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FEB 15 2001

L. Robert Shelton,
Executive Director
NATIONAL HIGHWAY TRAFFIC
SAFETY ADMINISTRATION
400 Seventh Street, S.W., Room 5220
Washington, DC 20590

Dear Mr. Shelton:

Re: **Settlement Agreement**
Section B. Fire Safety Research

Enclosed is a final report prepared by Jack L. Jensen and Jeffrey Santrock of General Motors Corporation, entitled, "Evaluation of Motor Vehicle Fire Initiation and Propagation Part 8: Crash Tests on a Sport-Utility-Vehicle."

This final report relates to Project B.3 (Fire Initiation and Propagation Tests).

Yours truly,

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Evaluation of Motor Vehicle Fire Initiation and Propagation
Part 8: Crash Tests on a Sport-Utility-Vehicle

Jack L. Jensen, Jeffrey Santrock

General Motors Corporation

Abstract

This report describes the test conditions and presents the results of three crash tests, each of a four-wheel-drive sport-utility-vehicle, to study post-collision fire potential. Specialized instrumentation was used to help identify potential ignition and fuel sources during the crash. These tests were part of a series of crash and fire propagation tests which General Motors Corporation conducted pursuant to an agreement between GM and the U.S. Department of Transportation (Project B.3).

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1. Introduction

Three crash tests were conducted on a four-wheel-drive sport-utility-vehicle (1997 Ford Explorer) to study post-collision fire potential. These tests were part of a series of crash and fire propagation tests that General Motors Corporation conducted pursuant to an agreement between GM and the U.S. Department of Transportation. An earlier report, "Vehicle Crash and Fire Propagation Test Program" [1] documented the overall strategies and test methodologies for this project. Part 2 of this report "Crash Tests on a Passenger Van" [2] presented the results of a series of tests similar to those presented here on a front-wheel-drive passenger van (1996 Dodge Caravan). Part 5 of this report "Crash Tests on a Rear Wheel Drive Passenger Car" [3] presented the results of tests on a 1997 Chevrolet Camaro.

One additional series of crash tests were conducted on a front-wheel-drive mid-sized passenger sedan (1998 Honda Accord). The results of these tests will be reported in a subsequent technical report.

The series of crash tests described in this report consisted of three tests each on a new 1997 Ford Explorer. The three crash conditions were an 85 km/h (53 mph) offset moving deformable barrier rear impact, a 55 km/h (34 mph) offset pole frontal impact, and a 105 km/h (65 mph) oblique moving deformable barrier frontal impact. The three test conditions used for the sport-utility-vehicle (SUV) were the same as for the test series on the rear-wheel-drive passenger vehicle (1997 Chevrolet Camaro) and the front-wheel-drive passenger vehicle (1998 Honda Accord). This combination of tests, however, was slightly different than the combination used for the initial series on the passenger van, which was the first series conducted. The reasons for the differences were described in Parts 1 and 2.

The three SUVs tested were newly purchased four-wheel-drive four door 1997 Ford Explorers. All three vehicles were equipped with a 4.0-liter V-6 engine, air conditioning, automatic overdrive transmission as well as other options. As in previous test series [1],[2],[3], the best selling engine, transmission and air conditioning options were selected. For 1997 Explorers, 76.9% were sold with the 4.0 liter engine, 100% with air conditioning, and 96.8% with automatic transmission [4]. Also, 67.2 % of 1997 Explorers were sold with the four-wheel-drive option [4]. Sales figures were not used to select any other options. All three Explorers were identically equipped with P235 all terrain tires, trailer towing package as well as other options. Standard equipment for 1997 Explorers included driver and passenger airbag systems, adjustable height front seat belts, and four-wheel anti-lock disc brakes.

2. Sport-Utility-Vehicle Oblique Moving Barrier Frontal Impact, Test C11687

A SUV oblique moving barrier frontal impact crash test was conducted at the General Motors Proving Ground on July 30, 1997. A total of 146 data channels were recorded for this test, including 140 on the test vehicle and Anthropomorphic Test Devices (ATDs) and 6 on the moving barrier. Similar to the other 105 km/h oblique moving deformable barrier frontal impacts, this test was conducted outdoors.

2.1. *Test Conditions*

2.1.1. Impact Conditions

This test was a frontal oblique moving deformable barrier frontal impact as depicted in Figure 1. The impact configuration was nearly identical to the two previous oblique moving barrier tests. However, the relative angle between the vehicle and moving barrier was set at 23 degrees, which is vehicle specific. This angle was set so the center of the moving barrier face impacted the front left corner of the test vehicle and its velocity vector passed through the CG of the test vehicle. The CG of the test vehicle was approximately 1371 mm rearward of the front wheel centerline and laterally in the center of the vehicle. Similar to the previous oblique moving barrier tests, the front left corner was defined as the intersection of two lines. The first 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. This resulted in a theoretical overlap of 52% based on the barrier width of 1676 mm and a vehicle width of 1784 mm. (0.51 = [(1676 / 2) / cos (23 degrees)] / 1784.)

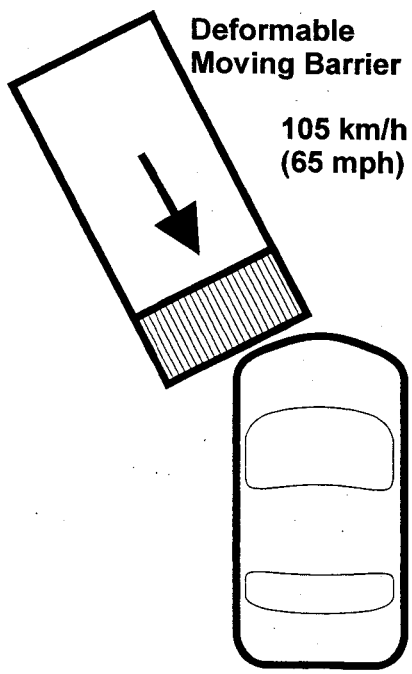

Figure 1
Crash Test Configuration for Test C11687

Figure 2
Pre-Test Photograph of Test C11687

The mass of the deformable barrier was 1638 kg (3611 lbs.). This mass was greater than what is used for FMVSS214 [5] tests (1367 kg or 3015 lb.) The height of the center of the simulated bumper form was 432 mm (17 in.) above grade (which is the same as specified in FMVSS214 [5].) 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 [5] testing. The aluminum honeycomb barrier face was also the same as what is used for FMVSS214 [5] testing. 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 was measured with radar and was 104.4 km/h (64.9 mph).

2.1.2. Vehicle Description

The test vehicle was a 1997 Ford Explorer (VIN: 1FMDU34X4VUB02606) which had a test mass of 2232 kg (1152 kg front, 1080 kg rear) which included the two ATDs, crash test instrumentation, and Stoddard Solvent in the gasoline tank. First, the fuel tank's unusable capacity was established (filled) with Stoddard

Solvent, then 74.8 liters of Stoddard were added to the unusable capacity of the tank. (74.8 liters represents 95% of the usable capacity of 78.7 liters.) The engine was operating at impact with complete engine compartment fluids, including battery electrolyte. The radio, low beam headlights, fog lights, and air conditioning were all operating at impact. The transmission was in neutral for the test.

2.1.3. Pre-test Engine Warm-up Procedure

The engine was started approximately 77 minutes before impact as outlined in Table 1.

Table 1.
Engine Warm-up Procedure for Test C11687

	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	30
Engine restarted, set to 1100 rpm	61	16
Impact	77	

The surface temperature of the left exhaust manifold was measured using a non-contact infrared meter twice during the engine warm-up period. At 18 minutes after the initial engine start the exhaust manifold temperature was 435 degrees F, and at 28 minutes it was 547 degrees F.

For comparison purposes, the manifold temperature was measured on another Explorer the previous day while the engine was operating and also following road loading. Following 20 minutes of normal idle (approx. 900 rpm) the manifold temperature was 450 degrees F. Following a subsequent 10-minute drive at 45 mph, it was 650 degrees F, and following a subsequent 3 minutes at 1800 rpm, it was 685 degrees F.

2.1.4. Modifications to Production Vehicle

Because the objective of this test was to conduct basic research on crash conditions that might result in post-collision fire 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.

Gasoline was supplied to the engine from an auxiliary tank mounted in the rear cargo area, as the production fuel tank contained Stoddard Solvent. The fuel supply and return lines were disconnected near the production fuel pump (on top of production fuel tank) and re-routed to near the left frame rail. Lines from the auxiliary tank were then connected to these re-routed lines to supply gasoline to the engine. The

remaining supply and return lines at the production fuel pump were connected to each other, to prevent the leakage of stoddard solvent.

The vehicle's rear brake lines were cut near the rear axle 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 to enable easy identification of fluid leaks. Unlike the pole impacts, no modifications were made to the front wheel brake calipers or pads.

The plastic throttle cover was removed from the engine compartment for the test to allow for easier adjustment of the idle speed during the engine warm-up procedure.

Similar to previous tests, every reasonable attempt was made to make the added instrumentation in the engine compartment as non-intrusive as possible so as not to affect the outcome of the test.

For all of the tests conducted for this project, the test vehicles were loaded with all required instrumentation for the test objective, independent of a target test mass. Thus, the test masses for different tests on the same vehicle model are likely different, and also different than the test mass required by FMVSS 208 [5].

2.1.5. Vehicle Measurements

Measurements listed here are ones taken to measure the vehicle properties during the crash and not necessarily to identify fire ignition potential. (As compared to, Section 2.1.11, which lists electrical voltages and currents used to identify potential shorts, and Section 2.1.10 which lists fluid pressures used to identify fluid leaks.)

- 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 floorpan acceleration (longitudinal)
- Right floorpan acceleration (longitudinal)
- 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 motion (rotation of crankshaft using an auxiliary magnetic pickup transducer) (labeled "engine speed – MP1A" in Appendix B)
- Fuel pump current (at auxiliary fuel tank)

- Fuel pump voltage (measured near auxiliary fuel tank)
- Fuel pump inertia switch voltage (near switch mounted under IP, gray/orange wire voltage drop to ground)
- Vehicle yaw angular velocity (measured using rate gyroscope located on the floorpan near the CG)

2.1.6. 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.

2.1.7. Moving Barrier Measurements

The following accelerations 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)

2.1.8. Anthropomorphic Test Device (ATD) Measurements

Two 50th percentile male Hybrid III ATDs (FMVSS reference part 572, Subpart E) [6] were located in the front outboard seating positions. The seats were located in the fore-aft mid position, and the seat backs were at 25.0 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 [7] guidelines and the pelvic angles were measured to be 25.0 degrees from horizontal for the left front ATD and 23.8 degrees for the right front ATD. The head target angle was at 0 degrees from horizontal for both ATDs. The following channels were measured for each ATD.

- 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)

The left front (driver) ATD only was instrumented to make the following additional measurements on the lower leg:

- Upper tibia shear load (Fx, anterior – posterior), left and right legs
- Lower tibia shear load (Fy, right - left), left and right legs
- Lower tibia bending moment (Mx, right – left), left and right legs

2.1.9. Hydrocarbon Vapor Measurements

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

- Right upper engine (location #1)
- Left exhaust manifold (location #2)
- Left upper engine (location #3)
- Left lower fuel line, near fuel filter (location #4)
- Near the catalytic converter (location #5)

The concentration of hydrocarbon vapors was measured using tin oxide sensors at each location [1]. In addition, the temperature from each tin oxide sensor was also measured to more accurately interpret the output of the gas sensors. Co-located with the tin oxide sensors were sample tubes that drew gas into collection tubes for subsequent analysis by gas chromatography/ mass spectrometry (GC/MS) [1].

2.1.10. Fluid Pressure Measurements

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

- Front brake system pressure (line tapped near ABS junction, left side of engine compartment)
- Power steering system pressure (measured near left side of power steering rack)
- Cooling system pressure (measured at thermostat housing)

- Auxiliary fuel supply line pressure (measured near the auxiliary fuel tank in the rear cargo area)
- Engine oil pressure (measured at the oil pressure sending unit on right side of engine)
- Transmission cooler fluid pressure (tapped into transmission fluid cooler line)

A fluorescent dye was added to the cooling system to help identify and distinguish coolant.

2.1.11. Additional Electrical Measurements

Electrical events such as shorts, arcs or overheated circuits are possible ignition sources for post-collision fires. Therefore, in addition to standard crash test electrical measurements (such as the air bag currents), electrical measurements were also made on some electrical circuits anticipated to be in the area of vehicle crush. Due to instrumentation limitations, only selected and not all electrical circuits in the area of anticipated crush were monitored.

Hall – effect clamp - on current monitoring transducers were used to measure the following currents:

- Alternator cable #1 (measured at fusible link near PDB)
- Alternator cable #2 (measured at fusible link near PDB)
- A/C clutch (measured near compressor)
- Starter cable and B+ (measured at battery)
- Power distribution box (PDB) (measured near box)
- HVAC blower (measured near relay box #2)
- Headlight / fog light (low beam and fog lights measured with one transducer, under the PDB)
- Ignition (measured in passenger compartment under instrument panel)

Voltages were measured on the following circuits:

- Ignition (measured under instrument panel inside of passenger compartment)
- Left front headlight low beam (measured at driver's side hinge pillar fuse panel)
- Left front headlight fog light (measured near rear of fog light)
- Starter (measured at terminal on starter)
- Battery (measured at terminal on battery)
- Alternator (measured at terminal on alternator)

2.1.12. Evaluation of the Crashworthiness of Potential Fire Detection or Suppression Technologies

Devices representing three different fire detection technologies were included on this test: optical sensors, thermal wires, and pneumatic wires.

The thermal wire device was supplied by Dual Spectrum Santa Barbara and was similar to those evaluated in previous tests in this series [2],[3]. It consists of two wires separated by an insulating material designed to melt when exposed to flames. The completion of the electrical circuit could be used to activate a fire suppression system. For test C11687, the thermal wire was located on the underside of the hood liner as shown in Figure 3.

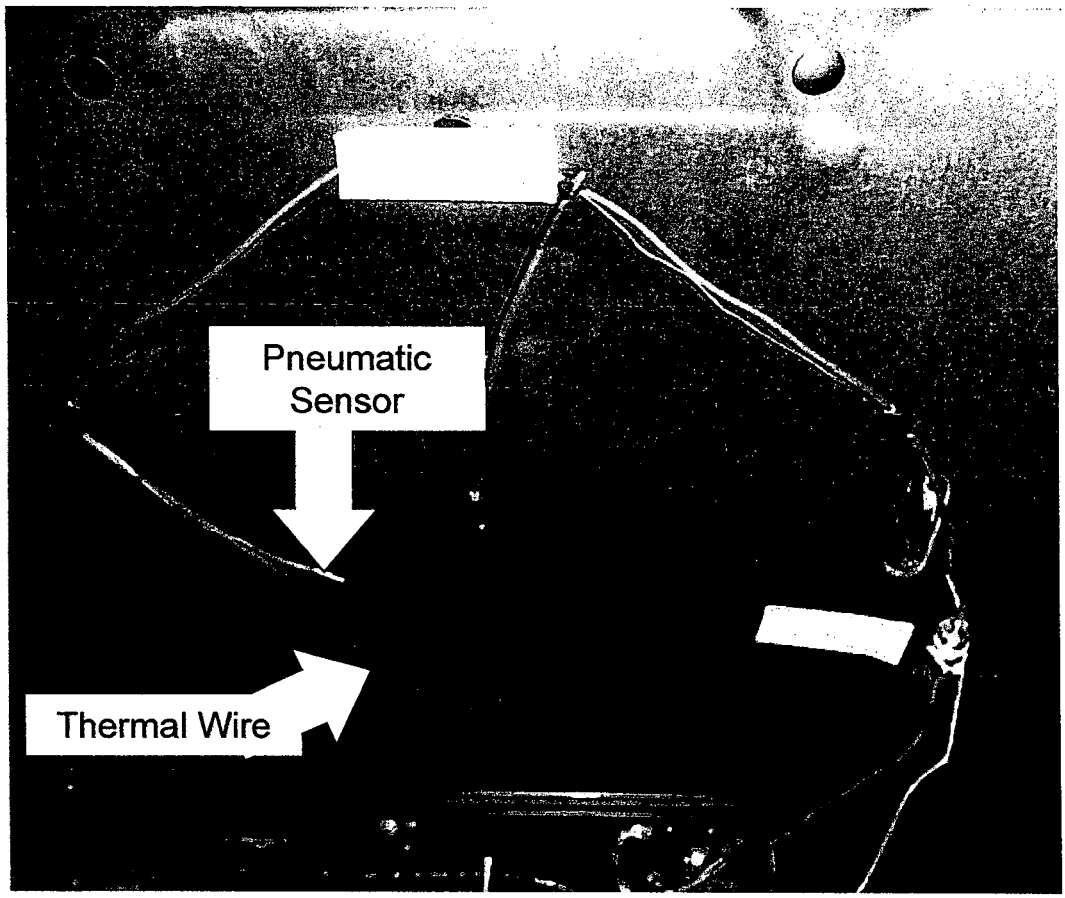

Figure 3
Thermal Wire and Pneumatic Detectors
Test C11687

Co-located with the thermal wire was a pneumatic fire detector tube which also was similar to tubes used in previous tests [2],[3]. This tube (supplied by Dual Spectrum Santa Barbara) is also shown in Figure 3. Due to its small diameter, the tube is not easily visible in the photograph but the pressure sensing part of the device is visible in the right portion of the photograph. This detector is designed to sense an increase in gas pressure inside of the tube when exposed to fire. Two channels were monitored for this device, one activation channel (which could be used to activate a suppression system) and a fault circuit.

Two Dual Spectrum PM-5V optical sensors were mounted in the rear portion of the engine compartment. The optical sensors used were similar to those used in previous tests [2],[3] and are designed to sense infrared energy to detect a fire. One was located in the left rear portion of the engine compartment and

was oriented (aimed) forward and slightly inboard. The other was symmetrically located on the right side of the engine compartment and was also oriented forward and slightly inboard. One activation channel was recorded for each sensor.

2.2. *Summary of Test Results*

Post-test photographs of the vehicle are shown in Figure 4 and Figure 5.

Figure 4
Post-Test Photograph of Test C11687, Front Left View

Figure 5
Post-Test Photograph of Test C11687, Front Right View

2.2.1. Summary of Vehicle Crash Test Measurements

The complete set of recorded and computed vehicle measurements are included in Appendix B (Plots 61 through 77, 81, 82, 88, 105, 106, 109, 119).

Because this vehicle was impacted at a 23 degree angle, it experienced both longitudinal (relative to the vehicle) and lateral accelerations early during the crash event. Similar to the other oblique moving barrier tests conducted for this project [2],[3] the accelerations and velocity changes of the vehicle's rocker panels were translated to a new coordinate system that is aligned with the initial motion of the moving barrier. 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 6. 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.

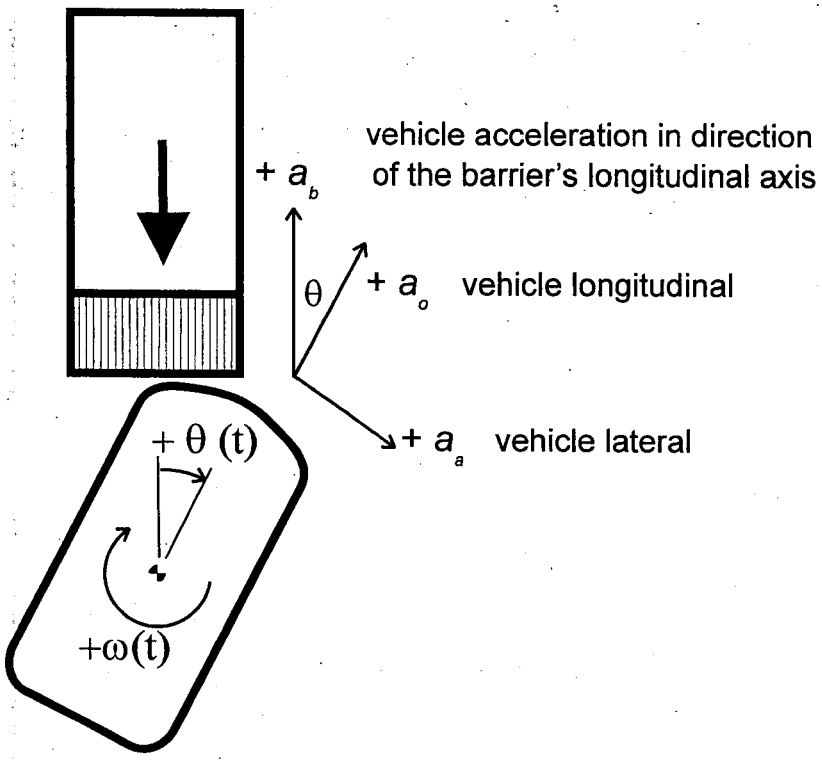

Figure 6
Vehicle and Barrier Axis
Test C11687

The translated measurement was calculated using the following steps.

The yaw velocity rate, $\omega(t)$ (which was measured and is shown in Plot 119, Appendix B) was integrated using a constant of 23° 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 7.

$$\theta(t) = \int \omega(t)\, \delta t + 23°$$

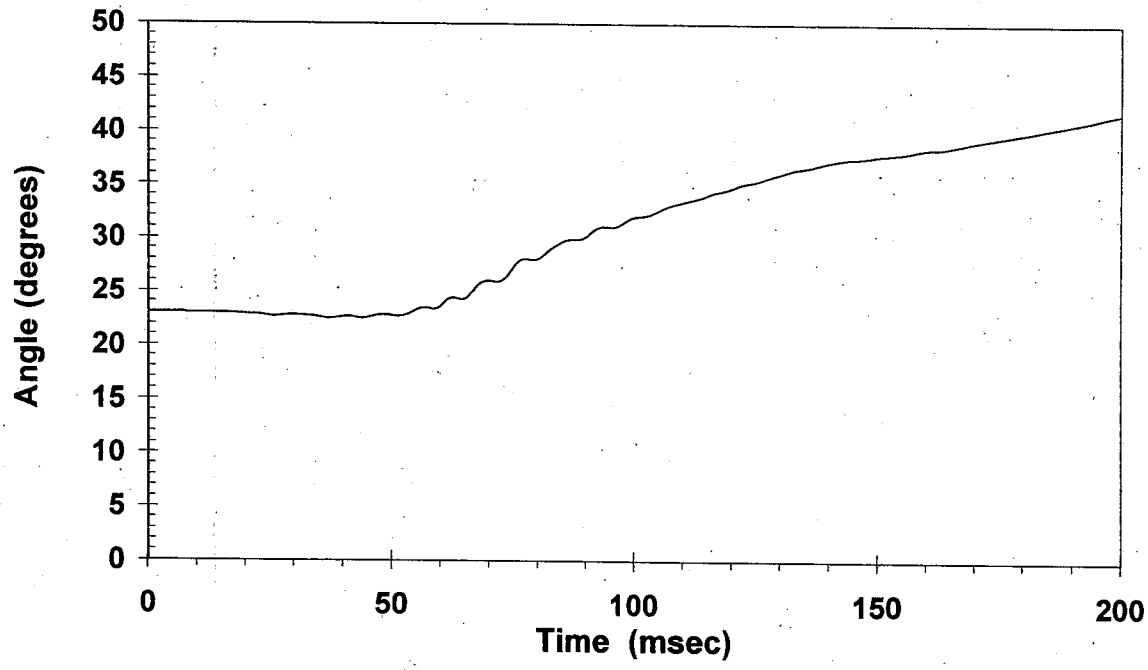

Figure 7
Vehicle's Yaw Angle, $\theta(t)$
Test C11687

Next, the following data channels were filtered at SAE class 60 [8] :

Right front rocker panel longitudinal acceleration, $a_{rfo}(t)$, (Plot 64, Appendix B)

Right front rocker panel lateral acceleration, $a_{rfa}(t)$, (Plot 65, Appendix B)

Left rear rocker panel longitudinal acceleration, $a_{lro}(t)$, (Plot 69, Appendix B)

Left rear rocker panel lateral acceleration, $a_{lra}(t)$, (Plot 70, Appendix B)

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 (Figure 8):

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

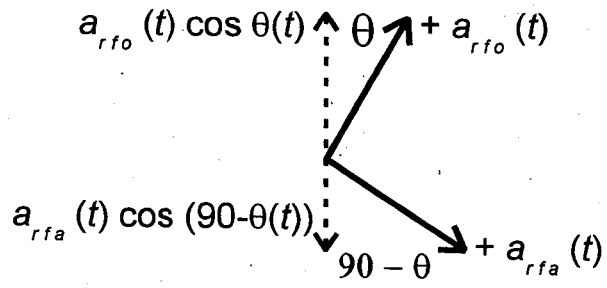

Figure 8
Translation of Accelerations to the Barrier's Initial Axes

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 using the following formula:

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

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 9.

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

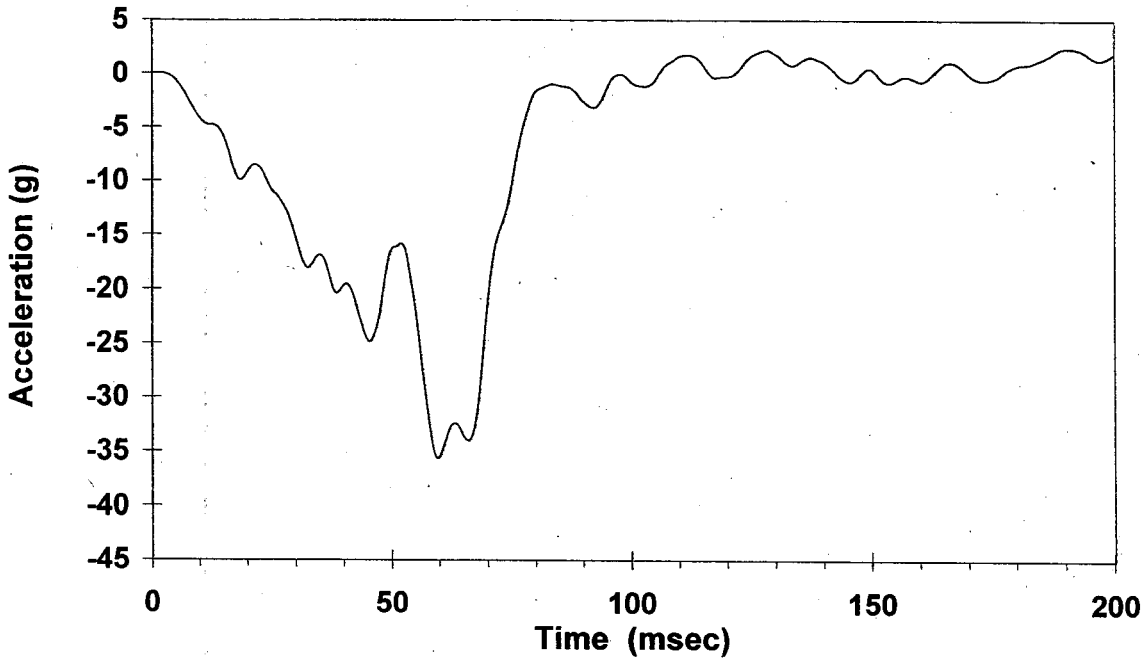

Figure 9
Vehicle's Averaged Acceleration In The Direction Of The Barrier's Longitudinal Axis, $A_{avgb}(T)$
Test C11687

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 10. The vehicle experienced a change in velocity of 45 km/h in the direction of the barrier's initial longitudinal axis.

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

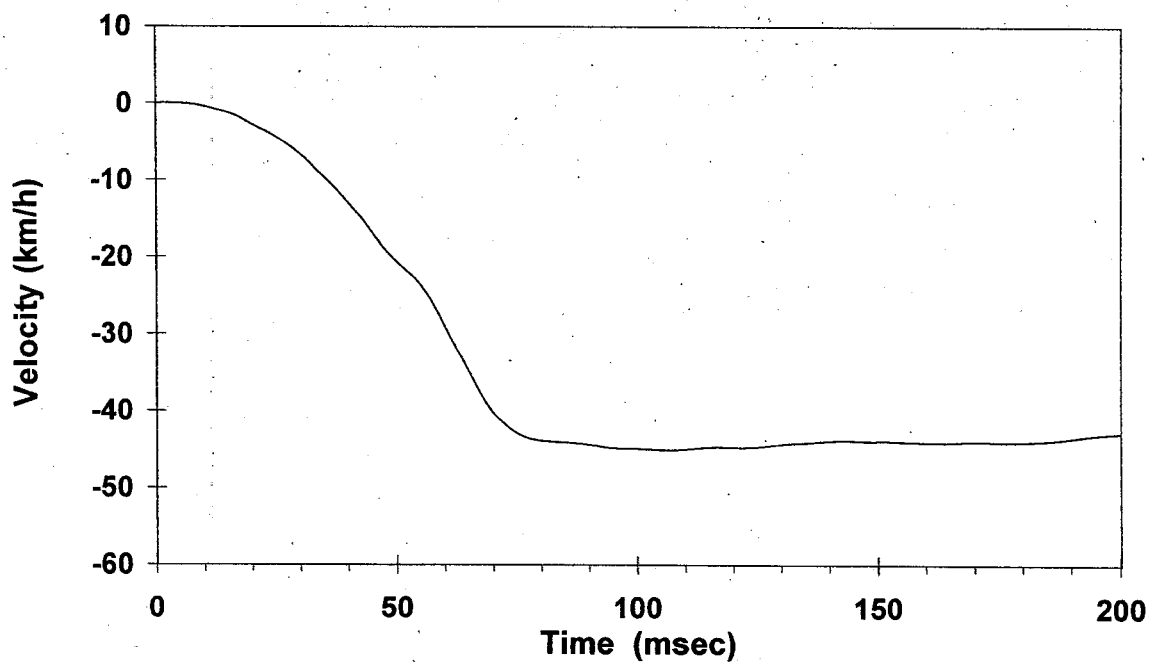

Figure 10
Vehicle's Averaged Velocity in the Direction of the Barrier's Longitudinal Axis, $V_{avgb}(T)$
Test C11687

The displacement of the driver's side toe pan was approximately 107 mm as shown in Figure 11 and Plot 77 Appendix B.

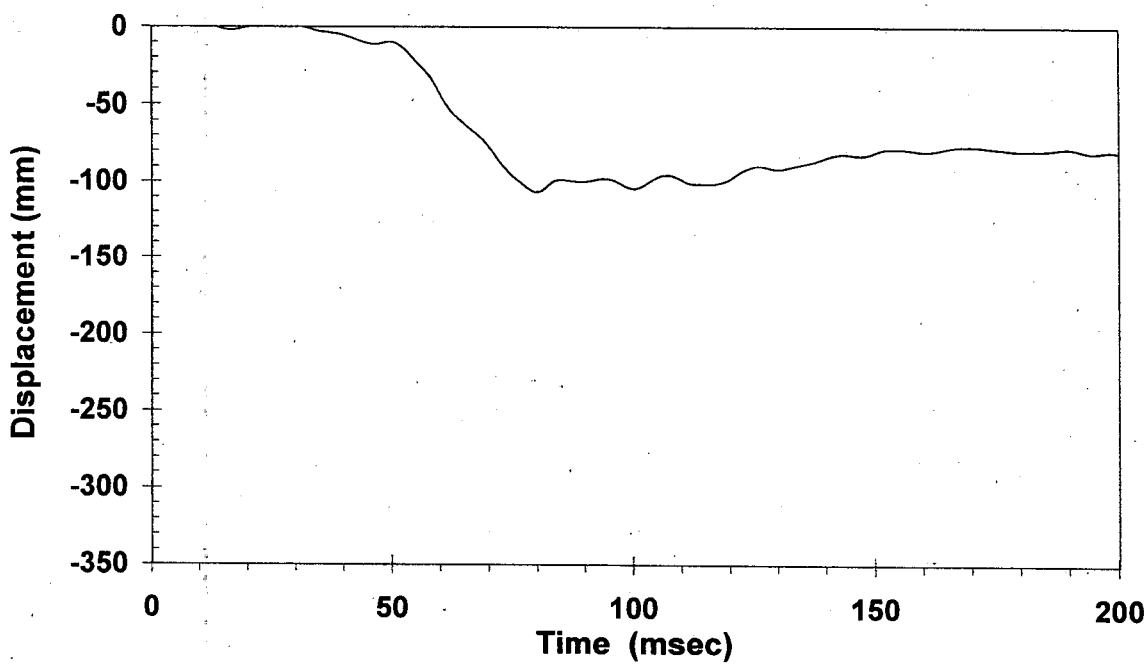

Figure 11
Left Toepan Displacement, Relative to Floorpan
Test C11687, filtered at SAE class 60 [8]

The current measurements of the driver and passenger air bag circuits indicated that both air bags deployed at 18 msec (Appendix B, Plots 105 and 106.)

The engine motion measurement is shown in Appendix B, Plot 88 and recreated here as Figure 12. This measurement indicated that the engine was turning at normal speed through about 40 msec after which it began to slow. The engine motion stopped by about 110 msec after impact.

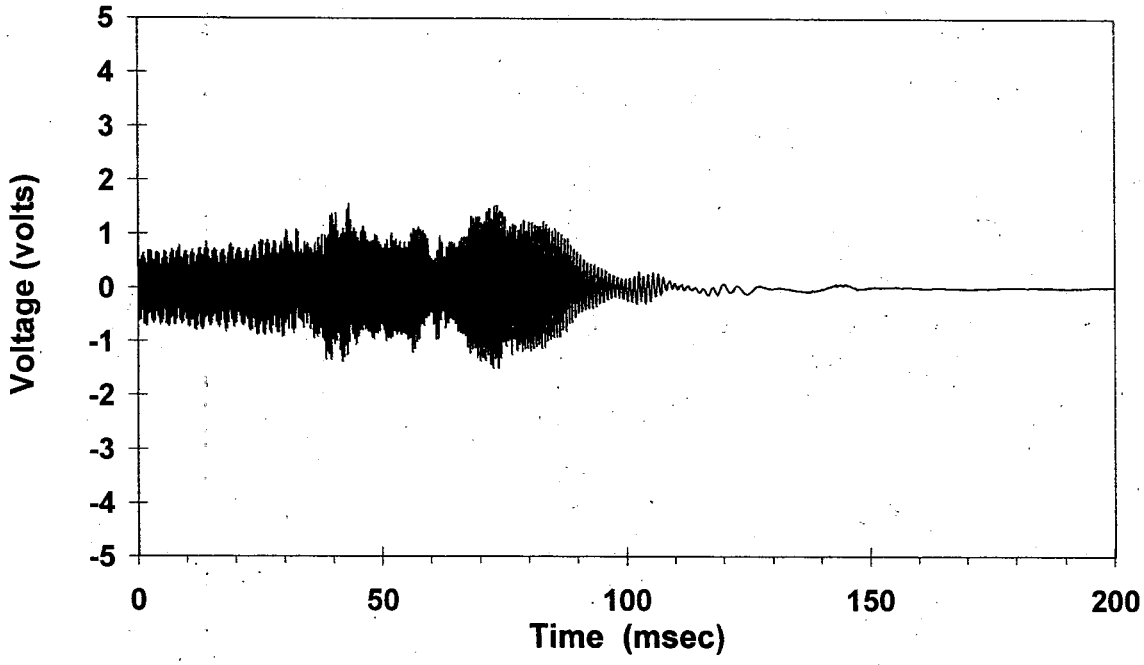

Figure 12
Engine Motion
Measured using Auxiliary Magnetic Pickup Transducer, Test C11687

Figure 13 and plot 109 in Appendix B show the fuel pump current draw during the impact. The fuel pump was drawing about 4.5 amps while it was operating at impact. The current dropped to zero at about 40 msec after impact indicating the pump was off. This is consistent with the other frontal tests of this series in that, the fuel pumps have lost electrical power early (before 100 msec) in every test conducted. The fuel pump was likely stopped due to the drop in main vehicle voltage.

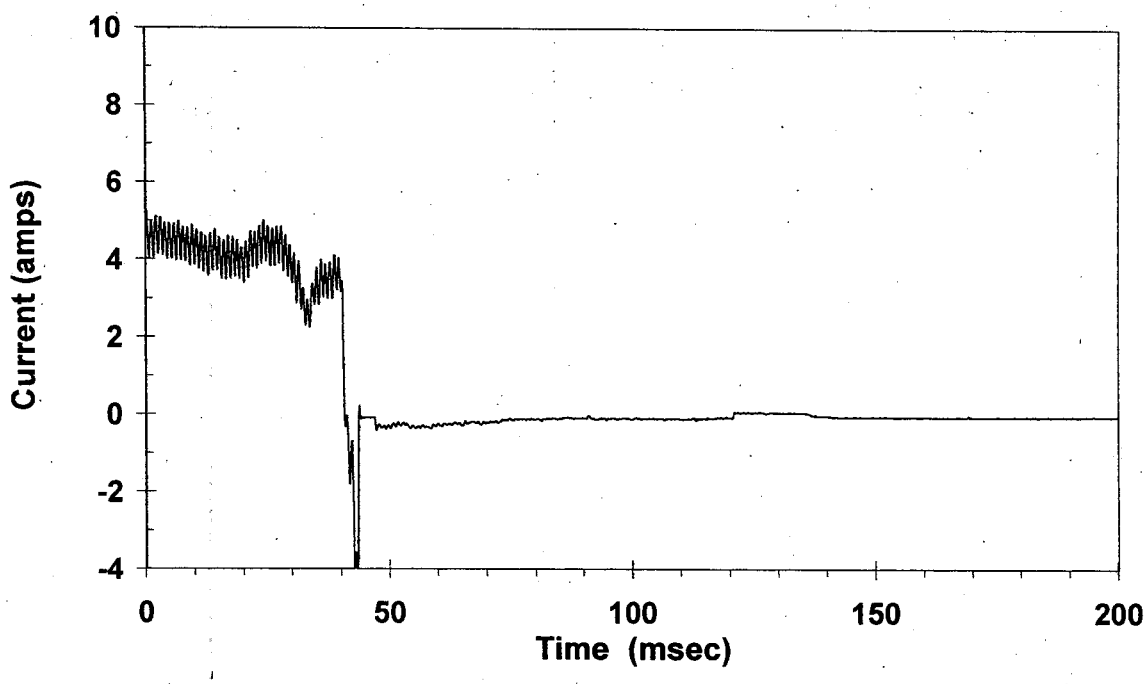

Figure 13
Fuel Pump Current
Test C11687

From 40 msec to 60 msec, the ignition voltage dropped from 13 volts to near zero in a stepwise manner (Figure 14 and Plot 85 in Appendix B). The fuel pump voltage decayed from 13 volts to near zero from about 40 msec to 180 msec as shown in Figure 15 and Plot 81 (Appendix B). Bench-tests on fuel pumps for other vehicles in the project [2], [3] indicated a gradual decay in voltage (lasting 40-150 msec) when current flow was stopped to the motor. This is likely due to the windings of the motor producing a voltage drop as the motor stops. The decay shown in Figure 15 is consistent with the observations from other tests.

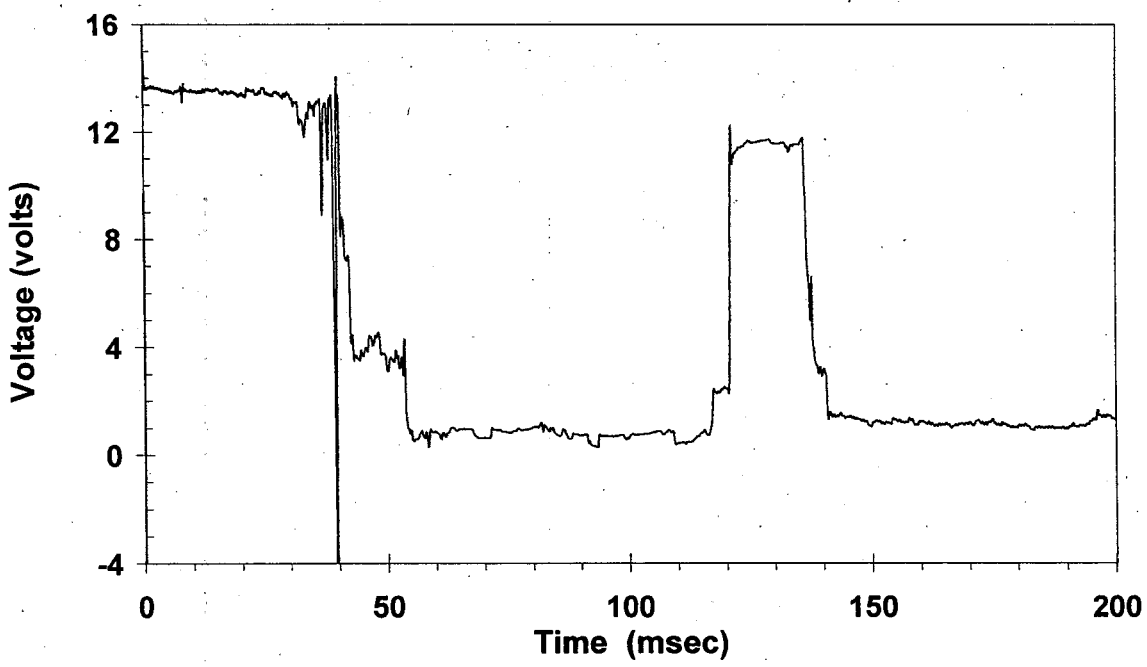

Figure 14
Ignition Voltage
Test C11687

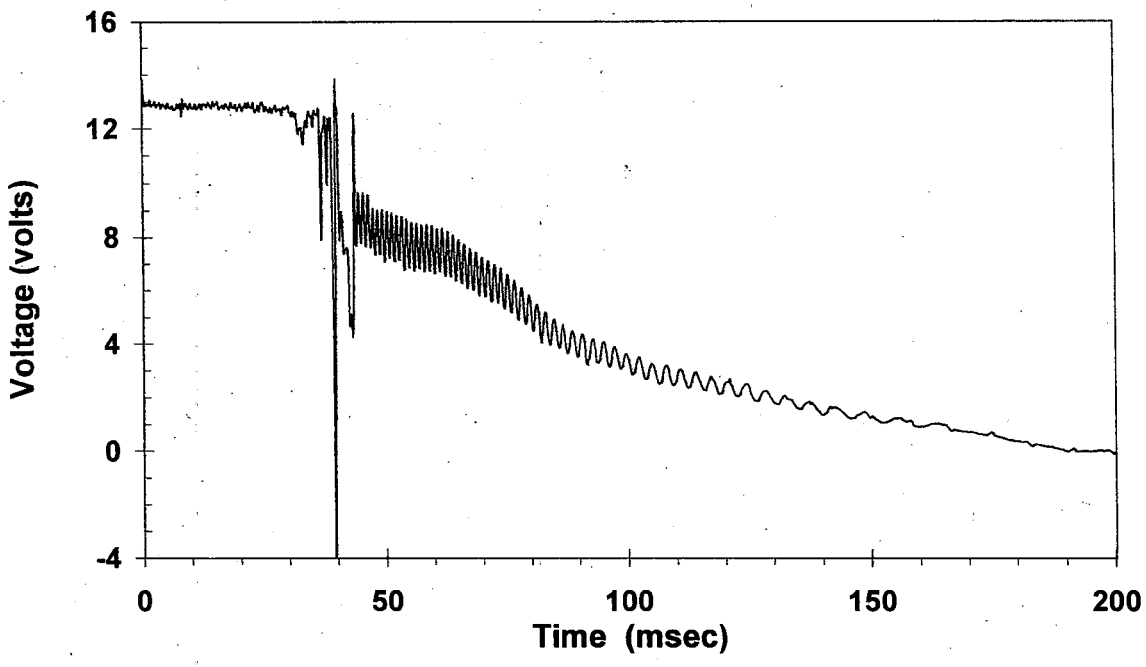

Figure 15
Fuel Pump Voltage
Test C11687

The fuel pump inertia switch did activate during the test at about 47 msec after impact. The switch was physically inspected following the test confirming its activation. The fuel pump inertia switch voltage measurement is shown in Figure 16 and Plot 82 in Appendix B. A schematic showing where this measurement was taken is shown in Figure 17. As indicated in the Figure 17, once the inertia switched is activated during the impact the fuel pump voltage (Figure 15) and the fuel pump switch voltage (Figure 16) should be the same. These two traces are nearly identical after about 47 msec, indicating that the switch likely activated at about 47 msec. The fuel pump was already shutting down at this point due to the loss of main vehicle power.

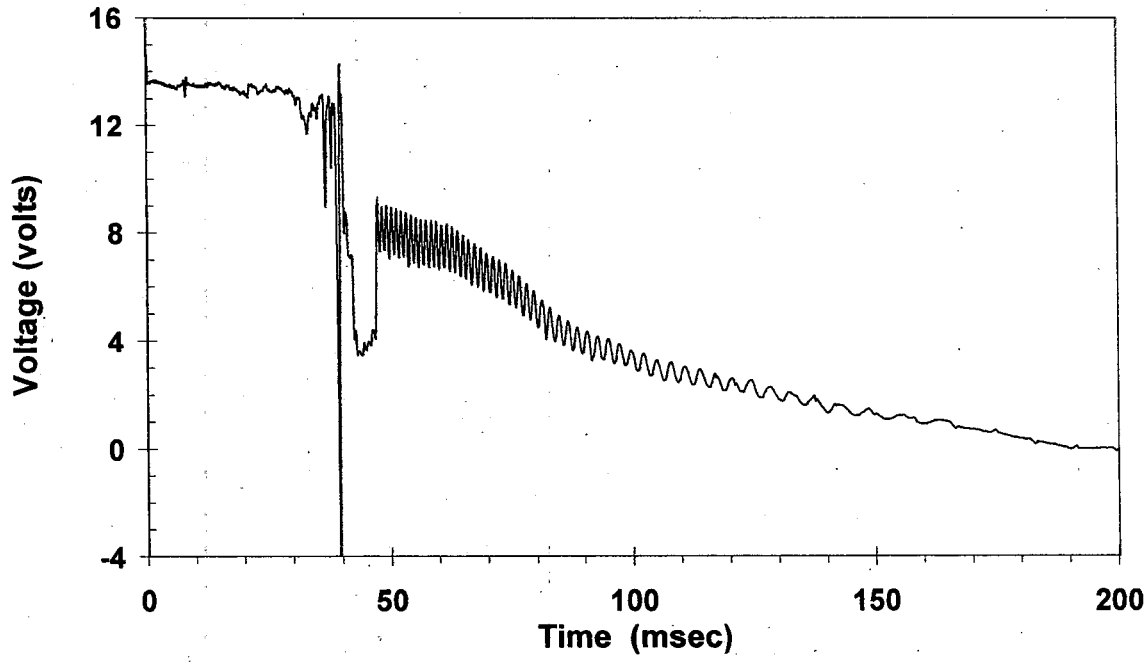

Figure 16
Fuel Pump Inertia Switch Voltage
Test C11687

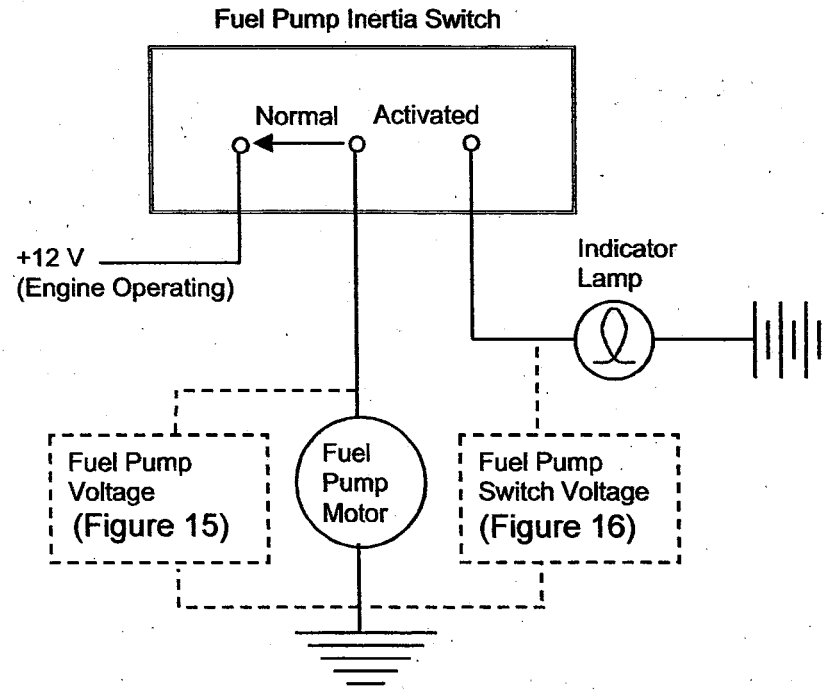

Figure 17
Fuel Pump Voltage Measurement Schematic
Test C11687

2.2.2. Summary of Recorded Barrier Measurements

The acceleration measurements and related computed values from the moving barrier are included in Appendix B (Plots 120 through 138).

The longitudinal velocity of the barrier's CG is re-created here as Figure 18. The barrier sustained a velocity change of about 66.9 km/h (42 mph) in 140 msec.

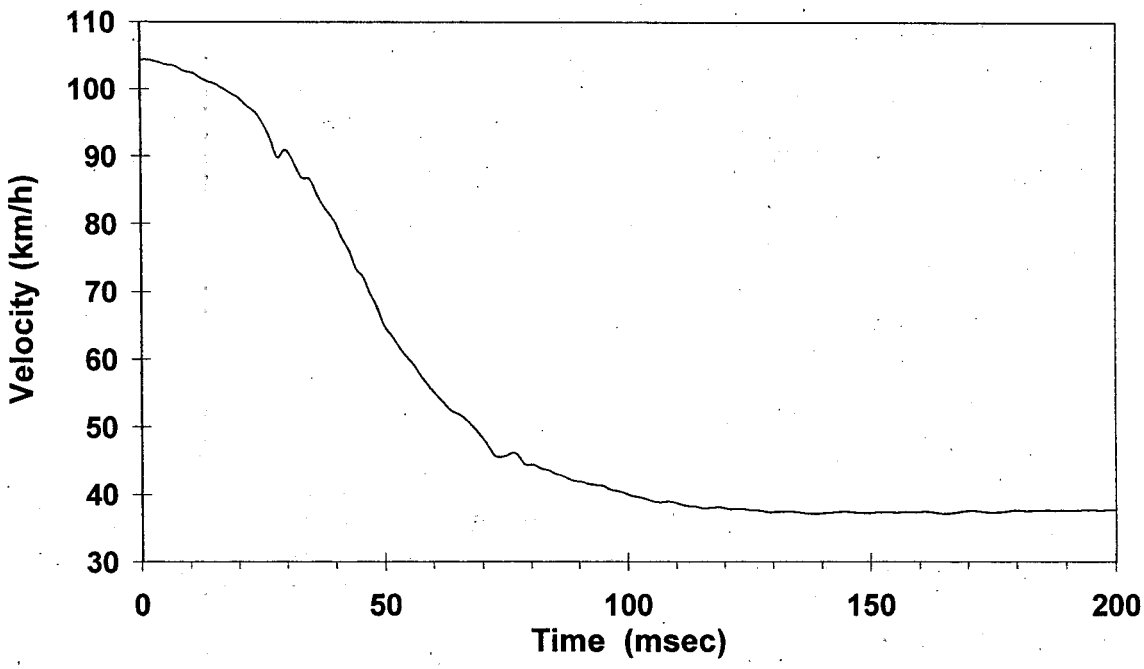

Figure 18
Moving Deformable Barrier Longitudinal Velocity at CG
Test C11687

2.2.3. 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 60).

For the left front ATD, the upper right tibia moment (Mx, My resultant) exceeded its Injury Assessment Reference Value (IARV). Its peak value was 231 Nm (Plot 21) which was 103% of the IARV of 225 Nm [9]. The computed lower leg index for the right leg (Plot 23) which uses the upper tibia bending moment also exceeded its IARV. The leg index was 1.14 compared to its IARV of 1.00.

For the right front occupant position, the maximum chest compression was 51.4 mm (Plot 30, Appendix B). This is less that the IARV of 75 mm specified in FMVSS208 [7], but greater than the IARV of 50 mm as specified for a shoulder belted occupant in the AGARD Report AR-330 [9], (also in Appendix A).

All other recorded and computed ATD measurements were below their respective IARVs.

2.2.4. Summary of Hydrocarbon Vapor Measurement

A complete set of the recorded measurements is included in Appendix C, Figures C1 through CC5, and Appendix B, Plots 89 through 104. The signal cable from the vapor sensor located near left lower fuel line (location #4) was cut during the crash test and no data was recorded. The sensor near the left upper

engine (location #3) was destroyed during the test. Of the remaining three locations, the right upper engine (location #1), and the left exhaust manifold (location #2) indicated the highest concentrations of hydrocarbon vapors. These two sensor outputs are recreated here as Figure 19 and Figure 20.

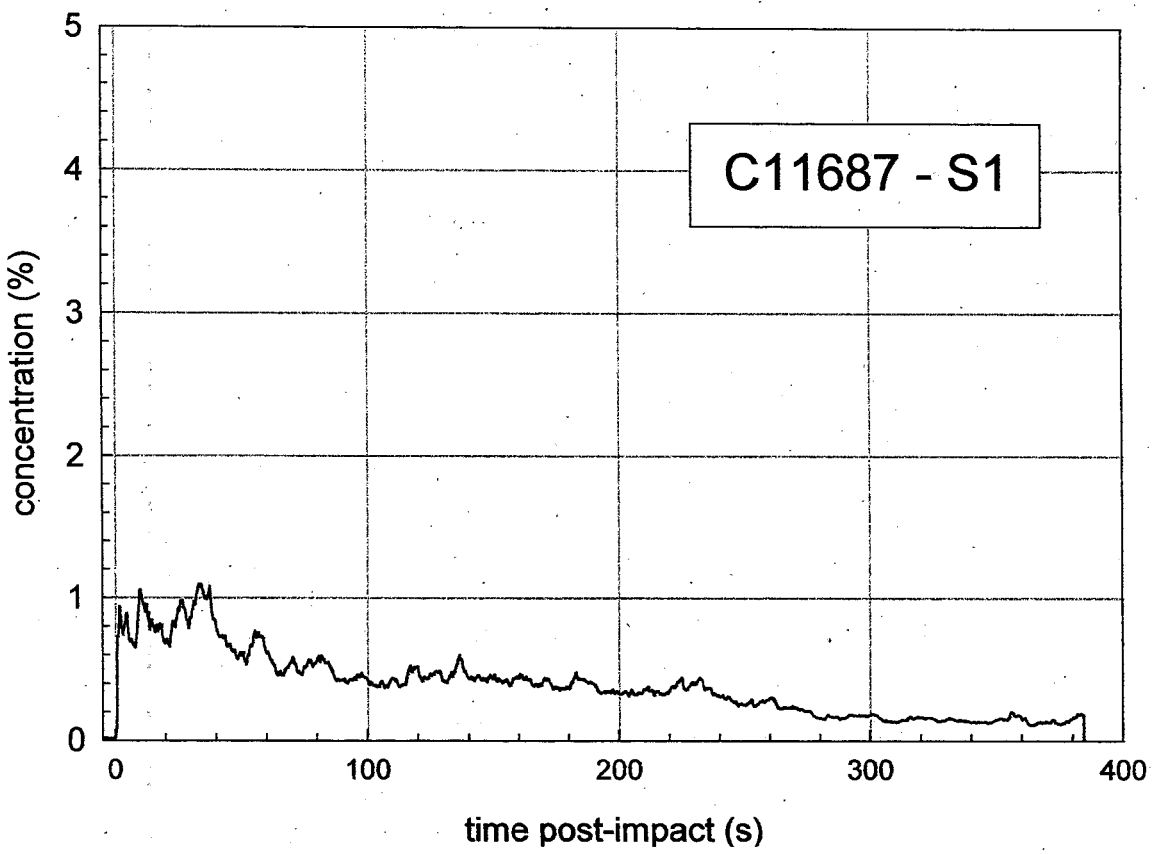

Figure 19
Concentration Of Hydrocarbon Vapors Measured Near Right Upper Engine (Location #1)
Test C11687

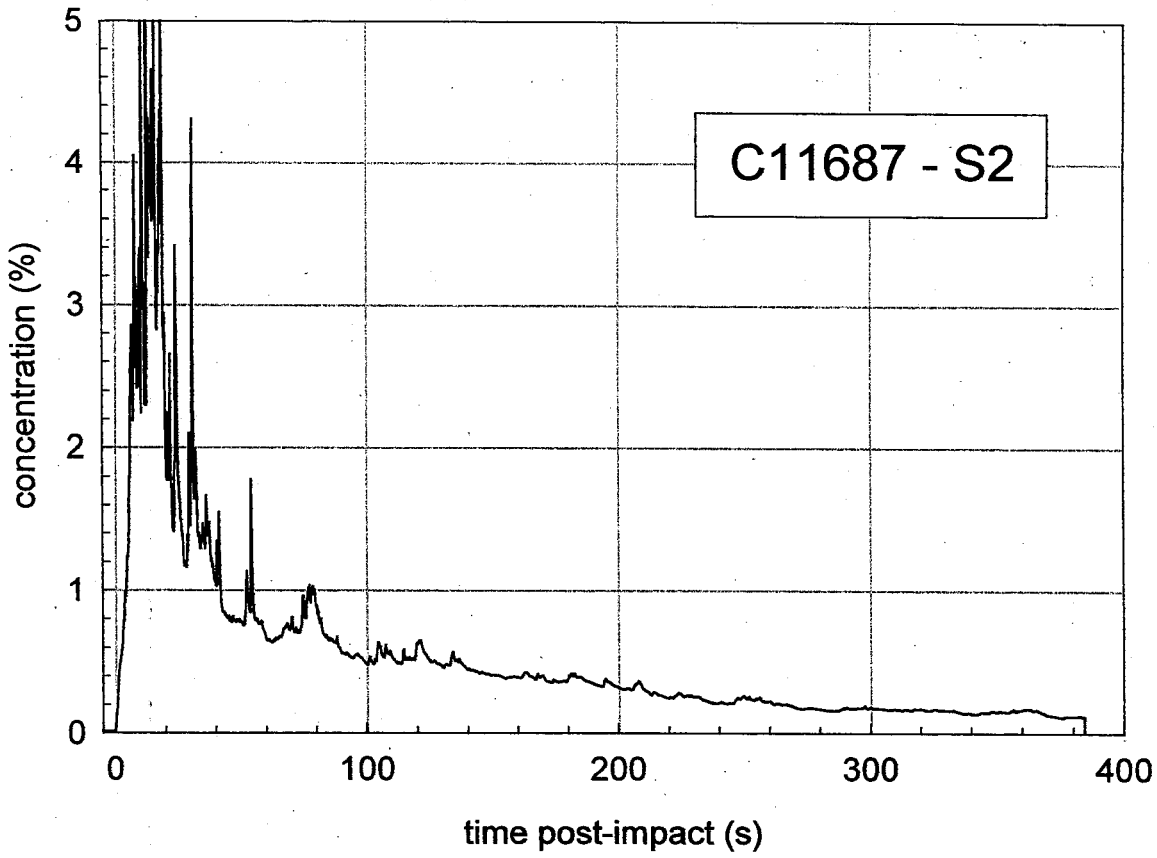

Figure 20
Concentration Of Hydrocarbon Vapors Measured Near Left Exhaust Manifold (Location #2)
Test C11687

The vapor concentration at location #1 increased to slightly greater than 1% in the first 60 seconds following the impact, while the concentration at location #2 exceeded 3% during the first 60 seconds. The GCMS analysis was completed on the vapors collected from these same locations [1]. The results of the GCMS analysis for locations #1 and #2 were similar. The results of the GCMS analysis for location #2 is recreated here as Figure 21 and Figure 22. The GCMS analysis indicated the source of the vapors were gasoline, stoddard solvent and oils.

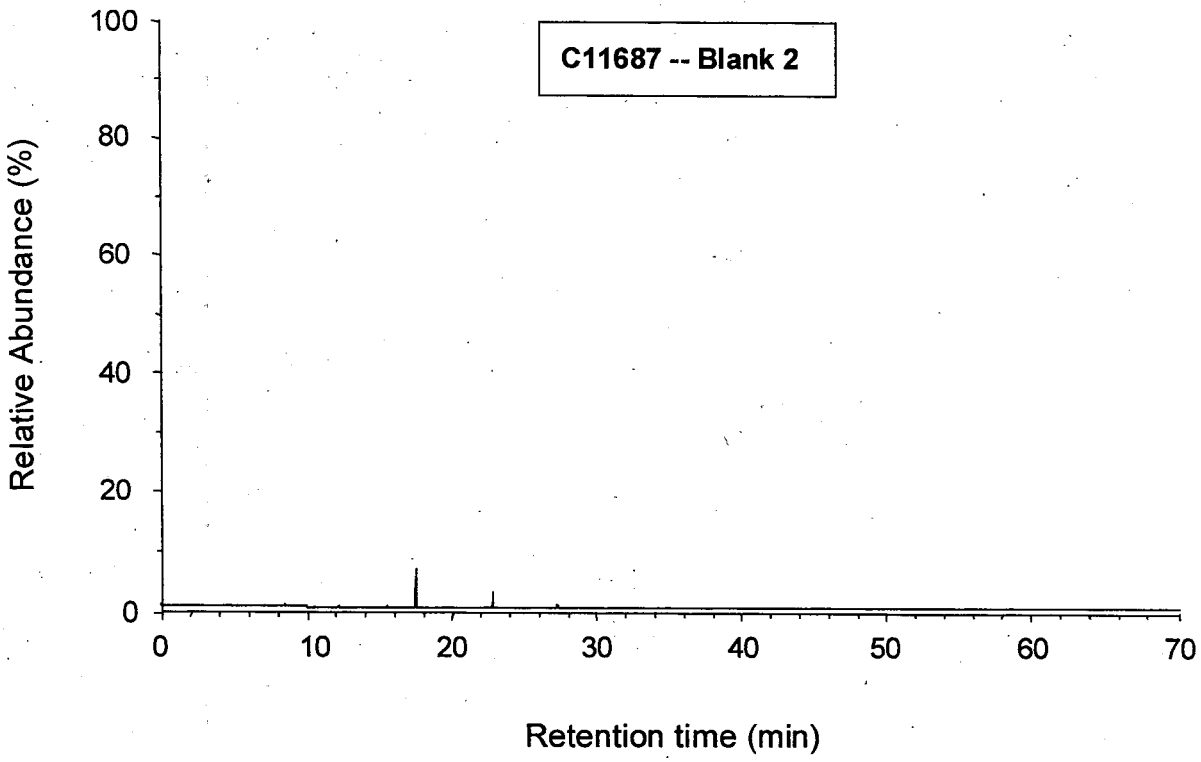

Figure 21
GCMS Analysis of Vapor Background Sample Collected near Left Exhaust Manifold (Location #2) Before the Test, Test C11687

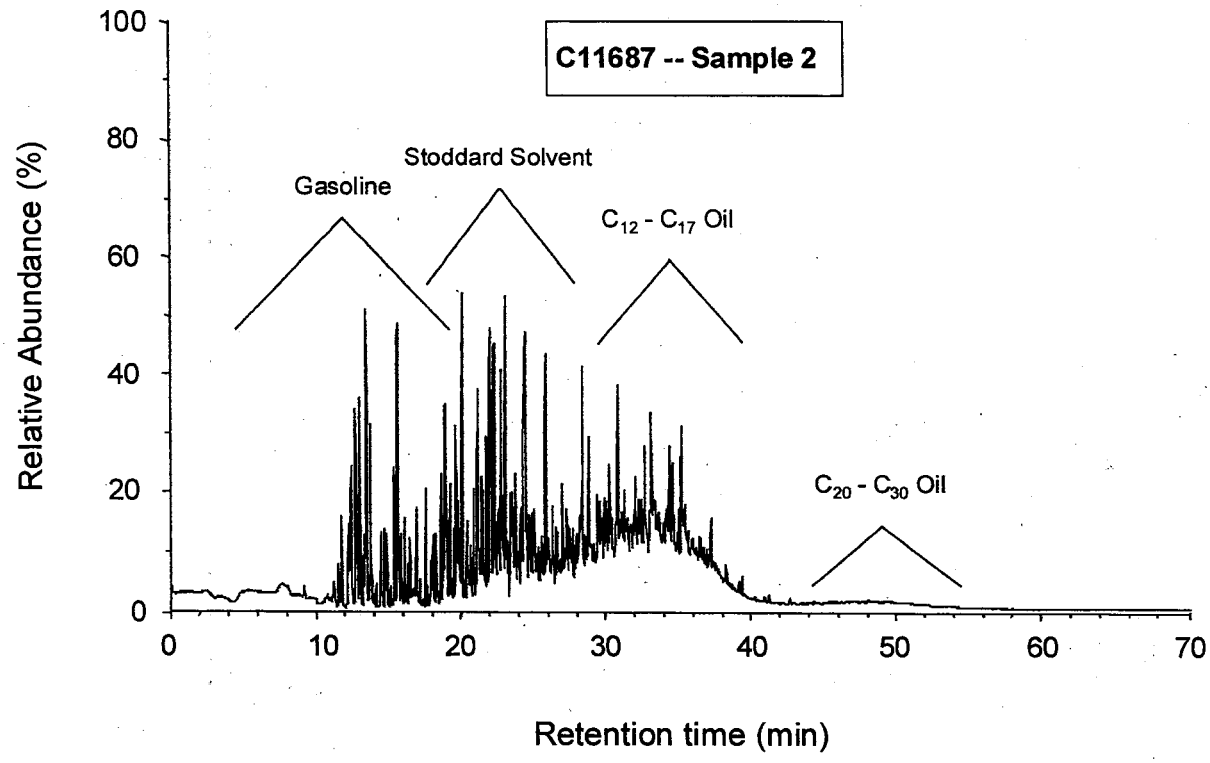

Figure 22
GCMS Analysis of Vapor Sample Collected near Left Exhaust Manifold (Location #2) Post-test, Test C11687

The source of the oil vapor observed in this test could not be positively identified through the GCMS analysis. The analysis does not distinguish vapors with similar molecular makeup. In this case, any of the heavy oils such as power steering fluid, transmission fluid, or motor oil could be the source of the vapor. Of these fluids, only transmission fluid and power steering systems leaked during the impact, so one of those two may have been the likely source. At ambient temperatures, these fluids do not vaporize, thus contact with a hot surface likely occurred vaporizing the fluid.

The source of the Stoddard vapor was likely the Stoddard that leaked out of the fuel tank during the impact. (Section 2.2.6.) Unlike the oils, Stoddard and gasoline will vaporize at ambient conditions, thus the presence of vapor does not necessarily indicate contact with a hot surface.

Gasoline vapor was also indicated in the GCMS analysis. However, there were no leaks identified in the pressurized fuel system (Section 2.2.5.) (The fuel tank contained Stoddard for the test, but the pressurized fuel system contained gasoline.) The source of the gasoline vapor could have been from a damaged (during the impact) air intake or manifold in which the air/fuel mixture could escape to the atmosphere from the normal flow to the engine. Since the fuel pump stopped early, this would result in only a small amount of gasoline vapor (not liquid gasoline) released and does not necessarily present an increased fire risk. An alternate source of the gasoline vapor could have been from contaminated Stoddard Solvent. To reduce the volume of hazardous waste generated in conducting full-vehicle crash tests, Stoddard Solvent is re-used in most crash test laboratories; that is, it is removed from fuel tanks from crash-tested vehicles and re-used for other tests. Thus the Stoddard, over time, can be contaminated with residual gasoline from fuel tanks.

2.2.5. Summary of Fluid Pressure Measurements

The dynamic pressure measurements of the engine compartment fluids are shown in Appendix B, Plots 138 through 146.

The front brake system pressure (Plot 139) indicates a gradual decline in pressure but not to zero, and does not indicate the presence of a leak. This is similar to observations in previous tests conducted for this project and could be due to the release of the mechanism used to hold down the brake pedal. This mechanism was attached to the forward bulkhead that deformed during the impact.

The power steering fluid pressure data (Plot 142) is inconclusive due to an instrumentation malfunction (likely caused by damage to the transducer during the vehicle crush.) However, the post-test inspection revealed that the pump housing was cracked and fluid was lost during the impact.

Similarly, the transmission cooler pressure measurement also was inconclusive due to damage to the transducer during the impact (Plot 146). The post-test inspection revealed that the transmission housing was cracked and fluid was lost during the impact.

The engine coolant system pressure (Plot 144) indicates a rise in pressure followed by a drop to zero at 60 msec. This is consistent with the post-test inspection which revealed a crushed and leaking radiator. Similar to previous tests, the engine cooling system maintained a steady state pressure while the engine was off during the set up of the instrumentation just prior to the test. An artifact of the data acquisition system forced some channels to zero, thus this measurement was biased back to the true steady state beginning pressure. Plot 143 is the unbiased data and Plot 144 shows the corrected (biased) data.

The pressure of the engine oil is shown in Plot 145, and does not indicate any leaks. This was confirmed during the post-test vehicle inspection.

The fuel supply pressure (Plot 141) indicated some fluctuations in fuel pressure during the impact, but did not indicate a complete loss in pressure. These fluctuations in fuel pressure are consistent with other tests conducted in which there was not a leak in the pressurized fuel system. This was also supported by the post-test vehicle inspection which did not reveal any leaks in the fuel system. Similar to the engine coolant, the fuel system maintains a pressure when the engine is off, thus both an unbiased (Plot 140) and a biased (corrected, Plot 141) trace are included.

2.2.6. Summary of Fuel System Integrity

There were no leaks to the pressurized fuel line (see Section 2.2.5). The production fuel tank was punctured during the test resulting in the loss of Stoddard Solvent following the impact. The leak rate of the Stoddard was not measured at the crash facility. The lateral movement of the drive shaft just rear of the transfer case caused the puncture. The yoke on the universal joint of the drive shaft punctured the tank just above the seam between the upper and lower sections of the tank. Figure 23 shows the proximity of the universal joint to the tank following the test. The puncture to the tank is not visible in Figure 23 but is located just above and hidden by the tank seam.

Figure 23
Rear Drive Shaft Universal Joint And Fuel Tank
Test C11687

Following the crash test and the post-test inspection, the fuel tank was removed and a subsequent test was conducted to determine an approximate leak rate of the Stoddard Solvent. This experiment was conducted so that the leak rate could be duplicated during the fire propagation test conducted with this vehicle. The measured leak rate was approximately 280 cm^3/min. The details of this leak rate experiment as well as the fire propagation test will be reported separately.

2.2.7. Summary of Additional Electrical Measurements

The results of the electrical measurements made in the engine compartment are shown in Appendix B (Plots 78 through 80, 83 through 85, and 107 through 108, and 110 through 115).

The battery voltage (Plot 79) measurement drops to near zero at about 50 msec and never recovers. However, other voltage measurements on the vehicle (Plots 78, 80, and 85) did indicate approximately 12 volts from 120 – 140 msec. Since the source of these voltages must be the battery, the battery voltage measurement (Plot 79) is likely invalid after about 50 msec. This measurement was taken directly at the positive battery terminal which was in the crush zone and was damaged during the impact. The electronic

noise indicated on Plot 79 also indicates instrumentation malfunctions due to the crush on this measurement.

The starter voltage (plot 78), alternator voltage (plot 80), and ignition voltage (plot 85) all show similar results. They all drop from 13 volts to less than 5 volts starting at about 40 msec. They all recover to 12 volts from 120 to 140 msec before returning to less than 2 volts. The main vehicle electrical voltage dropping intermittently and then recovering intermittently has been an observation of nearly every test conducted for this project [2], [3]. For tests on other vehicles, specific causes for the voltage drops have been identified such as the shorting of the starter cable to ground causing additional loading on the battery [2]. However, for this test, no specific cause was identified. Neither the post-test inspection nor the current measurements indicated a specific short to any of the large gage cables such as the alternator or starter cables. (Although all underhood electrical circuits were not measured and inspected.) The cause of the drops in the main vehicle voltage likely was caused by the opening and re-connection of the individual cells internal to the battery or by additional loading to the battery by un-identified shorts. The battery was in the crush zone and the post-test inspection did reveal significant damage to the battery housing and the cells inside the battery supporting the likelihood that internal damage to the battery resulted in the voltage drops. A photograph showing the bottom and side of the battery is shown in Figure 24.

Figure 24
Battery
(The test number tape is attached to the bottom of the battery)
Test C11687

The headlight low-beam voltage (Plot 83) and left front fog-light voltage (Plot 84) both drop from 13 volts to near zero at 30 msec but do not recover to 12 volts from 120 to 140 msec. It is possible that the vehicle crush (between 30 msec and 120 msec) caused damage to the instrumentation wiring that resulted in the signal staying low.

The Power Distribution Box (PDB) current (Plot 107), A/C clutch current (plot 110), HVAC blower current (Plot 113) and alternator cable #1 current (Plot 111) are all generally inconclusive due to damage to the transducers during the impact.

The ignition current (Plot 115) does not indicate any significant loads due to shorts. Neither does the head-light/fog-light current (Plot 114), however, this measurement is suspect because it does not indicate current flow at beginning of impact (0 msec.)

2.2.8. Summary of Numerical Film Analysis

No numeric film analysis was done for this test.

2.2.9. 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 frontal pole impact on the passenger van. [2]

2.2.10. Results of the Evaluation of the Crashworthiness of Potential Fire Detection or Suppression Technologies

The results of the electrical measurements of the experimental fire detectors are shown in Appendix B (Plots 86, 87, 116, 117, and 118).

The left optical fire detector voltage is shown in Plot 86 and does not indicate any activation during the impact. The right optical fire detector voltage (Plot 87) also does not indicate any activations (which would be indicated by a rise to 12 volts for at least 250 msec.) This plot does however drop from 4 volts to zero intermittently from 65 to 85 msec. This indicates possible electrical opens in the measurement wiring. These opens were not specifically identified. It is possible that they occurred in either the connectors or the wiring of the auxiliary signal-conditioning unit that was required to monitor the circuit. (This unit is not part of the actual detector and would not be necessary if the detector were used in a production application to activate a suppression system.)

The thermal wire contact did not indicate any activations or closures during the test (Plot 116.) This indicates that this device at its respective mounting location was crashworthy for this crash configuration.

The pneumatic wire contact did indicate a closure from 56 to 68 msec (Plot 117). This closure was likely due to either a false activation of the detector or a malfunction of the wiring used to monitor it (such as a pinched or cut wire.) However, no cut instrumentation wiring was identified during the post-test inspection.

2.2.11. Summary of Post-test Vehicle Inspection

The vehicle was disassembled and inspected for air passages from the exterior into the passenger compartment, the locations of any fluid leaks that occurred during the crash test, the locations of any electrical shorts that occurred during the crash test, and any contact between combustible materials and hot surfaces. As with any severe crash test, the vehicle residual crush makes the inspection of every component difficult if not impossible. Many components became buried and impossible to inspect without further damage. 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.

Consistent with the crash tests on other vehicles types in this project, openings from the exterior to the interior of the passenger compartment caused by the crash were identified. These openings were not evaluated for their potential contribution to fire propagation, instead all openings identified were noted. The presence of interior components, such as interior trim or carpeting, in many cases, would prohibit the free flow of air through the structural openings. Later fire propagation tests were conducted on some of the crash-tested vehicles to better characterize propagation characteristics, and are reported separately. Those openings (excluding glass breakage) identified for this test, follow:

- Separations along the left and right edges of the transmission shift cover plate on the center tunnel. The left opening was approximately 200 mm long by 15 mm wide at the widest point. The right opening was approximately 100 mm long by 15 mm wide at the widest point.

- A dislodged grommet plug at a electrical pass through in the floorpan under the driver's seat. (approximately 50 mm in diameter)

- A separation of the weld between the transmission hump and the center toe pan (comprised of several small openings all less than 10 mm in diameter.)

- Dislocation of the steering column boot at the steering column pass-through.

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

- Transmission fluid: case cracked, fluid lost
- Engine coolant: radiator crushed, coolant lost
- Power steering fluid: pump cracked, fluid lost
- Stoddard Solvent: drive shaft punctured fuel tank (see section 2.2.6)

- Battery electrolyte: 3 cells cracked and leaking

There were no leaks found in the brake system, pressurized fuel lines, engine oil system, or washer solvent reservoir.

There were no electrical shorts identified during the post-test vehicle inspection.

There was no contact between normally hot surfaces and combustible solids during the post-test inspection.

2.3. *Conclusions*

1. There were no fires observed during or after this crash test.

2. The electric fuel pump began stopping at 40 msec after impact due to the temporary loss of main vehicle system voltage. The fuel pump did not recover when the main electrical voltage temporarily returned from 120 msec to 140 msec.

3. The fuel pump inertia switch activated during the test at about 47 msec after impact.

4. The vehicle's acceleration measurements were translated to a new coordinate system in line with the longitudinal axis of the moving barrier. The peak acceleration of the vehicle along this axis was 36 g (filtered at 60 Hz). The change of velocity of the passenger compartment along this same axis was approximately 45 km/h (28 mph).

5. The moving deformable barrier sustained a longitudinal velocity change of 66.9 km/h (42 mph) in 140 msec.

6. Both air bags deployed at 18 msec past time zero.

7. Only the driver (left front) ATD's upper right tibia moment (resultant of Mx and My) was above its respective IARV. This resulted in a computed lower leg index above IARV as well. All other measurements on the left front were below their respective IARV.

8. The passenger (right front) ATD's chest compression measurement 51.4 mm. This is less than the IARV of 75 mm specified in FMVSS208 [7], but greater than the IARV of 50 mm as specified for a shoulder belted occupant in the AGARD Report AR-330 [9], (also in Appendix A). All other measurements on the right front ATD were below their respective IARV.

9. There was approximately 107 mm of toe pan intrusion on the driver's side.

10. The engine began slowing 40 msec after impact and was stopped by 110 msec.

11. Valid data was obtained from only 3 of the 5 vapor sensors. Of those three, the highest concentration of vapor was near the left exhaust manifold that exceeded 3% concentration for the first 60 seconds following the impact. The GCMS analysis indicated the source of the vapors was likely oils, stoddard and gasoline. The source of the oils was likely transmission fluid or power steering fluid contacting a hot surface in the engine. The source of the Stoddard vapor was the leak in the fuel tank, and the source of the gasoline vapor was either an opening in the air/fuel intake path (releasing gasoline vapors and not necessarily liquid) or contamination of the Stoddard Solvent with gasoline.

12. The universal joint on the rear drive shaft punctured the fuel tank during the impact. The leak rate of Stoddard Solvent was not measured at the crash test facility, but subsequently measured to be approximately 280 cm^3/min.

13. Transmission fluid, engine coolant, power steering fluid, and battery electrolyte all leaked during the test. No other engine compartment fluids leaked.

14. The main vehicle electrical voltage dropped from 13 volts to less than 5 volts intermittently during the impact. The cause of this drop was not positively identified. Intermittent drops in vehicle voltage have been observed in most frontal tests conducted for this project, and usually were caused by temporary shorts drawing the battery voltage down. In this case, the cause of the voltage drops was likely either unidentified shorts or damage to the internal cells of the battery.

15. The electrical monitoring of the experimental thermal wire fire detector attached to the underside of the hood did not show evidence of any electrical closures throughout the test, demonstrating crashworthiness for its given mounting location and this crash configuration.

16. Monitoring of the experimental pneumatic fire detector was inconclusive. An electrical closure of the circuit was recorded, which is indicative of an activation, but there was no apparent fire or heat damage to the sensor.

17. Monitoring of the experimental optical fire detectors was inconclusive. It appears they did not activate during the crash. However, their output signal did drop to zero intermittently during the impact possibly due to loose electrical connections in the signal conditioning of the sensors (not in the sensors themselves.)

18. Five crash-induced openings into the passenger compartment were identified: the separation along the left and right edges of the transmission shift cover plate on the center tunnel, a dislodged grommet plug

at an electrical pass through in the floorpan under the driver's seat, a separation of the weld between the transmission hump and the center toe pan, and a dislodged steering column boot.

19. There was no contact between any normally hot surfaces and solid combustibles.

3. Sport-Utility-Vehicle Offset Pole Frontal Impact, Test C11793

The sport utility vehicle offset pole frontal impact crash test (Test #C11793) was conducted on November 12, 1997 at the GM Proving Ground in Milford, Michigan. A total of 136 channels of data were recorded during the test.

3.1. *Test Conditions*

3.1.1. Impact Conditions

This test was an offset pole frontal impact as depicted in Figure 21 and Figure 22. 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 with radar, and was 55.8 km/h (34.7 mph).

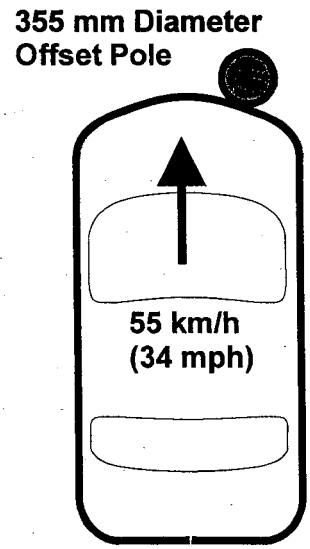

Figure 21
Crash Test Configuration for Test C11793

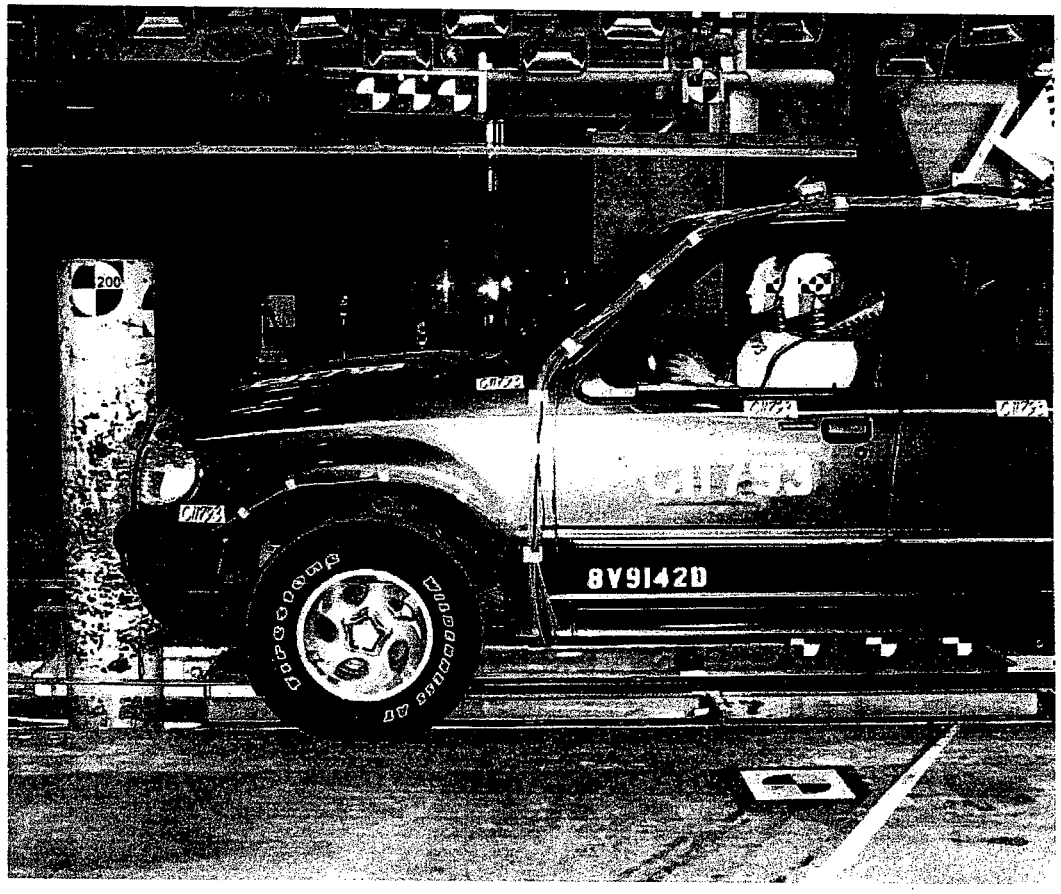

Figure 22
Pre-test Photograph of Test C11793

3.1.2. Vehicle Description

The test vehicle was a 1997 Ford Explorer (VIN: 1FMDU34X5VUA99103) which had a test mass of 2242 kg (1142 kg front, 1100 kg rear) which included the two ATDs, crash test instrumentation, and Stoddard Solvent in the gasoline tank. First, the fuel tank's unusable capacity was established (filled) with Stoddard Solvent, then 74.8 liters of Stoddard were added to the unusable capacity of the tank. (74.8 liters represents 95% of the usable capacity of 78.7 liters.) The engine was operating at impact with complete engine compartment fluids, including battery electrolyte. The radio, low beam headlights, fog lights, and air conditioning were all operating at impact. The transmission was in neutral for the test.

3.1.3. Pre-test Engine Warm-up Procedure

The engine was started approximately 77 minutes before impact as outlined in Table 2.

Table 2
Engine Warm-Up Procedure for Test C11793

	Time after initial engine start, (min)	Duration, (min)
Engine started (idle approximately 900 rpm)	0	14
Engine speed increased to 1200 rpm	14	21
Engine turned off for instrumentation set-up	35	22
Engine restarted, set to 1100 rpm	57	20
Impact	77	

The surface temperature of the left exhaust manifold was measured using a non-contact infrared meter twice during the engine warm-up period. At 10 minutes after the initial engine start the manifold temperature was 518 degrees F, and at 33 minutes it was 548 degrees F.

3.1.4. Modifications to Production Vehicle

The same modifications were made to the production vehicle as with test C11687 (Section 2) with the exception of the brakes. 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 pistons were removed from the front calipers and the brake fluid inlet port was welded shut. This allowed the front brake lines to be pre-charged and maintained at a steady state pressure, while still allowing the front wheels to rotate during tow. The front brakes were pre-charged by mechanically locking down the driver brake pedal. Unlike test C11687, the plastic throttle cover was replaced after the idle was adjusted and before the test.

3.1.5. Vehicle Measurements

The vehicle measurements were the same as for test C11687 (see Section 2.1.5) except the vehicle yaw was not measured and the toepan displacement measurement was on the right side rather than the left. In addition an electrical contact closure circuit was used to monitor the mechanical motion of the fuel inertia switch reset button. This measurement was independent of the vehicle circuitry.

3.1.6. 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.

3.1.7. Anthropomorphic Test Device (ATD) Measurements

Two 50th percentile male Hybrid III ATDs [6] were located in the front outboard seating positions. The ATDs were positioned similar to test C11687. The pelvic angle was 21.7 degrees for the left front occupant and 25.0 degrees for the right front occupant. The head target angle was at 0 degrees from horizontal for both ATDs. The seat back angle was 25.0 degrees for both seats.

The ATDs were both instrumented to make the same measurements as test C11687 (Section 2.1.8) except the six additional tibia measurements were recorded on the right front occupant rather than the left front occupant. (The six additional measurements were upper tibia shear load: left and right legs, lower tibia shear load: left and right legs, and lower tibia bending moment: left and right legs).

3.1.8. Hydrocarbon Vapor Measurements

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

- Left exhaust manifold (location #1)
- Right exhaust manifold (location #2)
- Lower rear intake manifold (location #3)
- Near the fuel pressure regulator (location #4)
- Near the catalytic converter (location #5)

The technique used to measure the vapors was similar to test C11687 (Section 2.1.9.) and was described in reference [1].

3.1.9. Fluid Pressure Measurements

Pressures in several of the vehicle's fluid systems were measured to help identify fluid leaks and the time during the impact when they occurred. Pressures measured were the same as for test C11687 (Section 2.1.10).

3.1.10. Additional Electrical Measurements

Additional electrical measurements were made to identify possible shorts, arcing or overheated circuits.

The currents measured for test C11793 were slightly different than for C11687 and included:

- Alternator cable #1 (measured at fusible link near PDB)
- Alternator cable #2 (measured at fusible link near PDB)
- A/C clutch (measured near compressor)
- Starter cable (measured at battery)

- B+ battery cable (measured at battery)
- Power distribution box (PDB) (measured near box)
- HVAC blower (measured near relay box #2)
- Headlight low beam (measured under the PDB)
- Fog light (measured under the PDB)
- Ignition (measured in passenger compartment under instrument panel)

The voltage measurements were the same as for test C11687, except the right headlight and fog lights were monitored rather than the left.

3.1.11. Evaluation of the Crashworthiness of Potential Fire Detection or Suppression Technologies

Devices representing three different fire detection technologies were included on this test: optical sensors, thermal wires, and pneumatic wires. These devices were similar to test C11687 (Section 2.1.12). except the routing of the thermal wire and pneumatic wire under the hood was slightly different. The location of the thermal wire and pneumatic wire is shown in Figure 23.

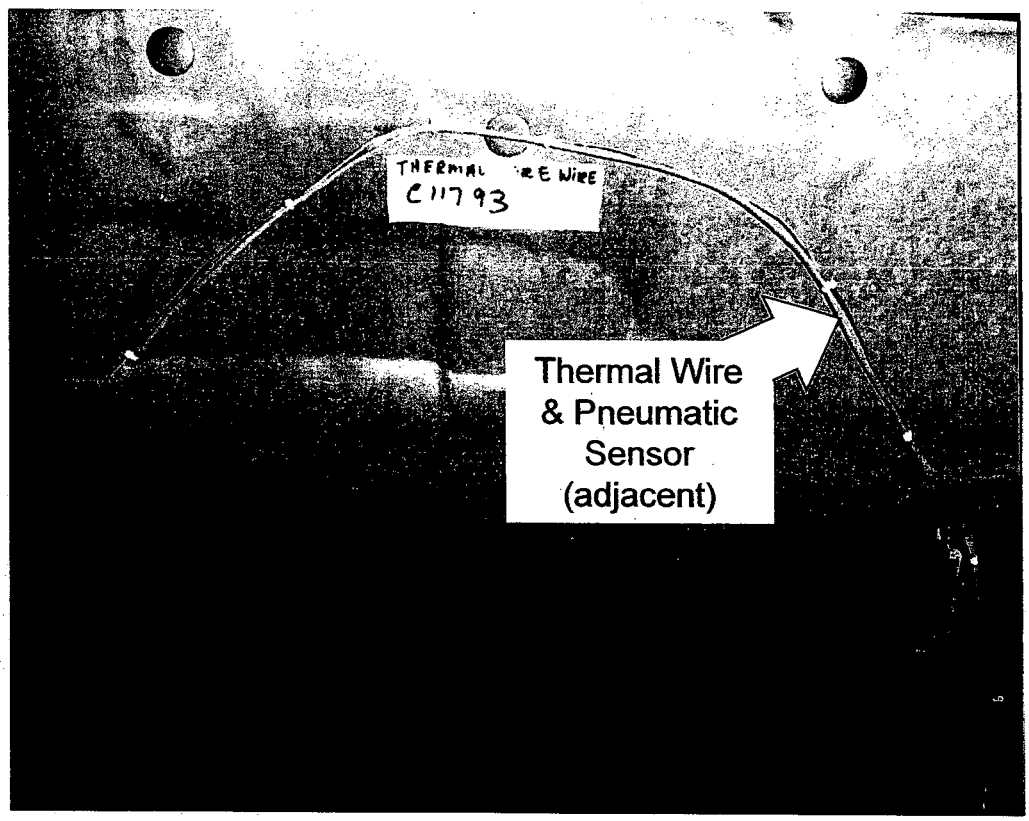

Figure 23
Thermal wire and pneumatic detectors
Test C11793

3.2. *Summary of Test Results*

Post-test photographs of the vehicle are shown in Figure 24 and Figure 25.

Figure 24
Post-Test Photograph of Test C11793, Front-Right View

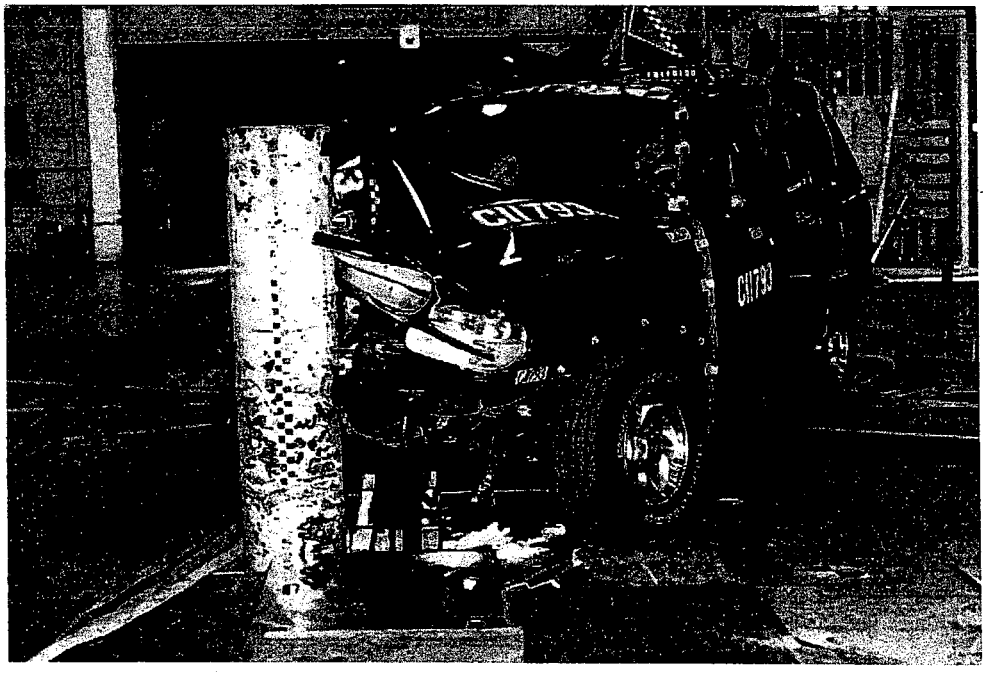

Figure 25
Post-Test Photograph of Test C11793, Front-Left View

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 61 through 77, 81, 85, 88, 94, 95, and 99).

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 [8]), was 28 g. The maximum longitudinal change in vehicle velocity was 61 km/h (37.9 mph), with the velocity crossing zero at 120 msec past time zero (impact.) The averaged rear rocker longitudinal acceleration and velocity are shown in Plot 75 and in Figure 26 and Figure 27.

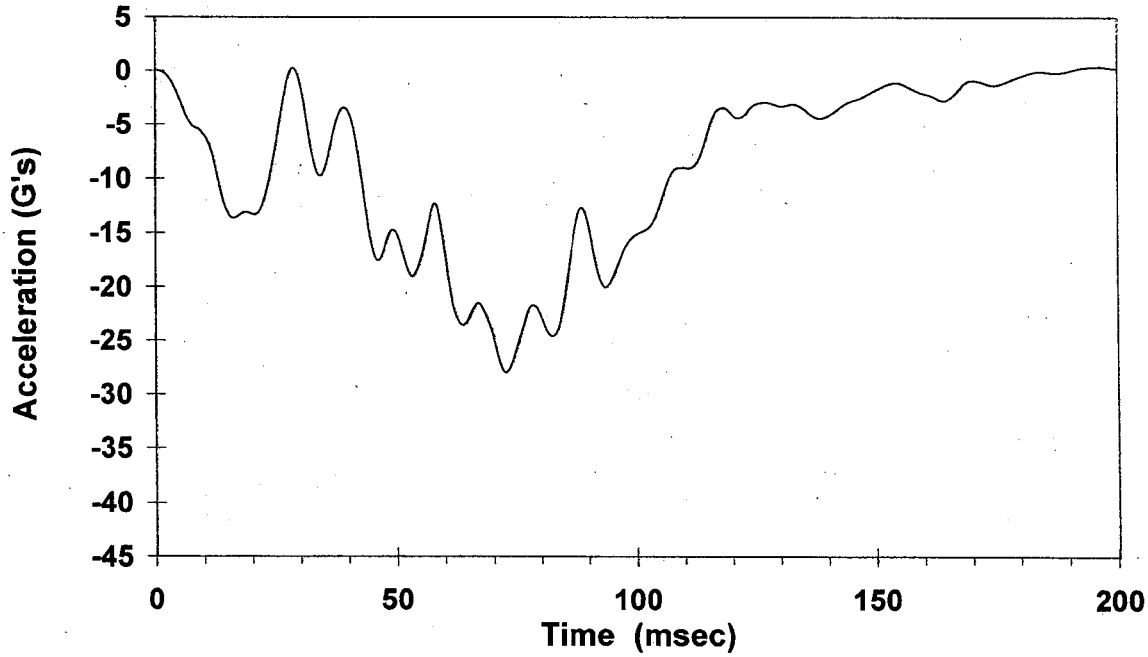

Figure 26
Averaged (Left & Right) Rear Rocker Panel Longitudinal Acceleration
Test C11793, filtered at SAE class 60 [8]

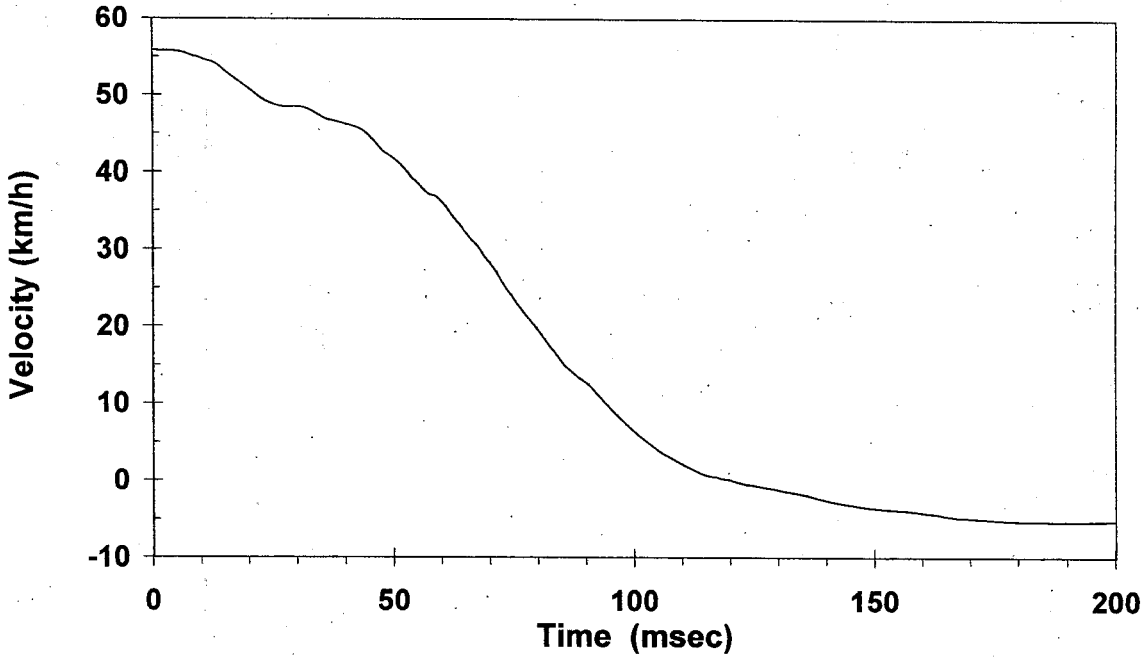

Figure 27
Averaged (Left & Right) Rear Rocker Panel Longitudinal Velocity
Test C11793

The displacement of the right toe pan, relative to the passenger compartment, was approximately 118 mm and is shown in Figure 28 and also Plot 77, Appendix D.

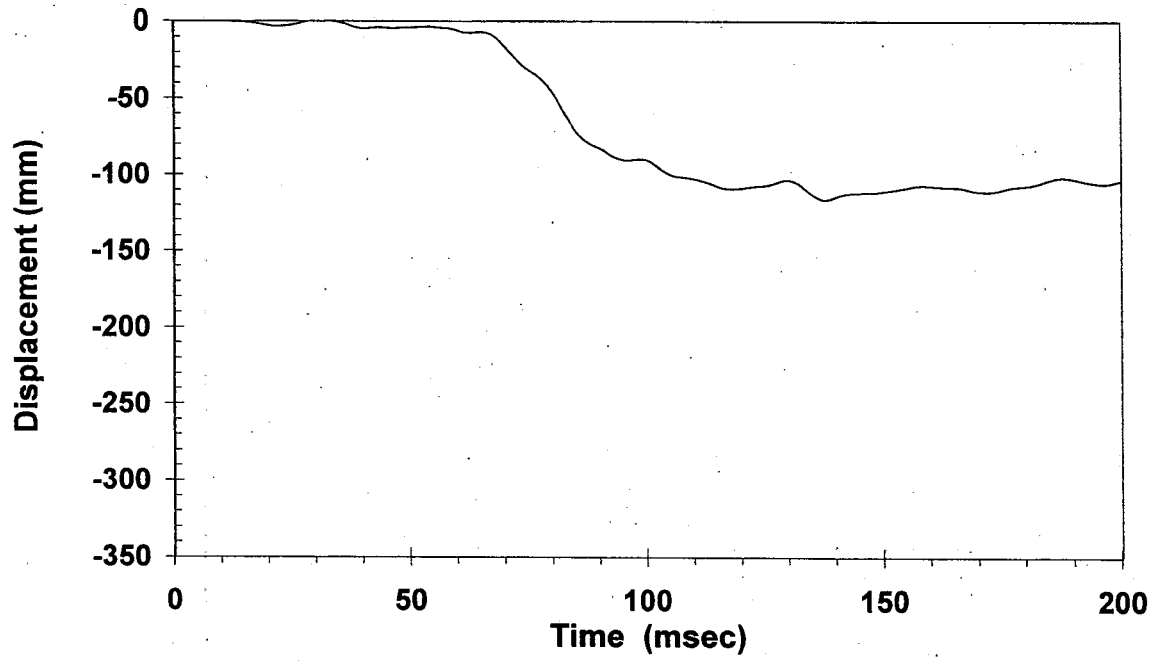

Figure 28
Right Toepan Displacement, Relative to Floorpan
Test C11793, filtered at SAE class 60 [8]

The engine motion began to slow at approximately 40 msec after time zero and stopped by 120 msec as shown in Figure 29 and Plot 88.

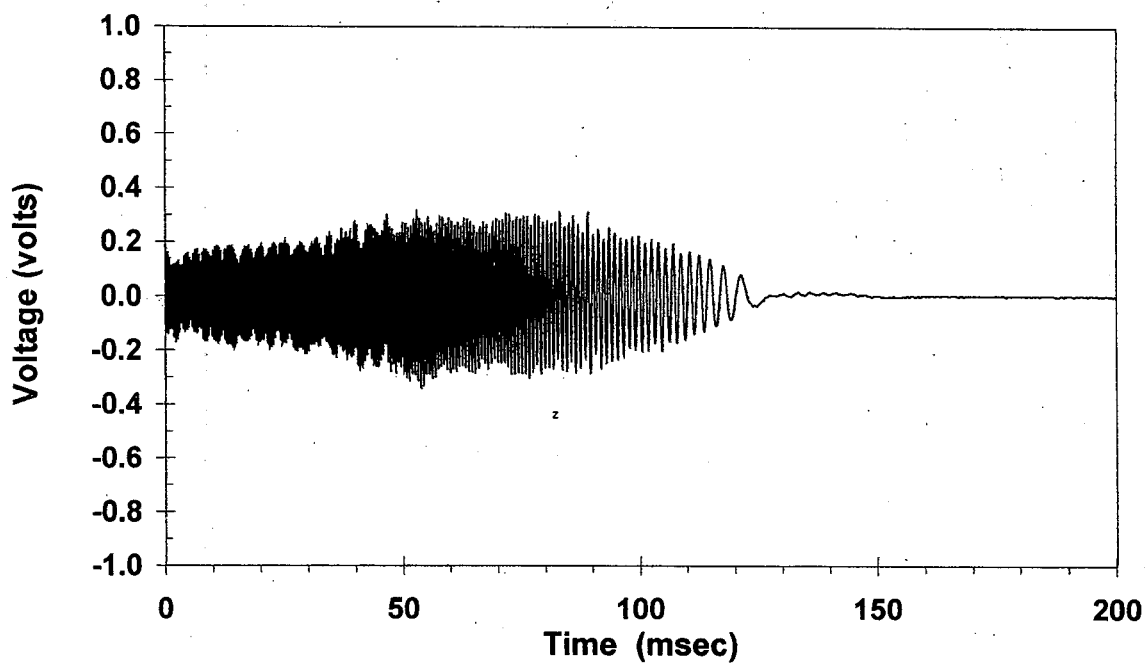

Figure 29
Engine Motion
Measured using Auxiliary Magnetic Pickup Transducer, Test C11793

The current measurements of the driver and passenger air bag circuits indicated that both air bags deployed at about 14 msec (Appendix D, Plots 94 and 95.)

Figure 30 and Plot 99 shows the current measurement at the auxiliary fuel pump and indicates that the current stopped flowing to the pump at about 48 msec. This correlates with the time at which the main battery voltage dropped from 13 to 9 volts as shown in Plot 79 and Figure 31. Temporary and partial drops in main vehicle voltage have caused fuel pumps to consistently shut down early during the crash tests conducted for this project [2],[3]. In addition, an inertia activated fuel pump cutoff switch protected this fuel pump circuit. This switch activated at about 60 msec after impact. This can be determined by comparing the fuel pump voltage (Figure 32 and Plot 81) and the fuel inertia switch voltage (Figure 33 and Plot 85). These two measurements should be nearly equal after the switch activates as schematically shown in Figure 17. The measurements are indeed nearly identical after 60 msec. In addition, an independent electrical contact circuit was used to monitor the mechanical movement of the switch reset button (Plot 110) also indicated closure at about 60 msec.

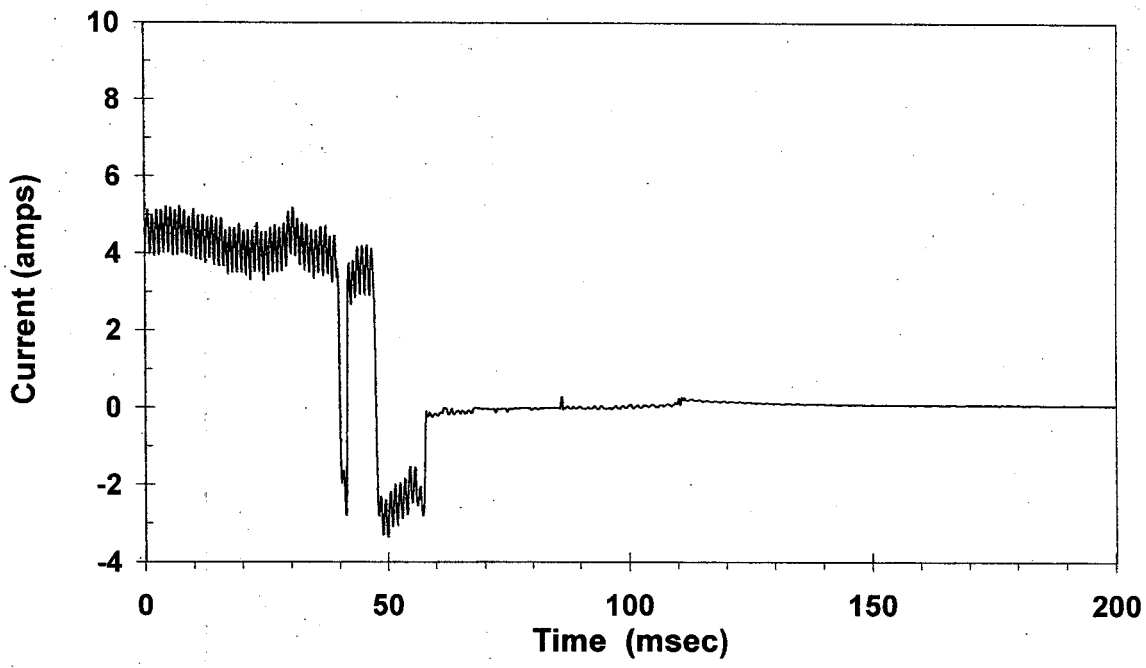

Figure 30
Fuel Pump Current
Test C11793

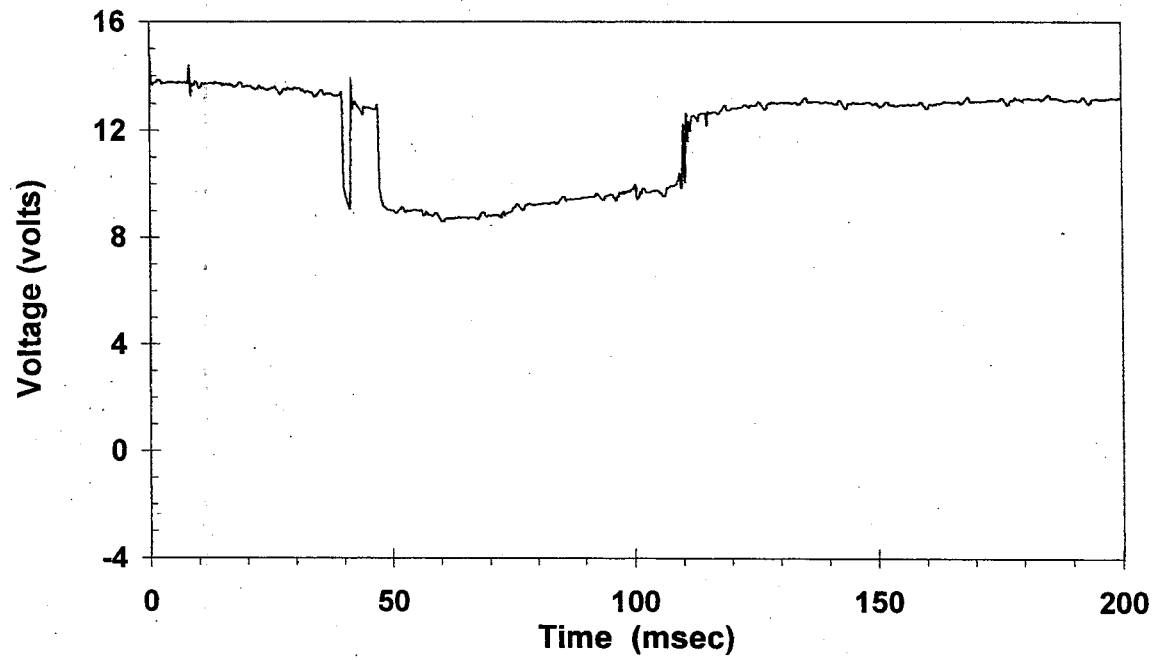

Figure 31
Battery Voltage
Test C11793

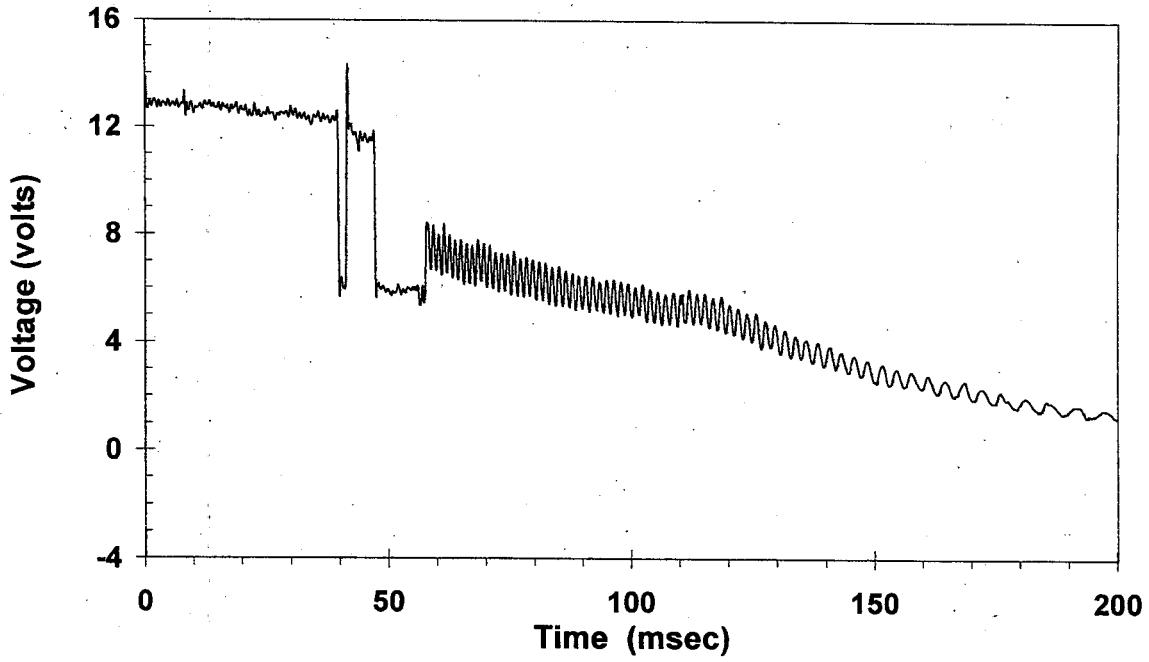

Figure 32
Fuel Pump Voltage
Test C11793

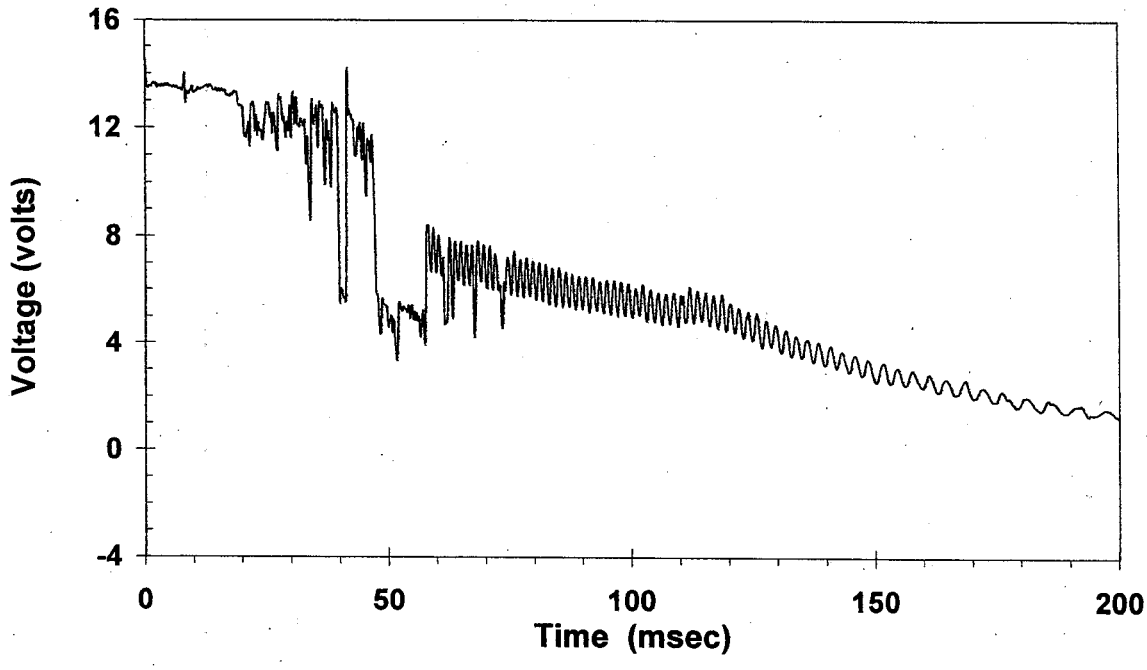

Figure 33
Fuel Inertia Switch Voltage
Test C11793

3.2.2. Summary of Recorded ATD Measurements

The complete set of recorded and computed ATD measurements is included in Appendix D (pages i and ii, and Plots 1 through 60).

For the left front ATD, only the lower right tibia moment (My) which had a peak value of 377 Nm exceeded its IARV of 225 Nm (Plot 22) [9]. All other measurements were below their respective IARVs.

For right front ATD, all recorded measurements were below their respective IARVs.

3.2.3. Summary of Hydrocarbon Vapor Measurements

A complete set of the recorded measurements is included in Appendix D, Plots 89 through 93, and also Appendix E, Figures E1 through EE5.

The signal cable from the vapor sensor located near the catalytic converter (location #5) was cut during the crash test and no useful data was recorded. The sensor near the right exhaust manifold (location #2) was sprayed with fluid and resulted in no useful data. Of the remaining three locations, the sensor near the fuel pressure regulator (location #4) indicated the highest concentration of hydrocarbon vapor. This sensor's output is recreated here as Figure 34 and indicates a concentration of hydrocarbon vapor exceeding 2% for the first 20 seconds following the test. The results of the GCMS analysis for location #4 is recreated here as Figure 35 and Figure 36. The GCMS analysis indicated the source of the vapors was likely gasoline.

Similar to test C11687, gasoline vapor was identified in the engine compartment but no leaks in the pressurized fuel system were identified. Since there was no Stoddard leak in this case, the source of the gasoline vapor could not have been contamination of the Stoddard Solvent but was likely an opening in the air/fuel intake path resulting in gasoline vapors being released to atmosphere. Also similar to test C11687, the fuel pump stopped early during the impact, thus only a small amount of vapor was likely released.

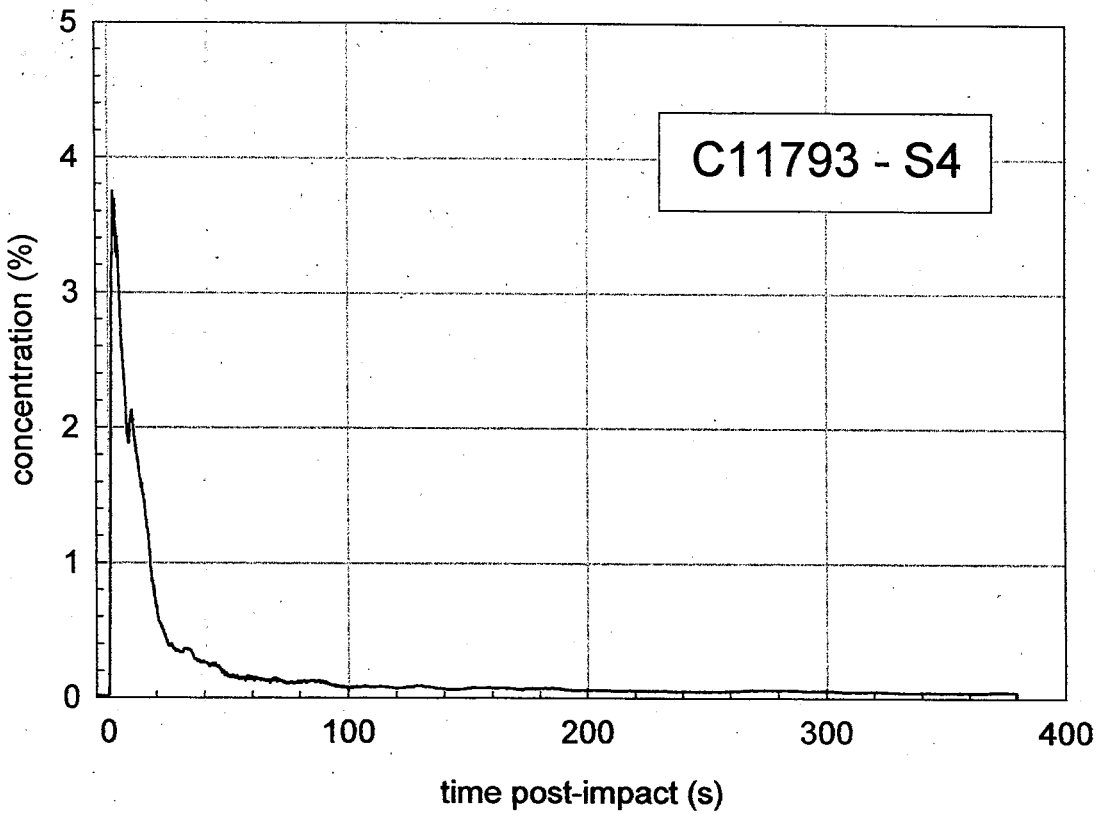

Figure 34
Concentration Of Hydrocarbon Vapor Measured near the fuel pressure regulator (location #4)
Test C11793

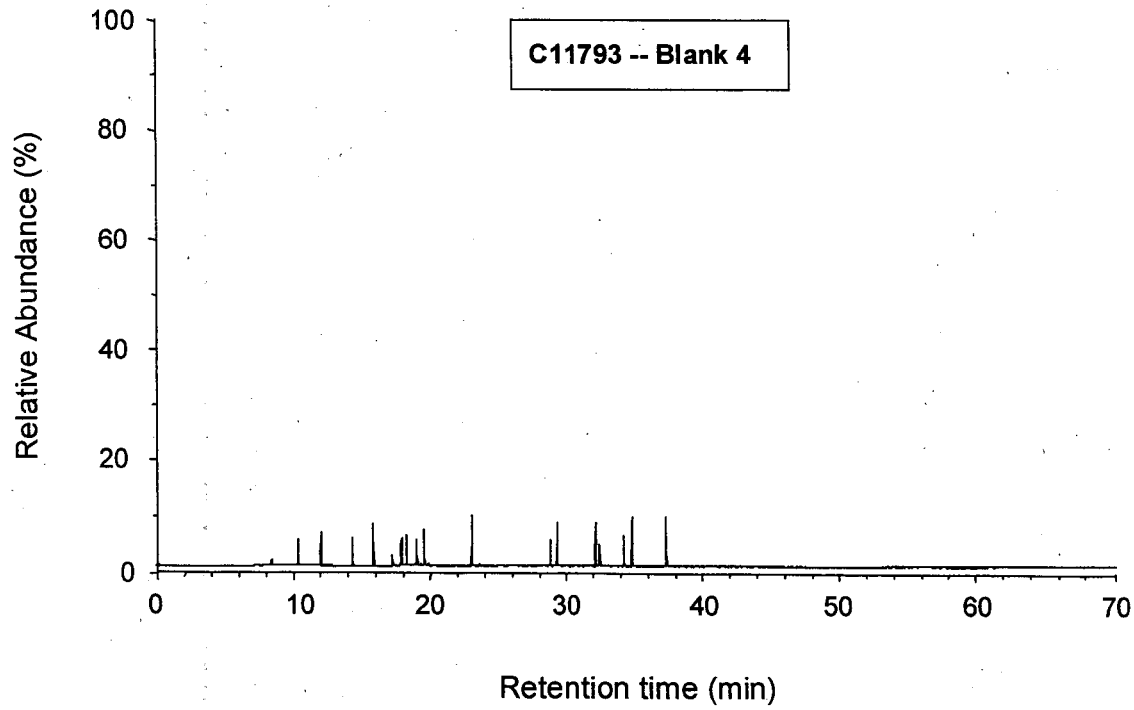

Figure 35
GCMS Analysis Of Vapor Background Sample Collected Near The Fuel Pressure Regulator (Location #4)
Before the Test,. Test C11793

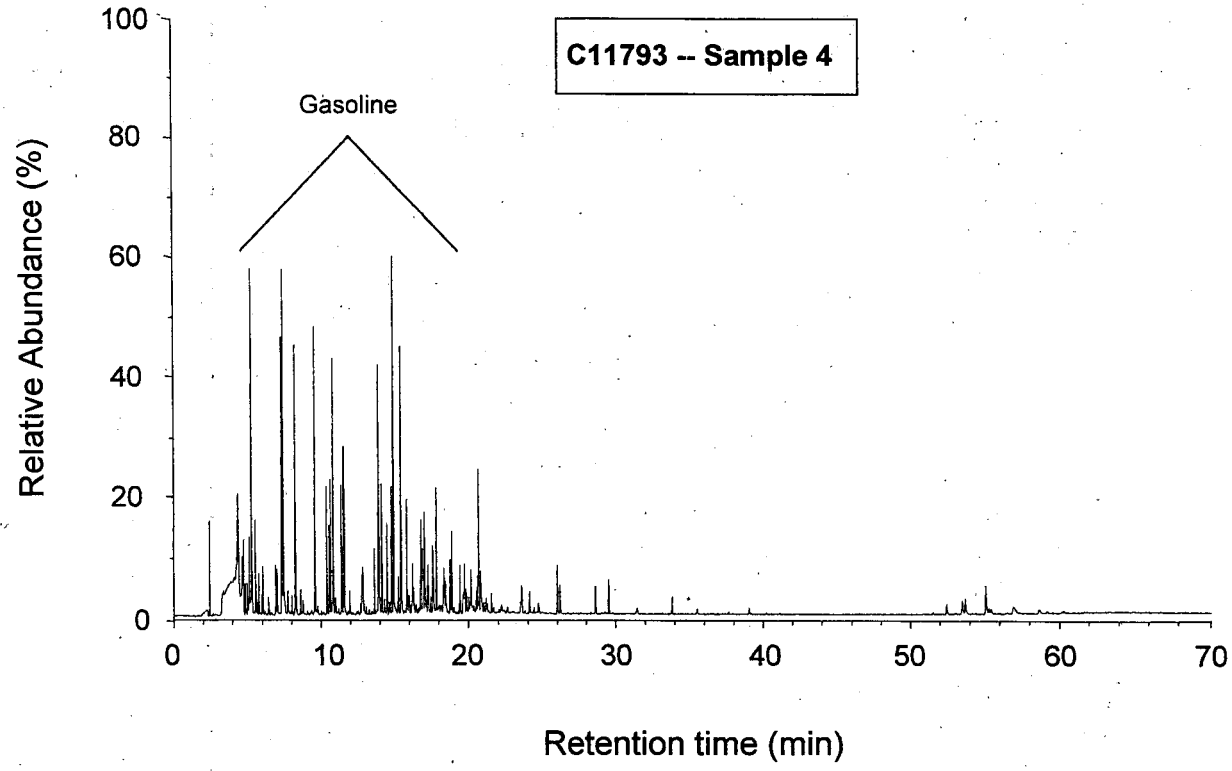

Figure 36
GCMS Analysis Of Vapor Sample Collected Near The Fuel Pressure Regulator (Location #4) Before the Post-Test, Test C11793

3.2.4. Summary of Fluid Pressure Measurements

The dynamic pressure measurements of the engine compartment fluids are shown in Appendix D, Plots 111 through 118.

The power steering fluid (Plot 114), pressurized fuel system (Plot 112 and 113), brake system (Plot 111), and engine oil (Plot 117) pressures did not indicate any leaks during the crash test. This was confirmed during the post test vehicle inspection in which no leaks were identified in these four systems. The steady state brake pressure before the impact was only about 500 kPa, significantly lower than what was achieved for previous frontal tests. This was due to problems with the test hardware used to pressurize the brake system. The engine oil pressure gradually dropped to zero due likely to the engine stoppage.

Both the engine coolant pressure and transmission fluid pressure measurements were inconclusive due to instrumentation malfunctions or full scale overloading. However, the post-test inspections revealed that fluid was lost from both of these systems (see section 3.2.9)

3.2.5. Summary of Additional Electrical Measurements

The results of the additional electrical measurements are shown in Appendix D (Plots 78 through 80, 82 through 84, 96 through 98, and 100 through 106).

The ignition voltage (Plot 84), battery voltage (Plot 84), and starter voltage (Plot 78) all indicated a drop of main system voltage of approximately 8 volts from 40 msec to 110 msec. Previous tests on other vehicles had indicated that temporary and partial drops in main battery voltage had been caused by electrical shorts during the crash [2], [3]. The post-test inspection indicated a cracked alternator housing and a possible internal short of the alternator. The two alternator current measurements (fusible link #1: Plot 101 and fusible link #2: Plot 102) indicated a negative current flow from 40 to 110 msec (current flowing in the opposite direction than for 0 to 40 msec.) This also is evidence of a possible alternator short. Both of these current measurements overloaded their full-scale capacity, even during normal alternator operation before the impact. This was not unexpected because relatively small current transducers (20 amp) were required due to physical space restrictions. Although these measurements overload, they are still helpful in determining when current stops or changes directions. The fuse #6, which protects the alternator field wiring and regulator, was open following the test. This probable internal short of the alternator was the likely cause of the drop in main system voltage from 40 to 110 msec. However, there was no evidence of any burning or charring of any solids in or around the alternator.

The battery current (Plot 96) also indicates a possible short from 40 msec through 110 msec. Since this main B+ cable feeds the alternator cables, this is not an indication of an additional short but of the previously referenced alternator short.

The alternator voltage measurement (Plot 80) is inconclusive due to an instrumentation malfunction. The instrumentation wire used to monitor this voltage shorted and opened during the crush. This was verified during the post-test vehicle inspection. This small gage wire was part of the crash test instrumentation and not part of the vehicle's production wiring. It is impossible to verify that the shorting of this instrumentation wire was not the cause of the main system voltage drop, however, it seems unlikely given the small current carrying capability of this wire.

Similar to test C11687, the headlight low beam voltage (Plot 82) and the foglight voltage (Plot 83) dropped when the system voltage dropped. However, unlike the system voltage they both dropped completely to zero at about 60 msec. The fog light relay was crushed during the impact; this is likely the reason the foglight signal drops to zero. The headlight voltage measurement wiring may have been damaged during the vehicle crush (between 40 msec and 60 msec).

Neither the starter current (Plot 98), A/C clutch current (Plot 100), nor the ignition current (Plot 106) plots indicate a short.

3.2.6. Summary of Numerical Film Analysis

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

The numerical analysis of the overhead film indicated that the dynamic pole penetration into the engine compartment was approximately 1196 mm at 139 msec after time zero, as shown Plot 8.

3.2.7. 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. [2]

3.2.8. Results of the Evaluation of the Crashworthiness of Potential Fire Detection or Suppression Technologies

The results of the electrical measurements of the experimental fire detectors are shown in Appendix D, (Plots 86, 87 and 107 through 109).

The two optical fire detectors mounted under the hood both activated as indicated by the rise in voltage from 4 to 8 volts as shown in Plots 86 and 87. The left sensor had an apparent activation at 85 msec, while the right apparently activated at 125 msec. The interface box used between the sensors and the data acquisition system was designed to maintain the voltage increase caused by an activation for 250 msec to insure it would be readily identifiable. Both of the detector voltages remained high for 250 msec before returning to a nominal voltage of 4 volts. (Note this 250 msec duration is not apparent in Plots 86 and 87 which are truncated at 240 msec but was verified by inspecting the data recorded after 240 msec.) There was no fire or flame identified in the high-speed movies or videos. In addition, the post-test vehicle inspection did not reveal any burning or charring of underhood solids. The activation of these sensors was either a false activation or a malfunction of the interface box (which was used only for testing purposes to help record the sensor outputs.) It is possible, but unlikely that they were reacting to a fast flame flash which was not apparent in either the films or during the post-test inspections. This scenario is unlikely because there was no apparent fuel source or ignition source identified.

Neither the thermal wire nor the pneumatic wire indicated any activations (Plots 107 through 109), demonstrating crashworthiness at their respective mounting locations for this crash event.

3.2.9. 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.

The following crash-induced openings into the passenger compartment were identified during the post-test inspection:

- Separation along the left and right edges of the transmission shift cover plate on the center tunnel. The left opening was approximately 150 mm long and less than 30 mm wide at the widest point. The right opening was similar in size.

- A puncture of the right front toe pan. The area of the opening was estimated to be 1250 mm^2 (1.9 in^2).

- A weld separation at the bottom of the passenger hinge pillar. The weld separated over the entire longitudinal length of the door, but this separation did not result in an opening to the exterior over its entire length. There were only two smaller openings at the front and rear portions of the separation. Both of these smaller openings were estimated at less than 30 mm wide at their widest point and less than 50 mm long each.

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

- Transmission fluid: case cracked, fluid lost
- Engine coolant: radiator crushed, coolant lost
- Battery electrolyte: housing cracked, electrolyte lost
- Washer solvent: reservoir crushed, solvent lost

The fuel filler tube pulled out of the fender and it was intact with the filler cap in place.

There were no leaks found in the brake system, fuel lines, engine oil system, or power steering system.

There was only one contact between a normally hot surface and a combustible solid identified. The right exhaust manifold contacted the aluminum-covered insulation of the HVAC housing. There was no evidence of charring or burning. The ignition temperature of the insulation was not determined.

3.3. *Conclusions*

1. There were no fires observed during or after this crash test.

2. The electric fuel pump began stopping at 48 msec after impact due to a temporary drop in the main vehicle system voltage. The fuel pump did not recover when the main electrical voltage returned at 110 msec.

3. The fuel pump inertia switch activated during the test at about 60 msec after impact.

4. The peak longitudinal acceleration of the passenger compartment was approximately 28 g (filtered at 60 Hz). The maximum longitudinal change in vehicle velocity was 61 km/h (37.9 mph), with the velocity crossing zero at 120 after impact.

5. Both air bags deployed at 14 msec past time zero.

6. Only the lower right tibia moment (My) for the left front ATD exceeded its respective IARV. It had a value of 167% of its IARV. All other ATD measurements were below their respective IARVs.

7. There was approximately 118 mm of toe pan intrusion on the passenger's side.

8. The engine rotation began to slow at approximately 40 msec after time zero and stopped by 120 msec.

9. There was no spillage of gasoline or Stoddard Solvent off of the vehicle during or immediately after the crash test.

10. The numerical analysis of the overhead film indicated that the dynamic pole penetration into the engine compartment was approximately 1196 mm at 139 msec after time zero.

11. Valid data was collected from only 3 of the 5 Hydrocarbon vapor. Of those three, the highest concentration of vapor was near the fuel pressure regulator which exceeded 2% concentration for the first 20 seconds following the impact. The GCMS analysis indicated the source of the vapors was likely gasoline. There was no leak in the pressurized fuel system, however, so it is likely the vapor source was a opening in the air/fuel intake path to the engine.

12. Transmission fluid, engine coolant, washer solvent, and battery electrolyte all leaked during the test. No other engine compartment fluids were released.

13. The main system voltage dropped and remained low from 40 msec through 110 msec. Previous tests on other vehicles indicated that shorts of heavy gage cables and circuits frequently caused temporary and/or partial drops in vehicle voltage [2] [3]. For this test, evidence of an internal alternator short was identified. It is possible (but impossible to verify) that this was the cause of the system voltage drop. There was no evidence of burning or charring of any solids in or around the alternator.

14. The electrical monitoring of the experimental thermal wire fire detector attached to the underside of the hood did not show evidence of any electrical closures throughout the test, demonstrating crashworthiness for its given mounting location and this crash configuration.

15. The electrical monitoring of the experimental pneumatic wire fire detector attached to the underside of the hood did not show evidence of any electrical closures throughout the test, demonstrating crashworthiness for its given mounting location and this crash configuration.

16. Both of the experimental optical fire detectors mounted in the engine compartment indicated activation. These were likely either false activations of the sensors themselves or a malfunction of the interface circuitry used to monitor the sensors during the crash test.

17. Three crash-induced openings into the passenger compartment were identified: the separation along the left and right edges of the transmission shift cover plate on the center tunnel, a puncture in the right front floorpan, and a weld separation at the bottom of the passenger's side hinge pillar.

18. Contact between the right exhaust manifold and the aluminum-covered insulation of the HVAC housing was the only identified contact between a hot surface and a possible combustible material.

4. Sport Utility Vehicle Offset Moving Deformable Barrier Rear Impact, Test C11317

This offset moving deformable barrier impact was conducted indoors on December 17, 1997, also at GM's Milford Proving Ground

A total of 74 data channels were recorded for this test, fewer than were recorded for the frontal impact tests. Fewer injury measurements were recorded from the Hybrid III Anthropomorphic Test Devices (ATDs) (located in the two front seating positions) because many of the injury measurements available with the Hybrid III dummy are more meaningful for frontal impacts (such as leg injury measurements.) In addition, it should be noted that the their Injury Assessment Reference Values (IARVs) for the recorded injury measurements were developed primarily for frontal impacts, and may not be appropriate for rear loading. Also, the rear impact was conducted without the engine running; thus no instrumentation was required to monitor the engine. Similarly, the hydrocarbon vapor measurements, which were recorded in the engine compartment for frontal tests were not included in this test. The purpose of the hydrocarbon vapor measurements for the frontal tests was to identify the presence of vapors resulting from gasoline or leaks of other engine compartment fluids. However, for the rear impacts, the fuel system contained Stoddard solvent, not gasoline, and no other engine compartment fluids were used.

4.1. *Test Conditions*

4.1.1. Impact Conditions

This test was an offset moving deformable barrier rear impact as depicted in Figure 34, Figure 35, and Figure 36. The test vehicle was parked and impacted with a deformable moving barrier similar to what is specified in FMVSS214 [5]. The impact velocity, measured with radar, was 84.4 km/h (52.4 mph). The moving barrier impacted the test vehicle in the rear on the filler neck side (left side) with a 70 % overlap. The overlap was computed by measuring the widest part of the vehicle body vertically in line with the rear axle and multiplying this width by 0.70. For this particular test, the vehicle width vertically in line with the rear wheel centerline was measured to be 1785 mm, resulting in a desired overlap of 1249 mm, as shown in Figure 36. The actual impacted overlap for this test was within 15 mm of the desired.

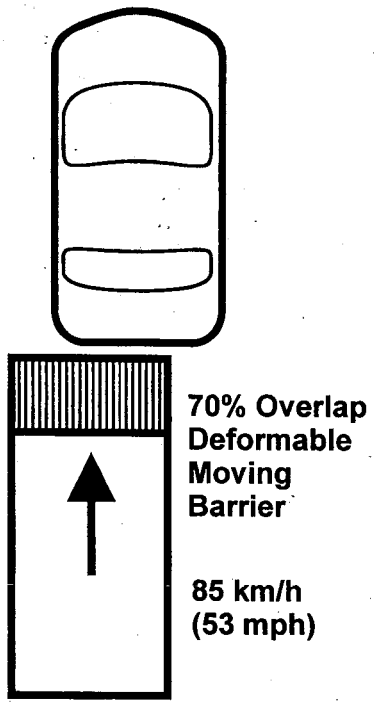

Figure 34
Crash Test Configuration for Test C11317

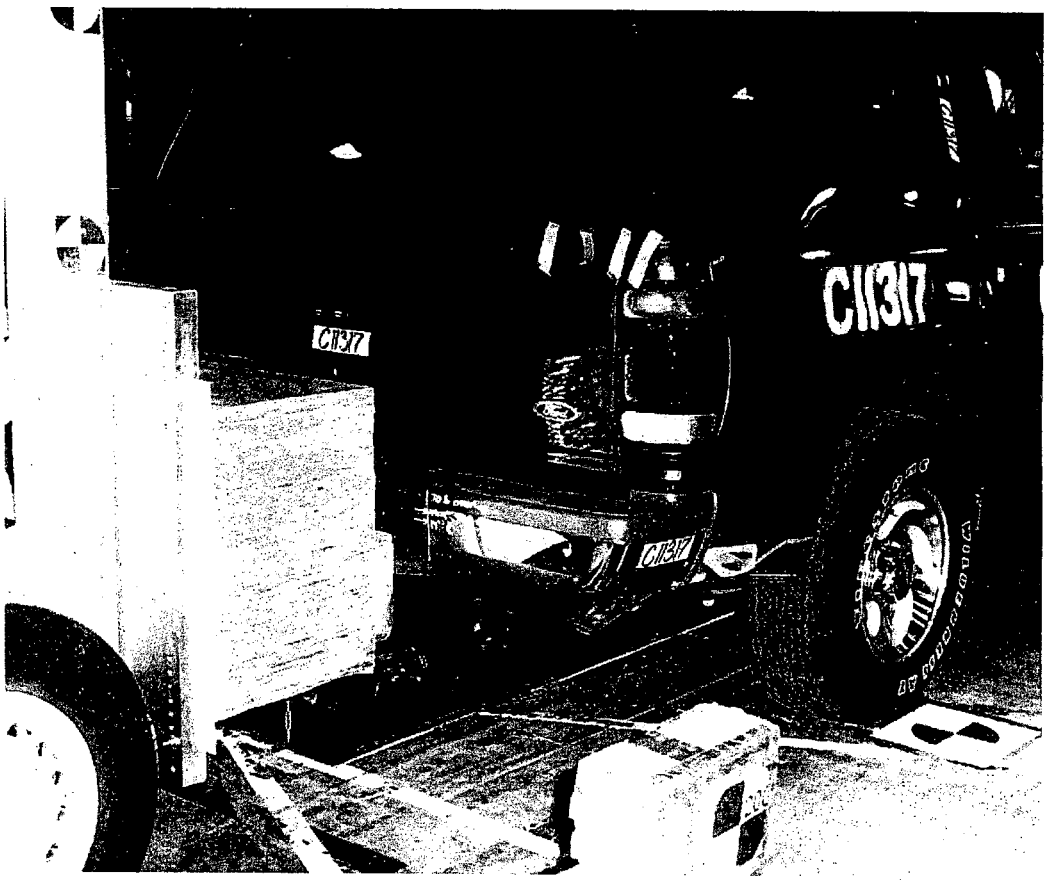

Figure 35
Pre-Test Photograph of Test C11317

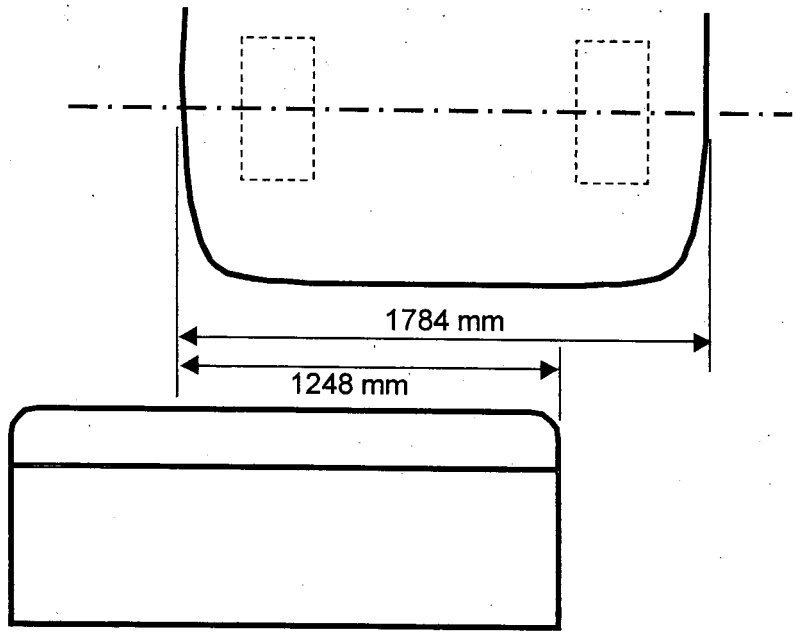

Figure 36
Schematic of Intended Vehicle Overlap
Test C11317

The moving barrier's total mass was 1371 kg (3022 lbs.); its frontal axle mass was 779 kg (1717 lbs.); and its rear axle mass was 592 kg (1305 lbs.) The center of gravity was measured to be 526 mm (20.7 inches) above grade, 1118 mm (44 inches) rearward of the front axle and laterally in the center of the barrier. Its wheels were aligned with the longitudinal axis of the moving barrier as shown in Figure 34. (unlike FMVSS 214 testing, in which the wheels are set at an angle.) The aluminum honeycomb barrier face was similar to that specified in FMVSS 214 and was located such that the center of the bumper form was 431 mm (17 inches) ± 12 mm (0.5 inches) above grade. The brakes on the moving barriers were activated at time zero (impact). However a mechanical delay in the pressurization of the brake lines resulted in an effective brake activation time of approximately 80-150 msec after impact. The barrier was also stopped following the impact using a cable attached to the barrier. This cable ("snubber" cable) was restrained with a remote brake system which was also activated at time zero, but had an effective activation time of about 100 – 150 msec.

4.1.2. Vehicle Description

The test vehicle was a 1997 Ford Explorer (VIN: 1FMDU34X6VUA99109) which had a test mass of 2249 kg (1279 kg front, 970 kg rear) which included the two ATDs, crash test instrumentation, and Stoddard Solvent in the gasoline tank. First, the fuel tank's unusable capacity was established (filled) with Stoddard Solvent, then 74.8 liters of Stoddard were added to the unusable capacity of the tank. (74.8 liters

represents 95% of the usable capacity of 78.7 liters.) The headlights, ignition, hazard lights, and rear defroster were all on for the test. The transmission selector was placed in reverse for the test.

4.1.3. Modifications to Production Vehicle

The test vehicle's front brakes were isolated from the brake system and connected to an auxiliary brake machine which charged the lines at about 150 msec after impact. There was also a mechanical delay of 80 – 150 msec from the time the auxiliary brake machine was activated until the lines were pressurized, resulting in a effective delay of 230 – 300 msec. The test vehicle's rear brakes were not activated during or after the test.

The vehicle's hood was removed to facilitate the installation of the crash test instrumentation above the engine compartment. In addition, a pressure transducer was installed in the fuel return line.

Electrical measurements, such as currents and voltages, of the rear brake and turn lights were made. Every reasonable attempt was made to locate this instrumentation in locations that would not affect the outcome of the test.

4.1.4. Vehicle Measurements

Measurements that were recorded during this test included:

- 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)
- Rear left frame acceleration (longitudinal, lateral, and vertical)
- Rear right frame acceleration (longitudinal, lateral, and vertical)
- Driver's and passenger's air bag current (using non-intrusive clamp-on current transducers)
- Fuel pump voltage (measured near the fuel pump inertia switch)
- Fuel pump inertia switch voltage (near the fuel pump inertia switch, gray/orange wire voltage drop to ground)
- Mechanical motion of fuel pump inertia switch reset button

In addition, electrical contact measurements were used to identify the times at which structural components contacted each other. Two vehicle contacts were monitored in the rear structure of the vehicle.

- Spare tire to differential

- Spare tire to spare tire deflector

4.1.5. Photographic Coverage

High-speed 16 mm movie cameras were used to film the crash test. All cameras were located off-board of the vehicle. Cameras were located at various locations around the impact including above, below, and to both sides of the vehicle. In addition, video cameras were located at two off-board locations. There was no numeric film analysis done for this test.

4.1.6. Moving Barrier Measurements

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

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

4.1.7. Anthropomorphic Test Device (ATD) Measurements

Two 50th percentile male Hybrid III ATDs [6] were located in the front outboard seating positions. The ATDs were positioned similar to test C11687. The pelvic angle was 24.1 degrees for the left front occupant and 20.8 degrees for the right front. The head target angle was at 0 degrees from horizontal for both ATDs. The seat back angle was 25.0 degrees for both seats. The following measurements were recorded for each ATD:

- 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

4.1.8. Hydrocarbon Vapor Measurements

There were no hydrocarbon vapor measurements made for this test.

4.1.9. Fluid Pressure Measurements

The fuel return line pressure was recorded. No other fluid pressure measurements were made.

4.1.10. Additional Electrical Measurements

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

- Rear window defroster (measured above headliner)
- CHMSL (Center High Mounted Stop Light)/ rear left brake light (measured above headliner)
- Rear left backup light (measured under left rear trim panel)
- Rear left tail light (measured under left rear trim panel)
- Rear left turn signal (measured under left rear trim panel)
- Battery (main B+ to PDB, transducer located near battery)

Direct voltage measurements (not requiring transducers) were also made of the following circuits:

- Ignition (measured under IP)
- CHMSL / rear left brake light (measured above rear headliner)
- Rear window defroster (measured above rear headliner)
- Rear left backup light (measured under left rear trim panel)
- Rear left tail light (measured under left rear trim panel)
- Rear left turn signal (measured under left rear trim panel)

4.1.11. Evaluation of the Crashworthiness of Potential Fire Detection or Suppression Technologies

Two separate experimental thermal wire fire detectors were mounted to the underside of the vehicle. One was wrapped on the upper surface of the rear differential. The other wire ran laterally inside of the lateral frame crossmember above the rear of the fuel tank. These two wires were measured independently. The wire type, however, was the same for the two locations and was similar to the wires used on previous tests in this series. A pneumatic fire detector was co-located with the thermal wire device inside of the frame lateral crossmember.

These two technologies were the same as used in test C11687 and C11793.

4.2. *Summary of Test Results*

Post-test photographs of the vehicle are shown in Figure 37 and Figure 38.

Figure 37
Post-Test Photograph of Test C11317, Left-Rear View

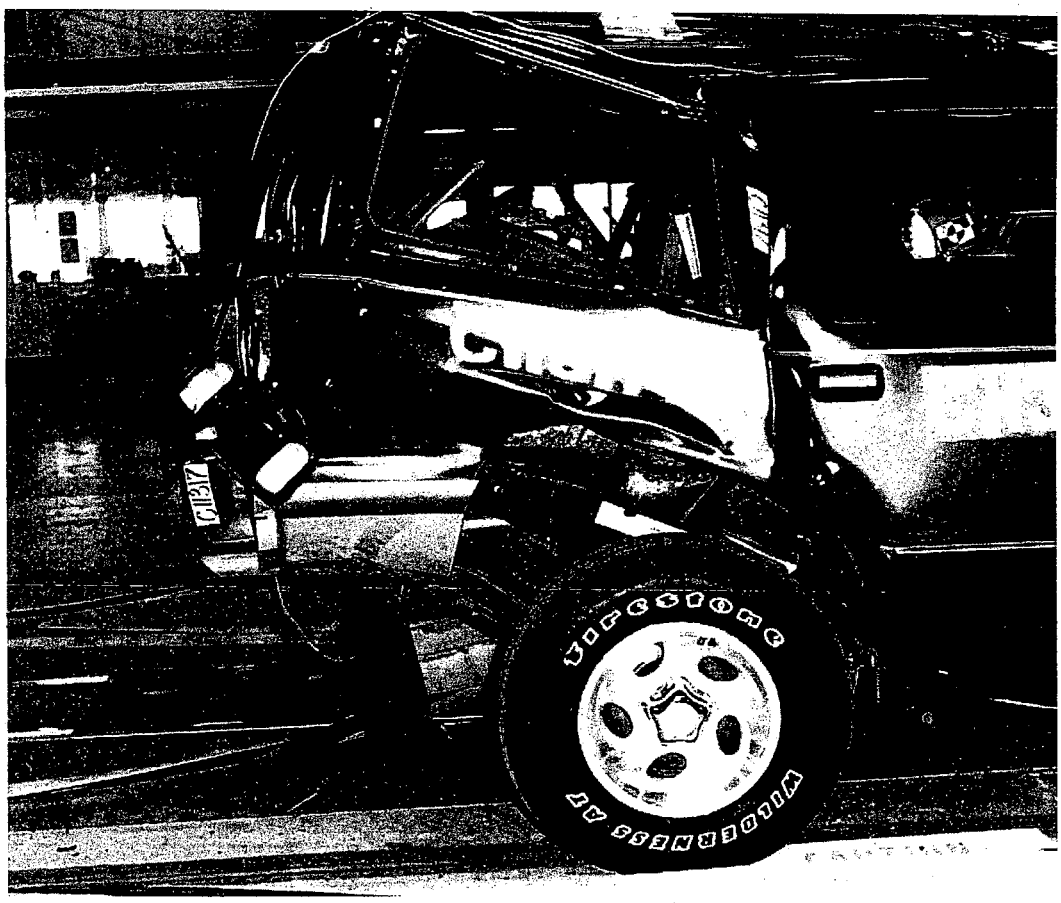

Figure 38
Post-Test Photograph of Test C11317, Right-Rear View

4.2.1. Summary of Standard Vehicle Crash Test Measurements

The complete set of recorded and computed vehicle measurements is included in Appendix G (Plots 19 through 36, 43 through 46, 57 through 59.)

The average of the two front rocker panel longitudinal acceleration measurements (Figure 39) was integrated to compute the change in vehicle longitudinal velocity (Figure 40). The peak vehicle longitudinal acceleration (after filtering at SAE class 60 [8]), was 16.8 g and the maximum longitudinal change in vehicle velocity was 37.0 km/h (23.0 mph).

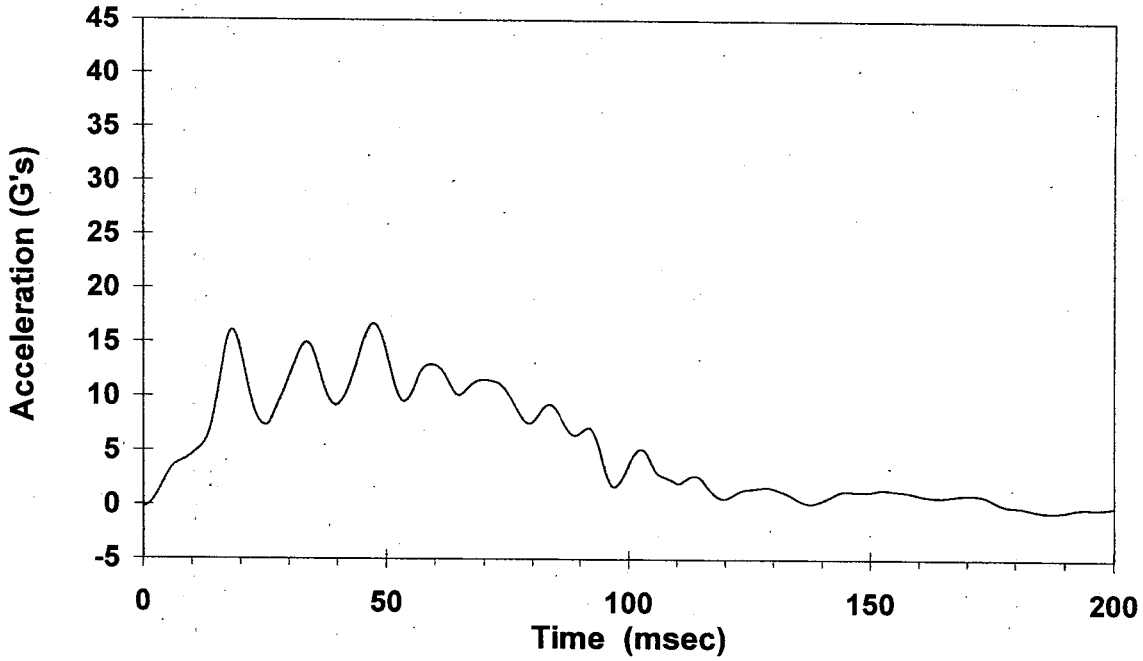

Figure 39
Averaged (Left & Right) Front Rocker Panel Longitudinal Acceleration,
Test C11317, filtered at SAE class 60 [8]

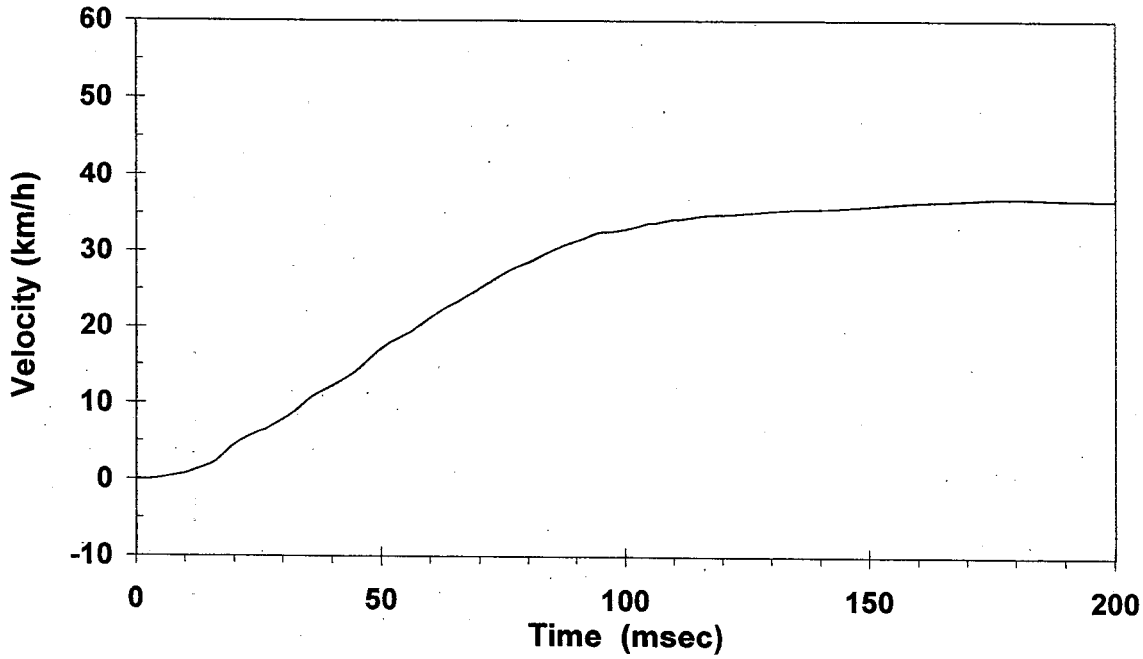

Figure 40
Averaged (Left & Right) Rear Rocker Panel Longitudinal Velocity
Test C11317

The results of the two vehicle contacts are shown in Appendix G, Plots 58-59. The spare tire first contacted the differential at 23 msec (Plot 58.) The spare tire first contacted the deflector at 19 msec (Plot 59.)

