

NEW CAR ASSESSMENT AND STANDARDS  
ENFORCEMENT INDICANT TESTING

CHEVROLET CITATION TO PLYMOUTH HORIZON  
Frontal Impact, 70 mph Closing Speed  
NHTSA 308-33-491

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MAY 22, 1980

FINAL REPORT

Prepared For

U. S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
Enforcement  
Office of Vehicle Safety Compliance  
400 Seventh Street, S.W., NASSIF Building  
Washington, D.C. 20590

This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DOT-HS-8-01938. This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

FINAL REPORT ACCEPTED BY:

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Contract Technical Manager

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Date of Report Acceptance

# TECHNICAL REPORT STANDARD TITLE PAGE

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| 1. Report No.<br>6525-V-33                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | 2. Government Accession No.                          |                                                                                                                                                                                                                              | 3. Recipient's Catalog No.                                              |  |
| 4. Title and Subtitle<br>NEW CAR ASSESSMENT AND STANDARDS ENFORCEMENT INDICANT TESTING - CHEVROLET CITATION TO PLYMOUTH HORIZON FRONTAL IMPACT, 70 MPH CLOSING SPEED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                                                      |                                                                                                                                                                                                                              | 5. Report Date<br>May 22, 1980                                          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                      |                                                                                                                                                                                                                              | 6. Performing Organization Code<br>92325                                |  |
| 7. Author(s)<br>Walter E. Levan, Test Engineer<br>Barbara J. Kelleher, Staff Associate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                      |                                                                                                                                                                                                                              | 8. Performing Organization Report No.<br>6525-V-33                      |  |
| 9. Performing Organization Name and Address<br>Calspan Advanced Technology Center<br>P.O. Box 400<br>Buffalo, New York 14225                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |                                                      |                                                                                                                                                                                                                              | 10. Work Unit No.<br>308 Series                                         |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                      |                                                                                                                                                                                                                              | 11. Contract or Grant No.<br>DOT-HS-8-01938                             |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                      |                                                                                                                                                                                                                              | 13. Type of Report and Period Covered<br>Final Report<br>April-May 1980 |  |
| 12. Sponsoring Agency Name and Address<br>U.S. Department of Transportation<br>National Highway Traffic Safety Administration<br>Office of Vehicle Safety Compliance<br>400 Seventh Street, S.W. Washington, D.C. 20590                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                                                      |                                                                                                                                                                                                                              | 14. Sponsoring Agency Code<br>NAD-30                                    |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                      |                                                                                                                                                                                                                              |                                                                         |  |
| 15. Supplementary Notes<br>Reviewed: <u>Donald A. Allamello</u> Project Engineer<br>Approved: <u>Kenneth C. Hendershot</u> Head, Transportation Research Dept.<br>Calspan Advanced Technology Center                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                                                      |                                                                                                                                                                                                                              |                                                                         |  |
| 16. Abstract<br><br>A symmetric frontal car-to-car frontal crash test of a 1980 General Motors Chevrolet Citation 2-door and a 1980 Chrysler-Plymouth Horizon 2-door TC-3 was performed at Calspan Corporation, Advanced Technology Center, Transportation Research Facility, Buffalo, New York.<br><br>Impact speed for each vehicle was 35.14 MPH. Test date was April 30, 1980 and ambient temperature was 49°F.<br><br>Both occupants of the Chevrolet Citation complied with FMVSS 208 Injury Criteria Value.<br><br>Both occupants of the Chrysler Plymouth Horizon exceeded FMVSS-208 Head Injury Criteria values but complied with all others. |  |                                                      |                                                                                                                                                                                                                              |                                                                         |  |
| 17. Key Words<br>Crash Test<br>Frontal Impact<br>Car-to-Car Tests                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                                                      | 18. Distribution Statement<br>Copies of this report are available from:<br>Technical Reference Division<br>National Highway Traffic Safety Admin.<br>Room 5108, NASSIF Building<br>400 7th St., S.W., Washington, D.C. 20590 |                                                                         |  |
| 19. Security Classif. (of this report)<br>UNCLASSIFIED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  | 20. Security Classif. (of this page)<br>UNCLASSIFIED |                                                                                                                                                                                                                              | 21. No. of Pages<br>22. Price                                           |  |

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## SECTION 1

### TEST PURPOSE AND PROCEDURE

This car-to-car crash test of a 1980 General Motors Chevrolet Citation and a 1980 Chrysler-Plymouth Horizon is part of the New Car Assessment Program B.O.A., Task 5, sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract DOT-HS-8-01938. The purpose of this test was to investigate mass effects of vehicles in a car-to-car crash tests.

The Calspan Corporation, Advanced Technology Center, Transportation Research Department Test Plan (Calspan Report No. 6525-V-101) for New Car Assessment Car-to-Car Crash Tests which was submitted to, and approved by, the Contract Technical Manager (CTM), contains the specific procedures used to perform this test.

## SECTION 2

### GENERAL TEST AND VEHICLE INFORMATION

#### 2.1 Narrative Summary of Test No. 33

A symmetric frontal car-to-car impact test, involving a 1980 Chevrolet Citation and a 1980 Plymouth Horizon, with a nominal closing speed of 70 MPH was performed at Calspan Corporation Advanced Technology Center on April 30, 1980. Ambient temperature on the day of impact was 49°F.

The crash test, originally scheduled for the afternoon of Friday, April 25, 1980 was delayed due to an electrical fire in the camera power supply truck. This fire occurred at 2:20 pm on April 25. Because of the necessity to thoroughly check out the power supply and replace all damaged components and the lateness of the hour, the test was rescheduled for Monday of the following week. Poor weather resulted in additional delays until Wednesday, April 30.

Both vehicles were occupied by Part 572 50th percentile male anthropometric test devices (ATDs) in the driver and right front passenger seating positions. Details on ATD placement, kinematics and performance evaluation criteria are discussed in Section 4.

Vehicle Number 1, the Chevrolet Citation, was a two-door coupe having a four cylinder engine and a four speed manual transmission. This vehicle did not contain an air conditioning unit. The fourteen gallon fuel tank, positioned under the rear passenger seat, was filled to ninety-three percent of its capacity with red Stoddard fluid.

Vehicle Number 2, the Chrysler-Plymouth Horizon TC-3 was a two-door vehicle equipped with a soft front bumper, automatic transmission, four cylinder engine and an air conditioning unit. The thirteen gallon fuel tank was filled to ninety-three percent capacity with red Stoddard fluid. The fuel tank was located under the rear passenger seat.

The Citation, at a test weight of 3000 pounds, was 160 pounds heavier than the Horizon, whose test weight was 2840 pounds.

The tires supplied with the Citation were the recommended tire size (P185) while the Horizon tires were larger than the recommended tire size (P175 tires were supplied, P165 tires were recommended).

The crash event was recorded by two real time and eleven high speed cameras. Camera locations and other pertinent camera information are found in Section 4 of this report. The crash test film was delivered under separate cover to the NHTSA.

Impact velocity for both vehicles, towed by a common cable, was 35.14 MPH. Appendix A, Figure A-3, presents the velocity trap counter display used to determine impact velocity. The readout in seconds is referenced to 40 inches of vehicle travel. The two readouts, 35.17 MPH and 35.11 MPH are averaged to provide impact speed of 35.14 MPH. Vehicle impact occurred approximately 4 inches east of the anticipated impact point. A brief summary of observations follows.

The Citation hood flew open on impact. Maximum crush of this vehicle was 21.1 inches measured along the vehicle centerline and the maximum intrusion of 7.2 inches was found on the right side of the firewall. The roof buckled slightly at the B-pillar location on the right side and windshield cracking was observed, also on the vehicle right side (see Figure A-8). The vehicle frame penetrated the rear of both front tires but did not cause deflation. Both doors could be opened after impact. The CDC was 12FDEW 2.

The Horizon maximum crush of 20.5 inches was observed on the left side of the vehicle and was measured from the backing plate located 1.3 inches behind the soft front bumper. The greatest firewall intrusion of 7.8 inches was found at the vehicle centerline. The windshield was cracked on both sides and the roof buckled at the B-pillar locations on both the right and left sides. A steel bar attached to the vehicle underbody by Calspan to carry abort loads

through the vehicle sheared off and penetrated the fuel tank (see Section 3). The left door could be opened but the right door was jammed. The after-impact CDC was 12FDEN 5.

Analysis of the high speed film indicates that there was significant dynamic steering column intrusion into the occupant compartment. It is believed that the automatic transmission housing, which is placed immediately in front of the steering column linkage, contributed to forcing the steering column into the driver occupant compartment. The post-test measurement taken from the center of the steering column, shows less than an inch of intrusion. This is due to the fact that the driver contacted the steering wheel, deforming the lower rim and hub and forcing the wheel back toward the dash. Appendix A, Figures A-24 and A-26, provide views of the post test steering wheel.

This test was performed in accordance with specifications found in 'Test Plan for New Car Assessment - Car to Car Crash Tests', Calspan Report No. 6525-V-101. The only data anomalies in this test were found in Vehicle #1, Citation data. They were:

- Accelerometer #2, Z direction - cut wire @ 65 msec.
- Accelerometer #3, X direction - cut wire @ 65 msec.
- Accelerometer #5, Z direction - zero shift @ 75 msec.

TABLE 1  
CRASH TEST SUMMARY

|                                                                |                                                                |                  |
|----------------------------------------------------------------|----------------------------------------------------------------|------------------|
| TEST NO. <u>33</u>                                             | PROJECT <u>New Car Assessment Program</u><br><u>Car-to-Car</u> |                  |
| DATE <u>4/30/80</u>                                            | TIME <u>1358 hrs</u>                                           | TEMP. <u>49°</u> |
| TEST CONDITION <u>Symmetric Frontal - 70 mph Closing Speed</u> |                                                                |                  |
| VEHICLE NO. 1                                                  | <u>1980 Chevrolet-Citation 2-Door Club Coupe</u>               |                  |
| VEHICLE NO. 2                                                  | <u>1980 Plymouth Horizon 2-Door TC-3</u>                       |                  |

|                         | VEH. NO. 1   | VEH. NO. 2   |
|-------------------------|--------------|--------------|
| TEST WEIGHT (lbs)       | <u>3000</u>  | <u>2840</u>  |
| IMPACT ANGLE (deg)*     | <u>0</u>     | <u>0</u>     |
| IMPACT VELOCITY (mph)** | <u>35.14</u> | <u>35.14</u> |
| MAX. CRUSH (in)         | <u>21.1</u>  | <u>20.5</u>  |
| MAX. INTRUSION (in)     | <u>7.2</u>   | <u>7.8</u>   |

|           | VEH. NO. 1                           | VEH. NO. 2                           |
|-----------|--------------------------------------|--------------------------------------|
| DUMMIES   |                                      |                                      |
| TYPE      | <u>Part 572 50th Percentile Male</u> | <u>Part 572 50th Percentile Male</u> |
| LOCATION  | <u>(1) Driver (2) RFP</u>            | <u>(1) Driver (2) RFP</u>            |
| RESTRAINT | <u>3-Point Production Belts</u>      | <u>3-Point Production Belts</u>      |
| I.D.      | <u>320, 163</u>                      | <u>162, 109</u>                      |

|                              |                         |
|------------------------------|-------------------------|
| NUMBER OF DATA CHANNELS      | <u>58</u>               |
| NUMBER OF HIGH SPEED CAMERAS | <u>11 + 2 Real Time</u> |

\*WITH RESPECT TO TOW TRACK CENTERLINE

\*\*SPEED TRAP MEASUREMENT (±0.5% ACCURACY)

TABLE 1 (Cont'd)

OBSERVATIONS (VEHICLE NO. 1) - Citation

GLAZING Windshield cracked

DOORS Both doors could be opened

SEAT ANCHORAGES No failure

RESTRAINTS No failure

OBSERVATIONS (VEHICLE NO. 2) - Horizon

GLAZING Windshield cracked

DOORS Left door opened, right door could not be opened

SEAT ANCHORAGES No failure

RESTRAINTS No failure

GENERAL COMMENTS Roping of the driver and right front passenger lap belts was  
observed on Vehicle 2, the Horizon

Table 2

VEHICLE TEST WEIGHTS AS TESTED

|               |                 |     |            |          |
|---------------|-----------------|-----|------------|----------|
| Vehicle No. 1 | <u>Citation</u> |     |            |          |
| Left Front    | 880             | lbs | Left Rear  | 640 lbs  |
| Right Front   | 880             | lbs | Right Rear | 600 lbs  |
| TOTAL FRONT   | 1760            | lbs | TOTAL REAR | 1240 lbs |

$$\text{Total Weight} = \underline{1760 + 1240 = 3000} \text{ lbs}$$

$$\text{Wheel Base} = \underline{105} \text{ inches}$$

$$\text{Cg}_{F.W.} = \frac{1240 \text{ lbs} \times 105 \text{ inches}}{3000 \text{ lbs}} = \underline{43.4} \text{ inches}$$

CALCULATION FOR TEST WEIGHT

RCLW = Rated Cargo and Luggage Weight  
 UDW = Unloaded Delivered Weight ( 2410 lbs)  
 VCW = Vehicle Capacity Weight ( 895 lbs)  
 DSC = Designated Seating Capacity ( 5 )

$$\text{RCLW} = \text{VCW} - 150 (\text{DSC})$$

$$\text{RCLW} = \underline{895} - 150 (5) = \underline{145} \text{ lbs}$$

$$\text{TEST WEIGHT} = \text{UDW} + \text{RCLW} + (\text{No. Dummies} \times 164 \text{ lbs})$$

$$\text{TEST WEIGHT} = \underline{2510} \text{ lbs} + \underline{145} \text{ lbs} + 2 (164 \text{ lbs})$$

$$\text{TEST WEIGHT} = \underline{2983} \text{ lbs} \quad (\text{CALCULATED})$$

Table 3

VEHICLE TEST WEIGHTS AS TESTEDVehicle No. 2 Horizon

|             |             |     |            |             |     |
|-------------|-------------|-----|------------|-------------|-----|
| Left Front  | 830         | lbs | Left Rear  | 580         | lbs |
| Right Front | 850         | lbs | Right Rear | 580         | lbs |
| TOTAL FRONT | <u>1680</u> | lbs | TOTAL REAR | <u>1160</u> | lbs |

Total Weight = 1680 + 1160 = 2840 lbsWheel Base = 96.5 inches
$$Cg_{F.W.} = \frac{1160 \text{ lbs} \times 96.5 \text{ inches}}{2840 \text{ lbs}} = \underline{39.4} \text{ inches}$$
CALCULATION FOR TEST WEIGHT

RCLW = Rated Cargo and Luggage Weight

UDW = Unloaded Delivered Weight (2410 lbs)VCW = Vehicle Capacity Weight (715 lbs)DSC = Designated Seating Capacity (4)

RCLW = VCW - 150 (DSC)

RCLW = 715 - 150 ( 4 ) = 115 lbs

TEST WEIGHT = UDW + RCLW + (No. Dummies x 164 lbs)

TEST WEIGHT = 2410 lbs + 115 lbs + 2 (164 lbs)TEST WEIGHT = 2853 lbs (CALCULATED)

Table 4

SUMMARY OF TEST CONDITIONSVehicle No. 1 CitationTEST VEHICLE INFORMATION

Vehicle Manufacturer General Motors Corp.  
 Make/Model Citation  
 Body Style 2 Door Club Coupe Model Year 1980  
 VIN \*1X115AW200326 Build Date 1-80  
 NHTSA No. 308-33-491 Color Dark Blue  
 Engine Data: 4 cylinders 2.5L displacement  
 Transmission Data: 4 speed ( ☒ ) Manual ( ) Automatic  
 Date Vehicle Received by Laboratory 4-23-80  
 Dealer's Name & Address Mernan Chev., Buffalo, N.Y.

DATA FROM CERTIFICATION LABEL ON LEFT DOOR REAR FACE OR 'B' POST

Vehicle Manufactured by General Motors Corp.  
 Date of Manufacture 1-80 VIN \*1X115AW200326  
 GVRW 3396 lbs GAWR: Front 1839 lbs Rear 1557 lbs

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVE BOX, ETC.

Vehicle Load (up to capacity) - Front 26 psi  
 Rear 26 psi  
 Recommended Tire Size P185/80-R13 Load Range: ☒ B ☐ C ☐ D  
 Vehicle Capacity: Types of Seats ☐ Bench ☐ Bucket ☒ Split Bench  
 Number of Occupants (Designated Seating Capacity): 2 Front  
3 Rear  
5 TOTAL  
 Cargo Load = 145 lbs  
 TOTAL = 895 lbs

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (WITH MAXIMUM FLUIDS)

Right Front = 770 lbs Right Rear = 430 lbs  
 Left Front = 840 lbs Left Rear = 470 lbs  
 TOTAL FRONT WEIGHT = 1610 lbs ( 64.1 % of Total Vehicle Weight)  
 TOTAL REAR WEIGHT = 900 lbs ( 35.9 % of Total Vehicle Weight)  
 TOTAL DELV. WEIGHT = 2510 lbs

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 0 lbs CARGO

Right Front = 880 lbs Right Rear = 600 lbs  
 Left Front = 880 lbs Left Rear = 640 lbs  
 TOTAL FRONT WEIGHT = 1760 lbs ( 58.7 % of Total Vehicle Weight)  
 TOTAL REAR WEIGHT = 1240 lbs ( 41.3 % of Total Vehicle Weight)  
 TOTAL TEST WEIGHT = 3000 lbs  
 Weight of ballast secured in vehicle trunk area = 0 lbs

Table 4  
SUMMARY OF TEST CONDITIONS (Cont'd)

Vehicle No. 1 Citation

TEST CONDITIONS

Date of Test 4/30/80 Time of Test 1358 am/pm  
Ambient Temperature 49 °F at impact area  
Temperature in Occupant Compartment 70 °F  
Impact Velocity 35.14 mph

VEHICLE ATTITUDE (all dimensions in inches)

Delivered Attitude: RF 27 1/2" LF 27" RR 26 1/2" LR 26 3/8"  
Test Attitude: RF 26.7" LF 26.7" RR 24.3" LR 24.4"

VEHICLE TIRE DATA

Recommended Cold Tire Pressure: Front = 26 psi Rear = 26 psi  
Recommended Tire Size P185/80-R13 Load Range B  
Tires on Vehicle P185/80-R13  
Is Spare Tire a "Space Saver"      yes      no  
Is Spare Tire Standard Equipment X yes      no

TEST FLUID DATA

Test Fluid Type: Red Stoddard Solvent #2 Spec. Grav.: 0.764  
Kinematic Viscosity 0.96 Centistokes  
EPA Capacity 14 gal  
Test Volume 13.03 gal (93% of EPA Capacity)  
Fuel System Capacity (data from Owner's Manual) 14 gal  
Details of fuel system Engine operated fuel pump. Fuel tank is under rear passenger seat with filler tube on left side of vehicle.  
      
      
Electric Fuel Pump      Yes X No Fuel Injection      Yes X No  
Does electric fuel pump operate with ignition switch "on" and the engine not operating NA Yes NA No

VEHICLE CRUSH

Overall Length of Test Vehicle: Pre-Test = R 174.2 / L 174.1 inches  
Post-Test = R 153.4 / L 154.1 inches  
Crush = R 20.8 / L 20.0

### SUMMARY OF TEST CONDITIONS

### TEST VEHICLE INFORMATION

DATA FROM CERTIFICATION LABEL ON LEFT DOOR REAR FACE OR 'B' POST

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVE BOX, ETC.

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (WITH MAXIMUM FLUIDS)

|                    |   |             |     |                                          |   |            |     |
|--------------------|---|-------------|-----|------------------------------------------|---|------------|-----|
| Right Front        | = | <u>760</u>  | lbs | Right Rear                               | = | <u>430</u> | lbs |
| Left Front         | = | <u>780</u>  | lbs | Left Rear                                | = | <u>440</u> | lbs |
| TOTAL FRONT WEIGHT | = | <u>1540</u> | lbs | ( <u>63.9</u> % of Total Vehicle Weight) |   |            |     |
| TOTAL REAR WEIGHT  | = | <u>870</u>  | lbs | ( <u>36.1</u> % of Total Vehicle Weight) |   |            |     |
| TOTAL DELV. WEIGHT | = | <u>2410</u> | lbs |                                          |   |            |     |

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 25 1bs CARGO

Right Front = 850 lbs      Right Rear = 580 lbs  
Left Front = 830 lbs      Left Rear = 580 lbs  
TOTAL FRONT WEIGHT = 1680 lbs ( 59.2 % of Total Vehicle Weight)  
TOTAL REAR WEIGHT = 1160 lbs ( 40.8 % of Total Vehicle Weight)  
TOTAL TEST WEIGHT = 2840 lbs  
Weight of ballast secured in vehicle trunk area = 0 lbs

Table 5  
SUMMARY OF TEST CONDITIONS (Cont'd)

Vehicle No. 2 Horizon

TEST CONDITIONS

Date of Test 4/30/80 Time of Test 1358 hrs.  
Ambient Temperature 49 °F at impact area  
Temperature in Occupant Compartment 68 °F  
Impact Velocity 35.14 mph

VEHICLE ATTITUDE (all dimensions in inches)

Delivered Attitude: RF 26 1/4" LF 26 1/4" RR 25 3/4" LR 25 5/8"  
Test Attitude: RF 24 3/4" LF 25" RR 24 1/2" LR 24 3/4"

VEHICLE TIRE DATA

Recommended Cold Tire Pressure: Front = 35 psi Rear = 35 psi  
Recommended Tire Size P165-75-R13 Load Range B  
Tires on Vehicle P175-75-R13  
Is Spare Tire a "Space Saver" yes X no  
Is Spare Tire Standard Equipment X yes no

TEST FLUID DATA

Test Fluid Type: Red Stoddard Solvent #2 Spec. Grav.: 0.764  
Kinematic Viscosity 0.96 Centistokes  
EPA Capacity 13.0 gal  
Test Volume 12.1 gal (93% of EPA Capacity)  
Fuel System Capacity (data from Owner's Manual) 13 gal  
Details of fuel system Engine operated fuel pump. Fuel tank is located  
under the rear seat with filler tube on right side of vehicle.  
  
  
Electric Fuel Pump Yes X No Fuel Injection Yes X No  
Does electric fuel pump operate with ignition switch "on" and the engine  
not operating NA Yes NA No

VEHICLE CRUSH

Overall Length of Test Vehicle: Pre-Test = R 170.5 / L 170.4 inches  
Post-Test = R 153.2 / L 149.9 inches  
Crush = R 17.3 / L 20.5

## SECTION 3

### COMPLIANCE-RELATED INFORMATION

Although testing for compliance to FMVSS numbers 212, Windshield Mounting, 219, Windshield Intrusion and 301-75, Fuel System Integrity are not required for this series of tests, observations regarding these federal regulations will be reported.

Vehicle number 1, the Chevrolet Citation, experienced no fuel leakage and no loss of windshield retention and, therefore, would have been in compliance with FMVSS numbers 301-75 and 212. Compliance to FMVSS 219 is unknown due to the fact that the protected zone styrofoam templates were not installed on these vehicles, and, on impact, the Citation hood latches disengaged and the hood flew open (see Appendix A, Figure A-2).

Vehicle number 2, the Chrysler Horizon, complied with FMVSS numbers 212 and 219. The fuel tank was punctured by the sharp edge of a sheared metal 'abort' bar attached to the underside of the vehicle causing all of the fuel to leak out of the fuel tank. This anomaly is considered to be artifactual to the test and, as no other damage to the fuel tank was observed, the Horizon is considered to have complied with FMVSS 301-75.

## SECTION 4

### OCCUPANT AND VEHICLE INFORMATION

#### 4.1 Narrative Summary of Occupant Responses

Vehicle Number 1, the Chevrolet Citation and Vehicle Number 2, the Chrysler-Plymouth Horizon were both occupied by Part 572 50th percentile male Anthropometric Test Devices (ATDs) in the driver and right front passenger seating locations. These ATDs had been positioned in the respective vehicles according to the dummy placement procedures specified in Laboratory Procedure TP-212-02 and documented in 'Test Plan for New Car Assessment, Car-to-Car Crash Tests', Calspan Report No. 6525-V-101. All dummies were secured in the vehicles by means of the production three-point belt systems. Owner's Manual Restraint System Operating Instructions for Vehicles 1 and 2 are found in Figures 7 and 8, respectively.

The ATDs were instrumented with triaxial accelerometer packages in the head and chest regions and load cells in each femur. Belt loads were measured on the lap and shoulder belts. All ATDs had been certified immediately preceding the crash test and certification data is available in Appendix C.

#### Vehicle Number 1, Citation

Both occupants of the Citation complied with FMVSS 208 Injury Criteria values. These results are summarized in Table 13 and the data traces are available in Appendix B.

The driver chest contacted the lower rim of the steering wheel and the upper right side of his head contacted the upper rim. Both knees contacted the lower dash panel and the left knee also contacted the left side of the steering column housing. Post-test views of the driver and driver compartment are provided in Appendix A, Figures A-13 and A-15.

The right front passenger struck the upper left side of his head on the right knee and struck the dash panel with his left knee. There was very little right knee chalk found on the dash panel, probably due to the fact that the ATD rotated outboard. Post-test views of this dummy and occupant compartment are supplied in Appendix A, Figures A-14 and A-15.

There was no evidence of roping or abdominal penetration on the lap belts in vehicle 1.

#### Vehicle Number 2, Horizon

Both occupants of the Horizon failed to comply with FMVSS 208 Head Injury Criteria (HIC), but were within the limits set for chest resultant and femur loads. A summary of Injury Criteria values is presented in Table 13 and the related data traces are found in Appendix B.

The driver struck the upper rim and the hub of the steering wheel with his head, generating a HIC number of 1774. As mentioned previously in Section 2, the steering wheel experienced significant dynamic intrusion into the occupant compartment in both the X and Z directions. The driver's left knee contacted the steering column housing contributing to the upward force on the steering wheel. Both knees also contacted the dash panel. The lower rim of the steering wheel was deformed from contact with the dummy chest. Appendix A, Figures A-24 and A-26 presents views of driver occupant compartment, post-test.

The right front passenger's head contacted his left knee, and possibly also sustained some lesser contact with the right knee, generating a HIC number of 1218. Both knees contacted the dash panel and this deformation can be seen in Figures A-25 and A-26. This dummy, whose torso belt load was over 2000 pounds, showed evidence of the shirt material melting into the torso belt webbing material. His shirt was ripped by the torso belt in the mid sternum and right clavicle areas.

Both of the front bucket seats appeared to be pitched forward after the impact. The occupants may have submarined as both lap belts had roped and penetrated the dummies abdominal areas.

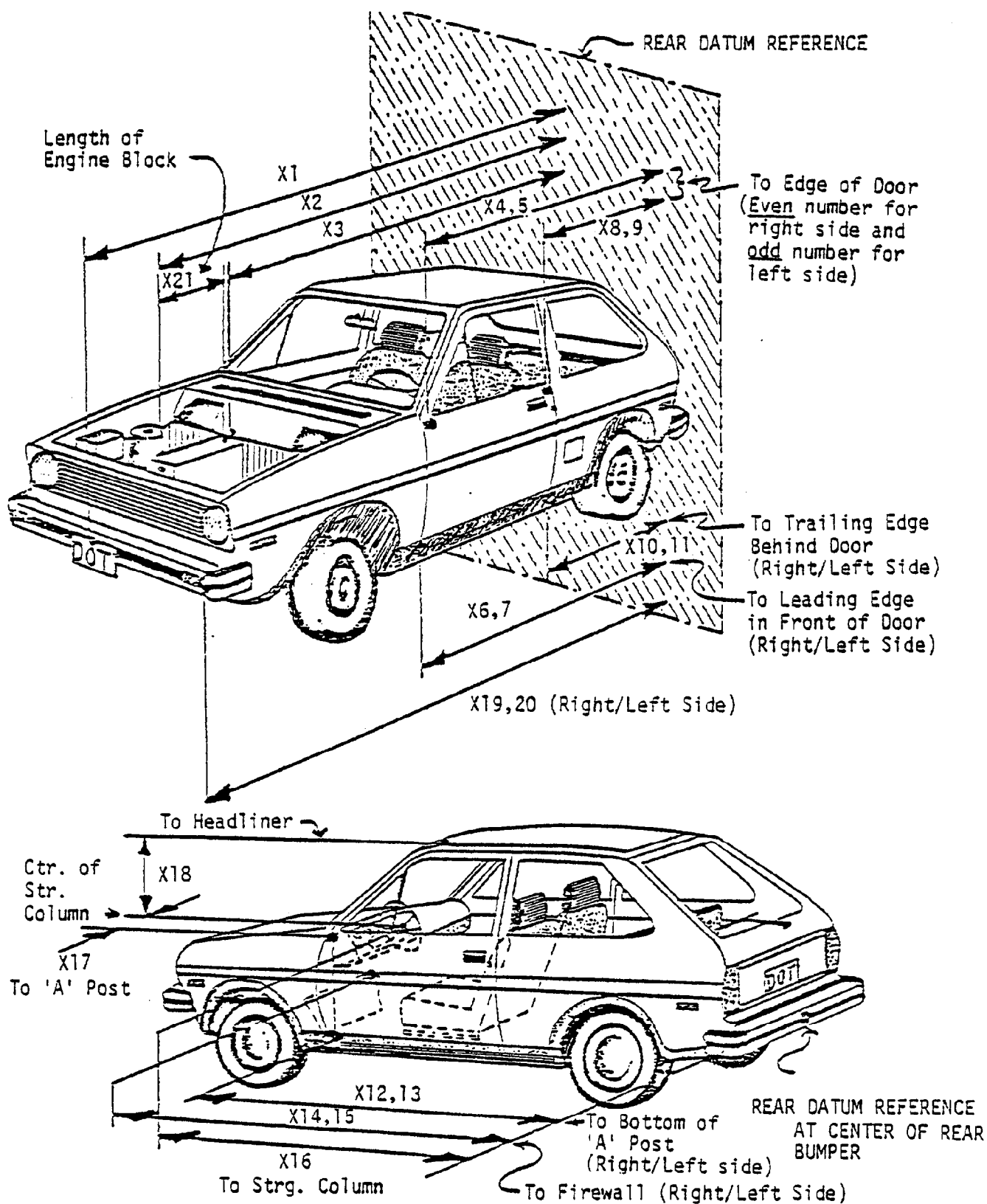


Figure 1 PRE-TEST AND POST-TEST MEASUREMENT POINTS

Table 6

## VEHICLE MEASUREMENTS

All Dimensions in Inches

| NO. | Vehicle No. 1                                                | Citation | Pre-Test | Post-Test |
|-----|--------------------------------------------------------------|----------|----------|-----------|
| X1  | Total Length of Vehicle at Centerline                        |          | 176.9    | 155.8     |
| X2  | Rear Surface of Vehicle to Front of Engine                   |          | 154.5    | 142.9     |
| X3  | Rear Surface of Vehicle to Firewall                          |          | 132.1    | 130.0     |
| X4  | Rear Surface of Vehicle to Upper Leading Edge of Right Door  |          | 121.8    | 121.1     |
| X5  | Rear Surface of Vehicle to Upper Leading Edge of Left Door   |          | 121.8    | 121.1     |
| X6  | Rear Surface of Vehicle to Lower Leading Edge of Right Door  |          | 121.0    | 120.8     |
| X7  | Rear Surface of Vehicle to Lower Leading Edge of Left Door   |          | 121.0    | 120.9     |
| X8  | Rear Surface of Vehicle to Upper Trailing Edge of Right Door |          | 71.4     | 71.1      |
| X9  | Rear Surface of Vehicle to Upper Trailing Edge of Left Door  |          | 71.5     | 70.8      |
| X10 | Rear Surface of Vehicle to Lower Trailing Edge of Right Door |          | 70.9     | 70.6      |
| X11 | Rear Surface of Vehicle to Lower Trailing Edge of Left Door  |          | 70.8     | 70.6      |
| X12 | Rear Surface of Vehicle to Bottom of "A" Post of Right Side  |          | 120.5    | 120.1     |
| X13 | Rear Surface of Vehicle to Bottom of "A" Post of Left Side   |          | 120.4    | 120.2     |
| X14 | Rear Surface of Vehicle to Firewall - Right Side             |          | 132.7    | 125.5     |
| X15 | Rear Surface of Vehicle to Firewall - Left Side              |          | 132.5    | 127.3     |
| X16 | Rear Surface of Vehicle to Steering Column                   |          | 104.4    | 102.6     |
| X17 | Center of Steering Column to "A" Post                        |          | 15.8     | 14.8      |
| X18 | Center of Steering Column to Headliner                       |          | 17.3     | 16.3      |
| X19 | Rear Surface of Vehicle to Right Side of Front Bumper        |          | 174.2    | 153.4     |
| X20 | Rear Surface of Vehicle to Left Side of Front Bumper         |          | 174.1    | 154.1     |
| X21 | Length of Engine Block                                       |          | 19.0     | 19.0      |
| X22 | Dash to Rear Window                                          |          | 84.5     | 81.8      |

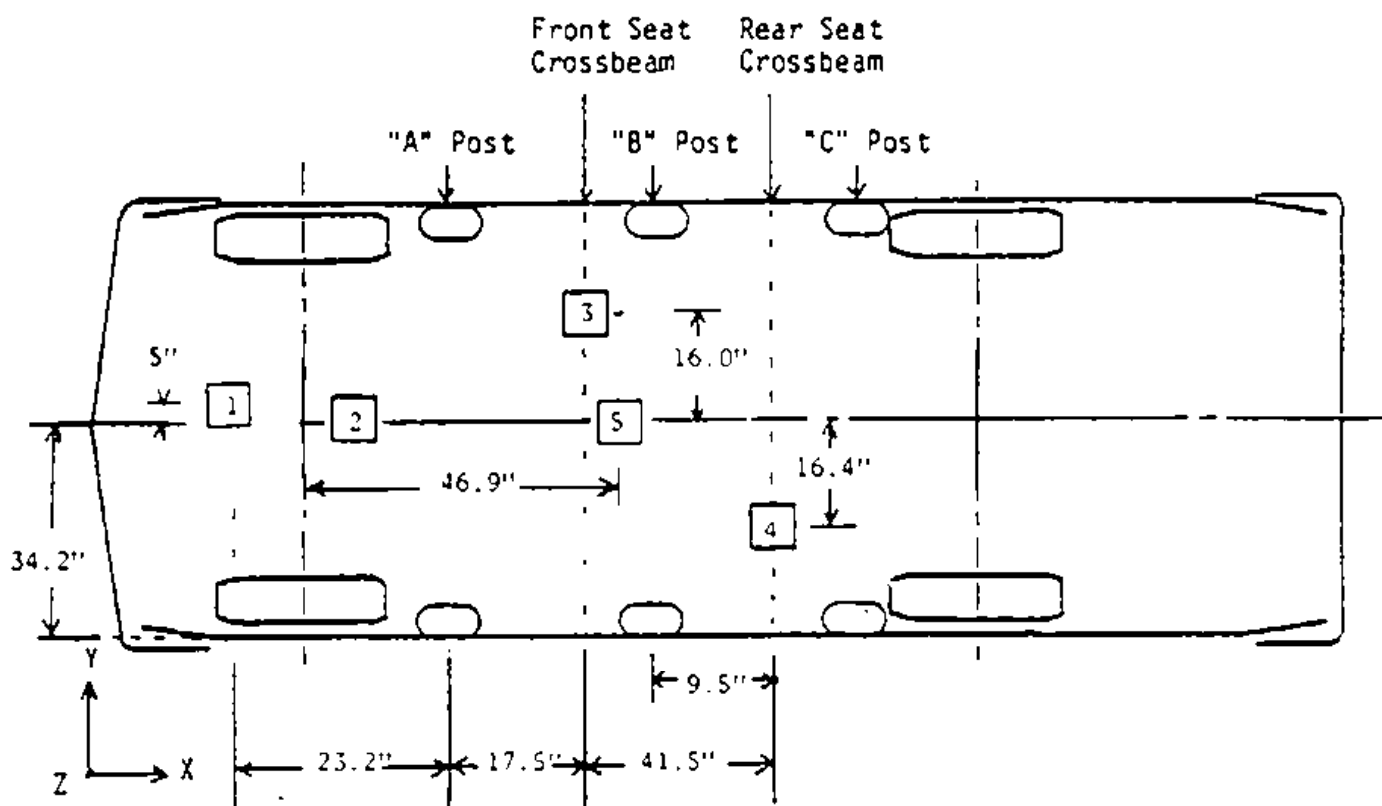
Table 7

## VEHICLE MEASUREMENTS

All Dimensions in Inches

| NO.       | Vehicle No. 2 Horizon                                        | Pre-Test    | Post-Test |
|-----------|--------------------------------------------------------------|-------------|-----------|
| X1, X1'   | Total Length of Vehicle at Centerline*                       | 169.6/173.4 | 150.8     |
| X2        | Rear Surface of Vehicle to Front of Engine                   | 145.9       | 136.3     |
| X3        | Rear Surface of Vehicle to Firewall                          | 128.6       | 120.8     |
| X4        | Rear Surface of Vehicle to Upper Leading Edge of Right Door  | 112.4       | 112.0     |
| X5        | Rear Surface of Vehicle to Upper Leading Edge of Left Door   | 112.4       | 112.3     |
| X6        | Rear Surface of Vehicle to Lower Leading Edge of Right Door  | 114.5       | 113.7     |
| X7        | Rear Surface of Vehicle to Lower Leading Edge of Left Door   | 114.5       | 113.8     |
| X8        | Rear Surface of Vehicle to Upper Trailing Edge of Right Door | 67.6        | 67.3      |
| X9        | Rear Surface of Vehicle to Upper Trailing Edge of Left Door  | 67.6        | 67.3      |
| X10       | Rear Surface of Vehicle to Lower Trailing Edge of Right Door | 66.6        | 65.8      |
| X11       | Rear Surface of Vehicle to Lower Trailing Edge of Left Door  | 66.5        | 66.0      |
| X12       | Rear Surface of Vehicle to Bottom of "A" Post of Right Side  | 115.4       | 114.4     |
| X13       | Rear Surface of Vehicle to Bottom of "A" Post of Left Side   | 115.3       | 114.3     |
| X14       | Rear Surface of Vehicle to Firewall - Right Side             | 128.7       | 128.6     |
| X15       | Rear Surface of Vehicle to Firewall - Left Side              | 129.8       | 129.5     |
| X16       | Rear Surface of Vehicle to Steering Column                   | 103.6       | 103.0     |
| X17       | Center of Steering Column to "A" Post                        | 14.1        | 14.9      |
| X18       | Center of Steering Column to Headliner                       | 18.7        | 15.6      |
| X19, X19' | Rear Surface of Vehicle to Right Side of Front Bumper*       | 170.5/171.8 | 153.2     |
| X20, X20' | Rear Surface of Vehicle to Left Side of Front Bumper*        | 170.4/171.7 | 149.9     |
| X21       | Length of Engine Block                                       | 18.5        | 18.5      |
| X22       | Dash to Trunk Lock                                           | 101.8       | 101.6     |

\* X1, X19, X20 measured to soft bumper backing plate. X1', X19', X20' measured to front of soft bumper. Post-test measurement taken to backing plate.



| ACCELEROMETER NUMBER * | ACCELEROMETER LOCATION         | DIRECTION |   |   |
|------------------------|--------------------------------|-----------|---|---|
|                        |                                | X         | Y | Z |
| 1                      | ENGINE                         | X         |   | X |
| 2                      | FIREWALL AT VEHICLE CENTERLINE | X         |   | X |
| 3                      | FRONT SEAT CROSSBEAM           | X         |   |   |
| 4                      | REAR SEAT CROSSBEAM            | X         |   |   |
| 5                      | C/G                            | X         | X | X |
|                        |                                |           |   |   |

\* The accelerometer pack number can be correlated with the vehicle response data traces found in Appendix B.

FIGURE 2 VEHICLE ACCELEROMETER LOCATIONS  
VEHICLE NO. 1 - CITATION

Table 8

ELECTRONIC INSTRUMENTATION TEST 33

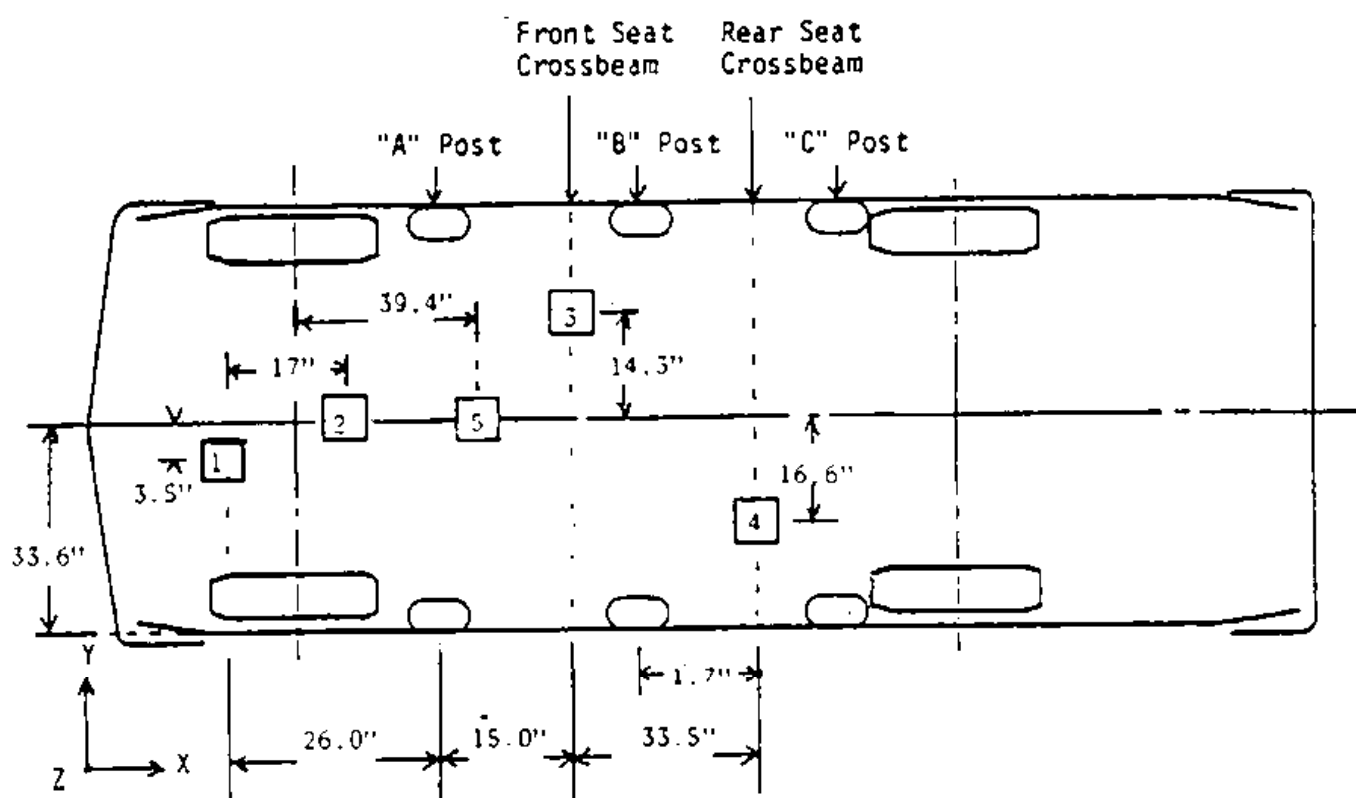
Vehicle No. 1 - 1980 Chevrolet Citation

| TRANSDUCER<br>DESCRIPTION OR<br>ACCELEROMETER LOCATION * | DIRECTION OF<br>PARAMETER<br>BEING MEASURED | LOCATION<br>ON<br>VEHICLE | DESCRIPTION LISTED<br>ON DATA PLOTS<br>APPENDIX B |
|----------------------------------------------------------|---------------------------------------------|---------------------------|---------------------------------------------------|
| <u>VEHICLE ACCELEROMETERS</u>                            |                                             |                           |                                                   |
| 1                                                        | X, Z                                        | Engine                    | Veh. #1 Acc. Pack #1                              |
| 2                                                        | X, Z                                        | Firewall at Centerline    | Veh. #1 Acc. Pack #2                              |
| 3                                                        | X                                           | Front Seat Crossmember    | Veh. #1 Acc. Pack #3                              |
| 4                                                        | X                                           | Rear Seat Crossmember     | Veh. #1 Acc. Pack #4                              |
| 5                                                        | X, Y, Z                                     | C/G of Vehicle            | Veh. #1 Acc. Pack #5                              |
| <u>DUMMY</u>                                             |                                             |                           |                                                   |
| <u>DRIVER POSITION 1</u>                                 |                                             |                           |                                                   |
| Head                                                     | X, Y, Z                                     | Left Front Seat           | Veh. #1 Pos. #1 Head                              |
| Chest                                                    | X, Y, Z                                     | Left Front Seat           | Veh. #1 Pos. #1 Chest                             |
| Femur                                                    | R, L**                                      | Left Front Seat           | Veh. #1 Pos. #1 Femur                             |
| Belts                                                    | U, L***                                     | Left Front Seat           | Veh. #1 Pos. #1 Belts                             |
| <u>RF PASSENGER POSITION 2</u>                           |                                             |                           |                                                   |
| Head                                                     | X, Y, Z                                     | Right Front Seat          | Veh. #1 Pos. #2 Head                              |
| Chest                                                    | X, Y, Z                                     | Right Front Seat          | Veh. #1 Pos. #2 Chest                             |
| Femur                                                    | R, L**                                      | Right Front Seat          | Veh. #1 Pos. #2 Femur                             |
| Belts                                                    | U, L***                                     | Right Front Seat          | Veh. #1 Pos. #2 Belts                             |

\* See Accelerometer Layout Diagram Figure 2.

\*\*\* Upper and Lower Belt Forces

\*\* Right and Left Femur Forces



| ACCELEROMETER NUMBER * | ACCELEROMETER LOCATION         | DIRECTION |   |   |
|------------------------|--------------------------------|-----------|---|---|
|                        |                                | X         | Y | Z |
| 1                      | ENGINE                         | X         |   | X |
| 2                      | FIREWALL AT VEHICLE CENTERLINE | X         |   | X |
| 3                      | FRONT SEAT CROSSBEAM           | X         |   |   |
| 4                      | REAR SEAT CROSSBEAM            | X         |   |   |
| 5                      | C/G                            | X         | X | X |
|                        |                                |           |   |   |

\*The accelerometer pack number can be correlated with the vehicle response data traces found in Appendix B.

FIGURE 3 VEHICLE ACCELEROMETER LOCATIONS  
VEHICLE NO. 2 - HORIZON  
4-9

Table 9

ELECTRONIC INSTRUMENTATION TEST 33

Vehicle No. 2 - 1980 Plymouth Horizon

| TRANSDUCER<br>DESCRIPTION OR<br>ACCELEROMETER LOCATION * | DIRECTION OF<br>PARAMETER<br>BEING MEASURED | LOCATION<br>ON<br>VEHICLE | DESCRIPTION LISTED<br>ON DATA PLOTS<br>APPENDIX B |
|----------------------------------------------------------|---------------------------------------------|---------------------------|---------------------------------------------------|
| <u>VEHICLE ACCELEROMETERS</u>                            |                                             |                           |                                                   |
| 1                                                        | X, Z                                        | Engine                    | Veh. #2 Acc. Pack #1                              |
| 2                                                        | X, Z                                        | Firewall at Center Line   | Veh. #2 Acc. Pack #2                              |
| 3                                                        | X                                           | Front Seat Crossmember    | Veh. #2 Acc. Pack #3                              |
| 4                                                        | X                                           | Rear Seat Crossmember     | Veh. #2 Acc. Pack #4                              |
| 5                                                        | X, Y, Z                                     | C/G of Vehicle            | Veh. #2 Acc. Pack #5                              |
| <u>DUMMY</u>                                             |                                             |                           |                                                   |
| <u>DRIVER POSITION #1</u>                                |                                             |                           |                                                   |
| Head                                                     | X, Y, Z                                     | Left Front Seat           | Veh. #2 Pos. #1 Head                              |
| Chest                                                    | X, Y, Z                                     | Left Front Seat           | Veh. #2 Pos. #1 Chest                             |
| Femur                                                    | R, L **                                     | Left Front Seat           | Veh. #2 Pos. #1 Femur                             |
| Belts                                                    | U, L ***                                    | Left Front Seat           | Veh. #2 Pos. #1 Belts                             |
| <u>RF PASSENGER POSITION #2</u>                          |                                             |                           |                                                   |
| Head                                                     | X, Y, Z                                     | Right Front Seat          | Veh. #2 Pos. #2 Head                              |
| Chest                                                    | X, Y, Z                                     | Right Front Seat          | Veh. #2 Pos. #2 Chest                             |
| Femur                                                    | R, L **                                     | Right Front Seat          | Veh. #2 Pos. #2 Femur                             |
| Belts                                                    | U, L ***                                    | Right Front Seat          | Veh. #2 Pos. #2 Belts                             |

\* See Accelerometer Layout Diagram Figure 3.

