if the system voltage drops.

An instrumentation malfunction effected the measurement of the left front headlight high beam voltage (plot 118). The low beam voltage trace (plot 119) is generally inconclusive (the low beams were not on during the test.)

The low-tone horn current measurement (plot 131) did not indicate any significant current flow.

The air conditioning clutch current (plot 132) dropped from a steady state current of 2.5 amps to near zero. This is due to the loss of system voltage as indicated in the ignition voltage plot.

The cooling fan current measurement (plot 133) is generally inconclusive. Current flow is indicated, but the trace is indicative of an instrumentation malfunction. The location of this transducer relative to the vehicle crush also makes it vulnerable to damage during the crash.

The battery current (plot 135) and starter current (plot 136) are also generally inconclusive. A significant change in current flow is indicated which overloaded the full-scale range of these transducers. However, both transducers were damaged during the impact. It is possible electrical shorts external to the battery caused significant current flow at these transducers, although no indications of significant shorts were identified during the post-test inspections and disassembly. It is more likely that these transducers were damaged early during the event and that the measurements are invalid. The interpretation of these measurements is even more confounded because, due to space limitations, these transducers are electrically under-sized for potential currents that could be present. This means that exceeding their full-scale range will not be uncommon.

4.2.6. Summary of Numerical Film Analysis

High speed film and video was used to document this crash test, however, no numerical analysis of the film was done.

4.2.7. Results of Post-test Static Rollover

No static rollover was conducted on this vehicle following the crash test for reasons described in the results of the first offset pole impact on the passenger van.

4.2.8. Results of the Evaluation of the Crashworthiness of Potential Fire Detection Technologies

The results of the electrical measurements made to monitor the condition of the experimental fire detection devices are shown in Appendix F (plots 143 through 145).

The thermal wire fire detector located forward of the wiper tray indicated a contact closure at 65 msec lasting about 20 msec and also at 110 msec lasting about 5 msec (Appendix F, plot 143). This closure was due to the physical pinching of the wire during the crash and not because of overheating. Similar to test C11167 the continuity of the thermal wire was checked following the test and it was found to be open.

The pneumatic fire detector did not indicate any contact closures during the test. The pressure transducer on the pneumatic device dislodged during the test, indicating the need for more secure mounting for subsequent tests.

For this test configuration and mounting location, the pneumatic wire device demonstrated better crashworthiness than the thermal wire device.

4.2.9. Summary of Post-test Vehicle Inspection

As with the previous tests, the vehicle was disassembled and inspected to identify air passages from the engine compartment into the passenger compartment, the locations of any fluid leaks identified during the crash test, locations of any electrical shorts identified during the crash test, and any contact between combustible materials and hot surfaces.

The instrument panel and HVAC module were removed to identify structural openings between the engine compartment and the passenger compartment. As with previous tests, in some cases, these openings did not result in a free flow opening due to the presence of interior components.

In general, the forward bulkhead had fewer openings for this test configuration than the other two frontal test configurations (offset pole and oblique moving barrier.) There were no separated welds identified near the forward bulkhead. Following are the locations of openings between the engine and passenger compartments that were identified:

- separation of engine coolant pass-through grommet from forward bulkhead
- air conditioning refrigerant passthrough
- separation of windshield bonding at lower center windshield area

One additional opening into the passenger compartment (not on the forward bulkhead) was a separation between the lower driver door and the rocker. This separation was less than 50 mm long.

The following fluid leaks were identified during the post-test inspection:

- transmission fluid: transmission case was cracked with no fluid inside post-test
- engine coolant: radiator was punctured and coolant lost
- washer solvent: reservoir empty after test, washer pump was pulled out of reservoir
- battery electrolyte: loss of electrolyte from cracked battery housing

No liquid gasoline or Stoddard spilled off of the vehicle and no gasoline leaks were identified during the post-test inspection.

No apparent electrical shorts, other than the internal battery short were identified during the post-test inspection.

No contact between hot surfaces and combustible materials was identified during the post-test inspection.

4.3. *Conclusions*

1. There were no post-collision fires identified during this crash test.

2. No liquid gasoline or Stoddard spilled off of the vehicle.

3. The vapor analysis detected the presence of oil vapor both in the background (pre-impact) and test (post-impact) samples. This was likely due to an engine oil leak or oil spilled on the engine surfaces during the

test preparations. No gasoline vapor was detected, which was consistent with the post-test vehicle inspection that did not reveal any fuel system leaks.

4. Engine compartment fluids that were released during the impact included transmission fluid, engine coolant, washer solvent, and battery electrolyte.

5. The electric fuel pump shut down at about 20 msec past time zero. Consistent with previous tests, the fuel pump shut stopped at the first indication of system voltage drop, and did not require to be "timed out" following engine stoppage.

6. The ATD measurements were generally higher than for the other frontal tests on the passenger van. Two of the upper neck measurements on the driver ATD as well as most of the lower leg measurements were above their respective IARV.

7. The battery shorted internally during the impact. External to the battery, however, there were no electrical shorts identified.

8. The thermal wire fire detector which was located forward of the wiper tray in the engine compartment, was pinched and inadvertently closed during the impact.

9. The pneumatic fire detector did not inadvertently close during the test. For this test configuration the pneumatic device appears to be more crashworthy than the thermal wire device.

10. The toe pan intrusion into the passenger compartment was greater for this test than the two previous frontal tests, however fewer openings through the forward bulkhead were identified.

Following are conclusions relating to test methodology useful for subsequent crash tests:

11. As compared to the previous two frontal tests, there were fewer forward bulkhead openings, fewer potential sources of ignition (heat) sources and fewer sources of fuel identified. This, in combination with the higher ATD measurements, led to the elimination of this test configuration from the test matrix for the remaining vehicles.

12. As with the previous two frontal tests on this vehicle, the hood was removed to allow for improved photographic coverage. However, the underhood fluid plumes may be markedly different in vehicles with versus without their hoods. Some subsequent frontal tests, including the repeat offset pole frontal impact on the passenger van, were conducted with the hood in place.

13. The method used to isolate the front brakes from the brake fluid pressure was successful for this test. A steady state brake pressure was achieved while still allowing wheel rotation during the tow of the test vehicle. This method (as opposed to the method used for test C11108) will be used for subsequent frontal tests in which the vehicle is towed.

14. Many of the electrical measurements (especially the current measurements) made in the engine compartment during the impact were difficult to analyze following the test, consistent with previous tests. This was because some of the instrumentation was damaged during the tests, the current transducers were generally undersized (due to space limitations) and the electrical system did not stay in a steady state condition (experienced voltage drops.)

5. Passenger Van Offset Pole Frontal Impact, Test C11279

On September 25, 1996 a passenger van offset pole frontal impact crash test (Test #C11279) was conducted. This test was also at the General Motors Proving Ground in Milford, Michigan. A total of 130 channels of data were recorded during the test. This was the second offset pole frontal impact on a passenger van in this series. The reasons for conducting a repeat test were to quantify the effects of removing the hood from the vehicle, to obtain some measurements which were lost on the first test due to instrumentation malfunctions, to obtain measurements from instrumentation which was not yet available for the first test, and to understand better the repeatability of the test.

5.1. *Test Conditions*

5.1.1. Impact Conditions

This test was a offset pole frontal impact as depicted in Figure 39 and 40. The test vehicle was towed into a 355 mm (14 inch) diameter steel pole. The lateral offset between the vehicle longitudinal centerline and the pole was 305 mm (12 inches), with the impact occurring on the right side of the vehicle centerline (passenger's side). The impact velocity was measured to be 55.4 km/h (34.4 mph) using radar.

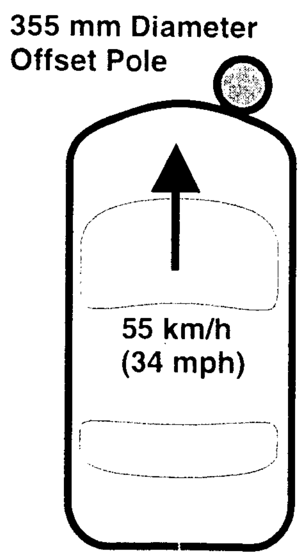


Figure 39.

Crash Test Configuration for Test C11279

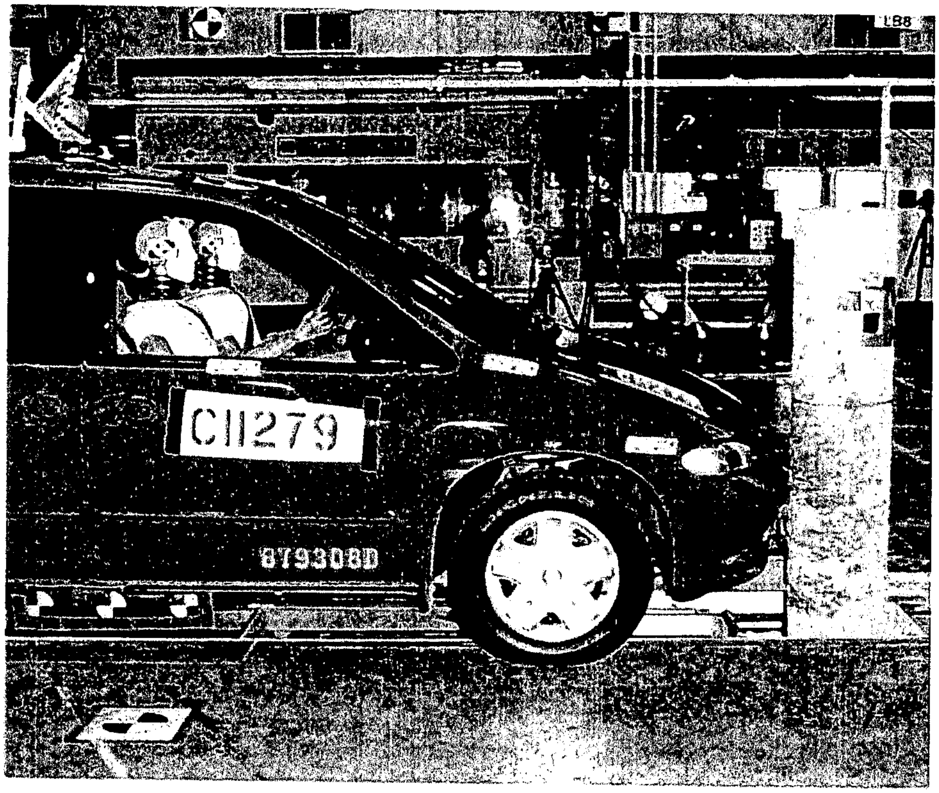


Figure 40.

Pre-test Photograph of Test C11279

5.1.2. Vehicle Description

The 1996 Dodge Caravan Sport (VIN:1B4GP45RXTB374145) had a test mass of 2015 kg (1166 kg front, 849 kg rear) which included the two Hybrid III ATDs, crash test instrumentation, and Stoddard Solvent in the gasoline tank. First, the fuel tank's unusable capacity was filled with Stoddard Solvent, then 71.3 liters of Stoddard were added to usable capacity of the tank. The engine was operating at impact with complete engine compartment fluids, including battery electrolyte. The radio, high beam headlights and air conditioning were operating at impact. The transmission was in neutral during the vehicle tow.

5.1.3. Pre-test Engine Warm-up Procedure

For the second passenger van offset pole frontal impact (Test C11279), the engine was started approximately 46 minutes before impact as outlined in Table 5.

Table 5.

Engine Warm-Up Procedure for Test C11279

	Time after initial engine start, (min)	Duration, (min)
Engine started (idle approximately 900 rpm)	0	15
Engine speed increased to 1200 rpm	15	11
Engine turned off for instrumentation set-up	26	6
Engine restarted, set to 1100 rpm	32	14
Impact	46	

5.1.4. Modifications to Production Vehicle

Unlike previous tests, this vehicle was tested with the hood in place. However, there were other modifications made to the vehicle for testing purposes as described below.

The production fuel tank was filled to 95% of its usable capacity with Stoddard Solvent. Gasoline was supplied to the engine from an auxiliary tank mounted in the passenger compartment similar to test C11108.

The rear seat was removed to facilitate the mounting of the crash test instrumentation. The spare tire was removed for the test.

The vehicle's rear brake lines were cut and an auxiliary brake machine was installed to abort the test during the tow, if necessary. The front brakes were pre-charged by mechanically locking down the driver brake pedal. The pistons were removed from the front calipers and the brake fluid inlet port was welded shut. This allowed the front brake pressure to be pre-charged and at a steady state pressure, while still allowing the front wheels to rotate during tow.

The instrumentation of the engine compartment was similar to Test C11226. Again every reasonable attempt was made to make the added instrumentation as non-intrusive as possible so as to not affect the outcome of the test.

5.1.5. Vehicle Measurements

Many standard crash test measurements were recorded during this test, including:

- Front left rocker panel acceleration (longitudinal, lateral, and vertical)
- Front right rocker panel acceleration (longitudinal, lateral, and vertical)
- Rear left rocker panel acceleration (longitudinal, lateral, and vertical)
- Rear right rocker panel acceleration (longitudinal, lateral, and vertical)
- Right toepan longitudinal displacement (relative to floorpan, using string potentiometer)
- Driver's and passenger's air bag current (using non-intrusive clamp on current transducers)
- Engine rpm voltage (voltage signal from the production engine speed sending unit)
- Engine motion (rotation of crankshaft using an auxiliary magnetic pickup transducer)
- Fuel pump current (at auxiliary fuel tank)

5.1.6. Photographic Coverage

High-speed 16 mm movie cameras were used to film the crash test. Cameras were located at various locations around the impact including above, in front of, below and to both sides of the vehicle. For this test only, the engine's main crank shaft pulley and serpentine drive belt were painted to help identify when the engine stopped during the impact.

5.1.7. Anthropomorphic Test Device (ATD) Measurements

Similar to the previous tests, two Hybrid III ATDs (FMVSS reference part 572, Subpart E)[3] were located in the front outboard seating positions. The seats were located in the fore-aft mid position, and the seat backs were at 22 degrees relative to vertical. The ATDs were restrained using the vehicle's production lap / shoulder belts with the adjustable guide loop set in the third position from the top. In addition, the ATDs were restrained by the vehicle's production frontal air bags. The ATDs were positioned per FMVSS 208 [4] guidelines and the pelvic angles were measured to be 24.5 degrees from horizontal for the left front ATD and 22.3 degrees for the right front ATD. The head target angle was at 0 degrees from horizontal for both ATDs.

Each Hybrid III ATD was instrumented to make the same measurements as on test C11108. The right front (driver) ATD only was instrumented to make the following additional measurements.

- Upper tibia triaxial acceleration, left and right legs
- Lower tibia triaxial acceleration, left and right legs

5.1.8. Hydrocarbon Vapor Measurements

Hydrocarbon vapor was measured at the five following locations in the engine compartment:

- left upper engine (location #1)
- right upper engine (location #2)
- left lower engine (location #3)
- right lower engine (location #4)
- exhaust manifold (location #5)

Similar to tests C11167 and C11226, the concentration of hydrocarbon vapors was measured using tin oxide sensors at each location. Gas sampled from each of these locations was collected in sorbent tubes for subsequent analysis by gas chromatography / mass spectrometry (GC/MS) [1].

5.1.9. Fluid Pressure Measurements

Pressures of several of the vehicle's fluids were measured to help identify fluid leaks and the time during the impact when they occurred. Pressure measurements included:

- Right front brake system pressure (brake line tapped near ABS junction box)
- Power steering system pressure (measured near power steering rack)
- Cooling system pressure (measured at thermostat housing, transducer remotely located)
- Auxiliary fuel line pressure (near production fuel tank where auxiliary line was tapped into production line)
- Engine oil pressure (measured at the oil pressure sending unit with a remotely located transducer)
- Transmission cooler fluid pressure (measured at transmission port going to cooler with a remotely located transducer)

Similar to Test C11226, a fluorescent dye was added to the cooling system.

5.1.10. Additional Electrical Measurements

The following additional electrical measurements were made to identify possible shorts, arcing or overheated circuits.

Clamp - on current monitoring transducers were used to measure the following currents:

- Horn (low tone) current (measured in passenger compartment near the steering column)
- Air conditioning compressor clutch (measured near forward lower engine mount)
- Radiator cooling fan (measured near front left midrail)
- Alternator cable (fusible link from battery to alternator, measured near battery)
- Battery main (B+) (measured near battery)

- Starter cable (measured near battery)

Voltage measurements were also made of the following circuits:

- Ignition
- Right front headlight high beam
- Right front headlight low beam
- Starter

5.1.11. Evaluation of the Crashworthiness of Potential Fire Detection Technologies

An experimental thermal wire fire detector was mounted to the underside of the hood, below the hood liner. This detection wire was the same type as for Test #C11167. This thermal wire was monitored for contact closure between the wires during the test.

A pneumatic fire detector was also included and was also located on the underside of the hood below the hood liner. Two channels were monitored on the pneumatic detector, one normally open activation circuit and a normally closed fault circuit.

These two devices were co-located and each spanned approximately 600 mm laterally, rearward of the crush initiator (on the rearward half of the hood) and then looped back and spanned approximately 600 mm on the forward half of the hood. Both of these detectors were supplied by Dual Spectrum (Goleta, CA). Devices of this type could be used with an active fire suppression system but for this test were only monitored to evaluate their crashworthiness.

5.2. *Summary of Test Results*

Post-test photographs of the vehicle are shown in Figures 41 and 42.

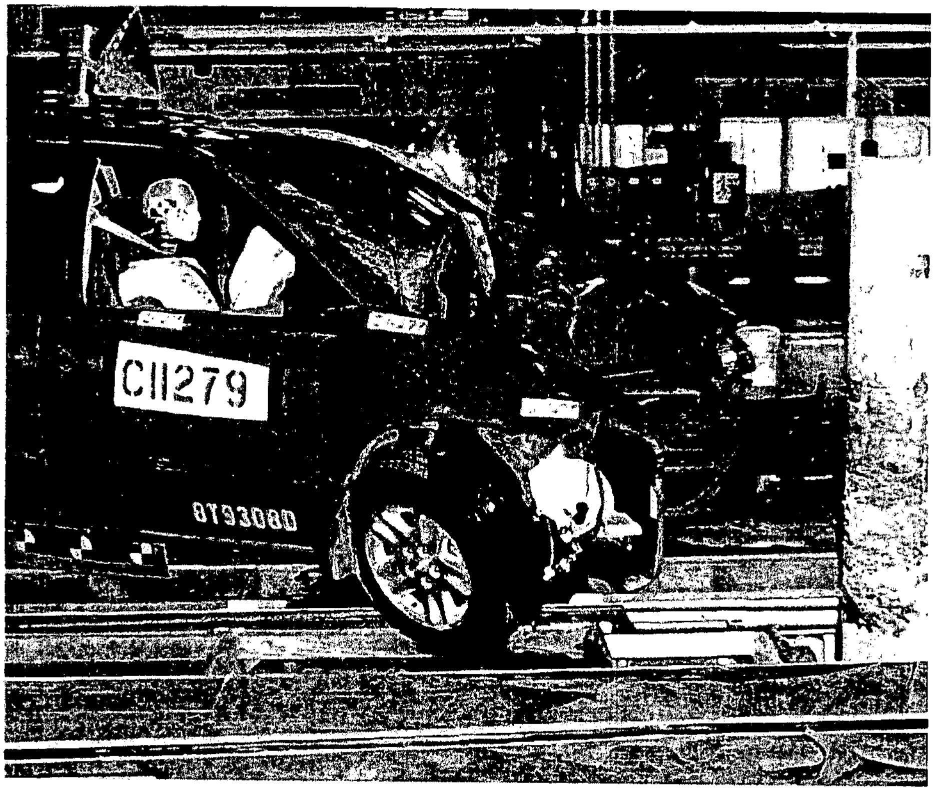


Figure 41.

Post-Test Photograph of Test C11279, Front-Right View

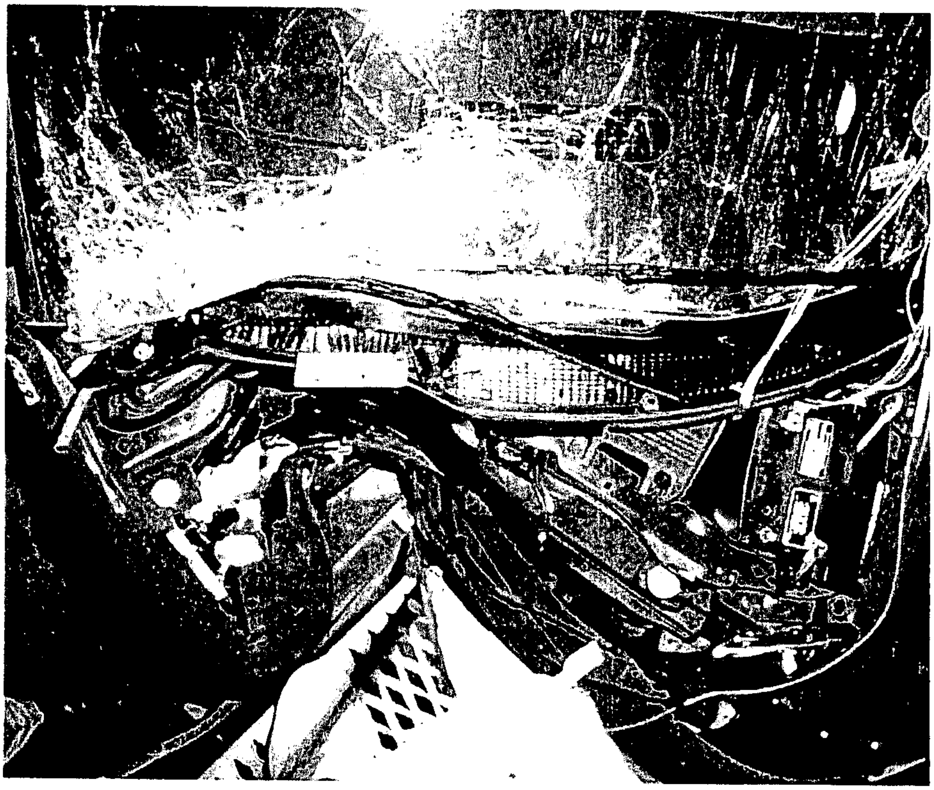


Figure 42.

Post-Test Photograph of Test C11279, From Above with the Hood Removed

5.2.1. Summary of Standard Vehicle Crash Test Measurements

The complete set of recorded and computed vehicle measurements are included in Appendix H (plots 59 through 117, 122, 123, and 129 through 131).

The two rear rocker panel longitudinal acceleration measurements were averaged and integrated to compute the change in vehicle velocity, and integrated again to compute vehicle displacement. The peak vehicle longitudinal acceleration (after filtering at SAE class 60 [6]), was 28 g and the maximum longitudinal change in vehicle velocity was 63 km/h (39.1 mph), with the velocity crossing zero at 118 msec past time zero (impact.) The averaged rear rocker longitudinal acceleration and velocity is shown in Figures 43 and 44, and plots 95 and 96, (Appendix H.)

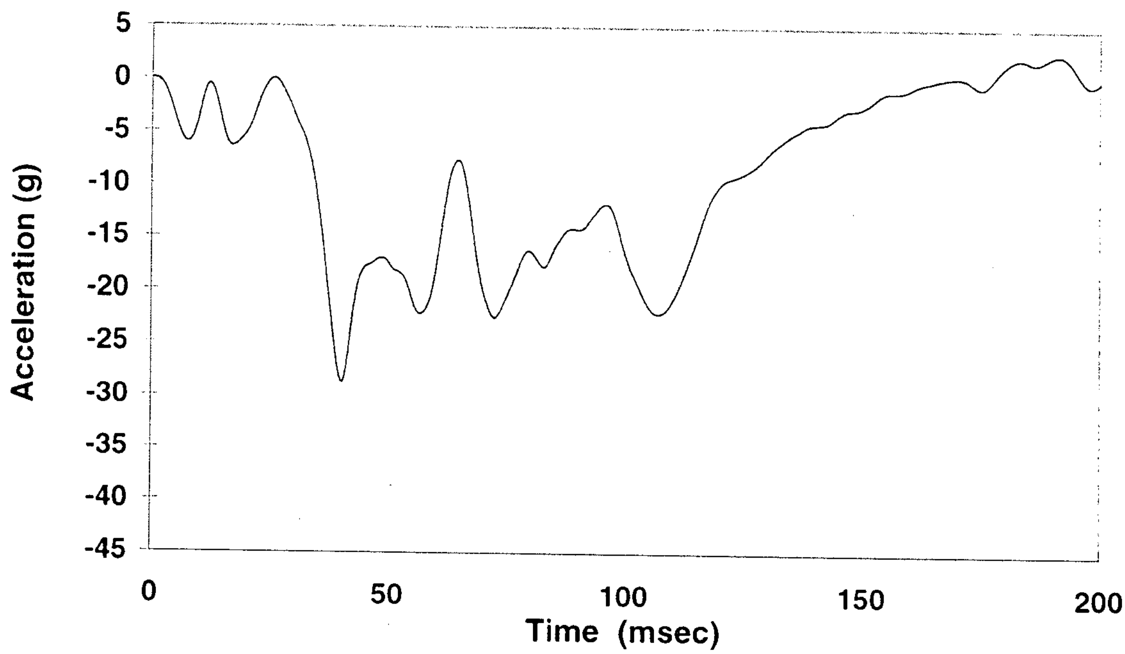


Figure 43

Averaged (Left & Right) Rear Rocker Panel Longitudinal Acceleration,
Test C11279, filtered at SAE class 60 [6]

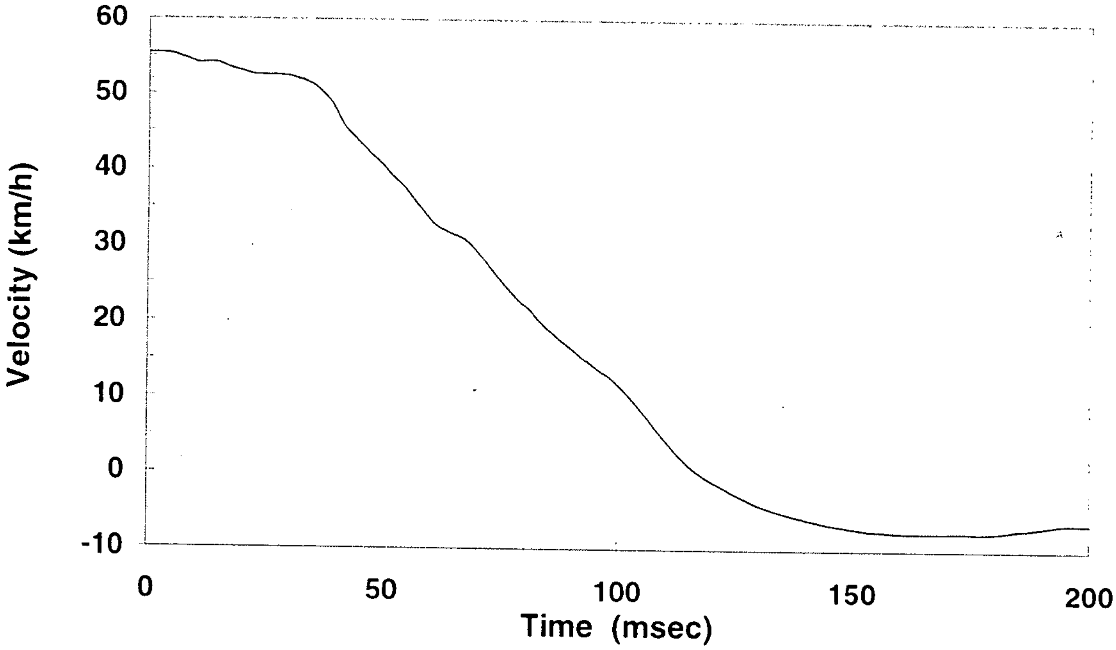


Figure 44

Averaged (Left & Right) Rear Rocker Panel Longitudinal Velocity

Test C11279

The displacement of the right toe pan, relative to the passenger compartment, was approximately 250 mm and is shown in Figure 45 and also plot 117 Appendix H.

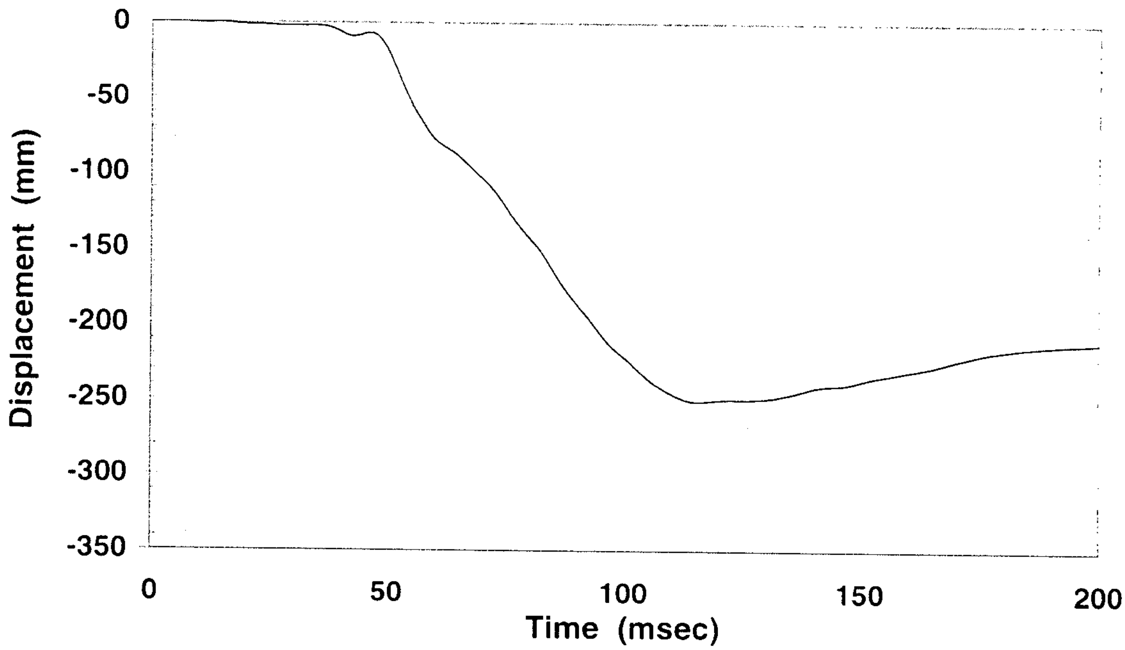


Figure 45

Right Toepan Displacement, Relative to Floorpan

Test C11279, filtered at SAE class 60 [6]

The peak acceleration was higher for this test than test C11108. However, this is a localized measurement and peak acceleration is not the best measurement to quantify passenger compartment deceleration. The vehicle's change in velocity, zero crossing time, and toe pan displacement were all very similar to test C11108. (63 km/h, 118 msec, 250 mm respectively for test C11279 and 62 km/h, 120 msec, 255 mm for test C11108.) This indicates that in this test configuration, the hood has only a small effect on the structural crashworthiness of the vehicle. In terms of post-collision fire research, however, the hood may play a more significant role in retaining fluid plumes and containing thermal energy in the engine compartment.

The engine motion measurement using an auxiliary magnetic pickup transducer indicated that the flywheel rotation began to decrease at about 40 msec and stopped by 90 msec. (See plot 122, Appendix H and Figure 46.) This measurement technique was more reliable than using the vehicle's own engine speed transducer (plot 123, Appendix H) and will be used in future testing.

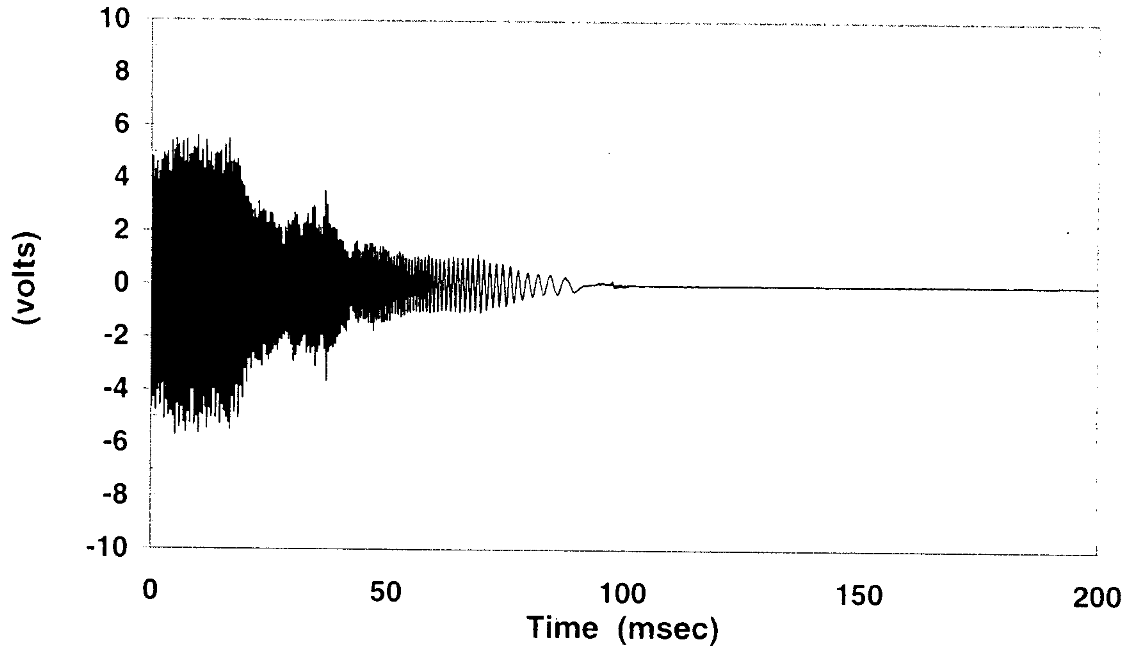


Figure 46

Engine Motion, Measured at Flywheel

Test C11279

The current measurements of the driver and passenger air bag circuits indicated that both air bags deployed at about 33 msec (Appendix H, plots 129 and 130.)

Figure 47 (and plot 131, Appendix H) shows the current measured at the auxiliary fuel pump. Note that Figures 47 and 48 display data through 1800 msec (1.8 seconds) after impact. The fuel pump drew 8 amps until about 60 msec, when the current dropped to zero. The ignition voltage also dropped from 13 volts to 6 volts at around 60 msec as shown in Figure 48, but later recovered back to 13 volts at about 1590 msec. The fuel pump remained off through 1590 msec when ignition voltage was restored. Similar to other frontal tests, this drop in system voltage is likely the reason the fuel pump shuts down relatively early during the impact.

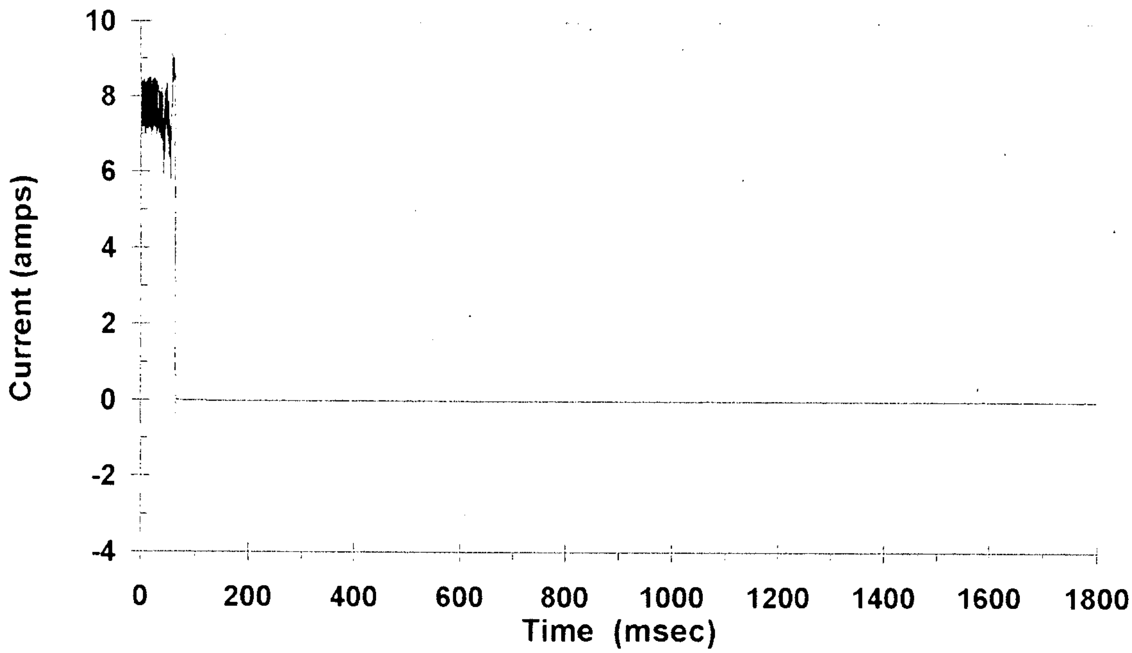


Figure 47

Fuel Pump Current

Test C11279

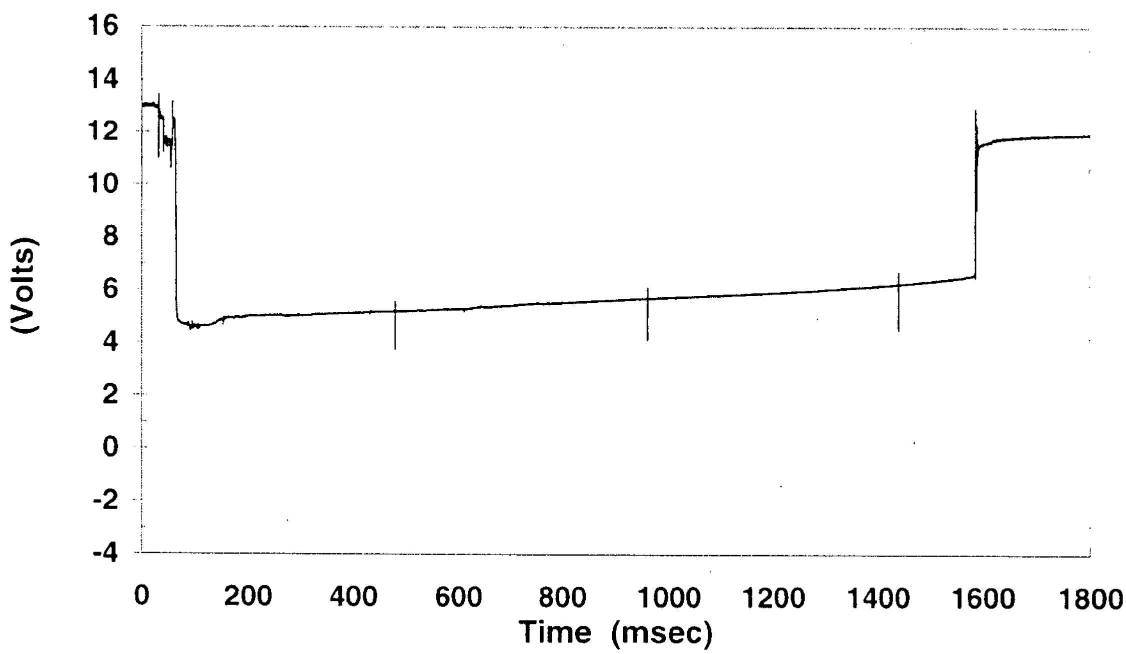


Figure 48

Ignition Voltage

Test C11279

5.2.2. Summary of Recorded ATD Measurements

The complete set of recorded and computed ATD measurements is included in Appendix H (pages i and ii, and plots 1 through 58).

A comparison of the left front occupant's (driver's) injury measurements to their respective Injury Assessment Reference Values (IARV) (Appendix A), indicates that all measurements were below their respective IARV except the lower tibia bending moment (My) on the right leg. This measurement exceeded its full scale over-range of 500 Nm established for this test. Test C11108 also had all driver measurements below the IARV except for the lower left tibia moment.

A similar comparison indicates right front (passenger) measurements above the IARVs for the lower left and lower right tibia moments, with all other measurements at or below IARV. The lower tibia bending moment (My) on the left leg had a peak measurement of 293 Nm (130% of 225 Nm), which resulted in a lower tibia index of 1.37 (137%). For the right leg, the lower tibia bending moment (My) had a peak measurement of 372 Nm (165% of 225 Nm), which resulted in a lower tibia index of 1.7 (170%). Test C11108 also indicated all passenger measurements below IARV except for the lower tibia moments on both legs.

5.2.3. Summary of Hydrocarbon Vapor Measurements

A complete set of the recorded measurements is included in Appendix H, plots 124 through 128, and also Appendix I, Figures I1 through I15.

The electrical cables to two of the five gas sensors were severed during the crash test. The signal from the sensor at the left upper engine (location #1) was lost at 120 msec. The signal from the sensor at the right upper engine (location #2) was lost at 80 msec. Sensors at the left lower engine (#3) and the right lower engine (#4) detected high concentrations of a hydrocarbon vapor in the lower engine compartment. The concentration of hydrocarbon vapor in the left lower engine compartment (#3) exceeded 5%, the upper limit of calibration of these sensors, from 0 to 10 seconds after impact (Figure 49). The concentration of hydrocarbon vapor in the right lower engine compartment (#4) exceeded 5% from 10 to 20 seconds after impact (Figure 50). The concentration measured by Sensor 5 did not exceed 0.3% from impact to 5 minutes after impact.

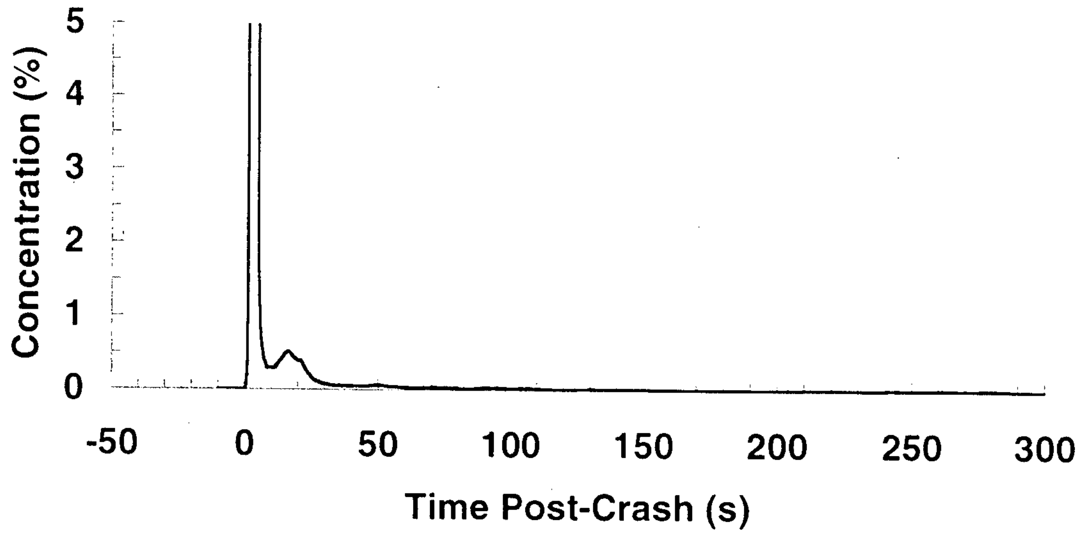


Figure 49

Concentration of Hydrocarbon Gas Measured at Left Lower Engine (Location #3)

Test C11279

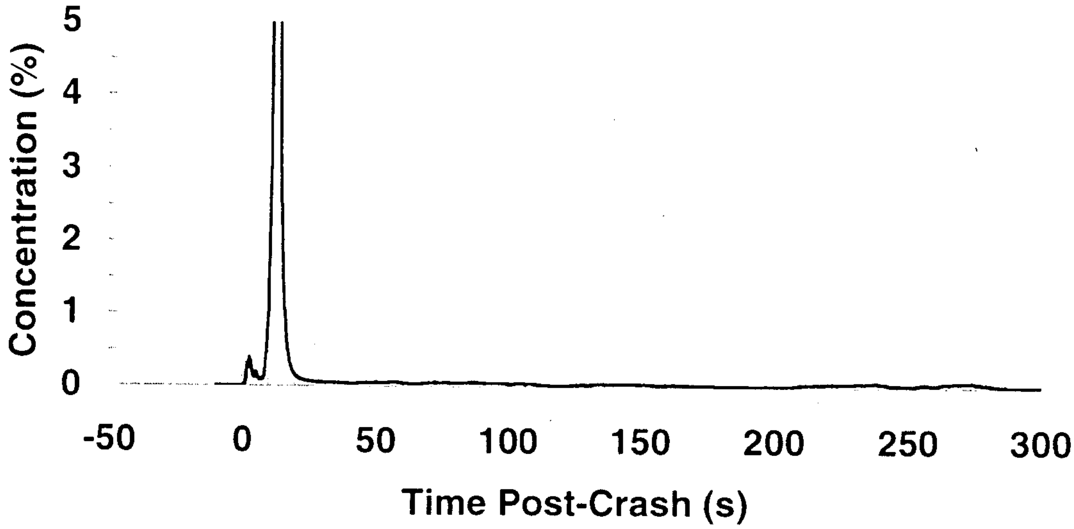


Figure 50

Concentration of Hydrocarbon Gas Measured at Right Lower Engine (Location #4)

Test C11279

Analysis of the gas sampled from the engine compartment indicated that the sensors were responding to gasoline vapor. For example, the mass chromatogram of the background from the left lower engine compartment contained only deuterated hydrocarbons (Figure 51), which were internal standards added to each sorbent tube immediately before analysis. The backgrounds from the other locations contained only the deuterated standards (Appendix I, Figures II1 through II5). In addition to the deuterated standards added to the sorbent tubes, the mass chromatogram of the test sample acquired from the left lower engine compartment during the crash test contained a mixture of aliphatic and aromatic hydrocarbons in the range of C5 to C10 (Figure 52). Gas sampled from the other locations during the crash test contained the same hydrocarbons (Appendix I, Figures II1 through II5). The abundance of the hydrocarbons in the mass chromatogram was proportional to the hydrocarbon vapor concentration measured by the gas sensor at that location.

Post-test inspection of the vehicle revealed that the fuel line had been severed near the shock tower in the right side of the engine compartment. The fuel line pressure dropped to zero 70 msec after impact (plot 141). However, the amount of gasoline that leaked from the severed fuel line was limited because the fuel pump lost electrical power 60 msec after impact. Without a supply from the fuel tank, only gasoline in the fuel line and fuel rail could have leaked into the engine compartment. The gas sensor data suggest that this relatively small volume of gasoline vaporized rapidly, creating a flammable mixture in the engine compartment for about 20 seconds after impact. No liquid gasoline was seen dripping from the vehicle after impact.

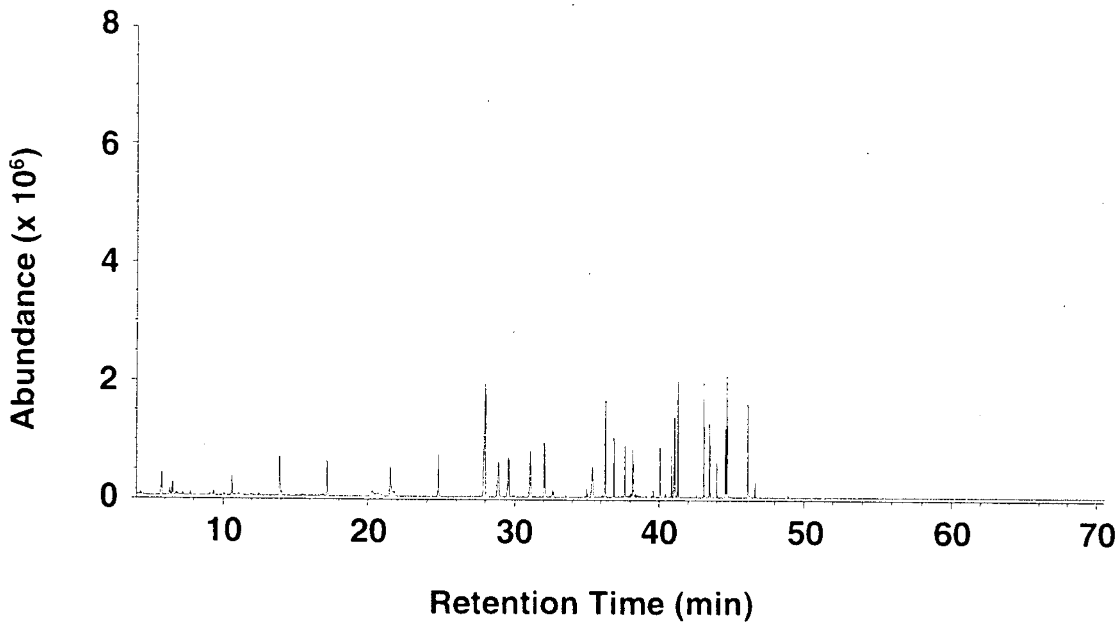


Figure 51.

Background Chromatogram from GC/MS Analysis from Left Lower Engine (Location #3)

Test C11279

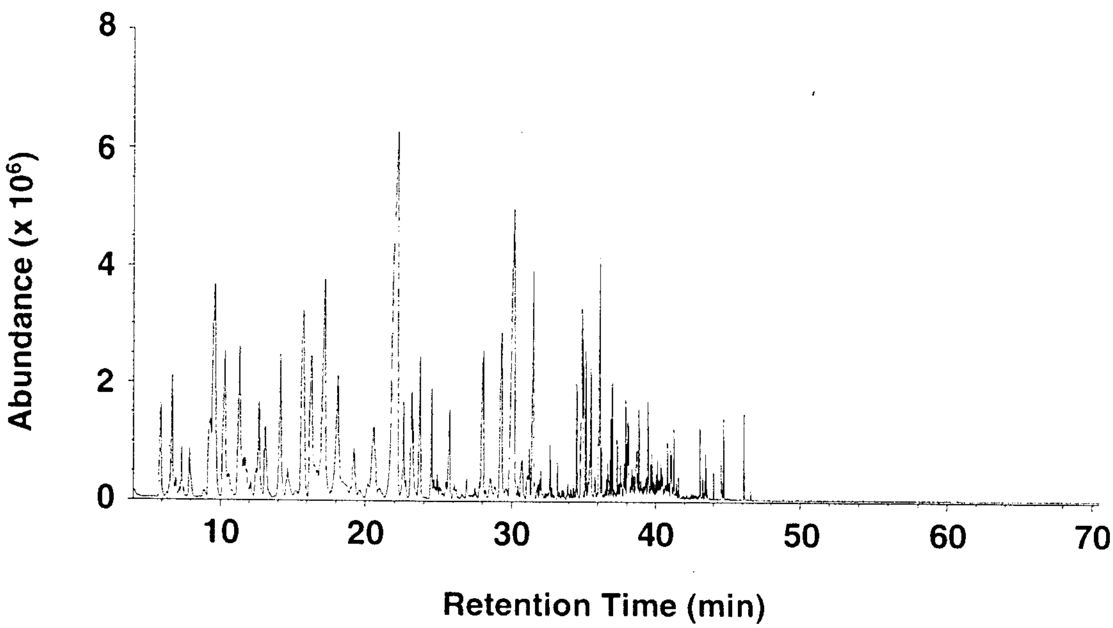


Figure 52

Test Chromatogram from GC/MS Analysis from Left Lower Engine (Location #3)

Test C11279

5.2.4. Summary of Fluid Pressure Measurements

The dynamic pressure measurements of the engine compartment fluids are shown in Appendix H, plots 138 through 142.

As with tests C11167 and C11226, the pressure in the left front brake line (plot 138) dropped gradually, although no leak was identified in the pressurized brake system during the post-test inspection. The loss of pressure could have been due to deformation of the brake line or release of the brake pedal, during the impact, as with the previous tests. The post-test inspection revealed that the non-pressurized brake fluid reservoir was still intact and full.

The power steering fluid pressure measurement (plot 139) indicates a loss of pressure during the test. The post-test inspection revealed that the pump had been destroyed during the impact and power steering fluid was released. It is likely that this fluid did not contact any hot surfaces causing vaporization, because no heavy oils were identified in the GC/MS vapor analysis.

The engine coolant pressure measurement (plot 140) was inconclusive due to instrumentation malfunctions, however as with all of the frontal impact tests the radiator was severely damaged and coolant was lost.

The pressure in the auxiliary fuel line dropped to zero around 70 msec (plot 141). The post-test inspection indicated that the fuel line was severed in the engine compartment, on the passenger (right) side, near the shock tower. The separation was near where the rubber fuel line connects to a metal swage fitting. The fuel pump was likely off by the time the line was severed as indicated by the fuel pump current (Figure 47).

The engine oil pressure (plot 142) declined gradually, but this is not indicative of a leak because the pressure never dropped to zero. The post-test inspection did not reveal any leaks in the engine oil system.

The transmission fluid pressure (plot 143) decreased at about 40 msec after the impact. The post-test inspection revealed the transmission housing was cracked which was the likely cause of the loss of transmission fluid pressure.

5.2.5. Summary of Additional Electrical Measurements

The results of the additional electrical measurements are shown in Appendix H (plots 118 through 121, 132 through 137).

The ignition voltage (Figure 48) dropped from 13 volts to about 5 volts at about 65 msec. The ignition voltage returned to 13 volts at around 1590 msec (1.6 seconds).

The main battery current is shown in Figure 53 and plot 137. This measurement represents all current flowing to or from the battery except for the starter circuit, which connects to the battery independently. The main battery cable connects the battery to the PDC, which, in turn, is connected to the alternator through the fusible link, so current from the battery to the alternator cable would also be measured at the main battery cable.

Current flow in the main battery cable (Figure 53) exceeded the full scale range of 50 amps intermittently from 30 msec through 65 msec, and continuously from about 65 msec through 1590 msec. It is possible that a short to chassis, causing significant current flow, caused the battery voltage to be drawn down though 1590 msec. The positive current flow indicated from the time of impact through about 30 msec represents normal current flow when the engine is operating (it is likely the alternator charging the battery). The negative current flow, however, indicates current flowing away from the stored source (battery) to the chassis short.

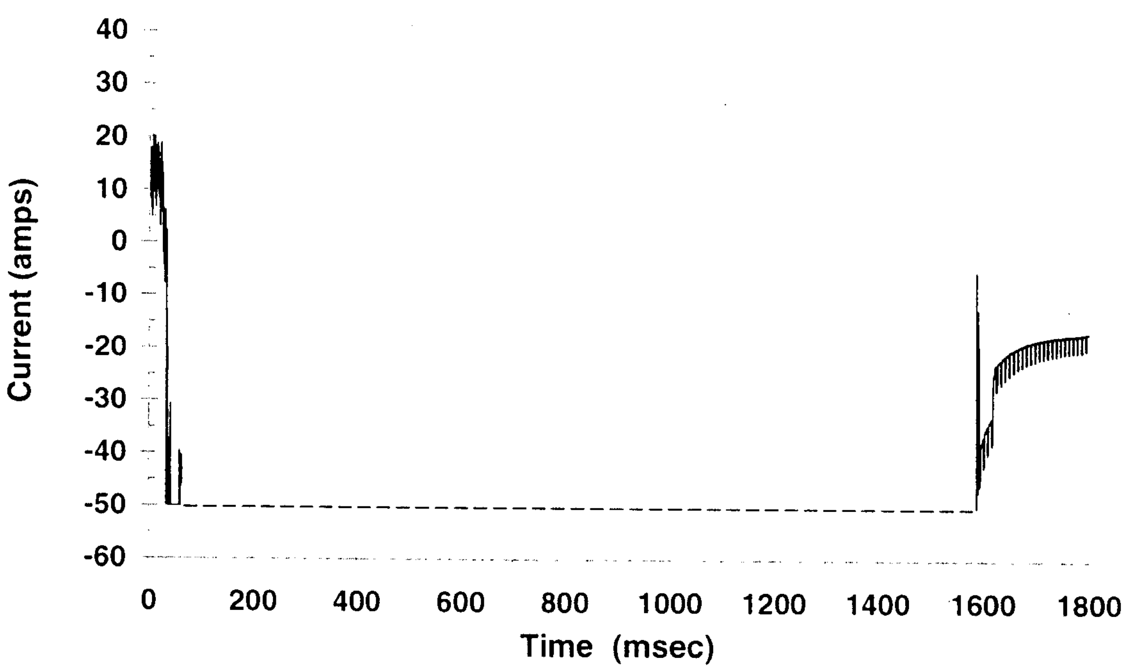


Figure 53

Battery Current

Test C11279

(Note: full scale range exceeded, dashed line represents current exceeding 50 amps in amplitude)

The fusible link (alternator) current measurement is shown in plot 135. This plot only has a duration of 240 msec and data exceeding the full scale range is not plotted. However, a review of the raw data (not included in the Appendix) indicated that again, current flow exceeded the full-scale range from about 65 msec to 1590 msec. This current flow was in the opposite direction from the current measured from 0 to 35 msec (normal engine operation). Consistent with the main battery current (Figure 53) a short in the alternator cable would cause current flow from the battery to the short, in the opposite direction of normal operation.

In addition, the post-test inspection revealed that the fusible link connecting the alternator to the Power Distribution Center was electrically open with the insulation partially melted. It is likely that a short in the alternator cable caused the fusible link to open, the drain on the battery, the high current flow through the main battery cable, and the high current flow through the fusible link (alternator cable). The fusible link activated (opened) providing overload protection for the remainder of the circuit.

As was observed in the other frontal crash tests, variation of the voltage measured at the starter motor (plot 119) was similar to variation of the voltage measured on the ignition circuit.

The right front headlight voltage (plot 120) also followed closely the ignition voltage until about 190 msec when the measurement dropped to zero. It also recovered to about 13 volts at around 1590 msec. This drop to zero is likely due to an intermittent open in either the instrumentation wiring (not normally on the vehicle) or the production circuit itself being intermittently open during the impact.

The headlight low beam voltage remained at or near zero for the duration of the recorded event, as expected (plot 121).

The low tone horn current remained at or near zero for the duration of the recorded event, as expected (plot 132).

The air conditioning clutch current measurement (plot 133) was inconclusive.

The current through cooling fans (plot 134) indicated near zero current flow except for 132 to 152 msec, when it exceeded the full scale range of the transducer. No apparent shorts in this circuit were identified during the post-test inspection. It is possible that this current flow was the result of an un-identified intermittent short in the fan or damage to the instrumentation during the impact.

The current through the starter cable (plot 136) indicated current flow from about 65 msec to 1590 msec, the same time period as the previously described alternator cable current flow. However, current flow was much less than in the alternator cable, as this measurement did not exceed the full scale range of the measurement.

No apparent shorts in the starter cable were identified. However, it is possible that this measurement was caused by interference from the much higher current flow in the main battery cable. The main battery current transducer, main battery cable, starter cable current transducer, and starter cable were bundled in close proximity near the battery for the test.

5.2.6. Summary of Numerical Film Analysis

The numerical film analysis plots are included in Appendix J (plots 1 through 8).

The numerical analysis of the overhead film indicated that the pole penetration into the engine compartment was approximately 1192 mm at 130 msec after time zero, as shown in Figure 54 and plot 7. This compares to a maximum pole penetration of 1157 mm for test #C11108 (Figure 10 and Appendix C, plot 8).

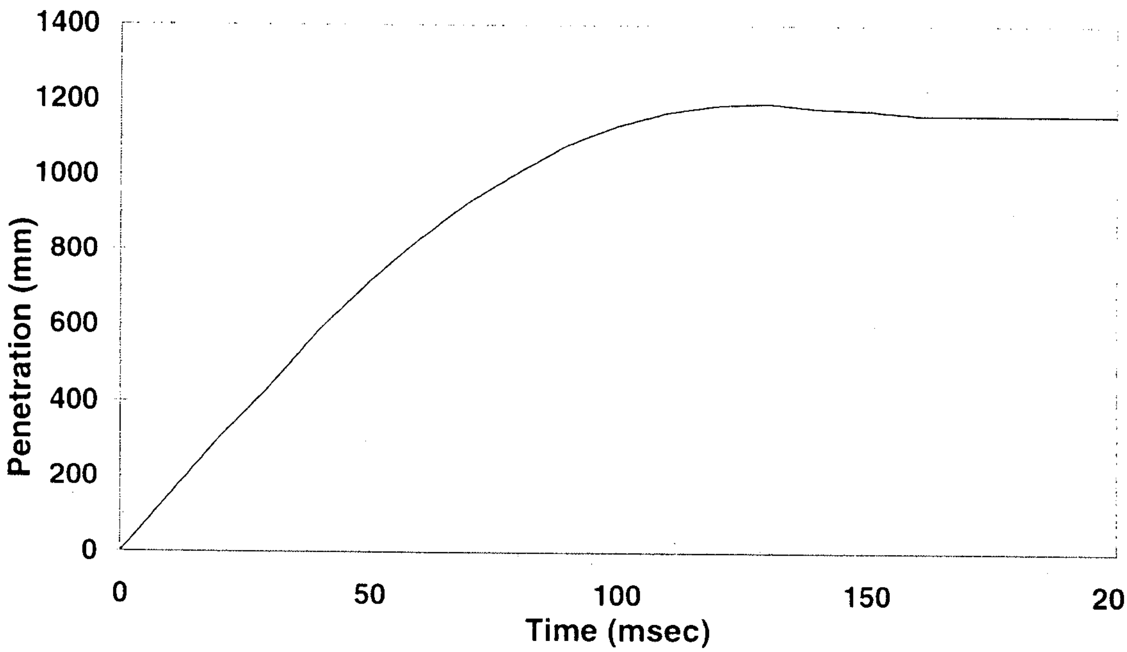


Figure 54.

Pole Penetration

Test C11279, Numerically Measured from High Speed Film

5.2.7. Results of Post-test Static Rollover

No static rollover was conducted on this vehicle following the crash test for reasons described in the results of the first offset frontal pole impact on the passenger van.

5.2.8. Results of the Evaluation of the Crashworthiness of Potential Fire Detection Technologies

The results of the electrical measurements of the experimental fire detectors are shown in Appendix H (plots 144 through 146).

The thermal wire fire detector attached to the hood indicated a contact closure at 60 msec lasting about 50 msec as shown in Appendix H, plot 144. As with previous tests, this closure was due to physical pinching during the impact and not due to overheating of the wire.

The pneumatic fire detector did not indicate any contact closures during the test. For this test configuration and mounting location, the pneumatic wire device demonstrated more crashworthiness than the thermal wire device.

5.2.9. Summary of Post-test Vehicle Inspection

As with the previous tests, the vehicle was disassembled and inspected to identify air passages from the engine compartment into the passenger compartment, the locations of any fluid leaks, the locations of any electrical shorts identified during the crash test, and any contact between combustible materials and hot surfaces.

Similar to test C11108, two air passages into the passenger compartment resulted in areas significantly larger than the rest, those two were:

- separation of horizontal lap weld seam near a/c evaporator feed-through (approximately 600 mm long x 40 mm wide at its widest point)
- separation of vertical weld between passenger hinge pillar and forward bulkhead (approximately 400 mm long x 100 mm wide at its widest point)

The remaining smaller openings identified included:

- cracked steering column boot
- separation of heater core line seal and bulkhead
- smaller hole in windshield (less than 20 mm), near the passenger A-pillar
- penetration of floorpan by engine cradle on the passenger side

The overall damage to the forward bulkhead was similar to the first offset pole impact (C11108). The separation of the horizontal lap weld seam and the separation of the vertical weld at the hinge pillar were nearly identical in shape, however the horizontal opening was longer for test C11279. Consistent with the velocity measurements of the passenger compartment, these structural observations indicated the hood did not have a major effect on the vehicle crush characteristics.

The following fluid leaks were identified during the post-test inspection:

- transmission fluid: fracture of transmission housing
- engine coolant: crushed radiator
- power steering fluid: crushed pump housing
- washer solvent: crushed reservoir
- battery electrolyte: loss of electrolyte from cracked battery housing
- gasoline: fuel line severed near passenger side shock tower

As previously reported, the fusible link in the alternator cable was electrically open with signs of melted insulation on the wire. These are indications that the fusible link opened during a period of high current flow providing overload protection for the remainder of the circuit, which is what fusible links are typically used for.

No contact between normally hot surfaces and combustible materials was identified during the post-test vehicle inspection.

5.3. Conclusions

1. There were no post-collision fires during or after this crash test.

2. The electric fuel pump shut down at about 60 msec past time zero. This was due to the drop of overall vehicle system voltage to 5 volts from 60 msec through 1590 msec. The fuel pump did not recover and turn on again at 1590 msec when the electrical system recovered to 13 volts.

3. No liquid gasoline or Stoddard spilled off of the vehicle. However, the vapor sensors indicated concentrations of hydrocarbon vapor exceeding 5% at locations #3 and #4 (locations #1 and #2 were lost during the test.) There was about a 10 second time lag between the maximum concentration measurements at locations #3 and #4 indicating a single hydrocarbon vapor cloud moving past these two locations in the seconds after the impact. Gas chromatography / mass spectrometry analysis indicated that the source of the vapor cloud was gasoline. A severed fuel line near the passenger shock tower was identified during the post-test inspection. In addition, the fuel pressure measurement indicated a loss of pressure at about 70msec, which was likely the time of the fuel line separation. However, consistent with previous tests the fuel pump shut down early (in this case 60 msec) thus only a small amount of gasoline leaked from the severed fuel line.

4. Other engine compartment fluids which leaked included transmission fluid, engine coolant, washer solvent, battery electrolyte, and power steering fluid.

5. The deceleration of the passenger compartment as measured by the change in velocity time history was very similar to test C11108 indicating that the hood had only a small effect on the structural crush.

6. The condition of the forward bulkhead as quantified by the toe pan intrusion and openings identified in the bulkhead also was very similar to test C11108. This also indicates the hood had only a small effect on the crush of the vehicle.

7. The head, neck, chest, and femur ATD measurements were below their respective IARVs for both front occupants. The only measurements above IARV were the lower tibia bending moments on the right leg of the driver and on both legs for the passenger ATD.

8. The cause of the electrical system voltage drop from 60 msec to 1590 msec was likely a short in the alternator cable. Higher than normal current flow (exceeding full scale range of the transducers used for this test) was measured on the alternator cable and main battery cable from 60 msec through 1590 msec. In addition, the fusible link on the alternator cable was open and had melted insulation following the test. This indicates the fusible link fused and provided overload protection for the remainder of the circuit.

9. No other evidence of electrical shorts, other than of the alternator cable, was identified.

10. The thermal wire fire detector device, which was attached to the underside of the hood, was pinched and closed during the impact and would have precluded proper operation following the impact.

11. The pneumatic fire detection device did not inadvertently close during the test. For this test configuration the pneumatic device appears to be more crashworthy than the thermal wire device.

Following are conclusions relating to test methodology useful for subsequent crash tests:

12. The measurement of engine flywheel motion using an auxiliary magnetic pickup transducer was successful in identifying when the engine stopped (about 90 msec). This measurement technique was more reliable than using the vehicle's production engine speed sending unit, which is susceptible to the loss of vehicle electrical power.

13. Although the structural performance of the vehicle has been demonstrated to be independent of the presence of the hood, a hood will be included on future frontal tests. This is so the fluid or vapor plumes are retained appropriately and also to provide the correct thermal environment.

6. Conclusions of the Passenger Van Crash Test Series

From the data collected on this series of crash tests, several conclusions can be made about how post-collision fires may start. It is important to note that the intent of these crash tests was not to determine if the vehicles met a crash test performance standard. Instead, the intent was to study how post-collision fires might start under a range of crash conditions.

Of the four tests, one resulted in a post-impact fire. There was no indication of fire on the other three tests. The fire occurred following the oblique moving deformable barrier frontal impact and was caused by electrical events during the crash. The fire was unrelated to gasoline, any other fluid (except battery electrolyte), or any normally hot operating surface. The fuel source for the fire was solid plastics near the battery such as polyethylene, polypropylene, and polycarbonate. The ignition was caused by a combination of crash related electrical events: the penetration of the battery by a chassis-mounted self-tapping screw, the separation of the negative battery terminal connections, and the short to chassis of the starter cable. Although the repeatability of these specific occurrences is unknown, as are the effects of the modifications made to the production vehicle, there are general conclusions that can be drawn. As an example, 1) electrical fires unrelated to fluids such as gasoline are possible and may propagate by burning solid combustibles in the engine compartment, 2) objects grounded to chassis which penetrate the battery housing can be a source of heat sufficient to ignite combustible materials, and 3) shorts between heavy gage non-fused cable (such as starter cables) and chassis ground can also contribute by increasing the overall current flow.

Other underhood electrical occurrences were observed on these frontal impacts including a severed positive battery cable resulting in arcing during the crash, a shorted alternator cable, and an internally shorted battery. Generally, the recorded electrical measurements (especially the current measurements) were difficult to analyze because of limitations on current transducers, instrumentation wires cut or damaged during the crash, and the overall unpredictable and sporadic behavior of electrical systems during the crashes.

System voltage was monitored in three of the four tests. In none of these cases, was system voltage (12 to 14 volts) maintained throughout the event. In two of the three tests, partial and/or temporary drops in voltage were observed. In only one test did the voltage cleanly drop to zero. In all cases, the fuel pump shut down at the first indication of ignition voltage drop. In all cases, the fuel pump was shut down by 65 msec after impact. In those cases where system voltage later recovered, the fuel pump remained off. In none of the tests did the fuel pump require to be "timed out", that is shut down after a predetermined time following engine stoppage (one or two seconds is sometimes used in engine control programming.) These small number of tests indicate that how an engine control module controls a fuel pump when it is subjected to chaotic and unpredictable voltage inputs (sometimes lasting for seconds after impact), may be as important as the ability to shut the fuel pump off at a pre set time after engine stoppage, or after a crash is detected through inertia sensors.

All four of these tests would have passed the gasoline leak criteria specified in FMVSS301 [7]. No liquid gasoline or Stoddard solvent spilled off of the vehicle in any of these tests. However, vapor measurements indicated the presence of gasoline vapors in the engine compartment in 2 of the 3 tests in which they were used. In one of the tests, the source of the gasoline was broken or un-sealed fuel injectors. In the other it was a severed fuel line. For one test, hydrocarbon vapor concentrations were measured, but samples were not taken to identify the source. For this test, unsealed fuel injectors were also identified during the post-test inspections. Therefore, it is likely that gasoline vapors were present in the engine compartment in 3 of the 4 tests. Because the fuel pumps shut down early in all cases, only residual gasoline in the lines was lost, that is, the pump did not supply the leaks with gasoline. Only a limited amount of gasoline was likely released, with no indication of pooling or spillage off of the vehicle.

With the exception of the offset rigid barrier frontal impact, the three remaining tests had ATD measurements below their IARV for all head, neck and chest measurements. Tests that were so severe that occupant fatality would be likely from trauma (high head, chest, or neck measurements) were not desired. All tests had at least one lower leg measurement above IARV, however, which indicates that tests of this severity may represent cases where occupant egress could be slowed due to impact injury. The severity of these three tests is appropriate for this research.

The offset rigid frontal barrier generally had higher ATD measurements and was the least useful in identifying post-collision fire potential. This is because this test resulted in the fewest openings identified into the passenger compartment and also had the least amount of electrical and fluid activity. For these reasons, this test configuration was dropped for subsequent vehicle types.

The air bags deployed in all tests, providing supplemental restraint to the belted occupants.

The release of engine compartment fluids into the engine compartment was monitored for each test. Due to the severity of the tests, fluid release was anticipated. Coolant, washer fluid, transmission fluid, and battery electrolyte were released in all four tests. Power steering fluid and limited amounts of gasoline were released in three of the four tests, brake fluid was released in two tests, and engine oil in one.

Inspections were performed on all four tests to identify contact between combustible solids and normally hot operating surfaces such as exhaust manifolds or catalytic converters. There was only one occurrence noted, contact between an exhaust manifold and cowl insulation on the first pole impact.

Inspections were also done to identify air passages from the engine compartment into the passenger compartment. The openings identified in the four crash tests are test specific, however, in general the two pole impacts had the most openings and the offset rigid barrier frontal impact had the least. For the oblique moving deformable barrier frontal impact vehicle, the openings were re-instrumented with thermal measuring instruments to identify if any contributed to the fire propagation into the passenger compartment during a future fire propagation test. Those tests will be reported separately.

An experimental thermal wire fire detector was included in three of the four tests and was mounted in a different engine compartment location for each test. Electrically monitoring of this device indicated it closed in all three tests. All of the closures were temporary, none lasting more than 50 msec, and all were the result of pinching or crushing during the impact and none were the result of overheating. Crash-caused activations are undesirable. Active fire suppression systems must be capable of surviving severe crash impacts and retain their ability to detect and suppress post-impact fires. Alternate mounting locations for the thermal wire device will be evaluated in subsequent crash tests of this project.

An experimental pneumatic fire detector device was included in two of the four crash tests. For one test it was mounted forward of the wiper tray and for the other it was mounted on the underside of the hood. The device did not indicate a false activation in either test, demonstrating better crashworthiness than the thermal wire device, at least in this limited sample of two crash tests.

Acknowledgements

The authors would like to thank Robert Wooley, Brian Frantz, Howard Bender, Mike Rogers and Yan Yun Chen for their contributions to this project. In addition, we commend Willie Tate and the entire staff at the General Motors Vehicle Safety and Crashworthiness Laboratory for their dedicated work related to this project.

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Appendix A:

Anthropomorphic Test Device (ATD) Injury Assessment Reference Values (IARV)

The Injury Assessment Reference Values (IARV) used for the mid-sized male Hybrid III ATD are recreated here from the Advisory Group for Aerospace Research & Development, Report 330, "Anthropomorphic Dummies for Crash and Escape System Testing" [5].

Body Region Injury Assessment Criteria	Injury Assessment Reference Value for the mid sized male Hybrid III
Head HIC; $(t_2 - t_1) \leq 15$ msec*	1000
Head/Neck Interface Upper neck longitudinal shear force, +Fx and −Fx Upper neck axial force, compression, -Fz Upper neck axial force, tension, +Fz Upper neck longitudinal moment, flexion, +My Upper neck longitudinal moment, extension, -My	Figure A1 Figure A2 Figure A3 190 Nm 57 Nm
Chest Resultant spinal acceleration Sternal deflection due to: Shoulder belt Air bag (no belt) Viscous Criterion (V*C)	60 g 50 mm 65 mm 1 m/s
Femur Axial compression	Figure A4
Knee Tibia-to-femur displacement Knee clevis loads (med./lat. Compression)	15 mm 4000 N
Tibia Axial load, compression, Fz Tibia index, TI = M/Mc + Fz/Fc Where, M = resultant moment, (of Mx & My), for upper index M = anterior/posterior moment, My, for lower index Mc = critical bending moment Fc = critical compersive force	8000 N 1.0 225 Nm 225 Nm 225 Nm 35,900 N

*: The Head Injury Criteria (HIC) is defined as: HIC = $(Aavg)^{2.5} (t_2 - t_1)$, where Aavg is the average resultant acceleration of the center of mass of the head (expressed in G) for the time interval $t_2 - t_1$ (expressed in seconds).

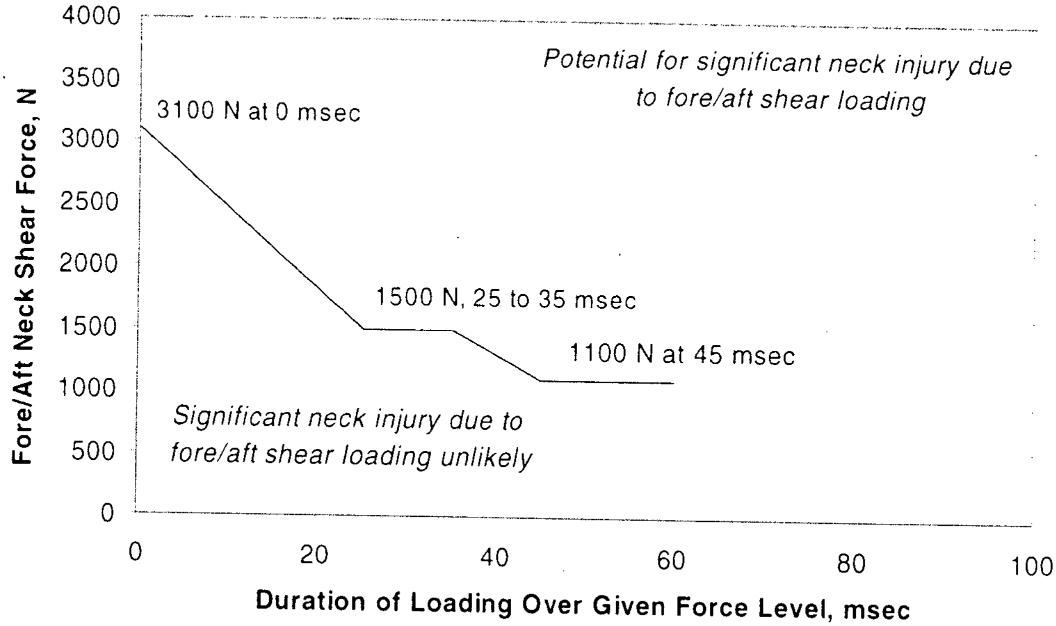


Figure A1
Injury Assessment Curves for Fore-and-Aft Sheer Forces Measured with Hybrid III Mid-sized Adult Male ATD [5]

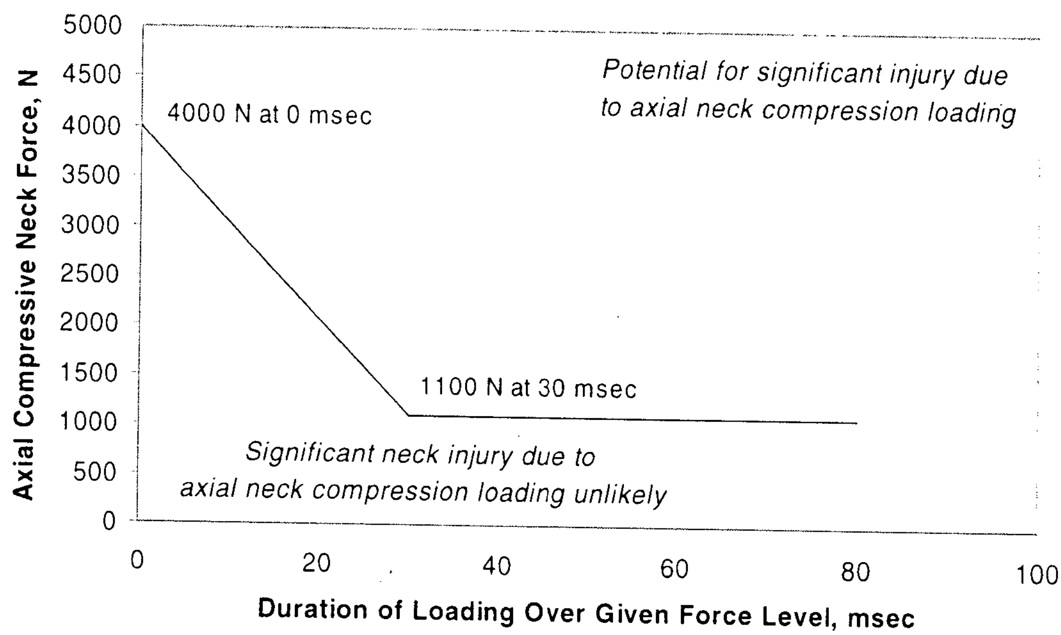


Figure A2
Injury Assessment Curves for Axial Neck Compression Measured with Hybrid III Mid-sized Adult Male ATD [5]

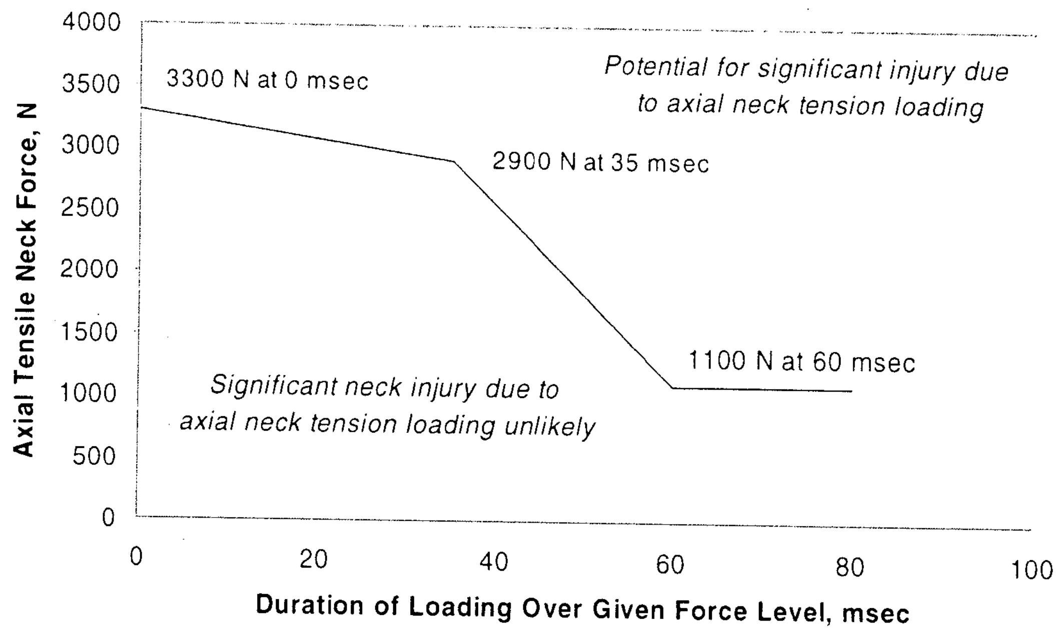


Figure A3
Injury Assessment Curves for Axial Neck Tension Measured with Hybrid III Mid-sized Adult Male ATD [5]

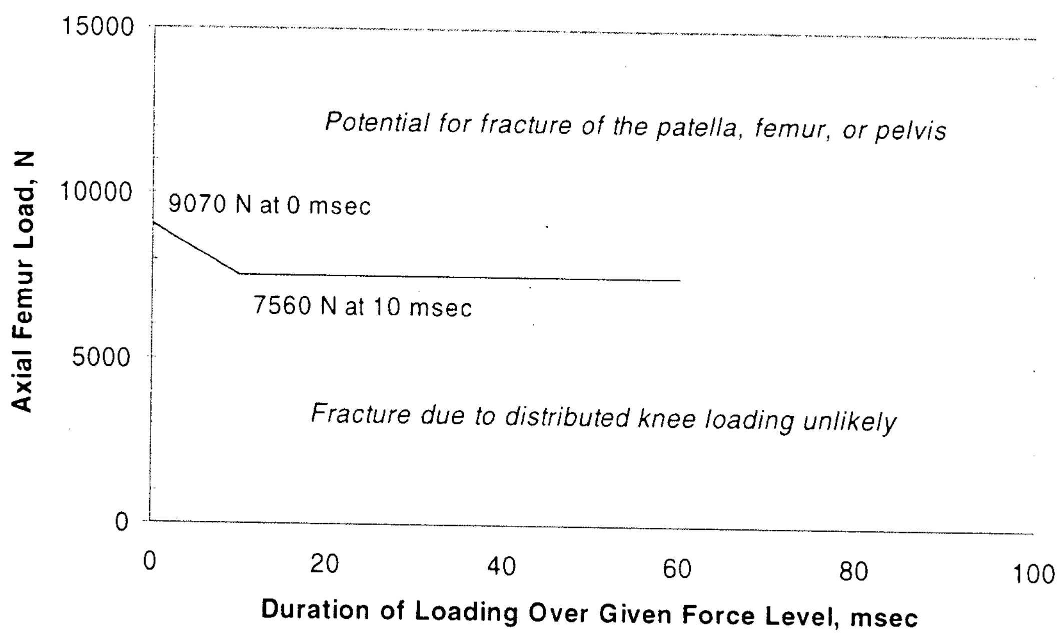


Figure A4
Injury Assessment Curves for Axial Compressive Femur Force Measured with Hybrid III Mid-sized Adult Male ATD [5]

Appendix B: C11108 data plots

LEFT FRONT
ANTHROPOMORPHIC TEST DEVICE SUMMARY DATA
MOVING VEHICLE TO FIXED POLE 55.2KM/H

C11108 FRONT IMPACT

R & D CTR 8T9307D VAN

ATD TYPE: GM50H

TEST DATE: 05/16/1996

MEASURED QUANTITY	100% OF IARV	150% OF IARV	IAV VALUE	IARV
HIC, LIMITED TO 15 MS			360	1000
HIC, LIMITED TO 36 MS			460	1000
NECK FLEXION			13NM	190NM
NECK EXTENSION			24NM	57NM
NECK TENSION			0.76	1.00
NECK COMPRESSION			0.01	1.00
NECK SHEAR FORWARD			0.18	1.00
NECK SHEAR REARWARD			0.05	1.00
CHEST ACCEL			41G	60G
! CHEST COMPRESSION W/O SH BELT			39.1MM	65.0MM !
! CHEST COMPRESSION W/ SH BELT			39.1MM	50.0MM !
CHEST VISCOUS CRITERIA			0.29M/SEC	1.00M/SEC
FEMUR COMP, LEFT			4095N	10000N
FEMUR COMP, RIGHT			6423N	10000N
FEMUR DURATION ASSESS, LEFT			0.45	1.00
FEMUR DURATION ASSESS, RIGHT			0.71	1.00
TIBIA/FEMUR DISP, LEFT			0.2MM	15.0MM
TIBIA/FEMUR DISP, RIGHT			0.6MM	15.0MM
KNEE CLEVIS, LEFT INSIDE			570N	4000N
KNEE CLEVIS, LEFT OUTSIDE			2174N	4000N
KNEE CLEVIS, RIGHT INSIDE			837N	4000N
KNEE CLEVIS, RIGHT OUTSIDE			1402N	4000N
TIBIA COMP, LEFT			2452N	8000N
TIBIA COMP, RIGHT			1529N	8000N
TIBIA MOM, UPPER, LEFT			124NM	225NM
TIBIA MOM, UPPER, RIGHT			89NM	225NM
TIBIA MOM, LOWER, LEFT		***	407NM	225NM
TIBIA MOM, LOWER, RIGHT			179NM	225NM
LEG INDEX, UPPER LEFT			0.59	1.00
LEG INDEX, UPPER RIGHT			0.43	1.00
LEG INDEX, LOWER LEFT		***	1.88	1.00
LEG INDEX, LOWER RIGHT			0.84	1.00

IAV - INJURY ASSESSMENT VALUE

IARV - INJURY ASSESSMENT REFERENCE VALUE

1 V2.04E

! RESTRAINT SYSTEM DEPENDENT. CHOOSE VALUE THAT APPLIES TO THIS TEST.

*** VALUE GREATER THAN 150% OF IAV

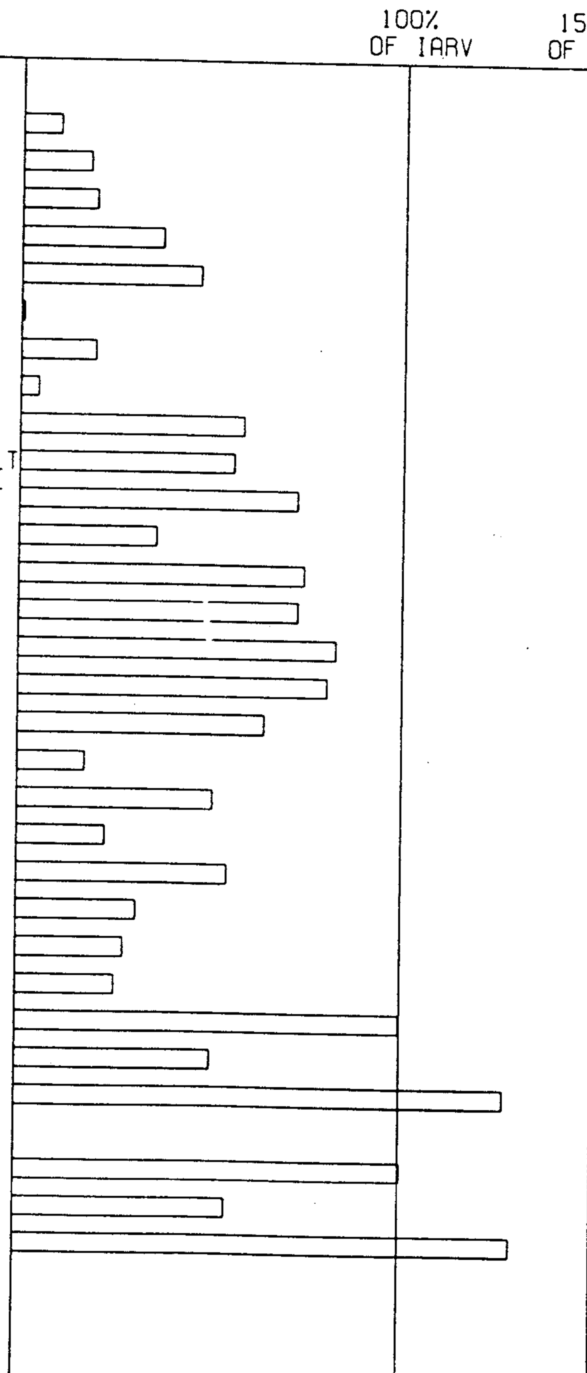
RIGHT FRONT
ANTHROPOMORPHIC TEST DEVICE SUMMARY DATA
MOVING VEHICLE TO FIXED POLE 55.2KM/H

C11108 FRONT IMPACT

R & D CTR 8T9307D VAN

ATD TYPE: GM50H

TEST DATE: 05/16/1996



MEASURED QUANTITY	IAV VALUE	IARV
HIC, LIMITED TO 15 MS	100	1000
HIC, LIMITED TO 36 MS	180	1000
NECK FLEXION	38NM	190NM
NECK EXTENSION	21NM	57NM
NECK TENSION	0.47	1.00
NECK COMPRESSION	0.01	1.00
NECK SHEAR FORWARD	0.20	1.00
NECK SHEAR REARWARD	0.05	1.00
CHEST ACCEL	35G	60G
! CHEST COMPRESSION W/O SH BELT	36.3MM	65.0MM !
! CHEST COMPRESSION W/ SH BELT	36.3MM	50.0MM !
CHEST VISCOUS CRITERIA	0.36M/SEC	1.00M/SEC
FEMUR COMP, LEFT	7453N	10000N
FEMUR COMP, RIGHT	7287N	10000N
FEMUR DURATION ASSESS, LEFT	0.83	1.00
FEMUR DURATION ASSESS, RIGHT	0.81	1.00
TIBIA/FEMUR DISP, LEFT	9.6 MM	15.0MM
TIBIA/FEMUR DISP, RIGHT	2.7MM	15.0MM
KNEE CLEVIS, LEFT INSIDE	2042N	4000N
KNEE CLEVIS, LEFT OUTSIDE	926N	4000N
KNEE CLEVIS, RIGHT INSIDE	2192N	4000N
KNEE CLEVIS, RIGHT OUTSIDE	1257N	4000N
TIBIA COMP, LEFT	2250N	8000N
TIBIA COMP, RIGHT	2075N	8000N
TIBIA MOM, UPPER, LEFT	224NM	225NM
TIBIA MOM, UPPER, RIGHT	114NM	225NM
TIBIA MOM, LOWER, LEFT	286NM	225NM
TIBIA MOM, LOWER, RIGHT	OVERLOADED	225NM
LEG INDEX, UPPER LEFT	1.00	1.00
LEG INDEX, UPPER RIGHT	0.55	1.00
LEG INDEX, LOWER LEFT	1.29	1.00
LEG INDEX, LOWER RIGHT	OVERLOADED	1.00

IAV - INJURY ASSESSMENT VALUE

IARV - INJURY ASSESSMENT REFERENCE VALUE

PROCESSED 05/20/1996 10:21 V2.04E

! RESTRAINT SYSTEM DEPENDENT. CHOOSE VALUE THAT APPLIES TO THIS TEST.

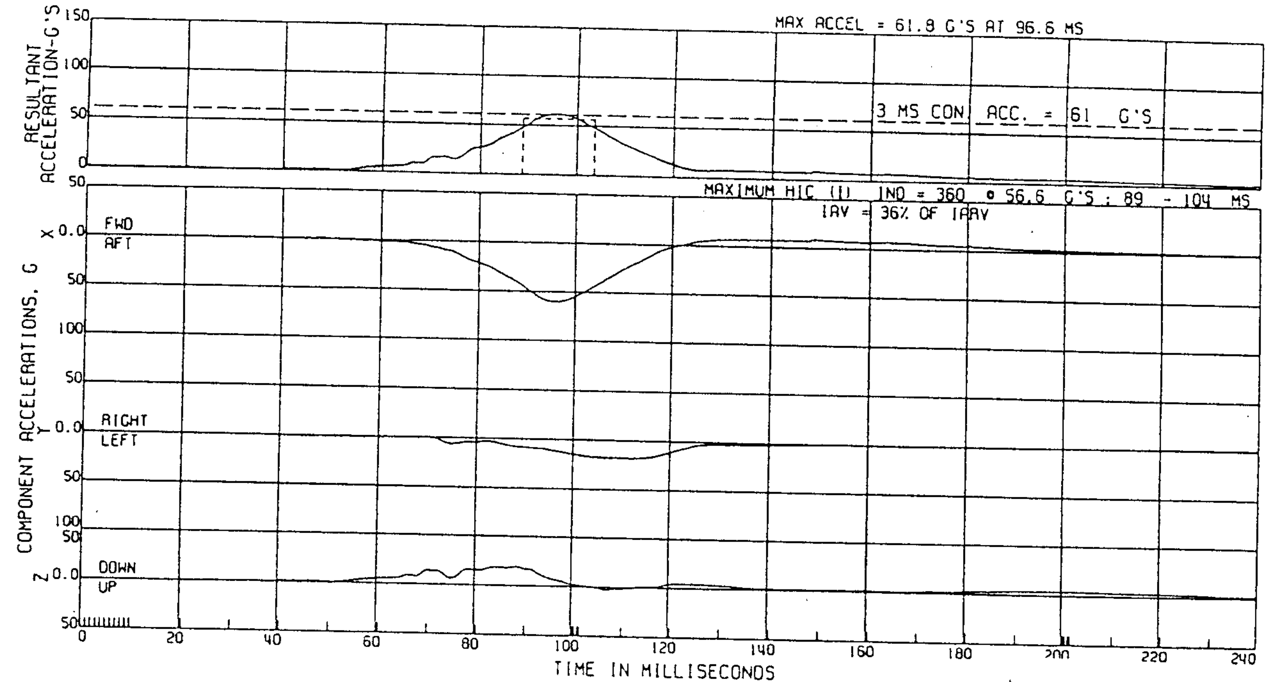
C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 1000

L. FRT HEAD ACCEL.

(HIC I LIMITED TO 15MS)

ATD TYPE: GM50H
TEST DATE:05/16/1996



Appendix B, plot # 1

1 PROCESSED 5/20/1996 10:20 V2.04E

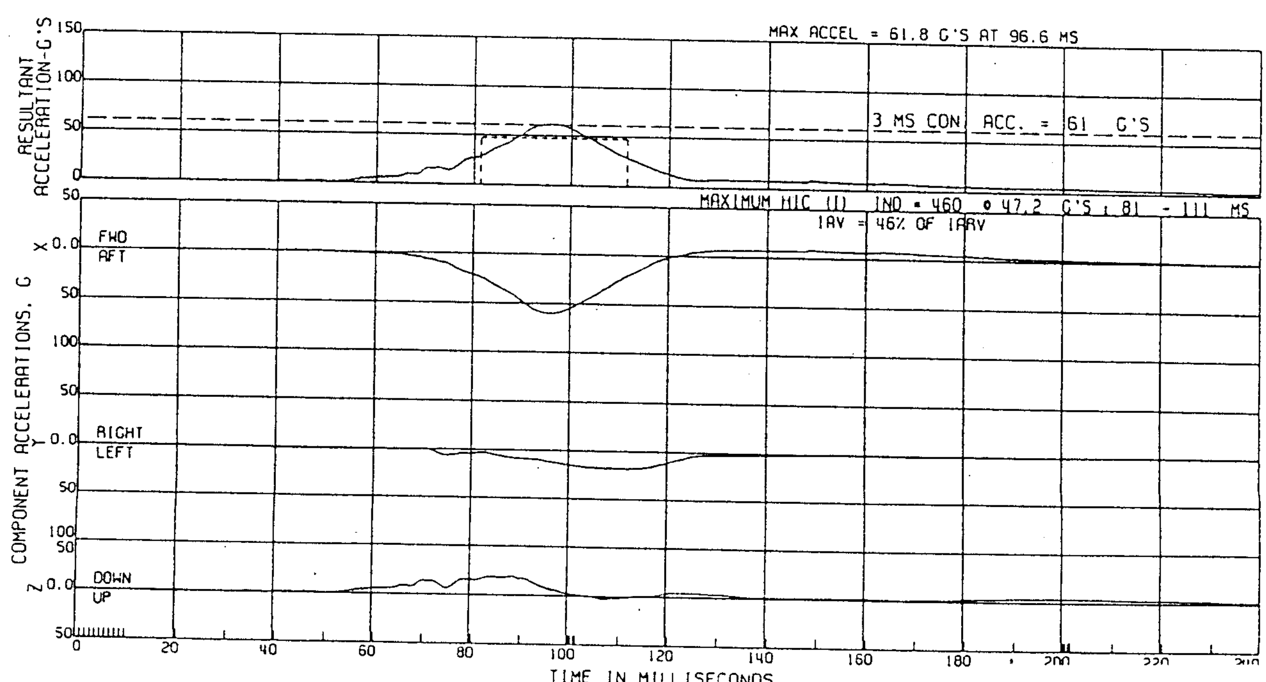
C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 1000

L. FRT HEAD ACCEL.

(HIC I LIMITED TO 36MS)

ATD TYPE: GM50H
TEST DATE:05/16/1996



Appendix B, plot # 2

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

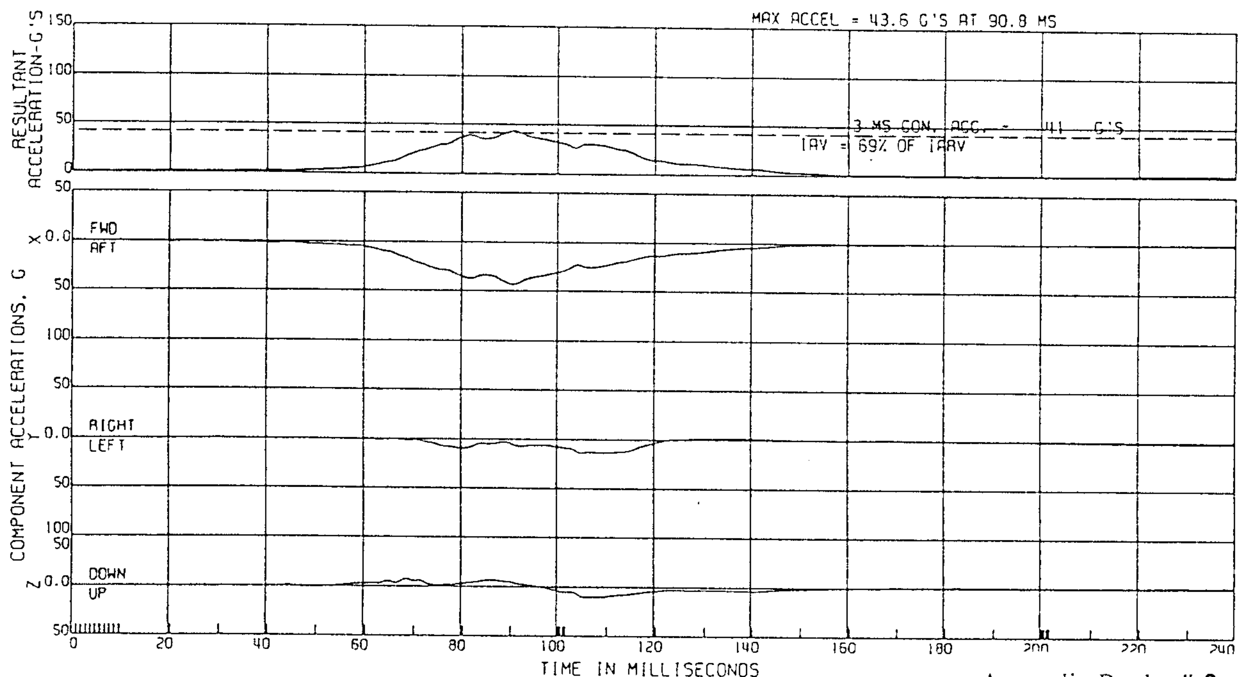
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

L. FRT CHEST ACCEL.

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 3

3 PROCESSED 5/20/1996 10:20 V2.04E

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

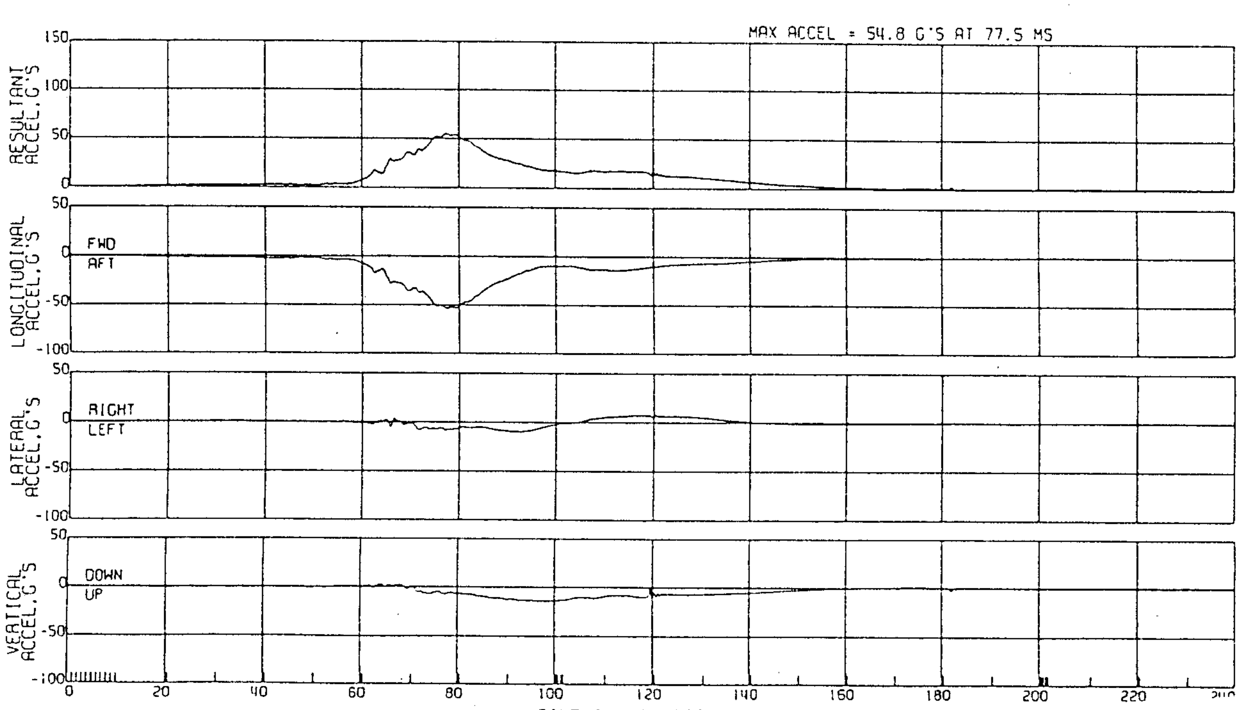
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

L. FRT PELVIC ACCEL.

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 4

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

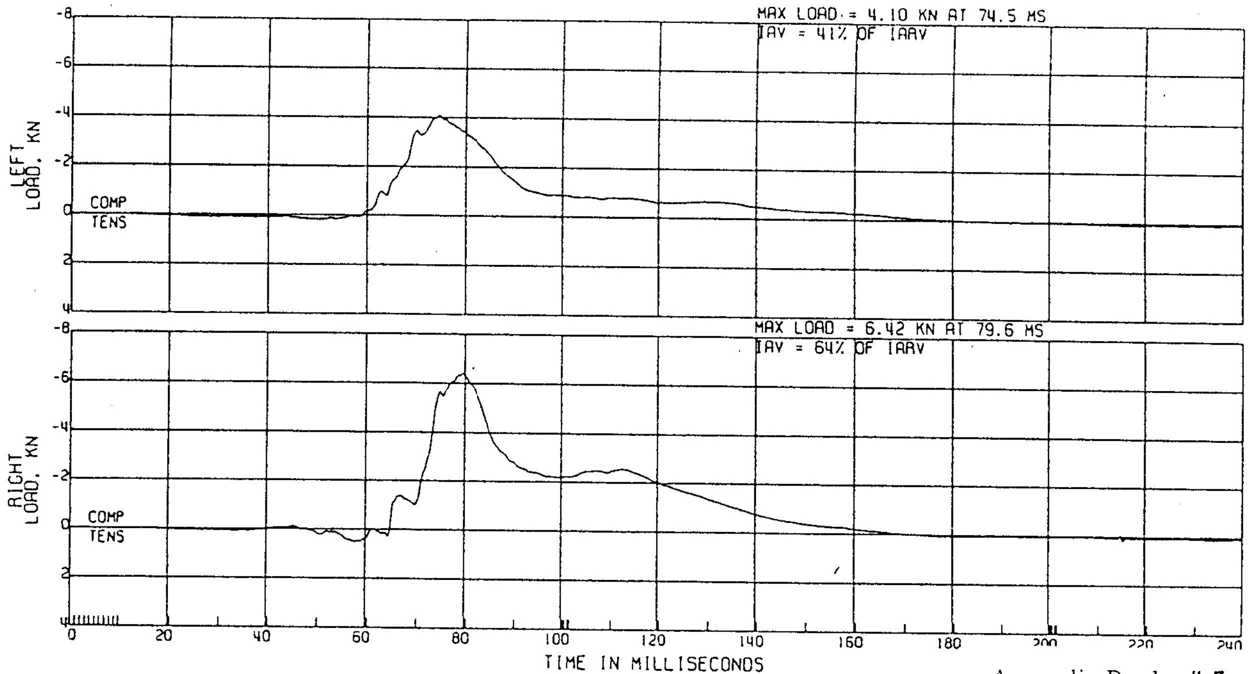
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 5

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

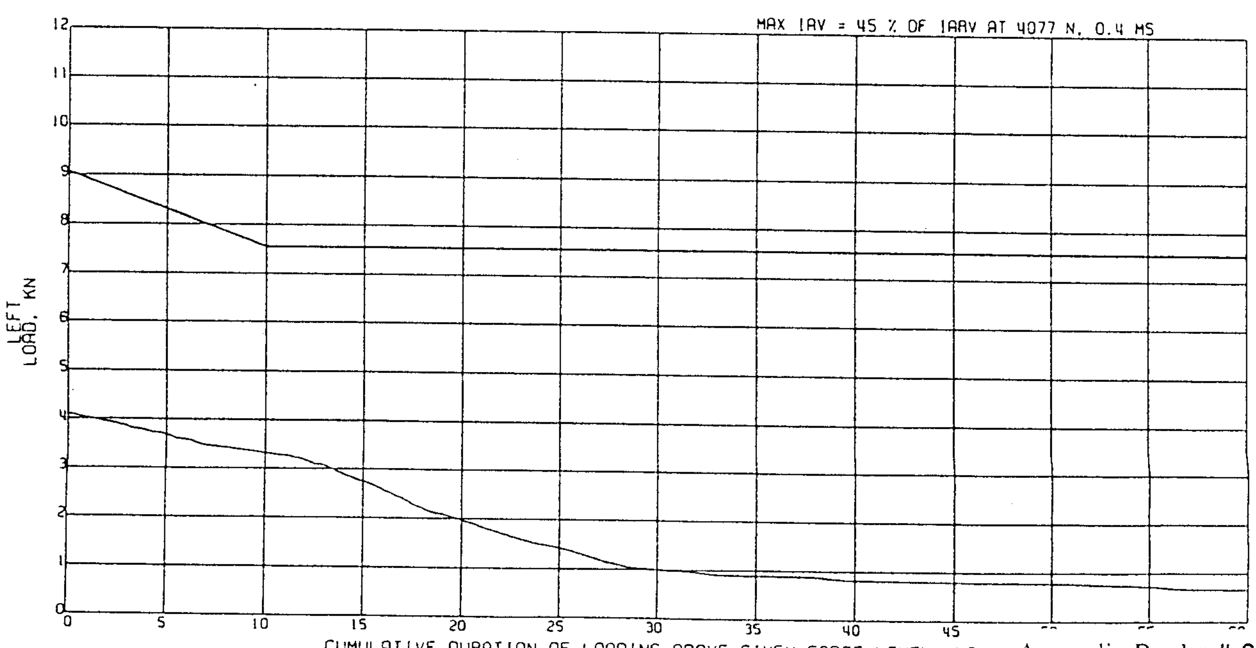
ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD

DURATION ASSESSMENT

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 6

C11108 FRONT IMPACT

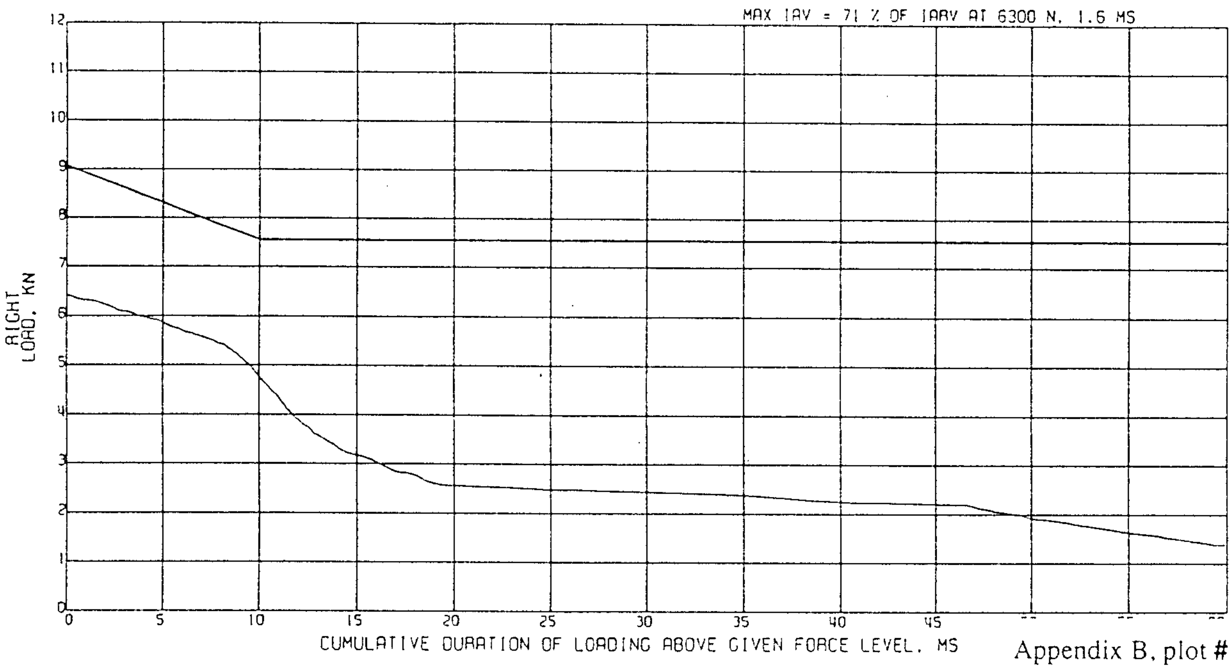
R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 600

MOVING VEHICLE TO FIXED POLE 55.2KM/H

L. FRT FEMUR LOAD

DURATION ASSESSMENT

ATD TYPE: GM50H
TEST DATE:05/16/1996



Appendix B, plot # 7

7 PROCESSED 5/20/1996 10:20 V2.04E

C11108 FRONT IMPACT

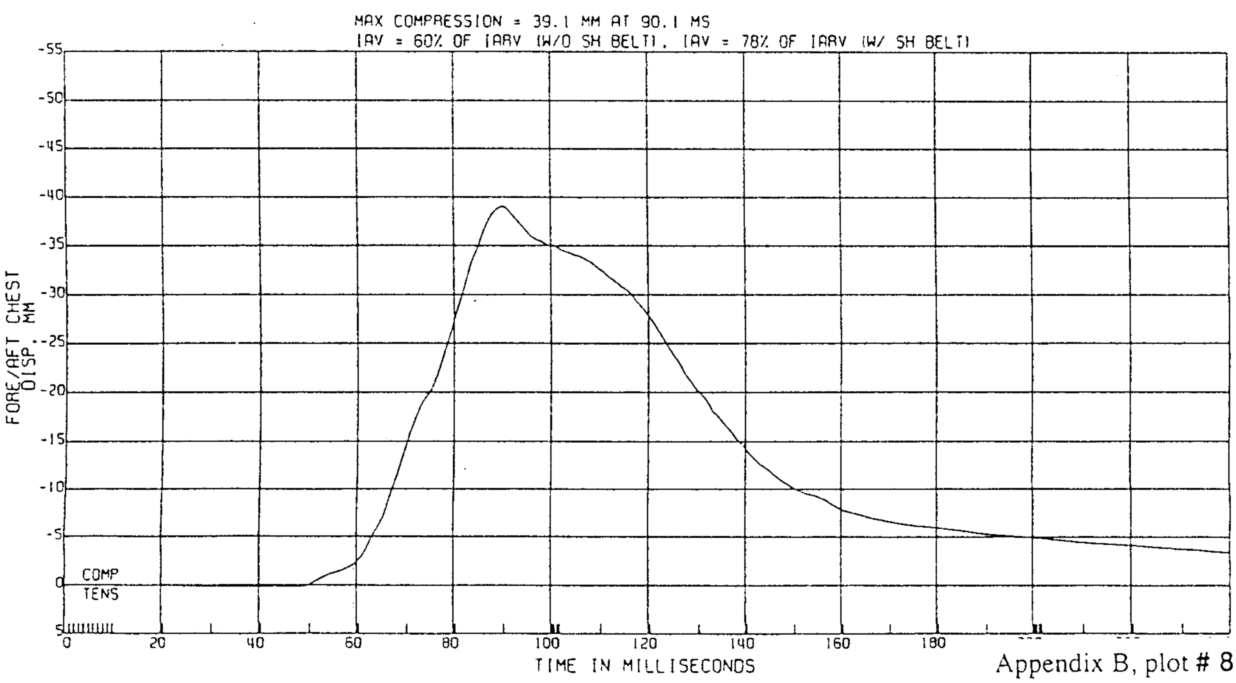
R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 180

MOVING VEHICLE TO FIXED POLE 55.2KM/H

L. FRT CHEST DISP, TEMP AT 71.2'F

NORMALIZED TO 70.7'F & PART 572 CORRIDOR

ATD TYPE: GM50H
TEST DATE:05/16/1996



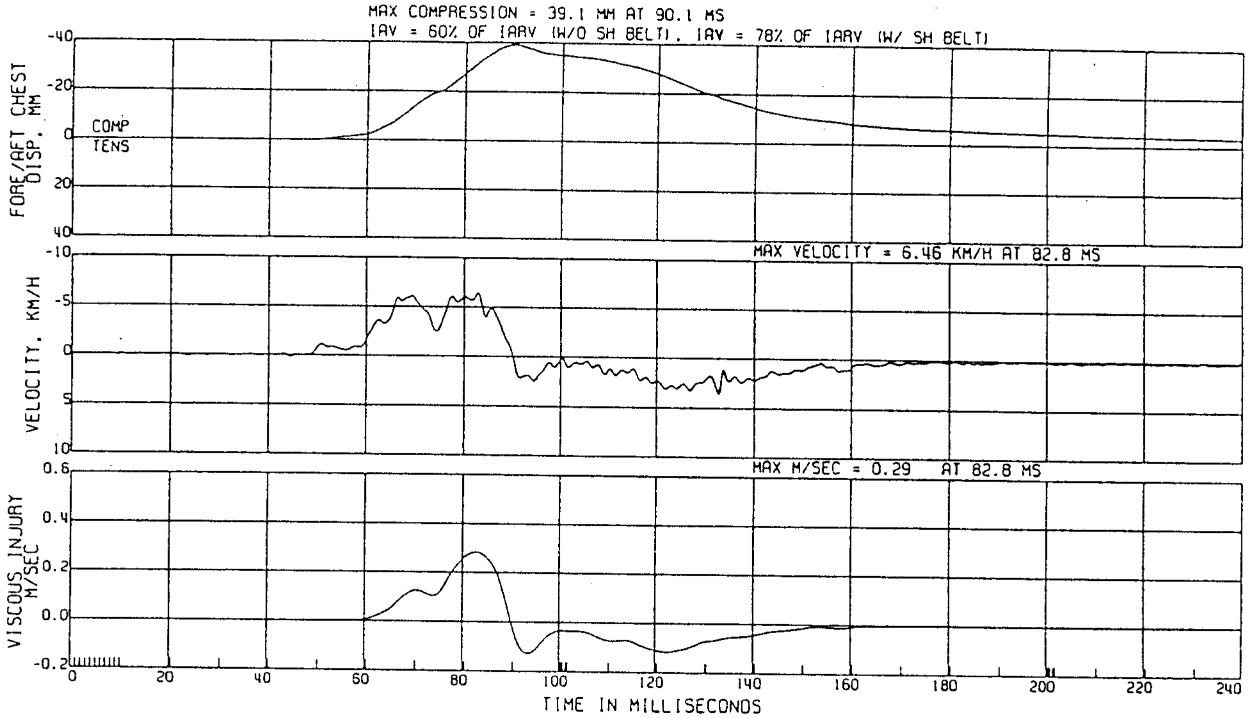
Appendix B, plot # 8

8 PROCESSED 5/20/1996 10:20 V2.04E

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN L. FRT CHEST COMPRESSIVE DISP. ATD TYPE: GM50H TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 180 NORMALIZED, W/CALC VEL & VISCOUS INJURY

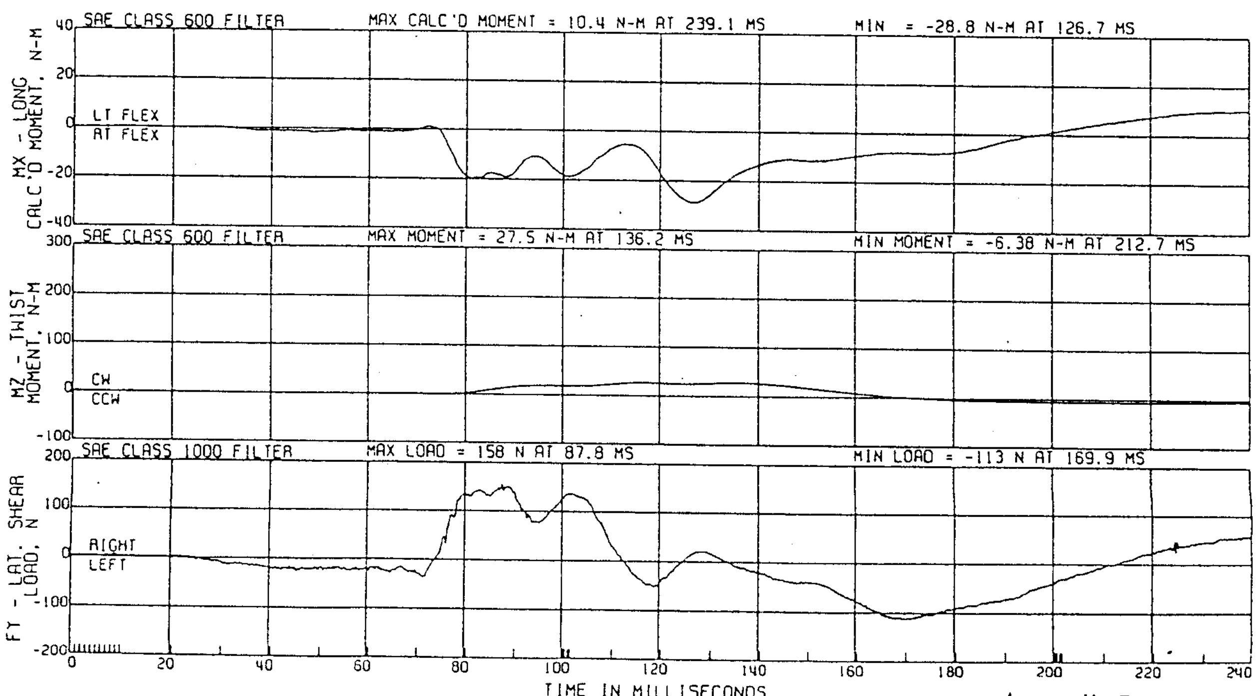


Appendix B, plot # 9

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN L. FRT NECK LOADING ON HEAD, UPPER LOAD ATD TYPE: GM50H TEST DATE:05/16/1996

ELEC DATA L. FRT NECK LOADING ON HEAD



Appendix B, plot # 10

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

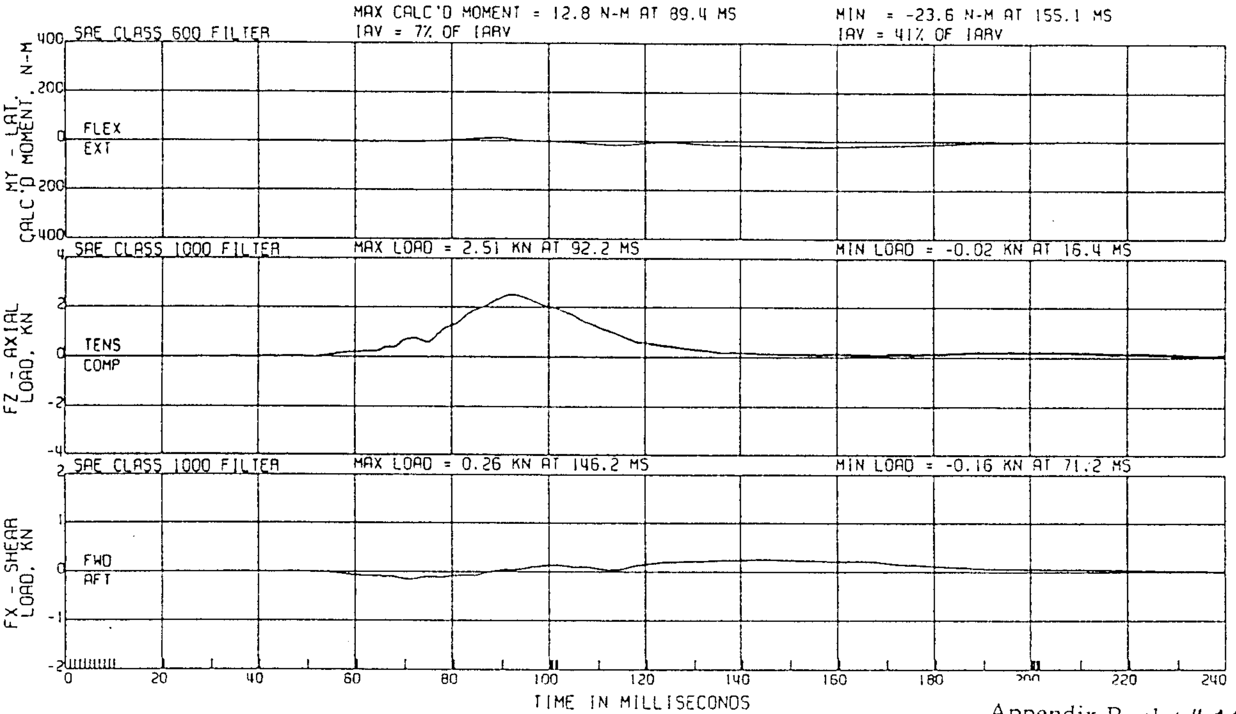
R & D CTR 8T93070 VAN

ELEC DATA

NECK LOADING ON HEAD

ATD TYPE: GM50H
TEST DATE:05/16/1996

L. FRT NECK LOADING ON HEAD



Appendix B, plot # 11

PROCESSED 5/20/1996

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

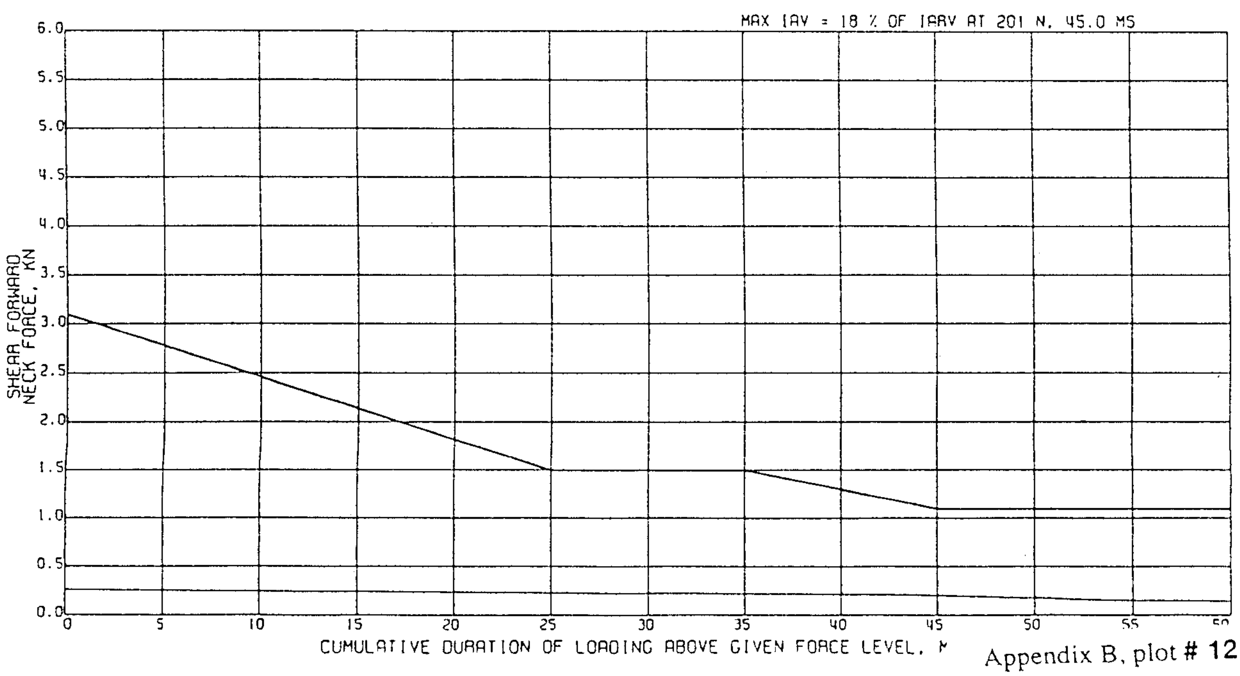
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

FORWARD NECK SHEAR ON HEAD.

ATD TYPE: GM50H
TEST DATE:05/16/1996

L. FRT INJURY REFERENCE



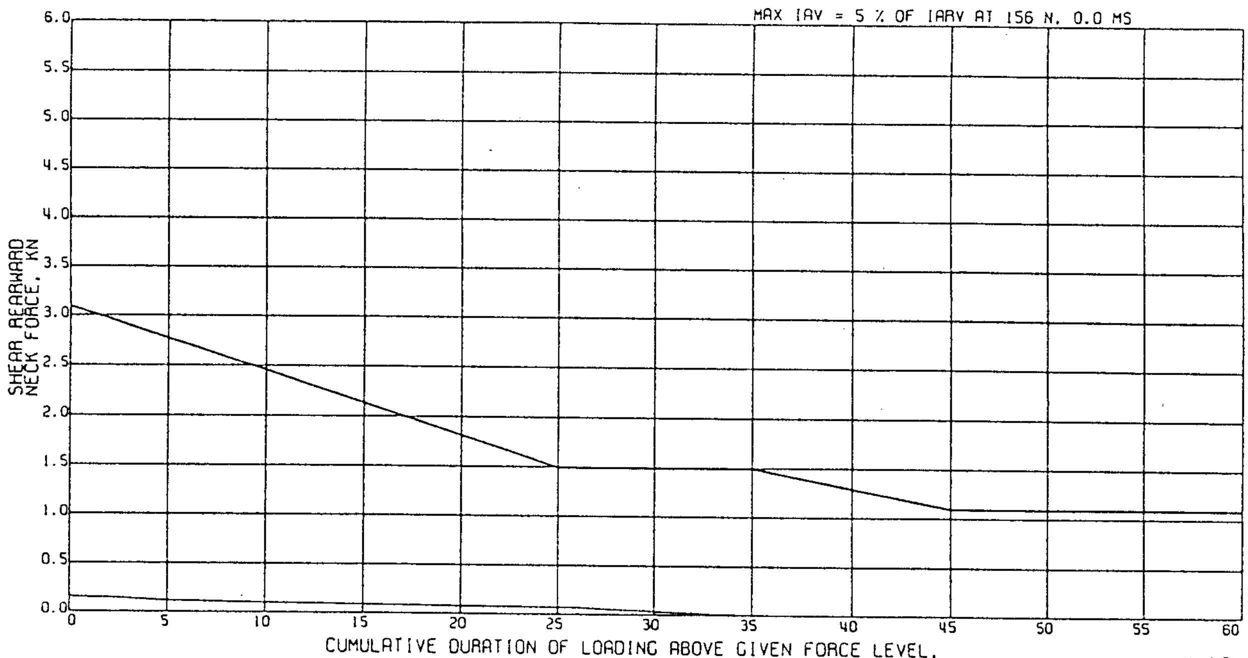
Appendix B, plot # 12

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:05/16/1996



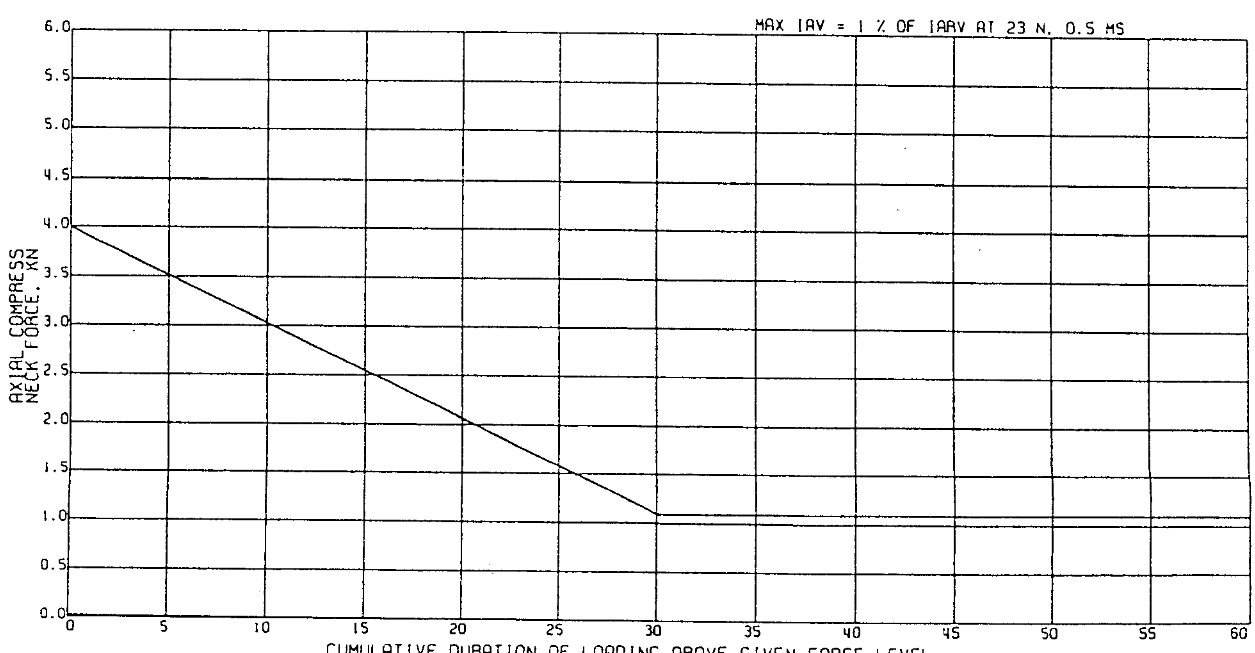
Appendix B, plot # 13

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:05/16/1996



Appendix B, plot # 14

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

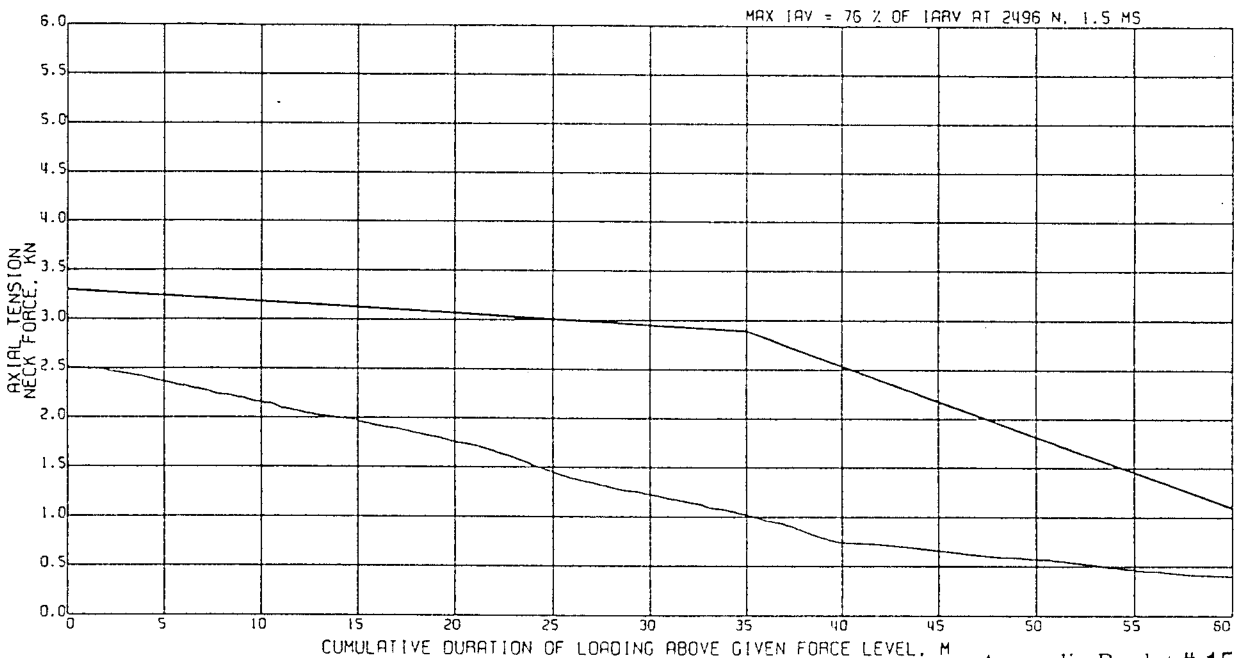
ELEC DATA, SAE CLASS 1000

AXIAL TENSION ON HEAD.

L. FRT INJURY REFERENCE

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 15

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

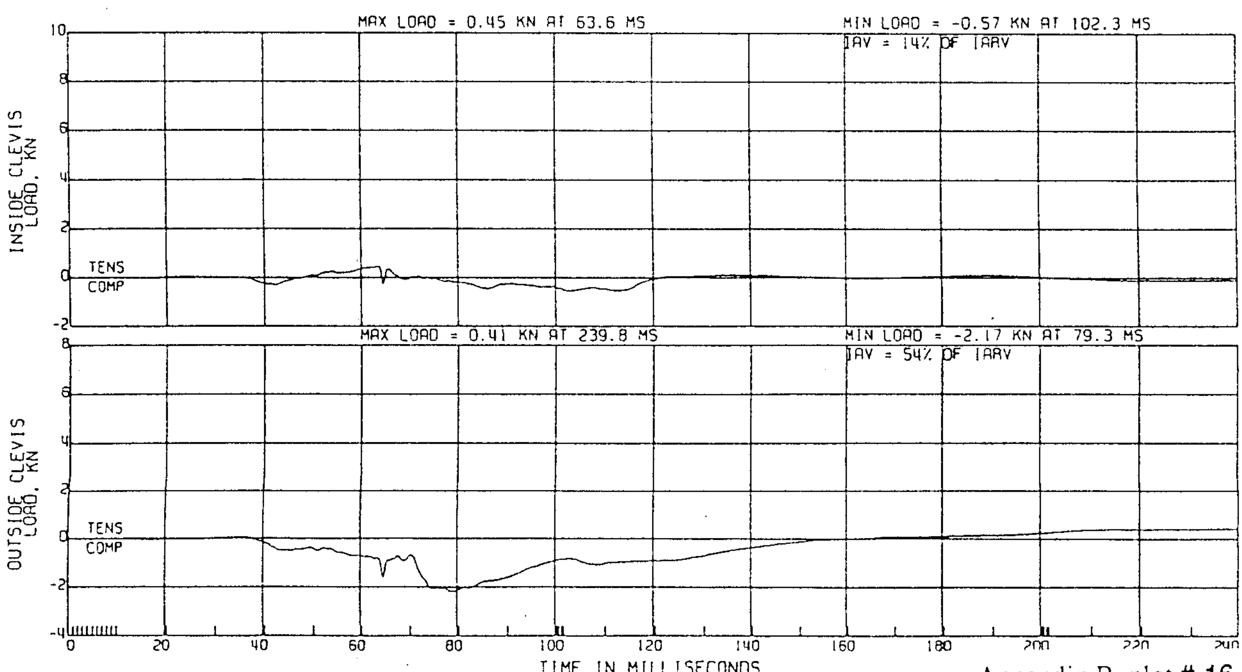
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 600

L. FRT LEFT KNEE CLEVIS LOAD

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 16

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

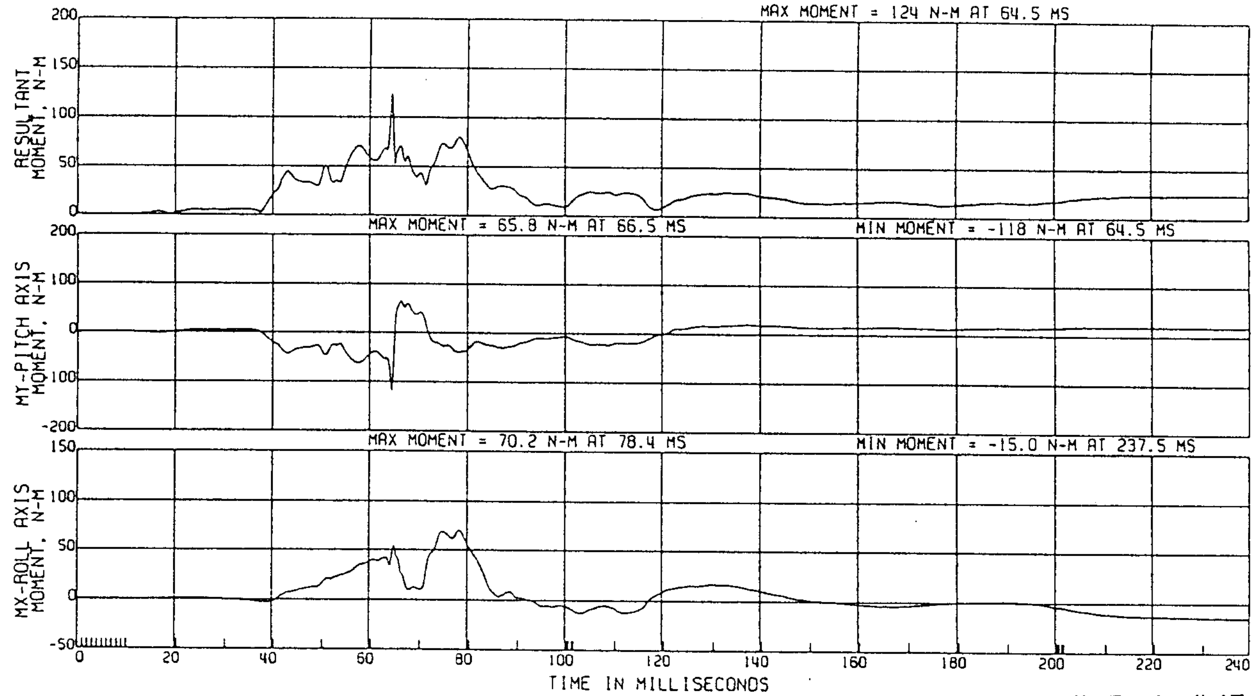
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 600

L. FRT LEFT TIBIA UPPER MOMENT

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 17

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

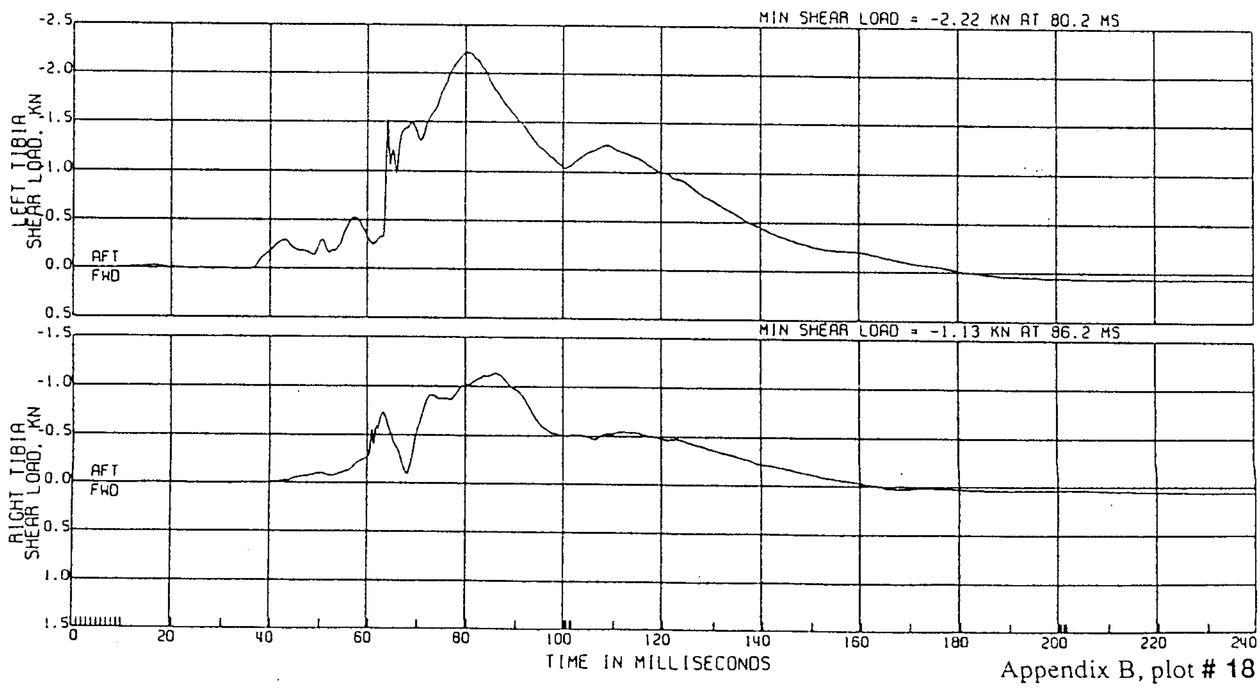
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 600

L. FRT TIBIA LOWER SHEAR LOAD CELLS

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 18

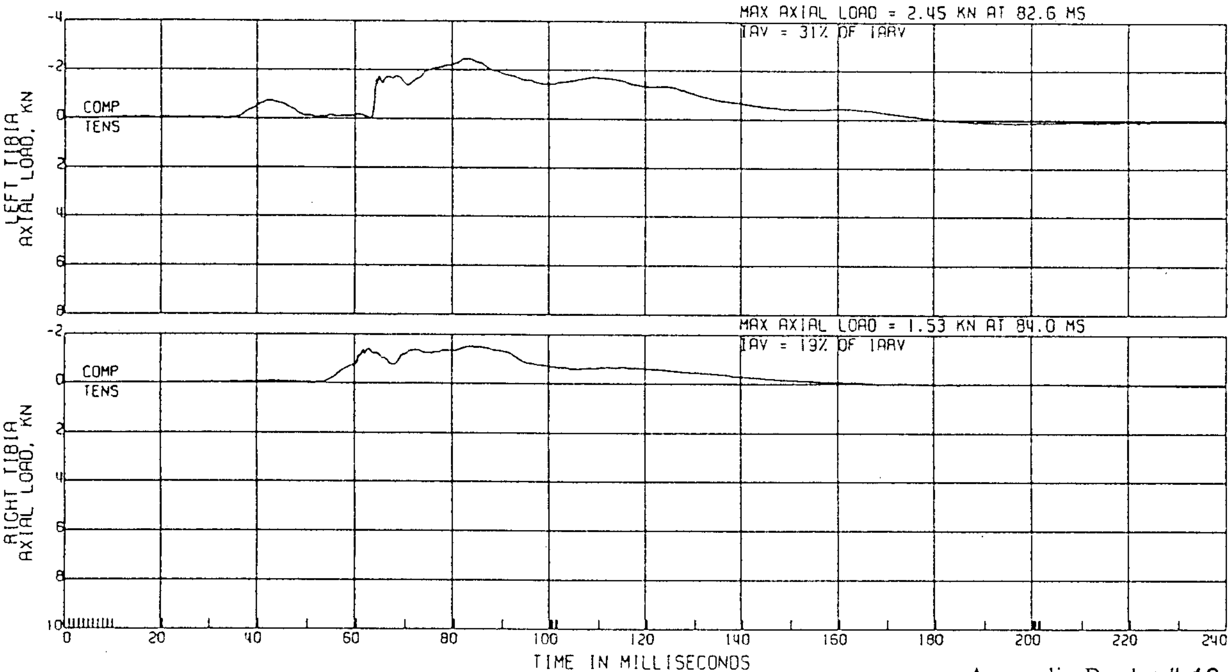
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

ATD TYPE: GMSOH

R & D CTR 8T93070 VAN TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 600

L. FRT TIBIA LOWER AXIAL LOAD



Appendix B, plot # 19

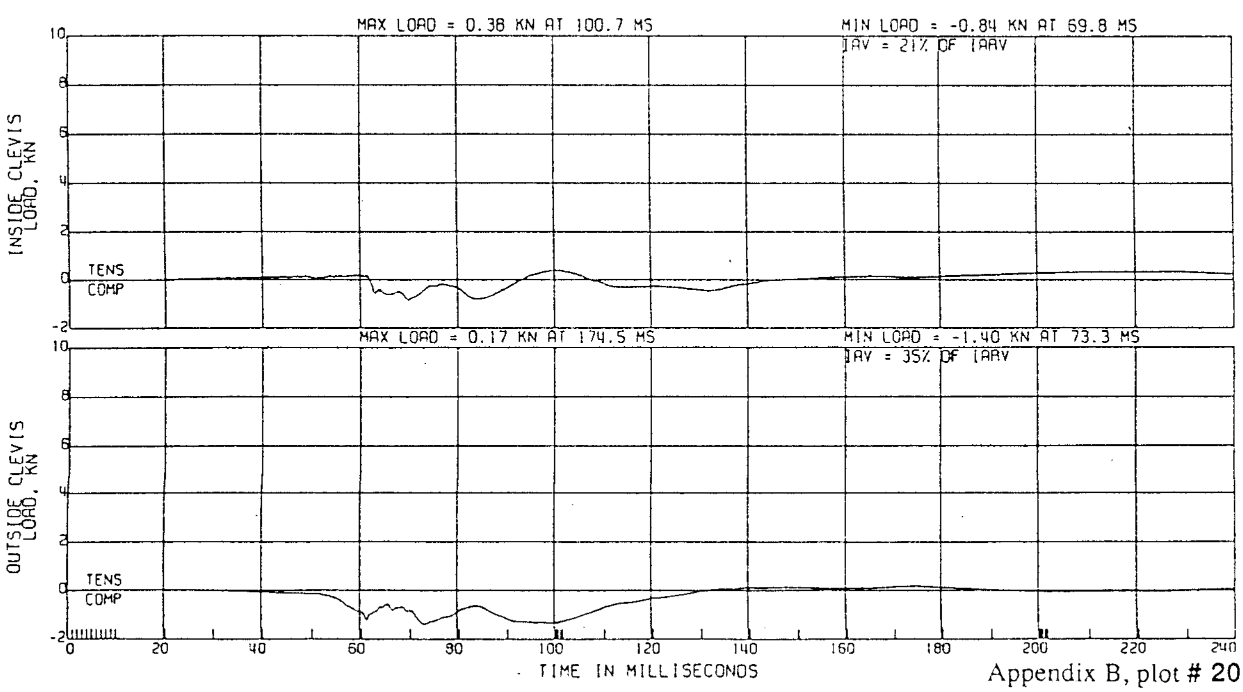
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

ATD TYPE: GMSOH

L. FRT RIGHT KNEE CLEVIS LOAD

R & D CTR 8T93070 VAN TEST DATE:05/16/1996

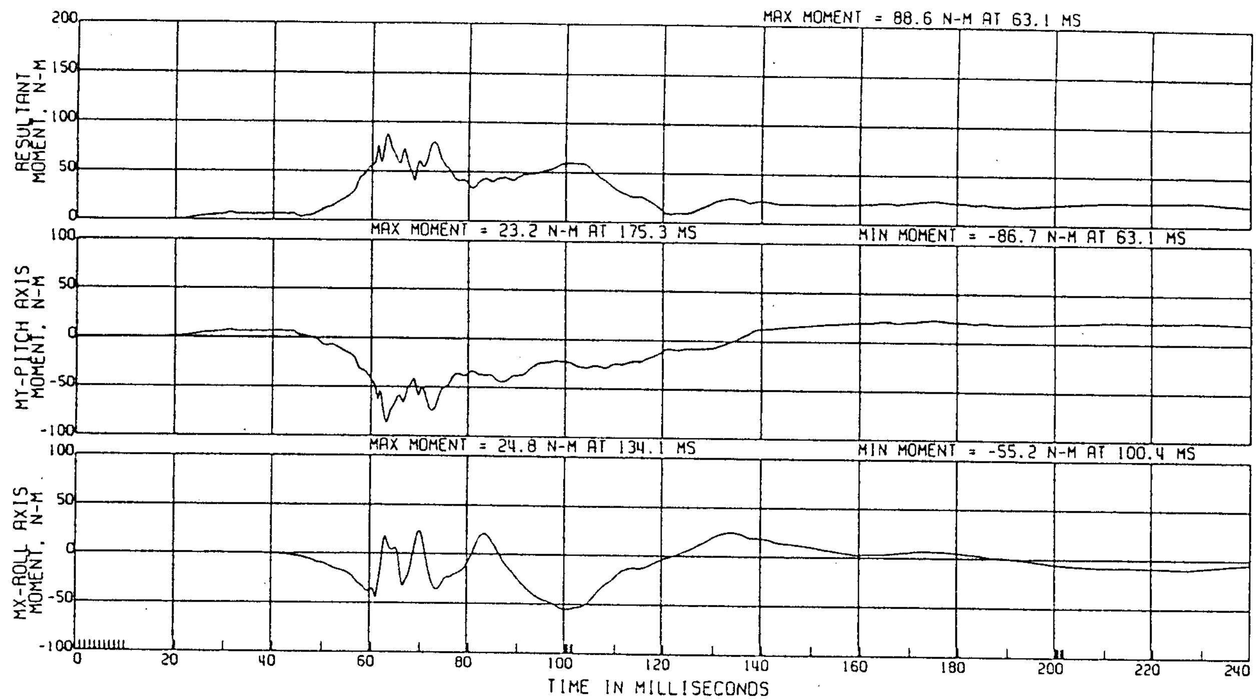
ELEC DATA, SAE CLASS 600



Appendix B, plot # 20

C11108 FRONT IMPACT   MOVING VEHICLE TO FIXED POLE   55.2KM/H

R & D CTR   8T93070 VAN   L. FRT RIGHT TIBIA UPPER MOMENT   ATD TYPE: GM50H
ELEC DATA, SAE CLASS 600   TEST DATE:05/16/1996

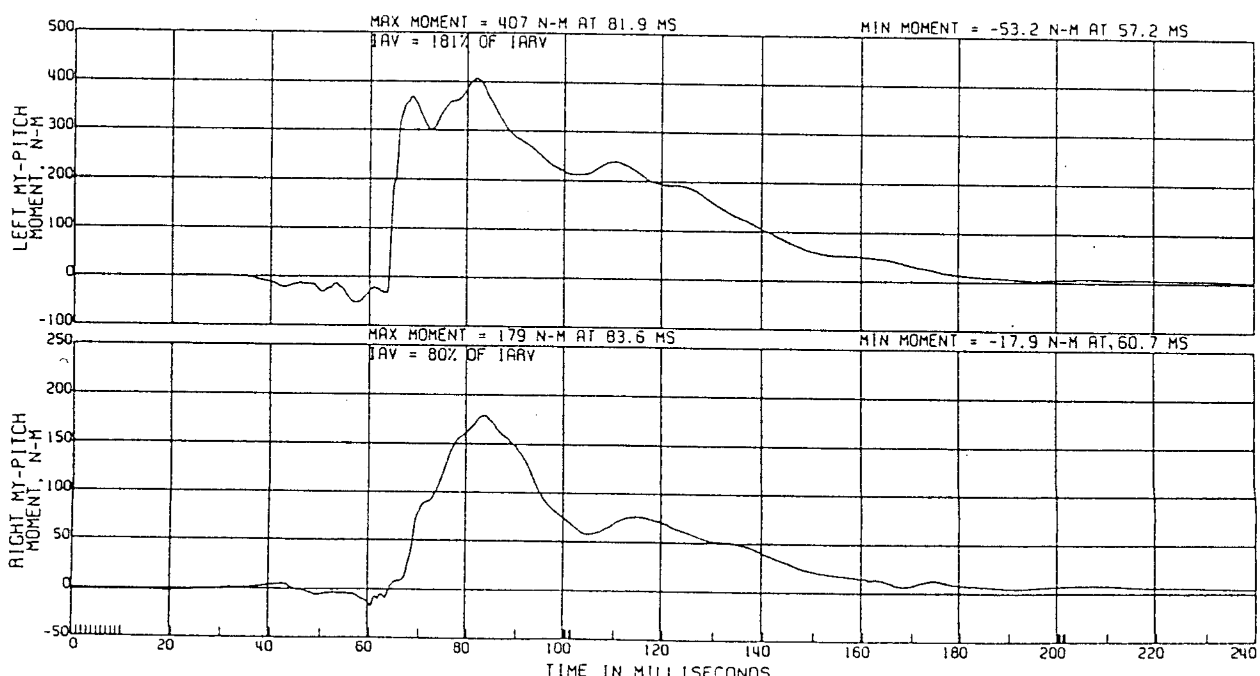


Appendix B, plot # **21**

C11108 FRONT IMPACT   MOVING VEHICLE TO FIXED POLE   55.2KM/H

R & D CTR   8T93070 VAN   ATD TYPE: GM50H
ELEC DATA, SAE CLASS 600   TEST DATE:05/16/1996

L. FRT TIBIA LOWER BENDING MOMENTS



Appendix B, plot # **22**

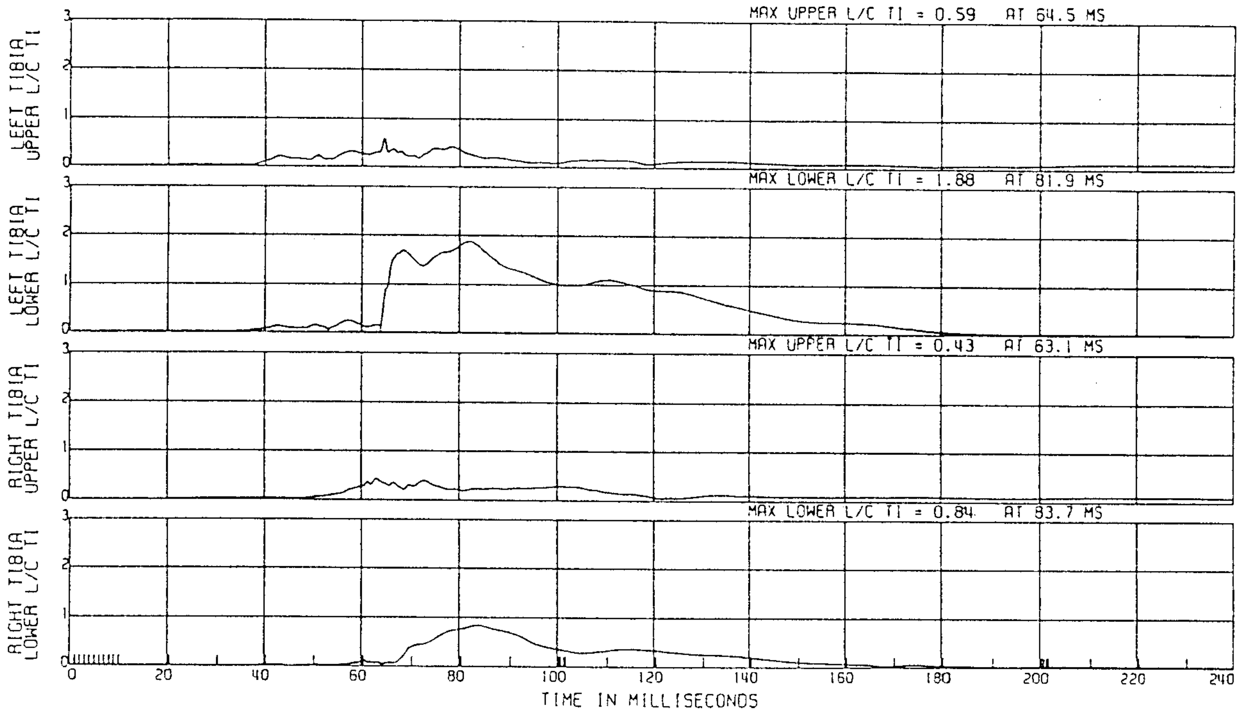
C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 600

L. FRT TIBIA INDICES

ATD TYPE: GM50H
TEST DATE:05/16/1996

TI = (RES MOM/225 NM) + (AXIAL/35900 N)



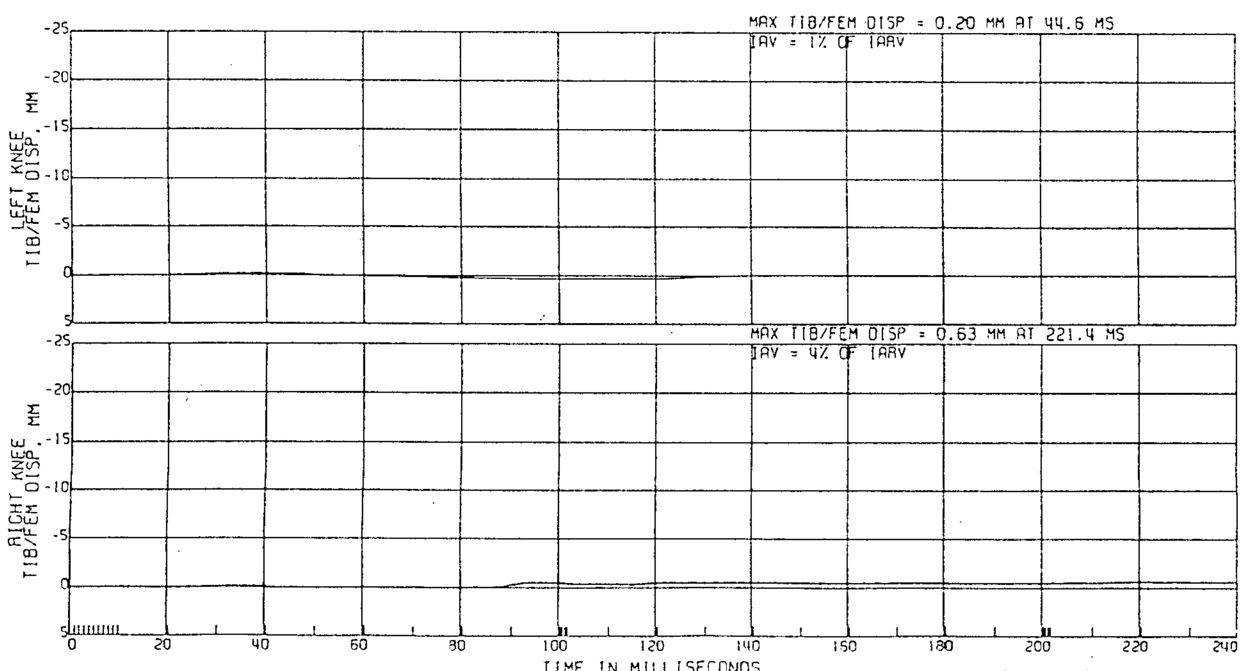
Appendix B, plot # 23

C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 180

L. FRT TIBIA/FEMUR DISPLACEMENT

ATD TYPE: GM50H
TEST DATE:05/16/1996



Appendix B, plot # 24

C11108 FRONT IMPACT

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

MOVING VEHICLE TO FIXED POLE

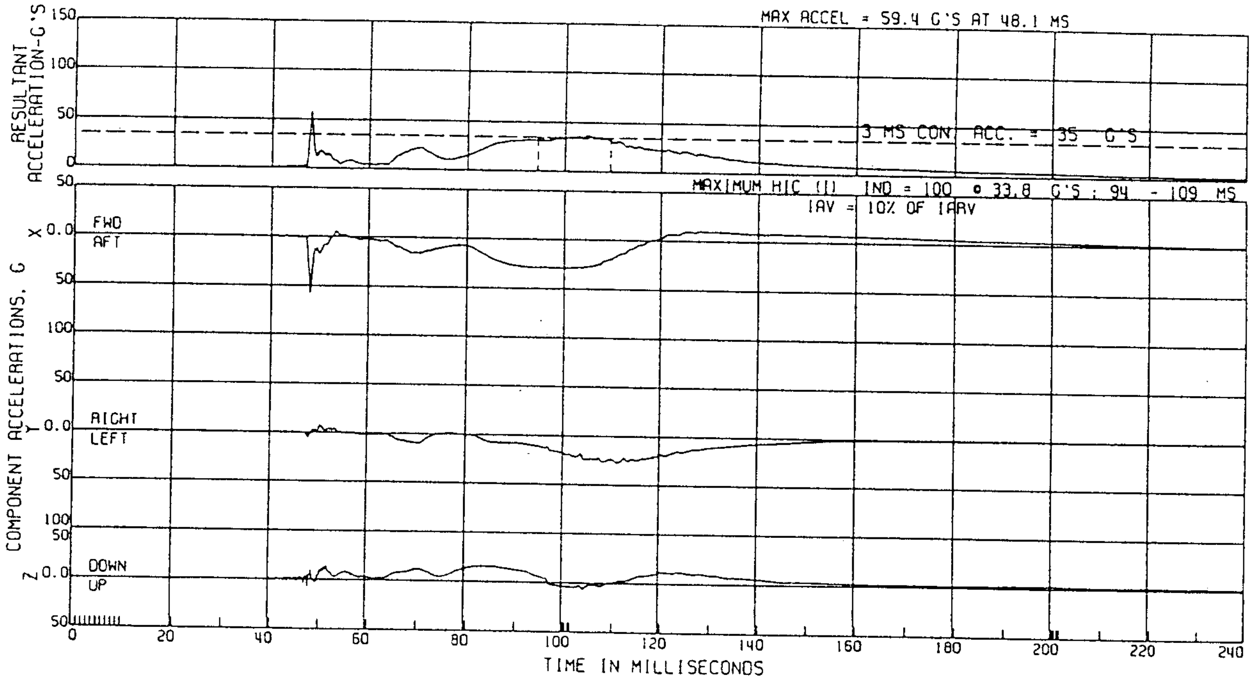
R. FRT HEAD ACCEL.

(HIC I LIMITED TO 15MS)

55.2KM/H

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 25

C11108 FRONT IMPACT

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

MOVING VEHICLE TO FIXED POLE

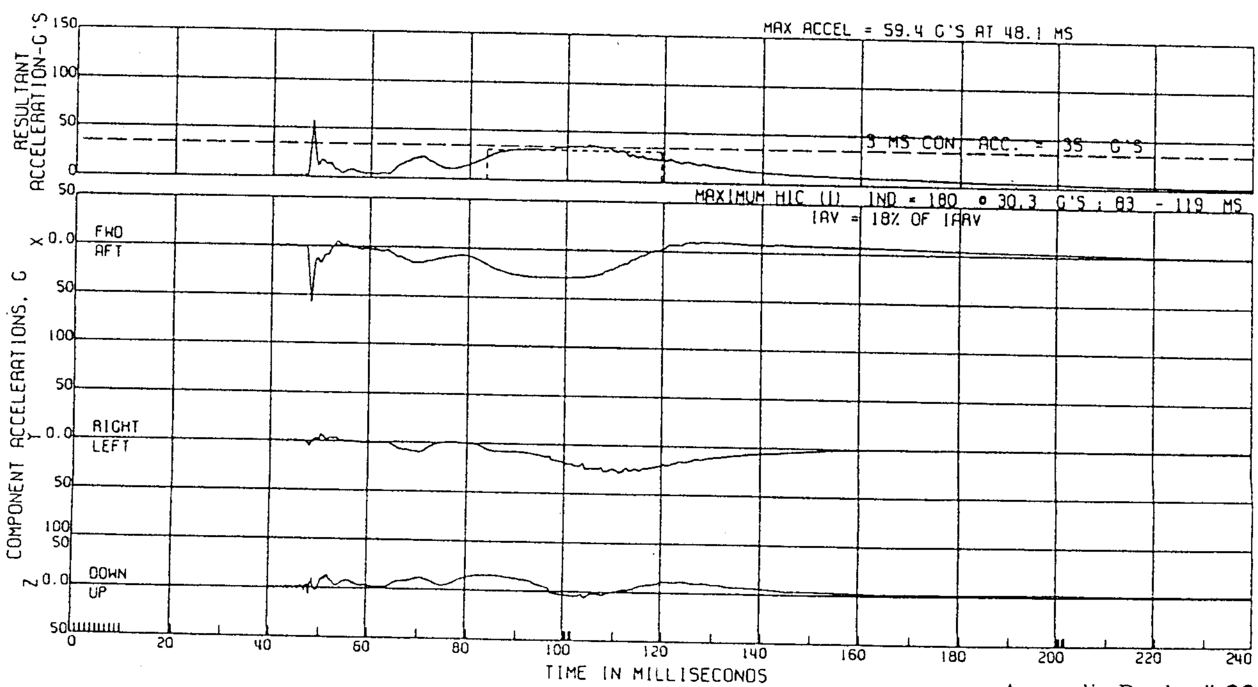
R. FRT HEAD ACCEL.

(HIC I LIMITED TO 36MS)

55.2KM/H

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 26

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

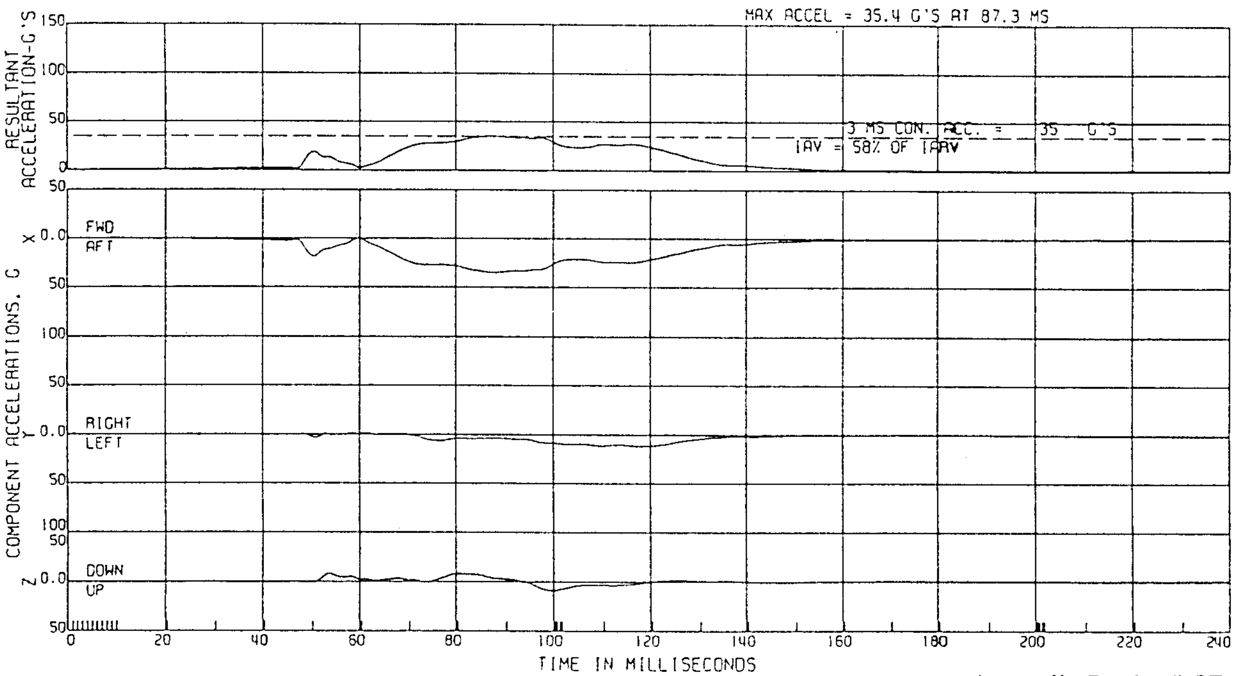
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

R. FRT CHEST ACCEL.

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 27

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

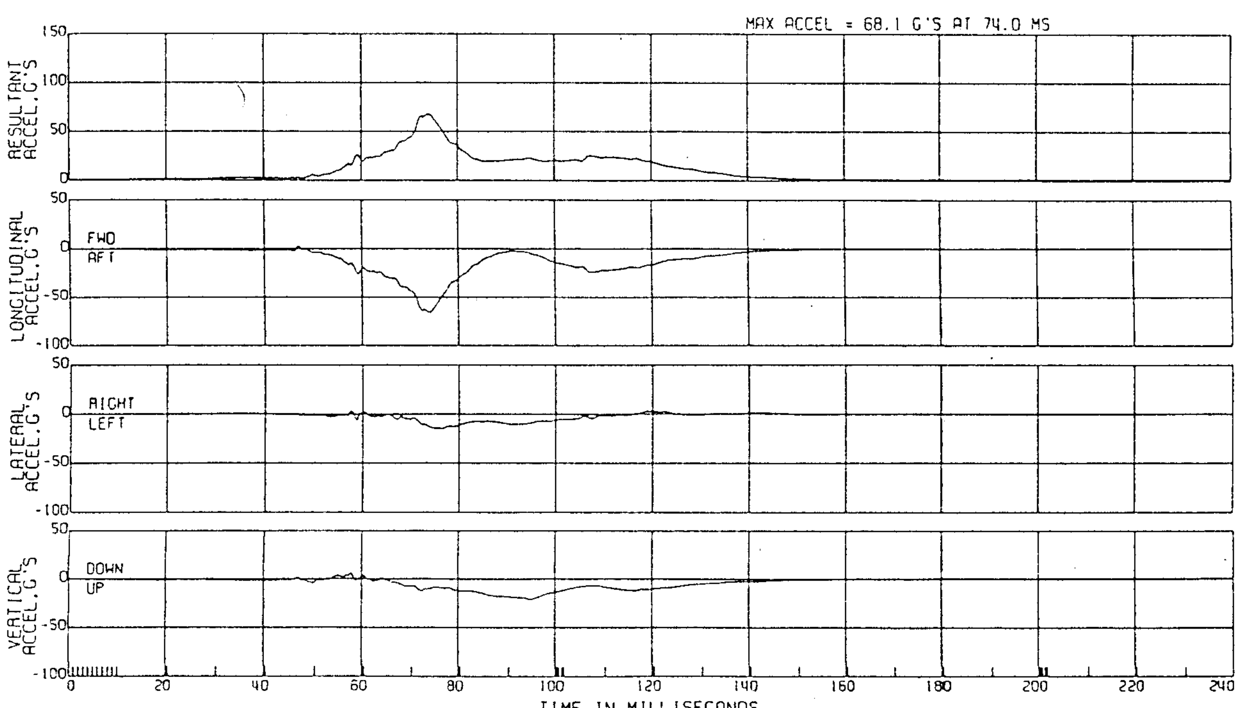
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

R. FRT PELVIC ACCEL.

ATD TYPE: GM50H

TEST DATE:05/16/1996



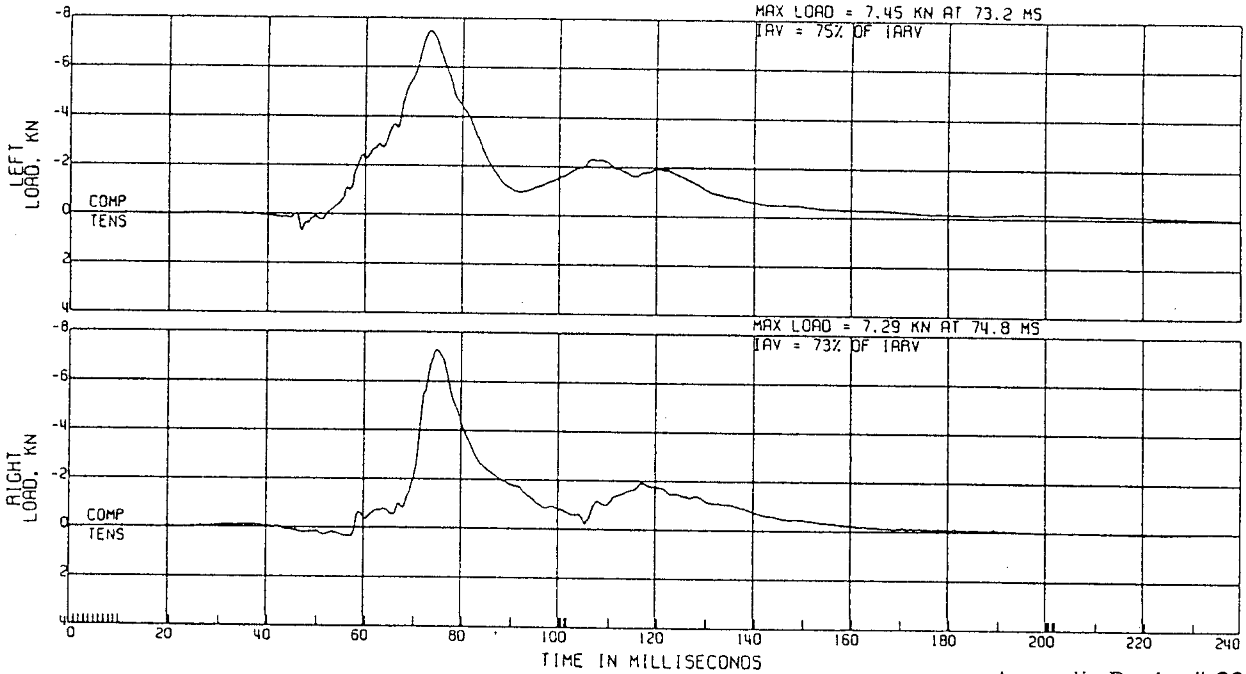
Appendix B, plot # 28

C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 600

R. FRT FEMUR LOAD

ATD TYPE: GM50H
TEST DATE:05/16/1996



Appendix B, plot # 29

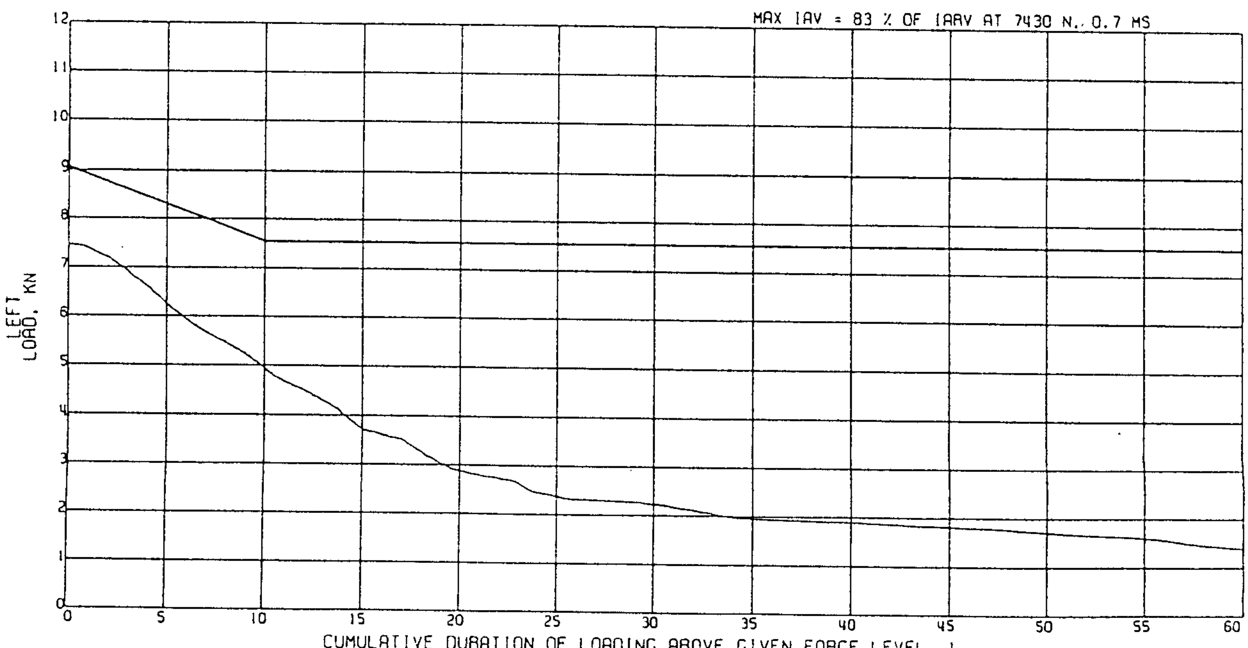
29 PROCESSED 5/20/1996 10:20 V2.04E

C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 600

R. FRT FEMUR LOAD
DURATION ASSESSMENT

ATD TYPE: GM50H
TEST DATE:05/16/1996



Appendix B, plot # 30

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

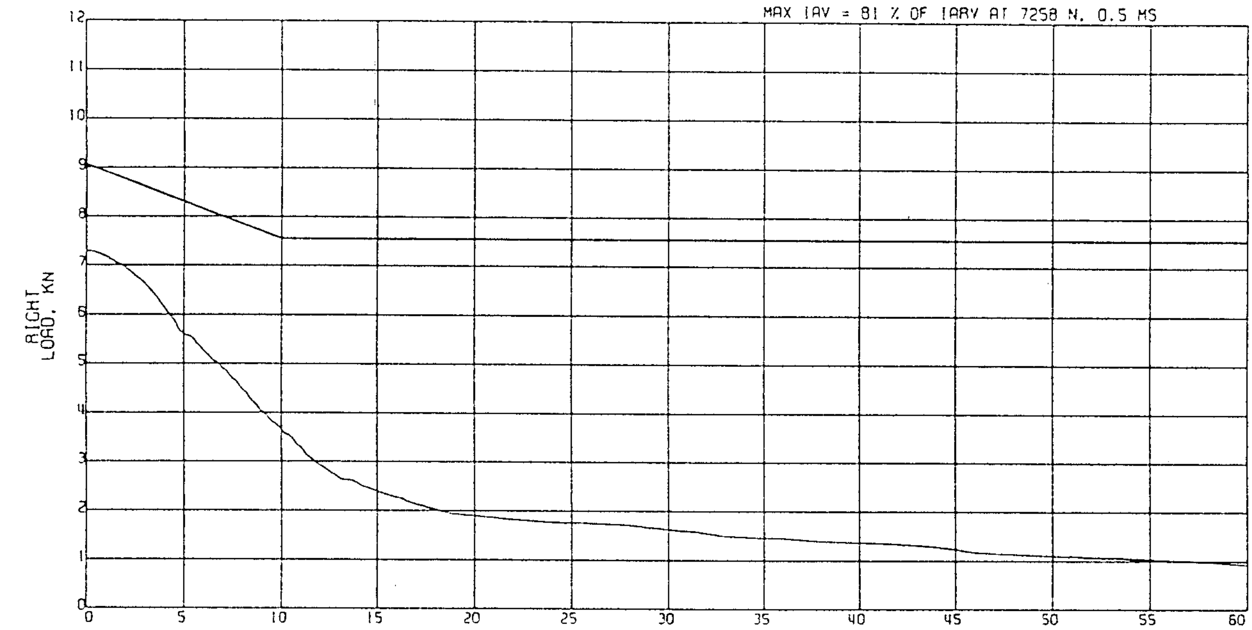
ELEC DATA, SAE CLASS 600

R. FRT FEMUR LOAD

DURATION ASSESSMENT

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 31

31 PROCESSED 5/20/1996 10:20 V2.04E

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

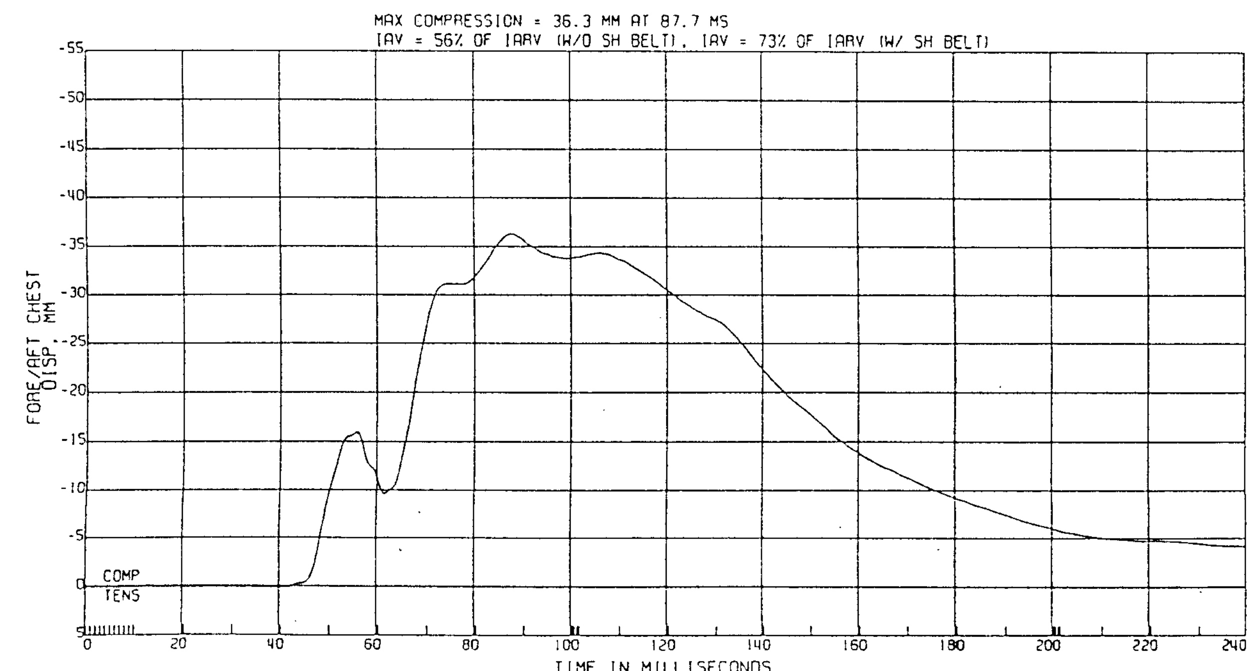
ELEC DATA, SAE CLASS 180

R. FRT CHEST DISP, TEMP AT 71.3'F

NORMALIZED TO 70.7'F & PART 572 CORRIDOR

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 32

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

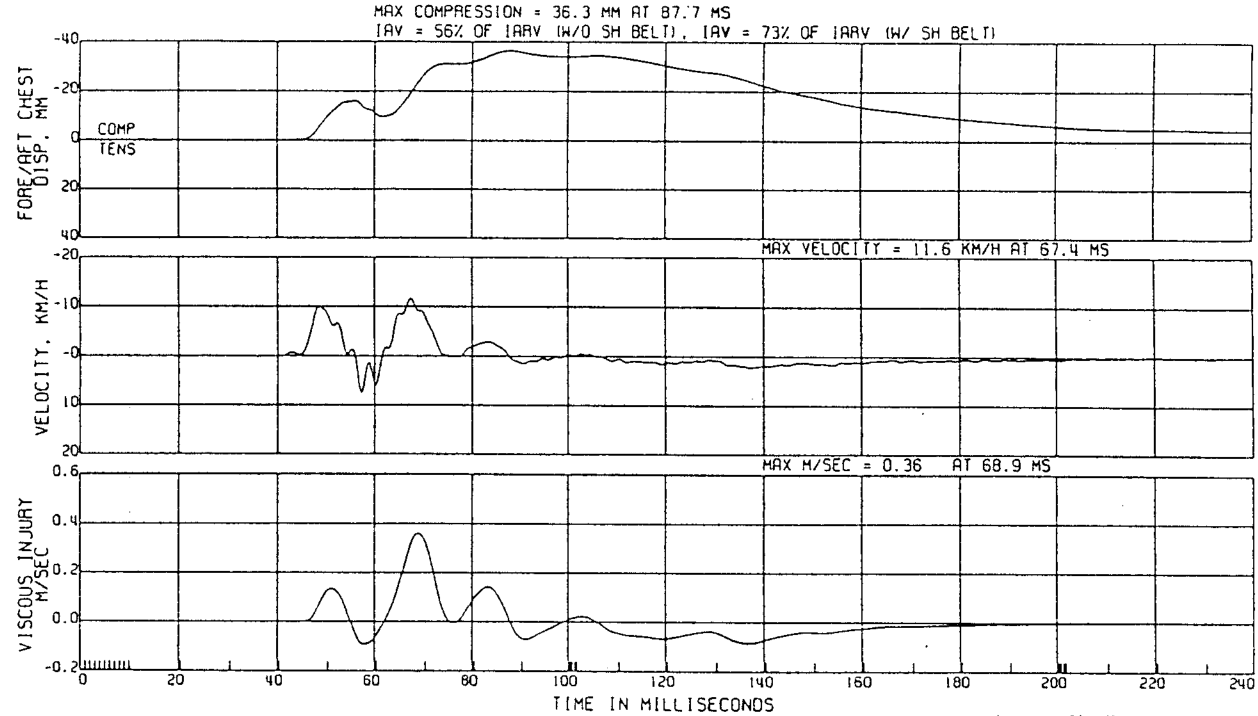
ELEC DATA, SAE CLASS 180

ATD TYPE: GM50H

TEST DATE:05/16/1996

R. FRT CHEST COMPRESSIVE DISP.

NORMALIZED, W/CALC VEL & VISCOUS INJURY



Appendix B, plot # 33

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

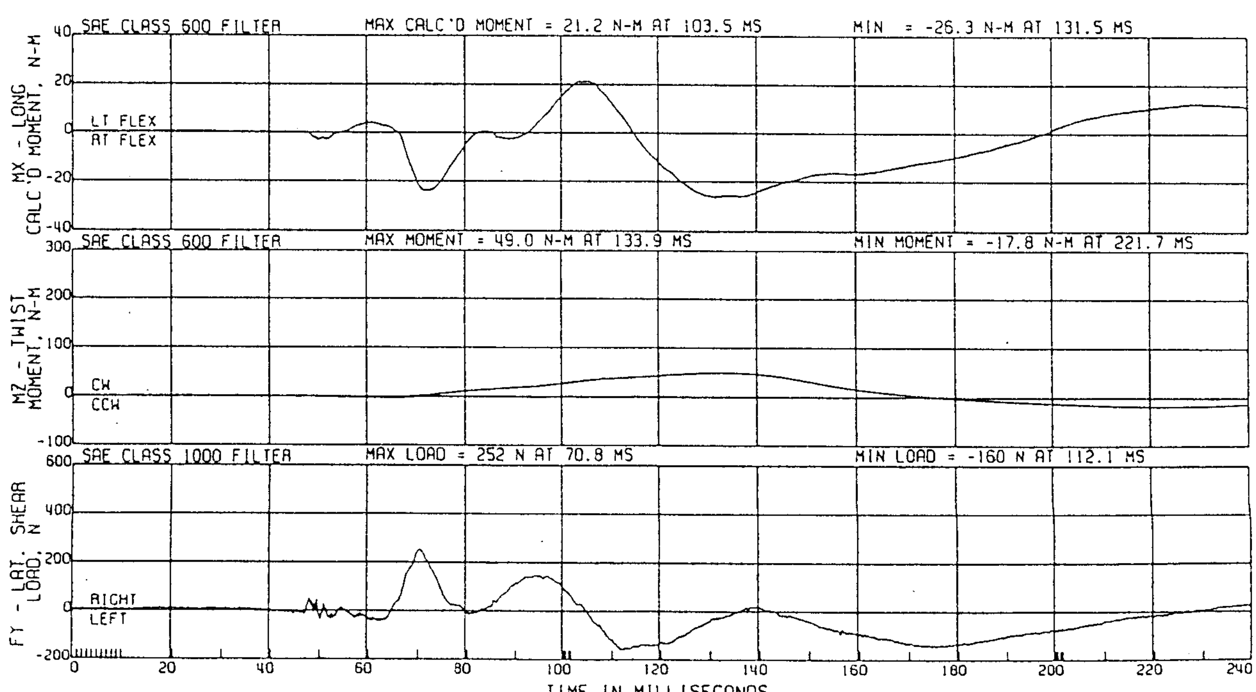
ELEC DATA

ATD TYPE: GM50H

TEST DATE:05/16/1996

R. FRT NECK LOADING ON HEAD, UPPER LOAD

R. FRT NECK LOADING ON HEAD



Appendix B, plot # 34

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

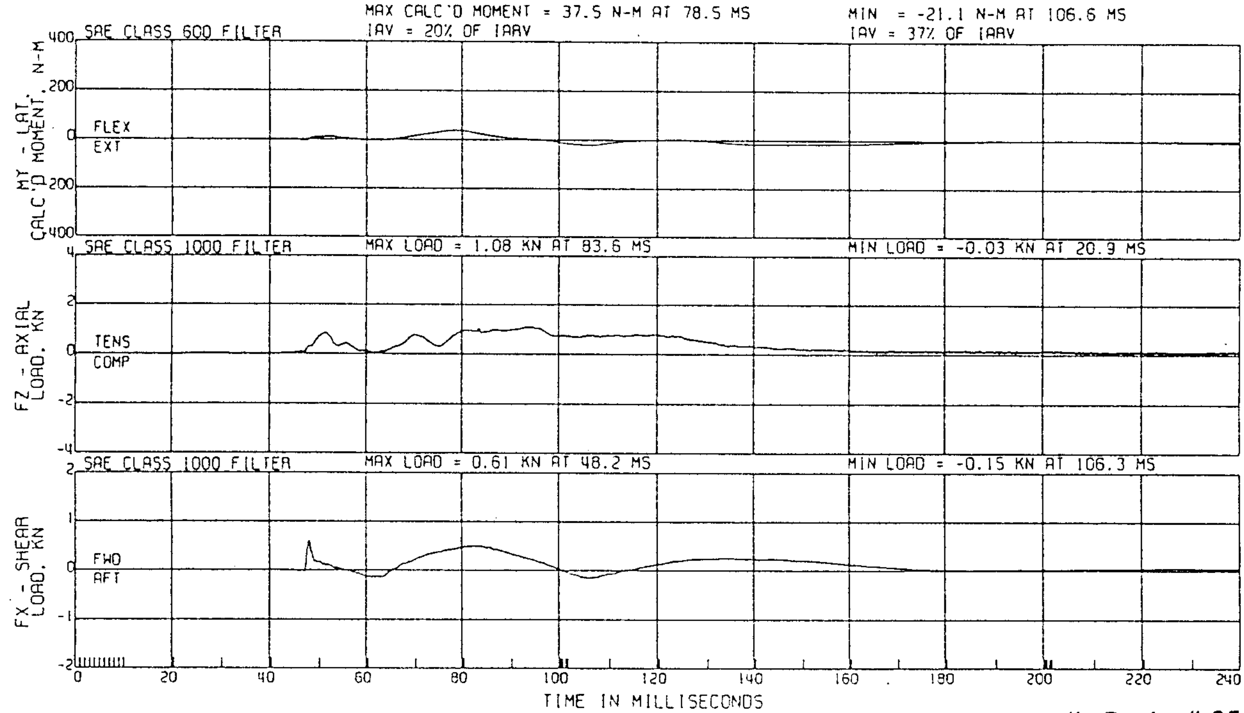
ELEC DATA

NECK LOADING ON HEAD

R. FRT NECK LOADING ON HEAD

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 35

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

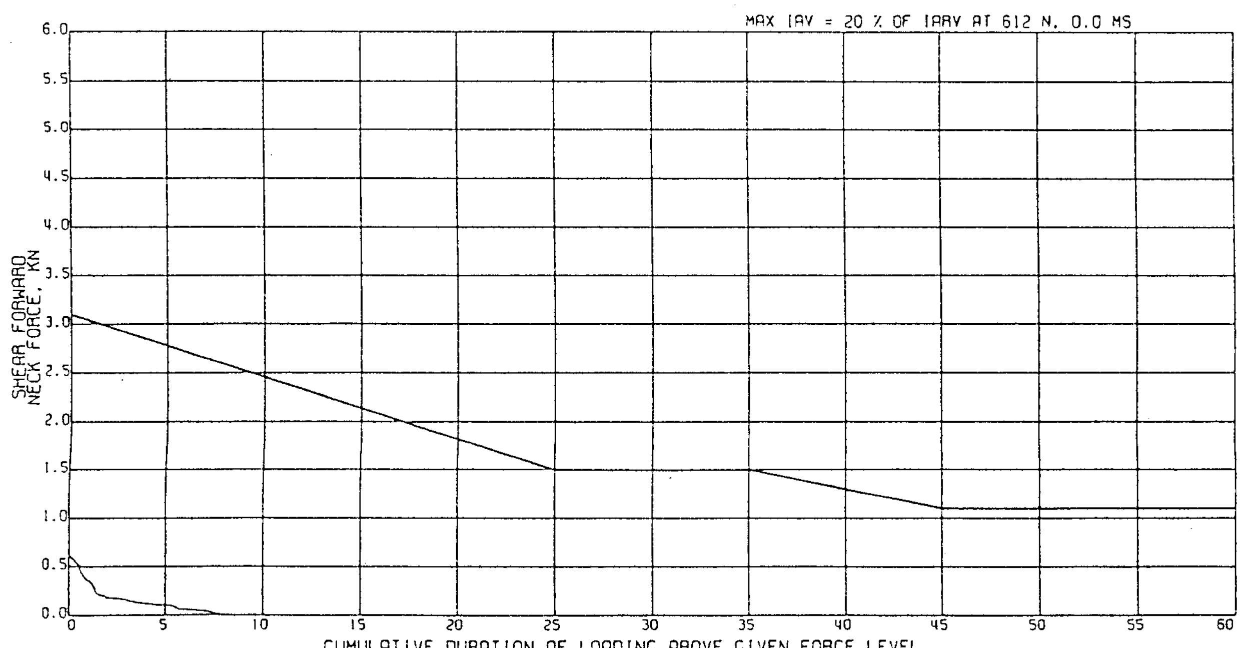
ELEC DATA, SAE CLASS 1000

FORWARD NECK SHEAR ON HEAD.

R. FRT INJURY REFERENCE

ATD TYPE: GM50H

TEST DATE:05/16/1996



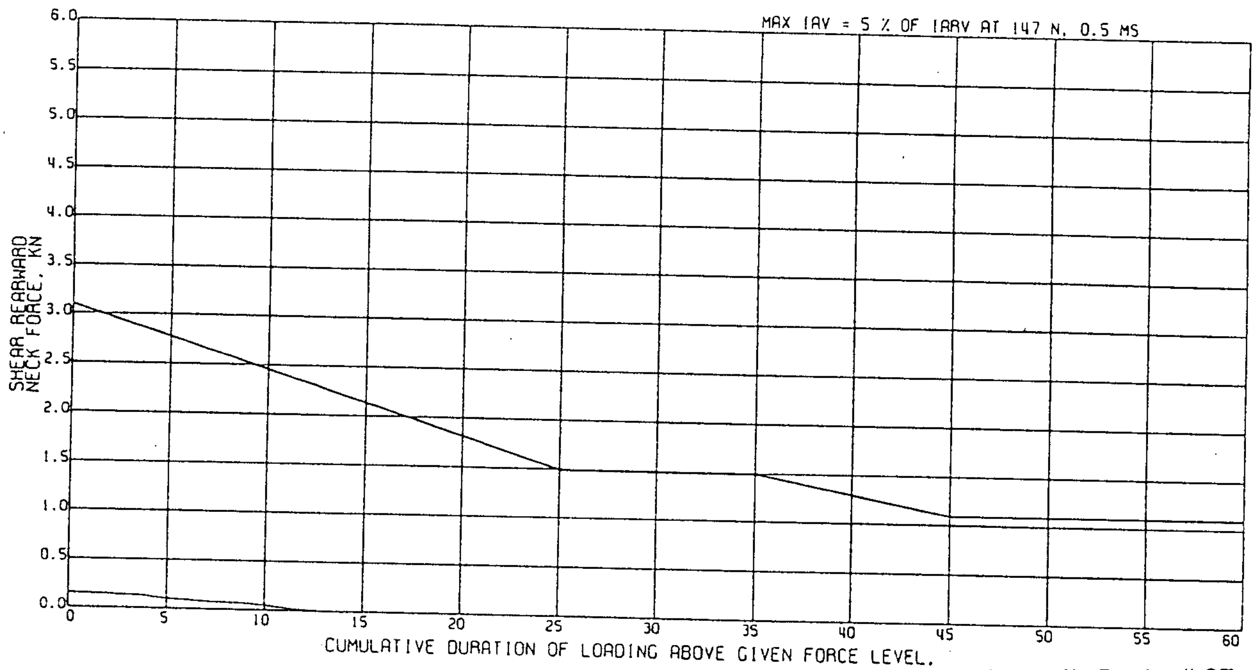
Appendix B, plot # 36

C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:05/16/1996



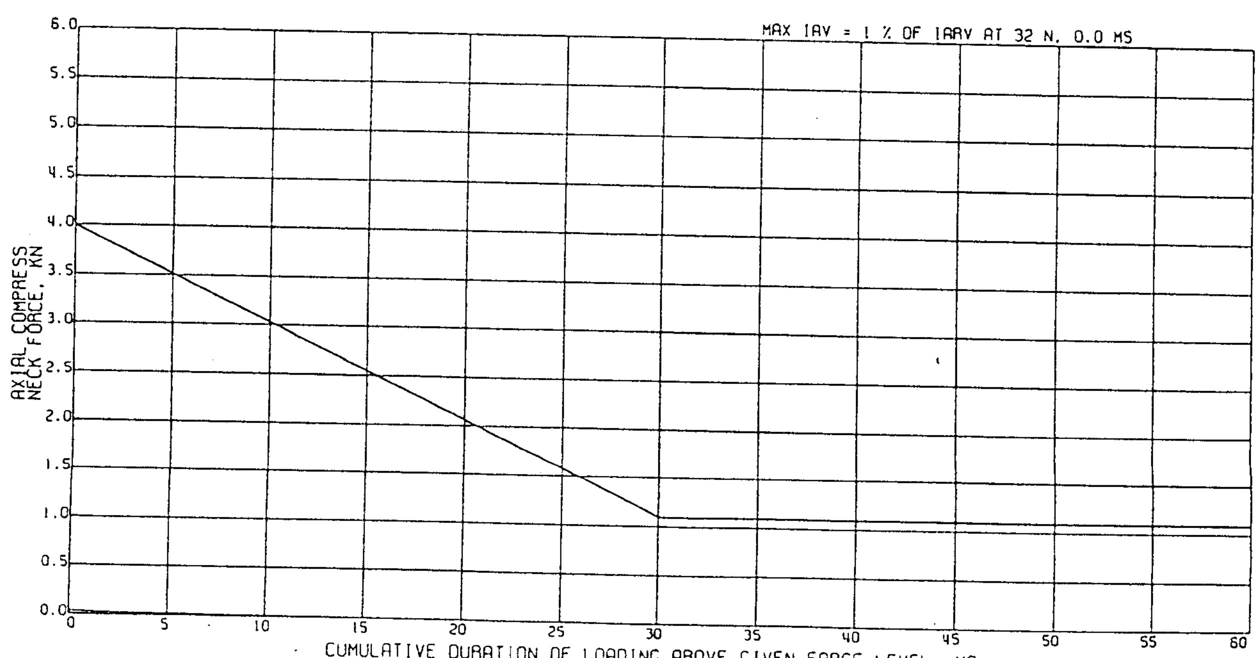
Appendix B, plot # 37

C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:05/16/1996



Appendix B, plot # 38

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

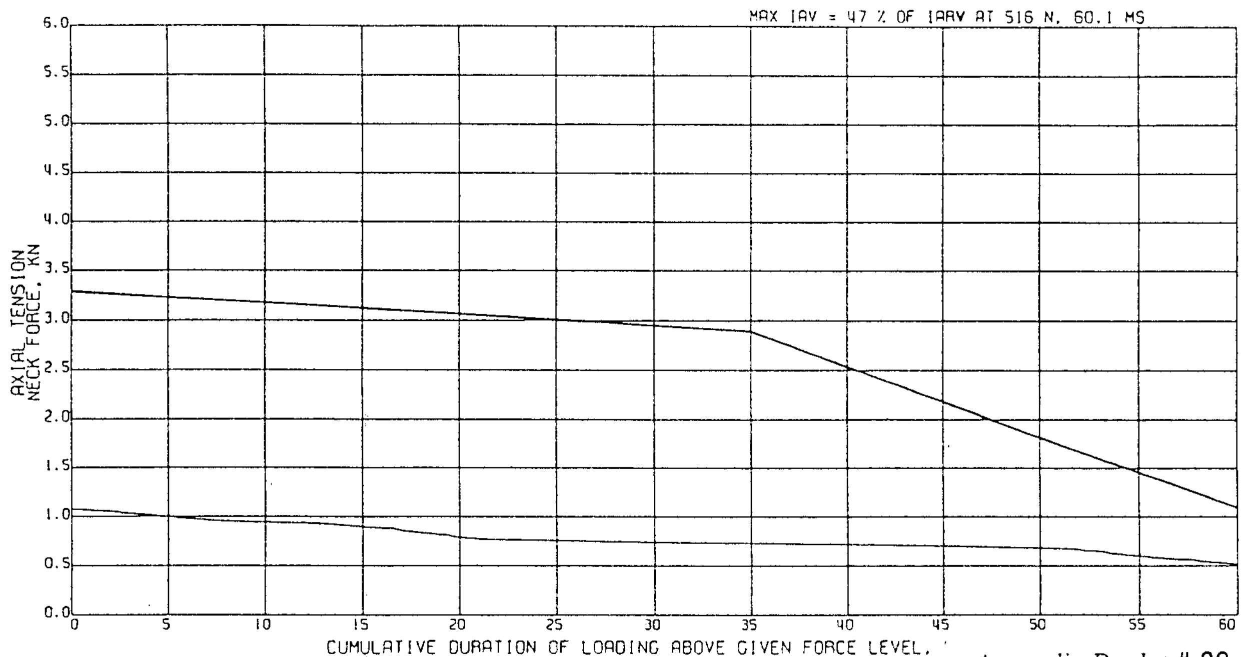
ELEC DATA, SAE CLASS 1000

AXIAL TENSION ON HEAD.