The frontal air bags did not deploy in this rear impact crash test (Plots 45 and 46).

The fuel pump voltage (Plot 43) began at near zero at the time of impact. This is normal, since the engine was not operating the fuel pump was off. The fuel pump inertia switch did not activate during this test as indicated in Plot 44. Upon activation of the switch, both the fuel pump voltage and the fuel inertia switch voltage would be the same, as was the case for tests C11687 and C11713, as shown in the schematic in Figure 17. Thus, the switch did not activate. This was confirmed with a physical inspection of the reset switch and indicator lamp following the test. The temporary partial drop in the fuel inertia switch voltage was due to a main drop in the vehicle's system voltage and is unrelated to the activation of the switch. This temporary drop in vehicle system voltage is also apparent in Plots 37, 39, 40, 41 and 42. The independent contact closure used to monitor the mechanical movement of the reset button malfunctioned, and is inconclusive. The instrumentation leads were pulled from this independent contact closure.

4.2.2. Summary of Recorded Barrier Measurements

The acceleration measurements and related computed values from the moving barrier are included in Appendix G (Plots 60 through 66).

The longitudinal velocity of the barrier's CG is shown in plot 60 and re-created here as Figure 41. The barrier sustained a velocity change of about 60.4 km/h (37.5 mph).

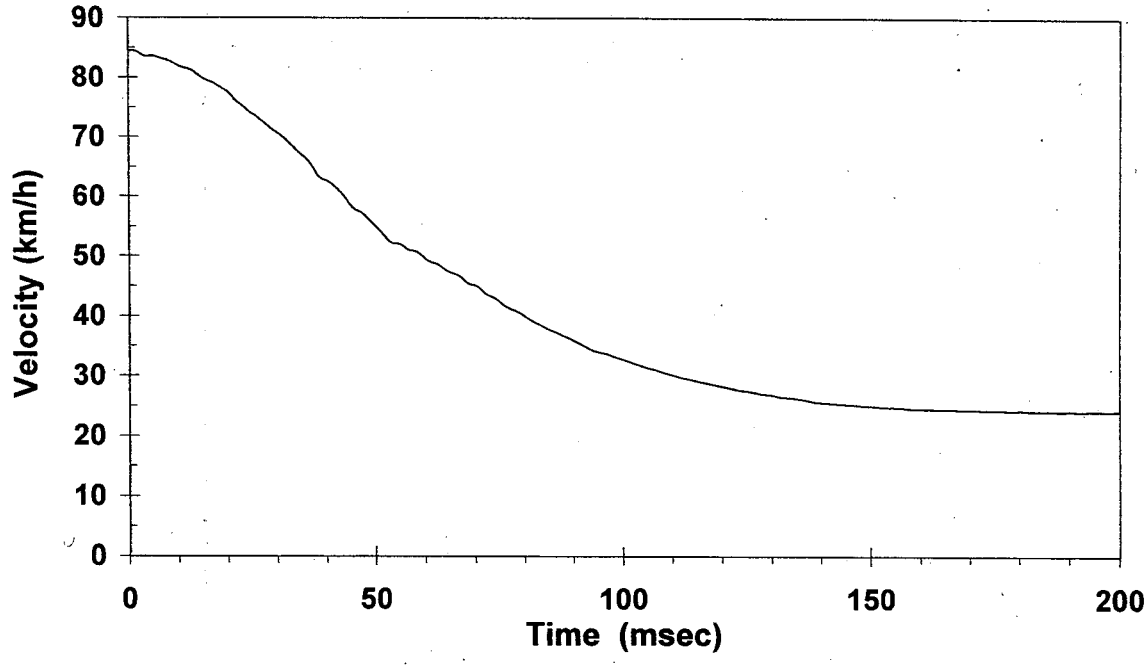

Figure 41
Moving Deformable Barrier Longitudinal Velocity at CG
Test C11317

4.2.3. Summary of Recorded ATD Measurements

The recorded and computed ATD measurements are included in Appendix G (pages i and ii, and Plots 1 through 18).

All recorded injury measurements were below their respective IARVs.

4.2.4. Summary of Hydrocarbon Vapor Measurements

There were no hydrocarbon vapor measurements taken for this test.

4.2.5. Summary of Fluid Pressure Measurements

The dynamic pressure of the fuel return line is shown in Plot 67. There is no significant overall increase in return line pressure during the impact. There is a return line check valve between the fuel tank and return line on this vehicle. This prevents a return line pressure measurement from accurately reflecting pressure changes in the tank. Thus, this measurement is not very useful.

4.2.6. Summary of Additional Electrical Measurements

The results of the additional electrical measurements made on some of the rear electrical circuits are shown in Appendix G, Plots 37 to 42 and 47 to 52.

The ignition voltage (Plot 37), the rear window defroster voltage (Plot 39), the backup light voltage (Plot 40), the tail light voltage (Plot 41) and the left rear turn signal voltage (Plot 42) all indicate a drop in system voltage of about 2 volts at 42 msec and remain low until 72 msec. The battery current (Plot 52) indicated a significant increase in current flow from 42 msec from 72 msec. Thus a short to ground putting excessive drain on the battery is the likely cause of the voltage drop. None of the few channels that were monitored, however, indicated shorting. Thus the source of the voltage drop was not identified.

In addition to the 2 volt drop at 42 msec, the left rear turn signal voltage (Plot 42) dropped to zero at 80 msec. This was due to the turn signal cycling off at this time and which was also apparent in the turn signal current (Plot 51).

The rear window defroster current (Plot 48) dropped from normal operating level of 13 amps to zero at 30 msec. This was due to the defroster circuit opening due to the crush of the rear window during the impact.

Both the CHMSL/brake light voltage (Plot 38) and the CHMSL/brake light current (Plot 47) dropped to zero at 32 msec. This was likely due to the release of the brake pedal (which was held by the ATDs foot) during the impact.

4.2.7. Results of Post-test Static Rollover

This vehicle was rolled on December 18, 1997 using a static roll procedure similar to the roll procedure specified in FMVSS 301 [10]. The vehicle was initially rolled in the negative direction (left side – filler neck side down.) Spillage of Stoddard Solvent in excess of 141.75 kg was noted during the first 2 minutes of the roll. The static roll was terminated following the first two minutes. The source of the leak is described in Section 4.2.9.

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

The electrical contact measurements used to monitor the pneumatic fire sensor and the two thermal wire fire detectors are shown in Appendix G, Plots 53 through 56. No contacts were recorded on any of the channels. This indicates that there were no activations due to fire (there was no fire) or inadvertent activations due to the vehicle crush. The detectors at the given locations were crashworthy for this crash configuration.

4.2.9. Summary of Post-test Vehicle Inspection

As with the previous tests, the vehicle was disassembled and inspected to identify openings 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.

The following crash-induced openings into the passenger compartment were identified during the post-test inspection:

- A separation on the rear of the left rear wheel well in the cargo area. The opening was no wider than 50 mm at its widest point and no more than 100 mm long.

- A separation on the floorpan near the left side c-pillar (near the kickup) in the cargo area. The opening was no wider than 30 mm at its widest point and no more than 200 mm long.

- A separation of the floorpan and the right rear quarter panel. The opening was no wider than 40 mm at its widest point and no more than 210 mm long.

- A separation on the floorpan near the right side c-pillar (near the kickup) in the cargo area. The opening was no wider than 7 mm at its widest point and no more than 165 mm long.

During the post-test inspection, an approximately 12 mm (0.5 inch) long tear in the rubber portion of the filler neck hose was found. This tear was just below the hose clamp attachment to the metal filler tube. This tear was the likely source of the Stoddard leak during the static rollover. In addition to the leak, the lower rear right corner of the fuel tank was deformed due to contact with the rear axle housing. A small amount of stoddard solvent dye was visible around the deformation indicating the Stoddard likely weeped out of a very small pinhole sized puncture in the tank, but no leakage off of the vehicle was noted at the crash site. The lower rear right hand corner of the tank is where a gasoline leak was simulated for the subsequent fire propagation test, which was reported separately.

The only other fluid leak identified during the post – test vehicle inspection was the rear washer solvent reservoir, which was crushed.

No electrical shorts were identified during the post-test vehicle inspection.

There was no identified contact between any combustible material and a normally hot surface.

4.3. *Conclusions*

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

2. The peak vehicle longitudinal acceleration (after filtering at SAE class 60 [8]), was 16.8 g and the maximum longitudinal change in vehicle velocity was 37.0 km/h (23.0 mph).

3. No liquid gasoline or Stoddard spilled off of the vehicle during or immediately after the impact. However, during a subsequent static rollover, spillage of Stoddard exceeding 141.75 grams occurred during the first 2 minutes of the roll. The source of the leak was later identified as a cut in the rubber filler neck hose.

4. The only non-gasoline fluid leak identified was windshield washer fluid resulting from the crush of the rear washer solvent reservoir bottle.

5. All of the ATD measurements recorded were below their respective IARV values.

6. Consistent with tests of other vehicle models in this series, the main system vehicle voltage fluctuated during the impact. This was apparent on all of the voltages recorded. However, for this test the source of this drop was not identified. It is possible that the drop was caused by electrical short(s) on circuits that were no monitored for this test.

7. The two different fire detection technologies evaluated in this test (thermal fire wire and pneumatic sensor) both were crashworthy at their mounting locations. That is, neither indicated a false activation nor were damaged during the impact.

8. Consistent with other vehicles tested in this series, crash-induced openings from outside to inside of the passenger compartment were identified. These openings were noted independent of their possible contribution to fire propagation. For this test, four separate openings were identified on the floor of the rear cargo area.

9. The fuel pump inertia switch did not activate during this test.

10. There was no evidence of any combustible materials contacting normally hot surfaces.

5. Conclusions Of The Four-Wheel-Drive Sport-Utility-Vehicle Crash Test Series

From the data collected on this series of crash tests, several conclusions and observations can be made concerning post-collision fire potential. It is important to note that the intent of the crash tests was not to determine if a production vehicle 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 three tests conducted (two frontal and one rear impact), none resulted in a post-collision fire.
For the two frontal tests in which the engine was operating, the fuel pump began to stop by 48 msec after impact in both tests. In the oblique moving barrier frontal impact (#C11687), the fuel pump began to stop by 40 msec and the fuel pump inertia switch activated at 47 msec. In the Offset Pole Frontal Impact (#C11793), the fuel pump began to stop by 48 msec and the fuel pump inertia switch activated at 60 msec. For both of these frontal impacts, a drop in main vehicle voltage due to the crash likely caused the stoppage of the fuel pump. This is consistent with observations of other vehicles tested for this project (i.e., fuel pumps have stopped early during the crash sometimes due to intermittent voltage fluctuations caused by the crash [2],[3].)

For the rear impact test, the engine was not operating for the test. For this test, the fuel pump inertia switch did not activate. However, the vehicle peak acceleration (16.8 g as shown in Figure 39) and longitudinal velocity change (37 km/h or 23 mph) was significantly lower than for the two frontal tests. (The oblique moving barrier frontal impact acceleration was 36 g with a 45 km/h (28 mph) velocity change and the offset pole impact acceleration was 28 g with a 61 km/h (37.9 mph) velocity change.)

The cause of the main voltage drop identified in all three tests was not positively identified. However, for the offset pole frontal impact, there was indication of an internal short in the alternator. However, it was not verified that this was the cause of the drop in system voltage. There was no burning or charring of any solids in or around the alternator.

The motion of the engine was monitored for the two frontal crash tests. In both cases the engine began to slow at about 40 msec and was stopped by 120 msec.

Three different experimental fire-sensing or extinguishing technologies were evaluated for their crashworthiness. The thermal wire fire detectors proved crashworthy at their given mounting locations on all three crash tests. That is, the thermal wire fire detectors did not false activate or become damaged during the test. No attempt was made as part of these crash tests to determine whether these devices together with extinguishing technologies would have been effective in controlling the spread of or extinguishing a fire.

The pneumatic wire fire detectors did not indicate an activation on the rear impact or the offset pole frontal impact. For the oblique moving barrier frontal impact, however, the recorded signal was inconclusive. It did indicate an activation, but there was no apparent fire or heat damage to the detector.

Two optical fire sensors were included on the two frontal tests only. They did not activate in the oblique moving barrier frontal impact. The recorded signal for both sensors did indicate an activation on the offset pole frontal impact, however. These were likely either false activations of the sensors themselves or a malfunction of the interface circuitry used to monitor the sensors during the crash test. The post-test vehicle inspection indicated no apparent fire or heat damage (no source of heat or fire was ever observed or detected.)

Consistent with the tests on other vehicles, crash-induced openings into the passenger compartment (as defined in section 2.2.11) were identified [2].[3]. Their possible contribution to fire propagation was evaluated in fire propagation tests and reported separately.

There was no liquid Stoddard spillage off of the vehicle on the offset pole frontal impact. For the oblique moving barrier frontal impact, the universal joint on the rear drive shaft punctured the fuel tank during the impact. The leak rate of Stoddard Solvent was not measured at the crash test facility, but subsequently measured to be 280 cm^3/min. For the rear impact, no Stoddard spillage was noted immediately after the impact, however spillage was noted during a subsequent static rollover. The leak was attributed to a cut in the rubber filler neck hose.

Of the non-gasoline fluids, transmission fluid, battery electrolyte, and engine coolant were released in both of the frontal impact tests. In addition, power steering fluid was released in the oblique moving barrier frontal impact and washer solvent was released during the offset frontal pole impact. For the rear impact test, washer solvent was released from the rear reservoir bottle.

Hydrocarbon vapor sensors were used and identified the presence of underhood vapors in the 2 frontal crash tests. The post-test GCMS analysis indicated the presence of oil vapors, Stoddard vapors and gasoline vapors for the oblique moving barrier frontal impact. Gasoline vapor was identified on the offset frontal pole impact. In neither test was a leak in the pressurized fuel system identified, however. The presence of gasoline vapor does not necessarily indicate the presence of a liquid gasoline leak. The vapor source could be the contamination of Stoddard Solvent with gasoline or the release of gasoline vapors from the intake path as the engine was crushed.

The vehicles were inspected for contact between potentially hot surfaces and combustible materials. The only occurrence noted was for the offset pole frontal impact; the exhaust manifold contacted aluminum-covered insulation of the HVAC housing. There was no indication of burning, however.

In general, most of the recorded injury measurements for the ATDs were below their respective IARVs. Only two exceptions were noted. For the offset pole impact, the lower right tibia moment on the left front ATD slightly exceeded its IARV. For the oblique moving barrier frontal impact, the right tibia resultant moment on the left front ATD exceeded its respective IARV.

REFERENCES

1. Jensen J.L.; and Santrock J., "Evaluation of Motor Vehicle Fire Initiation and Propagation, Part 1: Vehicle Crash and Fire Propagation Test Program", Technical report submitted to the National Highway Traffic Safety Administration, Washington D.C., July 31, 1997.

2. Jensen J.L.; and Santrock J., "Evaluation of Motor Vehicle Fire Initiation and Propagation, Part 2: Crash Tests on a Passenger Van", Technical report submitted to the National Highway Traffic Safety Administration, Washington D.C., August 25, 1998

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5. Federal Safety Standards. Motor Vehicle Safety Standard No. 214 Side Impact Protection - Passenger Cars, Trucks, Buses & Multipurpose Passenger Vehicles with GVWR of 10,000 Pounds or Less. 60FR57838-39 (November 22, 1995).

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7. Federal Safety Standards. Motor Vehicle Safety Standard No. 208 Occupant Crash Protection - Passenger Cars, Multipurpose Passenger Vehicles, Trucks, Buses. 61FR26845-46 (May 29, 1996).

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9. AGARD Report AR-330, "Anthropomorphic Dummies for Crash and Escape System Testing", Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France, July 1996.

10. Federal Safety Standards. Motor Vehicle Safety Standard No. 301 Fuel System Integrity. 63FR28922-57 (May 13, 1998).

APPENDIX A

Appendix A: Anthropomorphic Test Device (ATD) Injury Assessment Reference Values (IARV)

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" [7].

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	Figure A1
Upper neck axial force, compression, -Fz	Figure A2
Upper neck axial force, tension, +Fz	Figure A3
Upper neck longitudinal moment, flexion, +My	190 Nm
Upper neck longitudinal moment, extension, -My	57 Nm
Chest	
Resultant spinal acceleration	60 g
Sternal deflection due to:	
Shoulder belt	50 mm
Air bag (no belt)	65 mm
Viscous Criterion (V*C)	1 m/s
Femur	
Axial compression	Figure A4
Knee	
Tibia-to-femur displacement	15 mm
Knee clevis loads (med./lat. Compression)	4000 N
Tibia	
Axial load, compression, Fz	8000 N
Tibia index, TI = M/Mc + Fz/Fc	1.0
Where,	
M = resultant moment, (of Mx & My), for upper index	225 Nm
M = anterior/posterior moment, My, for lower index	225 Nm
Mc = critical bending moment	225 Nm
Fc = critical compersive force	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).

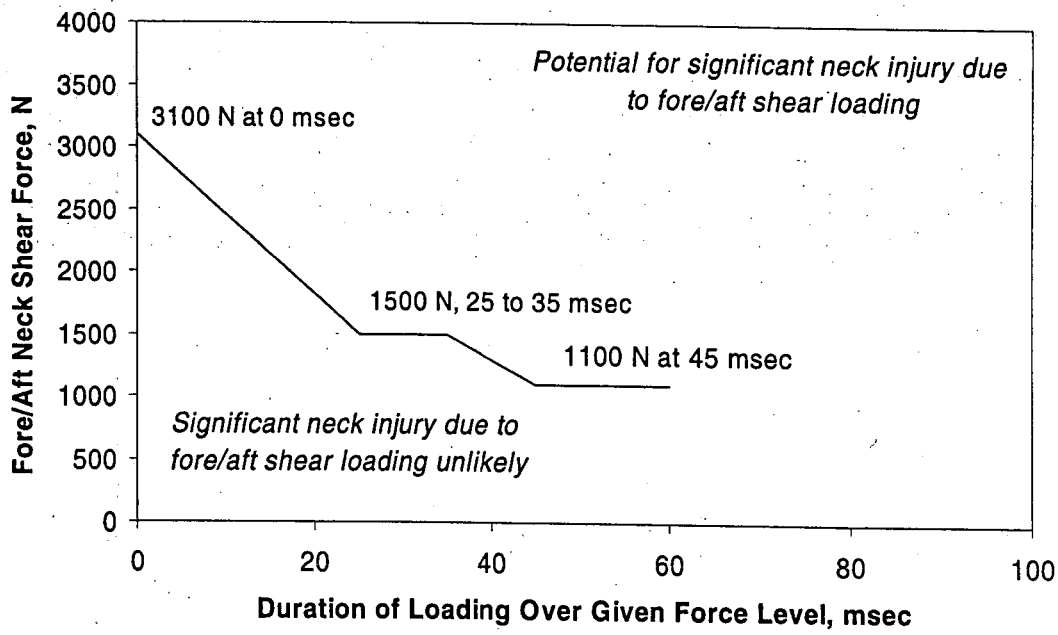


Figure A1
Injury Assessment Curves for Fore-and-Aft Sheer Forces Measured with Hybrid III Mid-sized Adult Male ATD [7]

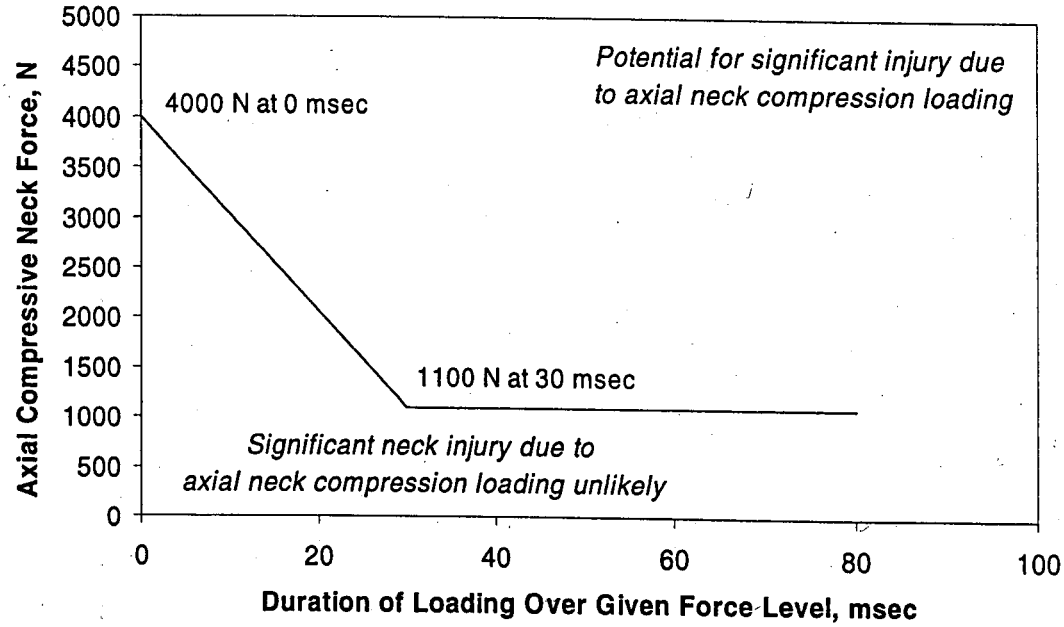


Figure A2
Injury Assessment Curves for Axial Neck Compression Measured with Hybrid III Mid-sized Adult Male ATD [7]

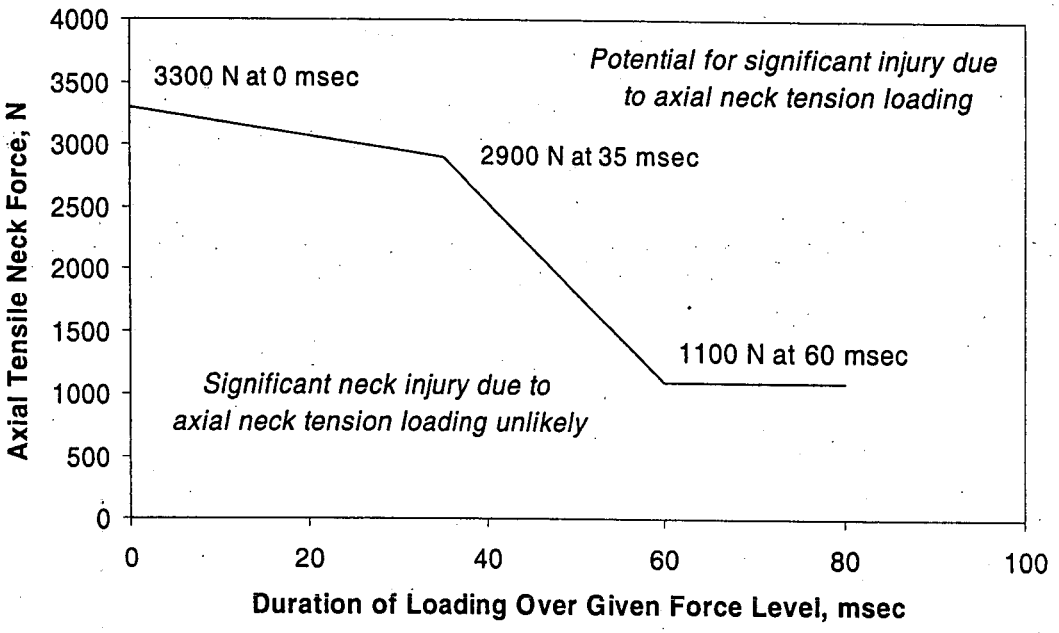


Figure A3
Injury Assessment Curves for Axial Neck Tension Measured with Hybrid III Mid-sized Adult Male ATD [7]

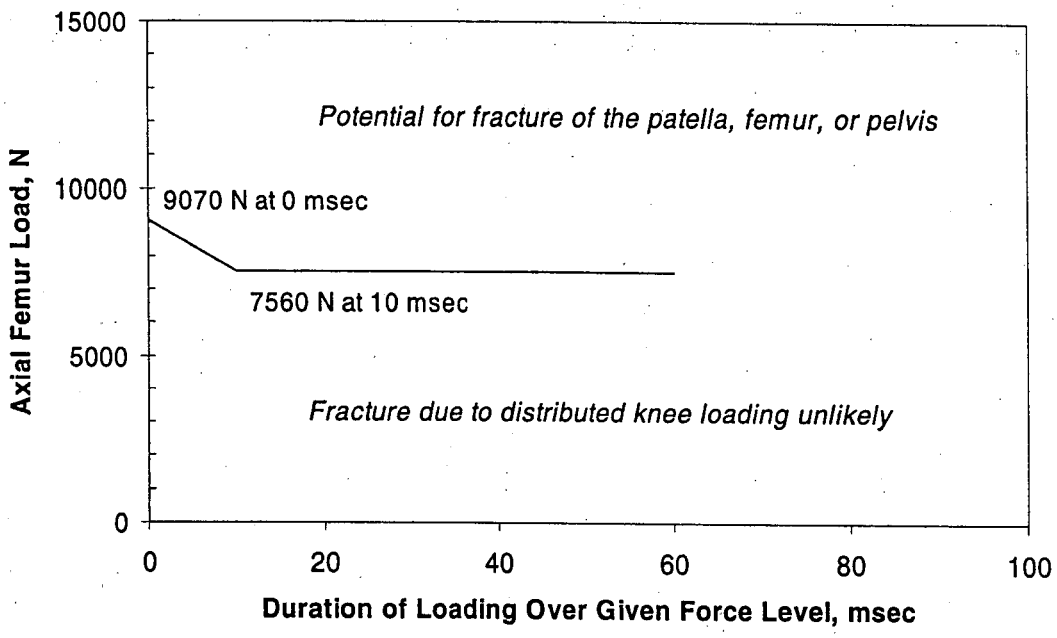


Figure A4
Injury Assessment Curves for Axial Compressive Femur Force Measured with Hybrid III Mid-sized Adult Male ATD [7]

APPENDIX B

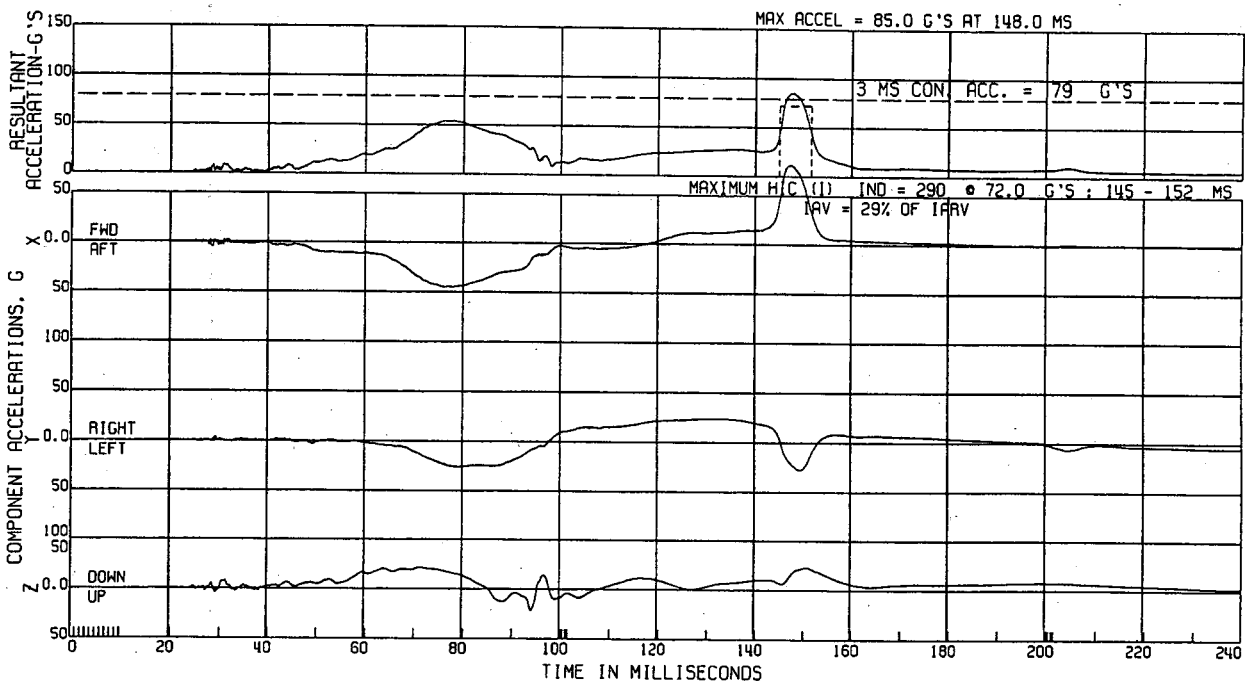
Appendix B: C11687 data plots

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 1000

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

ATD TYPE: GM50H
TEST DATE:07/30/1997



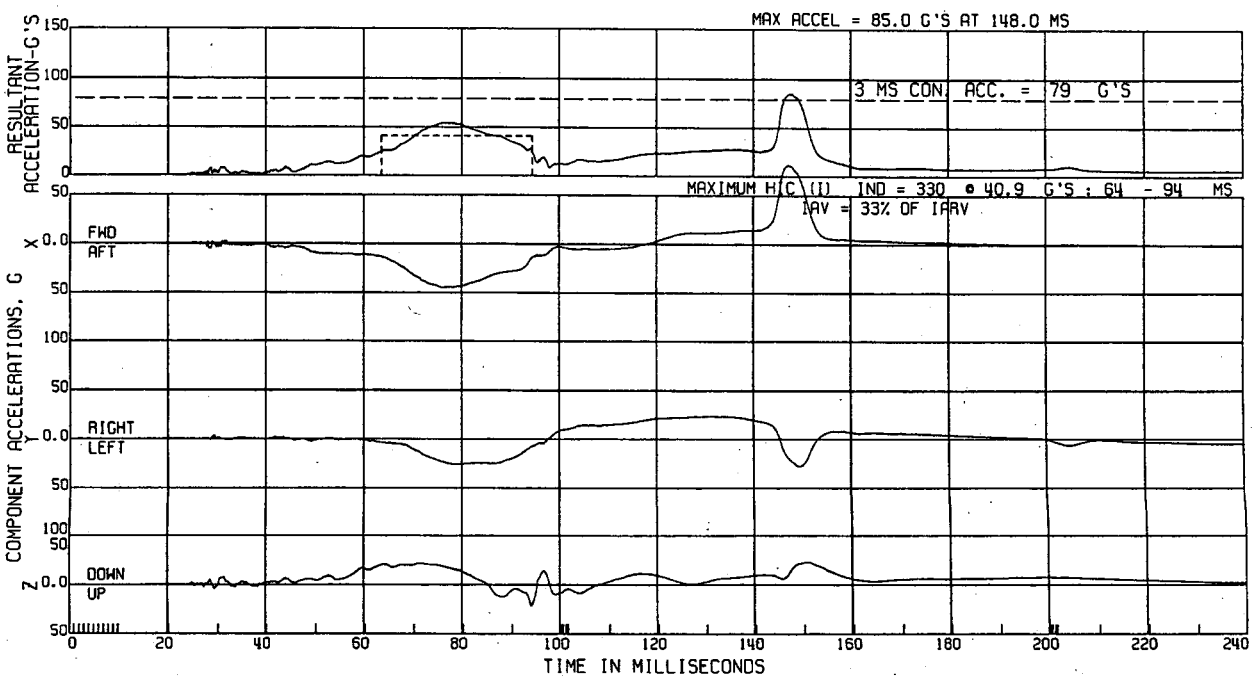
Appendix B, plot # 1

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 1000

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

ATD TYPE: GM50H
TEST DATE:07/30/1997



Appendix B, plot # 2

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

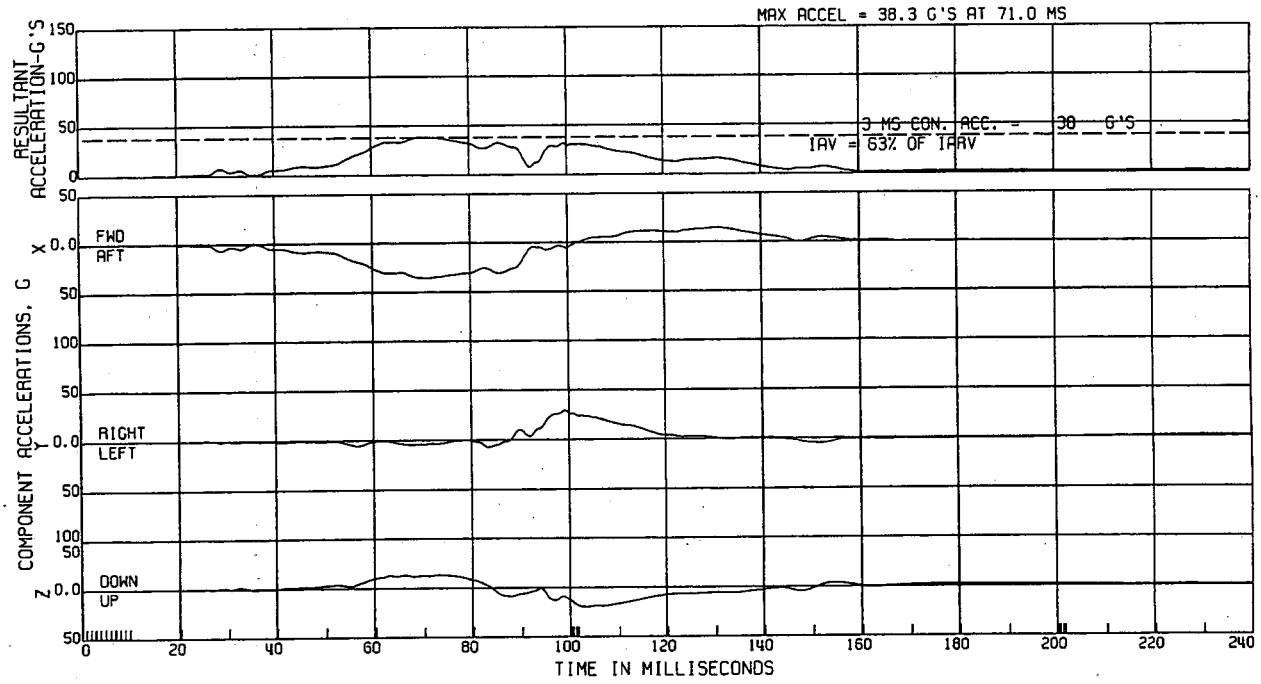
ATD TYPE: GM50H

R & D CTR 8V9140D 4 DOOR

L. FRT CHEST ACCEL.

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 180



Appendix B, plot # **3**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

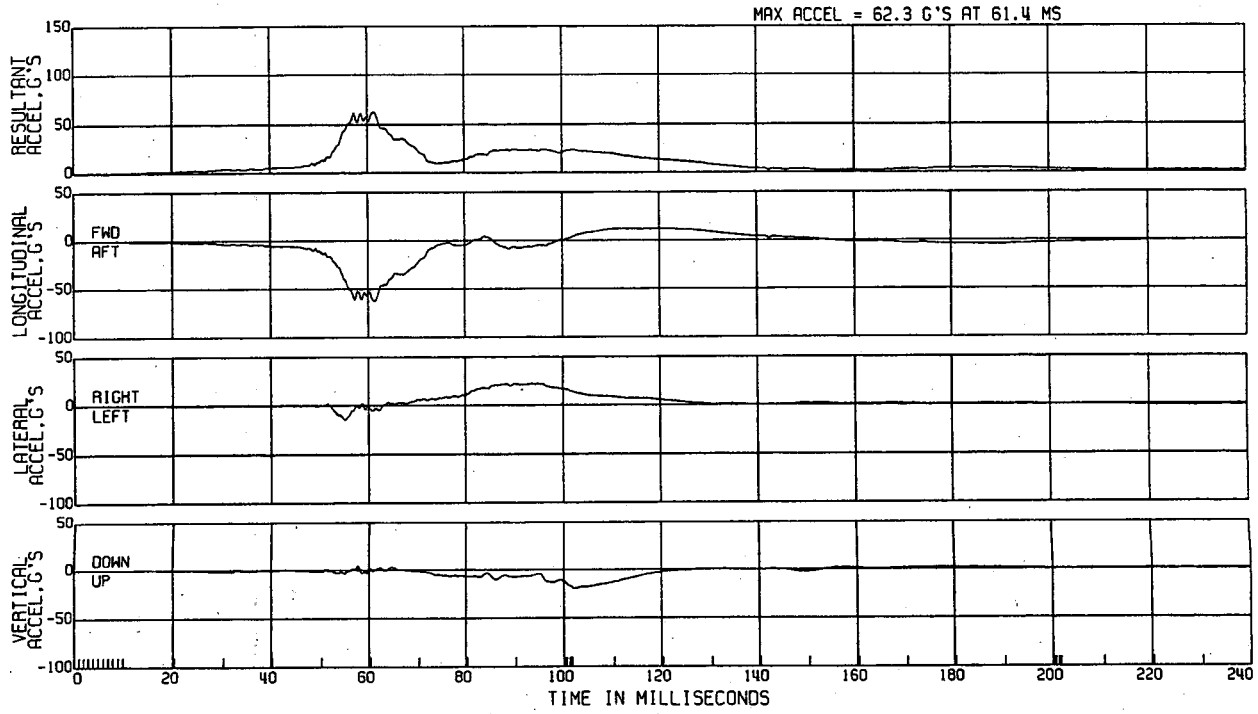
ATD TYPE: GM50H

R & D CTR 8V9140D 4 DOOR

L. FRT PELVIC ACCEL.

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000



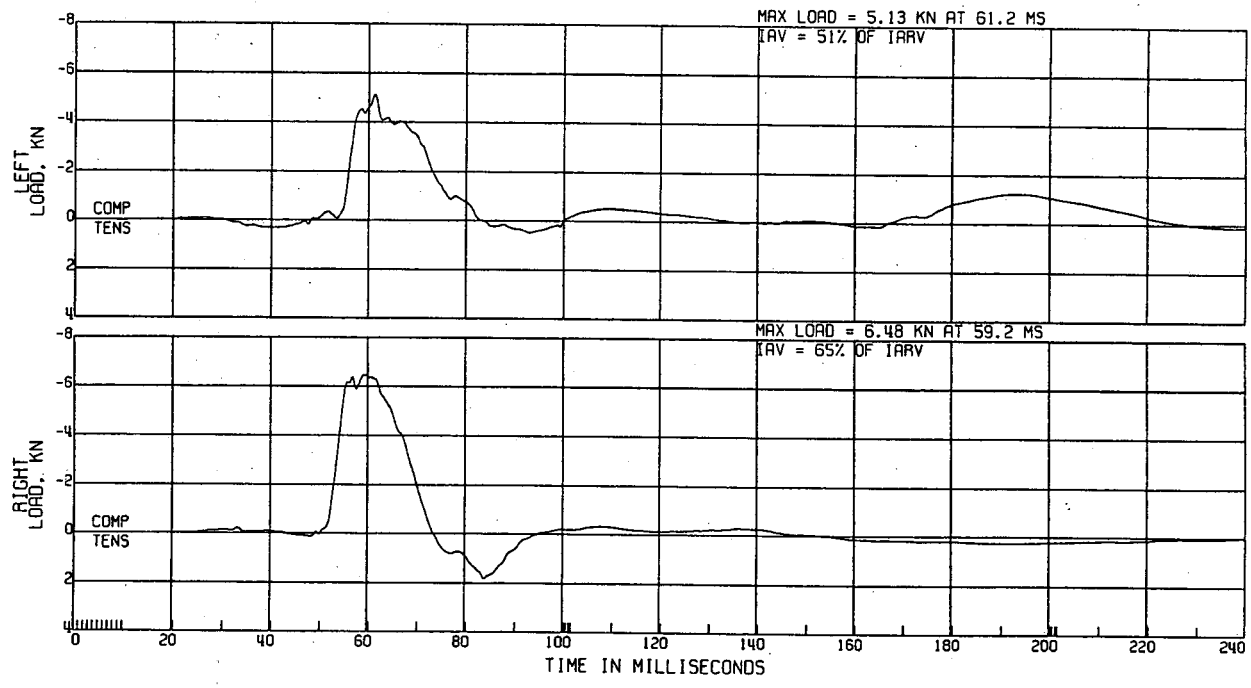
Appendix B, plot # **4**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD

ATD TYPE: GM50H
TEST DATE:07/30/1997



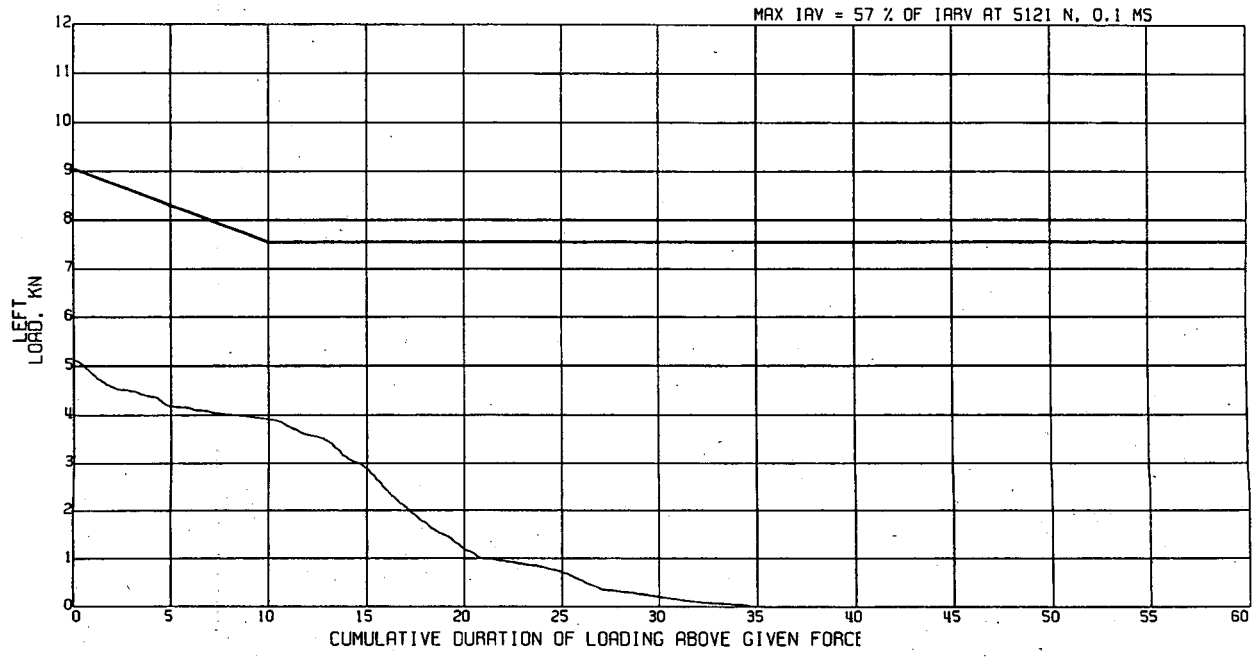
Appendix B, plot # **5**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD
DURATION ASSESSMENT

ATD TYPE: GM50H
TEST DATE:07/30/1997



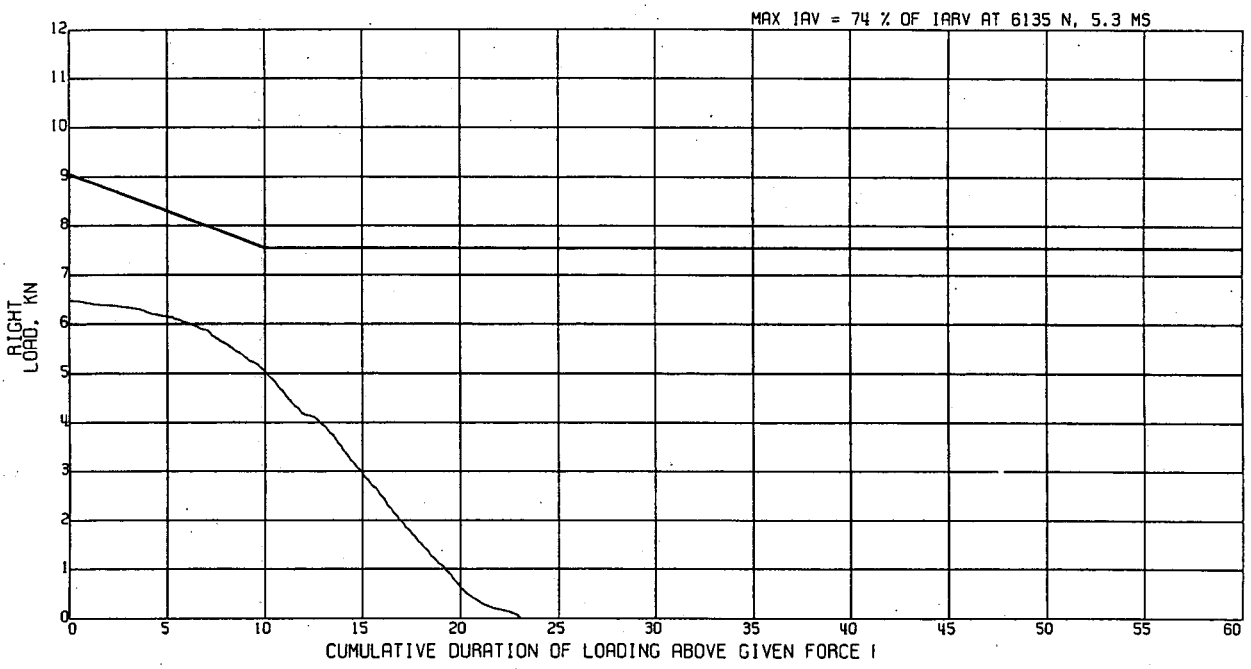
Appendix B, plot # **6**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:07/30/1997

L. FRT FEMUR LOAD
DURATION ASSESSMENT



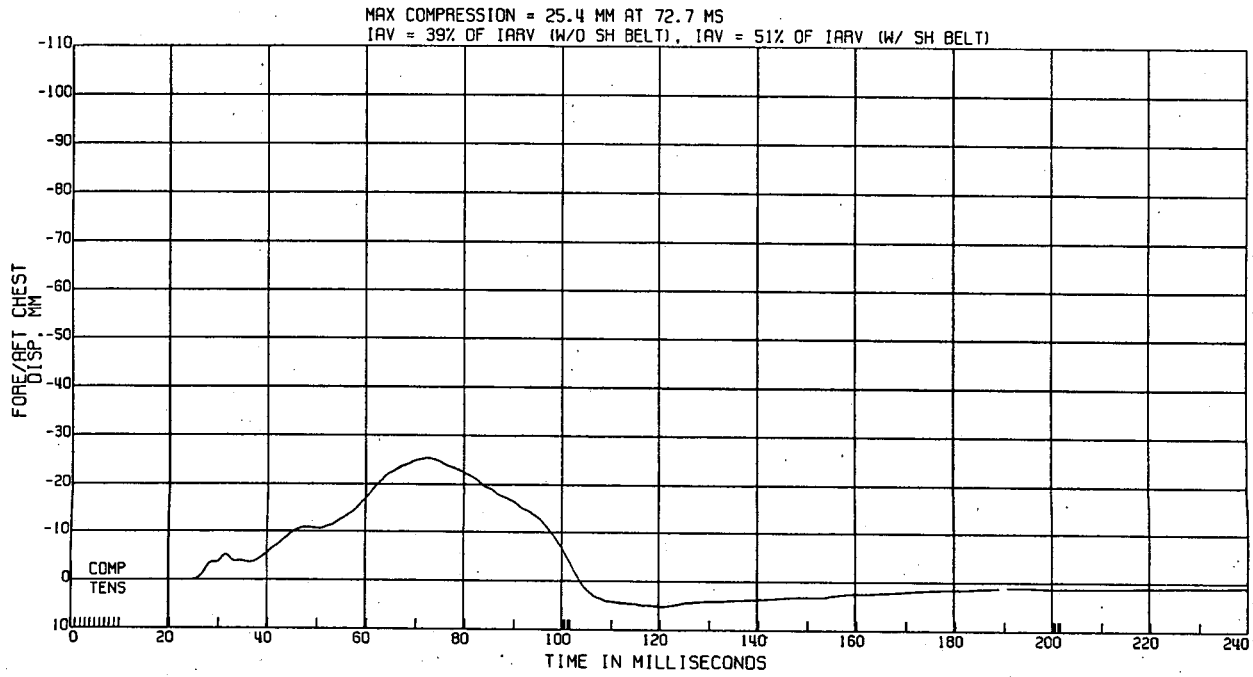
Appendix B, plot # **7**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 180

ATD TYPE: GM50H
TEST DATE:07/30/1997

L. FRT CHEST DISP, TEMP AT 69.0'F
NORMALIZED TO 70.7'F & PART 572 CORRIDOR



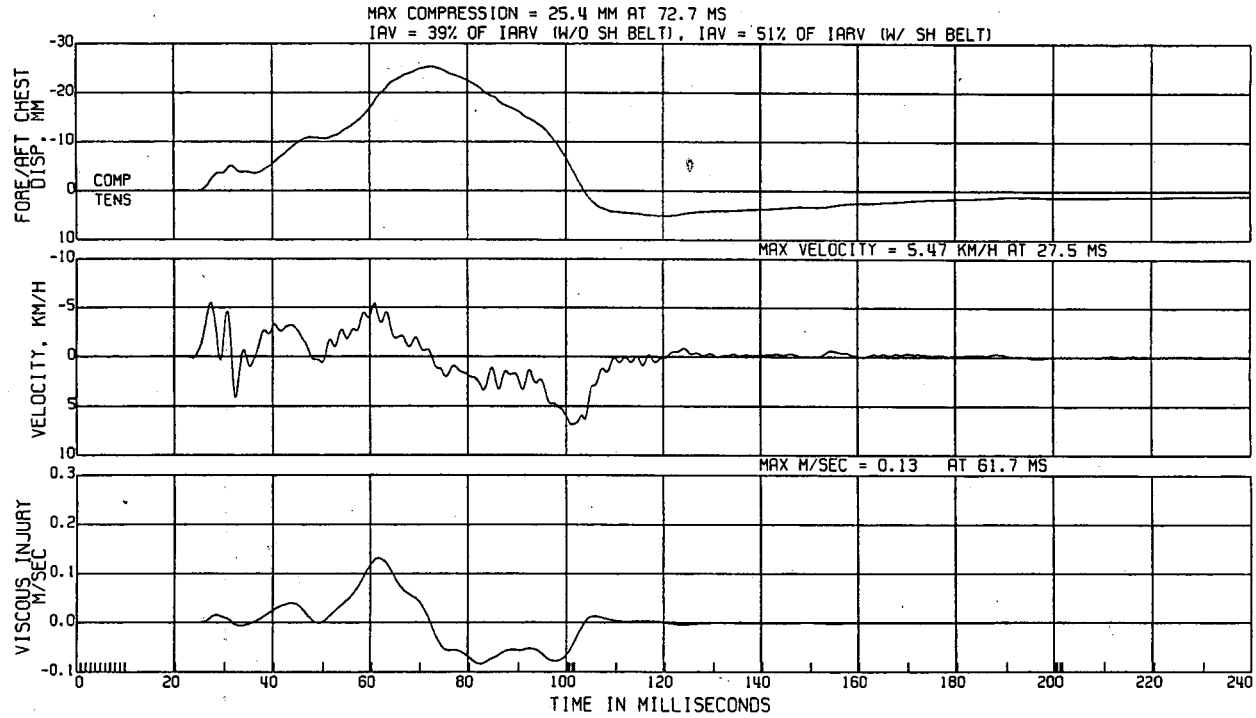
Appendix B, plot # **8**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 180

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

ATD TYPE: GM50H
TEST DATE:07/30/1997



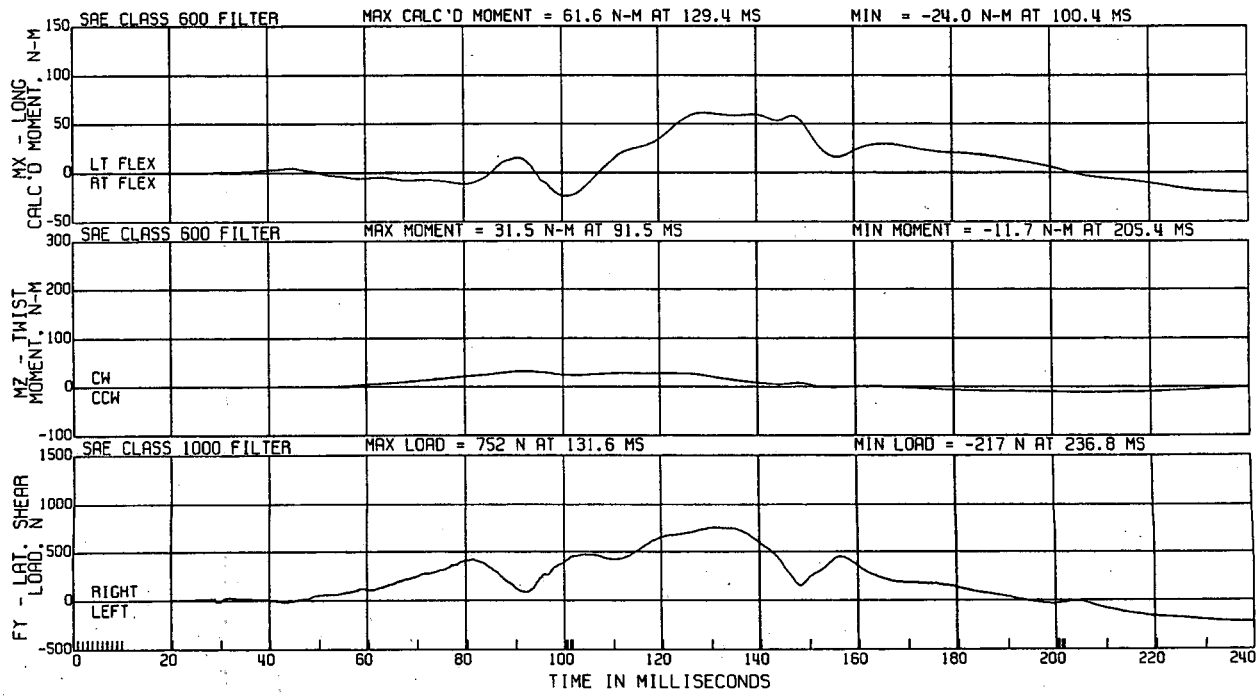
Appendix B, plot # **9**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA

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

ATD TYPE: GM50H
TEST DATE:07/30/1997



Appendix B, plot # **10**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

ATD TYPE: GM50H

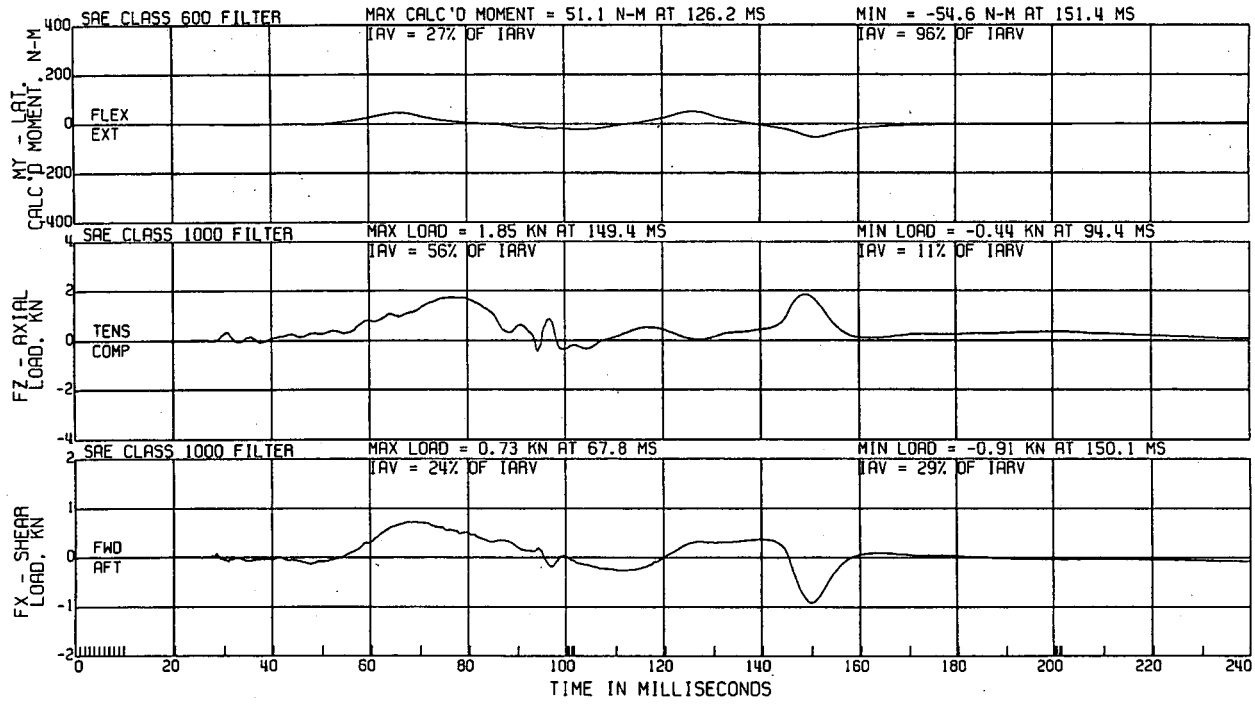
R & D CTR 8V91400 4 DOOR

NECK LOADING ON HEAD

TEST DATE:07/30/1997

ELEC DATA

L. FRT NECK LOADING ON HEAD



Appendix B, plot # **11**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

ATD TYPE: GM50H

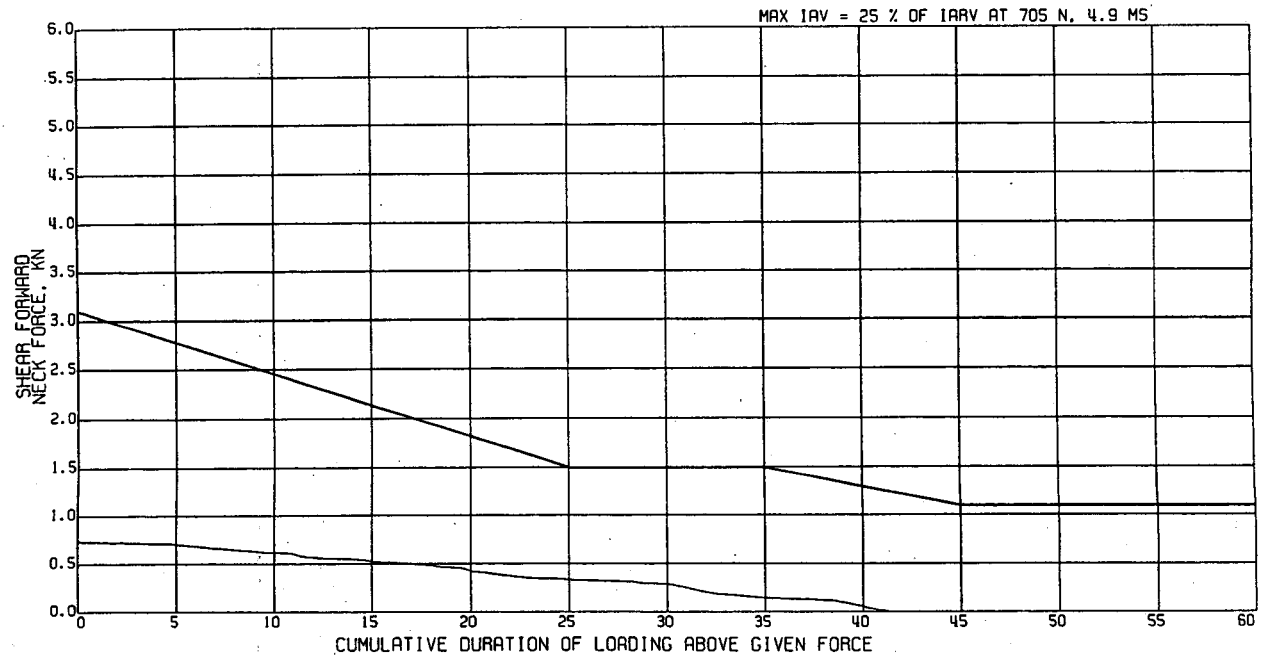
R & D CTR 8V91400 4 DOOR

FORWARD NECK SHEAR ON HEAD,

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

L. FRT INJURY REFERENCE



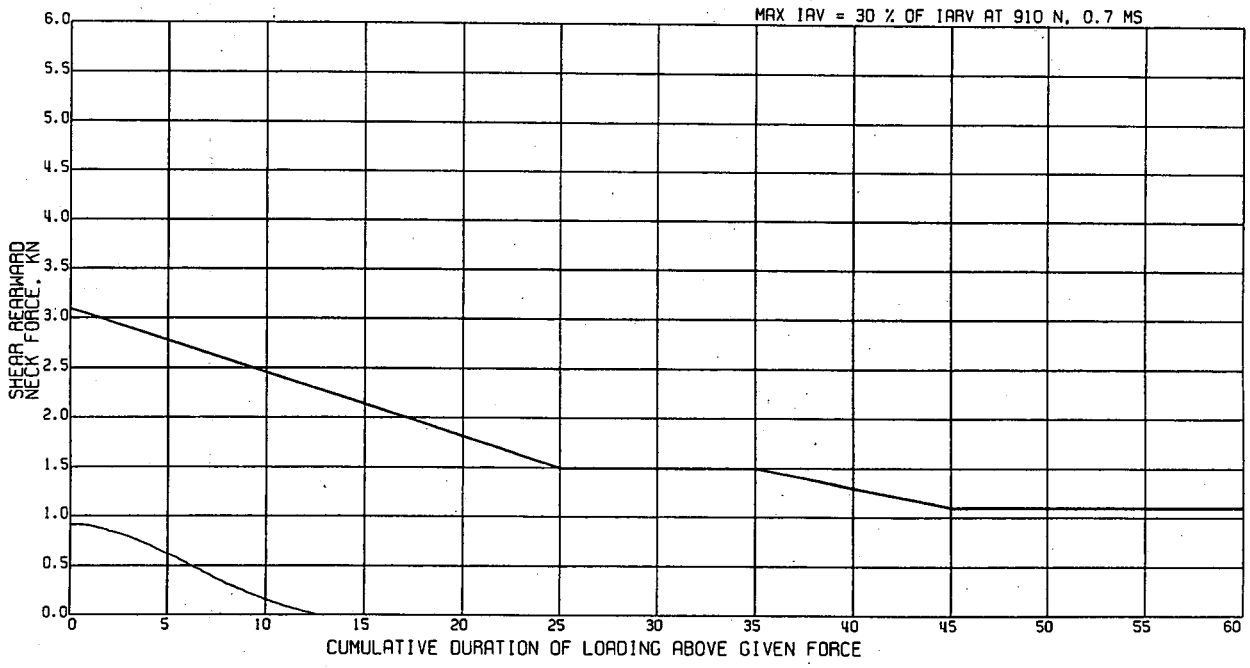
Appendix B, plot # **12**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:07/30/1997



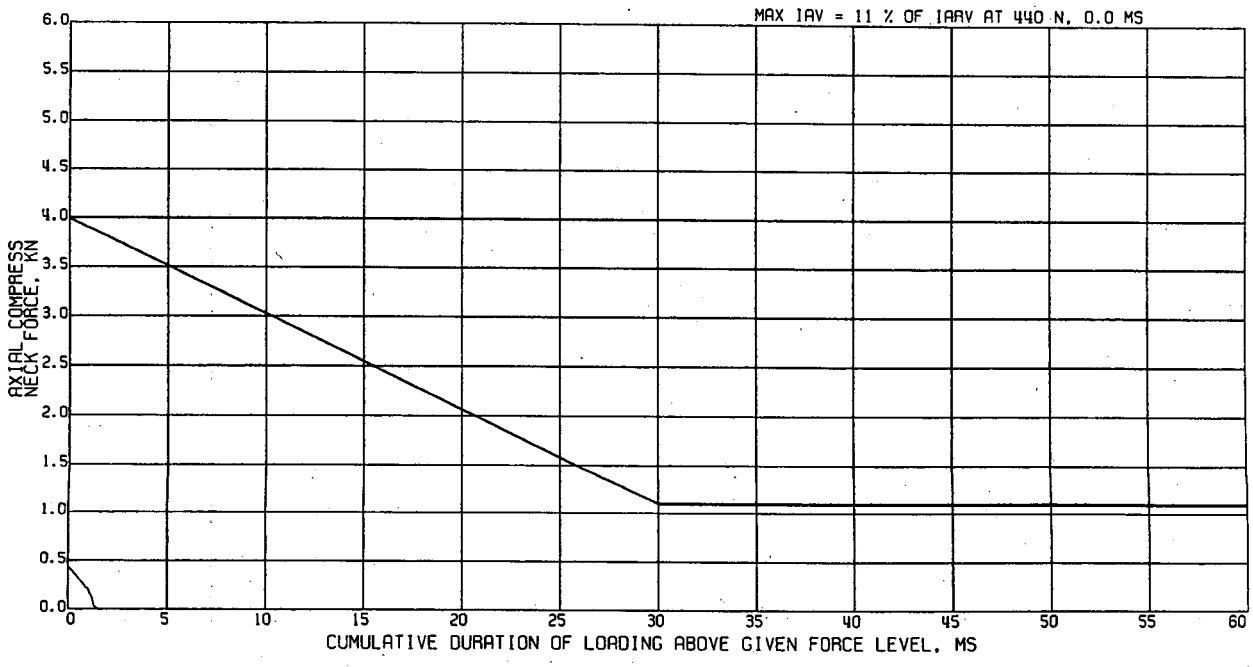
Appendix B, plot # **13**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:07/30/1997



Appendix B, plot # **14**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

ATD TYPE: GM50H

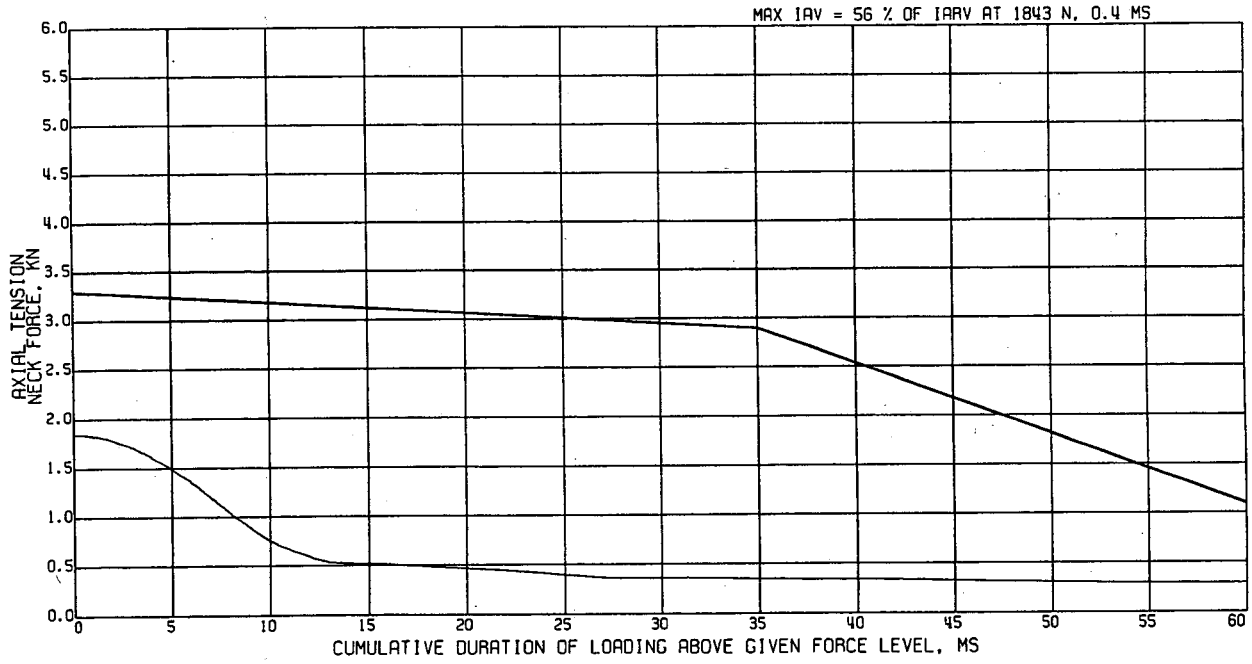
R & D CTR 8V9140D 4 DOOR

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

AXIAL TENSION ON HEAD,

L. FRT INJURY REFERENCE



IS Appendix B, plot # **15**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

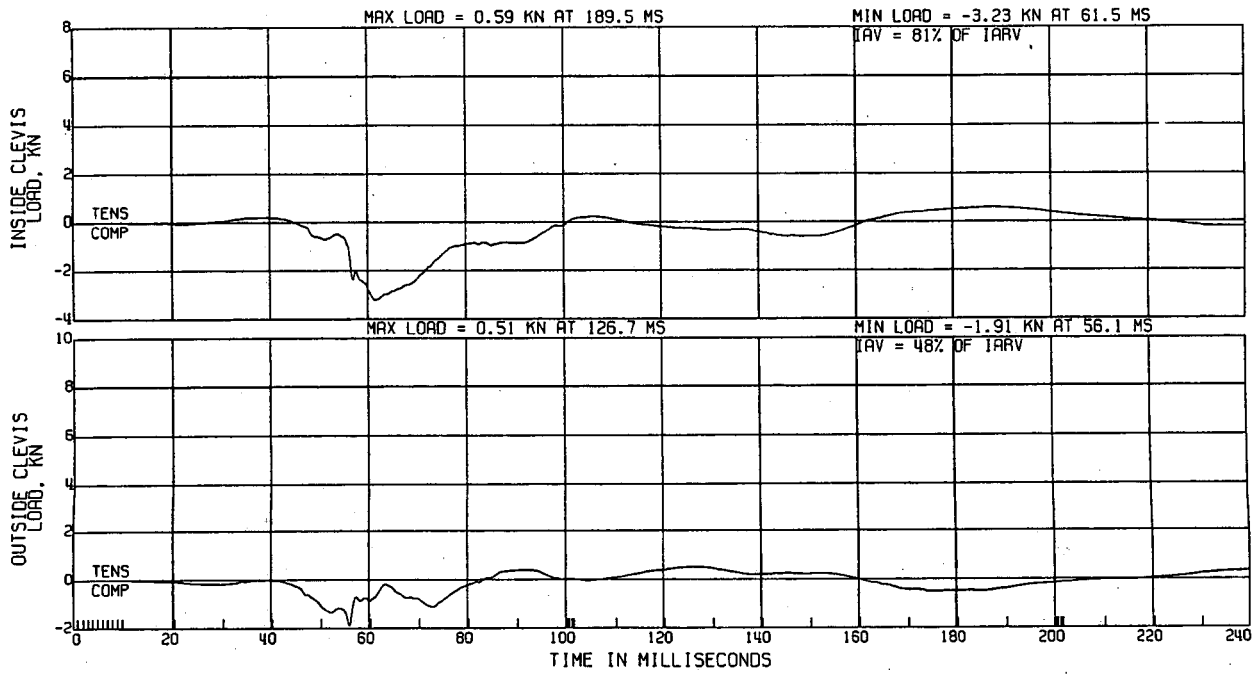
ATD TYPE: GM50H

R & D CTR 8V9140D 4 DOOR

L. FRT LEFT KNEE CLEVIS LOAD

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 600



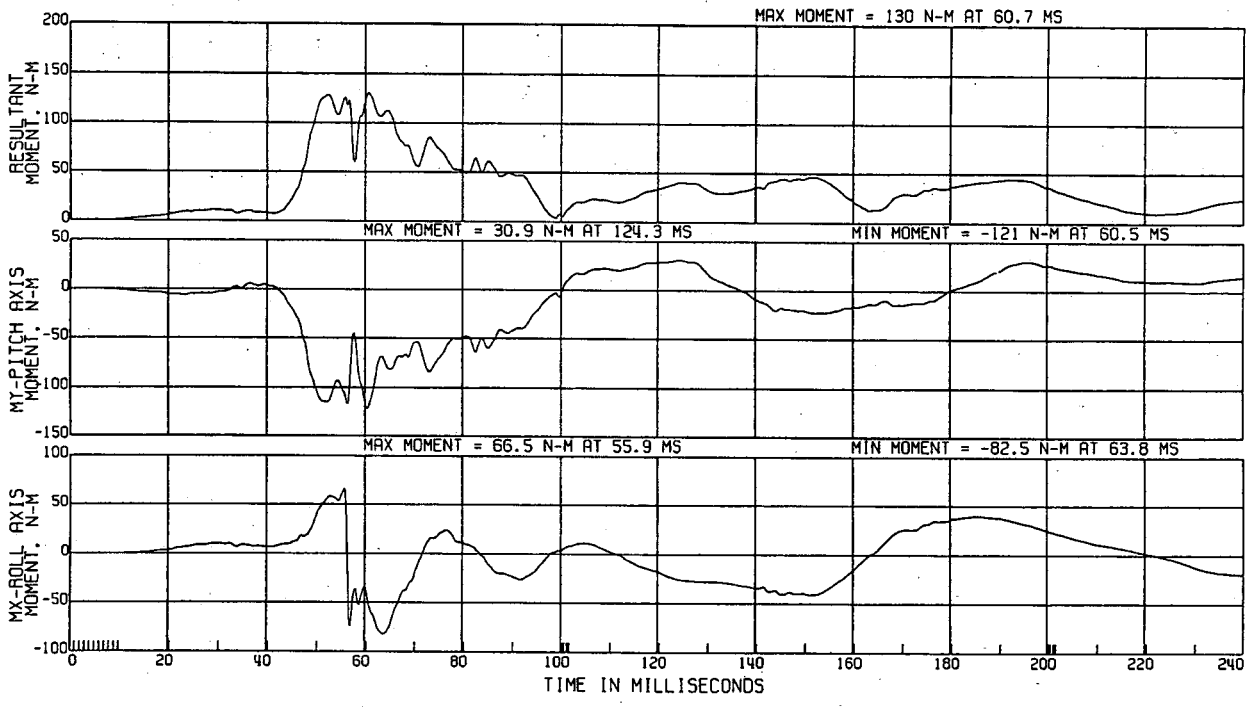
Appendix B, plot # **16**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 600

L. FRT LEFT TIBIA UPPER MOMENT

ATD TYPE: GM50H
TEST DATE:07/30/1997



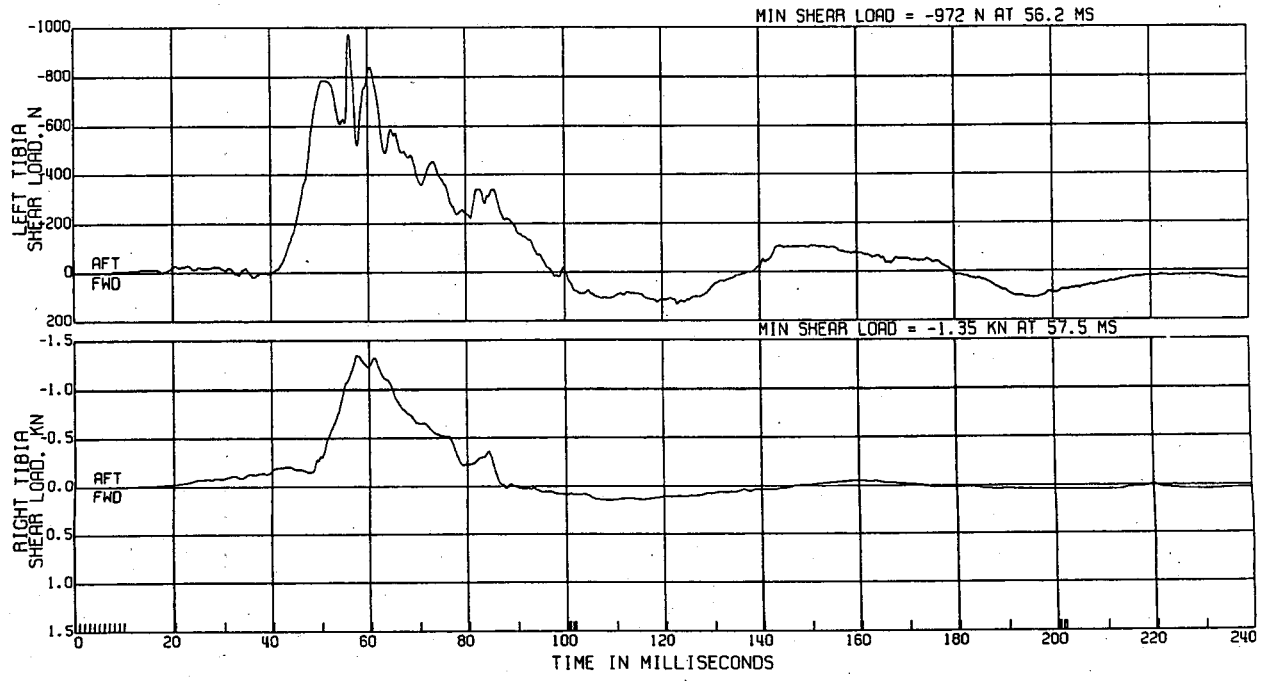
Appendix B, plot # **17**

C11687 L: SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

ATD TYPE: GM50H
TEST DATE:07/30/1997

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 600

L. FRT TIBIA LOWER SHEAR LOAD CELLS



Appendix B, plot # **18**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

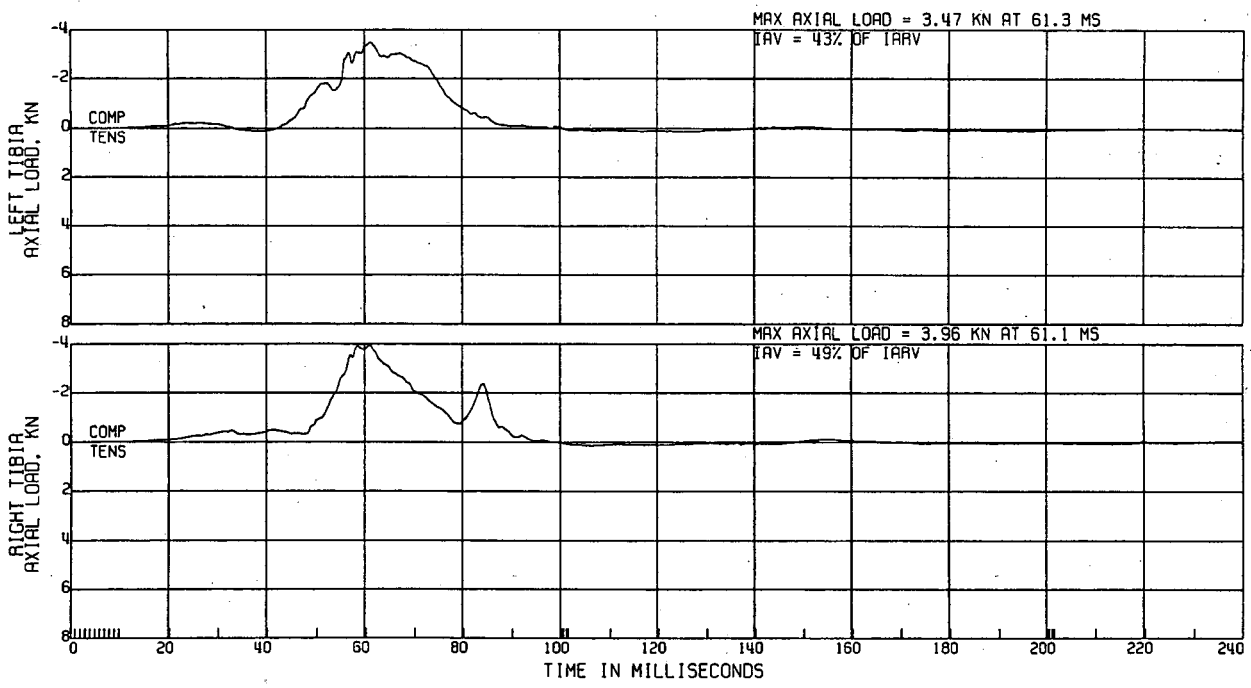
ATD TYPE: GM50H

R & D CTR 8V9140D 4 DOOR

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 600

L. FRT TIBIA LOWER AXIAL LOAD



Appendix B, plot # **19**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

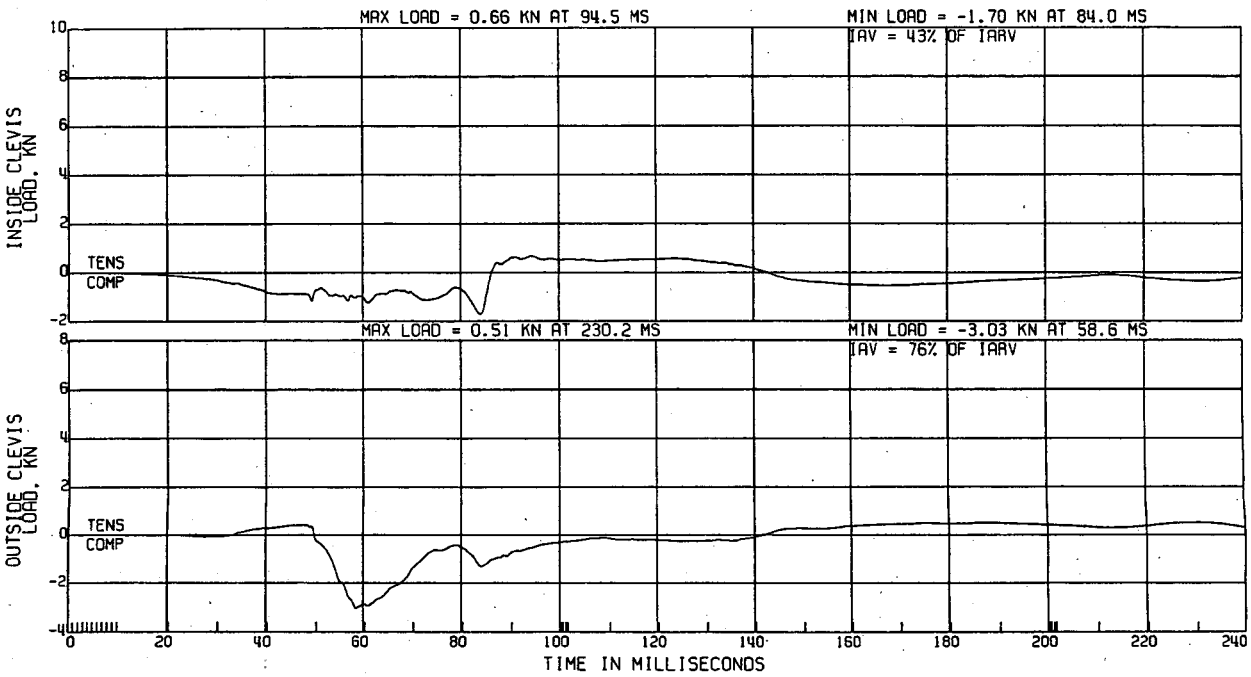
ATD TYPE: GM50H

R & D CTR 8V9140D 4 DOOR

L. FRT RIGHT KNEE CLEVIS LOAD

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 600



Appendix B, plot # **20**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

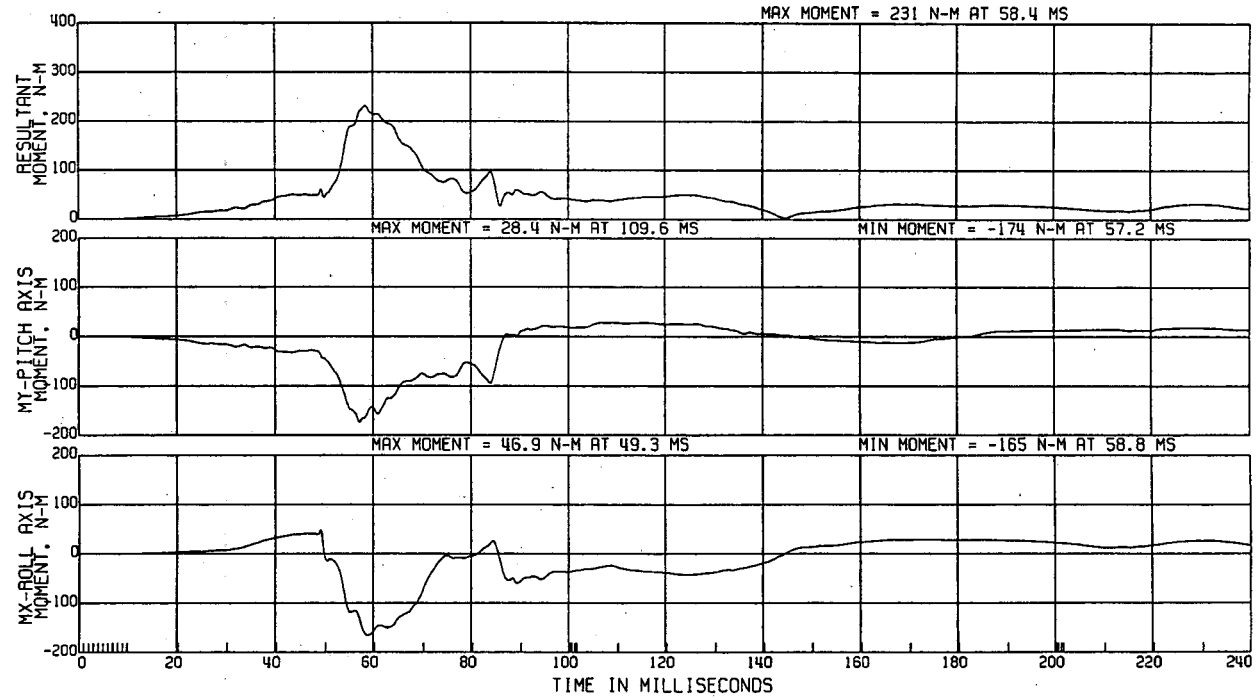
ATD TYPE: GM50H

R & D CTR 8V91400 4 DOOR

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 600

L. FRT RIGHT TIBIA UPPER MOMENT



Appendix B, plot # **21**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

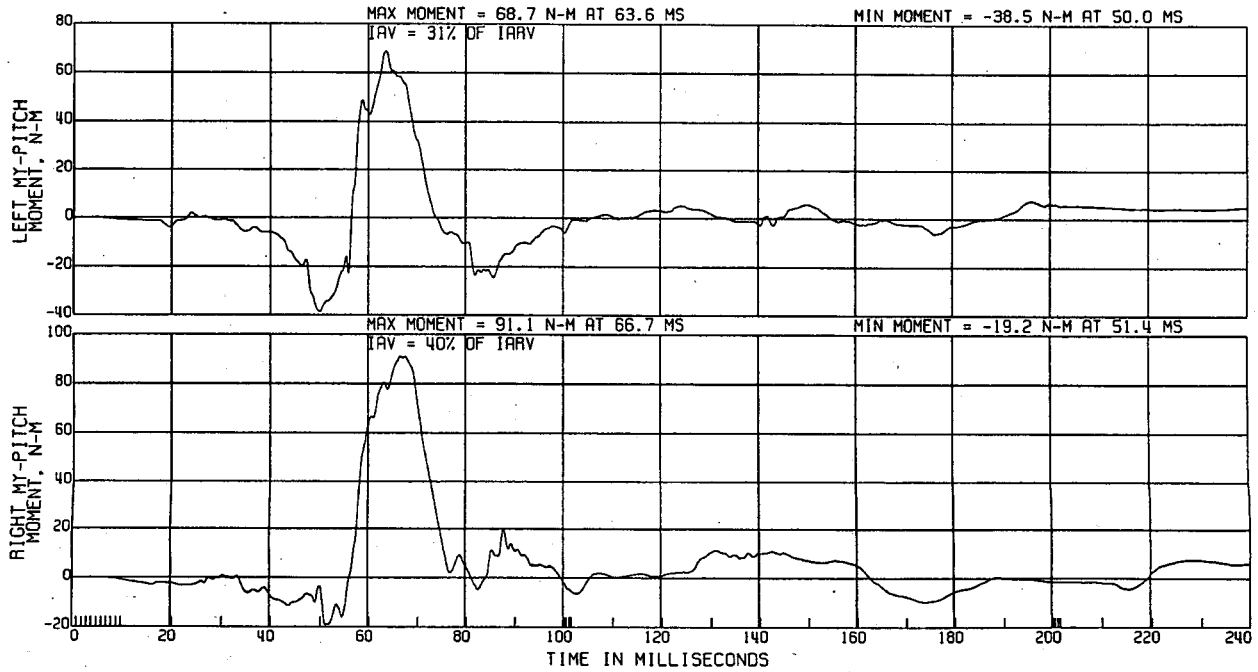
ATD TYPE: GM50H

R & D CTR 8V91400 4 DOOR

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 600

L. FRT TIBIA LOWER BENDING MOMENTS



Appendix B, plot # **22**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

ATD TYPE: GM50H

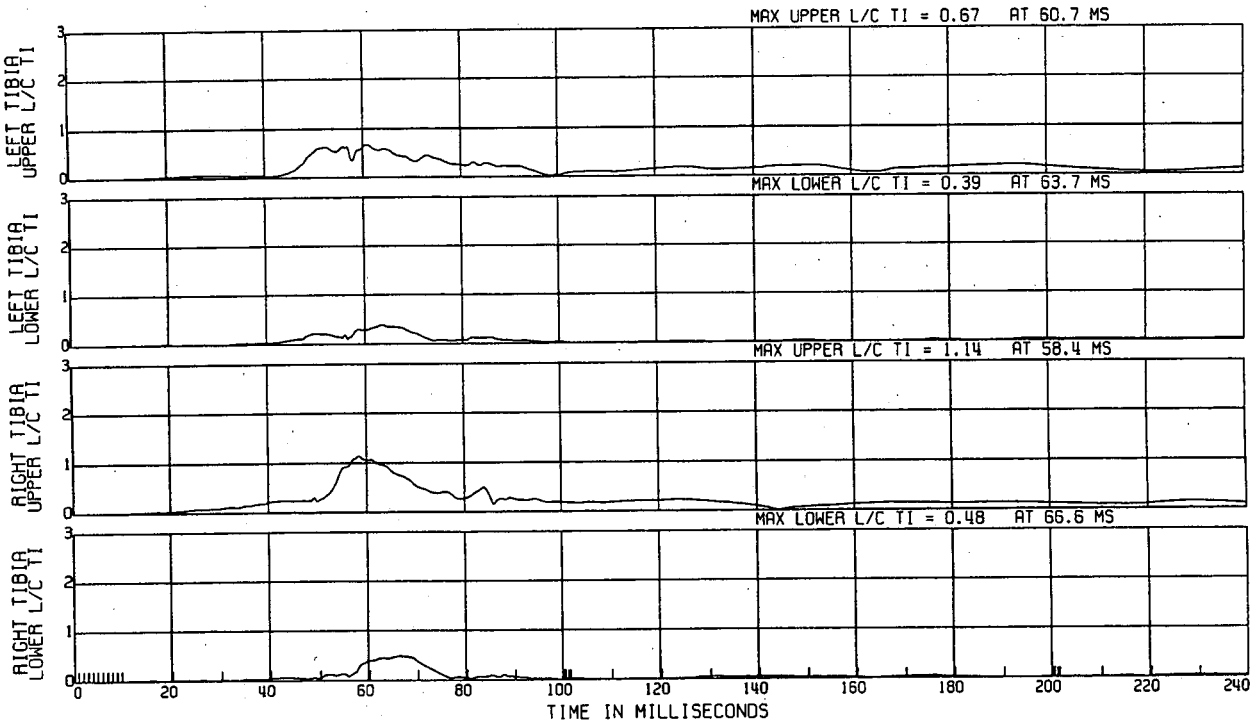
R & D CTR 8V9140D 4 DOOR

L. FRT TIBIA INDICES

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 600

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



Appendix B, plot # **23**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

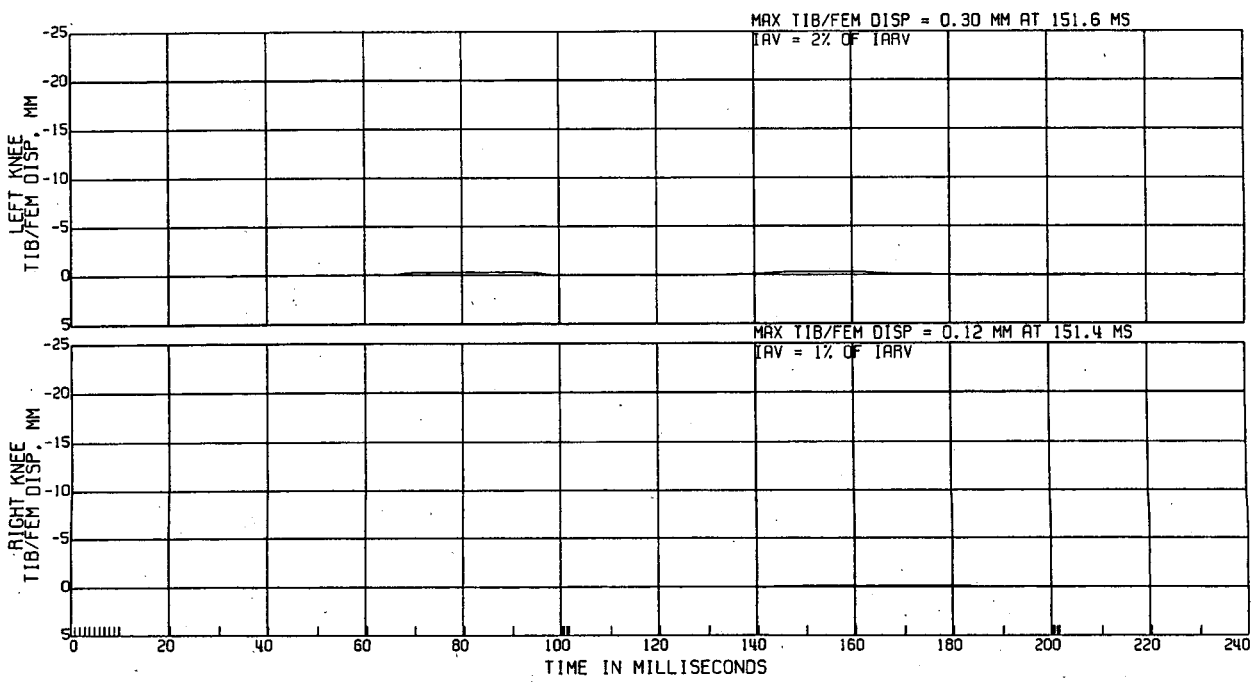
ATD TYPE: GM50H

R & D CTR 8V9140D 4 DOOR

L. FRT TIBIA/FEMUR DISPLACEMENT

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 180

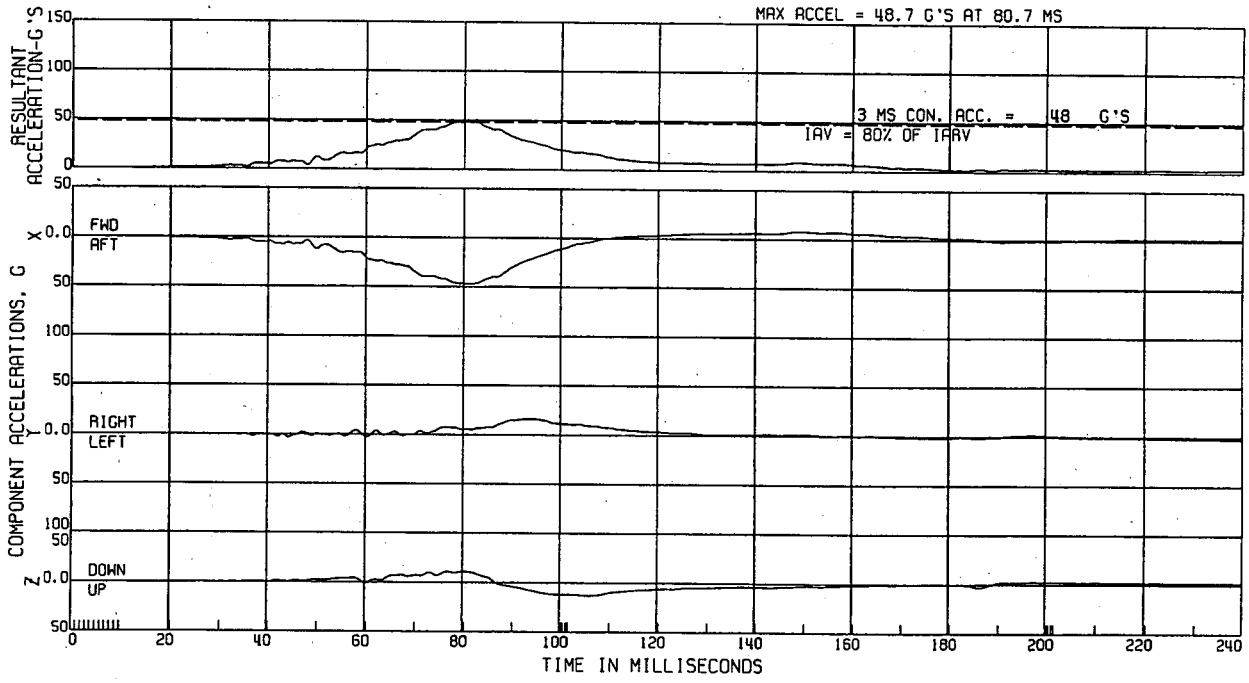


Appendix B, plot # **24**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR R. FRT CHEST ACCEL. ATD TYPE: GM50H

ELEC DATA, SAE CLASS 180 TEST DATE:07/30/1997

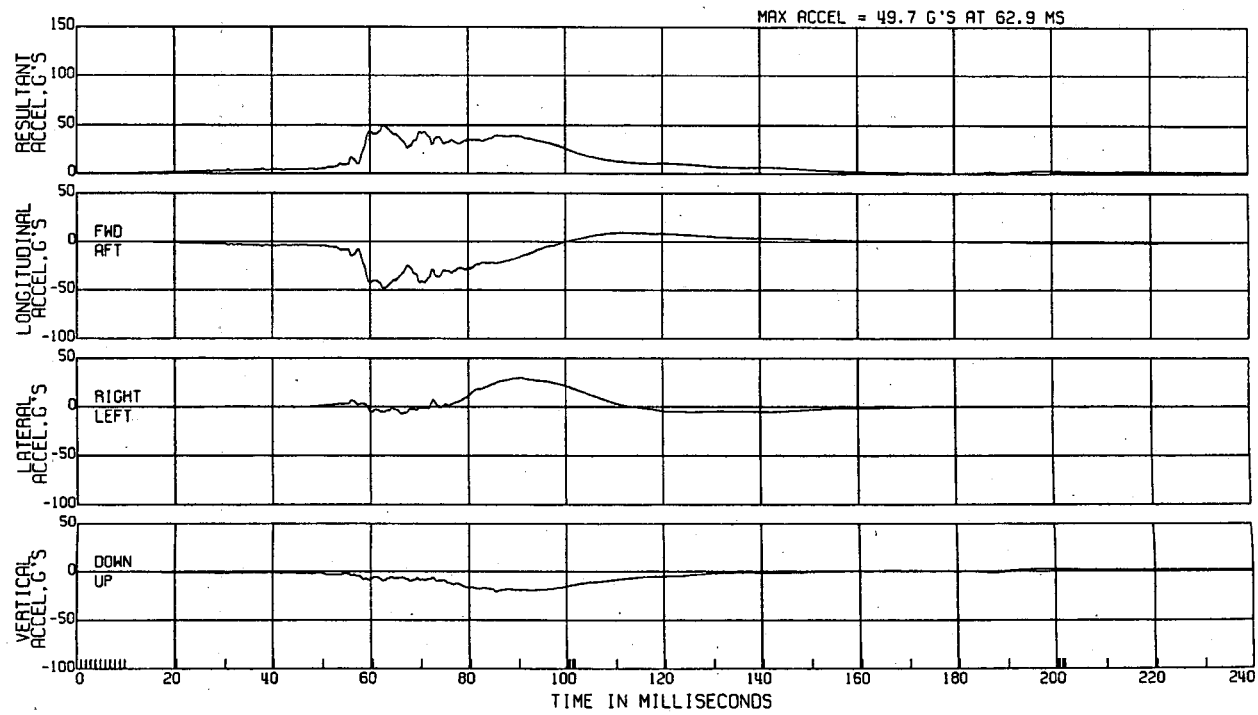


Appendix B, plot # **25**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR R. FRT PELVIC ACCEL. ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 TEST DATE:07/30/1997



Appendix B, plot # **26**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

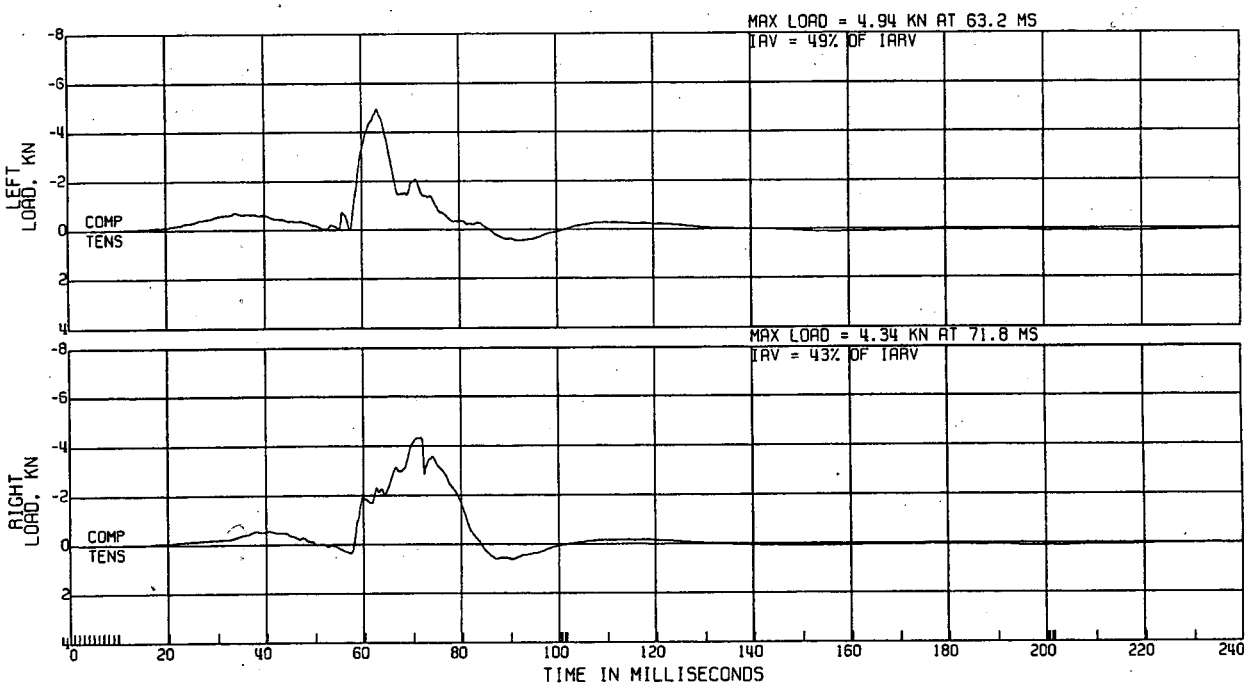
ATD TYPE: GM50H

R & D CTR 8V91400 4 DOOR

R. FRT FEMUR LOAD

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 600



Appendix B, plot # **27**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

ATD TYPE: GM50H

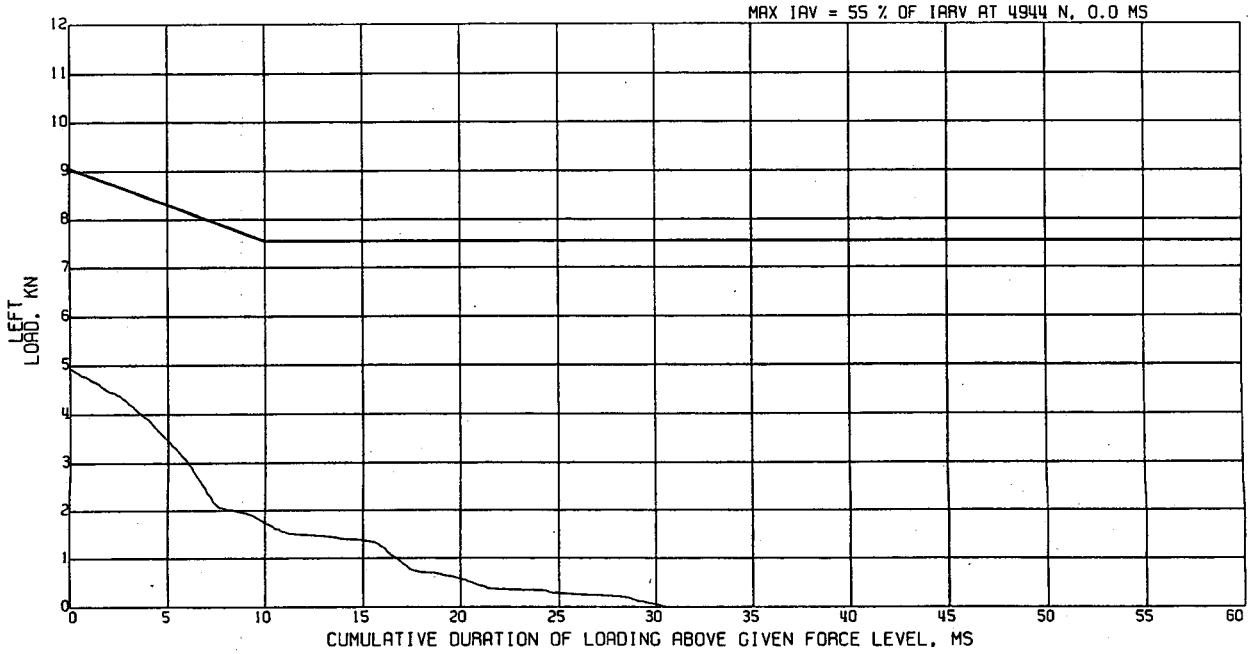
R & D CTR 8V91400 4 DOOR

R. FRT FEMUR LOAD

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 600

DURATION ASSESSMENT



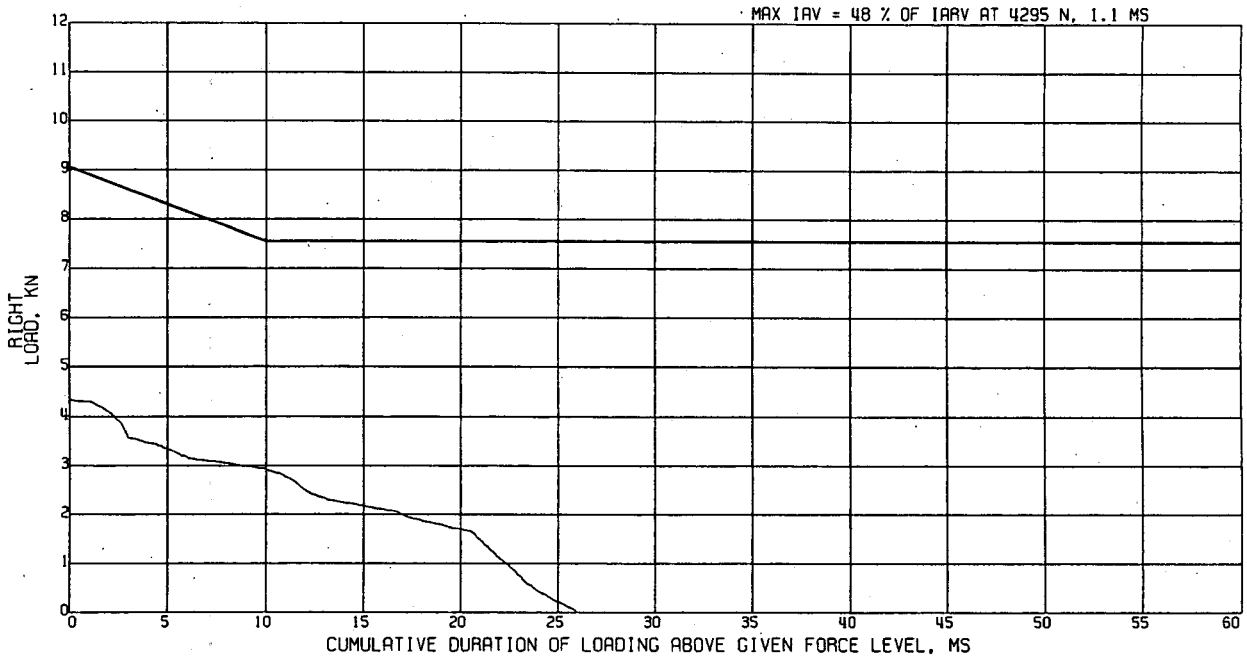
 Appendix B, plot # **28**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 600

R. FRT FEMUR LOAD
DURATION ASSESSMENT

ATD TYPE: GM50H
TEST DATE:07/30/1997



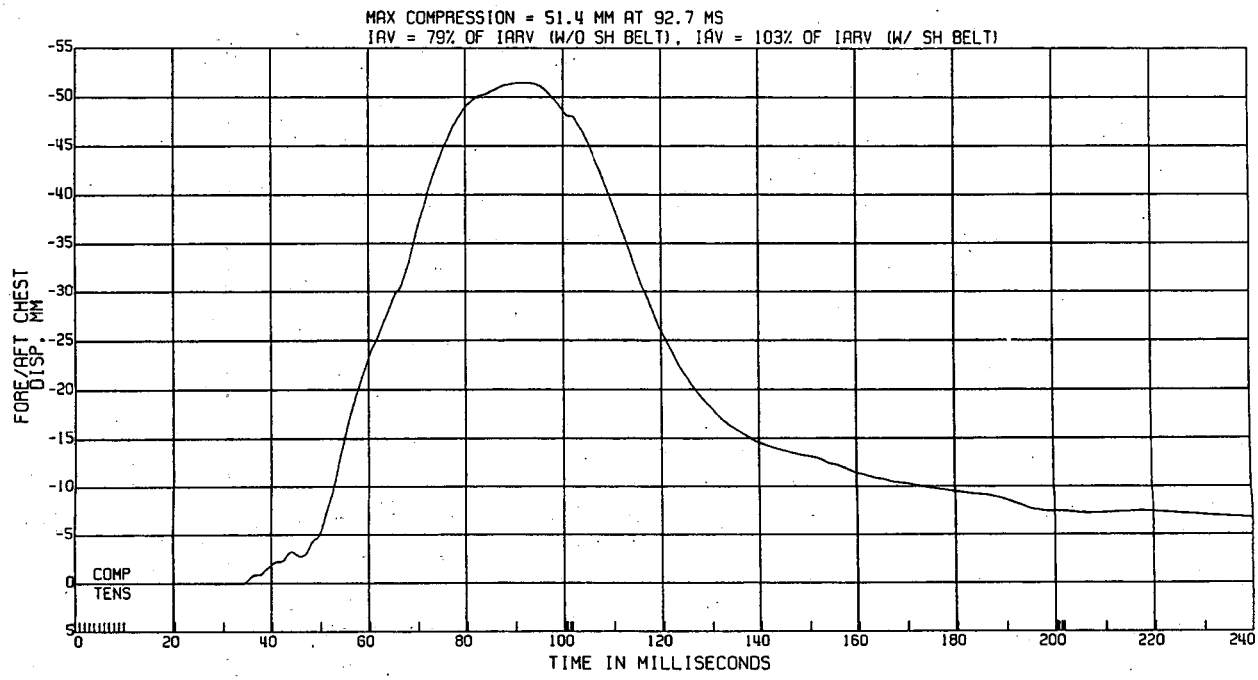
29 Appendix B, plot # 29

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 180

R. FRT CHEST DISP, TEMP AT 66.5'F
NORMALIZED TO 70.7'F & PART 572 CORRIDOR

ATD TYPE: GM50H
TEST DATE:07/30/1997



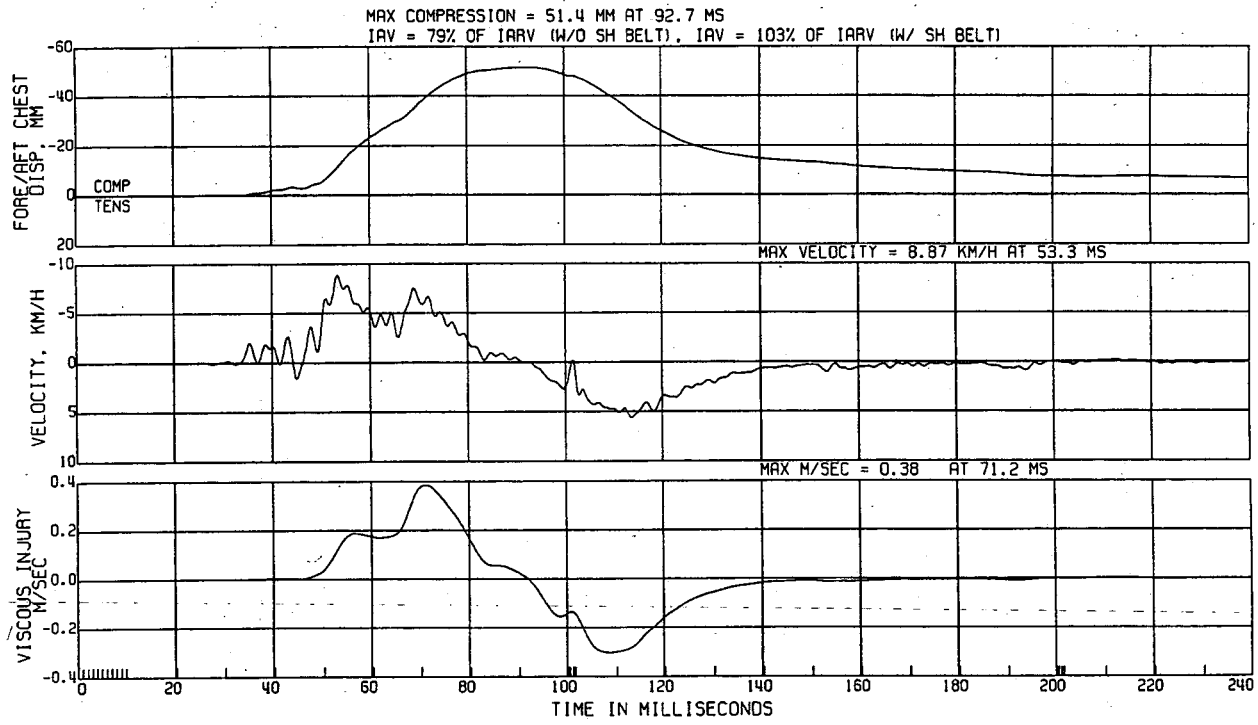
Appendix B, plot # 30

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 180

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

ATD TYPE: GM50H
TEST DATE:07/30/1997



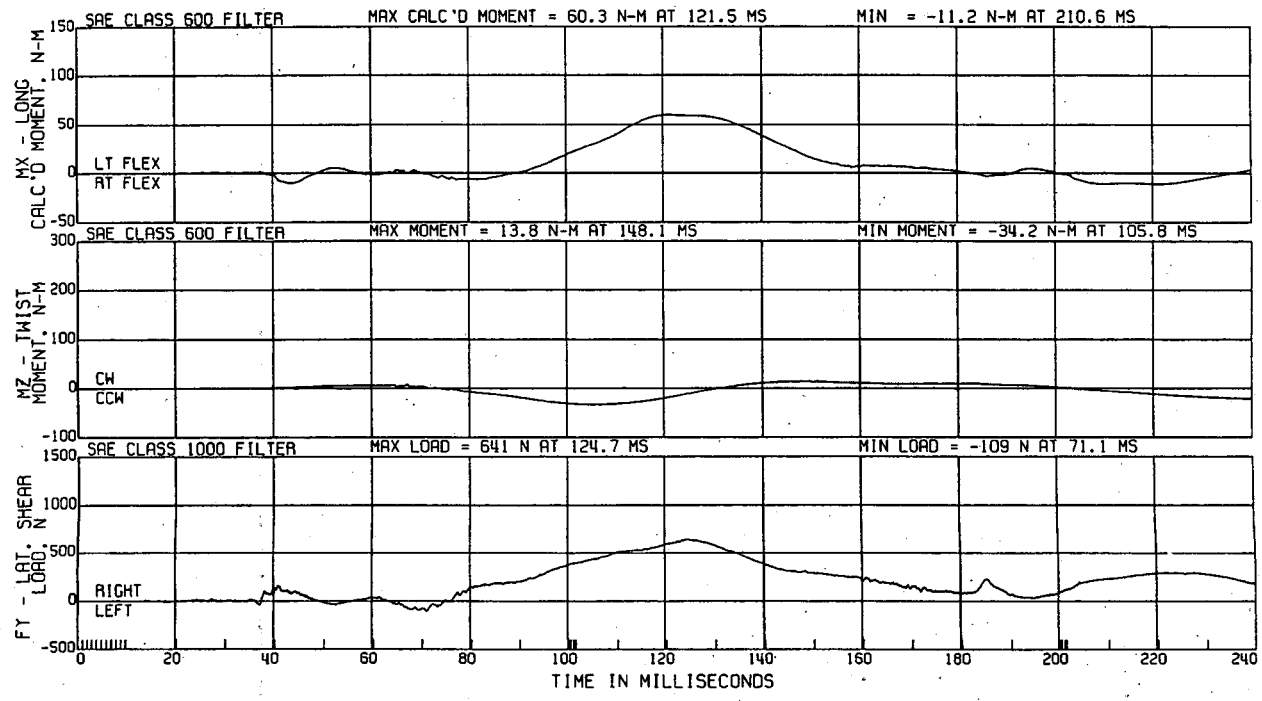
Appendix B, plot # **31**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA

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

ATD TYPE: GM50H
TEST DATE:07/30/1997



Appendix B, plot # **32**

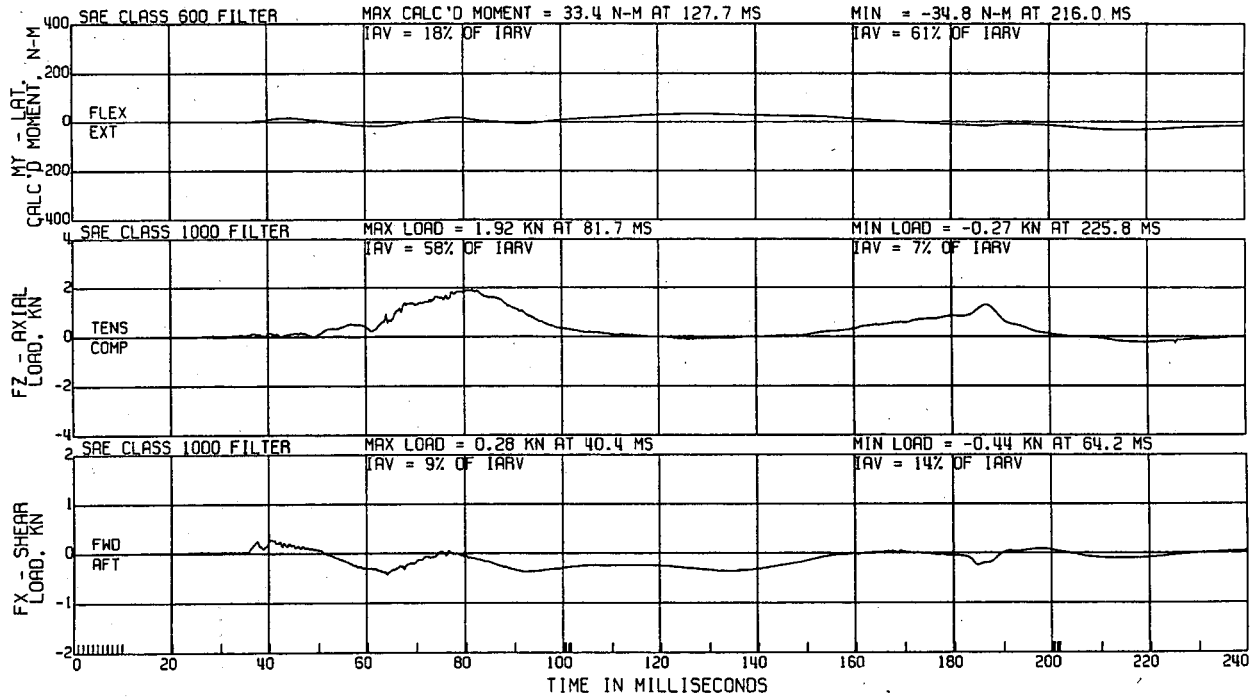
C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA

NECK LOADING ON HEAD

R. FRT NECK LOADING ON HEAD

ATD TYPE: GM50H
TEST DATE:07/30/1997



Appendix B, plot # **33**

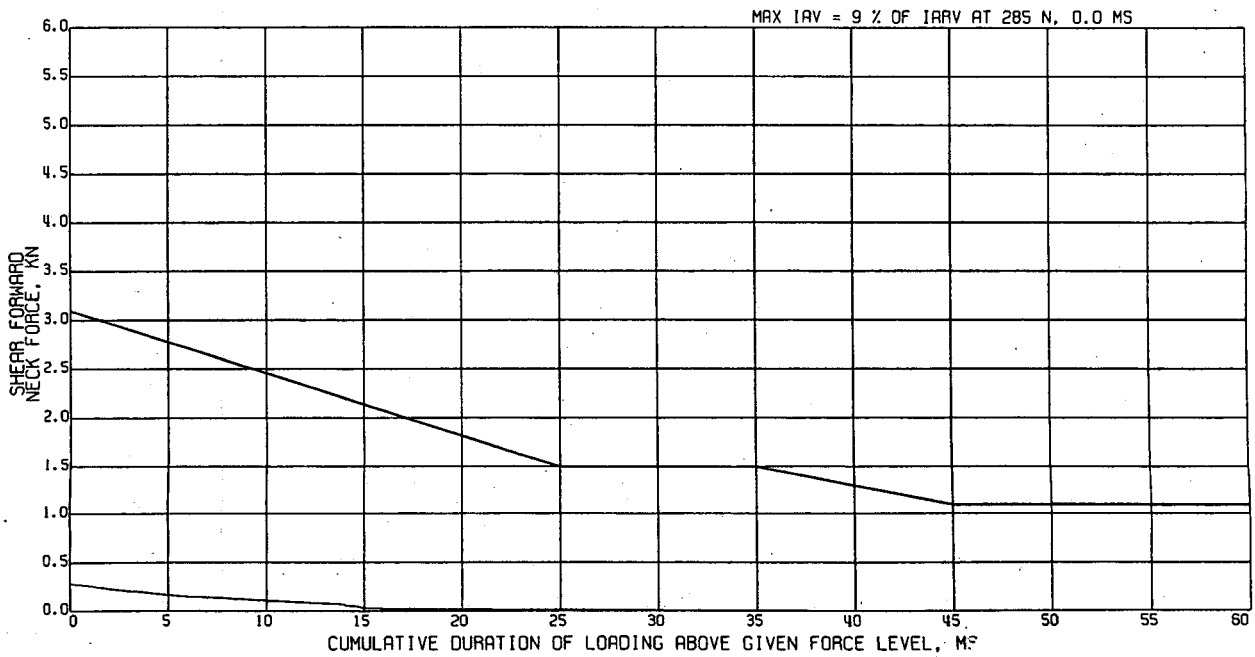
C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 1000

FORWARD NECK SHEAR ON HEAD,

R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:07/30/1997



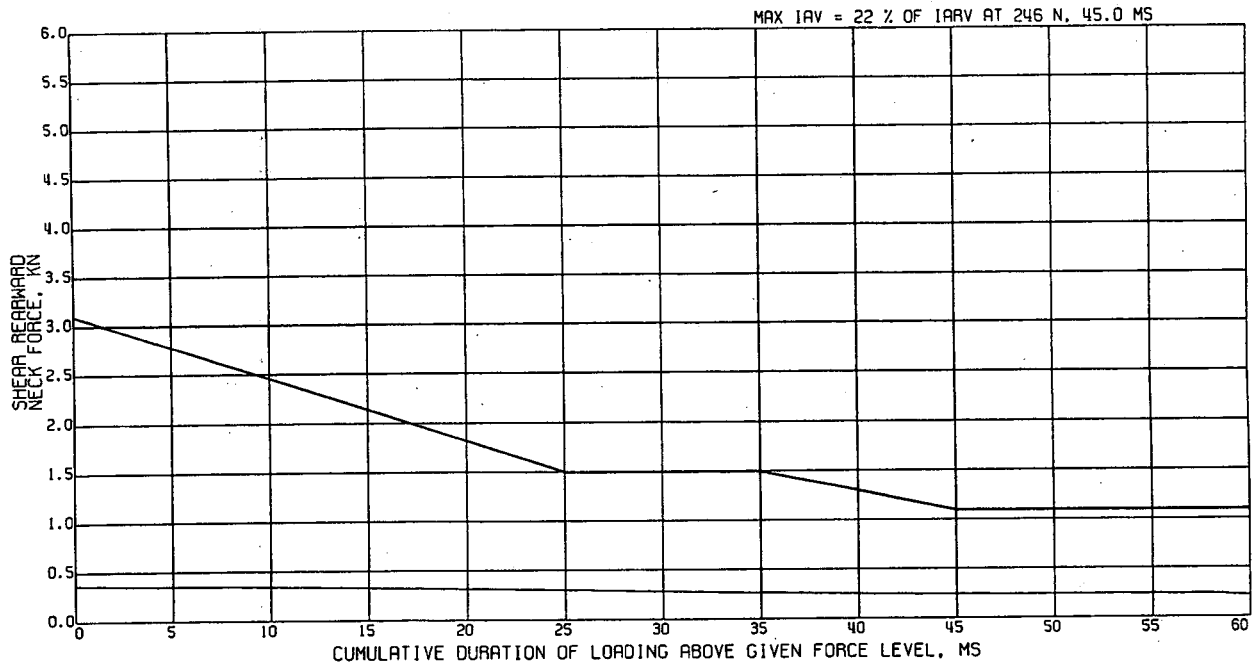
Appendix B, plot # **34**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:07/30/1997

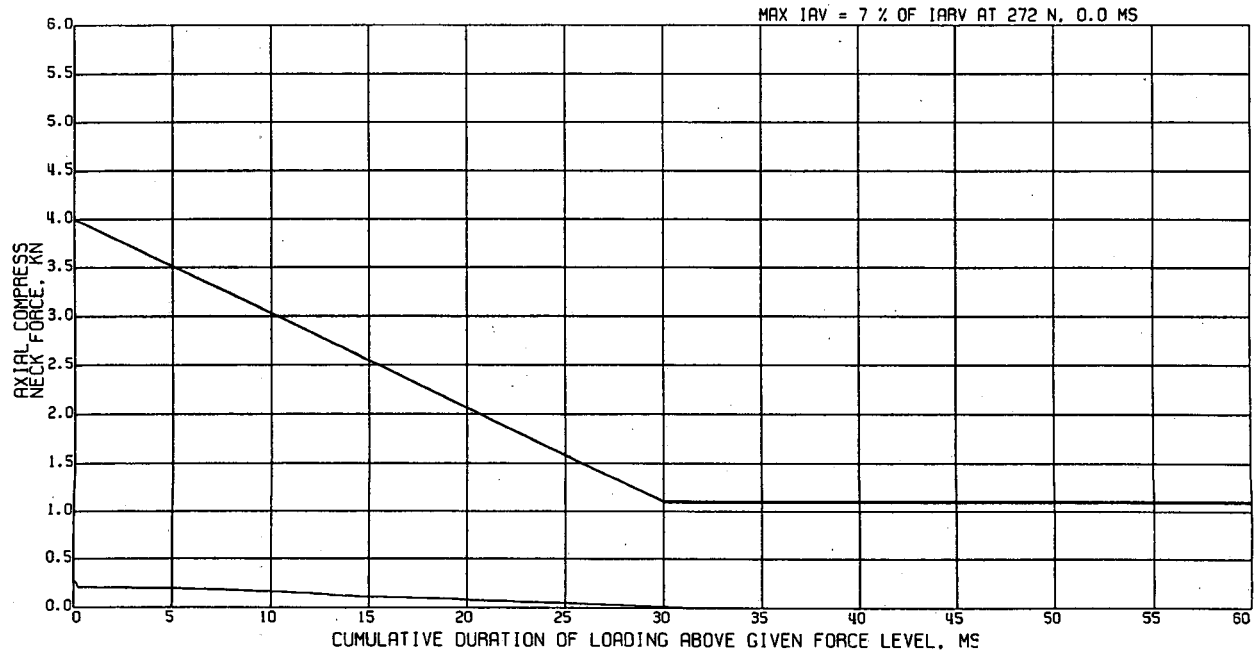


C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:07/30/1997

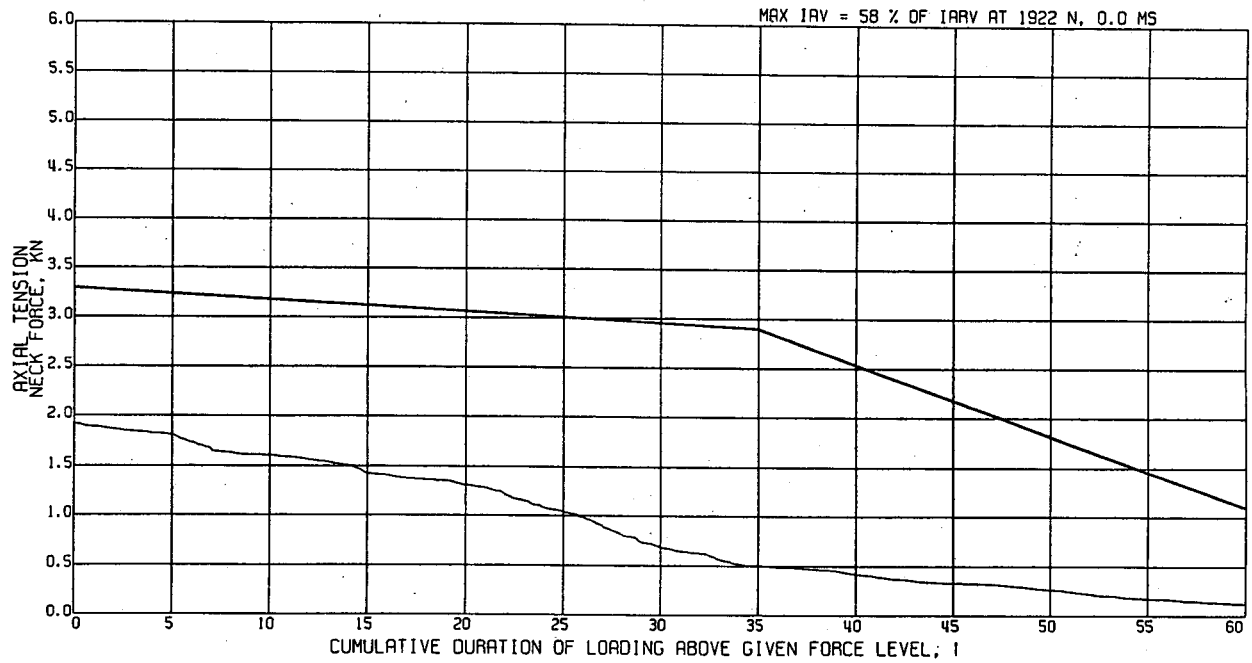


C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 1000

AXIAL TENSION ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:07/30/1997



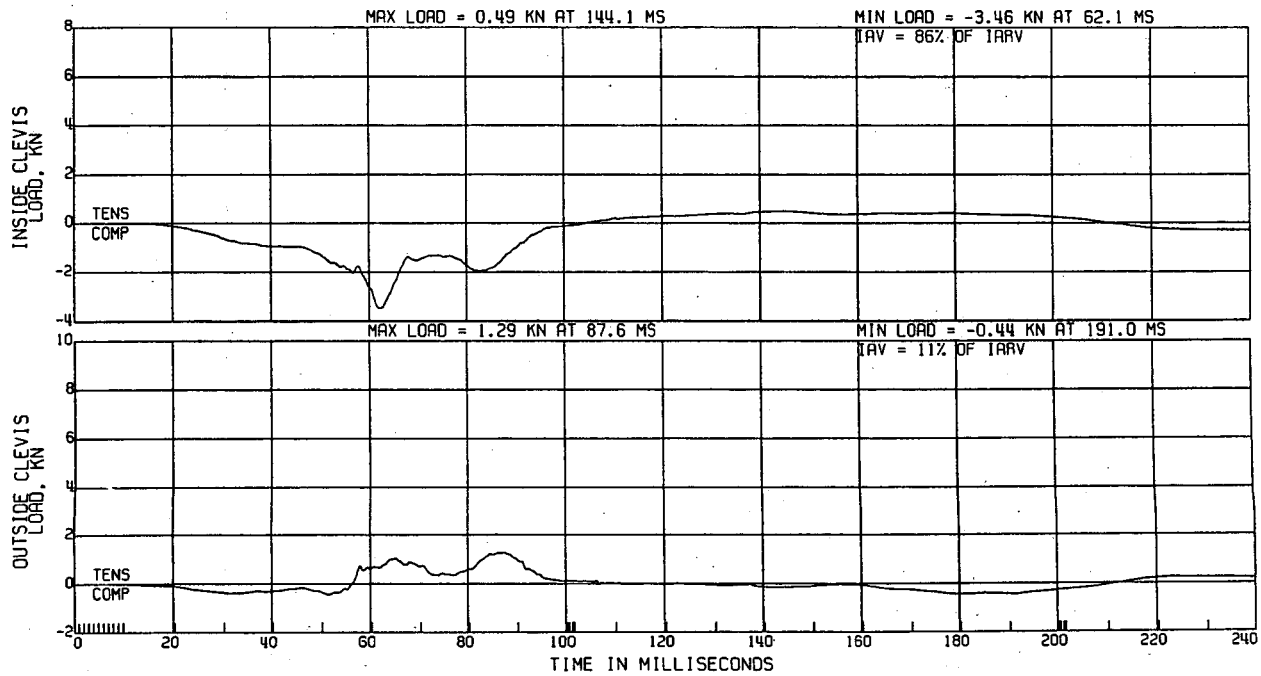
: Appendix B, plot # **37**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 600

R. FRT LEFT KNEE CLEVIS LOAD

ATD TYPE: GM50H
TEST DATE:07/30/1997



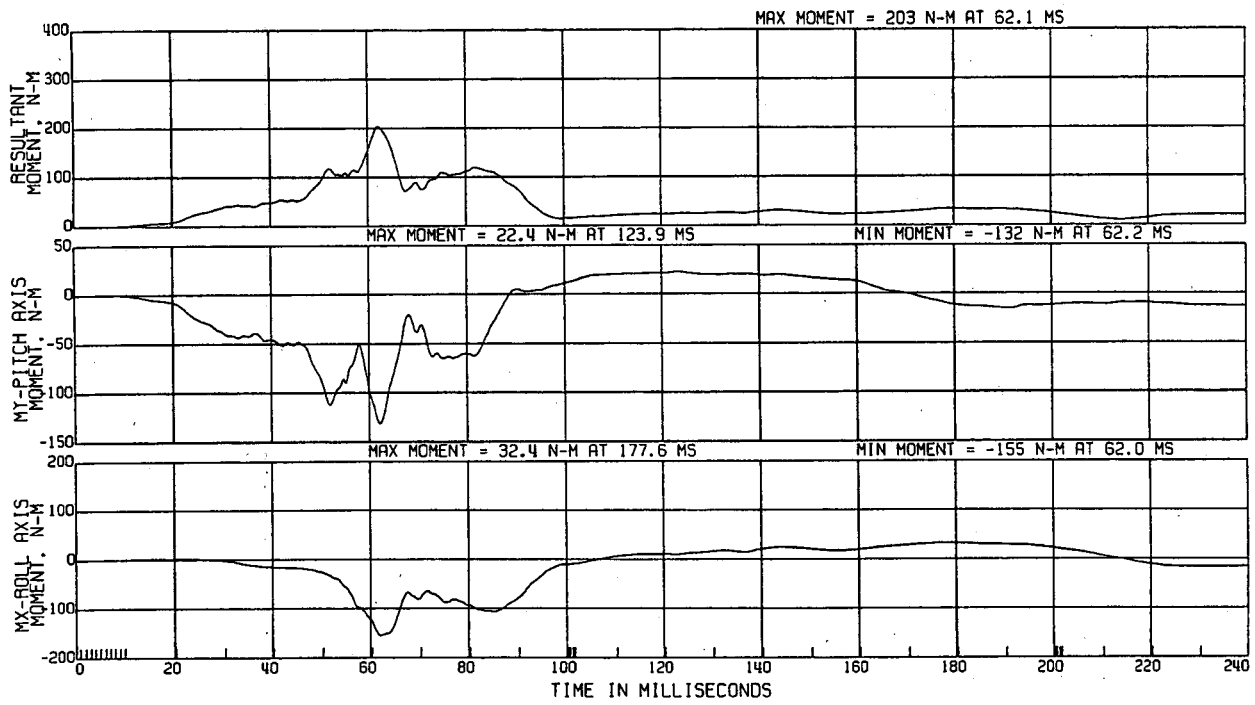
Appendix B, plot # **38**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:07/30/1997

R. FRT LEFT TIBIA UPPER MOMENT



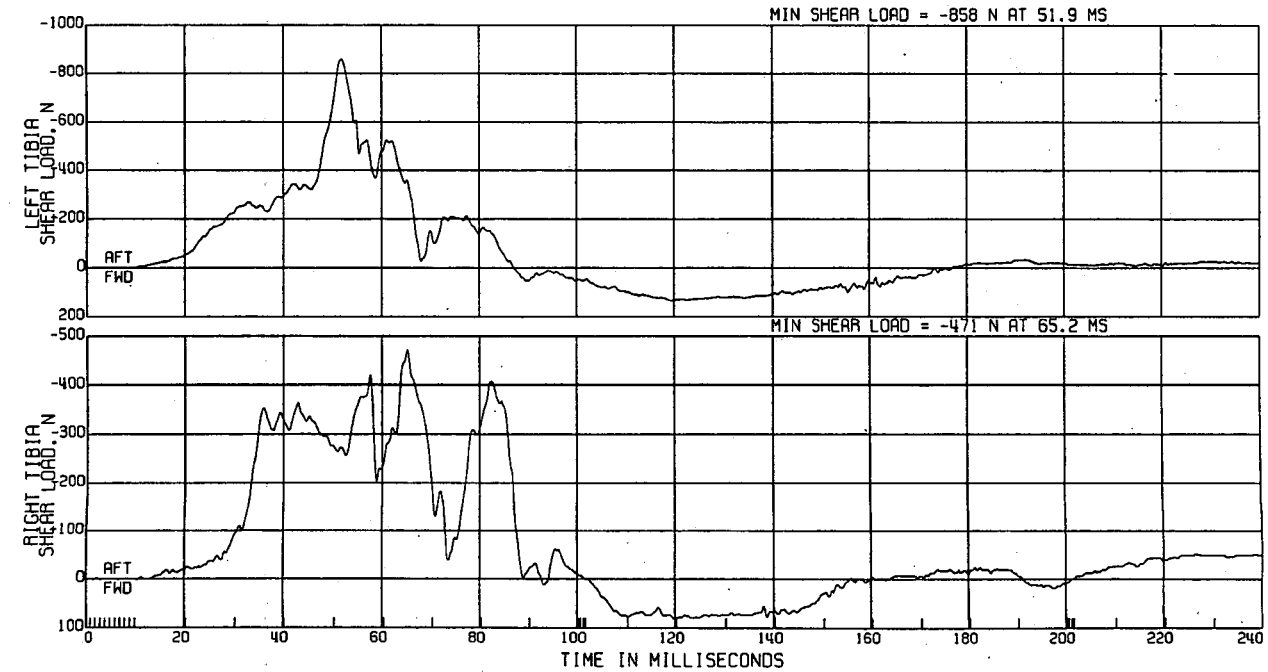
Appendix B, plot # **39**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:07/30/1997

R. FRT TIBIA LOWER SHEAR LOAD CELLS



Appendix B, plot # **40**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

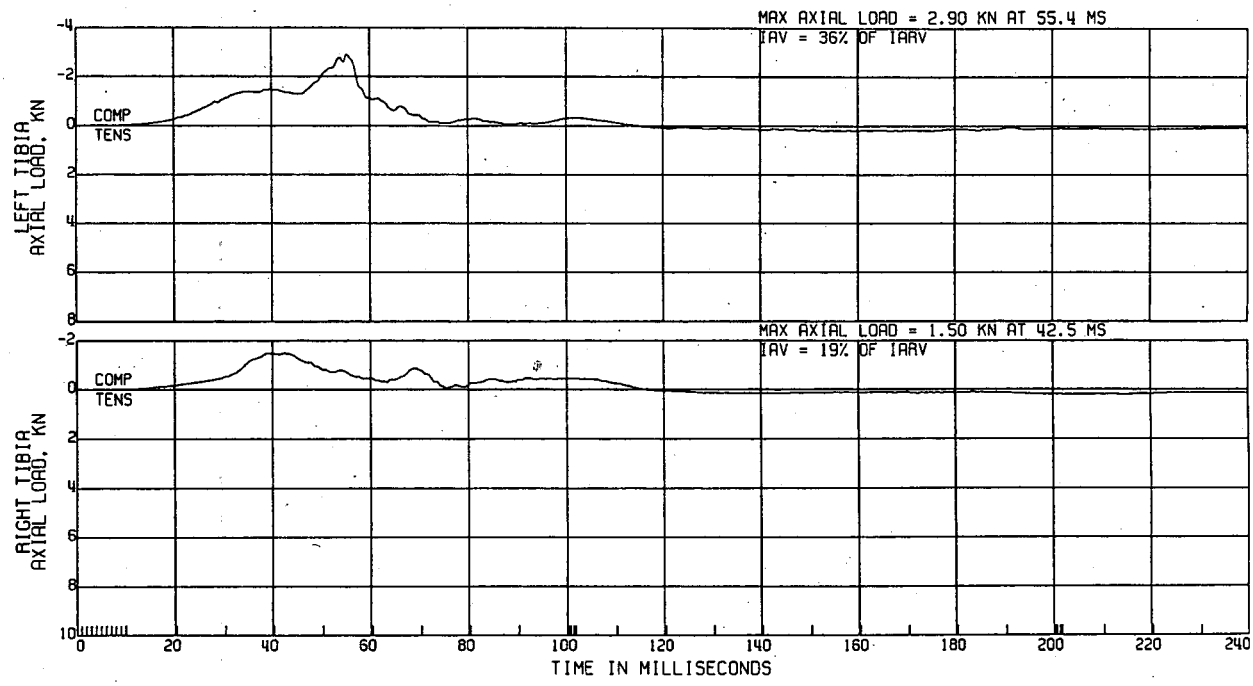
ATD TYPE: GM50H

R & D CTR 8V9140D 4 DOOR

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 600

R. FRT TIBIA LOWER AXIAL LOAD



Appendix B, plot # **41**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

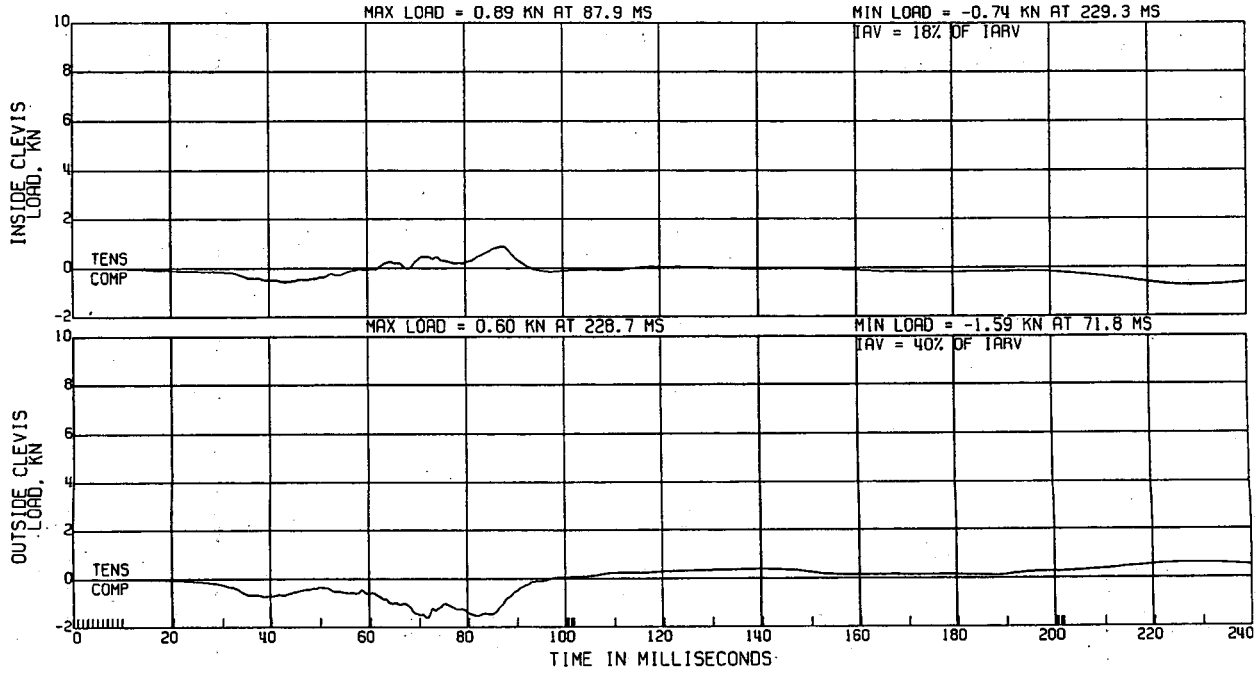
ATD TYPE: GM50H

R & D CTR 8V9140D 4 DOOR

R. FRT RIGHT KNEE CLEVIS LOAD

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 600



Appendix B, plot # **42**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

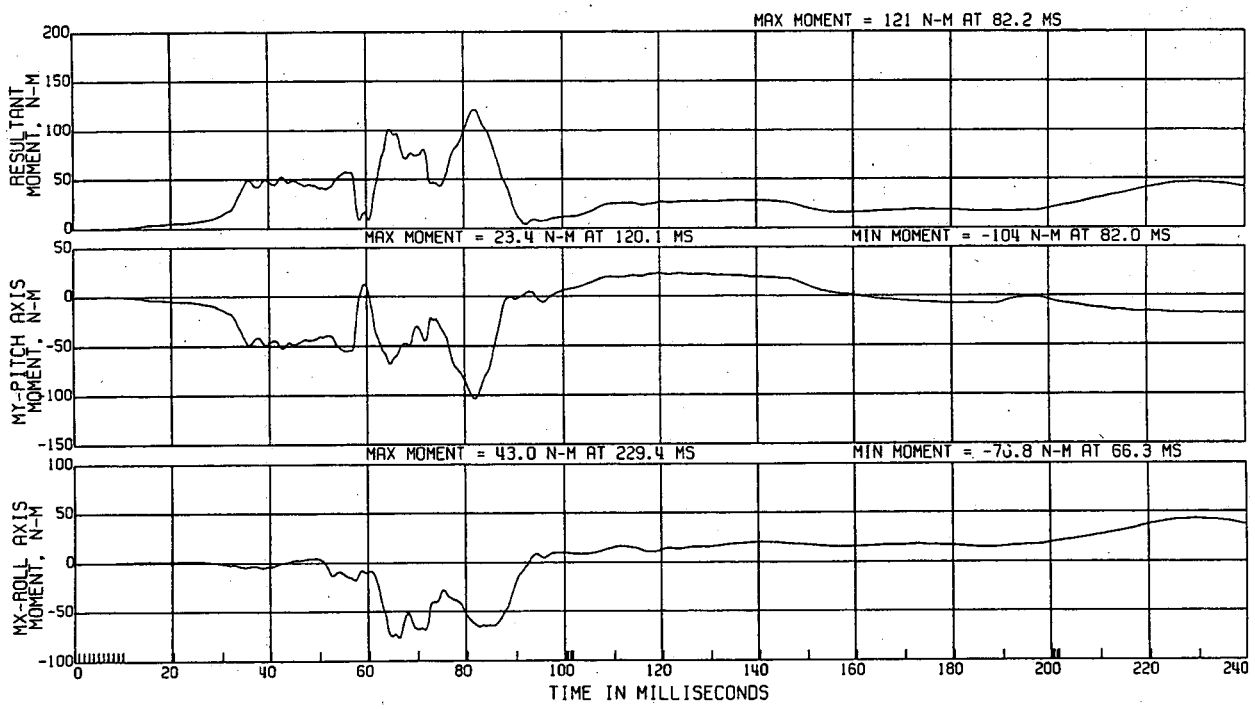
ATD TYPE: GM50H

R & D CTR 8V91400 4 DOOR

R. FRT RIGHT TIBIA UPPER MOMENT

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 600



Appendix B, plot # **43**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

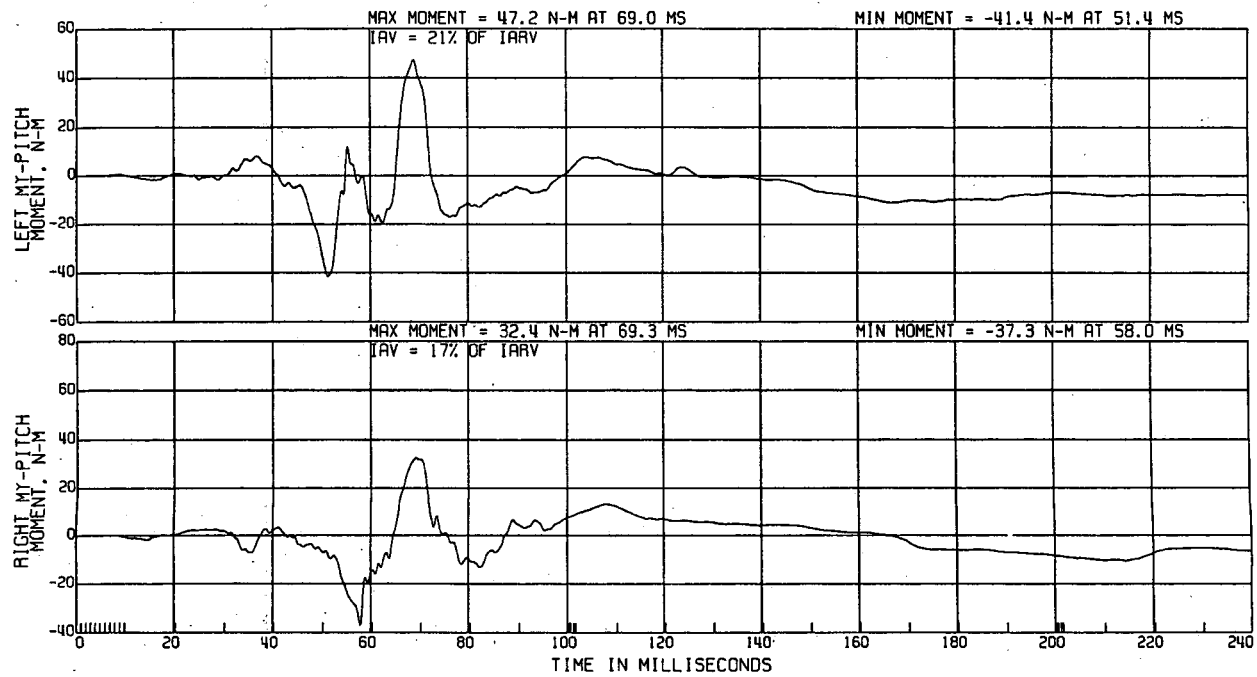
ATD TYPE: GM50H

R & D CTR 8V91400 4 DOOR

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 600

R. FRT TIBIA LOWER BENDING MOMENTS



Appendix B, plot # **44**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

ATD TYPE: GM50H

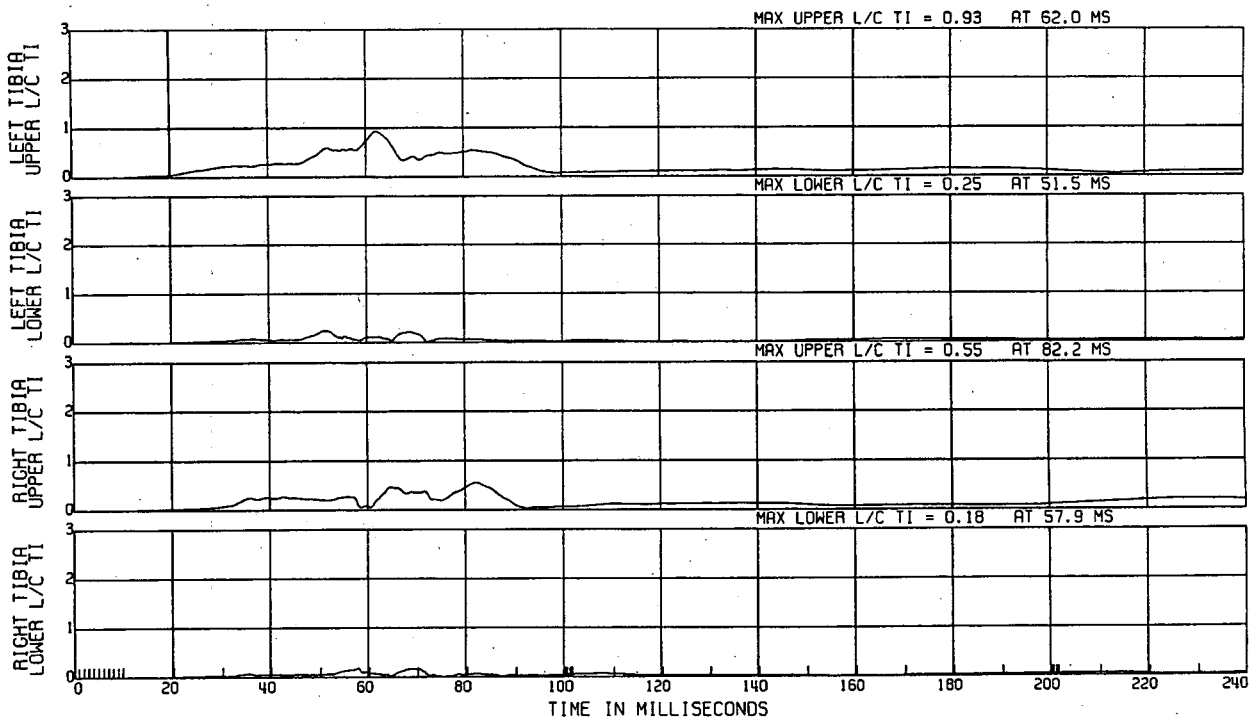
R & D CTR 8V91400 4 DOOR

R. FRT TIBIA INDICES

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 600

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



Appendix B, plot # **45**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

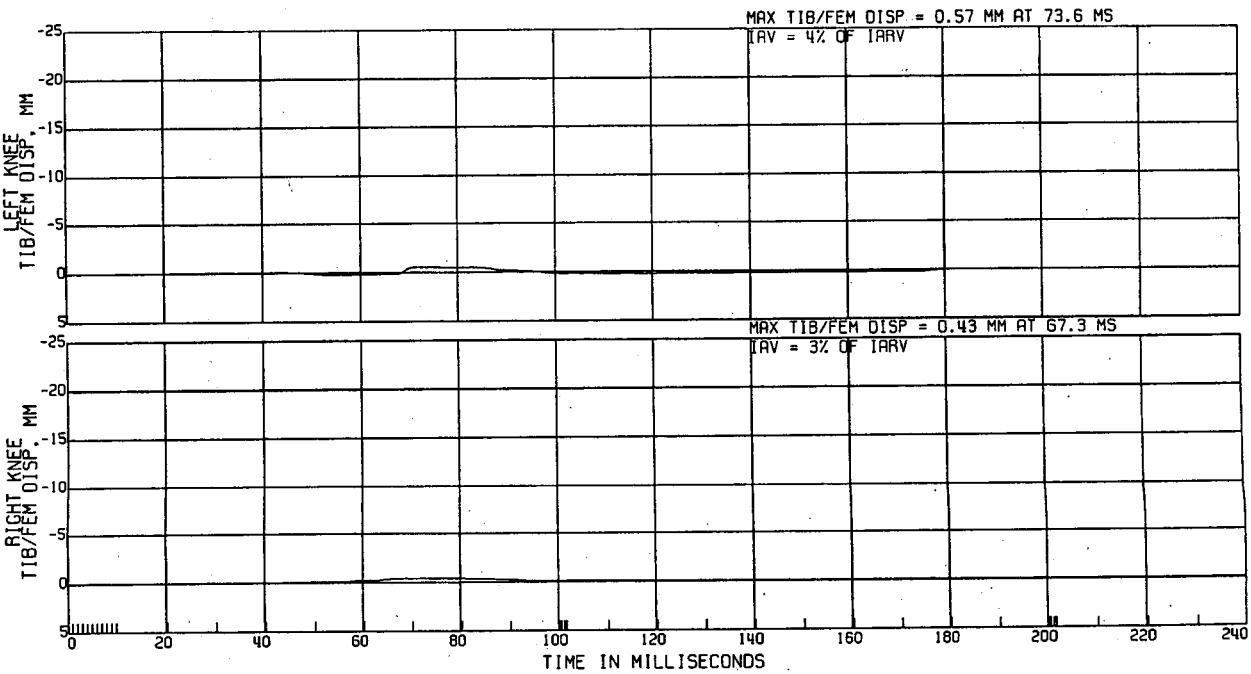
ATD TYPE: GM50H

R & D CTR 8V91400 4 DOOR

R. FRT TIBIA/FEMUR DISPLACEMENT

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 180

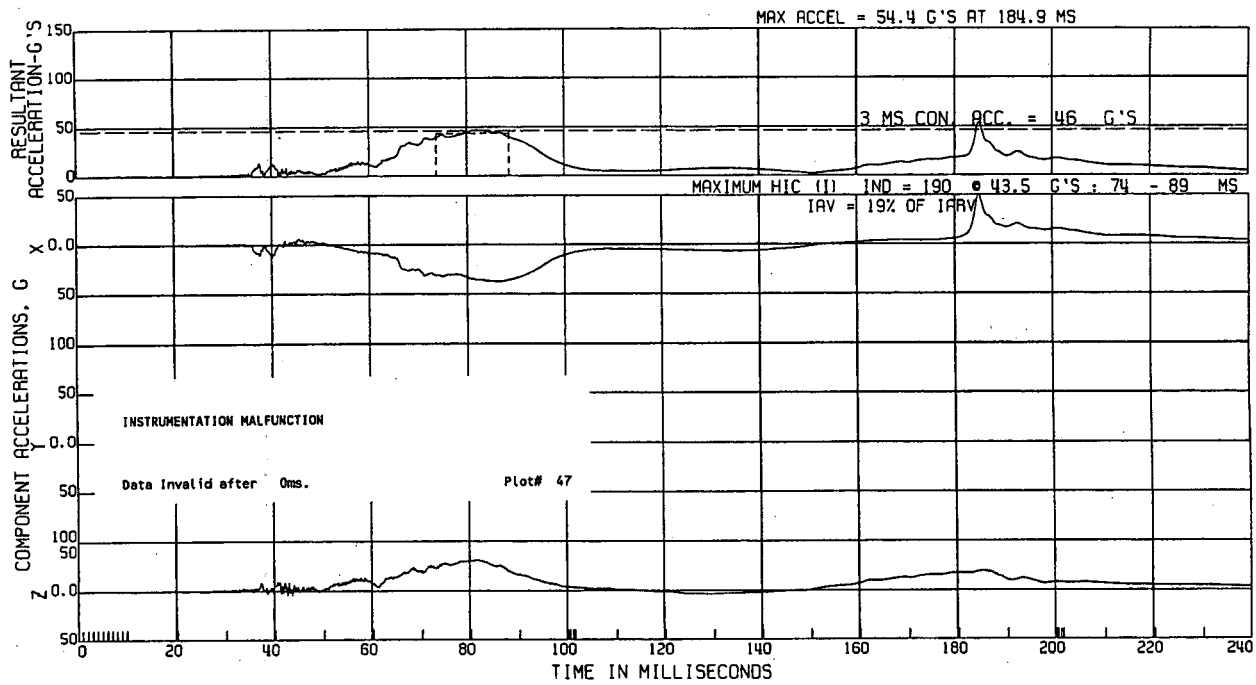


Appendix B, plot # **46**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR R. FRT HEAD ACCEL ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 (HIC I LIMITED TO 15MS) TEST DATE:07/30/1997