\*\* Upper and Lower Belt Forces

\*\*\* Right and Left Femur Forces

NOTE: Camera Information Shown on Tables 10 and 11

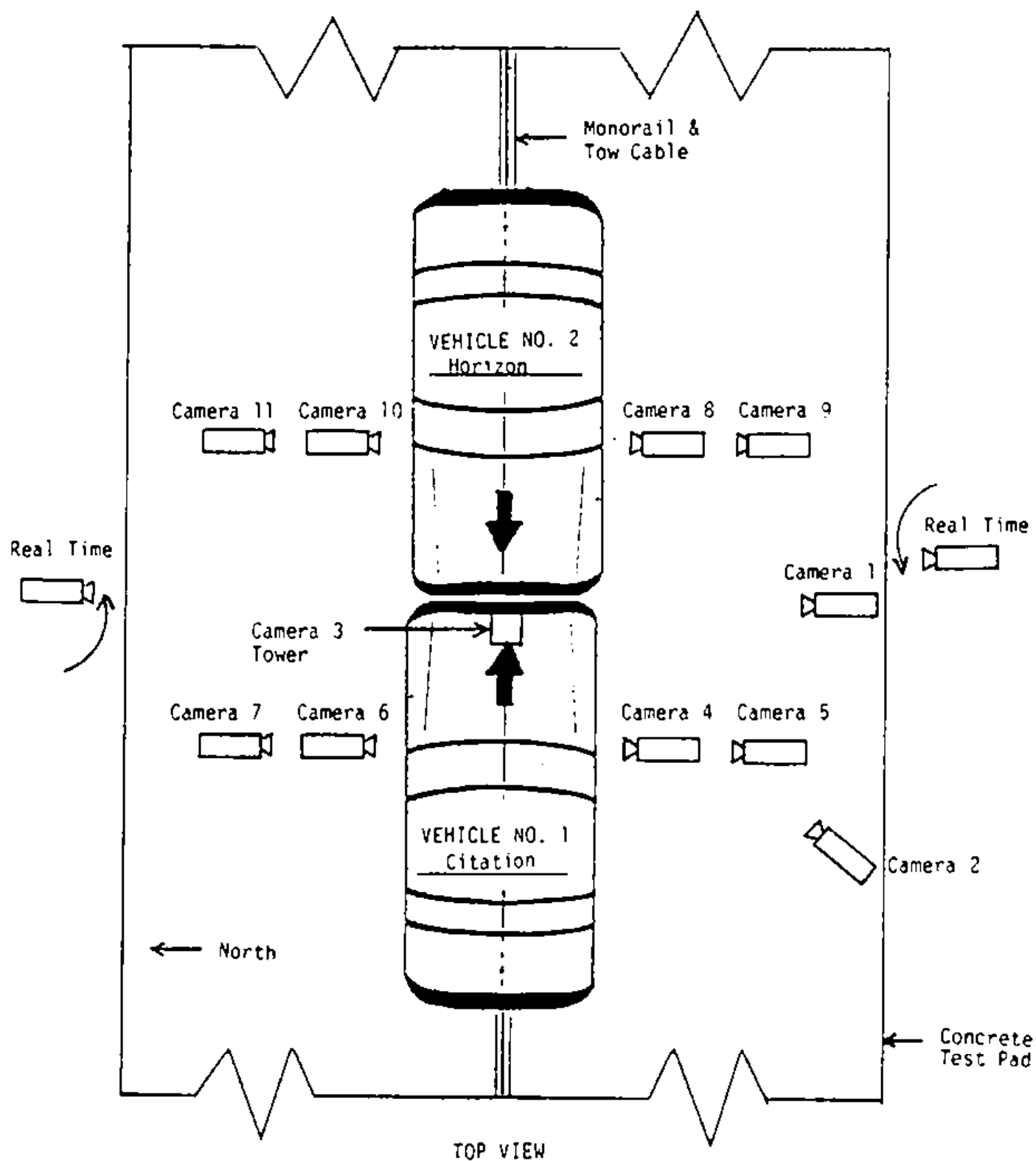


FIGURE 4 CAMERA POSITION FOR FRONTAL CAR-TO-CAR IMPACTS

Table 10

HIGH SPEED CAMERA LOCATIONSTest No. 308-33-491Vehicle 1 CitationVehicle 2 Horizon

| CAMERA<br>NUMBER | VIEW                              | CAMERA POSITIONS (IN)* |     |     | CAMERA<br>ANGLE<br>(DEG)** | FILM PLANE<br>TO HEAD<br>TARGET (IN)<br>X |
|------------------|-----------------------------------|------------------------|-----|-----|----------------------------|-------------------------------------------|
|                  |                                   | X                      | Y   | Z   |                            |                                           |
| 1                | Impact Event                      | 517                    | 33  | 47  | 0                          |                                           |
| 2                | Impact Event, 45° angle           | 210                    | 226 | 125 | -17                        |                                           |
| 3                | Overhead Tower                    | 0                      | 76  | 388 | -79                        |                                           |
| 4                | Vehicle 1 - right front passenger | 167                    | 74  | 41  | -3.0                       | 146.6                                     |
| 5                | Redundant for Camera 4            | 249                    | 92  | 69  | -9.0                       | 228.6                                     |
| 6                | Vehicle 1 - driver                | 160                    | 70  | 41  | -4.5                       | 139.5                                     |
| 7                | Redundant for Camera 6            | 246                    | 79  | 73  | -11.0                      | 225.5                                     |
| 8                | Vehicle 2 - driver                | 162                    | 57  | 41  | -3.5                       | 141.6                                     |
| 9                | Redundant for Camera 8            | 289                    | 58  | 65  | -7.0                       | 268.6                                     |
| 10               | Vehicle 2 - right front passenger | 160                    | 47  | 41  | -4.0                       | 139.8                                     |
| 11               | Redundant for Camera 10           | 242                    | 42  | 71  | -9.0                       | 221.8                                     |

\*X = film plane to monorail centerline  
 Y = film plane to impact location  
 Z = film plane to ground

\*\*Referenced to horizontal plane

Table 11  
CAMERA INFORMATION  
 (Test 33)

| CAMERA NO. | LOCATION                         | TYPE       | LENS<br>(mm) | SPEED<br>(fps) |
|------------|----------------------------------|------------|--------------|----------------|
| 1          | Impact                           | Photosonic | 13           | 900            |
| 2          | Tower, 45°                       | Photosonic | 13           | 875            |
| 3          | Tower                            | Photosonic | 13           | 975            |
| 4          | Citation - RFP                   | Photosonic | 13           | 900            |
| 5          | Citation - RFP<br>(Redundant)    | Photosonic | 25           | 900            |
| 6          | Citation - Driver                | Photosonic | 13           | 900            |
| 7          | Citation - Driver<br>(Redundant) | Photosonic | 25           | 1100           |
| 8          | Horizon - Driver                 | Photosonic | 13           | 900            |
| 9          | Horizon - Driver<br>(Redundant)  | Photosonic | 25           | 900            |
| 10         | Horizon - RFP                    | Photosonic | 13           | 900            |
| 11         | Horizon - RFP<br>(Redundant)     | Photosonic | 25           | 1000           |

NOTE: Cameras are numbered according to splicing sequence of film.

(24 fps) real time movie film coverage of pre-crash, post-crash and crash event spliced at start of film.

**FIGURE 5**  
**PART 572 DUMMY IN-VEHICLE POSITION**

Test No. 308-33-491

Vehicle No. 1 - Citation

**SEAT TYPE:**

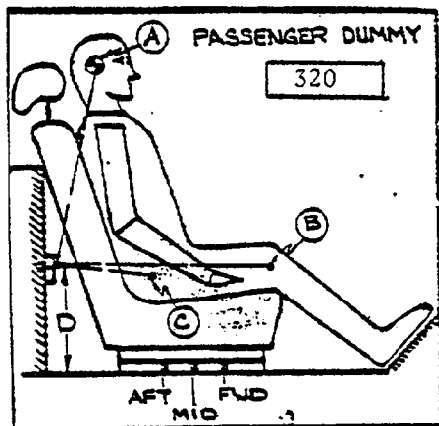
☐ Bench  
☐ Bucket  
☒ Split Bench

**ADJUSTER TYPE:**

☒ Manual  
☐ Power

**BUCKET SEAT BACK TYPE:**

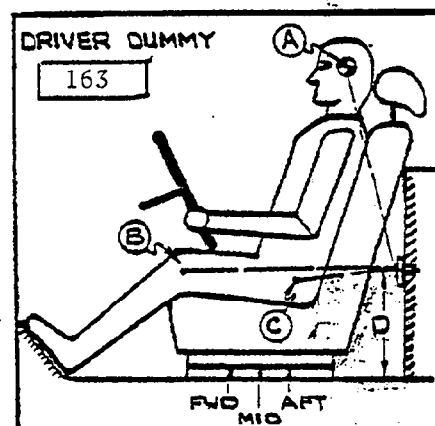
☒ Fixed  
☐ Adjustable Reclining



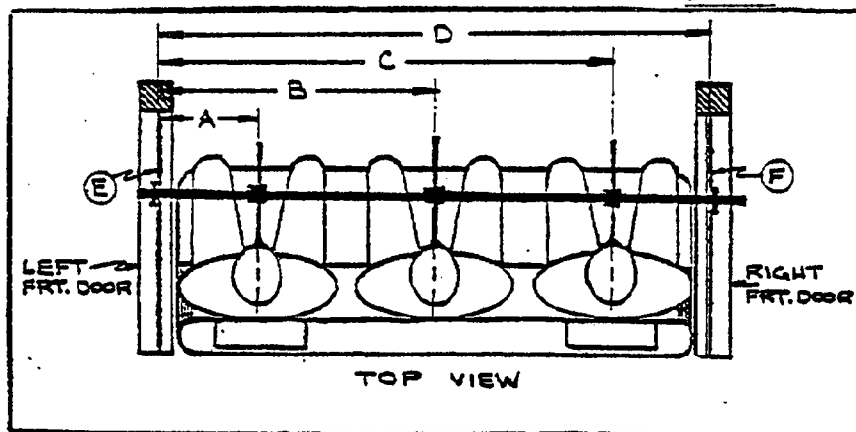
A =  $24 \frac{1}{8}$  in.      12 Degrees  
B =  $32 \frac{3}{8}$  in.      99 Degrees  
C =  $17 \frac{3}{4}$  in.      110 Degrees  
D = 14 in.

**MEASUREMENT LOCATION**

A - Head Target  
B - Knee Joint  
C - Approximate 'H' Point  
D - Sill to Reference Point



A =  $23 \frac{3}{4}$  in.      20 Degrees  
B =  $33 \frac{1}{4}$  in.      97 Degrees  
C =  $17 \frac{5}{8}$  in.      102 Degrees  
D = 14 in.



DUMMY ID

320

-

163

A = Left Door to Driver Centerline  
B = Left Door to Center Passenger Centerline  
C = Left Door to Right Passenger Centerline  
D = Left Door to Right Door  
E, F = Window Glass Height (Right and Left Must be Equal)

$14 \frac{1}{4}$  in.  
- in.  
 $40 \frac{3}{4}$  in.  
55 in.  
 $8 \frac{1}{4}$  in.

\* Referenced to vertical.

**FIGURE 6**  
**PART 572 DUMMY IN-VEHICLE POSITION**

Test No. 308-53-491

Vehicle No. 2 - Horizon

**SEAT TYPE:**

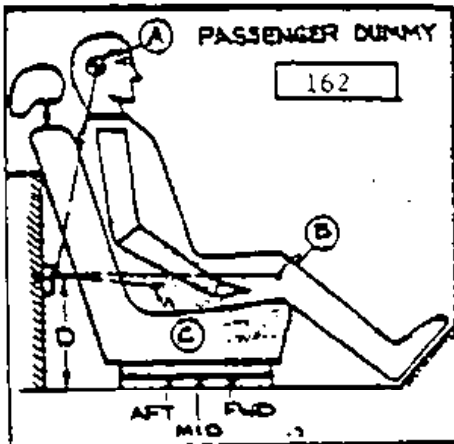
       Bench  
  X   Bucket  
       Split Bench

**ADJUSTER TYPE:**

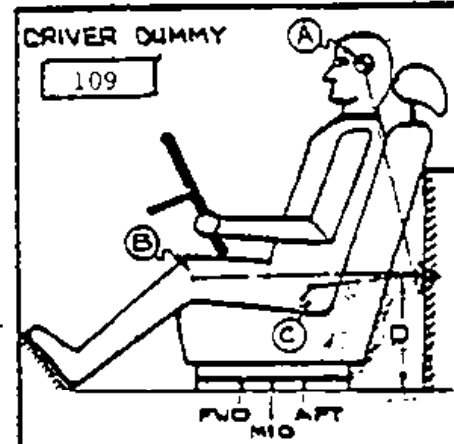
  X   Manual  
       Power

**BUCKET SEAT BACK TYPE:**

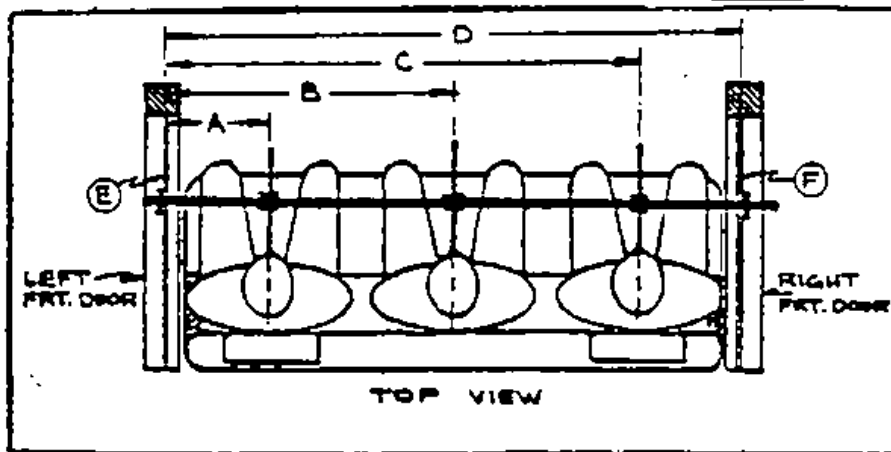
  X   Fixed  
       Adjustable Reclining



A =  $21 \frac{3}{4}$  in.      27 Degrees  
B =  $35 \frac{3}{4}$  in.      95 Degrees  
C =  $21 \frac{1}{4}$  in.      109 Degrees  
D =  $13 \frac{1}{4}$  in.



A =  $23 \frac{7}{8}$  in.      31 Degrees  
B =  $36$  in.      96 Degrees  
C =  $20 \frac{3}{4}$  in.      108 Degrees  
D =  $13 \frac{1}{4}$  in.



**DUMMY ID**

162

-

109

|      |   |                                                    |                   |
|------|---|----------------------------------------------------|-------------------|
| A    | = | Left Door to Driver Centerline                     | <u>13</u> in.     |
| B    | = | Left Door to Center Passenger Centerline           | <u>-</u> in.      |
| C    | = | Left Door to Right Passenger Centerline            | <u>39 1/2</u> in. |
| D    | = | Left Door to Right Door                            | <u>52</u> in.     |
| E, F | = | Window Glass Height (Right and Left Must be Equal) | <u>8</u> in.      |

\* Referenced to vertical.

## SEAT BELTS

To help lessen the chance of injury and/or the severity of injury in accidents or sudden stops, General Motors urges that people riding in the car be properly restrained at all times, using the seat belts provided. This includes women who are pregnant, and children of all ages. (See the following pages for the use of restraints by children and pregnant women). General Motors provides a seat belt at each position designed for occupant seating. Thus the front seat of this vehicle is equipped with seat belts for two occupants, and the rear seat for three occupants.

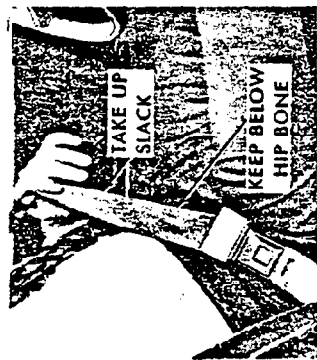
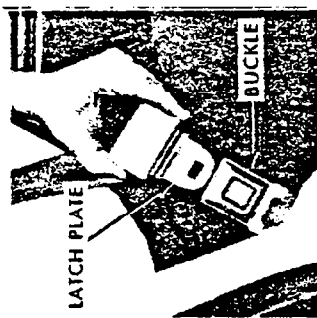
### Front Seat Lap-Shoulder Belt

- Close the front door fully (this activates the tension reliever).
- Adjust the front seat as needed and sit up straight and well back in the seat.
- There are a number of ways the lap-shoulder belt may be put on easily. For example...
- The lap-shoulder belt may be put on using one hand by: (1) Holding the latch plate and pulling the belt as far as it will reach across your waist (see illustration). (2) Then, hold the latch plate at a right angle to the webbing. At the same time slide it up the belt by raising it toward the upper outside corner of the windshield. (3) Finally, pull the latch plate down across your body and push it into the buckle until it clicks.

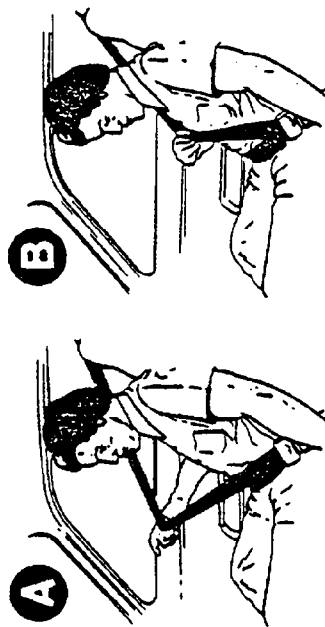


- One easy two-handed method is to hold the webbing just behind the latch plate using the hand nearest the belt. Then bring it down across your body. While holding the webbing taut with one hand, slide the latch plate up the belt with the other hand. Finally, hold the latch plate and push it into the buckle until it clicks.
- Position the "lap" portion of the belt across your lap as **LOW ON THE HIPS** as possible. If the lap portion did not snug itself to your satisfaction, adjust it to a **SNUG FIT** by grasping the "shoulder" portion of the belt and pulling it **UPWARD** through the latch plate, until the lap portion is snug across your lap. This reduces the risk of sliding under the belt during an accident.

**CAUTION:** A snug fit with the lap belt positioned low on the hips is necessary to help lessen the chance and/or severity of injury in an accident. This spreads the force of the lap belt over the strong hip bone instead of across the soft abdomen. To help lessen the chance and/or severity of injury in an accident, never use the same belt for more than one person at a time; do not wear belts twisted; and do not let belts or belt hardware become damaged by pinching them in the seat or door.



- The shoulder portion of the front seat belt is designed to lock only during a sudden stop or impact. At other times it is designed to move freely with the person.
- For those who find the shoulder belt too snug, belt pressure against the chest can be reduced by using the tension reliever built into the retractor. To use this feature: (A) Start by pulling the shoulder belt outward far enough so that when you let go, it returns to the chest (Step "A" in the figure). (B) Then adjust the belt tension by pulling down slightly on the shoulder portion of the belt and letting go (Step "B" in the figure). The least amount of belt possible should be pulled from the retractor (about 25 millimeters or one inch) to minimize belt pressure.



- To release the tension reliever and get rid of slack, pull the shoulder belt out and let it retract. Or lean far forward and then back.

**CAUTION:** Use the least amount of shoulder belt slack to minimize belt pressure. Too much belt slack could reduce the amount of protection because the belt may not be able to properly restrain you in an accident.

Do not wear the shoulder portion of the belt under your arm nearest the door or otherwise out of position. Such use could increase the chance and/or the severity of injury in an accident.

Figure 7 OWNER'S MANUAL RESTRAINT SYSTEM OPERATING INSTRUCTIONS

Vehicle #1 Citation

# Seats, Seat Belts, Mirrors

## Seat Belts

Always use the seat belts. The chance of a serious injury is greatly reduced when the seat belts are properly used.

Seat belts provide protection against being thrown from the vehicle as well as reducing the risk of an injury caused by striking the interior of the vehicle.

The following pages contain the recommended procedures for fastening, adjusting and wearing the belts for maximum comfort and safety.

## Front Seats

The "UNIBELT" or single belt restraint system, is installed for the driver and front seat passenger. This system incorporates a vehicle sensitive shoulder belt retractor, designed to lock (i.e. restrict belt travel) only during very sudden stops or impacts. This feature allows the shoulder belt to move freely with the wearer. It will not lock by jerking or pulling the webbing.



## UNIBELT OPERATING INSTRUCTIONS

1. Enter the car and adjust the seat.
2. Grasp the metal tip located beside the seat and pull the belt forward across the body so that the shoulder portion of the belt crosses the shoulder and chest.
3. As you pull the metal tip toward the buckle, allow the webbing to slide through the tip. This system will not lock up if you stop or hesitate, so relax and continue to "buckle-up".
4. Slack will automatically be removed due to tension created by the retractor.
5. To release the belt, push the button on the buckle. The belt will automatically return to its stowed position.



## DELUXE UNIBELT SYSTEM WITH TENSION RELIEVER AND AUTOMATIC RELEASE (optional)

1. Enter the car and adjust the seat. Note the metal tip of the Unibelt in stowed position high on the vertical pillar - 4-door; or at the guide loop on the headrest - 2-door.

### CLOSE DOOR

2. Grasp the metal tip and slide it up the webbing as far as necessary to go around your lap, as you pull out the webbing. A couple of ones and thus will become an automatic one handed operation.

3. As you pull the webbing, move the metal tip toward the buckle. This system will not lock up if you stop or hesitate, so relax and continue to "buckle-up".

Insert the tip into the buckle until a "click" is heard.



4. Slack will automatically be removed due to tension created by the retractor. If a snug fit in the lap belt portion is desired, pull up on the shoulder belt as shown.
5. If the shoulder belt feels snug, move your shoulder forward slightly, or give a slight tug on the belt, such that you withdraw an inch or so of webbing.

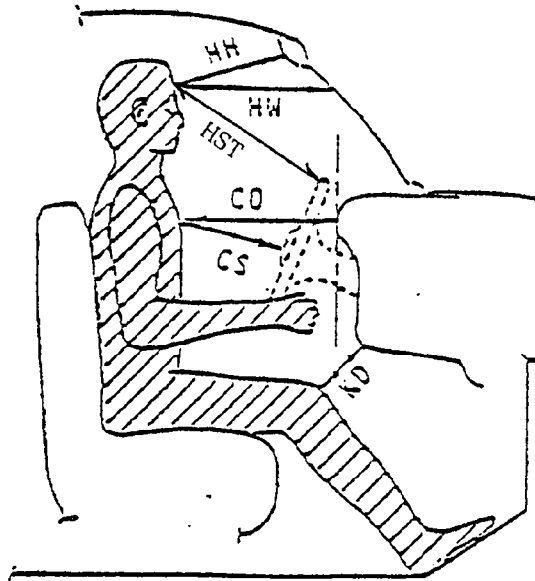
The belt will retain the small amount of slack necessary for comfort when you return to your normal seating position. If the belt is still too tight, pull out 6" to 8" of webbing, let it return to your chest and repeat the above motion. NOTE: The door must be closed to achieve belt tension relief.

The shoulder belt will allow unrestricted movement under normal conditions. Extreme movements will probably require resetting the slack in the shoulder belt. The belt will lock tightly in the event of an accident.

6. To release the belt, push the button on the buckle. The belt will automatically retract to its stowed position when the door is opened.

Figure 8 OWNER'S MANUAL RESTRAINT SYSTEM OPERATING INSTRUCTIONS  
Vehicle #2 Horizon

|     | <u>DRIVER</u> | <u>PASS</u> |
|-----|---------------|-------------|
| HH  | 16            | 16 1/2      |
| HW  | 20 1/2        | 20 1/4      |
| CD  | 25 1/4        | 29          |
| CS  | 17            | N/A         |
| KDL | 8 7/8         | 11          |
| KDR | 8 7/8         | 11          |
| HST | 21 7/8        | N/A         |



|    |       |       |
|----|-------|-------|
| HR | 6 1/4 | 6 1/2 |
| HS | 7 1/2 | 7 5/8 |
| AD | 5 3/4 | 6     |
| HD | 7 3/4 | 7 1/2 |

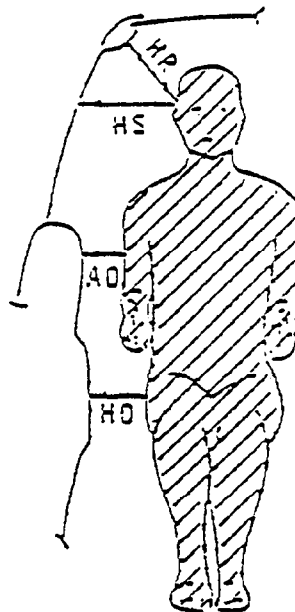
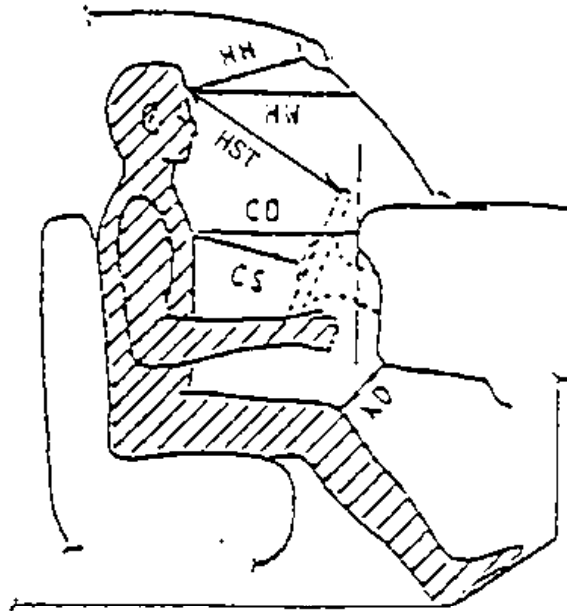


Figure 9 OCCUPANT CLEARANCE DIMENSIONS  
VEHICLE NO. 1 - CITATION

|     | <u>DRIVER</u> | <u>PASS</u> |
|-----|---------------|-------------|
| SH  | 11 1/4        | 10 1/4      |
| HW  | 16 1/4        | 15          |
| CD  | 20 1/2        | 23 1/2      |
| CS  | 18 1/8        | N/A         |
| KDL | 8 1/8         | 8 3/4       |
| KDR | 8 1/4         | 8 3/4       |
| HST | 20 1/2        | N/A         |



|    |       |       |
|----|-------|-------|
| HR | 4 3/4 | 4 3/4 |
| HS | 5 5/8 | 5 3/4 |
| AD | 3 3/4 | 3 3/4 |
| HO | 6 1/4 | 6     |

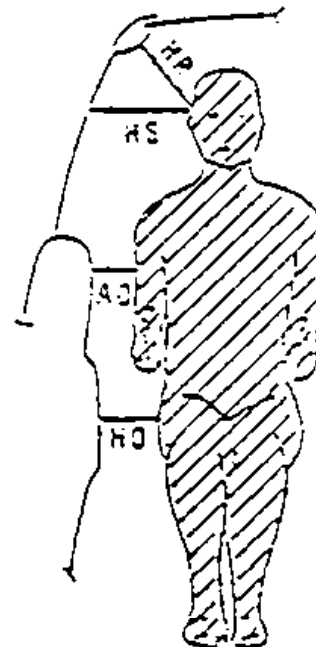


Figure 10 OCCUPANT CLEARANCE DIMENSIONS  
VEHICLE NO. 2 - HORIZON

Table 12

**DUMMY INJURY CRITERIA VALUES**Vehicle No. 1 1980 Chevrolet Citation

|           | MAXIMUM ACCELERATION ("G") * |      |      |      |       |      |      |      |
|-----------|------------------------------|------|------|------|-------|------|------|------|
|           | HEAD                         |      |      |      | CHEST |      |      |      |
|           | X                            | Y    | Z    | R    | X     | Y    | Z    | R    |
| DUMMY (1) | -45.7                        | -16  | 41.7 | 63.4 | -34.5 | -8.5 | -15  | 39   |
| DUMMY (2) | -21.3                        | 37.3 | 57.0 | 64.0 | -24.3 | 33   | 11.5 | 37.3 |
| DUMMY (3) |                              |      |      |      |       |      |      |      |
| DUMMY (4) |                              |      |      |      |       |      |      |      |

|           | MAXIMUM FORCE-FEMUR LOAD (LBS) |            |
|-----------|--------------------------------|------------|
|           | RIGHT FEMUR                    | LEFT FEMUR |
| DUMMY (1) | 520                            | 1170       |
| DUMMY (2) | 595                            | 1000       |
| DUMMY (3) |                                |            |
| DUMMY (4) |                                |            |

|           | MAXIMUM FORCE-SEAT BELTS LOADS (LBS) |                          |
|-----------|--------------------------------------|--------------------------|
|           | SHOULDER STRAP<br>UPPER BELT LOAD    | LAP STRAP<br>BELT LOAD † |
| DUMMY (1) | 1480                                 | 577                      |
| DUMMY (2) | 1750                                 | 812                      |
| DUMMY (3) |                                      |                          |
| DUMMY (4) |                                      |                          |

|           | HEAD INJURY CRITERIA** |                      |                      |                                                   | SEVERITY INDEX |
|-----------|------------------------|----------------------|----------------------|---------------------------------------------------|----------------|
|           | HIC                    | t <sub>1</sub> (SEC) | t <sub>2</sub> (SEC) | AVE. ACC. (g)<br>t <sub>1</sub> TO t <sub>2</sub> | HEAD           |
| DUMMY (1) | 448.6                  | .0783                | .1131                | 44.1                                              | 695.9          |
| DUMMY (2) | 674.0                  | .0858                | .1167                | 54.4                                              | 934.7          |
| DUMMY (3) |                        |                      |                      |                                                   |                |
| DUMMY (4) |                        |                      |                      |                                                   |                |

\*DEFINED AS EXCEEDING 0.003 SEC. DURATION

\*\*AS DEFINED IN FMVSS NO. 208

Table 13

## DUMMY INJURY CRITERIA VALUES

Vehicle No. 2 1980 Plymouth Horizon

|           | MAXIMUM ACCELERATION ("G") * |      |    |     |       |       |      |      |
|-----------|------------------------------|------|----|-----|-------|-------|------|------|
|           | HEAD                         |      |    |     | CHEST |       |      |      |
|           | X                            | Y    | Z  | R   | X     | Y     | Z    | R    |
| DUMMY (1) | -111                         | 14.1 | 70 | 125 | -44   | -11.5 | 9.5  | 44.1 |
| DUMMY (2) | -56.4                        | 15   | 81 | 94  | -42   | 6.1   | -6.6 | 42.3 |
| DUMMY (3) |                              |      |    |     |       |       |      |      |
| DUMMY (4) |                              |      |    |     |       |       |      |      |

|           | MAXIMUM FORCE-FEMUR LOAD (LBS) |            |
|-----------|--------------------------------|------------|
|           | RIGHT FEMUR                    | LEFT FEMUR |
| DUMMY (1) | 590                            | 1360       |
| DUMMY (2) | 460                            | 550        |
| DUMMY (3) |                                |            |
| DUMMY (4) |                                |            |

|           | MAXIMUM FORCE-SEAT BELTS LOADS (LBS) |                        |
|-----------|--------------------------------------|------------------------|
|           | SHOULDER STRAP<br>UPPER BELT LOAD    | LAP STRAP<br>BELT LOAD |
| DUMMY (1) | 1560                                 | 1587                   |
| DUMMY (2) | 2120                                 | 1612                   |
| DUMMY (3) |                                      |                        |
| DUMMY (4) |                                      |                        |

|           | HEAD INJURY CRITERIA** |                      |                      |                                                   | SEVERITY INDEX |
|-----------|------------------------|----------------------|----------------------|---------------------------------------------------|----------------|
|           | HIC                    | t <sub>1</sub> (SEC) | t <sub>2</sub> (SEC) | AVE. ACC. (g)<br>t <sub>1</sub> TO t <sub>2</sub> | HEAD           |
| DUMMY (1) | 1774.3                 | .0837                | .0879                | 178.0                                             | 2816.2         |
| DUMMY (2) | 1218.6                 | .0690                | .1137                | 59.5                                              | 2092.4         |
| DUMMY (3) |                        |                      |                      |                                                   |                |
| DUMMY (4) |                        |                      |                      |                                                   |                |

\*DEFINED AS EXCEEDING 0.003 SEC. DURATION

\*\*AS DEFINED IN FMVSS NO. 208

APPENDIX A

STILL PHOTOGRAPHS

VEHICLE #1 - CITATION

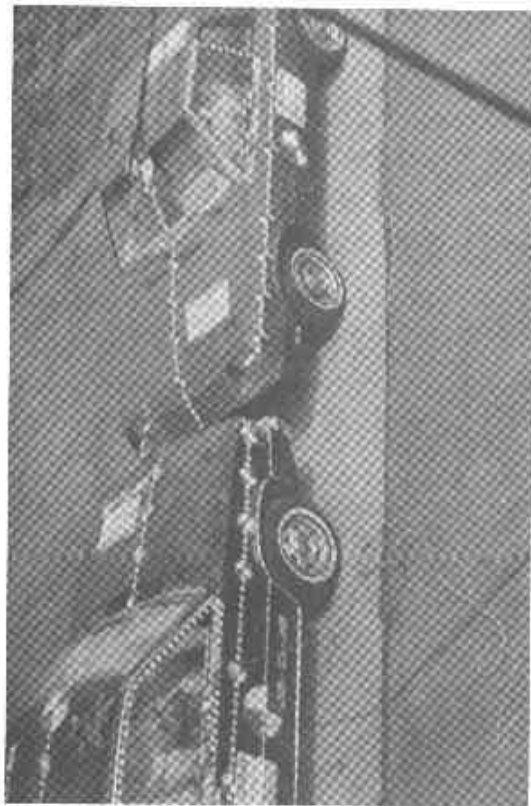


Figure A-1 VEHICLES #1 AND #2 - PRE-TEST  
IMPACT CONFIGURATION

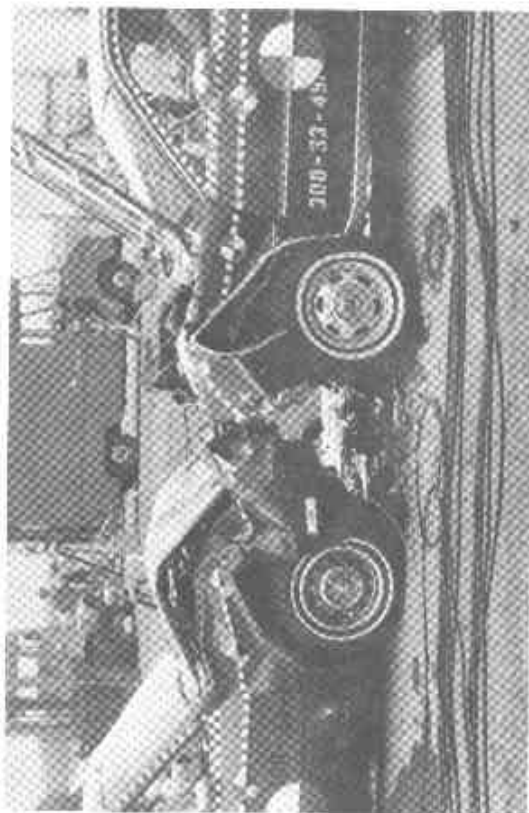


Figure A-2 VEHICLES #2 AND #1 - POST-TEST VIEW

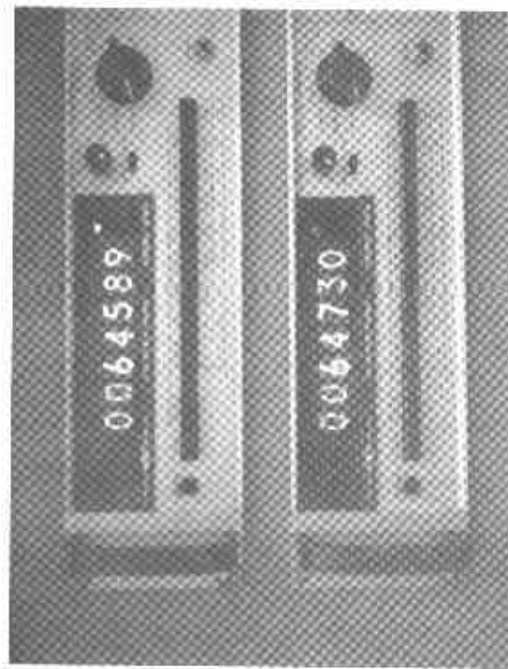


Figure A-3 VELOCITY TRAP COUNTER DISPLAY

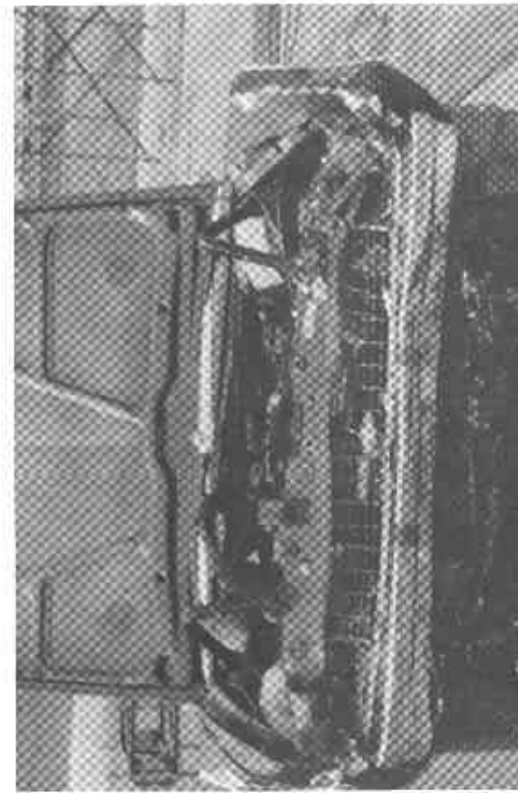
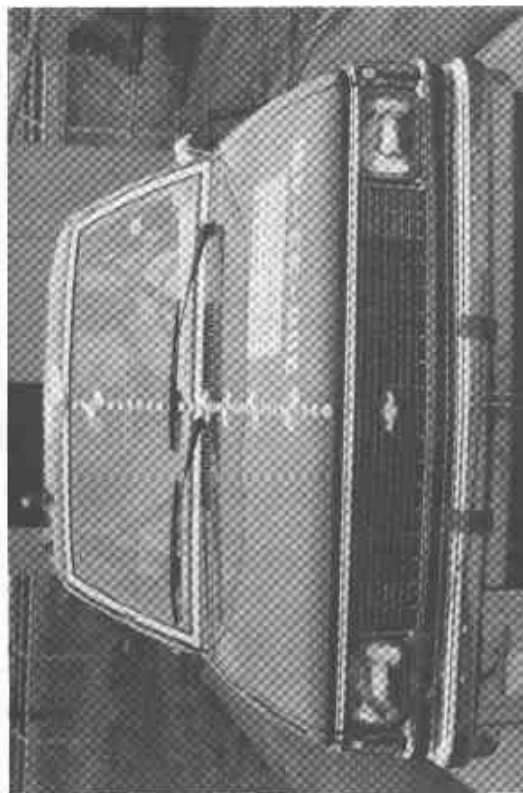
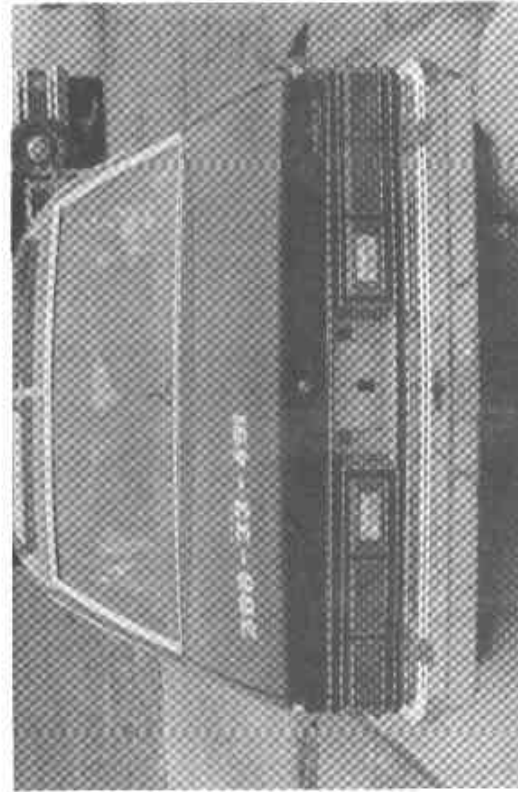
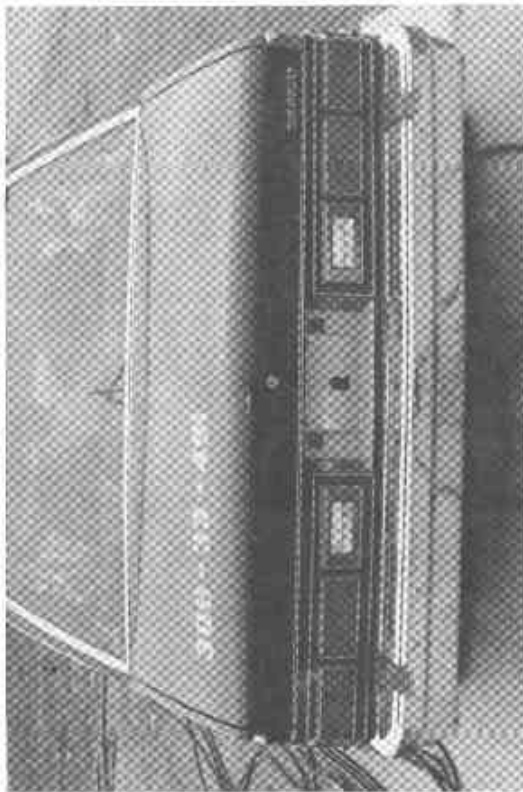


Figure A-4 VEHICLE #1 - PRE- AND POST-TEST VIEWS OF FRONT AND REAR

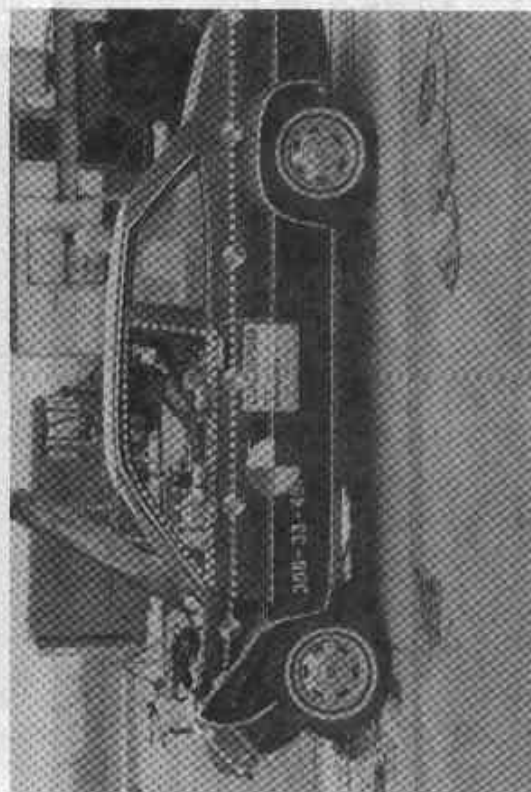
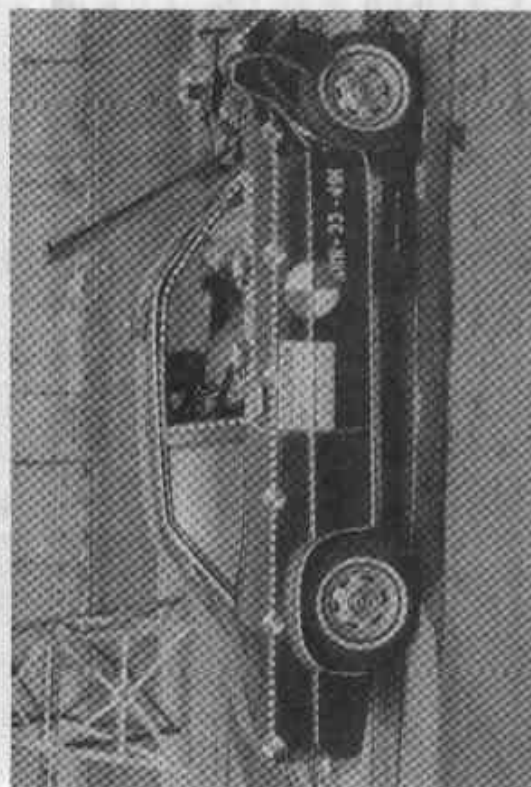
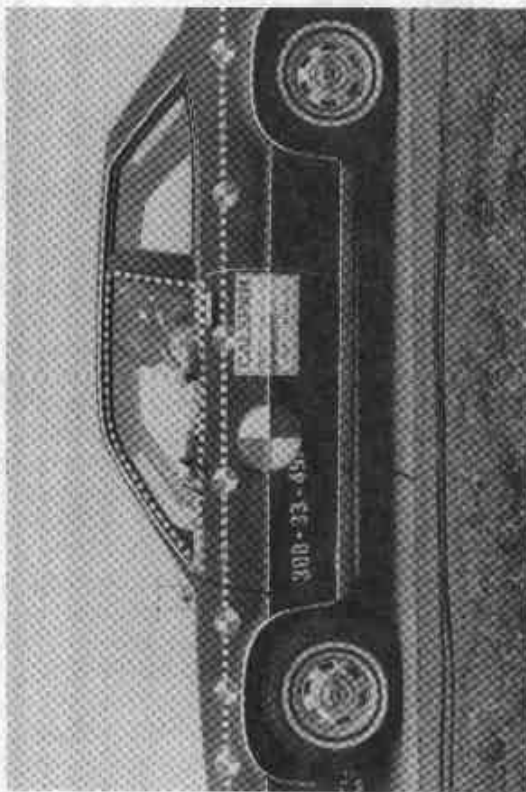
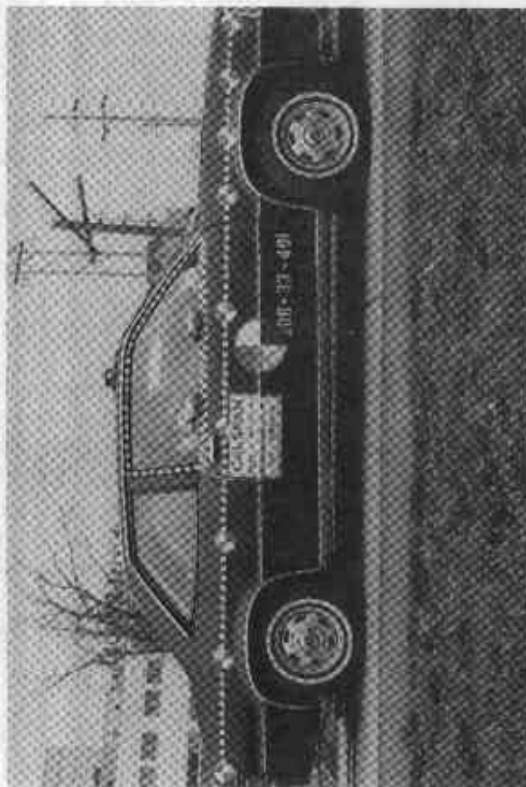


Figure A-5 VEHICLE #1 - PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT SIDES

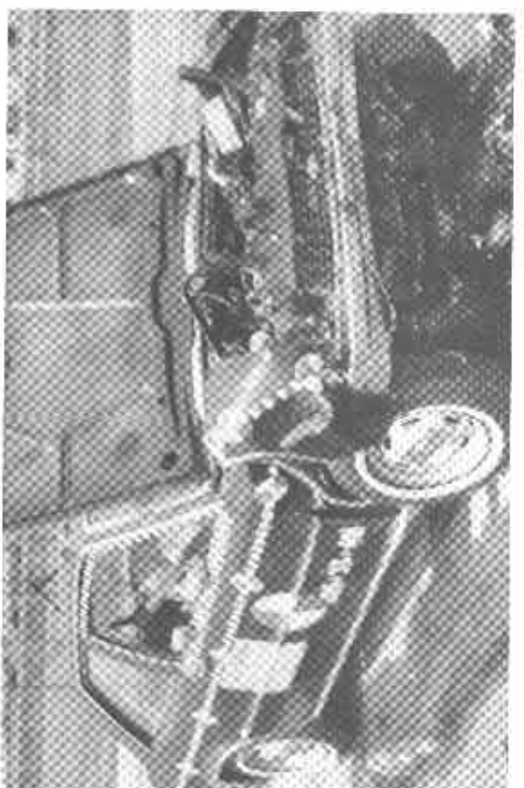
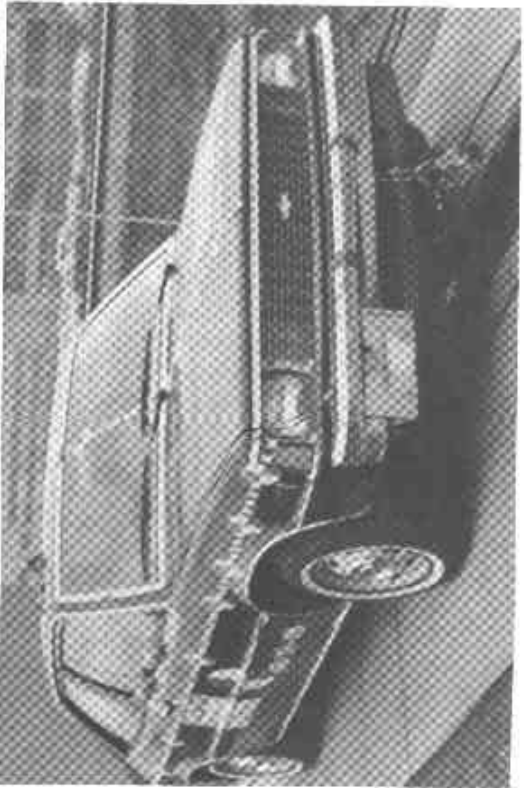
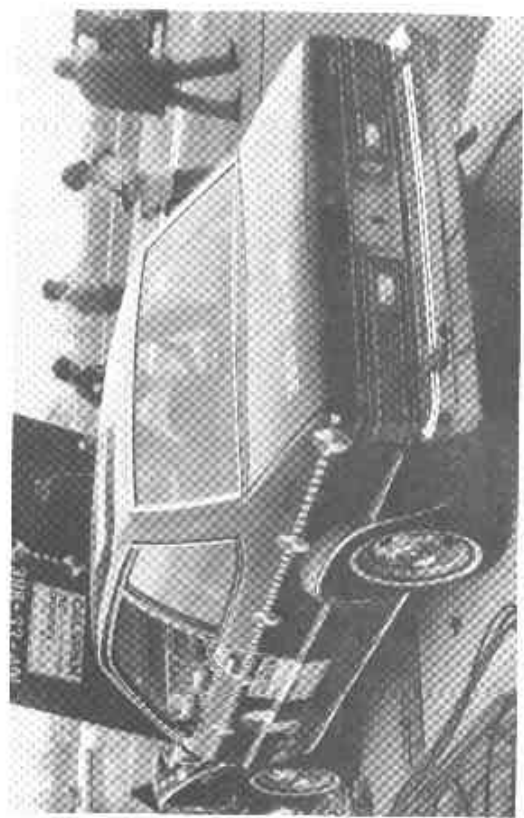


Figure A-6 VEHICLE #1 - PRE- AND POST-TEST VIEWS OF FRONT AND REAR THREE-QUARTER

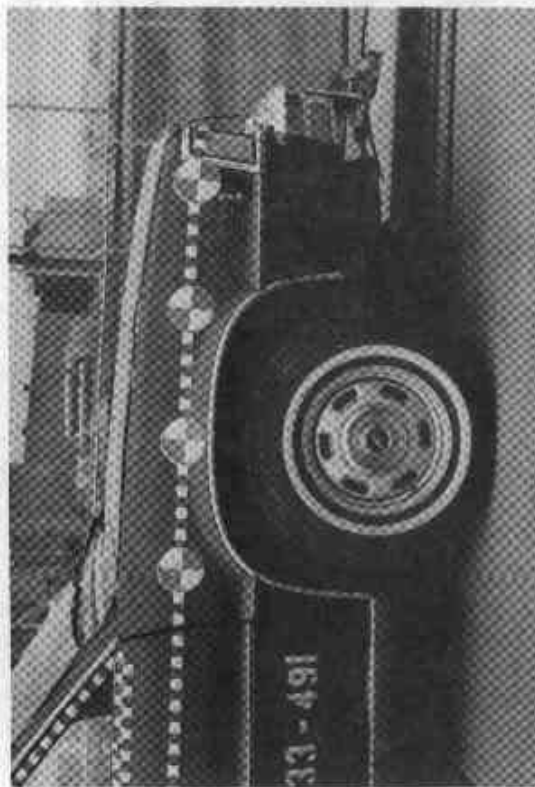
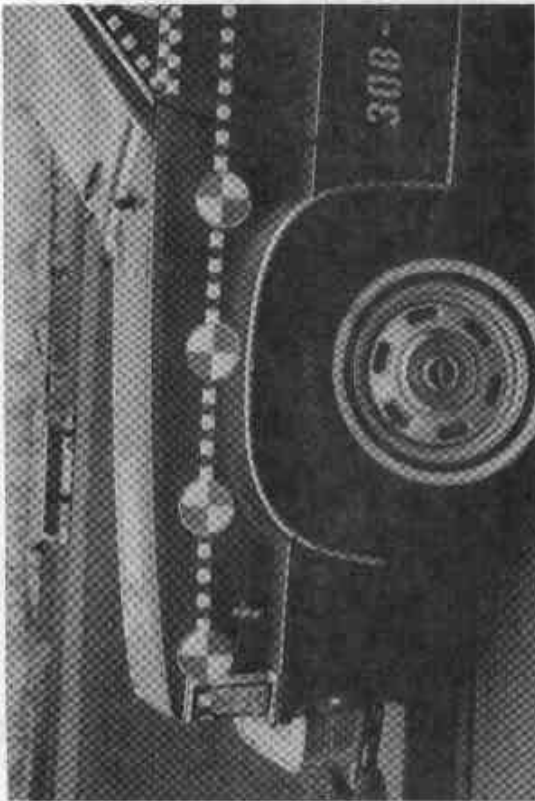


Figure A-7 VEHICLE #1 - PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT FRONT QUARTER