R. FRT INJURY REFERENCE

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 39

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

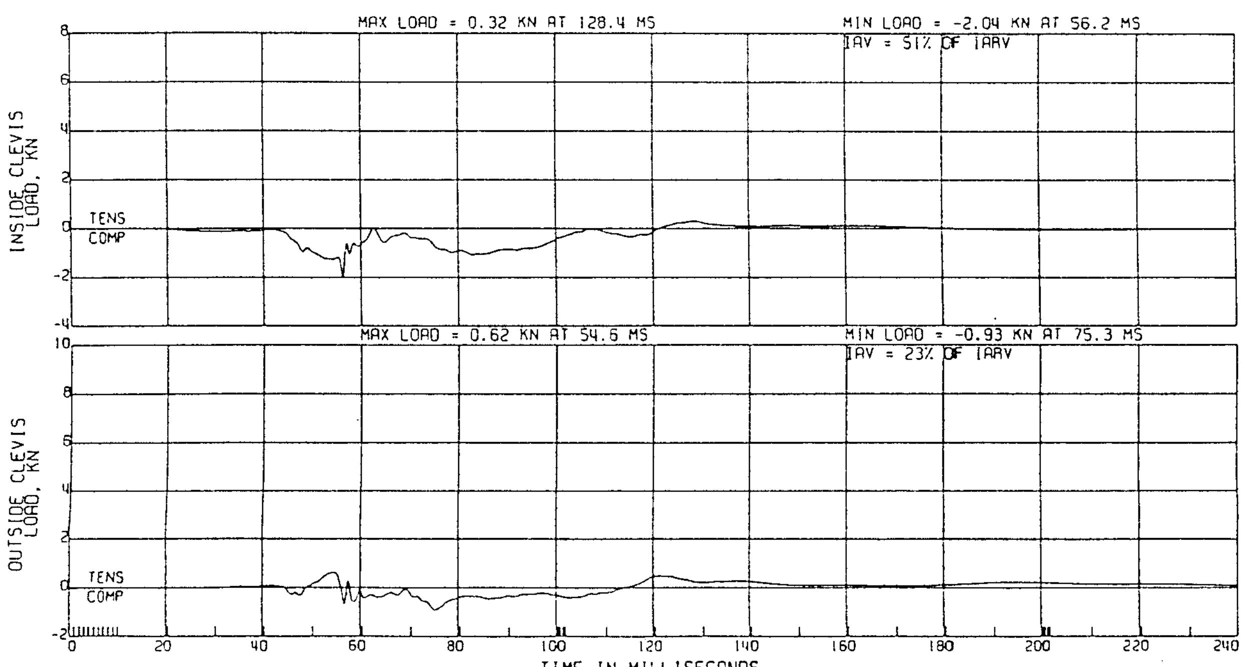
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 600

R. FRT LEFT KNEE CLEVIS LOAD

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 40

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

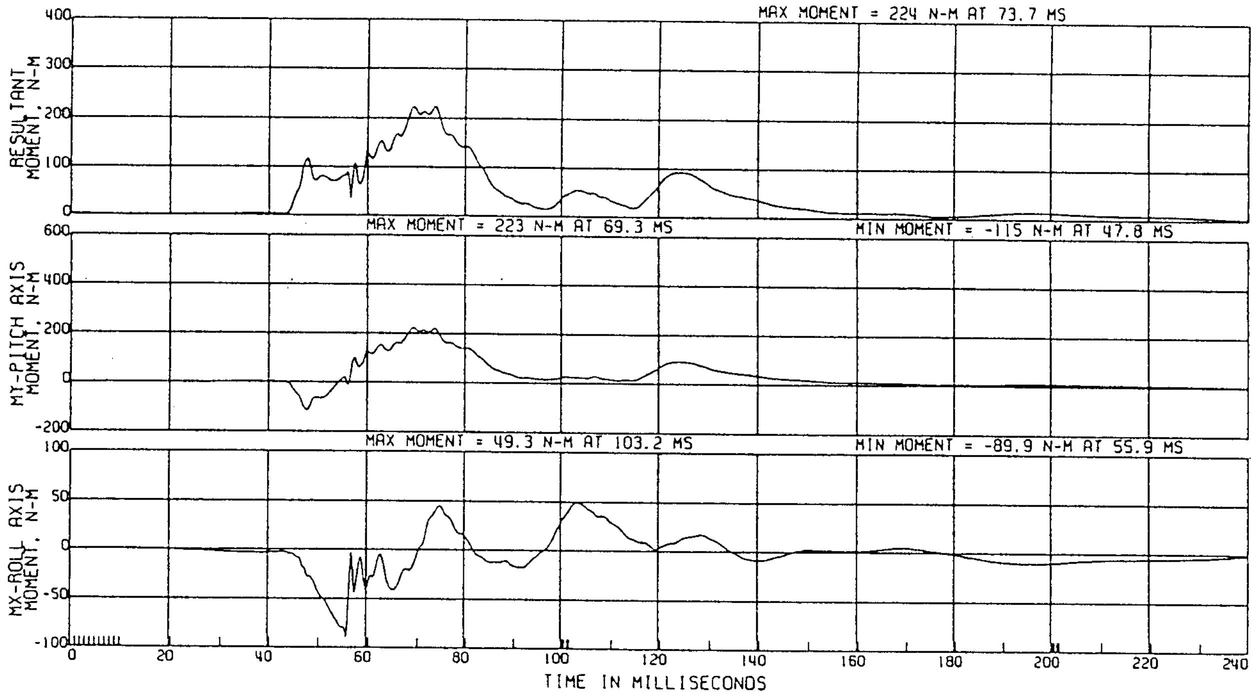
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 600

R. FRT LEFT TIBIA UPPER MOMENT

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot **# 41**

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

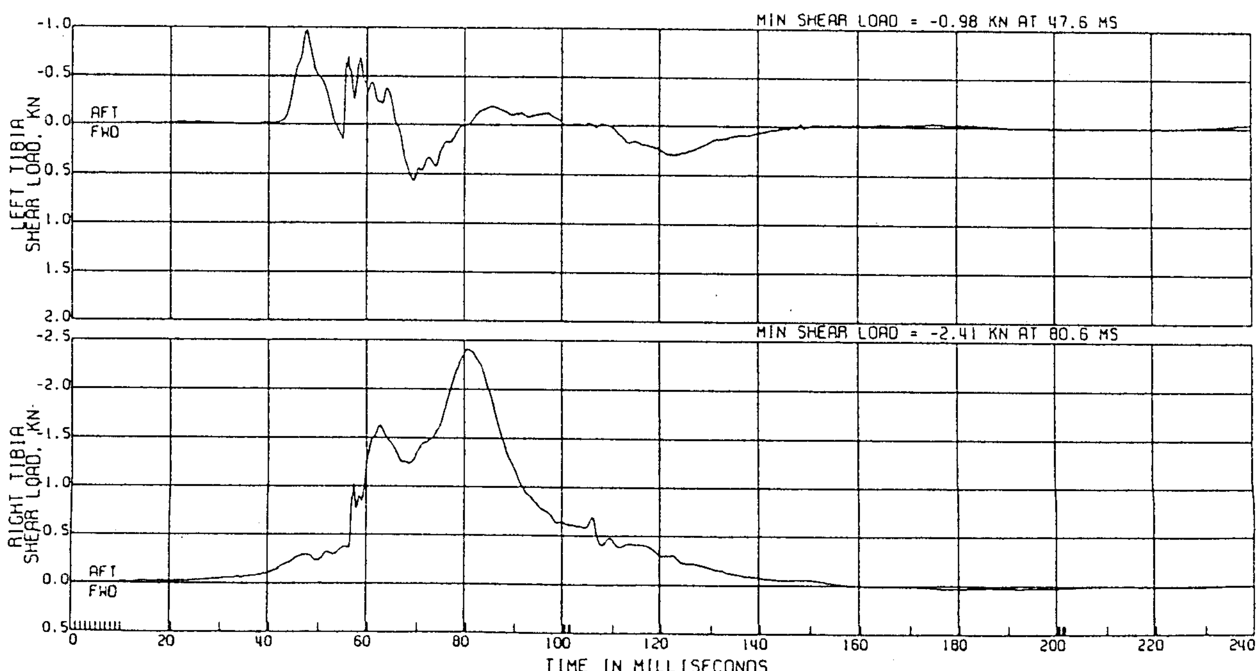
ATD TYPE: GM50H

R & D CTR 8T93070 VAN

TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 600

R. FRT TIBIA LOWER SHEAR LOAD CELLS



Appendix B, plot **# 42**

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

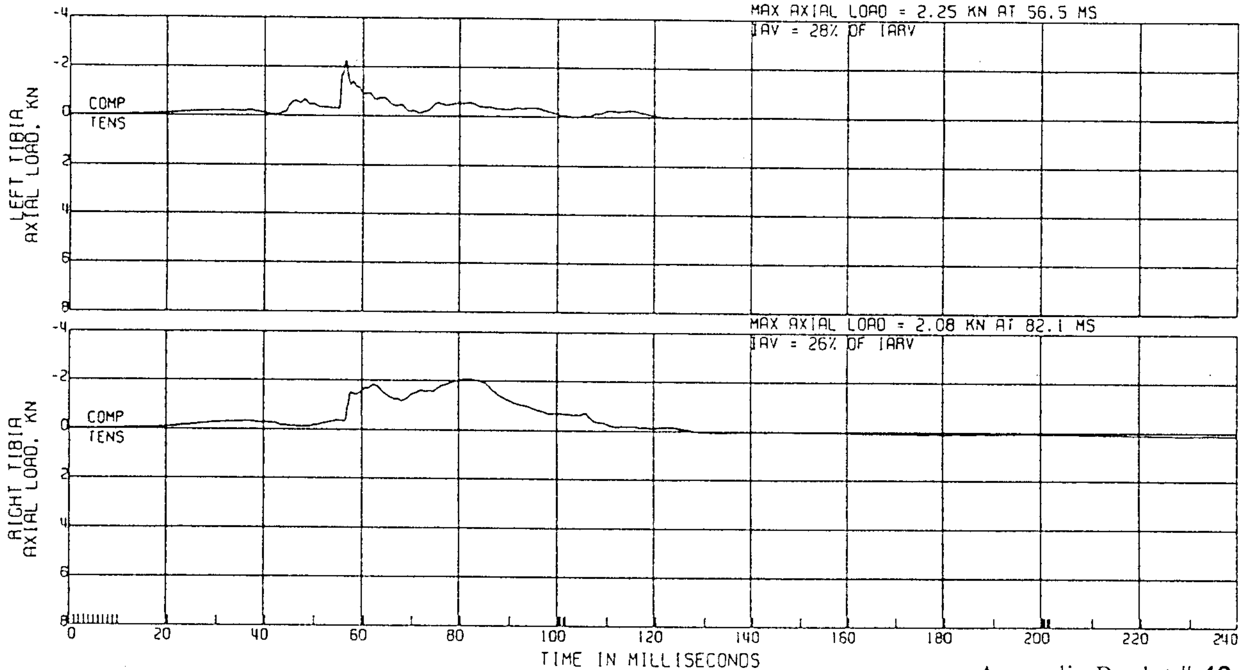
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H

TEST DATE:05/16/1996

R. FRT TIBIA LOWER AXIAL LOAD



Appendix B, plot # 43

43 PROCESSED 5/20/1996 10:21 V2.04E

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

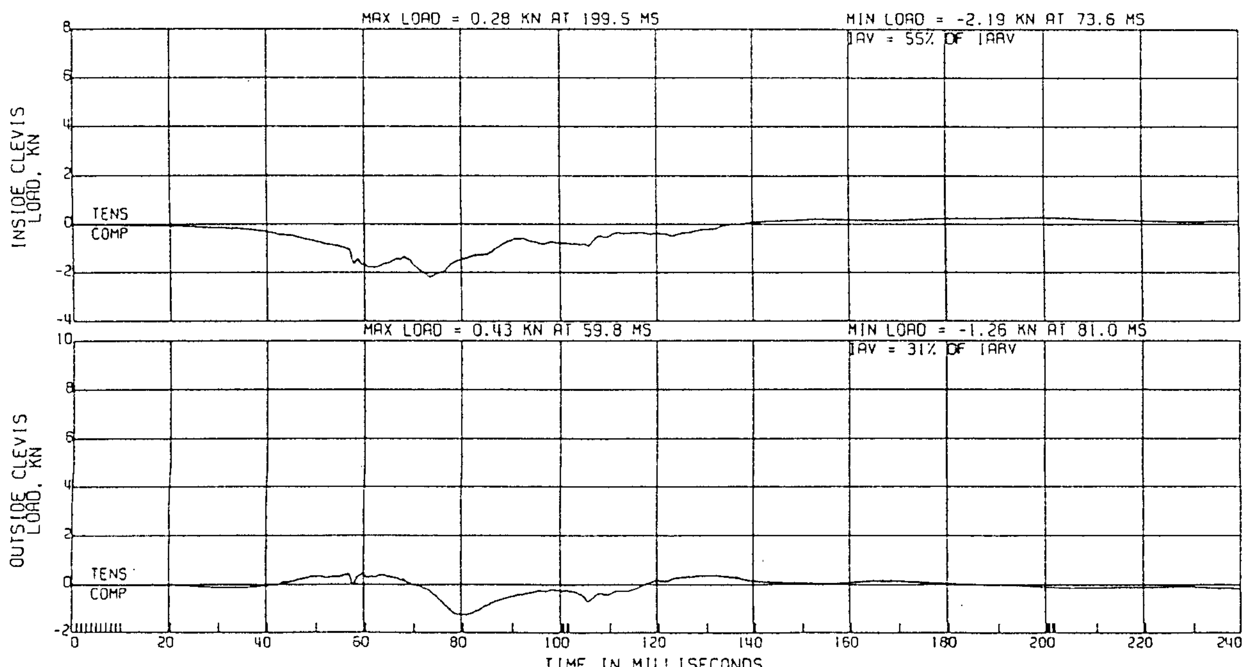
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H

TEST DATE:05/16/1996

R. FRT RIGHT KNEE CLEVIS LOAD



Appendix B, plot # 44

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

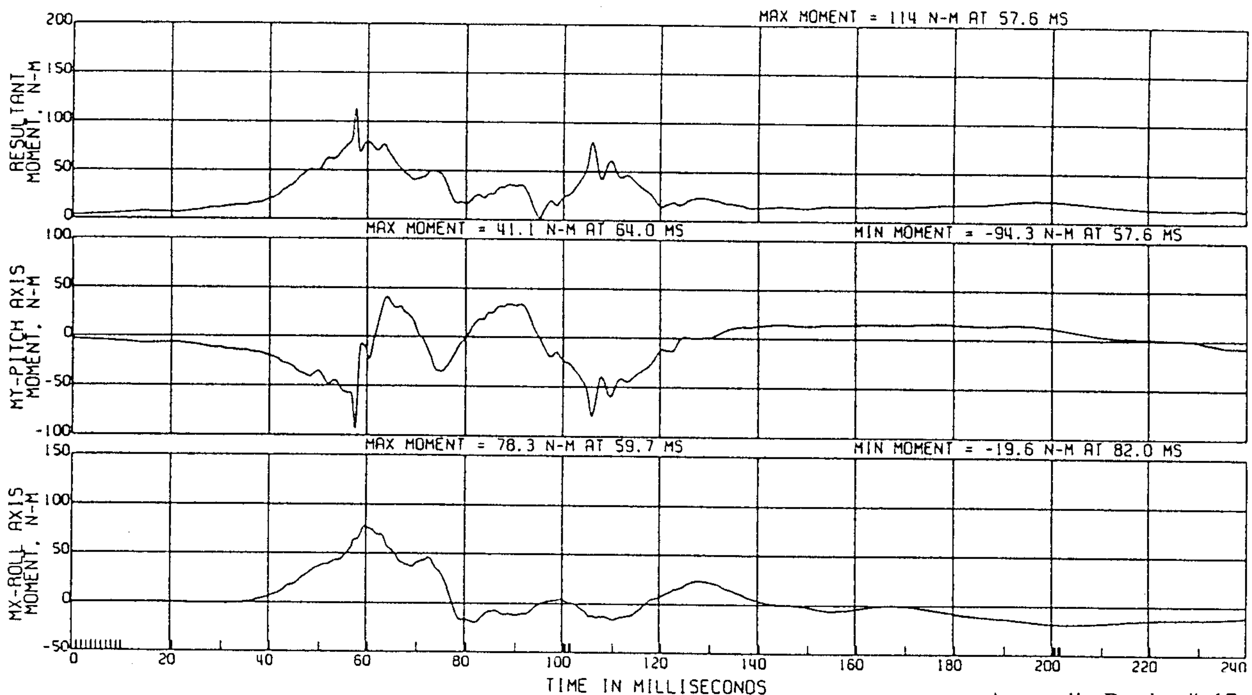
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 600

R. FRT RIGHT TIBIA UPPER MOMENT

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 45

45 PROCESSED 5/20/1996 10:21 V2.04E

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

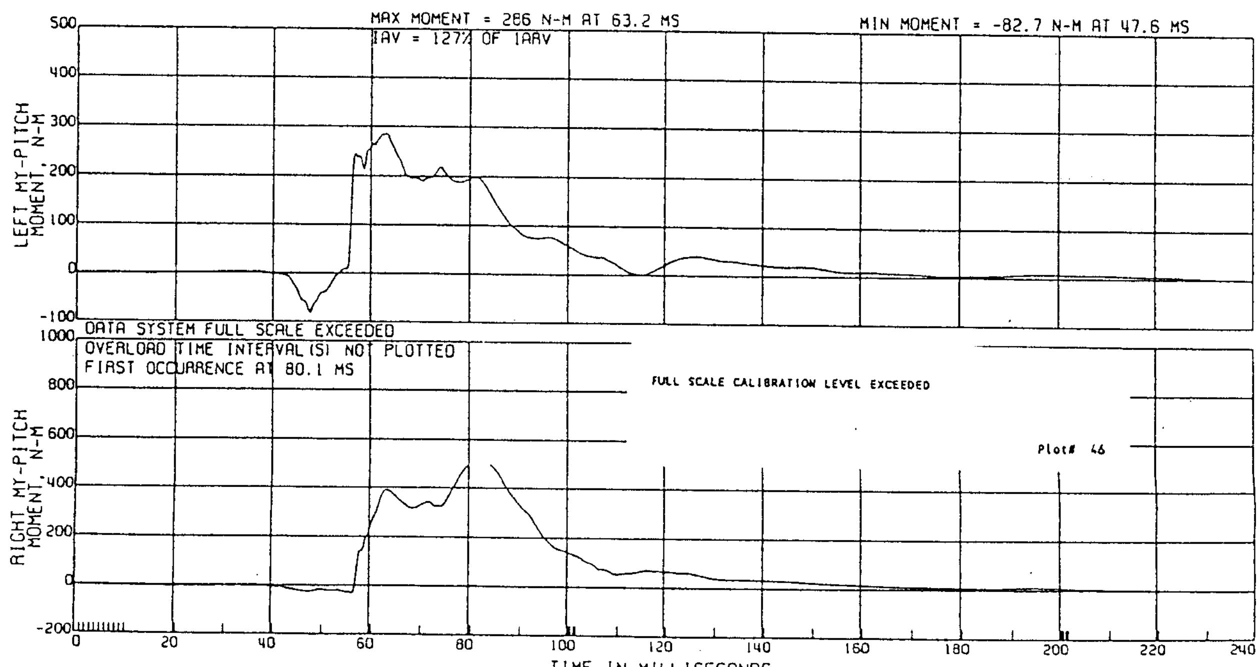
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H

TEST DATE:05/16/1996

R. FRT TIBIA LOWER BENDING MOMENTS



Appendix B, plot # 46

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

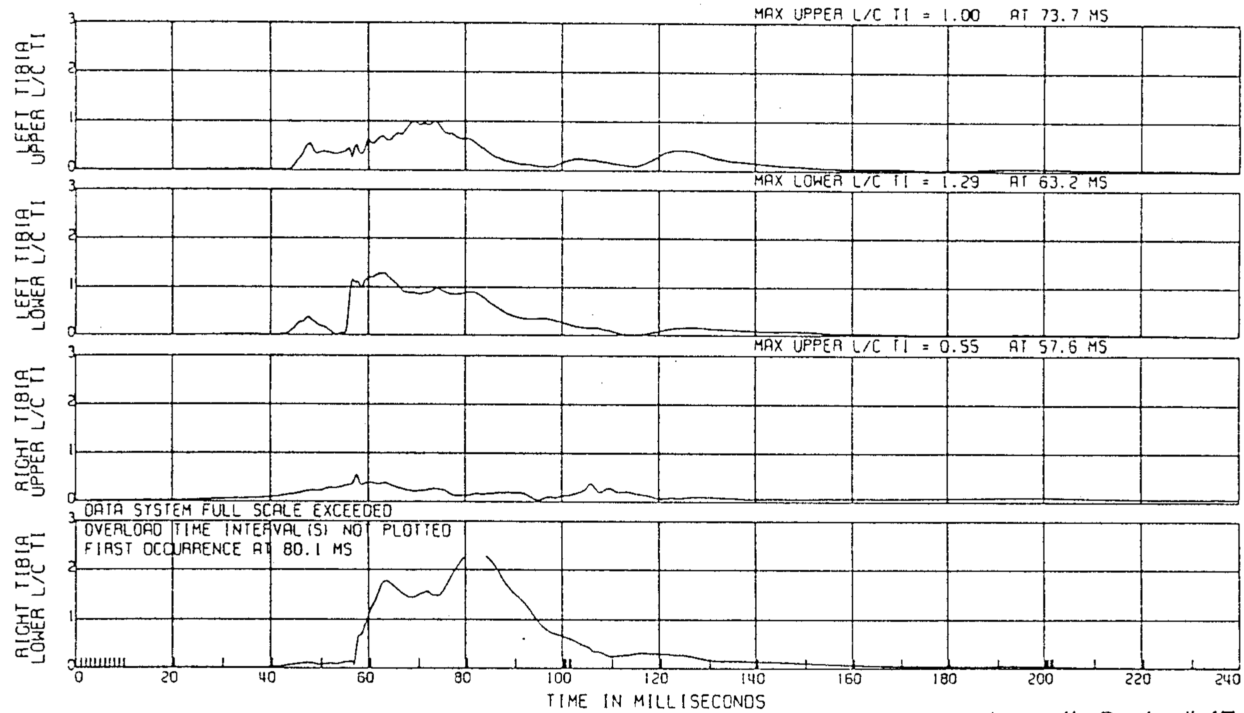
ELEC DATA, SAE CLASS 600

R. FRT TIBIA INDICES

TI = (RES MOM/225 NM) + (AXIAL/35900 N)

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 47

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

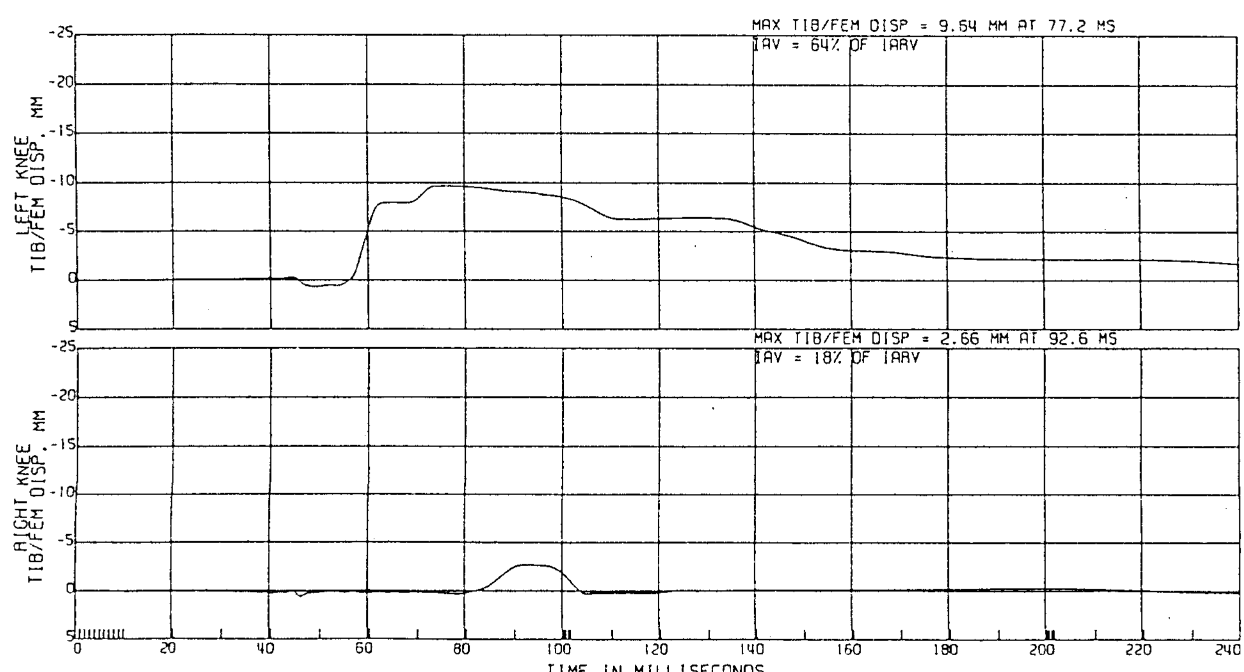
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

R. FRT TIBIA/FEMUR DISPLACEMENT

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 48

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

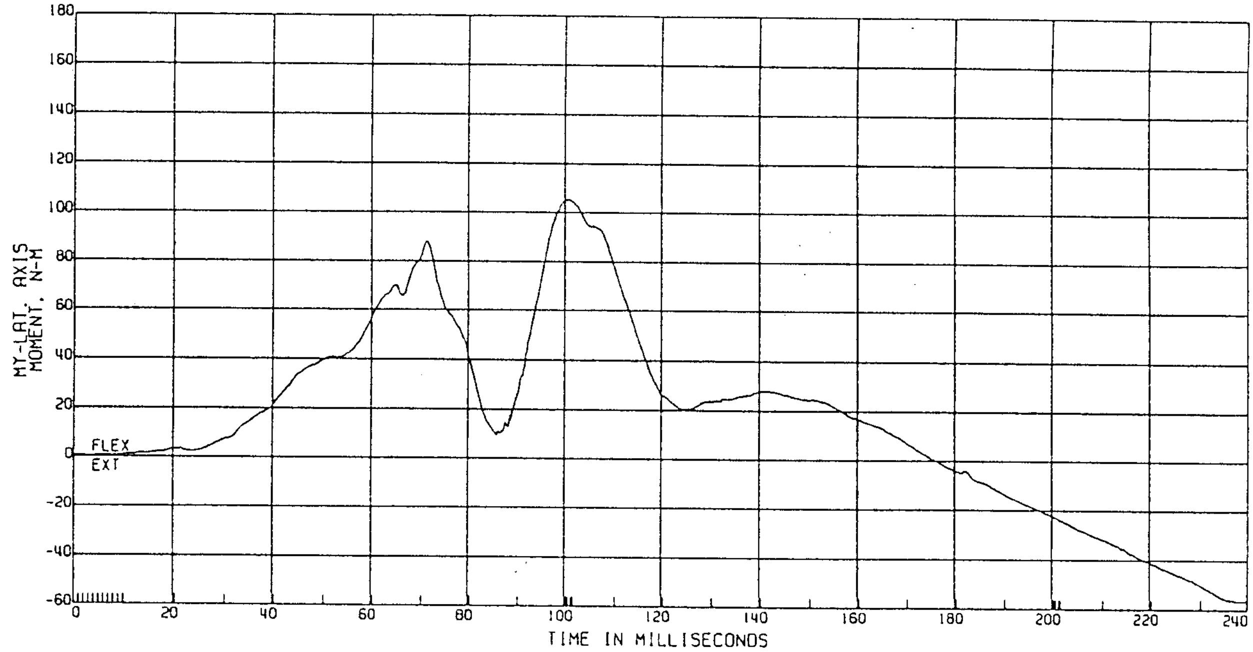
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

L. FRT LOWER LUMBAR MOMENT

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 49

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

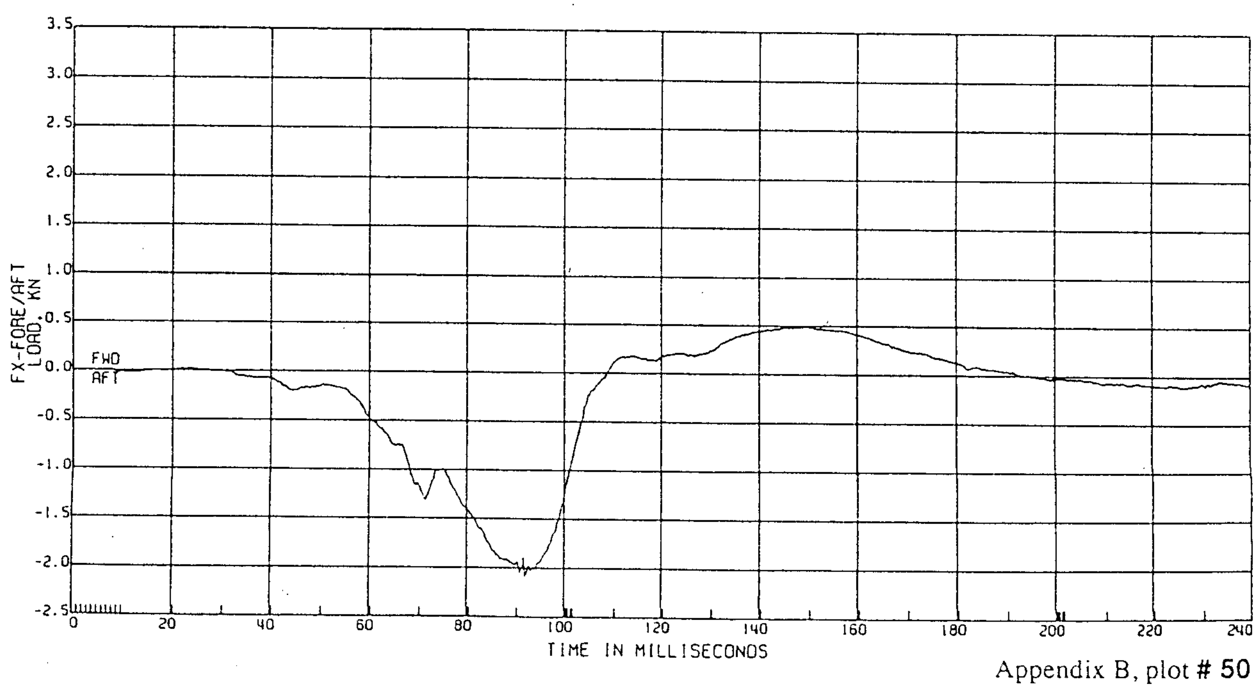
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

L. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 50

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

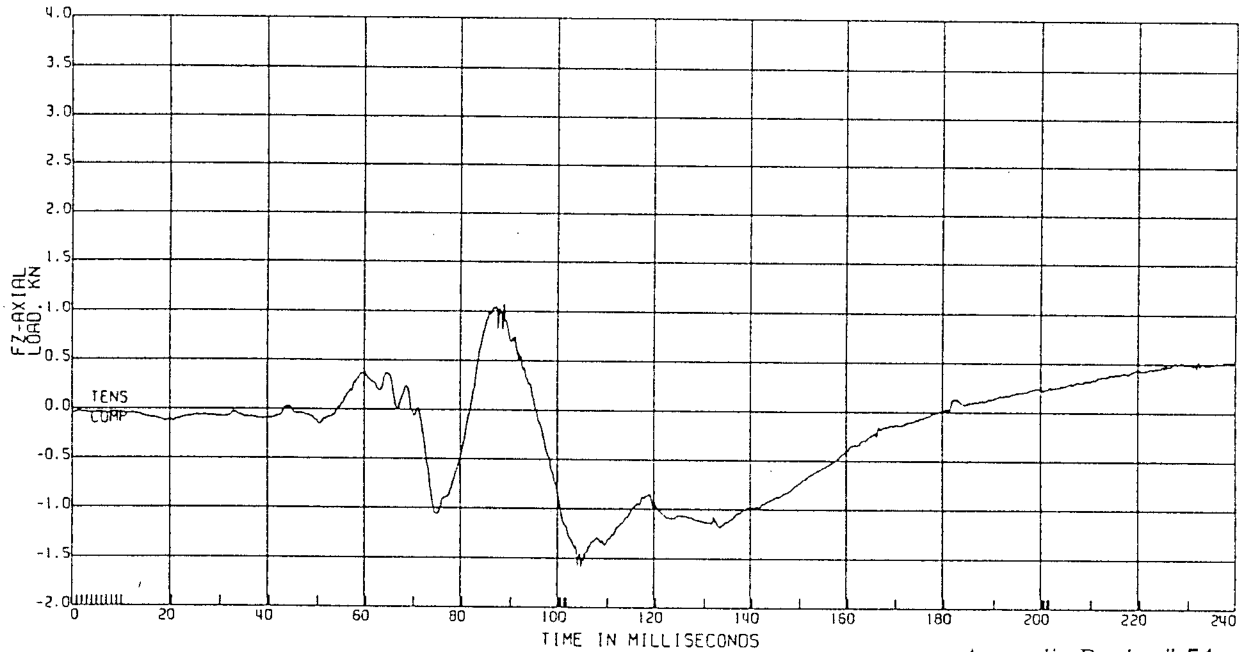
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

L. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 51

51 PROCESSED 5/20/1996 10:21 V2.04E

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

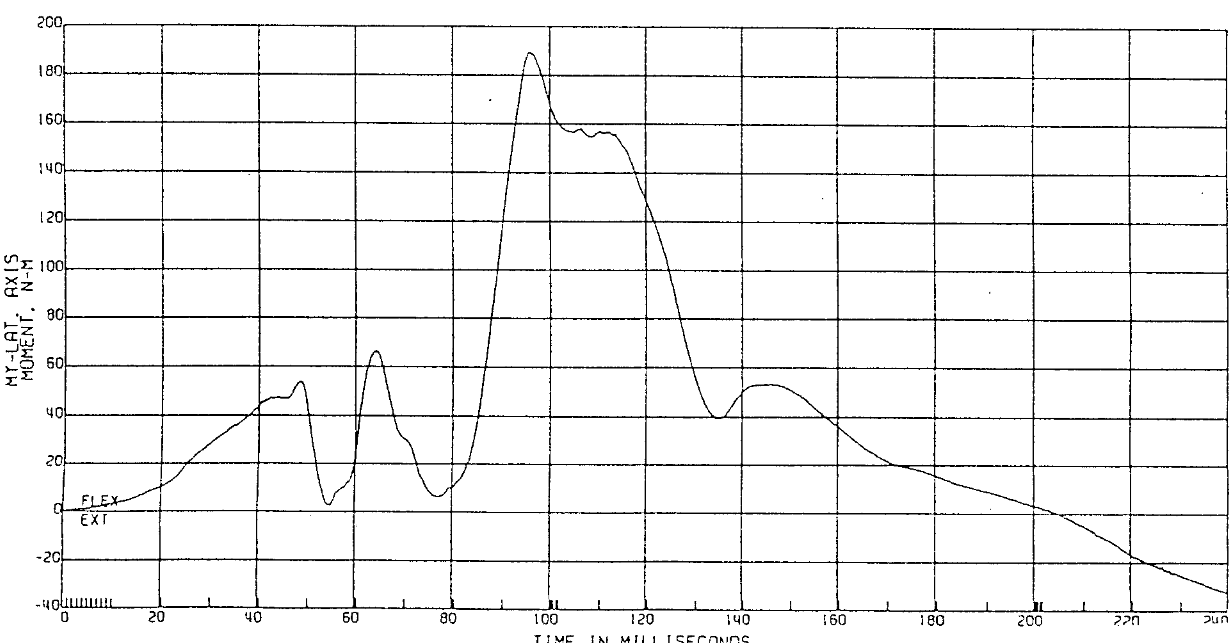
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

R. FRT LOWER LUMBAR MOMENT

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 52

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

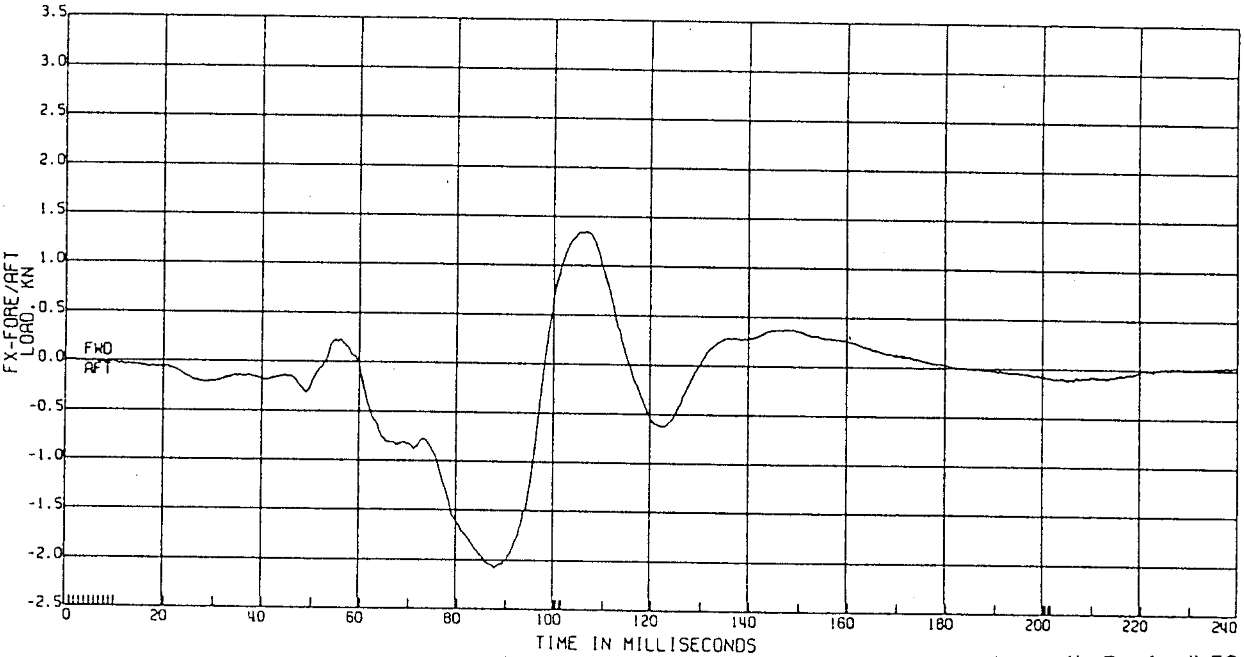
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

R. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H

TEST DATE:05/16/1996



Appendix B, plot # 53

53 PROCESSED 5/20/1996 10:21 V2.04E

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

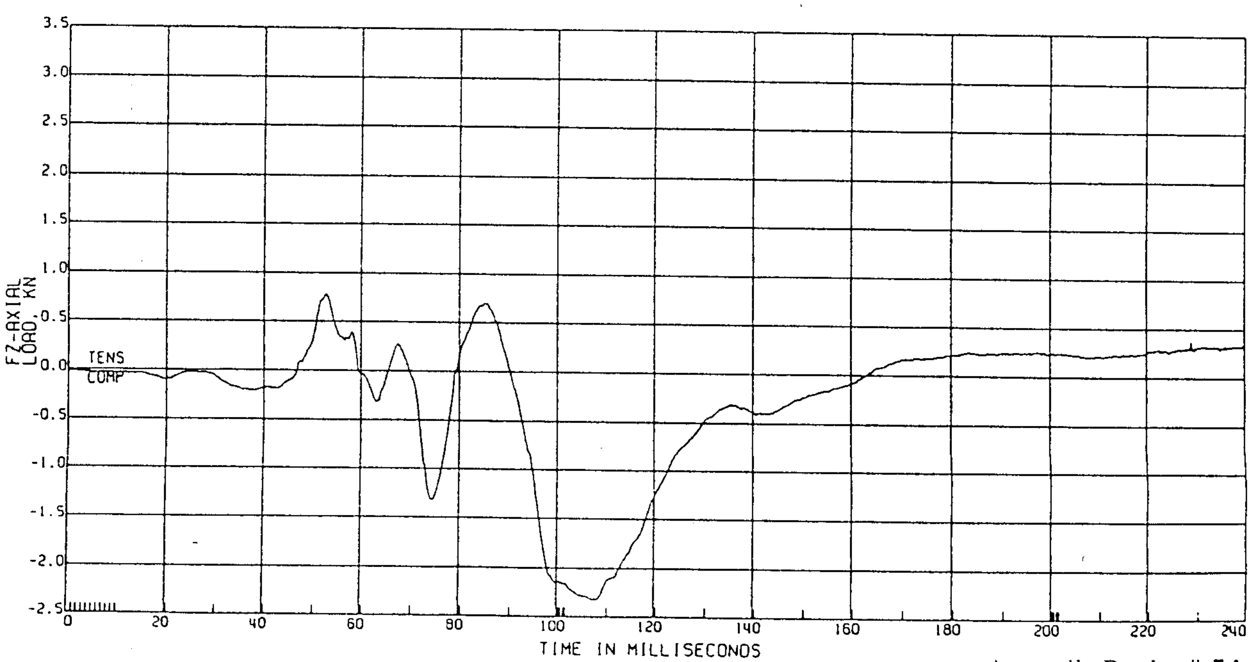
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

R. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H

TEST DATE:05/16/1996



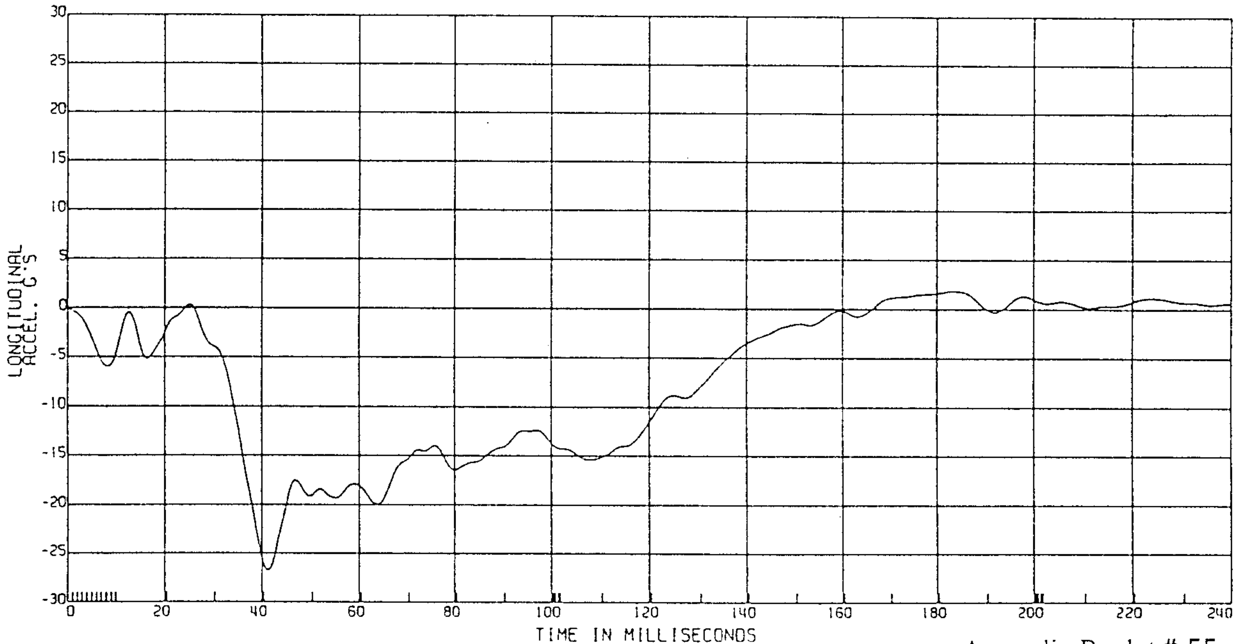
Appendix B, plot # 54

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

L. FRT ROCKER ACCEL

R & D CTR 8T93070 VAN TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 60



Appendix B, plot # 55

55 PROCESSED 5/20/1996 10:21 V2.04E

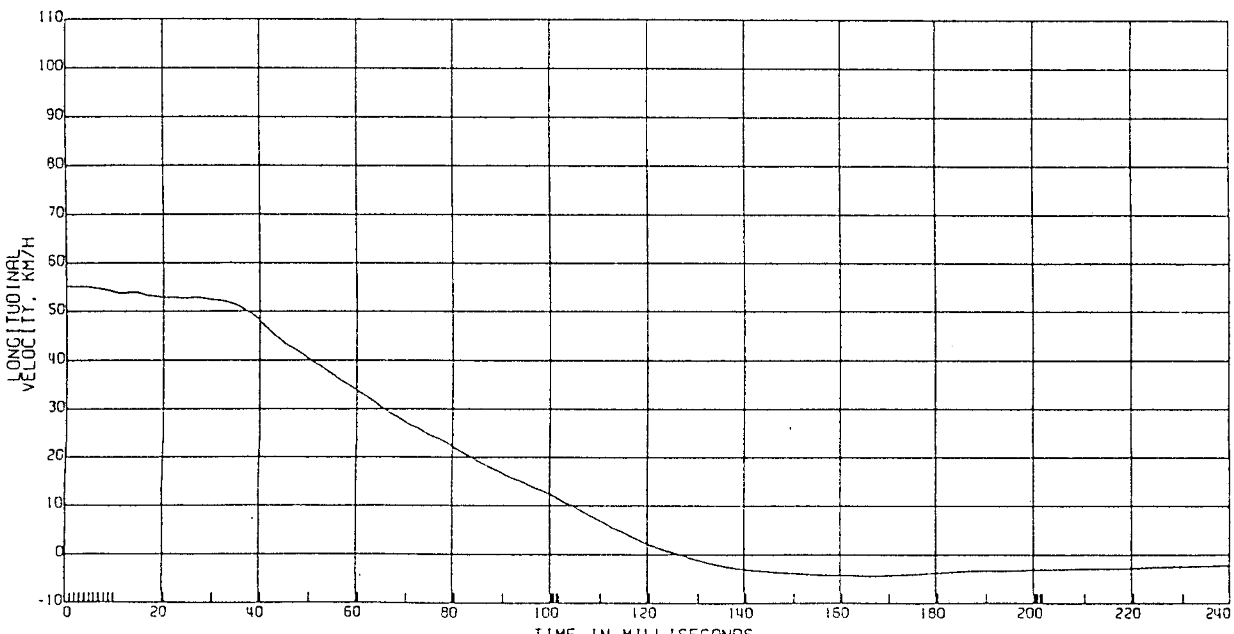
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

L. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

R & D CTR 8T93070 VAN TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 180



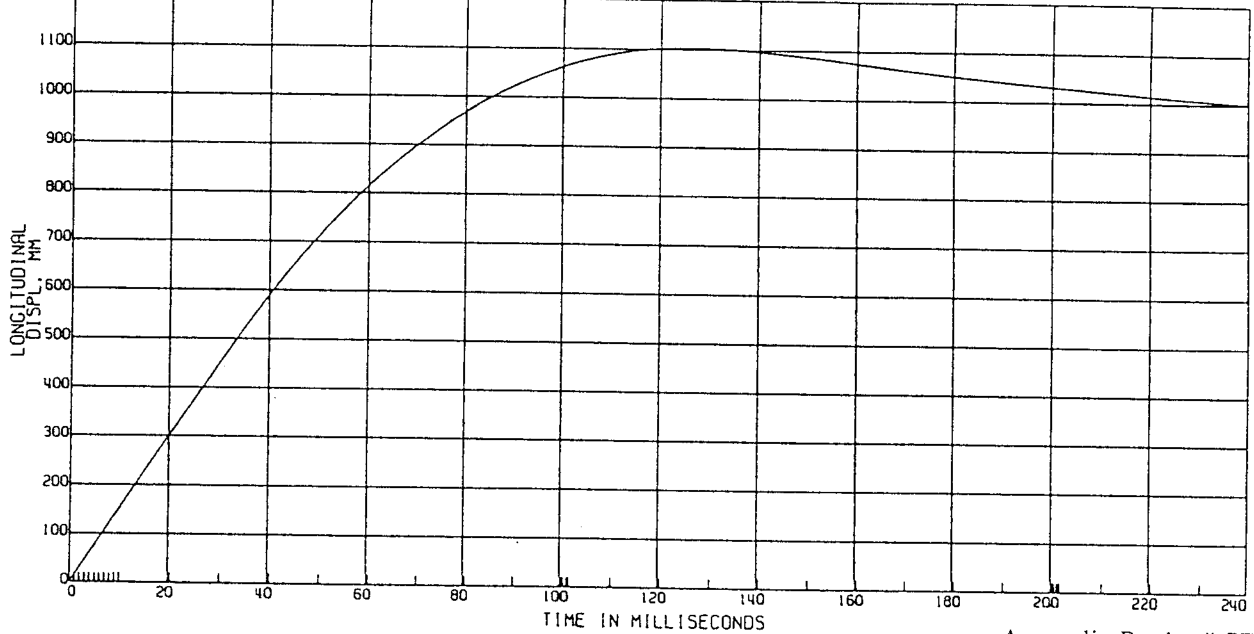
Appendix B, plot # 56

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 180

L. FRT ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 57

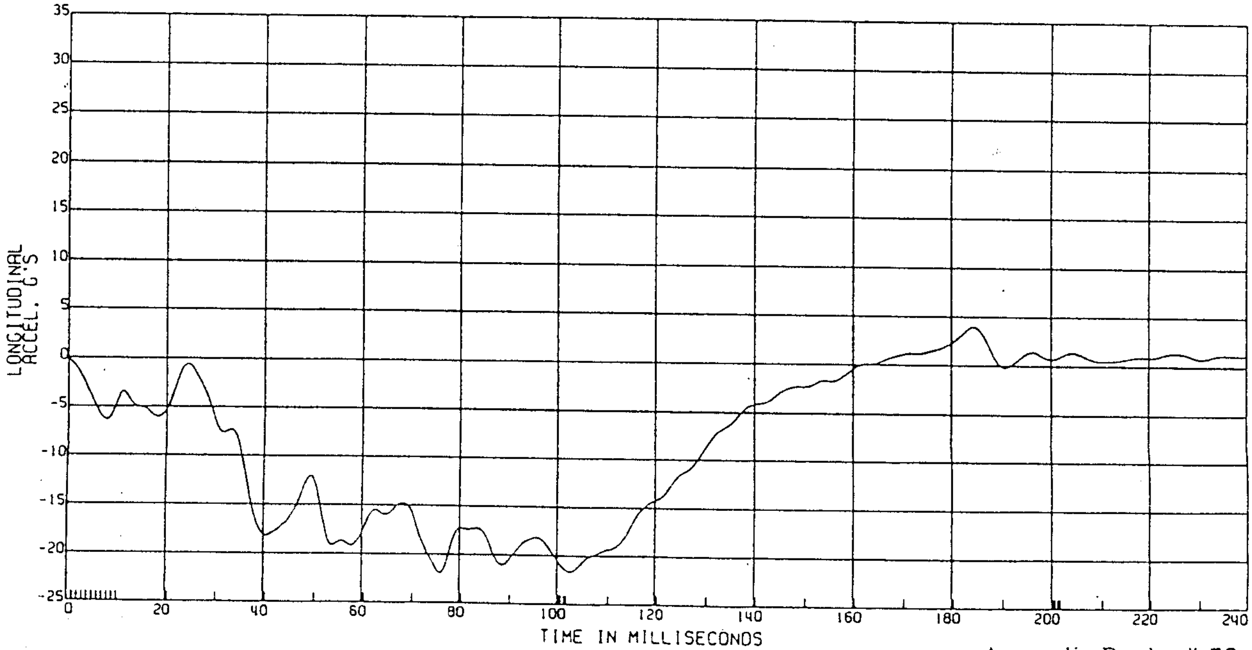
57 PROCESSED 5/20/1996 10:21 V2.04E

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 60

R. FRT ROCKER ACCEL

TEST DATE:05/16/1996



Appendix B, plot # 58

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

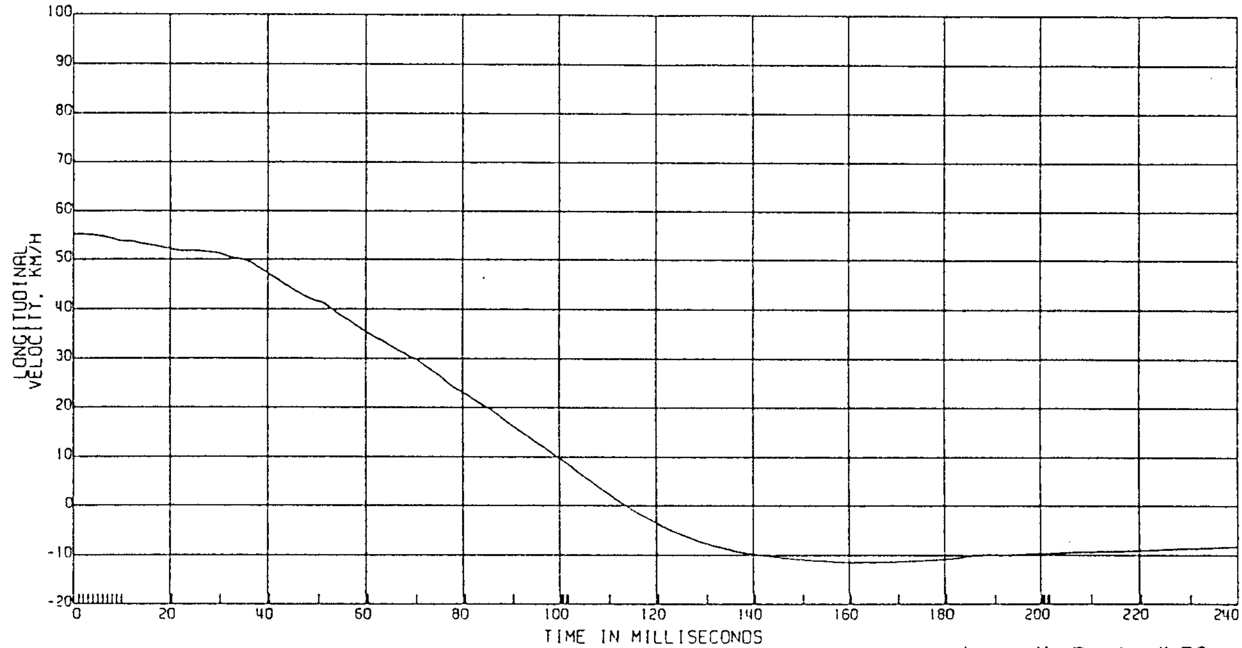
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

R. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 59

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

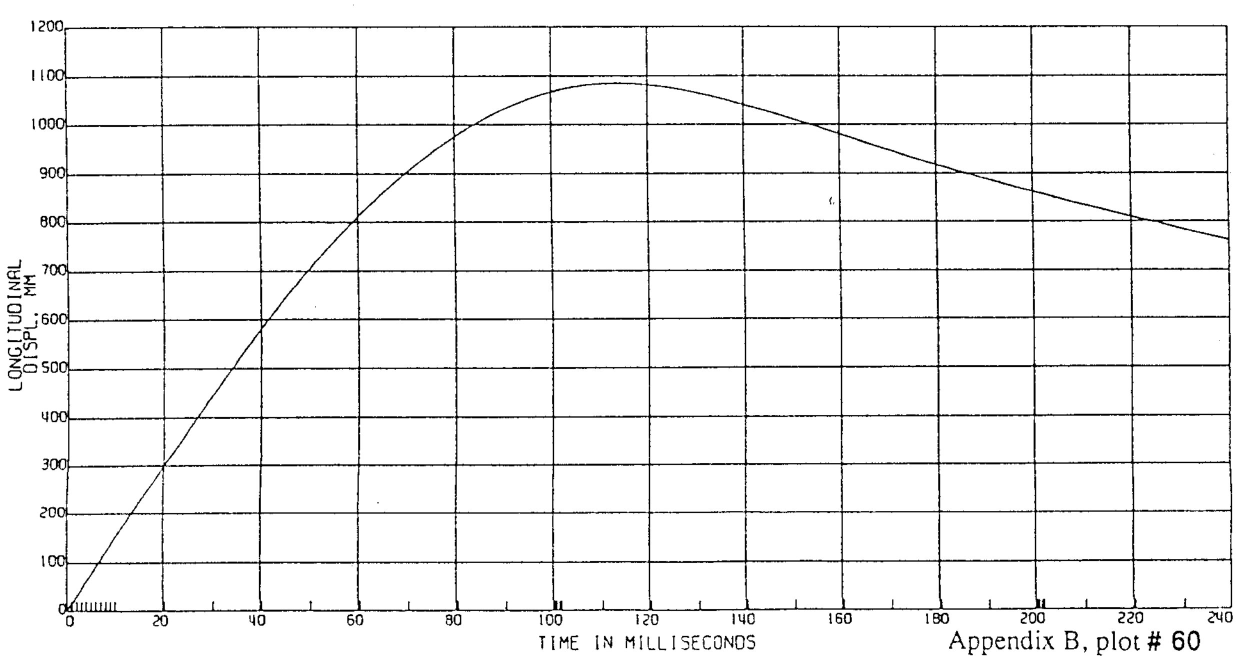
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

R. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 60

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

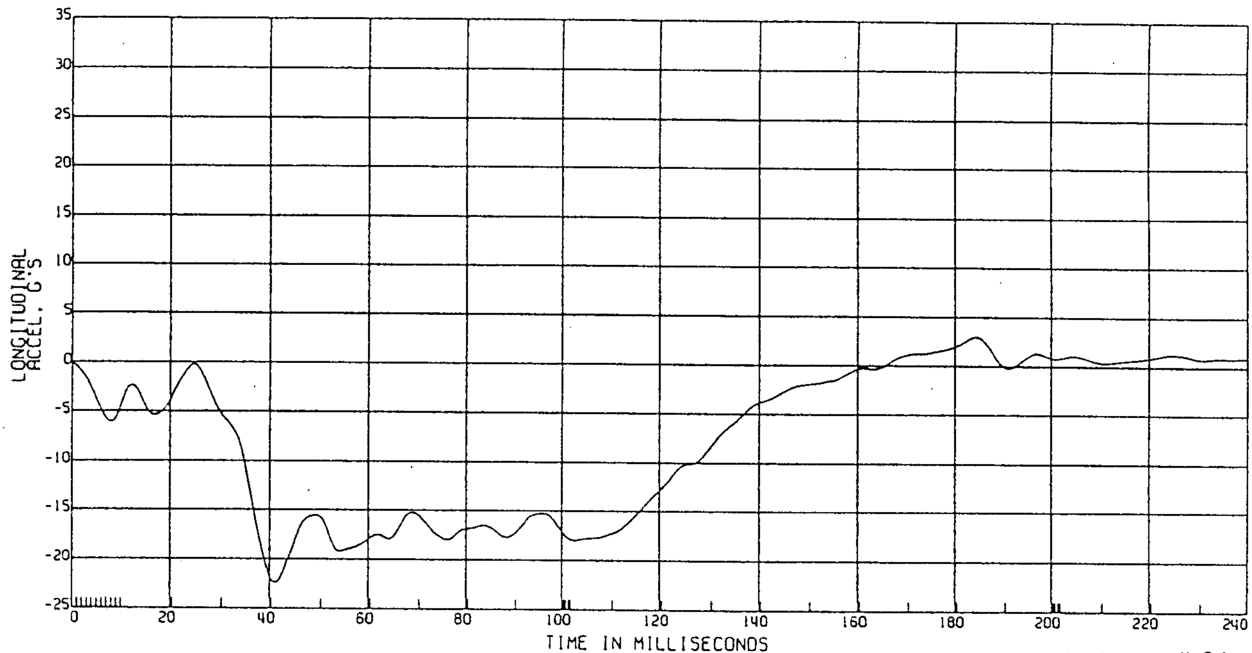
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 60

AVERAGED FRT ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:05/16/1996



Appendix B, plot # 61

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

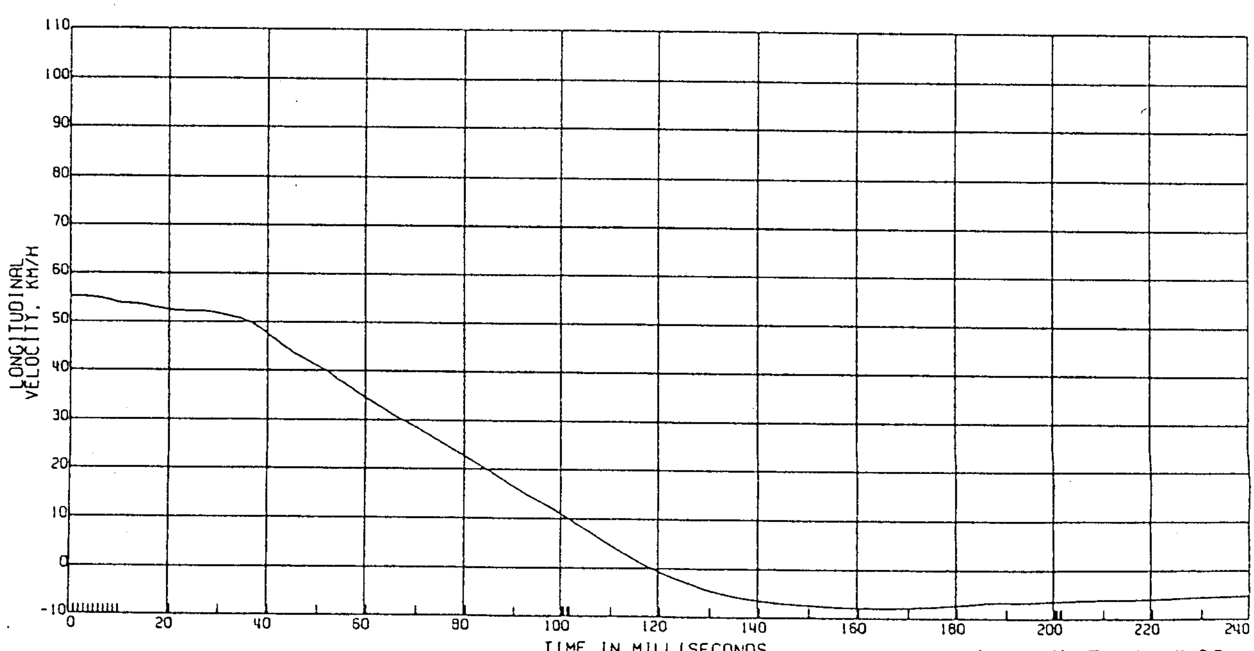
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 62

CI1108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

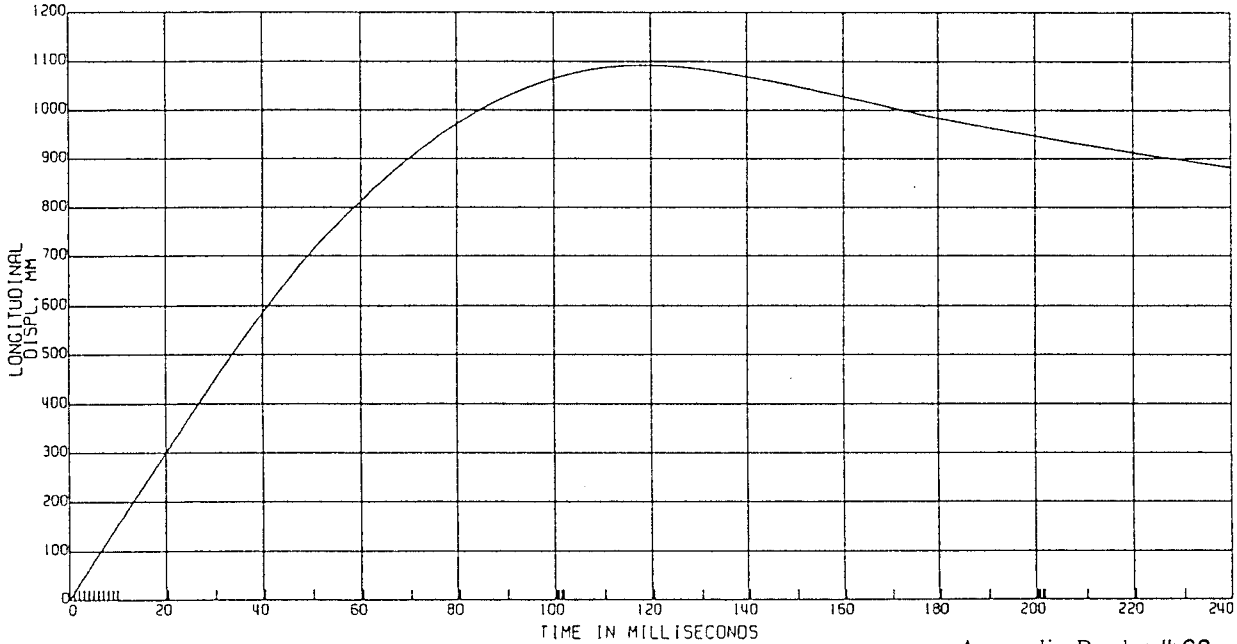
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 63

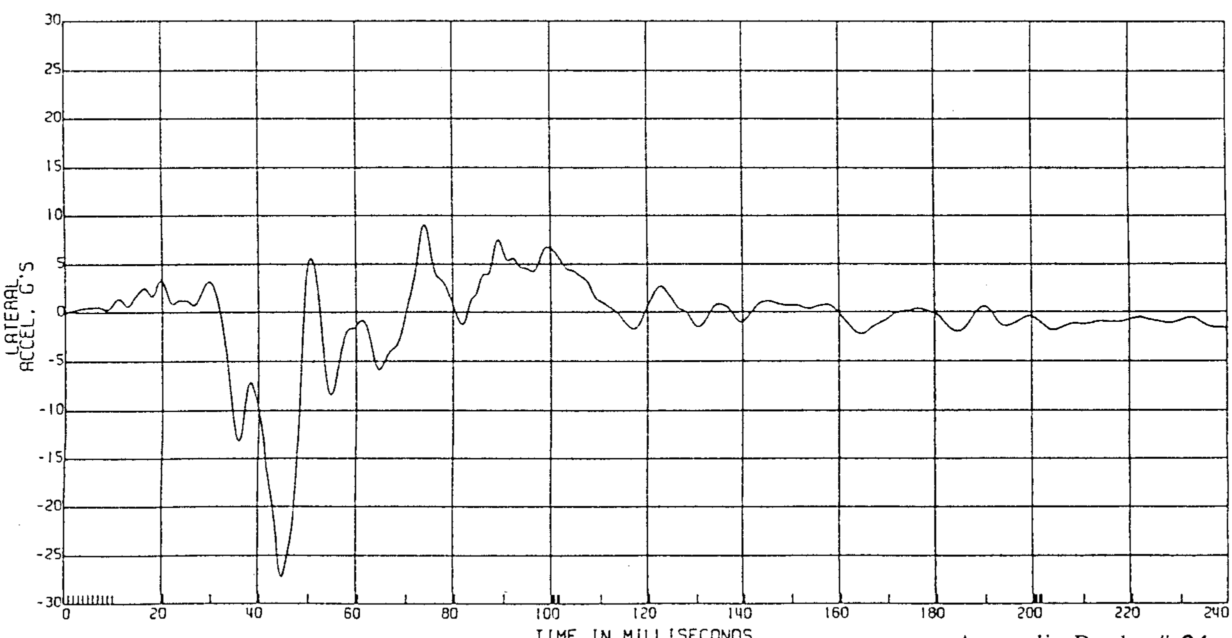
CI1108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 60

L. FRT ROCKER ACCEL

TEST DATE:05/16/1996



Appendix B, plot # 64

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

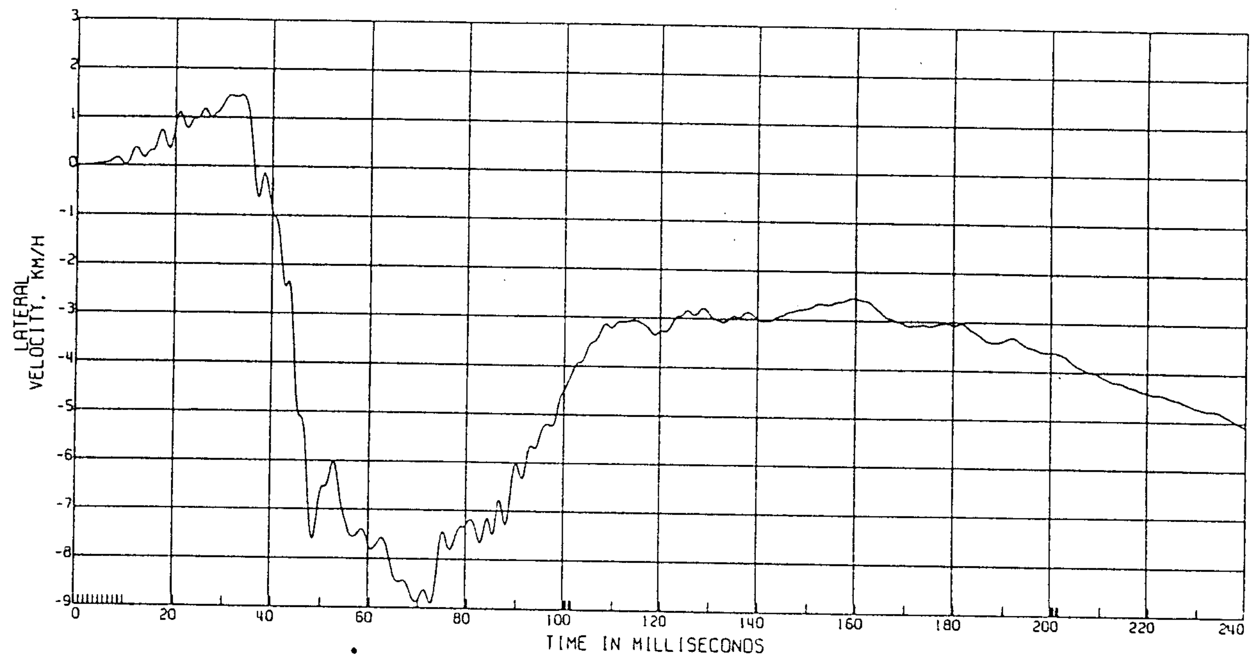
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 65

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

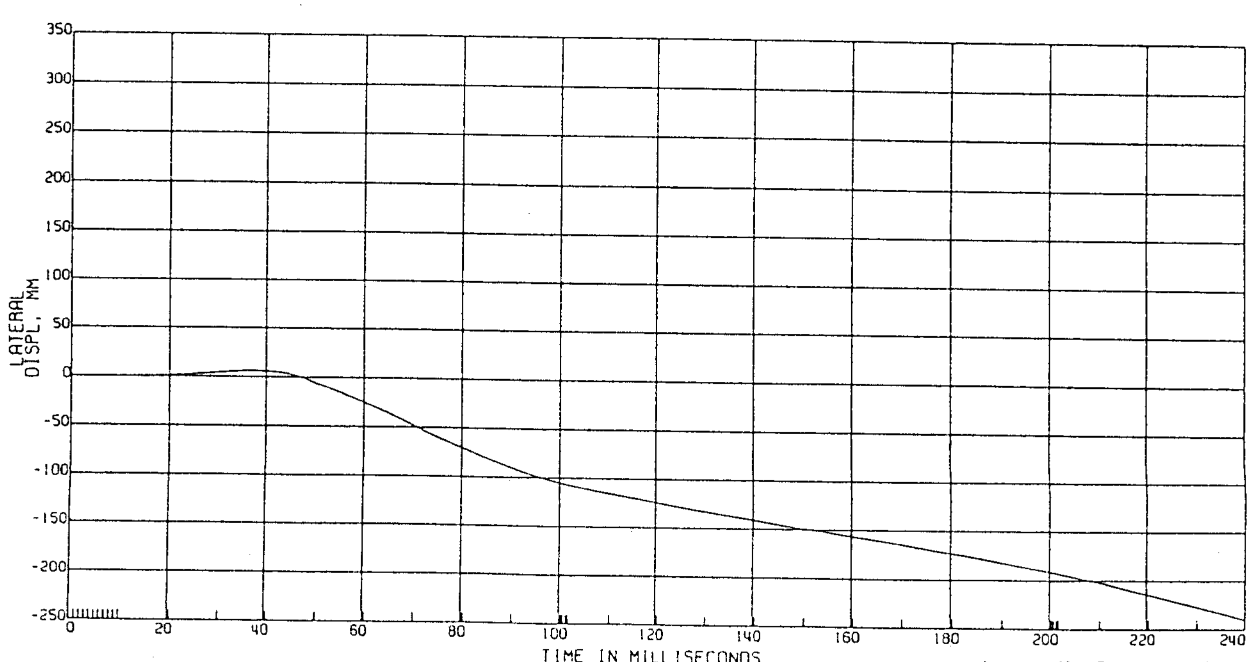
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 66

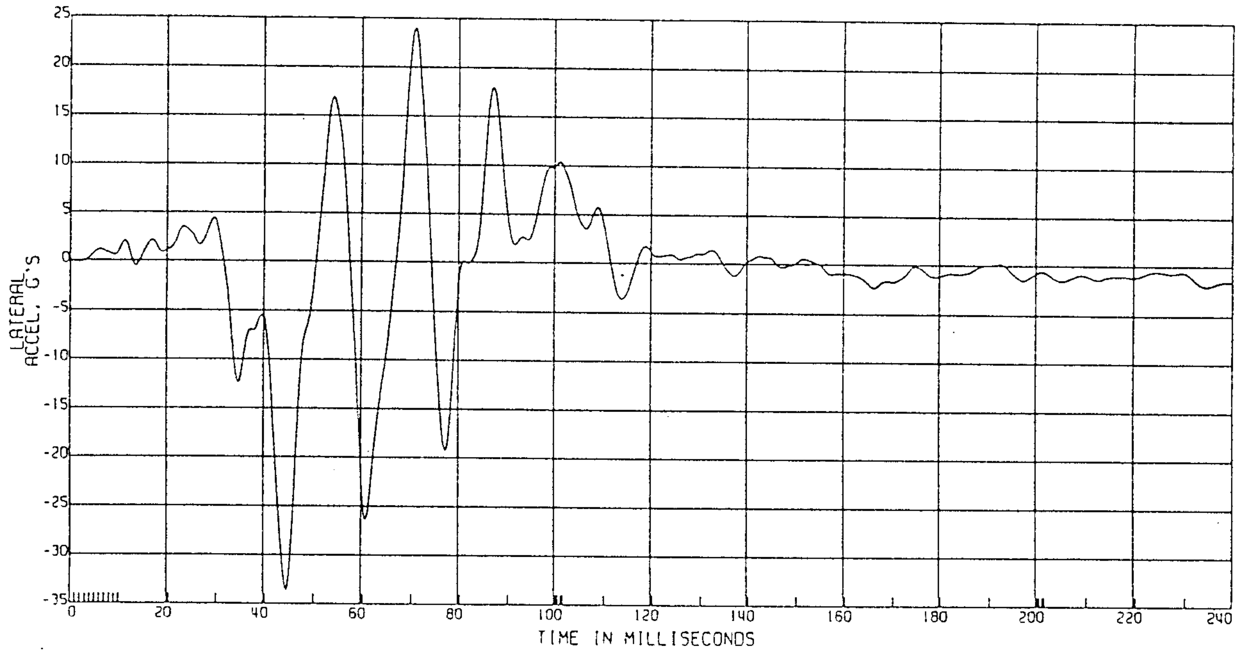
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

R. FRT ROCKER ACCEL

TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 60



Appendix B, plot # 67

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

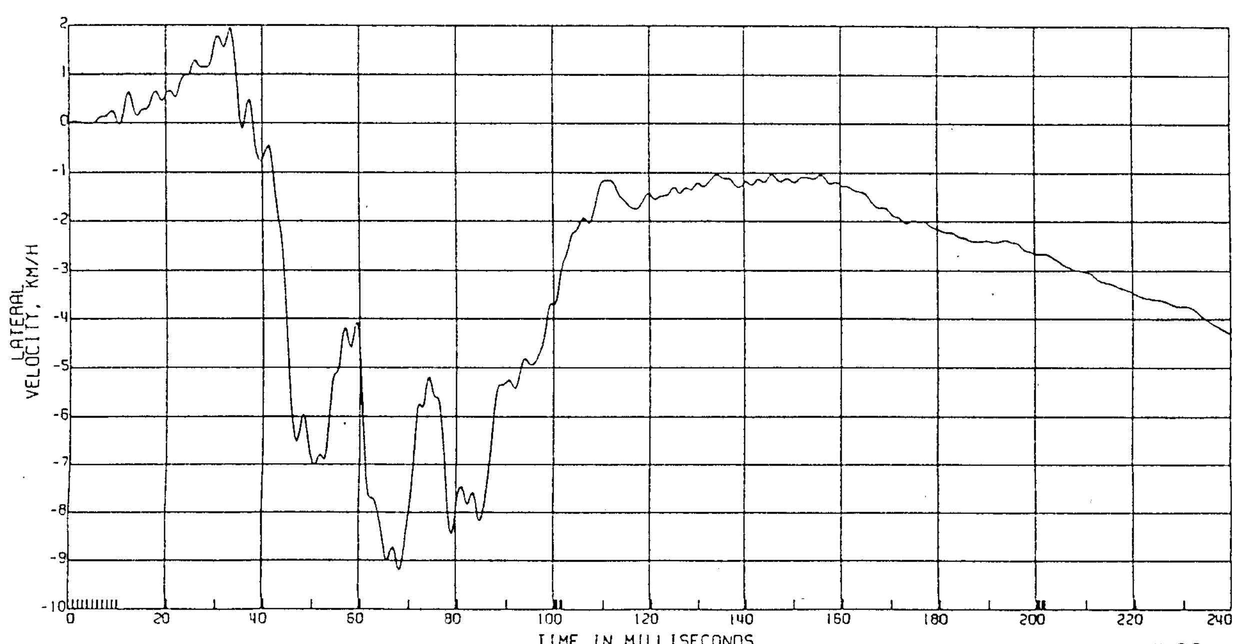
R & D CTR 8T93070 VAN

R. FRT ROCKER VELOCITY

TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 180

(COMPUTED FROM ACCELERATION)



Appendix B, plot # 68

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

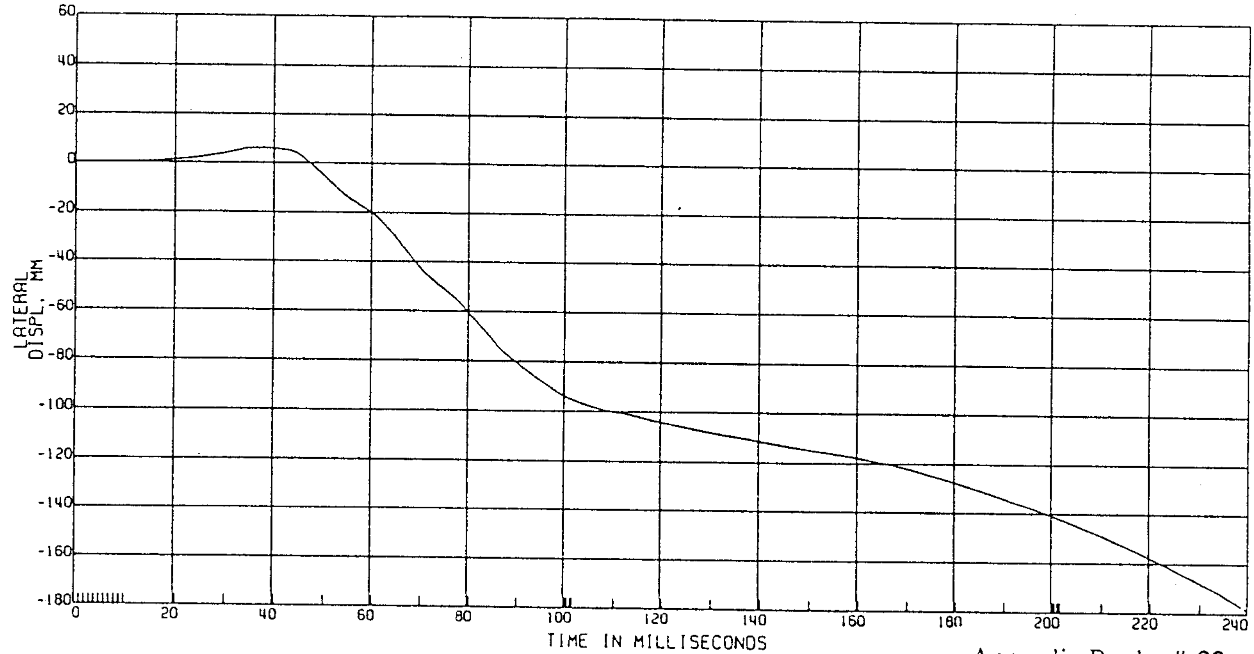
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

R. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 69

69 PROCESSED 5/20/1996 10:21 V2.04E

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

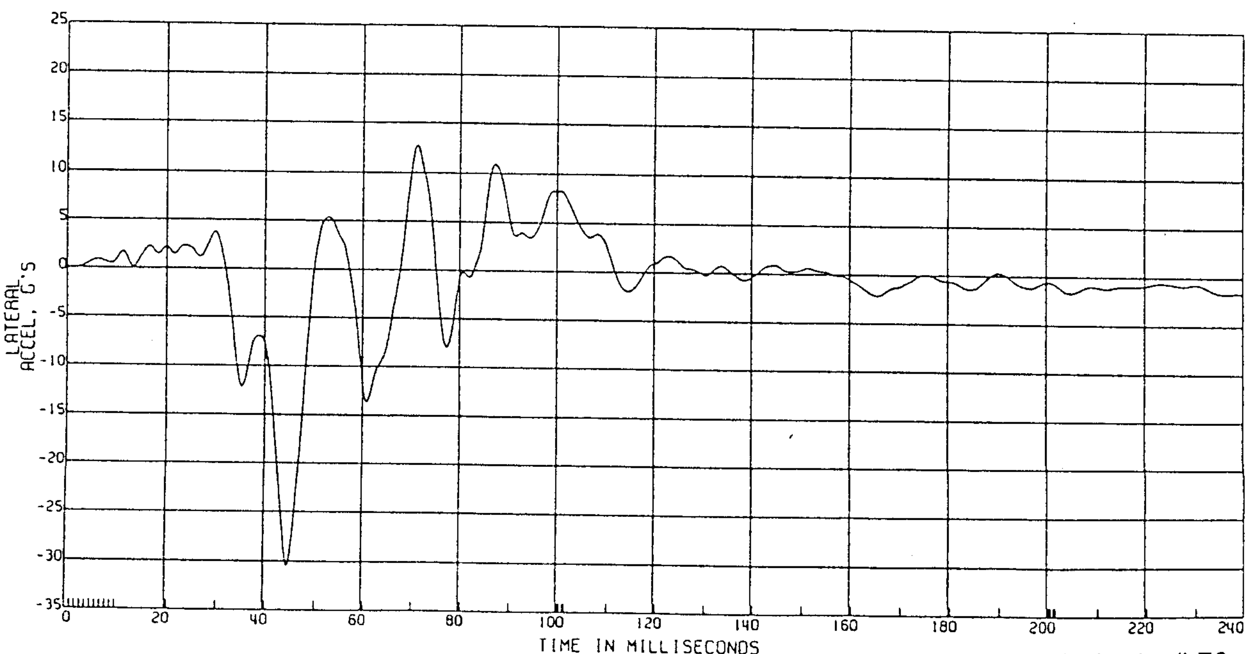
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 60

AVERAGED FRT ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:05/16/1996



Appendix B, plot # 70

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

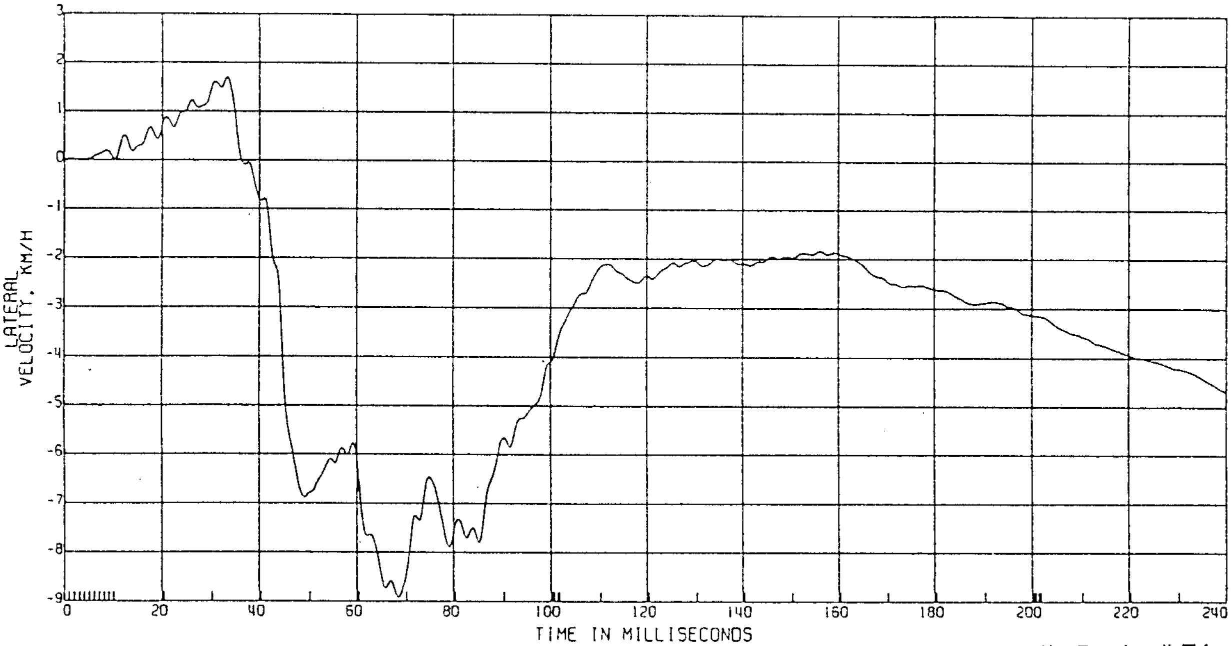
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 71

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

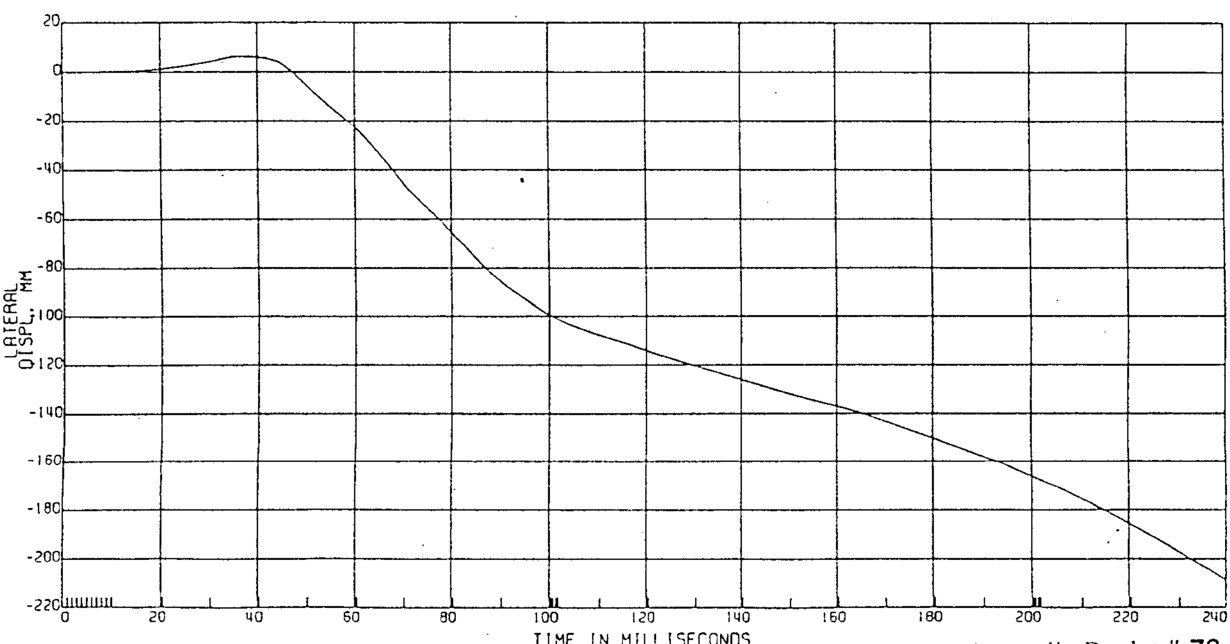
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996

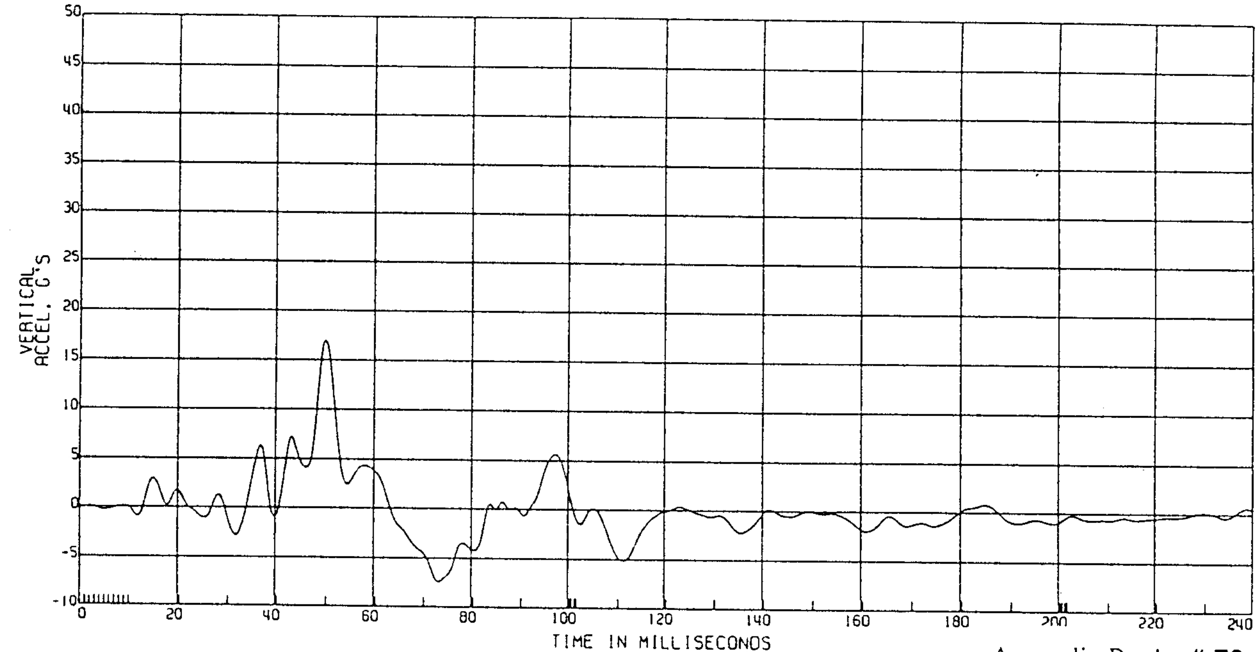


Appendix B, plot # 72

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN L. FRT ROCKER ACCEL TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 60



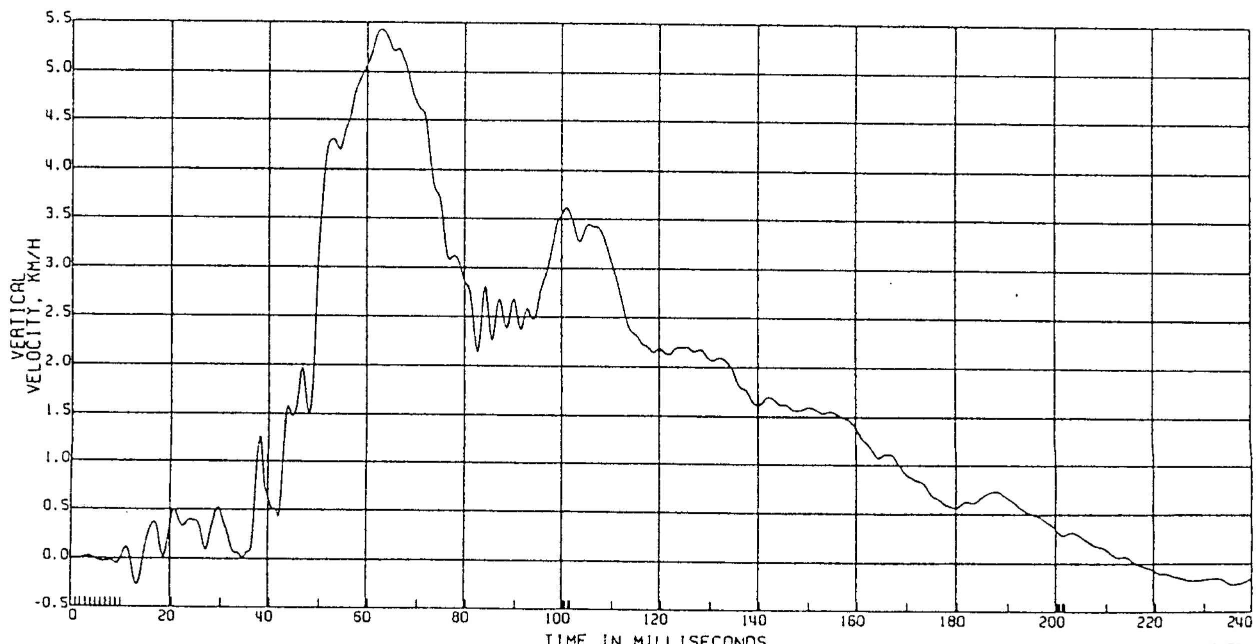
Appendix B, plot # 73

73 PROCESSED 5/20/1996 10:21 V2.04E

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN L. FRT ROCKER VELOCITY TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 180 (COMPUTED FROM ACCELERATION)



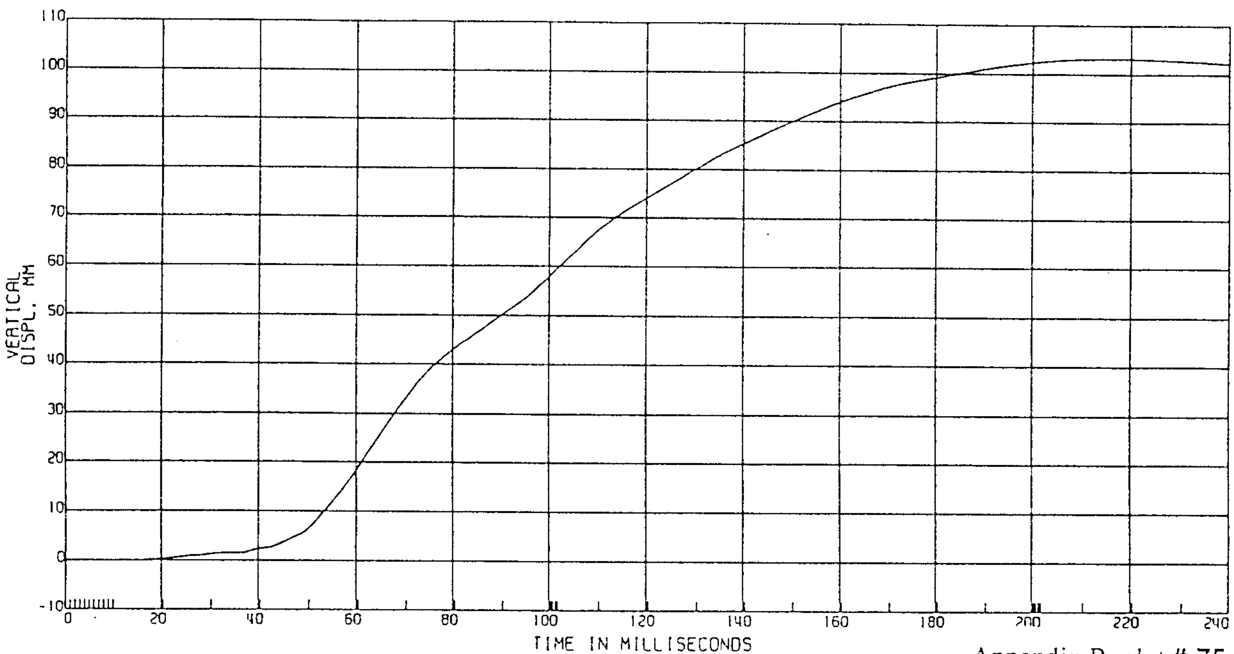
Appendix B, plot # 74

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 180

L. FRT ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 75

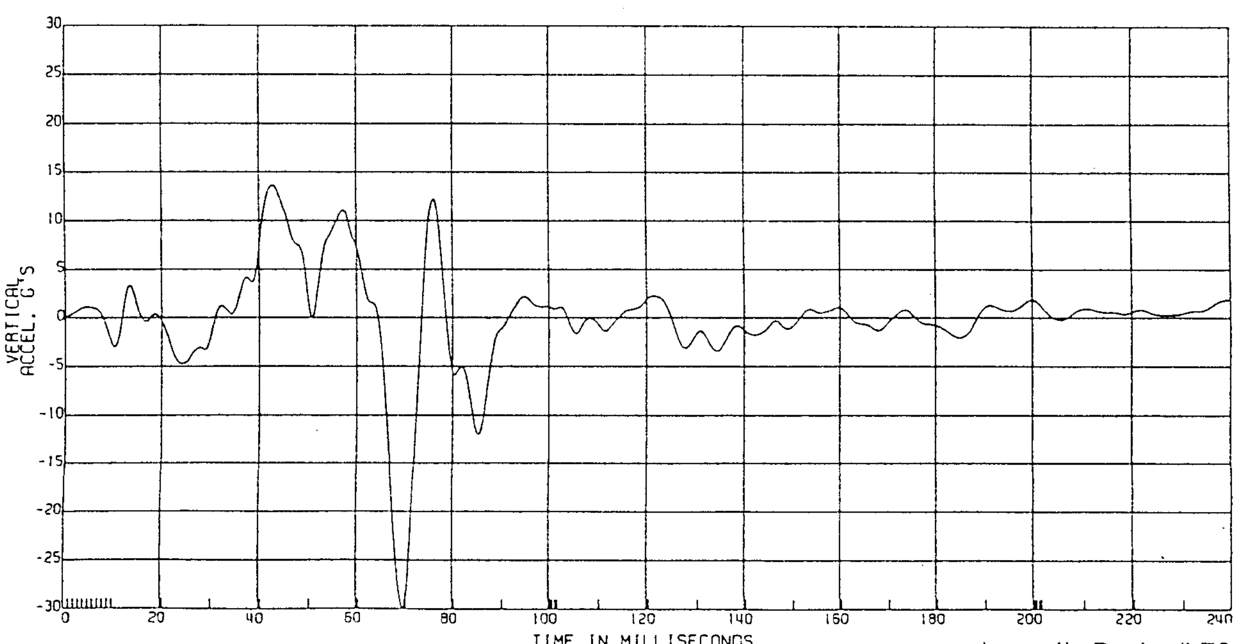
75 PROCESSED 5/20/1996 10:21 V2.04E

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 60

R. FRT ROCKER ACCEL

TEST DATE:05/16/1996



Appendix B, plot # 76

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

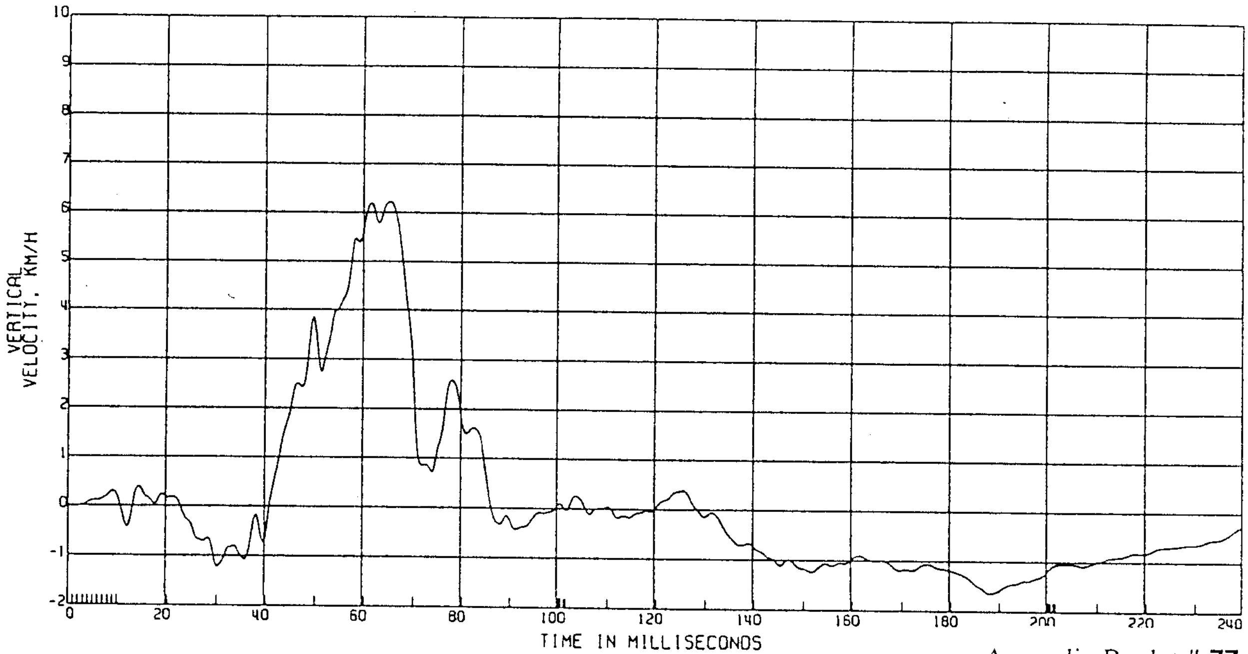
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

R. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 77

77 PROCESSED 5/20/1996 10:21 V2.04E

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

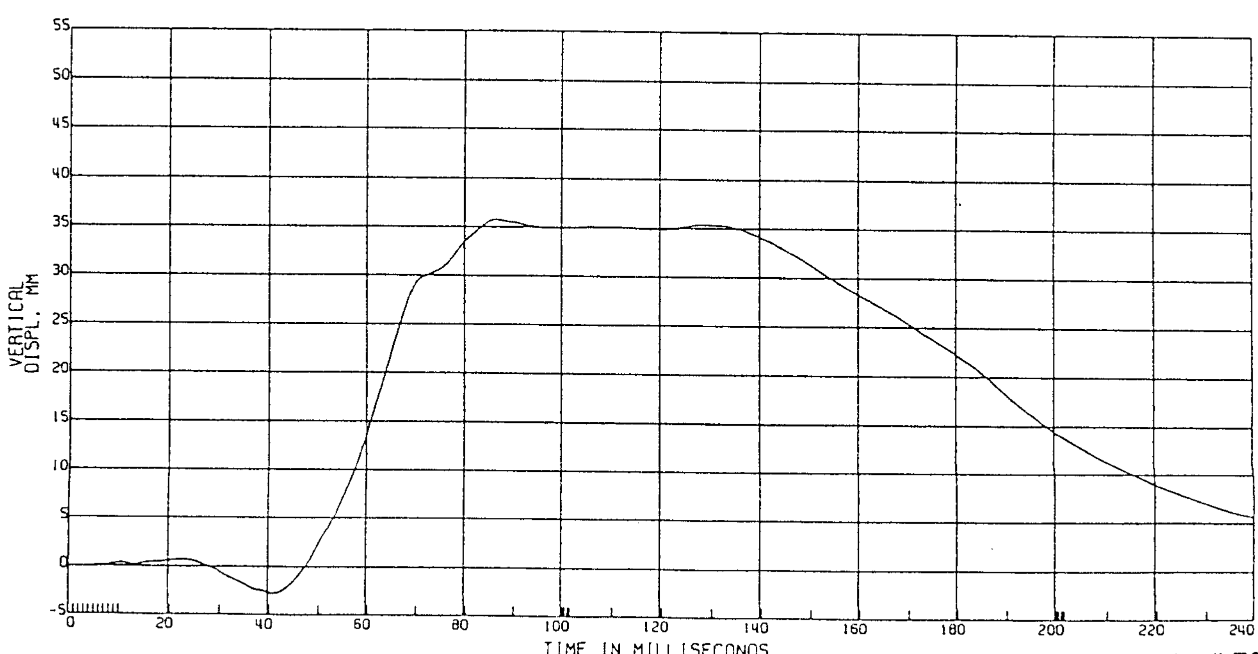
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

R. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 78

C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

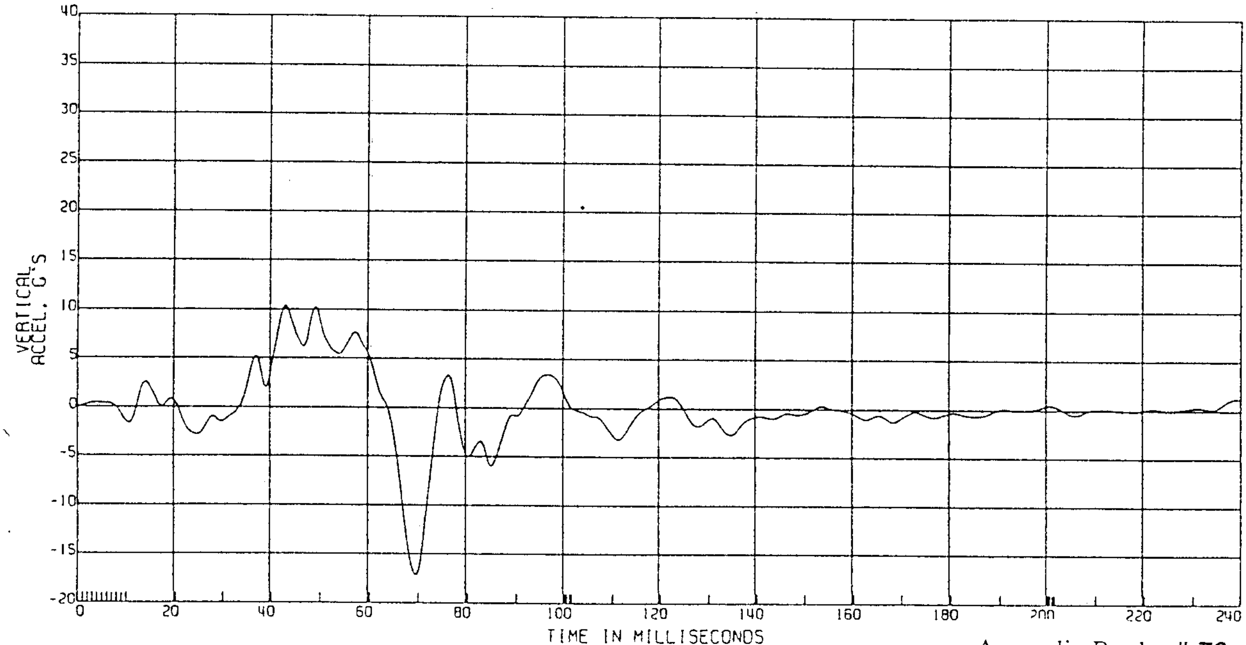
R & D CTR 8T9307D VAN

ELEC DATA, SAE CLASS 60

AVERAGED FRT ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:05/16/1996



Appendix B, plot # 79

79 PROCESSED 5/20/1996 10:21 V2.04E

C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

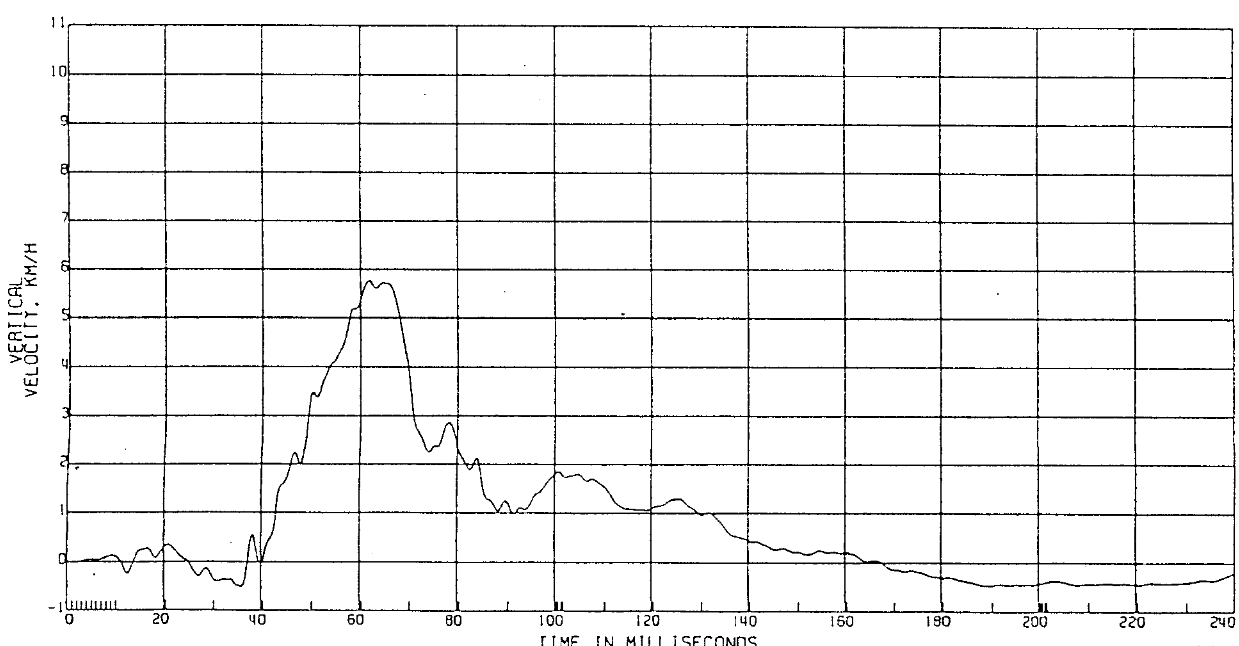
R & D CTR 8T9307D VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 80

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

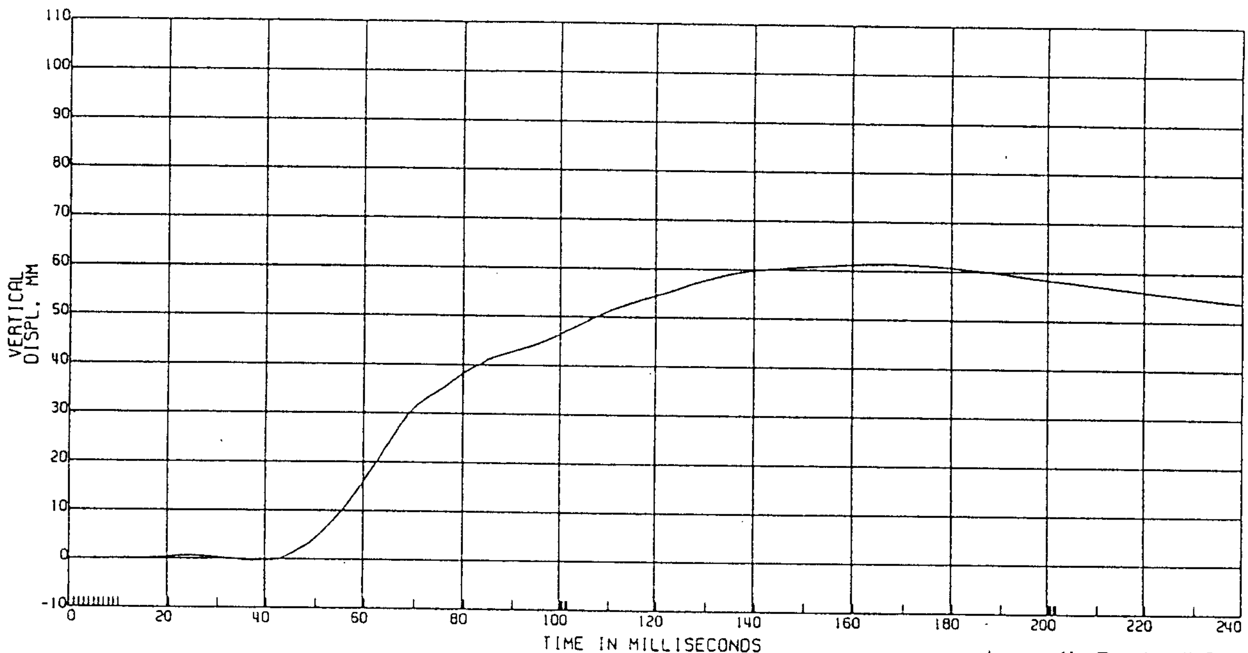
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 81

81 PROCESSED 5/20/1996 10:21 V2.04E

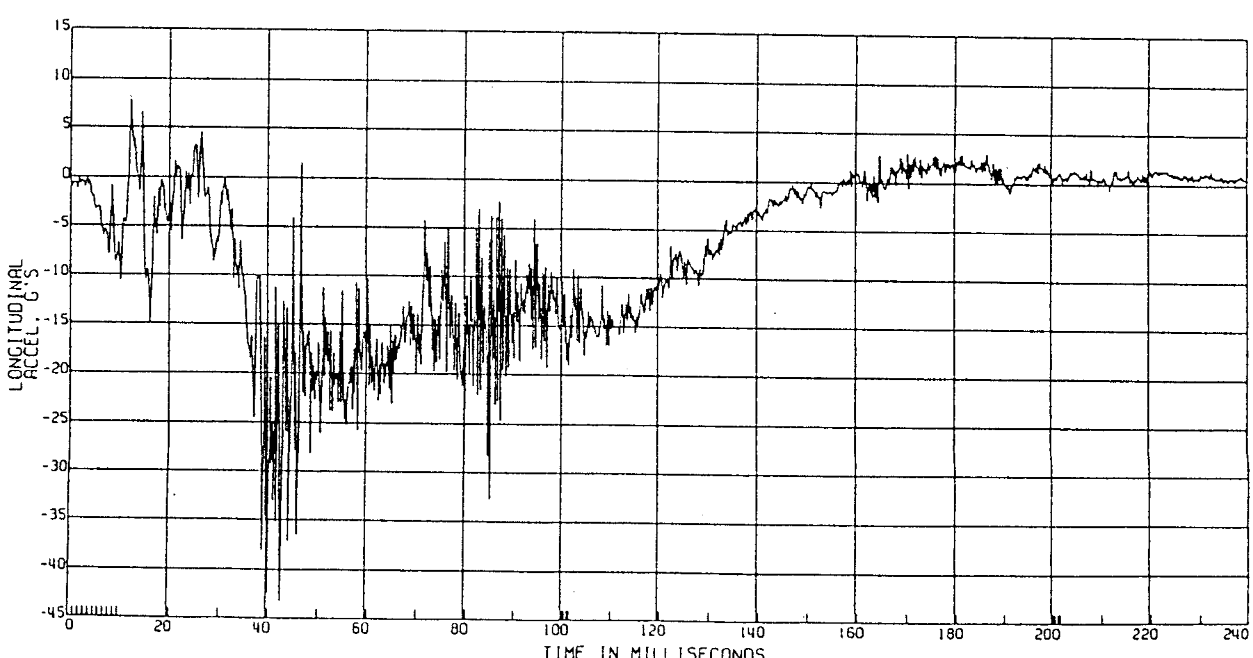
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

L.REAR ROCKER ACCEL

TEST DATE:05/16/1996

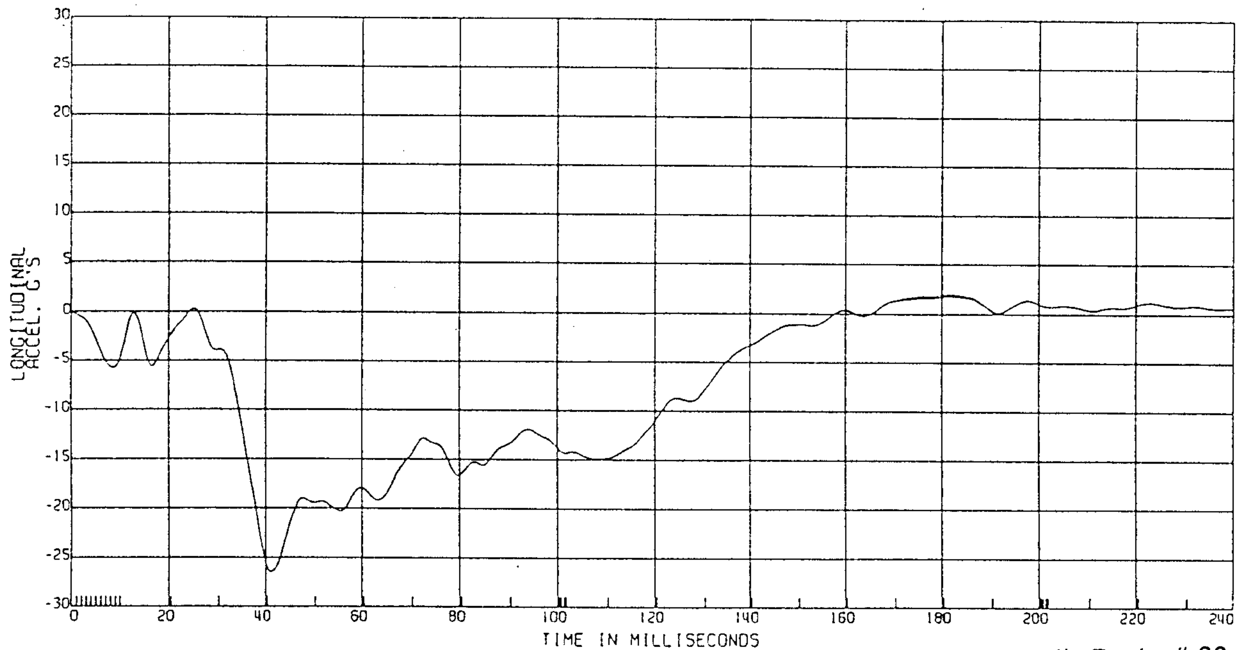


Appendix B, plot # 82

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

L.REAR ROCKER ACCEL

R & D CTR 8T93070 VAN TEST DATE:05/16/1996
ELEC DATA, SAE CLASS 60

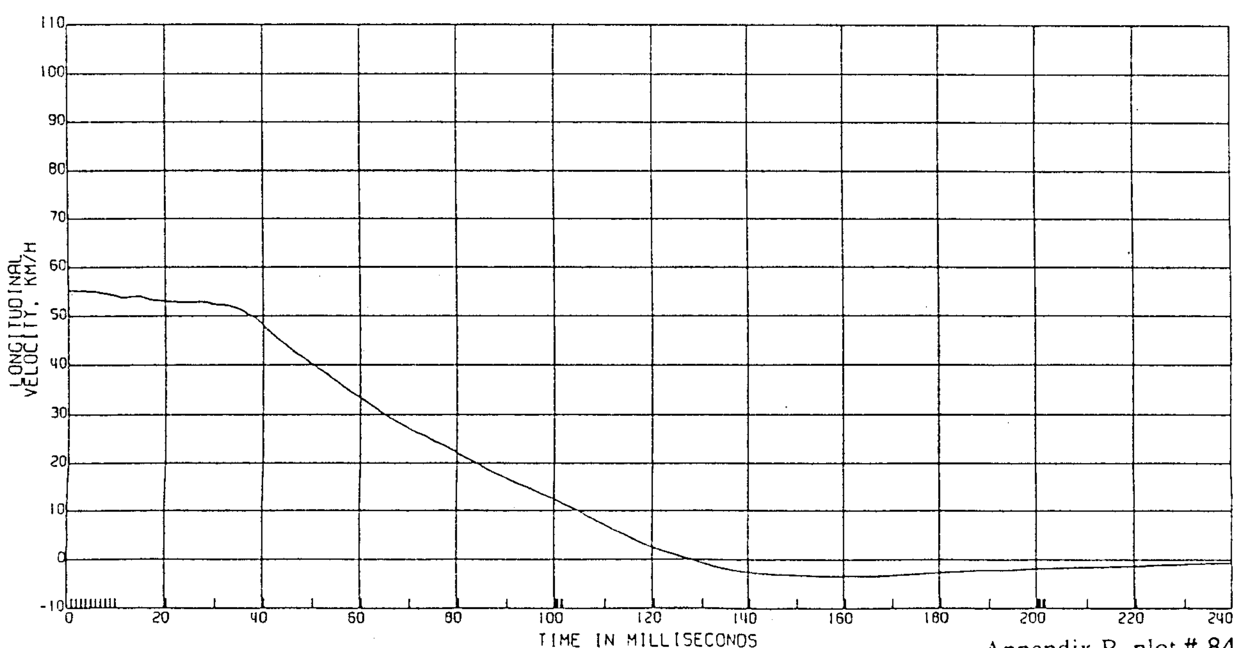


Appendix B, plot # 83

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

L.REAR ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

R & D CTR 8T93070 VAN TEST DATE:05/16/1996
ELEC DATA, SAE CLASS 180



Appendix B, plot # 84

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

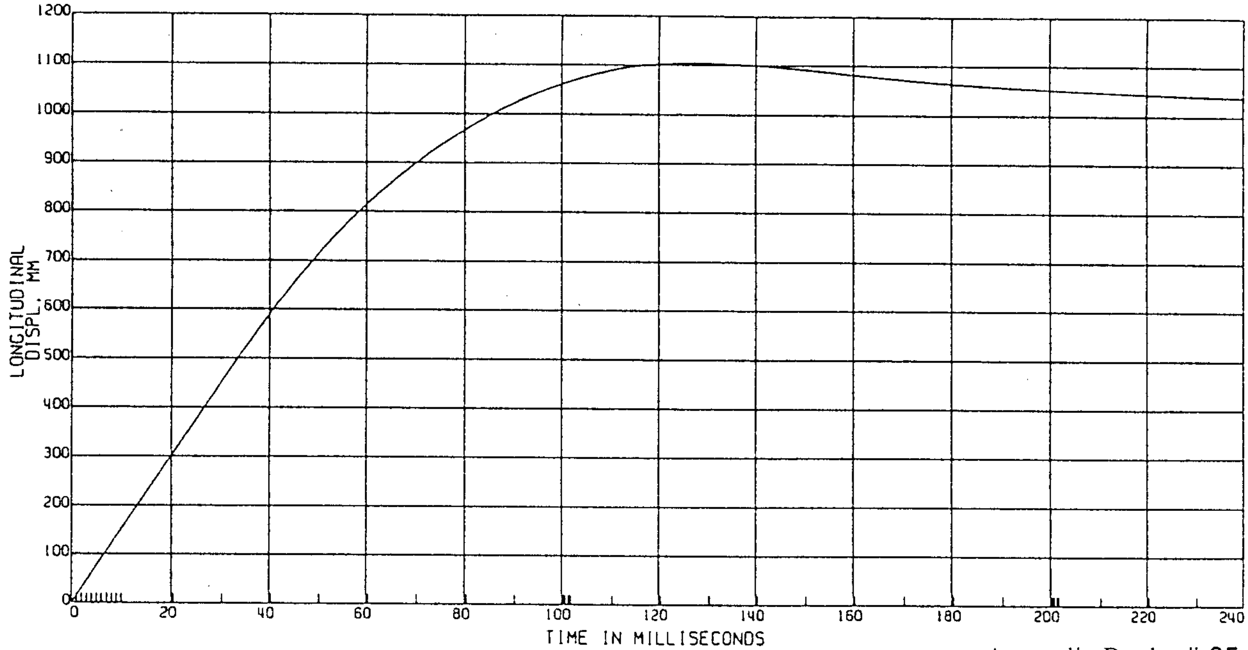
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

L.REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 85

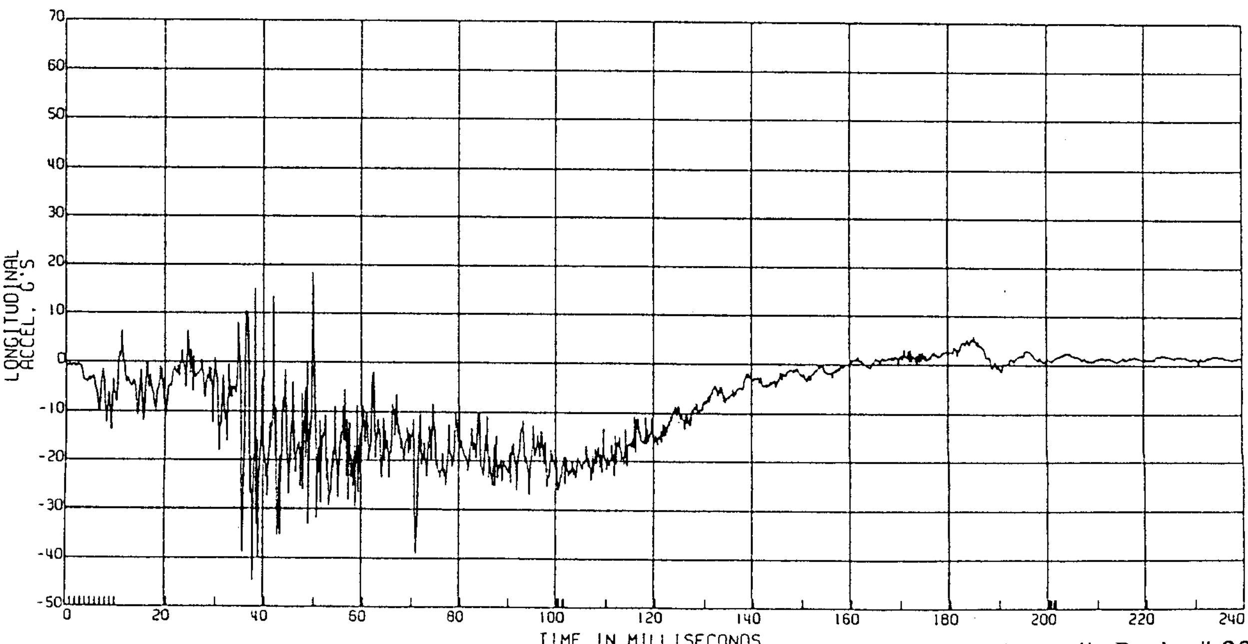
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

R.REAR ROCKER ACCEL

TEST DATE:05/16/1996



Appendix B, plot # 86

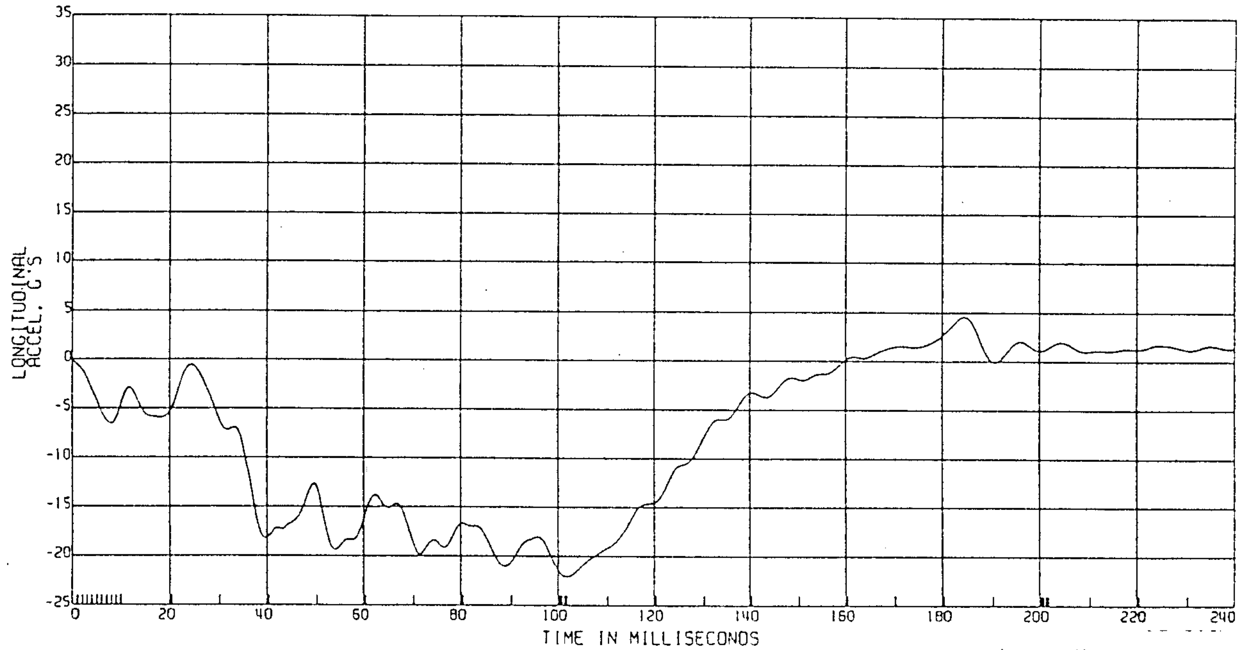
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

R.REAR ROCKER ACCEL

TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 60



Appendix B, plot # 87

87

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

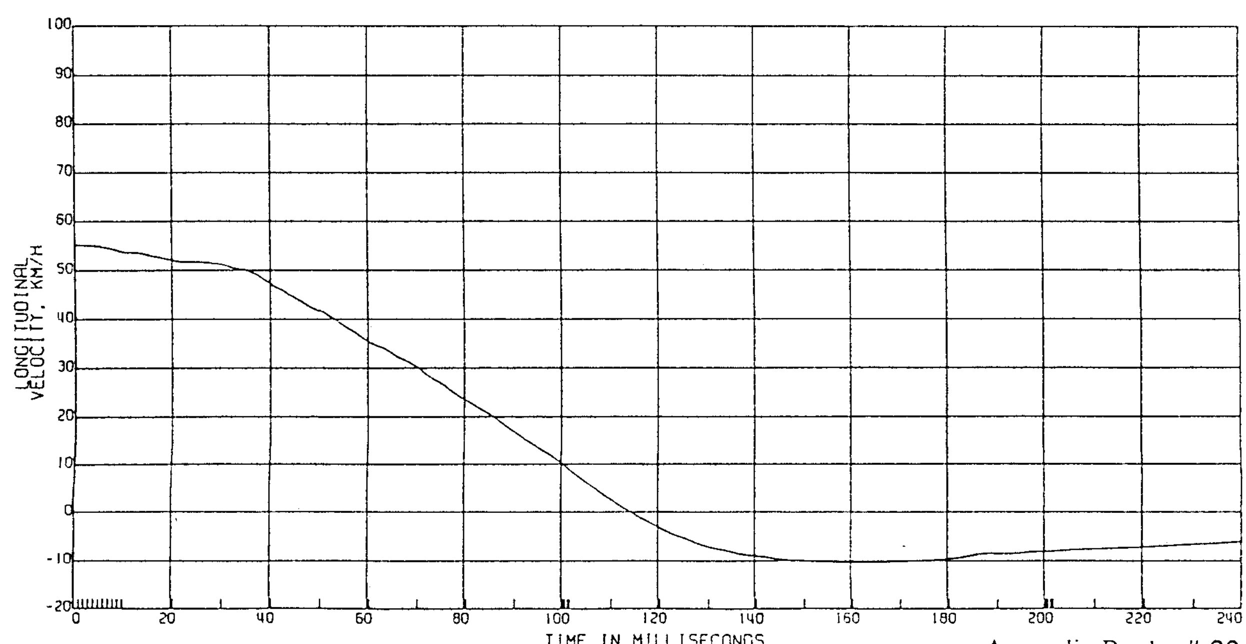
R & D CTR 8T93070 VAN

R.REAR ROCKER VELOCITY

TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 180

(COMPUTED FROM ACCELERATION)



Appendix B, plot # 88

88

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE

55.2KM/H

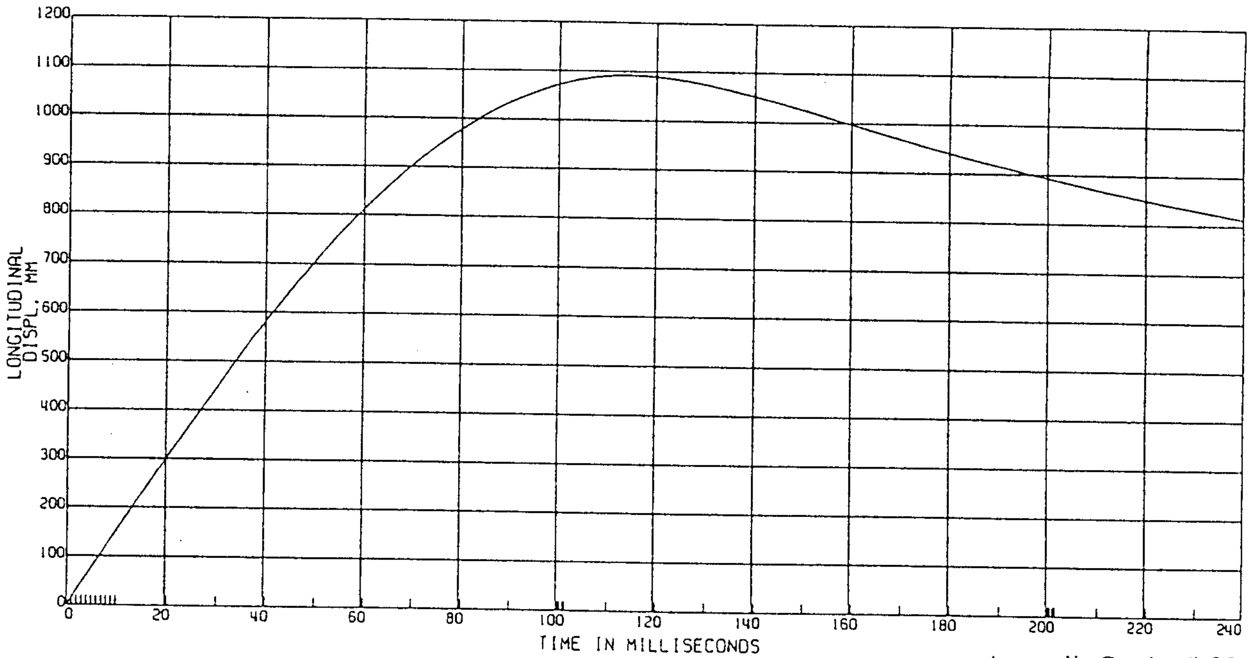
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

R.REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 89

89 PROCESSED 5/20/1996 10:21 V2.04E

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE

55.2KM/H

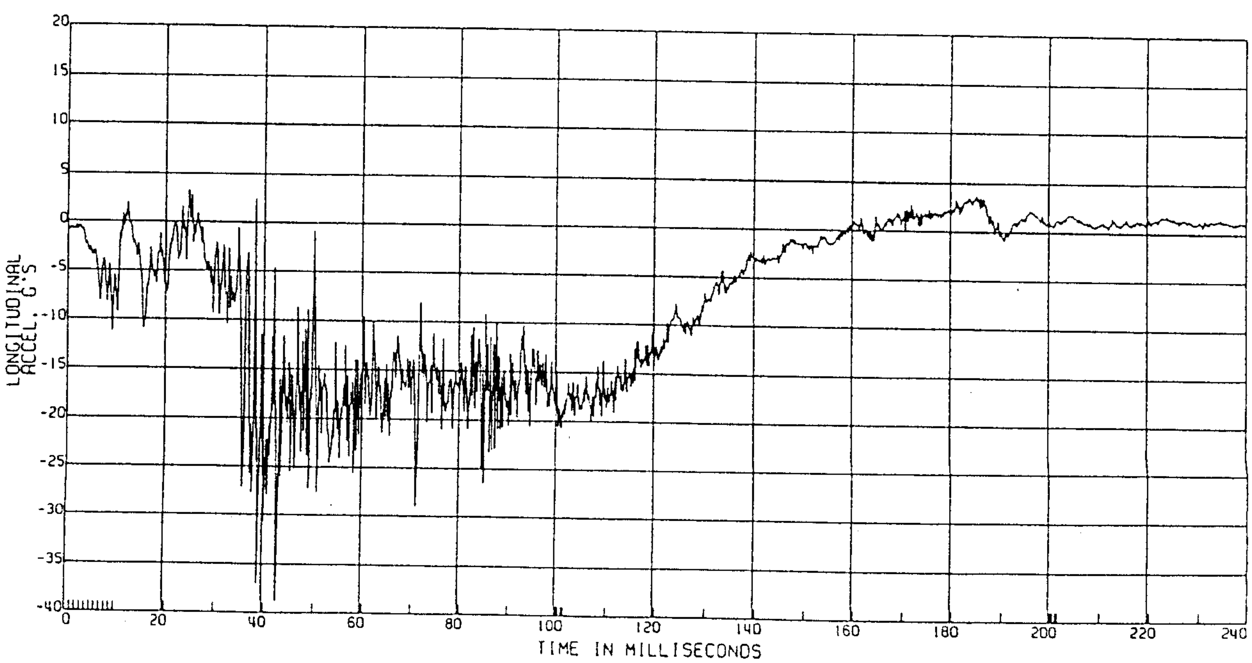
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

AVERAGED REAR ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:05/16/1996



Appendix B, plot # 90

90

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

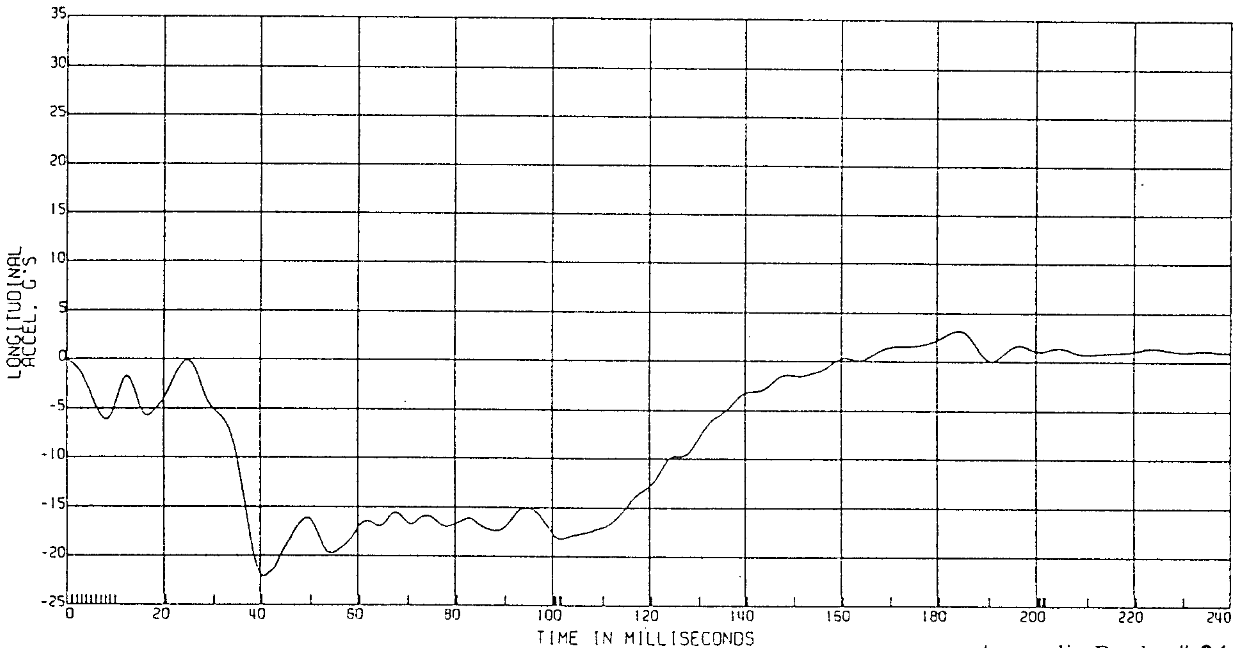
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 60

AVERAGED REAR ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:05/16/1996



Appendix B, plot # 91

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

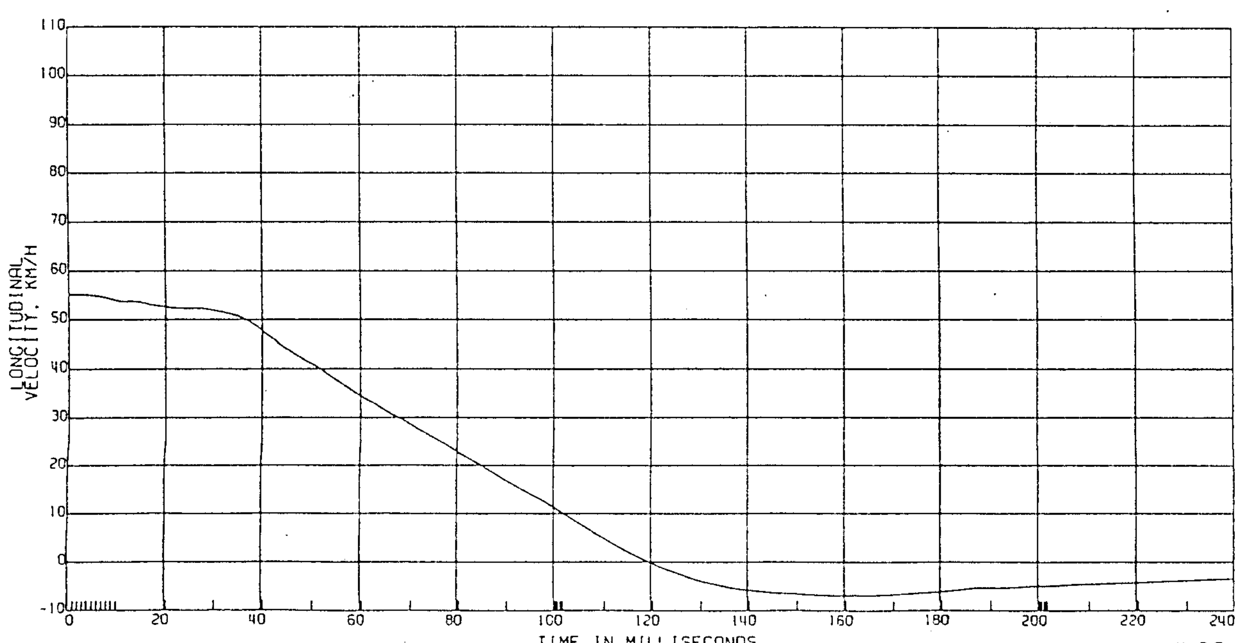
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996

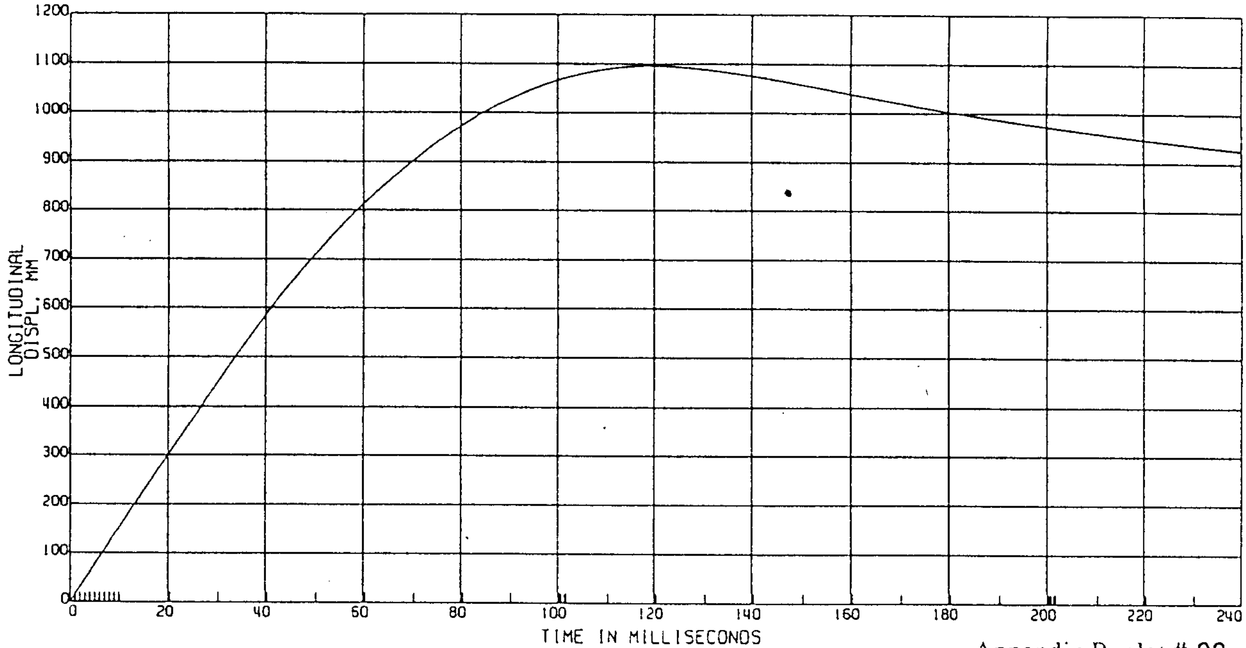


Appendix B, plot # 92

C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

R & D CTR 8T93070 VAN | AVGD REAR ROCKER DISPL | TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 180 | (COMPUTED FROM ACCELERATION)



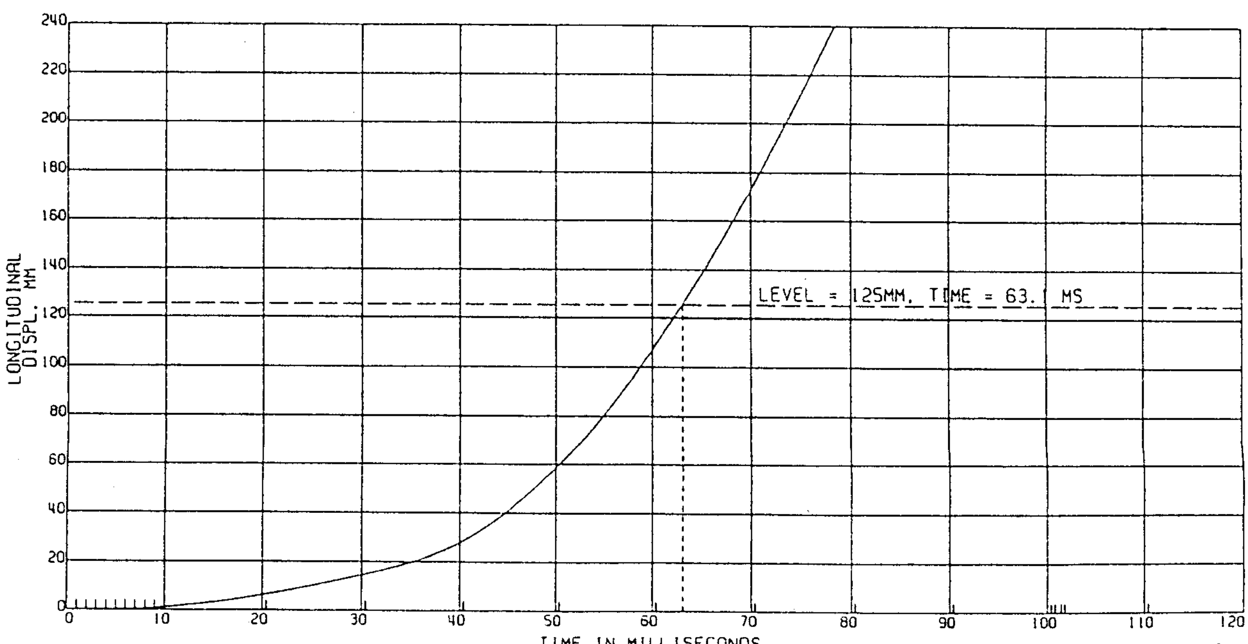
Appendix B, plot # 93

93 PROCESSED 5/20/1996 10:21

C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

R & D CTR 8T93070 VAN | COMP. FREE MASS DISP. REL. TO VEHICLE | TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 180

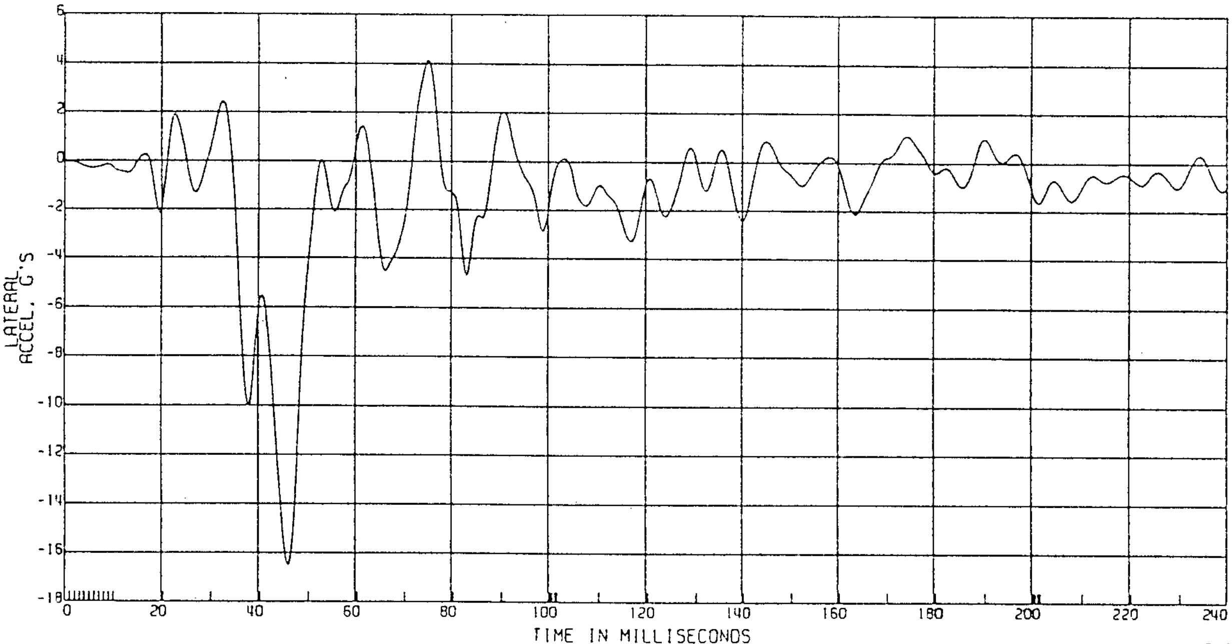


Appendix B, plot # 94

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN L.REAR ROCKER ACCEL TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 60



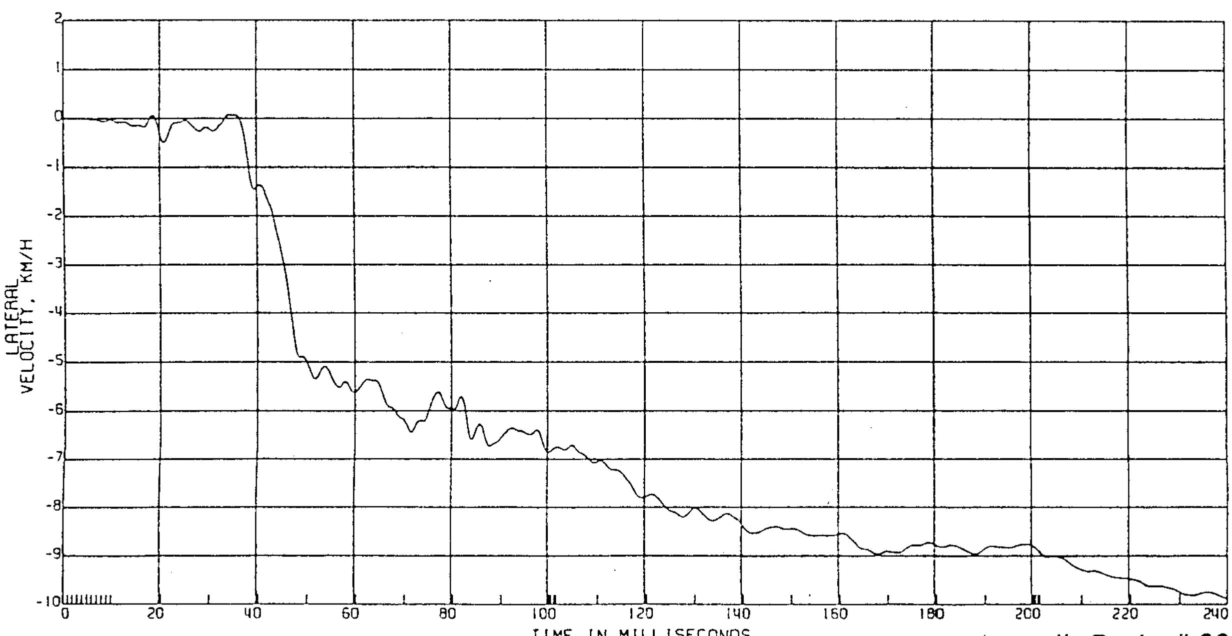
Appendix B, plot # 95

95

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN L.REAR ROCKER VELOCITY TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 180 (COMPUTED FROM ACCELERATION)



Appendix B, plot # 96

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

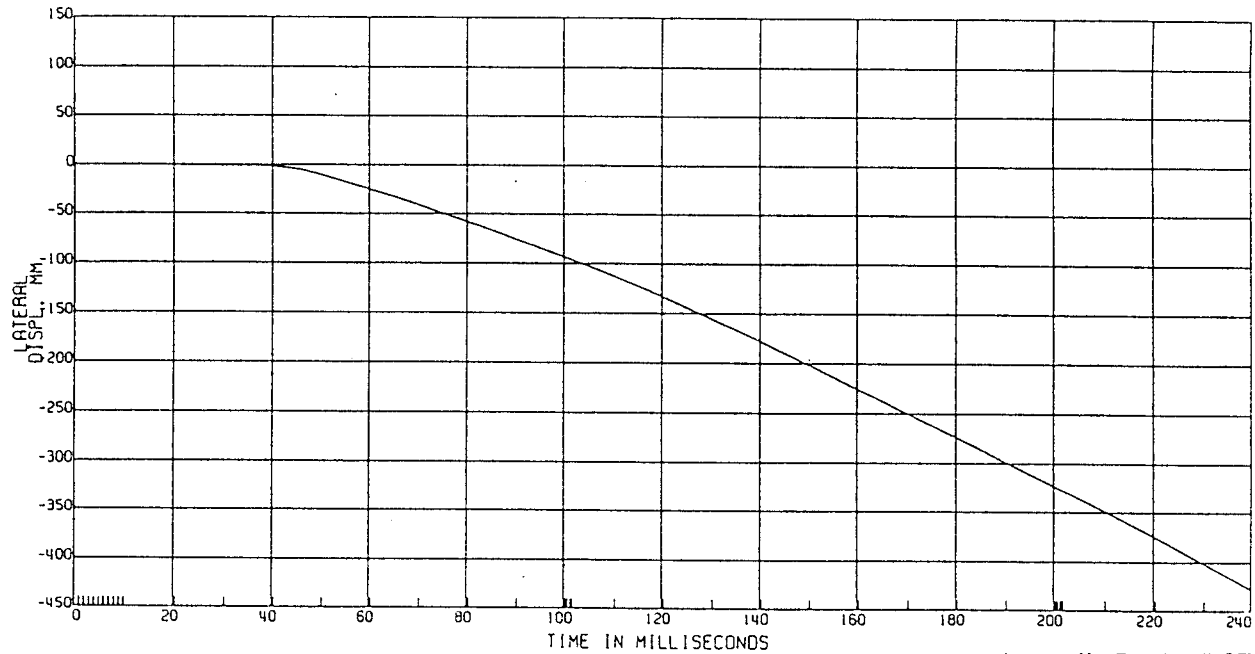
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

L.REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 97

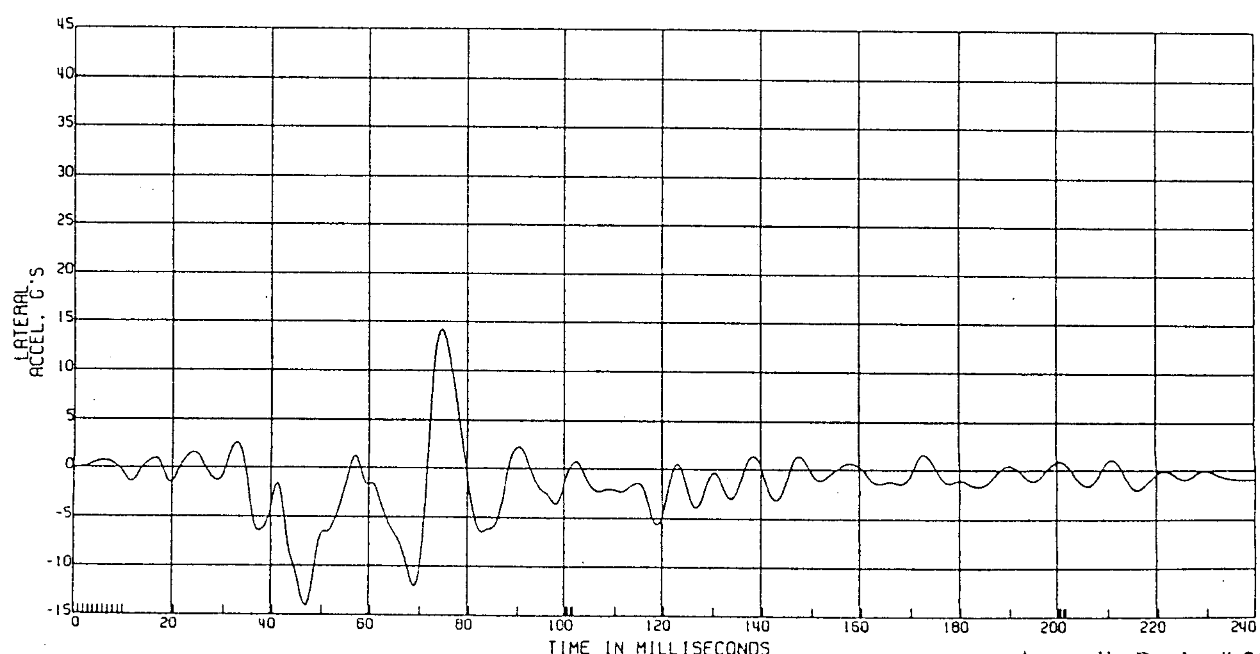
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 60

R.REAR ROCKER ACCEL

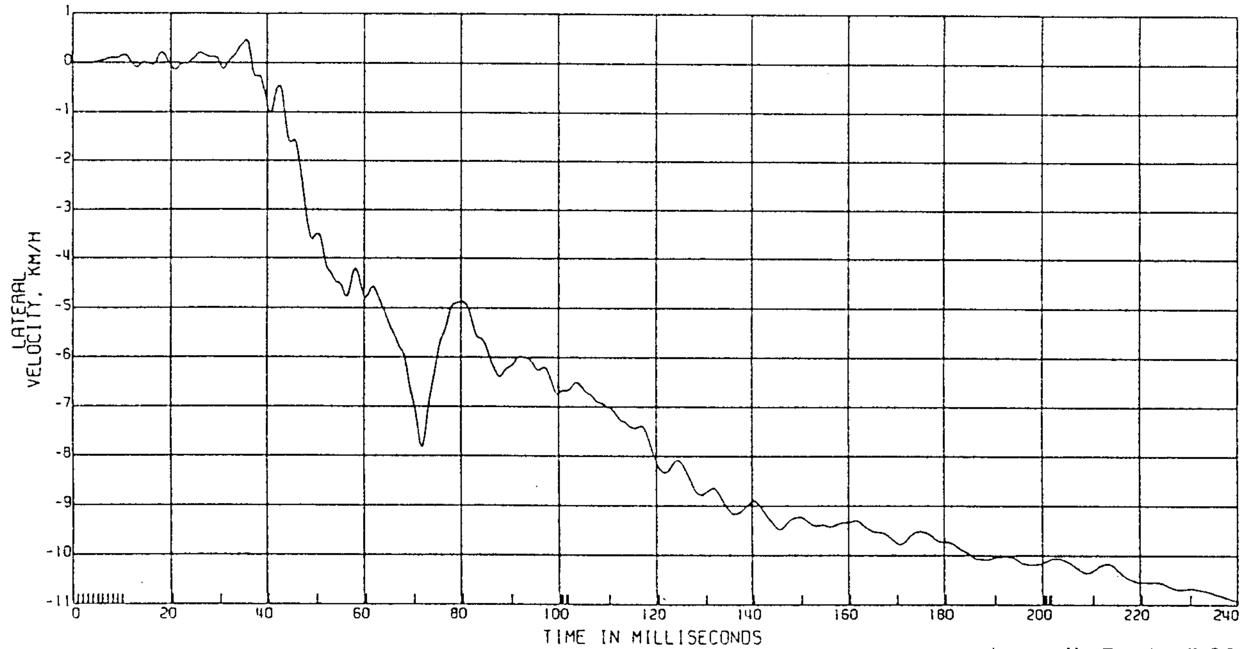
TEST DATE:05/16/1996



Appendix B, plot # 98

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

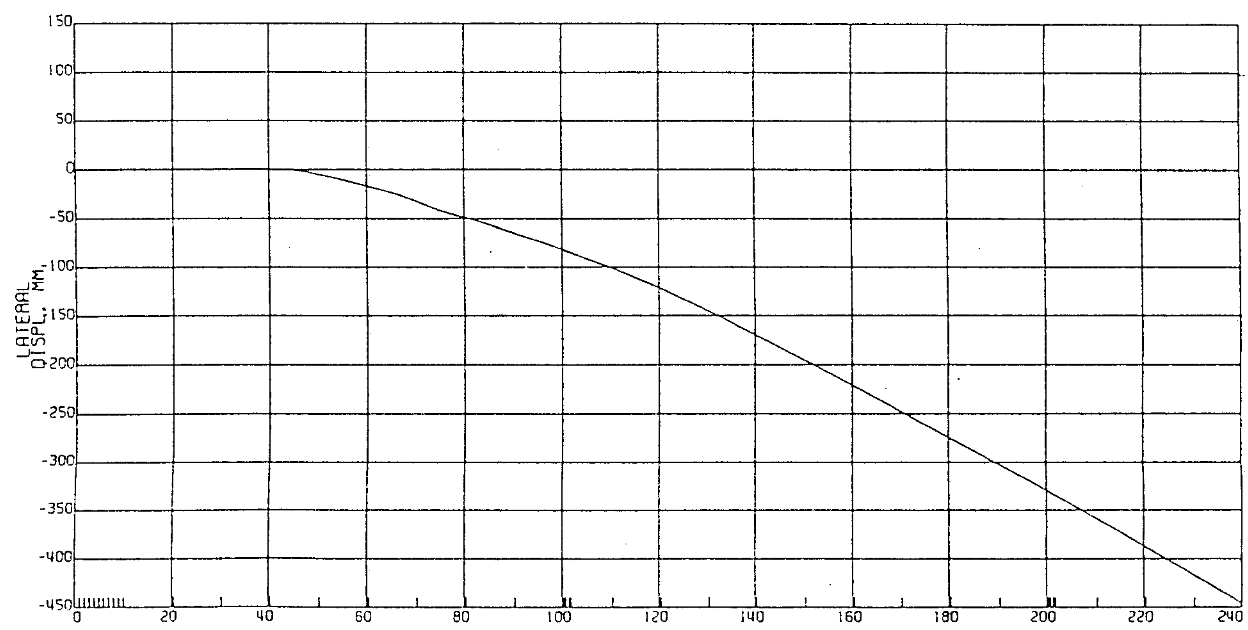
R & D CTR 8T93070 VAN R.REAR ROCKER VELOCITY TEST DATE:05/16/1996
ELEC DATA, SAE CLASS 180 (COMPUTED FROM ACCELERATION)



Appendix B, plot # 99

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN R.REAR ROCKER DISPL TEST DATE:05/16/1996
ELEC DATA, SAE CLASS 180 (COMPUTED FROM ACCELERATION)



Appendix B, plot # 100

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

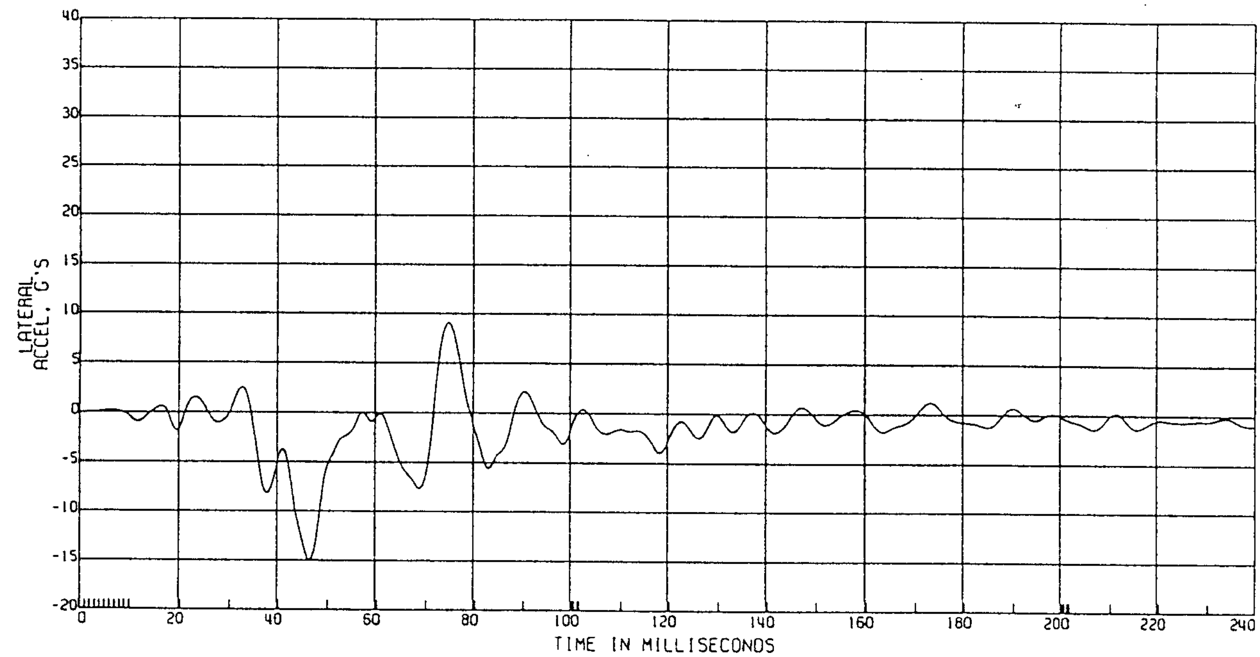
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 60

AVERAGED REAR ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:05/16/1996



Appendix B, plot # 101

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

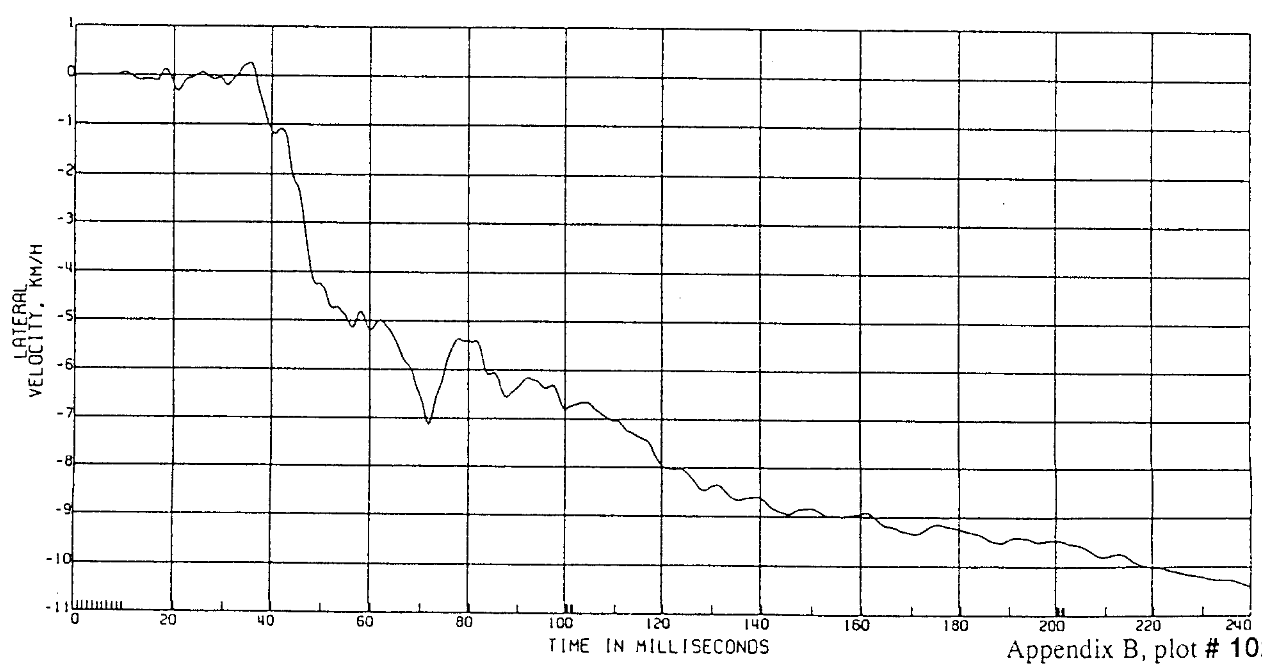
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 102

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

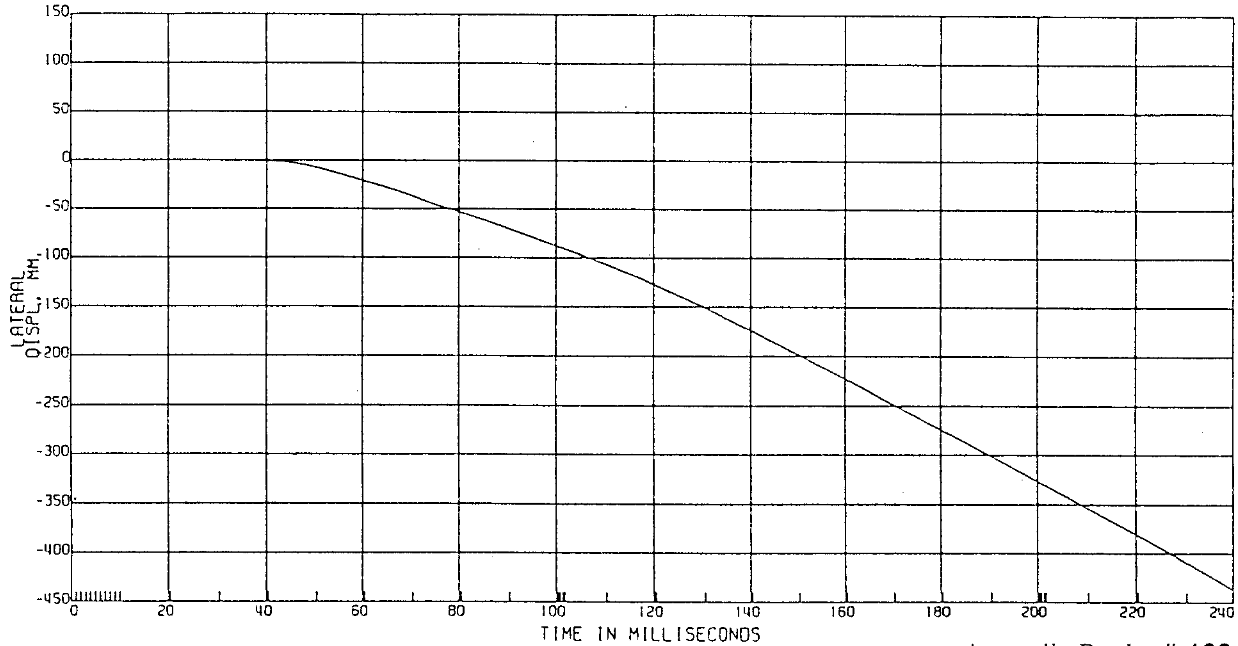
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 103

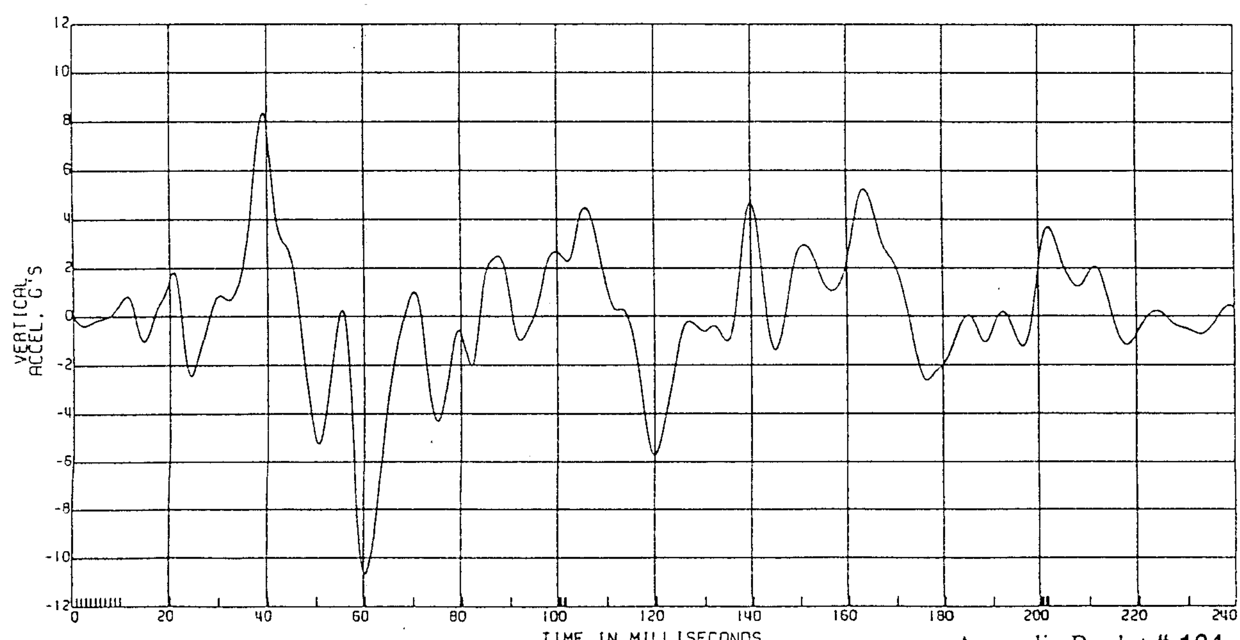
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 60

L.REAR ROCKER ACCEL

TEST DATE:05/16/1996



Appendix B, plot # 104

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

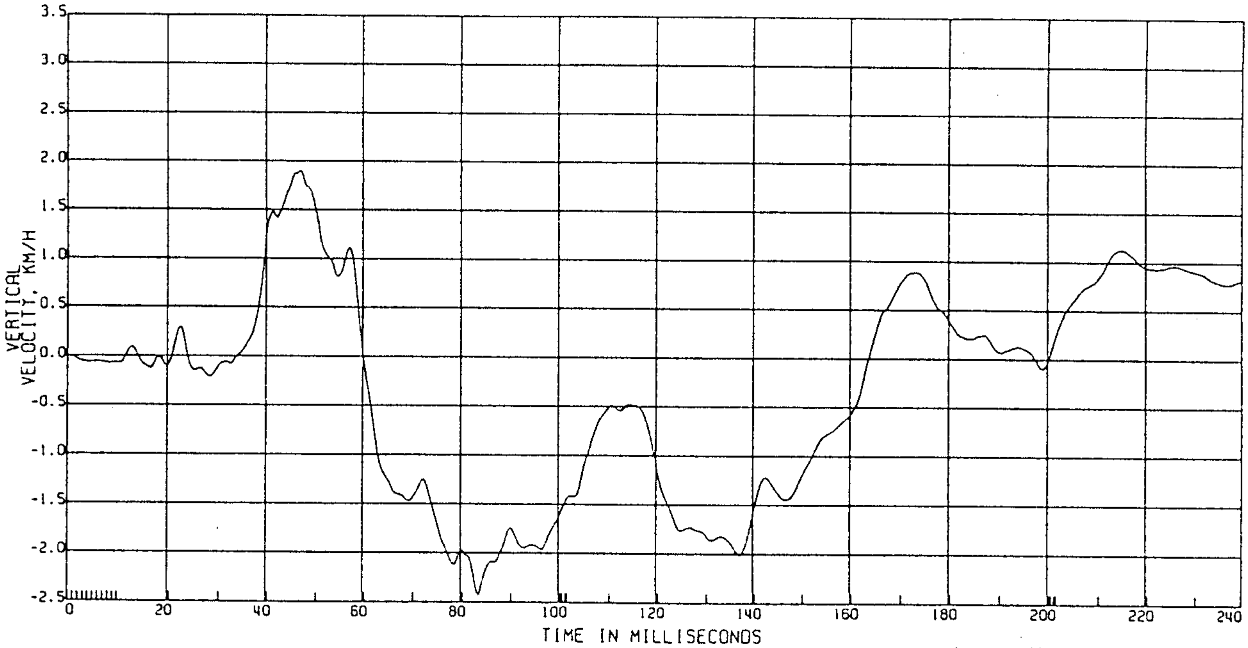
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

L.REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 105

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

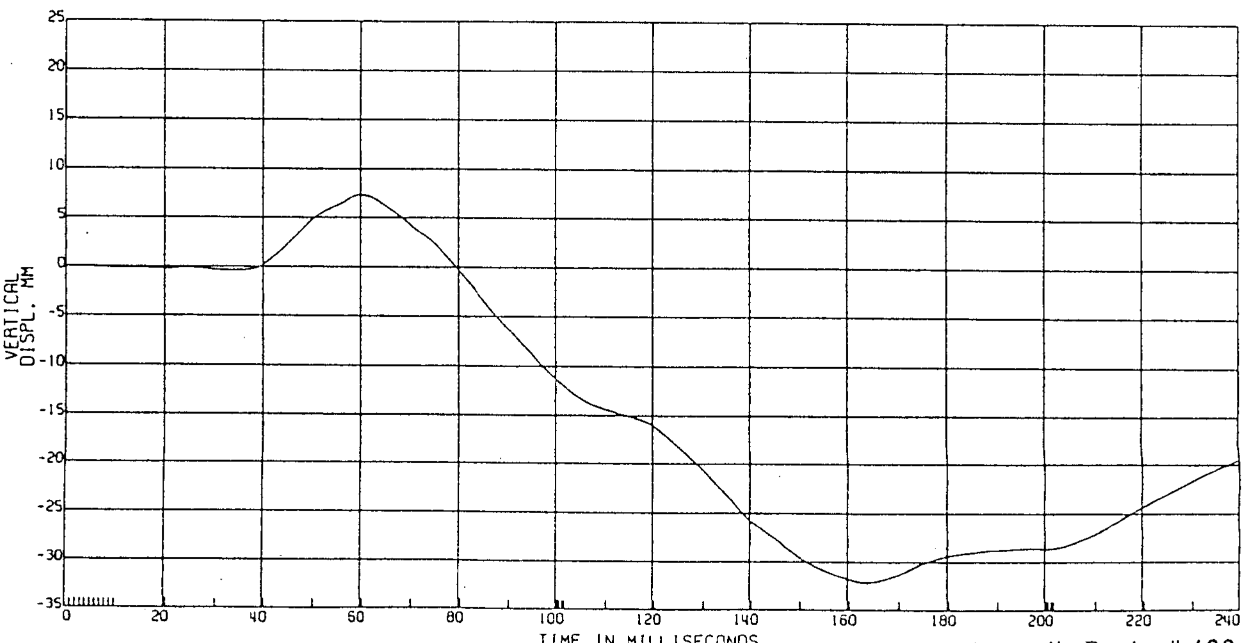
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

L.REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 106

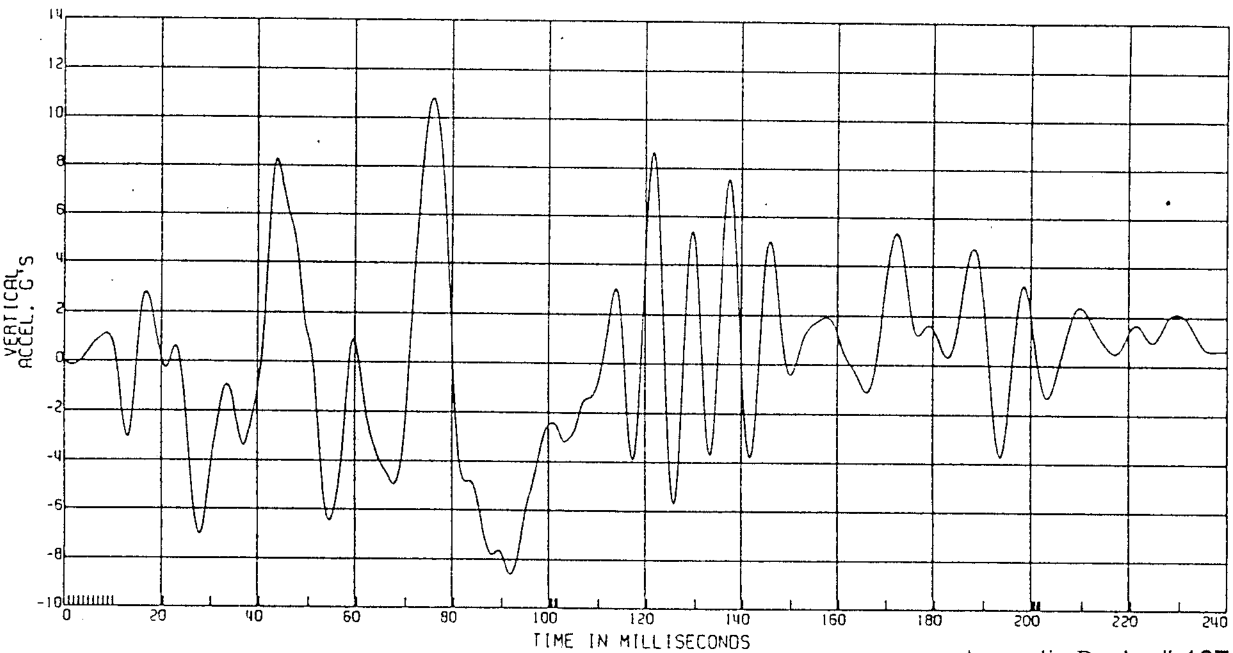
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 60

R.REAR ROCKER ACCEL

TEST DATE:05/16/1996



Appendix B, plot # 107

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

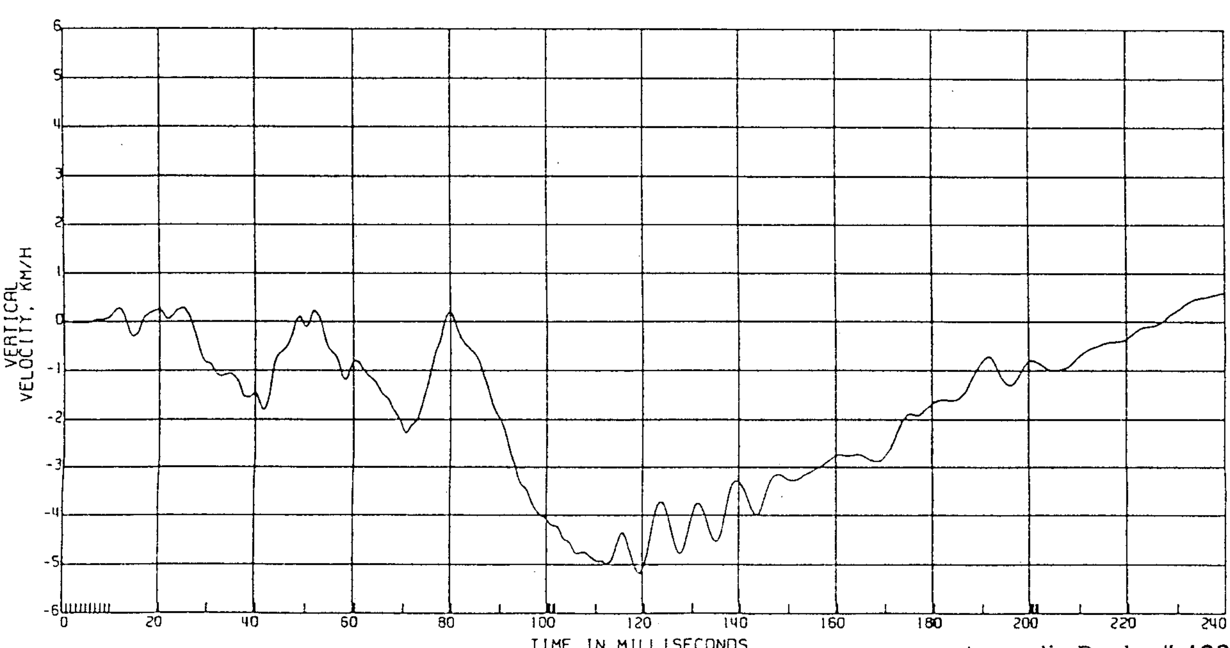
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

R.REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



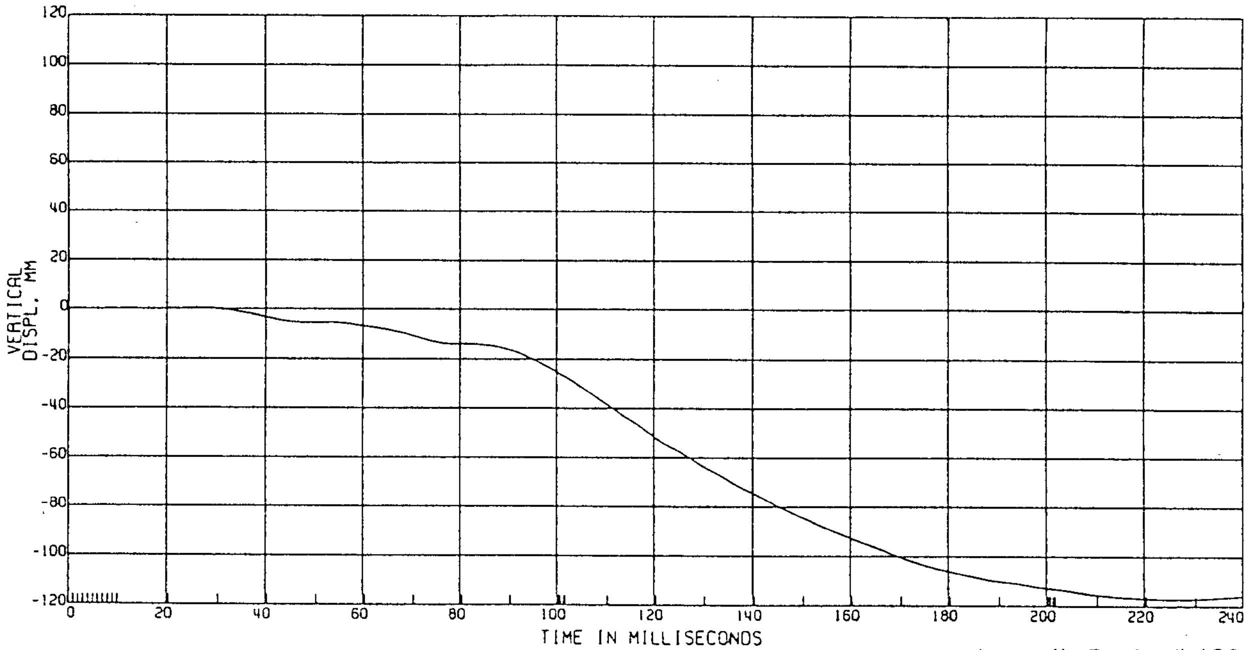
Appendix B, plot # 108

C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 180

R.REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



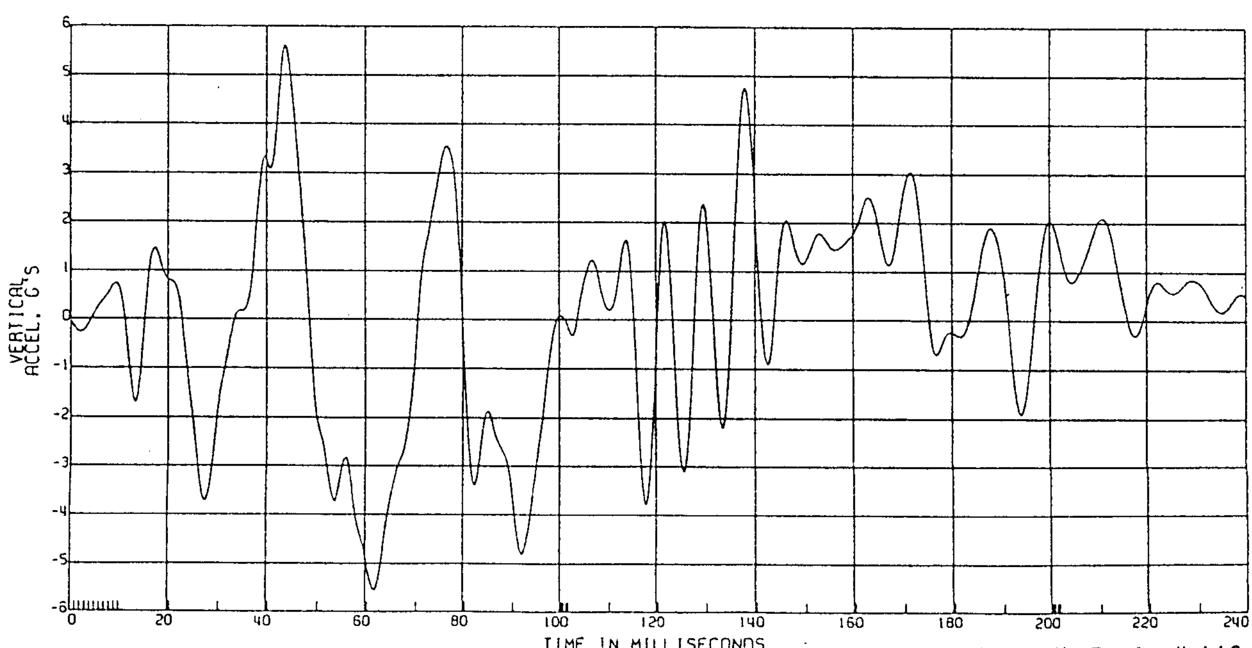
Appendix B, plot # 109

C11108 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.2KM/H

R & D CTR 8T93070 VAN
ELEC DATA, SAE CLASS 60

AVERAGED REAR ROCKER ACCELERATION
(AVGD L. & R. ROCKER ACCELS)

TEST DATE:05/16/1996



Appendix B, plot # 110

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

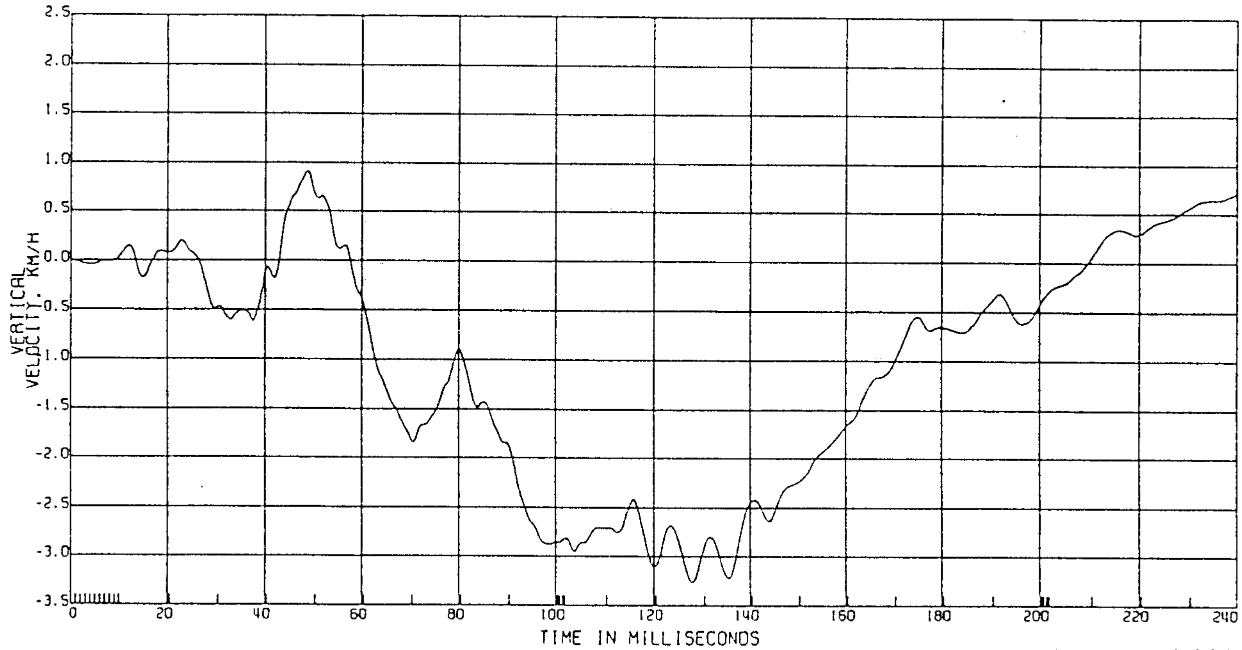
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 111

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

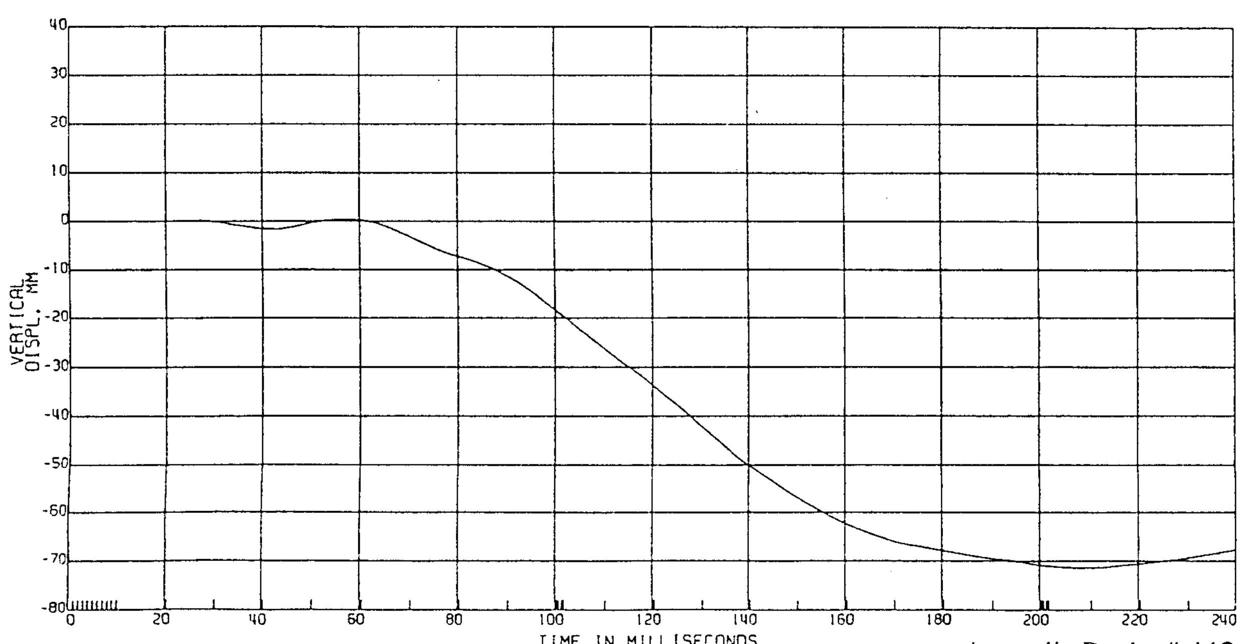
R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:05/16/1996



Appendix B, plot # 112

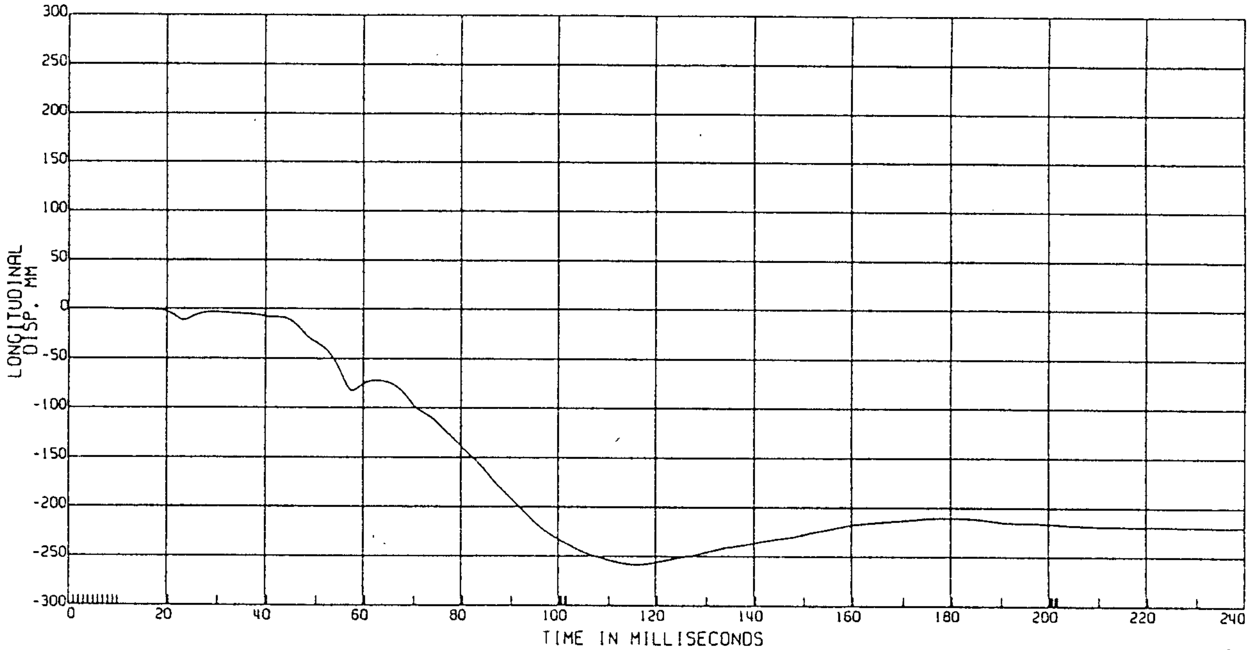
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 60

R. TOE PAN DISPL

TEST DATE:05/16/1996



Appendix B, plot # 113

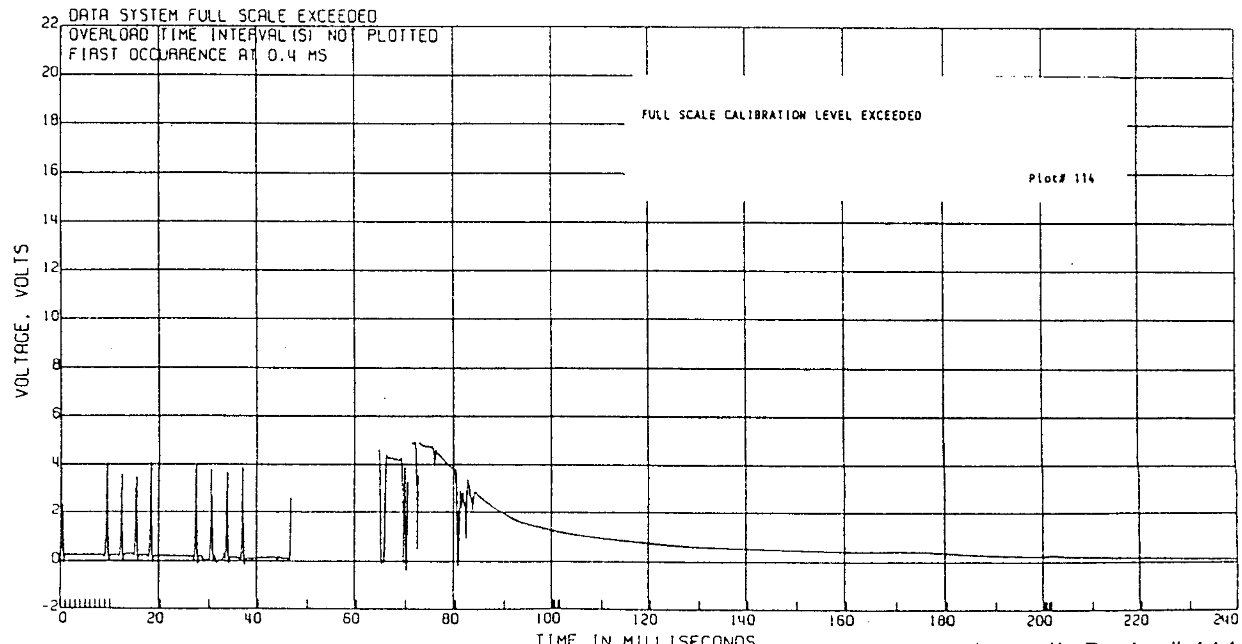
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

ENGINE RPM VOLTAGE

TEST DATE:05/16/1996



Appendix B, plot # 114

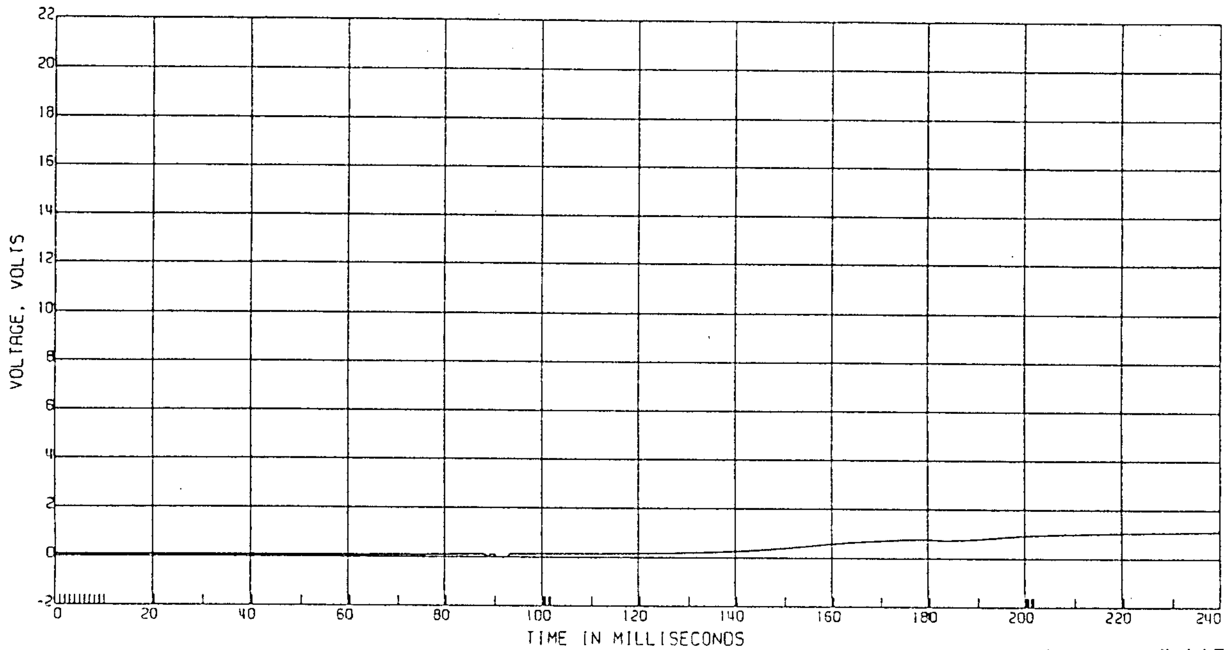
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

VAPOR SENSOR VOLTAGE

TEST DATE:05/16/1996



Appendix B, plot # 115

115

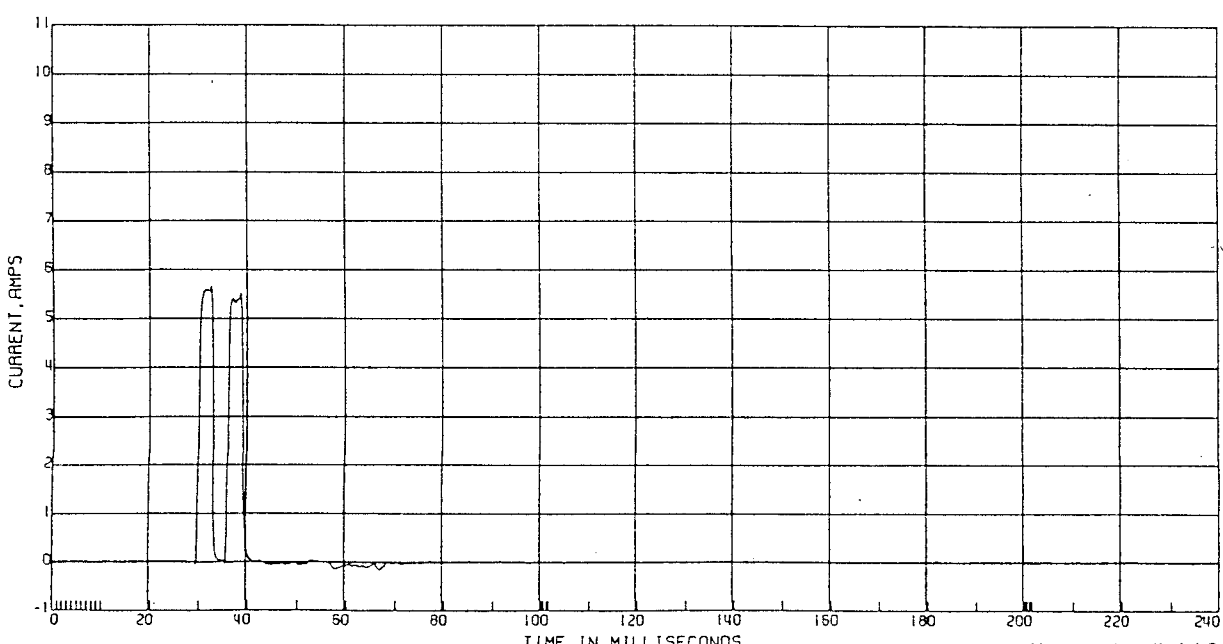
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

L. WHEEL BAG CURRENT

TEST DATE:05/16/1996



Appendix B, plot # 116

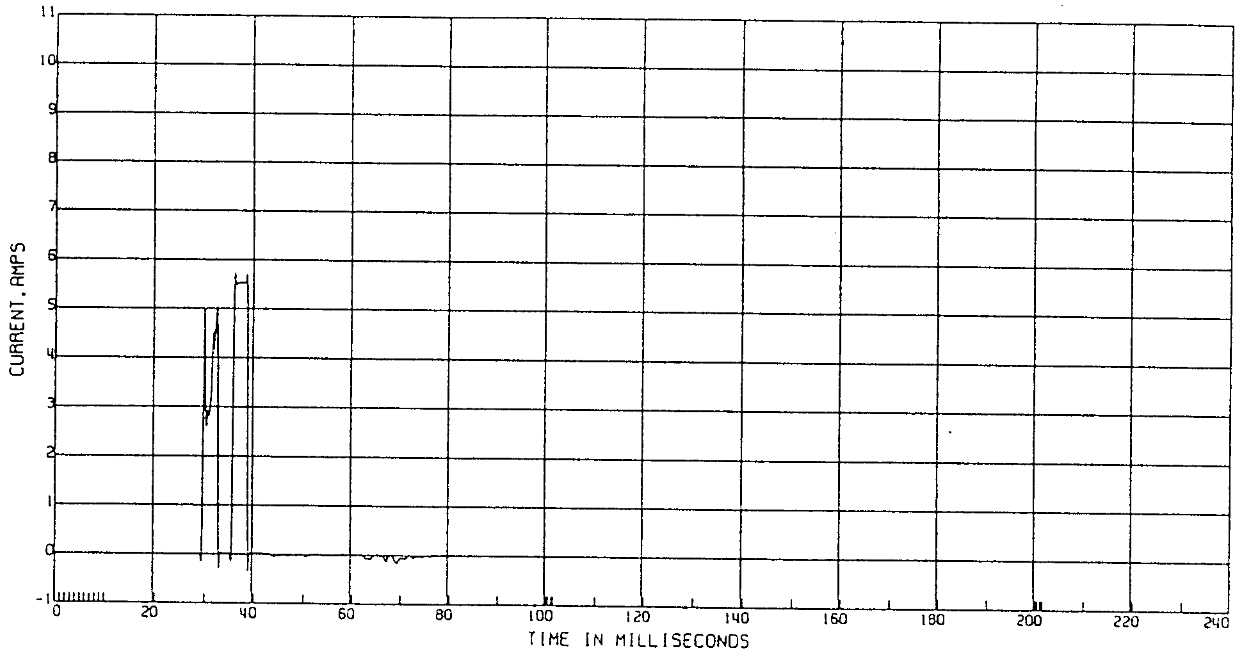
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

R. I/P BAG CURRENT

TEST DATE:05/16/1996



Appendix B, plot # 117

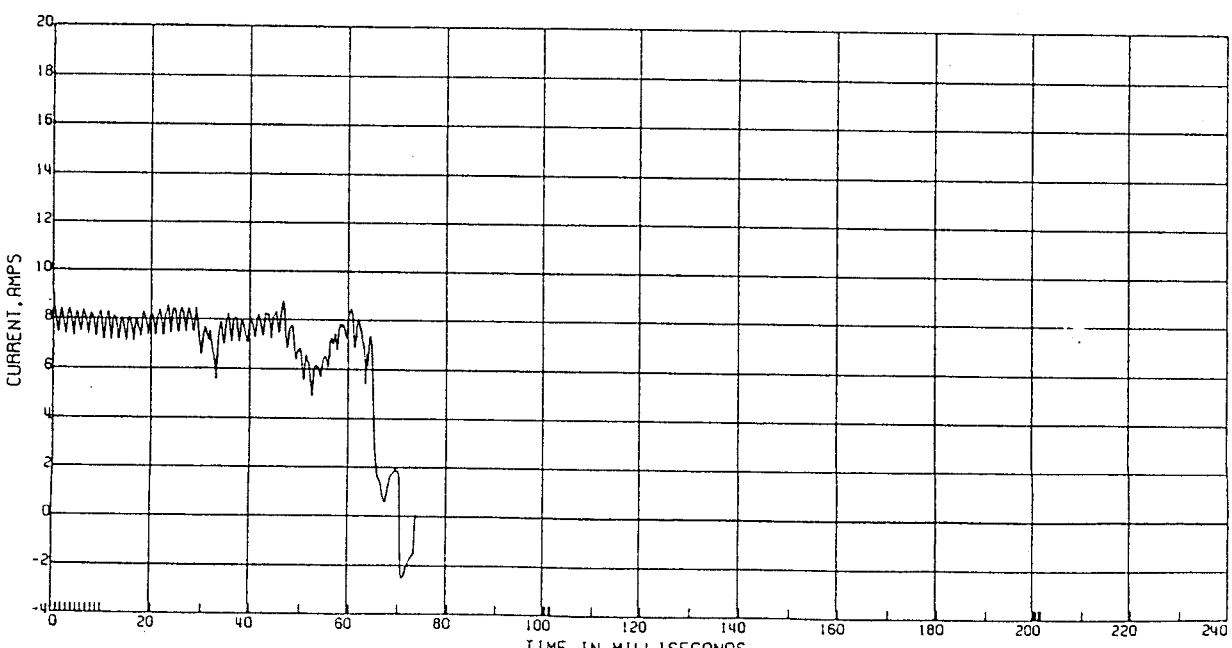
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

FUEL PUMP CURRENT

TEST DATE:05/16/1996



Appendix B, plot # 118

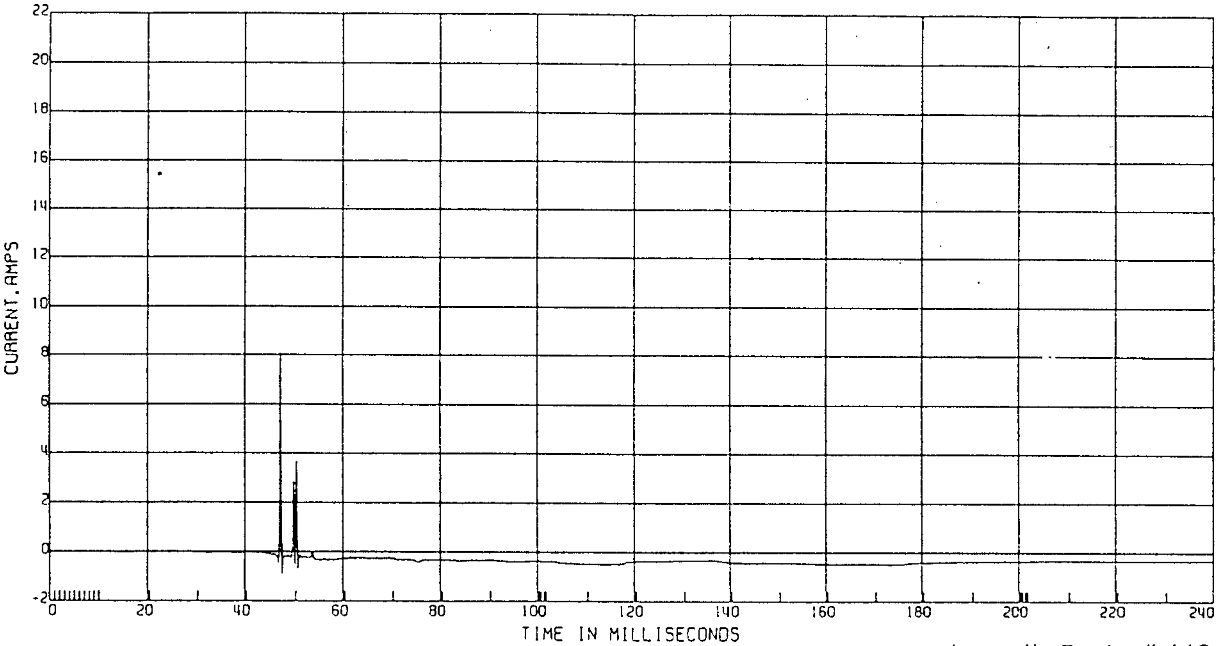
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

R. FRT HEADLIGHT-HI BEAM CURRENT

TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 1000



Appendix B, plot # 119

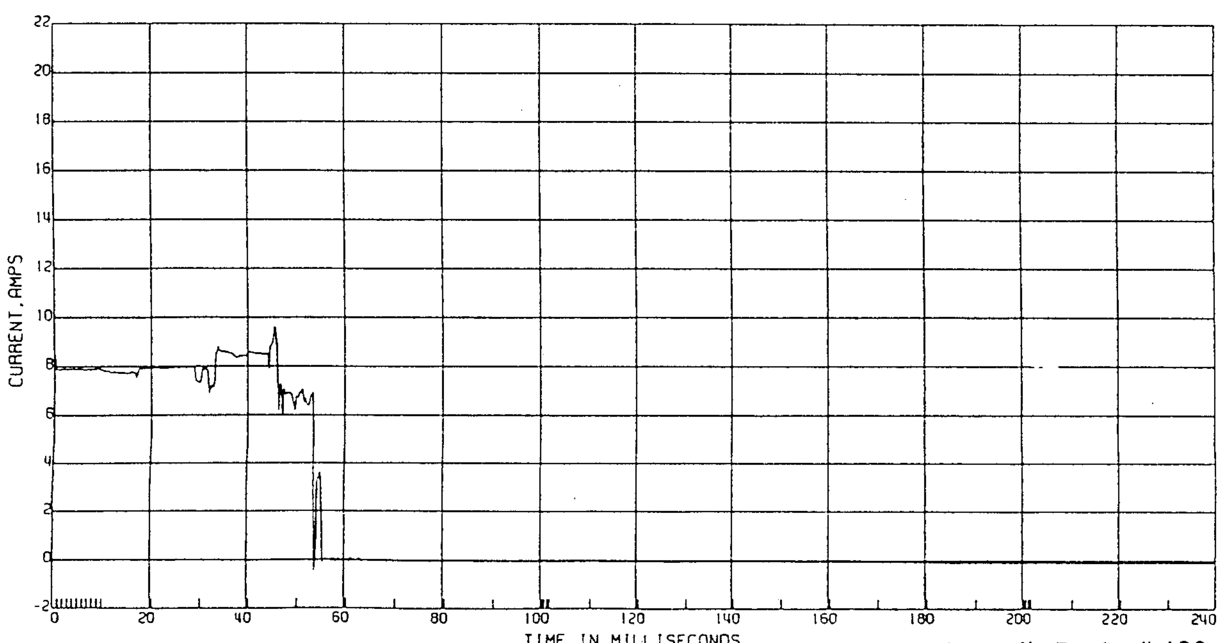
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

R. FRT HEADLIGHT-LO BEAM CURRENT

TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 1000



Appendix B, plot # 120

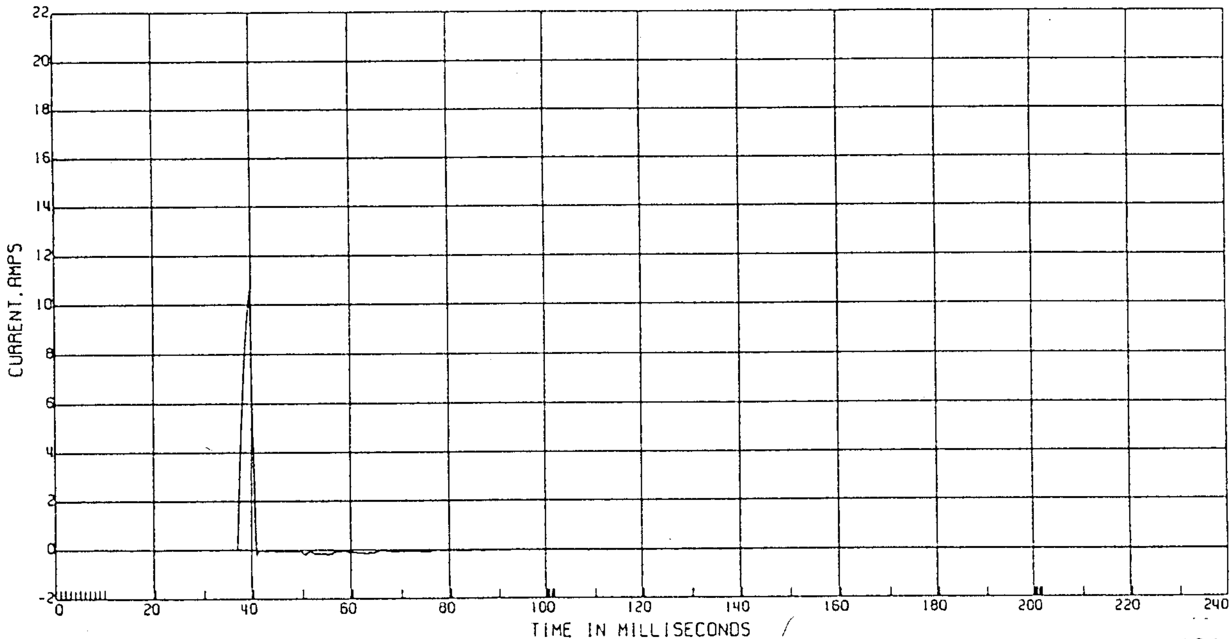
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

L. HORN-HIGH CURRENT

TEST DATE:05/16/1996



Appendix B, plot # 121

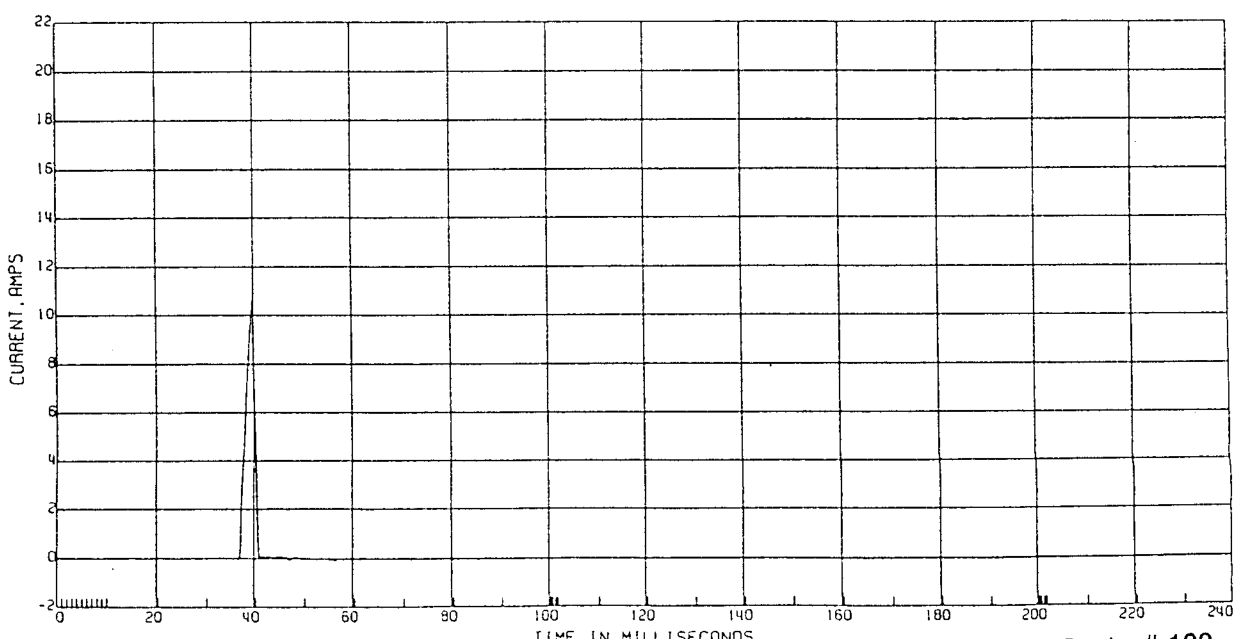
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

L. HORN-LOW CURRENT

TEST DATE:05/16/1996



Appendix B, plot # 122

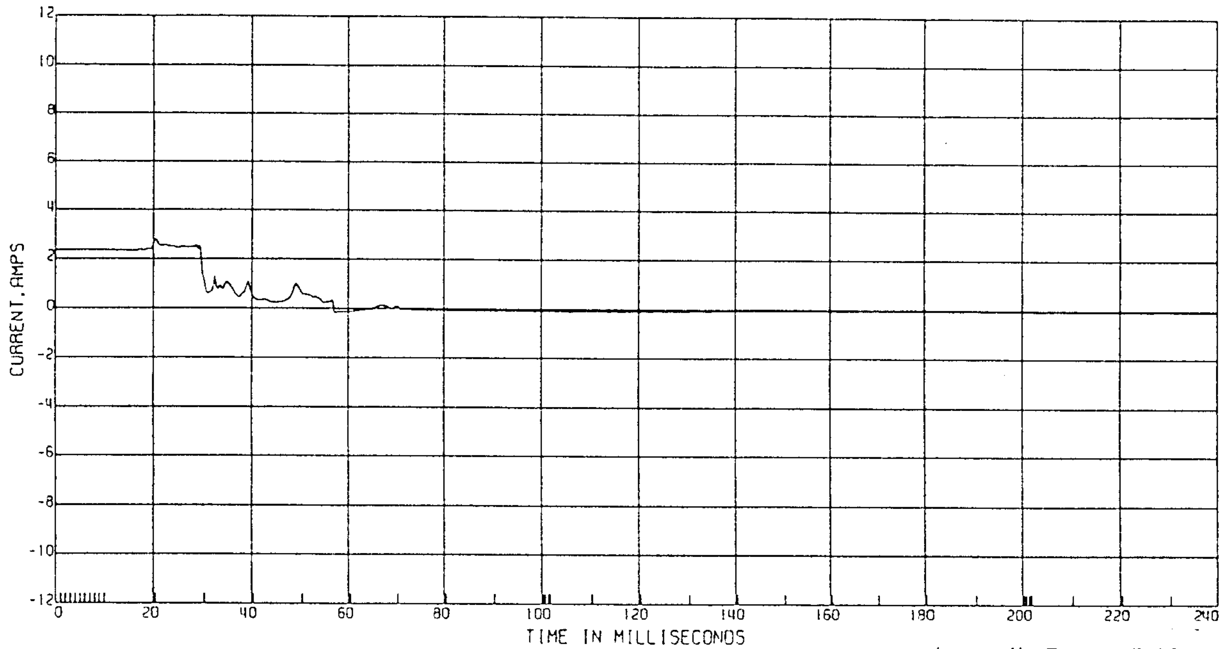
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

A/C CLUTCH CURRENT

TEST DATE:05/16/1996



Appendix B, plot # 123

123

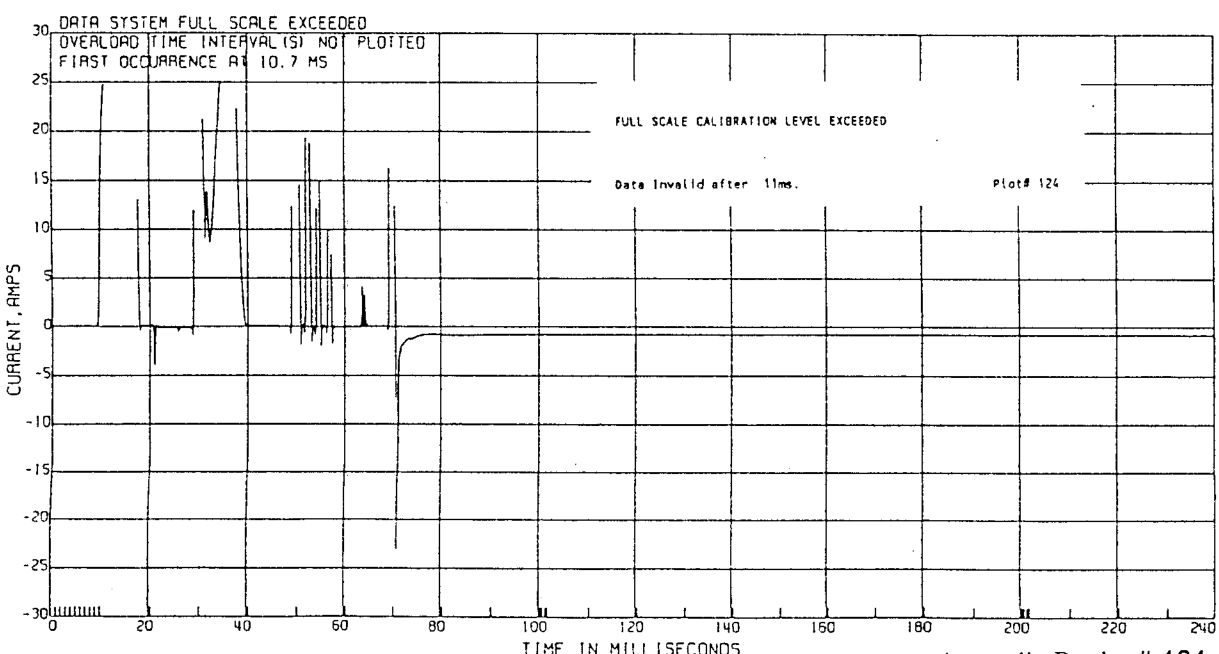
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

COOLING FAN CURRENT

TEST DATE:05/16/1996



Appendix B, plot # 124

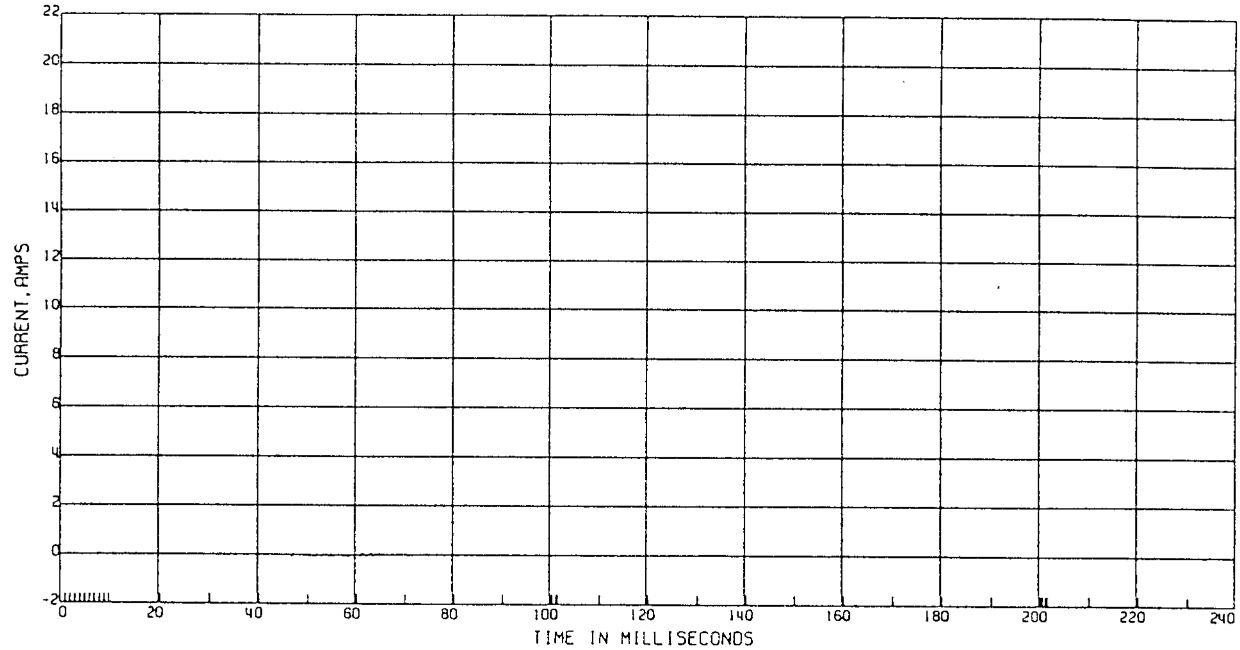
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

TCM FUSED IGNITION CURRENT

TEST DATE:05/16/1996



Appendix B, plot # **125**

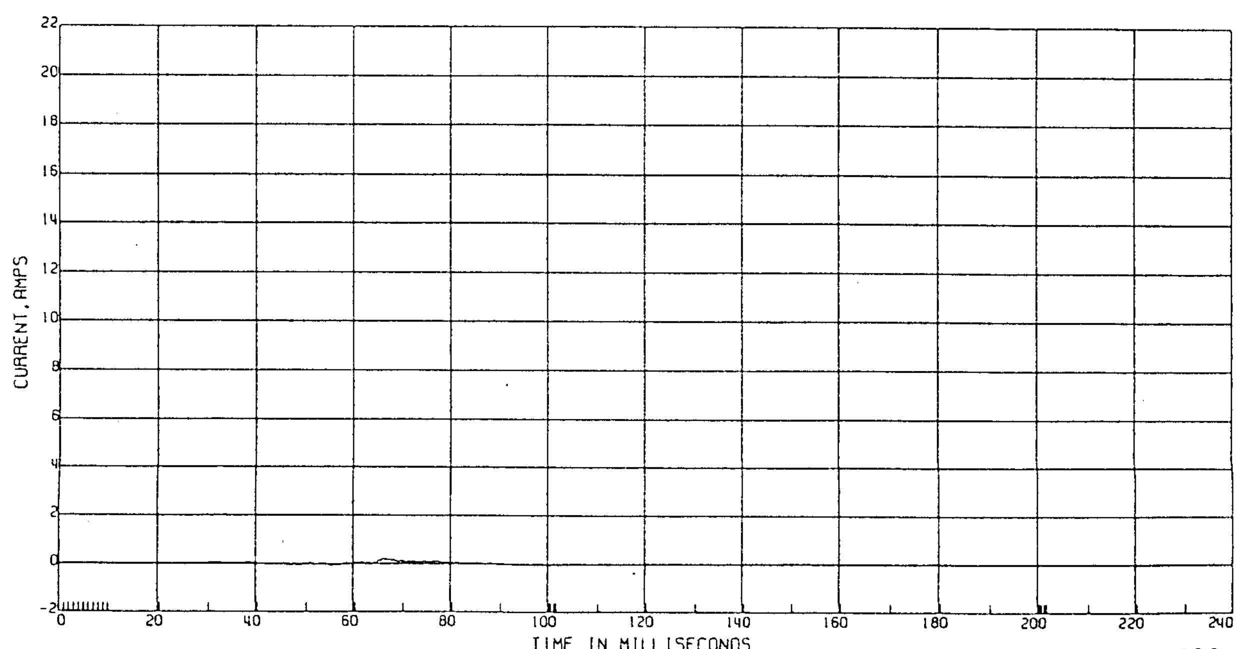
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

TCM IGNITION SWITCH CURRENT

TEST DATE:05/16/1996

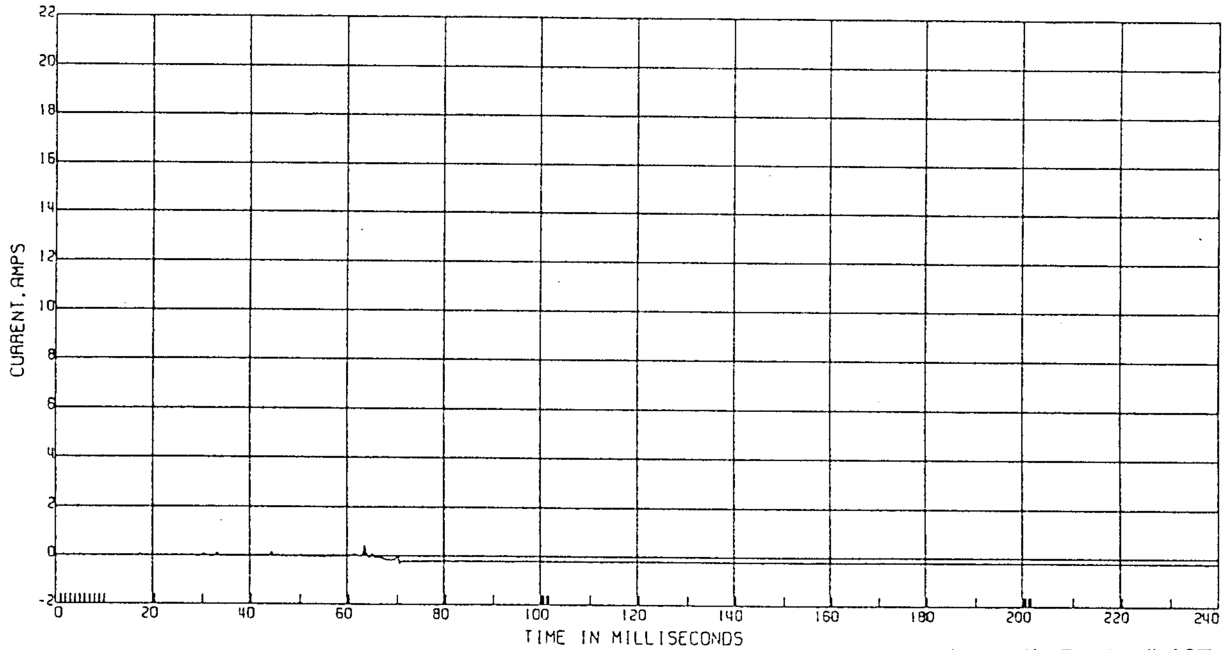


Appendix B, plot # **126**

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN TCM FUSED POWER CURRENT TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 1000

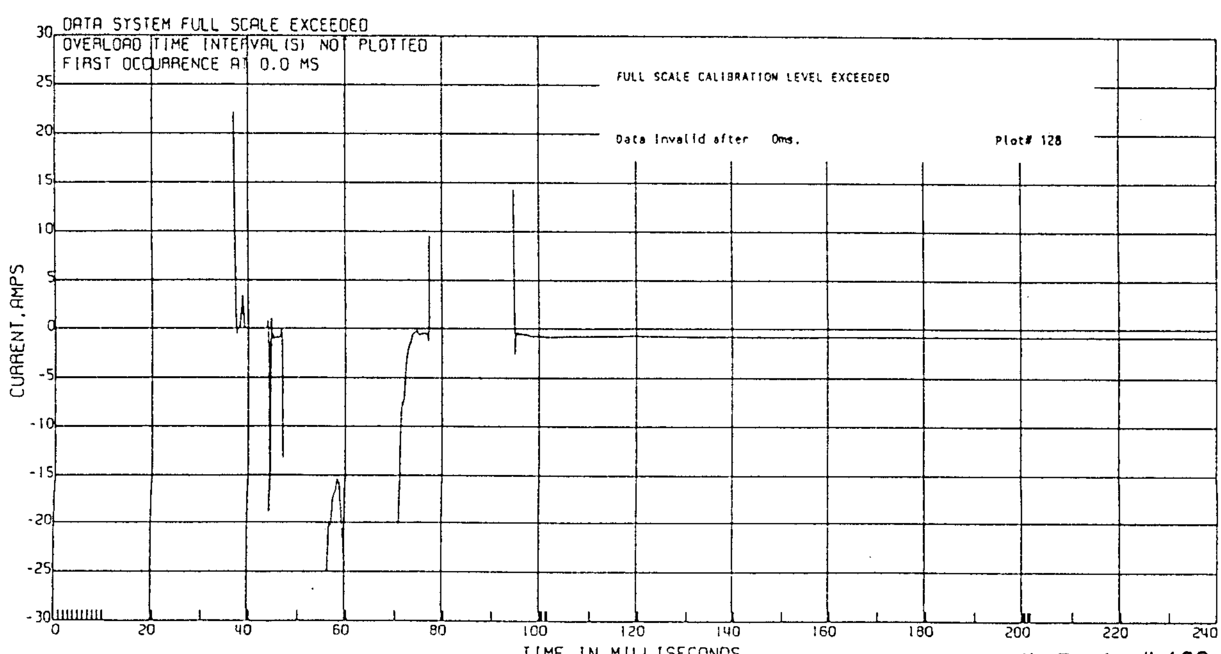


Appendix B, plot # 127

C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN FUSABLE LINK CURRENT TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 1000



Appendix B, plot # 128

C11108 FRONT IMPACT

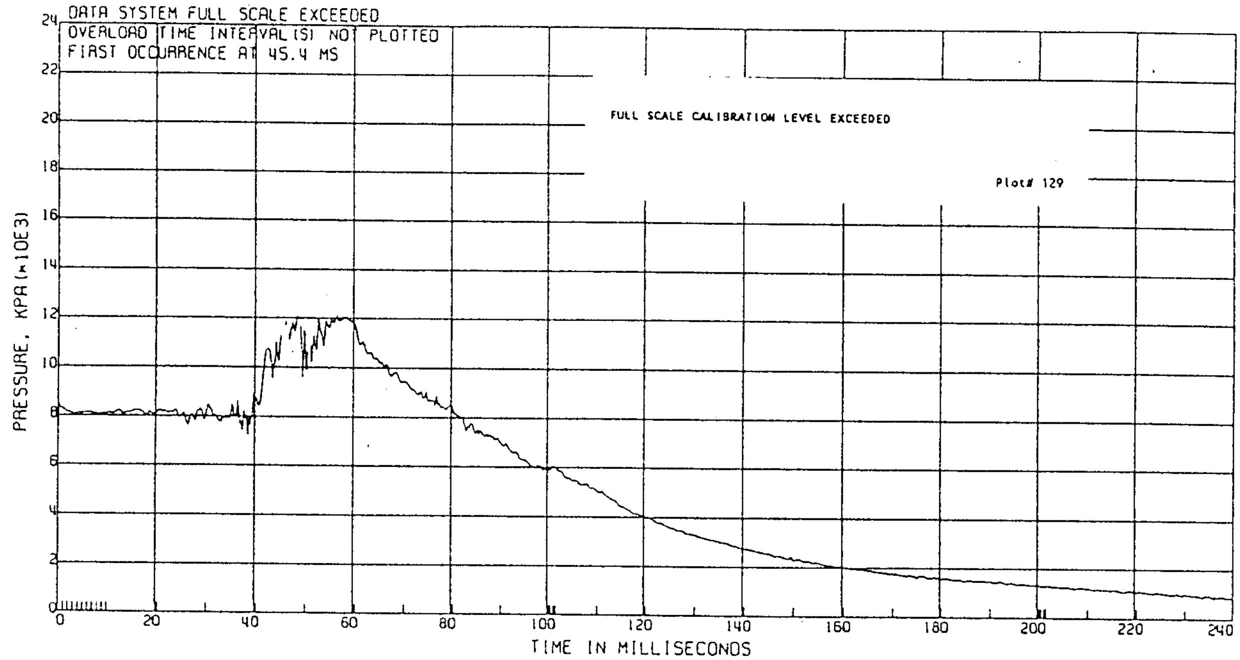
MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

R. FRT BRAKE SYSTEM PRESSURE

TEST DATE:05/16/1996



Appendix B, plot # 129

129

C11108 FRONT IMPACT

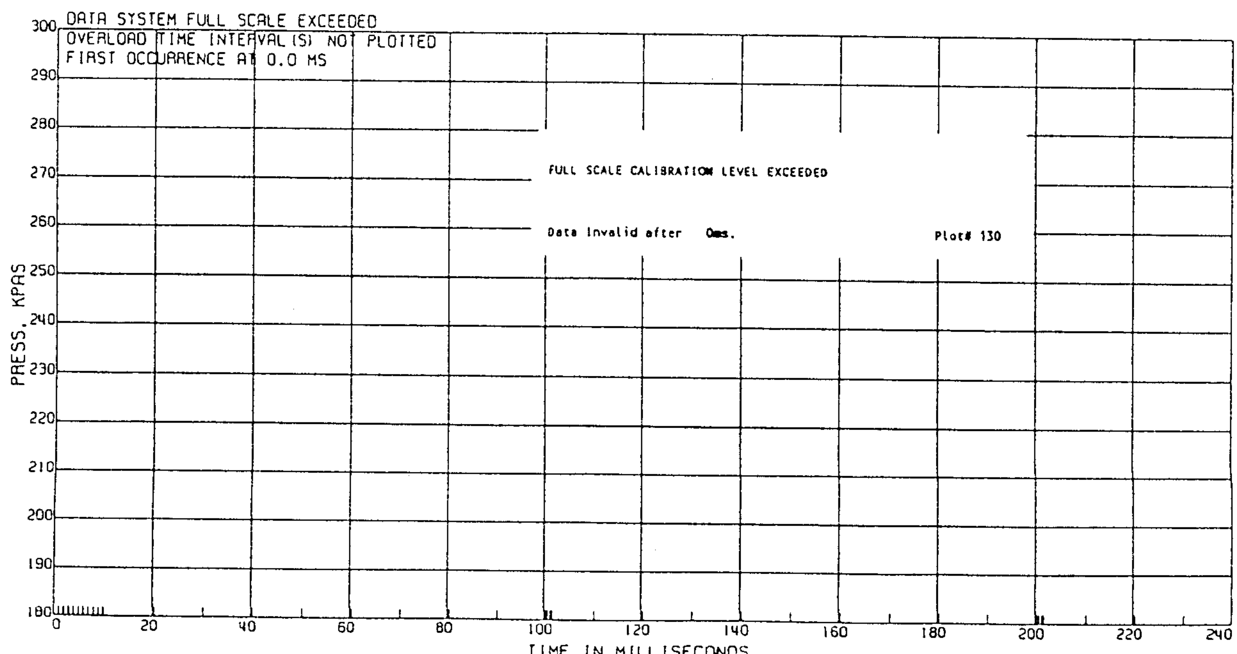
MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

POWER STEERING SYSTEM PRESSURE

TEST DATE:05/16/1996



Appendix B, plot # 130

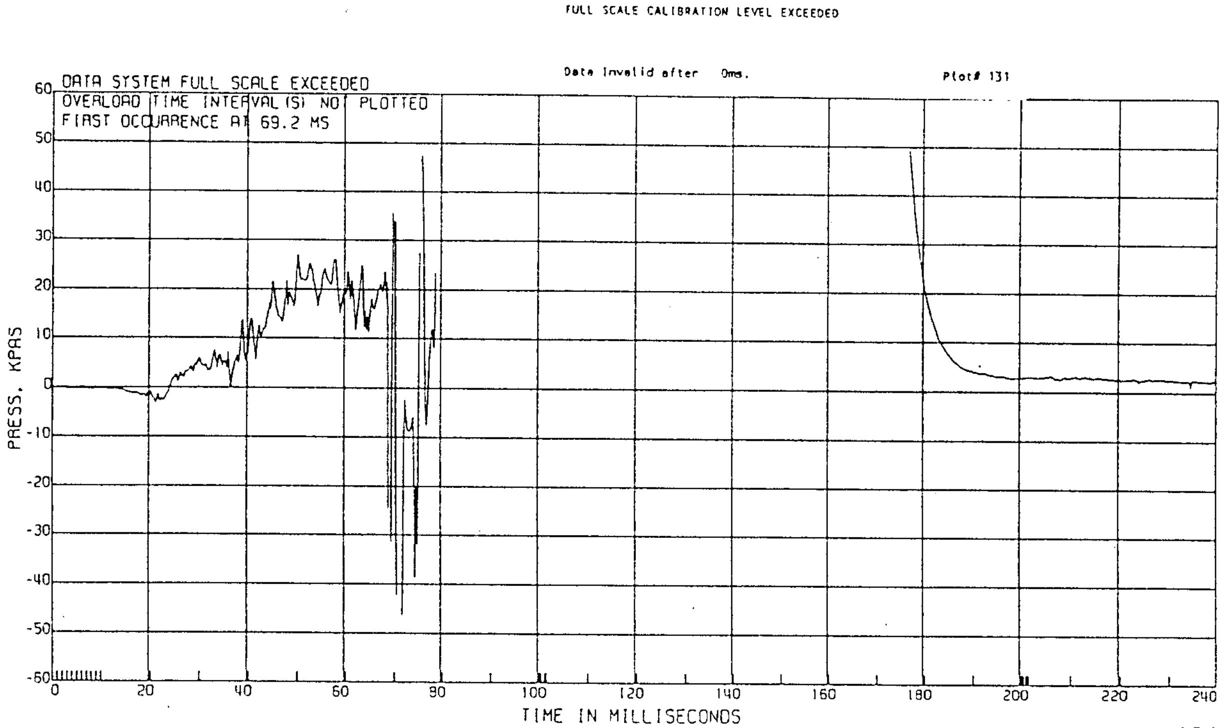
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

COOLING SYSTEM PRESSURE

TEST DATE:05/16/1996



Appendix B, plot # 131

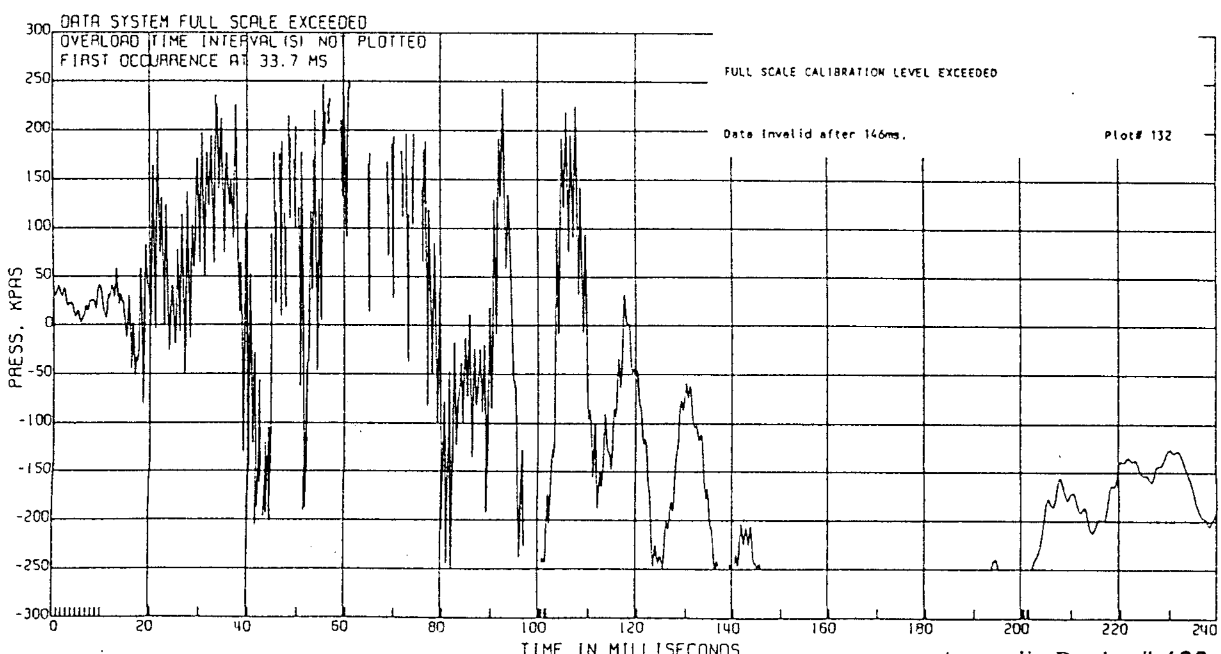
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

AUXILIARY FUEL LINE PRESSURE

TEST DATE:05/16/1996



Appendix B, plot # 132

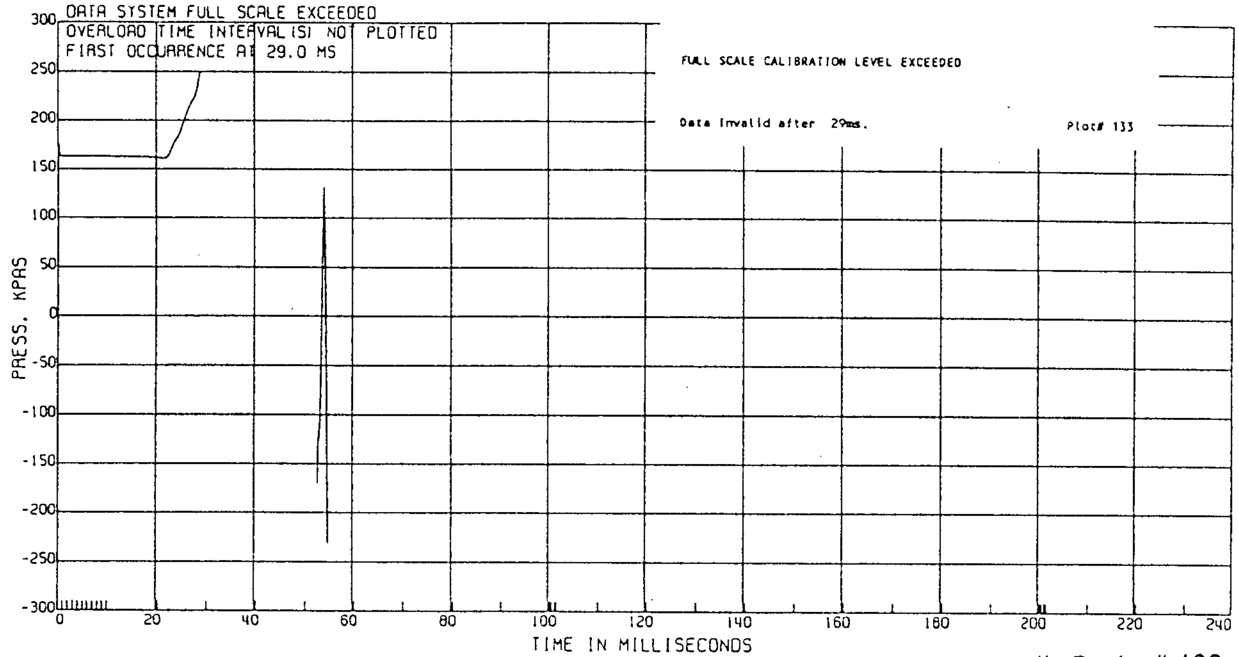
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

ENGINE OIL PRESSURE

TEST DATE:05/16/1996



Appendix B, plot # 133

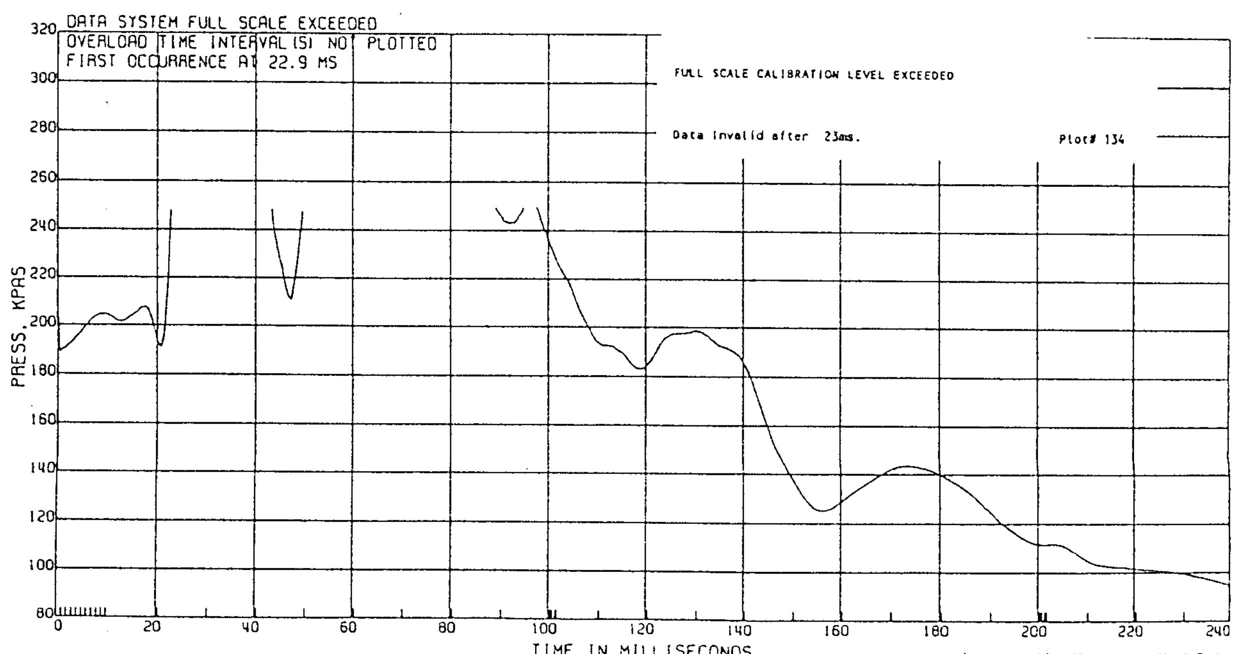
C11108 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T93070 VAN

ELEC DATA, SAE CLASS 1000

TRANSMISSION COOLER FLUID PRESSURE

TEST DATE:05/16/1996



Appendix B, plot # 134

C11108 FRONT IMPACT

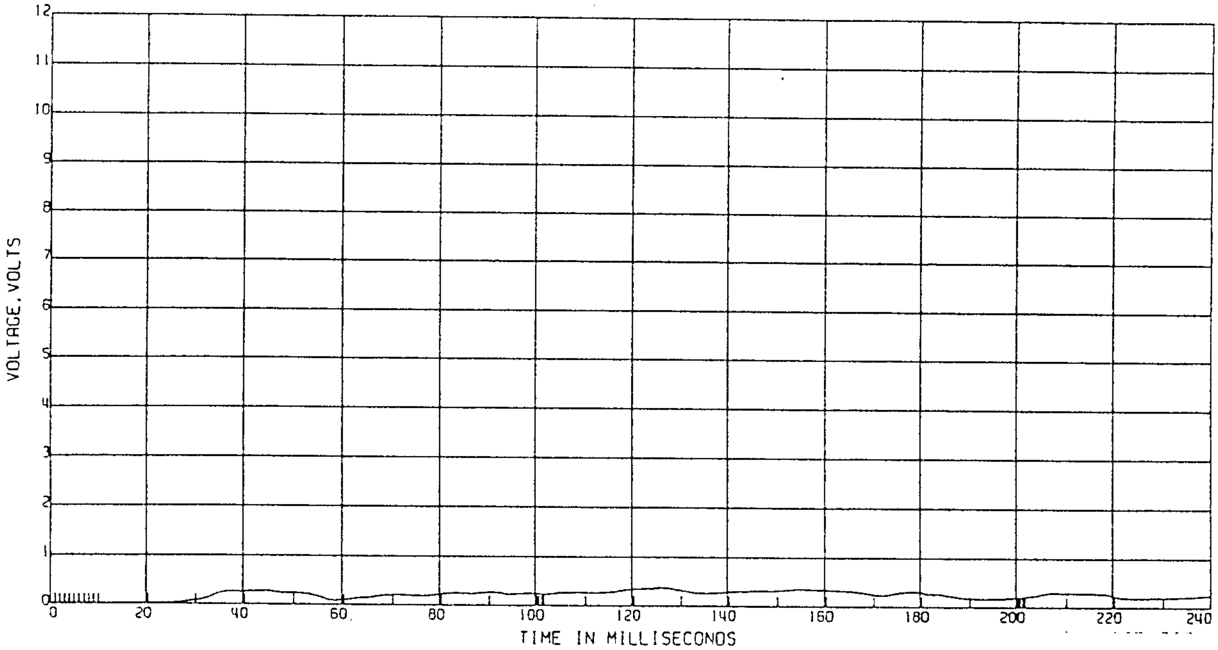
MOVING VEHICLE TO FIXED POLE 55.2KM/H

R & D CTR 8T9307D VAN

VAPOR SENSOR TIME ZERO VOLTAGE

TEST DATE:05/16/1996

ELEC DATA, SAE CLASS 1000



Appendix B, plot # 135

Appendix C: C11108 film plots

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

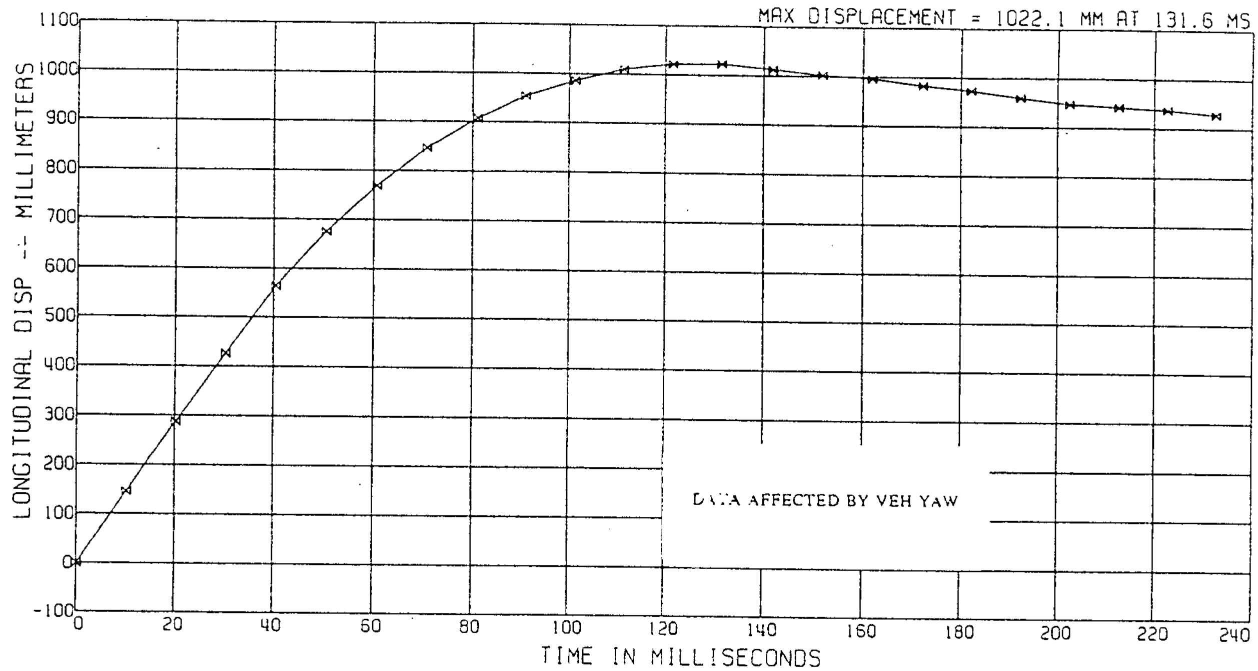
FIGURE

R & D CTR 8T93070 VAN
FILM DATA

LEFT SIDE

TEST DATE:05/16/96

VEHICLE DISPL RELATIVE TO GROUND REFERENCE



Appendix C, plot # 1

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

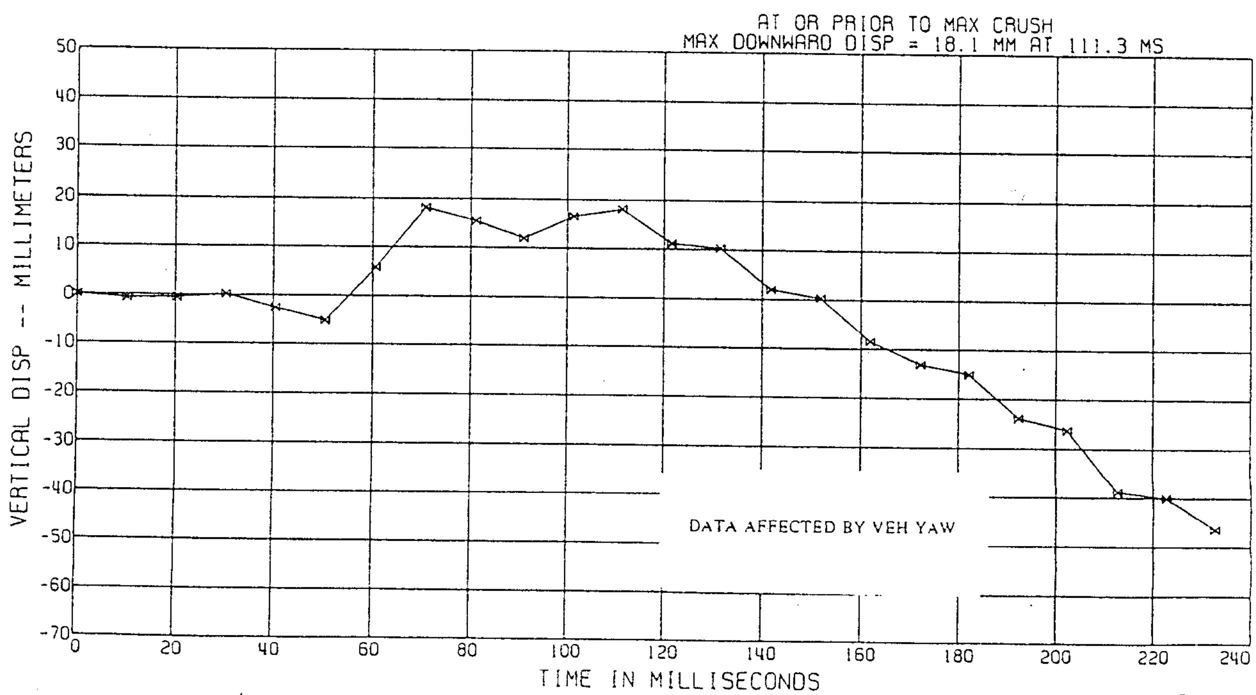
FIGURE

R & D CTR 8T93070 VAN
FILM DATA

LEFT SIDE

TEST DATE:05/16/96

VEHICLE DISPL RELATIVE TO GROUND REFERENCE



Appendix C, plot # 2

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

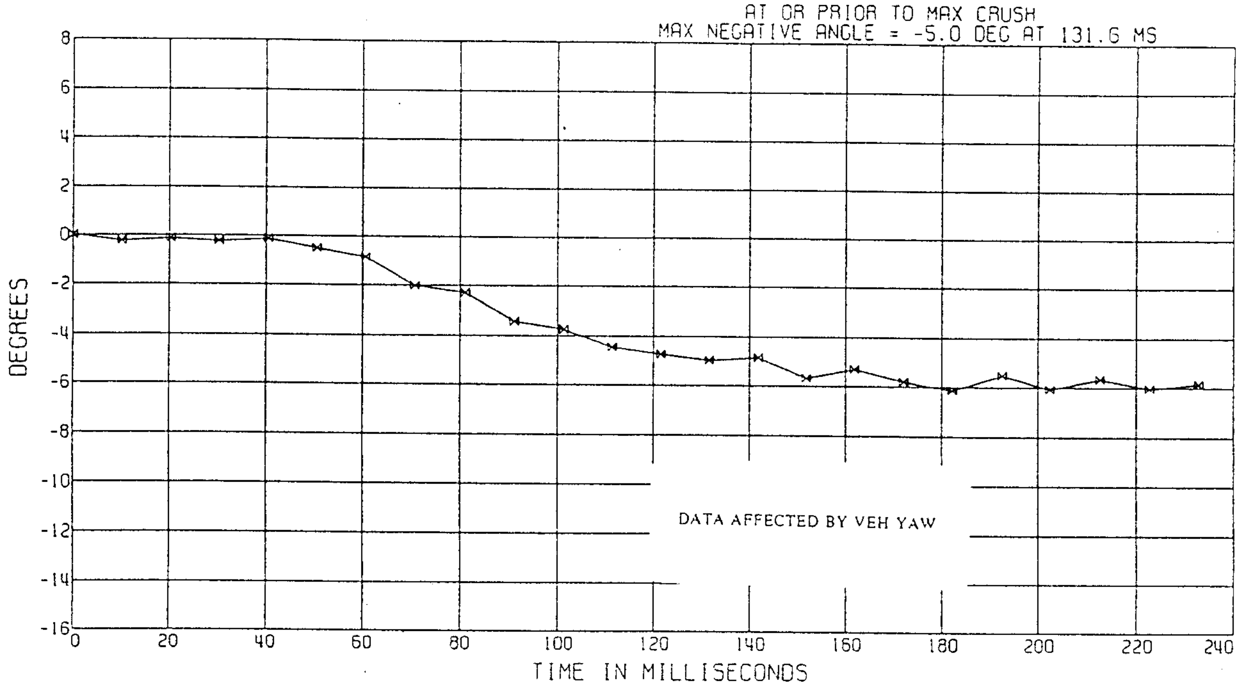
FIGURE

R & D CTR 8T93070 VAN
FILM DATA

LEFT SIDE

TEST DATE:05/16/96

VEHICLE PITCH RELATIVE TO GROUND REFERENCE



Appendix C, plot # 3

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

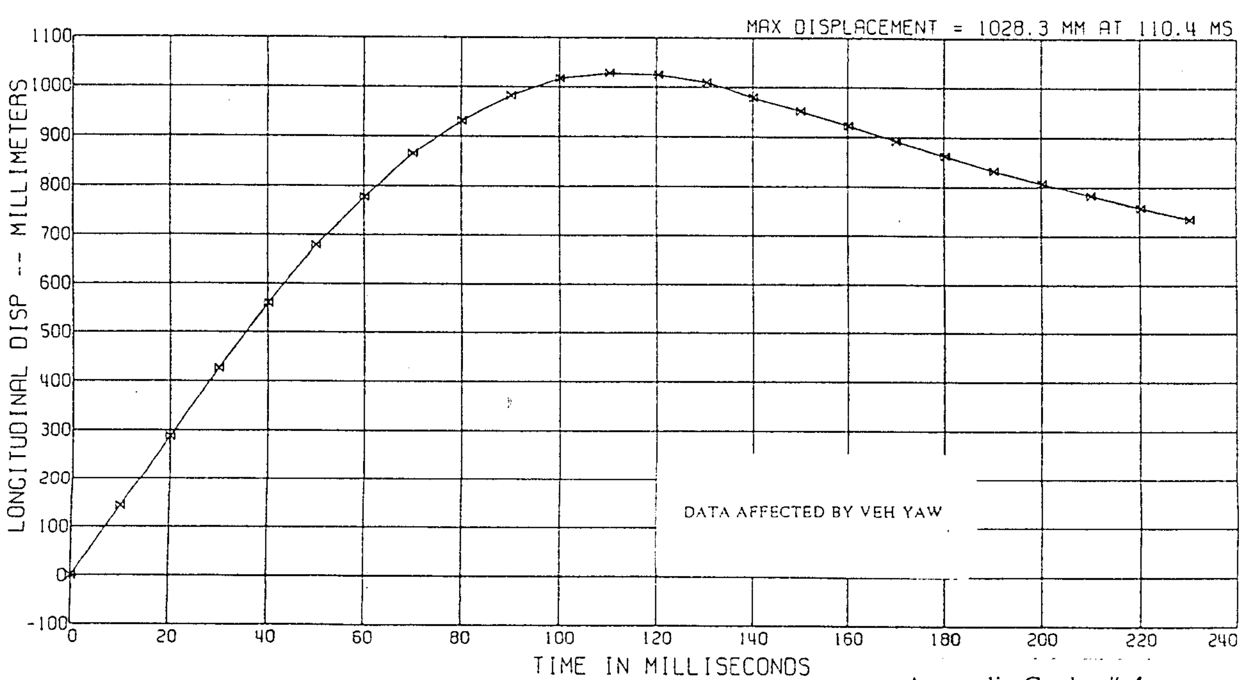
FIGURE

R & D CTR 8T93070 VAN
FILM DATA

RIGHT SIDE

TEST DATE:05/16/96

VEHICLE DISPL RELATIVE TO GROUND REFERENCE



Appendix C, plot # 4

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

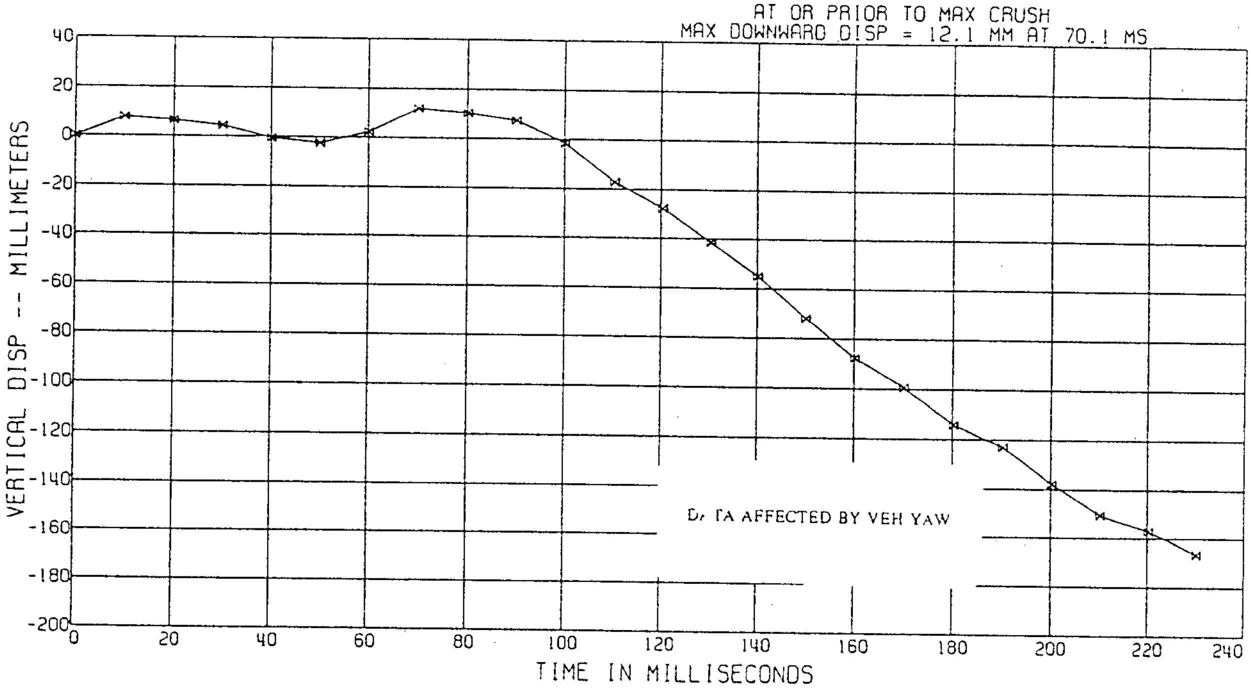
FIGURE

R & D CTR 8T93070 VAN
FILM DATA

RIGHT SIDE

TEST DATE:05/16/96

VEHICLE DISPL RELATIVE TO GROUND REFERENCE



Appendix C, plot # 5

C11108 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.2KM/H

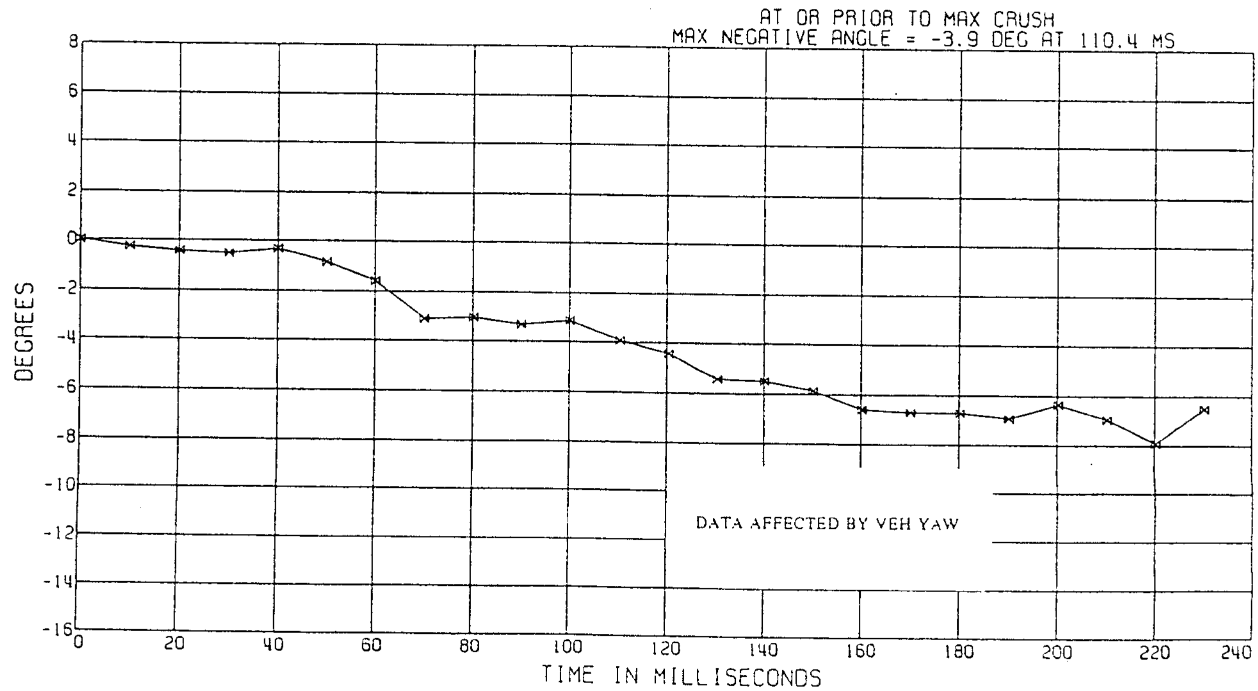
FIGURE

R & D CTR 8T93070 VAN
FILM DATA

RIGHT SIDE

TEST DATE:05/16/96

VEHICLE PITCH RELATIVE TO GROUND REFERENCE



Appendix C, plot # 6

C11108 FRONT IMPACT

R & D CTR 8T9307D VAN
FILM DATA

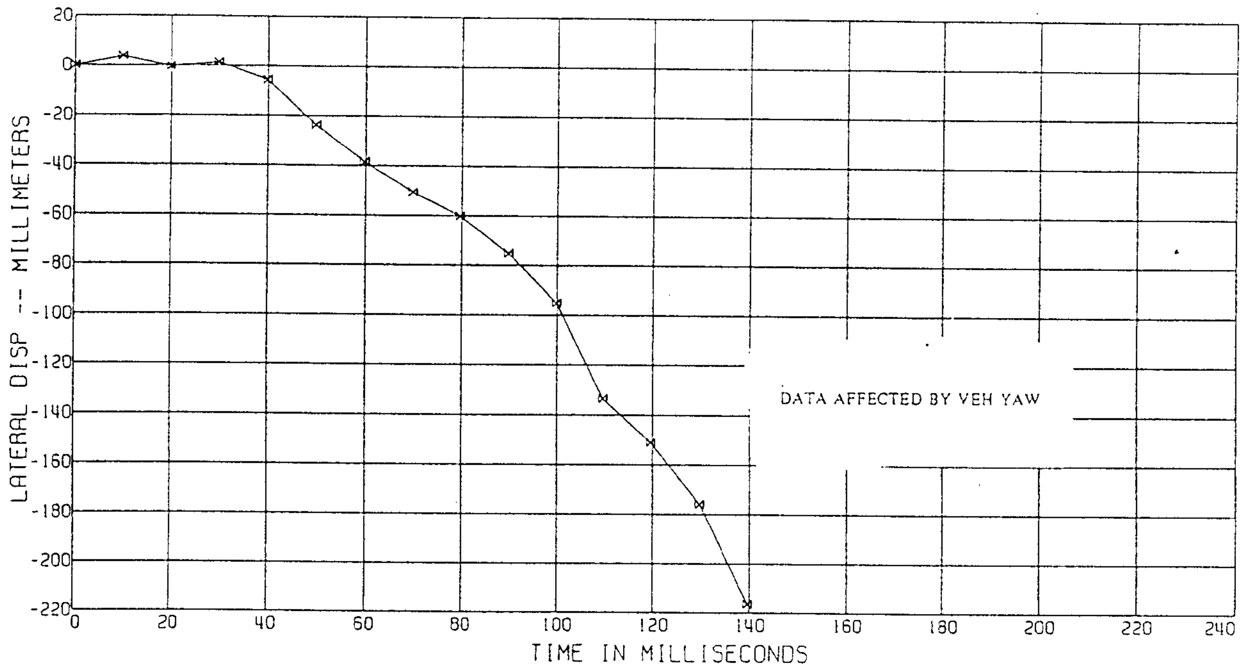
MOVING VEHICLE TO FIXED POLE 55.2KM/H

OVERHEAD VIEW

FIGURE

TEST DATE:05/16/96

VEHICLE DISPL RELATIVE TO POLE REFERENCE



Appendix C, plot # 7

C11108 FRONT IMPACT

R & D CTR 8T9307D VAN
FILM DATA

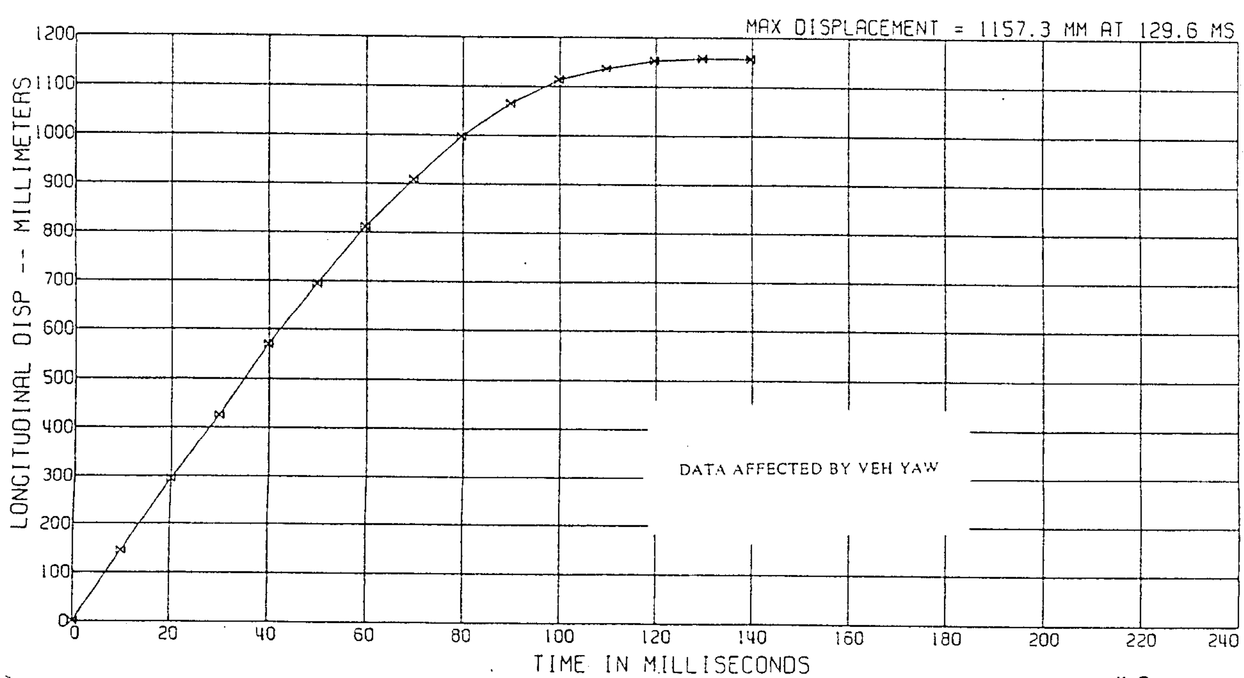
MOVING VEHICLE TO FIXED POLE 55.2KM/H

OVERHEAD VIEW

FIGURE

TEST DATE:05/16/96

VEHICLE DISPL RELATIVE TO POLE REFERENCE



Appendix C, plot # 8

Appendix D: C11167 data plots

LEFT FRONT
ANTHROPOMORPHIC TEST DEVICE SUMMARY DATA
LTV MDB TO STATIONARY VEHICLE 105.7KM/H

C11167 L. FRT IMPACT-335 DEG

R & D CTR 8T9309D VAN

ATD TYPE: GM50H

TEST DATE: 06/26/1996

MEASURED QUANTITY	100% OF IARV	150% OF IARV	IAV VALUE	IARV
HIC, LIMITED TO 15 MS			150	1000
HIC, LIMITED TO 36 MS			230	1000
NECK FLEXION			30NM	190NM
NECK EXTENSION			31NM	57NM
NECK TENSION			0.63	1.00
NECK COMPRESSION			0.25	1.00
NECK SHEAR FORWARD			0.20	1.00
NECK SHEAR REARWARD			0.14	1.00
CHEST ACCEL			49G	60G
! CHEST COMPRESSION W/O SH BELT			39.1MM	65.0MM !
! CHEST COMPRESSION W/ SH BELT			39.1MM	50.0MM !
CHEST VISCOUS CRITERIA			0.67M/SEC	1.00M/SEC
FEMUR COMP, LEFT			12454N	10000N
FEMUR COMP, RIGHT			7509N	10000N
FEMUR DURATION ASSESS, LEFT			1.38	1.00
FEMUR DURATION ASSESS, RIGHT			0.83	1.00
TIBIA/FEMUR DISP, LEFT			2.1MM	15.0MM
TIBIA/FEMUR DISP, RIGHT			0.0MM	15.0MM
KNEE CLEVIS, LEFT INSIDE			2857N	4000N
KNEE CLEVIS, LEFT OUTSIDE			1232N	4000N
KNEE CLEVIS, RIGHT INSIDE			3027N	4000N
KNEE CLEVIS, RIGHT OUTSIDE			3878N	4000N
TIBIA COMP, LEFT			3274N	8000N
TIBIA COMP, RIGHT			6265N	8000N
TIBIA MOM, UPPER, LEFT			182NM	225NM
TIBIA MOM, UPPER, RIGHT			274NM	225NM
TIBIA MOM, LOWER, LEFT		***	338NM	225NM
TIBIA MOM, LOWER, RIGHT		***	461NM	225NM
LEG INDEX, UPPER LEFT			0.84	1.00
LEG INDEX, UPPER RIGHT			1.35	1.00
LEG INDEX, LOWER LEFT		***	1.55	1.00
LEG INDEX, LOWER RIGHT		***	2.15	1.00

IAV - INJURY ASSESSMENT VALUE

IARV - INJURY ASSESSMENT REFERENCE VALUE

1E

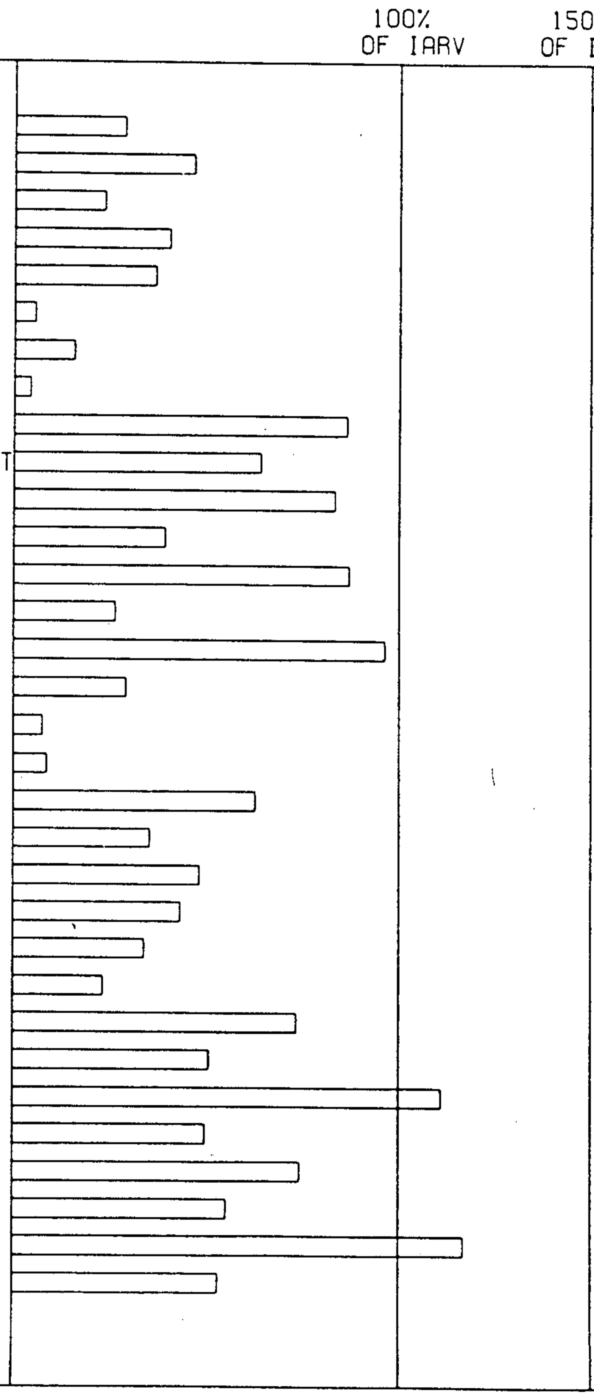
! RESTRAINT SYSTEM DEPENDENT. CHOOSE VALUE THAT APPLIES TO THIS TEST.