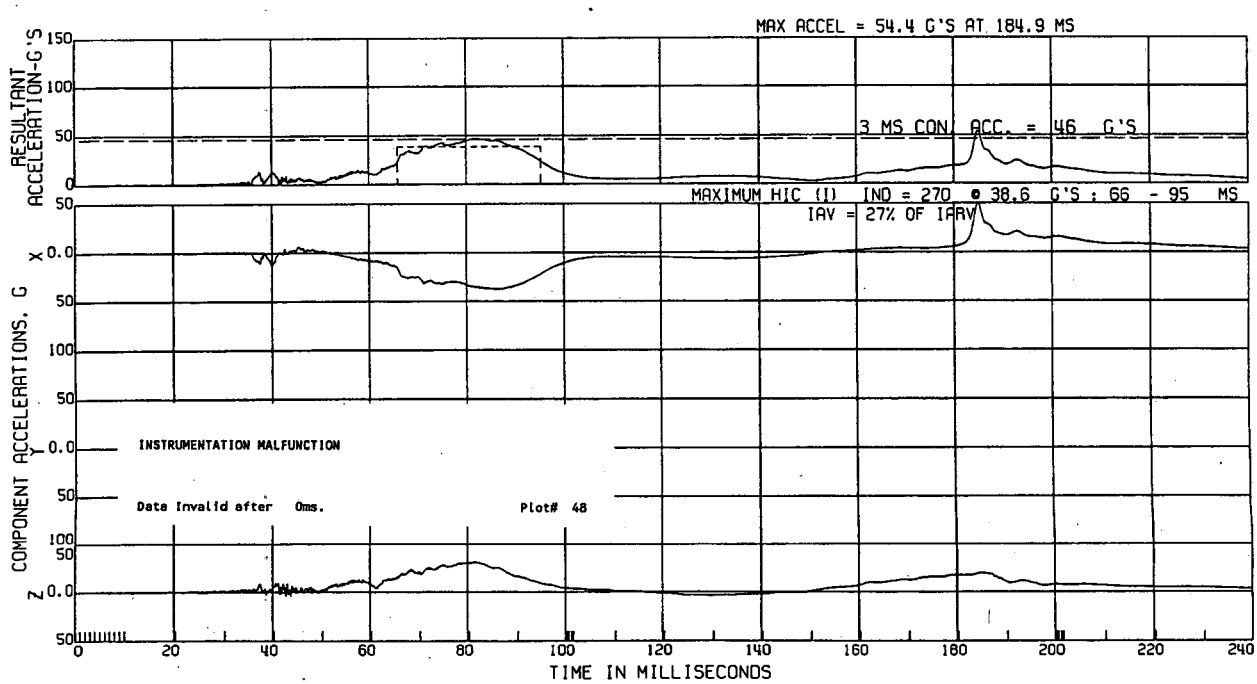


Appendix B, plot # **47**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR R. FRT HEAD ACCEL ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 (HIC I LIMITED TO 36MS) TEST DATE:07/30/1997



Appendix B, plot # **48**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

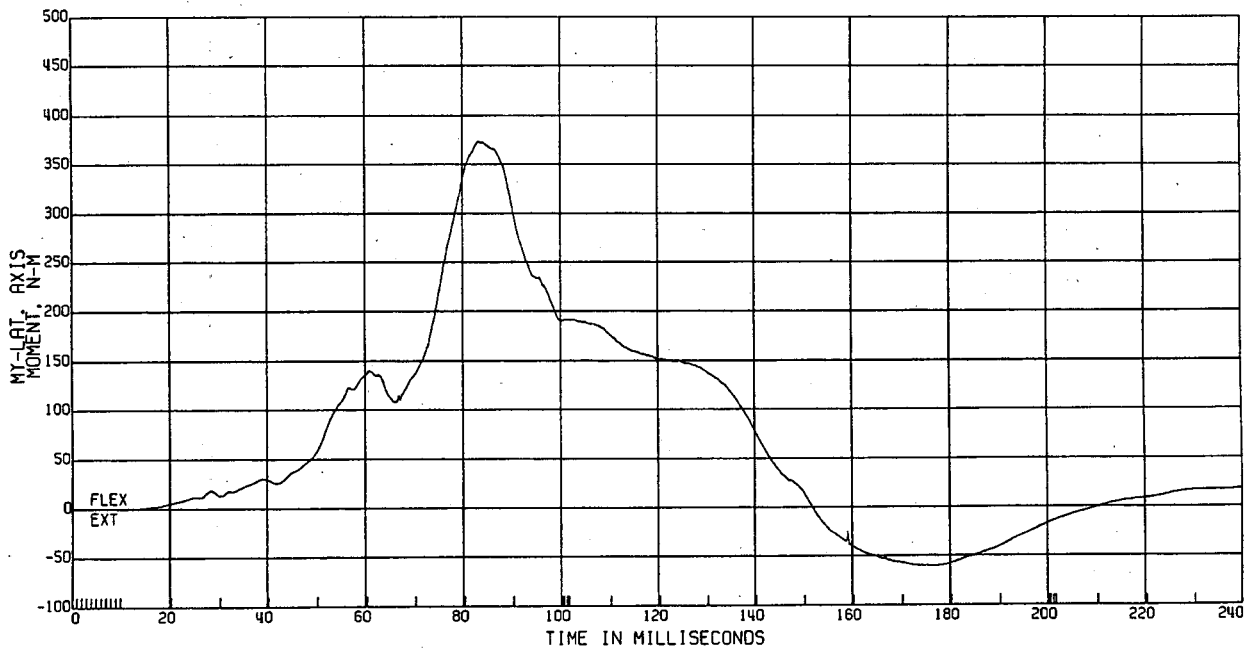
ATD TYPE: GM50H

R & D CTR 8V9140D 4 DOOR

L. FRT LOWER LUMBAR MOMENT

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000



Appendix B, plot # **49**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

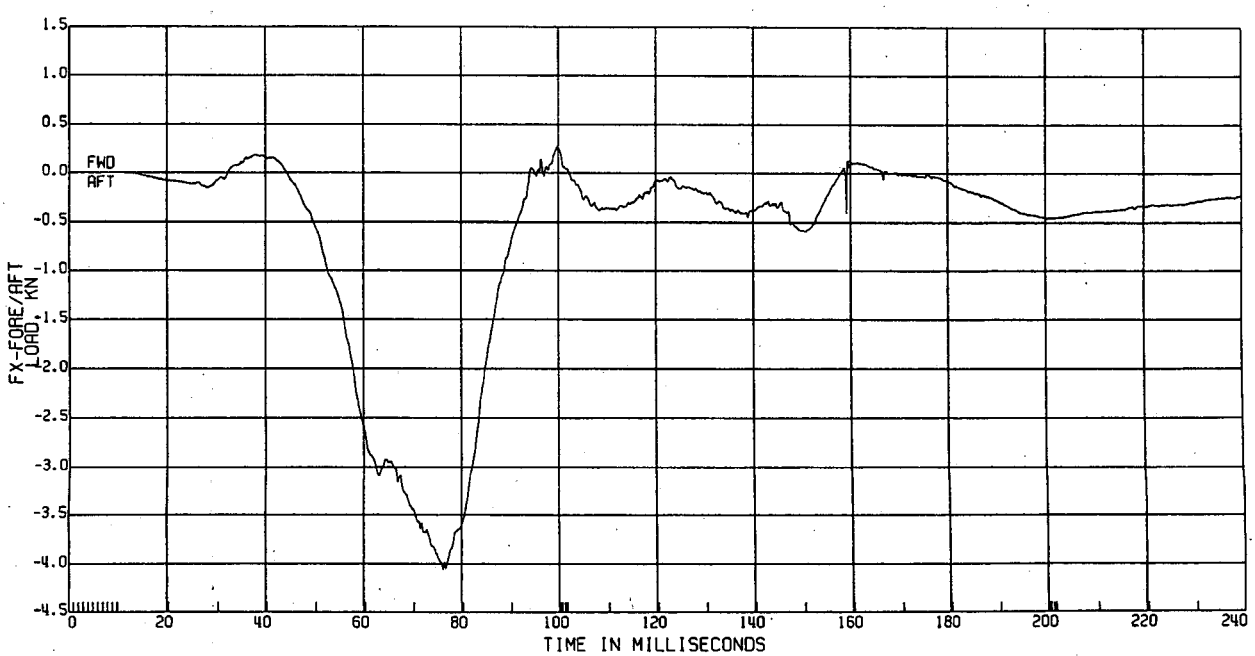
ATD TYPE: GM50H

R & D CTR 8V9140D 4 DOOR

L. FRT LOWER LUMBAR LOAD

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000



Appendix B, plot # **50**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

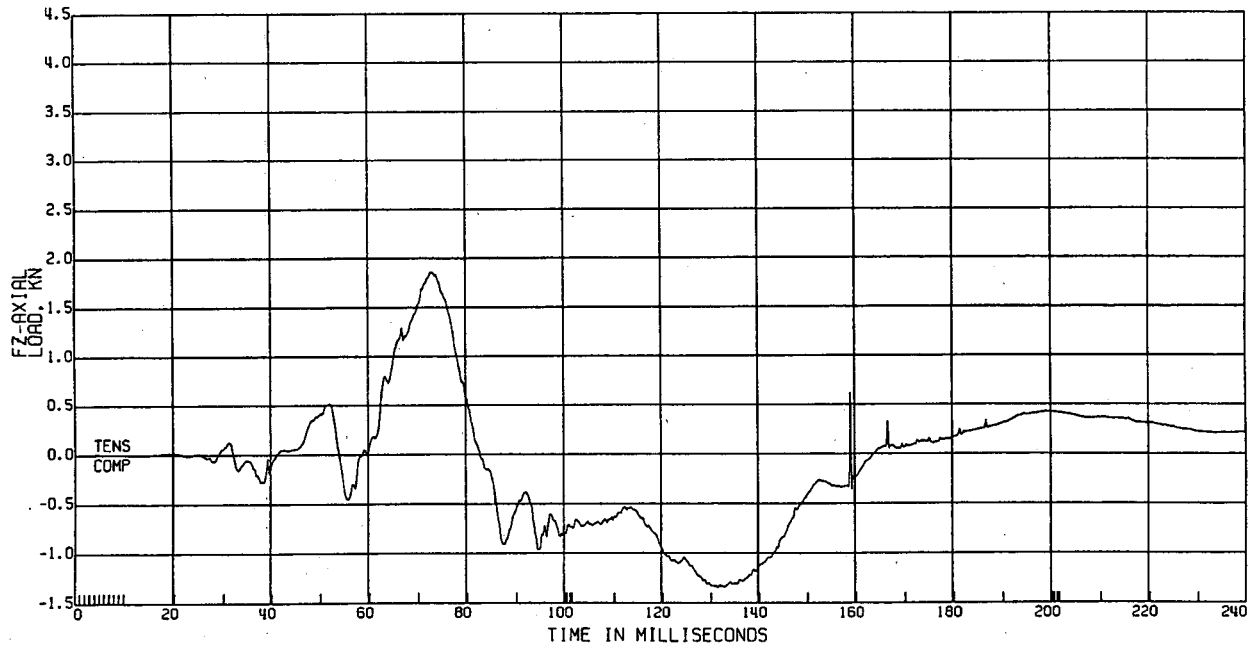
R & D CTR 8V91400 4 DOOR

ELEC DATA, SAE CLASS 1000

L. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H

TEST DATE:07/30/1997



Appendix B, plot # **51**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

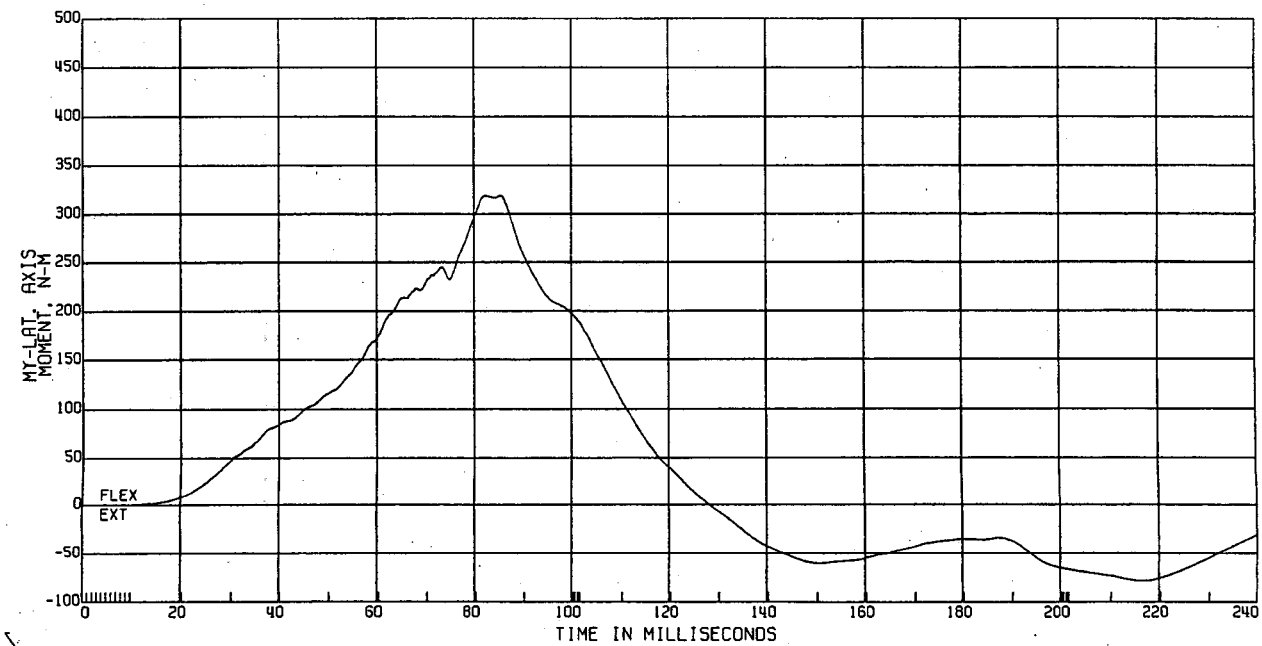
R & D CTR 8V91400 4 DOOR

ELEC DATA, SAE CLASS 1000

R. FRT LOWER LUMBAR MOMENT

ATD TYPE: GM50H

TEST DATE:07/30/1997



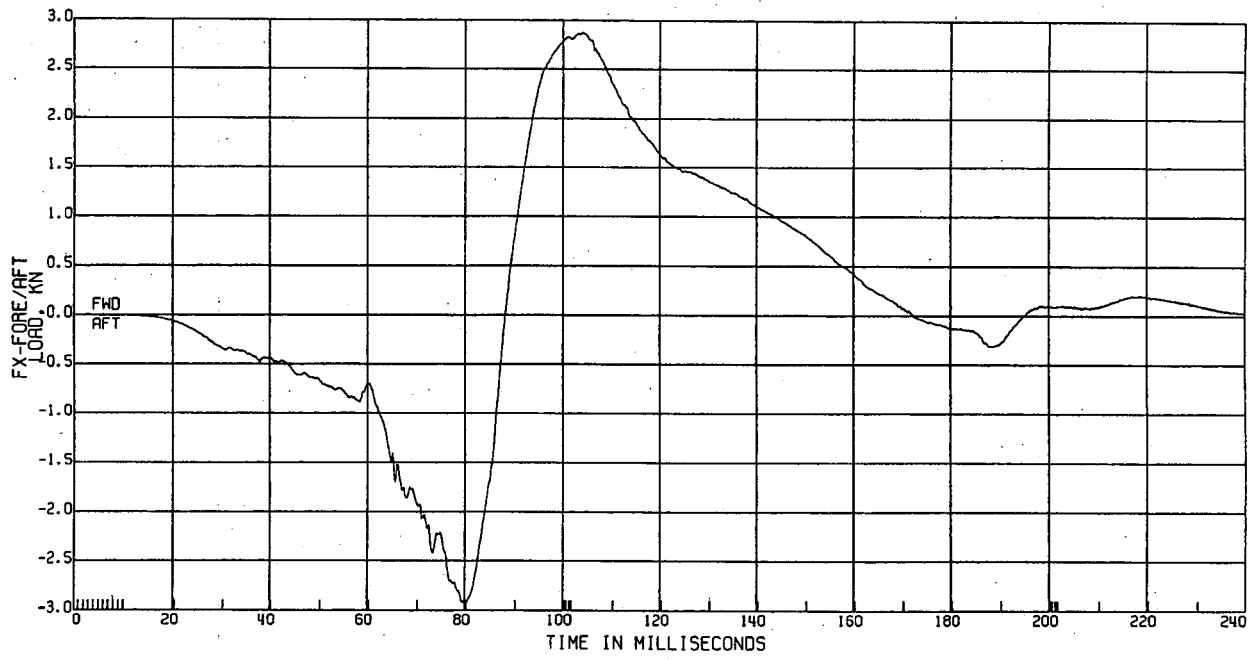
Appendix B, plot # **52**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 1000

R. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H
TEST DATE:07/30/1997



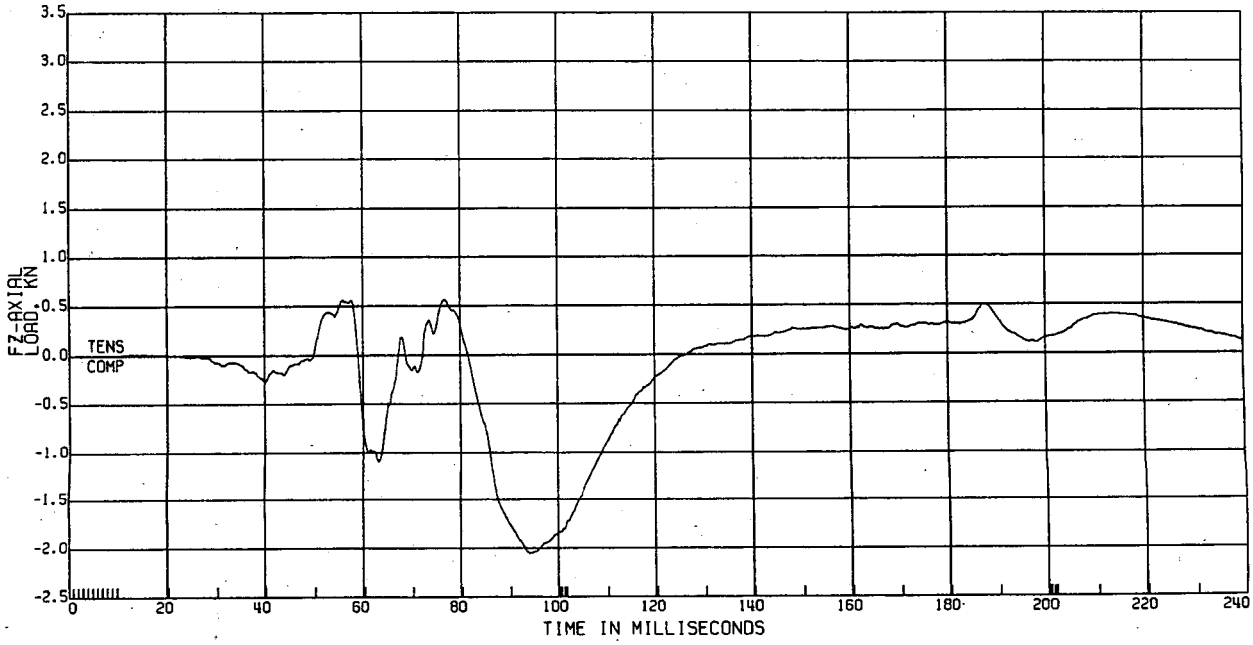
Appendix B, plot # **53**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 1000

R. FRT LOWER LUMBAR LOAD

ATD TYPE: GM50H
TEST DATE:07/30/1997



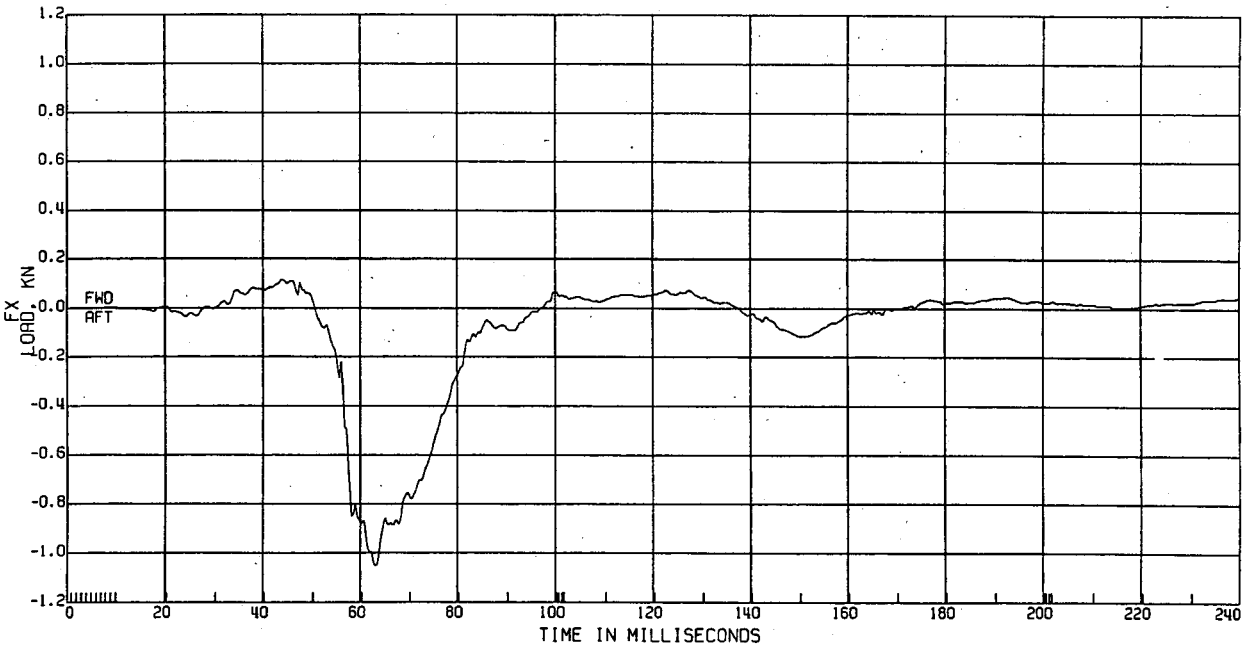
Appendix B, plot # **54**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 600

L. FRT TIBIA LEFT UPPER LOAD
(ENHANCED LOWER LEG)

ATD TYPE: GM50H
TEST DATE:07/30/1997



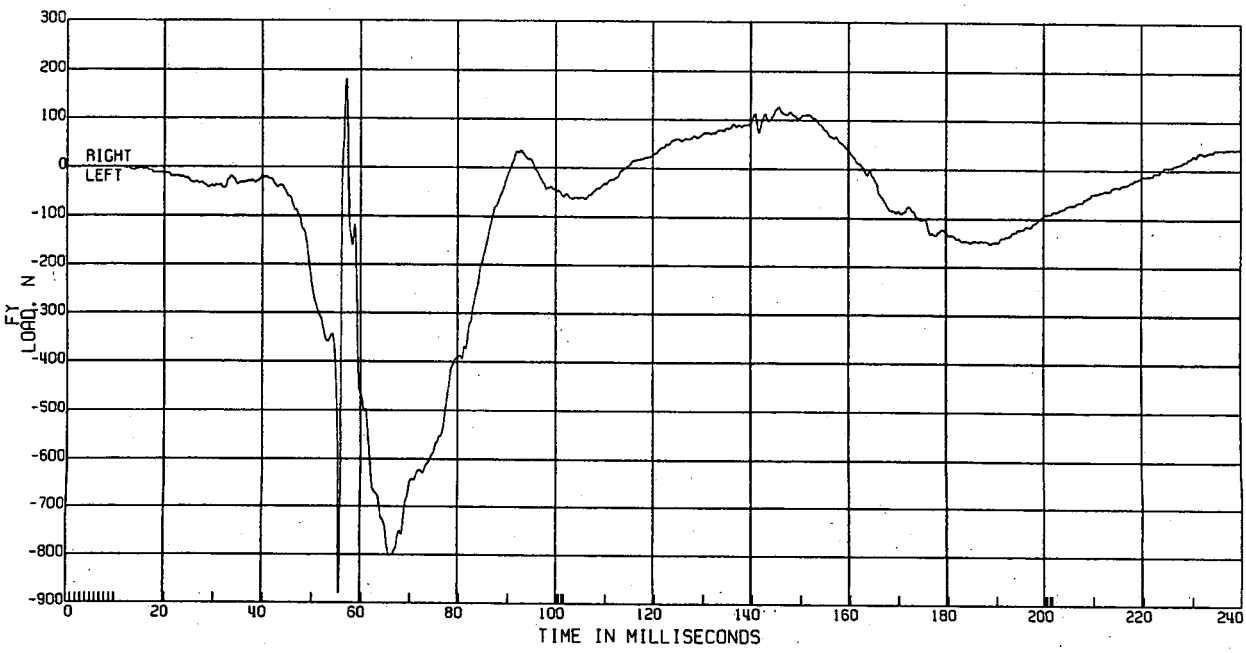
Appendix B, plot # **55**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 600

L. FRT TIBIA LEFT LOWER LOAD
(ENHANCED LOWER LEG)

ATD TYPE: GM50H
TEST DATE:07/30/1997



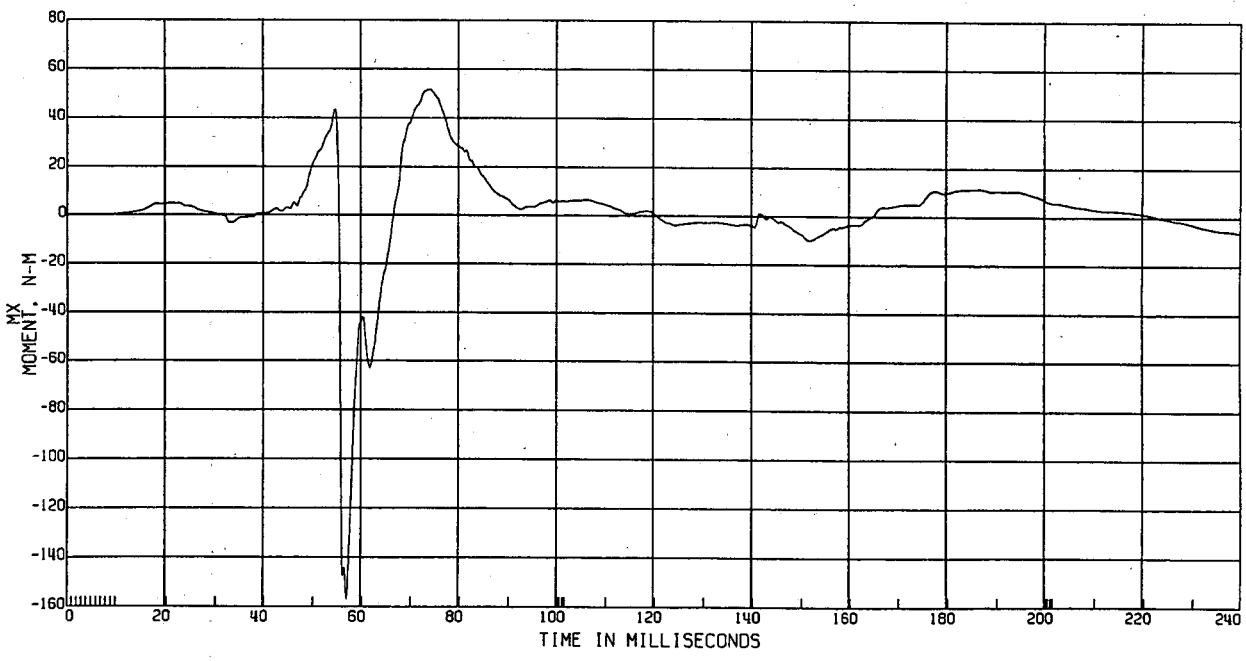
Appendix B, plot # **56**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 600

L. FRT TIBIA LEFT LOWER MOMENT
(ENHANCED LOWER LEG)

ATD TYPE: GM50H
TEST DATE:07/30/1997



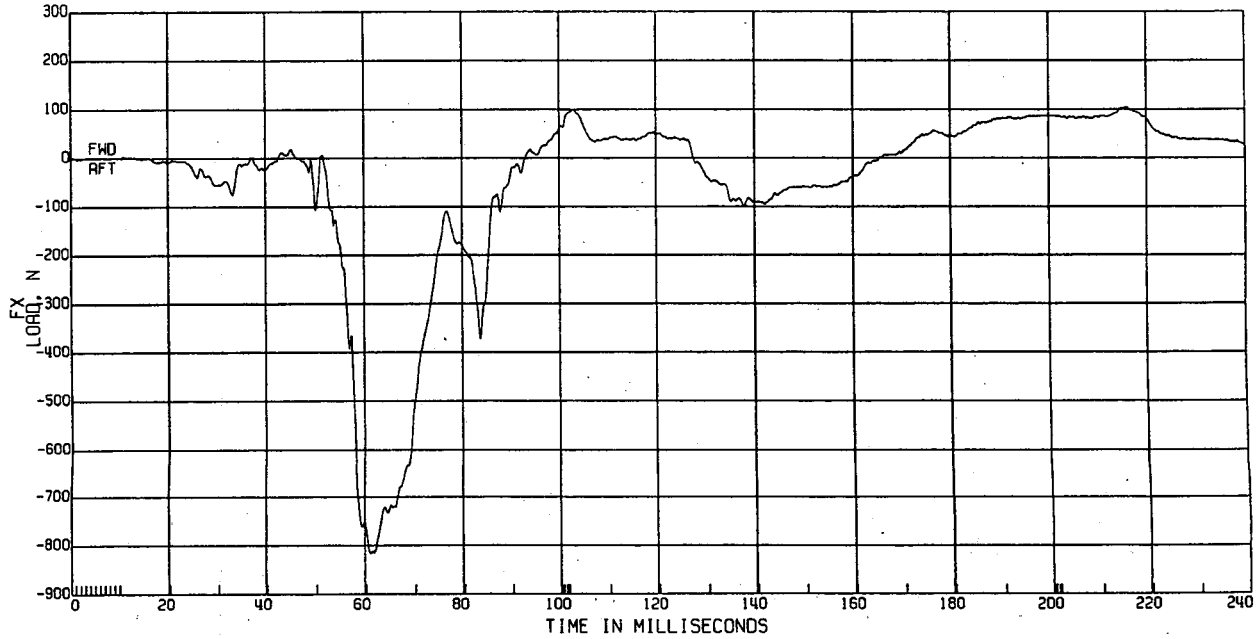
Appendix B, plot # **57**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 600

L. FRT TIBIA RIGHT UPPER LOAD
(ENHANCED LOWER LEG)

ATD TYPE: GM50H
TEST DATE:07/30/1997



Appendix B, plot # **58**

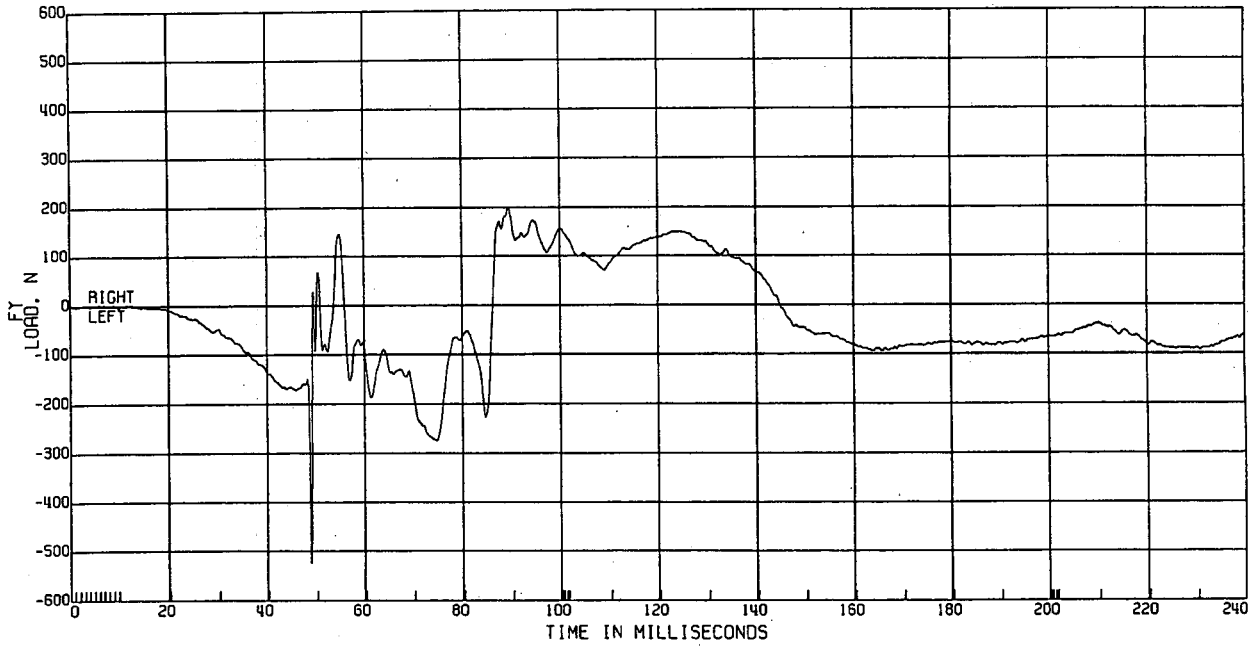
C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:07/30/1997

L. FRT TIBIA RIGHT LOWER LOAD

(ENHANCED LOWER LEG)



Appendix B, plot # **59**

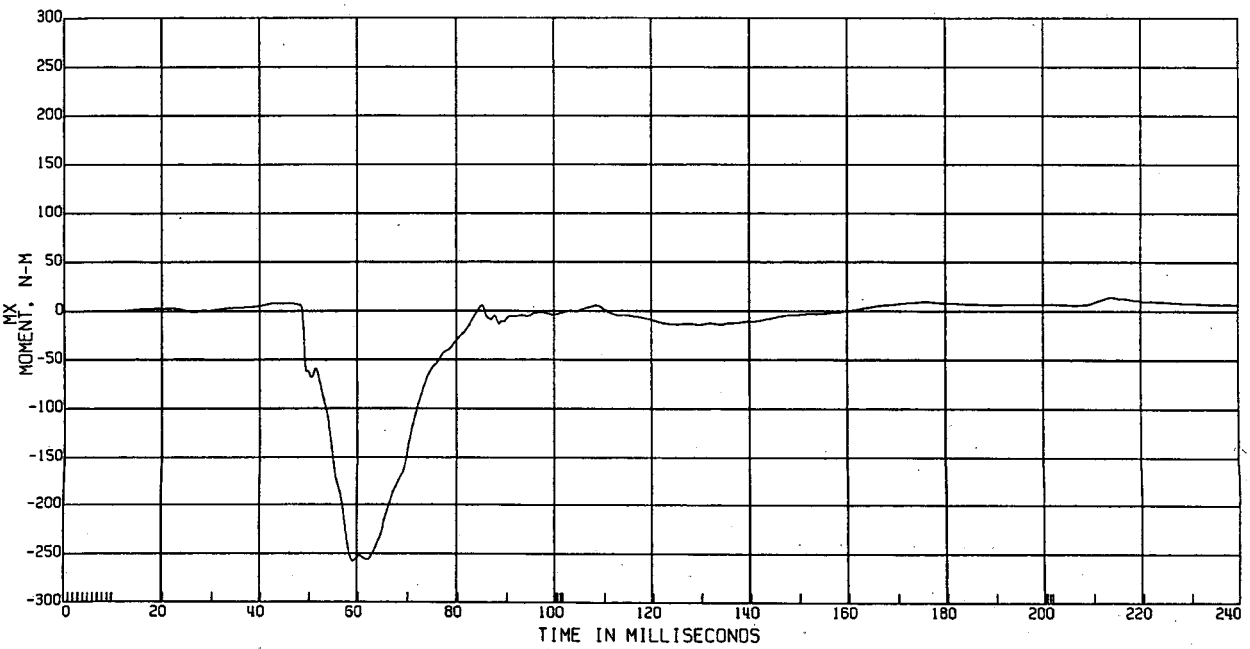
C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:07/30/1997

L. FRT TIBIA RIGHT LOWER MOMENT

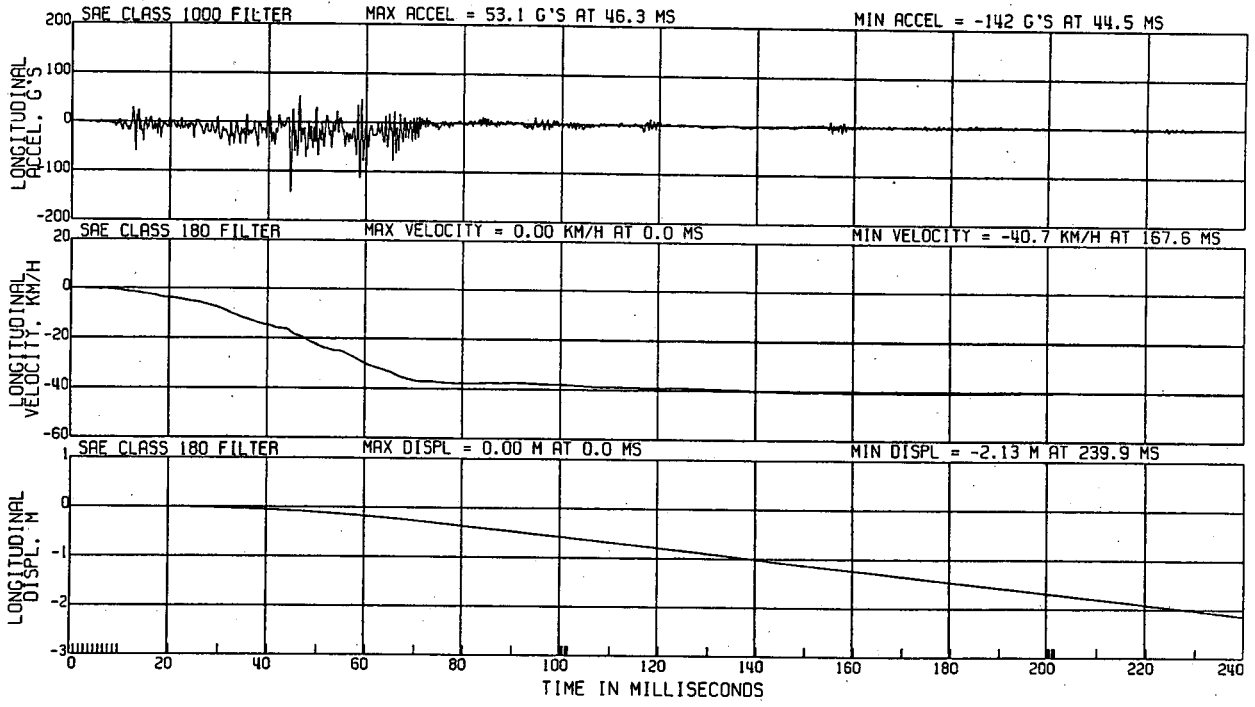
(ENHANCED LOWER LEG)



Appendix B, plot # **60**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

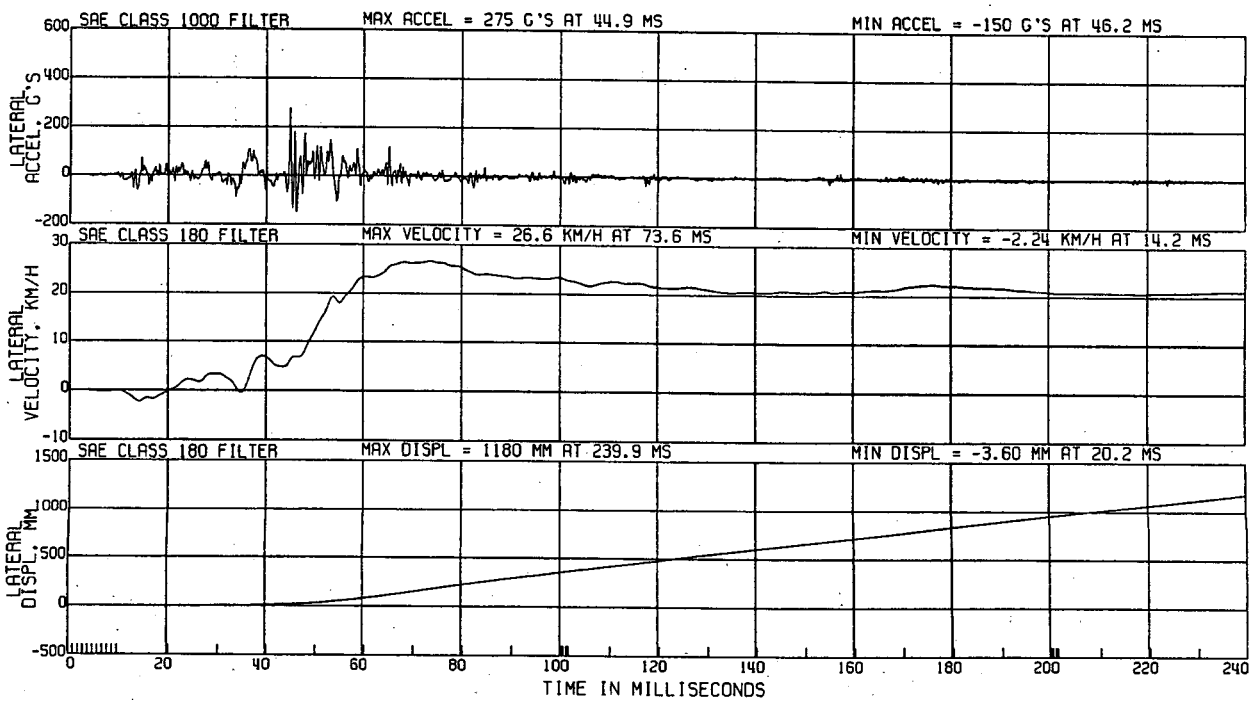
R & D CTR 8V91400 4 DOOR L. FRT ROCKER TEST DATE:07/30/1997
ELEC DATA



Appendix B, plot # **61**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L. FRT ROCKER TEST DATE:07/30/1997
ELEC DATA

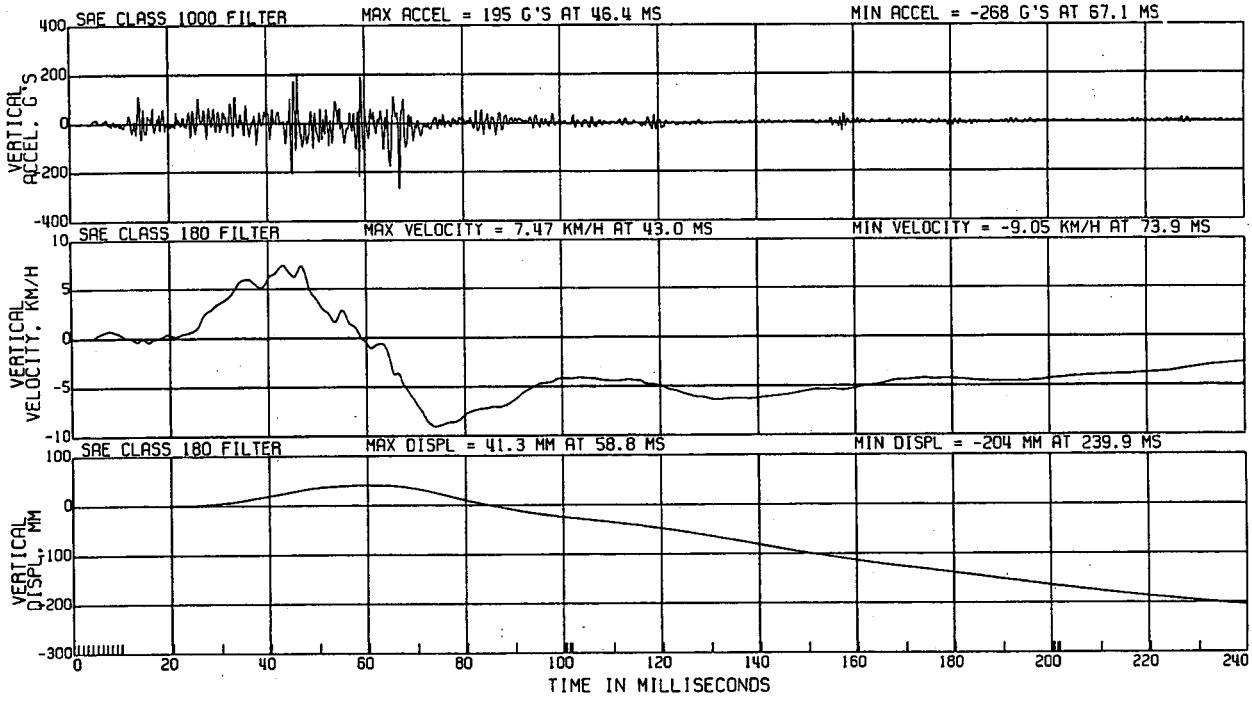


Appendix B, plot # **62**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L. FRT ROCKER TEST DATE:07/30/1997

ELEC DATA

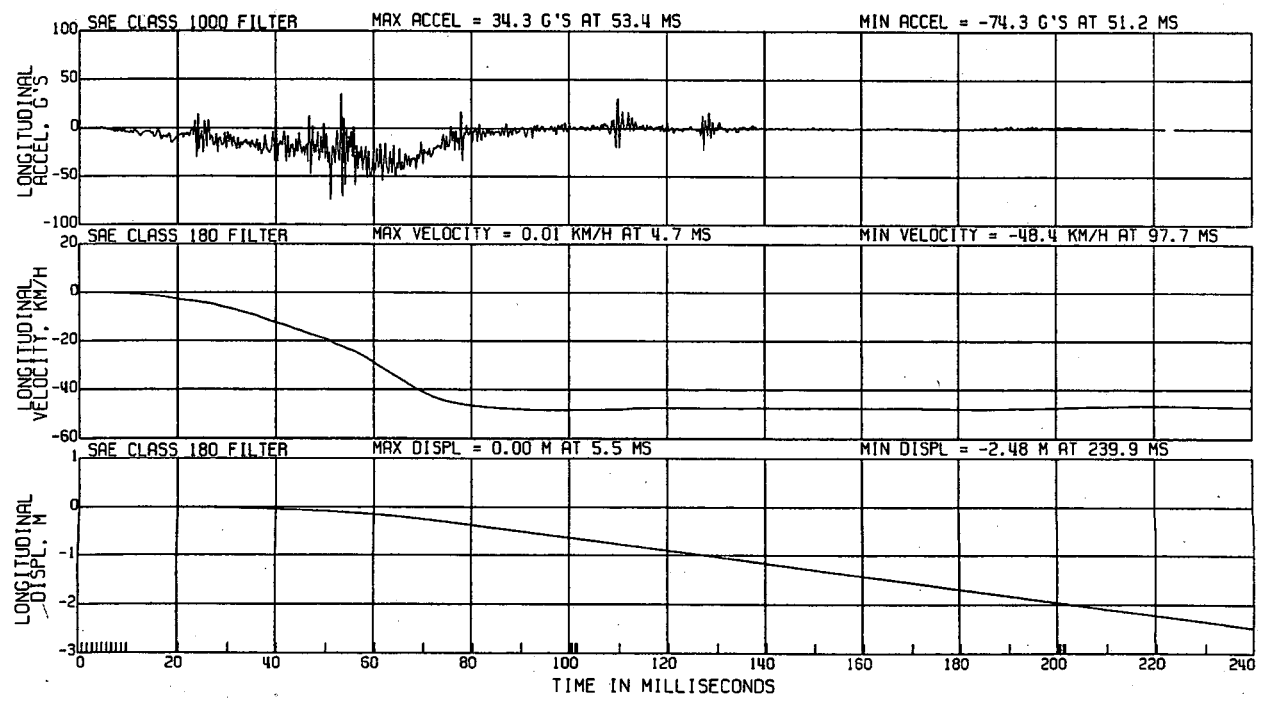


Appendix B, plot # **63**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR R. FRT ROCKER TEST DATE:07/30/1997

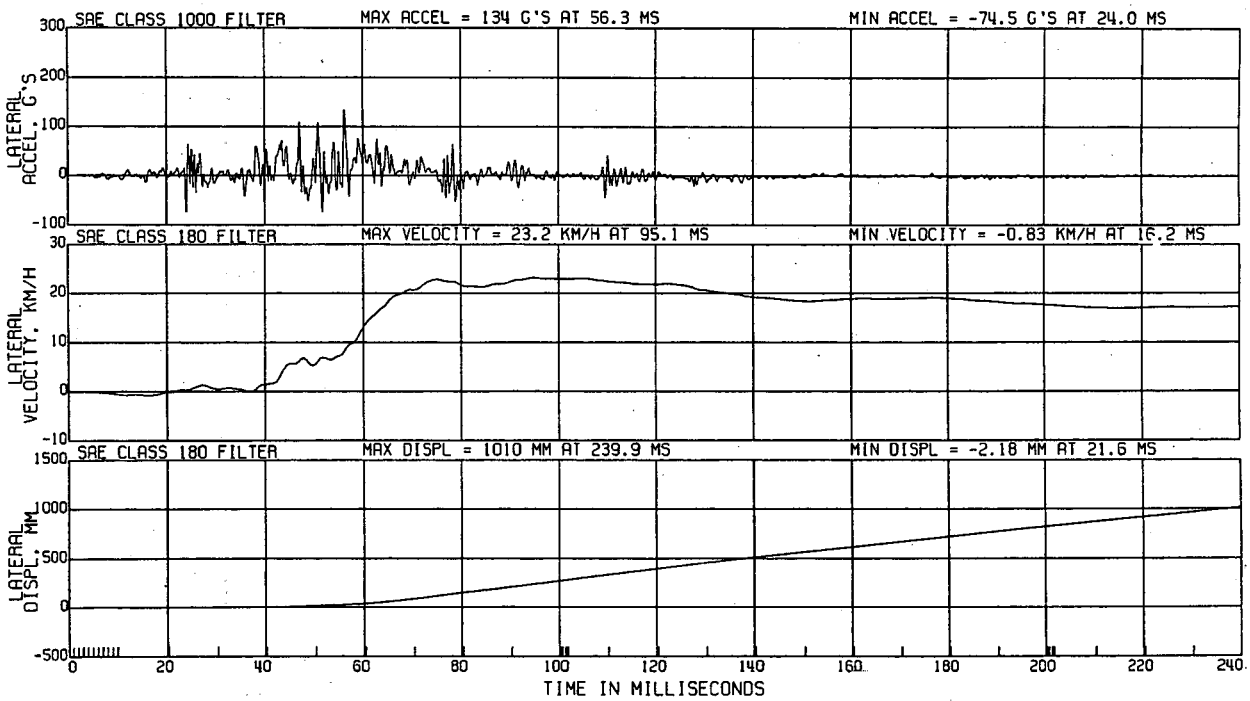
ELEC DATA



Appendix B, plot # **64**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

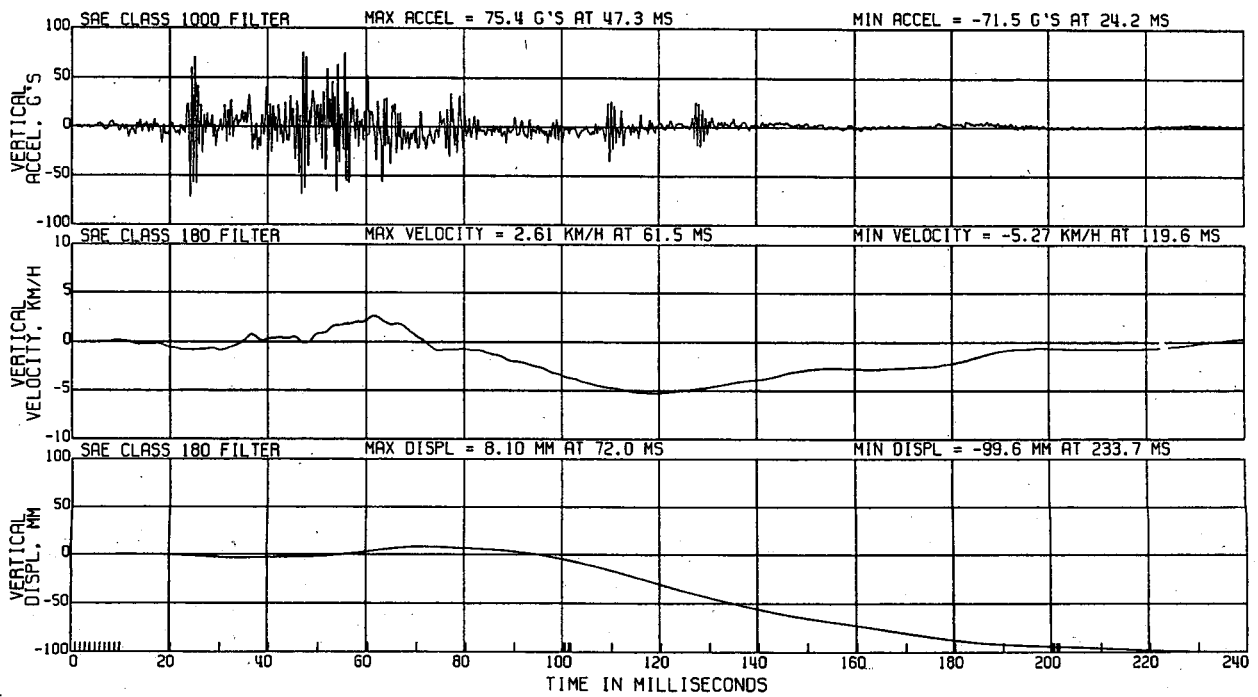
R & D CTR 8V91400 4 DOOR R. FRT ROCKER TEST DATE:07/30/1997
ELEC DATA



Appendix B, plot # **65**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR R. FRT ROCKER TEST DATE:07/30/1997
ELEC DATA

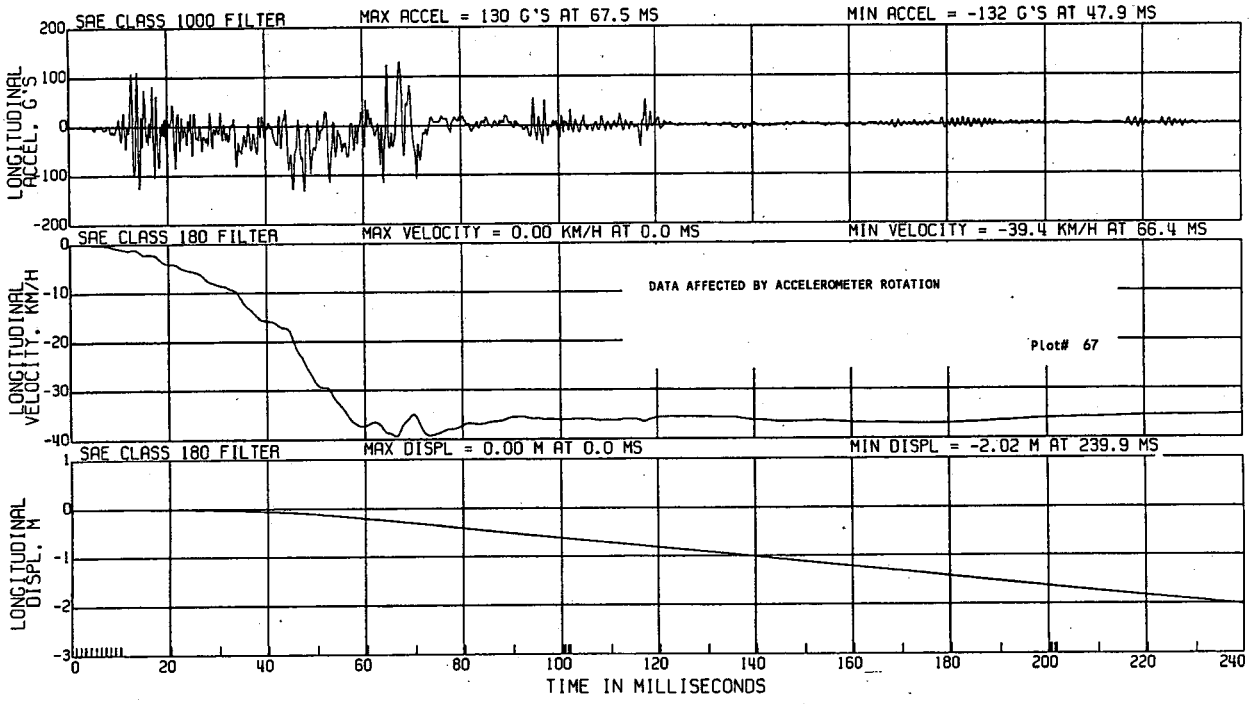


Appendix B, plot # **66**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L. FLOORPAN TEST DATE:07/30/1997

ELEC DATA

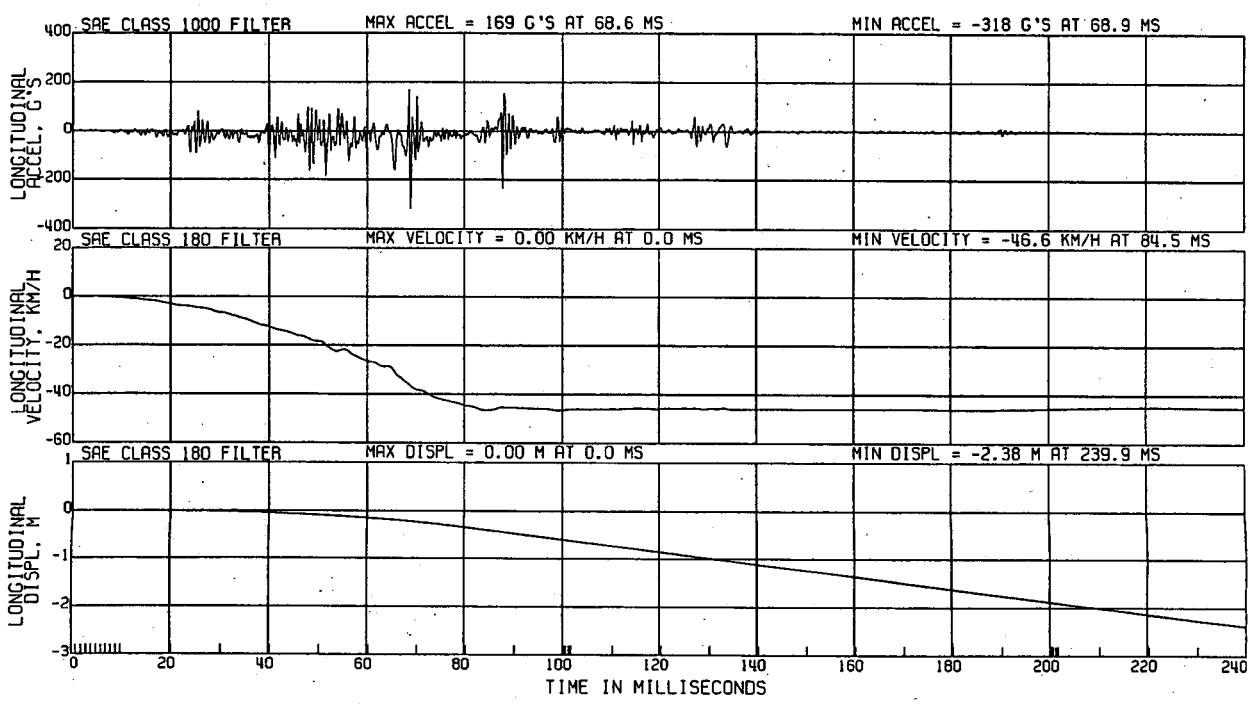


Appendix B, plot # **67**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR R. FLOORPAN TEST DATE:07/30/1997

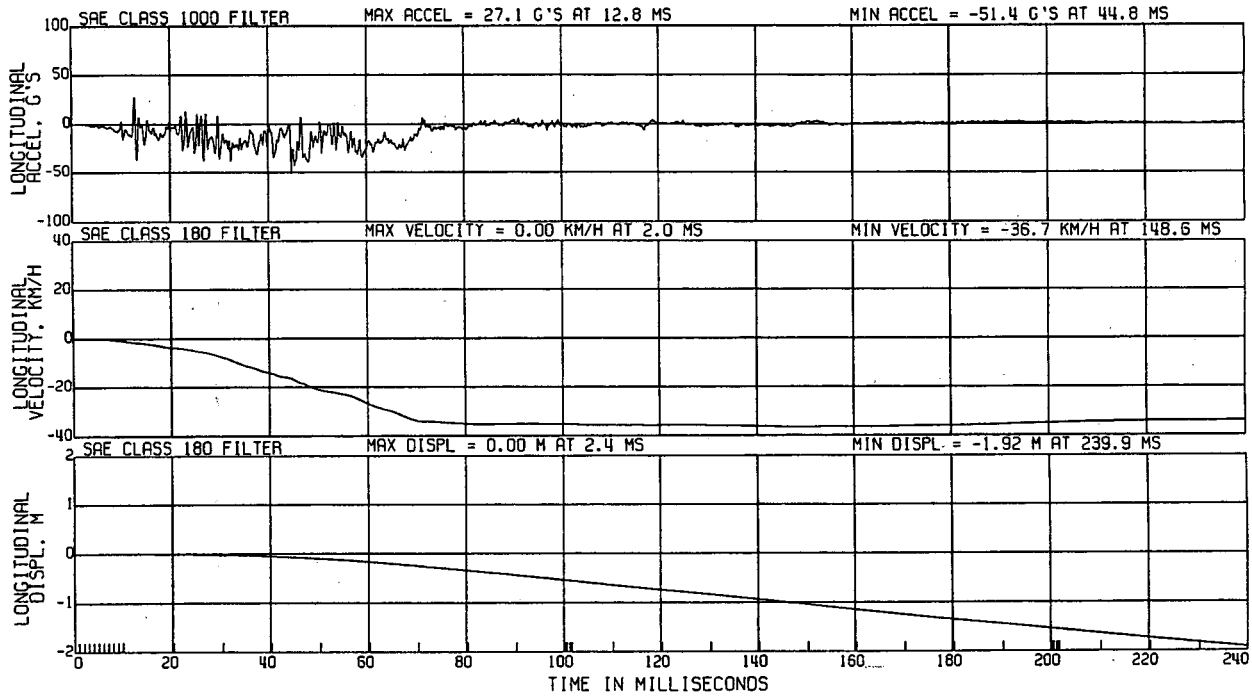
ELEC DATA



Appendix B, plot # **68**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

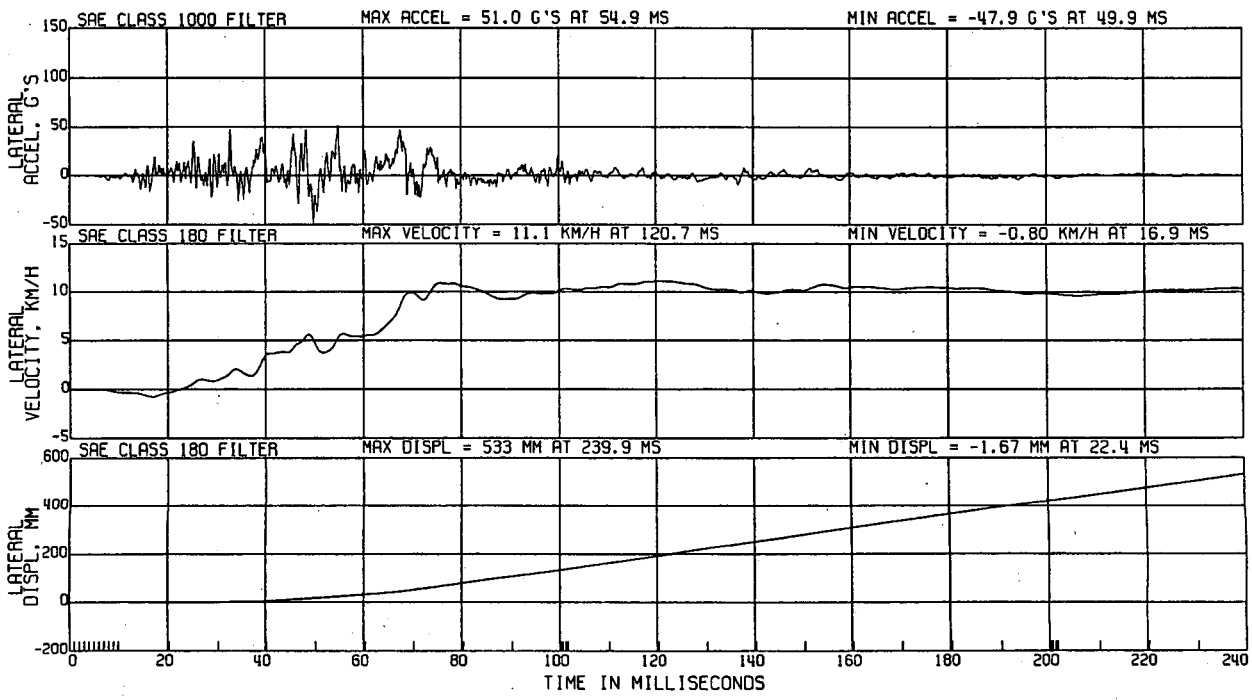
R & D CTR 8V91400 4 DOOR L.REAR ROCKER TEST DATE:07/30/1997
ELEC DATA



Appendix B, plot # **69**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L.REAR ROCKER TEST DATE:07/30/1997
ELEC DATA

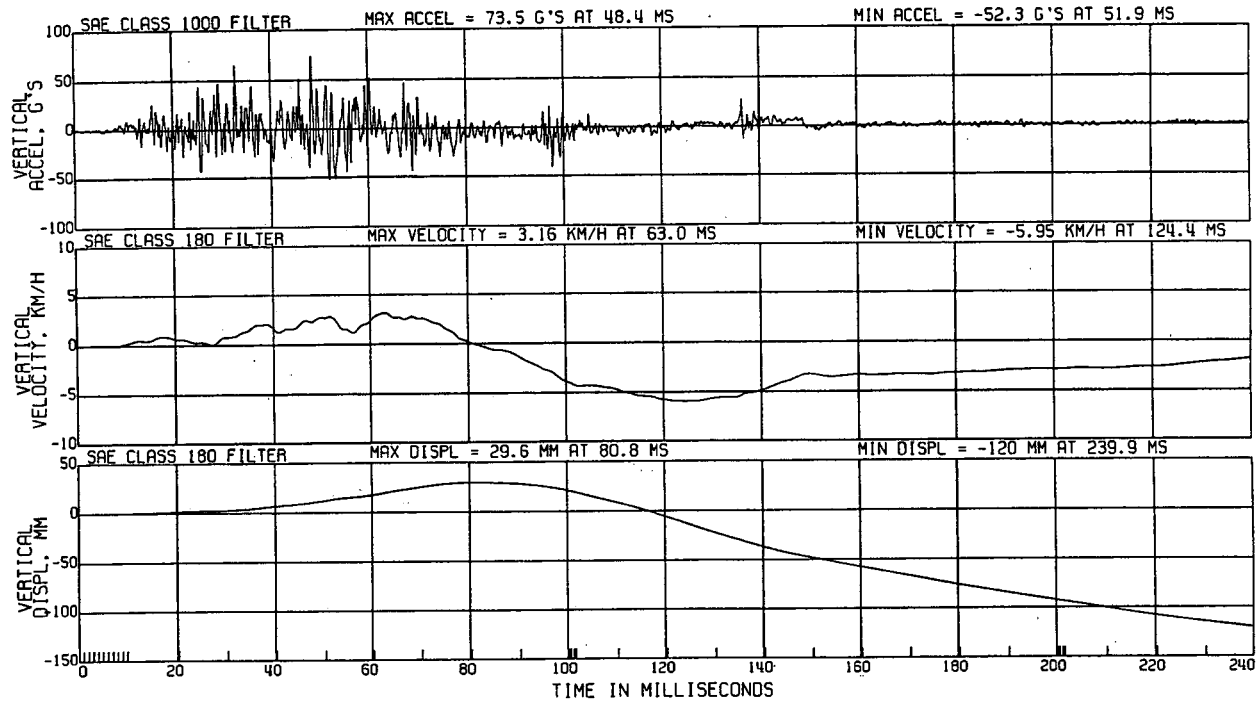


Appendix B, plot # **70**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L.REAR ROCKER TEST DATE:07/30/1997

ELEC DATA

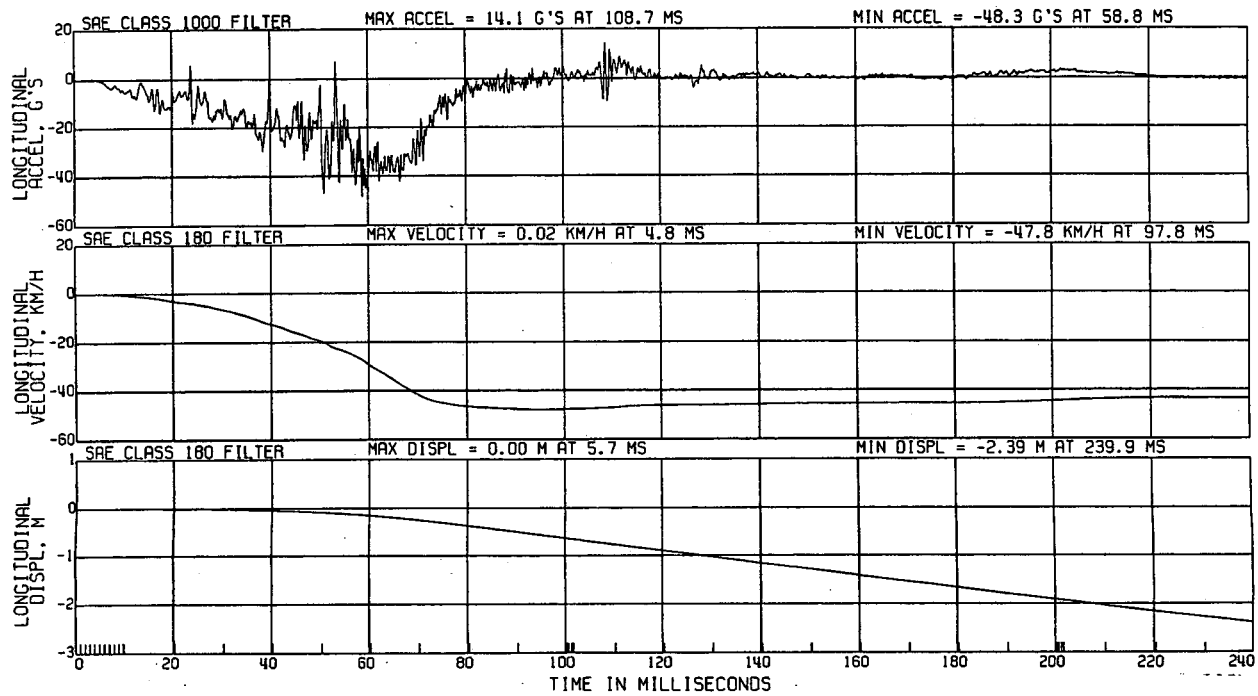


Appendix B, plot # **71**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR R.REAR ROCKER TEST DATE:07/30/1997

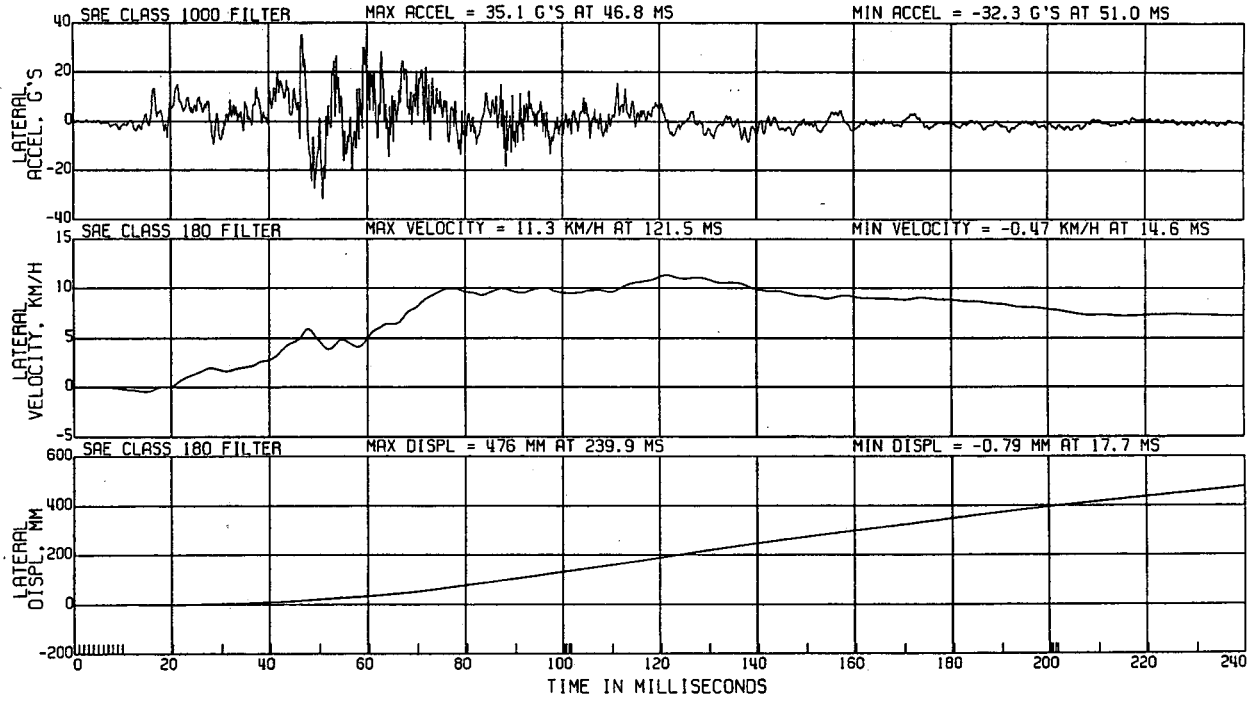
ELEC DATA



Appendix B, plot # **72**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

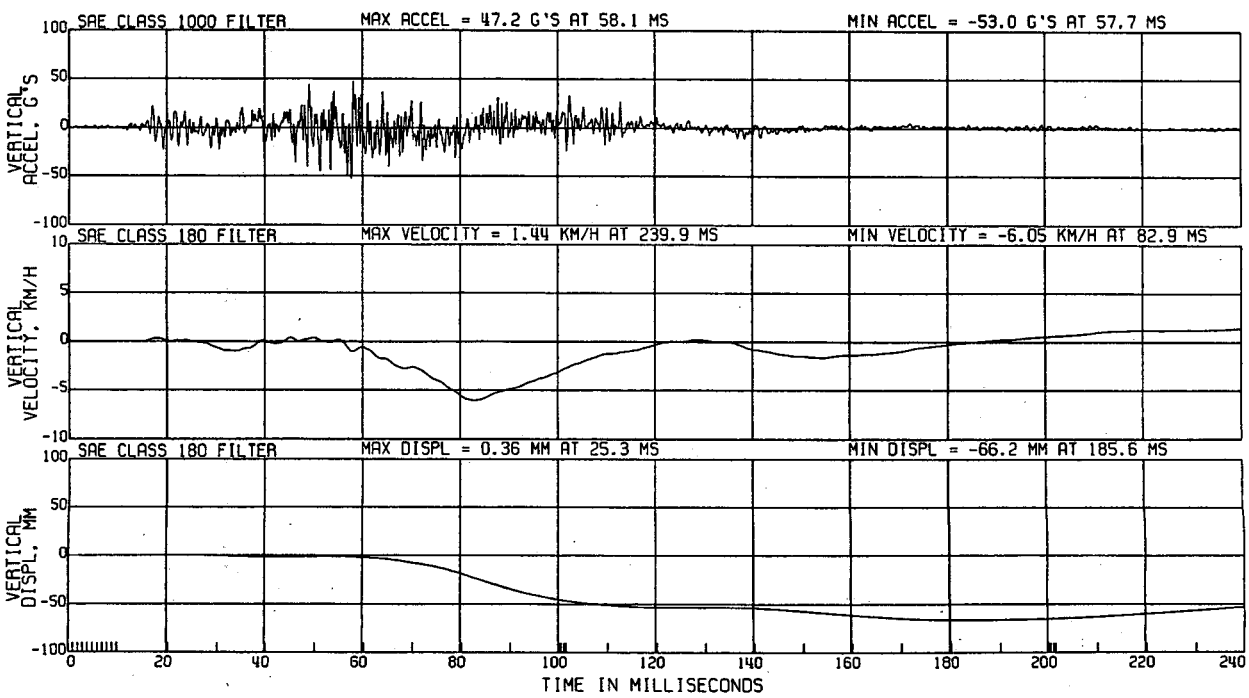
R & D CTR 8V91400 4 DOOR R.REAR ROCKER TEST DATE:07/30/1997
ELEC DATA



Appendix B, plot # **73**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR R.REAR ROCKER TEST DATE:07/30/1997
ELEC DATA

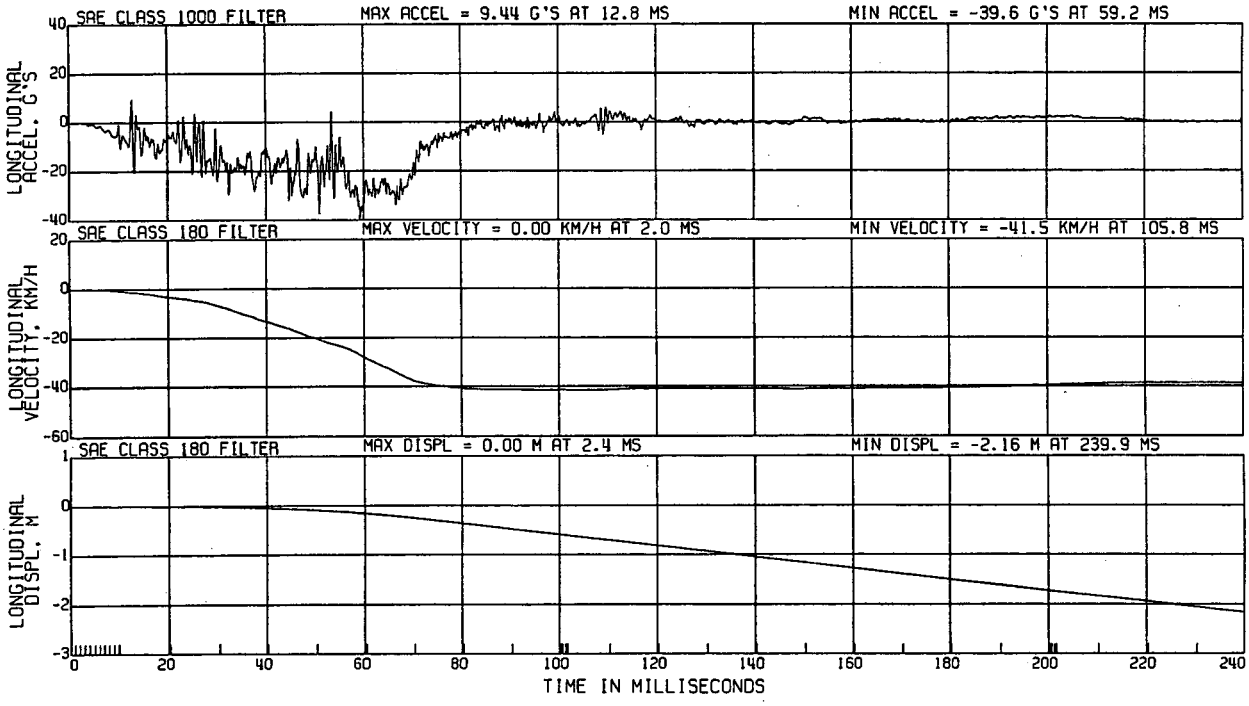


Appendix B, plot # **74**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR AVERAGED REAR ROCKER TEST DATE:07/30/1997

ELEC DATA

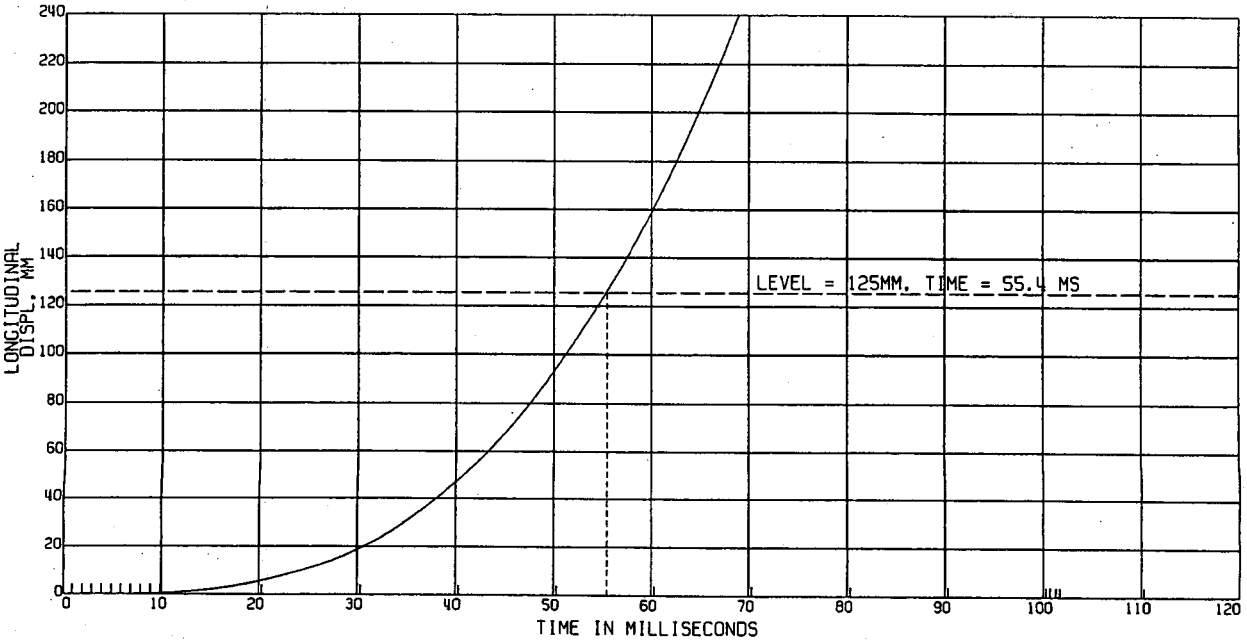


Appendix B, plot # **75**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR COMP. FREE MASS DISP. REL. TO VEHICLE TEST DATE:07/30/1997

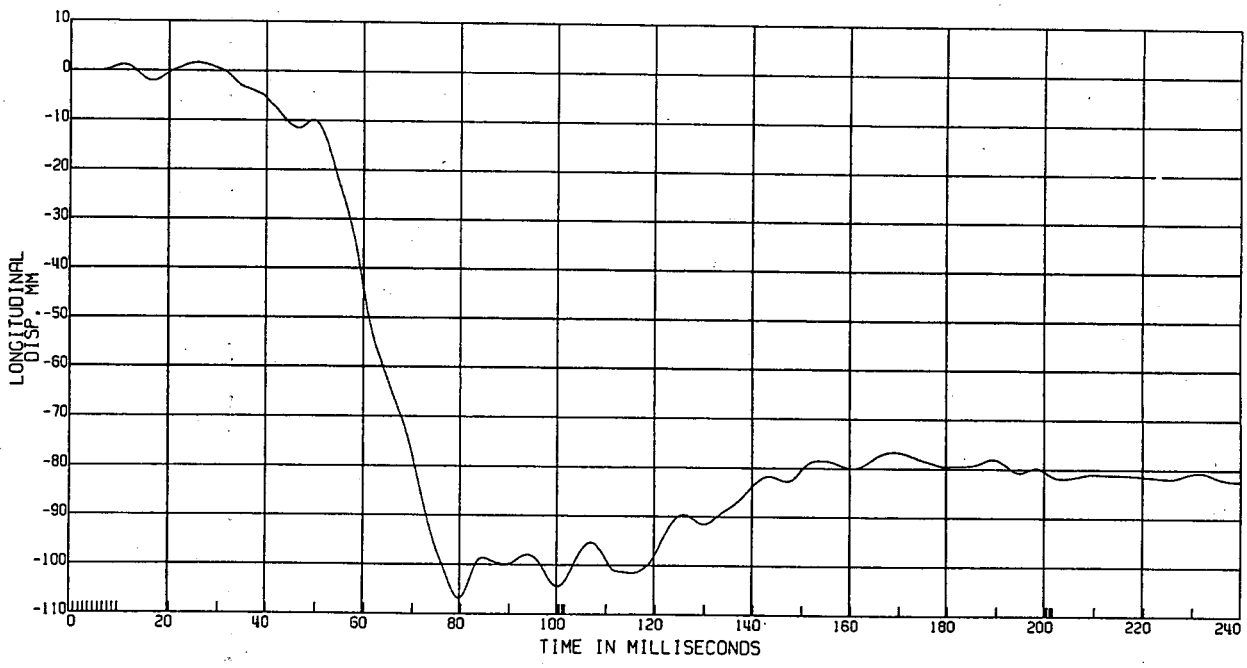
ELEC DATA, SAE CLASS 180



Appendix B, plot # **76**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

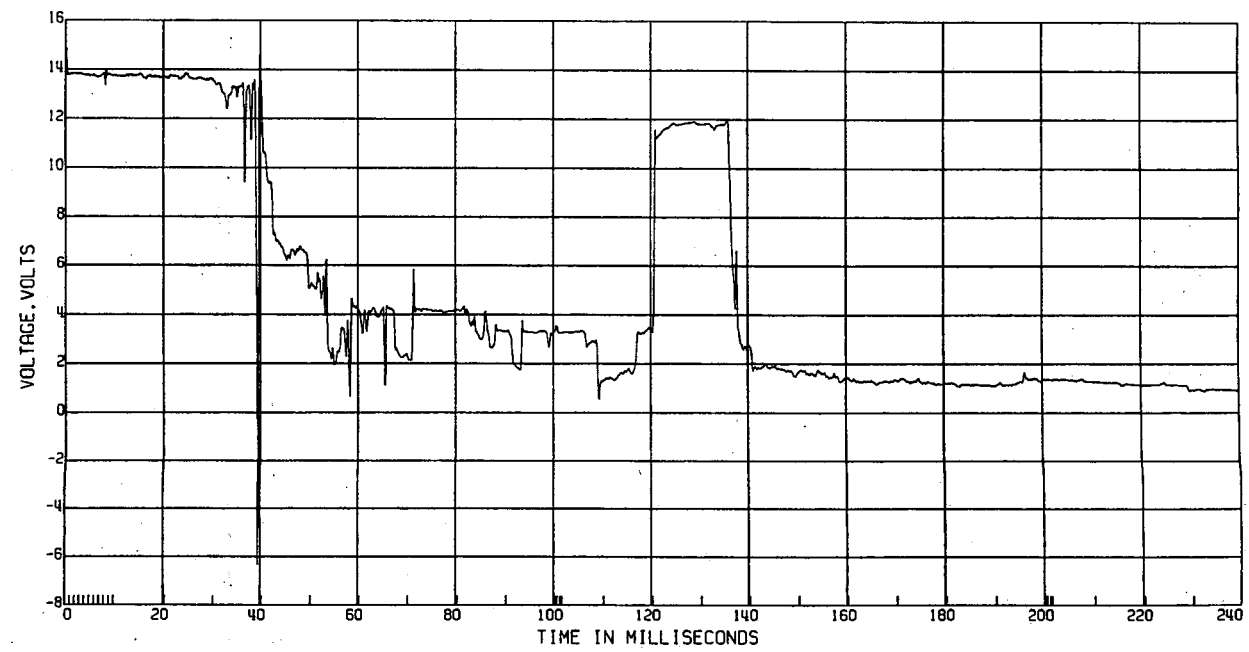
R & D CTR 8V91400 4 DOOR L. TOE PAN DISPL TEST DATE:07/30/1997
ELEC DATA, SAE CLASS 60



Appendix B, plot # **77**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR STARTER VOLTAGE TEST DATE:07/30/1997
ELEC DATA, SAE CLASS 1000

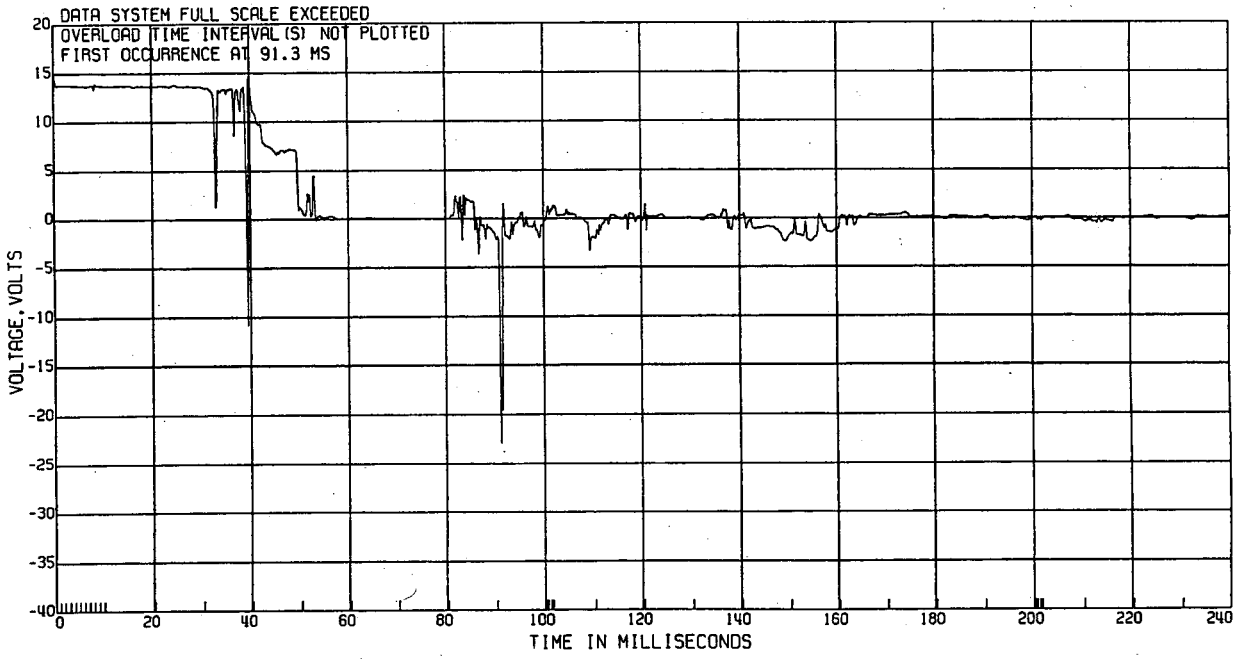


Appendix B, plot # **78**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR BATTERY VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

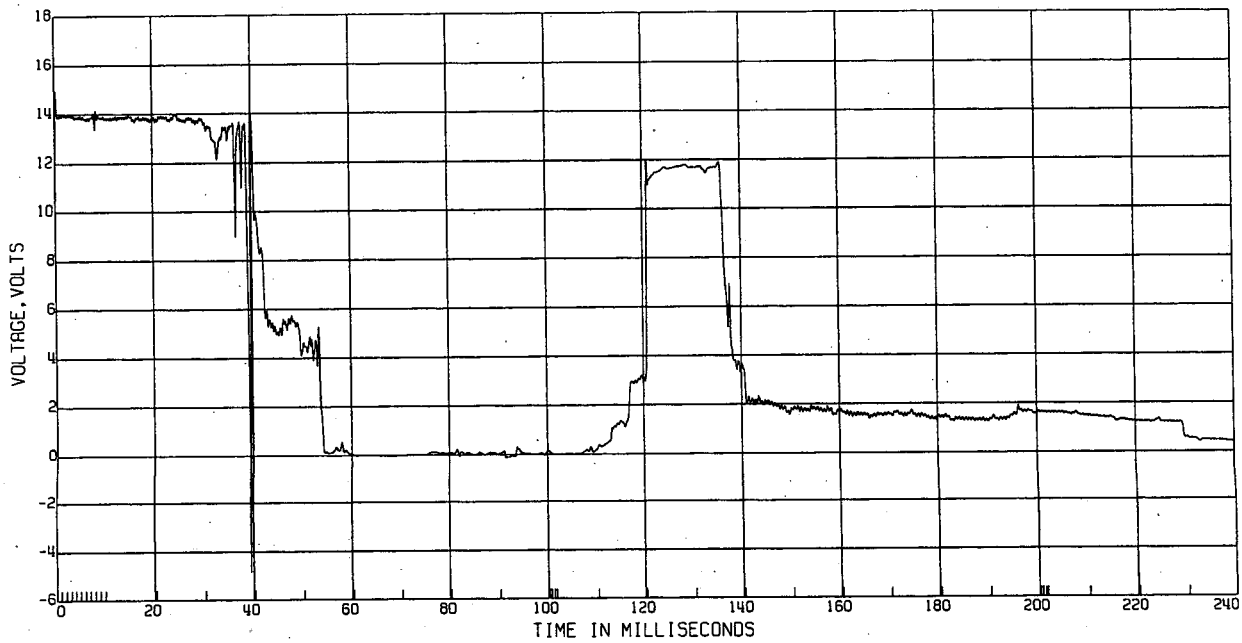


Appendix B, plot # **79**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR ALTERNATOR VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000



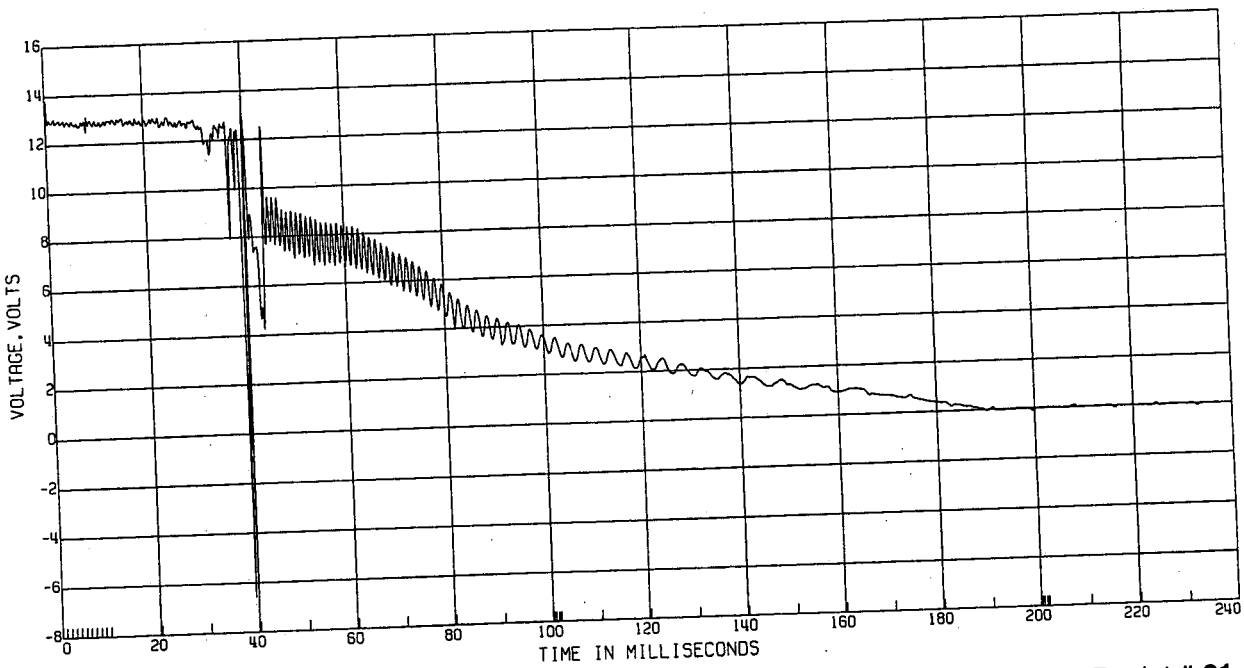
Appendix B, plot # **80**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

FUEL PUMP VOLTAGE

TEST DATE:07/30/1997

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 1000



Appendix B, plot # **81**

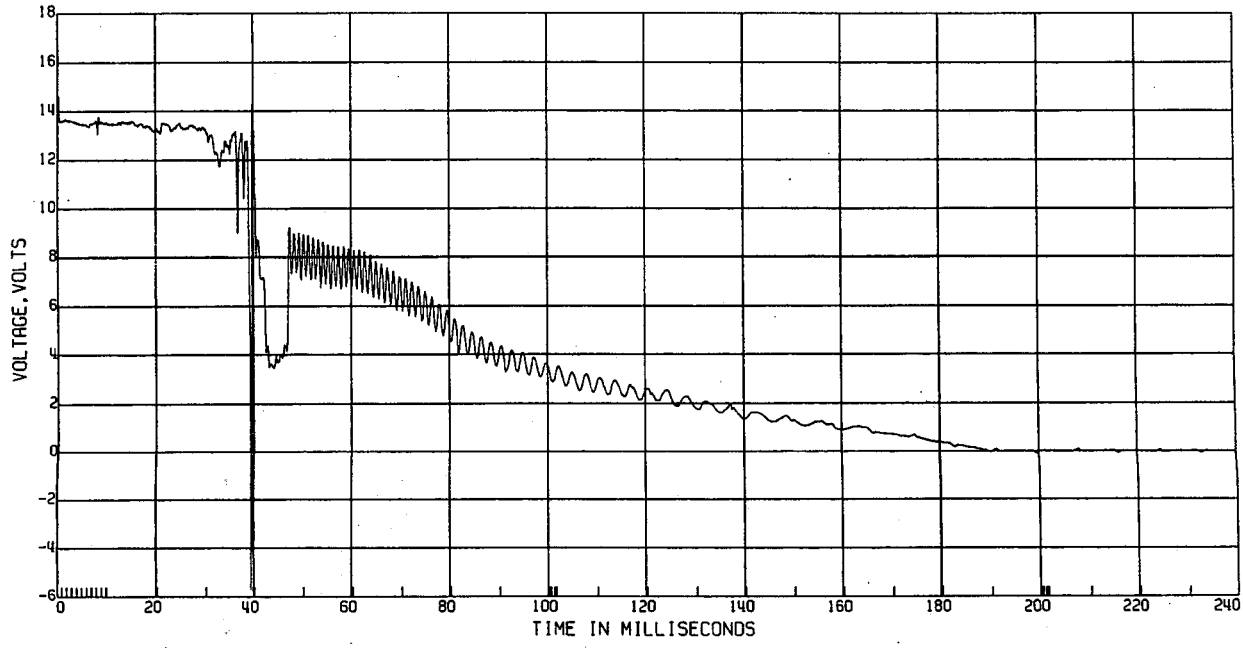
ATT: 2

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

FUEL PUMP SWITCH VOLTAGE

TEST DATE:07/30/1997

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 1000

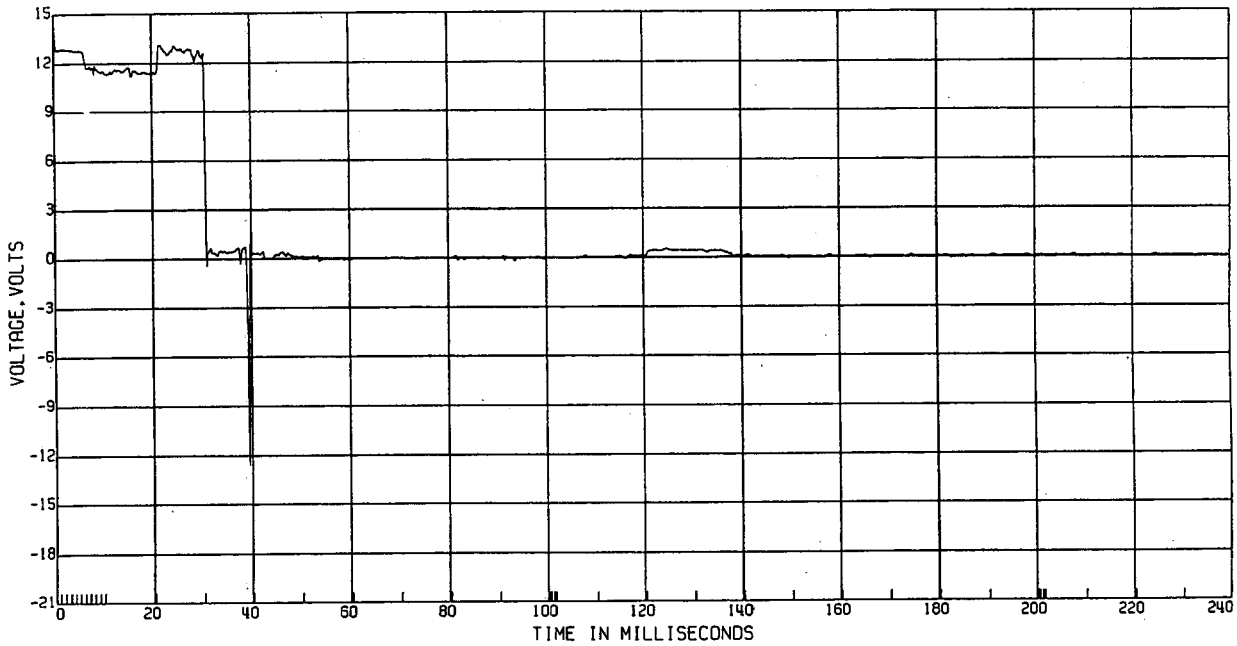


Appendix B, plot # **82**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L. FRT HEADLIGHT-LO BEAM VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

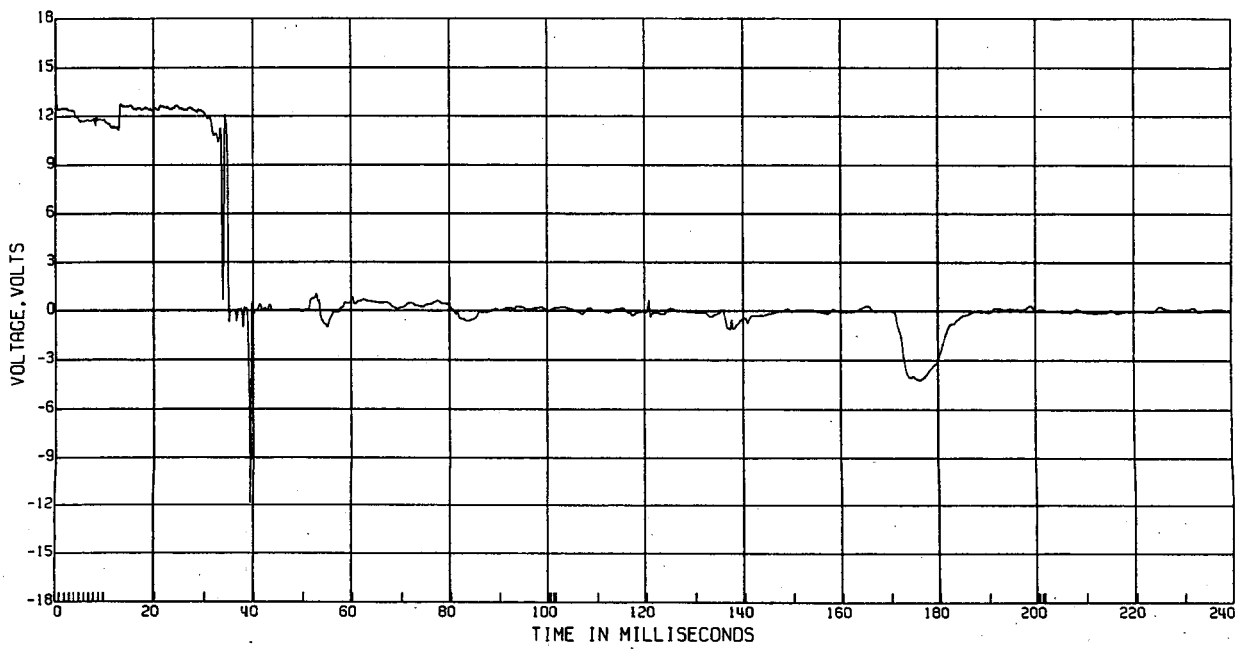


Appendix B, plot # **83**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L. FRT FOG LIGHT VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

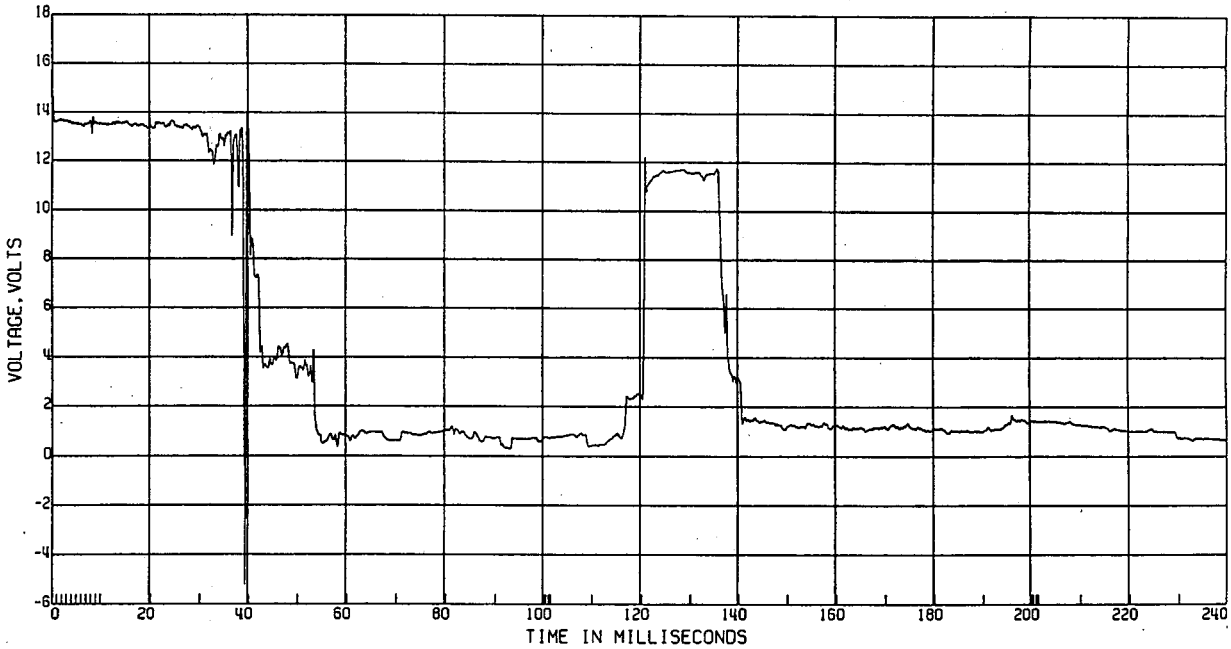


Appendix B, plot # **84**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR IGNITION VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

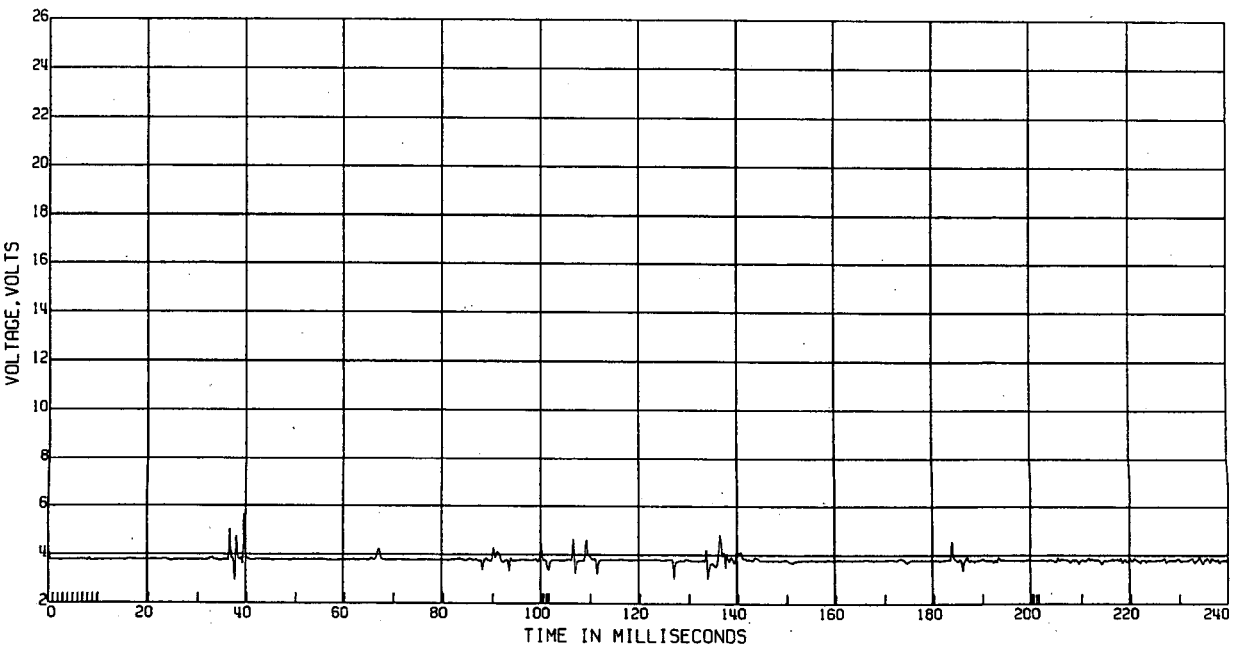


Appendix B, plot # **85**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L. OPTICAL FIRE DETECTOR VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

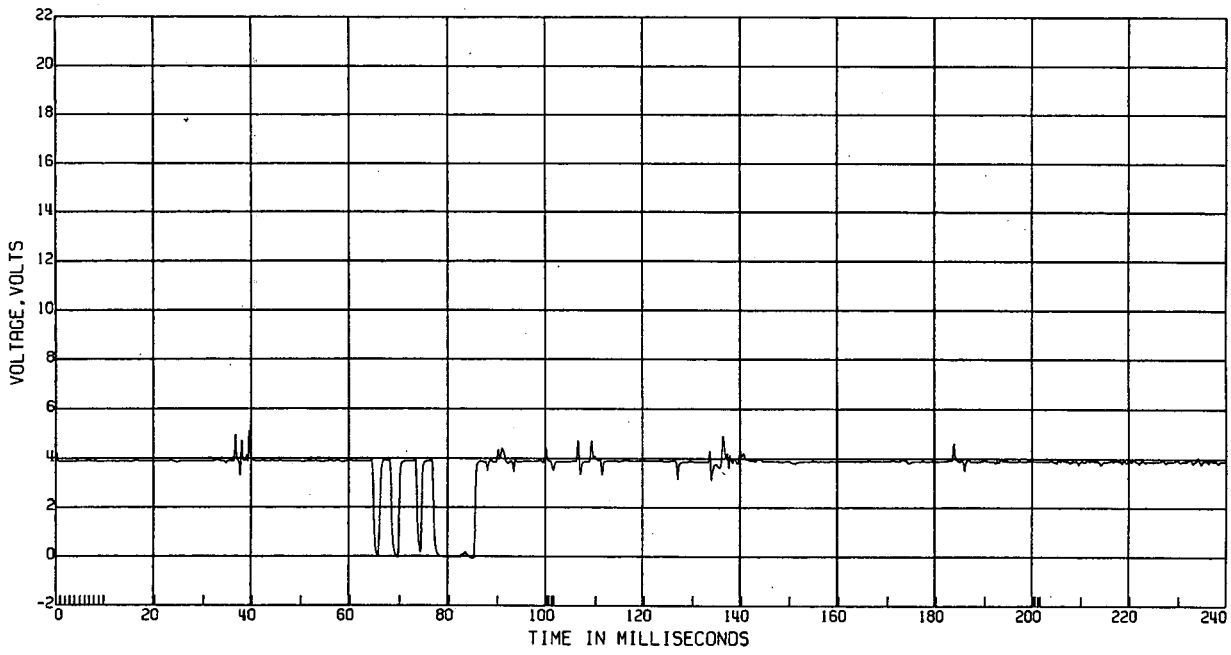


Appendix B, plot # **86**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR R. OPTICAL FIRE DETECTOR VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

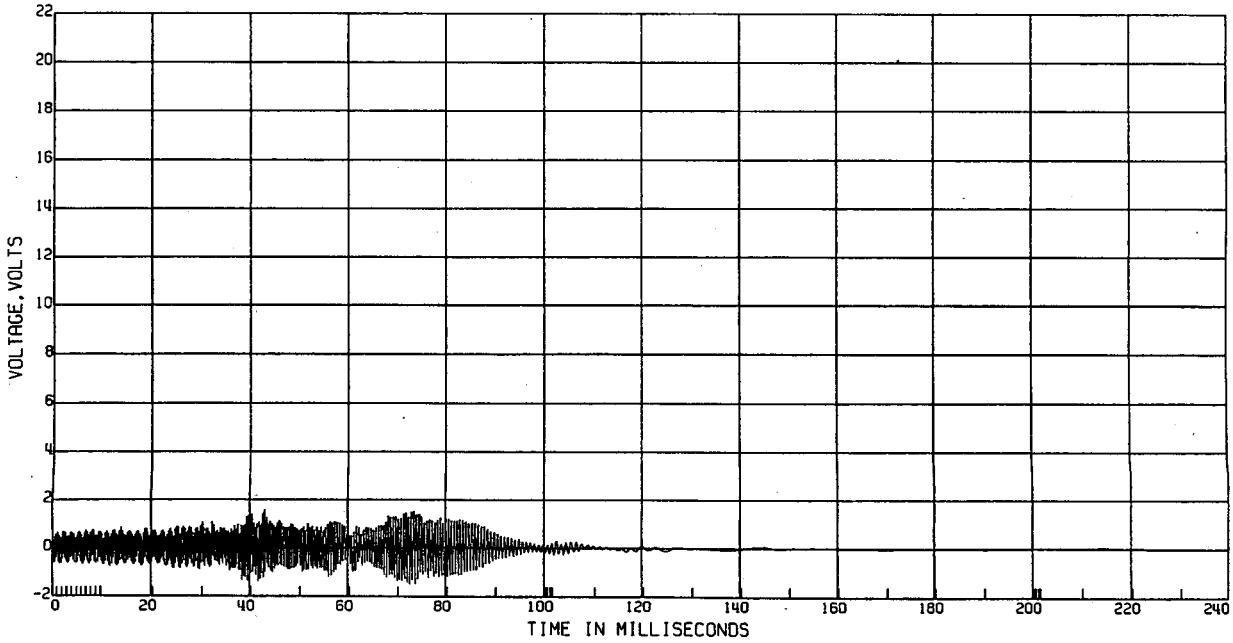


Appendix B, plot # **87**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR ENGINE SPEED-(MP1A) VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

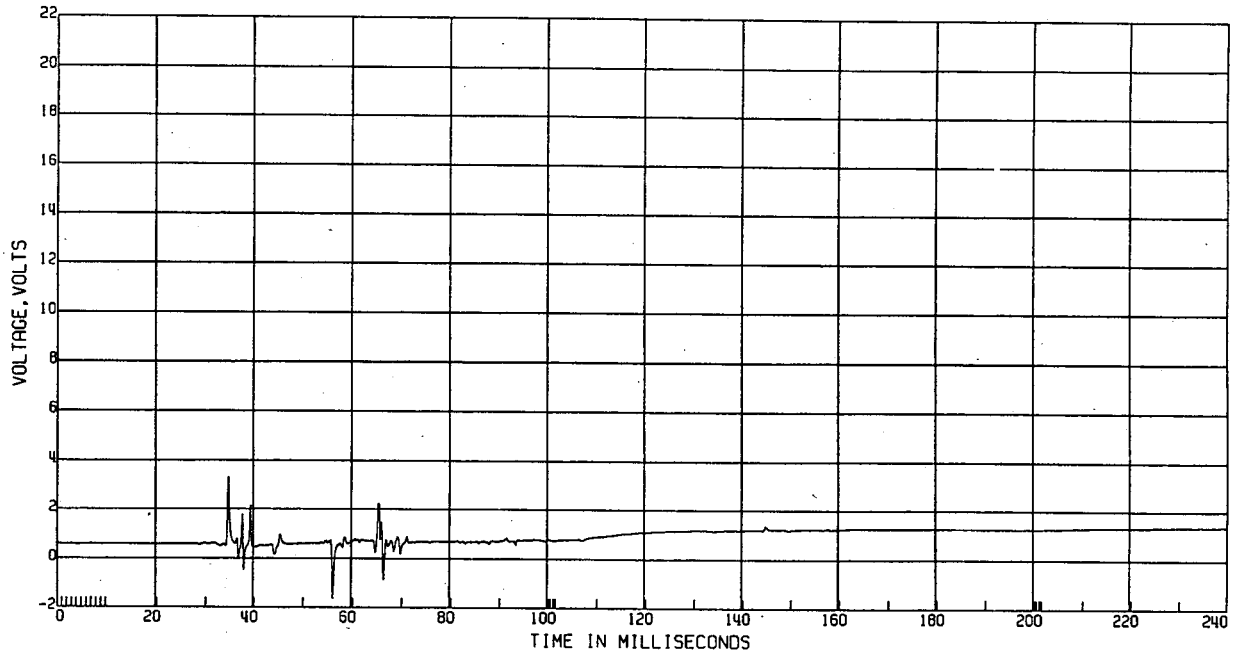


Appendix B, plot # **88**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L. EXHAUST VAPOR (S2) VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

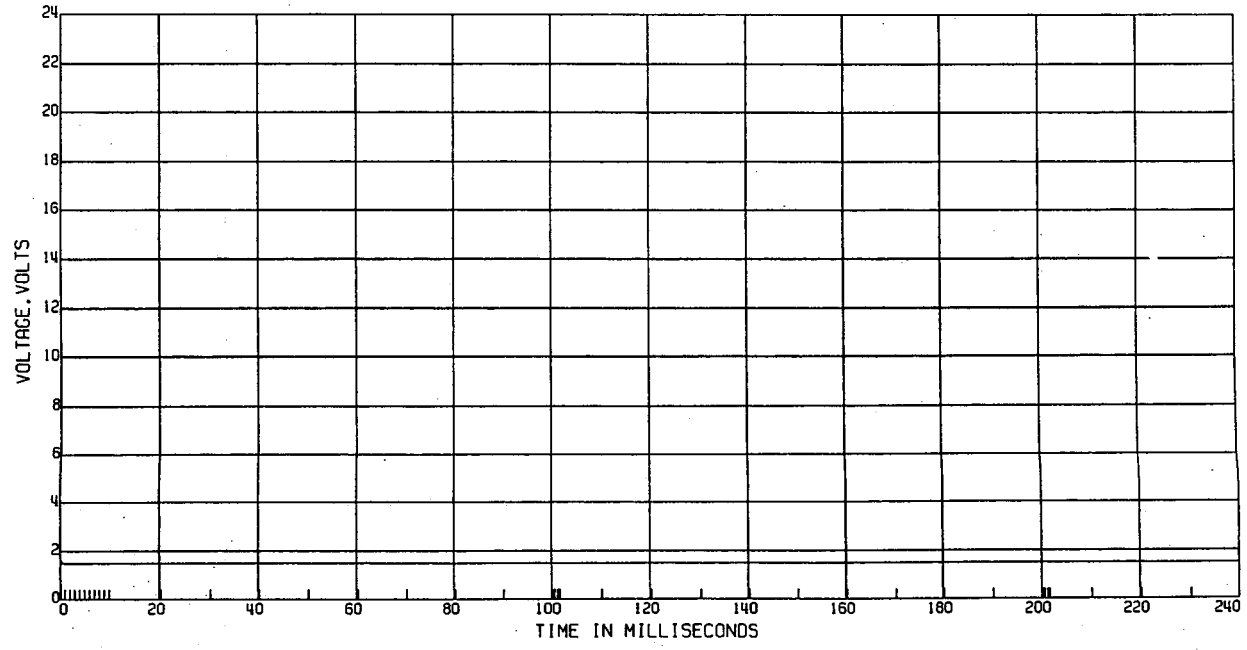


Appendix B, plot # **89**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L. EXHAUST TEMP (T2) VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

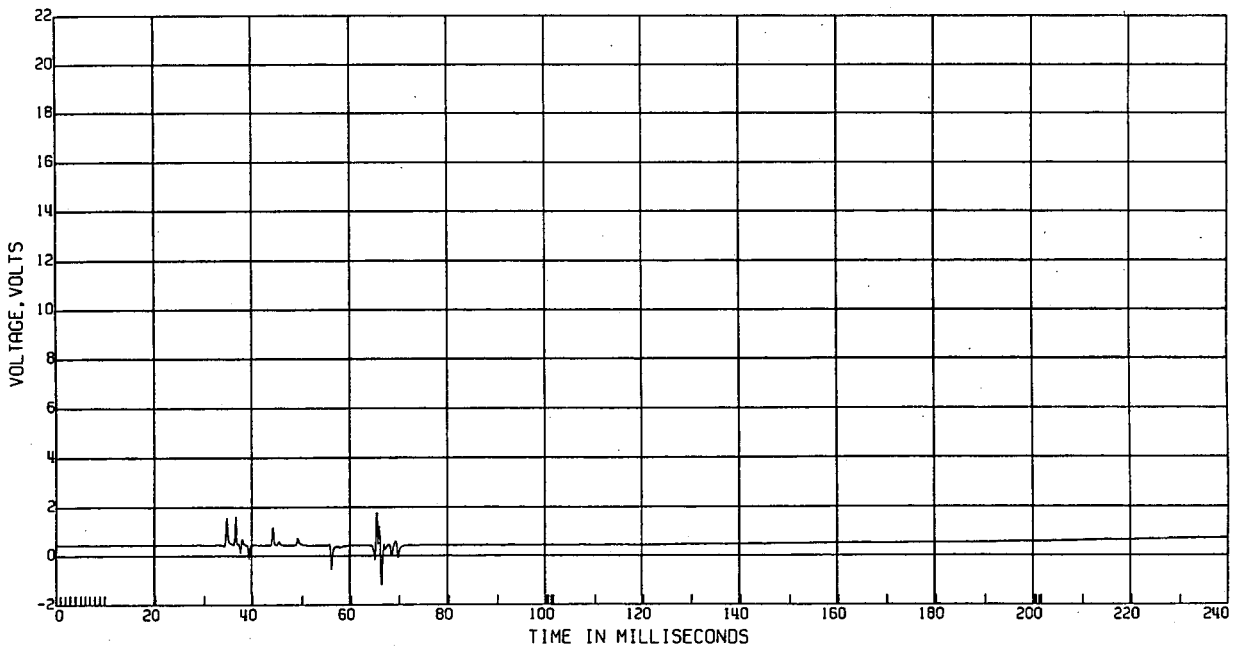


Appendix B, plot # **90**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR R. UPR ENGINE VAPOR(S1) VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

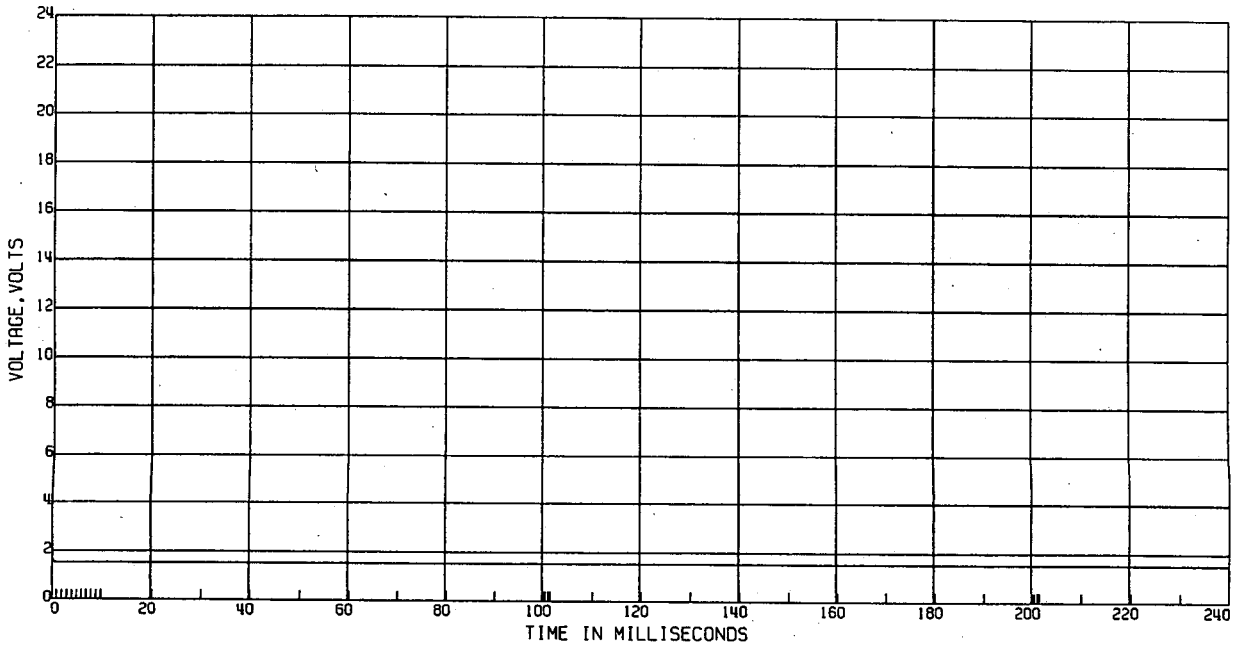


Appendix B, plot # **91**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR R. UPR ENGINE TEMPERATURE(T1) VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

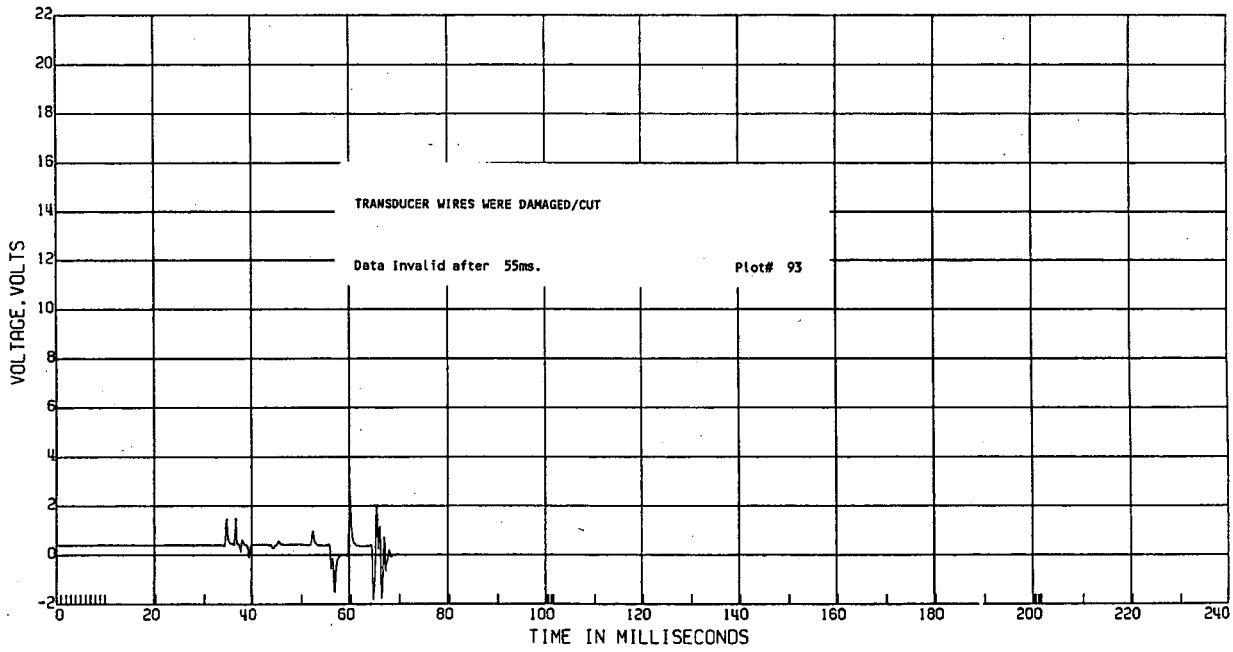


Appendix B, plot # **92**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L. UPR ENGINE VAPOR (S3) VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

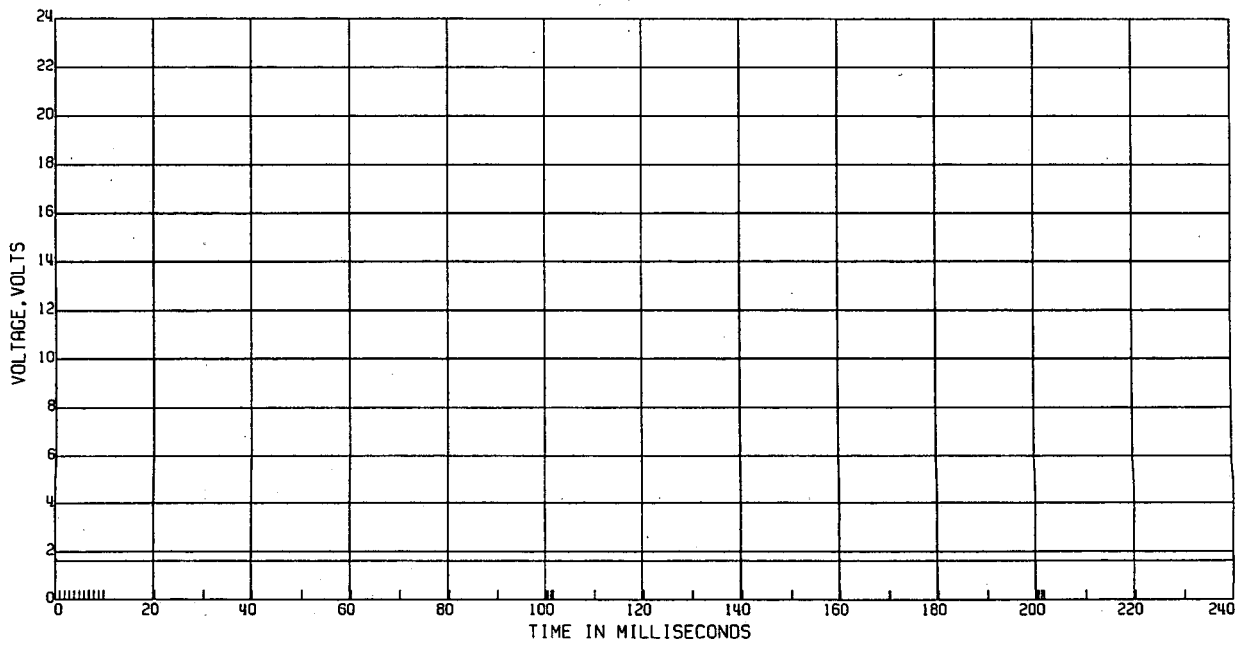


Appendix B, plot # **93**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L. UPR ENGINE TEMPERATURE (T3) VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

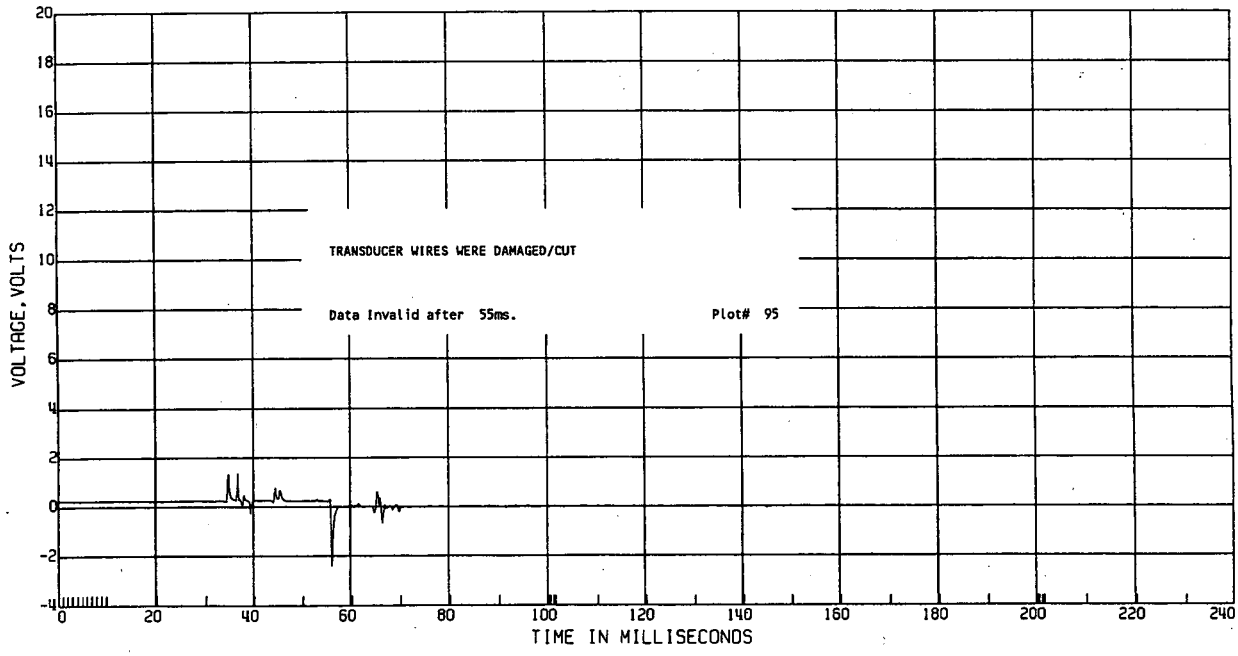


Appendix B, plot # **94**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L. LWR FUEL LINE VAPOR (S4) VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

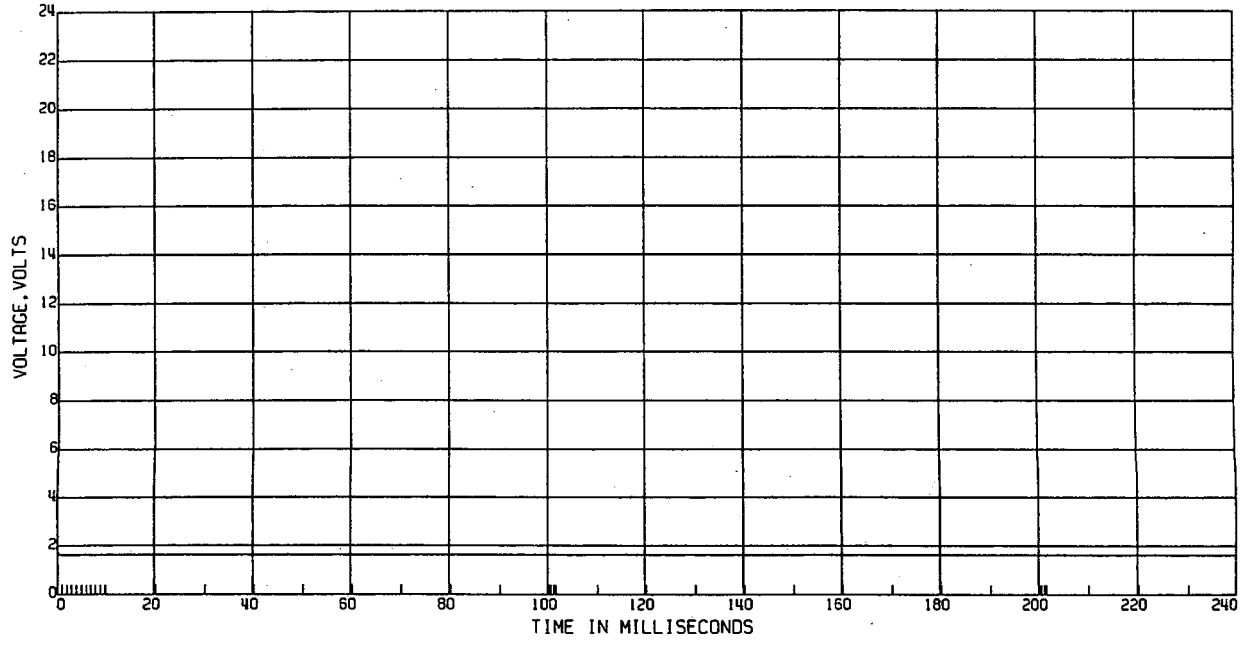


Appendix B, plot # **95**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR L. LWR FUEL LINE TEMP (T4) VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

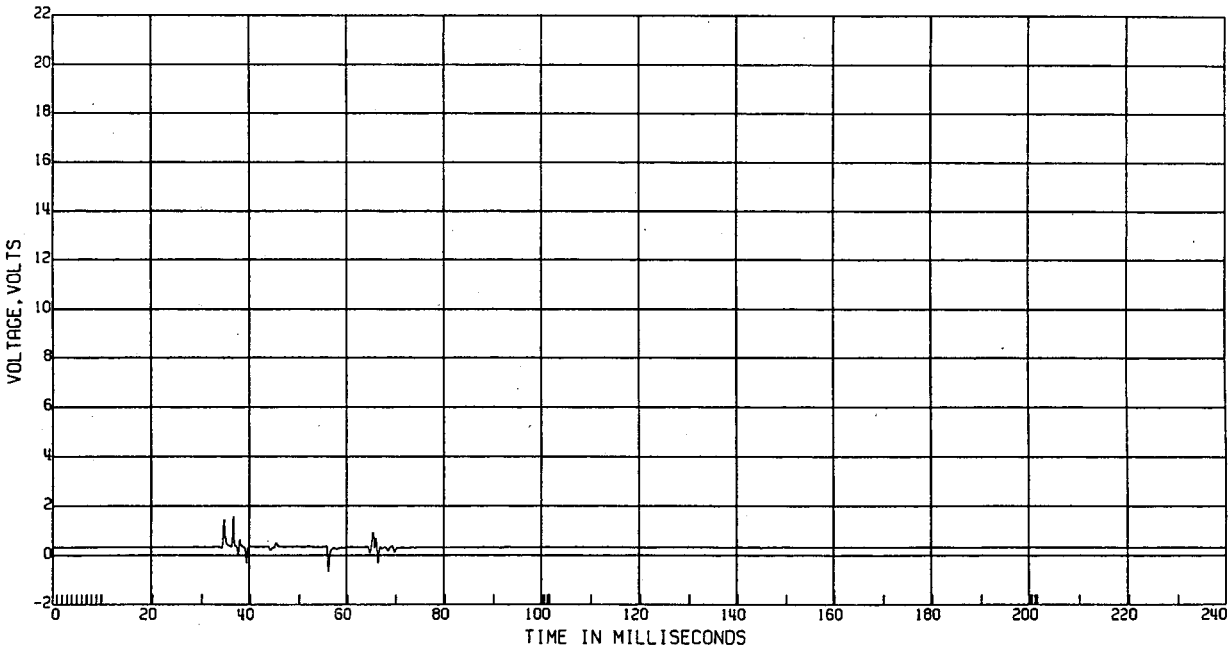


Appendix B, plot # **96**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR CONVERTER VAPOR(S5) VOLTAGE TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

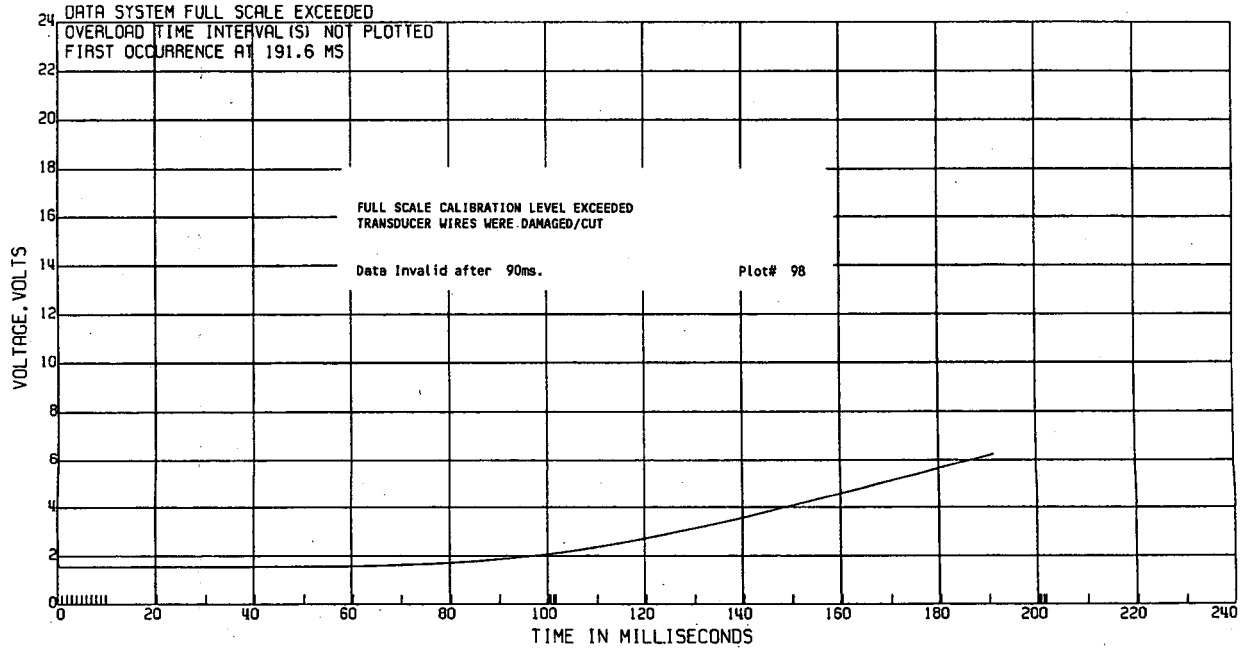


Appendix B, plot # **97**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR CONVERTER TEMPERATURE(T5) VOLTAGE TEST DATE:07/30/1997

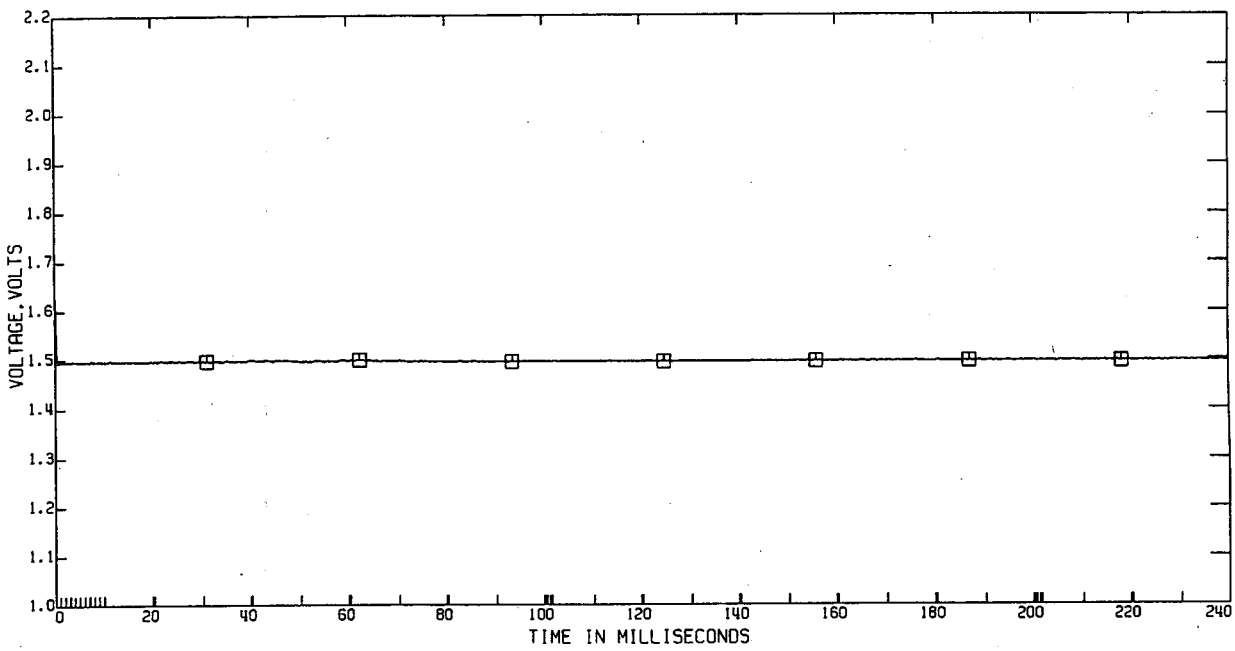
ELEC DATA, SAE CLASS 1000



Appendix B, plot # **98**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4 KM/H
R & D CTR 8V91400 4 DOOR TEST DATE:07/30/1997
, ELEC DATA, SAE CLASS 1000

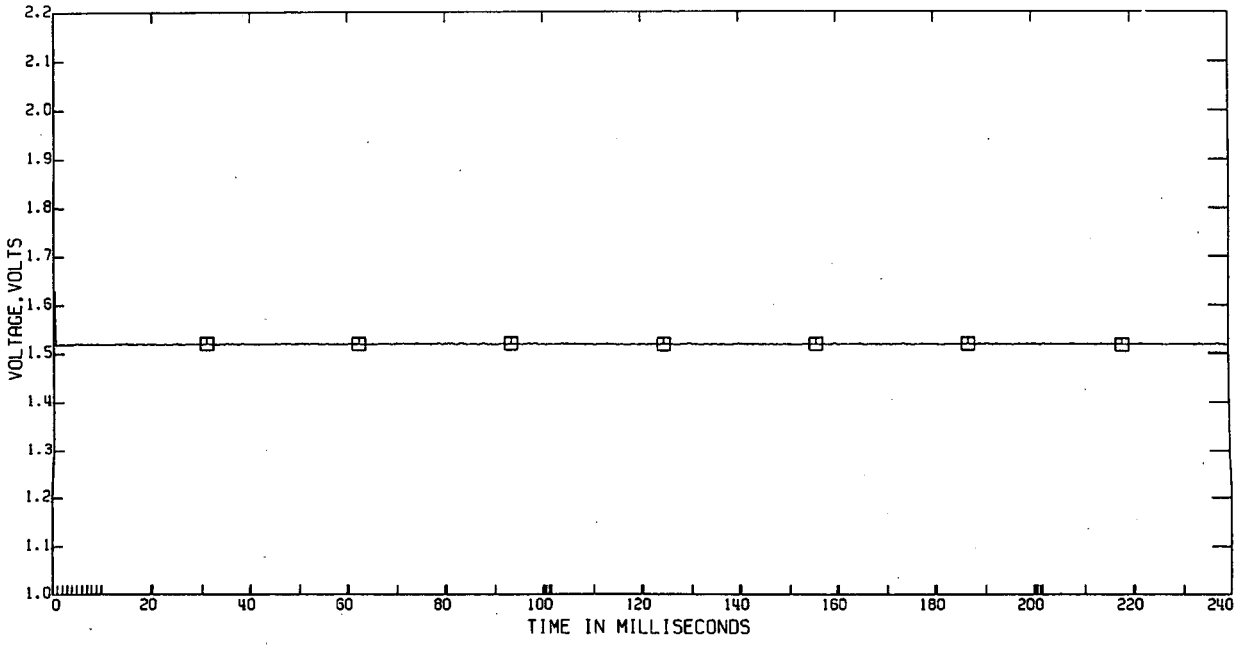
[1] L. EXHAUST TEMP (T2) VOLTAGE



Appendix B, plot # **99**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4 KM/H
R & D CTR 8V91400 4 DOOR TEST DATE:07/30/1997
, ELEC DATA, SAE CLASS 1000

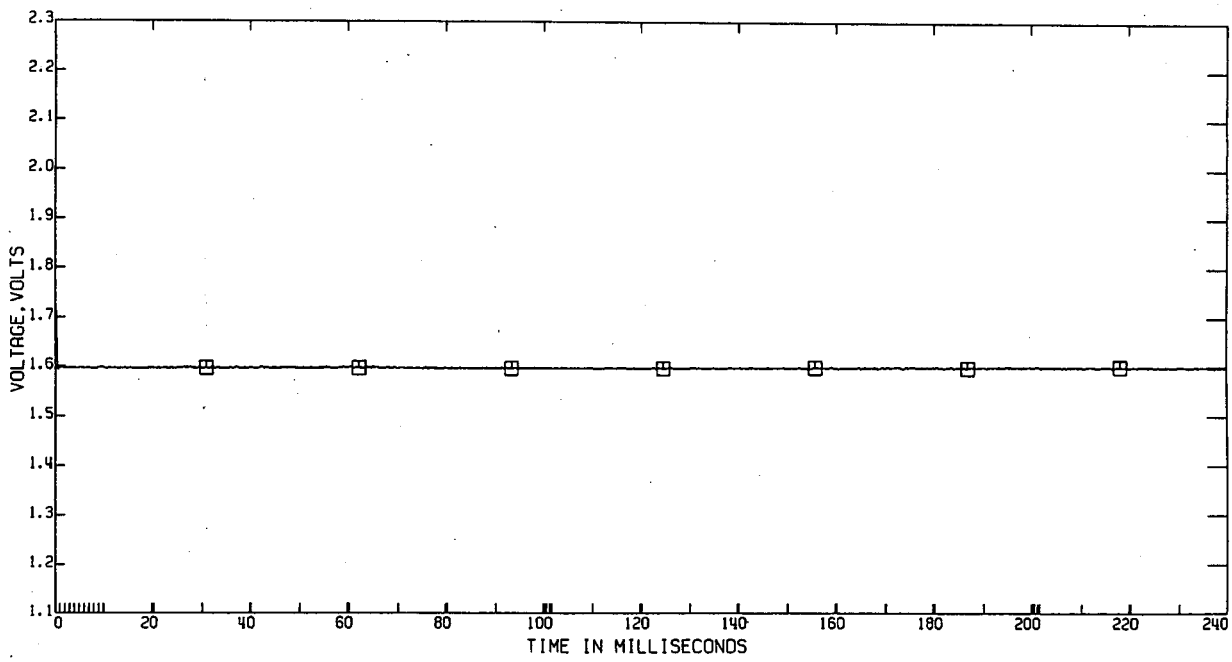
[1] R. UPR ENGINE TEMPERATURE (T1) VOLTAGE



Appendix B, plot # **100**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4 KM/H
R & D CTR 8V9140D 4 DOOR
, ELEC DATA, SAE CLASS 1000
TEST DATE:07/30/1997