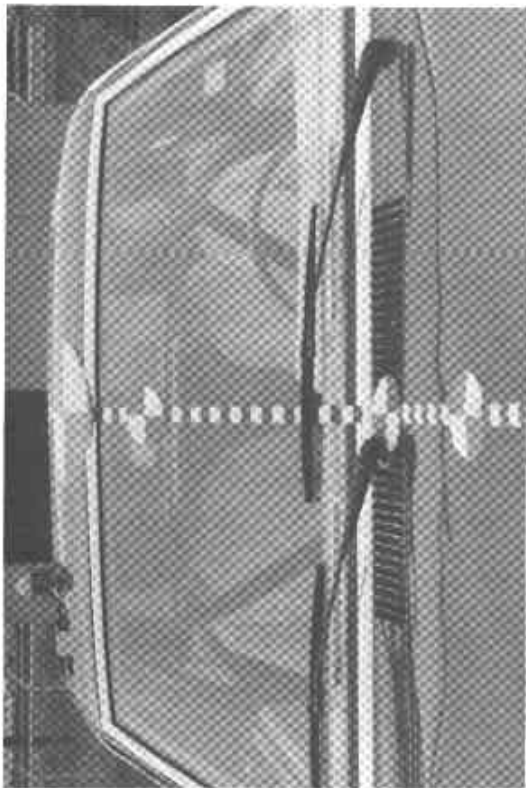


Figure A-8 VEHICLE #1 - PRE- AND POST-TEST VIEW OF WINDSHIELD

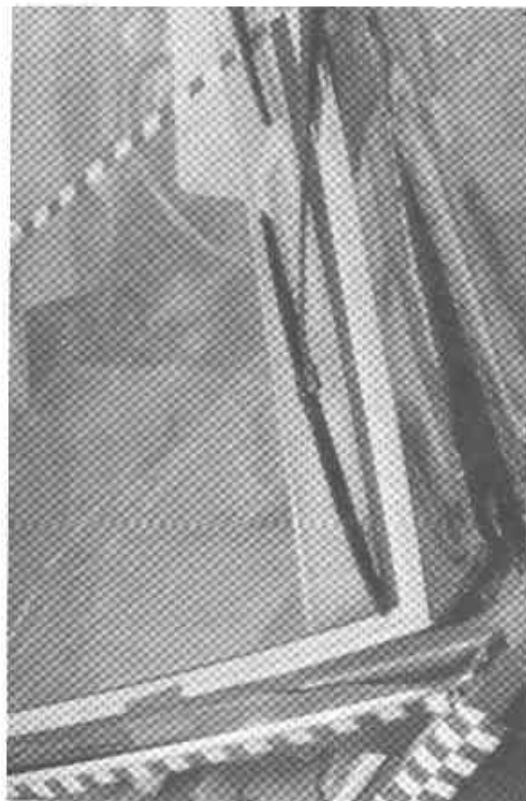


Figure A-10 VEHICLE #1 - POST-TEST VIEW OF ENGINE COMPARTMENT

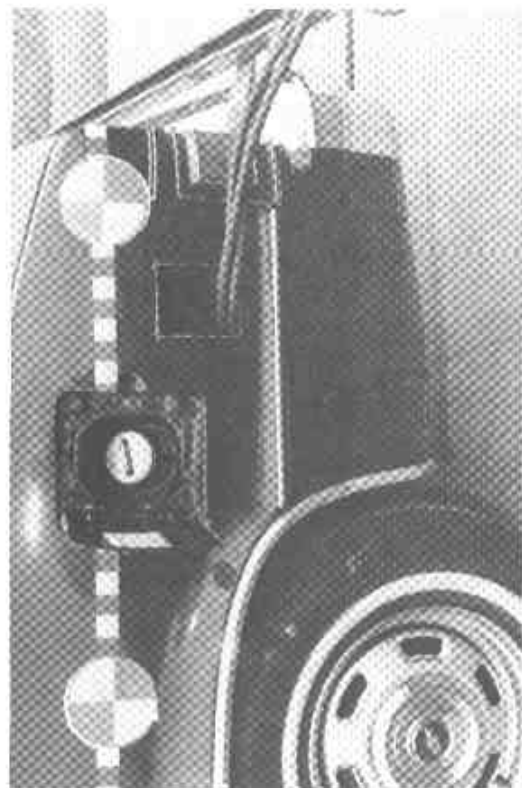


Figure A-9 VEHICLE #1 - FUEL TUBE AND CAP

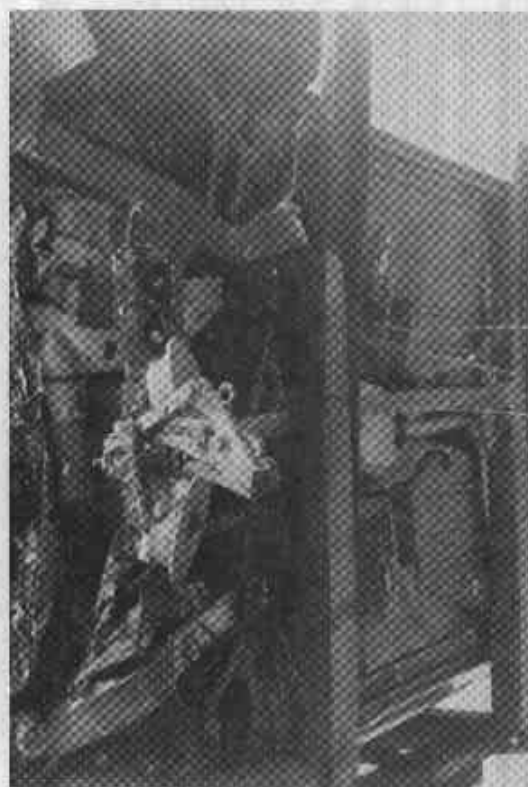
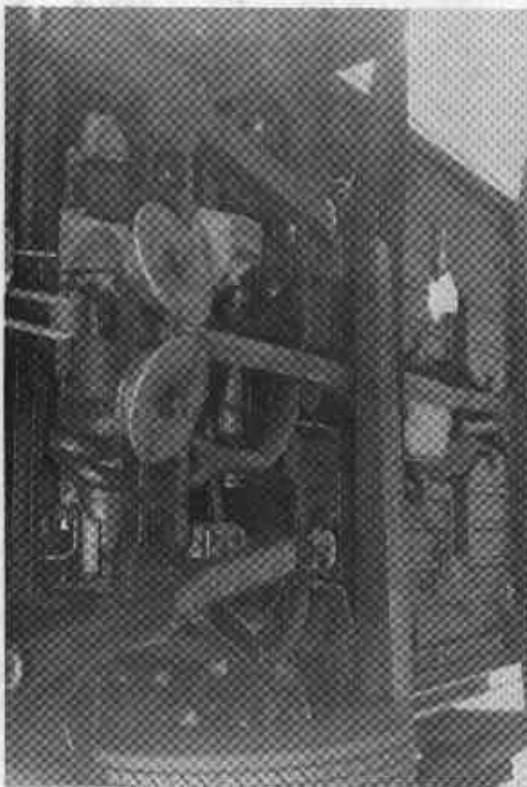


Figure A-11 VEHICLE #1 - PRE- AND POST-TEST VIEW OF FRONT AND REAR UNDERBODY

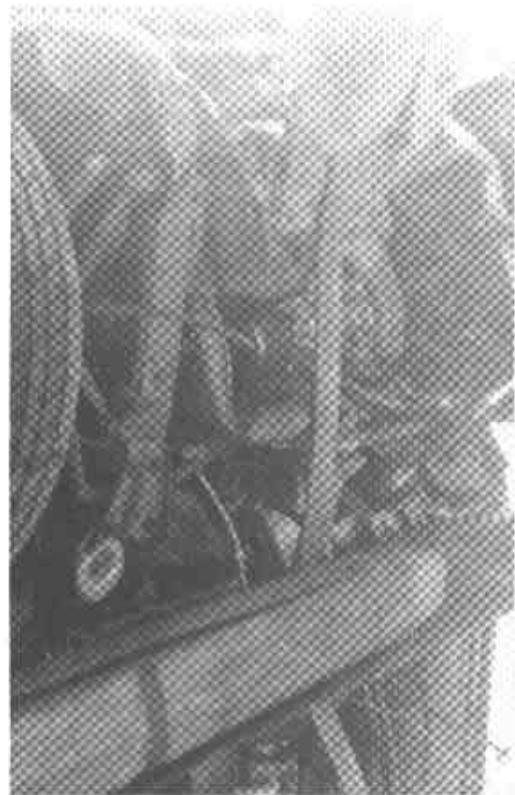


Figure A-12 VEHICLE #1 - PRE- AND POST-TEST VIEW OF RIGHT AND LEFT FRONT UNDERBODY

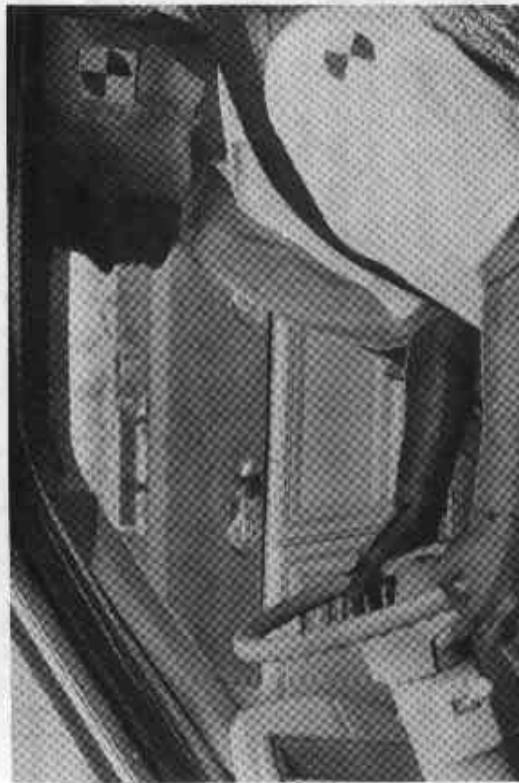
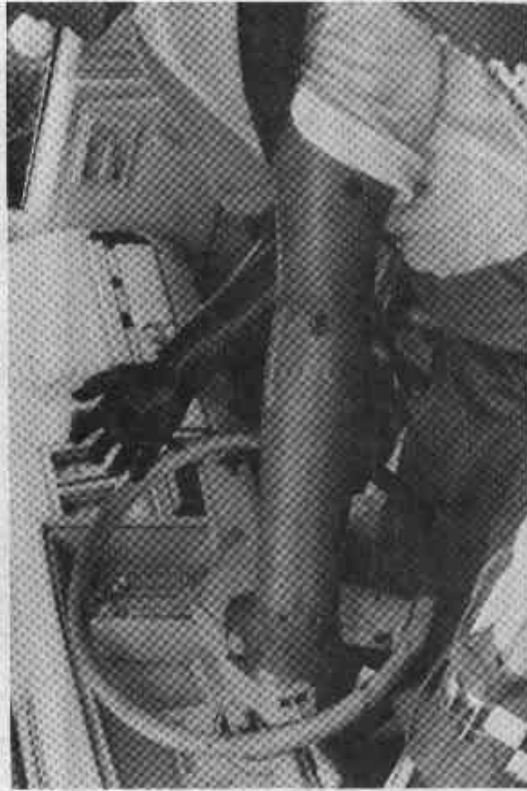


Figure A-13 VEHICLE #1 - PRE- AND POST-TEST VIEW OF DRIVER POSITION



Figure A-14 VEHICLE #1 - PRE- AND POST-TEST VIEW OF RIGHT FRONT PASSENGER

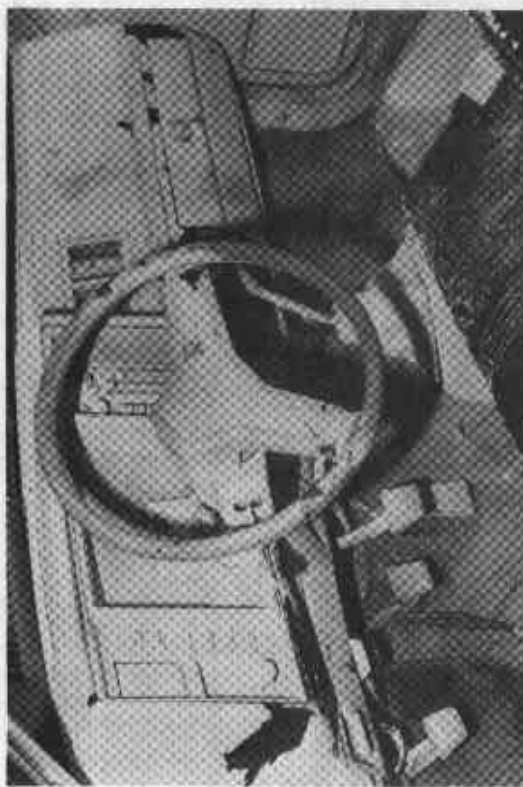


Figure A-15 VEHICLE #1 - POST-TEST VIEW OF INTERIOR

STILL PHOTOGRAPHS

VEHICLE #2 - HORIZON

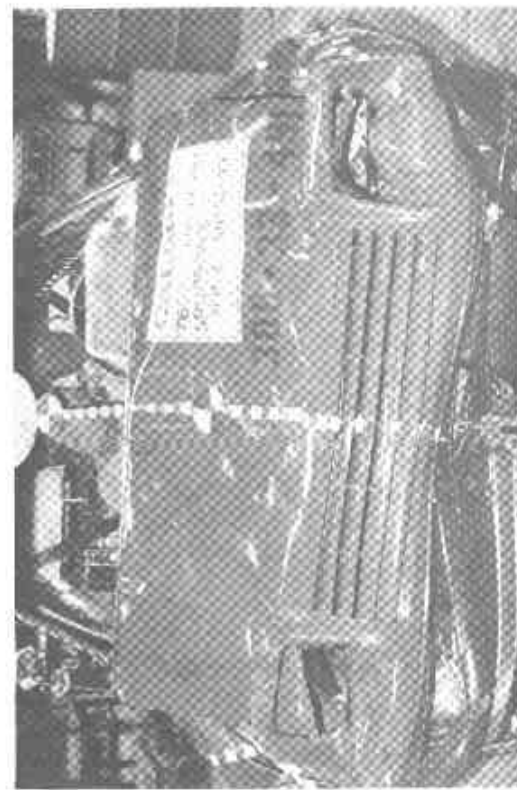
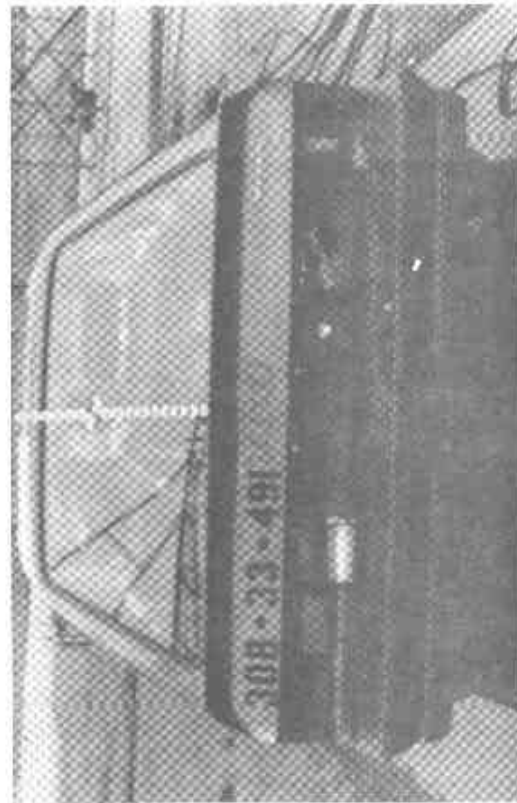
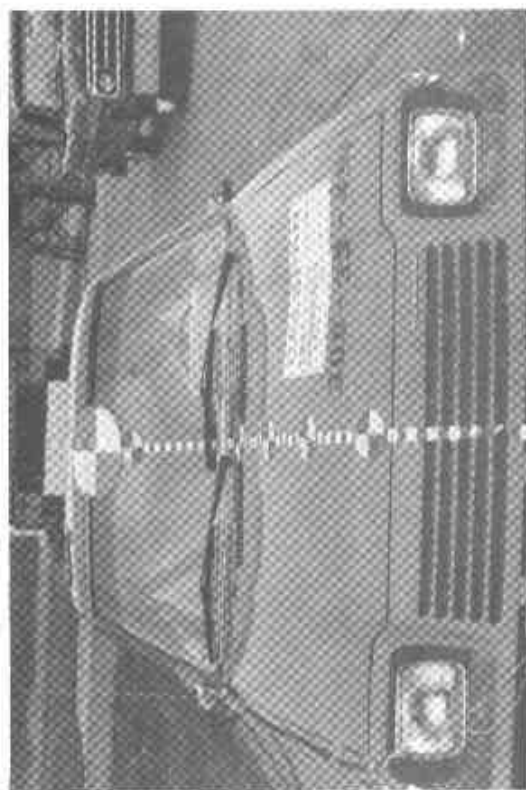
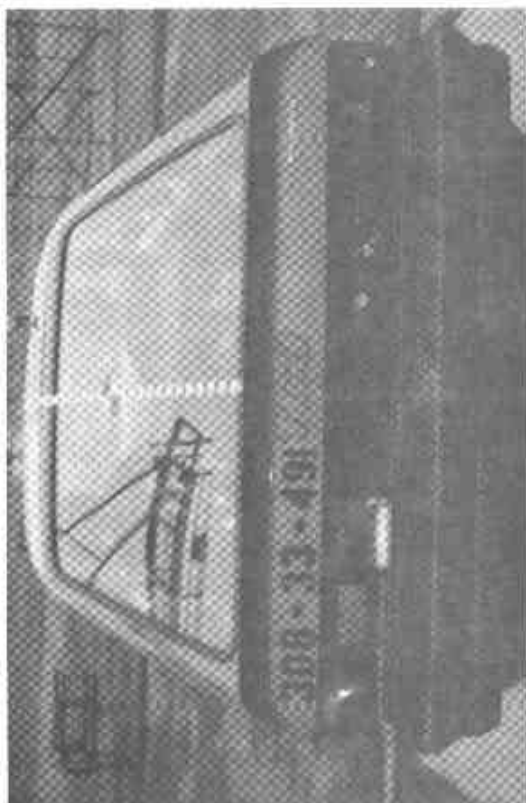


Figure A-16 VEHICLE #2 - PRE- AND POST-TEST VIEWS OF FRONT AND REAR

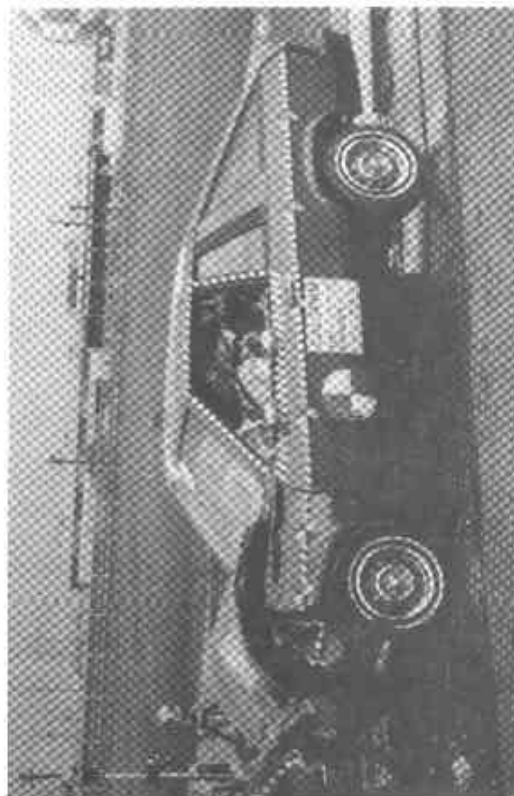
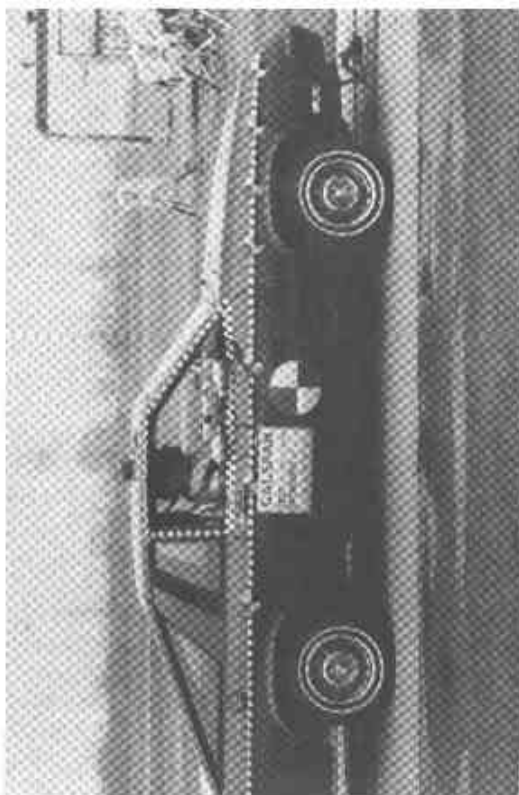
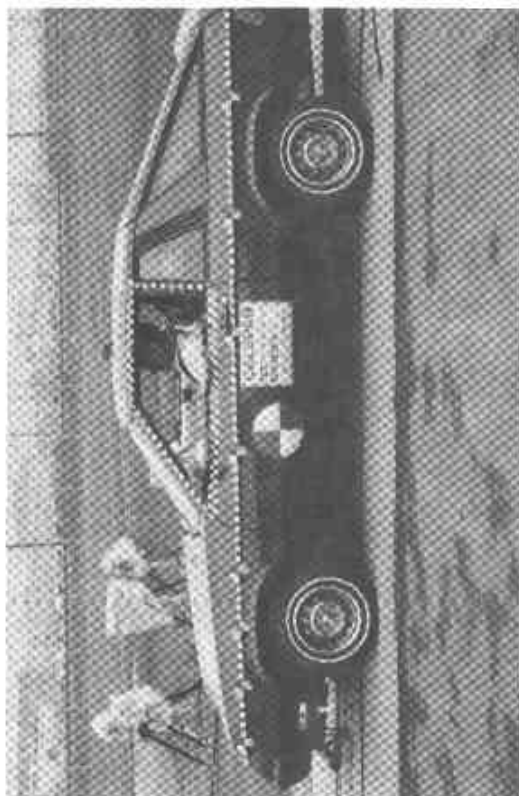


Figure A-17 VEHICLE #2 - PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT SIDE

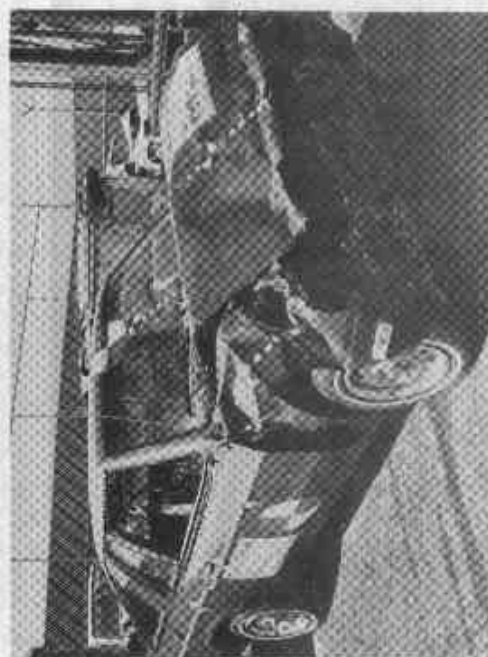
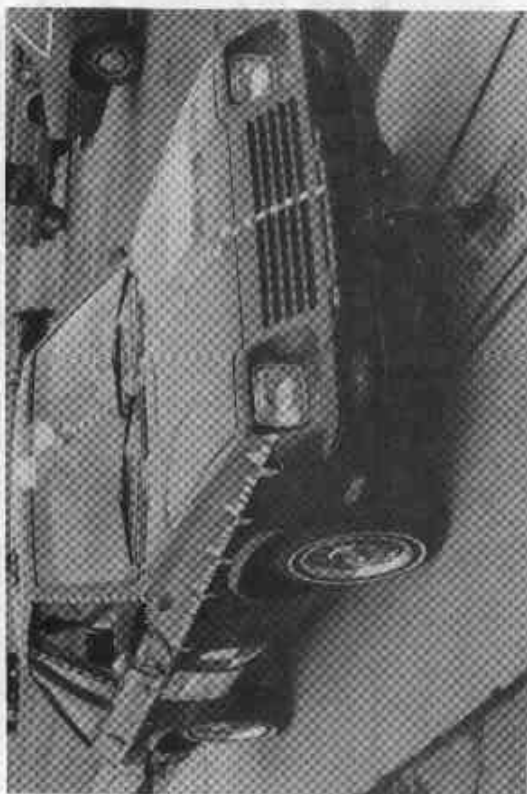


Figure A-18 VEHICLE #2 - PRE- AND POST-TEST VIEWS OF FRONT AND REAR THREE-QUARTER

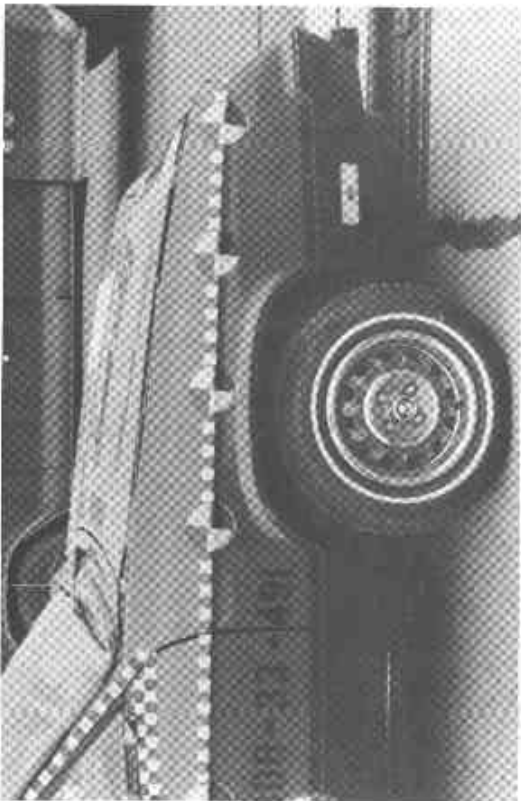


Figure A-19 VEHICLE #2 - PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT FRONT QUARTER



Figure A-20 VEHICLE #2 - PRE- AND POST-TEST VIEW OF WINDSHIELD

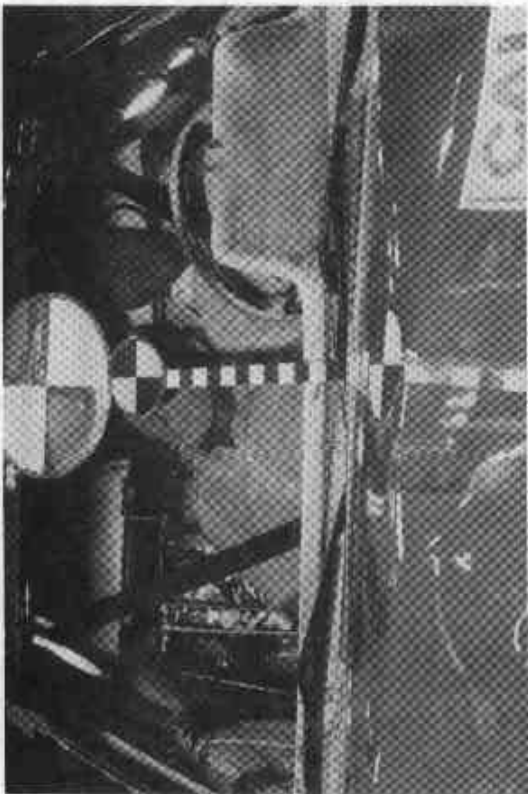


Figure A-22 VEHICLE #2 - POST-TEST VIEW OF ENGINE

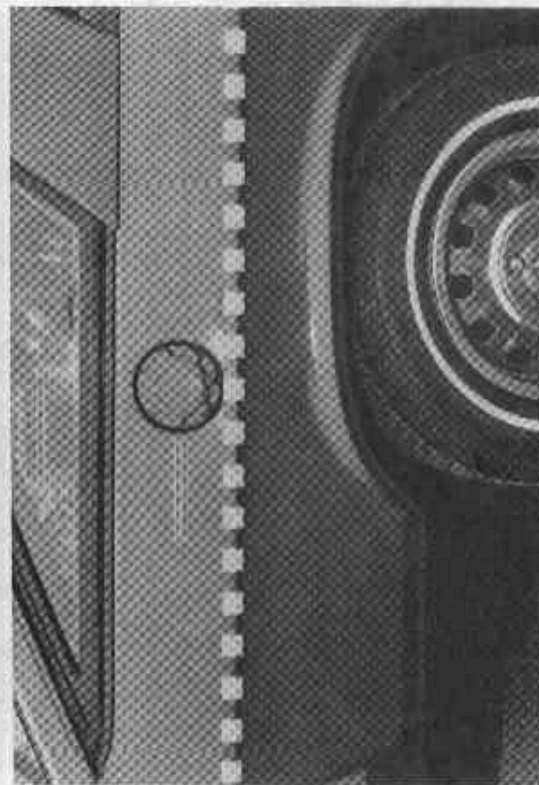


Figure A-21 VEHICLE #2 - FUEL TUBE AND CAP

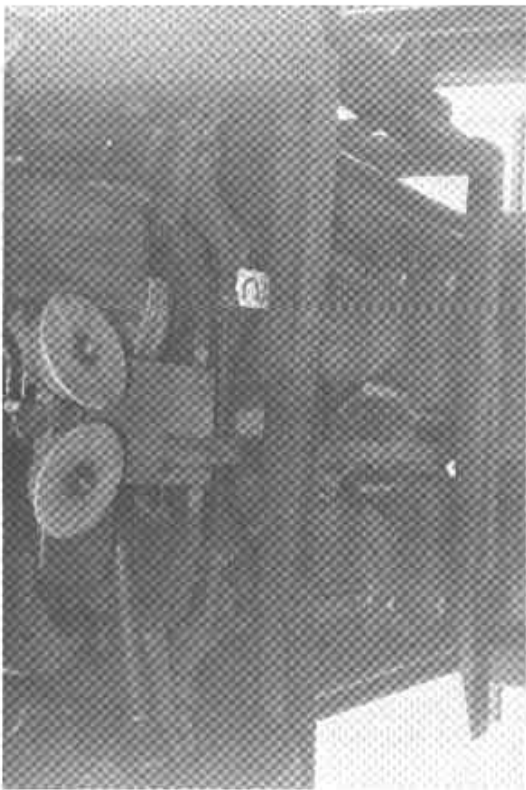
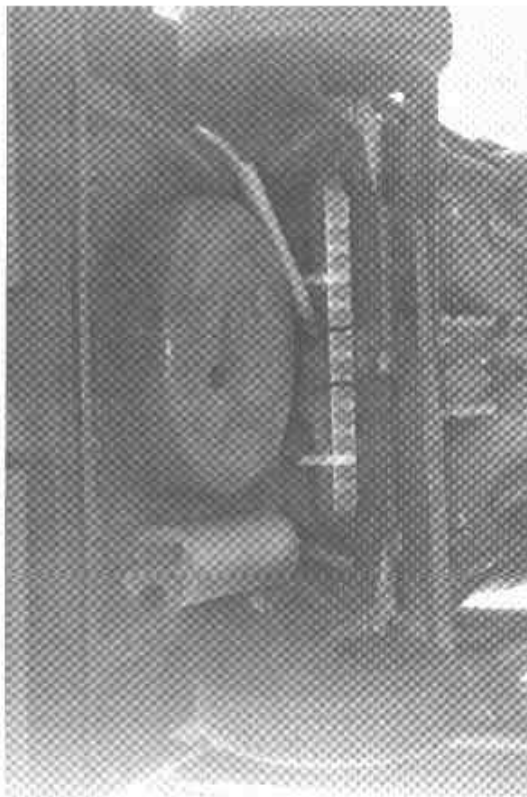
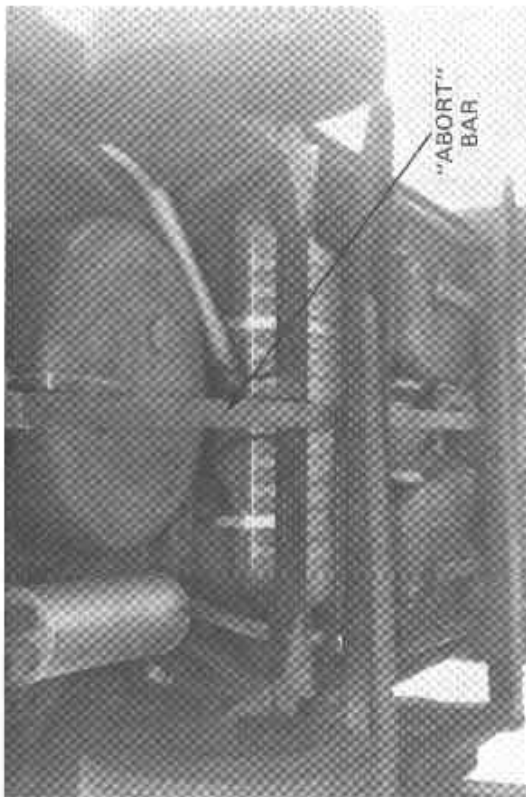


Figure A-23 VEHICLE #2 - PRE- AND POST-TEST VIEW OF FRONT AND REAR UNDERBODY

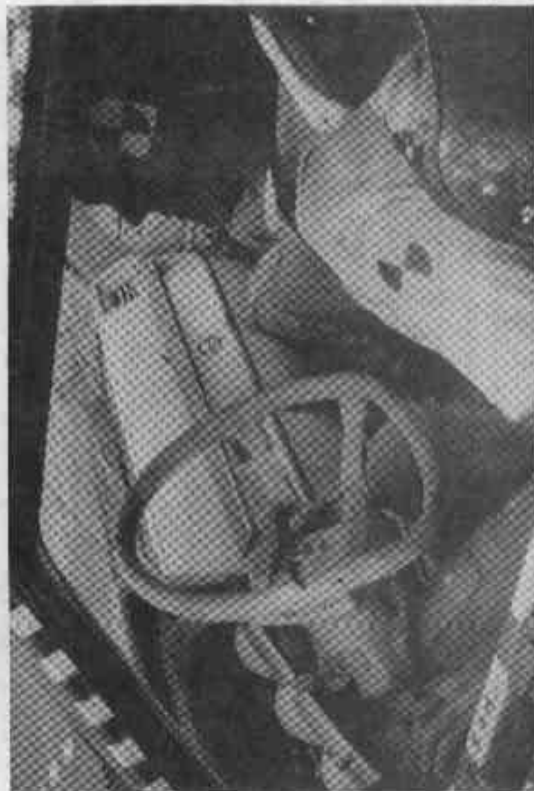
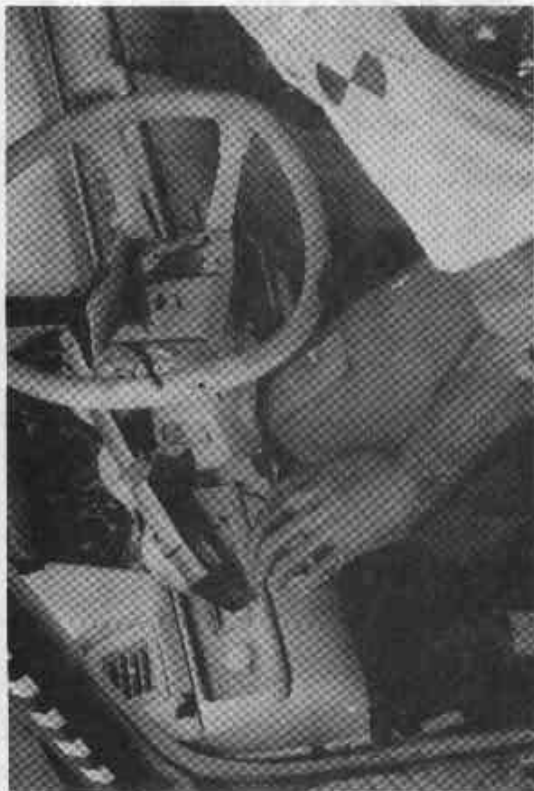


Figure A-24 VEHICLE #2 - PRE- AND POST-TEST VIEW OF DRIVER POSITION

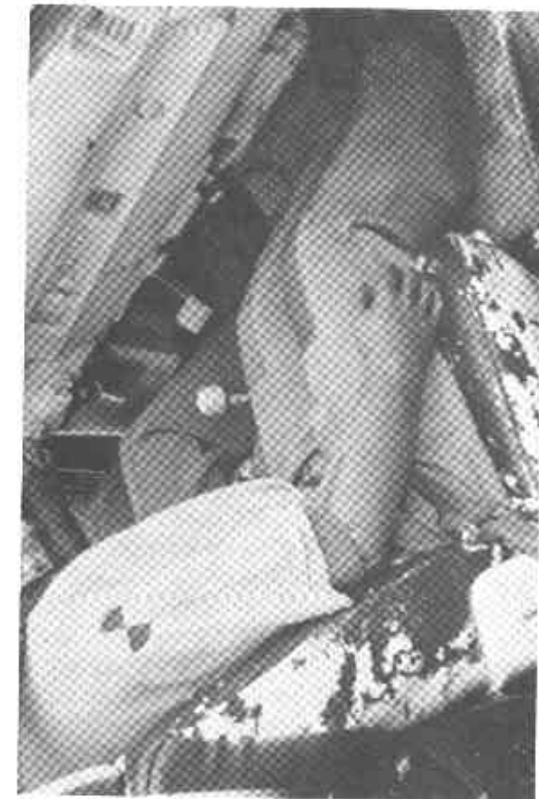


Figure A-25 VEHICLE #2 - PRE- AND POST-TEST VIEW OF RIGHT FRONT PASSENGER

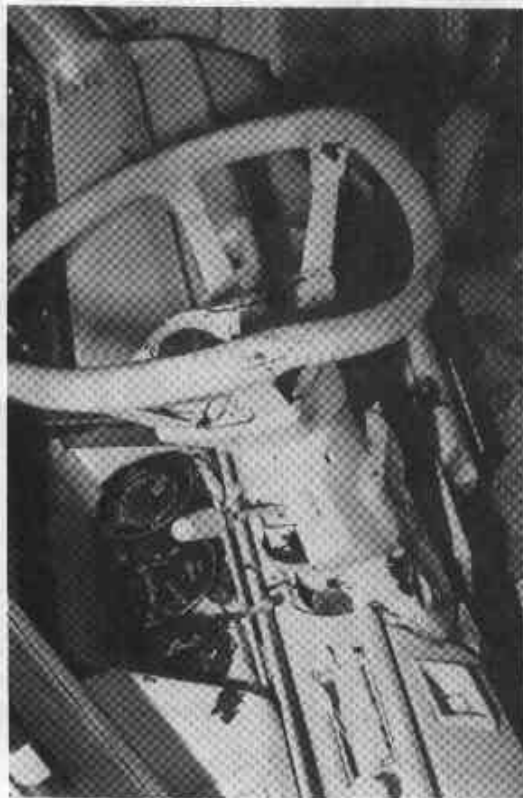
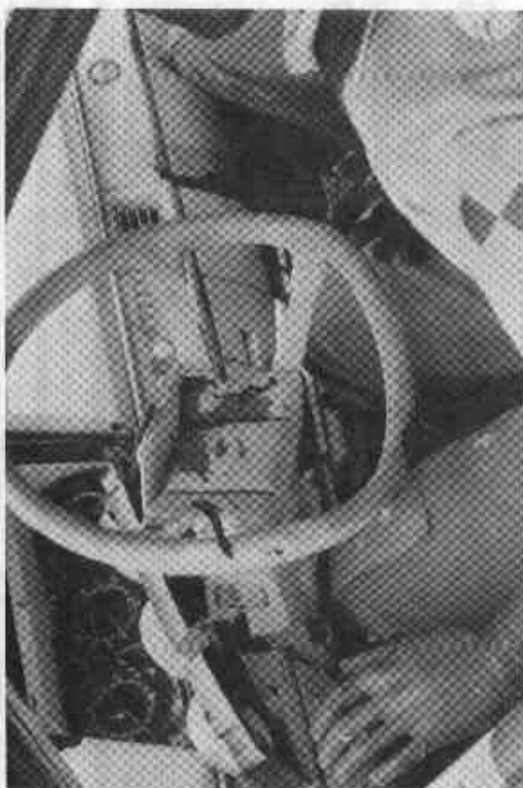


Figure A-26 VEHICLE #2 - POST-TEST VIEW OF INTERIOR

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA

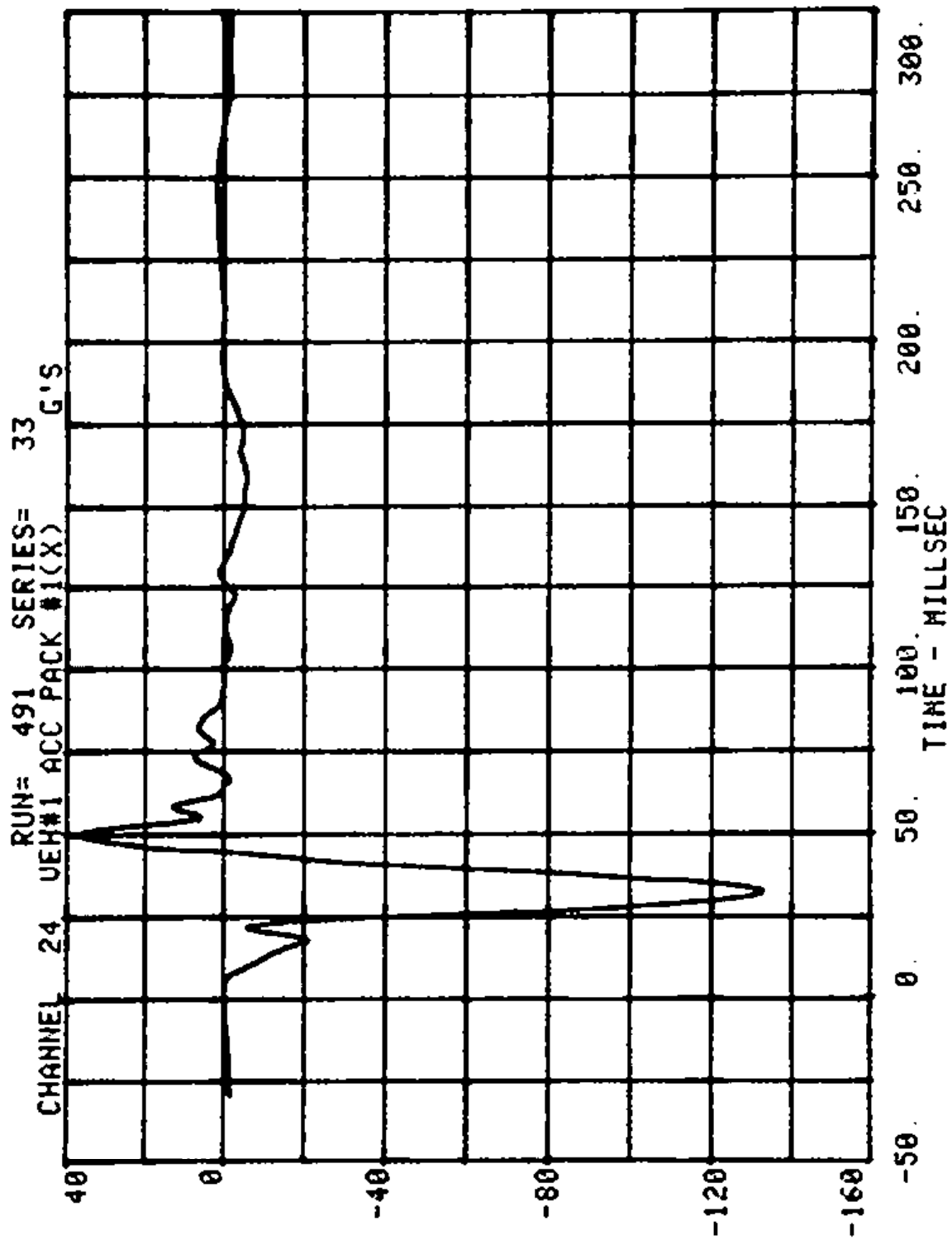
Test No. 308-33-491  
1980 Chevrolet Citation  
Vehicle #1 Data

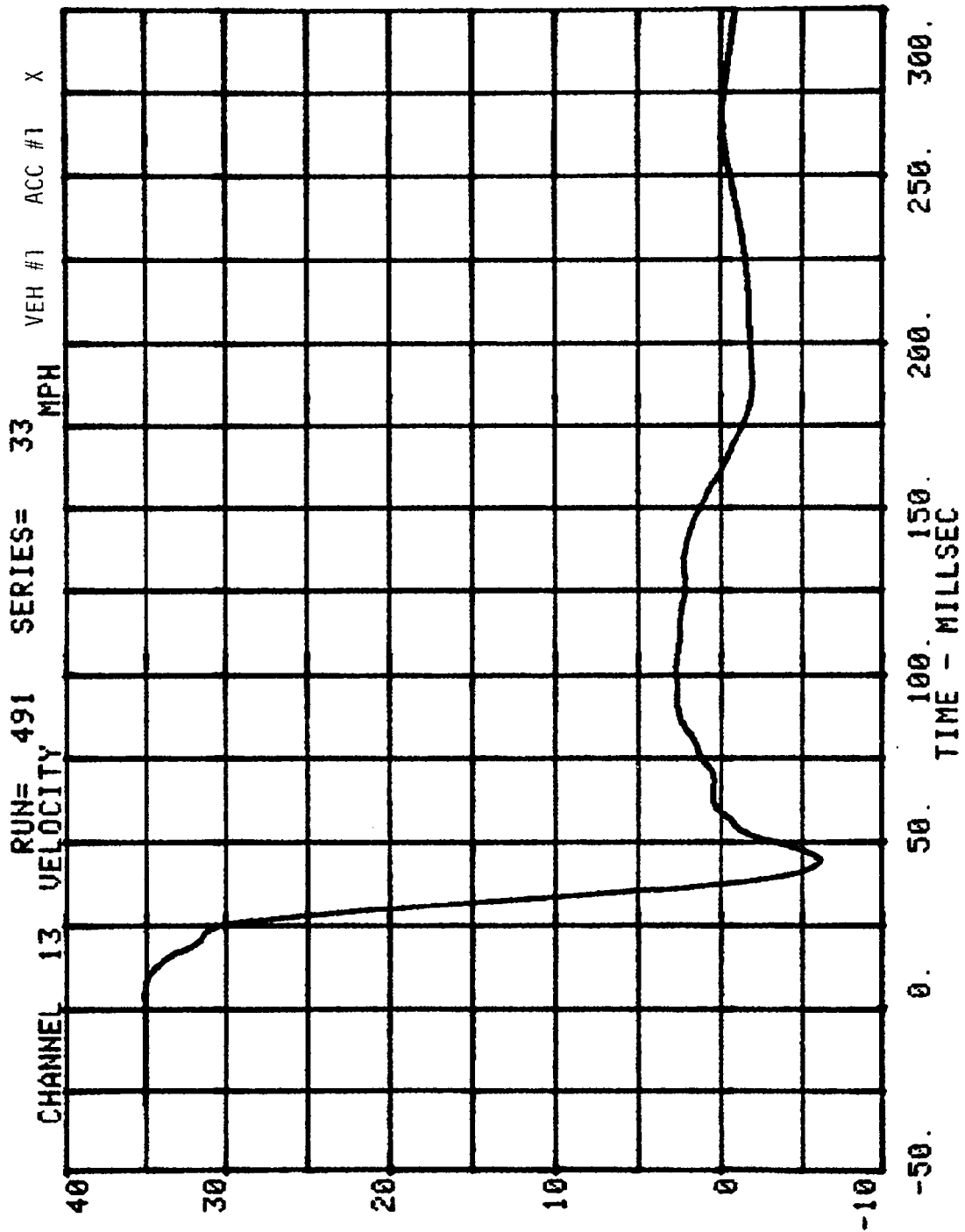
Vehicle Data

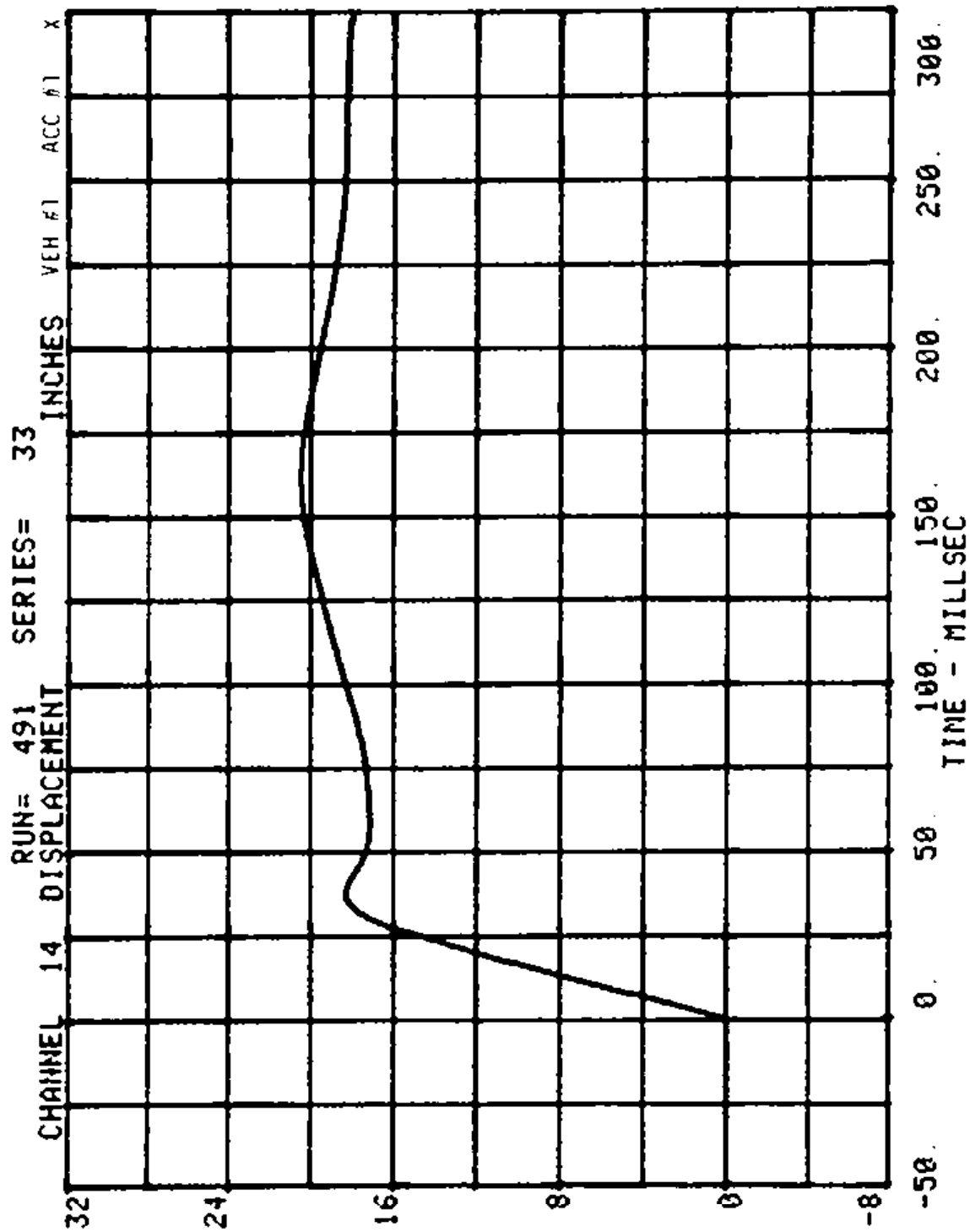
Filter Channel Class

60

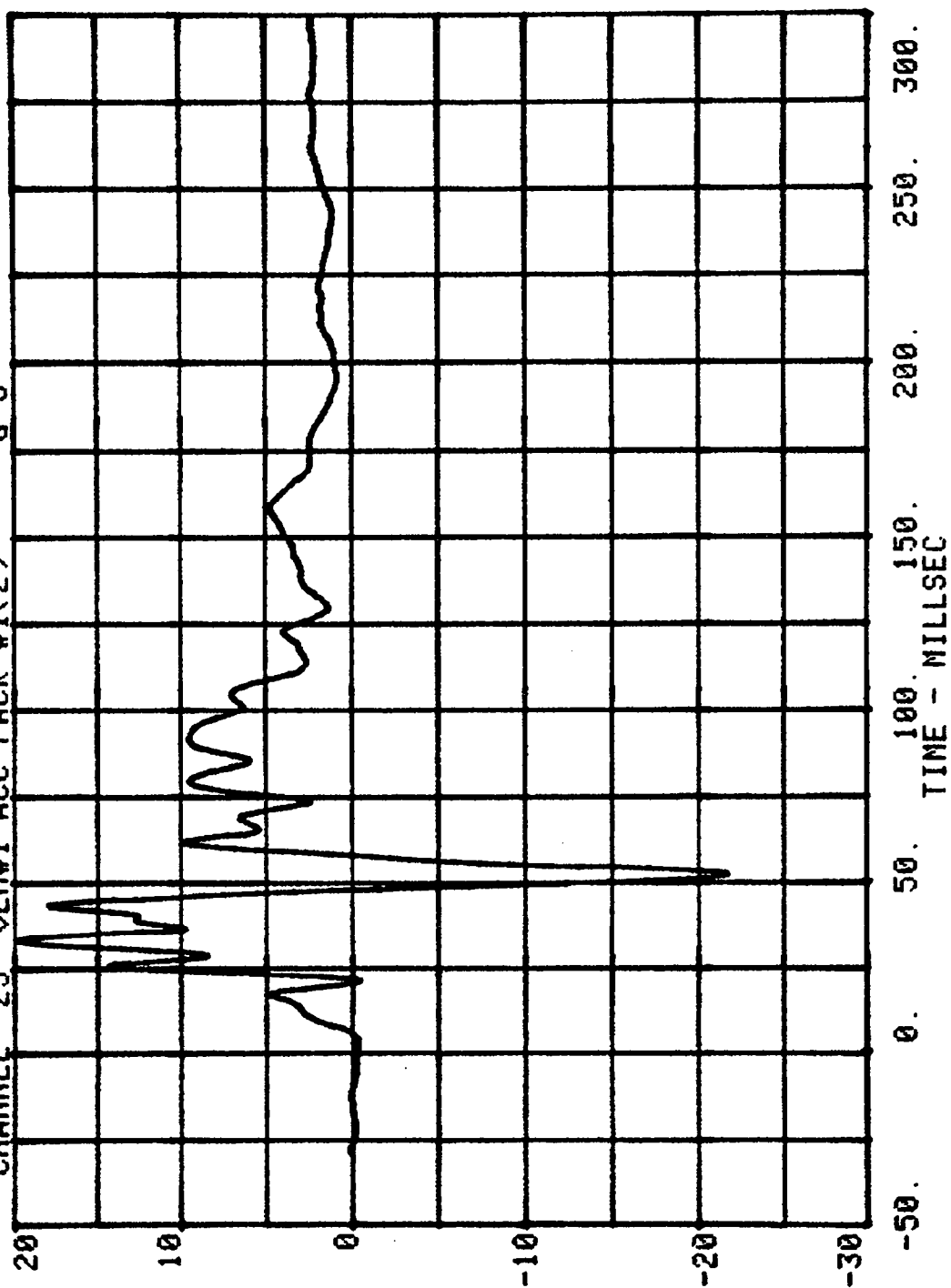
See Figure 2 for Accelerometer Layout,  
See Table 8 for Electronic Instrumentation Descriptors,