*** VALUE GREATER THAN 150% OF IAV

RIGHT FRONT
ANTHROPOMORPHIC TEST DEVICE SUMMARY DATA
LTV MDB TO STATIONARY VEHICLE 105.7KM/H

C11167 L. FRT IMPACT-335 DEG
R & D CTR 8T9309D VAN

ATD TYPE: GM50H
TEST DATE:- 06/26/1996



MEASURED QUANTITY	IAV VALUE	IARV
HIC, LIMITED TO 15 MS	290	1000
HIC, LIMITED TO 36 MS	470	1000
NECK FLEXION	45NM	190NM
NECK EXTENSION	23NM	57NM
NECK TENSION	0.37	1.00
NECK COMPRESSION	0.06	1.00
NECK SHEAR FORWARD	0.16	1.00
NECK SHEAR REARWARD	0.04	1.00
CHEST ACCEL	52G	60G
! CHEST COMPRESSION W/O SH BELT	41.8MM	65.0MM !
! CHEST COMPRESSION W/ SH BELT	41.8MM	50.0MM !
CHEST VISCOUS CRITERIA	0.40M/SEC	1.00M/SEC
FEMUR COMP, LEFT	8731N	10000N
FEMUR COMP, RIGHT	2672N	10000N
FEMUR DURATION ASSESS, LEFT	0.96	1.00
FEMUR DURATION ASSESS, RIGHT	0.30	1.00
TIBIA/FEMUR DISP, LEFT	1.1MM	15.0MM
TIBIA/FEMUR DISP, RIGHT	1.3MM	15.0MM
KNEE CLEVIS, LEFT INSIDE	2521N	4000N
KNEE CLEVIS, LEFT OUTSIDE	1431N	4000N
KNEE CLEVIS, RIGHT INSIDE	1947N	4000N
KNEE CLEVIS, RIGHT OUTSIDE	1748N	4000N
TIBIA COMP, LEFT	2751N	8000N
TIBIA COMP, RIGHT	1887N	8000N
TIBIA MOM, UPPER, LEFT	166NM	225NM
TIBIA MOM, UPPER, RIGHT	115NM	225NM
TIBIA MOM, LOWER, LEFT	249NM	225NM
TIBIA MOM, LOWER, RIGHT	113NM	225NM
LEG INDEX, UPPER LEFT	0.75	1.00
LEG INDEX, UPPER RIGHT	0.56	1.00
LEG INDEX, LOWER LEFT	1.17	1.00
LEG INDEX, LOWER RIGHT	0.54	1.00

IAV - INJURY ASSESSMENT VALUE
IARV - INJURY ASSESSMENT REFERENCE VALUE

PROCESSED 06/27/1996 15:57 V2.04E

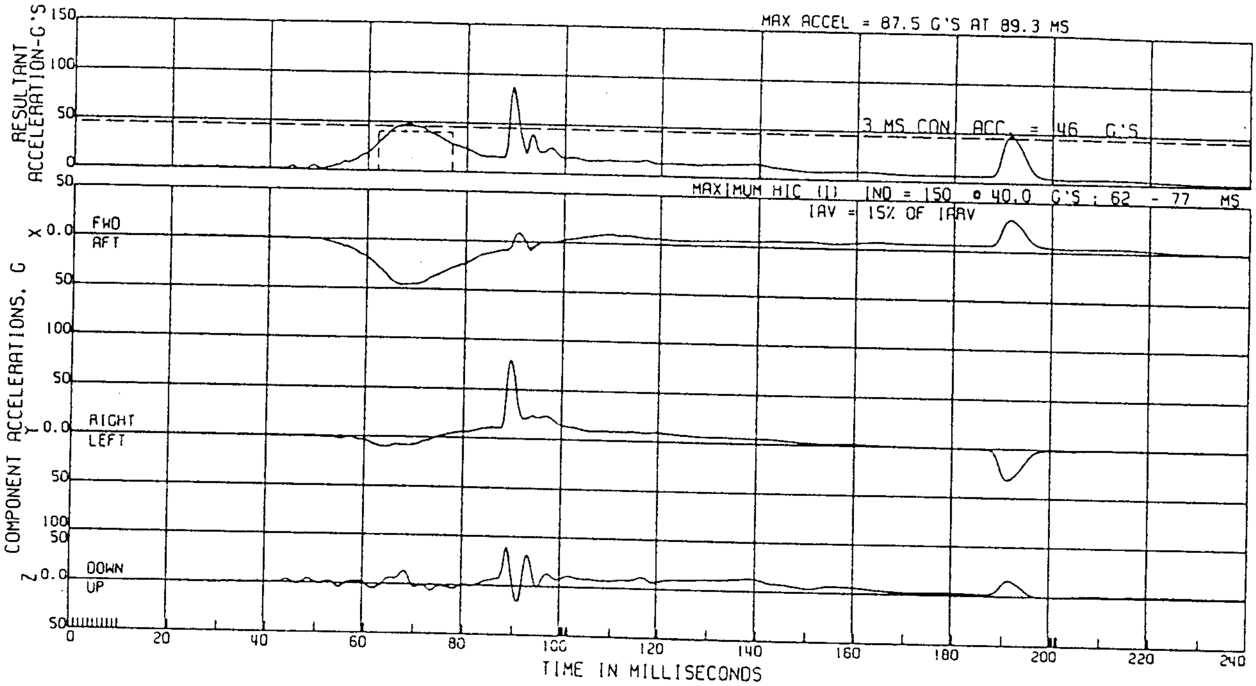
! RESTRAINT SYSTEM DEPENDENT. CHOOSE VALUE THAT APPLIES TO THIS TEST.

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

L. FRT HEAD ACCEL.
(HIC I LIMITED TO 15MS)

ATD TYPE: GM50H
TEST DATE:06/26/1996



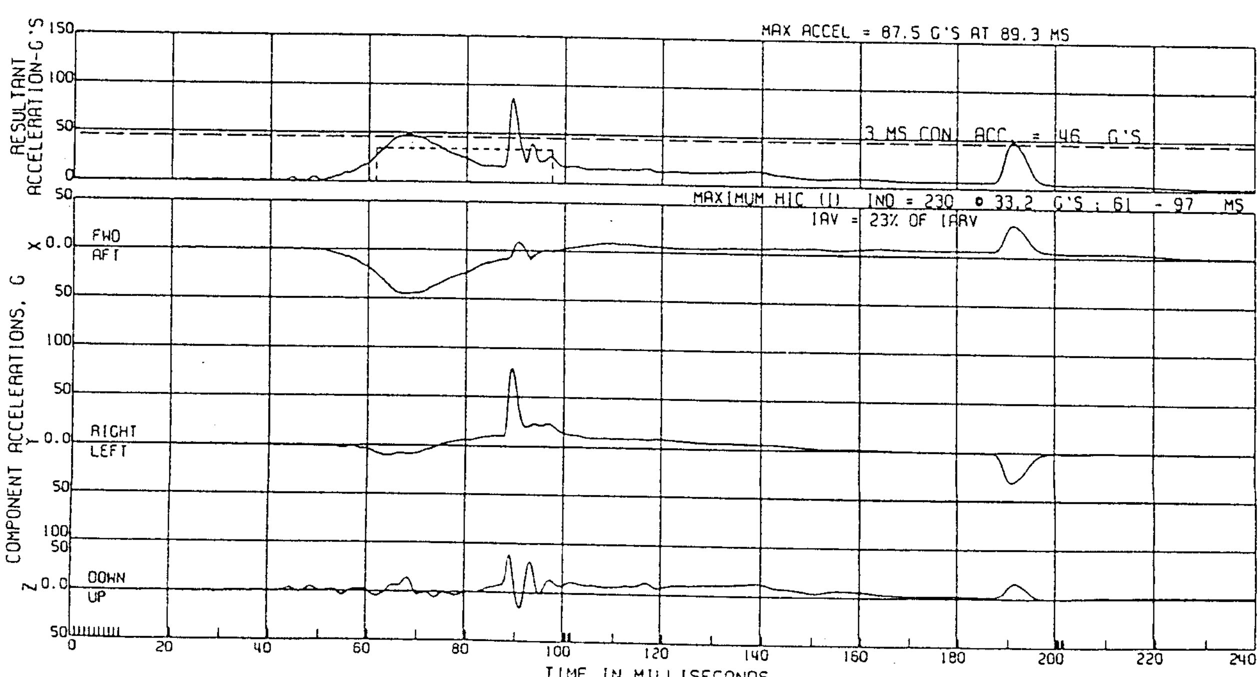
Appendix D, plot # 1

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

L. FRT HEAD ACCEL.
(HIC I LIMITED TO 36MS)

ATD TYPE: GM50H
TEST DATE:06/26/1996



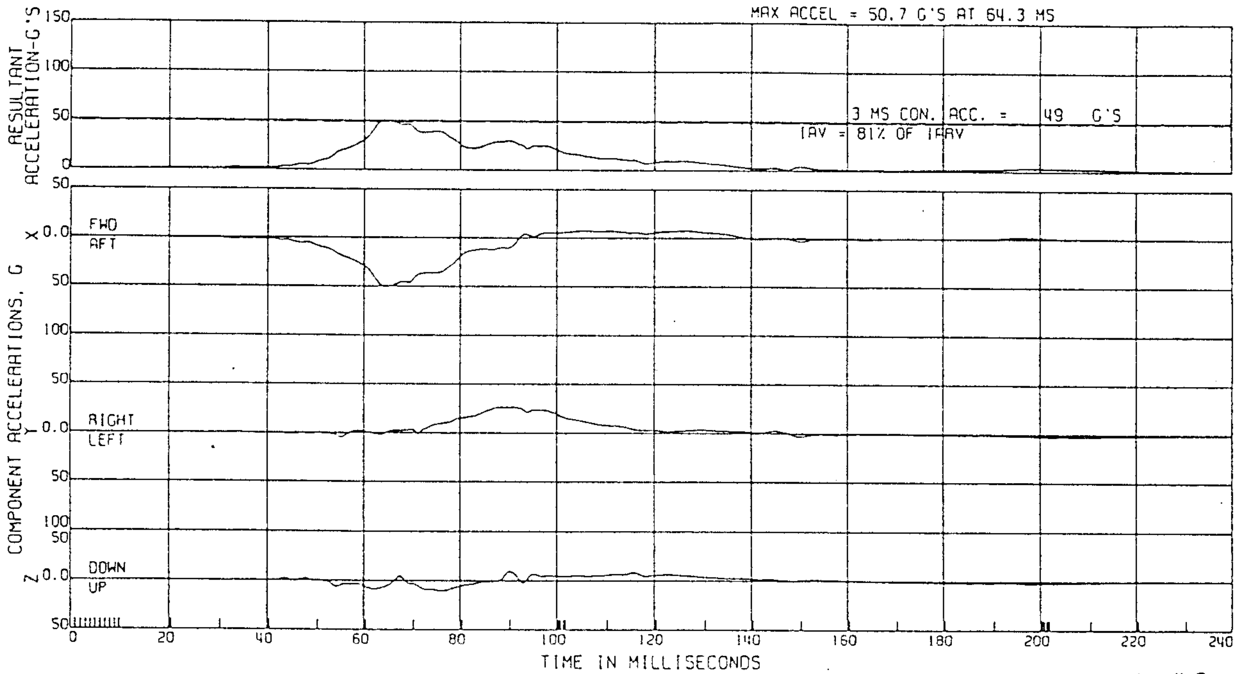
Appendix D, plot # 2

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

L. FRT CHEST ACCEL.

ATD TYPE: GM50H
TEST DATE:06/26/1996



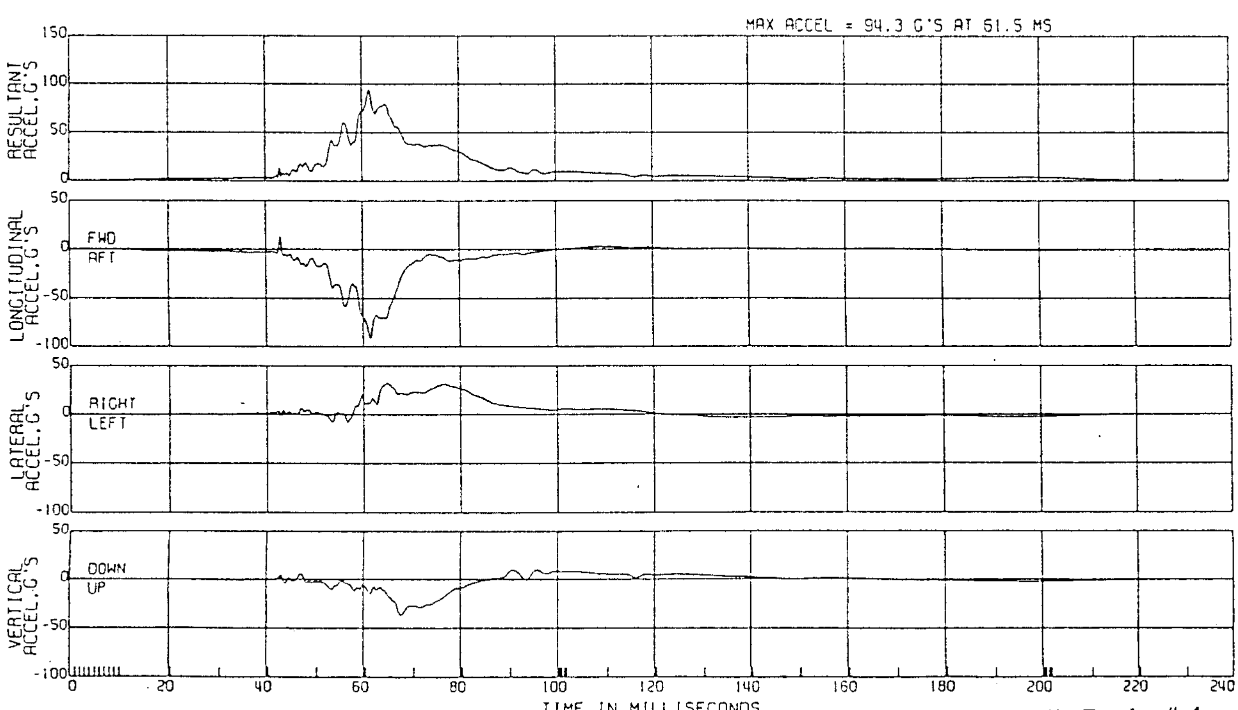
Appendix D, plot # 3

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

L. FRT PELVIC ACCEL.

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 4

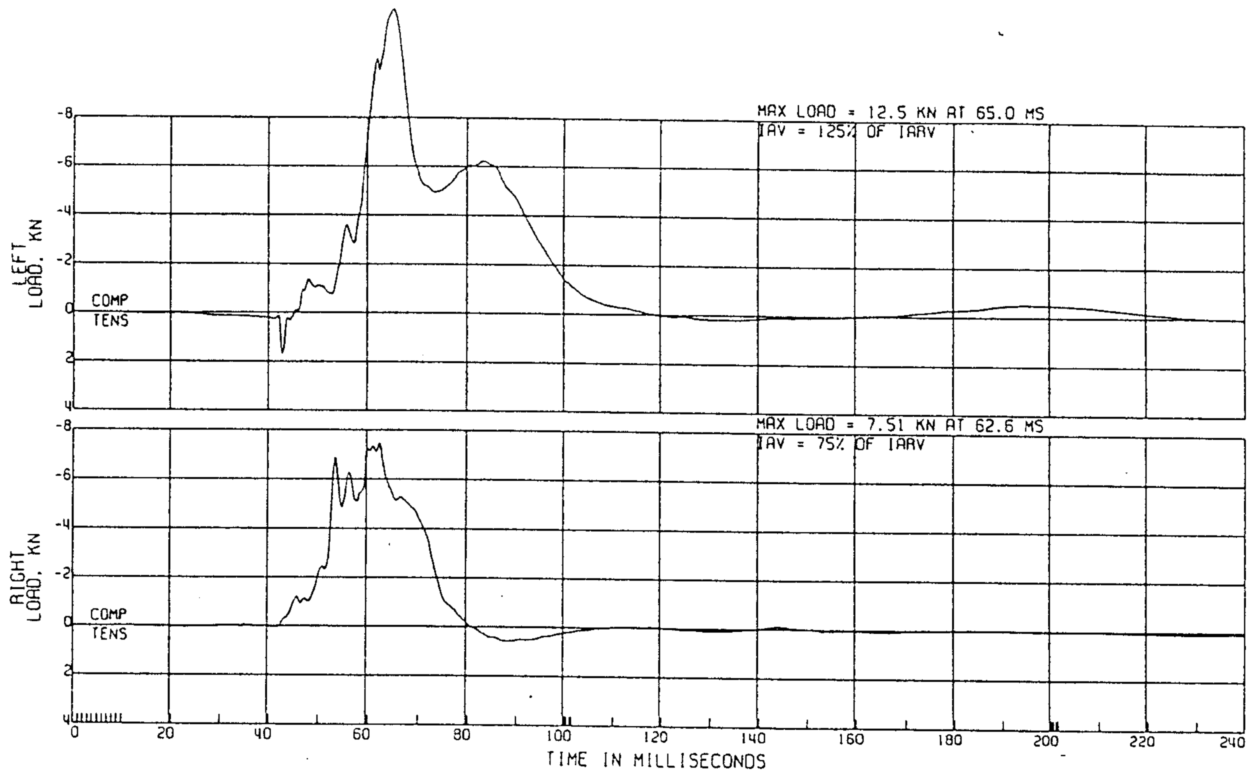
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 5

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

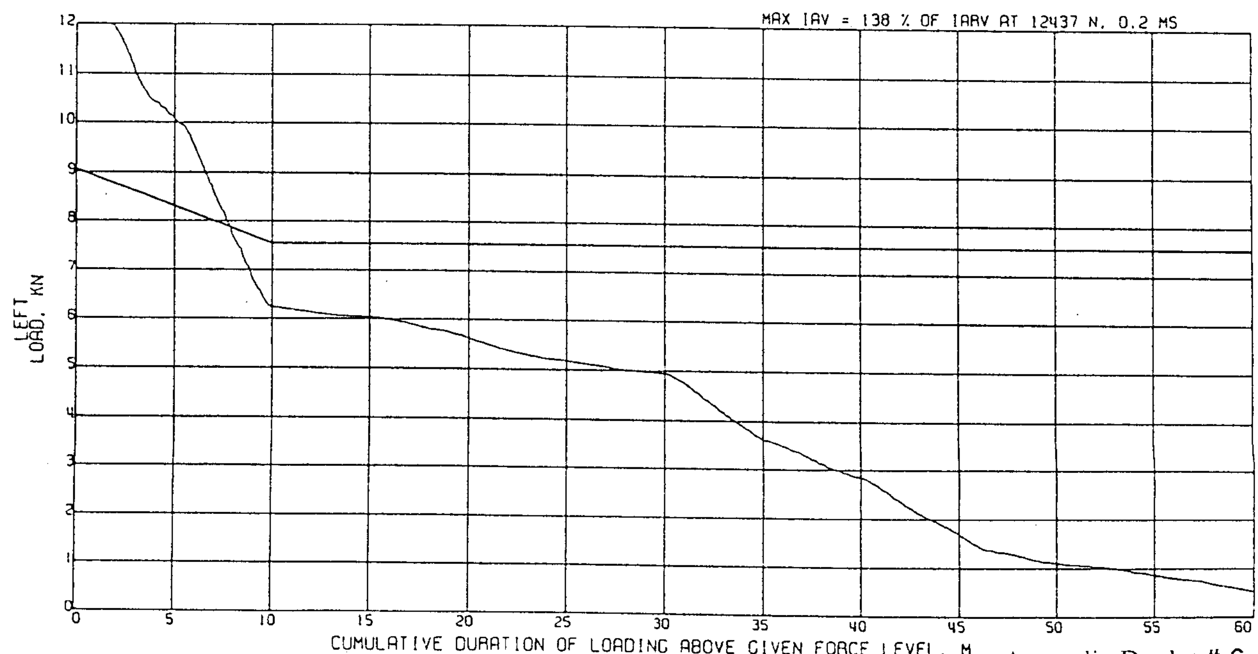
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD

DURATION ASSESSMENT

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 6

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

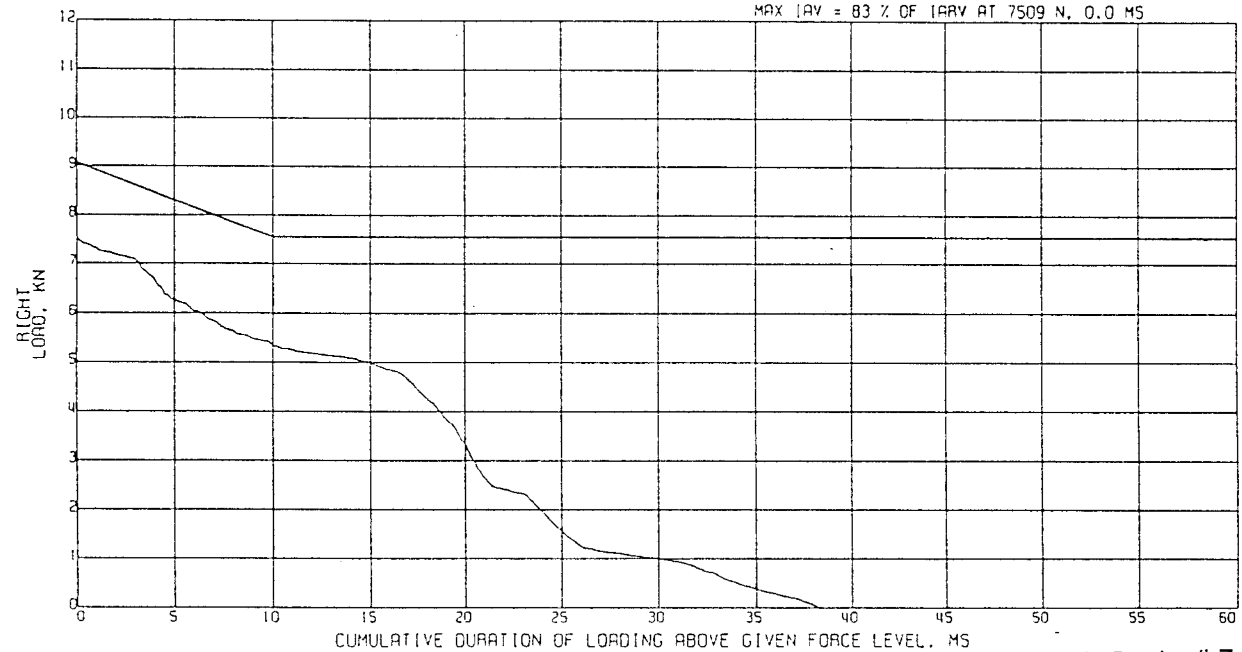
ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD

DURATION ASSESSMENT

ATD TYPE: GM50H

TEST DATE:06/26/1996



Appendix D, plot # 7

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

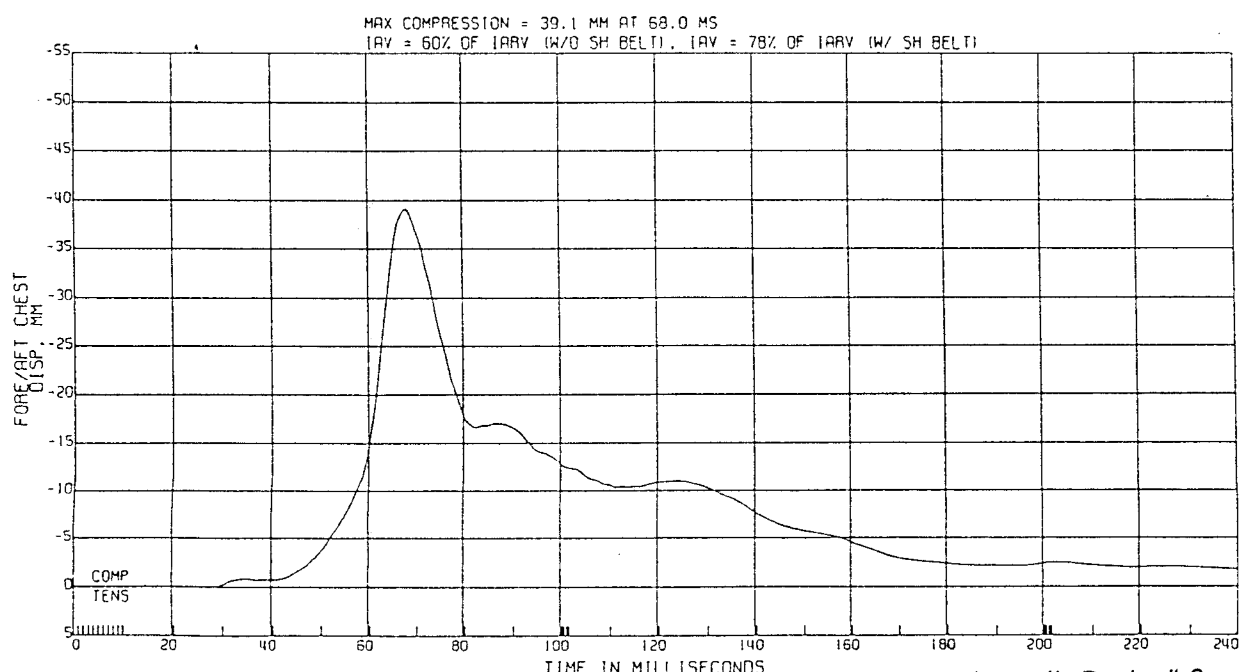
ELEC DATA, SAE CLASS 180

L. FRT CHEST DISP, TEMP AT 78.3'F

NORMALIZED TO 70.7'F & PART 572 CORRIDOR

ATD TYPE: GM50H

TEST DATE:06/26/1996



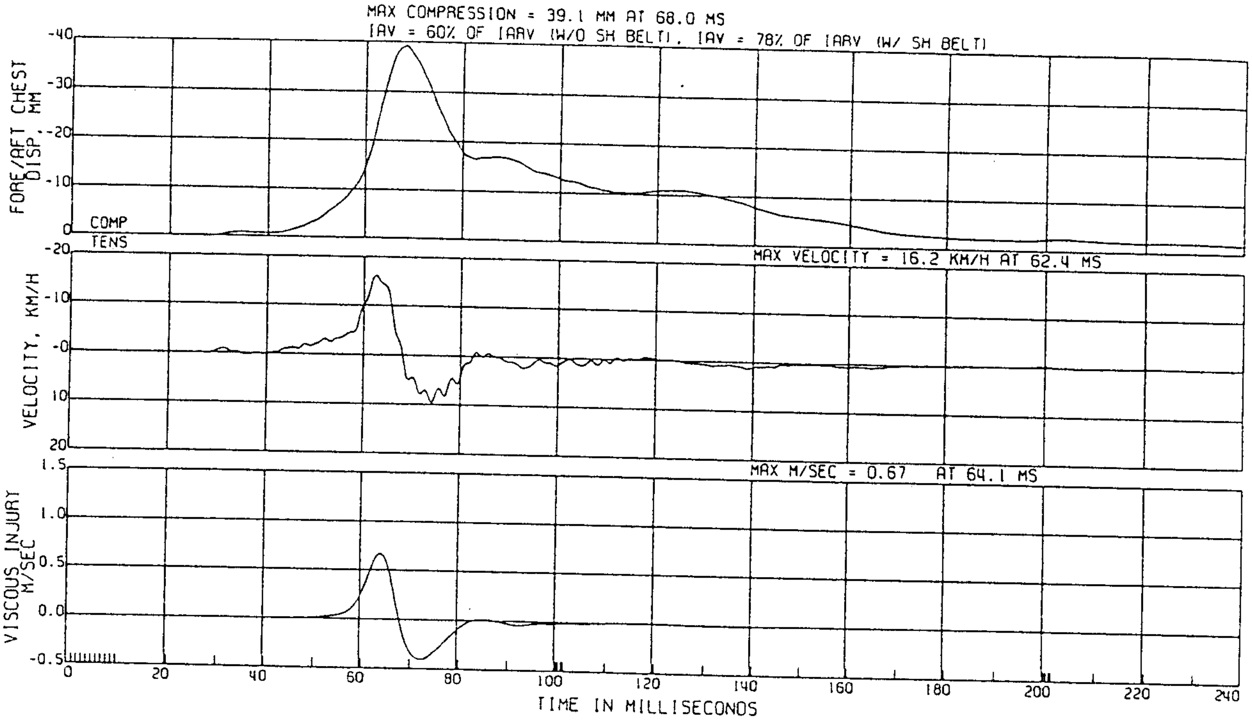
Appendix D, plot # 8

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

L. FRT CHEST COMPRESSIVE DISP.
NORMALIZED, W/CALC VEL & VISCOUS INJURY

ATD TYPE: GM50H
TEST DATE:06/26/1996



9

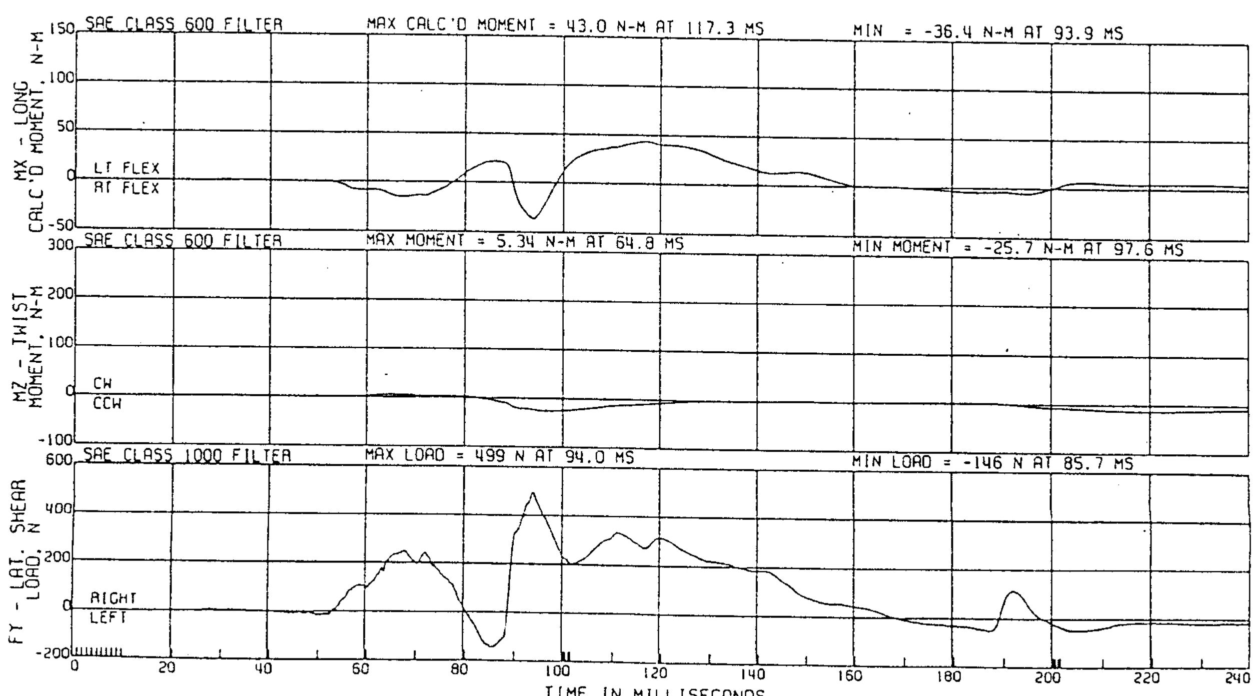
Appendix D, plot # 9

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA

L. FRT NECK LOADING ON HEAD, UPPER LOAD
L. FRT NECK LOADING ON HEAD

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 10

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

ATD TYPE: GM50H

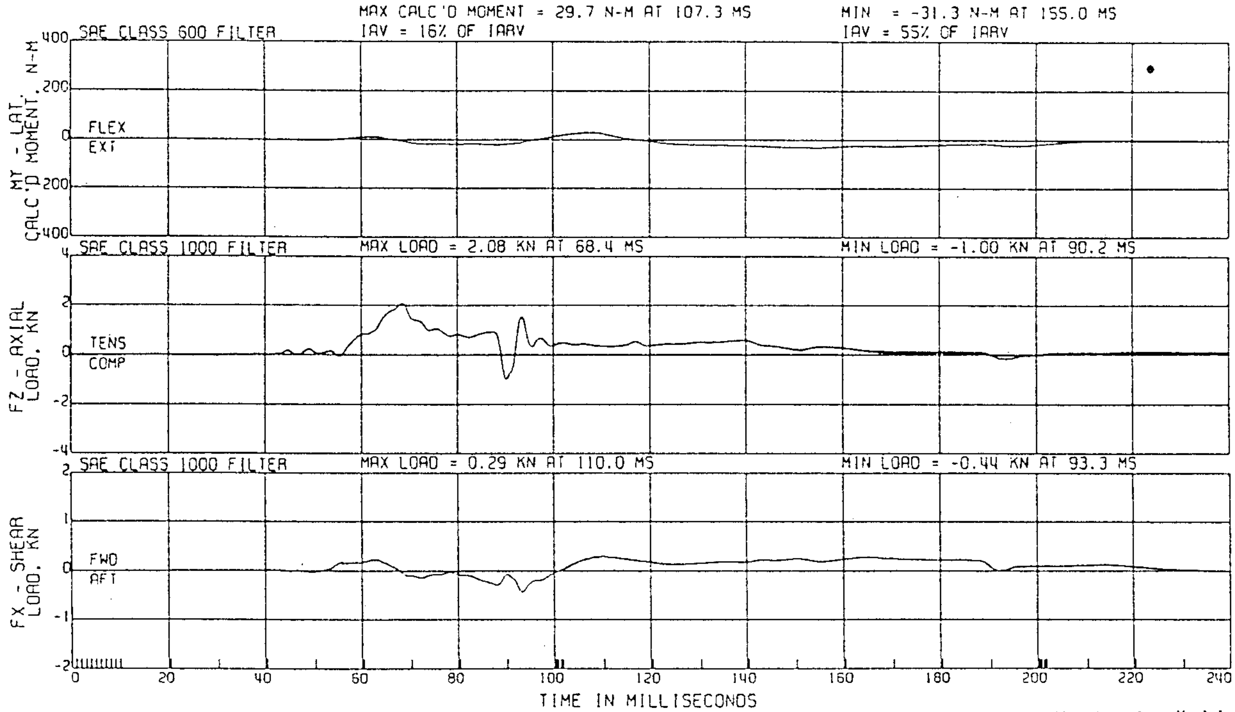
R & D CTR 8T93090 VAN

TEST DATE:06/26/1996

ELEC DATA

NECK LOADING ON HEAD

L. FRT NECK LOADING ON HEAD



Appendix D, plot # 11

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

ATD TYPE: GM50H

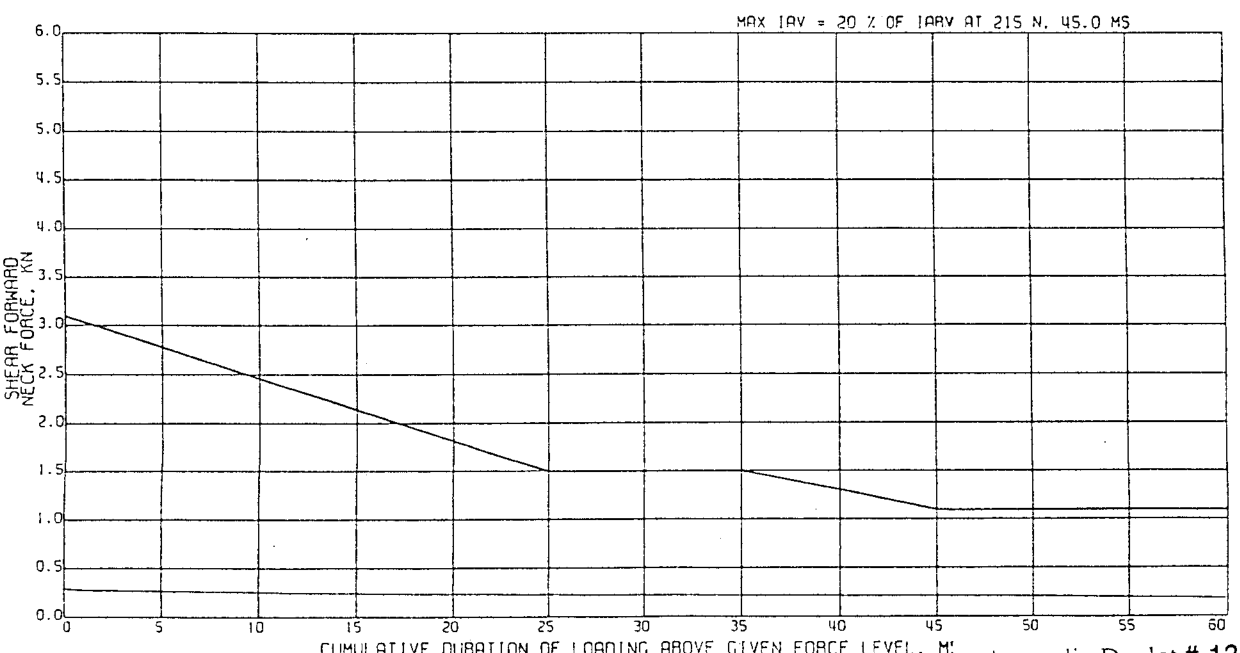
R & D CTR 8T93090 VAN

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 1000

FORWARD NECK SHEAR ON HEAD,

L. FRT INJURY REFERENCE



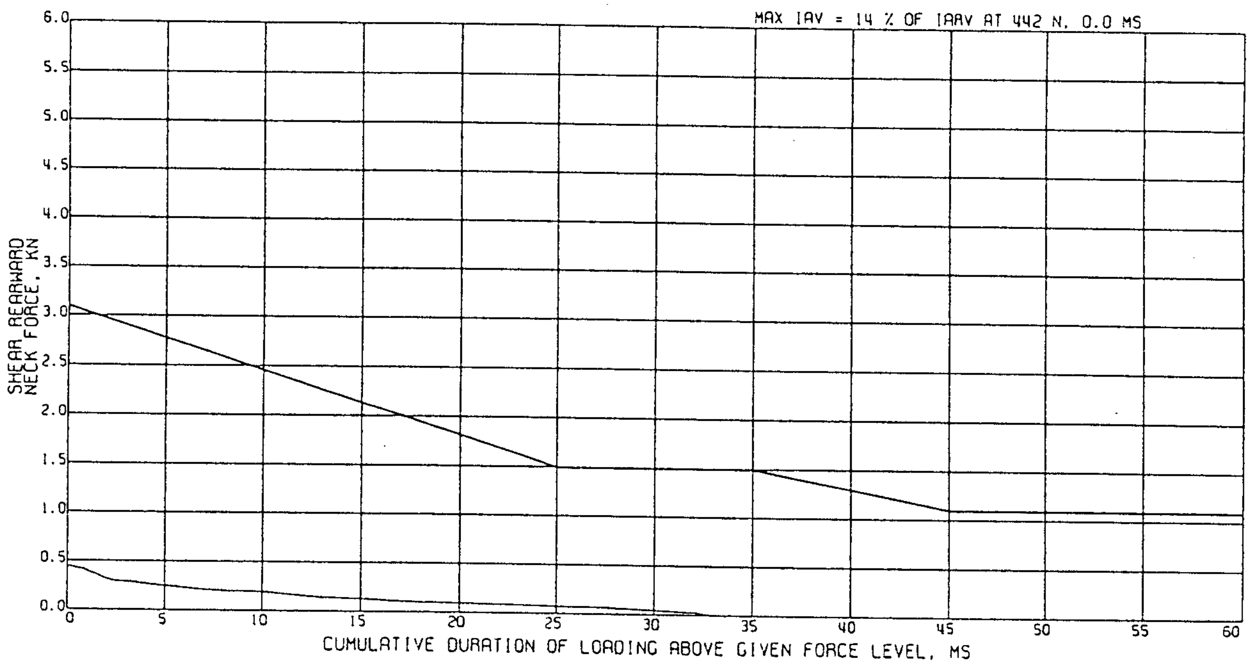
Appendix D, plot # 12

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 13

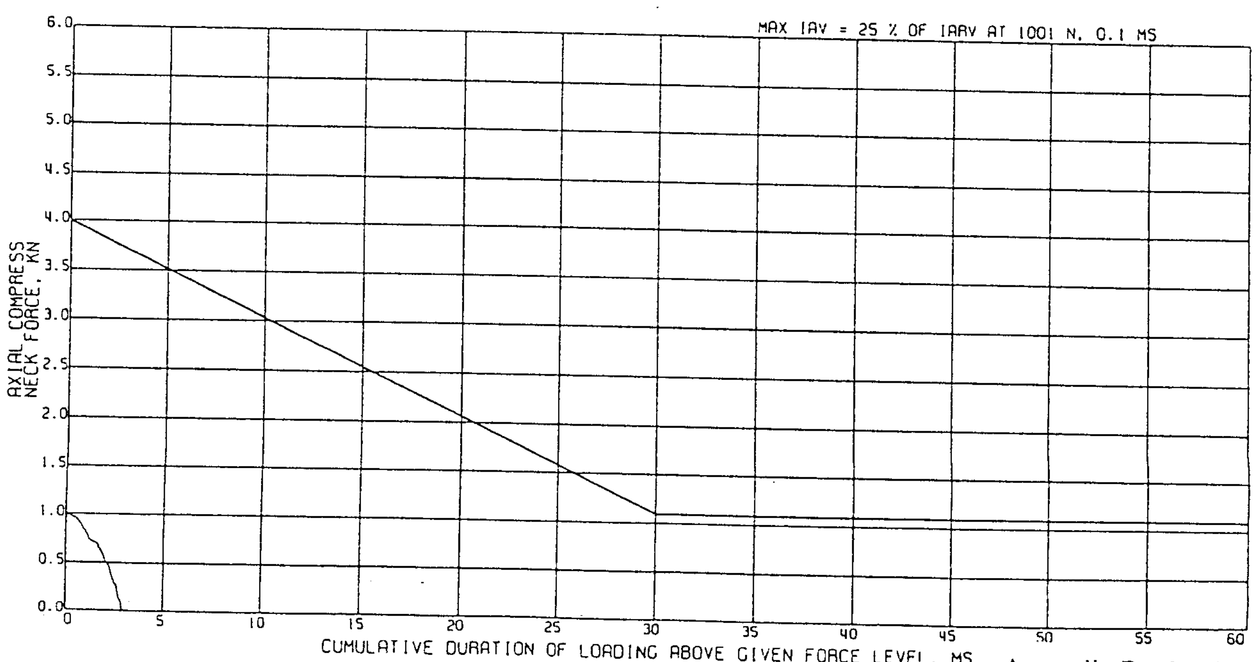
13

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:06/26/1996



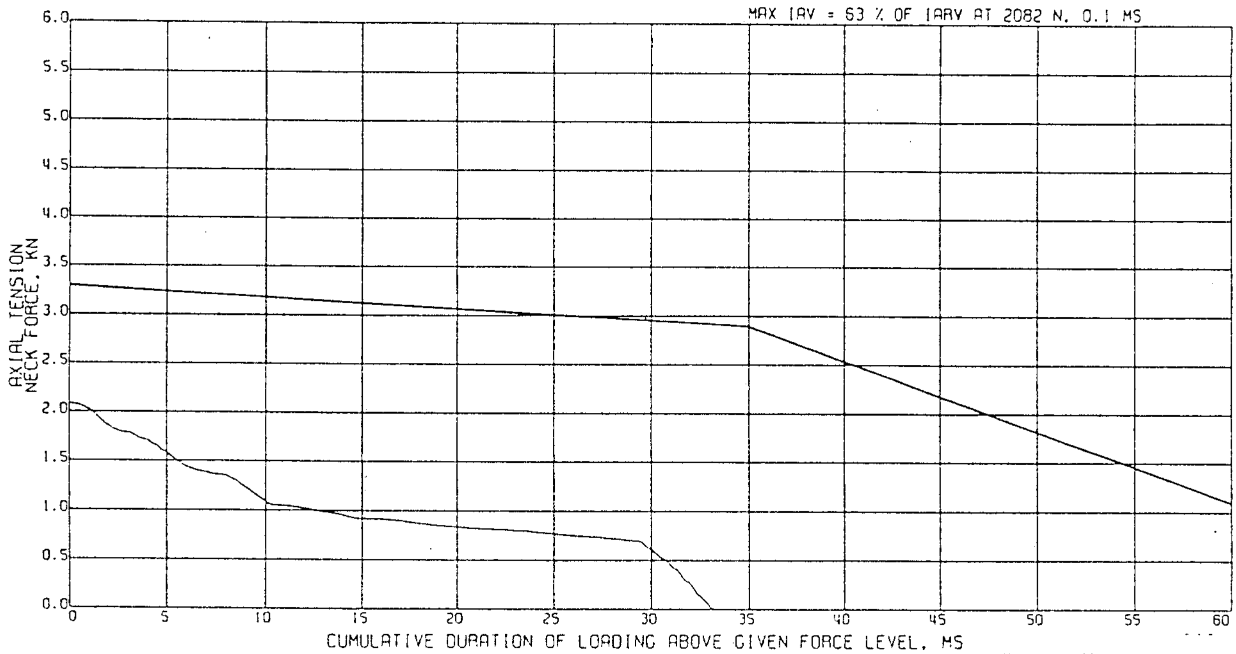
Appendix D, plot # 14

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

AXIAL TENSION ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:06/26/1996



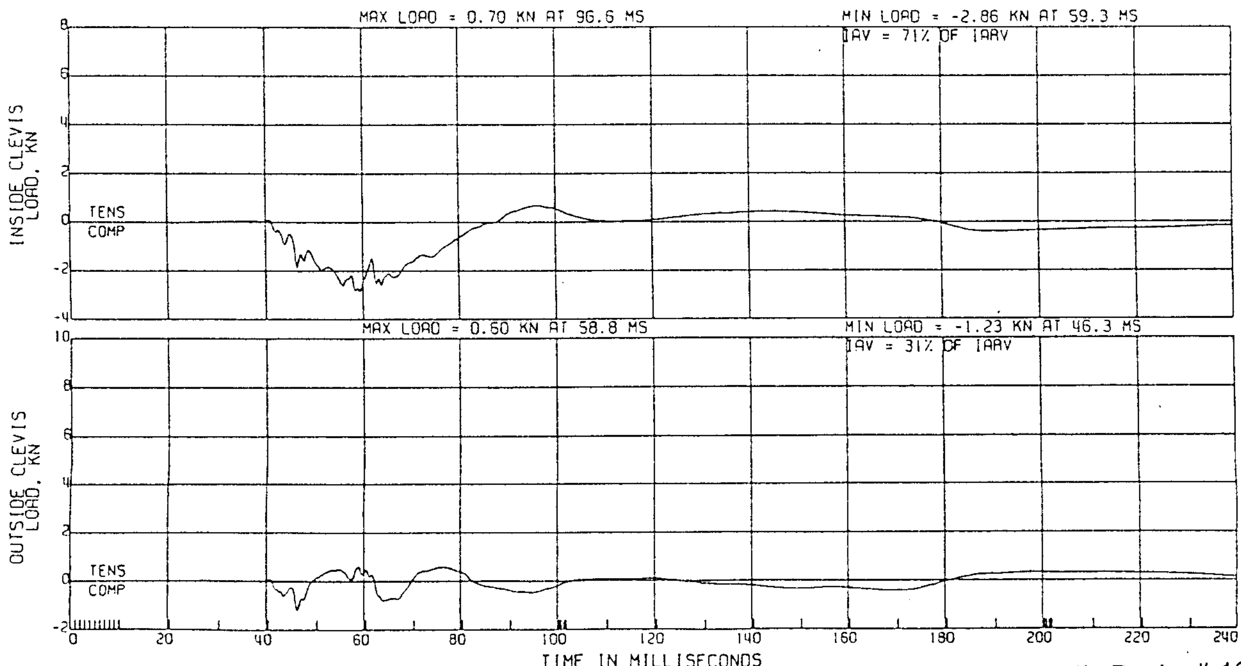
Appendix D, plot # 15

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 600

L. FRT LEFT KNEE CLEVIS LOAD

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 16

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

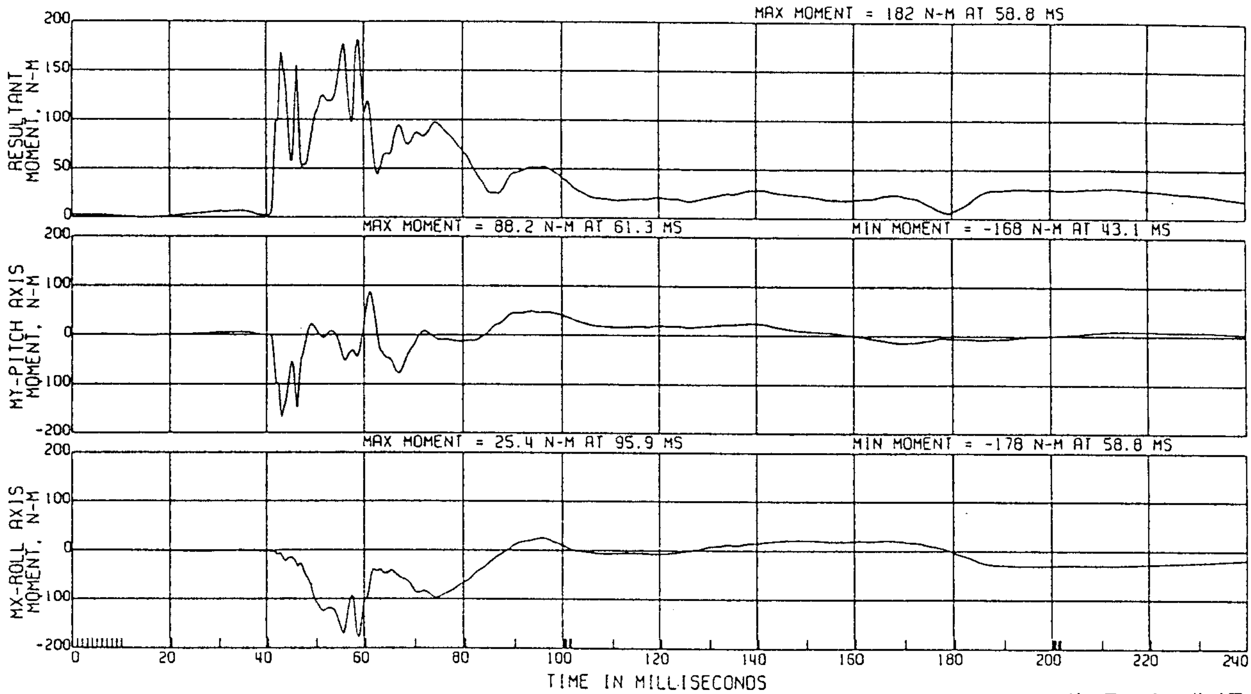
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 600

L. FRT LEFT TIBIA UPPER MOMENT

ATD TYPE: GM50H

TEST DATE:06/26/1996



Appendix D, plot # **17**

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

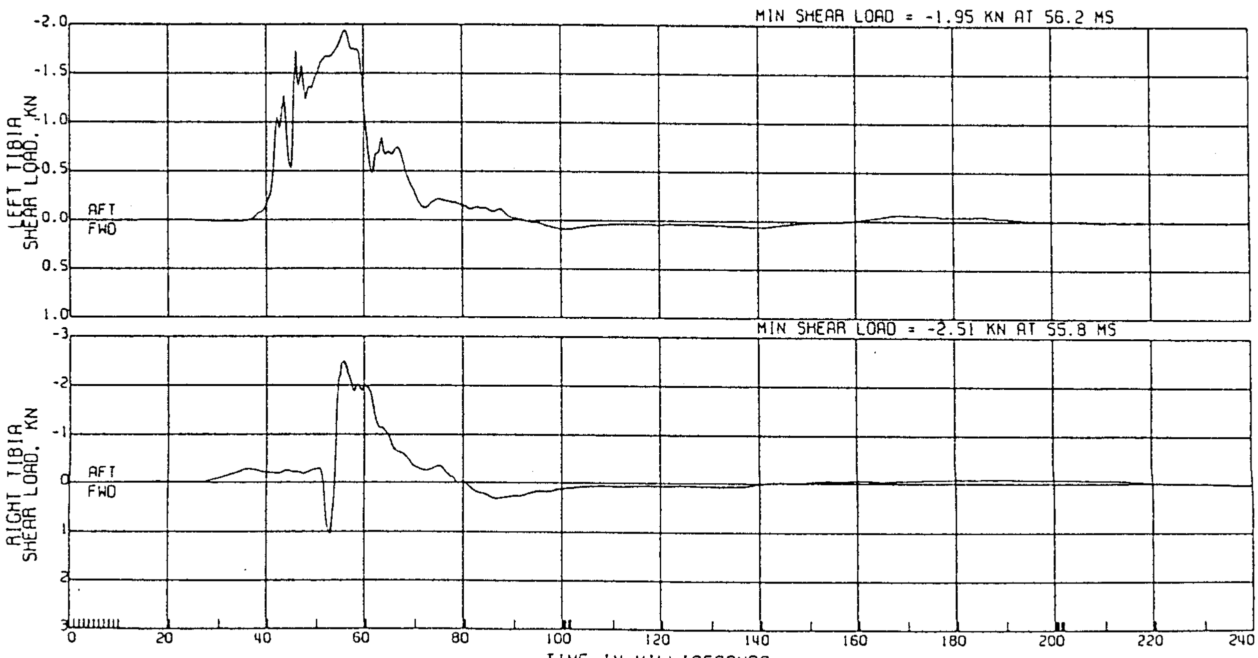
ATD TYPE: GM50H

R & D CTR 8T93090 VAN

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 600

L. FRT TIBIA LOWER SHEAR LOAD CELLS



Appendix D, plot # **18**

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

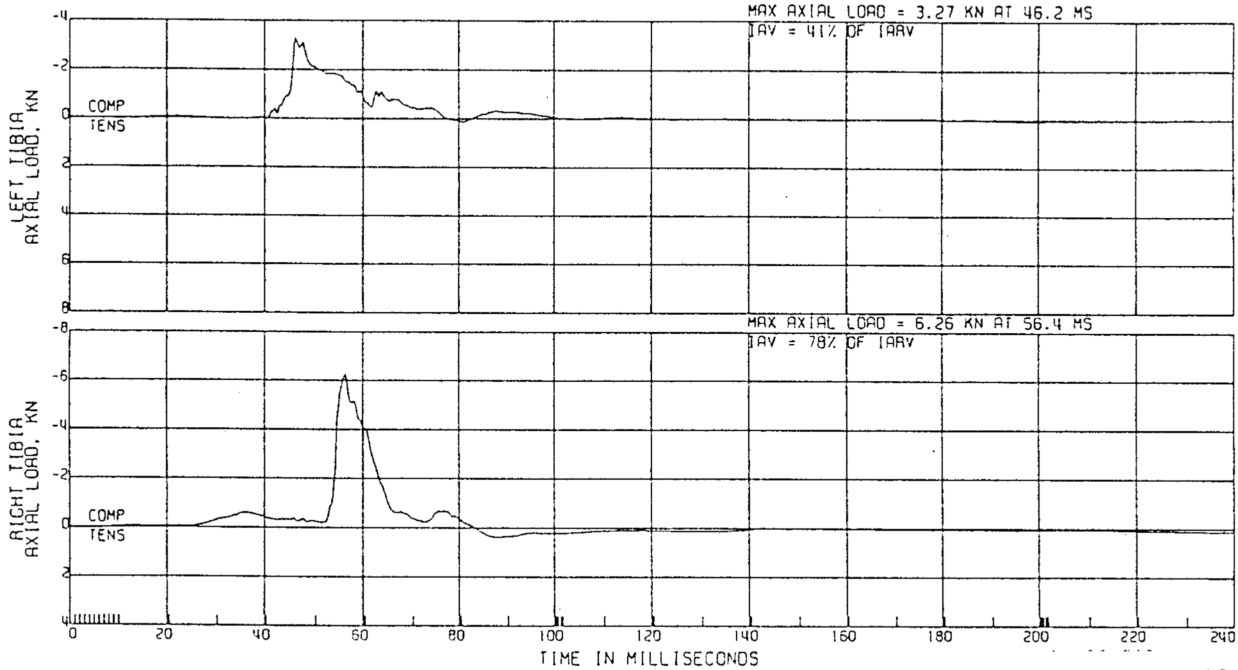
ATD TYPE: GM50H

R & D CTR 8T93090 VAN

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 600

L. FRT TIBIA LOWER AXIAL LOAD



Appendix D, plot # 19

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

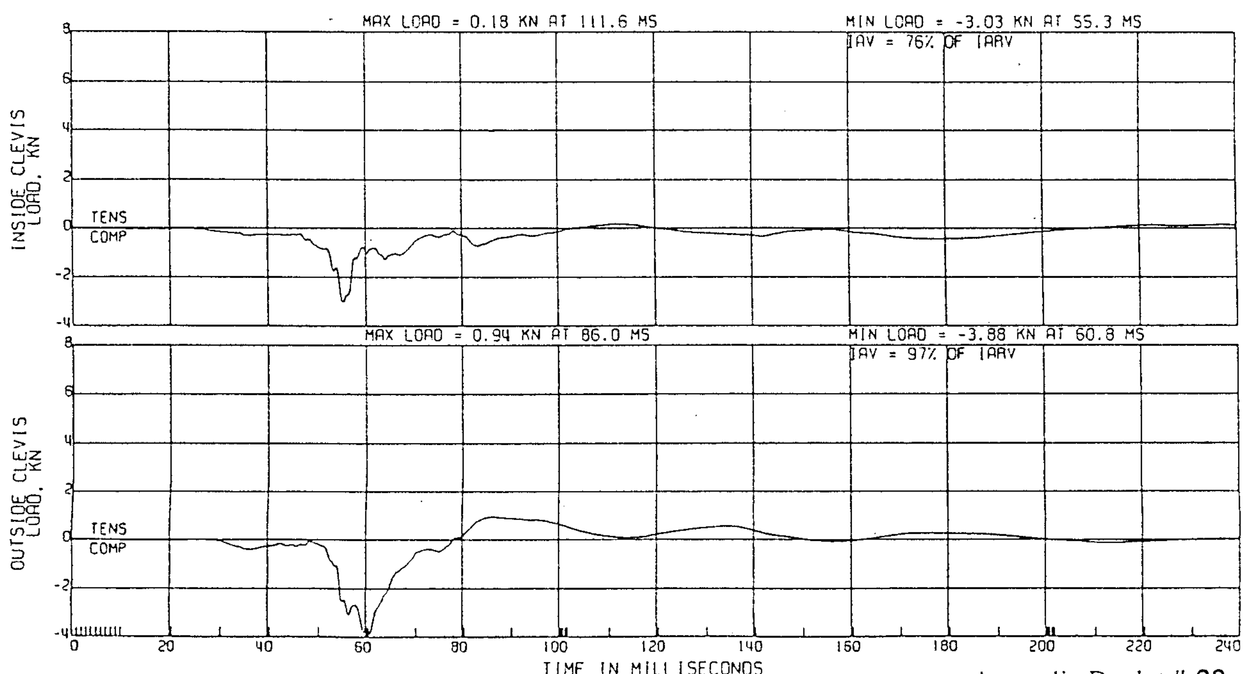
ATD TYPE: GM50H

R & D CTR 8T93090 VAN

L. FRT RIGHT KNEE CLEVIS LOAD

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 600



Appendix D, plot # 20

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

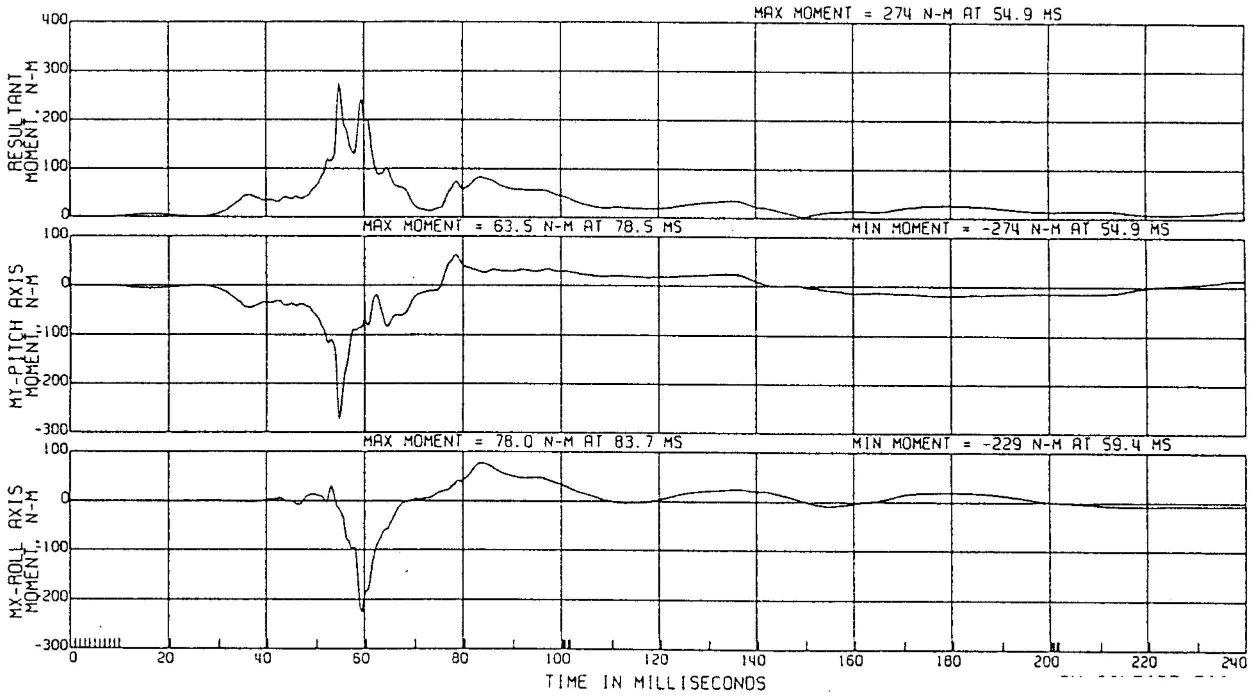
ATD TYPE: GM50H

R & D CTR 8T93090 VAN

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 600

L. FRT RIGHT TIBIA UPPER MOMENT



Appendix D, plot # 21

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

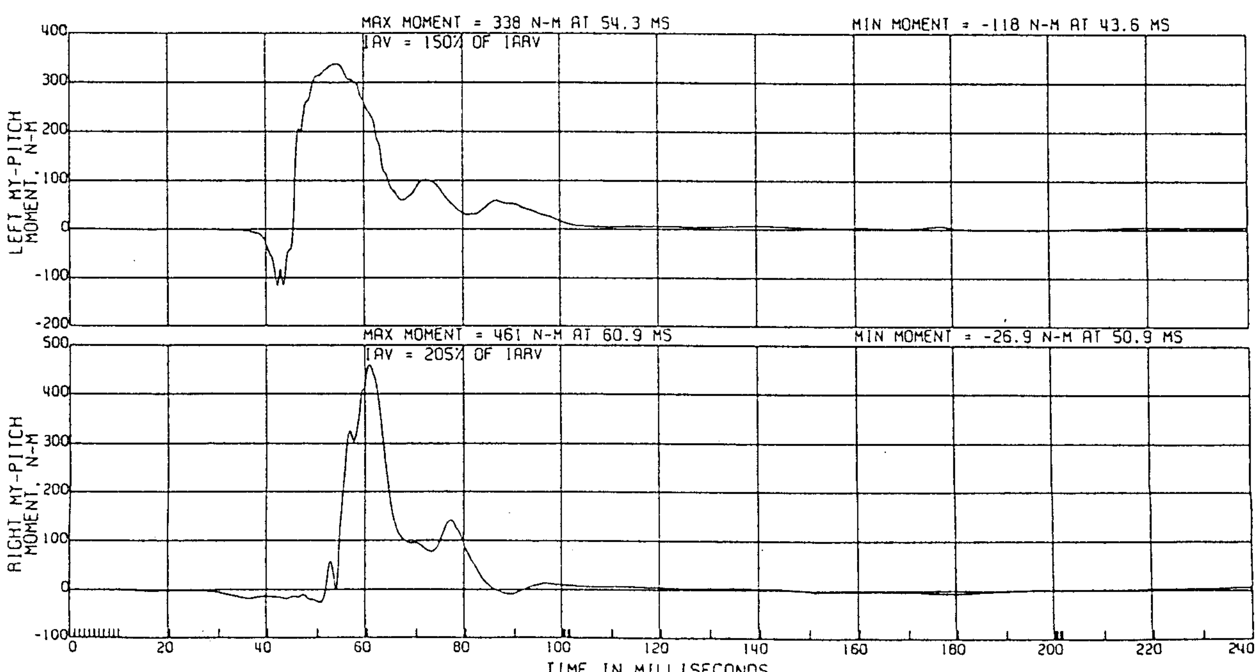
ATD TYPE: GM50H

R & D CTR 8T93090 VAN

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 600

L. FRT TIBIA LOWER BENDING MOMENTS



Appendix D, plot # 22

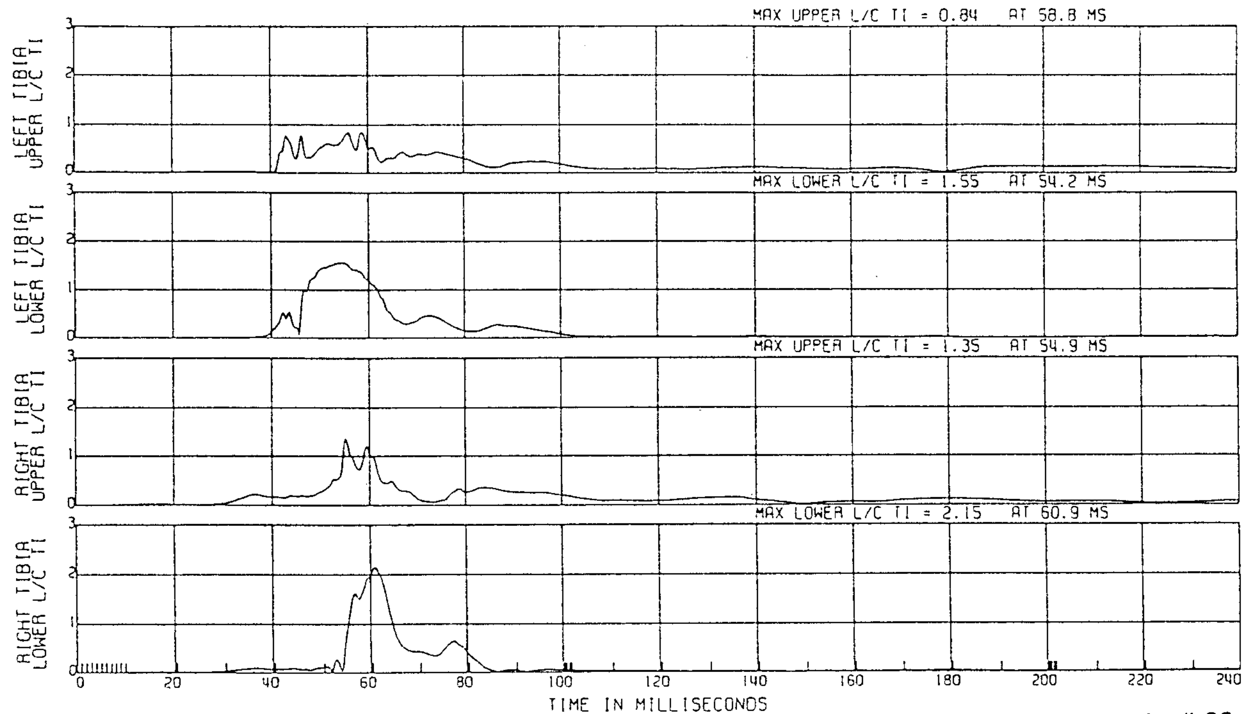
C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 600

L. FRT TIBIA INDICES

TI = (RES MOM/225 NM) + (AXIAL/35900 N)

ATD TYPE: GM50H
TEST DATE:06/26/1996



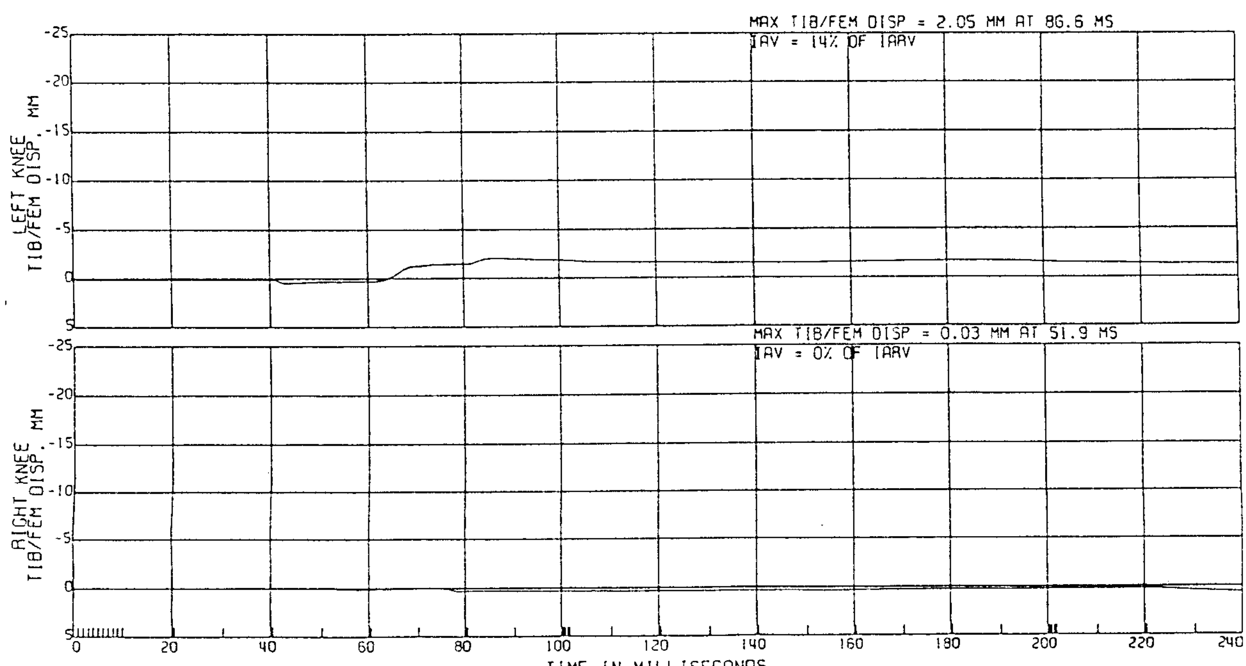
Appendix D, plot # 23

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

L. FRT TIBIA/FEMUR DISPLACEMENT

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 24

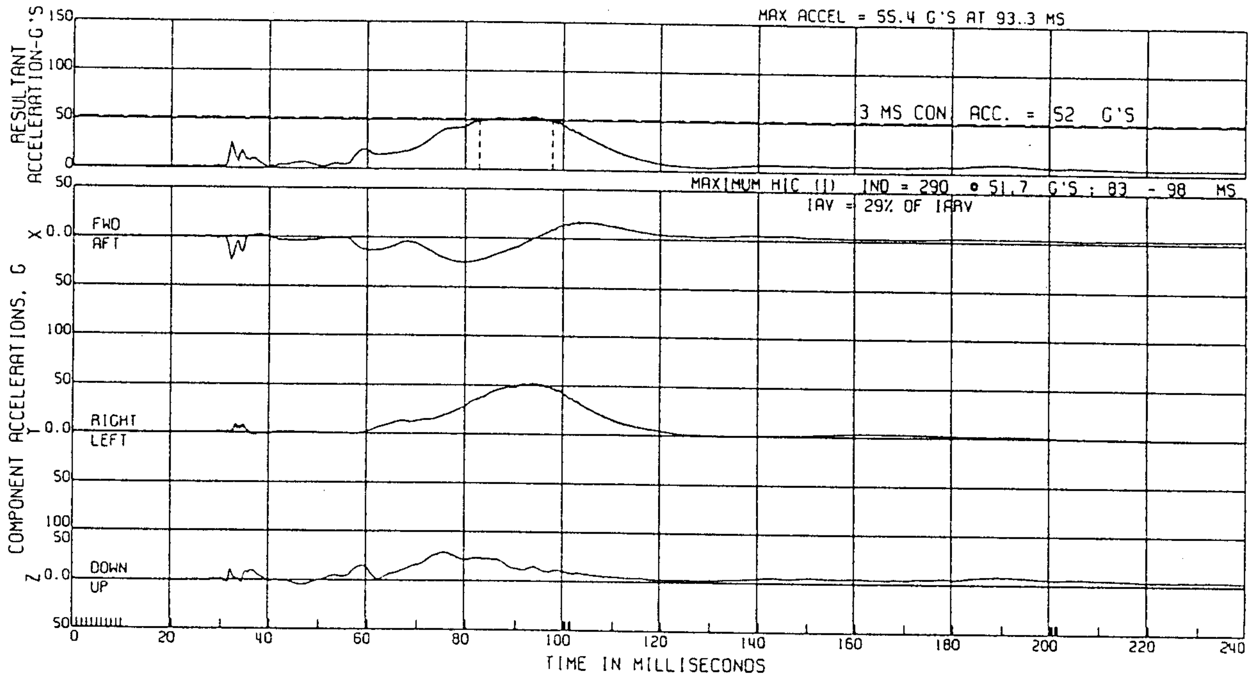
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

R. FRT HEAD ACCEL.

(HIC I LIMITED TO 15MS)

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 25

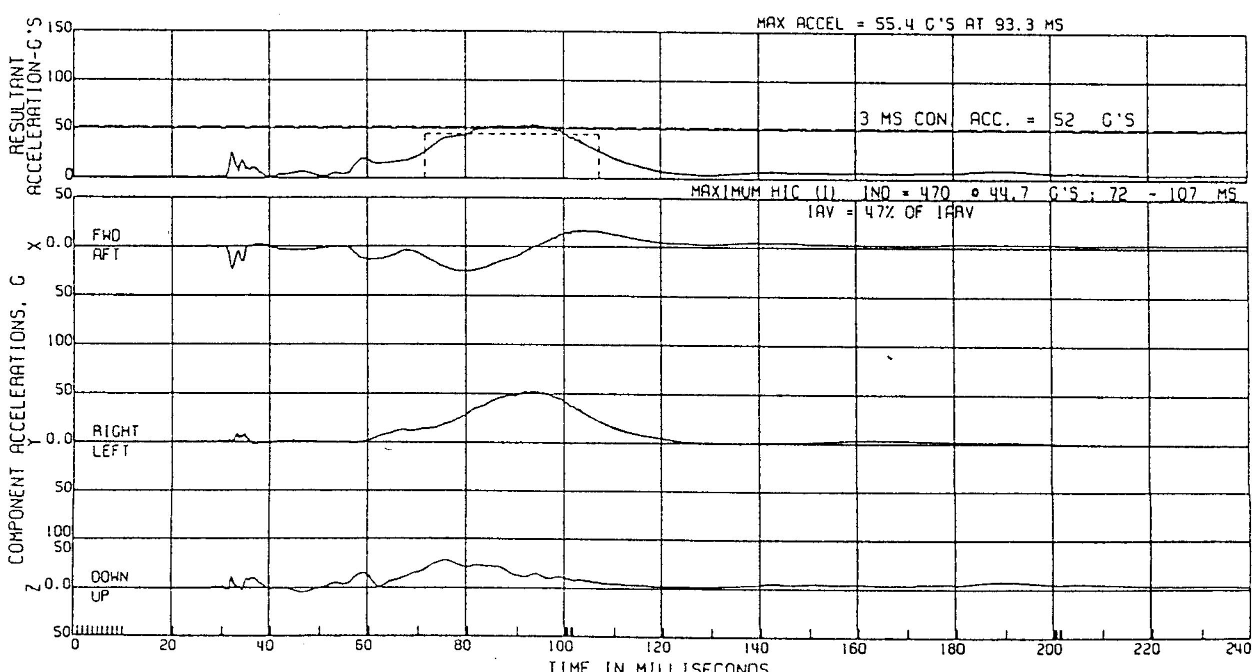
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T9309D VAN
ELEC DATA, SAE CLASS 1000

R. FRT HEAD ACCEL.

(HIC I LIMITED TO 36MS)

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 26

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

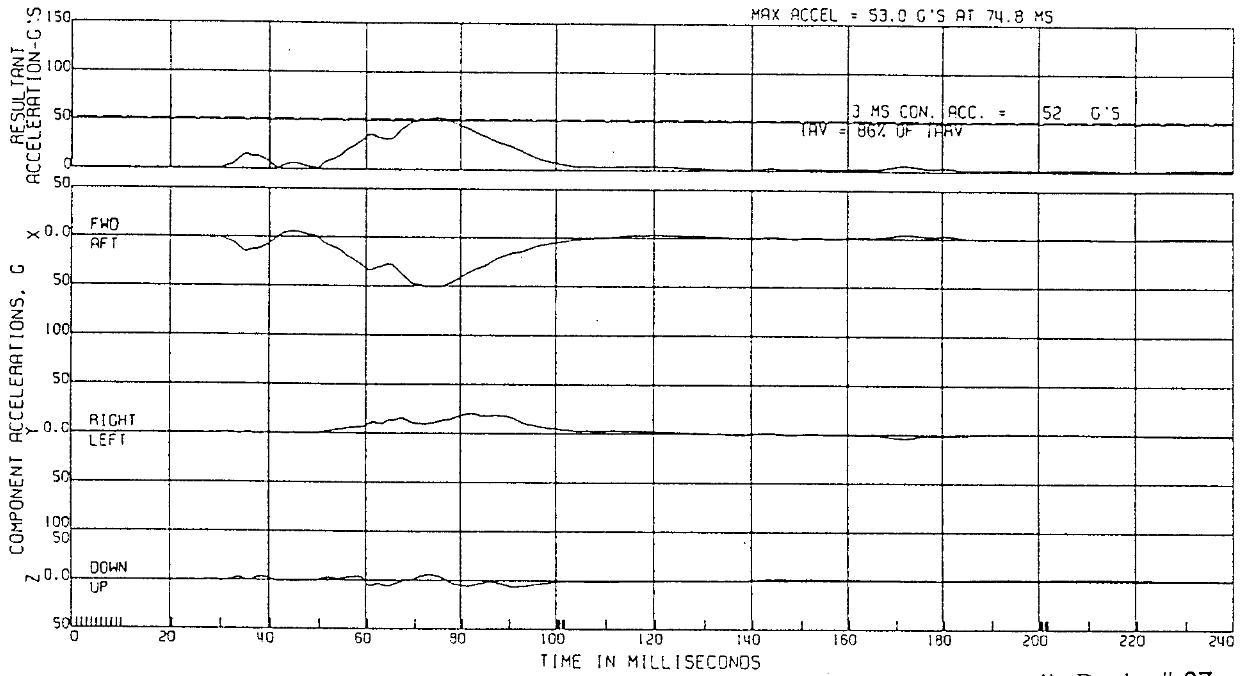
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

R. FRT CHEST ACCEL.

ATD TYPE: GM50H

TEST DATE:06/26/1996



Appendix D, plot # 27

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

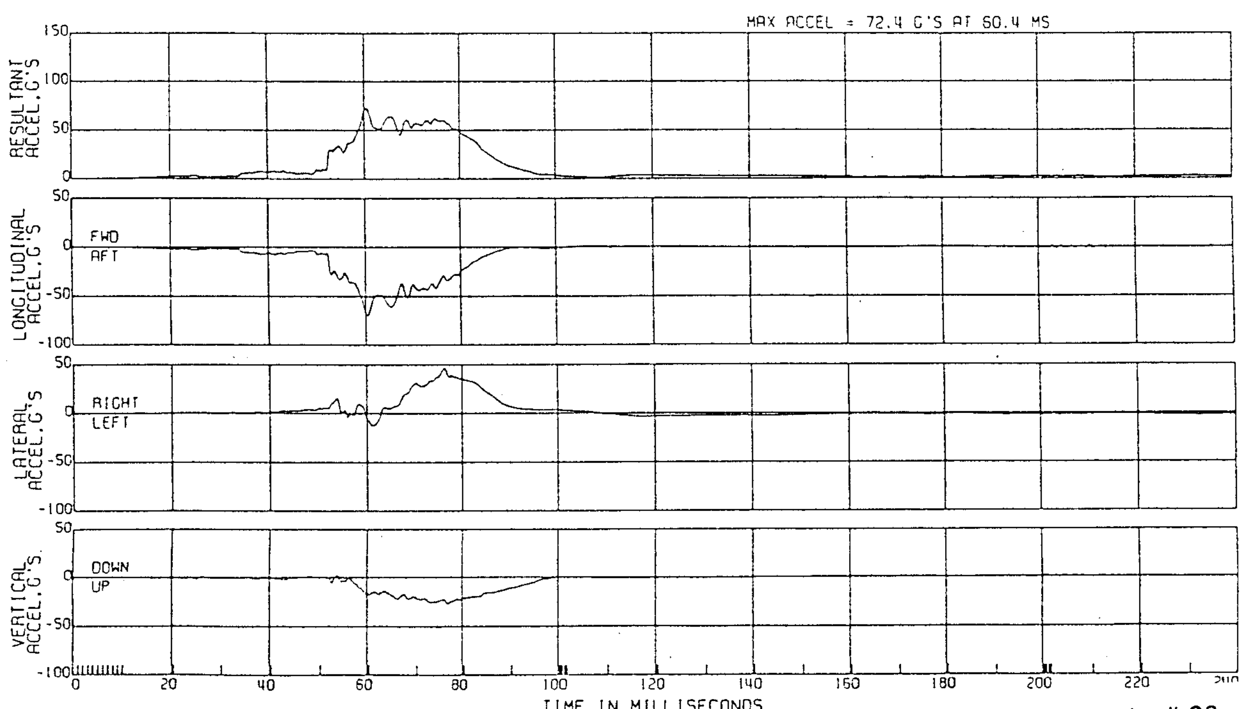
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

R. FRT PELVIC ACCEL.

ATD TYPE: GM50H

TEST DATE:06/26/1996



Appendix D, plot # 28

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

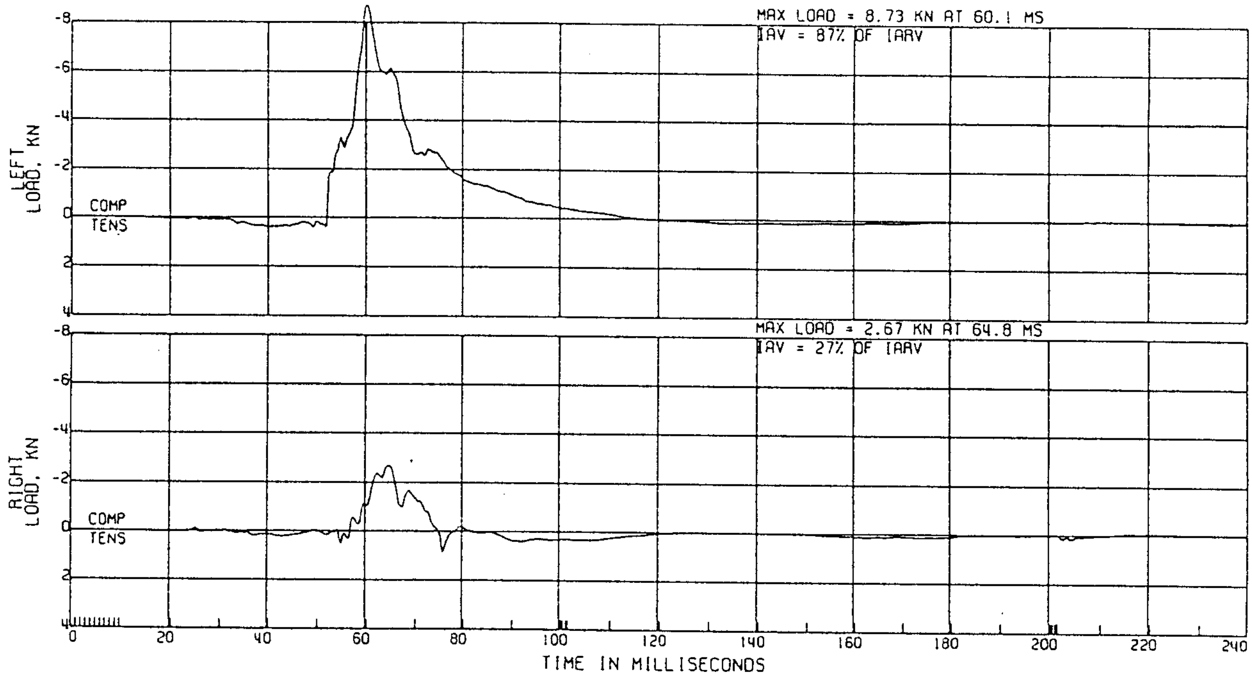
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 600

R. FRT FEMUR LOAD

ATD TYPE: GM50H

TEST DATE:06/26/1996



Appendix D, plot # 29

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

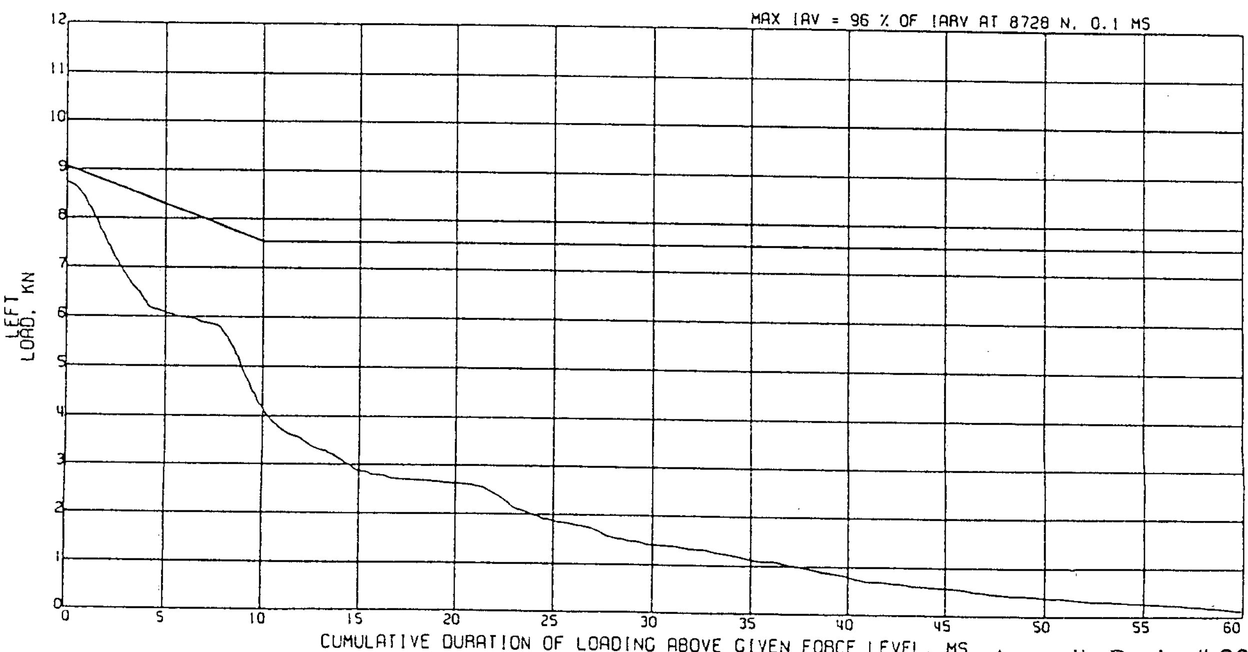
ELEC DATA, SAE CLASS 600

R. FRT FEMUR LOAD

DURATION ASSESSMENT

ATD TYPE: GM50H

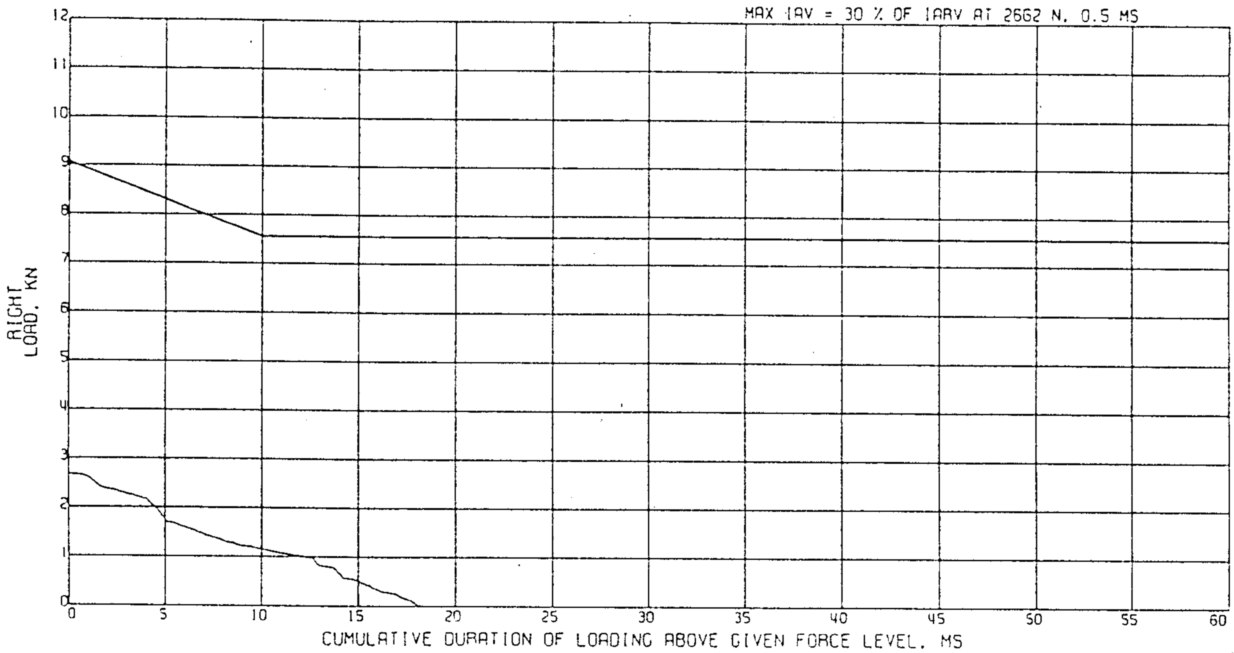
TEST DATE:06/26/1996



Appendix D, plot # 30

C11167 L. FRT IMPACT-335 DEG   LTV MDB TO STATIONARY VEHICLE   105.7KM/H

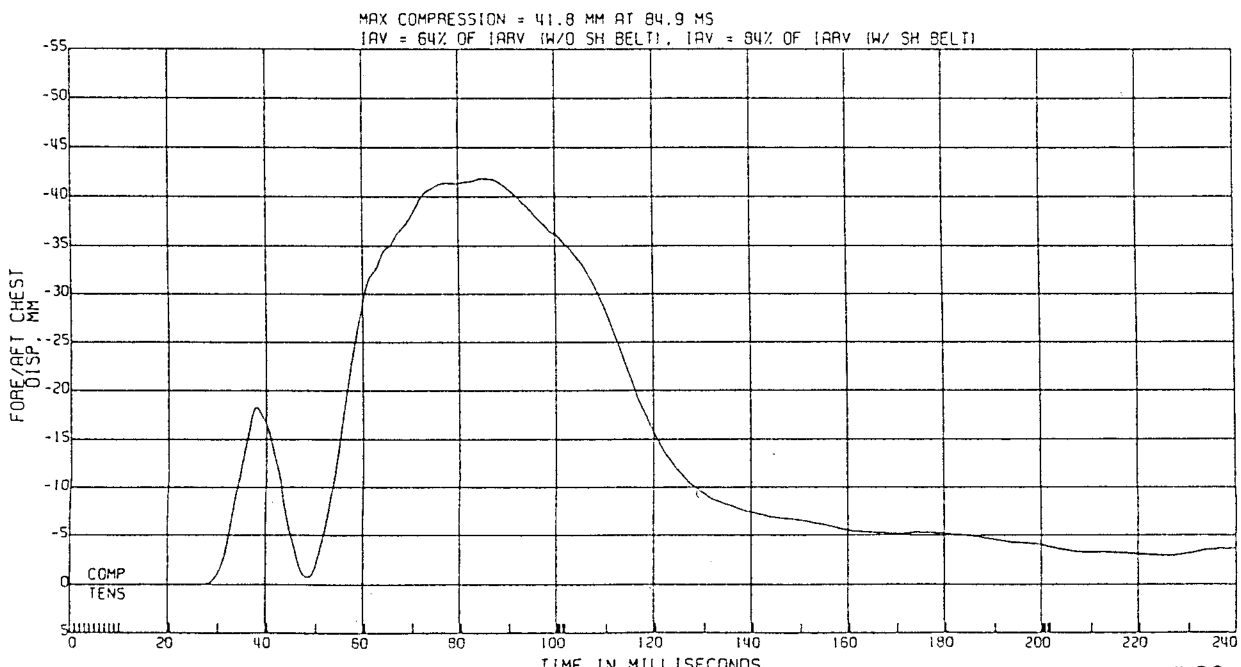
R & D CTR   8T93090 VAN   R. FRT FEMUR LOAD   ATD TYPE: GM50H
ELEC DATA, SAE CLASS 600   DURATION ASSESSMENT   TEST DATE:06/26/1996



Appendix D, plot # 31

C11167 L. FRT IMPACT-335 DEG   LTV MDB TO STATIONARY VEHICLE   105.7KM/H

R & D CTR   8T93090 VAN   R. FRT CHEST DISP, TEMP AT 78.7'F   ATD TYPE: GM50H
ELEC DATA, SAE CLASS 180   NORMALIZED TO 70.7'F & PART 572 CORRIDOR   TEST DATE:06/26/1996



Appendix D, plot # 32

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

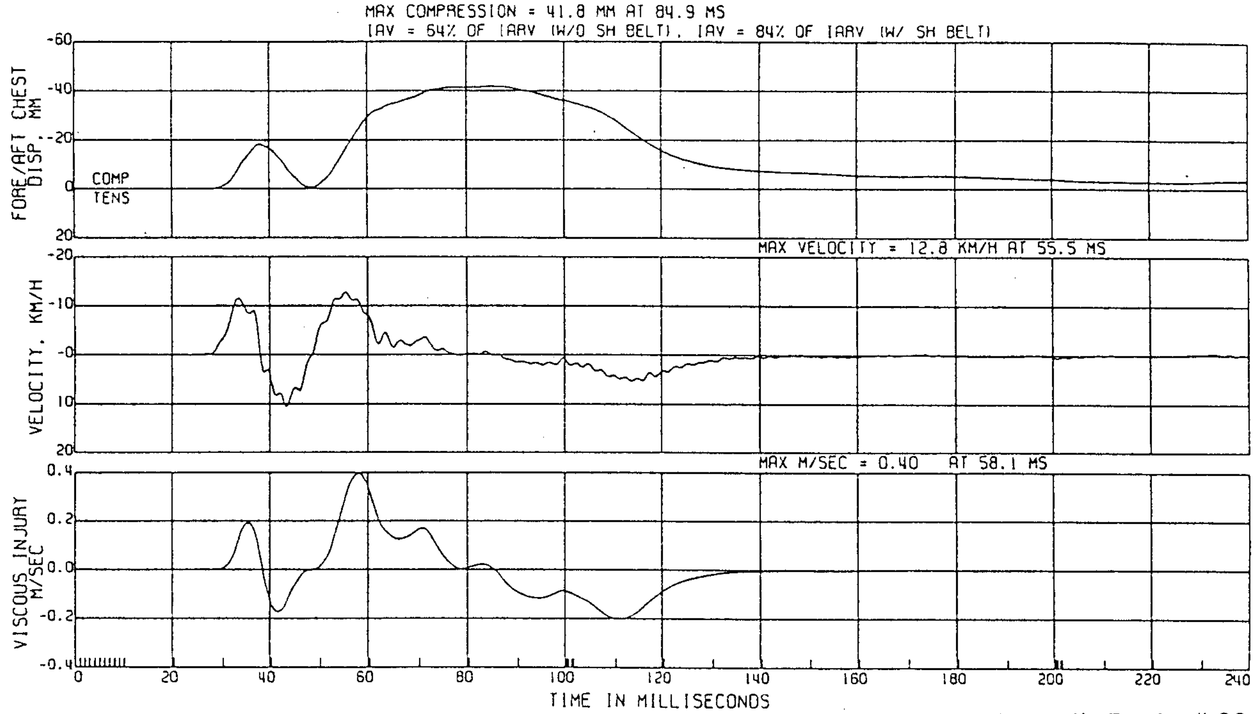
ELEC DATA, SAE CLASS 180

R. FRT CHEST COMPRESSIVE DISP.

NORMALIZED, W/CALC VEL & VISCOUS INJURY

ATD TYPE: GM50H

TEST DATE:06/26/1996



Appendix D, plot # 33

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

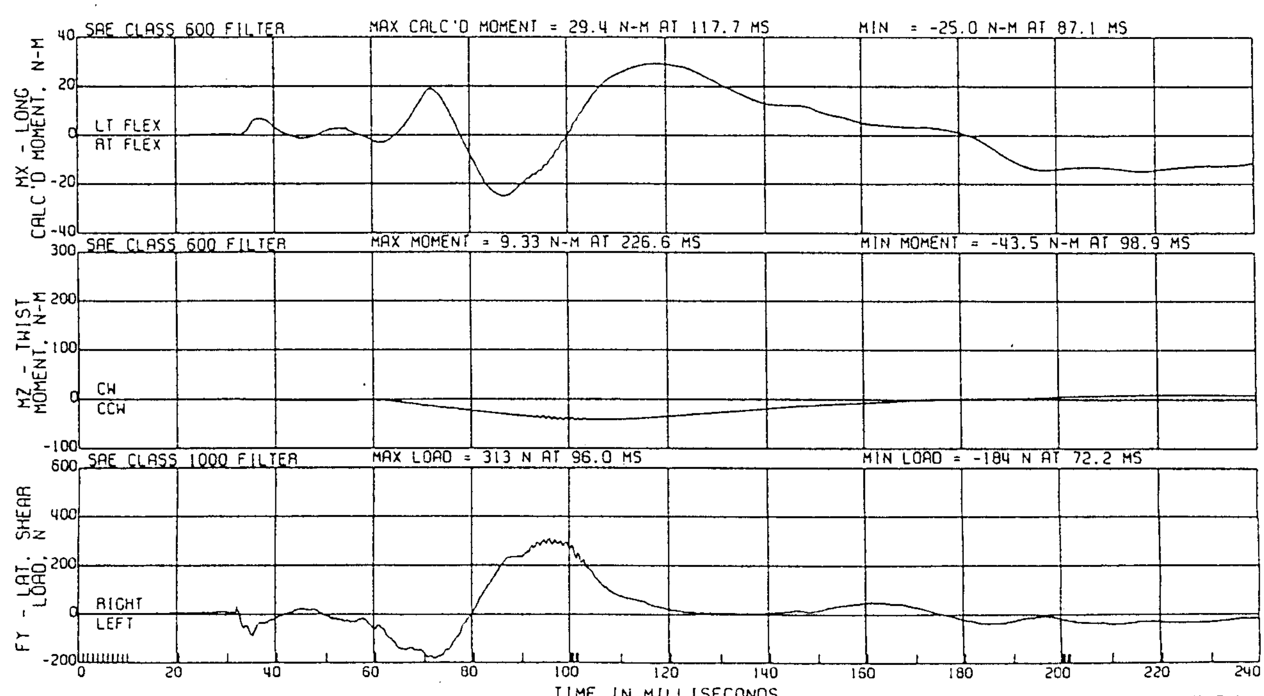
ELEC DATA

R. FRT NECK LOADING ON HEAD, UPPER LOAD

R. FRT NECK LOADING ON HEAD

ATD TYPE: GM50H

TEST DATE:06/26/1996



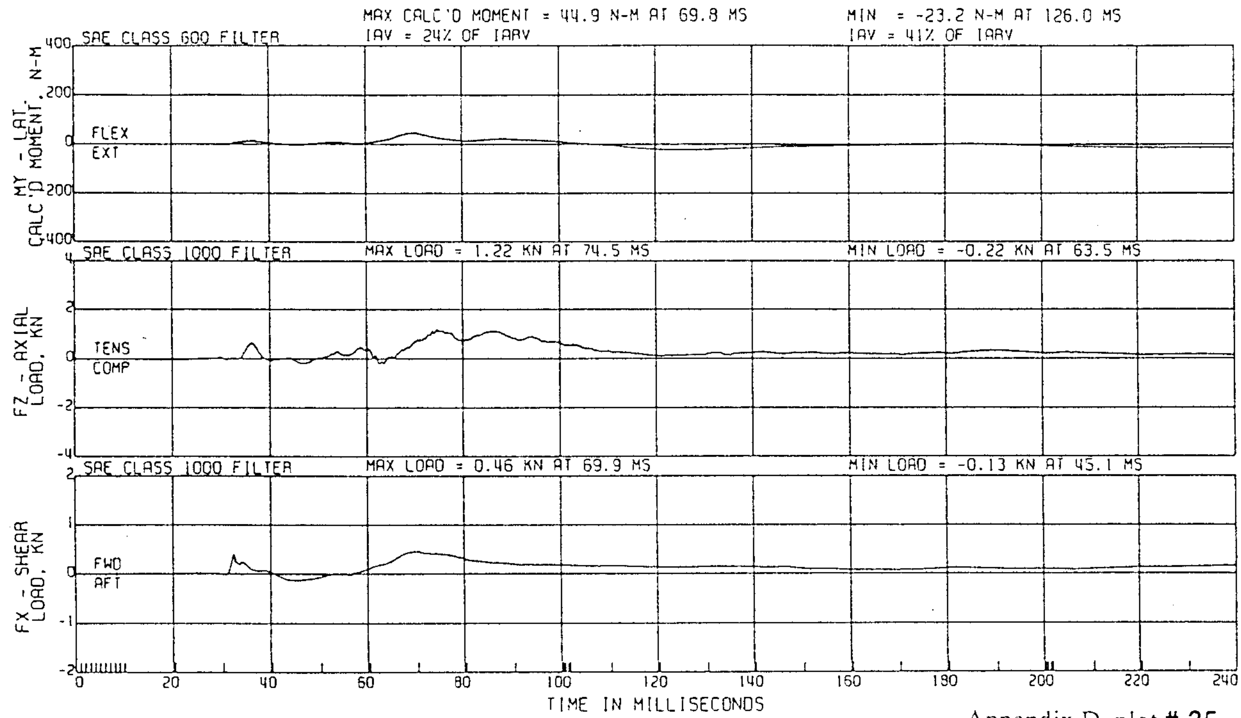
Appendix D, plot # 34

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA

NECK LOADING ON HEAD
R. FRT NECK LOADING ON HEAD

ATD TYPE: GM50H
TEST DATE:06/26/1996



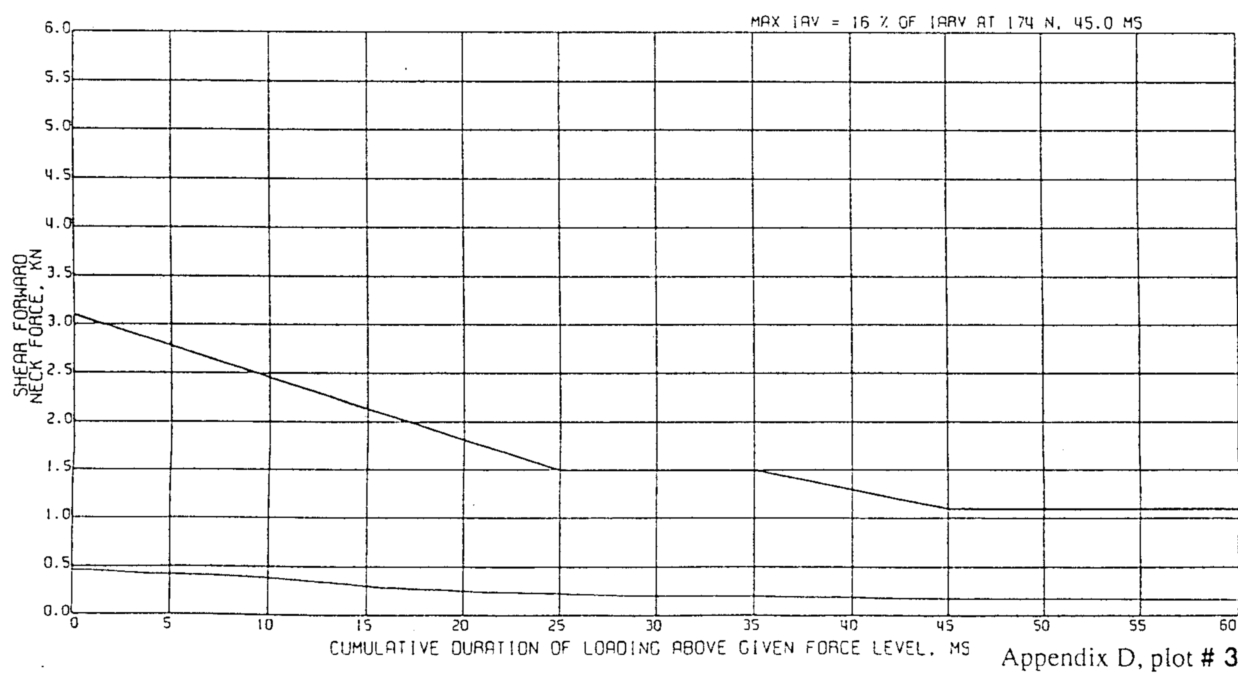
Appendix D, plot # 35

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

FORWARD NECK SHEAR ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:06/26/1996



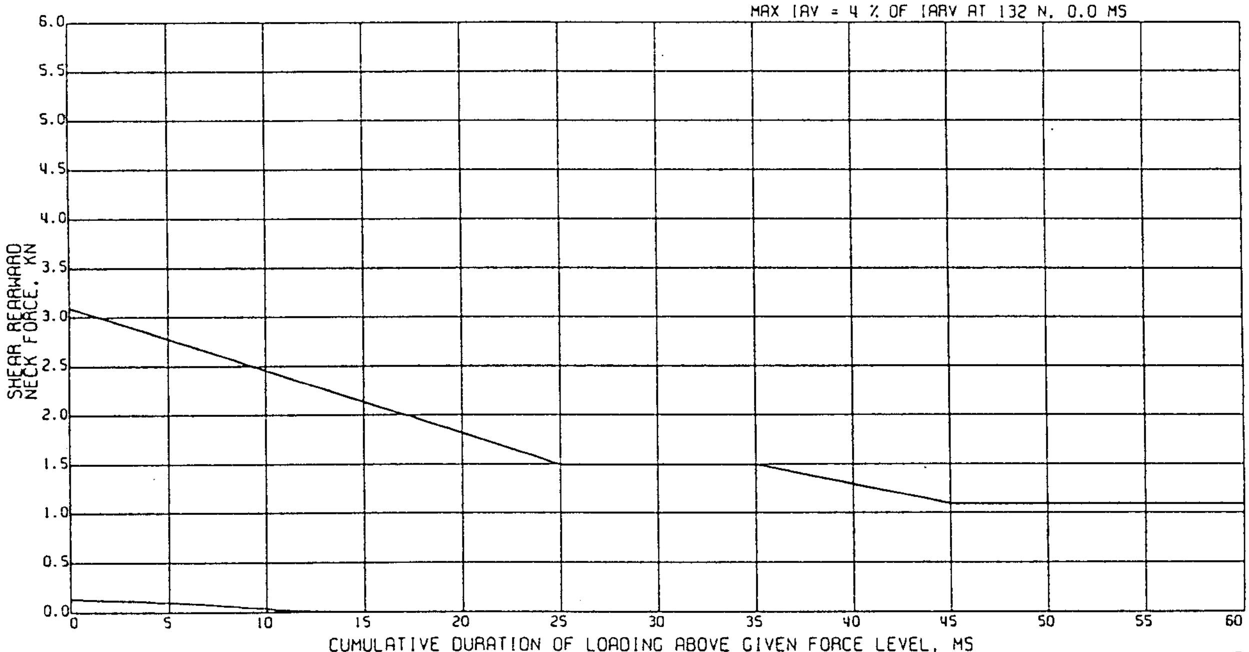
Appendix D, plot # 36

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 37

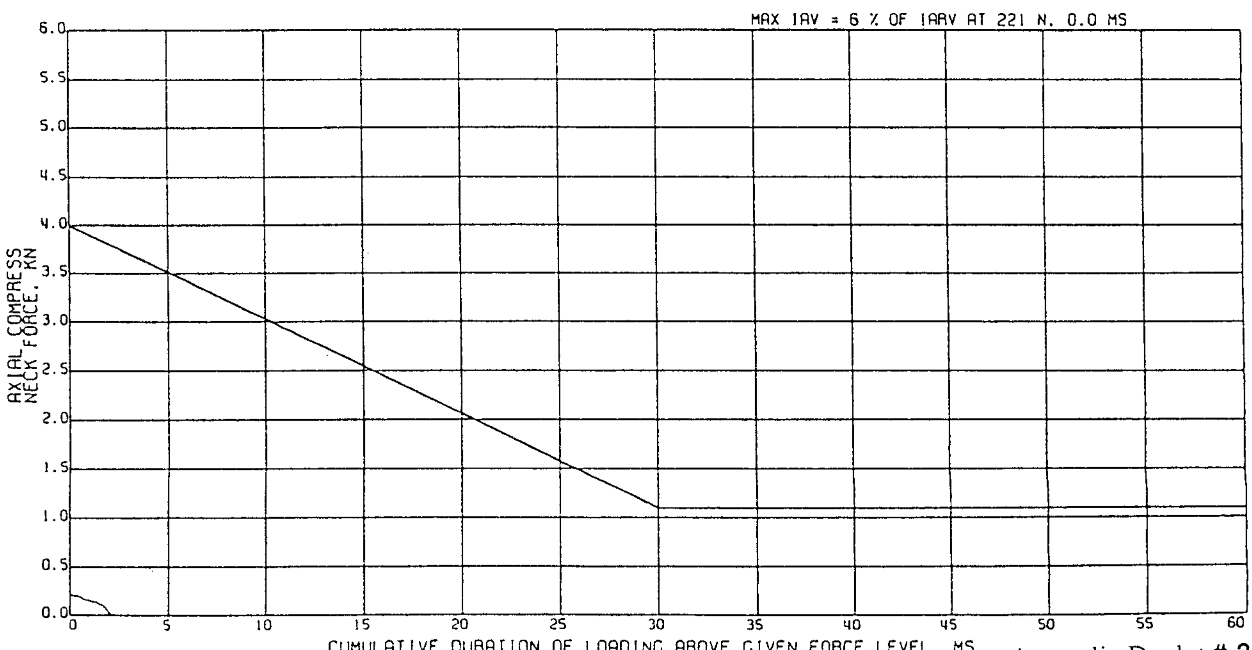
37

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 38

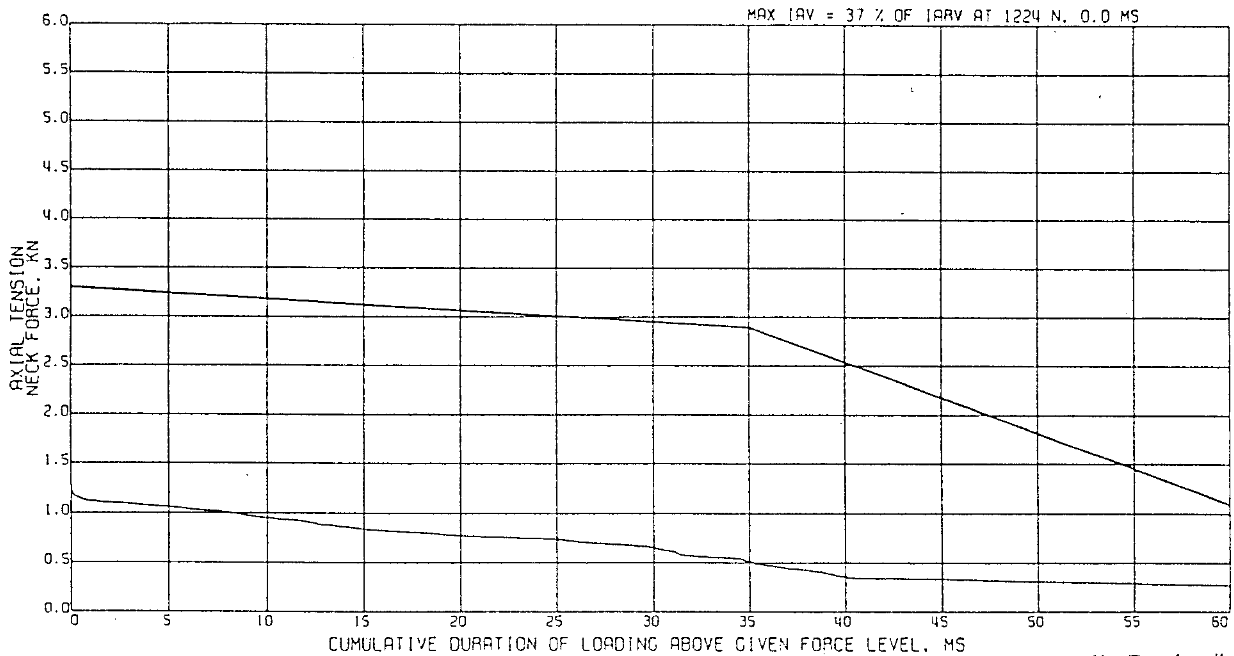
38

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

AXIAL TENSION ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:06/26/1996



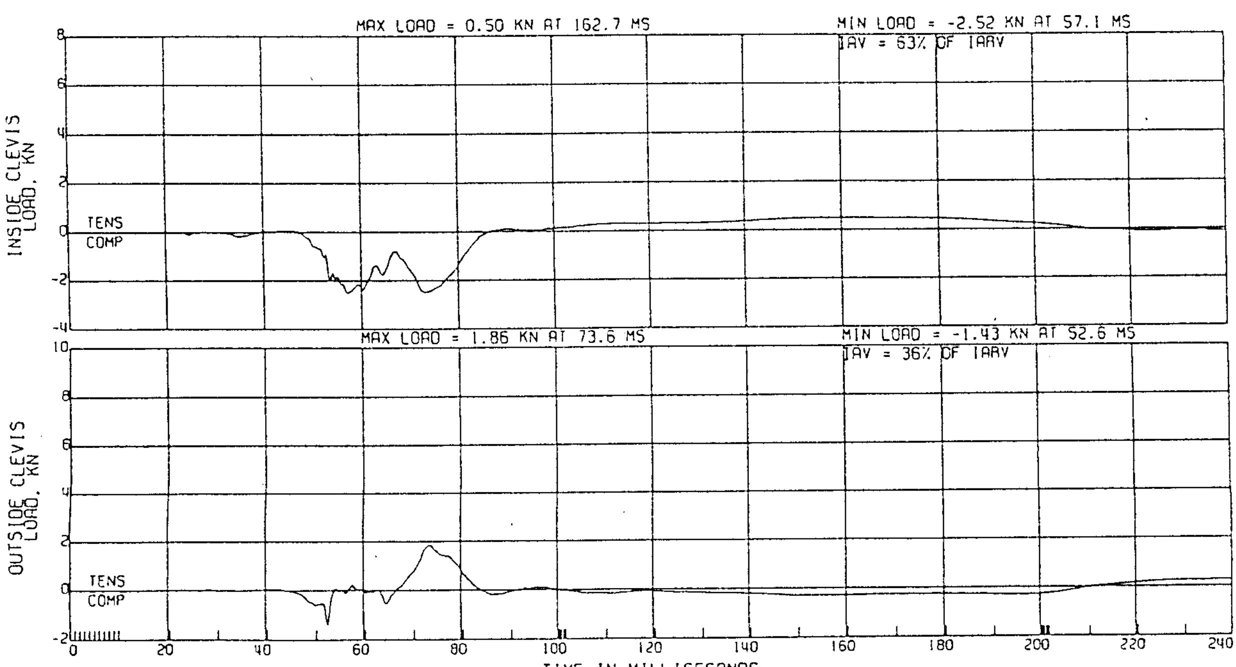
Appendix D, plot # 39

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 600

R. FRT LEFT KNEE CLEVIS LOAD

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 40

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

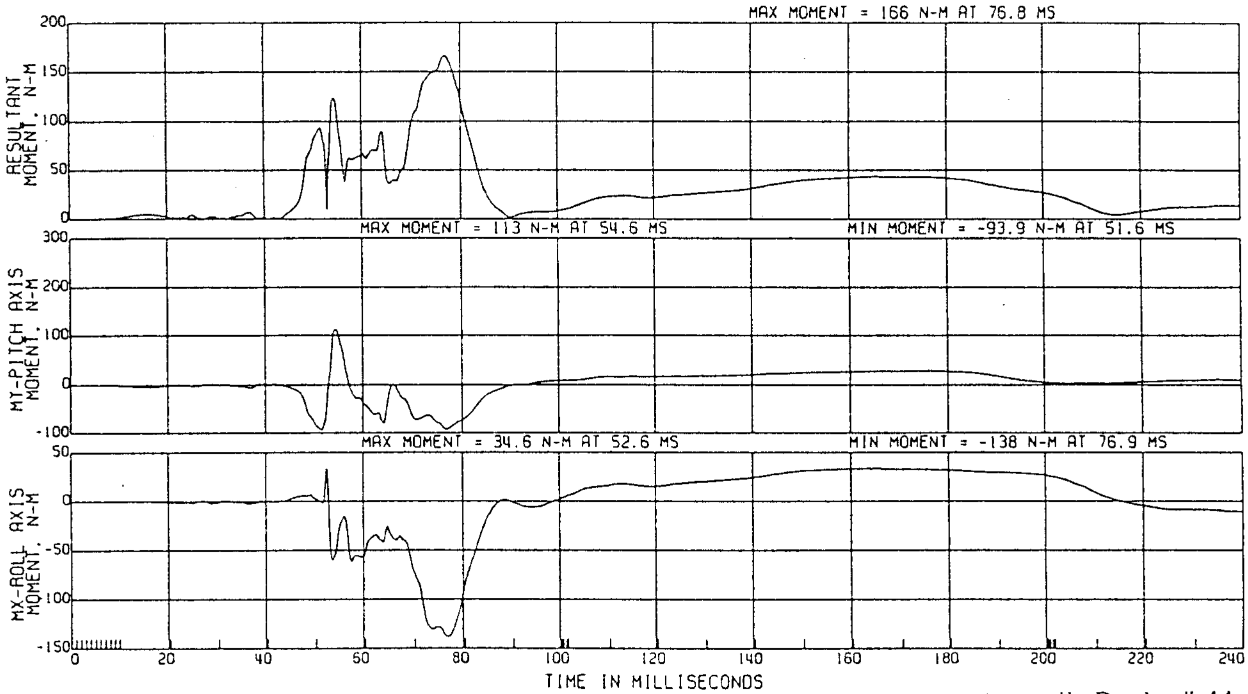
ATD TYPE: GM50H

R & D CTR 8T93090 VAN

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 600

R. FRT LEFT TIBIA UPPER MOMENT



Appendix D, plot # **41**

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

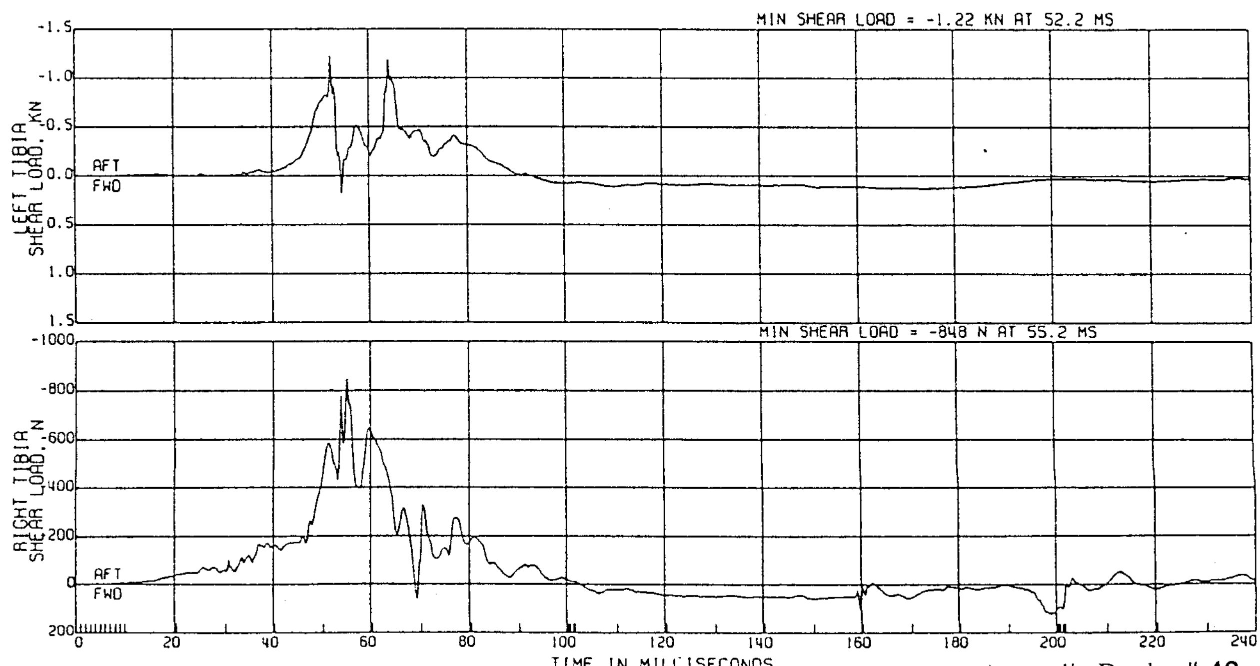
ATD TYPE: GM50H

R & D CTR 8T93090 VAN

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 600

R. FRT TIBIA LOWER SHEAR LOAD CELLS



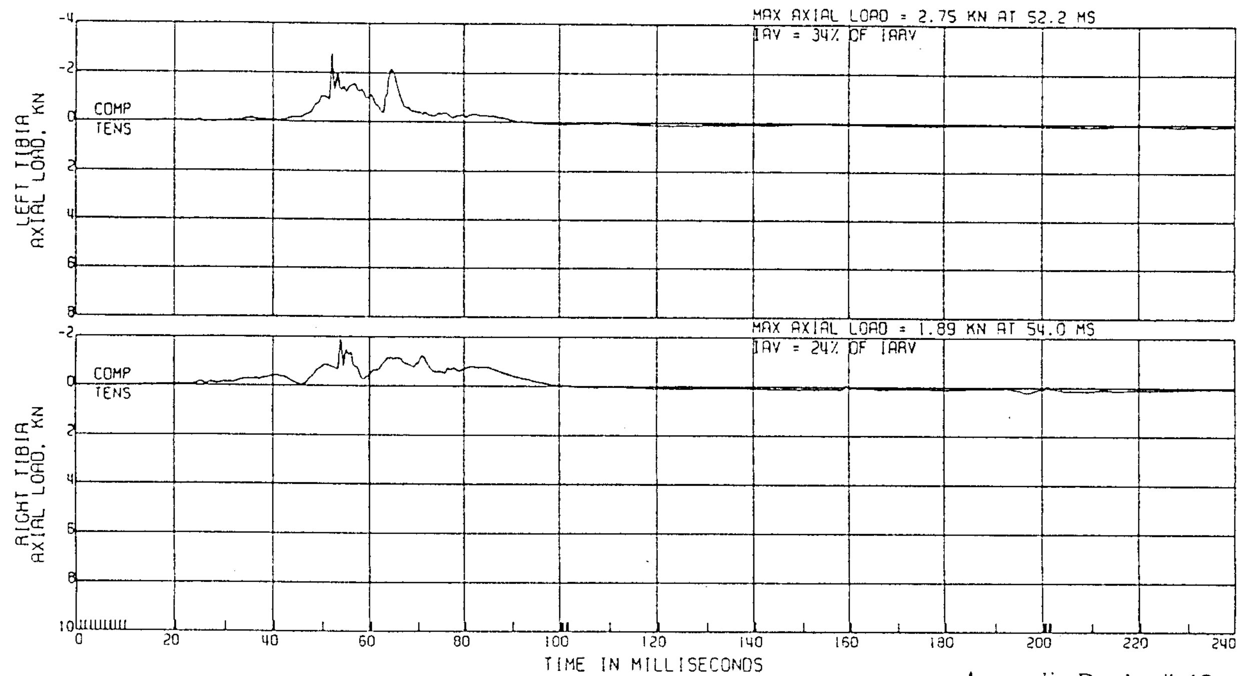
Appendix D, plot # **42**

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:06/26/1996

R. FRT TIBIA LOWER AXIAL LOAD



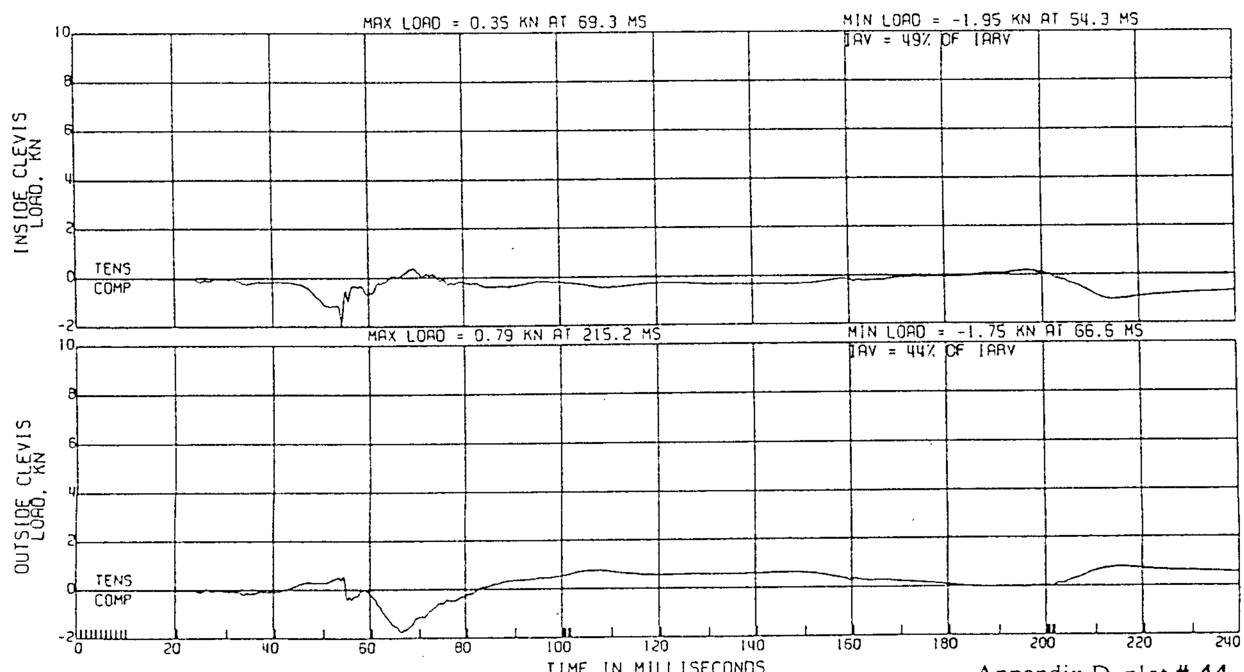
Appendix D, plot # 43

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 600

R. FRT RIGHT KNEE CLEVIS LOAD

ATD TYPE: GM50H
TEST DATE:06/26/1996



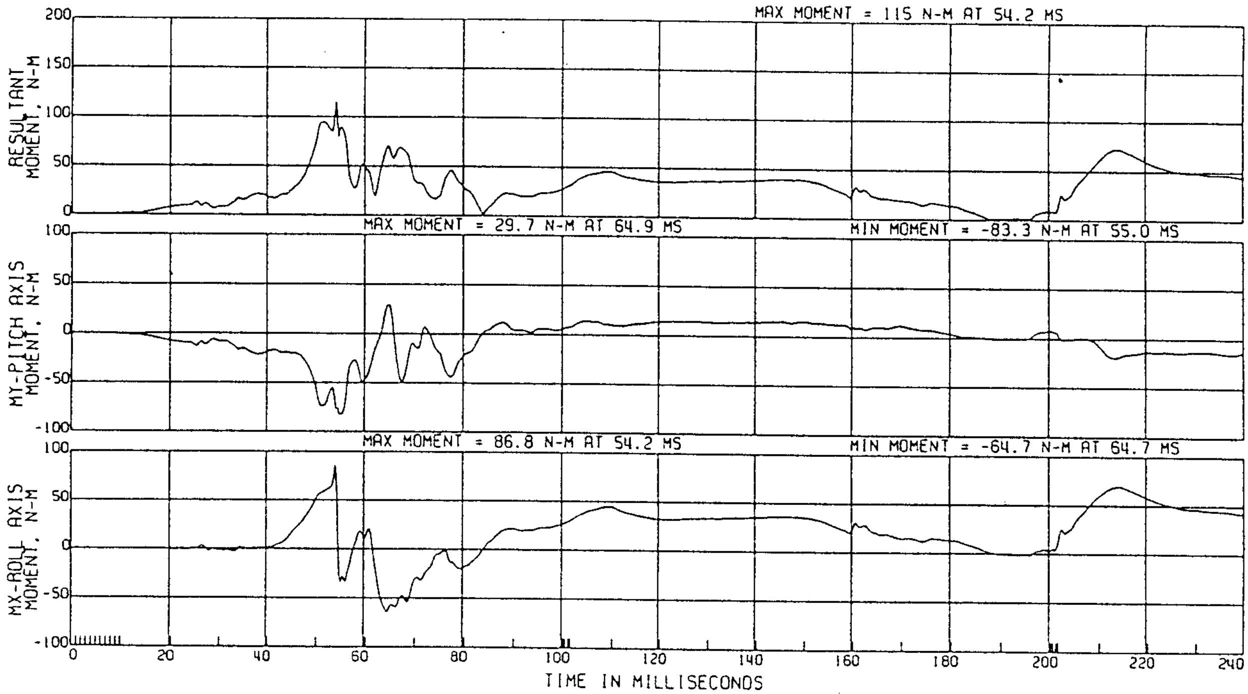
Appendix D, plot # 44

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 600

R. FRT RIGHT TIBIA UPPER MOMENT

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 45

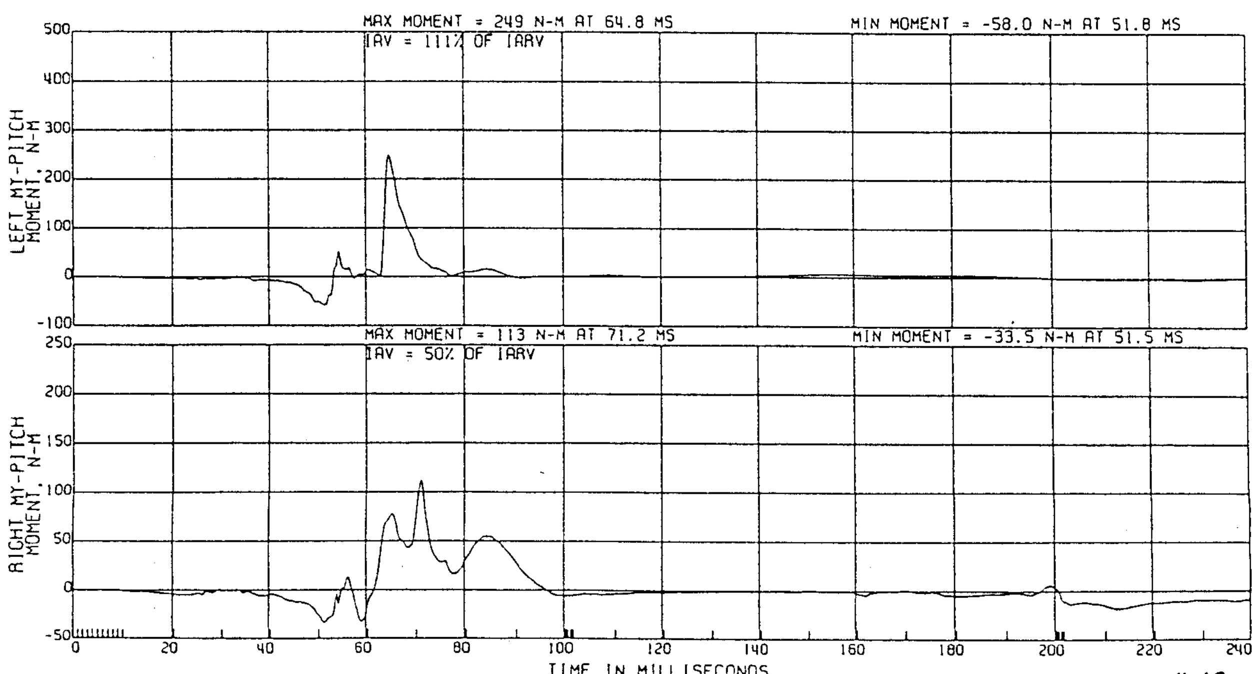
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

ATD TYPE: GM50H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 600

TEST DATE:06/26/1996

R. FRT TIBIA LOWER BENDING MOMENTS



Appendix D, plot # 46

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

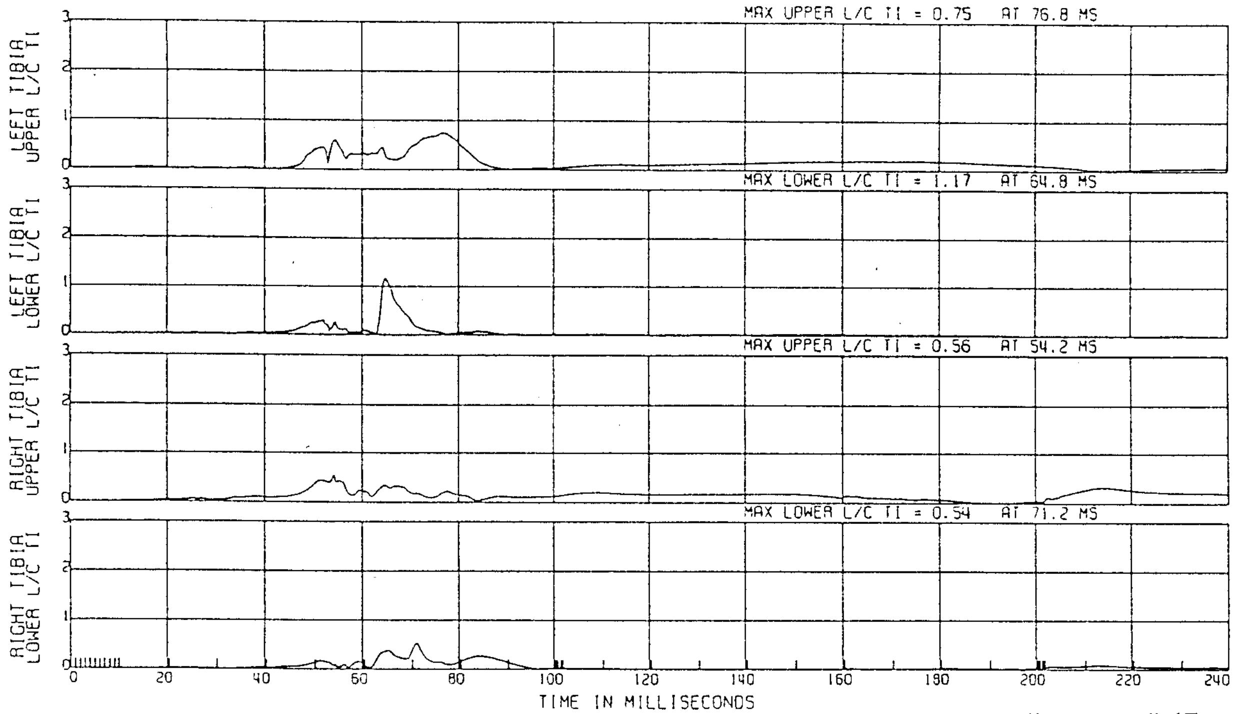
ELEC DATA, SAE CLASS 600

R. FRT TIBIA INDICES

TI = (RES MOM/225 NM) + (AXIAL/35900 N)

ATD TYPE: GM50H

TEST DATE:06/26/1996



Appendix D, plot # 47

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

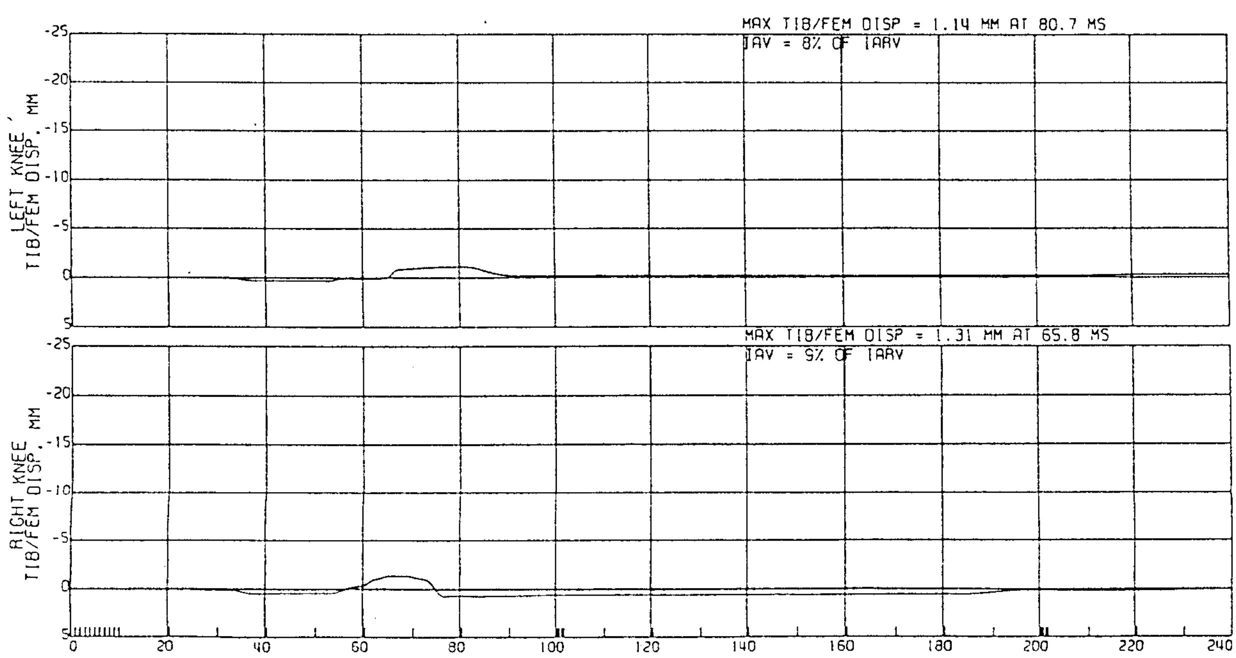
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

R. FRT TIBIA/FEMUR DISPLACEMENT

ATD TYPE: GM50H

TEST DATE:06/26/1996



Appendix D, plot # 48

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

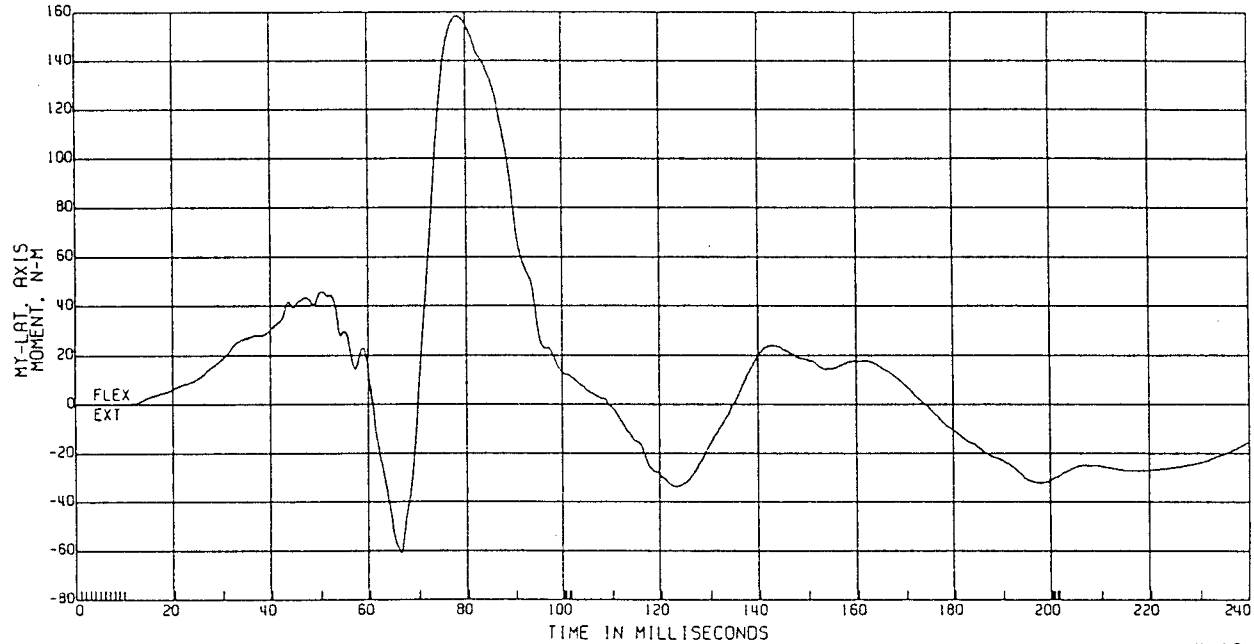
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

L. FRT LOWER LUMBAR MOMENT

ATD TYPE: GM50H

TEST DATE:06/26/1996



Appendix D, plot # 49

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

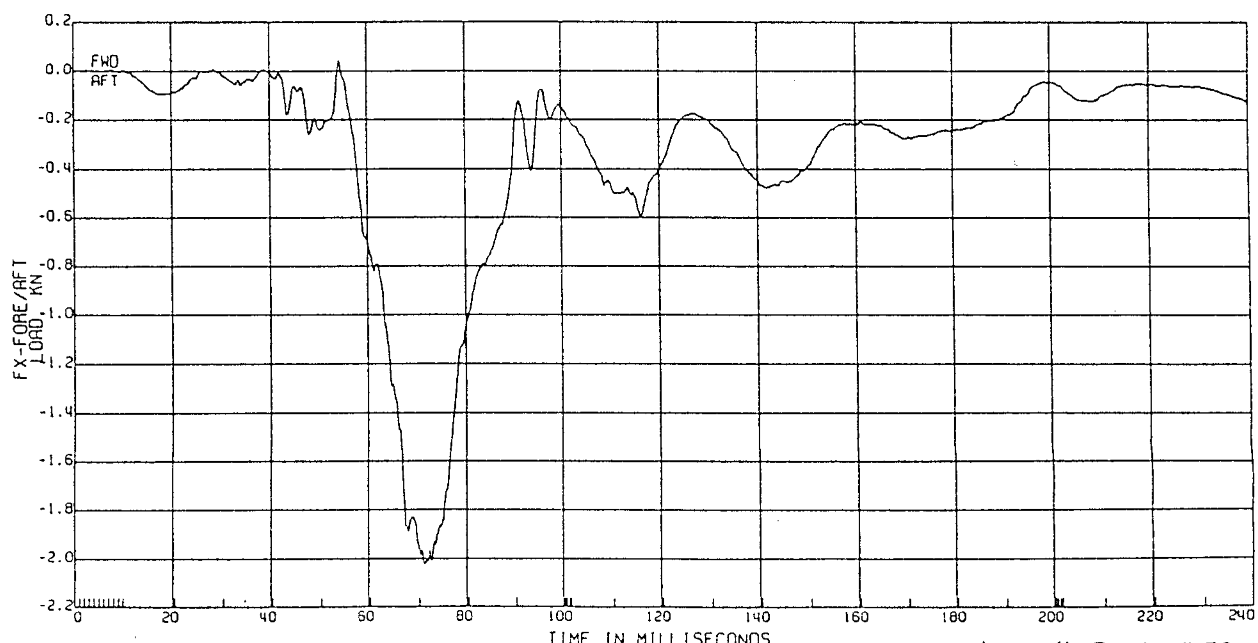
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

L. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H

TEST DATE:06/26/1996



Appendix D, plot # 50

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

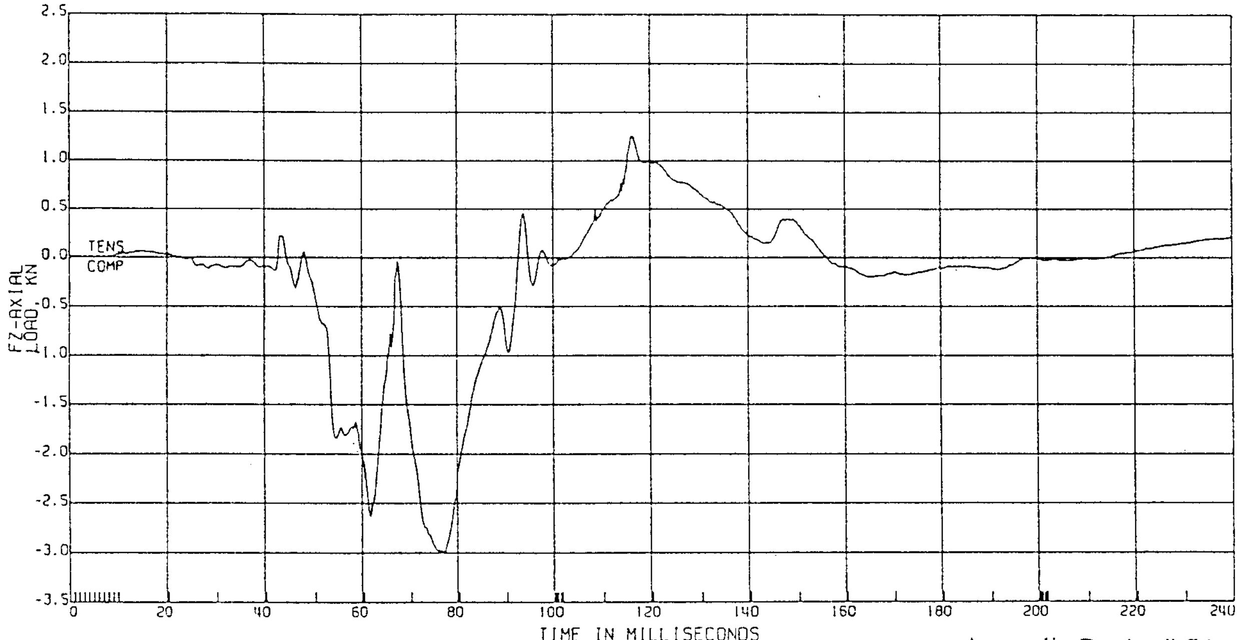
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

L. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H

TEST DATE:06/26/1996



Appendix D, plot # 51

51 PROCESSED 6/27/1996 15:56 V2.04E

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

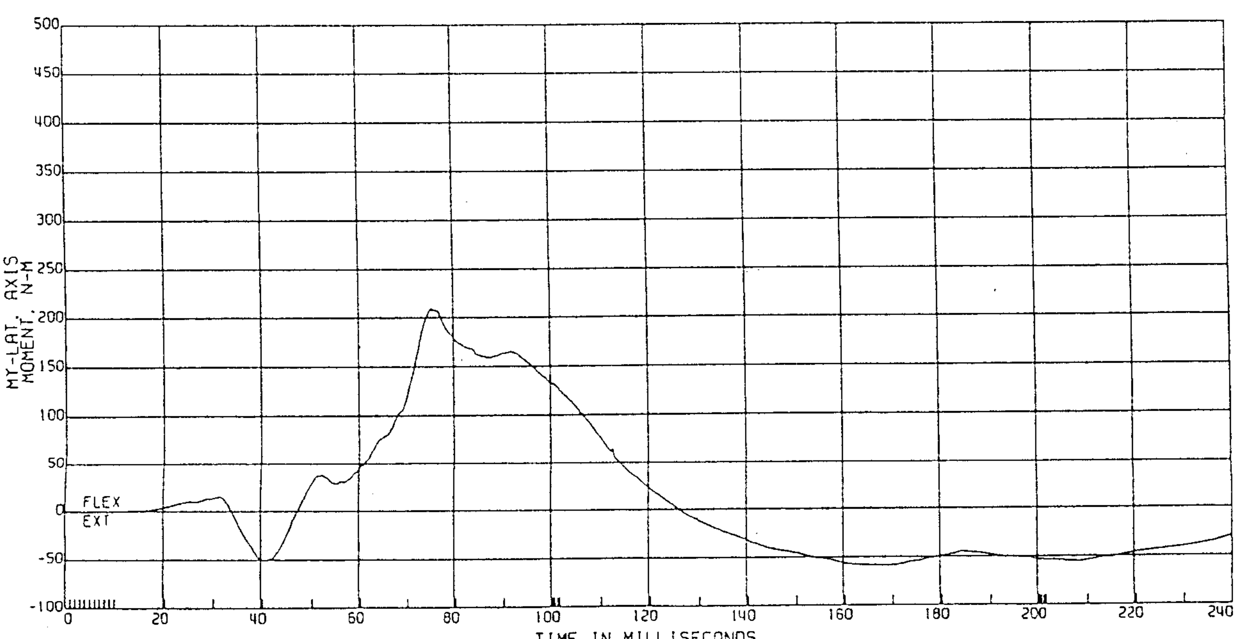
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

R. FRT LOWER LUMBAR MOMENT

ATD TYPE: GM50H

TEST DATE:06/26/1996



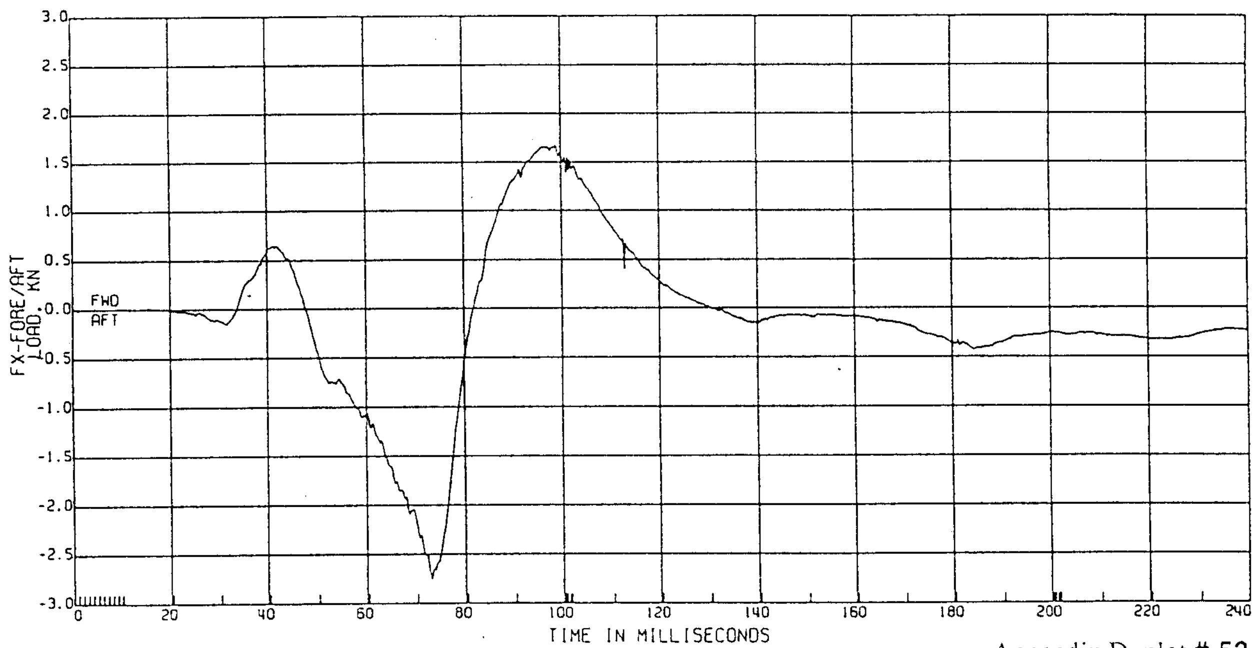
Appendix D, plot # 52

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

R. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H
TEST DATE:06/26/1996



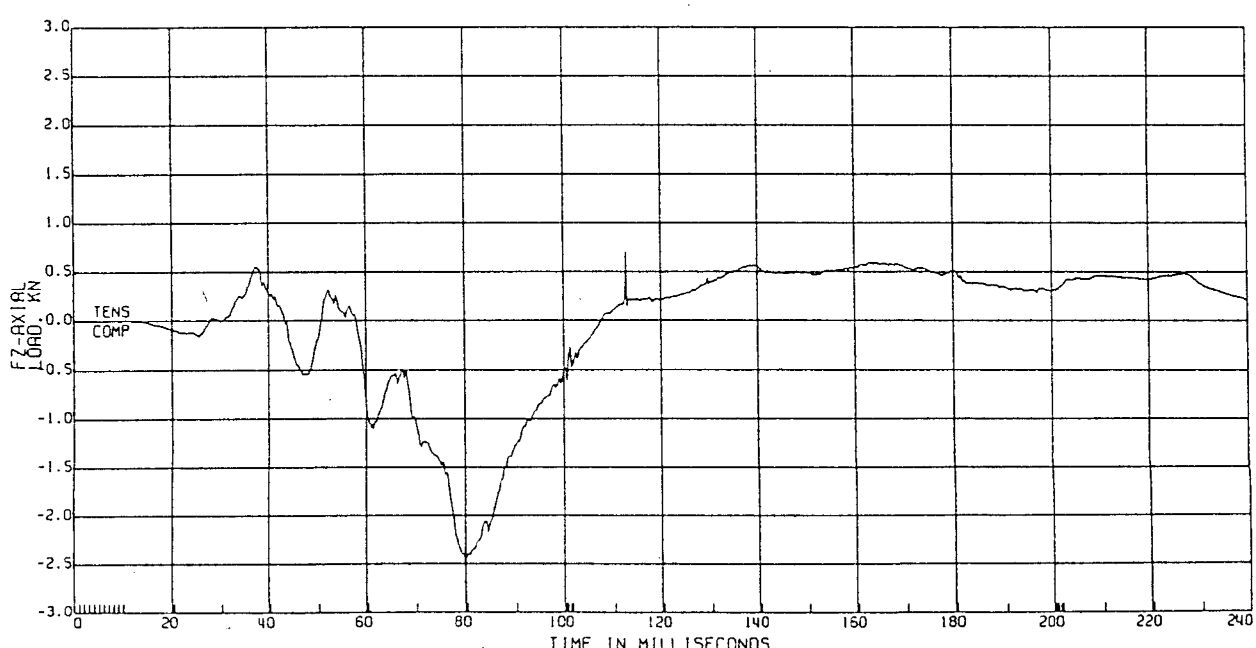
Appendix D, plot # 53

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

R. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H
TEST DATE:06/26/1996



Appendix D, plot # 54

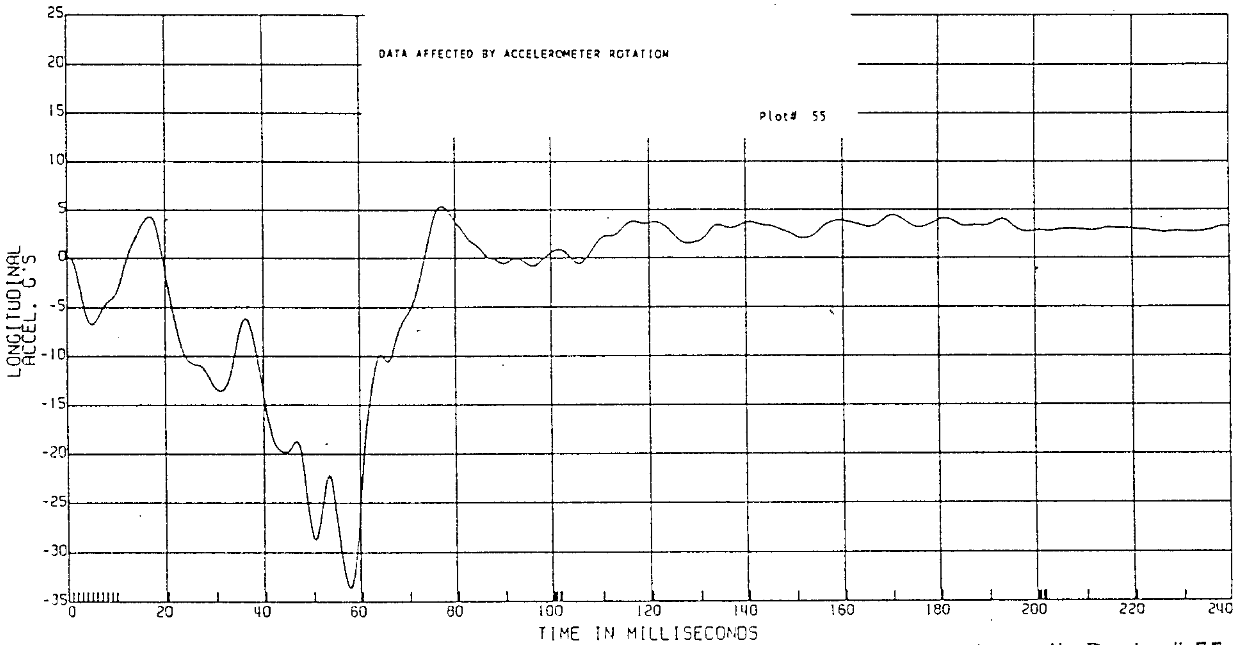
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

L. FRT ROCKER ACCEL

TEST DATE:06/26/1996



Appendix D, plot # 55

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

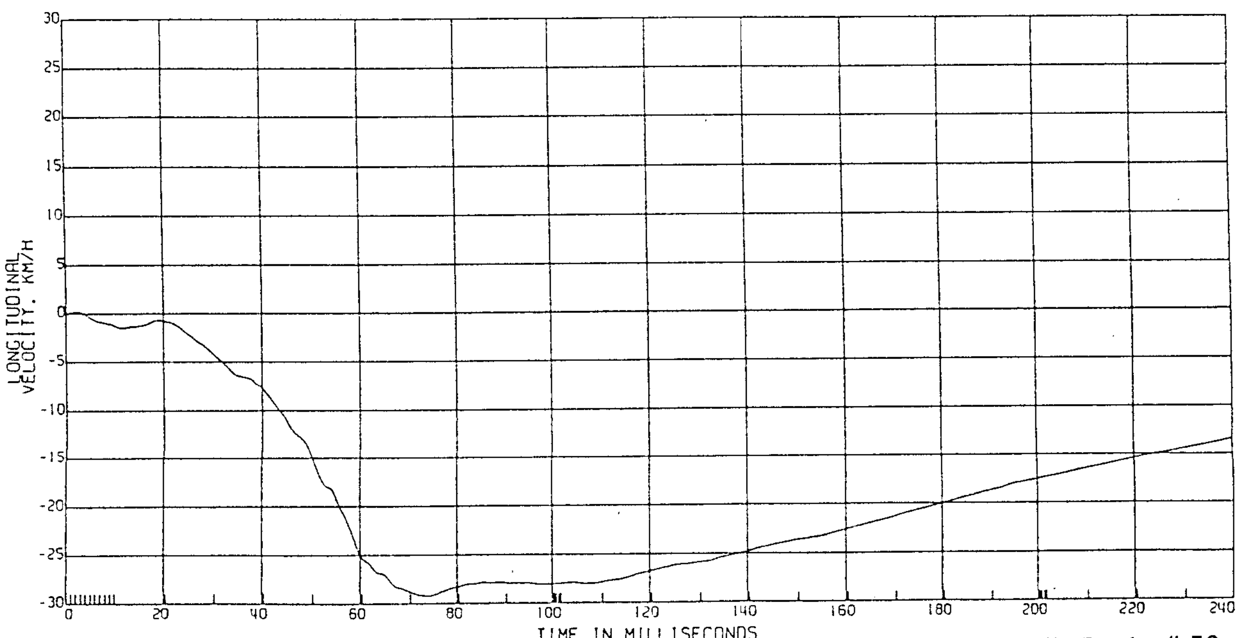
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 56

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

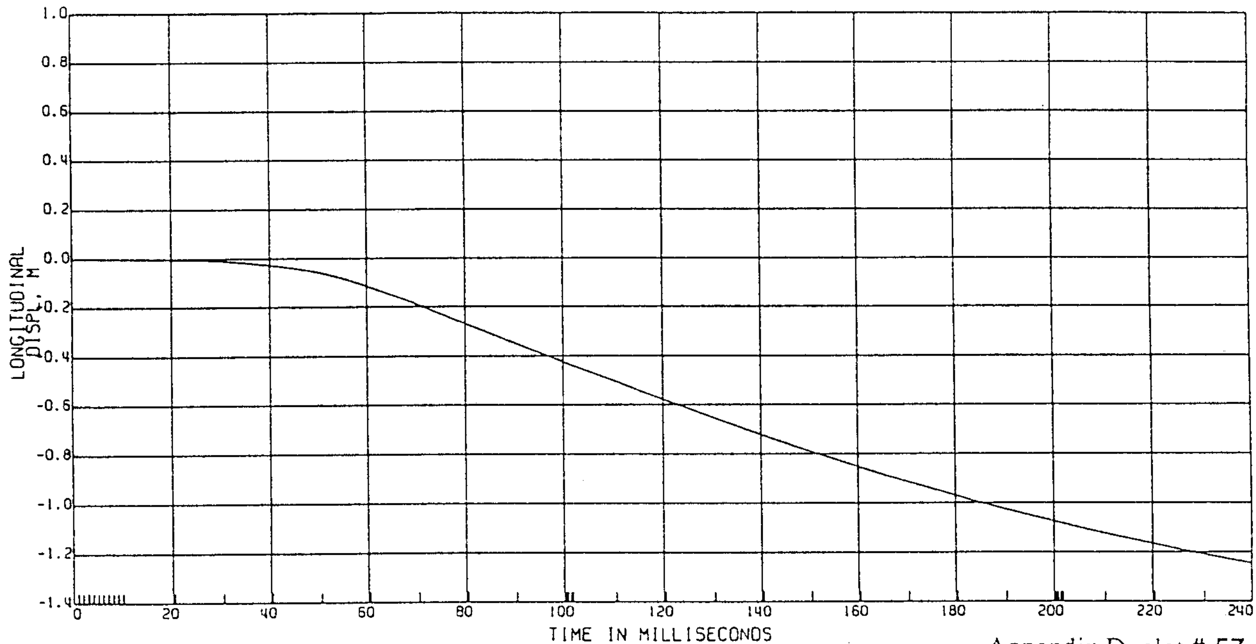
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 57

57 PROCESSED 6/27/1996 15:56 V2.04E

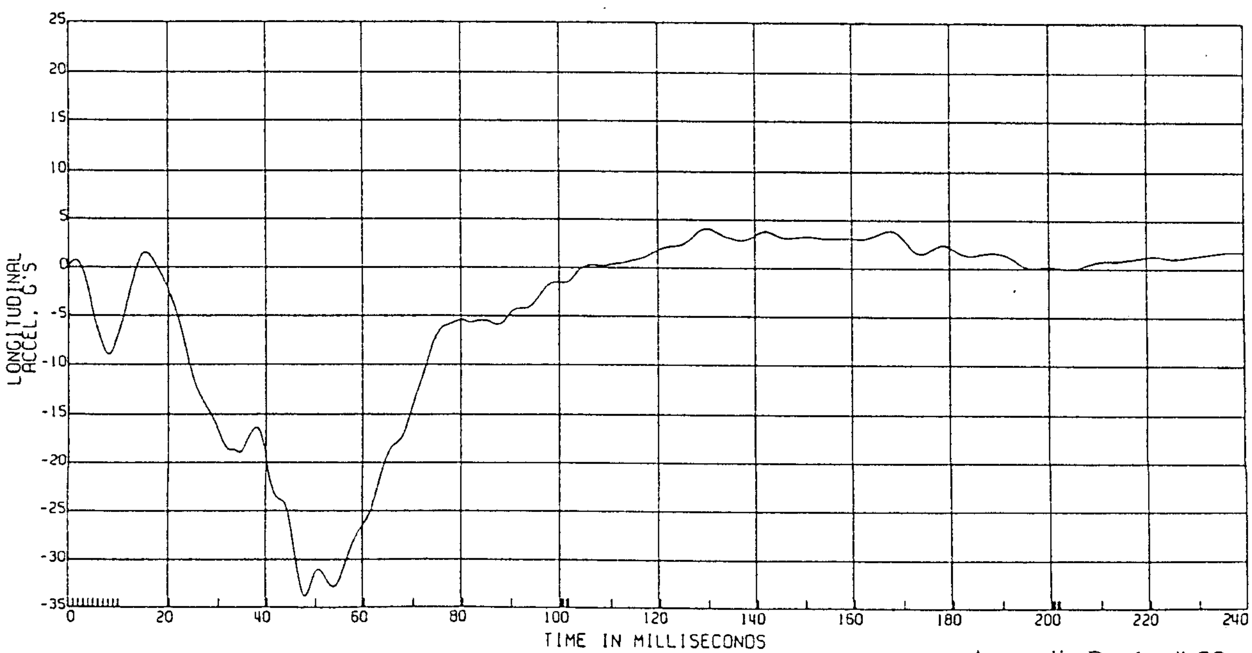
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

R. FRT ROCKER ACCEL

TEST DATE:06/26/1996



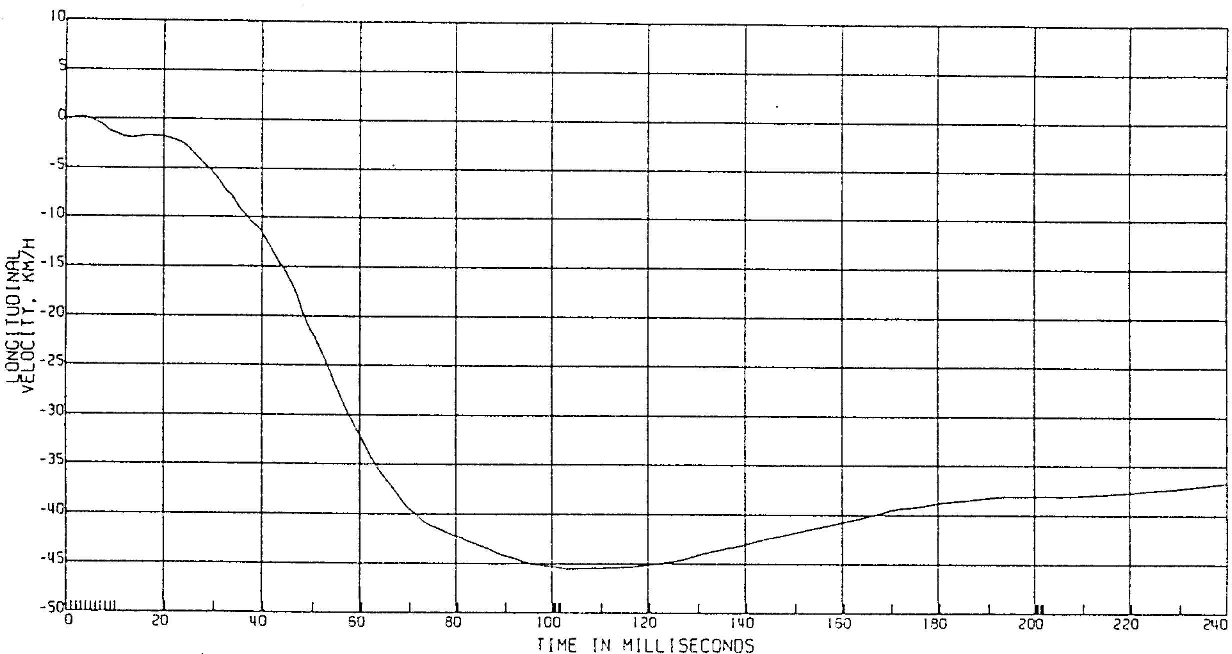
Appendix D, plot # 58

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

R. FRT ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



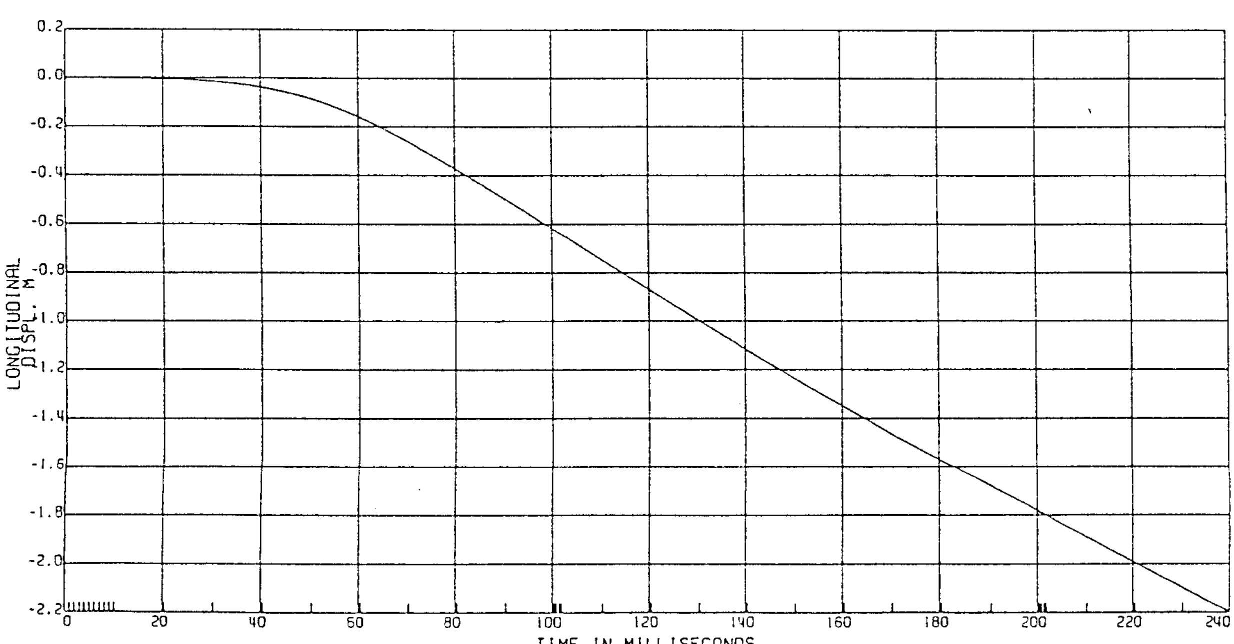
Appendix D, plot # 59

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

R. FRT ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



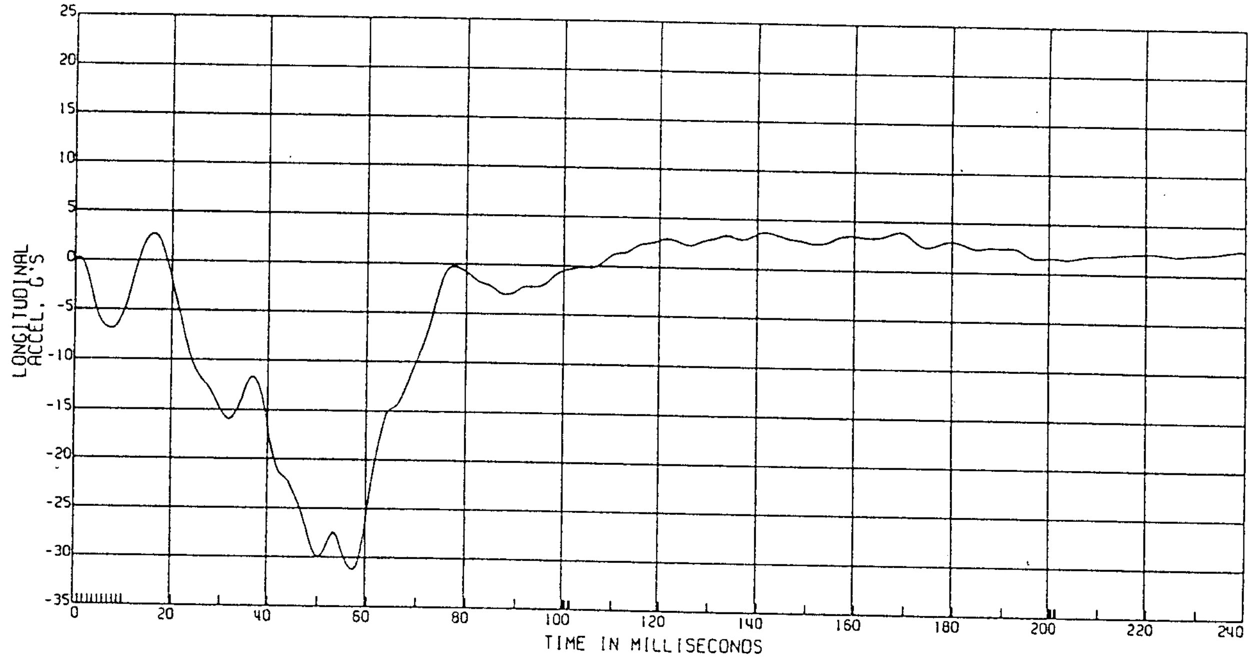
Appendix D, plot # 60

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 60

AVERAGED FRT ROCKER ACCELERATION
(AVGD L. & R. ROCKER ACCELS)

TEST DATE:06/26/1996



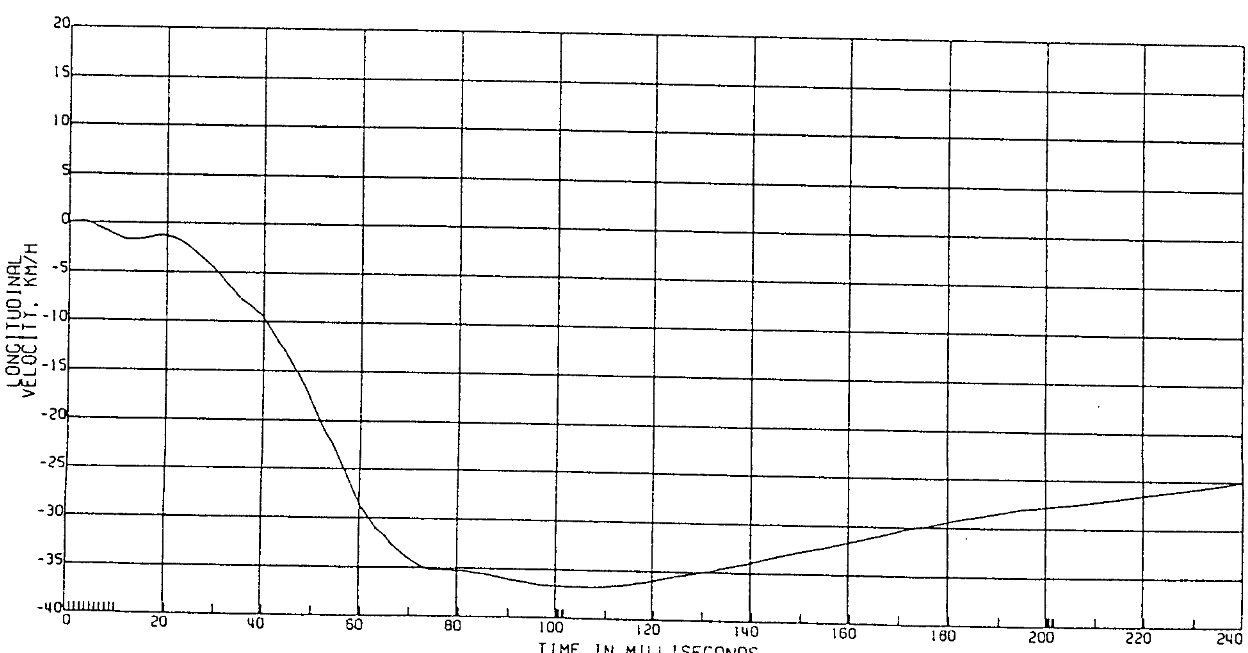
Appendix D, plot # 61

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



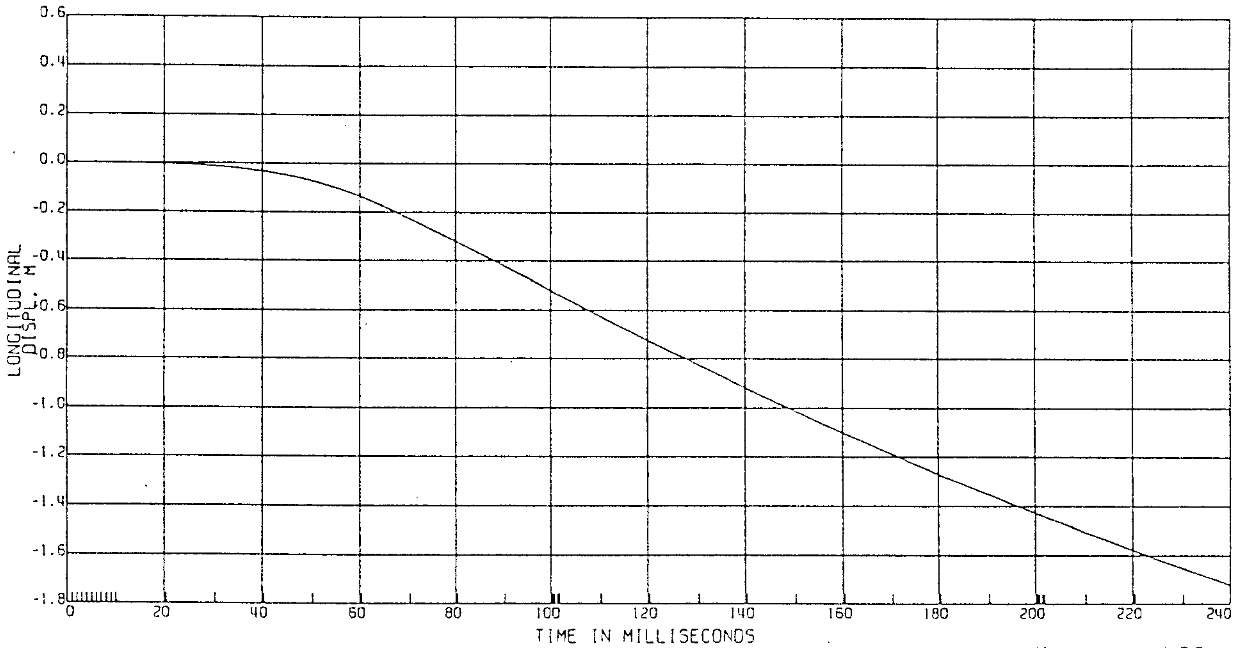
Appendix D, plot # 62

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



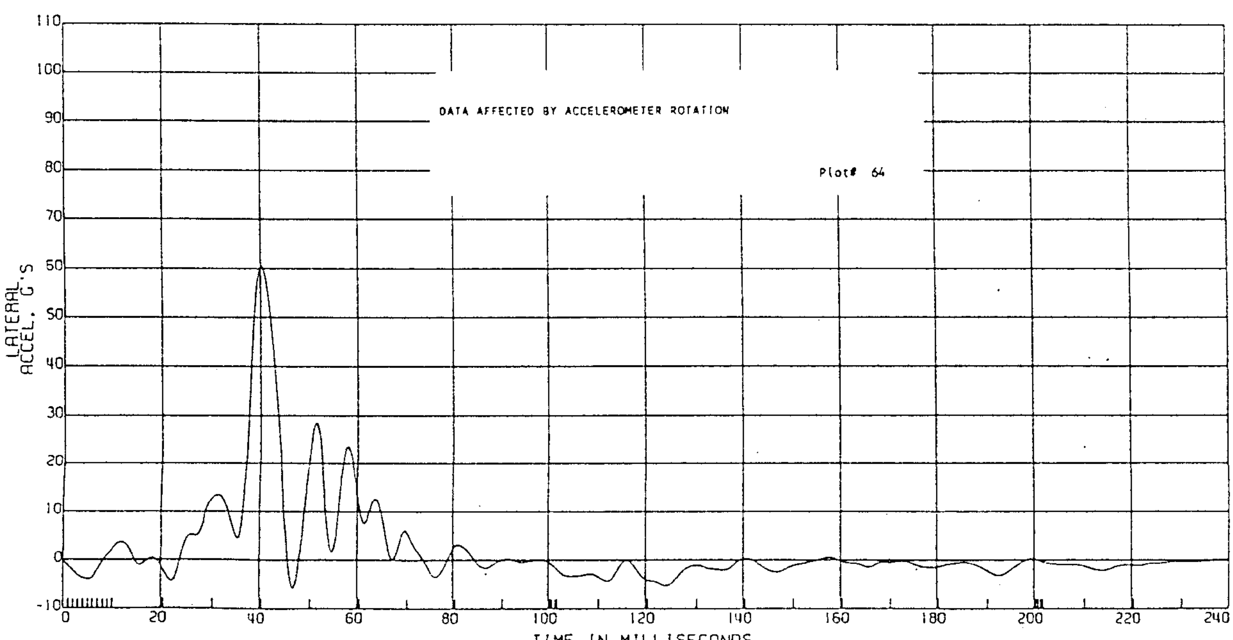
Appendix D, plot # 63

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 60

L. FRT ROCKER ACCEL

TEST DATE:06/26/1996



Appendix D, plot # 64

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

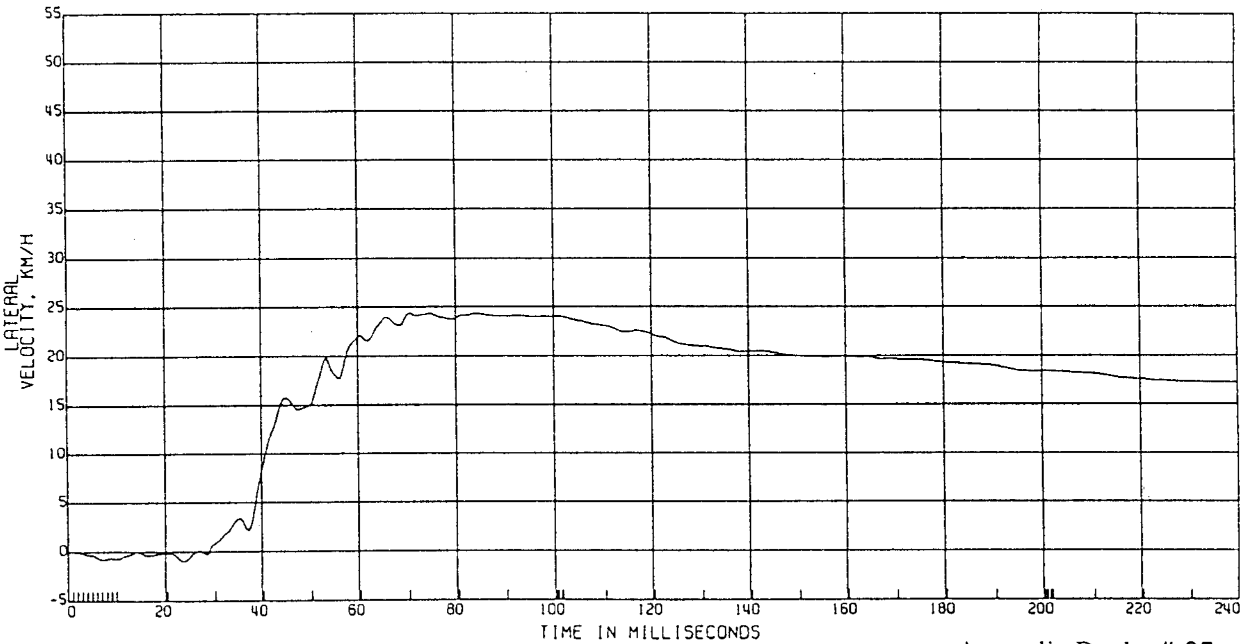
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 65

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

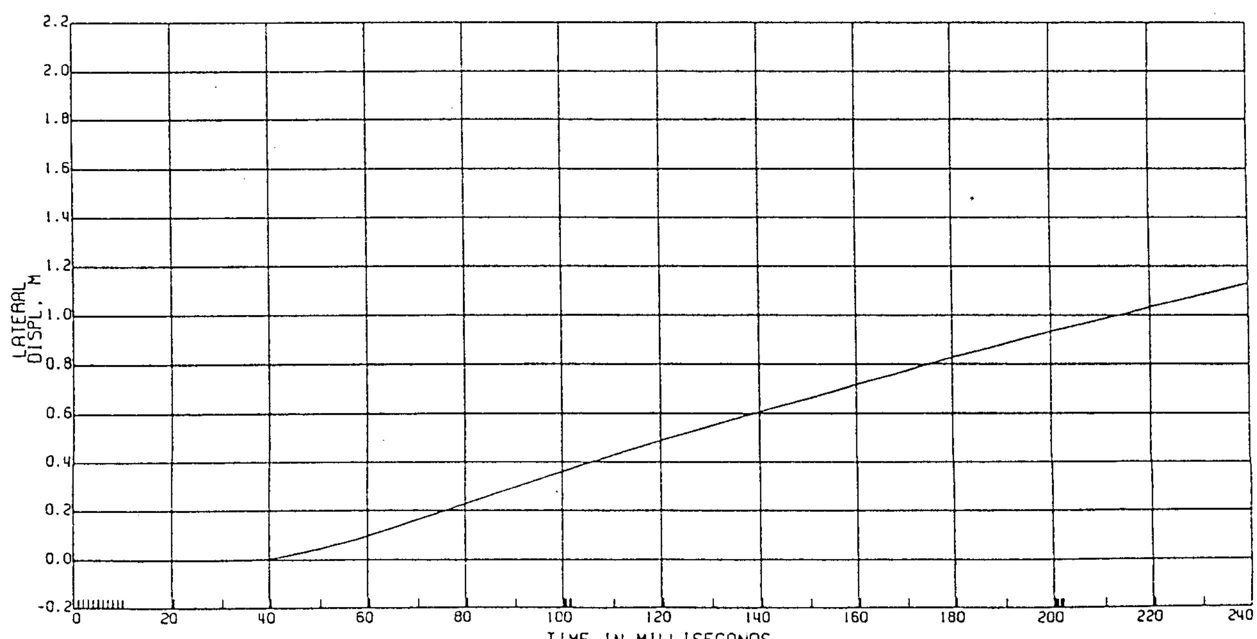
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 66

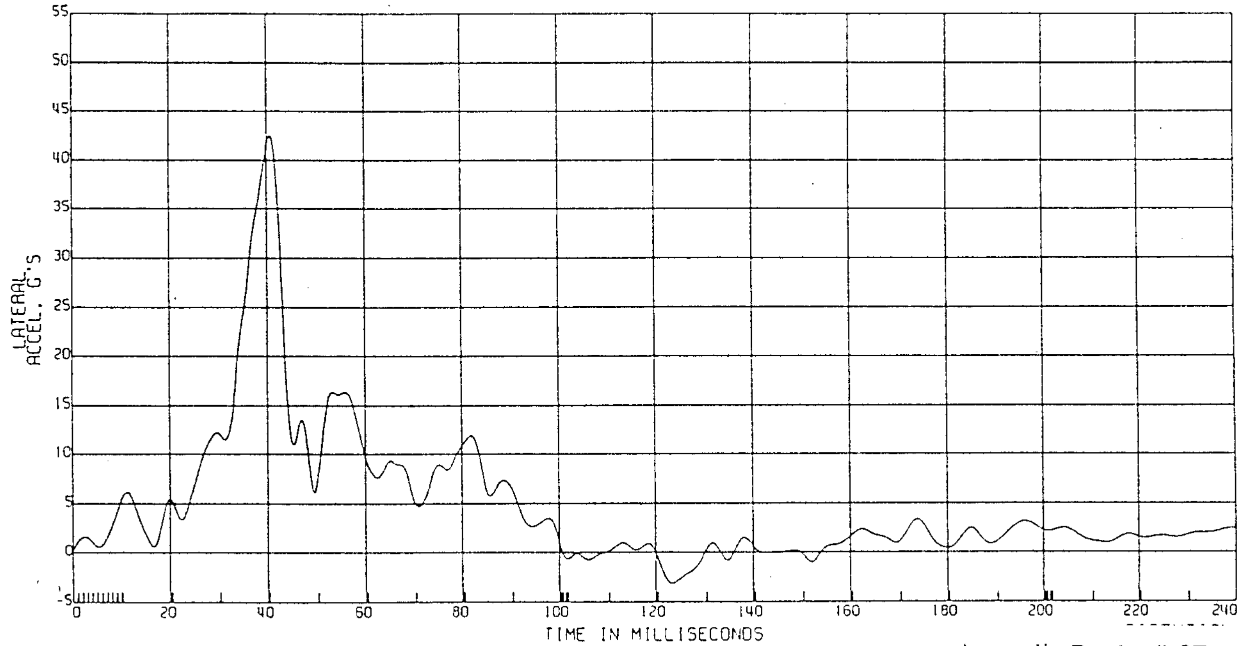
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

R. FRT ROCKER ACCEL

TEST DATE:06/26/1996



Appendix D, plot # 67

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

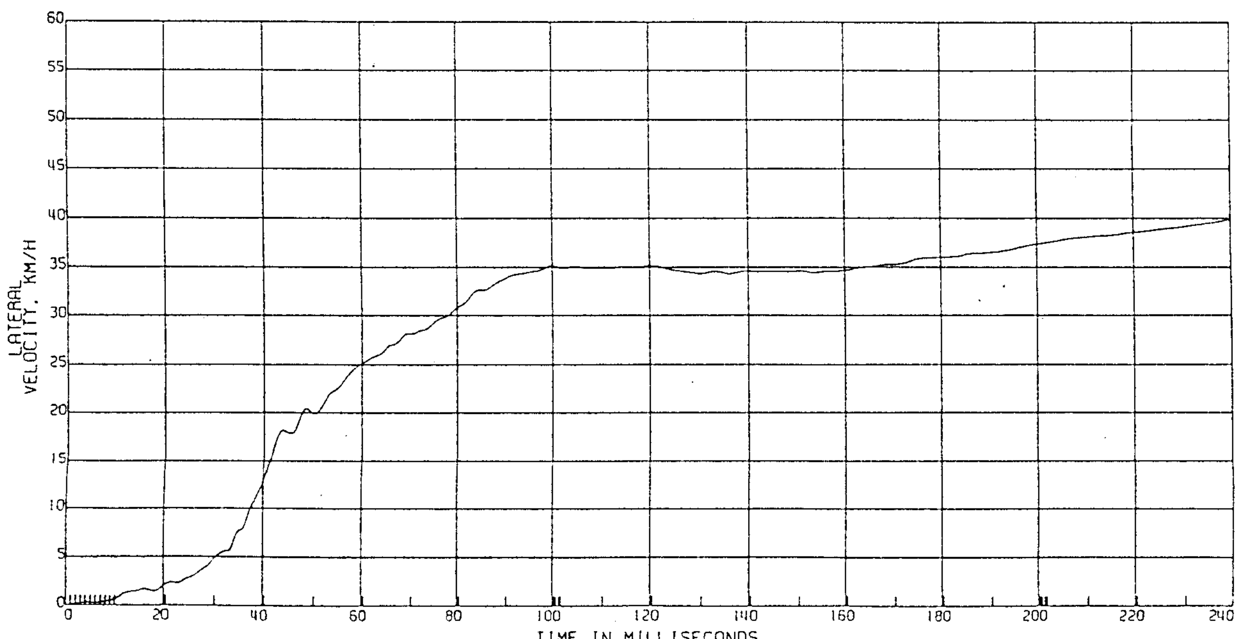
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

R. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 68

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

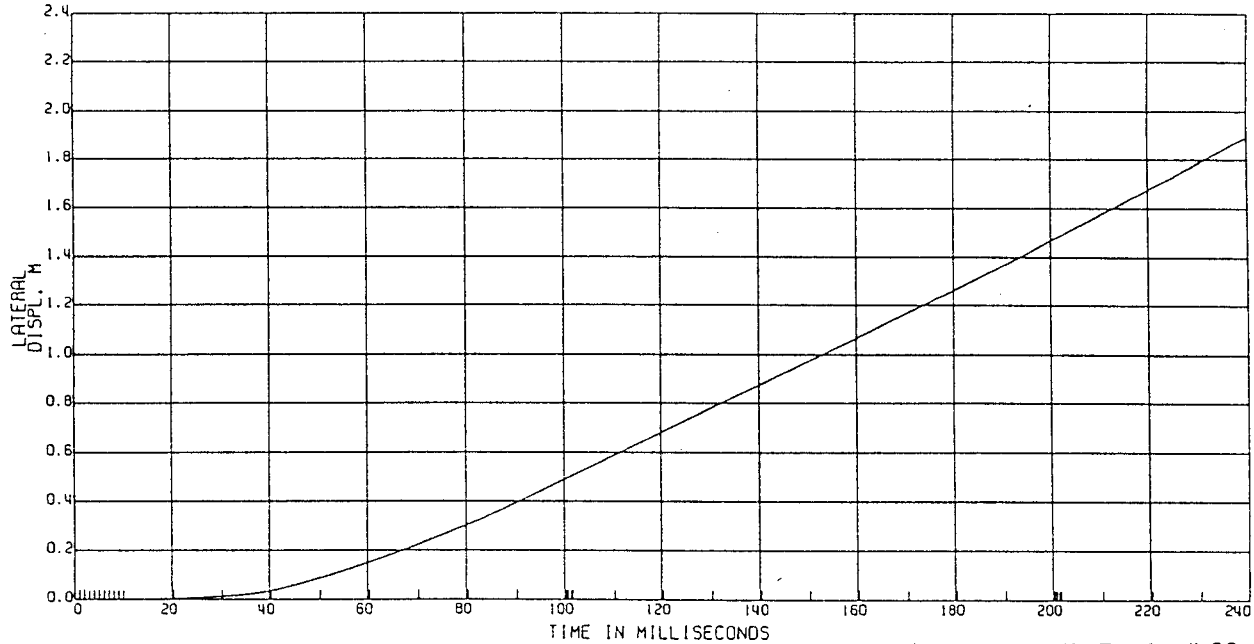
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

R. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 69

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

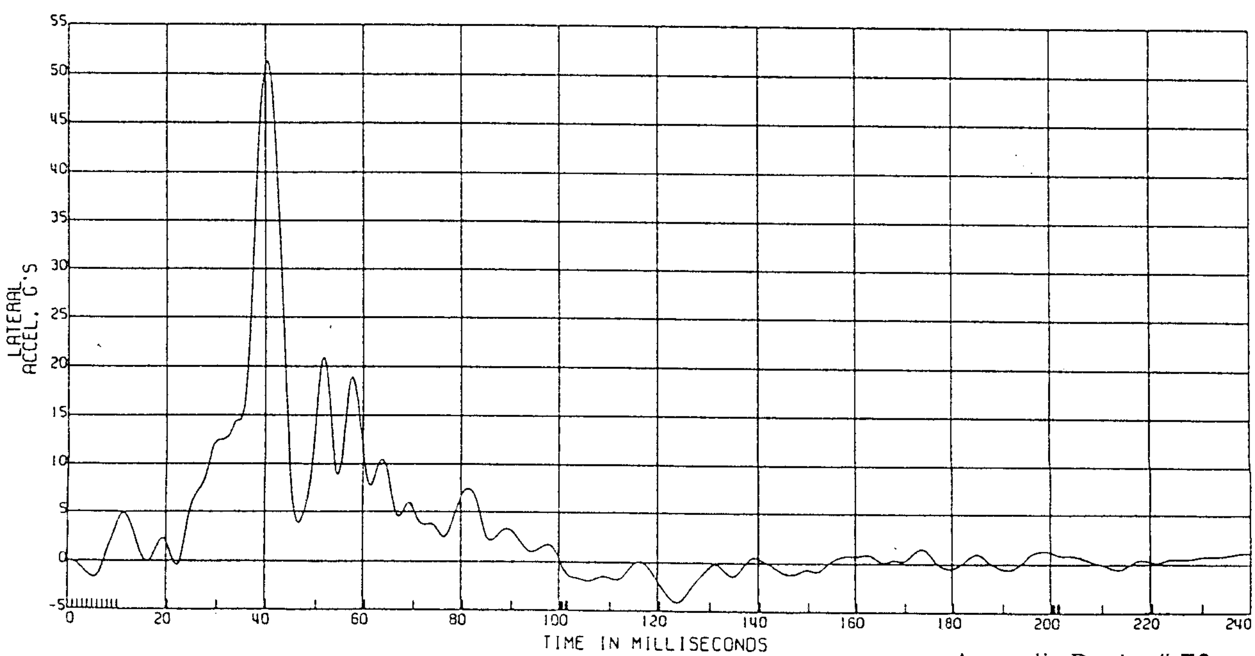
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

AVERAGED FRT ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:06/26/1996



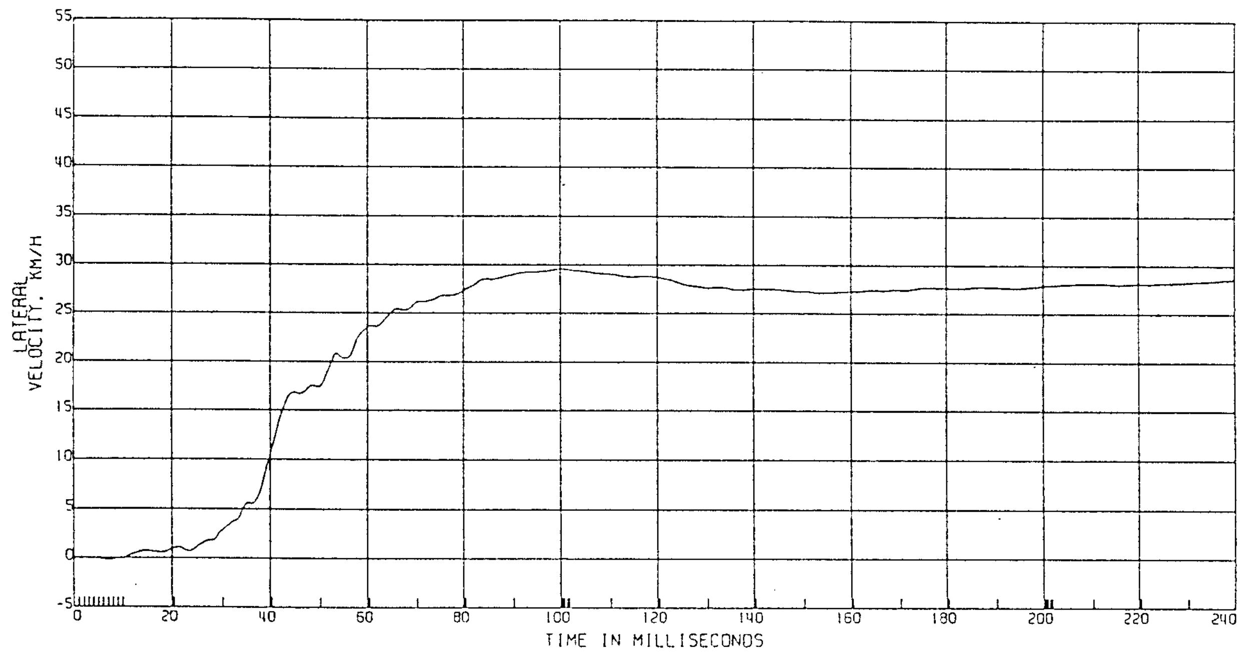
Appendix D, plot # 70

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



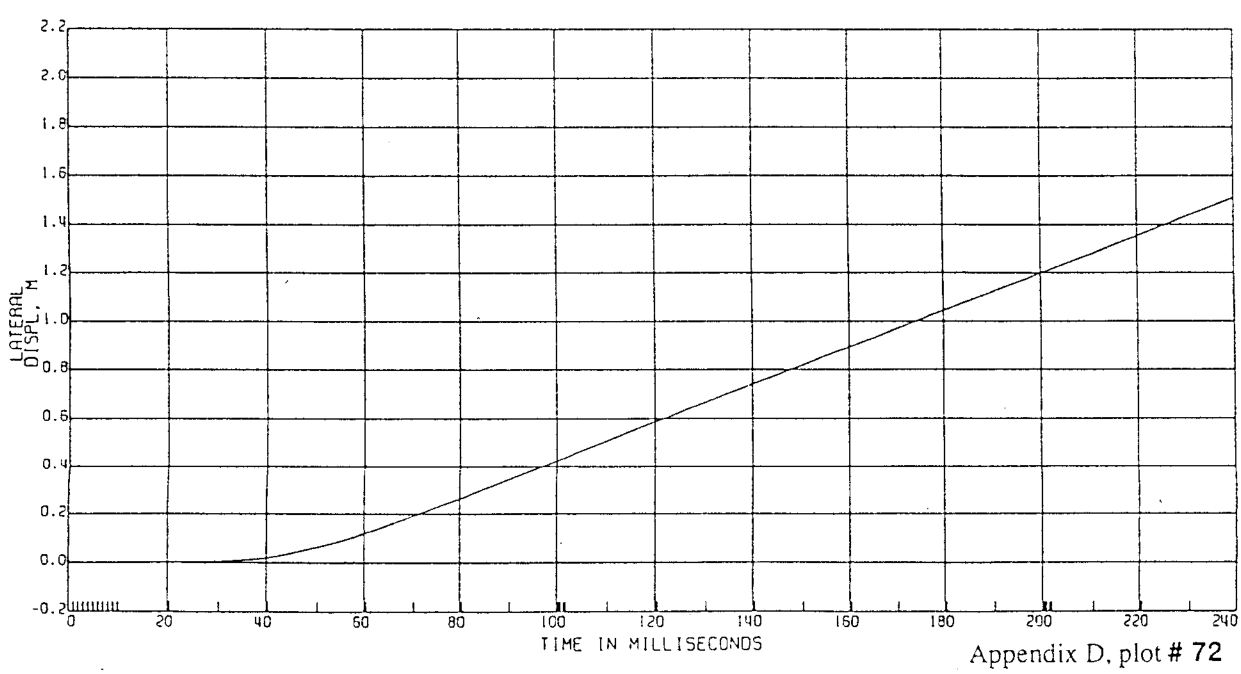
Appendix D, plot # 71

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 72

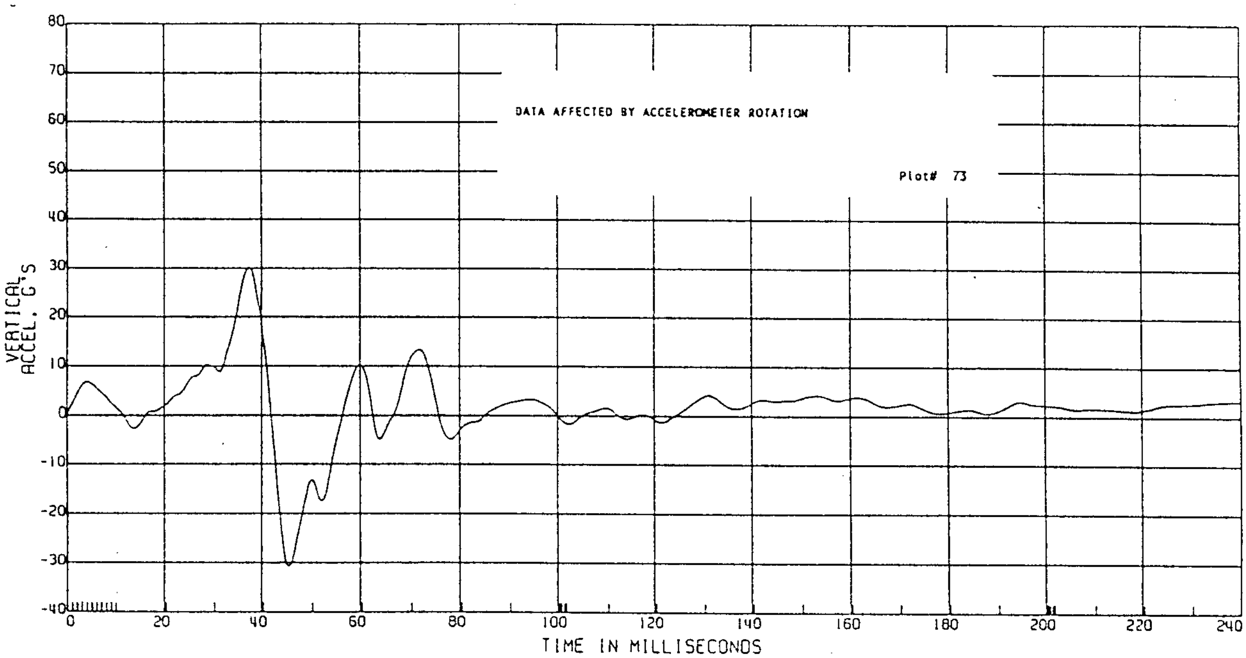
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

L. FRT ROCKER ACCEL

TEST DATE:06/26/1996



Appendix D, plot # 73

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

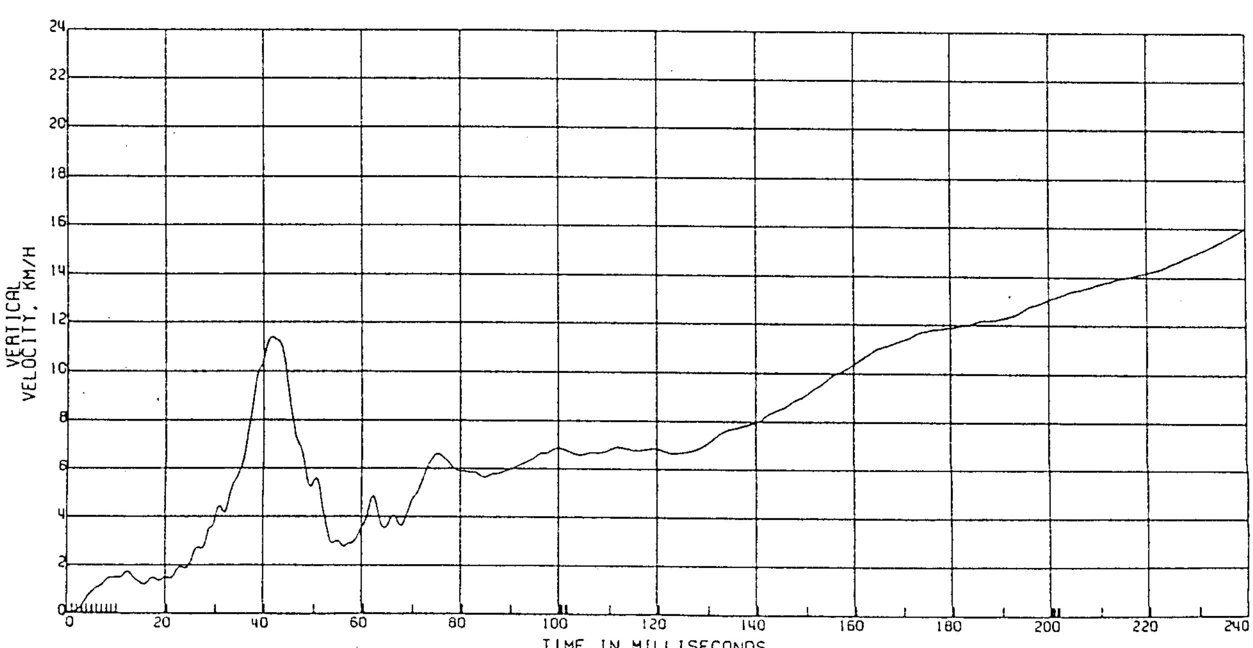
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



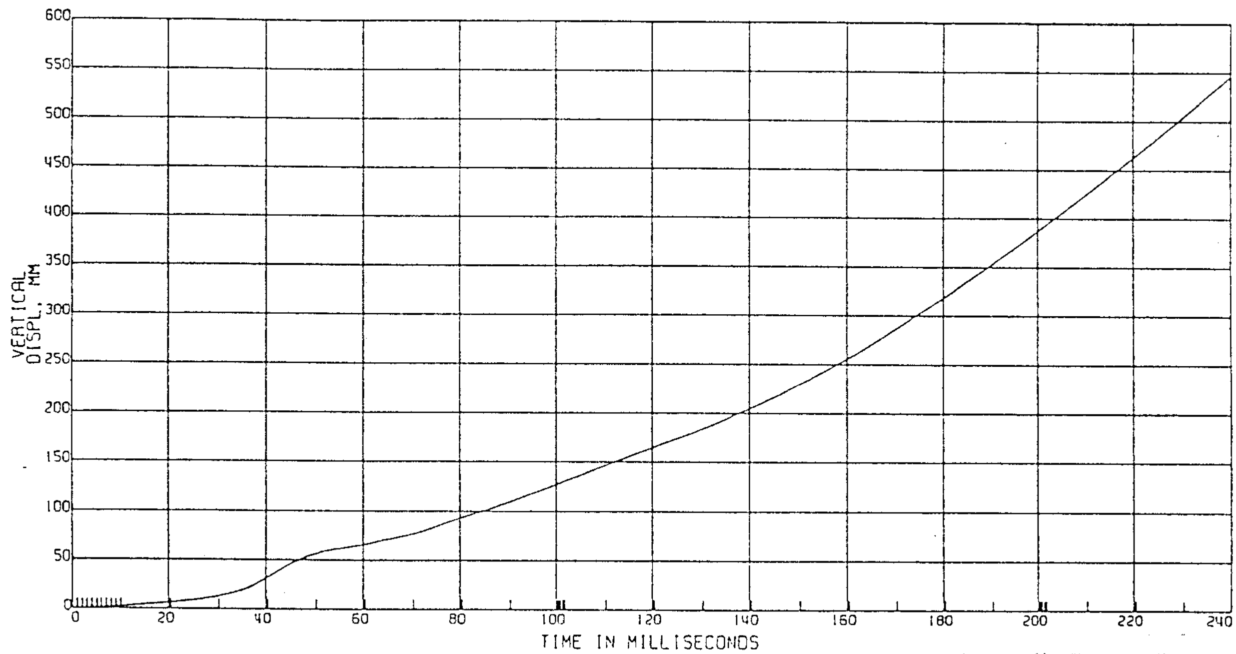
Appendix D, plot # 74

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

L. FRT ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



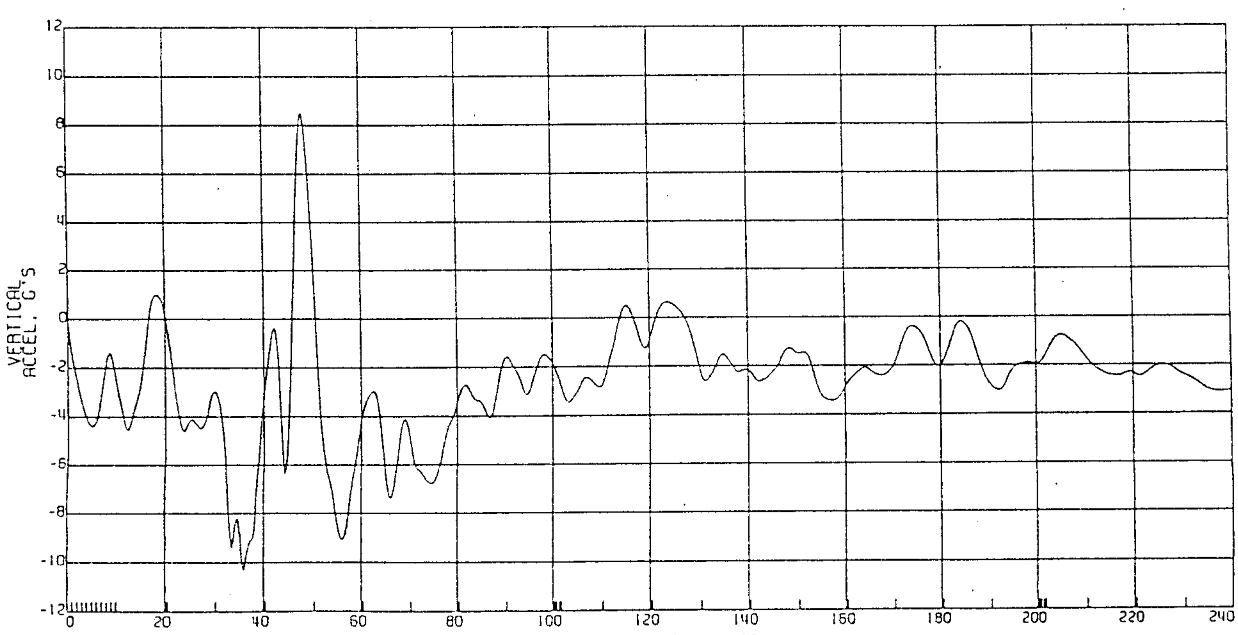
Appendix D, plot # 75

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 60

R. FRT ROCKER ACCEL

TEST DATE:06/26/1996



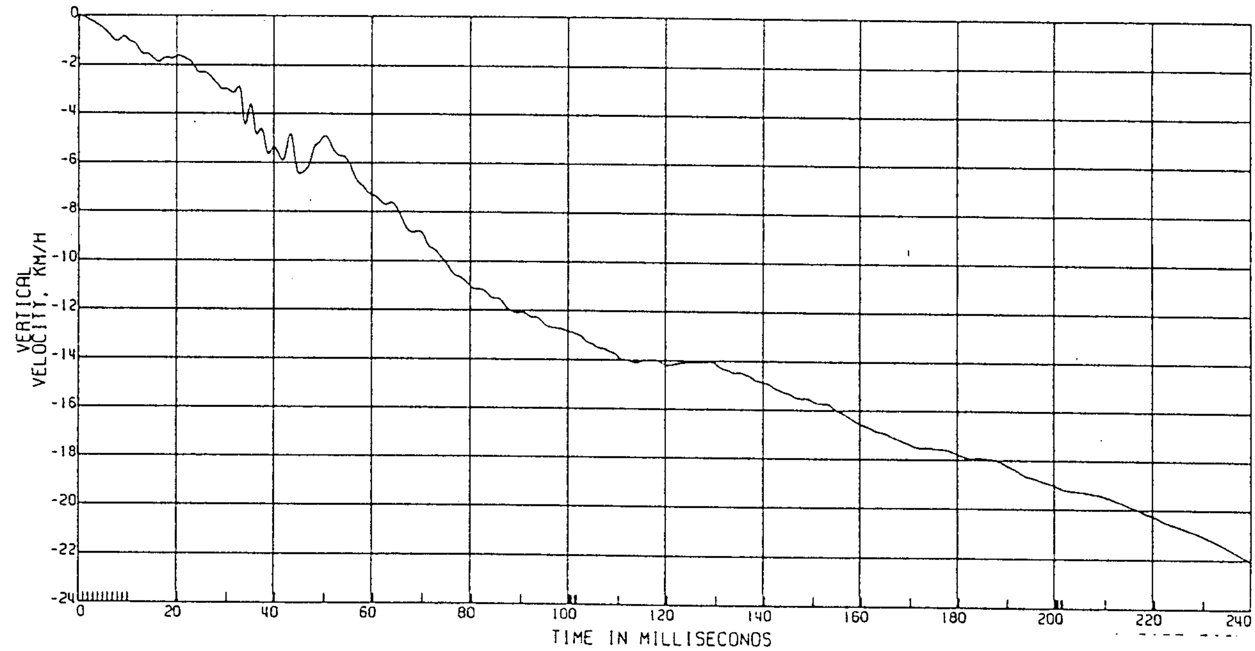
Appendix D, plot # 76

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

R. FRT ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



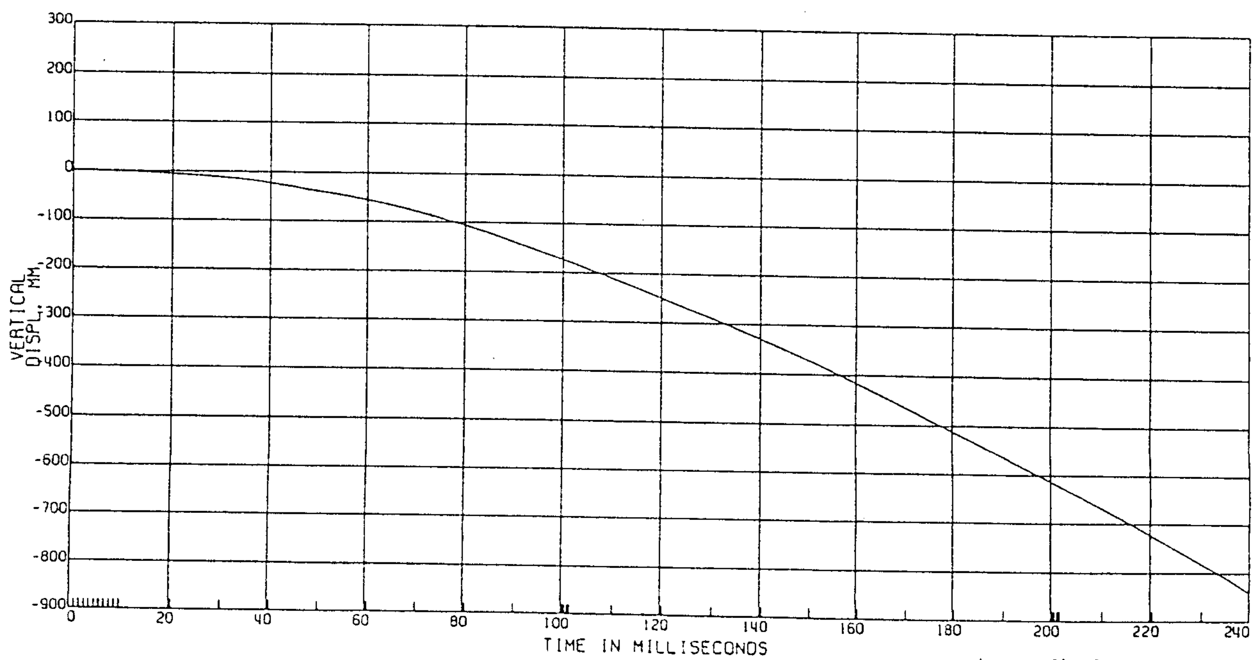
Appendix D, plot # 77

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

R. FRT ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 78

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

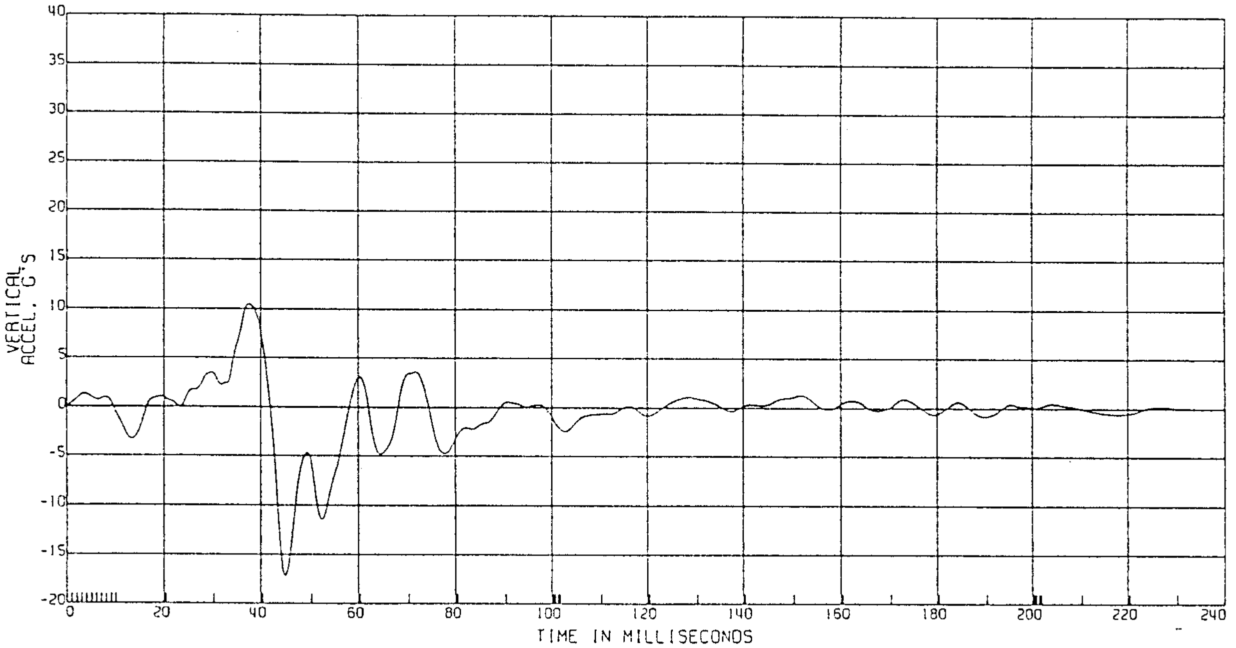
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