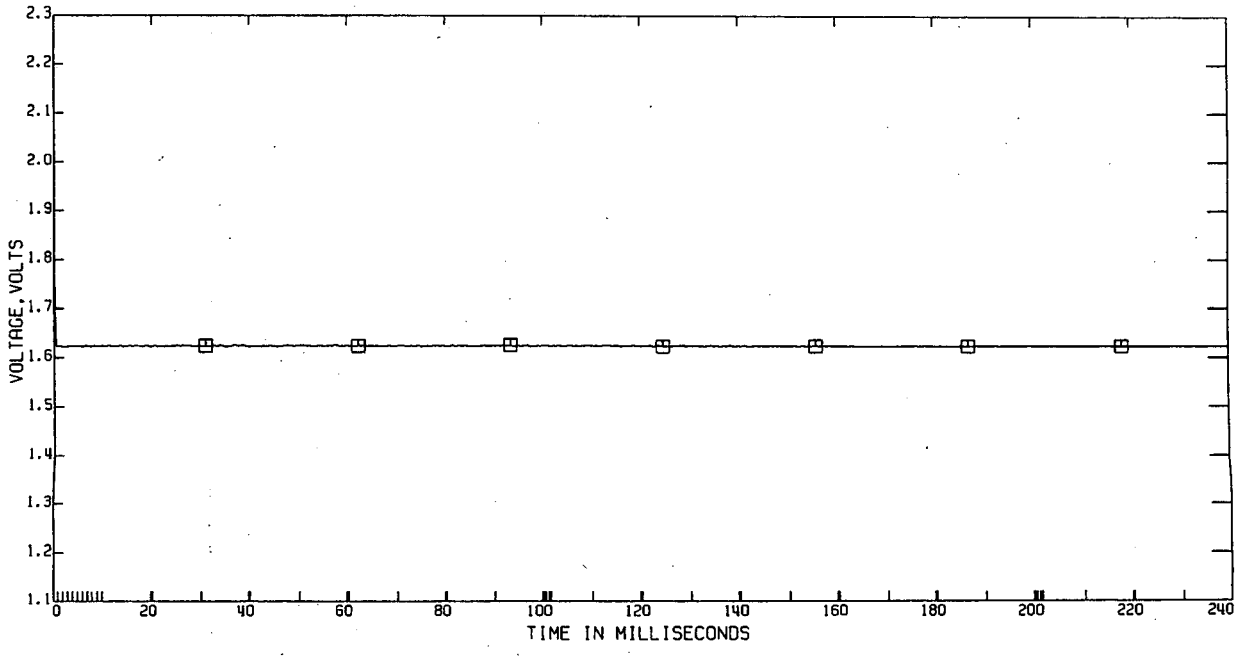
[1] L. UPR ENGINE TEMPERATURE (T3) VOLTAGE



Appendix B, plot # **101**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4 KM/H
R & D CTR 8V9140D 4 DOOR
, ELEC DATA, SAE CLASS 1000
TEST DATE:07/30/1997

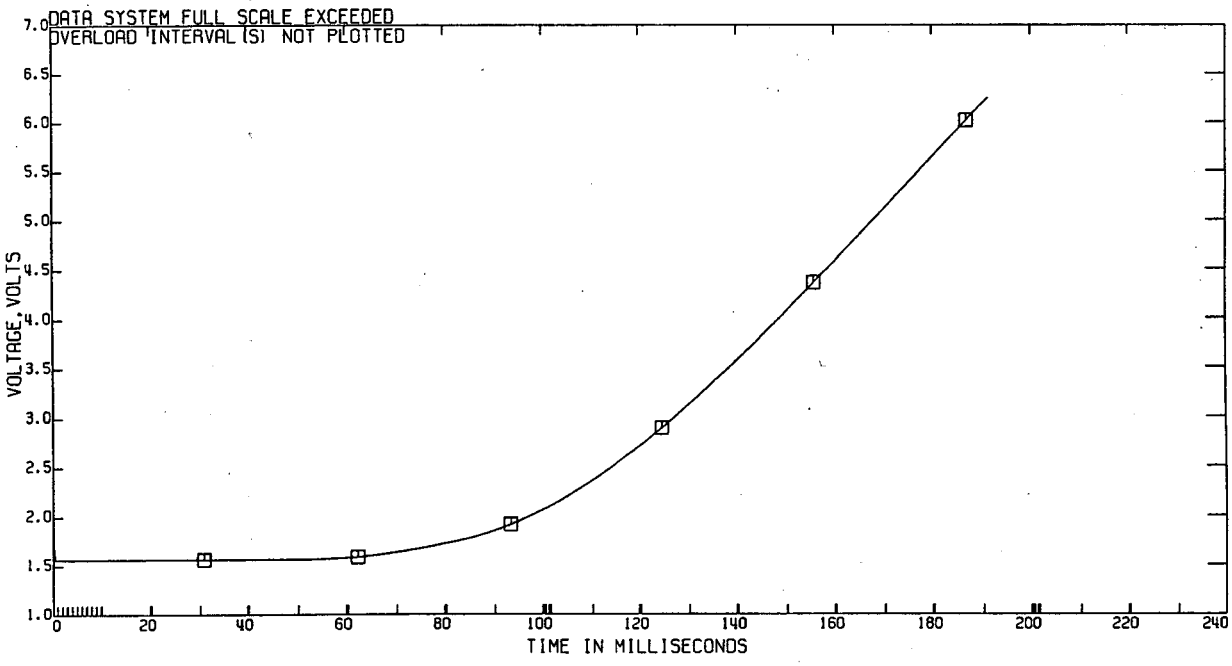
[1] L. LWR FUEL LINE TEMP (T4) VOLTAGE



Appendix B, plot # **102**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4 KM/H
R & D CTR 8V9140D 4 DOOR
, ELEC DATA, SAE CLASS 1000
TEST DATE:07/30/1997

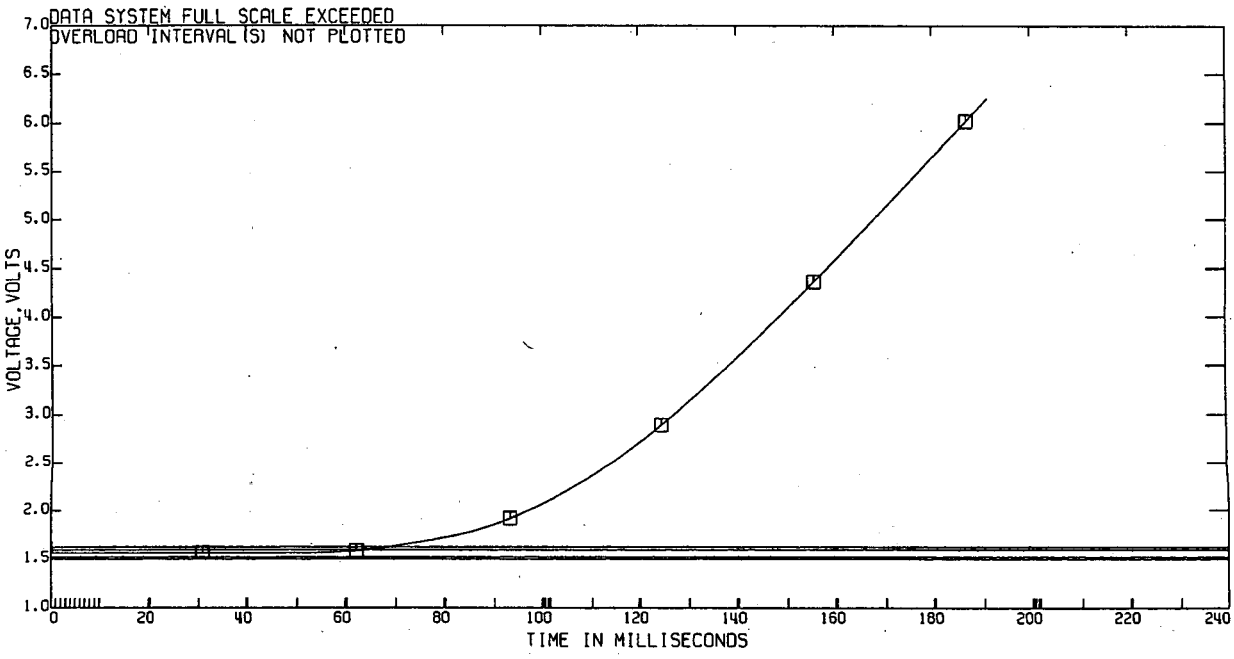
CONVERTER TEMPERATURE (T5) VOLTAGE



Appendix B, plot # **103**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4 KM/H
R & D CTR 8V9140D 4 DOOR
TEST DATE:07/30/1997

CONVERTER TEMP (T5) VOLTAGE	ELEC DATA, SAE CLASS 1000
L. EXHAUST TEMP (T2) VOLTAGE	ELEC DATA, NO FILTER
R. UPR ENGINE TEMP (T1) VOLTAGE	ELEC DATA, NO FILTER
L. UPR ENGINE TEMP (T3) VOLTAGE	ELEC DATA, NO FILTER
L. LWR FUEL LINE TEMP (T4) VOLTAGE	ELEC DATA, NO FILTER



Appendix B, plot # **104**

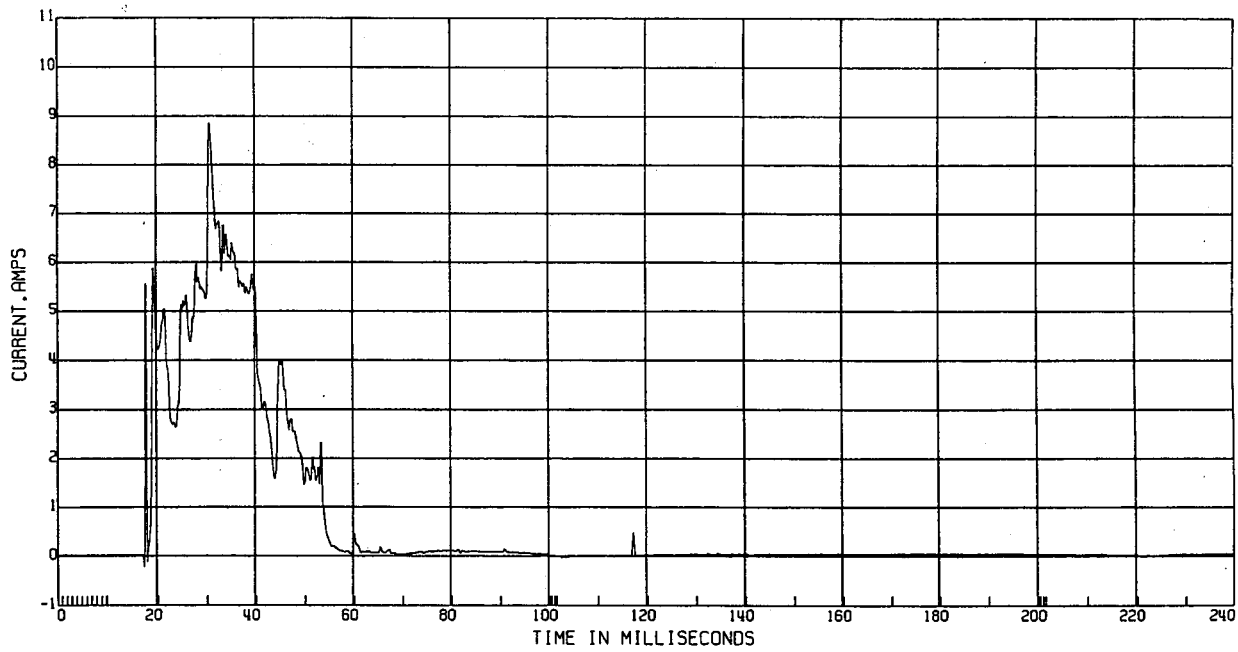
C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR

L. WHEEL BAG CURRENT

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000



Appendix B, plot # **105**

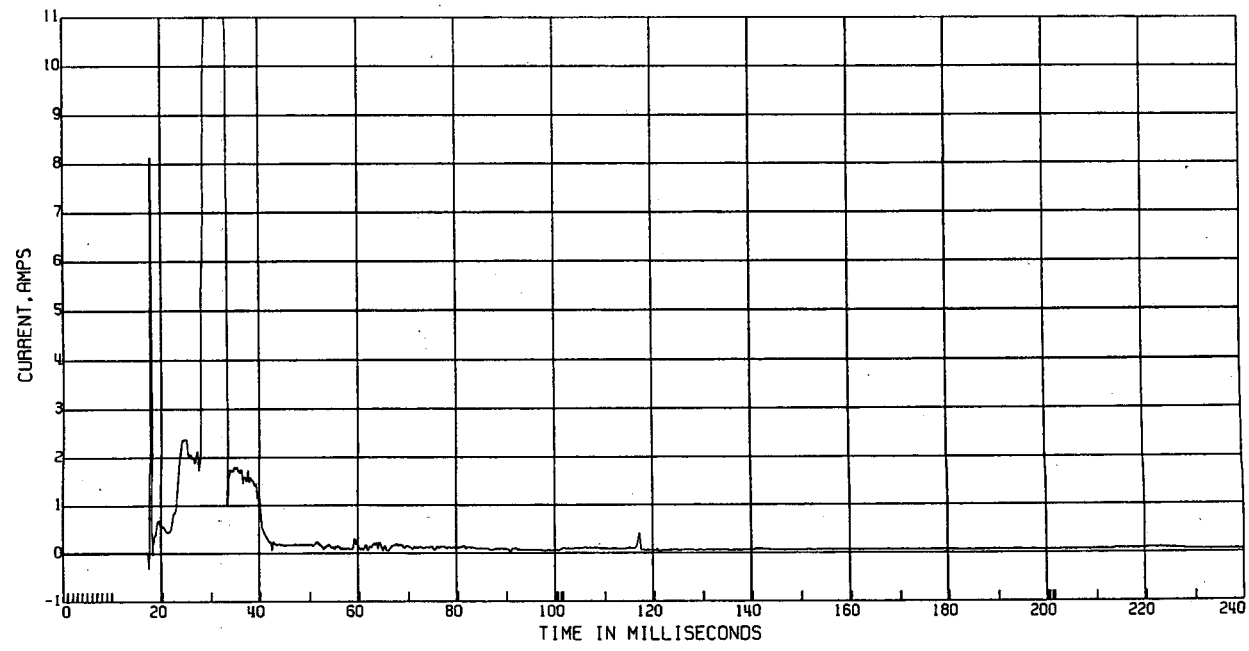
C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR

R. I/P BAG CURRENT

TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

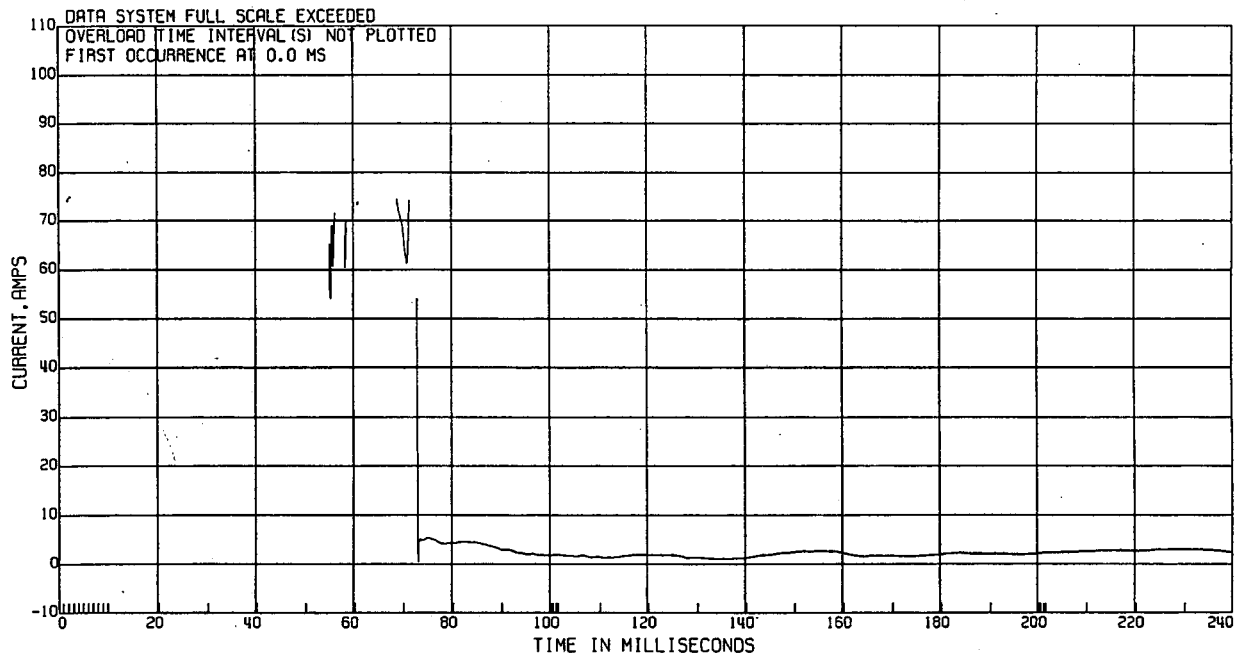


Appendix B, plot # **106**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR PDB CURRENT TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

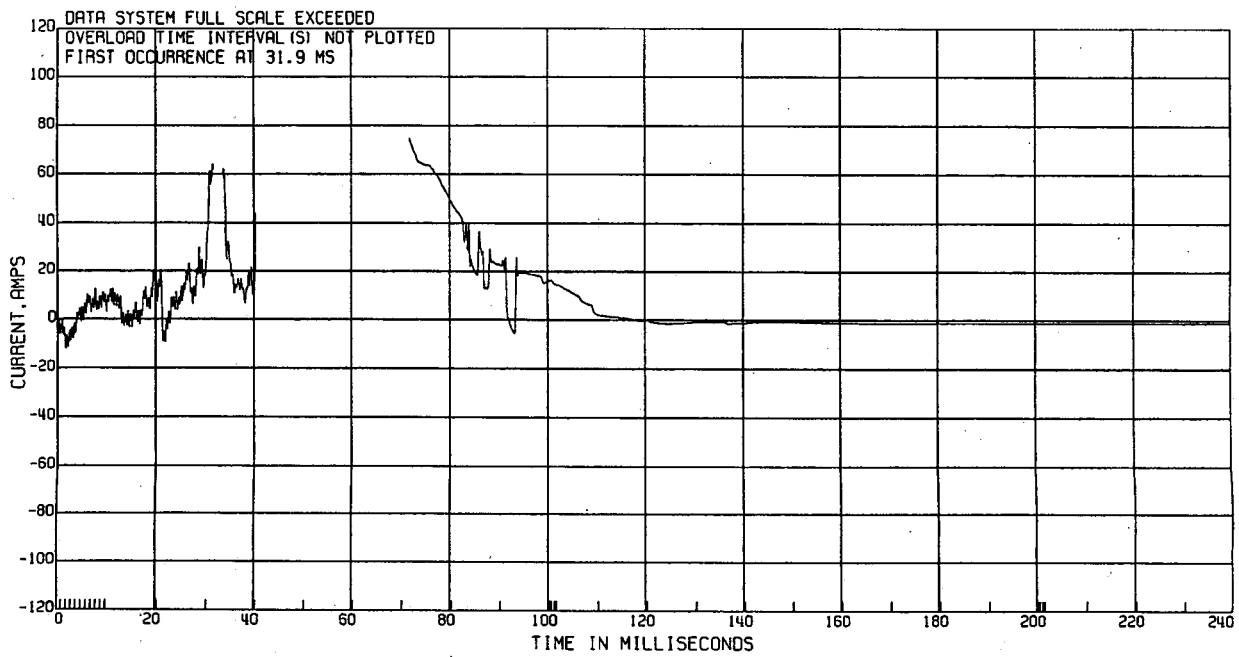


Appendix B, plot # **107**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR STARTER AND B+ CURRENT TEST DATE:07/30/1997

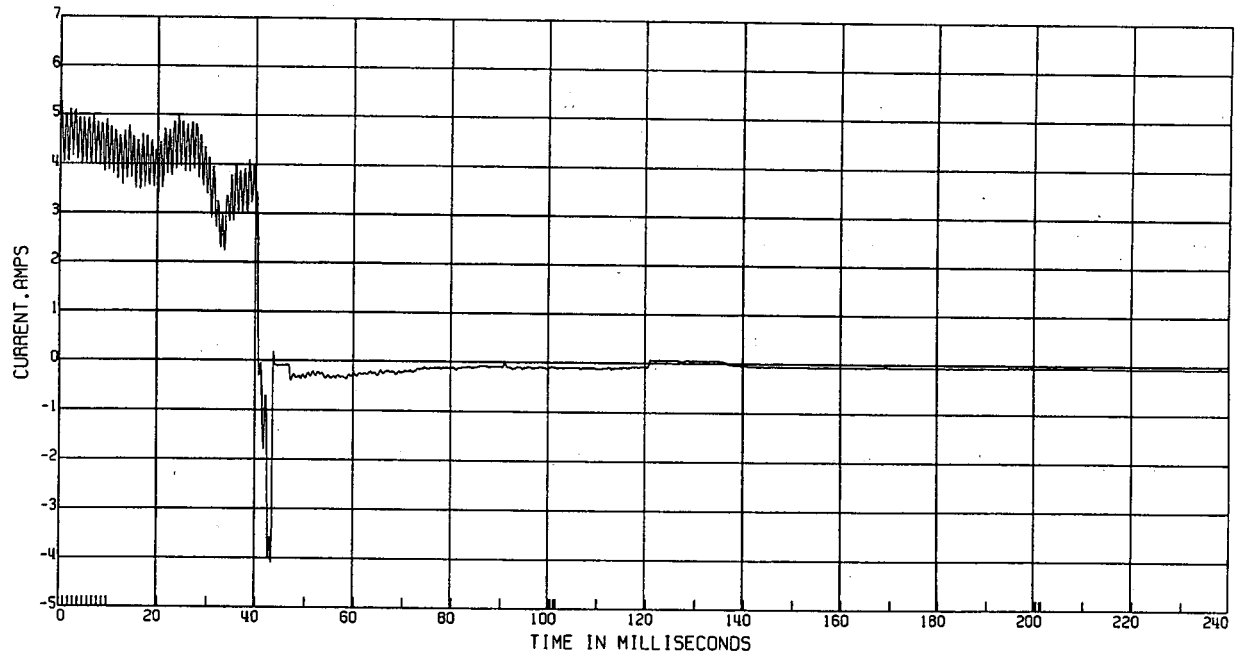
ELEC DATA, SAE CLASS 1000



Appendix B, plot # **108**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

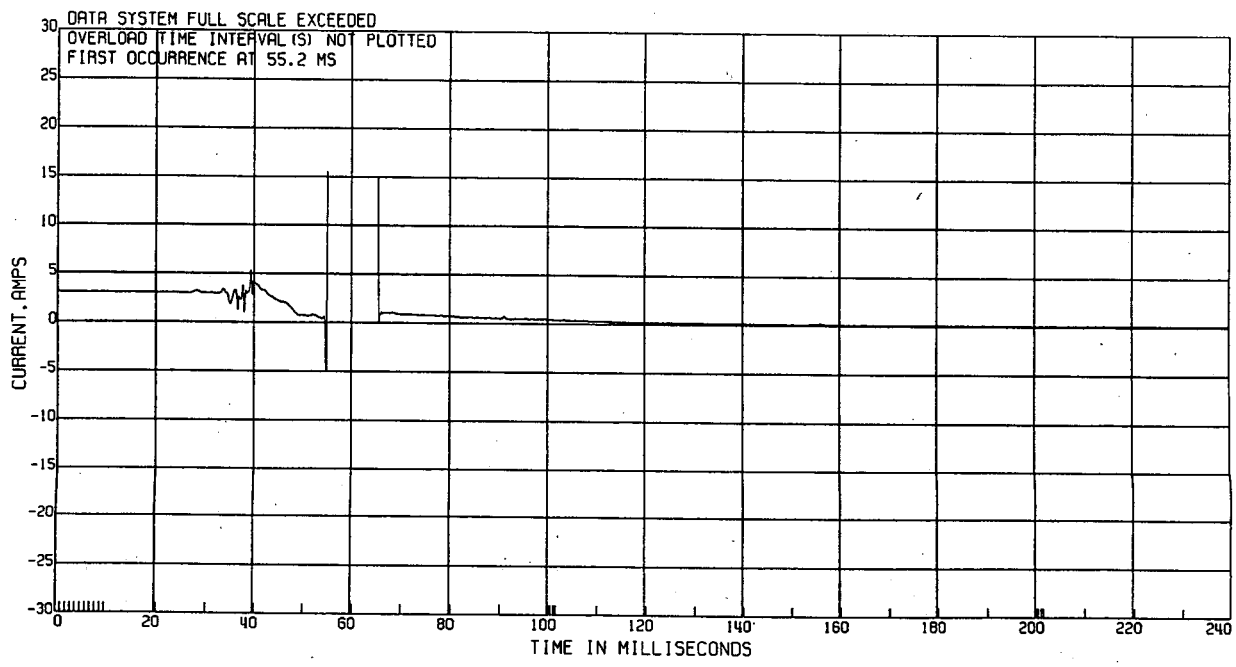
R & D CTR 8V91400 4 DOOR FUEL PUMP CURRENT TEST DATE:07/30/1997
ELEC DATA, SAE CLASS 1000



Appendix B, plot # **109**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR A/C CLUTCH CURRENT TEST DATE:07/30/1997
ELEC DATA, SAE CLASS 1000

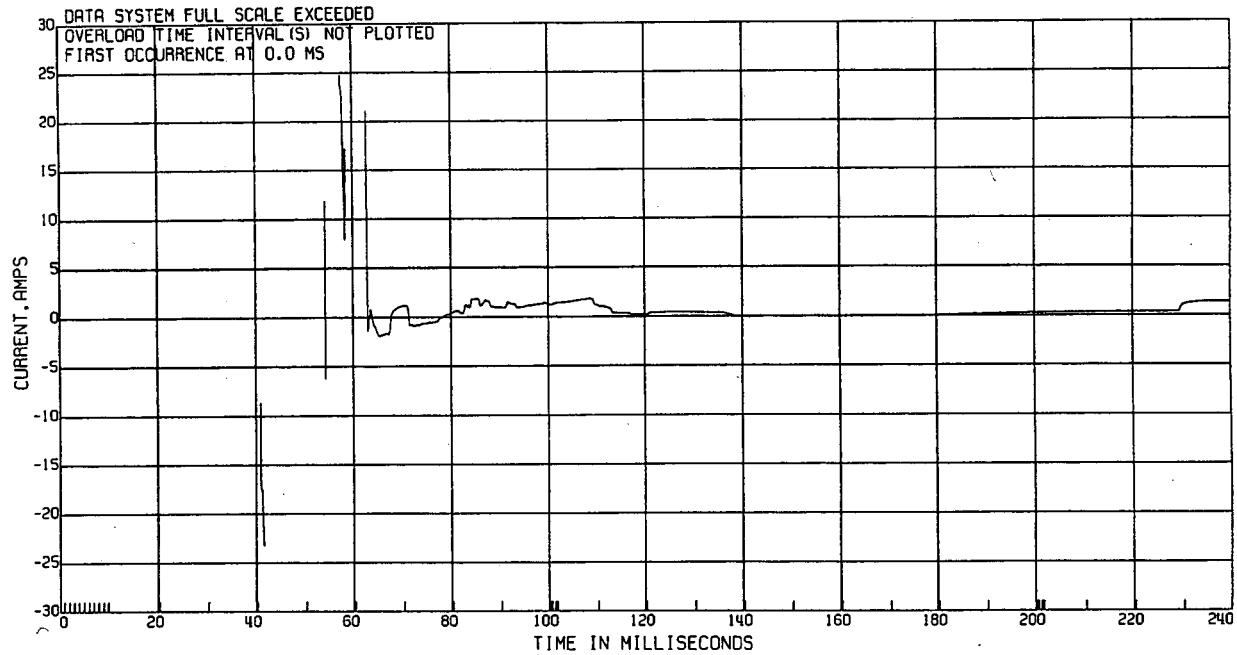


Appendix B, plot # **110**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR ALTERNATOR CABLE #1 CURRENT TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

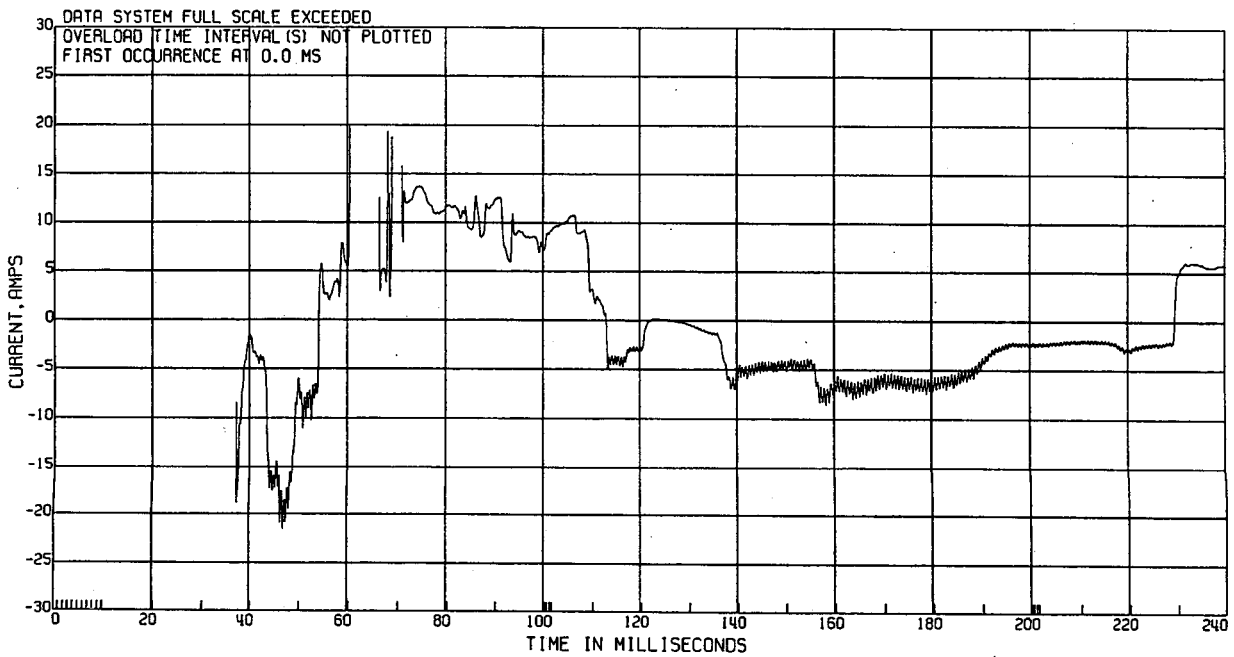


Appendix B, plot # **111**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR ALTERNATOR CABLE #2 CURRENT TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

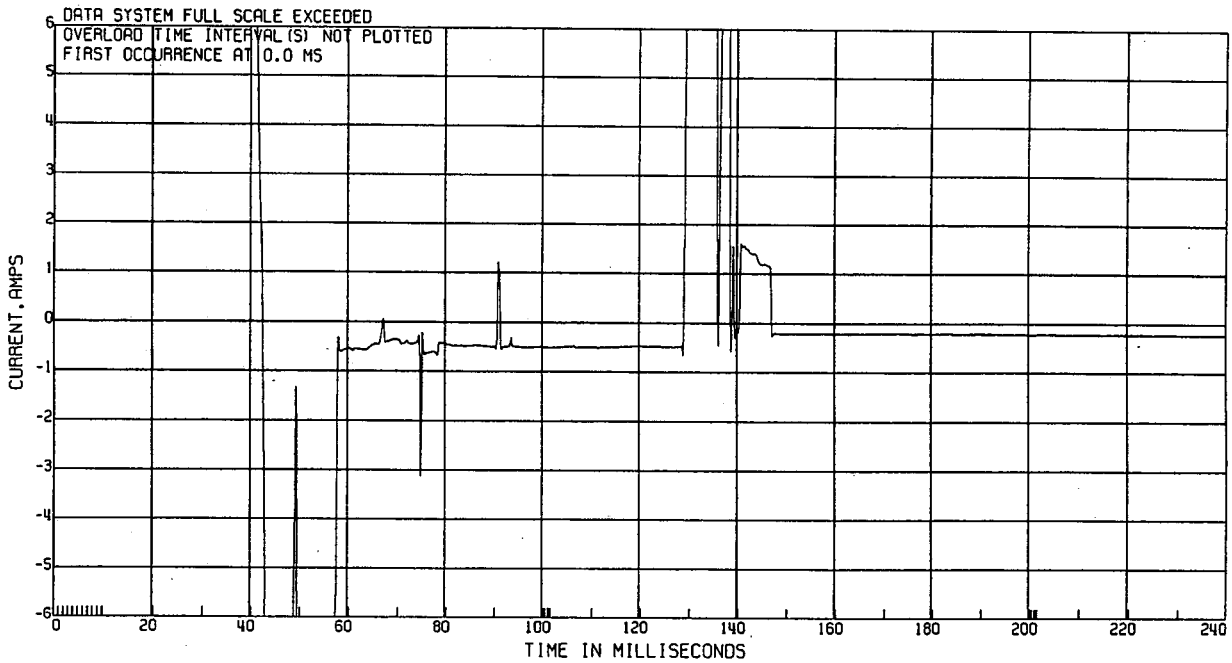


Appendix B, plot # **112**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR HVAC BLOWER CURRENT TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

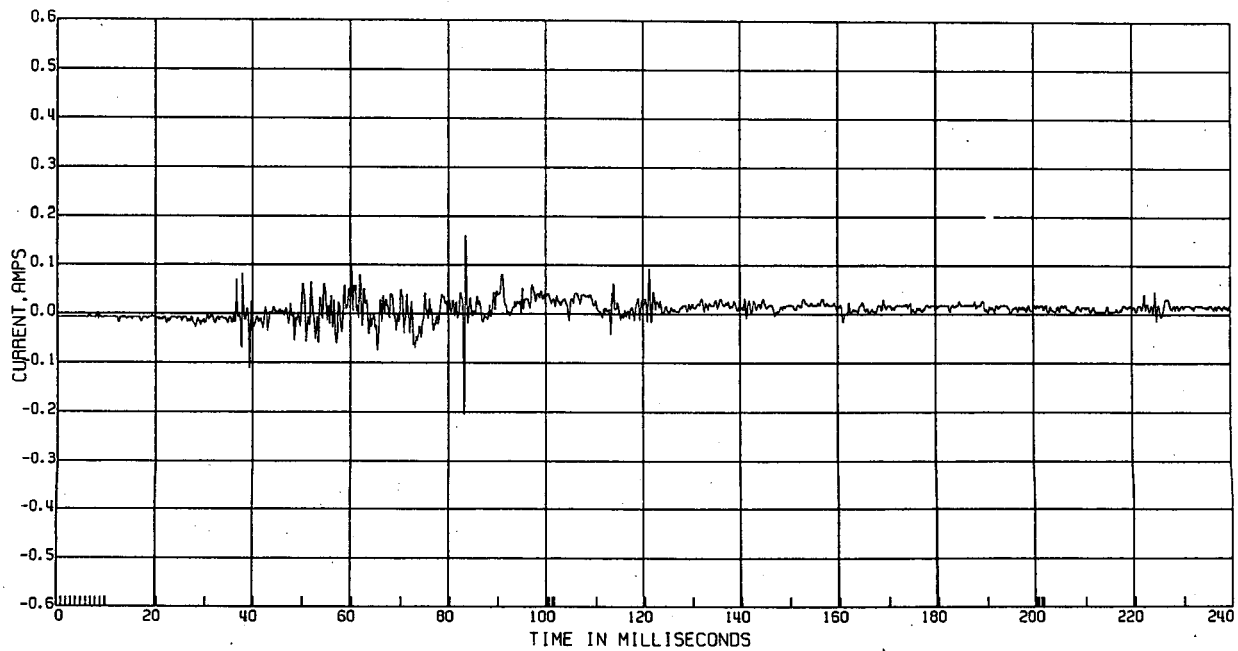


Appendix B, plot # **113**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR HEADL/FOG LIGHT CURRENT TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

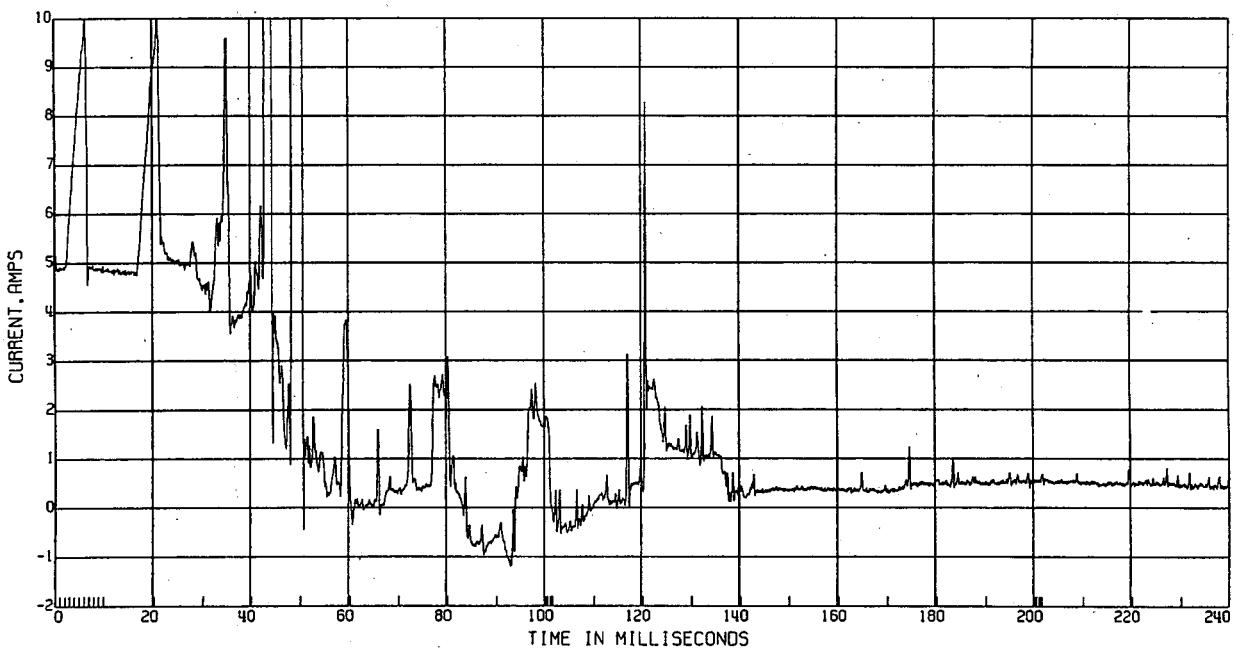


Appendix B, plot # **114**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR IGNITION CURRENT TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

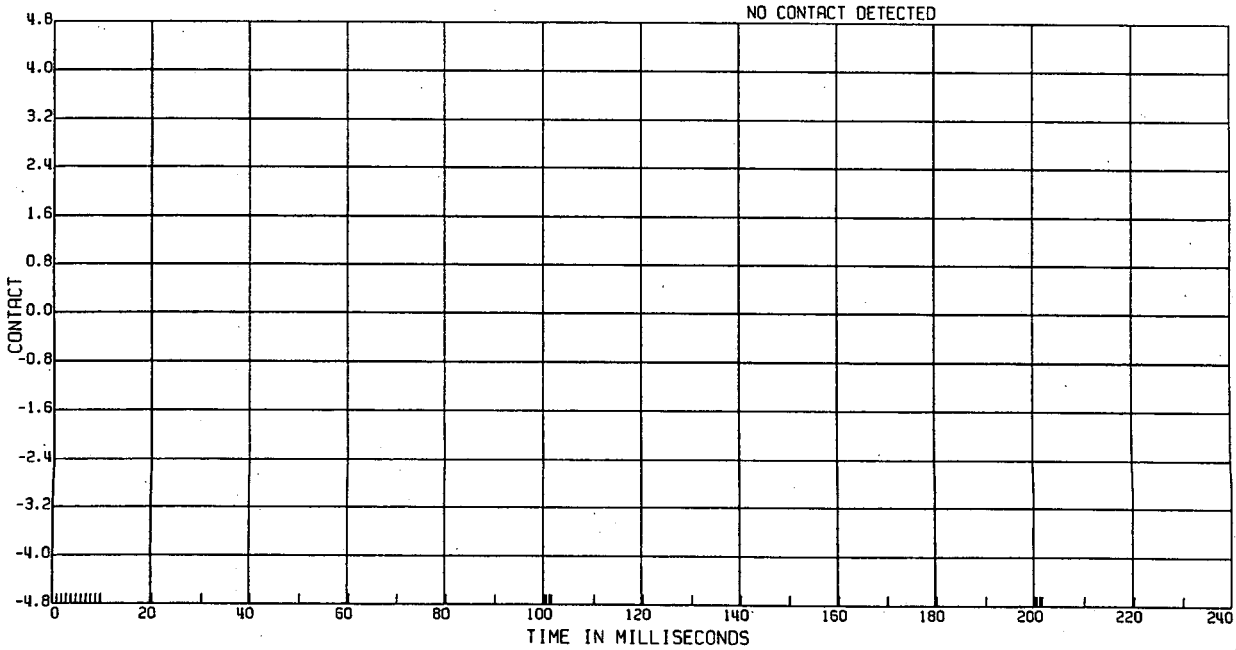


Appendix B, plot # **115**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR THERMAL WIRE CONTACT TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

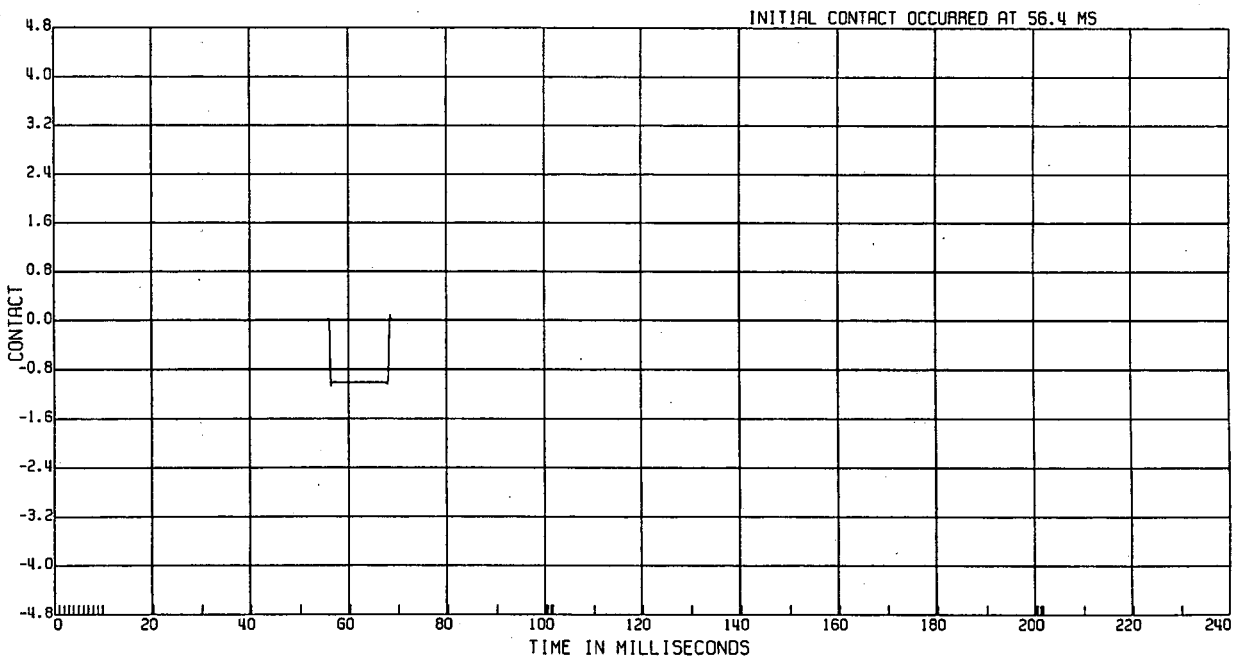


Appendix B, plot # **116**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR PNEUMATIC WIRE CONTACT TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

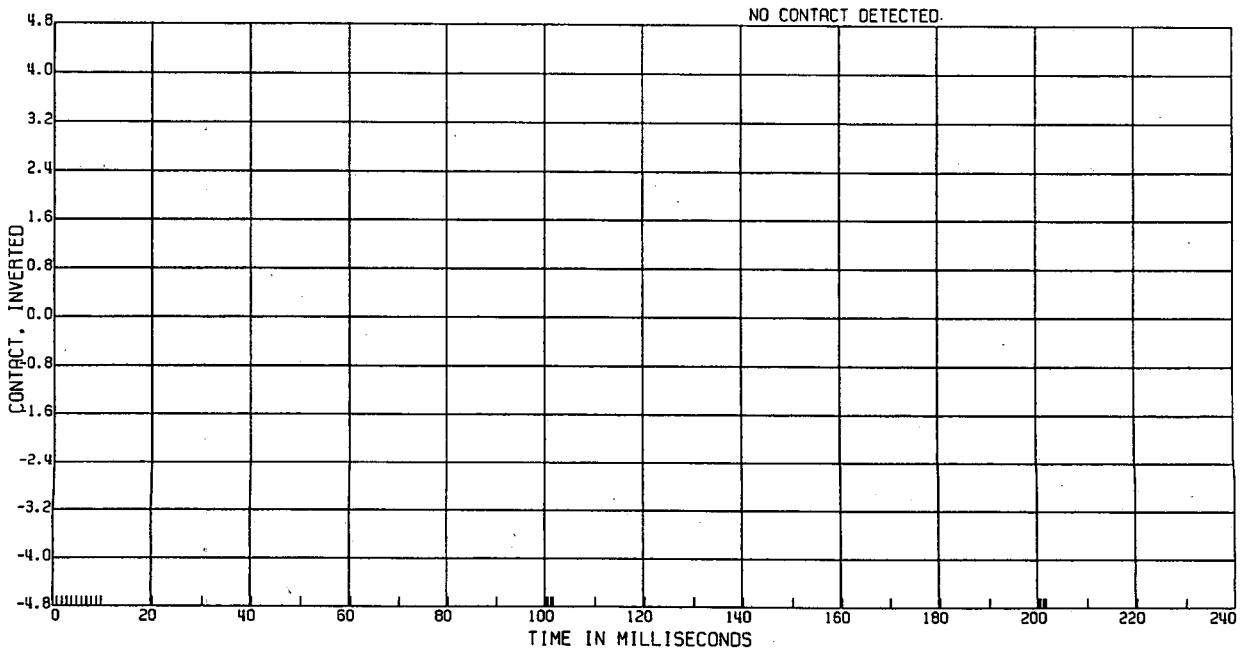


Appendix B, plot # **117**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR PNEUMATIC WIRE FAULT CONTACT TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 1000

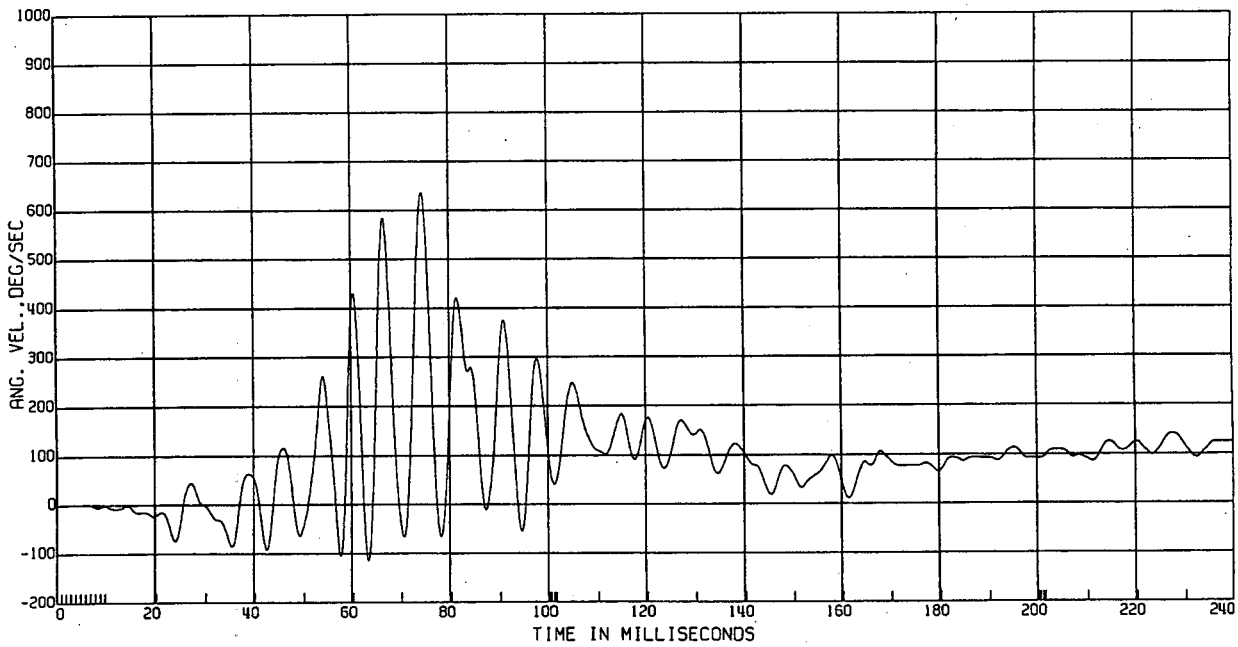


Appendix B, plot # **118**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR CTR RATE GYROSCOPE ANG. VEL. TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 180

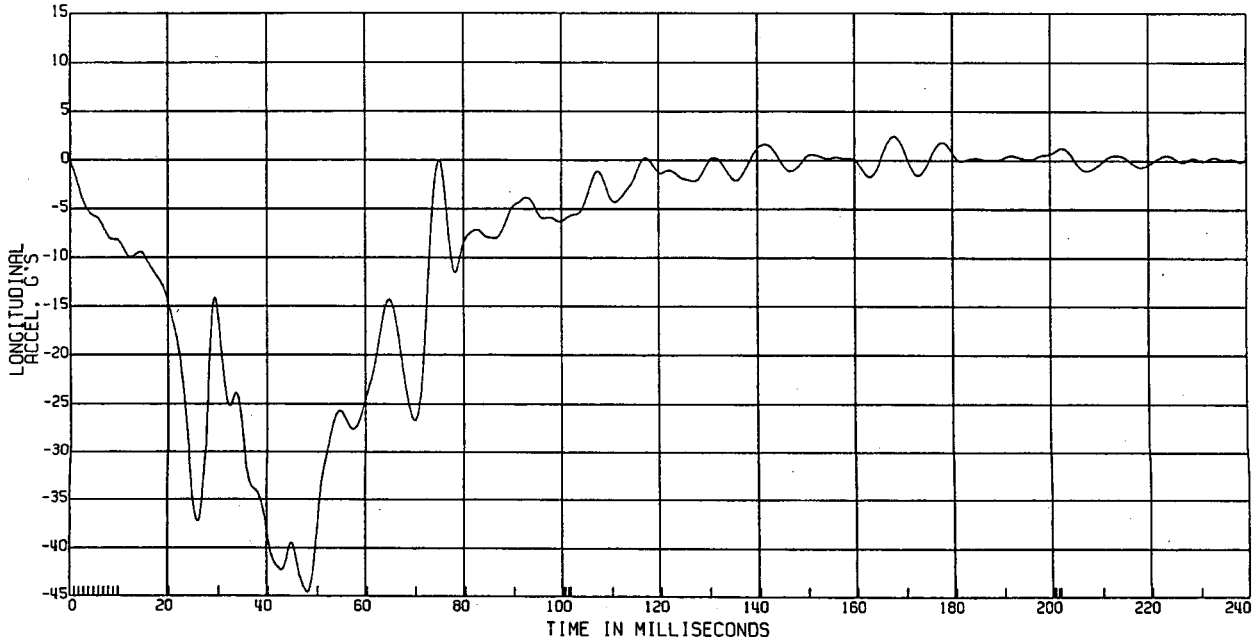


Appendix B, plot # **119**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR LTV MDB AT C.G. ACCEL TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 60



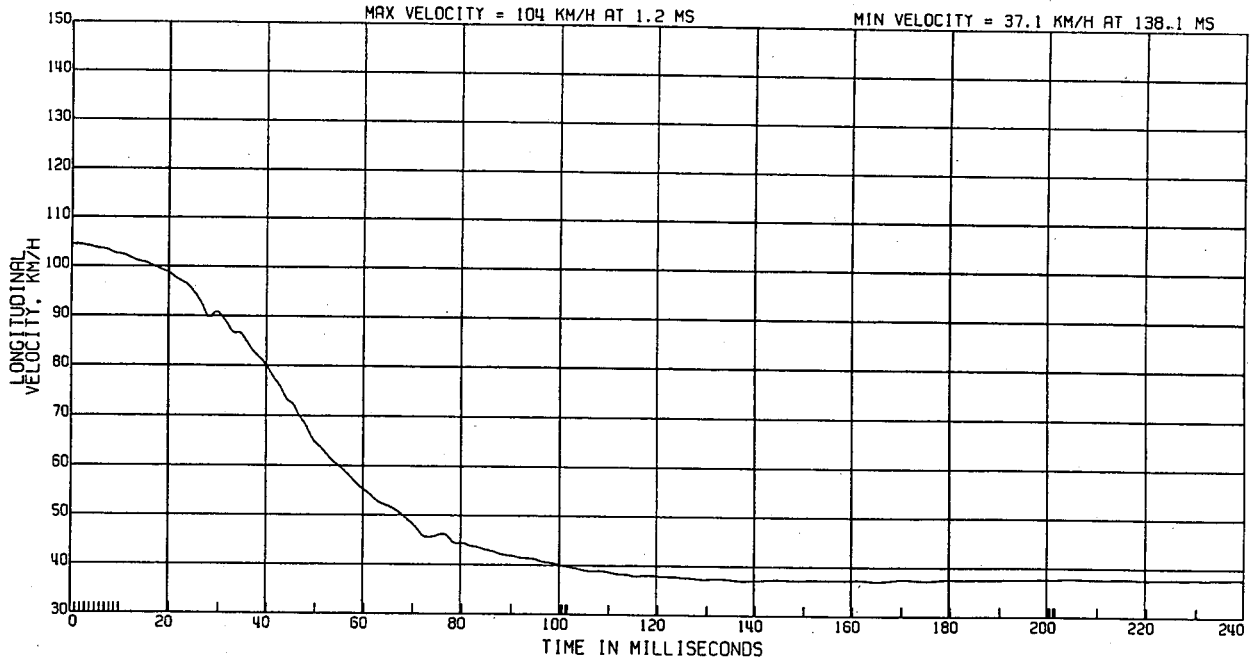
Appendix B, plot # **120**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 180

LTV MDB AT C.G. VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:07/30/1997



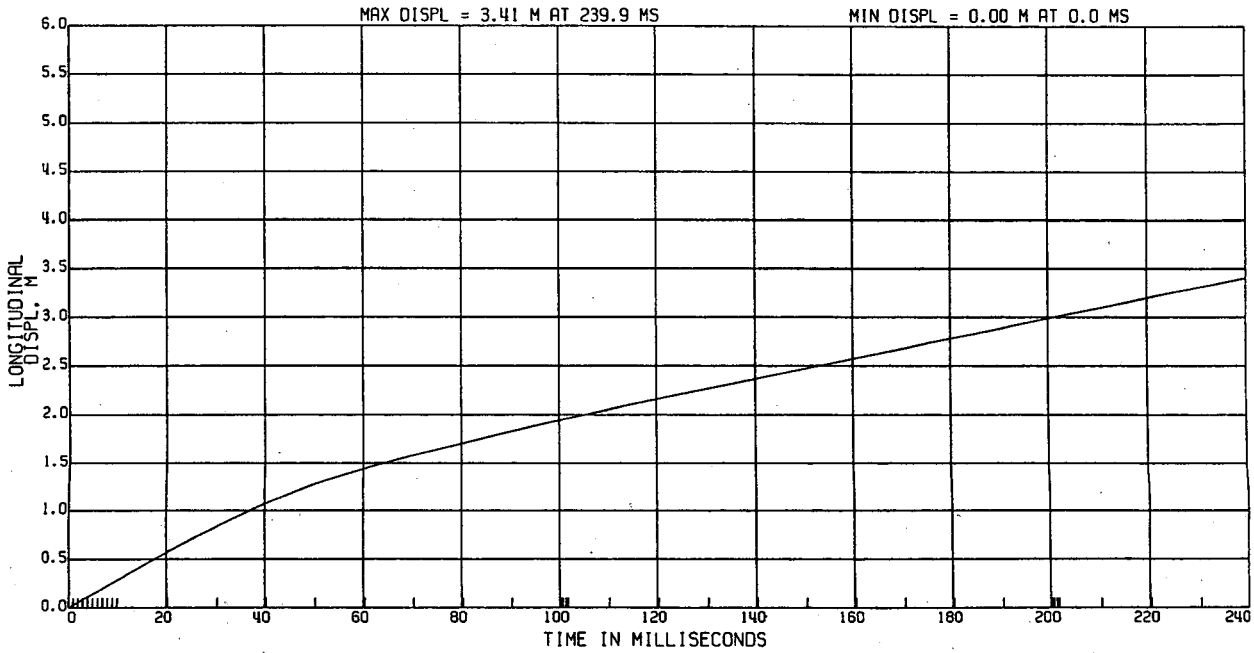
Appendix B, plot # **121**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 180

LTV MDB AT C.G. DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:07/30/1997



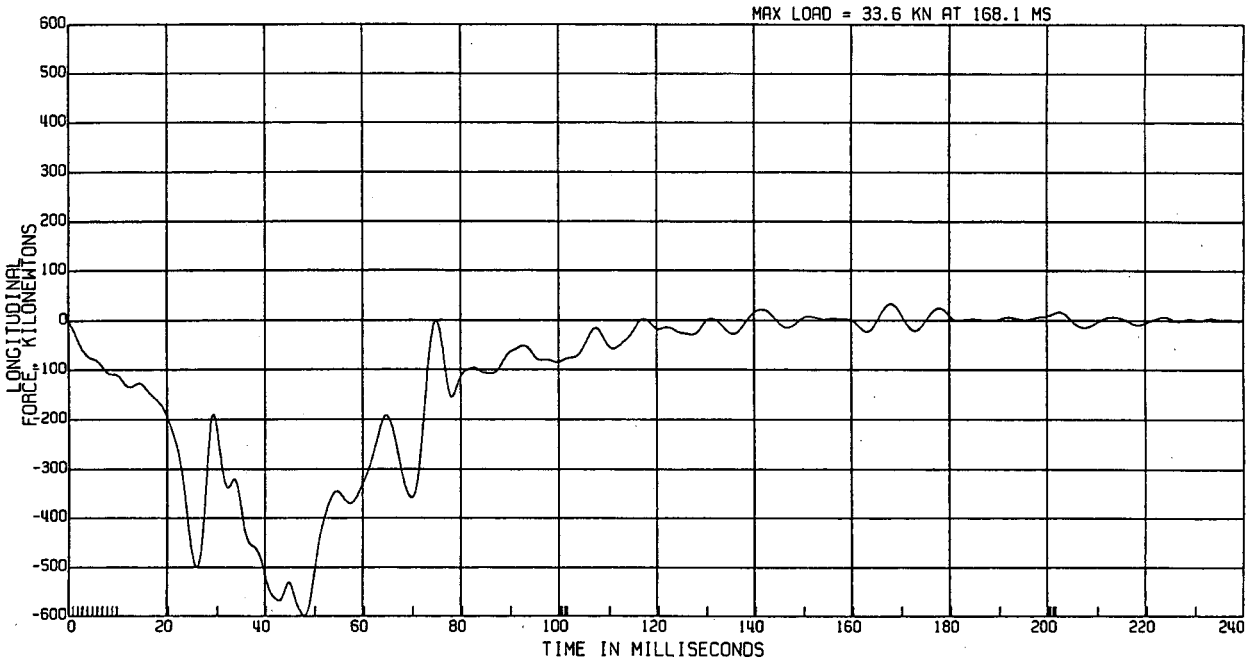
Appendix B, plot # **122**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 60

LTV MDB LONG. FORCE AT C.G.
(1371.0 KG) (9.807) (LONG.ACCEL)

TEST DATE:07/30/1997



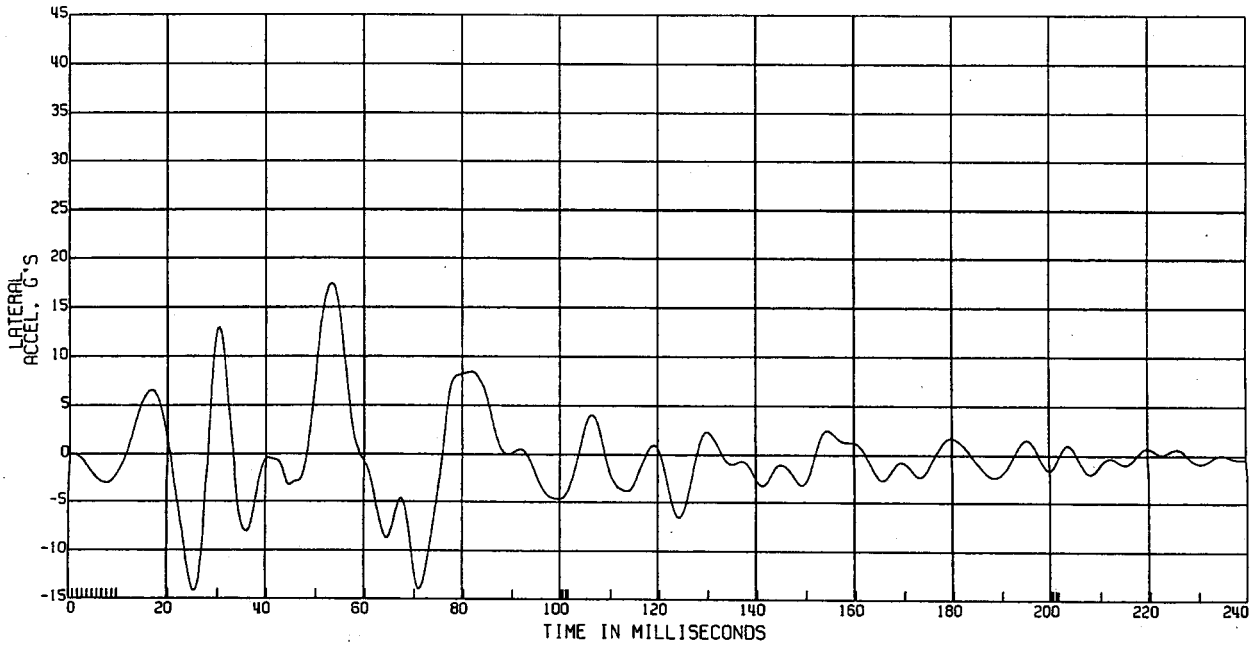
Appendix B, plot # **123**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 60

LTV MDB AT C.G. ACCEL

TEST DATE:07/30/1997



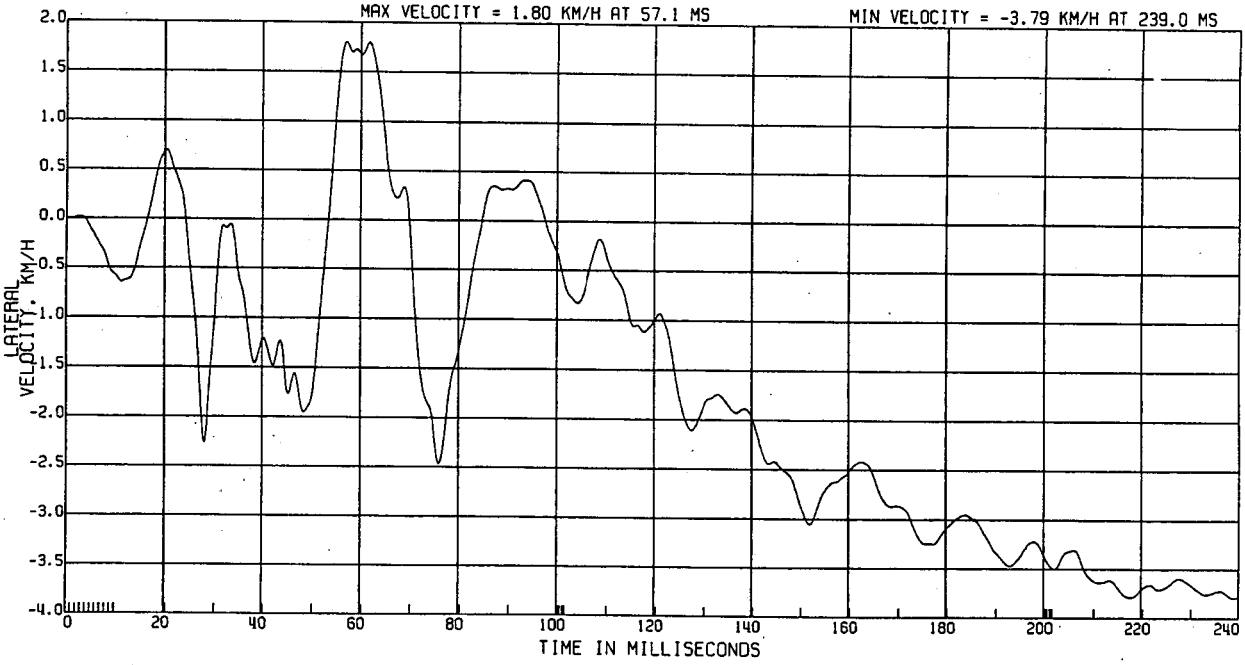
Appendix B, plot # **124**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 180

LTV MDB AT C.G. VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:07/30/1997



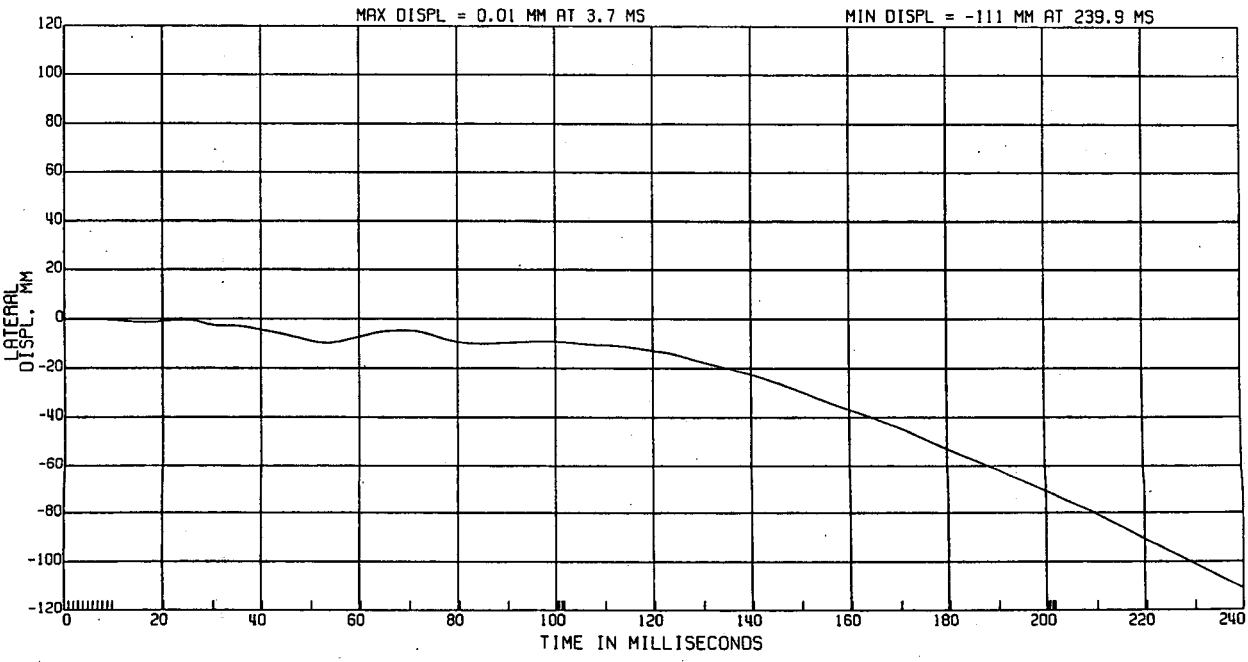
Appendix B, plot # **125**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 180

LTV MDB AT C.G. DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:07/30/1997

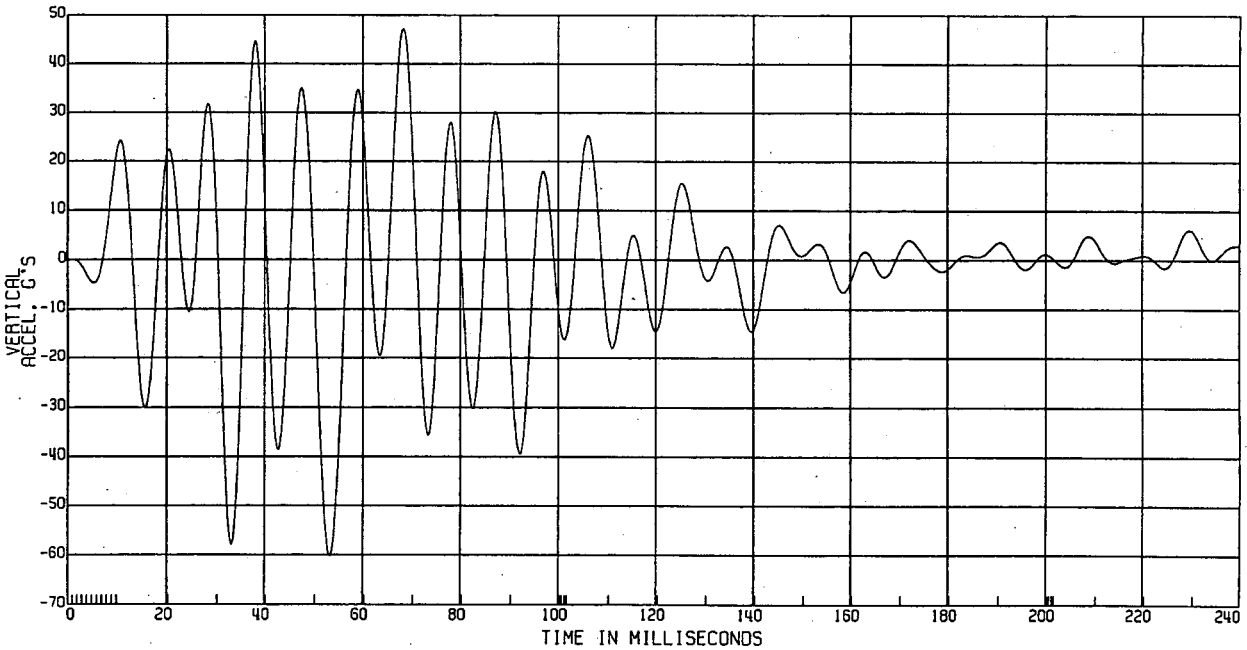


Appendix B, plot # **126**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR LTV MDB AT C.G. ACCEL TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 60

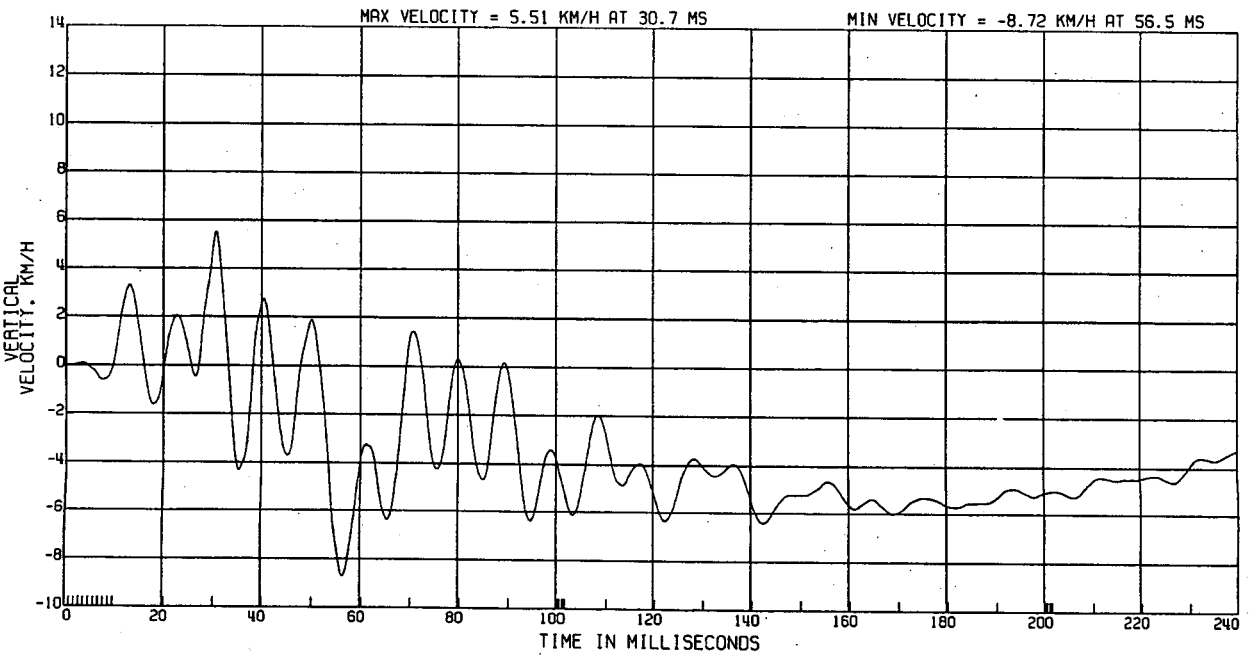


Appendix B, plot # **127**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR LTV MDB AT C.G. VELOCITY TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 180 (COMPUTED FROM ACCELERATION)



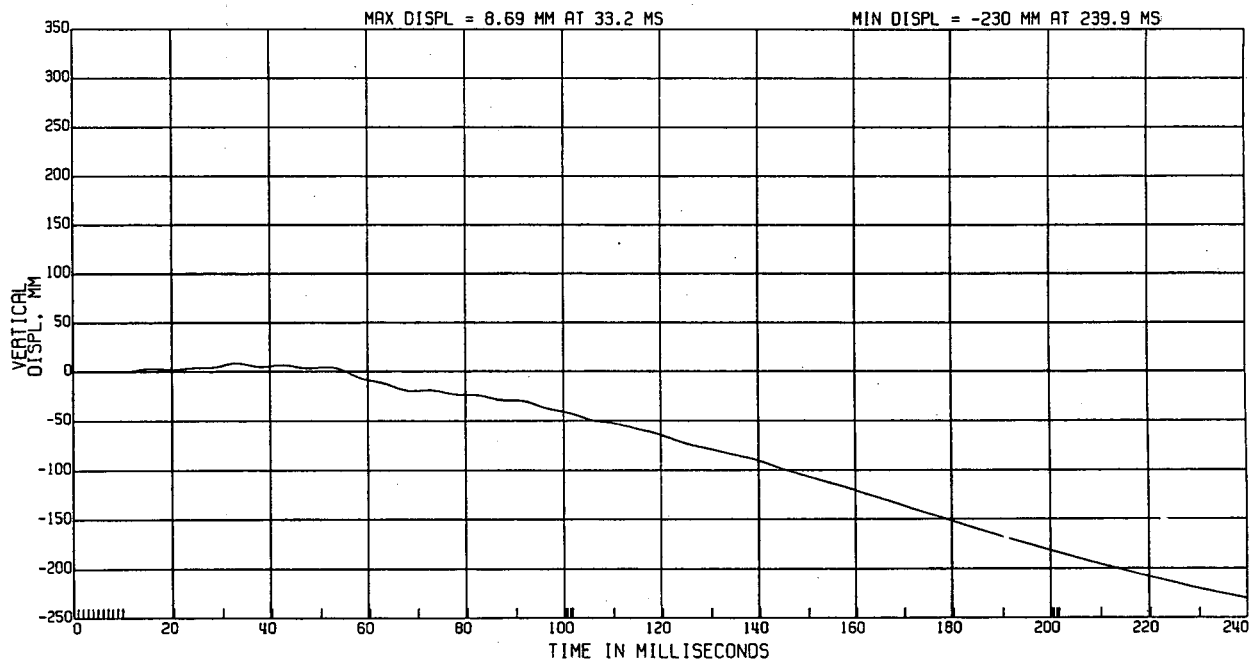
Appendix B, plot # **128**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 180

LTV MDB AT C.G. DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:07/30/1997



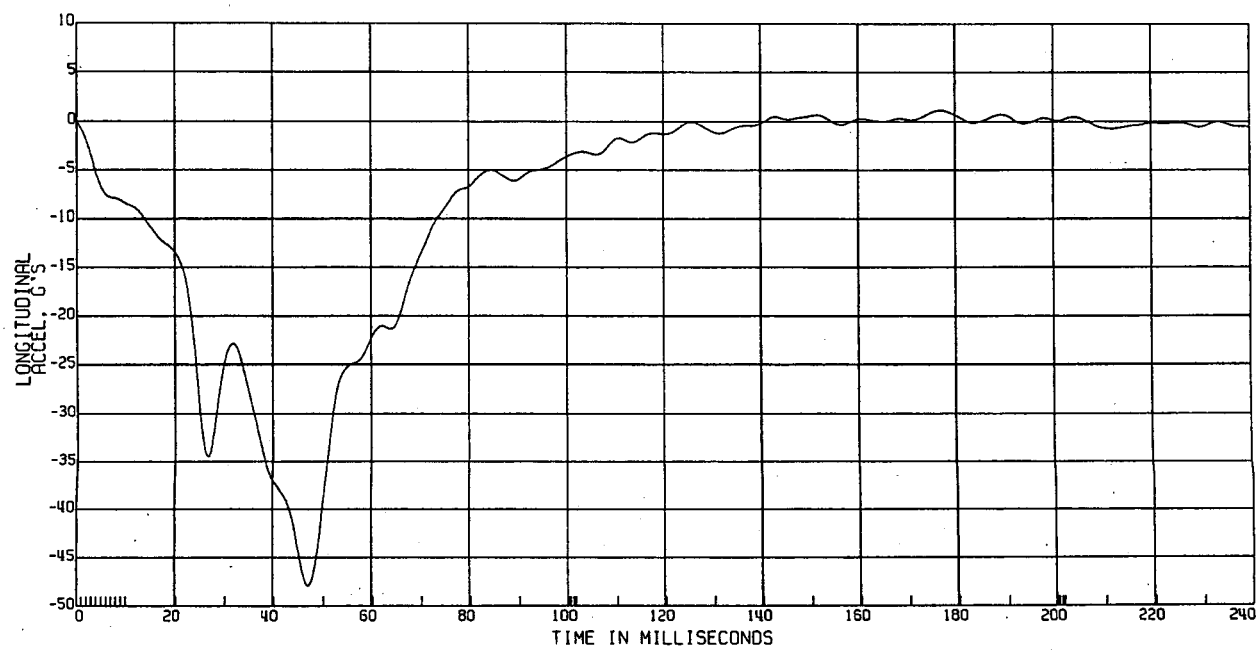
Appendix B, plot # **129**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 60

LTV MDB AT REAR C/MBR ACCEL

TEST DATE:07/30/1997



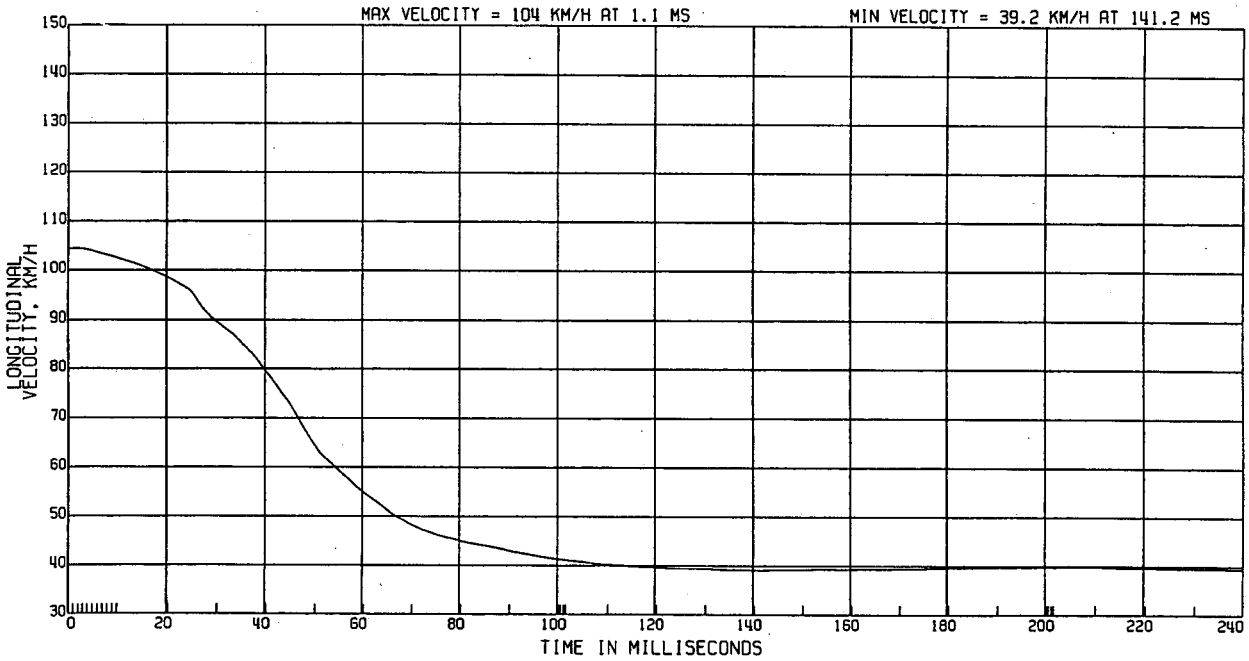
Appendix B, plot # **130**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 180

LTV MDB AT REAR C/MBR VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:07/30/1997



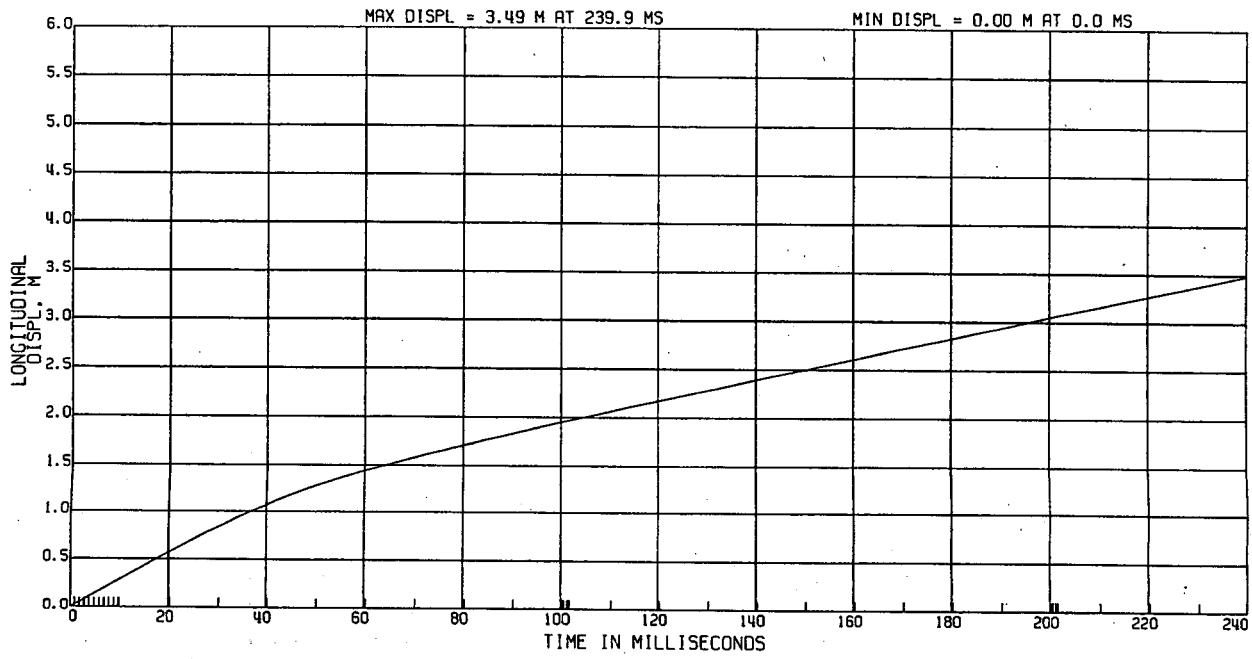
Appendix B, plot # **131**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 180

LTV MDB AT REAR C/MBR DISPL
(COMPUTED FROM ACCELERATION)

TEST DATE:07/30/1997



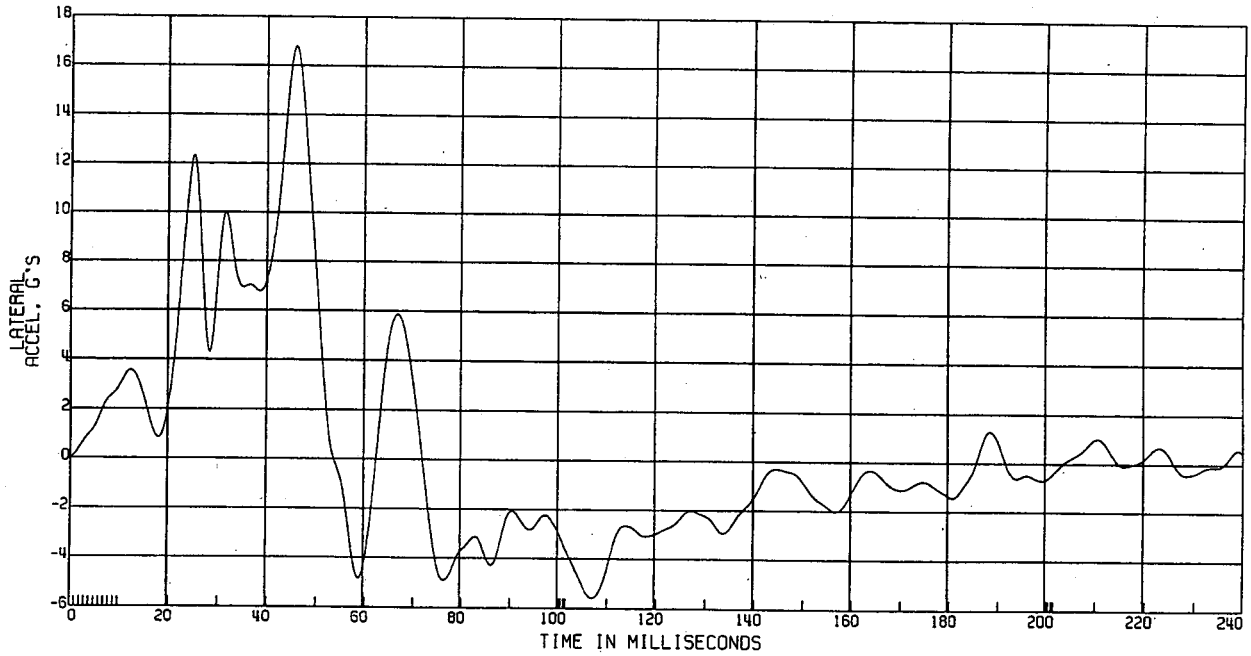
Appendix B, plot # **132**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 60

LTV MDB AT REAR C/MBR ACCEL

TEST DATE:07/30/1997



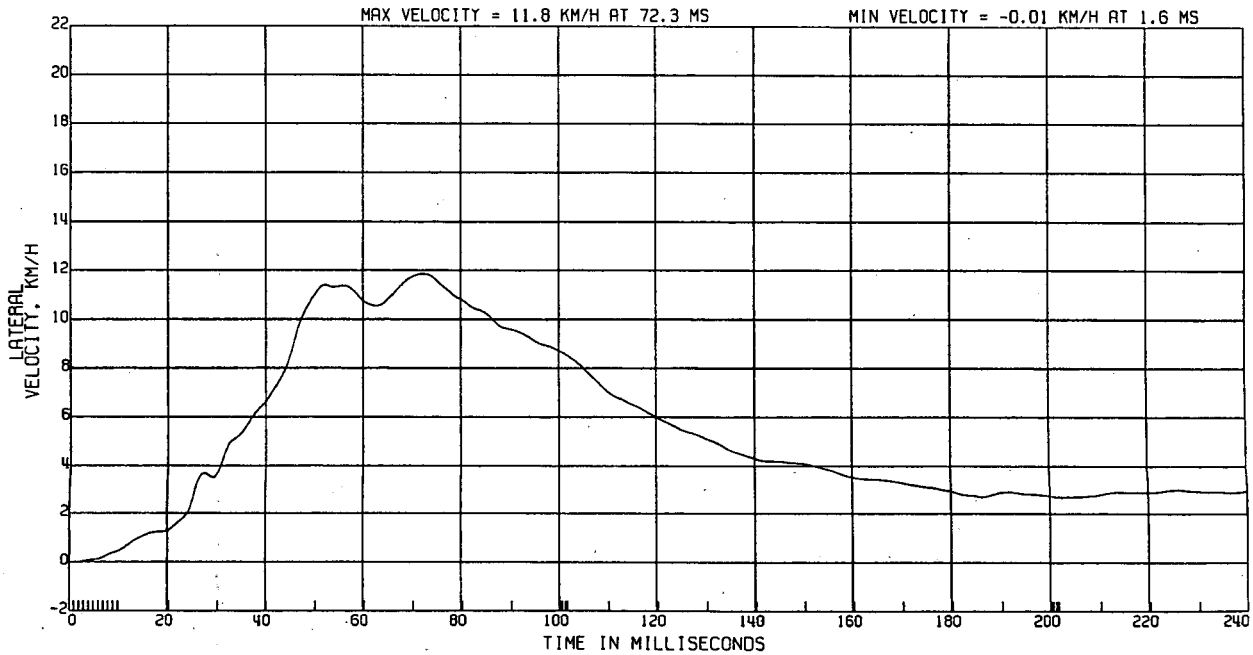
Appendix B, plot # **133**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR
ELEC DATA, SAE CLASS 180

LTV MDB AT REAR C/MBR VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:07/30/1997

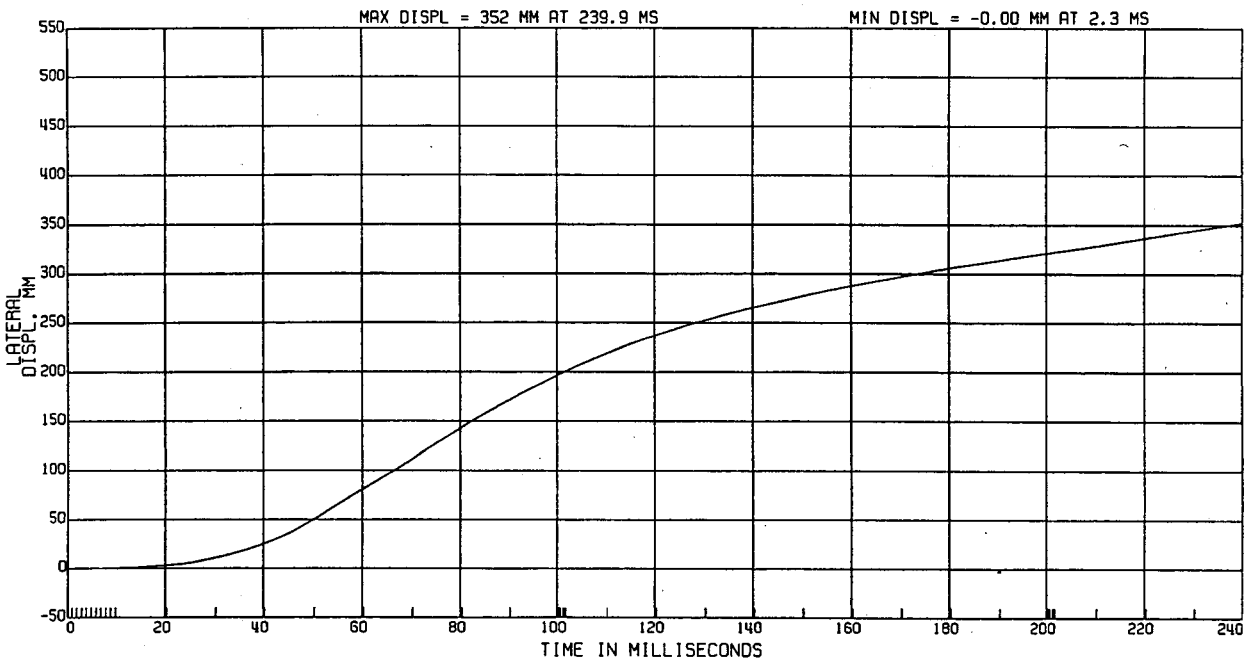


Appendix B, plot # **134**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR LTV MDB AT REAR C/MBR DISPL TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 180 (COMPUTED FROM ACCELERATION)

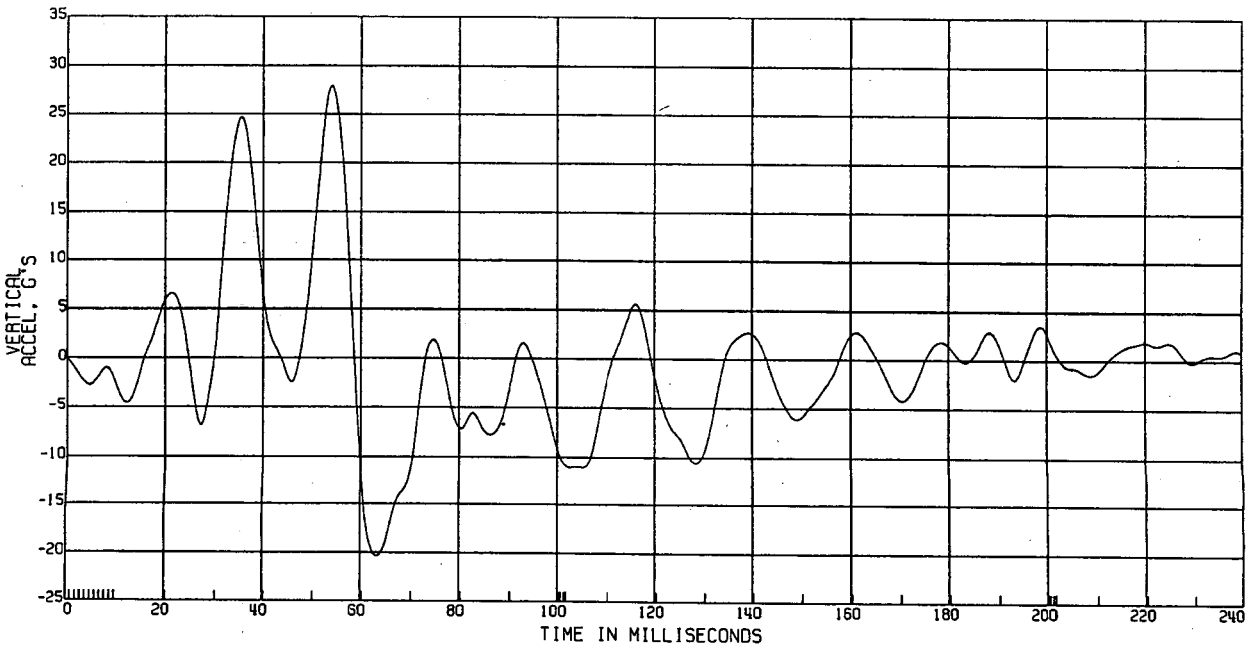


Appendix B, plot # **135**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR LTV MDB AT REAR C/MBR ACCEL TEST DATE:07/30/1997

ELEC DATA, SAE CLASS 60



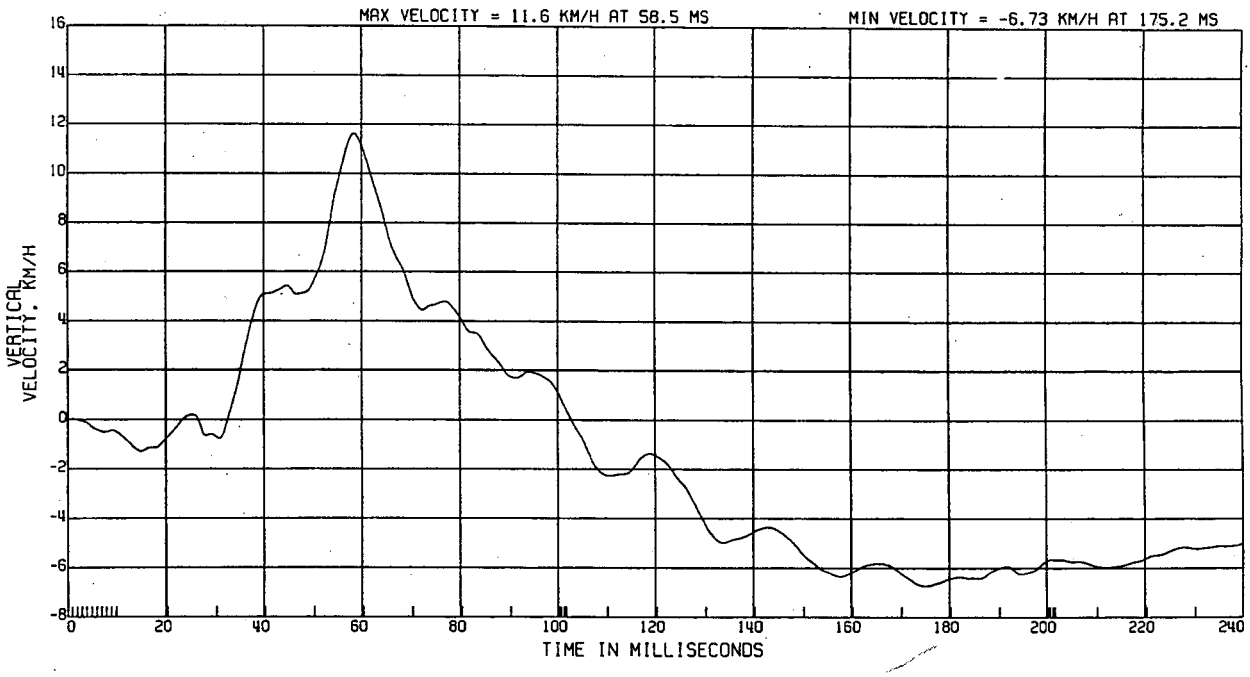
Appendix B, plot # **136**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 180

LTV MDB AT REAR C/MBR VELOCITY
(COMPUTED FROM ACCELERATION)

TEST DATE:07/30/1997



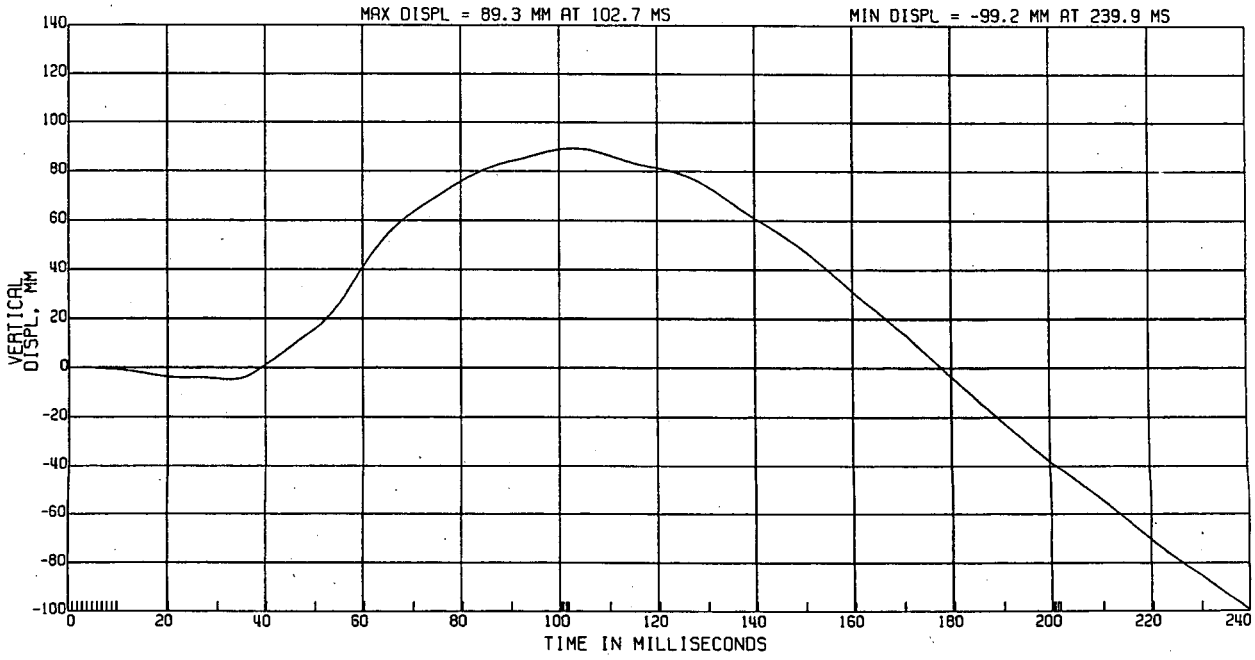
Appendix B, plot # **137**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 180

LTV MDB AT REAR C/MBR DISPL
(COMPUTED FROM ACCELERATION)

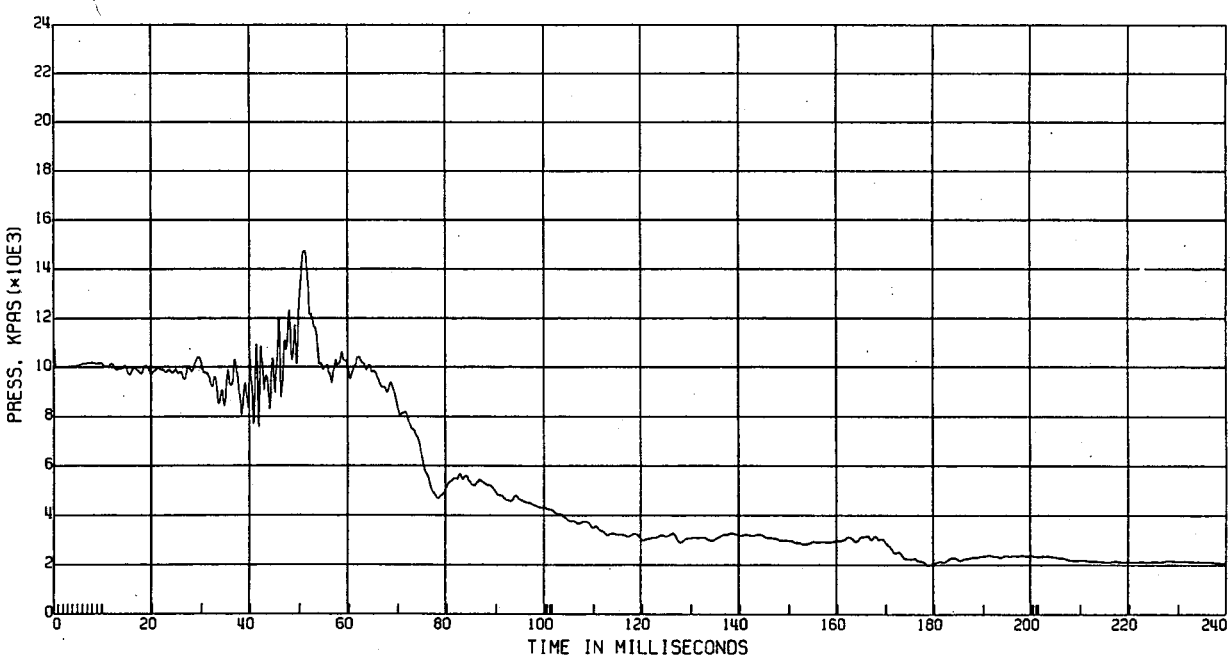
TEST DATE:07/30/1997



Appendix B, plot # **138**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

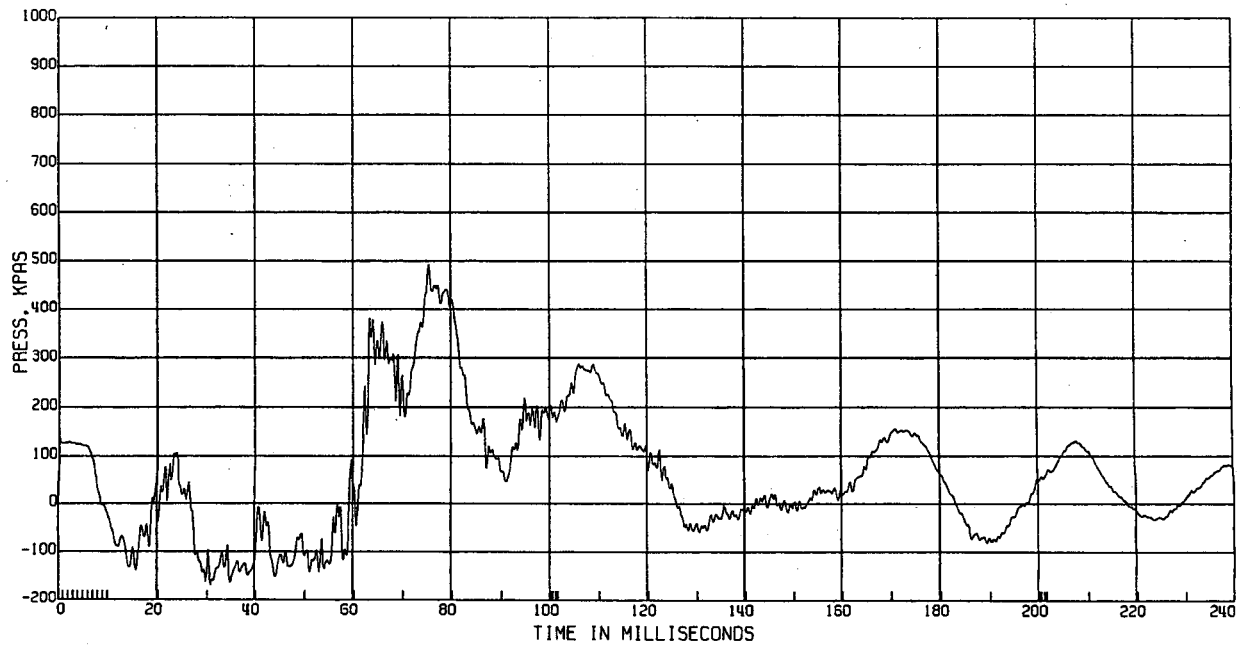
R & D CTR 8V91400 4 DOOR FRT BRAKE SYSTEM PRESSURE TEST DATE:07/30/1997
ELEC DATA, SAE CLASS 1000



Appendix B, plot # **139**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR FUEL SUPPLY LINE PRESSURE TEST DATE:07/30/1997
ELEC DATA, SAE CLASS 1000



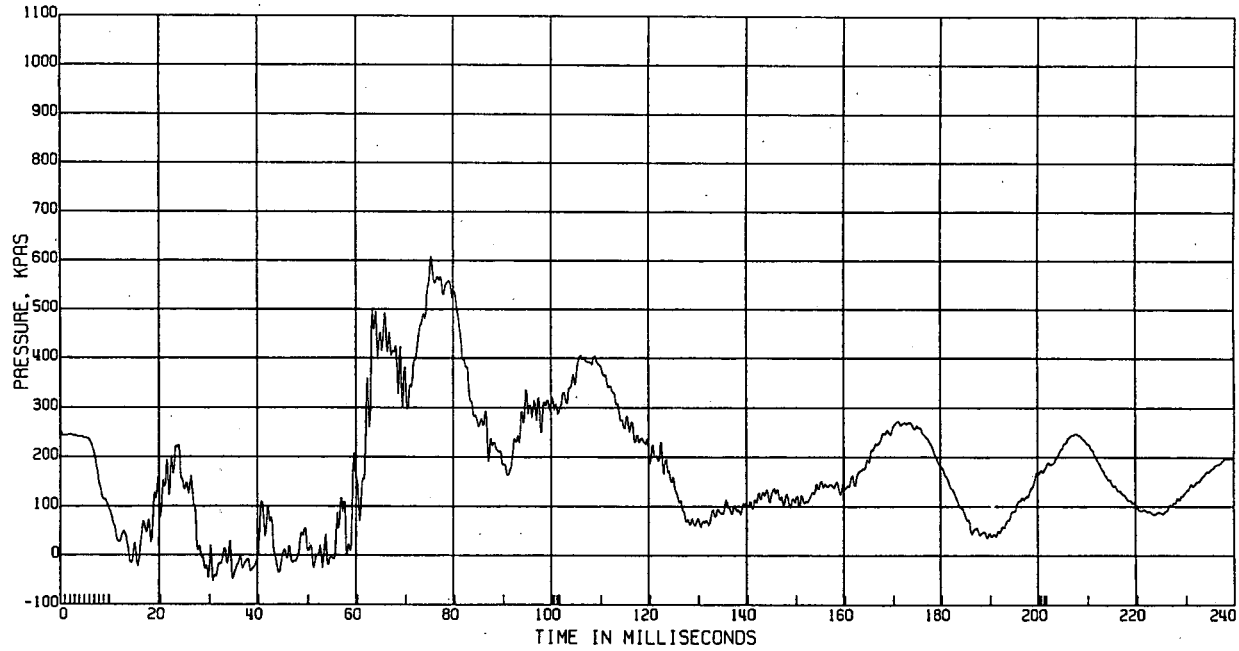
Appendix B, plot # **140**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 1000

FUEL SUPPLY LINE PRESSURE
(BIASED DATA BY 117.0KPAS)

TEST DATE:07/30/1997



Appendix B, plot # **141**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 1000

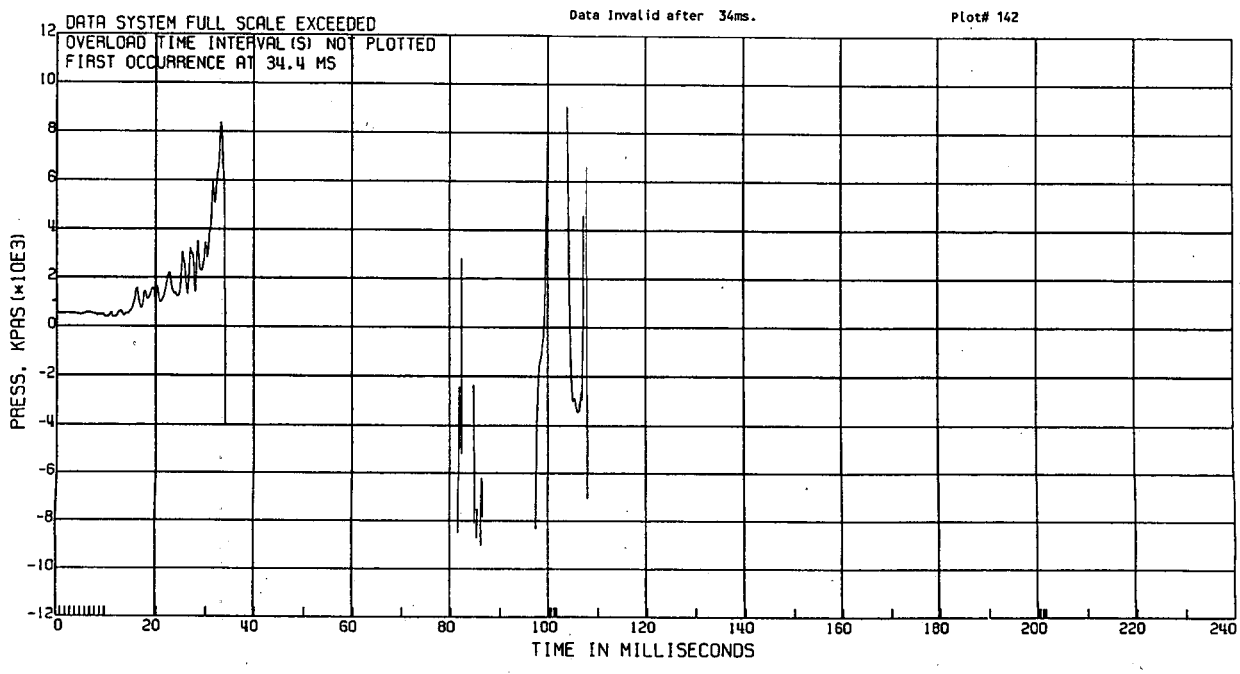
POWER STEERING SYSTEM PRESSURE

TEST DATE:07/30/1997

TRANSDUCER WIRES WERE DAMAGED/CUT

Data Invalid after 34ms.

Plot# 142



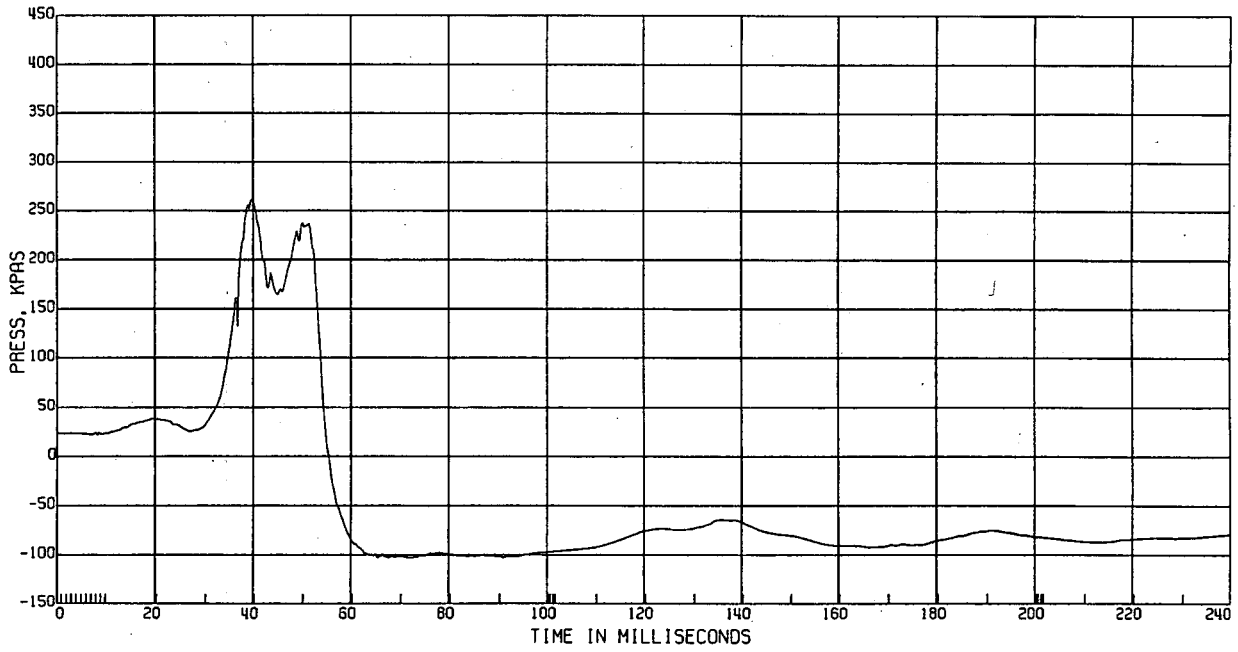
Appendix B, plot # **142**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 1000

ENG COOLANT SYSTEM PRESSURE

TEST DATE:07/30/1997



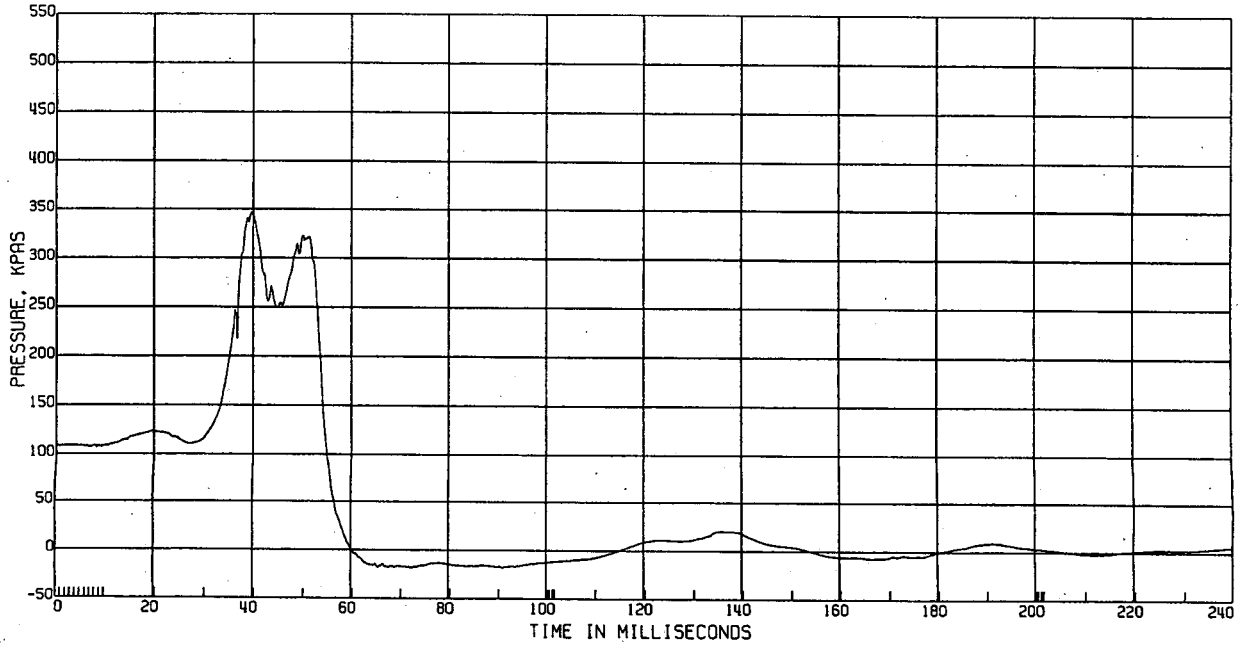
Appendix B, plot # **143**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V9140D 4 DOOR
ELEC DATA, SAE CLASS 1000

ENG COOLANT SYSTEM PRESSURE
(BIASED DATA BY 085.0KPAS)

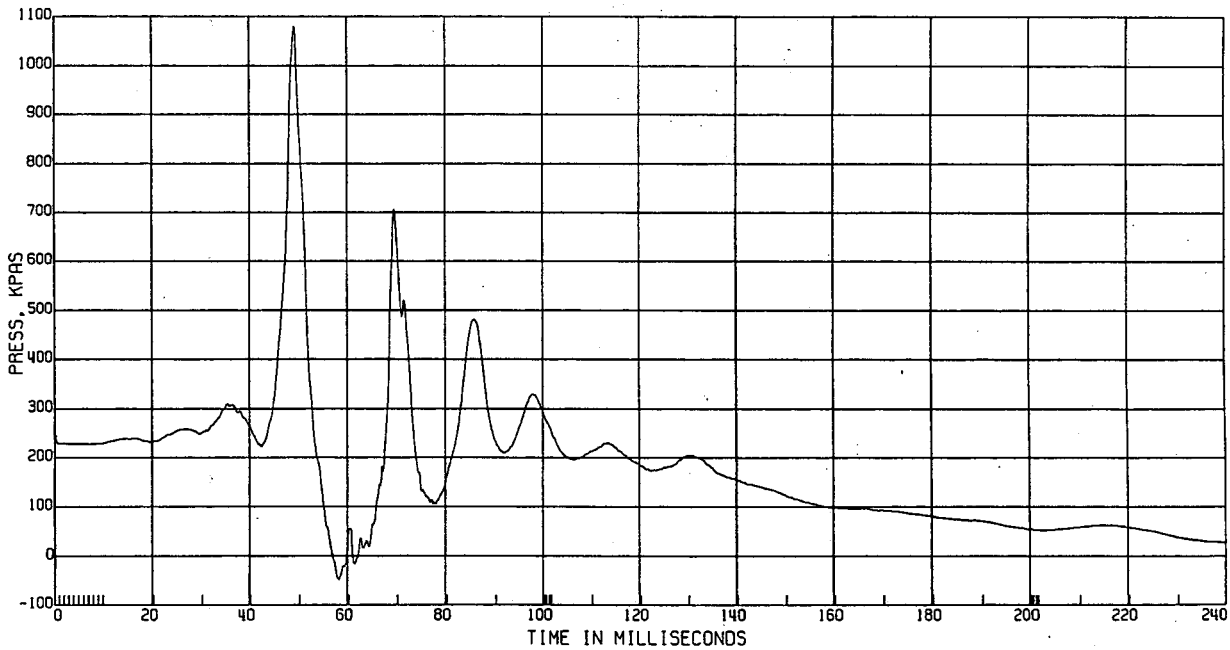
TEST DATE:07/30/1997



Appendix B, plot # **144**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

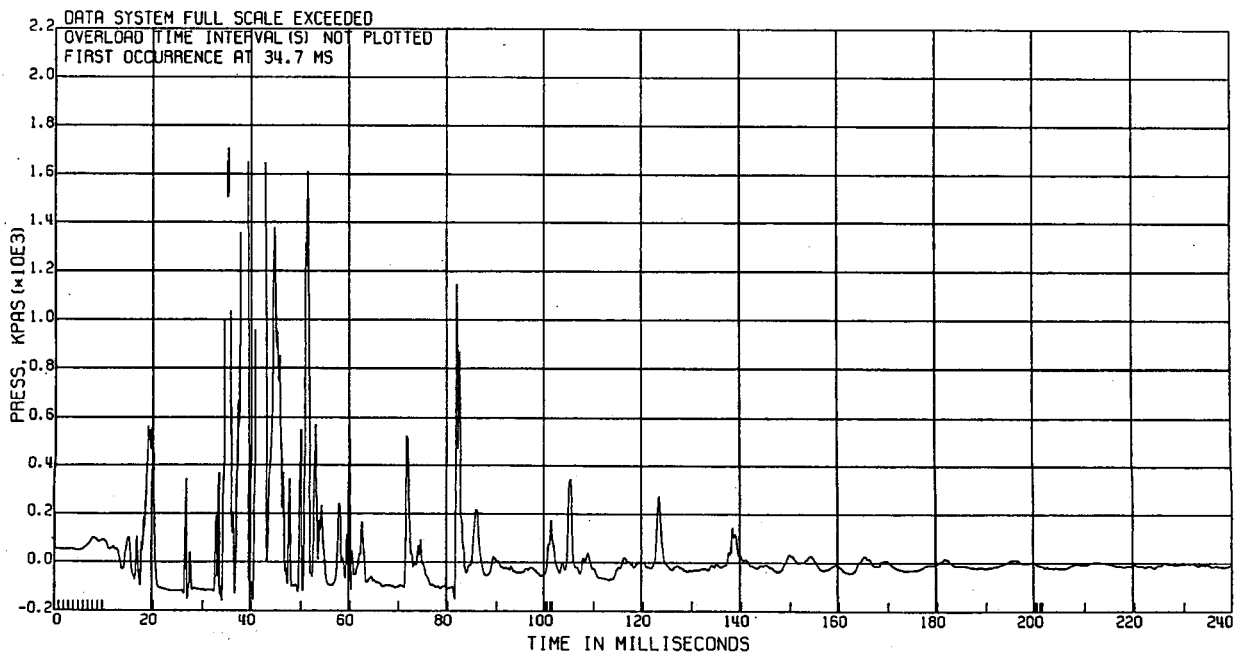
R & D CTR 8V91400 4 DOOR ENGINE OIL PRESSURE TEST DATE:07/30/1997
ELEC DATA, SAE CLASS 1000



Appendix B, plot # **145**

C11687 L. SIDE IMPACT-337 DEG LTV MDB TO STATIONARY VEHICLE 104.4KM/H

R & D CTR 8V91400 4 DOOR TRANSMISSION COOLER PRESSURE TEST DATE:07/30/1997
ELEC DATA, SAE CLASS 1000



Appendix B, plot # **146**

APPENDIX C

Appendix C: C11687 hydrocarbon vapor measurement plots

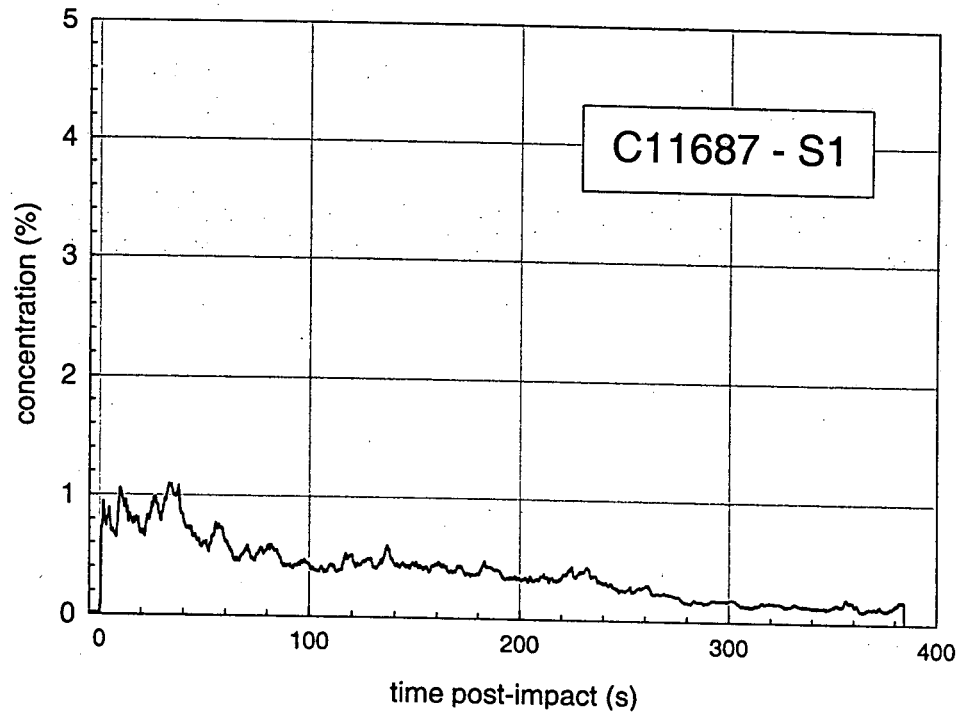


Figure C1
Concentration of Hydrocarbon Vapor Above the Right Upper Engine (Location #1)
Test C11687

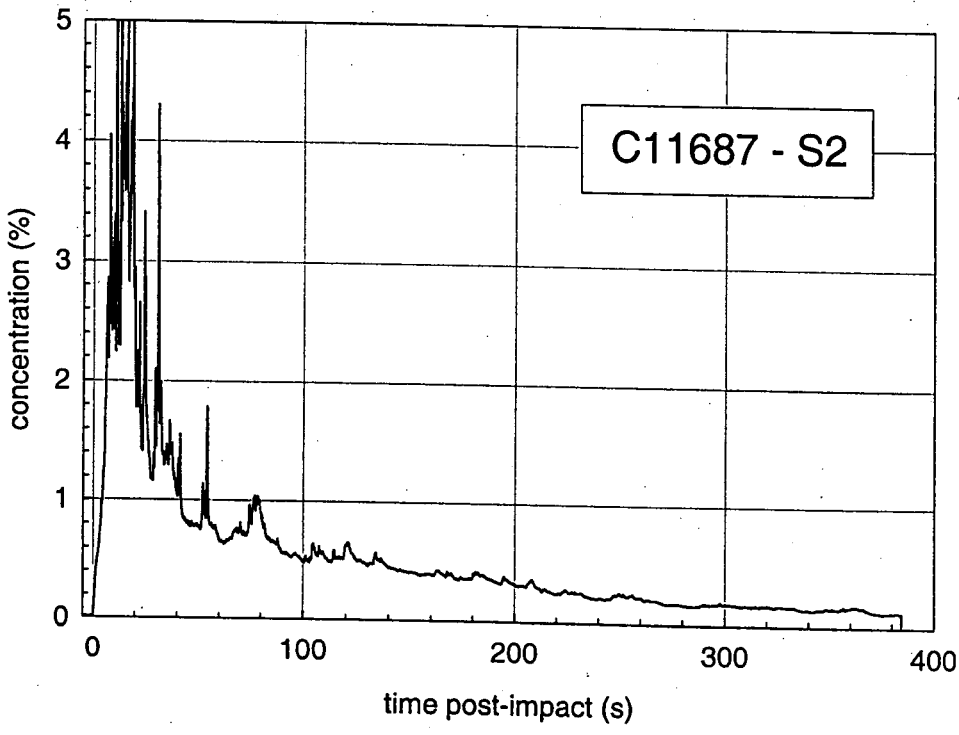


Figure C2
Concentration of Hydrocarbon Vapor Measured Near the Left Exhaust Manifold (Location #2)
Test C11687

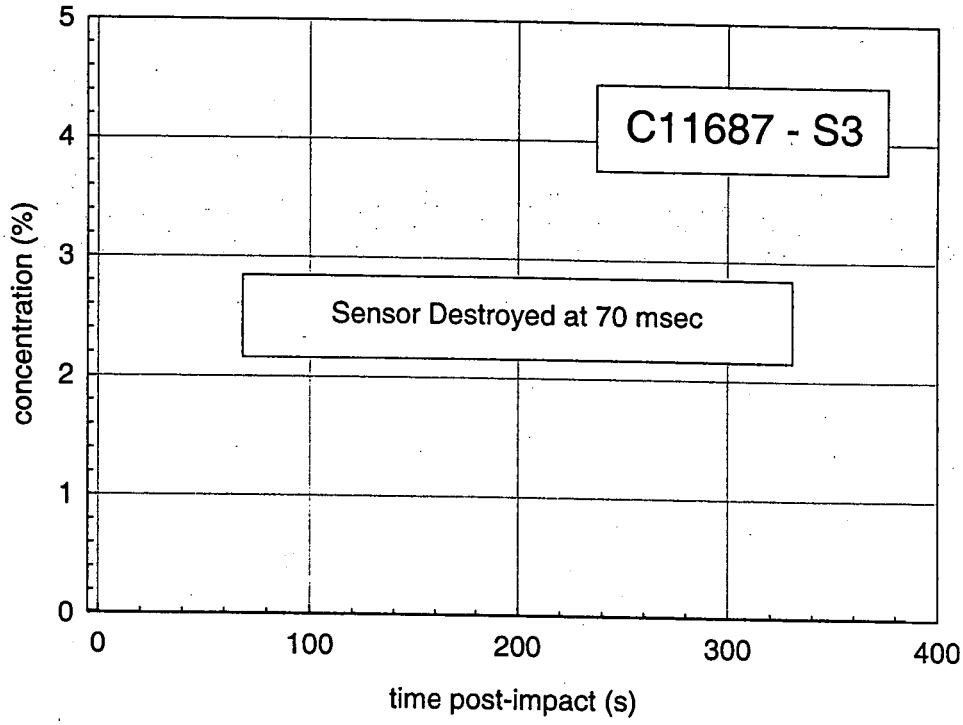


Figure C3
Concentration of Hydrocarbon Vapor Measured Near the Left Upper Engine (Location #3)
Test C11687

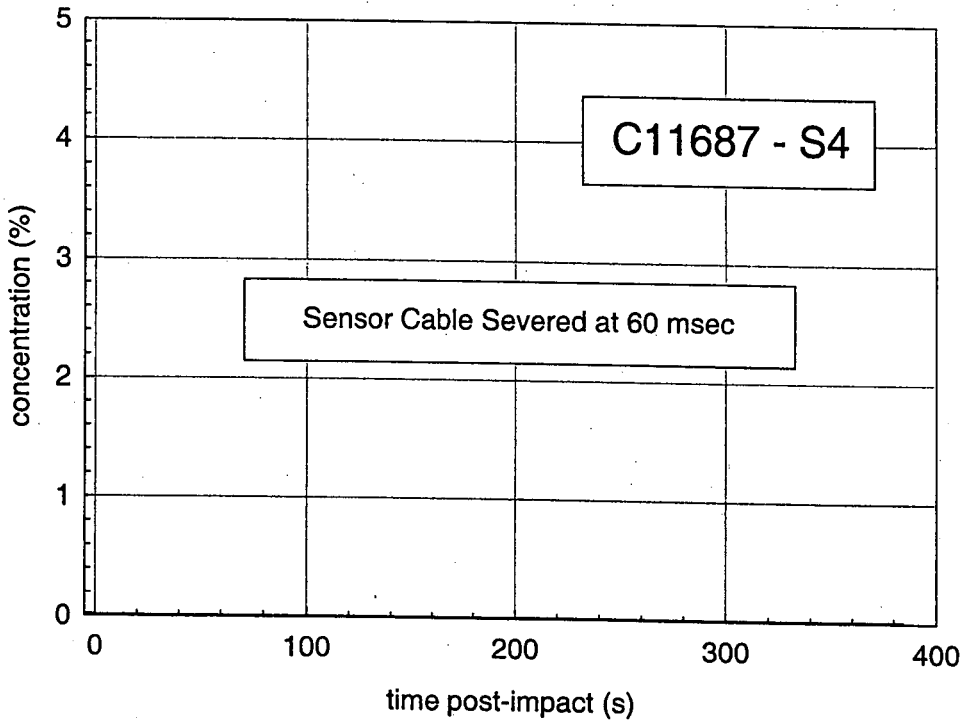


Figure C4
Concentration of Hydrocarbon Vapor Measured Near the Left Lower Fuel Line (Location #4)
Test C11687

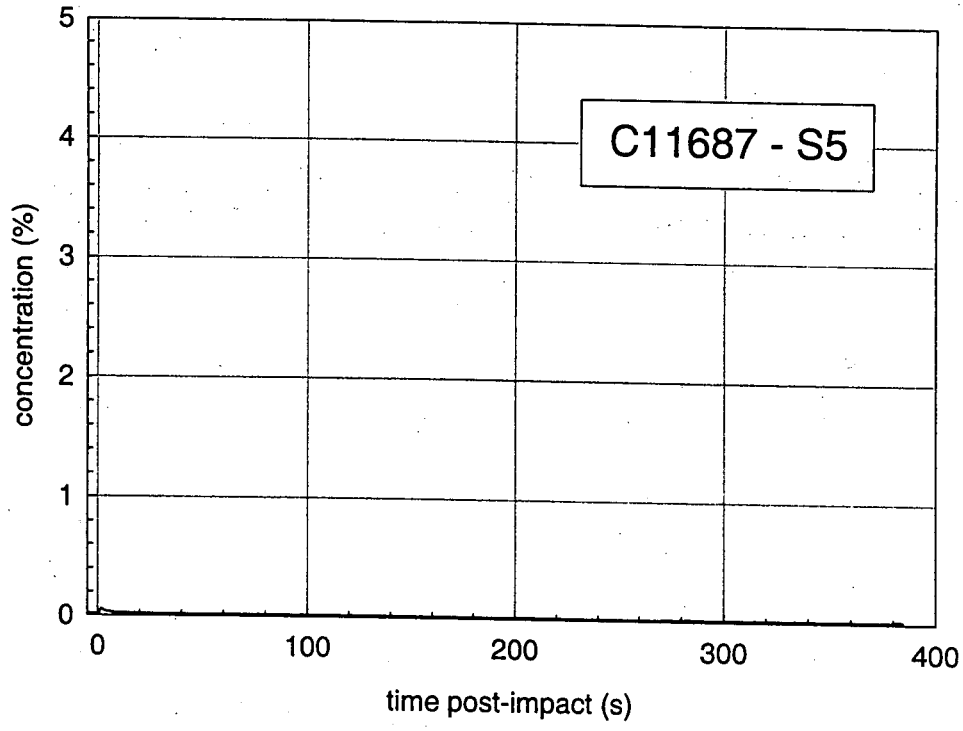


Figure C5
Concentration of Hydrocarbon Vapor Measured Near the Catalytic Converter (Location #5)
Test C11687

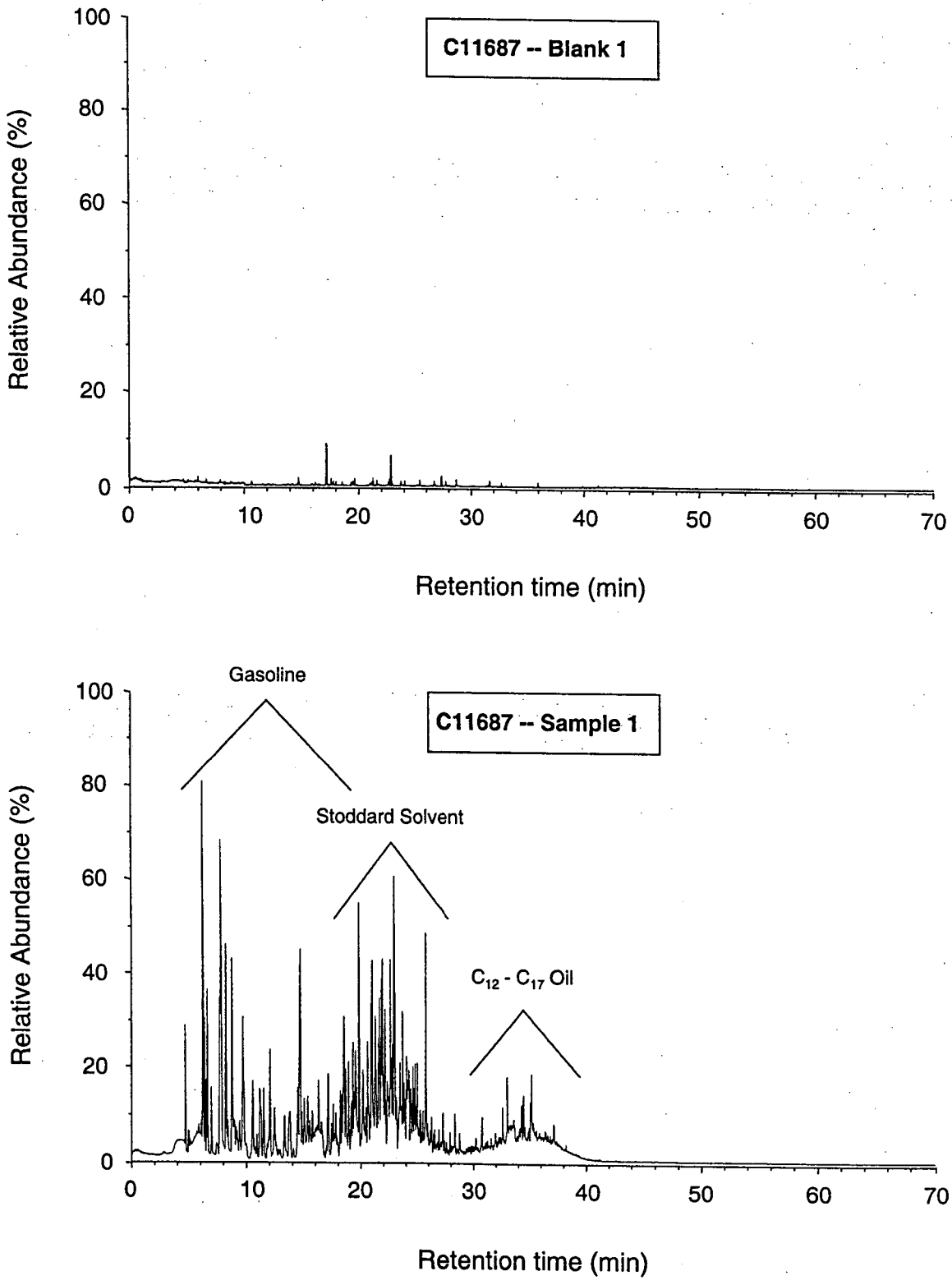


Figure CC1
GC/MS analysis of hydrocarbon vapor sample from Above the Right Upper Engine (Location #1) during Crash Test C11687. The top panel is the chromatogram of background sample and the bottom panel is the chromatogram of the post-crash sample.

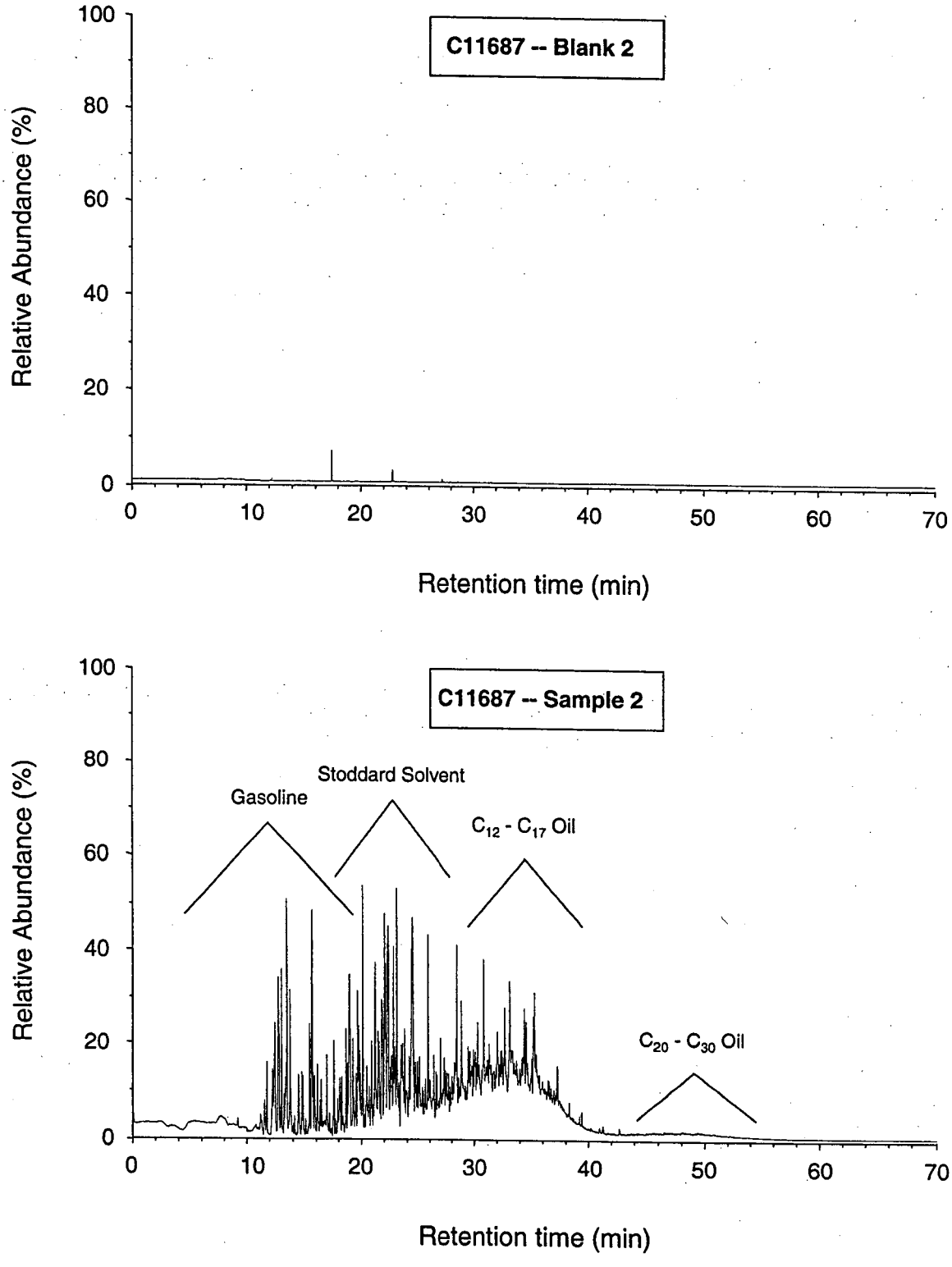


Figure CC2

GC/MS analysis of hydrocarbon vapor sample from near the left exhaust manifold (Location #2) during Crash Test C11687. The top panel is the chromatogram of background sample and the bottom panel is the chromatogram of the post-crash sample.

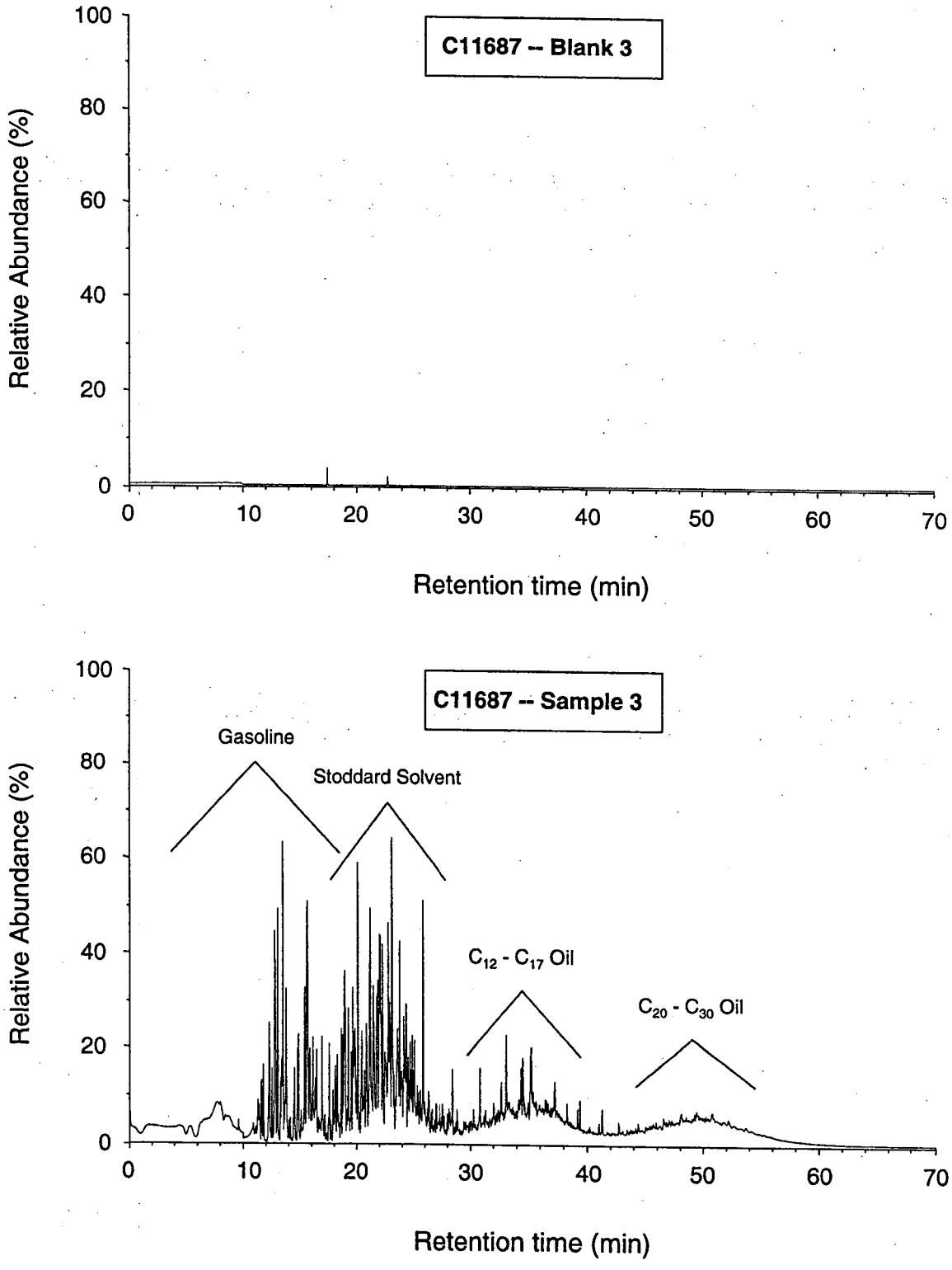


Figure CC3
GC/MS analysis of hydrocarbon vapor sample from near the left the Left Upper Engine (Location #3) during Crash Test C11687. The top panel is the chromatogram of background sample and the bottom panel is the chromatogram of the post-crash sample.

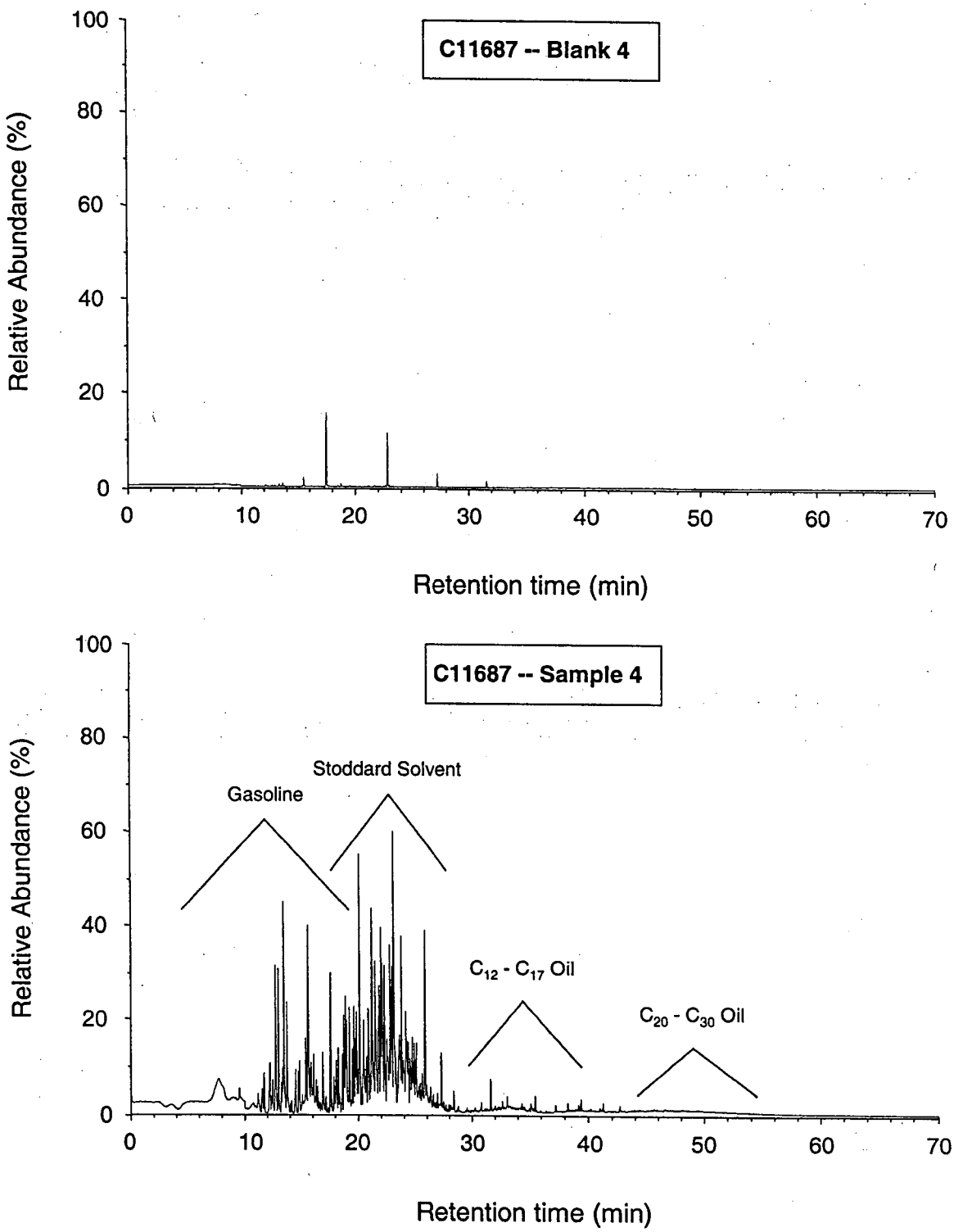


Figure CC4
GC/MS analysis of hydrocarbon vapor sample from near the Left Lower Fuel Line (Location #4) during Crash Test C11687. The top panel is the chromatogram of background sample and the bottom panel is the chromatogram of the post-crash sample.

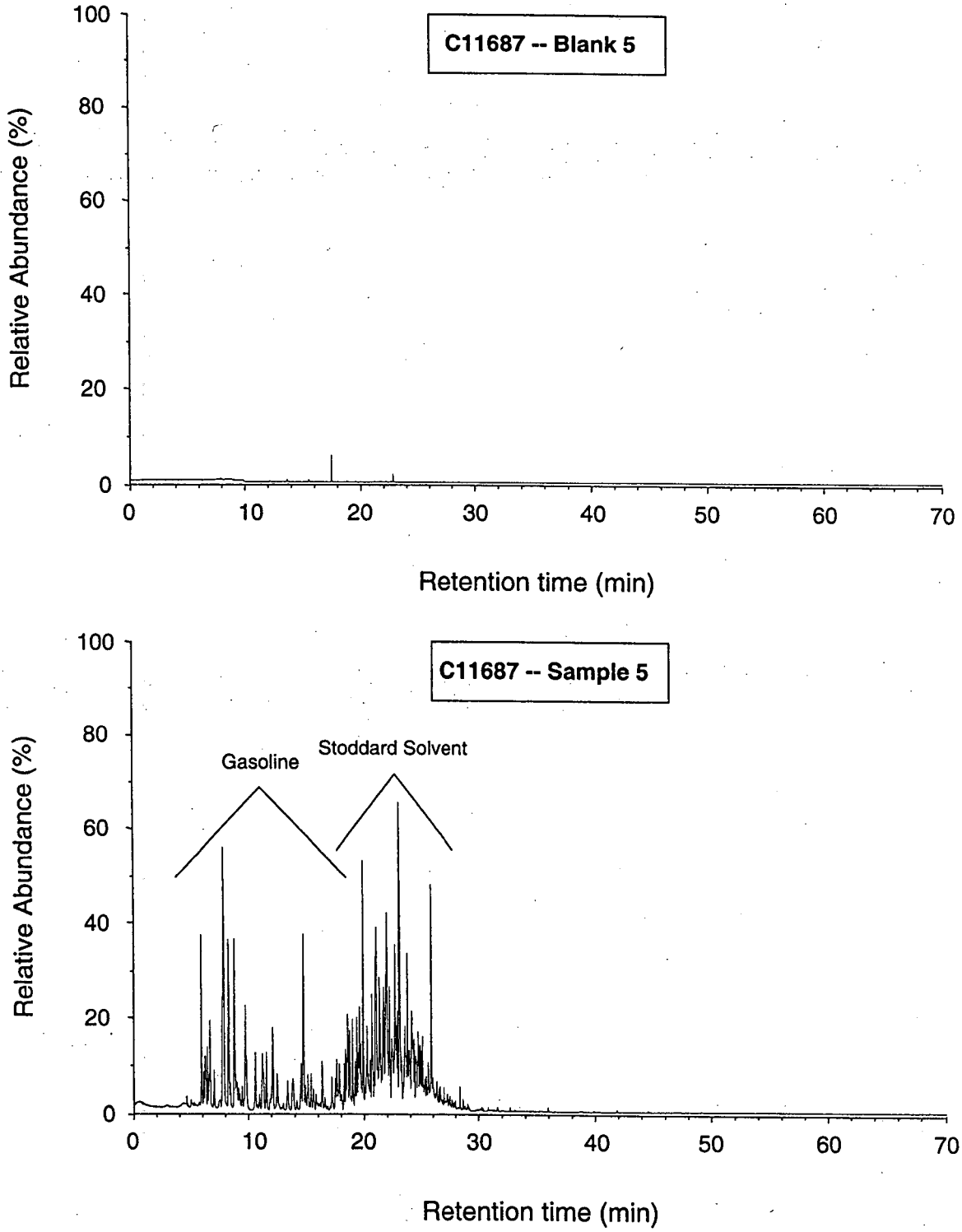


Figure CC5

GC/MS analysis of hydrocarbon vapor sample from near the Catalytic Converter (Location #5). During Crash Test C11687. The top panel is the chromatogram of background sample and the bottom panel is the chromatogram of the post-crash sample.