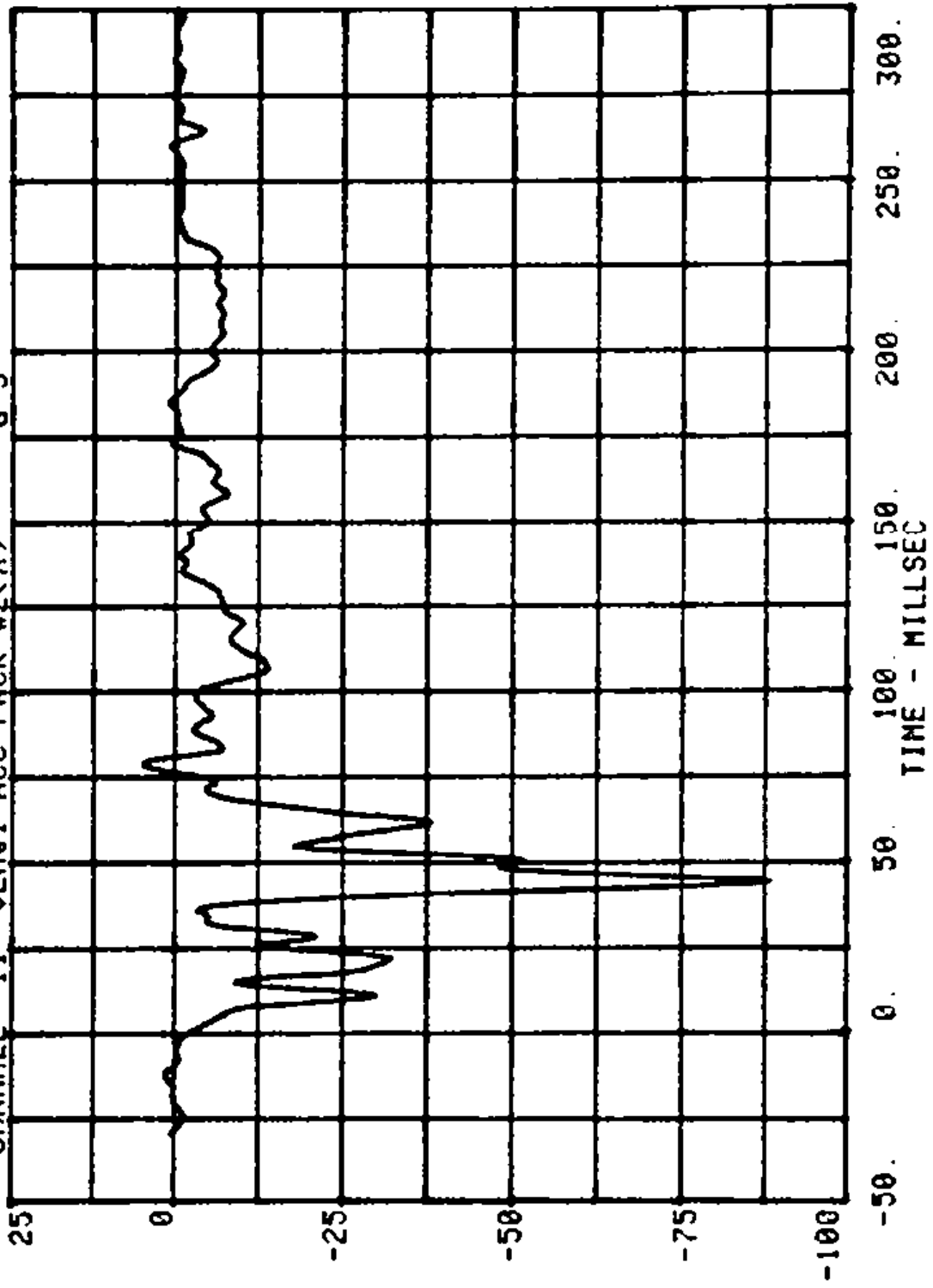


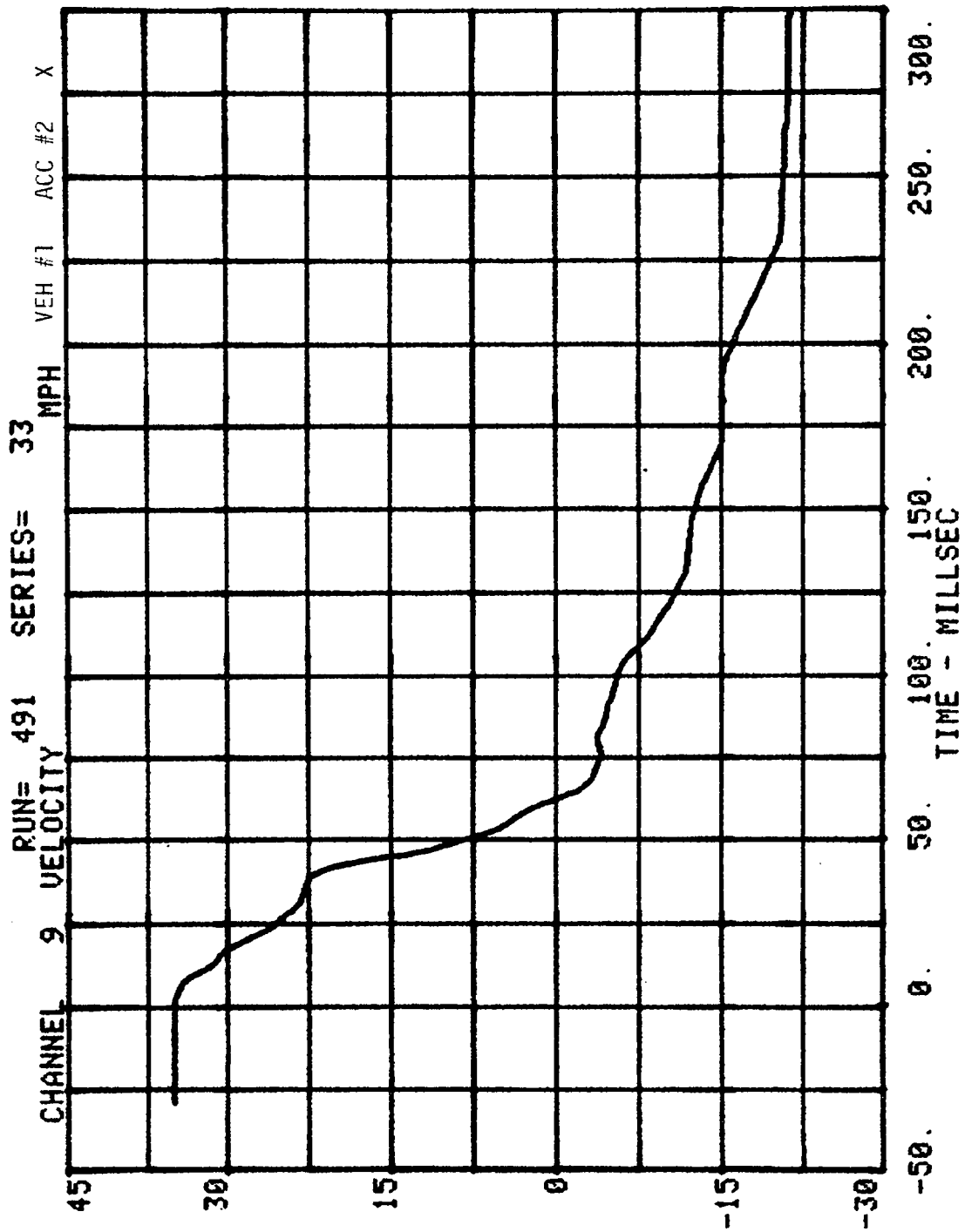


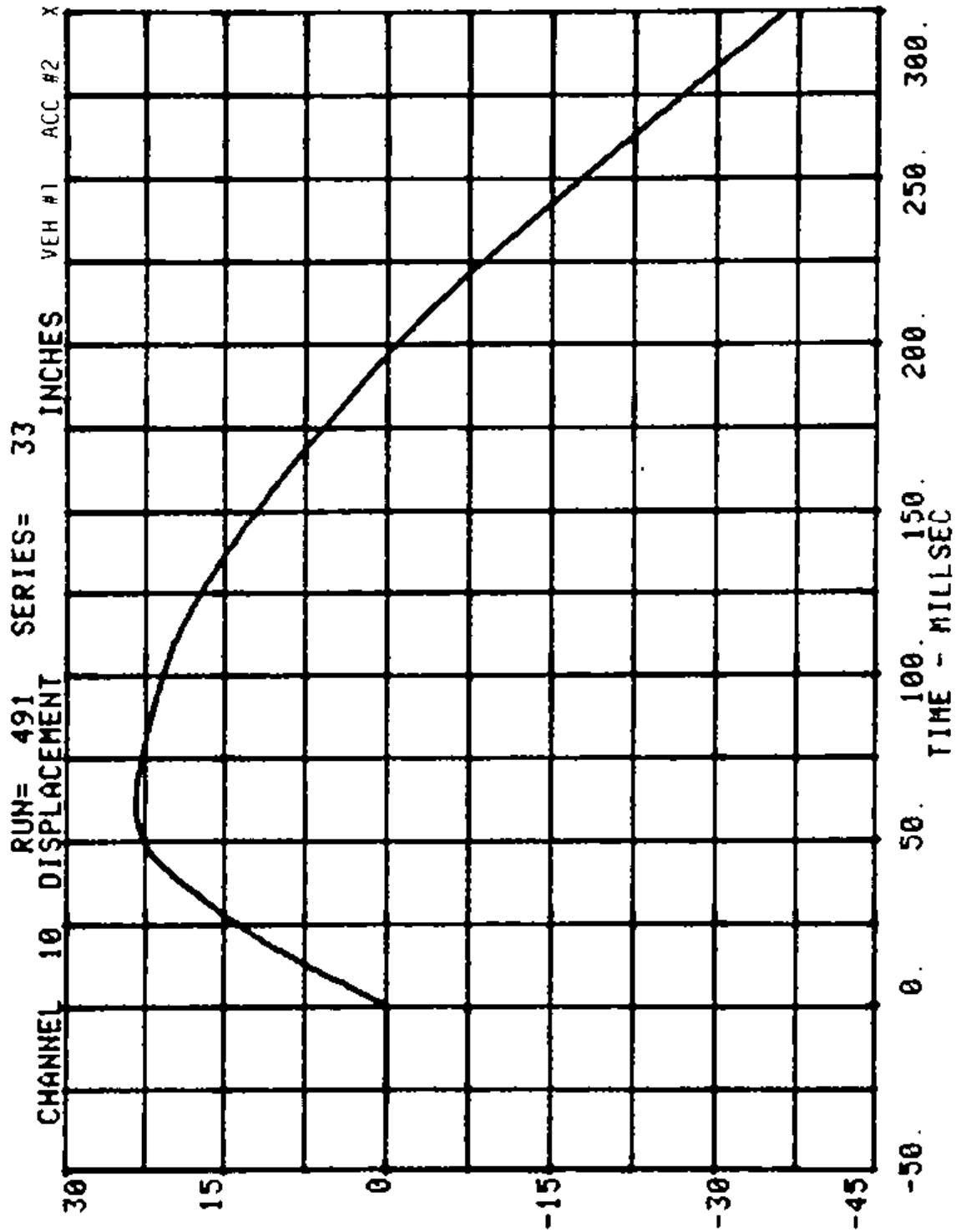
RUN= 491 SERIES= 33  
CHANNEL 25 VEH#1 ACC PACK #1(Z) G'S



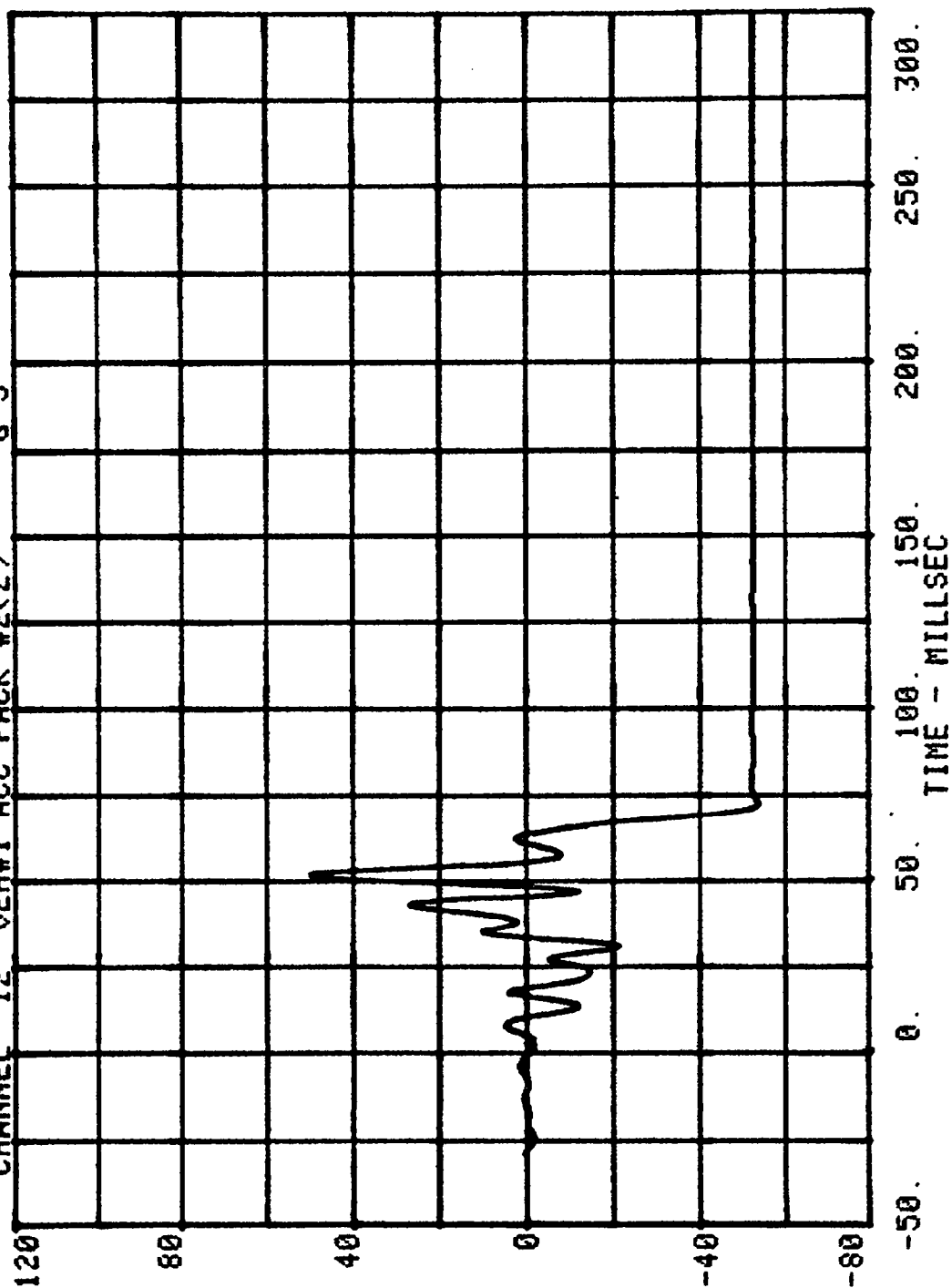
CHANNEL 11 RUN= 491 SERIES= 33  
VEH#1 ACC PACK #2(X) G'S



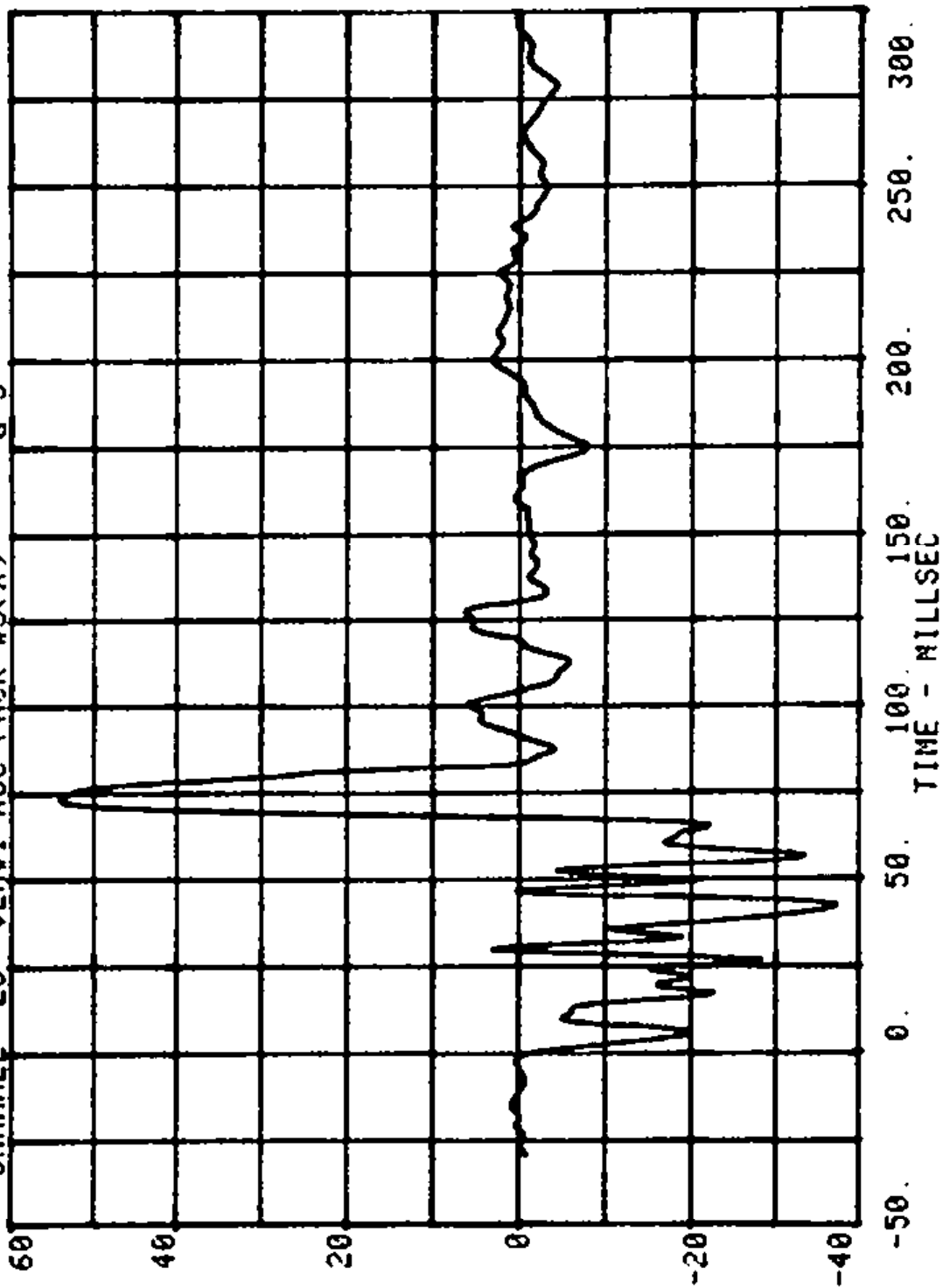


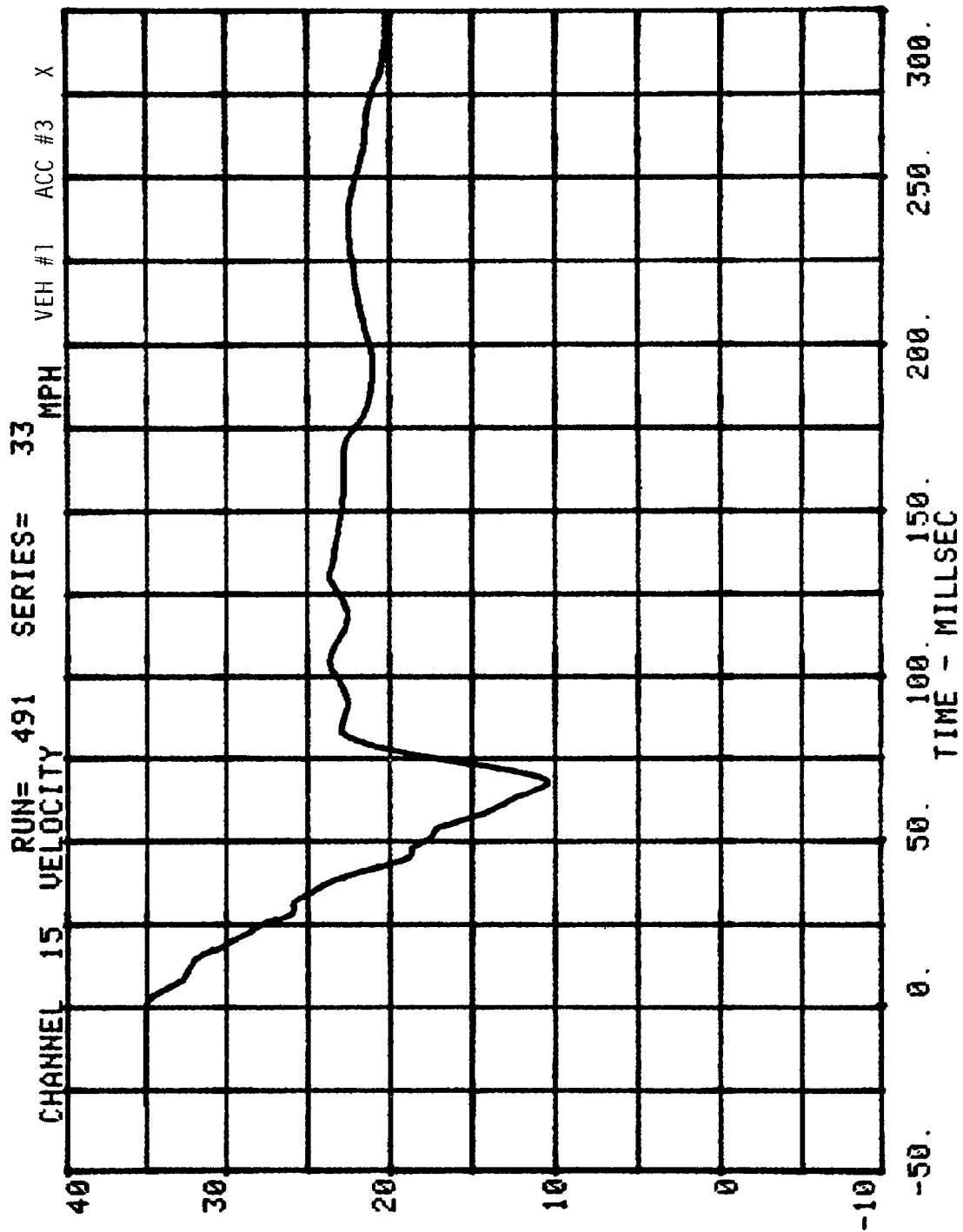


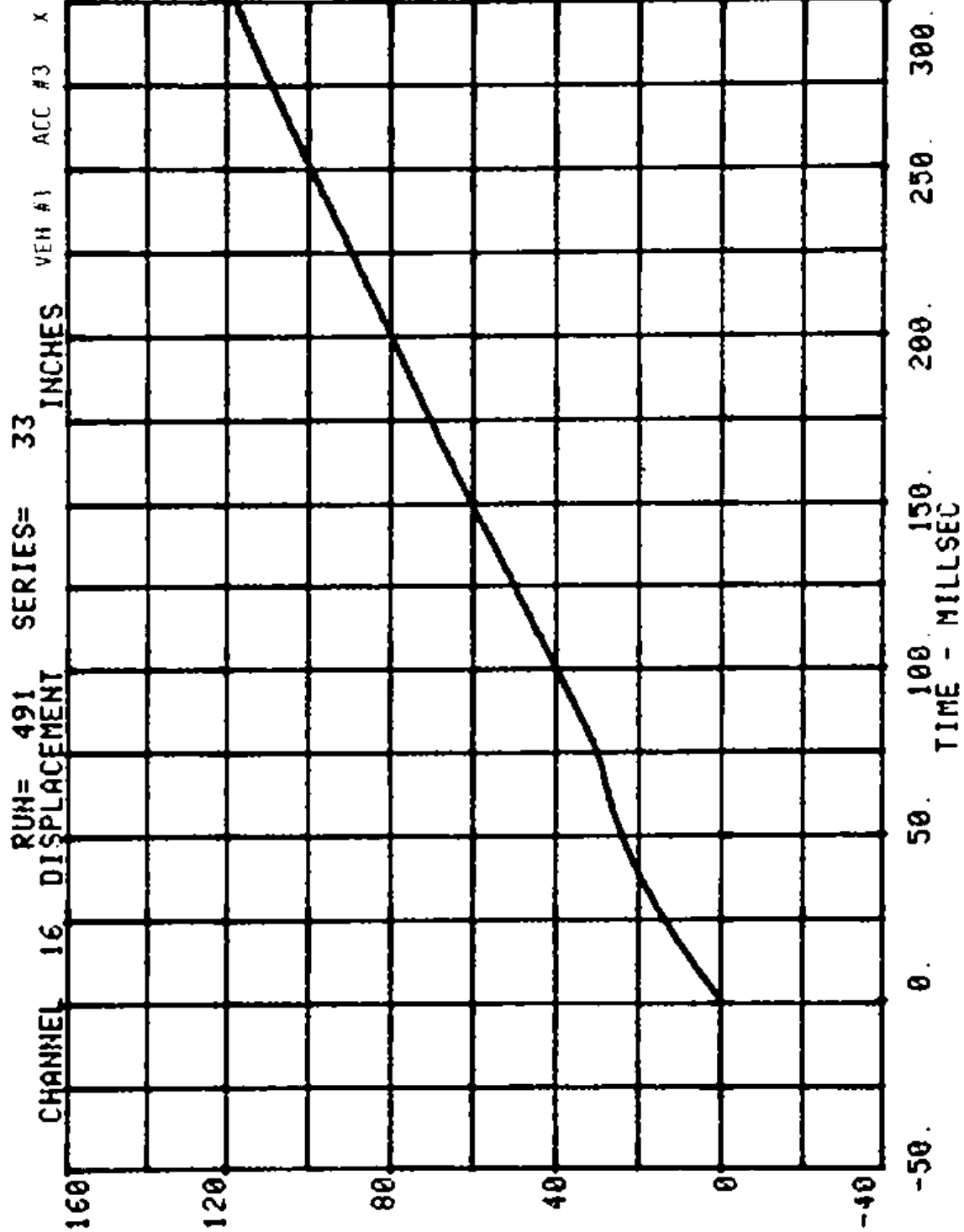
RUN= 491 SERIES= 33  
CHANNEL 12 VEH#1 ACC PACK #2(Z) G'S



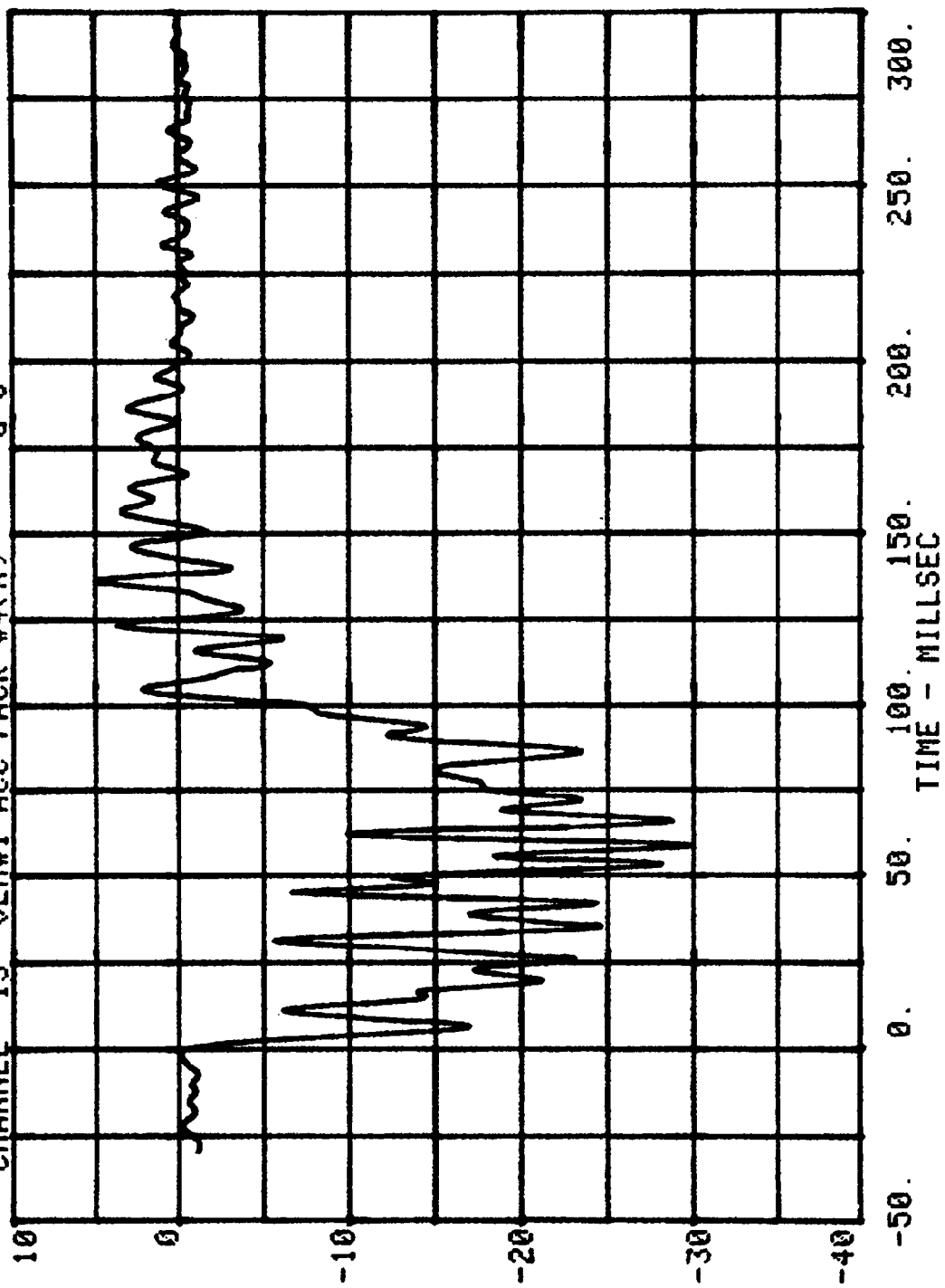
CHANNEL 26 RUN= 491 SERIES= 33  
VEH#1 ACC PACK #3(X) G'S

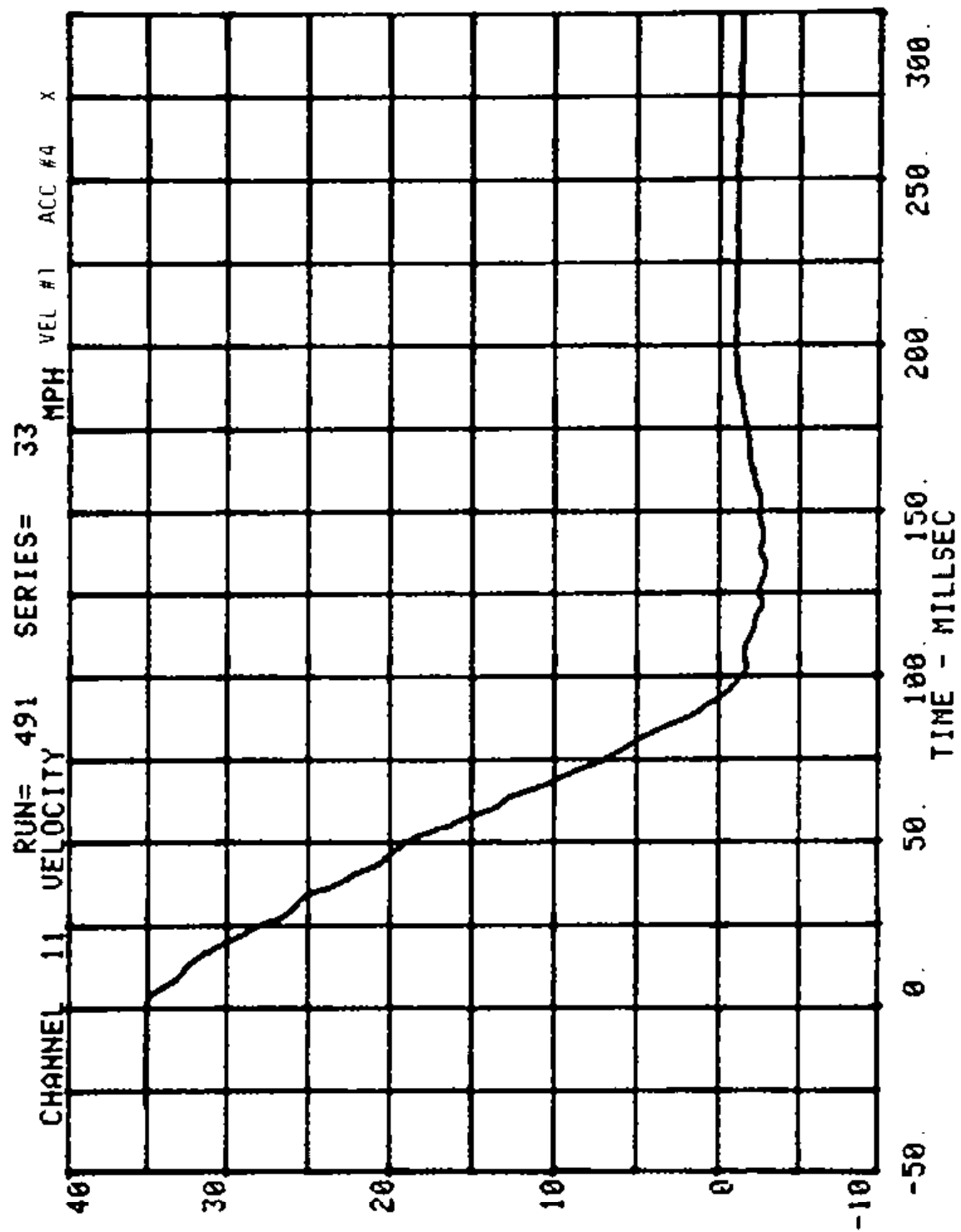


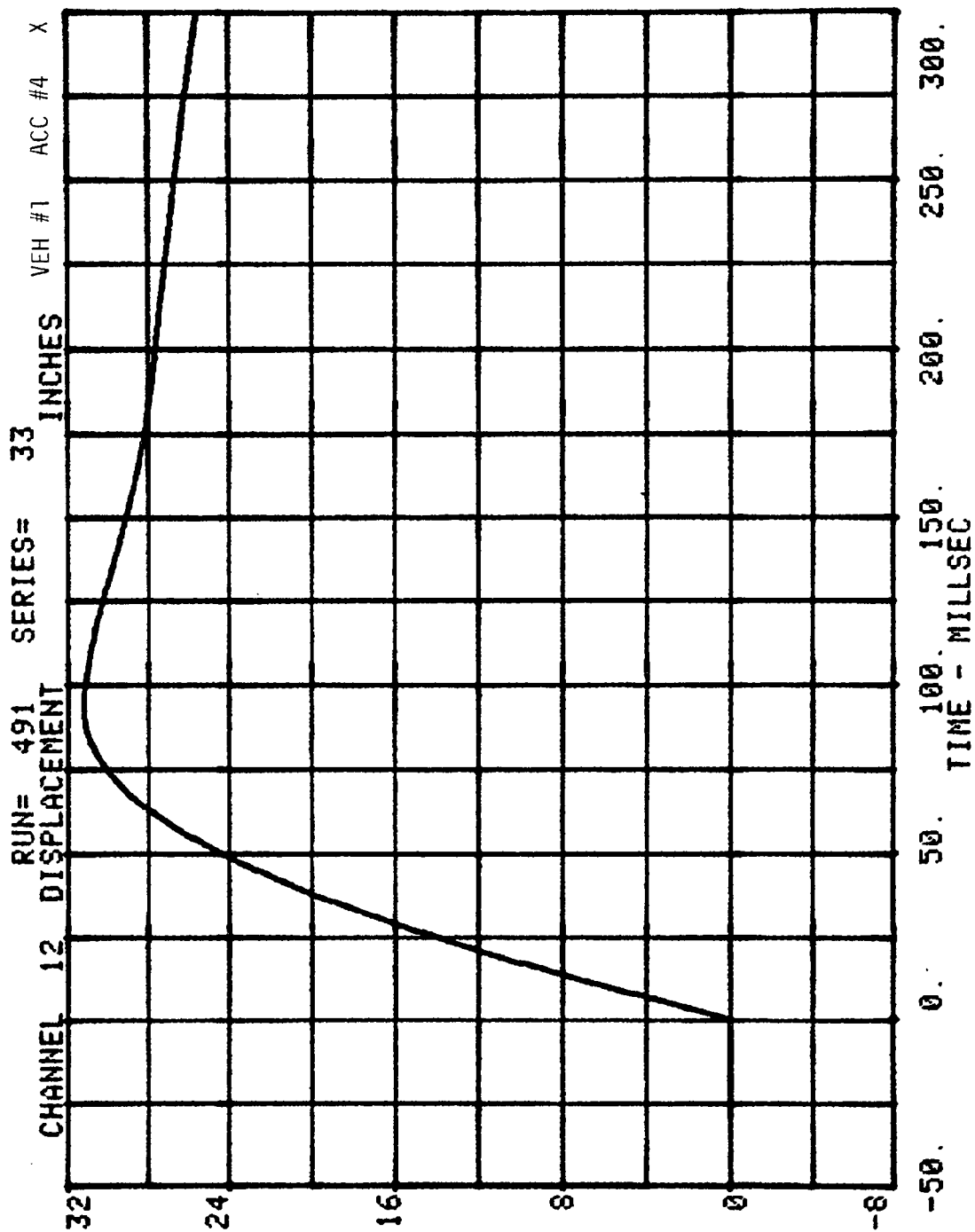




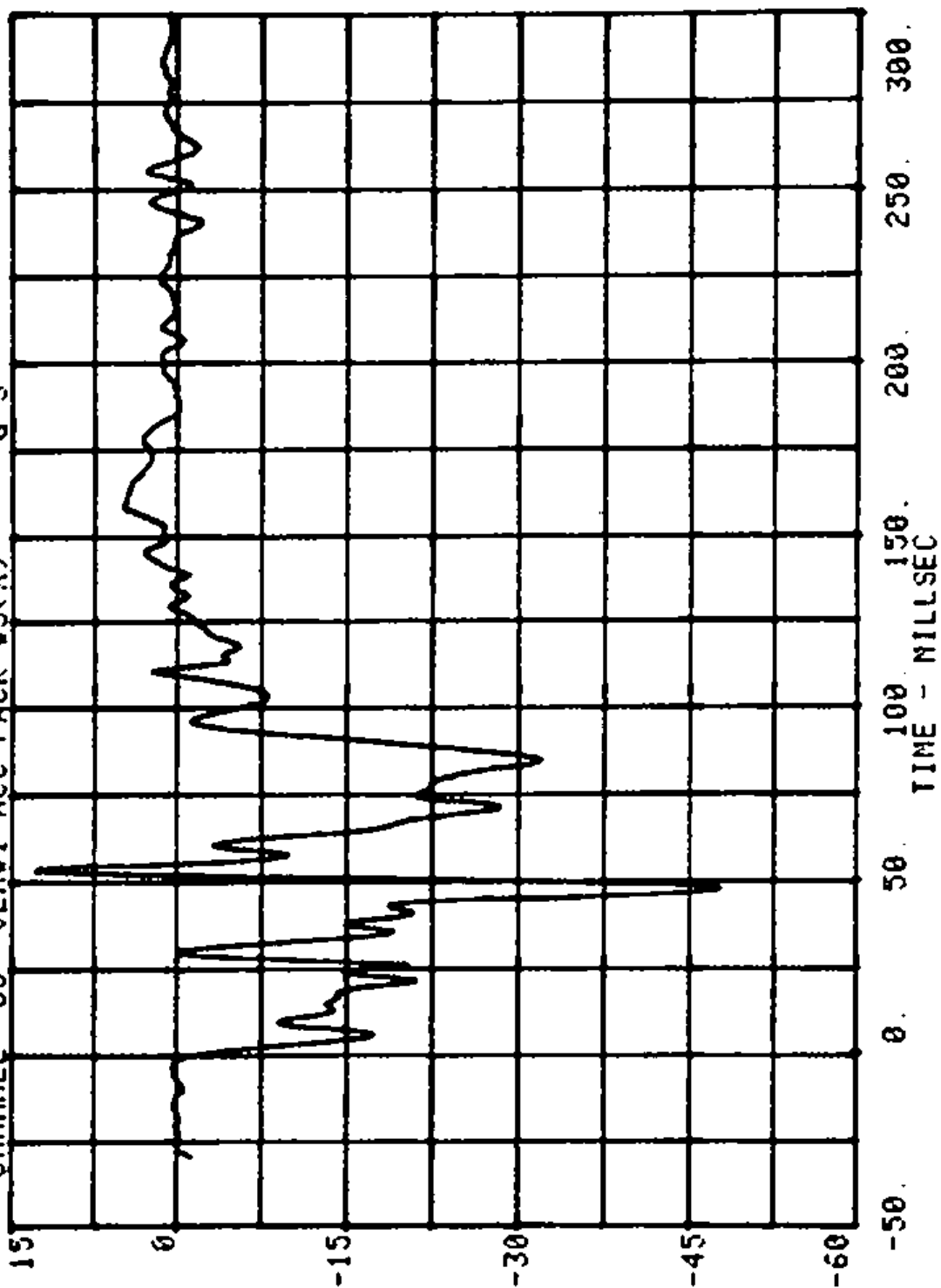
CHANNEL 13 RUN= 491 SERIES= 33  
VEH#1 ACC PACK #4(X) G'S

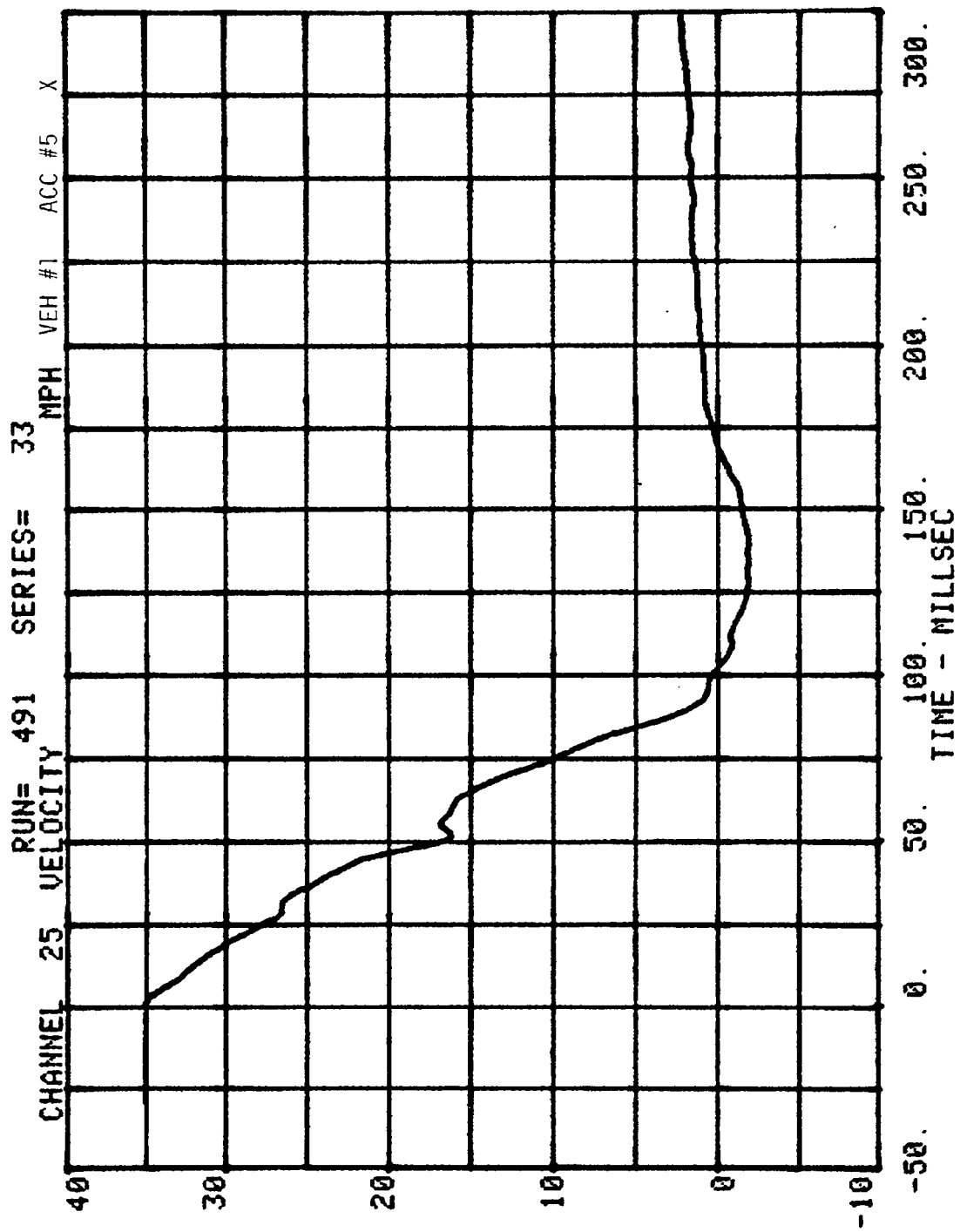


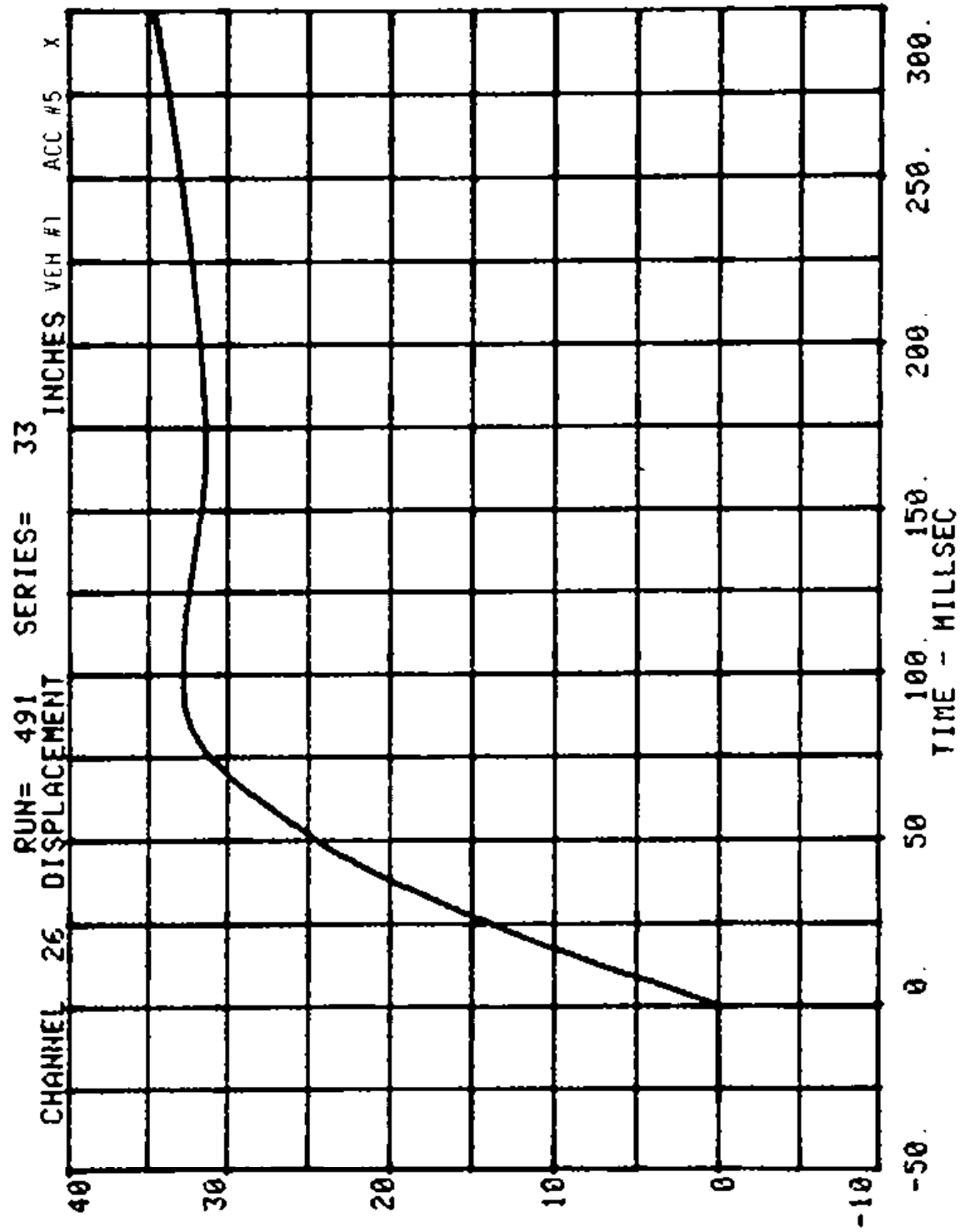




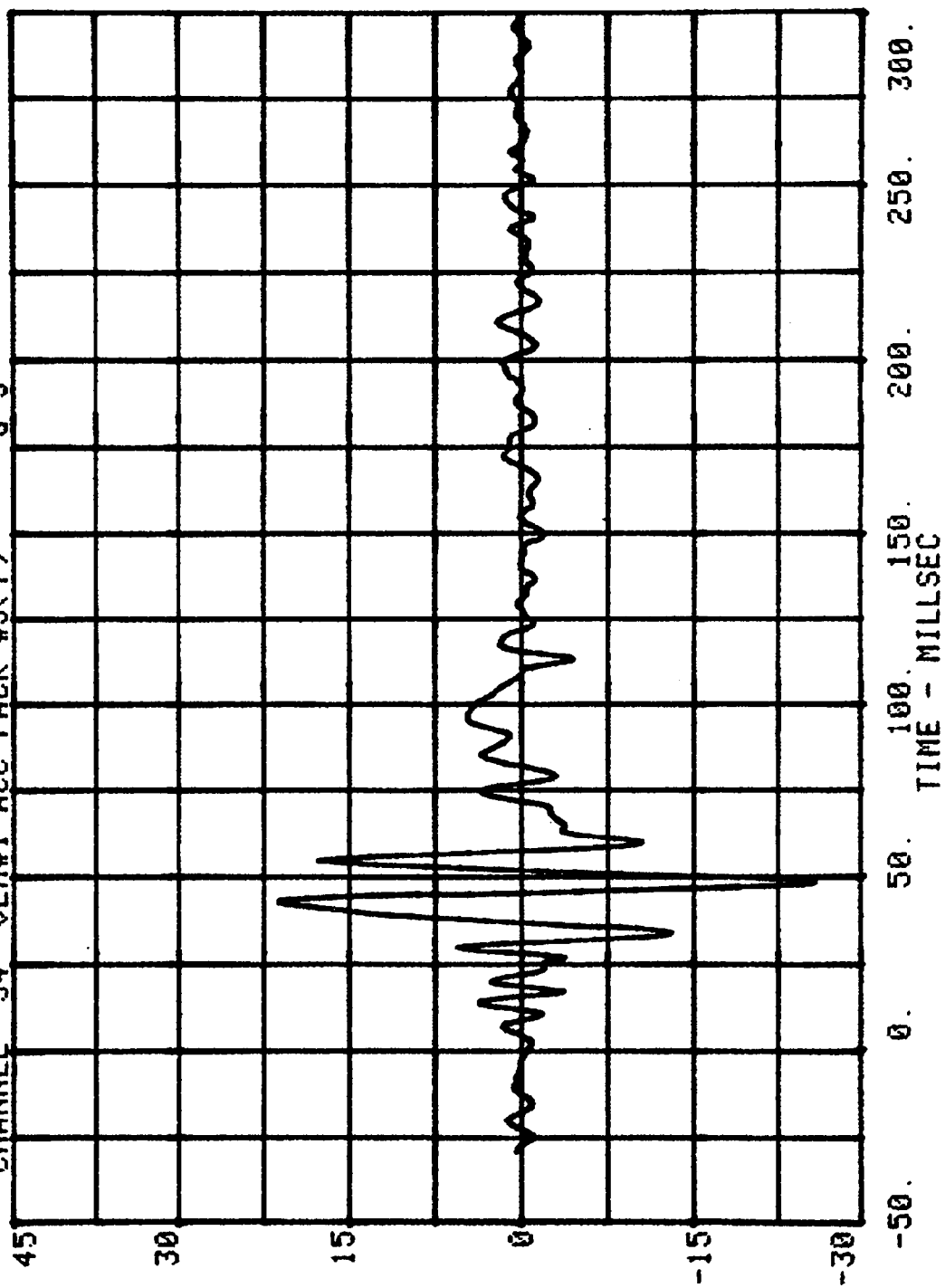
CHANNEL 53 RUN= 491 SERIES= 33  
VEH#1 ACC PACK #5(X) G'S