AVERAGED FRT ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:06/26/1996



Appendix D, plot # 79

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

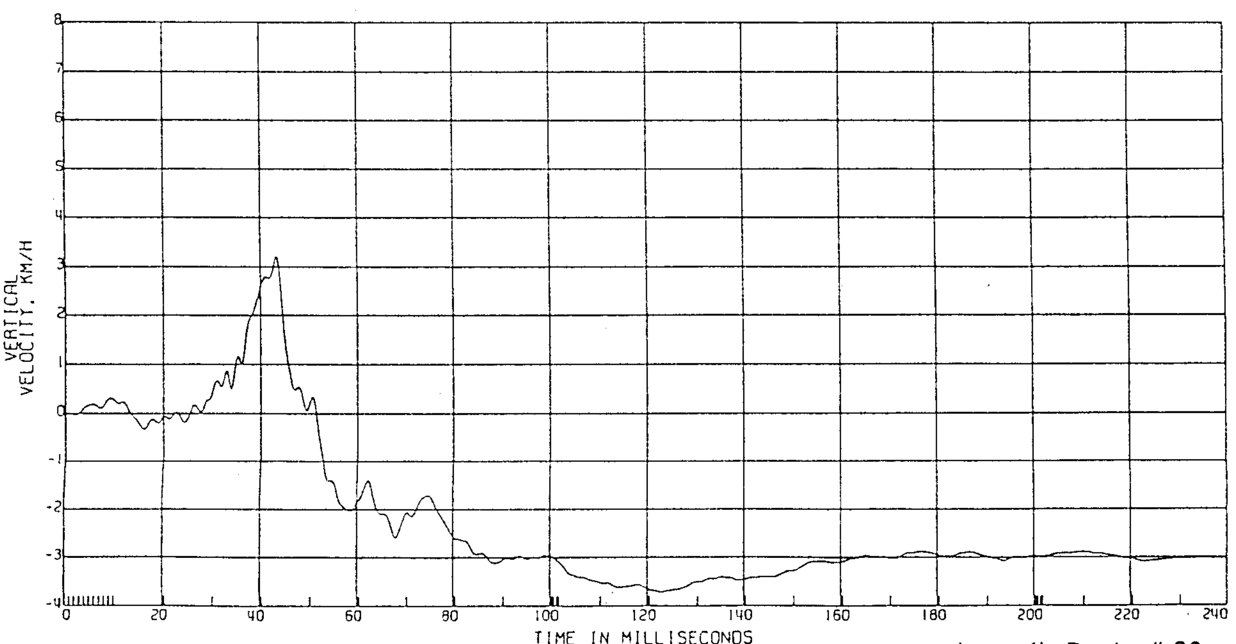
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 80

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

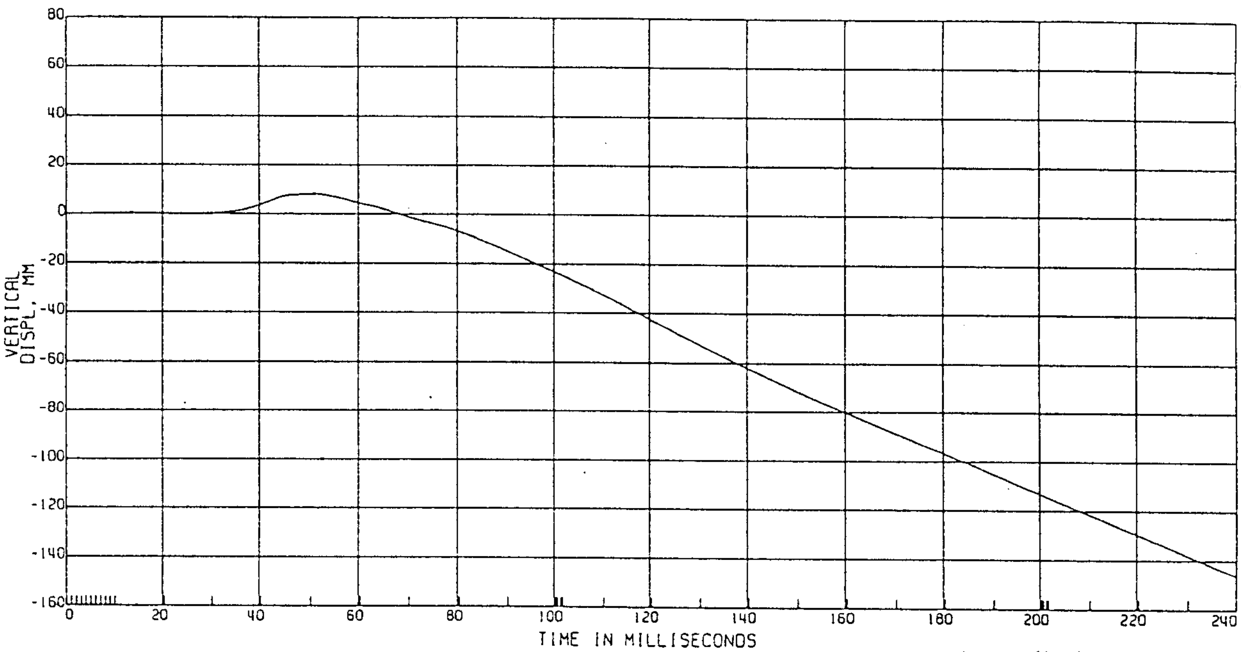
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 81

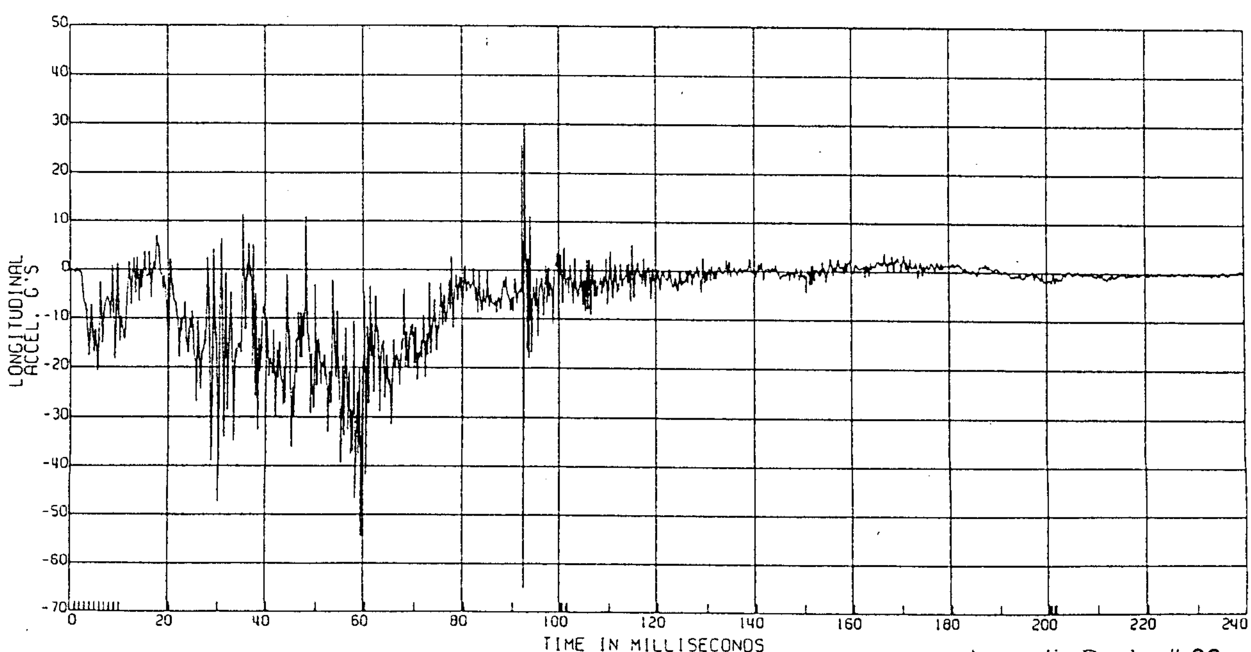
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

L.REAR ROCKER ACCEL

TEST DATE:06/26/1996



Appendix D, plot # 82

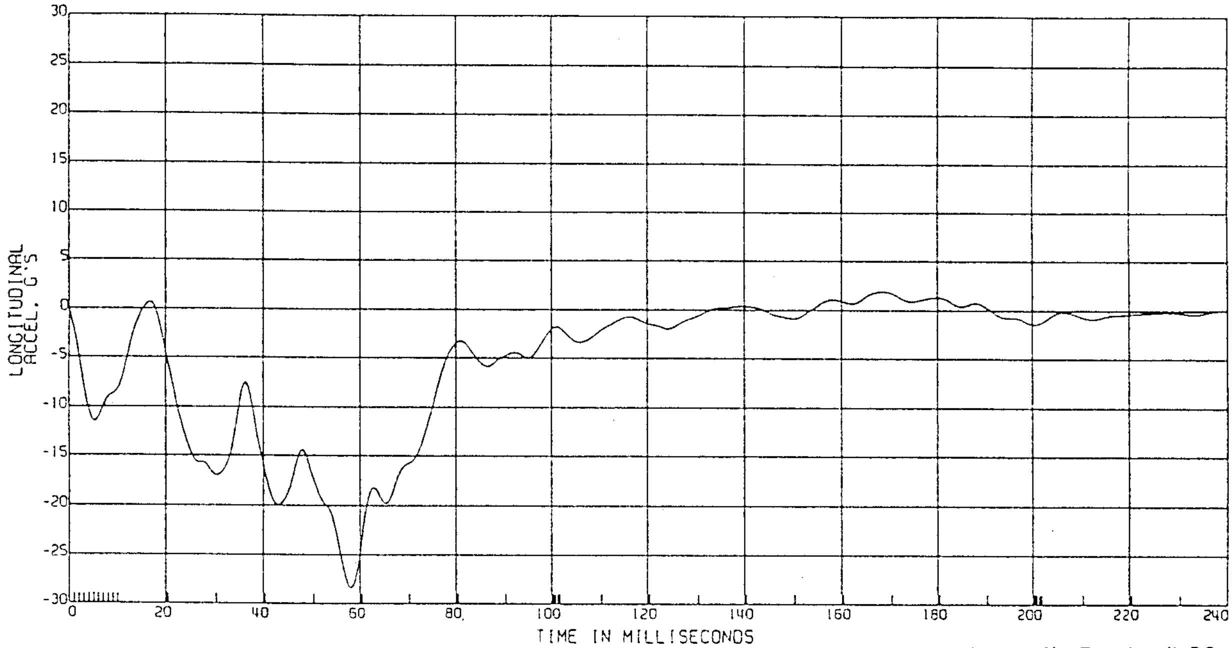
C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

L.REAR ROCKER ACCEL

TEST DATE:06/26/1996



Appendix D, plot # 83

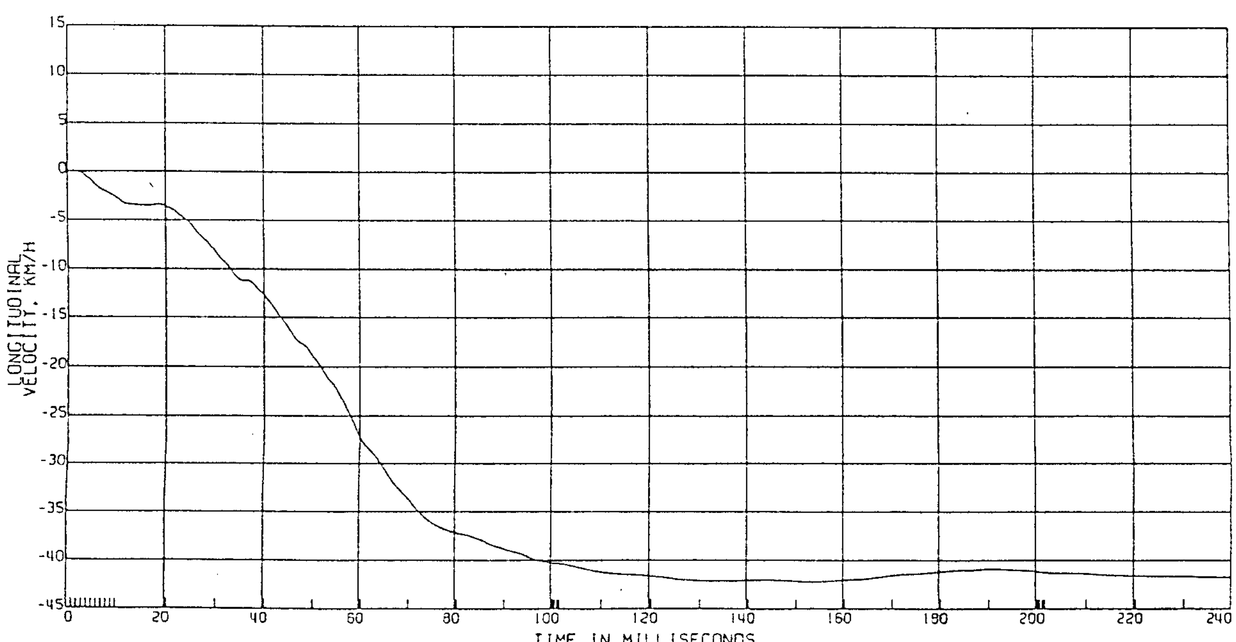
C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

L.REAR ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



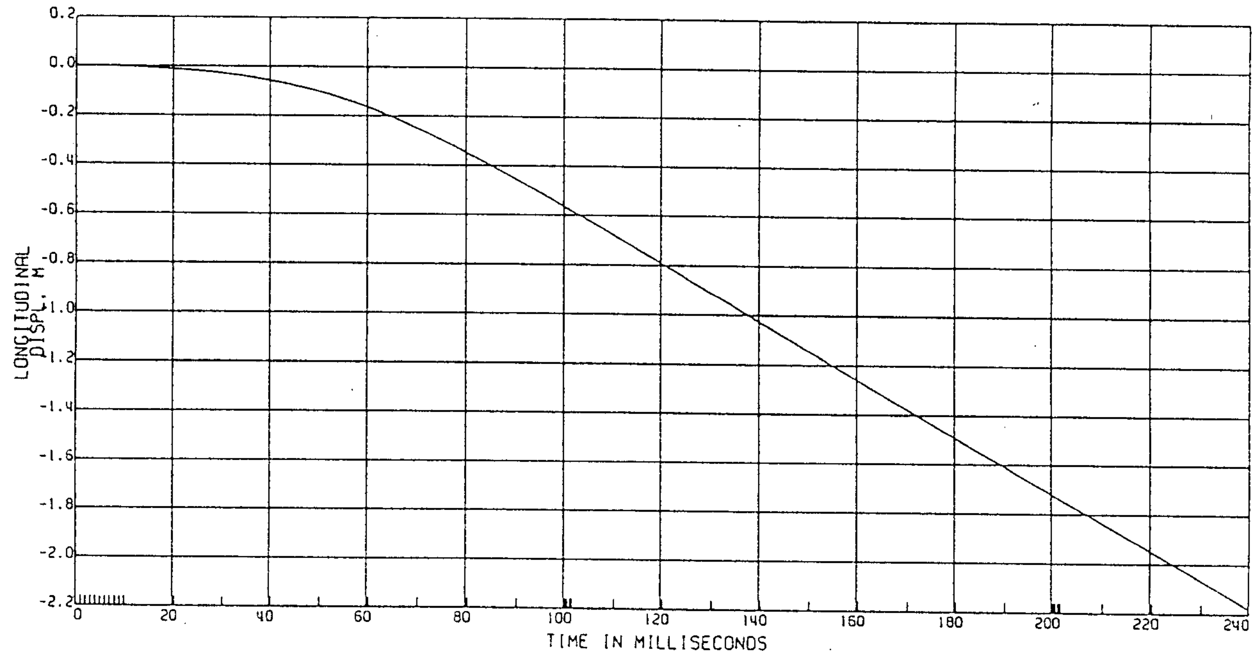
Appendix D, plot # 84

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

L.REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



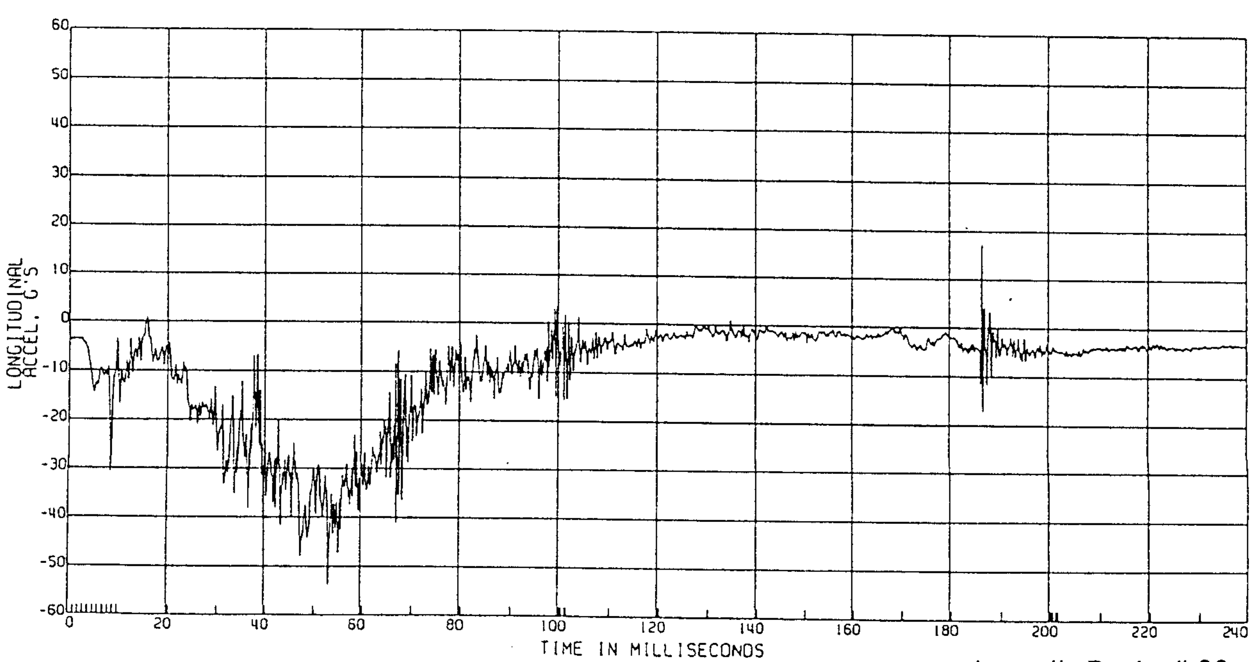
Appendix D, plot # 85

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 1000

R.REAR ROCKER ACCEL

TEST DATE:06/26/1996



Appendix D, plot # 86

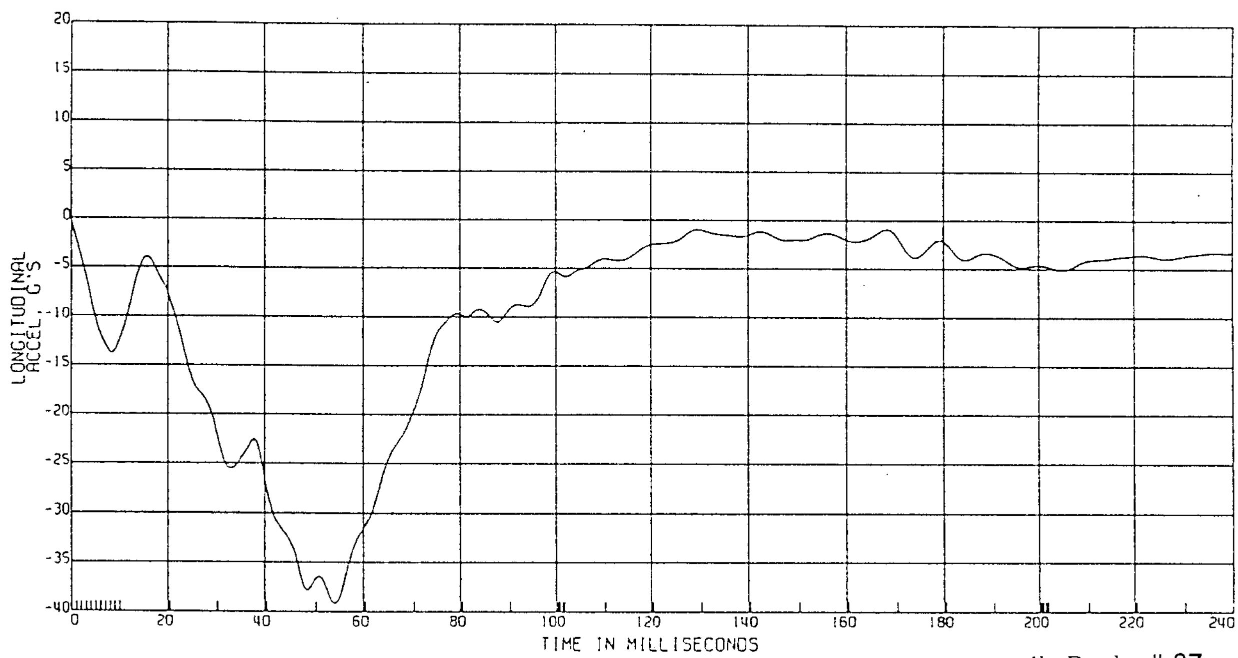
C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

R.REAR ROCKER ACCEL

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 60



Appendix D, plot # 87

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

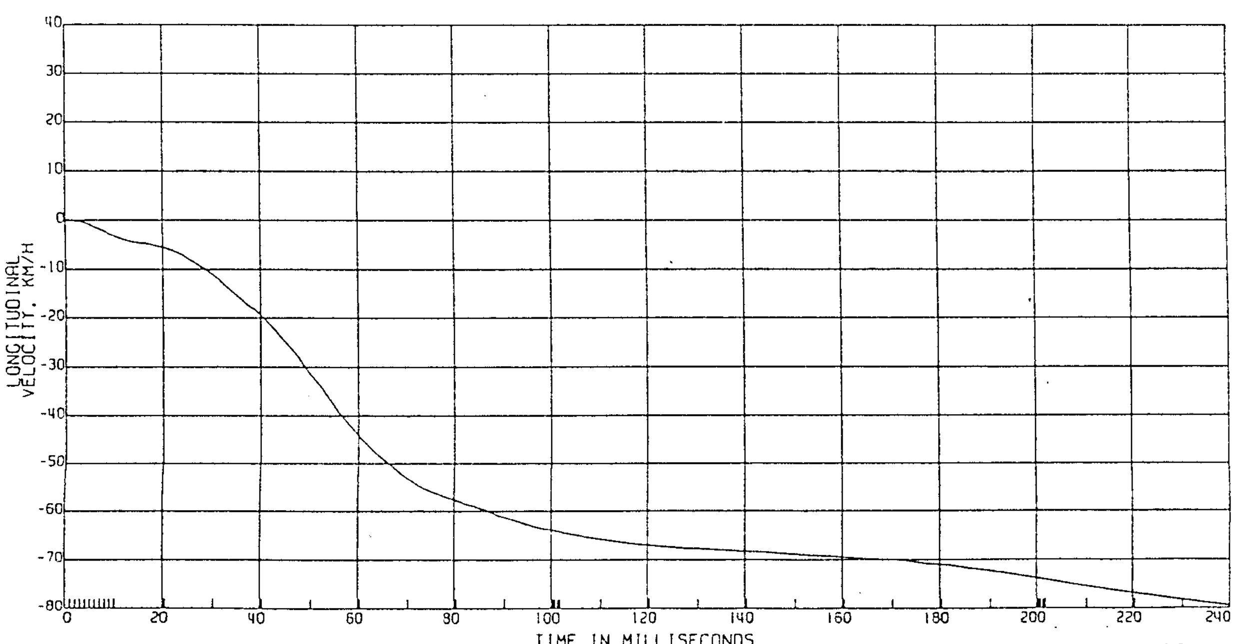
R & D CTR 8T93090 VAN

R.REAR ROCKER VELOCITY

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 180

(COMPUTED FROM ACCELERATION)



Appendix D, plot # 88

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

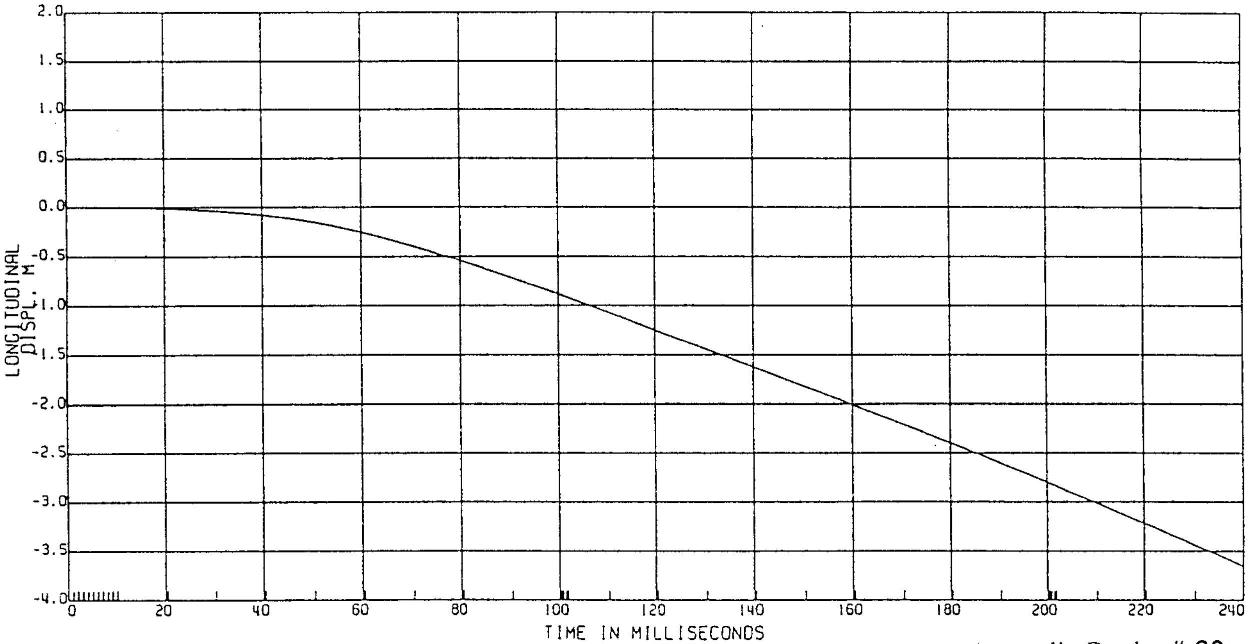
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

R. REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 89

US PROCESSED 8/27/1996 15:56 V2.04E

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

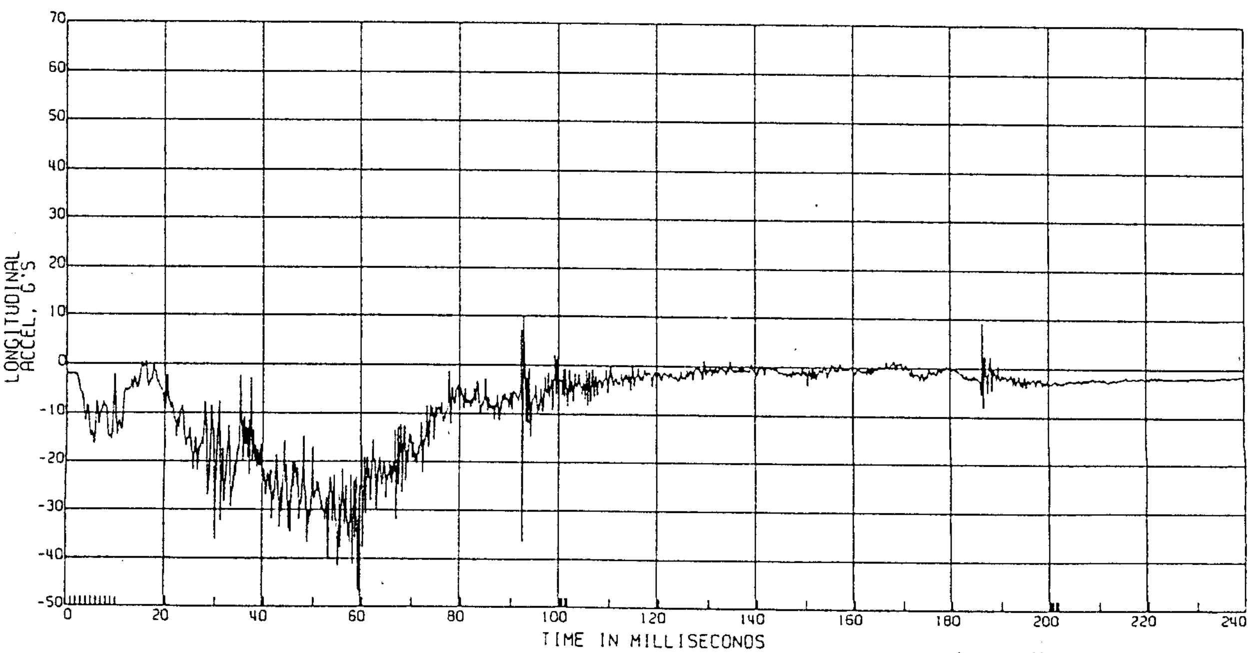
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

AVERAGED REAR ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:06/26/1996



Appendix D, plot # 90

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

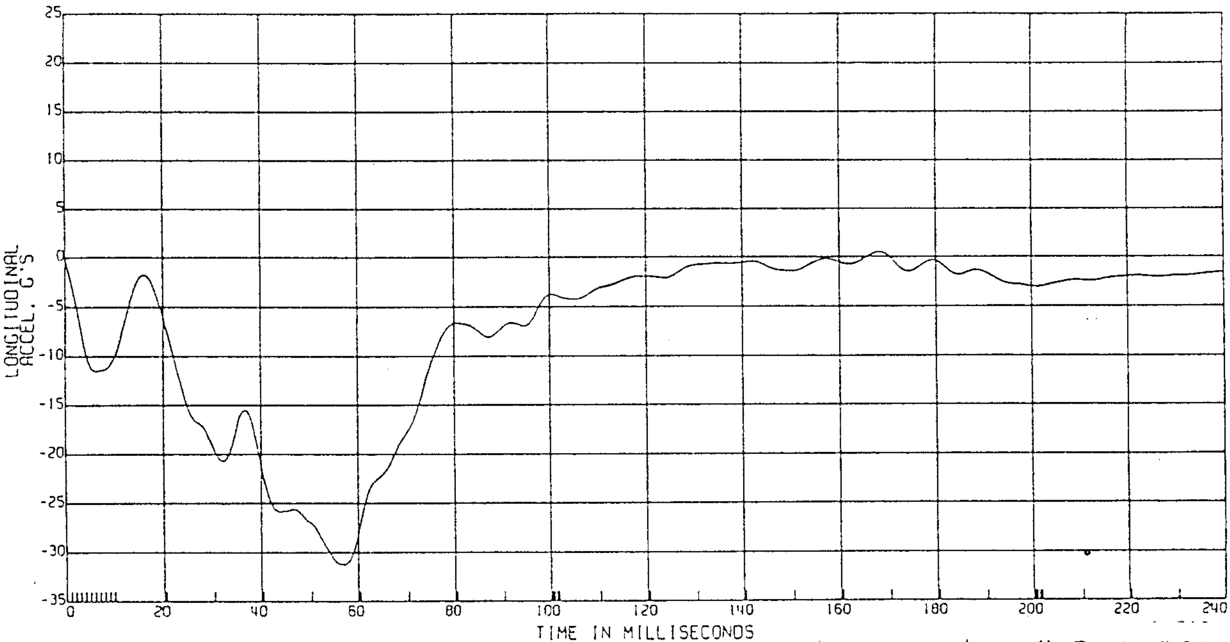
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

AVERAGED REAR ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:06/26/1996



Appendix D, plot # 91

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

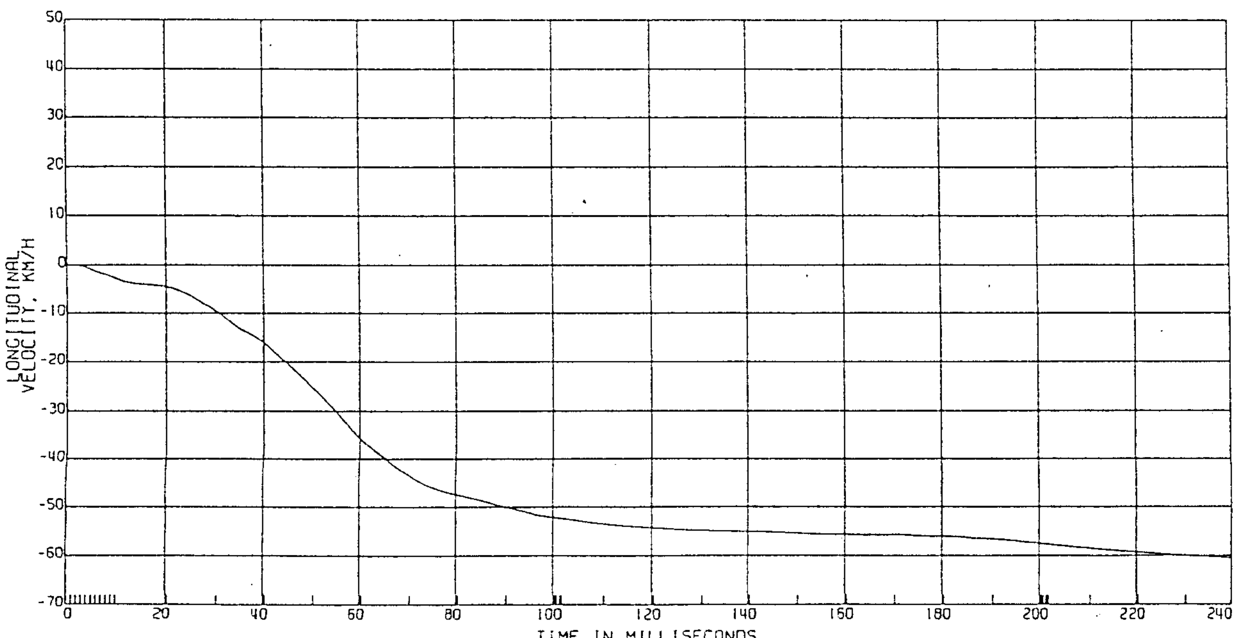
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 92

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

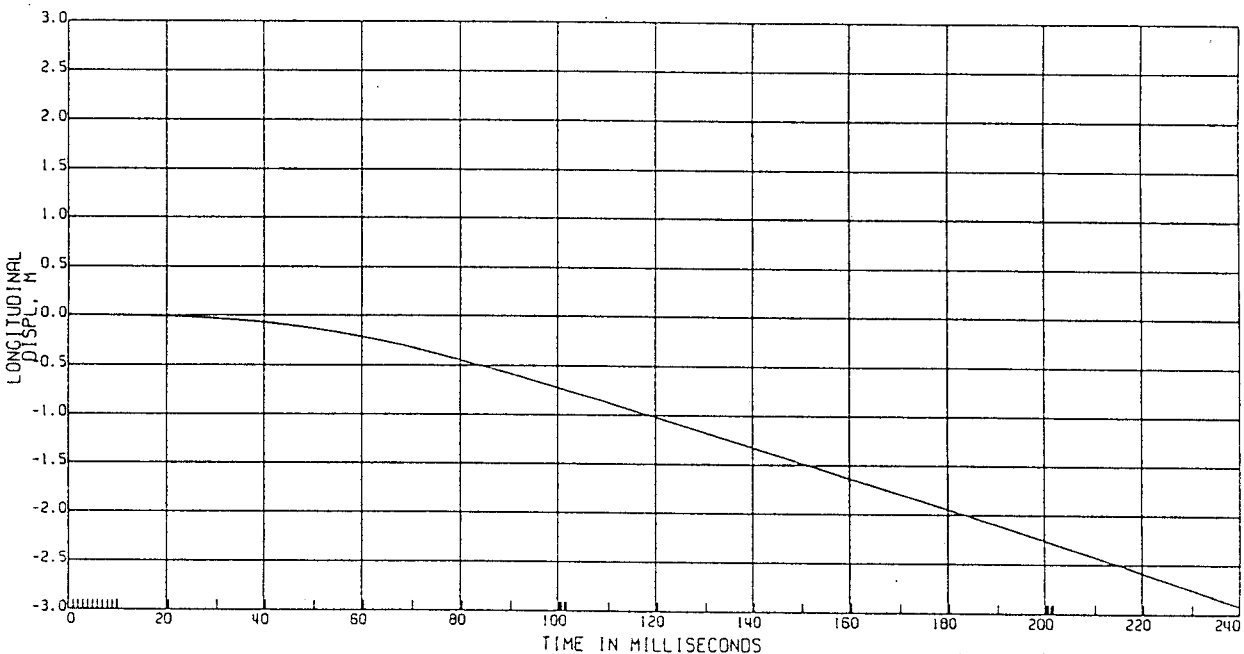
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 93

93 PROCESSED 6/27/1996 15:56 V2.04E

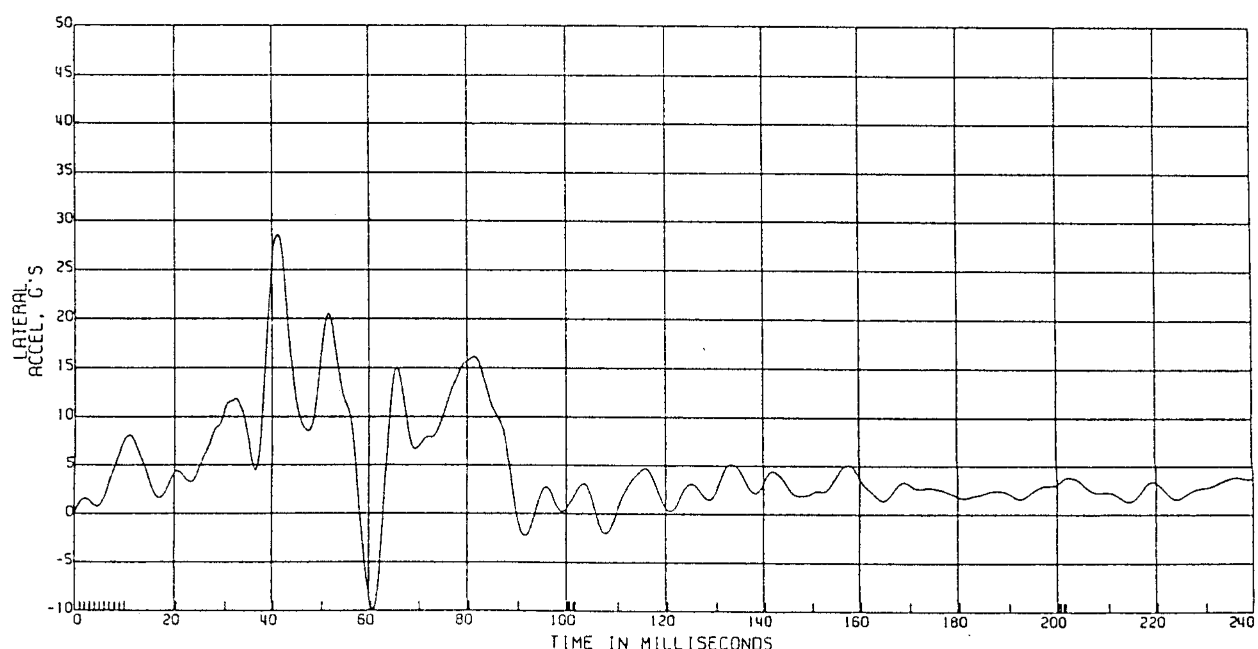
C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

L.REAR ROCKER ACCEL

TEST DATE:06/26/1996



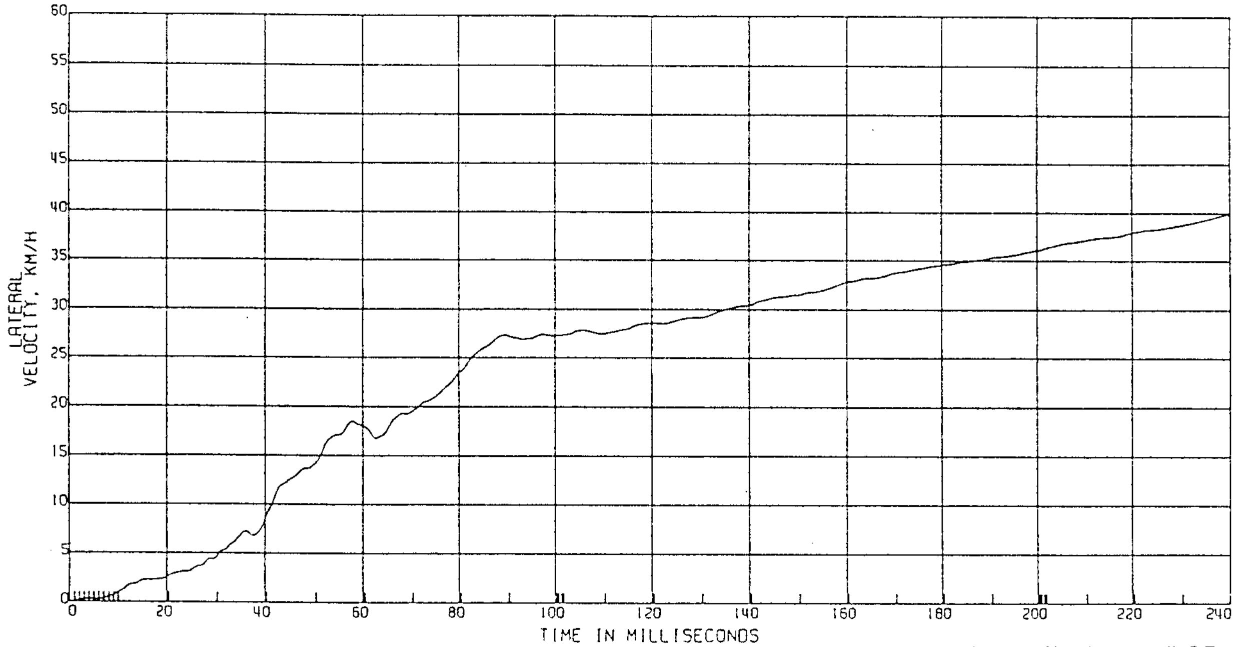
Appendix D, plot # 94

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

L.REAR ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



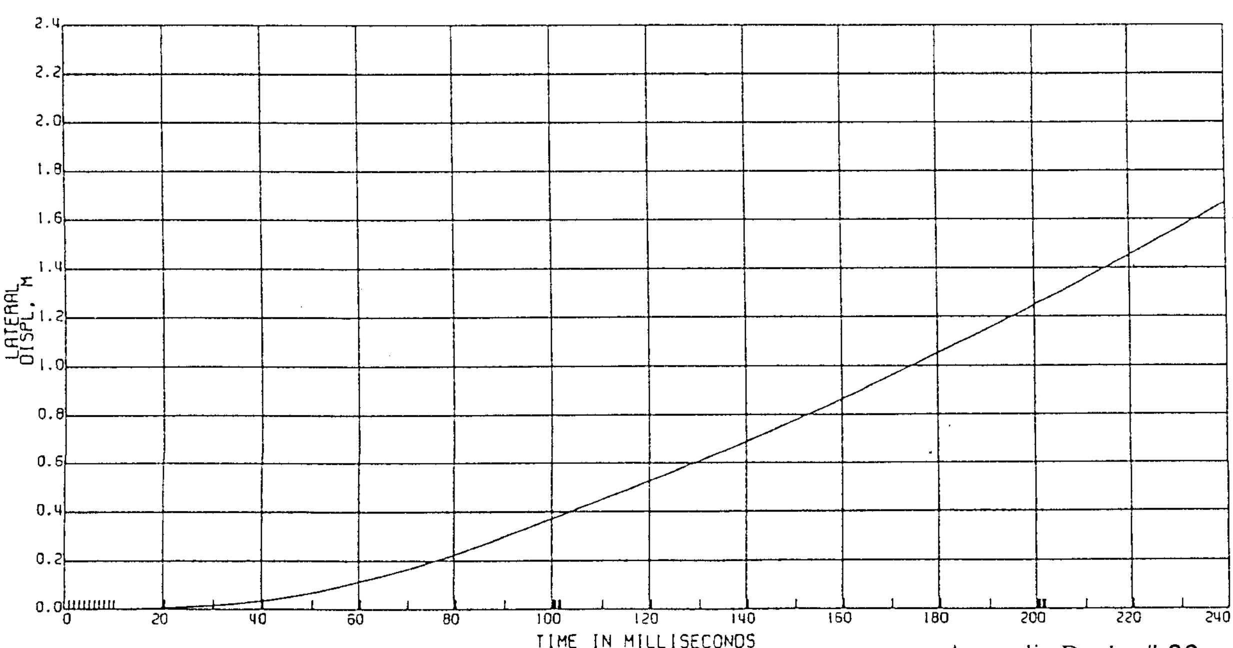
Appendix D, plot # 95

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

L.REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 96

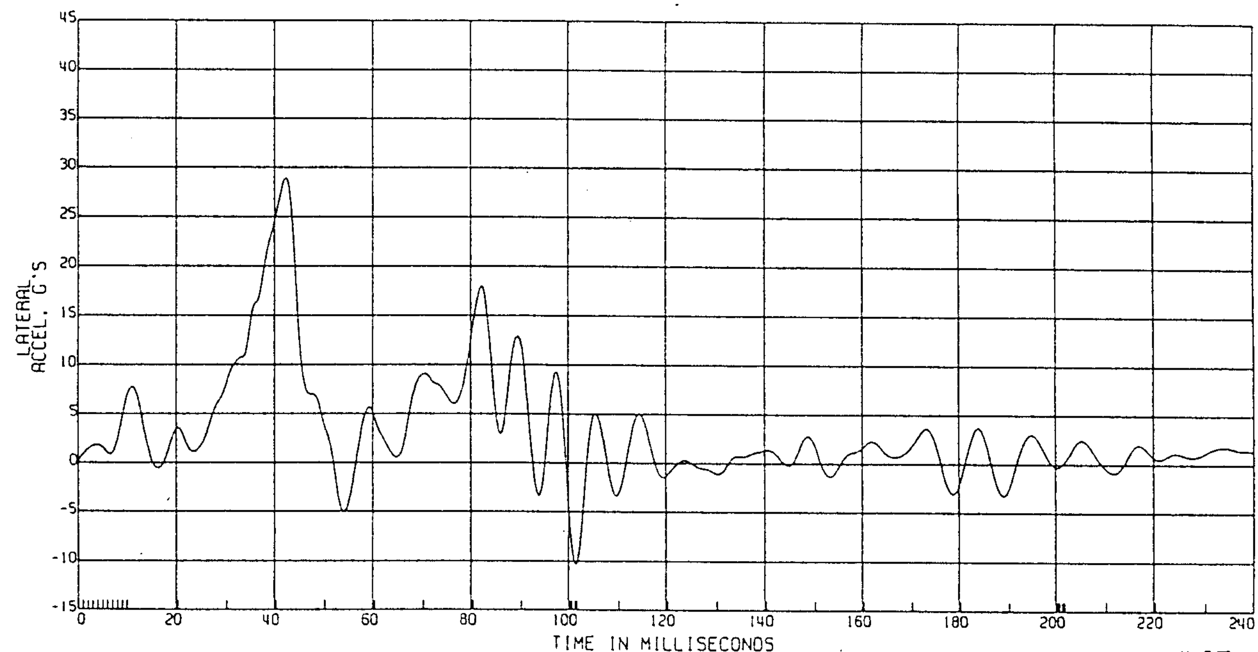
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

R.REAR ROCKER ACCEL

TEST DATE:06/26/1996



Appendix D, plot # 97

97 PROCESSED 6/27/1996 15:56 V2.04E

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

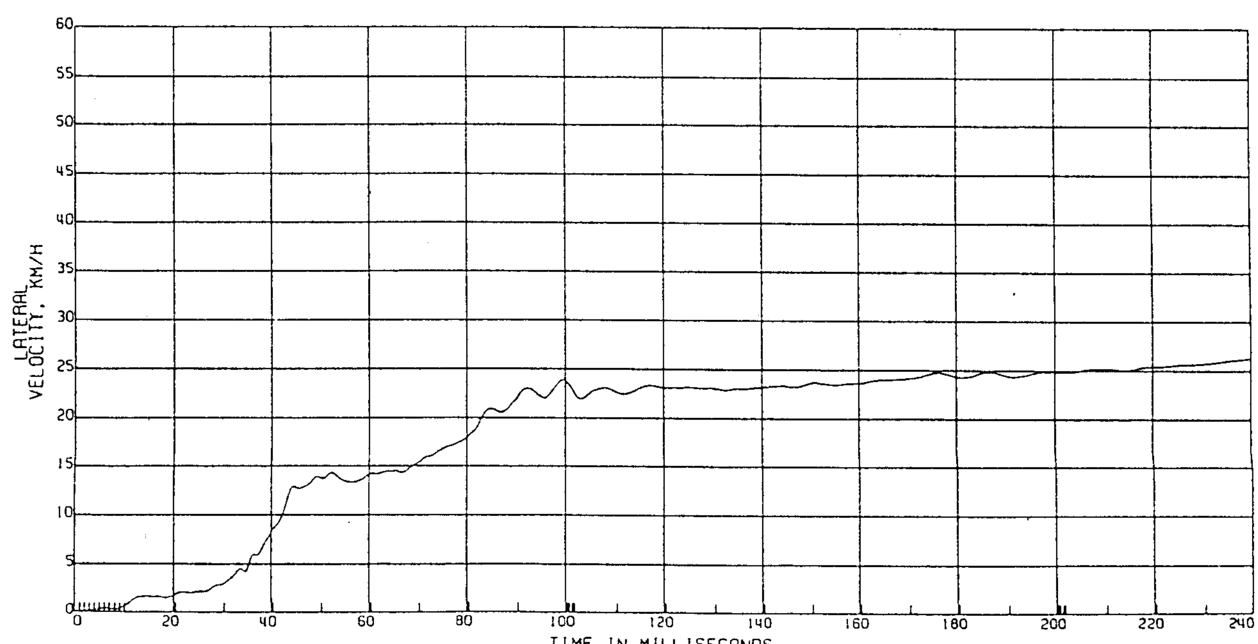
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

R.REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



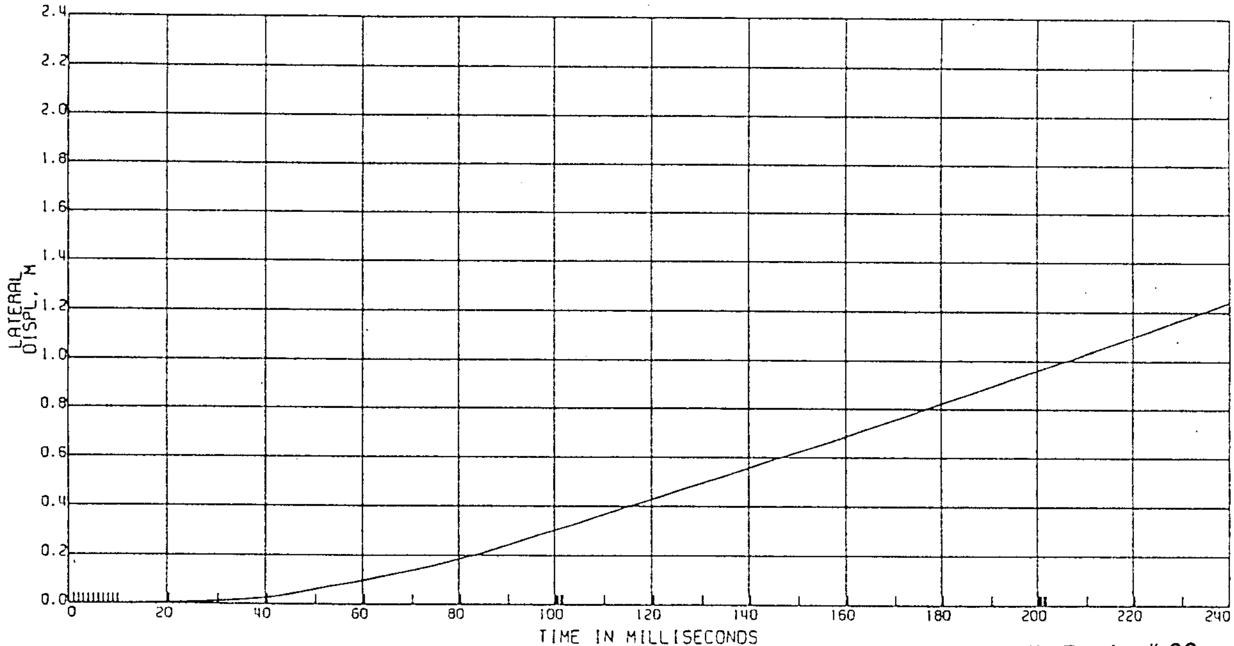
Appendix D, plot # 98

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

R.REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 99

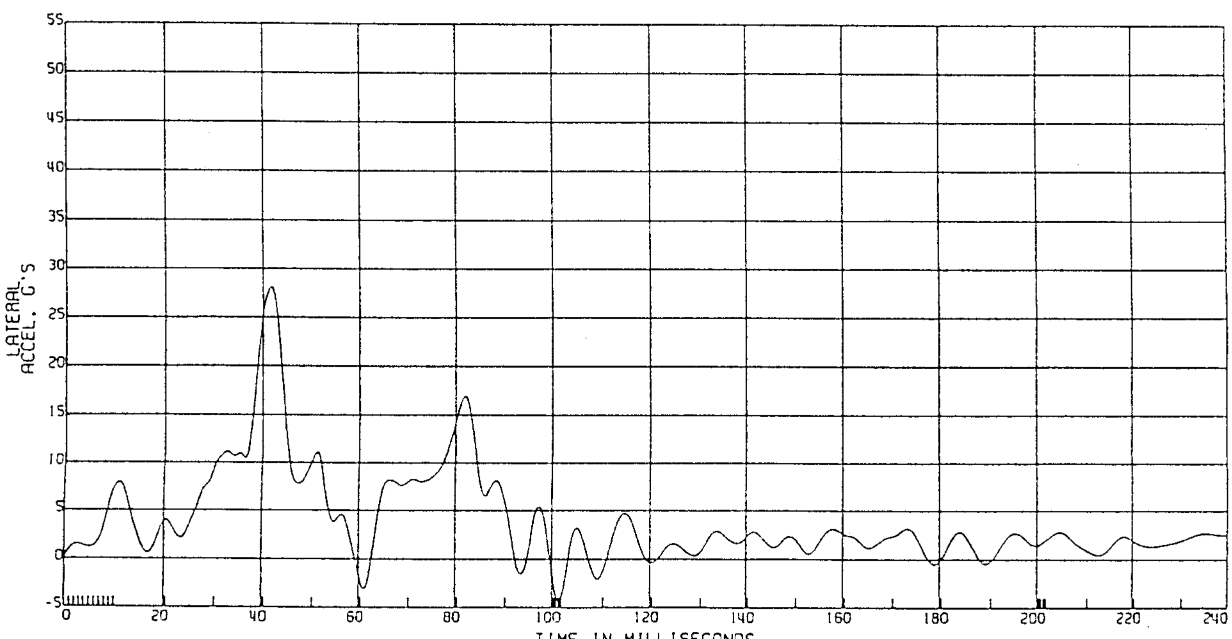
99 PROCESSED 6/27/1996 15:56 V2.04E

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 60

AVERAGED REAR ROCKER ACCELERATION
(AVGD L. & R. ROCKER ACCELS)

TEST DATE:06/26/1996



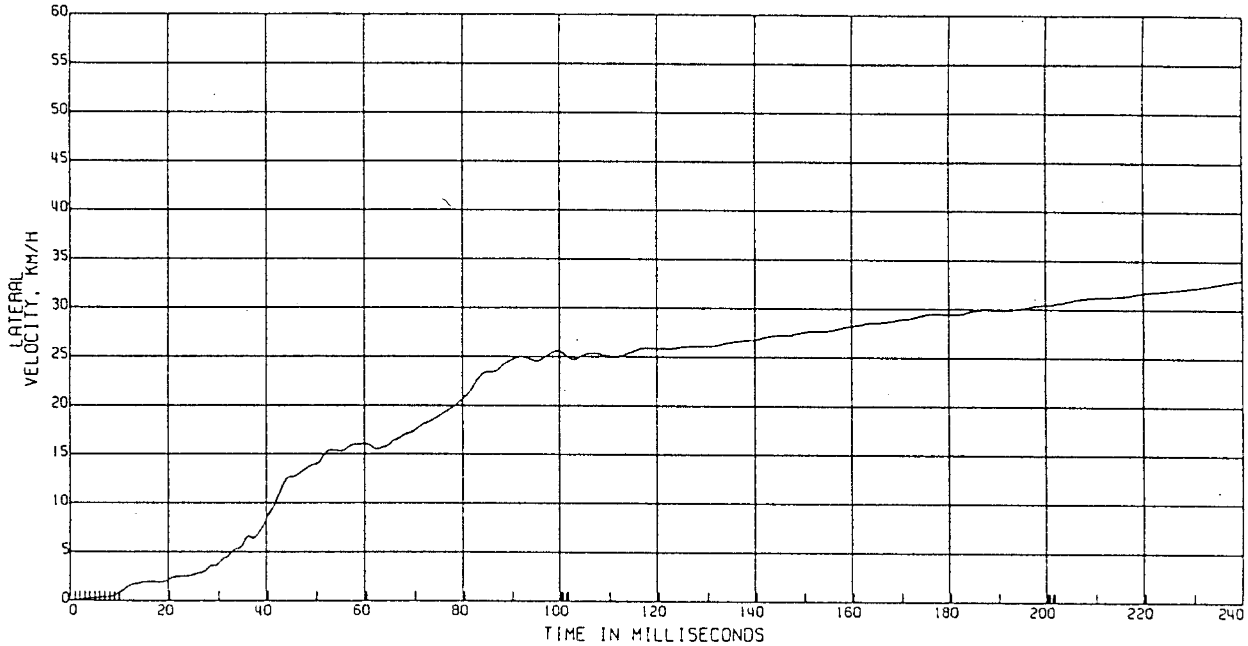
Appendix D, plot # 100

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



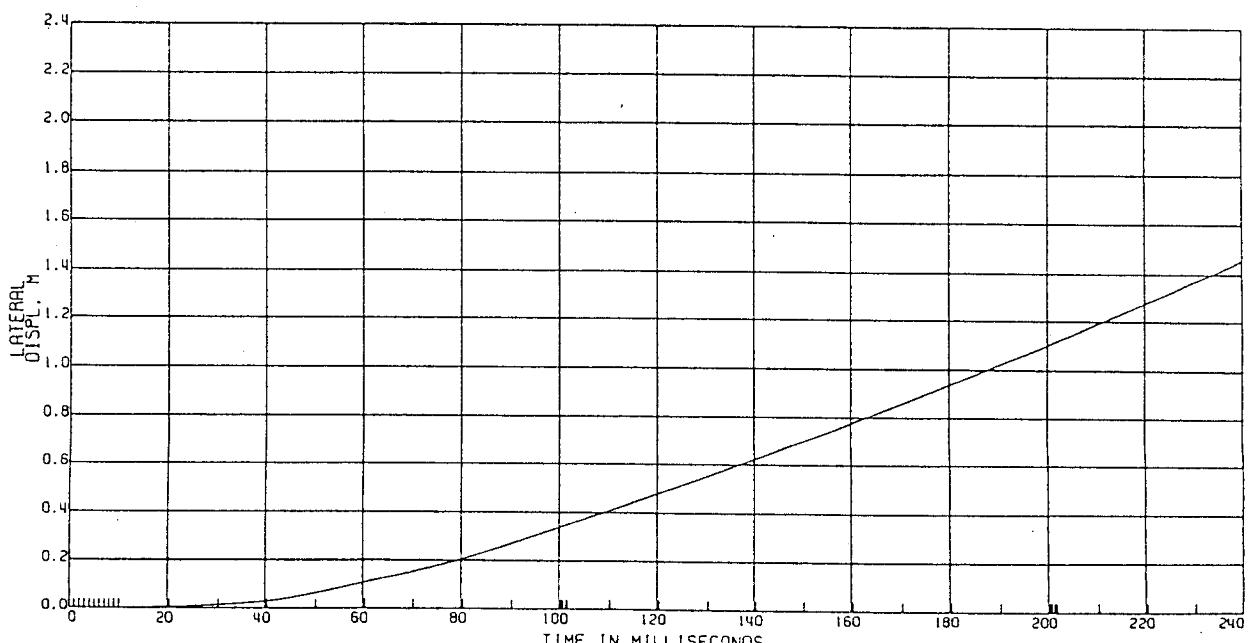
Appendix D, plot # 101

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 102

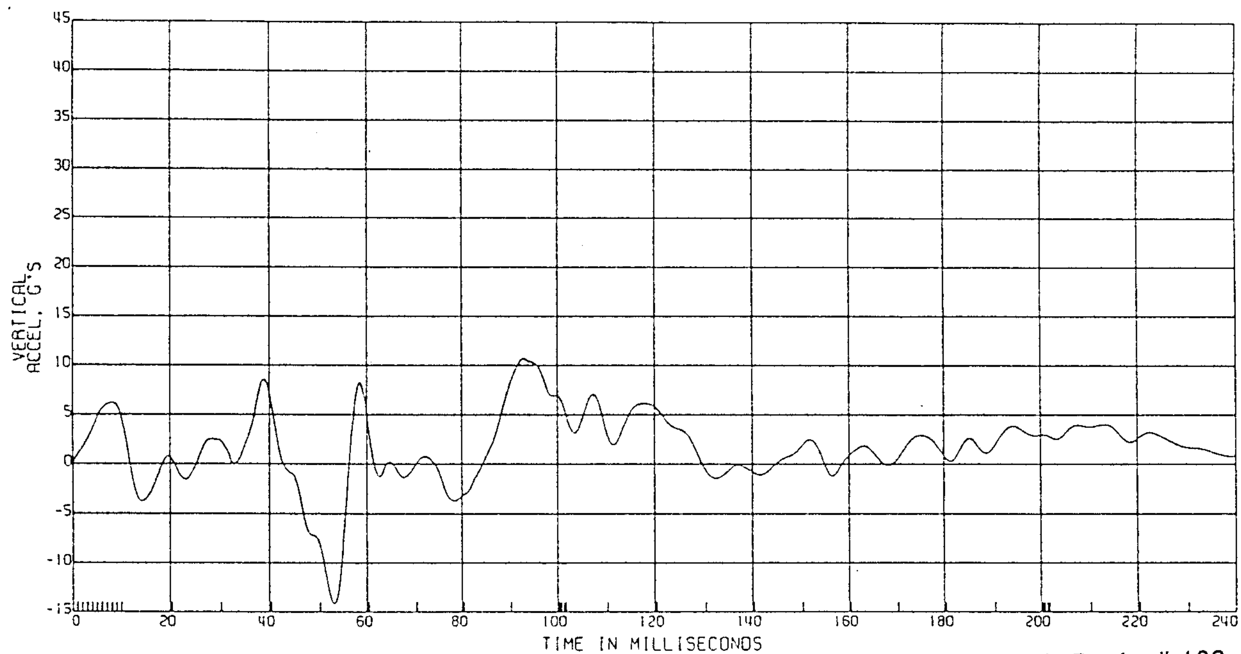
C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

L.REAR ROCKER ACCEL

TEST DATE:06/26/1996



Appendix D, plot # 103

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

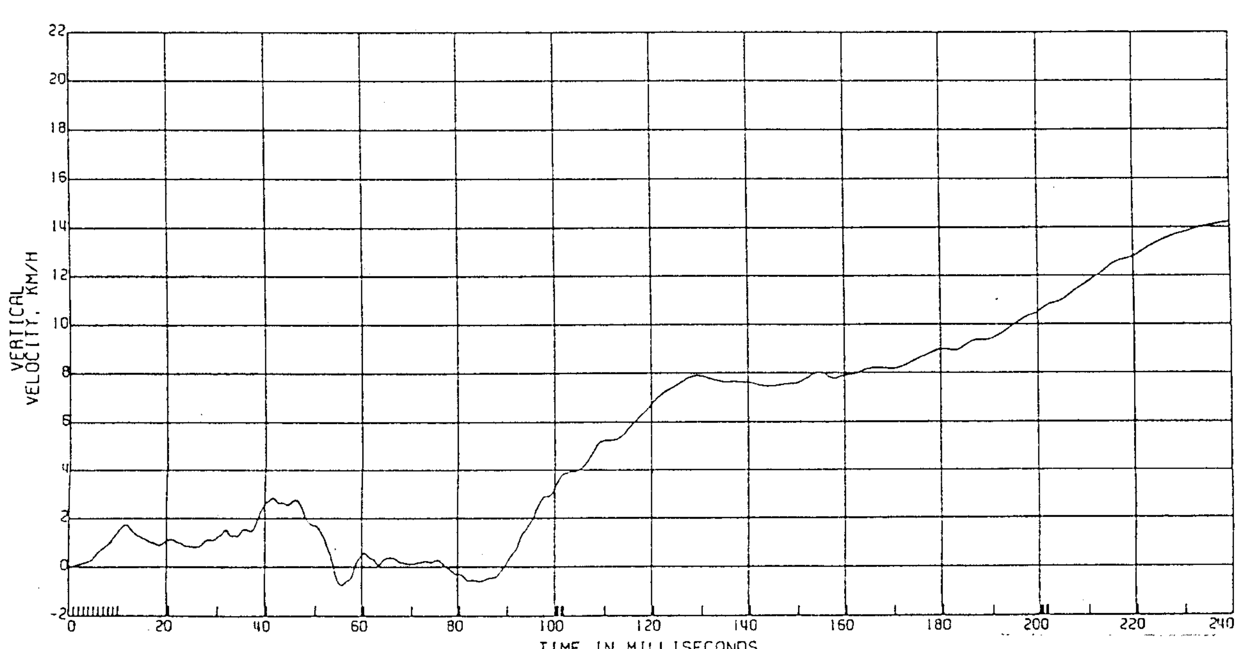
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

L.REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 104

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

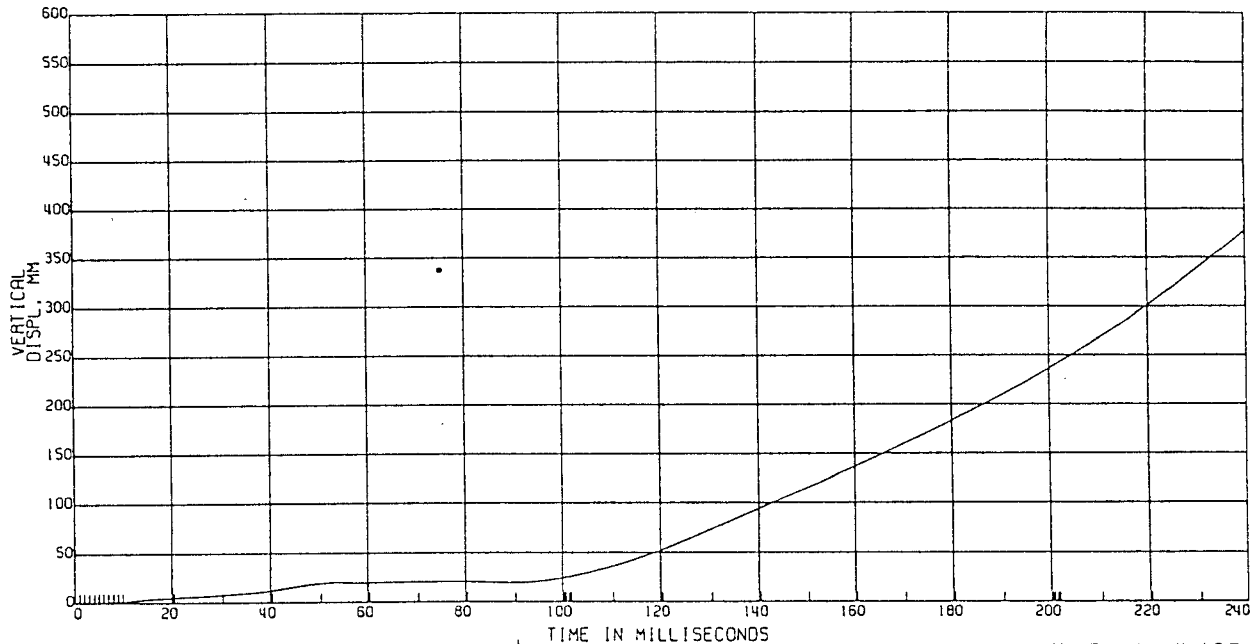
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

L.REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 105

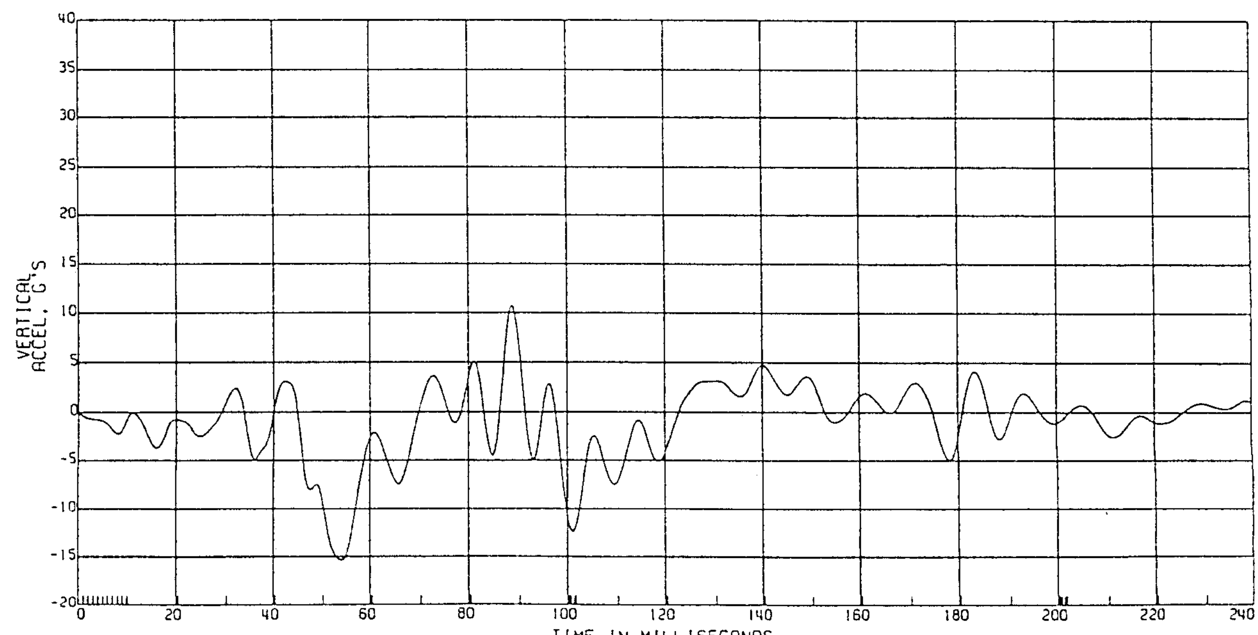
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

R.REAR ROCKER ACCEL

TEST DATE:06/26/1996



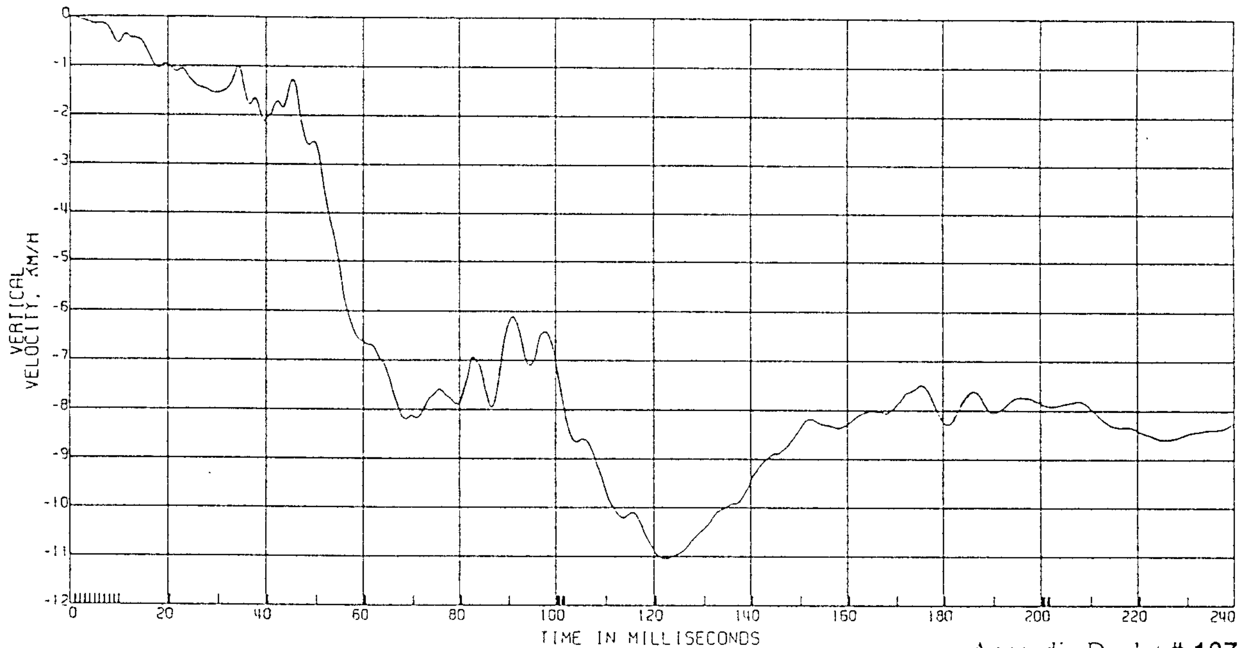
Appendix D, plot # 106

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T9309D VAN
ELEC DATA, SAE CLASS 180

R.REAR ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 107

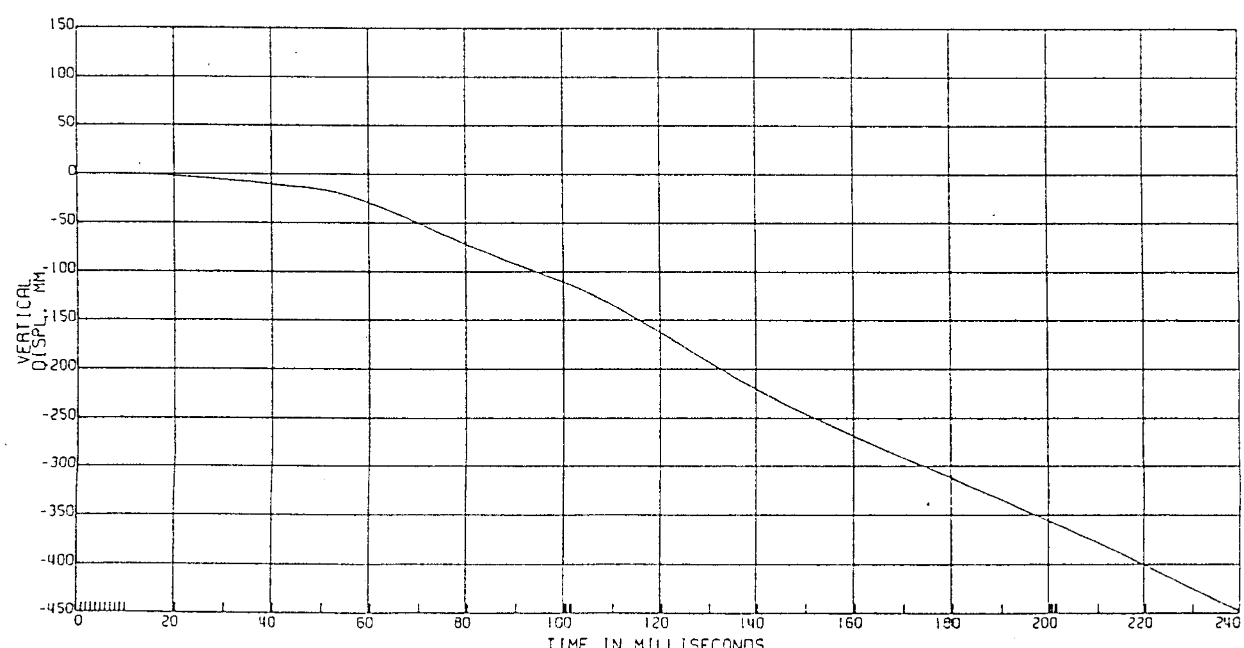
107 PROCESSED 6/27/1996 15:56Y2.04E

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T9309D VAN
ELEC DATA, SAE CLASS 180

R.REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 108

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

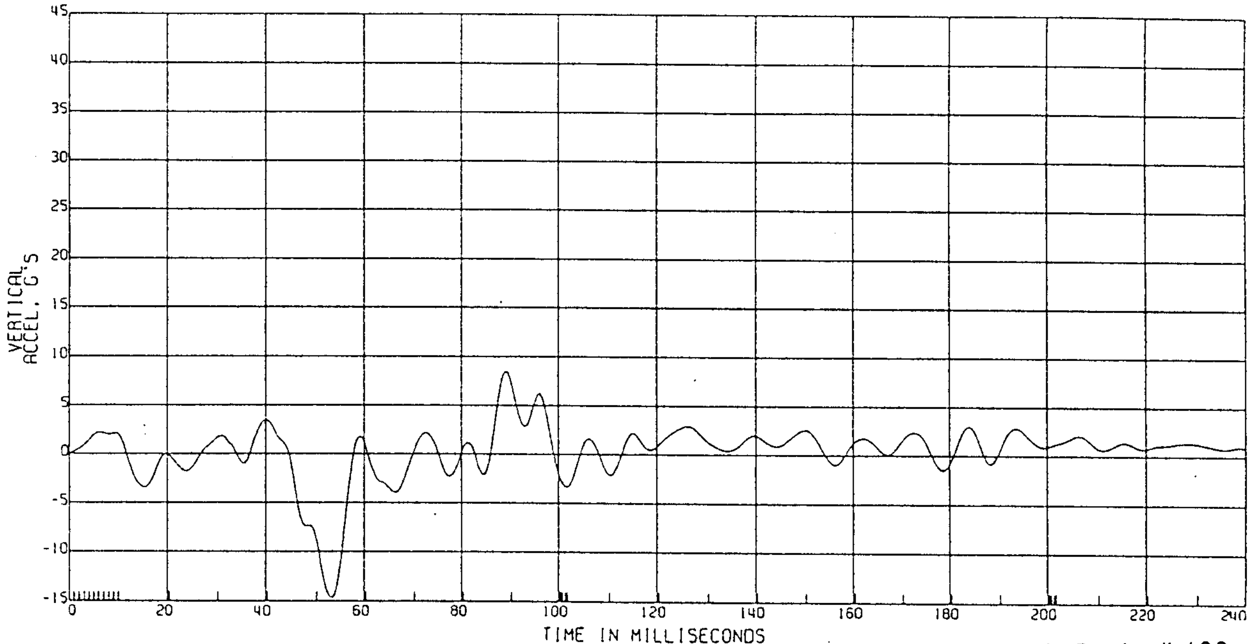
R & D CTR 8T9309D VAN

ELEC DATA, SAE CLASS 60

AVERAGED REAR ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:06/26/1996



Appendix D, plot # 109

109 PROCESSED 6/27/1996 15:56V2.04E

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

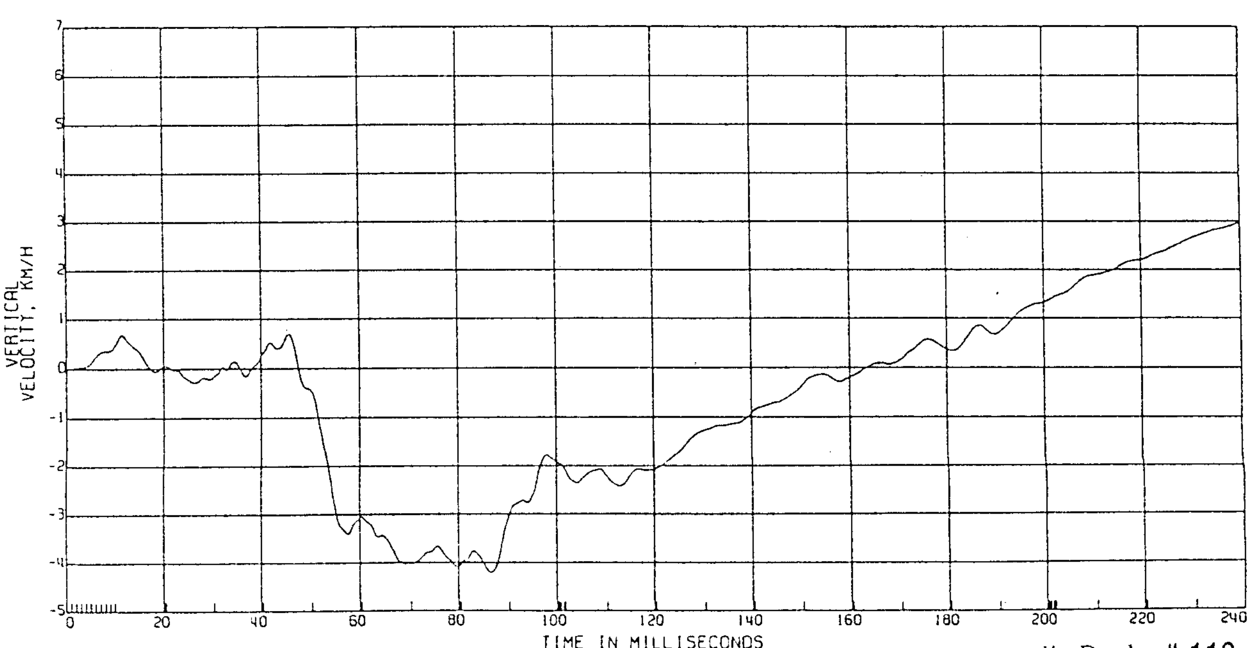
R & D CTR 8T9309D VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



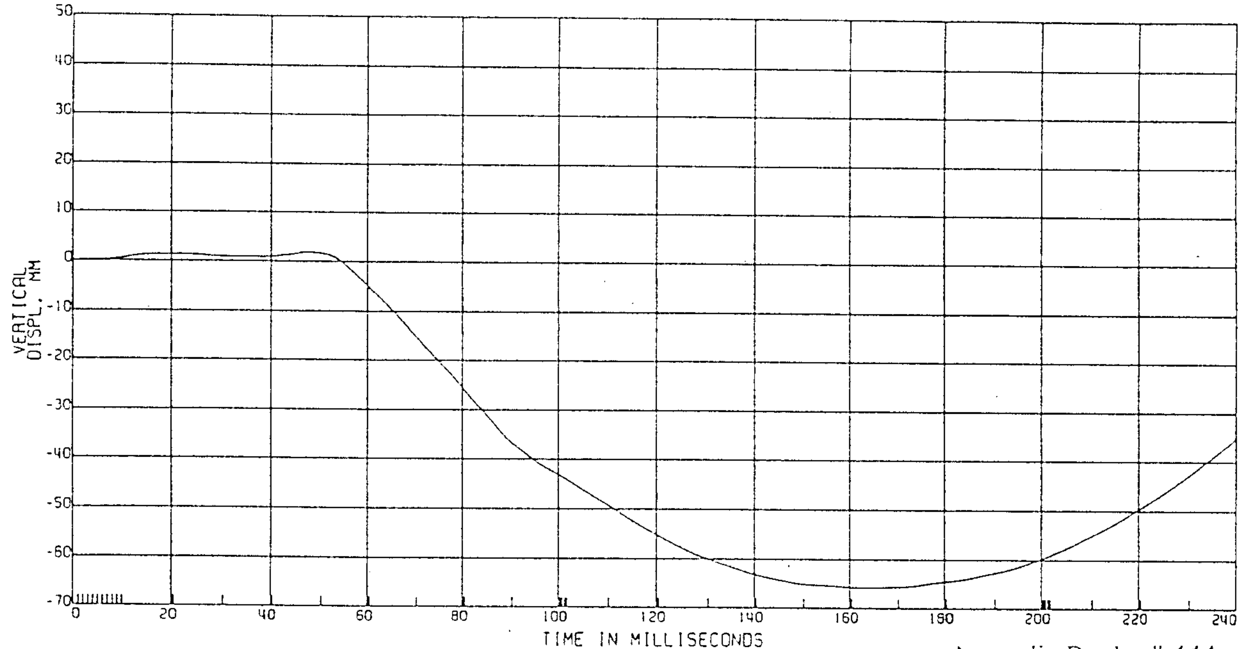
Appendix D, plot # 110

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 111

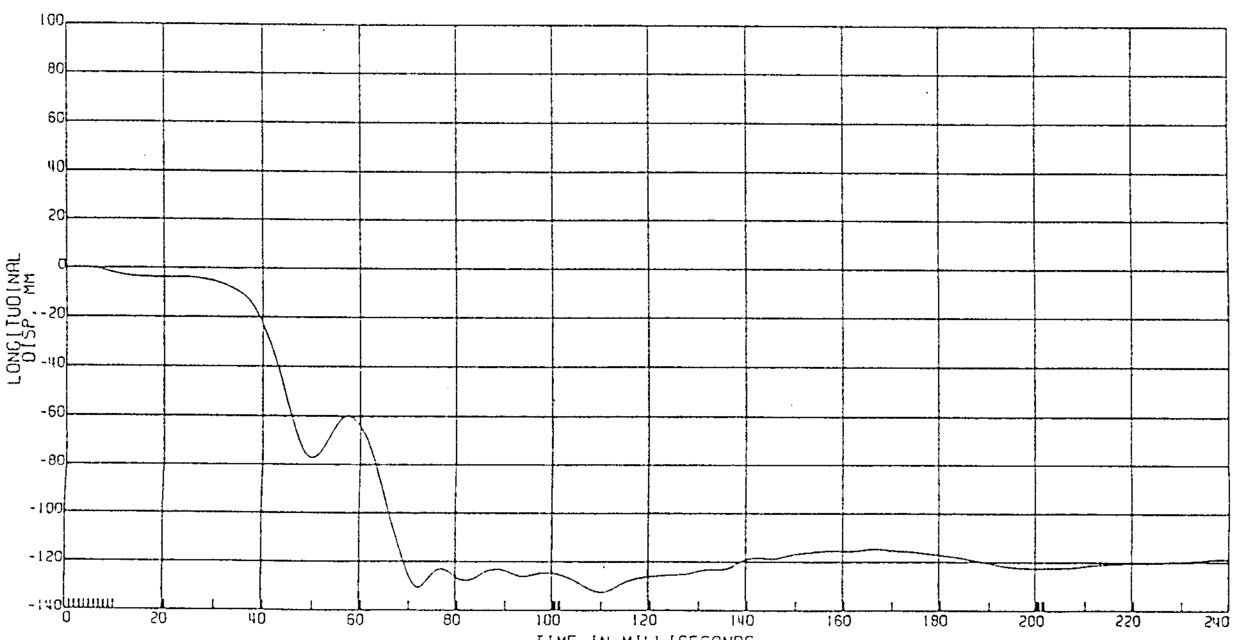
111 PROCESSED 6/27/1996 15:56V2.04E

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 60

L. TOE PAN DISPL

TEST DATE:06/26/1996



Appendix D, plot # 112

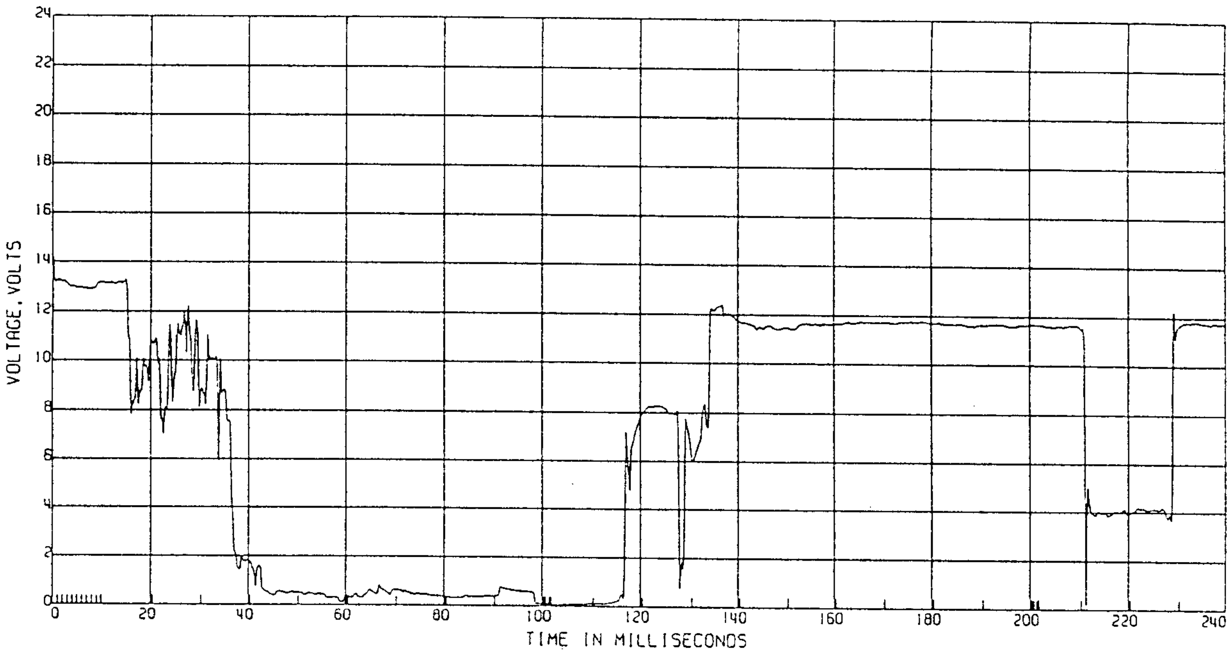
C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

L. IGNITION VOLTAGE

TEST DATE:06/26/1996



Appendix D, plot # 113

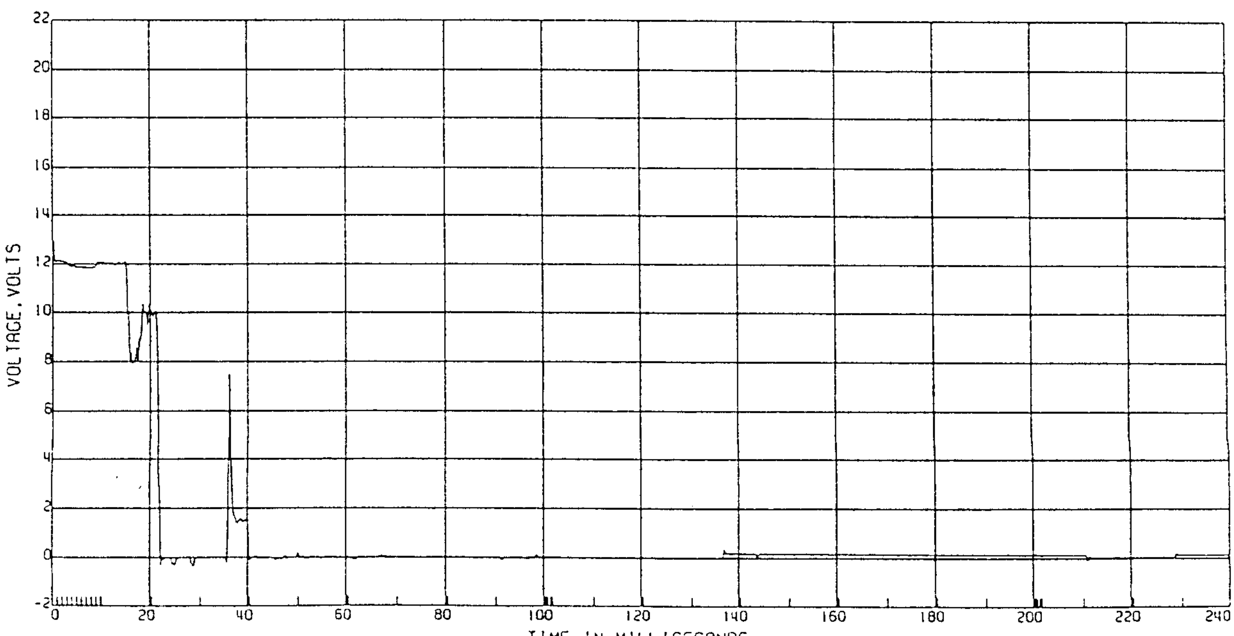
C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

L. FRT HEADLIGHT-HI BEAM VOLTAGE

TEST DATE:06/26/1996



Appendix D, plot # 114

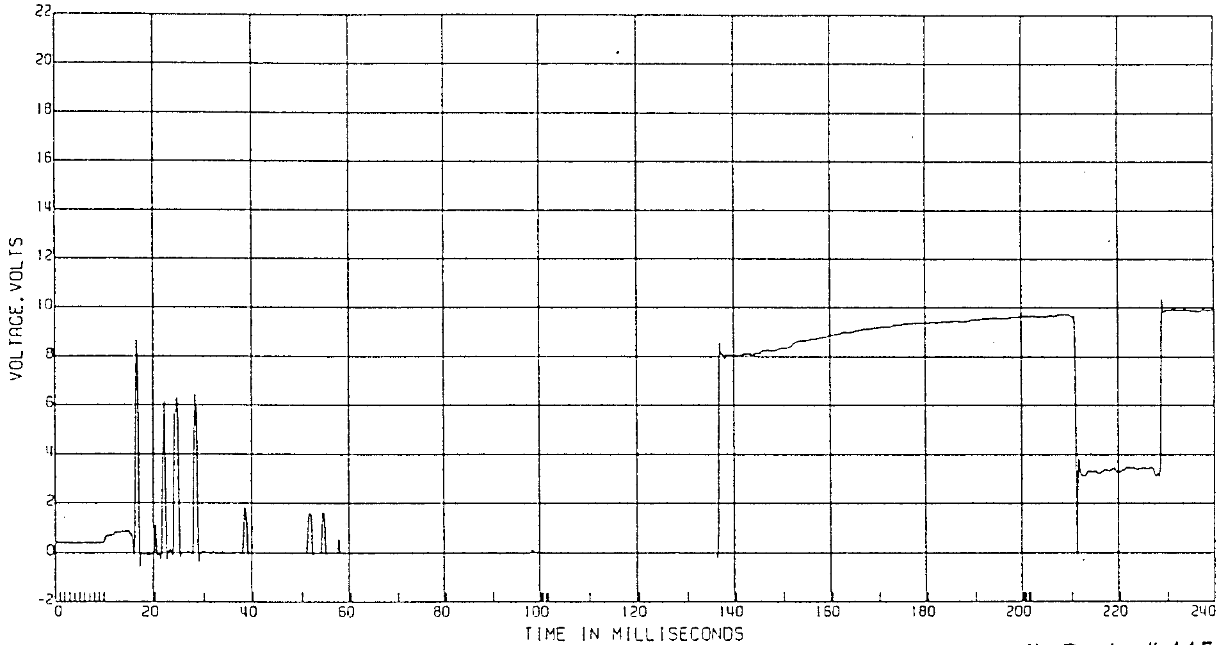
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

L. FRT HEADLIGHT-LO BEAM VOLTAGE

TEST DATE:06/26/1996



Appendix D, plot # 115

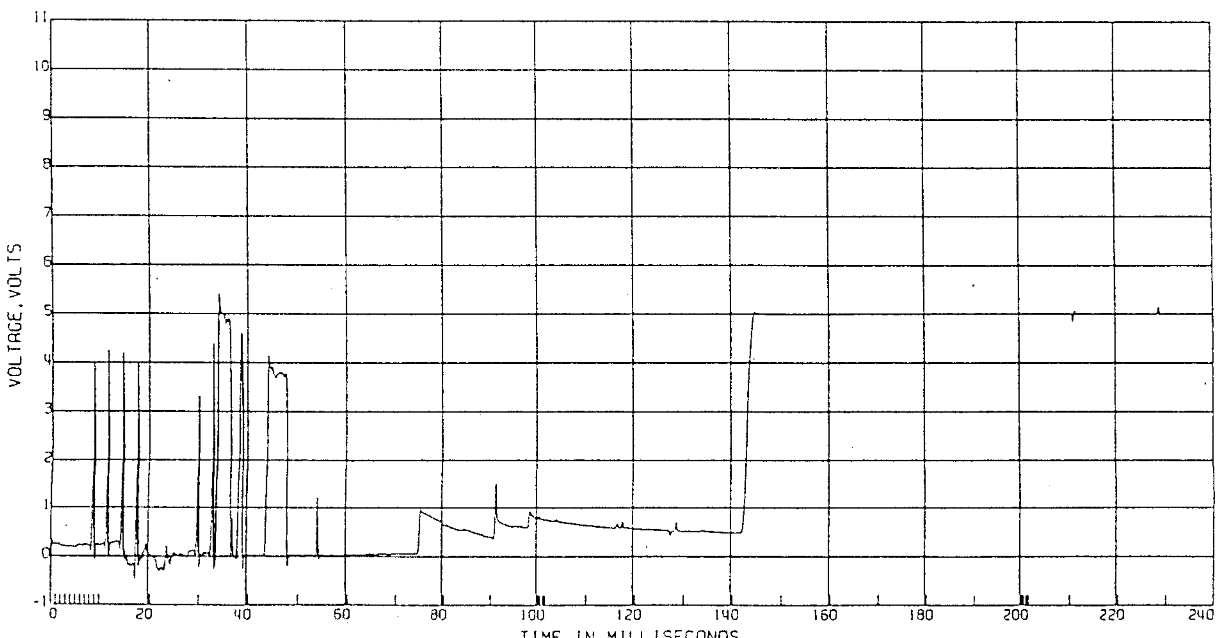
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

ENGINE RPM VOLTAGE

TEST DATE:06/26/1996



Appendix D, plot # 116

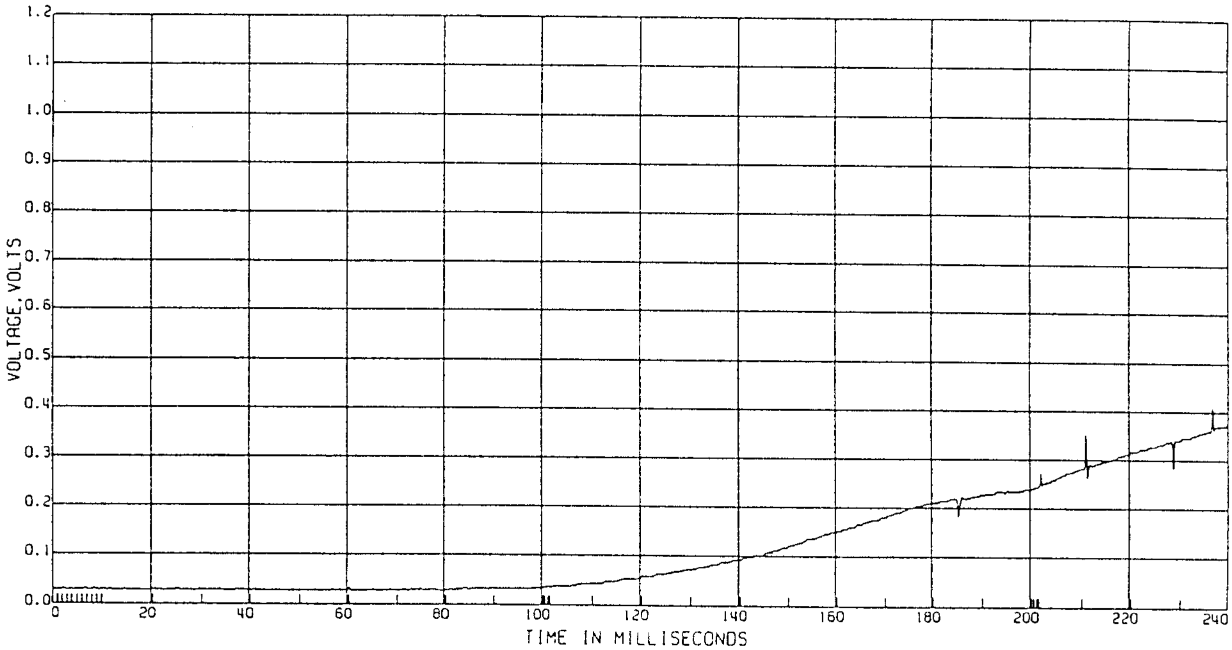
C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

MANIFOLD VAPOR SENSOR #1 VOLTAGE

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 1000



Appendix D, plot # 117

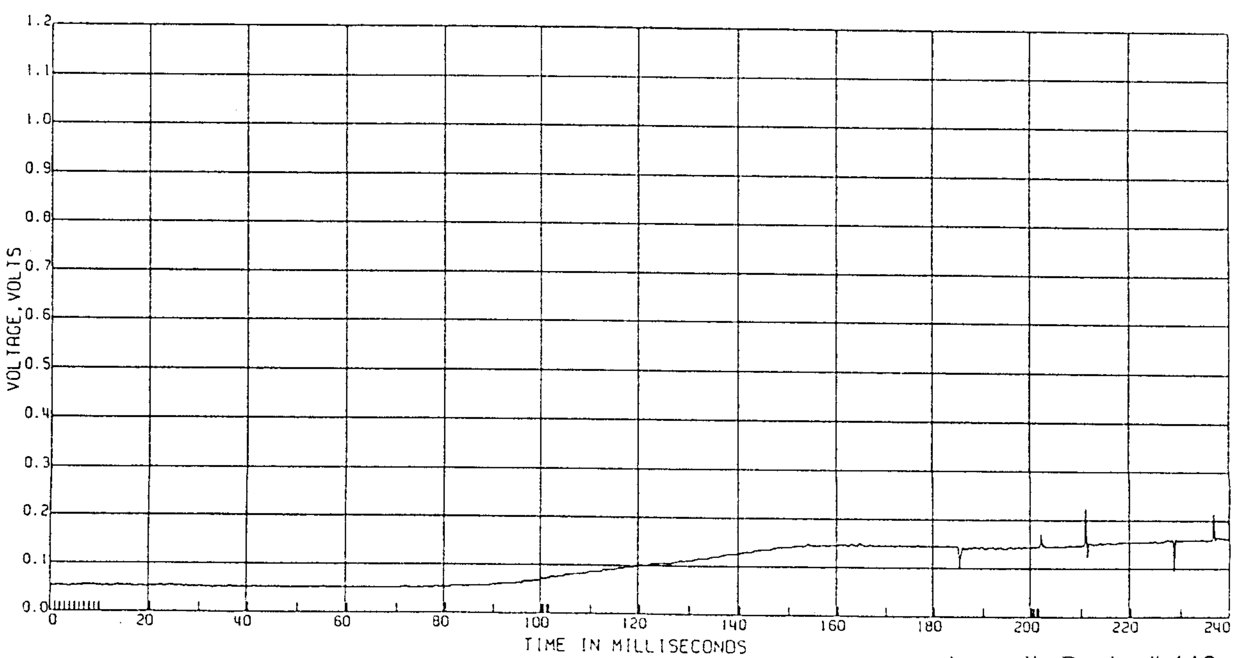
C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

RIGHT UPR ENG VAPOR SENSOR #2 VOLTAGE

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 1000



Appendix D, plot # 118

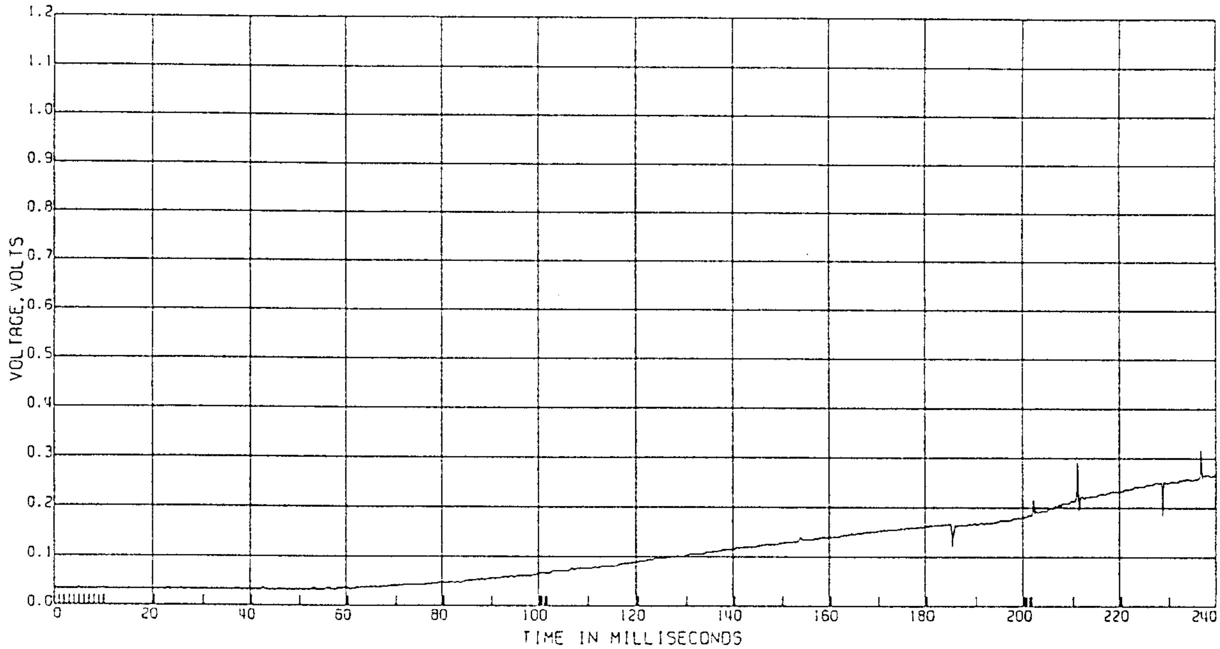
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

LEFT UPR ENG VAPOR SENSOR #3 VOLTAGE

TEST DATE:06/26/1996



Appendix D, plot # 119

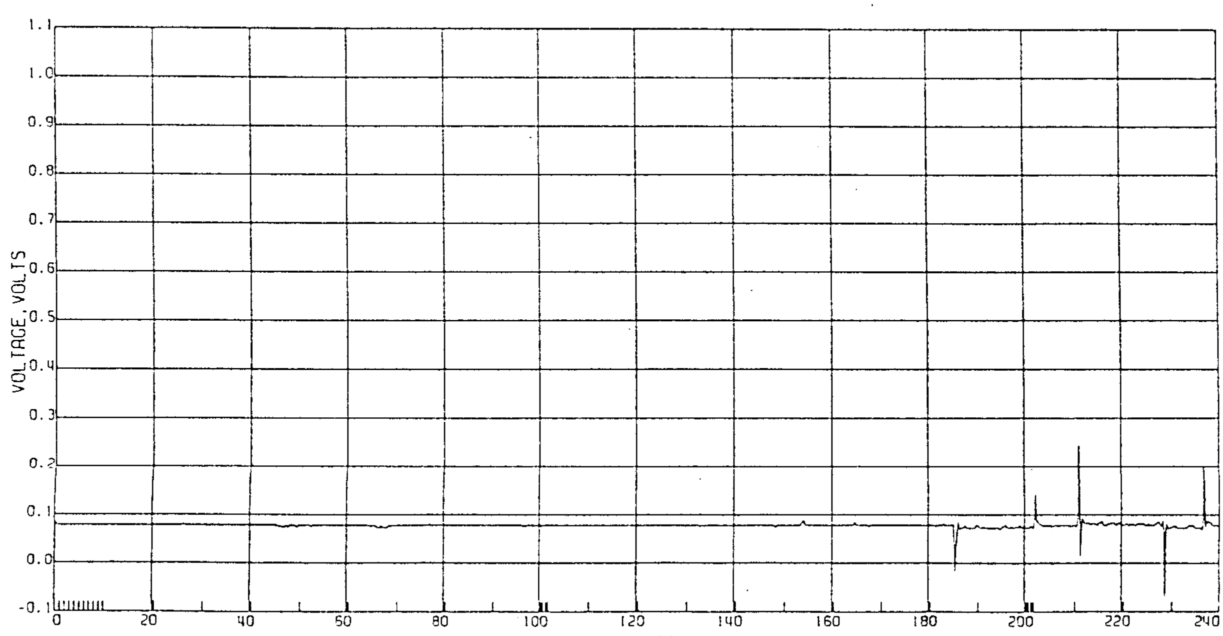
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

RIGHT LWR ENG VAPOR SENSOR #4 VOLTAGE

TEST DATE:06/26/1996

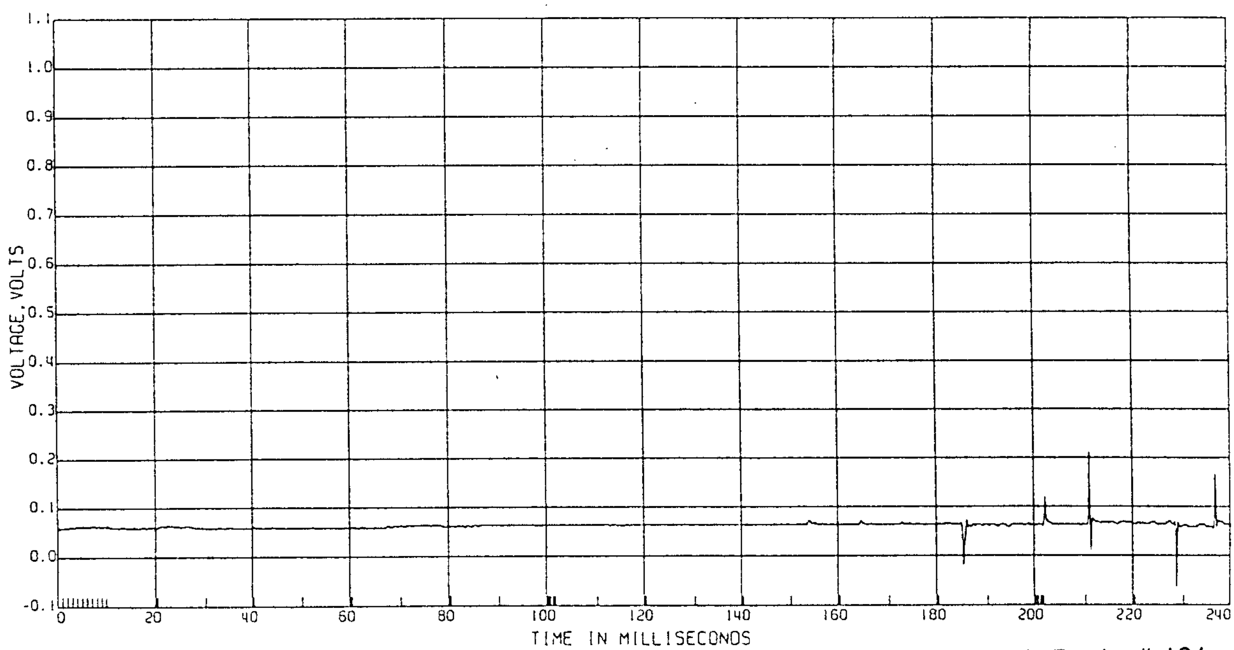


Appendix D, plot # 120

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN LEFT LWR ENG VAPOR SENSOR #5 VOLTAGE TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 1000

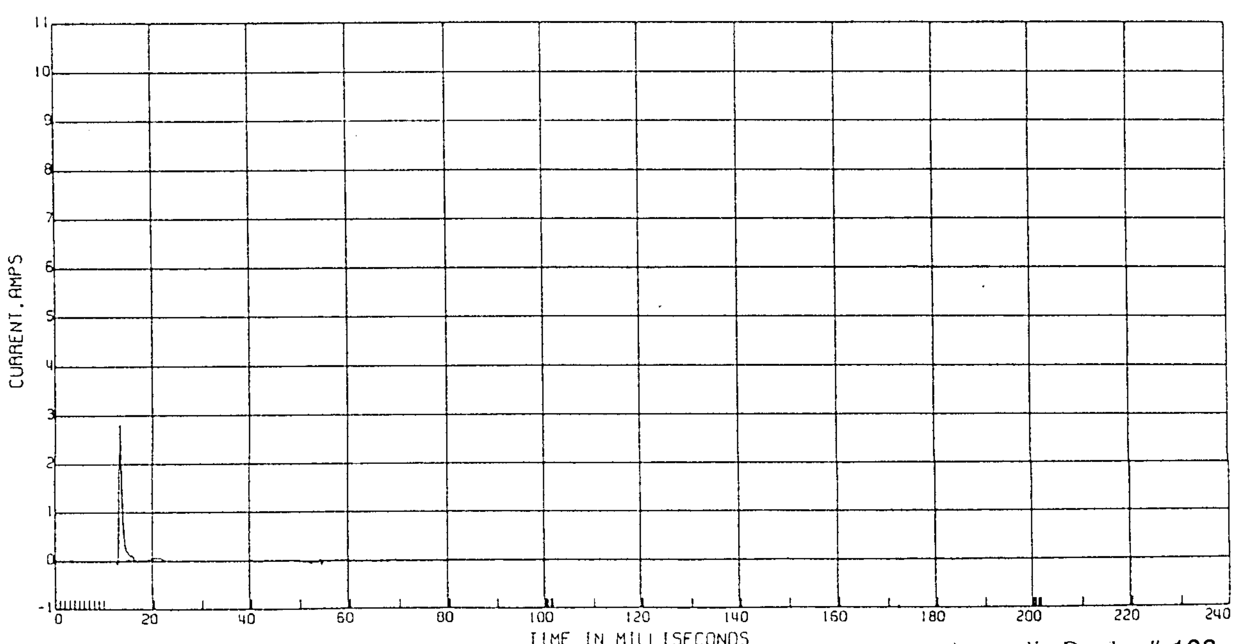


Appendix D, plot # 121

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN L. WHEEL BAG CURRENT TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 1000



Appendix D, plot # 122

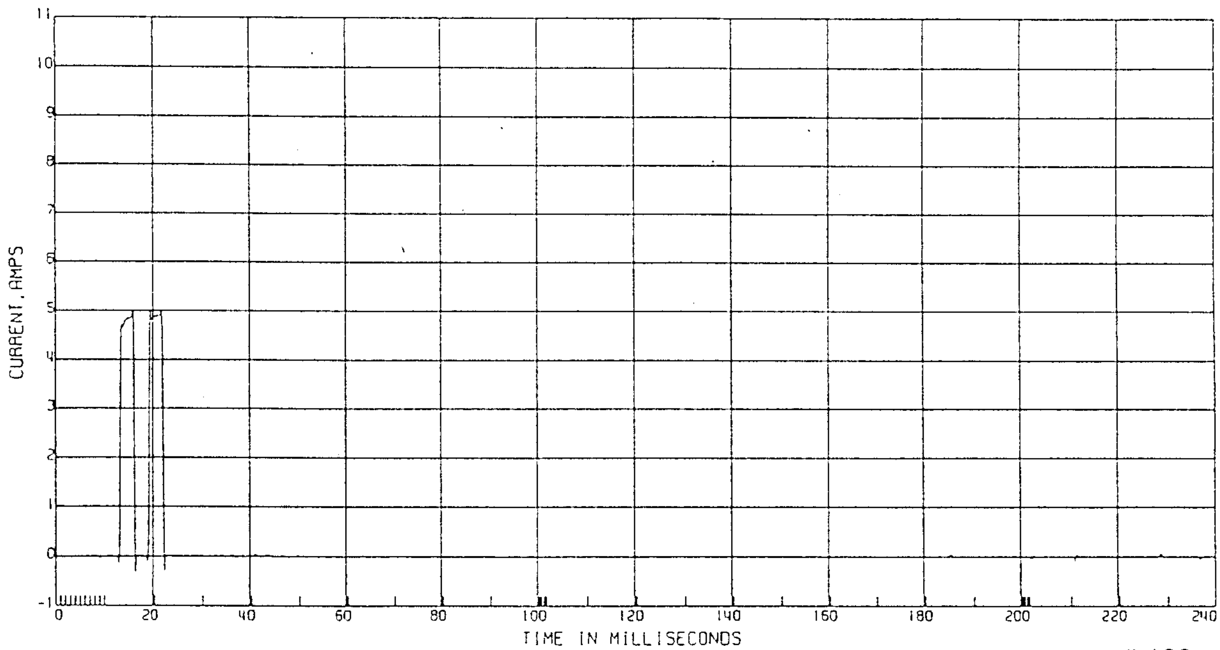
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

R. I/P BAG CURRENT

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 1000



Appendix D, plot # 123

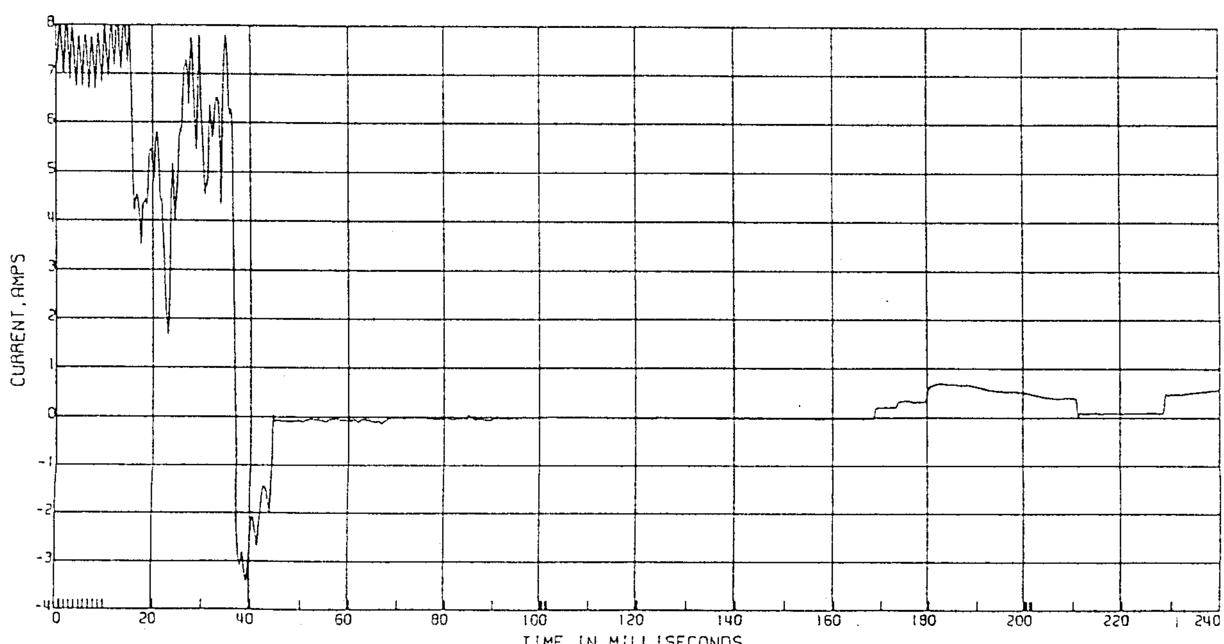
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

FUEL PUMP CURRENT

TEST DATE:06/26/1996

ELEC DATA, SAE CLASS 1000



Appendix D, plot # 124

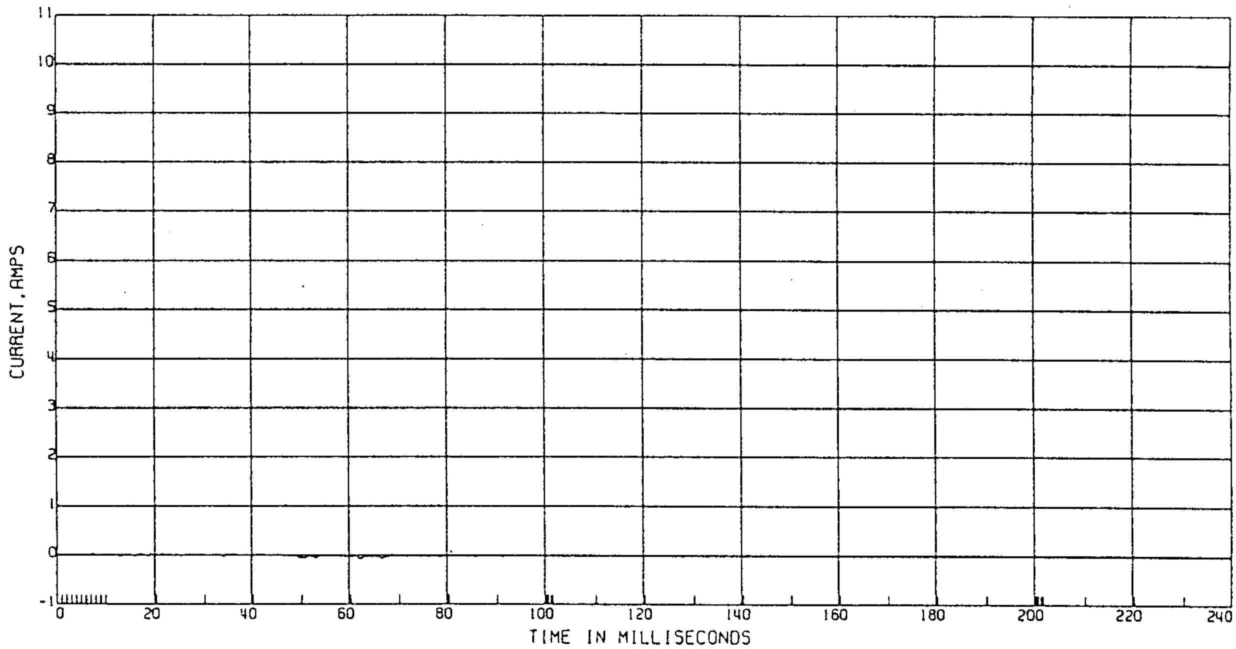
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

L. HORN-LO CURRENT

TEST DATE:06/26/1996



Appendix D, plot # 125

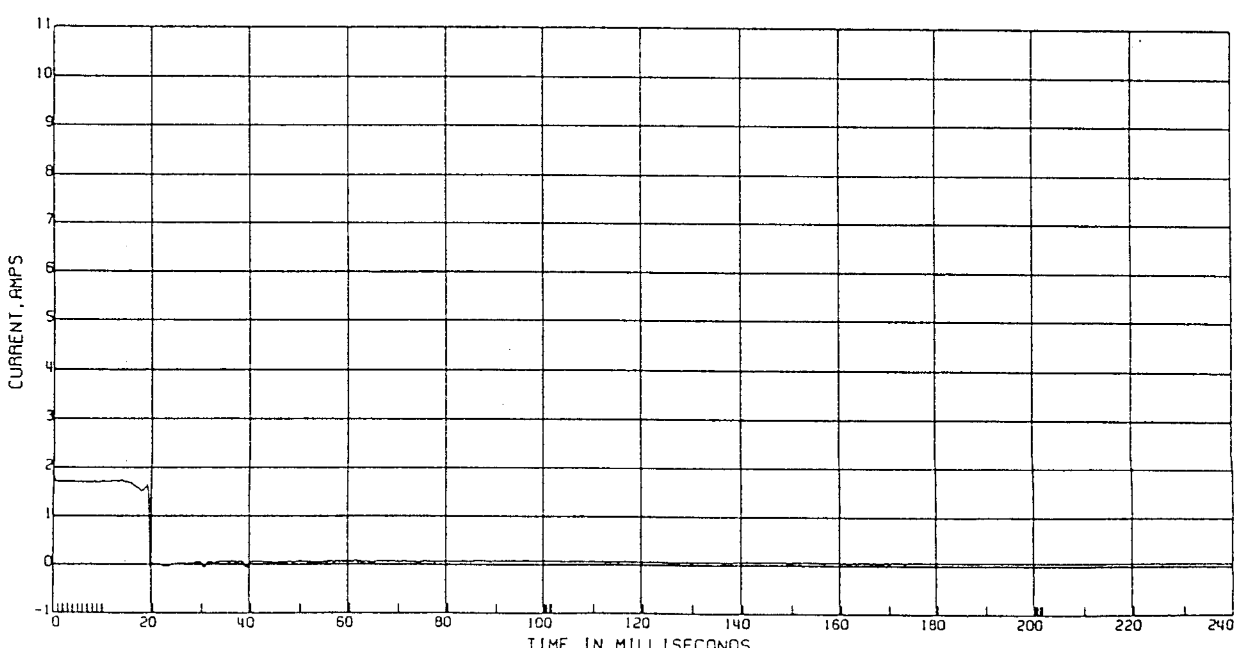
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

A/C CLUTCH CURRENT

TEST DATE:06/26/1996



Appendix D, plot # 126

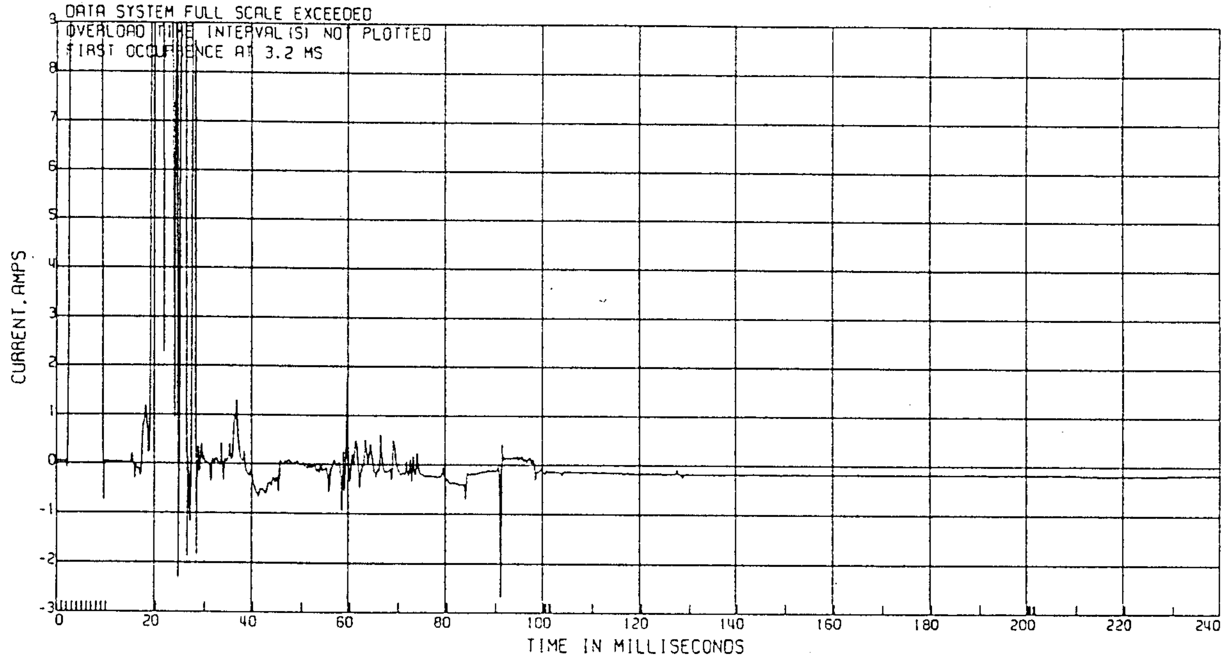
CI1167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

COOLING FAN CURRENT

TEST DATE:06/26/1996



Appendix D, plot # 127

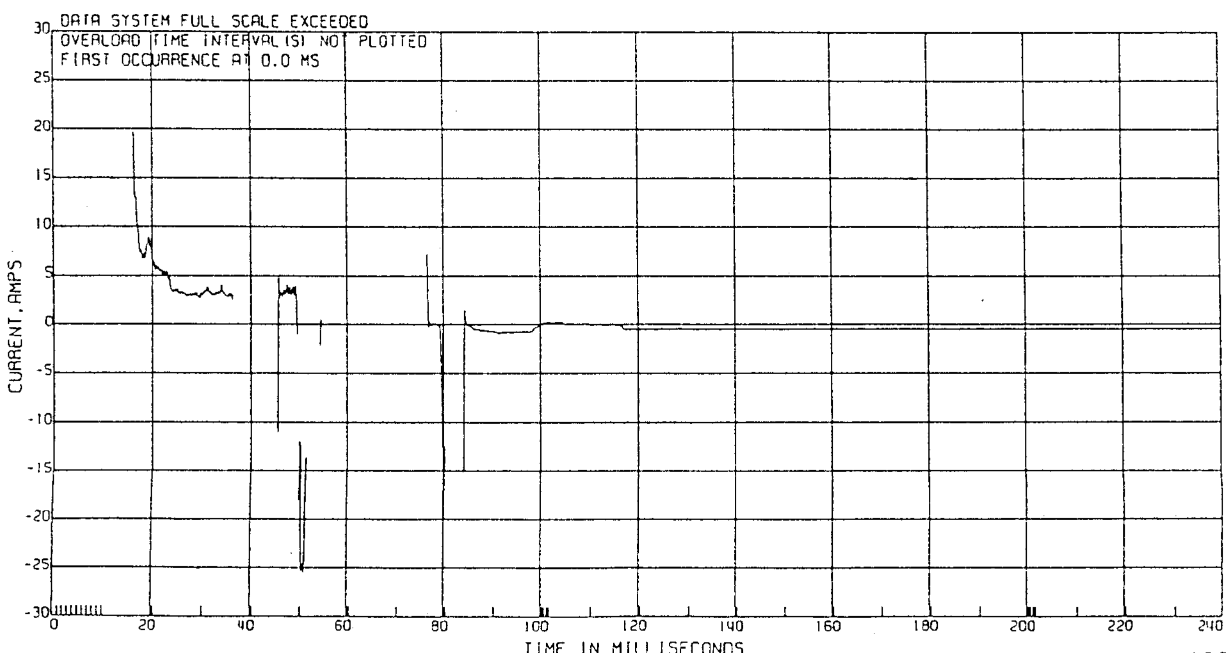
CI1167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

FUSIBLE LINK CURRENT

TEST DATE:06/26/1996



Appendix D, plot # 128

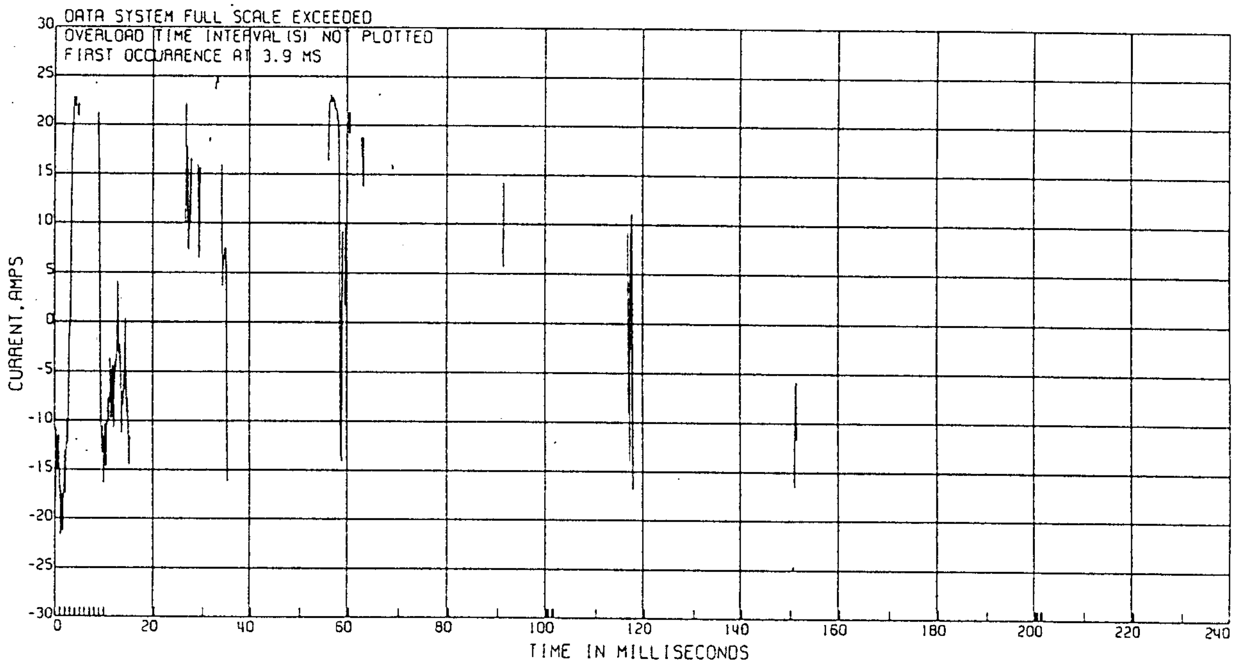
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

BATTERY CURRENT

TEST DATE:06/26/1996



Appendix D, plot # 129

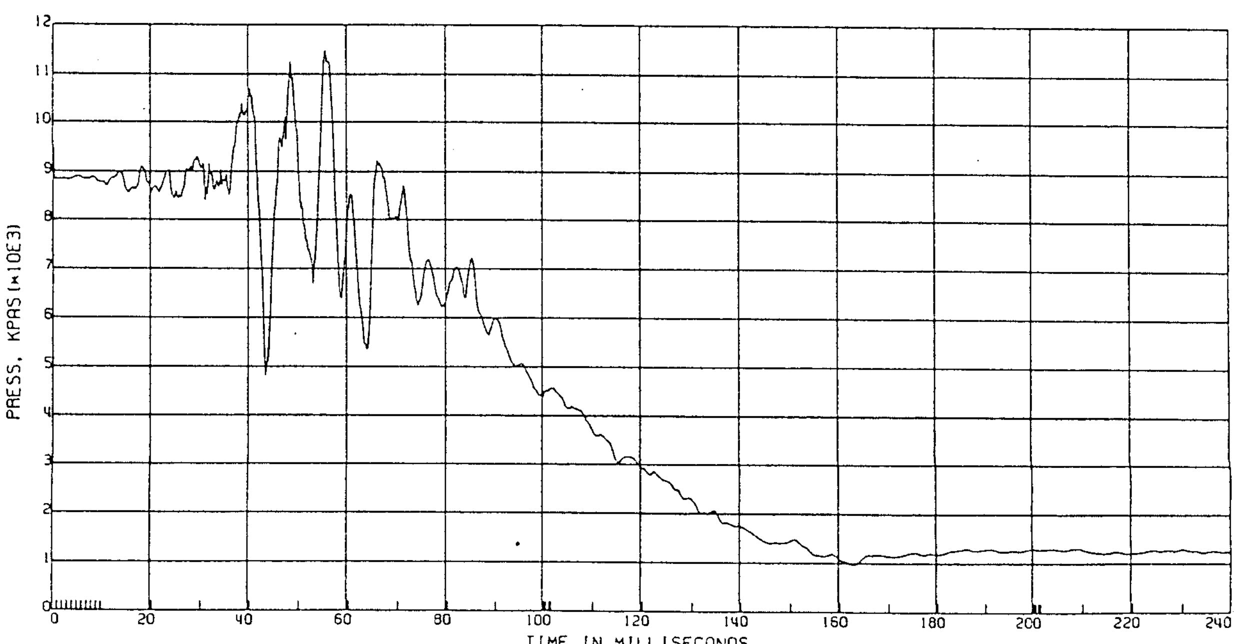
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

R. FRT BRAKE SYSTEM PRESSURE

TEST DATE:06/26/1996



Appendix D, plot # 130

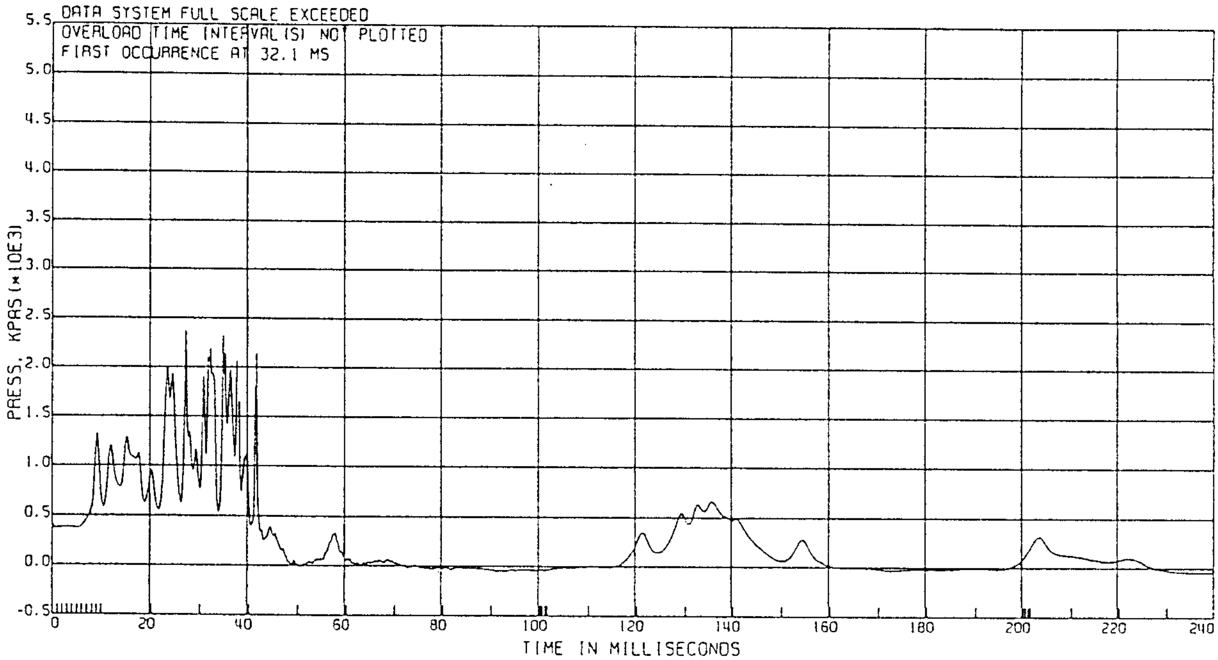
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

POWER STEERING SYSTEM PRESSURE

TEST DATE:06/26/1996



Appendix D, plot # 131

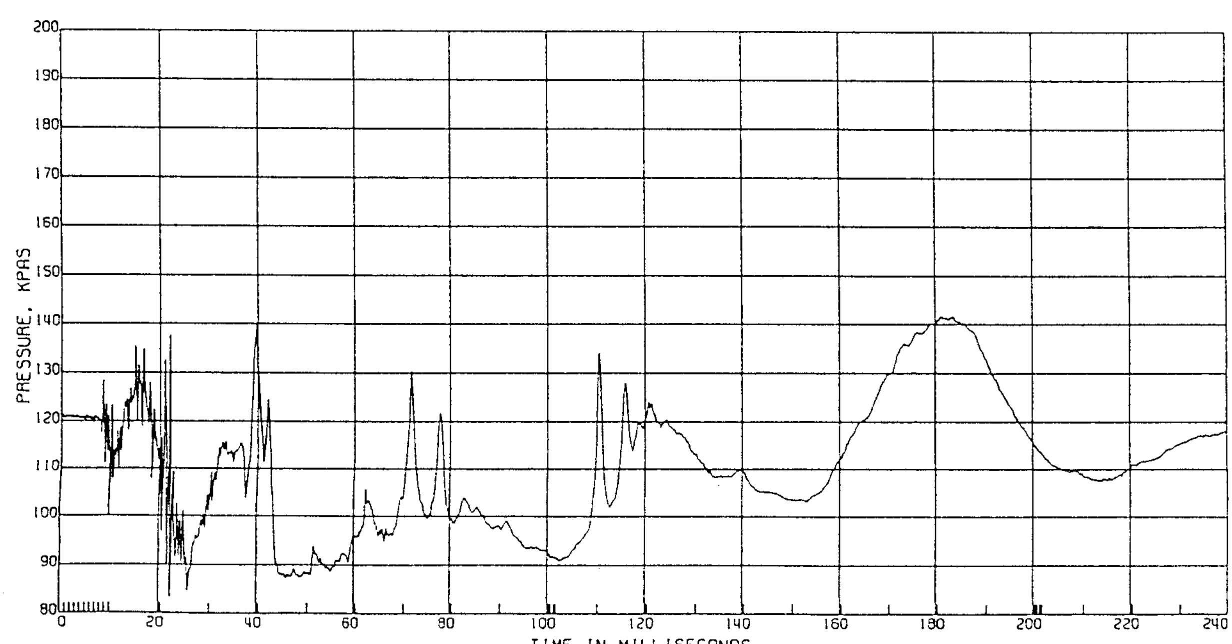
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

COOLING SYSTEM PRESSURE

TEST DATE:06/26/1996



Appendix D, plot # 132

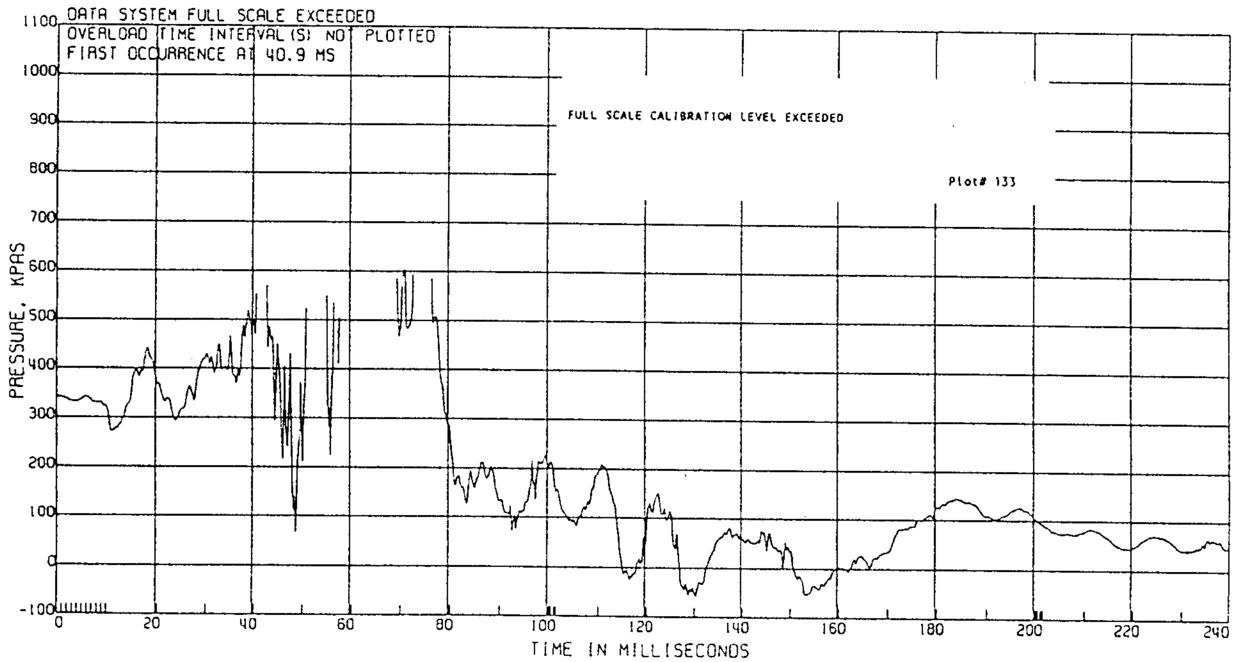
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

AUXILIARY FUEL TANK PRESSURE

TEST DATE:06/26/1996



Appendix D, plot # 133

133

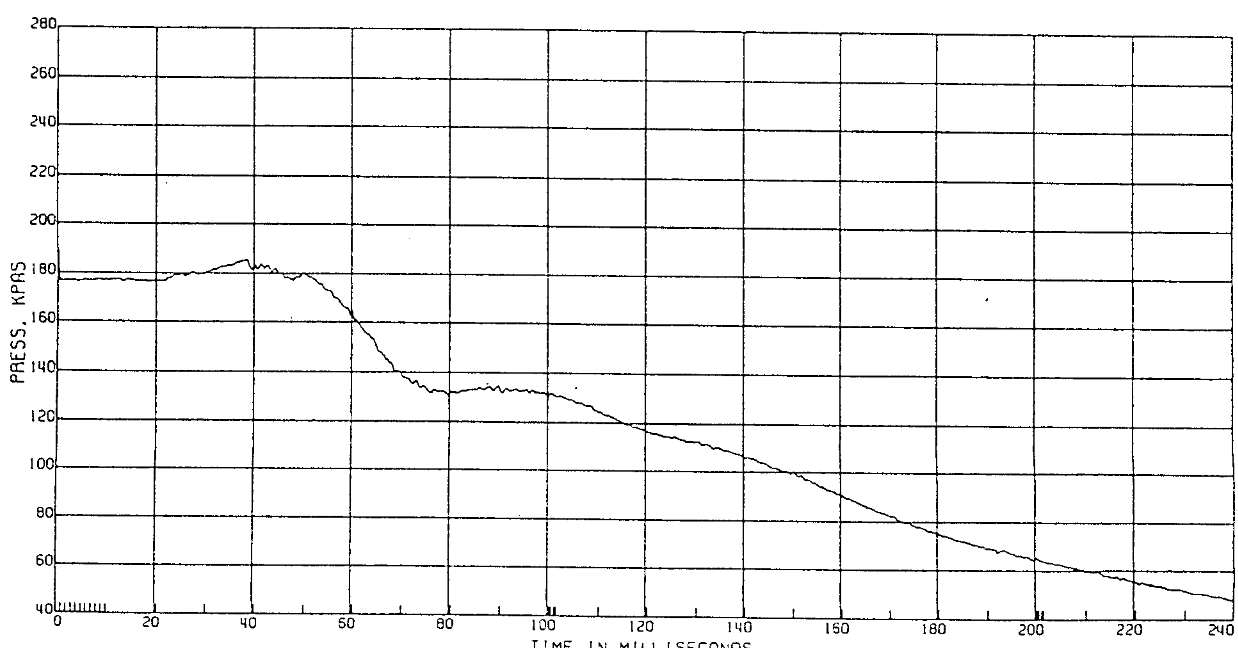
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

ENGINE OIL PRESSURE

TEST DATE:06/26/1996



Appendix D, plot # 134

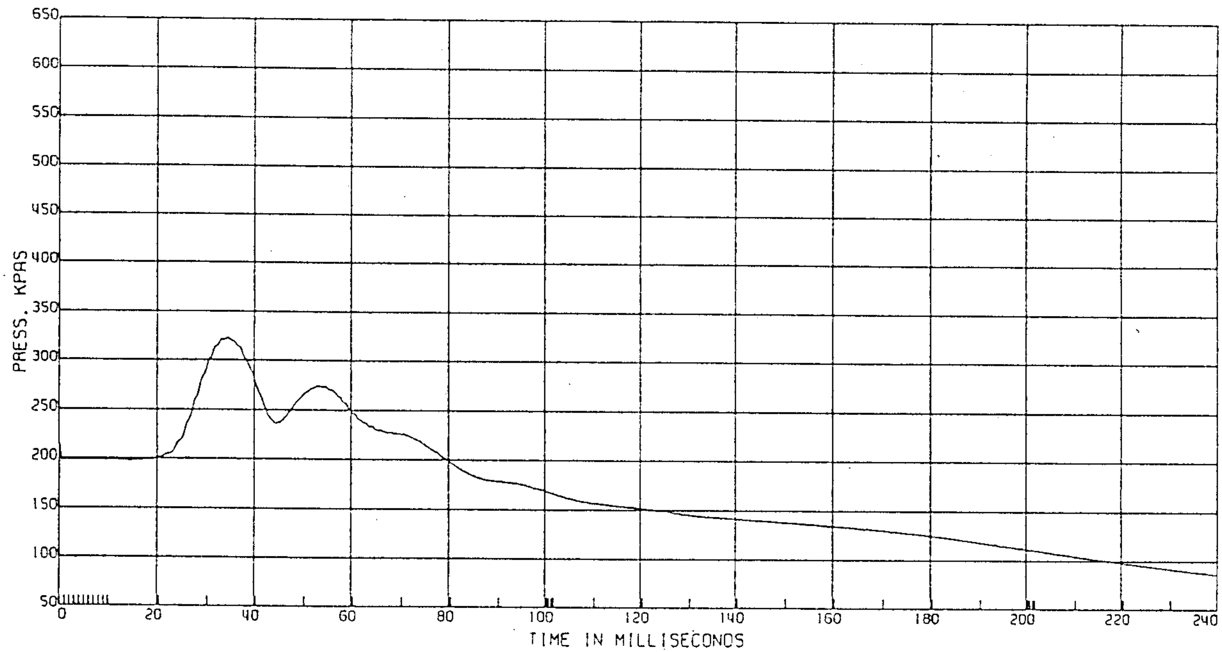
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

TRANSMISSION FLUID PRESSURE

TEST DATE:06/26/1996



Appendix D, plot # 135

135

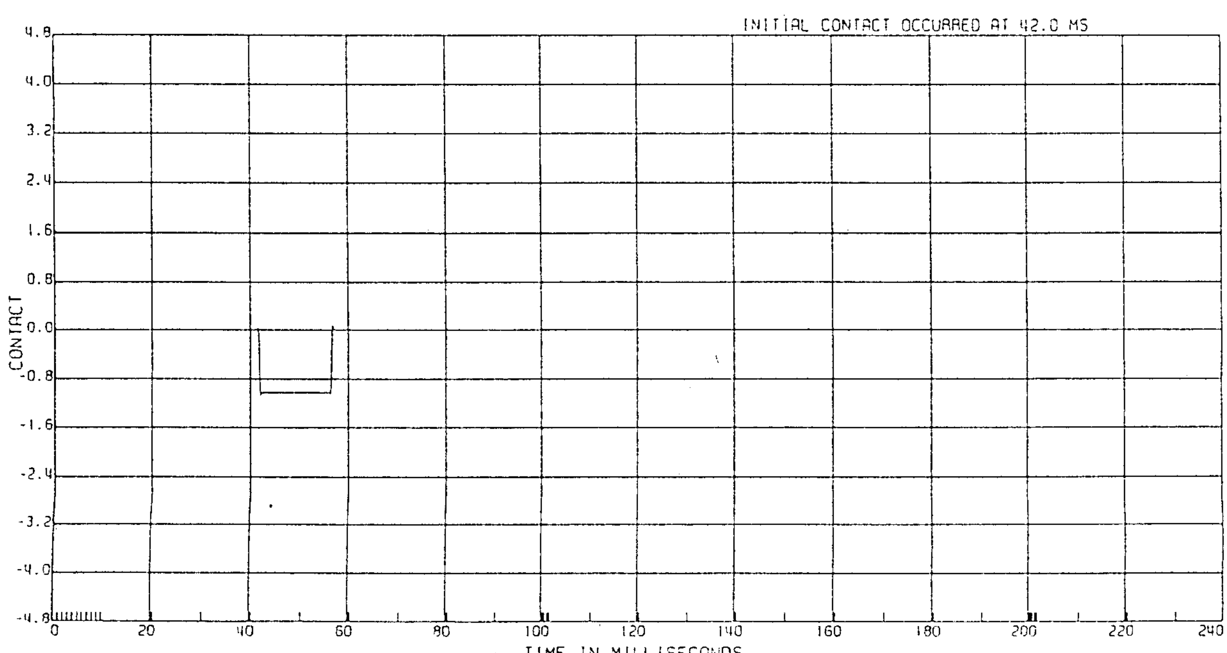
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 1000

THERMAL WIRE CONTACT

TEST DATE:06/26/1996



Appendix D, plot # 136

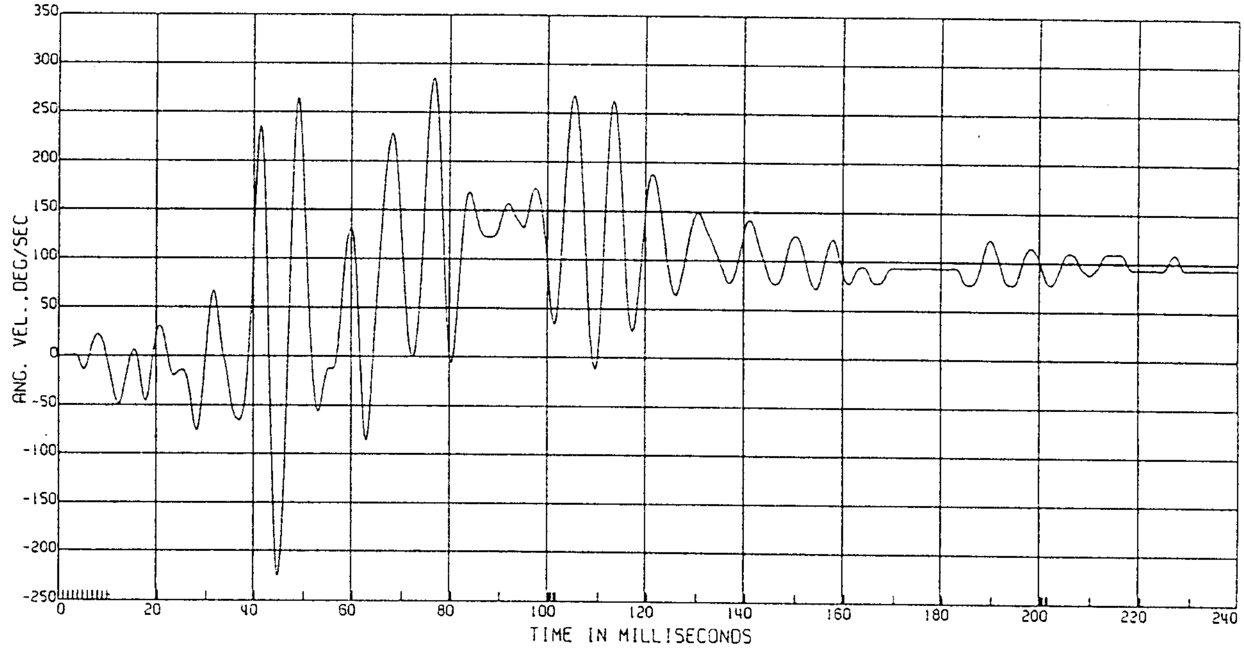
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T9309D VAN

ELEC DATA, SAE CLASS 180

CTR RATE GYROSCOPE ANG. VEL.

TEST DATE:06/26/1996



137

Appendix D, plot # 137

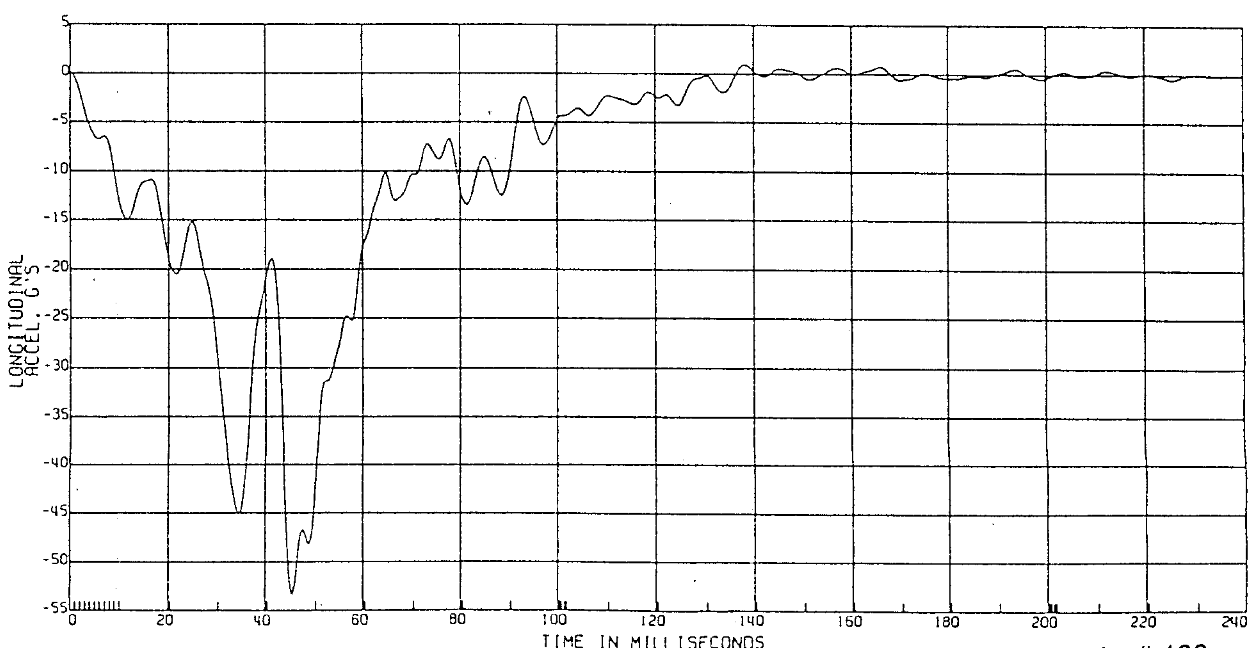
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T9309D VAN

ELEC DATA, SAE CLASS 60

LTV MDB AT C.G. ACCEL

TEST DATE:06/26/1996



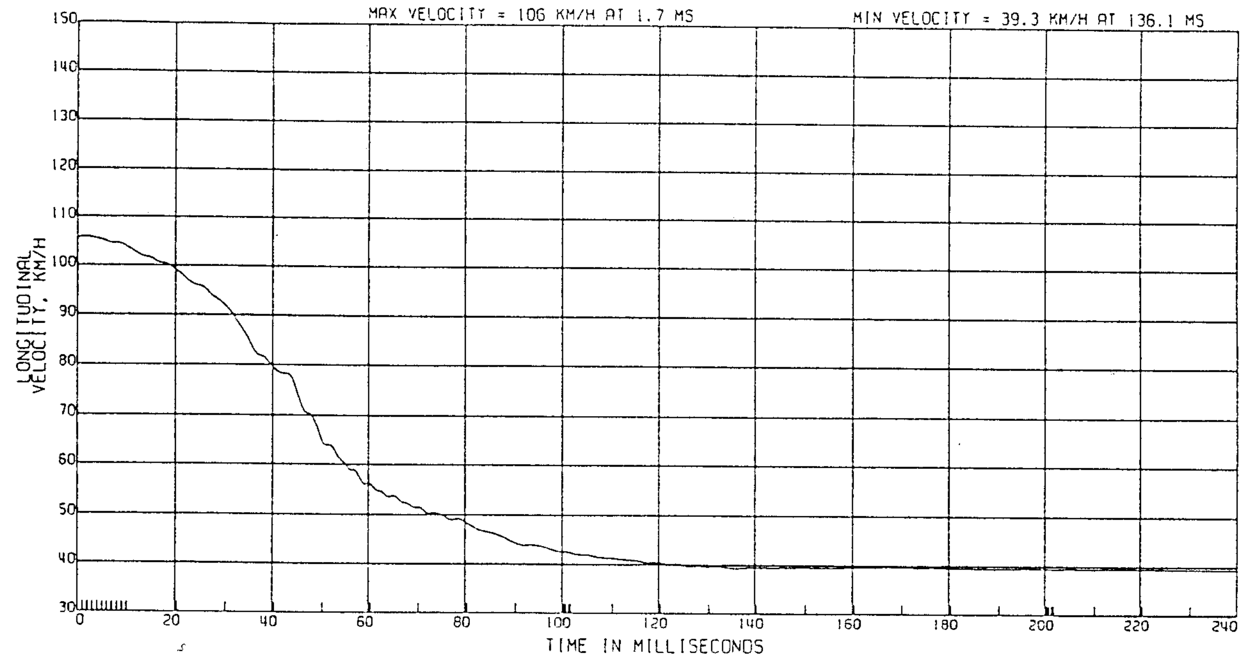
Appendix D, plot # 138

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

LTV MDB AT C.G. VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 139

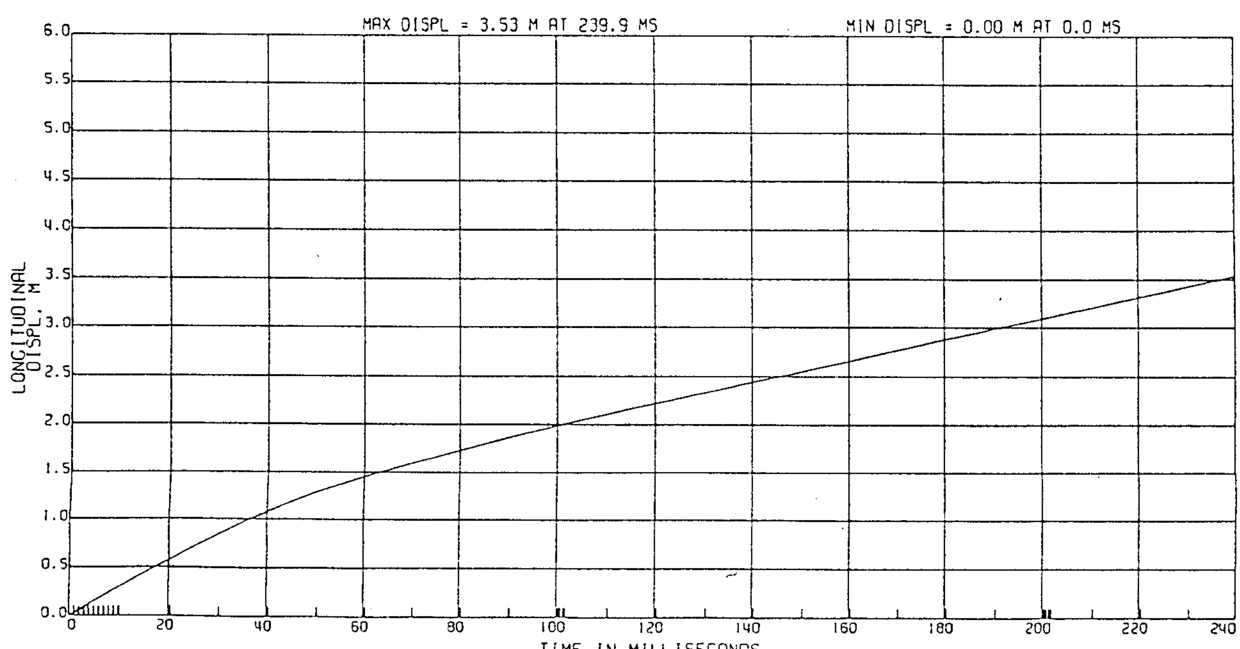
139

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

LTV MDB AT C.G. DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



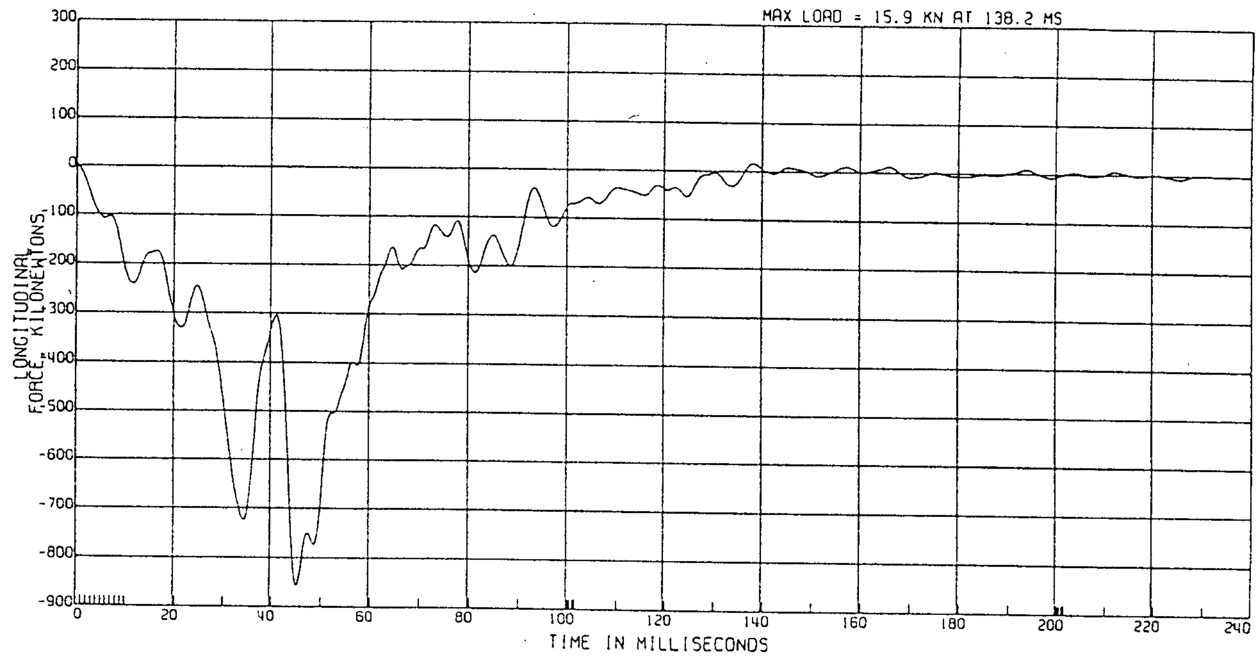
Appendix D, plot # 140

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 60

LTV MOB LONG. FORCE AT C.G.
(1638.5 KG) (9.807) (LONG.ACCEL)

TEST DATE:06/26/1996



Appendix D, plot # **141**

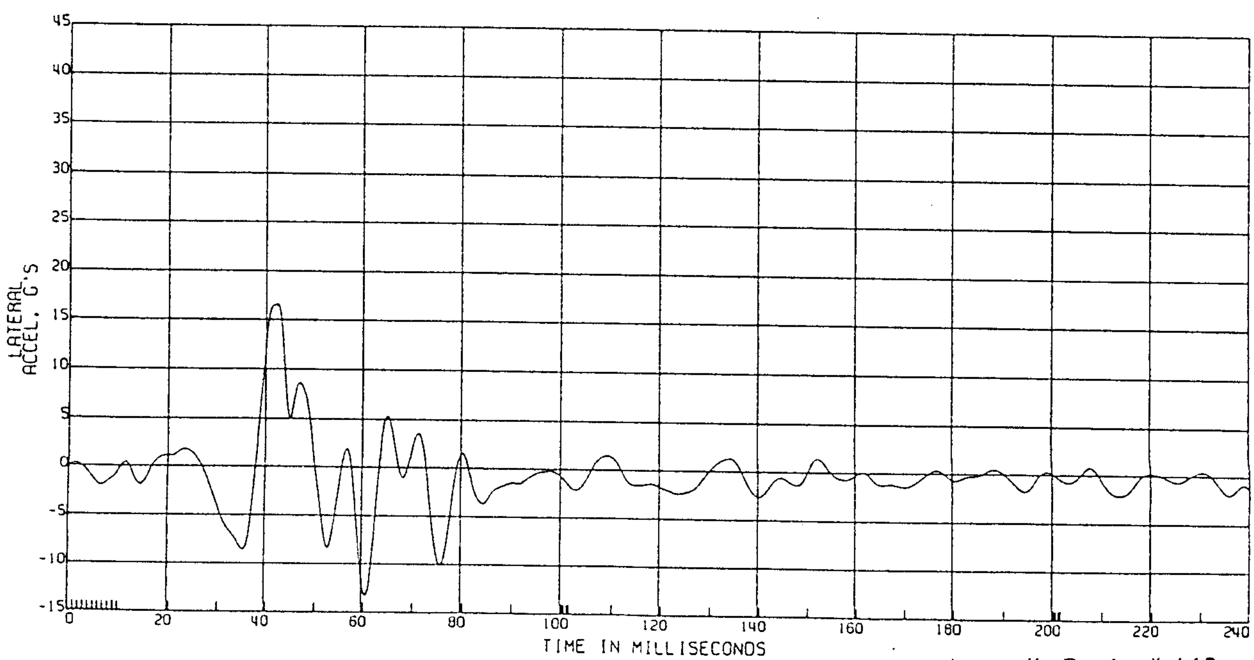
141

C11167 L. FRT IMPACT-335 DEG LTV MOB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 60

LTV MOB AT C.G. ACCEL

TEST DATE:06/26/1996



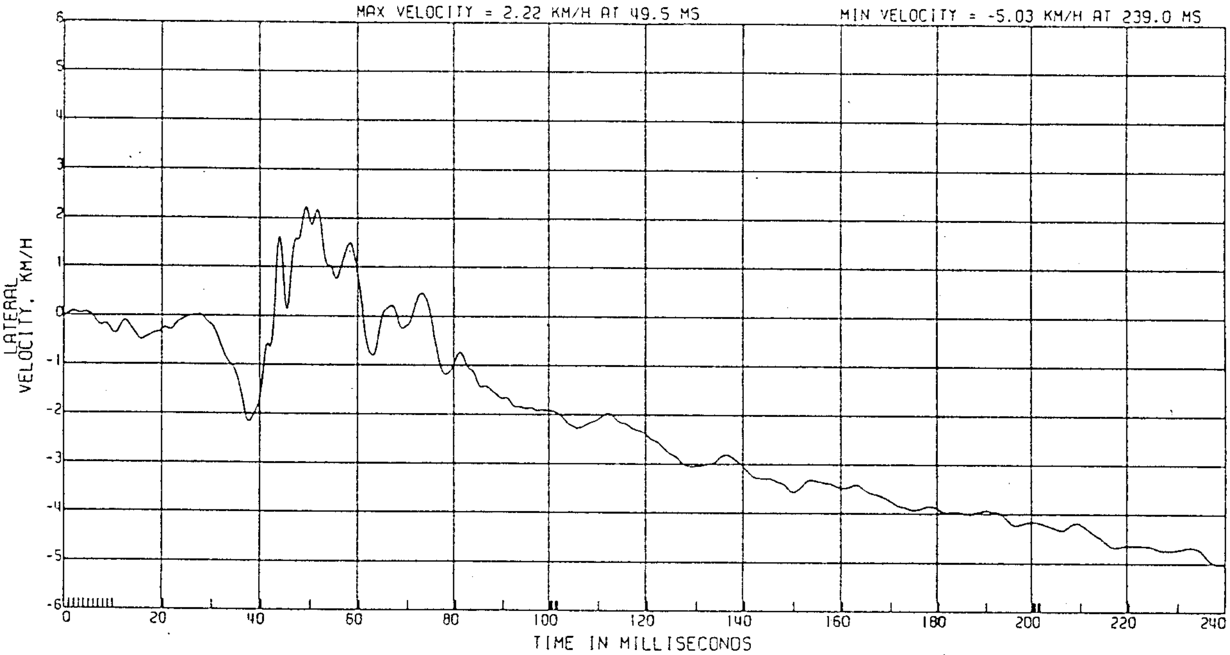
Appendix D, plot # **142**

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

LTV MDB AT C.G. VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 143

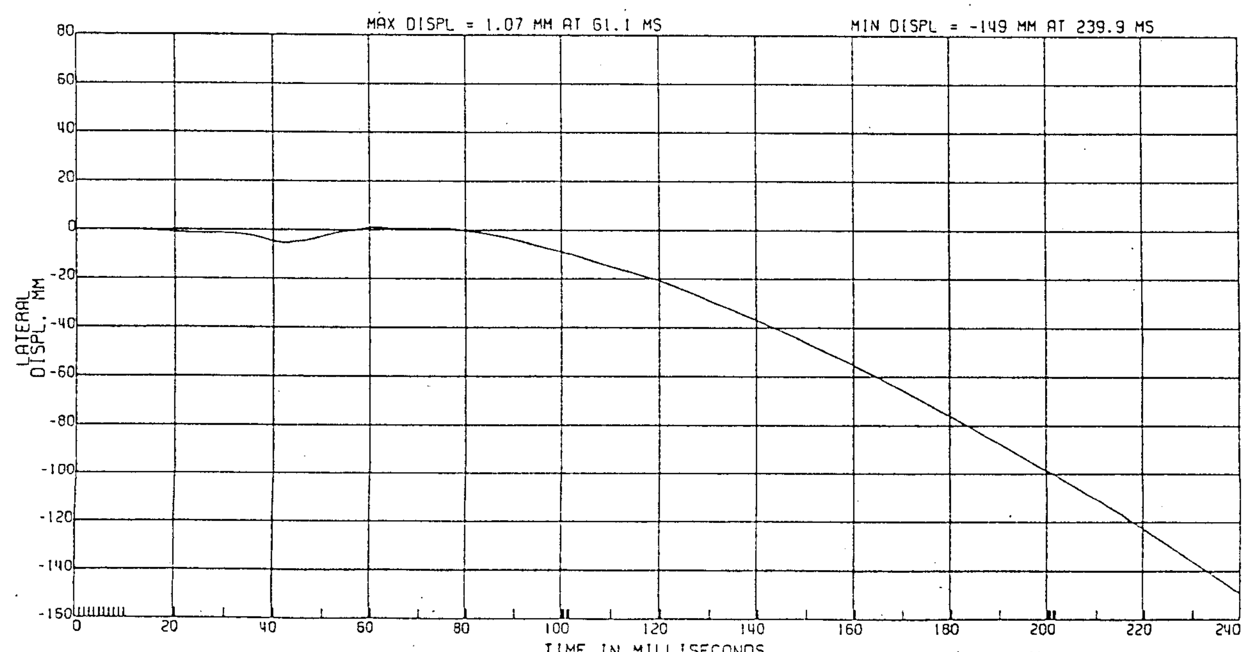
143

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

LTV MDB AT C.G. DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 144

144

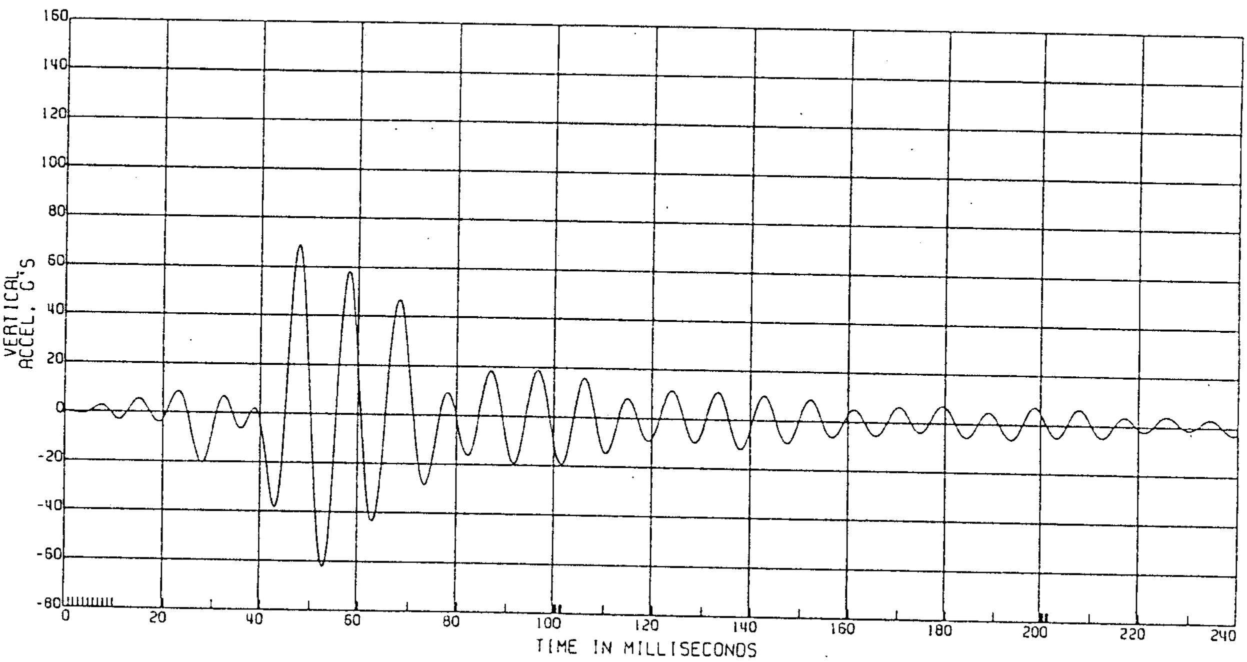
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

LTV MDB AT C.G. ACCEL

TEST DATE:06/26/1996



Appendix D, plot # 145

145

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

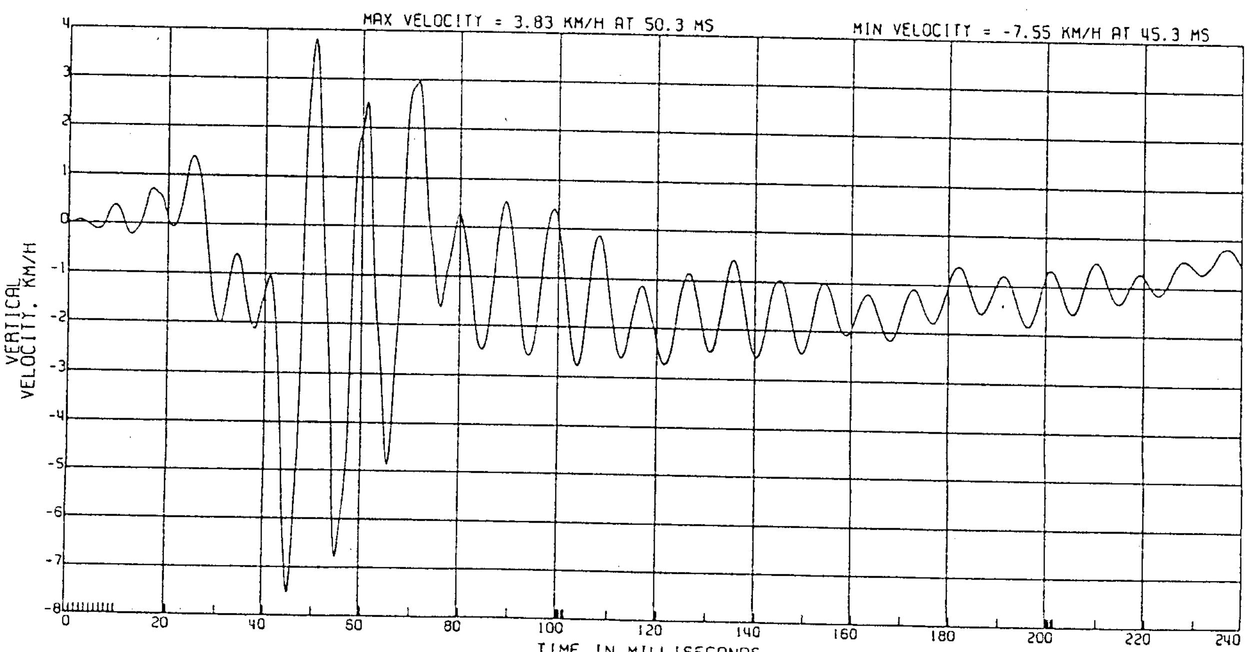
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

LTV MDB AT C.G. VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 146

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

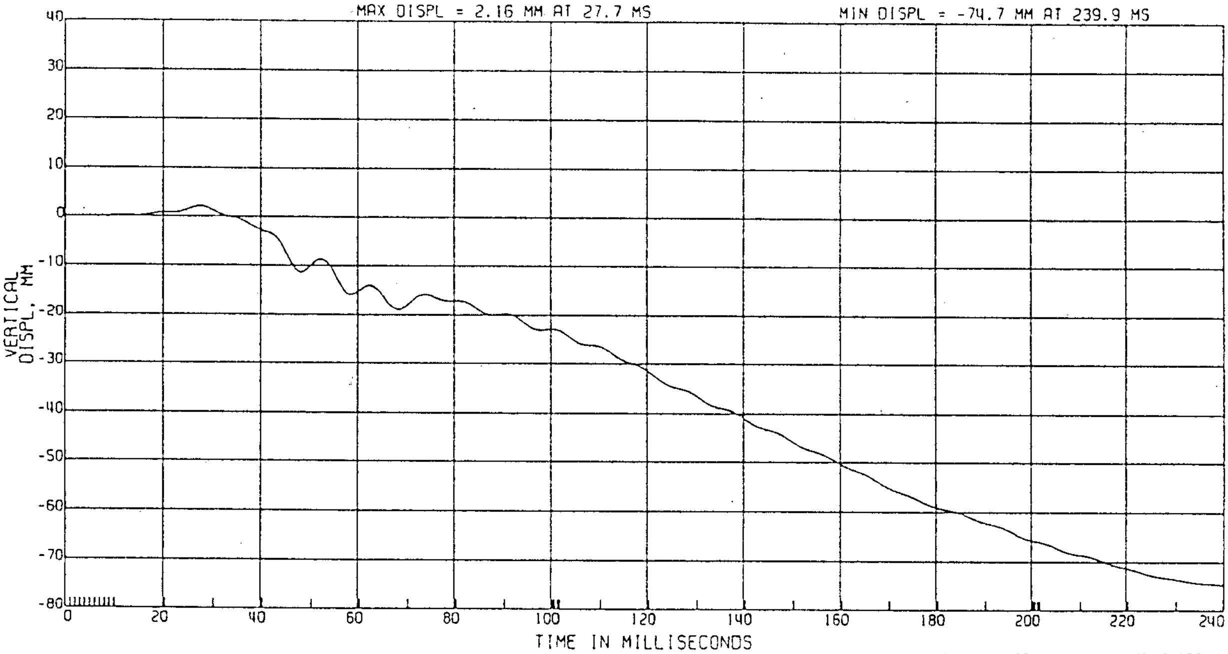
R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

LTV MDB AT C.G. DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 147

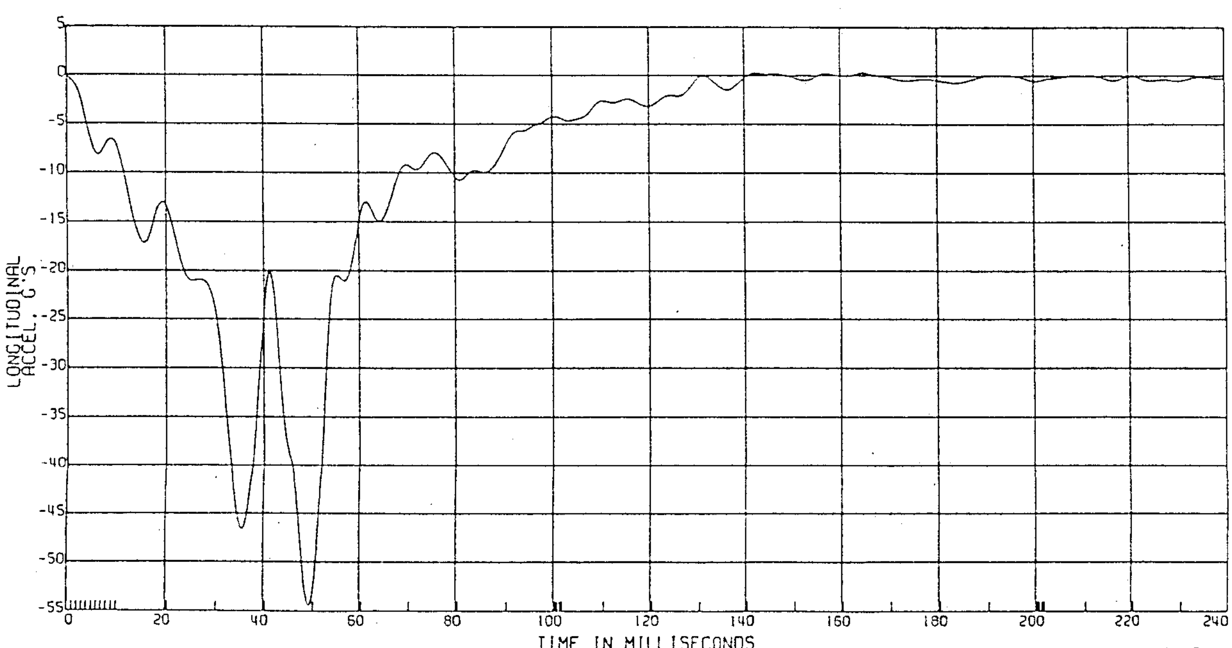
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

LTV MDB AT REAR C/MBR ACCEL

TEST DATE:06/26/1996



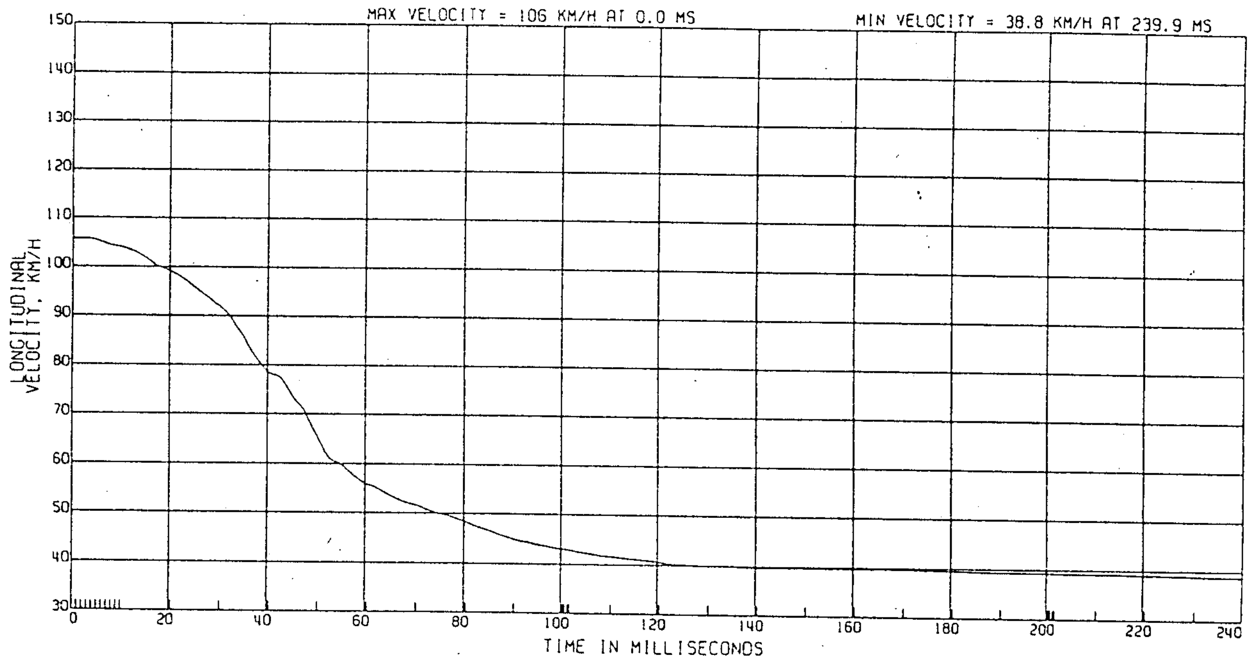
Appendix D, plot # 148

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

LTV MDB AT REAR C/MBR VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 149

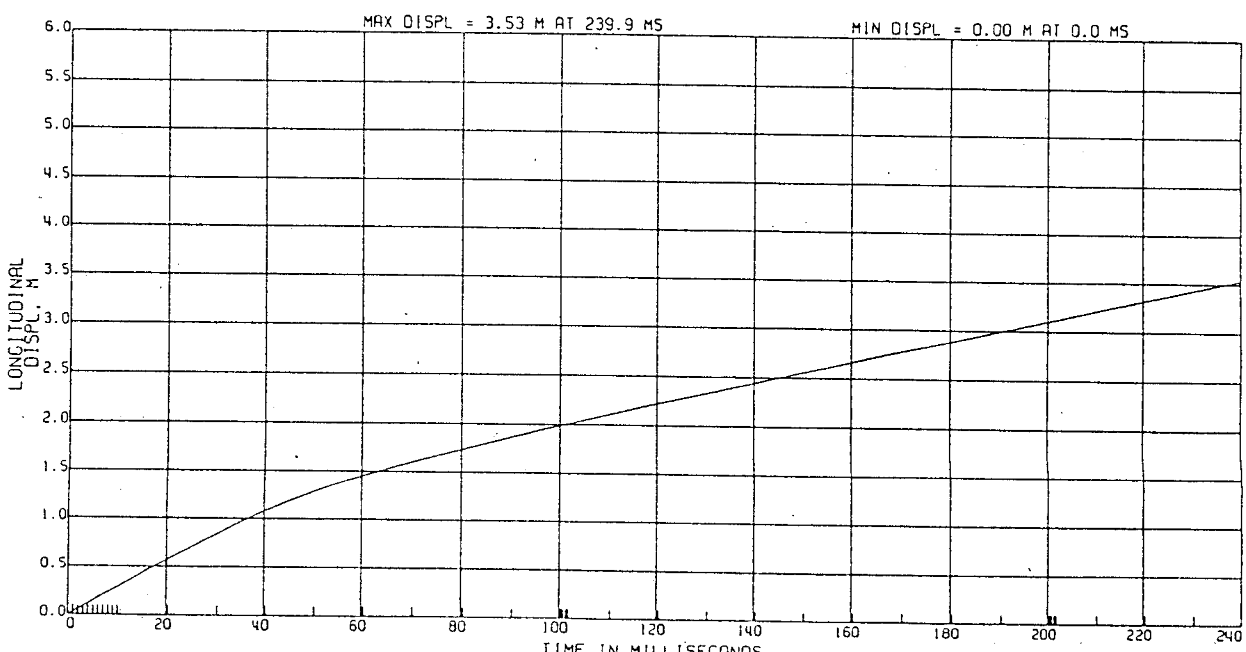
149

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

LTV MDB AT REAR C/MBR DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 150

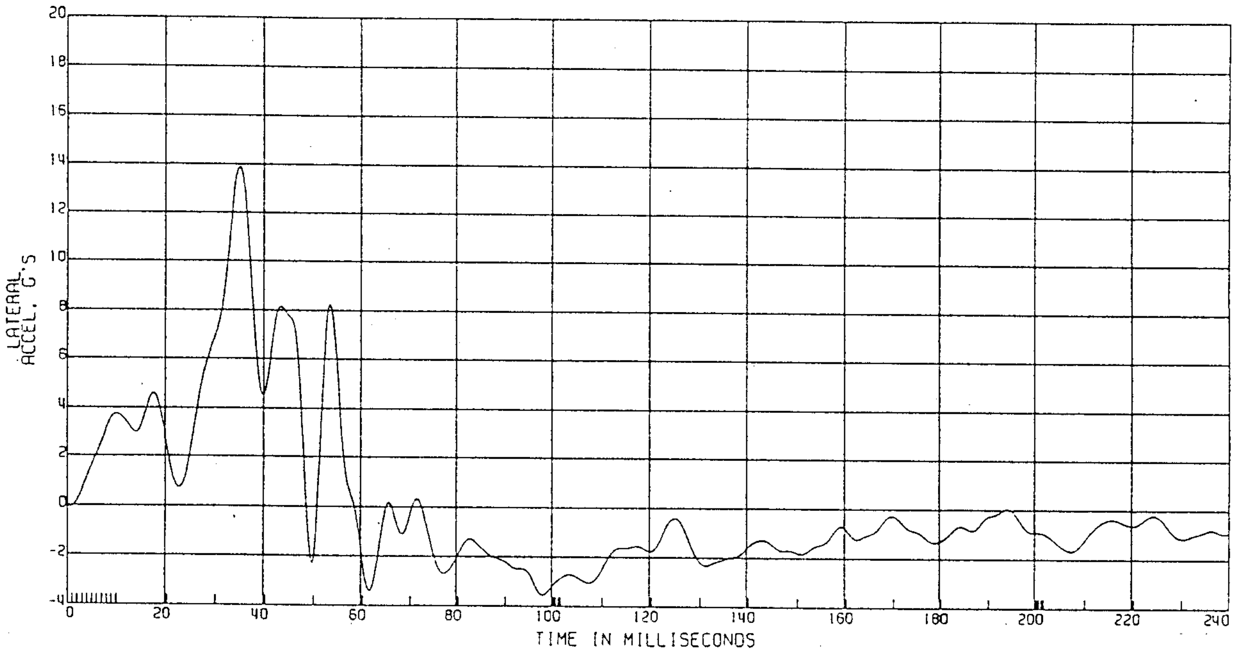
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T9309D VAN

ELEC DATA, SAE CLASS 60

LTV MDB AT REAR C/MBR ACCEL

TEST DATE:06/26/1996



Appendix D, plot # 151

T51

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

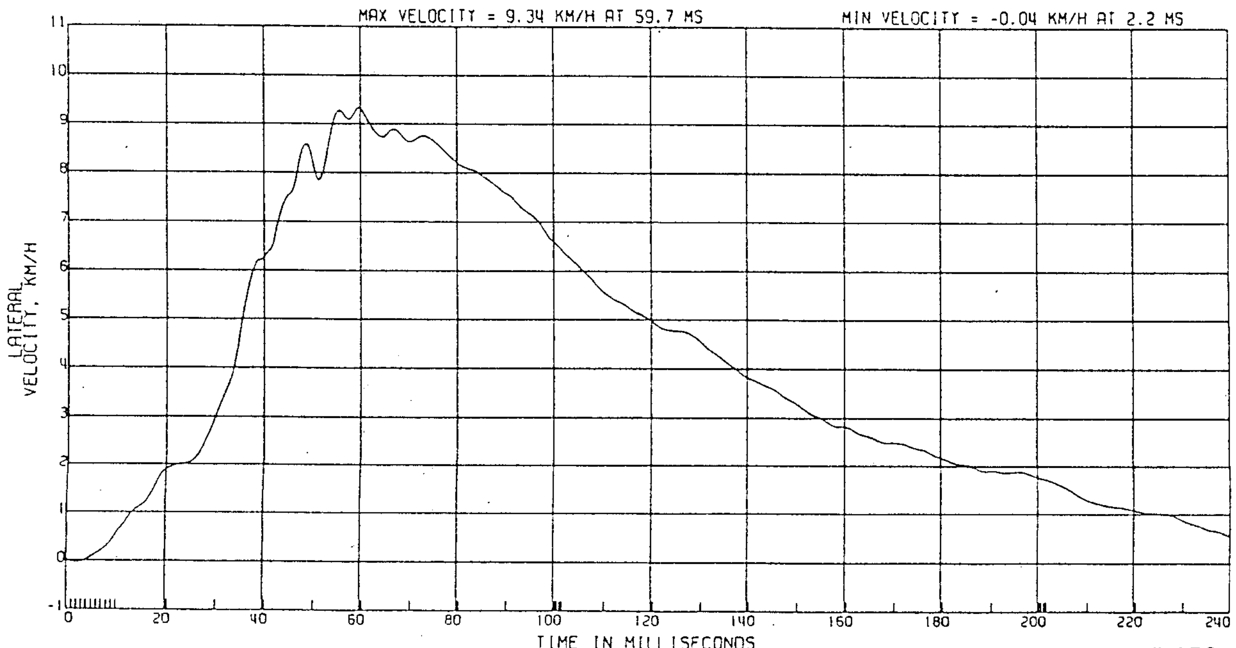
R & D CTR 8T9309D VAN

ELEC DATA, SAE CLASS 180

LTV MDB AT REAR C/MBR VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 152

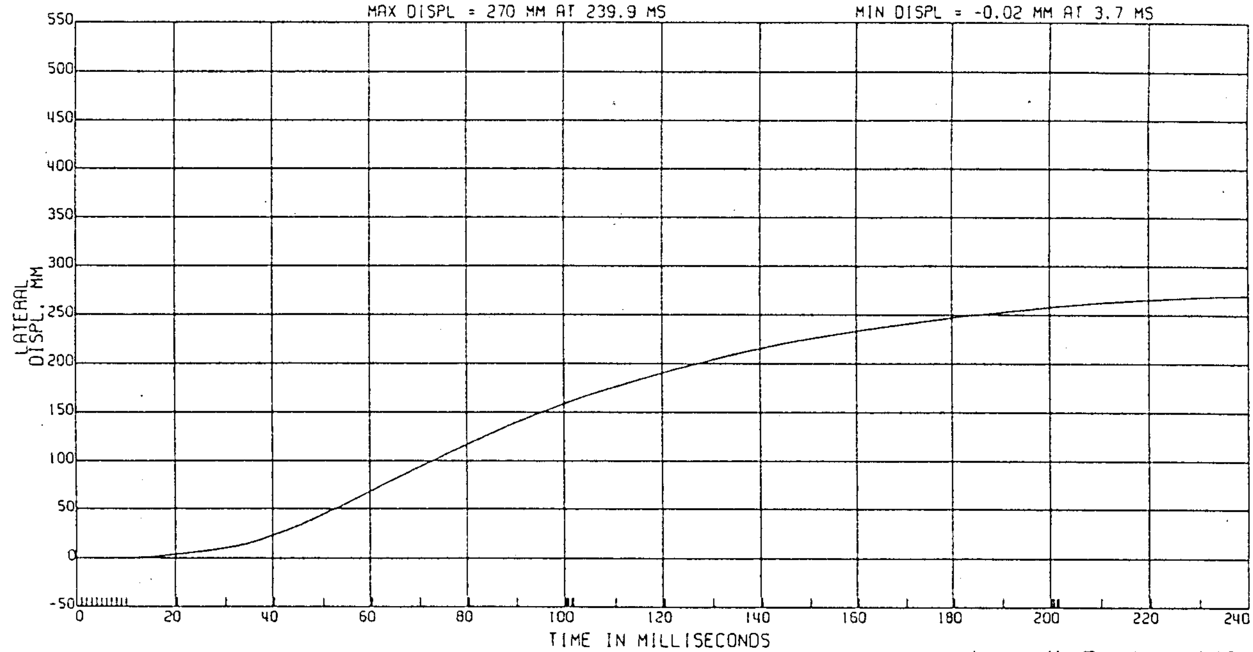
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 180

LTV MDB AT REAR C/MBR DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 153

153

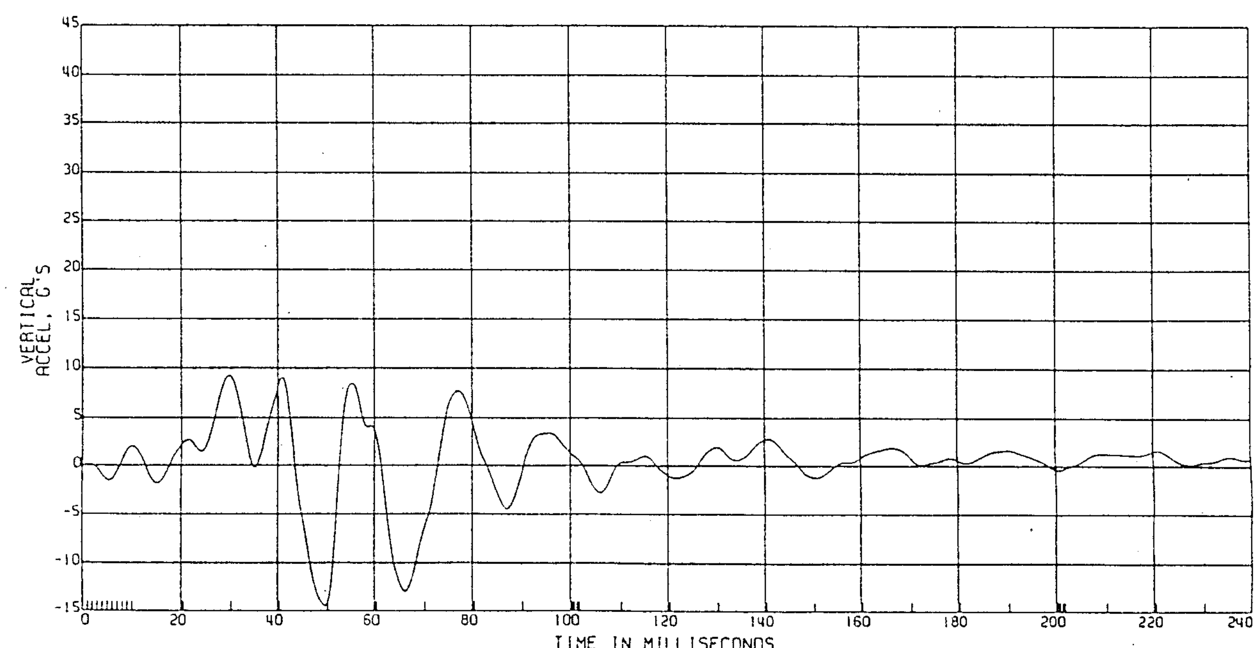
C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN

ELEC DATA, SAE CLASS 60

LTV MDB AT REAR C/MBR ACCEL

TEST DATE:06/26/1996



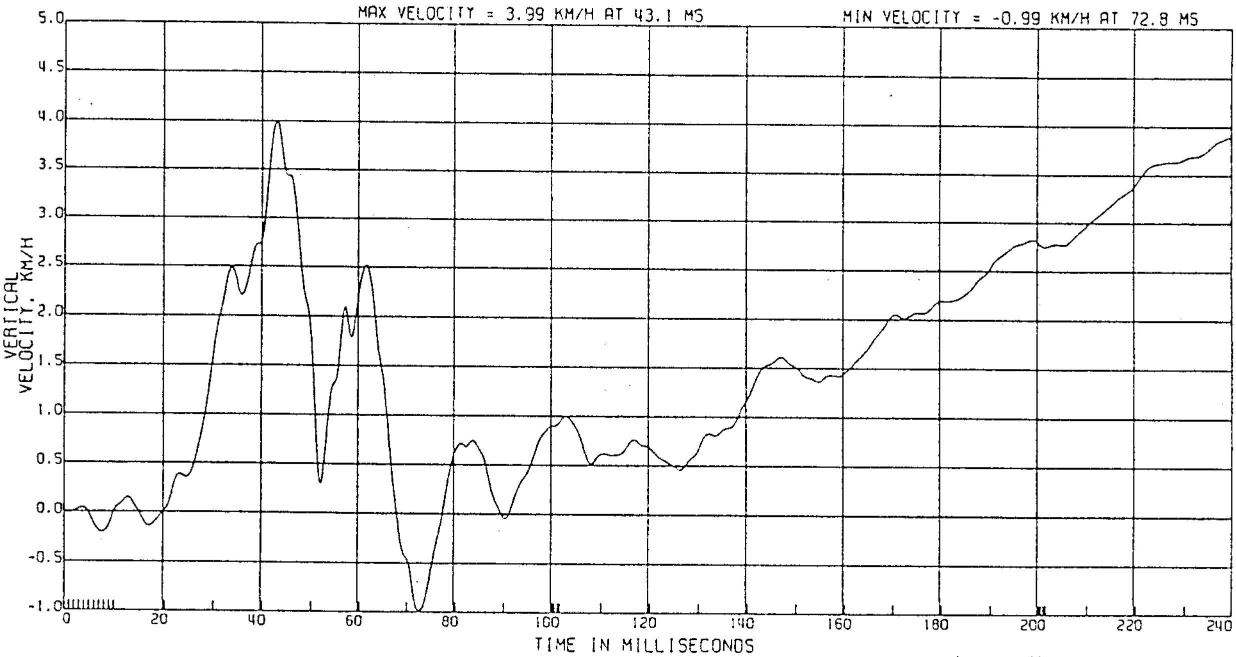
Appendix D, plot # 154

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

LTV MDB AT REAR C/MBR VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 155

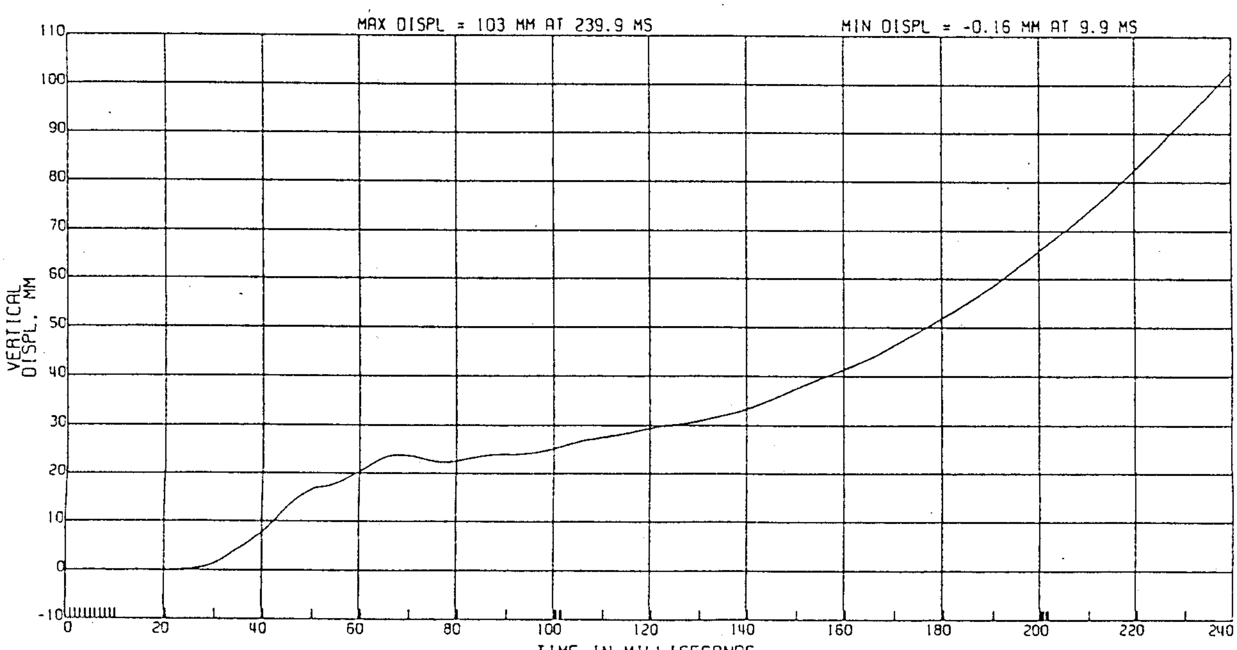
155

C11167 L. FRT IMPACT-335 DEG LTV MDB TO STATIONARY VEHICLE 105.7KM/H

R & D CTR 8T93090 VAN
ELEC DATA, SAE CLASS 180

LTV MDB AT REAR C/MBR DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:06/26/1996



Appendix D, plot # 156

Appendix E: C11167 hydrocarbon vapor measurement plots

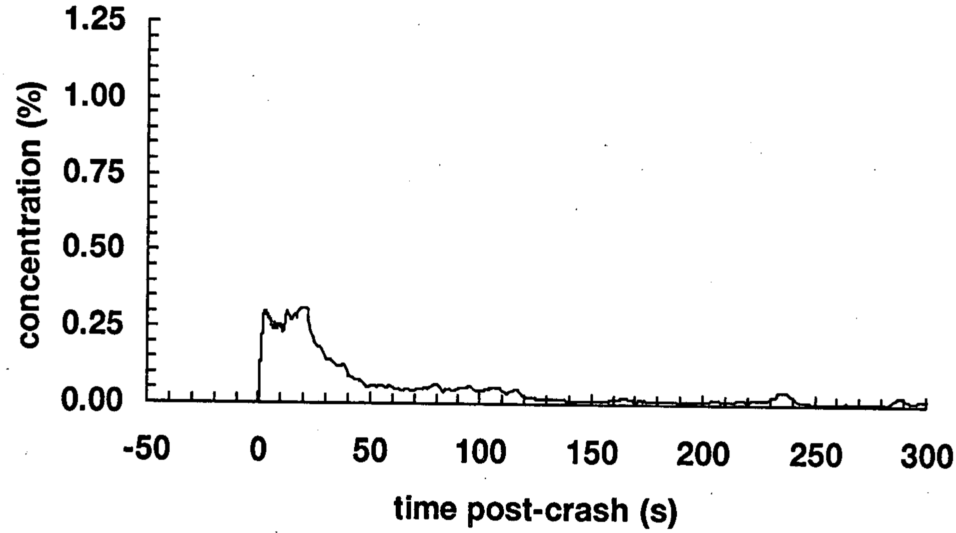


Figure E1

Concentration of Hydrocarbon Vapor Measured at the Left Upper Engine (Location #1)
Test C11167

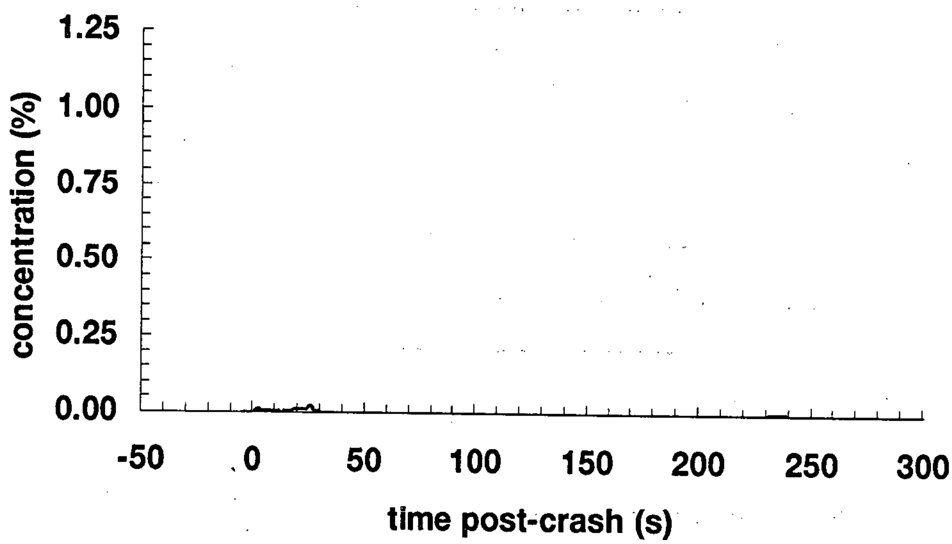


Figure E2

Concentration of Hydrocarbon Vapor Measured at the Right Upper Engine (Location #2)
Test C11167

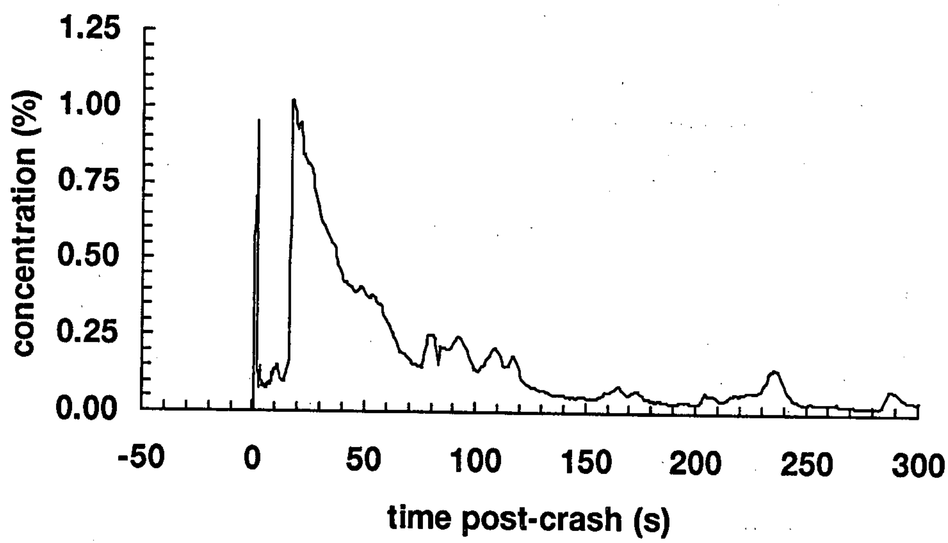


Figure E3

Concentration of Hydrocarbon Vapor Measured at the Left Lower Engine (Location #3)
Test C11167

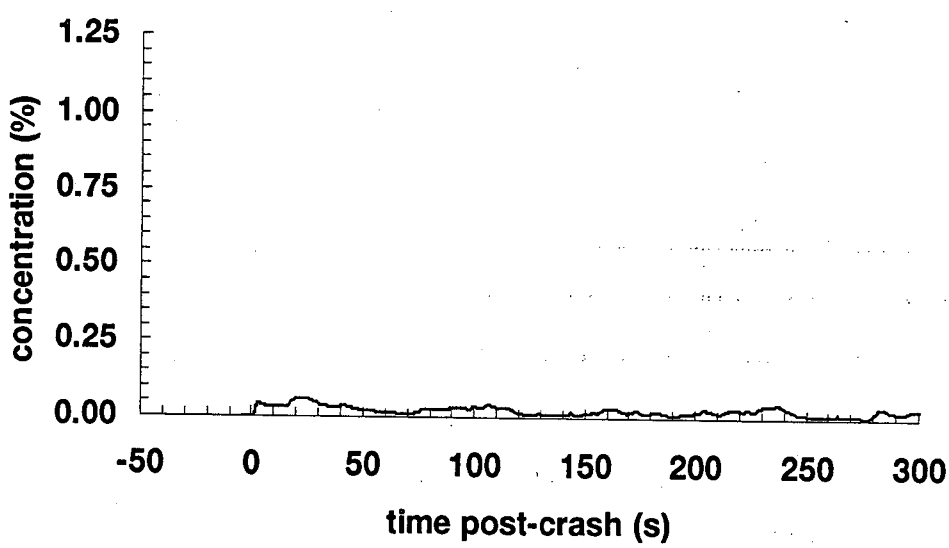


Figure E4

Concentration of Hydrocarbon Vapor Measured at the Right Lower Engine (Location #4)
Test C11167

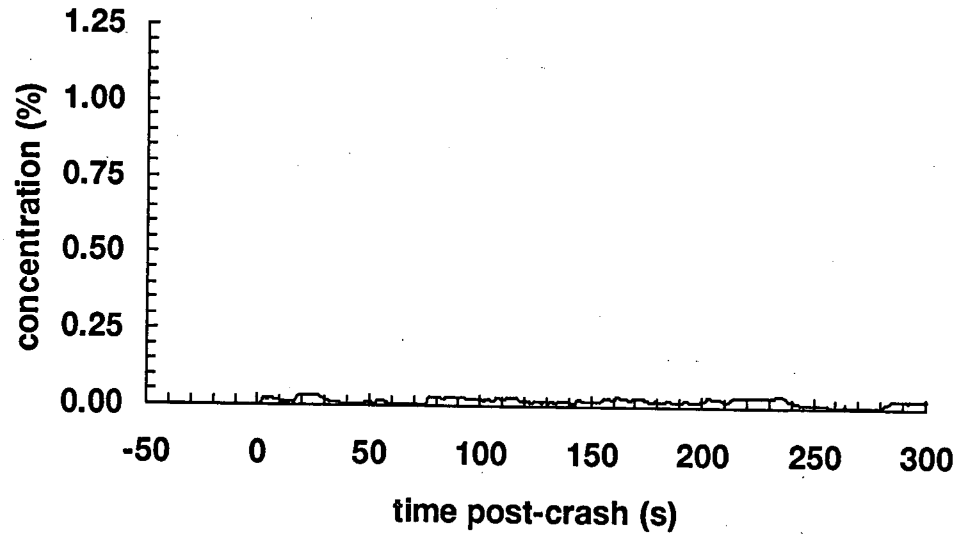


Figure E5

Concentration of Hydrocarbon Vapor Measured at the Exhaust Manifold (Location #5)

Test C11167

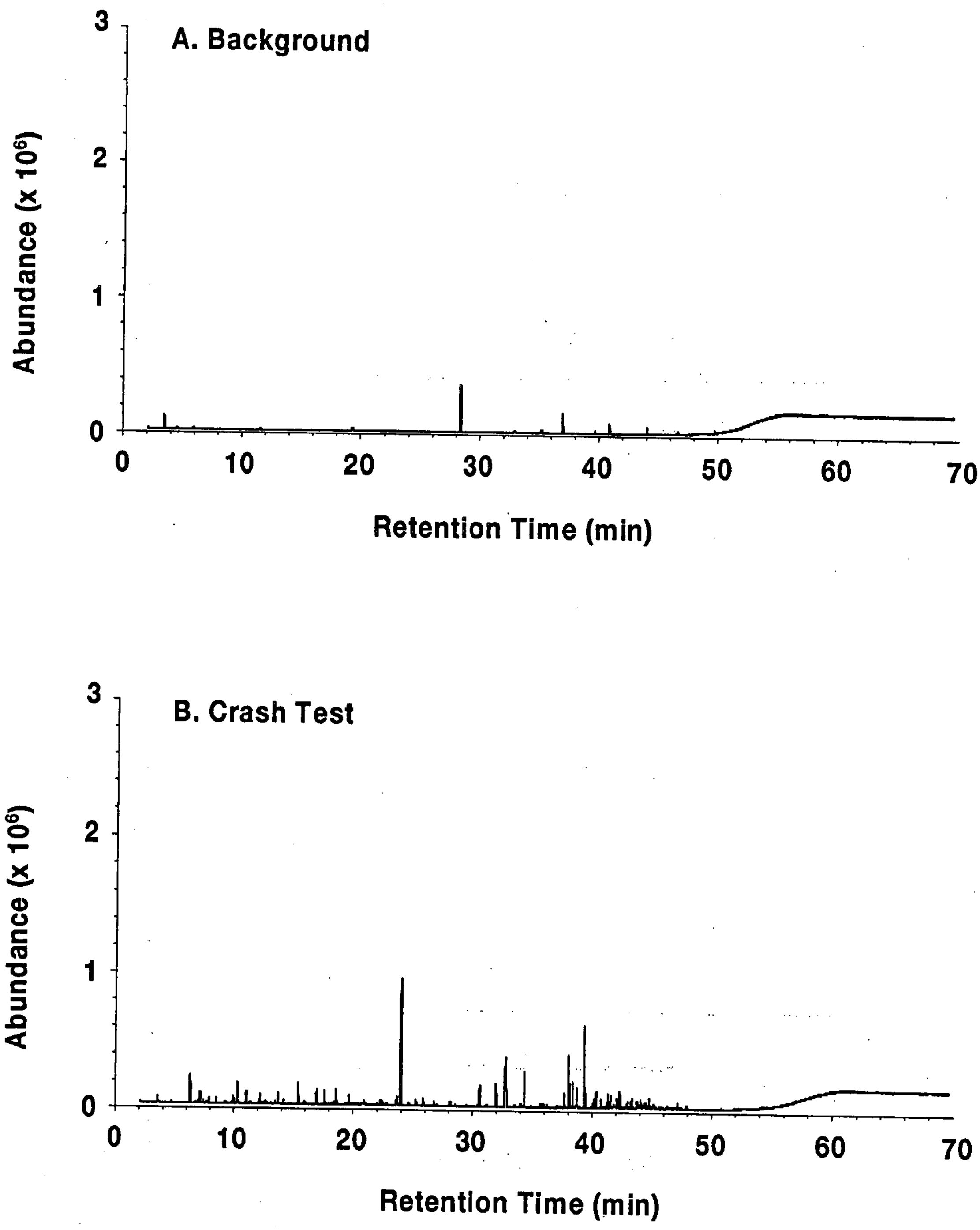


Figure EE1.
GC/MS analysis of hydrocarbon vapor sampled from the left upper engine (location #1) during Crash Test C11167. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample

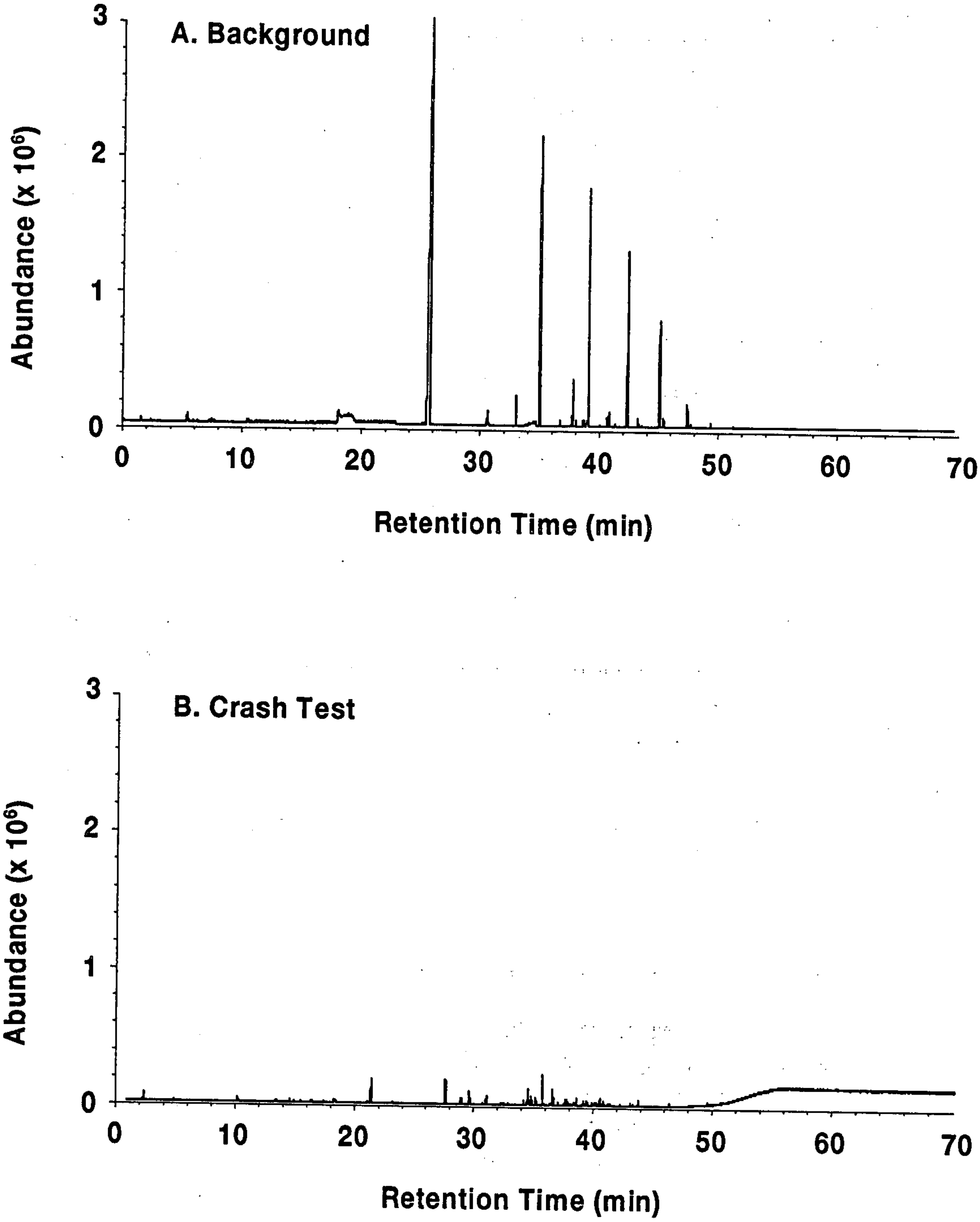
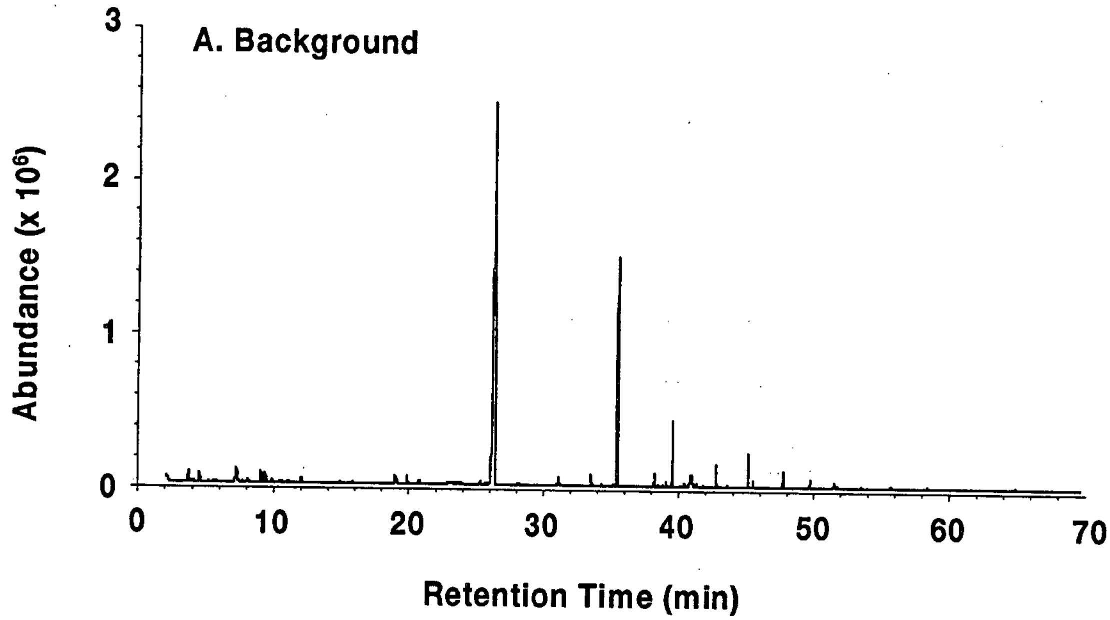


Figure EE2

GC/MS analysis of hydrocarbon vapor sampled from the right upper engine (location #2) during Crash Test C11167. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample.



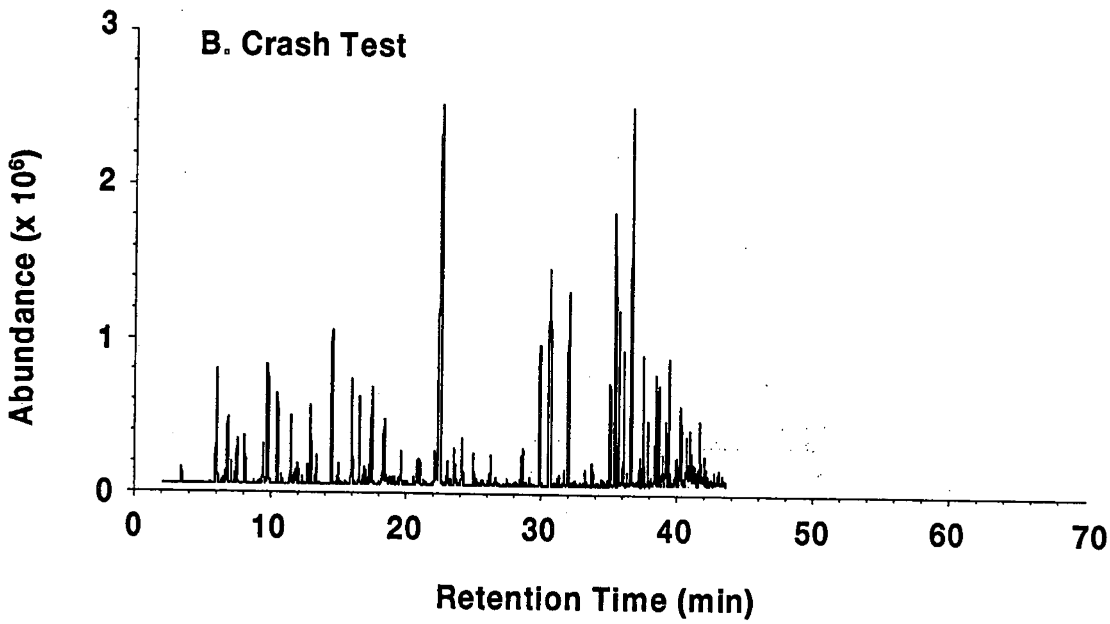


Figure EE3

GC/MS analysis of hydrocarbon vapor sampled from the left lower engine (location #3) during Crash Test C11167. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample.

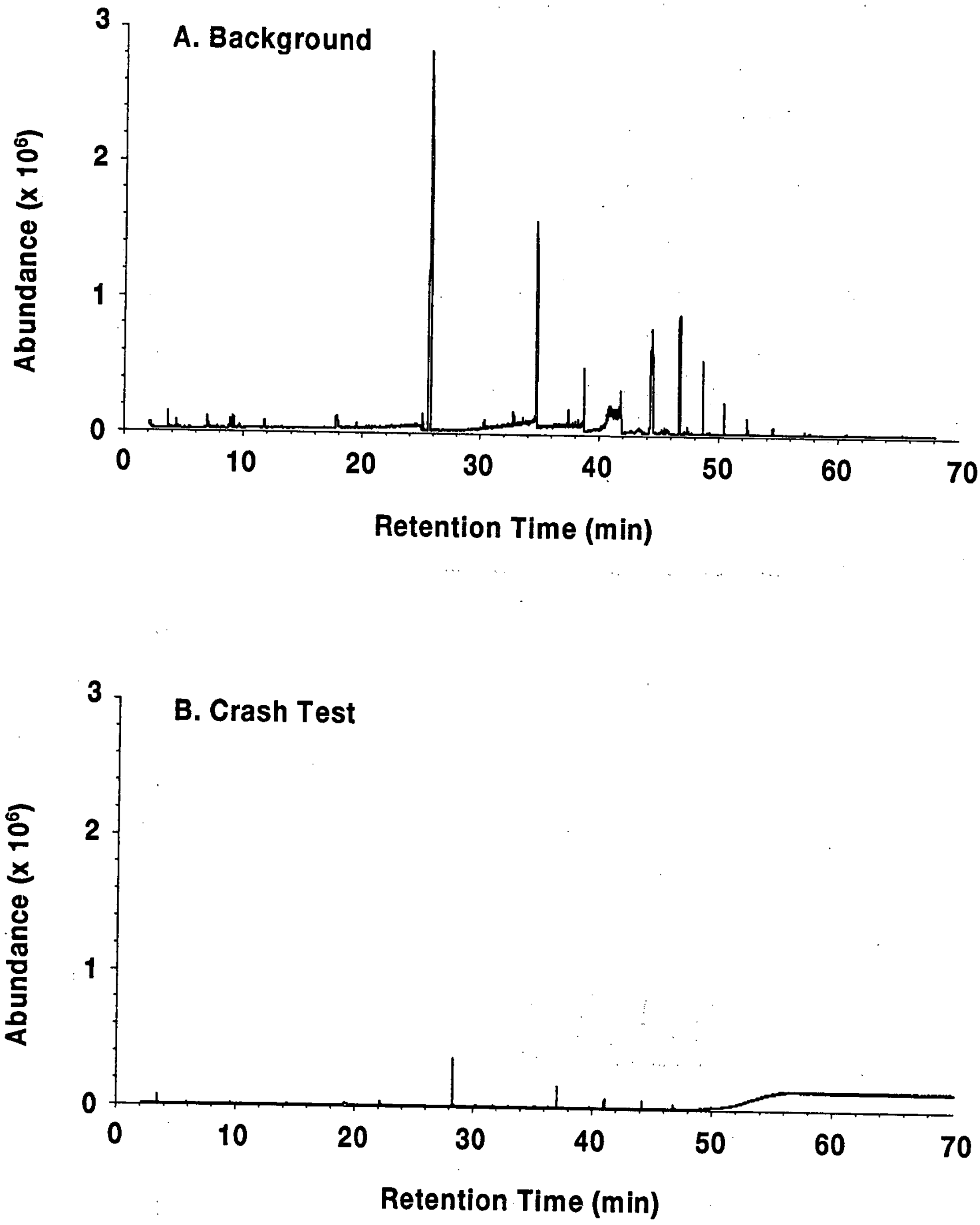


Figure EE4

GC/MS analysis of hydrocarbon vapor sampled from the right lower engine (location #4) during Crash Test C11167. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample.

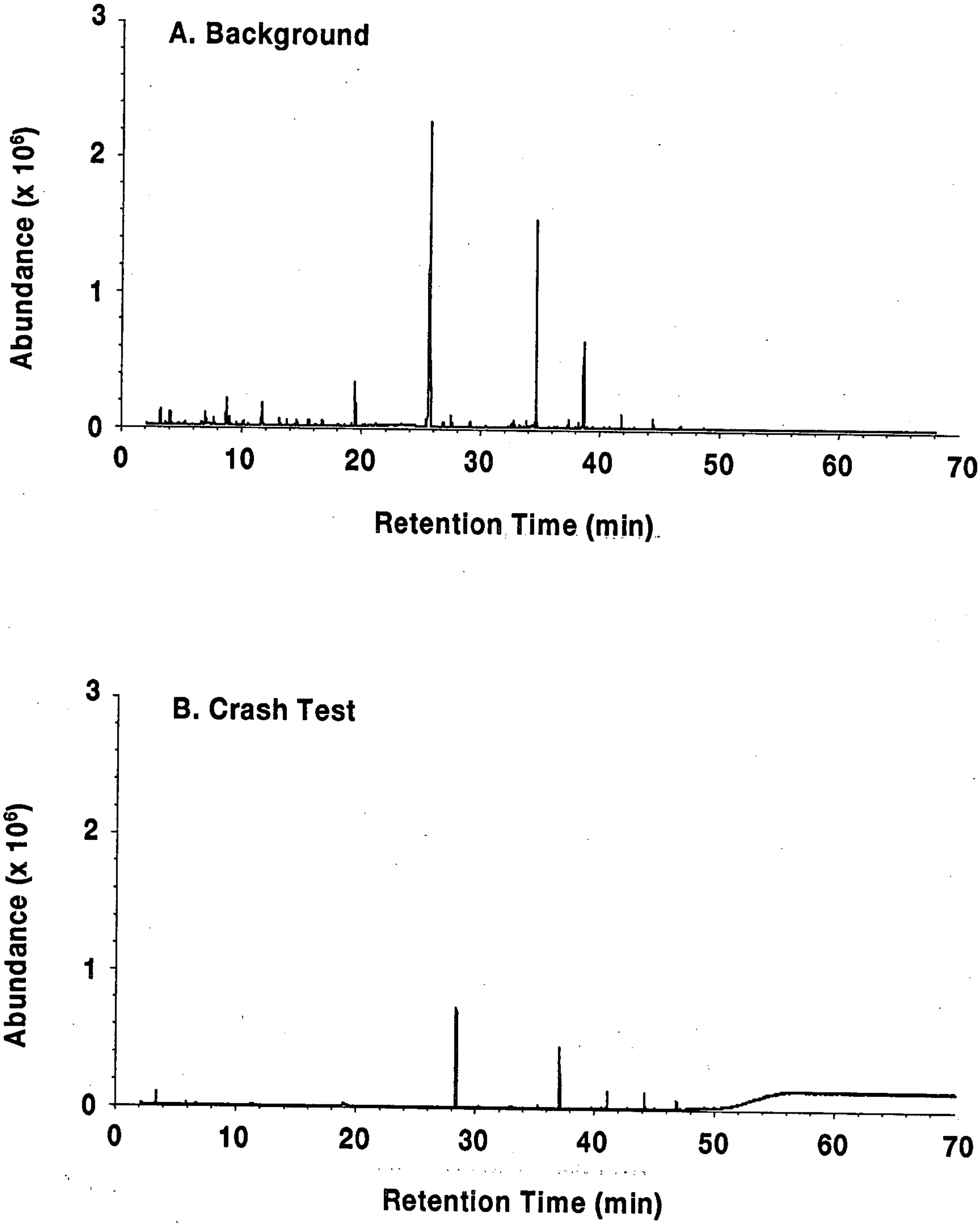


Figure EE5
GC/MS analysis of hydrocarbon vapor sampled from the exhaust manifold (location #5) during Crash Test C11167. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample

Appendix F: C11226 data plots

LEFT FRONT
ANTHROPOMORPHIC TEST DEVICE SUMMARY DATA
MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

C11226 L. FRT IMP 50% OVERLAP
R & D CTR 8T9306D VAN

ATD TYPE: GM50H
TEST DATE: 08/14/1996

MEASURED QUANTITY	100% OF IARV / 150% OF IARV	IAV VALUE	IARV
HIC, LIMITED TO 15 MS		920	1000
HIC, LIMITED TO 36 MS		1110	1000
NECK FLEXION		46NM	190NM
NECK EXTENSION		65NM	57NM
NECK TENSION		1.30	1.00
NECK COMPRESSION		0.02	1.00
NECK SHEAR FORWARD		0.34	1.00
NECK SHEAR REARWARD		0.20	1.00
CHEST ACCEL		56G	60G
‡ CHEST COMPRESSION W/O SH BELT		42.8MM	65.0MM ‡
‡ CHEST COMPRESSION W/ SH BELT		42.8MM	50.0MM ‡
CHEST VISCOUS CRITERIA		0.49M/SEC	1.00M/SEC
FEMUR COMP, LEFT		7820N	10000N
FEMUR COMP, RIGHT		8174N	10000N
FEMUR DURATION ASSESS, LEFT		0.87	1.00
FEMUR DURATION ASSESS, RIGHT		0.90	1.00
TIBIA/FEMUR DISP, LEFT		4.7MM	15.0MM
TIBIA/FEMUR DISP, RIGHT		0.0MM	15.0MM
KNEE CLEVIS, LEFT INSIDE		2254N	4000N
KNEE CLEVIS, LEFT OUTSIDE		1837N	4000N
KNEE CLEVIS, RIGHT INSIDE		2073N	4000N
KNEE CLEVIS, RIGHT OUTSIDE		2366N	4000N
TIBIA COMP, LEFT		3643N	8000N
TIBIA COMP, RIGHT		3957N	8000N
TIBIA MOM, UPPER, LEFT	***	342NM	225NM
TIBIA MOM, UPPER, RIGHT		306NM	225NM
TIBIA MOM, LOWER, LEFT		OVERLOADED	225NM
TIBIA MOM, LOWER, RIGHT	***	372NM	225NM
LEG INDEX, UPPER LEFT	***	1.55	1.00
LEG INDEX, UPPER RIGHT		1.46	1.00
LEG INDEX, LOWER LEFT		OVERLOADED	1.00
LEG INDEX, LOWER RIGHT	***	1.76	1.00

IAV - INJURY ASSESSMENT VALUE
IARV - INJURY ASSESSMENT REFERENCE VALUE

‡ RESTRAINT SYSTEM DEPENDENT. CHOOSE VALUE THAT APPLIES TO THIS TEST.