APPENDIX D

Appendix D: C11793 data plots

C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE

55.8KM/H

R & D CTR 8V91420 4 DOOR

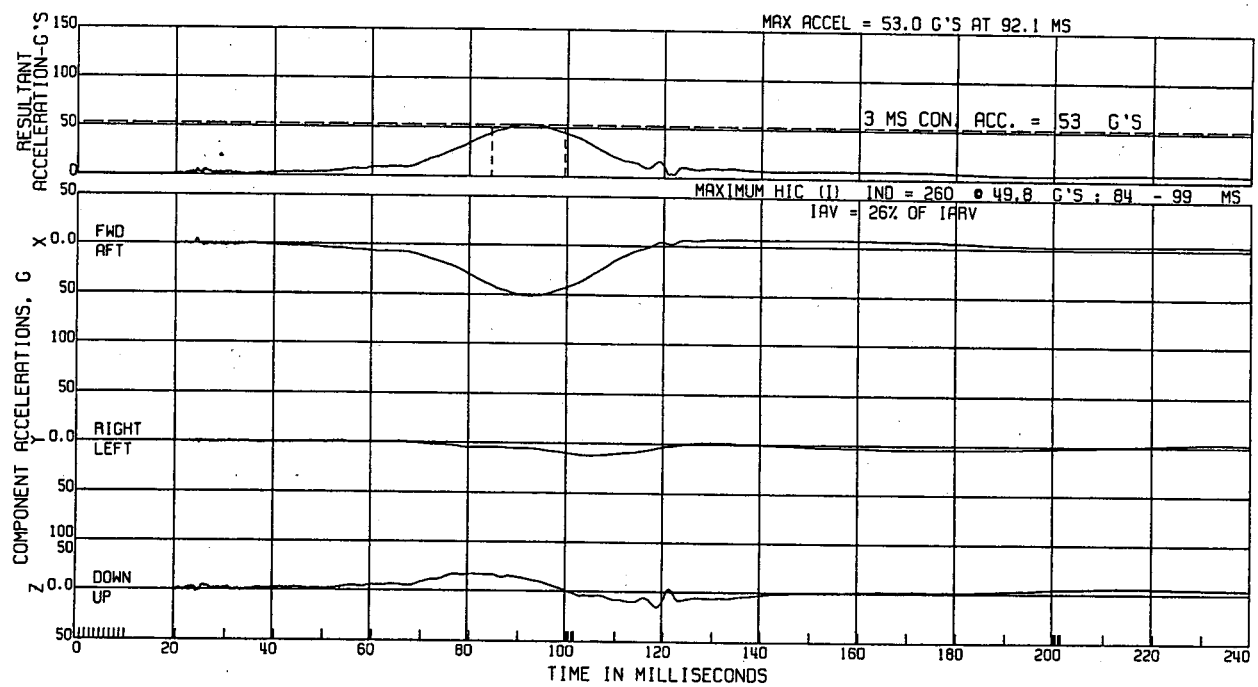
ELEC DATA, SAE CLASS 1000

L. FRT HEAD ACCEL.

(HIC I LIMITED TO 15MS)

ATD TYPE: GM50H

TEST DATE:11/12/1997



Appendix D, plot # 1

C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE

55.8KM/H

R & D CTR 8V91420 4 DOOR

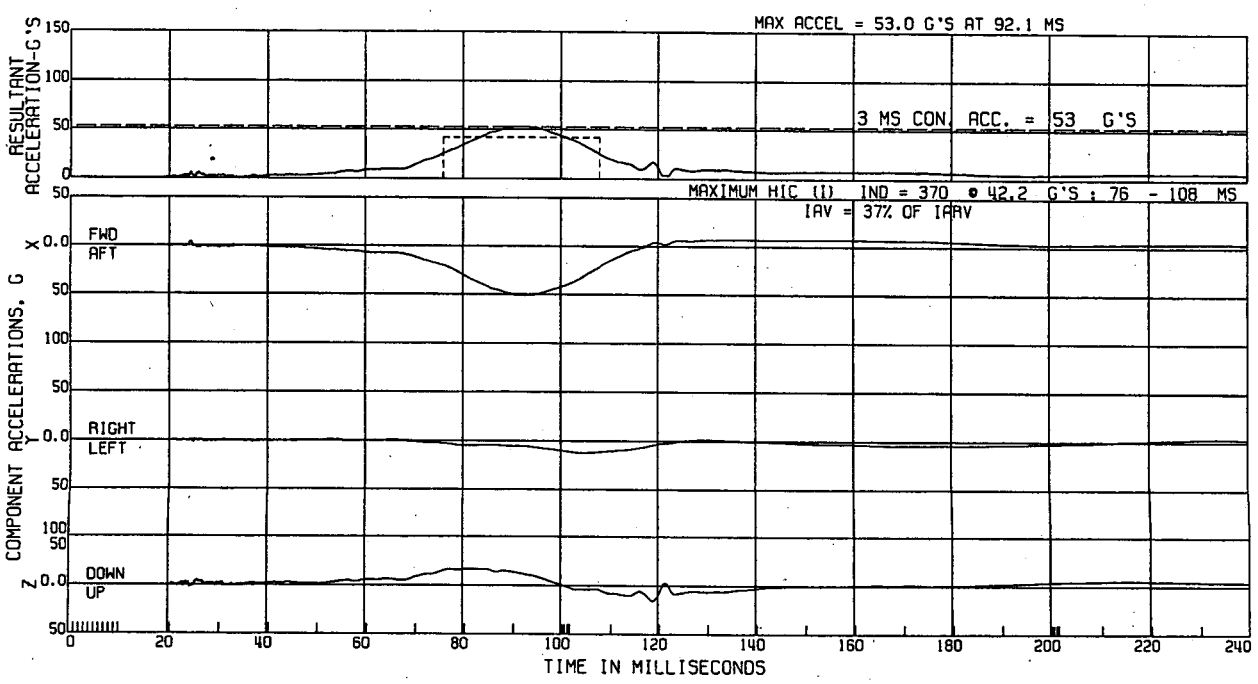
ELEC DATA, SAE CLASS 1000

L. FRT HEAD ACCEL.

(HIC I LIMITED TO 36MS)

ATD TYPE: GM50H

TEST DATE:11/12/1997

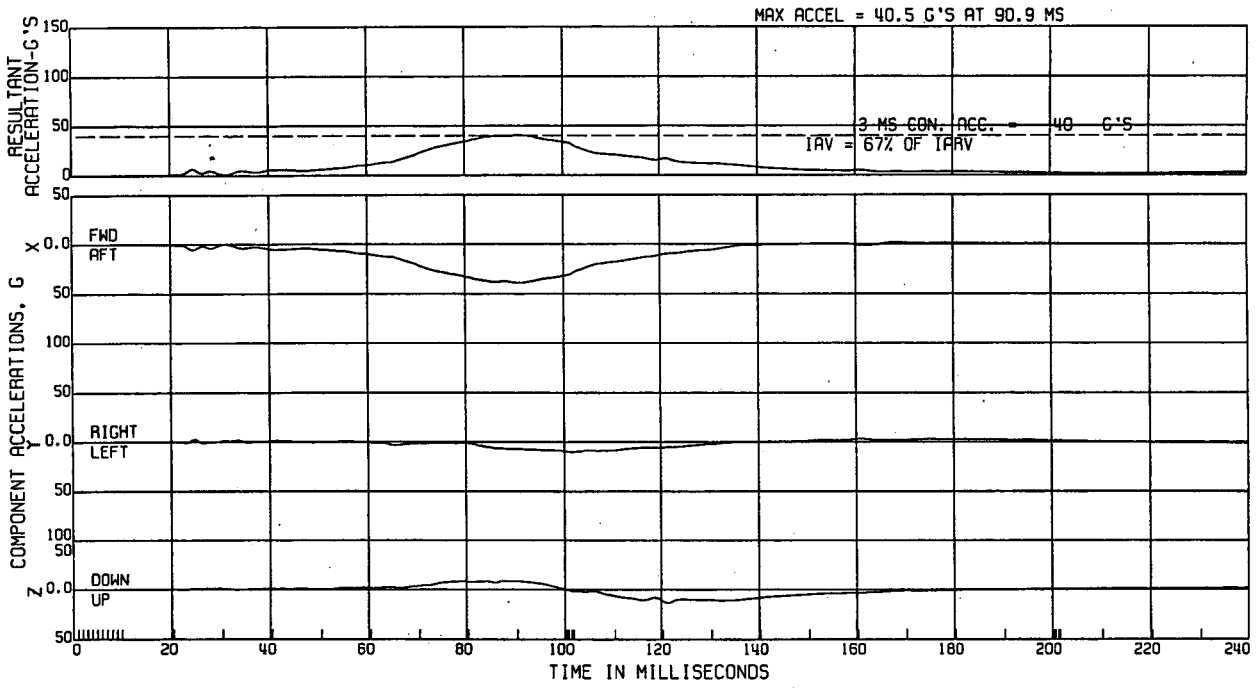


Appendix D, plot # 2

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR L. FRT CHEST ACCEL. ATD TYPE: GM50H

ELEC DATA, SAE CLASS 180 TEST DATE:11/12/1997

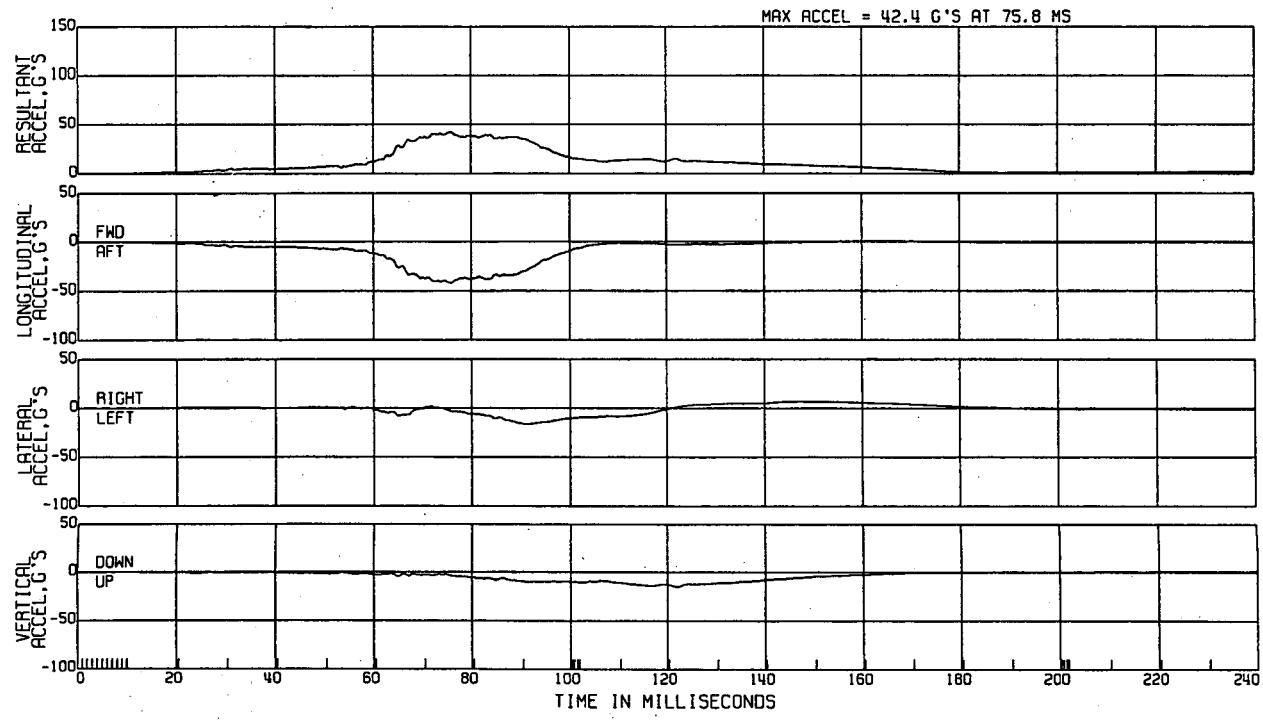


Appendix D, plot # 3

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR L. FRT PELVIC ACCEL. ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 TEST DATE:11/12/1997

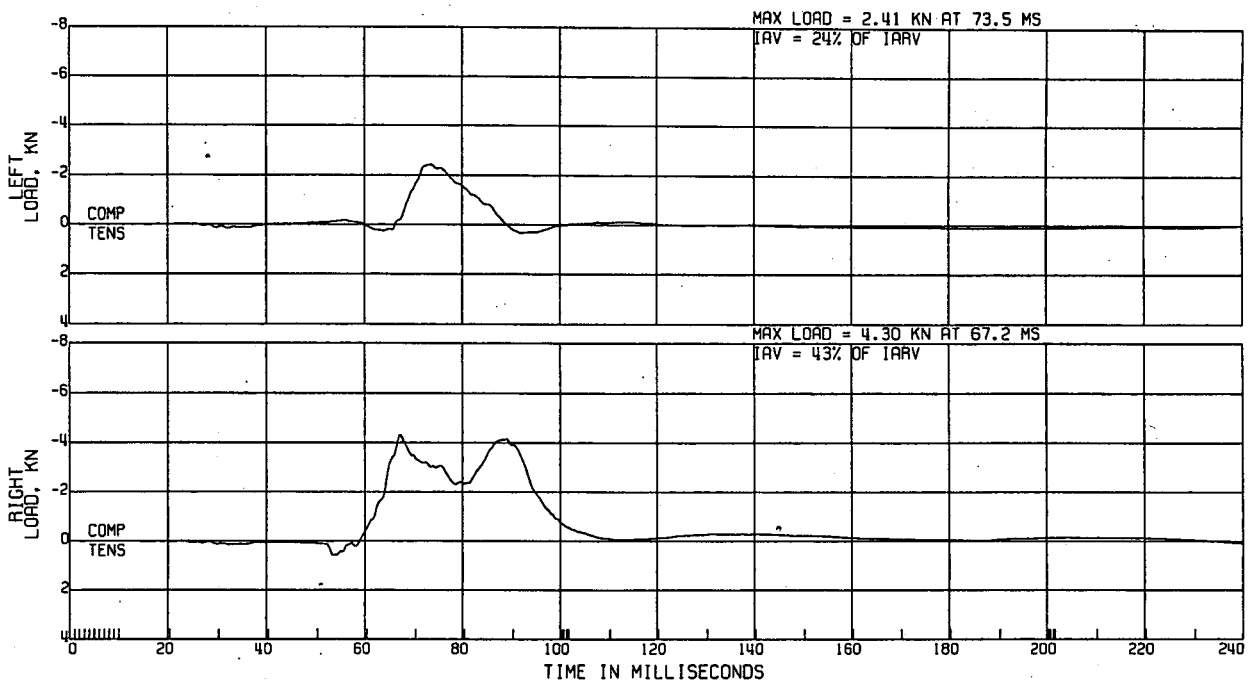


Appendix D, plot # 4

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR L. FRT FEMUR LOAD ATD TYPE: GM50H

ELEC DATA, SAE CLASS 600 TEST DATE:11/12/1997

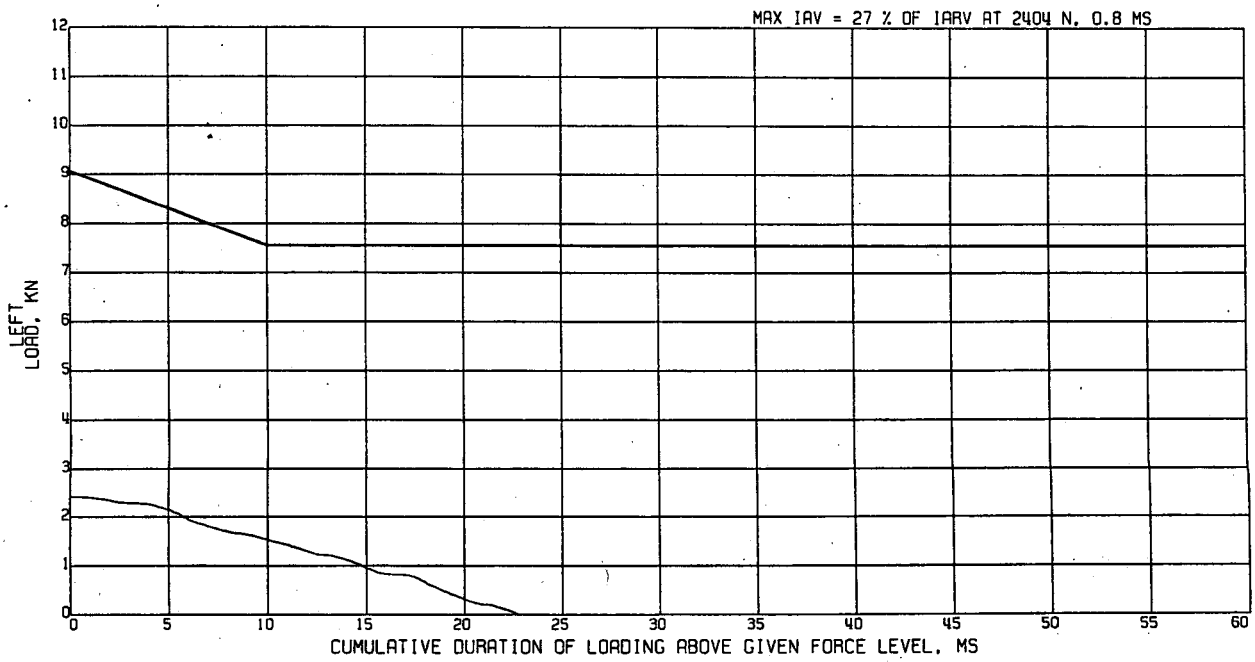


Appendix D, plot # **5**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR L. FRT FEMUR LOAD ATD TYPE: GM50H

ELEC DATA, SAE CLASS 600 DURATION ASSESSMENT TEST DATE:11/12/1997



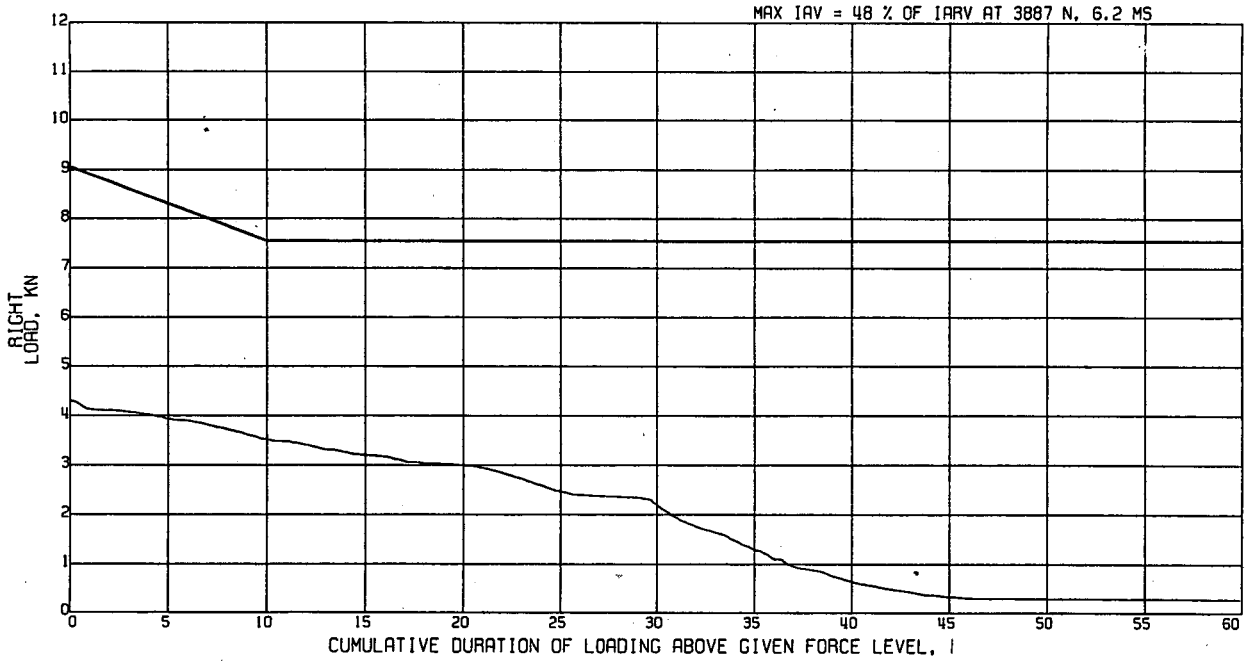
 Appendix D, plot # **6**

C11793 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.8KM/H

R & D CTR 8V9142D 4 DOOR
ELEC DATA, SAE CLASS 600

L. FRT FEMUR LOAD
DURATION ASSESSMENT

ATD TYPE: GM50H
TEST DATE:11/12/1997



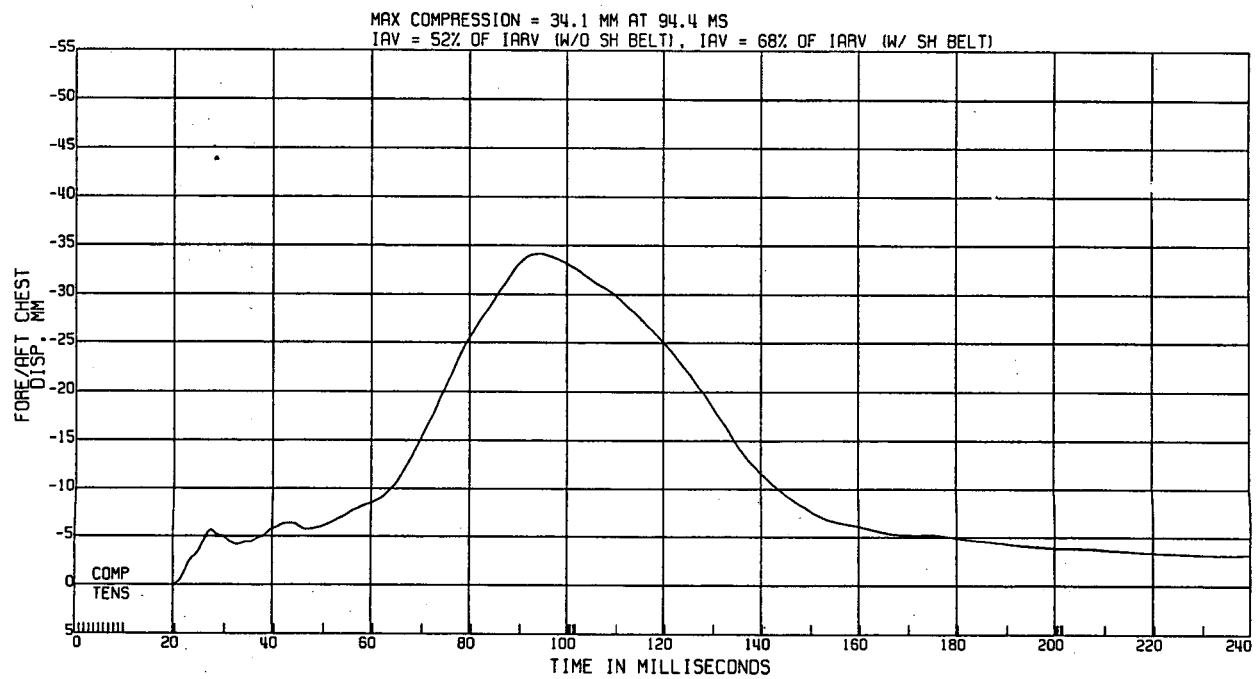
Appendix D, plot # **7**

C11793 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.8KM/H

R & D CTR 8V9142D 4 DOOR
ELEC DATA, SAE CLASS 180

L. FRT CHEST DISP, TEMP AT 68.0'F
NORMALIZED TO 70.7'F & PART 572 CORRIDOR

ATD TYPE: GM50H
TEST DATE:11/12/1997

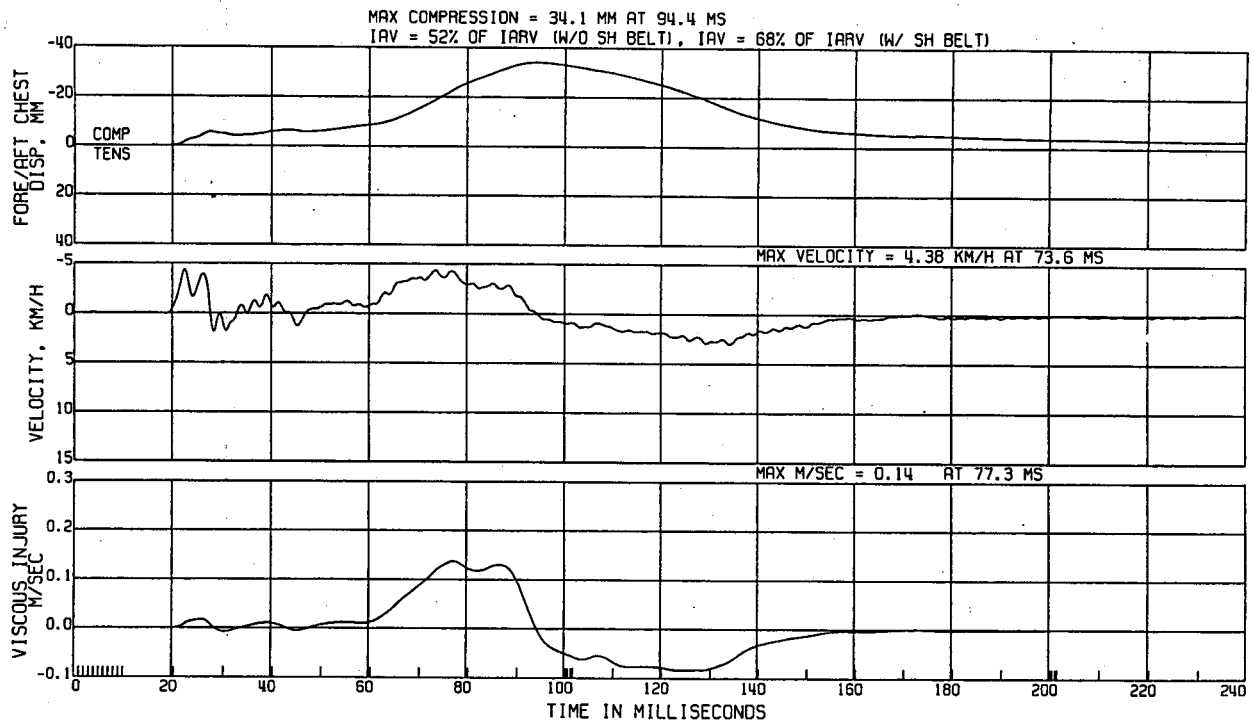


Appendix D, plot # **8**

C11793 FRONT IMPACT — MOVING VEHICLE TO FIXED POLE — 55.8KM/H

R & D CTR 8V91142D 4 DOOR — L. FRT CHEST COMPRESSIVE DISP. — ATD TYPE: GM50H

ELEC DATA, SAE CLASS 180 — NORMALIZED, W/CALC VEL & VISCOUS INJURY — TEST DATE:11/12/1997

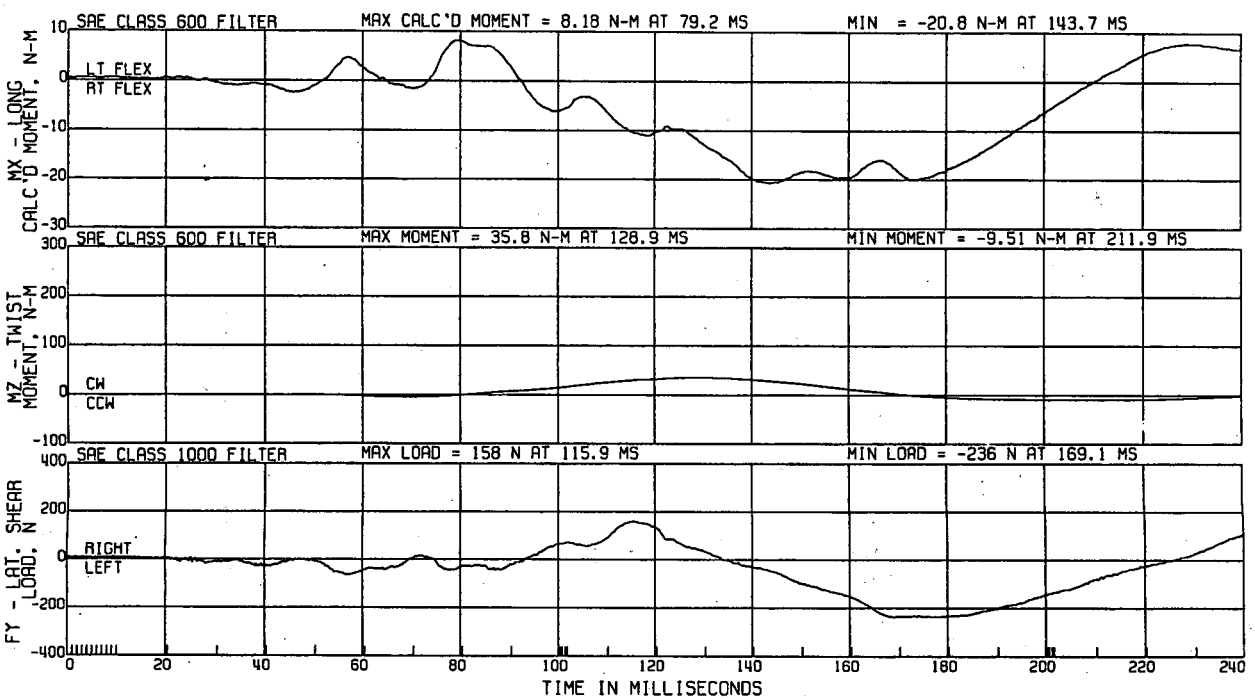


Appendix D, plot # **9**

C11793 FRONT IMPACT — MOVING VEHICLE TO FIXED POLE — 55.8KM/H

R & D CTR 8V91142D 4 DOOR — L. FRT NECK LOADING ON HEAD, UPPER LOAD — ATD TYPE: GM50H

ELEC DATA — L. FRT NECK LOADING ON HEAD — TEST DATE:11/12/1997

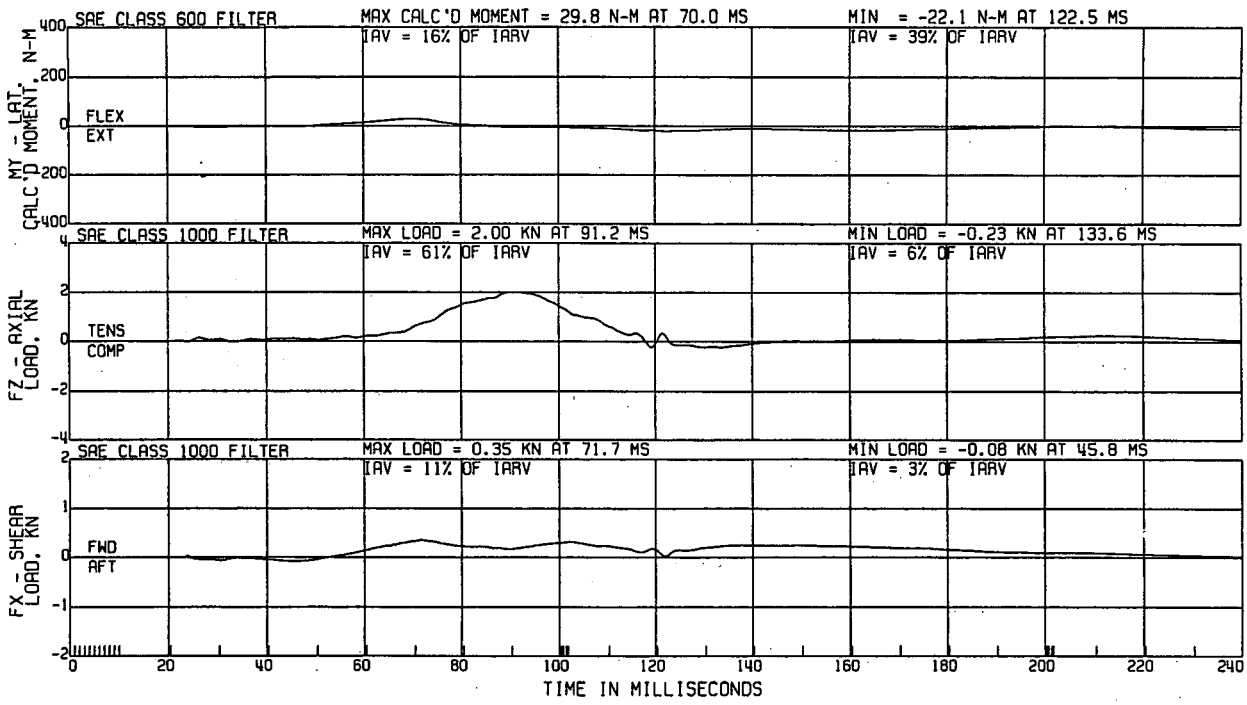


Appendix D, plot # **10**

C11793 FRONT IMPACT | MOVING VEHICLE.TO FIXED POLE | 55.8KM/H

R & D CTR 8V91142D 4 DOOR | NECK LOADING ON HEAD | ATD TYPE: GM50H

ELEC DATA | L. FRT NECK LOADING ON HEAD | TEST DATE:11/12/1997

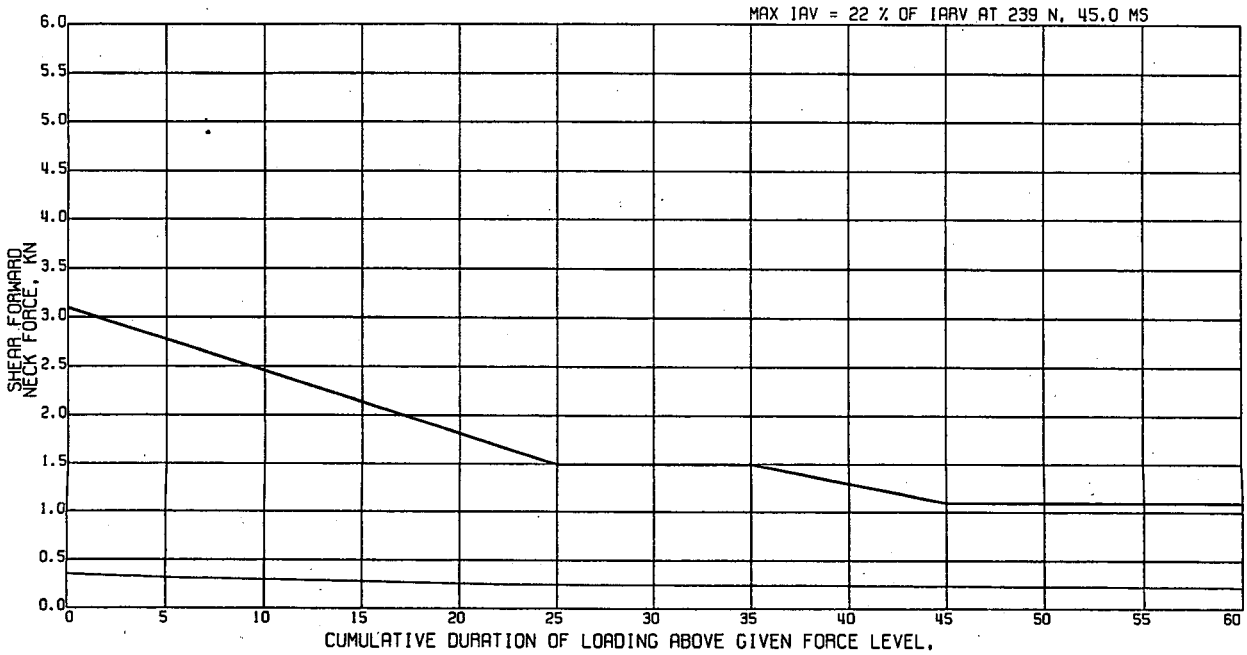


Appendix D, plot # **11**

C11793 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.8KM/H

R & D CTR 8V91142D 4 DOOR | FORWARD NECK SHEAR ON HEAD, | ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 | L. FRT INJURY REFERENCE | TEST DATE:11/12/1997



Appendix D, plot # **12**

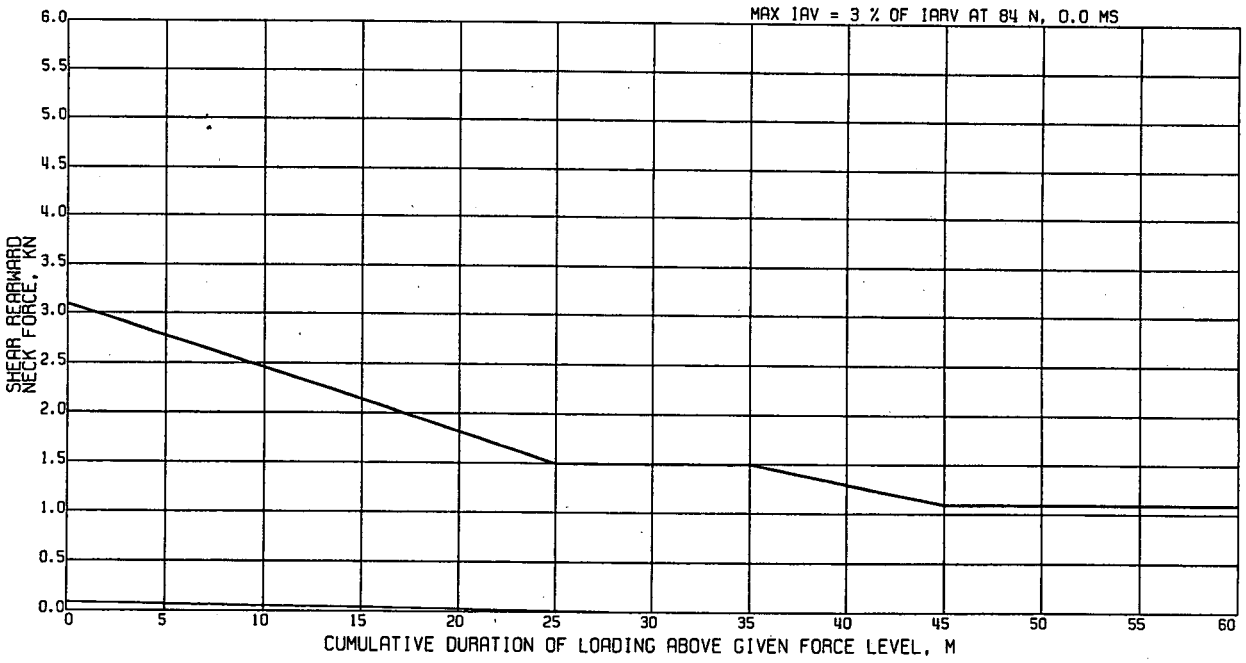
C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR
ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:11/12/1997



1: Appendix D, plot # 13

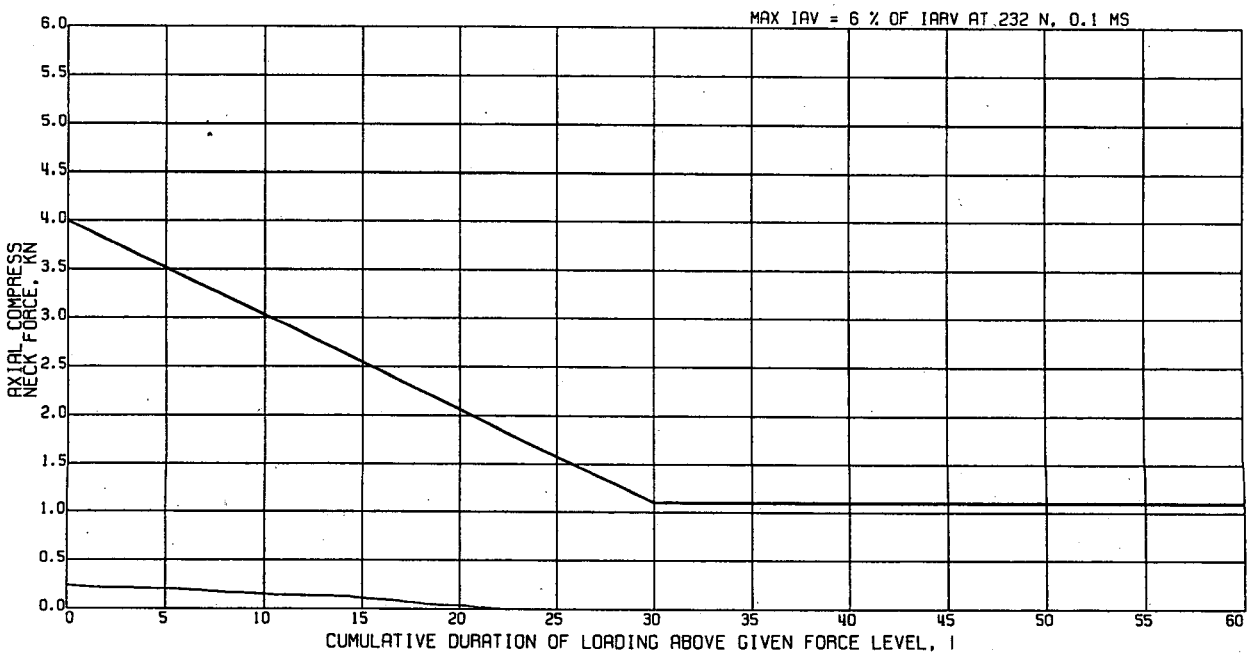
C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR
ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,
L. FRT INJURY REFERENCE

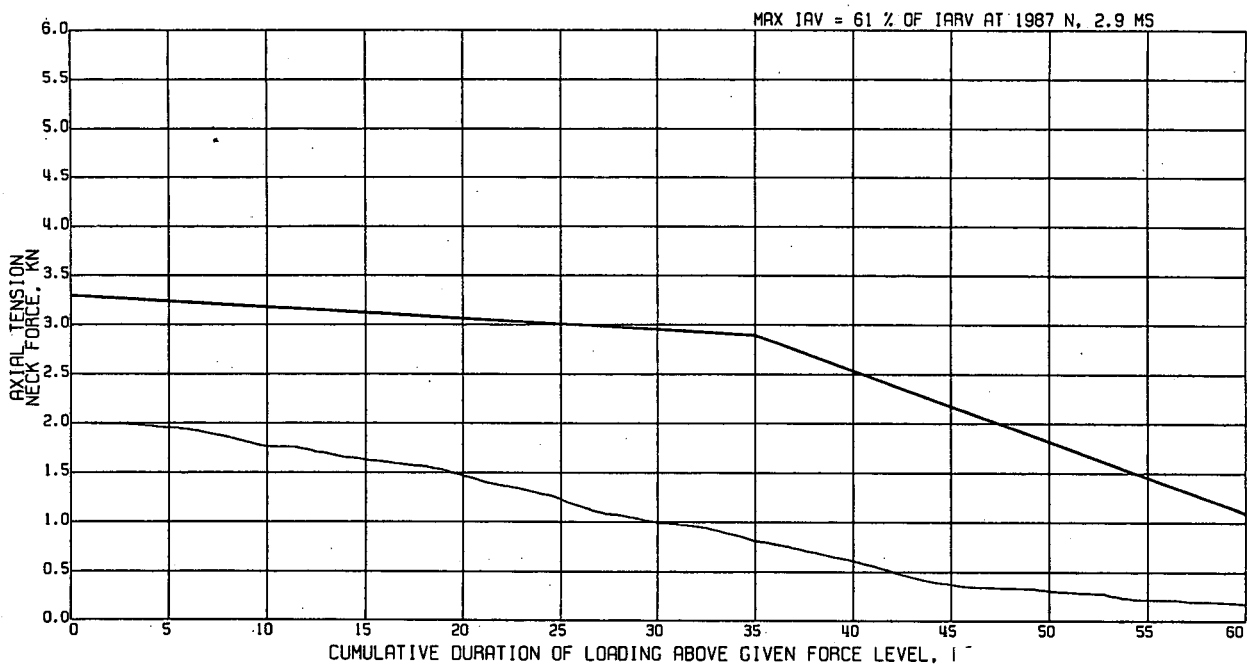
ATD TYPE: GM50H
TEST DATE:11/12/1997



1 Appendix D, plot # 14

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

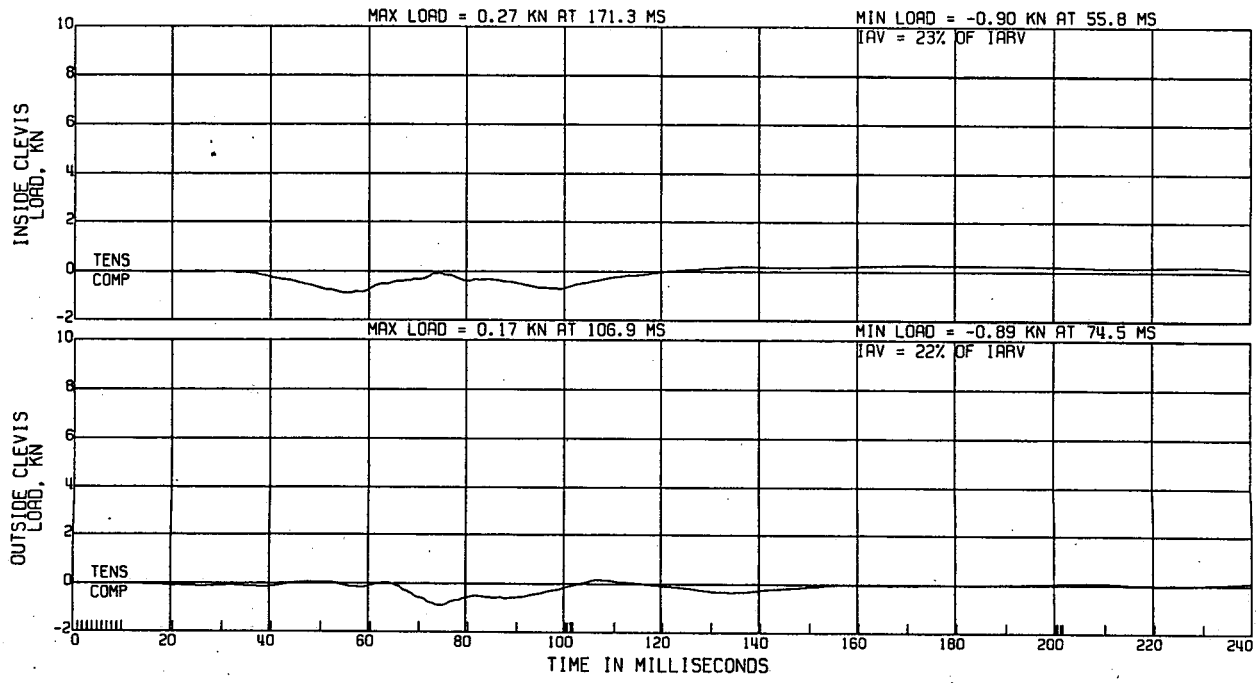
R & D CTR 8V91142D 4 DOOR ATD TYPE: GM50H
ELEC DATA, SAE CLASS 1000 AXIAL TENSION ON HEAD, TEST DATE:11/12/1997
L. FRT INJURY REFERENCE



[1] Appendix D, plot # **15**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

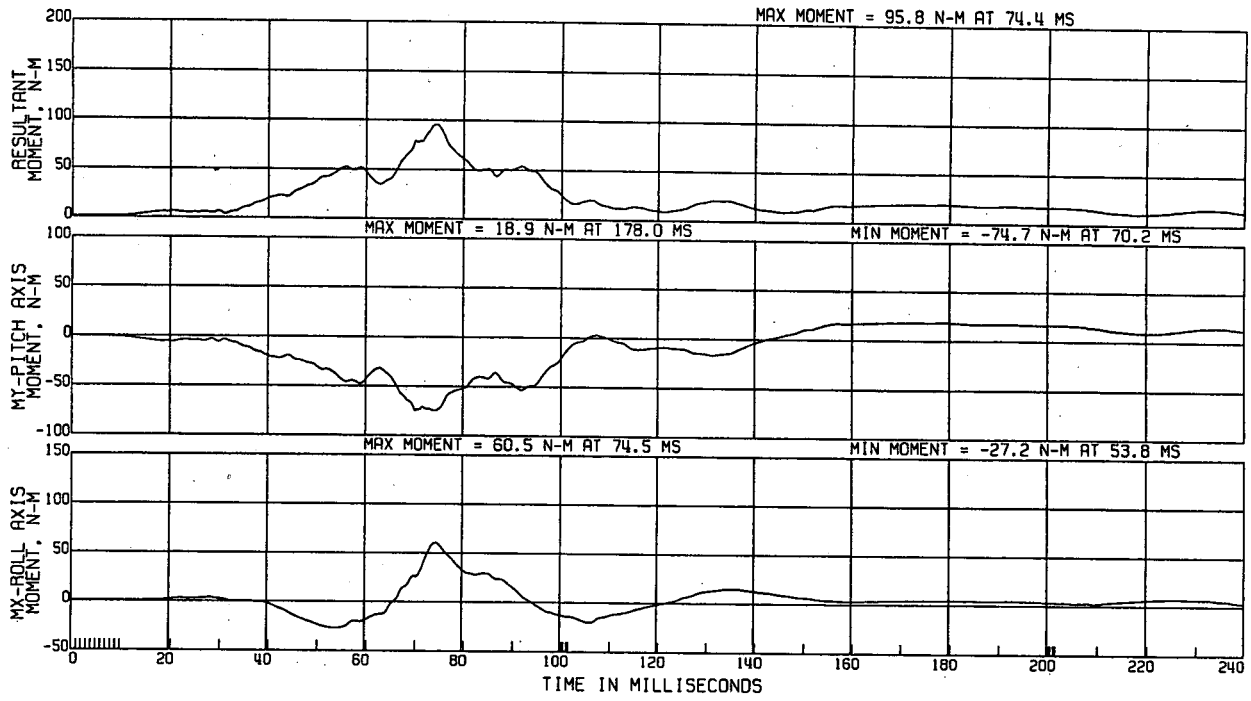
R & D CTR 8V91142D 4 DOOR L. FRT LEFT KNEE CLEVIS LOAD ATD TYPE: GM50H
ELEC DATA, SAE CLASS 600 TEST DATE:11/12/1997



Appendix D, plot # **16**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

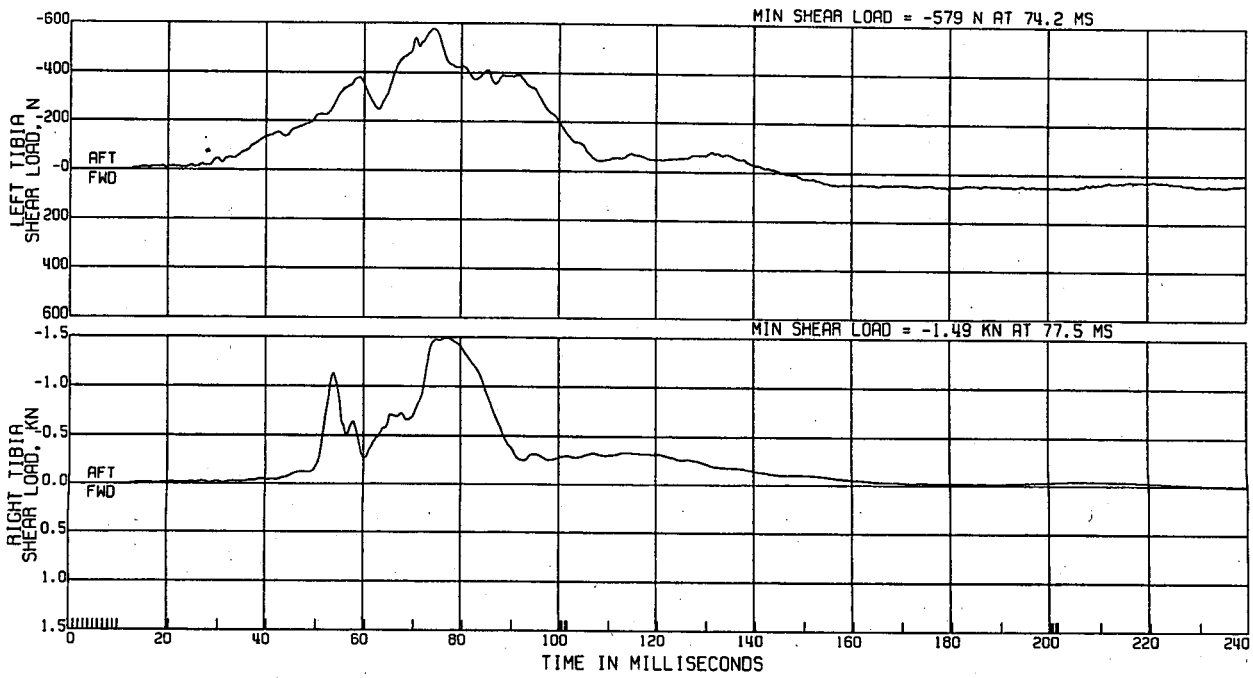
R & D CTR 8V91142D 4 DOOR ATD TYPE: GM50H
ELEC DATA, SAE CLASS 600 L. FRT LEFT TIBIA UPPER MOMENT TEST DATE:11/12/1997



Appendix D, plot # **17**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

ATD TYPE: GM50H
R & D CTR 8V91142D 4 DOOR TEST DATE:11/12/1997
ELEC DATA, SAE CLASS 600 L. FRT TIBIA LOWER SHEAR LOAD CELLS



Appendix D, plot # **18**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

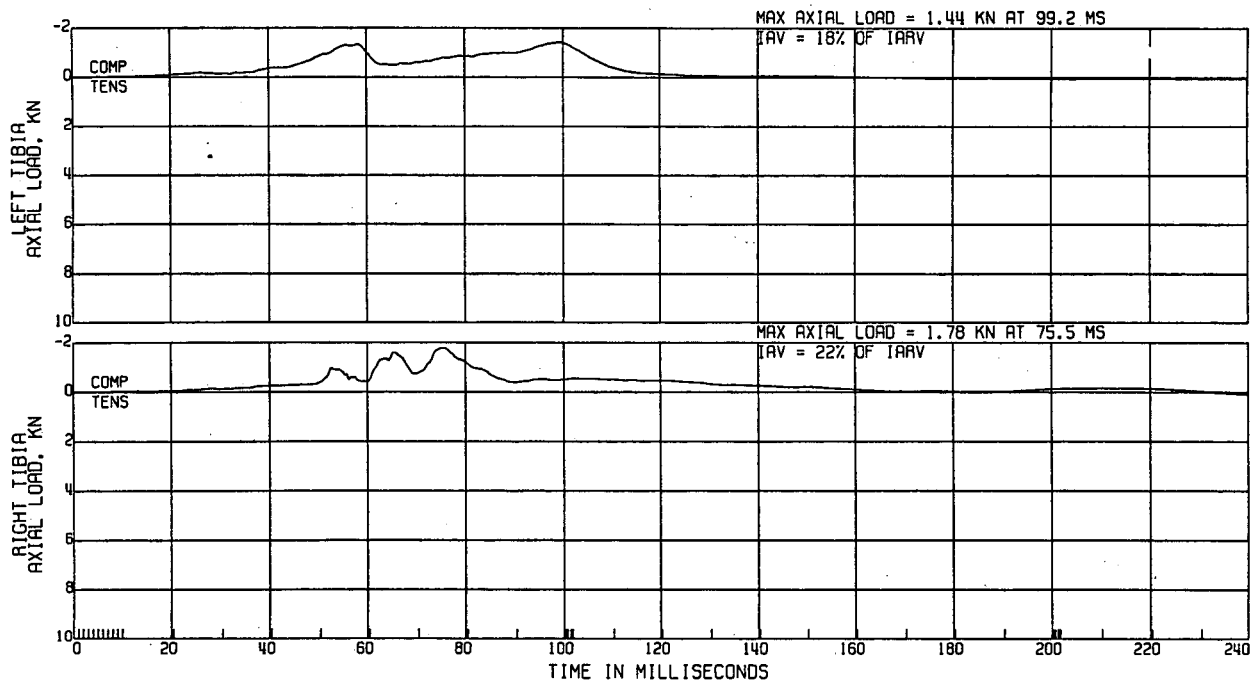
ATD TYPE: GM50H

R & D CTR 8V9142D 4 DOOR

TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 600

L. FRT TIBIA LOWER AXIAL LOAD



Appendix D, plot # **19**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

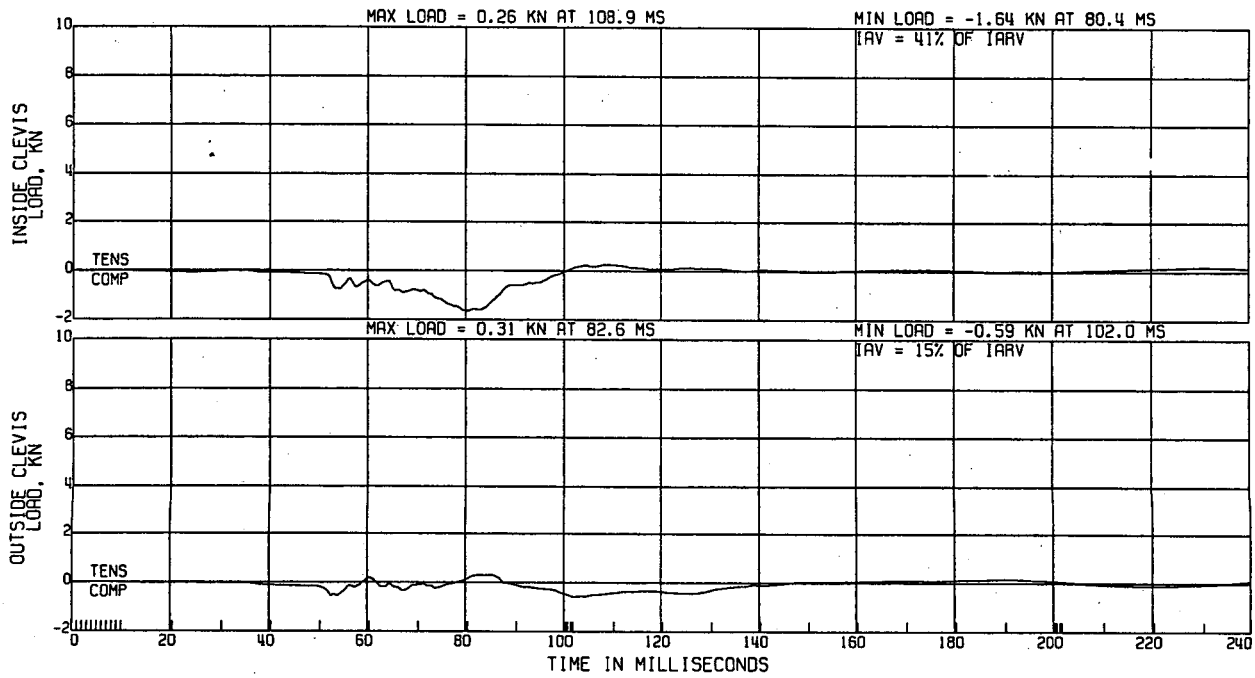
ATD TYPE: GM50H

R & D CTR 8V9142D 4 DOOR

L. FRT RIGHT KNEE CLEVIS LOAD

TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 600



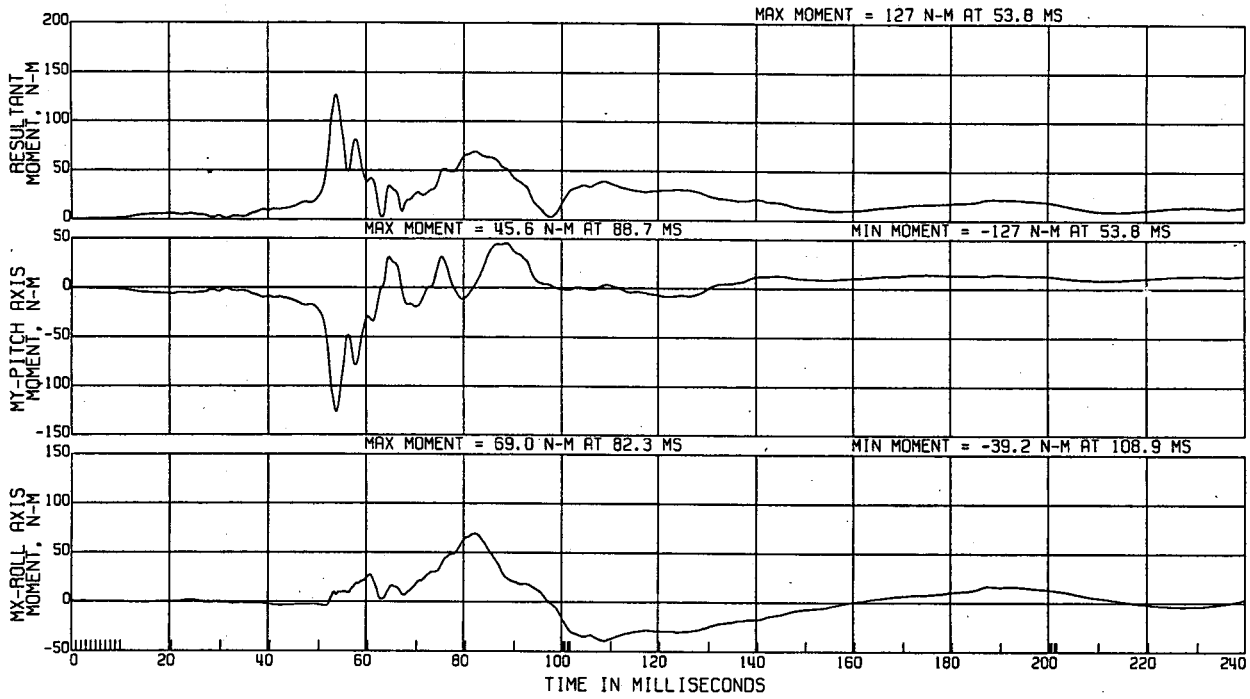
Appendix D, plot # **20**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR
ELEC DATA, SAE CLASS 600

L. FRT RIGHT TIBIA UPPER MOMENT

ATD TYPE: GM50H
TEST DATE:11/12/1997



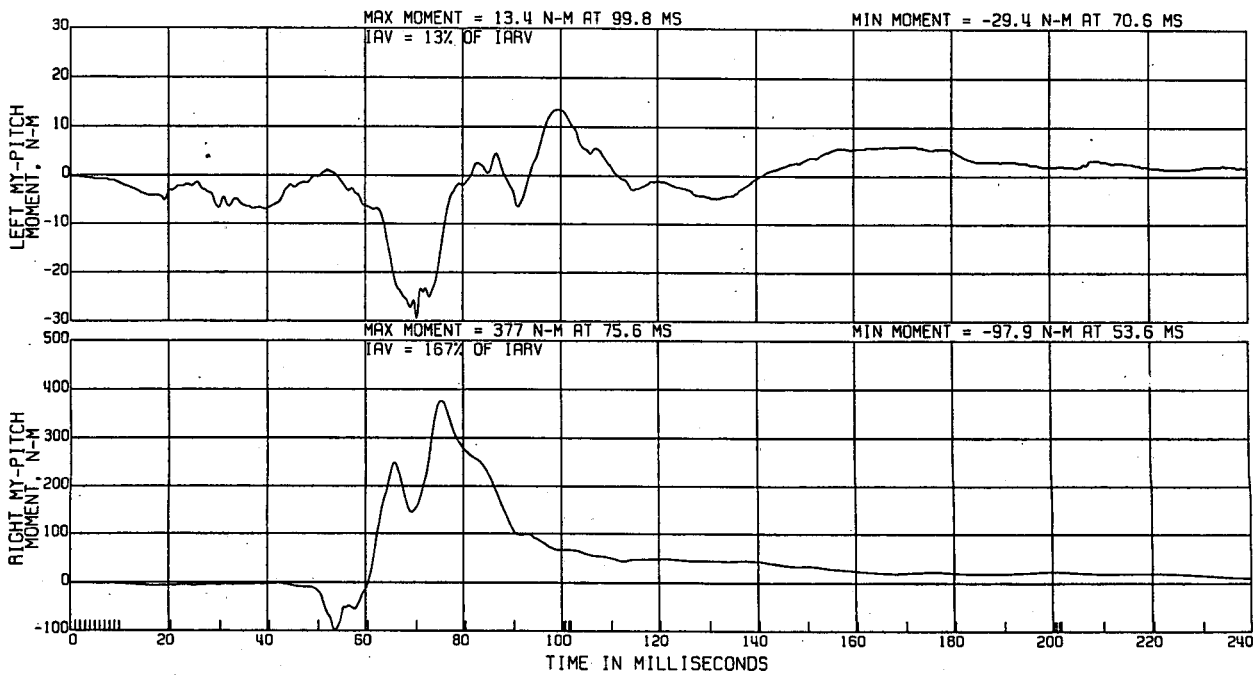
Appendix D, plot # **21**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR
ELEC DATA, SAE CLASS 600

ATD TYPE: GM50H
TEST DATE:11/12/1997

L. FRT TIBIA LOWER BENDING MOMENTS



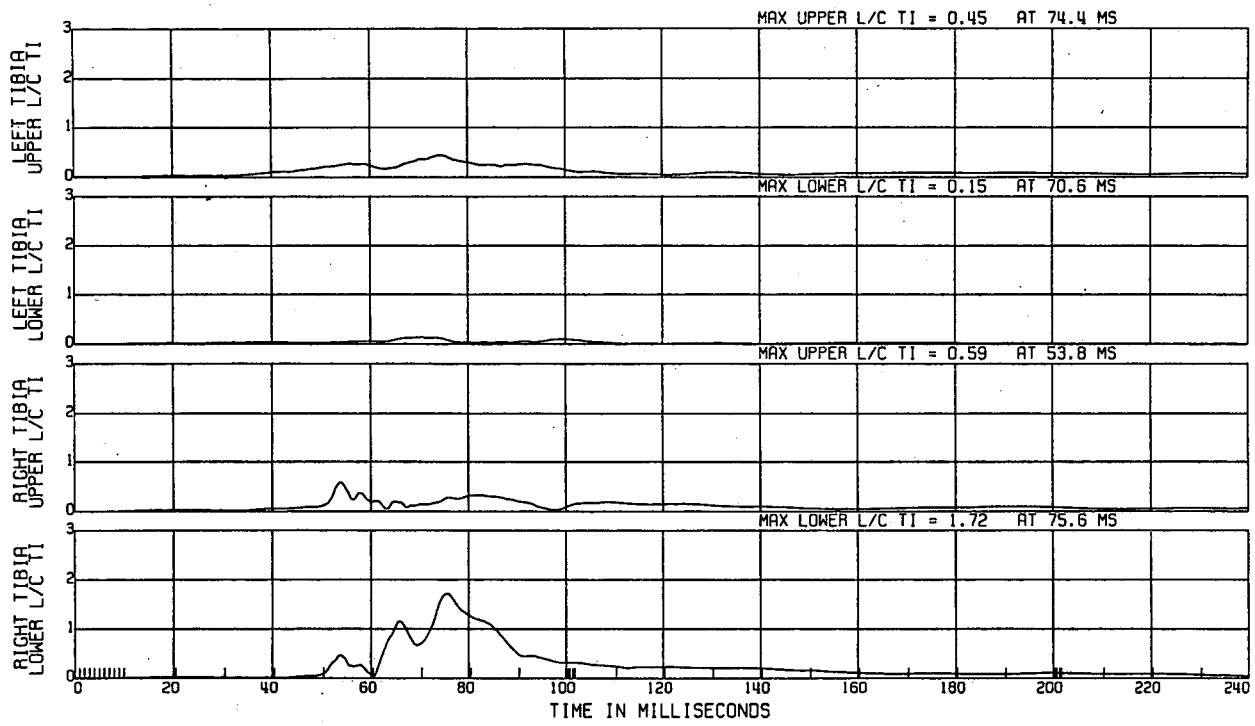
 Appendix D, plot # **22**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

ATD TYPE: GM50H

R & D CTR 8V91142D 4 DOOR L. FRT TIBIA INDICES TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 600 TI = (RES MOM/225 NM) + (AXIAL/35900 N)



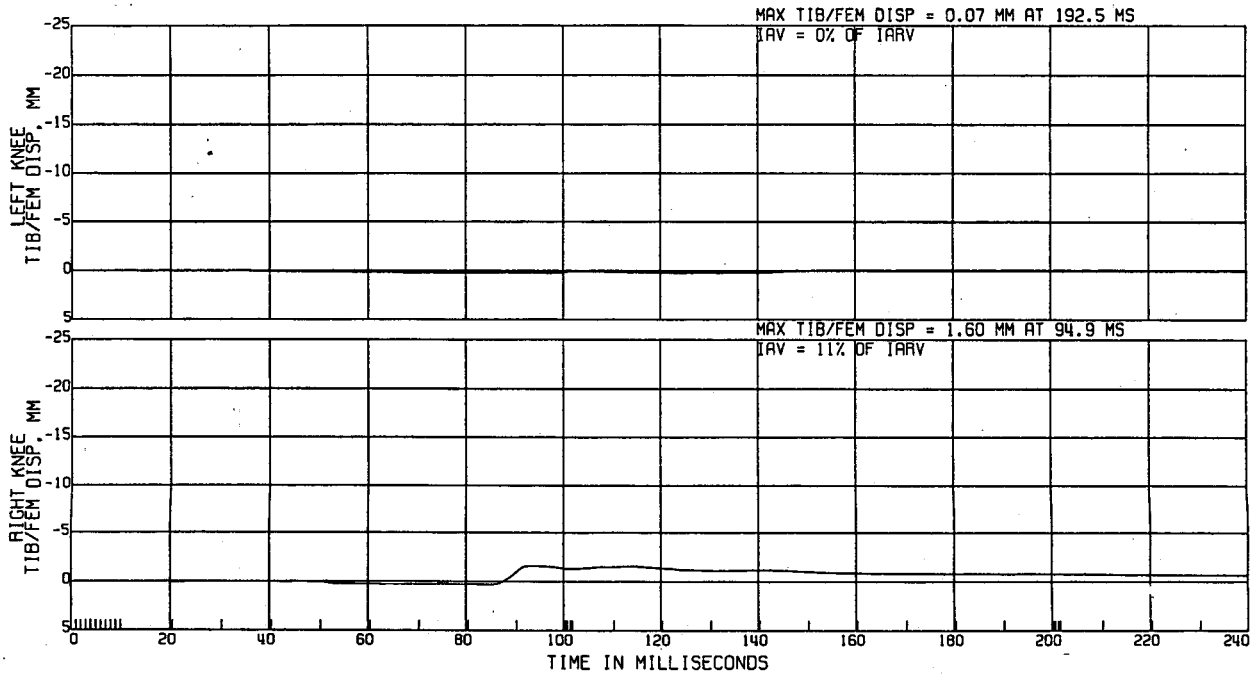
Appendix D, plot # **23**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

ATD TYPE: GM50H

R & D CTR 8V91142D 4 DOOR L. FRT TIBIA/FEMUR DISPLACEMENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 180

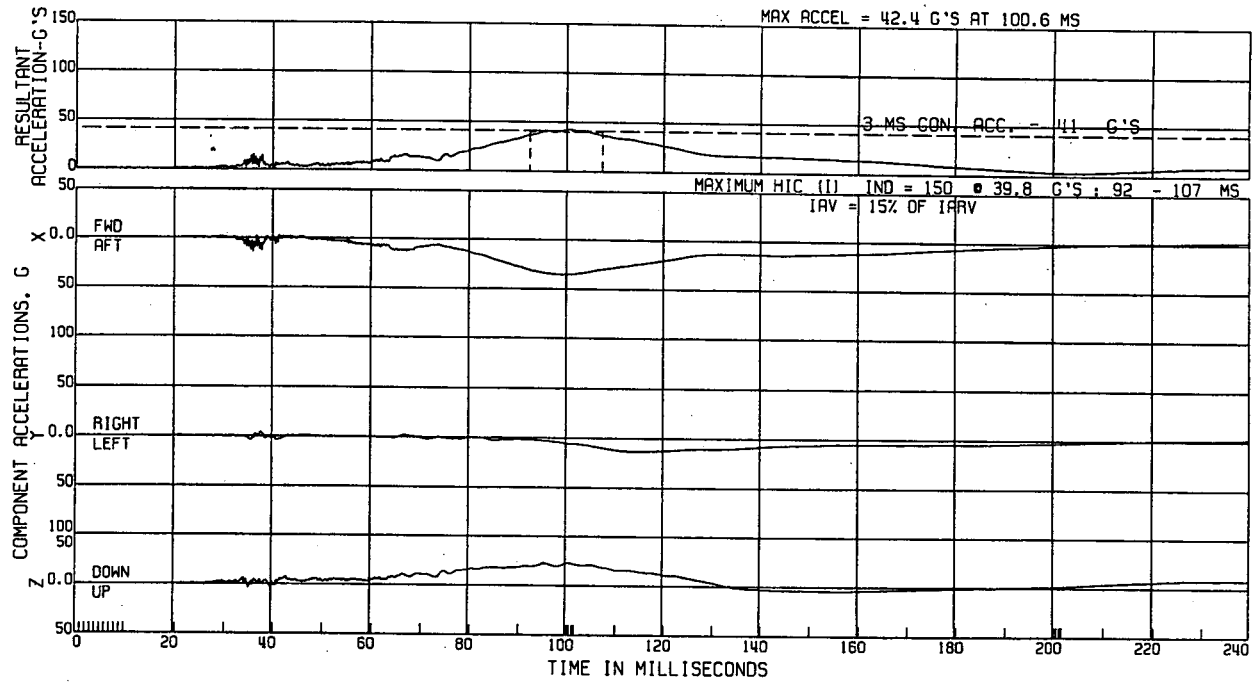


Appendix D, plot # **24**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR R. FRT HEAD ACCEL. ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 (HIC I LIMITED TO 15MS) TEST DATE:11/12/1997

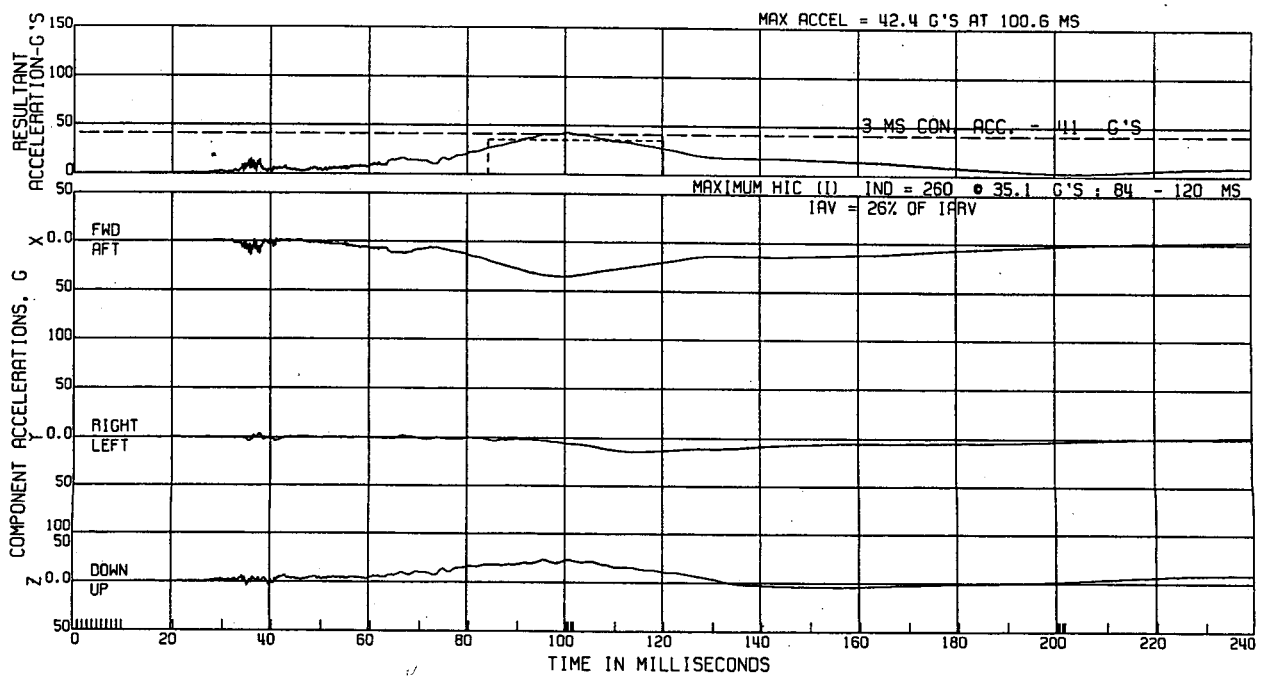


Appendix D, plot # **25**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR R. FRT HEAD ACCEL. ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 (HIC I LIMITED TO 36MS) TEST DATE:11/12/1997



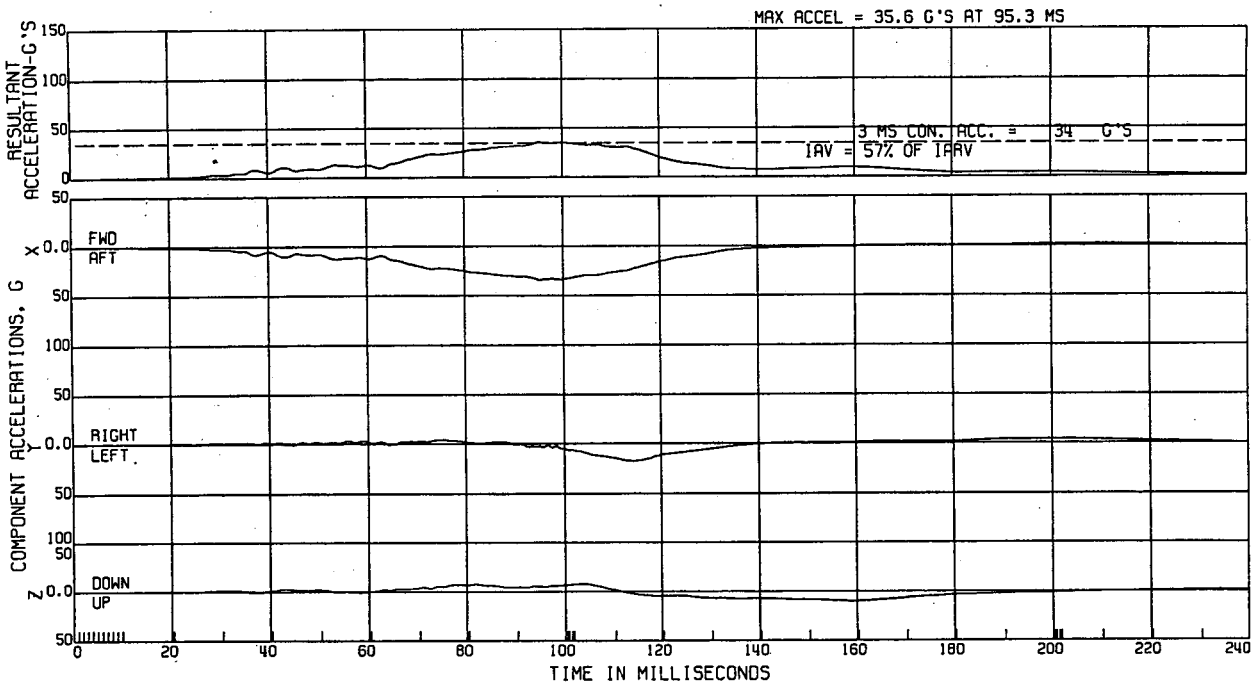
Appendix D, plot # **26**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

ATD TYPE: GM50H

R & D CTR 8V9142D 4 DOOR R. FRT CHEST ACCEL. TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 180



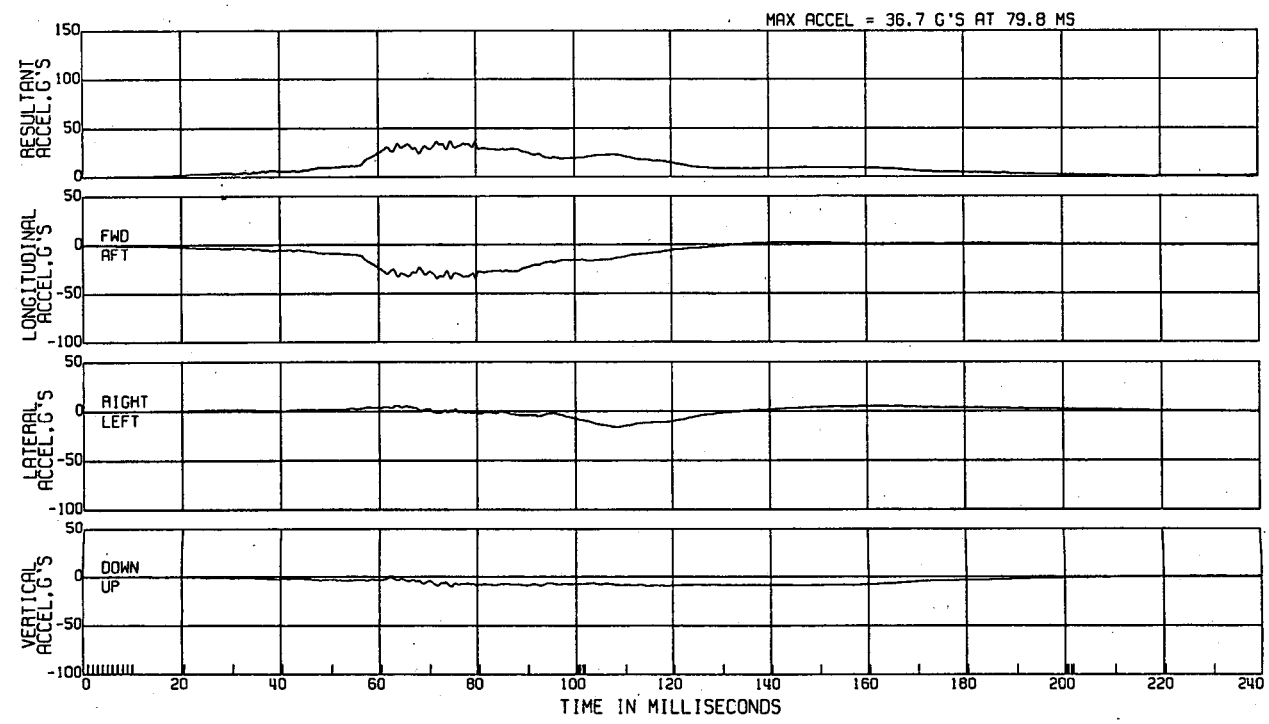
27 Appendix D, plot # **27**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

ATD TYPE: GM50H

R & D CTR 8V9142D 4 DOOR R. FRT PELVIC ACCEL. TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

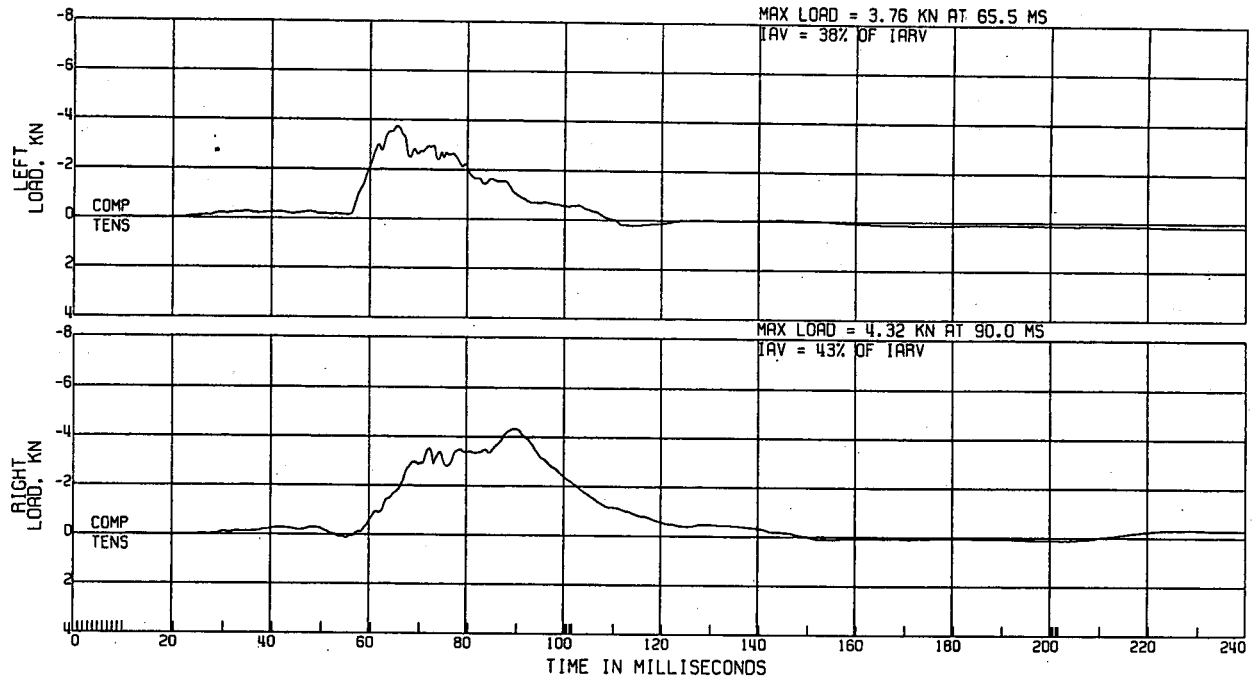


: Appendix D, plot # **28**

C11793 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.8KM/H

R & D CTR 8V91142D 4 DOOR | R. FRT FEMUR LOAD | ATD TYPE: GM50H

ELEC DATA, SAE CLASS 600 | TEST DATE:11/12/1997

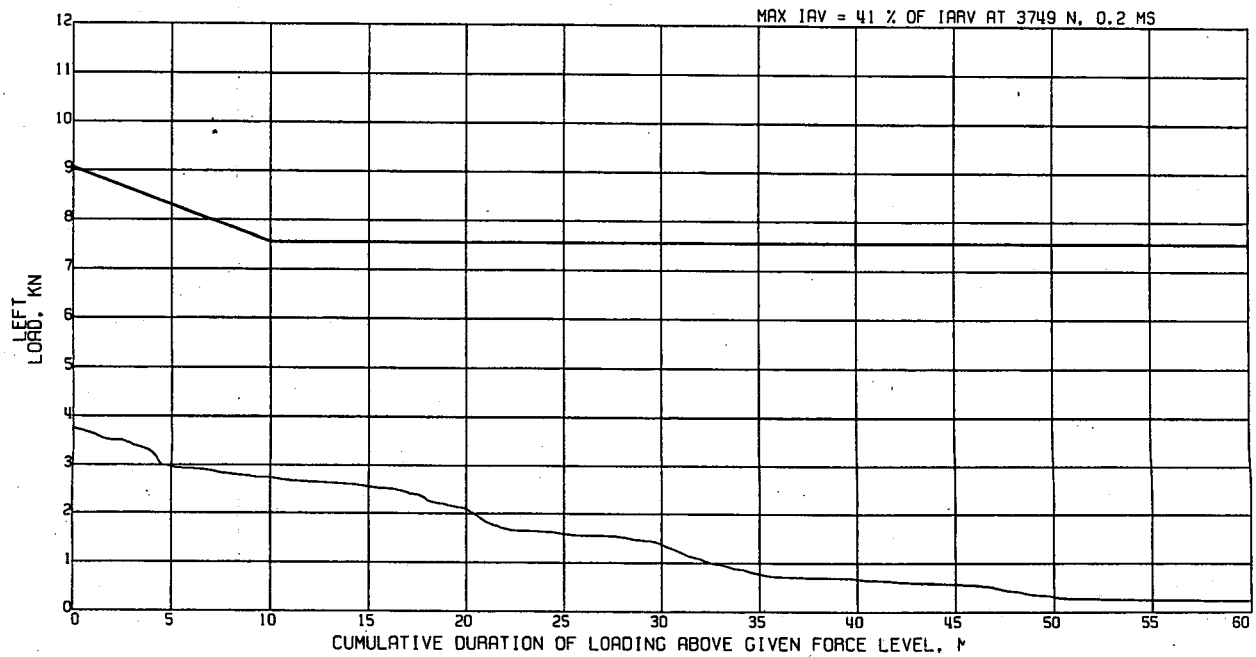


Appendix D, plot # **29**

C11793 FRONT IMPACT | MOVING VEHICLE TO FIXED POLE | 55.8KM/H

R & D CTR 8V91142D 4 DOOR | R. FRT FEMUR LOAD | ATD TYPE: GM50H

ELEC DATA, SAE CLASS 600 | DURATION ASSESSMENT | TEST DATE:11/12/1997



Appendix D, plot # **30**

C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE

55.8KM/H

ATD TYPE: GM50H

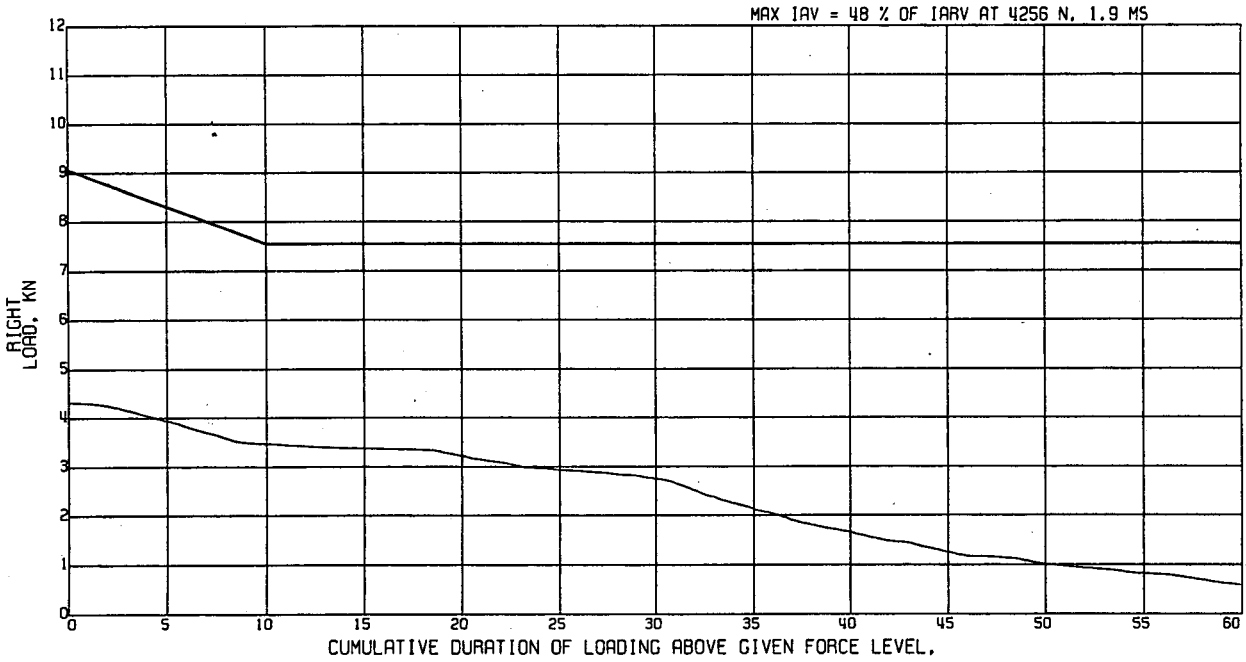
R & D CTR 8V9142D 4 DOOR

ELEC DATA, SAE CLASS 600

R. FRT FEMUR LOAD

DURATION ASSESSMENT

TEST DATE:11/12/1997



Appendix D, plot # **31**

C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE

55.8KM/H

ATD TYPE: GM50H

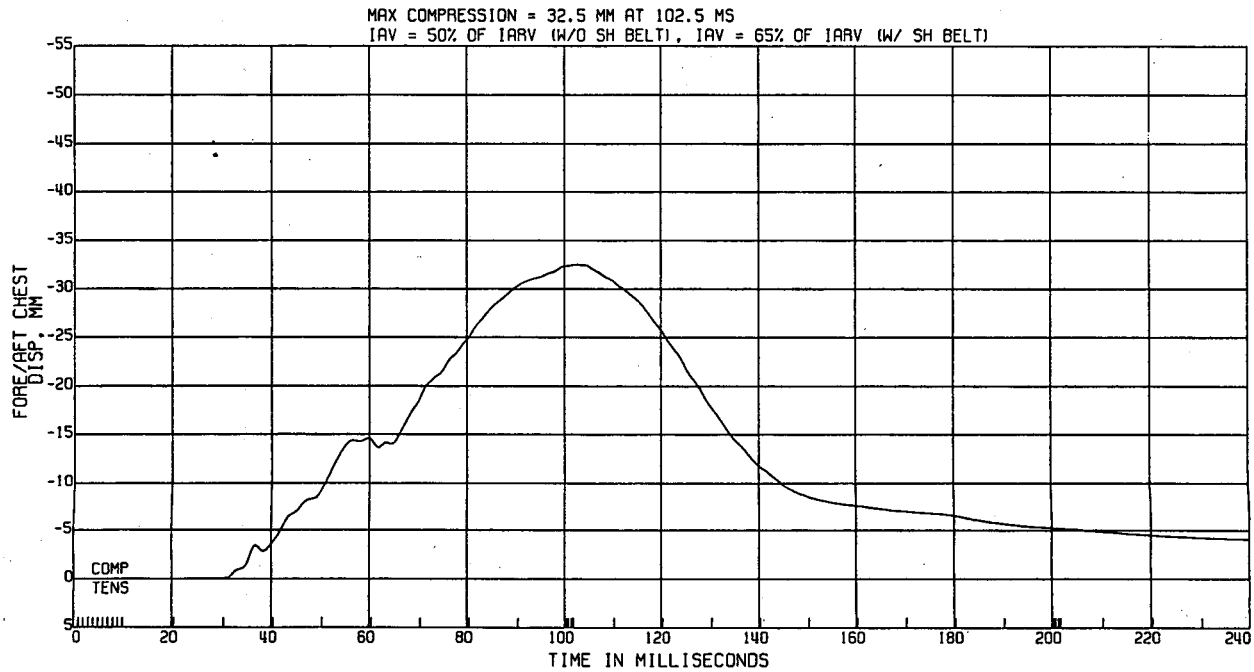
R & D CTR 8V9142D 4 DOOR

ELEC DATA, SAE CLASS 180

R. FRT CHEST DISP, TEMP AT 68.0'F

NORMALIZED TO 70.7'F & PART 572 CORRIDOR

TEST DATE:11/12/1997

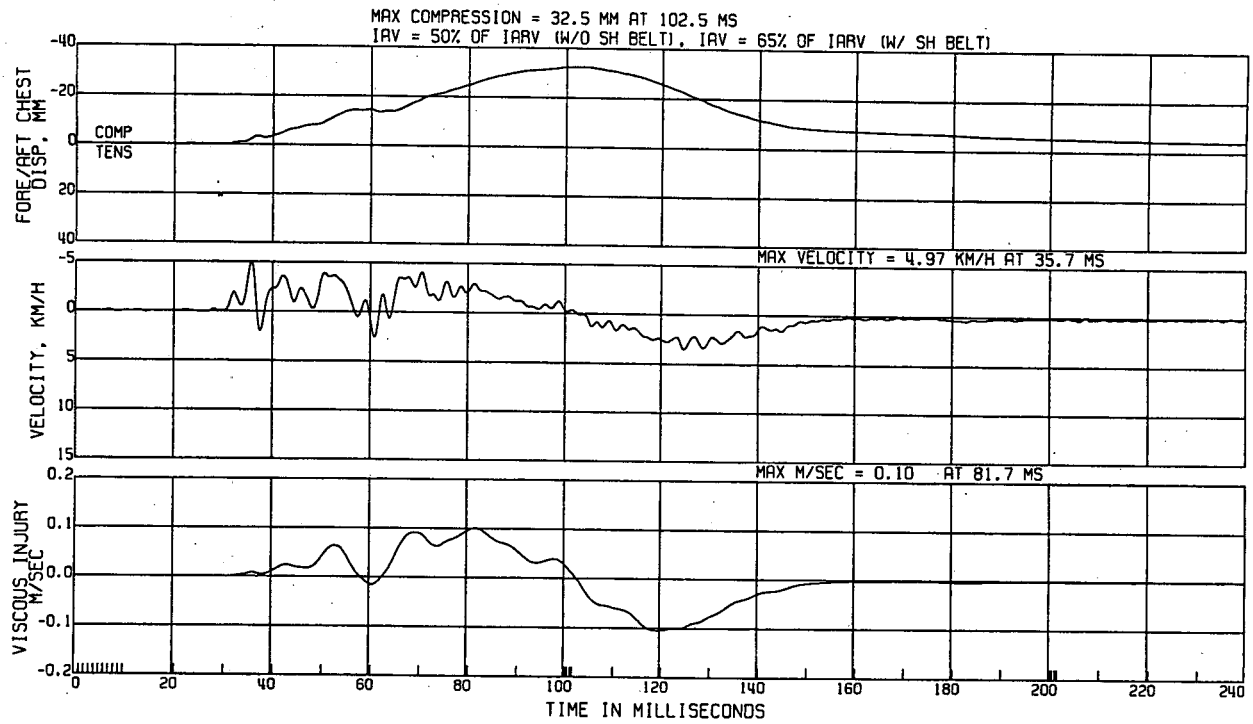


Appendix D, plot # **32**

C11793 FRONT IMPACT — MOVING VEHICLE TO FIXED POLE — 55.8KM/H

R & D CTR 8V91142D 4 DOOR — R. FRT CHEST COMPRESSIVE DISP. — ATD TYPE: GM50H

ELEC DATA, SAE CLASS 180 — NORMALIZED, W/CALC VEL & VISCOUS INJURY — TEST DATE:11/12/1997

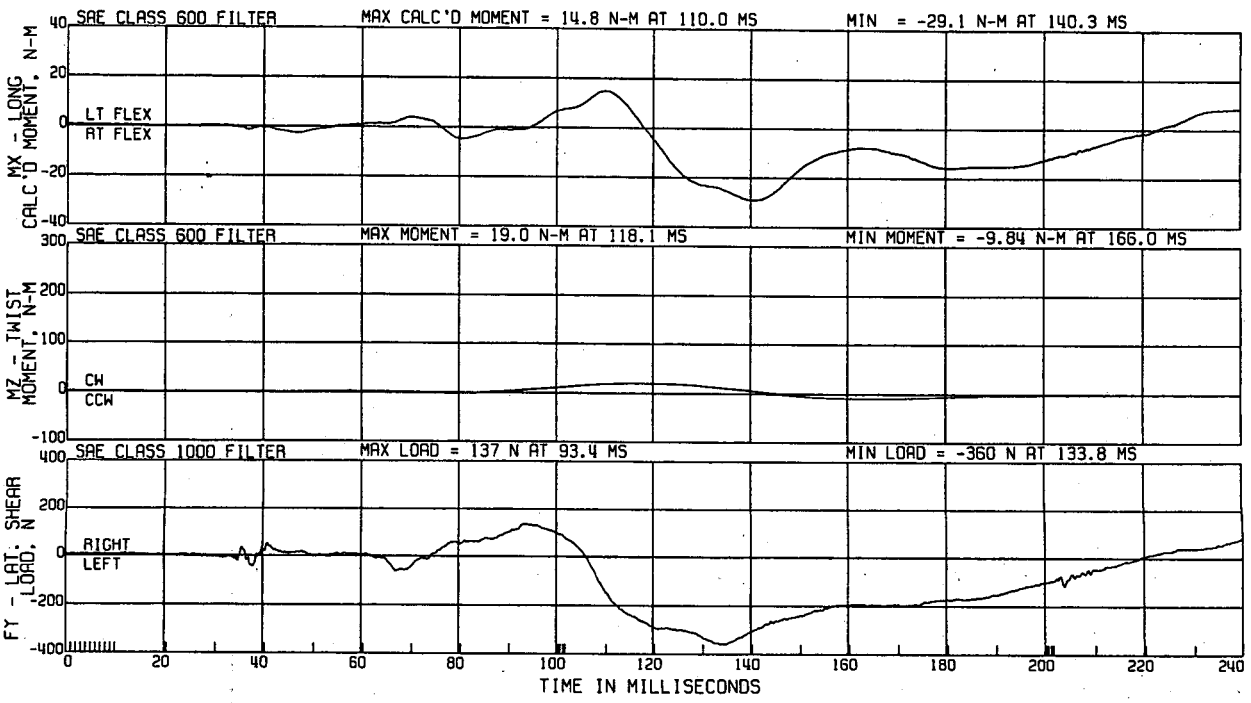


Appendix D, plot # **33**

C11793 FRONT IMPACT — MOVING VEHICLE TO FIXED POLE — 55.8KM/H

R & D CTR 8V91142D 4 DOOR — R. FRT NECK LOADING ON HEAD, UPPER LOAD — ATD TYPE: GM50H

ELEC DATA — R. FRT NECK LOADING ON HEAD — TEST DATE:11/12/1997



Appendix D, plot # **34**

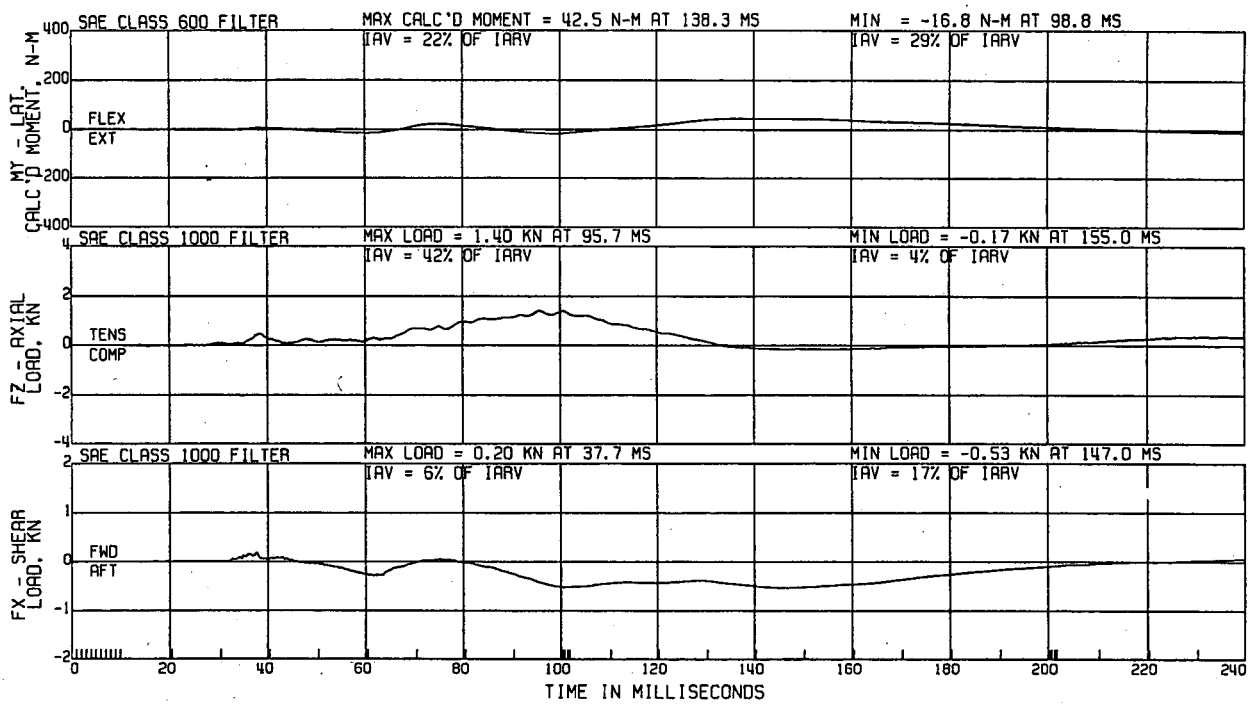
C11793 FRONT IMPACT — MOVING VEHICLE TO FIXED POLE — 55.8KM/H

R & D CTR 8V9142D 4 DOOR
ELEC DATA

NECK LOADING ON HEAD

R. FRT NECK LOADING ON HEAD

ATD TYPE: GM50H
TEST DATE:11/12/1997



Appendix D, plot # **35**

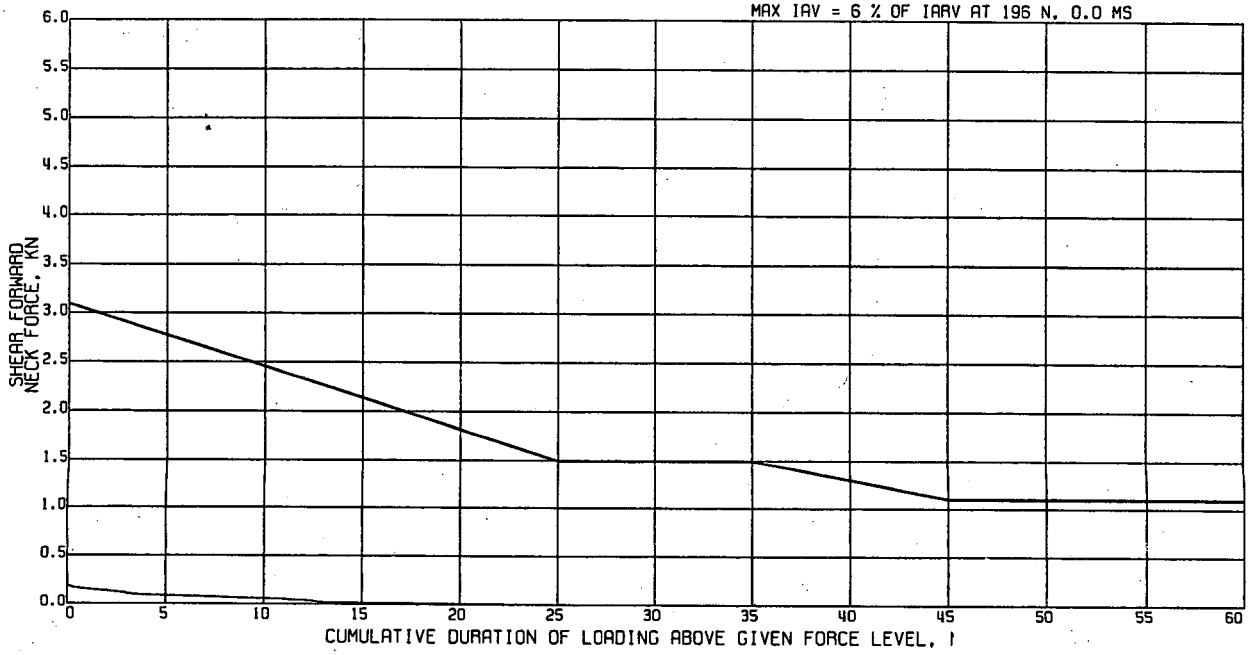
C11793 FRONT IMPACT — MOVING VEHICLE TO FIXED POLE — 55.8KM/H

R & D CTR 8V9142D 4 DOOR
ELEC DATA, SAE CLASS 1000

FORWARD NECK SHEAR ON HEAD,

R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:11/12/1997



Appendix D, plot # **36**

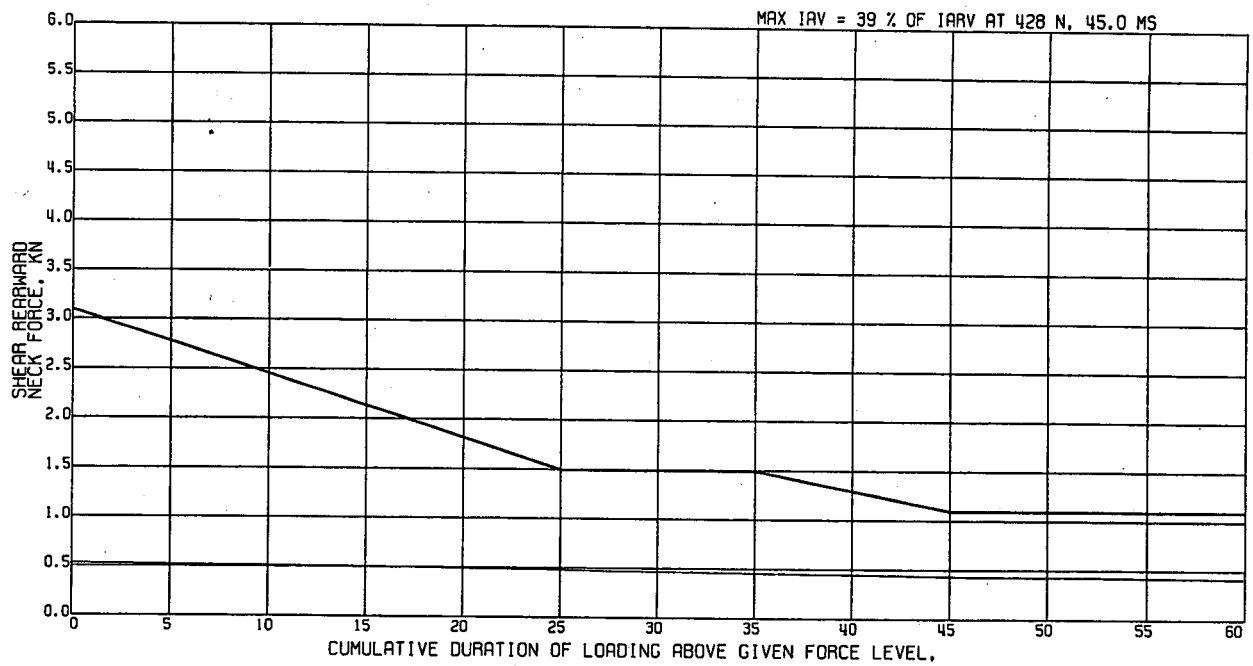
C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR
ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:11/12/1997



Appendix D, plot # **37**

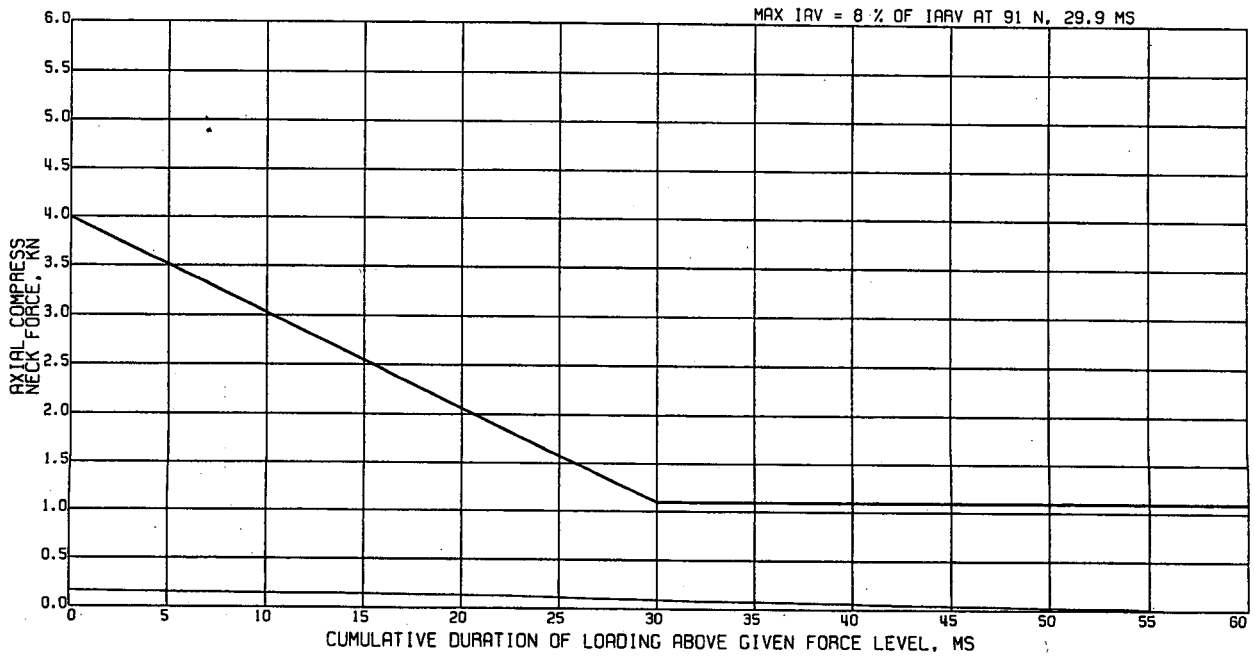
C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR
ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:11/12/1997



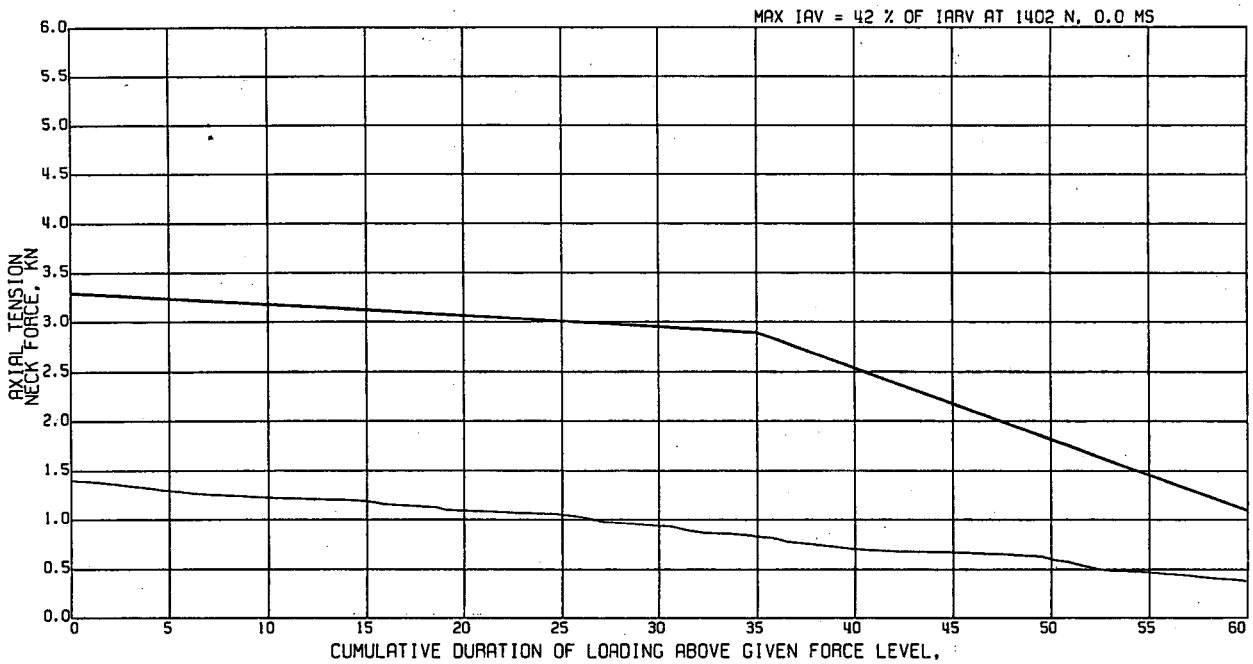
 Appendix D, plot # **38**

C11793 FRONT IMPACT — MOVING VEHICLE TO FIXED POLE — 55.8KM/H

R & D CTR 8V91142D 4 DOOR
ELEC DATA, SAE CLASS 1000

AXIAL TENSION ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:11/12/1997



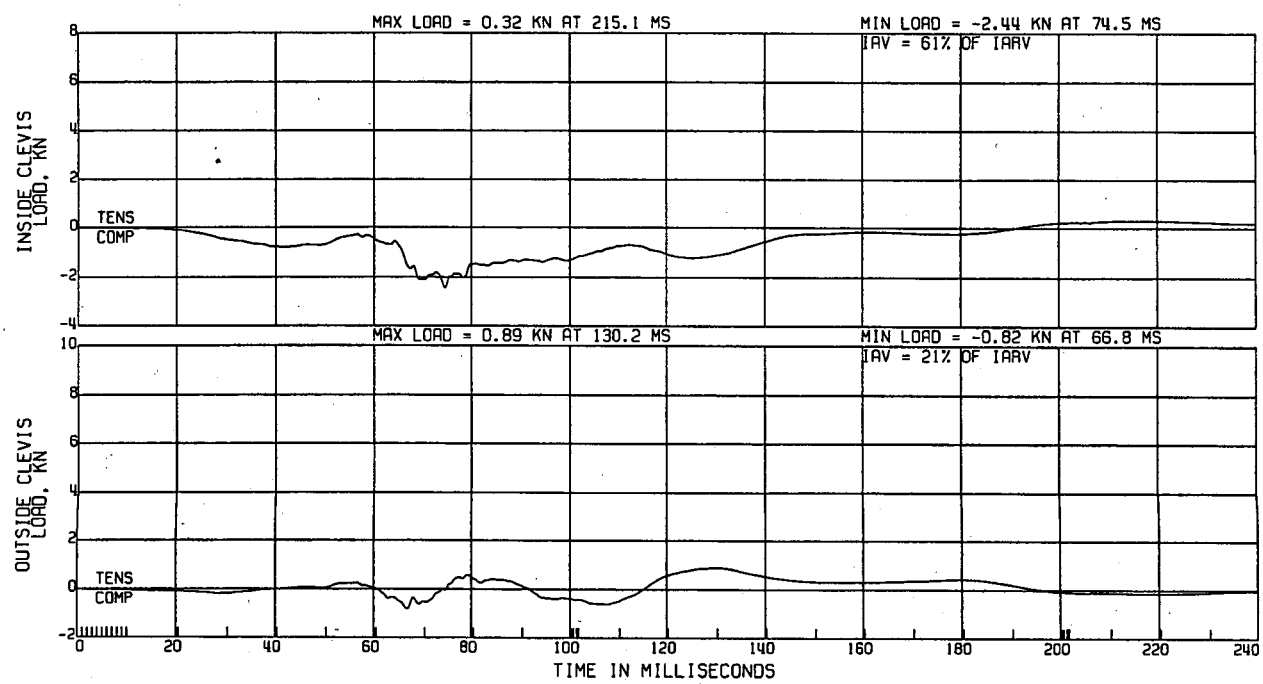
: Appendix D, plot # **39**

C11793 FRONT IMPACT — MOVING VEHICLE TO FIXED POLE — 55.8KM/H

R & D CTR 8V91142D 4 DOOR
ELEC DATA, SAE CLASS 600

R. FRT LEFT KNEE CLEVIS LOAD

ATD TYPE: GM50H
TEST DATE:11/12/1997

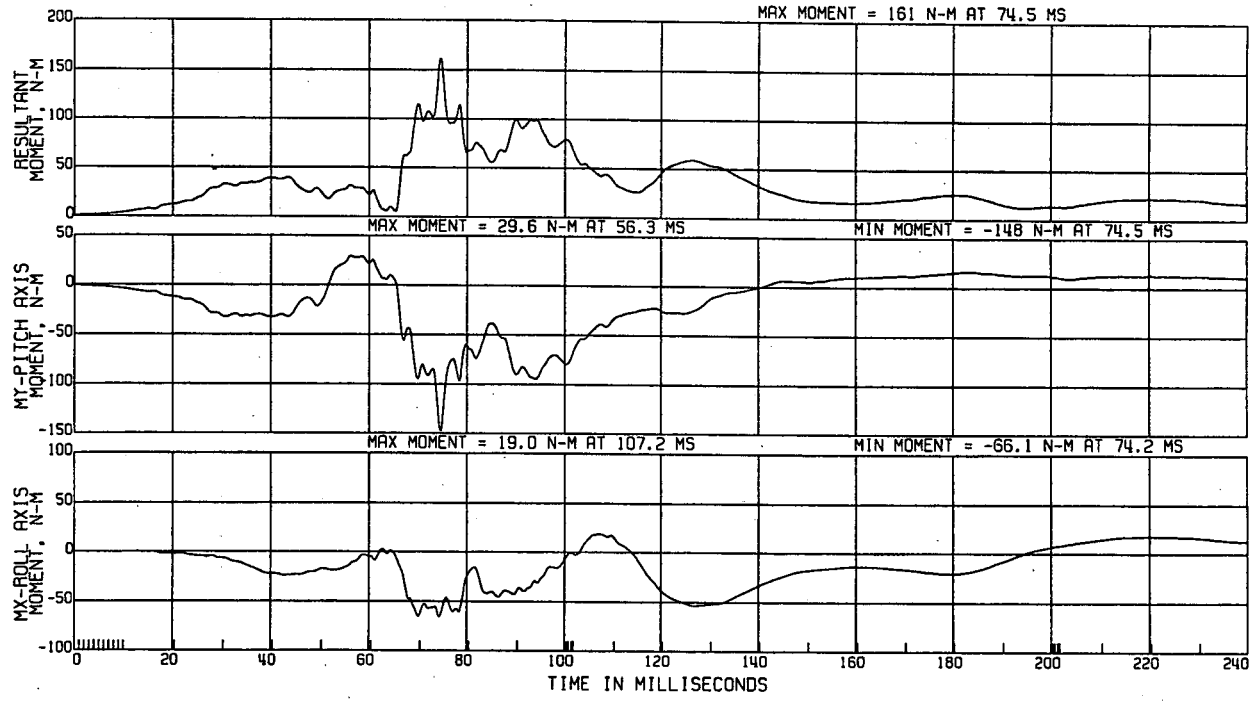


4 Appendix D, plot # **40**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR R. FRT LEFT TIBIA UPPER MOMENT ATD TYPE: GM50H

ELEC DATA, SAE CLASS 600 TEST DATE:11/12/1997



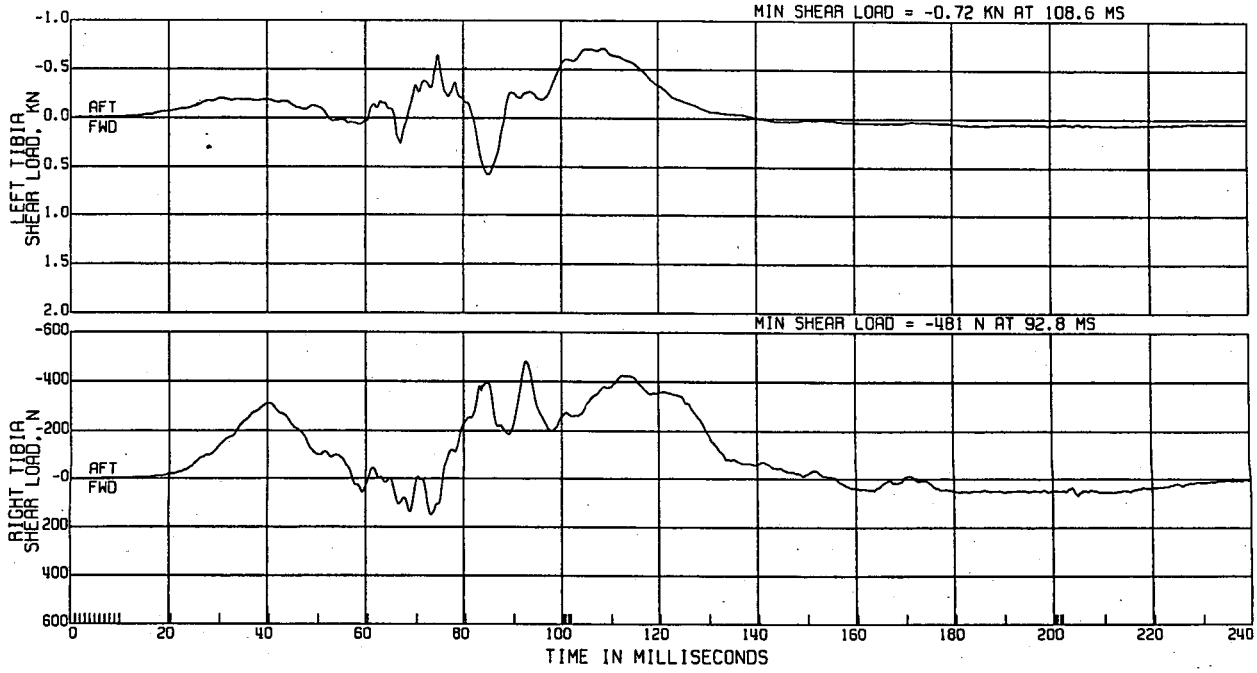
Appendix D, plot # **41**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

ATD TYPE: GM50H

R & D CTR 8V91142D 4 DOOR TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 600 R. FRT TIBIA LOWER SHEAR LOAD CELLS



Appendix D, plot # **42**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

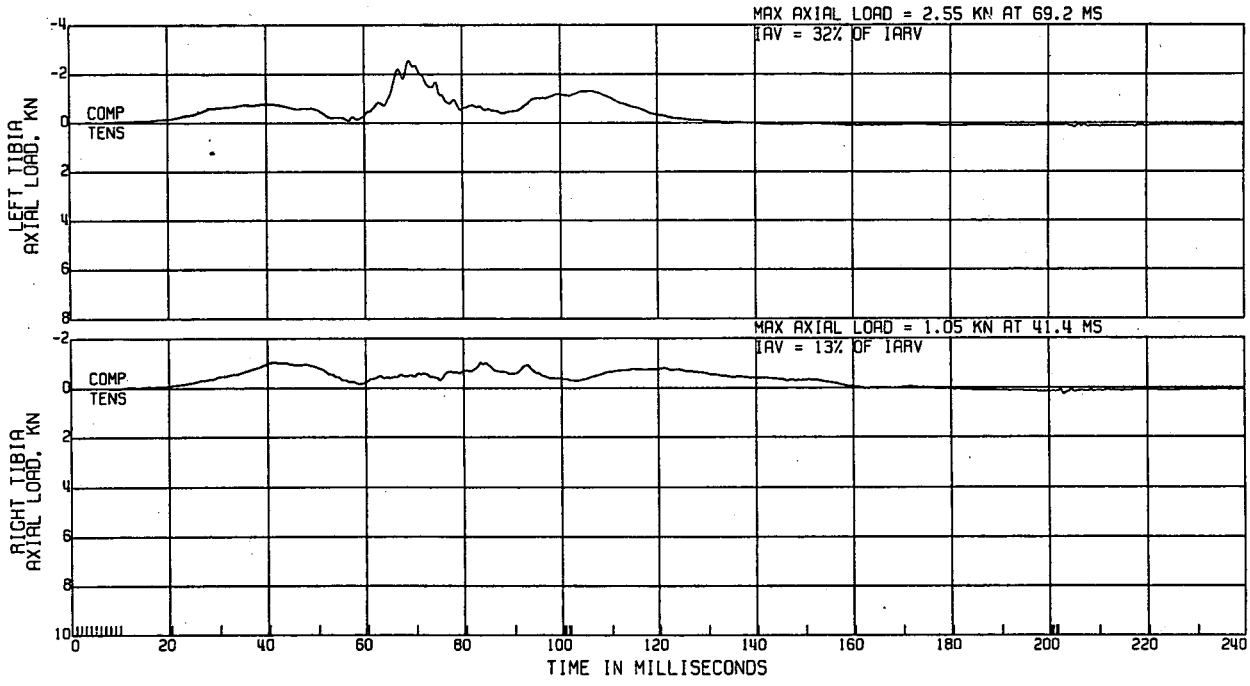
ATD TYPE: GM50H

R & D CTR 8V91420 4 DOOR

TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 600

R. FRT TIBIA LOWER AXIAL LOAD



Appendix D, plot # **43**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

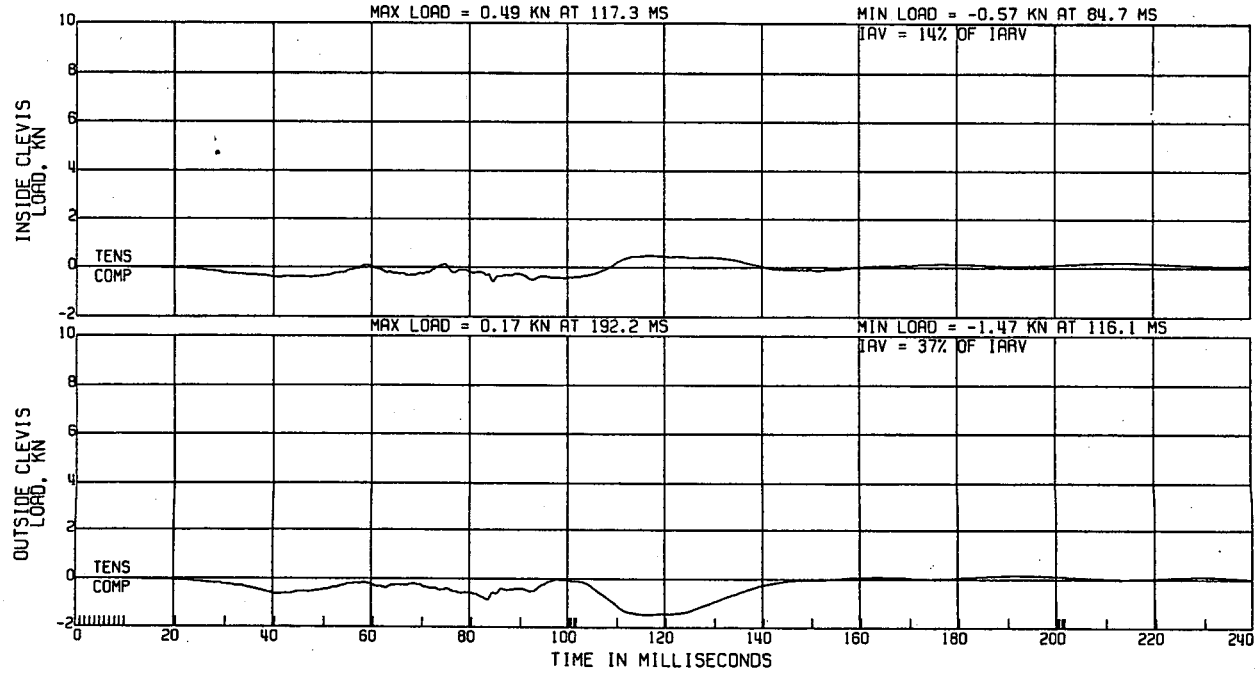
ATD TYPE: GM50H

R & D CTR 8V91420 4 DOOR

R. FRT RIGHT KNEE CLEVIS LOAD

TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 600

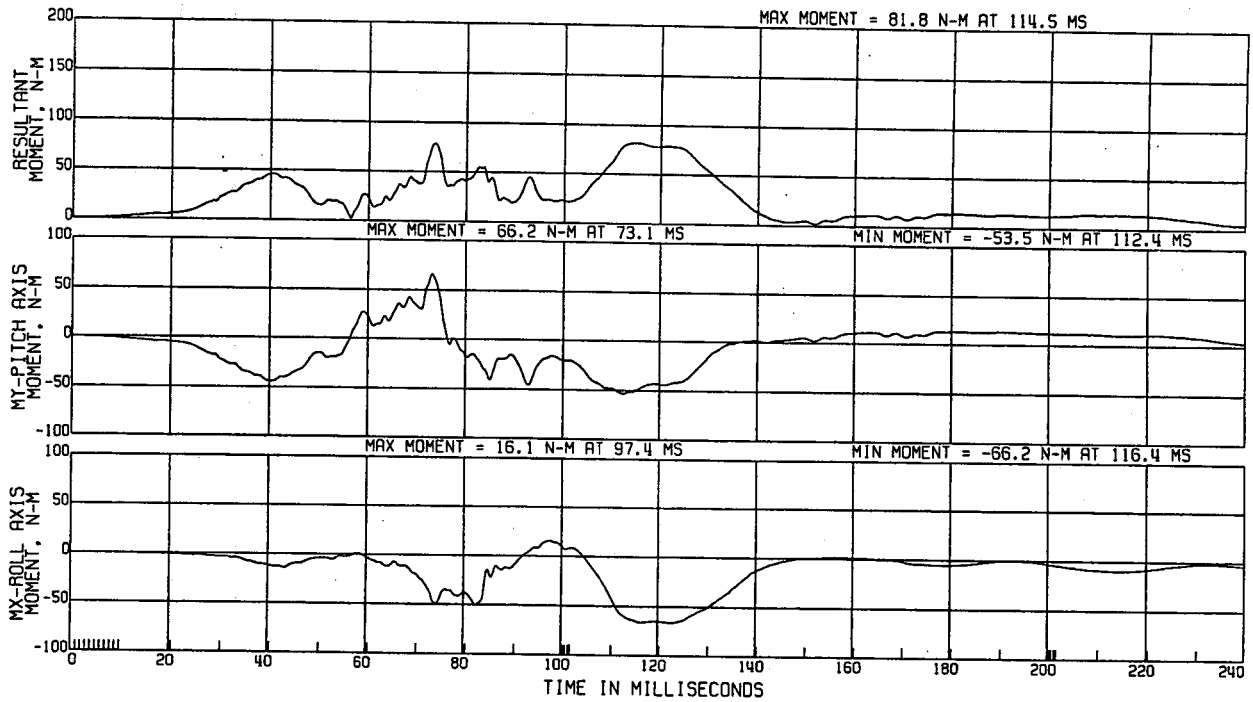


Appendix D, plot # **44**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V9142D 4 DOOR R. FRT RIGHT TIBIA UPPER MOMENT ATD TYPE: GM50H

ELEC DATA, SAE CLASS 600 TEST DATE:11/12/1997



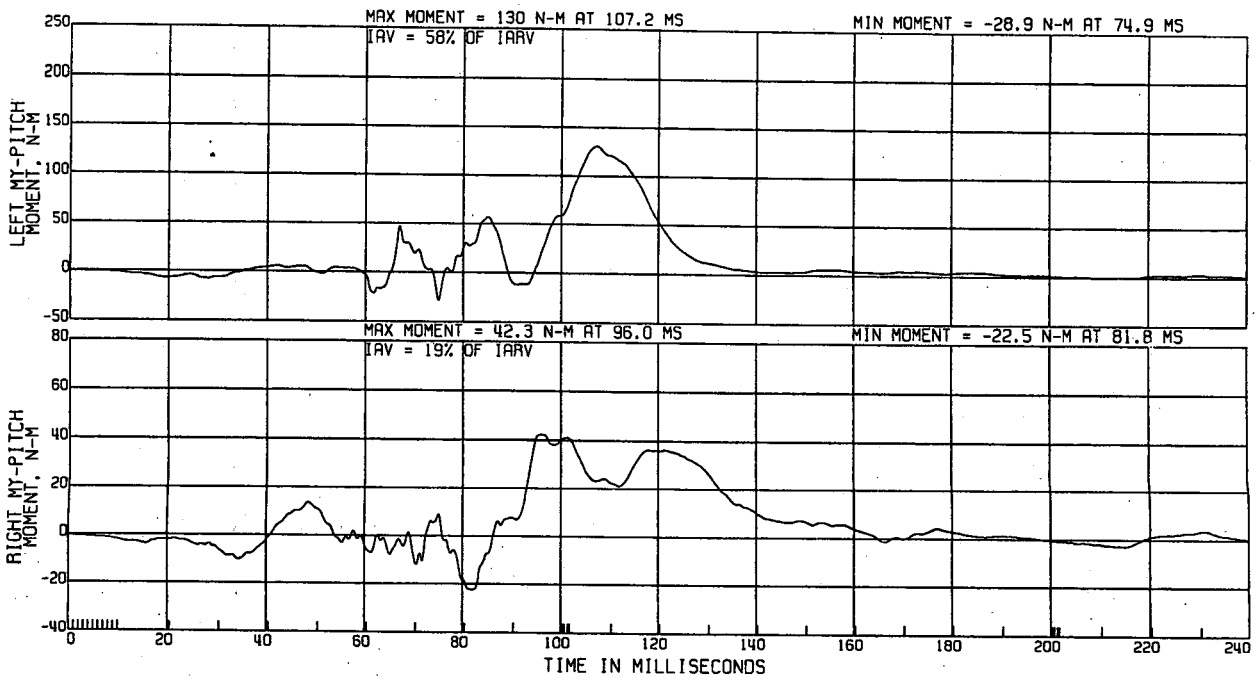
Appendix D, plot # **45**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

ATD TYPE: GM50H

R & D CTR 8V9142D 4 DOOR TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 600 R. FRT TIBIA LOWER BENDING MOMENTS

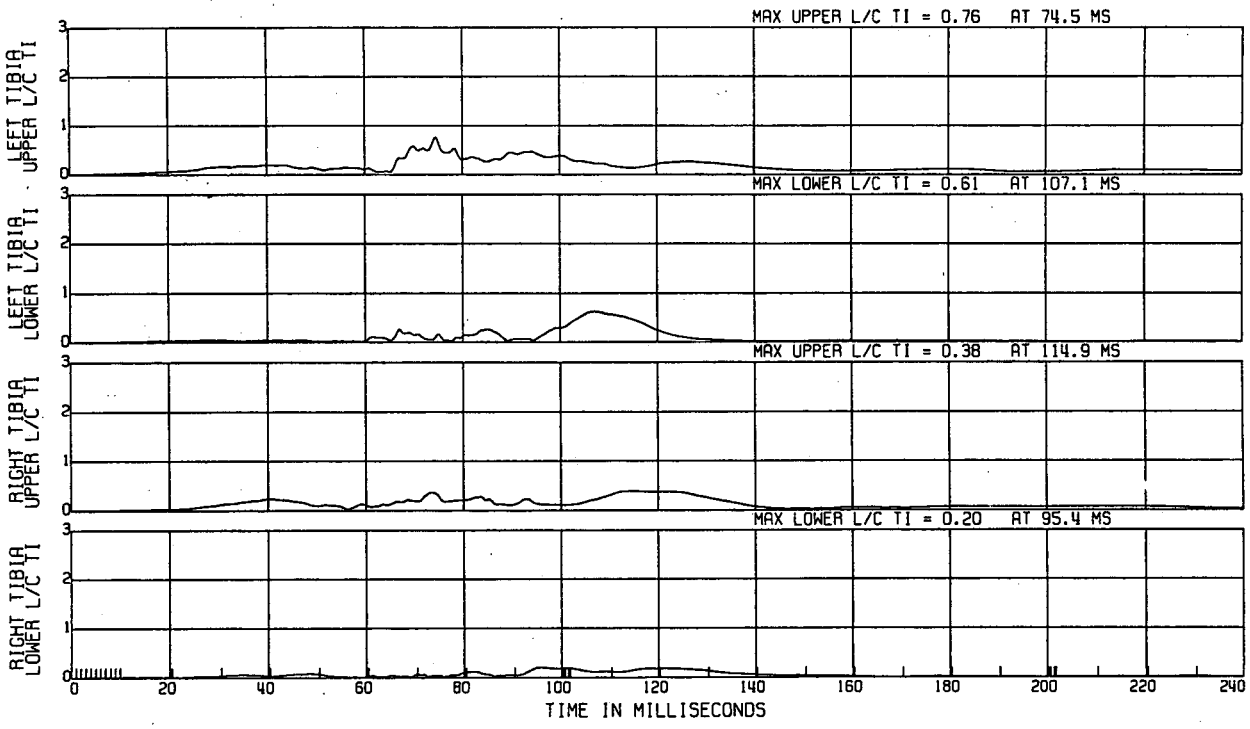


Appendix D, plot # **46**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR R. FRT TIBIA INDICES ATD TYPE: GM50H

ELEC DATA, SAE CLASS 600 TI = (RES MOM/225 NM) + (AXIAL/35900 N) TEST DATE:11/12/1997

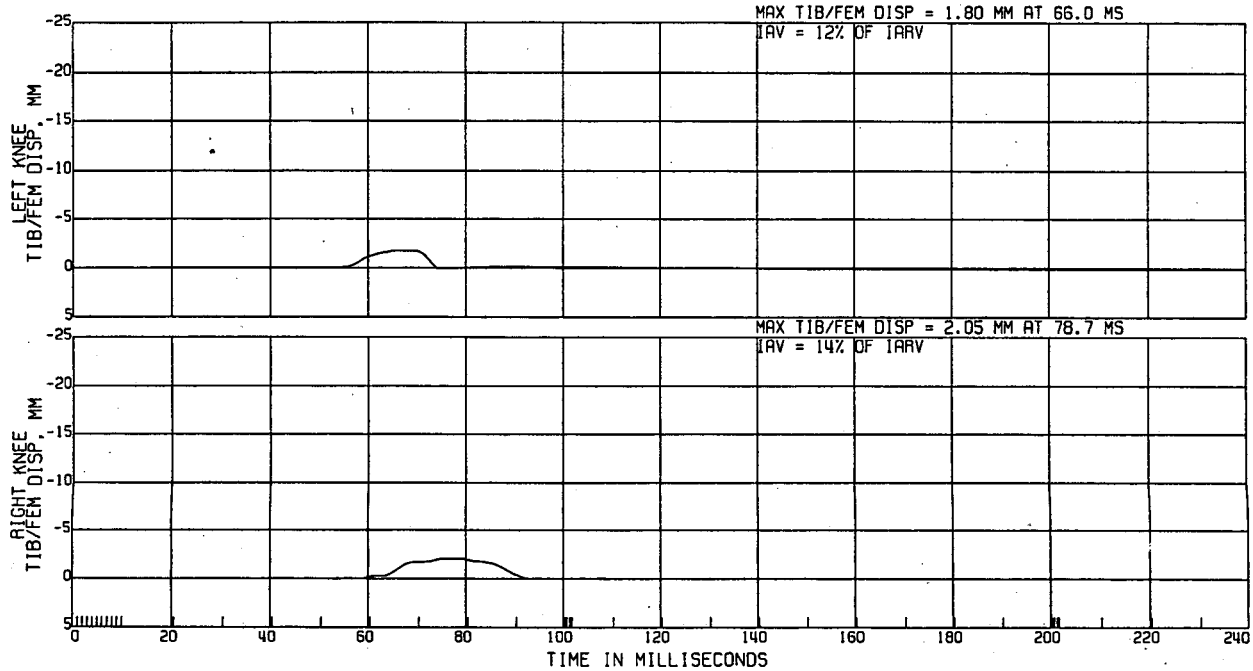


Appendix D, plot # **47**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR R. FRT TIBIA/FEMUR DISPLACEMENT ATD TYPE: GM50H

ELEC DATA, SAE CLASS 180 TEST DATE:11/12/1997

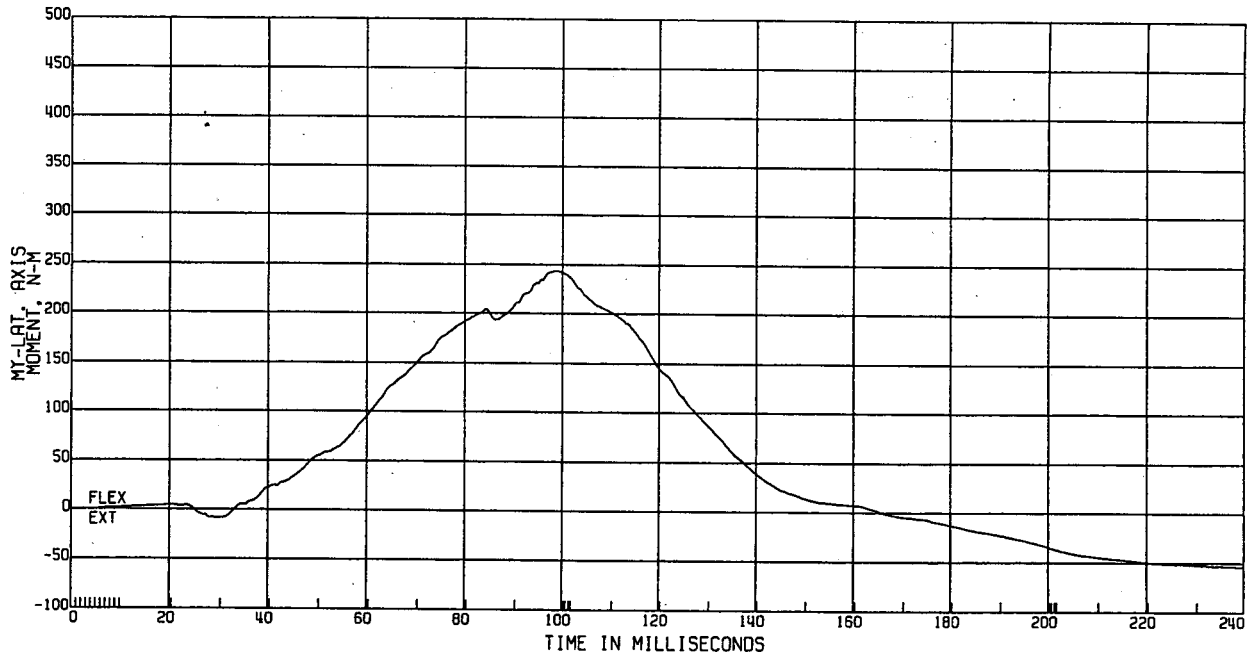


Appendix D, plot # **48**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR L. FRT LOWER LUMBAR MOMENT ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 TEST DATE:11/12/1997

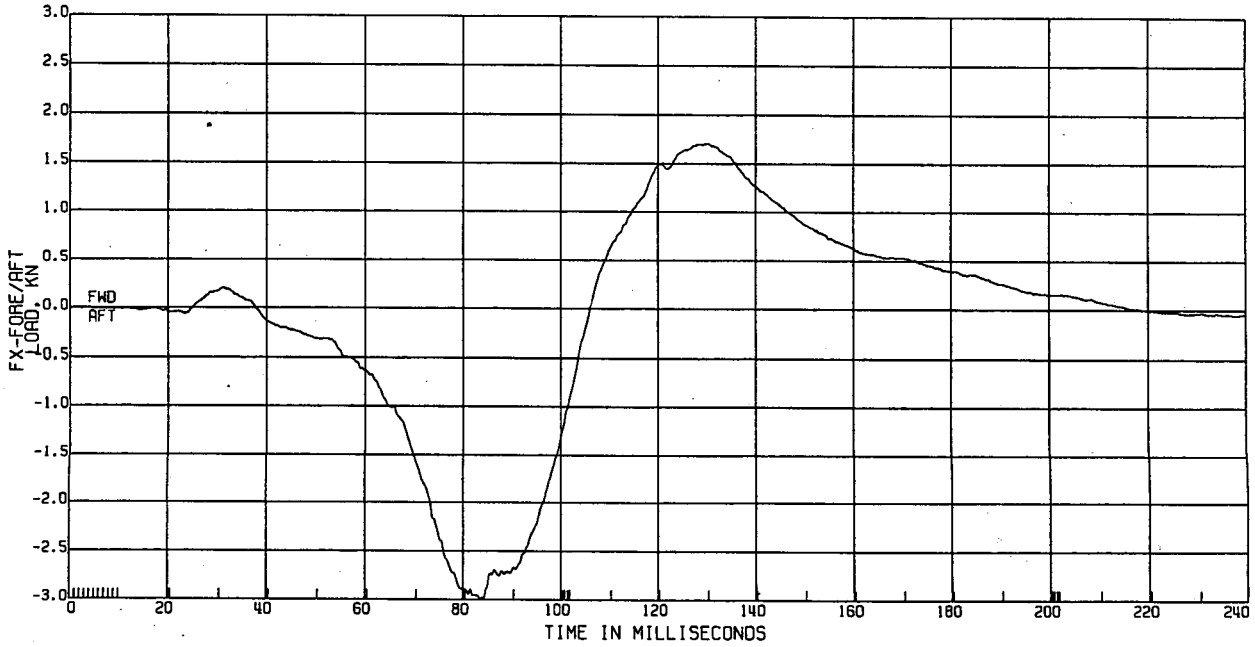


Appendix D, plot # **49**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR L. FRT LOWER LUMBAR LOAD ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 TEST DATE:11/12/1997

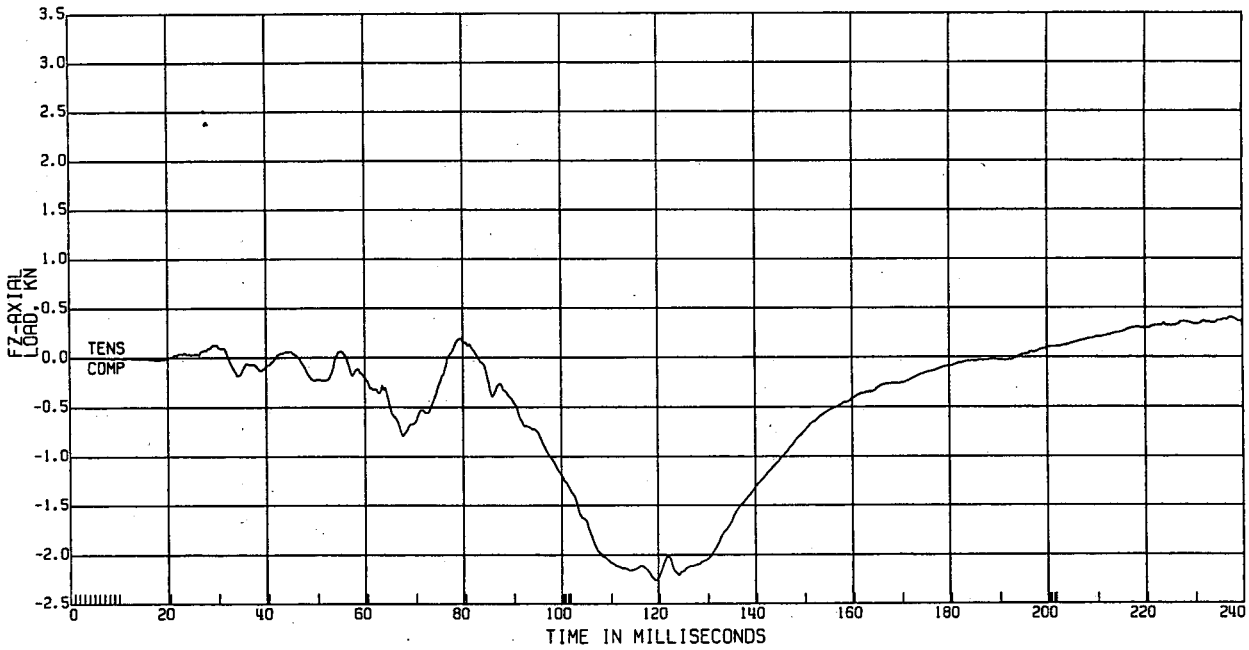


Appendix D, plot # **50**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR L. FRT LOWER LUMBAR LOAD ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 TEST DATE:11/12/1997

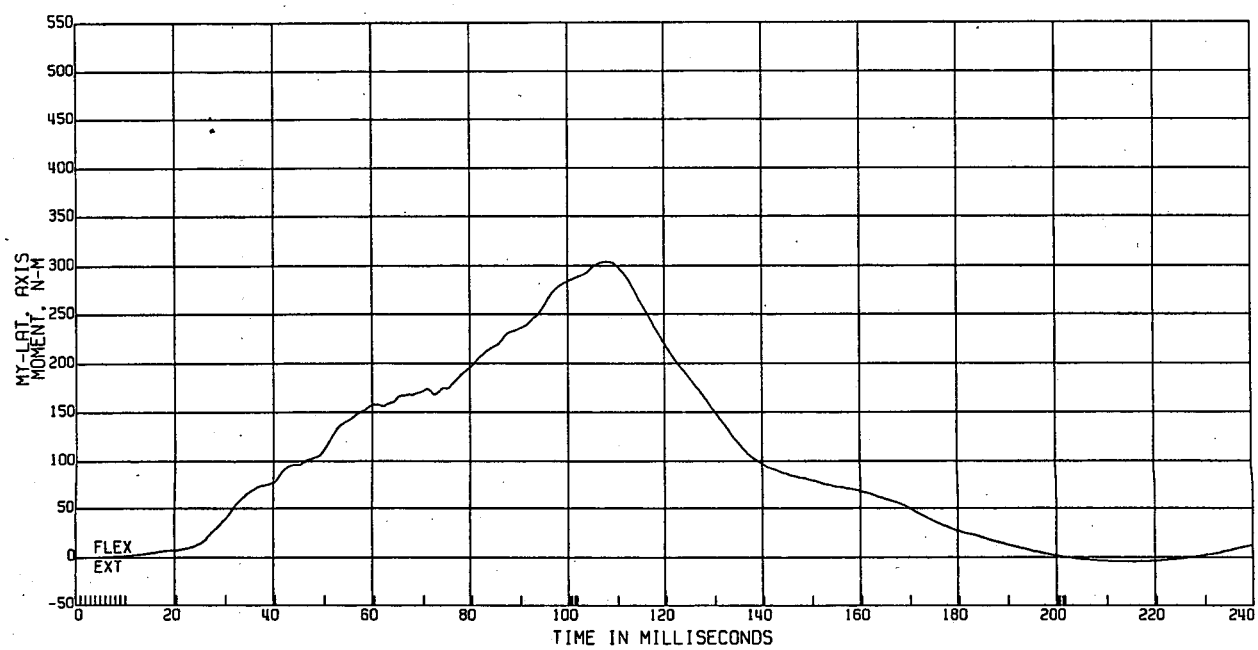


Appendix D, plot # **51**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR R. FRT LOWER LUMBAR MOMENT ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 TEST DATE:11/12/1997

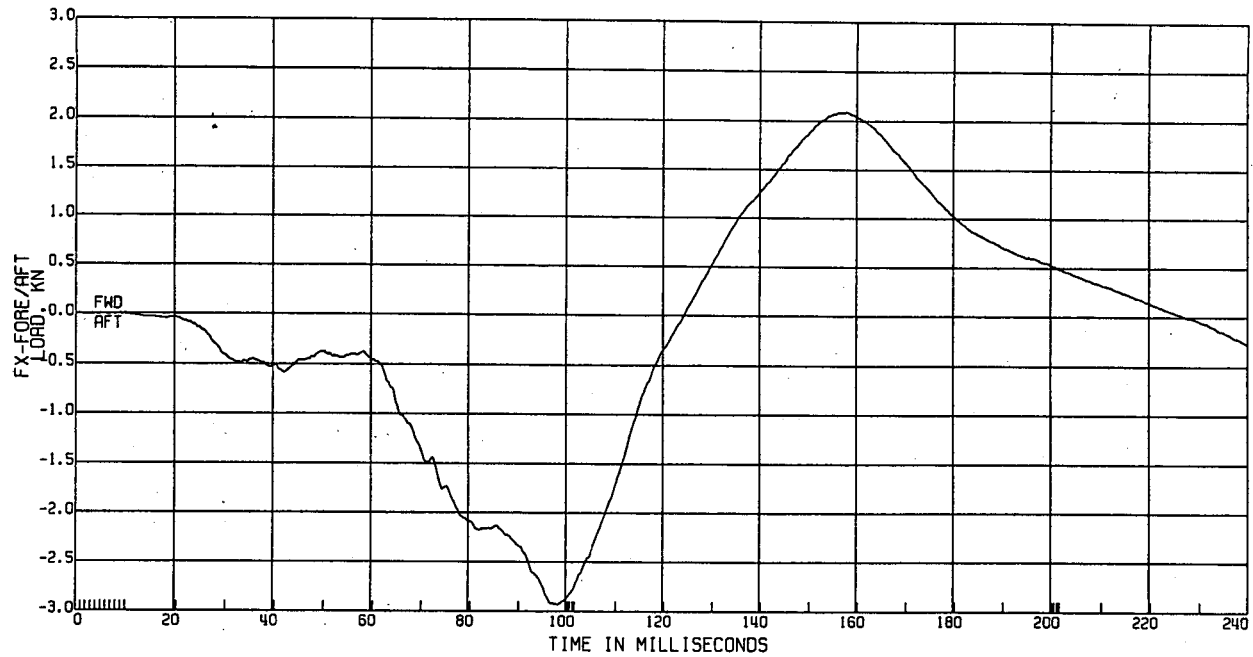


Appendix D, plot # **52**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR R. FRT LOWER LUMBAR LOAD ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 TEST DATE:11/12/1997

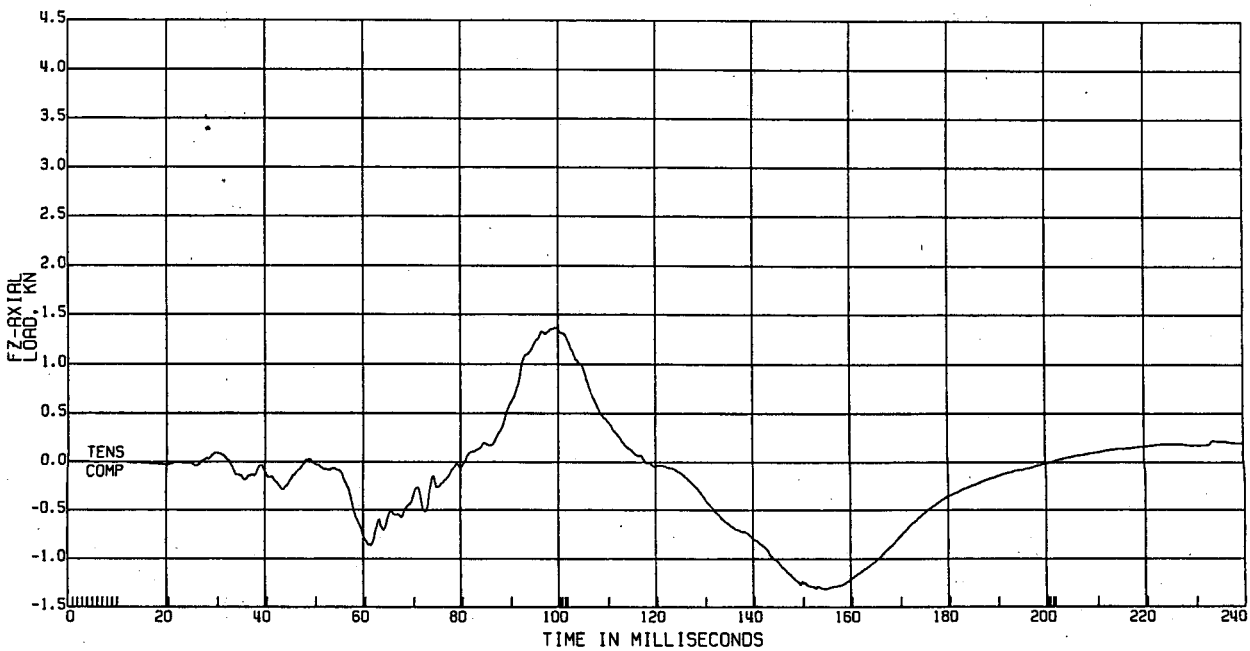


Appendix D, plot # **53**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR R. FRT LOWER LUMBAR LOAD ATD TYPE: GM50H