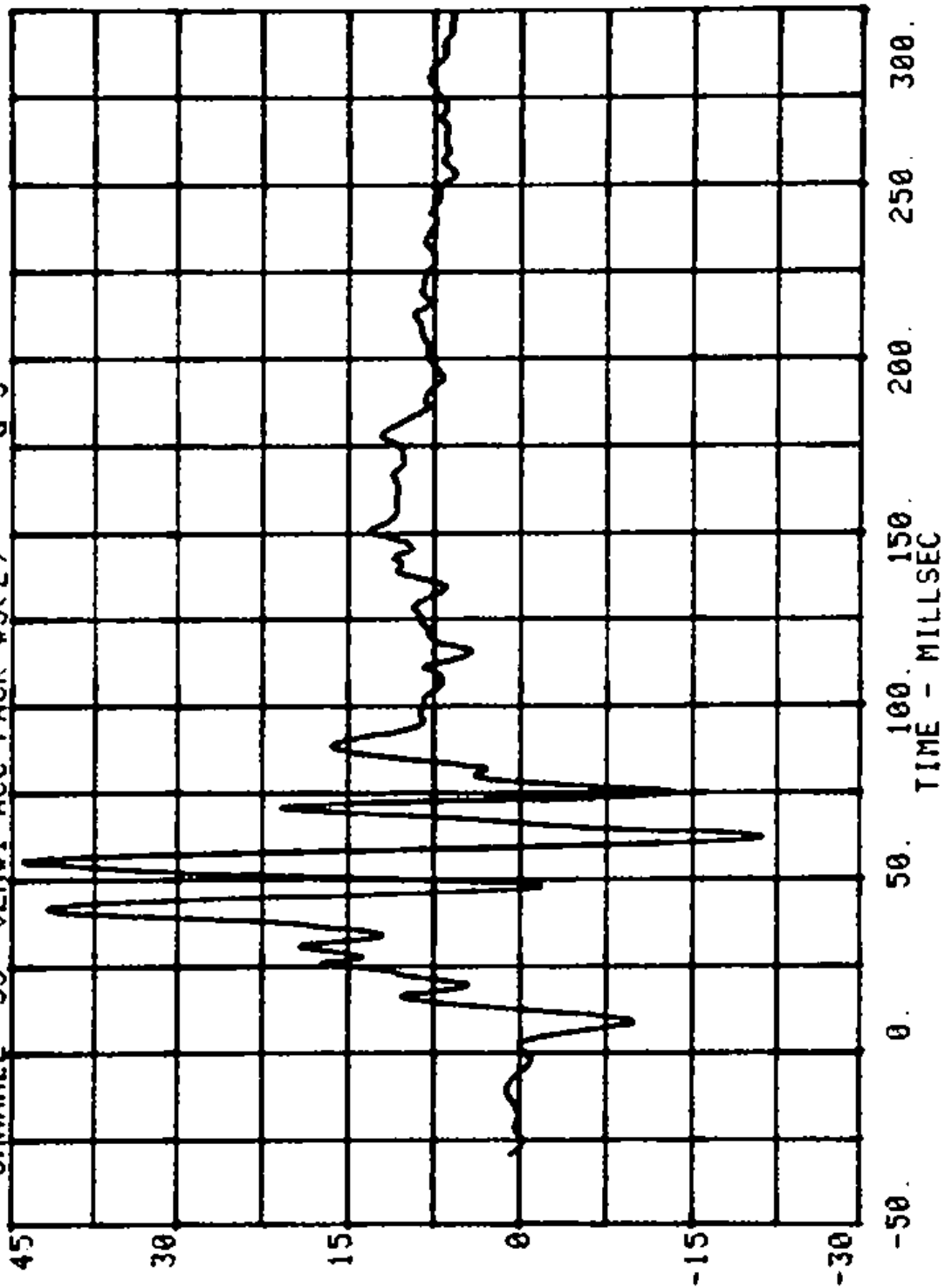




CHANNEL 54 RUN= 491 SERIES= 33  
VEH#1 ACC PACK #5(Y) G'S



CHANNEL 55 RUN= 491 SERIES= 33  
VEH#1 ACC PACK #5(Z) G'S



Test No, 308-33-491  
1980 Chevrolet Citation  
Dummy Data

|                    | Filter Channel Class |
|--------------------|----------------------|
| Head Acceleration  | 1000                 |
| Chest Acceleration | 180                  |
| Femur Forces       | 600                  |
| Belt Loads         | 60                   |

See Table 8 for Electronic Instrumentation Descriptor.

HEAD INJURY CRITERION  
HEAD SEVERITY INDEX

BOA TASK 3 TEST #33 CAR-TO-CAR

RUN= 491

VEH#1 POS#1 HEAD R

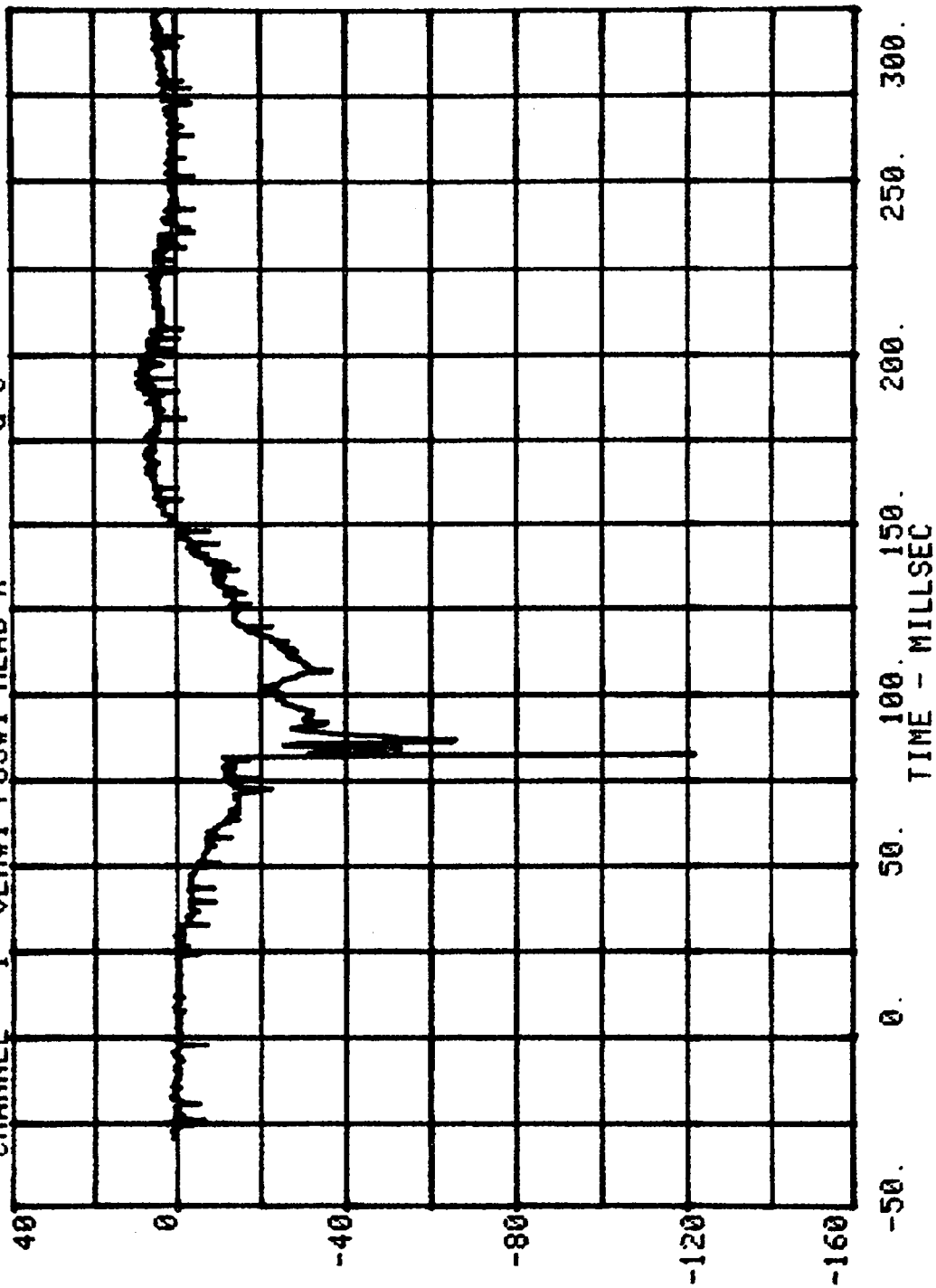
HIC= 448.6 FROM T1= 07830 TO T2= 11310

AVERAGE ACCELERATION BETWEEN T1 AND T2= 44.1G'S

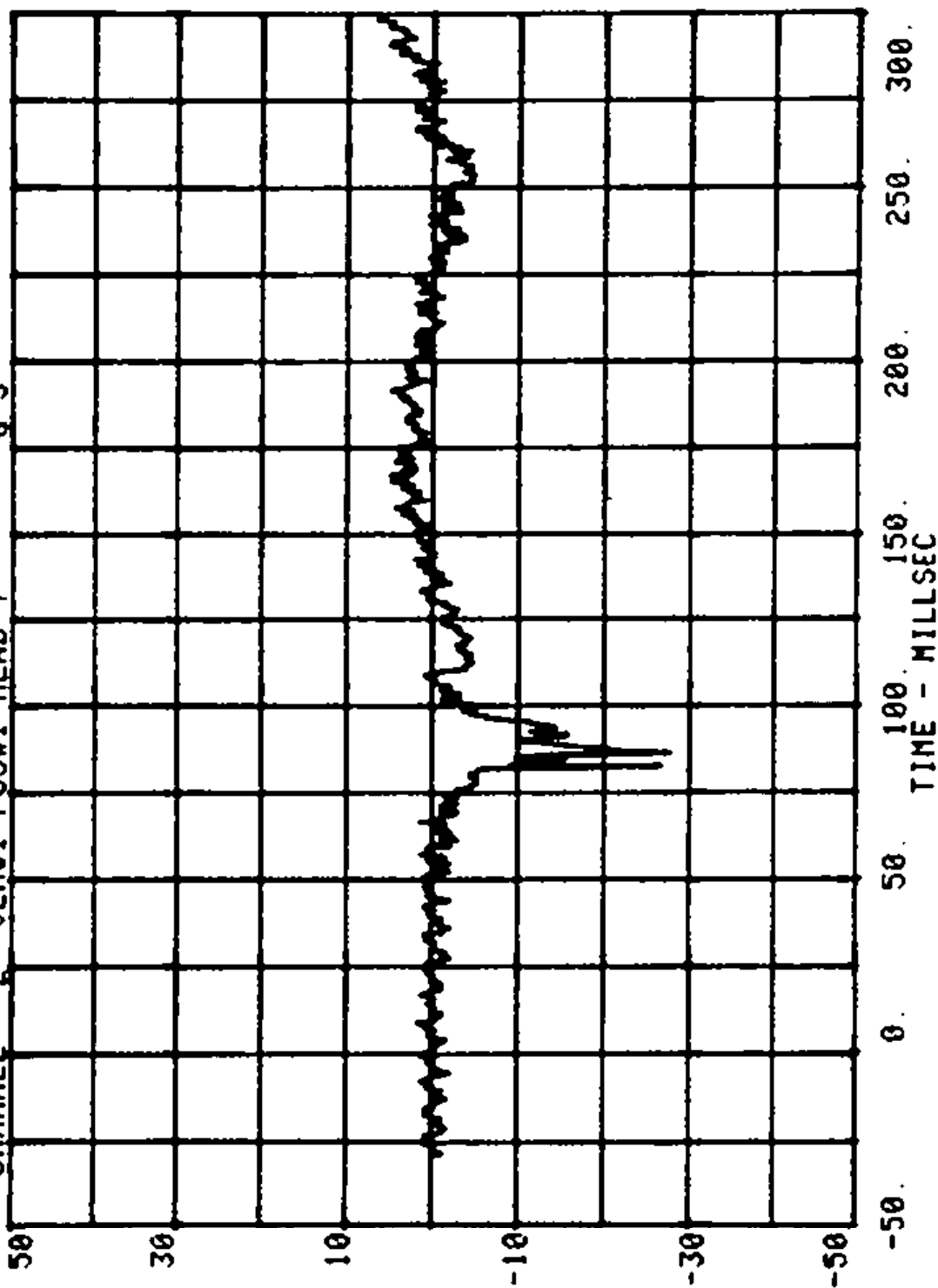
EVENT TIME= 300.0 MSEC

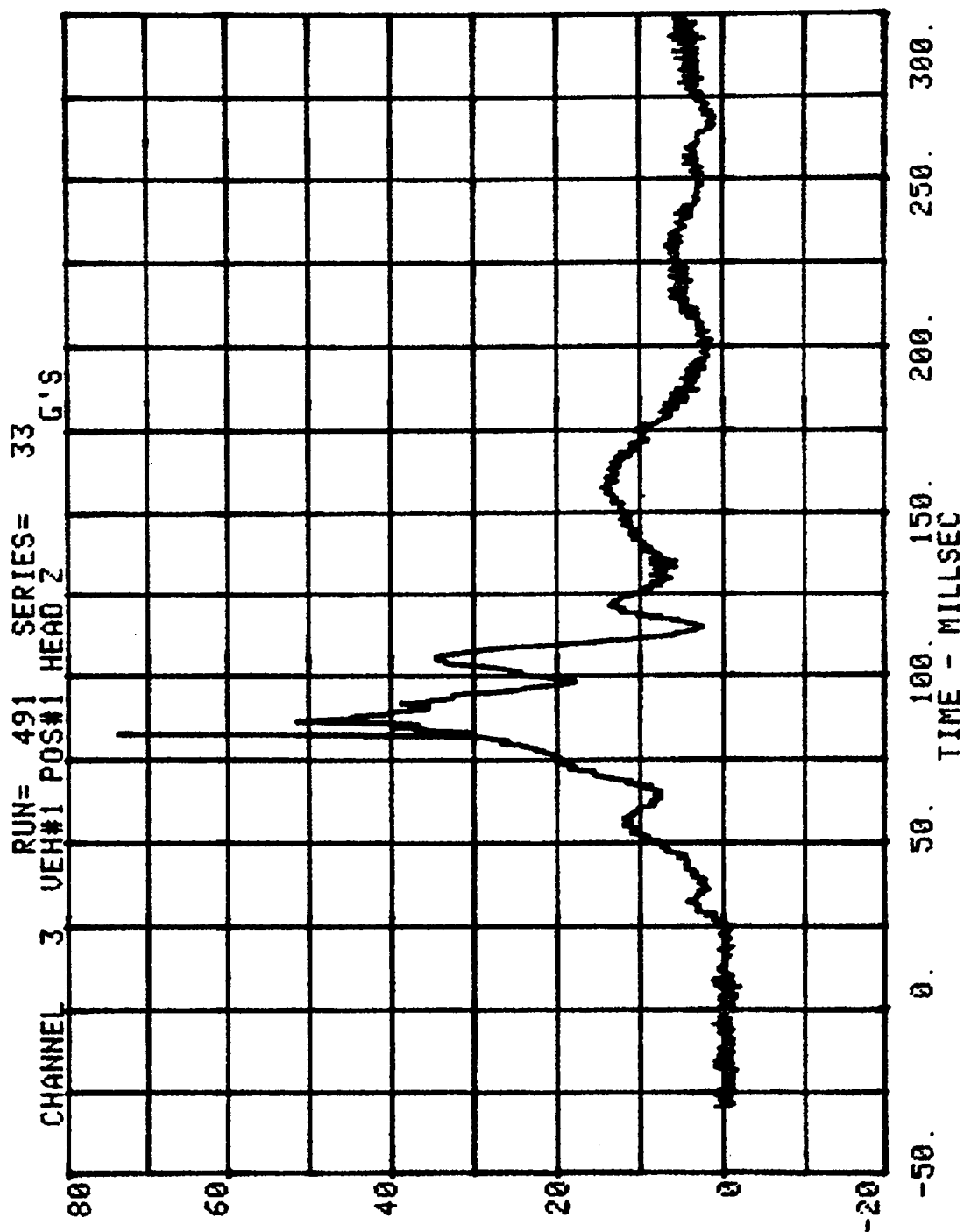
SEVERITY INDEX= 695.9

CHANNEL 1 RUN= 491 SERIES= 33  
VEH#1 POS#1 HEAD X G'S



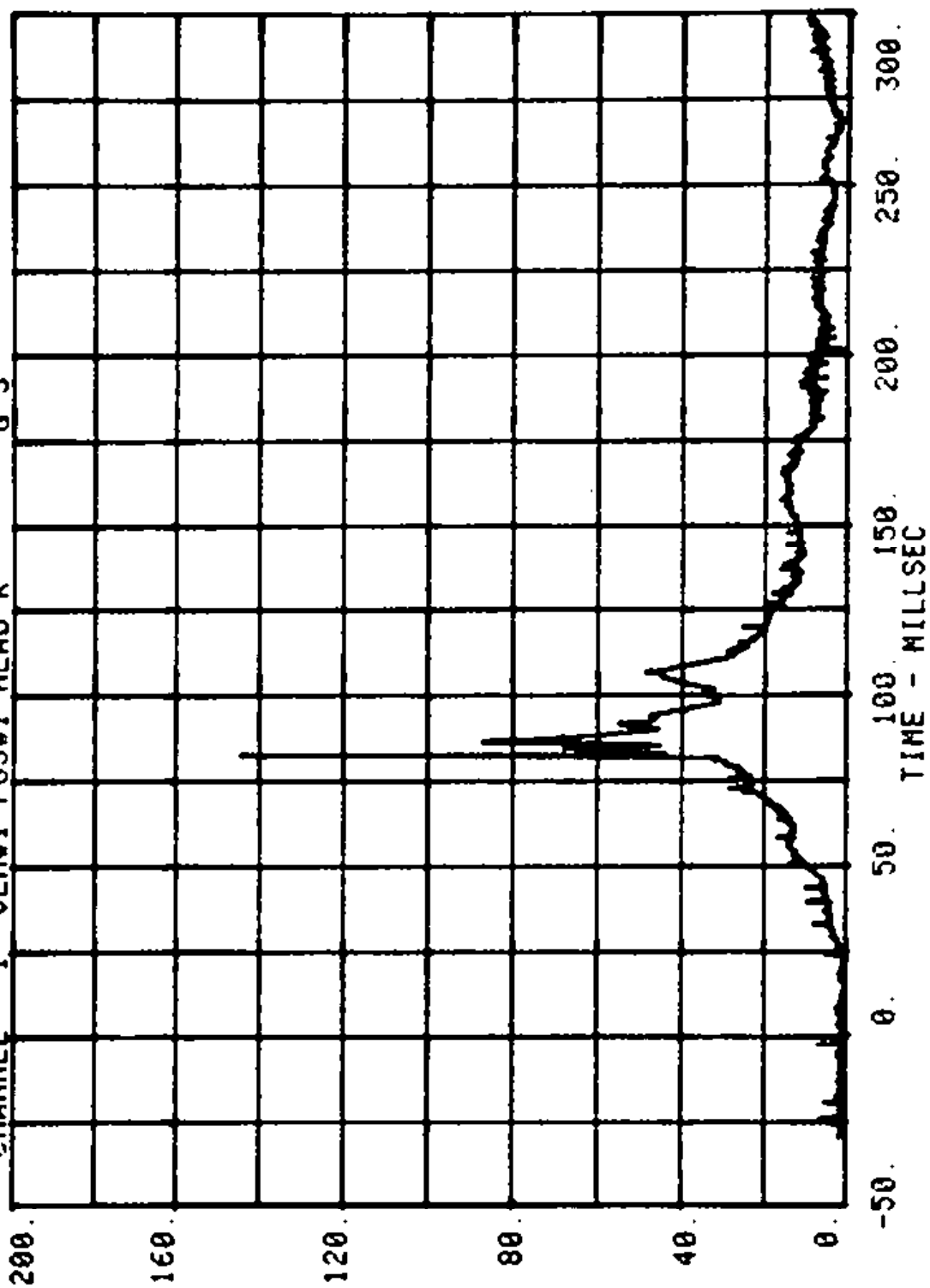
CHANNEL 2 RUN= 491 SERIES= 33  
VEH#1 POS#1 HEAD Y G'S

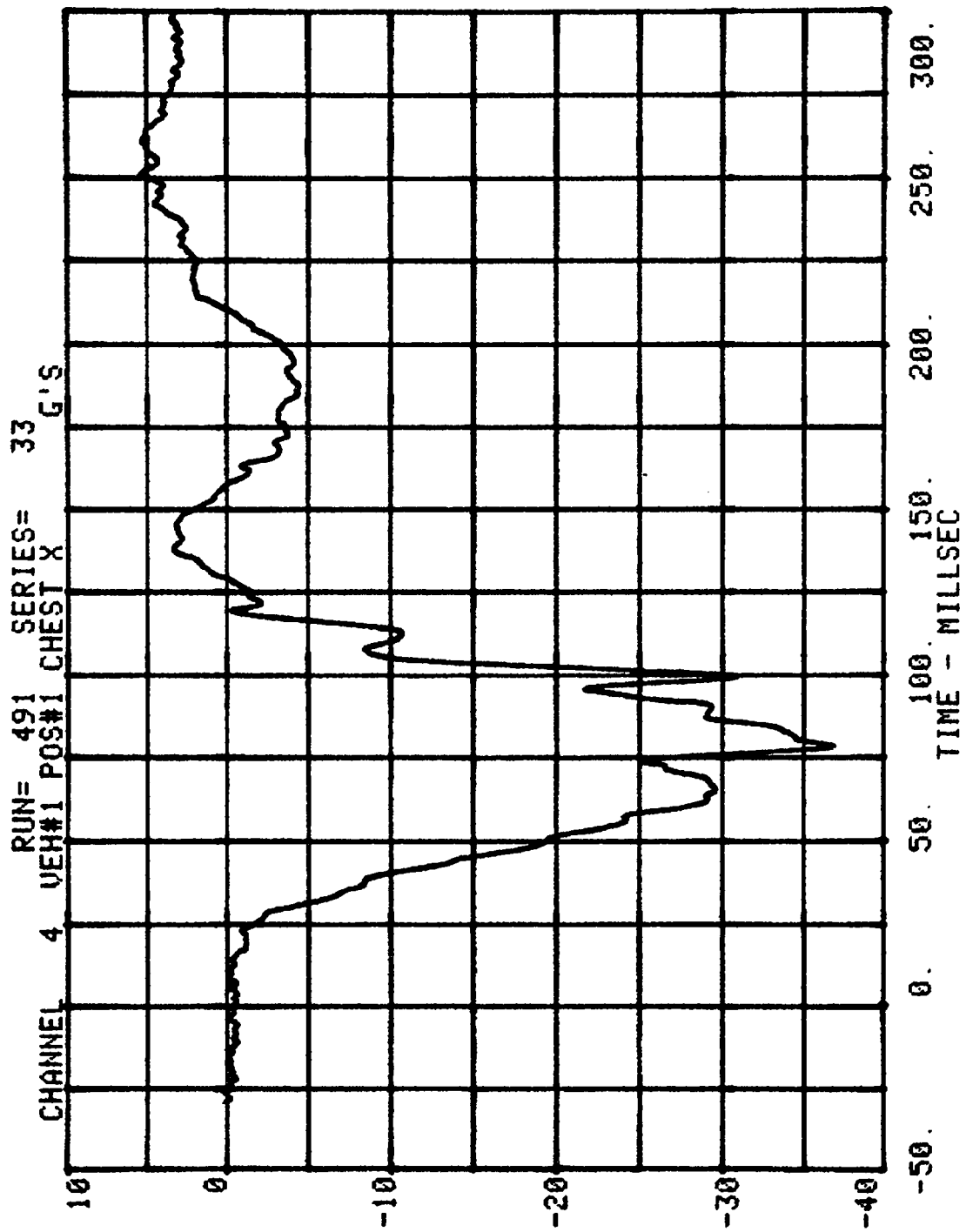




CHANNEL 1 VEH#1 POS#1 HEAD R G'S

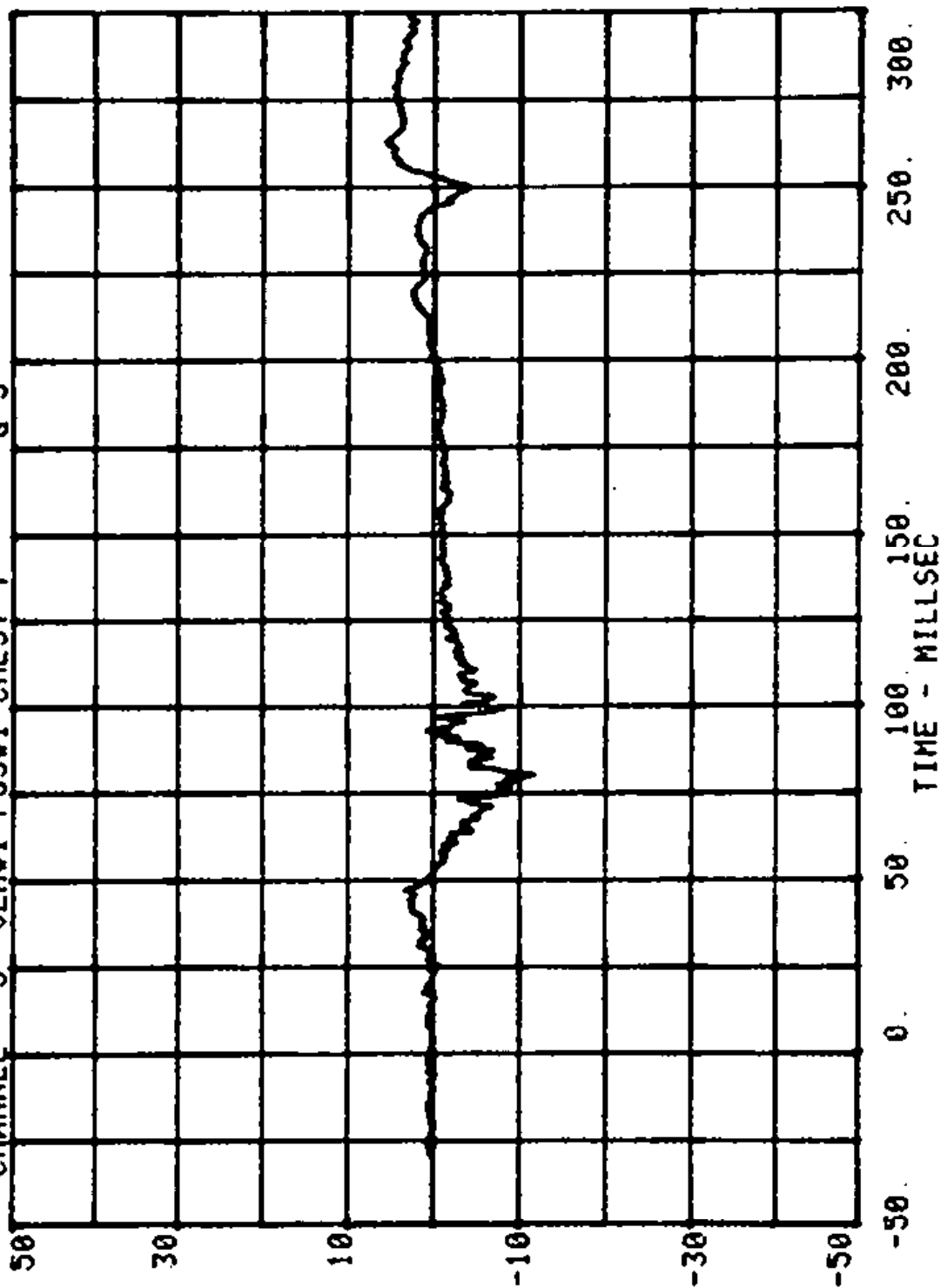
RUN= 491 SERIES= 33



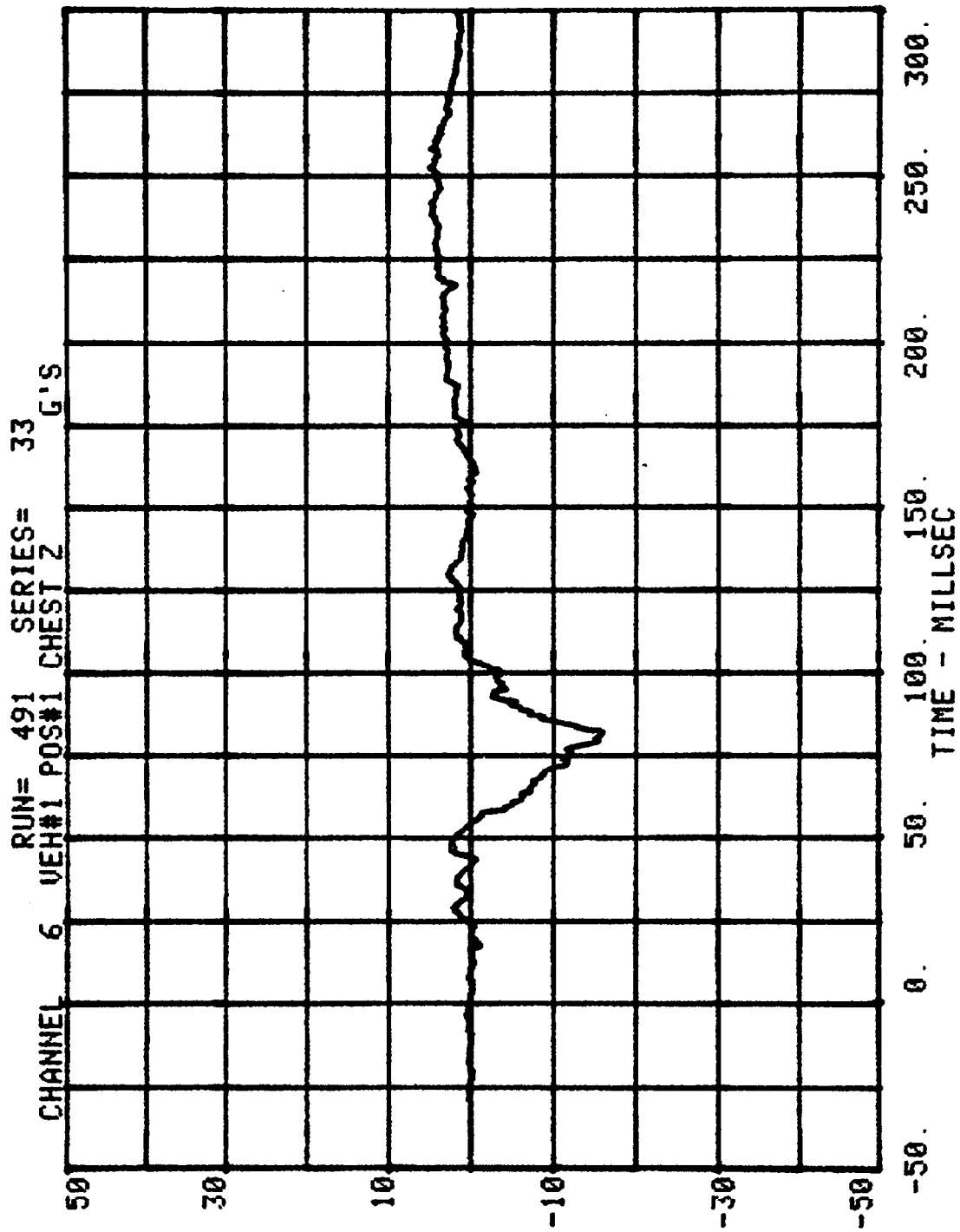


CHANNEL 5 VEH#1 POS#1 CHEST Y G'S

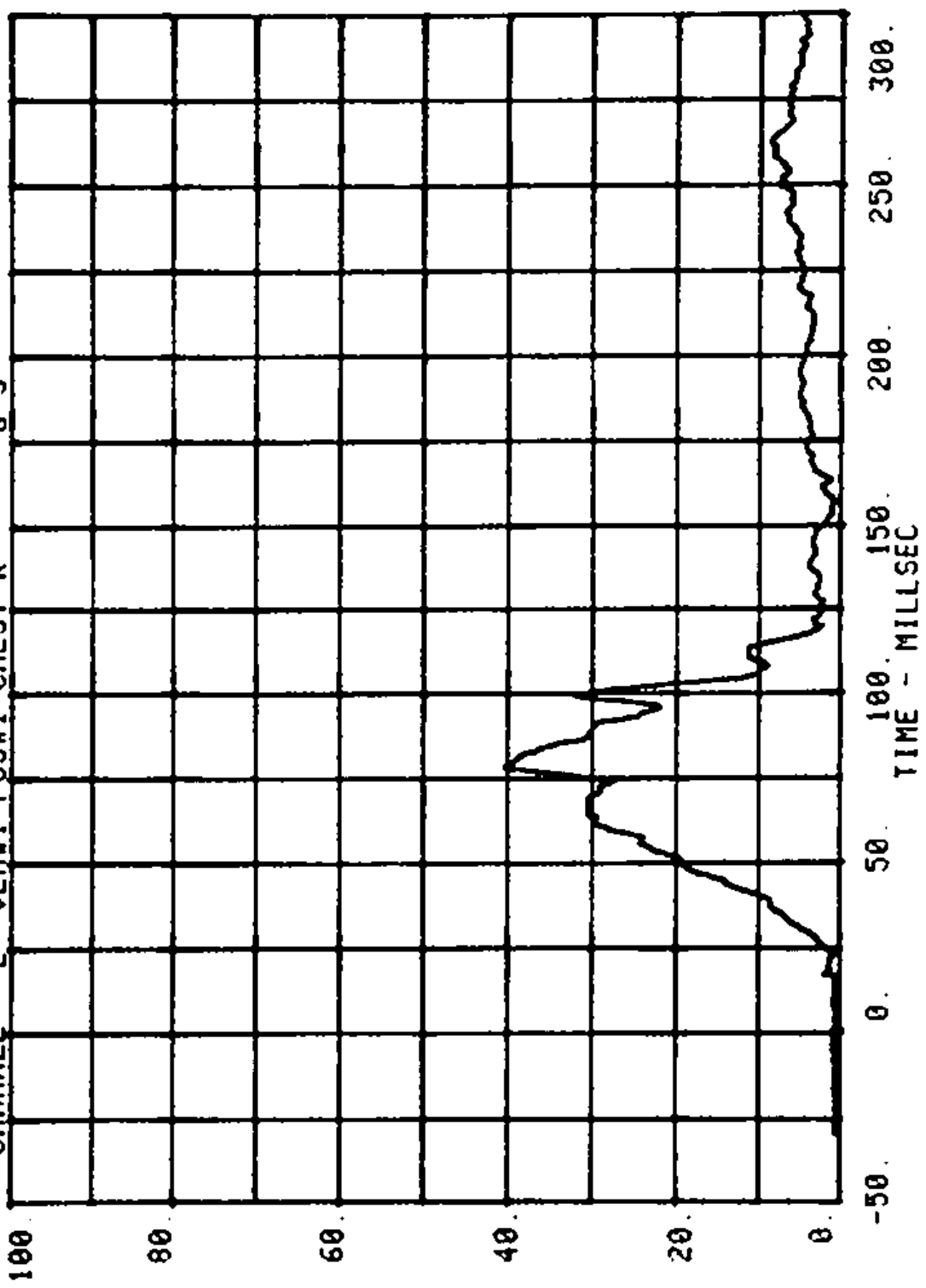
RUN= 491 SERIES= 33



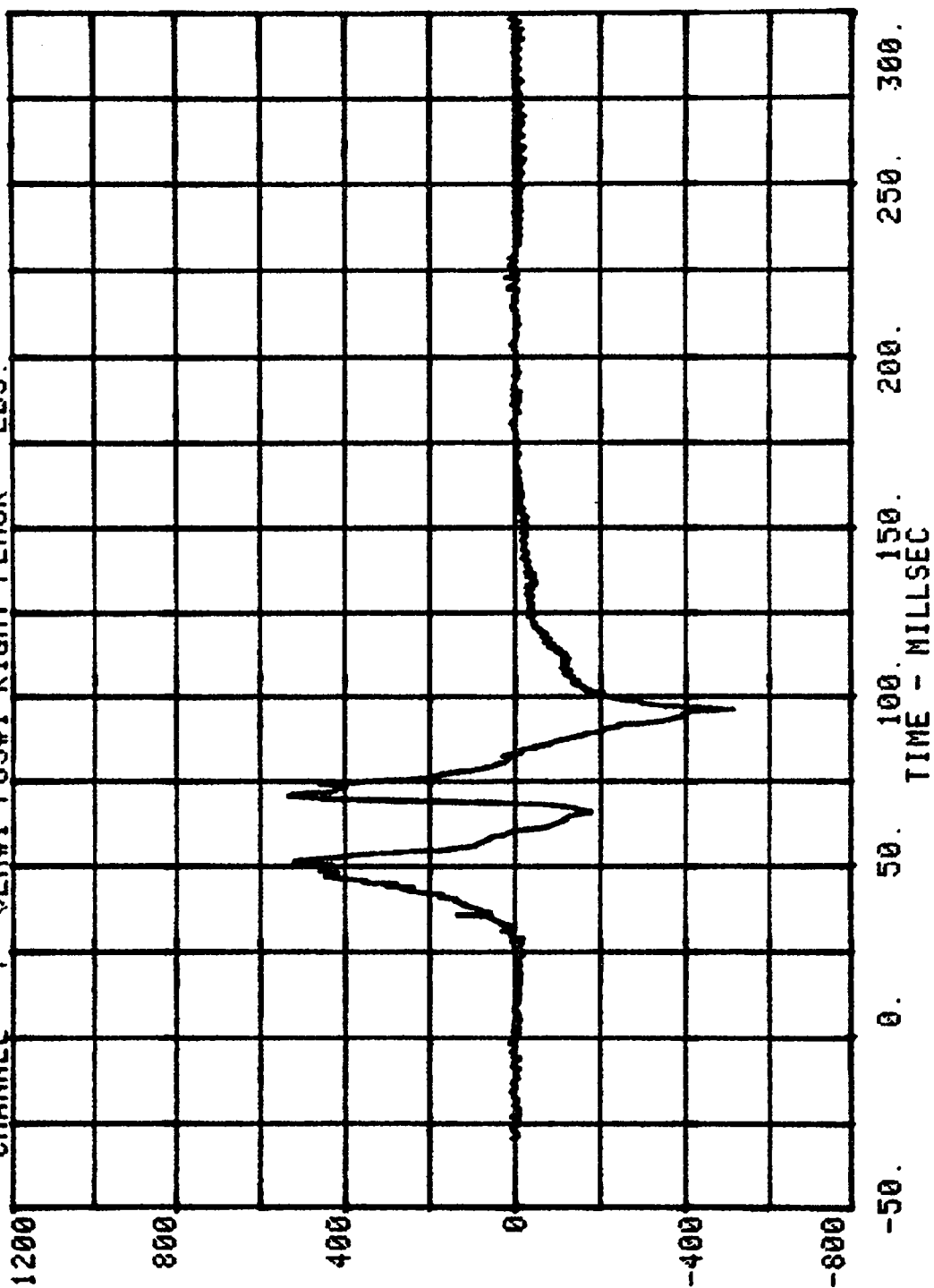
CHANNEL 6 VEH#1 POS#1 CHEST Z 33 G'S



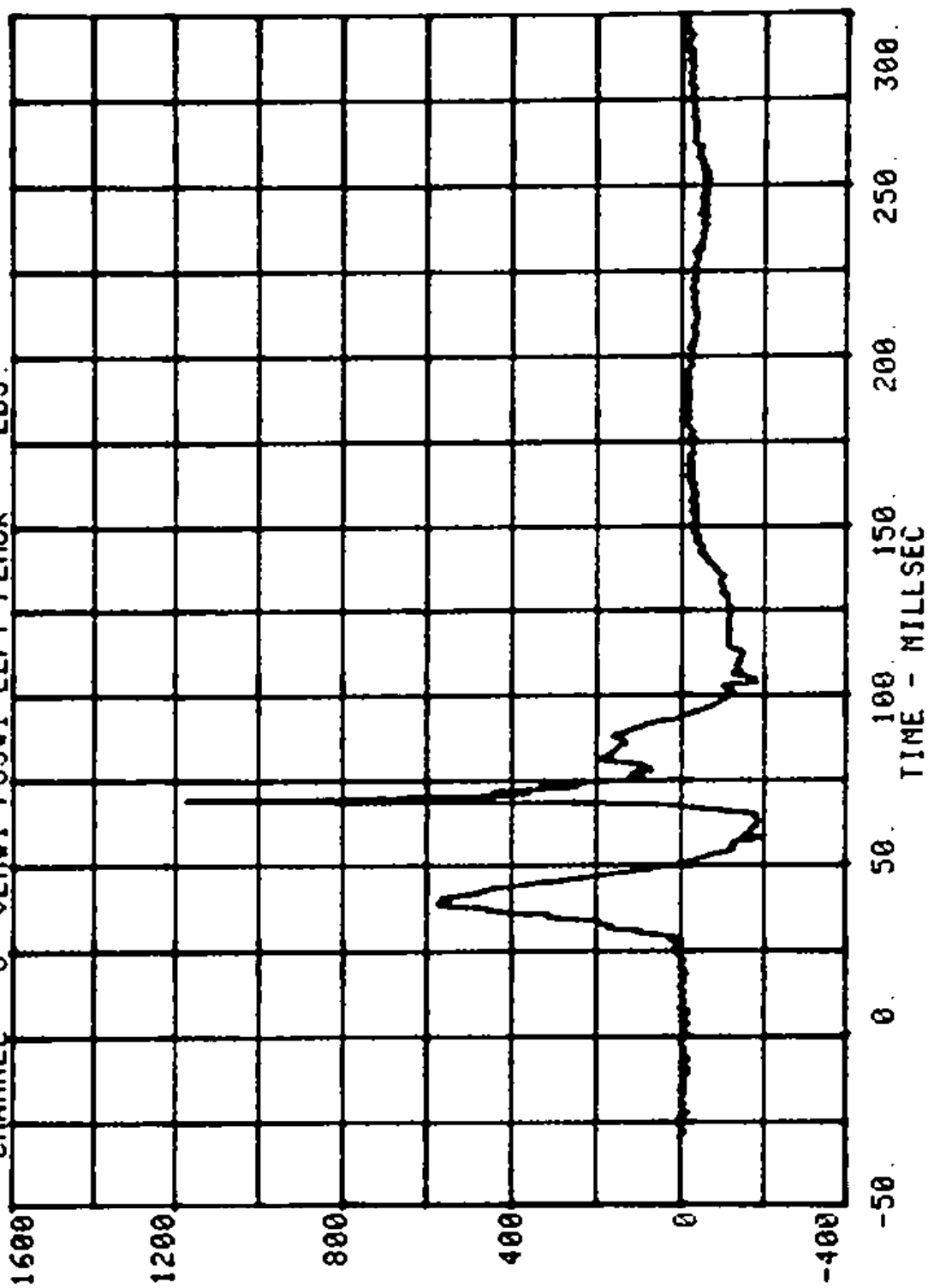
CHANNEL 2 VEH#1 POS#1 CHEST R 33 G'S

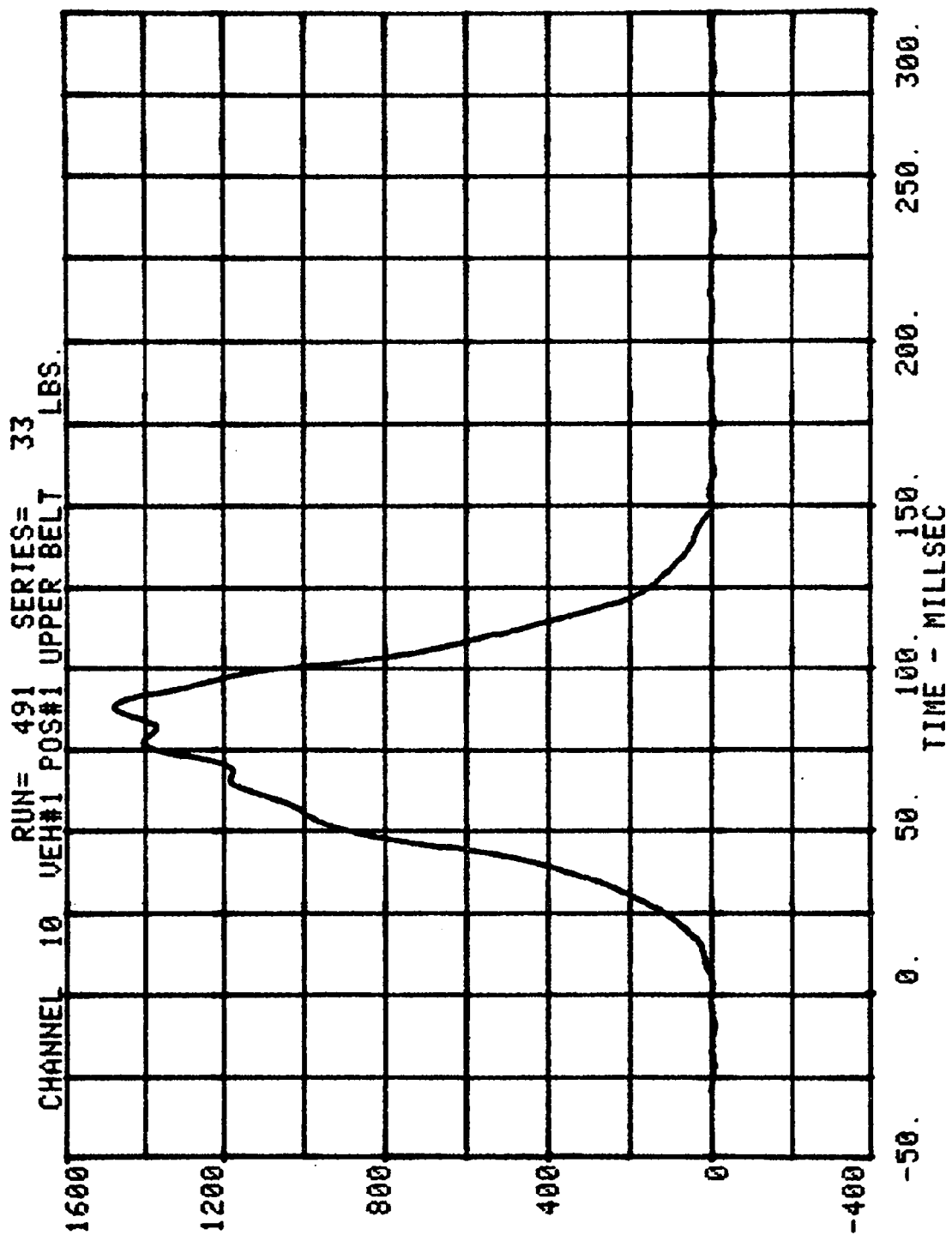


CHANNEL 7 RUN= 491 SERIES= 33  
VEH#1 POS#1 RIGHT FEMUR LBS.