*** VALUE GREATER THAN 150% OF IAV

RIGHT FRONT
ANTHROPOMORPHIC TEST DEVICE SUMMARY DATA
MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

C11226 L. FRT IMP 50% OVERLAP
R & D CTR 8T9306D VAN

ATD TYPE: GM50H
TEST DATE: 08/14/1996

MEASURED QUANTITY	100% OF IARV	150% OF IARV	IAV VALUE	IARV
HIC, LIMITED TO 15 MS			450	1000
HIC, LIMITED TO 36 MS			680	1000
NECK FLEXION			43NM	190NM
NECK EXTENSION			20NM	57NM
NECK TENSION			0.34	1.00
NECK COMPRESSION			0.31	1.00
NECK SHEAR FORWARD			0.18	1.00
NECK SHEAR REARWARD			0.05	1.00
CHEST ACCEL			56G	60G
† CHEST COMPRESSION W/O SH BELT			44.8MM	65.0MM †
† CHEST COMPRESSION W/ SH BELT			44.8MM	50.0MM †
CHEST VISCOUS CRITERIA			0.24M/SEC	1.00M/SEC
FEMUR COMP, LEFT			4980N	10000N
FEMUR COMP, RIGHT			5812N	10000N
FEMUR DURATION ASSESS, LEFT			0.59	1.00
FEMUR DURATION ASSESS, RIGHT			0.64	1.00
TIBIA/FEMUR DISP, LEFT			0.5MM	15.0MM
TIBIA/FEMUR DISP, RIGHT			0.6MM	15.0MM
KNEE CLEVIS, LEFT INSIDE			3244N	4000N
KNEE CLEVIS, LEFT OUTSIDE			1175N	4000N
KNEE CLEVIS, RIGHT INSIDE			2065N	4000N
KNEE CLEVIS, RIGHT OUTSIDE			2318N	4000N
TIBIA COMP, LEFT			5315N	8000N
TIBIA COMP, RIGHT			2900N	8000N
TIBIA MOM, UPPER, LEFT			220NM	225NM
TIBIA MOM, UPPER, RIGHT			133NM	225NM
TIBIA MOM, LOWER, LEFT			51NM	225NM
TIBIA MOM, LOWER, RIGHT			115NM	225NM
LEG INDEX, UPPER LEFT			1.13	1.00
LEG INDEX, UPPER RIGHT			0.62	1.00
LEG INDEX, LOWER LEFT			0.34	1.00
LEG INDEX, LOWER RIGHT			0.57	1.00

IAV - INJURY ASSESSMENT VALUE
IARV - INJURY ASSESSMENT REFERENCE VALUE

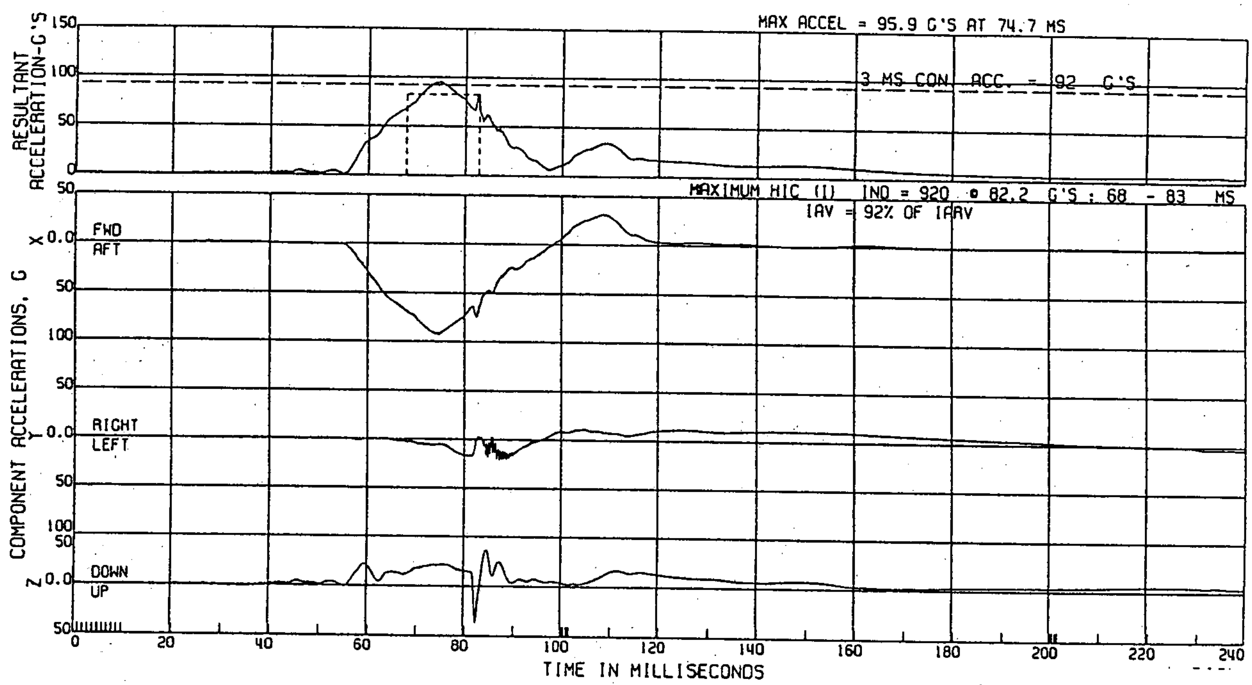
† RESTRAINT SYSTEM DEPENDENT. CHOOSE VALUE THAT APPLIES TO THIS TEST.

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

L. FRT HEAD ACCEL.
(HIC I LIMITED TO 15MS)

ATD TYPE: GM50H
TEST DATE:08/14/1996



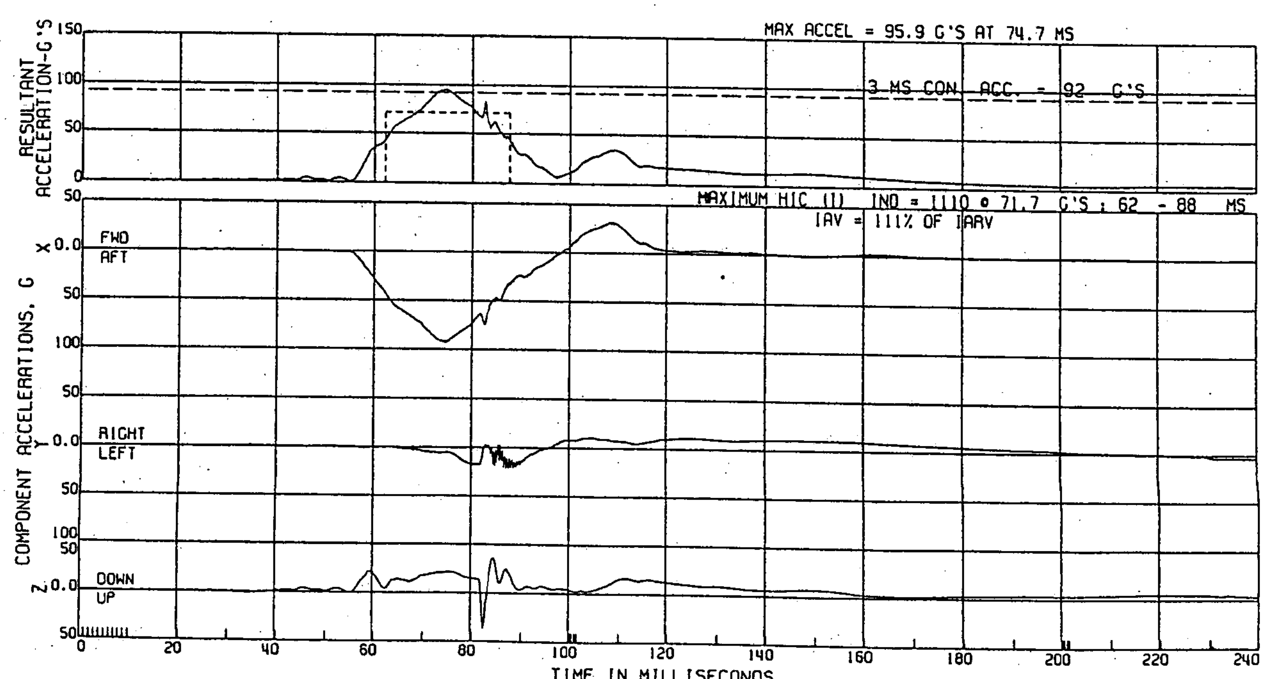
Appendix F, plot # 1

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

L. FRT HEAD ACCEL.
(HIC I LIMITED TO 36MS)

ATD TYPE: GM50H
TEST DATE:08/14/1996



Appendix F, plot # 2

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

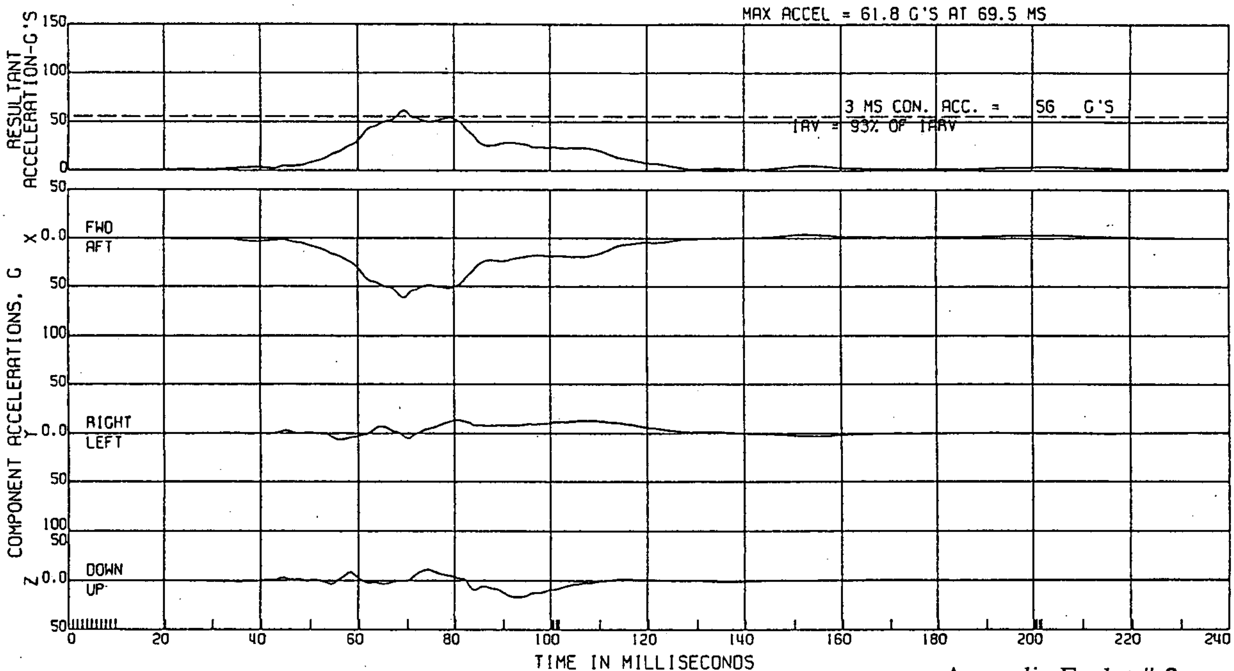
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 180

L. FRT CHEST ACCEL.

ATD TYPE: GM50H

TEST DATE:08/14/1996



Appendix F, plot # 3

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

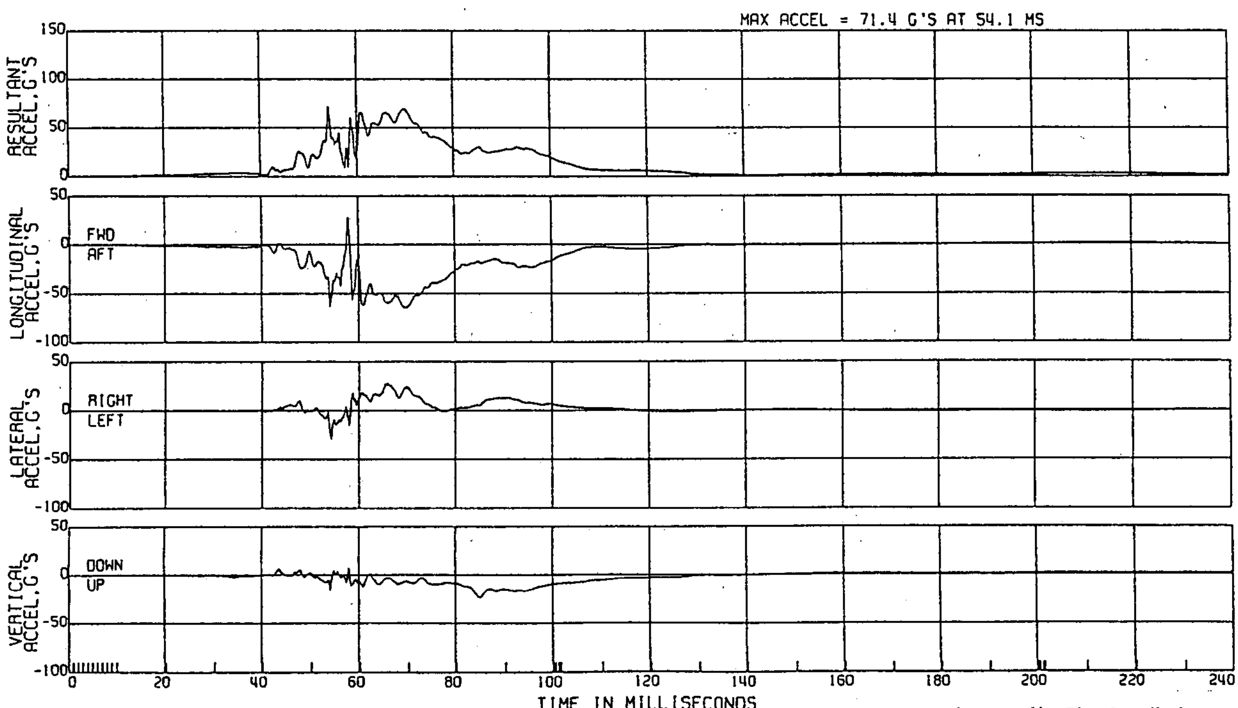
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

L. FRT PELVIC ACCEL.

ATD TYPE: GM50H

TEST DATE:08/14/1996



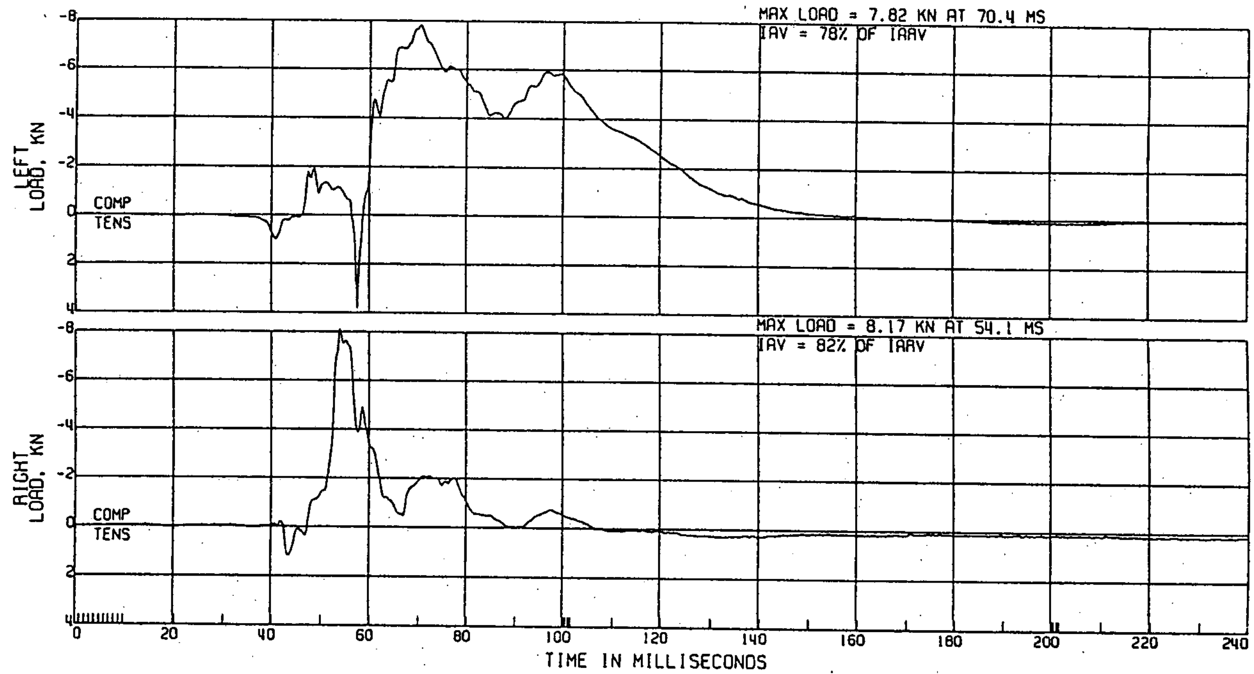
Appendix F, plot # 4

C11226 L. FRT IMP 50% OVERLAP   MOVING VEH TO 345 DEG ANGLED BARR   60.0KM/H

R & D CTR   8T9306D VAN
ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD

ATD TYPE: GM50H
TEST DATE:08/14/1996



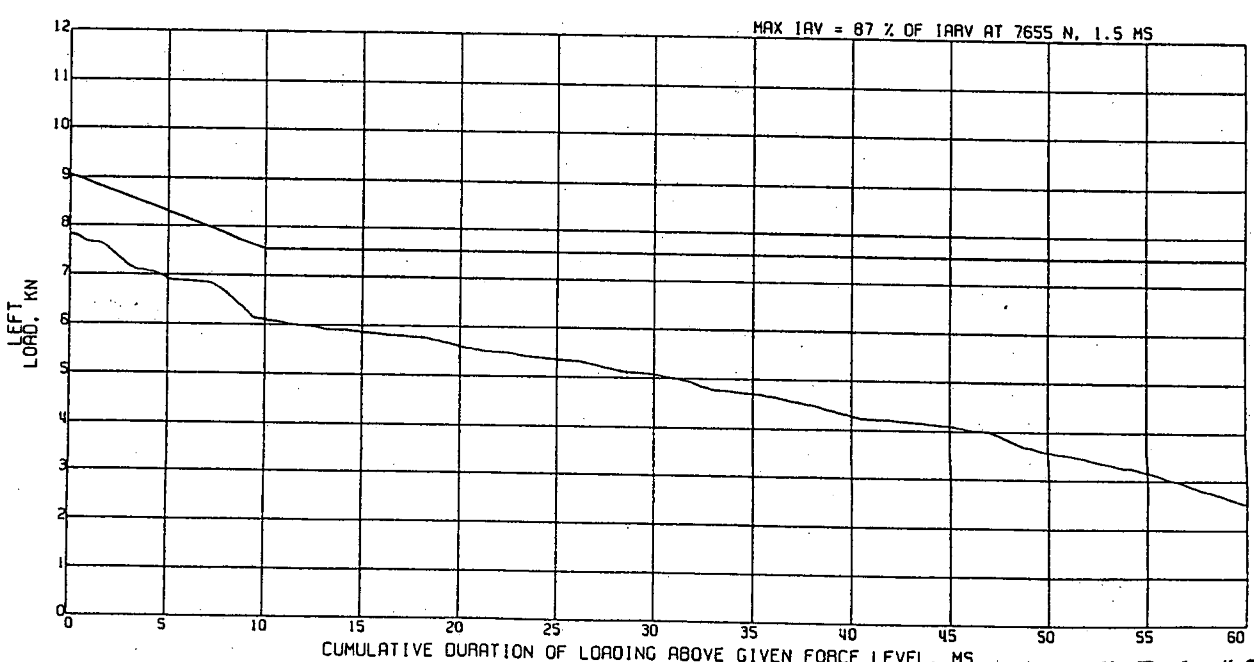
Appendix F, plot # 5

C11226 L. FRT IMP 50% OVERLAP   MOVING VEH TO 345 DEG ANGLED BARR   60.0KM/H

R & D CTR   8T9306D VAN
ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD
DURATION ASSESSMENT

ATD TYPE: GM50H
TEST DATE:08/14/1996



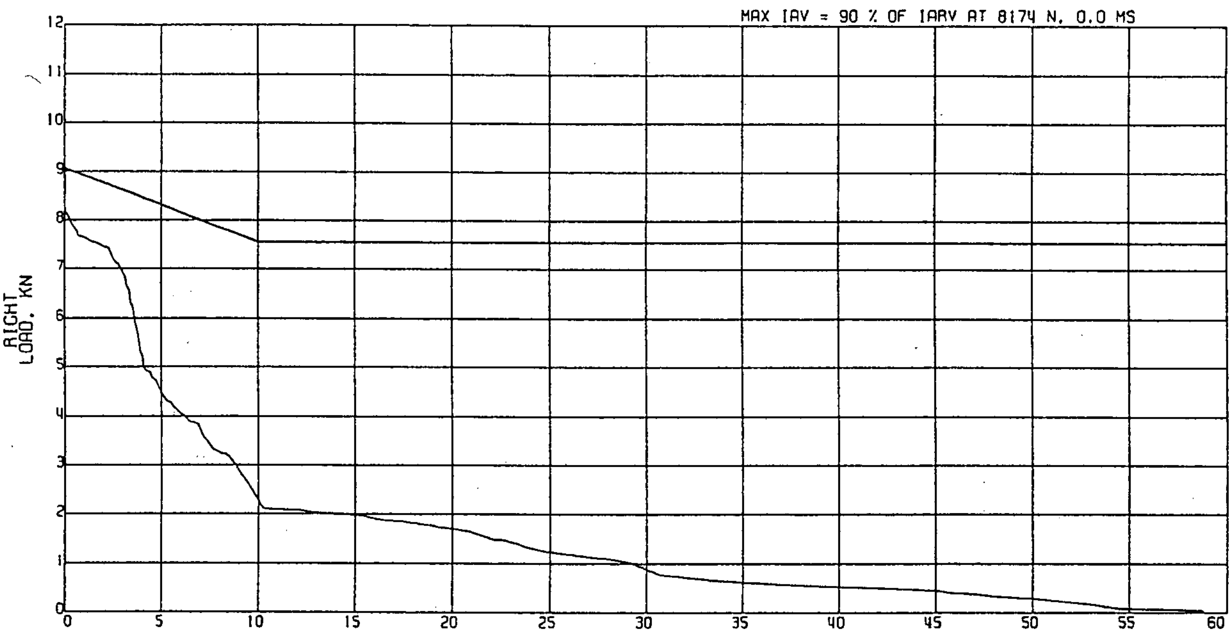
Appendix F, plot # 6

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD
DURATION ASSESSMENT

ATD TYPE: GM50H
TEST DATE:08/14/1996



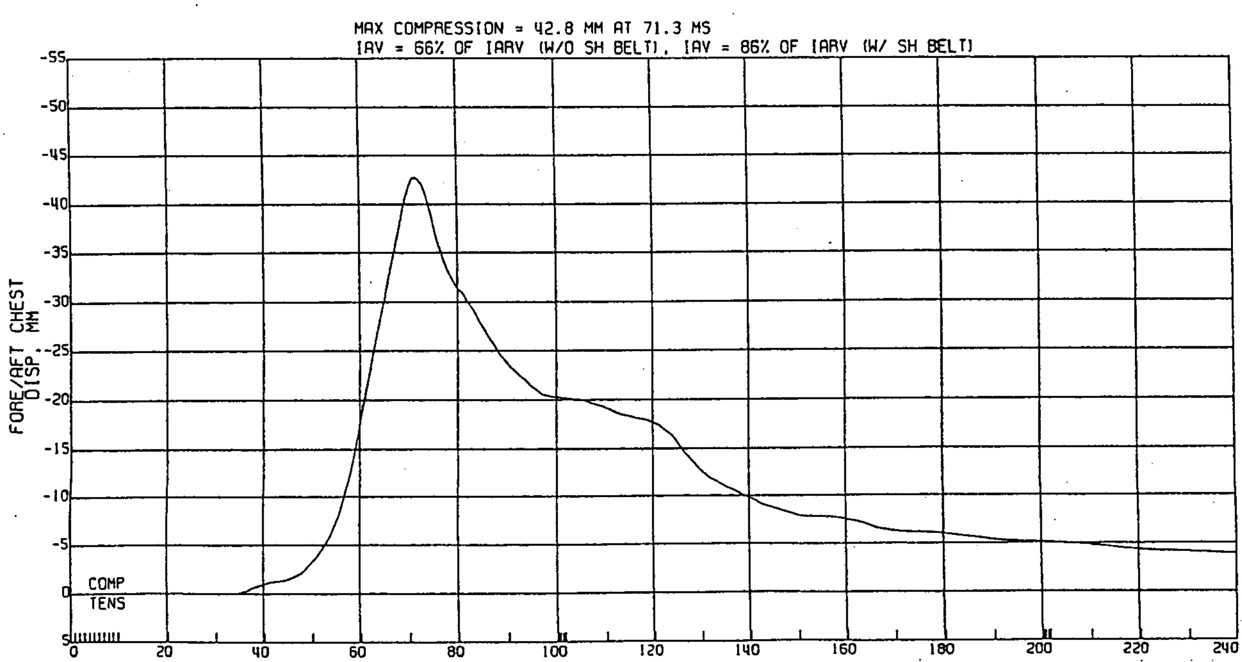
Appendix F, plot # 7

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 180

L. FRT CHEST DISP, TEMP AT 72.4'F
NORMALIZED TO 70.7'F & PART 572 CORRIDOR

ATD TYPE: GM50H
TEST DATE:08/14/1996

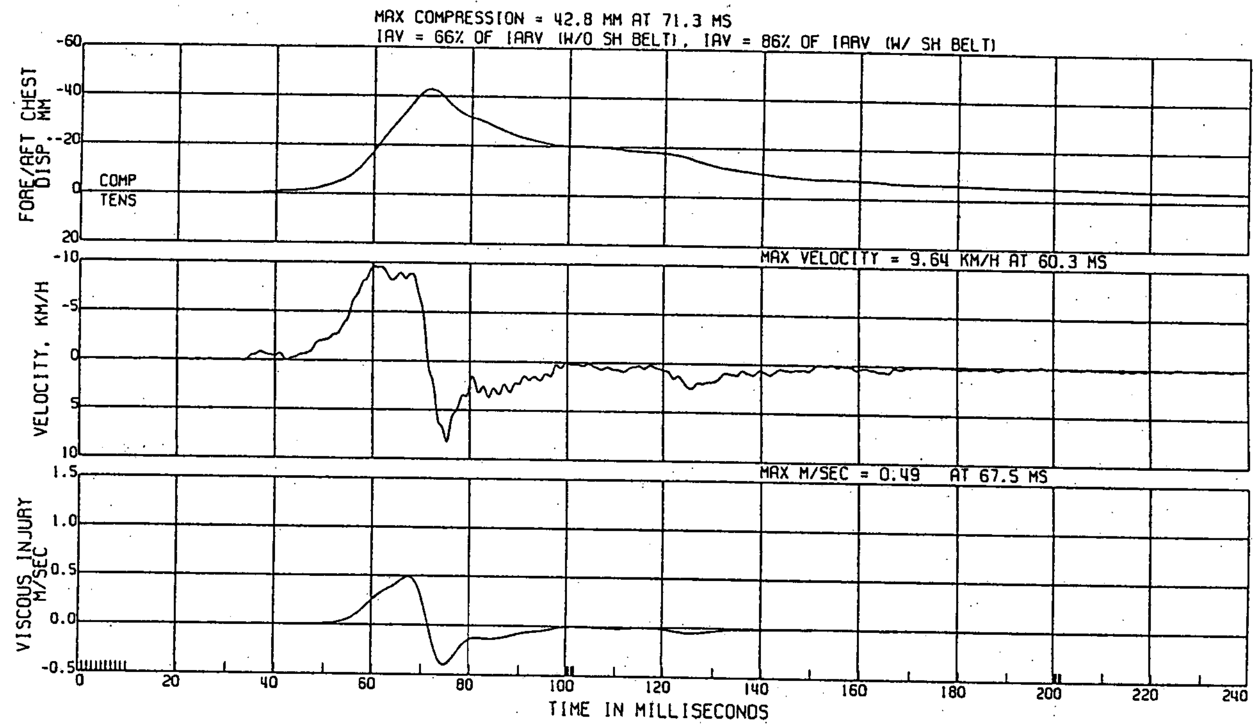


Appendix F, plot # 8

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN L. FRT CHEST COMPRESSIVE DISP. ATD TYPE: GM50H
ELEC DATA, SAE CLASS 180 TEST DATE:08/14/1996

NORMALIZED, W/CALC VEL & VISCOUS INJURY

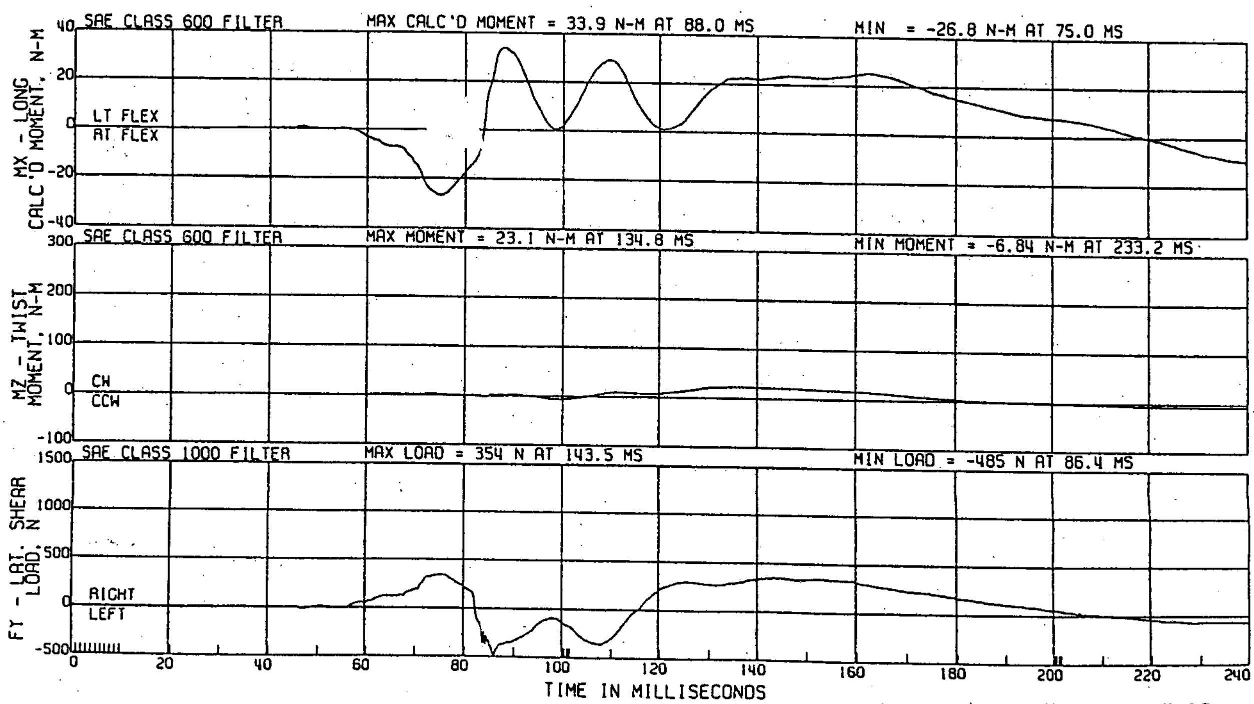


Appendix F, plot # 9

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN L. FRT NECK LOADING ON HEAD, UPPER LOAD ATD TYPE: GM50H
ELEC DATA TEST DATE:08/14/1996

L. FRT NECK LOADING ON HEAD



Appendix F, plot # 10

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

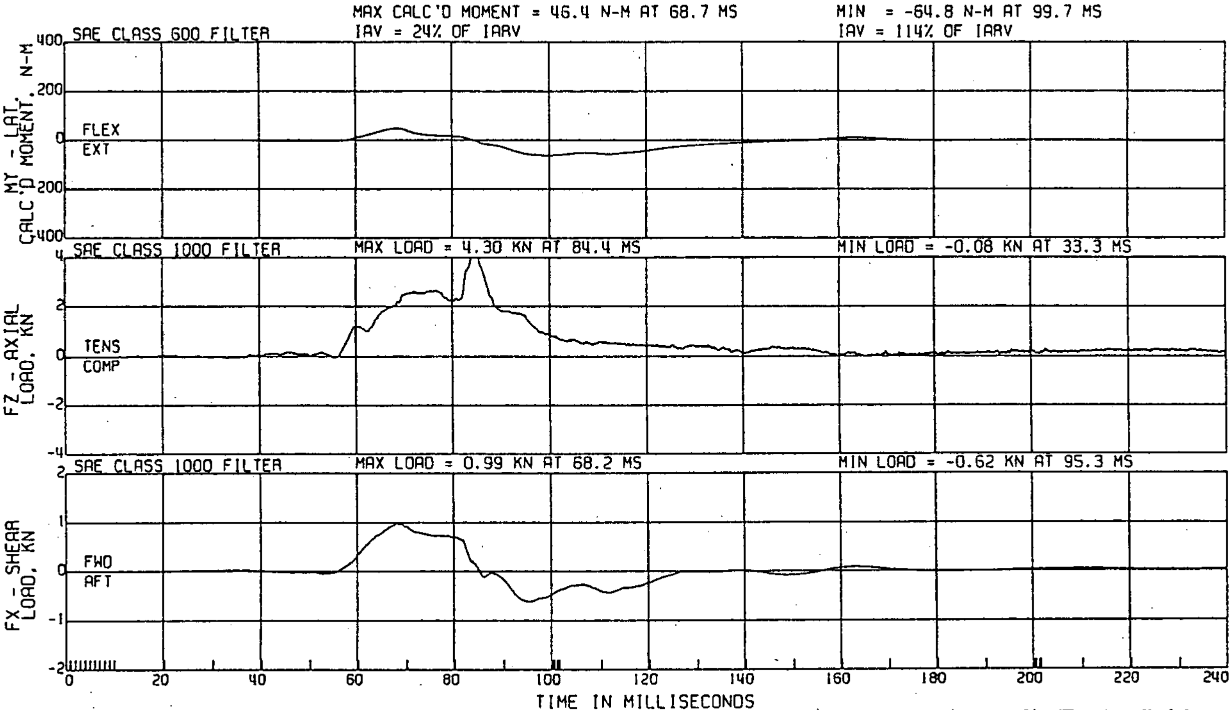
R & D CTR 8T9306D VAN

ELEC DATA

NECK LOADING ON HEAD

ATD TYPE: GM50H
TEST DATE:08/14/1996

L. FRT NECK LOADING ON HEAD



Appendix F, plot **# 11**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

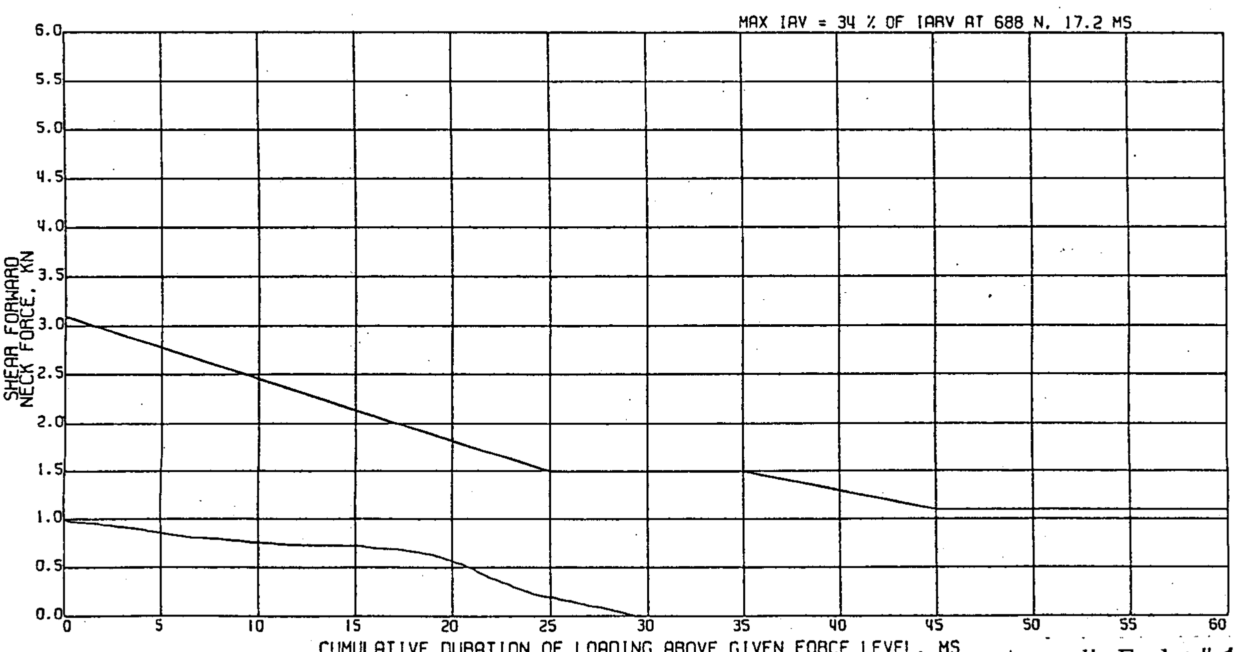
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

FORWARD NECK SHEAR ON HEAD,

L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:08/14/1996



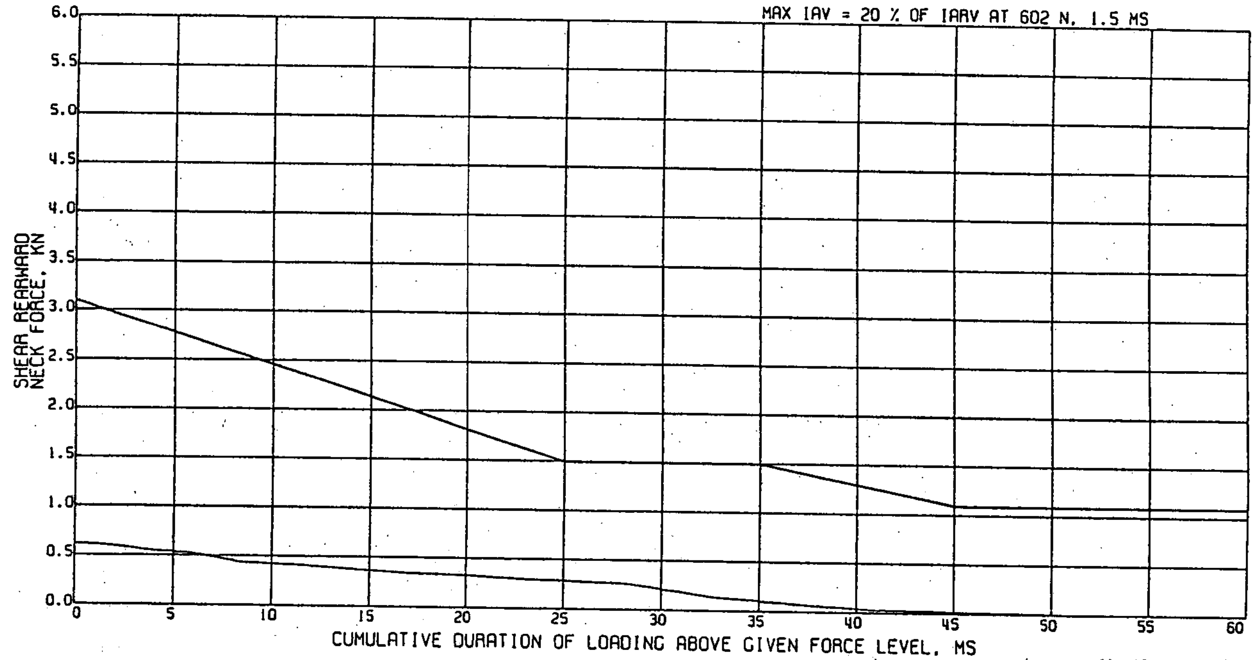
Appendix F, plot **# 12**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:08/14/1996



Appendix F, plot # 13

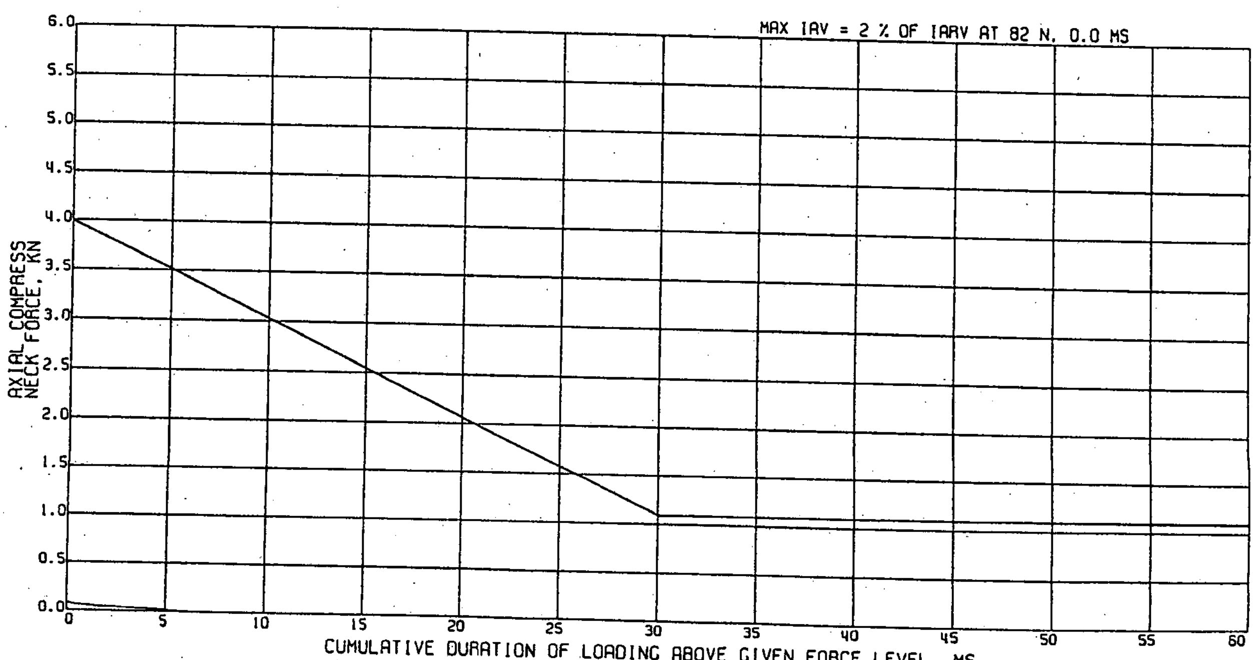
13

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:08/14/1996



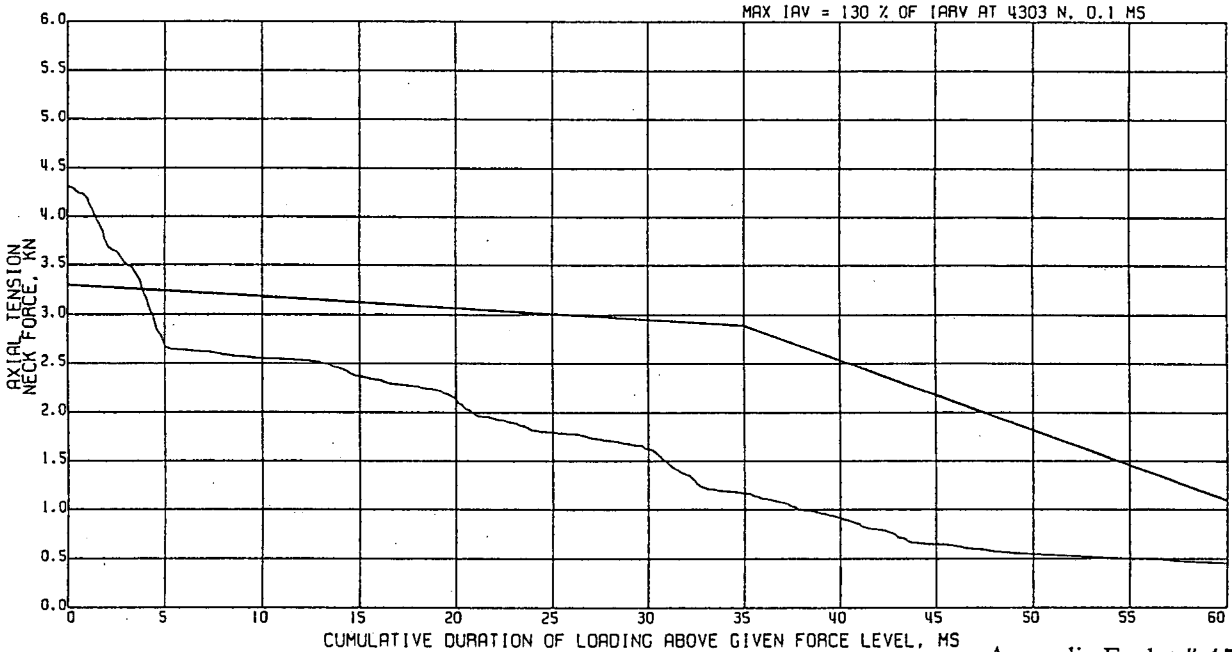
Appendix F, plot # 14

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

AXIAL TENSION ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:08/14/1996



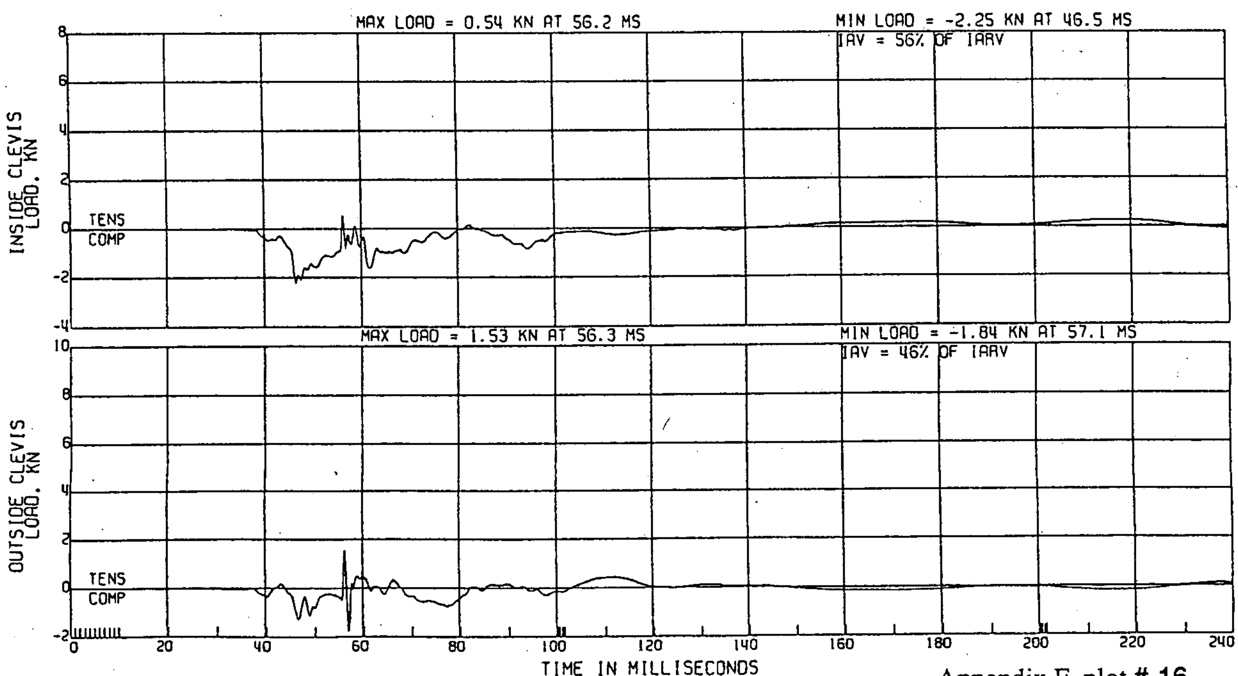
Appendix F, plot # 15

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 600

L. FRT LEFT KNEE CLEVIS LOAD

ATD TYPE: GM50H
TEST DATE:08/14/1996



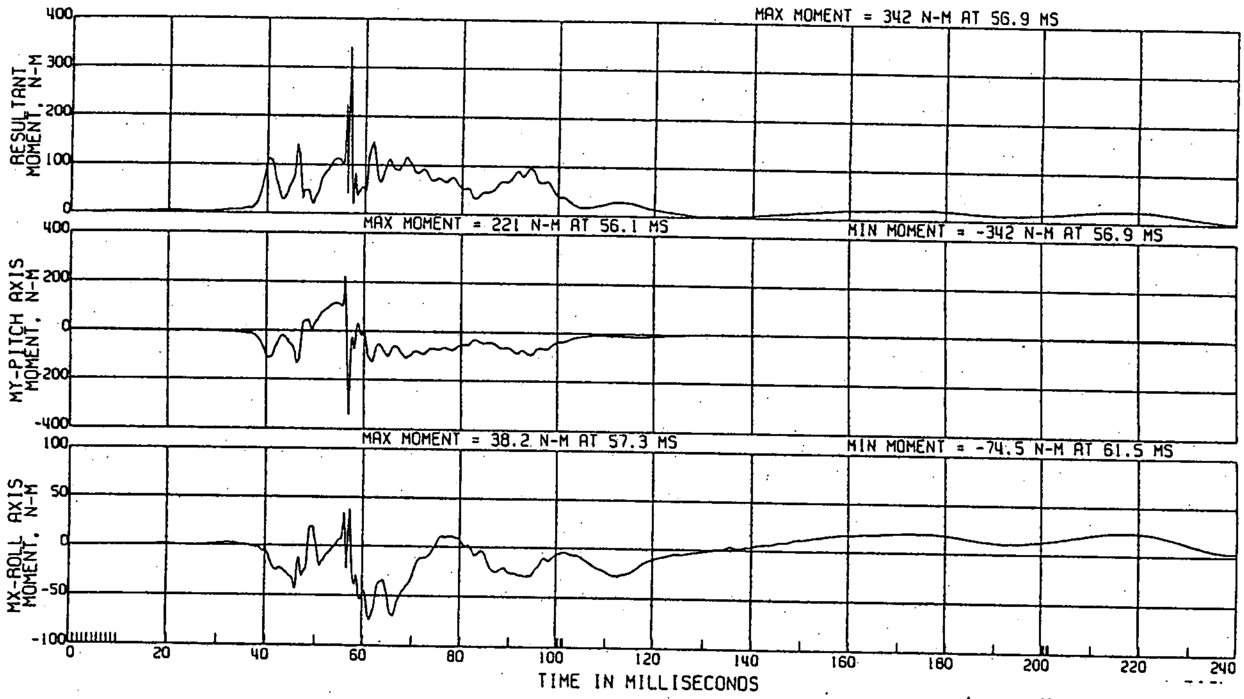
Appendix F, plot # 16

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 600

L. FRT LEFT TIBIA UPPER MOMENT

ATD TYPE: GM50H
TEST DATE:08/14/1996



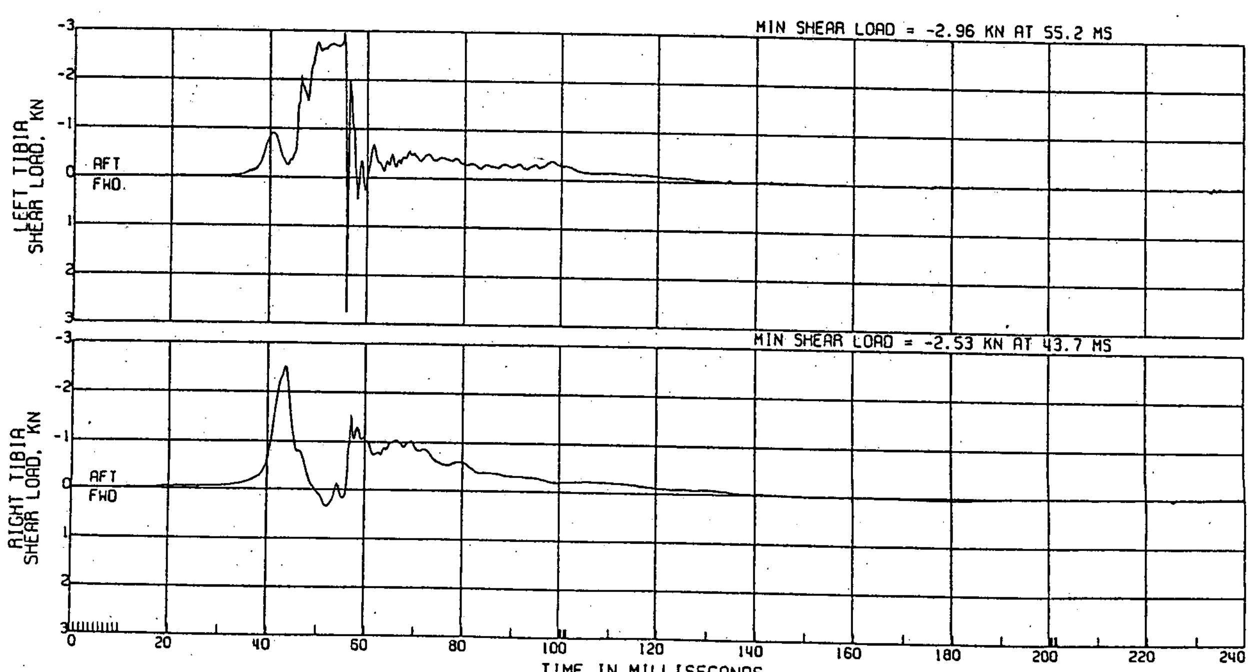
Appendix F, plot # 17

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:08/14/1996

L. FRT TIBIA LOWER SHEAR LOAD CELLS



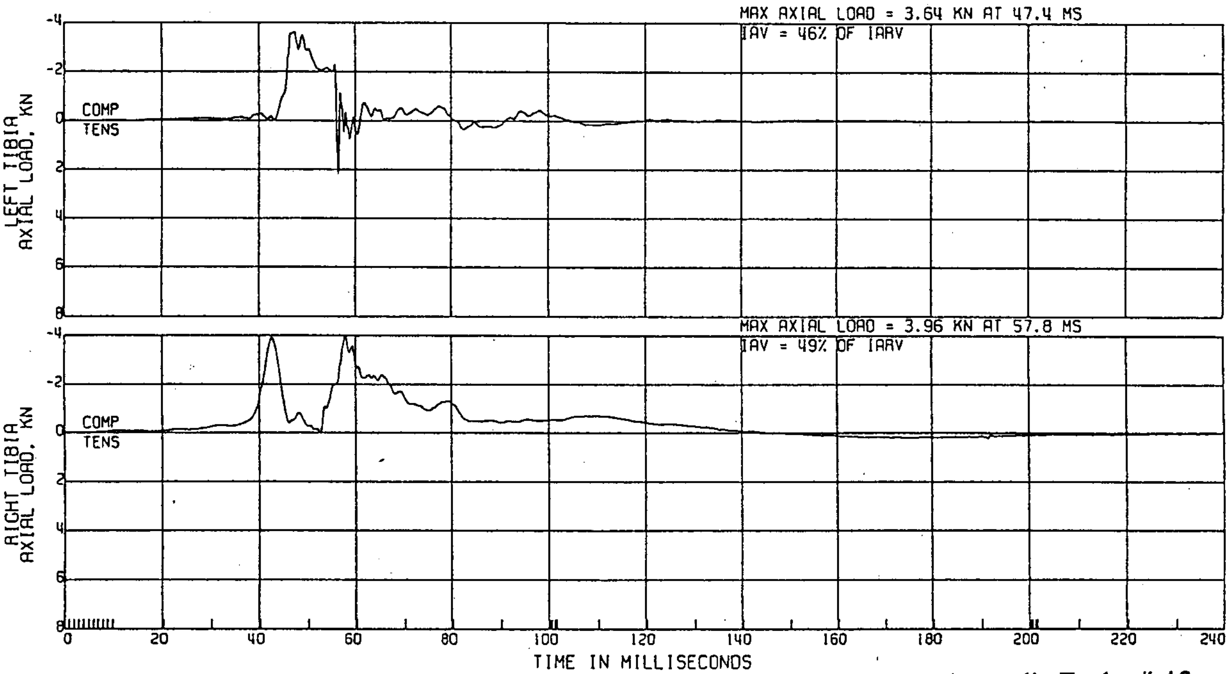
Appendix F, plot # 18

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:08/14/1996

L. FRT TIBIA LOWER AXIAL LOAD



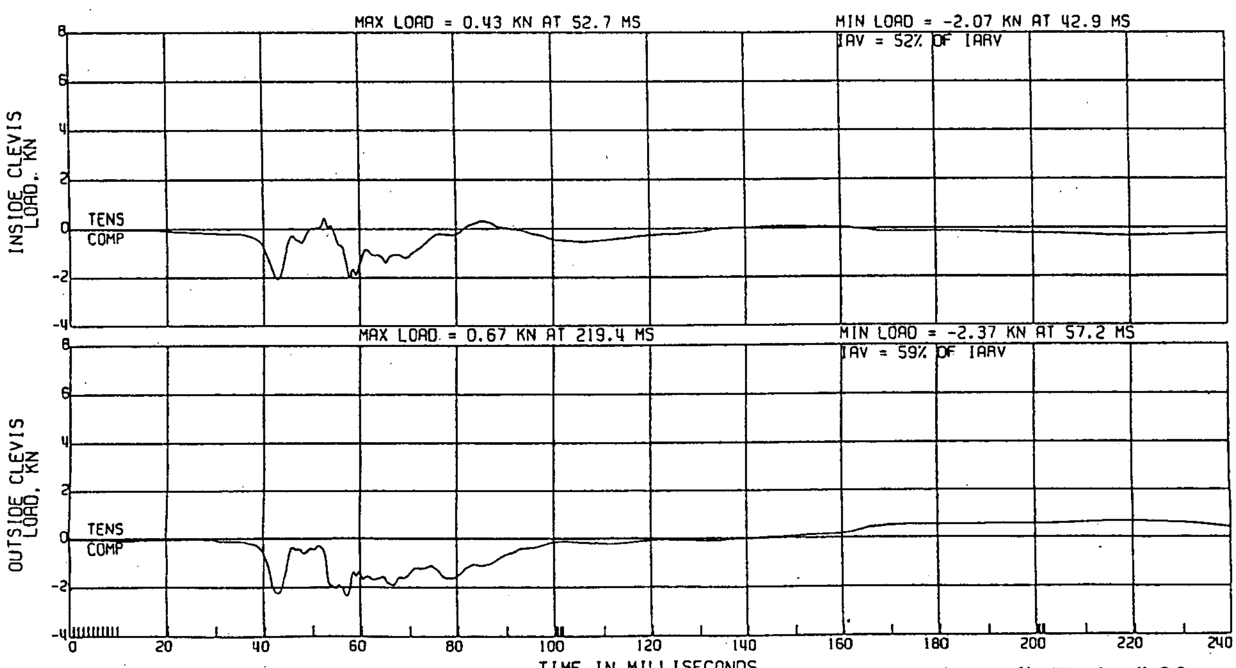
Appendix F, plot # 19

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:08/14/1996

L. FRT RIGHT KNEE CLEVIS LOAD



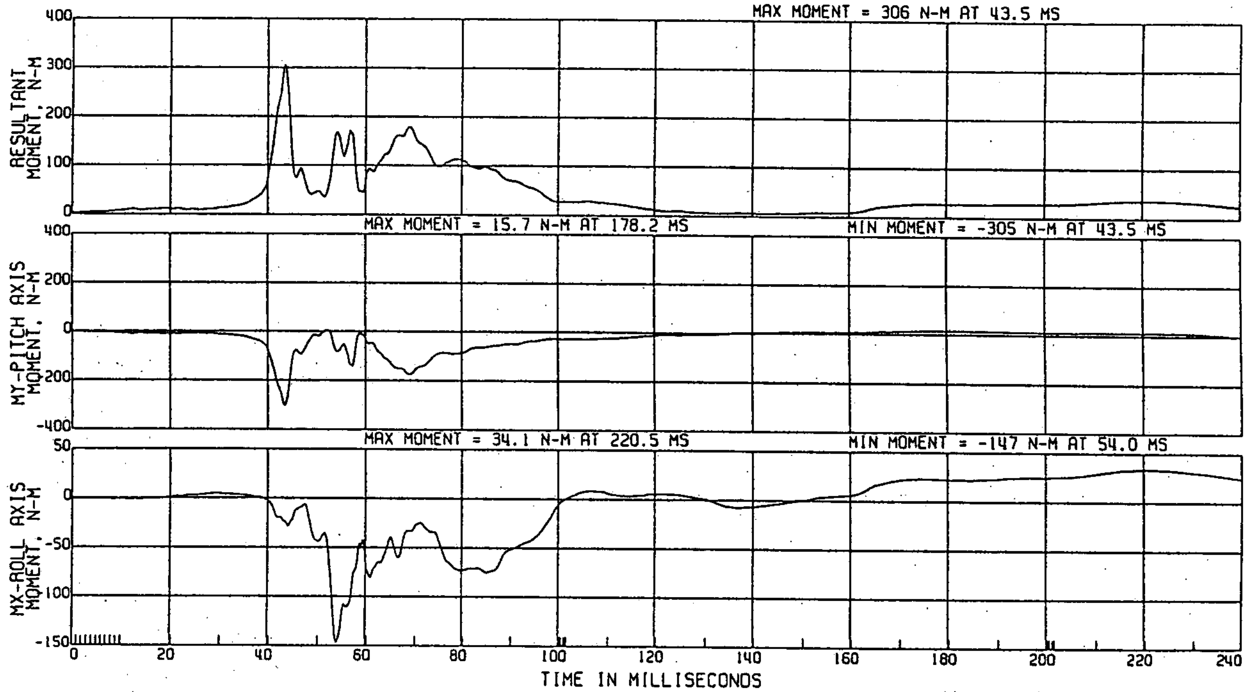
Appendix F, plot # 20

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 600

L. FRT RIGHT TIBIA UPPER MOMENT

ATD TYPE: GM50H
TEST DATE:08/14/1996



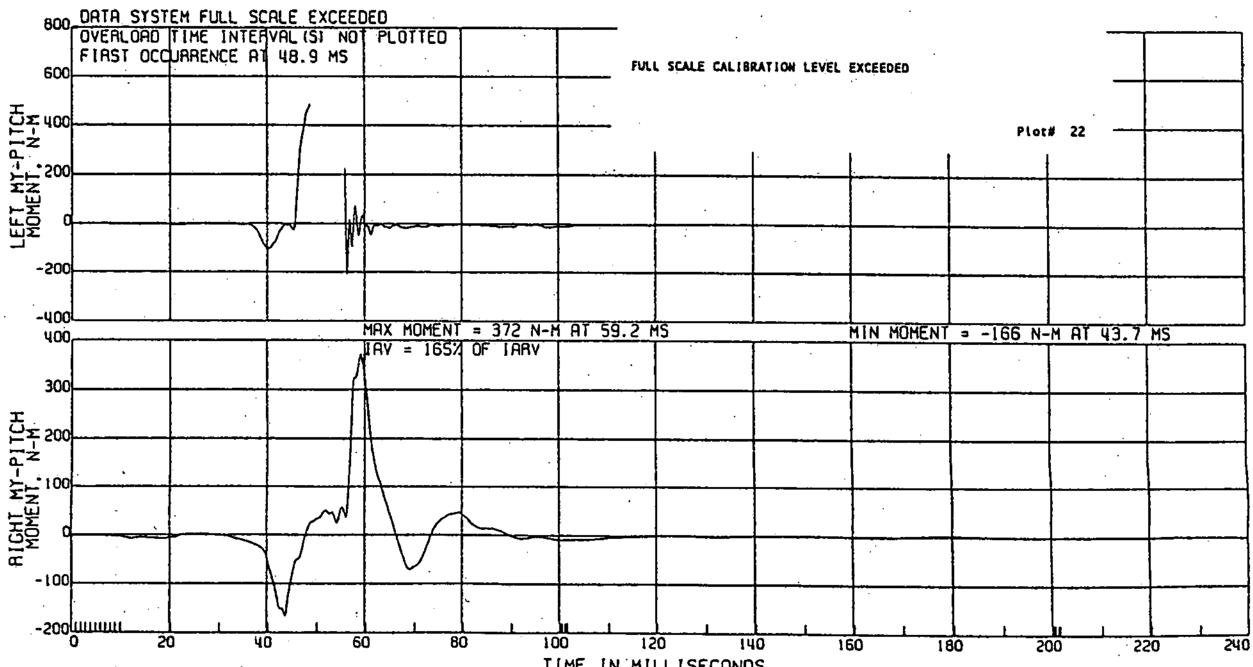
Appendix F, plot # **21**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:08/14/1996

L. FRT TIBIA LOWER BENDING MOMENTS



Appendix F, plot # **22**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

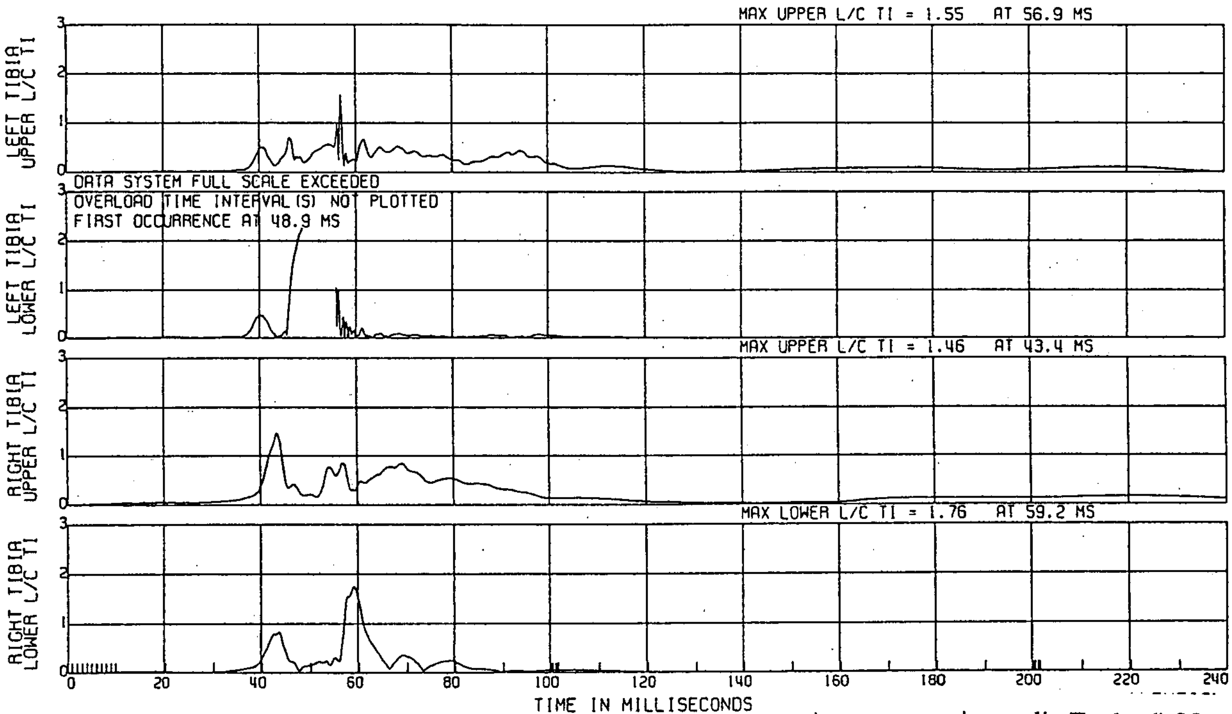
R & D CTR 8T930GD VAN

ELEC DATA, SAE CLASS 600

L. FRT TIBIA INDICES

ATD TYPE: GM50H
TEST DATE:08/14/1996

TI = (RES MOM/225 NM) + (AXIAL/35900 N)



Appendix F, plot # **23**

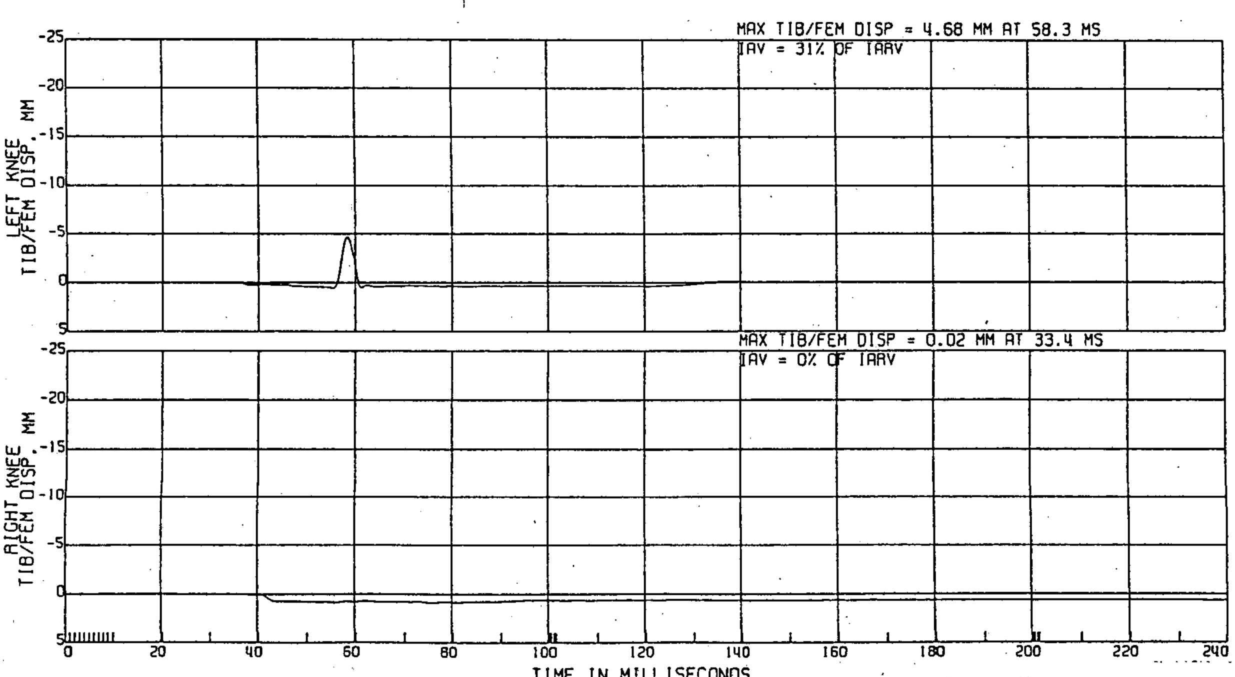
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T930GD VAN

ELEC DATA, SAE CLASS 180

L. FRT TIBIA/FEMUR DISPLACEMENT

ATD TYPE: GM50H
TEST DATE:08/14/1996



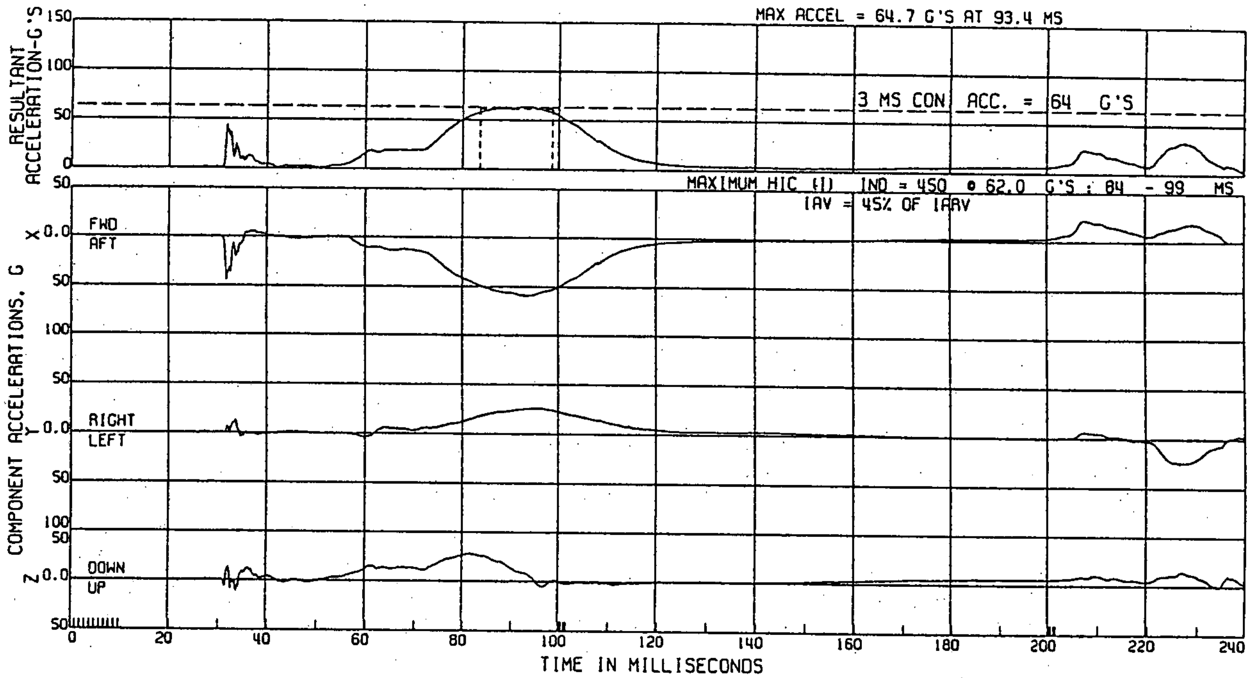
Appendix F, plot # **24**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 1000

R. FRT HEAD ACCEL.
(HIC I LIMITED TO 15MS)

ATD TYPE: GM50H
TEST DATE:08/14/1996



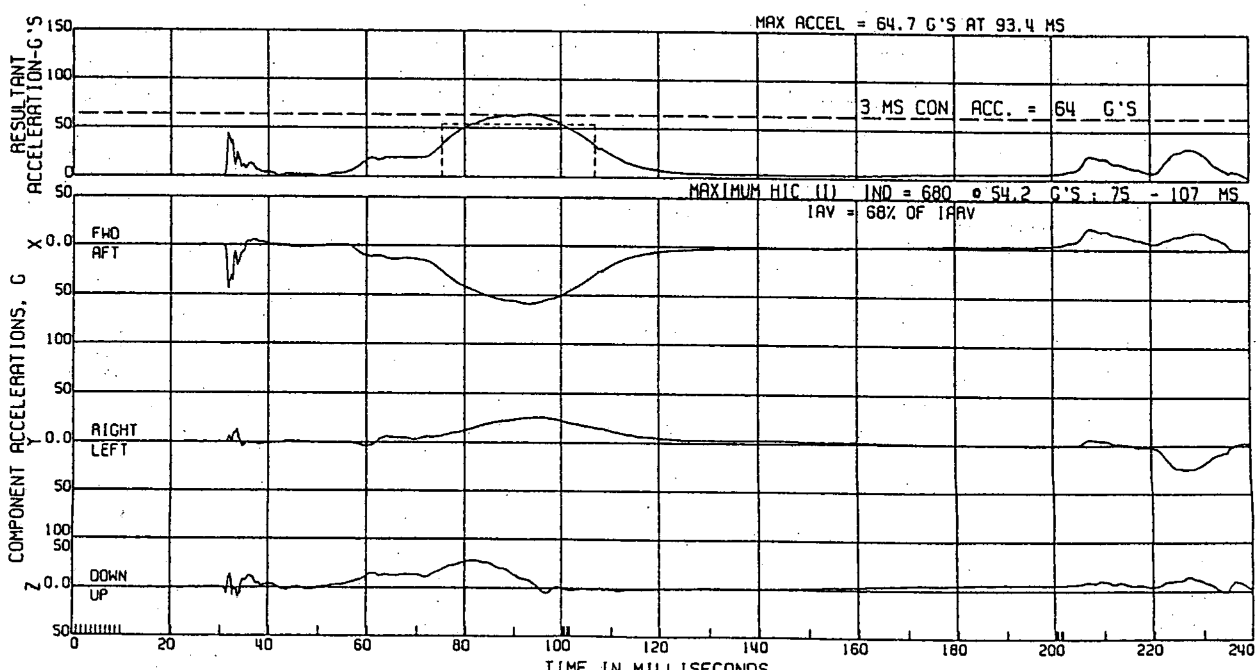
Appendix F, plot # 25

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 1000

R. FRT HEAD ACCEL.
(HIC I LIMITED TO 36MS)

ATD TYPE: GM50H
TEST DATE:08/14/1996



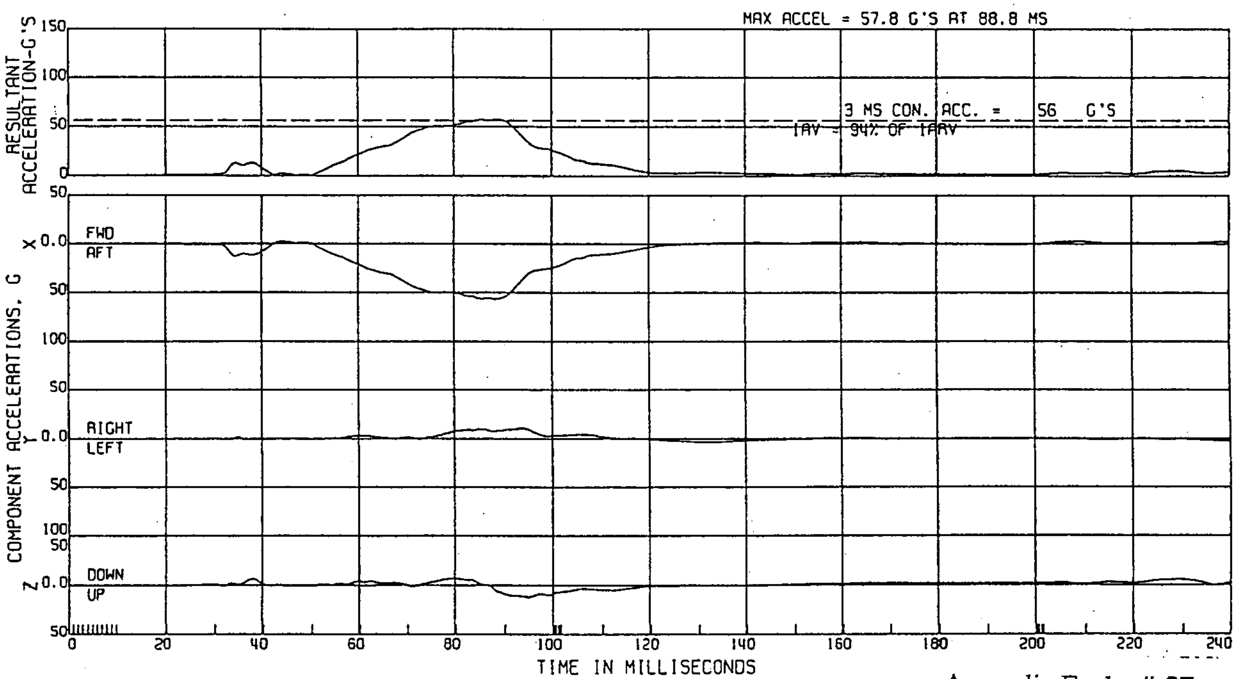
Appendix F, plot # 26

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 180

R. FRT CHEST ACCEL.

ATD TYPE: GM50H
TEST DATE:08/14/1996



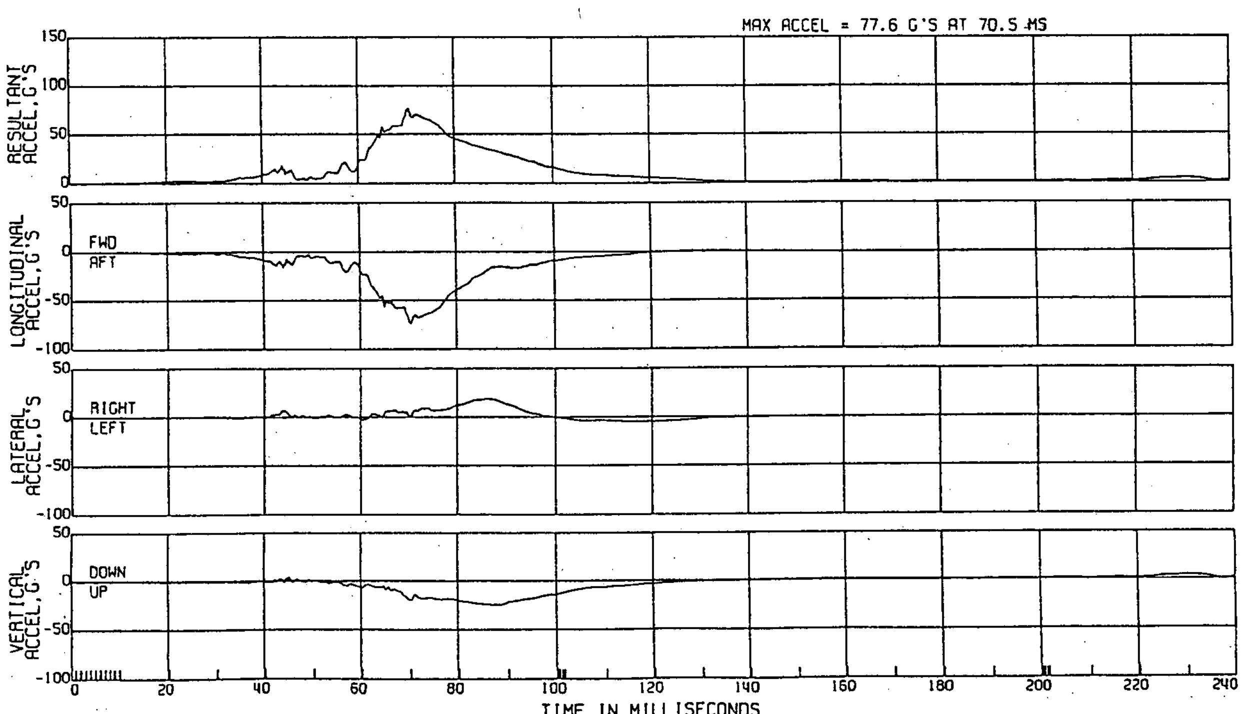
Appendix F, plot # **27**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

R. FRT PELVIC ACCEL.

ATD TYPE: GM50H
TEST DATE:08/14/1996



Appendix F, plot # **28**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

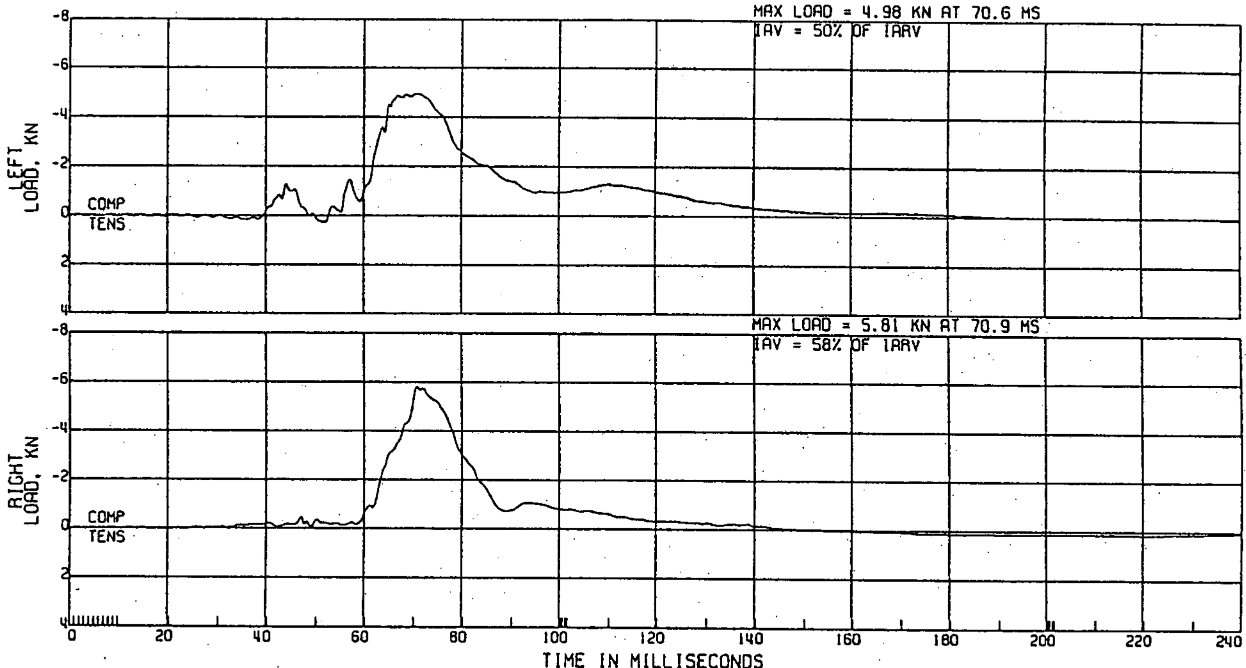
R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 600

R. FRT FEMUR LOAD

ATD TYPE: GM50H

TEST DATE:08/14/1996



Appendix F, plot # 29

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN

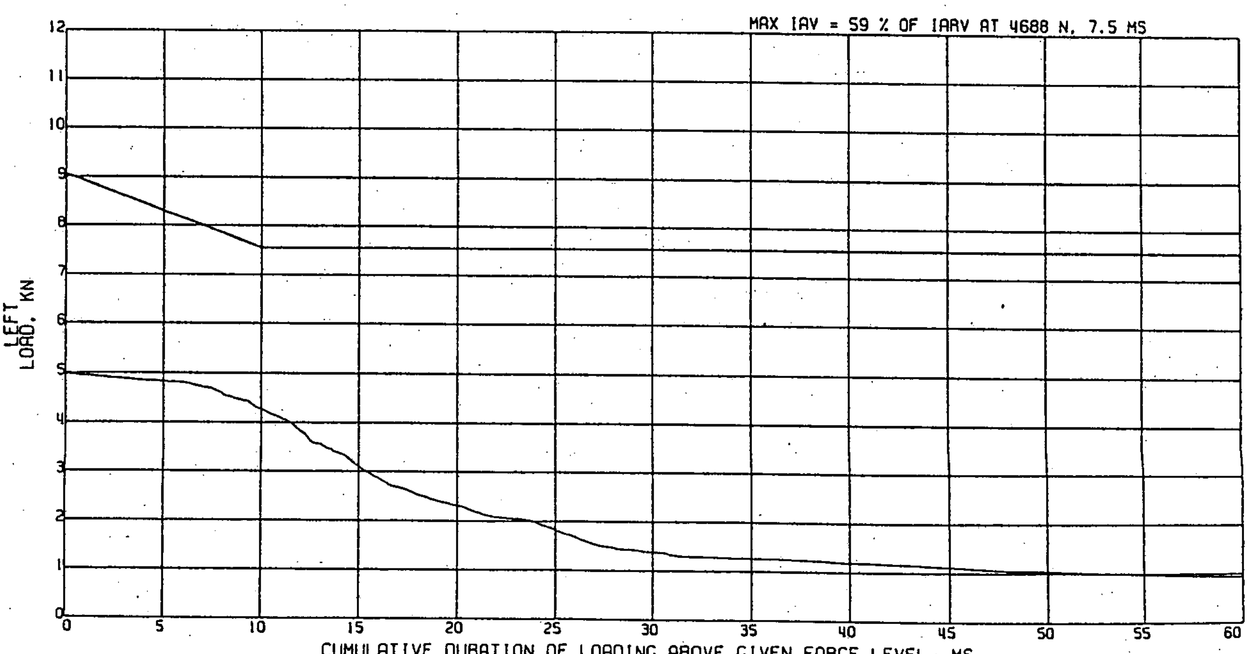
ELEC DATA, SAE CLASS 600

R. FRT FEMUR LOAD

DURATION ASSESSMENT

ATD TYPE: GM50H

TEST DATE:08/14/1996



Appendix F, plot # 30

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

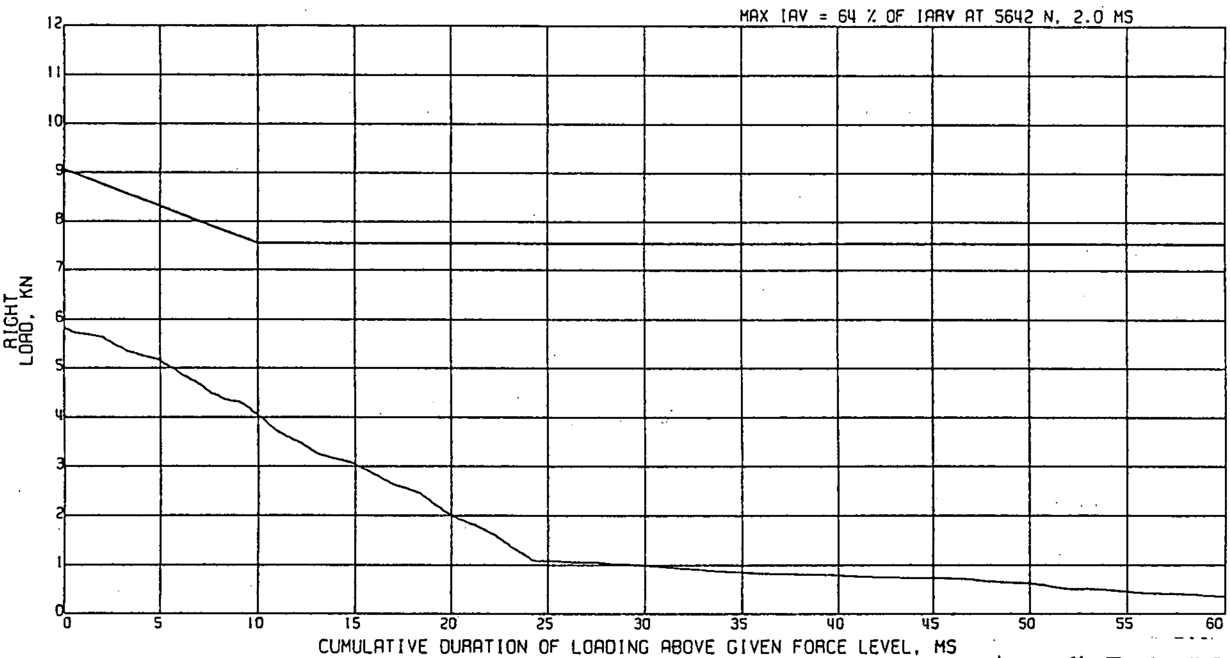
ELEC DATA, SAE CLASS 600

R. FRT FEMUR LOAD

DURATION ASSESSMENT

ATD TYPE: GM50H

TEST DATE:08/14/1996



Appendix F, plot # **31**

31

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

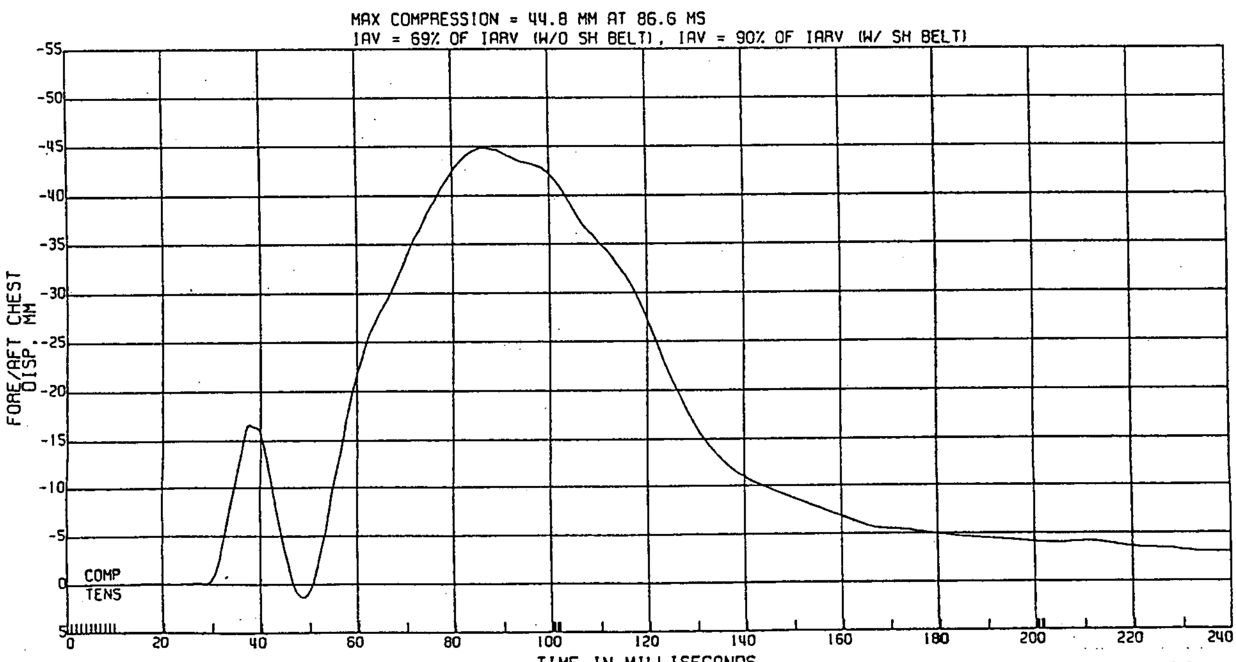
ELEC DATA, SAE CLASS 180

R. FRT CHEST DISP, TEMP AT 74.2'F

NORMALIZED TO 70.7'F & PART 572 CORRIDOR

ATD TYPE: GM50H

TEST DATE:08/14/1996



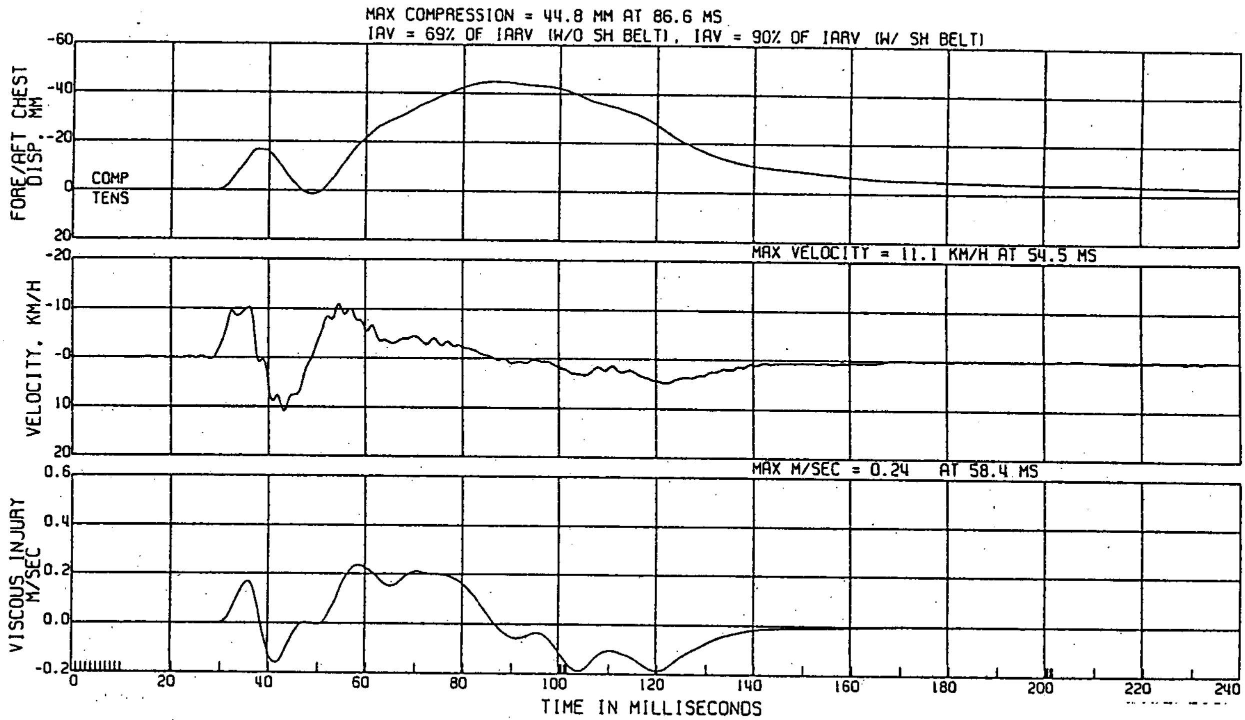
Appendix F, plot # **32**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 180

R. FRT CHEST COMPRESSIVE DISP.
NORMALIZED, W/CALC VEL & VISCOUS INJURY

ATD TYPE: GM50H
TEST DATE:08/14/1996



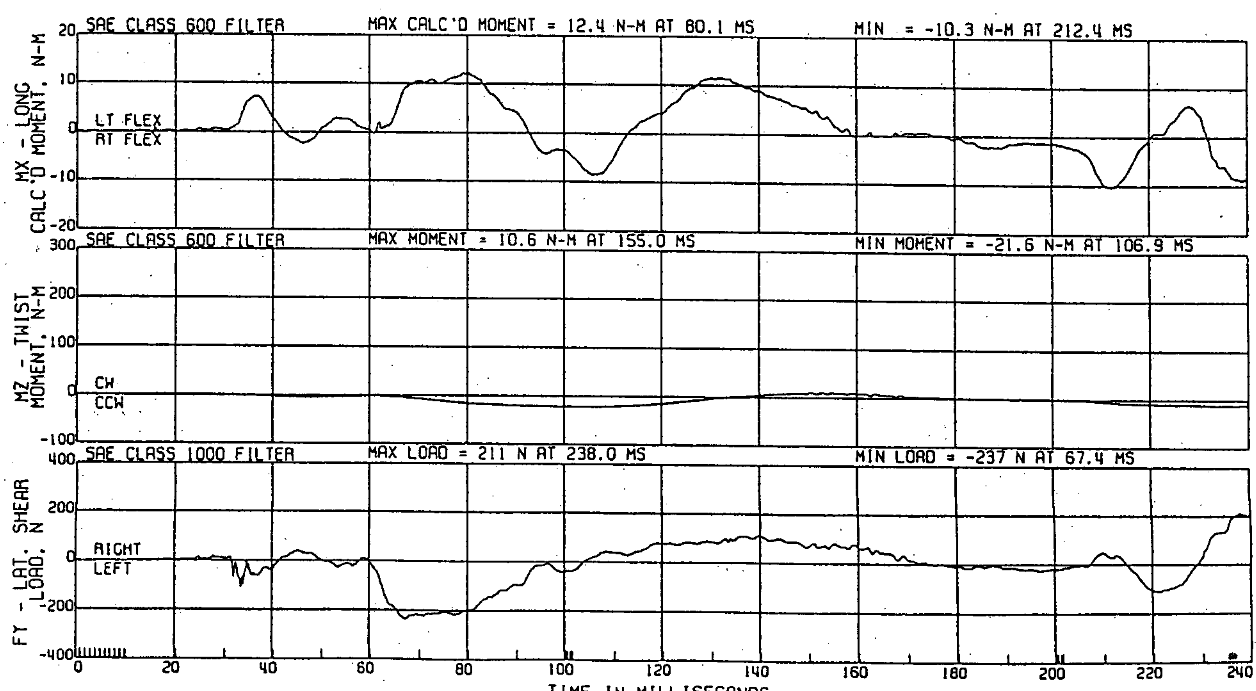
Appendix F, plot # 33

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA

R. FRT NECK LOADING ON HEAD, UPPER LOAD
R. FRT NECK LOADING ON HEAD

ATD TYPE: GM50H
TEST DATE:08/14/1996



Appendix F, plot # 34

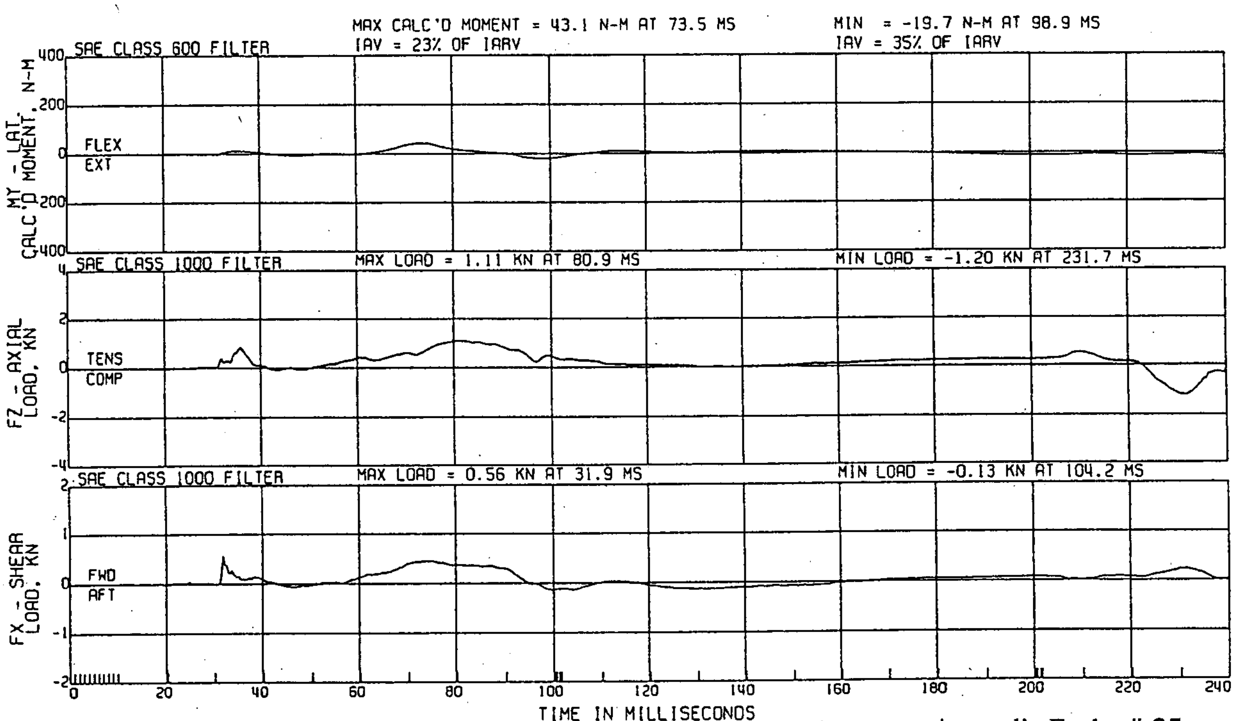
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA

NECK LOADING ON HEAD

R. FRT NECK LOADING ON HEAD

ATD TYPE: GM50H
TEST DATE:08/14/1996



Appendix F, plot # 35

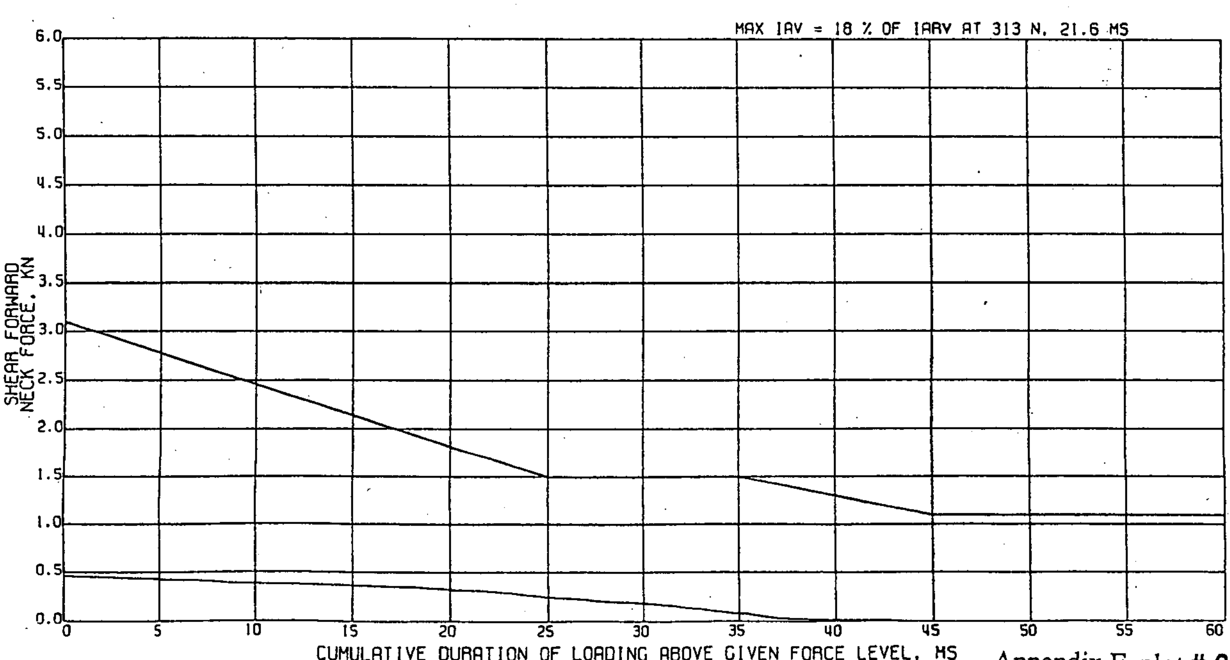
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 1000

FORWARD NECK SHEAR ON HEAD,

R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:08/14/1996



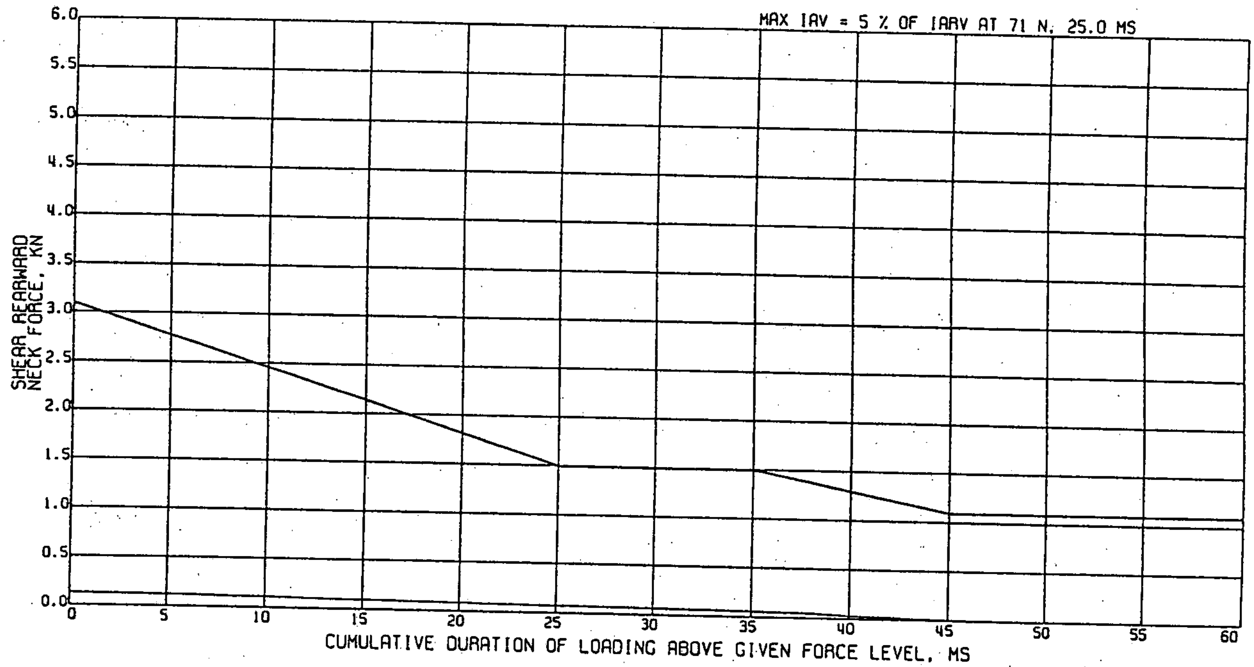
Appendix F, plot # 36

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:08/14/1996



Appendix F, plot # 37

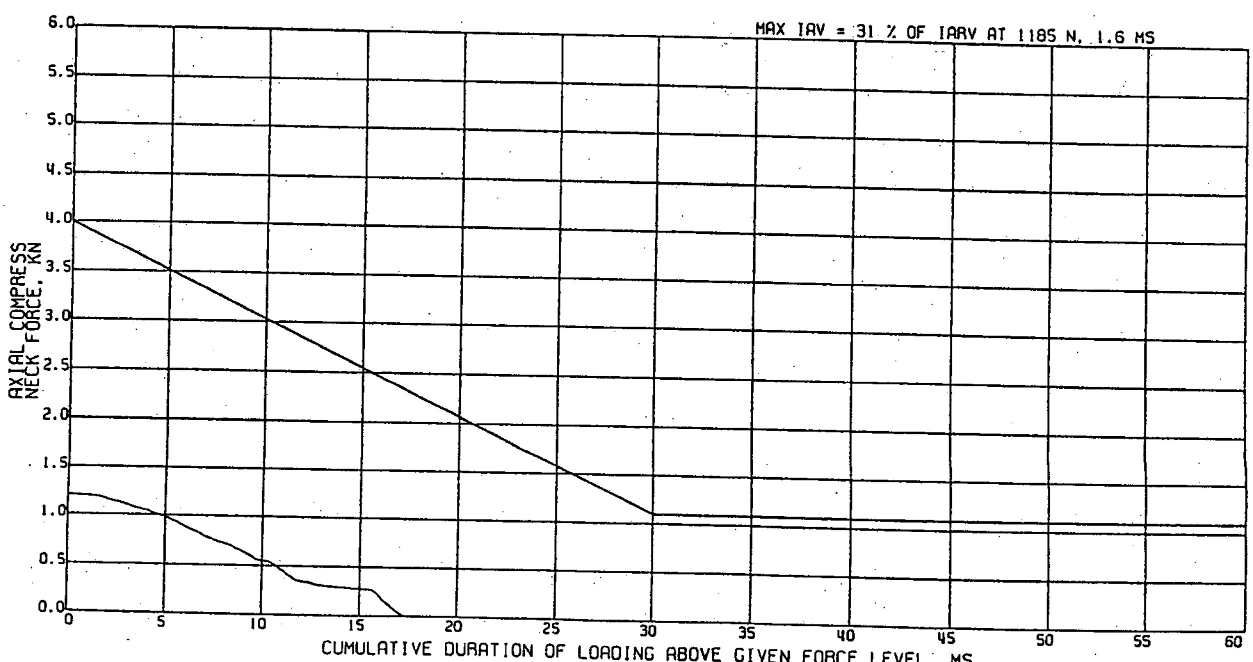
37

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:08/14/1996



Appendix F, plot # 38

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN

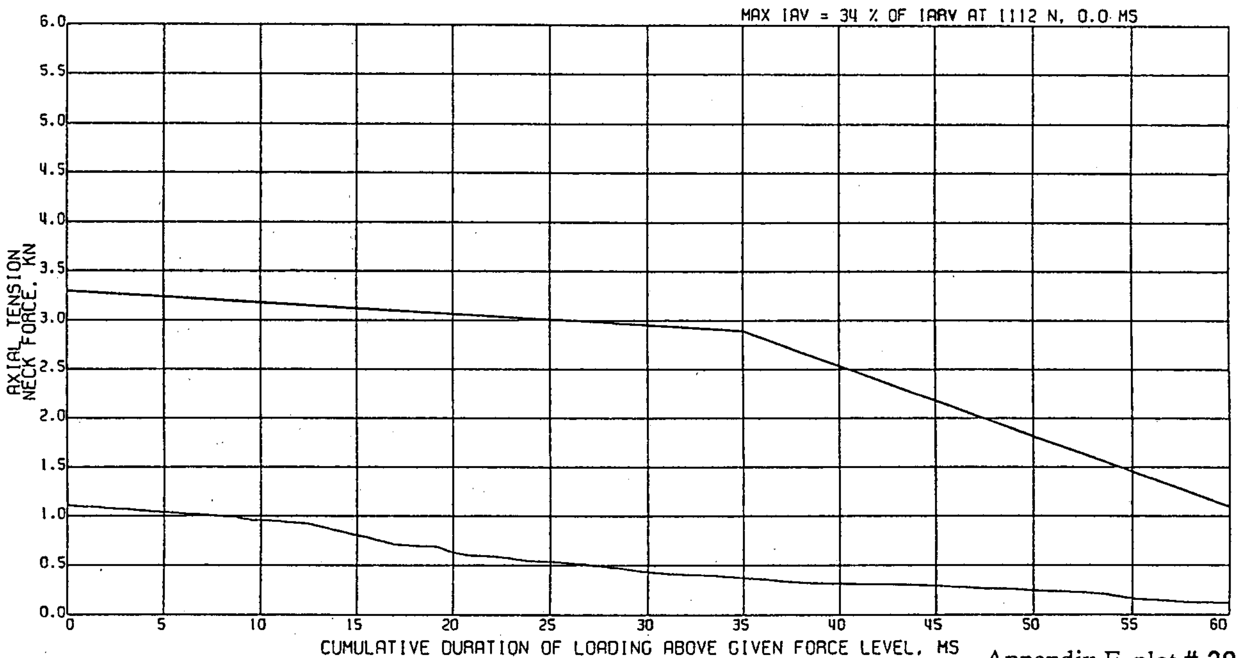
ELEC DATA, SAE CLASS 1000

AXIAL TENSION ON HEAD,

R. FRT INJURY REFERENCE

ATD TYPE: GM50H

TEST DATE:08/14/1996



Appendix F, plot # 39

39 PROCESSED 8/14/1996

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

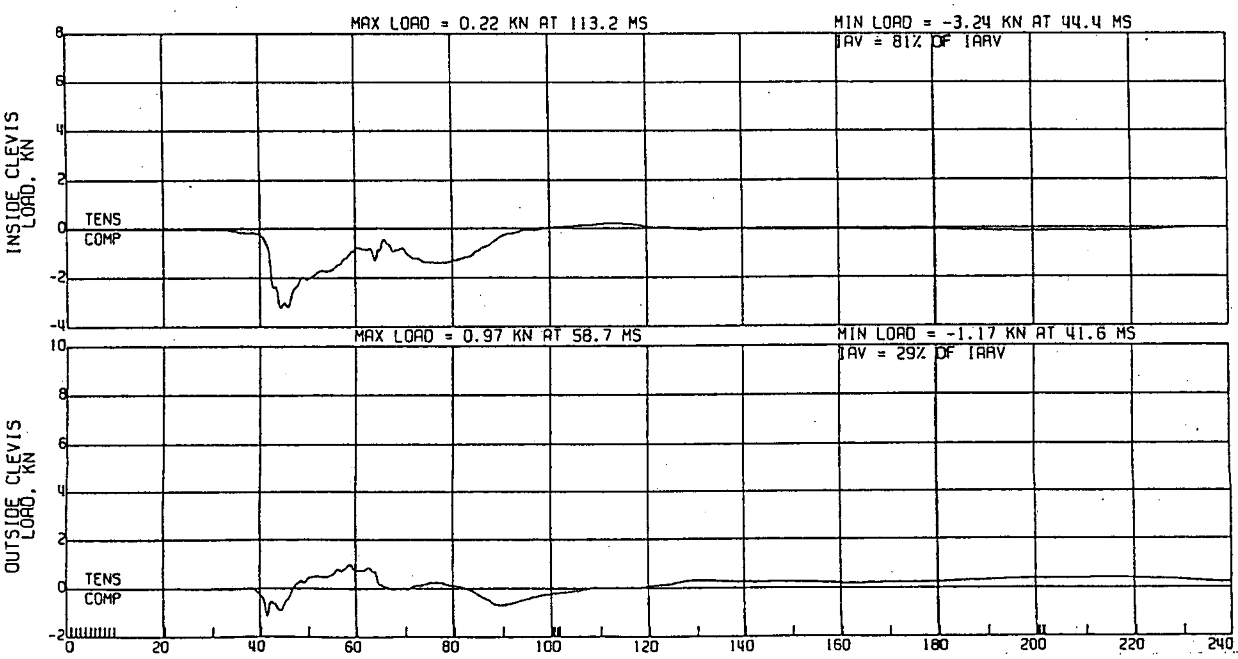
R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 600

R. FRT LEFT KNEE CLEVIS LOAD

ATD TYPE: GM50H

TEST DATE:08/14/1996



Appendix F, plot # 40

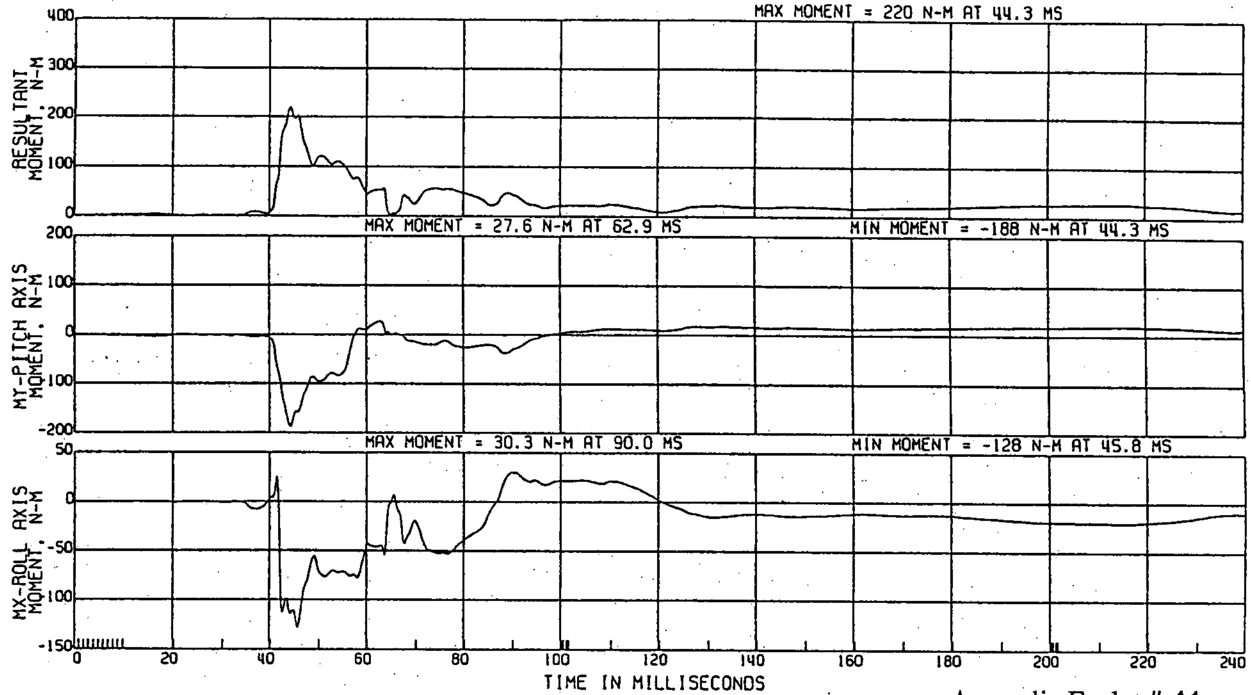
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 600

R. FRT LEFT TIBIA UPPER MOMENT

ATD TYPE: GM50H
TEST DATE:08/14/1996



Appendix F, plot # 41

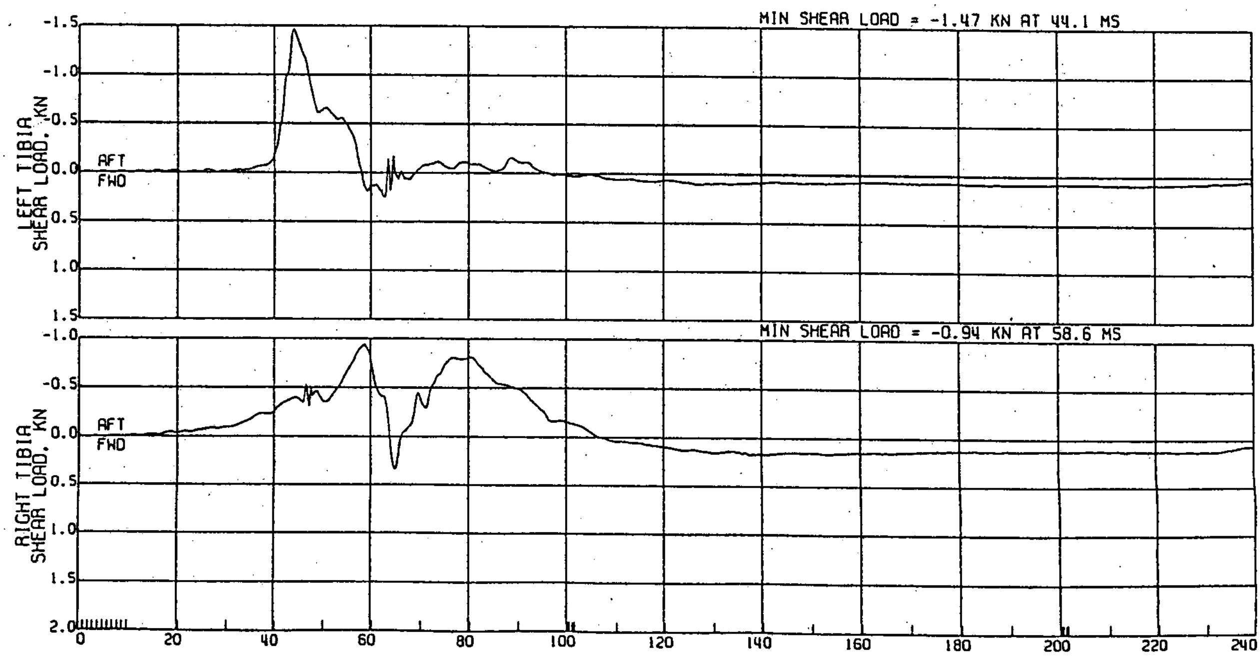
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:08/14/1996

R. FRT TIBIA LOWER SHEAR LOAD CELLS



Appendix F, plot # 42

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

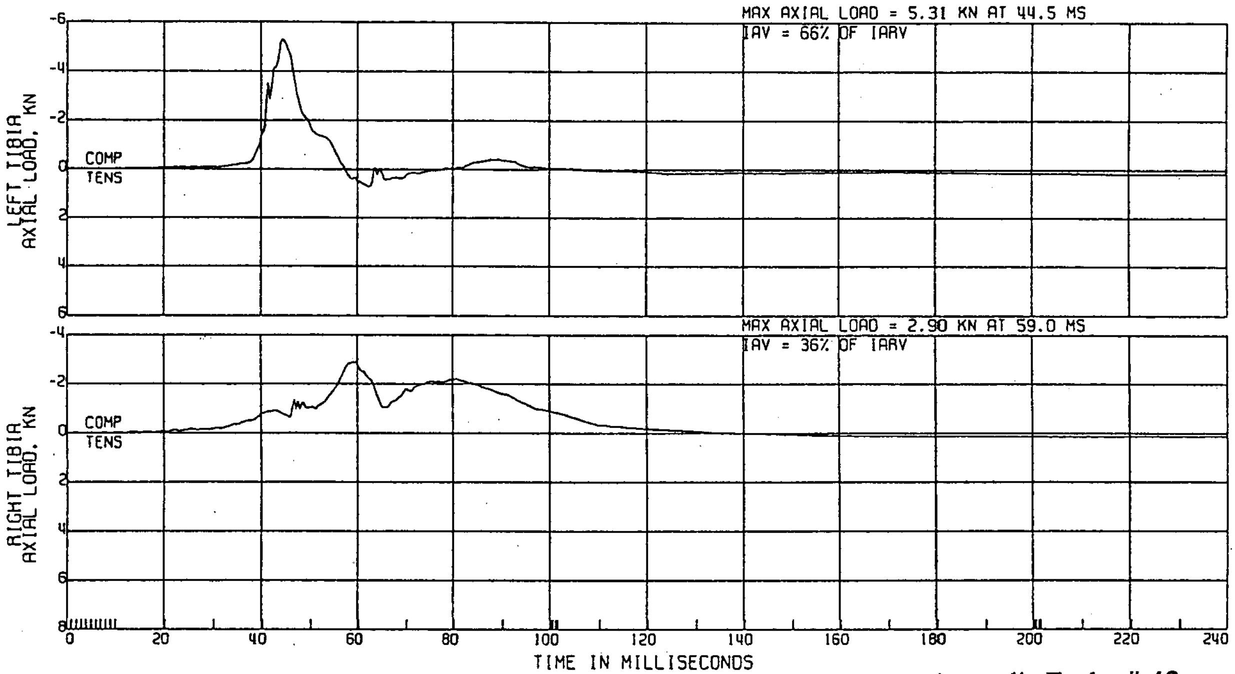
ATD TYPE: GM50H

R & D CTR 8T93060 VAN

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 600

R. FRT TIBIA LOWER AXIAL LOAD



Appendix F, plot # 43

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

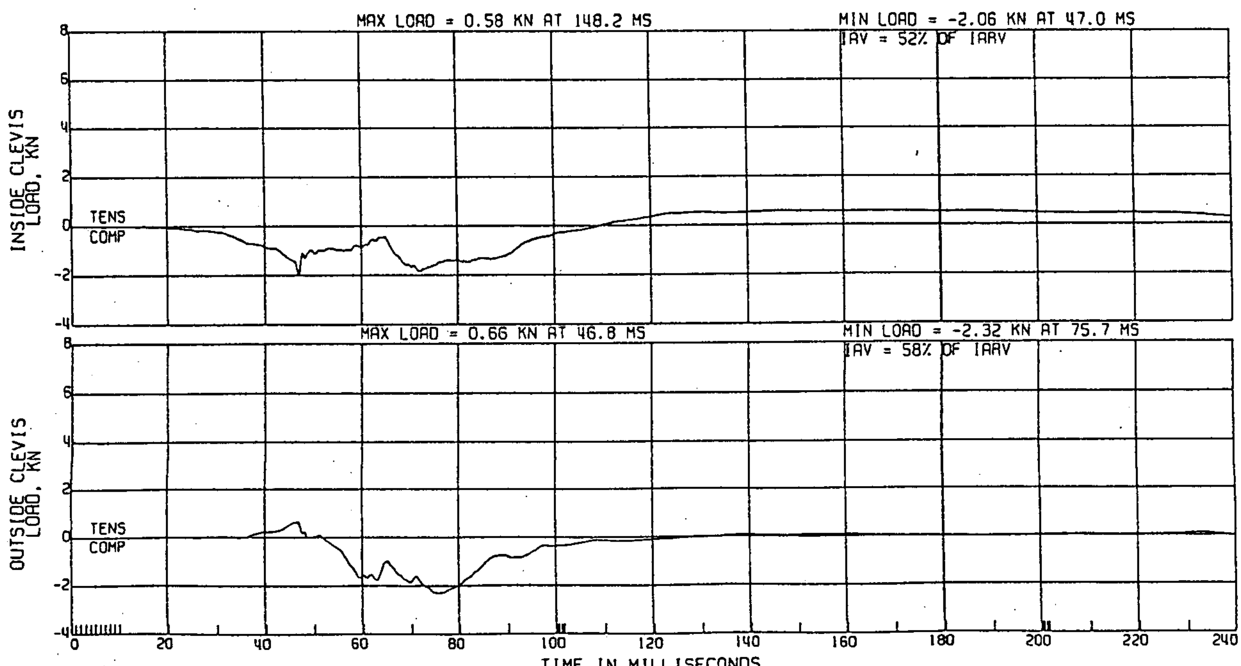
ATD TYPE: GM50H

R. FRT RIGHT KNEE CLEVIS LOAD

R & D CTR 8T93060 VAN

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 600



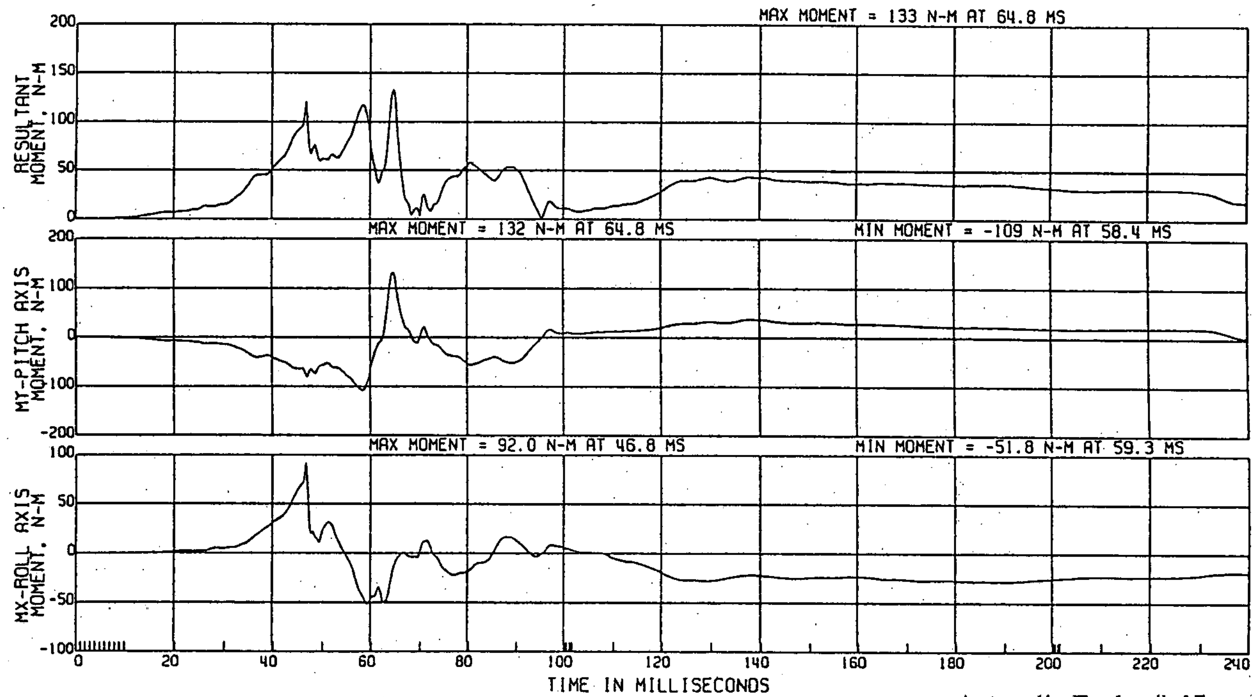
Appendix F, plot # 44

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 600

R. FRT RIGHT TIBIA UPPER MOMENT

ATD TYPE: GM50H
TEST DATE:08/14/1996



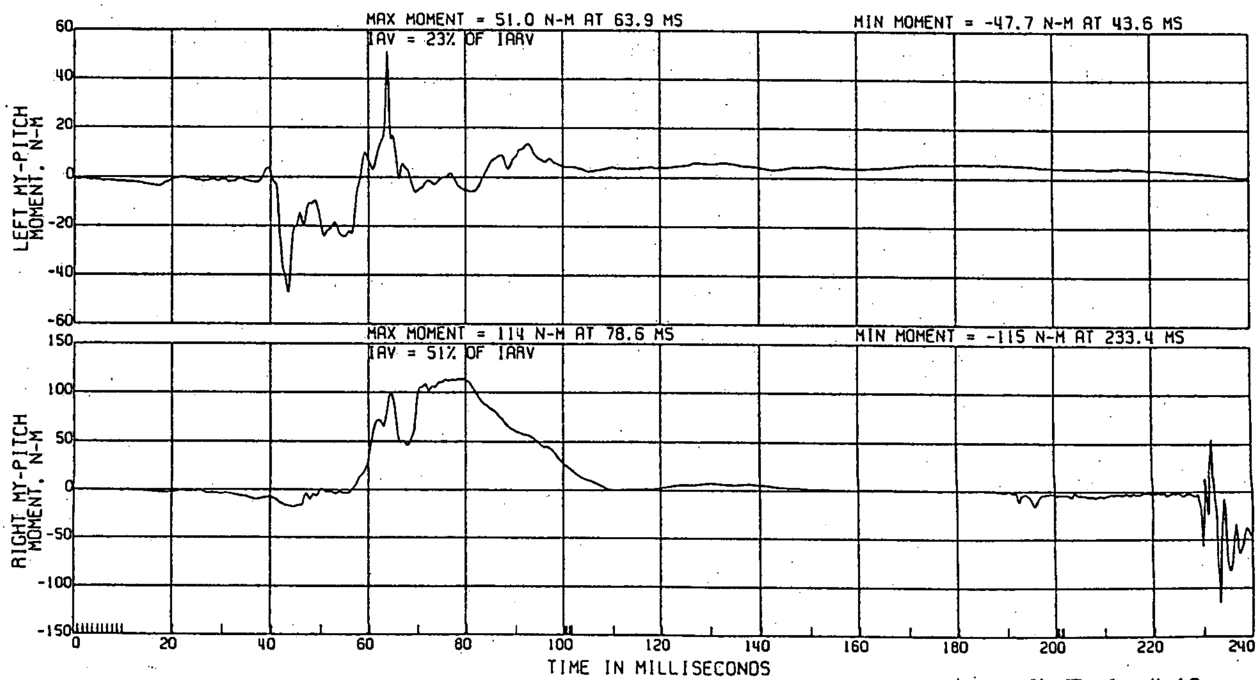
Appendix F, plot # 45

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:08/14/1996

R. FRT TIBIA LOWER BENDING MOMENTS



Appendix F, plot # 46

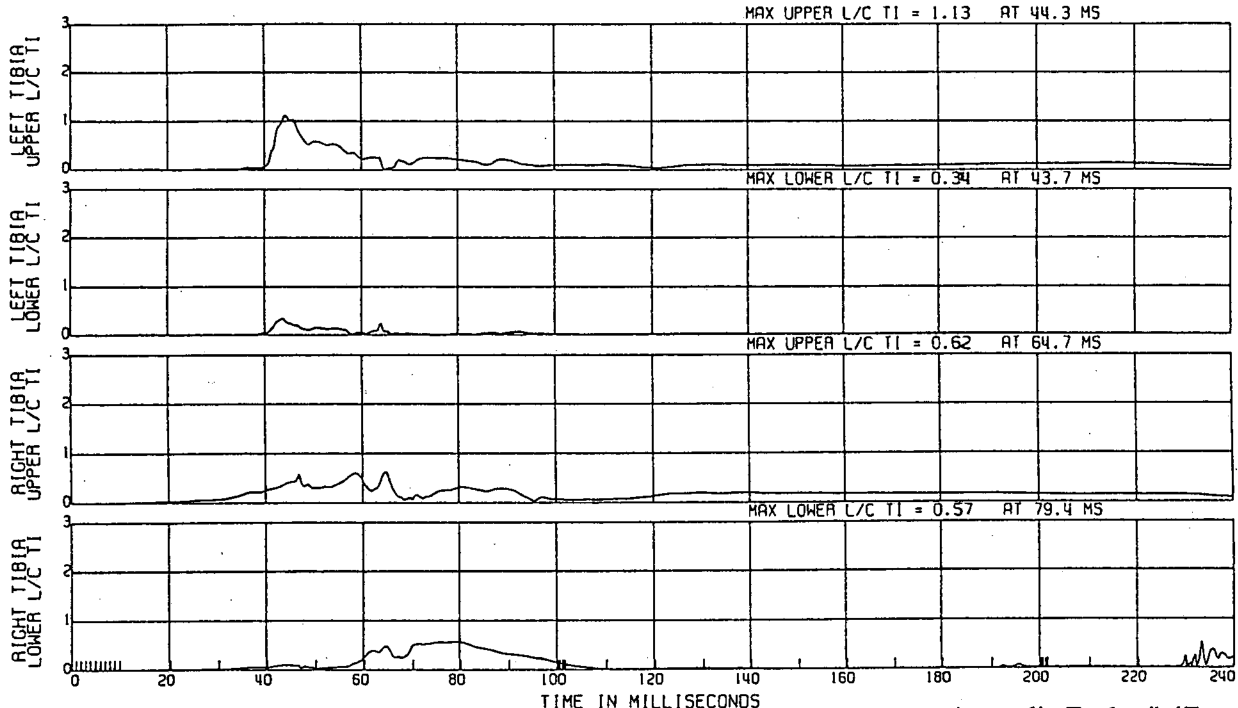
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 600

R. FRT TIBIA INDICES

TI = (RES MOM/225 NM) + (AXIAL/35900 N)

ATD TYPE: GM50H
TEST DATE:08/14/1996



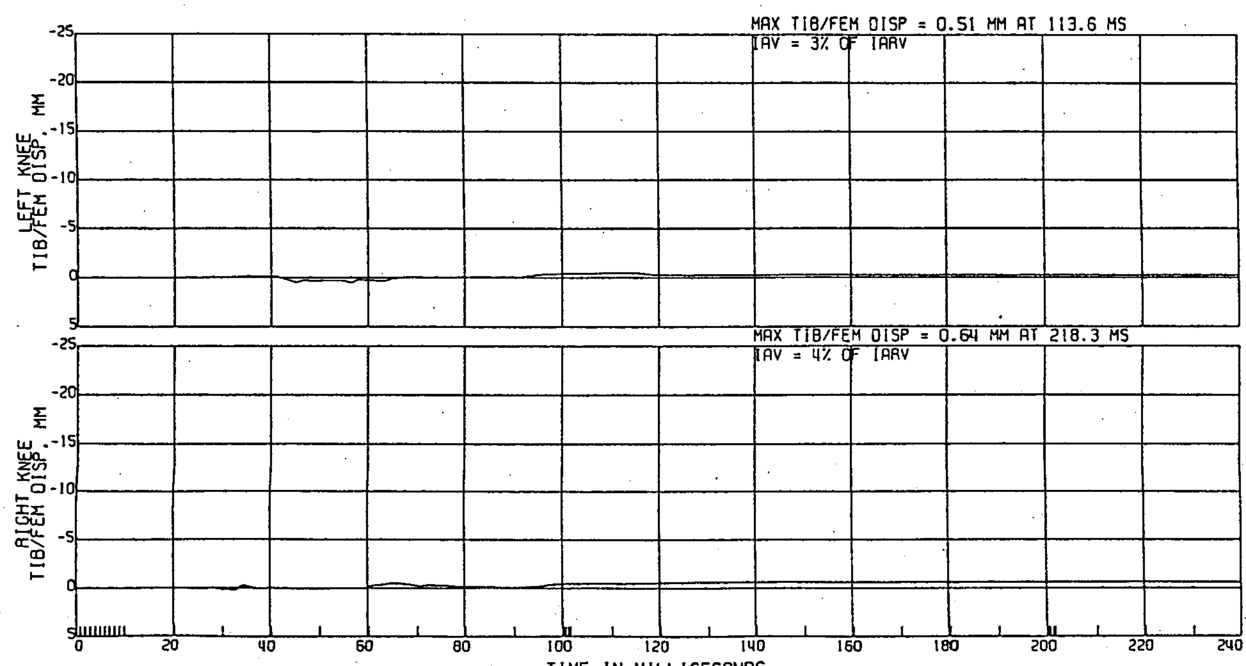
Appendix F, plot # 47

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 180

R. FRT TIBIA/FEMUR DISPLACEMENT

ATD TYPE: GM50H
TEST DATE:08/14/1996



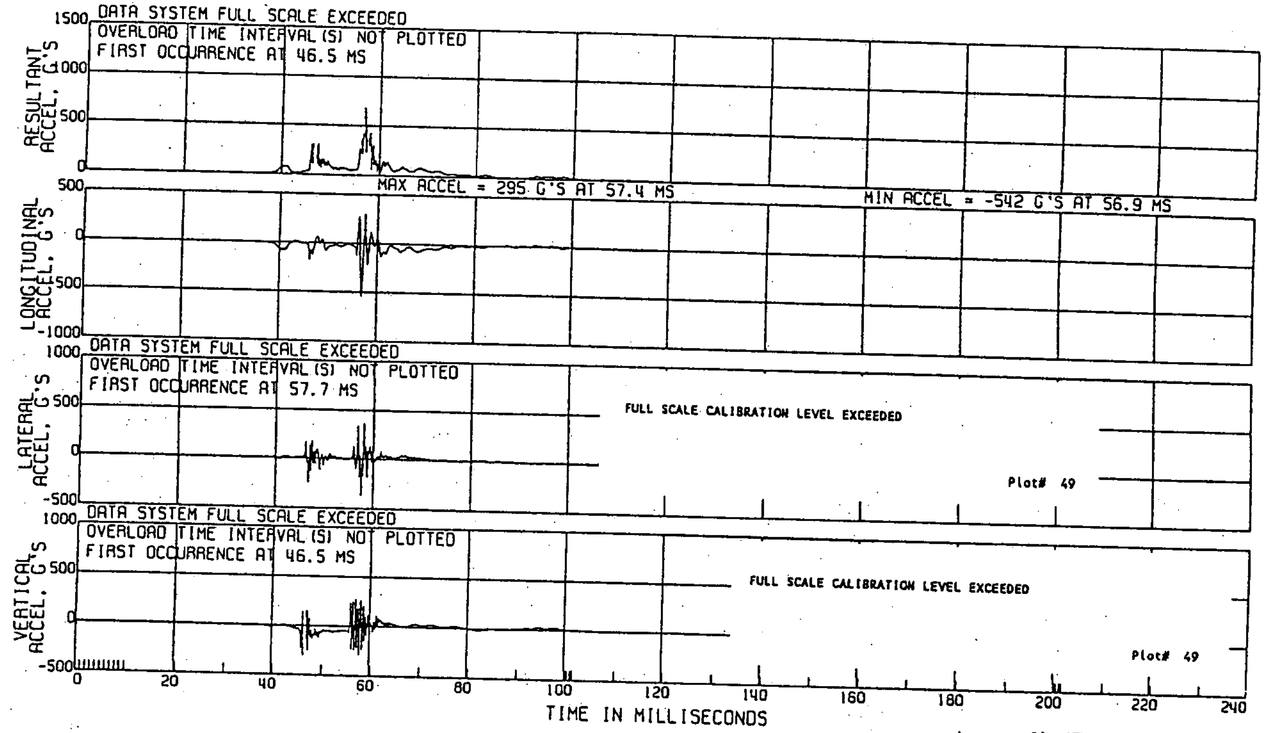
Appendix F, plot # 48

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

L. FRT LEFT UPPER TIBIA ACCEL
(VEC SUM OF TIBIA ACCELS)

ATD TYPE: GM50H
TEST DATE:08/14/1996



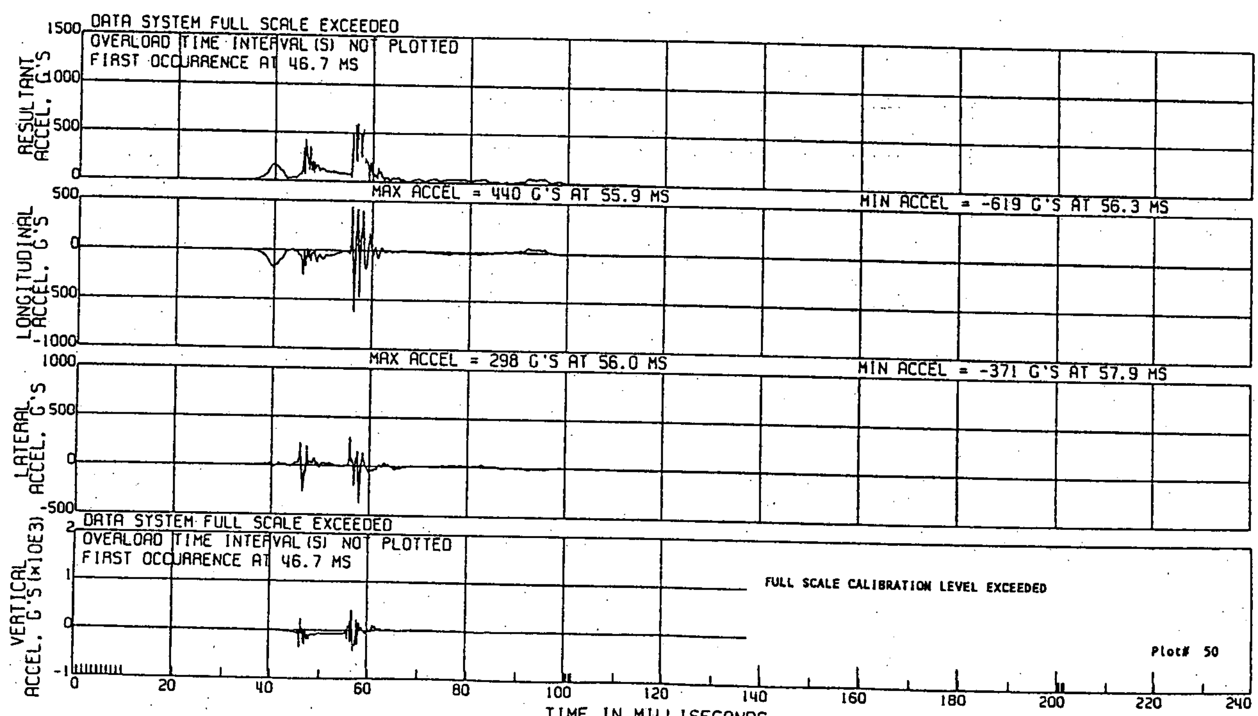
Appendix F, plot # 49

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

L. FRT LEFT LOWER TIBIA ACCEL
(VEC SUM OF TIBIA ACCELS)

ATD TYPE: GM50H
TEST DATE:08/14/1996



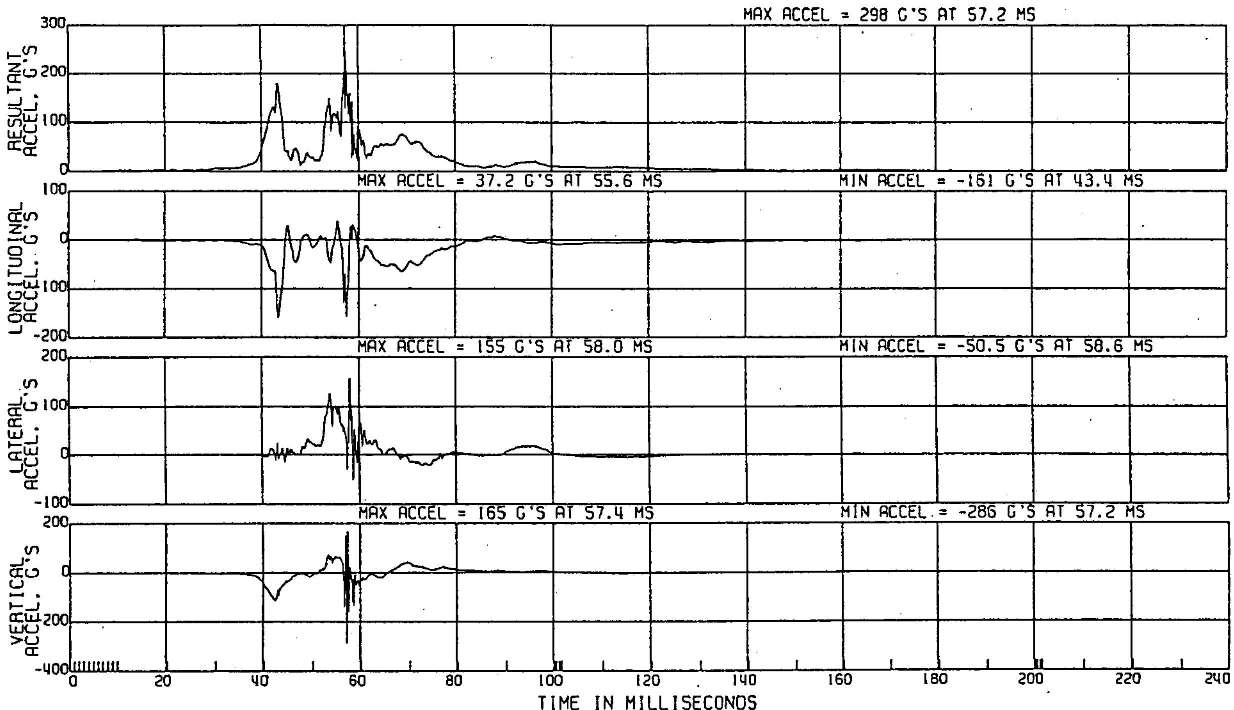
Appendix F, plot # 50

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

L. FRT RIGHT UPPER TIBIA ACCEL
(VEC SUM OF TIBIA ACCELS)

ATD TYPE: GM50H
TEST DATE:08/14/1996



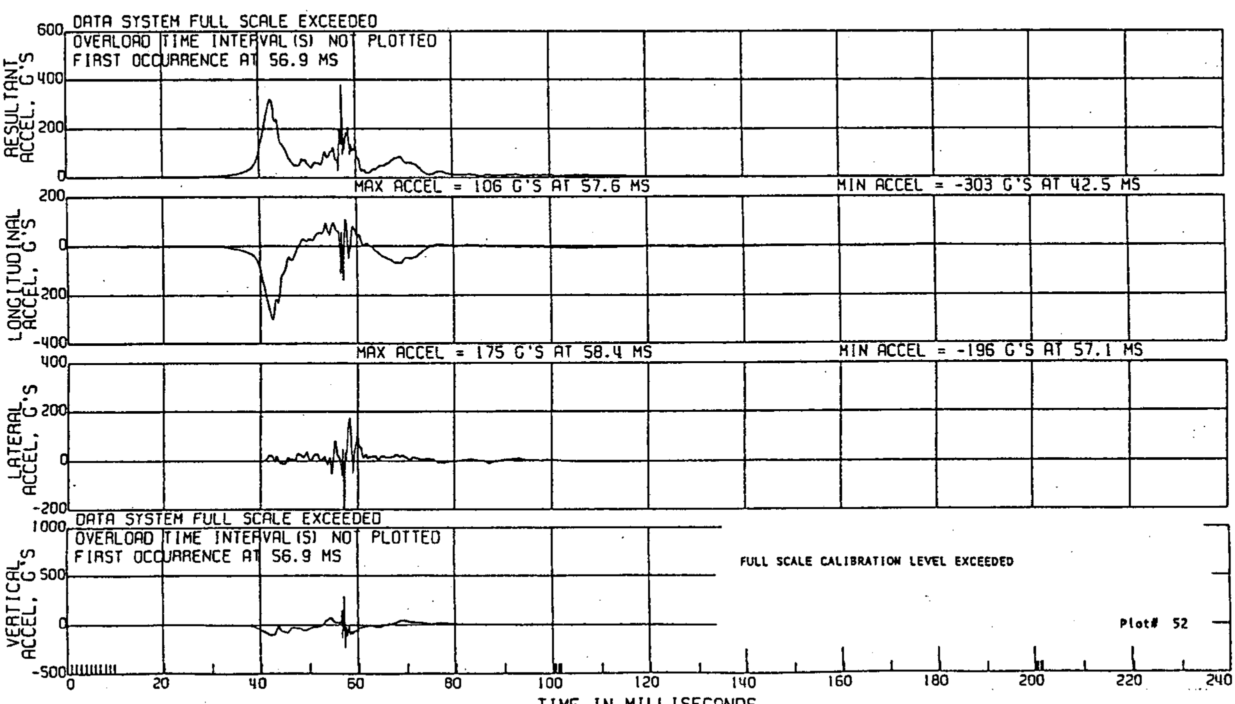
Appendix F, plot # **51**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

L. FRT RIGHT LOWER TIBIA ACCEL
(VEC SUM OF TIBIA ACCELS)

ATD TYPE: GM50H
TEST DATE:08/14/1996



Appendix F, plot # **52**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

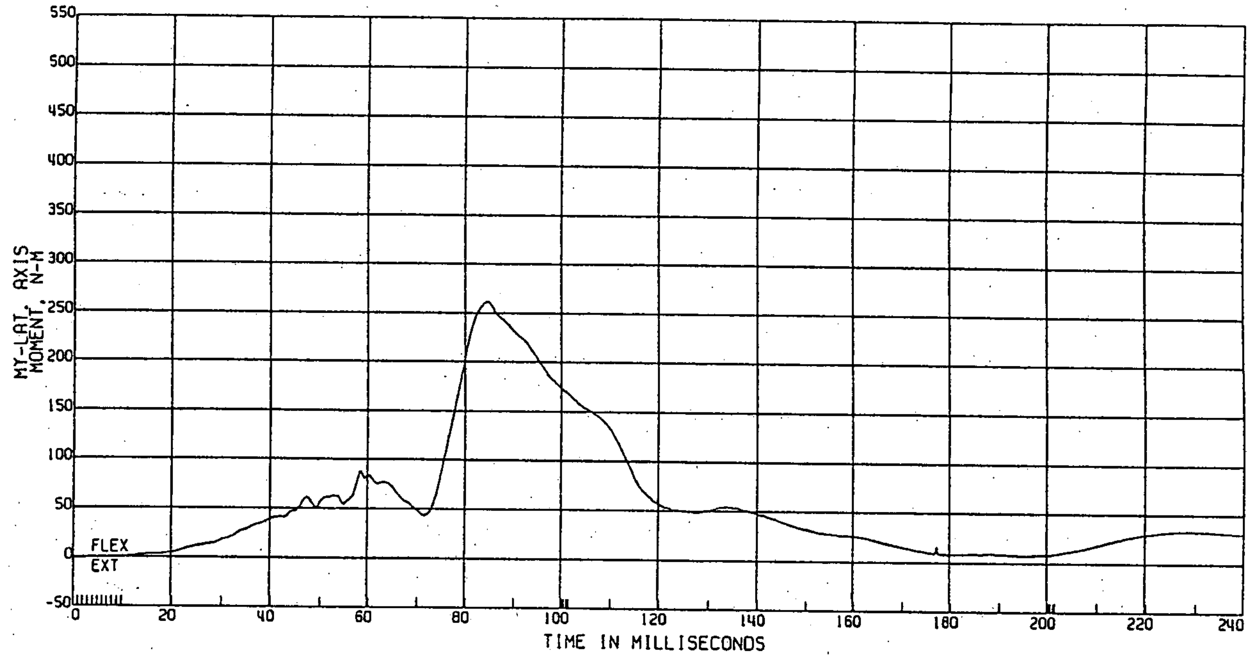
R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 1000

L. FRT LOWER LUMBAR MOMENT

ATD TYPE: GM50H

TEST DATE:08/14/1996



Appendix F, plot # 53

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

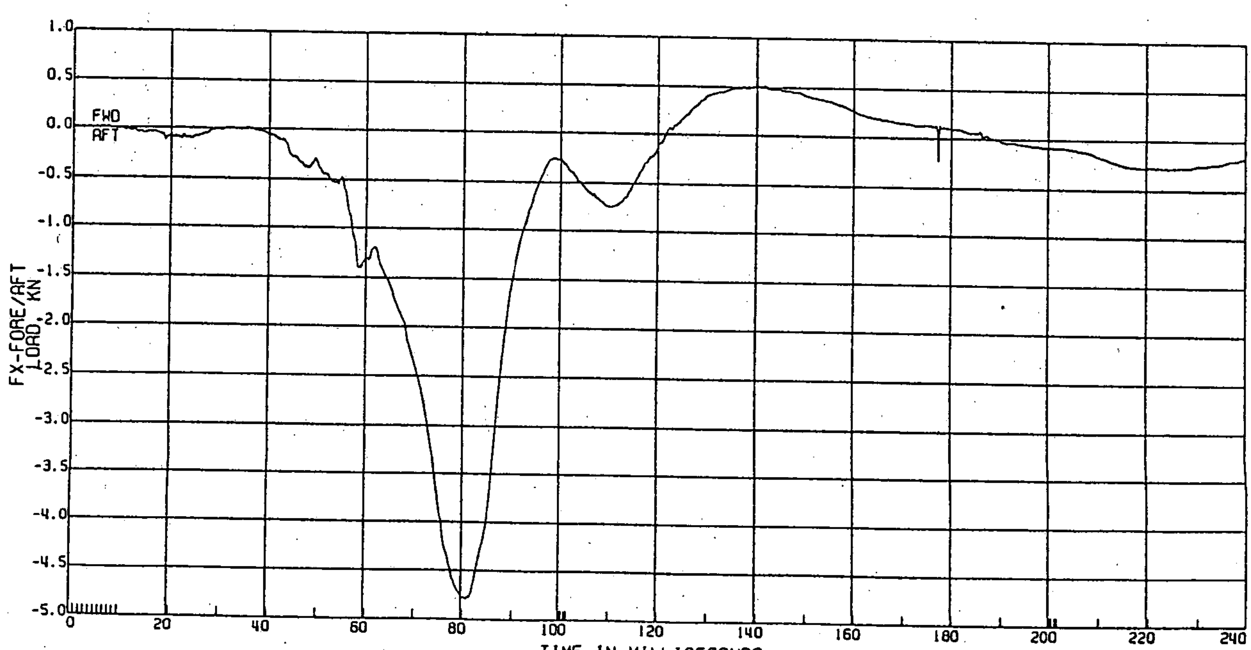
R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 1000

L. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H

TEST DATE:08/14/1996



Appendix F, plot # 54

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

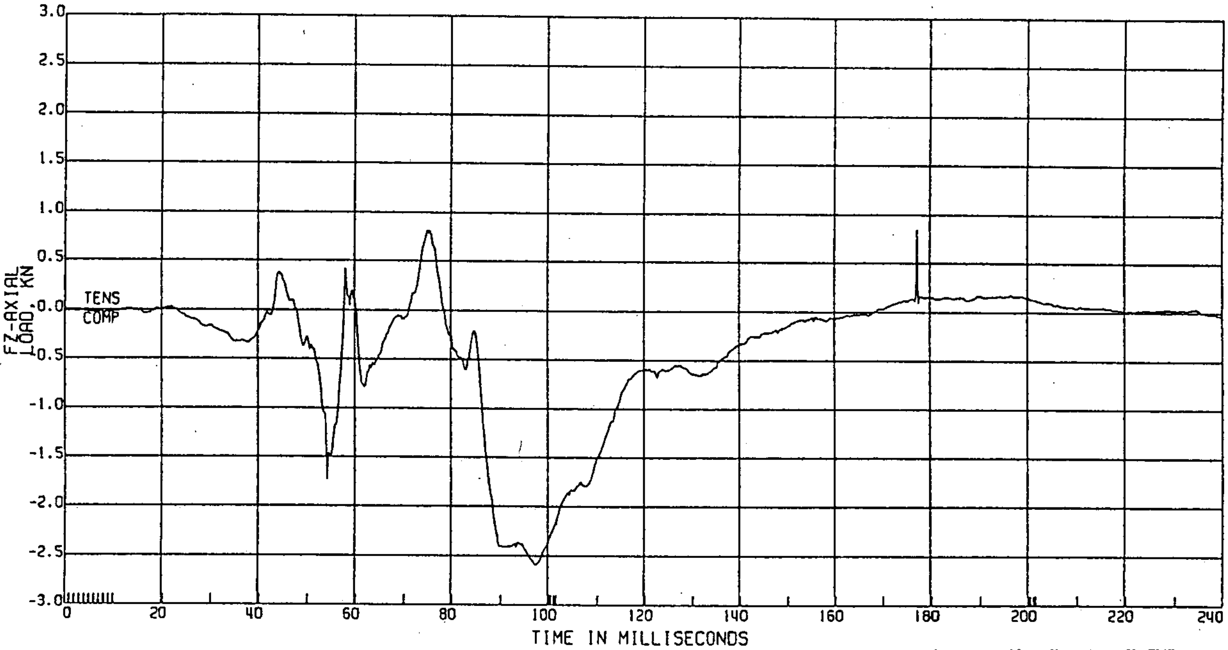
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

L. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H

TEST DATE:08/14/1996



Appendix F, plot # 55

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

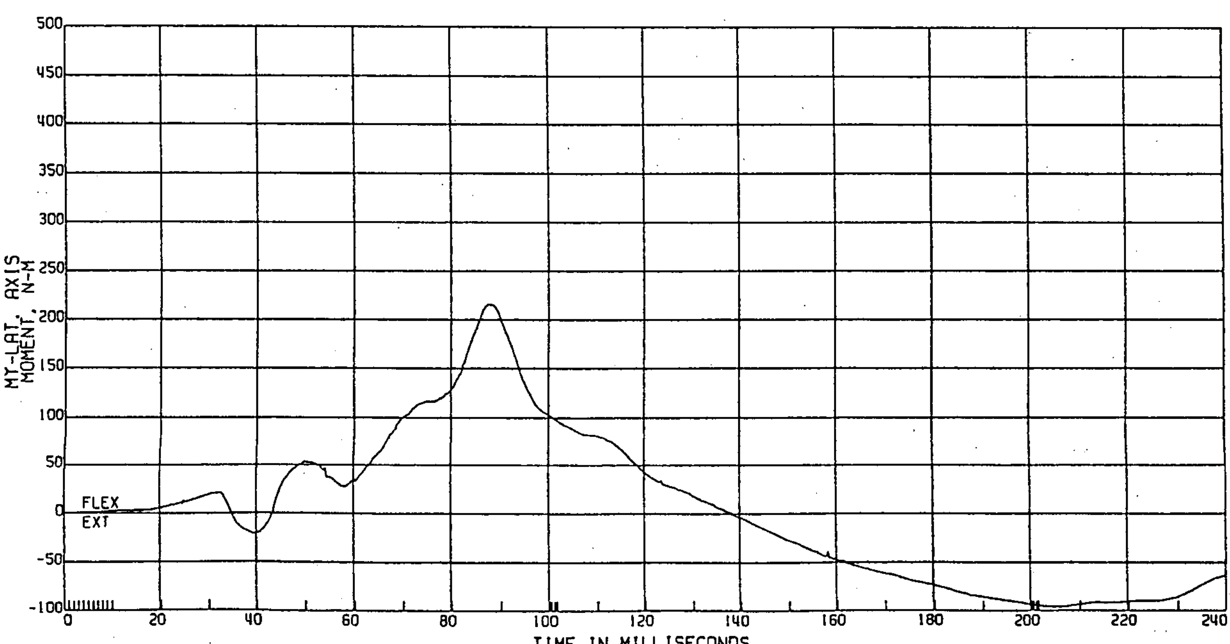
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

R. FRT LOWER LUMBAR MOMENT

ATD TYPE: GM50H

TEST DATE:08/14/1996



Appendix F, plot # 56

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

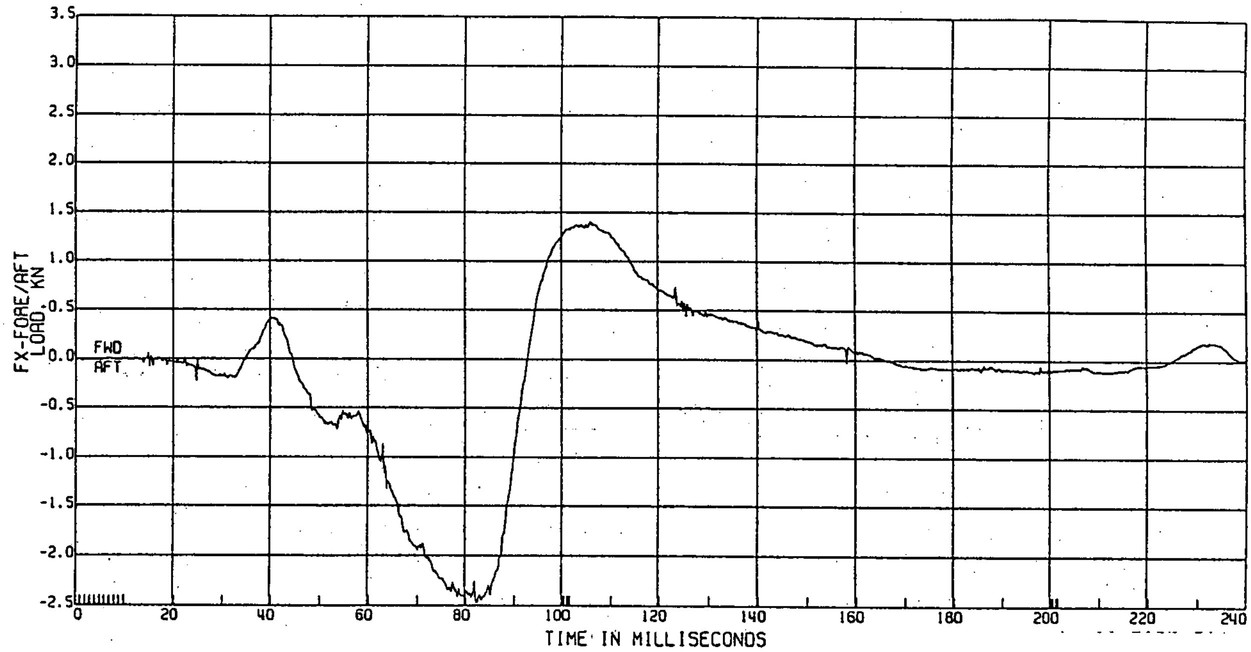
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

R. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H

TEST DATE:08/14/1996



Appendix F, plot # 57

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

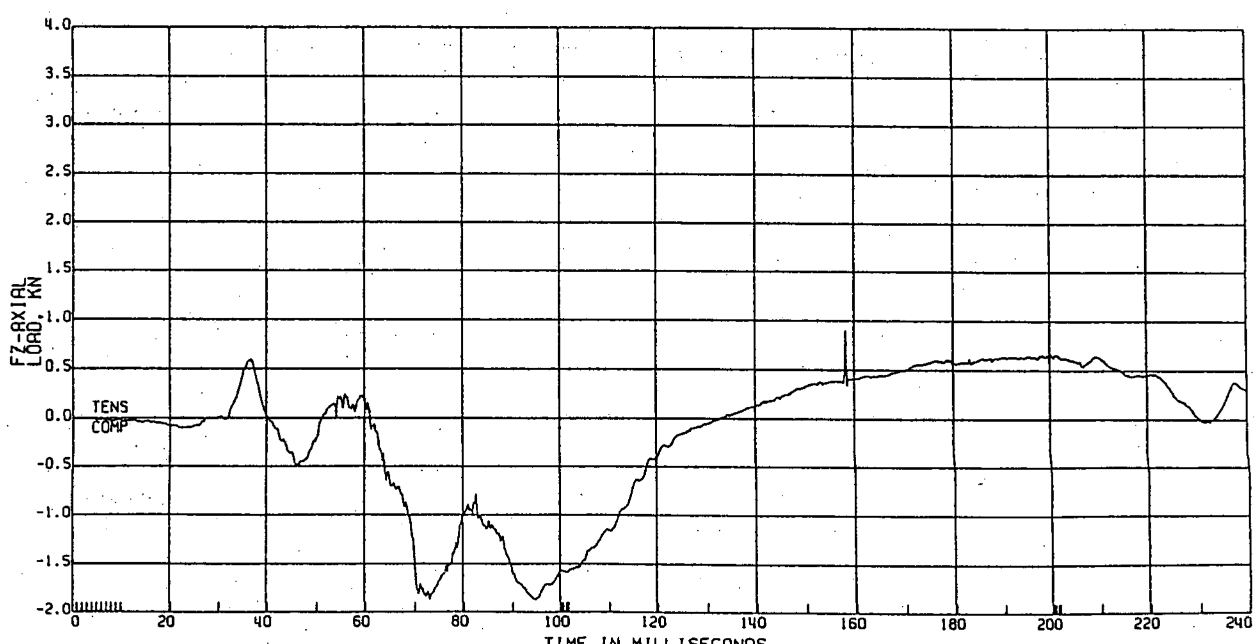
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

R. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H

TEST DATE:08/14/1996



Appendix F, plot # 58

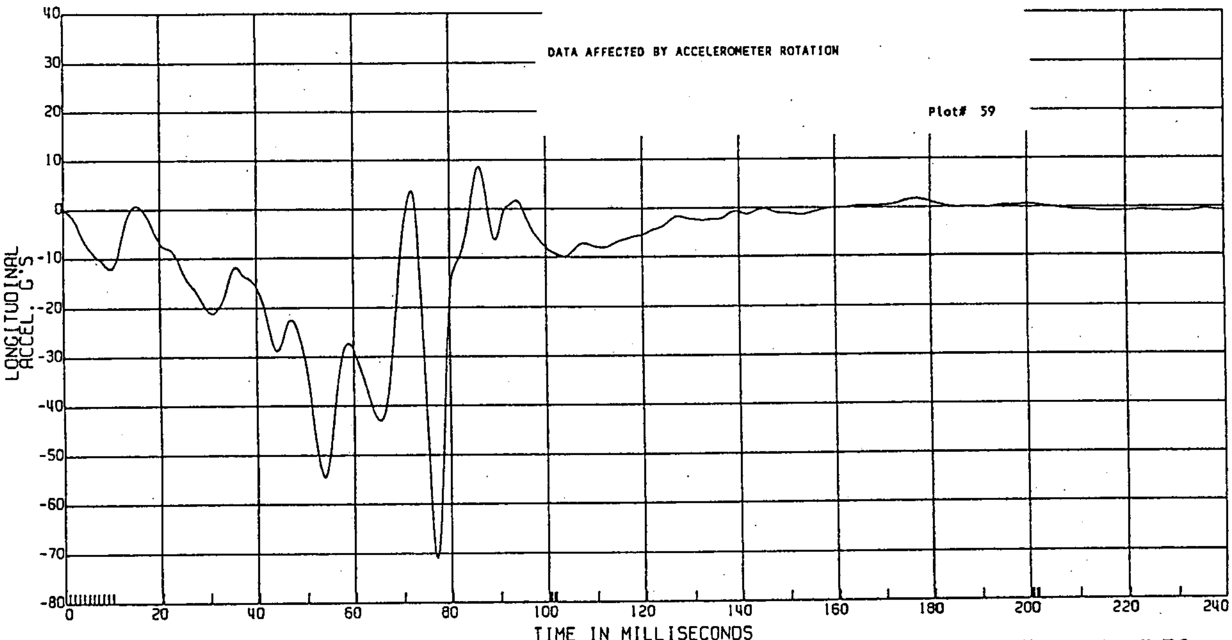
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 60

L. FRT ROCKER ACCEL

TEST DATE:08/14/1996



Appendix F, plot # 59

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

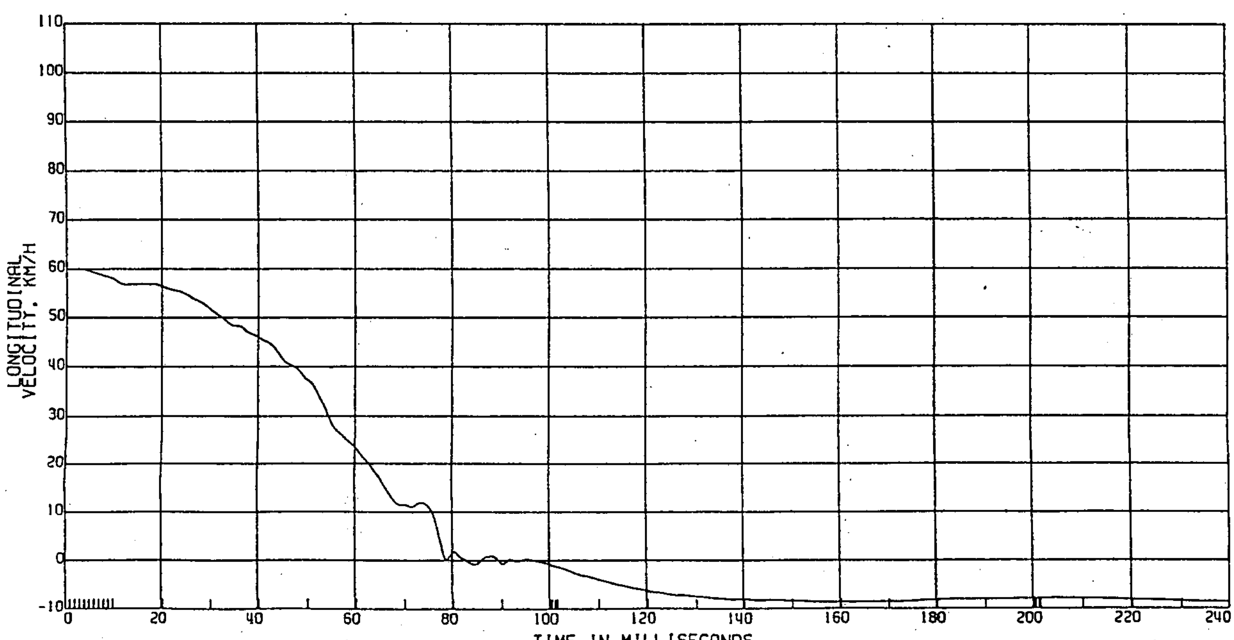
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



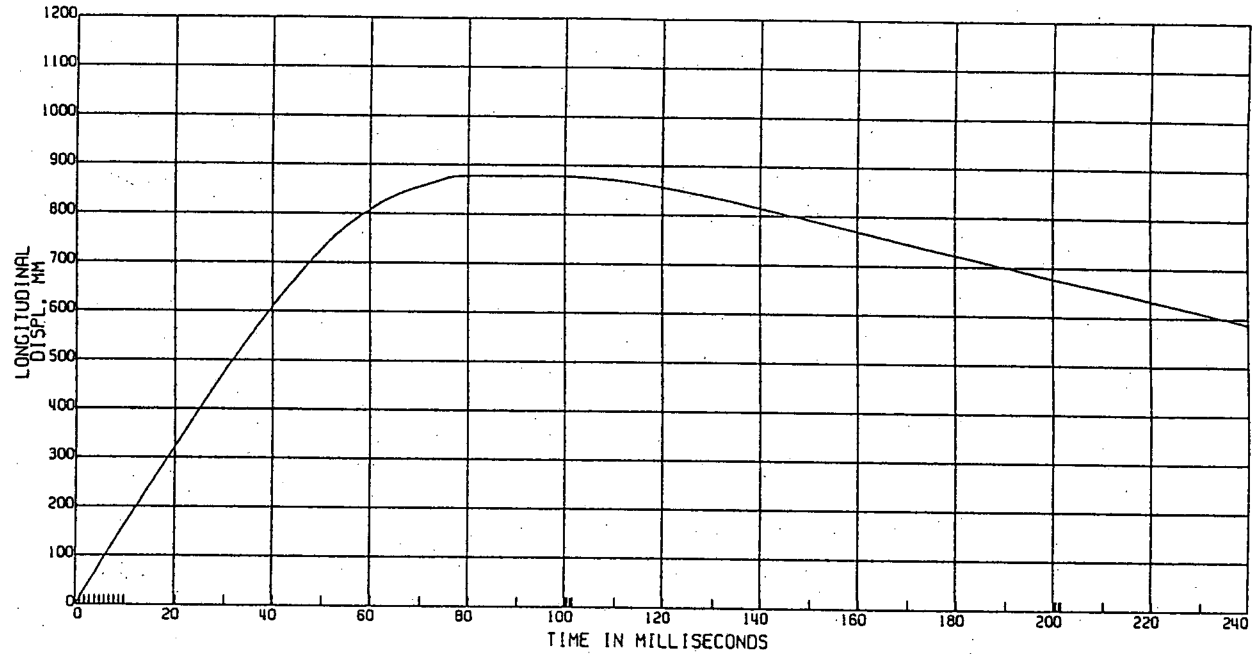
Appendix F, plot # 60

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 180

L. FRT ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



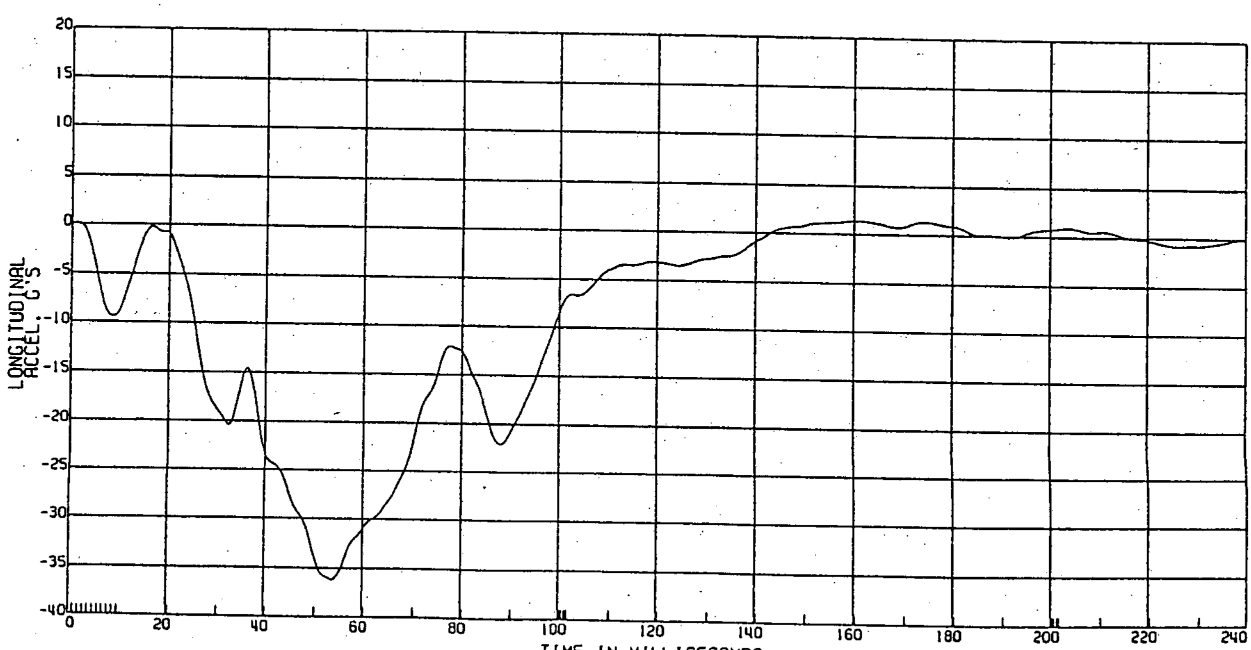
Appendix F, plot # 61

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 60

R. FRT ROCKER ACCEL

TEST DATE:08/14/1996



Appendix F, plot # 62

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

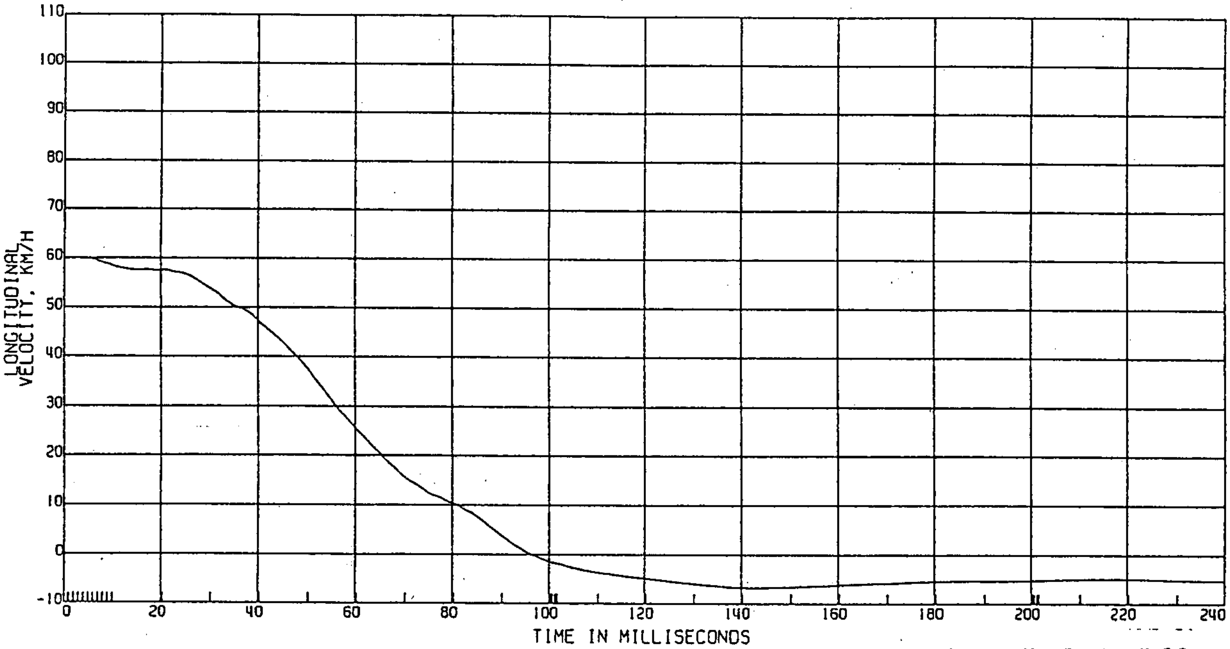
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 180

R. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # 63

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

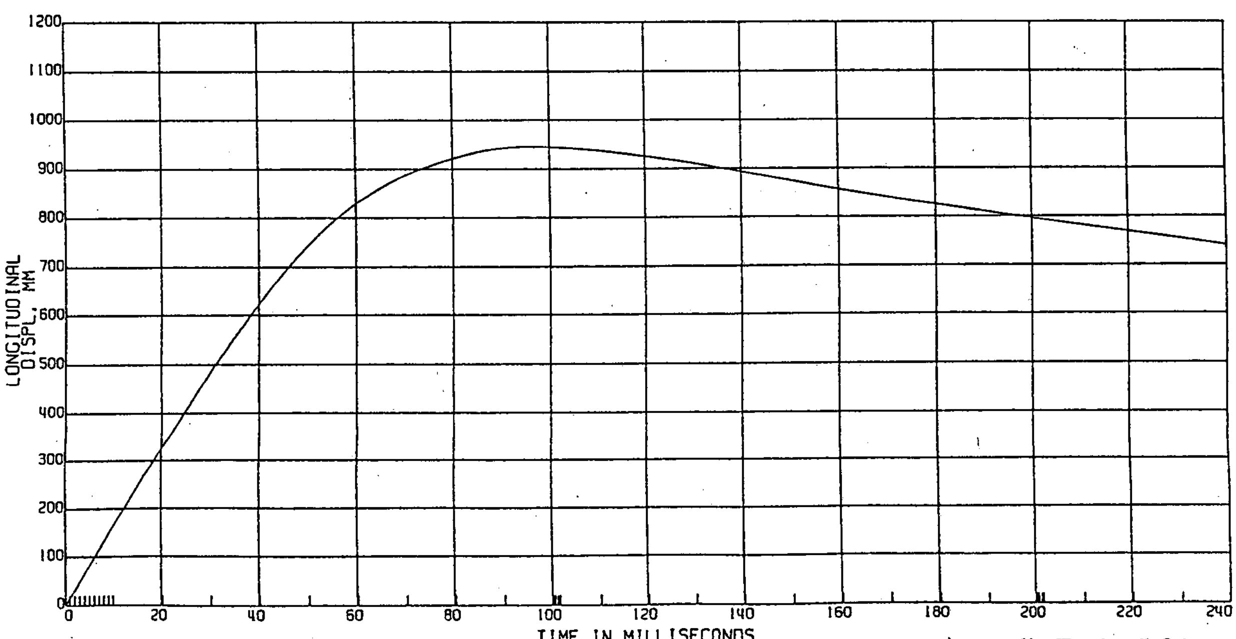
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 180

R. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # 64

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

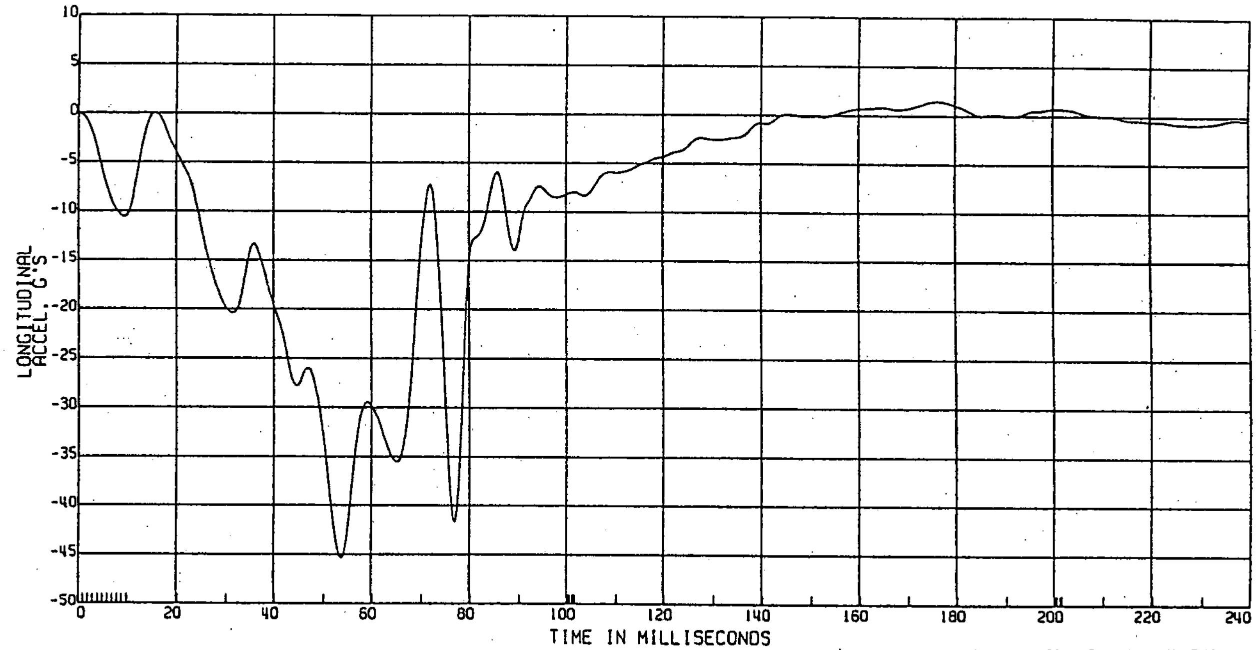
R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 60

AVERAGED FRT ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:08/14/1996



Appendix F, plot # 65

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

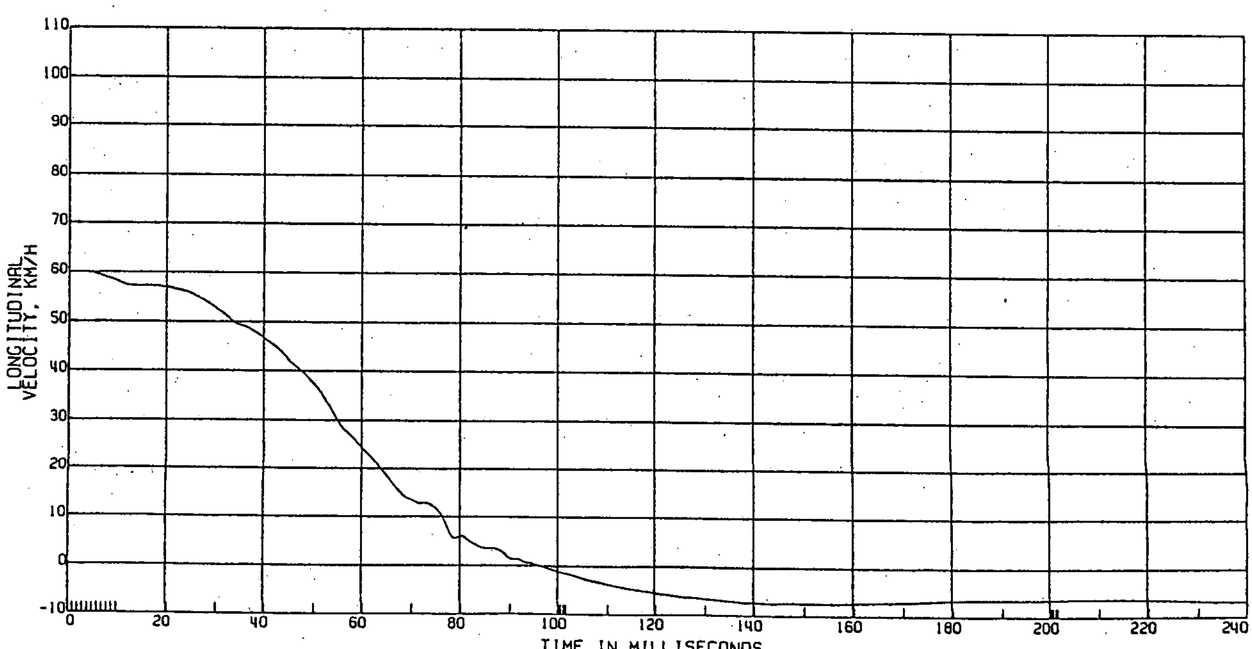
R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # 66

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

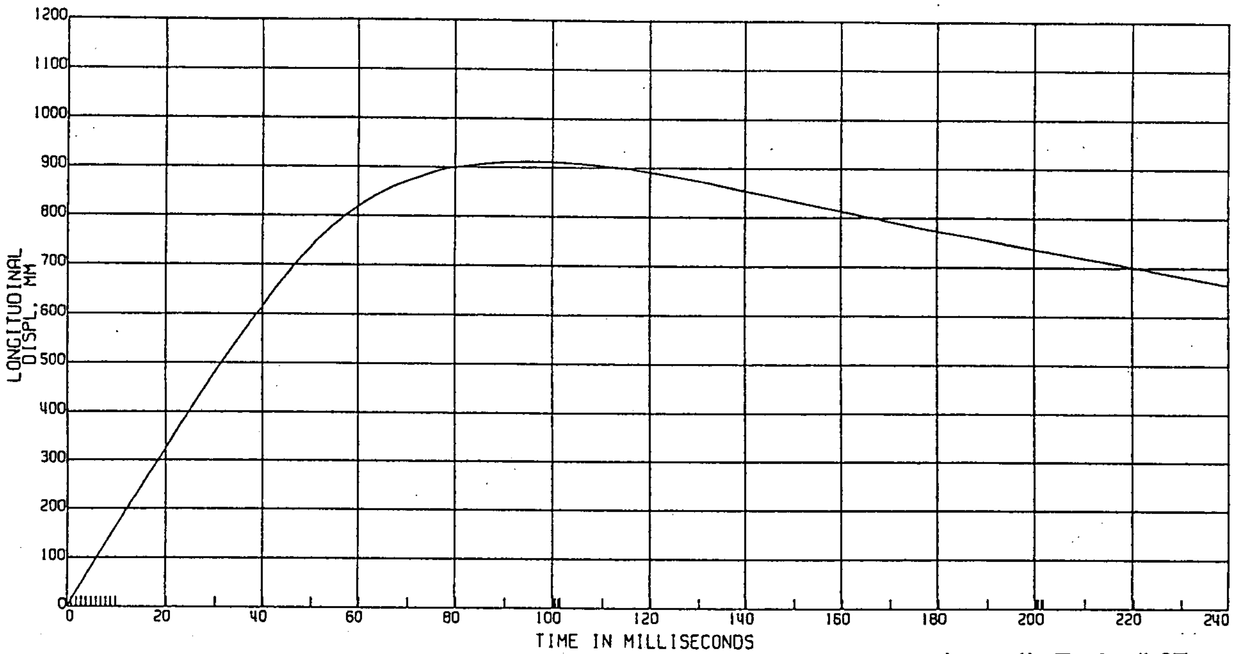
R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # 67

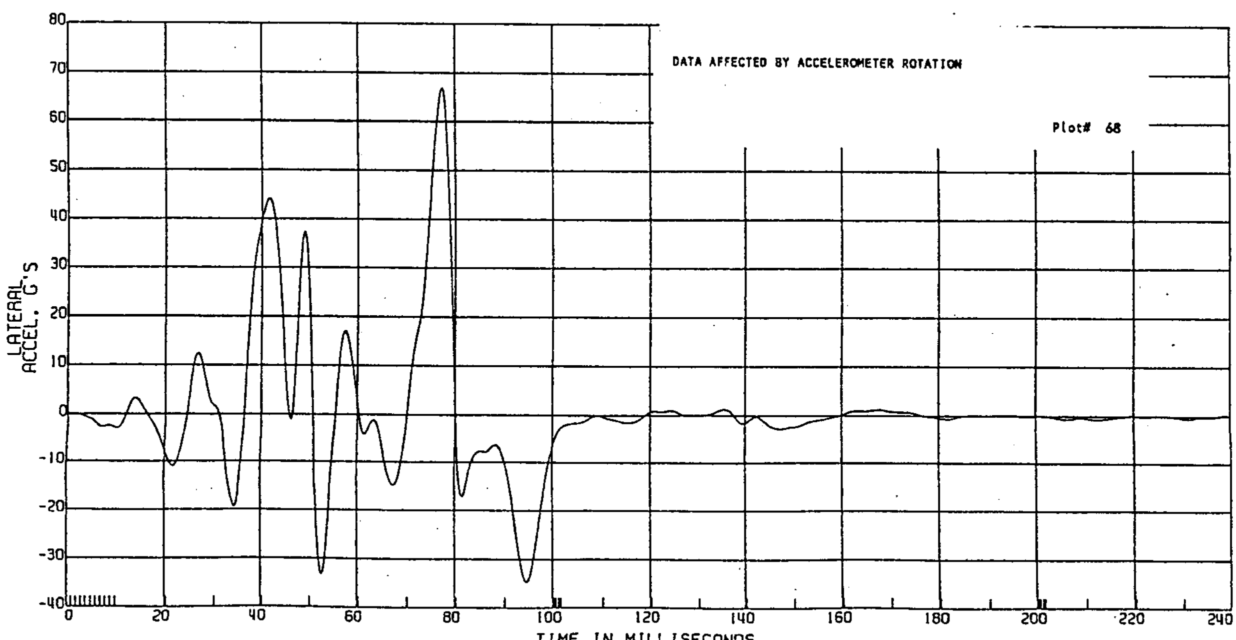
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 60

L. FRT ROCKER ACCEL

TEST DATE:08/14/1996



Appendix F, plot # 68

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

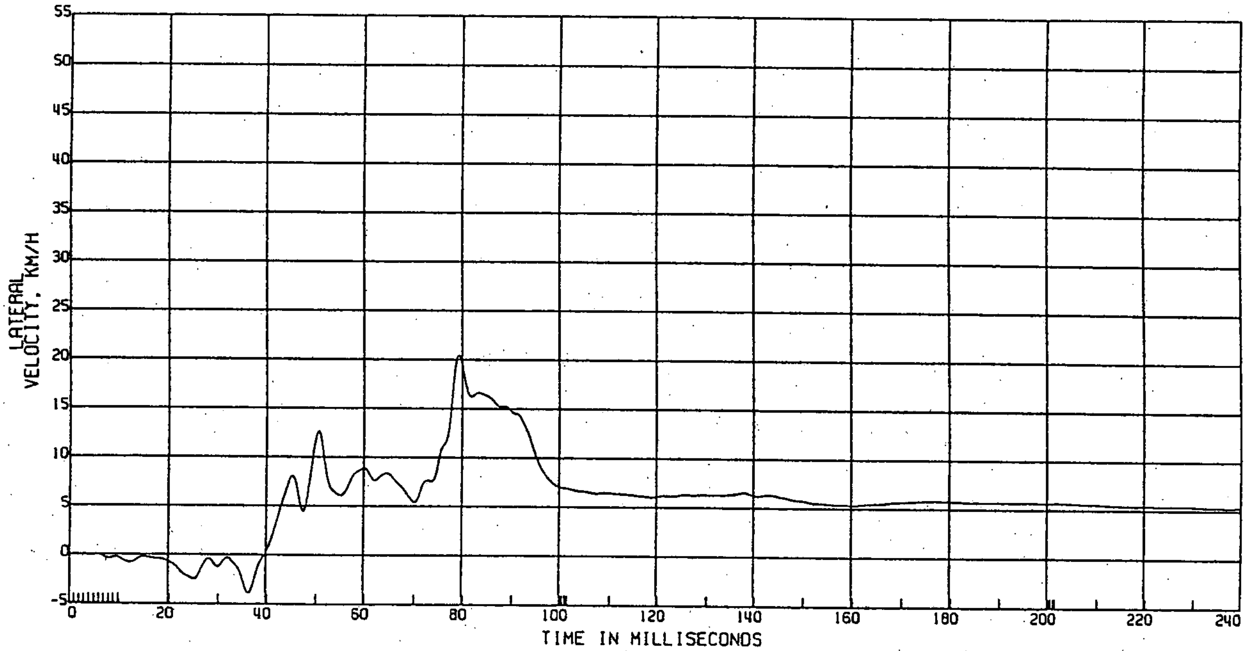
R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # 69

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

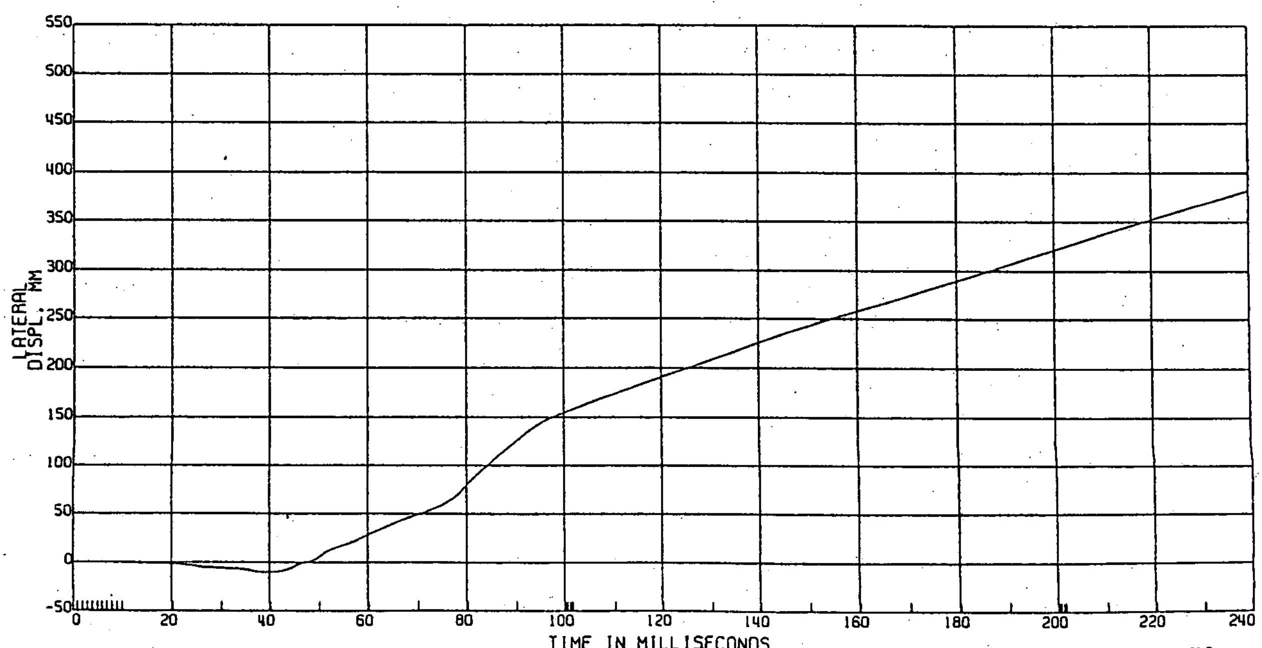
R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # 70

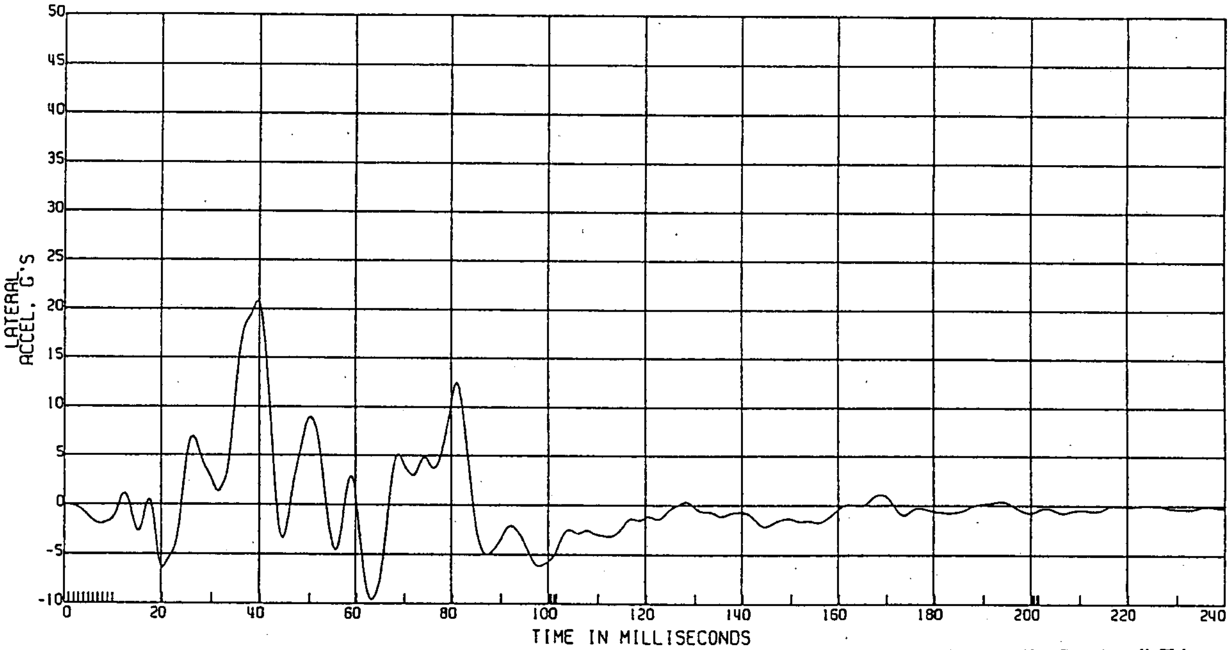
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

R. FRT ROCKER ACCEL

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 60



Appendix F, plot # 71

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

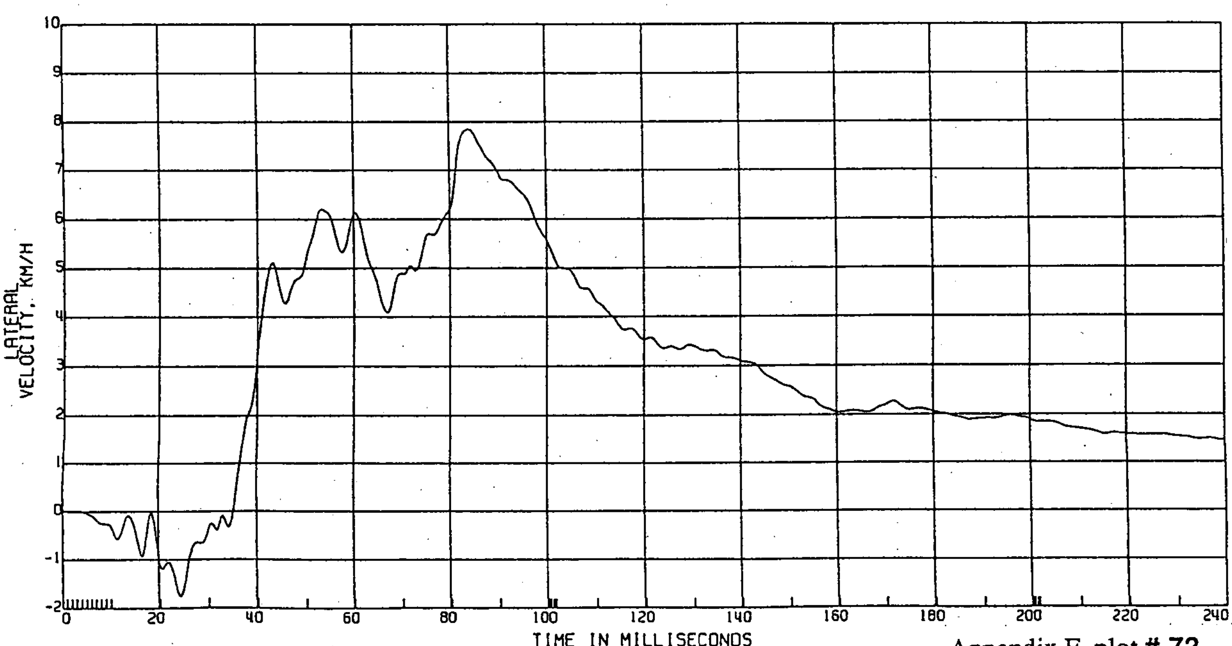
R & D CTR 8T9306D VAN

R. FRT ROCKER VELOCITY

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 180

(COMPUTED FROM ACCELERATION)



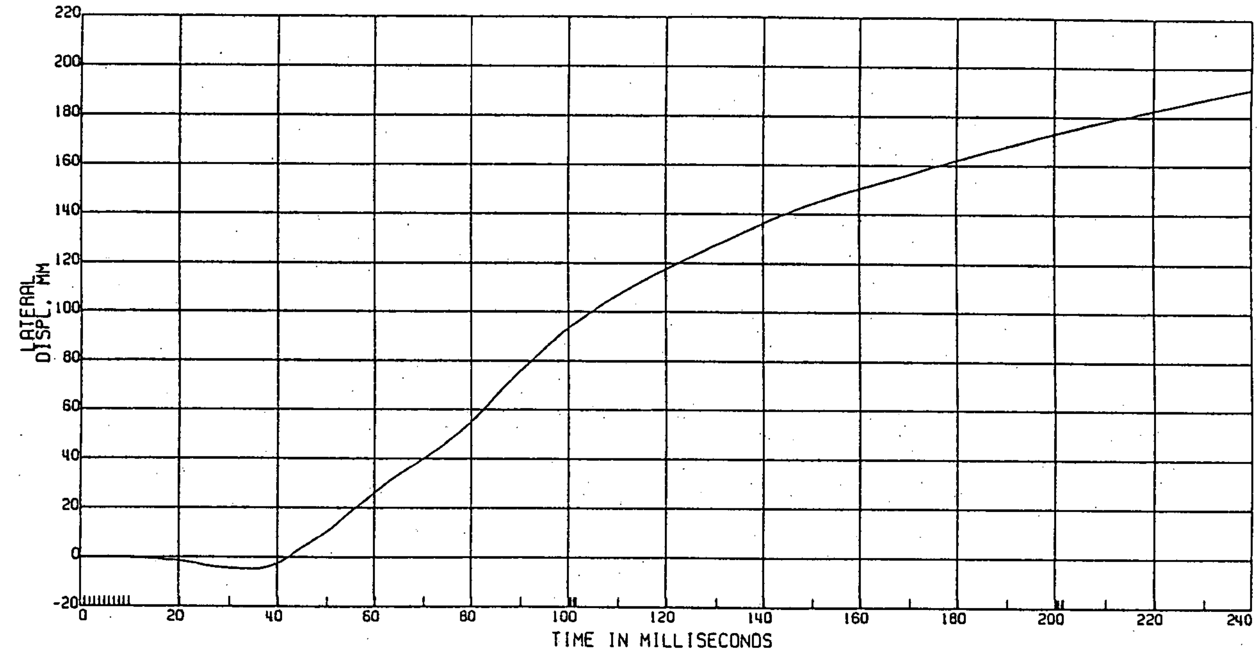
Appendix F, plot # 72

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 180

R. FRT ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



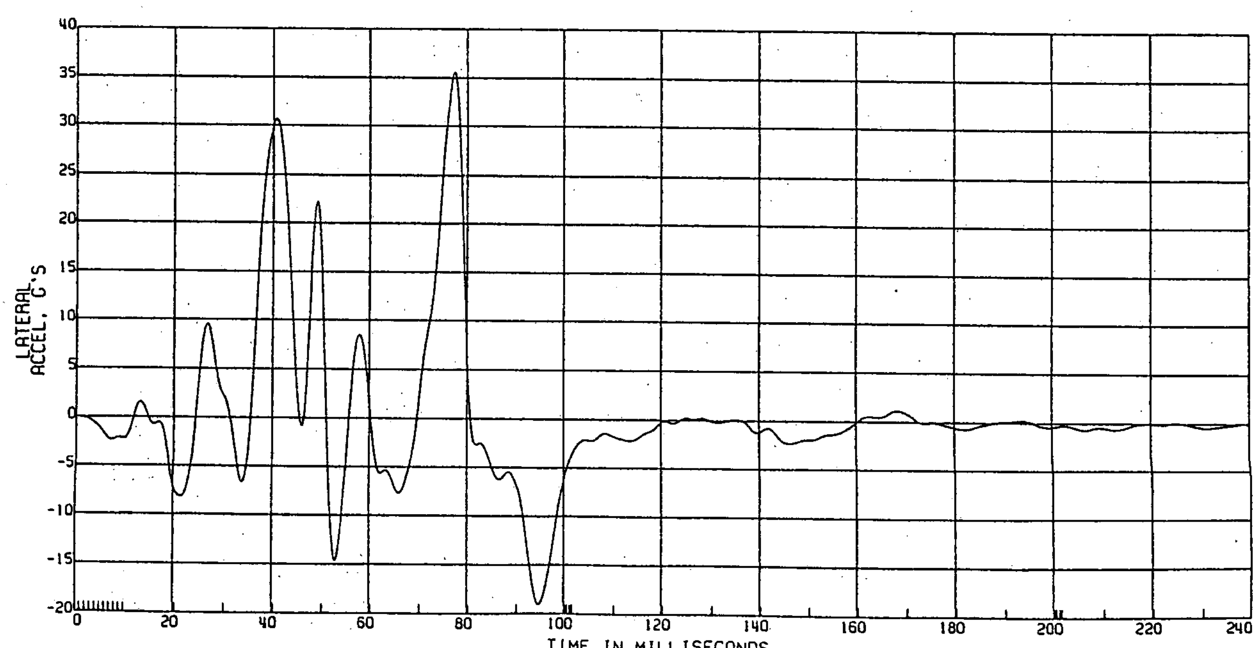
Appendix F, plot # 73

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 60

AVERAGED FRT ROCKER ACCELERATION
(AVGD L. & R. ROCKER ACCELS)

TEST DATE:08/14/1996



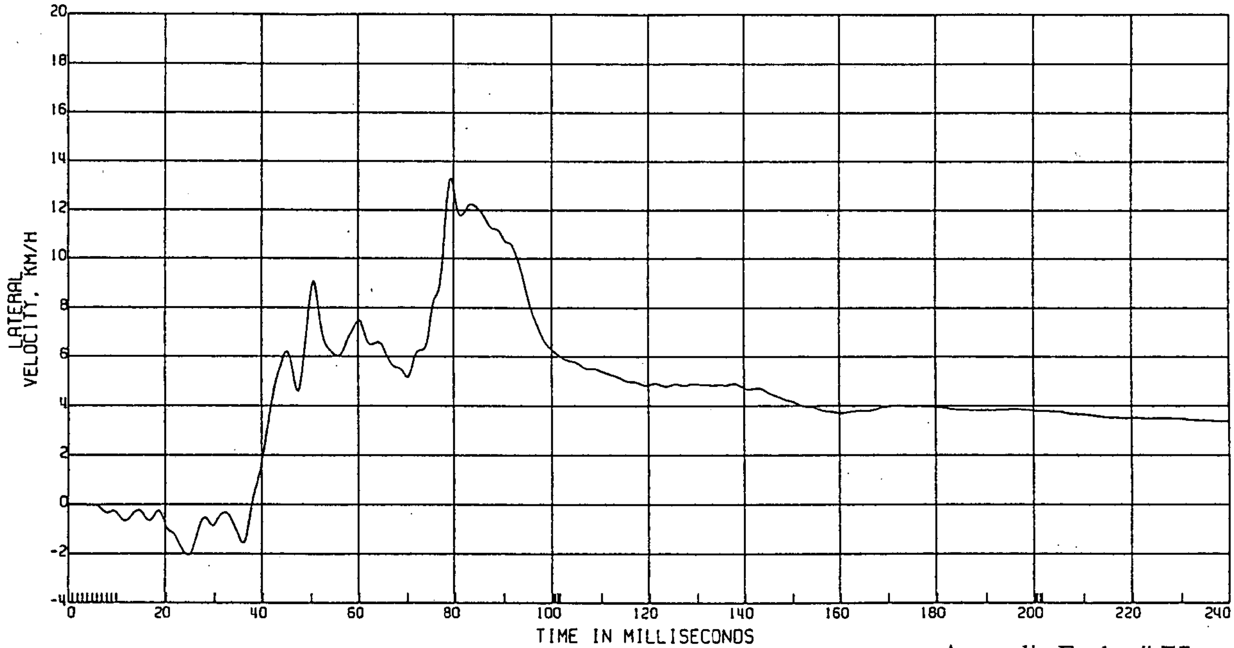
Appendix F, plot # 74

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



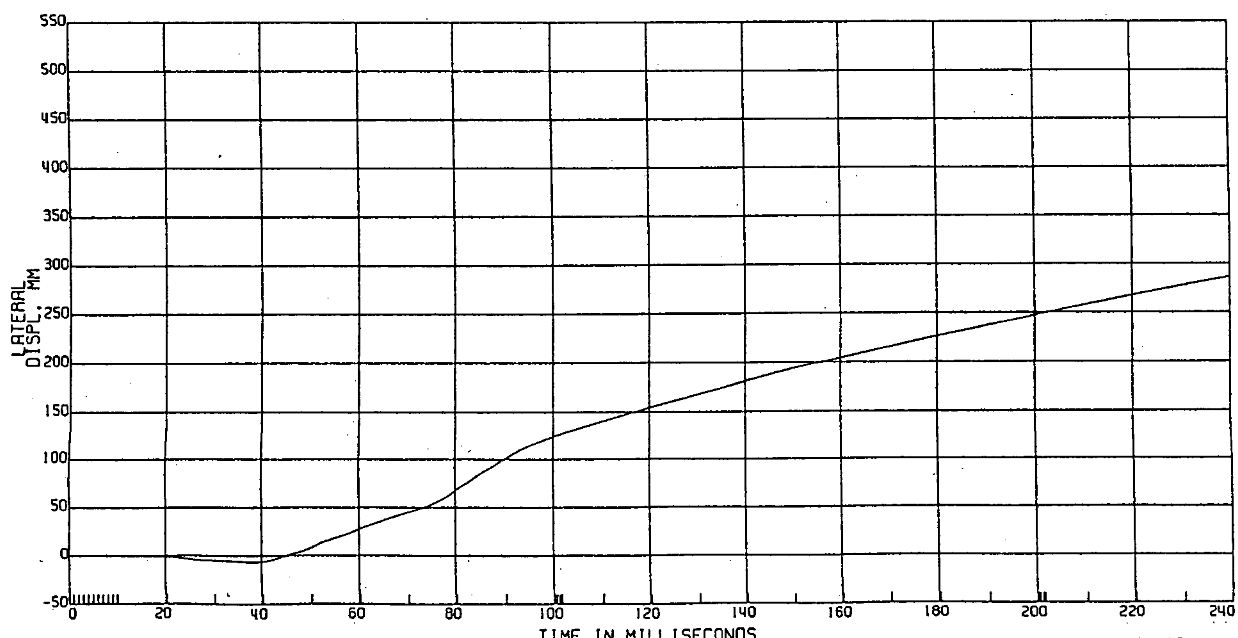
Appendix F, plot # 75

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



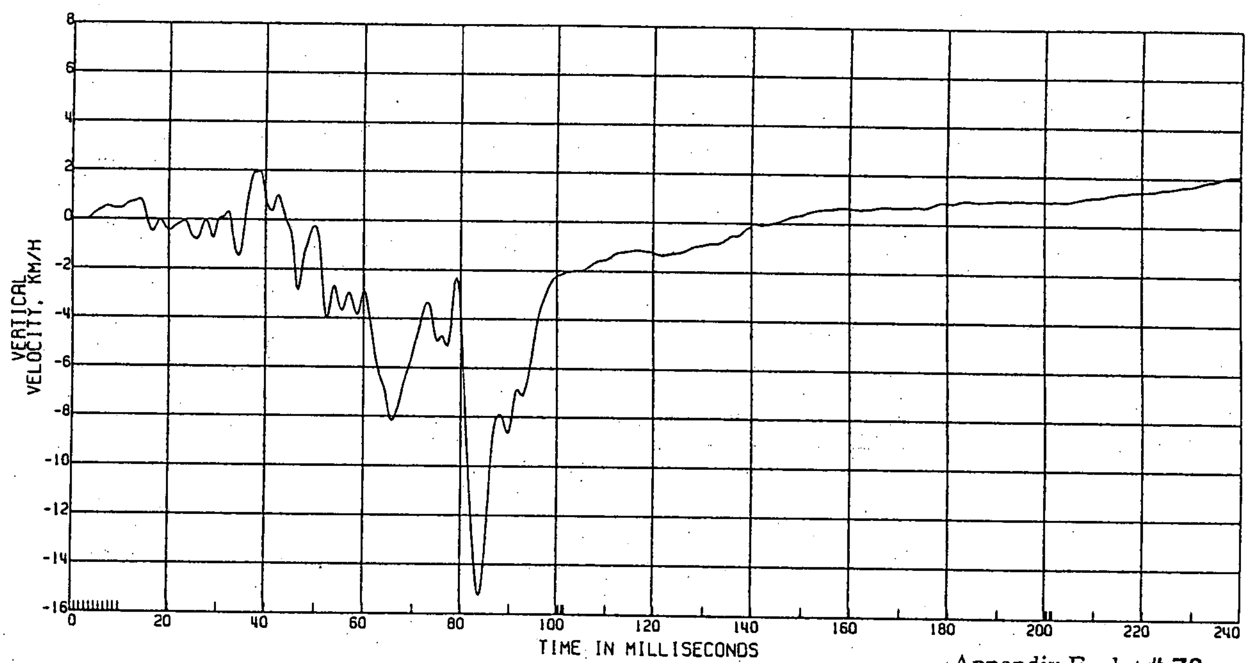
Appendix F, plot # 76

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 180

L. FRT ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



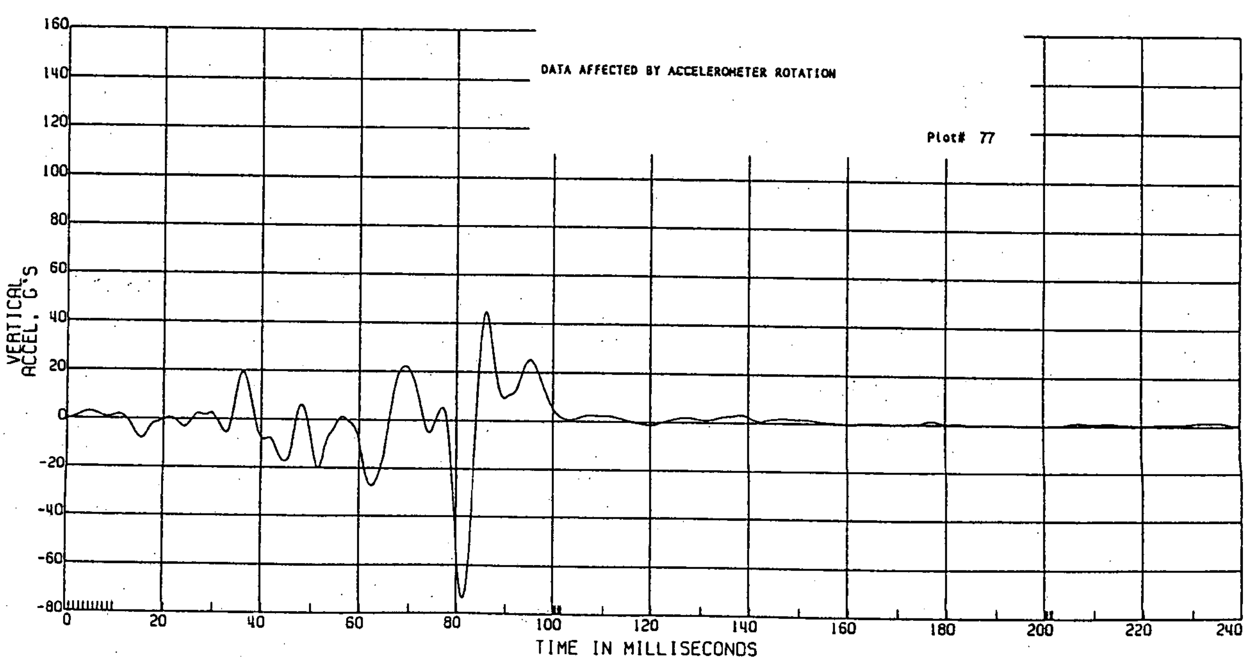
Appendix F, plot # 78

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 60

L. FRT ROCKER ACCEL

TEST DATE:08/14/1996



Appendix F, plot # 77

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

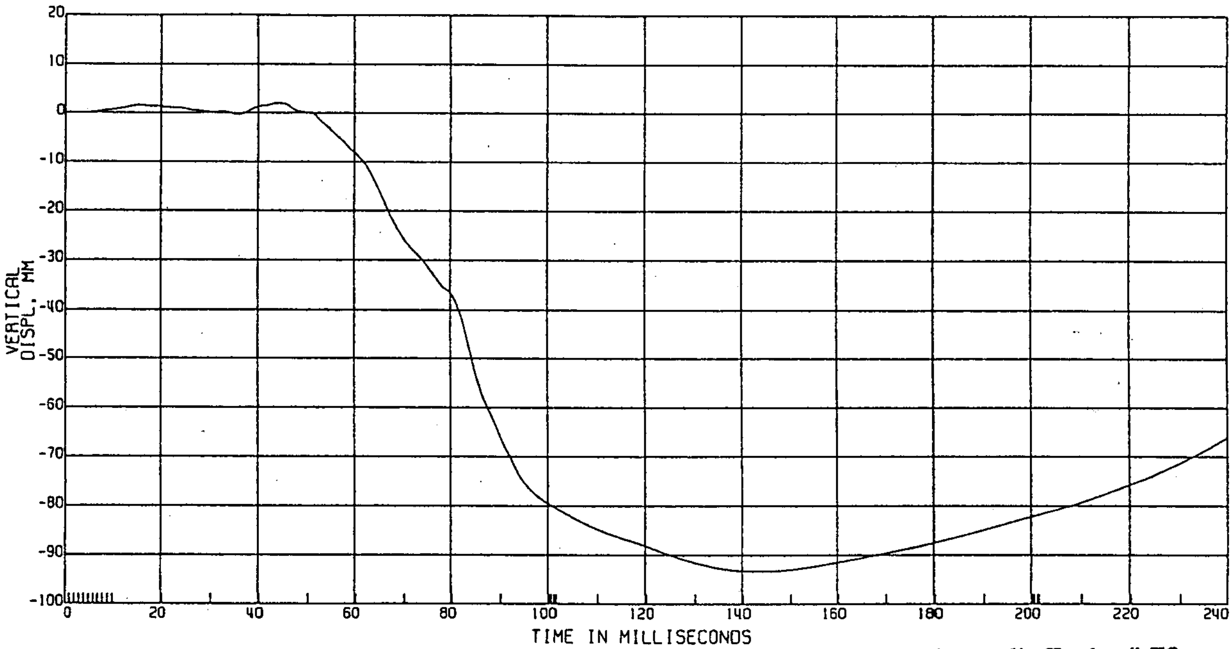
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # 79

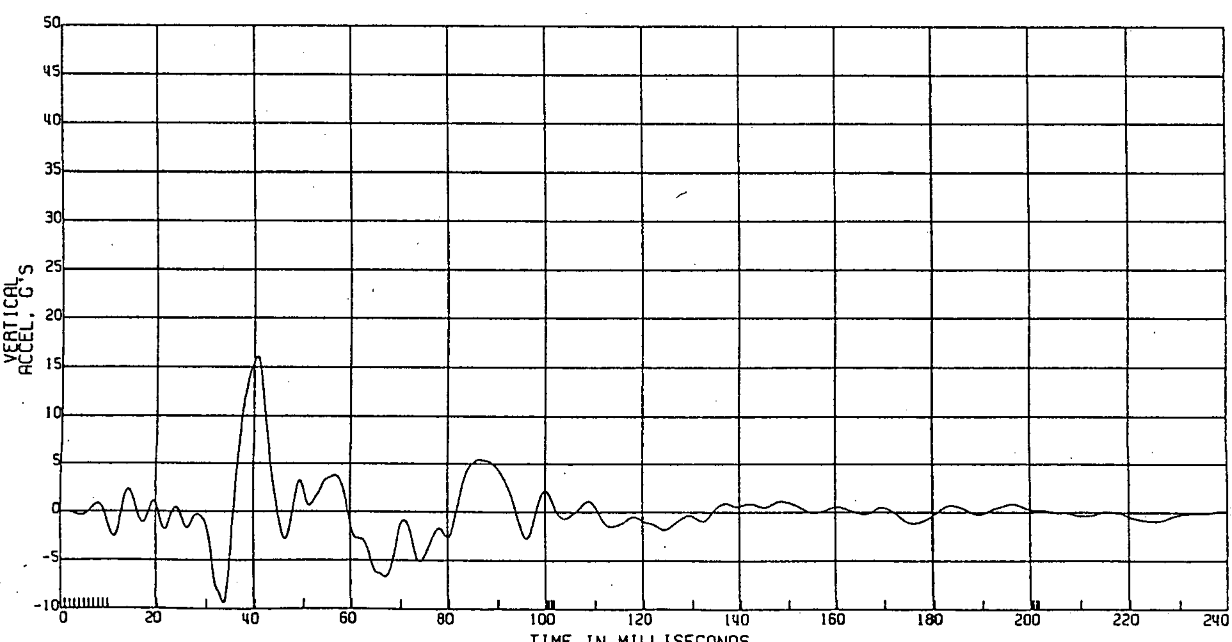
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 60

R. FRT ROCKER ACCEL

TEST DATE:08/14/1996



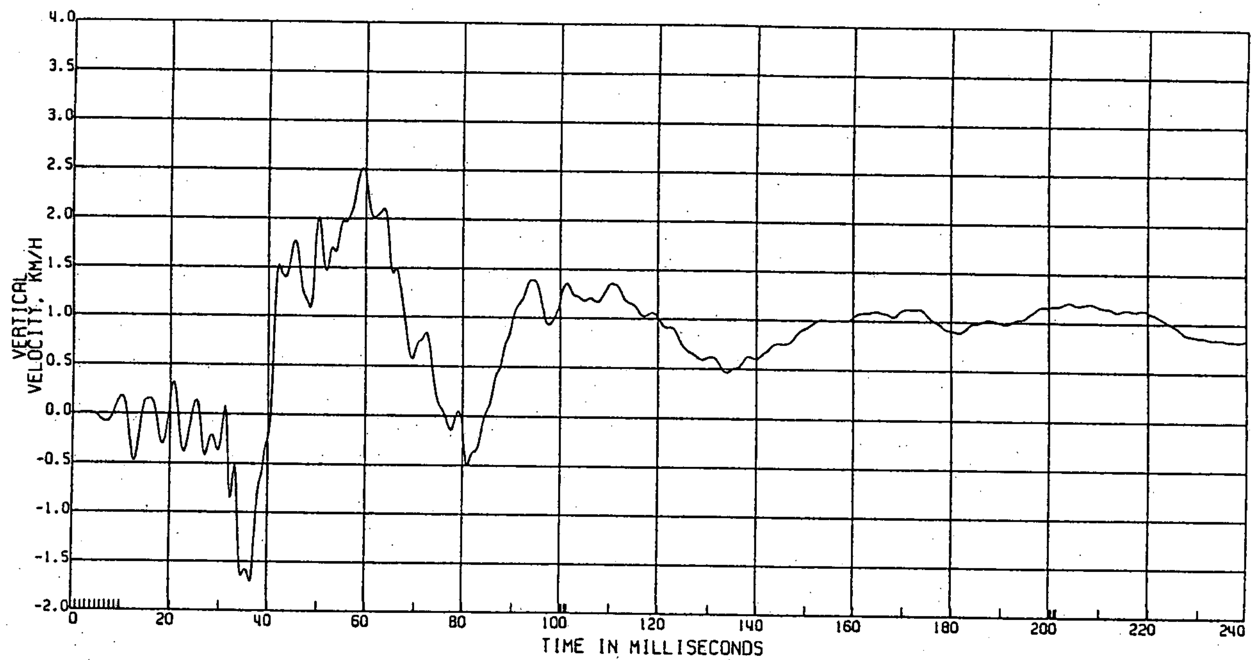
Appendix F, plot # 80

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 180

R. FRT ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



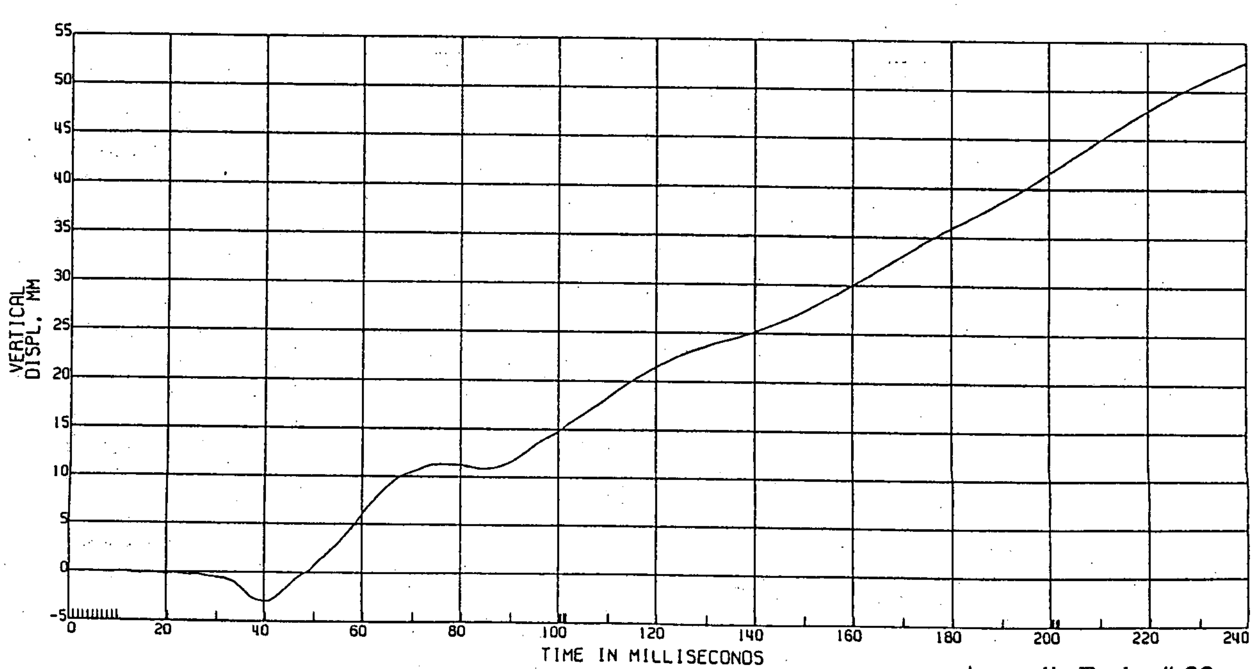
Appendix F, plot # 81

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 180

R. FRT ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # 82

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

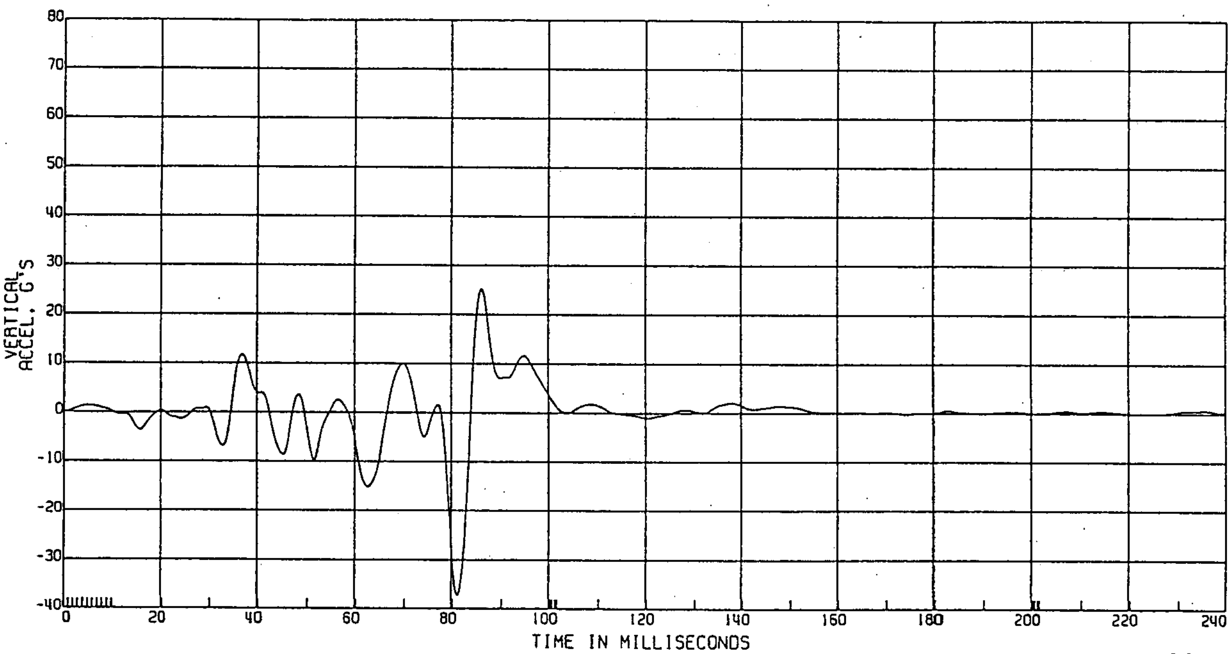
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 60

AVERAGED FRT ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:08/14/1996



Appendix F, plot # 83

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

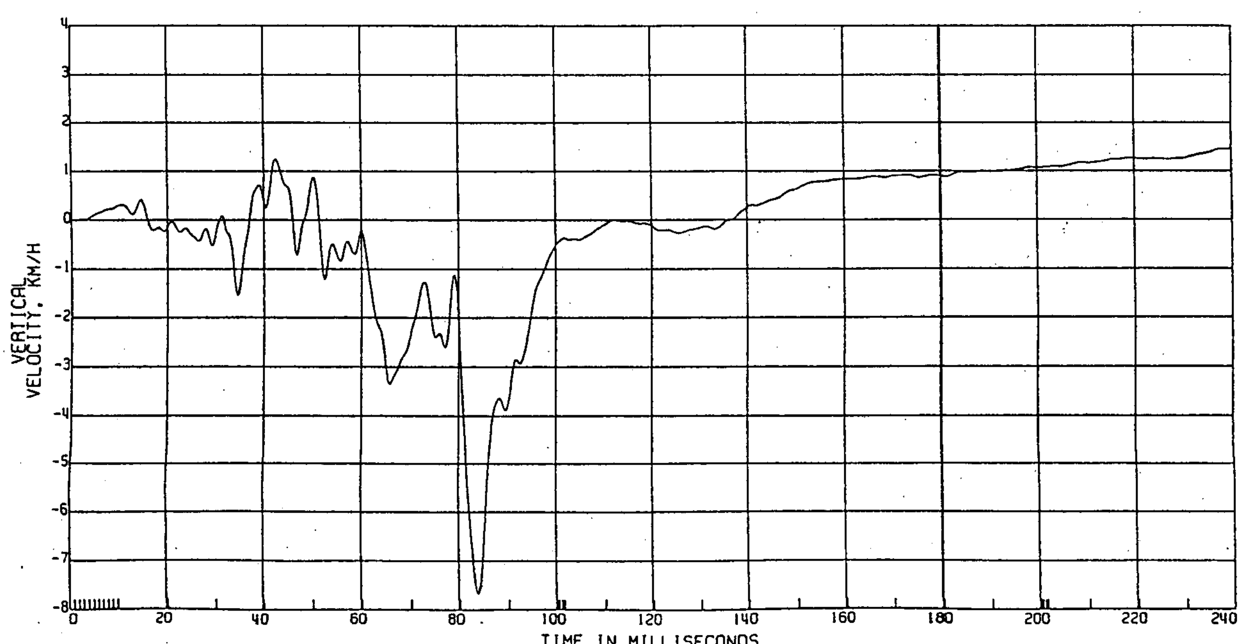
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