ELEC DATA, SAE CLASS 1000 TEST DATE:11/12/1997



 Appendix D, plot # **54**

C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

ATD TYPE: GM50H

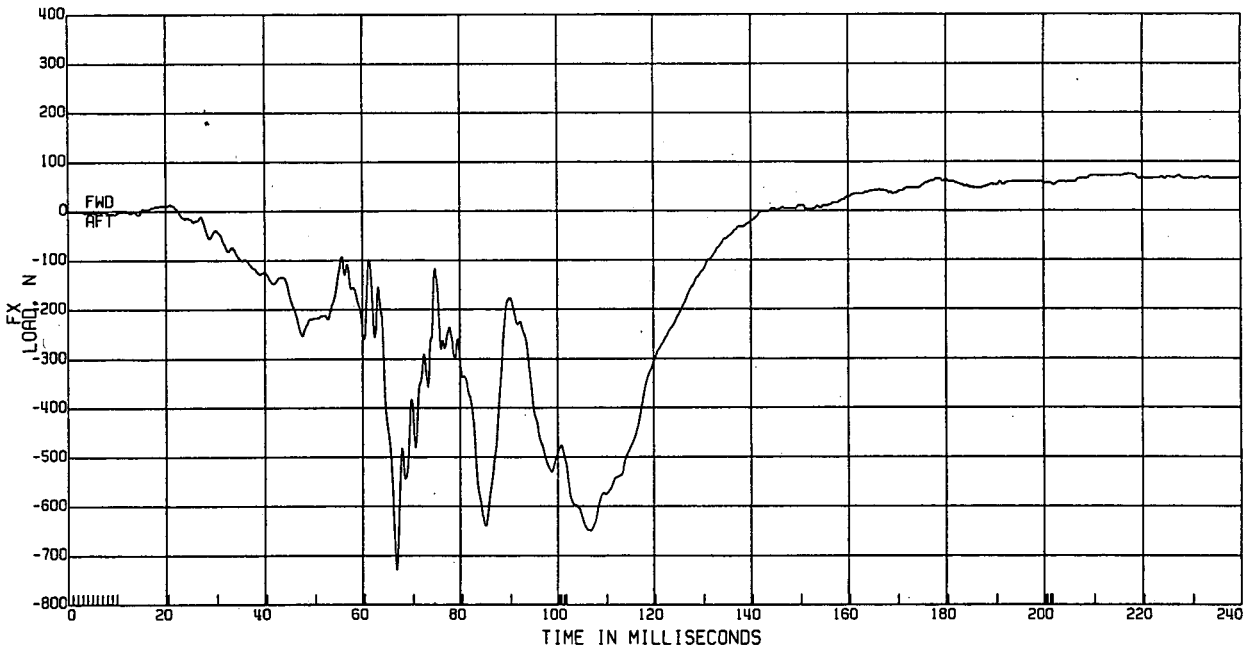
R & D CTR 8V91420 4 DOOR

R. FRT TIBIA LEFT UPPER LOAD

TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 600

(ENHANCED LOWER LEG)



Appendix D, plot # **55**

C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

ATD TYPE: GM50H

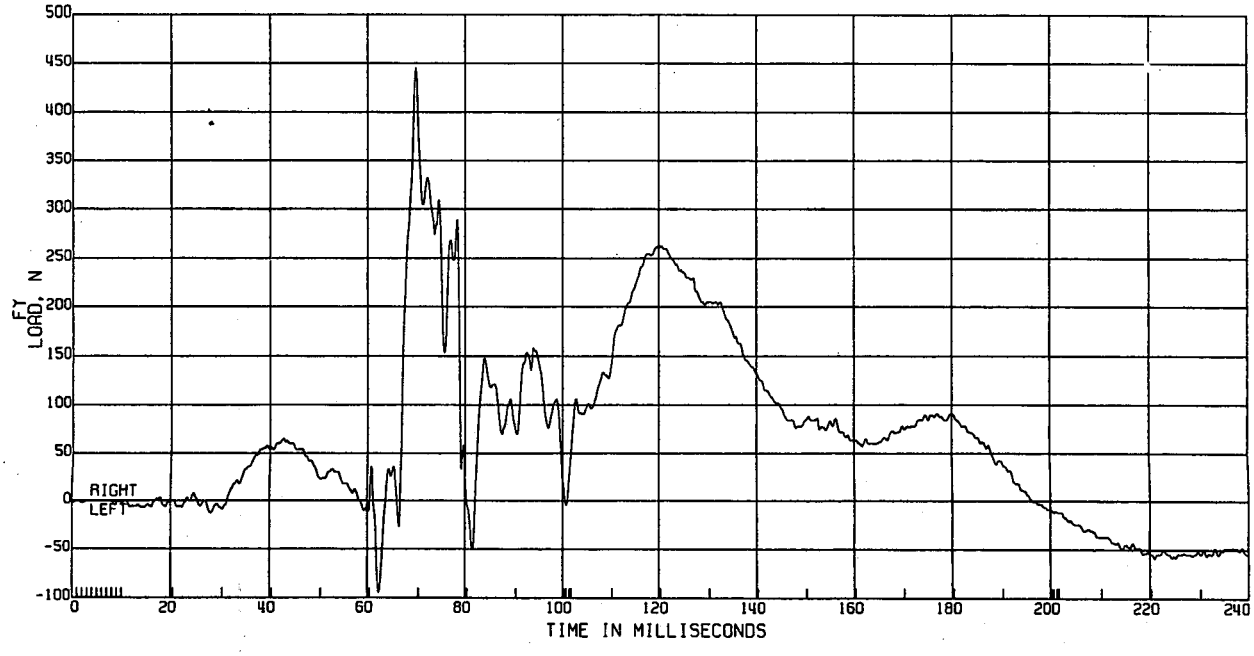
R & D CTR 8V91420 4 DOOR

R. FRT TIBIA LEFT LOWER LOAD

TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 600

(ENHANCED LOWER LEG)



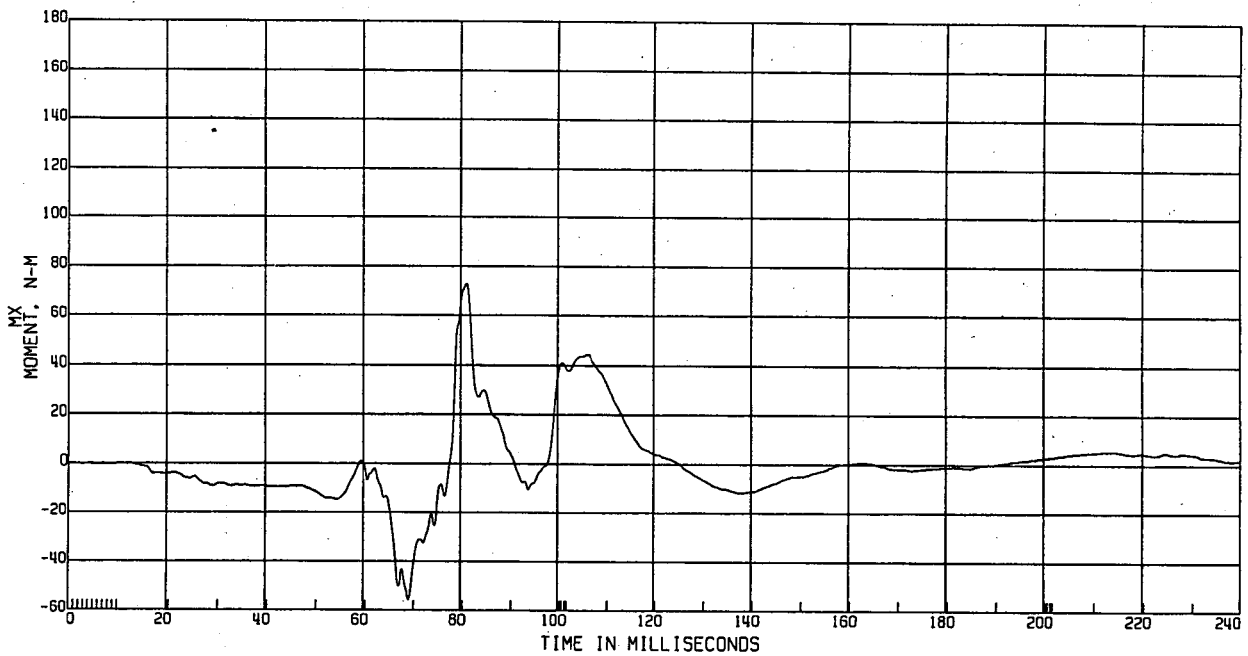
Appendix D, plot # **56**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR
ELEC DATA, SAE CLASS 600

R. FRT TIBIA LEFT LOWER MOMENT
(ENHANCED LOWER LEG)

ATD TYPE: GM50H
TEST DATE:11/12/1997



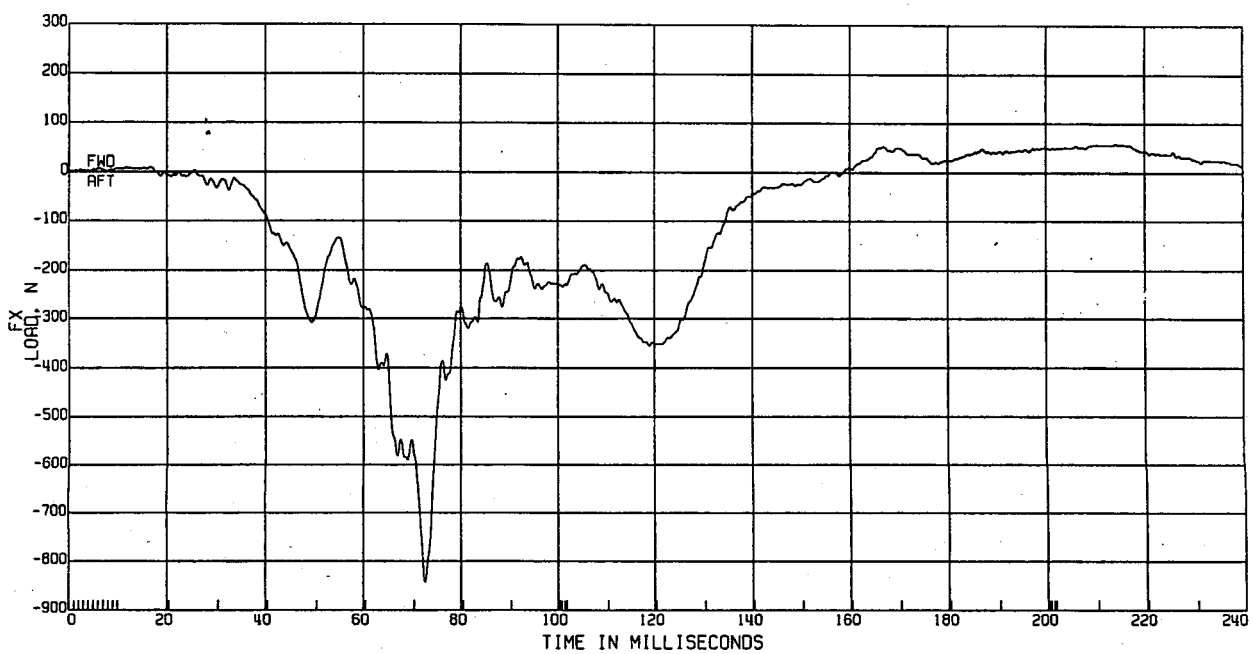
Appendix D, plot # **57**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR
ELEC DATA, SAE CLASS 600

R. FRT TIBIA RIGHT UPPER LOAD
(ENHANCED LOWER LEG)

ATD TYPE: GM50H
TEST DATE:11/12/1997



 Appendix D, plot # **58**

C11793 FRONT IMPACT

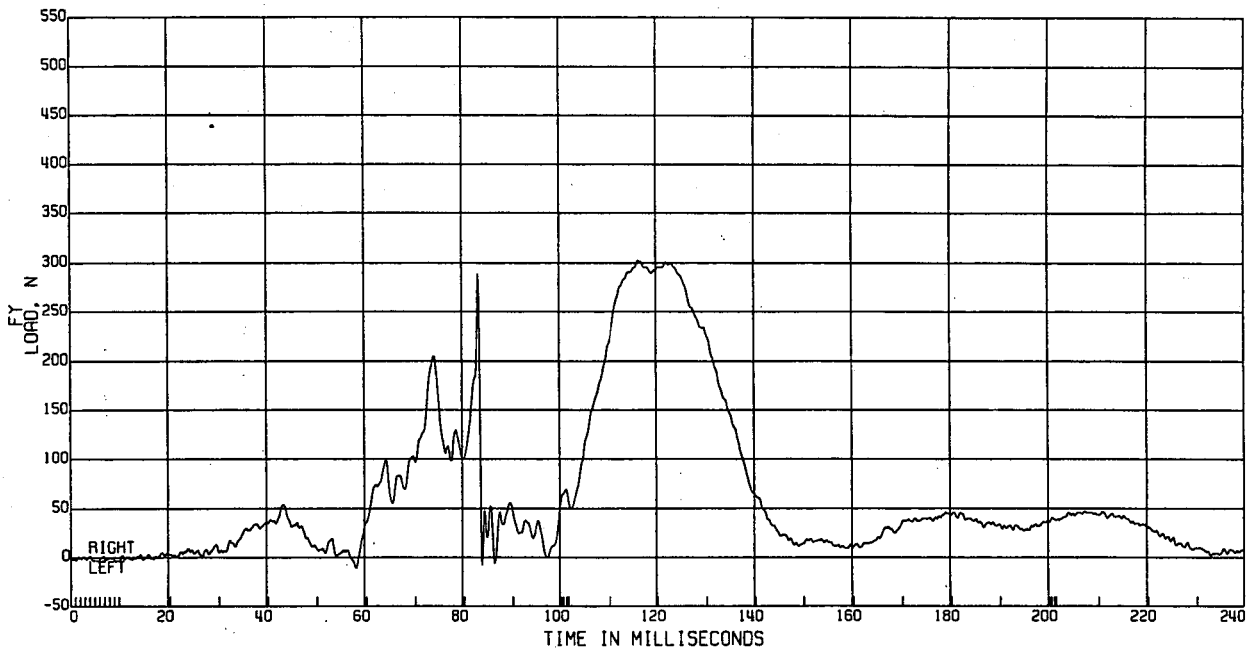
MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V9142D 4 DOOR
ELEC DATA, SAE CLASS 600

R. FRT TIBIA RIGHT LOWER LOAD

(ENHANCED LOWER LEG)

ATD TYPE: GM50H
TEST DATE:11/12/1997



Appendix D, plot # **59**

C11793 FRONT IMPACT

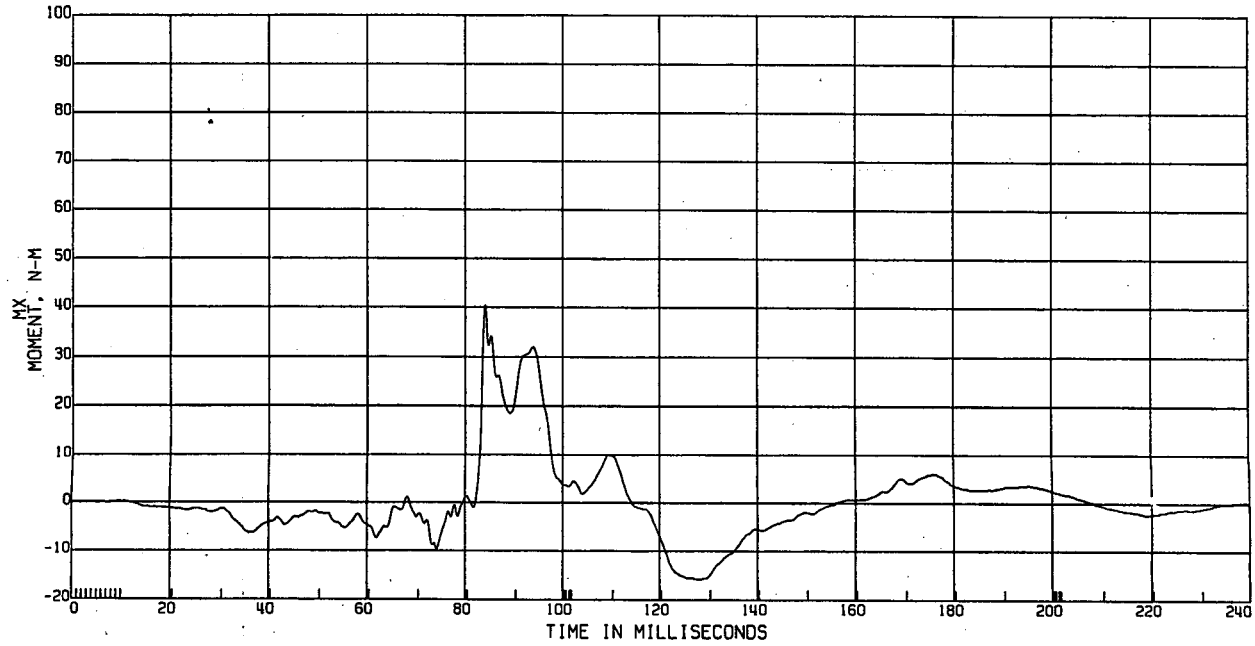
MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V9142D 4 DOOR
ELEC DATA, SAE CLASS 600

R. FRT TIBIA RIGHT LOWER MOMENT

(ENHANCED LOWER LEG)

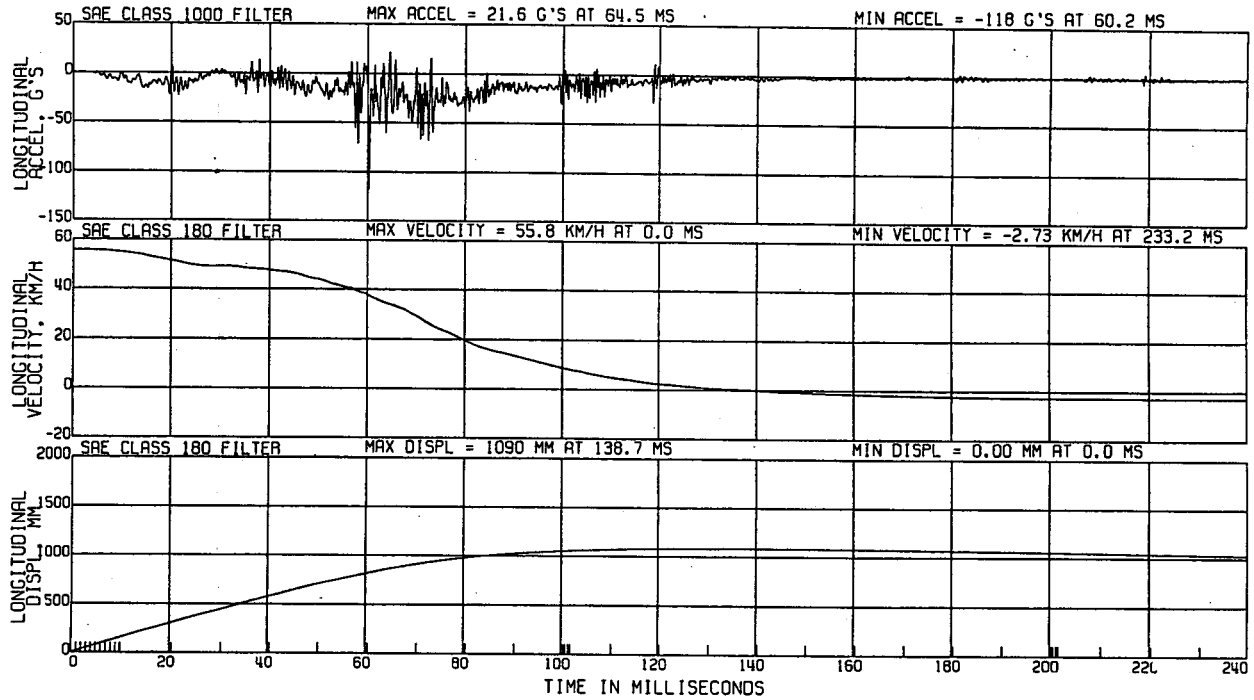
ATD TYPE: GM50H
TEST DATE:11/12/1997



Appendix D, plot # **60**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

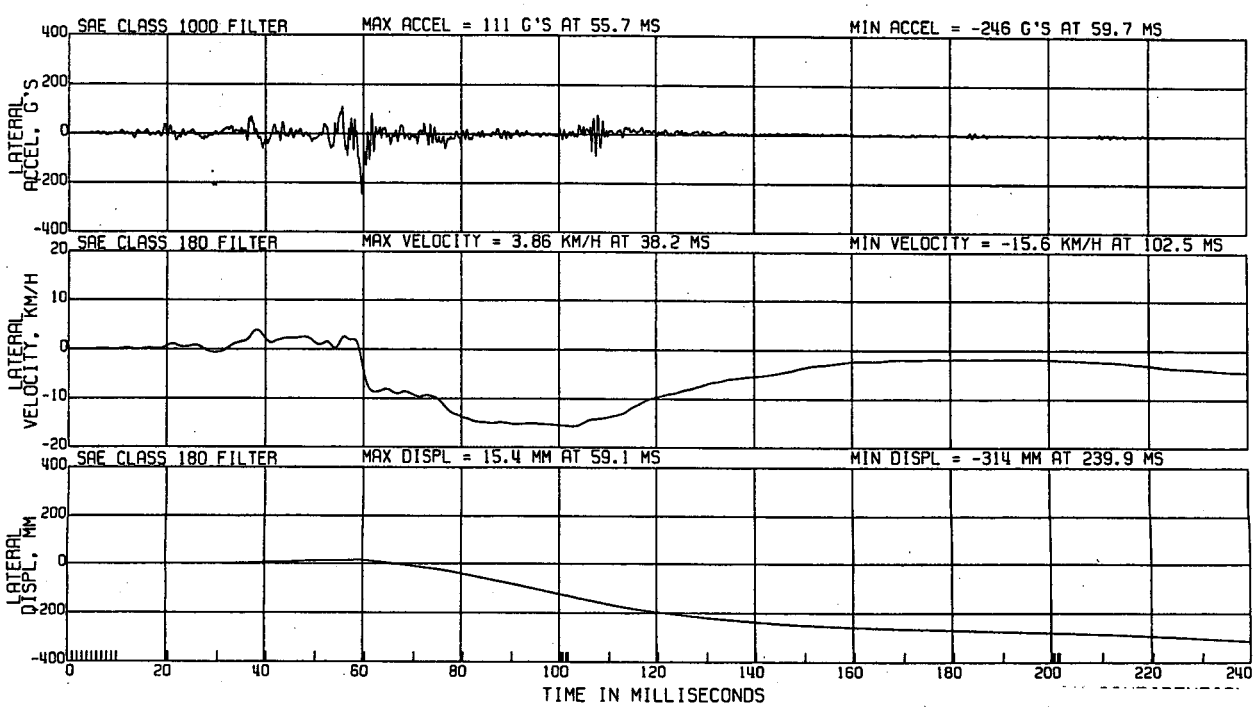
R & D CTR 8V91420 4 DOOR L. FRT ROCKER TEST DATE:11/12/1997
ELEC DATA



Appendix D, plot # **61**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR L. FRT ROCKER TEST DATE:11/12/1997
ELEC DATA

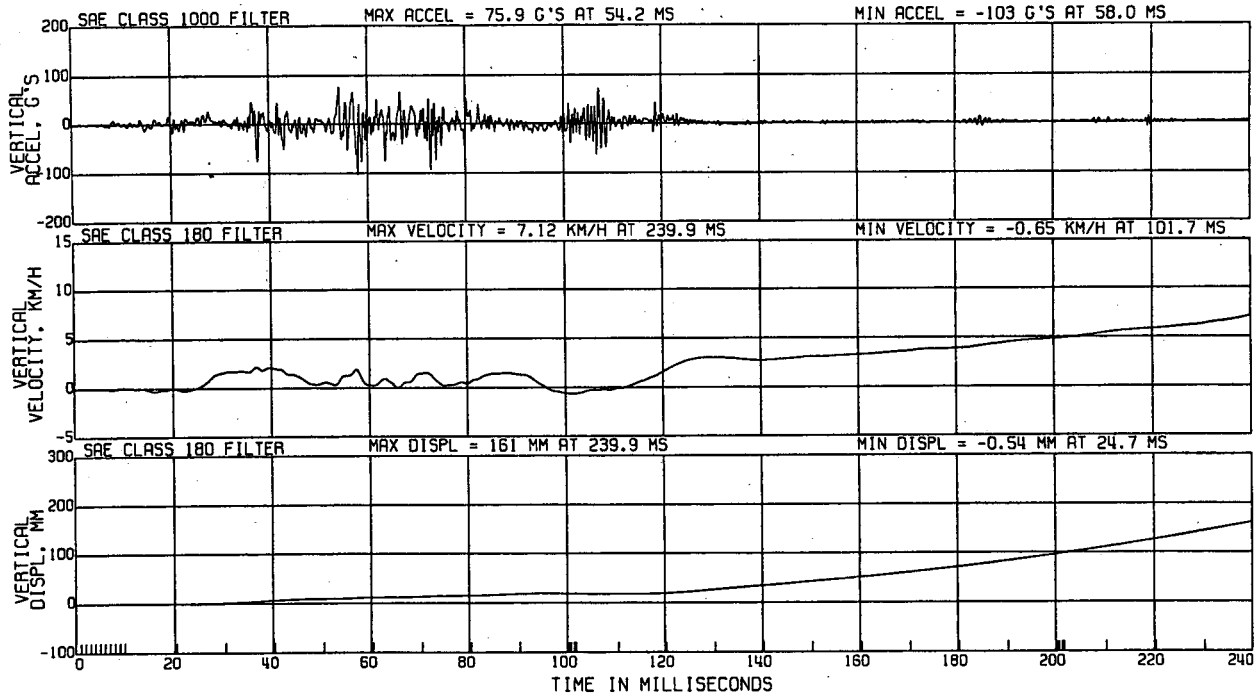


Appendix D, plot # **62**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR L. FRT ROCKER TEST DATE:11/12/1997

ELEC DATA

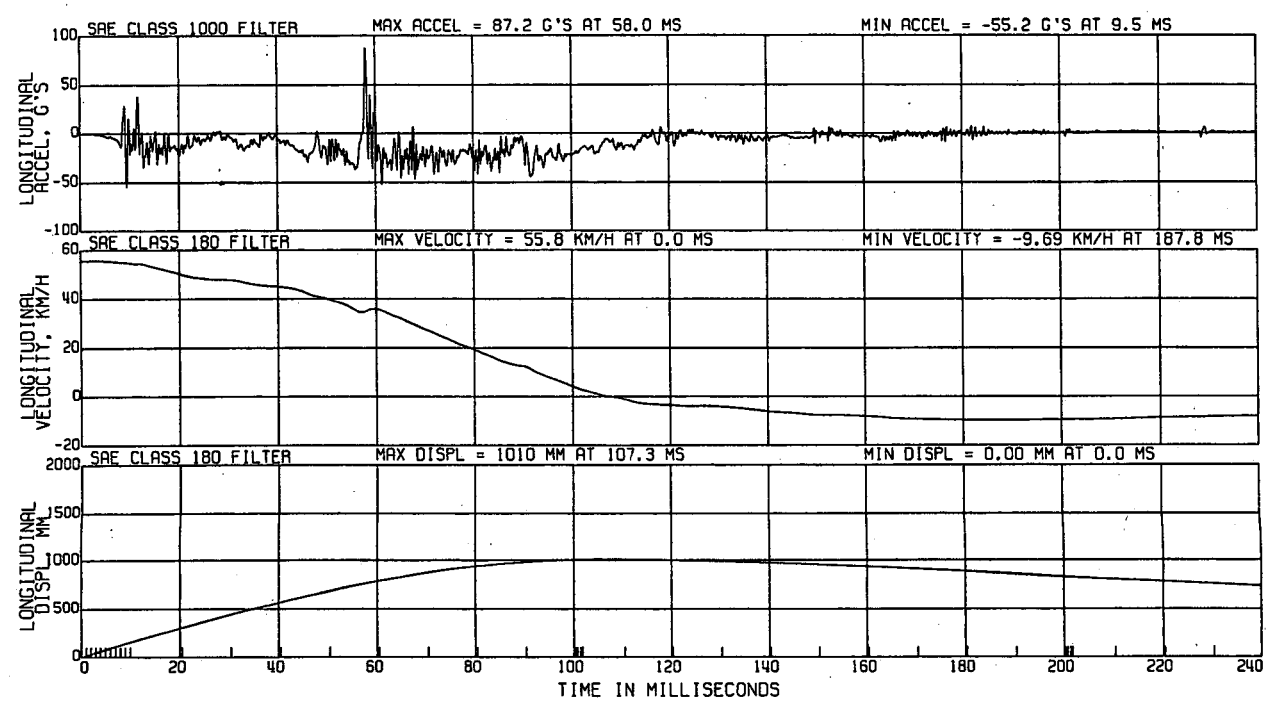


Appendix D, plot # **63**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR R. FRT ROCKER TEST DATE:11/12/1997

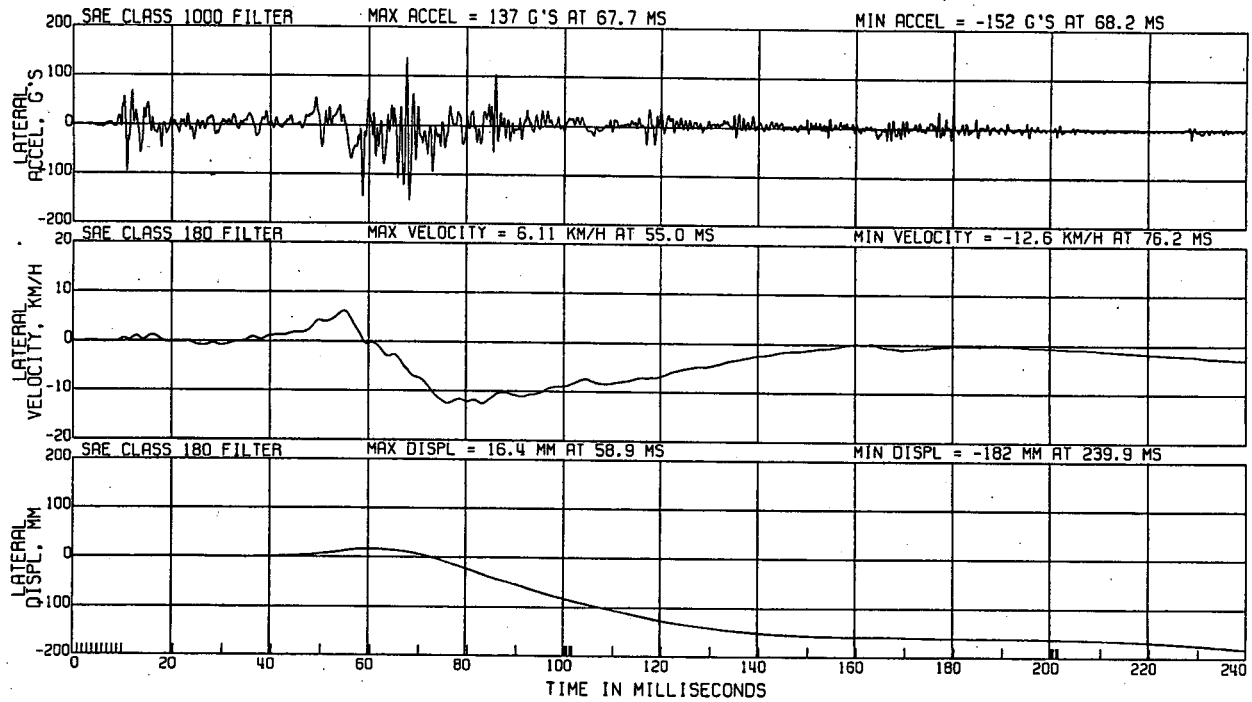
ELEC DATA



Appendix D, plot # **64**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

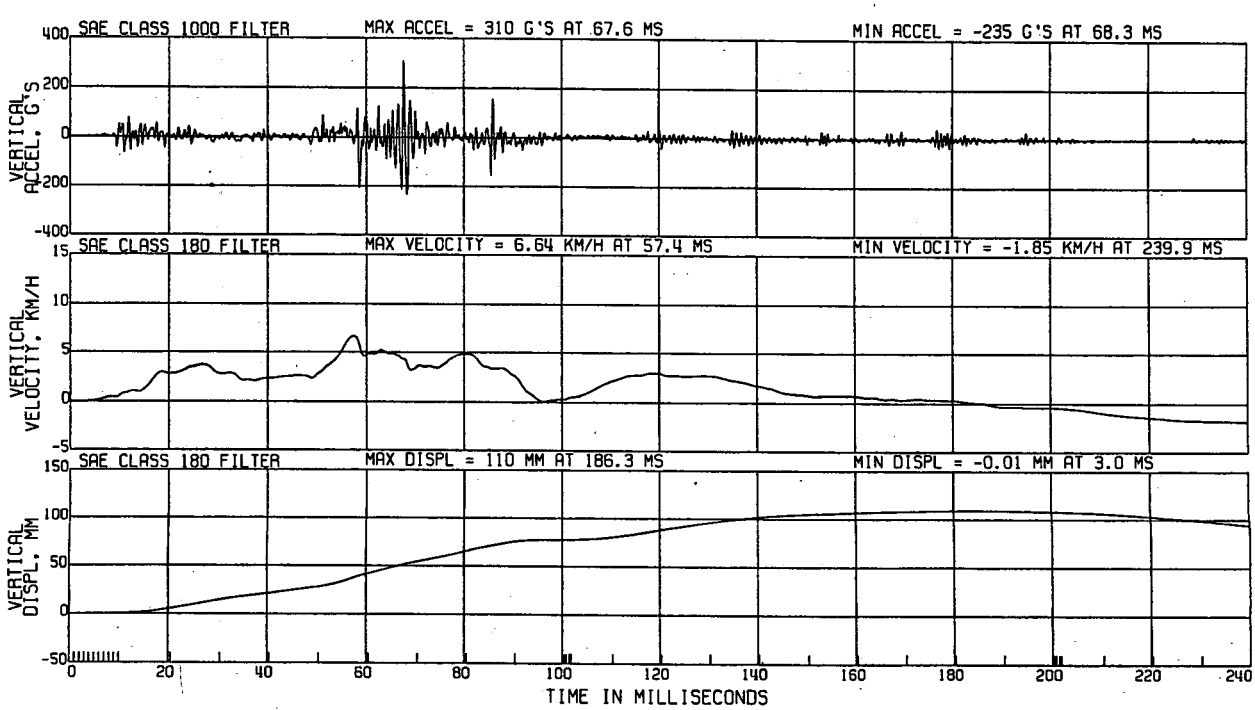
R & D CTR 8V91142D 4 DOOR R. FRT ROCKER TEST DATE:11/12/1997
ELEC DATA



Appendix D, plot # **65**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

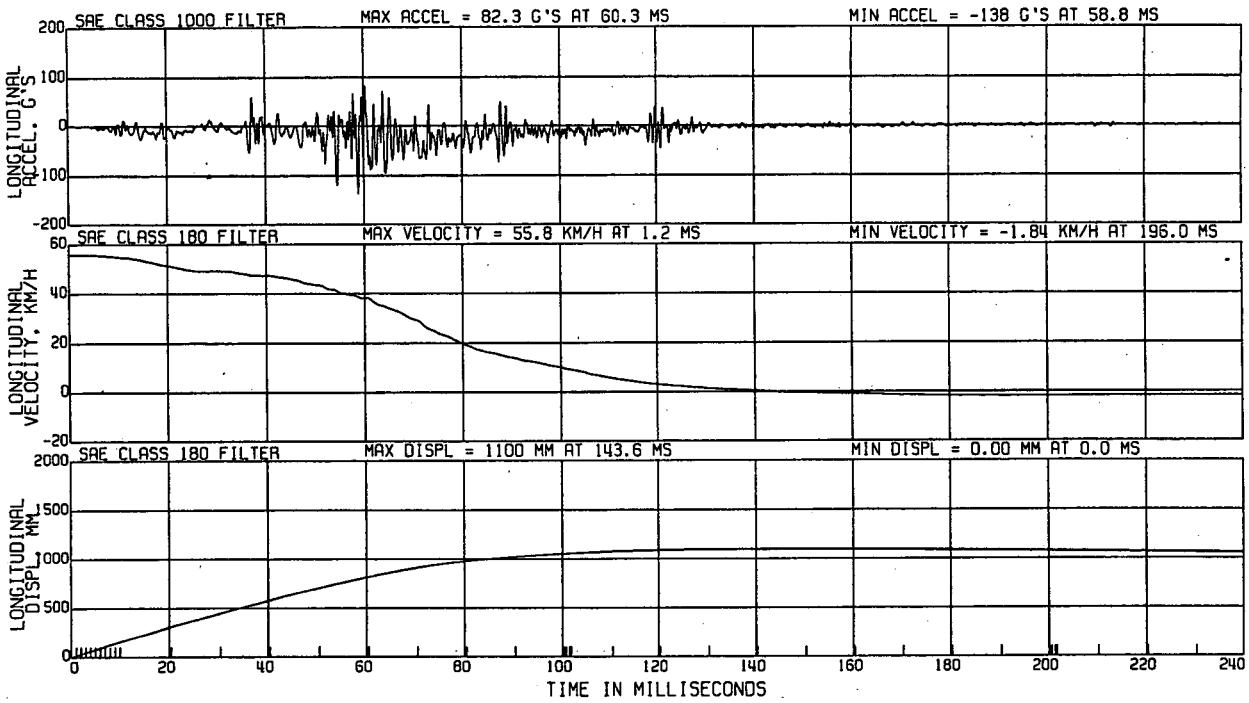
R & D CTR 8V91142D 4 DOOR R. FRT ROCKER TEST DATE:11/12/1997
ELEC DATA



Appendix D, plot # **66**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

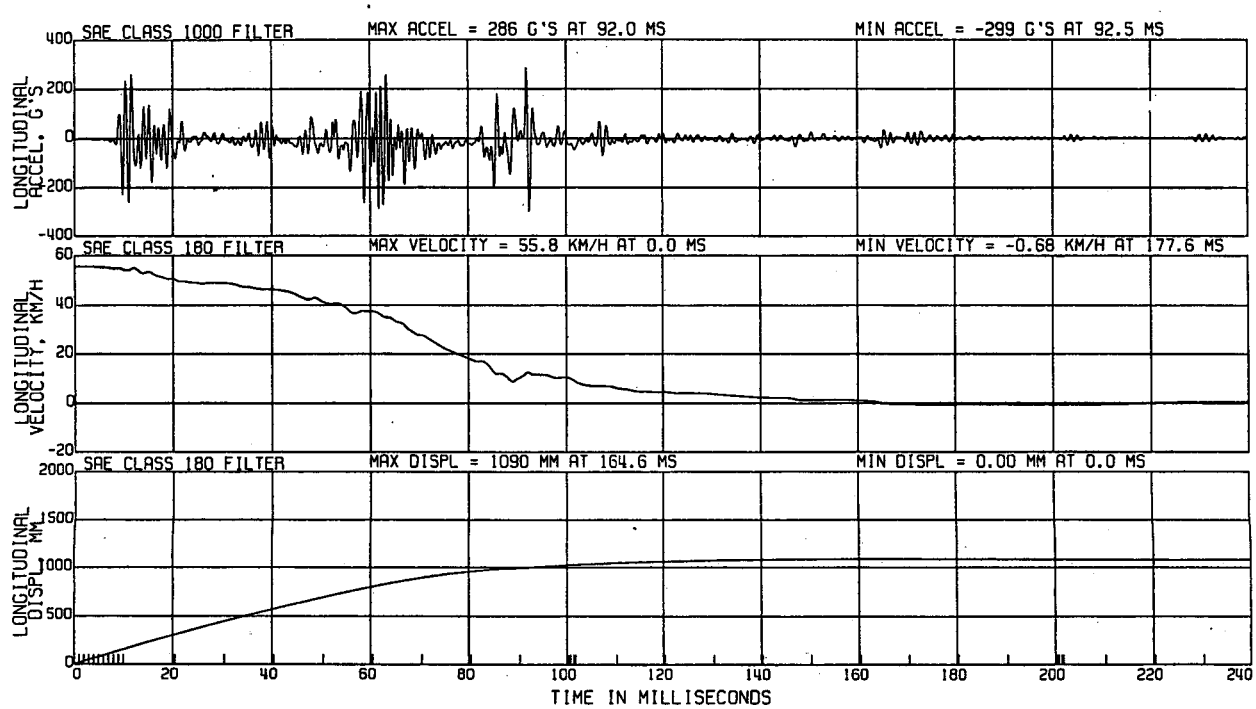
R & D CTR 8V91142D 4 DOOR L. FLOORPAN TEST DATE:11/12/1997
ELEC DATA



Appendix D, plot # **67**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

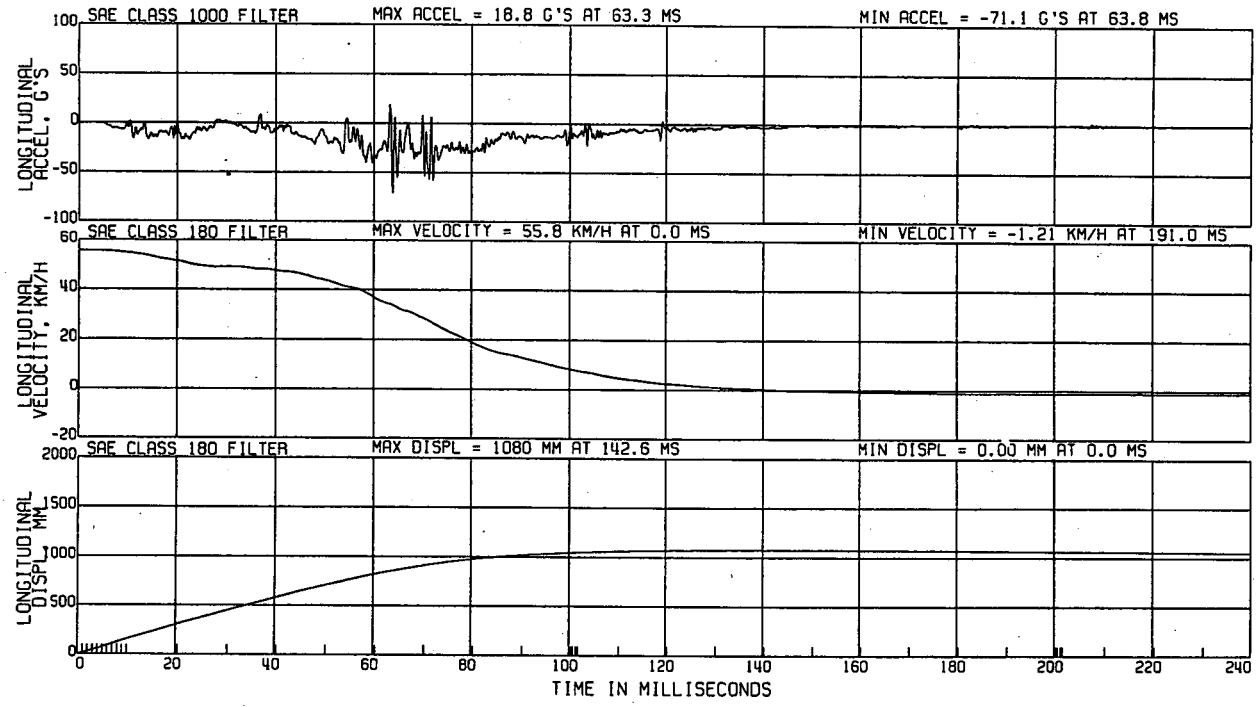
R & D CTR 8V91142D 4 DOOR R. FLOORPAN TEST DATE:11/12/1997
ELEC DATA



Appendix D, plot # **68**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

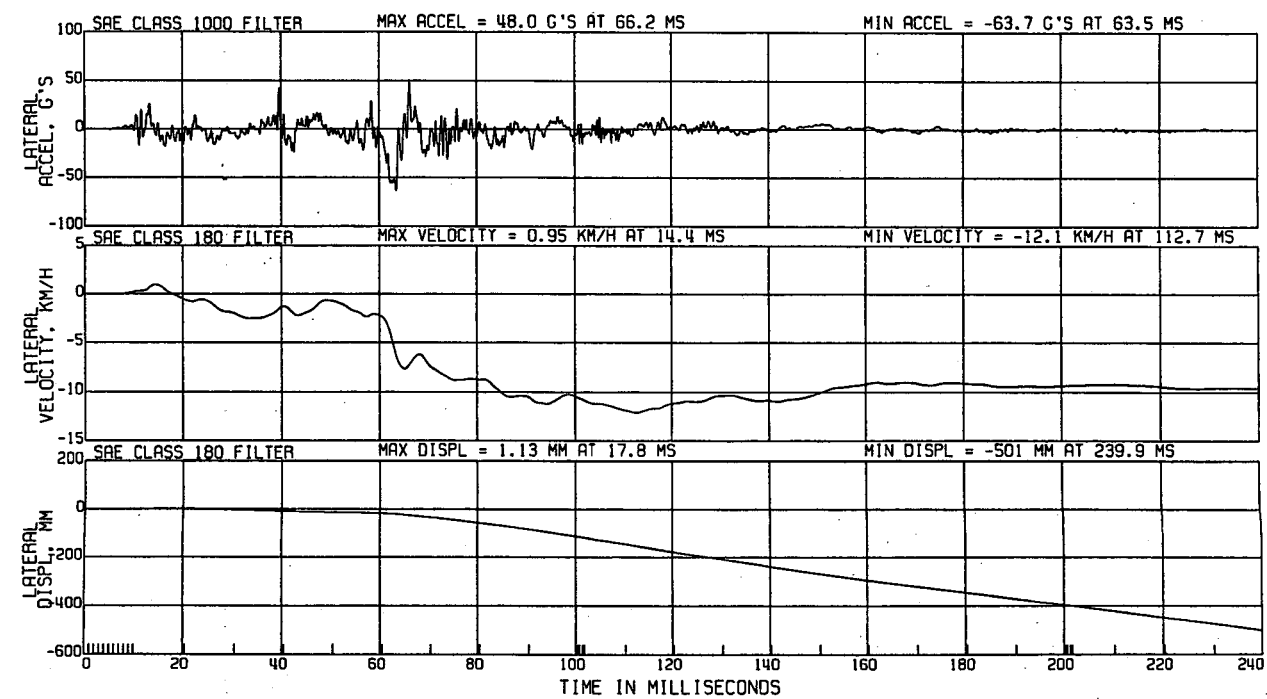
R & D CTR 8V91420 4 DOOR L.REAR ROCKER TEST DATE:11/12/1997
ELEC DATA



Appendix D, plot # **69**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

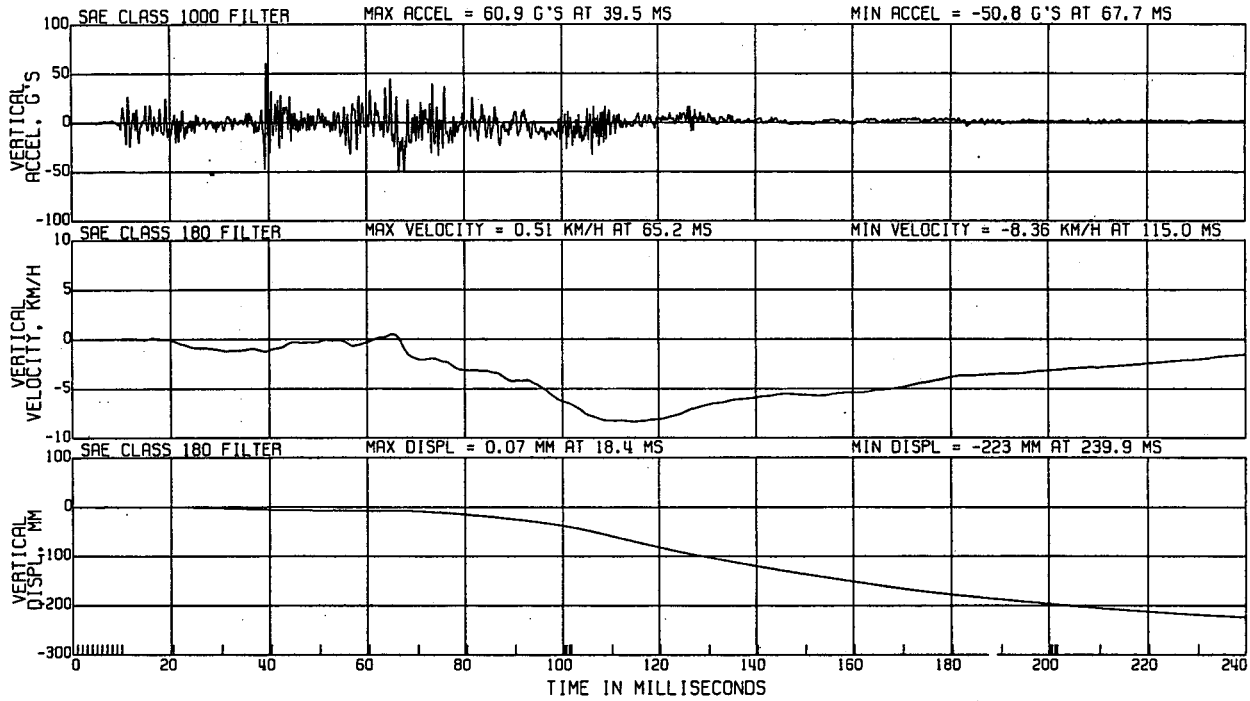
R & D CTR 8V91420 4 DOOR L.REAR ROCKER TEST DATE:11/12/1997
ELEC DATA



Appendix D, plot # **70**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

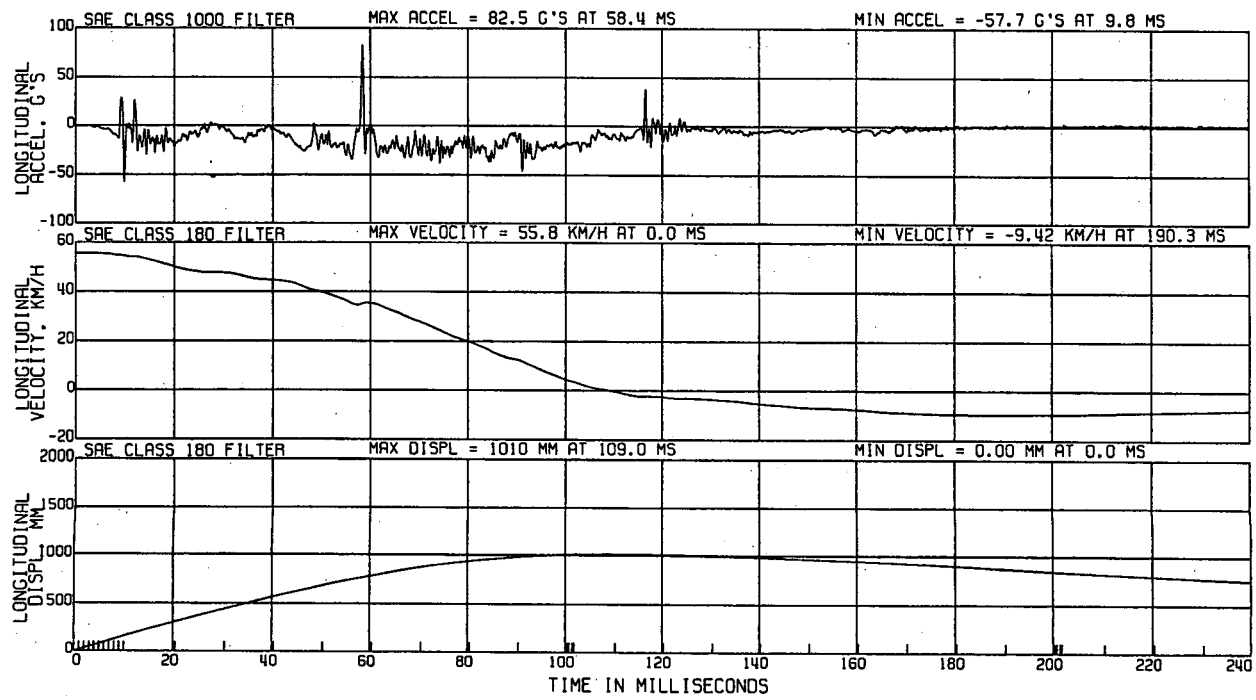
R & D CTR 8V91420 4 DOOR L.REAR ROCKER TEST DATE:11/12/1997
ELEC DATA



Appendix D, plot # **71**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

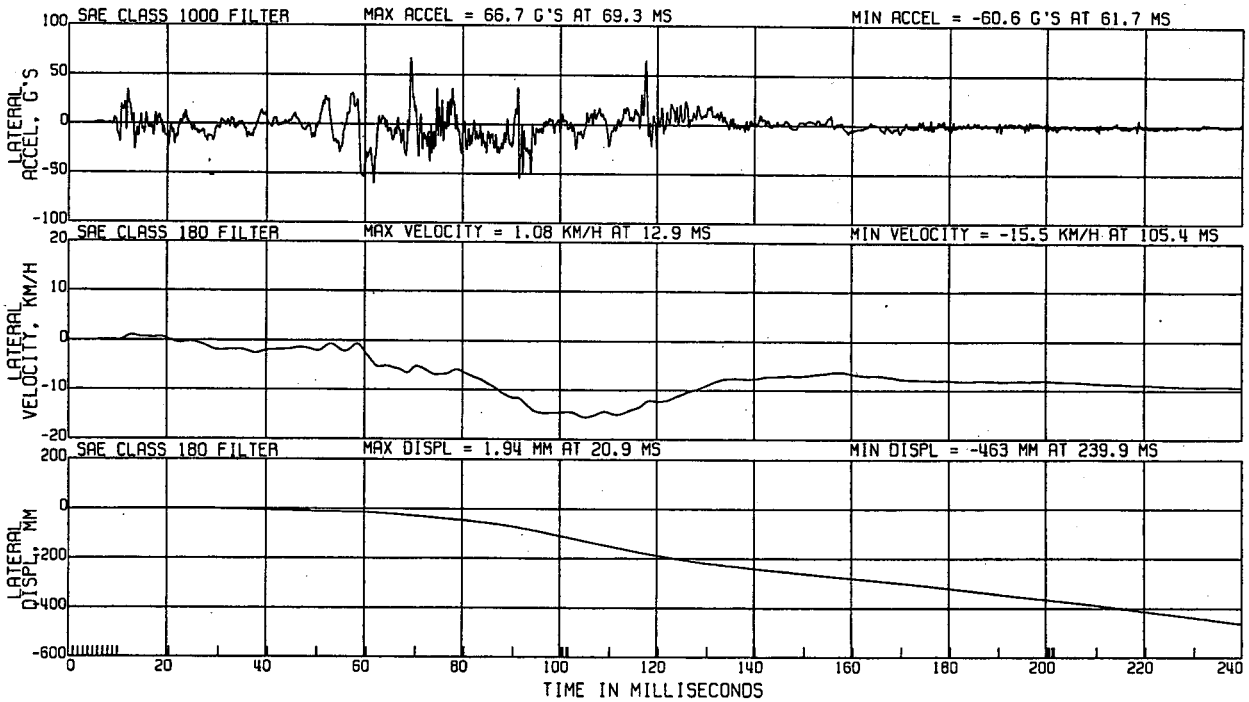
R & D CTR 8V91420 4 DOOR R.REAR ROCKER TEST DATE:11/12/1997
ELEC DATA



Appendix D, plot # **72**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

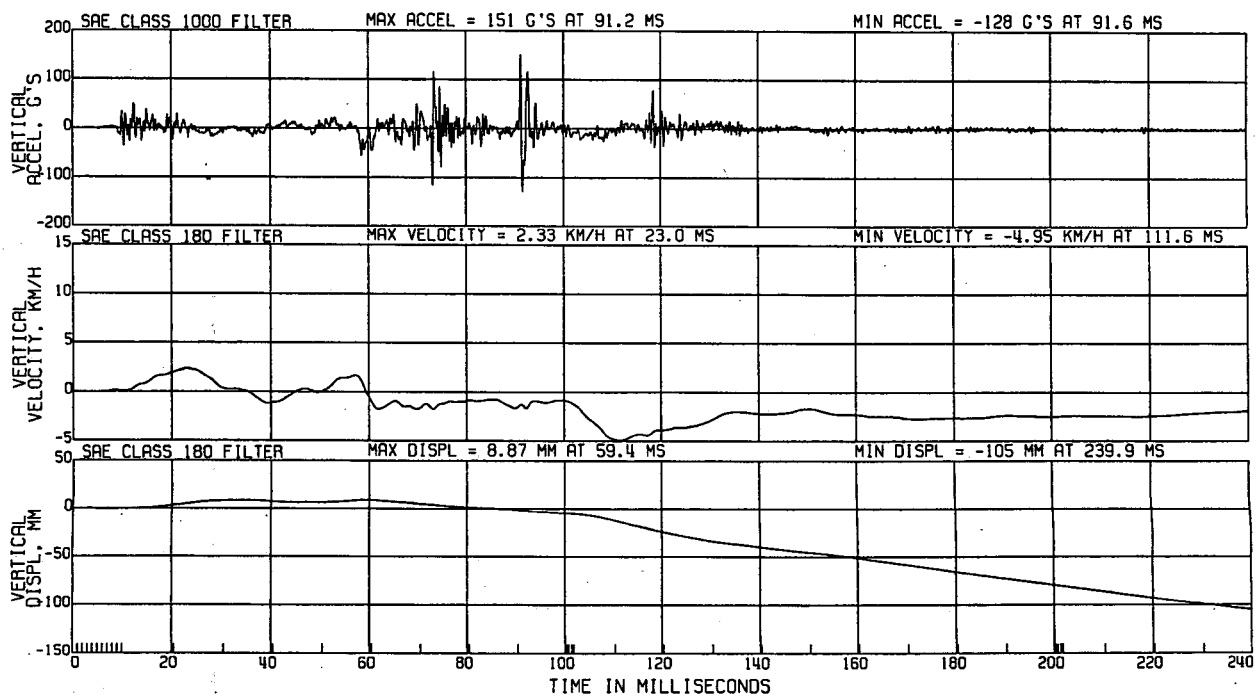
R & D CTR 8V91142D 4 DOOR R.REAR ROCKER TEST DATE:11/12/1997
ELEC DATA



Appendix D, plot # **73**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR R.REAR ROCKER TEST DATE:11/12/1997
ELEC DATA

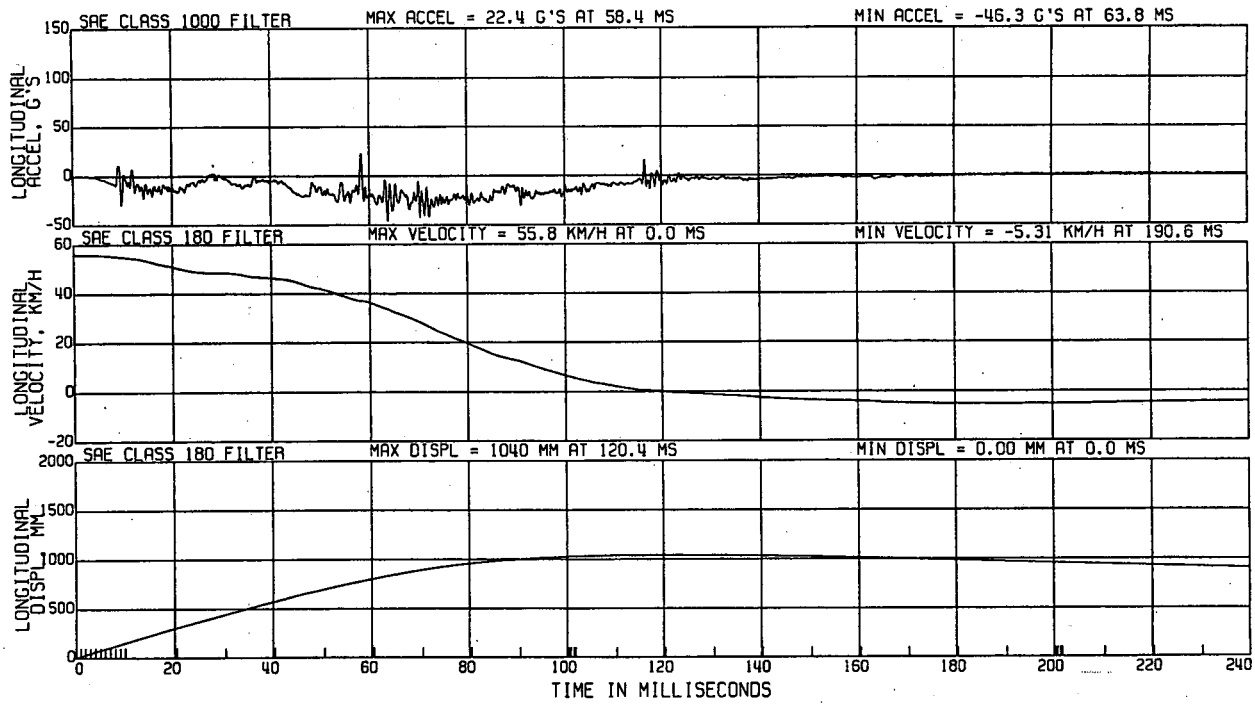


Appendix D, plot # **74**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR AVERAGED REAR ROCKER TEST DATE:11/12/1997

ELEC DATA

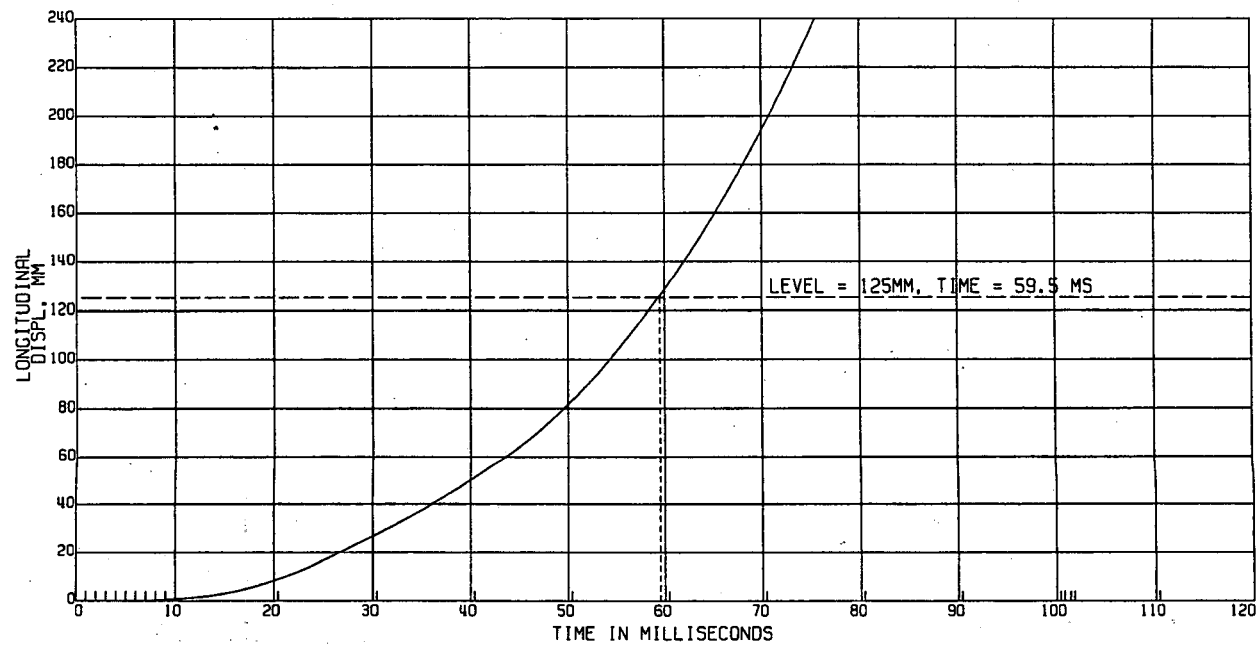


Appendix D, plot # **75**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR COMP. FREE MASS DISP. REL. TO VEHICLE TEST DATE:11/12/1997

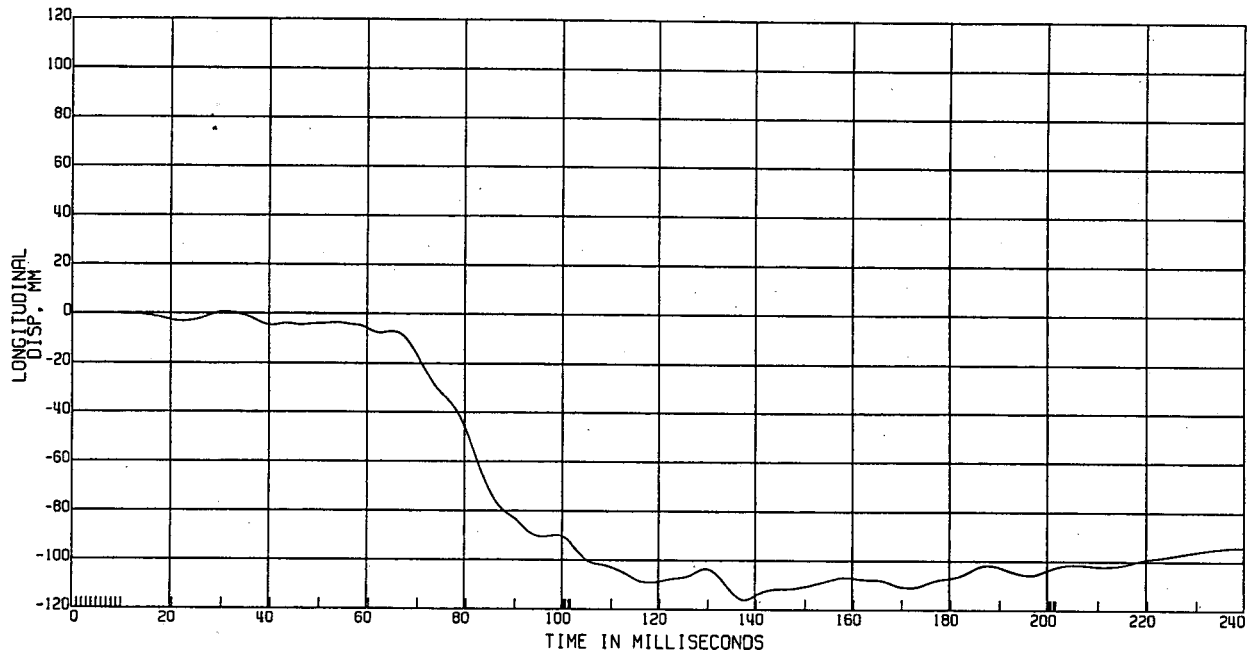
ELEC DATA, SAE CLASS 180



Appendix D, plot # **76**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

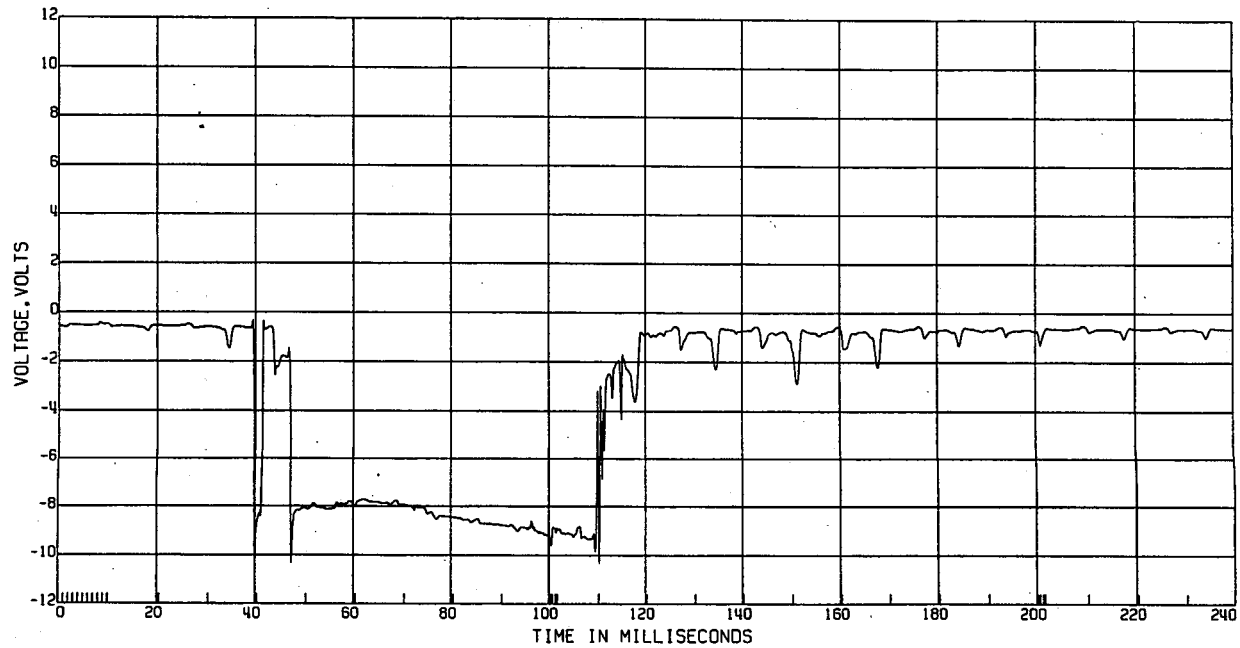
R & D CTR 8V91142D 4 DOOR R. TOE PAN DISPL TEST DATE:11/12/1997
ELEC DATA, SAE CLASS 60



Appendix D, plot # **77**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR STARTER VOLTAGE TEST DATE:11/12/1997
ELEC DATA, SAE CLASS 1000

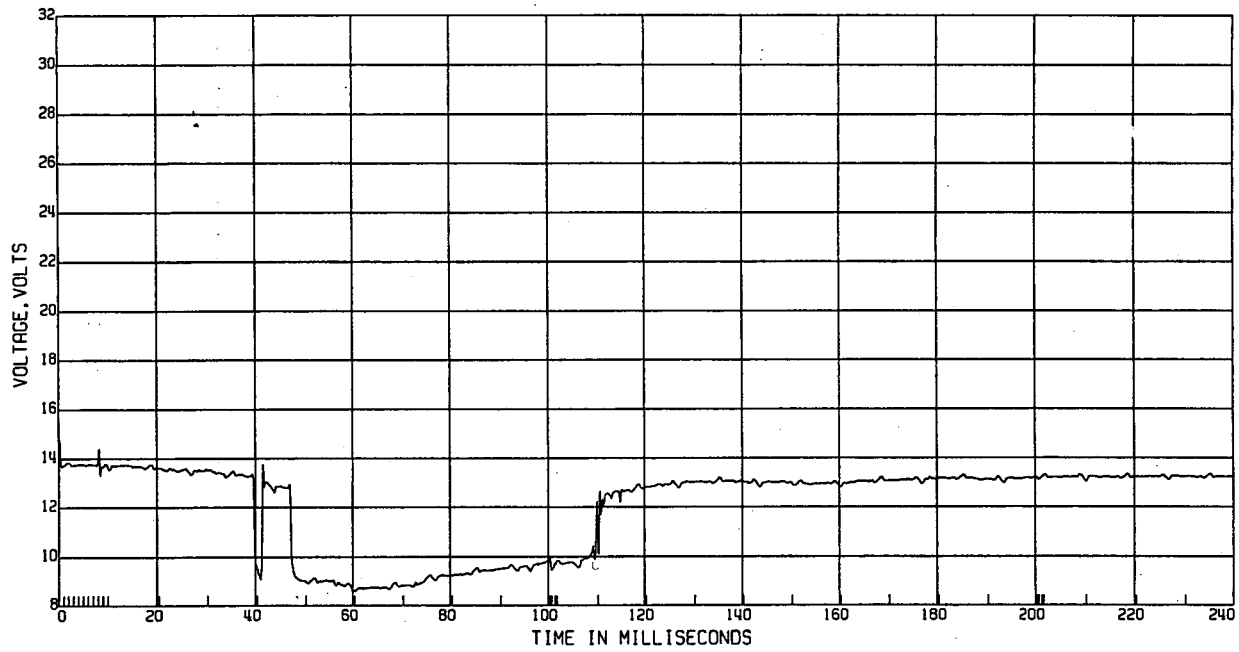


Appendix D, plot # **78**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR BATTERY VOLTAGE TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

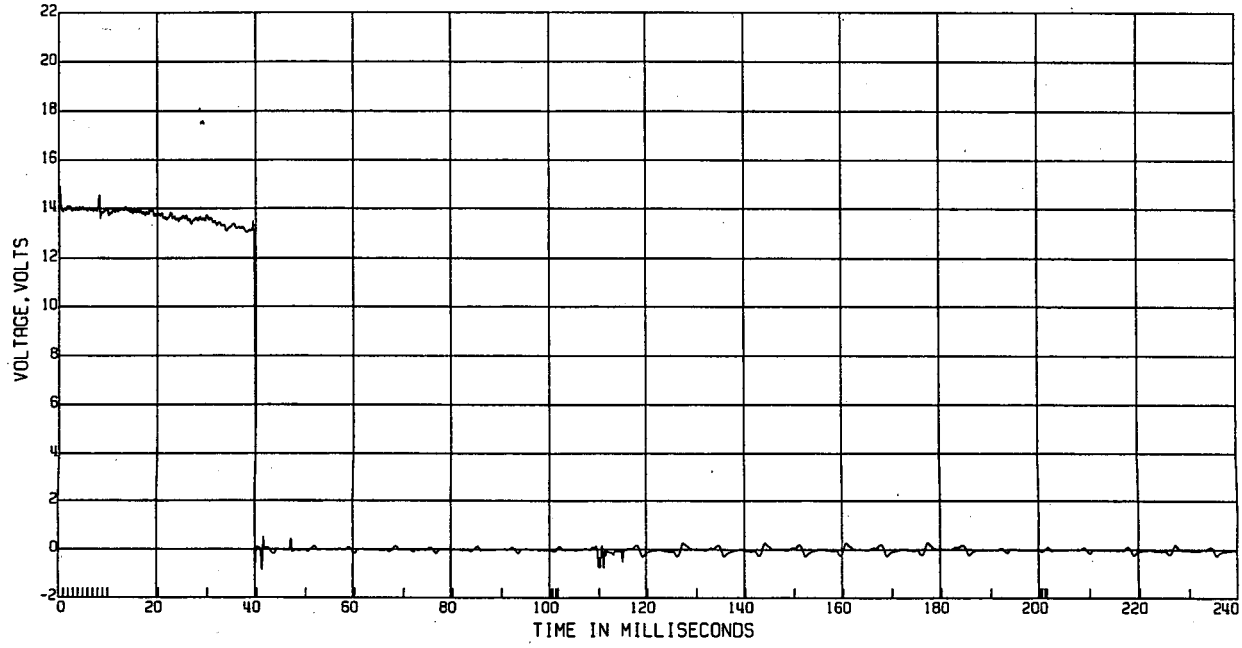


Appendix D, plot # **79**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR ALTERNATOR VOLTAGE TEST DATE:11/12/1997

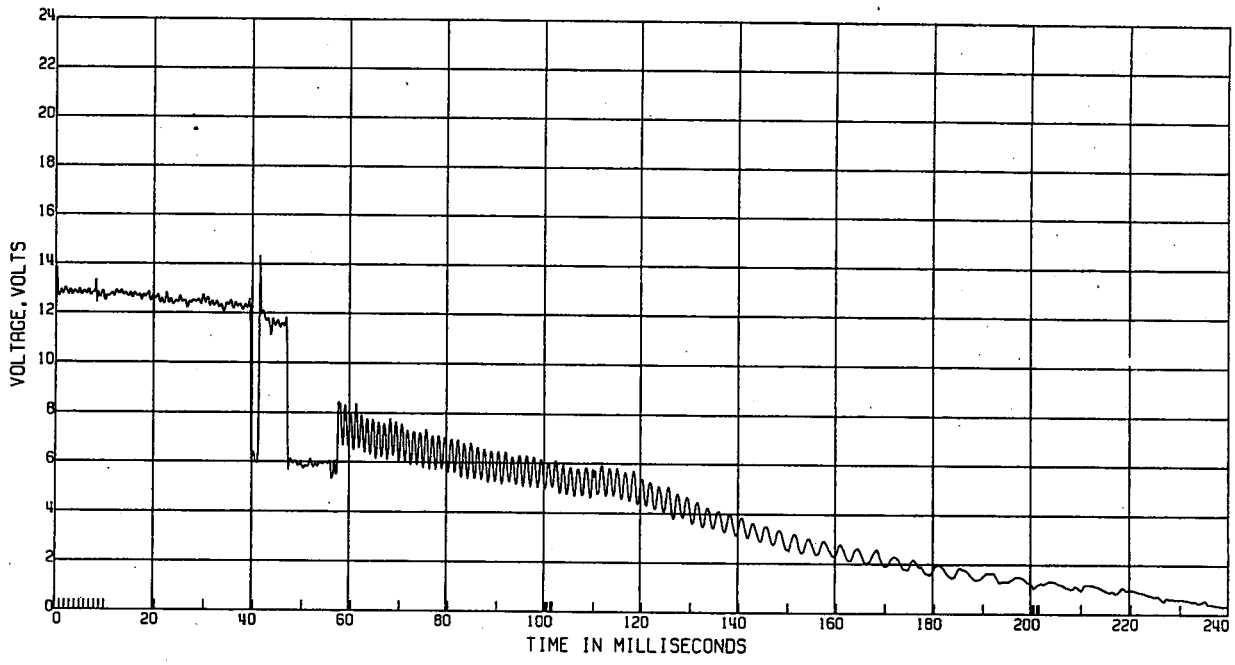
ELEC DATA, SAE CLASS 1000



Appendix D, plot # **80**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

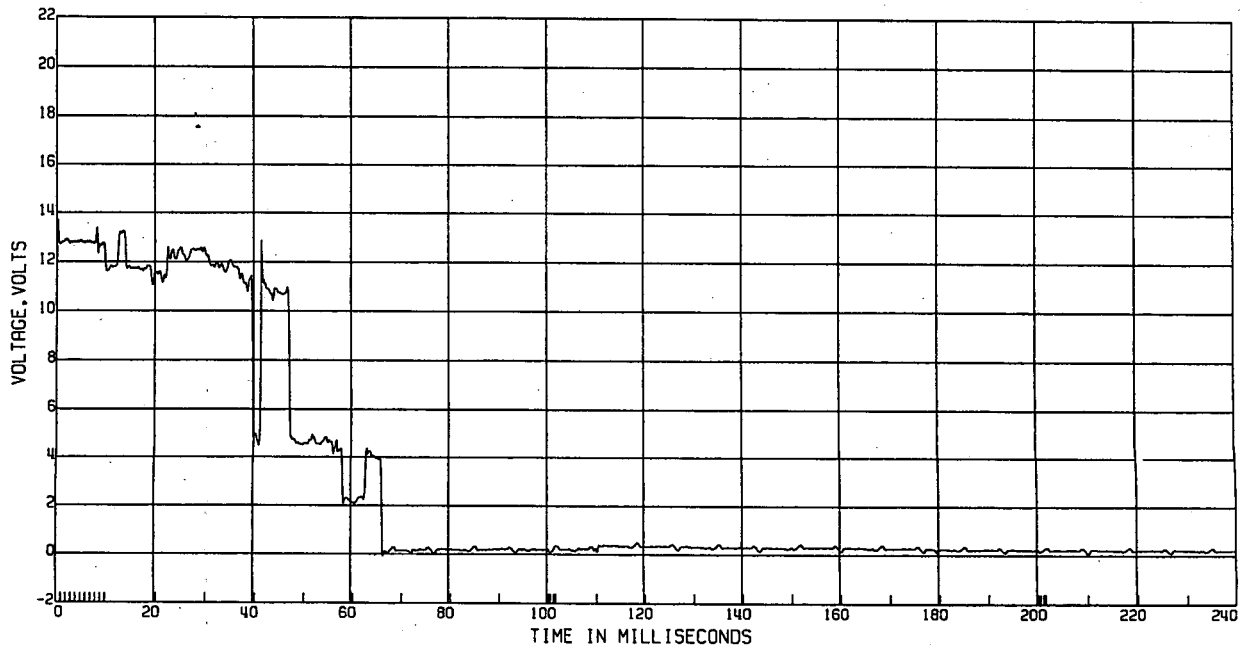
R & D CTR 8V91142D 4 DOOR FUEL PUMP VOLTAGE TEST DATE:11/12/1997
ELEC DATA, SAE CLASS 1000



Appendix D, plot # **81**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR R. FRT HEADLIGHT-LO BEAM VOLTAGE TEST DATE:11/12/1997
ELEC DATA, SAE CLASS 1000

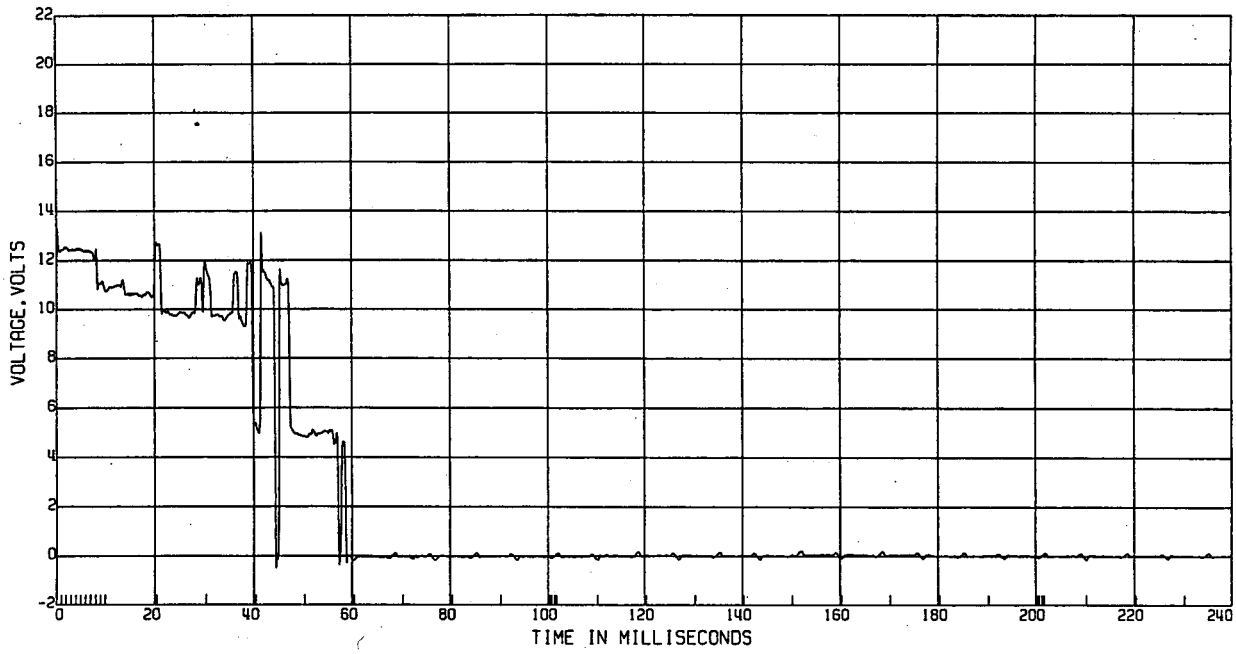


Appendix D, plot # **82**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V9142D 4 DOOR R. FRT FOG LIGHT VOLTAGE TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

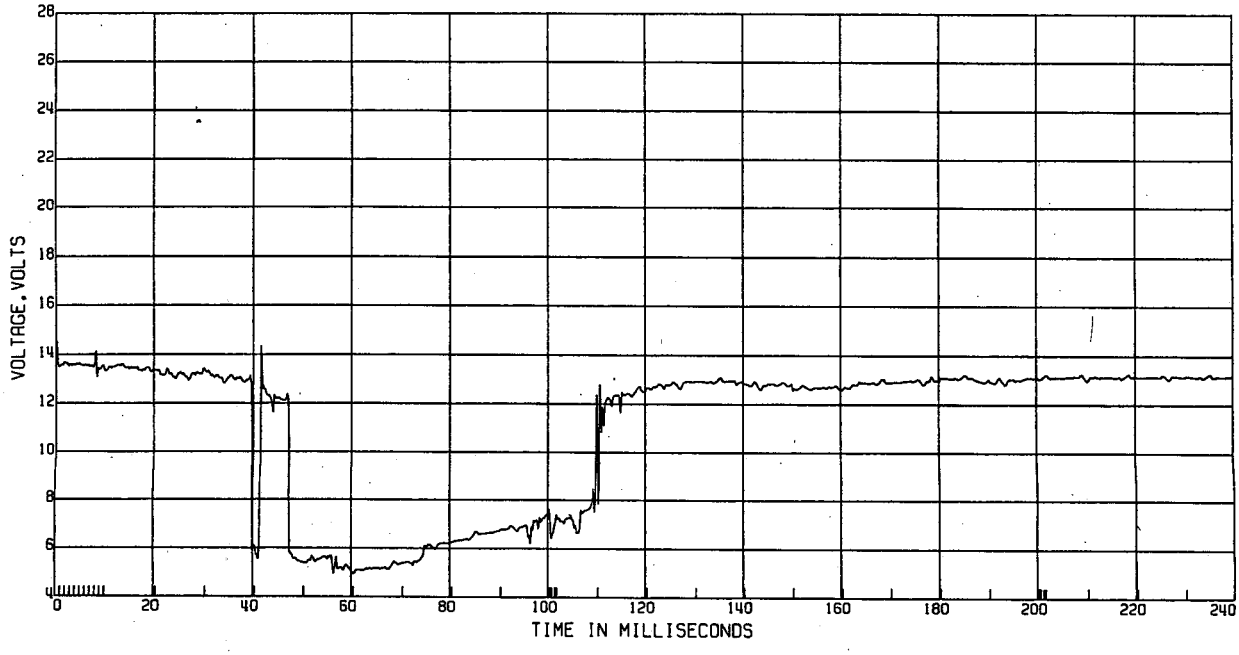


Appendix D, plot # **83**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V9142D 4 DOOR IGNITION VOLTAGE TEST DATE:11/12/1997

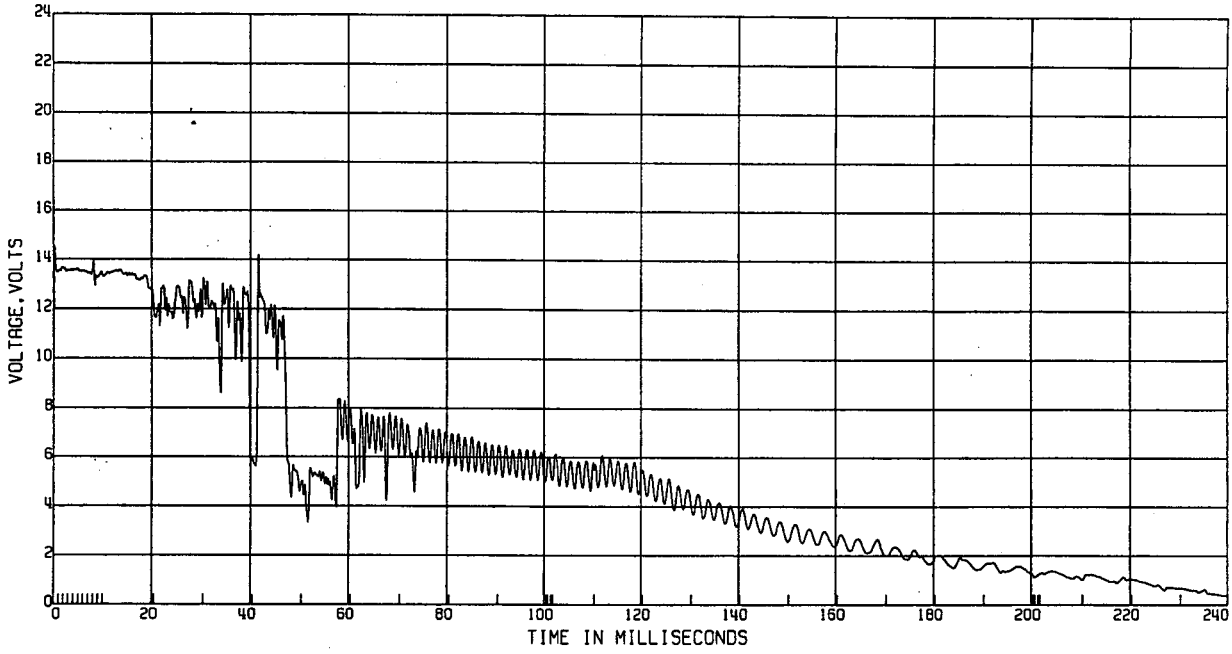
ELEC DATA, SAE CLASS 1000



Appendix D, plot # **84**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

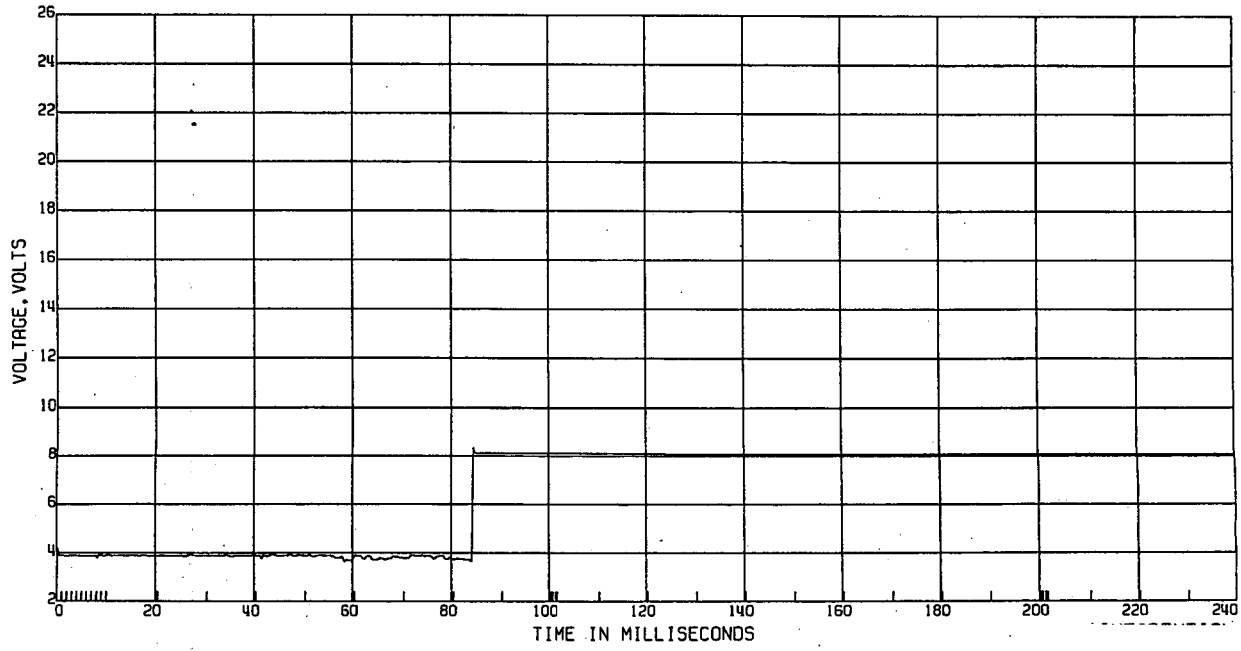
R & D CTR 8V91420 4 DOOR FUEL INERTIA SWITCH VOLTAGE TEST DATE:11/12/1997
ELEC DATA, SAE CLASS 1000



Appendix D, plot # **85**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR L. OPTICAL FIRE DETECTOR VOLTAGE TEST DATE:11/12/1997
ELEC DATA, SAE CLASS 1000

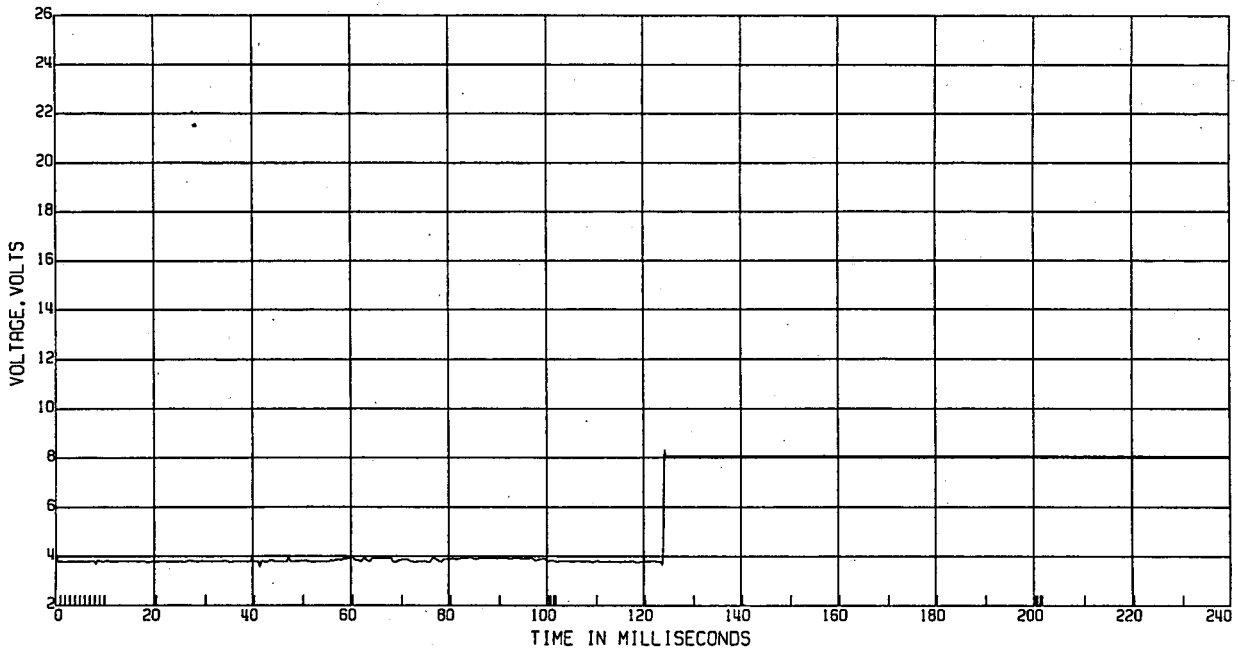


Appendix D, plot # **86**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR R. OPTICAL FIRE DETECTOR VOLTAGE TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

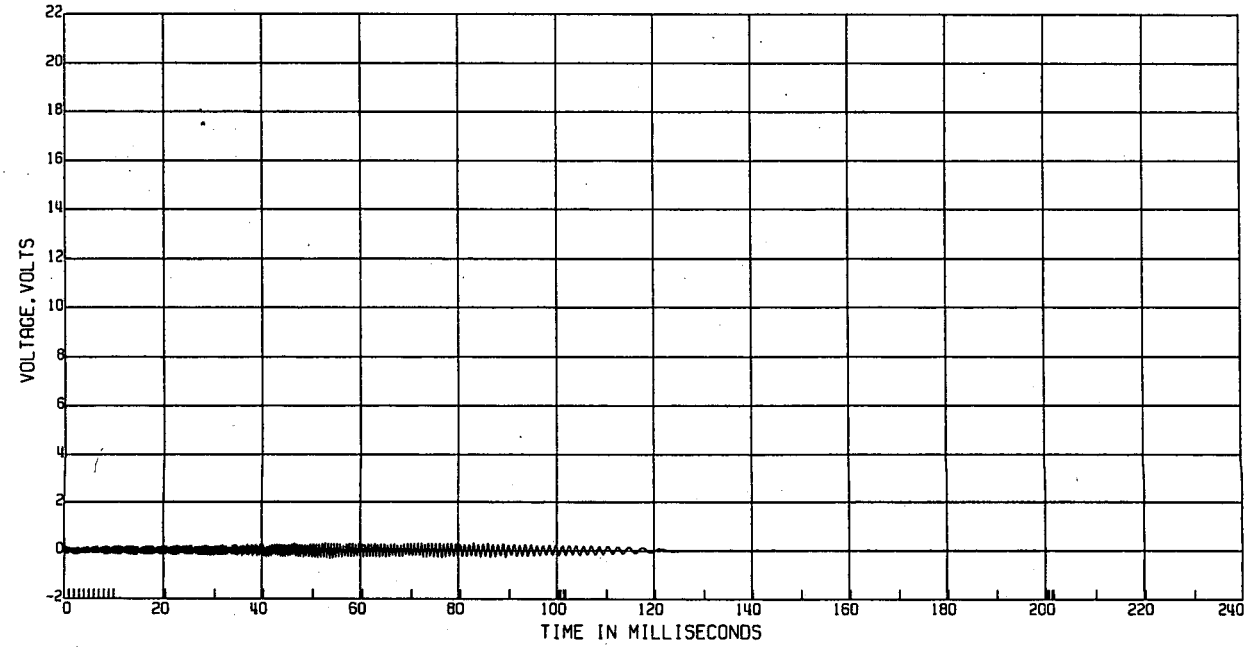


Appendix D, plot # **87**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR ENGINE SPEED- (MP1A) VOLTAGE TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

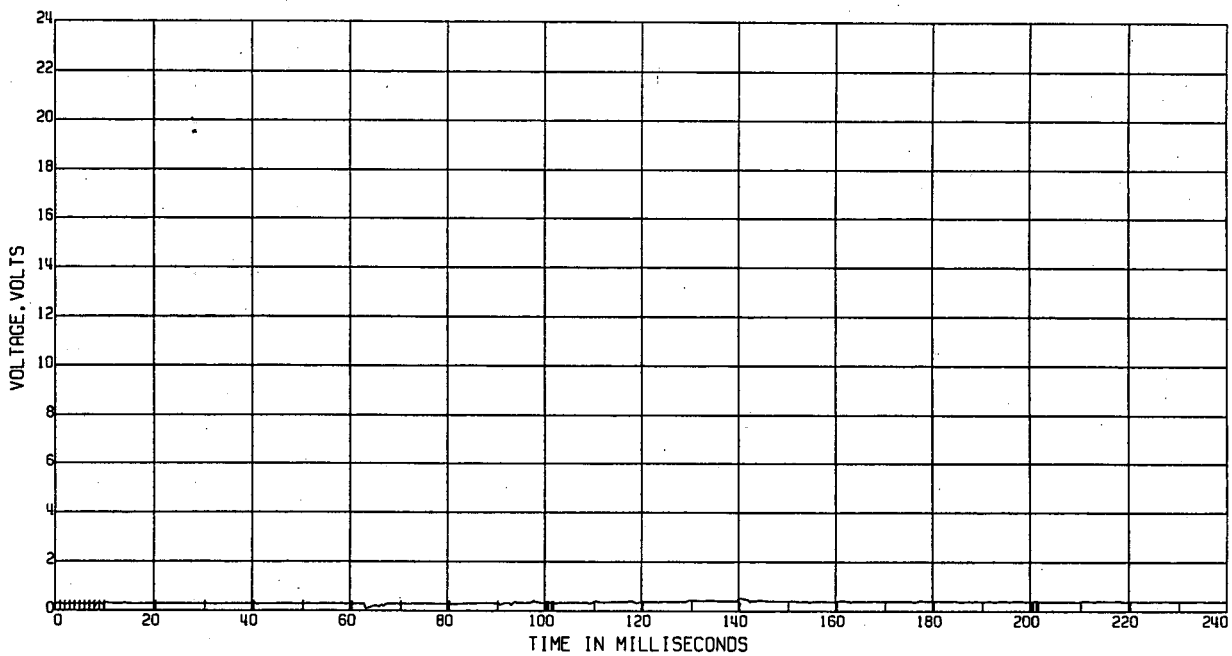


Appendix D, plot # **88**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR L. EXHAUST MANIFOLD (S1) VOLTAGE TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

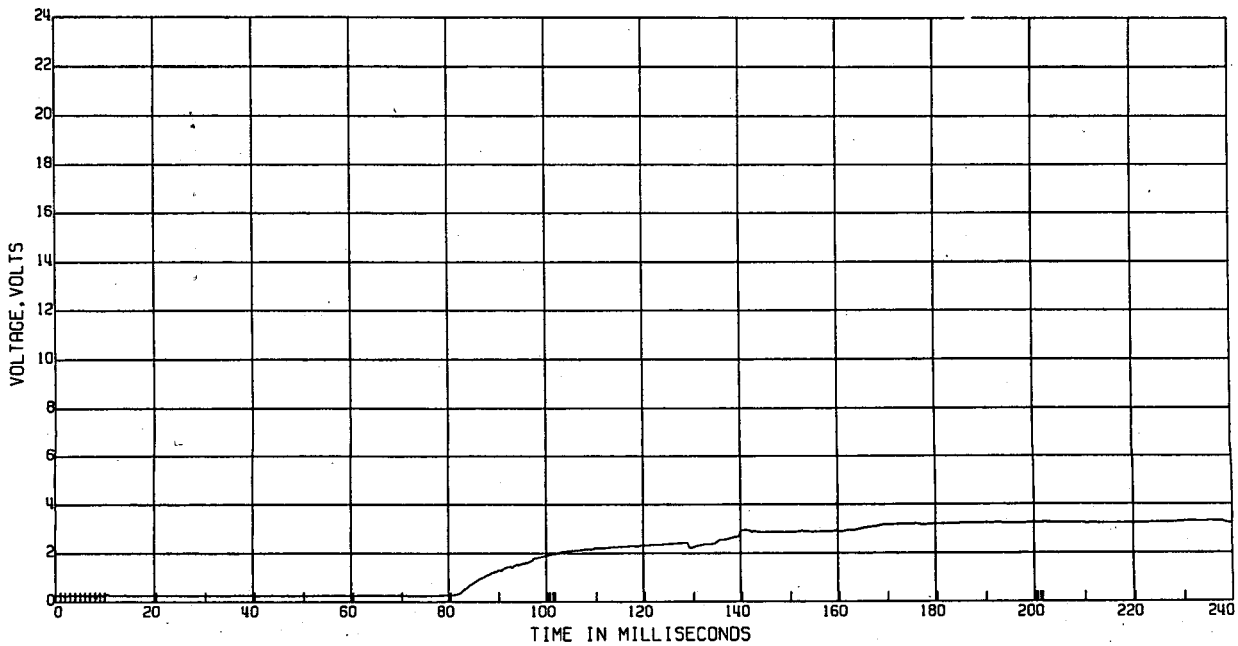


Appendix D, plot # **89**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR R. EXHAUST MANIFOLD (S2) VOLTAGE TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

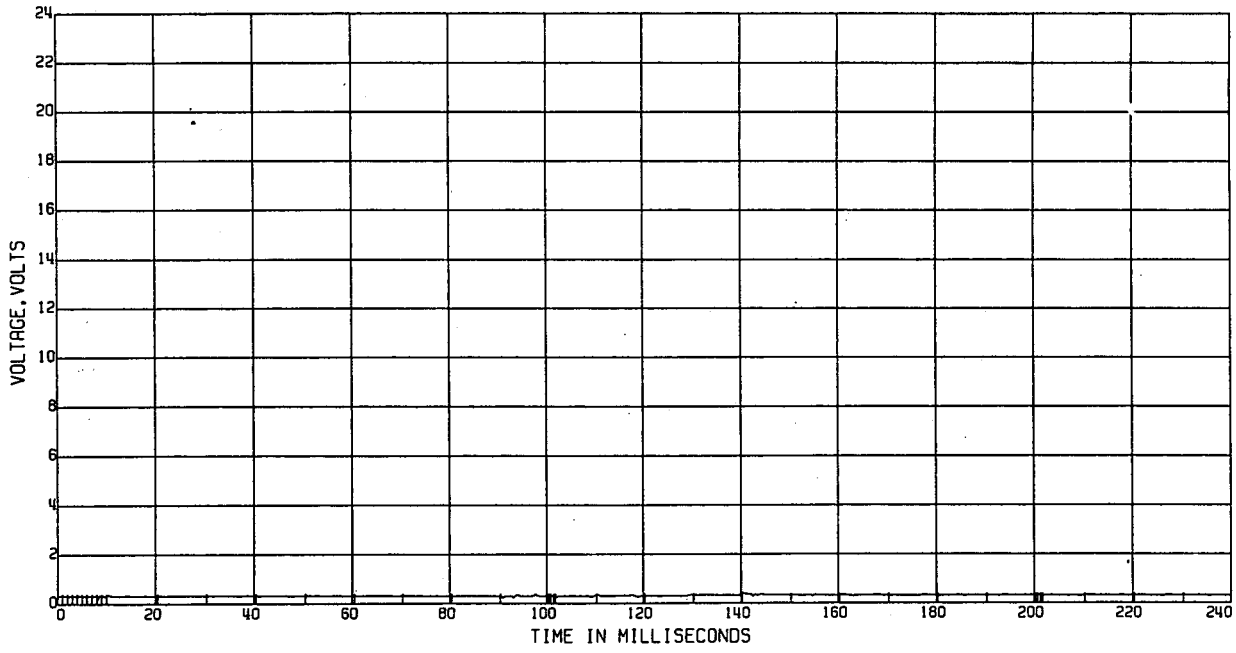


Appendix D, plot # **90**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR LWR REAR INTAKE MANIFOLD (S3) VOLTAGE TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

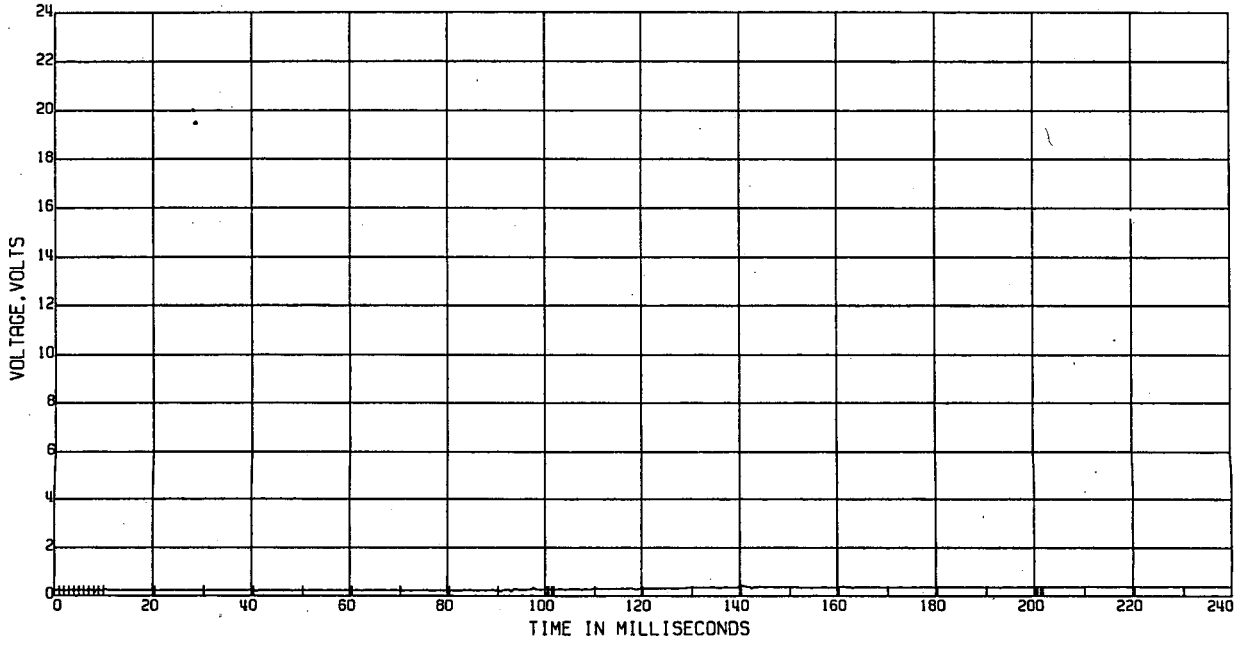


Appendix D, plot # **91**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR FUEL PRESSURE REG (S4) VOLTAGE TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

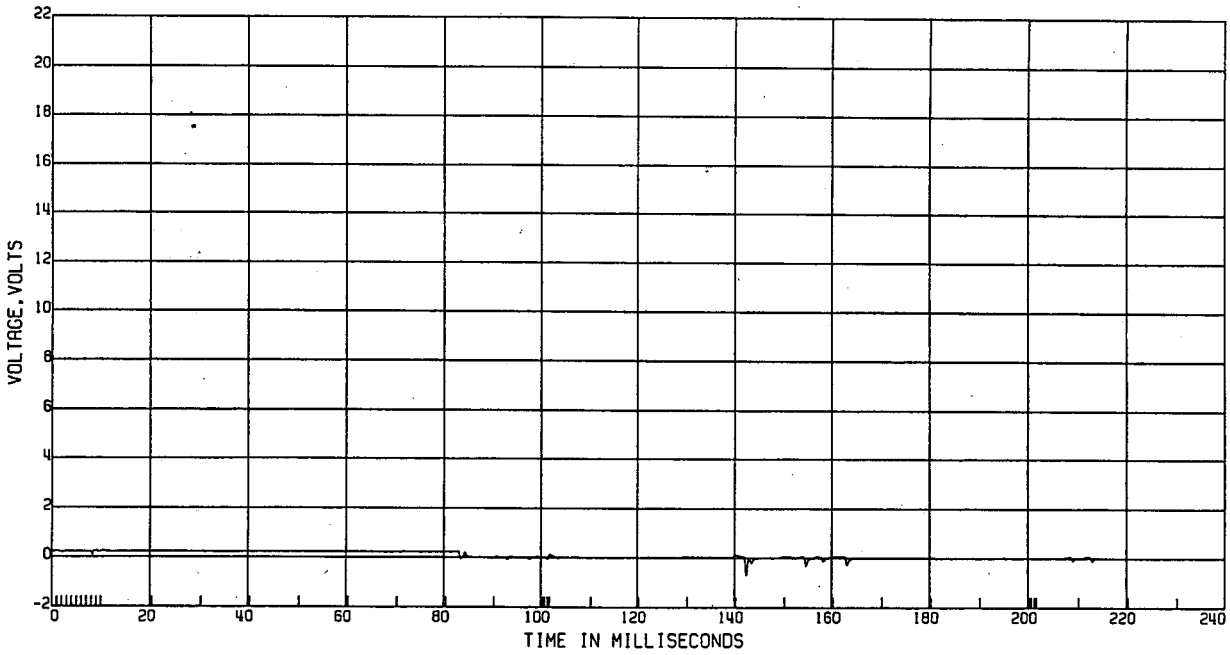


Appendix D, plot # **92**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR CATALYTIC CONVERTER(S5) VOLTAGE TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

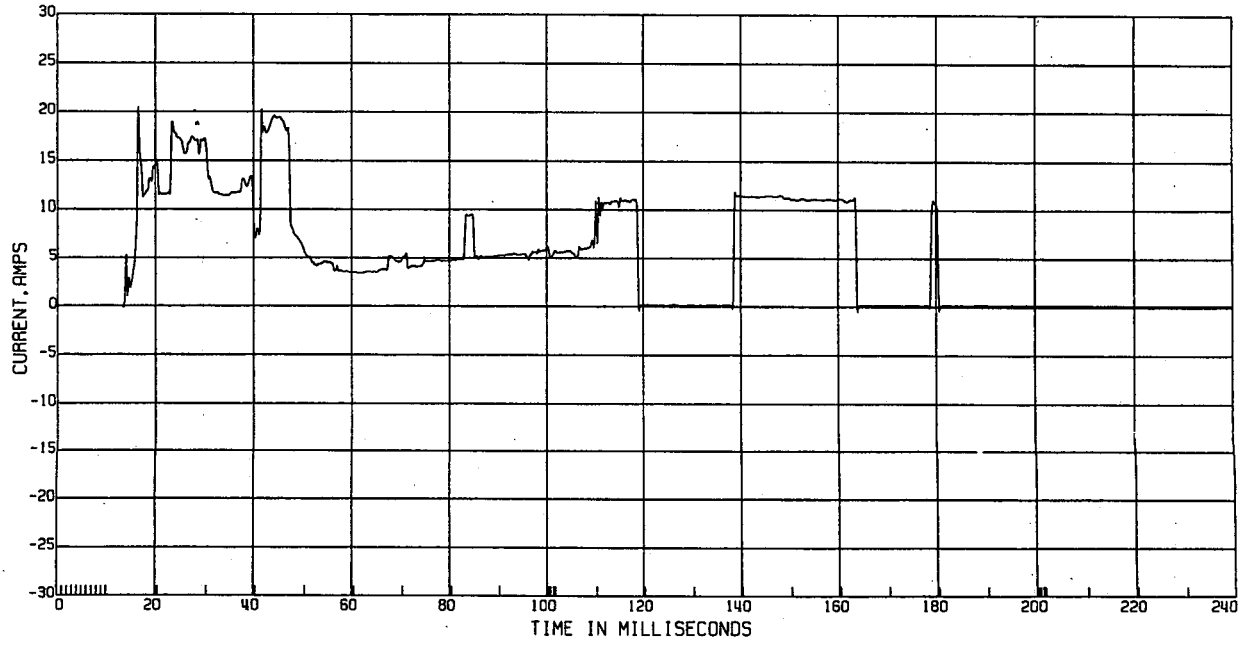


Appendix D, plot # **93**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR L. WHEEL BAG CURRENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

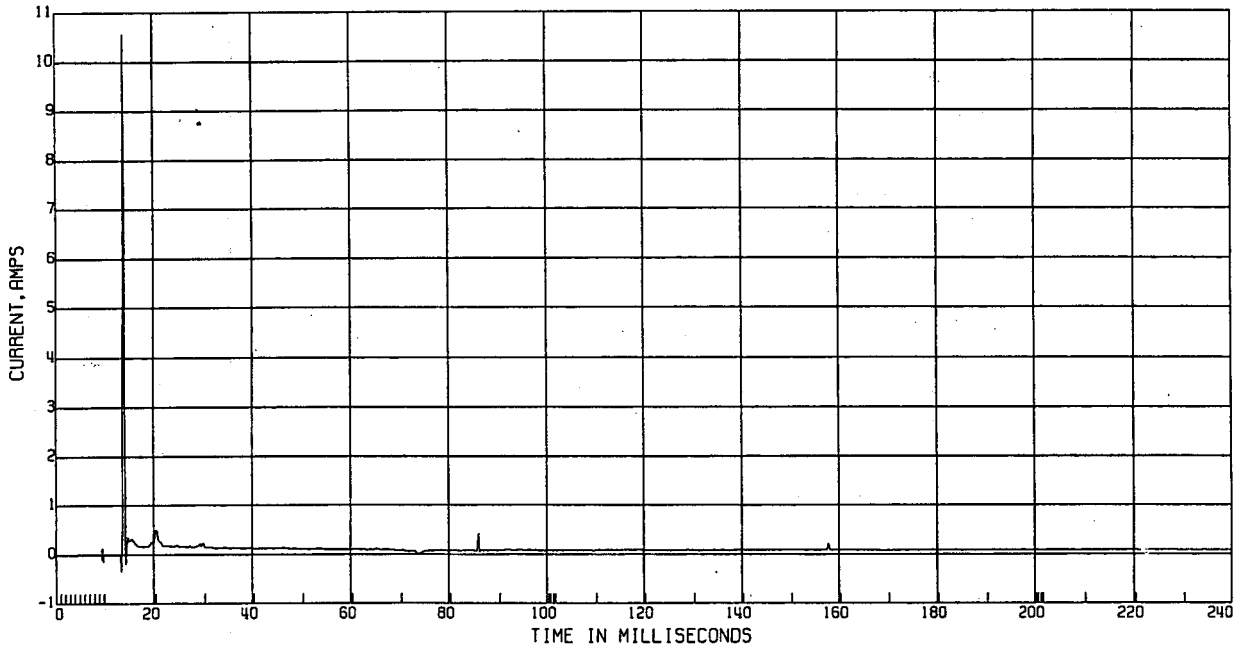


Appendix D, plot # **94**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR R. I/P BAG CURRENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

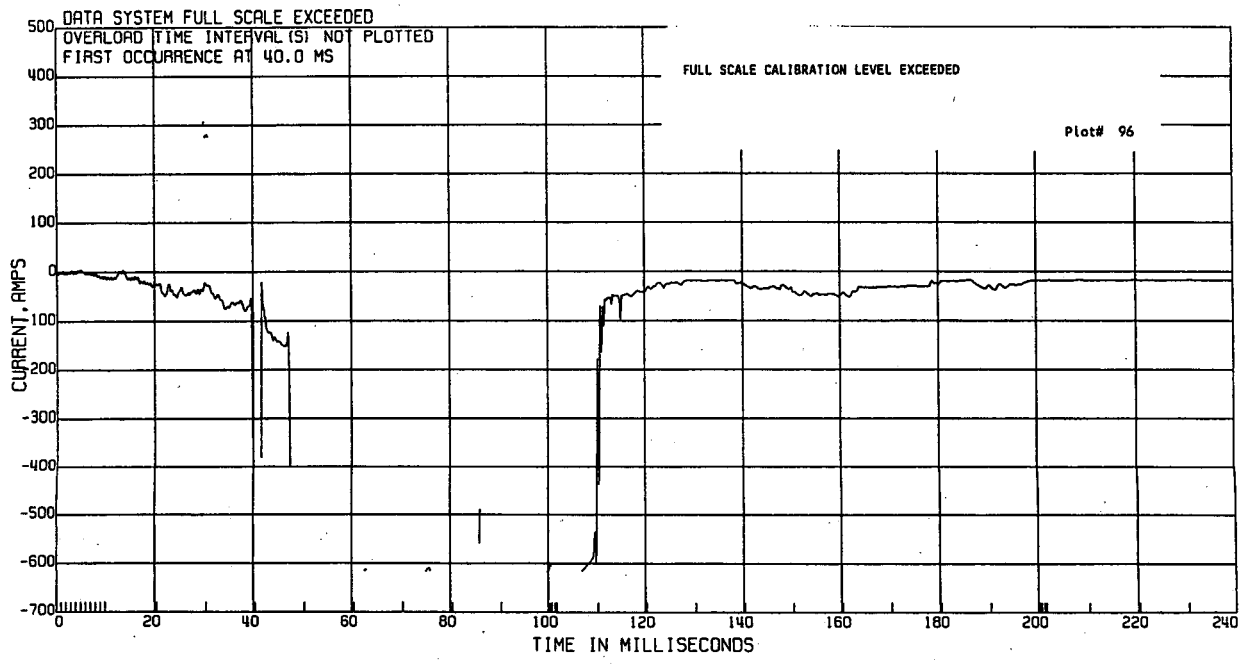


Appendix D, plot # **95**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR BATTERY CURRENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

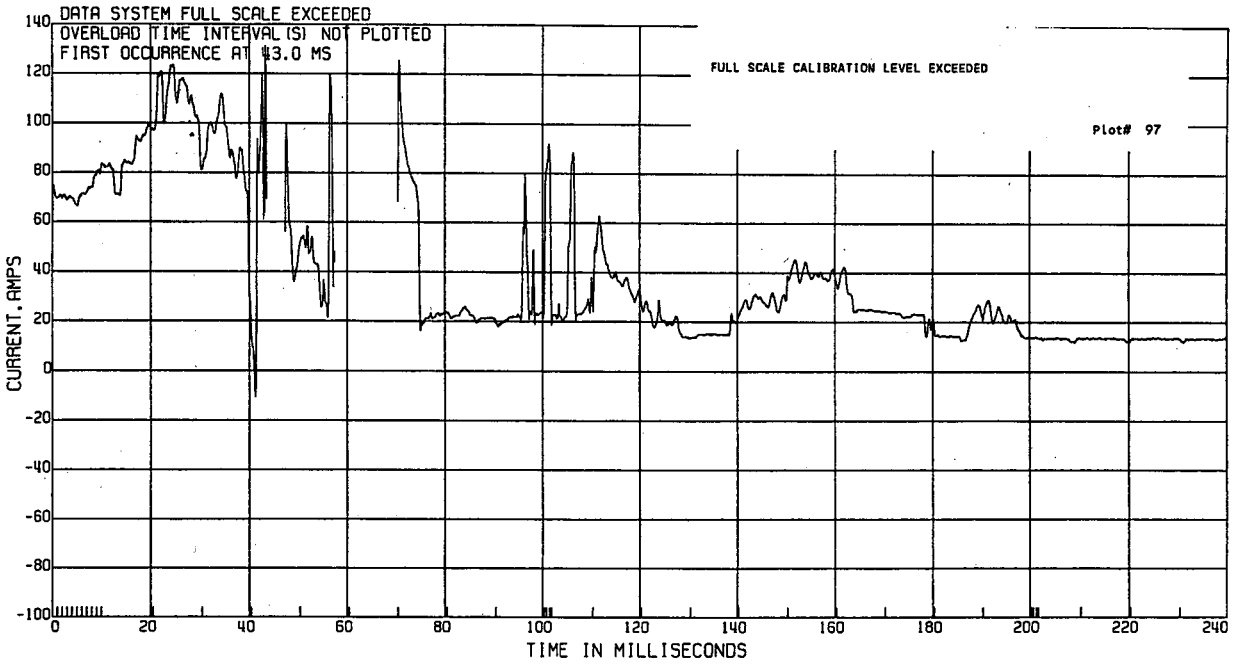


Appendix D, plot # **96**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR PDB CURRENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

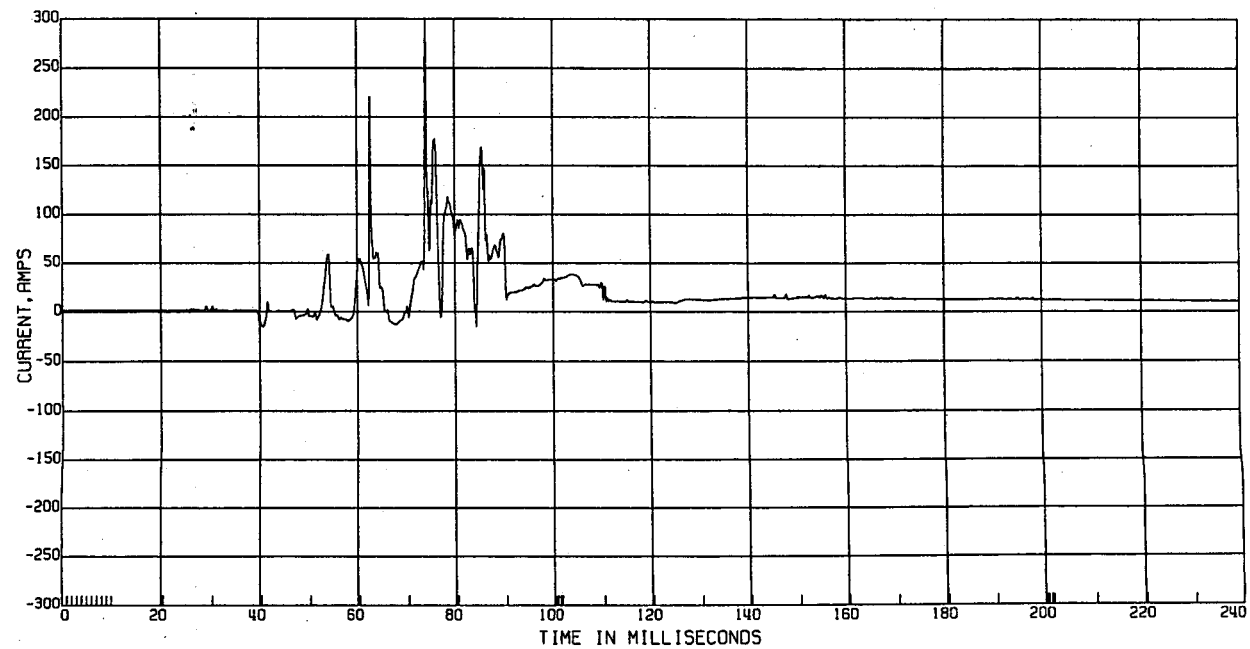


Appendix D, plot # **97**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR STARTER CURRENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

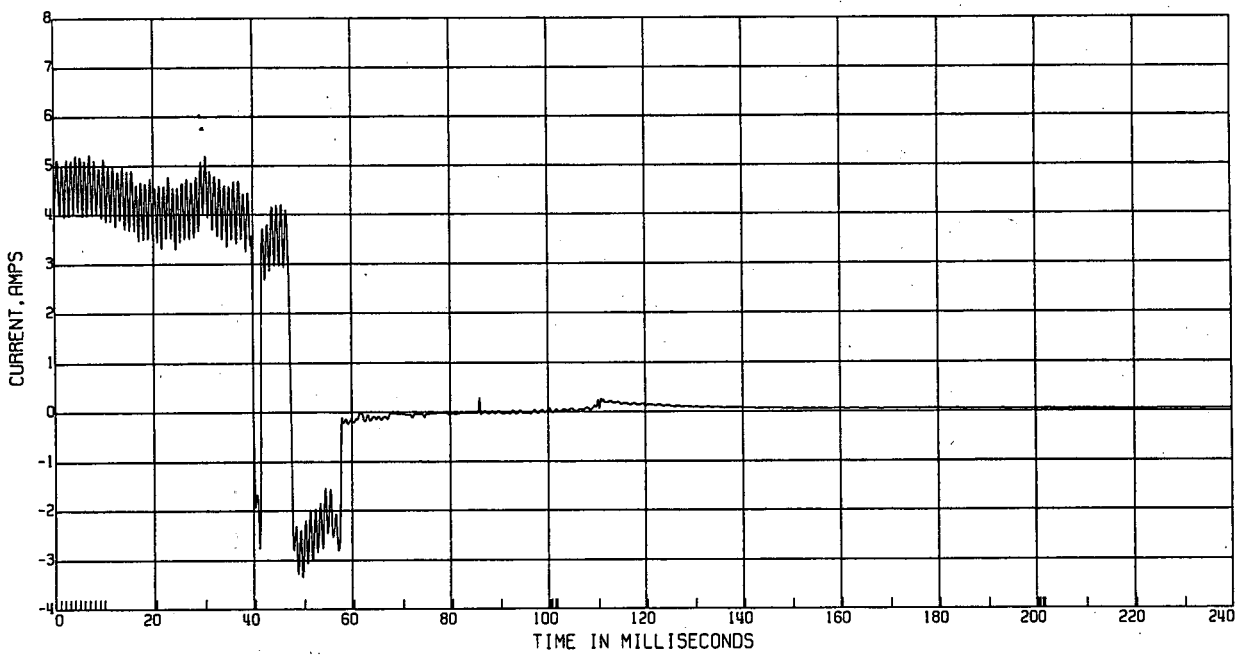


Appendix D, plot # **98**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR FUEL PUMP CURRENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

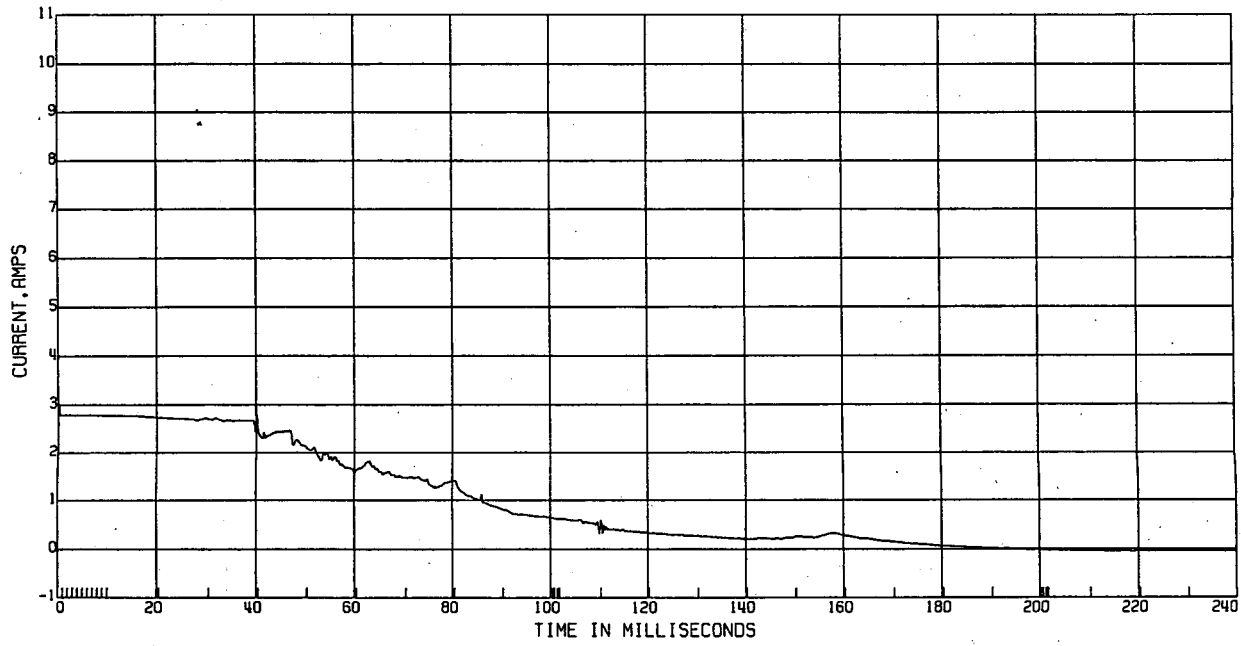


Appendix D, plot # **99**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR A/C CLUTCH CURRENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

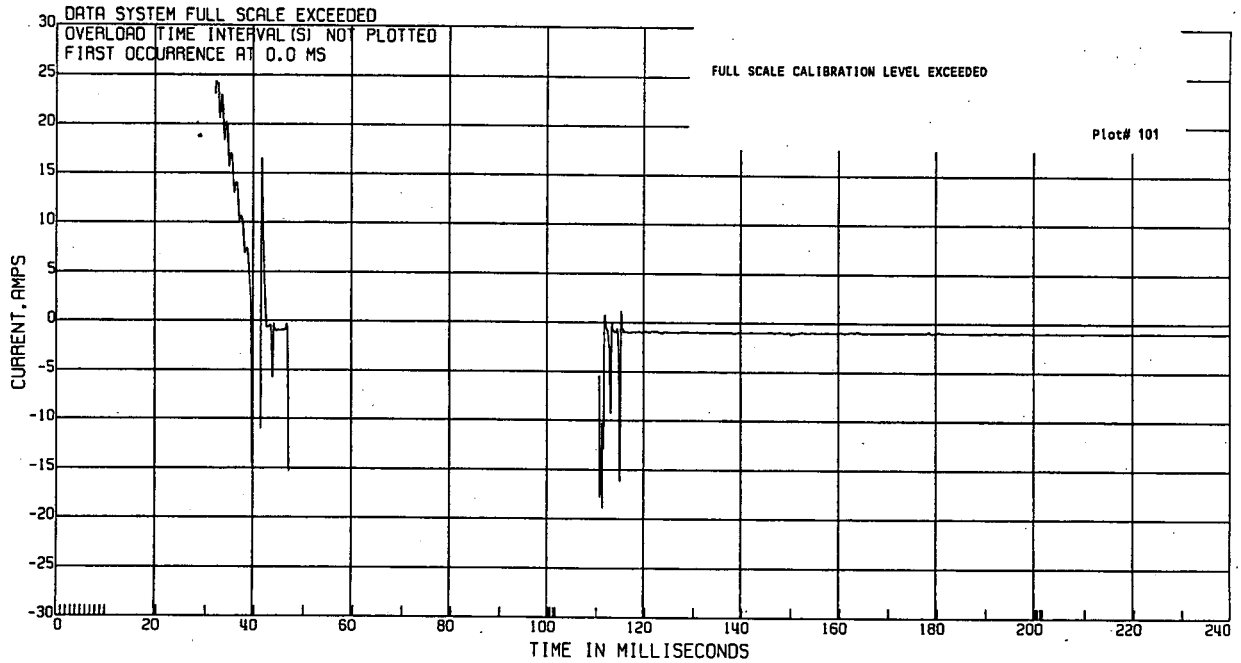


Appendix D, plot # **100**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR ALTERNATOR CABLE #1 CURRENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

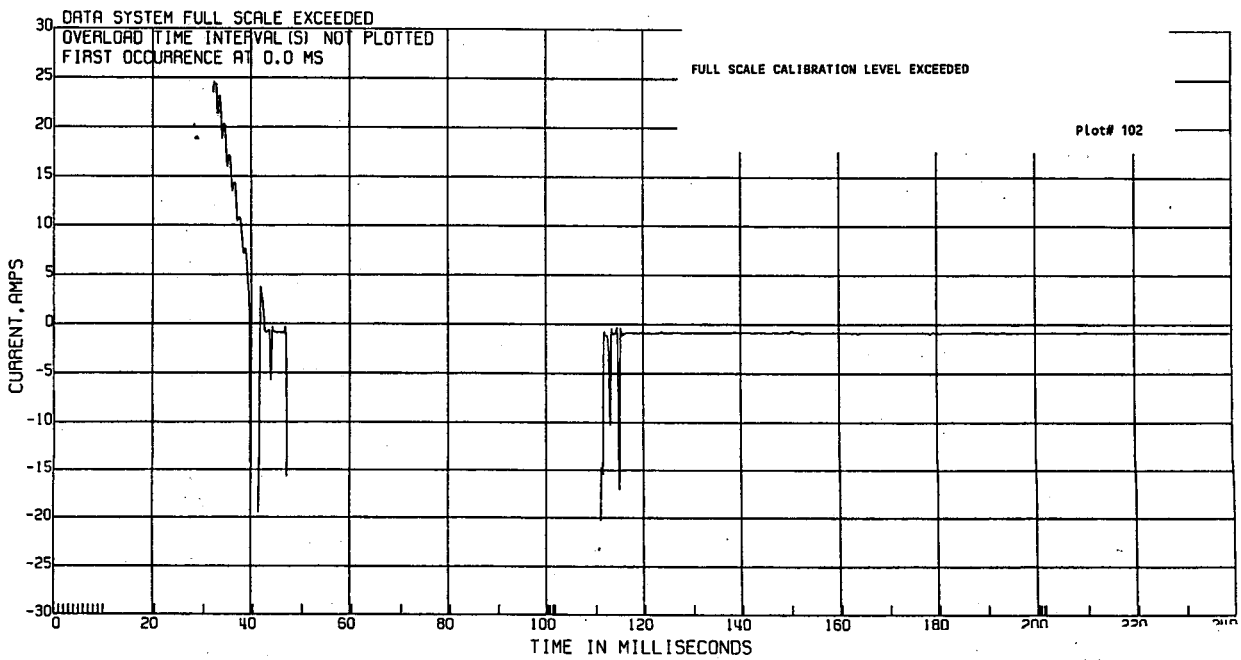


Appendix D, plot # **101**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR ALTERNATOR CABLE #2 CURRENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

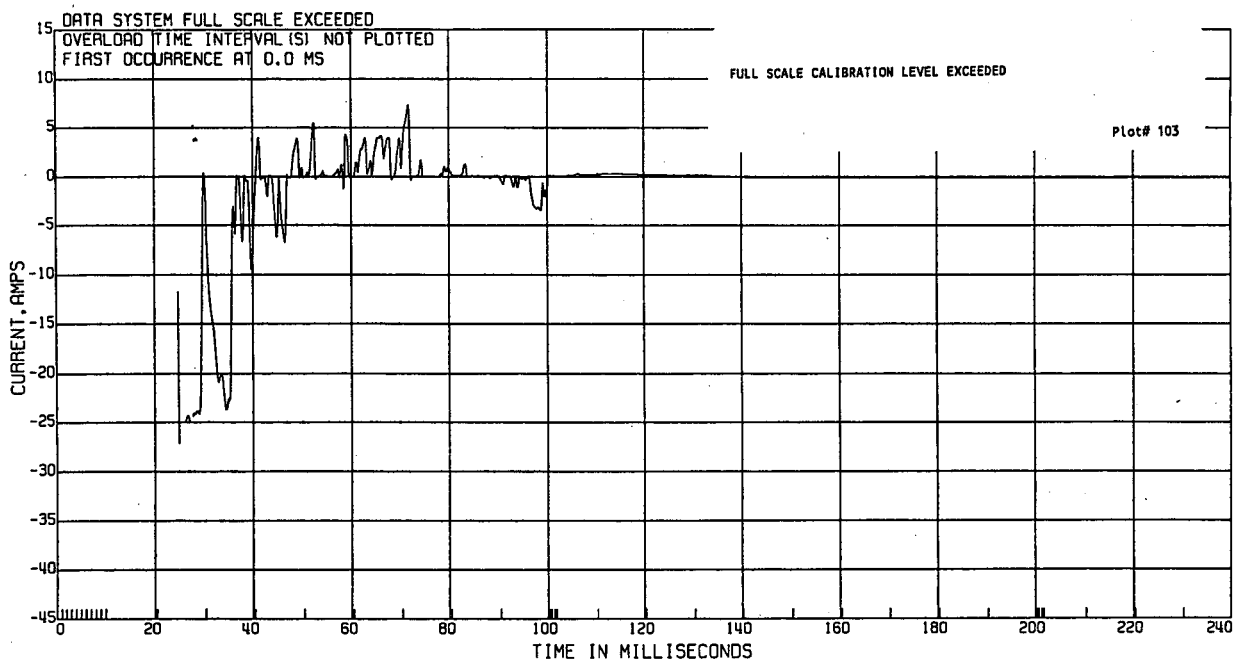


Appendix D, plot # **102**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR HVAC BLOWER CURRENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

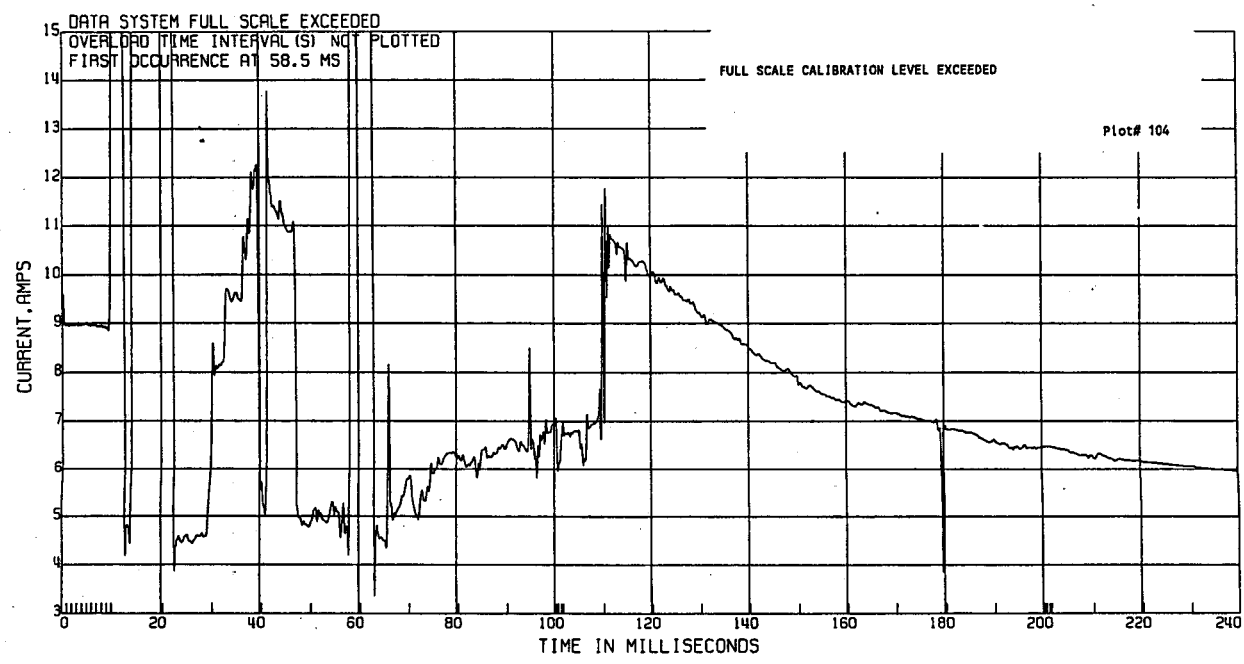


Appendix D, plot # **103**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR HEADLIGHT LOW BEAM CURRENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

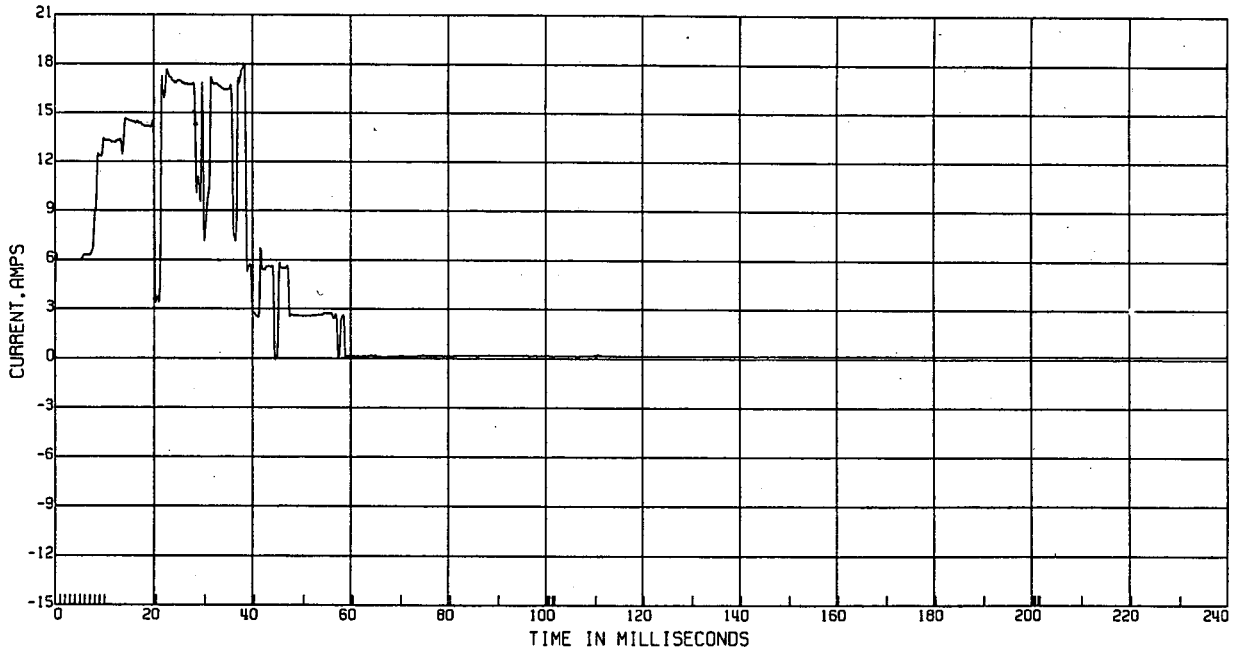


Appendix D, plot # **104**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR FOG LIGHT CURRENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

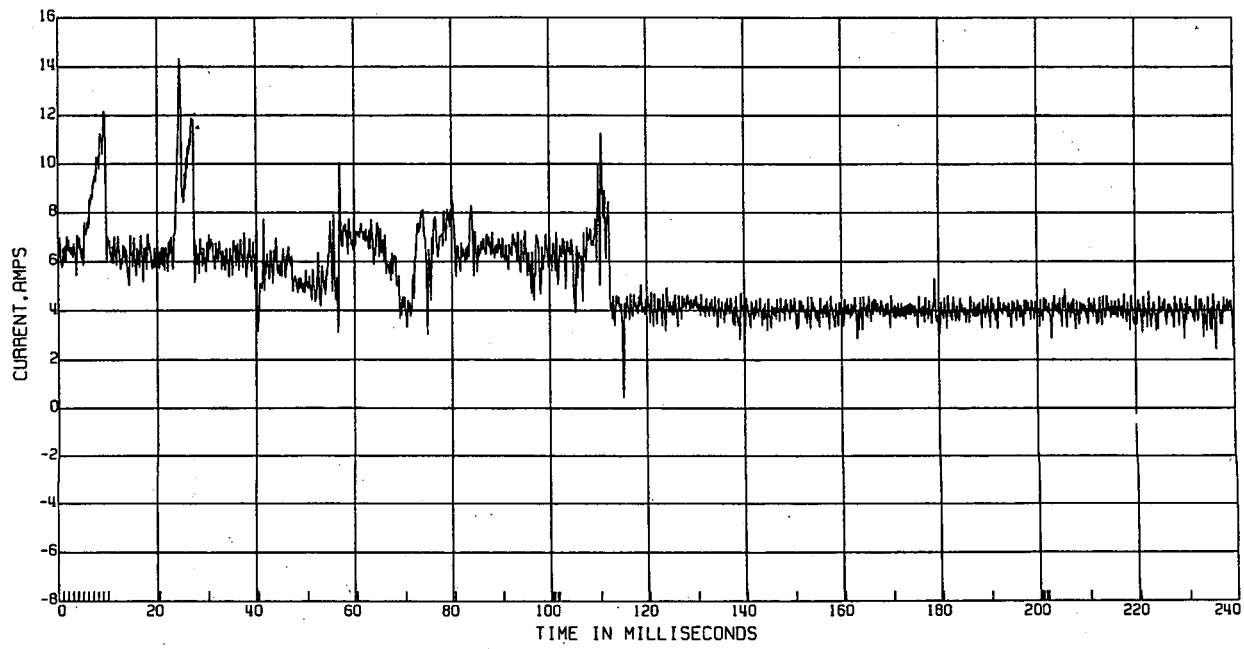


Appendix D, plot # **105**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR IGNITION CURRENT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

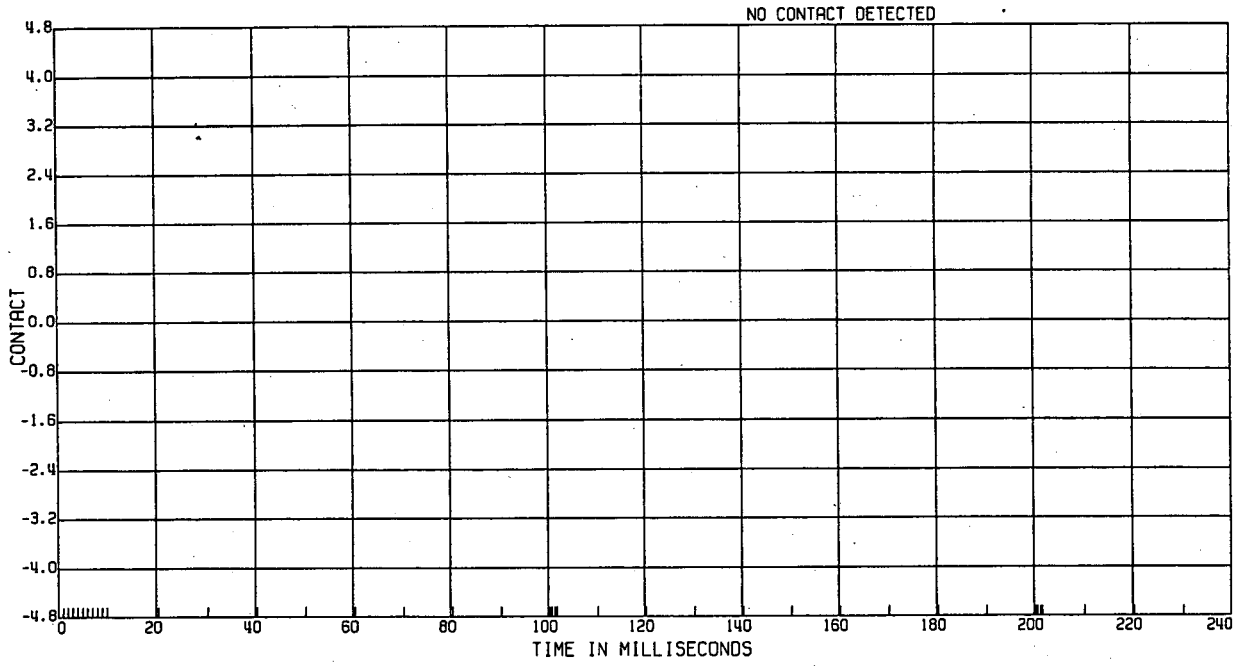


Appendix D, plot # **106**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR THERMAL WIRE CONTACT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

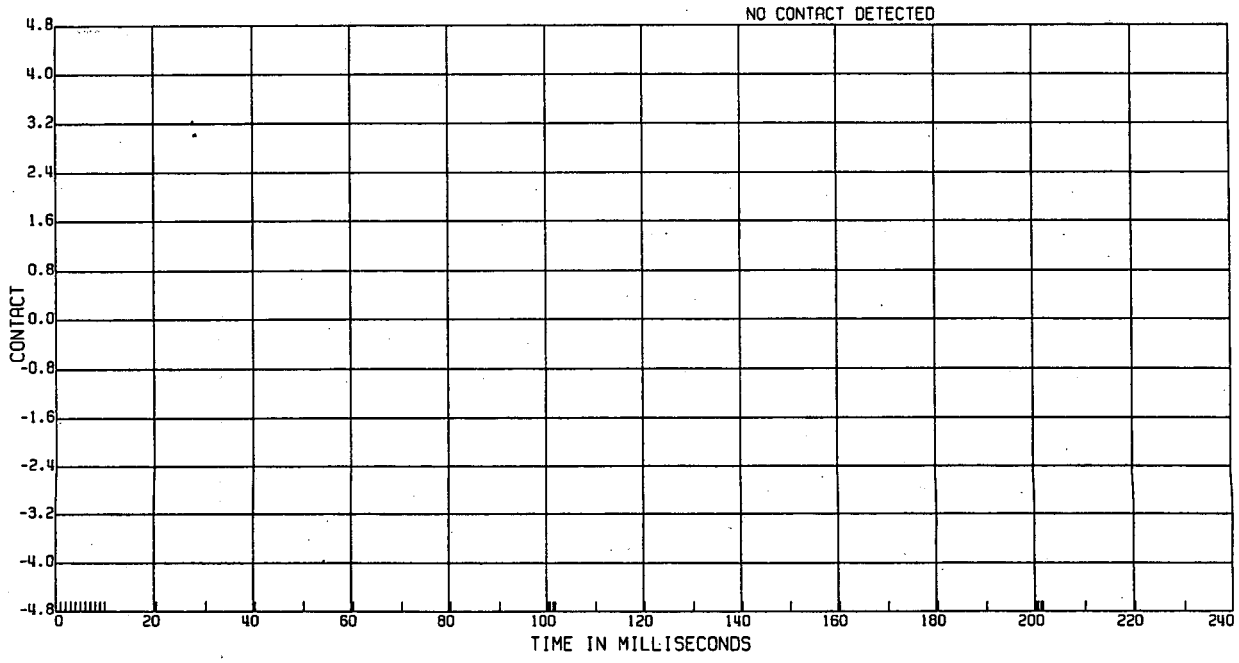


Appendix D, plot # **107**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR PNEUMATIC WIRE CONTACT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

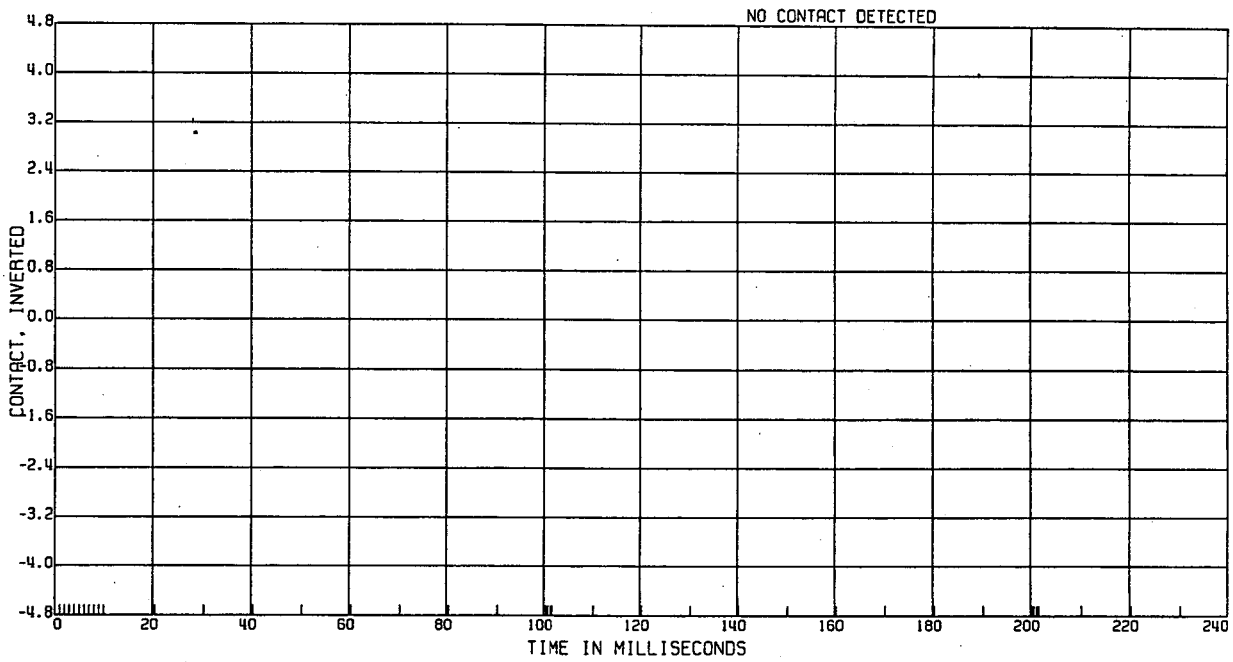


Appendix D, plot # **108**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR PNEUMATIC WIRE FAULT CONTACT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

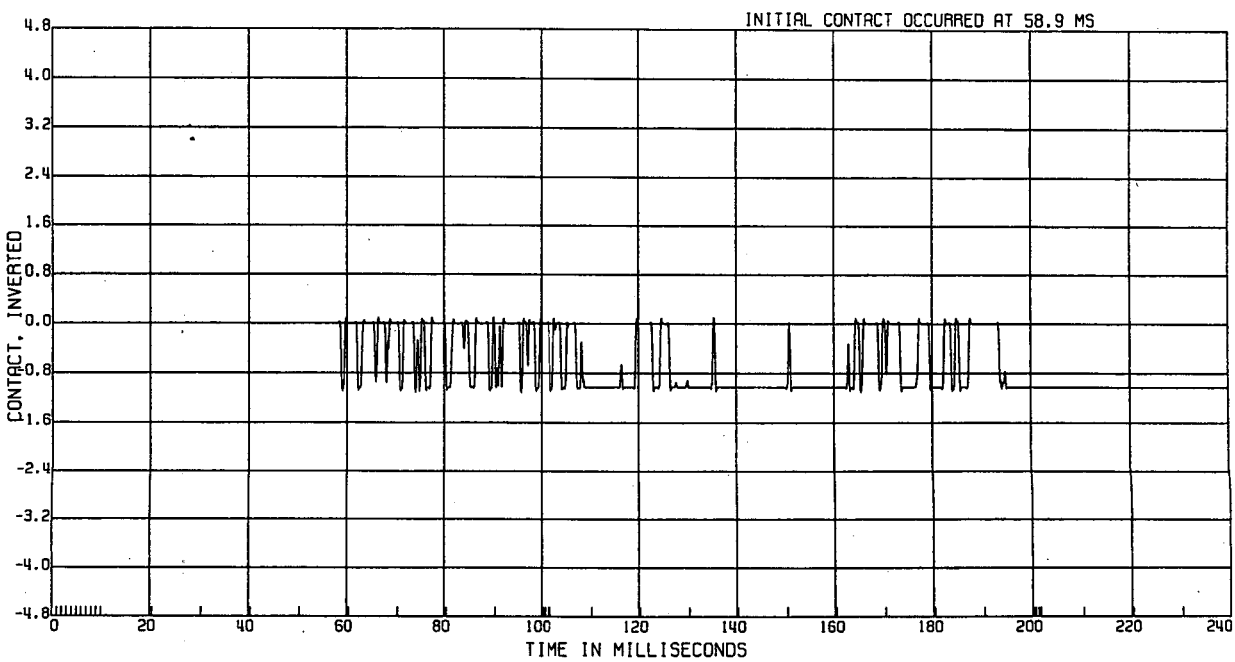


Appendix D, plot # **109**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR MECHANICAL FUEL SWITCH CONTACT TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