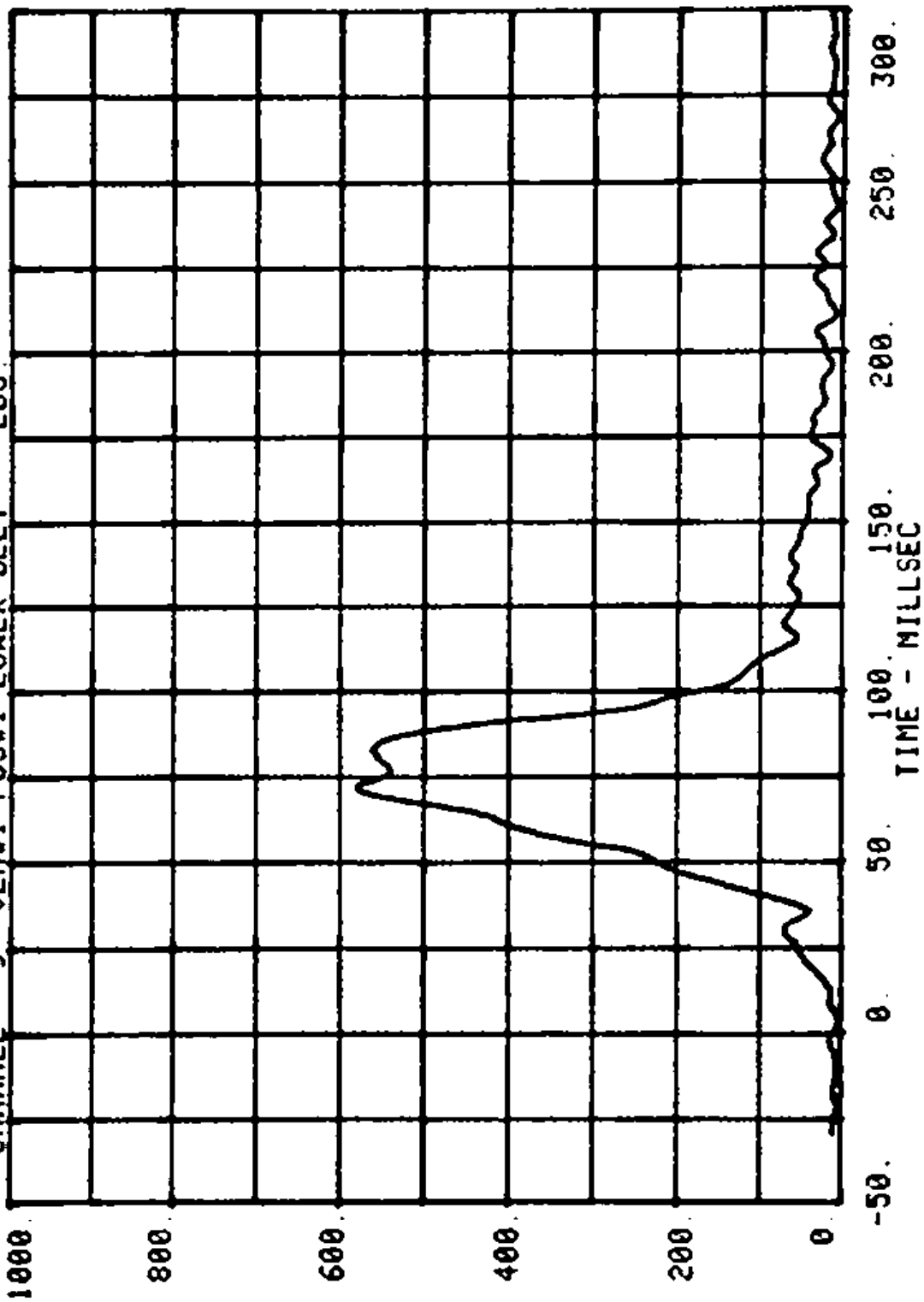


CHANNEL 8 RUN= 491 SERIES= 33  
VEH#1 POS#1 LEFT FEMUR LBS.





CHANNEL 9 RUN= 491 SERIES= 33  
VEH#1 POS#1 LOWER BELT LBS.



HEAD INJURY CRITERION  
HEAD SEVERITY INDEX

BOA TASK 3 TEST #33 CAR-TO-CAR

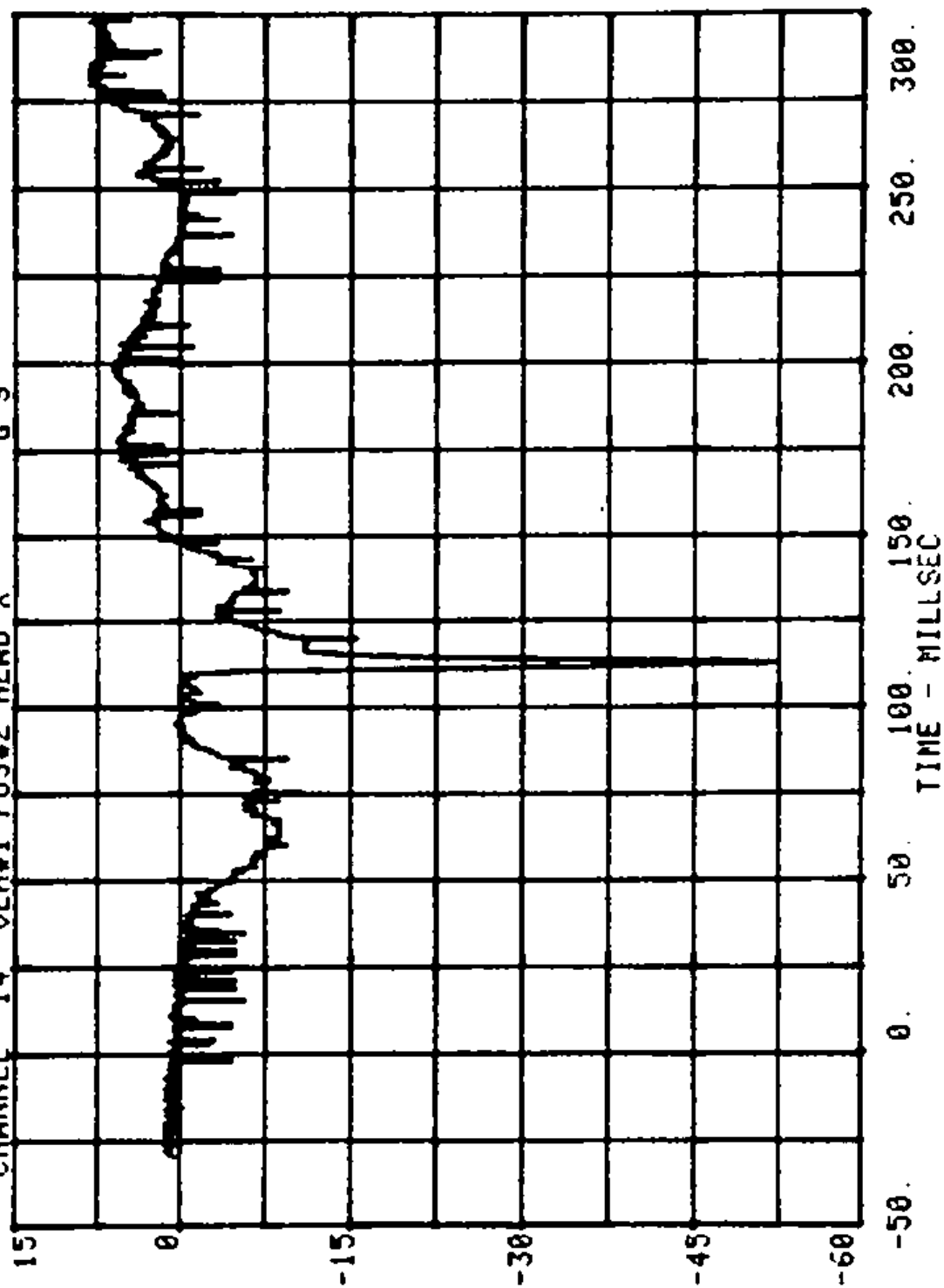
RUN= 491

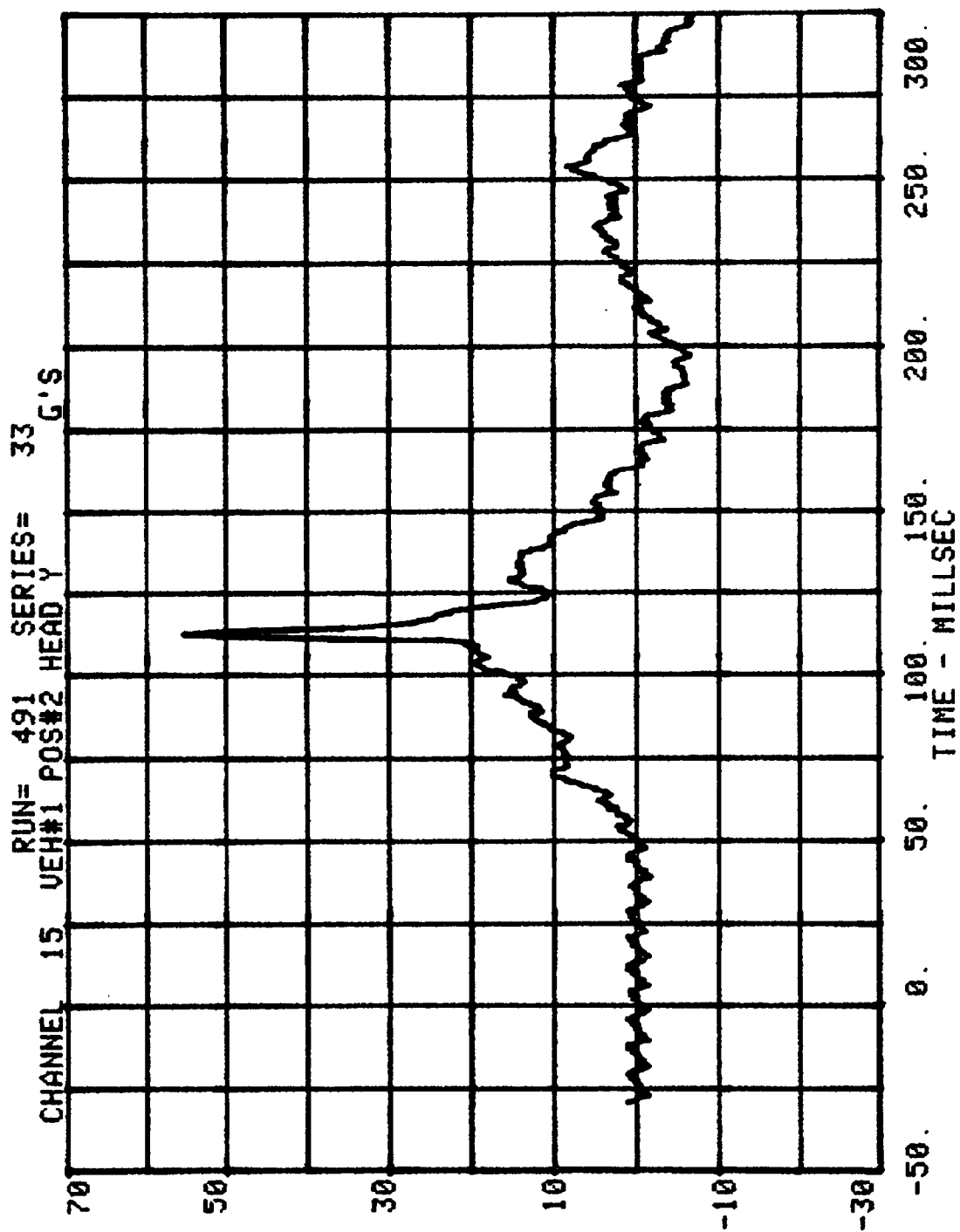
VEH#1 POS#2 HEAD R

HIC= 674.0 FROM T1= .08580 TO T2= .11670  
AVERAGE ACCELERATION BETWEEN T1 AND T2= 54.4G'S  
EVENT TIME= 300.0 MSEC  
SEVERITY INDEX= 934.7

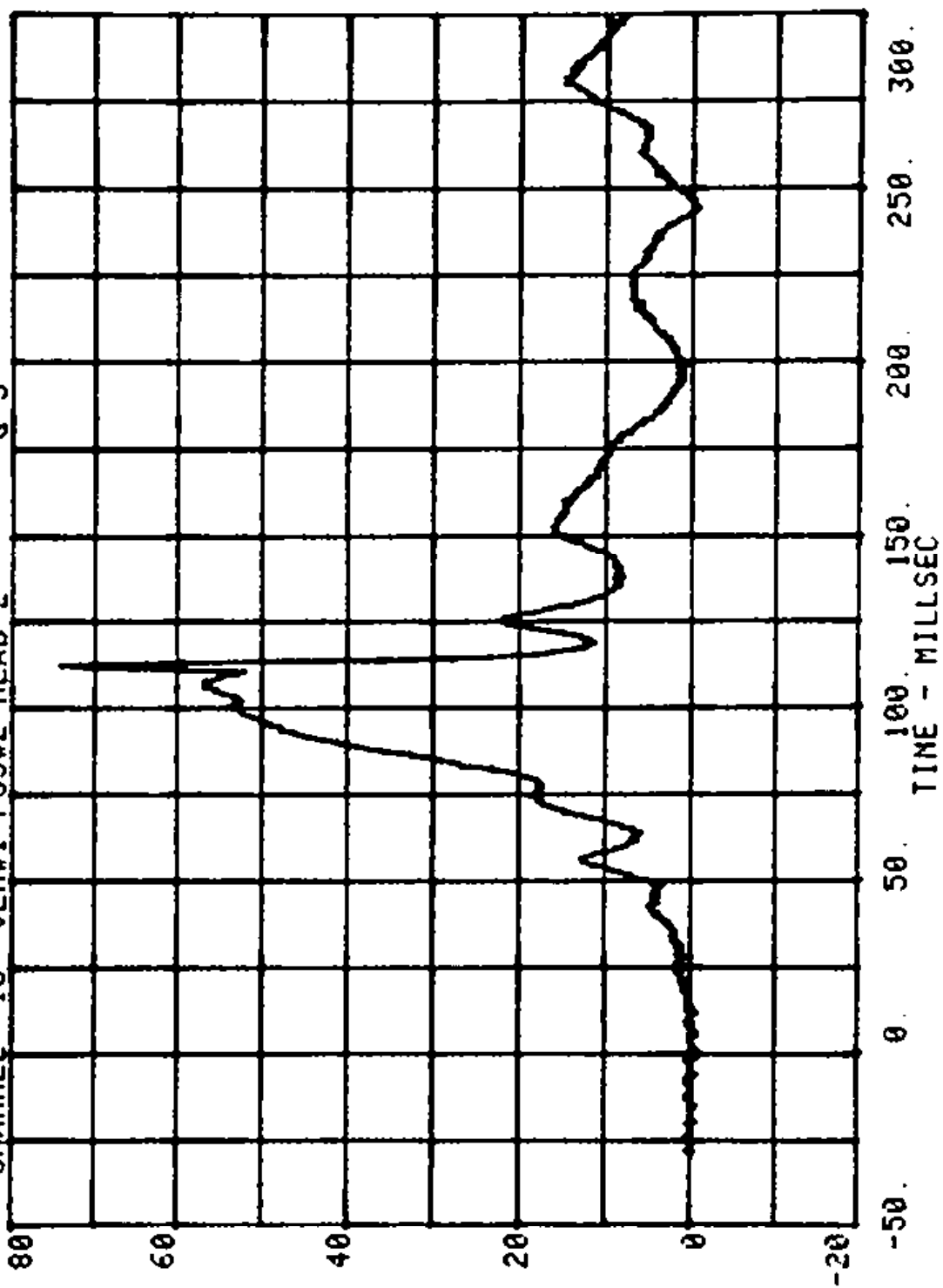
CHANNEL 14 VEH#1 POS#2 HEAD X G'S

RUN= 491 SERIES= 33

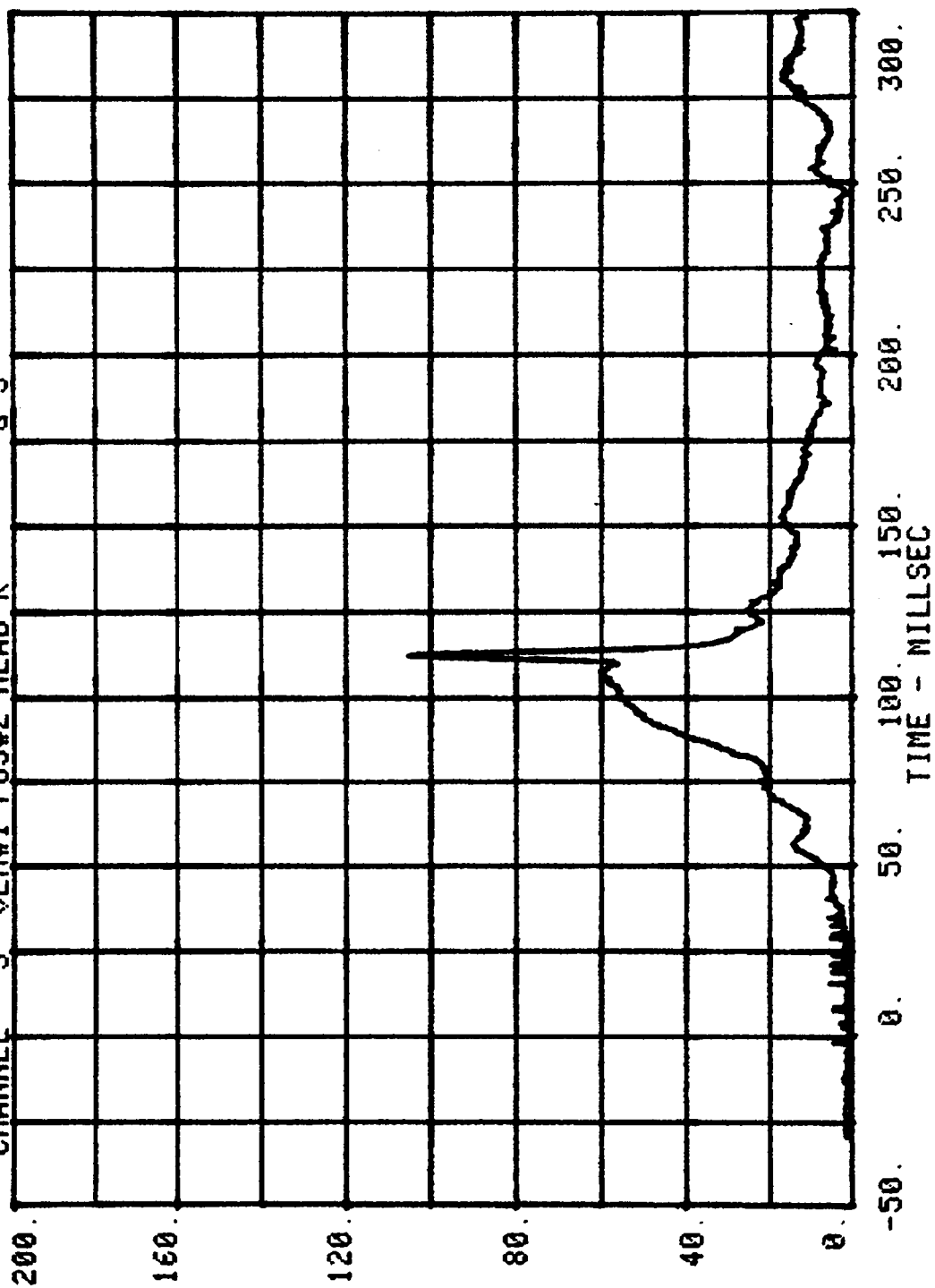




CHANNEL 16 RUN= 491 SERIES= 33  
VEH#1 POS#2 HEAD Z G'S

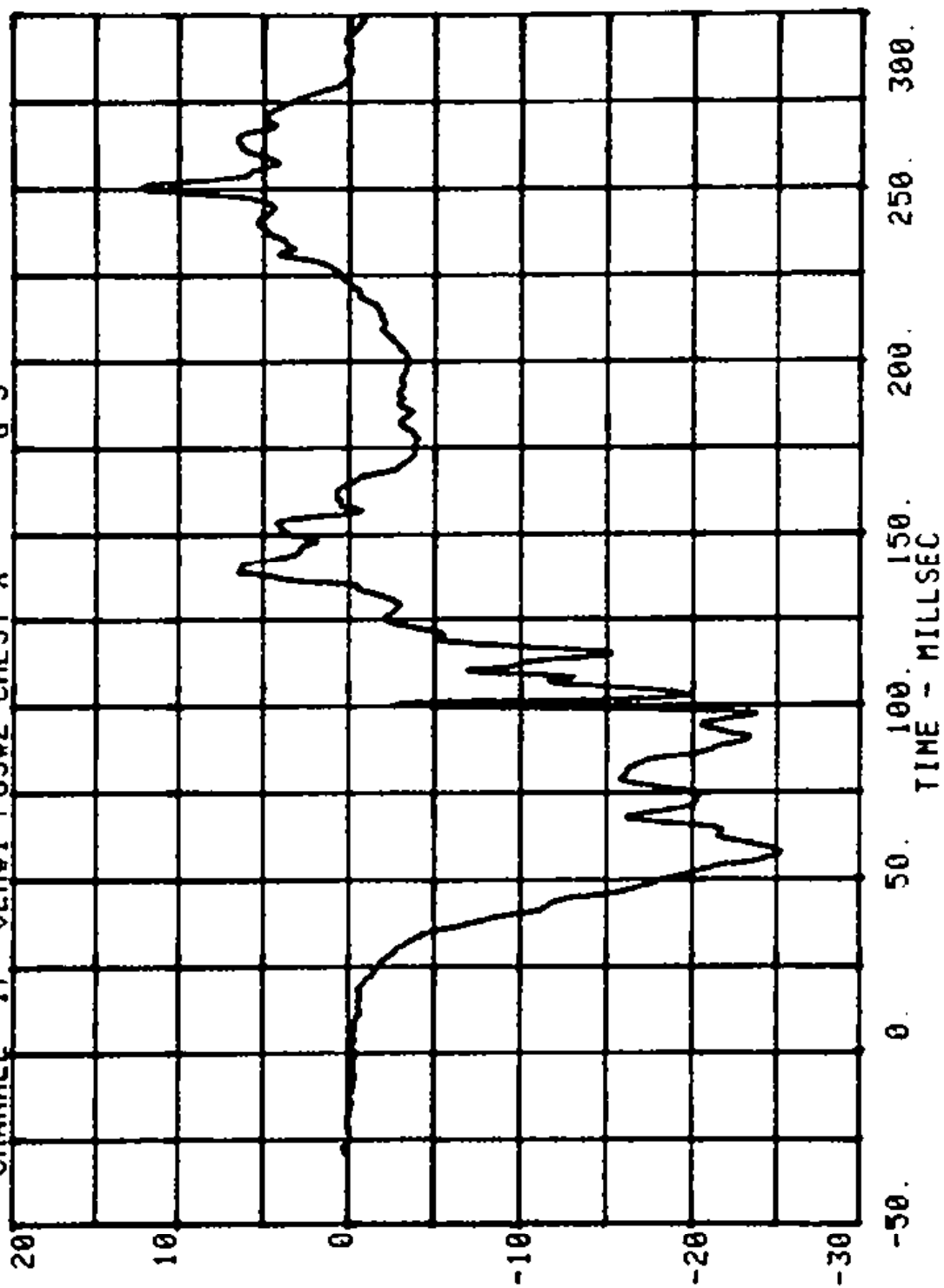


CHANNEL 3 RUN= 491 SERIES= 33  
VEH#1 POS#2 HEAD R G'S

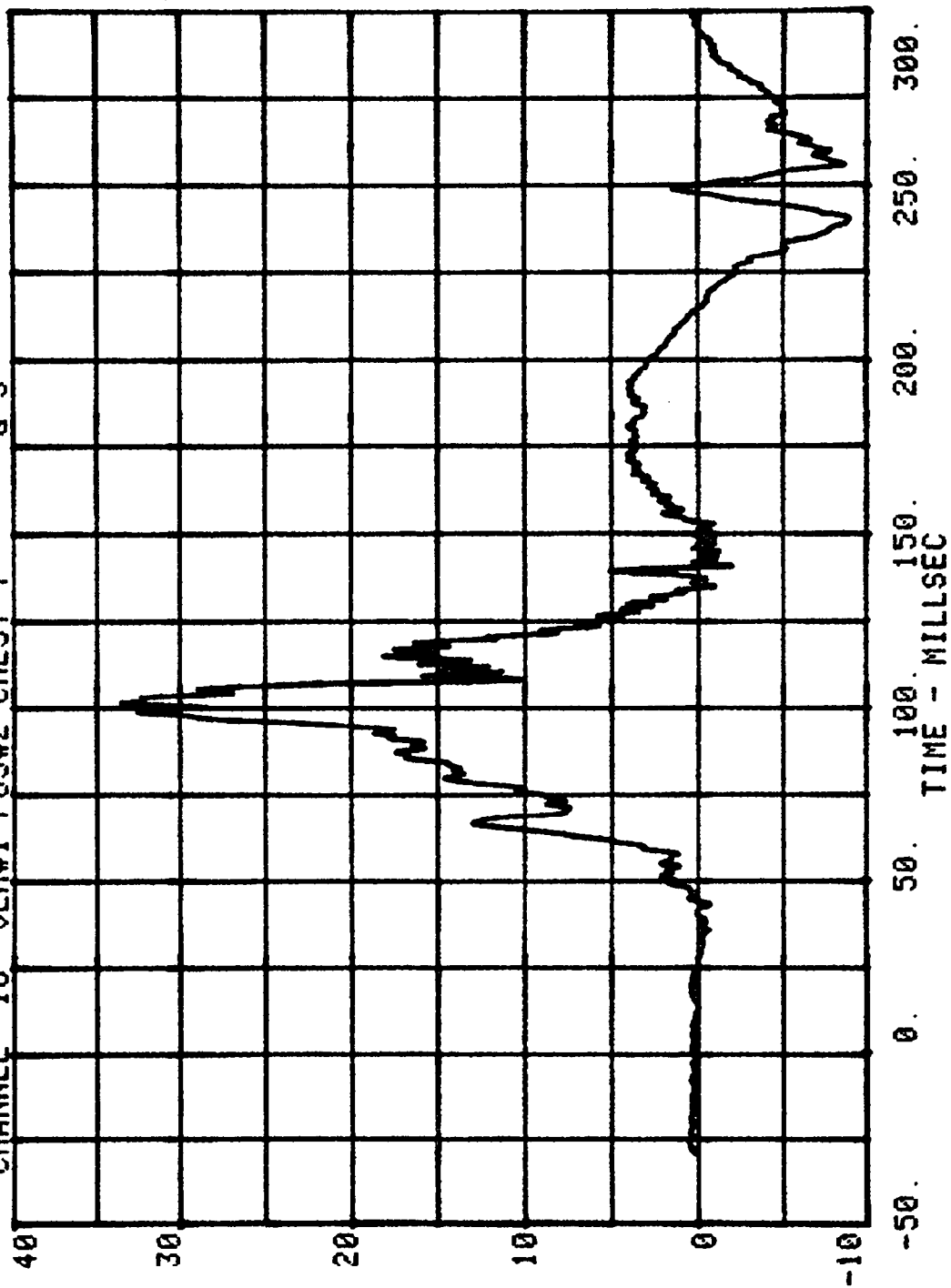


CHANNEL 17 VEH#1 POS#2 CHEST X G'S

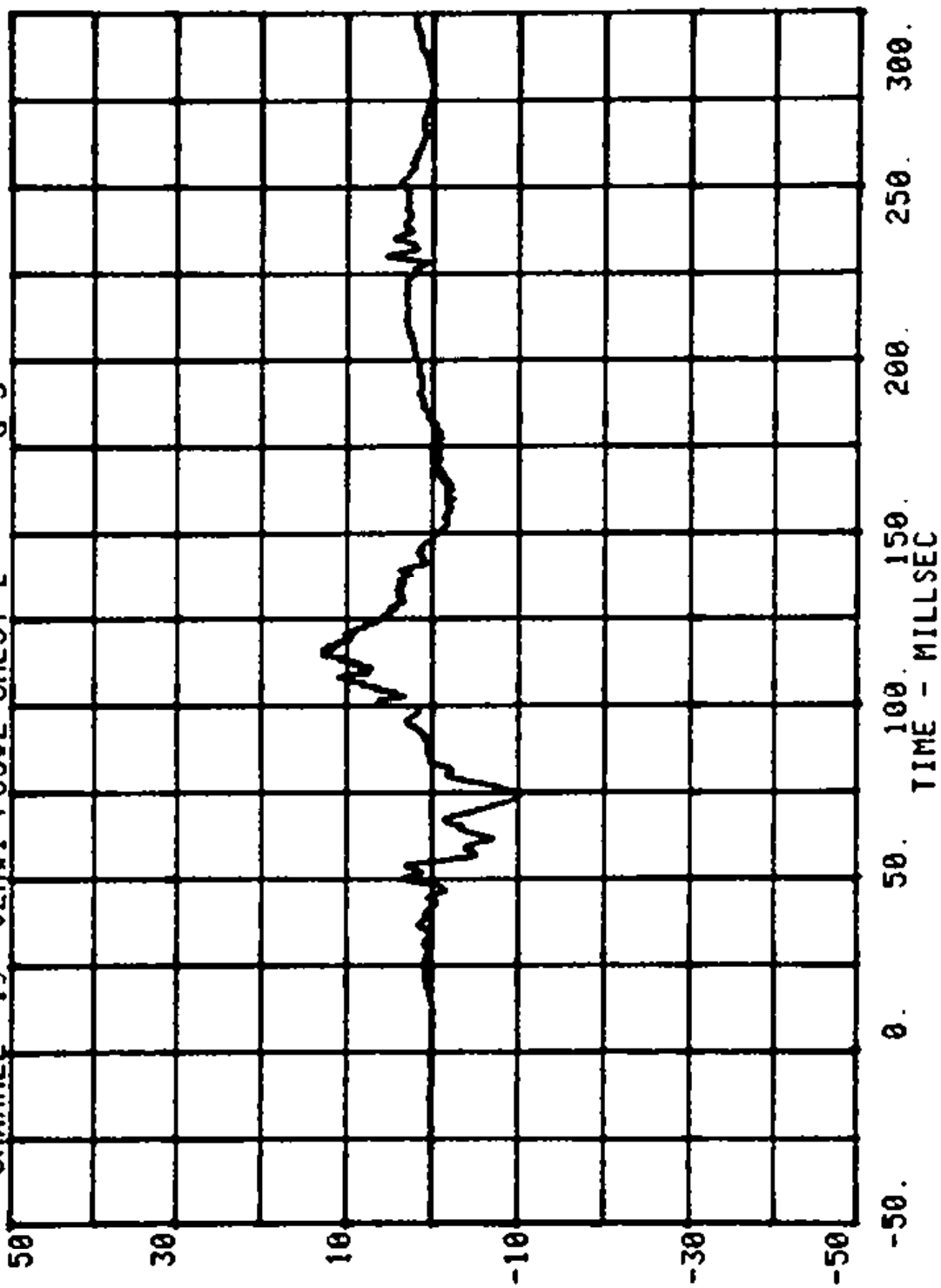
RUN= 491 SERIES= 33



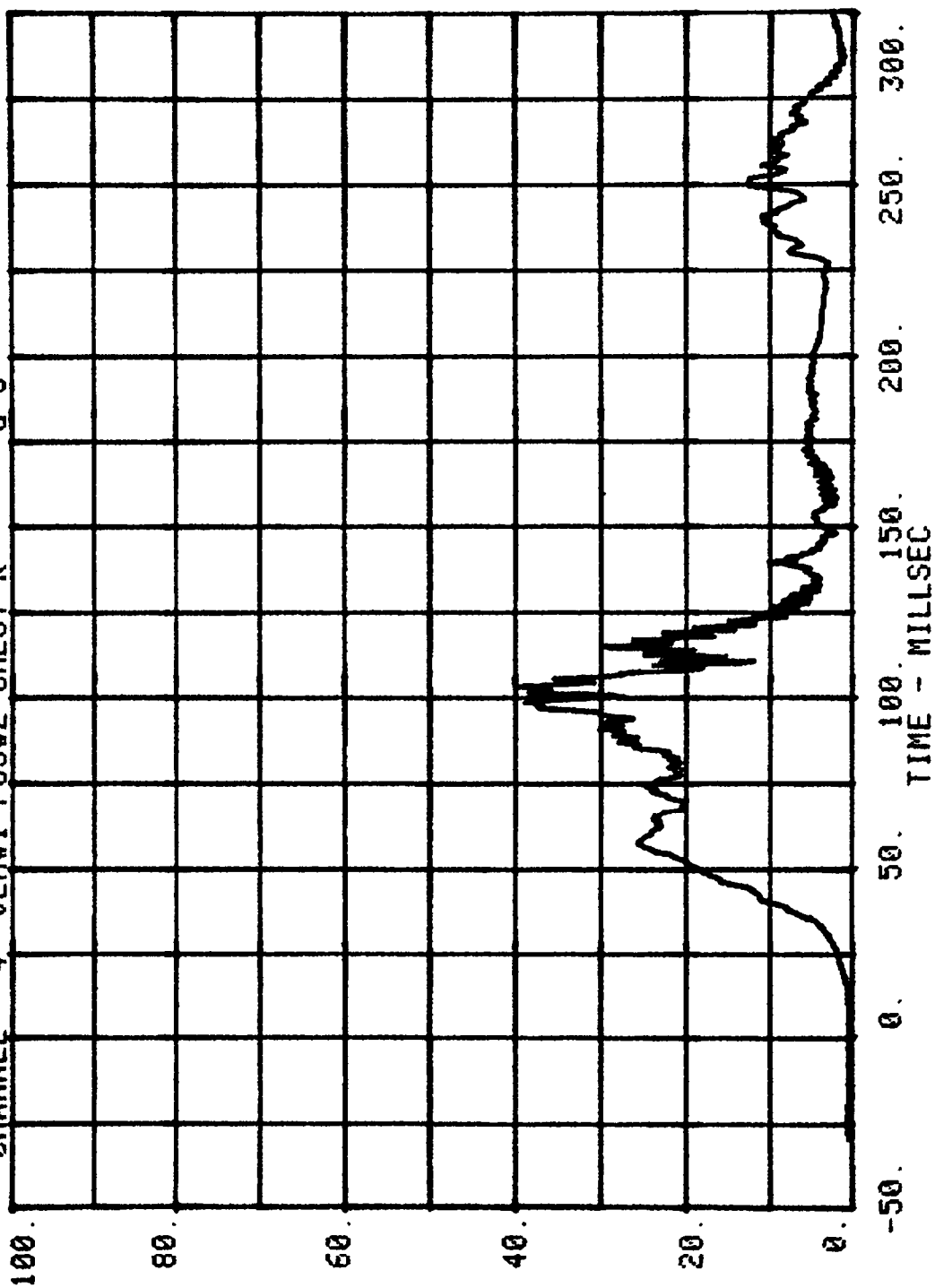
CHANNEL 18 RUN= 491 SERIES= 33  
VEH#1 POS#2 CHEST Y G'S



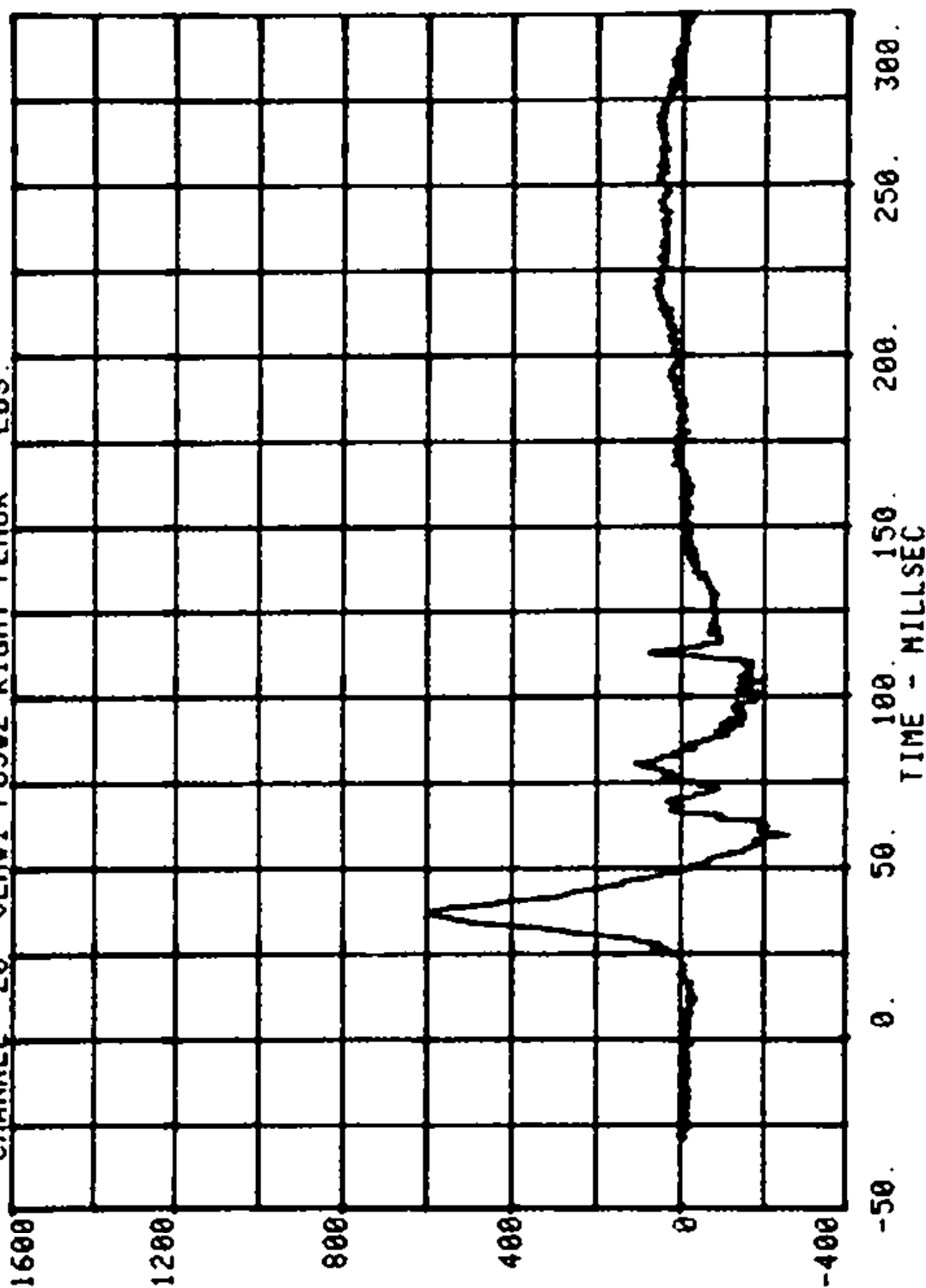
CHANNEL 19 VE#1 POS#2 CHEST 2 33 G'S

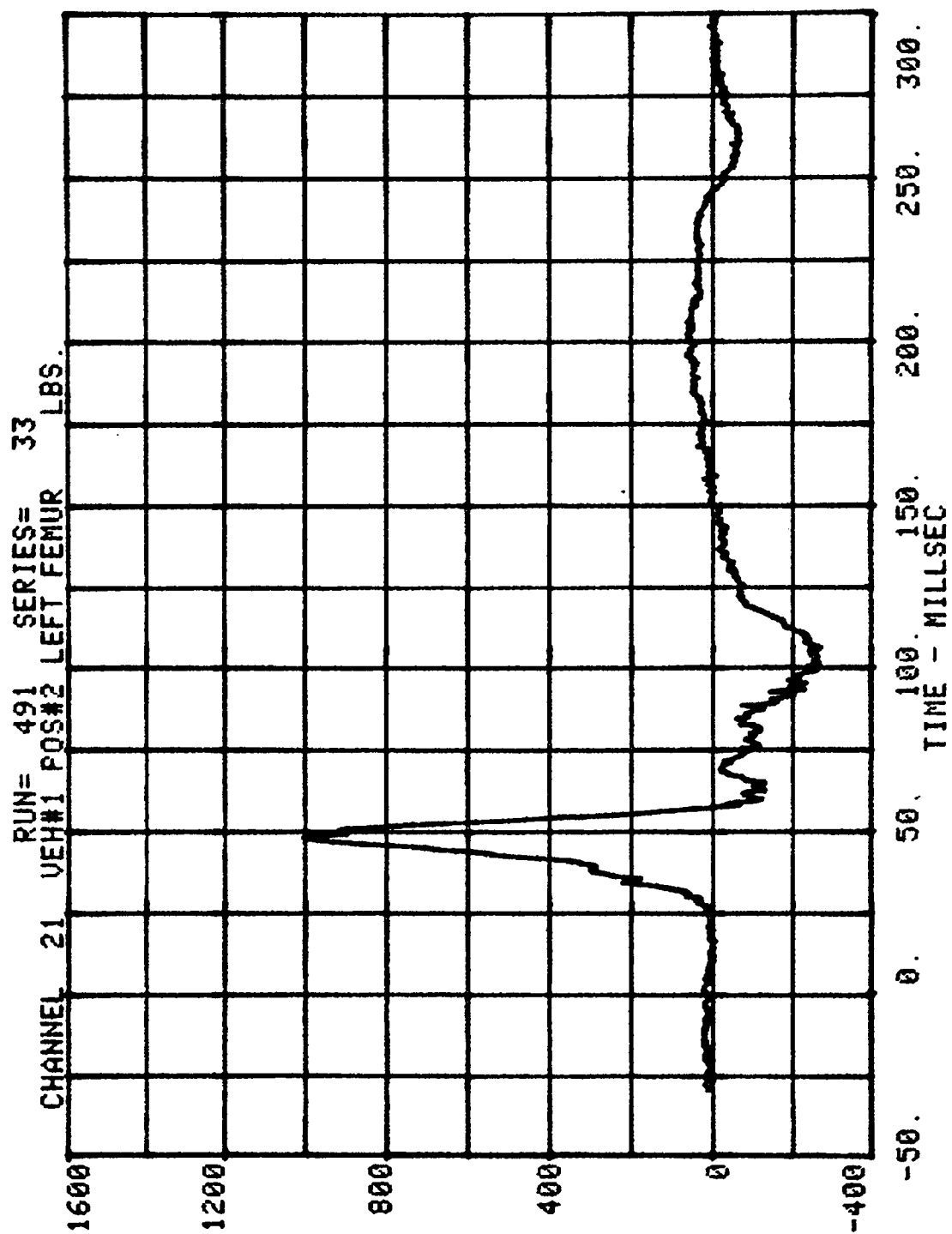


CHANNEL 4 RUN= 491 SERIES= 33  
VEH#1 POS#2 CHEST R G'S

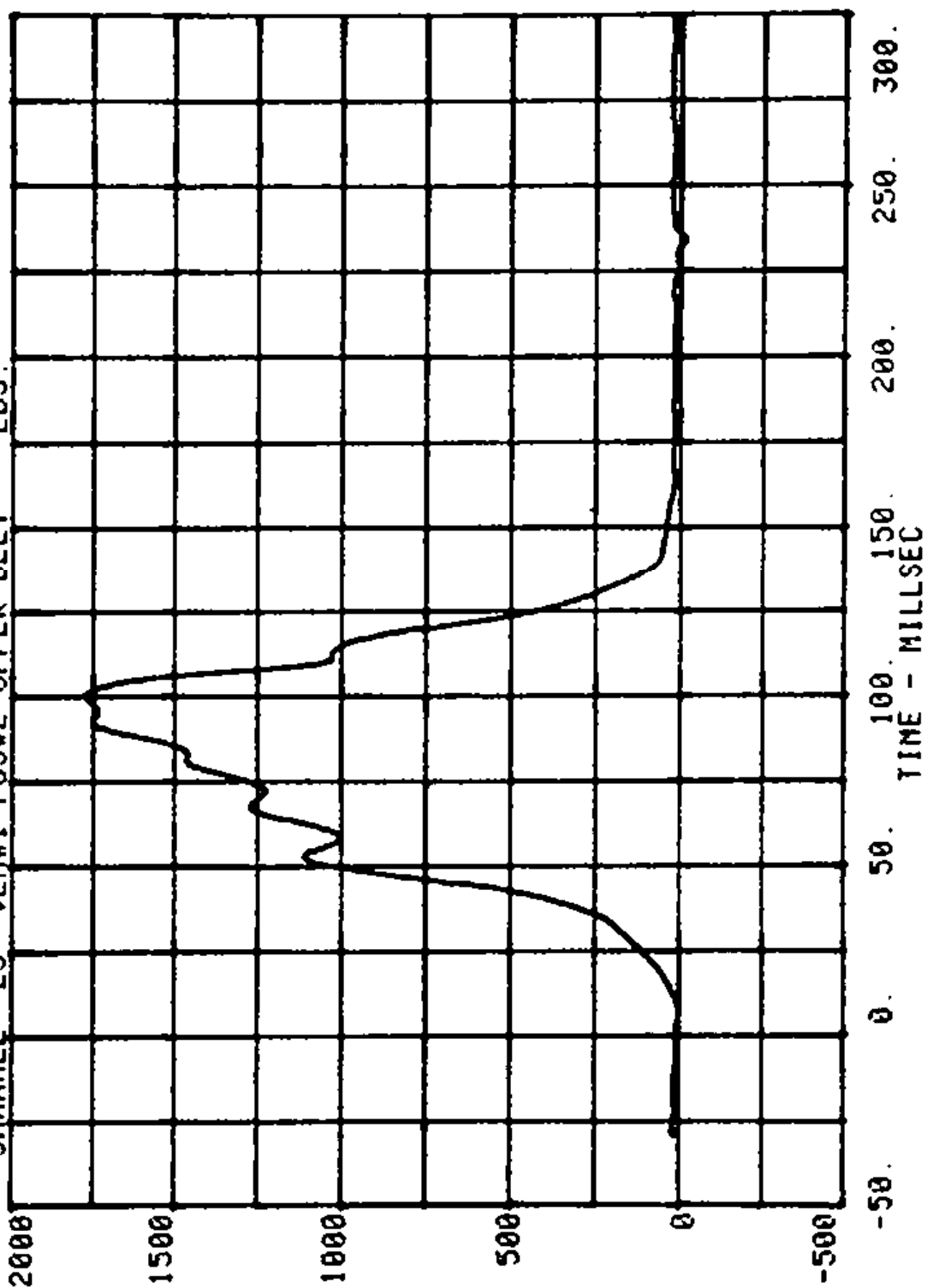


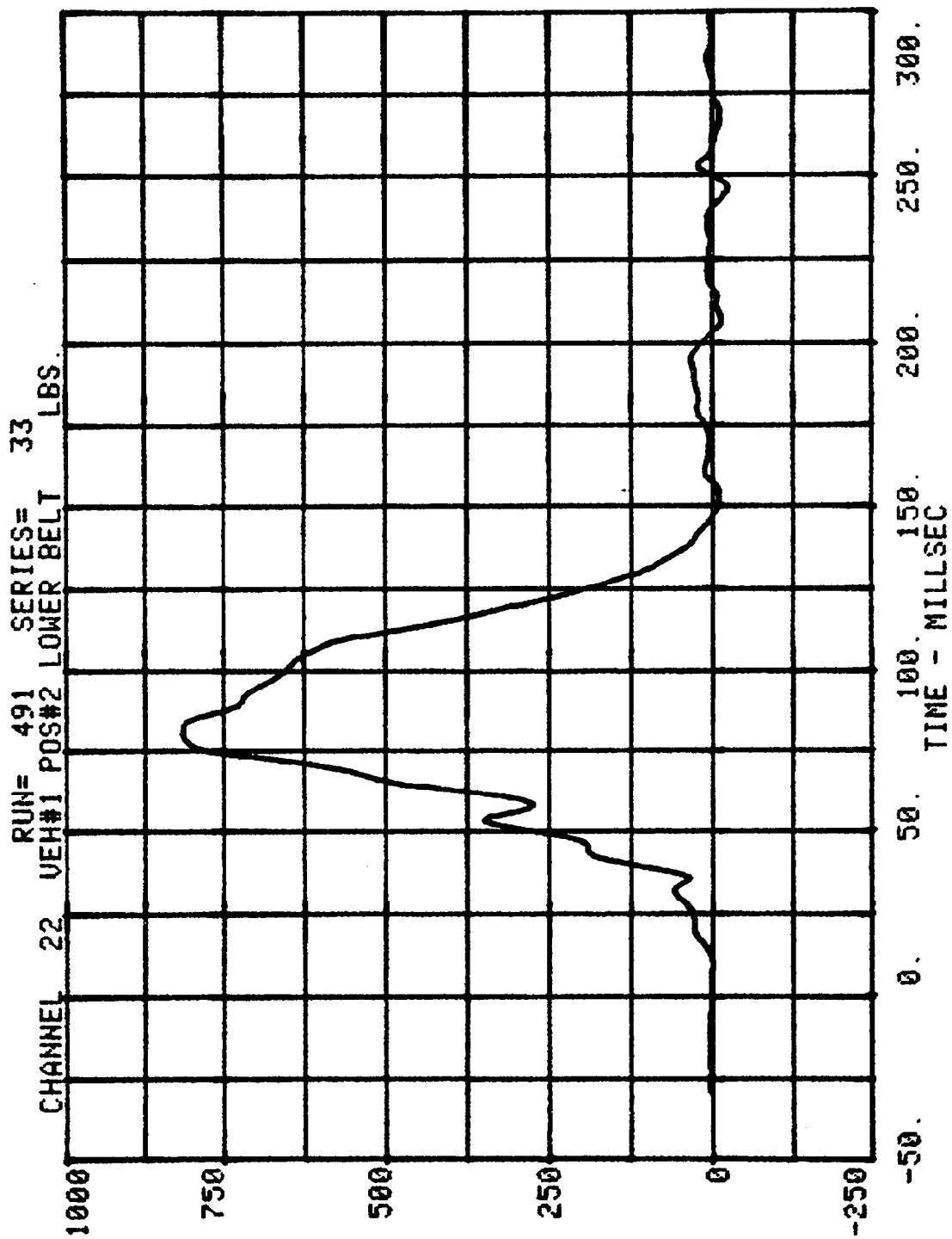
CHANNEL 20 RUN= 491 SERIES= 33  
VEH#1 POS#2 RIGHT FEMUR LBS.





CHANNEL 23 RUN= 491 SERIES= 33  
VEH#1 POS#2 UPPER BELT LBS.