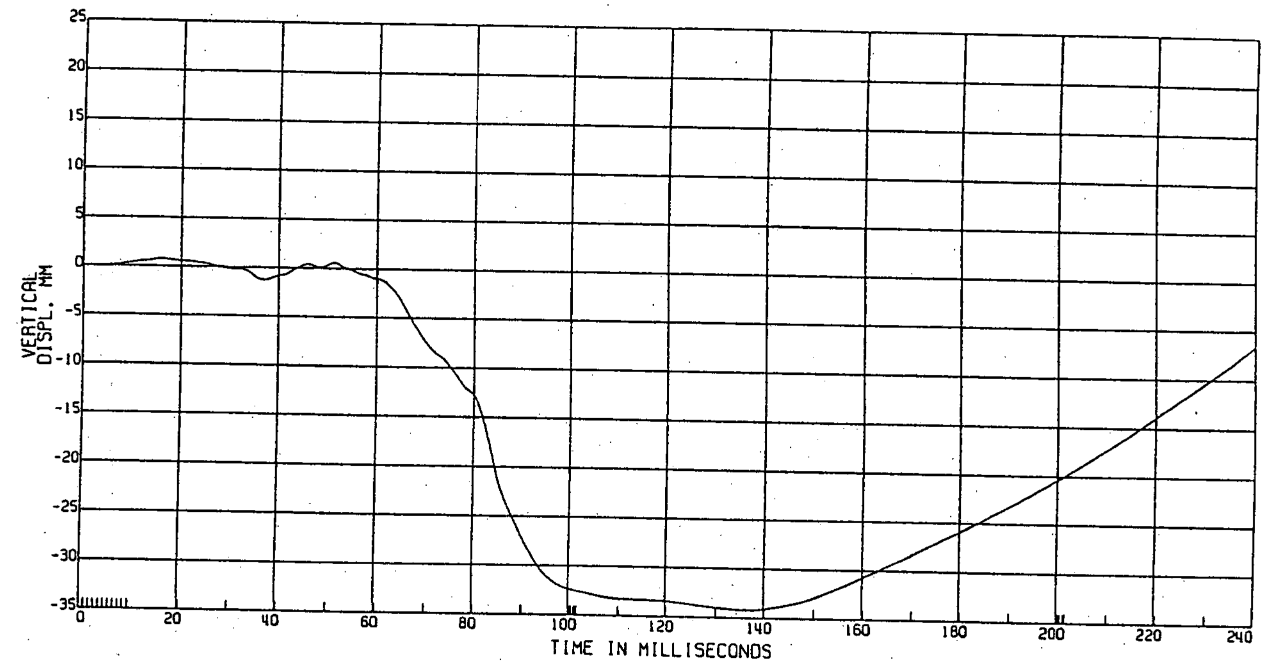
Appendix F, plot # 84

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



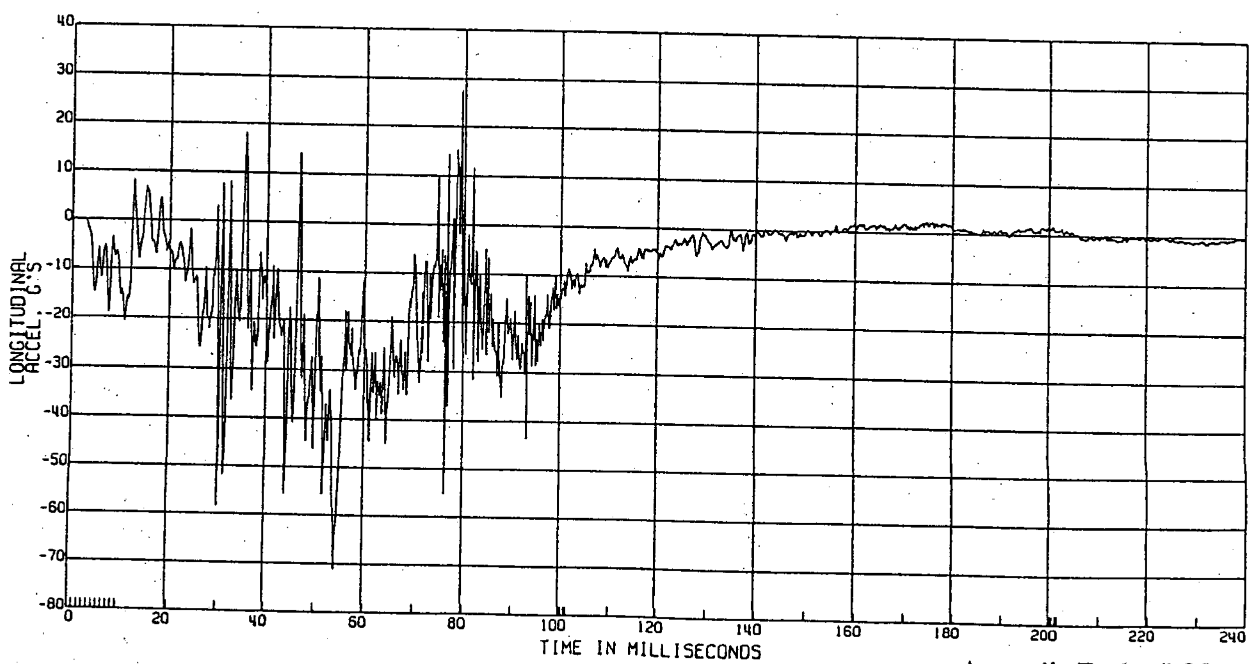
Appendix F, plot # 85

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 1000

L.REAR ROCKER ACCEL

TEST DATE:08/14/1996



Appendix F, plot # 86

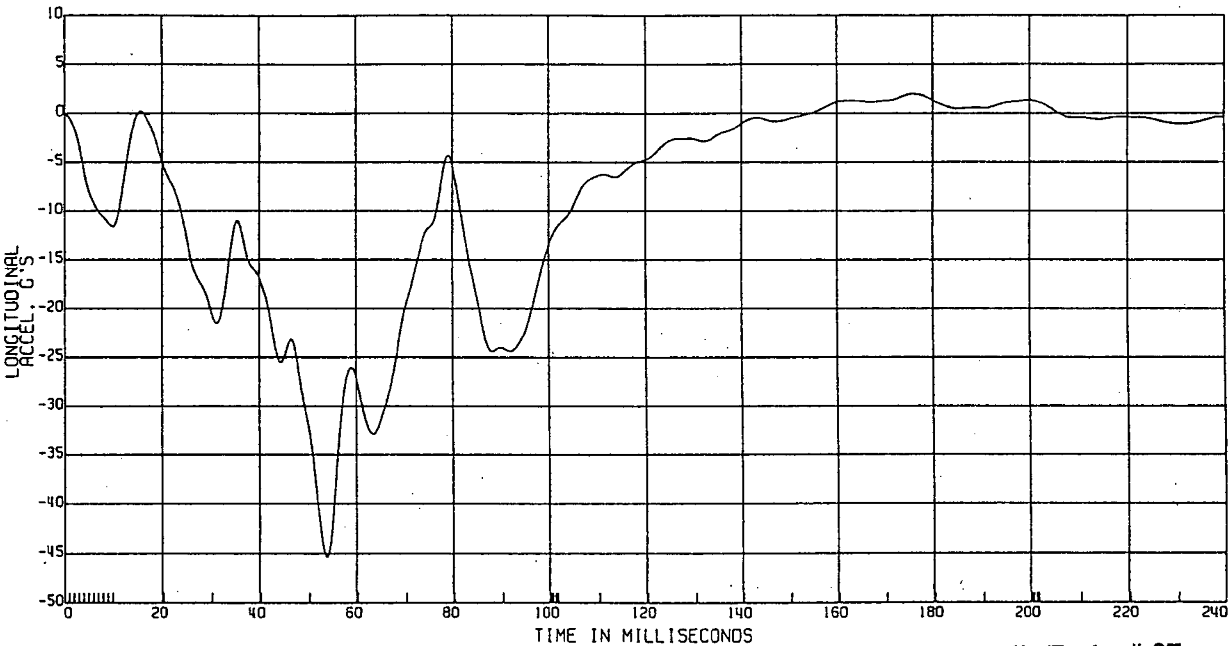
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 60

L.REAR ROCKER ACCEL

TEST DATE:08/14/1996



Appendix F, plot # 87

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

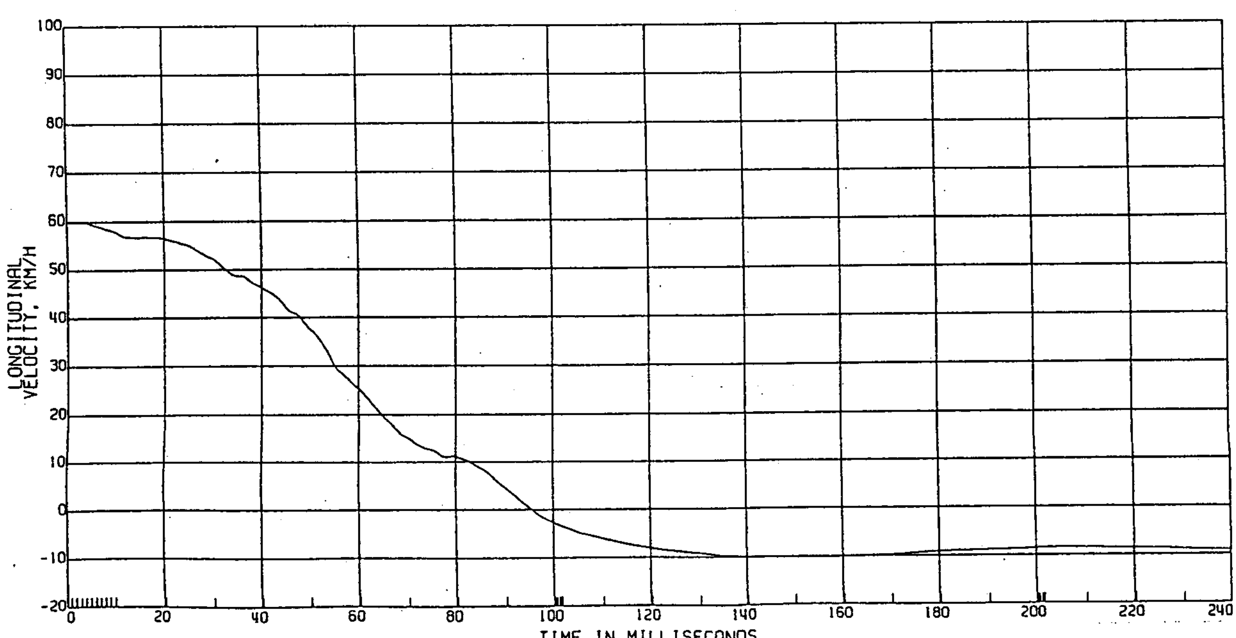
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 180

L.REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



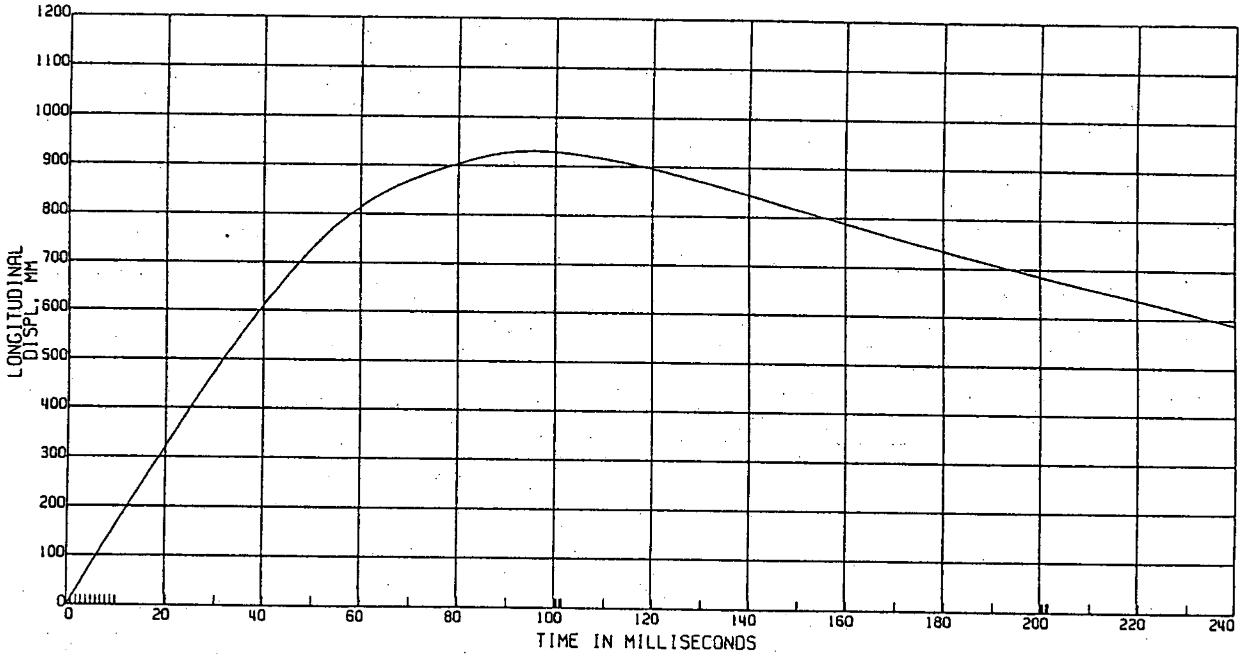
Appendix F, plot # 88

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 180

L.REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



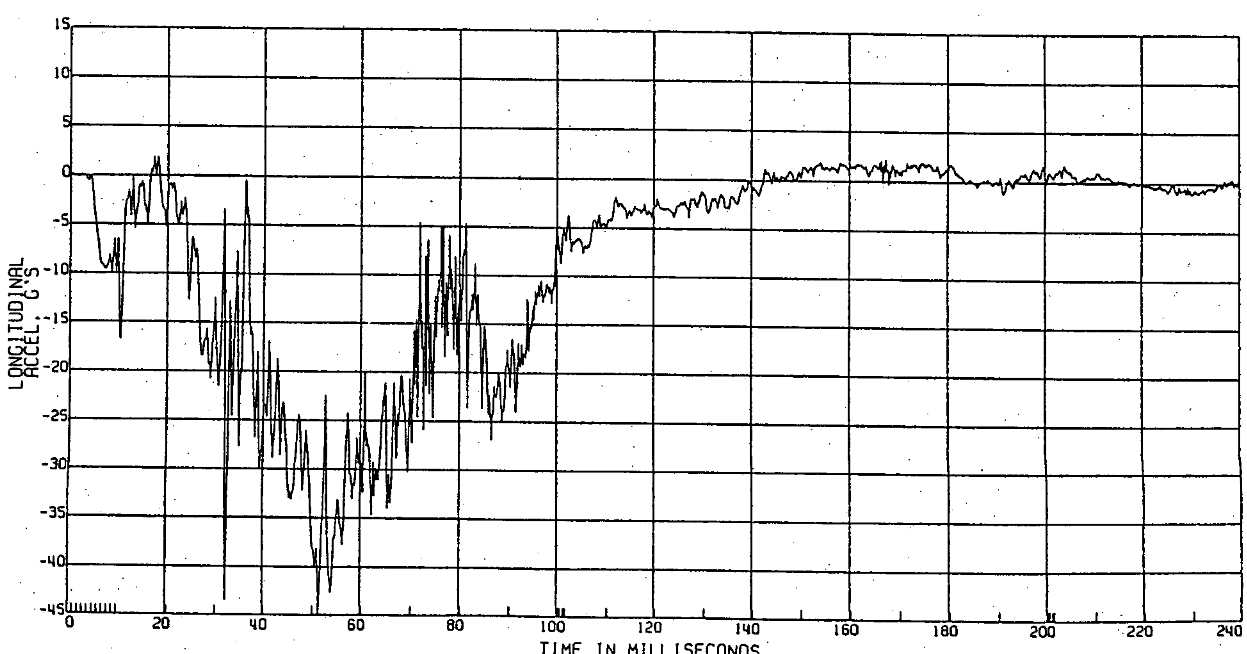
Appendix F, plot # 89

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

R.REAR ROCKER ACCEL

TEST DATE:08/14/1996



Appendix F, plot # 90

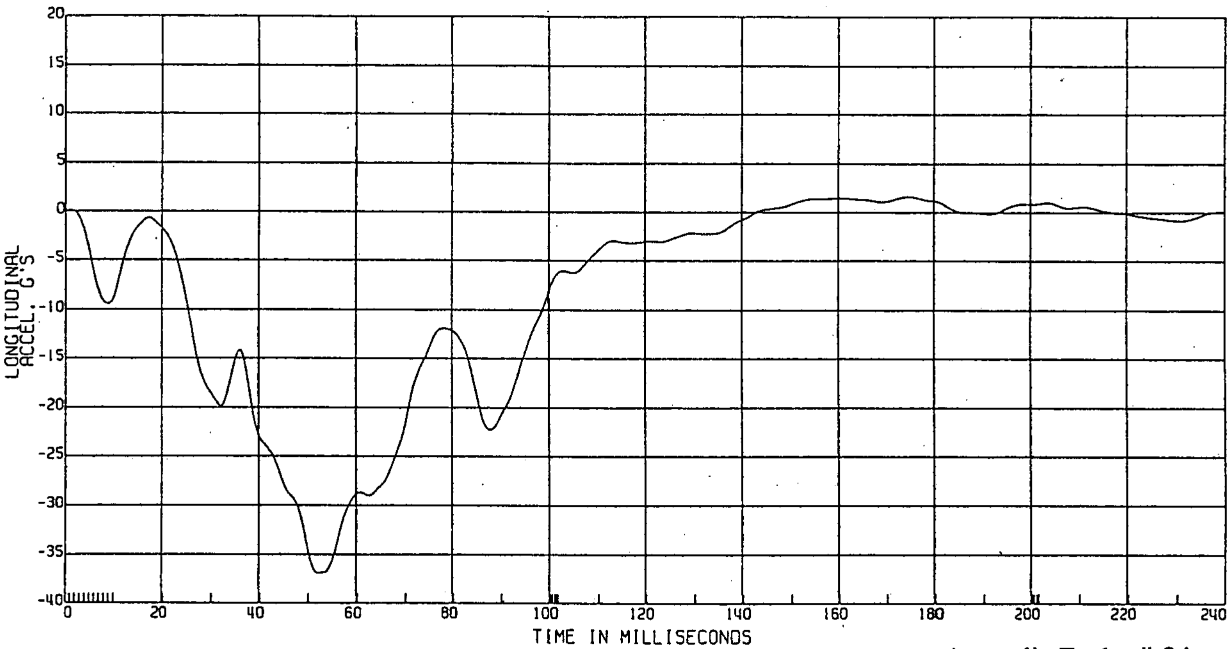
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 60

R.REAR ROCKER ACCEL

TEST DATE:08/14/1996



Appendix F, plot # 91

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

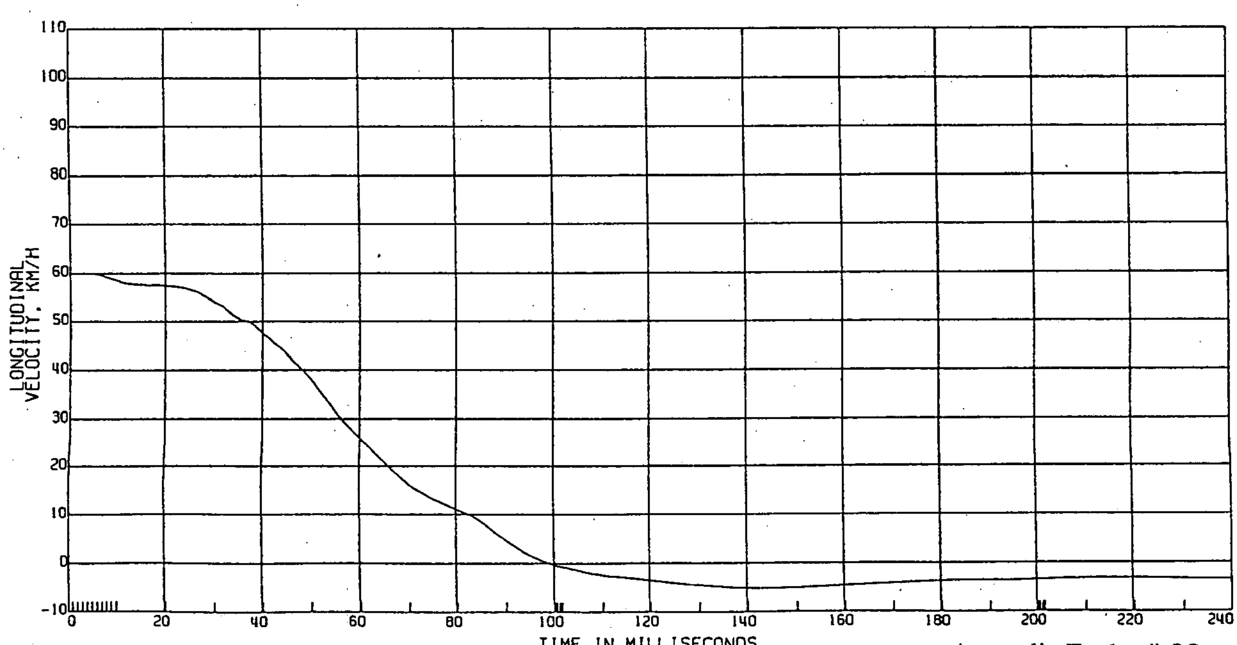
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 180

R.REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



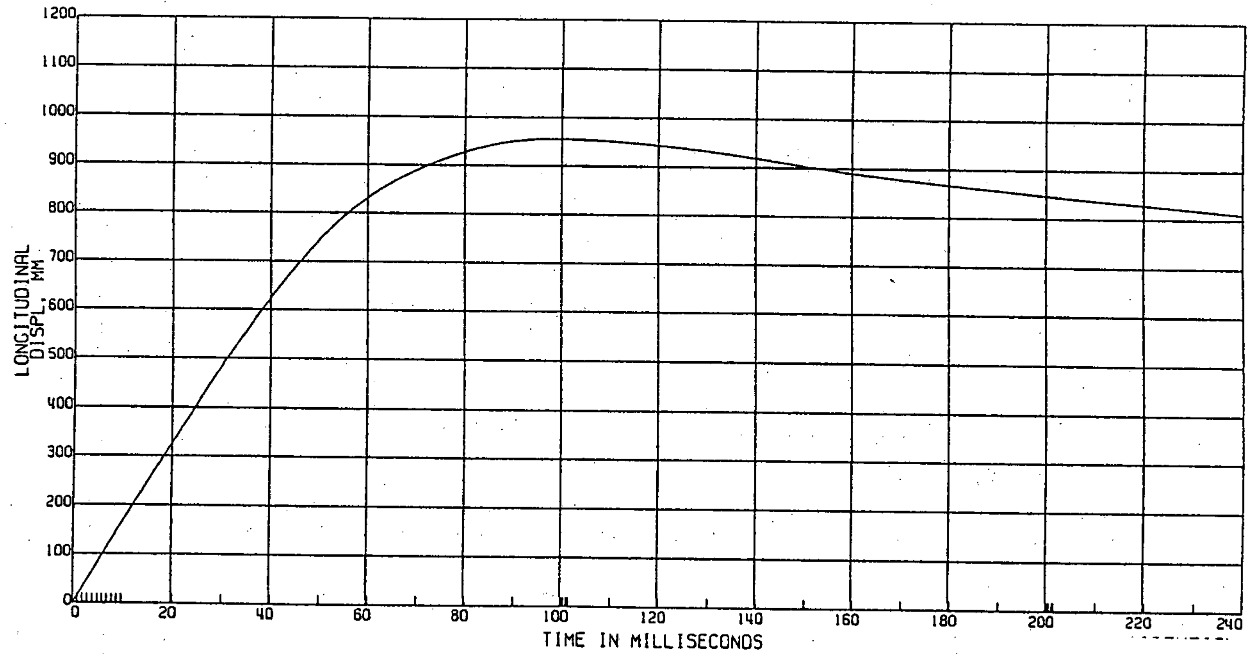
Appendix F, plot # 92

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 180

R.REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



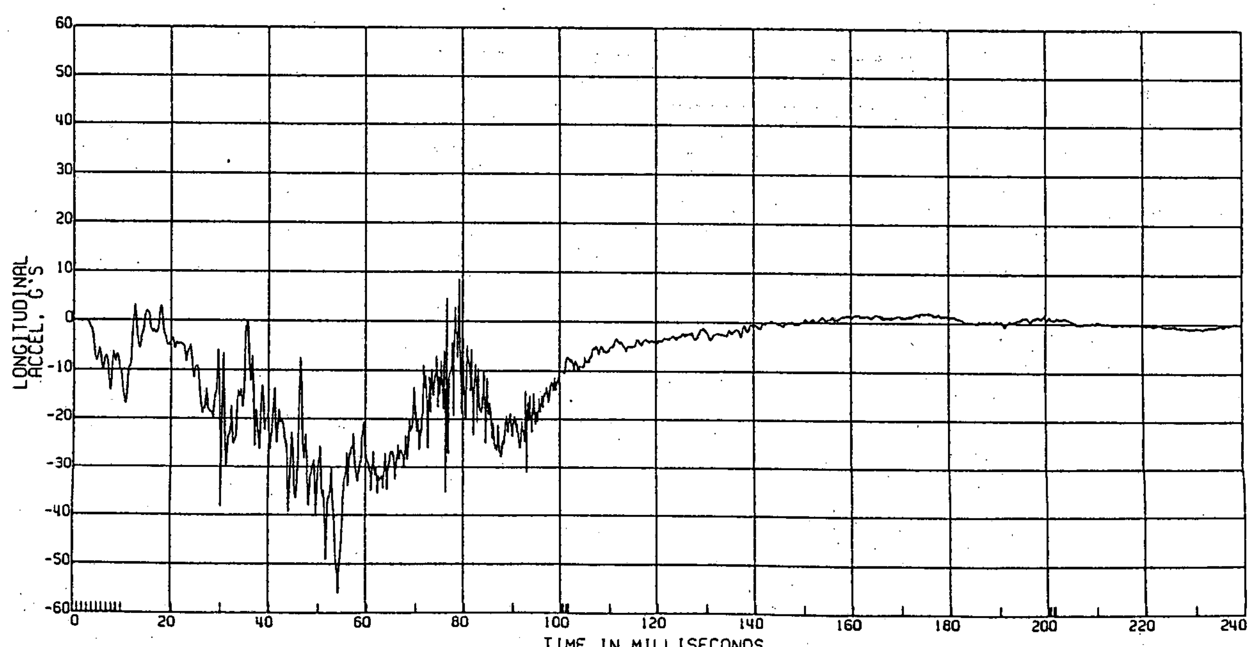
Appendix F, plot # 93

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

AVERAGED REAR ROCKER ACCELERATION
(AVGD L. & R. ROCKER ACCELS)

TEST DATE:08/14/1996



Appendix F, plot # 94

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

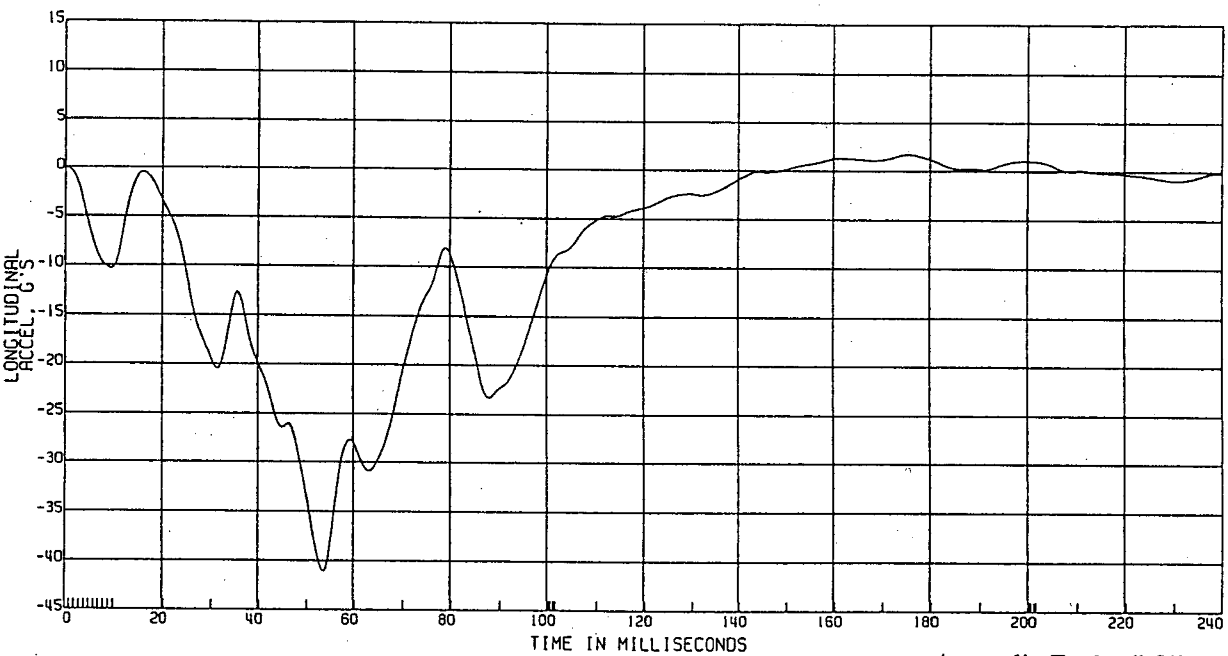
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 60

AVERAGED REAR ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:08/14/1996



Appendix F, plot # 95

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

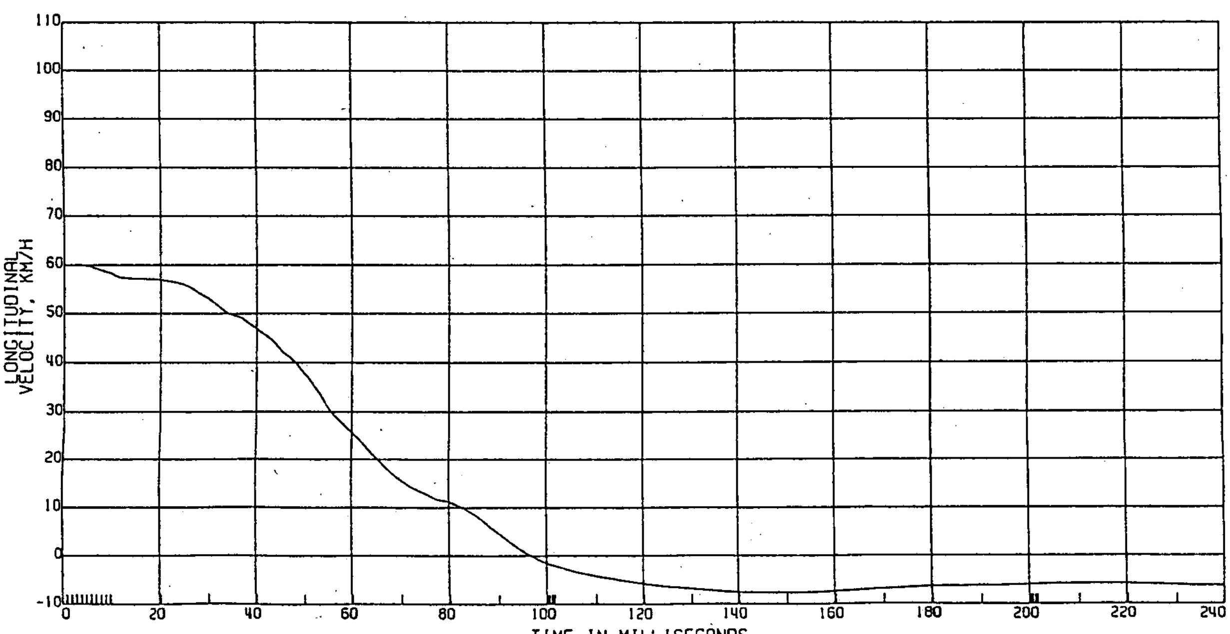
R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



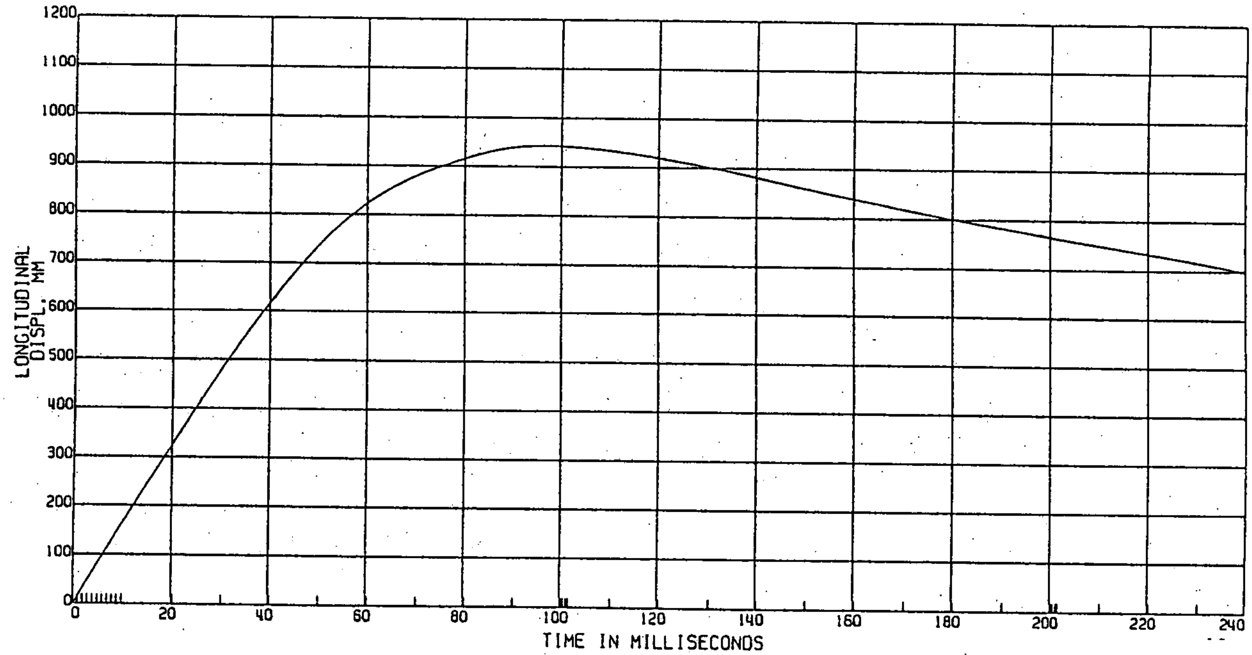
Appendix F, plot # 96

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



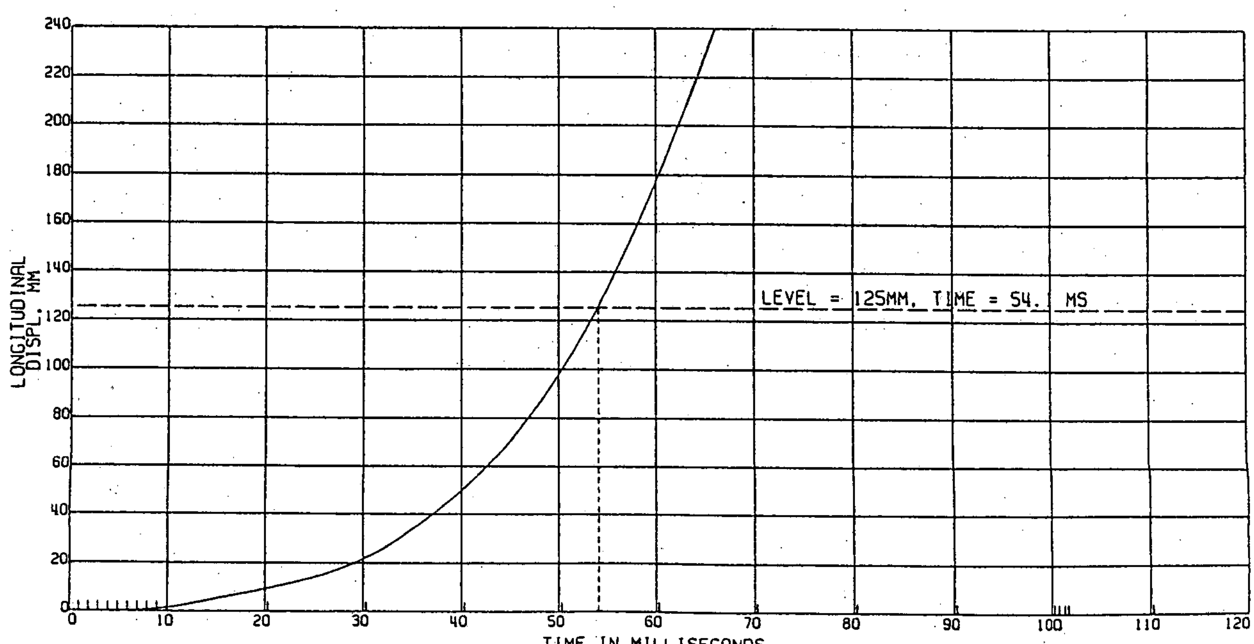
Appendix F, plot # 97

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 180

COMP. FREE MASS DISP. REL. TO VEHICLE

TEST DATE:08/14/1996



Appendix F, plot # 98

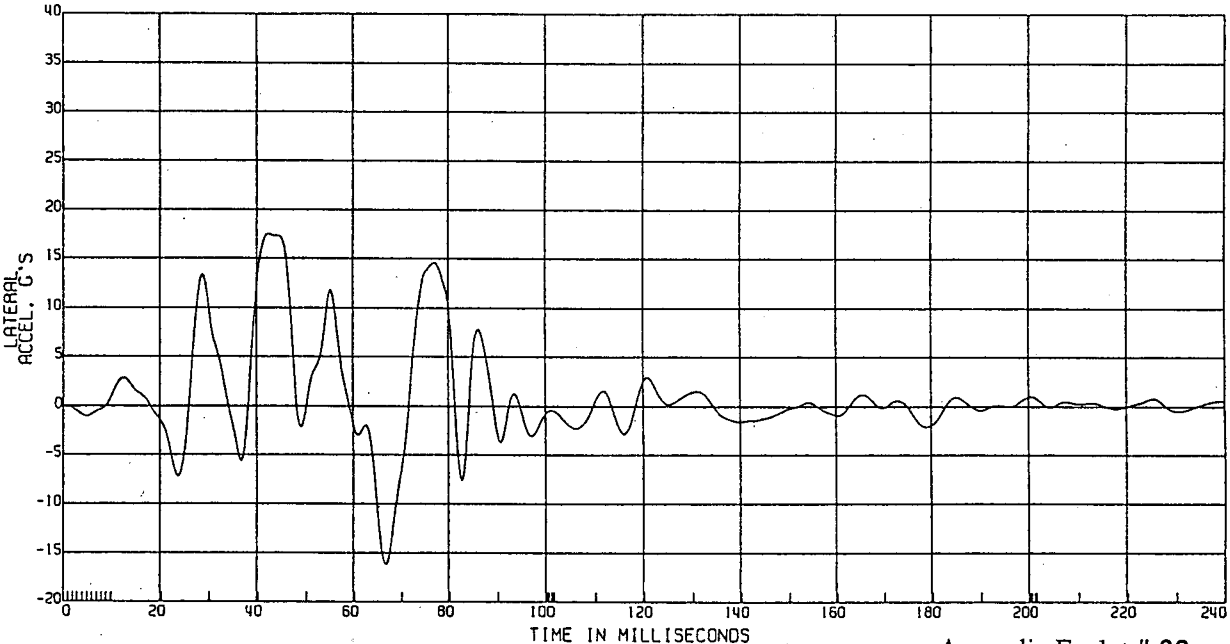
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

L.REAR ROCKER ACCEL

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 60



Appendix F, plot # 99

99 PROCESSED 8/14/1996 15:32 V2.04E

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

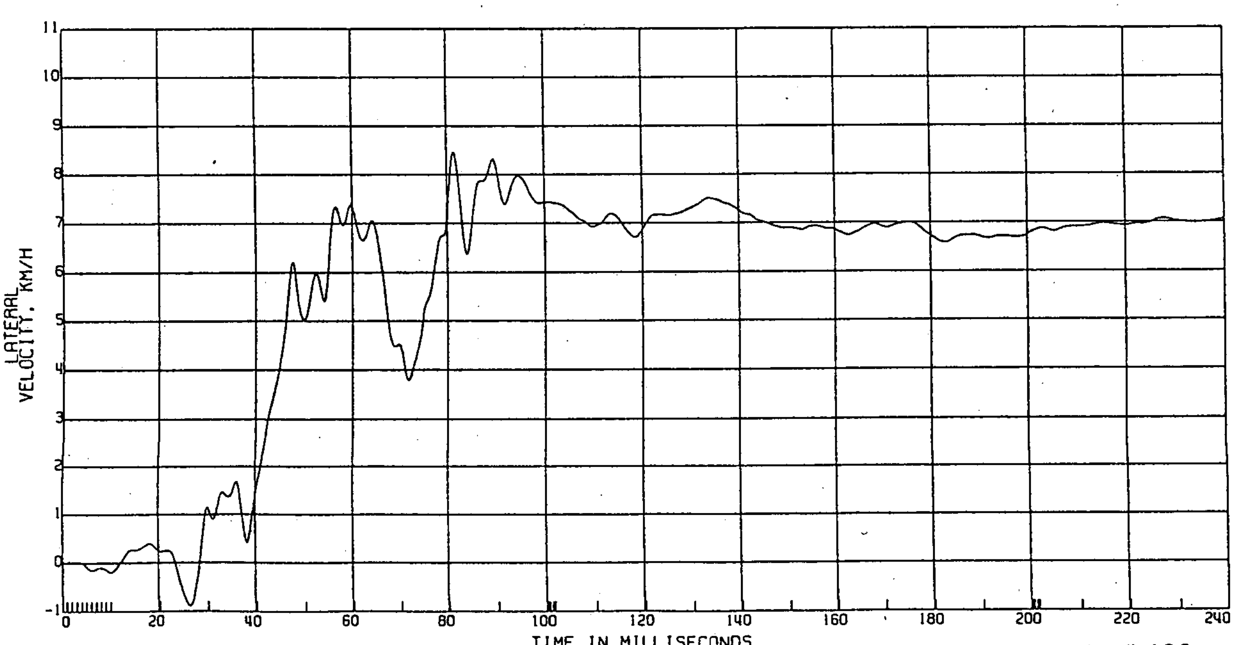
R & D CTR 8T9306D VAN

L.REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 180



Appendix F, plot # 100

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

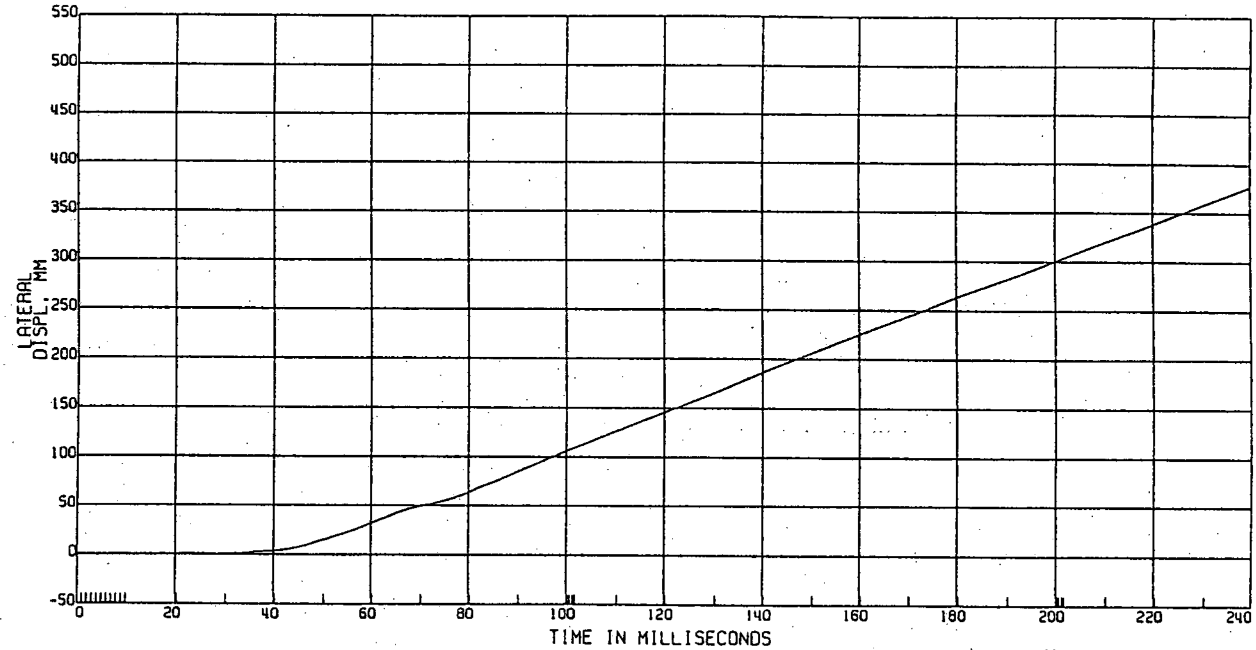
R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 180

L.REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # **101**

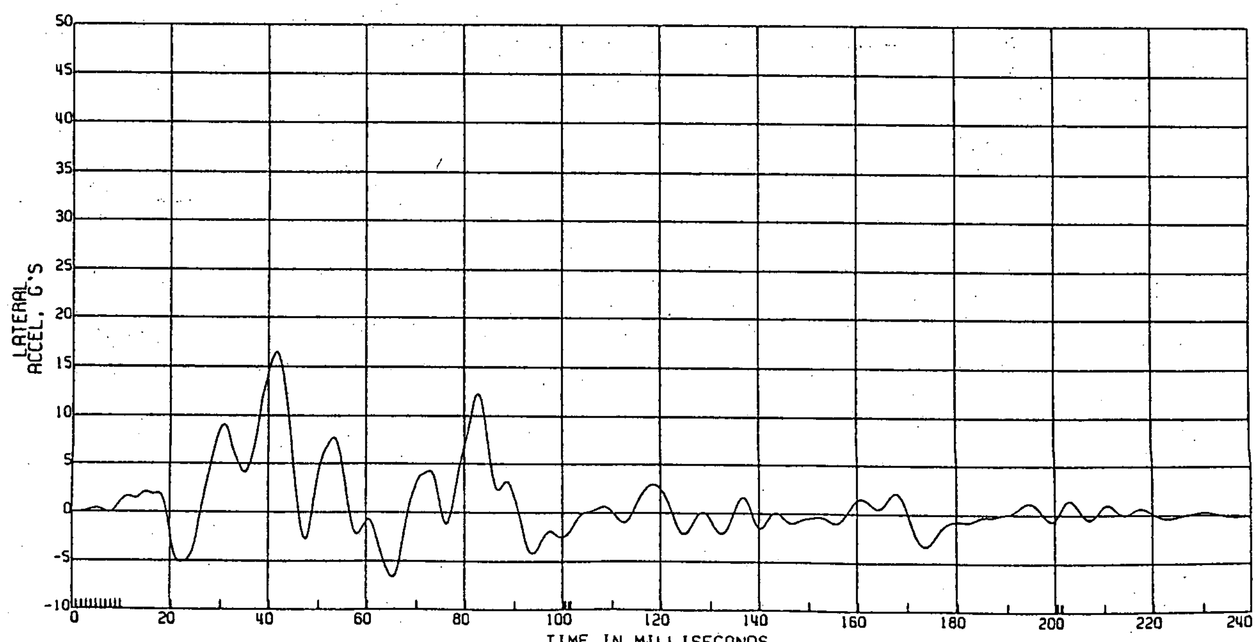
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 60

R.REAR ROCKER ACCEL

TEST DATE:08/14/1996



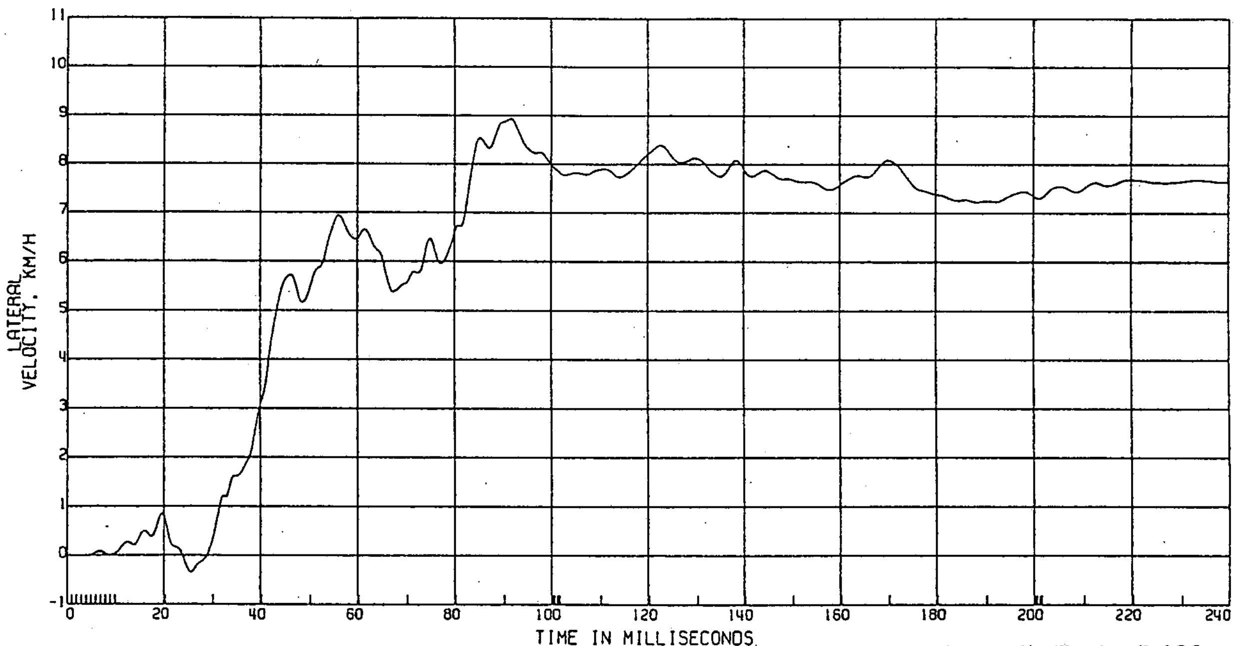
Appendix F, plot # **102**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 180

R.REAR ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



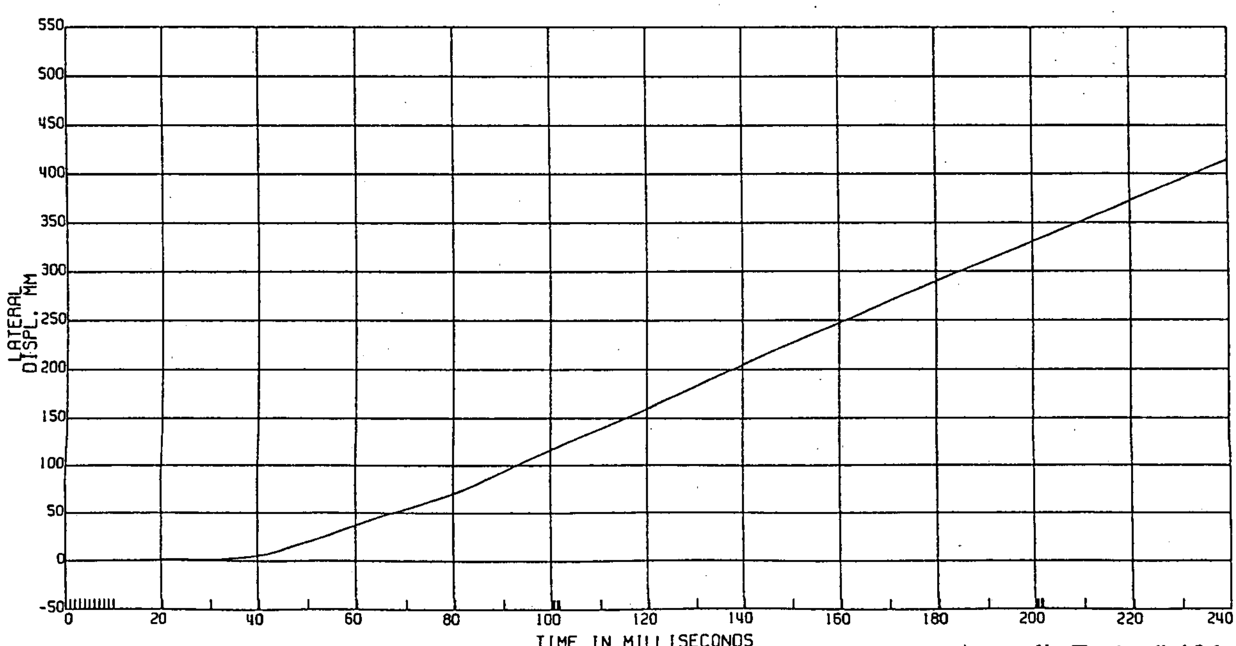
Appendix F, plot # **103**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 180

R.REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



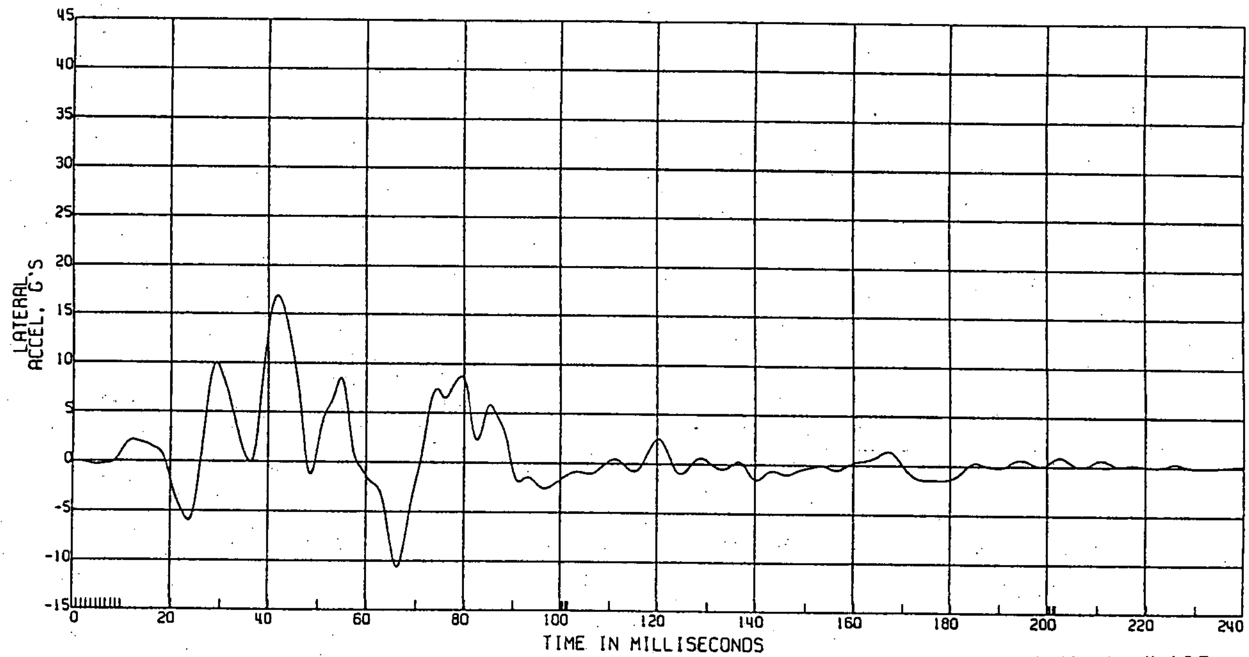
Appendix F, plot # **104**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 60

AVERAGED REAR ROCKER ACCELERATION
(AVGD L. & R. ROCKER ACCELS)

TEST DATE:08/14/1996



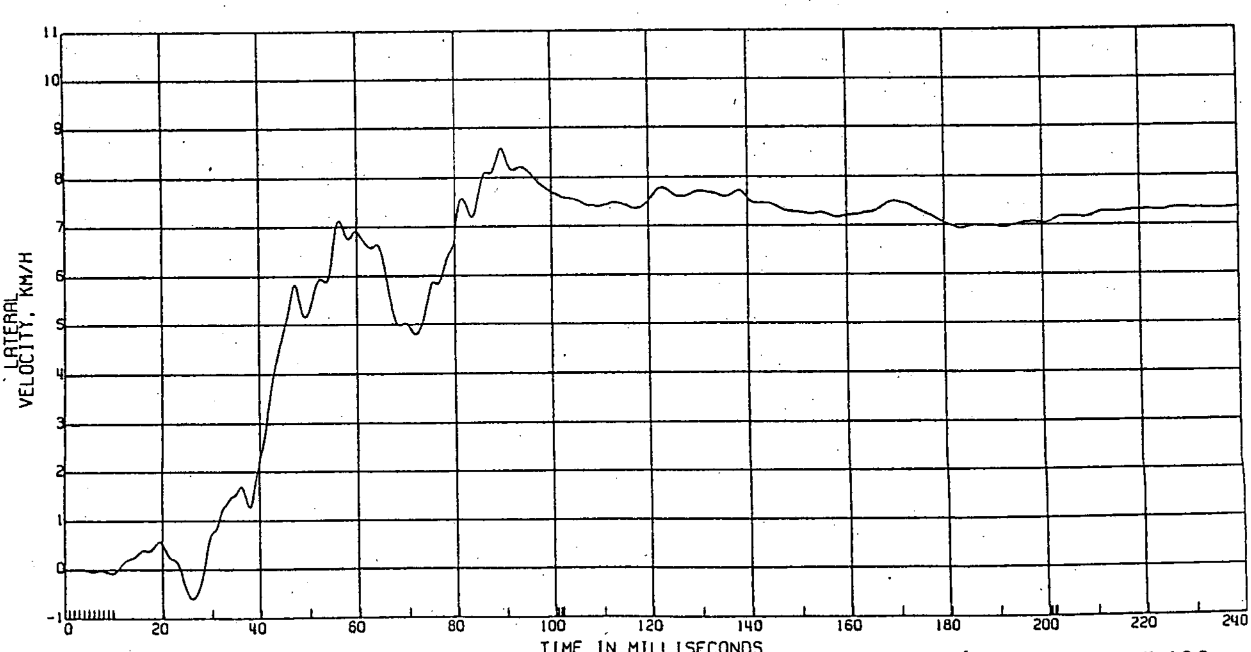
Appendix F, plot # **105**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



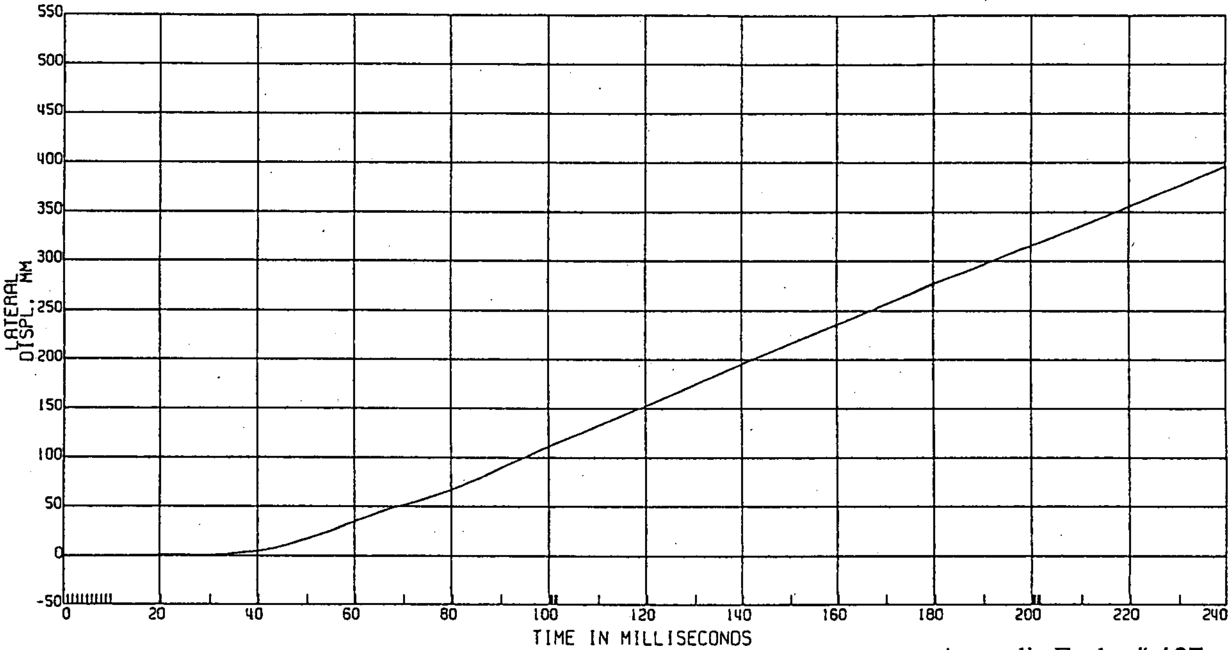
Appendix F, plot # **106**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



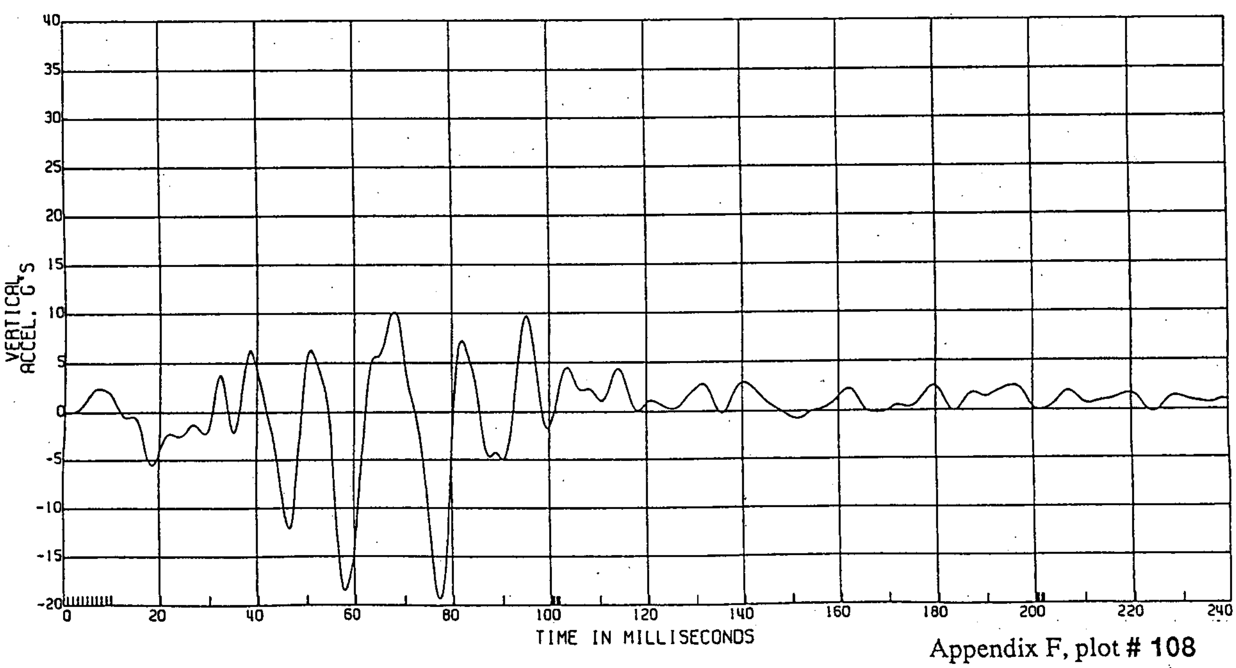
Appendix F, plot # 107

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 60

L.REAR ROCKER ACCEL

TEST DATE:08/14/1996



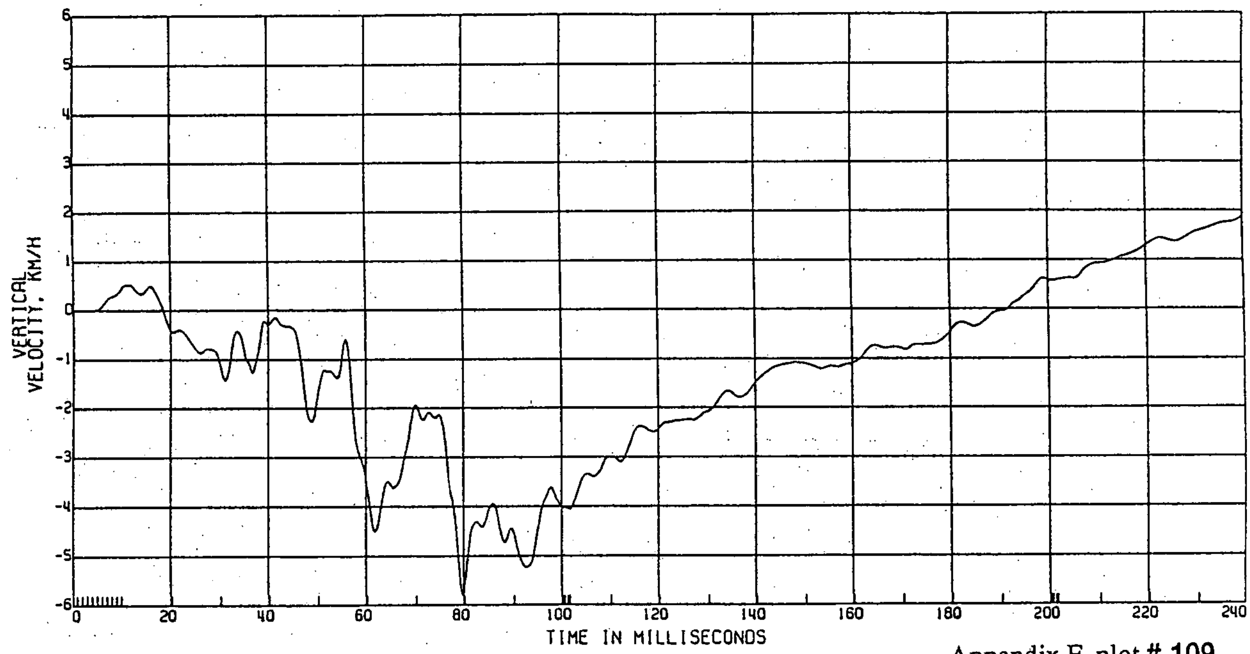
Appendix F, plot # 108

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 180

L.REAR ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



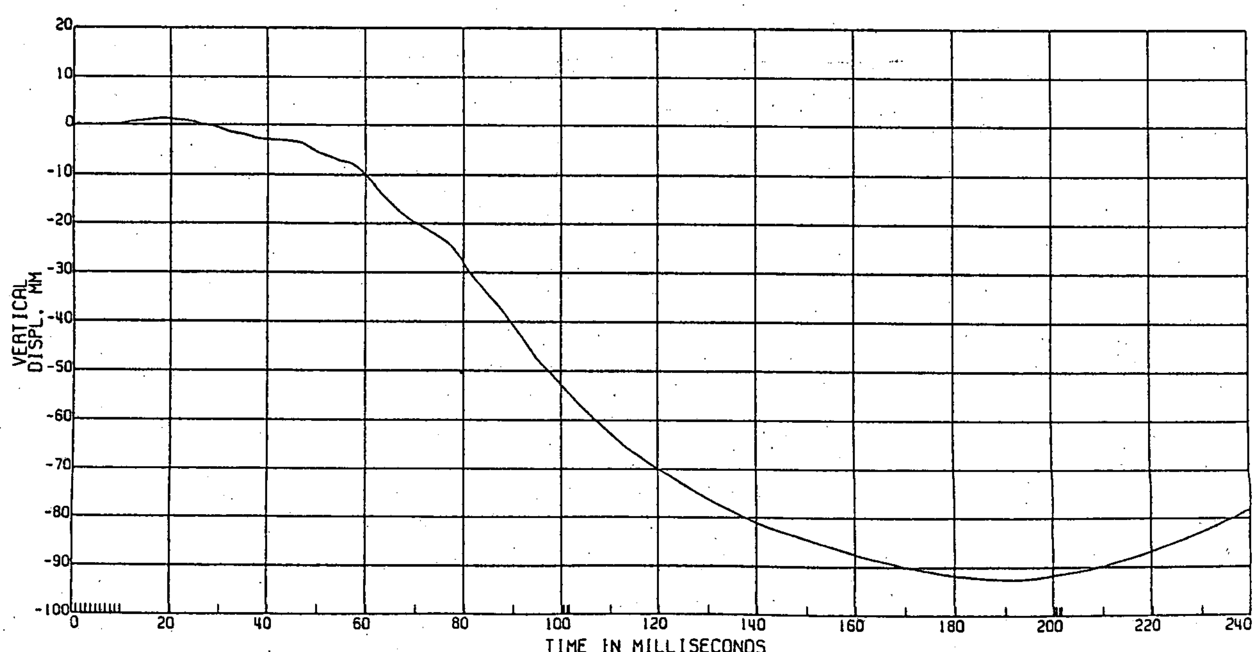
Appendix F, plot # 109

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 180

L.REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # 110

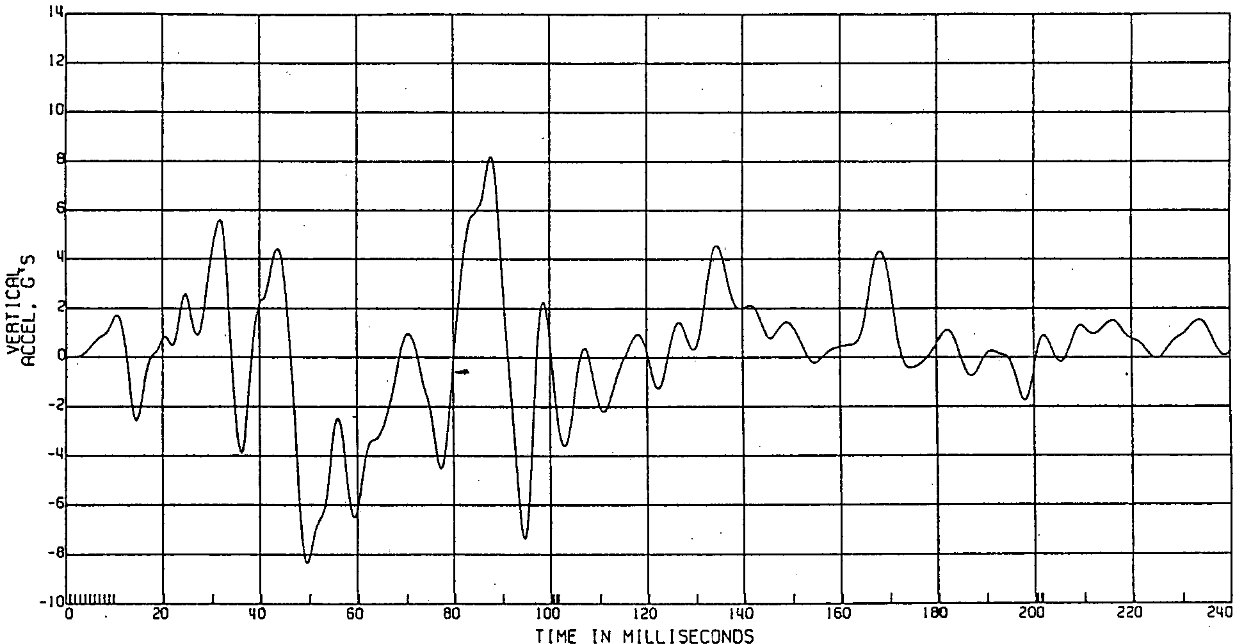
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 60

R.REAR ROCKER ACCEL

TEST DATE:08/14/1996



Appendix F, plot # 111

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

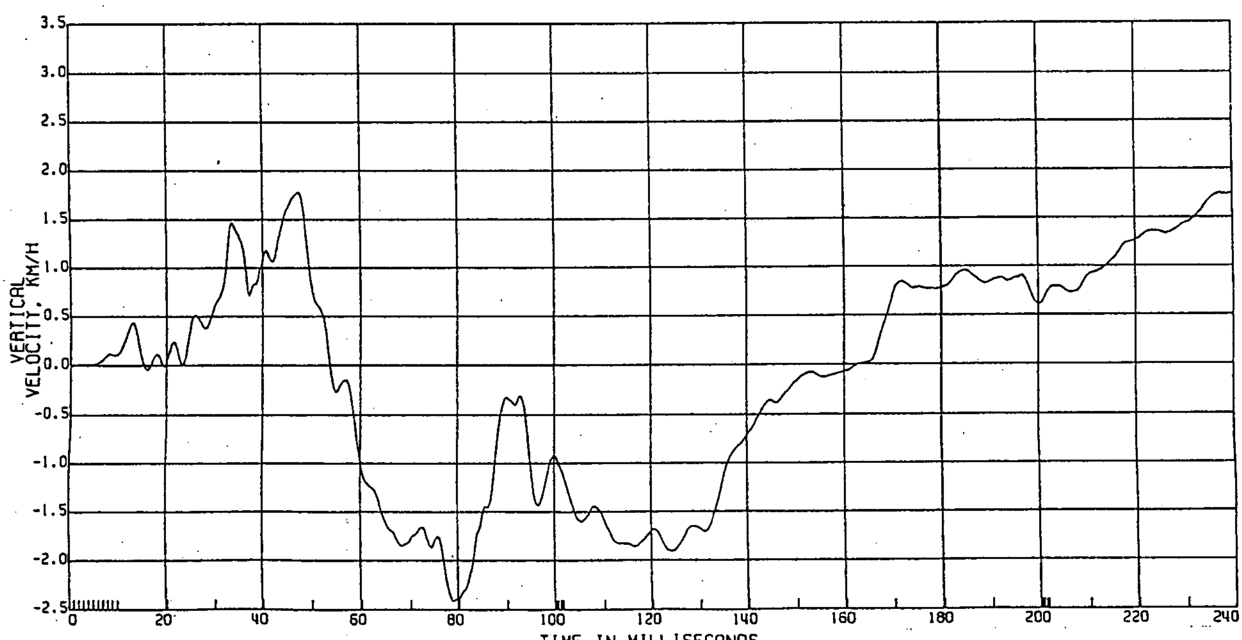
R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 180

R.REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # 112

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

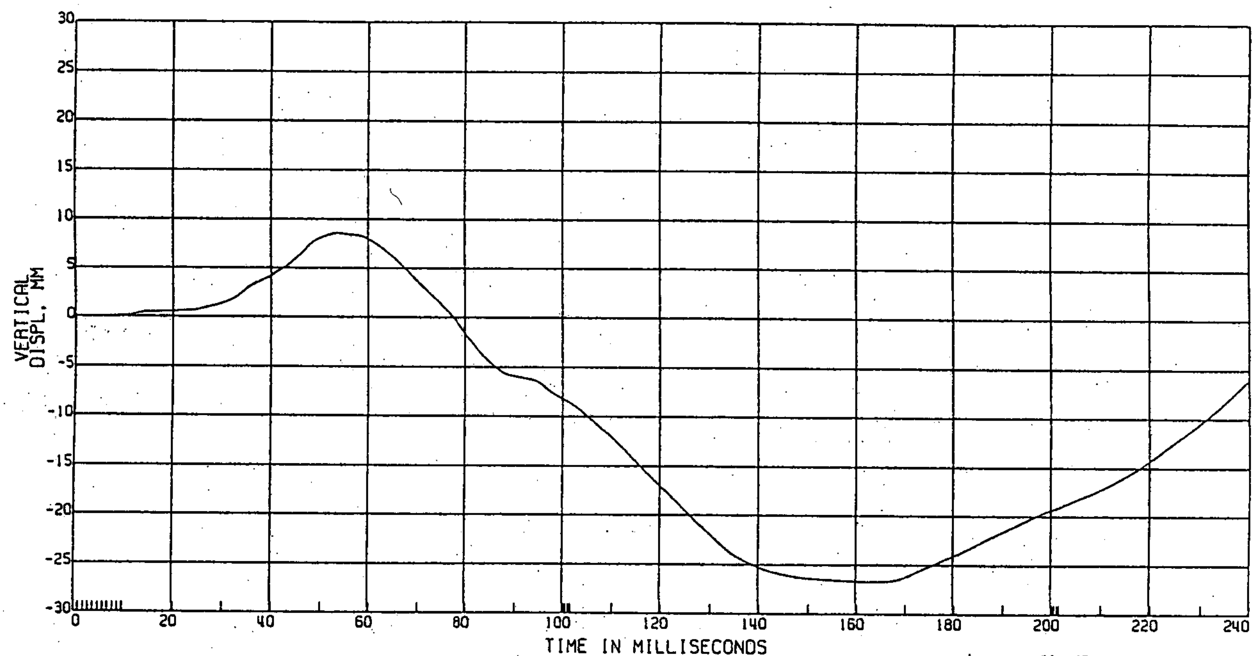
R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 180

R.REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # **113**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

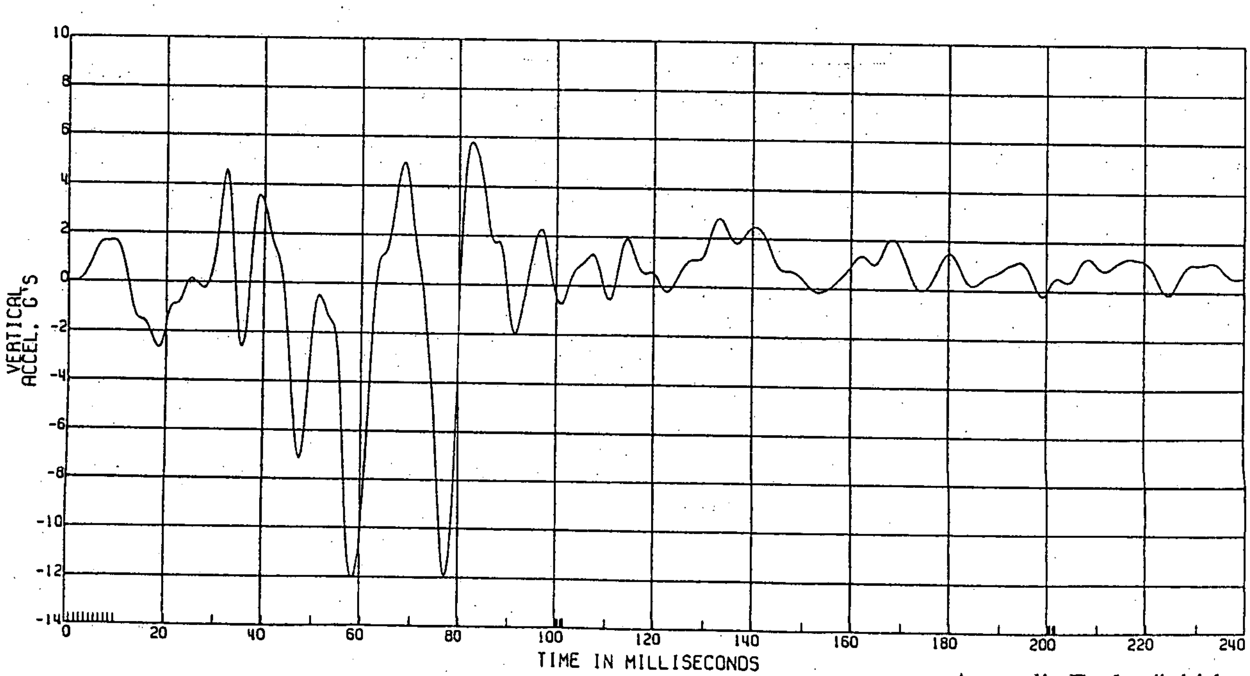
R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 60

AVERAGED REAR ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:08/14/1996



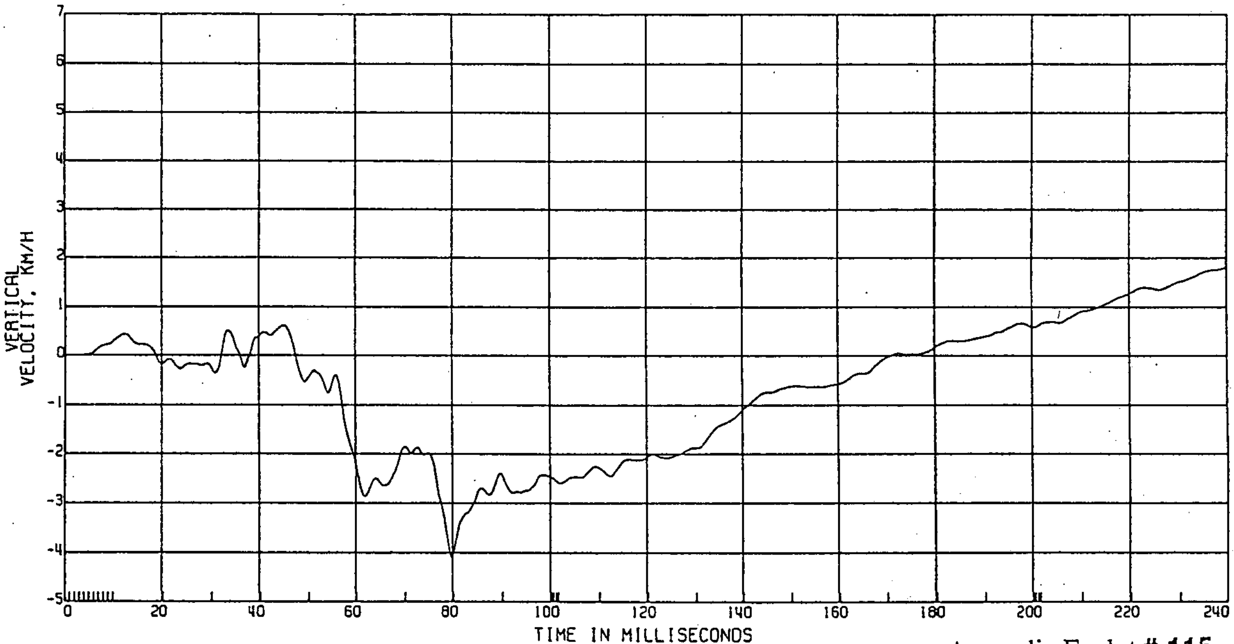
Appendix F, plot # **114**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # 115

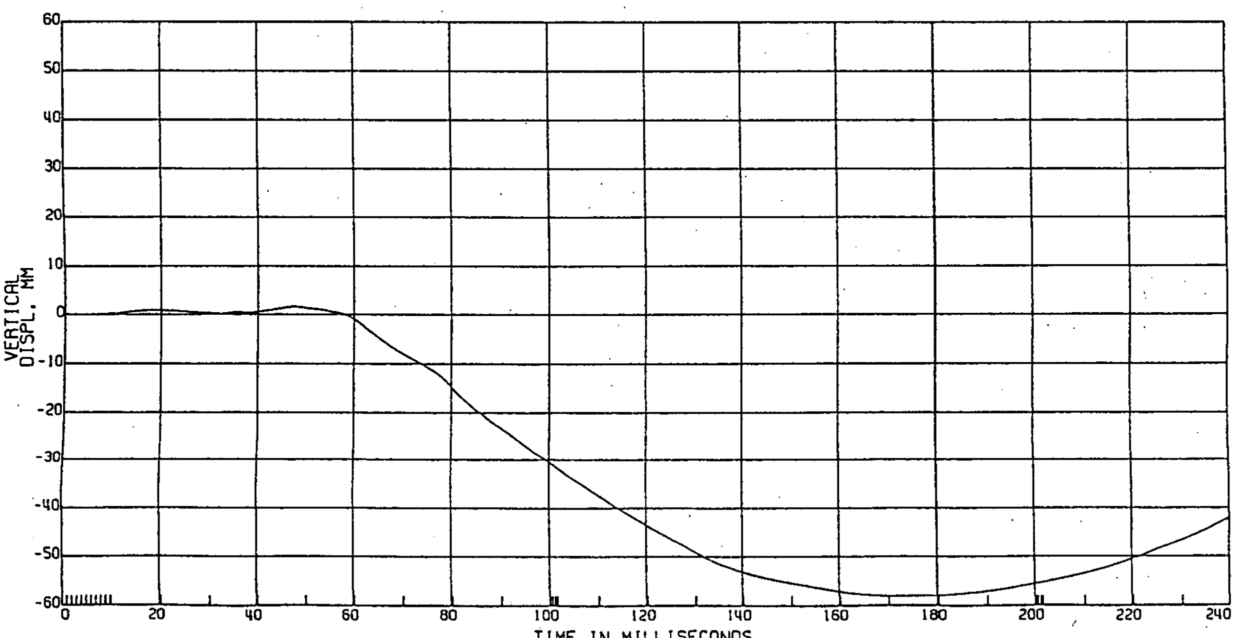
115 PROCESSED 8/14/1996 15:32V2.04E

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN
ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:08/14/1996



Appendix F, plot # 116

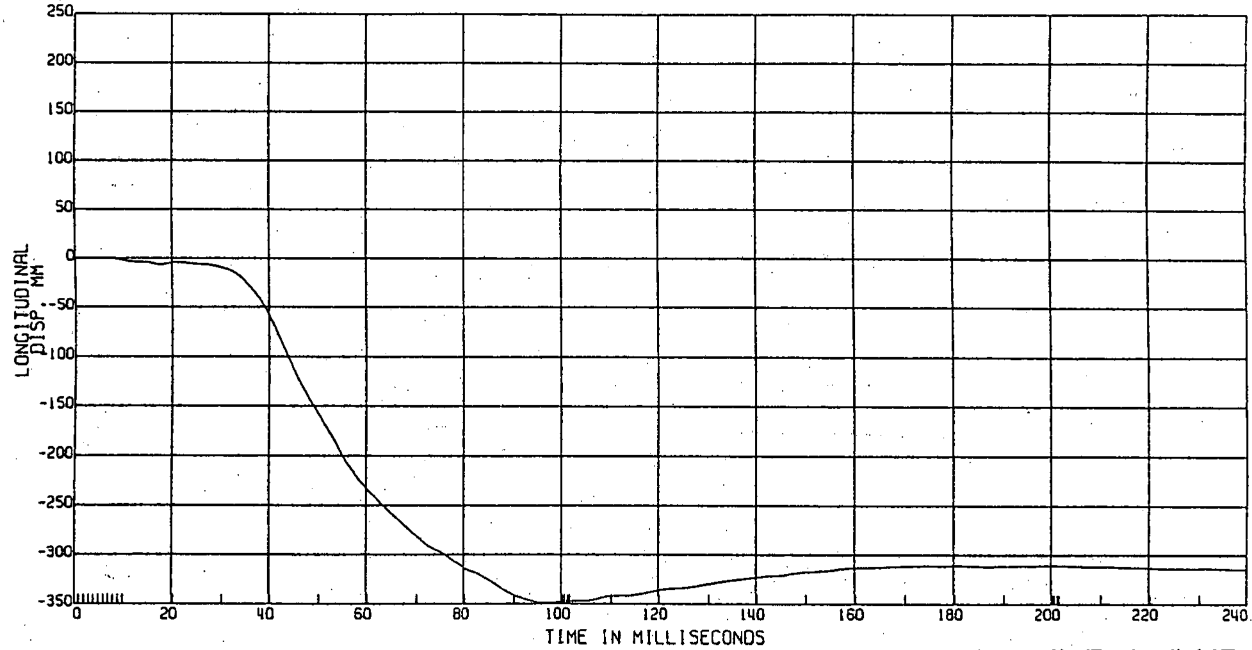
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

L. TOE PAN DISPL

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 60



Appendix F, plot # 117

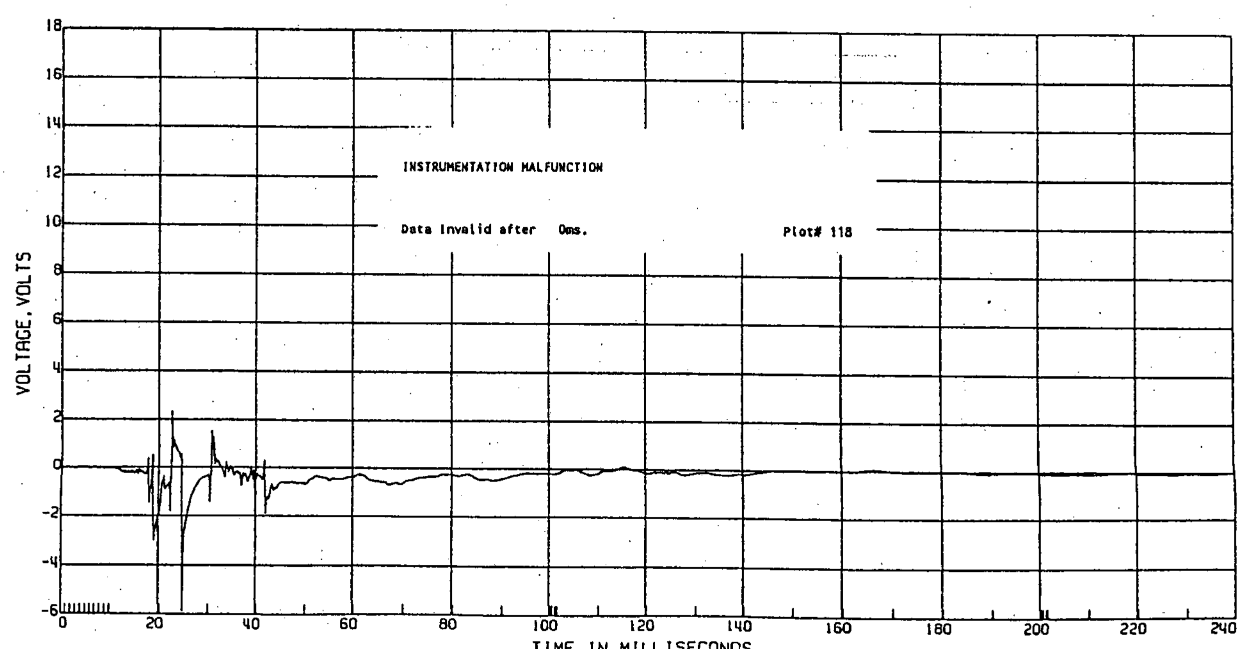
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

L. FRT HEADLIGHT-HI BEAM VOLTAGE

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 1000



Appendix F, plot # 118

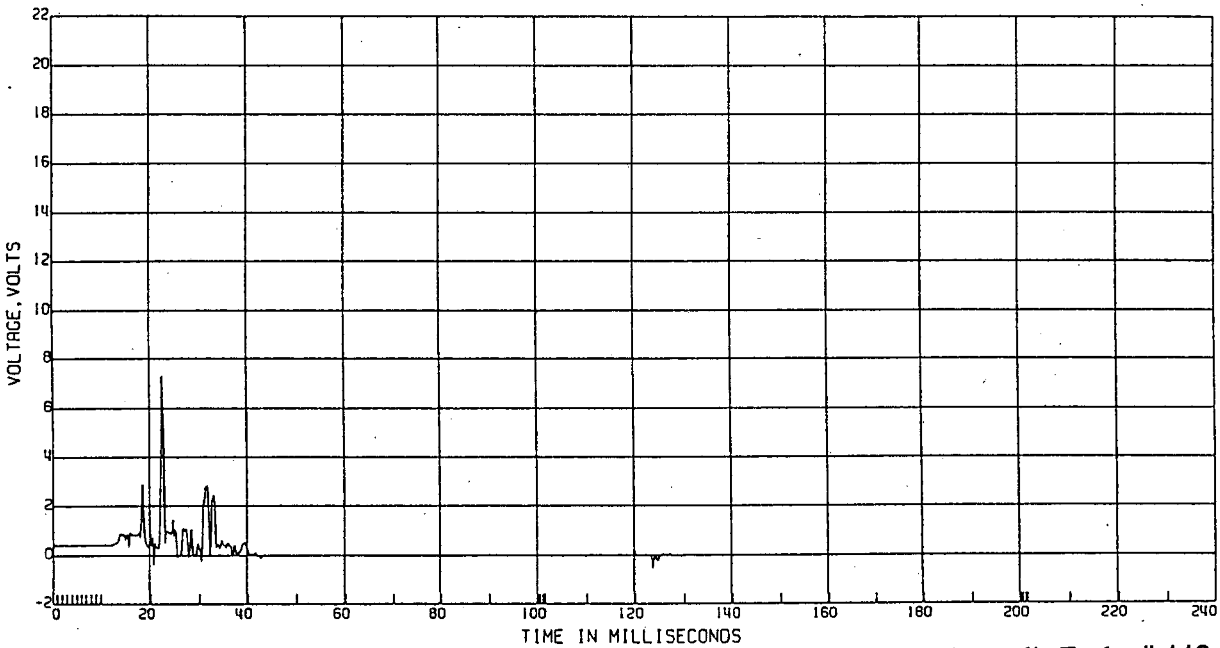
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

L. FRT HEADLIGHT-LO BEAM VOLTAGE

TEST DATE:08/14/1996



Appendix F, plot # **119**

119

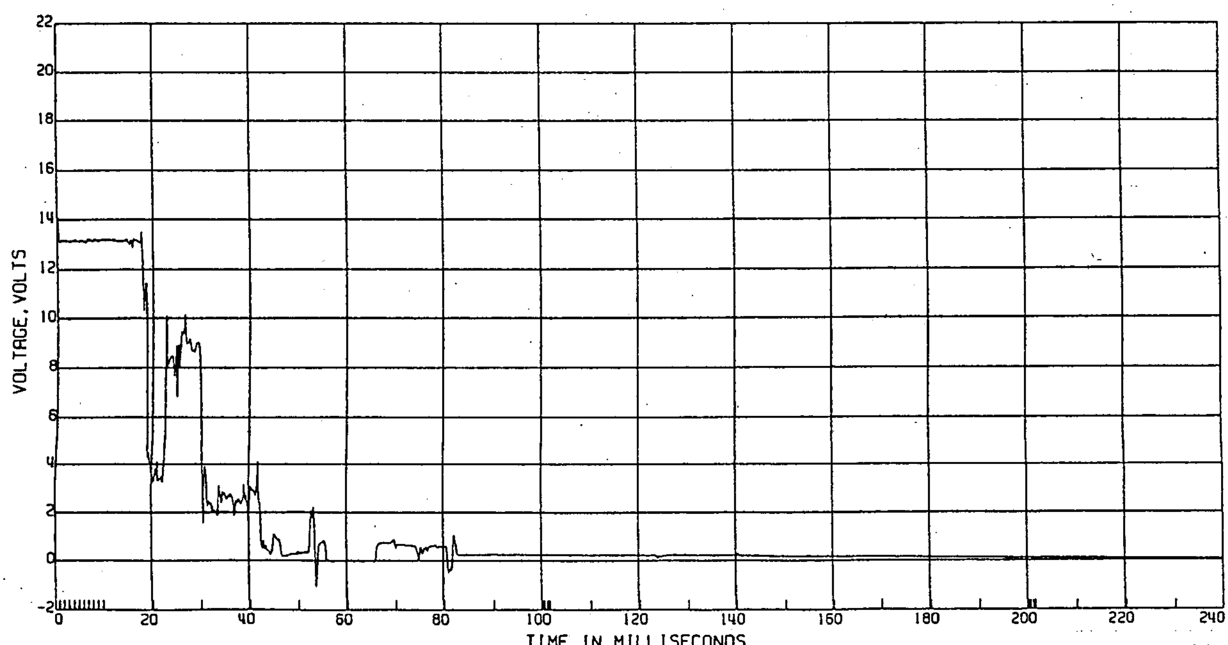
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

IGNITION VOLTAGE

TEST DATE:08/14/1996



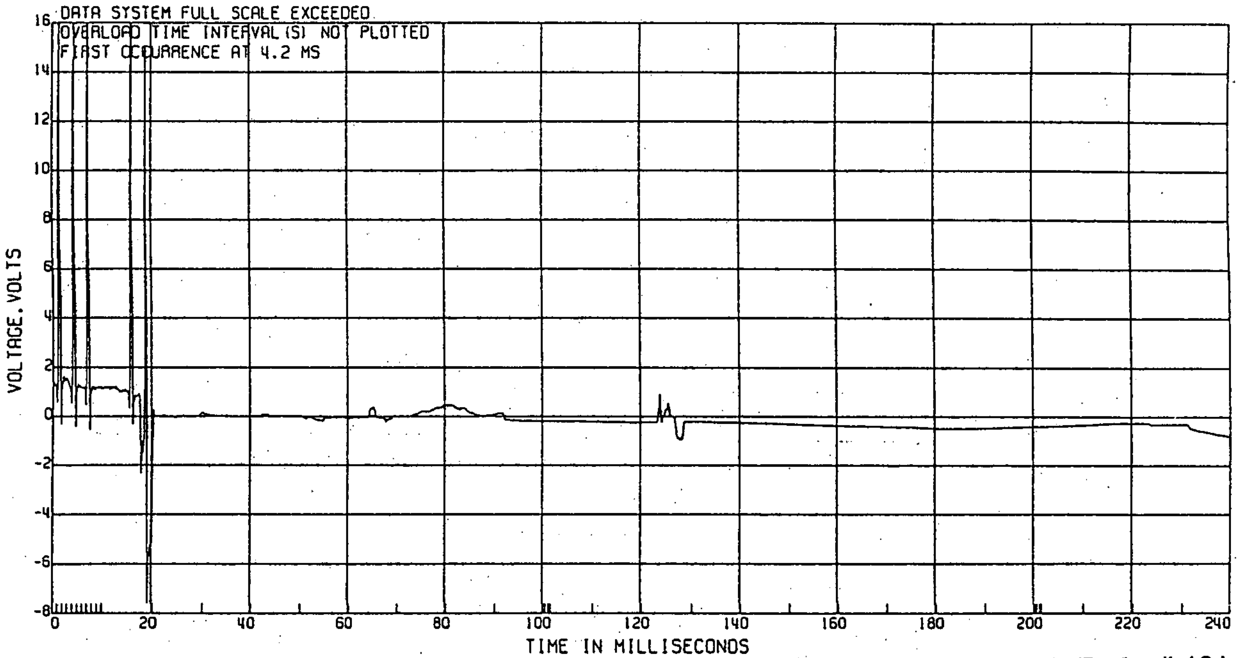
Appendix F, plot # **120**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

ENGINE RPM VOLTAGE

TEST DATE:08/14/1996



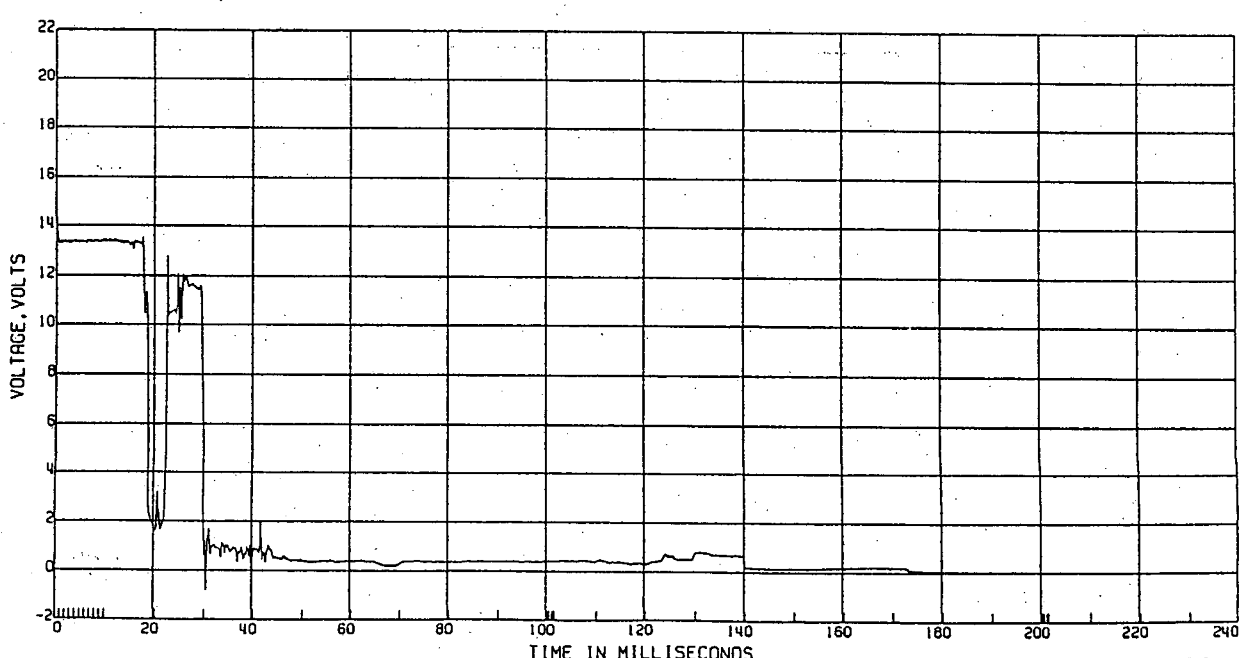
Appendix F, plot # **121**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

STARTER VOLTAGE

TEST DATE:08/14/1996



Appendix F, plot # **122**

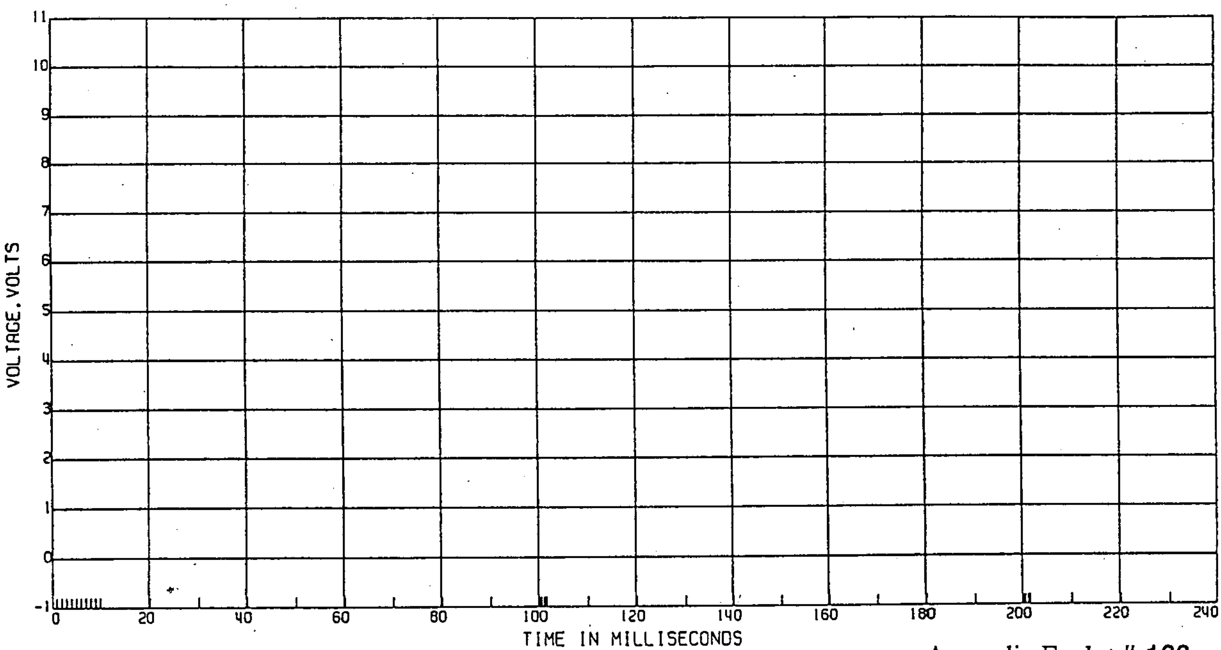
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

L. UPPER ENGINE VAPOR SENSOR VOLTAGE

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 1000



Appendix F, plot # 123

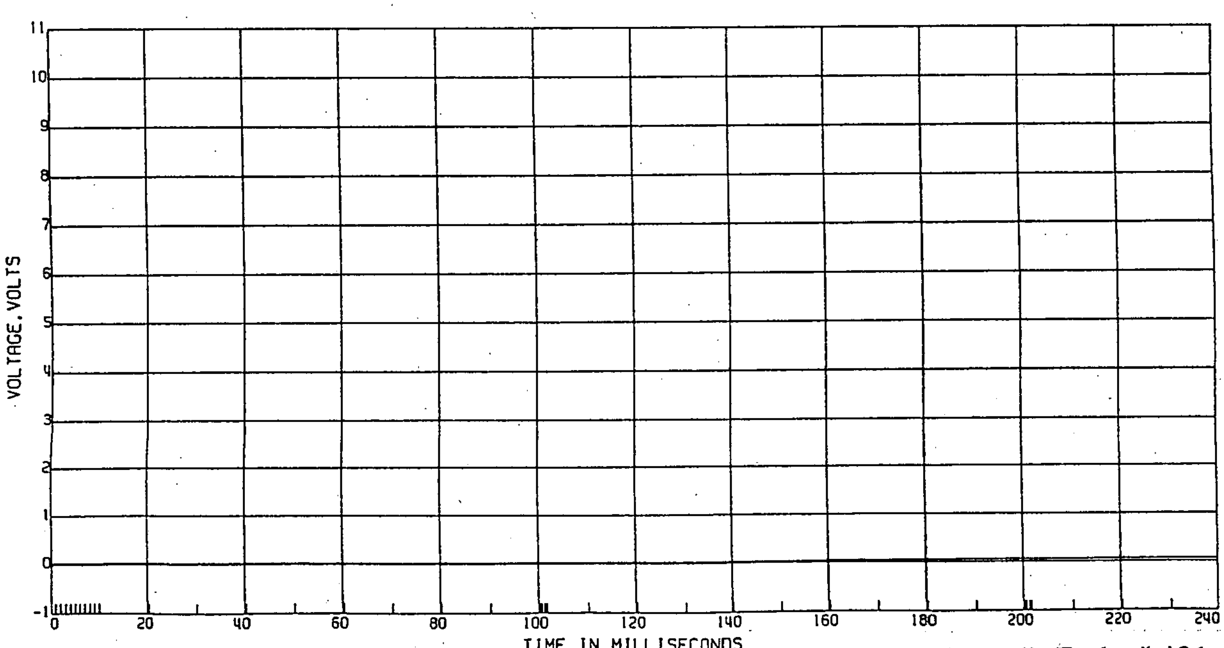
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

R. UPPER ENGINE VAPOR SENSOR VOLTAGE

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 1000



Appendix F, plot # 124

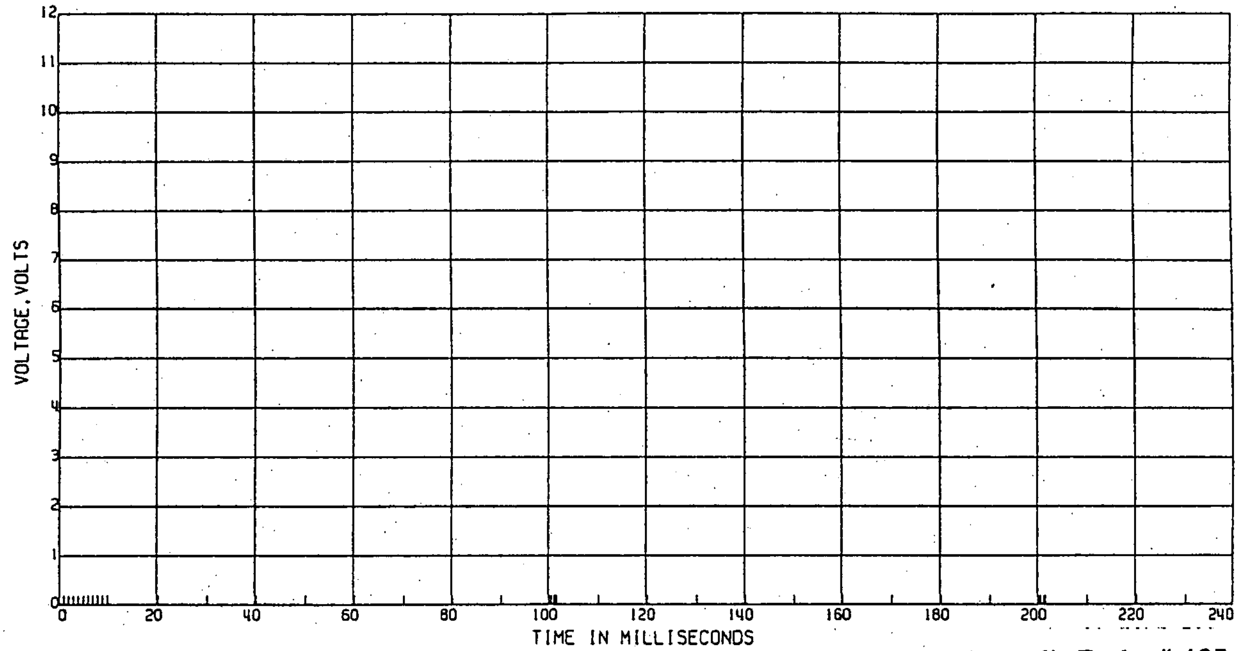
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

L. LOWER ENGINE VAPOR SENSOR VOLTAGE

TEST DATE:08/14/1996



Appendix F, plot # **125**

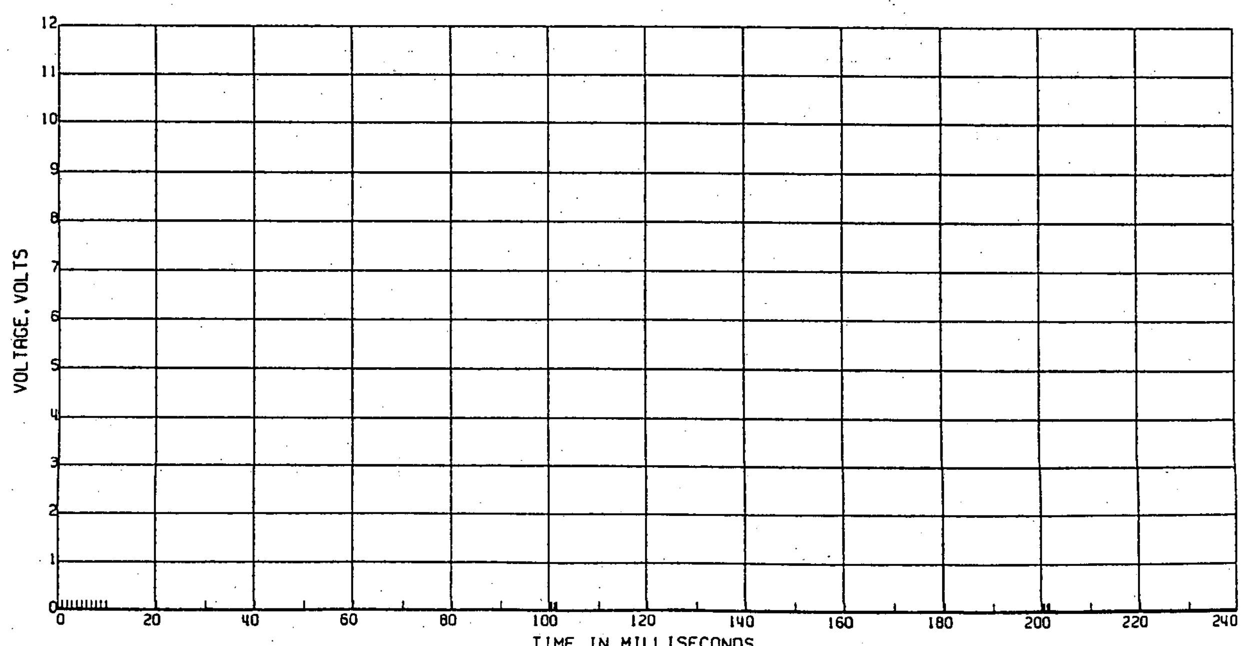
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

R. LOWER ENGINE VAPOR SENSOR VOLTAGE

TEST DATE:08/14/1996



Appendix F, plot # **126**

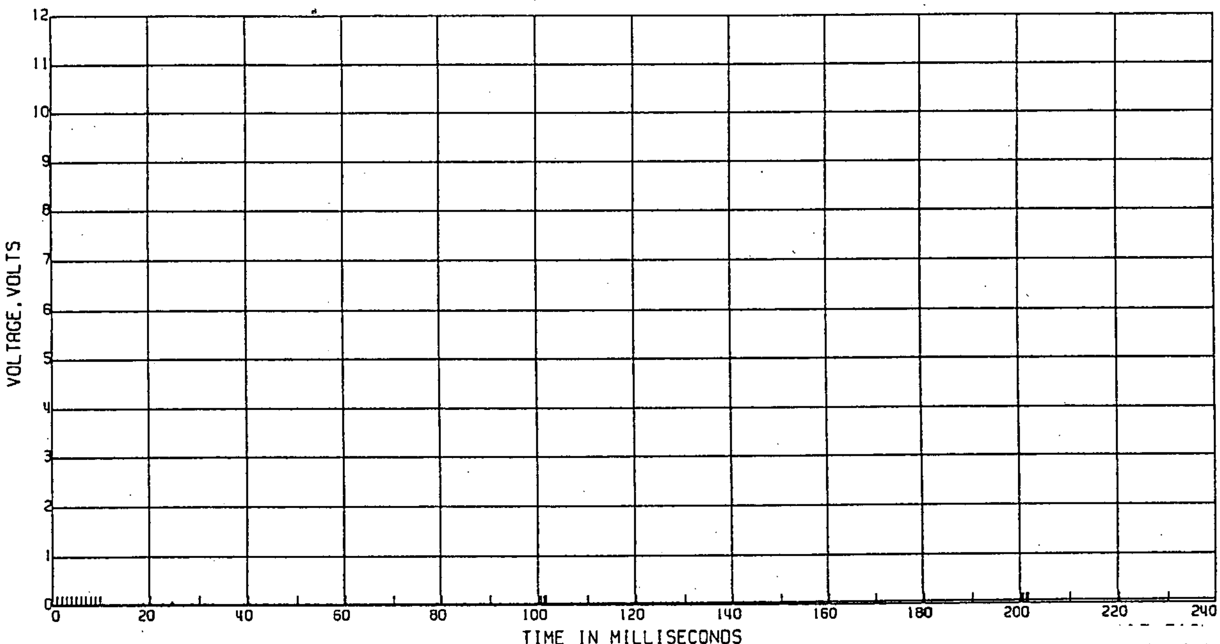
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

MANIFOLD VAPOR SENSOR VOLTAGE

TEST DATE:08/14/1996



Appendix F, plot # 127

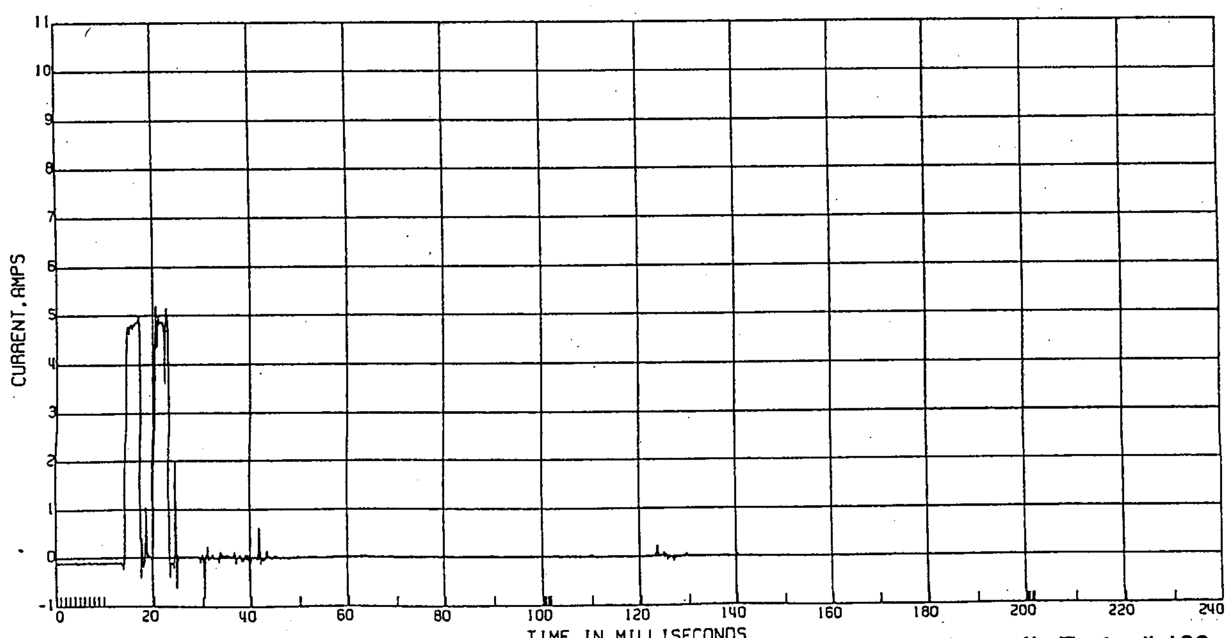
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

L. WHEEL BAG CURRENT

TEST DATE:08/14/1996



Appendix F, plot # 128

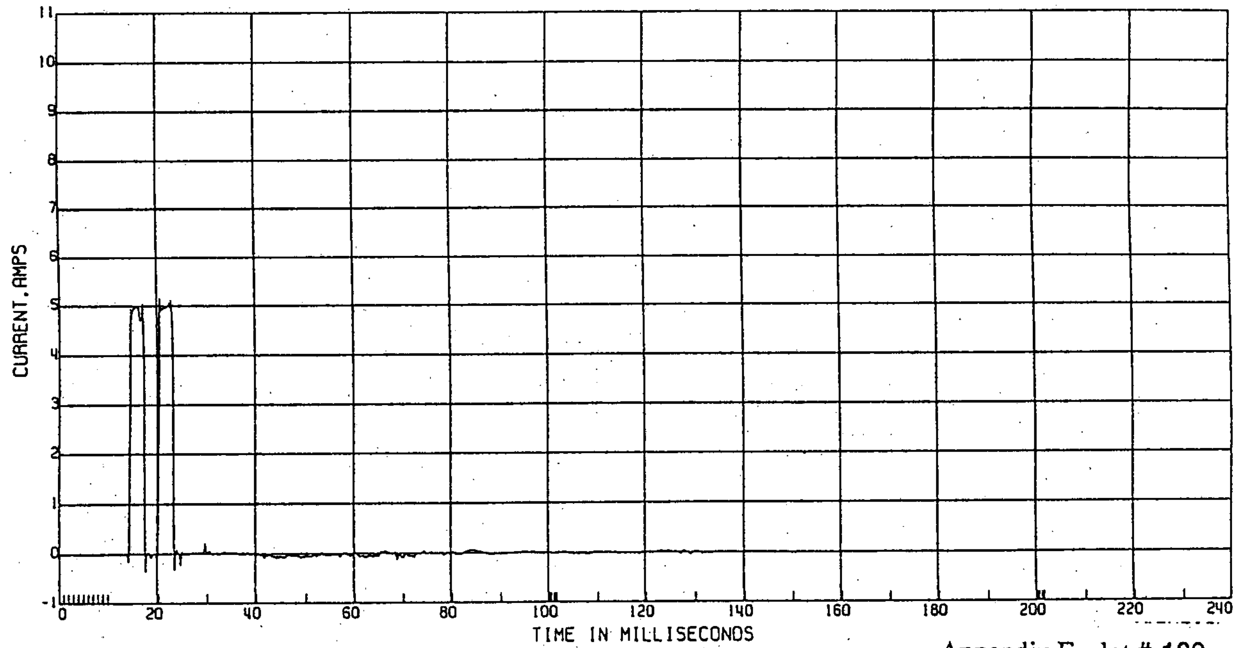
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

R. I/P BAG CURRENT

TEST DATE:08/14/1996



Appendix F, plot # 129

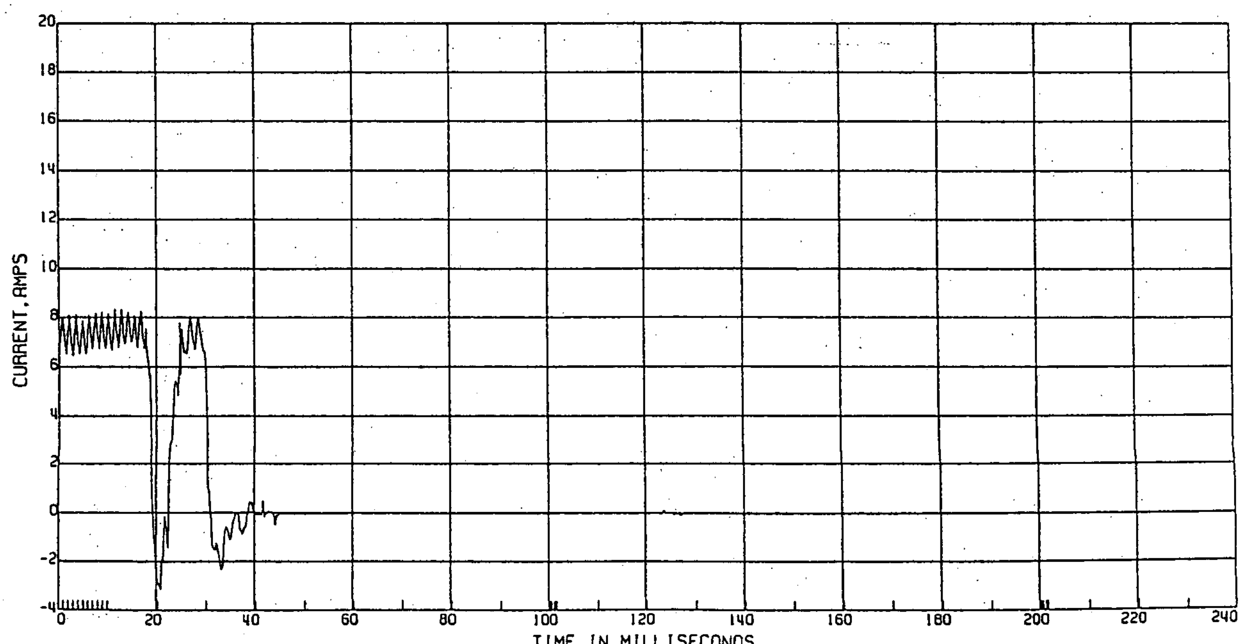
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

FUEL PUMP CURRENT

TEST DATE:08/14/1996



Appendix F, plot # 130

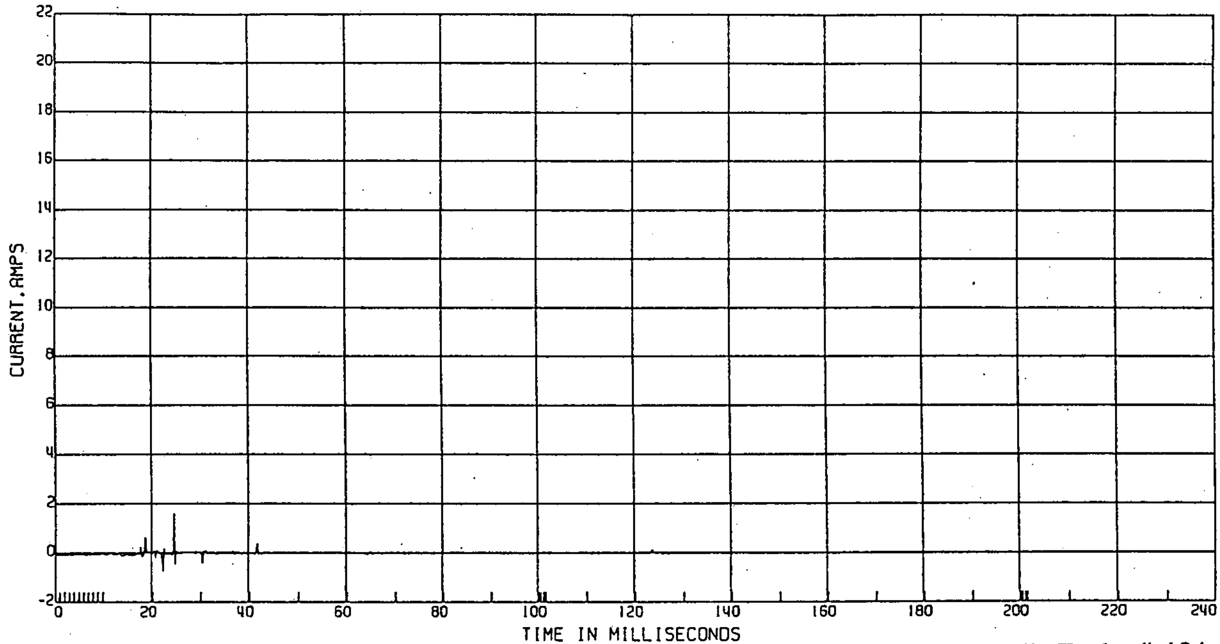
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

L. HORN CURRENT

TEST DATE:08/14/1996



Appendix F, plot # **131**

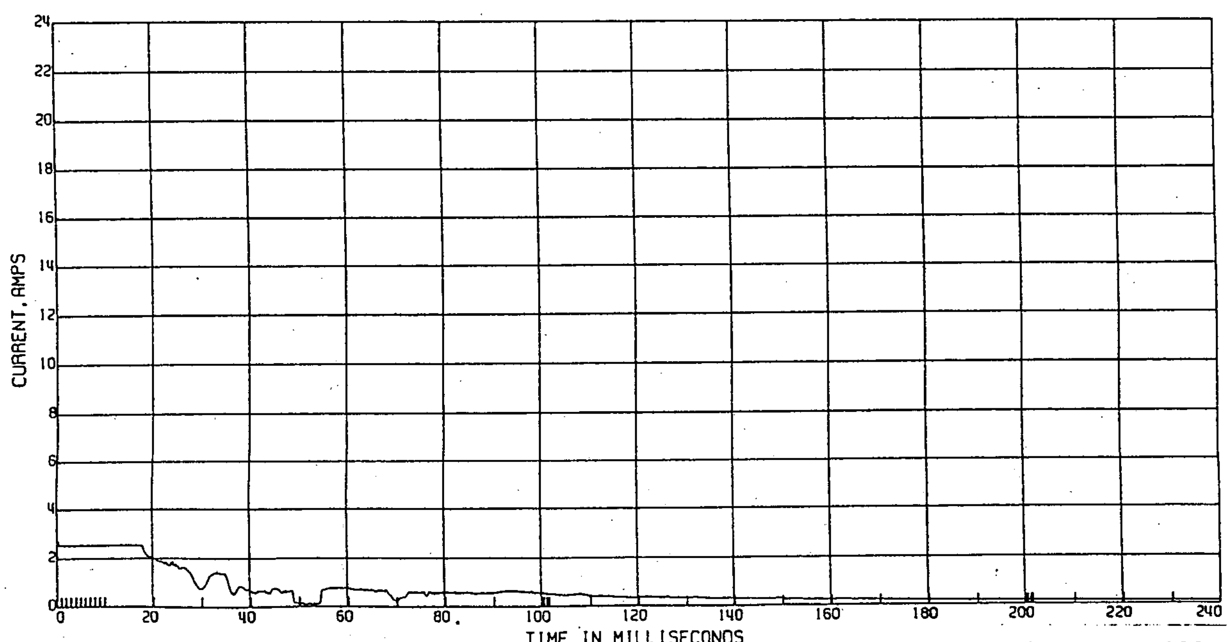
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

A/C CLUTCH CURRENT

TEST DATE:08/14/1996



Appendix F, plot # **132**

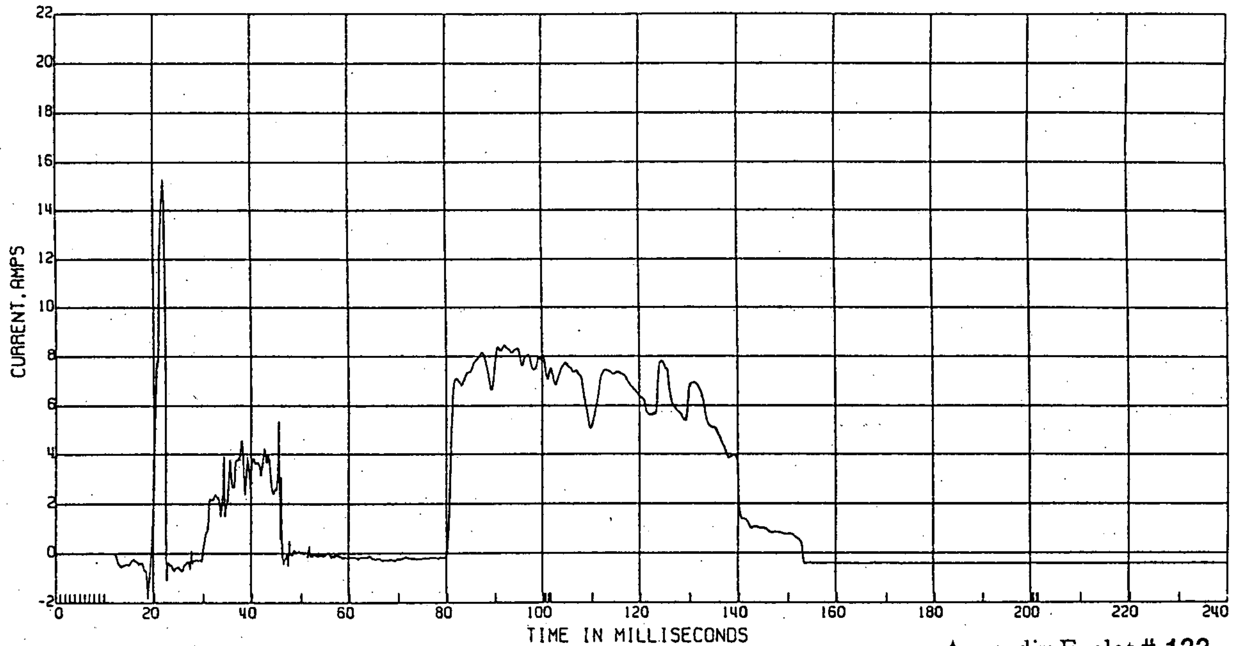
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN

COOLING FAN CURRENT

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 1000



Appendix F, plot # 133

133 PROCESSED 8/14/1996 15:32V2.04E

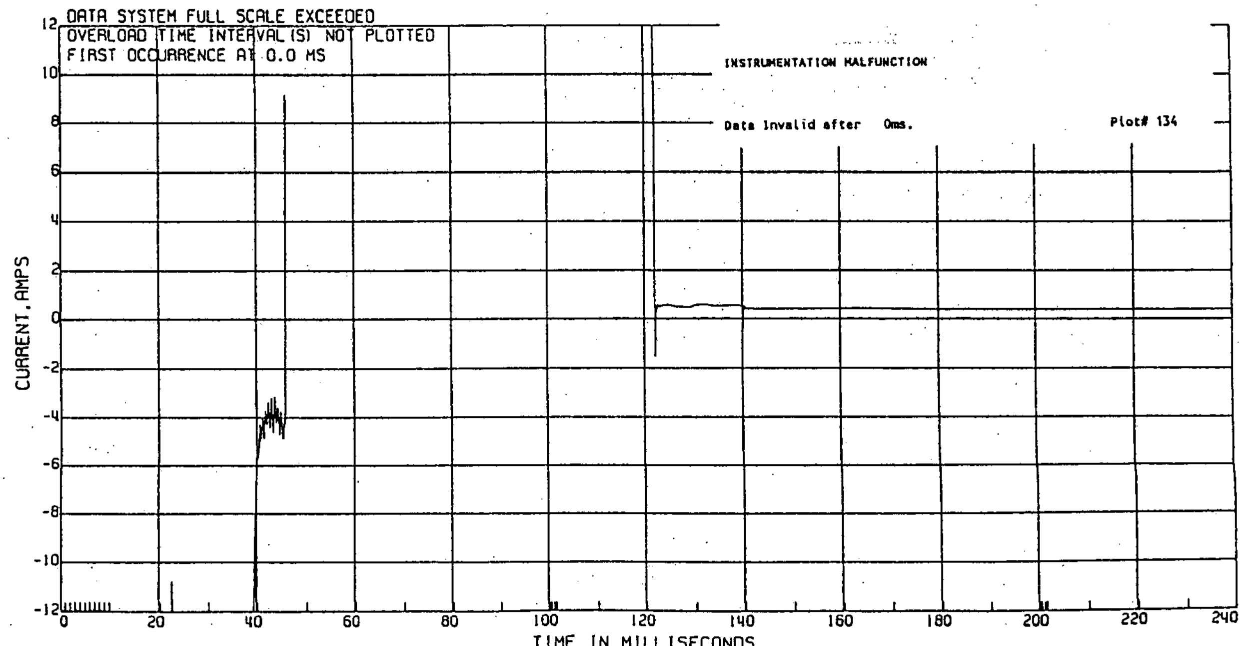
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN

FUSABLE LINK CURRENT

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 1000



Appendix F, plot # 134

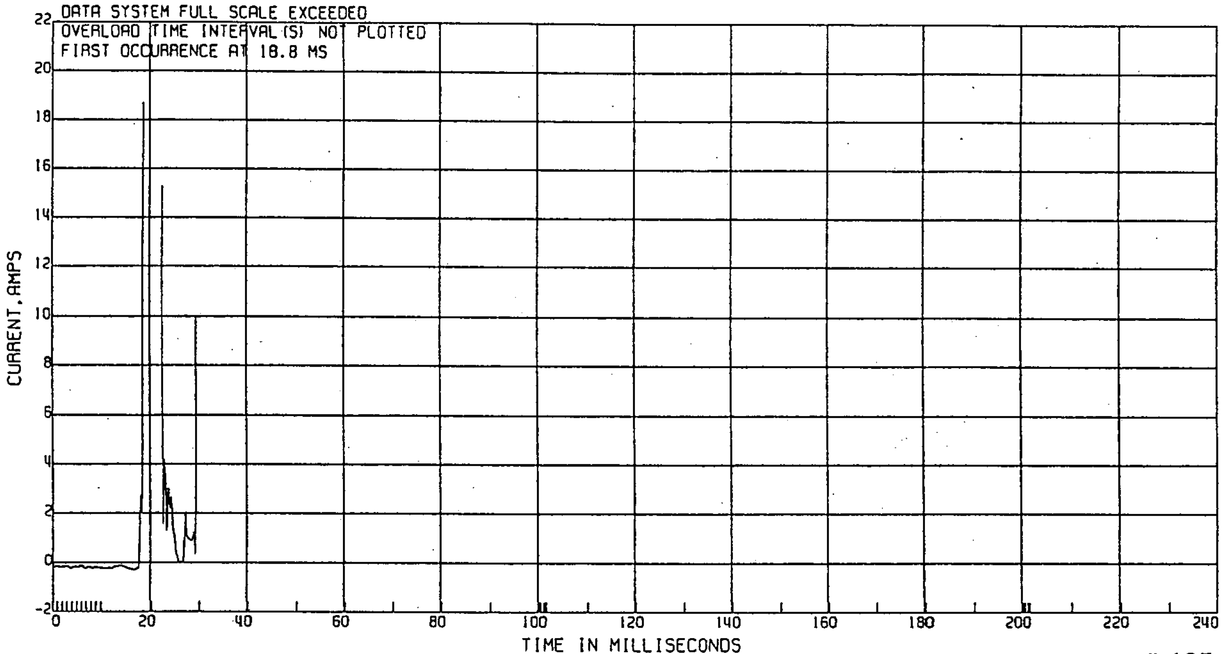
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 1000

BATTERY CURRENT

TEST DATE:08/14/1996



Appendix F, plot # **135**

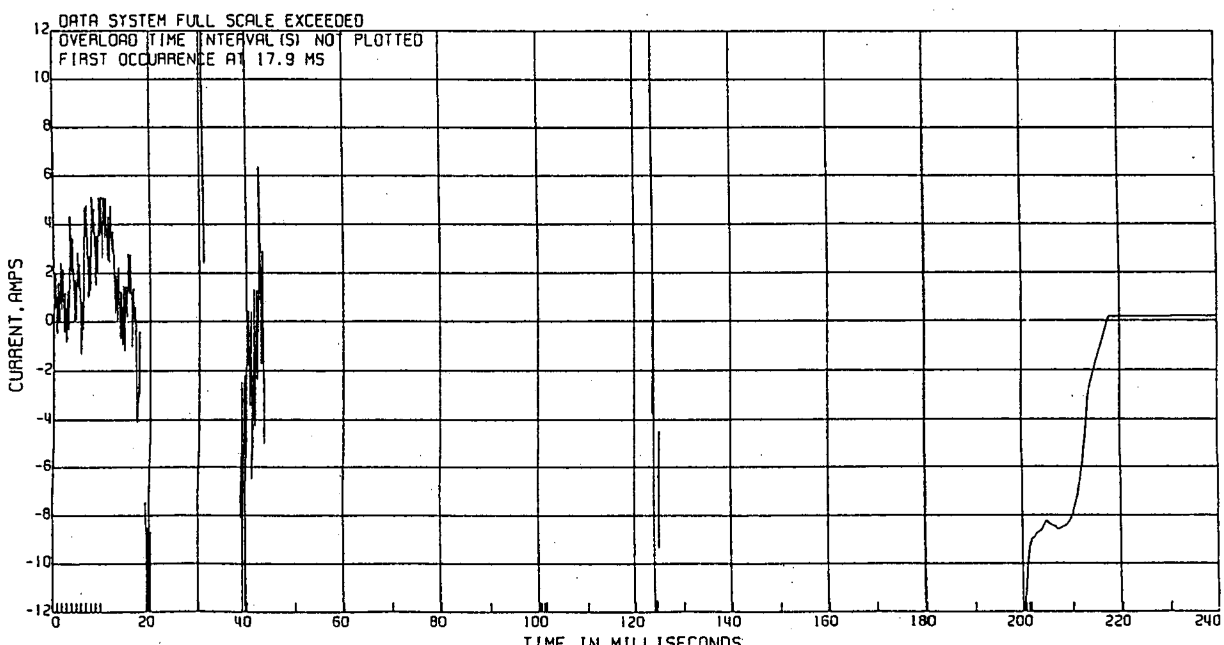
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 1000

STARTER WIRE CURRENT

TEST DATE:08/14/1996



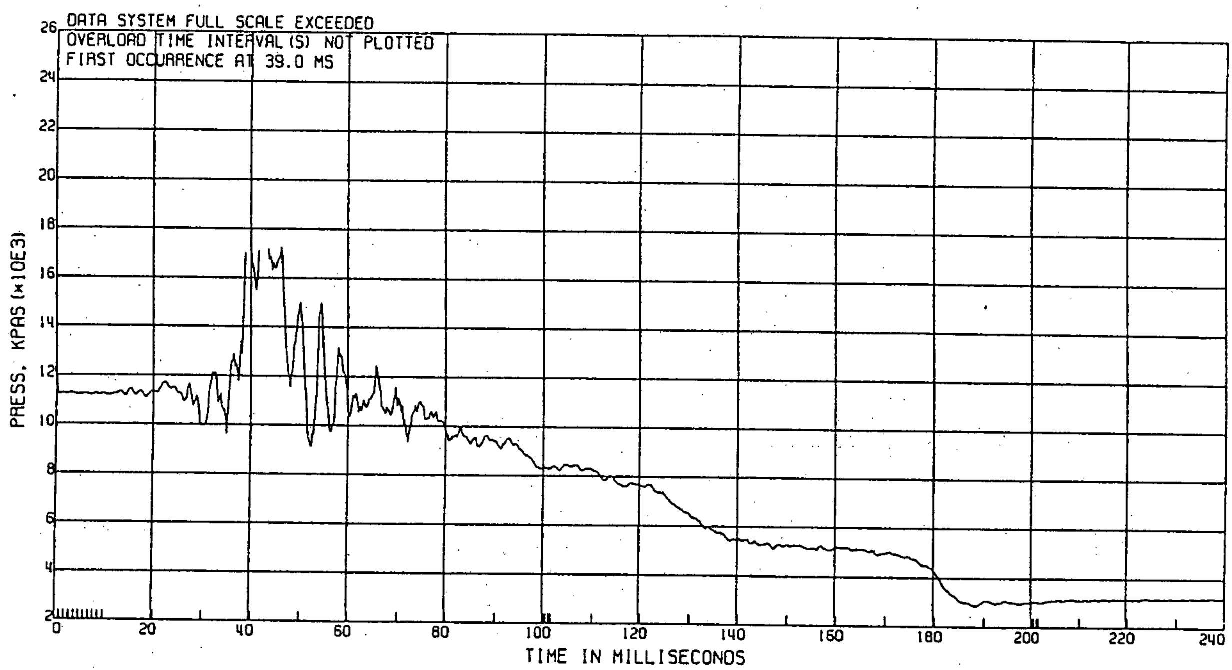
Appendix F, plot # **136**

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

L. FRT BRAKE SYSTEM PRESSURE

TEST DATE:08/14/1996



Appendix F, plot # 137

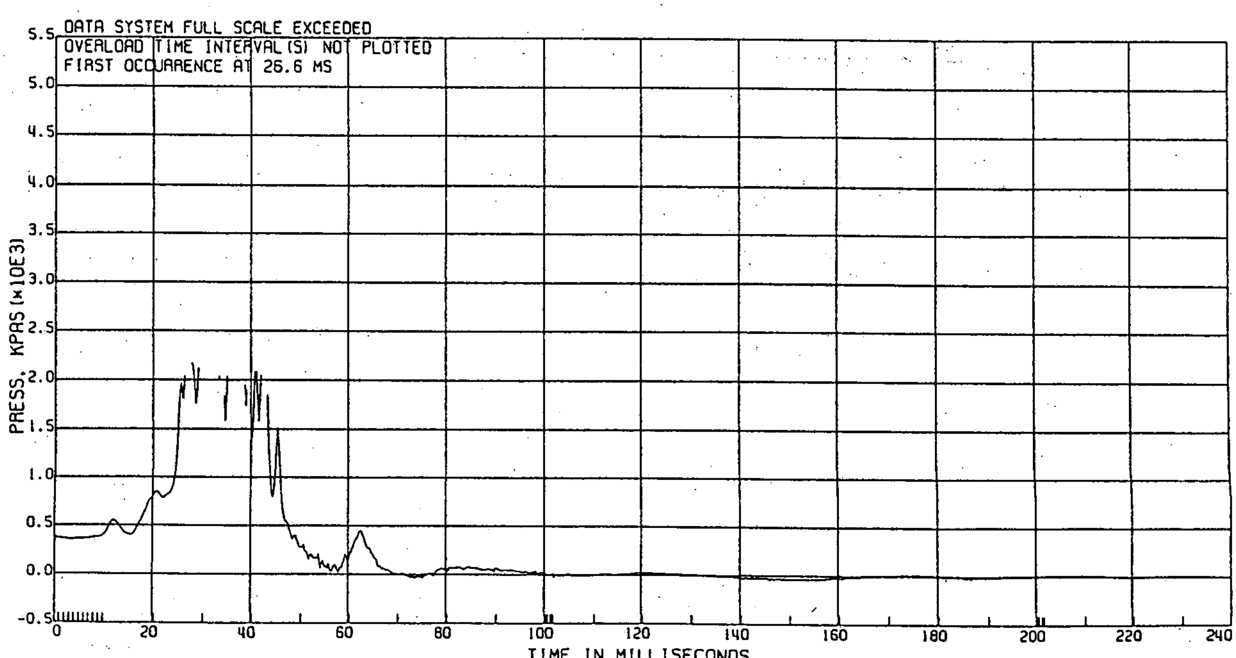
137

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN
ELEC DATA, SAE CLASS 1000

POWER STEERING SYSTEM PRESSURE

TEST DATE:08/14/1996



Appendix F, plot # 138

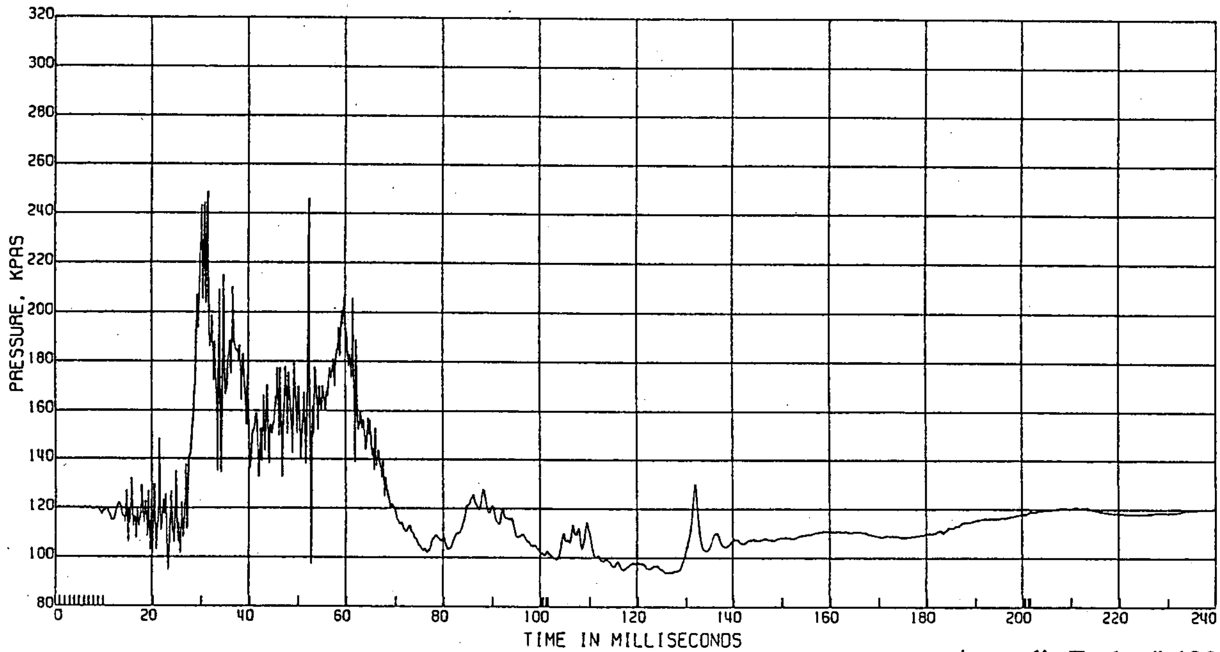
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

COOLING SYSTEM PRESSURE

TEST DATE:08/14/1996



Appendix F, plot # **139**

139

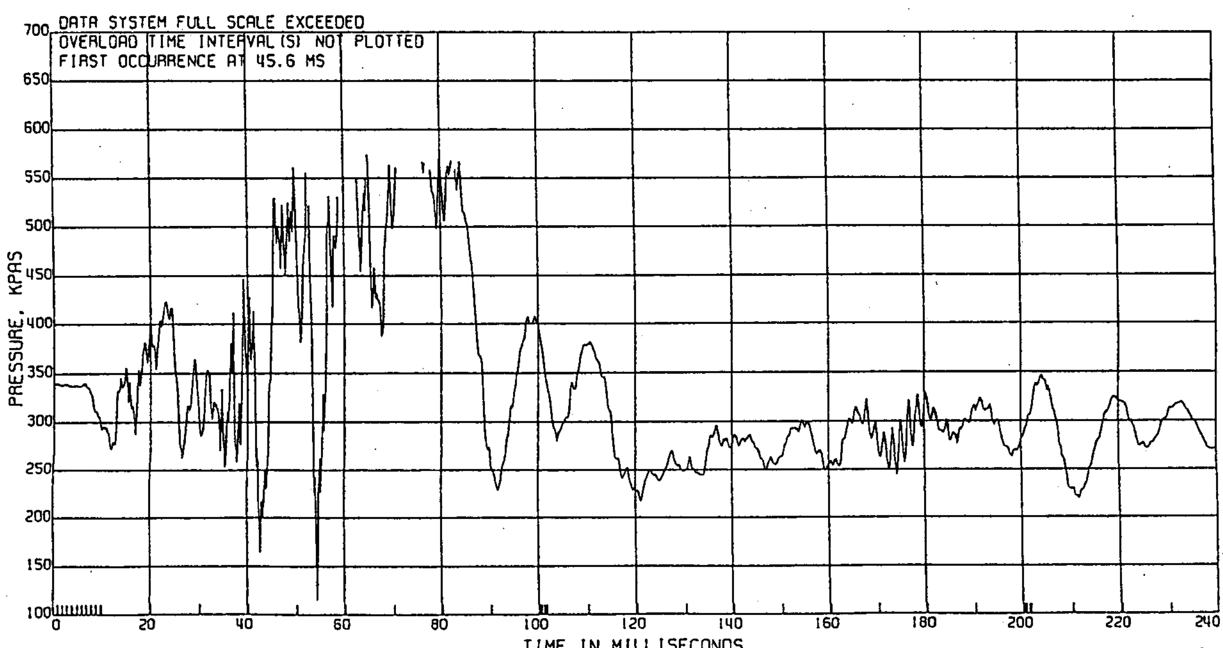
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

ELEC DATA, SAE CLASS 1000

AUXILIARY FUEL TANK PRESSURE

TEST DATE:08/14/1996



Appendix F, plot # **140**

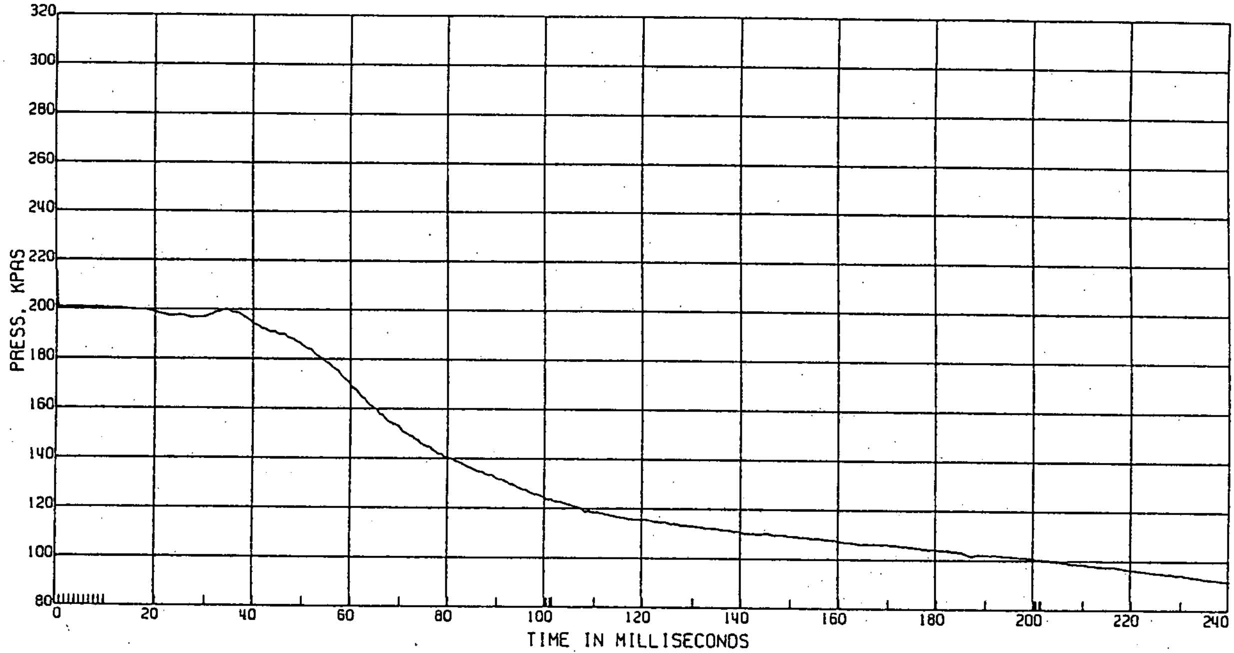
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 1000

ENGINE OIL PRESSURE

TEST DATE:08/14/1996



Appendix F, plot # 141

141

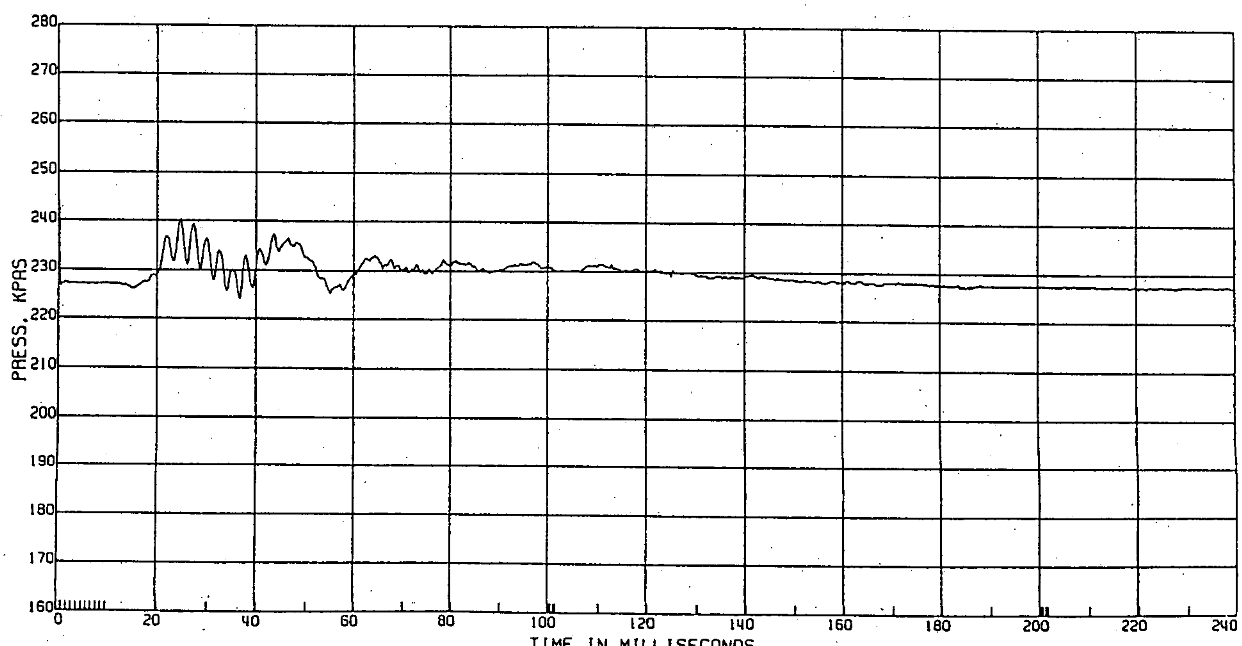
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN

ELEC DATA, SAE CLASS 1000

TRANSMISSION FLUID PRESSURE

TEST DATE:08/14/1996



Appendix F, plot # 142

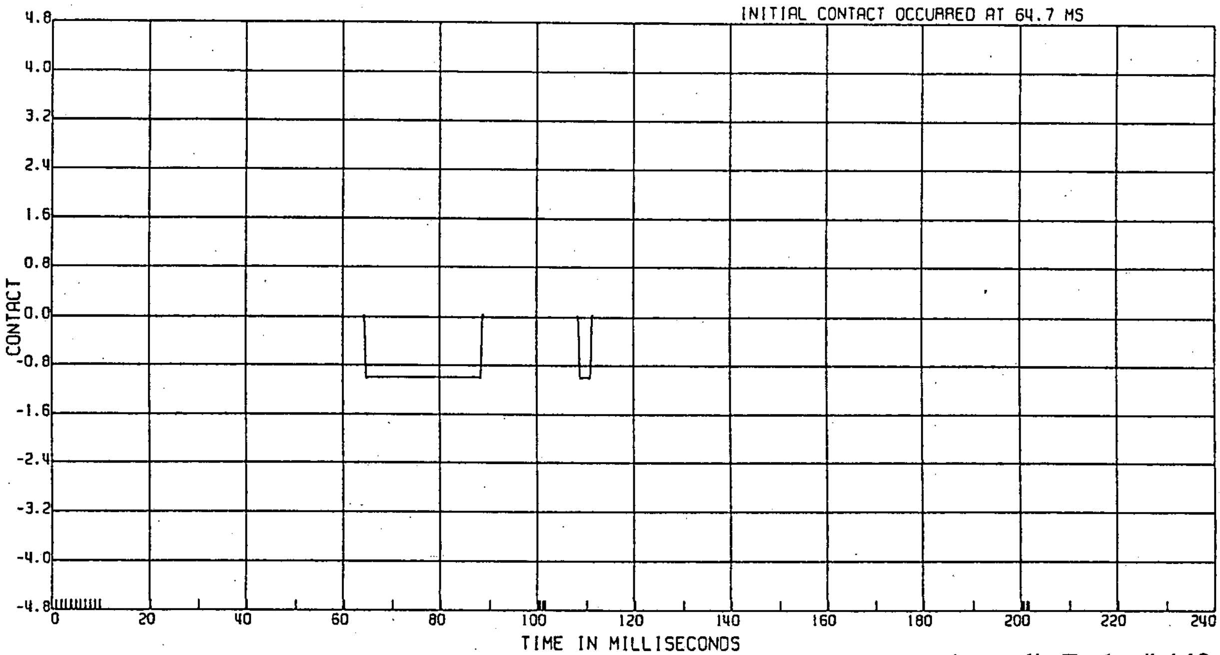
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

THERMAL WIRE CONTACT

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 1000



Appendix F, plot # 143

143

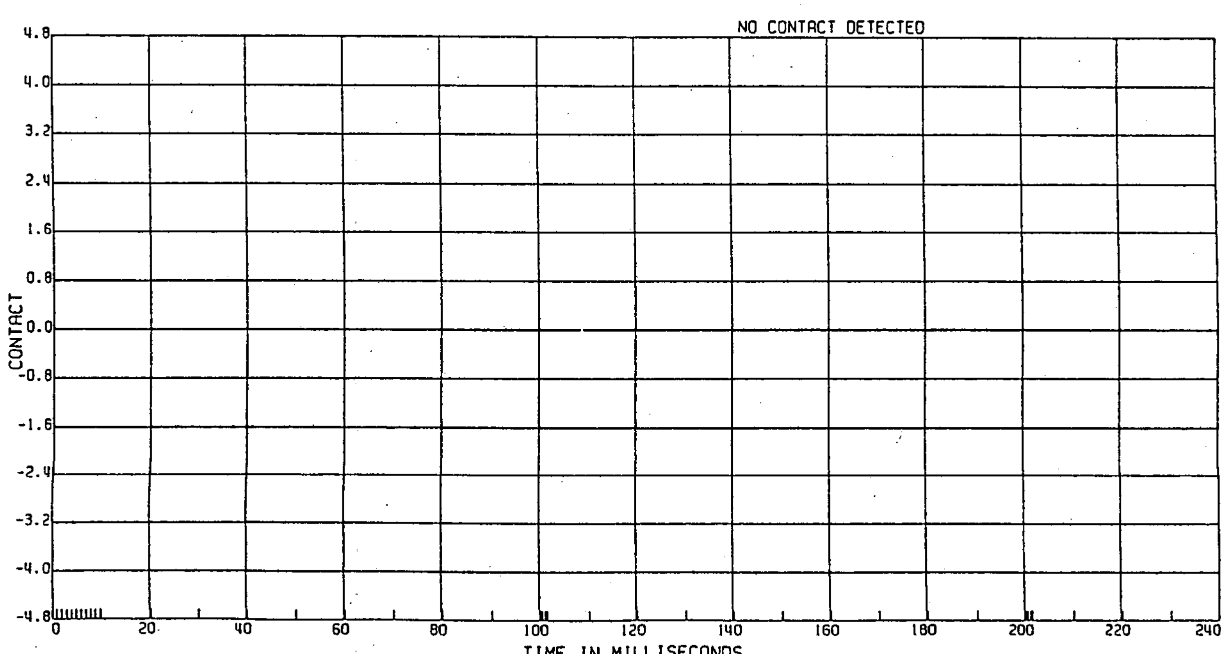
C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T9306D VAN

PNEUMATIC WIRE CONTACT

TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 1000

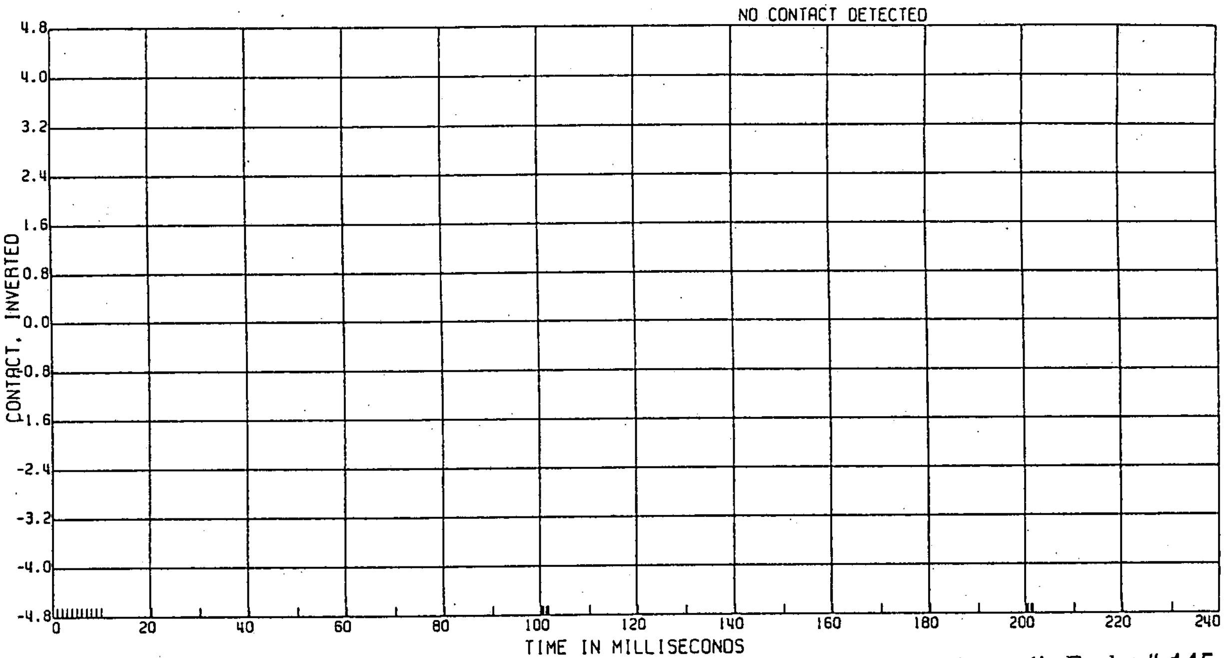


Appendix F, plot # 144

C11226 L. FRT IMP 50% OVERLAP MOVING VEH TO 345 DEG ANGLED BARR 60.0KM/H

R & D CTR 8T93060 VAN PNEUMATIC WIRE FAULT CONTACT TEST DATE:08/14/1996

ELEC DATA, SAE CLASS 1000



Appendix F, plot # 145

145

Appendix G: C11226 hydrocarbon vapor measurement plots

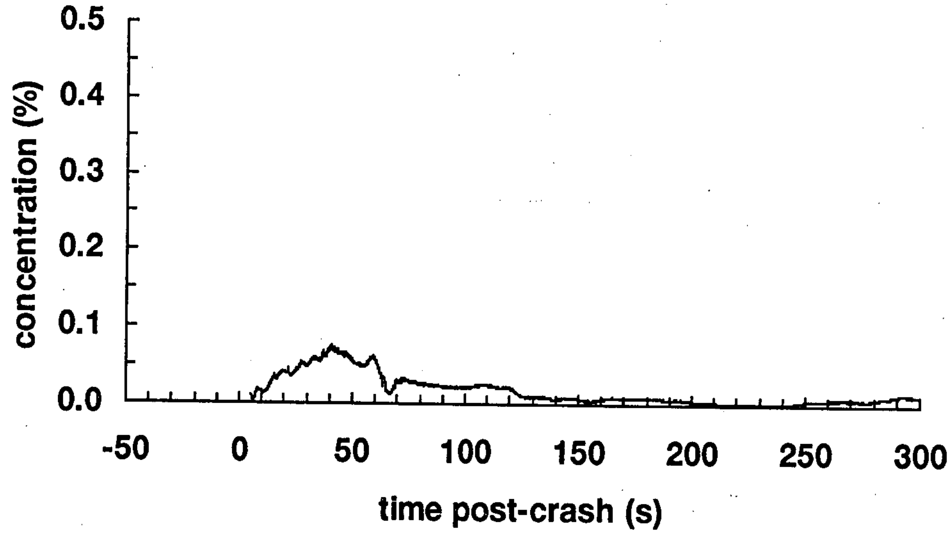


Figure G1

Concentration of Hydrocarbon Vapor Measured at the Left Upper Engine (Location #1)
Test C11226

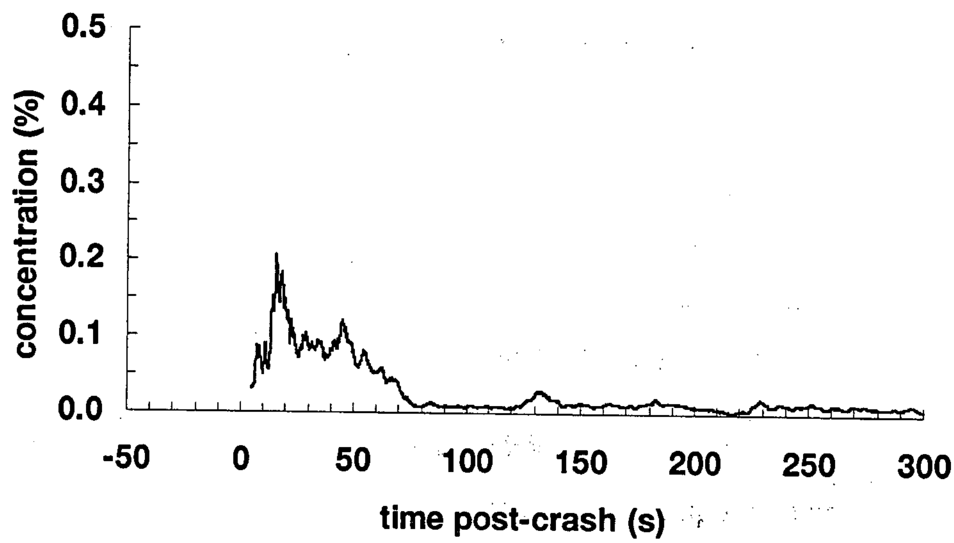


Figure G2

Concentration of Hydrocarbon Vapor Measured at the Right Upper Engine (Location #2)
Test C11226

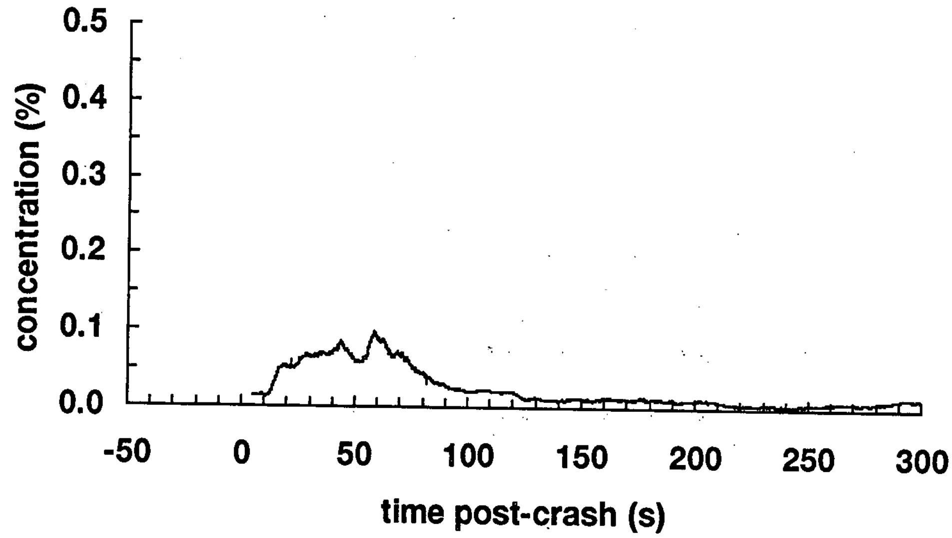


Figure G3

Concentration of Hydrocarbon Vapor Measured at the Left Lower Engine (Location #3)

Test C11226

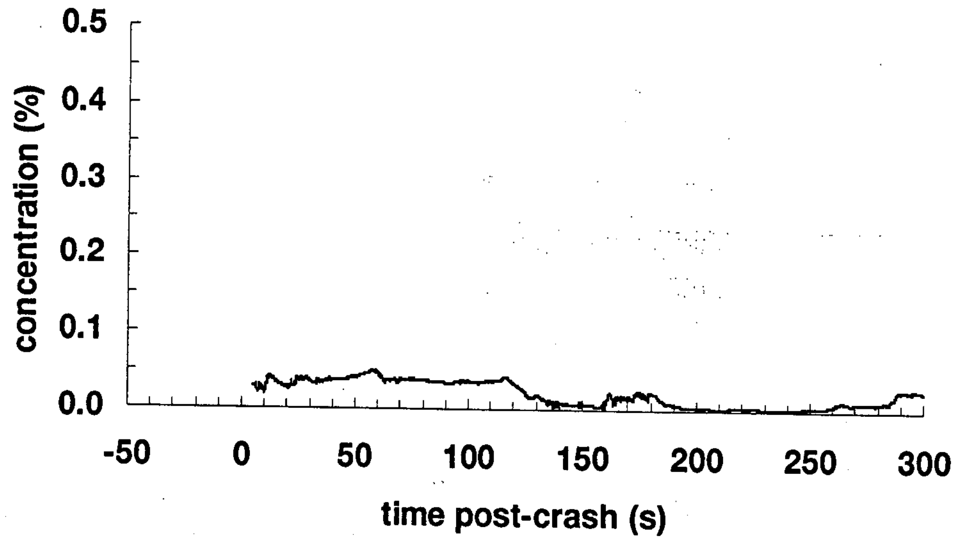


Figure G4

Concentration of Hydrocarbon Vapor Measured at the Right Lower Engine (Location #4)

Test C11226

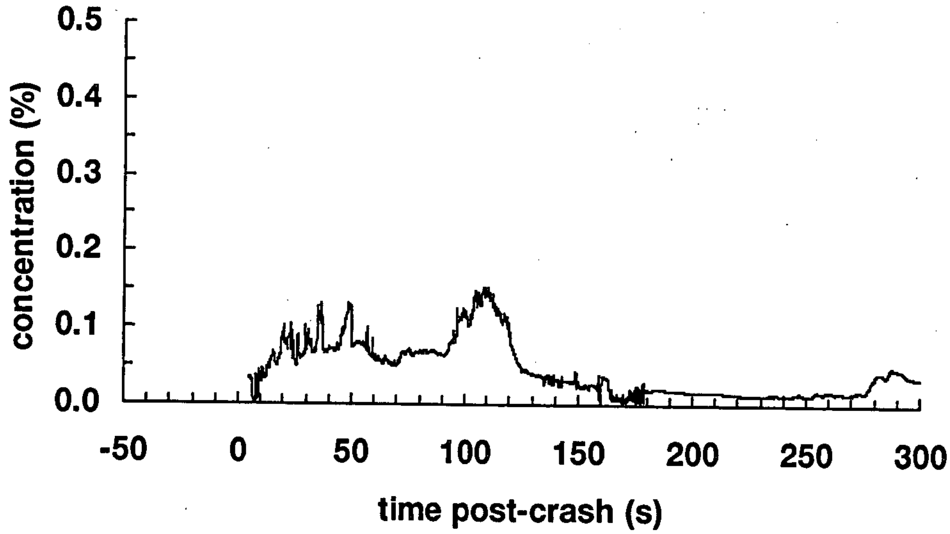


Figure G5

Concentration of Hydrocarbon Vapor Measured at the Exhaust Manifold (Location #5)

Test C11226

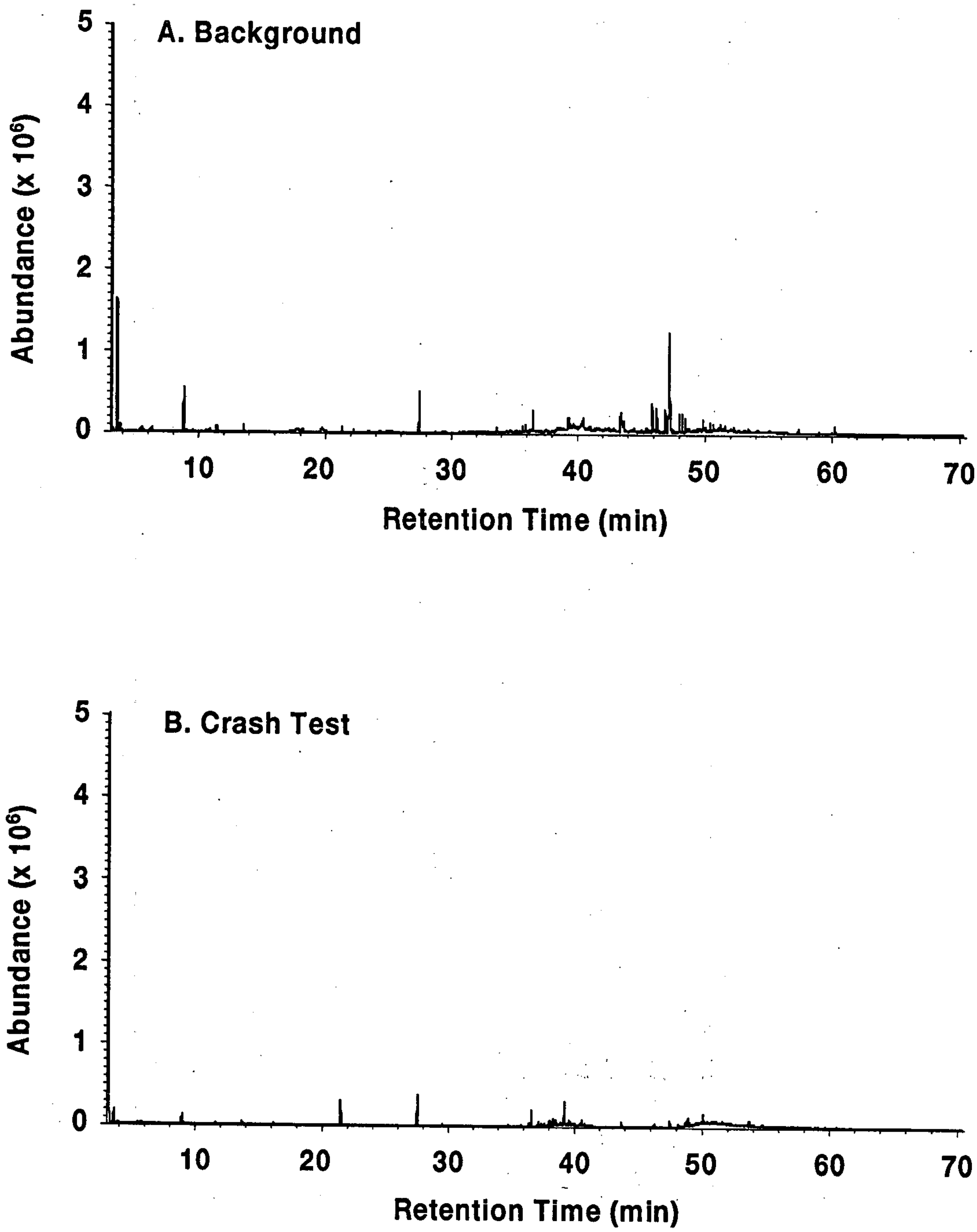
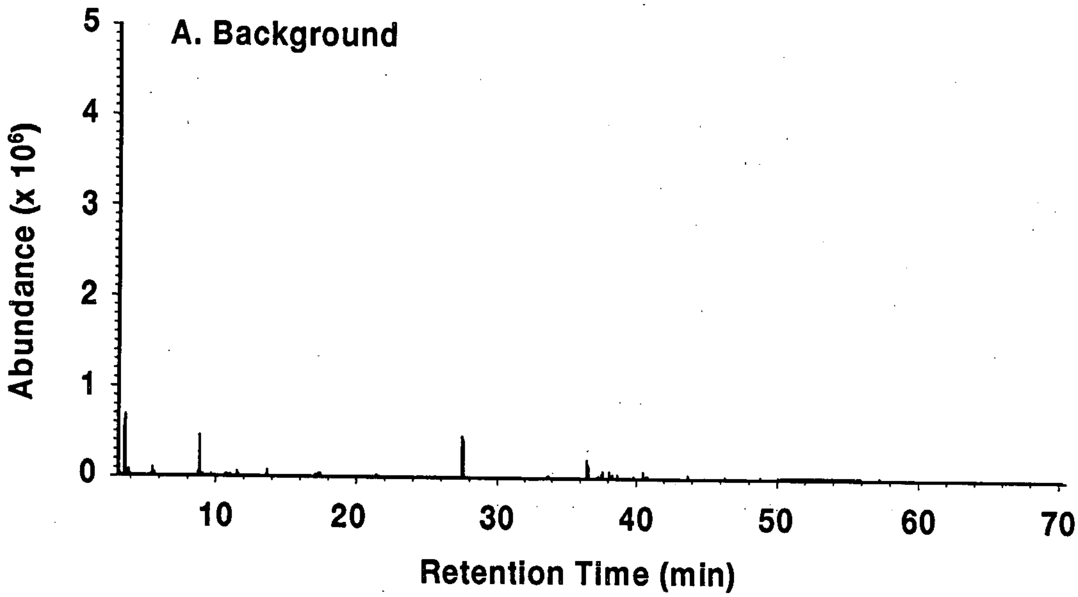


Figure GG1.
GC/MS analysis of hydrocarbon vapor sampled from the left upper engine (location #1) during Crash Test C11226. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample



This sample was lost during analysis

Figure GG2
GC/MS analysis of hydrocarbon vapor sampled from the right upper engine (location #2) during Crash Test C11226. Panel A shows the chromatogram of a background sample. The test sample was lost during analysis.

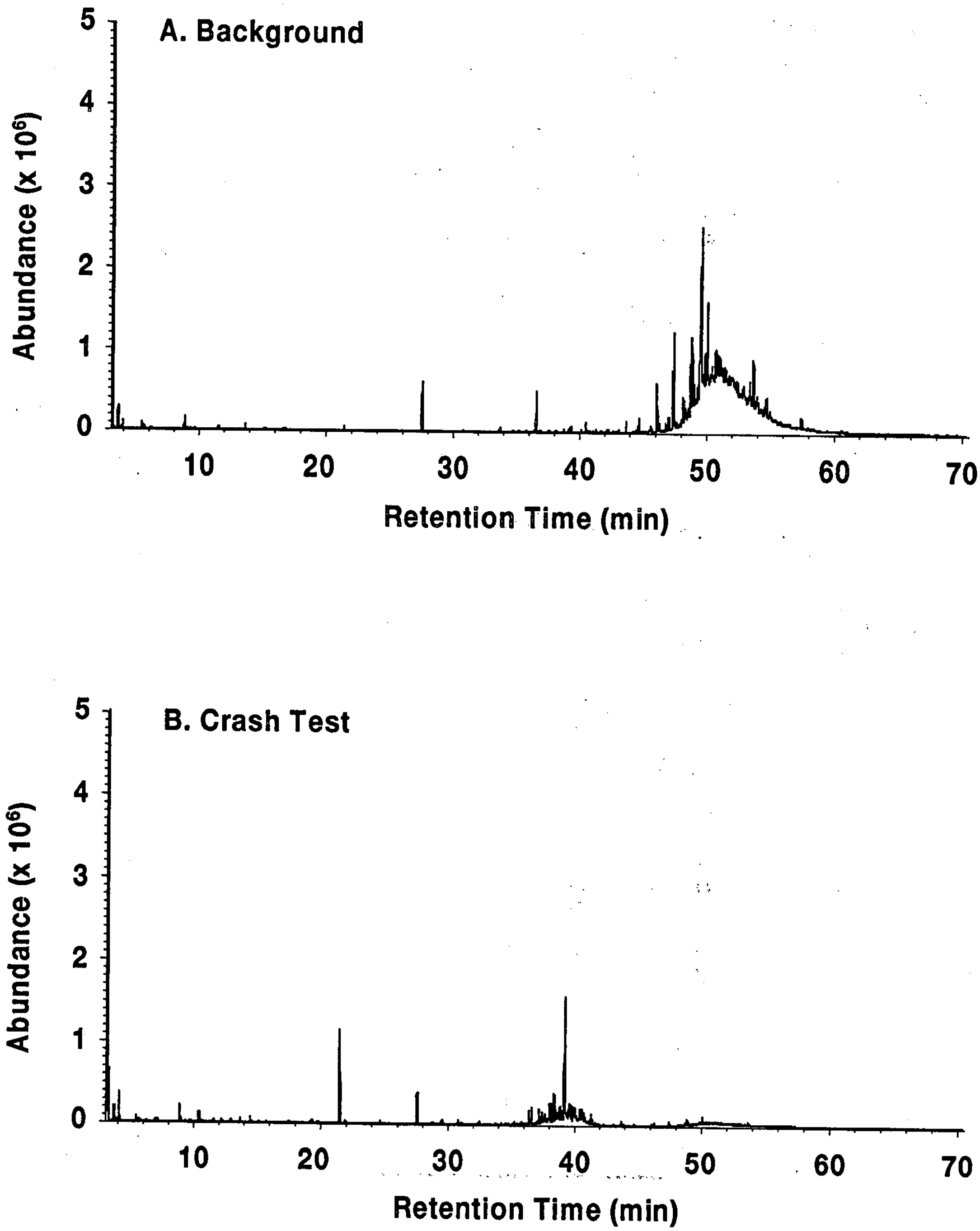


Figure GG3

GC/MS analysis of hydrocarbon vapor sampled from the left lower engine (location #3) during Crash Test C11226. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample.

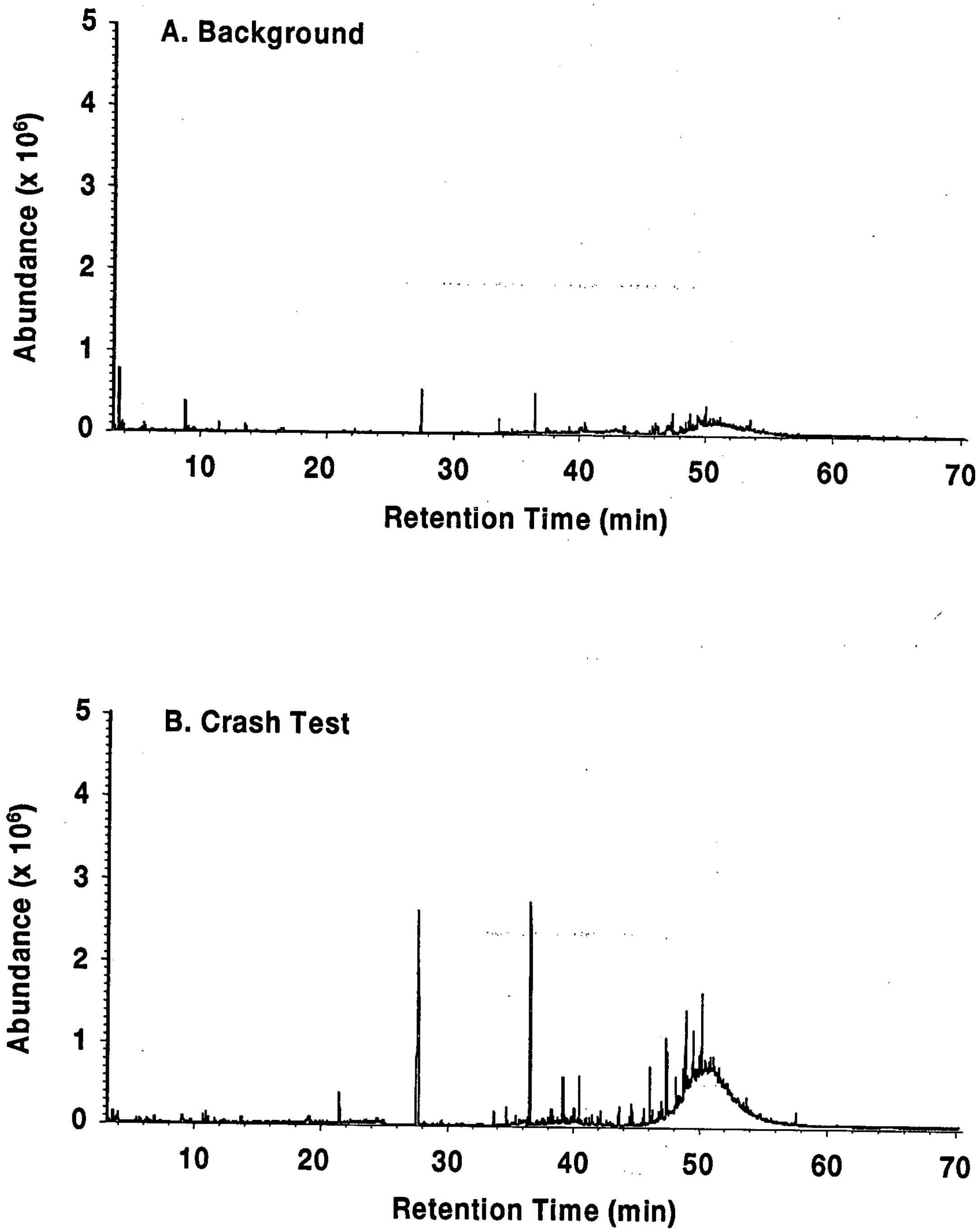


Figure GG4

GC/MS analysis of hydrocarbon vapor sampled from the right lower engine (location #4) during Crash Test C11226. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample.

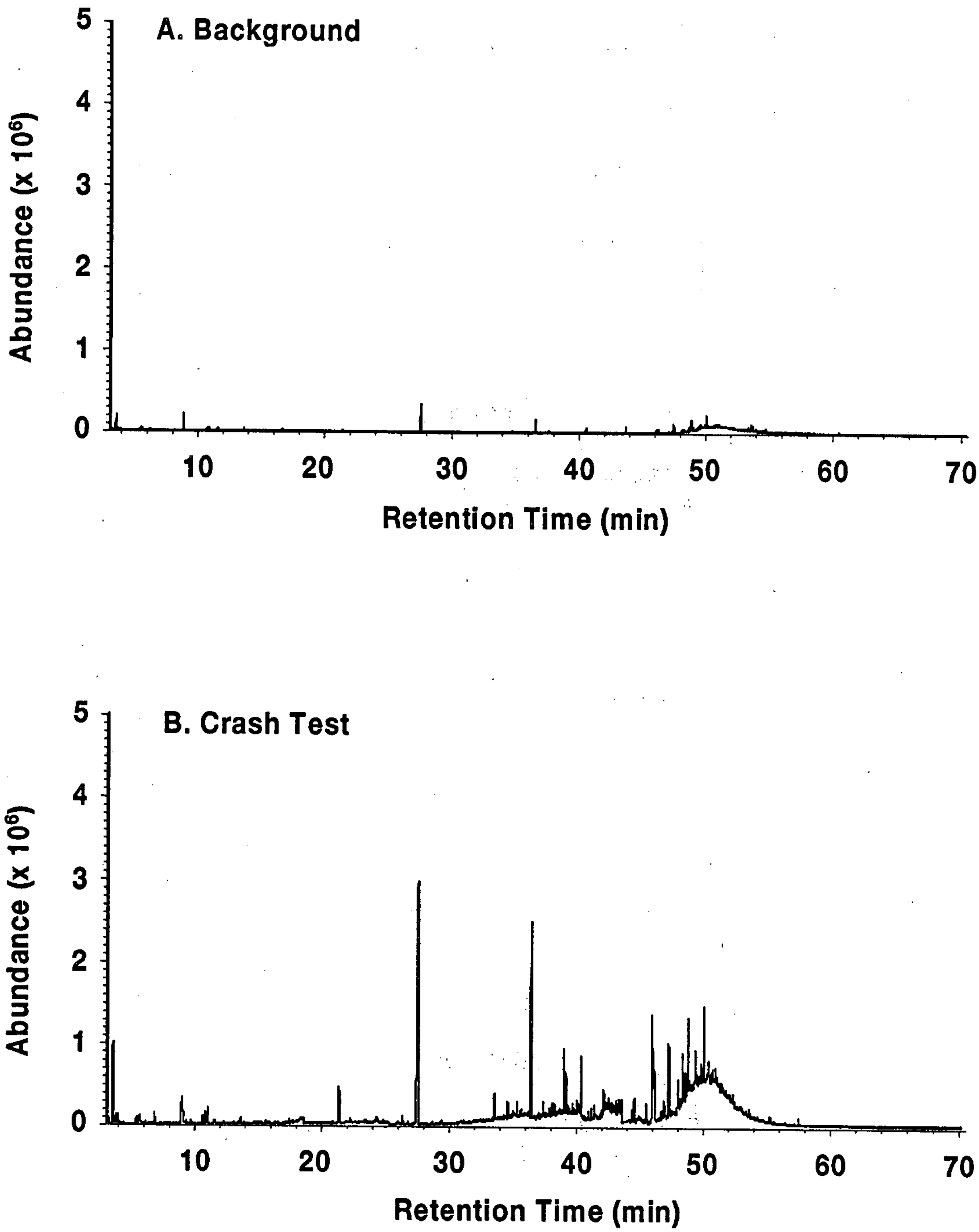


Figure GG5

GC/MS analysis of hydrocarbon vapor sampled from the exhaust manifold (location #5) during Crash Test C11226. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample.

Appendix H: C11279 data plots

LEFT FRONT
ANTHROPOMORPHIC TEST DEVICE SUMMARY DATA
MOVING VEHICLE TO FIXED POLE 55.4KM/H

C11279 FRONT IMPACT
R & D CTR 8T9308D VAN

ATD TYPE: GM50H
TEST DATE: 09/25/1996

MEASURED QUANTITY	100% OF IARV	150% OF IARV	IAV VALUE	IARV
HIC, LIMITED TO 15 MS			250	1000
HIC, LIMITED TO 36 MS			340	1000
NECK FLEXION			2NM	190NM
NECK EXTENSION			44NM	57NM
NECK TENSION			0.69	1.00
NECK COMPRESSION			0.01	1.00
NECK SHEAR FORWARD			0.20	1.00
NECK SHEAR REARWARD			0.11	1.00
CHEST ACCEL			38G	60G
‡ CHEST COMPRESSION W/O SH BELT			38.3MM	65.0MM ‡
‡ CHEST COMPRESSION W/ SH BELT			38.3MM	50.0MM ‡
CHEST VISCOUS CRITERIA			0.24M/SEC	1.00M/SEC
FEMUR COMP, LEFT			4504N	10000N
FEMUR COMP, RIGHT			6228N	10000N
FEMUR DURATION ASSESS, LEFT			0.50	1.00
FEMUR DURATION ASSESS, RIGHT			0.70	1.00
TIBIA/FEMUR DISP, LEFT			0.1MM	15.0MM
TIBIA/FEMUR DISP, RIGHT			0.7MM	15.0MM
KNEE CLEVIS, LEFT INSIDE			1117N	4000N
KNEE CLEVIS, LEFT OUTSIDE			589N	4000N
KNEE CLEVIS, RIGHT INSIDE			2103N	4000N
KNEE CLEVIS, RIGHT OUTSIDE			1435N	4000N
TIBIA COMP, LEFT			1178N	8000N
TIBIA COMP, RIGHT			2183N	8000N
TIBIA MOM, UPPER, LEFT			89NM	225NM
TIBIA MOM, UPPER, RIGHT			140NM	225NM
TIBIA MOM, LOWER, LEFT			96NM	225NM
TIBIA MOM, LOWER, RIGHT			OVERLOADED	225NM
LEG INDEX, UPPER LEFT			0.42	1.00
LEG INDEX, UPPER RIGHT			0.66	1.00
LEG INDEX, LOWER LEFT			0.45	1.00
LEG INDEX, LOWER RIGHT			OVERLOADED	1.00

IAV - INJURY ASSESSMENT VALUE
IARV - INJURY ASSESSMENT REFERENCE VALUE

‡ RESTRAINT SYSTEM DEPENDENT. CHOOSE VALUE THAT APPLIES TO THIS TEST.

RIGHT FRONT
ANTHROPOMORPHIC TEST DEVICE SUMMARY DATA
MOVING VEHICLE TO FIXED POLE 55.4KM/H

C11279 FRONT IMPACT

R & D CTR 8T9308D VAN

ATD TYPE: GM50H

TEST DATE: 09/25/1996

MEASURED QUANTITY	100% OF IARV	150% OF IARV	IAV VALUE	IARV
HIC, LIMITED TO 15 MS			180	1000
HIC, LIMITED TO 36 MS			230	1000
NECK FLEXION			41NM	190NM
NECK EXTENSION			20NM	57NM
NECK TENSION			0.37	1.00
NECK COMPRESSION			0.01	1.00
NECK SHEAR FORWARD			0.27	1.00
NECK SHEAR REARWARD			0.05	1.00
CHEST ACCEL			36G	60G
‡ CHEST COMPRESSION W/O SH BELT			28.8MM	65.0MM ‡
‡ CHEST COMPRESSION W/ SH BELT			28.8MM	50.0MM ‡
CHEST VISCOUS CRITERIA			0.26M/SEC	1.00M/SEC
FEMUR COMP, LEFT			5936N	10000N
FEMUR COMP, RIGHT			5077N	10000N
FEMUR DURATION ASSESS, LEFT			0.66	1.00
FEMUR DURATION ASSESS, RIGHT			0.57	1.00
TIBIA/FEMUR DISP, LEFT			8.0MM	15.0MM
TIBIA/FEMUR DISP, RIGHT			0.4MM	15.0MM
KNEE CLEVIS, LEFT INSIDE			1716N	4000N
KNEE CLEVIS, LEFT OUTSIDE			754N	4000N
KNEE CLEVIS, RIGHT INSIDE			1407N	4000N
KNEE CLEVIS, RIGHT OUTSIDE			623N	4000N
TIBIA COMP, LEFT			2365N	8000N
TIBIA COMP, RIGHT			1633N	8000N
TIBIA MOM, UPPER, LEFT			192NM	225NM
TIBIA MOM, UPPER, RIGHT			65NM	225NM
TIBIA MOM, LOWER, LEFT			293NM	225NM
TIBIA MOM, LOWER, RIGHT		***	372NM	225NM
LEG INDEX, UPPER LEFT			0.88	1.00
LEG INDEX, UPPER RIGHT			0.31	1.00
LEG INDEX, LOWER LEFT			1.37	1.00
LEG INDEX, LOWER RIGHT		***	1.70	1.00

IAV - INJURY ASSESSMENT VALUE

IARV - INJURY ASSESSMENT REFERENCE VALUE

‡ RESTRAINT SYSTEM DEPENDENT. CHOOSE VALUE THAT APPLIES TO THIS TEST.

*** VALUE GREATER THAN 150% OF IAV

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

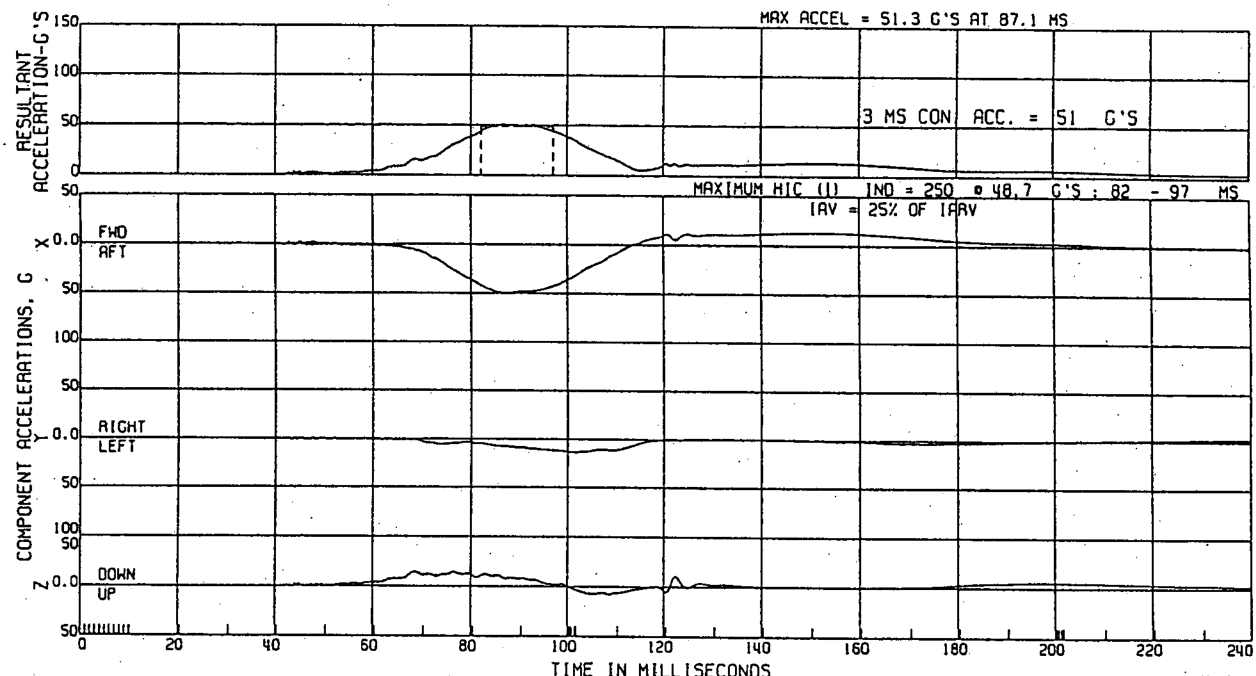
ELEC DATA, SAE CLASS 1000

L. FRT HEAD ACCEL.

(HIC I LIMITED TO 15MS)

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 1

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

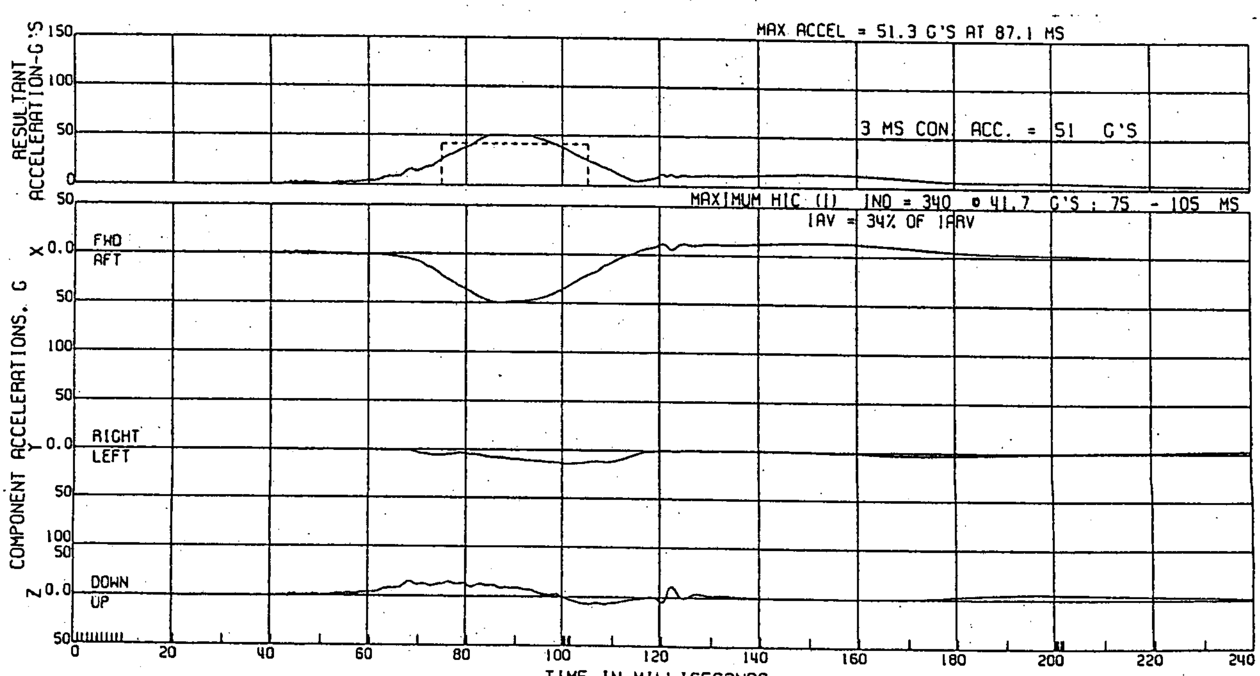
ELEC DATA, SAE CLASS 1000

L. FRT HEAD ACCEL.

(HIC I LIMITED TO 36MS)

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 2

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

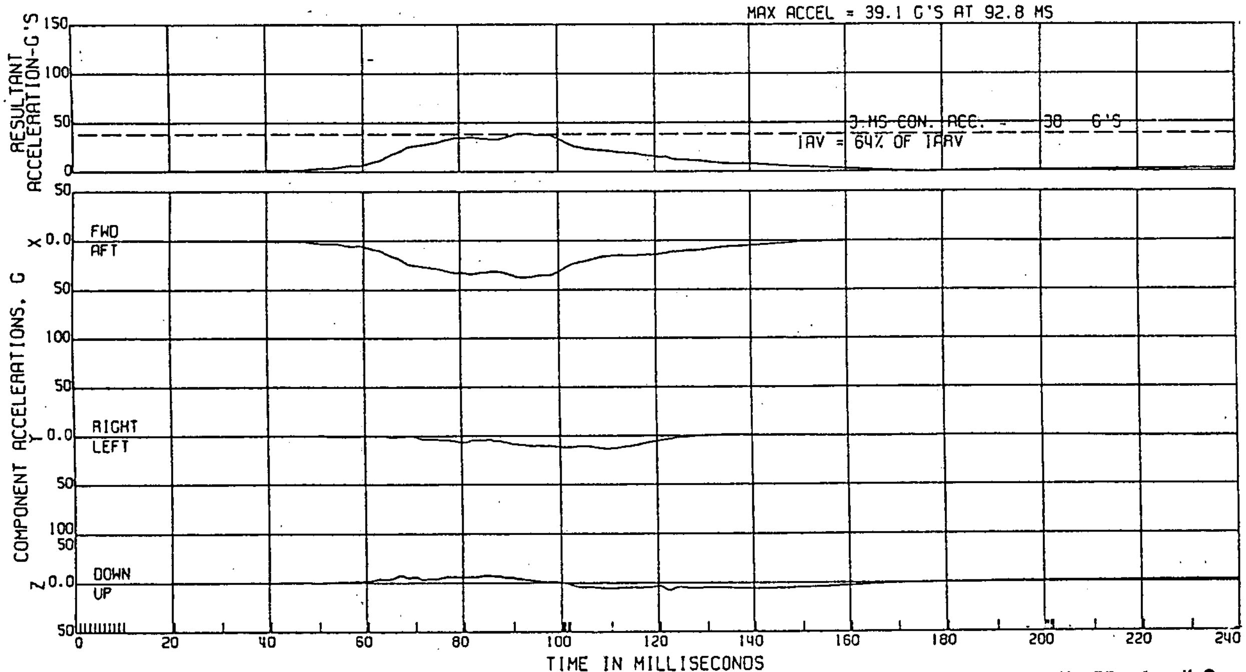
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

ATD TYPE: GM50H

TEST DATE:09/25/1996

L. FRT CHEST ACCEL.



Appendix H, plot # 3

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

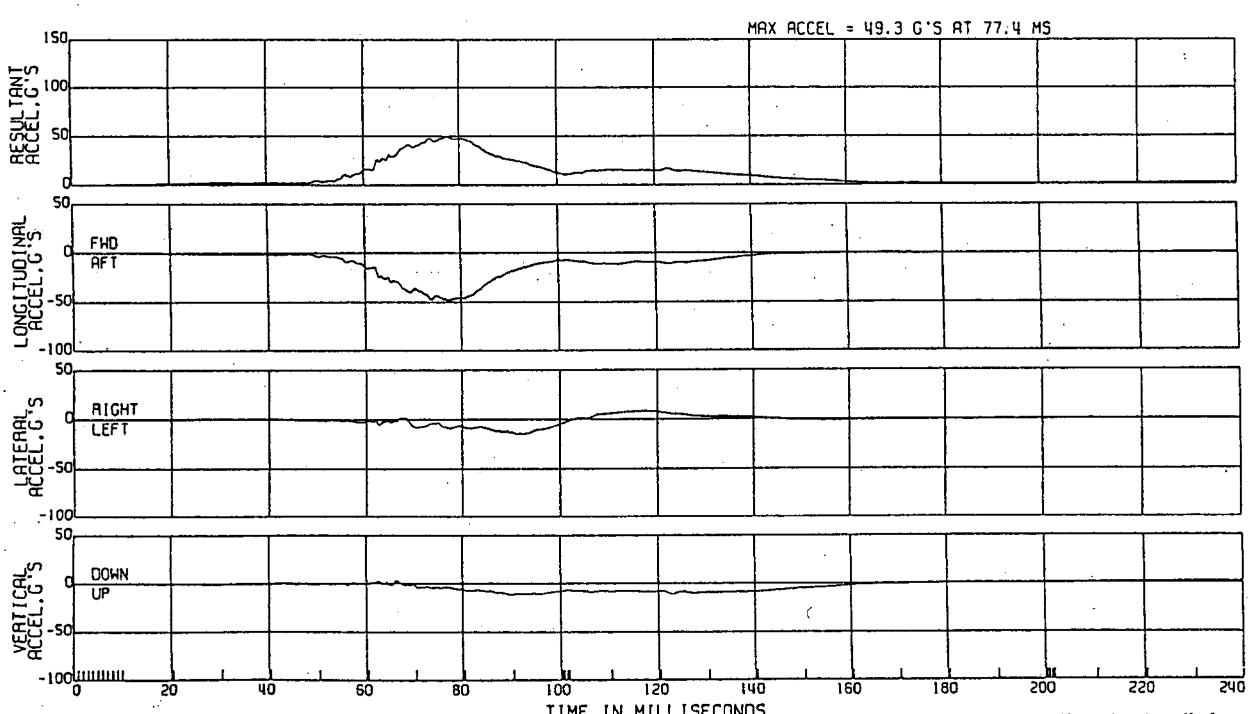
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

ATD TYPE: GM50H

TEST DATE:09/25/1996

L. FRT PELVIC ACCEL.



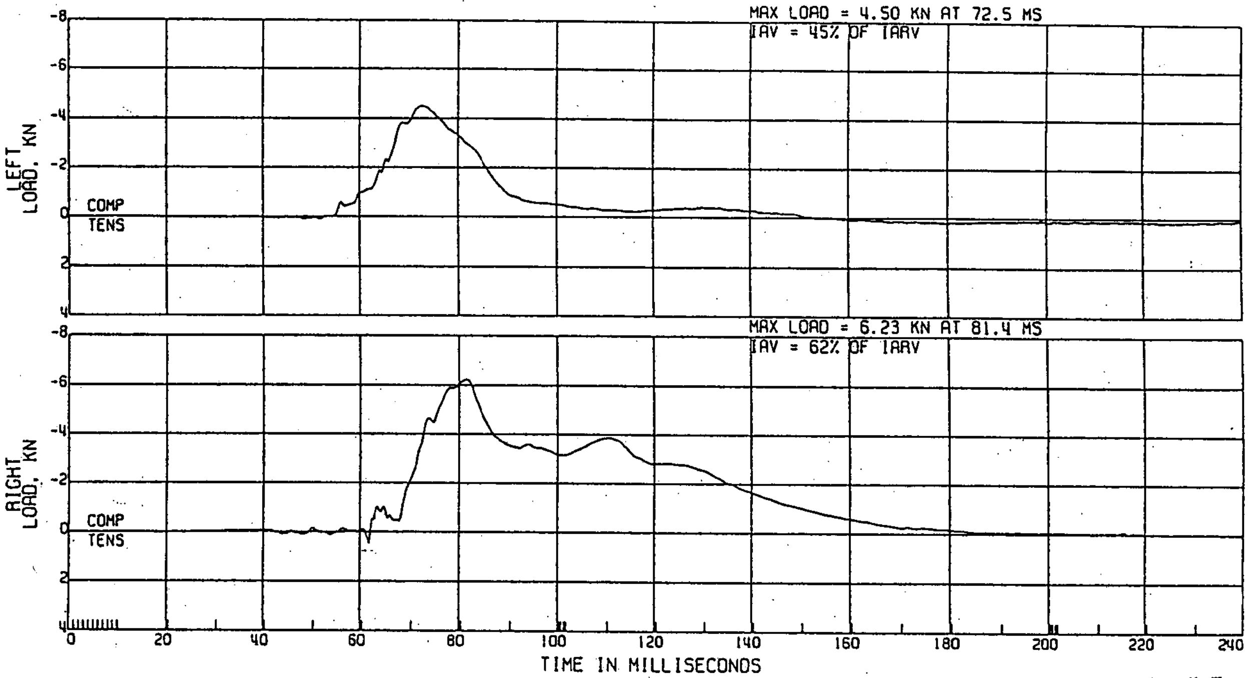
Appendix H, plot # 4

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD

ATD TYPE: GM50H
TEST DATE:09/25/1996



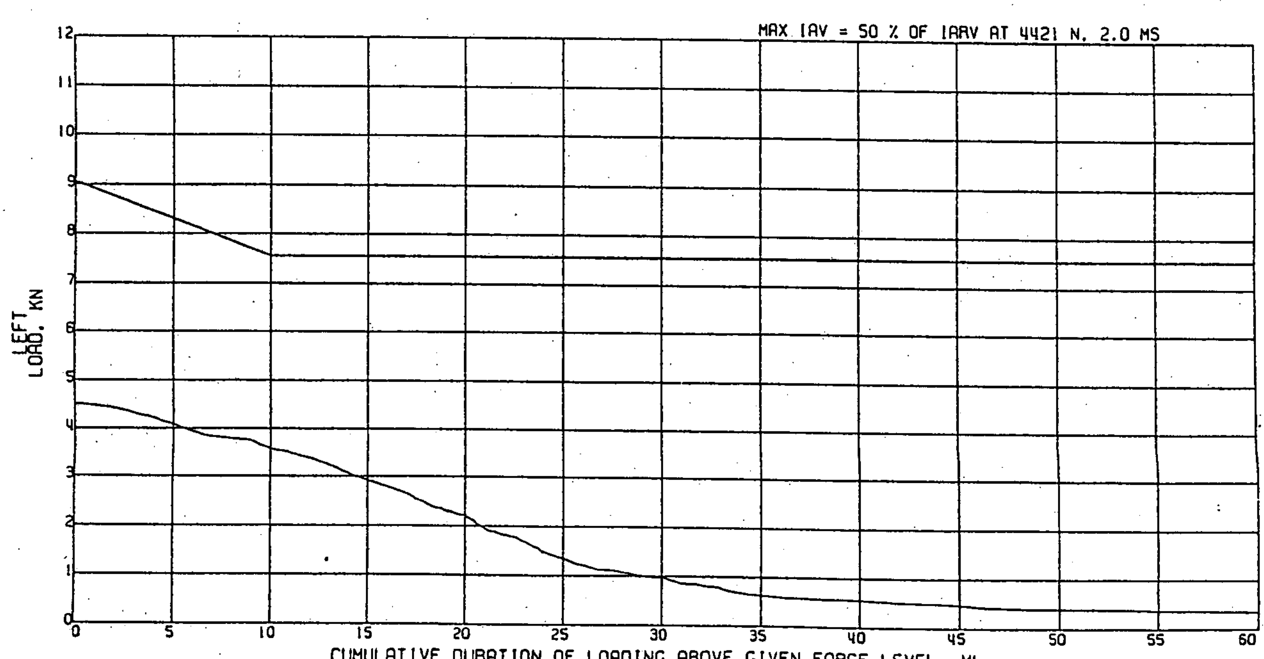
Appendix H, plot # 5

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD
DURATION ASSESSMENT

ATD TYPE: GM50H
TEST DATE:09/25/1996



Appendix H, plot # 6

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE

55.4KM/H

R & D CTR 8T93080 VAN

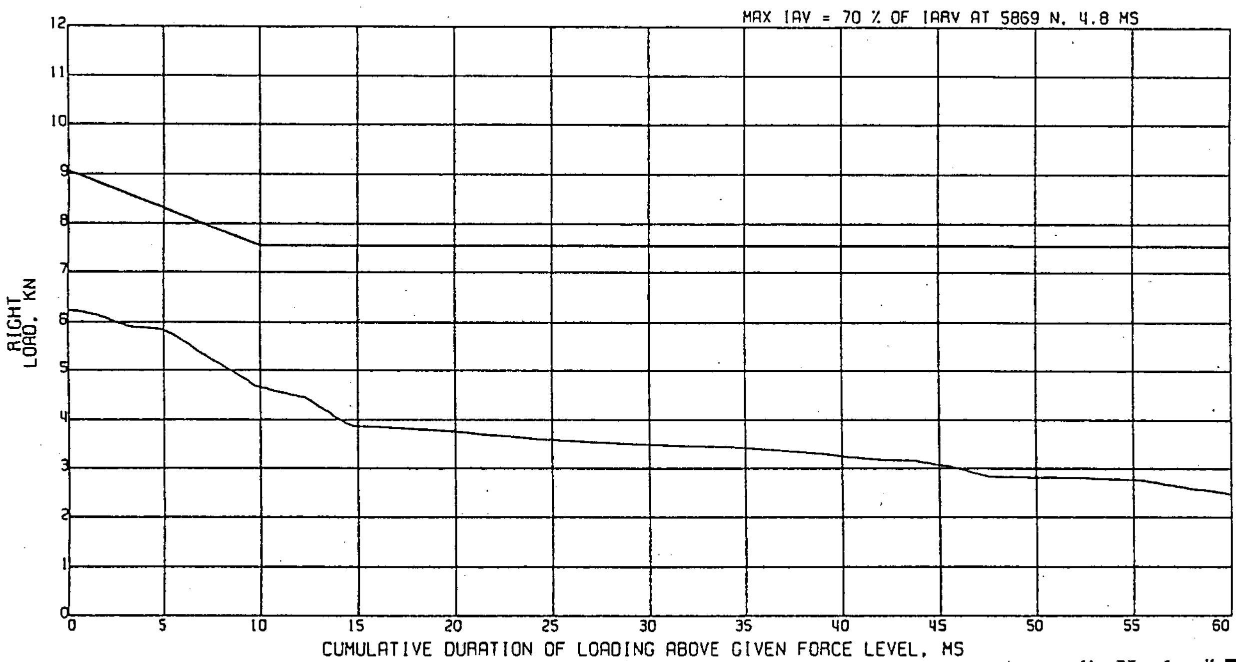
ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD

DURATION ASSESSMENT

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 7

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE

55.4KM/H

R & D CTR 8T93080 VAN

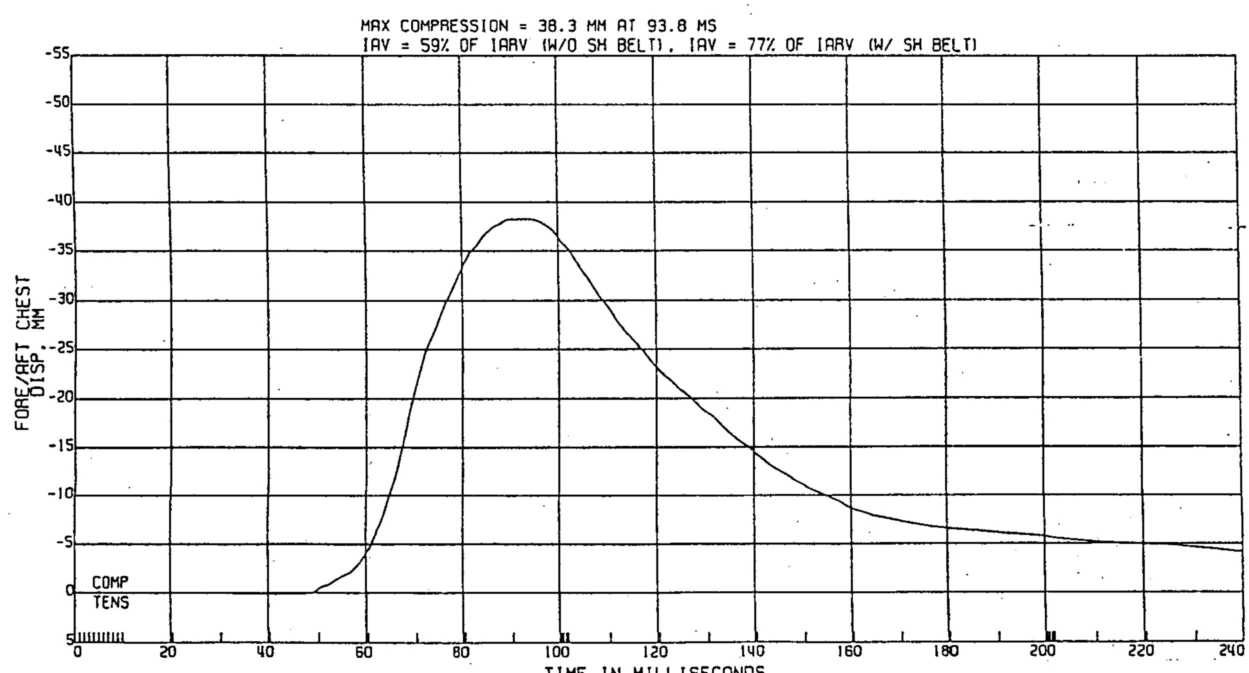
ELEC DATA, SAE CLASS 180

L. FRT CHEST DISP, TEMP AT 74.4'F

NORMALIZED TO 70.7'F & PART 572 CORRIDOR

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 8

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

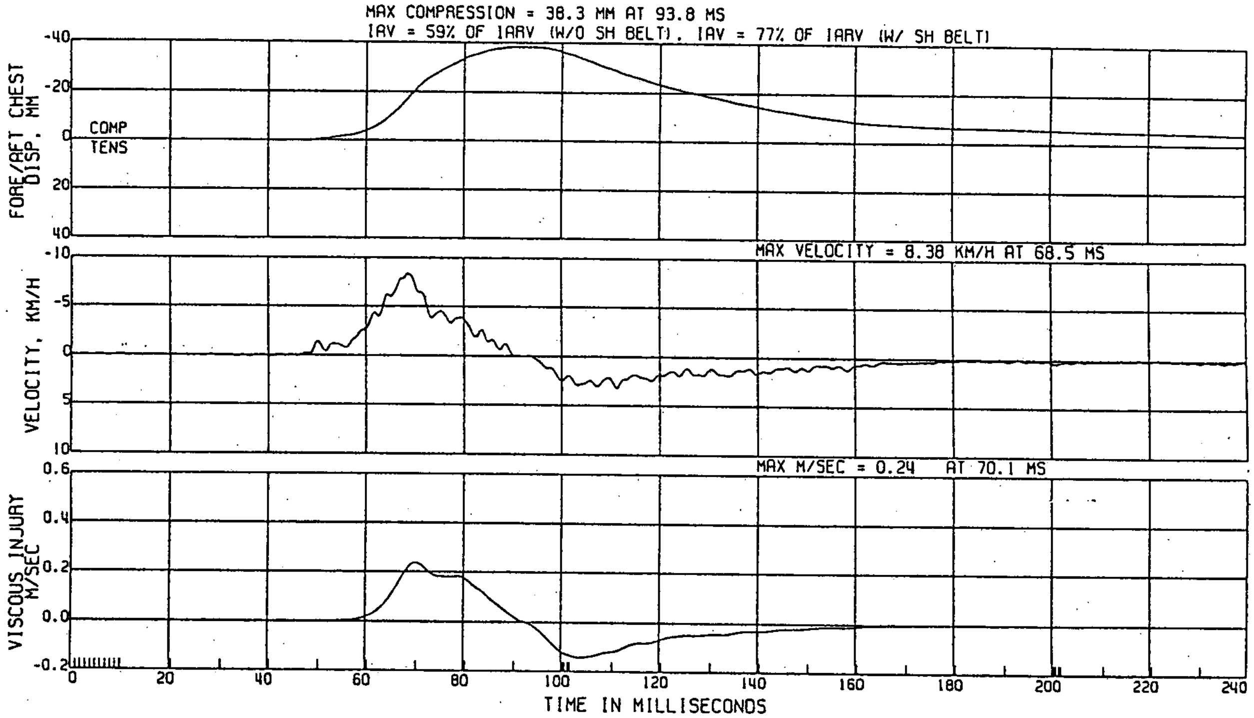
ELEC DATA, SAE CLASS 180

L. FRT CHEST COMPRESSIVE DISP.

NORMALIZED, W/CALC VEL & VISCOUS INJURY

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 9

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

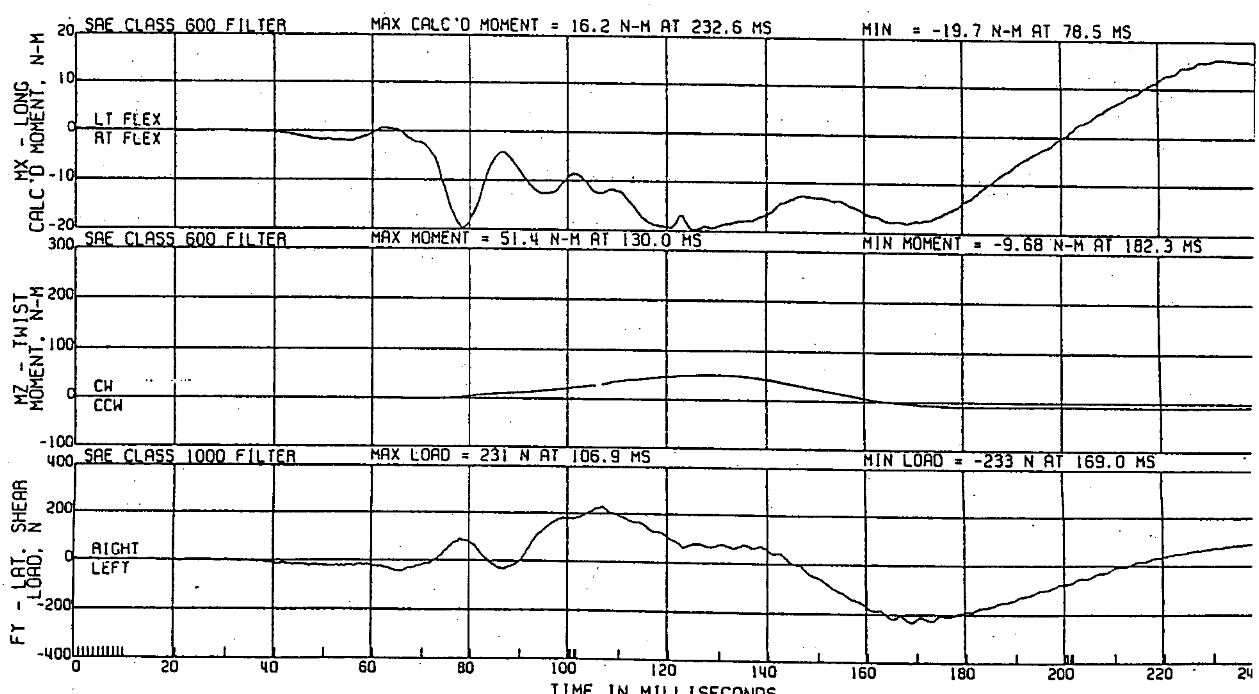
ELEC DATA

L. FRT NECK LOADING ON HEAD, UPPER LOAD

L. FRT NECK LOADING ON HEAD

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 10

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN

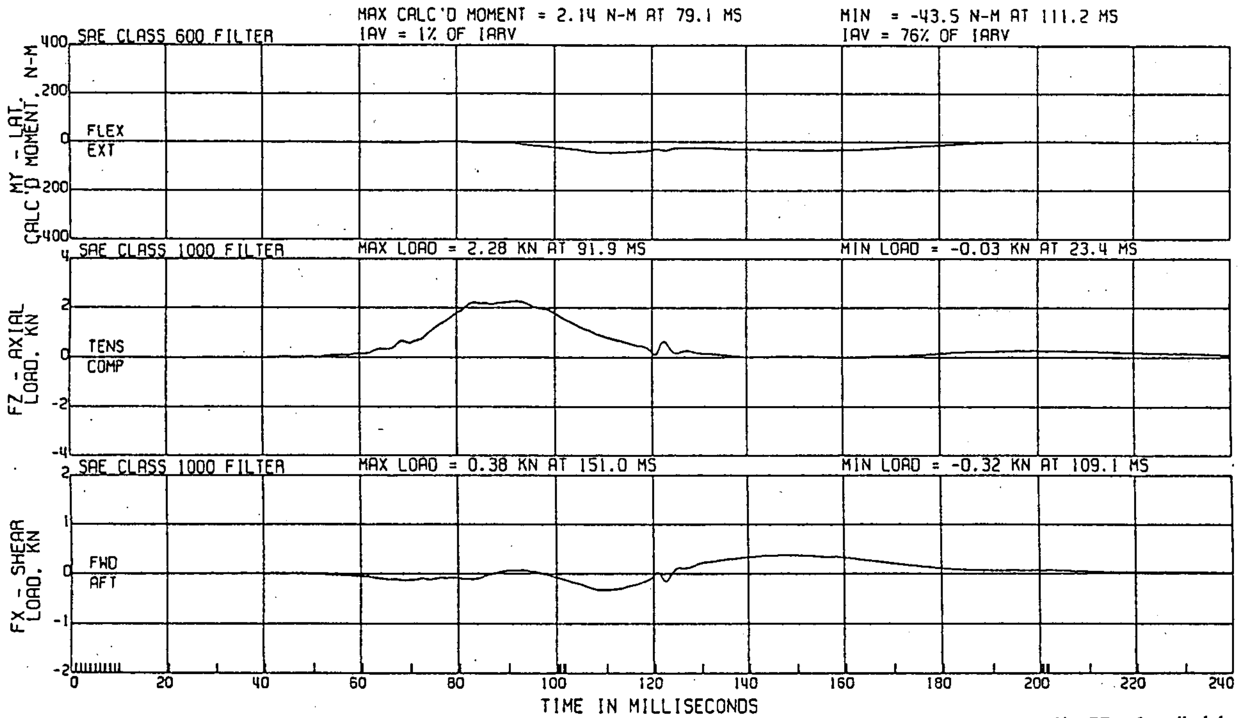
ELEC DATA

ATD TYPE: GM50H

TEST DATE:09/25/1996

NECK LOADING ON HEAD

L. FRT NECK LOADING ON HEAD



Appendix H, plot # **11**

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN

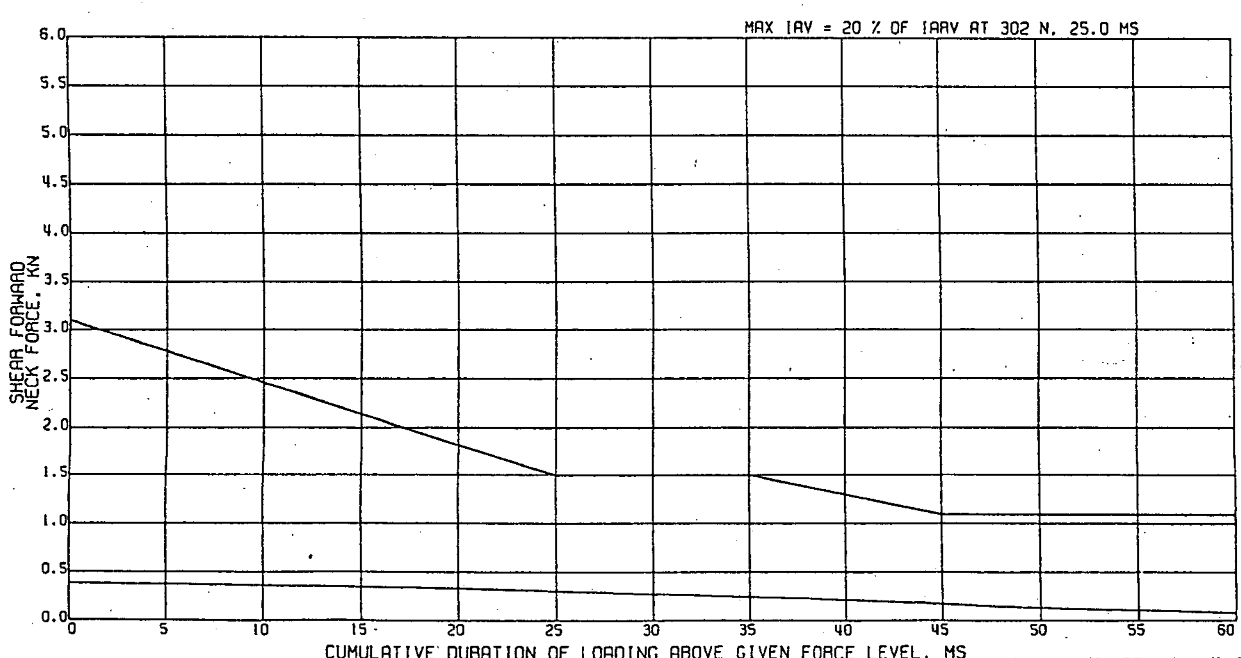
ELEC DATA, SAE CLASS 1000

ATD TYPE: GM50H

TEST DATE:09/25/1996

FORWARD NECK SHEAR ON HEAD,

L. FRT INJURY REFERENCE



Appendix H, plot # **12**

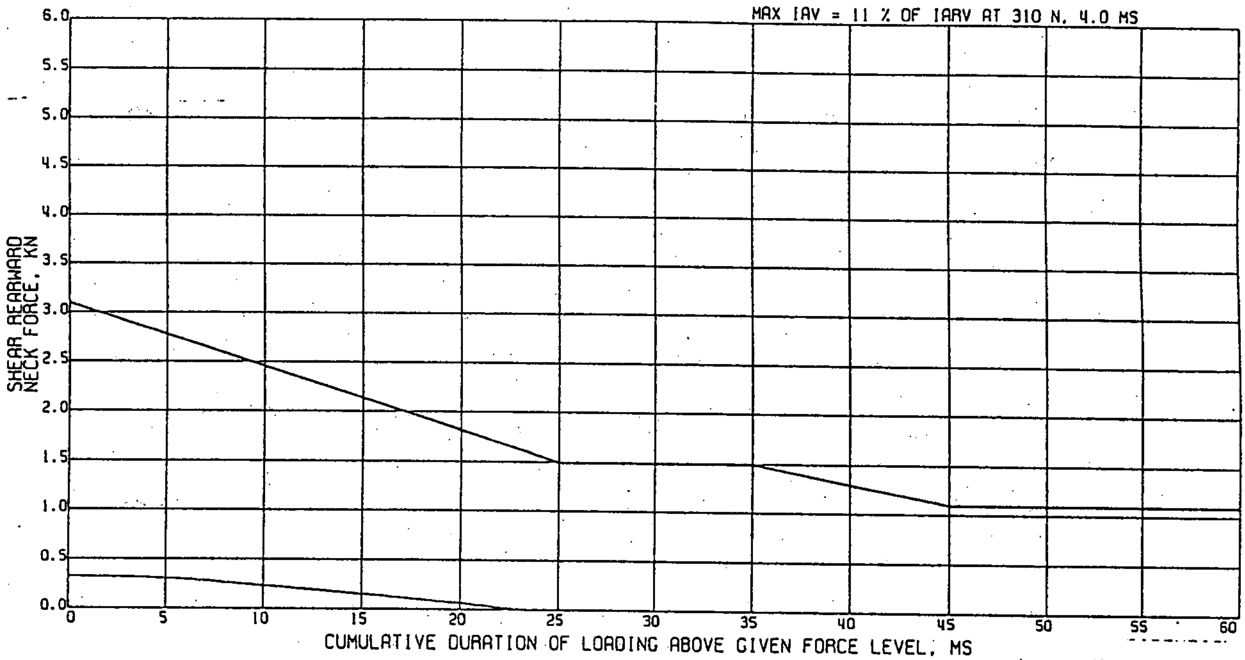
C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN
ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:09/25/1996



Appendix H, plot # 13

13

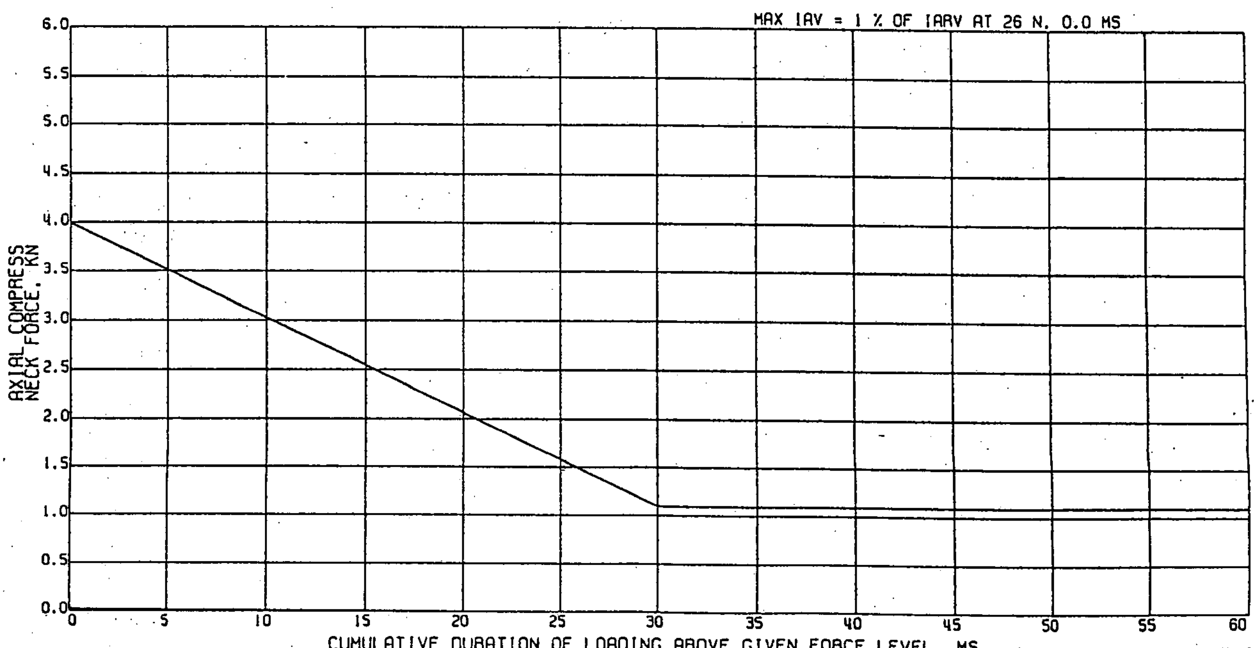
C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN
ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:09/25/1996



Appendix H, plot # 14

14

C11279 FRONT IMPACT

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

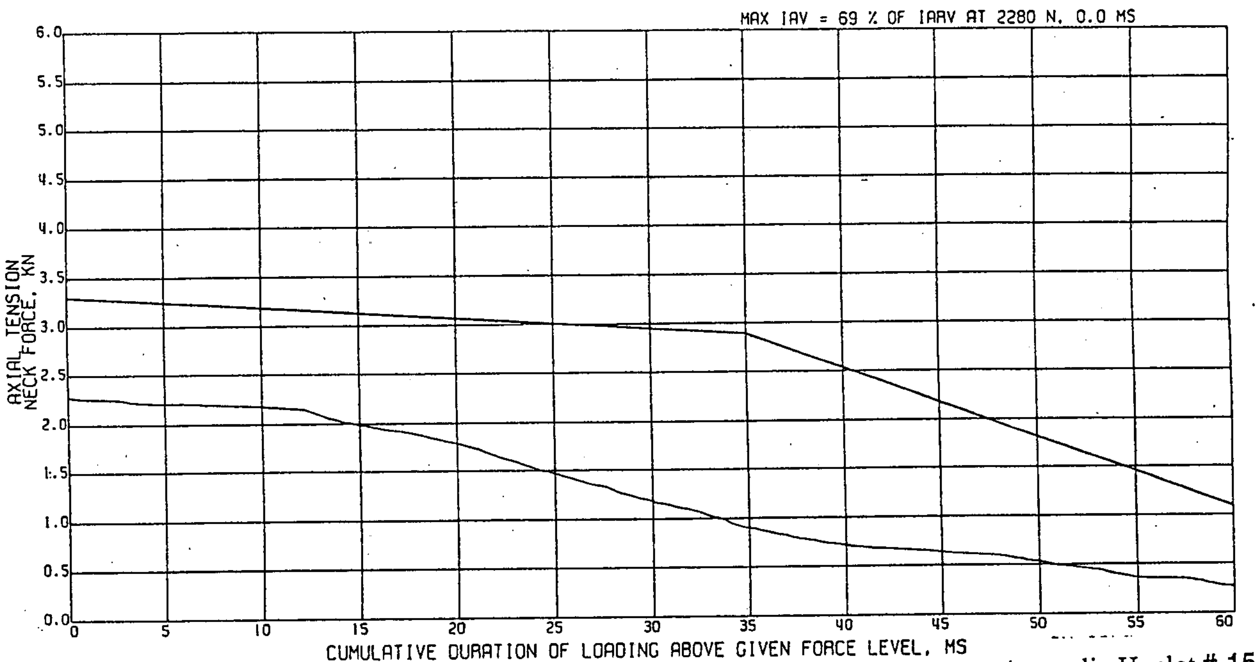
MOVING VEHICLE TO FIXED POLE 55.4KM/H

AXIAL TENSION ON HEAD,

L. FRT INJURY REFERENCE

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 15

C11279 FRONT IMPACT

R & D CTR 8T93080 VAN

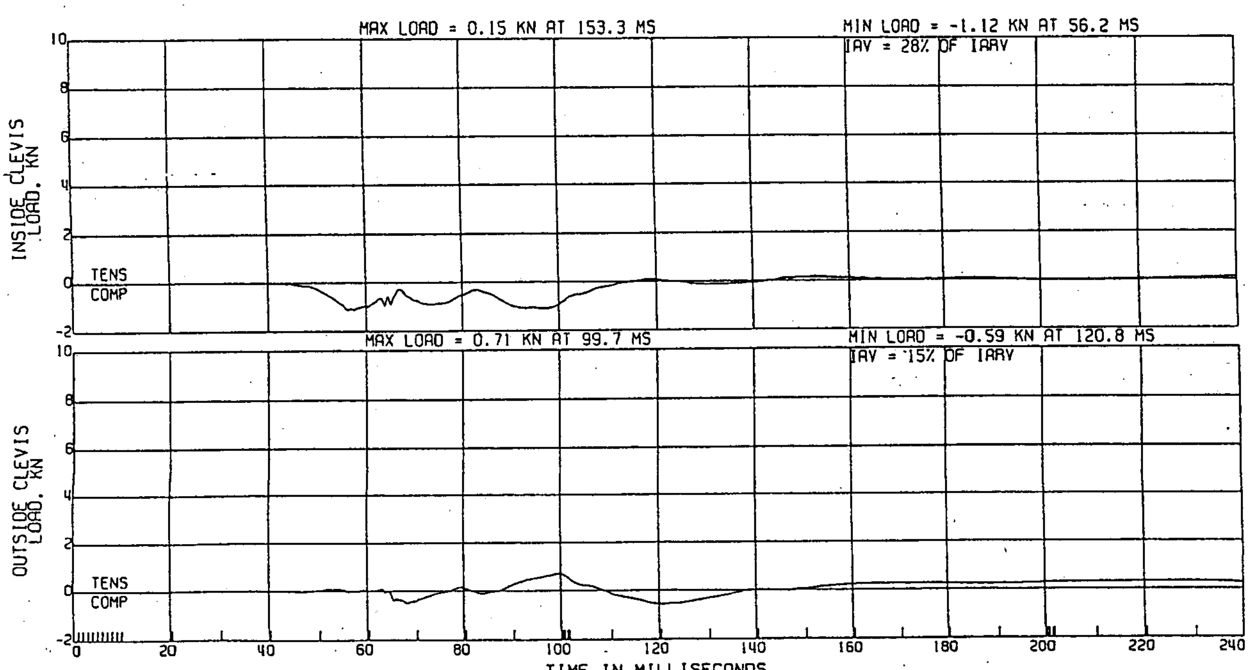
ELEC DATA, SAE CLASS 600

MOVING VEHICLE TO FIXED POLE 55.4KM/H

L. FRT LEFT KNEE CLEVIS LOAD

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 16

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

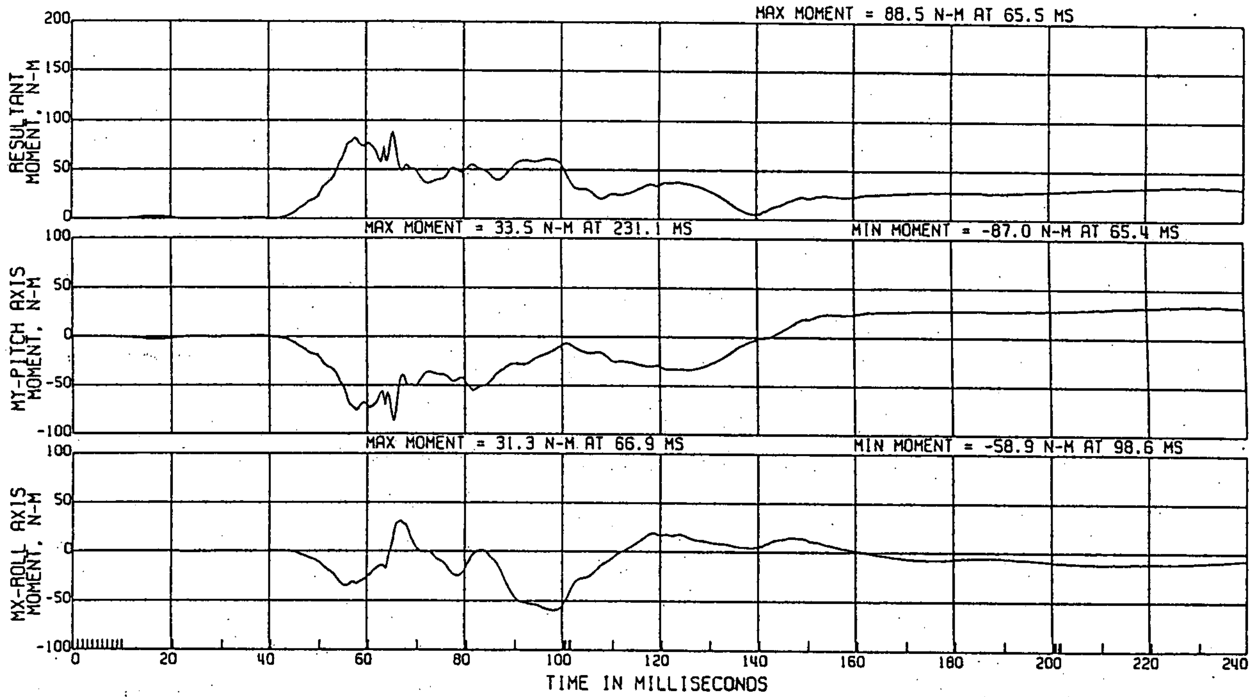
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 600

L. FRT LEFT TIBIA UPPER MOMENT

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 17

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

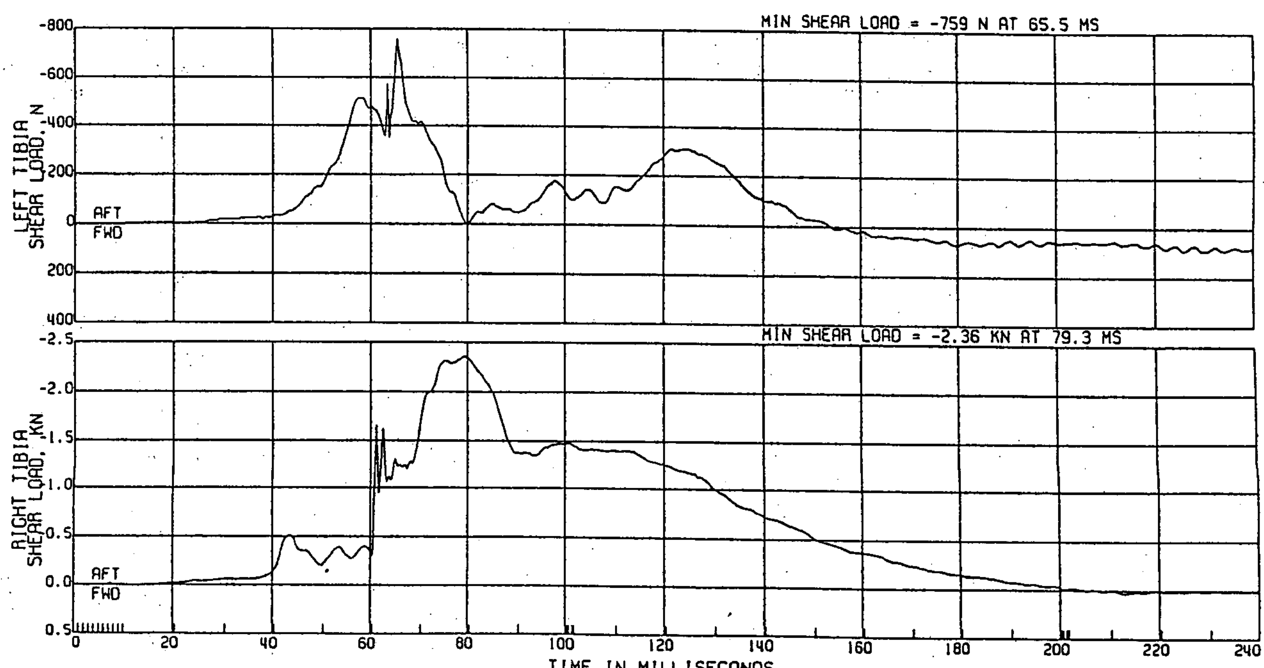
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H

TEST DATE:09/25/1996

L. FRT TIBIA LOWER SHEAR LOAD CELLS



Appendix H, plot # 18

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

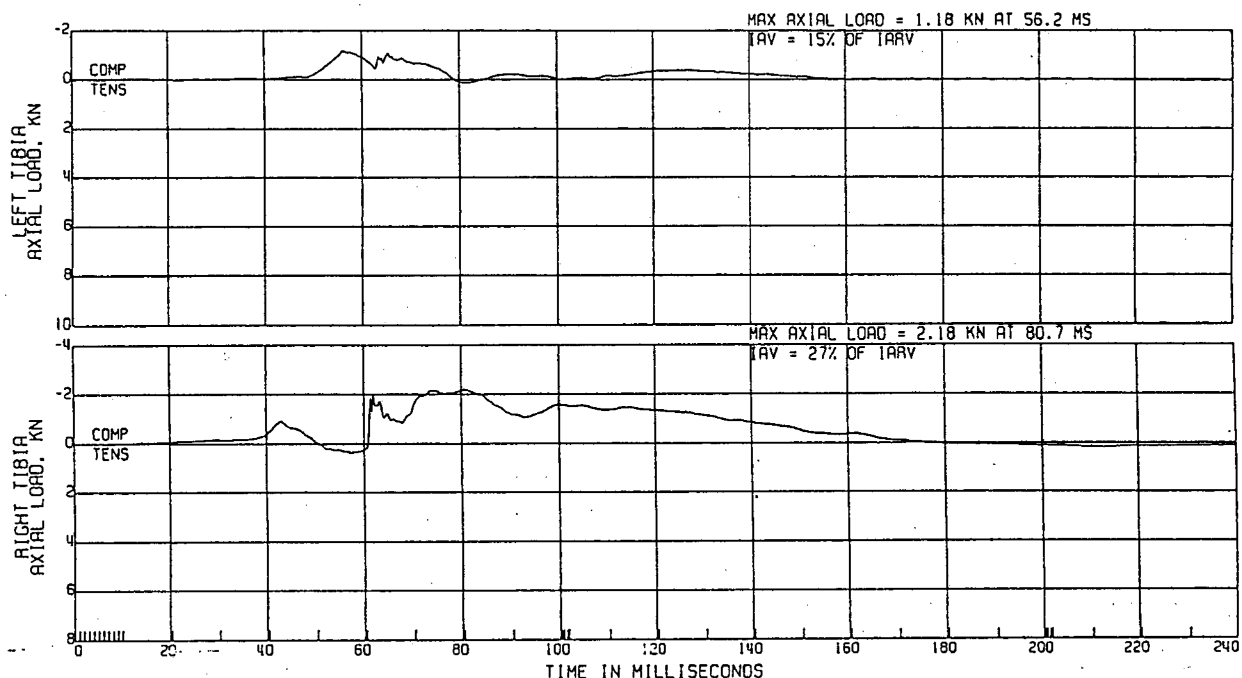
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H

TEST DATE:09/25/1996

L. FRT TIBIA LOWER AXIAL LOAD



Appendix H, plot # **19**

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

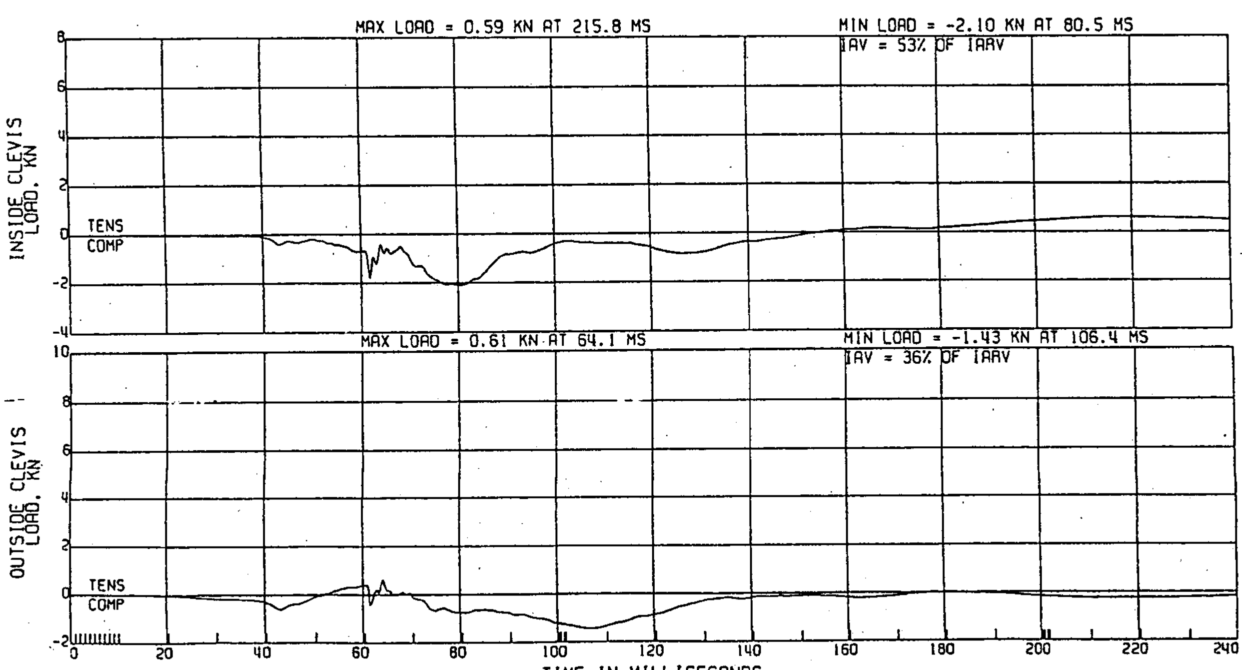
L. FRT RIGHT KNEE CLEVIS LOAD

ATD TYPE: GM50H

TEST DATE:09/25/1996

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 600



Appendix H, plot # **20**

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

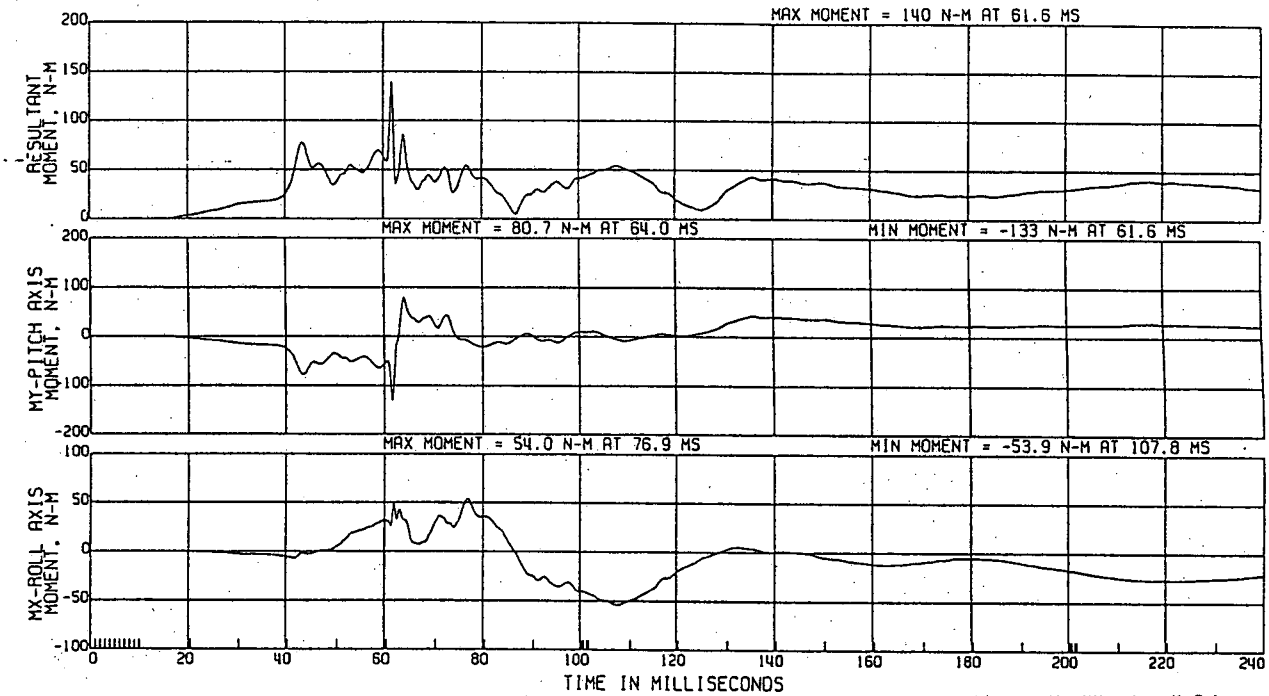
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H

TEST DATE:09/25/1996

L. FRT RIGHT TIBIA UPPER MOMENT



Appendix H, plot # 21

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

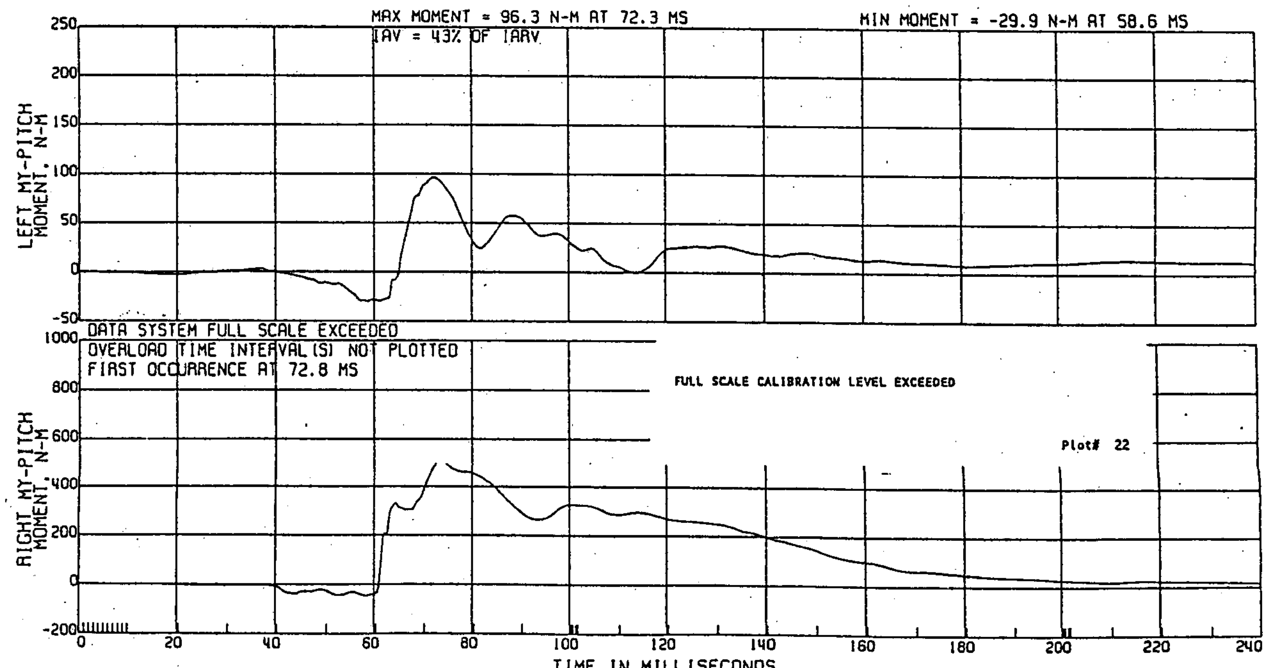
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H

TEST DATE:09/25/1996

L. FRT TIBIA LOWER BENDING MOMENTS



Appendix H, plot # 22

CI1279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

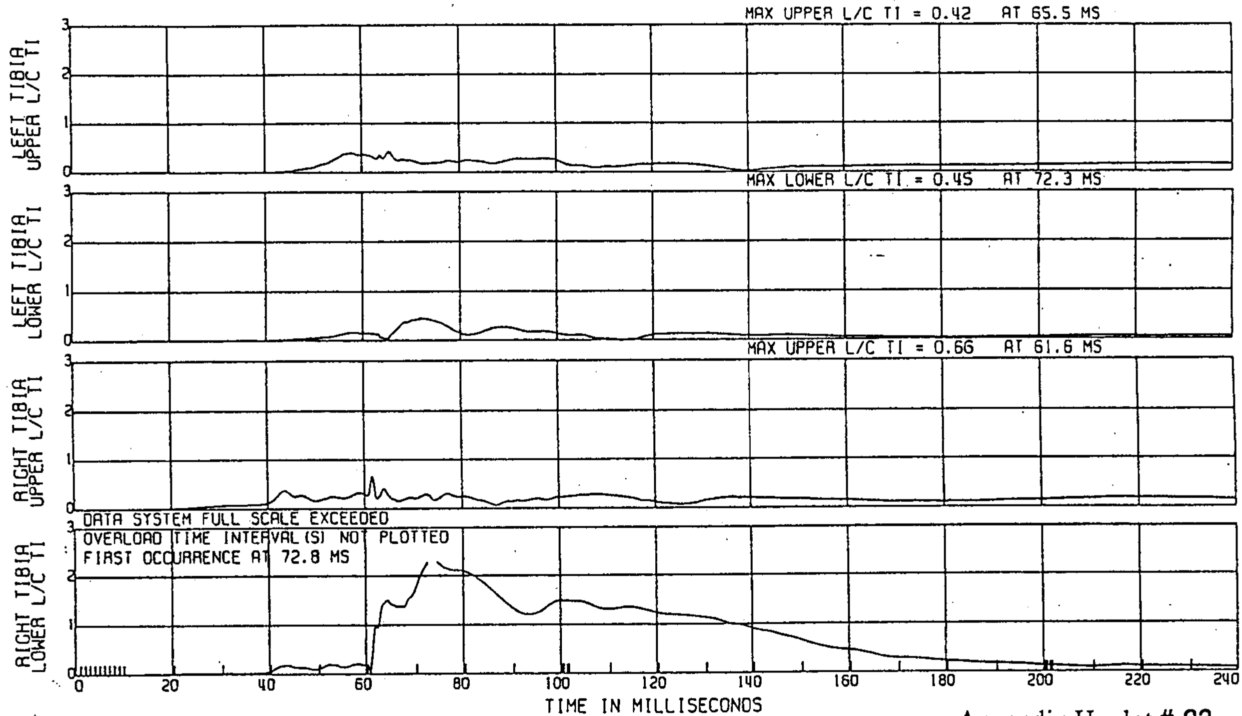
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H

TEST DATE:09/25/1996

L. FRT TIBIA INDICES

TI = (RES MOM/225 NM) + (AXIAL/35900 N)



Appendix H, plot # 23

23 PROCESSED 9/25/1996 15:30 V2.04

CI1279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

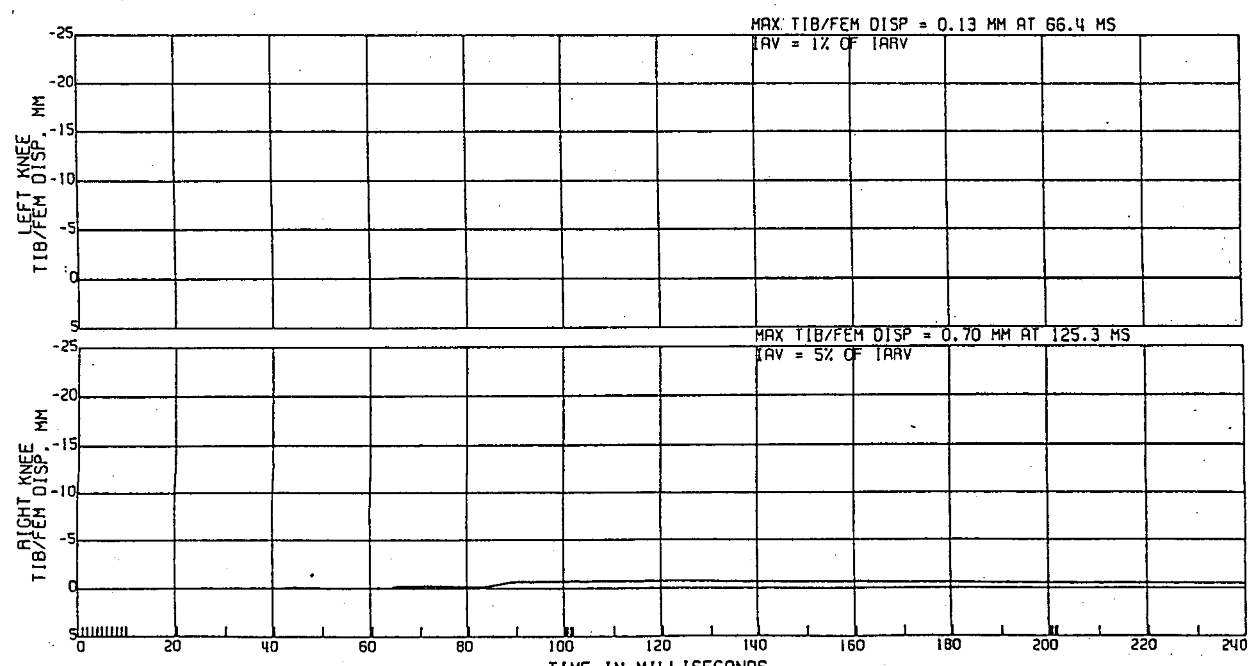
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

ATD TYPE: GM50H

TEST DATE:09/25/1996

L. FRT TIBIA/FEMUR DISPLACEMENT



Appendix H, plot # 24

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

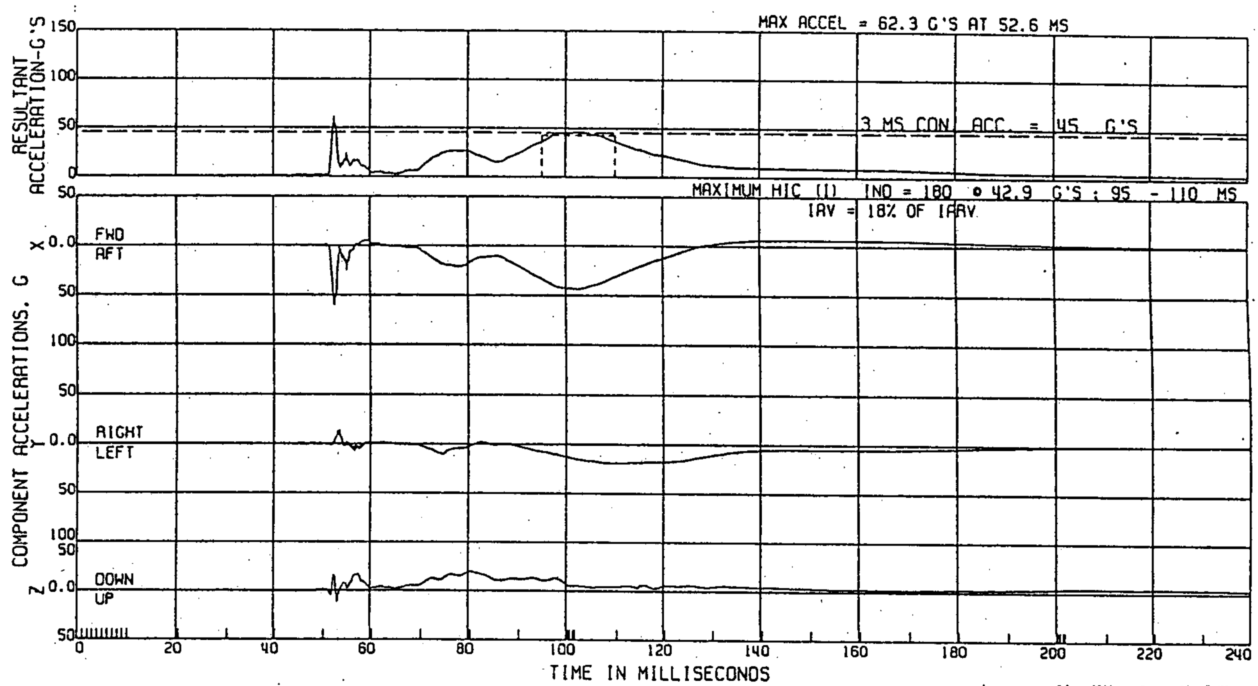
ELEC DATA, SAE CLASS 1000

R. FRT HEAD ACCEL.

(HIC I LIMITED TO 15MS)

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 25

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

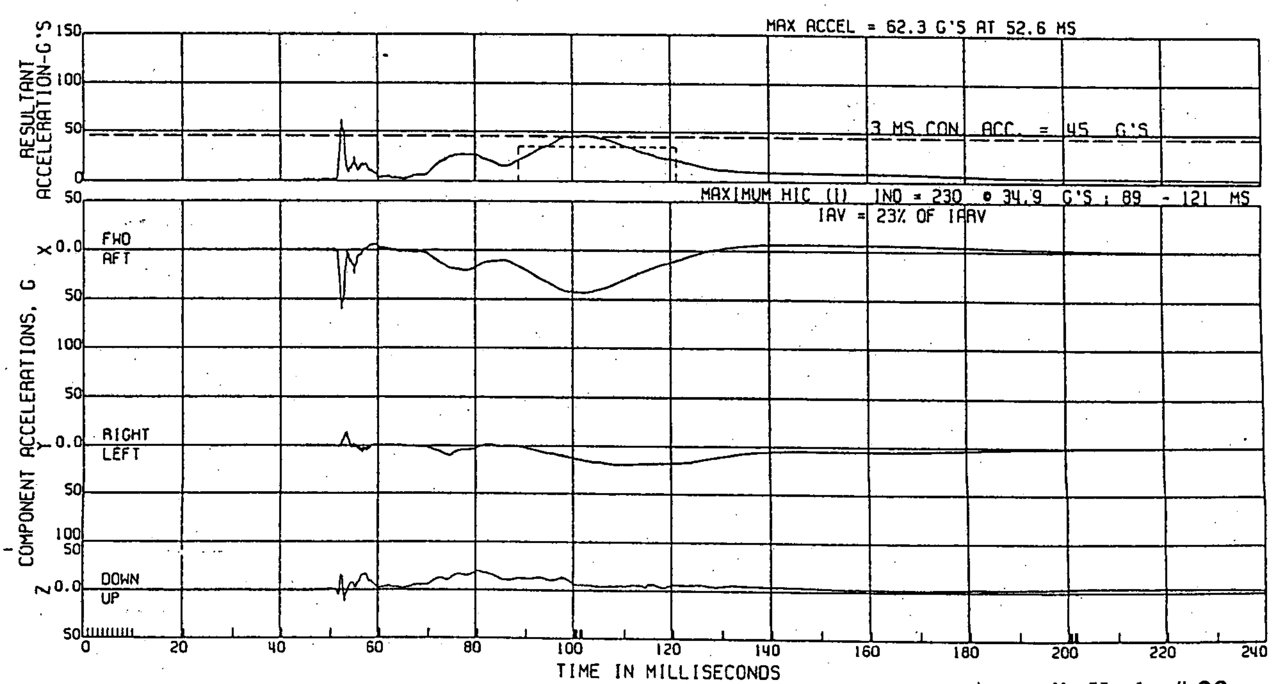
ELEC DATA, SAE CLASS 1000

R. FRT HEAD ACCEL.

(HIC I LIMITED TO 36MS)

ATD TYPE: GM50H

TEST DATE:09/25/1996



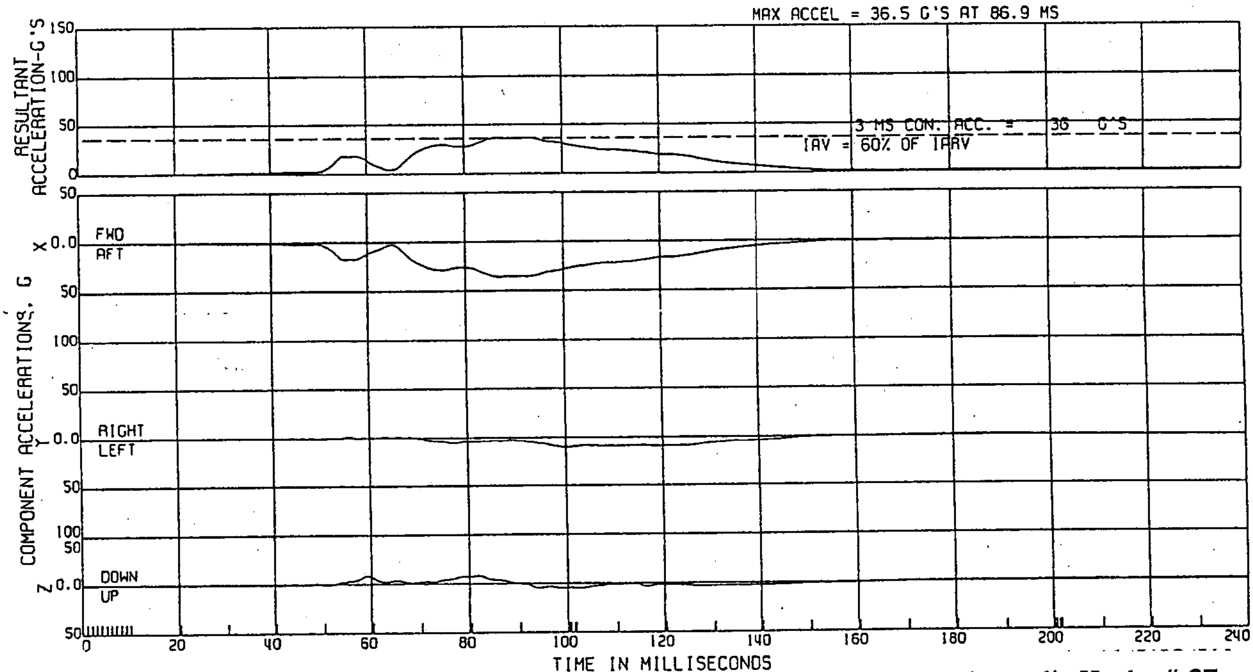
Appendix H, plot # 26

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R. FRT CHEST ACCEL.