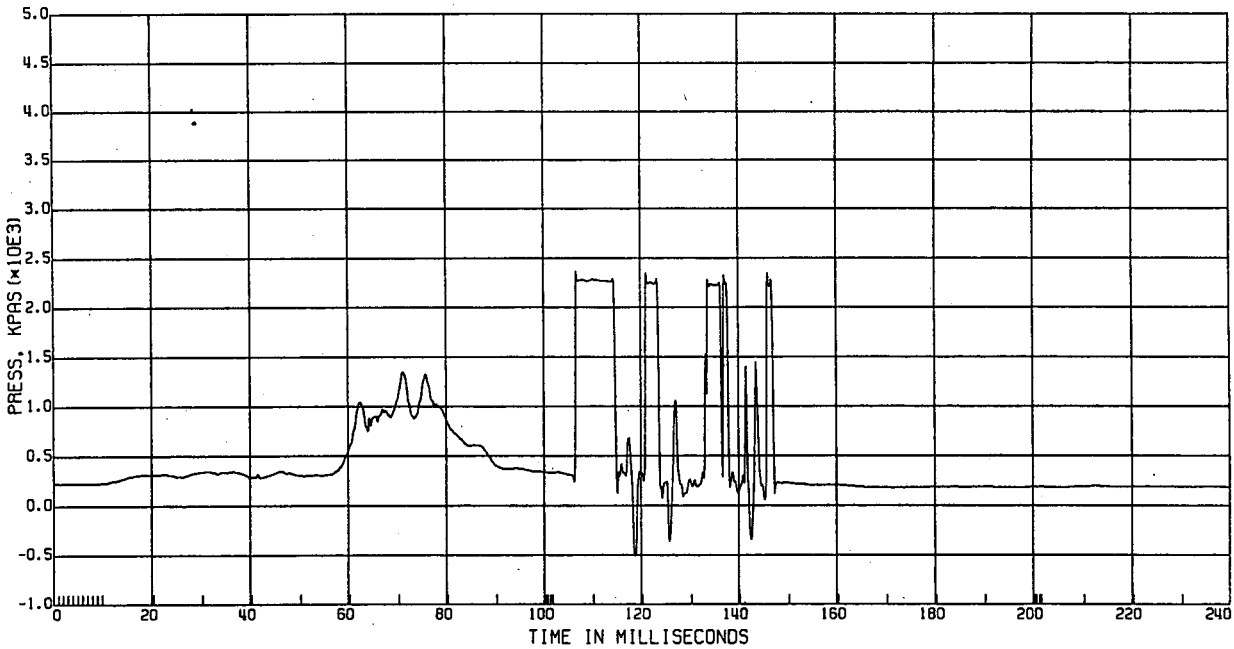


Appendix D, plot # **110**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR FRT BRAKE SYSTEM PRESSURE TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

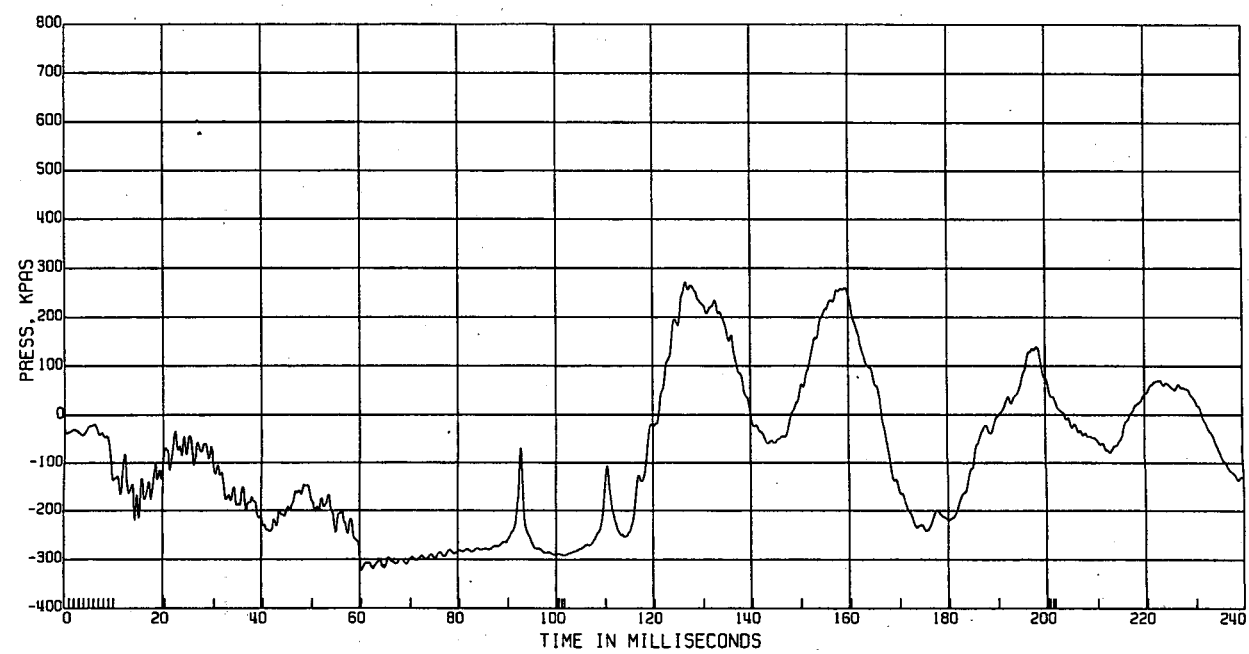


Appendix D, plot # **111**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR FUEL SUPPLY LINE PRESSURE TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000



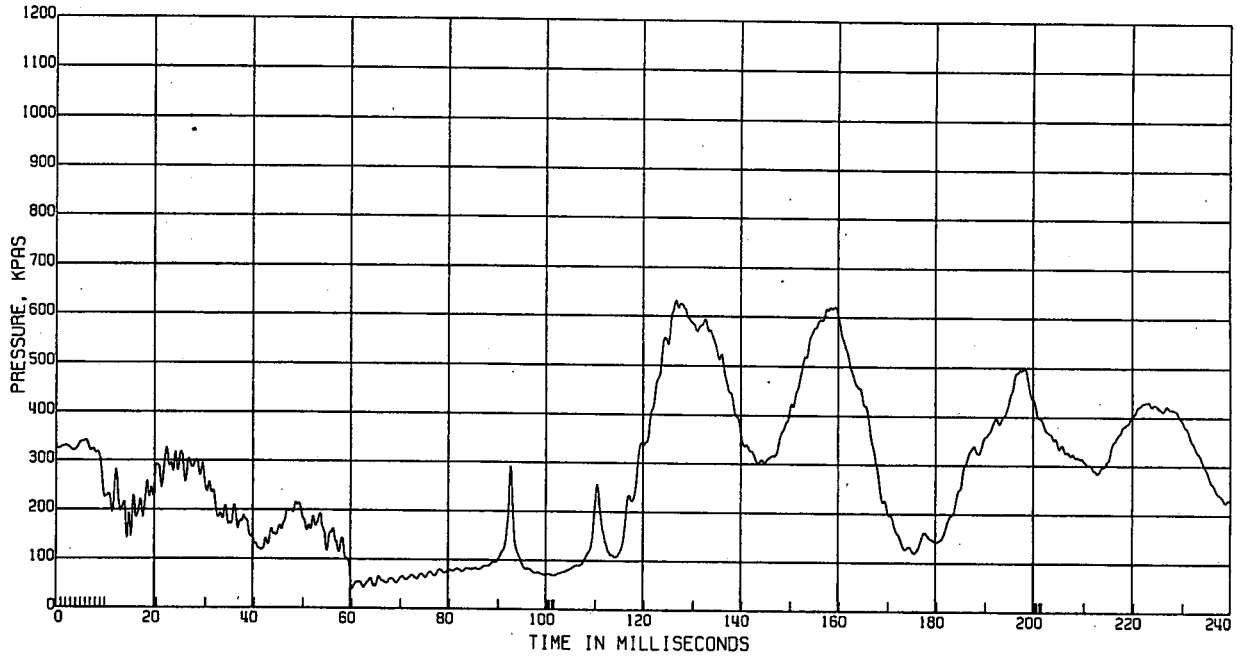
Appendix D, plot # **112**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR
ELEC DATA, SAE CLASS 1000

FUEL SUPPLY LINE PRESSURE
(BIASED DATA BY 361.0KPAS)

TEST DATE:11/12/1997



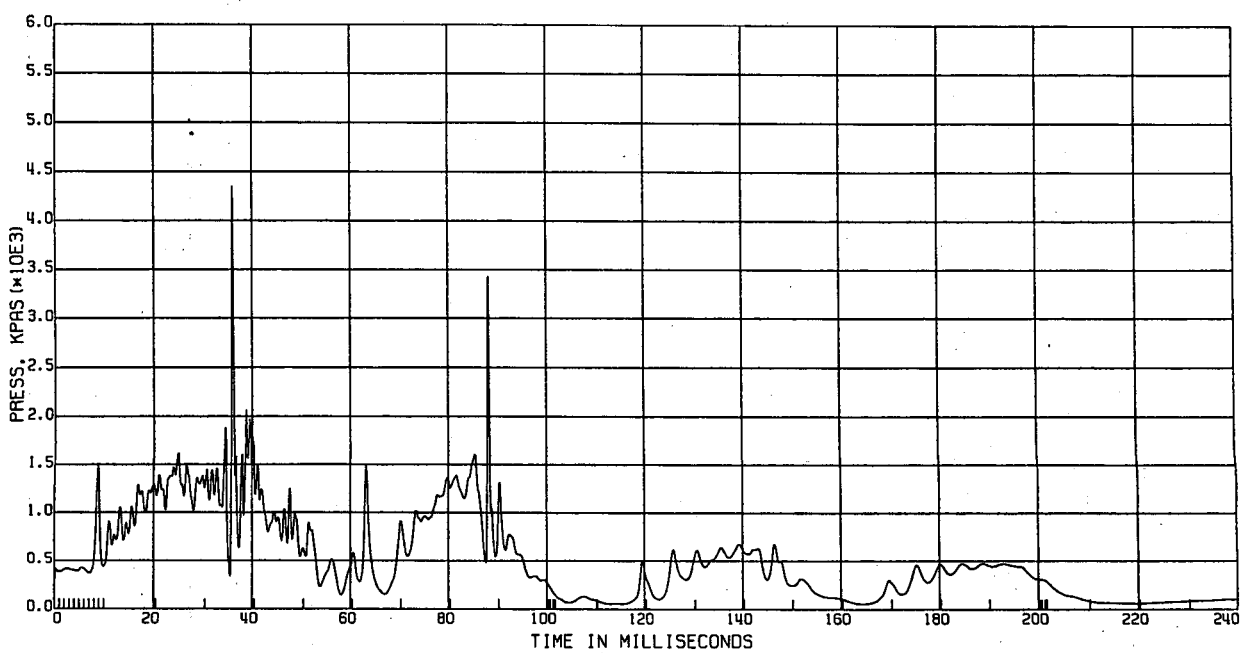
Appendix D, plot # **113**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91142D 4 DOOR
ELEC DATA, SAE CLASS 1000

POWER STEERING SYSTEM PRESSURE

TEST DATE:11/12/1997

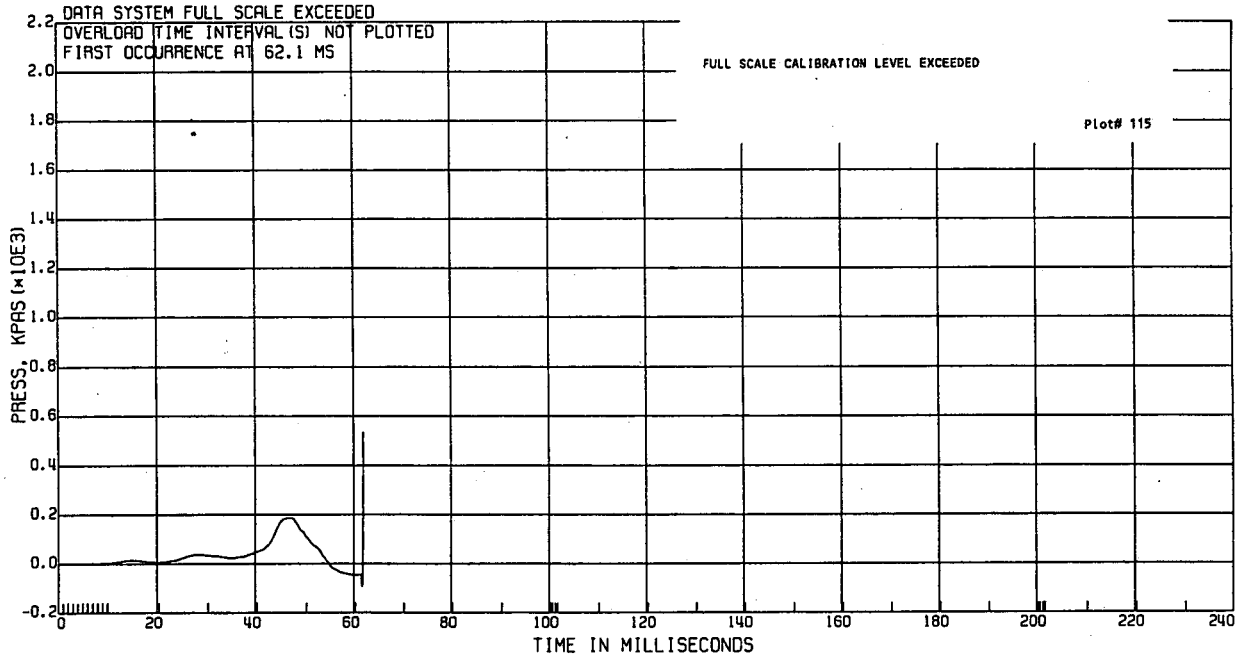


Appendix D, plot # **114**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V9142D 4 DOOR ENG COOLANT SYSTEM PRESSURE TEST DATE:11/12/1997

ELEC DATA, SAE CLASS 1000

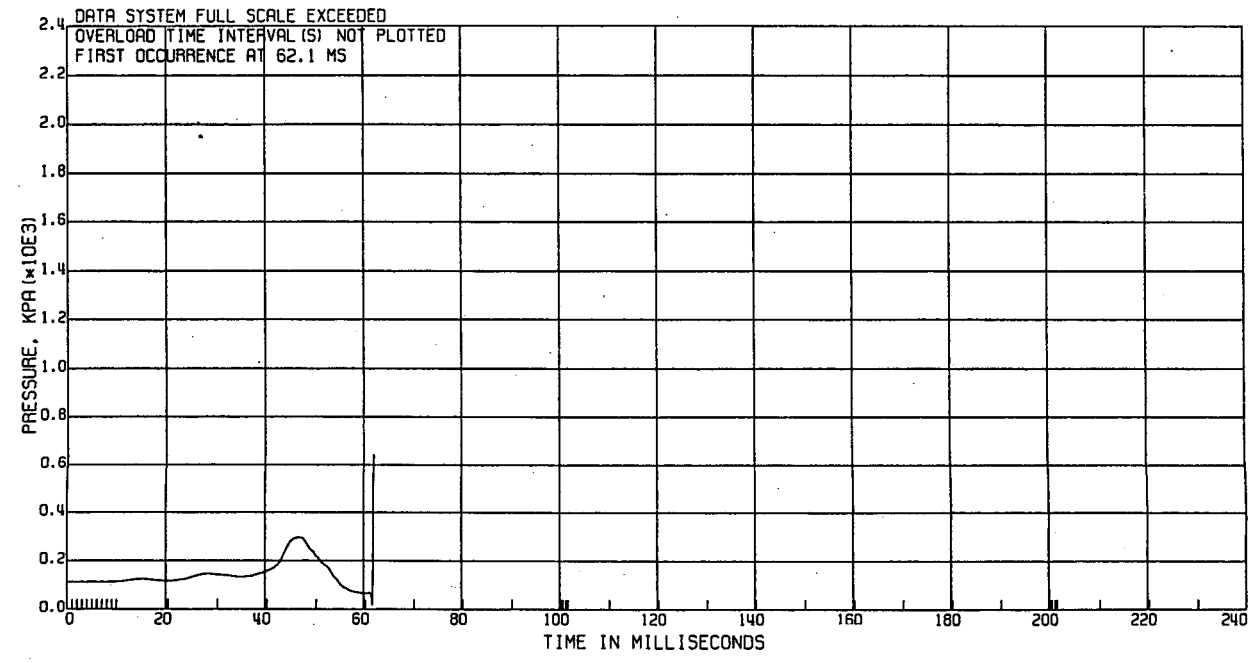


Appendix D, plot # **115**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V9142D 4 DOOR ENG COOLANT SYSTEM PRESSURE TEST DATE:11/12/1997

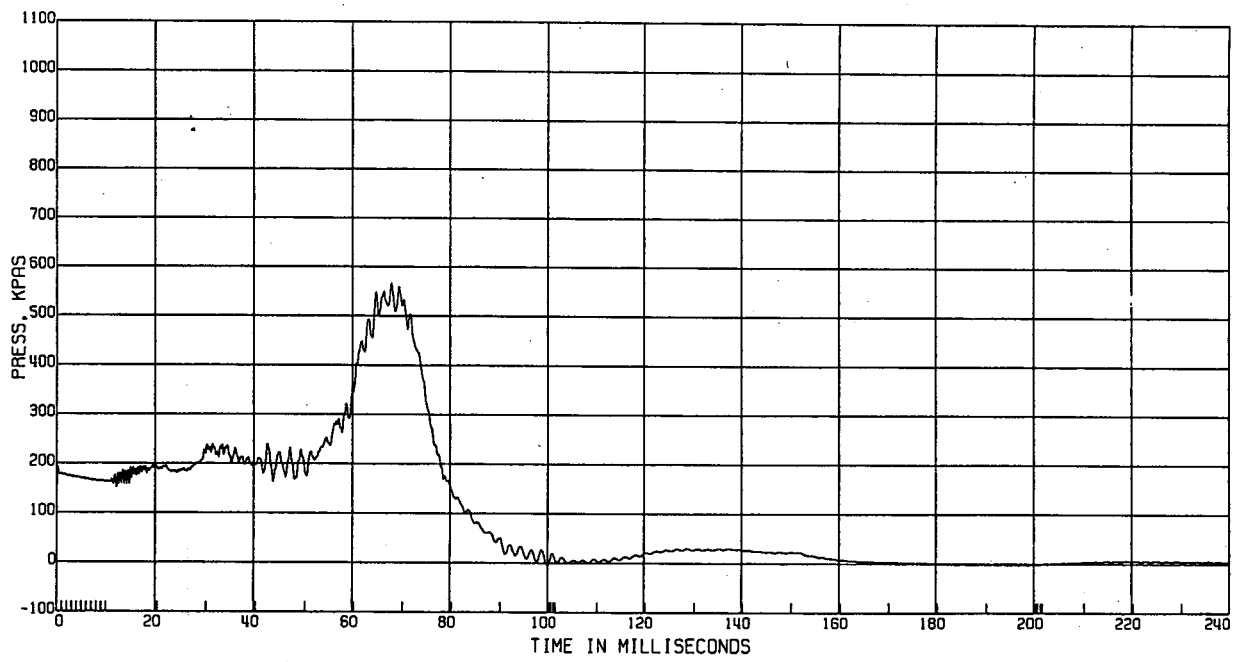
ELEC DATA, SAE CLASS 1000 (BIASED DATA BY 110.0KPAS)



Appendix D, plot # **116**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

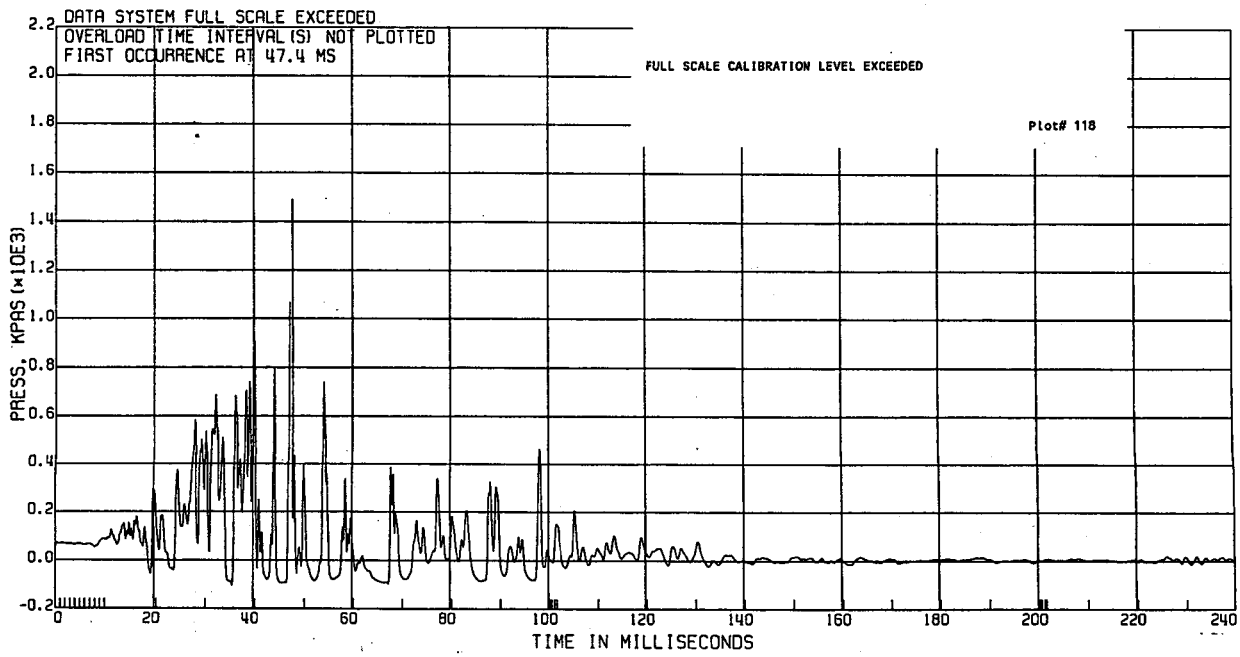
R & D CTR 8V91420 4 DOOR ENGINE OIL PRESSURE TEST DATE:11/12/1997
ELEC DATA, SAE CLASS 1000



Appendix D, plot # **117**

C11793 FRONT IMPACT MOVING VEHICLE TO FIXED POLE 55.8KM/H

R & D CTR 8V91420 4 DOOR TRANSMISSION COOLER PRESSURE TEST DATE:11/12/1997
ELEC DATA, SAE CLASS 1000



Appendix D, plot # **118**

APPENDIX E

Appendix E: C11793 hydrocarbon vapor measurement plots

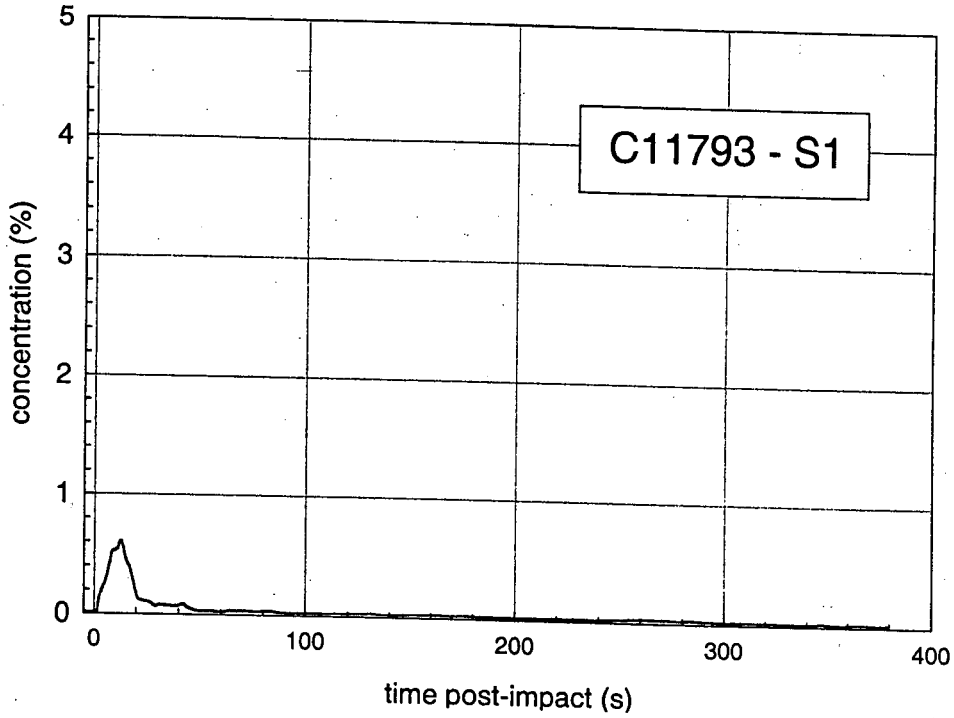


Figure E1
Concentration Of Hydrocarbon Vapor Above Left Exhaust Manifold (Location #1)
Test C11793

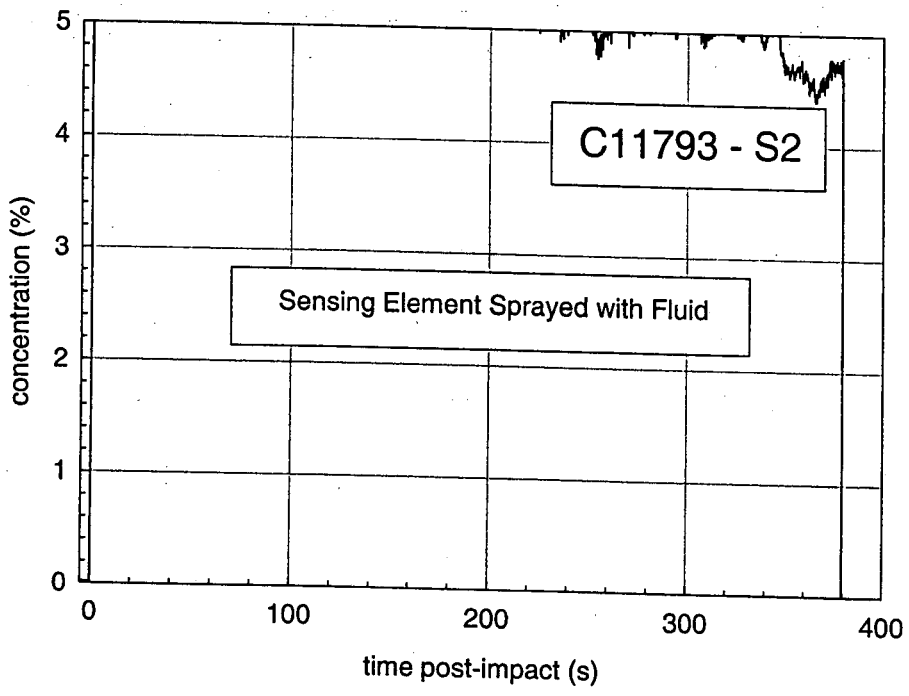


Figure E2
Concentration Of Hydrocarbon Vapor Above Right Exhaust Manifold (Location #2)
Test C11793

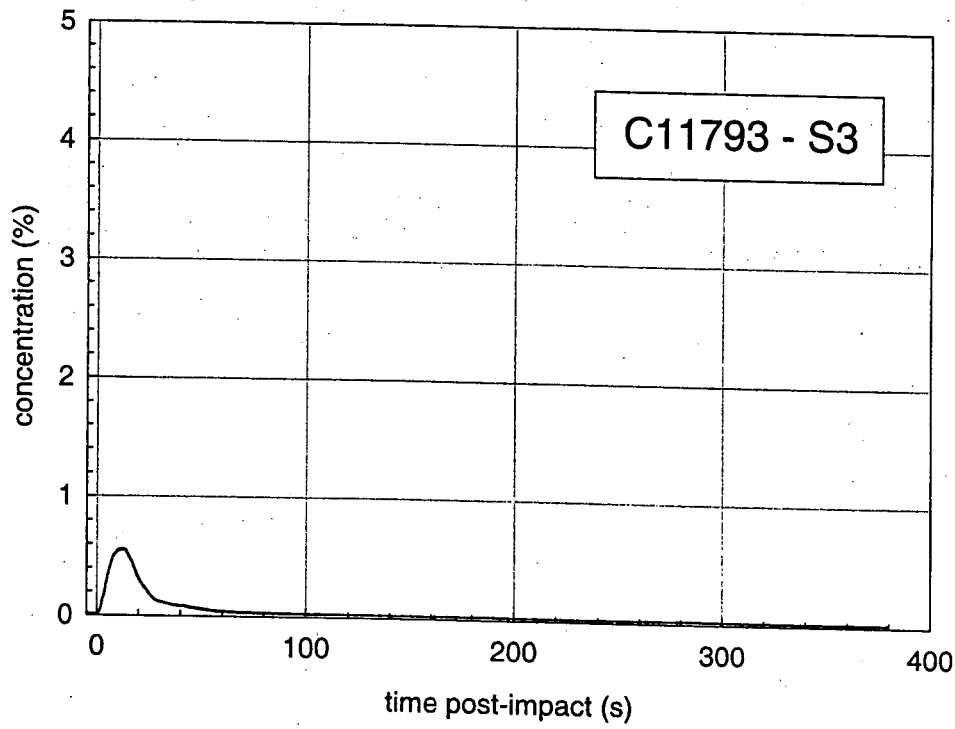


Figure E3
Concentration Of Hydrocarbon Vapor Above Lower Rear Intake Manifold (Location #3)
Test C11793

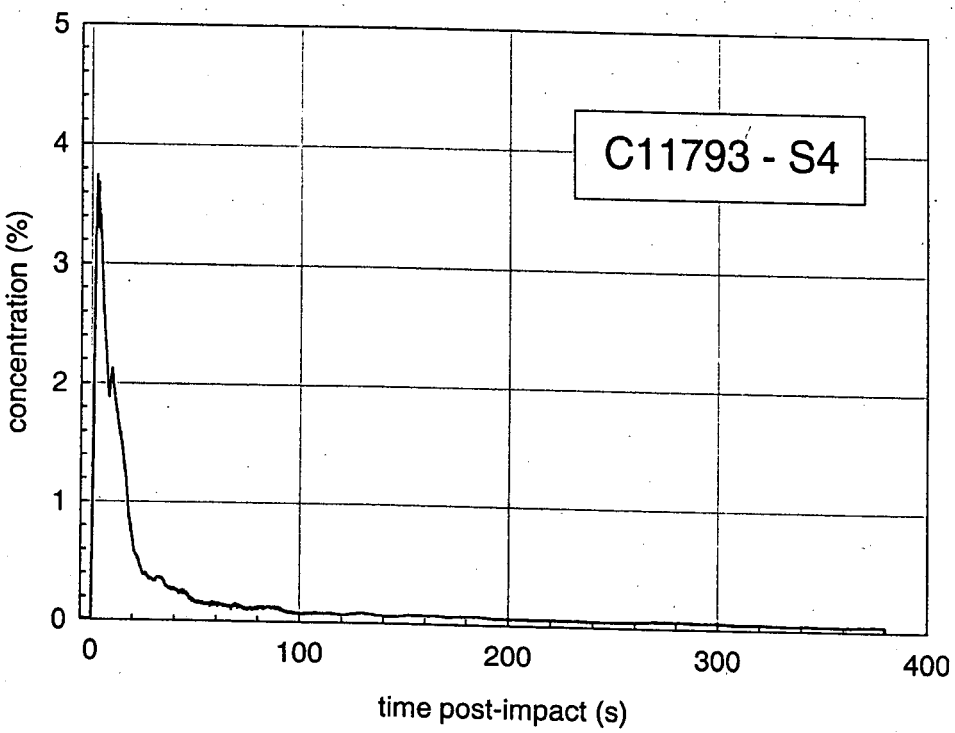


Figure E4
Concentration Of Hydrocarbon Vapor Near the Fuel Pressure Regulator (Location #4)
Test C11793

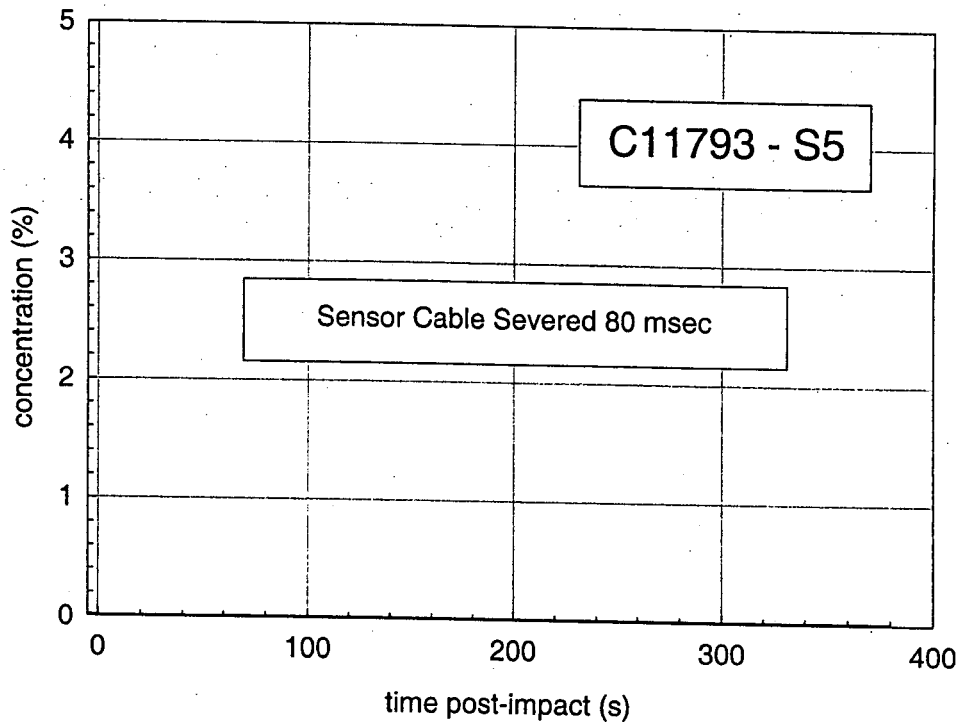


Figure E5
Concentration Of Hydrocarbon Vapor Near the Catalytic Converter (Location #5)
Test C11793

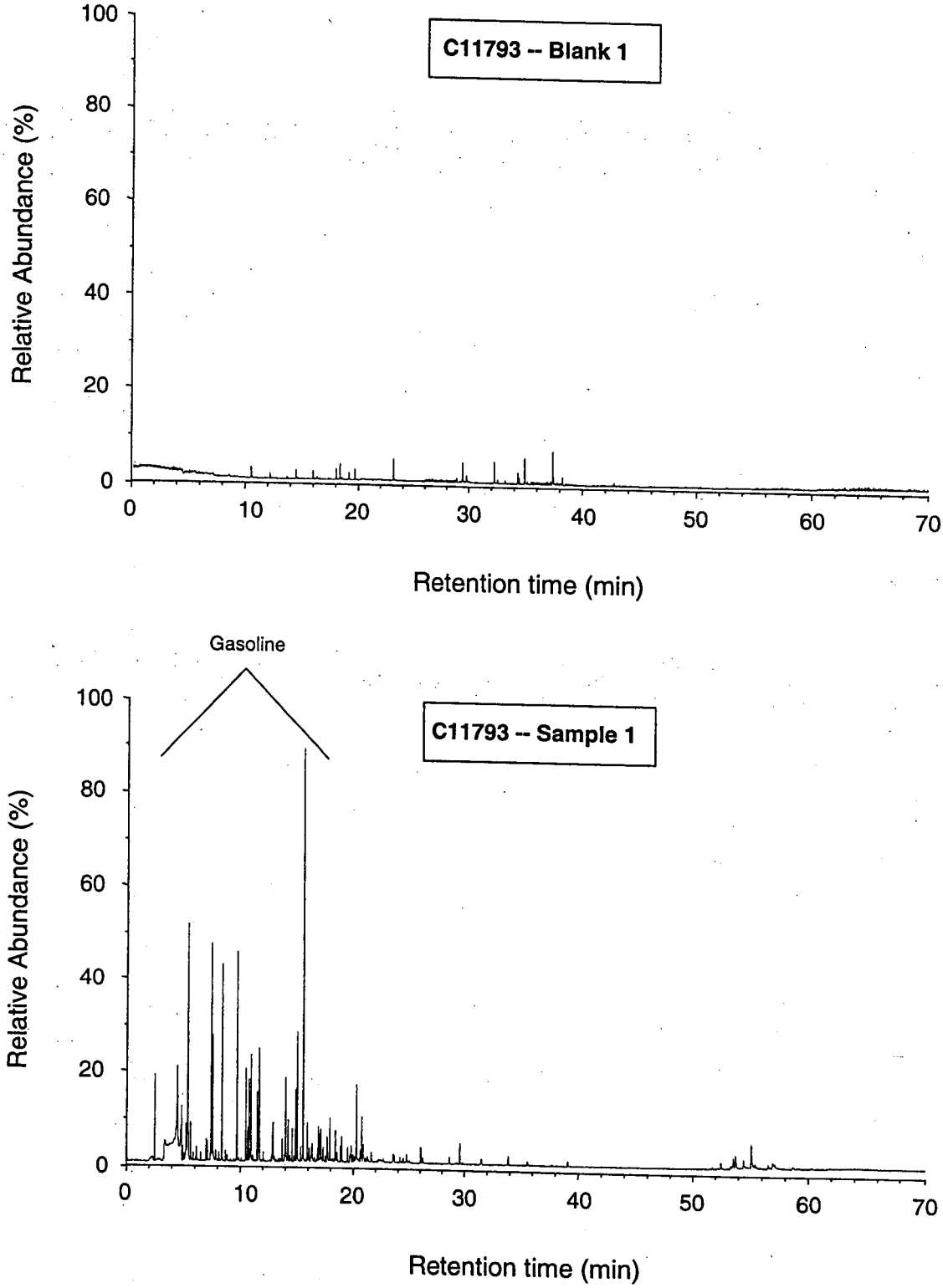


Figure EE1
GC/MS analysis of hydrocarbon vapor sample from above the left exhaust manifold (Location #1) during Crash Test C11793. The top panel is the chromatogram of background sample and the bottom panel is the chromatogram of the post-crash sample.

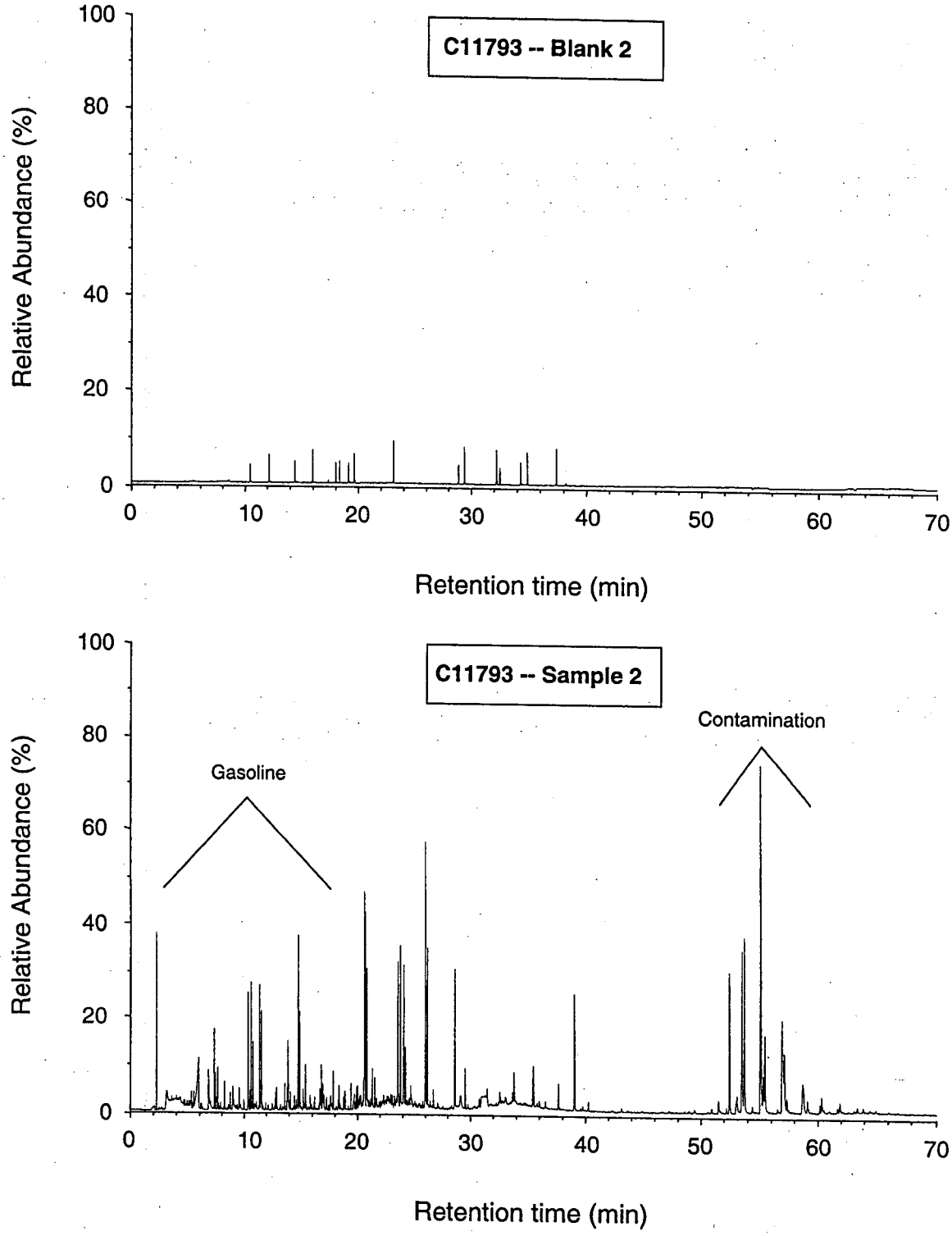


Figure EE2
GC/MS analysis of hydrocarbon vapor sample from above the right exhaust manifold (Location#2) during Crash Test C11793. The top panel is the chromatogram of background sample and the bottom panel is the chromatogram of the post-crash sample.

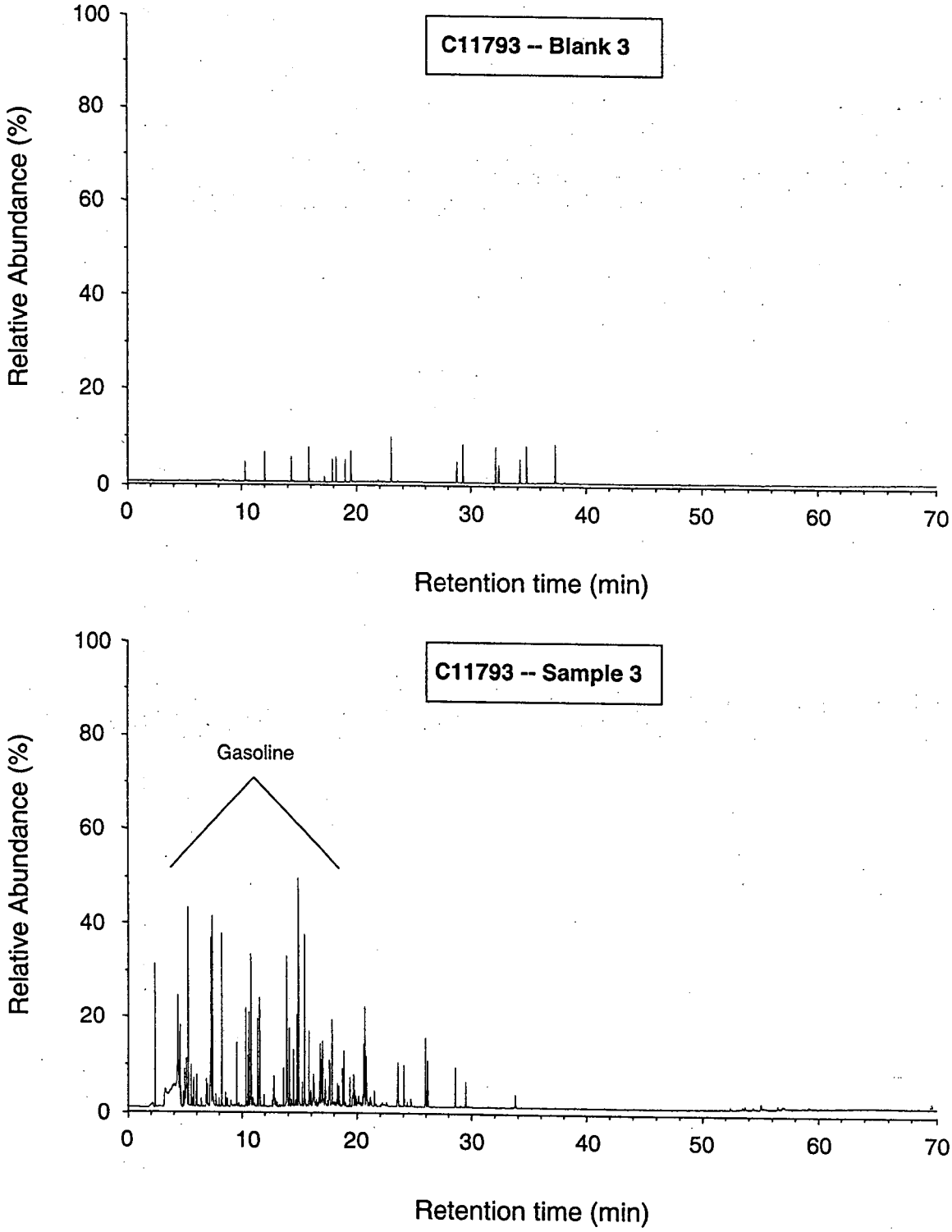


Figure EE3
GC/MS analysis of hydrocarbon vapor sample from above the lower rear intake manifold (Location #3) during Crash Test C11793. The top panel is the chromatogram of background sample and the bottom panel is the chromatogram of the post-crash sample.

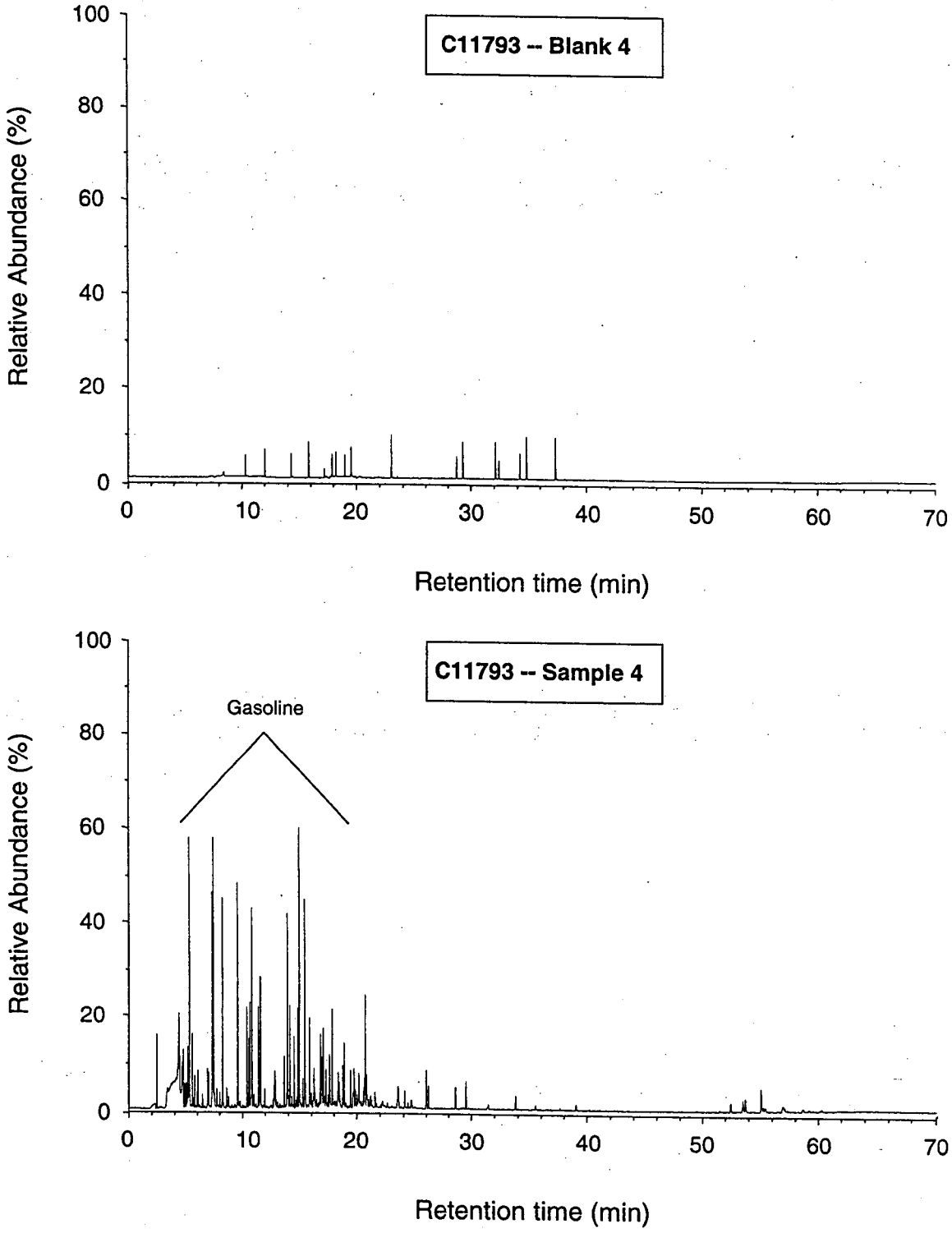


Figure EE4

GC/MS analysis of hydrocarbon vapor sample from above the fuel pressure regulator (Location #4) during Crash Test C11793. The top panel is the chromatogram of background sample and the bottom panel is the chromatogram of the post-crash sample.

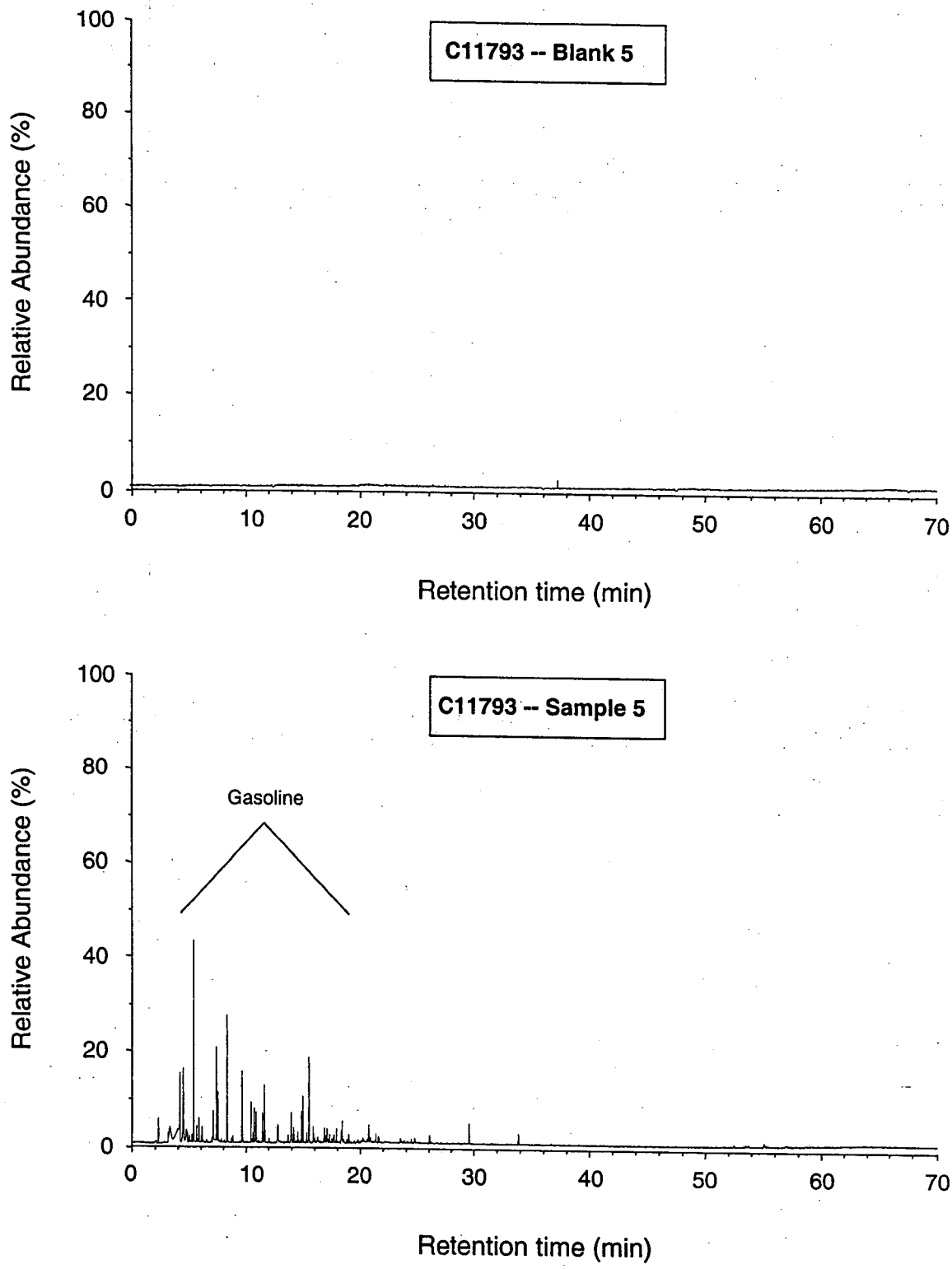


Figure EE5
GC/MS analysis of hydrocarbon vapor sample from above the catalytic converter (Location #5) during Crash Test C11793. The top panel is the chromatogram of background sample and the bottom panel is the chromatogram of the post-crash sample.

APPENDIX F

Appendix F: C11793 numeric film plots

C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

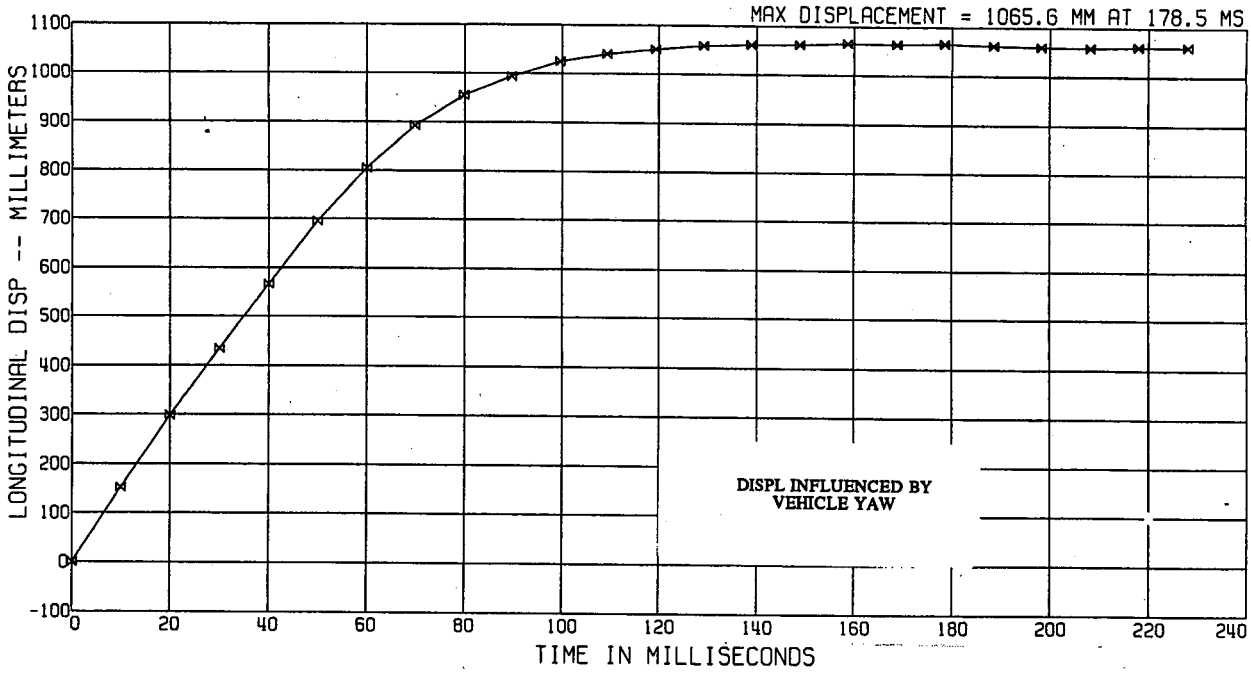
FIGURE

R & D CTR 8V91142D 4 DOOR
FILM DATA

LEFT SIDE

TEST DATE:11/12/97

VEHICLE DISPL RELATIVE TO GROUND REFERENCE



Appendix F, plot # 1

C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

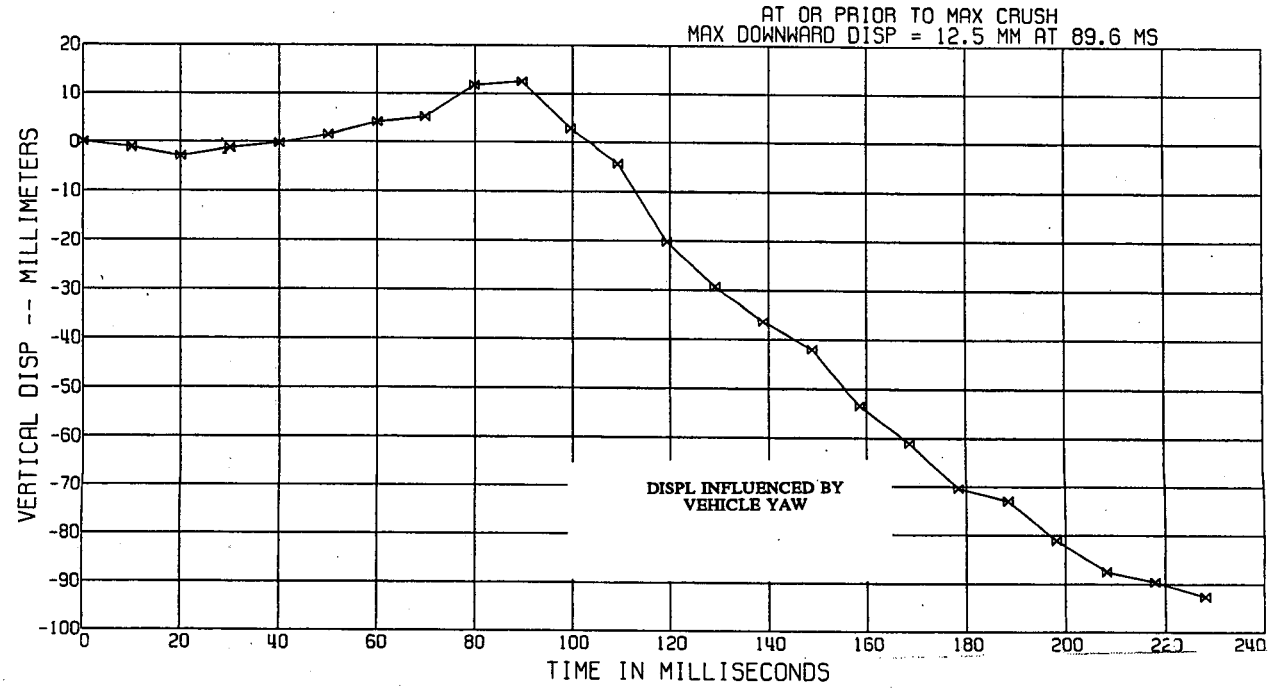
FIGURE

R & D CTR 8V91142D 4 DOOR
FILM DATA

LEFT SIDE

TEST DATE:11/12/97

VEHICLE DISPL RELATIVE TO GROUND REFERENCE



Appendix F, plot # 2

C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

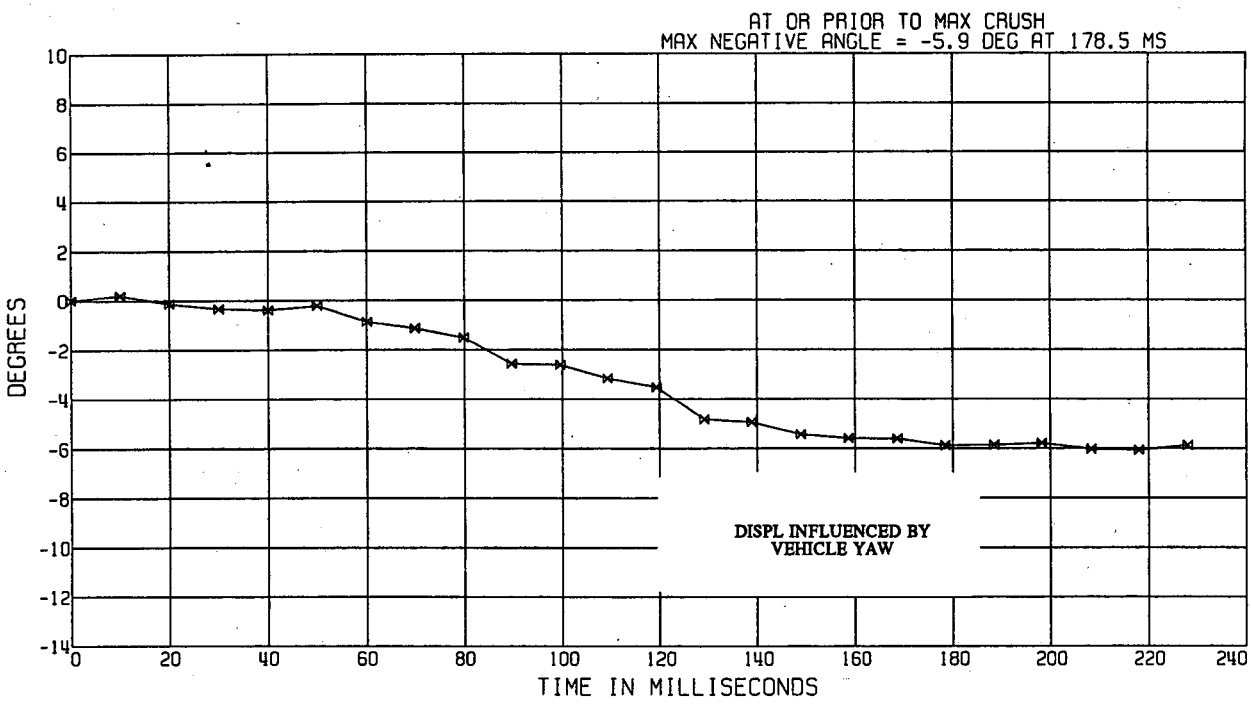
FIGURE

R & D CTR 8V9142D 4 DOOR
FILM DATA

LEFT SIDE

TEST DATE:11/12/97

VEHICLE PITCH RELATIVE TO GROUND REFERENCE



Appendix F, plot # 3

C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

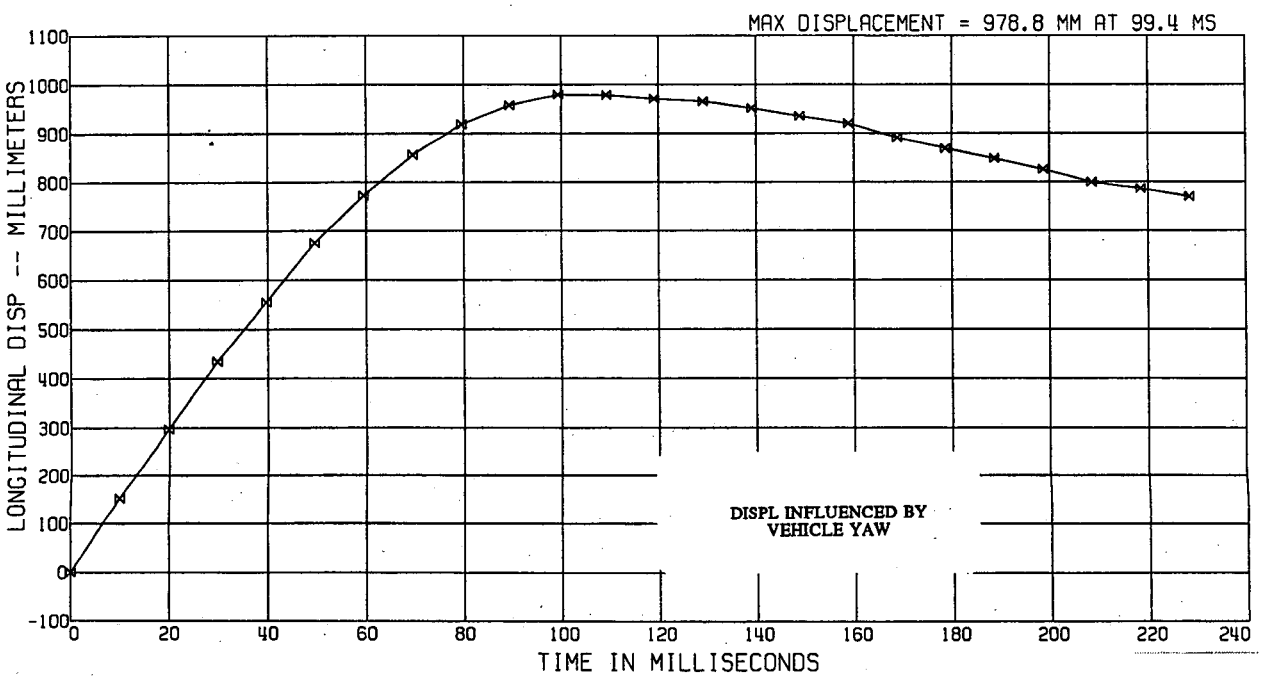
FIGURE

R & D CTR 8V9142D 4 DOOR
FILM DATA

RIGHT SIDE

TEST DATE:11/12/97

VEHICLE DISPL RELATIVE TO GROUND REFERENCE



Appendix F, plot # 4

C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

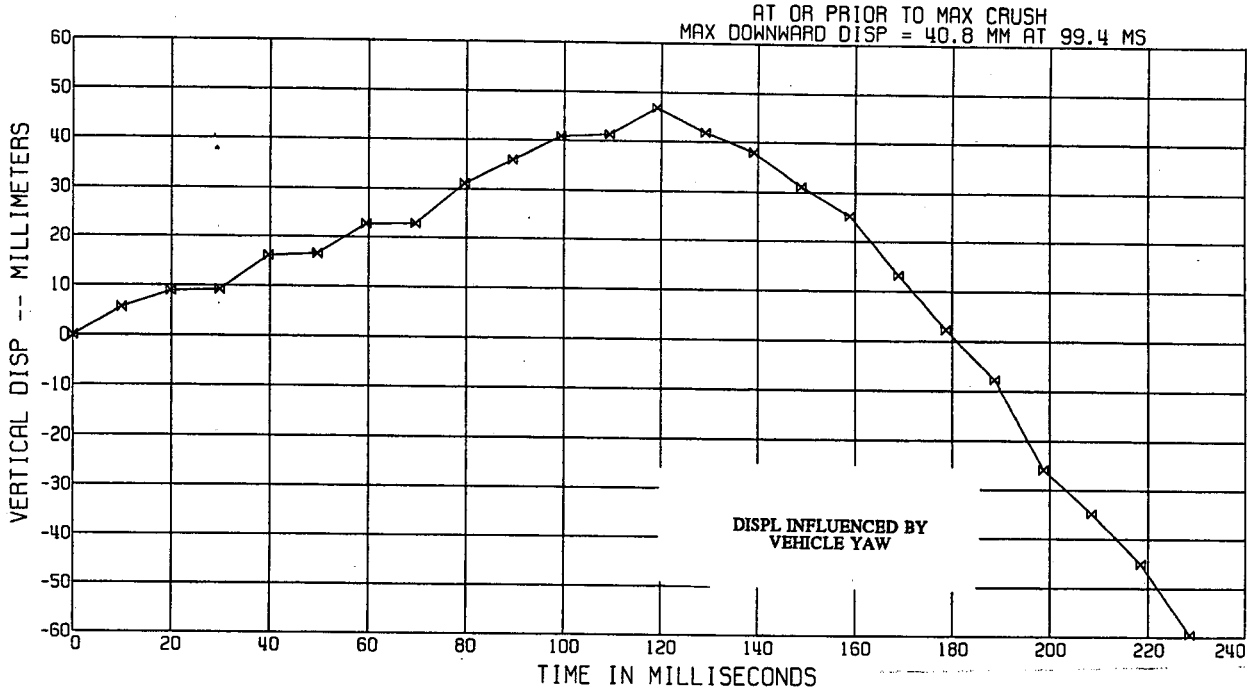
FIGURE

R & D CTR 8V91420 4 DOOR
FILM DATA

RIGHT SIDE

TEST DATE:11/12/97

VEHICLE DISPL RELATIVE TO GROUND REFERENCE



Appendix F, plot # **5**

C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

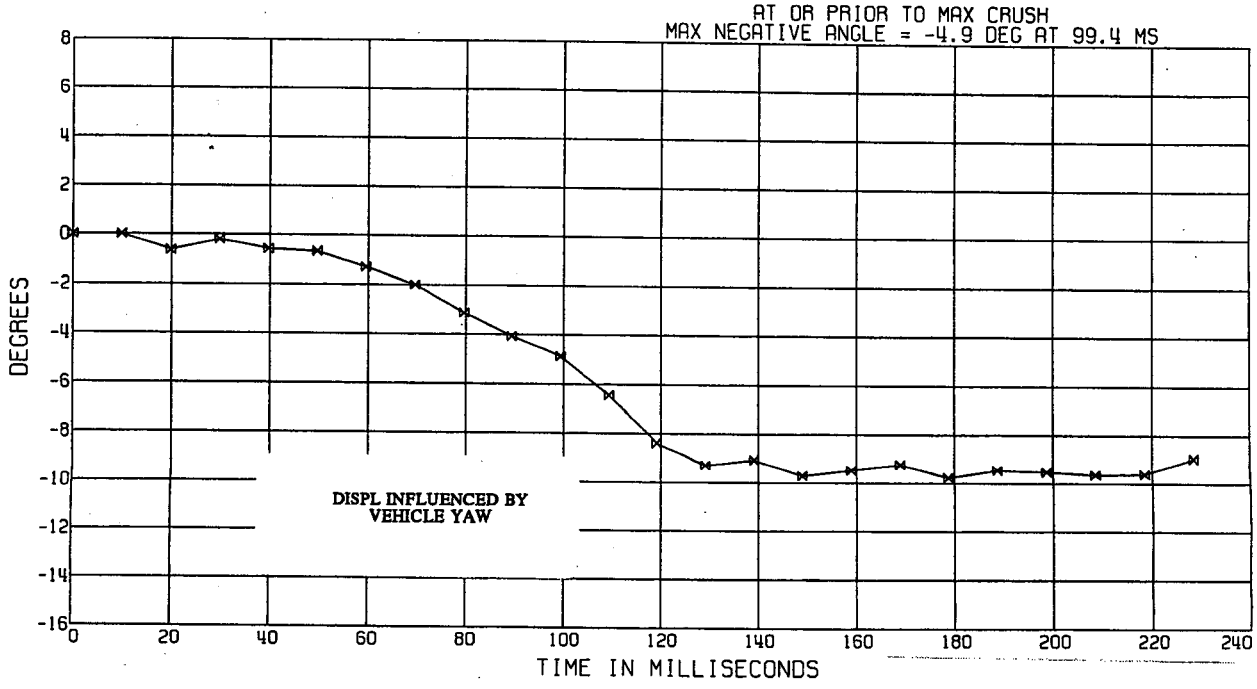
FIGURE

R & D CTR 8V91420 4 DOOR
FILM DATA

RIGHT SIDE

TEST DATE:11/12/97

VEHICLE PITCH RELATIVE TO GROUND REFERENCE



C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

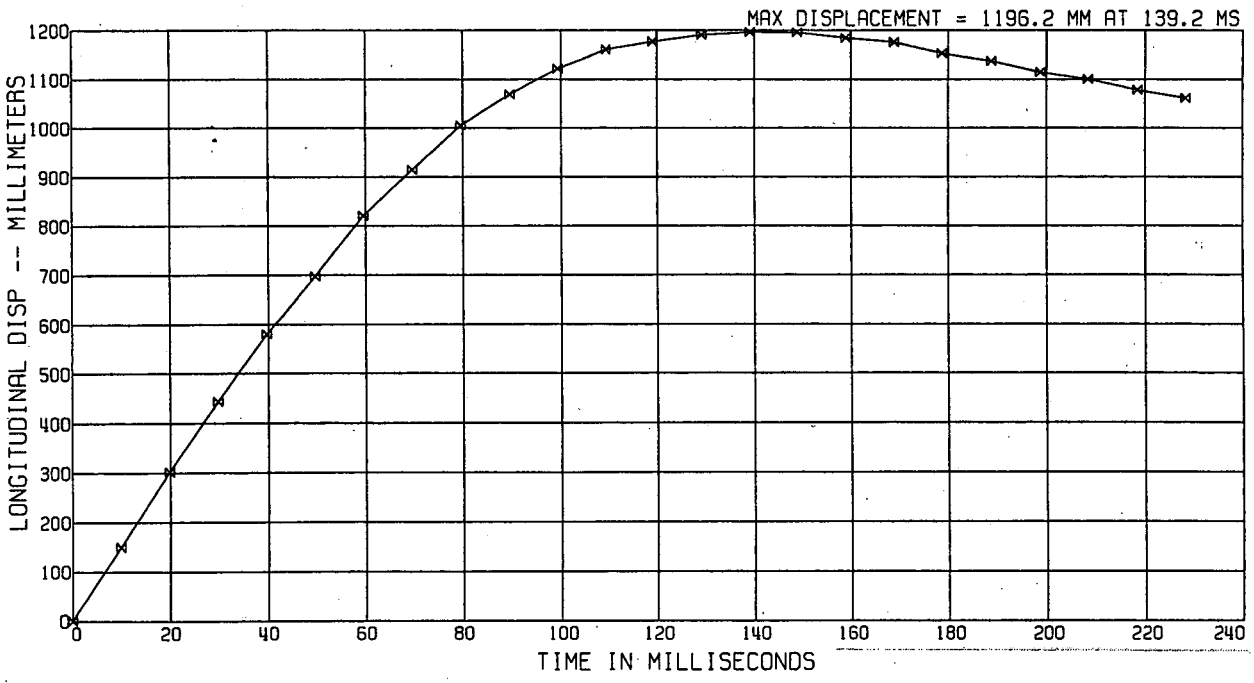
FIGURE

R & D CTR 8V9142D 4 DOOR
FILM DATA

OVERHEAD VIEW

TEST DATE:11/12/97

VEHICLE DISPL RELATIVE TO POLE REFERENCE



Appendix F, plot # **7**

C11793 FRONT IMPACT

MOVING VEHICLE TO FIXED POLE 55.8KM/H

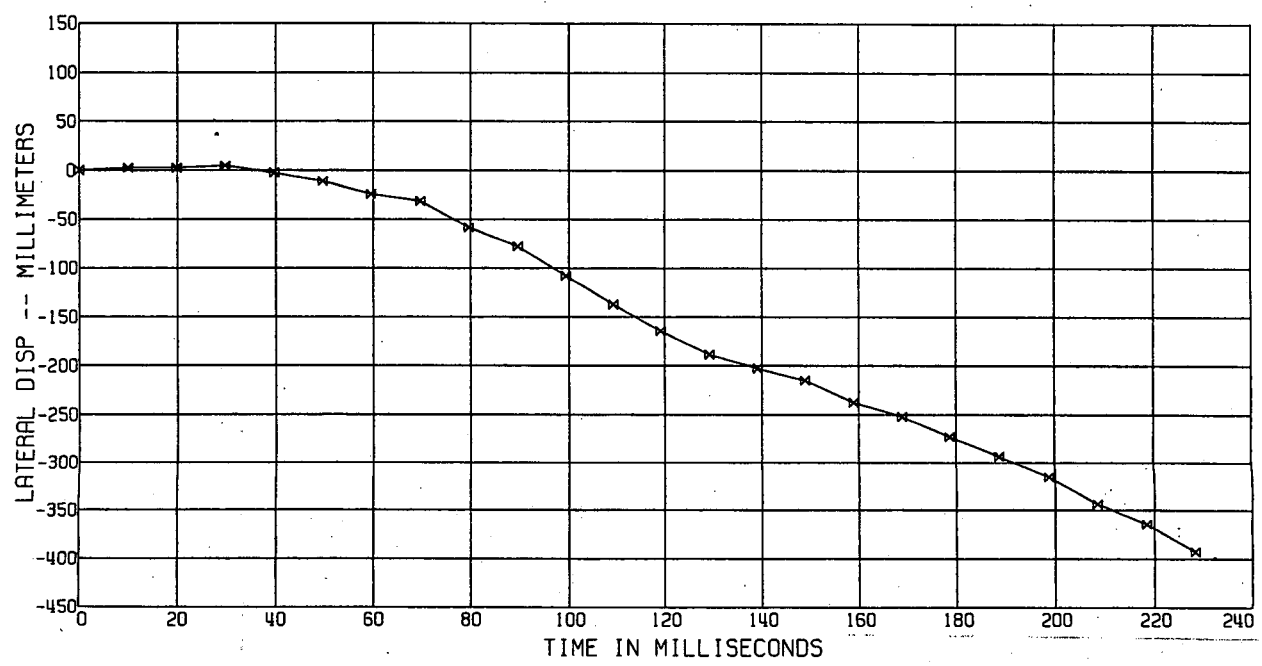
FIGURE

R & D CTR 8V9142D 4 DOOR
FILM DATA

OVERHEAD VIEW

TEST DATE:11/12/97

VEHICLE DISPL RELATIVE TO POLE REFERENCE



Appendix F, plot # **8**

APPENDIX G

Appendix G: C11317 data plots

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

ATD TYPE: GM50H

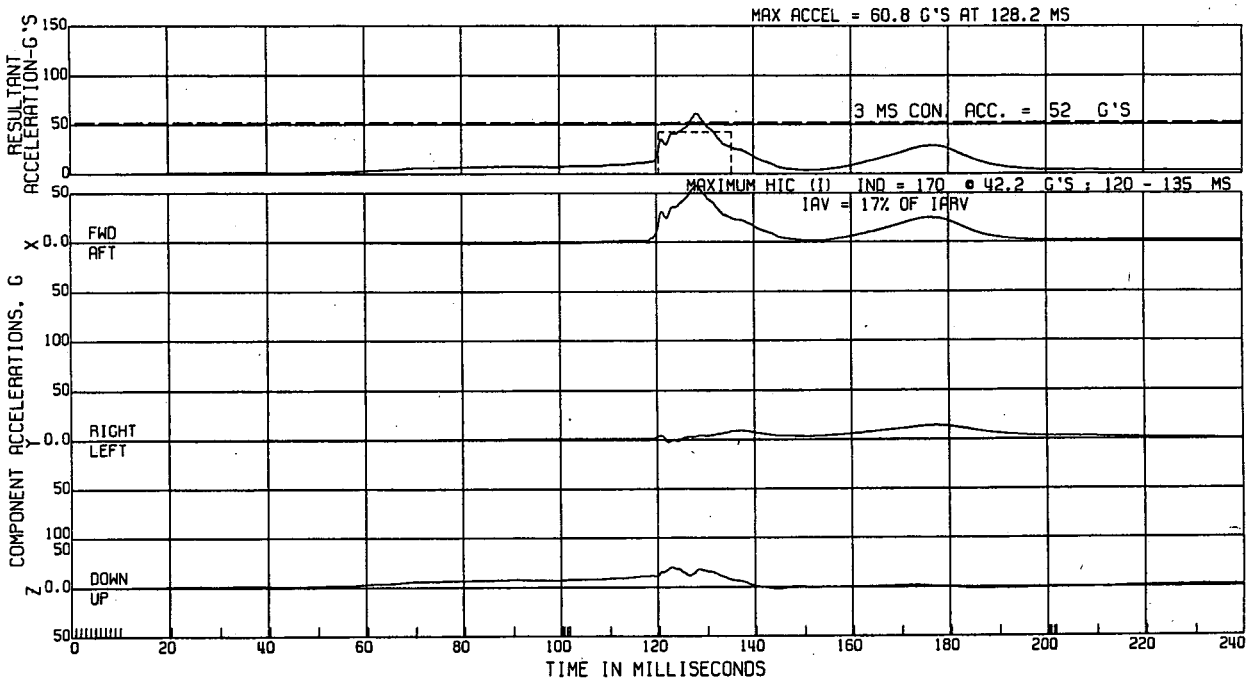
R & D CTR 8V91141D 4 DOOR

L. FRT HEAD ACCEL.

TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

(HIC I LIMITED TO 15MS)



Appendix G, plot # 1

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

ATD TYPE: GM50H

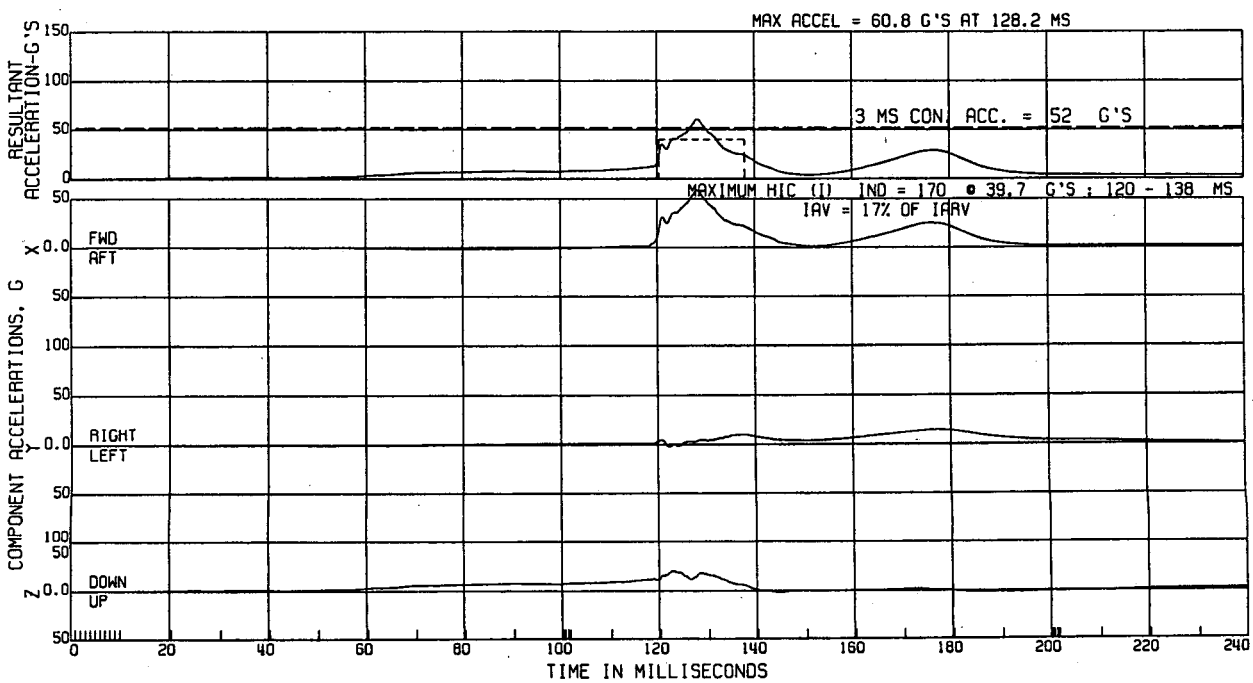
R & D CTR 8V91141D 4 DOOR

L. FRT HEAD ACCEL.

TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

(HIC I LIMITED TO 36MS)

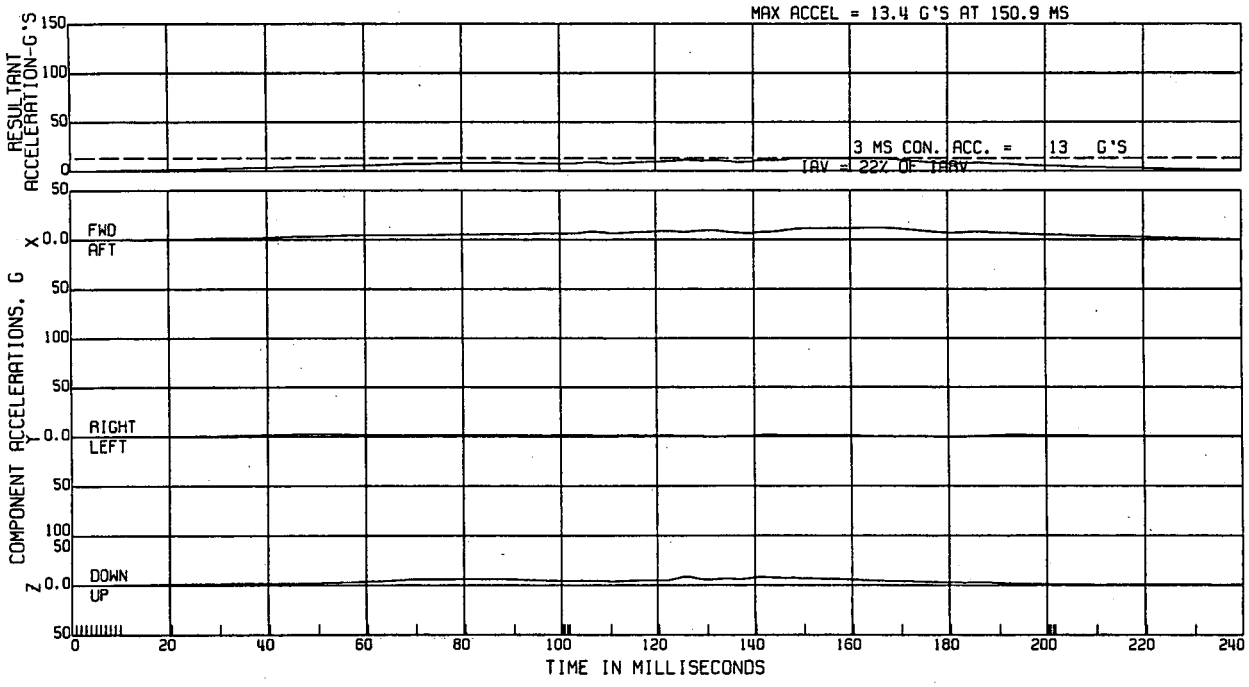


Appendix G, plot # 2

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR L. FRT CHEST ACCEL. ATD TYPE: GM50H

ELEC DATA, SAE CLASS 180 TEST DATE:12/17/1997



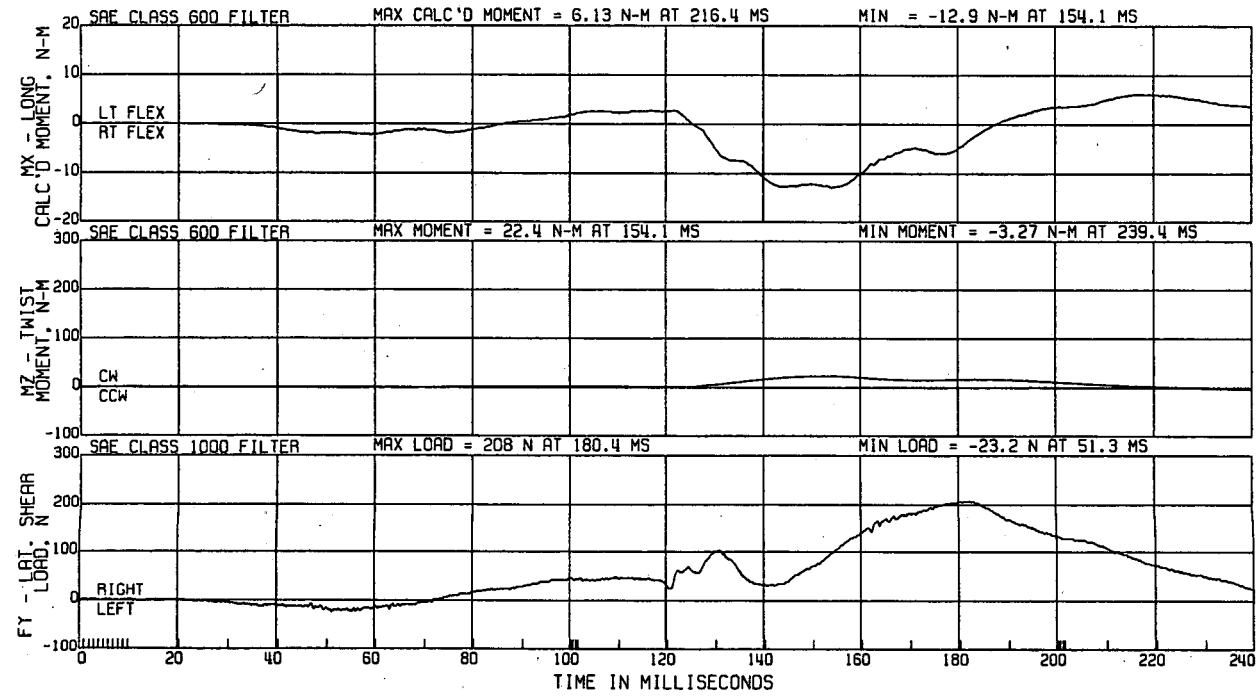
Appendix G, plot # **3**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR L. FRT NECK LOADING ON HEAD, UPPER LOAD ATD TYPE: GM50H

ELEC DATA TEST DATE:12/17/1997

L. FRT NECK LOADING ON HEAD



Appendix G, plot # **4**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

ATD TYPE: GM50H

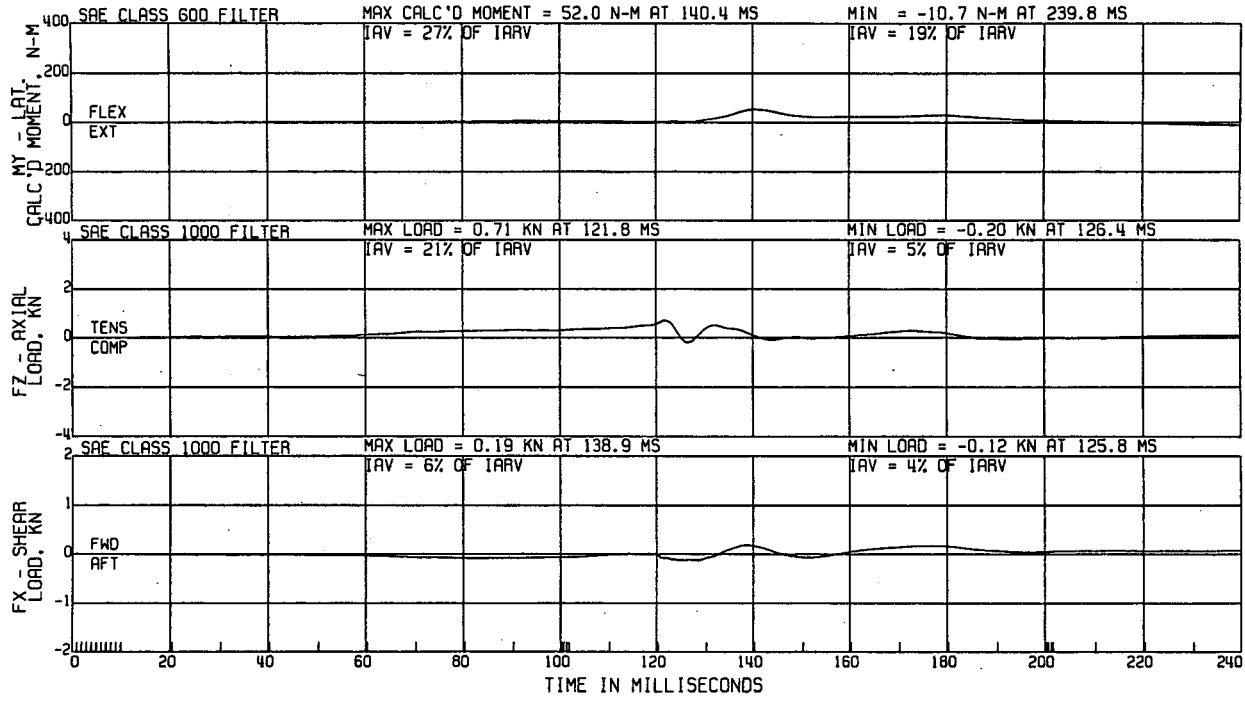
R & D CTR 8V91141D 4 DOOR

TEST DATE:12/17/1997

ELEC DATA

NECK LOADING ON HEAD

L. FRT NECK LOADING ON HEAD



Appendix G, plot # **5**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

ATD TYPE: GM50H

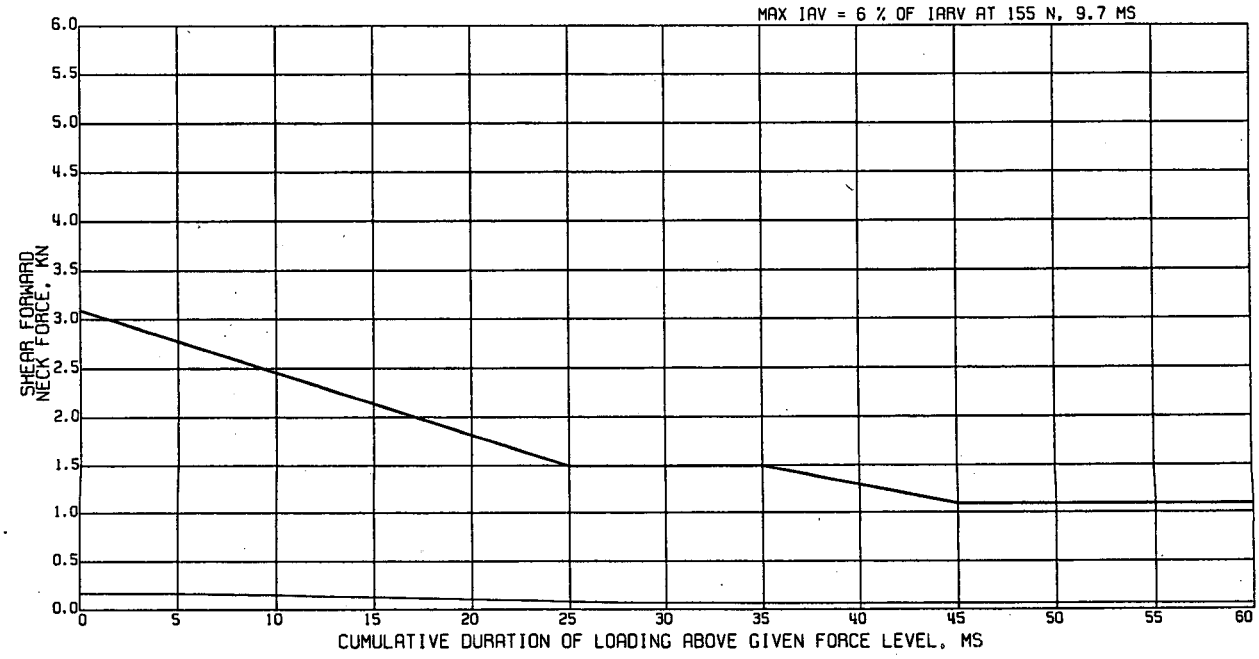
R & D CTR 8V91141D 4 DOOR

TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

FORWARD NECK SHEAR ON HEAD,

L. FRT INJURY REFERENCE



 Appendix G, plot # **6**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

ATD TYPE: GM50H

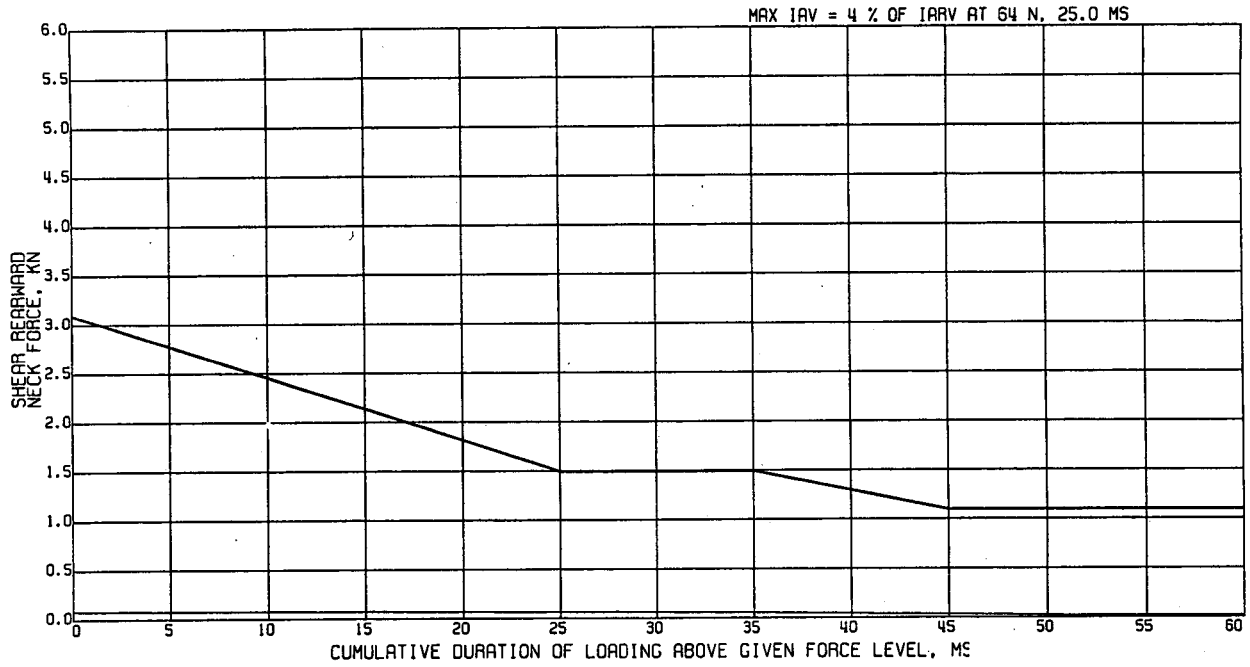
R & D CTR 8V91141D 4 DOOR

TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,

L. FRT INJURY REFERENCE



7 Appendix G, plot # **7**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

ATD TYPE: GM50H

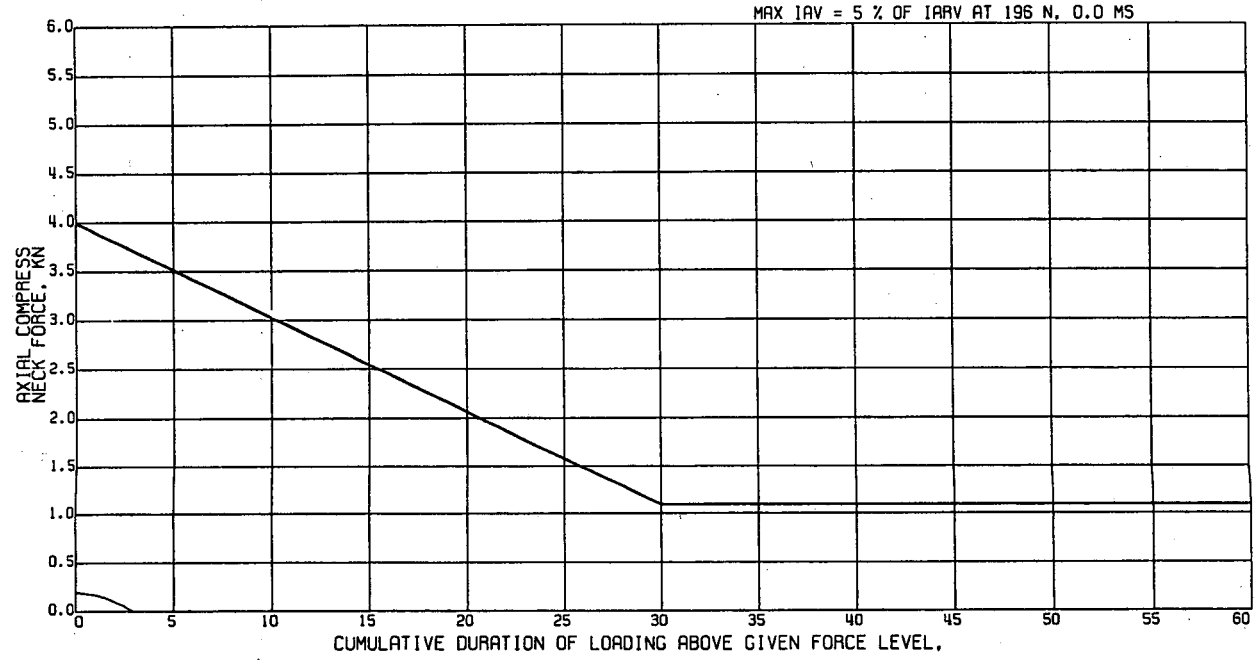
R & D CTR 8V91141D 4 DOOR

TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,

L. FRT INJURY REFERENCE



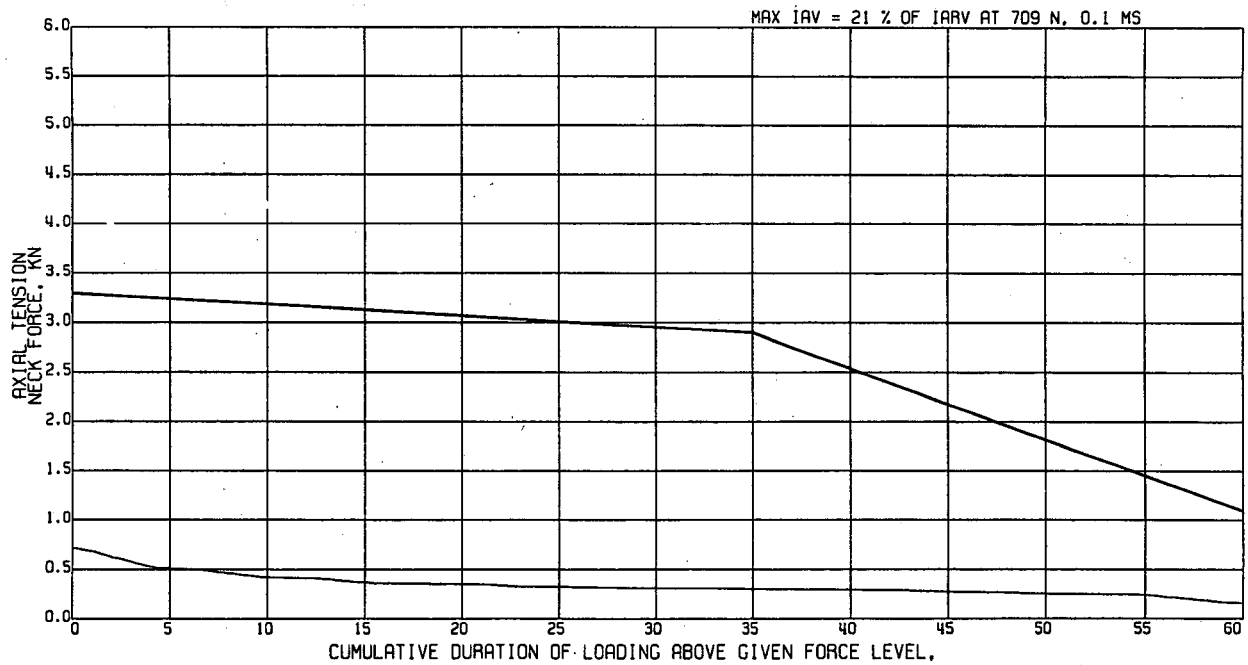
Appendix G, plot # **8**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR
ELEC DATA, SAE CLASS 1000

AXIAL TENSION ON HEAD,
L. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:12/17/1997



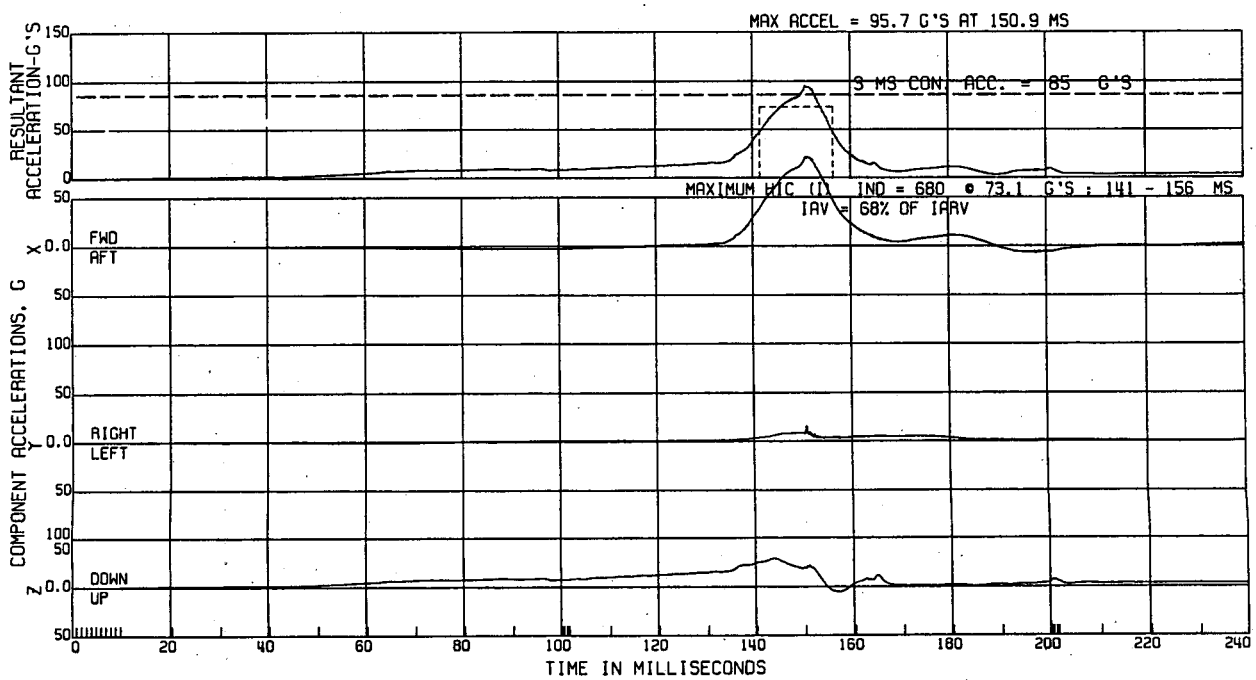
Appendix G, plot # **9**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR
ELEC DATA, SAE CLASS 1000

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

ATD TYPE: GM50H
TEST DATE:12/17/1997



Appendix G, plot # **10**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR

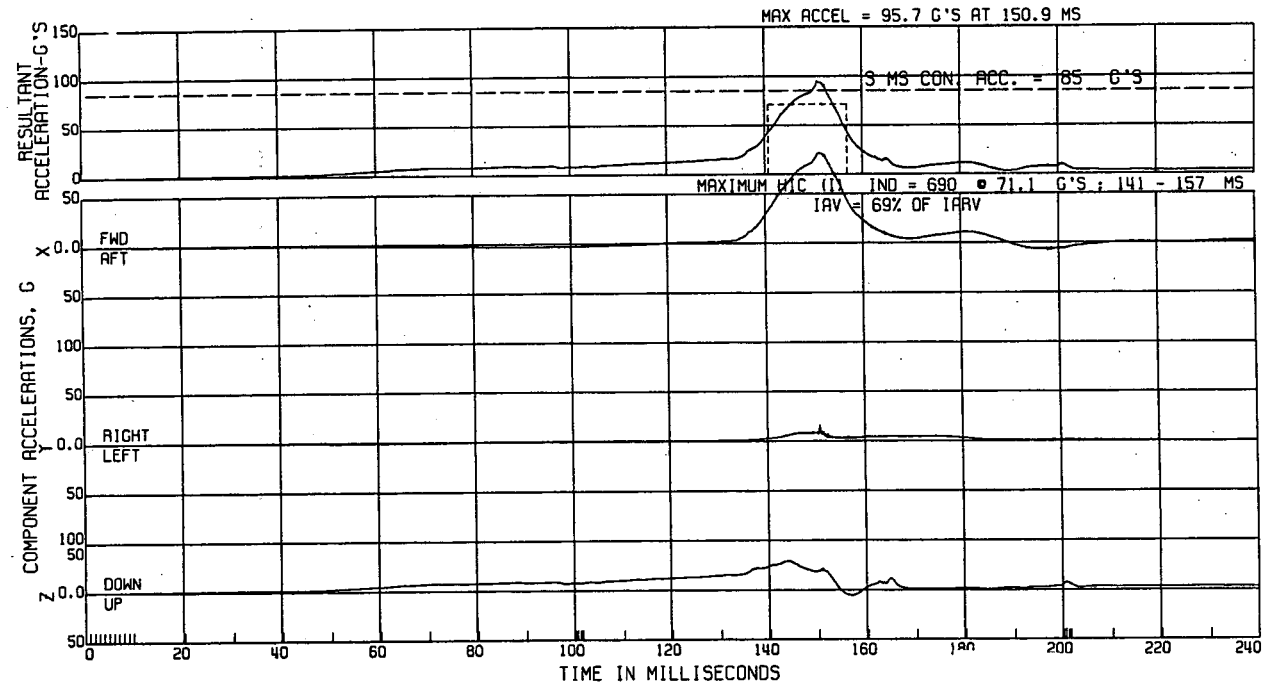
ELEC DATA, SAE CLASS 1000

R. FRT HEAD ACCEL.

(HIC I LIMITED TO 36MS)

ATD TYPE: GM50H

TEST DATE:12/17/1997



Appendix G, plot # **11**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

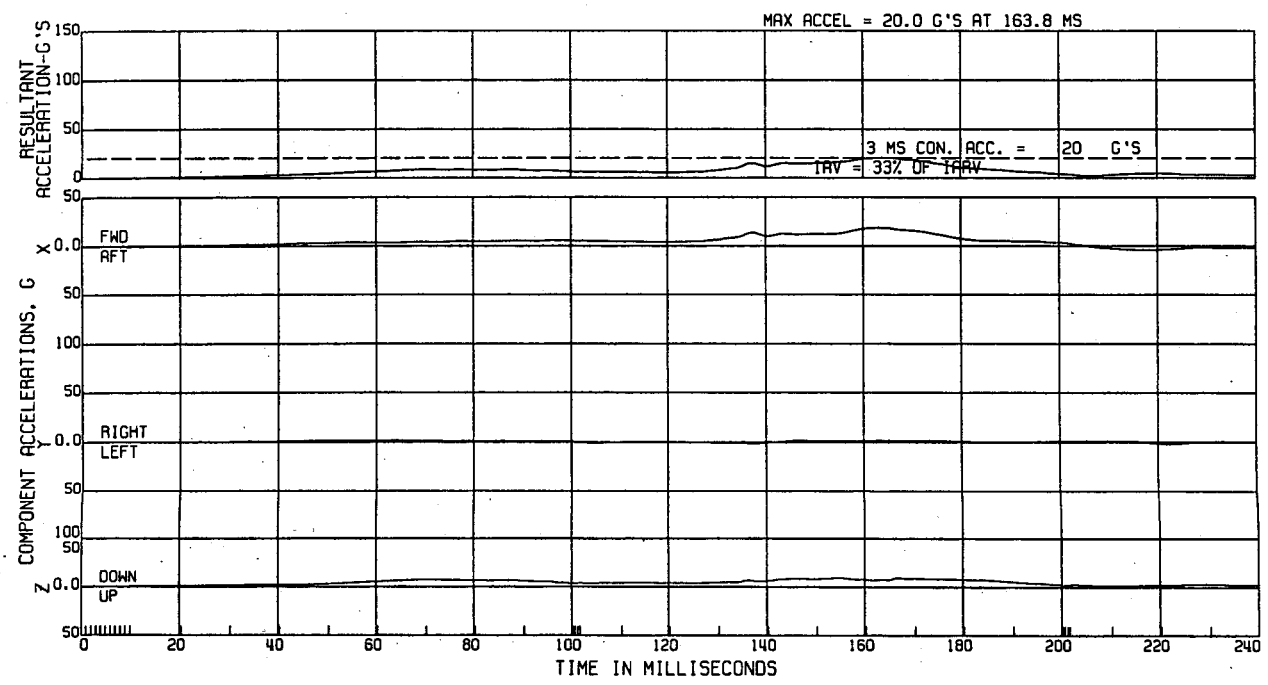
R & D CTR 8V9141D 4 DOOR

ELEC DATA, SAE CLASS '80

R. FRT CHEST ACCEL.

ATD TYPE: GM50H

TEST DATE:12/17/1997



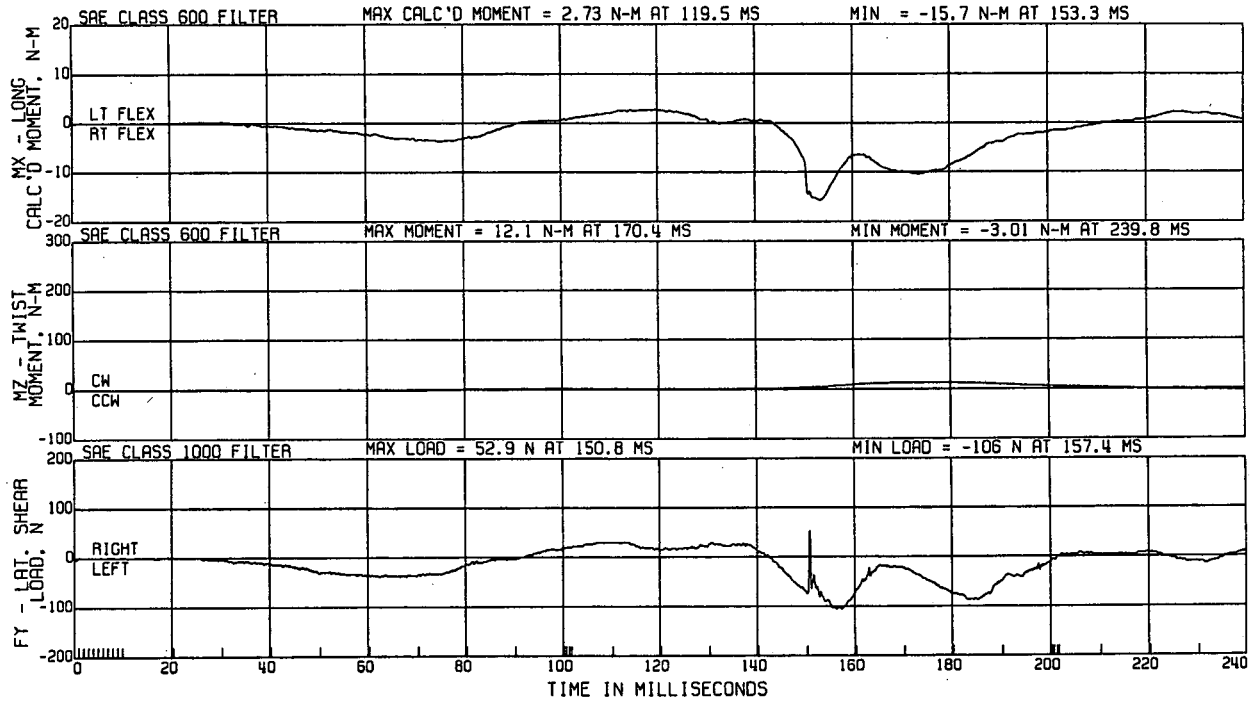
Appendix G, plot # **12**

C11317 ..REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR R. FRT NECK LOADING ON HEAD, UPPER LOAD ATD TYPE: GM50H TEST DATE:12/17/1997

ELEC DATA

R. FRT NECK LOADING ON HEAD



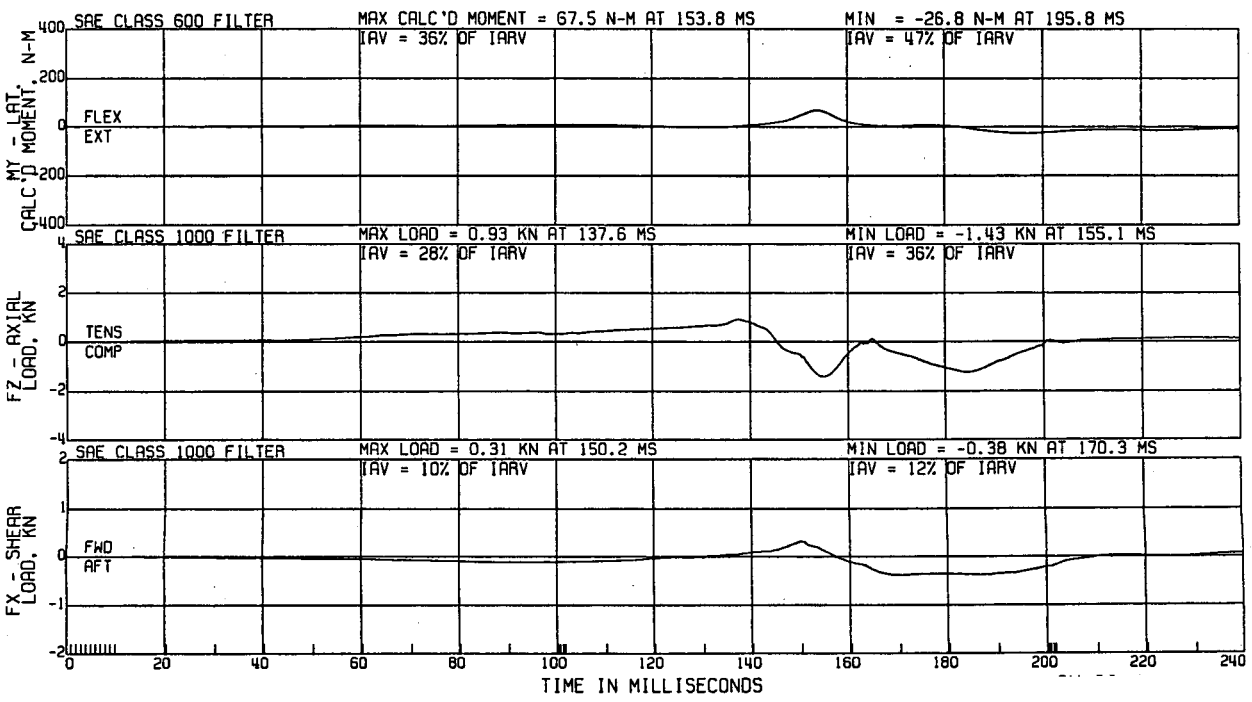
Appendix G, plot # **13**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR NECK LOADING ON HEAD ATD TYPE: GM50H TEST DATE:12/17/1997

ELEC DATA

R. FRT NECK LOADING ON HEAD



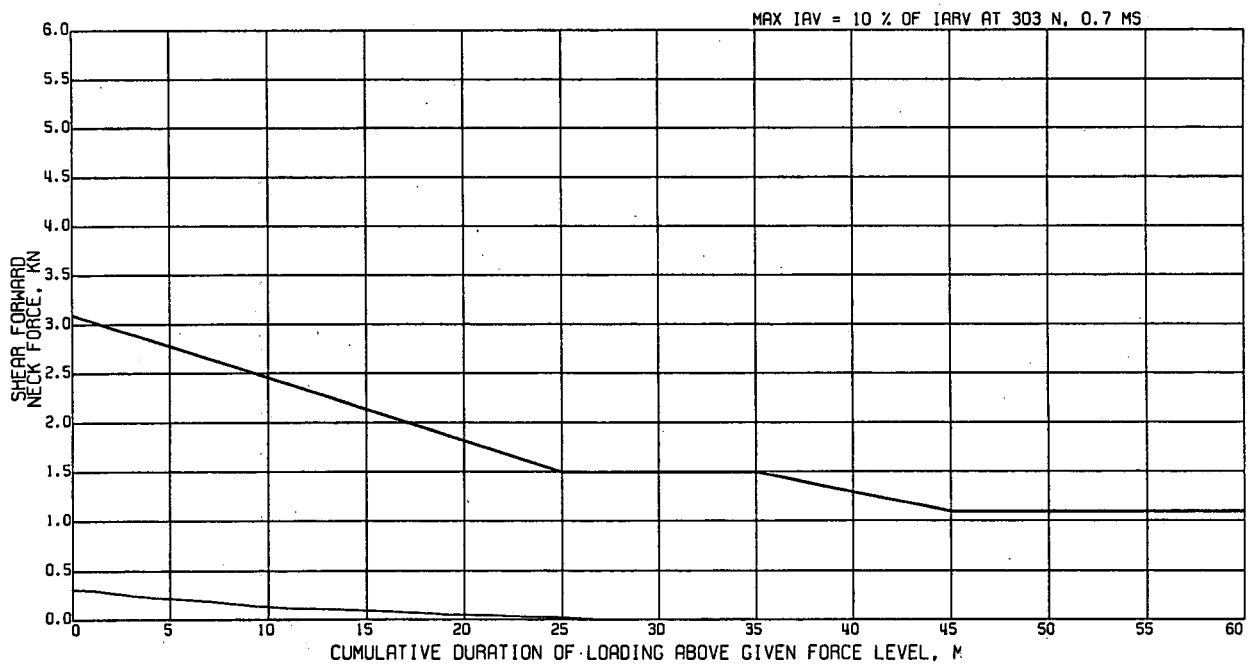
Appendix G, plot # **14**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR
ELEC DATA, SAE CLASS 1000

FORWARD NECK SHEAR ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:12/17/1997



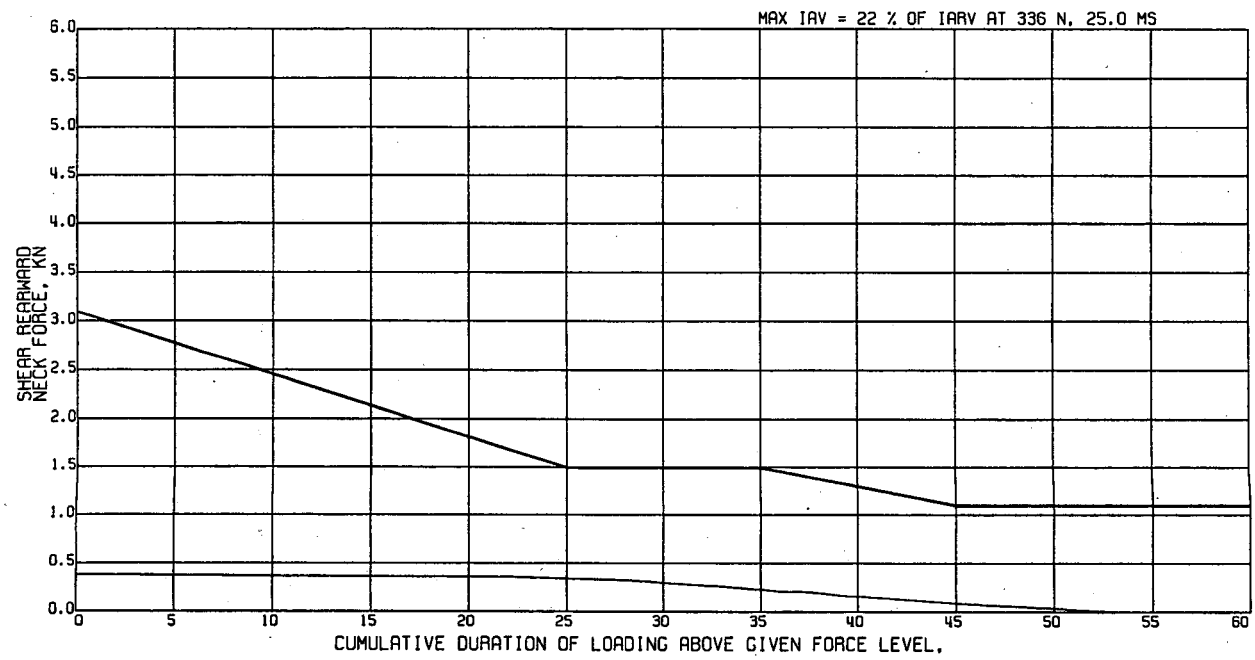
Appendix G, plot # **15**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR
ELEC DATA, SAE CLASS 1000

REARWARD NECK SHEAR ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:12/17/1997



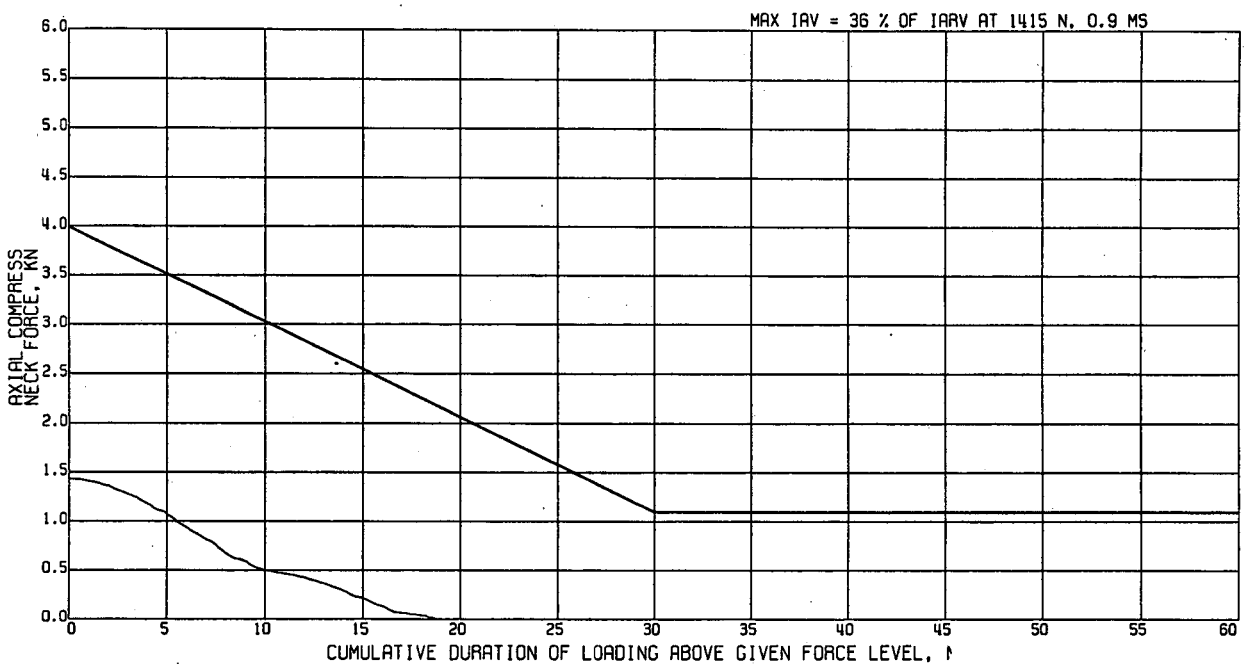
Appendix G, plot # **16**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91410 4 DOOR
ELEC DATA, SAE CLASS 1000

AXIAL COMPRESSION ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:12/17/1997



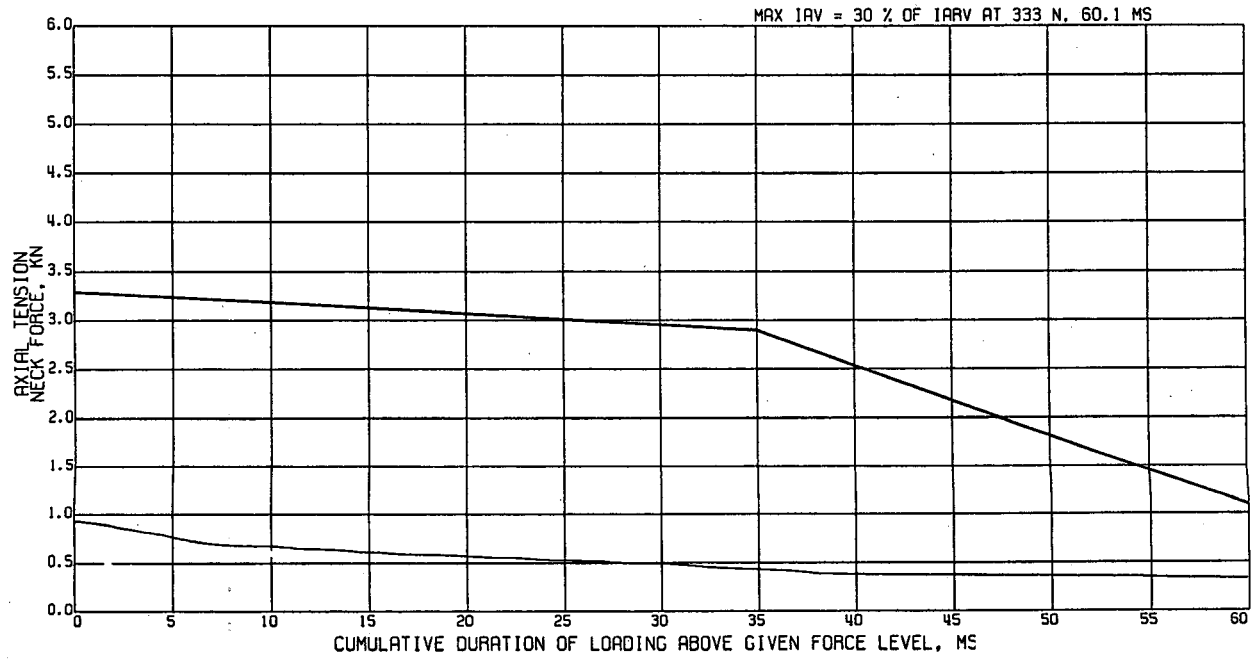
1 Appendix G, plot # **17**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91410 4 DOOR
ELEC DATA, SAE CLASS 1000

AXIAL TENSION ON HEAD,
R. FRT INJURY REFERENCE

ATD TYPE: GM50H
TEST DATE:12/17/1997

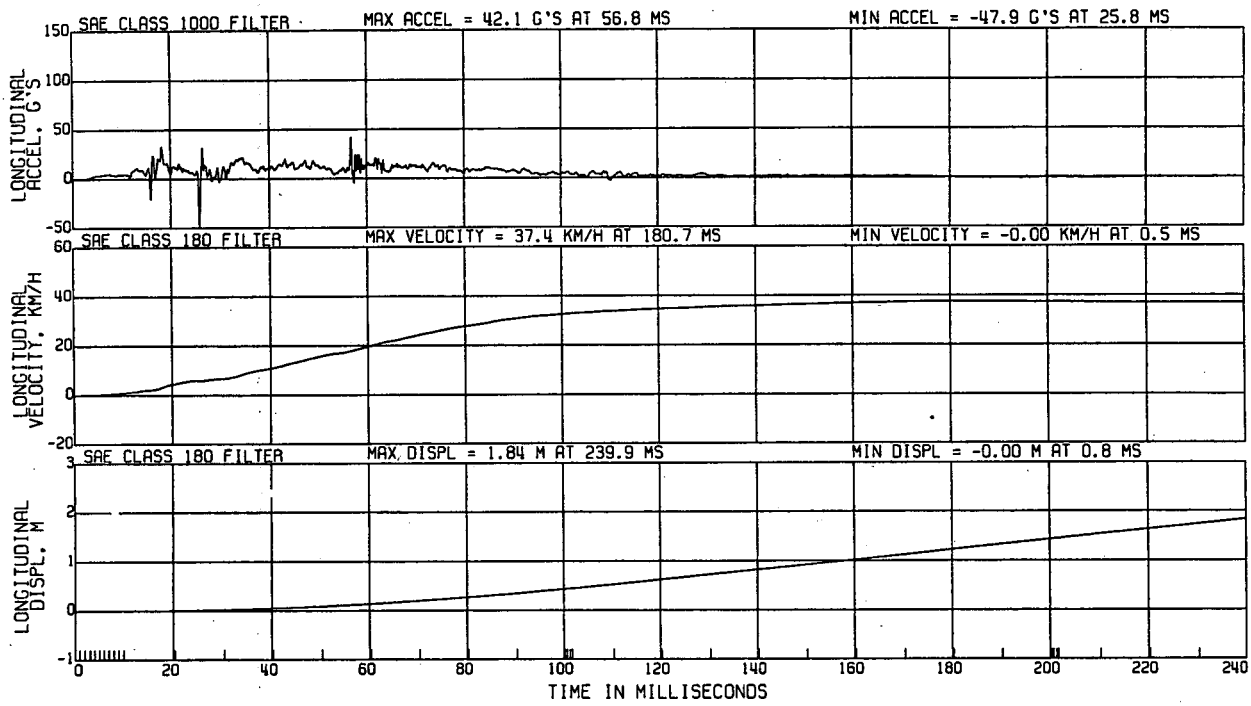


18 Appendix G, plot # **18**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR L. FRT ROCKER TEST DATE:12/17/1997

ELEC DATA

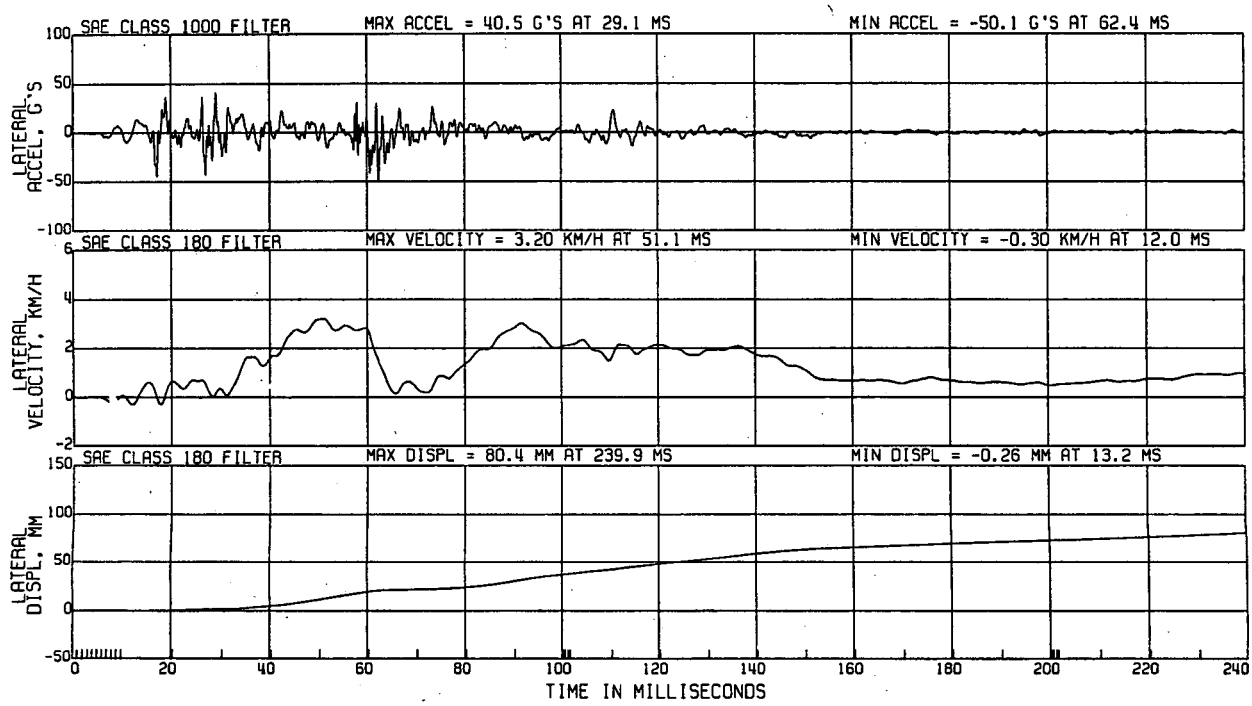


Appendix G, plot # **19**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR L. FRT ROCKER TEST DATE:12/17/1997

ELEC DATA

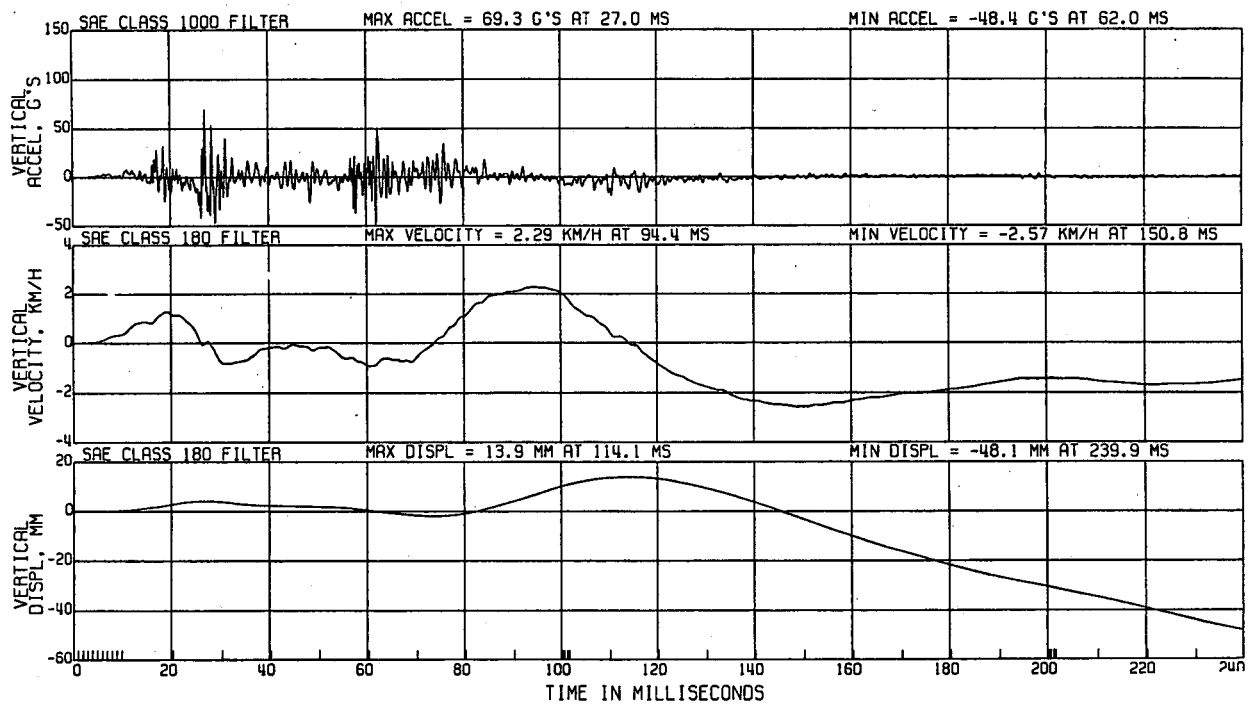


Appendix G, plot # **20**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR L. FRT ROCKER TEST DATE:12/17/1997

ELEC DATA

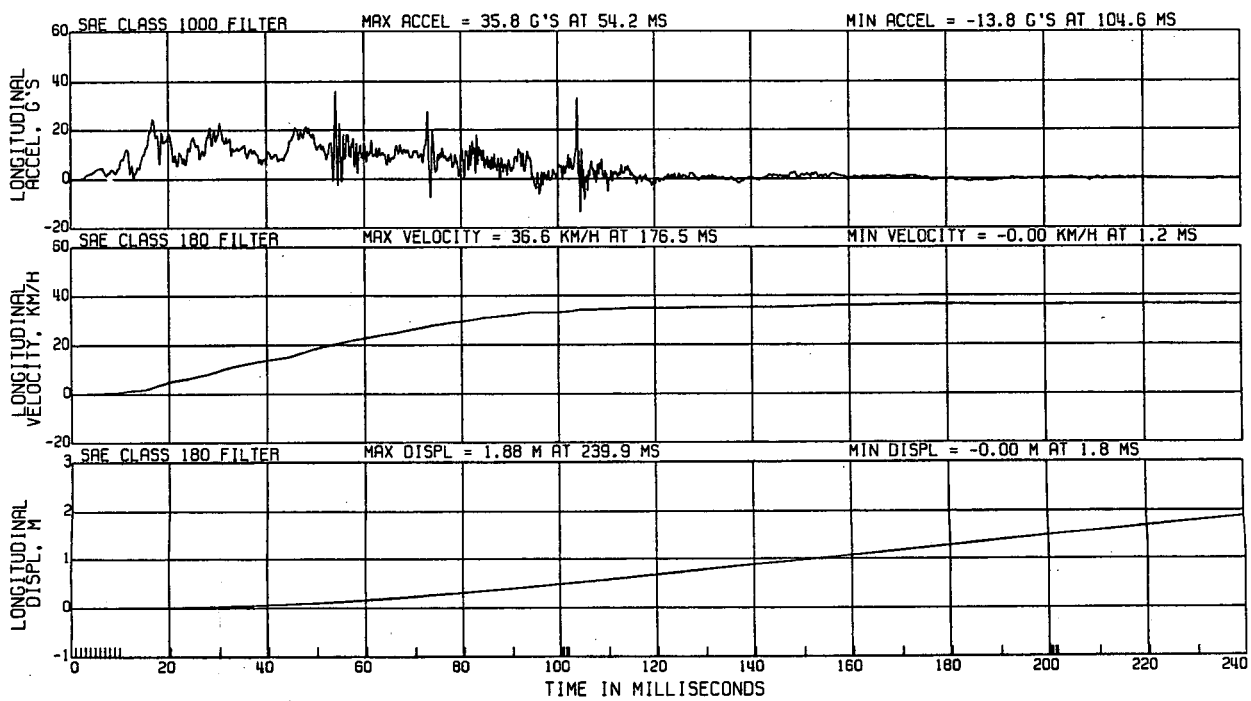


Appendix G, plot # **21**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR R. FRT ROCKER TEST DATE:12/17/1997

ELEC DATA

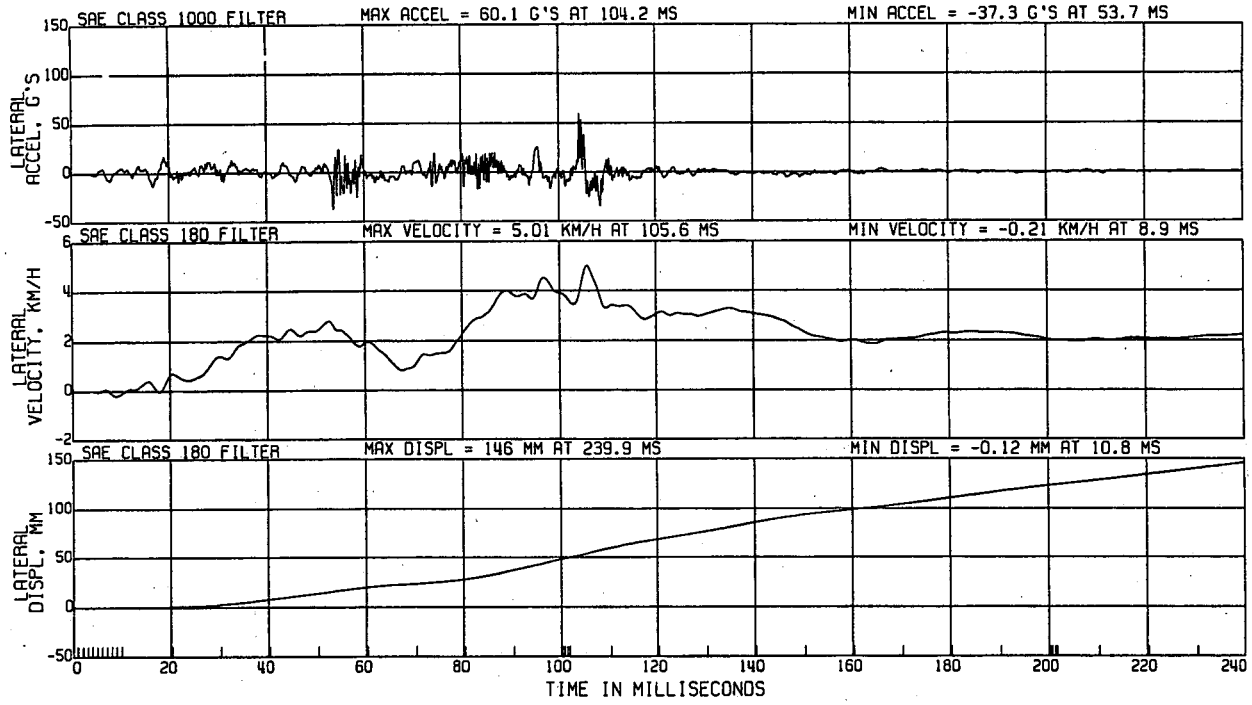


Appendix G, plot # **22**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR R. FRT ROCKER TEST DATE:12/17/1997

ELEC DATA

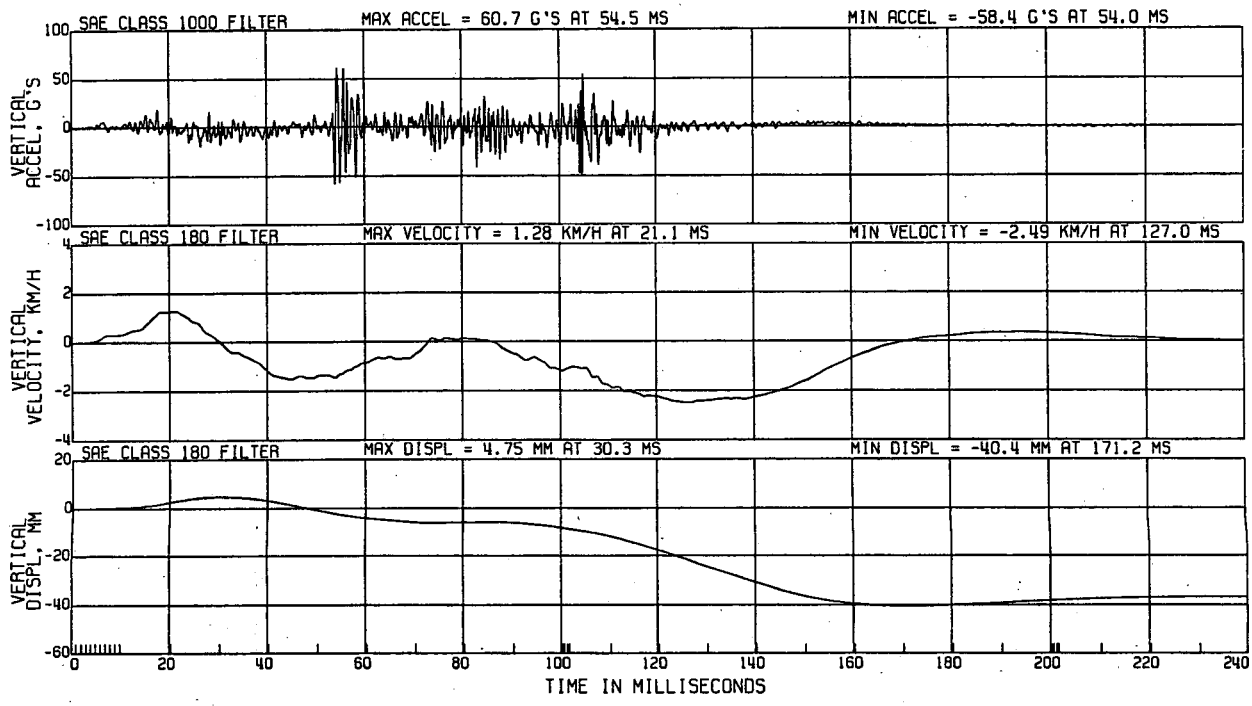


Appendix G, plot # **23**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR R. FRT ROCKER TEST DATE:12/17/1997

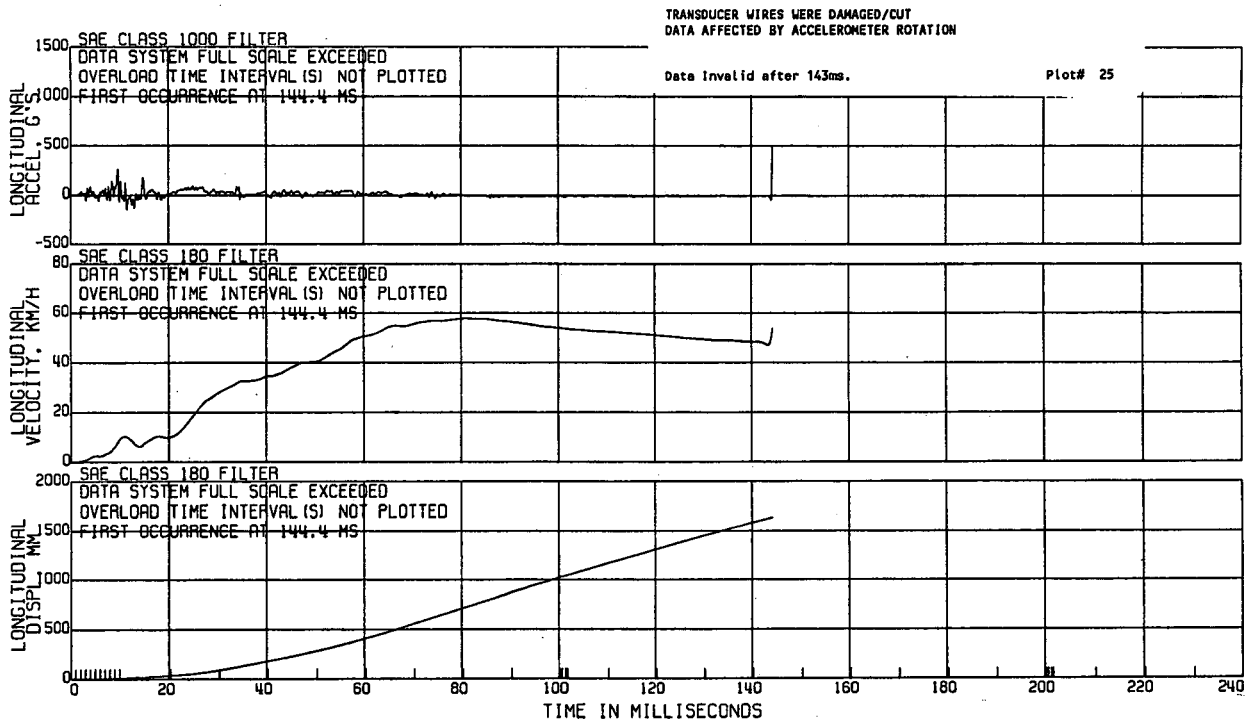
ELEC DATA



Appendix G, plot # **24**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

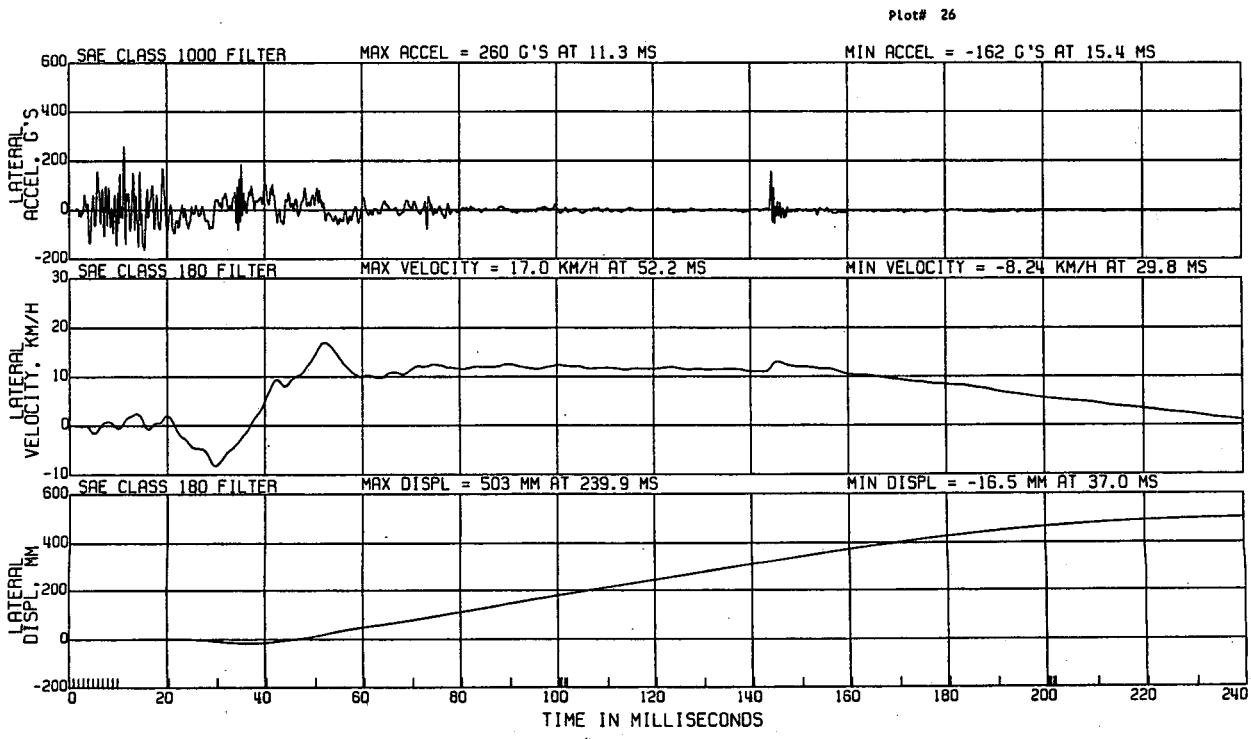
R & D CTR 8V91141D 4 DOOR L.REAR FRAME TEST DATE:12/17/1997
ELEC DATA



Appendix G, plot # **25**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

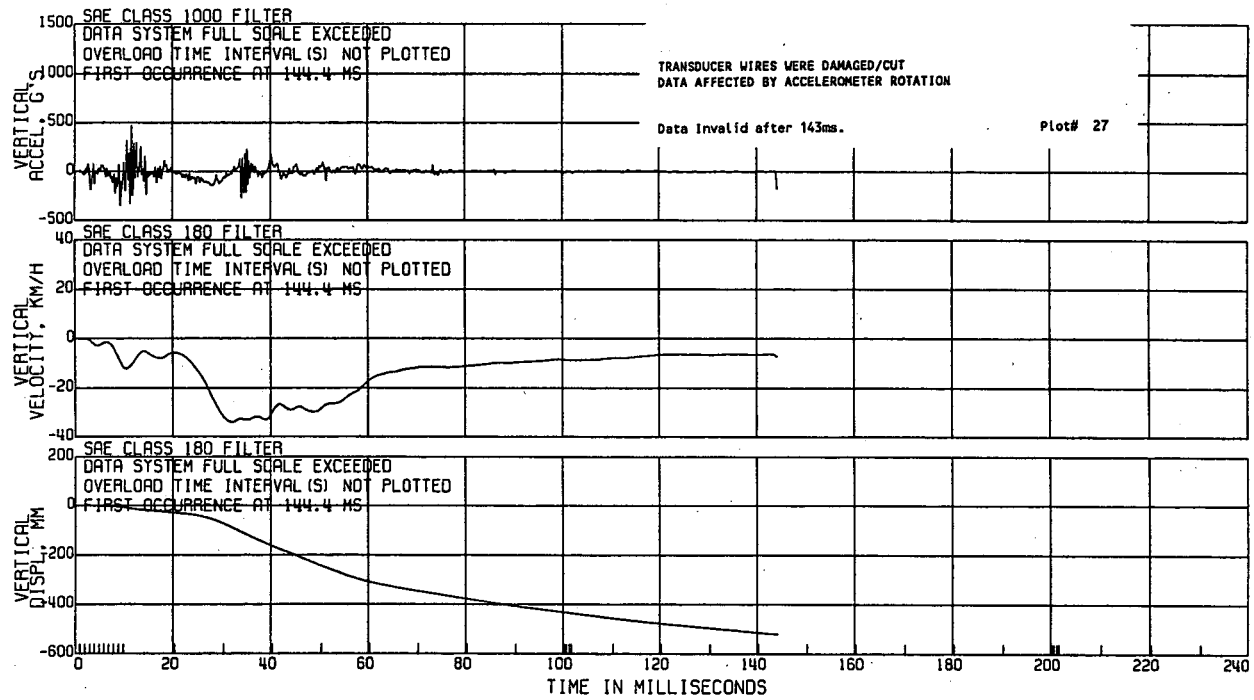
R & D CTR 8V91141D 4 DOOR L.REAR FRAME TEST DATE:12/17/1997
ELEC DATA