Test No. 308-33-491  
1980 Plymouth Horizon  
Vehicle #2 Data

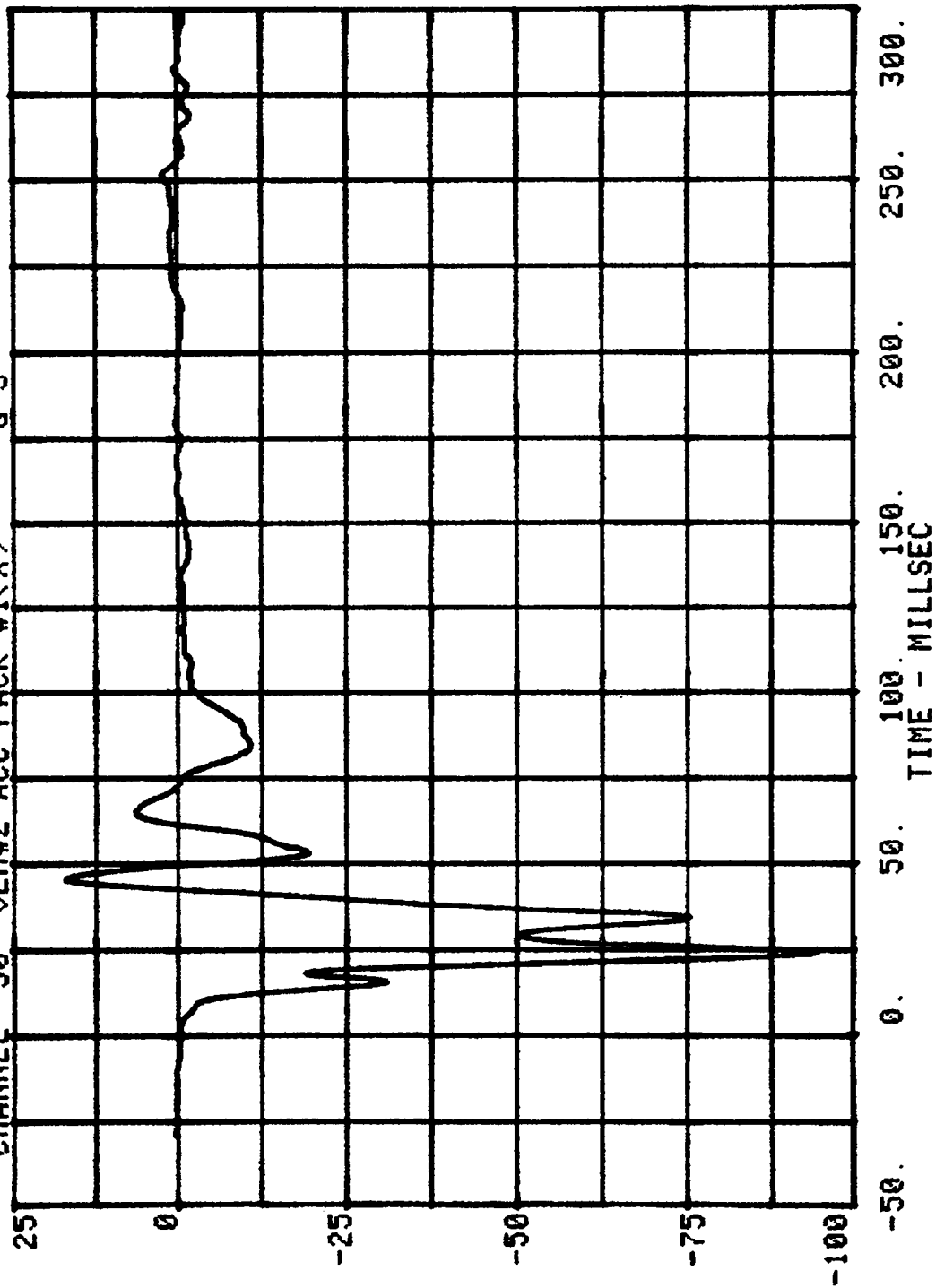
Vehicle Data

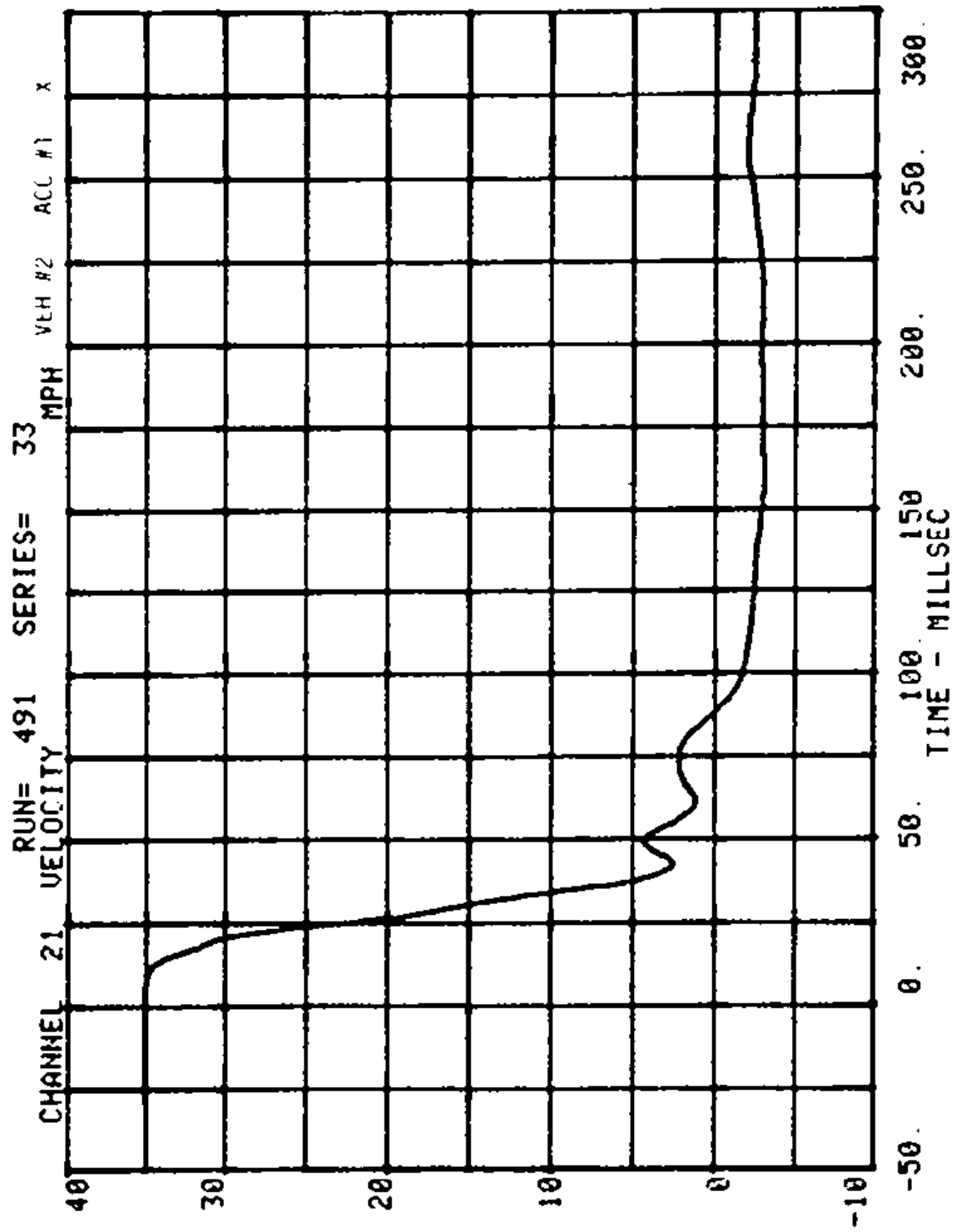
Filter Channel Class

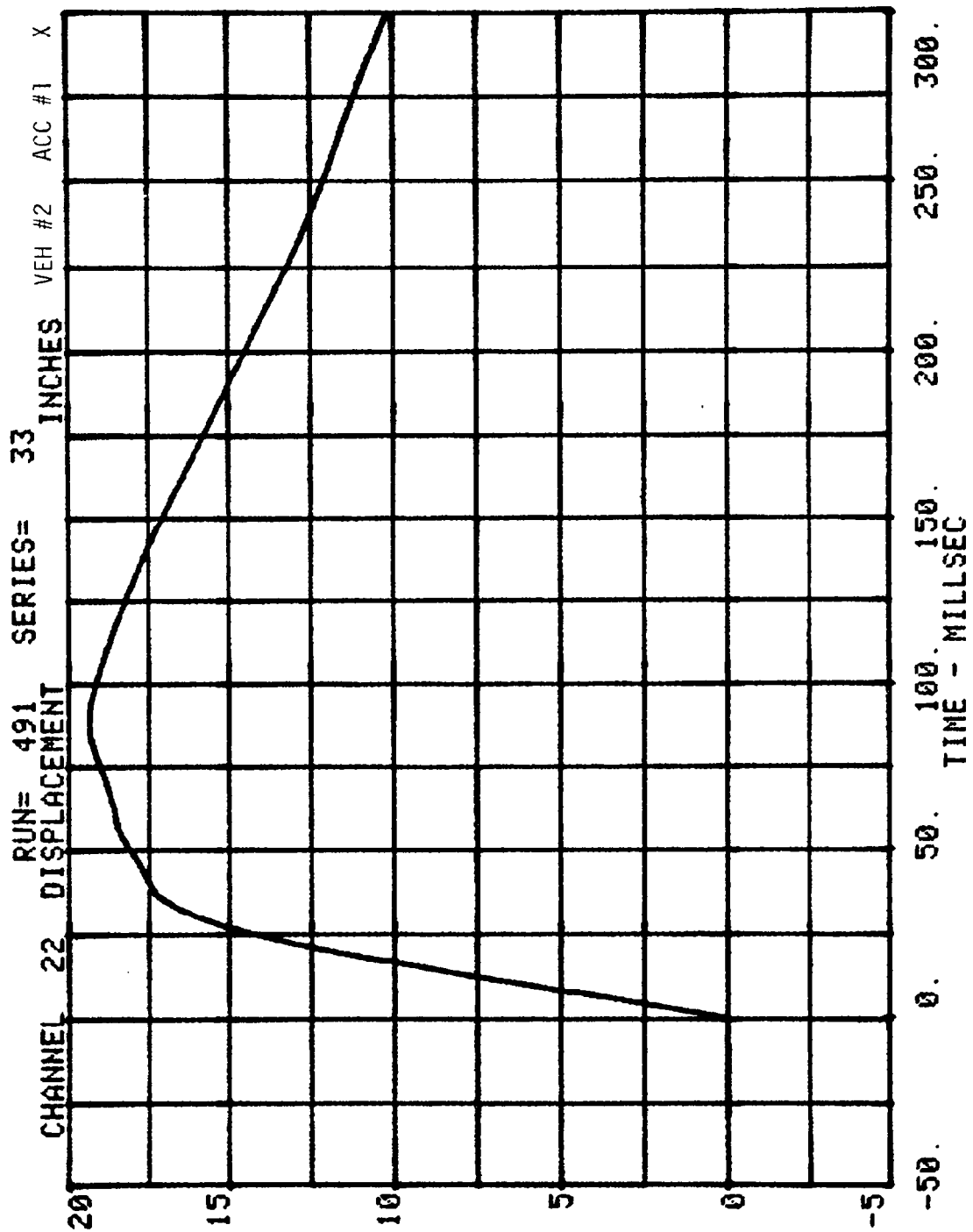
60

See Figure 3 for Accelerometer Layout.  
See Table 9 for Electronic Instrumentation Descriptor.

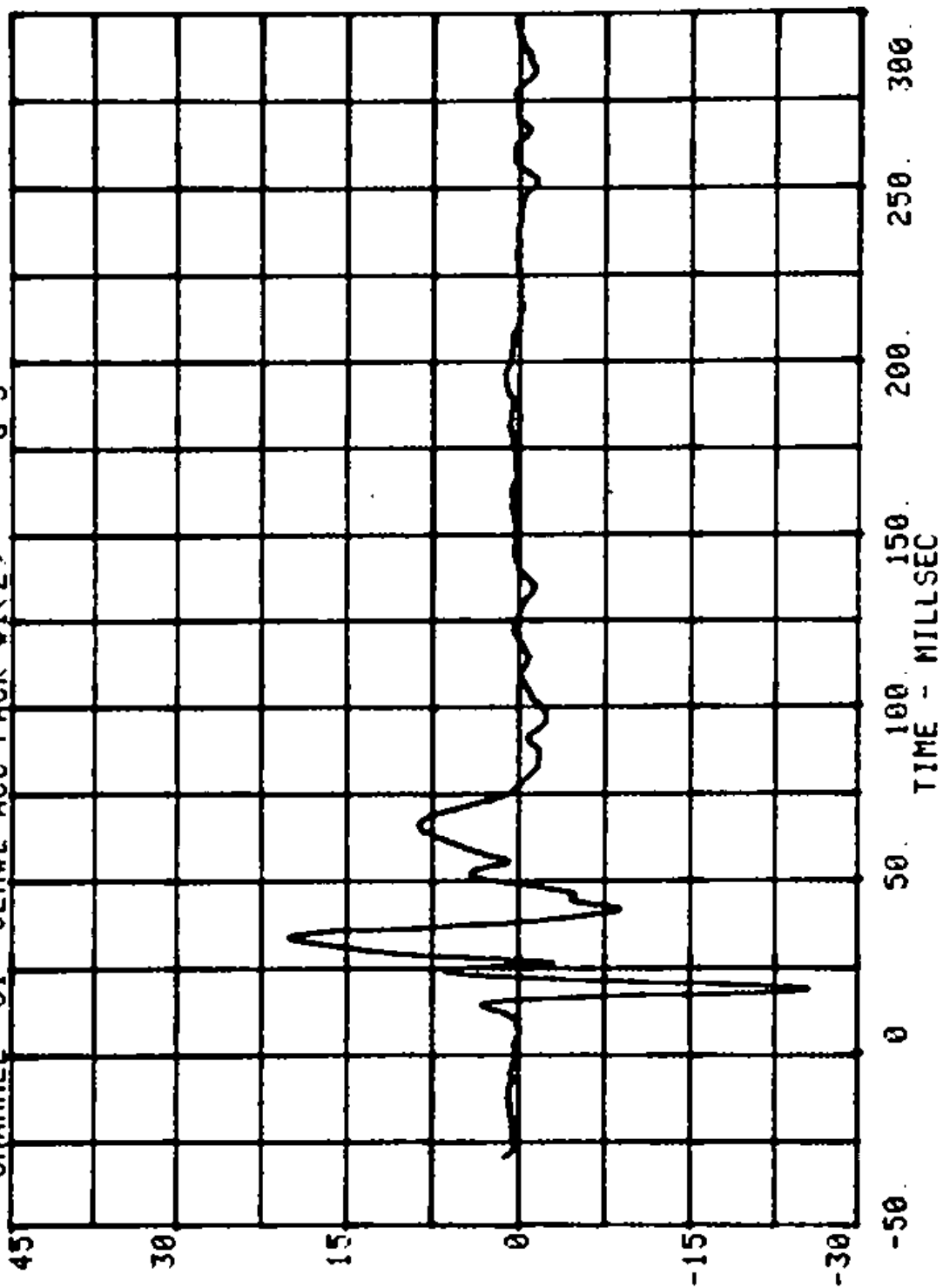
CHANNEL 50 RUN= 491 SERIES= 33  
VEH#2 ACC PACK #1(X) G'S



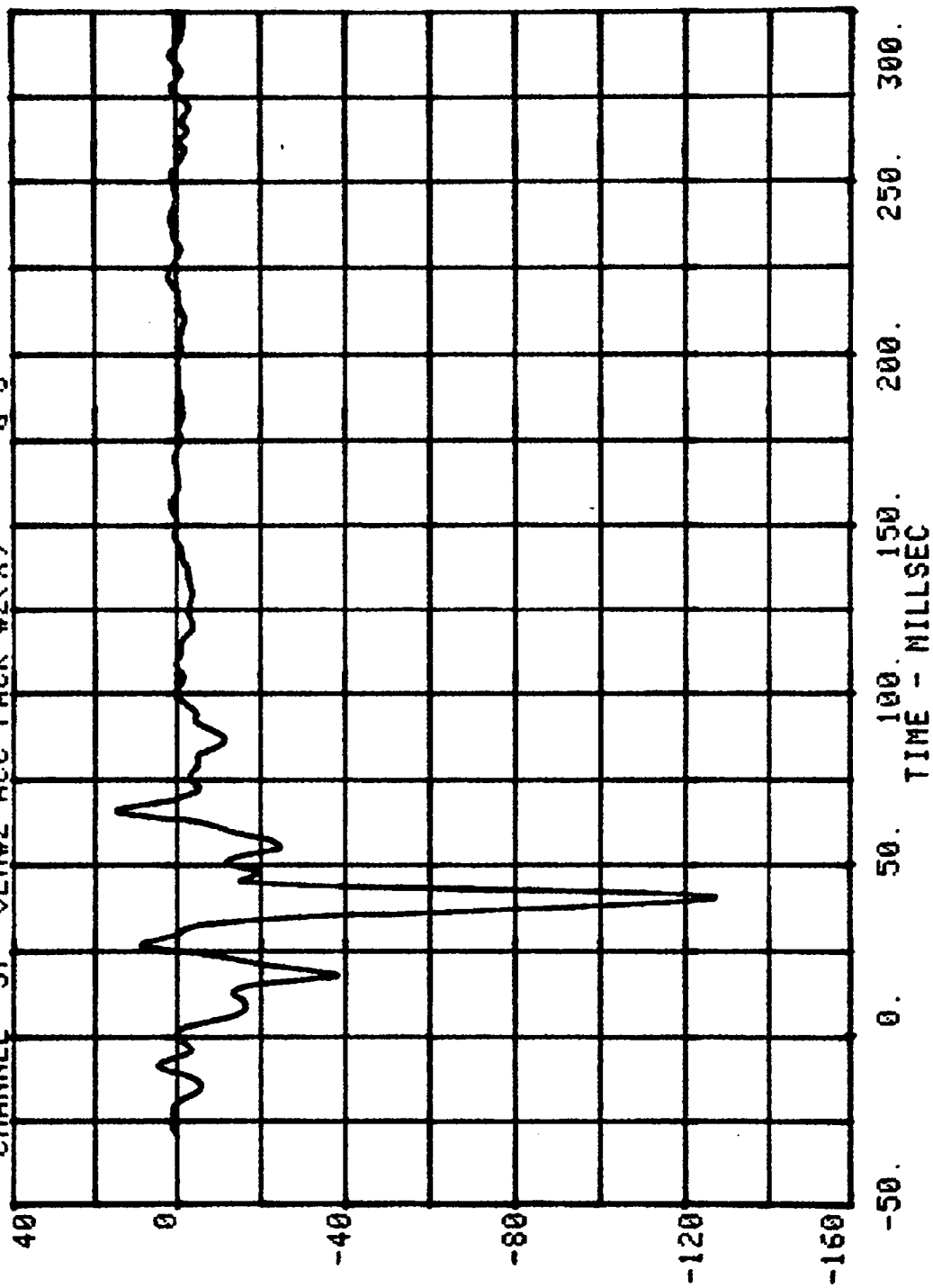


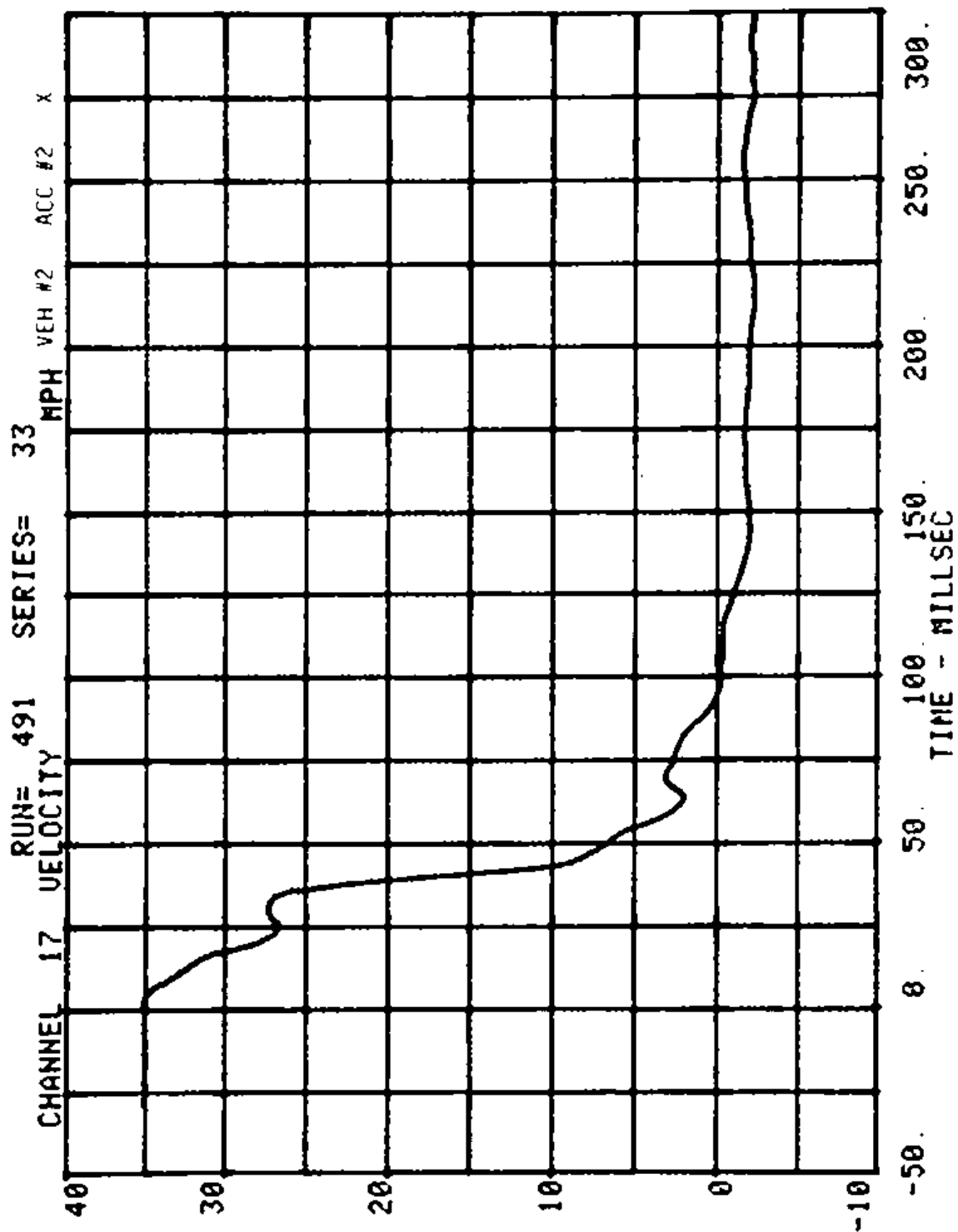


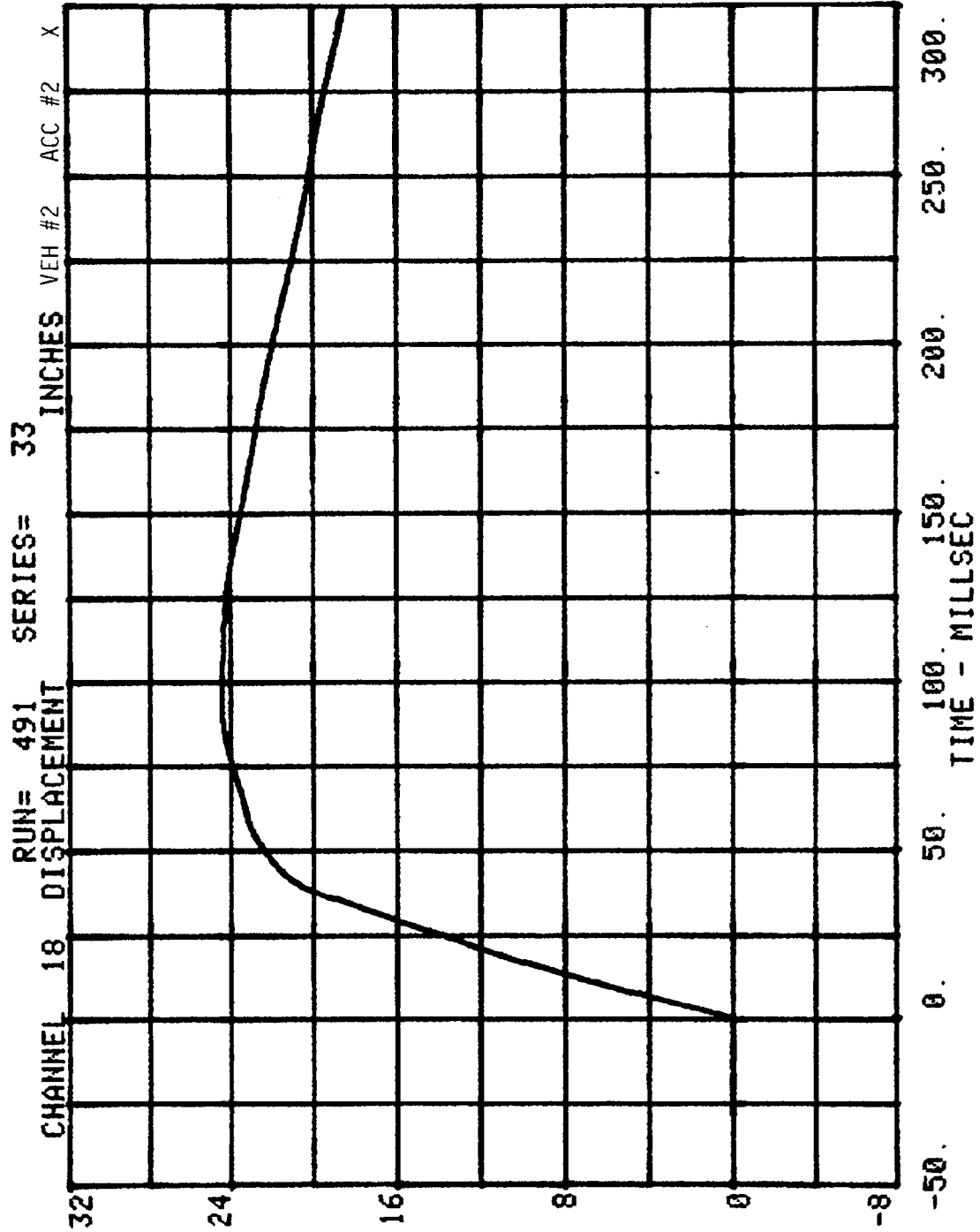
CHANNEL 51 RUN= 491 SERIES= 33  
UEH#2 ACC PACK #1(2) G'S



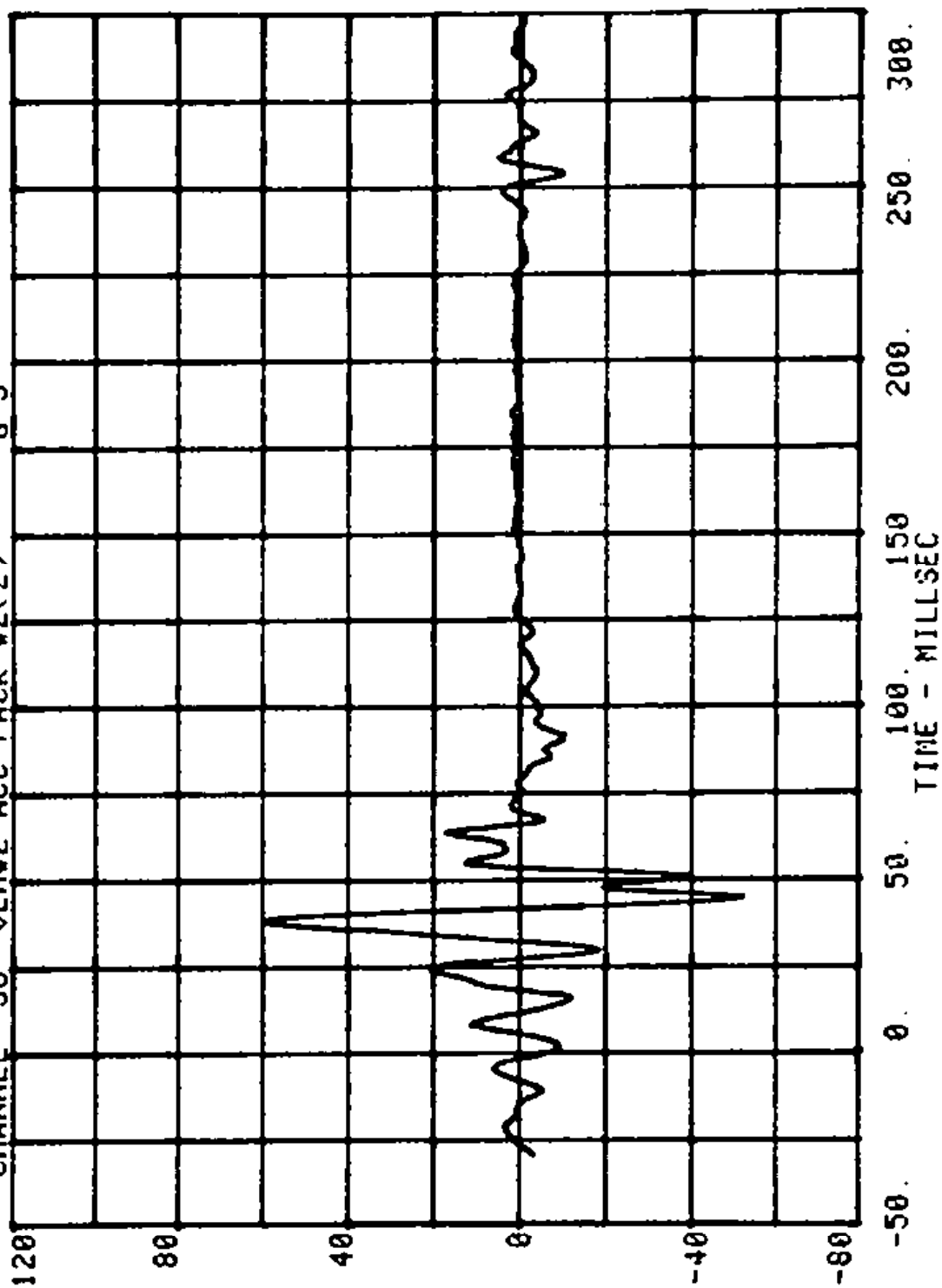
CHANNEL 37 RUN= 491 SERIES= 33  
VEH#2 ACC PACK #2(X) 5'S



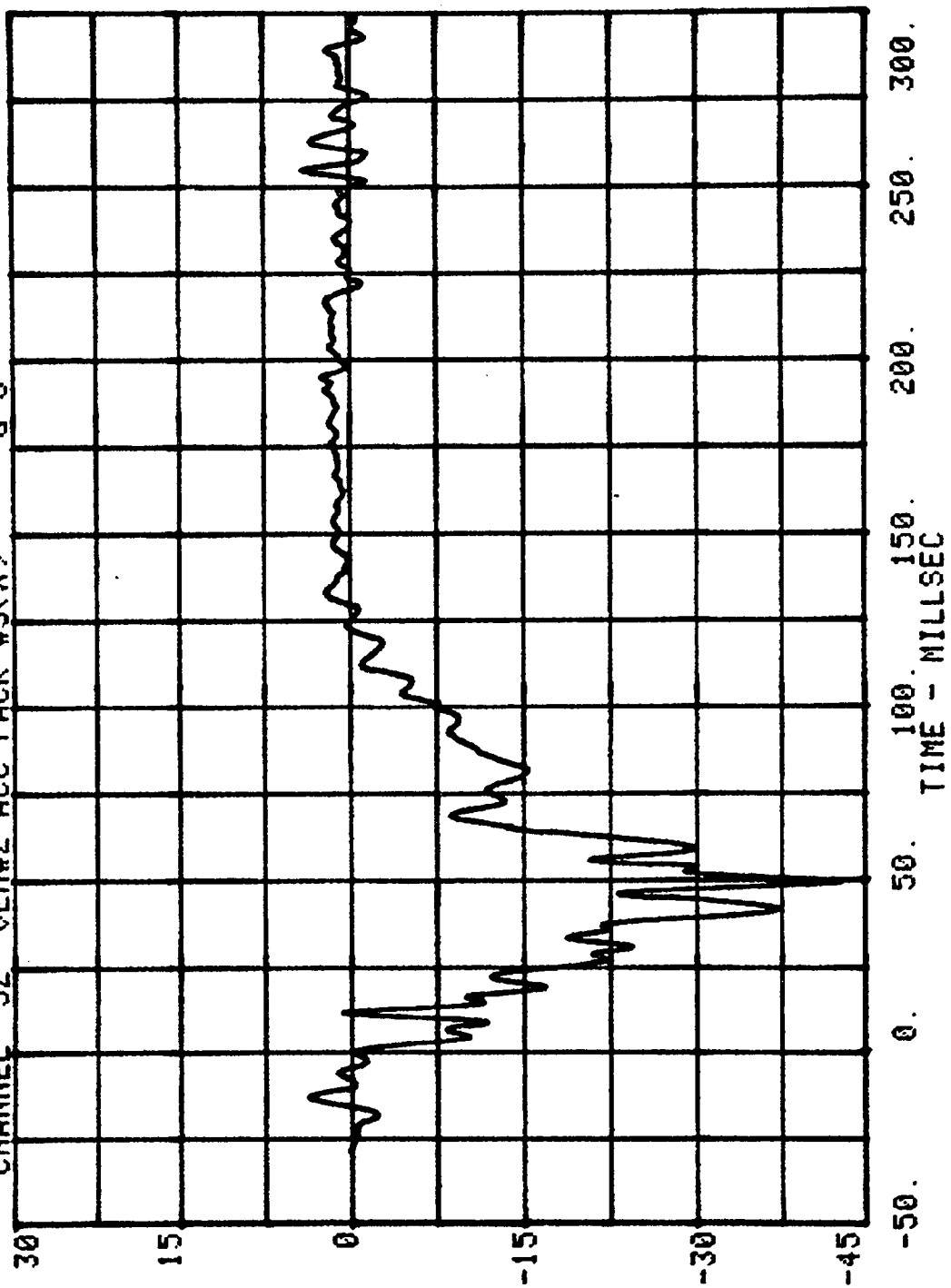


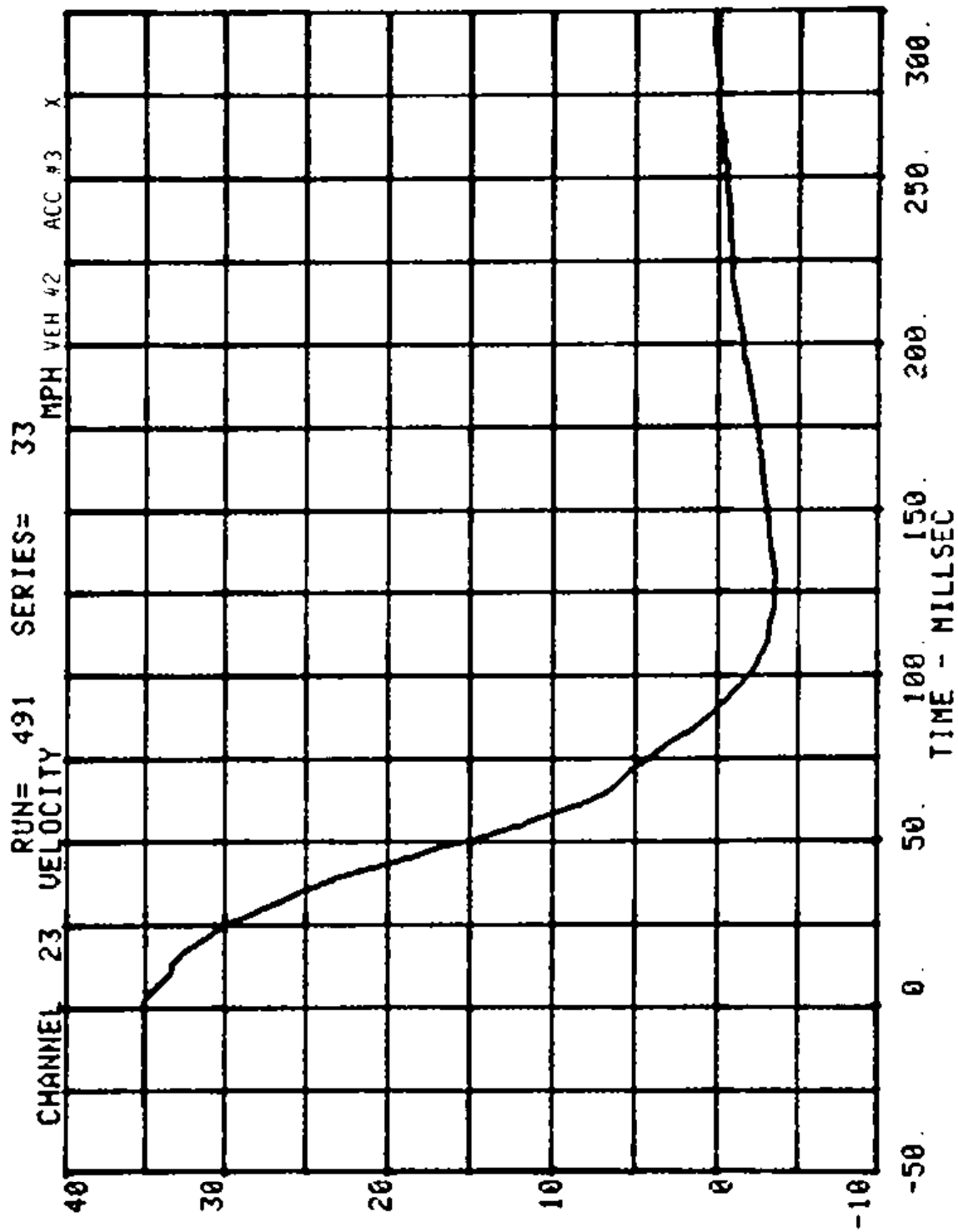


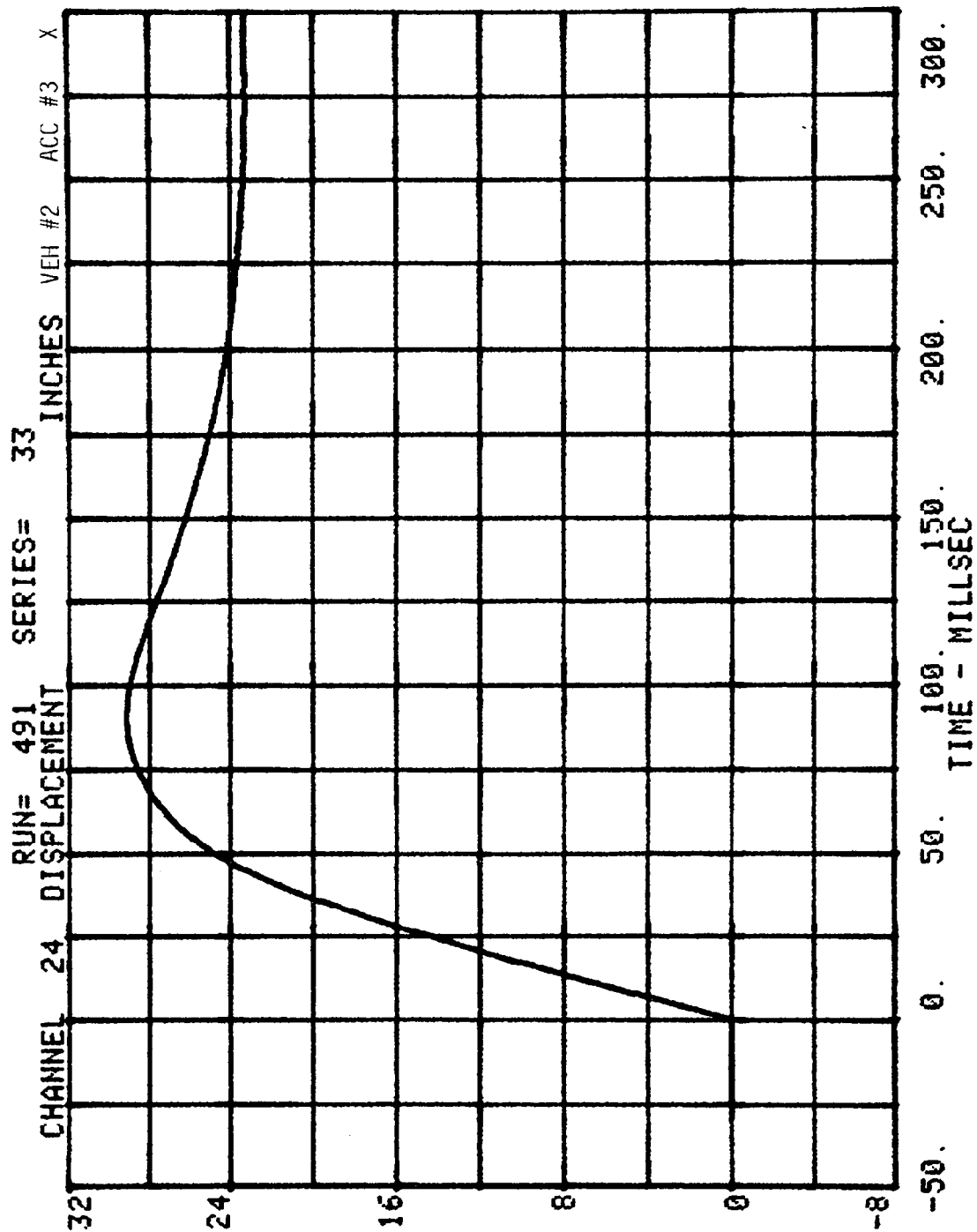
RUN= 491 SERIES= 33  
CHANNEL 38 VEH#2 ACC PACK #2(Z) G'S



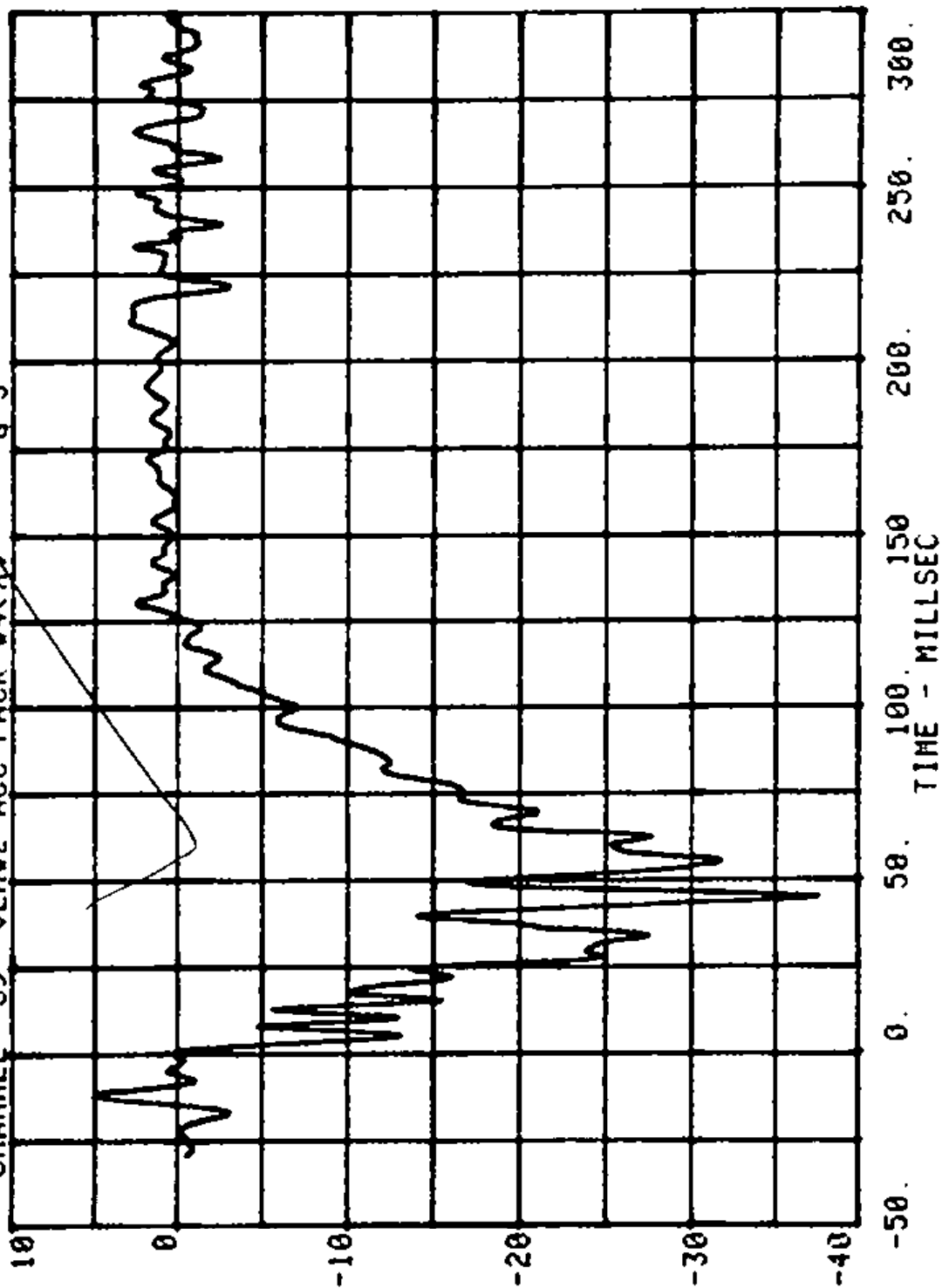
CHANNEL 52 RUN= 491 SERIES= 33  
VEH#2 ACC PACK #3(X) G'S

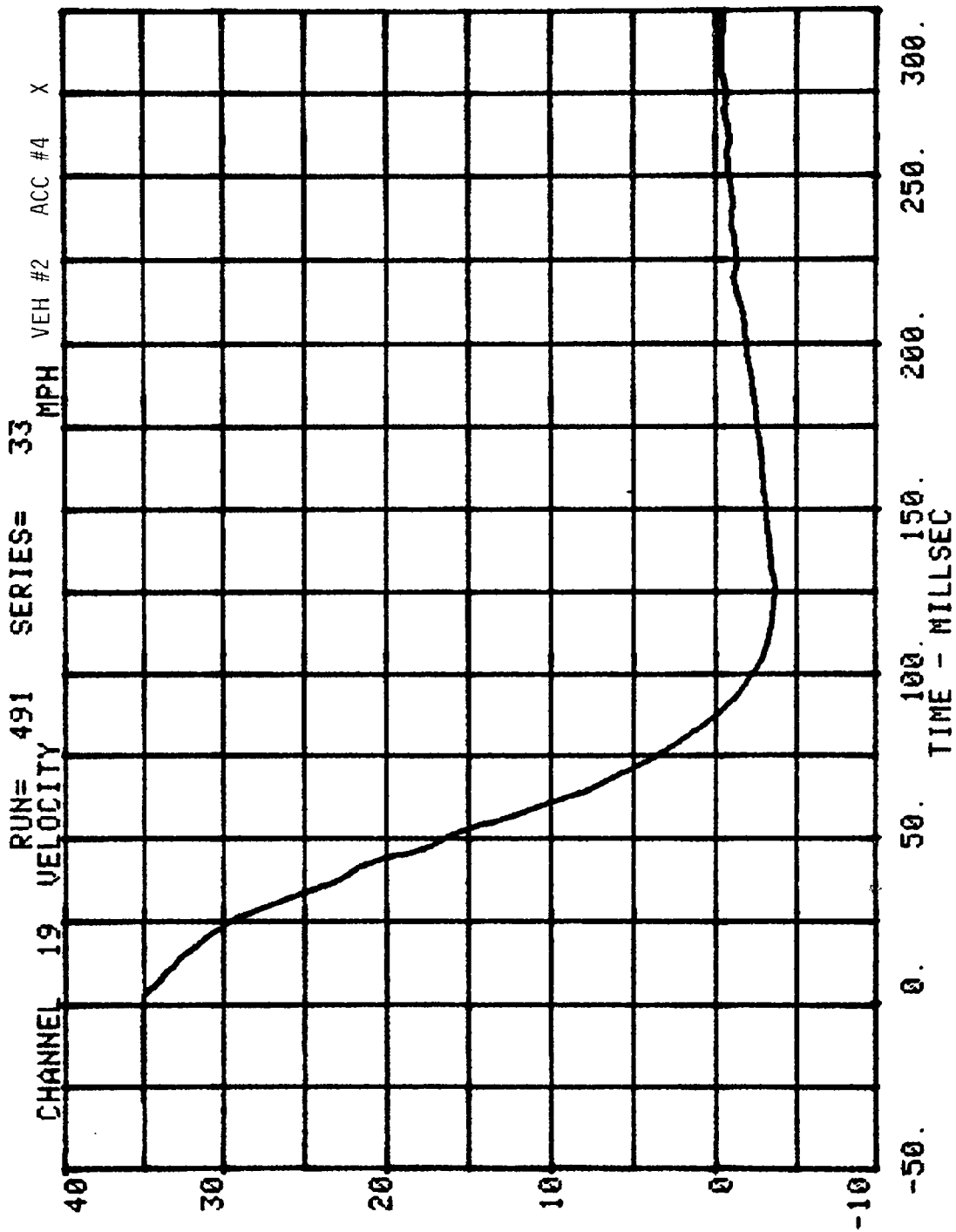


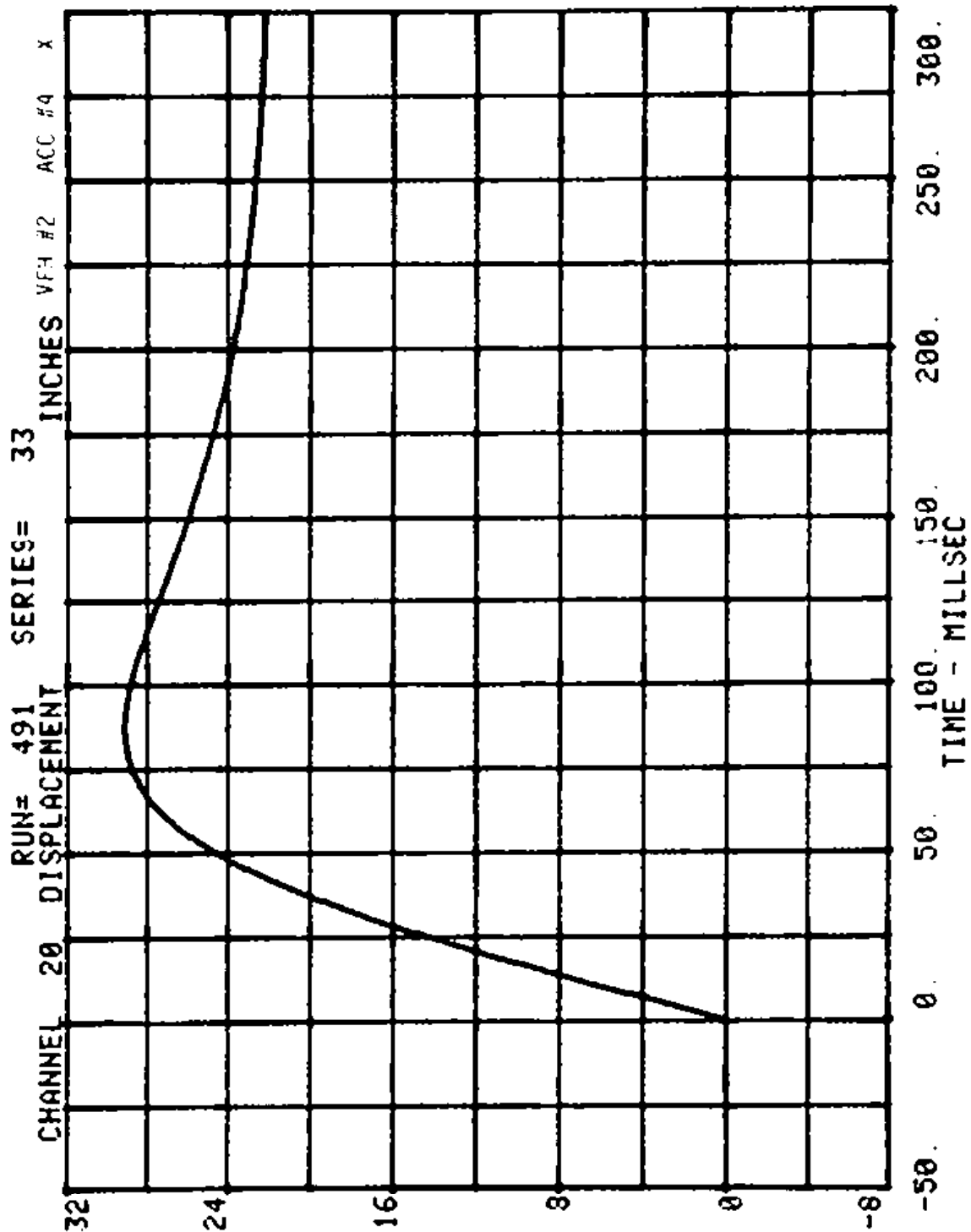




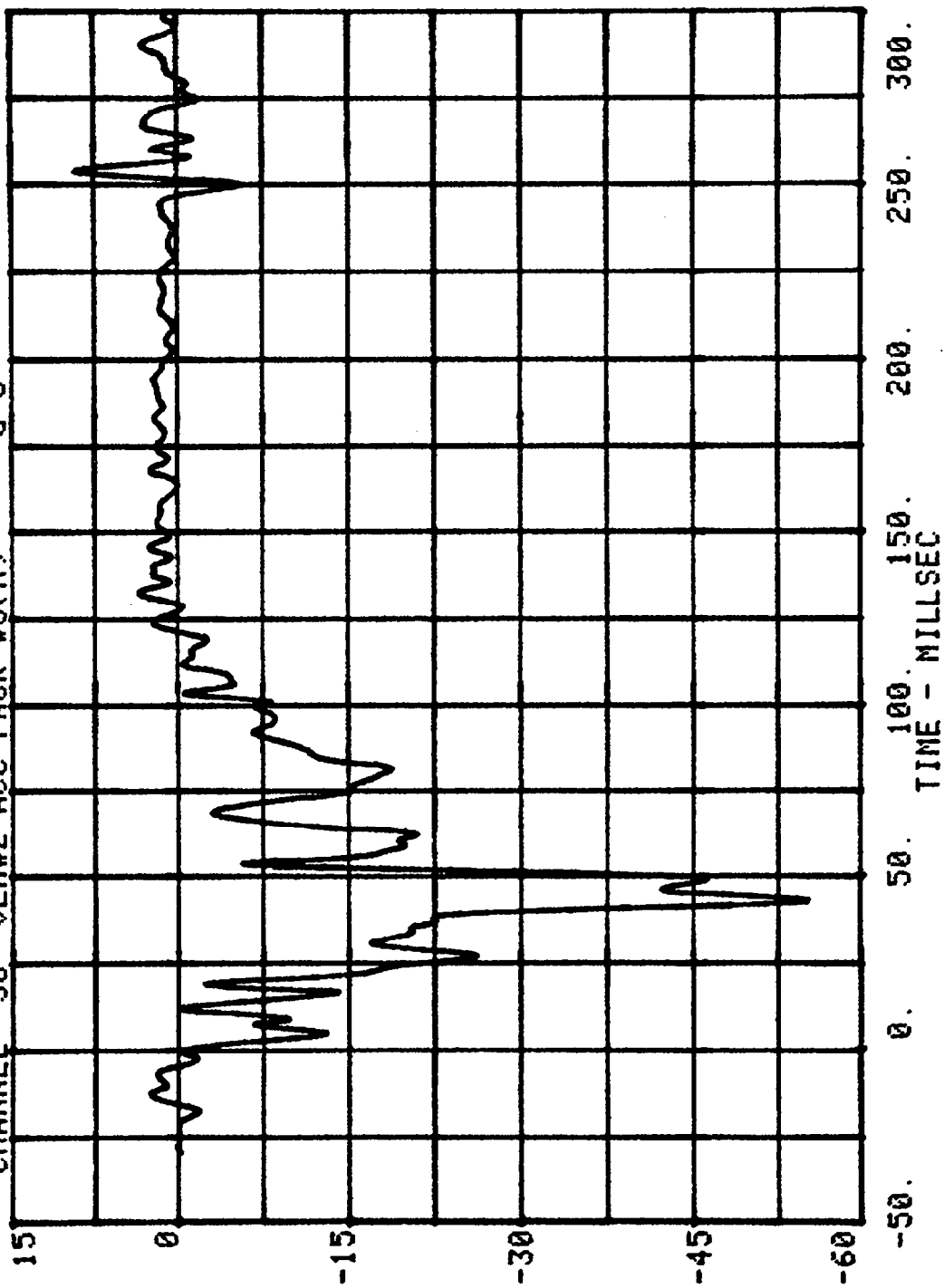
CHANNEL 39 RUN= 491 SERIES= 33  
VEH#2 ACC PACK #4(X) G'S