ATD TYPE: GM50H
TEST DATE:09/25/1996

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 180



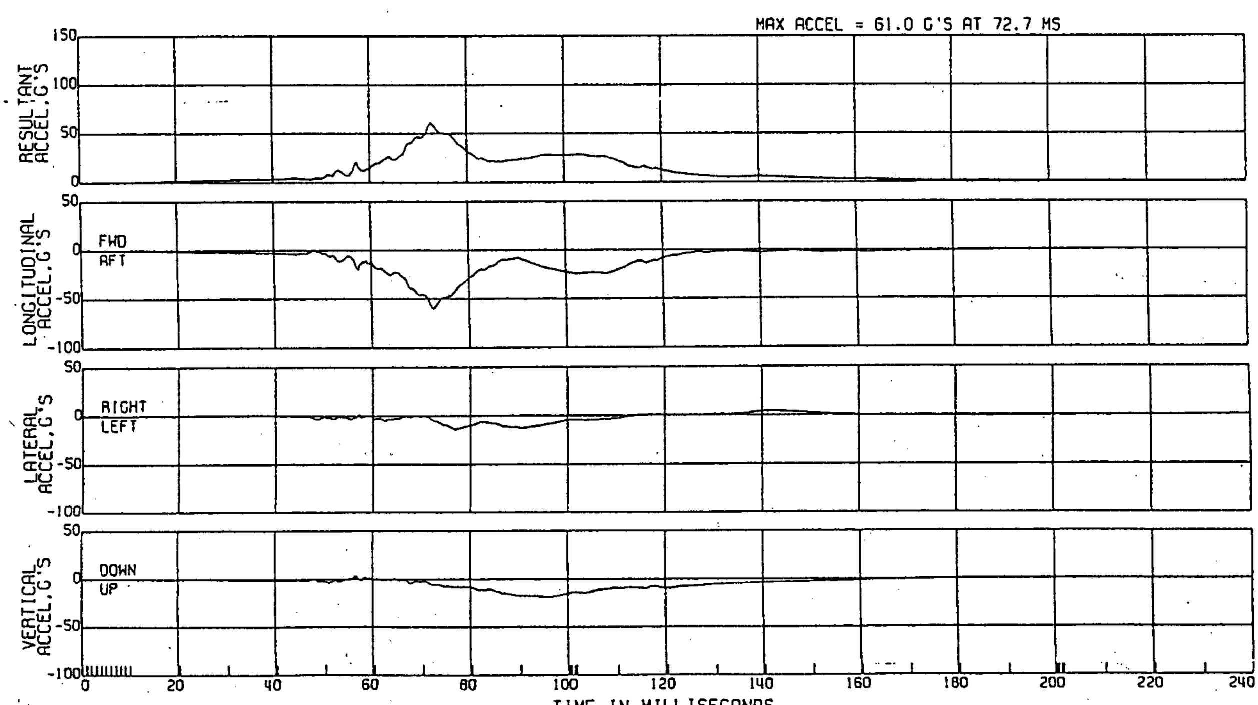
Appendix H, plot # **27**

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R. FRT PELVIC ACCEL.

ATD TYPE: GM50H
TEST DATE:09/25/1996

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 1000



Appendix H, plot # **28**

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE

55.4KM/H

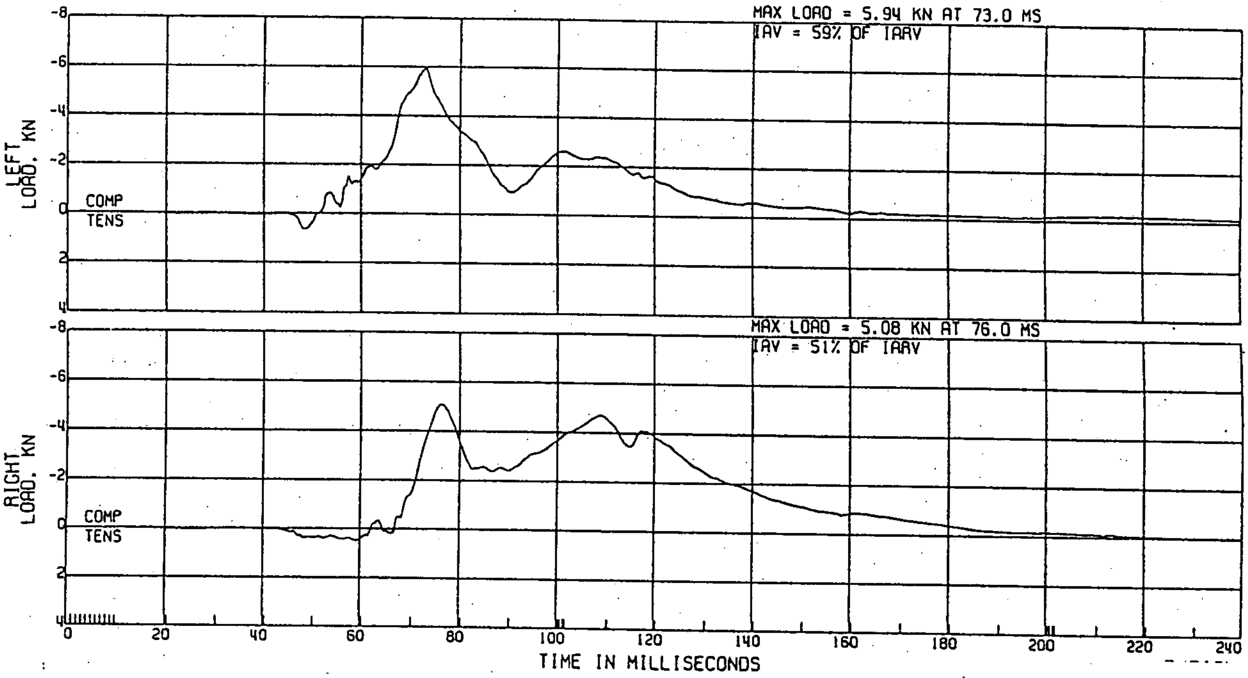
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 600

R. FRT FEMUR LOAD

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 29

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE

55.4KM/H

R & D CTR 8T93080 VAN

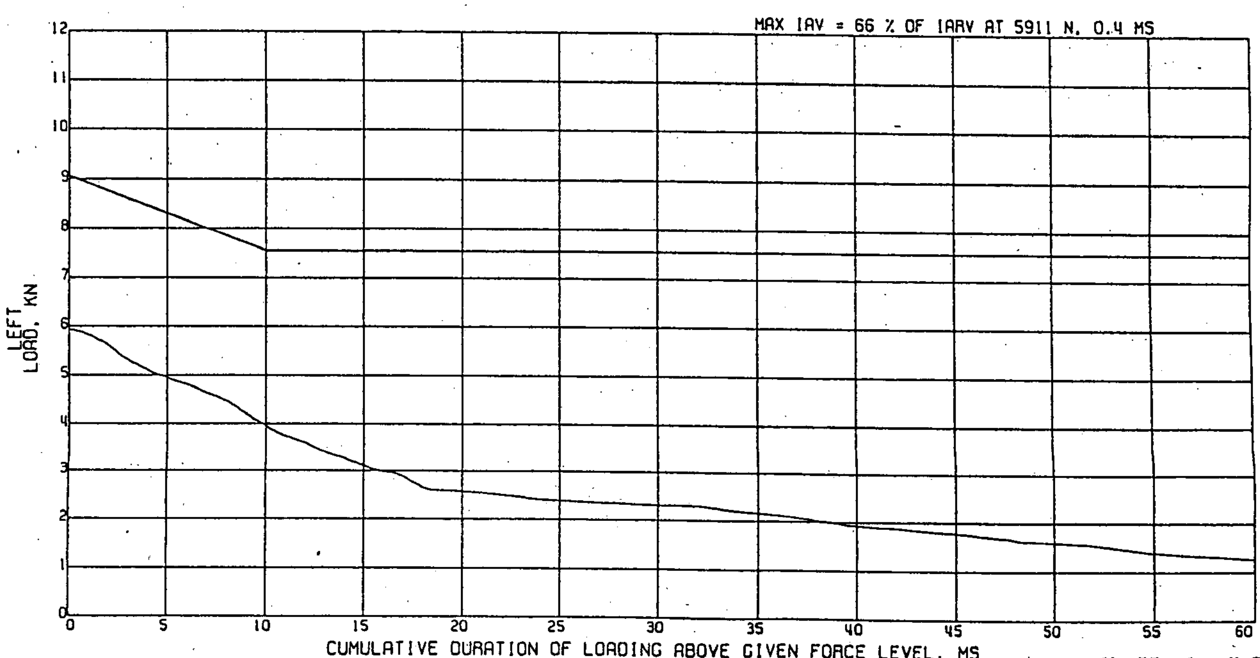
ELEC DATA, SAE CLASS 600

R. FRT FEMUR LOAD

DURATION ASSESSMENT

ATD TYPE: GM50H

TEST DATE:09/25/1996

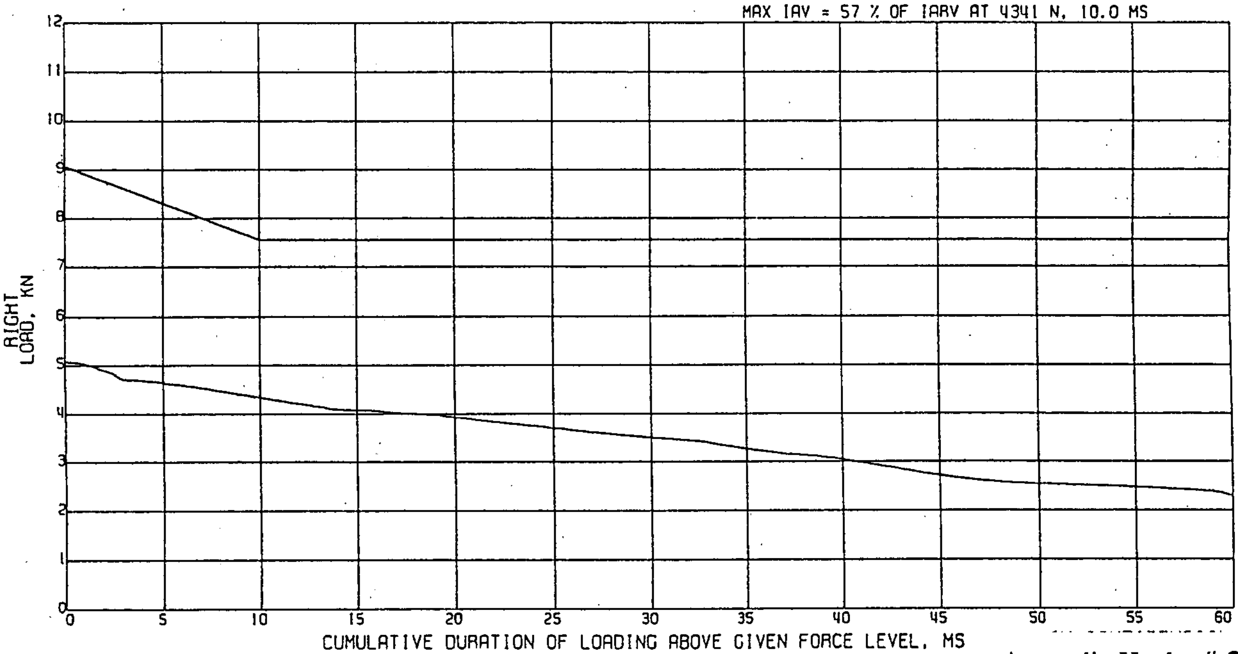


Appendix H, plot # 30

C11279 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.4KM/H

R & D CTR 8T93080 VAN | R. FRT FEMUR LOAD | ATD TYPE: GM50H

ELEC DATA, SAE CLASS 600 | DURATION ASSESSMENT | TEST DATE:09/25/1996

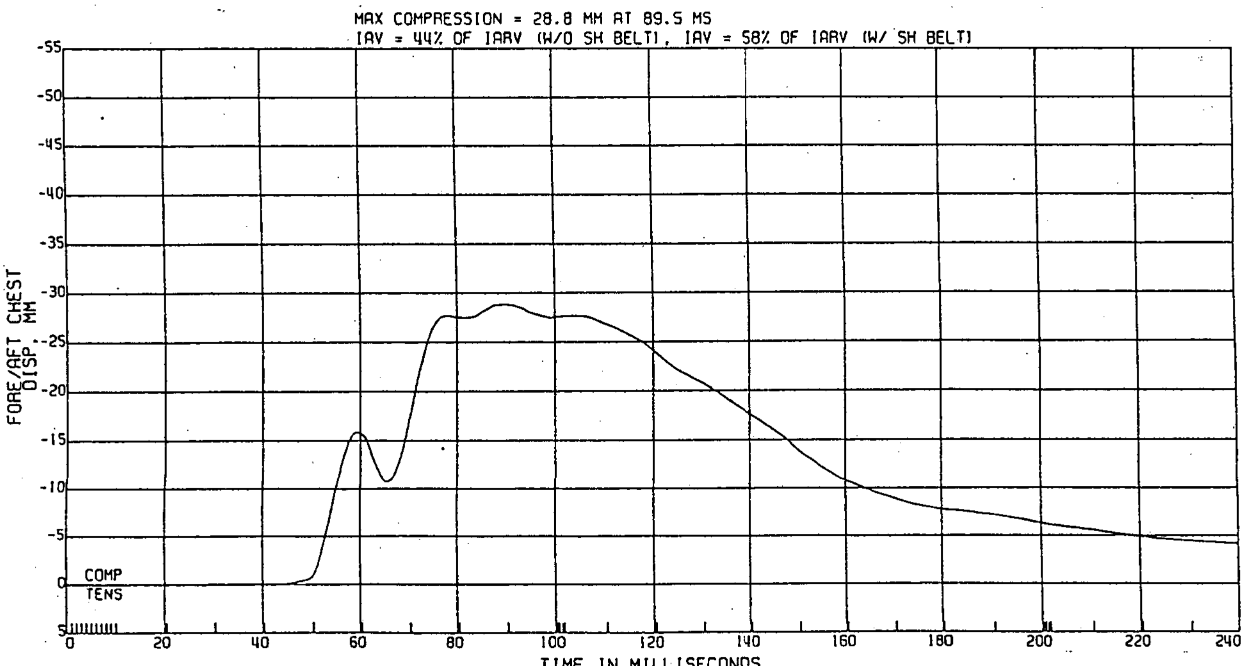


Appendix H, plot # 31

C11279 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.4KM/H

R & D CTR 8T93080 VAN | R. FRT CHEST DISP, TEMP AT 74.9'F | ATD TYPE: GM50H

ELEC DATA, SAE CLASS 180 | NORMALIZED TO 70.7'F & PART 572 CORRIDOR | TEST DATE:09/25/1996

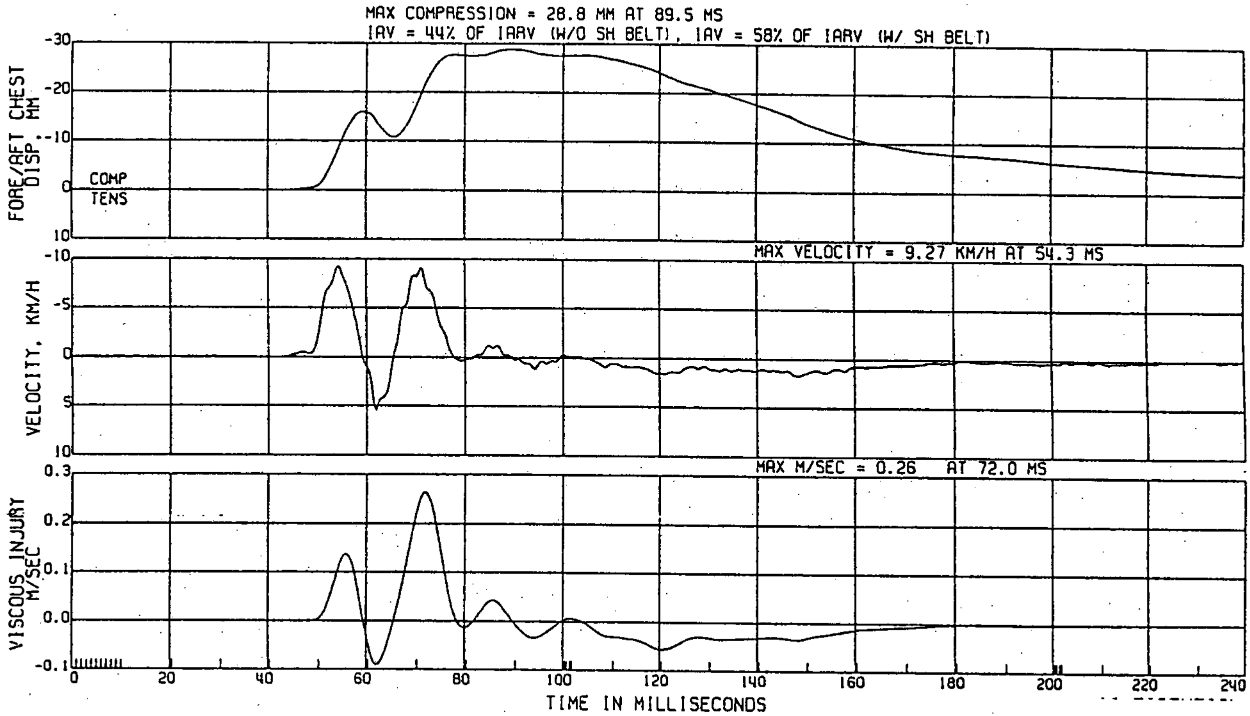


Appendix H, plot # 32

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN R. FRT CHEST COMPRESSIVE DISP. ATD TYPE: GM50H TEST DATE:09/25/1996

ELEC DATA, SAE CLASS 180 NORMALIZED, W/CALC VEL & VISCOUS INJURY

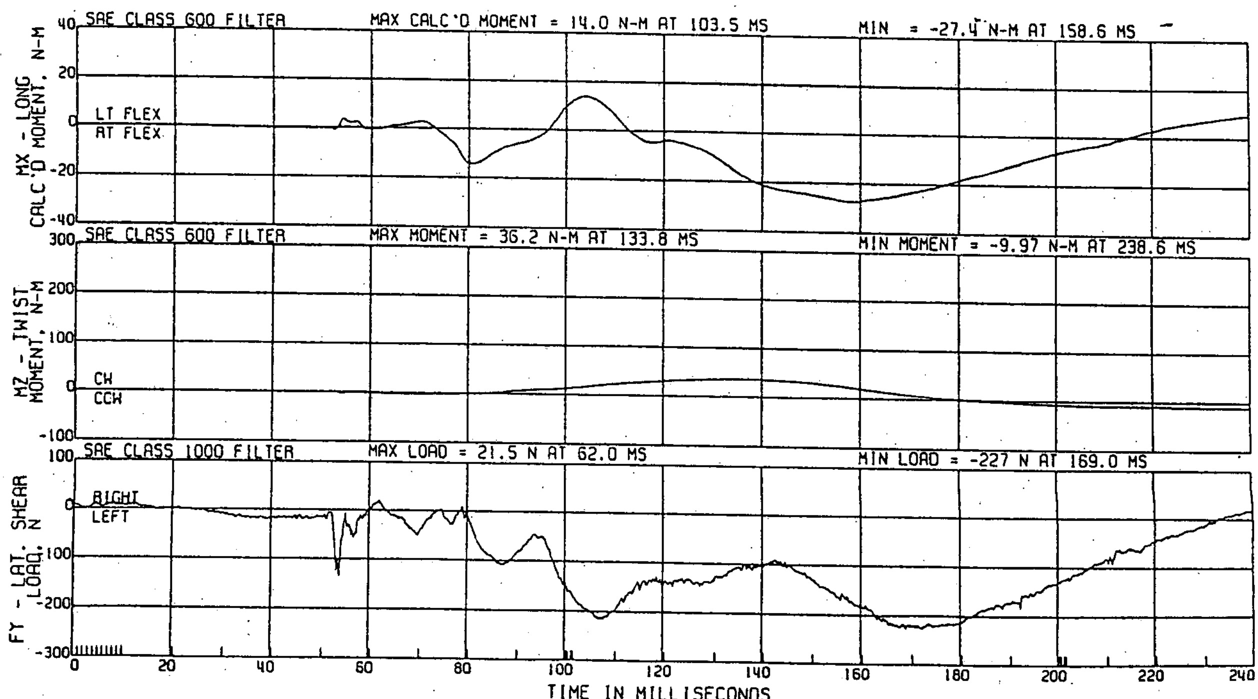


Appendix H, plot # 33

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN R. FRT NECK LOADING ON HEAD, UPPER LOAD ATD TYPE: GM50H TEST DATE:09/25/1996

ELEC DATA R. FRT NECK LOADING ON HEAD



Appendix H, plot # 34

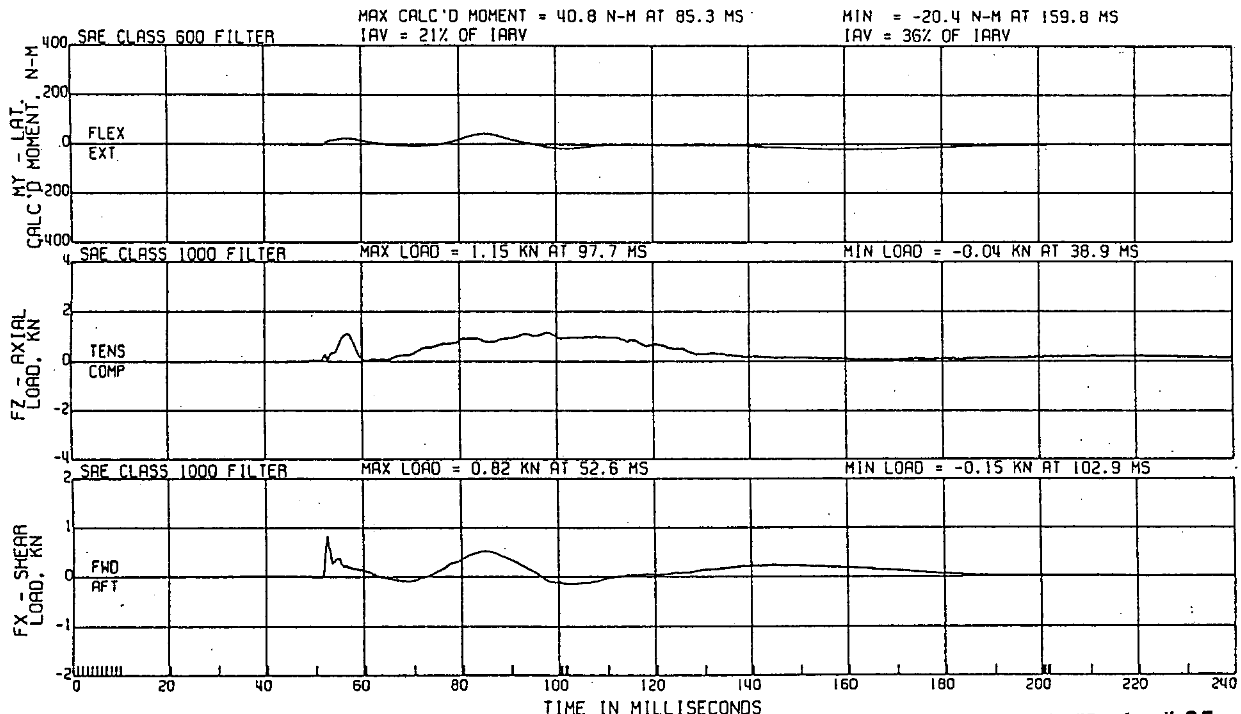
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN
ELEC DATA

NECK LOADING ON HEAD

ATD TYPE: GM50H
TEST DATE:09/25/1996

R. FRT NECK LOADING ON HEAD



Appendix H, plot # 35

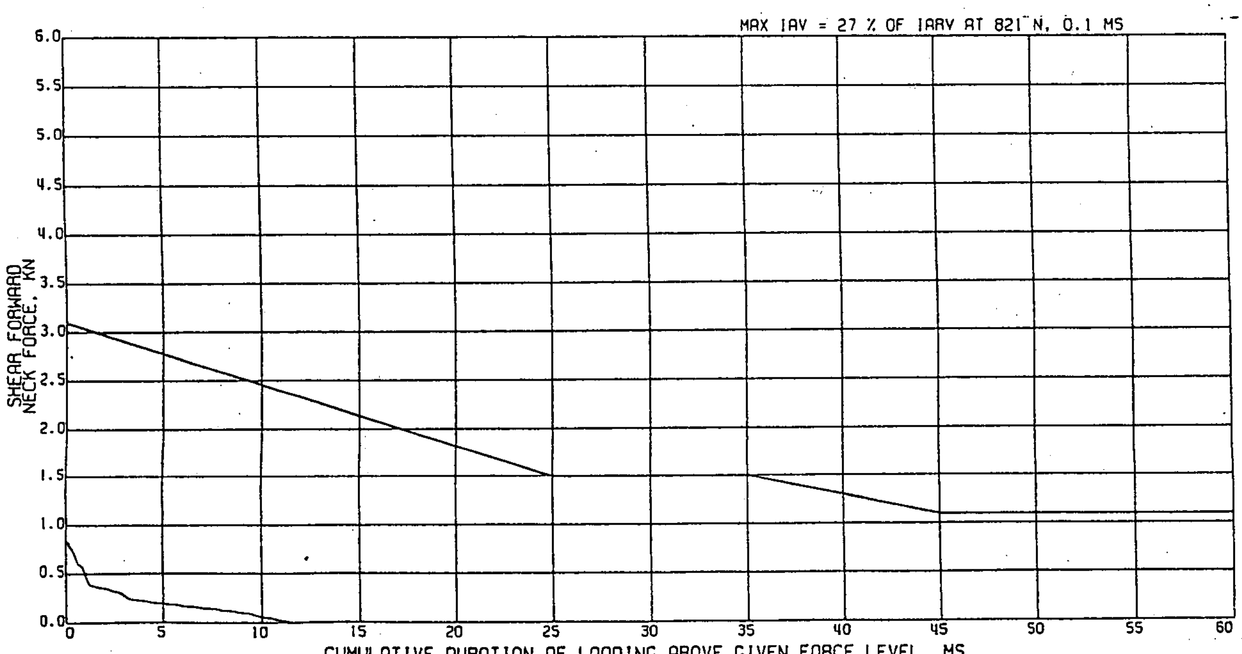
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 1000

FORWARD NECK SHEAR ON HEAD,

ATD TYPE: GM50H
TEST DATE:09/25/1996

R. FRT INJURY REFERENCE

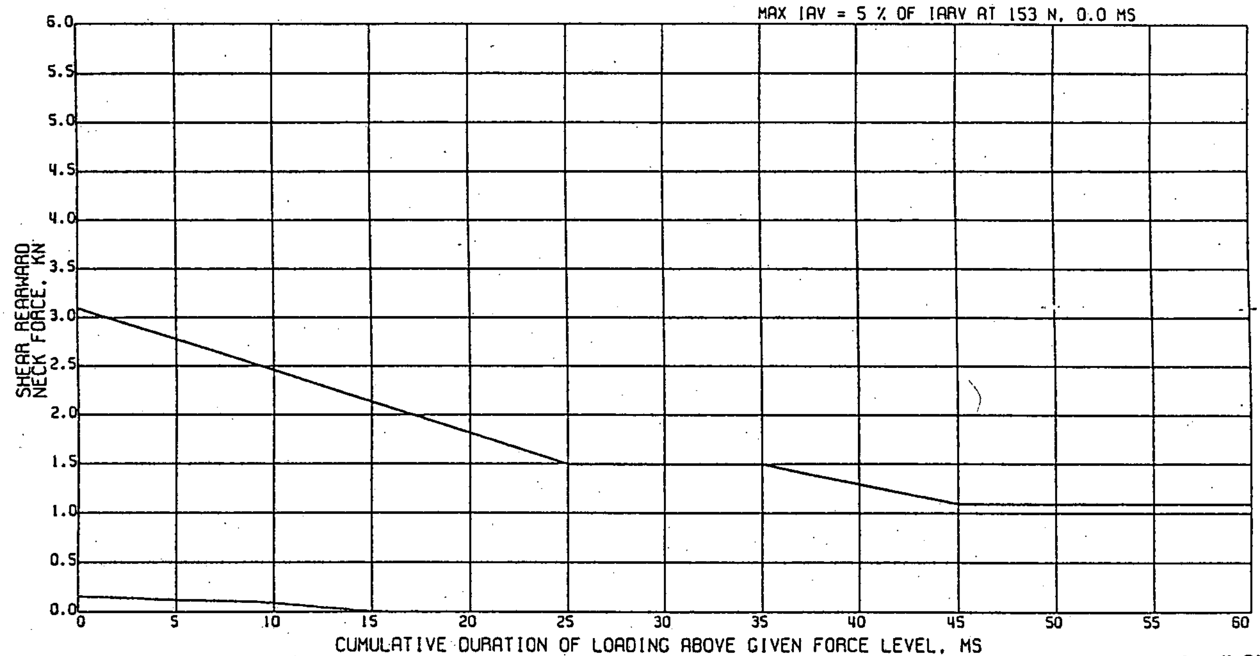


Appendix H, plot # 36

C11279 FRONT IMPACT
MOVING VEHICLE TO FIXED POLE 55.4KM/H
R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:09/25/1996

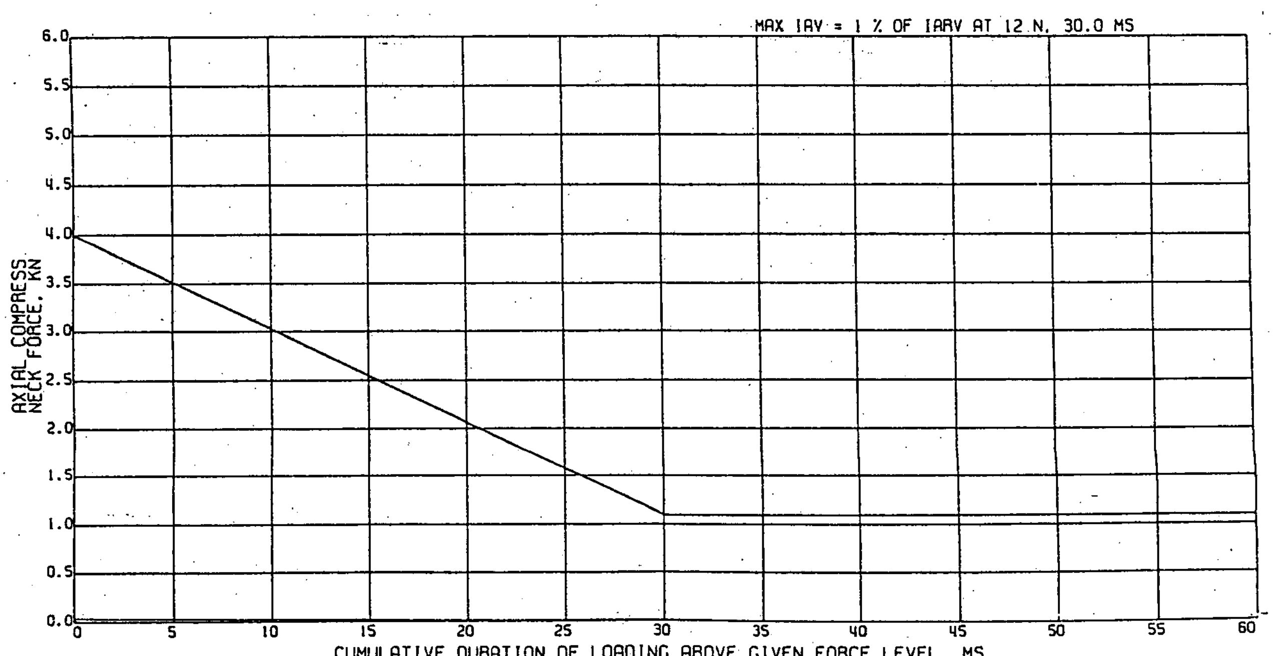


Appendix H, plot # 37

C11279 FRONT IMPACT
MOVING VEHICLE TO FIXED POLE 55.4KM/H
R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:09/25/1996



Appendix H, plot # 38

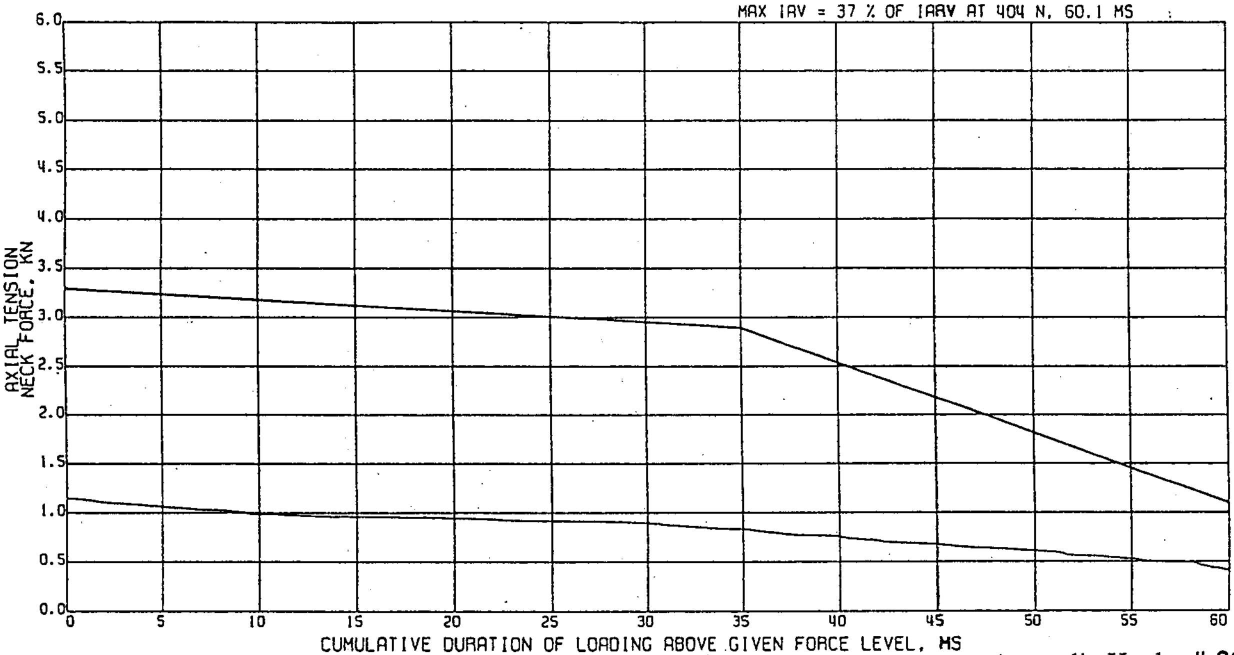
C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

ATD TYPE: GM50H
TEST DATE:09/25/1996

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 1000

AXIAL TENSION ON HEAD,
R. FRT INJURY REFERENCE



Appendix H, plot # 39

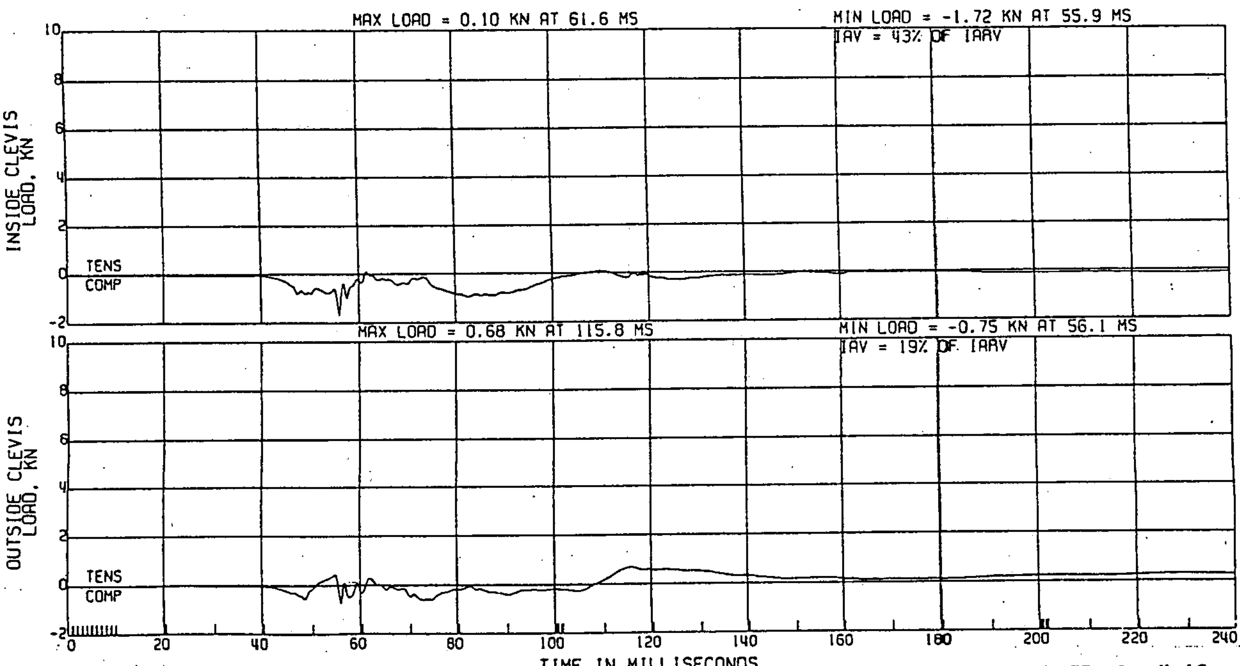
C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

ATD TYPE: GM50H
TEST DATE:09/25/1996

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 600

R. FRT LEFT KNEE CLEVIS LOAD



Appendix H, plot # 40

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

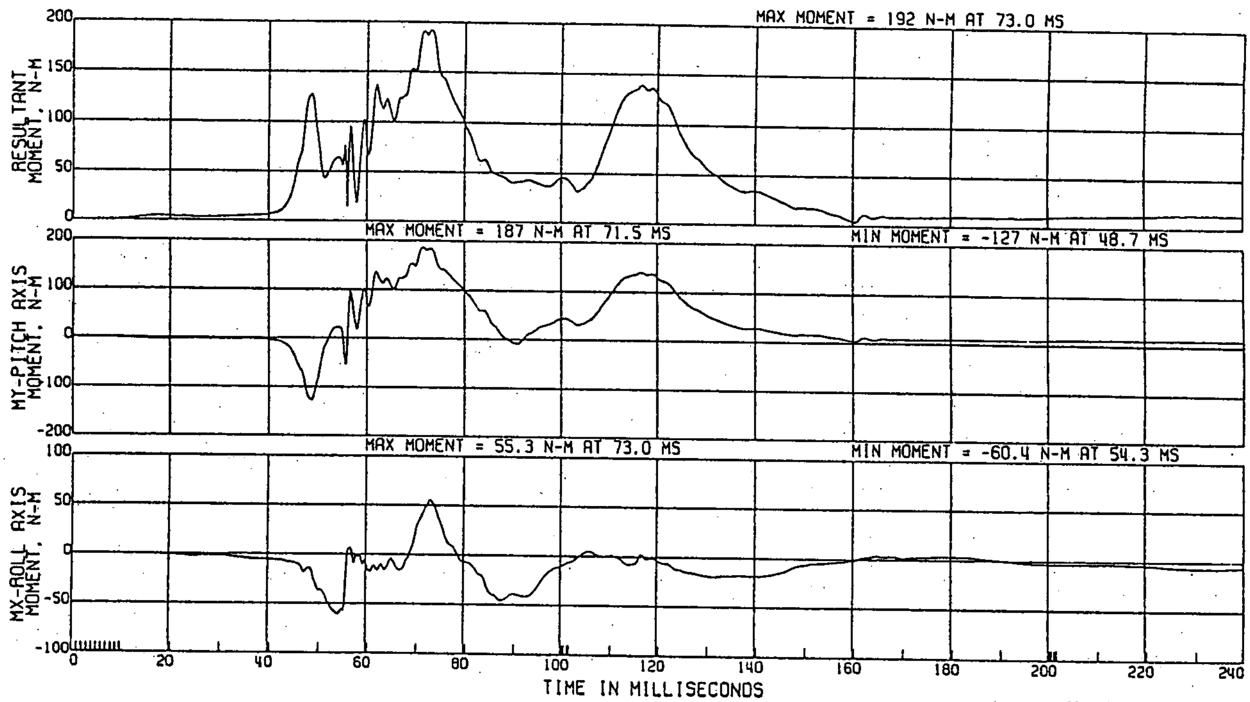
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 600

R. FRT LEFT TIBIA UPPER MOMENT

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # **41**

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

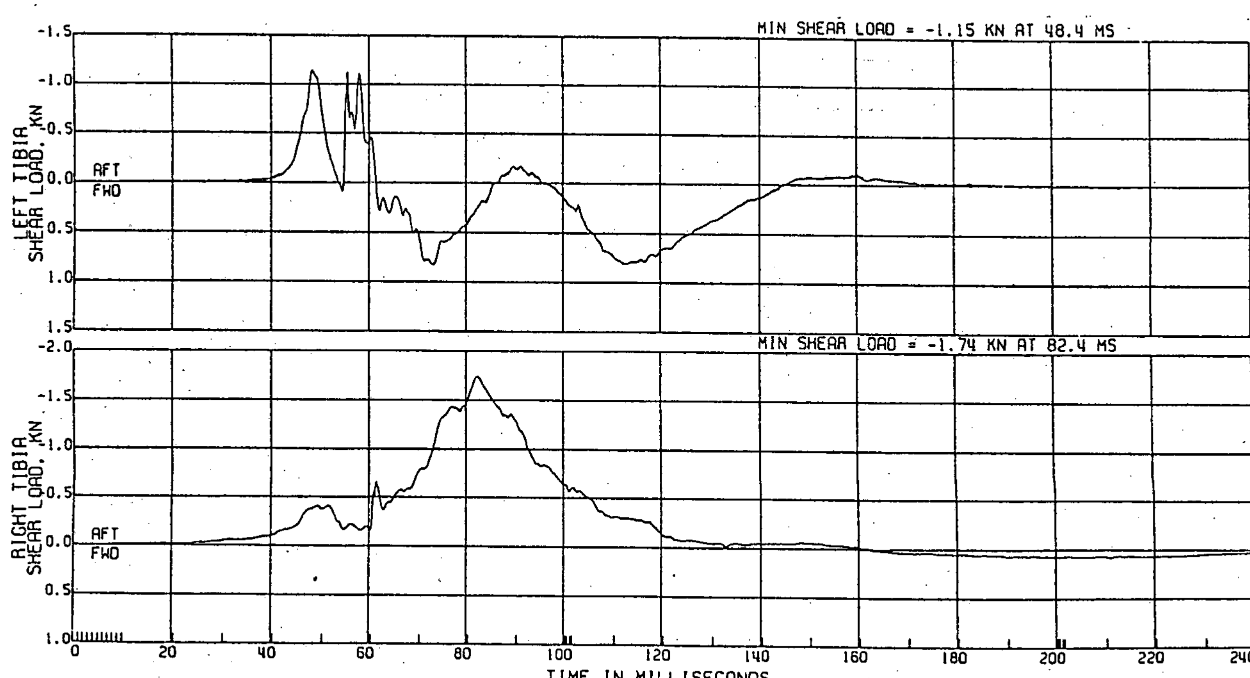
ATD TYPE: GM50H

R & D CTR 8T93080 VAN

TEST DATE:09/25/1996

ELEC DATA, SAE CLASS 600

R. FRT TIBIA LOWER SHEAR LOAD CELLS



Appendix H, plot # **42**

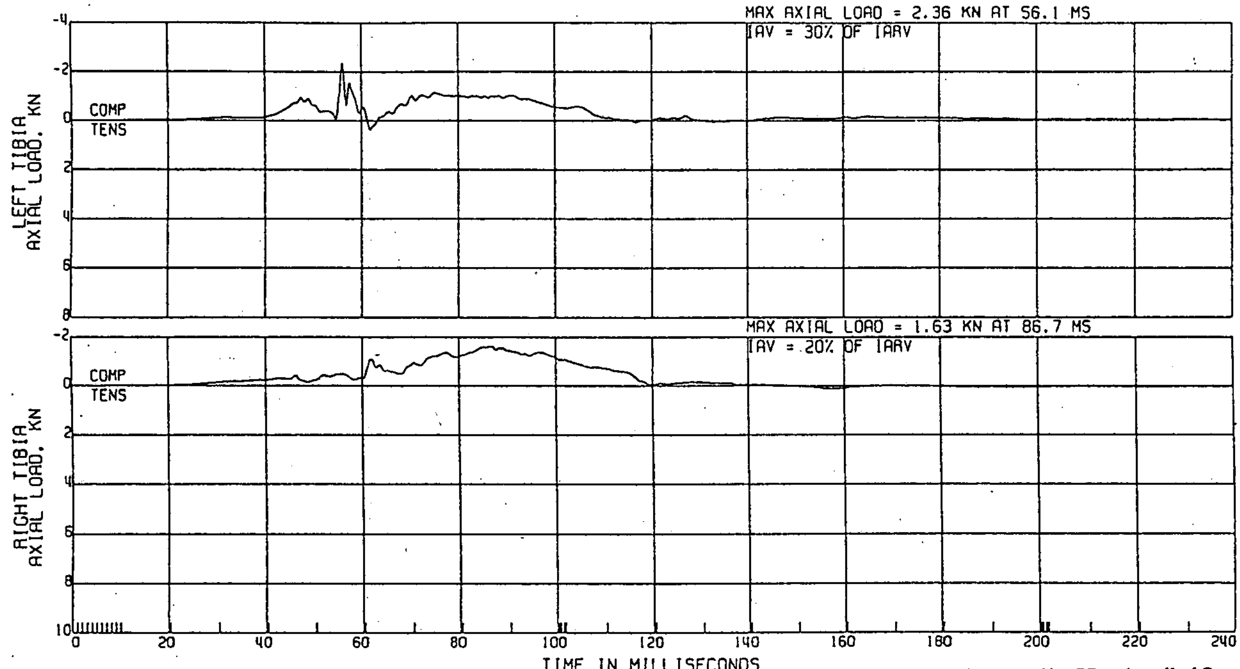
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

ATD TYPE: GM50H

R & D CTR 8T93080 VAN TEST DATE:09/25/1996

ELEC DATA, SAE CLASS 600

R. FRT TIBIA LOWER AXIAL LOAD



Appendix H, plot # 43

43 PROCESSED 9/25/1996 15:30 V2.04

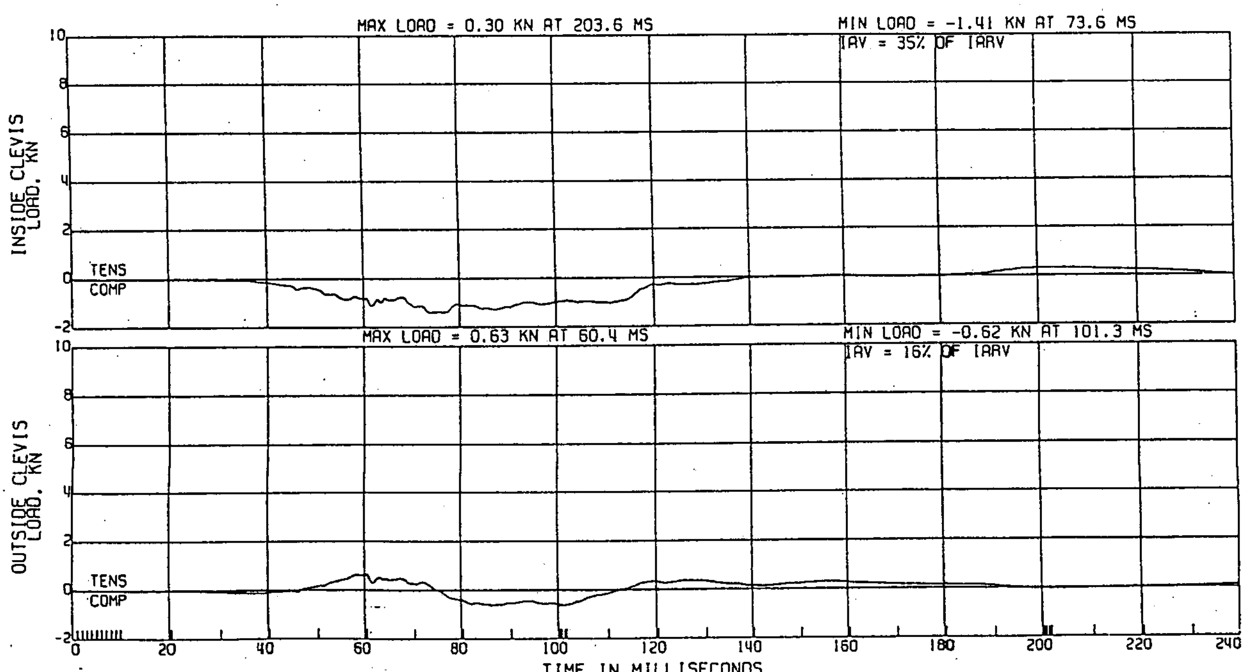
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

ATD TYPE: GM50H

R. FRT RIGHT KNEE CLEVIS LOAD

R & D CTR 8T93080 VAN TEST DATE:09/25/1996

ELEC DATA, SAE CLASS 600



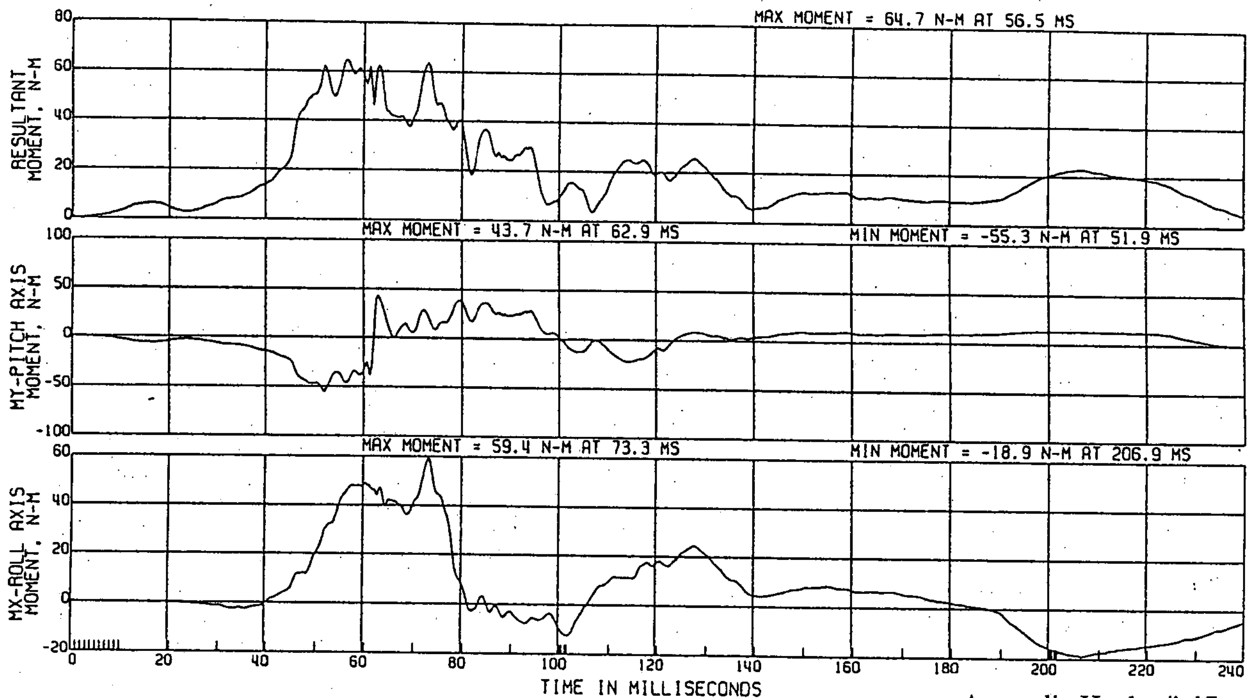
Appendix H, plot # 44

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 600

R. FRT RIGHT TIBIA UPPER MOMENT

ATD TYPE: GM50H
TEST DATE:09/25/1996



Appendix H, plot # **45**

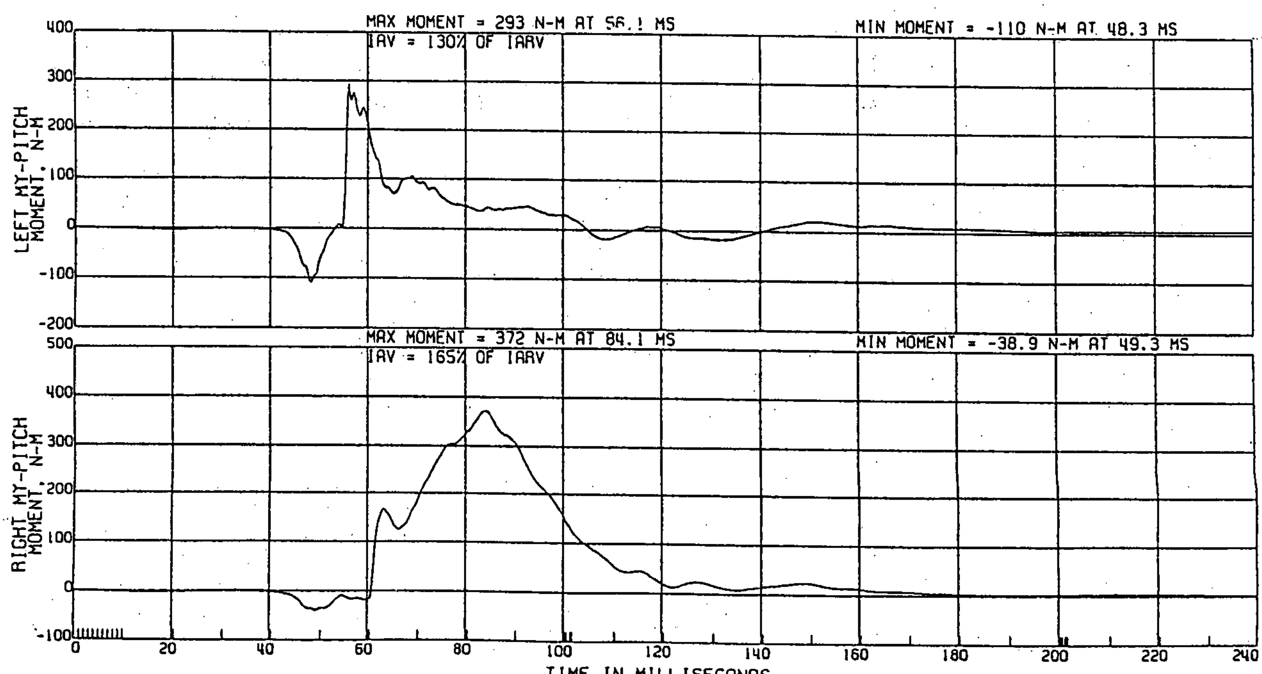
45 PROCESSED 9/25/1996 15:30 V2.04

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:09/25/1996

R. FRT TIBIA LOWER BENDING MOMENTS



Appendix H, plot # **46**

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

ATD TYPE: GM50H

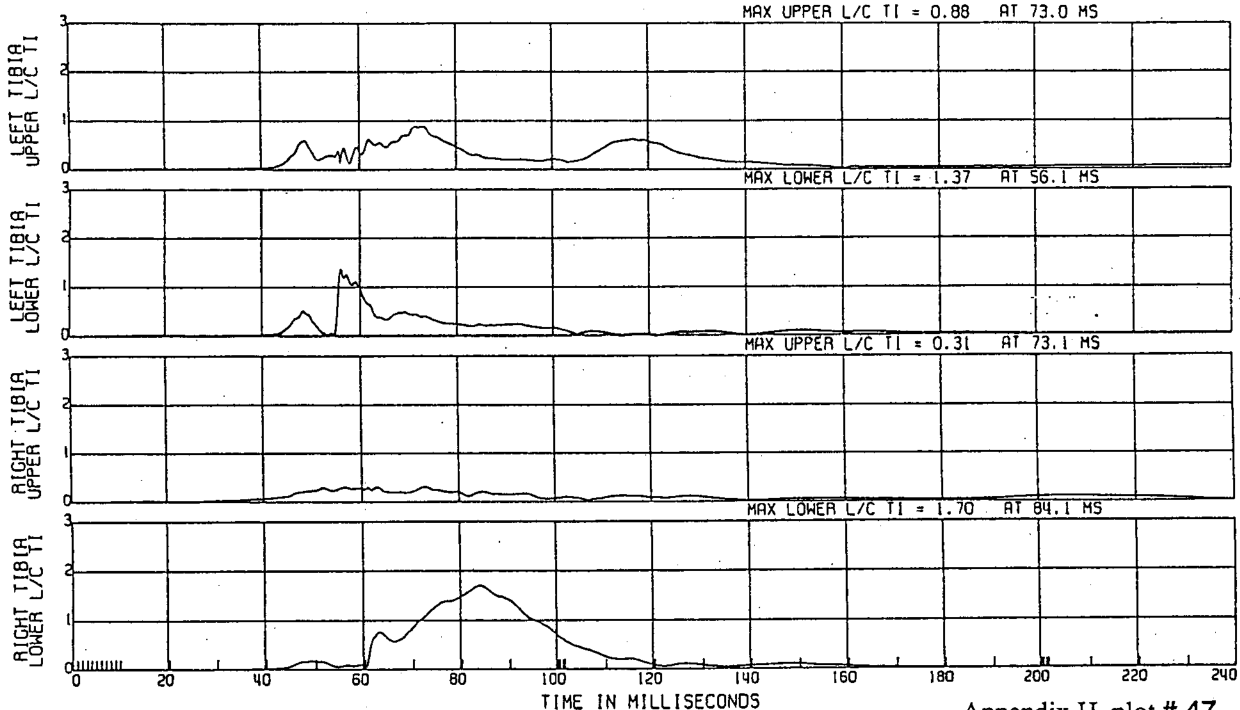
R & D CTR 8T93080 VAN

R. FRT TIBIA INDICES

TEST DATE:09/25/1996

ELEC DATA, SAE CLASS 600

TI = (RES MOM/225 NM) + (AXIAL/35900 N)



Appendix H, plot # 47

47 PROCESSED 9/25/1996 15:30 V2.04

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

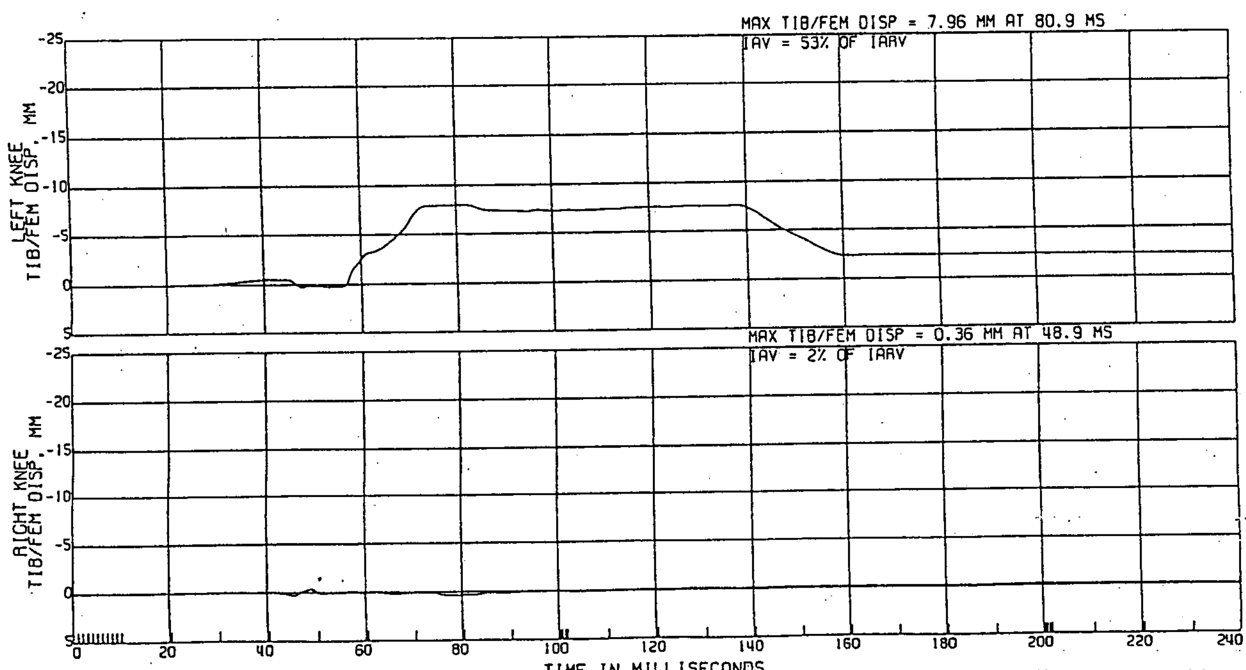
ATD TYPE: GM50H

R & D CTR 8T93080 VAN

R. FRT TIBIA/FEMUR DISPLACEMENT

TEST DATE:09/25/1996

ELEC DATA, SAE CLASS 180

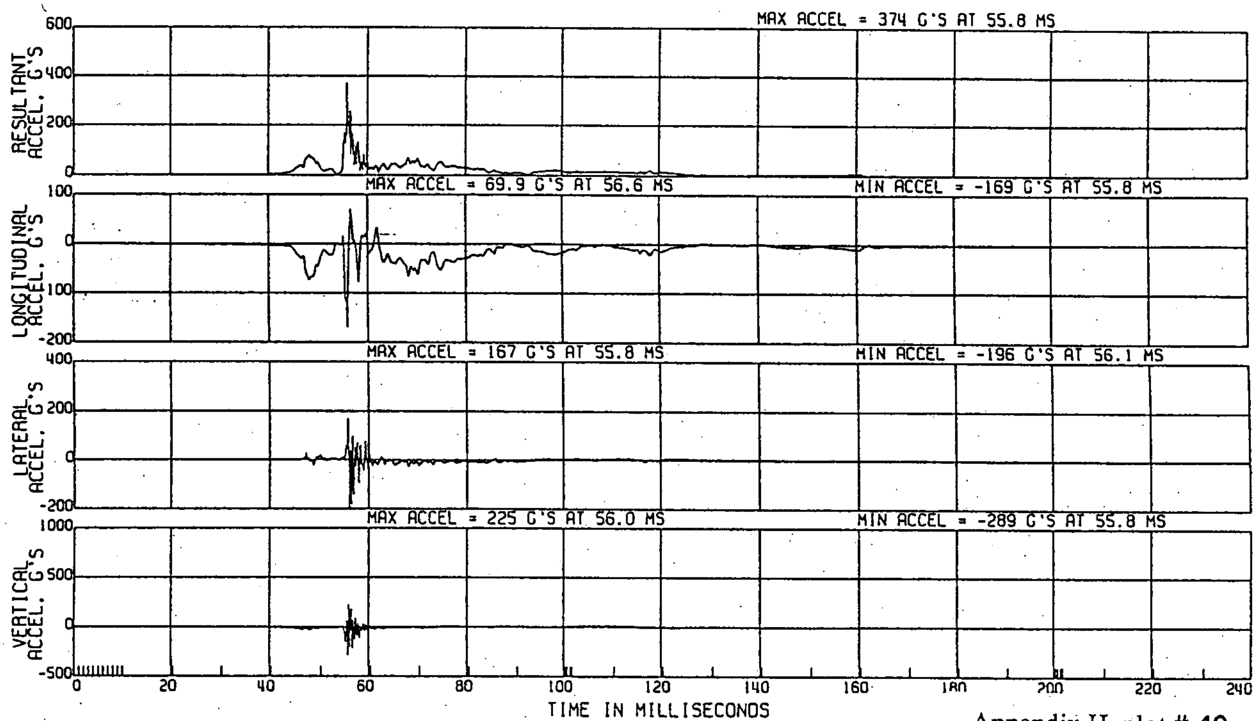


Appendix H, plot # 48

C11279 FRONT IMPACT　　MOVING VEHICLE TO FIXED POLE　　55.4KM/H

R & D CTR　　8T93080 VAN　　R. FRT LEFT UPPER TIBIA ACCEL　　ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000　　(VEC SUM OF TIBIA ACCELS)　　TEST DATE:09/25/1996



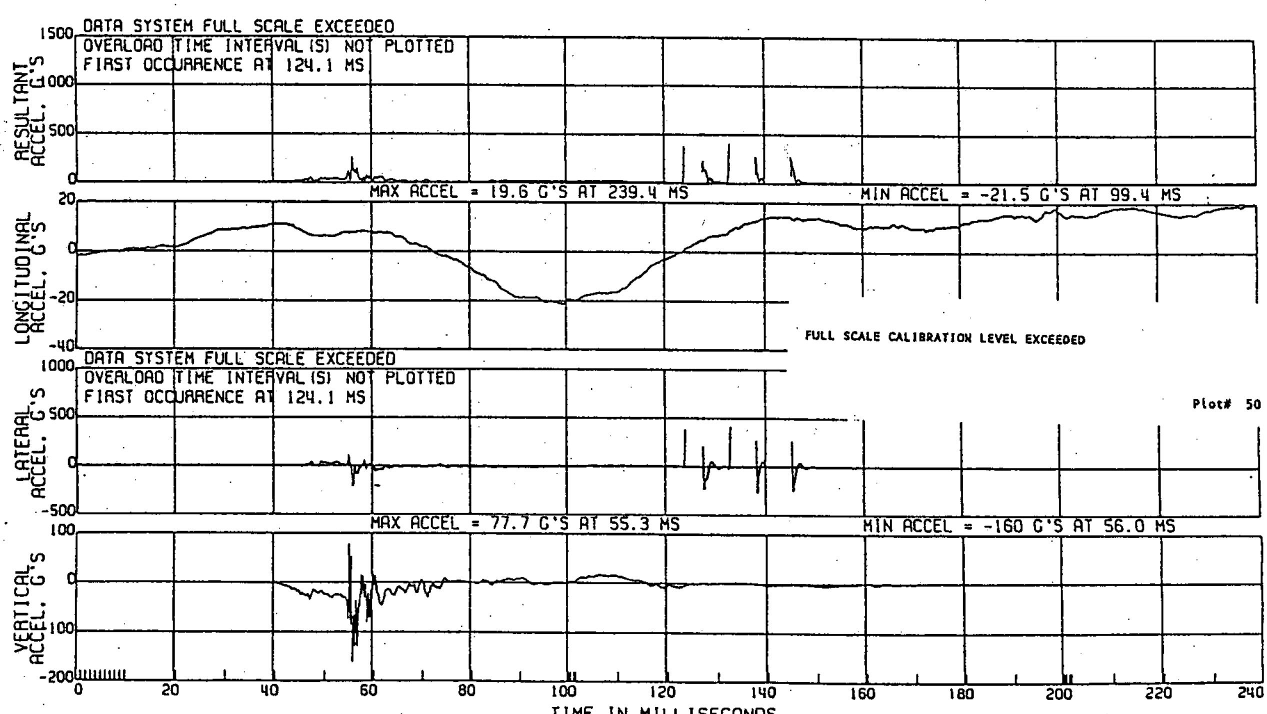
Appendix H, plot # 49

49 PROCESSED 9/25/1996 15:30 V2.04

C11279 FRONT IMPACT　　MOVING VEHICLE TO FIXED POLE　　55.4KM/H

R & D CTR　　8T93080 VAN　　R. FRT LEFT LOWER TIBIA ACCEL　　ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000　　(VEC SUM OF TIBIA ACCELS)　　TEST DATE:09/25/1996



Appendix H, plot # 50

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN

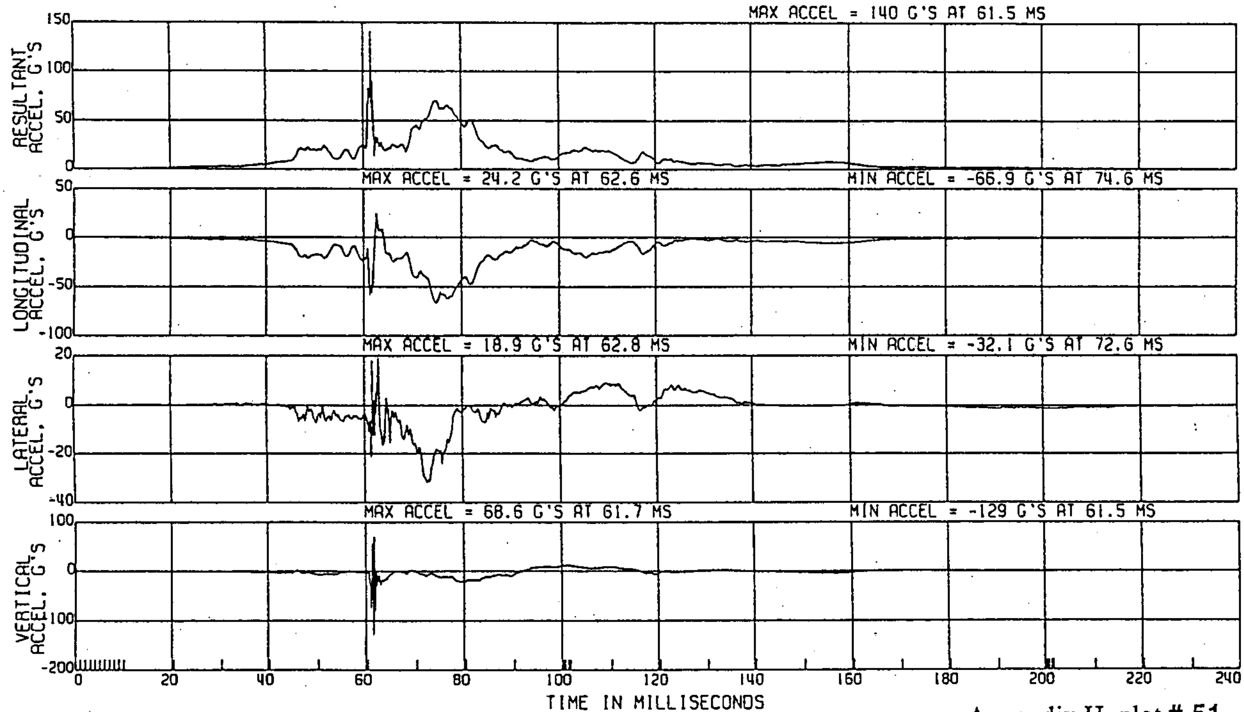
ELEC DATA, SAE CLASS 1000

R. FRT RIGHT UPPER TIBIA ACCEL

(VEC SUM OF TIBIA ACCELS)

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 51

51 PROCESSED 9/25/1996 15:30 V2.04

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN

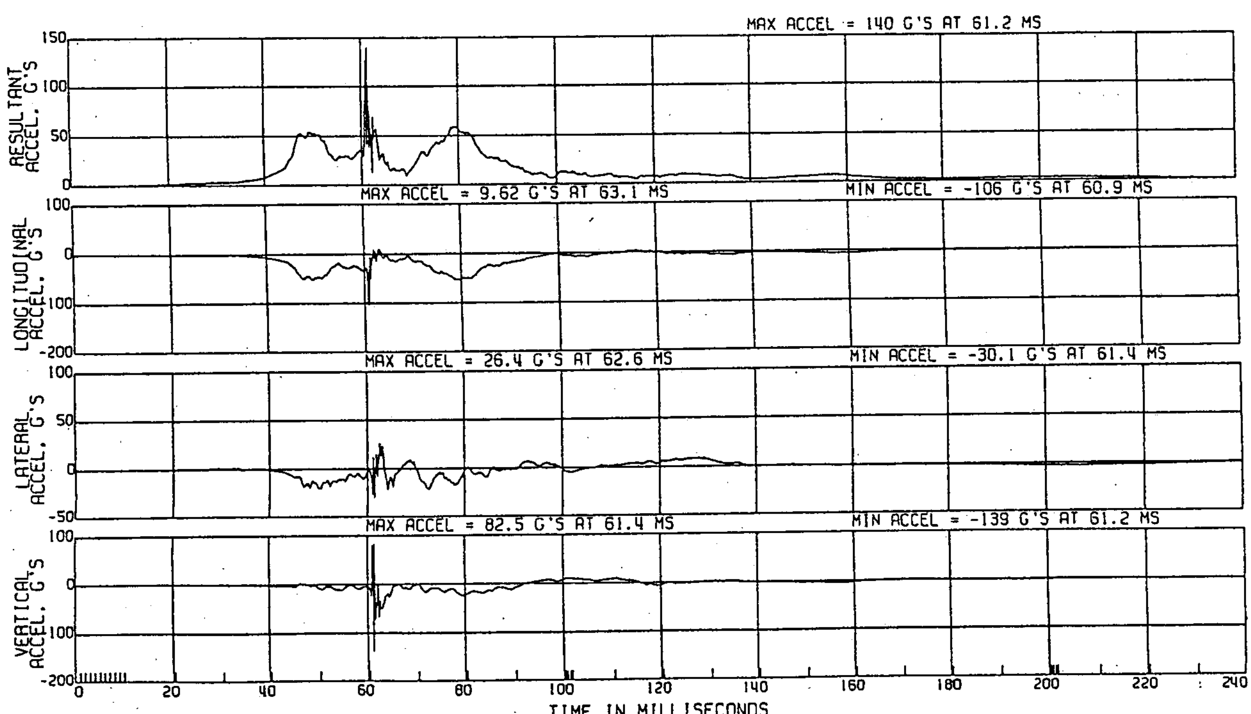
ELEC DATA, SAE CLASS 1000

R. FRT RIGHT LOWER TIBIA ACCEL

(VEC SUM OF TIBIA ACCELS)

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 52

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

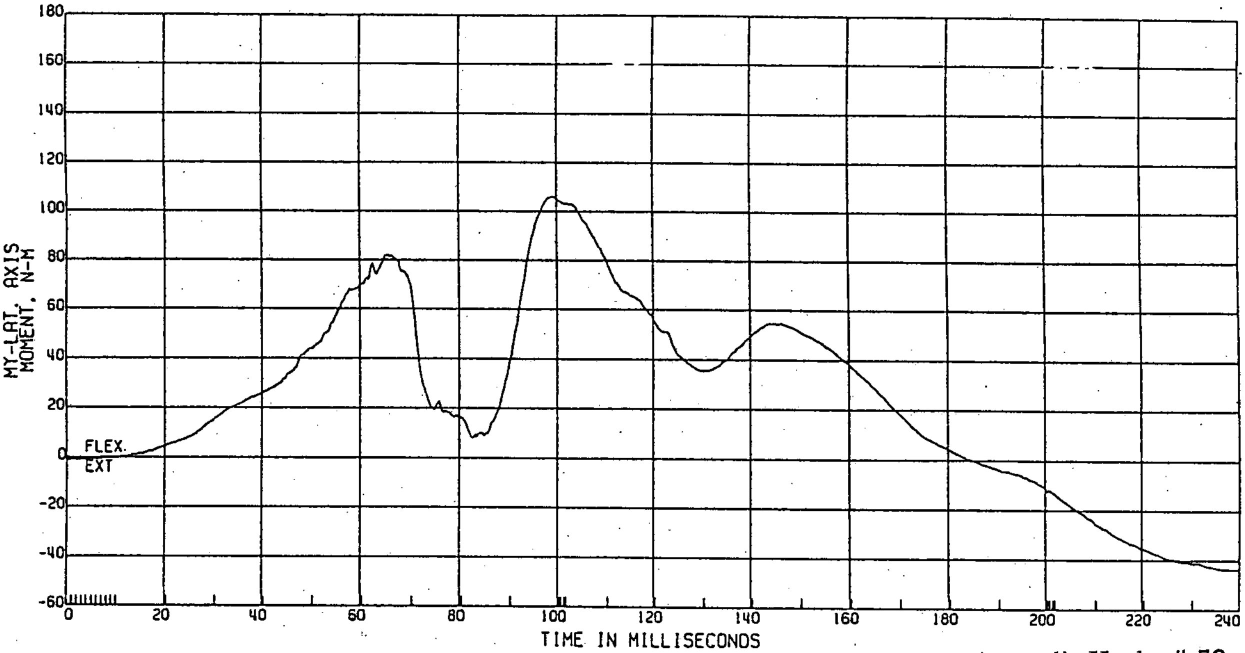
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

L. FRT LOWER LUMBAR MOMENT

ATD TYPE: GM50H

TEST DATE:09/25/1996



Appendix H, plot # 53

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

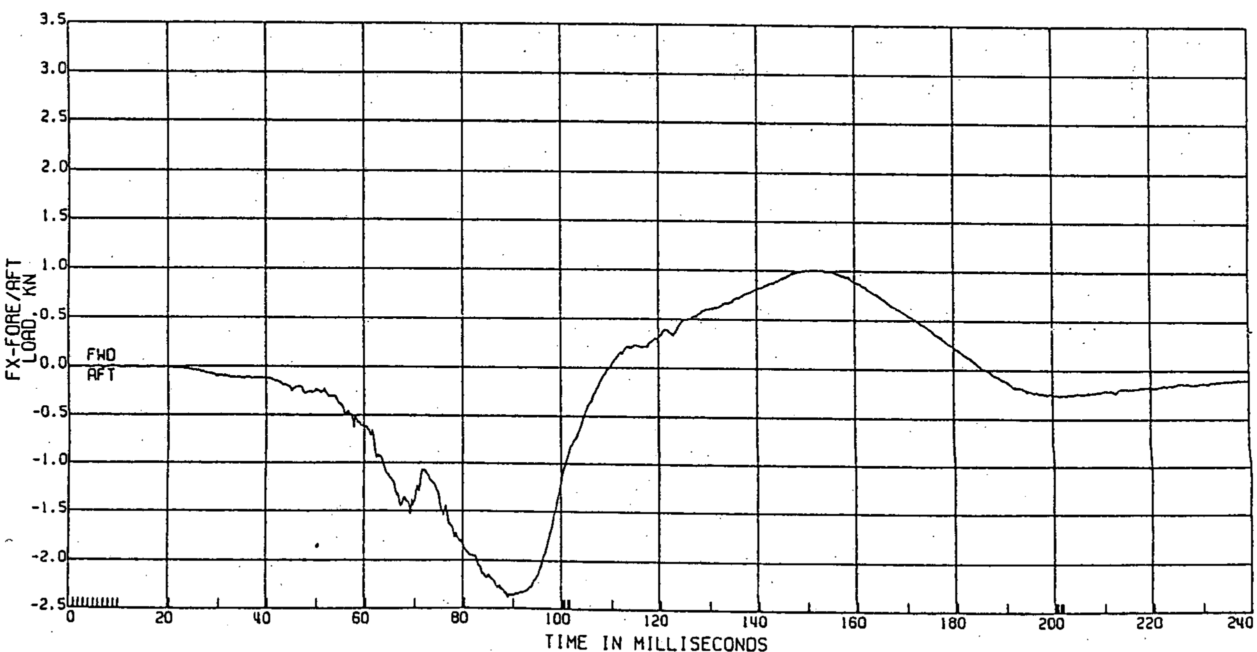
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

L. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H

TEST DATE:09/25/1996



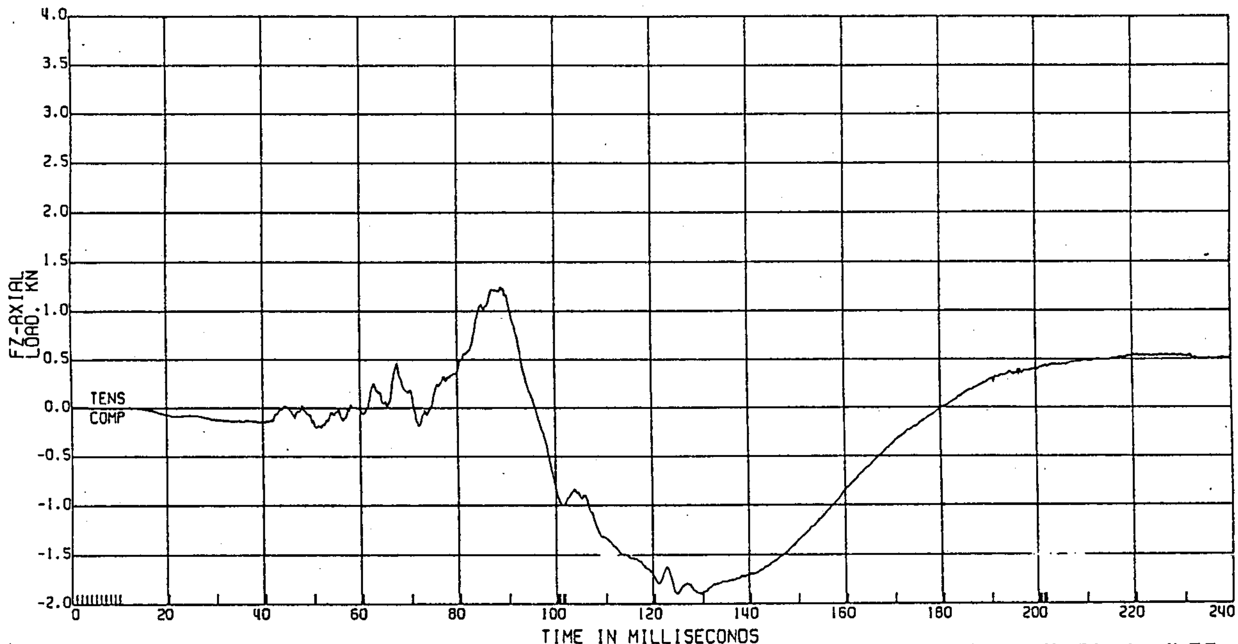
Appendix H, plot # 54

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

L. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H
TEST DATE:09/25/1996

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 1000



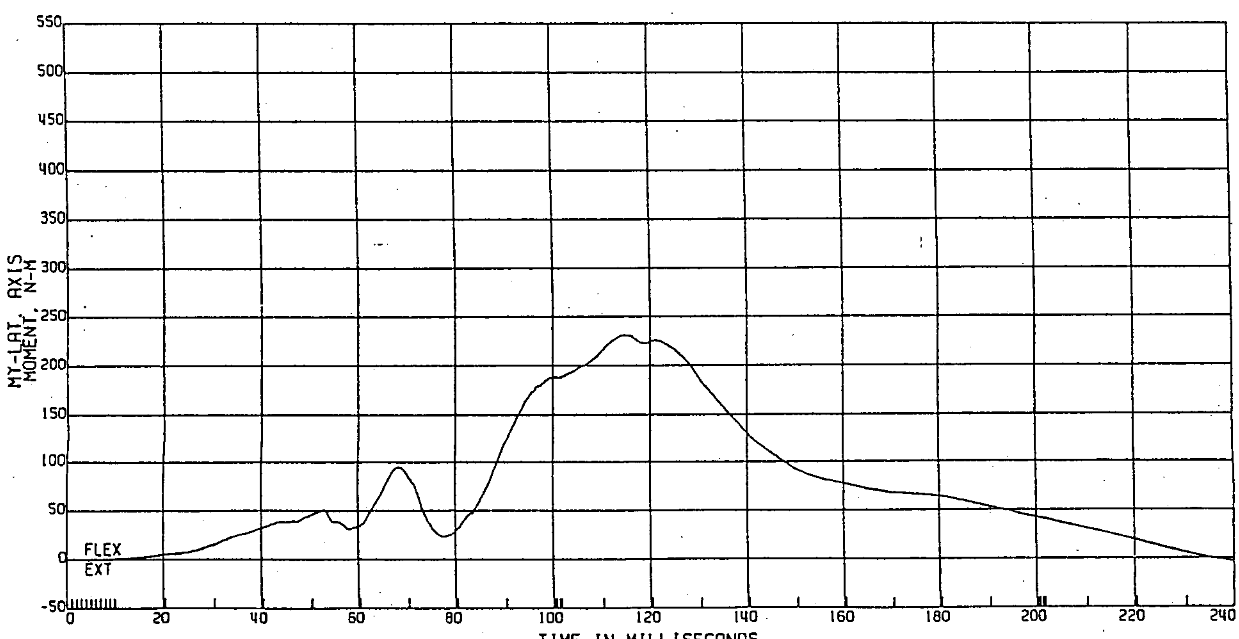
Appendix H, plot # 55

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R. FRT LOWER LUMBAR MOMENT

ATD TYPE: GM50H
TEST DATE:09/25/1996

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 1000

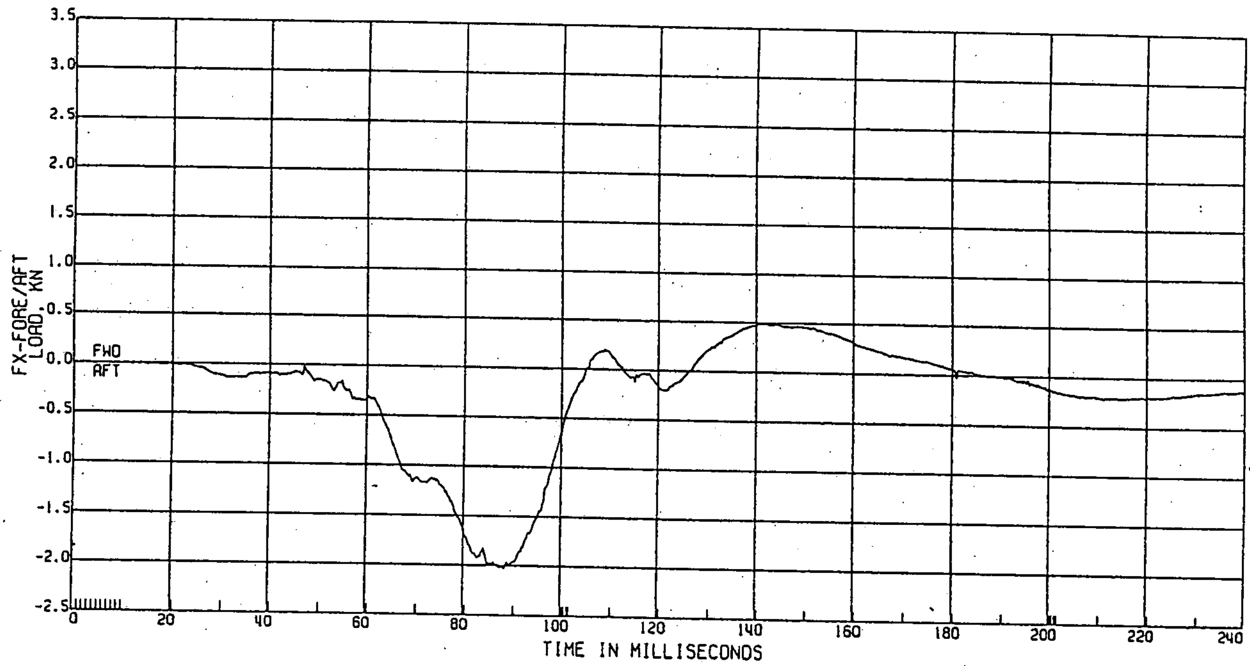


Appendix H, plot # 56

C11279 FRONT IMPACT — MOVING VEHICLE TO FIXED POLE — 55.4KM/H

R & D CTR 8T9308D VAN — R. FRT LOWER LUMBAR LOAD — ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 — TEST DATE:09/25/1996



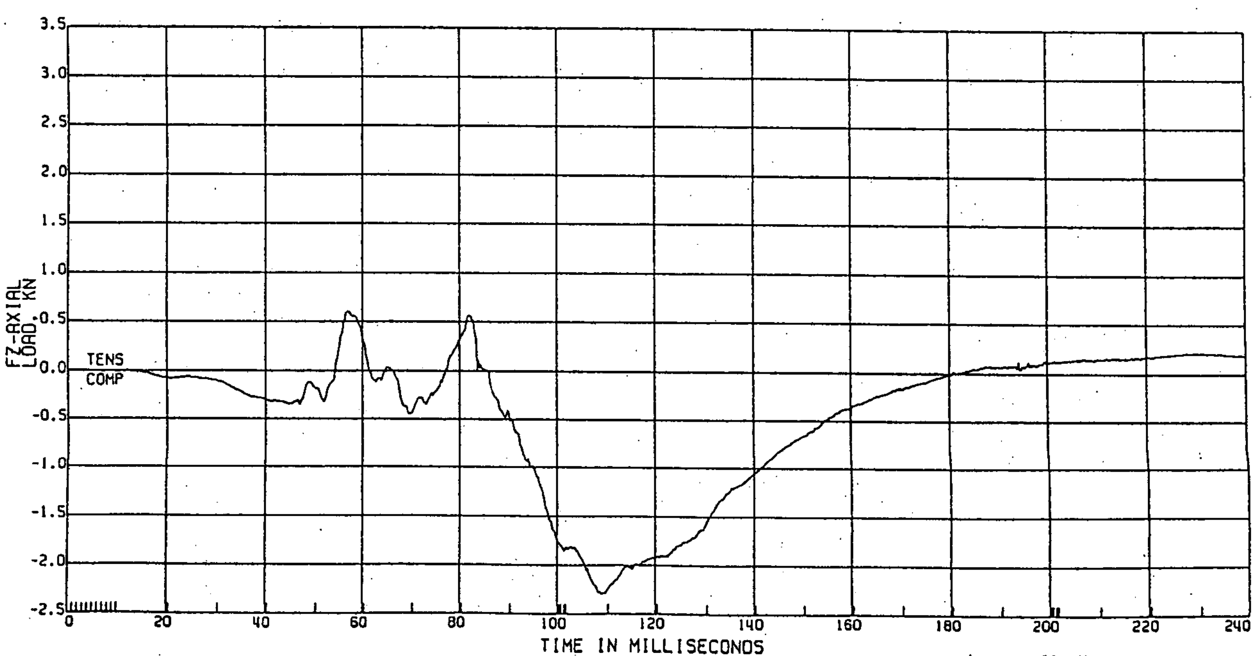
Appendix H, plot # 57

57 PROCESSED 9/25/1996 15:30 V2.04

C11279 FRONT IMPACT — MOVING VEHICLE TO FIXED POLE — 55.4KM/H

R & D CTR 8T9308D VAN — R. FRT LOWER LUMBAR LOAD — ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 — TEST DATE:09/25/1996



Appendix H, plot # 58

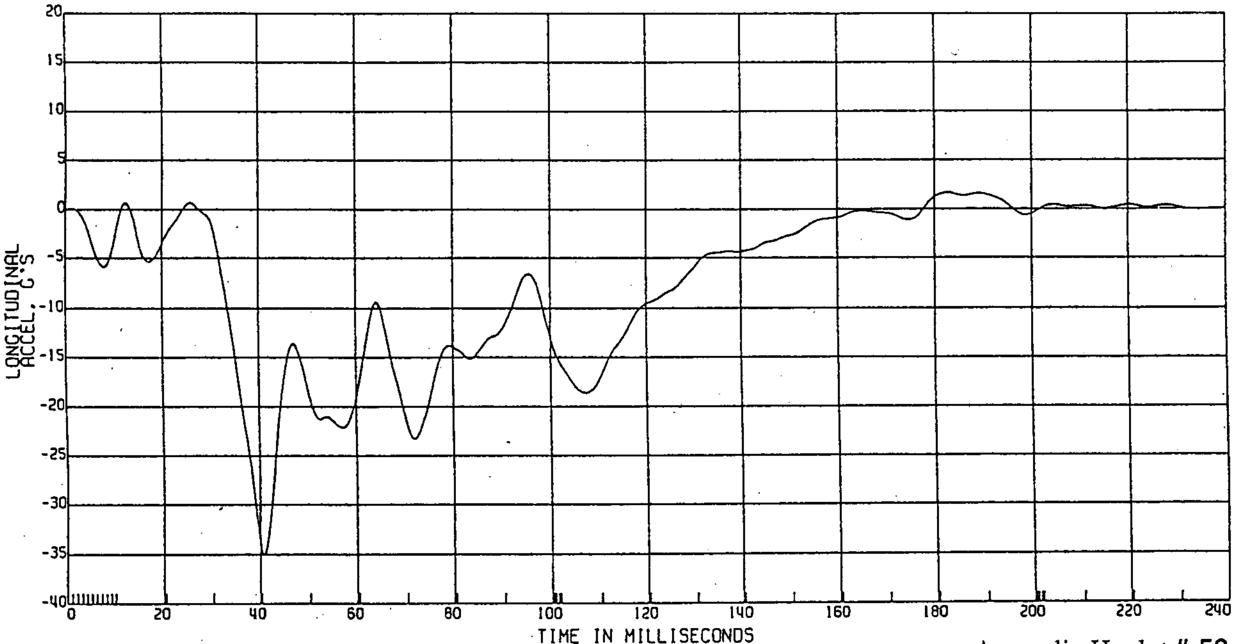
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 60

L. FRT ROCKER ACCEL

TEST DATE:09/25/1996



Appendix H, plot # 59

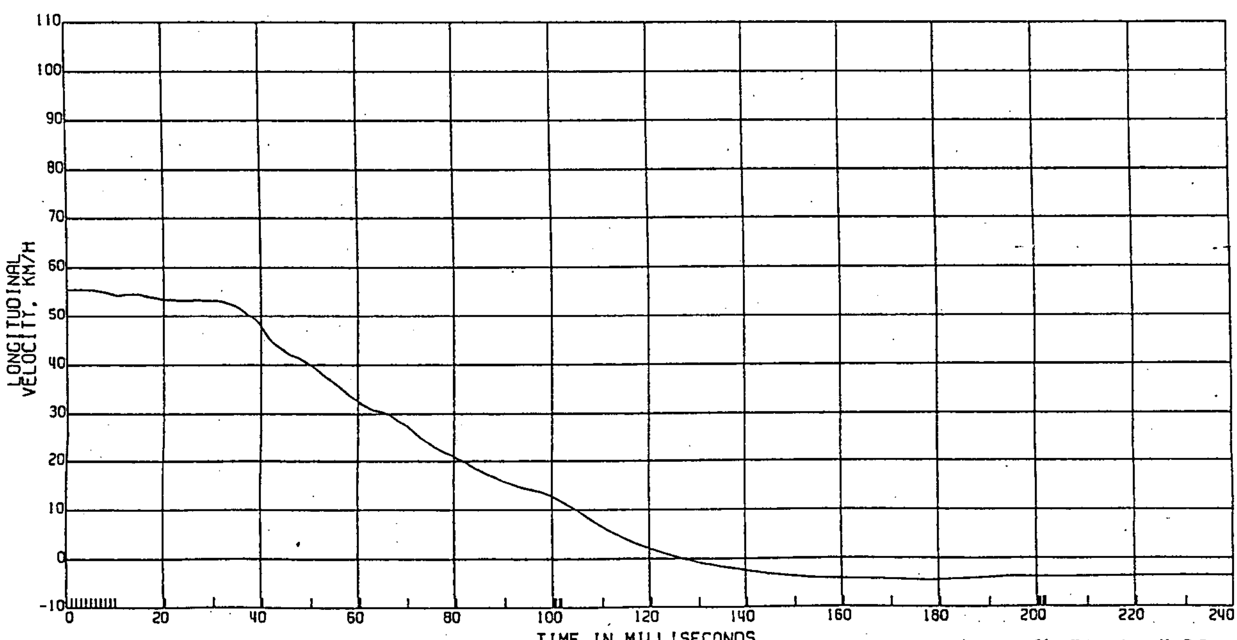
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 60

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

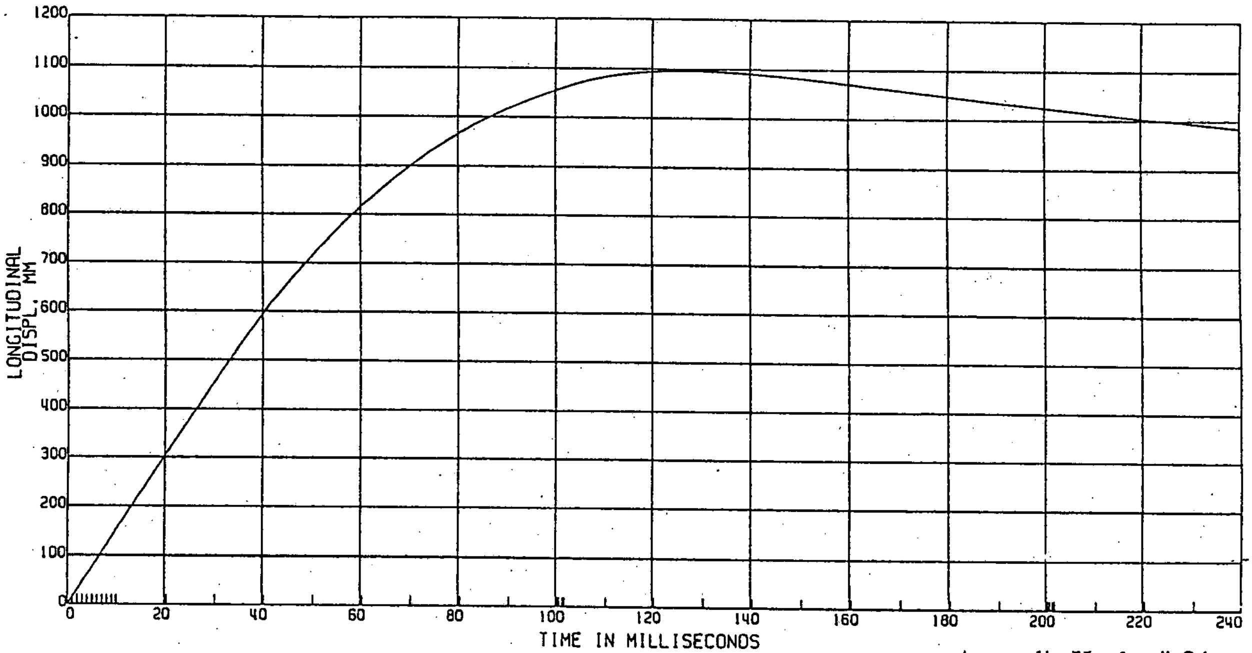
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # **61**

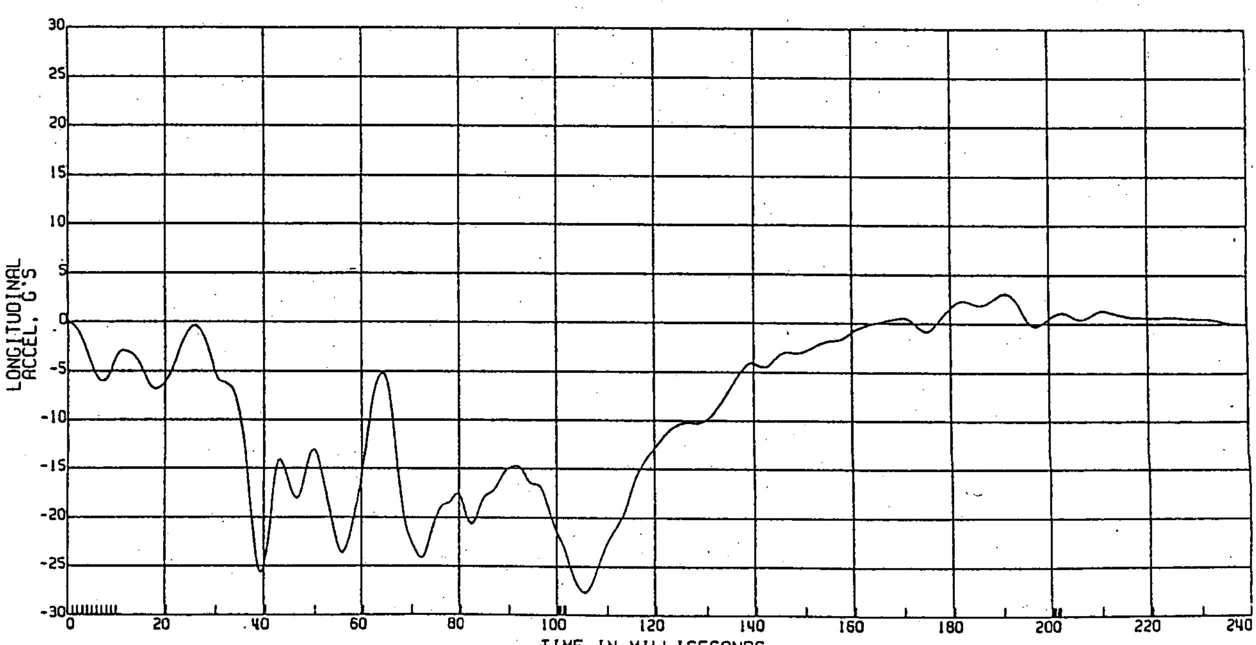
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 60

R. FRT ROCKER ACCEL

TEST DATE:09/25/1996



Appendix H, plot # **62**

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

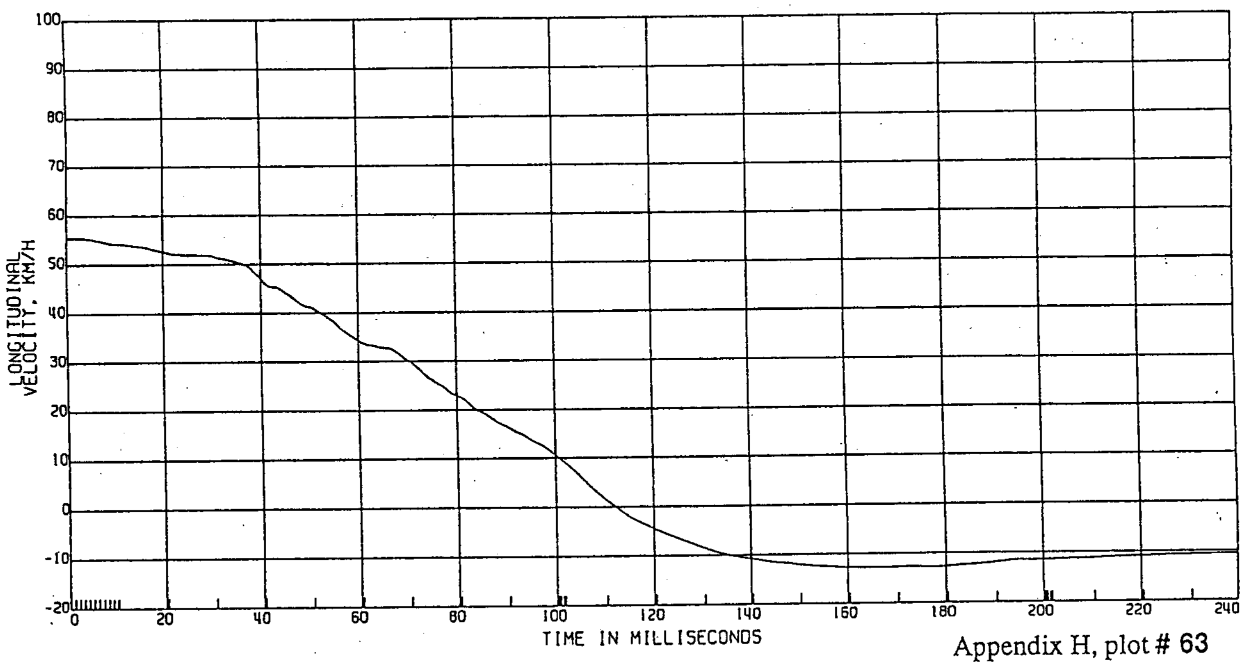
R. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996

R & D CTR 8T9308D VAN

ELEC DATA, SAE CLASS 180



Appendix H, plot # 63

63 PROCESSED 9/25/1996 15:30 V2.04

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

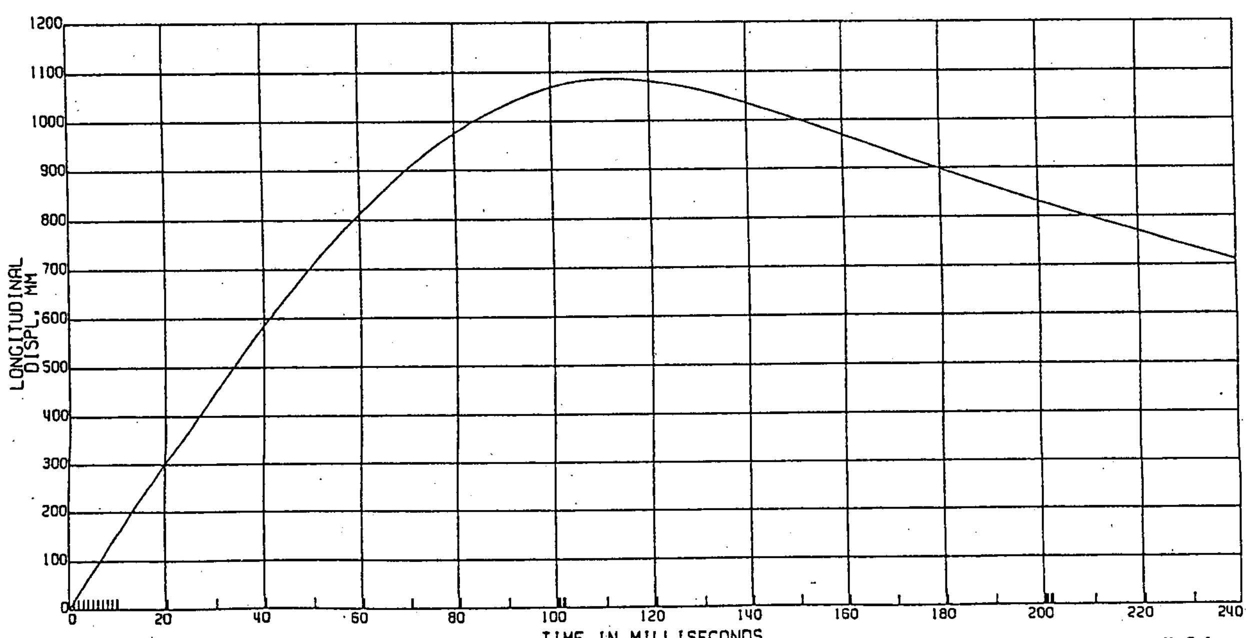
R. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996

R & D CTR 8T9308D VAN

ELEC DATA, SAE CLASS 180



Appendix H, plot # 64

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

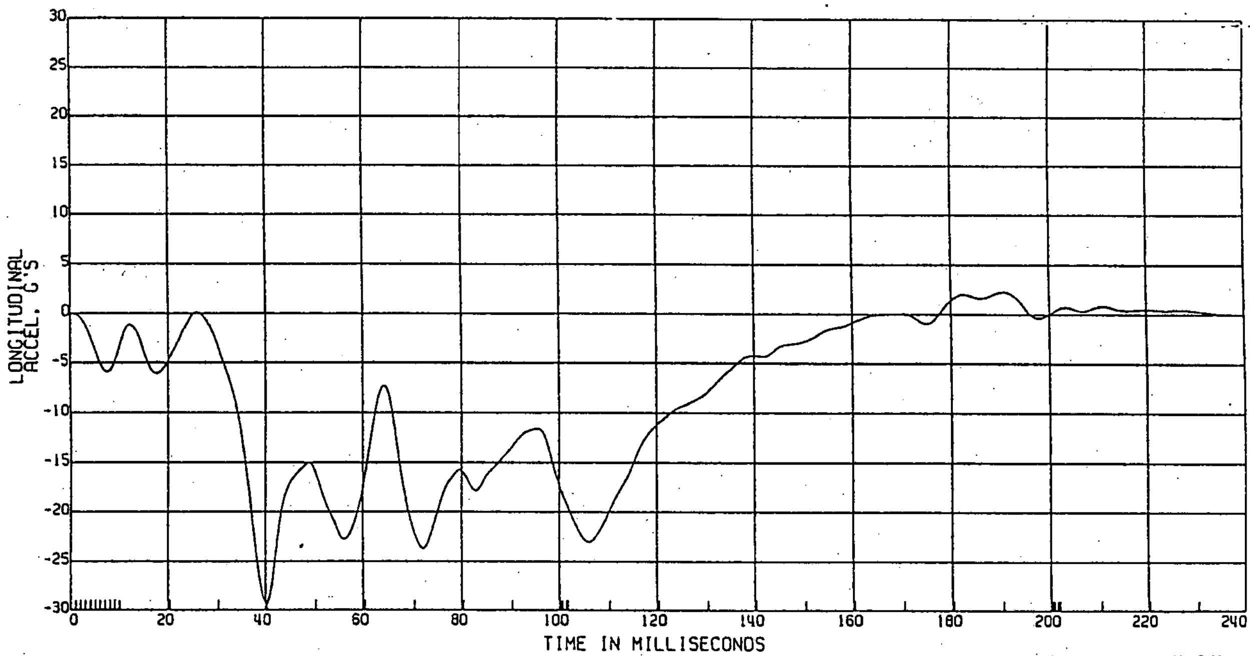
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 60

AVERAGED FRT ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:09/25/1996



Appendix H, plot # 65

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

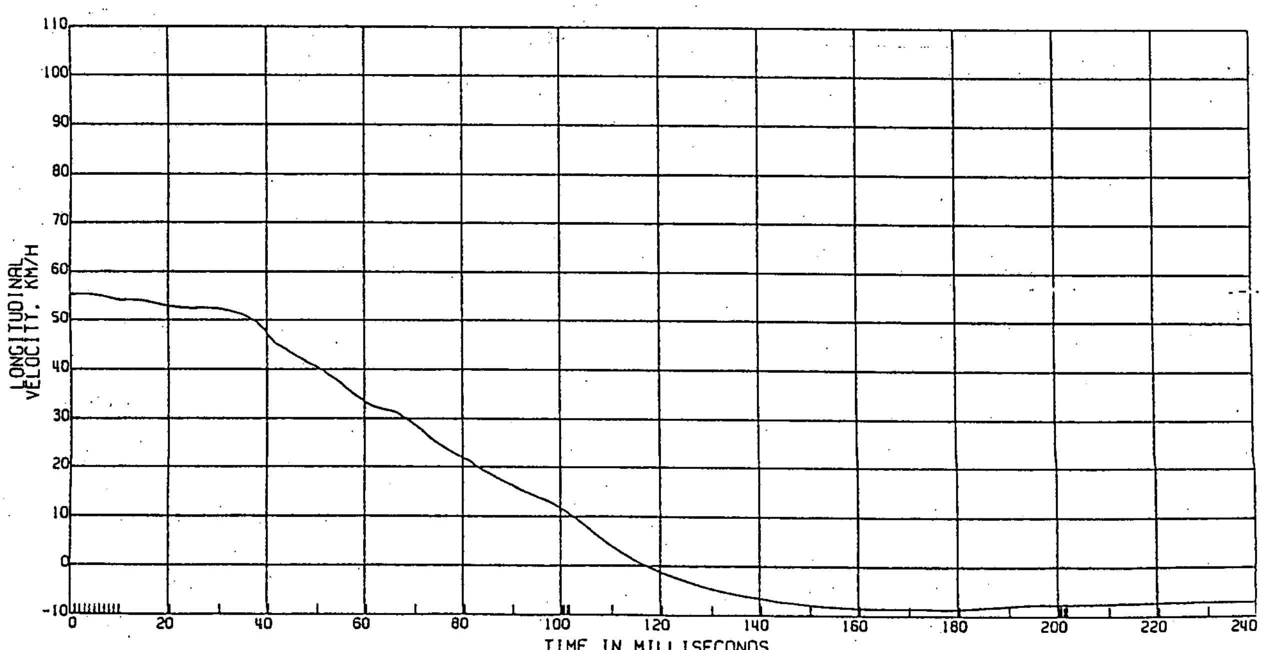
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 66

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

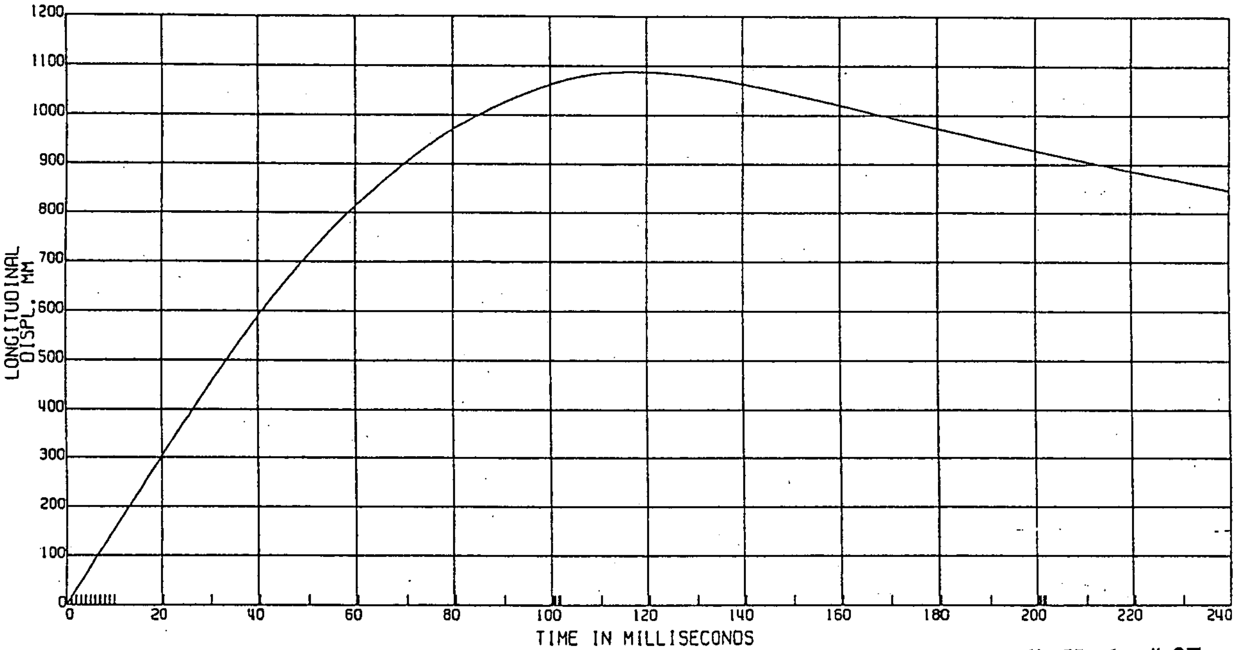
R & D CTR 8T9308D VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 67

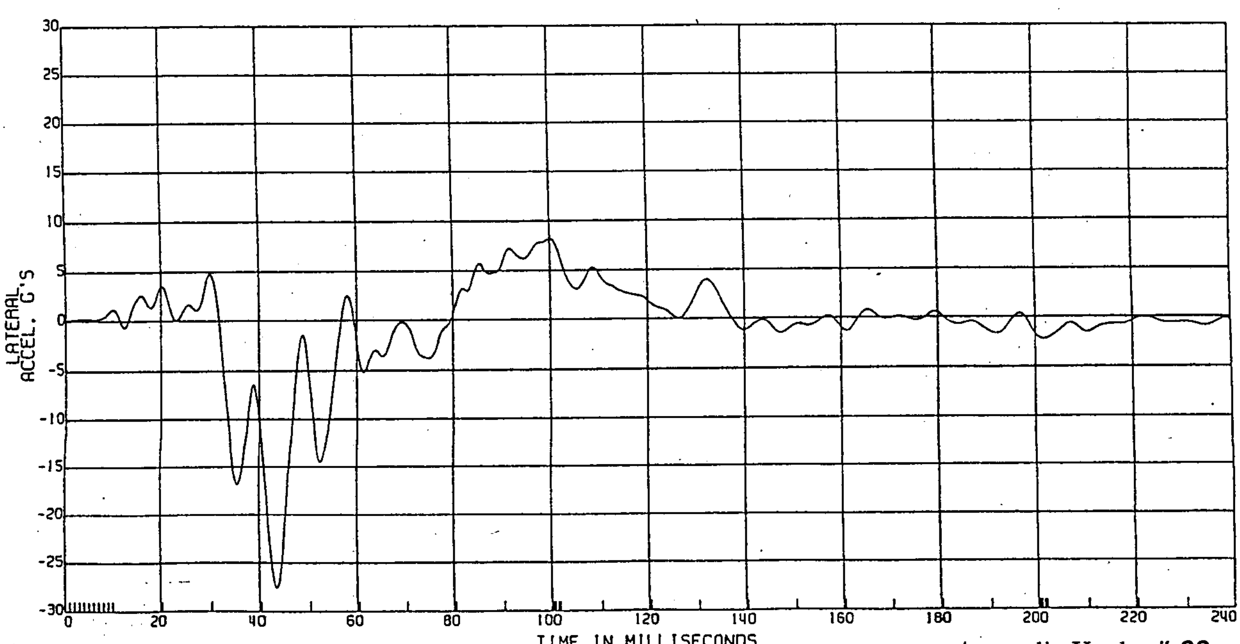
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN

ELEC DATA, SAE CLASS 60

L. FRT ROCKER ACCEL

TEST DATE:09/25/1996



Appendix H, plot # 68

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

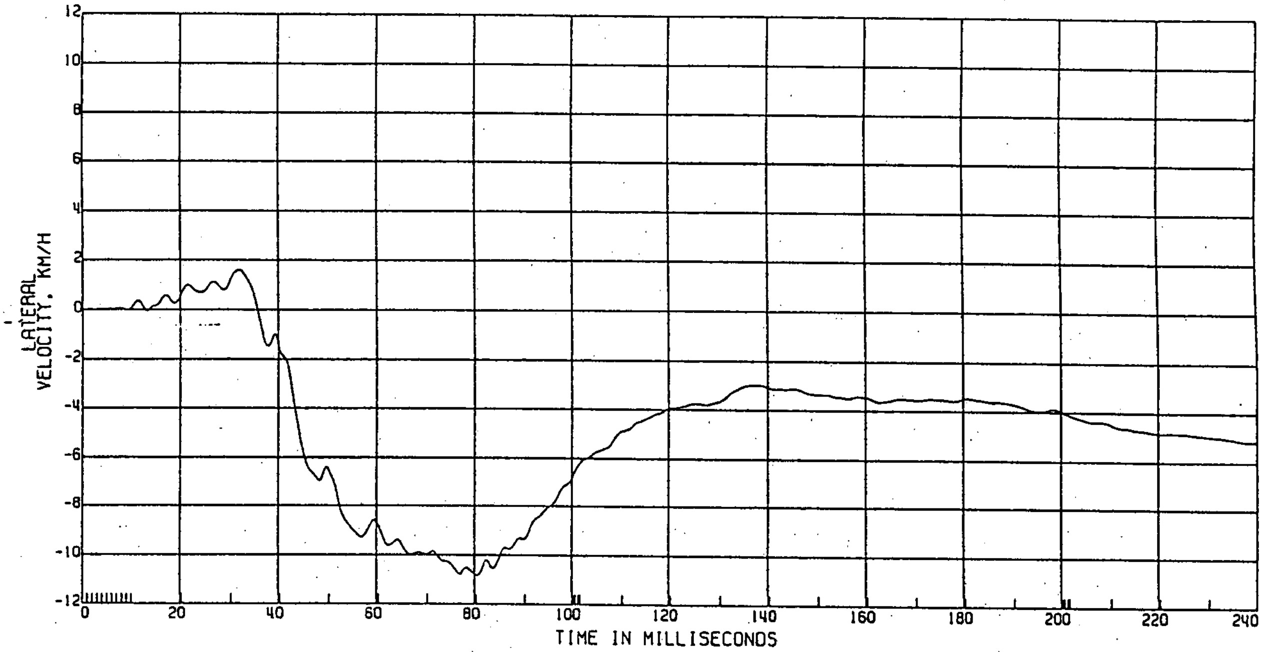
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 69

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

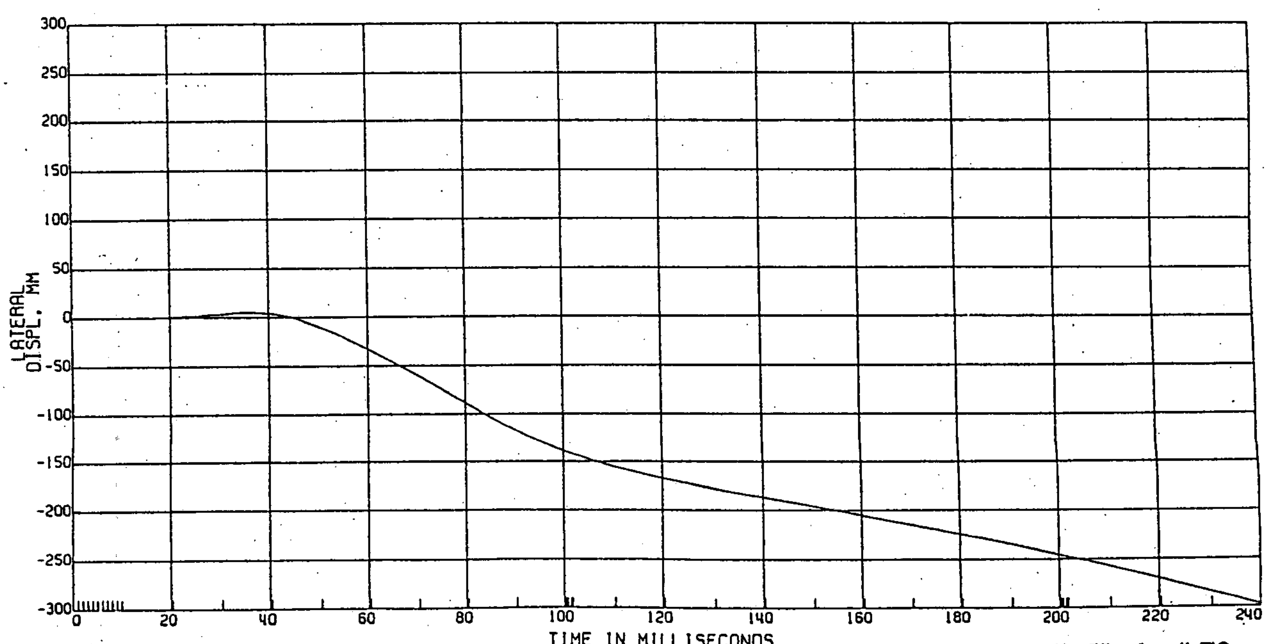
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 70

C11279 FRONT IMPACT

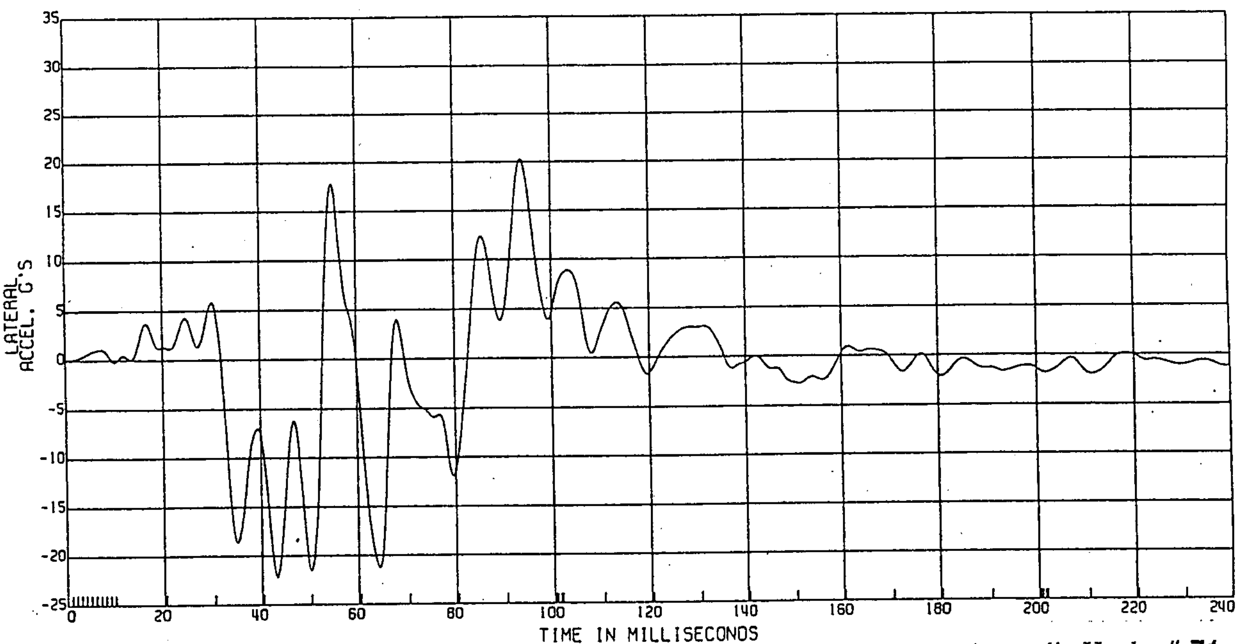
MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 60

R. FRT ROCKER ACCEL

TEST DATE:09/25/1996



Appendix H, plot # 71

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

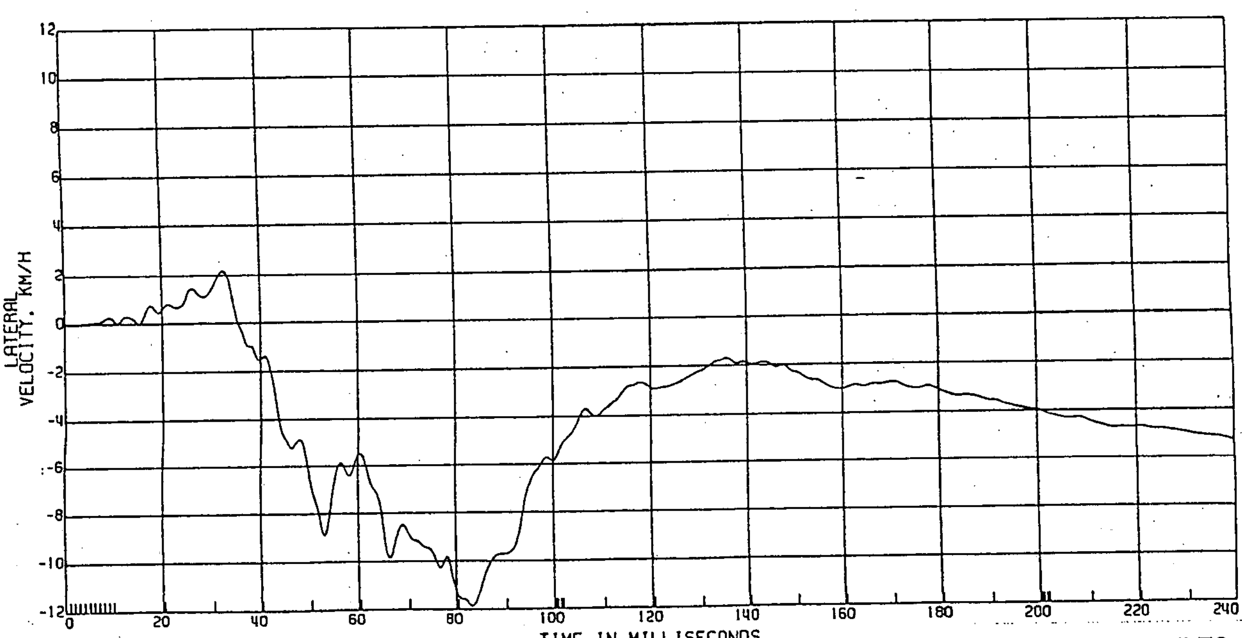
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

R. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 72

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

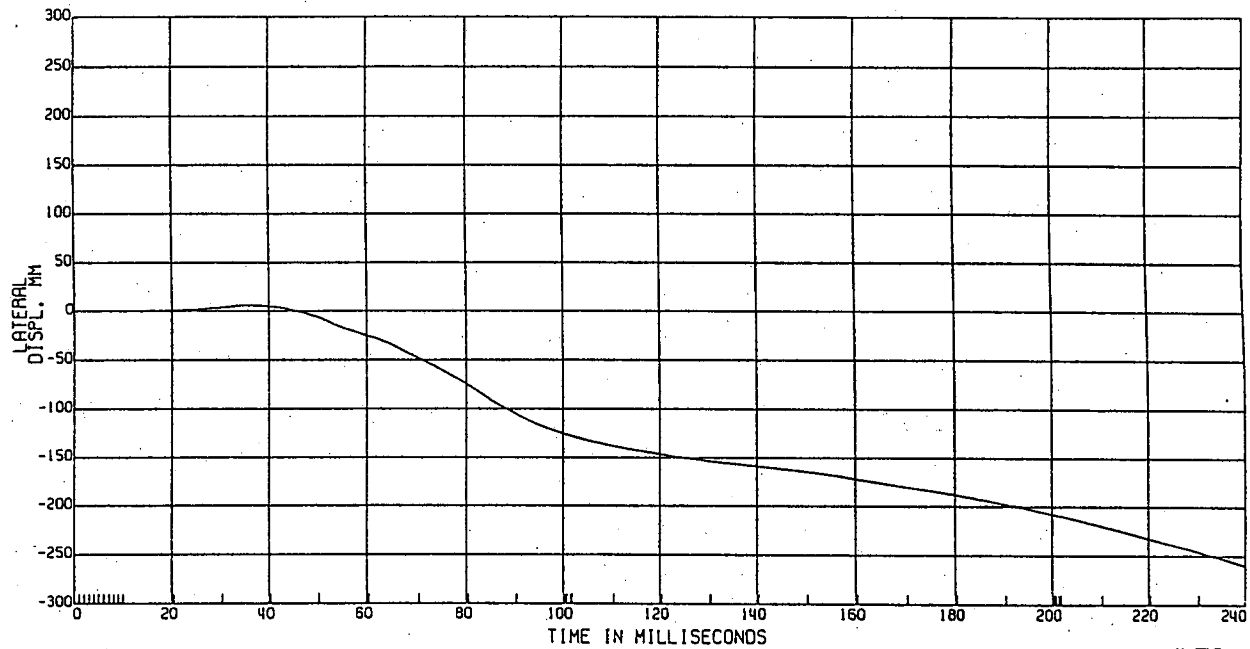
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

R. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 73

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

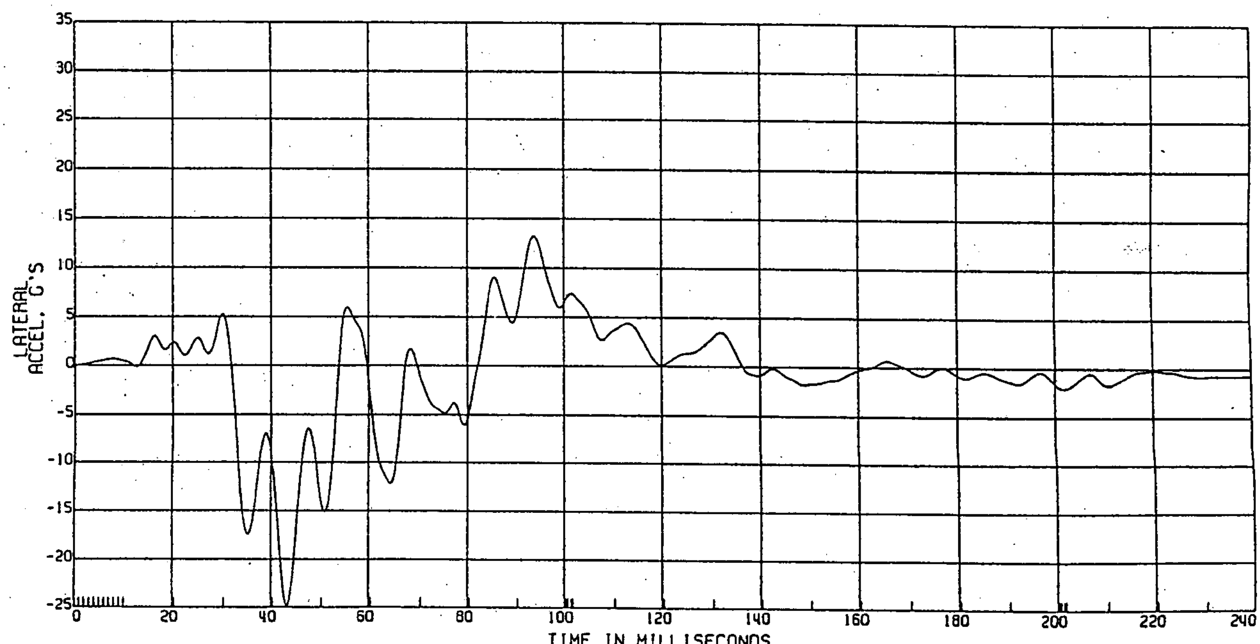
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 60

AVERAGED FRT ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:09/25/1996



Appendix H, plot # 74

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

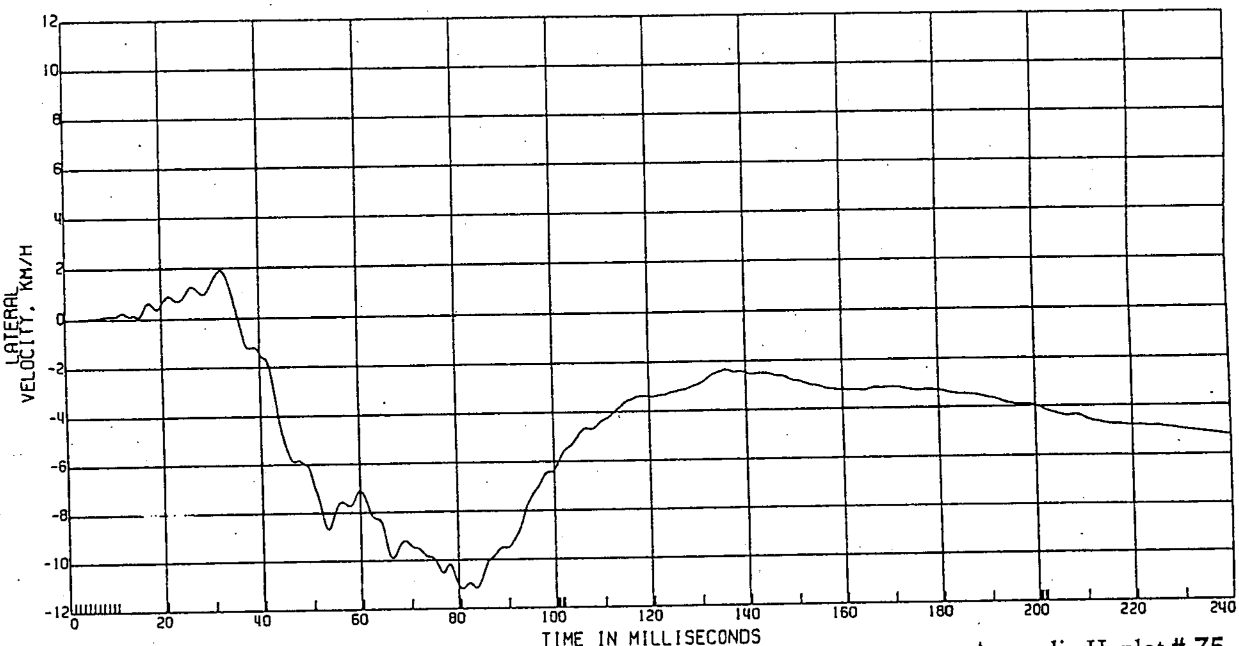
AVGD FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

TEST DATE:09/25/1996



Appendix H, plot # 75

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

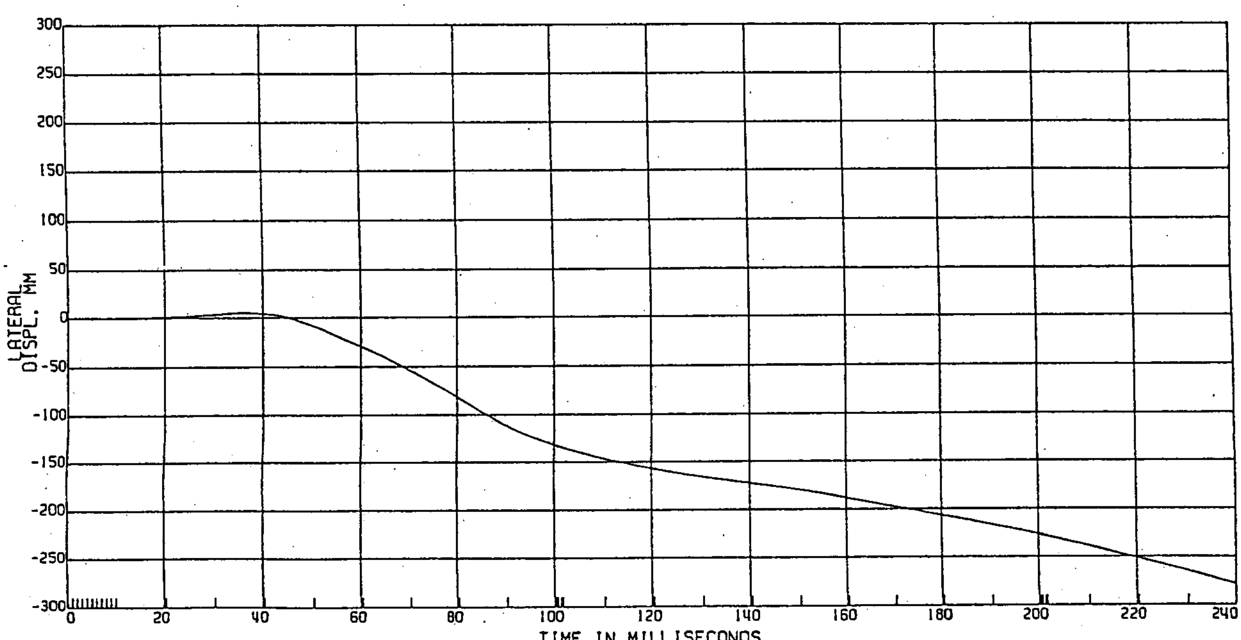
AVGD FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

TEST DATE:09/25/1996



Appendix H, plot # 76

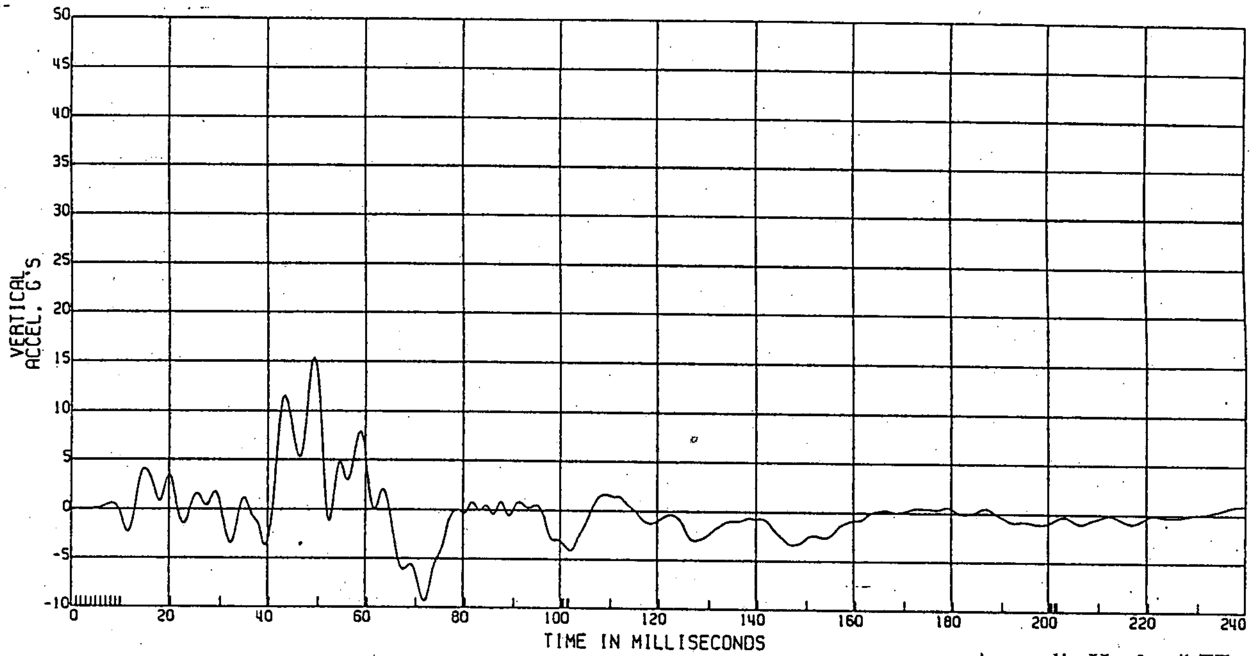
C11279 FRONT IMPACT　　MOVING VEHICLE TO FIXED POLE　　55.4KM/H

R & D CTR　　8T93080 VAN

ELEC DATA, SAE CLASS 60

L. FRT ROCKER ACCEL

TEST DATE:09/25/1996



Appendix H, plot # 77

C11279 FRONT IMPACT　　MOVING VEHICLE TO FIXED POLE　　55.4KM/H

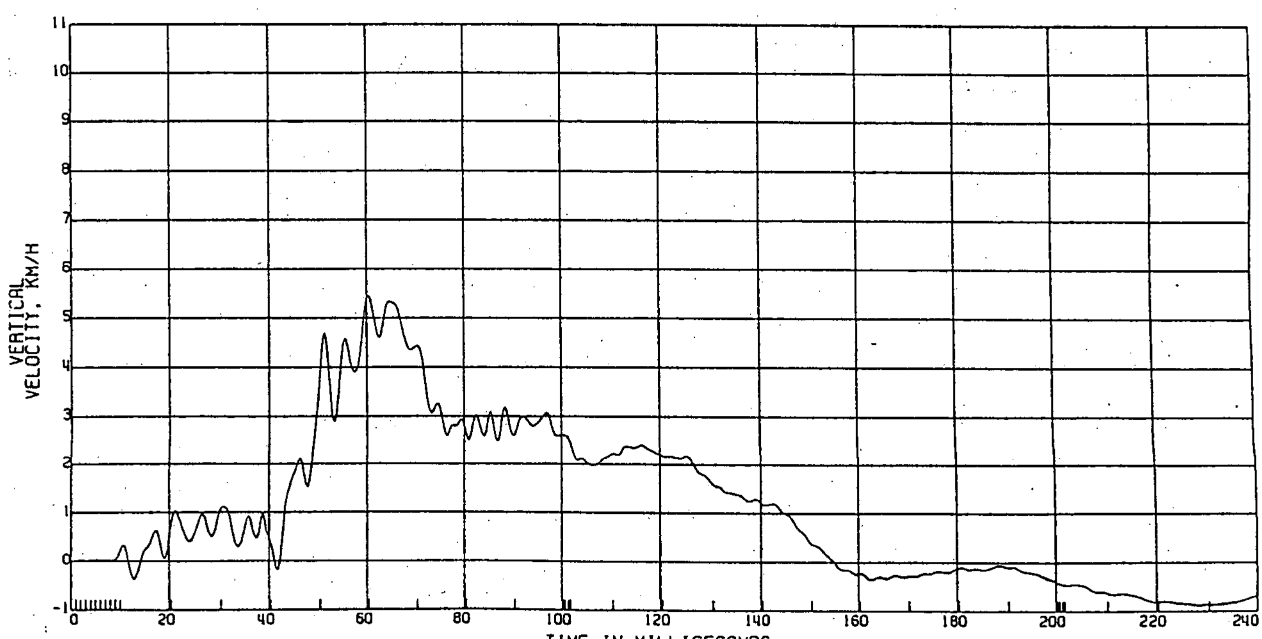
R & D CTR　　8T93080 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 78

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

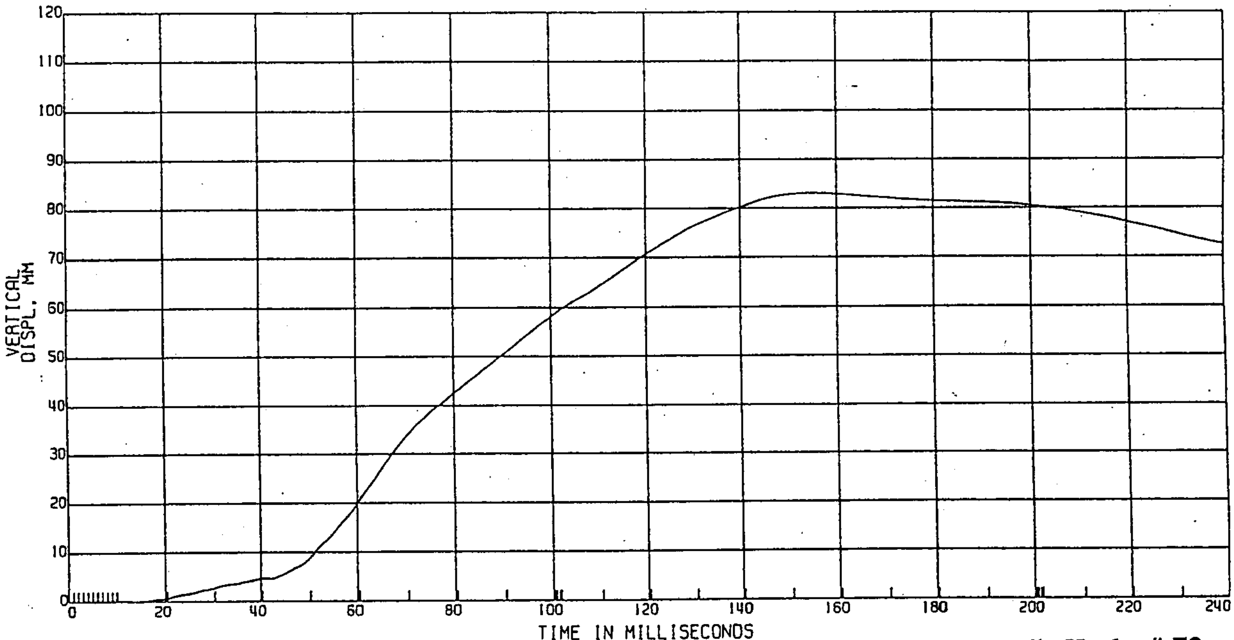
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

L. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 79

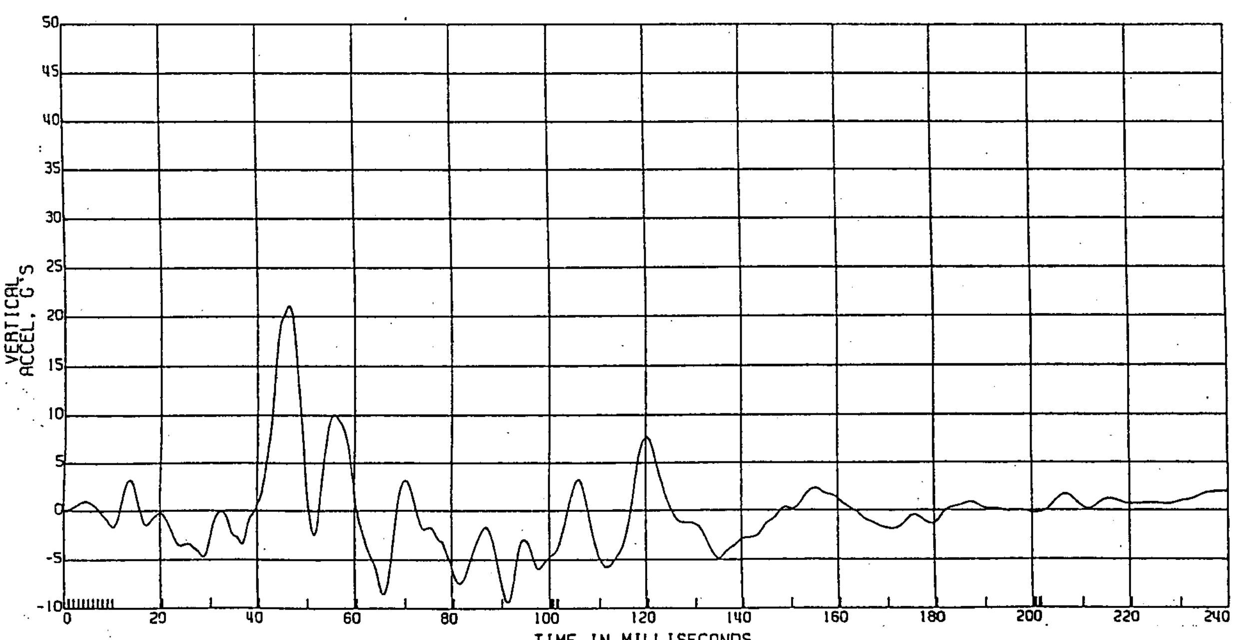
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 60

R. FRT ROCKER ACCEL

TEST DATE:09/25/1996



Appendix H, plot # 80

C11279 FRONT IMPACT   MOVING VEHICLE TO FIXED POLE   55.4KM/H

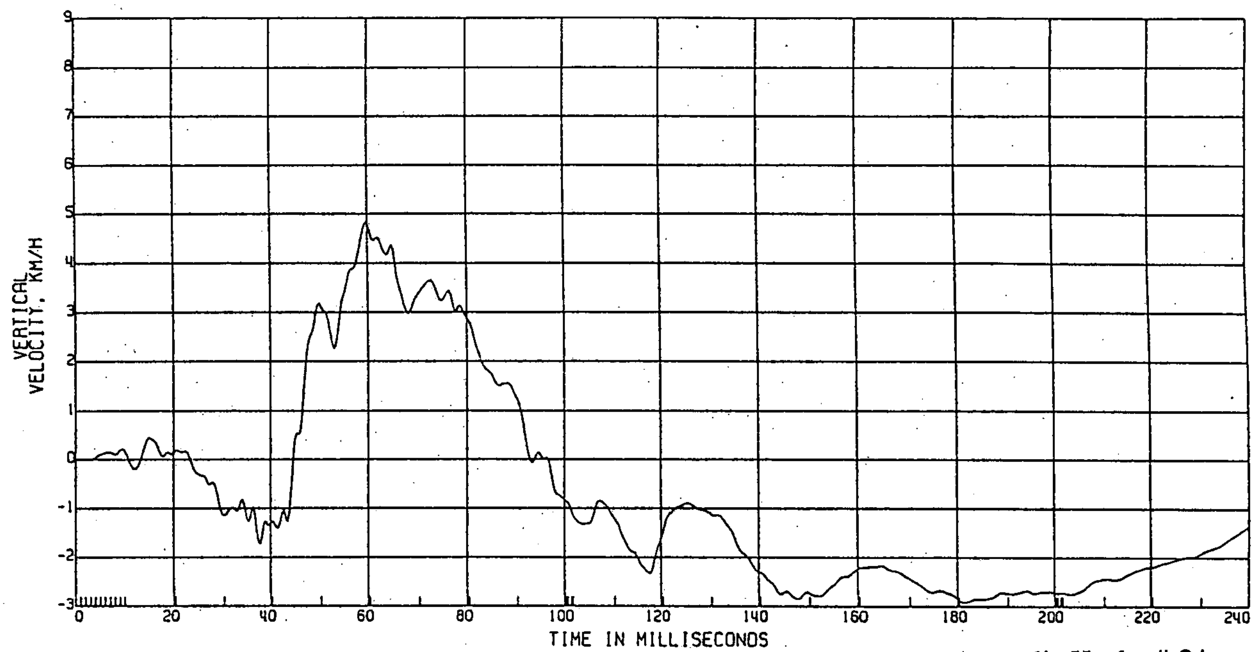
R & D CTR   8T93080 VAN

ELEC DATA, SAE CLASS 180

R. FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 81

C11279 FRONT IMPACT   MOVING VEHICLE TO FIXED POLE   55.4KM/H

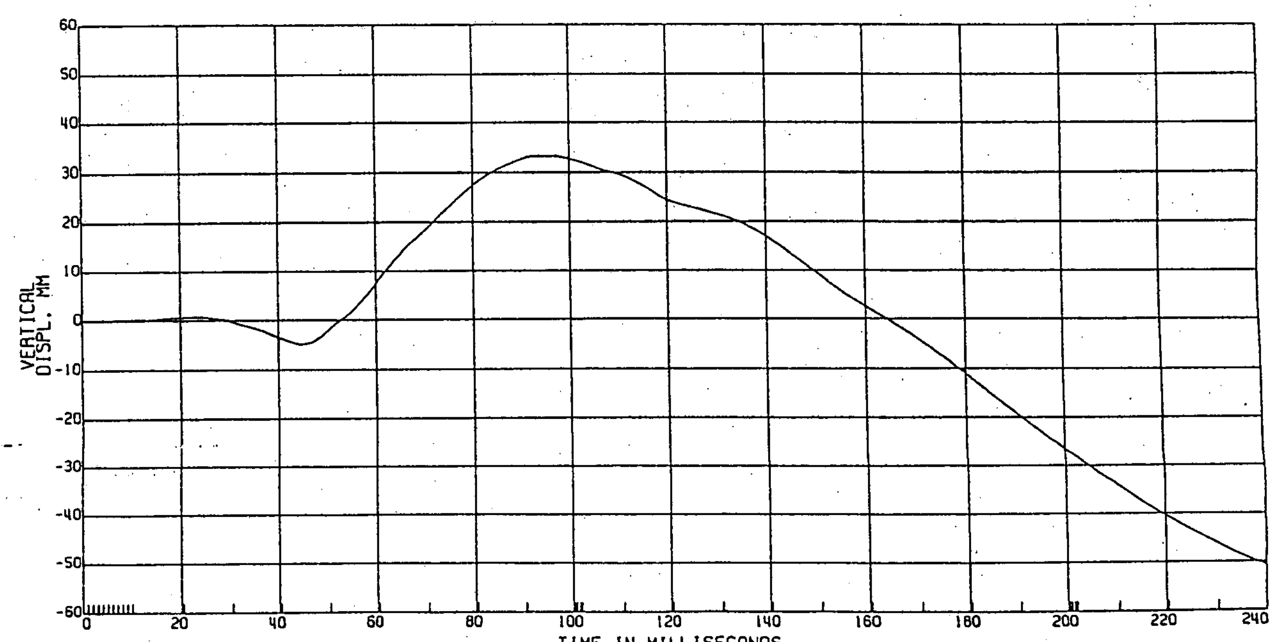
R & D CTR   8T93080 VAN

ELEC DATA, SAE CLASS 180

R. FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 82

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

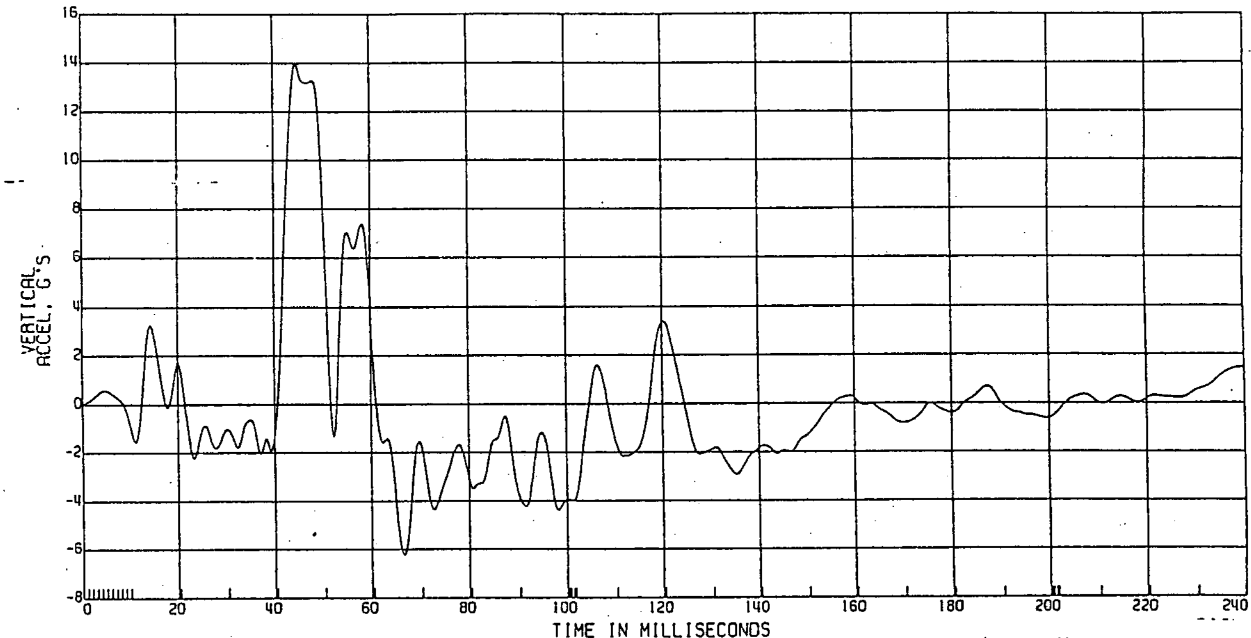
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 60

AVERAGED FRT ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:09/25/1996



Appendix H, plot # 83

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

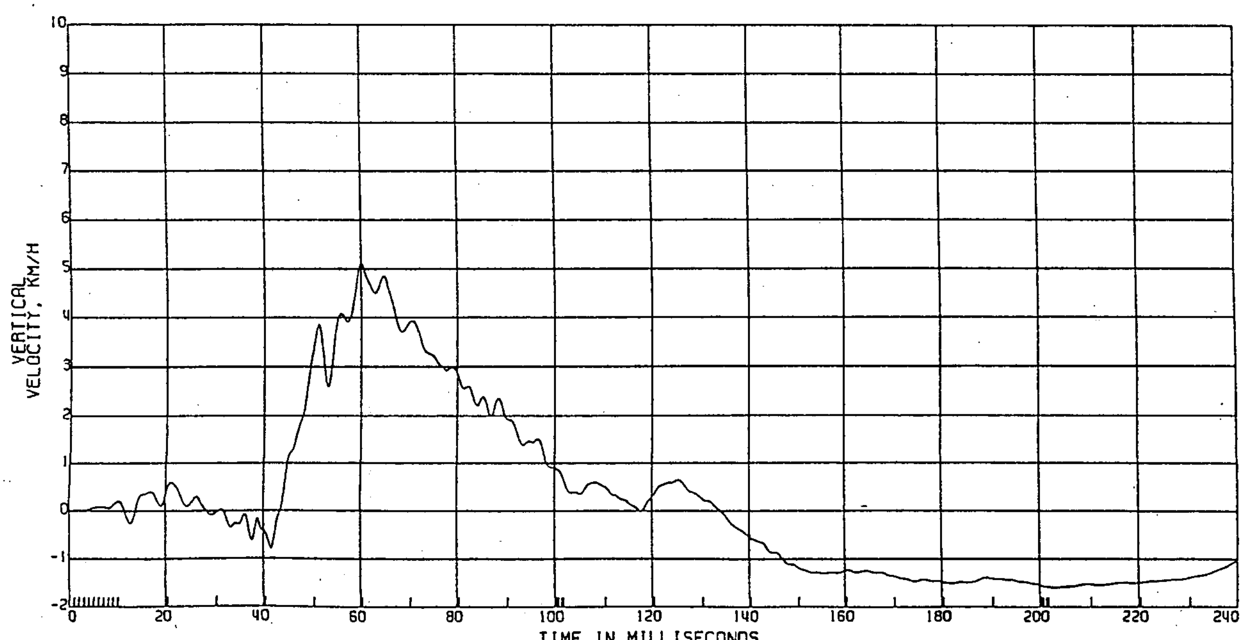
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 84

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

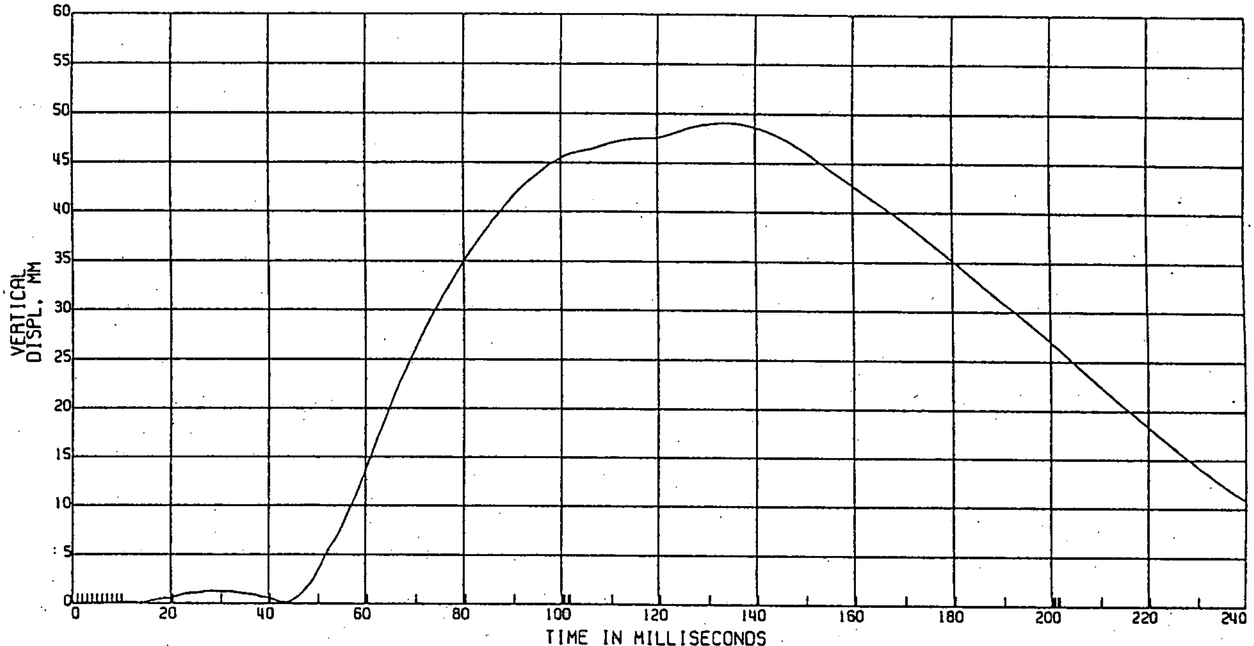
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

AVGD FRT ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 85

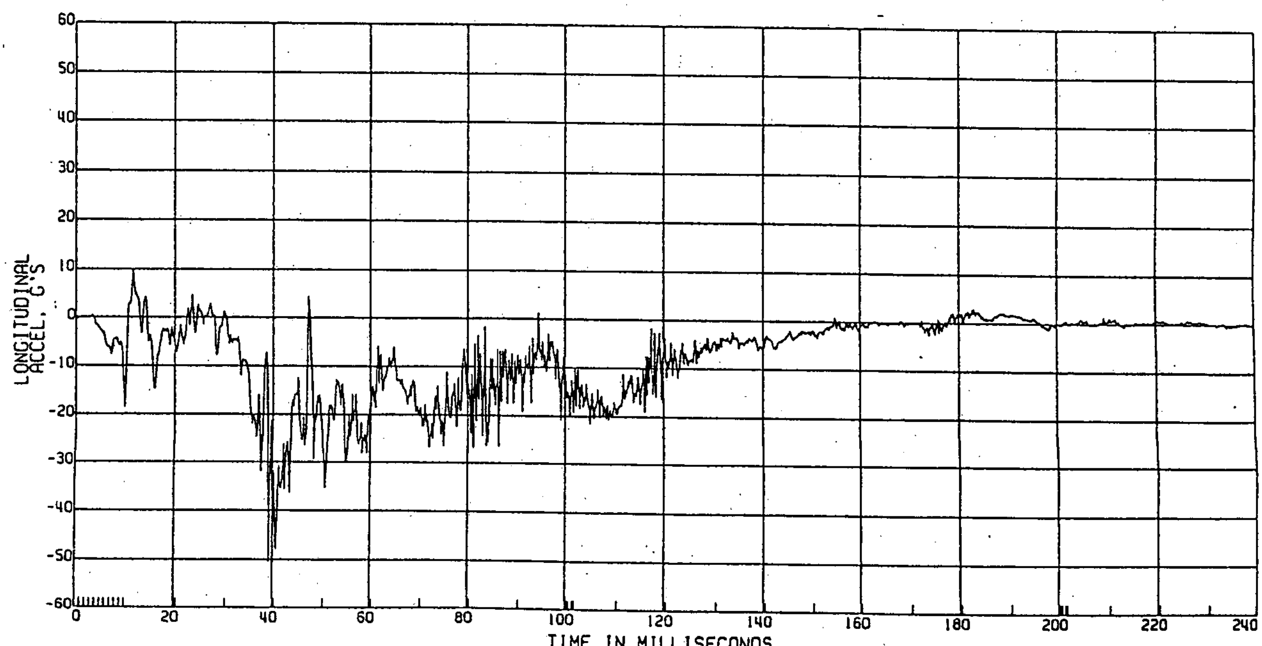
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

L.REAR ROCKER ACCEL

TEST DATE:09/25/1996



Appendix H, plot # 86

C11279 FRONT IMPACT

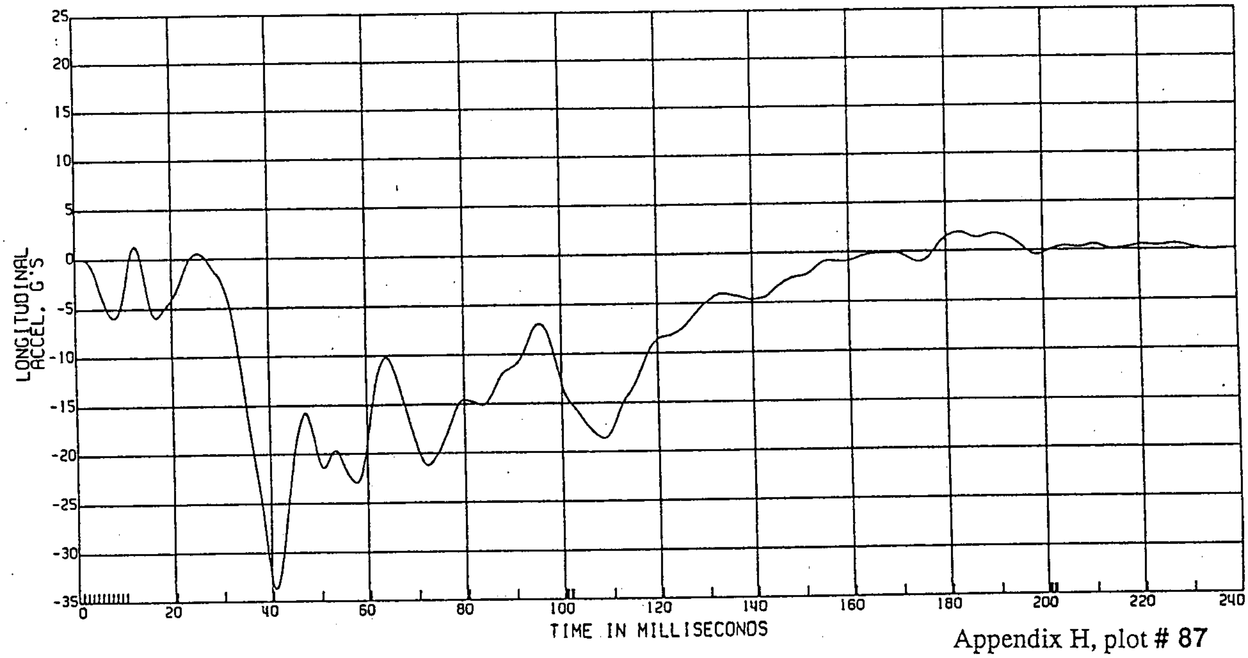
MOVING VEHICLE TO FIXED POLE 55.4KM/H

L.REAR ROCKER ACCEL

TEST DATE:09/25/1996

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 60



Appendix H, plot # 87

87 PROCESSED 9/25/1996 15:31 V2.04

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

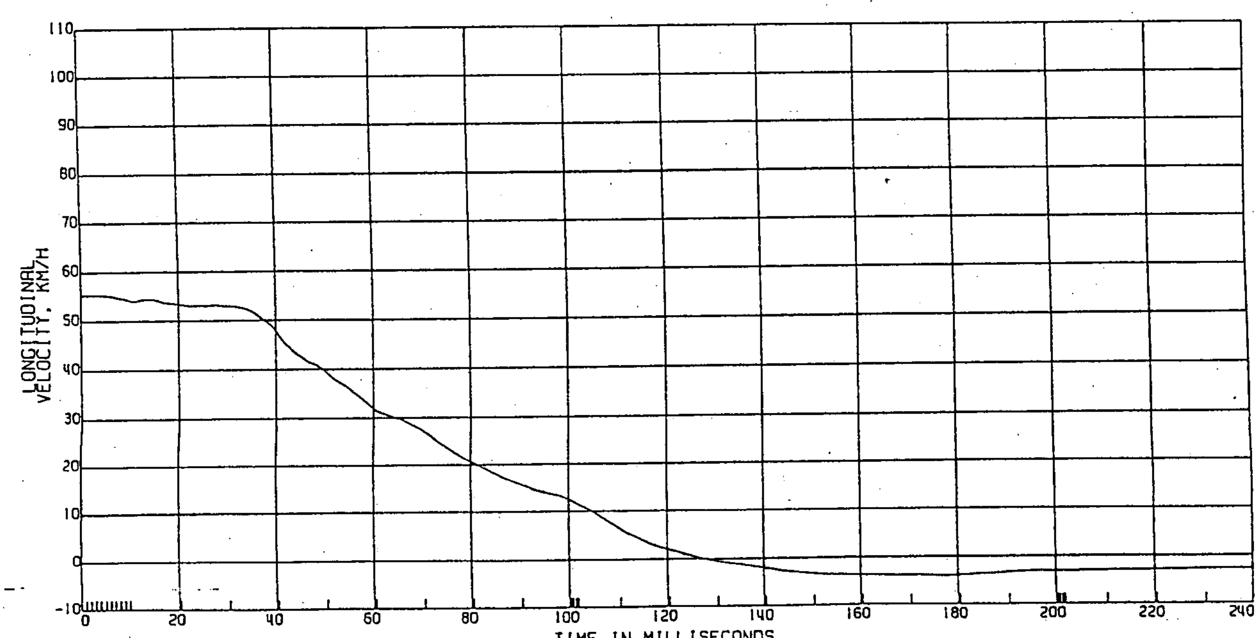
L.REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180



Appendix H, plot # 88

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

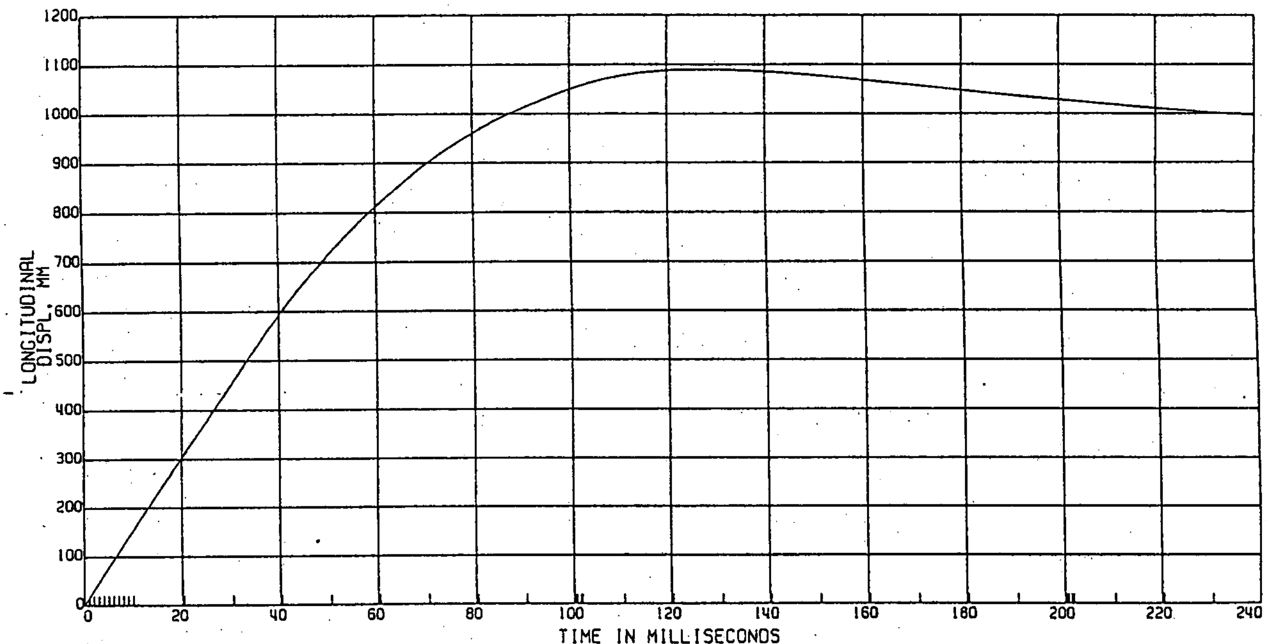
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

L.REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 89

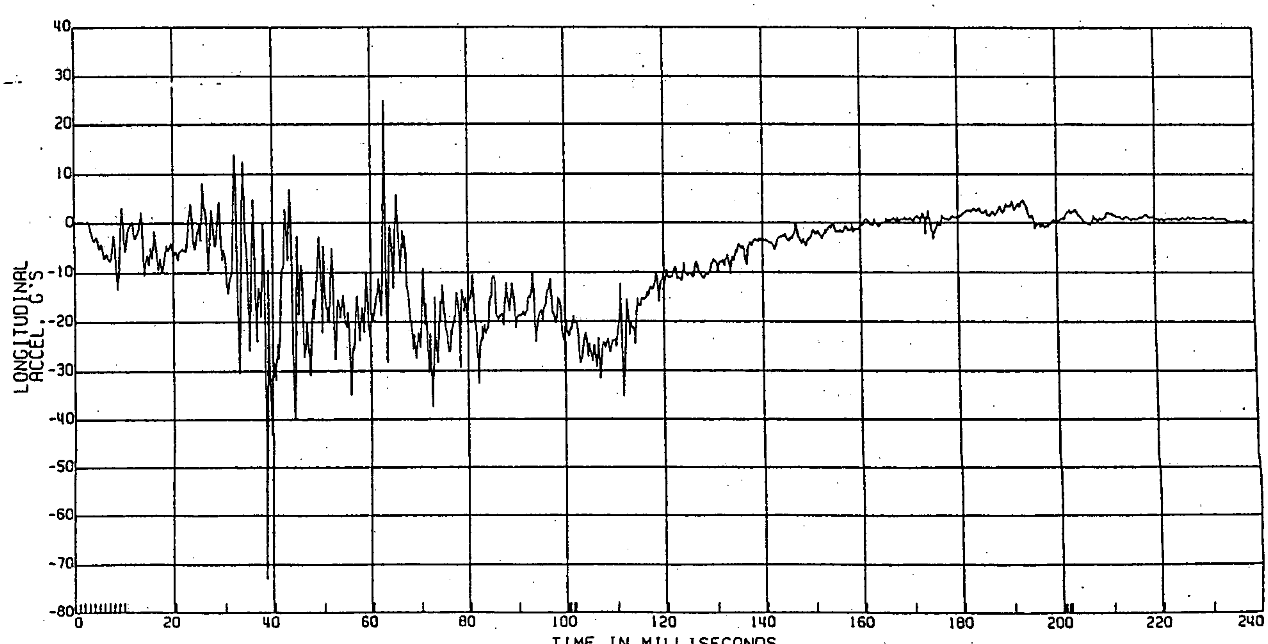
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

R.REAR ROCKER ACCEL

TEST DATE:09/25/1996



Appendix H, plot # 90

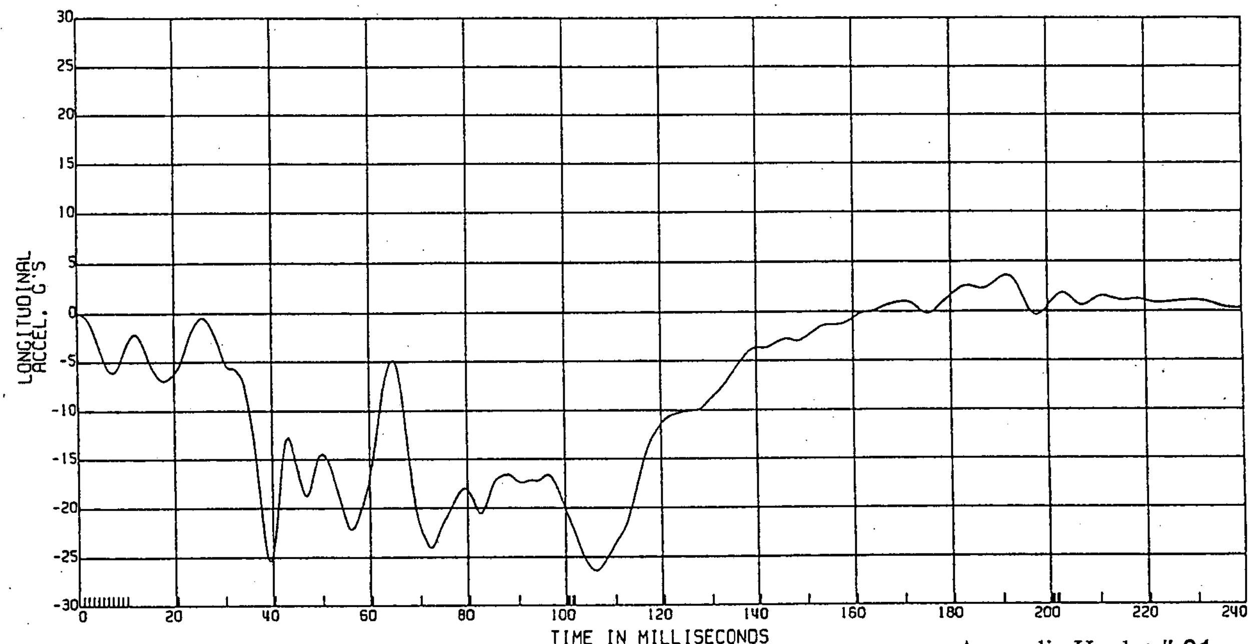
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 60

R.REAR ROCKER ACCEL

TEST DATE:09/25/1996



Appendix H, plot # **91**

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

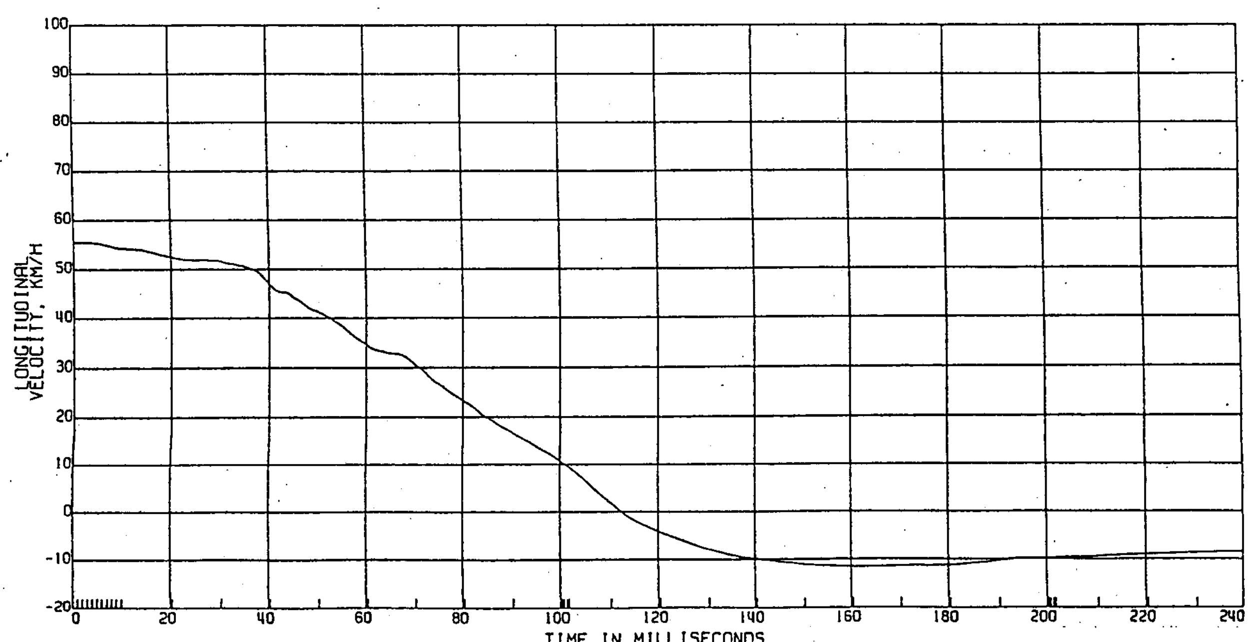
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

R.REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

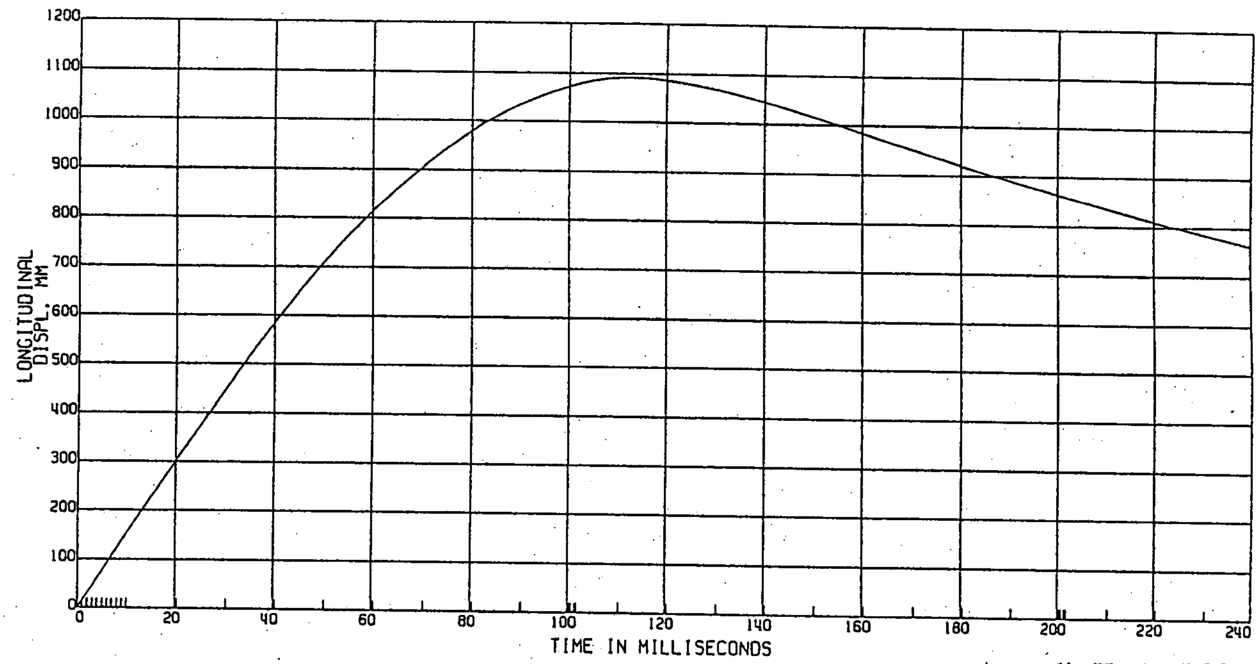
TEST DATE:09/25/1996



Appendix H, plot # **92**

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

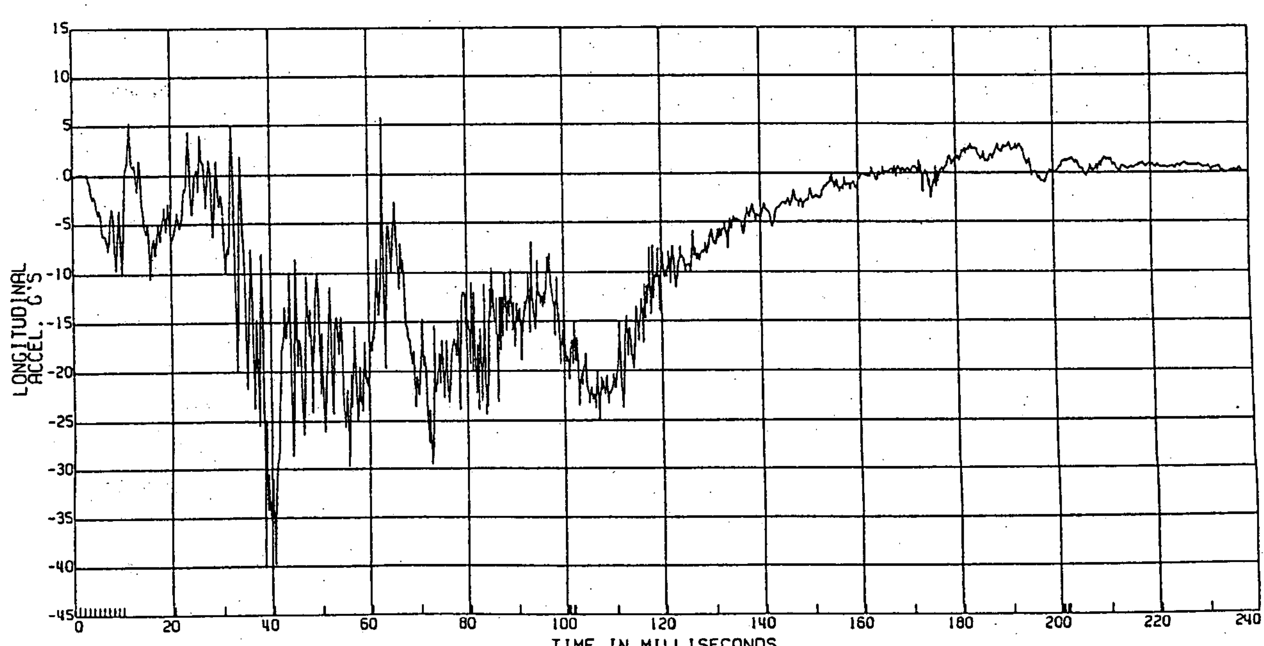
R & D CTR 8T93080 VAN R.REAR ROCKER DISPL TEST DATE:09/25/1996
ELEC DATA, SAE CLASS 180 (COMPUTED FROM ACCELERATION)



Appendix H, plot # 93

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN AVERAGED REAR ROCKER ACCELERATION TEST DATE:09/25/1996
ELEC DATA, SAE CLASS 1000 (AVGD L. & R. ROCKER ACCELS)

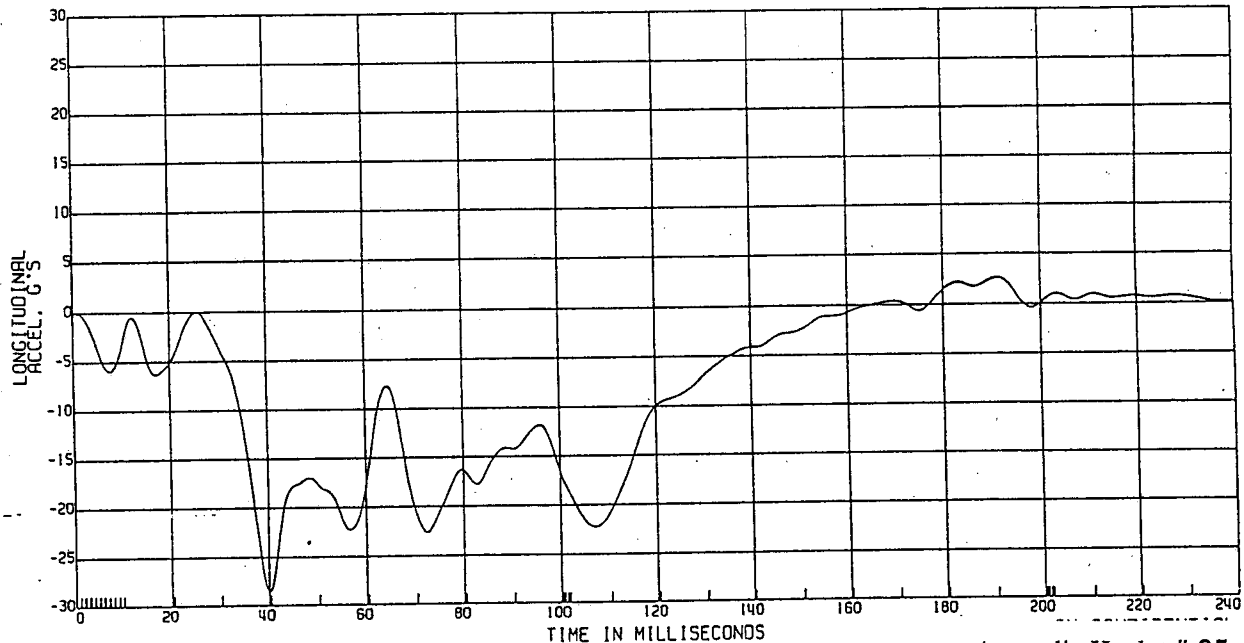


Appendix H, plot # 94

C11279 FRONT IMPACT
R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 60

MOVING VEHICLE TO FIXED POLE 55.4KM/H
AVERAGED REAR ROCKER ACCELERATION
(AVGD L. & R. ROCKER ACCELS)

TEST DATE:09/25/1996

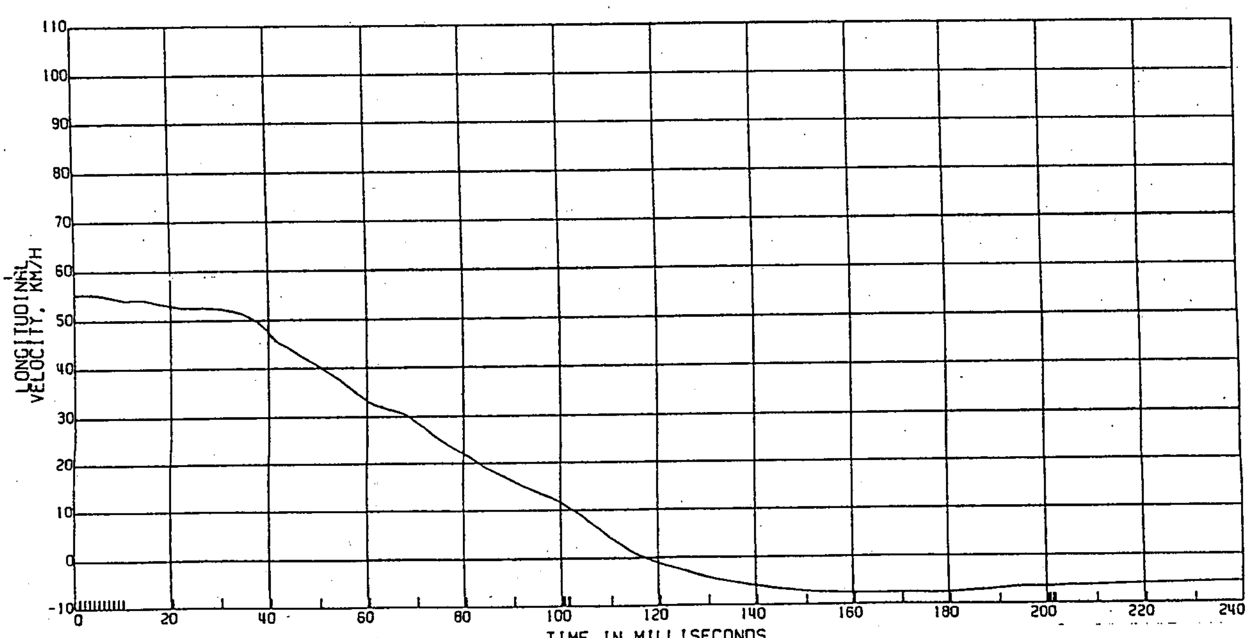


Appendix H, plot # 95

C11279 FRONT IMPACT
R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 180

MOVING VEHICLE TO FIXED POLE 55.4KM/H
AVGD REAR ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 96

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

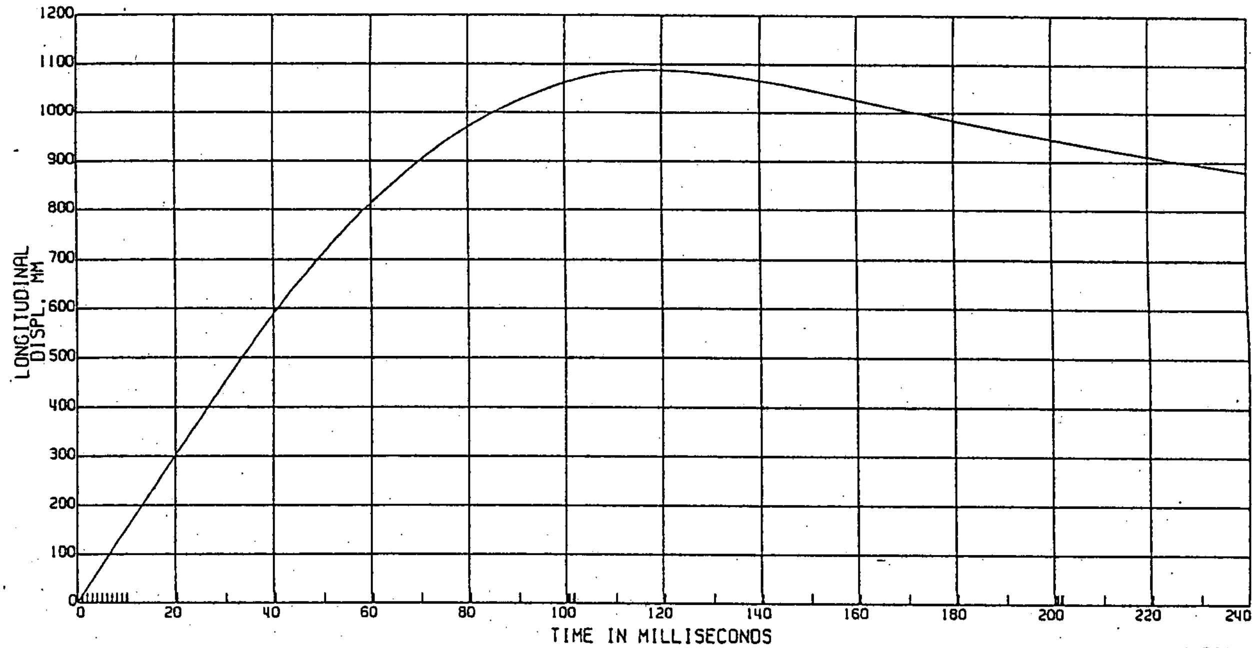
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 97

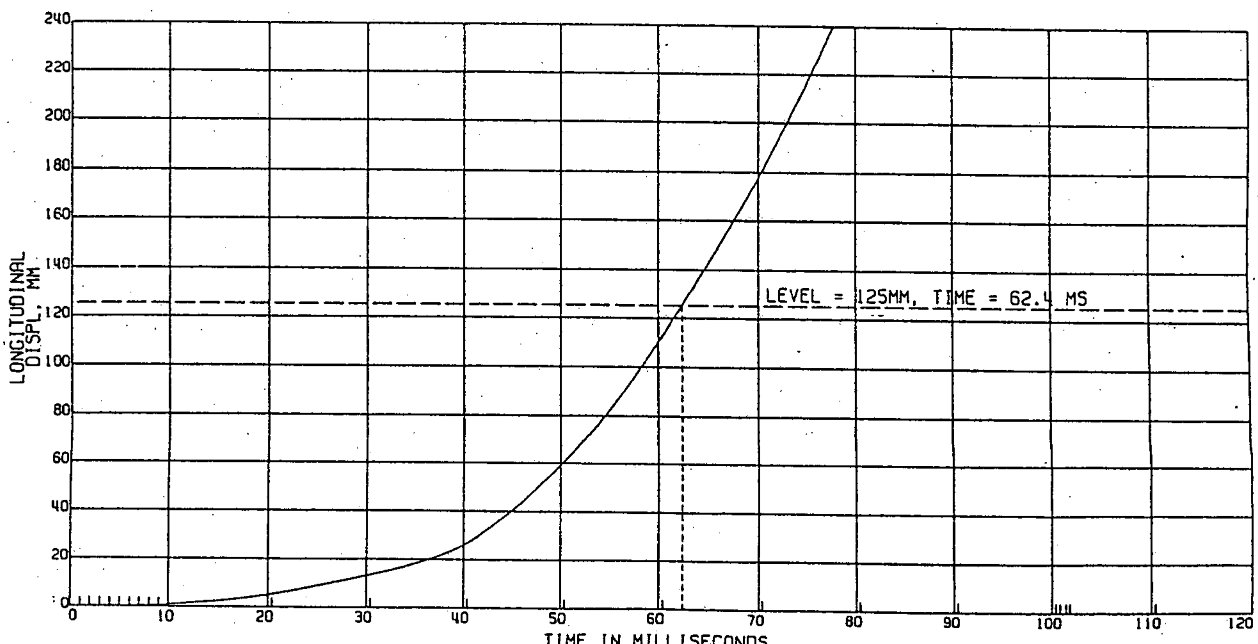
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