Appendix G, plot # **26**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

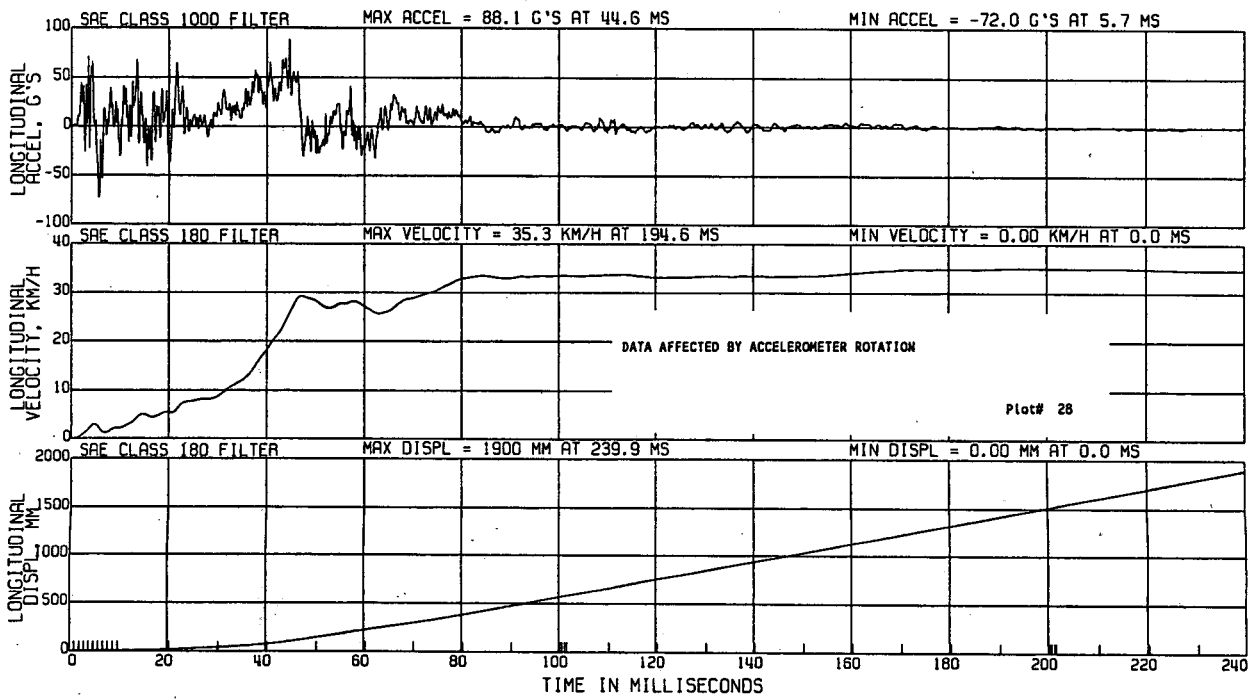
R & D CTR 8V91141D 4 DOOR L.REAR FRAME TEST DATE:12/17/1997
ELEC DATA



Appendix G, plot # **27**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

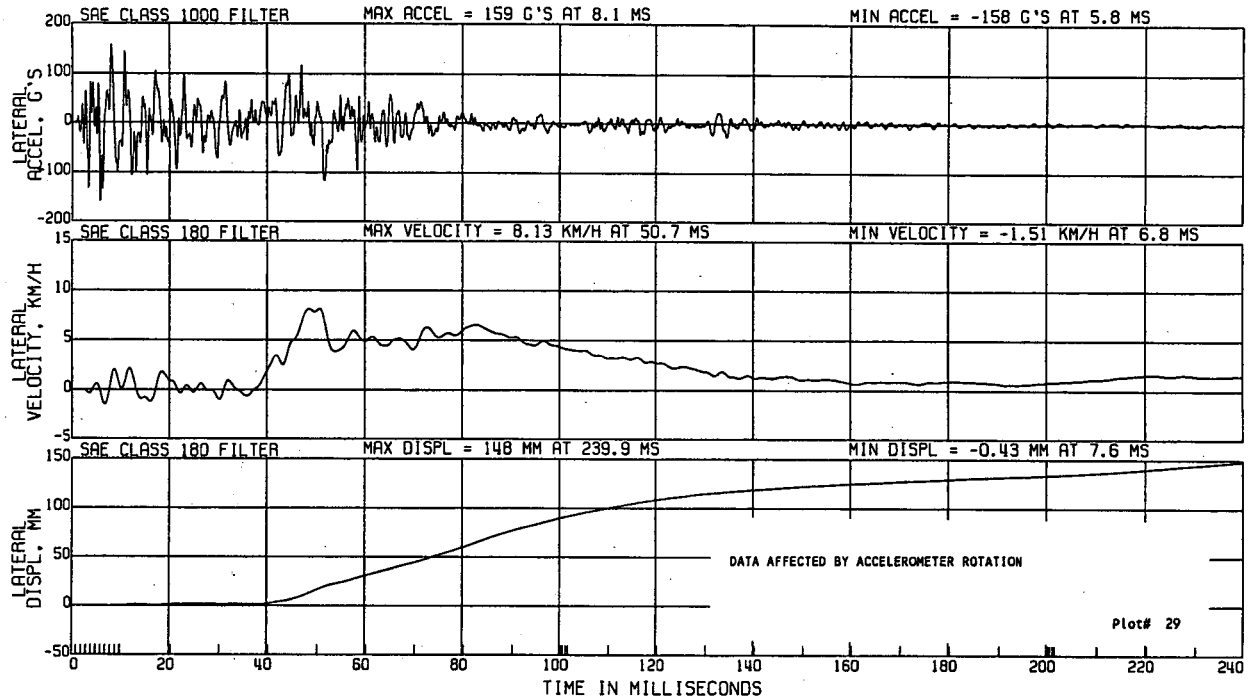
R & D CTR 8V91141D 4 DOOR R.REAR FRAME TEST DATE:12/17/1997
ELEC DATA



Appendix G, plot # **28**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

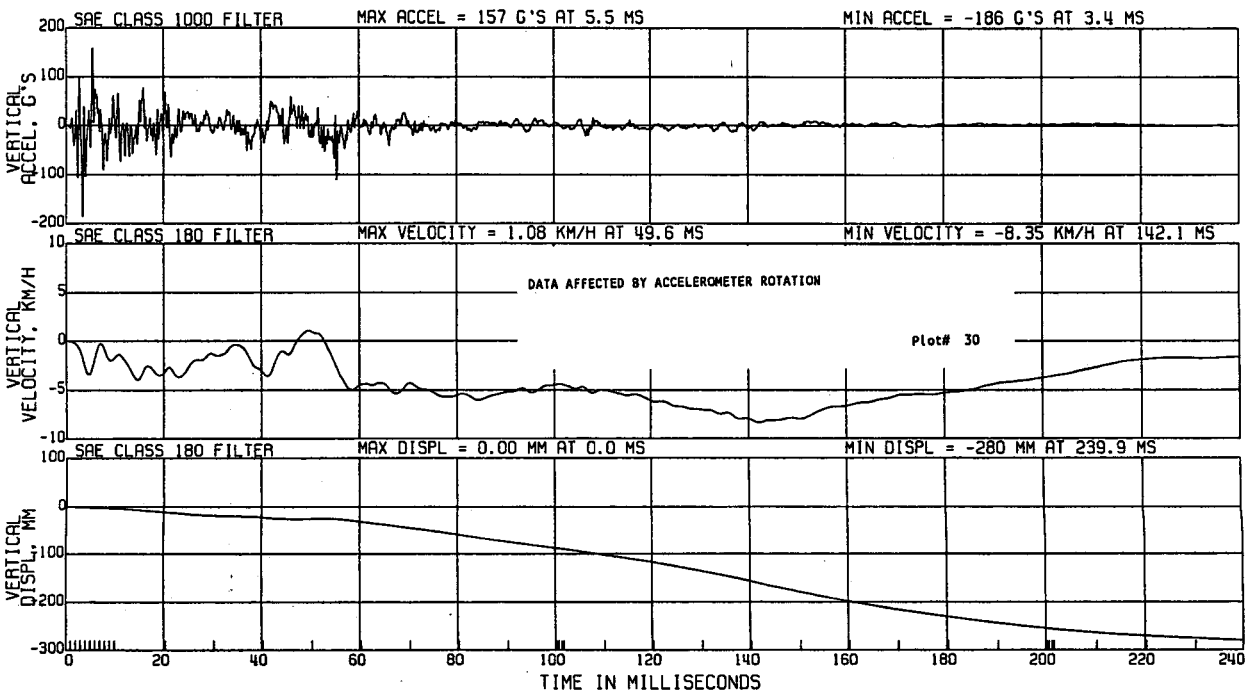
R & D CTR 8V91141D 4 DOOR R.REAR FRAME TEST DATE:12/17/1997
ELEC DATA



Appendix G, plot # **29**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

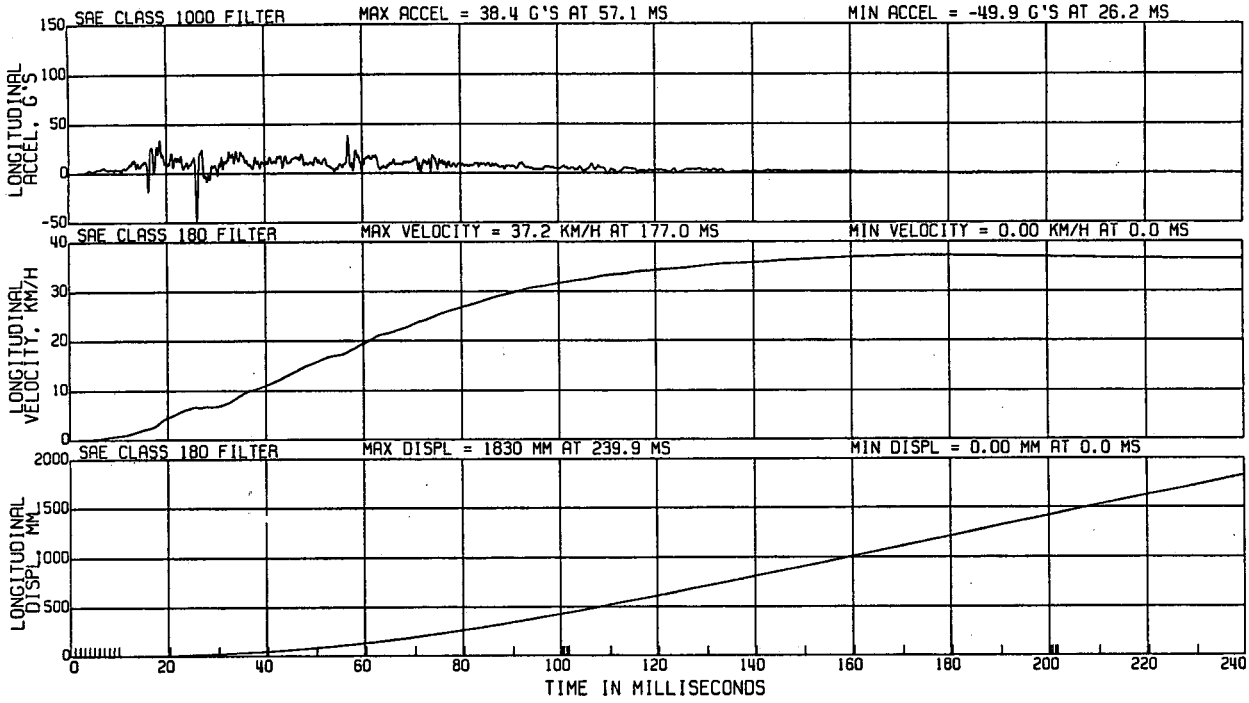
R & D CTR 8V91141D 4 DOOR R.REAR FRAME TEST DATE:12/17/1997
ELEC DATA



Appendix G, plot # **30**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR L.REAR ROCKER TEST DATE:12/17/1997
ELEC DATA



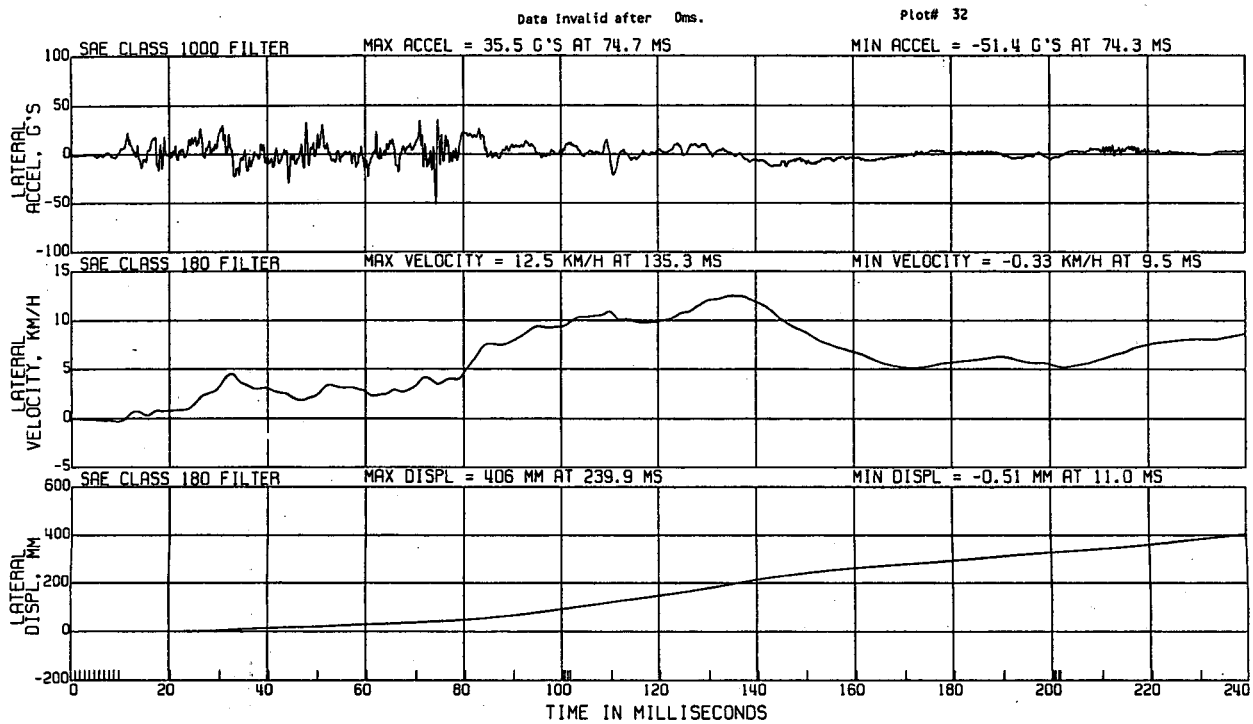
Appendix G, plot # **31**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR L.REAR ROCKER TEST DATE:12/17/1997
ELEC DATA

ACCELEROMETER EXHIBITED A DC SHIFT

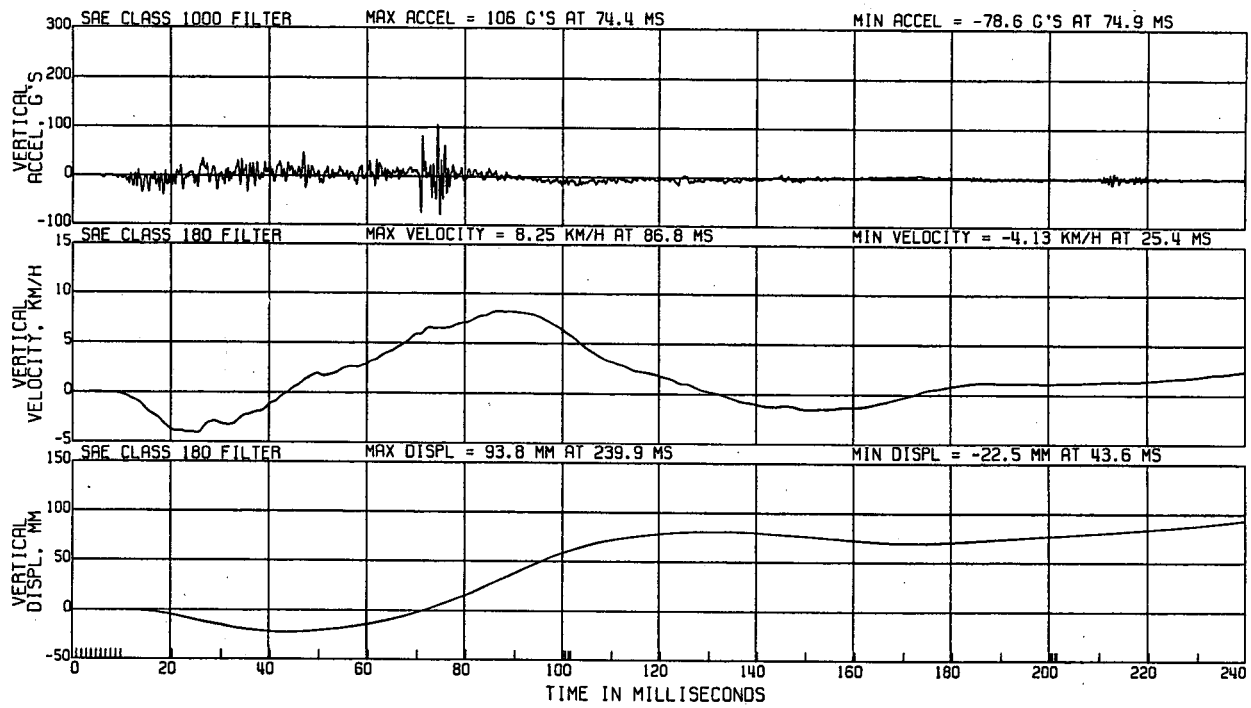
Data Invalid after 0ms. Plot# 32



Appendix G, plot # **32**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

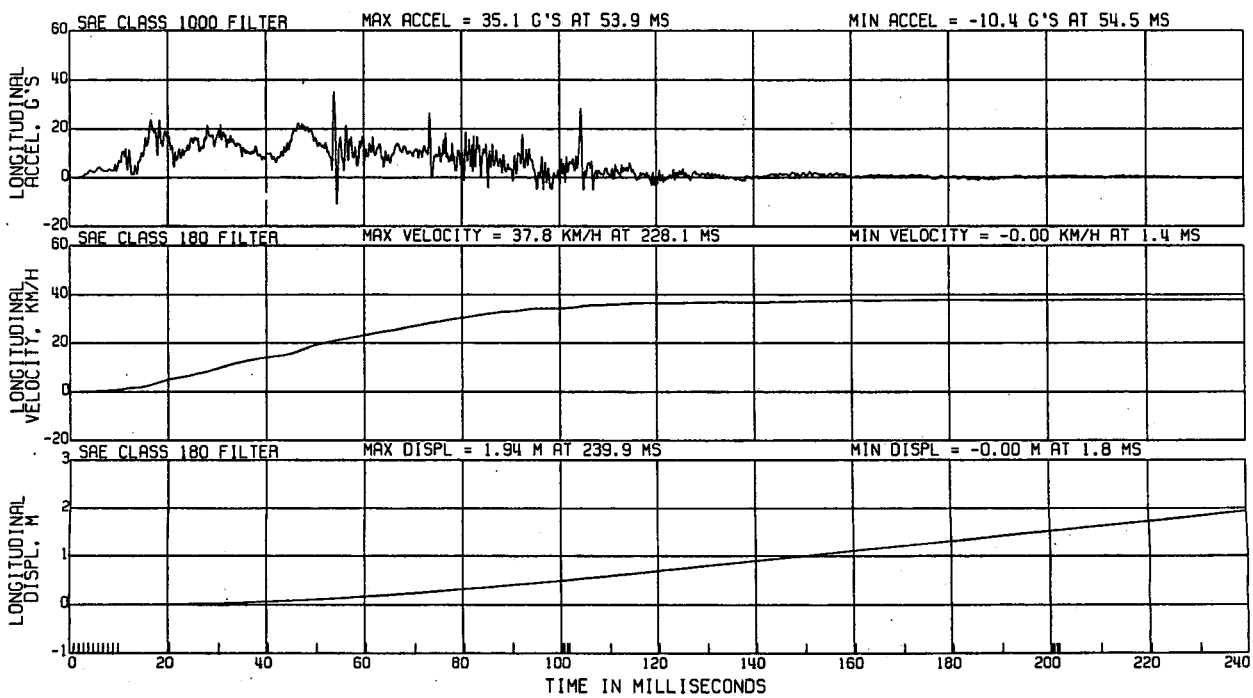
R & D CTR 8V91141D 4 DOOR L.REAR ROCKER TEST DATE:12/17/1997
ELEC DATA



Appendix G, plot # **33**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR R.REAR ROCKER TEST DATE:12/17/1997
ELEC DATA

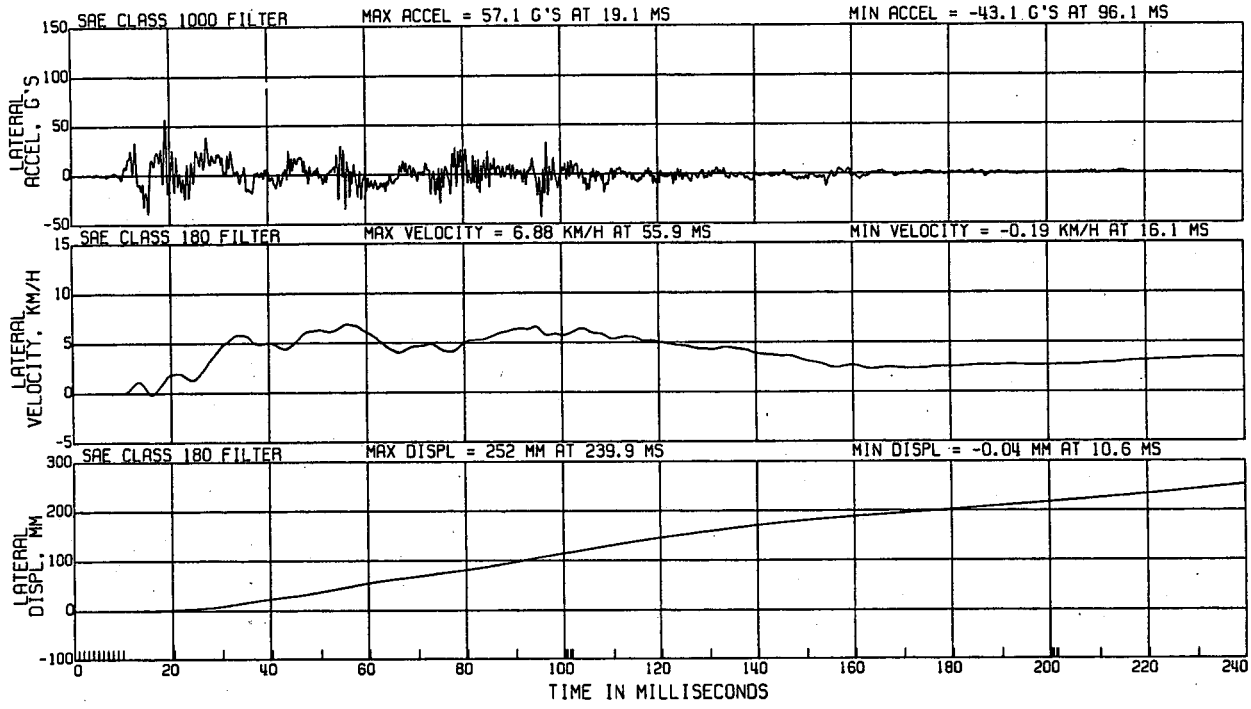


Appendix G, plot # **34**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR R.REAR ROCKER TEST DATE:12/17/1997

ELEC DATA

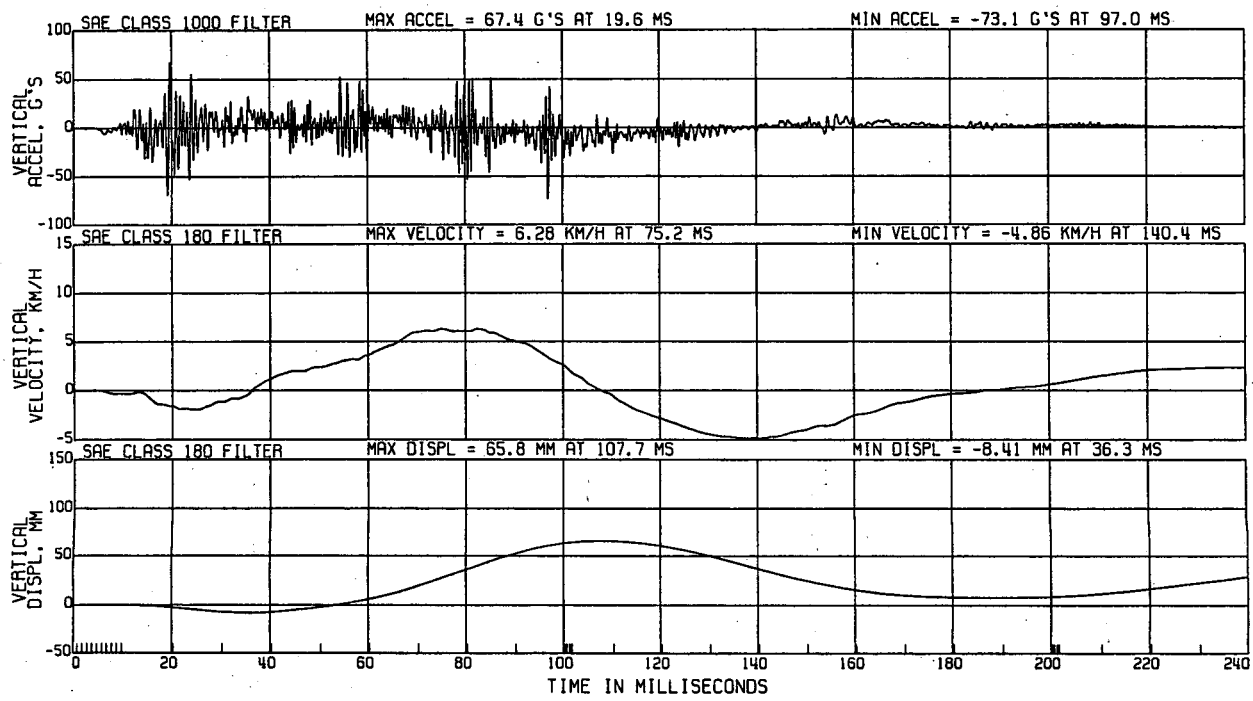


Appendix G, plot # **35**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR R.REAR ROCKER TEST DATE:12/17/1997

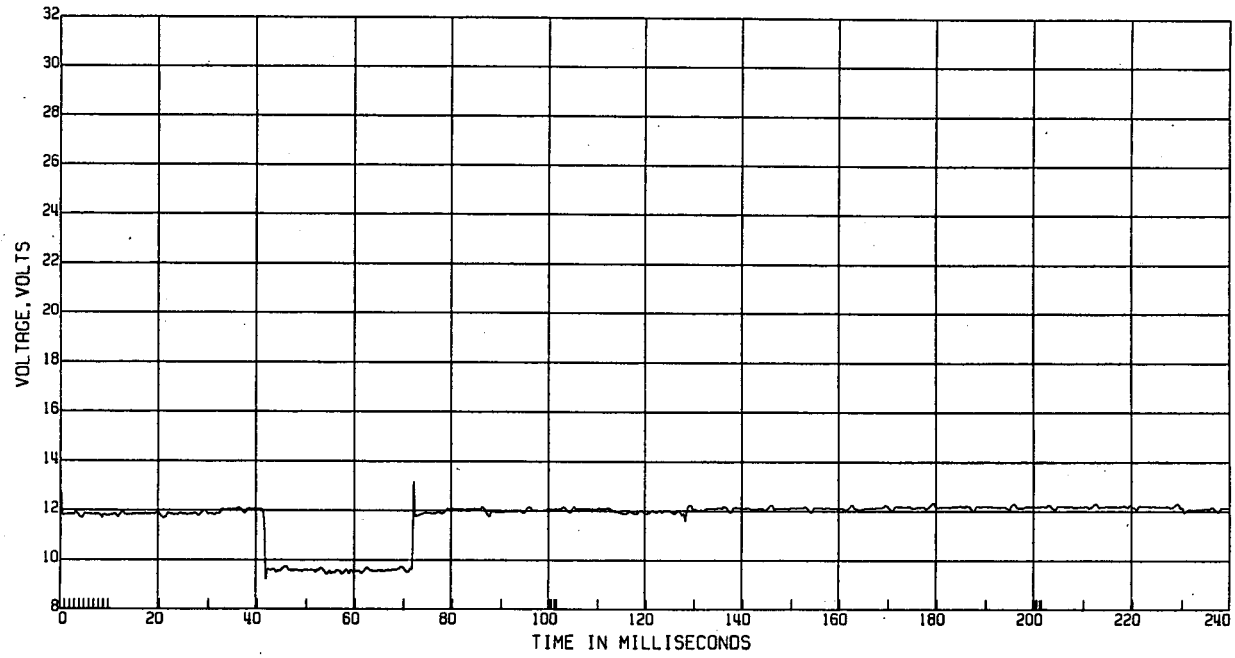
ELEC DATA



Appendix G, plot # **36**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

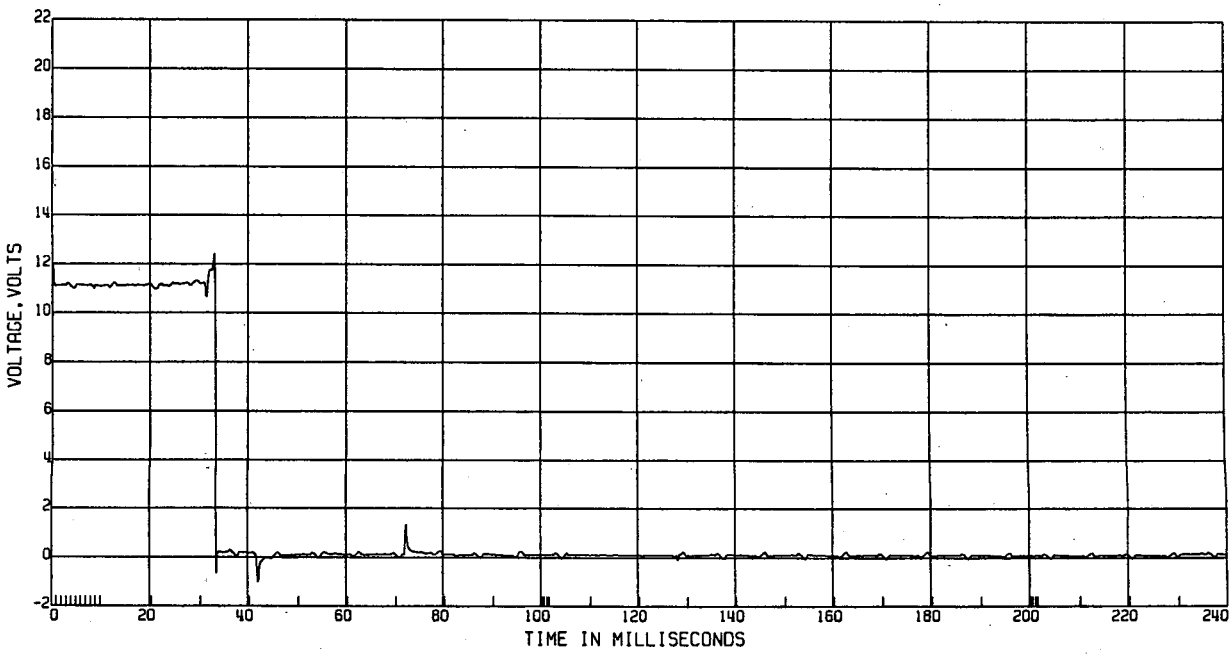
R & D CTR 8V91410 4 DOOR IGNITION VOLTAGE TEST DATE:12/17/1997
ELEC DATA, SAE CLASS 1000



Appendix G, plot # **37**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

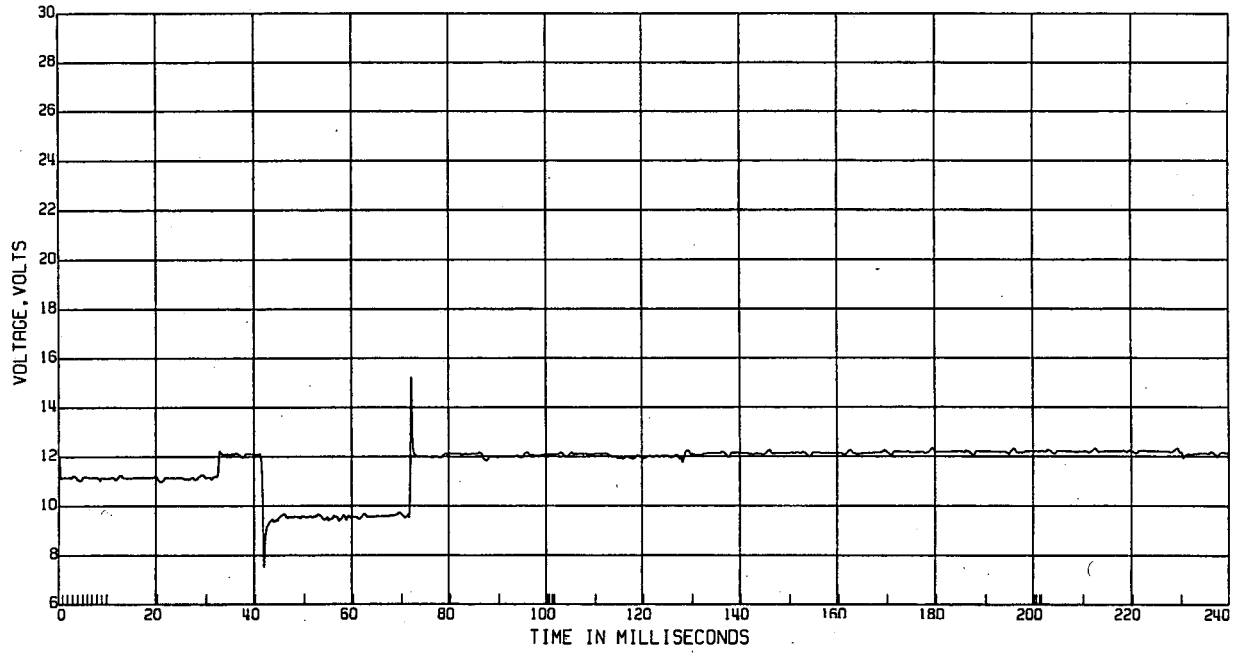
R & D CTR 8V91410 4 DOOR CHMSL/BRAKE LIGHT VOLTAGE TEST DATE:12/17/1997
ELEC DATA, SAE CLASS 1000



Appendix G, plot # **38**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

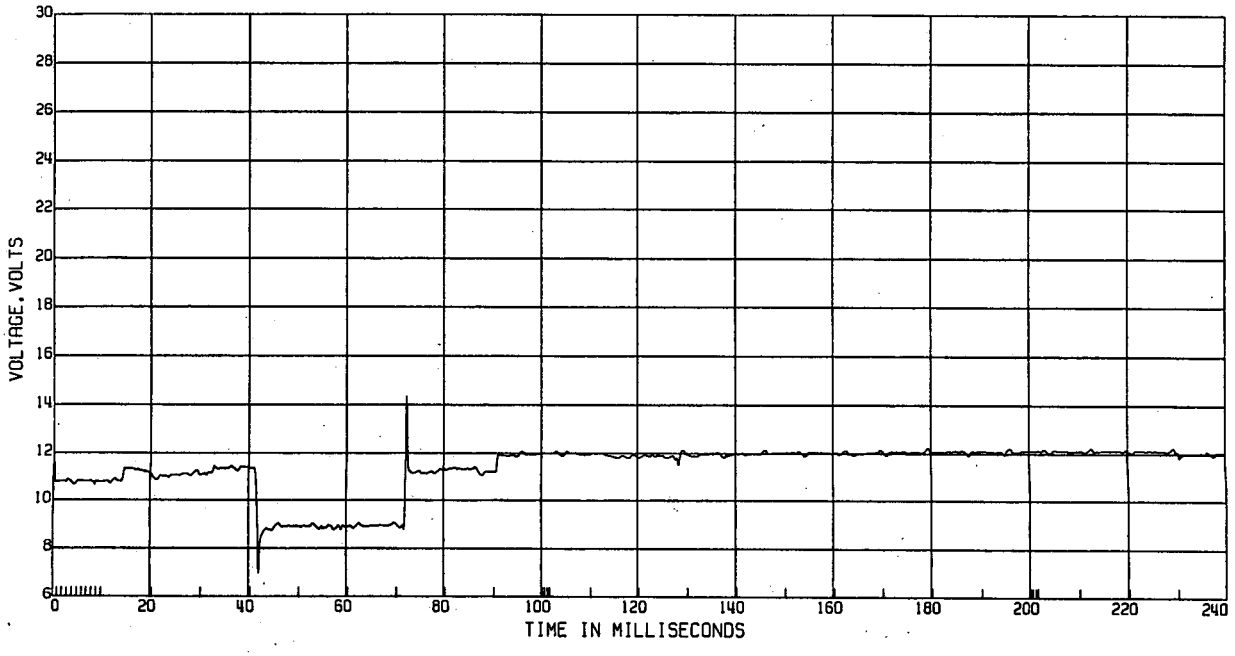
R & D CTR 8V91141D 4 DOOR REAR WINDOW DEFROSTER VOLTAGE TEST DATE:12/17/1997
ELEC DATA, SAE CLASS 1000



Appendix G, plot # **39**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR L.REAR BACKUP LIGHT VOLTAGE TEST DATE:12/17/1997
ELEC DATA, SAE CLASS 1000



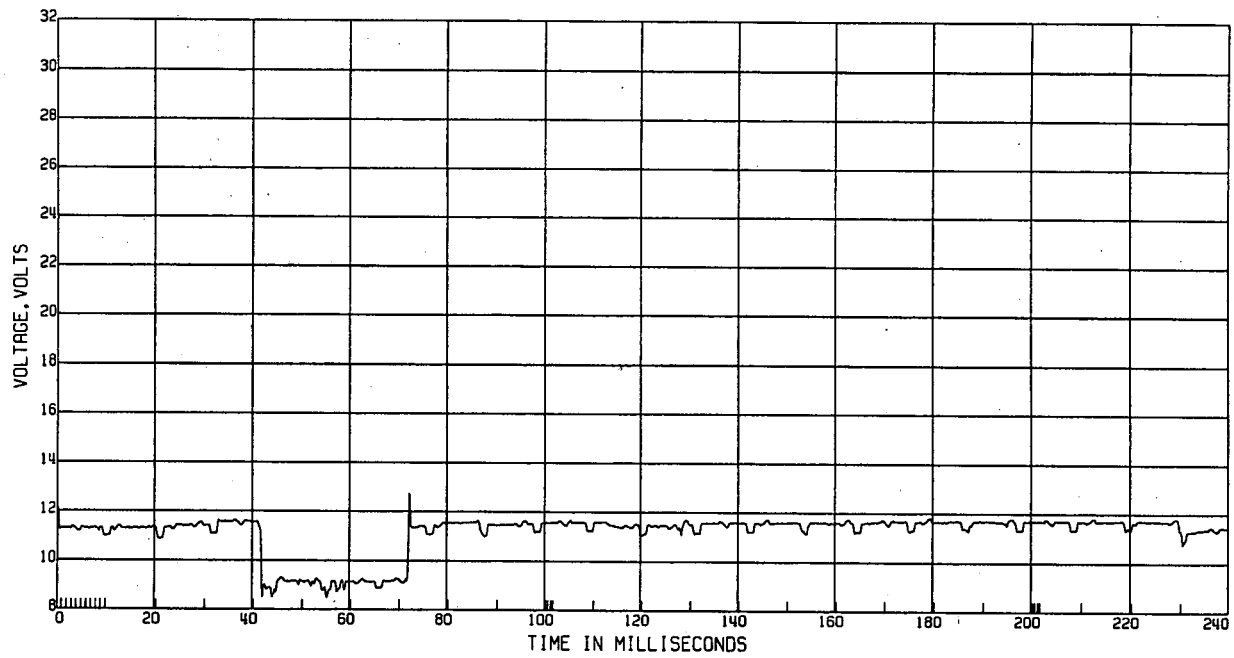
Appendix G, plot # **40**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR
ELEC DATA, SAE CLASS 1000

L.REAR TAIL LIGHT VOLTAGE

TEST DATE:12/17/1997



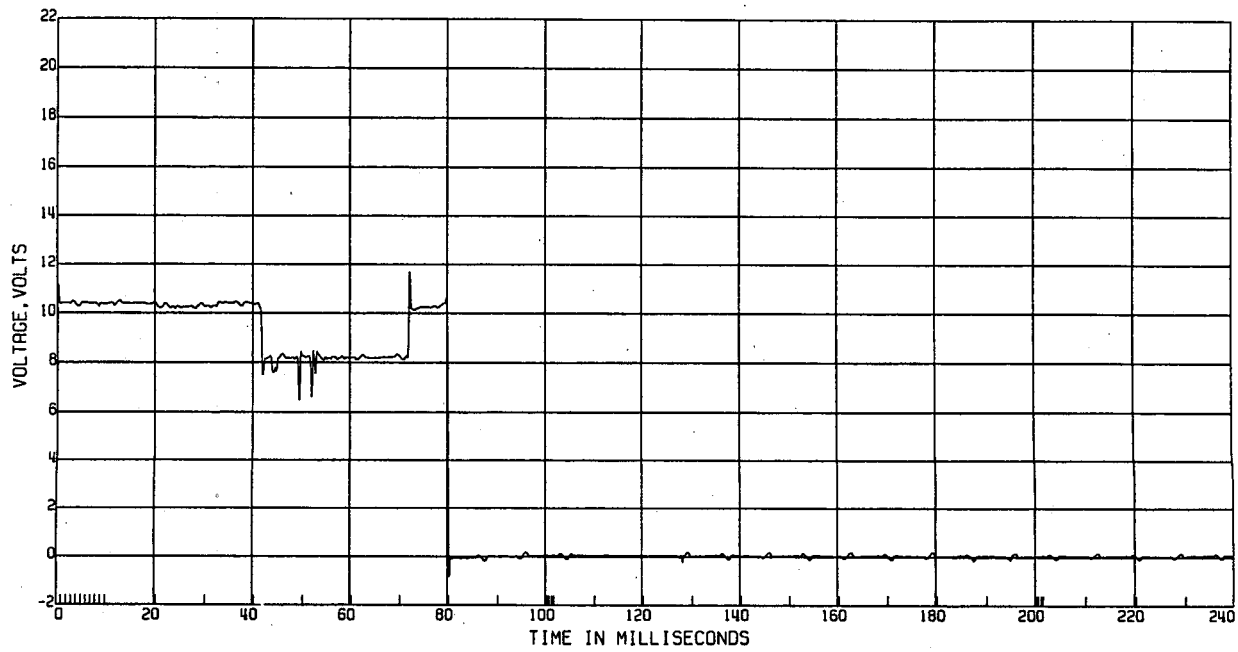
Appendix G, plot # **41**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR
ELEC DATA, SAE CLASS 1000

L.REAR TURN SIGNAL VOLTAGE

TEST DATE:12/17/1997



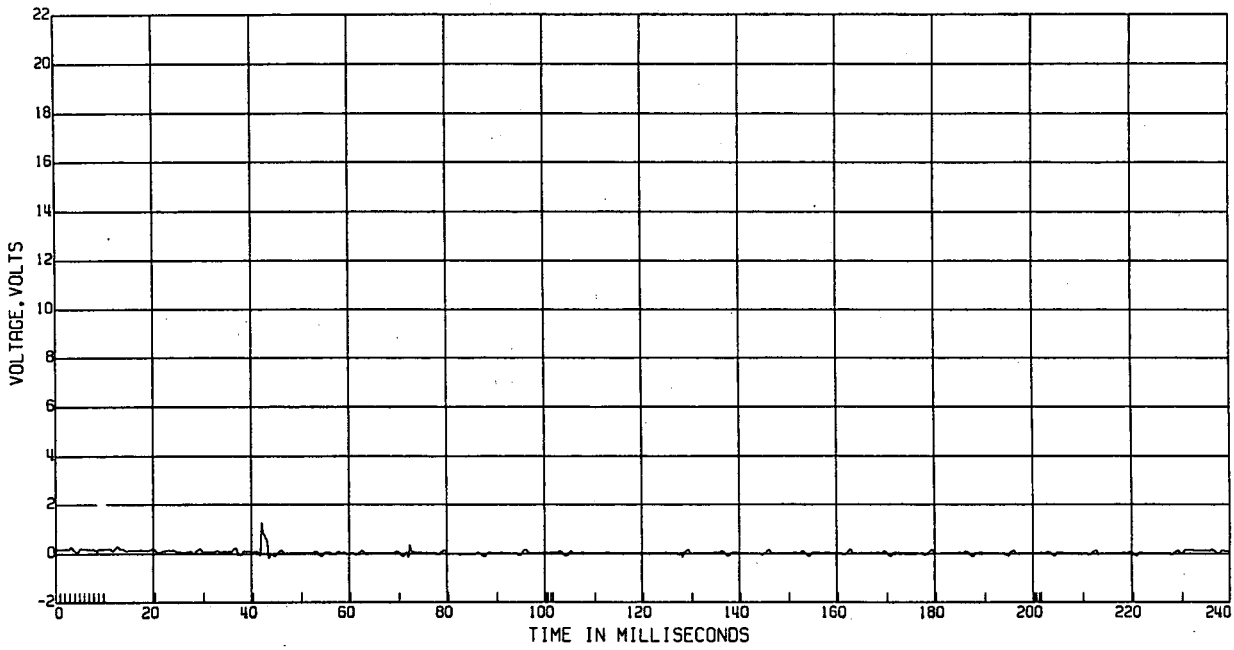
Appendix G, plot # **42**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR
ELEC DATA, SAE CLASS 1000

FUEL PUMP VOLTAGE

TEST DATE:12/17/1997



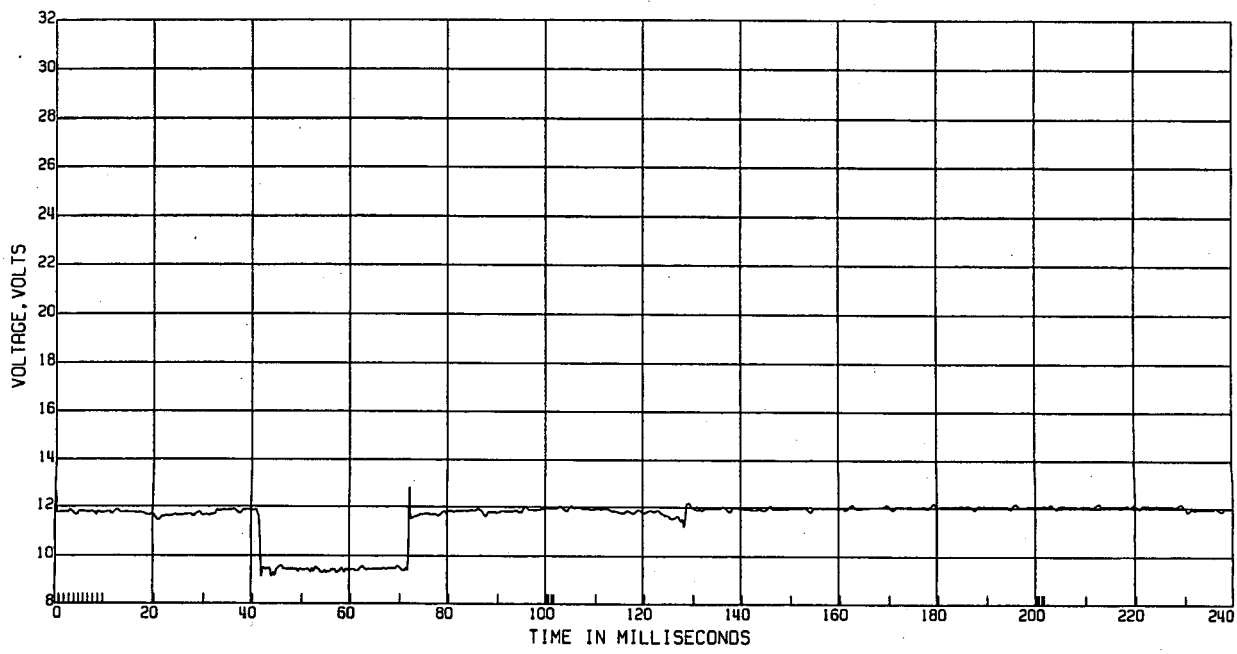
Appendix G, plot # **43**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR
ELEC DATA, SAE CLASS 1000

FUEL INERTIA SWITCH VOLTAGE

TEST DATE:12/17/1997

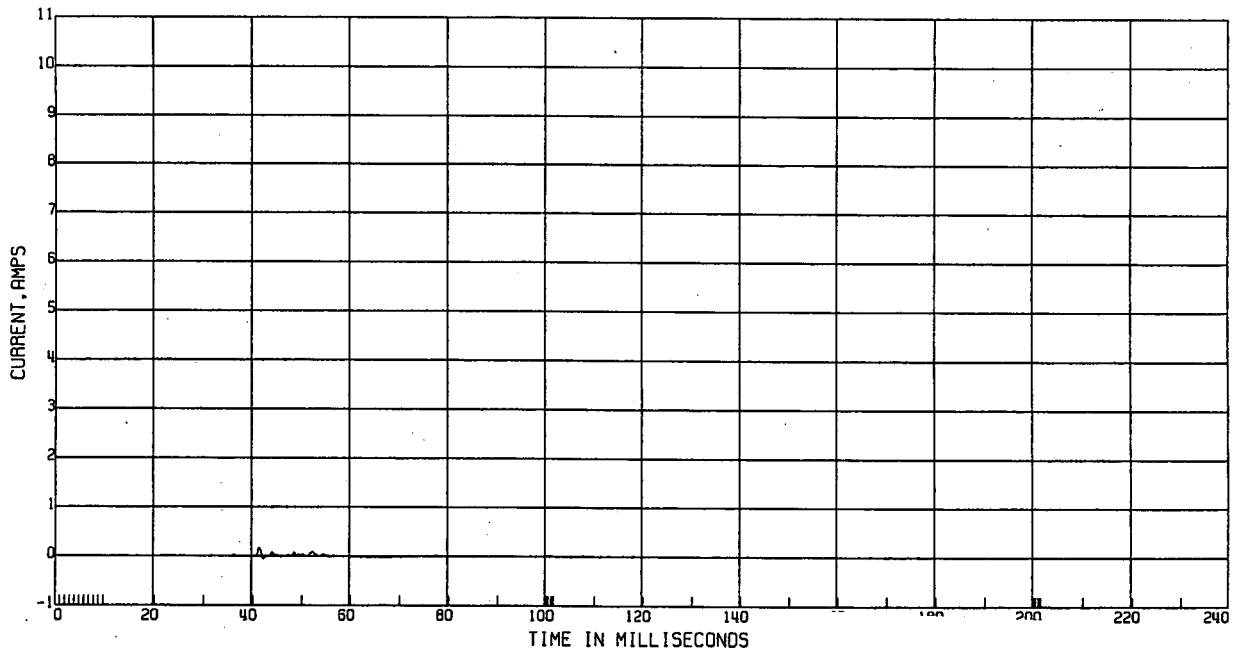


Appendix G, plot # **44**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR L. WHEEL BAG CURRENT TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

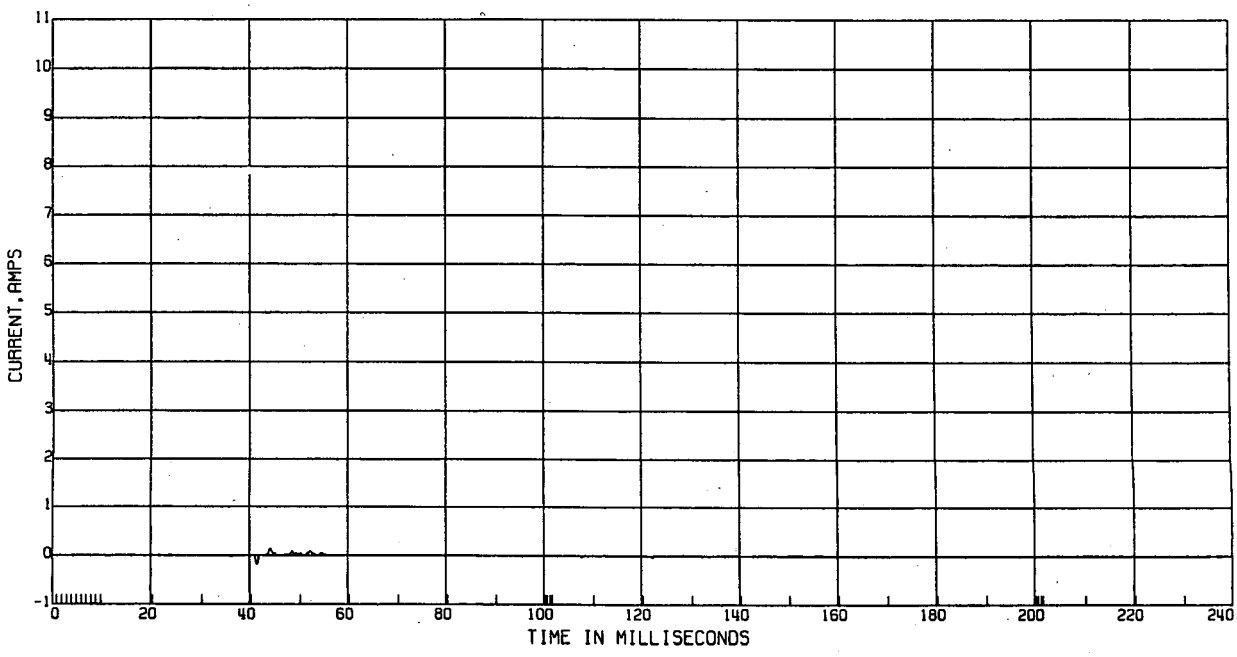


Appendix G, plot # **45**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR R. I/P BAG CURRENT TEST DATE:12/17/1997

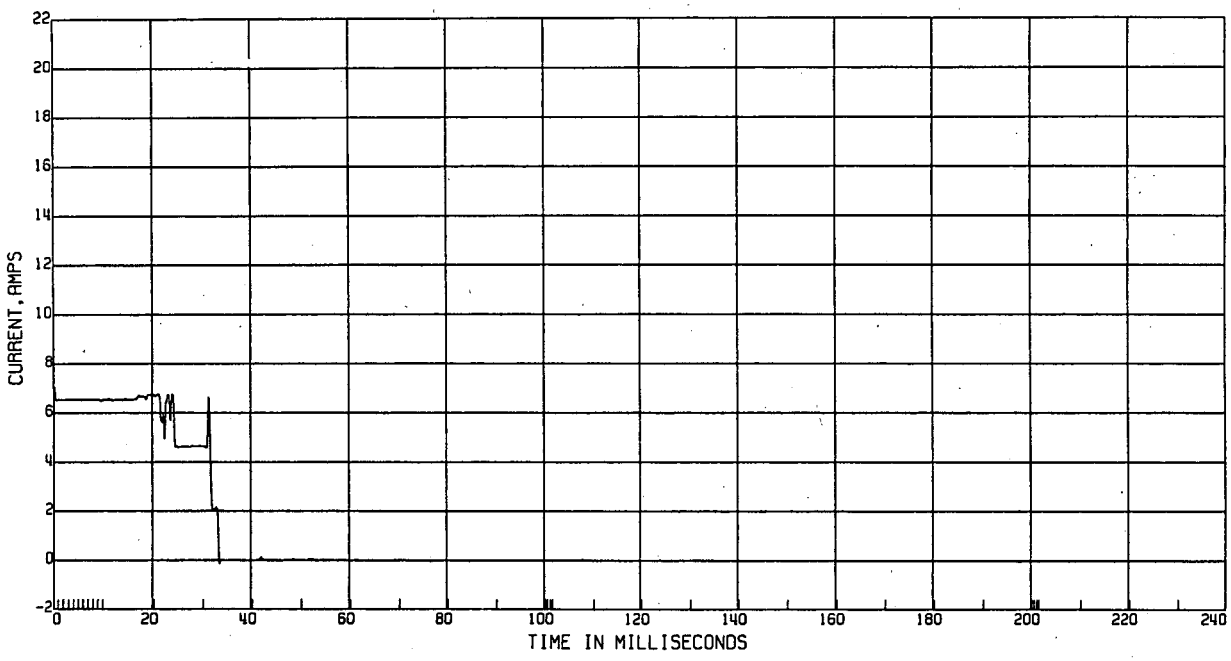
ELEC DATA, SAE CLASS 1000



Appendix G, plot # **46**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

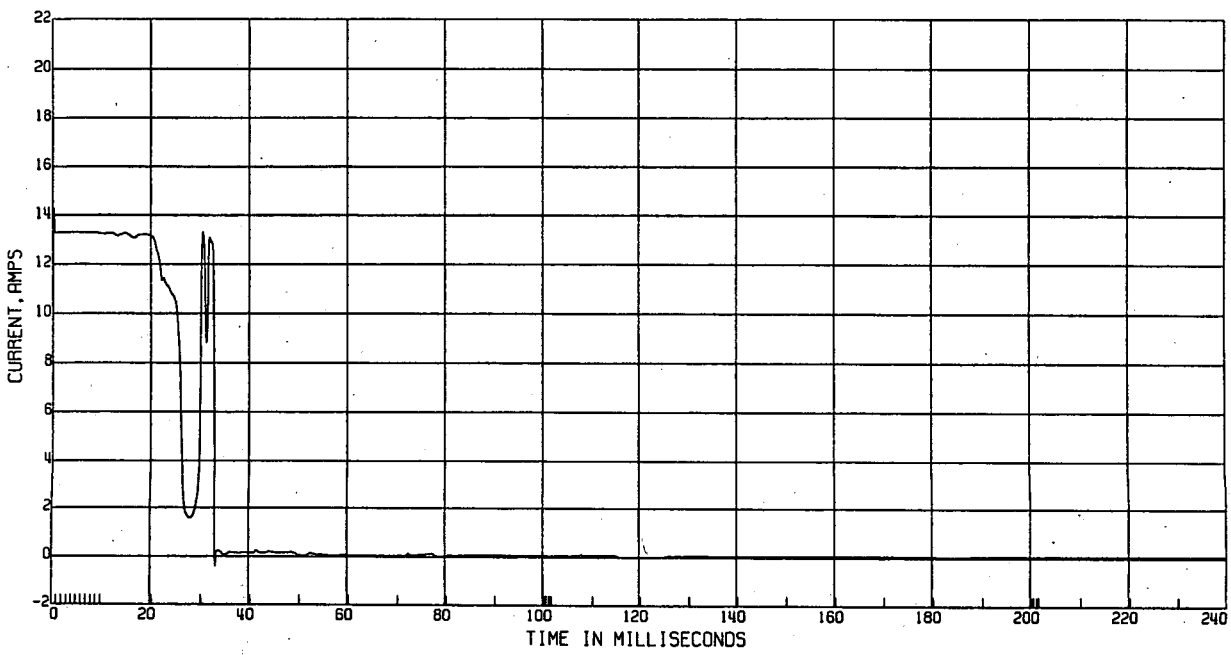
R & D CTR 8V91410 4 DOOR CHMSL/BRAKE LIGHT CURRENT TEST DATE:12/17/1997
ELEC DATA, SAE CLASS 1000



Appendix G, plot # **47**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91410 4 DOOR REAR WINDOW DEFROSTER CURRENT TEST DATE:12/17/1997
ELEC DATA, SAE CLASS 1000

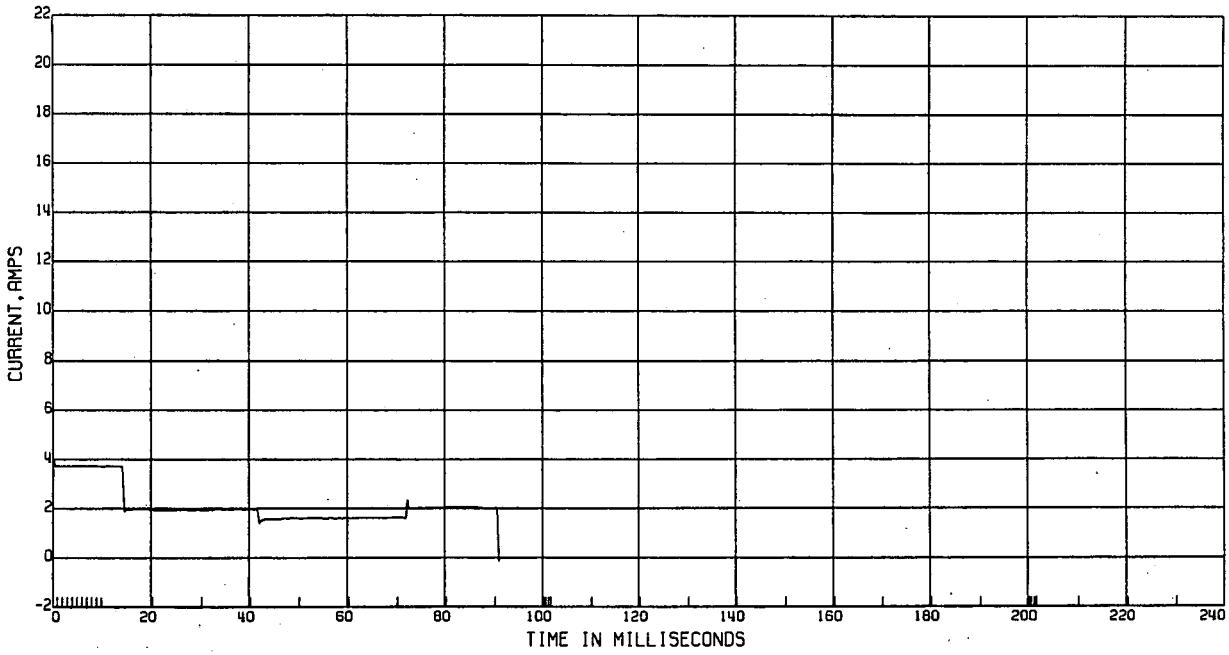


Appendix G, plot # **48**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR REAR BACKUP LIGHTS CURRENT TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

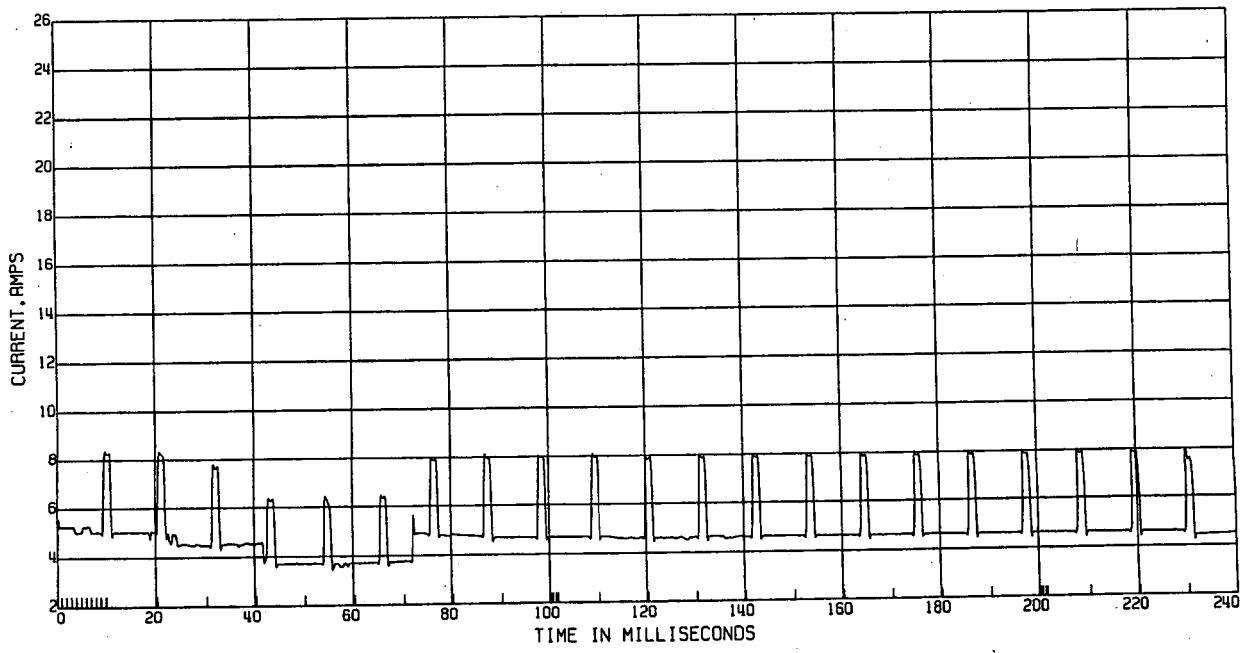


Appendix G, plot # **49**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR L.REAR TAIL LIGHT CURRENT TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

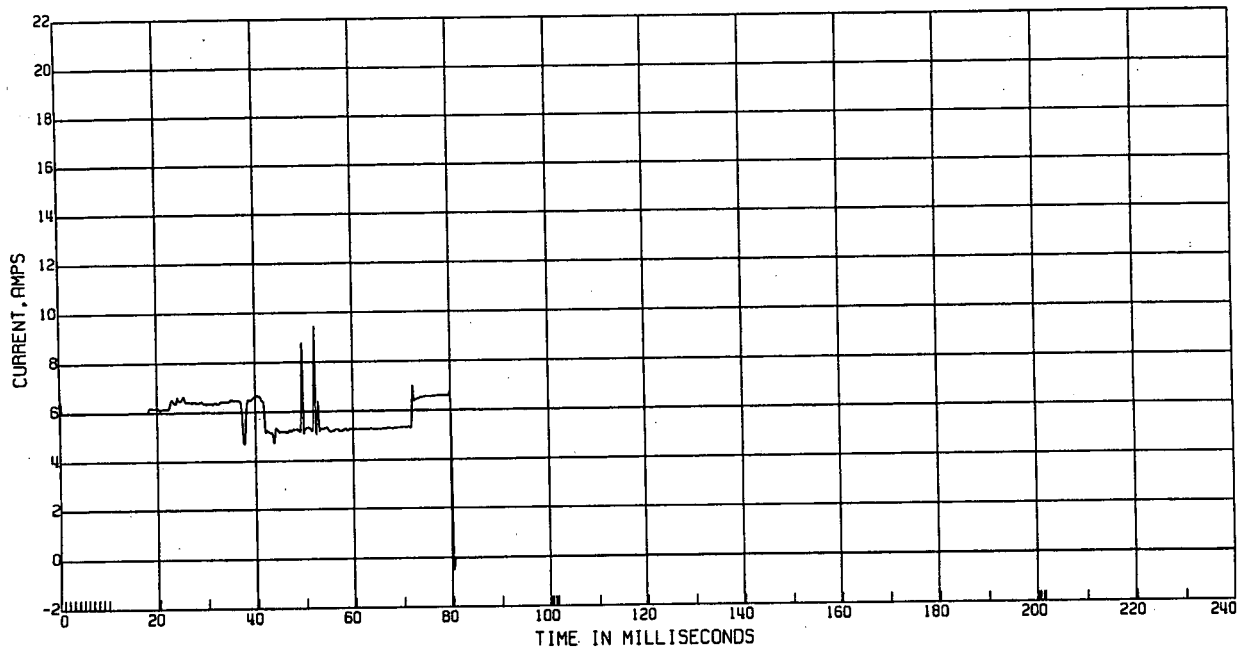


Appendix G, plot # **50**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR L.REAR TURN SIGNAL CURRENT TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

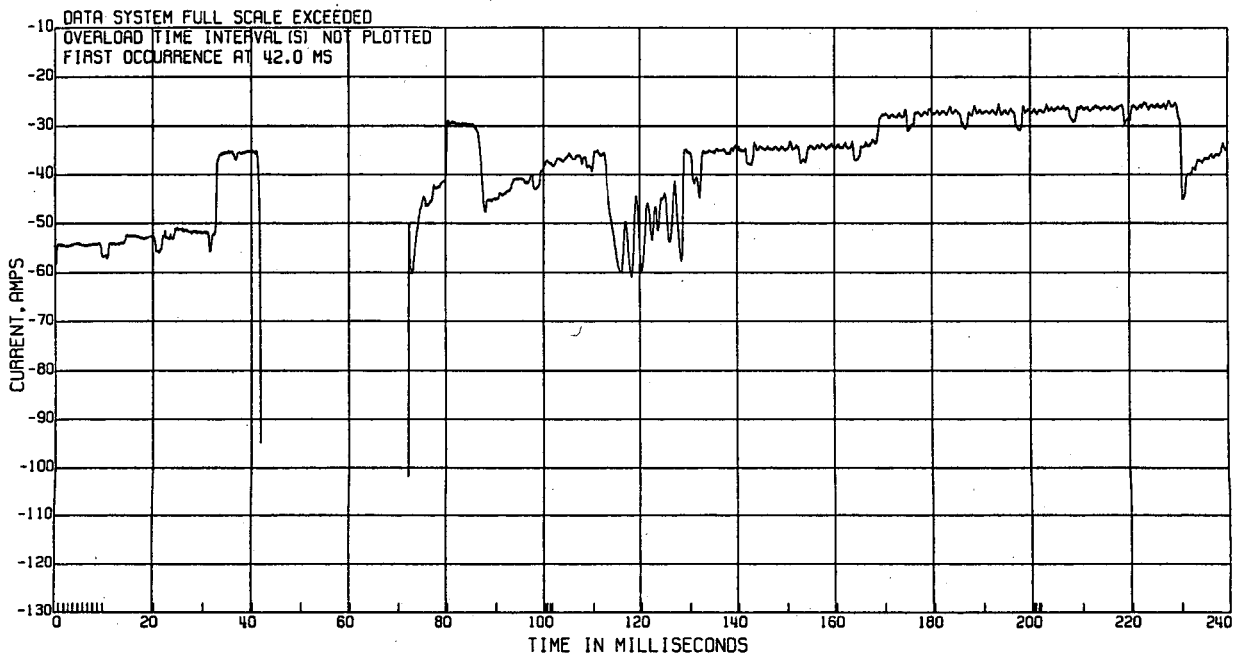


Appendix G, plot # **51**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR BATTERY (B+ TO PDB) CURRENT TEST DATE:12/17/1997

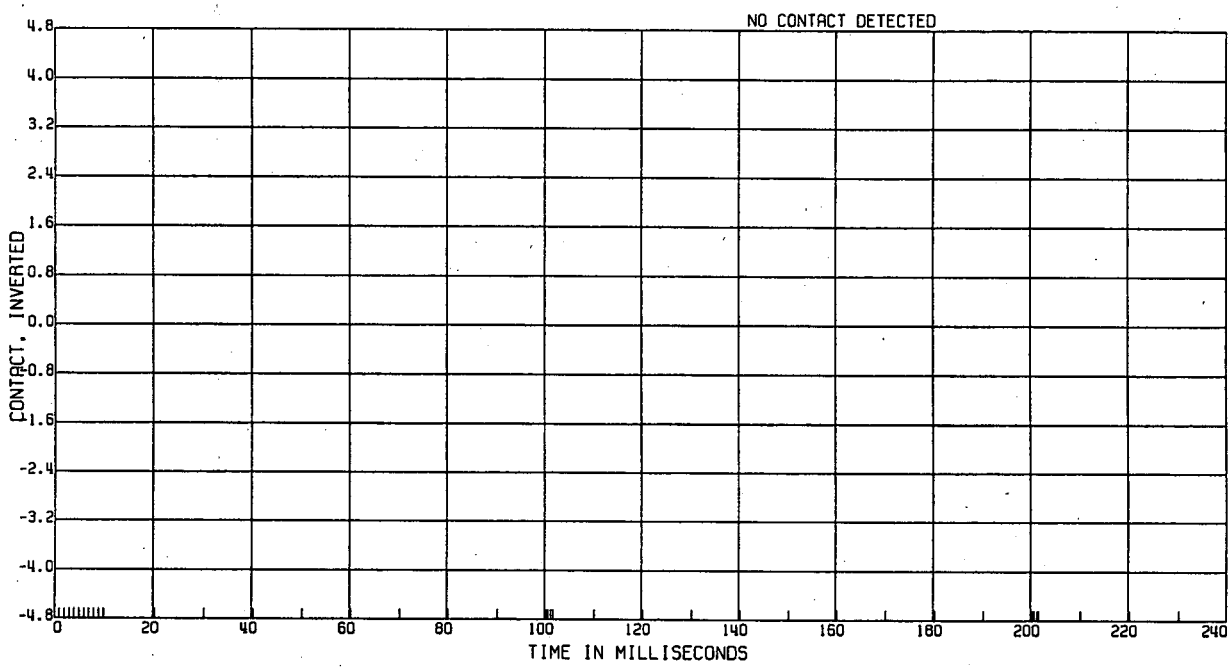
ELEC DATA, SAE CLASS 1000



Appendix G, plot # **52**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

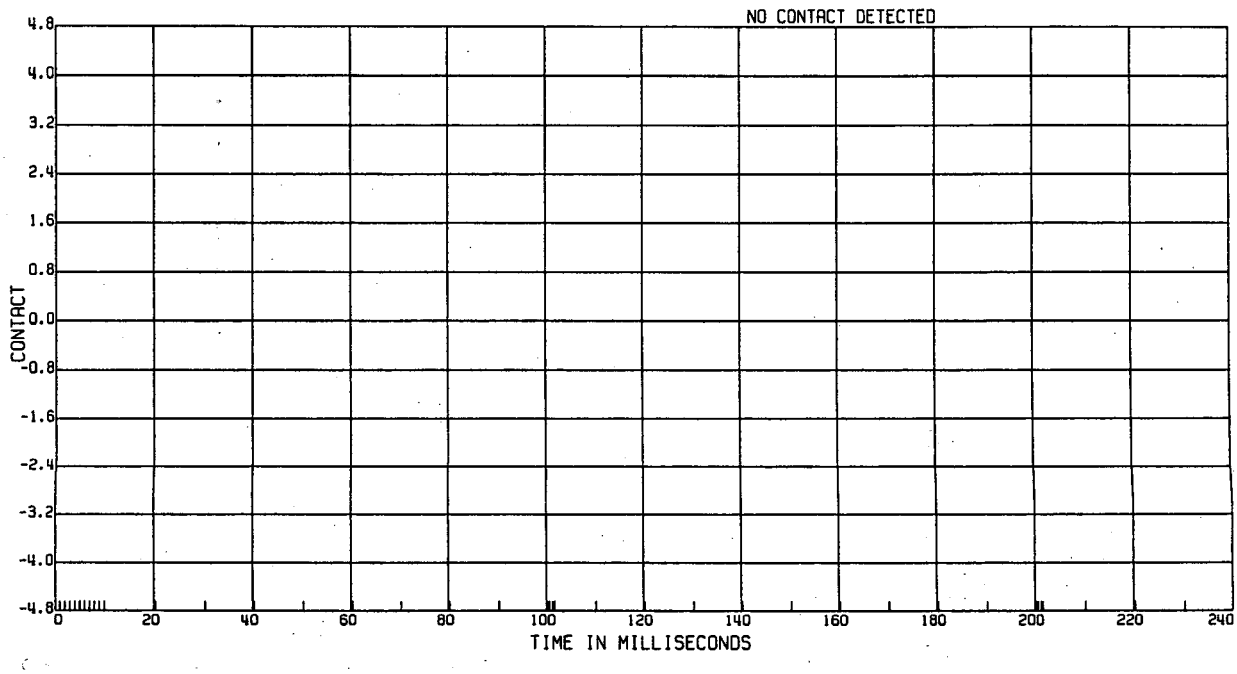
R & D CTR 8V9141D 4 DOOR PNEUMATIC WIRE FAULT-XMBR CONTACT TEST DATE:12/17/1997
ELEC DATA, SAE CLASS 1000



Appendix G, plot # **53**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR PNEUMATIC WIRE-XMBR CONTACT TEST DATE:12/17/1997
ELEC DATA, SAE CLASS 1000

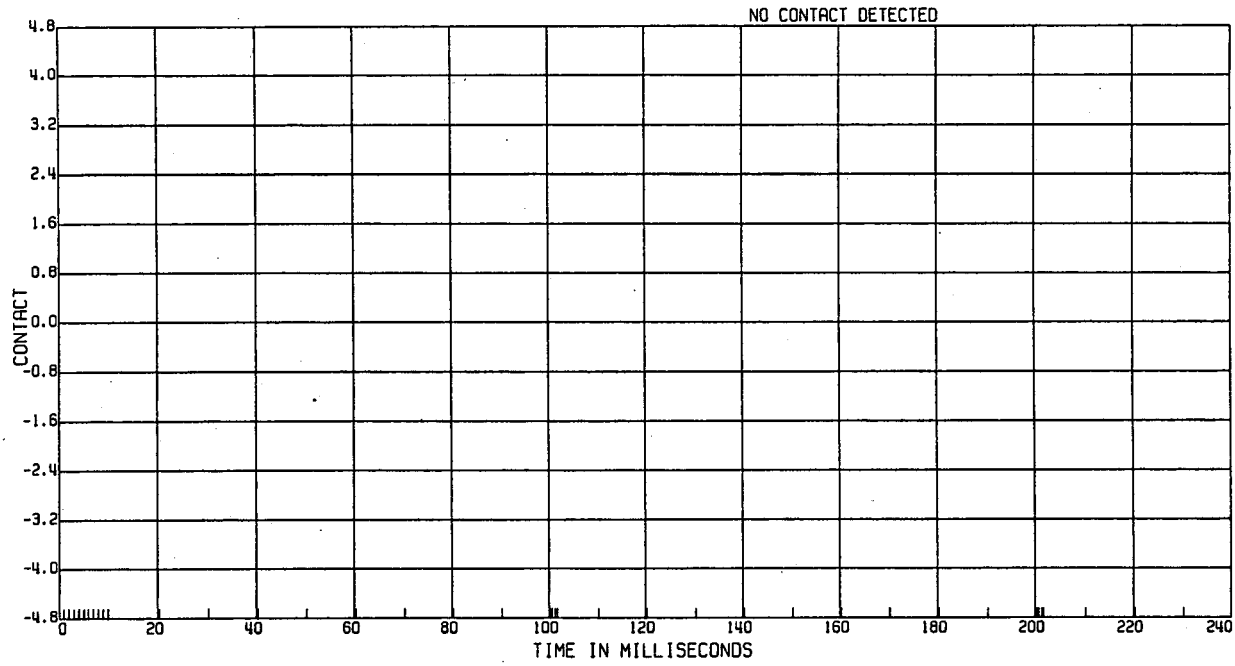


Appendix G, plot # **54**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR THERMAL WIRE-XMBR CONTACT TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

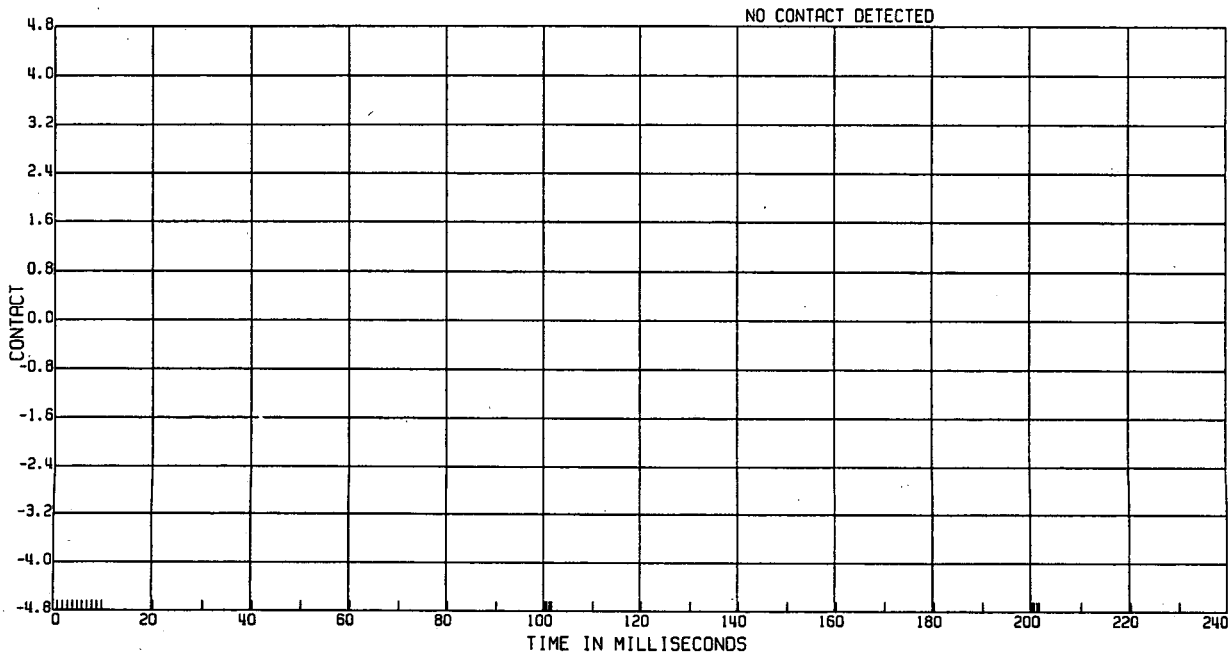


Appendix G, plot # **55**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR THERMAL WIRE-DIFFERENTIAL CONTACT TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

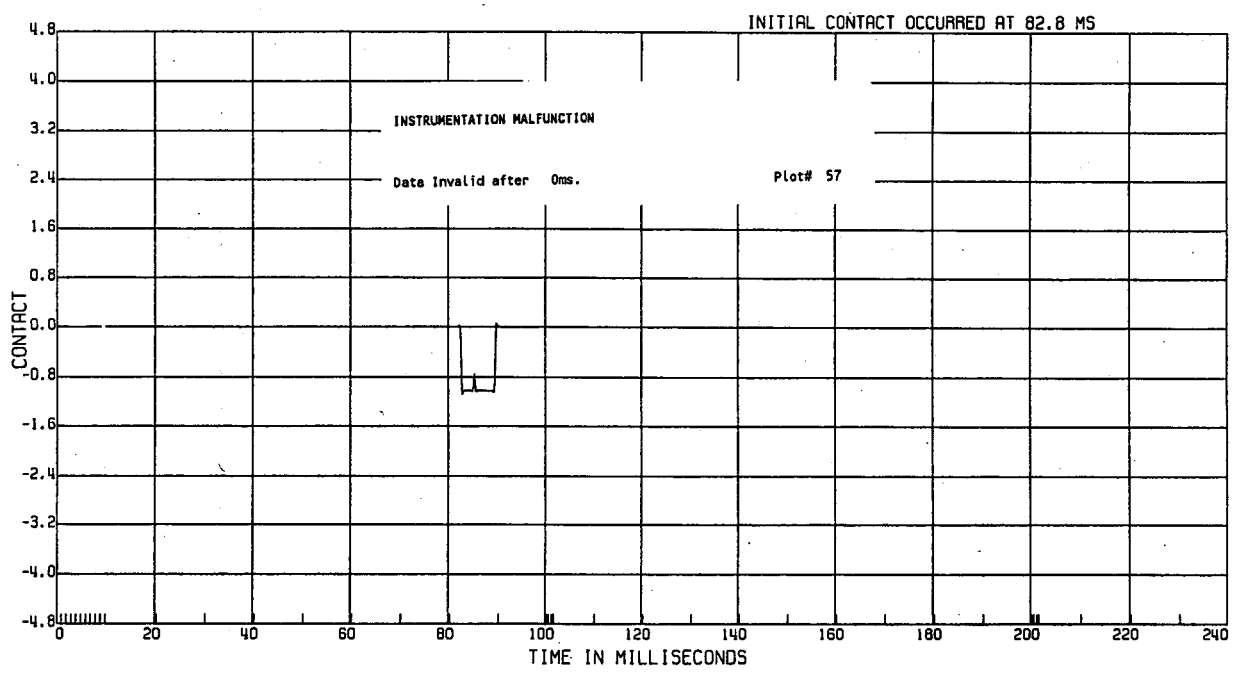


Appendix G, plot # **56**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR MECHANICAL FUEL SWITCH CONTACT TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

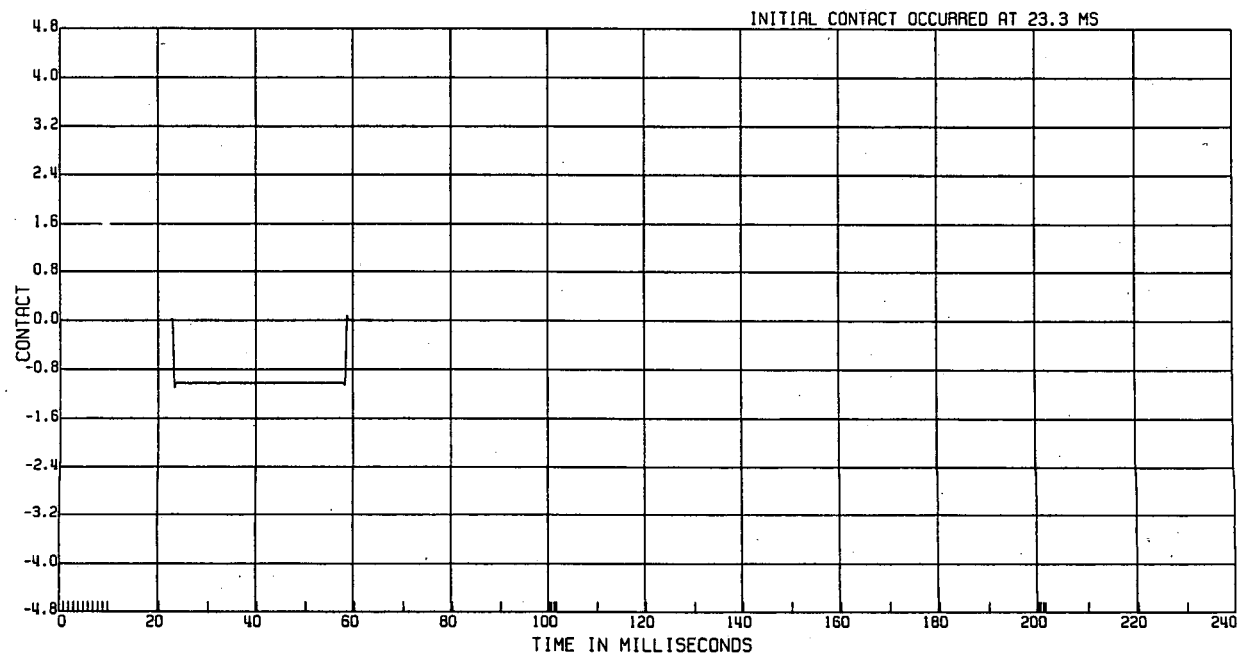


Appendix G, plot # **57**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V9141D 4 DOOR CTR SPARE TIRE TO DIFFERENTIAL CONTACT TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

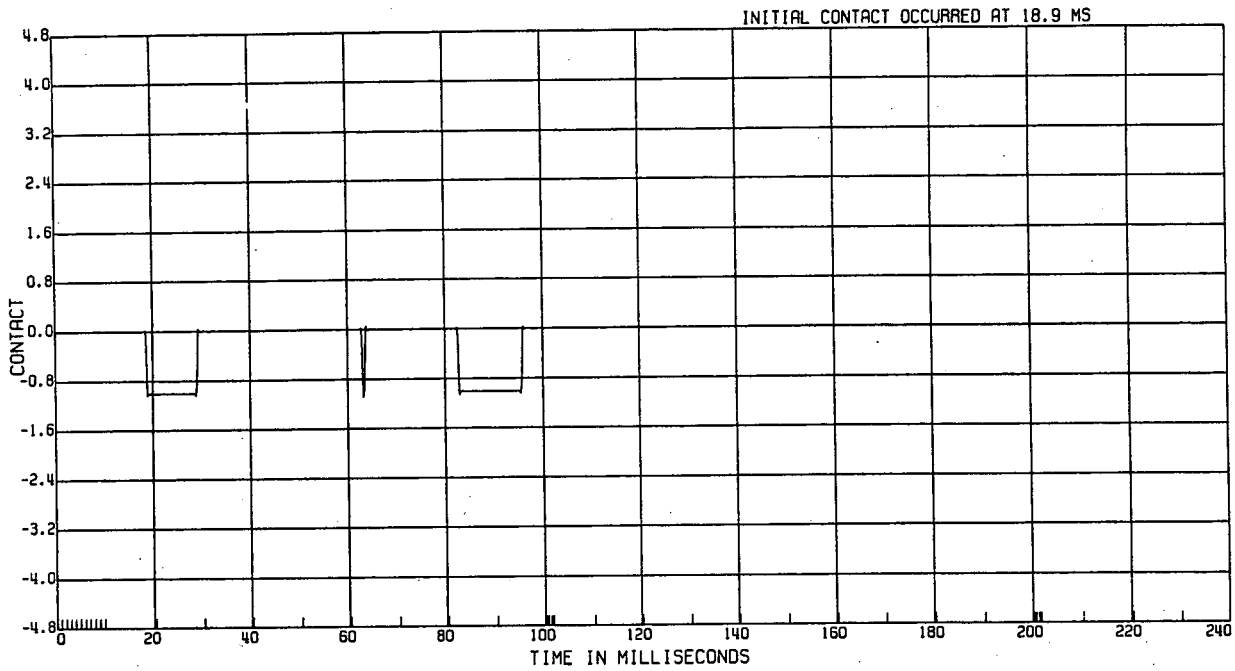


Appendix G, plot # **58**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR CTR SPARE TIRE TO DEFLECTOR CONTACT TEST DATE:12/17/1997

ELEC DATA, SAE CLASS 1000

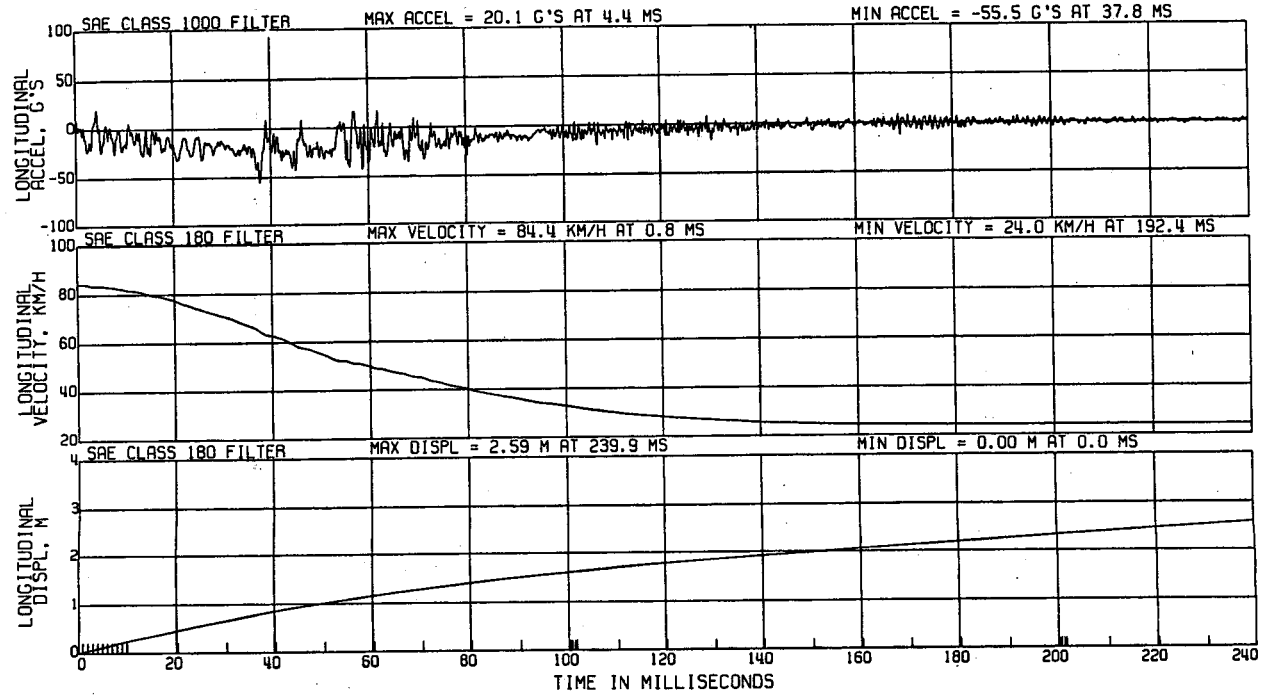


Appendix G, plot # **59**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR LTV MDB AT C.G. TEST DATE:12/17/1997

ELEC DATA



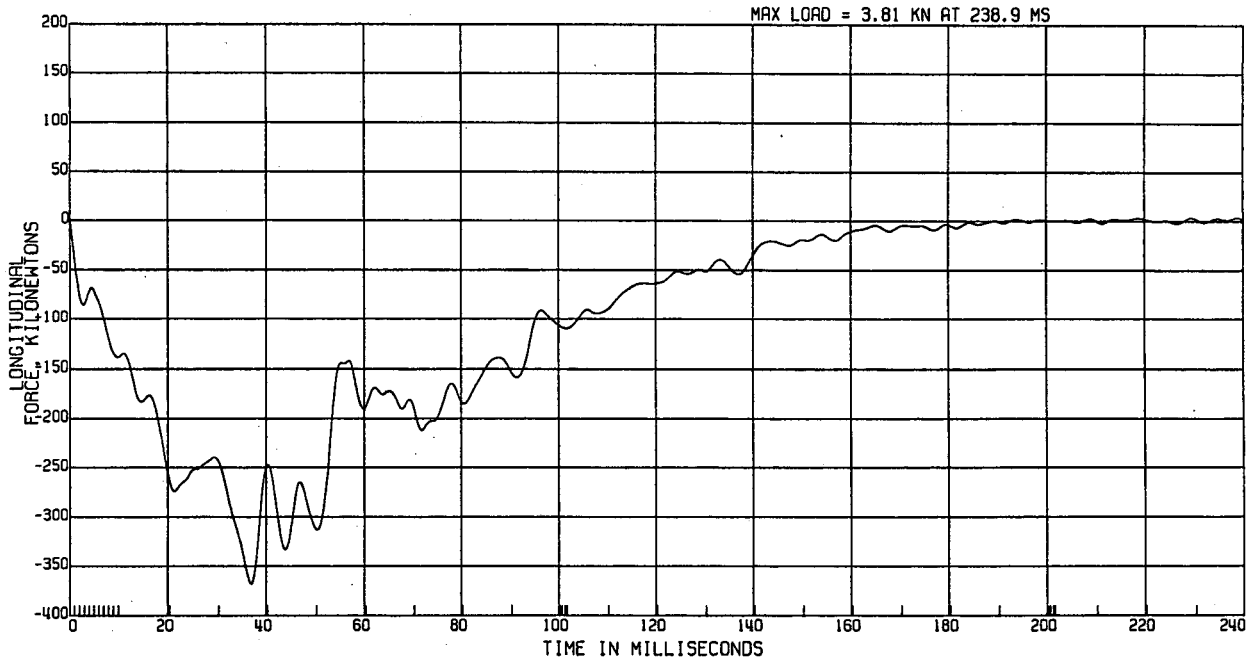
Appendix G, plot # **60**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR
ELEC DATA, SAE CLASS 60

LTV MDB LONG. FORCE AT C.G.
(1370.0 KG) (9.807) (LONG.ACCEL)

TEST DATE:12/17/1997



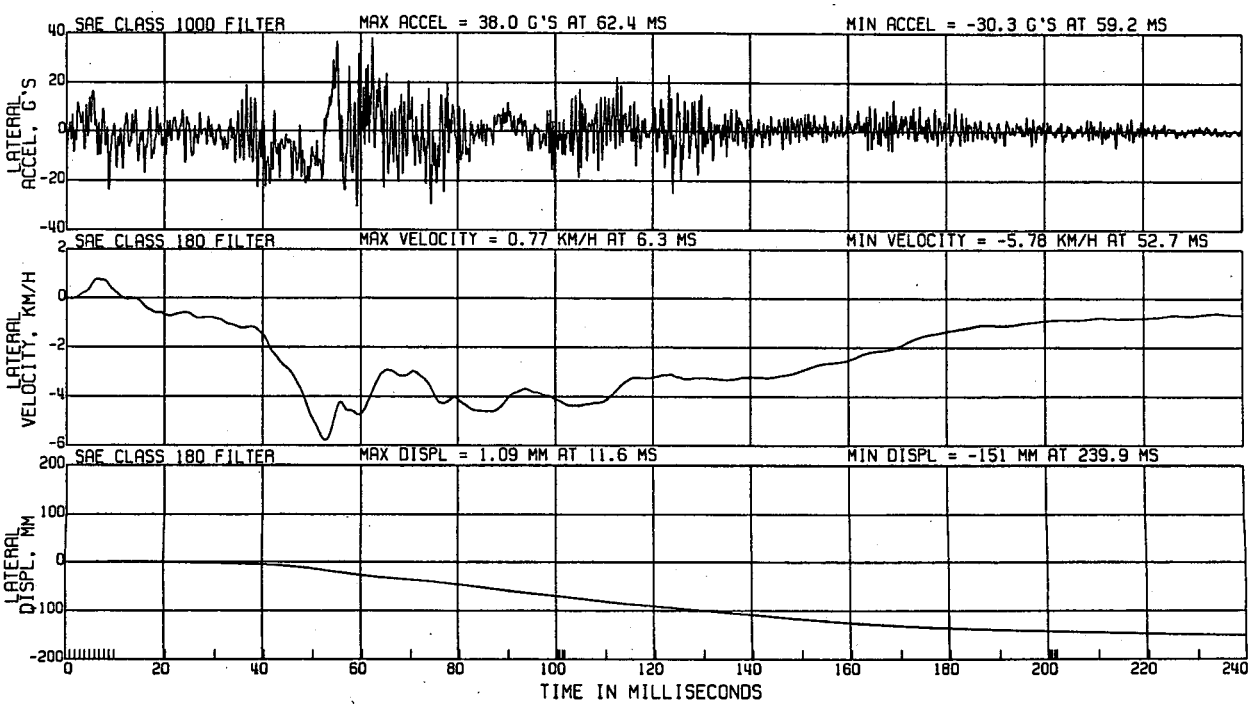
Appendix G, plot # **61**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR
ELEC DATA

LTV MDB AT C.G.

TEST DATE:12/17/1997

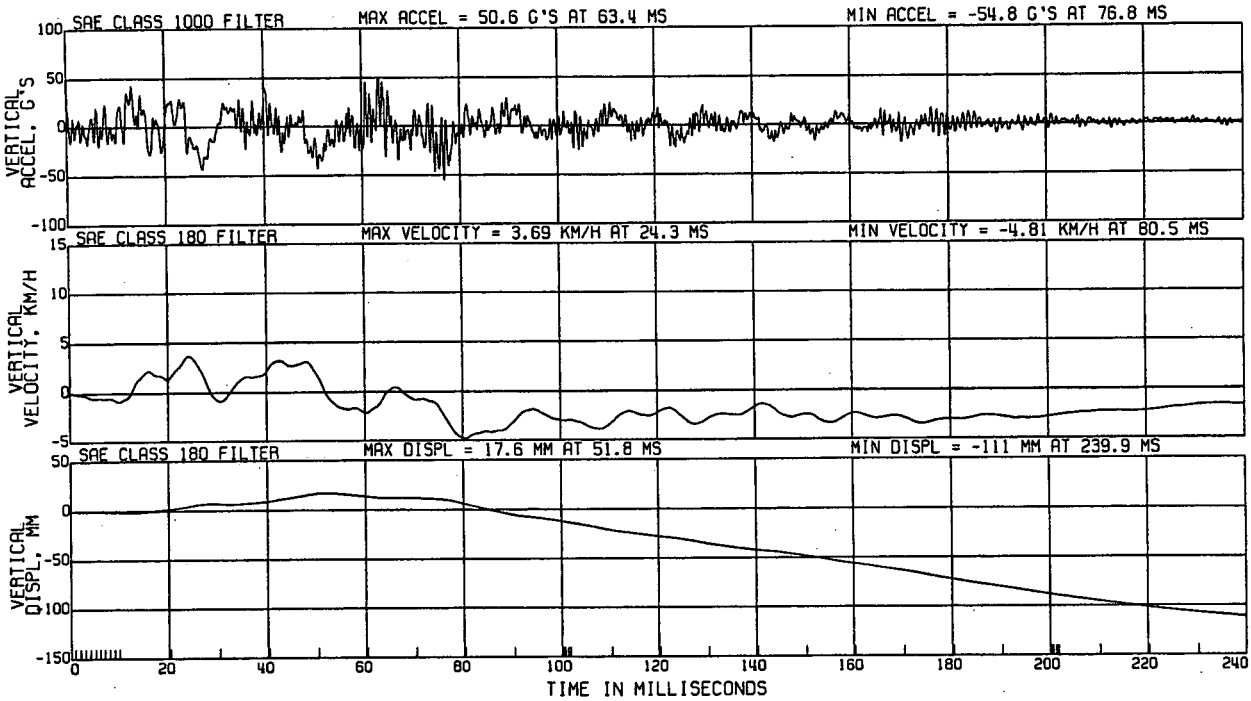


Appendix G, plot # **62**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR LTV MDB AT C.G. TEST DATE:12/17/1997

ELEC DATA

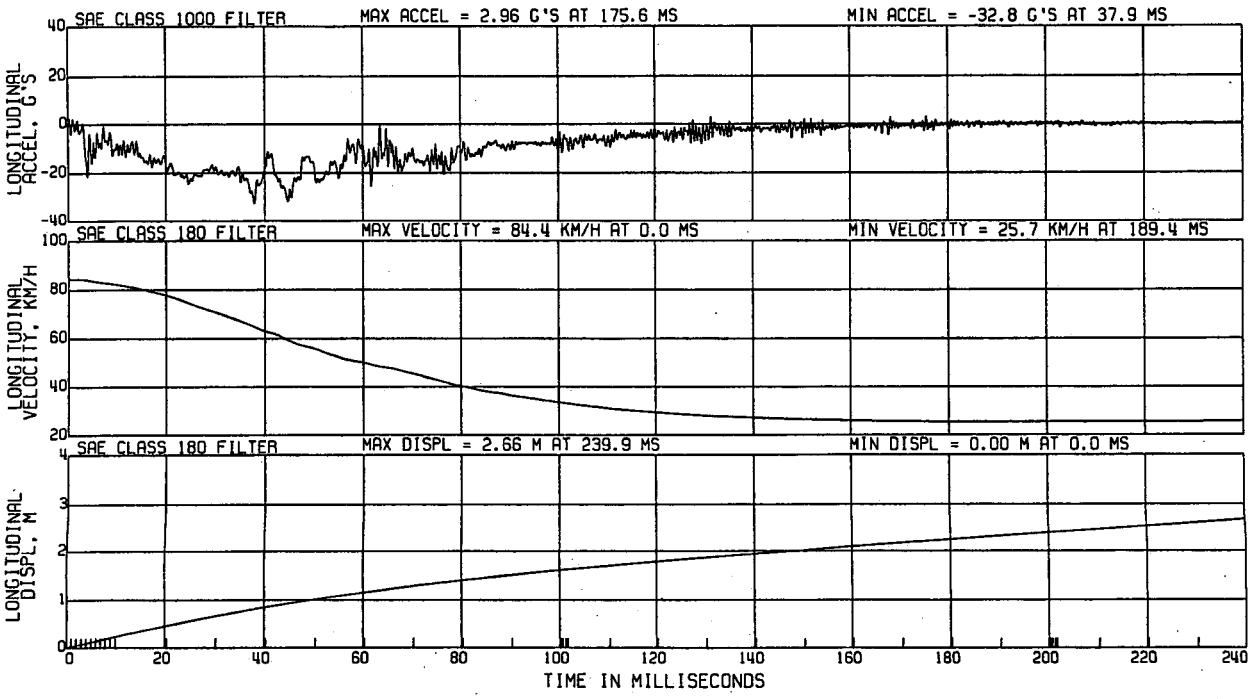


Appendix G, plot # **63**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR LTV MDB AT REAR C/MBR TEST DATE:12/17/1997

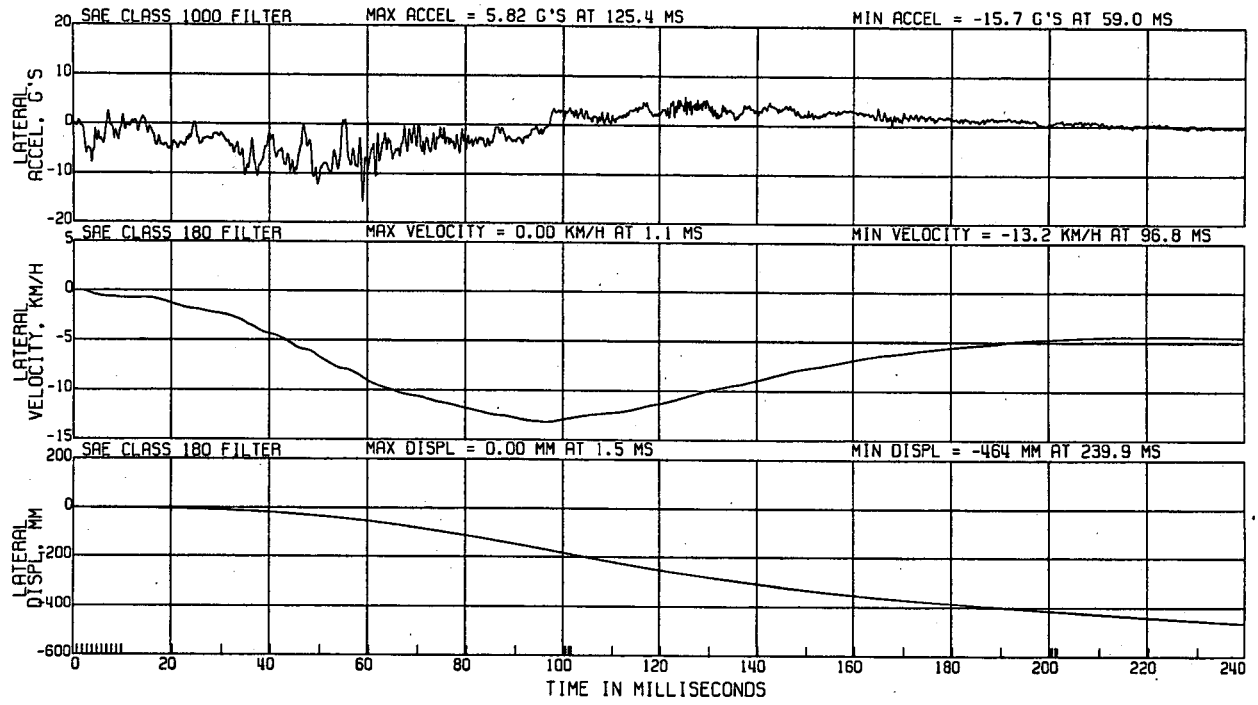
ELEC DATA



Appendix G, plot # **64**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

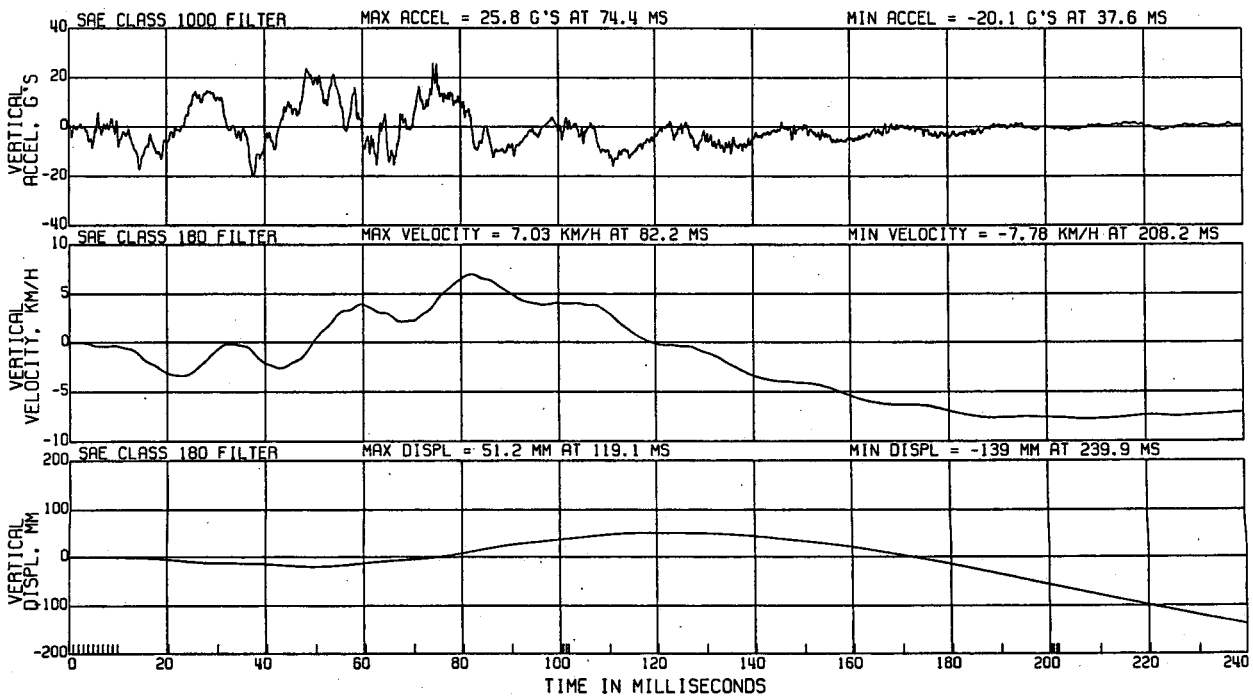
R & D CTR 8V91141D 4 DOOR LTV MDB AT REAR C/MBR TEST DATE:12/17/1997
ELEC DATA



Appendix G, plot # **65**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91141D 4 DOOR LTV MDB AT REAR C/MBR TEST DATE:12/17/1997
ELEC DATA



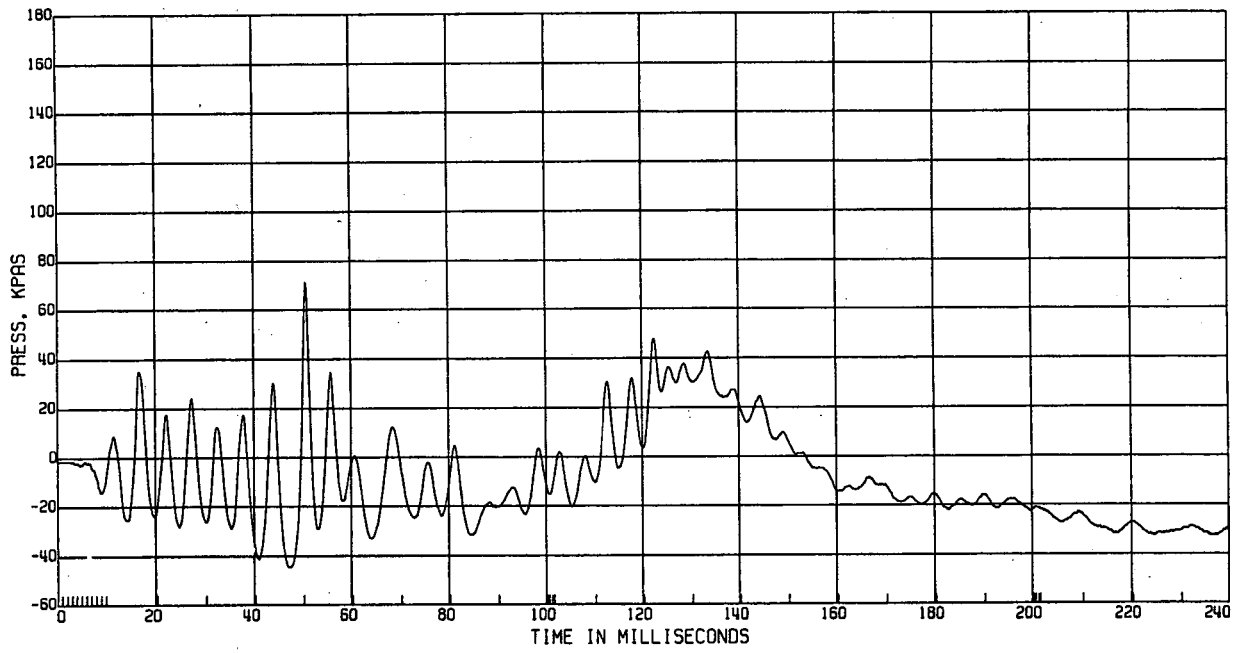
Appendix G, plot # **66**

C11317 L.REAR IMP 70% OVERLAP LTV MDB TO STATIONARY VEHICLE 84.4KM/H

R & D CTR 8V91410 4 DOOR
ELEC DATA, SAE CLASS 1000

RETURN FUEL LINE PRESSURE

TEST DATE:12/17/1997



Appendix G, plot # **67**

APPENDIX H

Appendix H: Instrumentation Summaries

Standard ISF Printout

Test Number : C11687
Test Type : LTV MDB TO STAT. VEH-2
Division :
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	E01	CY54.1	200	N	G	L. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0031
4	E02	DA54.1	200	N	G	L. FRT	HEAD	LATERAL	ACCEL,G'S	0041
5	E03	DB32.1	200	N	G	L. FRT	HEAD	VERTICAL	ACCEL,G'S	0051
6	E04	AA74.1	200	R	G	L. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0062
7	E05	AA75.1	200	N	G	L. FRT	CHEST	LATERAL	ACCEL,G'S	0071
8	E06	AA76.1	200	R	G	L. FRT	CHEST	VERTICAL	ACCEL,G'S	0082
9	E07	CC62.1	400	N	G	L. FRT	PELVIC	LONGITUDINAL	ACCEL,G'S	0091
10	E08	CD27.1	400	N	G	L. FRT	PELVIC	LATERAL	ACCEL,G'S	0101
11	E09	CB41.1	400	N	G	L. FRT	PELVIC	VERTICAL	ACCEL,G'S	0111
12	E20	P24L.1	14000	N	N	L. FRT	FEMUR	LEFT	LOAD,N'S	0121
13	E21	P24R.1	14000	N	N	L. FRT	FEMUR	RIGHT	LOAD,N'S	0131
14	E22	P24D.1	80	N	MM	L. FRT	CHEST	LONGITUDINAL	DISPL,MM'S	0141
15	E10	P24N.1	6000	N	N	L. FRT	NECK	UAP SHEAR	LOAD,N'S	0151
16	E11	P24N.2	6000	N	N	L. FRT	NECK	URL SHEAR	LOAD,N'S	0161
17	E12	P24N.3	6000	N	N	L. FRT	NECK	UPPER AXIAL	LOAD,N'S	0171
18	E13	P24N.4	400	N	N-M	L. FRT	NECK	URL MOMENT	MOMENT,NM'S	0181
19	E14	P24N.5	400	N	N-M	L. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0191
20	E15	P24N.6	400	N	N-M	L. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0201
21	E23	P24TUL.1	400	N	N-M	L. FRT	LEFT TIBIA	URL MOMENT	MOMENT,NM'S	0211
22	E24	P24TUL.2	400	N	N-M	L. FRT	LEFT TIBIA	UAP MOMENT	MOMENT,NM'S	0221
23	E25	P24TLL.1	400	N	N-M	L. FRT	LEFT TIBIA	LAP MOMENT	MOMENT,NM'S	0231
24	E26	P24TLL.2	10000	N	N	L. FRT	LEFT TIBIA	LAP SHEAR	LOAD,N'S	0241
25	E27	P24TUL.3	8000	N	N	L. FRT	LEFT TIBIA	LOWER AXIAL	LOAD,N'S	0251
26	E16	P24KNL.1	7000	N	N	L. FRT	LEFT KNEE	L. CLEVIS	LOAD,N'S	0261
27	E17	P24KNL.2	7000	N	N	L. FRT	LEFT KNEE	R. CLEVIS	LOAD,N'S	0271
28	E28	P24TUR.1	400	N	N-M	L. FRT	RIGHT TIBIA	URL MOMENT	MOMENT,NM'S	0281
29	E29	P24TUR.2	400	N	N-M	L. FRT	RIGHT TIBIA	UAP MOMENT	MOMENT,NM'S	0291
30	E30	P24TLR.1	400	N	N-M	L. FRT	RIGHT TIBIA	LAP MOMENT	MOMENT,NM'S	0301
31	E31	P24TLR.2	10000	N	N	L. FRT	RIGHT TIBIA	LAP SHEAR	LOAD,N'S	0311
32	E32	P24TUR.3	8000	N	N	L. FRT	RIGHT TIBIA	LOWER AXIAL	LOAD,N'S	0321

Date: 08-20-1998 Time: 14:58:06

Test Number : C11687
Test Type : LTV MDB TO STAT. VEH-2
Division : 105 KMH
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	E18	P24KNR.1	7000	N	N	L. FRT	RIGHT KNEE	L. CLEVIS	LOAD,N'S	0331
34	E19	P24KNR.2	7000	N	N	L. FRT	RIGHT KNEE	R. CLEVIS	LOAD,N'S	0341
35	B01	P24TFL.1	24	N	MM	L. FRT	TIBIA/FEMUR LEFT		DISPL,MM'S	0351
36	B02	P24TFR.1	24	N	MM	L. FRT	TIBIA/FEMUR RIGHT		DISP,MM'S	0361
37	F01	CM07.1	200	N	G	R. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0371
38	F02	NODATA.1	1	N	V	R. FRT	INSTRUMENTATION MALFUNCTION 07-30-97	LATERAL	ACCEL,G'S	0381
39	F03	CR45.1	200	N	G	R. FRT	HEAD	VERTICAL	ACCEL,G'S	0391
40	F04	AA23.1	200	R	G	R. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0402
41	F05	AA34.1	200	N	G	R. FRT	CHEST	LATERAL	ACCEL,G'S	0411
42	F06	AA63.1	200	R	G	R. FRT	CHEST	VERTICAL	ACCEL,G'S	0422
43	F07	CF70.1	400	N	G	R. FRT	PELVIC	LONGITUDINAL	ACCEL,G'S	0431
44	F08	CE63.1	400	N	G	R. FRT	PELVIC	LATERAL	ACCEL,G'S	0441
45	F09	CE38.1	400	N	G	R. FRT	PELVIC	VERTICAL	ACCEL,G'S	0451
46	F20	P09L.1	14000	N	N	R. FRT	FEMUR	LEFT	LOAD,N'S	0461
47	F21	P09R.1	14000	N	N	R. FRT	FEMUR	RIGHT	LOAD,N'S	0471
48	F22	P09D.1	80	N	MM	R. FRT	CHEST	LONGITUDINAL	DISPL,MM'S	0481
49	F10	P09N.1	6000	N	N	R. FRT	NECK	UAP SHEAR	LOAD,N'S	0491
50	F11	P09N.2	6000	N	N	R. FRT	NECK	URL SHEAR	LOAD,N'S	0501
51	F12	P09N.3	6000	N	N	R. FRT	NECK	UPPER AXIAL	LOAD,N'S	0511
52	F13	P09N.4	400	N	N-M	R. FRT	NECK	URL MOMENT	MOMENT,NM'S	0521
53	F14	P09N.5	400	N	N-M	R. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0531
54	F15	P09N.6	400	N	N-M	R. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0541
55	F23	P09TUL.1	395	N	N-M	R. FRT	LEFT TIBIA	URL MOMENT	MOMENT,NM'S	0551
56	F24	P09TUL.2	395	N	N-M	R. FRT	LEFT TIBIA	UAP MOMENT	MOMENT,NM'S	0561
57	F25	P09TLL.1	395	N	N-M	R. FRT	LEFT TIBIA	LAP MOMENT	MOMENT,NM'S	0571
58	F26	P09TLL.2	10000	N	N	R. FRT	LEFT TIBIA	LAP SHEAR	LOAD,N'S	0581
59	F27	P09TLL.3	8000	N	N	R. FRT	LEFT TIBIA	LOWER AXIAL	LOAD,N'S	0591
60	F16	P09KNL.1	7000	N	N	R. FRT	LEFT KNEE	L. CLEVIS	LOAD,N'S	0601
61	F17	P09KNL.2	7000	N	N	R. FRT	LEFT KNEE	R. CLEVIS	LOAD,N'S	0611
62	F28	P09TUR.1	395	N	N-M	R. FRT	RIGHT TIBIA	URL MOMENT	MOMENT,NM'S	0621
63	F29	P09TUR.2	395	N	N-M	R. FRT	RIGHT TIBIA	UAP MOMENT	MOMENT,NM'S	0631
64	F30	P09TLR.1	395	N	N-M	R. FRT	RIGHT TIBIA	LAP MOMENT	MOMENT,NM'S	0641

Test Number : C11687
Test Type : LTV MDB TO STAT. VEH-2
Division : 05 KMH
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	F31	P09TLR.2	10000	N	N	R. FRT	RIGHT TIBIA	LAP SHEAR	LOAD,N'S	0651
66	F32	P09TLR.3	8000	N	N	R. FRT	RIGHT TIBIA	LOWER AXIAL	LOAD,N'S	0661
67	F18	P09KNR.1	7000	N	N	R. FRT	RIGHT KNEE	L. CLEVIS	LOAD,N'S	0671
68	F19	P09KNR.2	7000	N	N	R. FRT	RIGHT KNEE	R. CLEVIS	LOAD,N'S	0681
69	B03	P09TFL.1	24	N	MM	R. FRT	TIBIA/FEMUR LEFT		DISP,MM'S	0691
70	B04	P09TFR.1	24	N	MM	R. FRT	TIBIA/FEMUR RIGHT		DISP,MM'S	0701
71	B05	LS141.1	700	N	N-M	L. FRT	LOWER LUMBAR	MY-LAT. AXIS	MOMENT,NM'S	0711
72	B06	LS141.2	10000	N	N	L. FRT	LOWER LUMBAR	FX-FORE/AFT	LOAD,N'S	0721
73	B07	LS141.3	6000	N	N	L. FRT	LOWER LUMBAR	FZ-AXIAL	LOAD,N'S	0731
74	B08	LS163.1	700	N	N-M	R. FRT	LOWER LUMBAR	MY-LAT. AXIS	MOMENT,NM'S	0741
75	B09	LS163.2	10000	N	N	R. FRT	LOWER LUMBAR	FX-FORE/AFT	LOAD,N'S	0751
76	B10	LS163.3	6000	N	N	R. FRT	LOWER LUMBAR	FZ-AXIAL	LOAD,N'S	0761
77	B11	P24TUL.4	10000	N	N	L. FRT	LEFT TIBIA	TUL FX	LOAD,N'S	0771
78	B12	P24TLL.3	10000	N	N	L. FRT	LEFT TIBIA	TLL FY	LOAD,N'S	0781
79	B13	P24TLL.4	395	N	N-M	L. FRT	LEFT TIBIA	TLL MX	MOMENT,NM'S	0791
80	B14	P24TUR.4	10000	N	N	L. FRT	RIGHT TIBIA	TUR FX	LOAD,N'S	0801
81	B15	P24TLR.3	10000	N	N	L. FRT	RIGHT TIBIA	TLR FY	LOAD,N'S	0811
82	B16	P24TLR.4	395	N	N-M	L. FRT	RIGHT TIBIA	TLR MX	MOMENT,NM'S	0821
83	B17	J11526.1	750	R	G	L. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0832
84	B18	J18333.1	750	R	G	L. FRT	ROCKER	LATERAL	ACCEL,G'S	0842
85	B19	ALDA3.1	750	N	G	L. FRT	ROCKER	VERTICAL	ACCEL,G'S	0851
86	B20	J17719.1	750	R	G	R. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0862
87	B21	J17796.1	750	N	G	R. FRT	ROCKER	LATERAL	ACCEL,G'S	0871
88	B22	J17718.1	750	R	G	R. FRT	ROCKER	VERTICAL	ACCEL,G'S	0882
89	B23	J11794.1	750	R	G	L.	FLOORPAN	LONGITUDINAL	ACCEL,G'S	0892
90	B24	J11080.1	750	N	G	R.	FLOORPAN	LONGITUDINAL	ACCEL,G'S	0901
91	B25	J17923.1	750	R	G	L. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0912
92	B26	J17959.1	750	R	G	L. REAR	ROCKER	LATERAL	ACCEL,G'S	0922
93	B27	J17943.1	750	N	G	L. REAR	ROCKER	VERTICAL	ACCEL,G'S	0931
94	B28	J18099.1	750	R	G	R. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0942
95	B29	J17397.1	750	N	G	R. REAR	ROCKER	LATERAL	ACCEL,G'S	0951
96	B30	J18097.1	750	R	G	R. REAR	ROCKER	VERTICAL	ACCEL,G'S	0962

Date: 08-20-1998 Time: 14:58:09

Test Number : C11687
Test Type : LTV MDB TO STAT. VEH-2
Division :
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	B31	SR87.1	400	N	MM	L.	TOE PAN	LONGITUDINAL	DISPL,MM'S	0971
98	C01	VOLTCOND.1	20	N	V		STARTER		VOLTAGE,VOLTS	0981
99	C02	VOLTCOND.1	20	N	V		BATTERY		VOLTAGE,VOLTS	0991
100	C24	VOLTCOND.1	20	N	V		ALTERNATOR		VOLTAGE,VOLTS	1001
101	C04	VOLTCOND.1	20	N	V		FUEL PUMP		VOLTAGE,VOLTS	1011
102	C05	VOLTCOND.1	20	N	V		FUEL PUMP SWITCH		VOLTAGE,VOLTS	1021
103	C06	VOLTCOND.1	20	N	V	L. FRT	HEADLIGHT - LOW BEAM		VOLTAGE,VOLTS	1031
104	C07	VOLTCOND.1	20	N	V	L. FRT	FOG LIGHT		VOLTAGE,VOLTS	1041
105	C08	VOLTCOND.1	20	N	V		IGNITION		VOLTAGE,VOLTS	1051
106	C09	VOLTAGE.1	8	N	V	L.	OPTICAL FIRE DETECTOR		VOLTAGE,VOLTS	1061
107	C25	VOLTAGE.1	8	N	V	R.	OPTICAL FIRE DETECTOR		VOLTAGE,VOLTS	1071
108	C11	VOLTAGE.1	8	N	V		ENG SPEED-(MP1A)		VOLTAGE,VOLTS	1081
109	C12	VOLTAGE.1	5	N	V	L.	EXHAUST VAPOR (S2)		VOLTAGE,VOLTS	1091
110	C13	VOLTAGE.1	5	N	V	L.	EXHAUST TEMP (T2)		VOLTAGE,VOLTS	1101
111	C14	VOLTAGE.1	5	N	V	R. UPR	ENGINE VAPOR (S1)		VOLTAGE,VOLTS	1111
112	C15	VOLTAGE.1	5	N	V	R. UPR	ENGINE TEMP (T1)		VOLTAGE,VOLTS	1121
113	C16	VOLTAGE.1	5	N	V	L. UPR	ENGINE VAPOR (S3)		VOLTAGE,VOLTS	1131
114	C17	VOLTAGE.1	5	N	V	L. UPR	ENGINE TEMP (T3)		VOLTAGE,VOLTS	1141
115	C18	VOLTAGE.1	5	N	V	L. LWR	FUEL LINE VAPOR (S4)		VOLTAGE,VOLTS	1151
116	C19	VOLTAGE.1	5	N	V	L. LWR	FUEL LINE TEMP (T4)		VOLTAGE,VOLTS	1161
117	C20	VOLTAGE.1	5	N	V		CONVERTER VAPOR (S5)		VOLTAGE,VOLTS	1171
118	C21	VOLTAGE.1	5	N	V		CONVERTER TEMP (T5)		VOLTAGE,VOLTS	1181
119	D01	CP183.1	20	N	A		WHEEL BAG		CURRENT,AMPS	1191
120	D02	CP238.1	20	N	A		I/P BAG		CURRENT,AMPS	1201
121	D03	CG101.1	60	N	A		PDB		CURRENT,AMPS	1211
122	D04	CG112.1	60	N	A		STARTER AND B+		CURRENT,AMPS	1221
123	D05	CP200.1	20	N	A		FUEL PUMP		CURRENT,AMPS	1231
124	D06	CP236.1	20	N	A		A/C CLUTCH		CURRENT,AMPS	1241
125	D07	CP199.1	20	N	A		ALTERNATOR CABLE #1		CURRENT,AMPS	1251
126	D08	CP198.1	20	N	A		ALTERNATOR CABLE #2		CURRENT,AMPS	1261
127	D09	CP106.1	20	N	A		HVAC BLOWER		CURRENT,AMPS	1271
128	D10	CP195.1	20	N	A		HEADL/FOG LIGHT		CURRENT,AMPS	1281

Test Number : C11687
Test Type : LTV MDB TO STAT. VEH-2
Division : KMH
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	D11	CG105.1	60	N	A		IGNITION		CURRENT,AMPS	1291
130	D12	APKC9.1	14000	N	KPA	FRT	BRAKE SYSTEM		PRESSURE,KPA'S	1301
131	D26	10009.1	1200	N	KPA		FUEL SUPPLY LINE		PRESSURE,KPA'S	1311
132	D14	10168-2.1	8000	N	KPA		POWER STEERING		PRESSURE,KPA'S	1321
133	D15	AM1C4.1	250	N	KPA		ENG COOLANT SYSTEM		PRESSURE,KPA'S	1331
134	D16	AM6F0.1	1000	N	KPA		ENGINE OIL		PRESSURE,KPA'S	1341
135	D17	10069-2.1	1500	N	KPA		TRANSMISSION COOLER		PRESSURE,KPA'S	1351
136	D18	CONTACT.1	8	N	V		THERMAL WIRE		CONTACT,N/O	1361
137	D27	CONTACT.1	8	N	V		PNEUMATIC WIRE		CONTACT,N/O	1371
138	D20	CONTACT.1	8	N	V		PNEUMATIC WIRE FAULT		CONTACT,N/C	1381
139	D21	RG101.1	1000	N	DEG/SEC	CTR	RATE GYROSCOPE		DEG/SEC	1391
140	A01	A98C.1	250	N	G		LTV MDB AT C.G.	LONGITUDINAL	ACCEL,G'S	1401
141	A02	AN3P2.1	250	R	G		LTV MDB AT C.G.	LATERAL	ACCEL,G'S	1412
142	A03	A58A.1	250	N	G		LTV MDB AT C.G.	VERTICAL	ACCEL,G'S	1421
143	A04	J12804.1	250	N	G		LTV MDB AT REAR C/MBR	LONGITUDINAL	ACCEL,G'S	1431
144	A05	J12812.1	250	R	G		LTV MDB AT REAR C/MBR	LATERAL	ACCEL,G'S	1442
145	A06	J12759.1	250	N	G		LTV MDB AT REAR C/MBR	VERTICAL	ACCEL,G'S	1451

Standard ISF Printout

Test Number : C11793
Test Type : CENTER HIGH POLE
Division :
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	CJ50.1	200	N	G	L. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0031
4	D02	DA19.1	200	N	G	L. FRT	HEAD	LATERAL	ACCEL,G'S	0041
5	D03	CM80.1	200	N	G	L. FRT	HEAD	VERTICAL	ACCEL,G'S	0051
6	D04	CB16.1	200	R	G	L. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0062
7	D05	CB17.1	200	N	G	L. FRT	CHEST	LATERAL	ACCEL,G'S	0071
8	D06	CB18.1	200	R	G	L. FRT	CHEST	VERTICAL	ACCEL,G'S	0082
9	D07	CF92.1	400	N	G	L. FRT	PELVIC	LONGITUDINAL	ACCEL,G'S	0091
10	D08	CE31.1	400	N	G	L. FRT	PELVIC	LATERAL	ACCEL,G'S	0101
11	D09	CE10.1	400	N	G	L. FRT	PELVIC	VERTICAL	ACCEL,G'S	0111
12	D20	P04L.1	14000	N	N	L. FRT	FEMUR	LEFT	LOAD,N'S	0121
13	D21	P04R.1	14000	N	N	L. FRT	FEMUR	RIGHT	LOAD,N'S	0131
14	D22	P04D.1	80	N	MM	L. FRT	CHEST	LONGITUDINAL	DISPL,MM'S	0141
15	D10	P04N.1	6000	N	N	L. FRT	NECK	UAP SHEAR	LOAD,N'S	0151
16	D11	P04N.2	6000	N	N	L. FRT	NECK	URL SHEAR	LOAD,N'S	0161
17	D12	P04N.3	6000	N	N	L. FRT	NECK	UPPER AXIAL	LOAD,N'S	0171
18	D13	P04N.4	400	N	N-M	L. FRT	NECK	URL MOMENT	MOMENT,NM'S	0181
19	D14	P04N.5	400	N	N-M	L. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0191
20	D15	P04N.6	400	N	N-M	L. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0201
21	D23	P04TUL.1	400	N	N-M	L. FRT	LEFT TIBIA	URL MOMENT	MOMENT,NM'S	0211
22	D24	P04TUL.2	400	N	N-M	L. FRT	LEFT TIBIA	UAP MOMENT	MOMENT,NM'S	0221
23	D25	P04TLL.1	400	N	N-M	L. FRT	LEFT TIBIA	LAP MOMENT	MOMENT,NM'S	0231
24	D26	P04TLL.2	10000	N	N	L. FRT	LEFT TIBIA	LAP SHEAR	LOAD,N'S	0241
25	D27	P04TLL.3	8000	N	N	L. FRT	LEFT TIBIA	LOWER AXIAL	LOAD,N'S	0251
26	D16	P04KNL.1	7000	N	N	L. FRT	LEFT KNEE	L. CLEVIS	LOAD,N'S	0261
27	D17	P04KNL.2	7000	N	N	L. FRT	LEFT KNEE	R. CLEVIS	LOAD,N'S	0271
28	D28	P04TUR.1	400	N	N-M	L. FRT	RIGHT TIBIA	URL MOMENT	MOMENT,NM'S	0281
29	D29	P04TUR.2	400	N	N-M	L. FRT	RIGHT TIBIA	UAP MOMENT	MOMENT,NM'S	0291
30	D30	P04TLR.1	400	N	N-M	L. FRT	RIGHT TIBIA	LAP MOMENT	MOMENT,NM'S	0301
31	D31	P04TLR.2	10000	N	N	L. FRT	RIGHT TIBIA	LAP SHEAR	LOAD,N'S	0311
32	D32	P04TLR.3	8000	N	N	L. FRT	RIGHT TIBIA	LOWER AXIAL	LOAD,N'S	0321

Date: 11-13-1997 Time: 08:49:06

Standard ISF Printout

Test Number : C11793
Test Type : CENTER HIGH POLE
Division :
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	PO4KNR.1	7000	N	N	L. FRT	RIGHT KNEE	L. CLEVIS	LOAD,N'S	0331
34	D19	PO4KNR.2	7000	N	N	L. FRT	RIGHT KNEE	R. CLEVIS	LOAD,N'S	0341
35	A01	PO4STL.1	24	N	MM	L. FRT	TIBIA/FEMUR LEFT		DISPL,MM'S	0351
36	A02	PO4STR.1	24	N	MM	L. FRT	TIBIA/FEMUR RIGHT		DISP,MM'S	0361
37	E01	CY54.1	200	N	G	R. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0371
38	E02	DA54.1	200	N	G	R. FRT	HEAD	LATERAL	ACCEL,G'S	0381
39	E03	DB32.1	200	N	G	R. FRT	HEAD	VERTICAL	ACCEL,G'S	0391
40	E04	AA74.1	200	R	G	R. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0402
41	E05	AA75.1	200	N	G	R. FRT	CHEST	LATERAL	ACCEL,G'S	0411
42	E06	AA76.1	200	R	G	R. FRT	CHEST	VERTICAL	ACCEL,G'S	0422
43	E07	CC62.1	400	N	G	R. FRT	PELVIC	LONGITUDINAL	ACCEL,G'S	0431
44	E08	CD27.1	400	N	G	R. FRT	PELVIC	LATERAL	ACCEL,G'S	0441
45	E09	CB41.1	400	N	G	R. FRT	PELVIC	VERTICAL	ACCEL,G'S	0451
46	E20	P24L.1	14000	N	N	R. FRT	FEMUR	LEFT	LOAD,N'S	0461
47	E21	P24R.1	14000	N	N	R. FRT	FEMUR	RIGHT	LOAD,N'S	0471
48	E22	P24D.1	80	N	MM	R. FRT	CHEST	LONGITUDINAL	DISPL,MM'S	0481
49	E10	P24N.1	6000	N	N	R. FRT	NECK	UAP SHEAR	LOAD,N'S	0491
50	E11	P24N.2	6000	N	N	R. FRT	NECK	URL SHEAR	LOAD,N'S	0501
51	E12	P24N.3	6000	N	N	R. FRT	NECK	UPPER AXIAL	LOAD,N'S	0511
52	E13	P24N.4	400	N	N-M	R. FRT	NECK	URL MOMENT	MOMENT,NM'S	0521
53	E14	P24N.5	400	N	N-M	R. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0531
54	E15	P24N.6	400	N	N-M	R. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0541
55	E23	P24TUL.1	400	N	N-M	R. FRT	LEFT TIBIA	URL MOMENT	MOMENT,NM'S	0551
56	E24	P24TUL.2	400	N	N-M	R. FRT	LEFT TIBIA	UAP MOMENT	MOMENT,NM'S	0561
57	E25	P24TLL.1	400	N	N-M	R. FRT	LEFT TIBIA	LAP MOMENT	MOMENT,NM'S	0571
58	E26	P24TLL.2	10000	N	N	R. FRT	LEFT TIBIA	LAP SHEAR	LOAD,N'S	0581
59	E27	P24TUL.3	8000	N	N	R. FRT	LEFT TIBIA	LOWER AXIAL	LOAD,N'S	0591
60	E16	P24KNL.1	7000	N	N	R. FRT	LEFT KNEE	L. CLEVIS	LOAD,N'S	0601
61	E17	P24KNL.2	7000	N	N	R. FRT	LEFT KNEE	R. CLEVIS	LOAD,N'S	0611
62	E28	P24TUR.1	400	N	N-M	R. FRT	RIGHT TIBIA	URL MOMENT	MOMENT,NM'S	0621
63	E29	P24TUR.2	400	N	N-M	R. FRT	RIGHT TIBIA	UAP MOMENT	MOMENT,NM'S	0631
64	E30	P24TLR.1	400	N	N-M	R. FRT	RIGHT TIBIA	LAP MOMENT	MOMENT,NM'S	0641

Date: 11-13-1997 Time: 08:49:11

Test Number : C11793
Test Type : CENTER HIGH POLE
Division :
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	E31	P24TLR.2	10000	N	N	R. FRT	RIGHT TIBIA	LAP SHEAR	LOAD,N'S	0651
66	E32	P24TUR.3	8000	N	N	R. FRT	RIGHT TIBIA	LOWER AXIAL	LOAD,N'S	0661
67	E18	P24KNR.1	7000	N	N	R. FRT	RIGHT KNEE	L. CLEVIS	LOAD,N'S	0671
68	E19	P24KNR.2	7000	N	N	R. FRT	RIGHT KNEE	R. CLEVIS	LOAD,N'S	0681
69	A03	P24TFL.1	24	N	MM	R. FRT	TIBIA/FEMUR LEFT		DISP,MM'S	0691
70	A04	P24TFR.1	24	N	MM	R. FRT	TIBIA/FEMUR RIGHT		DISP,MM'S	0701
71	A05	P04LS.1	700	N	N-M	L. FRT	LOWER LUMBAR	MY-LAT. AXIS	MOMENT,NM'S	0711
72	A06	P04LS.2	10000	N	N	L. FRT	LOWER LUMBAR	FX-FORE/AFT	LOAD,N'S	0721
73	A07	P04LS.3	6000	N	N	L. FRT	LOWER LUMBAR	FZ-AXIAL	LOAD,N'S	0731
74	A08	LS141.1	700	N	N-M	R. FRT	LOWER LUMBAR	MY-LAT. AXIS	MOMENT,NM'S	0741
75	A09	LS141.2	10000	N	N	R. FRT	LOWER LUMBAR	FX-FORE/AFT	LOAD,N'S	0751
76	A10	LS141.3	6000	N	N	R. FRT	LOWER LUMBAR	FZ-AXIAL	LOAD,N'S	0761
77	A11	P24TUL.4	10000	N	N	R. FRT	LEFT TIBIA	TUL FX	LOAD,N'S	0771
78	A12	P24TLL.3	10000	N	N	R. FRT	LEFT TIBIA	TLL FY	LOAD,N'S	0781
79	A13	P24TLL.4	400	N	N-M	R. FRT	LEFT TIBIA	TLL MX	MOMENT,NM'S	0791
80	A14	P24TUR.4	10000	N	N	R. FRT	RIGHT TIBIA	TUR FX	LOAD,N'S	0801
81	A15	P24TLR.3	10000	N	N	R. FRT	RIGHT TIBIA	TLR FY	LOAD,N'S	0811
82	A16	P24TLR.4	400	N	N-M	R. FRT	RIGHT TIBIA	TLR MX	MOMENT,NM'S	0821
83	A17	J12748.1	750	R	G	L. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0832
84	A18	J12841.1	750	R	G	L. FRT	ROCKER	LATERAL	ACCEL,G'S	0842
85	A19	J12749.1	750	N	G	L. FRT	ROCKER	VERTICAL	ACCEL,G'S	0851
86	A20	J14203.1	750	R	G	R. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0862
87	A21	J14202.1	750	N	G	R. FRT	ROCKER	LATERAL	ACCEL,G'S	0871
88	A22	J14201.1	750	N	G	R. FRT	ROCKER	VERTICAL	ACCEL,G'S	0881
89	A23	J12320.1	750	N	G	L.	FLOORPAN	LONGITUDINAL	ACCEL,G'S	0891
90	A24	AM9C8.1	750	N	G	R.	FLOORPAN	LONGITUDINAL	ACCEL,G'S	0901
91	A25	J11013.1	750	R	G	L. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0912
92	A26	J11036.1	750	R	G	L. REAR	ROCKER	LATERAL	ACCEL,G'S	0922
93	A27	J11016.1	750	N	G	L. REAR	ROCKER	VERTICAL	ACCEL,G'S	0931
94	A28	J19735.1	750	R	G	R. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0942
95	A29	J19731.1	750	N	G	R. REAR	ROCKER	LATERAL	ACCEL,G'S	0951
96	A30	J19701.1	750	R	G	R. REAR	ROCKER	VERTICAL	ACCEL,G'S	0962

Date: 11-13-1997 Time: 08:49:14

Test Number : C11793
Test Type : CENTER HIGH POLE
Division :
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	SR14.1	400	N	MM	R.	TOE PAN	LONGITUDINAL	DISPL,MM'S	0971
98	B01	VOLTCOND.1	20	N	V		STARTER		VOLTAGE,VOLTS	0981
99	B02	VOLTCOND.1	20	N	V		BATTERY		VOLTAGE,VOLTS	0991
100	B03	VOLTCOND.1	20	N	V		ALTERNATOR		VOLTAGE,VOLTS	1001
101	B04	VOLTCOND.1	20	N	V		FUEL PUMP		VOLTAGE,VOLTS	1011
102	B05	VOLTCOND.1	20	N	V	R. FRT	HEADLIGHT - LOW BEAM		VOLTAGE,VOLTS	1021
103	B06	VOLTCOND.1	20	N	V	R. FRT	FOG LIGHT		VOLTAGE,VOLTS	1031
104	B07	VOLTCOND.1	20	N	V		IGNITION		VOLTAGE,VOLTS	1041
105	B08	VOLTCOND.1	20	N	V		FUEL INERTIA SWITCH		VOLTAGE,VOLTS	1051
106	B09	VOLTAGE.1	8	N	V	L.	OPTICAL FIRE DETECTOR		VOLTAGE,VOLTS	1061
107	B10	VOLTAGE.1	8	N	V	R.	OPTICAL FIRE DETECTOR		VOLTAGE,VOLTS	1071
108	B11	VOLTAGE.1	8	N	V		ENG SPEED-(MP1A)		VOLTAGE,VOLTS	1081
109	B12	VOLTAGE.1	5	N	V	L.	EXHAUST MANIFOLD (S1)		VOLTAGE,VOLTS	1091
110	B13	VOLTAGE.1	5	N	V	R.	EXHAUST MANIFOLD (S2)		VOLTAGE,VOLTS	1101
111	B14	VOLTAGE.1	5	N	V	LWR	REAR INTAKE MANIFOLD (S3)		VOLTAGE,VOLTS	1111
112	B15	VOLTAGE.1	5	N	V		FUEL PRESSURE REG (S4)		VOLTAGE,VOLTS	1121
113	B16	VOLTAGE.1	5	N	V		CATALYTIC CONVERTER (S5)		VOLTAGE,VOLTS	1131
114	C01	CP206.1	20	N	A		WHEEL BAG		CURRENT,AMPS	1141
115	C02	CP234.1	20	N	A		I/P BAG		CURRENT,AMPS	1151
116	C30	CG201.1	500	N	A		BATTERY		CURRENT,AMPS	1161
117	C04	CG104.1	100	N	A		PDB		CURRENT,AMPS	1171
118	C05	CG202.1	500	N	A		STARTER		CURRENT,AMPS	1181
119	C06	CP195.1	20	N	A		FUEL PUMP		CURRENT,AMPS	1191
120	C07	CP115.1	20	N	A		A/C CLUTCH		CURRENT,AMPS	1201
121	C08	CP141.1	20	N	A		ALTERNATOR CABLE #1		CURRENT,AMPS	1211
122	C31	CP208.1	20	N	A		ALTERNATOR CABLE #2		CURRENT,AMPS	1221
123	C10	CP237.1	20	N	A		HVAC BLOWER		CURRENT,AMPS	1231
124	C11	CP214.1	20	N	A		HEADLIGHT LOW BEAM		CURRENT,AMPS	1241
125	C12	CP137.1	20	N	A		FOGLIGHT		CURRENT,AMPS	1251
126	C13	CG102.1	100	N	A		IGNITION		CURRENT,AMPS	1261
127	C14	10416.1	14000	N	KPA	FRT	BRAKE SYSTEM		PRESSURE,KPA'S	1271
128	C15	10143.1	1200	N	KPA		FUEL SUPPLY LINE		PRESSURE,KPA'S	1281

Date: 11-13-1997 Time: 08:49:18

Test Number : C11793
Test Type : CENTER HIGH POLE
Division :
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	C16	10417.1	8000	N	KPA		POWER STEERING		PRESSURE,KPA'S	1291
130	C17	10095.1	1000	N	KPA		ENG COOLANT SYSTEM		PRESSURE,KPA'S	1301
131	C18	10094.1	1000	N	KPA		ENGINE OIL		PRESSURE,KPA'S	1311
132	C19	10111.1	1400	N	KPA		TRANSMISSION COOLER		PRESSURE,KPA'S	1321
133	C20	CONTACT.1	8	N	V		THERMAL WIRE		CONTACT,N/O	1331
134	C21	CONTACT.1	8	N	V		PNEUMATIC WIRE		CONTACT,N/O	1341
135	C22	CONTACT.1	8	N	V		PNEUMATIC WIRE FAULT		CONTACT,N/C	1351
136	C23	CONTACT.1	8	N	V		MECHANICAL FUEL SWITCH		CONTACT,N/O	1361

Standard ISF Printout

Test Number : C11317
Test Type : REAR IMPACT
Division :
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	E01	CQ97.1	200	N	G	L. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0031
4	E02	CK32.1	200	N	G	L. FRT	HEAD	LATERAL	ACCEL,G'S	0041
5	E03	CM45.1	200	N	G	L. FRT	HEAD	VERTICAL	ACCEL,G'S	0051
6	E04	CB89.1	200	R	G	L. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0062
7	E05	CB86.1	200	N	G	L. FRT	CHEST	LATERAL	ACCEL,G'S	0071
8	E06	CB95.1	200	R	G	L. FRT	CHEST	VERTICAL	ACCEL,G'S	0082
9	E10	P35N.1	6000	N	N	L. FRT	NECK	UAP SHEAR	LOAD,N'S	0091
10	E11	P35N.2	6000	N	N	L. FRT	NECK	URL SHEAR	LOAD,N'S	0101
11	E12	P35N.3	6000	N	N	L. FRT	NECK	UPPER AXIAL	LOAD,N'S	0111
12	E13	P35N.4	400	N	N-M	L. FRT	NECK	URL MOMENT	MOMENT,NM'S	0121
13	E14	P35N.5	400	N	N-M	L. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0131
14	E15	P35N.6	400	N	N-M	L. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0141
15	D01	CY22.1	200	N	G	R. FRT	HEAD	LONGITUDINAL	ACCEL,G'S	0151
16	D02	CJ39.1	200	N	G	R. FRT	HEAD	LATERAL	ACCEL,G'S	0161
17	D03	CS49.1	200	N	G	R. FRT	HEAD	VERTICAL	ACCEL,G'S	0171
18	D04	CR02.1	200	R	G	R. FRT	CHEST	LONGITUDINAL	ACCEL,G'S	0182
19	D05	CR98.1	200	N	G	R. FRT	CHEST	LATERAL	ACCEL,G'S	0191
20	D06	CM46.1	200	R	G	R. FRT	CHEST	VERTICAL	ACCEL,G'S	0202
21	D10	P40N.1	6000	N	N	R. FRT	NECK	UAP SHEAR	LOAD,N'S	0211
22	D11	P40N.2	6000	N	N	R. FRT	NECK	URL SHEAR	LOAD,N'S	0221
23	D12	P40N.3	6000	N	N	R. FRT	NECK	UPPER AXIAL	LOAD,N'S	0231
24	D13	P40N.4	400	N	N-M	R. FRT	NECK	URL MOMENT	MOMENT,NM'S	0241
25	D14	P40N.5	400	N	N-M	R. FRT	NECK	UAP MOMENT	MOMENT,NM'S	0251
26	D15	P40N.6	400	N	N-M	R. FRT	NECK	ROT MOMENT	MOMENT,NM'S	0261
27	A01	J17314.1	450	N	G	L. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0271
28	A02	J11067.1	450	R	G	L. FRT	ROCKER	LATERAL	ACCEL,G'S	0282
29	A03	J15297.1	450	R	G	L. FRT	ROCKER	VERTICAL	ACCEL,G'S	0292
30	A04	J17824.1	450	R	G	R. FRT	ROCKER	LONGITUDINAL	ACCEL,G'S	0302
31	A05	J17821.1	450	N	G	R. FRT	ROCKER	LATERAL	ACCEL,G'S	0311
32	A06	J17791.1	450	N	G	R. FRT	ROCKER	VERTICAL	ACCEL,G'S	0321

Date: 01-20-1998 Time: 08:00:08

Test Number : C11317
Test Type : REAR IMPACT
Division :
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	A07	J12254.1	750	N	G	L. REAR	FRAME	LONGITUDINAL	ACCEL,G'S	0331
34	A08	J12250.1	750	N	G	L. REAR	FRAME	LATERAL	ACCEL,G'S	0341
35	A09	J10872.1	750	R	G	L. REAR	FRAME	VERTICAL	ACCEL,G'S	0352
36	A10	J18588.1	750	N	G	R. REAR	FRAME	LONGITUDINAL	ACCEL,G'S	0361
37	A11	J18644.1	750	R	G	R. REAR	FRAME	LATERAL	ACCEL,G'S	0372
38	A12	J18654.1	750	R	G	R. REAR	FRAME	VERTICAL	ACCEL,G'S	0382
39	A13	J17746.1	450	N	G	L. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0391
40	A14	J17756.1	450	R	G	L. REAR	ROCKER	LATERAL	ACCEL,G'S	0402
41	A15	J17750.1	450	R	G	L. REAR	ROCKER	VERTICAL	ACCEL,G'S	0412
42	A16	J18416.1	450	N	G	R. REAR	ROCKER	LONGITUDINAL	ACCEL,G'S	0421
43	A17	J18497.1	450	N	G	R. REAR	ROCKER	LATERAL	ACCEL,G'S	0431
44	A18	J18430.1	450	N	G	R. REAR	ROCKER	VERTICAL	ACCEL,G'S	0441
45	A19	VOLTCOND.1	20	N	V		IGNITION		VOLTAGE,VOLTS	0451
46	A20	VOLTCOND.1	20	N	V		CHMSL/BRAKE LIGHT		VOLTAGE,VOLTS	0461
47	A21	VOLTCOND.1	20	N	V	REAR	WINDOW DEFROSTER		VOLTAGE,VOLTS	0471
48	A22	VOLTCOND.1	20	N	V	L. REAR	BACKUP LIGHT		VOLTAGE,VOLTS	0481
49	A23	VOLTCOND.1	20	N	V	L. REAR	TAIL LIGHT		VOLTAGE,VOLTS	0491
50	A24	VOLTCOND.1	20	N	V	L. REAR	TURN SIGNAL		VOLTAGE,VOLTS	0501
51	A25	VOLTCOND.1	20	N	V		FUEL PUMP		VOLTAGE,VOLTS	0511
52	A26	VOLTCOND.1	20	N	V		FUEL INTERITA SWITCH		VOLTAGE,VOLTS	0521
53	B01	CP137.1	10	N	A	L.	WHEEL BAG		CURRENT,AMPS	0531
54	B02	CP121.1	10	N	A	R.	I/P BAG		CURRENT,AMPS	0541
55	B03	CP141.1	20	N	A		CHMSL/BRAKE LIGHT		CURRENT,AMPS	0551
56	B04	CP230.1	20	N	A	REAR	WINDOW DEFROSTER		CURRENT,AMPS	0561
57	B05	CP114.1	20	N	A	L. REAR	BACKUP LIGHT		CURRENT,AMPS	0571
58	B06	CP162.1	20	N	A	L. REAR	TAIL LIGHT		CURRENT,AMPS	0581
59	B07	CP208.1	20	N	A	L. REAR	TURN SIGNAL		CURRENT,AMPS	0591
60	B08	CG104.1	100	N	A		BATTERY (B+ TO PDB)		CURRENT,AMPS	0601
61	B09	10145.1	1400	N	KPA		RETURN FUEL LINE		PRESSURE,KPA'S	0611
62	B10	CONTACT.1	8	N	V		PNEUMATIC WIRE-XMEMBER		CONTACT,N/C	0621
63	B11	CONTACT.1	8	N	V		PNEUMATIC WIRE-XMEMBER		CONTACT,N/O	0631
64	B12	CONTACT.1	8	N	V		THERMAL WIRE-XMEMBER		CONTACT,N/O	0641

Date: 01-20-1998 Time: 08:00:13

Test Number : C11317
Test Type : REAR IMPACT
Division :
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	B13	CONTACT.1	8	N	V		THERMAL WIRE-DIFFERENTIAL		CONTACT,N/O	0651
66	B14	CONTACT.1	8	N	V		MECHANICAL FUEL SWITCH		CONTACT,N/O	0661
67	B15	CONTACT.1	8	N	V	CTR	SPARE TIRE TO DIFFERENTIAL		CONTACT,N/O	0671
68	B16	CONTACT.1	8	N	V	CTR	SPARE TIRE TO DEFLECTOR		CONTACT,N/O	0681
69	C01	A98C.1	450	N	G		LTV MDB AT C.G.	LONGITUDINAL	ACCEL,G'S	0691
70	C02	AN3P2.1	450	N	G		LTV MDB AT C.G.	LATERAL	ACCEL,G'S	0701
71	C03	A58A.1	450	N	G		LTV MDB AT C.G.	VERTICAL	ACCEL,G'S	0711
72	C04	J12804.1	450	N	G		LTV MDB AT REAR C/MBR	LONGITUDINAL	ACCEL,G'S	0721
73	C05	J12812.1	450	N	G		LTV MDB AT REAR C/MBR	LATERAL	ACCEL,G'S	0731
74	C06	J12759.1	450	N	G		LTV MDB AT REAR C/MBR	VERTICAL	ACCEL,G'S	0741