COMP. FREE MASS DISP. REL. TO VEHICLE

TEST DATE:09/25/1996

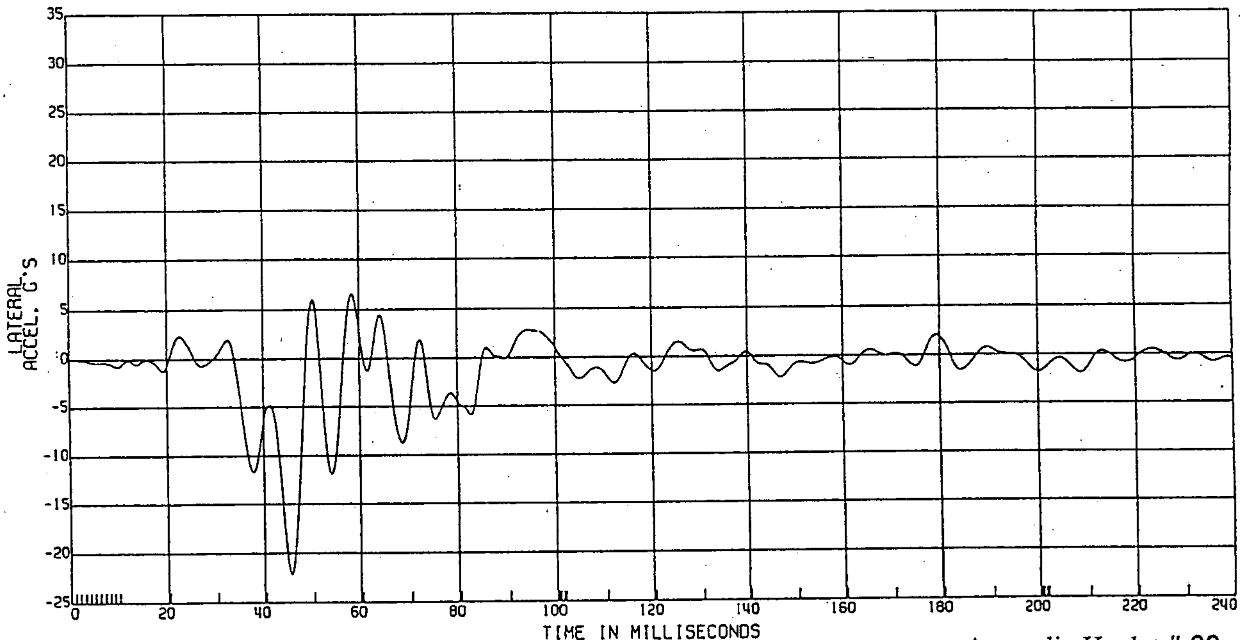


Appendix H, plot # 98

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

L.REAR ROCKER ACCEL

R & D CTR 8T93080 VAN TEST DATE:09/25/1996
ELEC DATA, SAE CLASS 60

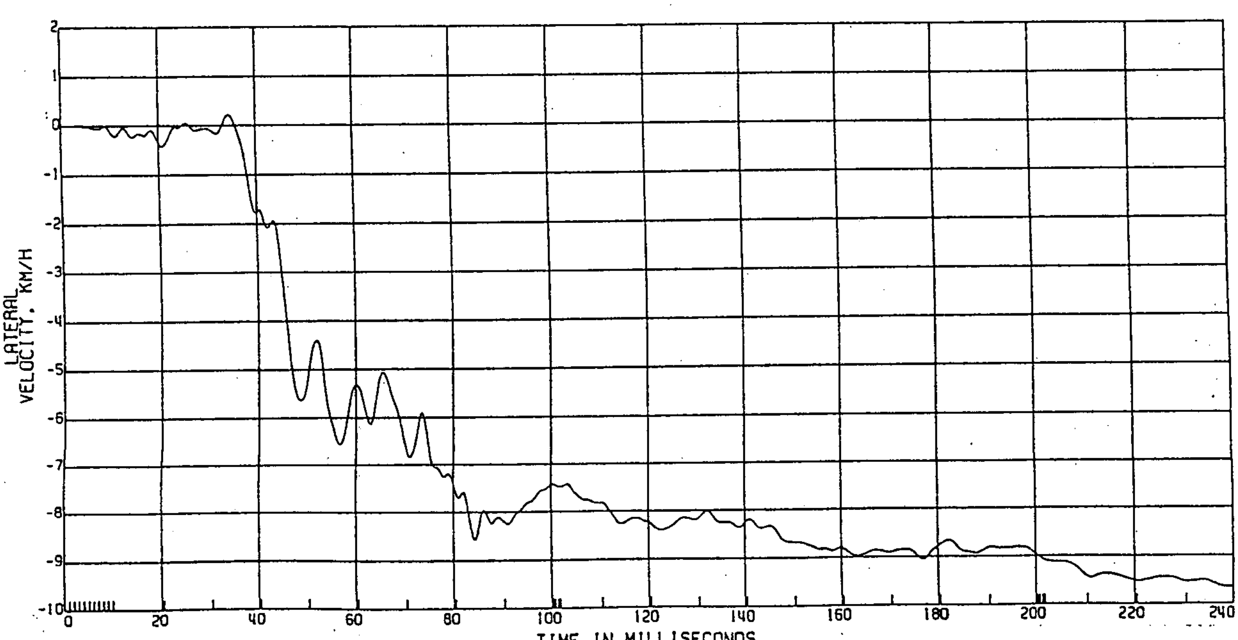


Appendix H, plot # 99

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

L.REAR ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

R & D CTR 8T93080 VAN TEST DATE:09/25/1996
ELEC DATA, SAE CLASS 180



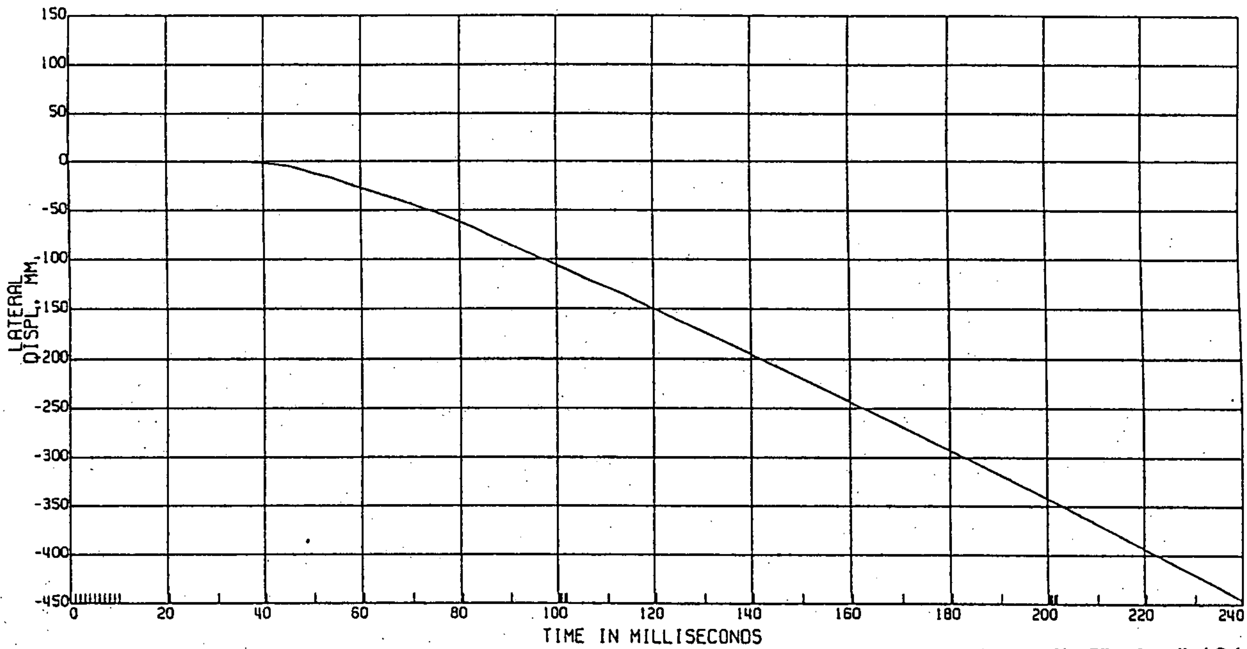
Appendix H, plot # 100

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 180

L.REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



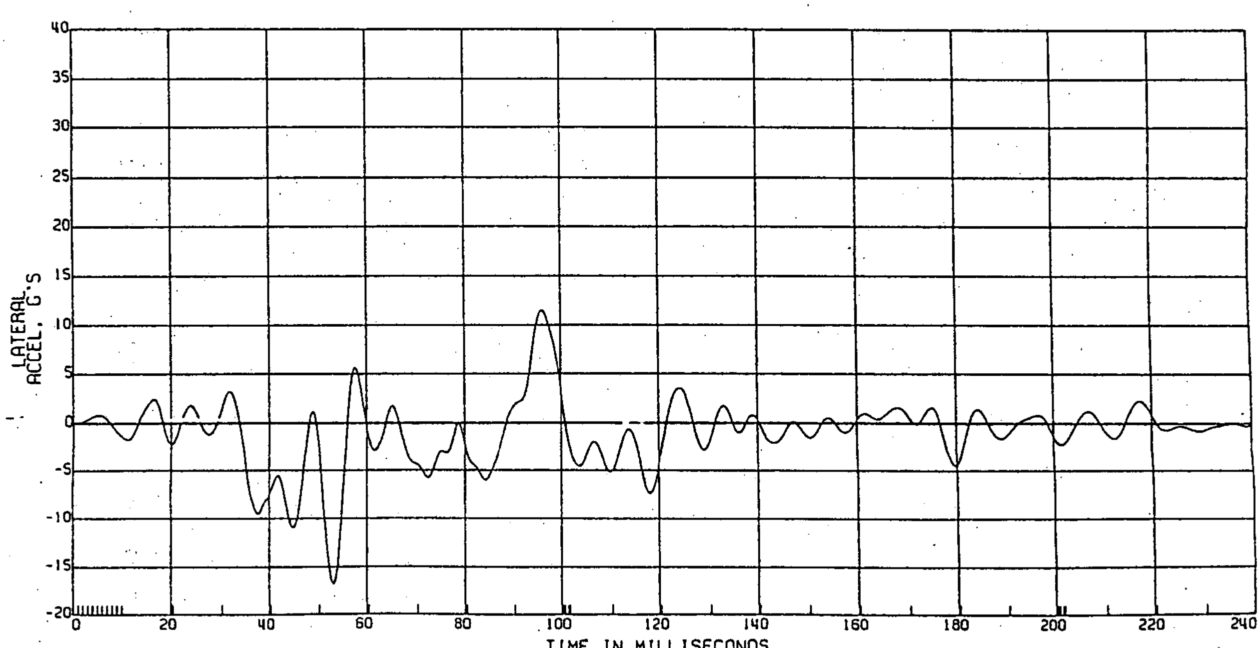
Appendix H, plot # **101**

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 60

R.REAR ROCKER ACCEL

TEST DATE:09/25/1996



Appendix H, plot # **102**

C11279 FRONT IMPACT

R & D CTR 8T93080 VAN

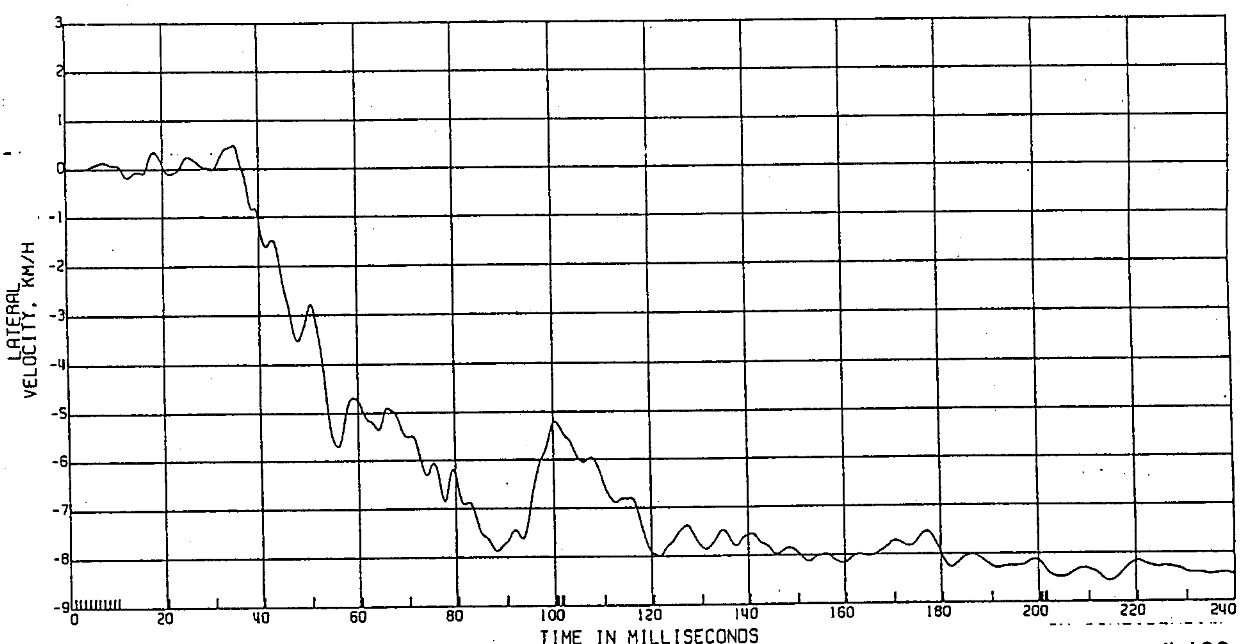
ELEC DATA, SAE CLASS 180

MOVING VEHICLE TO FIXED POLE 55.4KM/H

R.REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 103

C11279 FRONT IMPACT

R & D CTR 8T93080 VAN

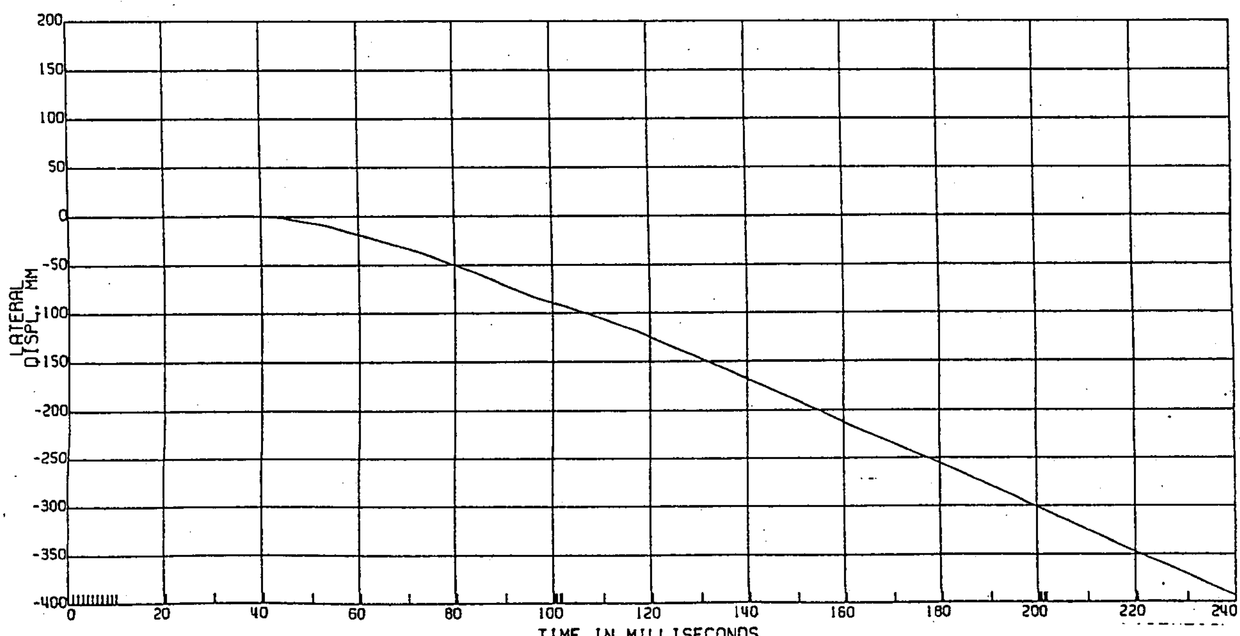
ELEC DATA, SAE CLASS 180

MOVING VEHICLE TO FIXED POLE 55.4KM/H

R.REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 104

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

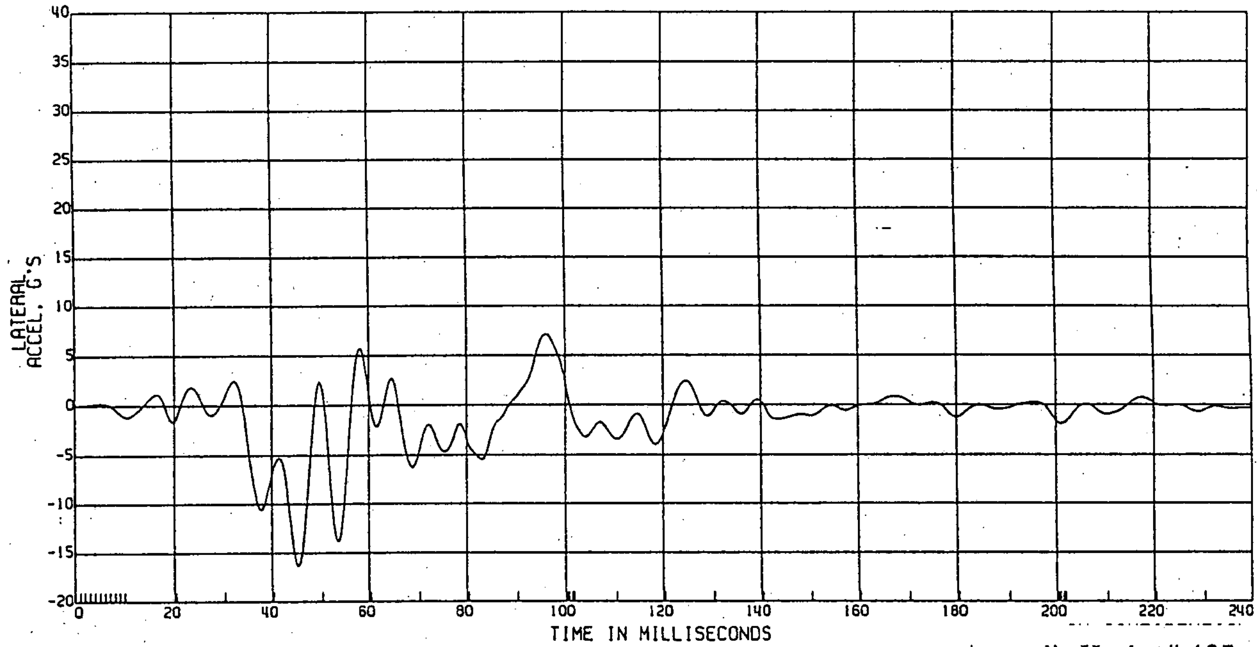
R & D CTR 8T9308D VAN

ELEC DATA, SAE CLASS 60

AVERAGED REAR ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:09/25/1996



Appendix H, plot # 105

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

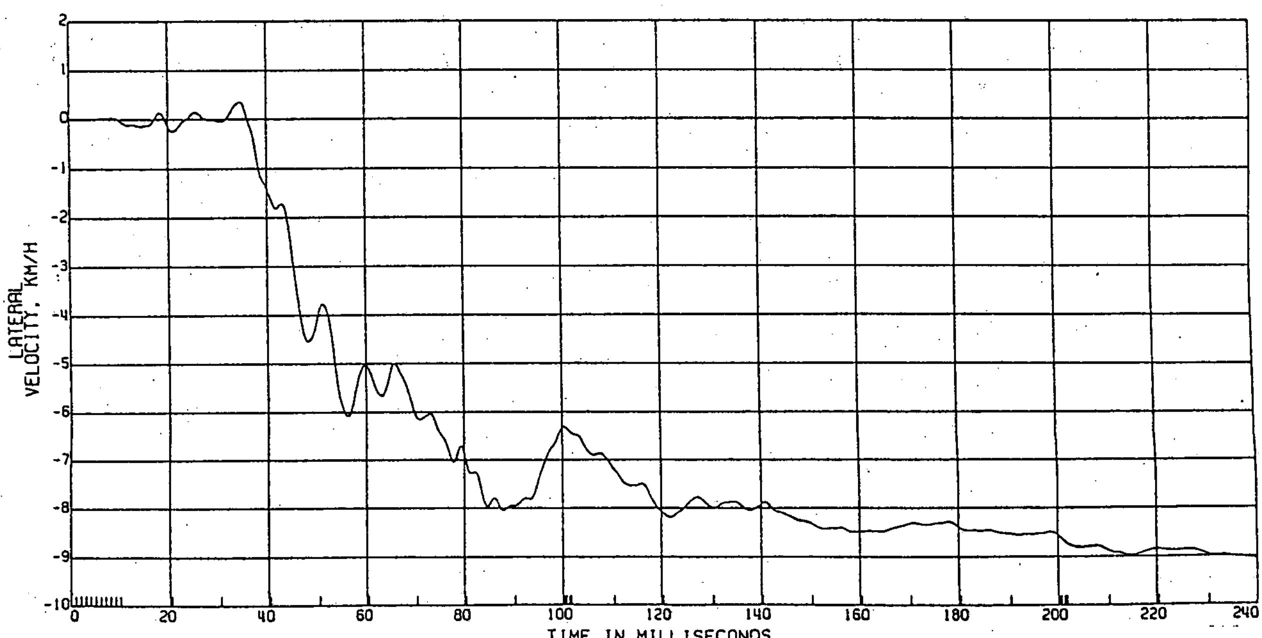
R & D CTR 8T9308D VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 106

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

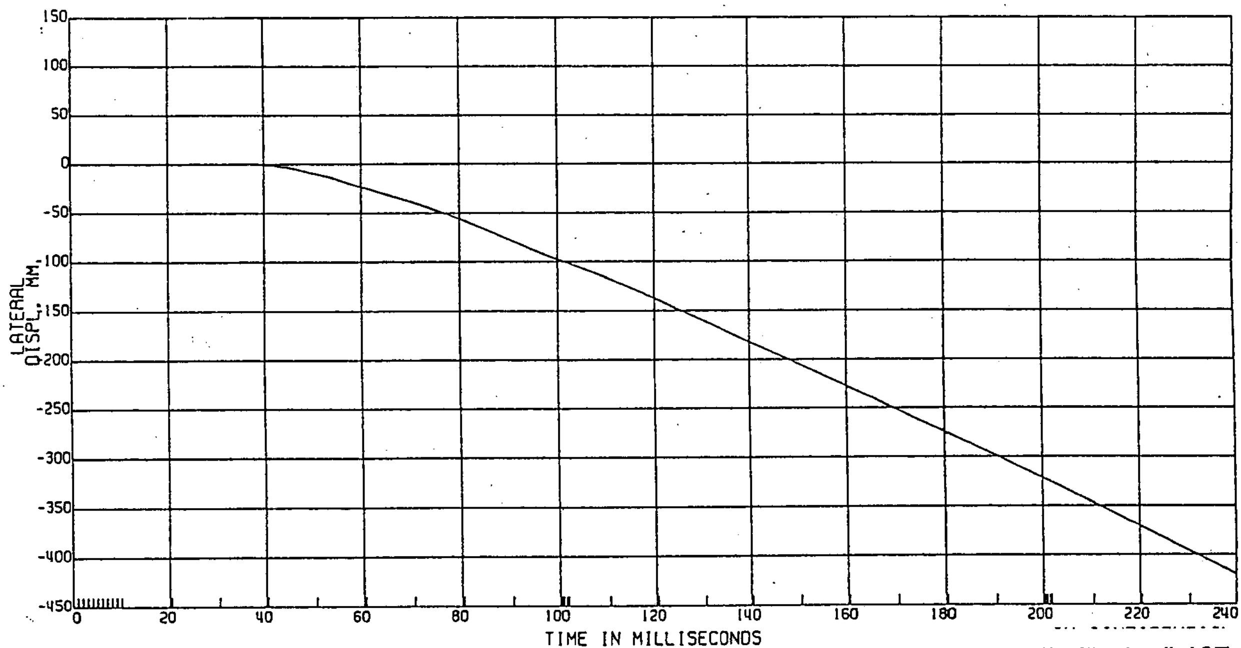
R & D CTR 8T93080D VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # 107

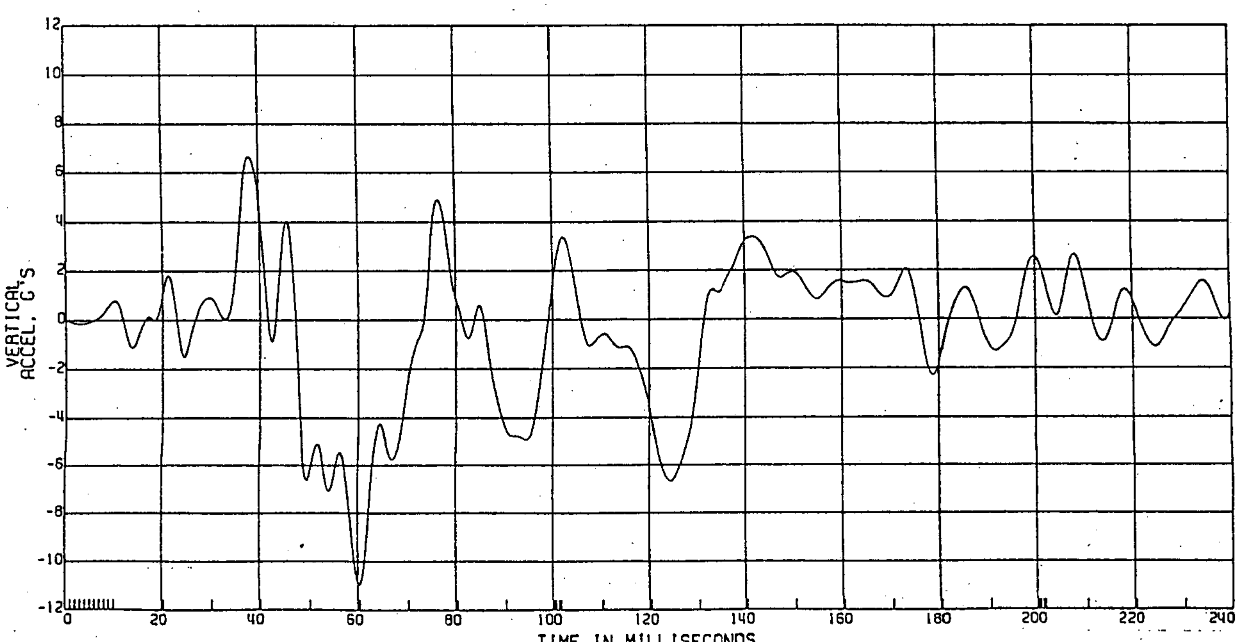
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080D VAN

ELEC DATA, SAE CLASS 60

L.REAR ROCKER ACCEL

TEST DATE:09/25/1996



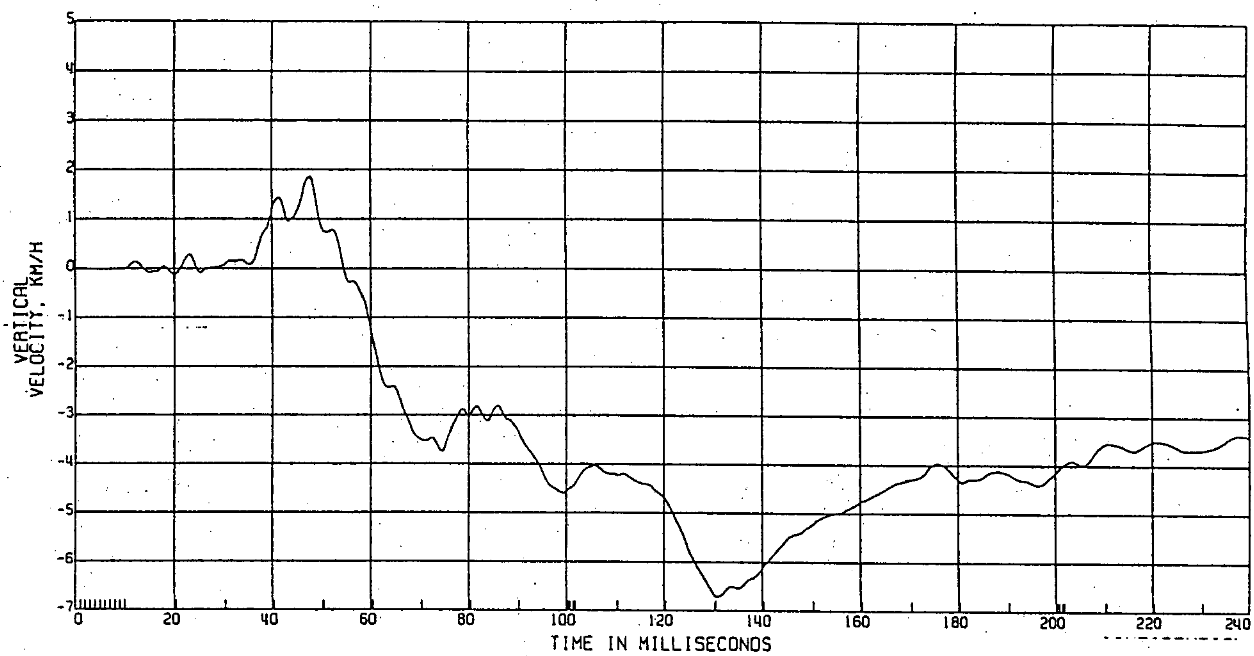
Appendix H, plot # 108

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 180

L.REAR ROCKER VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



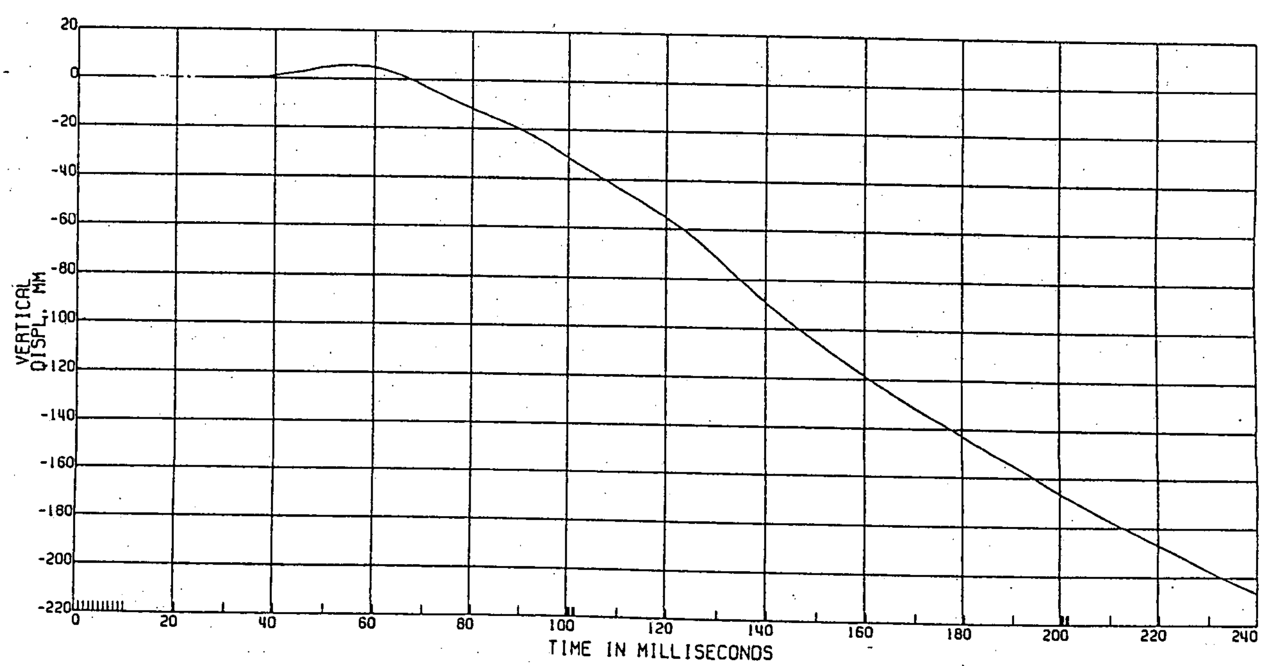
Appendix H, plot # **109**

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN
ELEC DATA, SAE CLASS 180

L.REAR ROCKER DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996

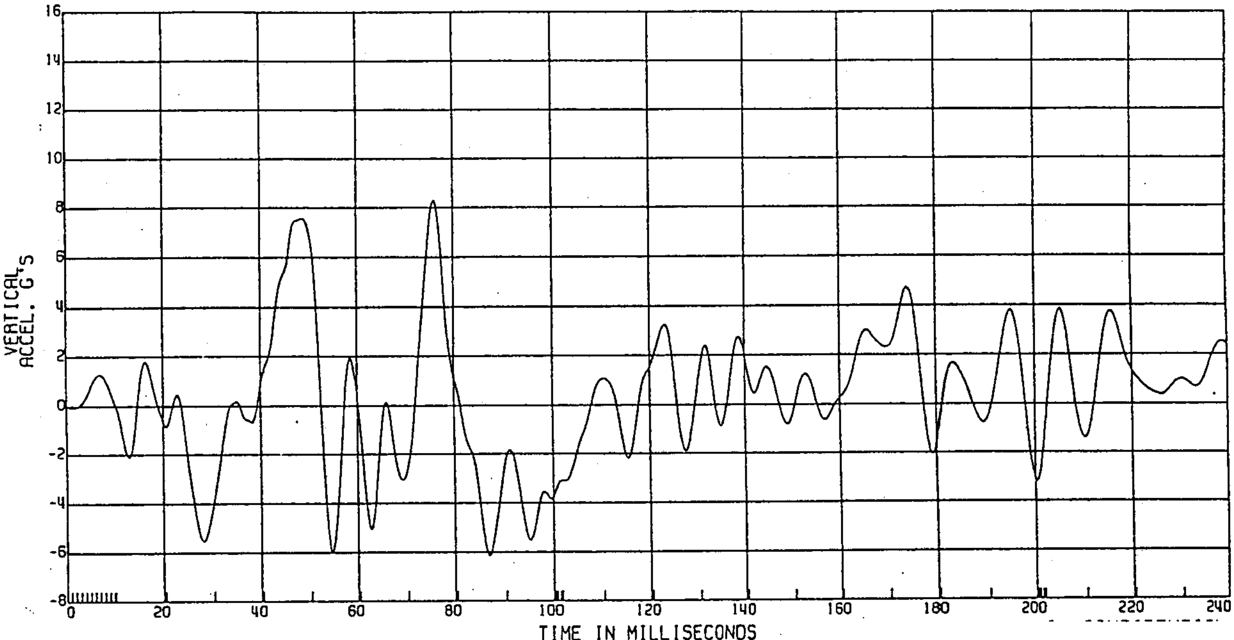


Appendix H, plot # **110**

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN R.REAR ROCKER ACCEL TEST DATE:09/25/1996

ELEC DATA, SAE CLASS 60

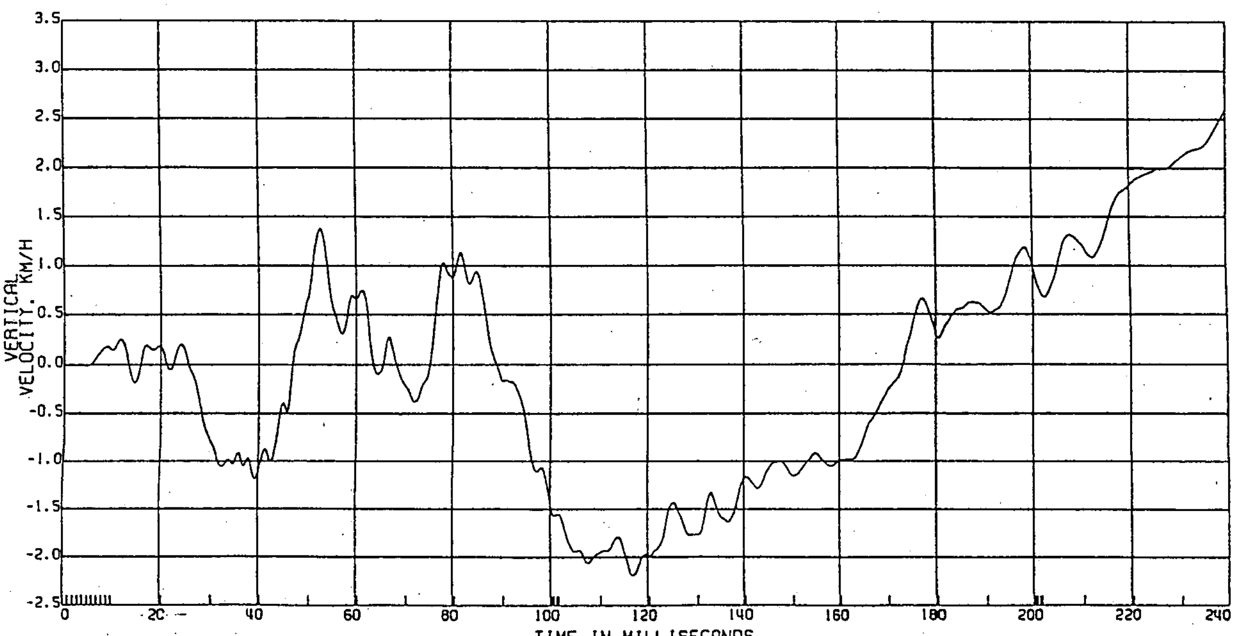


Appendix H, plot # 111

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN R.REAR ROCKER VELOCITY TEST DATE:09/25/1996

ELEC DATA, SAE CLASS 180 (COMPUTED FROM ACCELERATION)



Appendix H, plot # 112

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

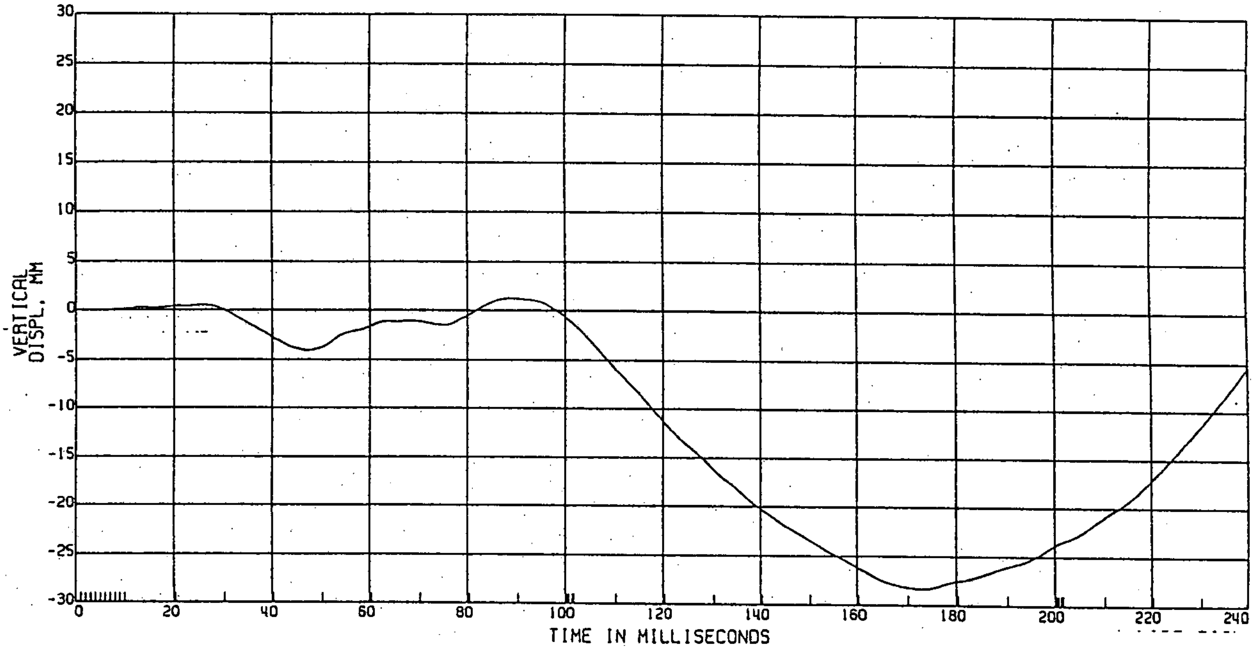
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

R.REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # **113**

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

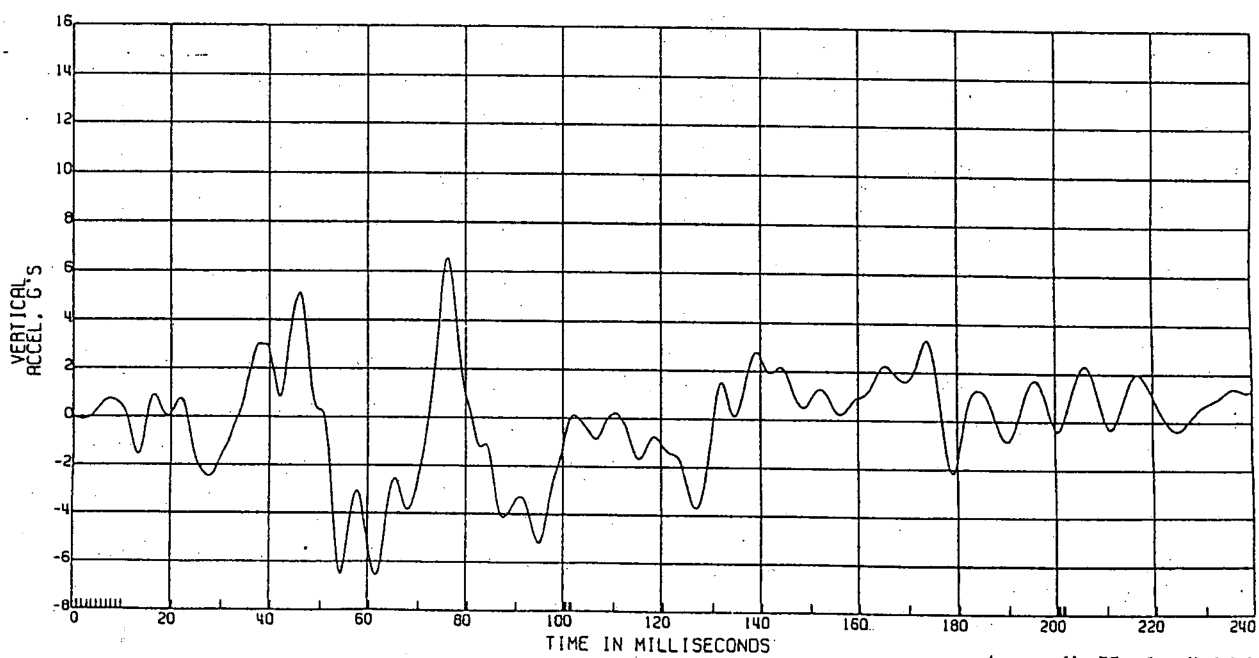
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 60

AVERAGED REAR ROCKER ACCELERATION

(AVGD L. & R. ROCKER ACCELS)

TEST DATE:09/25/1996



Appendix H, plot # **114**

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

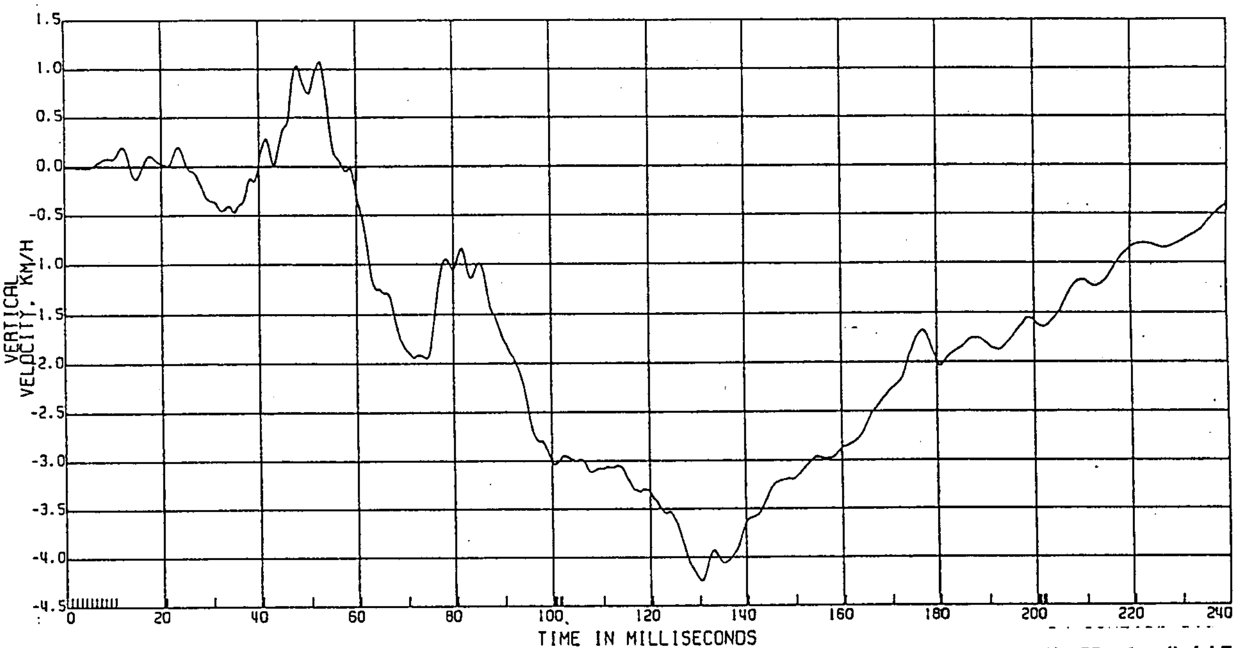
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER VELOCITY

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # **115**

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

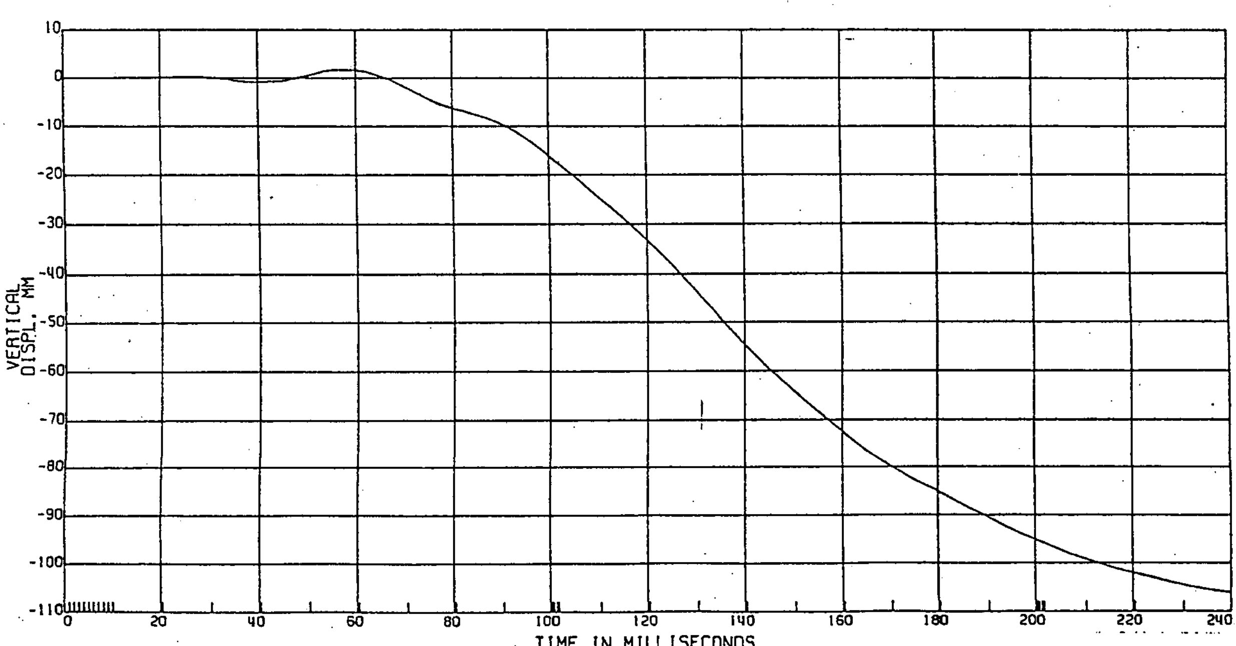
R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 180

AVGD REAR ROCKER DISPL

(COMPUTED FROM ACCELERATION)

TEST DATE:09/25/1996



Appendix H, plot # **116**

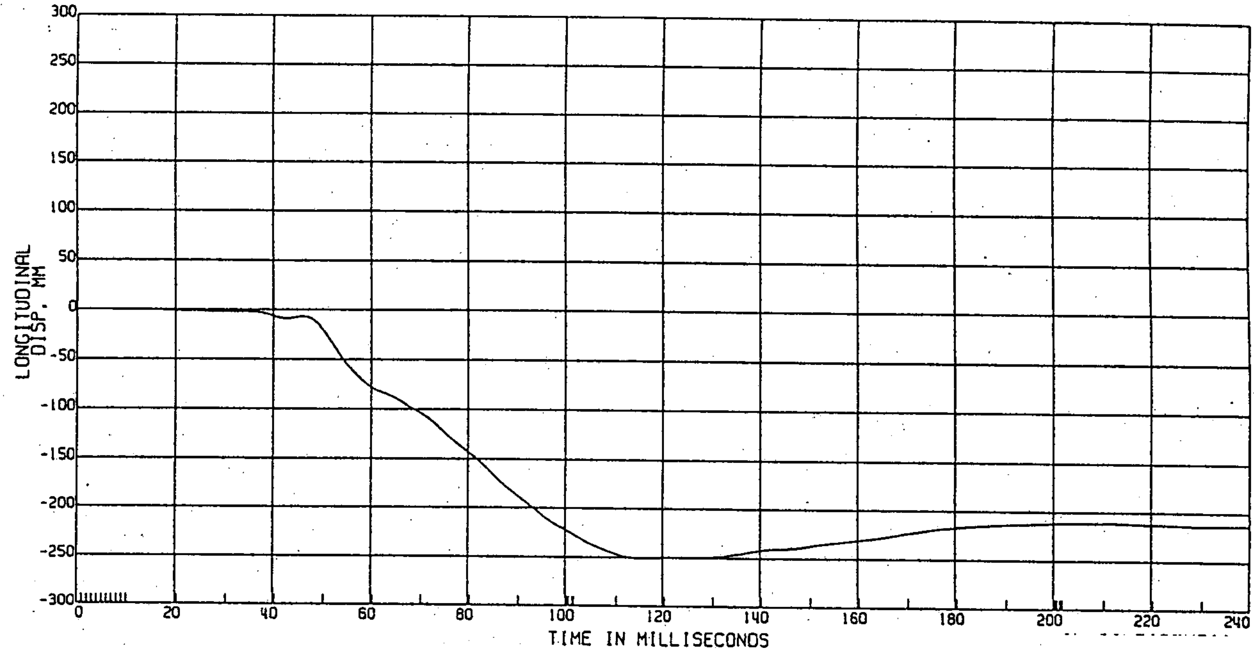
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN

R. TOE PAN DISPL

ELEC DATA, SAE CLASS 60

TEST DATE:09/25/1996



Appendix H, plot # 117

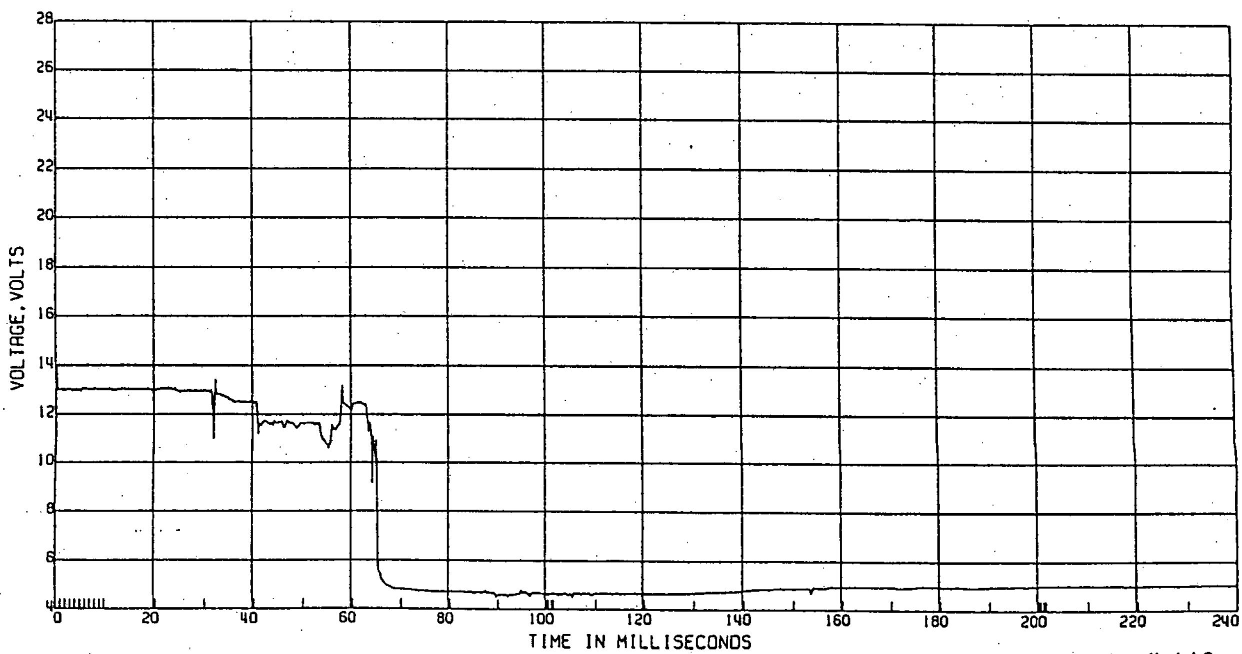
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN

IGNITION VOLTAGE

ELEC DATA, SAE CLASS 1000

TEST DATE:09/25/1996



Appendix H, plot # 118

C11279 FRONT IMPACT

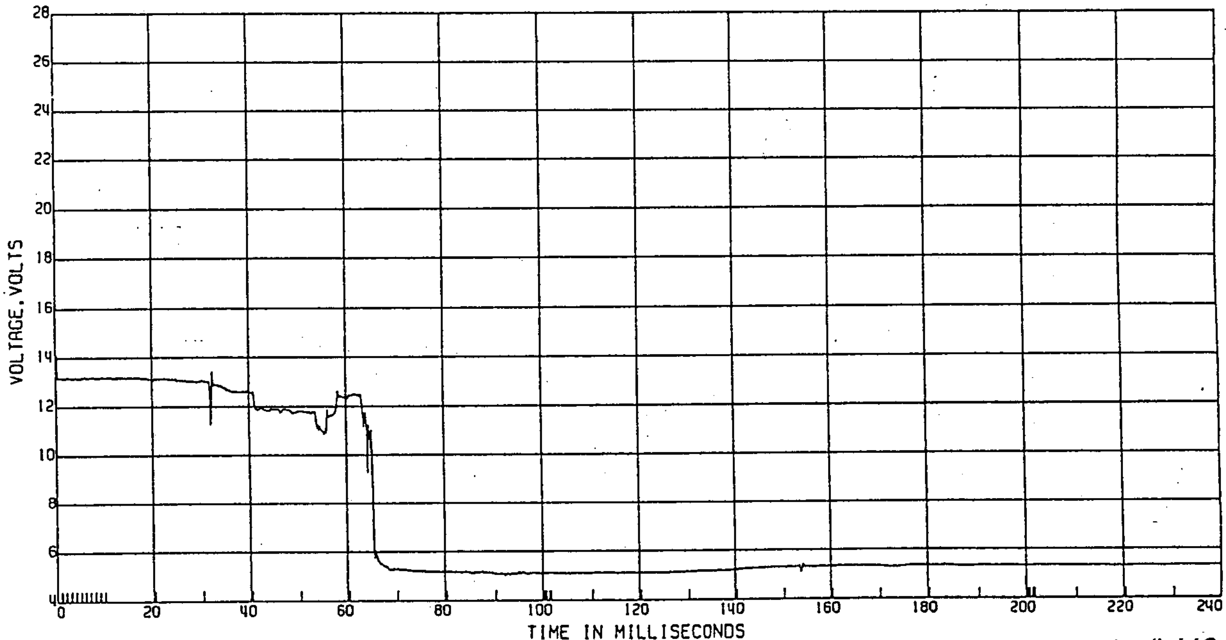
MOVING VEHICLE TO FIXED POLE 55.4KM/H

STARTER VOLTAGE

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

TEST DATE:09/25/1996



Appendix H, plot # **119**

C11279 FRONT IMPACT

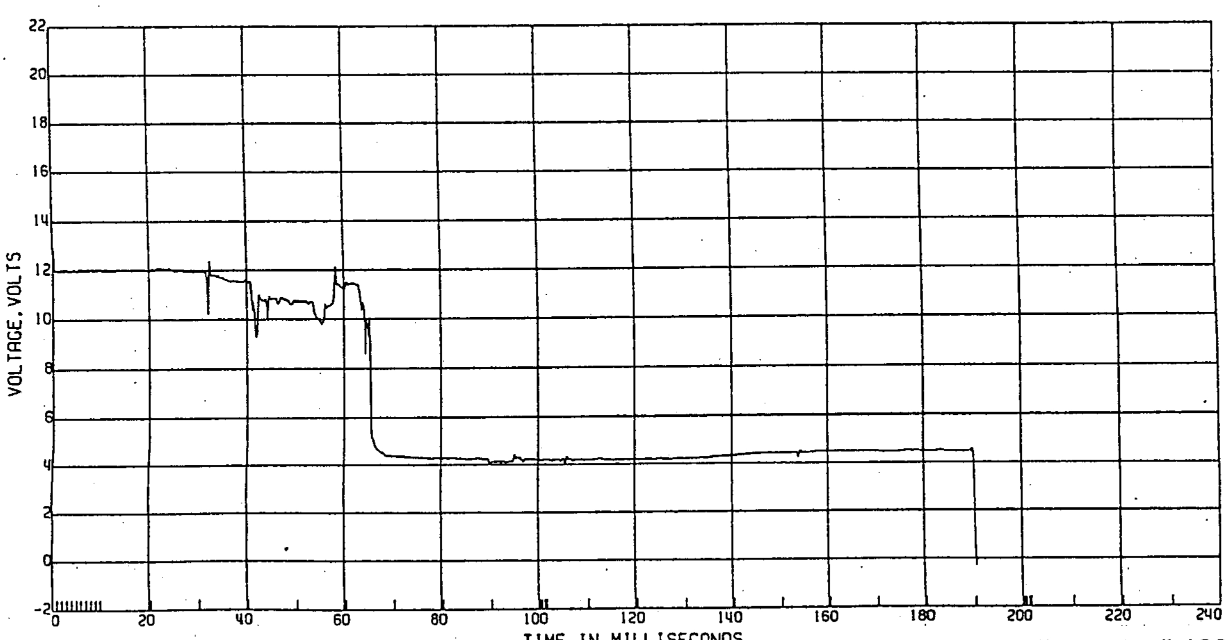
MOVING VEHICLE TO FIXED POLE 55.4KM/H

R. FRT HEADLIGHT-HI BEAM VOLTAGE

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

TEST DATE:09/25/1996



Appendix H, plot # **120**

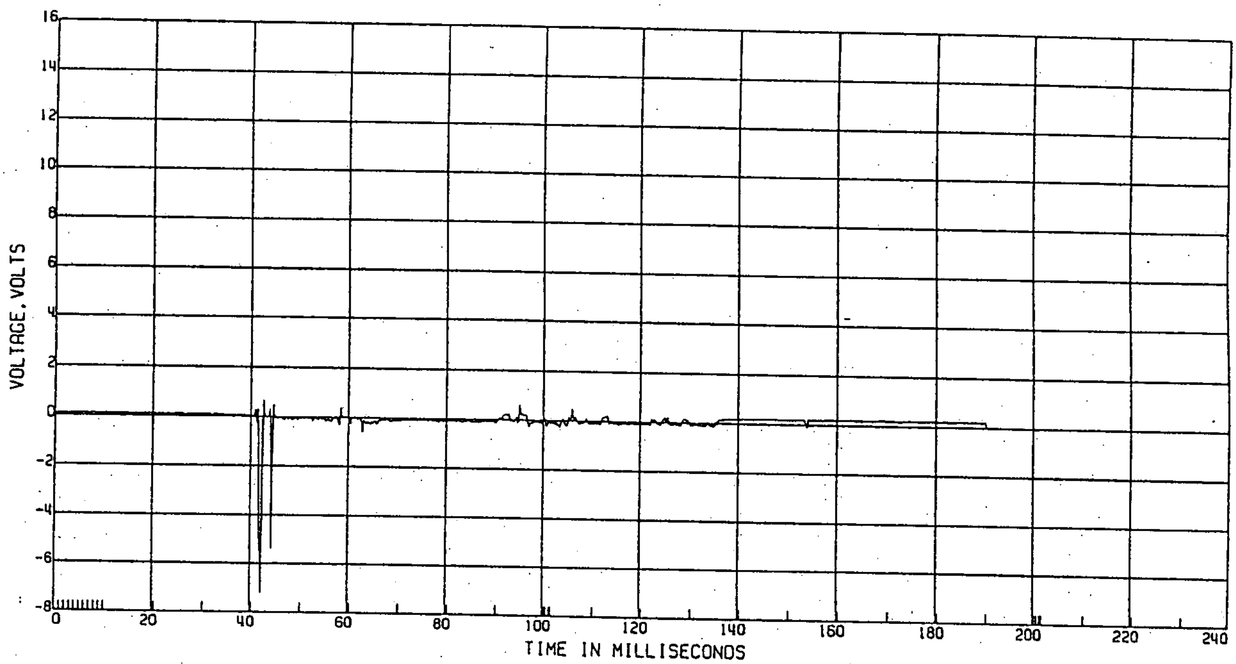
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

R. FRT HEADLIGHT-LO BEAM VOLTAGE

TEST DATE:09/25/1996



Appendix H, plot # 121

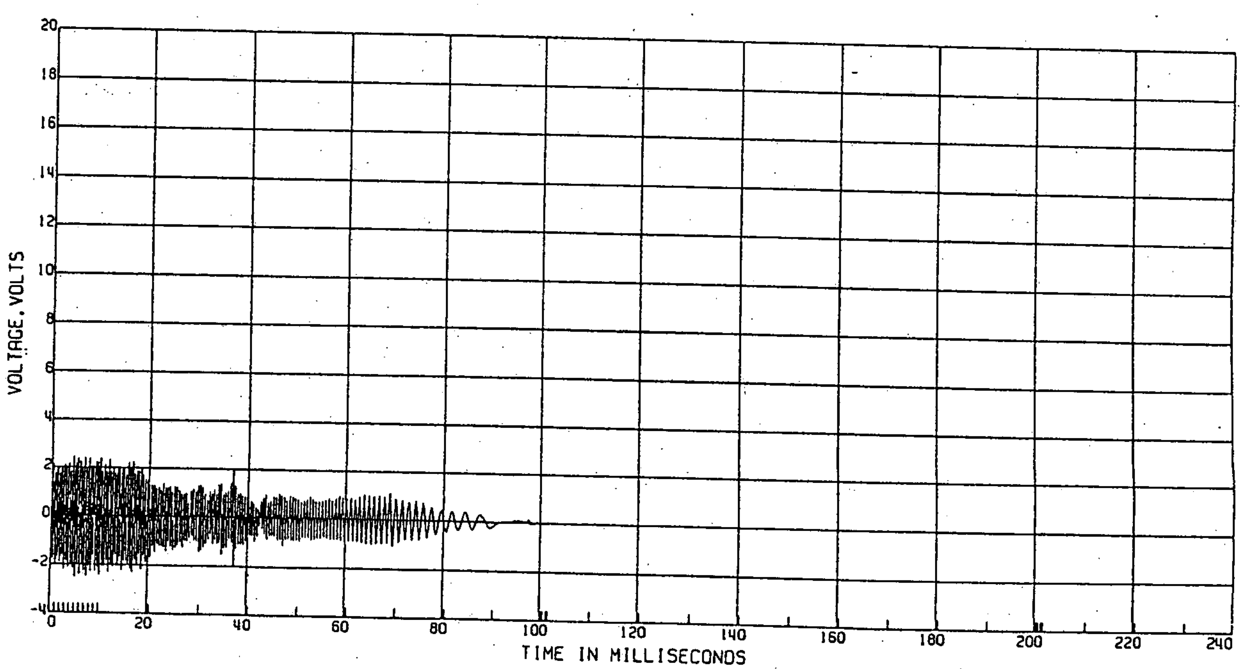
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

ENGINE MOTION VOLTAGE

TEST DATE:09/25/1996



Appendix H, plot # 122

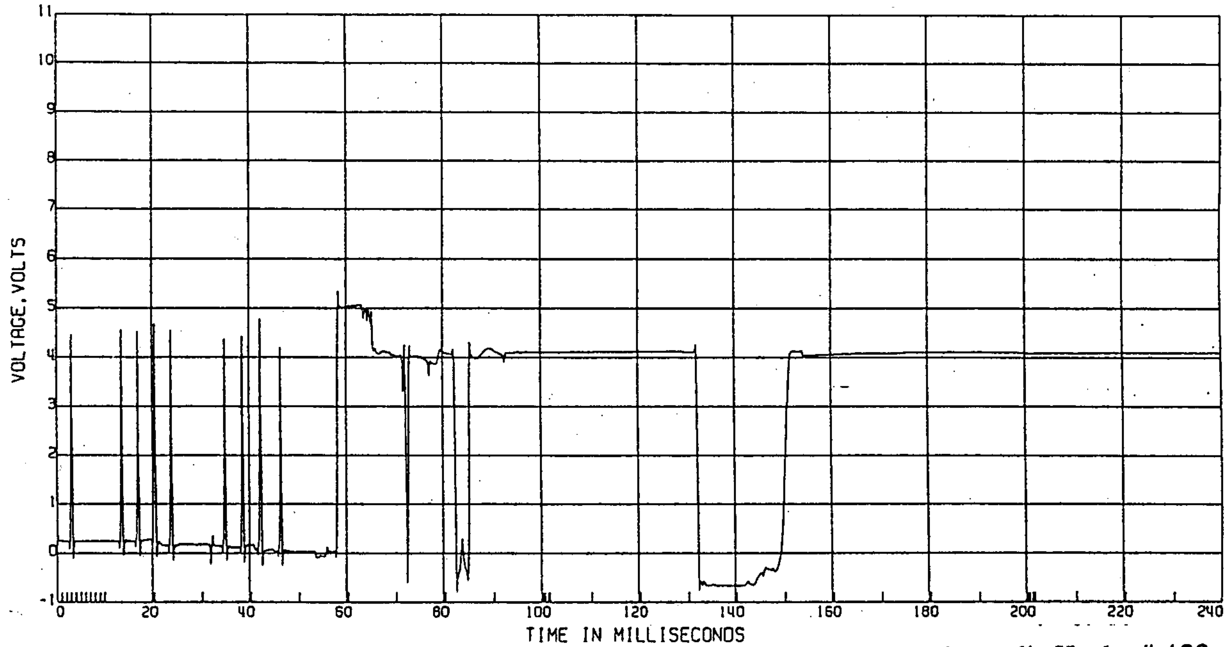
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

ENGINE RPM VOLTAGE

TEST DATE:09/25/1996



Appendix H, plot # 123

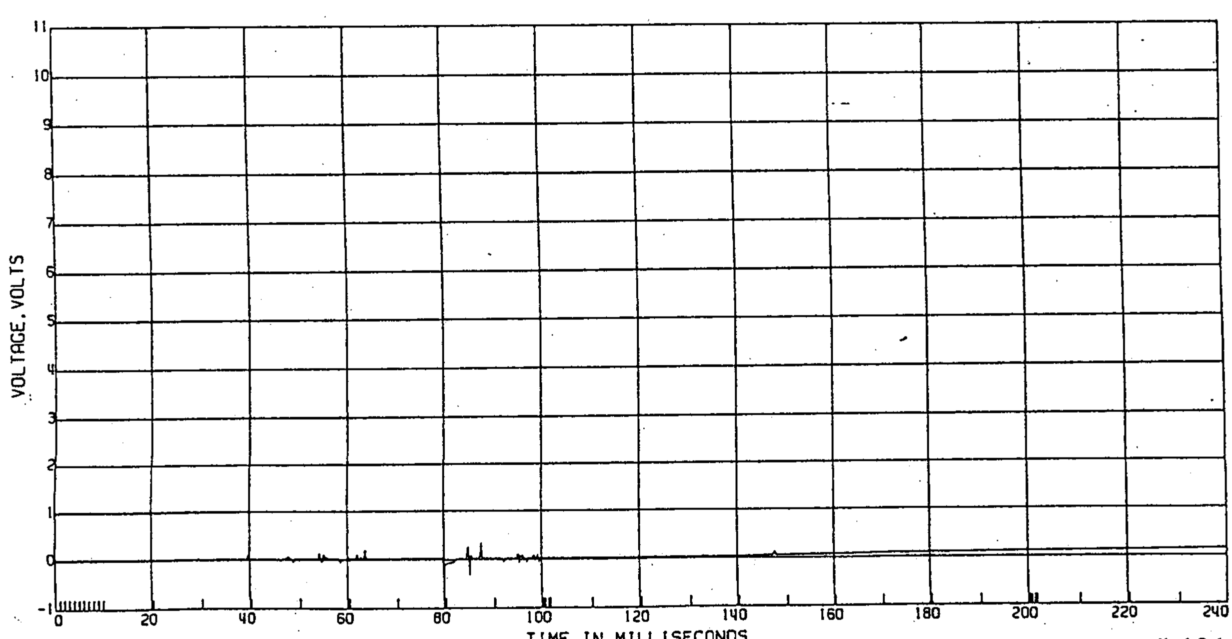
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

L. UPPER ENGINE VAPOR SENSOR VOLTAGE

TEST DATE:09/25/1996

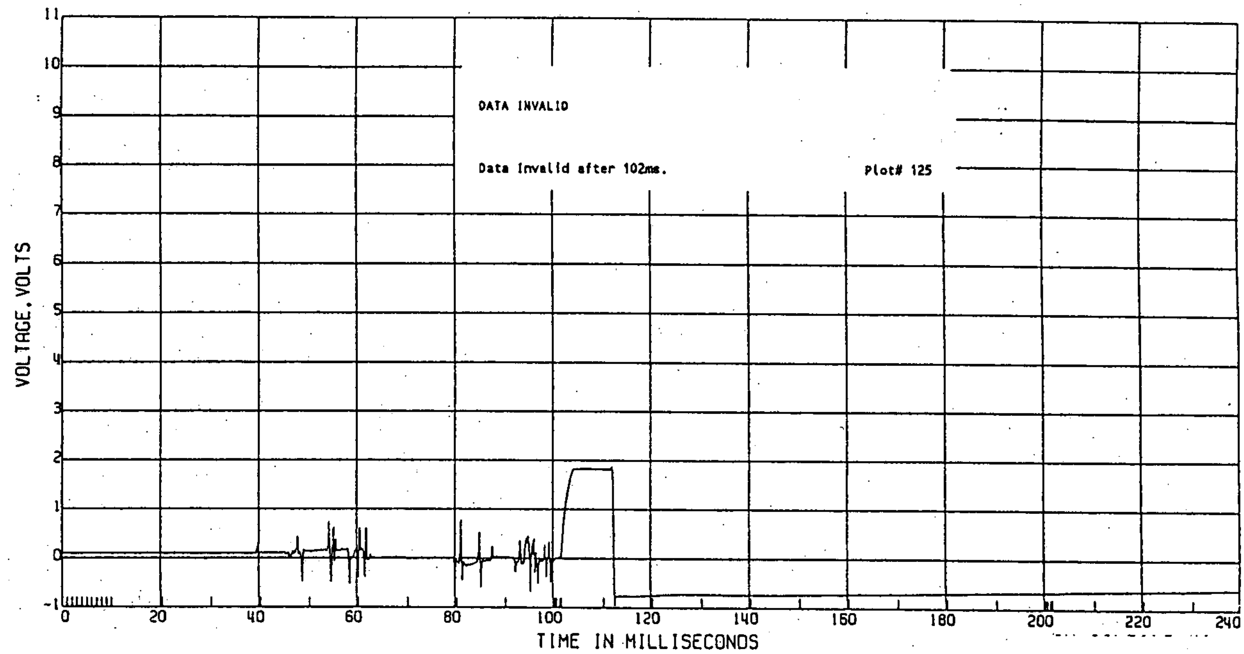


Appendix H, plot # 124

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN R. UPPER ENGINE VAPOR SENSOR VOLTAGE TEST DATE:09/25/1996

ELEC DATA, SAE CLASS 1000

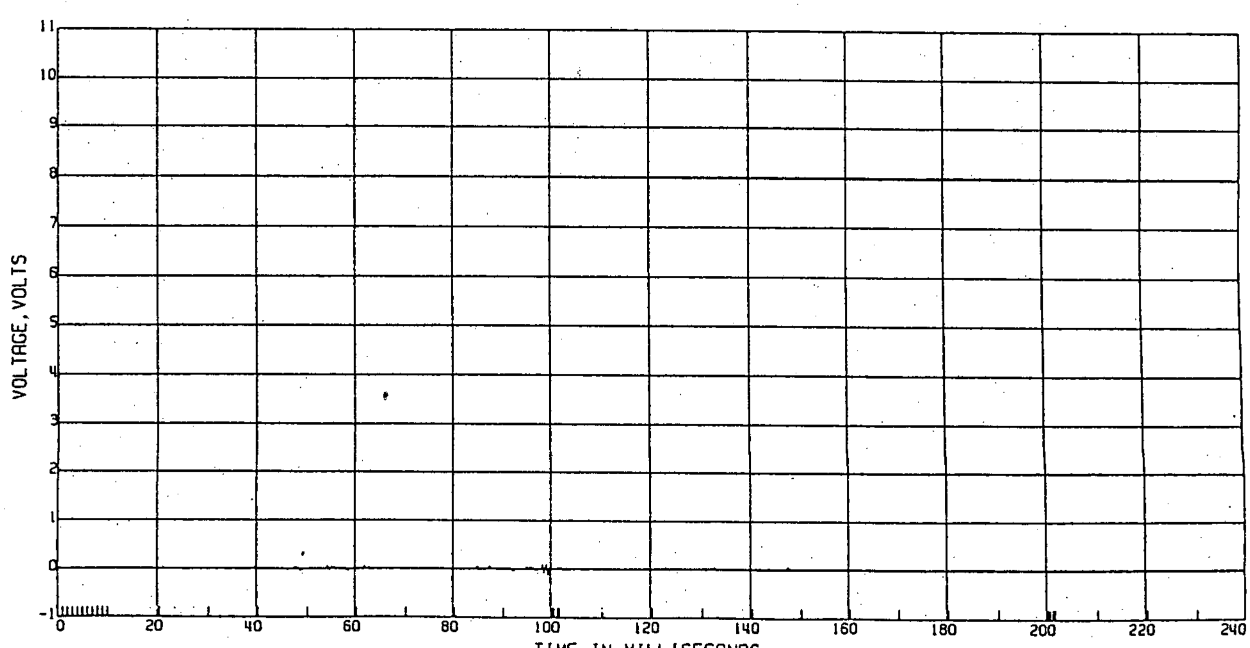


Appendix H, plot # 125

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN L. LOWER ENGINE VAPOR SENSOR VOLTAGE TEST DATE:09/25/1996

ELEC DATA, SAE CLASS 1000



Appendix H, plot # 126

C11279 FRONT IMPACT

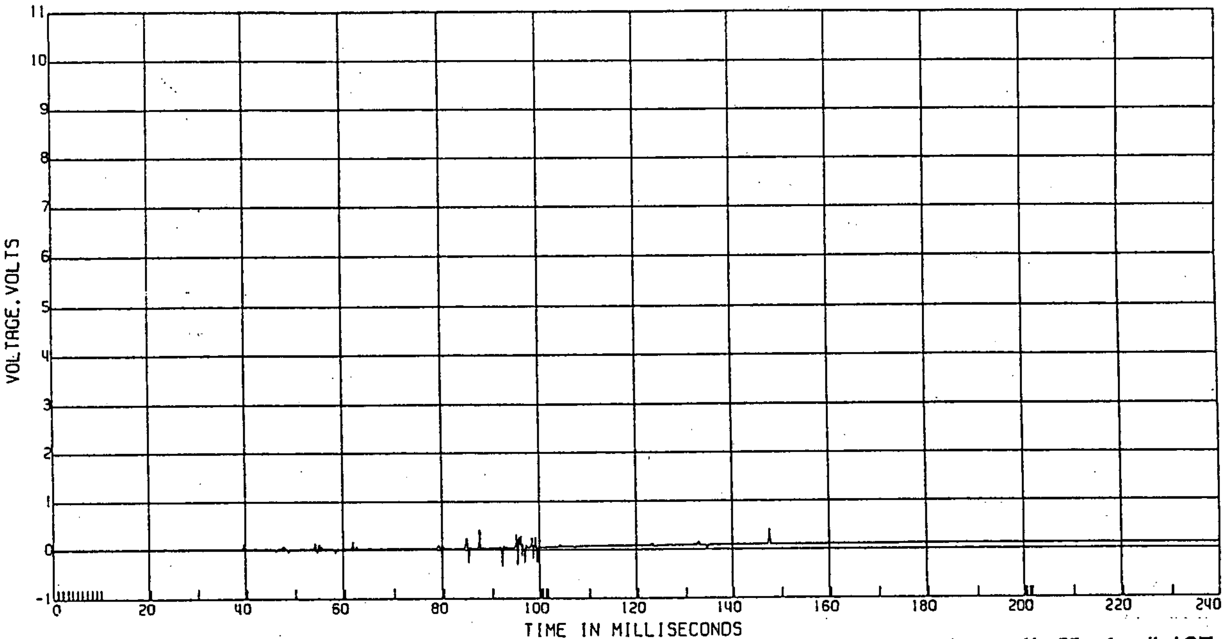
MOVING VEHICLE TO FIXED POLE 55.4KM/H

R. LOWER ENGINE VAPOR SENSOR VOLTAGE

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

TEST DATE:09/25/1996



Appendix H, plot # 127

C11279 FRONT IMPACT

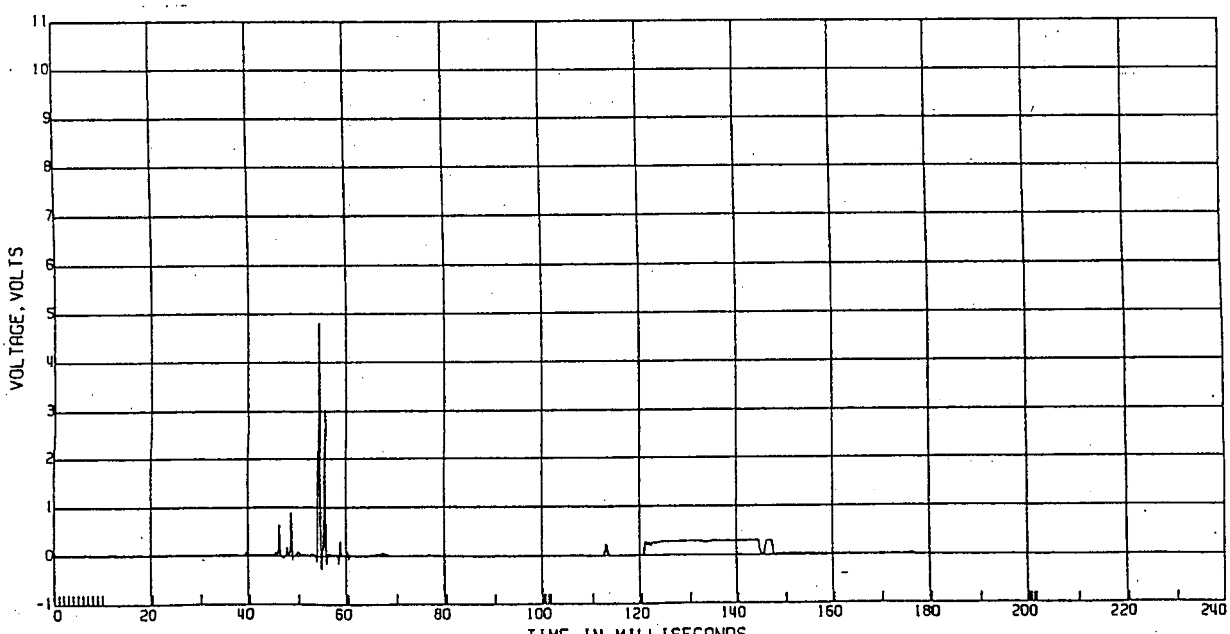
MOVING VEHICLE TO FIXED POLE 55.4KM/H

MANIFOLD VAPOR SENSOR VOLTAGE

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

TEST DATE:09/25/1996



Appendix H, plot # 128

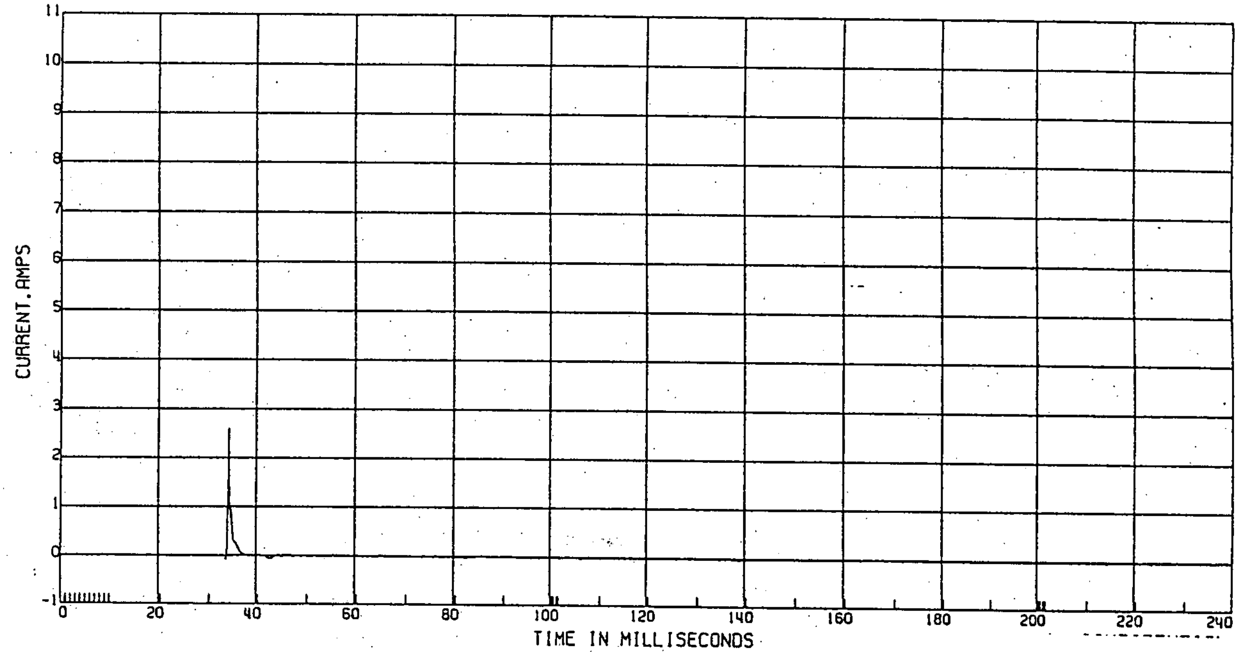
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

L. WHEEL BAG CURRENT

TEST DATE:09/25/1996



Appendix H, plot # 129

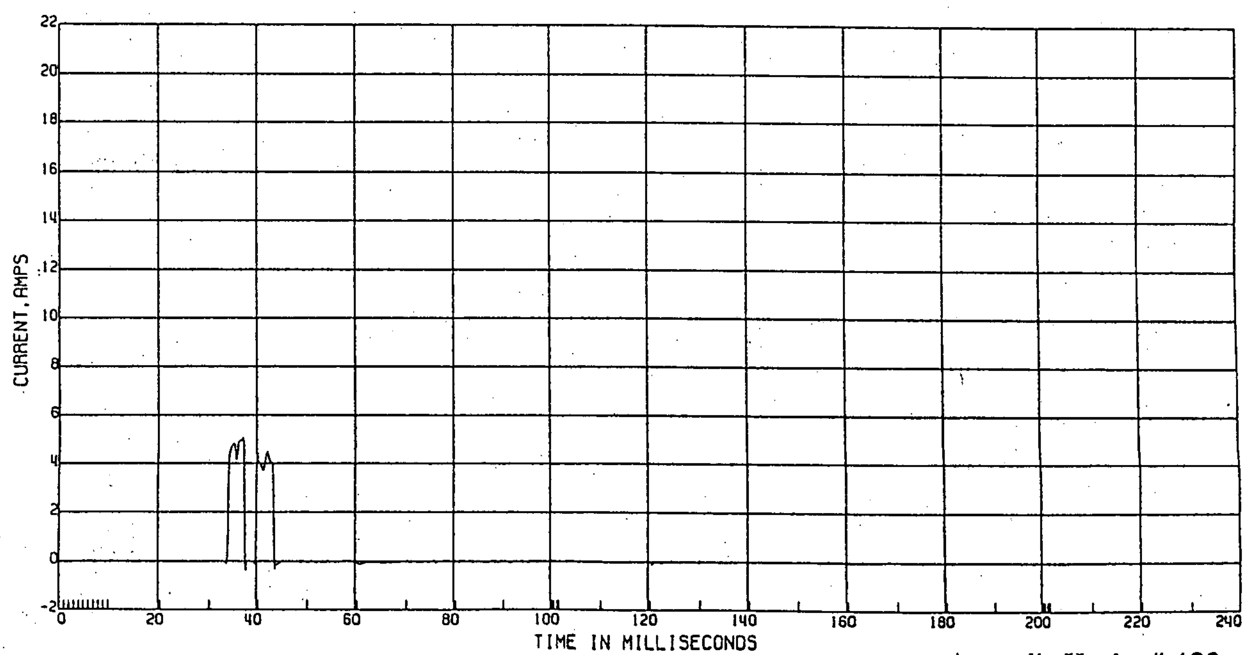
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

R. I/P BAG CURRENT

TEST DATE:09/25/1996



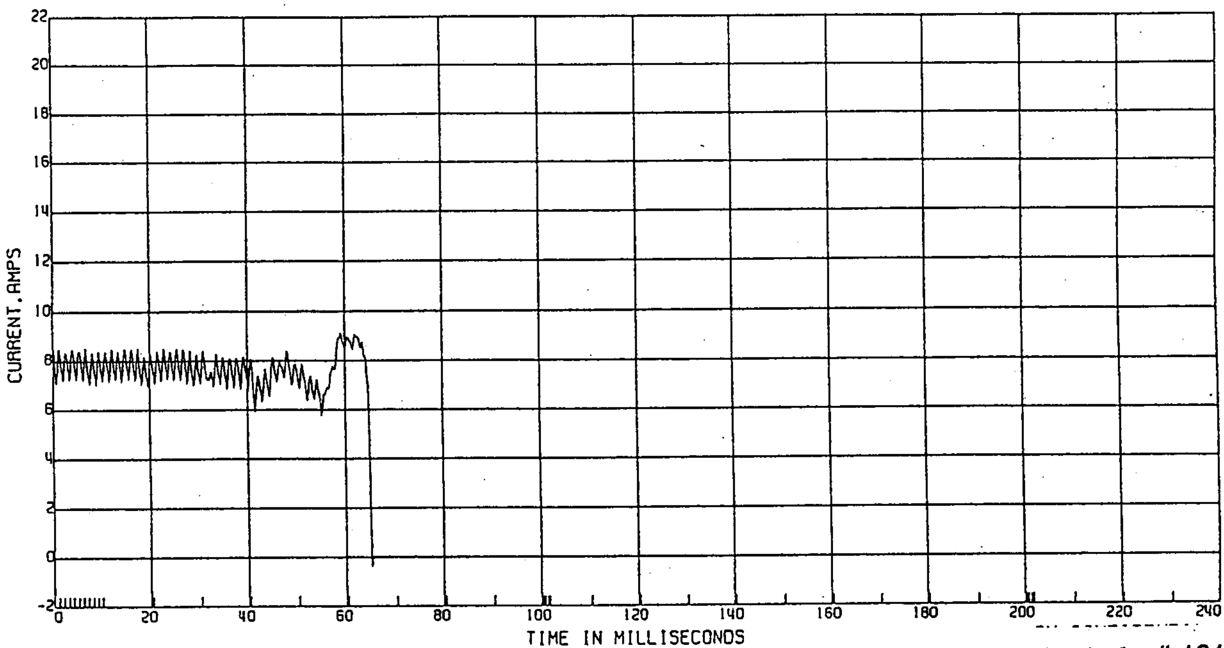
Appendix H, plot # 130

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

FUEL PUMP CURRENT

R & D CTR 8T93080 VAN TEST DATE:09/25/1996

ELEC DATA, SAE CLASS 1000



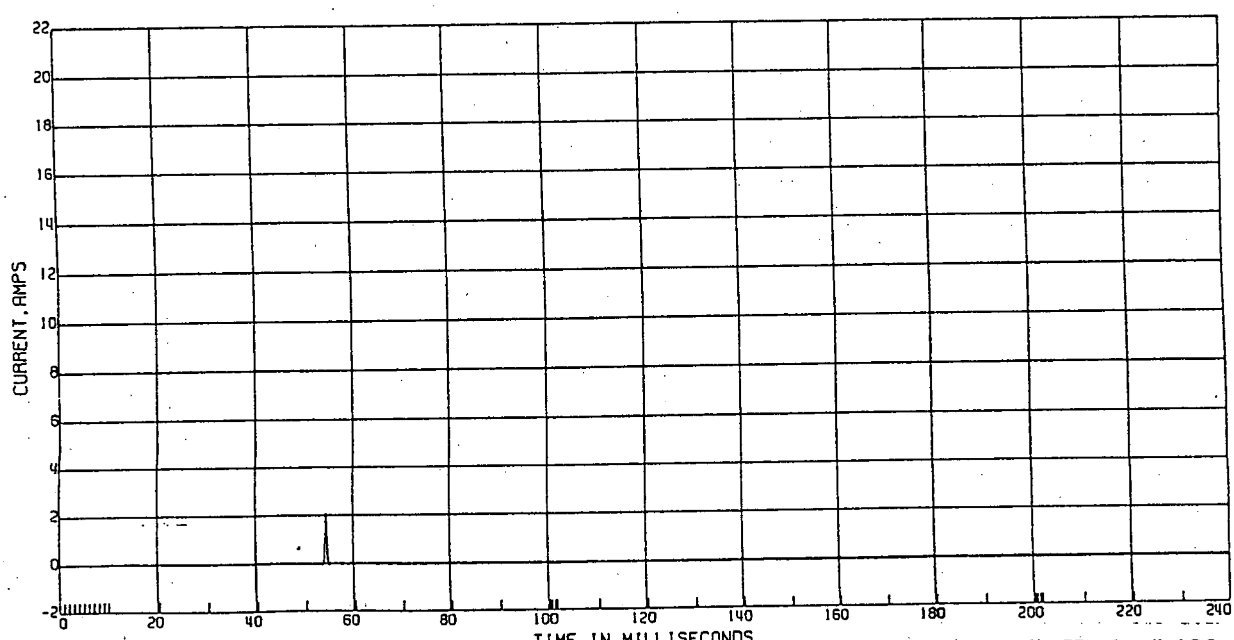
Appendix H, plot # **131**

C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

L. HORN CURRENT

R & D CTR 8T93080 VAN TEST DATE:09/25/1996

ELEC DATA, SAE CLASS 1000



Appendix H, plot # **132**

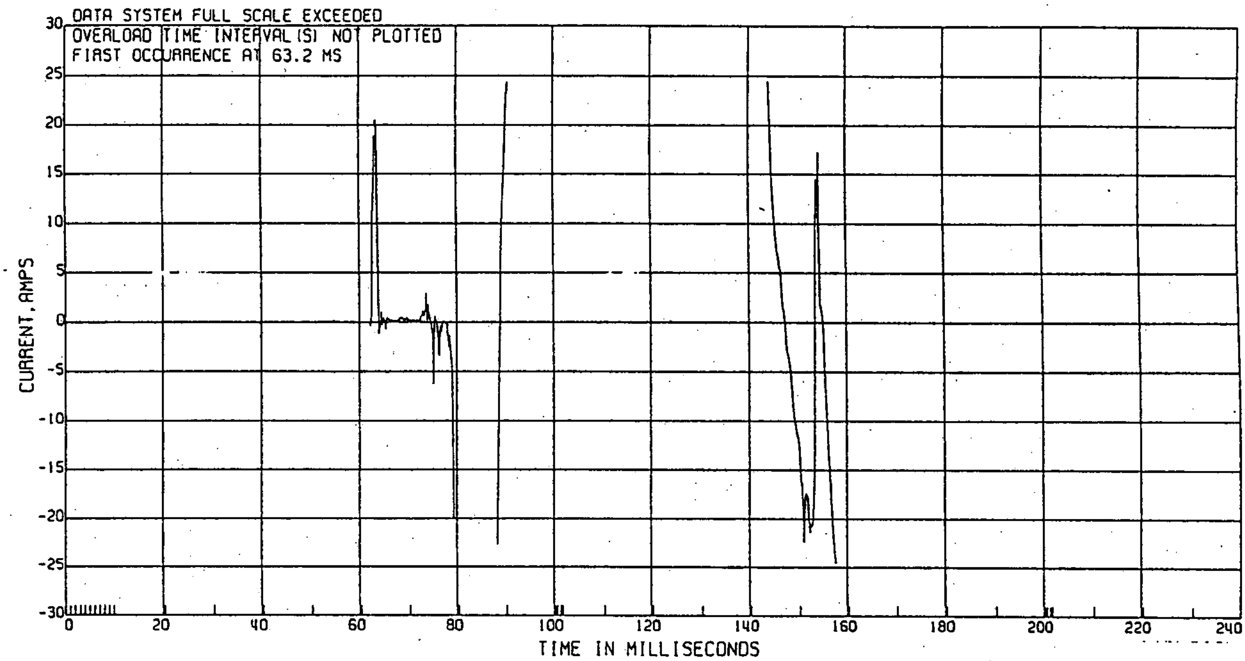
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

A/C CLUTCH CURRENT

TEST DATE:09/25/1996



Appendix H, plot # 133

133

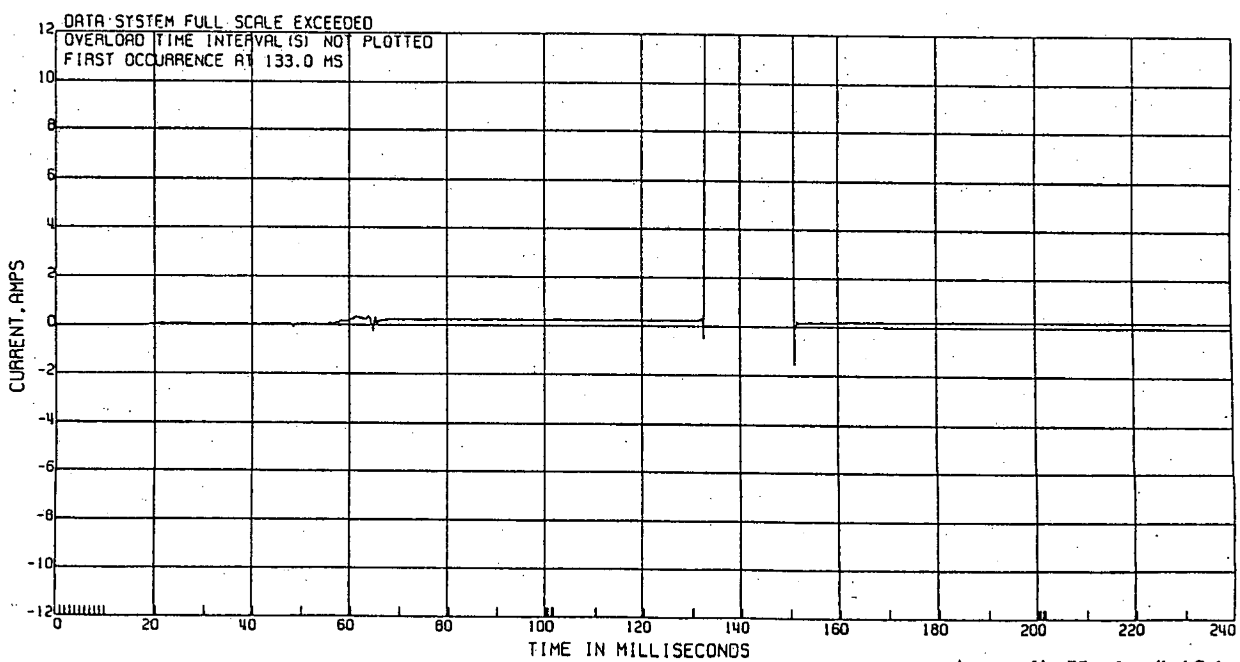
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

COOLING FAN CURRENT

TEST DATE:09/25/1996



Appendix H, plot # 134

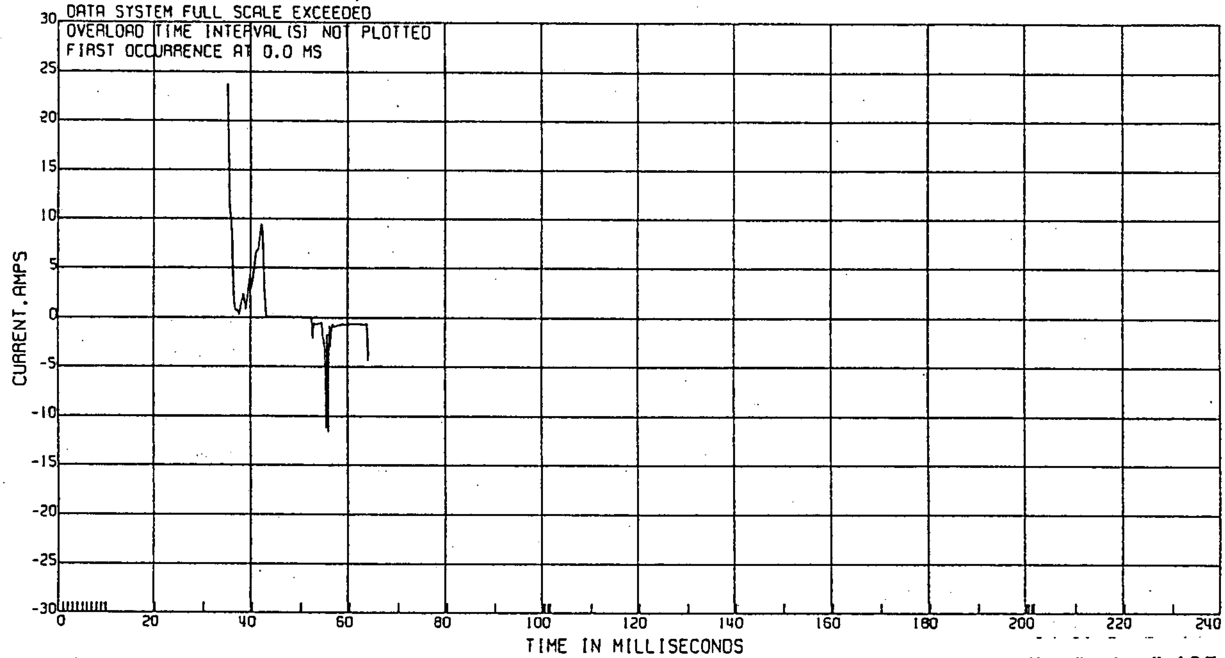
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

FUSABLE LINK CURRENT

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

TEST DATE:09/25/1996



Appendix H, plot # 135

135

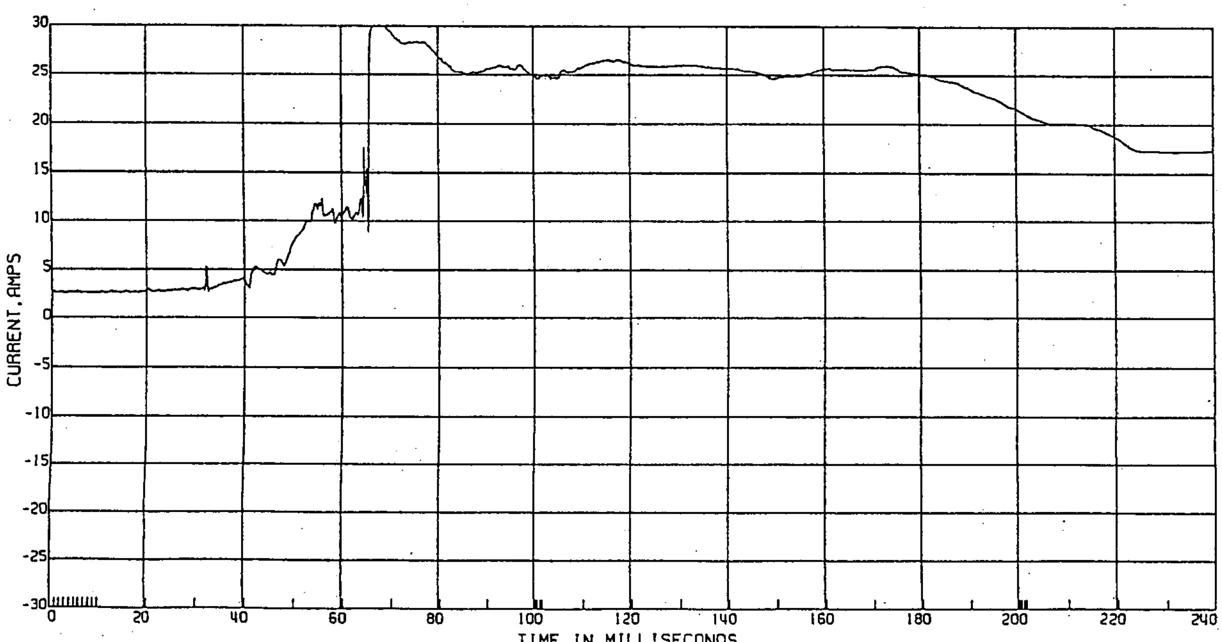
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

STARTER WIRE CURRENT

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

TEST DATE:09/25/1996



Appendix H, plot # 136

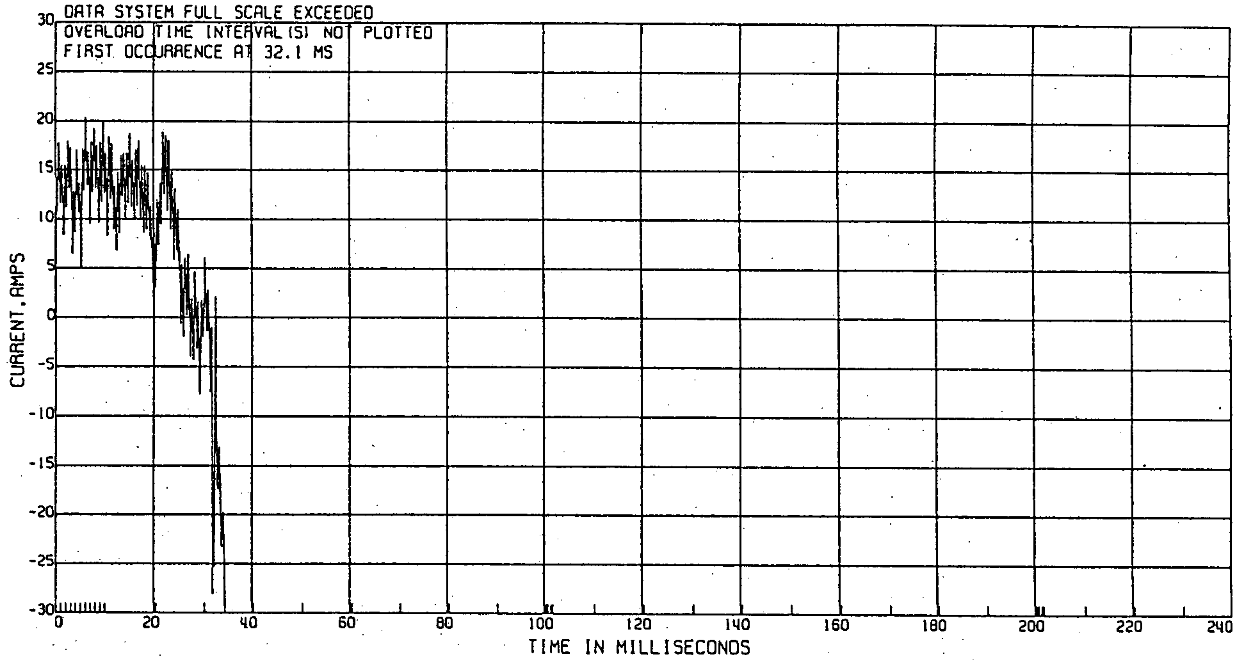
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

MAIN BATTERY CURRENT

TEST DATE:09/25/1996



Appendix H, plot # **137**

137

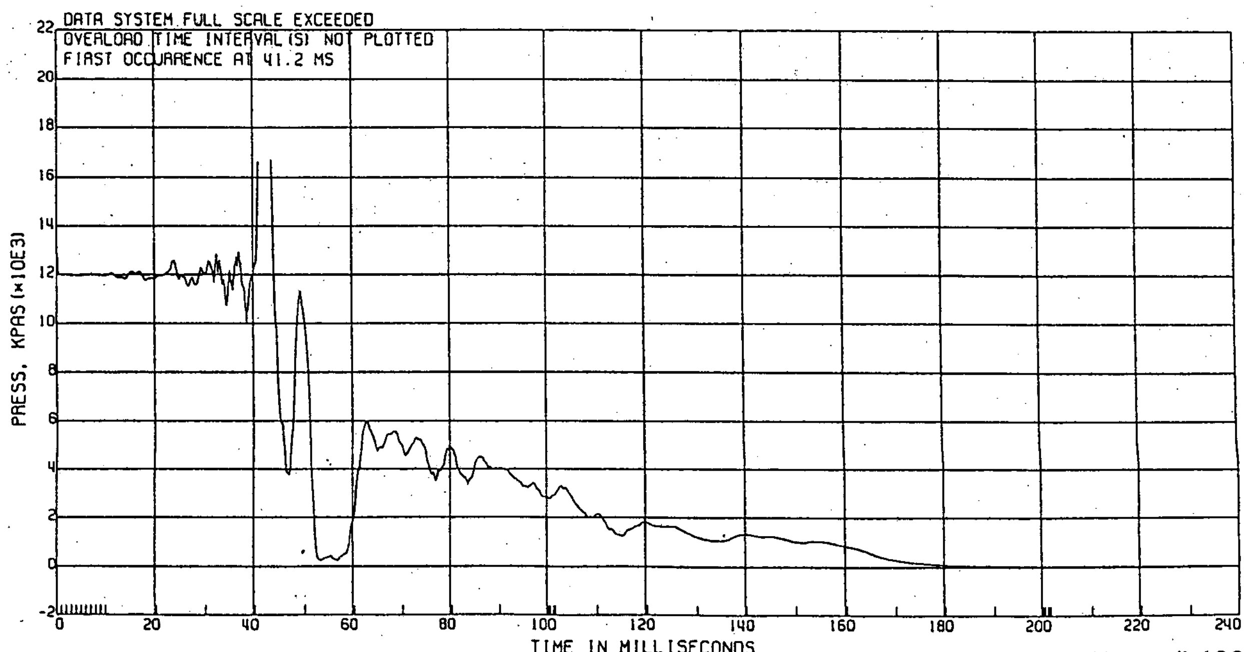
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

R. FRT BRAKE SYSTEM PRESSURE

TEST DATE:09/25/1996



Appendix H, plot # **138**

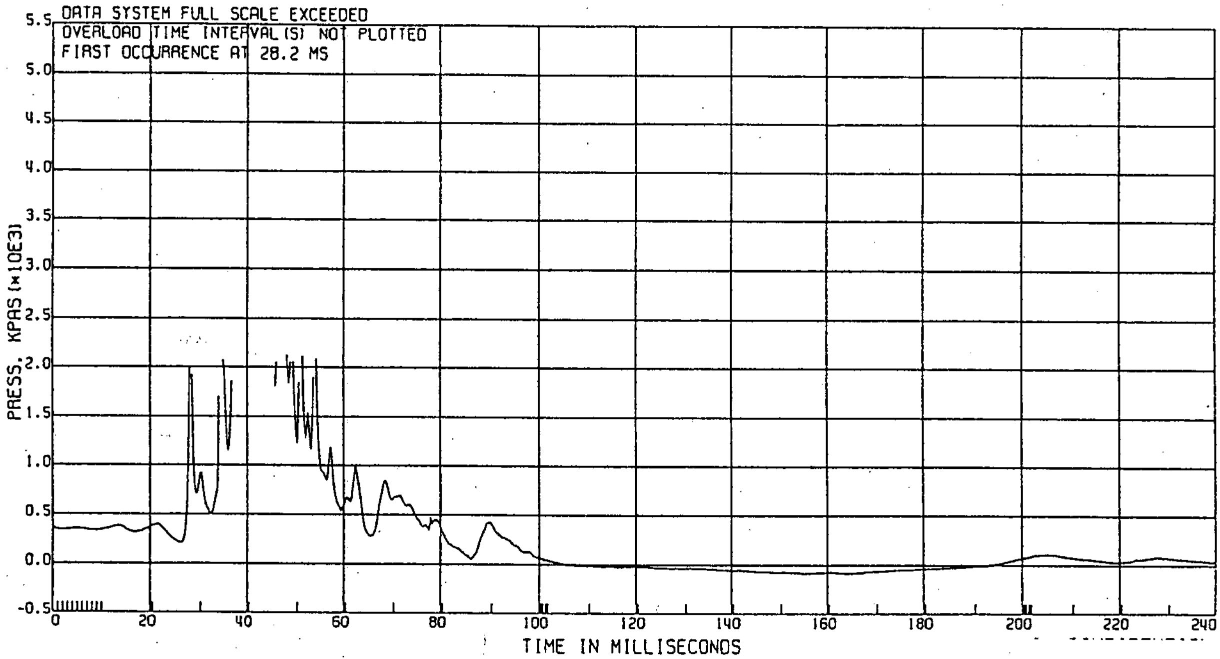
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN

ELEC DATA, SAE CLASS 1000

POWER STEERING SYSTEM PRESSURE

TEST DATE:09/25/1996



Appendix H, plot # 139

139

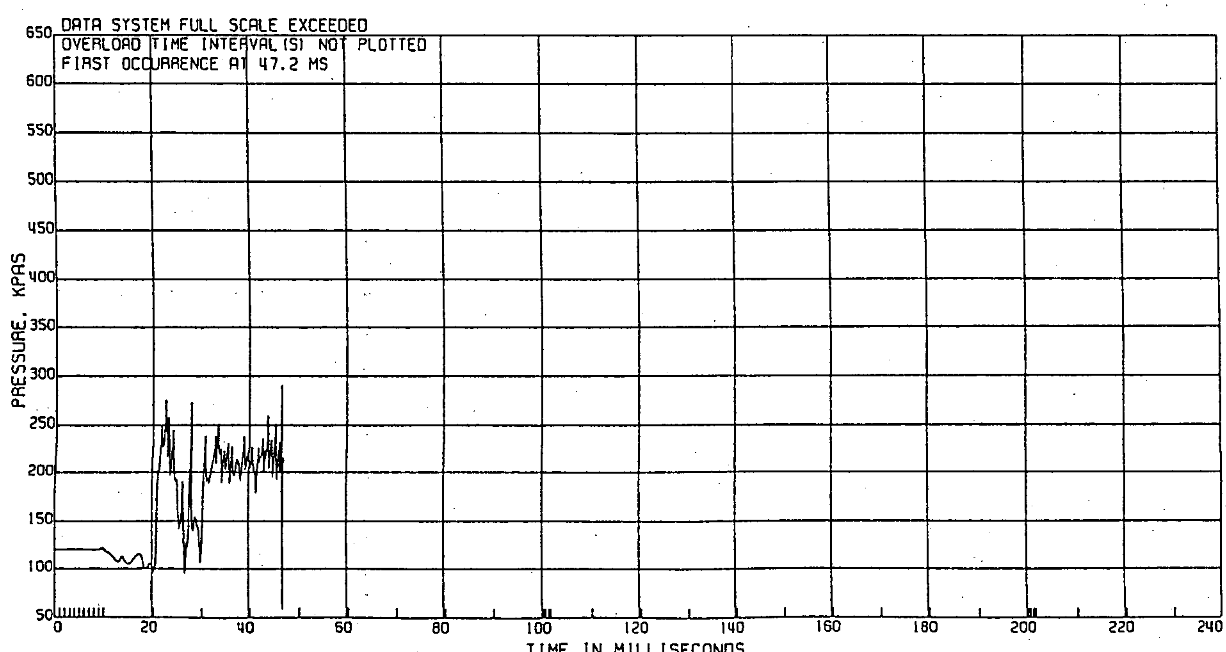
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN

ELEC DATA, SAE CLASS 1000

COOLING SYSTEM PRESSURE

TEST DATE:09/25/1996



Appendix H, plot # 140

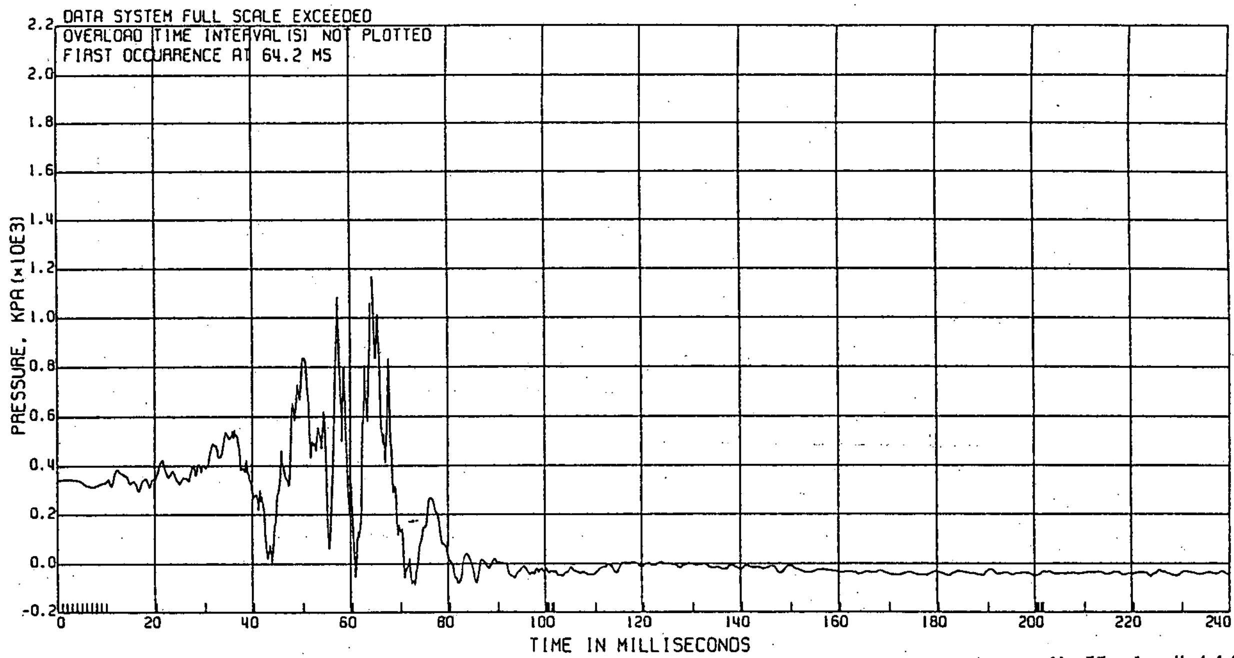
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

AUXILIARY FUEL TANK PRESSURE

TEST DATE:09/25/1996



Appendix H, plot # **141**

141

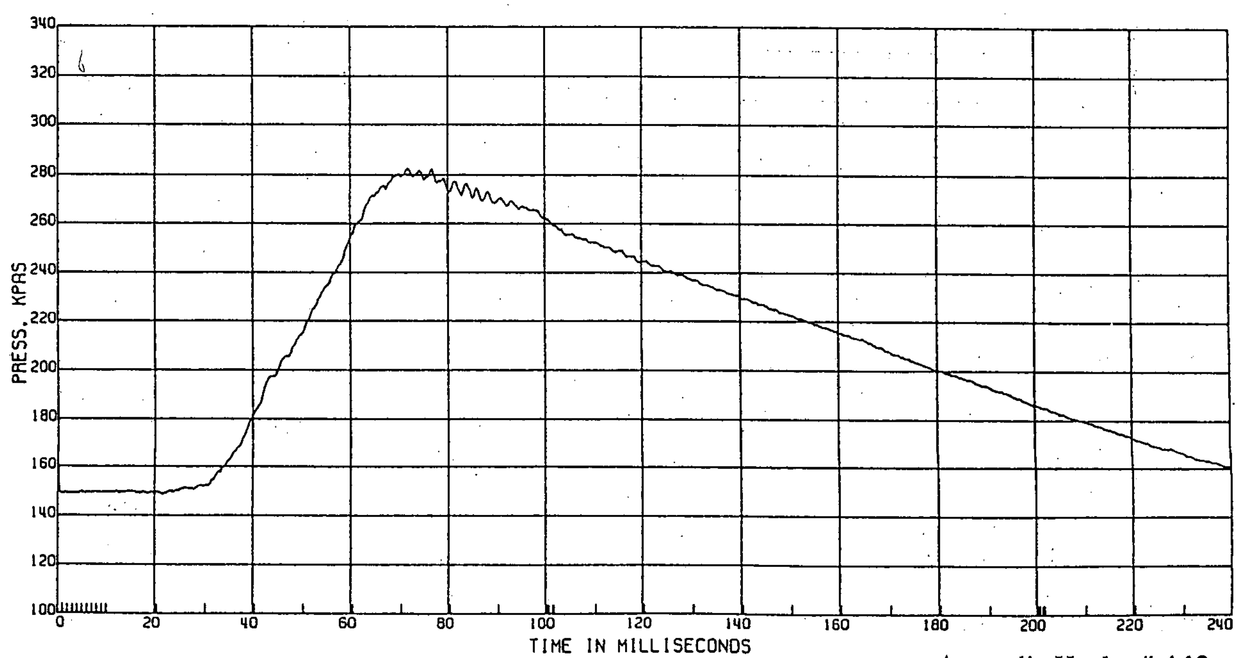
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

ENGINE OIL PRESSURE

TEST DATE:09/25/1996



Appendix H, plot # **142**

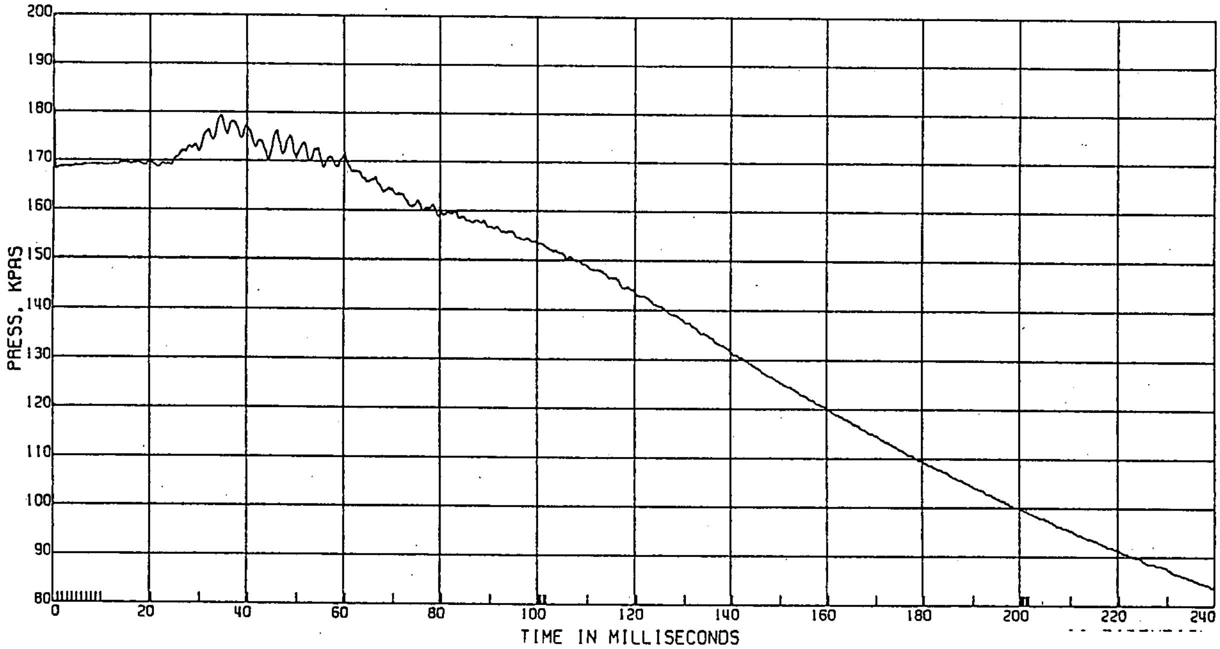
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

TRANSMISSION FLUID PRESSURE

TEST DATE:09/25/1996



Appendix H, plot # 143

143

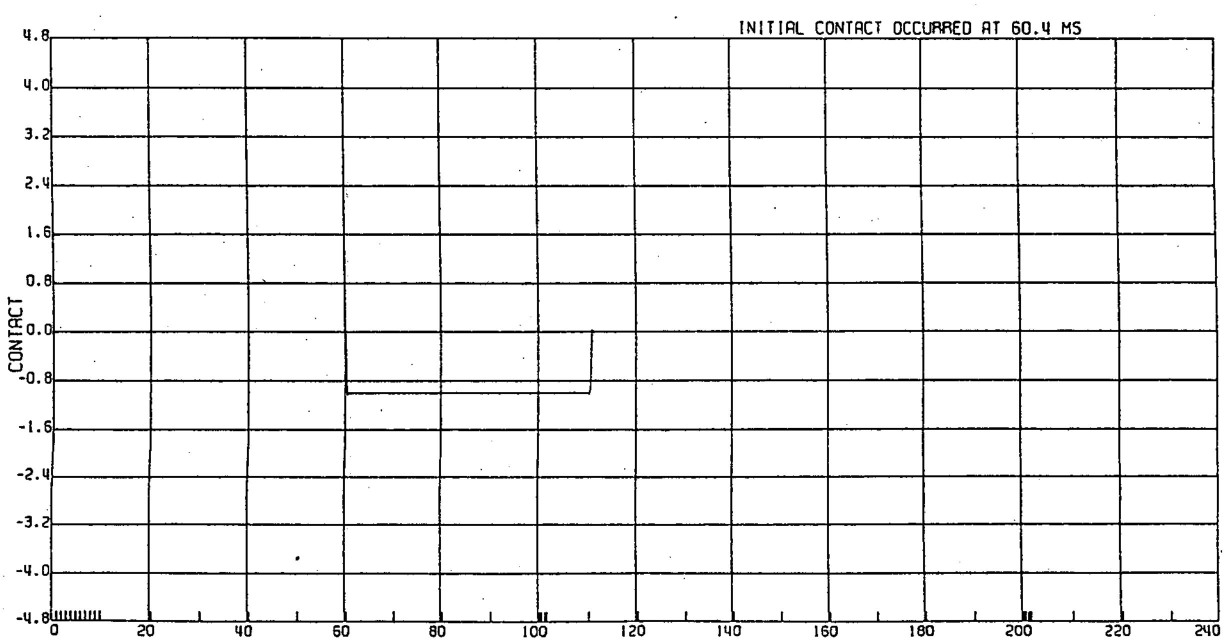
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T93080 VAN

ELEC DATA, SAE CLASS 1000

THERMAL WIRE CONTACT

TEST DATE:09/25/1996



Appendix H, plot # 144

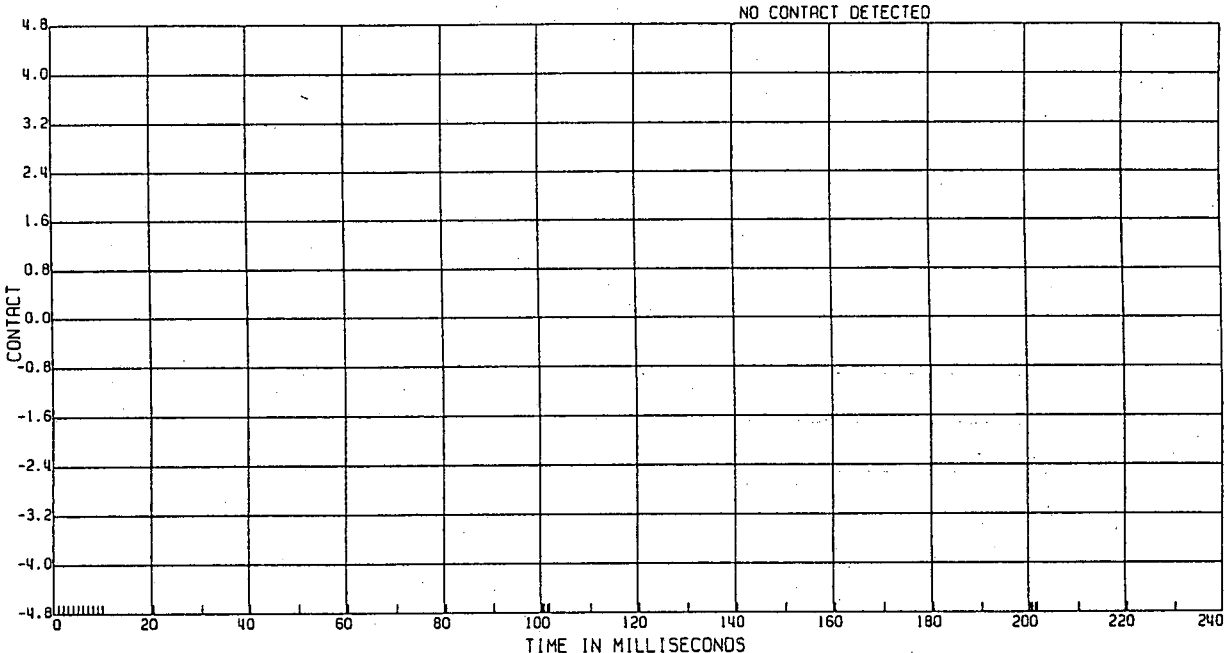
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN

ELEC DATA, SAE CLASS 1000

PNEUMATIC WIRE CONTACT

TEST DATE:09/25/1996



Appendix H, plot # 145

145

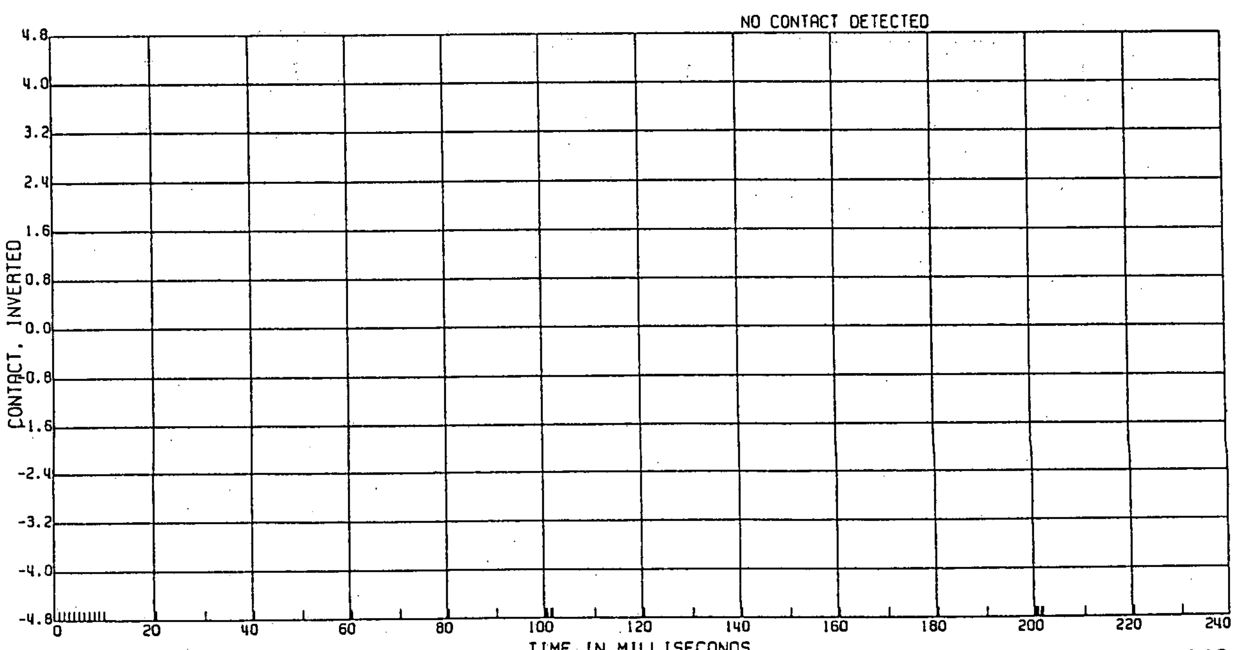
C11279 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.4KM/H

R & D CTR 8T9308D VAN

ELEC DATA, SAE CLASS 1000

PNEUMATIC WIRE FAULT CONTACT

TEST DATE:09/25/1996



Appendix H, plot # 146

Appendix I: C11279 hydrocarbon vapor measurement plots

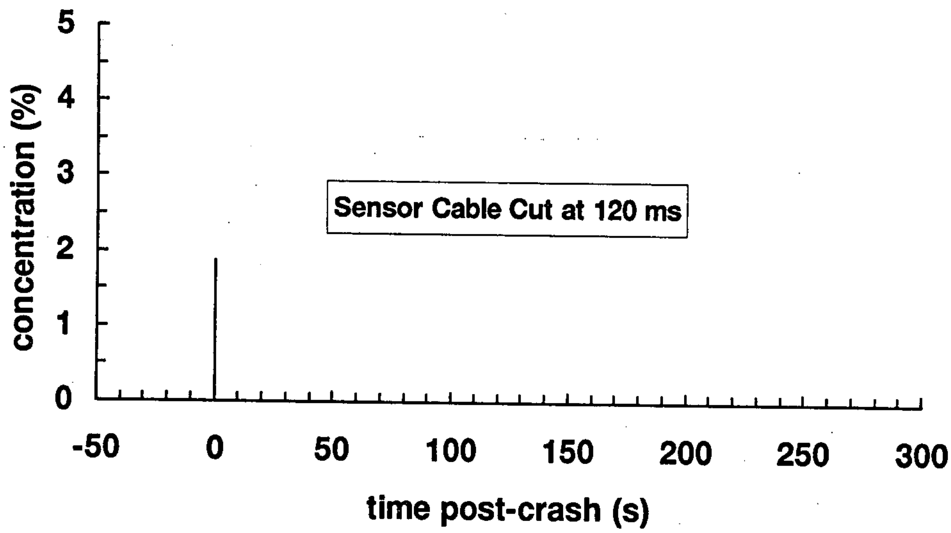


Figure I1

Concentration of Hydrocarbon Vapor Measured at Left Upper Engine (Location #1)

Test C11279

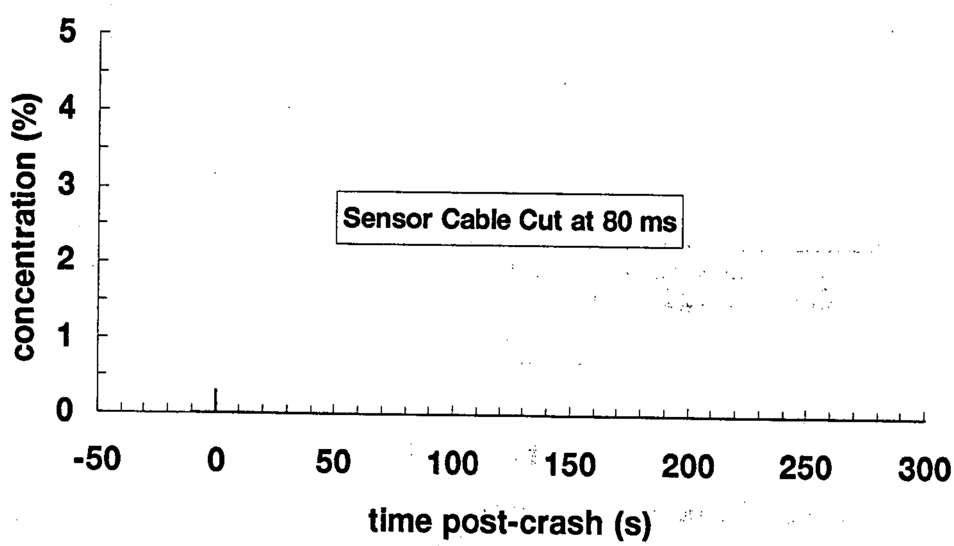


Figure I2

Concentration of Hydrocarbon Vapor Measured at Right Upper Engine (Location #2)

Test C11279

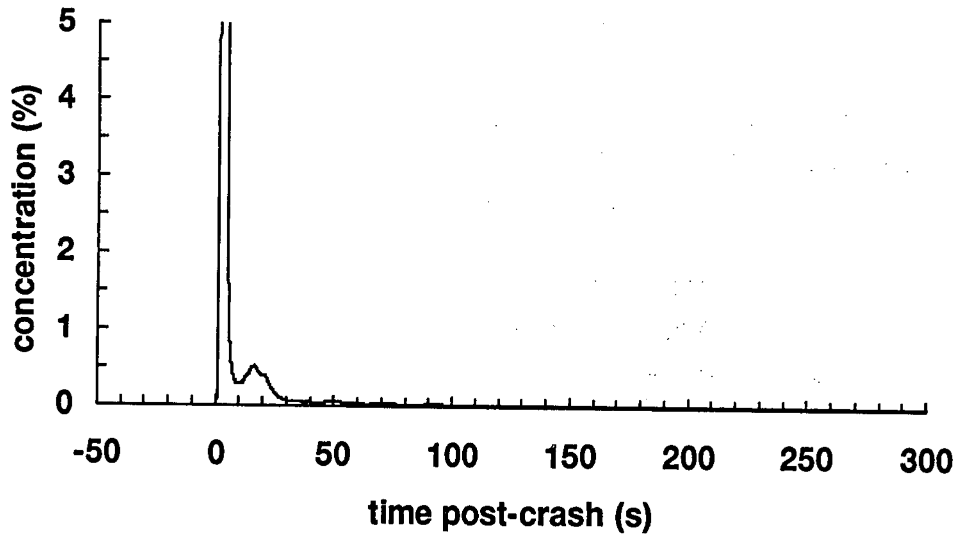


Figure I3

Concentration of Hydrocarbon Vapor Measured at Left Lower Engine (Location #3)
Test C11279

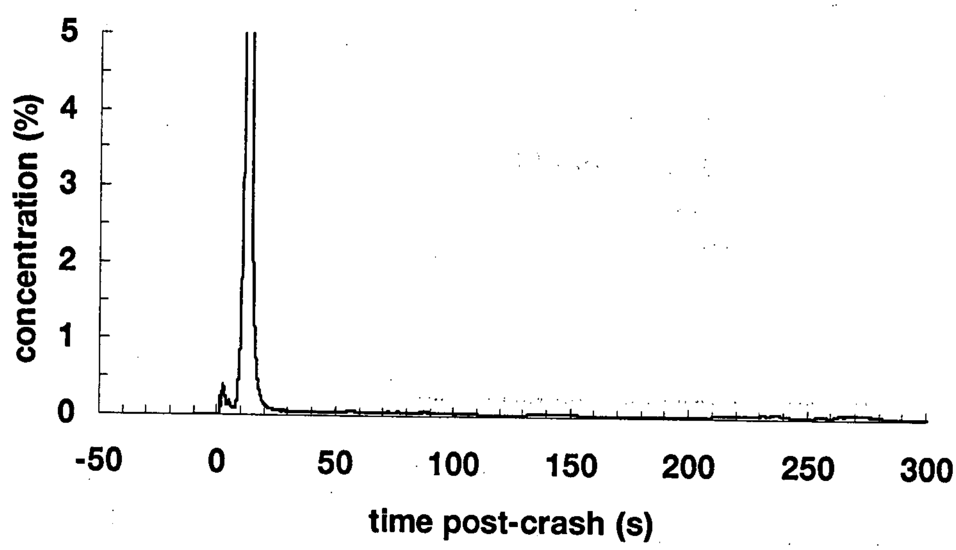


Figure I4

Concentration of Hydrocarbon Vapor Measured at Right Lower Engine (Location #4)
Test C11279

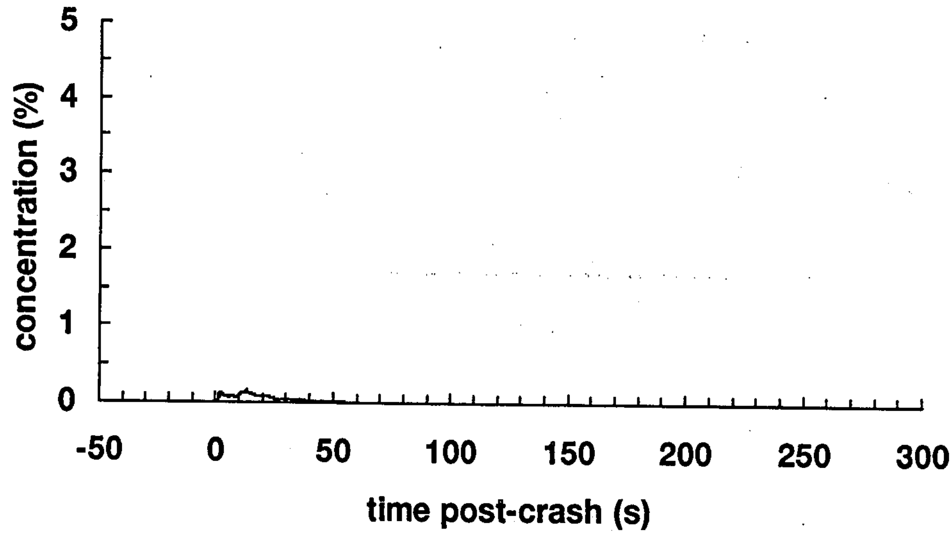


Figure I5

Concentration of Hydrocarbon Vapor Measured at Exhaust Manifold (Location #5)
Test C11279

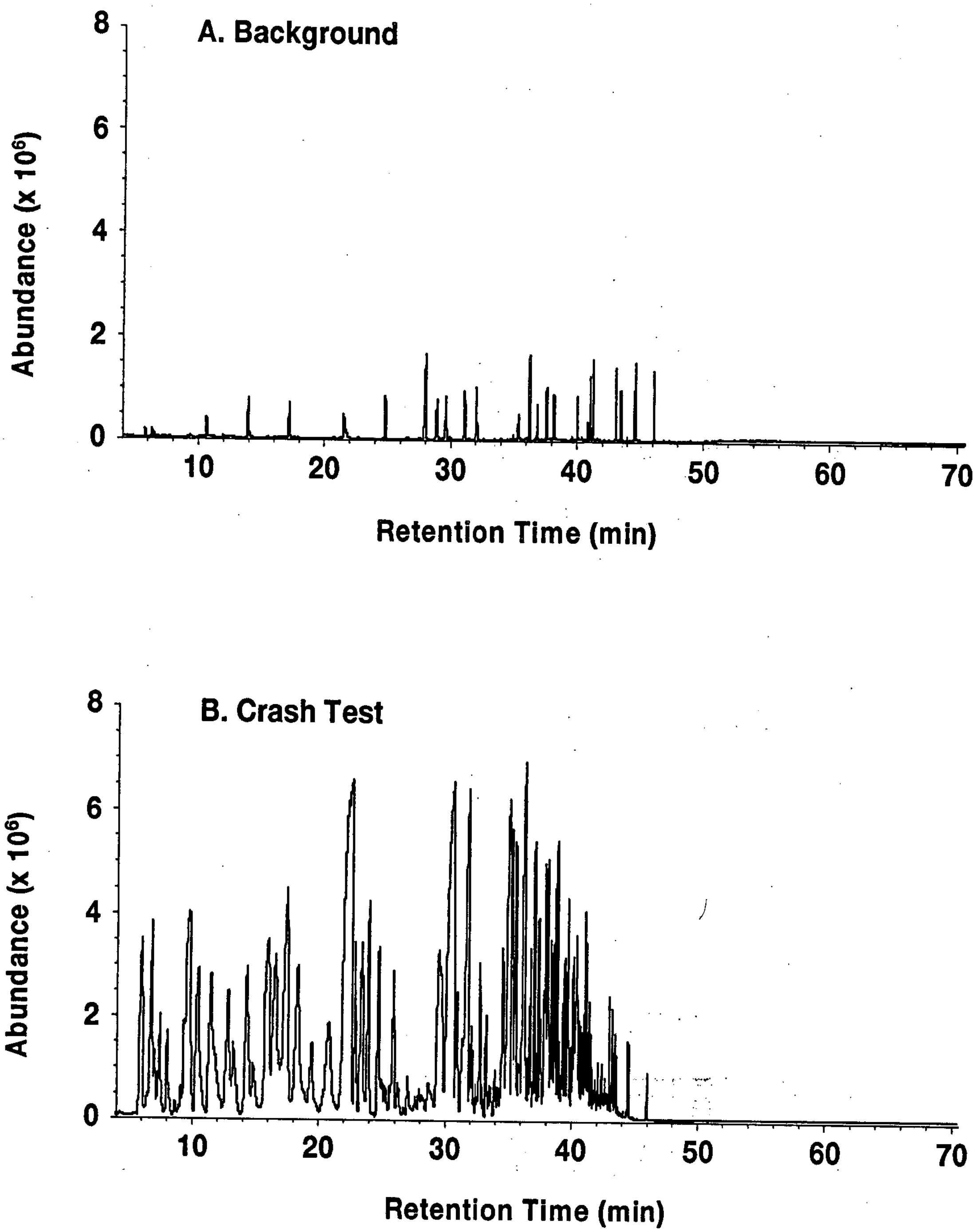
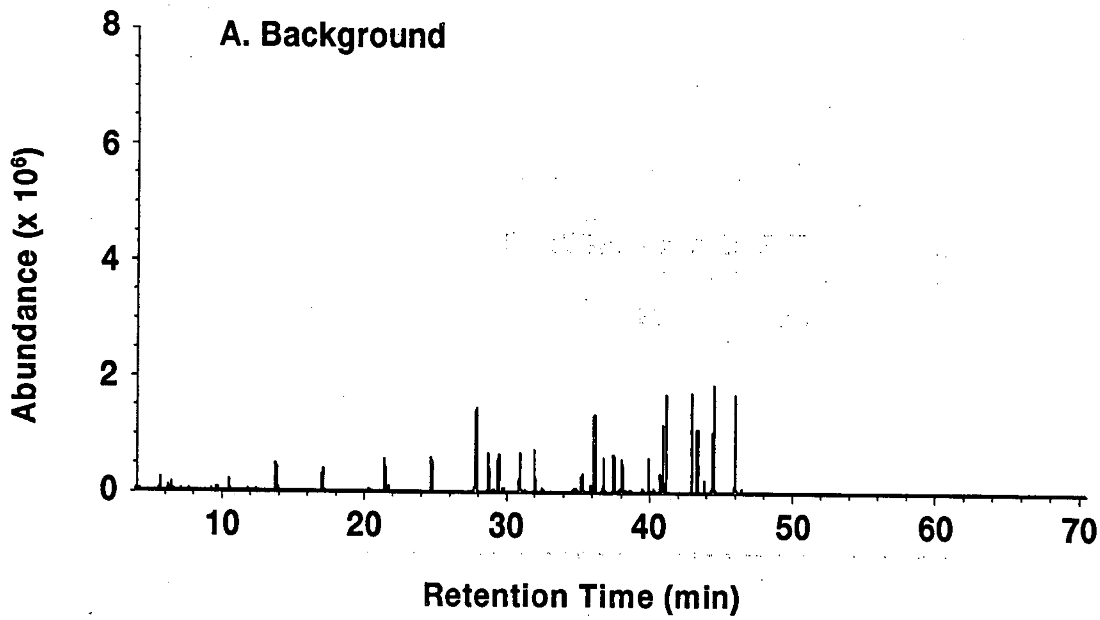


Figure II1.
GC/MS analysis of hydrocarbon vapor sampled from the left upper engine (location #1) during Crash Test C11279. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample



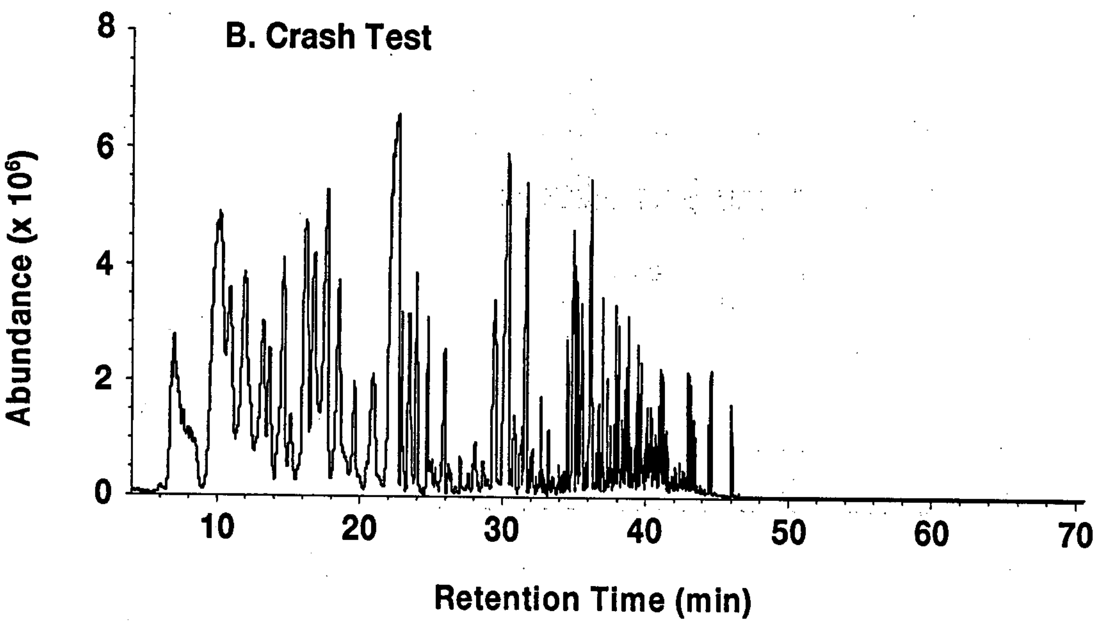


Figure II2
GC/MS analysis of hydrocarbon vapor sampled from the right upper engine (location #2) during Crash Test C11279. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample.

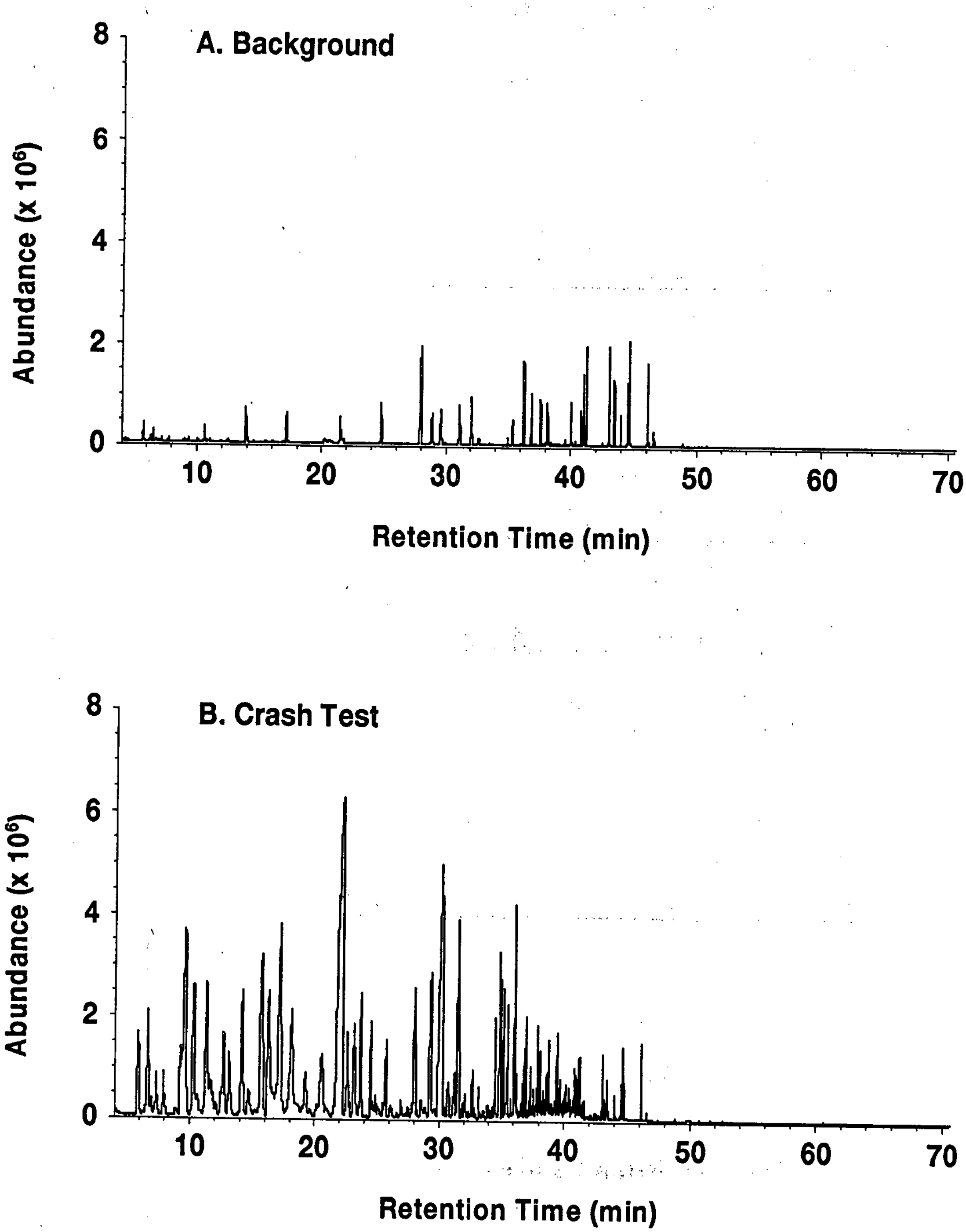


Figure II3

GC/MS analysis of hydrocarbon vapor sampled from the left lower engine (location #3) during Crash Test C11279. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample.

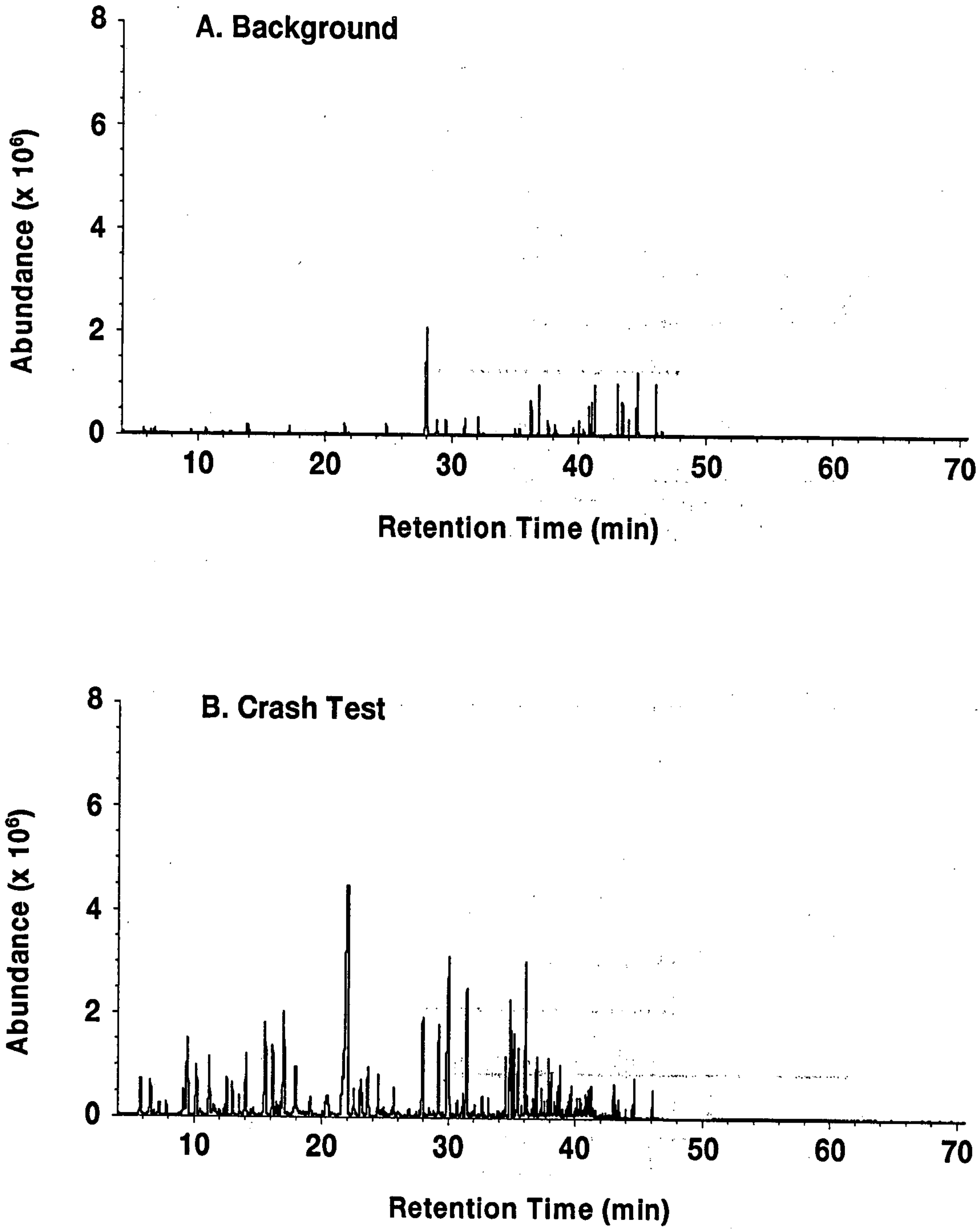


Figure II4

GC/MS analysis of hydrocarbon vapor sampled from the right lower engine (location #4) during Crash Test C11279. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample.

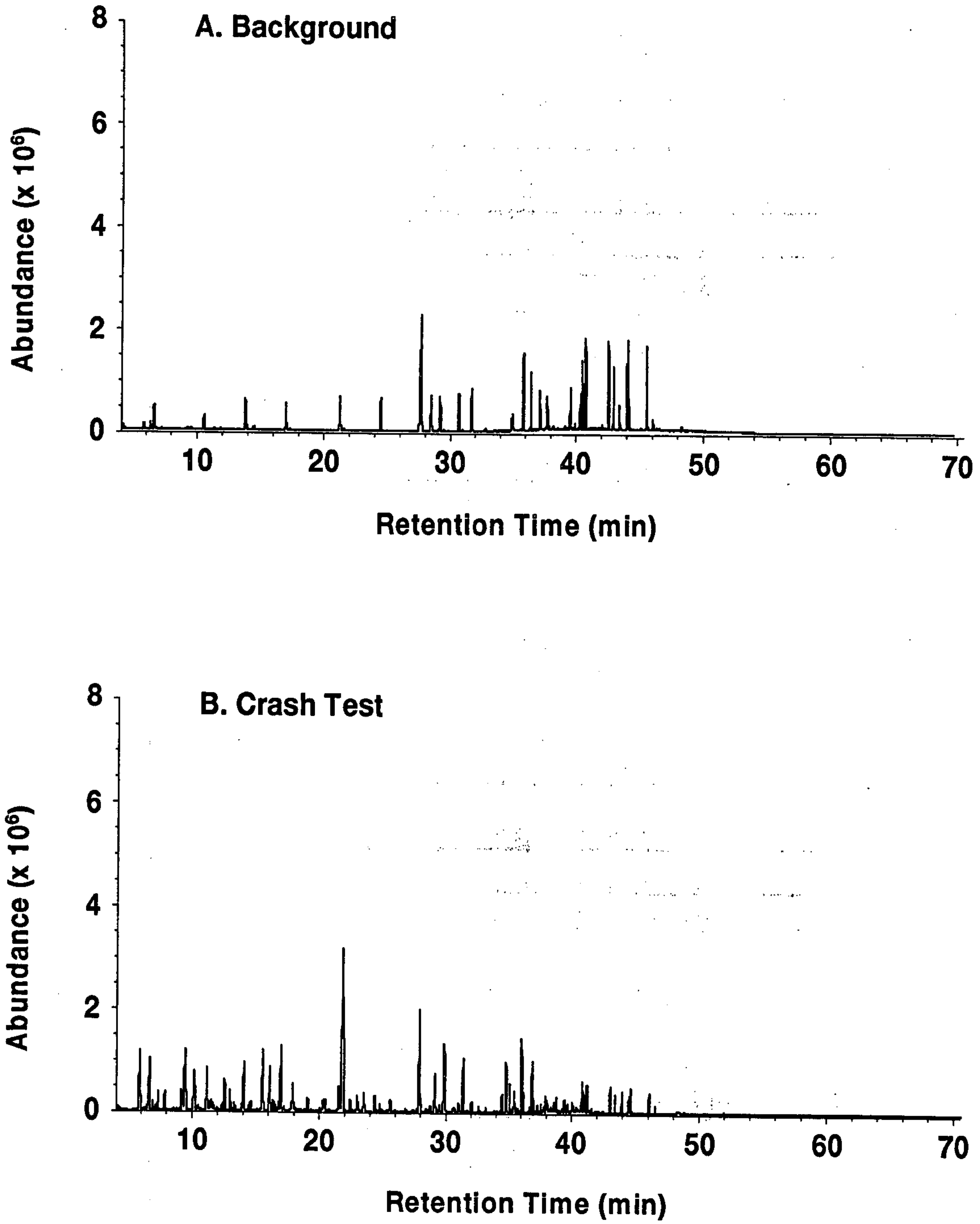


Figure II5
GC/MS analysis of hydrocarbon vapor sampled from the exhaust manifold (location #5) during Crash Test C11279. Panel A shows the chromatogram of a background sample and panel B shows the chromatogram of the post-crash sample

Appendix J: C11279 film plots

C11279 FRONT IMPACT

R & D CTR 8T93080 VAN
FILM DATA

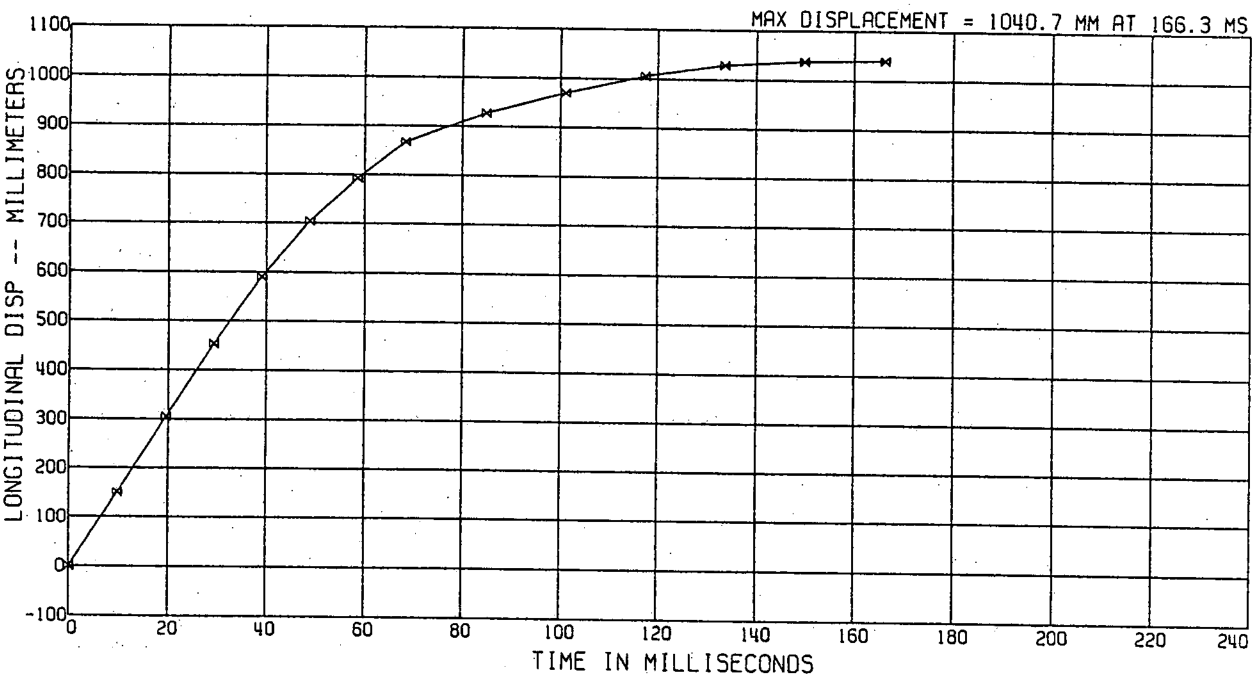
MOVING VEHICLE TO FIXED POLE 55.4KM/H

LEFT SIDE

FIGURE

TEST DATE:09/25/96

VEHICLE DISPL RELATIVE TO GROUND REFERENCE



Appendix J, plot # **1**

C11279 FRONT IMPACT

R & D CTR 8T93080 VAN
FILM DATA

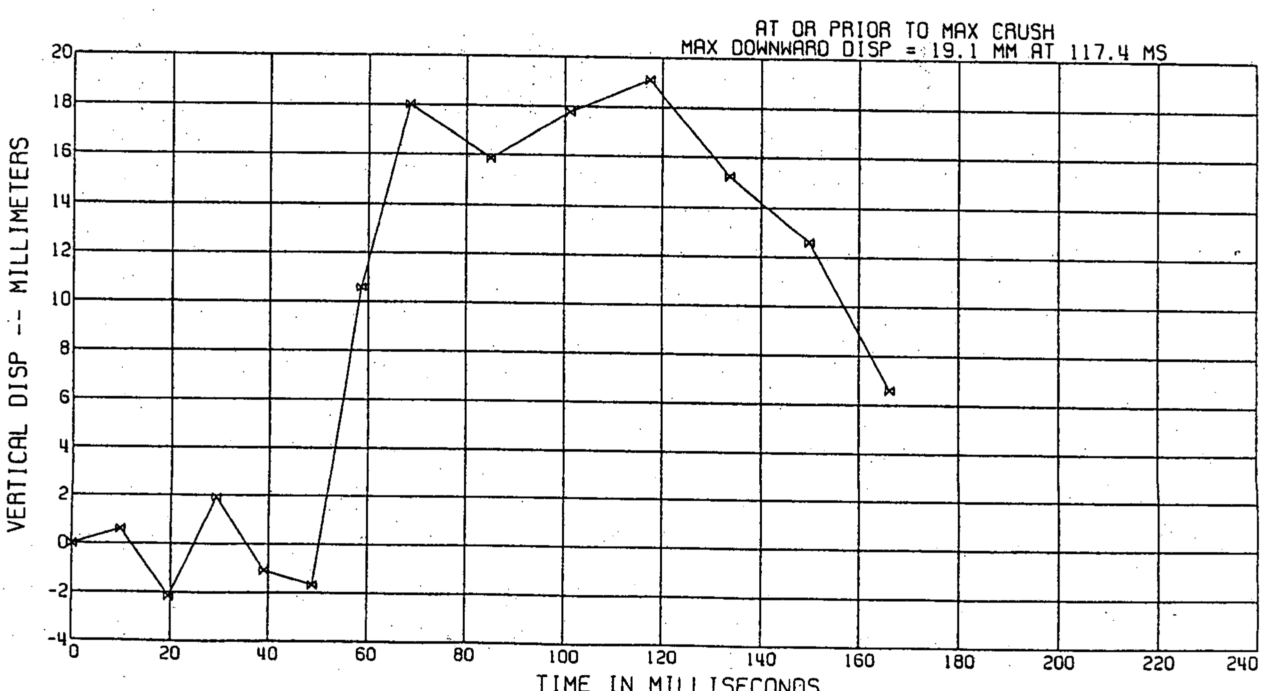
MOVING VEHICLE TO FIXED POLE 55.4KM/H

LEFT SIDE

FIGURE

TEST DATE:09/25/96

VEHICLE DISPL RELATIVE TO GROUND REFERENCE



Appendix J, plot # **2**

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

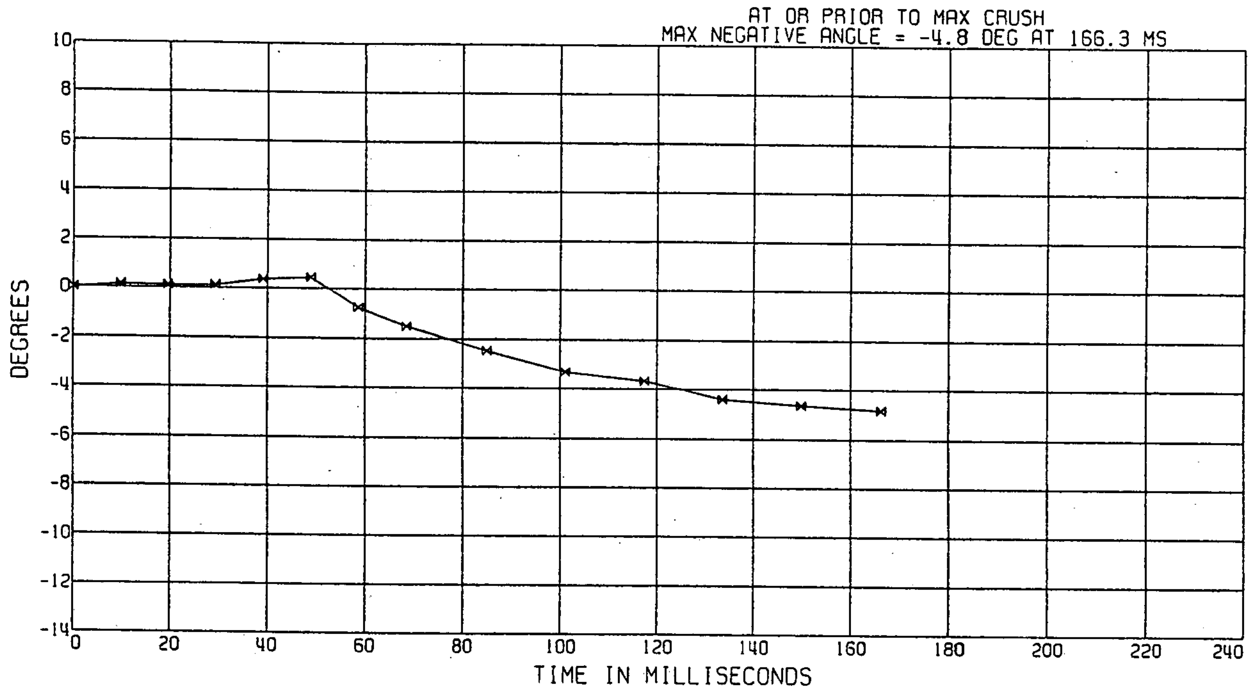
FIGURE

R & D CTR 8T93080 VAN
FILM DATA

LEFT SIDE

TEST DATE:09/25/96

VEHICLE PITCH RELATIVE TO GROUND REFERENCE



Appendix J, plot # 3

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

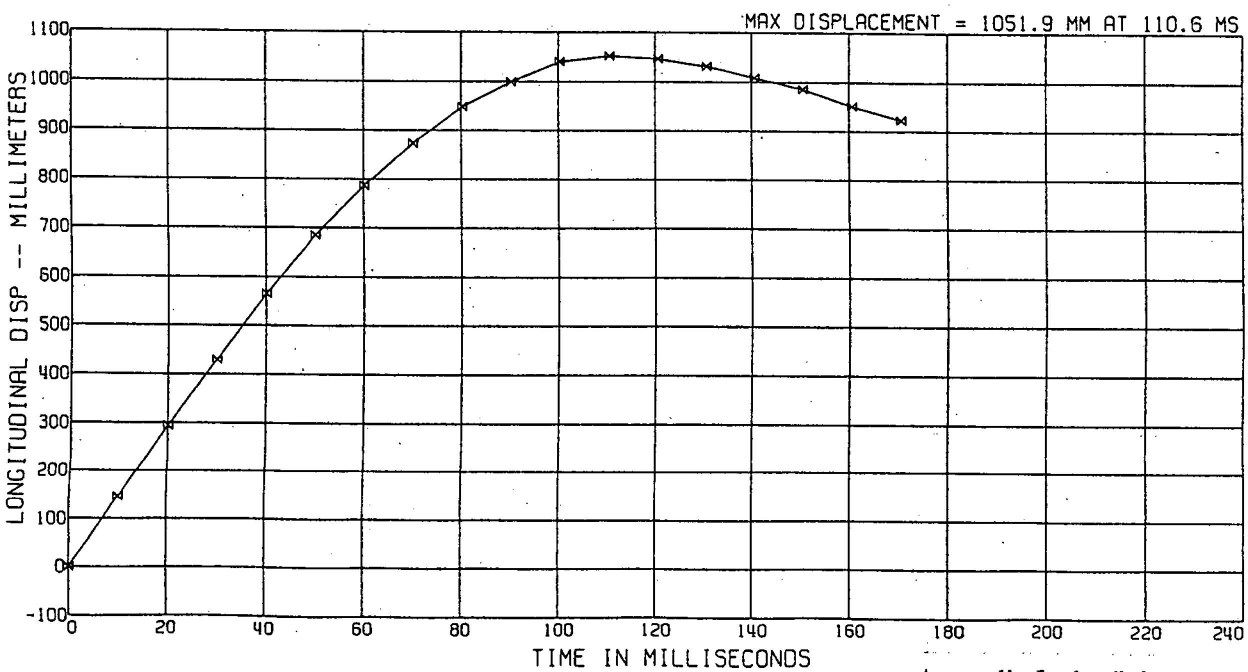
FIGURE

R & D CTR 8T93080 VAN
FILM DATA

RIGHT SIDE

TEST DATE:09/25/96

VEHICLE DISPL RELATIVE TO GROUND REFERENCE



Appendix J, plot # 4

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

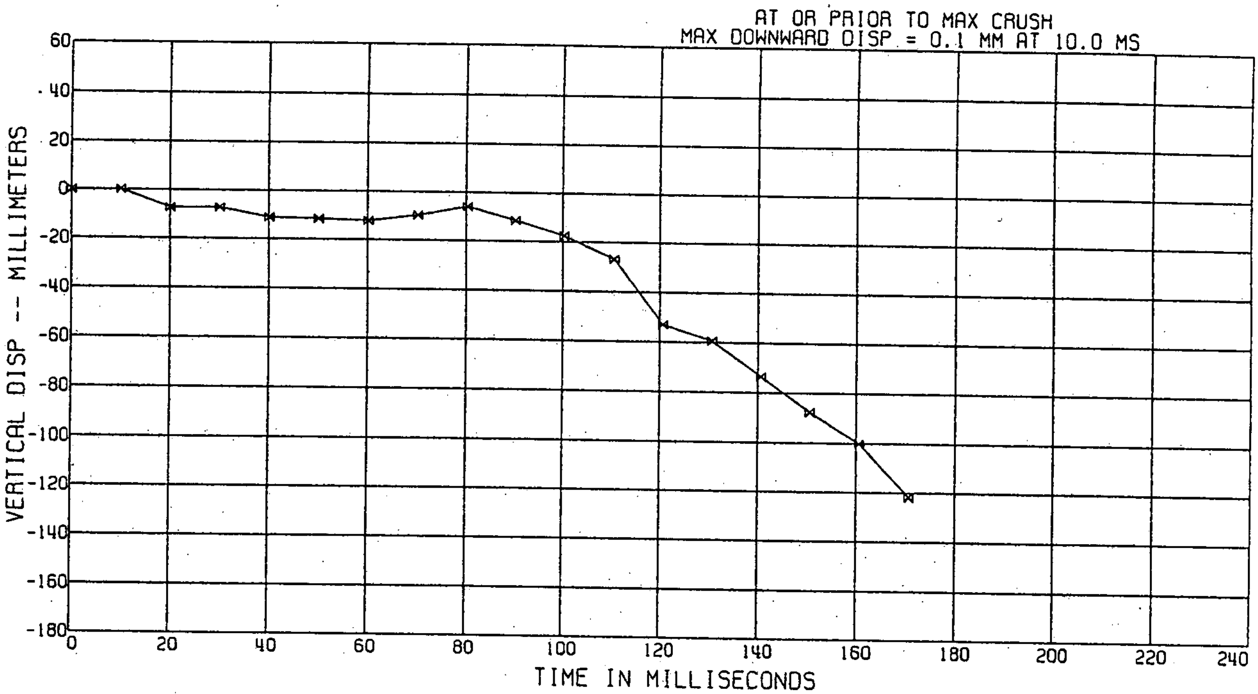
FIGURE

R & D CTR 8T93080 VAN
FILM DATA

RIGHT SIDE

TEST DATE:09/25/96

VEHICLE DISPL RELATIVE TO GROUND REFERENCE



Appendix J, plot # 5

C11279 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.4KM/H

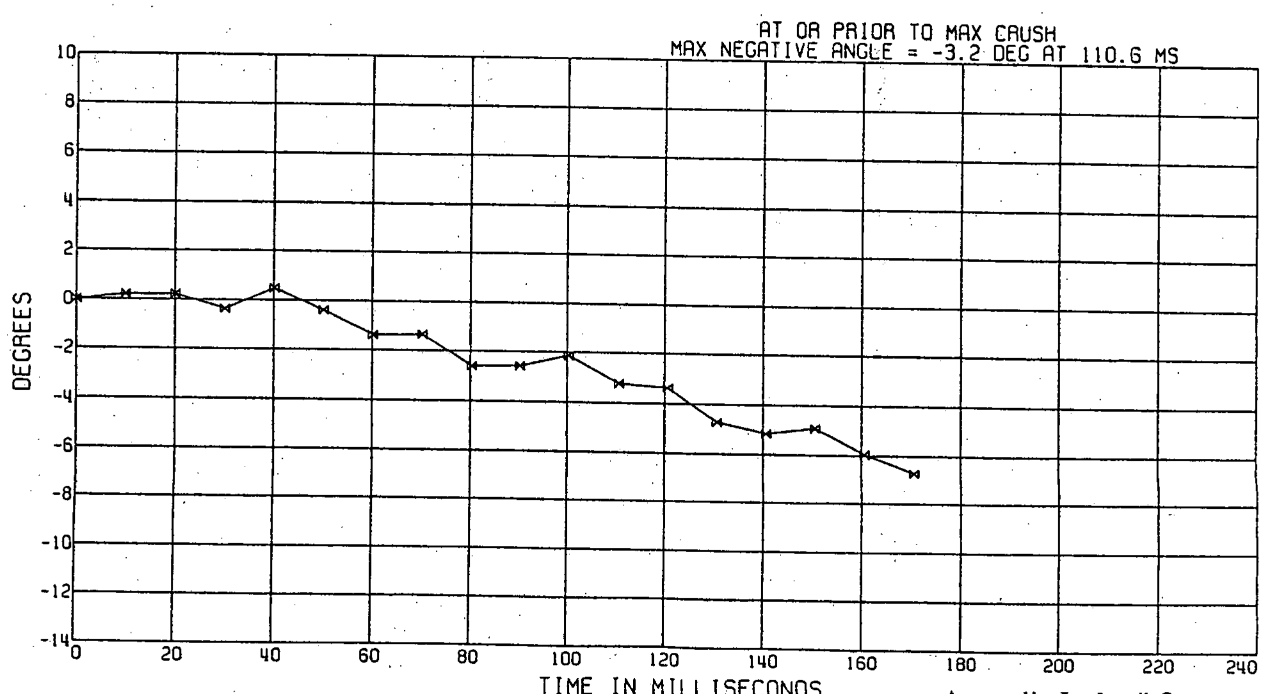
FIGURE

R & D CTR 8T93080 VAN
FILM DATA

RIGHT SIDE

TEST DATE:09/25/96

VEHICLE PITCH RELATIVE TO GROUND REFERENCE



Appendix J, plot # 6

C11279 FRONT IMPACT

R & D CTR 8T93080 VAN
FILM DATA

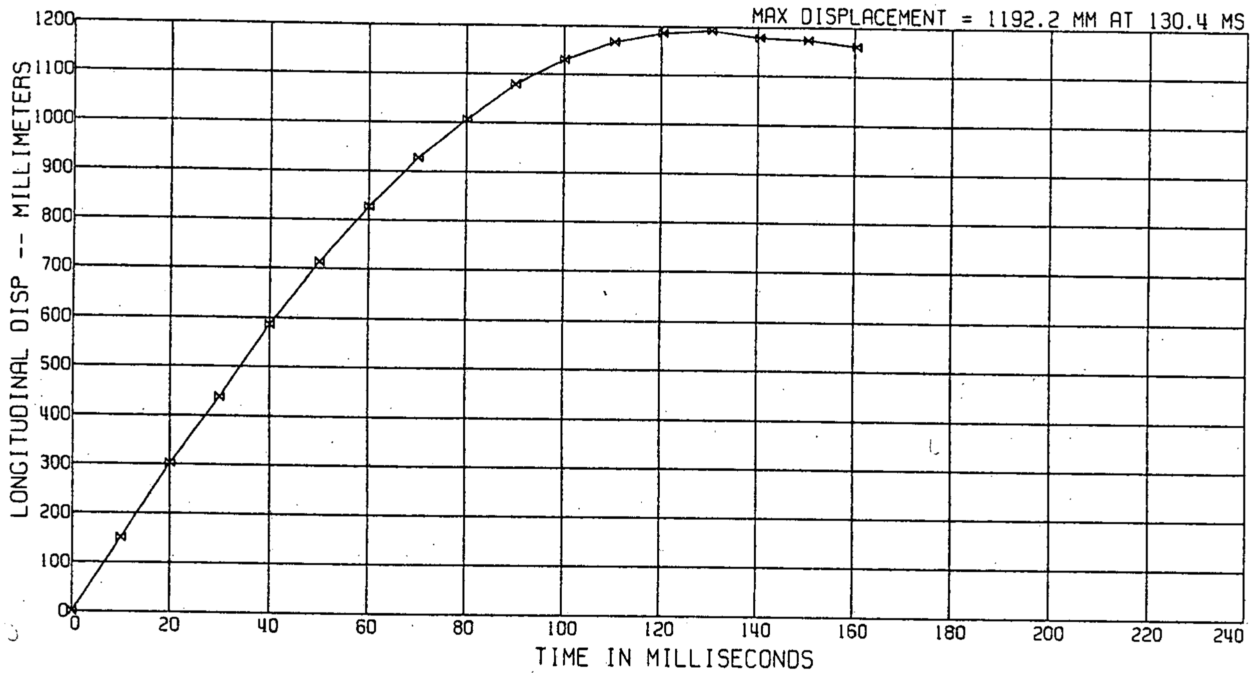
MOVING VEHICLE TO FIXED POLE 55.4KM/H

OVERHEAD VIEW

FIGURE

TEST DATE:09/25/96

VEHICLE DISPL RELATIVE TO POLE REFERENCE



Appendix J, plot # 7

C11279 FRONT IMPACT

R & D CTR 8T93080 VAN
FILM DATA

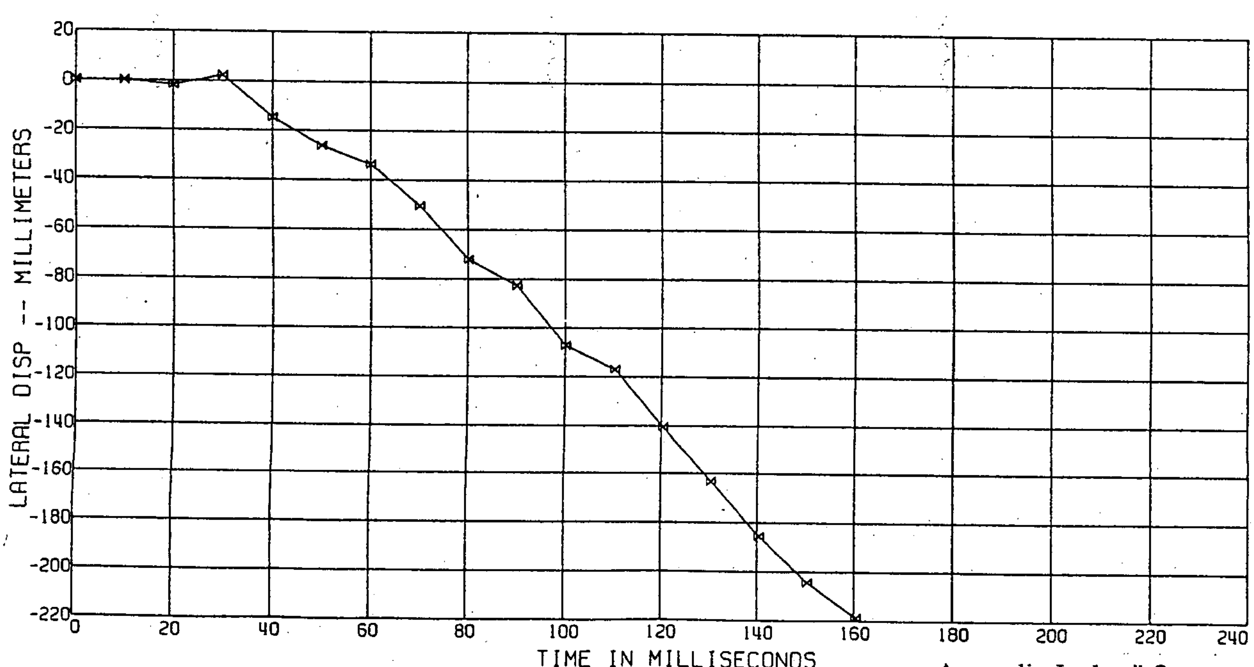
MOVING VEHICLE TO FIXED POLE 55.4KM/H

OVERHEAD VIEW

FIGURE

TEST DATE:09/25/96

VEHICLE DISPL RELATIVE TO POLE REFERENCE



Appendix J, plot # 8

Appendix K: Instrumentation Summaries

Standard ISF Printout

Test Number : C11108
Test Type : FRT HIGH POLE OFF SET
Division : R & D CTR 8T9307D PLBV00131
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

ISF as tested

ATD Usage:

Position	ID Number

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
1	G15	VOLTAGE.1	5	N	V	TIME ZERO			VOLTAGE,VOLTS	0011
2	G16	VOLTAGE.1	5	N	V	PHOTO TIMING			VOLTAGE,VOLTS	0021
3	D01	CR26.1	200	N	G	L. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0031
4	D02	DE74.1	200	N	G	L. FRT	HEAD	LATERAL	ACCEL,G'S	0041
5	D03	CS69.1	200	N	G	L. FRT	HEAD	VERTICAL	ACCEL,G'S	0051
6	D04	CB50.1	200	R	G	L. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0062
7	D05	CB59.1	200	N	G	L. FRT	CHEST	LATERAL	ACCEL,G'S	0071
8	D06	CB65.1	200	R	G	L. FRT	CHEST	VERTICAL	ACCEL,G'S	0082
9	D07	CB06.1	200	N	G	L. FRT	PELVIC	LONGITUDINAL	ACCEL,G'S	0091
10	D08	CB07.1	200	N	G	L. FRT	PELVIC	LATERAL	ACCEL,G'S	0101
11	D09	CB11.1	200	N	G	L. FRT	PELVIC	VERTICAL	ACCEL,G'S	0111
12	D20	P05L.1	14000	N	N	L. FRT	FEMUR	LEFT	LOAD,N'S	0121
13	D21	P05R.1	14000	N	N	L. FRT	FEMUR	RIGHT	LOAD,N'S	0131
14	D22	P05D.1	80	N	MM	L. FRT	CHEST	LONGITUDINAL	DISPL,MM'S	0141
15	D10	P05N.1	6000	N	N	L. FRT	NECK	UAP SHEAR	LOAD,N'S	0151
16	D11	P05N.2	6000	N	N	L. FRT	NECK	URL SHEAR	LOAD,N'S	0161
17	D12	P05N.3	6000	N	N	L. FRT	NECK	UPPER AXIAL	LOAD,N'S	0171
18	D13	P05N.4	400	N	N-M	L. FRT	NECK	URL MOMENT	MOMENT,NM'S	0181
19	D14	P05N.5	400	N	N-M	L. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0191
20	D15	P05N.6	400	N	N-M	L. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0201
21	D23	P05TUL.1	400	N	N-M	L. FRT	LEFT TIBIA	URL MOMENT	MOMENT,NM'S	0211
22	D24	P05TUL.2	400	N	N-M	L. FRT	LEFT TIBIA	UAP MOMENT	MOMENT,NM'S	0221
23	D25	P05TLL.1	400	N	N-M	L. FRT	LEFT TIBIA	LAP MOMENT	MOMENT,NM'S	0231
24	D26	P05TLL.2	10000	N	N	L. FRT	LEFT TIBIA	LAP SHEAR	LOAD,N'S	0241
25	D27	P05TLL.3	8000	N	N	L. FRT	LEFT TIBIA	LOWER AXIAL	LOAD,N'S	0251
26	D16	P05KNL.1	7000	N	N	L. FRT	LEFT KNEE	L. CLEVIS	LOAD,N'S	0261
27	D17	P05KNL.2	7000	N	N	L. FRT	LEFT KNEE	R. CLEVIS	LOAD,N'S	0271
28	D28	P05TUR.1	400	N	N-M	L. FRT	RIGHT TIBIA	URL MOMENT	MOMENT,NM'S	0281
29	D29	P05TUR.2	400	N	N-M	L. FRT	RIGHT TIBIA	UAP MOMENT	MOMENT,NM'S	0291
30	D30	P05TLR.1	400	N	N-M	L. FRT	RIGHT TIBIA	LAP MOMENT	MOMENT,NM'S	0301
31	D31	P05TLR.2	10000	N	N	L. FRT	RIGHT TIBIA	LAP SHEAR	LOAD,N'S	0311
32	D32	P05TLR.3	8000	N	N	L. FRT	RIGHT TIBIA	LOWER AXIAL	LOAD,N'S	0321

Date: 07-25-1997 Time: 07:55:34

Test Number : C11108
Test Type : FRT HIGH POLE OFF SET
Division : R & D CTR 8T9307D PLBV00131
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

ISF as tested

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
33	D18	P05KNR.1	7000	N	N	L. FRT	RIGHT KNEE	L. CLEVIS	LOAD,N'S	0331
34	D19	P05KNR.2	7000	N	N	L. FRT	RIGHT KNEE	R. CLEVIS	LOAD,N'S	0341
35	A01	P05STL.1	24	N	MM	L. FRT	TIBIA/FEMUR LEFT		DISP,MM'S	0351
36	A02	P05STR.1	24	N	MM	L. FRT	TIBIA/FEMUR RIGHT		DISP,MM'S	0361
37	C01	CJ50.1	200	N	G	R. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0371
38	C02	DA19.1	200	N	G	R. FRT	HEAD	LATERAL	ACCEL,G'S	0381
39	C03	CM80.1	200	N	G	R. FRT	HEAD	VERTICAL	ACCEL,G'S	0391
40	C04	CB16.1	200	R	G	R. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0402
41	C05	CB17.1	200	N	G	R. FRT	CHEST	LATERAL	ACCEL,G'S	0411
42	C06	CB18.1	200	R	G	R. FRT	CHEST	VERTICAL	ACCEL,G'S	0422
43	C07	CF92.1	200	N	G	R. FRT	PELVIC	LONGITUDINAL	ACCEL,G'S	0431
44	C08	CE31.1	200	N	G	R. FRT	PELVIC	LATERAL	ACCEL,G'S	0441
45	C09	CE10.1	200	N	G	R. FRT	PELVIC	VERTICAL	ACCEL,G'S	0451
46	C20	P04L.1	14000	N	N	R. FRT	FEMUR	LEFT	LOAD,N'S	0461
47	C21	P04R.1	14000	N	N	R. FRT	FEMUR	RIGHT	LOAD,N'S	0471
48	C22	P04D.1	80	N	MM	R. FRT	CHEST	LONGITUDINAL	DISPL,MM'S	0481
49	C10	P04N.1	6000	N	N	R. FRT	NECK	UAP SHEAR	LOAD,N'S	0491
50	C11	P04N.2	6000	N	N	R. FRT	NECK	URL SHEAR	LOAD,N'S	0501
51	C12	P04N.3	6000	N	N	R. FRT	NECK	UPPER AXIAL	LOAD,N'S	0511
52	C13	P04N.4	400	N	N-M	R. FRT	NECK	URL MOMENT	MOMENT,NM'S	0521
53	C14	P04N.5	400	N	N-M	R. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0531
54	C15	P04N.6	400	N	N-M	R. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0541
55	C23	P04TUL.1	400	N	N-M	R. FRT	LEFT TIBIA	URL MOMENT	MOMENT,NM'S	0551
56	C24	P04TUL.2	400	N	N-M	R. FRT	LEFT TIBIA	UAP MOMENT	MOMENT,NM'S	0561
57	C25	P04TLL.1	400	N	N-M	R. FRT	LEFT TIBIA	LAP MOMENT	MOMENT,NM'S	0571
58	C26	P04TLL.2	10000	N	N	R. FRT	LEFT TIBIA	LAP SHEAR	LOAD,N'S	0581
59	C27	P04TLL.3	8000	N	N	R. FRT	LEFT TIBIA	LOWER AXIAL	LOAD,N'S	0591
60	C16	P04KNL.1	7000	N	N	R. FRT	LEFT KNEE	L. CLEVIS	LOAD,N'S	0601
61	C17	P04KNL.2	7000	N	N	R. FRT	LEFT KNEE	R. CLEVIS	LOAD,N'S	0611
62	C28	P04TUR.1	400	N	N-M	R. FRT	RIGHT TIBIA	URL MOMENT	MOMENT,NM'S	0621
63	C29	P04TUR.2	400	N	N-M	R. FRT	RIGHT TIBIA	UAP MOMENT	MOMENT,NM'S	0631
64	C30	P04TLR.1	400	N	N-M	R. FRT	RIGHT TIBIA	LAP MOMENT	MOMENT,NM'S	0641

Standard ISF Printout

ISF as tested

Test Number : C11108
Test Type : FRT HIGH POLE OFF SET
Division : R & D CTR 8T9307D PLBV00131
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
65	C31	P04TLR.2	10000	N	N	R. FRT	RIGHT TIBIA	LAP SHEAR	LOAD,N'S	0651
66	C32	P04TLR.3	8000	N	N	R. FRT	RIGHT TIBIA	LOWER AXIAL	LOAD,N'S	0661
67	C18	P04KNR.1	7000	N	N	R. FRT	RIGHT KNEE	L. CLEVIS	LOAD,N'S	0671
68	C19	P04KNR.2	7000	N	N	R. FRT	RIGHT KNEE	R. CLEVIS	LOAD,N'S	0681
69	A03	P04STL.1	24	N	MM	R. FRT	TIBIA/FEMUR LEFT		DISP,MM'S	0691
70	A04	P04STR.1	24	N	MM	R. FRT	TIBIA/FEMUR RIGHT		DISP,MM'S	0701
71	A05	LS128.1	700	N	N-M	L. FRT	LOWER LUMBAR	MY-LAT. AXIS	MOMENT,NM'S	0711
72	A06	LS128.2	10000	N	N	L. FRT	LOWER LUMBAR	FX-FORE/AFT	LOAD,N'S	0721
73	A07	LS128.3	6000	N	N	L. FRT	LOWER LUMBAR	FZ-AXIAL	LOAD,N'S	0731
74	A08	LS153.1	700	N	N-M	R. FRT	LOWER LUMBAR	MY-LAT. AXIS	MOMENT,NM'S	0741
75	A09	LS153.2	10000	N	N	R. FRT	LOWER LUMBAR	FX-FORE/AFT	LOAD,N'S	0751
76	A10	LS153.3	6000	N	N	R. FRT	LOWER LUMBAR	FZ-AXIAL	LOAD,N'S	0761
77	A11	J10163.1	450	R	G	L. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0772
78	A12	J10963.1	450	R	G	L. FRT	ROCKER	LATERAL	ACCEL,G'S	0782
79	A13	J10388.1	450	R	G	L. FRT	ROCKER	VERTICAL	ACCEL,G'S	0792
80	A14	J11670.1	450	R	G	R. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0802
81	A15	J10670.1	450	N	G	R. FRT	ROCKER	LATERAL	ACCEL,G'S	0811
82	A16	J10654.1	450	N	G	R. FRT	ROCKER	VERTICAL	ACCEL,G'S	0821
83	A27	J10287.1	450	N	G	L. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0831
84	A18	J10289.1	450	N	G	L. REAR	ROCKER	LATERAL	ACCEL,G'S	0841
85	A19	J10286.1	450	N	G	L. REAR	ROCKER	VERTICAL	ACCEL,G'S	0851
86	A20	ANBA7.1	450	N	G	R. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0861
87	A21	ANAW7.1	450	N	G	R. REAR	ROCKER	LATERAL	ACCEL,G'S	0871
88	A22	ANB07.1	450	N	G	R. REAR	ROCKER	VERTICAL	ACCEL,G'S	0881
89	A23	SR12.1	350	N	MM	R.	TOE PAN	LONGITUDINAL	DISPL,MM'S	0891
90	B22	VOLTCOND.1	20	N	V		ENGINE RPM		VOLTAGE,VOLTS	0901
91	B02	VOLTCOND.1	20	N	V		VAPOR SENSOR		VOLTAGE,VOLTS	0911
92	B03	CP179.1	10	N	A		WHEEL BAG		CURRENT,AMPS	0921
93	B04	CP121.1	10	N	A		I/P BAG		CURRENT,AMPS	0931
94	B05	CP195.1	20	N	A		FUEL PUMP		CURRENT,AMPS	0941
95	B06	CP194.1	20	N	A	R. FRT	HEADLIGHT - HI BEAM		CURRENT,AMPS	0951
96	B07	CP136.1	20	N	A	R. FRT	HEADLIGHT - LO BEAM		CURRENT,AMPS	0961

Date: 07-25-1997 Time: 07:55:42

Standard ISF Printout

Test Number : C11108
Test Type : FRT HIGH POLE OFF SET
Division : R & D CTR 8T9307D PLBV00131
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
97	B08	CP201.1	20	N	A	L.	HORN-HI		CURRENT,AMPS	0971
98	B09	CP184.1	20	N	A	L.	HORN-LO		CURRENT,AMPS	0981
99	B10	CP130.1	20	N	A		A/C CLUTCH		CURRENT,AMPS	0991
100	B11	CP228.1	20	N	A		COOLING FAN		CURRENT,AMPS	1001
101	B12	CP198.1	20	N	A		TCM - FUSED IGNITION		CURRENT,AMPS	1011
102	B13	CP206.1	20	N	A		TCM - IGNITION SWITCH		CURRENT,AMPS	1021
103	B14	CP125.1	20	N	A		TCM - FUSED HOT		CURRENT,AMPS	1031
104	B15	CP234.1	20	N	A		FUSABLE LINK		CURRENT,AMPS	1041
105	B16	5931.1	5000	N	KPA	R. FRT	BRAKE SYSTEM		PRESSURE,KPA'S	1051
106	B17	10415.1	200	N	KPA		POWER STEERING SYSTEM		PRESSURE,KPA'S	1061
107	B18	2153.1	40	N	KPA		COOLING SYSTEM		PRESSURE,KPA'S	1071
108	B19	10389.1	200	N	KPA		AUXILIARY FUEL TANK		PRESSURE,KPA'S	1081
109	B20	2119.1	200	N	KPA		ENGINE OIL		PRESSURE,KPA'S	1091
110	B21	12132.1	200	N	KPA		TRANSMISSION FLUID		PRESSURE,KPA'S	1101
111	B01	VOLTAGE.1	5	N	V		VAPOR SENSOR TIME ZERO		VOLTAGE,VOLTS	1111

Standard ISF Printout

Test Number : C11167
Test Type : L. FRT IMPACT-25 DEG
Division : R & D CTR 8T9309D PLBV00131
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

ISF as tested

ATD Usage:

Position	ID Number

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
1	G15	VOLTAGE.1	5	N	V	TIME ZERO			VOLTAGE,VOLTS	0011
2	G16	VOLTAGE.1	5	N	V	PHOTO TIMING			VOLTAGE,VOLTS	0021
3	A01	CY54.1	200	N	G	L. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0031
4	A02	DA54.1	200	N	G	L. FRT	HEAD	LATERAL	ACCEL,G'S	0041
5	A03	DB32.1	200	N	G	L. FRT	HEAD	VERTICAL	ACCEL,G'S	0051
6	A04	AA74.1	200	R	G	L. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0062
7	A05	AA75.1	200	N	G	L. FRT	CHEST	LATERAL	ACCEL,G'S	0071
8	A06	AA76.1	200	R	G	L. FRT	CHEST	VERTICAL	ACCEL,G'S	0082
9	A07	CC62.1	200	N	G	L. FRT	PELVIC	LONGITUDINAL	ACCEL,G'S	0091
10	A08	CD27.1	200	N	G	L. FRT	PELVIC	LATERAL	ACCEL,G'S	0101
11	A09	CB41.1	200	N	G	L. FRT	PELVIC	VERTICAL	ACCEL,G'S	0111
12	A20	P24L.1	14000	N	N	L. FRT	FEMUR	LEFT	LOAD,N'S	0121
13	A21	P24R.1	14000	N	N	L. FRT	FEMUR	RIGHT	LOAD,N'S	0131
14	A22	P24D.1	80	N	MM	L. FRT	CHEST	LONGITUDINAL	DISPL,MM'S	0141
15	A10	P24N.1	6000	N	N	L. FRT	NECK	UAP SHEAR	LOAD,N'S	0151
16	A11	P24N.2	6000	N	N	L. FRT	NECK	URL SHEAR	LOAD,N'S	0161
17	A12	P24N.3	6000	N	N	L. FRT	NECK	UPPER AXIAL	LOAD,N'S	0171
18	A13	P24N.4	400	N	N-M	L. FRT	NECK	URL MOMENT	MOMENT,NM'S	0181
19	A14	P24N.5	400	N	N-M	L. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0191
20	A15	P24N.6	400	N	N-M	L. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0201
21	A23	P24TUL.1	400	N	N-M	L. FRT	LEFT TIBIA	URL MOMENT	MOMENT,NM'S	0211
22	A24	P24TUL.2	400	N	N-M	L. FRT	LEFT TIBIA	UAP MOMENT	MOMENT,NM'S	0221
23	A25	P24TLL.1	400	N	N-M	L. FRT	LEFT TIBIA	LAP MOMENT	MOMENT,NM'S	0231
24	A26	P24TLL.2	10000	N	N	L. FRT	LEFT TIBIA	LAP SHEAR	LOAD,N'S	0241
25	A27	P24TLL.3	8000	N	N	L. FRT	LEFT TIBIA	LOWER AXIAL	LOAD,N'S	0251
26	A16	P24KNL.1	7000	N	N	L. FRT	LEFT KNEE	L. CLEVIS	LOAD,N'S	0261
27	A17	P24KNL.2	7000	N	N	L. FRT	LEFT KNEE	R. CLEVIS	LOAD,N'S	0271
28	A28	P24TUR.1	400	N	N-M	L. FRT	RIGHT TIBIA	URL MOMENT	MOMENT,NM'S	0281
29	A29	P24TUR.2	400	N	N-M	L. FRT	RIGHT TIBIA	UAP MOMENT	MOMENT,NM'S	0291
30	A30	P24TLR.1	400	N	N-M	L. FRT	RIGHT TIBIA	LAP MOMENT	MOMENT,NM'S	0301
31	A31	P24TLR.2	10000	N	N	L. FRT	RIGHT TIBIA	LAP SHEAR	LOAD,N'S	0311
32	A32	P24TLR.3	8000	N	N	L. FRT	RIGHT TIBIA	LOWER AXIAL	LOAD,N'S	0321

Test Number : C11167
Test Type : L. FRT IMPACT-25 DEG
Division : R & D CTR 8T9309D PLBV00131
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

ISF as tested

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
33	A18	P24KNR.1	7000	N	N	L. FRT	RIGHT KNEE	L. CLEVIS	LOAD,N'S	0331
34	A19	P24KNR.2	7000	N	N	L. FRT	RIGHT KNEE	R. CLEVIS	LOAD,N'S	0341
35	C01	P24TFL.1	24	N	MM	L. FRT	TIBIA/FEMUR LEFT		DISP,MM'S	0351
36	C02	P24TFR.1	24	N	MM	L. FRT	TIBIA/FEMUR RIGHT		DISP,MM'S	0361
37	B01	CP25.1	200	N	G	R. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0371
38	B02	CP80.1	200	N	G	R. FRT	HEAD	LATERAL	ACCEL,G'S	0381
39	B03	CG99.1	200	N	G	R. FRT	HEAD	VERTICAL	ACCEL,G'S	0391
40	B04	AA16-2.1	200	R	G	R. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0402
41	B05	CU55.1	200	N	G	R. FRT	CHEST	LATERAL	ACCEL,G'S	0411
42	B06	CV58.1	200	R	G	R. FRT	CHEST	VERTICAL	ACCEL,G'S	0422
43	B07	CF13.1	200	N	G	R. FRT	PELVIC	LONGITUDINAL	ACCEL,G'S	0431
44	B08	CC38.1	200	N	G	R. FRT	PELVIC	LATERAL	ACCEL,G'S	0441
45	B09	CD99.1	200	N	G	R. FRT	PELVIC	VERTICAL	ACCEL,G'S	0451
46	B20	P26L.1	14000	N	N	R. FRT	FEMUR	LEFT	LOAD,N'S	0461
47	B21	P26R.1	14000	N	N	R. FRT	FEMUR	RIGHT	LOAD,N'S	0471
48	B22	P26D.1	80	N	MM	R. FRT	CHEST	LONGITUDINAL	DISPL,MM'S	0481
49	B10	P26N.1	6000	N	N	R. FRT	NECK	UAP SHEAR	LOAD,N'S	0491
50	B11	P26N.2	6000	N	N	R. FRT	NECK	URL SHEAR	LOAD,N'S	0501
51	B12	P26N.3	6000	N	N	R. FRT	NECK	UPPER AXIAL	LOAD,N'S	0511
52	B13	P26N.4	400	N	N-M	R. FRT	NECK	URL MOMENT	MOMENT,NM'S	0521
53	B14	P26N.5	400	N	N-M	R. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0531
54	B15	P26N.6	400	N	N-M	R. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0541
55	B23	P26TUL.1	400	N	N-M	R. FRT	LEFT TIBIA	URL MOMENT	MOMENT,NM'S	0551
56	B24	P26TUL.2	400	N	N-M	R. FRT	LEFT TIBIA	UAP MOMENT	MOMENT,NM'S	0561
57	B25	P26TLL.1	400	N	N-M	R. FRT	LEFT TIBIA	LAP MOMENT	MOMENT,NM'S	0571
58	B26	P26TLL.2	10000	N	N	R. FRT	LEFT TIBIA	LAP SHEAR	LOAD,N'S	0581
59	B27	P26TLL.3	8000	N	N	R. FRT	LEFT TIBIA	LOWER AXIAL	LOAD,N'S	0591
60	B16	P26KNL.1	7000	N	N	R. FRT	LEFT KNEE	L. CLEVIS	LOAD,N'S	0601
61	B17	P26KNL.2	7000	N	N	R. FRT	LEFT KNEE	R. CLEVIS	LOAD,N'S	0611
62	B28	P26TUR.1	400	N	N-M	R. FRT	RIGHT TIBIA	URL MOMENT	MOMENT,NM'S	0621
63	B29	P26TUR.2	400	N	N-M	R. FRT	RIGHT TIBIA	UAP MOMENT	MOMENT,NM'S	0631
64	B30	P26TLR.1	400	N	N-M	R. FRT	RIGHT TIBIA	LAP MOMENT	MOMENT,NM'S	0641

Standard ISF Printout

Test Number : C11167
Test Type : L. FRT IMPACT-25 DEG
Division : R & D CTR 8T9309D PLBV00131
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

ISF as tested

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
65	B31	P26TLR.2	10000	N	N	R. FRT	RIGHT TIBIA	LAP SHEAR	LOAD,N'S	0651
66	B32	P26TLR.3	8000	N	N	R. FRT	RIGHT TIBIA	LOWER AXIAL	LOAD,N'S	0661
67	B18	P26KNR.1	7000	N	N	R. FRT	RIGHT KNEE	L. CLEVIS	LOAD,N'S	0671
68	B19	P26KNR.2	7000	N	N	R. FRT	RIGHT KNEE	R. CLEVIS	LOAD,N'S	0681
69	C03	P26TFL.1	24	N	MM	R. FRT	TIBIA/FEMUR LEFT		DISP,MM'S	0691
70	C04	P26TFR.1	24	N	MM	R. FRT	TIBIA/FEMUR RIGHT		DISP,MM'S	0701
71	C05	LS141.1	700	N	N-M	L. FRT	LOWER LUMBAR	MY-LAT. AXIS	MOMENT,NM'S	0711
72	C06	LS141.2	10000	N	N	L. FRT	LOWER LUMBAR	FX-FORE/AFT	LOAD,N'S	0721
73	C07	LS141.3	6000	N	N	L. FRT	LOWER LUMBAR	FZ-AXIAL	LOAD,N'S	0731
74	C08	LS135.1	700	N	N-M	R. FRT	LOWER LUMBAR	MY-LAT. AXIS	MOMENT,NM'S	0741
75	C09	LS135.2	10000	N	N	R. FRT	LOWER LUMBAR	FX-FORE/AFT	LOAD,N'S	0751
76	C10	LS135.3	6000	N	N	R. FRT	LOWER LUMBAR	FZ-AXIAL	LOAD,N'S	0761
77	C11	AP1C0.1	450	R	G	L. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0772
78	C12	AP1D1.1	450	R	G	L. FRT	ROCKER	LATERAL	ACCEL,G'S	0782
79	C13	AP1L8.1	450	R	G	L. FRT	ROCKER	VERTICAL	ACCEL,G'S	0792
80	C14	AJ774.1	450	R	G	R. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0802
81	C15	AJ661.1	450	N	G	R. FRT	ROCKER	LATERAL	ACCEL,G'S	0811
82	C16	AJ689.1	450	N	G	R. FRT	ROCKER	VERTICAL	ACCEL,G'S	0821
83	C17	AMRM0.1	450	R	G	L. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0832
84	C18	AMRN4.1	450	R	G	L. REAR	ROCKER	LATERAL	ACCEL,G'S	0842
85	C19	AMRM5.1	450	N	G	L. REAR	ROCKER	VERTICAL	ACCEL,G'S	0851
86	C20	J11563.1	450	R	G	R. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0862
87	C21	J11588.1	450	N	G	R. REAR	ROCKER	LATERAL	ACCEL,G'S	0871
88	C22	J11564.1	450	R	G	R. REAR	ROCKER	VERTICAL	ACCEL,G'S	0882
89	C23	SR47.1	350	N	MM	L.	TOE PAN	LONGITUDINAL	DISPL,MM'S	0891
90	F01	VOLTCOND.1	20	N	V	L.	IGNITION		VOLTAGE,VOLTS	0901
91	F02	VOLTCOND.1	20	N	V	L. FRT	HEADLIGHT - HI BEAM		VOLTAGE,VOLTS	0911
92	F03	VOLTCOND.1	20	N	V	L. FRT	HEADLIGHT - LO BEAM		VOLTAGE,VOLTS	0921
93	F04	VOLTAGE.1	8	N	V		ENGINE RPM		VOLTAGE,VOLTS	0931
94	F05	VOLTAGE.1	8	N	V	LEFT UPPER	ENGINE VAPOR SENSOR #1		VOLTAGE,VOLTS	0941
95	F06	VOLTAGE.1	8	N	V	RIGHT UPPER	ENGINE VAPOR SENSOR #2		VOLTAGE,VOLTS	0951
96	F07	VOLTAGE.1	8	N	V	LEFT LOWER	ENGINE VAPOR SENSOR #3		VOLTAGE,VOLTS	0961

Standard ISF Printout

Test Number : C11167
Test Type : L. FRT IMPACT-25 DEG
Division : R & D CTR 8T9309D PLBV00131
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

ISF as tested

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
97	F08	VOLTAGE.1	8	N	V	RIGHT LOWER	ENGINE VAPOR SENSOR #4		VOLTAGE,VOLTS	0971
98	F09	VOLTAGE.1	8	N	V	MANIFOLD	VAPOR SENSOR #5		VOLTAGE,VOLTS	0981
99	F10	CP227.1	10	N	A		WHEEL BAG		CURRENT,AMPS	0991
100	F31	CP236.1	10	N	A		I/P BAG		CURRENT,AMPS	1001
101	F12	CP190.1	20	N	A		FUEL PUMP		CURRENT,AMPS	1011
102	F13	CP226.1	20	N	A	L.	HORN LOW		CURRENT,AMPS	1021
103	F14	CP125.1	20	N	A		A/C CLUTCH		CURRENT,AMPS	1031
104	F15	CP200.1	20	N	A		COOLING FAN		CURRENT,AMPS	1041
105	F16	CP183.1	20	N	A		FUSABLE LINK		CURRENT,AMPS	1051
106	F17	CP191.1	20	N	A		BATTERY		CURRENT,AMPS	1061
107	F18	APKE2.1	14000	N	KPA	L ~~R~~ FRT	BRAKE SYSTEM		PRESSURE,KPA'S	1071
108	F19	5931.1	2000	N	KPA		POWER STEERING SYSTEM		PRESSURE,KPA'S	1081
109	F20	G1001.1	350	N	KPA		COOLING SYSTEM		PRESSURE,KPA'S	1091
110	F21	G1002.1	350	N	KPA		AUXILIARY FUEL TANK		PRESSURE,KPA'S	1101
111	F22	AMJM5.1	1000	N	KPA		ENGINE OIL		PRESSURE,KPA'S	1111
112	F23	AM1C6.1	1000	N	KPA		TRANSMISSION FLUID		PRESSURE,KPA'S	1121
113	F24	CONTACT.1	8	N	V		THERMAL WIRE		CONTACT,N/O	1131
114	F25	RG101.1	1000	N	DEG/SEC	CTR	RATE GYROSCOPE		DEG/SEC	1141
115	G01	A98C.1	250	R	G		LTV MDB AT C.G.	LONGITUDINAL	ACCEL,G'S	1152
116	G02	AN3P2.1	250	N	G		LTV MDB AT C.G.	LATERAL	ACCEL,G'S	1161
117	G03	A58A.1	250	R	G		LTV MDB AT C.G.	VERTICAL	ACCEL,G'S	1172
118	G04	A61E.1	250	N	G		LTV MDB AT REAR C/MBR	LONGITUDINAL	ACCEL,G'S	1181
119	G05	A57E.1	250	R	G		LTV MDB AT REAR C/MBR	LATERAL	ACCEL,G'S	1192
120	G06	ACTRO.1	250	N	G		LTV MDB AT REAR C/MBR	VERTICAL	ACCEL,G'S	1201

Standard ISF Printout

Test Number : C11226
Test Type : FRONT-IMPACT-OFFSET
Division : R & D CTR 8T9306D PLBV00131
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

ISF as tested

ATD Usage:

Position	ID Number

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
1	G15	VOLTAGE.1	5	N	V	TIME ZERO			VOLTAGE,VOLTS	0011
2	G16	VOLTAGE.1	5	N	V	PHOTO TIMING			VOLTAGE,VOLTS	0021
3	C01	CM05.1	200	N	G	L. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0031
4	C02	CU77.1	200	N	G	L. FRT	HEAD	LATERAL	ACCEL,G'S	0041
5	C03	FL43.1	200	N	G	L. FRT	HEAD	VERTICAL	ACCEL,G'S	0051
6	C04	CB22.1	200	R	G	L. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0062
7	C05	CB04.1	200	N	G	L. FRT	CHEST	LATERAL	ACCEL,G'S	0071
8	C06	CB98.1	200	R	G	L. FRT	CHEST	VERTICAL	ACCEL,G'S	0082
9	C07	CD82.1	200	N	G	L. FRT	PELVIC	LONGITUDINAL	ACCEL,G'S	0091
10	C08	CB48.1	200	N	G	L. FRT	PELVIC	LATERAL	ACCEL,G'S	0101
11	C09	CF58.1	200	N	G	L. FRT	PELVIC	VERTICAL	ACCEL,G'S	0111
12	C20	P31L.1	14000	N	N	L. FRT	FEMUR	LEFT	LOAD,N'S	0121
13	C21	P31R.1	14000	N	N	L. FRT	FEMUR	RIGHT	LOAD,N'S	0131
14	C22	P31D.1	80	N	MM	L. FRT	CHEST	LONGITUDINAL	DISPL,MM'S	0141
15	C10	P31N.1	6000	N	N	L. FRT	NECK	UAP SHEAR	LOAD,N'S	0151
16	C11	P31N.2	6000	N	N	L. FRT	NECK	URL SHEAR	LOAD,N'S	0161
17	C12	P31N.3	6000	N	N	L. FRT	NECK	UPPER AXIAL	LOAD,N'S	0171
18	C13	P31N.4	400	N	N-M	L. FRT	NECK	URL MOMENT	MOMENT,NM'S	0181
19	C14	P31N.5	400	N	N-M	L. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0191
20	C15	P31N.6	400	N	N-M	L. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0201
21	C23	3115077.1	395	N	N-M	L. FRT	LEFT TIBIA	URL MOMENT	MOMENT,NM'S	0211
22	C24	3115077.2	395	N	N-M	L. FRT	LEFT TIBIA	UAP MOMENT	MOMENT,NM'S	0221
23	C25	3114077.1	395	N	N-M	L. FRT	LEFT TIBIA	LAP MOMENT	MOMENT,NM'S	0231
24	C26	3114077.2	10000	N	N	L. FRT	LEFT TIBIA	LAP SHEAR	LOAD,N'S	0241
25	C27	3115077.3	8000	N	N	L. FRT	LEFT TIBIA	LOWER AXIAL	LOAD,N'S	0251
26	C16	1587497.1	7000	N	N	L. FRT	LEFT KNEE	L. CLEVIS	LOAD,N'S	0261
27	C17	1587497.2	7000	N	N	L. FRT	LEFT KNEE	R. CLEVIS	LOAD,N'S	0271
28	C28	3115078.1	395	N	N-M	L. FRT	RIGHT TIBIA	URL MOMENT	MOMENT,NM'S	0281
29	C29	3115078.2	395	N	N-M	L. FRT	RIGHT TIBIA	UAP MOMENT	MOMENT,NM'S	0291
30	C30	3114078.1	395	N	N-M	L. FRT	RIGHT TIBIA	LAP MOMENT	MOMENT,NM'S	0301
31	C31	3114078.2	10000	N	N	L. FRT	RIGHT TIBIA	LAP SHEAR	LOAD,N'S	0311
32	C32	3115078.3	8000	N	N	L. FRT	RIGHT TIBIA	LOWER AXIAL	LOAD,N'S	0321

Date: 07-25-1997 Time: 07:58:28

Standard ISF Printout

Test Number : C11226
Test Type : FRONT IMPACT-OFFSET
Division : R & D CTR 8T9306D PLBV00131
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

ISF as tested

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
33	C18	1587496.1	7000	N	N	L. FRT	RIGHT KNEE	L. CLEVIS	LOAD,N'S	0331
34	C19	1587496.2	7000	N	N	L. FRT	RIGHT KNEE	R. CLEVIS	LOAD,N'S	0341
35	A01	P31STL.1	24	N	MM	L. FRT	TIBIA/FEMUR LEFT		DISP,MM'S	0351
36	A02	P31STR.1	24	N	MM	L. FRT	TIBIA/FEMUR RIGHT		DISP,MM'S	0361
37	A03	CF92H.1	500	N	G	L. FRT	LEFT UPPER TIBIA	LONGITUDINAL	ACCEL,G'S	0371
38	A04	CW31H.1	500	N	G	L. FRT	LEFT UPPER TIBIA	LATERAL	ACCEL,G'S	0381
39	A05	EM90J.1	500	N	G	L. FRT	LEFT UPPER TIBIA	VERTICAL	ACCEL,G'S	0391
40	A06	AC8P2.1	500	N	G	L. FRT	LEFT LOWER TIBIA	LONGITUDINAL	ACCEL,G'S	0401
41	A07	AF9L5.1	500	N	G	L. FRT	LEFT LOWER TIBIA	LATERAL	ACCEL,G'S	0411
42	A08	AC8P5.1	500	N	G	L. FRT	LEFT LOWER TIBIA	VERTICAL	ACCEL,G'S	0421
43	A09	BN89J.1	500	N	G	L. FRT	RIGHT UPPER TIBIA	LONGITUDINAL	ACCEL,G'S	0431
44	A10	CB31H.1	500	N	G	L. FRT	RIGHT UPPER TIBIA	LATERAL	ACCEL,G'S	0441
45	A11	CG66H.1	500	N	G	L. FRT	RIGHT UPPER TIBIA	VERTICAL	ACCEL,G'S	0451
46	A12	FC25J.1	500	N	G	L. FRT	RIGHT LOWER TIBIA	LONGITUDINAL	ACCEL,G'S	0461
47	A13	FG05J.1	500	N	G	L. FRT	RIGHT LOWER TIBIA	LATERAL	ACCEL,G'S	0471
48	A14	FH76J.1	500	N	G	L. FRT	RIGHT LOWER TIBIA	VERTICAL	ACCEL,G'S	0481
49	D01	CZ13.1	200	N	G	R. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0491
50	D02	CN34.1	200	N	G	R. FRT	HEAD	LATERAL	ACCEL,G'S	0501
51	D03	FN09.1	200	N	G	R. FRT	HEAD	VERTICAL	ACCEL,G'S	0511
52	D04	CB62.1	200	R	G	R. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0522
53	D05	CB43.1	200	N	G	R. FRT	CHEST	LATERAL	ACCEL,G'S	0531
54	D06	CB67.1	200	R	G	R. FRT	CHEST	VERTICAL	ACCEL,G'S	0542
55	D07	CD17.1	200	N	G	R. FRT	PELVIC	LONGITUDINAL	ACCEL,G'S	0551
56	D08	CF49.1	200	N	G	R. FRT	PELVIC	LATERAL	ACCEL,G'S	0561
57	D09	CG02.1	200	N	G	R. FRT	PELVIC	VERTICAL	ACCEL,G'S	0571
58	D20	SF13.1	14000	N	N	R. FRT	FEMUR	LEFT	LOAD,N'S	0581
59	D21	P20R.1	14000	N	N	R. FRT	FEMUR	RIGHT	LOAD,N'S	0591
60	D22	P20D.1	80	N	MM	R. FRT	CHEST	LONGITUDINAL	DISPL,MM'S	0601
61	D10	P20N.1	6000	N	N	R. FRT	NECK	UAP SHEAR	LOAD,N'S	0611
62	D11	P20N.2	6000	N	N	R. FRT	NECK	URL SHEAR	LOAD,N'S	0621
63	D12	P20N.3	6000	N	N	R. FRT	NECK	UPPER AXIAL	LOAD,N'S	0631
64	D13	P20N.4	400	N	N-M	R. FRT	NECK	URL MOMENT	MOMENT,NM'S	0641

Standard ISF Printout

Test Number : C11226
Test Type : FRONT IMPACT-OFFSET
Division : R & D CTR 8T9306D PLBV00131
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

ISF as tested

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
65	D14	P20N.5	400	N	N-M	R. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0651
66	D15	P20N.6	400	N	N-M	R. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0661
67	D23	P20TUL.1	400	N	N-M	R. FRT	LEFT TIBIA	URL MOMENT	MOMENT,NM'S	0671
68	D24	P20TUL.2	400	N	N-M	R. FRT	LEFT TIBIA	UAP MOMENT	MOMENT,NM'S	0681
69	D25	P20TLL.1	400	N	N-M	R. FRT	LEFT TIBIA	LAP MOMENT	MOMENT,NM'S	0691
70	D26	P20TLL.2	10000	N	N	R. FRT	LEFT TIBIA	LAP SHEAR	LOAD,N'S	0701
71	D27	P20TLL.3	8000	N	N	R. FRT	LEFT TIBIA	LOWER AXIAL	LOAD,N'S	0711
72	D16	P20KNL.1	7000	N	N	R. FRT	LEFT KNEE	L. CLEVIS	LOAD,N'S	0721
73	D17	P20KNL.2	7000	N	N	R. FRT	LEFT KNEE	R. CLEVIS	LOAD,N'S	0731
74	D28	P20TUR.1	400	N	N-M	R. FRT	RIGHT TIBIA	URL MOMENT	MOMENT,NM'S	0741
75	D29	P20TUR.2	400	N	N-M	R. FRT	RIGHT TIBIA	UAP MOMENT	MOMENT,NM'S	0751
76	D30	P20TLR.1	400	N	N-M	R. FRT	RIGHT TIBIA	LAP MOMENT	MOMENT,NM'S	0761
77	D31	P20TLR.2	10000	N	N	R. FRT	RIGHT TIBIA	LAP SHEAR	LOAD,N'S	0771
78	D32	P20TLR.3	8000	N	N	R. FRT	RIGHT TIBIA	LOWER AXIAL	LOAD,N'S	0781
79	D18	P20KNR.1	7000	N	N	R. FRT	RIGHT KNEE	L. CLEVIS	LOAD,N'S	0791
80	D19	P20KNR.2	7000	N	N	R. FRT	RIGHT KNEE	R. CLEVIS	LOAD,N'S	0801
81	A15	P20STL.1	24	N	MM	R. FRT	TIBIA/FEMUR LEFT		DISP,MM'S	0811
82	A16	P20STR.1	24	N	MM	R. FRT	TIBIA/FEMUR RIGHT		DISP,MM'S	0821
83	A17	LS169.1	700	N	N-M	L. FRT	LOWER LUMBAR	MY-LAT. AXIS	MOMENT,NM'S	0831
84	A18	LS169.2	10000	N	N	L. FRT	LOWER LUMBAR	FX-FORE/AFT	LOAD,N'S	0841
85	A19	LS169.3	6000	N	N	L. FRT	LOWER LUMBAR	FZ-AXIAL	LOAD,N'S	0851
86	A20	LS127.1	700	N	N-M	R. FRT	LOWER LUMBAR	MY-LAT. AXIS	MOMENT,NM'S	0861
87	A21	LS127.2	10000	N	N	R. FRT	LOWER LUMBAR	FX-FORE/AFT	LOAD,N'S	0871
88	A22	LS127.3	6000	N	N	R. FRT	LOWER LUMBAR	FZ-AXIAL	LOAD,N'S	0881
89	A23	APAH4.1	450	R	G	L. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0892
90	A24	APAH6.1	450	R	G	L. FRT	ROCKER	LATERAL	ACCEL,G'S	0902
91	A25	APAH5.1	450	N	G	L. FRT	ROCKER	VERTICAL	ACCEL,G'S	0911
92	A26	APA23.1	450	R	G	R. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0922
93	A27	AP1F2.1	450	N	G	R. FRT	ROCKER	LATERAL	ACCEL,G'S	0931
94	A28	AP072.1	450	N	G	R. FRT	ROCKER	VERTICAL	ACCEL,G'S	0941
95	A29	APAY9.1	450	R	G	L. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0952
96	A30	APAY8.1	450	R	G	L. REAR	ROCKER	LATERAL	ACCEL,G'S	0962

Test Number : C11226
Test Type : FRONT IMPACT-OFFSET
Division : R & D CTR 8T9306D PLBV00131
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

ISF as tested

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
97	A31	APAY3.1	450	N	G	L. REAR	ROCKER	VERTICAL	ACCEL,G'S	0971
98	B01	AM702.1	450	R	G	R. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0982
99	B02	AM709.1	450	N	G	R. REAR	ROCKER	LATERAL	ACCEL,G'S	0991
100	B03	AM7W5.1	450	N	G	R. REAR	ROCKER	VERTICAL	ACCEL,G'S	1001
101	B04	SR01.1	350	N	MM	L.	TOE PAN	LONGITUDINAL	DISPL,MM'S	1011
102	B05	VOLTCOND.1	20	N	V	L. FRT	HEADLIGHT - HI BEAM		VOLTAGE,VOLTS	1021
103	B06	VOLTCOND.1	20	N	V	L. FRT	HEADLIGHT - LO BEAM		VOLTAGE,VOLTS	1031
104	B07	VOLTCOND.1	20	N	V	L.	IGNITION		VOLTAGE,VOLTS	1041
105	B08	VOLTCOND.1	20	N	V		ENGINE RPM		VOLTAGE,VOLTS	1051
106	B09	VOLTCOND.1	20	N	V	L.	STARTER		VOLTAGE,VOLTS	1061
107	B10	VOLTAGE.1	5	N	V	LEFT UPPER	ENGINE VAPOR SENSOR		VOLTAGE,VOLTS	1071
108	B11	VOLTAGE.1	5	N	V	RIGHT UPPER	ENGINE VAPOR SENSOR		VOLTAGE,VOLTS	1081
109	B12	VOLTAGE.1	5	N	V	LEFT LOWER	ENGINE VAPOR SENSOR		VOLTAGE,VOLTS	1091
110	B13	VOLTAGE.1	5	N	V	RIGHT LOWER	ENGINE VAPOR SENSOR		VOLTAGE,VOLTS	1101
111	A32	VOLTAGE.1	5	N	V	MANIFOLD	VAPOR SENSOR		VOLTAGE,VOLTS	1111
112	B15	CP234.1	10	N	A		WHEEL BAG		CURRENT,AMPS	1121
113	B16	CP195.1	10	N	A		I/P BAG		CURRENT,AMPS	1131
114	B17	CP162.1	20	N	A		FUEL PUMP		CURRENT,AMPS	1141
115	B18	CP228.1	20	N	A	L.	HORN		CURRENT,AMPS	1151
116	B19	CP190.1	20	N	A		A/C CLUTCH		CURRENT,AMPS	1161
117	B20	CP194.1	20	N	A		COOLING FAN		CURRENT,AMPS	1171
118	B21	CP191.1	20	N	A		FUSABLE LINK		CURRENT,AMPS	1181
119	B22	CP130.1	20	N	A		BATTERY		CURRENT,AMPS	1191
120	B23	CP196.1	20	N	A		STARTER WIRE		CURRENT,AMPS	1201
121	B24	APKE2.1	14000	N	KPA	R. FRT	BRAKE SYSTEM		PRESSURE,KPA'S	1211
122	B25	5931.1	1750	N	KPA		POWER STEERING SYSTEM		PRESSURE,KPA'S	1221
123	B26	G1001.1	200	N	KPA		COOLING SYSTEM		PRESSURE,KPA'S	1231
124	B27	G1002.1	200	N	KPA		AUXILIARY FUEL TANK		PRESSURE,KPA'S	1241
125	B28	AMJM5.1	700	N	KPA		ENGINE OIL		PRESSURE,KPA'S	1251
126	B29	AM1C6.1	700	N	KPA		TRANSMISSION FLUID		PRESSURE,KPA'S	1261
127	B30	CONTACT.1	8	N	V		THERMAL WIRE		CONTACT,N/O	1271
128	B31	CONTACT.1	8	N	V		PNEUMATIC WIRE		CONTACT,N/O	1281

Test Number : C11226
Test Type : FRONT IMPACT-OFFSET
Division : R & D CTR 8T9306D PLBV00131
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

ISF as tested

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
129	B32	CONTACT.1	8	N	V		PNEUMATIC WIRE FAULT		CONTACT,N/C	1291

Standard ISF Printout

Test Number : C11279
Test Type : FRT HI POLE OFFSET,RT
Division : R & D CTR 8T9308D PLJW00063
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

ISF as tested

ATD Usage:

Position	ID Number

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
1	G15	VOLTAGE.1	5	N	V	TIME ZERO			VOLTAGE,VOLTS	0011
2	G16	VOLTAGE.1	5	N	V	PHOTO TIMING			VOLTAGE,VOLTS	0021
3	D01	CY54.1	200	N	G	L. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0031
4	D02	DA54.1	200	N	G	L. FRT	HEAD	LATERAL	ACCEL,G'S	0041
5	D03	DB32.1	200	N	G	L. FRT	HEAD	VERTICAL	ACCEL,G'S	0051
6	D04	AA74.1	200	R	G	L. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0062
7	D05	AA75.1	200	N	G	L. FRT	CHEST	LATERAL	ACCEL,G'S	0071
8	D06	AA76.1	200	R	G	L. FRT	CHEST	VERTICAL	ACCEL,G'S	0082
9	D07	CC62.1	200	N	G	L. FRT	PELVIC	LONGITUDINAL	ACCEL,G'S	0091
10	D08	CD27.1	200	N	G	L. FRT	PELVIC	LATERAL	ACCEL,G'S	0101
11	D09	CB41.1	200	N	G	L. FRT	PELVIC	VERTICAL	ACCEL,G'S	0111
12	D20	P24L.1	14000	N	N	L. FRT	FEMUR	LEFT	LOAD,N'S	0121
13	D21	P24R.1	14000	N	N	L. FRT	FEMUR	RIGHT	LOAD,N'S	0131
14	D22	P24D.1	80	N	MM	L. FRT	CHEST	LONGITUDINAL	DISPL,MM'S	0141
15	D10	P24N.1	6000	N	N	L. FRT	NECK	UAP SHEAR	LOAD,N'S	0151
16	D11	P24N.2	6000	N	N	L. FRT	NECK	URL SHEAR	LOAD,N'S	0161
17	D12	P24N.3	6000	N	N	L. FRT	NECK	UPPER AXIAL	LOAD,N'S	0171
18	D13	P24N.4	400	N	N-M	L. FRT	NECK	URL MOMENT	MOMENT,NM'S	0181
19	D14	P24N.5	400	N	N-M	L. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0191
20	D15	P24N.6	400	N	N-M	L. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0201
21	D23	P24TUL.1	400	N	N-M	L. FRT	LEFT TIBIA	URL MOMENT	MOMENT,NM'S	0211
22	D24	P24TUL.2	400	N	N-M	L. FRT	LEFT TIBIA	UAP MOMENT	MOMENT,NM'S	0221
23	D25	P24TLL.1	400	N	N-M	L. FRT	LEFT TIBIA	LAP MOMENT	MOMENT,NM'S	0231
24	D26	P24TLL.2	10000	N	N	L. FRT	LEFT TIBIA	LAP SHEAR	LOAD,N'S	0241
25	D27	P24TLL.3	8000	N	N	L. FRT	LEFT TIBIA	LOWER AXIAL	LOAD,N'S	0251
26	D16	P24KNL.1	7000	N	N	L. FRT	LEFT KNEE	L. CLEVIS	LOAD,N'S	0261
27	D17	P24KNL.2	7000	N	N	L. FRT	LEFT KNEE	R. CLEVIS	LOAD,N'S	0271
28	D28	P24TUR.1	400	N	N-M	L. FRT	RIGHT TIBIA	URL MOMENT	MOMENT,NM'S	0281
29	D29	P24TUR.2	400	N	N-M	L. FRT	RIGHT TIBIA	UAP MOMENT	MOMENT,NM'S	0291
30	D30	P24TLR.1	400	N	N-M	L. FRT	RIGHT TIBIA	LAP MOMENT	MOMENT,NM'S	0301
31	D31	P24TLR.2	10000	N	N	L. FRT	RIGHT TIBIA	LAP SHEAR	LOAD,N'S	0311
32	D32	P24TLR.3	8000	N	N	L. FRT	RIGHT TIBIA	LOWER AXIAL	LOAD,N'S	0321

Date: 07-25-1997 Time: 08:00:40

Test Number : C11279
Test Type : FRT HI POLE OFFSET,RT
Division : R & D CTR 8T9308D PLJW00063
Divisional Engineer :
Test Engineer :
Instrument Technician:
Test Technician :

ISF as tested

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
33	D18	P24KNR.1	7000	N	N	L. FRT	RIGHT KNEE	L. CLEVIS	LOAD,N'S	0331
34	D19	P24KNR.2	7000	N	N	L. FRT	RIGHT KNEE	R. CLEVIS	LOAD,N'S	0341
35	A01	P24TFL.1	24	N	MM	L. FRT	TIBIA/FEMUR LEFT		DISP,MM'S	0351
36	A02	P24TFR.1	24	N	MM	L. FRT	TIBIA/FEMUR RIGHT		DISP,MM'S	0361
37	E01	CM05.1	200	N	G	R. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0371
38	E02	CU77.1	200	N	G	R. FRT	HEAD	LATERAL	ACCEL,G'S	0381
39	E03	FL43.1	200	N	G	R. FRT	HEAD	VERTICAL	ACCEL,G'S	0391
40	E04	CB22.1	200	R	G	R. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0402
41	E05	CB04.1	200	N	G	R. FRT	CHEST	LATERAL	ACCEL,G'S	0411
42	E06	CB98.1	200	R	G	R. FRT	CHEST	VERTICAL	ACCEL,G'S	0422
43	E07	CD82.1	200	N	G	R. FRT	PELVIC	LONGITUDINAL	ACCEL,G'S	0431
44	E08	CB48.1	200	N	G	R. FRT	PELVIC	LATERAL	ACCEL,G'S	0441
45	E09	CF58.1	200	N	G	R. FRT	PELVIC	VERTICAL	ACCEL,G'S	0451
46	E20	P31L.1	14000	N	N	R. FRT	FEMUR	LEFT	LOAD,N'S	0461
47	E21	P31R.1	14000	N	N	R. FRT	FEMUR	RIGHT	LOAD,N'S	0471
48	E22	P31D.1	80	N	MM	R. FRT	CHEST	LONGITUDINAL	DISPL,MM'S	0481
49	E10	P31N.1	6000	N	N	R. FRT	NECK	UAP SHEAR	LOAD,N'S	0491
50	E11	P31N.2	6000	N	N	R. FRT	NECK	URL SHEAR	LOAD,N'S	0501
51	E12	P31N.3	6000	N	N	R. FRT	NECK	UPPER AXIAL	LOAD,N'S	0511
52	E13	P31N.4	400	N	N-M	R. FRT	NECK	URL MOMENT	MOMENT,NM'S	0521
53	E14	P31N.5	400	N	N-M	R. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0531
54	E15	P31N.6	400	N	N-M	R. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0541
55	E23	3115077.1	395	N	N-M	R. FRT	LEFT TIBIA	URL MOMENT	MOMENT,NM'S	0551
56	E24	3115077.2	395	N	N-M	R. FRT	LEFT TIBIA	UAP MOMENT	MOMENT,NM'S	0561
57	E25	3114077.1	395	N	N-M	R. FRT	LEFT TIBIA	LAP MOMENT	MOMENT,NM'S	0571
58	E26	3114077.2	10000	N	N	R. FRT	LEFT TIBIA	LAP SHEAR	LOAD,N'S	0581
59	E27	3115077.3	8000	N	N	R. FRT	LEFT TIBIA	LOWER AXIAL	LOAD,N'S	0591
60	E16	1587497.1	7000	N	N	R. FRT	LEFT KNEE	L. CLEVIS	LOAD,N'S	0601
61	E17	1587497.2	7000	N	N	R. FRT	LEFT KNEE	R. CLEVIS	LOAD,N'S	0611
62	E28	3115078.1	395	N	N-M	R. FRT	RIGHT TIBIA	URL MOMENT	MOMENT,NM'S	0621
63	E29	3115078.2	395	N	N-M	R. FRT	RIGHT TIBIA	UAP MOMENT	MOMENT,NM'S	0631
64	E30	3114078.1	395	N	N-M	R. FRT	RIGHT TIBIA	LAP MOMENT	MOMENT,NM'S	0641

Test Number : C11279
Test Type : FRT HI POLE OFFSET,RT
Division : R & D CTR 8T9308D PLJW00063
Divisional Engineer :
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Instrument Technician:
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ISF as tested

Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
65	E31	3114078.2	10000	N	N	R. FRT	RIGHT TIBIA	LAP SHEAR	LOAD,N'S	0651
66	E32	3115078.3	8000	N	N	R. FRT	RIGHT TIBIA	LOWER AXIAL	LOAD,N'S	0661
67	E18	1587496.1	7000	N	N	R. FRT	RIGHT KNEE	L. CLEVIS	LOAD,N'S	0671
68	E19	1587496.2	7000	N	N	R. FRT	RIGHT KNEE	R. CLEVIS	LOAD,N'S	0681
69	B01	P31STL.1	24	N	MM	R. FRT	TIBIA/FEMUR LEFT		DISP,MM'S	0691
70	B02	P31STR.1	24	N	MM	R. FRT	TIBIA/FEMUR RIGHT		DISP,MM'S	0701
71	A03	CF92H.1	500	N	G	R. FRT	LEFT UPPER TIBIA	LONGITUDINAL	ACCEL,G'S	0711
72	A04	CW31H.1	500	N	G	R. FRT	LEFT UPPER TIBIA	LATERAL	ACCEL,G'S	0721
73	A05	EM90J.1	500	N	G	R. FRT	LEFT UPPER TIBIA	VERTICAL	ACCEL,G'S	0731
74	A06	AC8P2.1	500	N	G	R. FRT	LEFT LOWER TIBIA	LONGITUDINAL	ACCEL,G'S	0741
75	A07	AF9L5.1	500	N	G	R. FRT	LEFT LOWER TIBIA	LATERAL	ACCEL,G'S	0751
76	A08	AC8P5.1	500	N	G	R. FRT	LEFT LOWER TIBIA	VERTICAL	ACCEL,G'S	0761
77	A09	BN89J.1	500	N	G	R. FRT	RIGHT UPPER TIBIA	LONGITUDINAL	ACCEL,G'S	0771
78	A10	CB31H.1	500	N	G	R. FRT	RIGHT UPPER TIBIA	LATERAL	ACCEL,G'S	0781
79	A11	CG66H.1	500	N	G	R. FRT	RIGHT UPPER TIBIA	VERTICAL	ACCEL,G'S	0791
80	A12	FC25J.1	500	N	G	R. FRT	RIGHT LOWER TIBIA	LONGITUDINAL	ACCEL,G'S	0801
81	A13	FG05J.1	500	N	G	R. FRT	RIGHT LOWER TIBIA	LATERAL	ACCEL,G'S	0811
82	A14	FH76J.1	500	N	G	R. FRT	RIGHT LOWER TIBIA	VERTICAL	ACCEL,G'S	0821
83	A15	LS141.1	700	N	N-M	L. FRT	LOWER LUMBAR	MY-LAT. AXIS	MOMENT,NM'S	0831
84	A16	LS141.2	10000	N	N	L. FRT	LOWER LUMBAR	FX-FORE/AFT	LOAD,N'S	0841
85	A17	LS141.3	6000	N	N	L. FRT	LOWER LUMBAR	FZ-AXIAL	LOAD,N'S	0851
86	A18	LS169.1	700	N	N-M	R. FRT	LOWER LUMBAR	MY-LAT. AXIS	MOMENT,NM'S	0861
87	A19	LS169.2	10000	N	N	R. FRT	LOWER LUMBAR	FX-FORE/AFT	LOAD,N'S	0871
88	A20	LS169.3	6000	N	N	R. FRT	LOWER LUMBAR	FZ-AXIAL	LOAD,N'S	0881
89	A21	AM702.1	450	R	G	L. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0892
90	A22	AM709.1	450	R	G	L. FRT	ROCKER	LATERAL	ACCEL,G'S	0902
91	A23	AM7W5.1	450	R	G	L. FRT	ROCKER	VERTICAL	ACCEL,G'S	0912
92	A24	APA23.1	450	R	G	R. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0922
93	A25	AP1F2.1	450	N	G	R. FRT	ROCKER	LATERAL	ACCEL,G'S	0931
94	A26	AP072.1	450	N	G	R. FRT	ROCKER	VERTICAL	ACCEL,G'S	0941
95	A27	APAY9.1	450	R	G	L. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0952
96	A28	APAY8.1	450	R	G	L. REAR	ROCKER	LATERAL	ACCEL,G'S	0962

Standard ISF Printout

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Divisional Engineer :
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Instrument Technician:
Test Technician :

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Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
97	A29	APAY3.1	450	N	G	L. REAR	ROCKER	VERTICAL	ACCEL,G'S	0971
98	A30	APAH4.1	450	R	G	R. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0982
99	A31	APAH6.1	450	N	G	R. REAR	ROCKER	LATERAL	ACCEL,G'S	0991
100	A32	APAH5.1	450	R	G	R. REAR	ROCKER	VERTICAL	ACCEL,G'S	1002
101	B03	SR65.1	400	N	MM	R.	TOE PAN	LONGITUDINAL	DISPL,MM'S	1011
102	B04	VOLTCOND.1	20	N	V	L.	IGNITION		VOLTAGE,VOLTS	1021
103	B05	VOLTCOND.1	20	N	V		STARTER		VOLTAGE,VOLTS	1031
104	B06	VOLTCOND.1	20	N	V	R. FRT	HEADLIGHT - HI BEAM		VOLTAGE,VOLTS	1041
105	B07	VOLTCOND.1	20	N	V	R. FRT	HEADLIGHT - LO BEAM		VOLTAGE,VOLTS	1051
106	B08	VOLTAGE.1	5	N	V		ENGINE MOTION		VOLTAGE,VOLTS	1061
107	B09	VOLTAGE.1	5	N	V		ENGINE RPM		VOLTAGE,VOLTS	1071
108	B10	VOLTAGE.1	5	N	V	LEFT UPPER	ENGINE VAPOR SENSOR (S3)		VOLTAGE,VOLTS	1081
109	B11	VOLTAGE.1	5	N	V	RIGHT UPPER	ENGINE VAPOR SENSOR (S1)		VOLTAGE,VOLTS	1091
110	B12	VOLTAGE.1	5	N	V	LEFT LOWER	ENGINE VAPOR SENSOR (S5)		VOLTAGE,VOLTS	1101
111	B13	VOLTAGE.1	5	N	V	RIGHT LOWER	ENGINE VAPOR SENSOR (S4)		VOLTAGE,VOLTS	1111
112	B14	VOLTAGE.1	5	N	V	MANIFOLD	VAPOR SENSOR (S2)		VOLTAGE,VOLTS	1121
113	B15	CP234.1	10	N	A		WHEEL BAG		CURRENT,AMPS	1131
114	B16	CP195.1	10	N	A		I/P BAG		CURRENT,AMPS	1141
115	B17	CP162.1	20	N	A		FUEL PUMP		CURRENT,AMPS	1151
116	B18	CP114.1	20	N	A	L.	HORN		CURRENT,AMPS	1161
117	B19	CP207.1	20	N	A		A/C CLUTCH		CURRENT,AMPS	1171
118	B20	CP212.1	20	N	A		COOLING FAN		CURRENT,AMPS	1181
119	B21	CP210.1	20	N	A		FUSABLE LINK		CURRENT,AMPS	1191
120	B22	CG101.1	40	N	A		STARTER WIRE		CURRENT,AMPS	1201
121	B23	CG102.1	40	N	A		MAIN BATTERY		CURRENT,AMPS	1211
122	B24	APKE2.1	14000	N	KPA	R. FRT	BRAKE SYSTEM		PRESSURE,KPA'S	1221
123	B25	5931.1	1750	N	KPA		POWER STEERING SYSTEM		PRESSURE,KPA'S	1231
124	B26	G1001.1	200	N	KPA		COOLING SYSTEM		PRESSURE,KPA'S	1241
125	B27	AK3M2.1	700	N	KPA		AUXILIARY FUEL TANK		PRESSURE,KPA'S	1251
126	B28	AMJM5.1	700	N	KPA		ENGINE OIL		PRESSURE,KPA'S	1261
127	B29	AM1C6.1	700	N	KPA		TRANSMISSION FLUID		PRESSURE,KPA'S	1271
128	B30	CONTACT.1	8	N	V		THERMAL WIRE		CONTACT,N/O	1281

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Ref	DAS	Tran ID#	Req FS	P	Units	Position	Location	Component	Units	PrCd
129	B31	CONTACT.1	8	N	V		PNEUMATIC WIRE		CONTACT,N/O	1291
130	B32	CONTACT.1	8	N	V		PNEUMATIC WIRE FAULT		CONTACT,N/C	1301