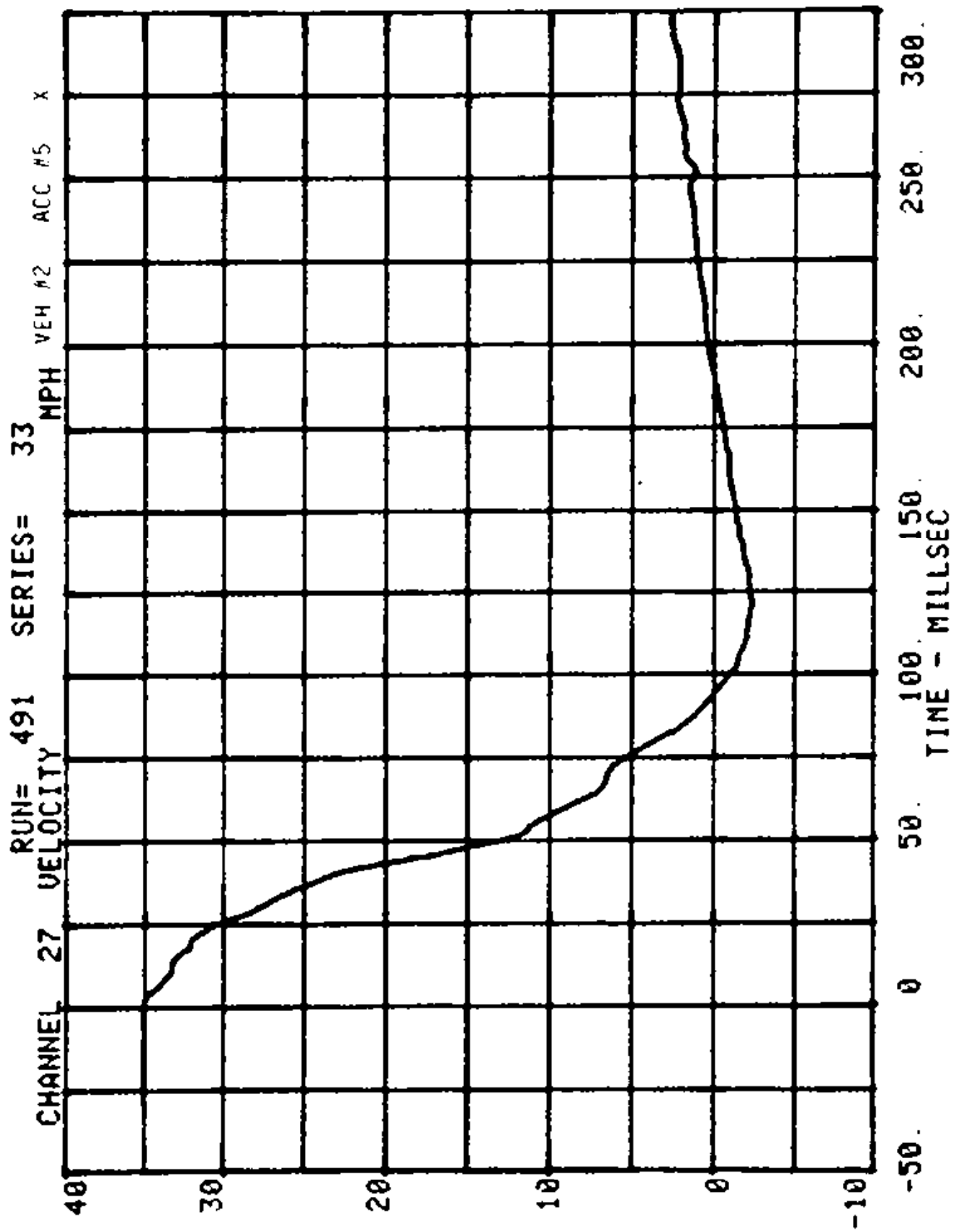


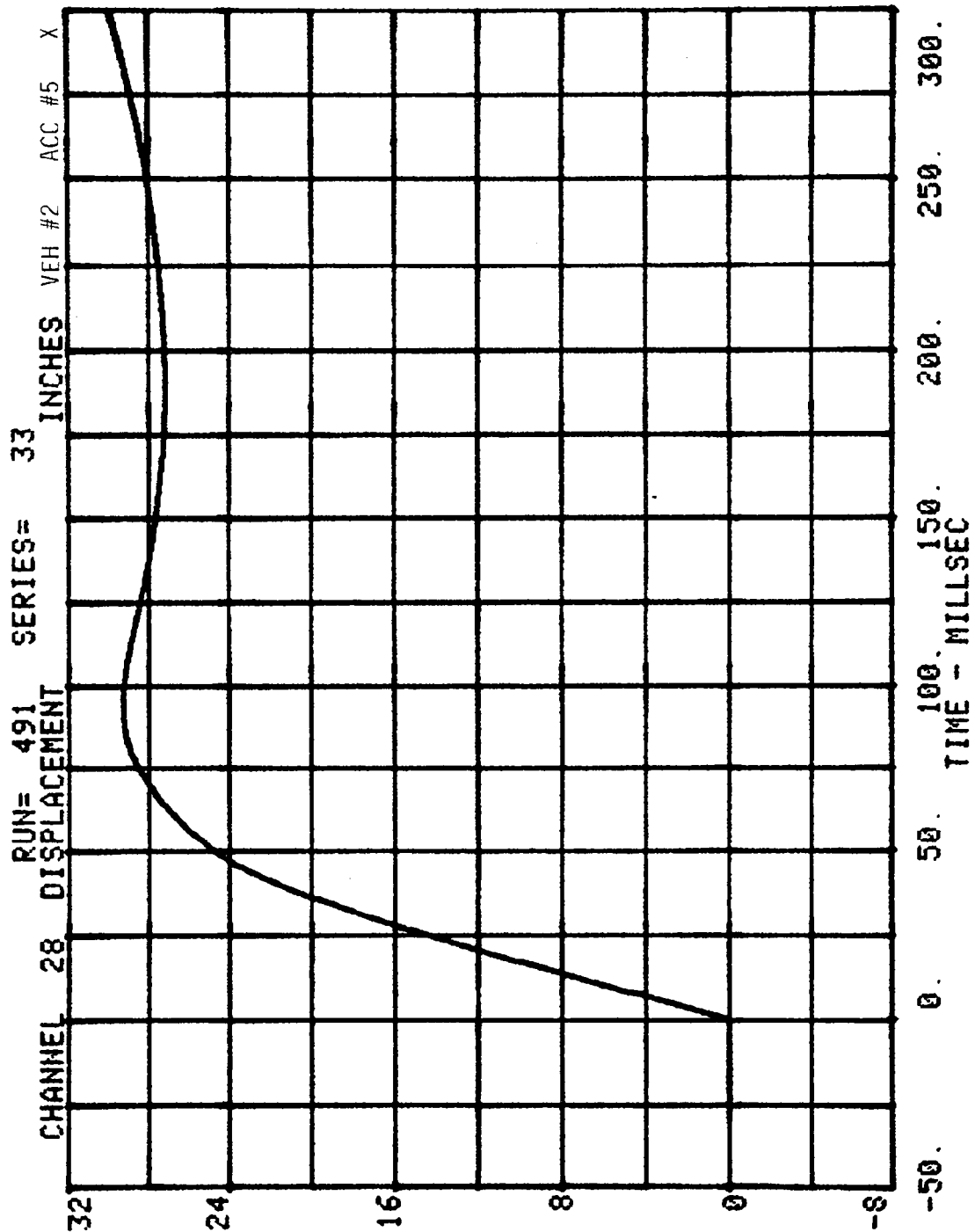




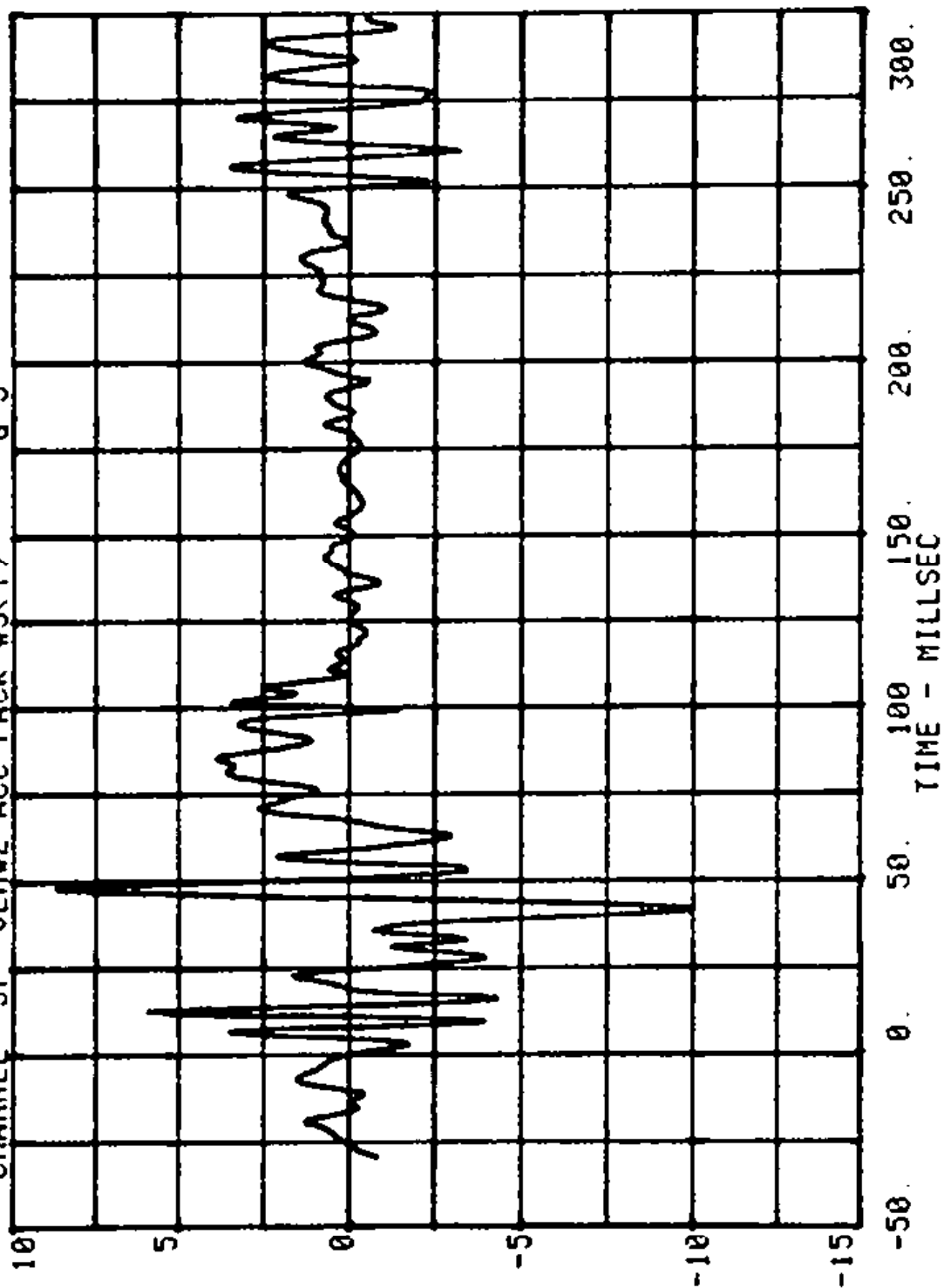
CHANNEL 56 RUN= 491 SERIES= 33  
VEH#2 ACC PACK #5(X) G'S



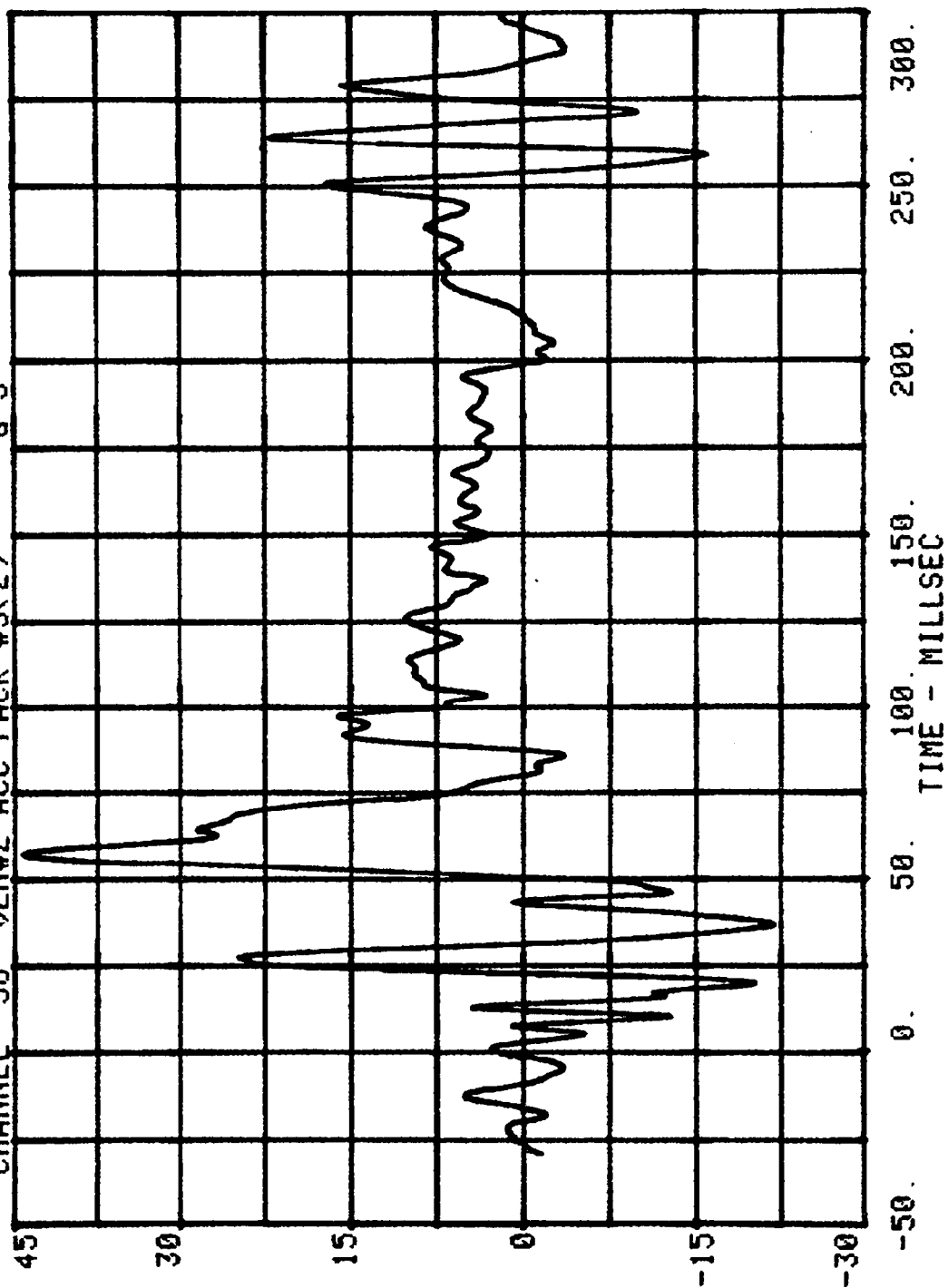




CHANNEL 57 RUN= 491 SERIES= 33  
VEH#2 ACC PACK #5(Y) G'S



CHANNEL 58 RUN= 491 SERIES= 33  
VEH#2 ACC PACK #5(2) G'S



Test No. 308-33-491  
1980 Plymouth Volare  
Dummy Data

|                     | Filter Channel Class |
|---------------------|----------------------|
| Head Accelerations  | 1000                 |
| Chest Accelerations | 180                  |
| Femur Forces        | 600                  |
| Belt Load           | 60                   |

See Table 9 for Electronic Instrumentation Descriptor.

HEAD INJURY CRITERION  
HEAD SEVERITY INDEX

BOA TASK 3 TEST #33 CAR-T0-CAR

RUN= 491

VEH#2 POS#1 HEAD R

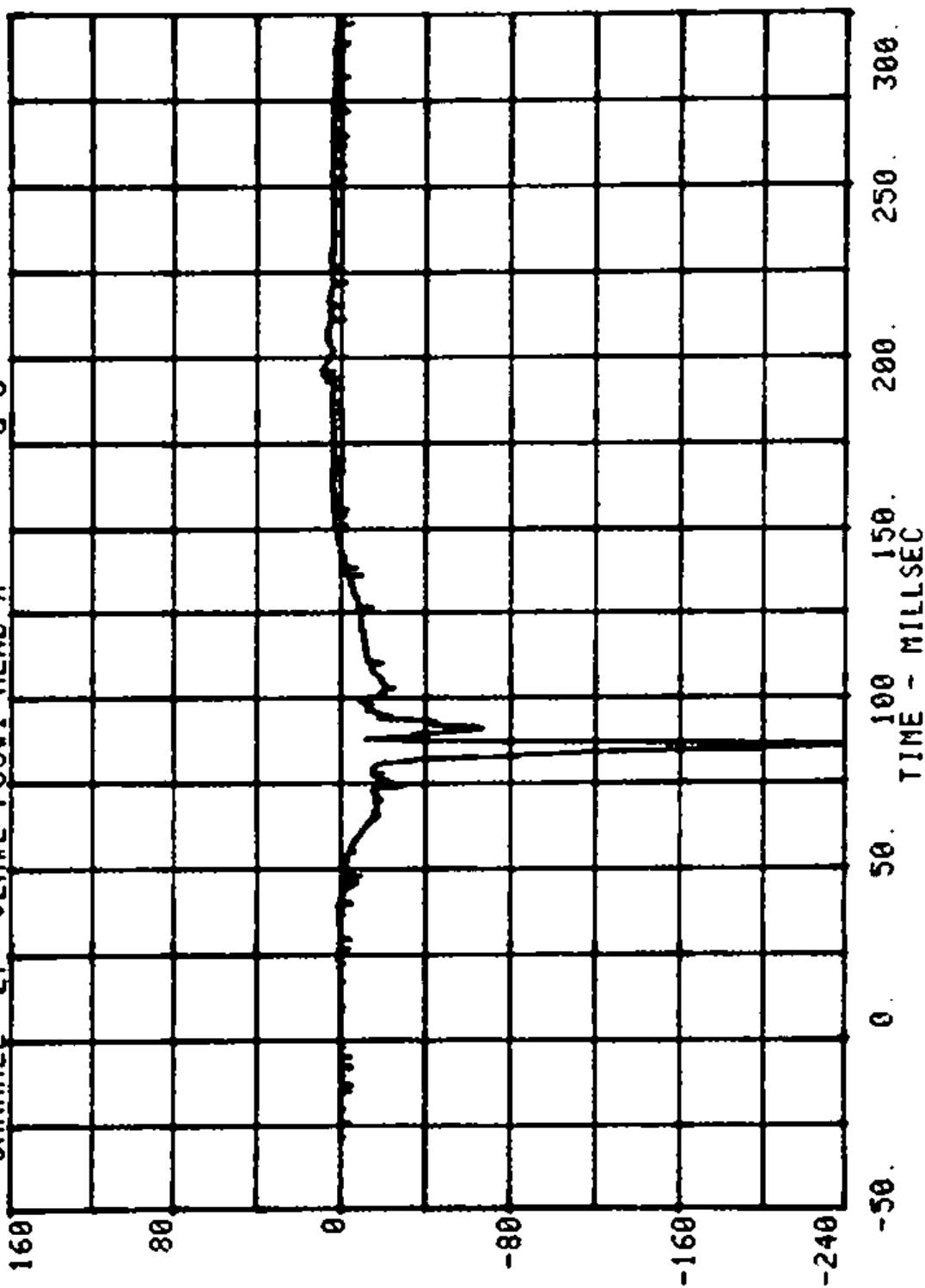
HIC=1774.3 FROM T1= .08370 TO T2= .08790

AVERAGE ACCELERATION BETWEEN T1 AND T2= 178.0G'S

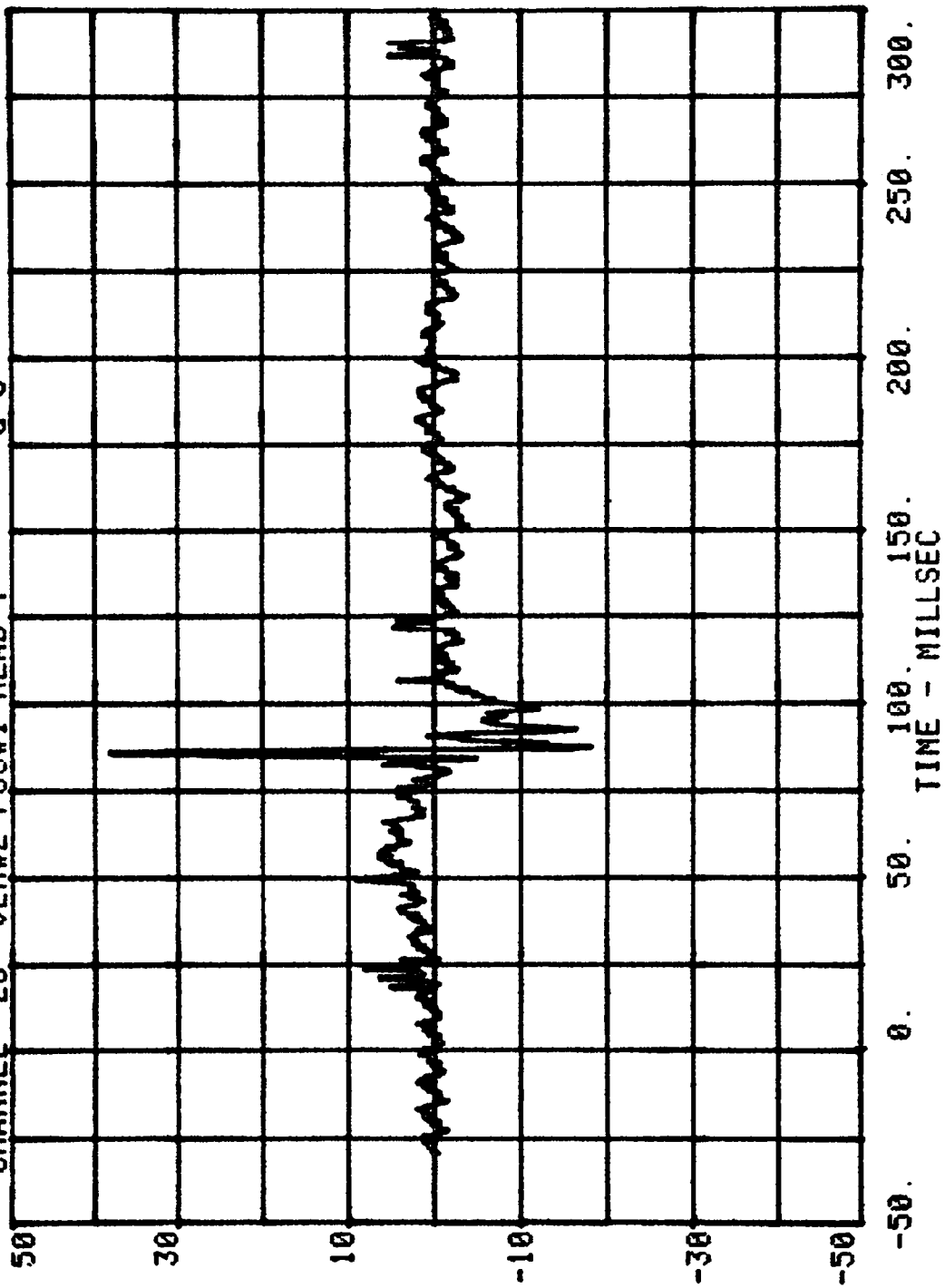
EVENT TIME= 300.0 MSEC

SEVERITY INDEX=2816.2

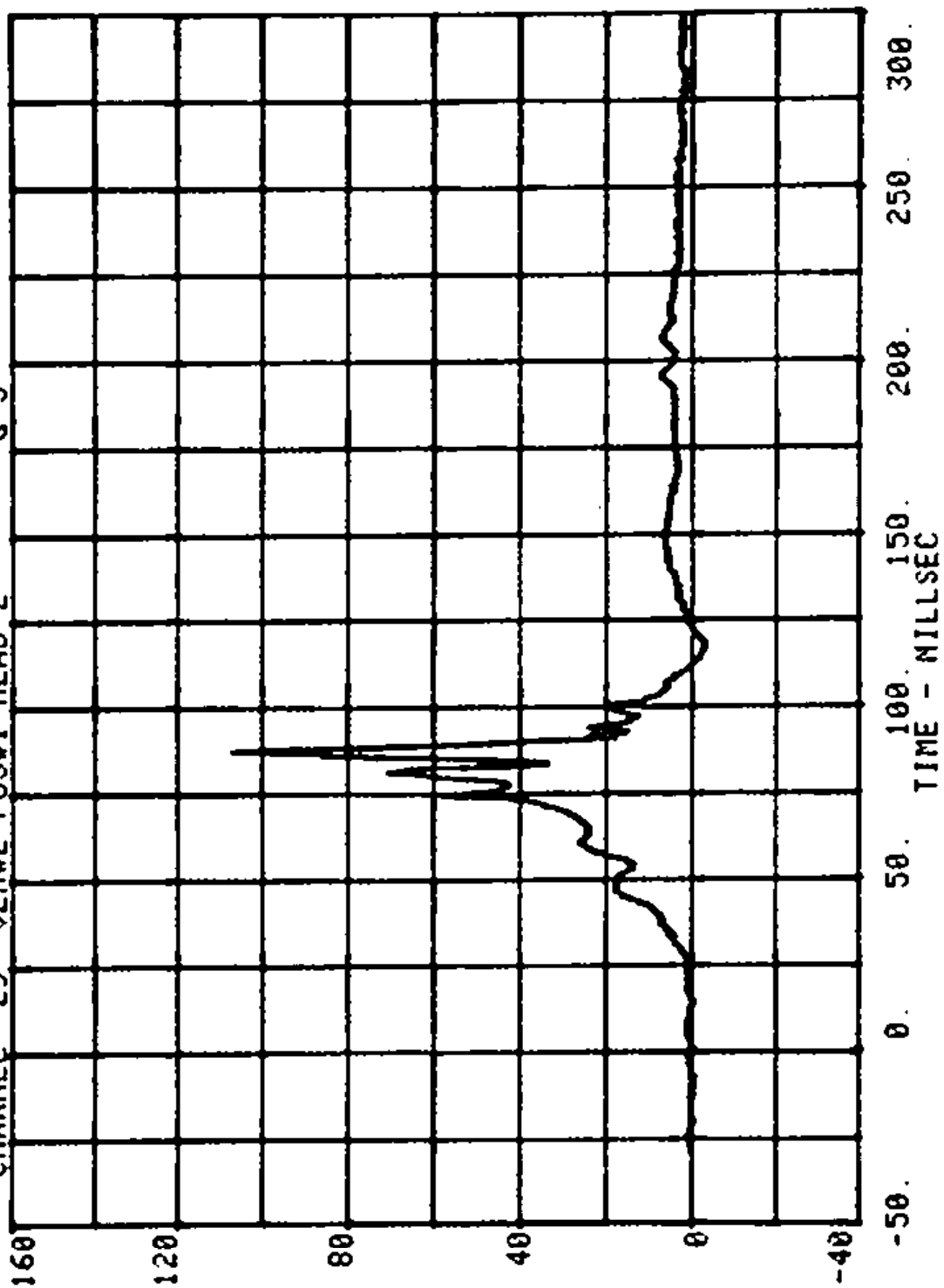
CHANNEL 27 RUN= 491 SERIES= 33 G'S  
VEH#2 POS#1 HEAD X



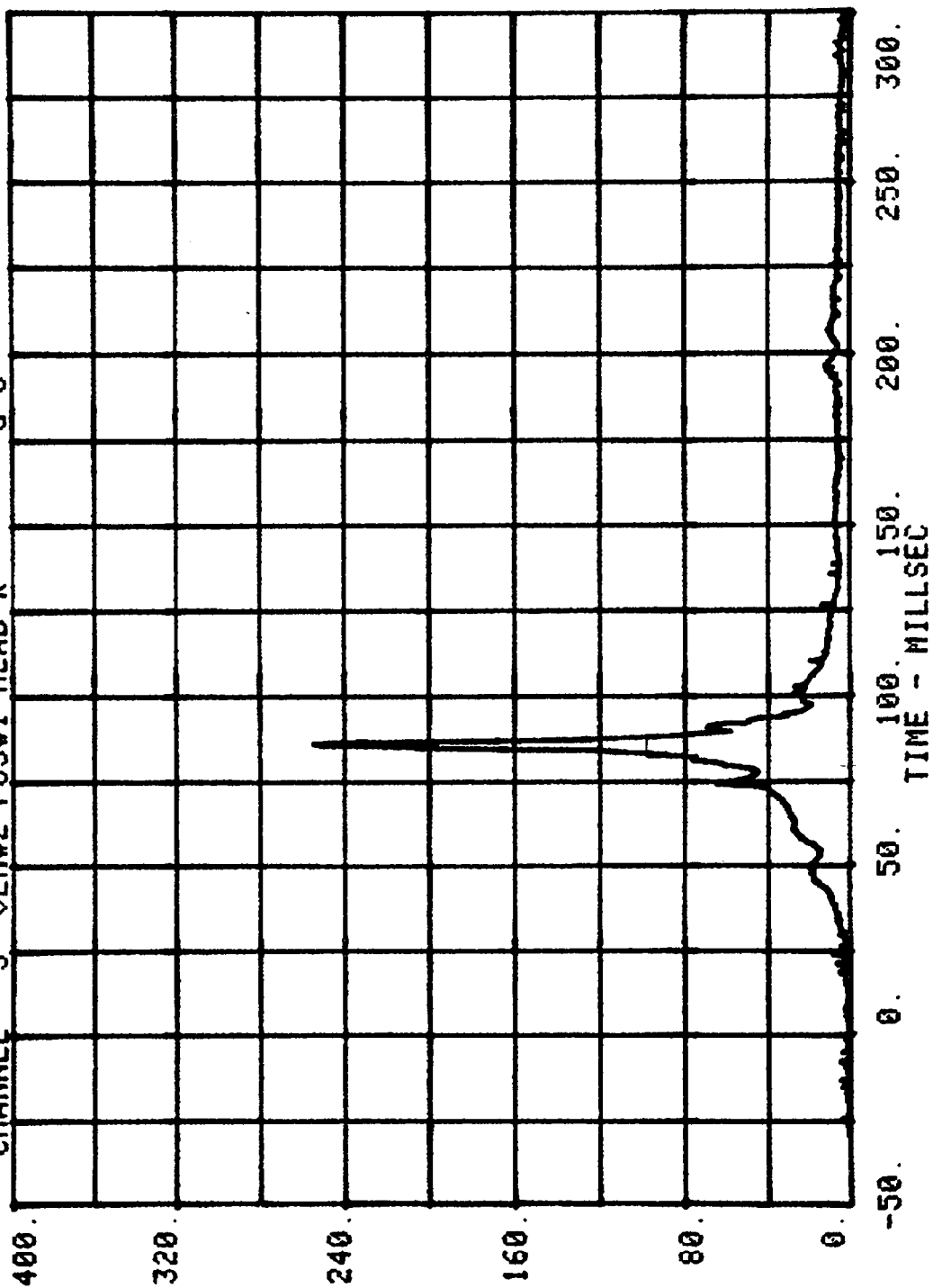
CHANNEL 28 RUN= 491 SERIES= 33  
VEH#2 POS#1 HEAD Y G'S



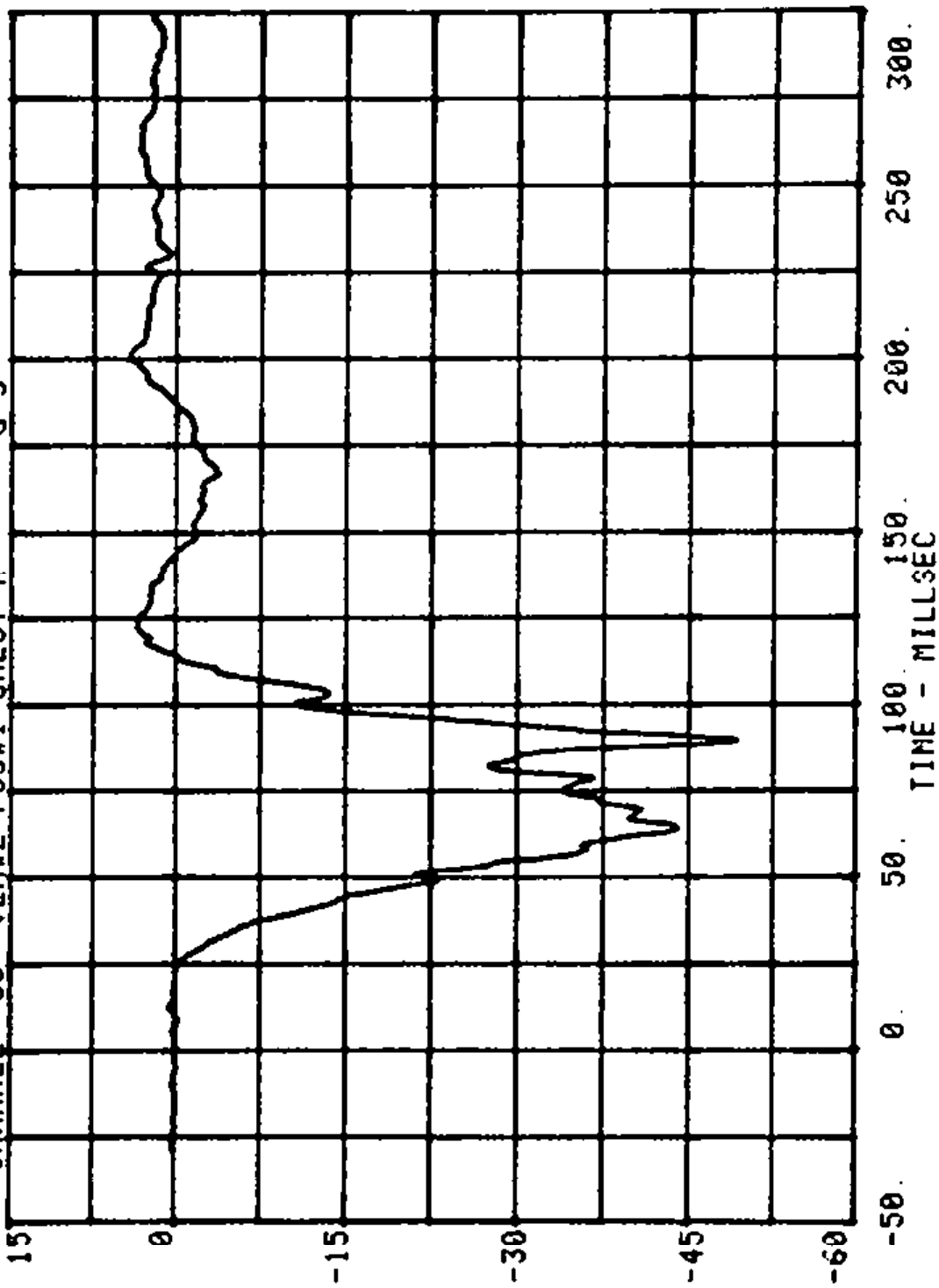
CHANNEL 23 RUN= 491 SERIES= 33  
VEH#2 POS#1 HEAD 2 G'S



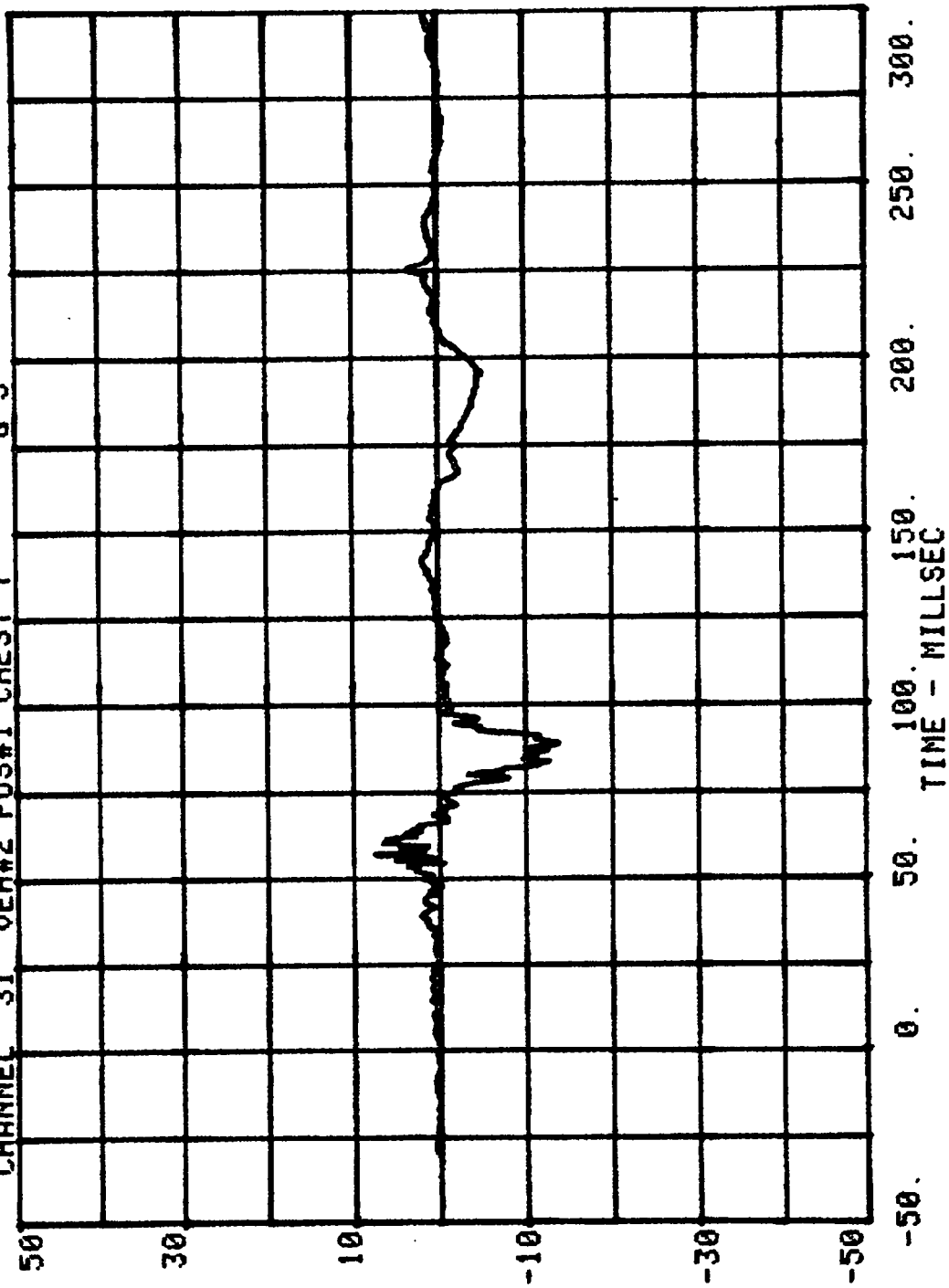
CHANNEL 5 RUN= 491 SERIES= 33  
VEH#2 POS#1 HEAD R G'S



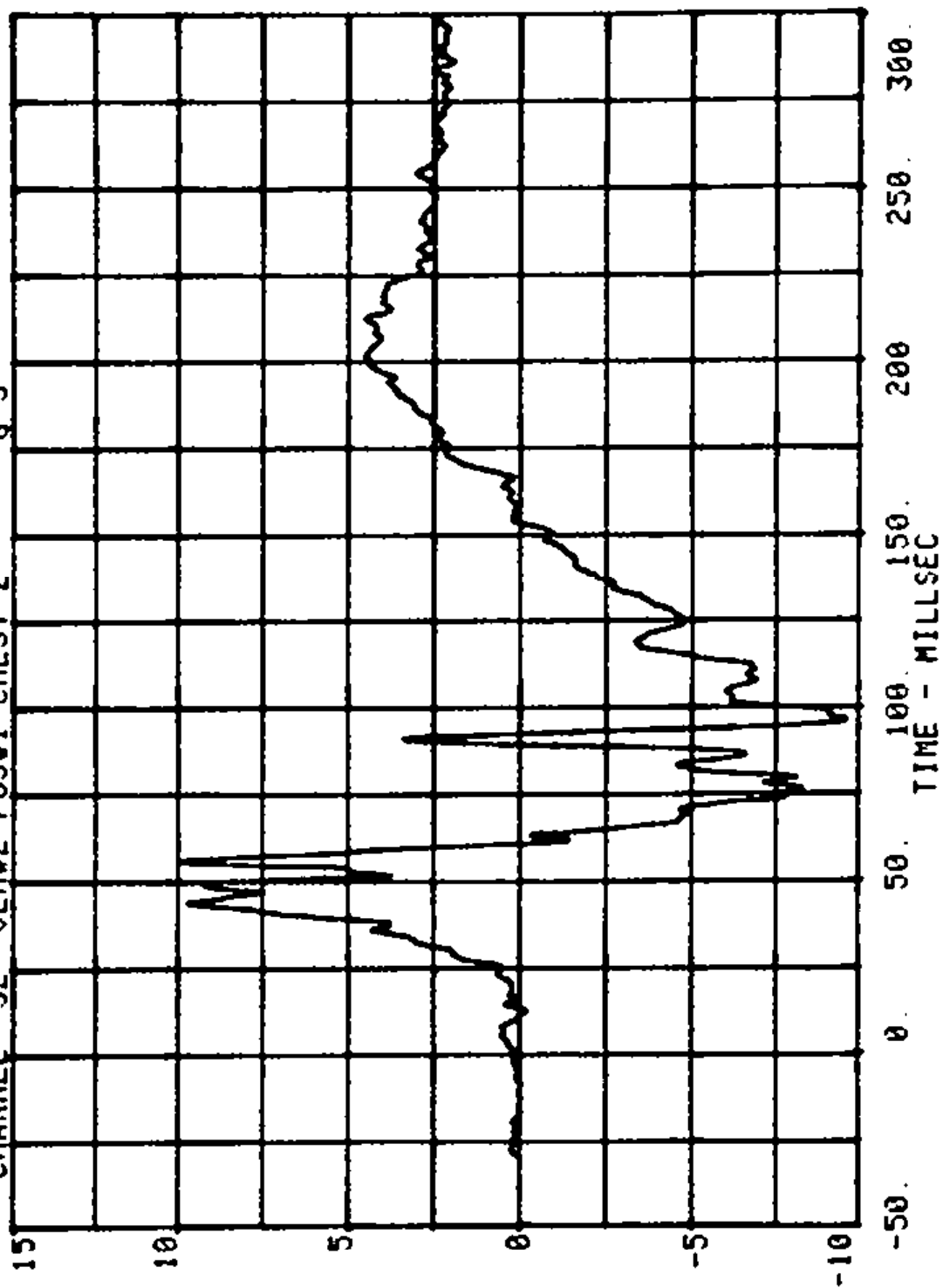
CHANNEL 30 RUN= 491 SERIES= 33  
VEH#2 POS#1 CHEST X G'S

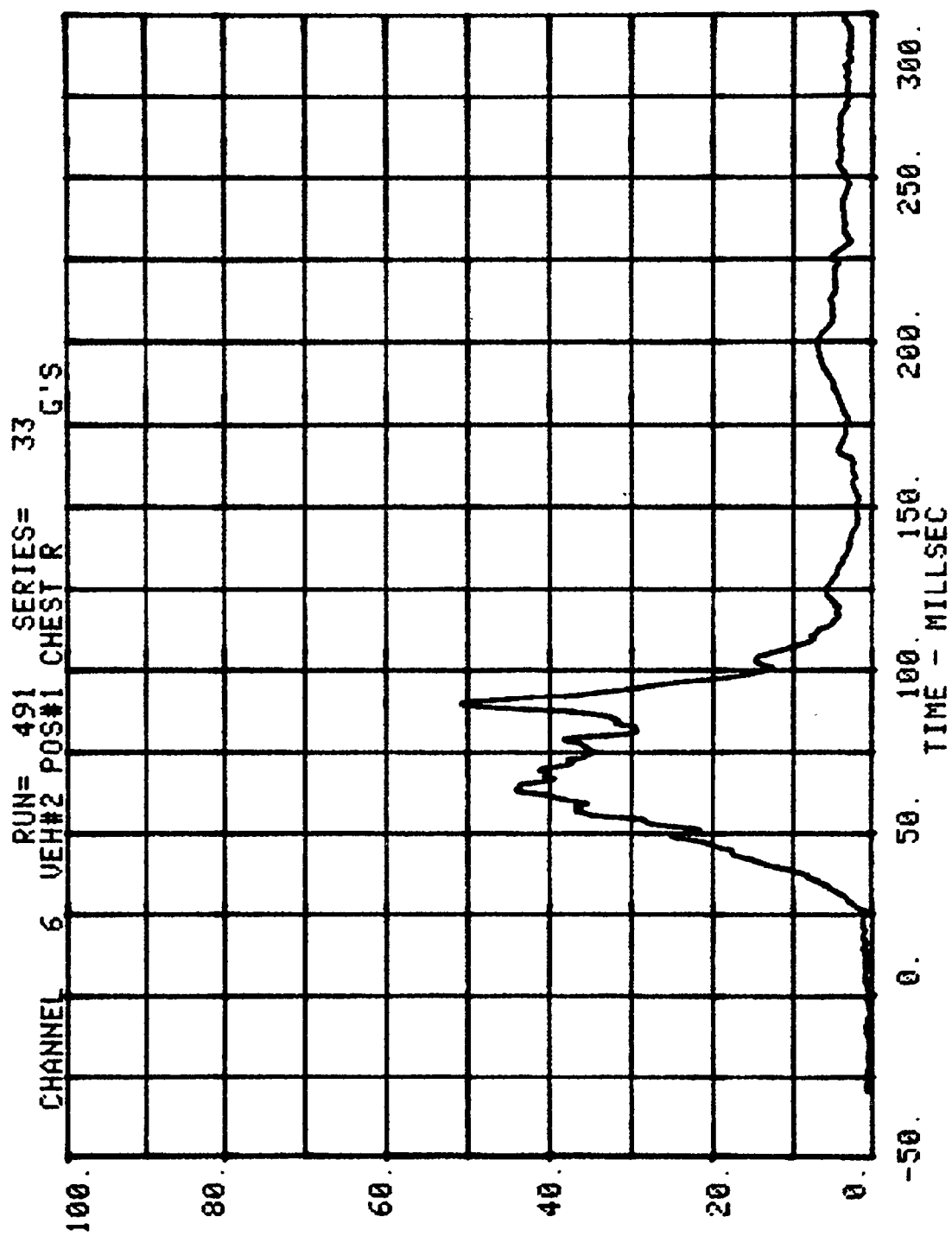


CHANNEL 31 RUN= 491 SERIES= 33  
VEH#2 POS#1 CHEST Y G'S

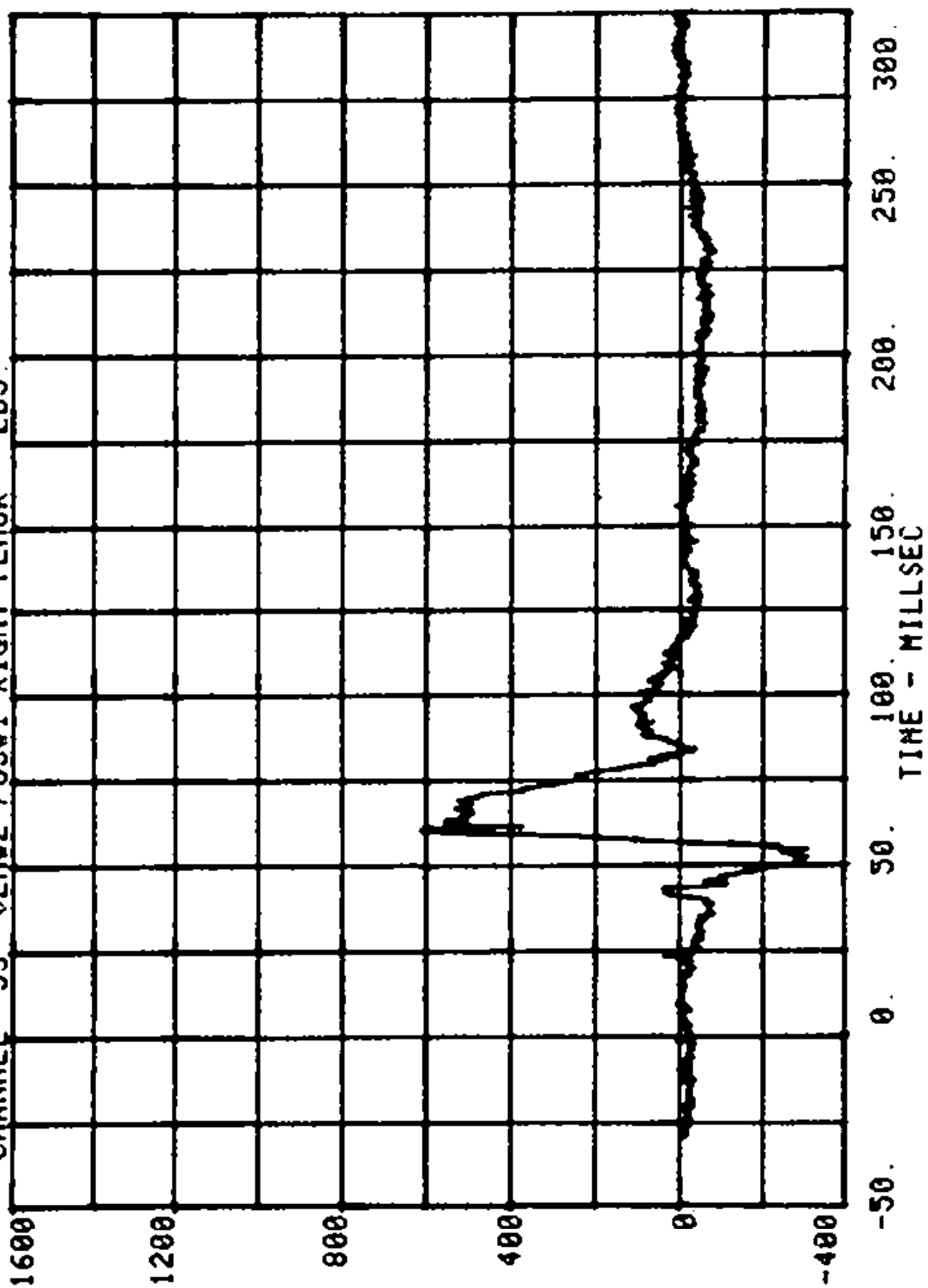


CHANNEL 32 RUN= 491 SERIES= 33  
VEH#2 POS#1 CHEST Z G'S



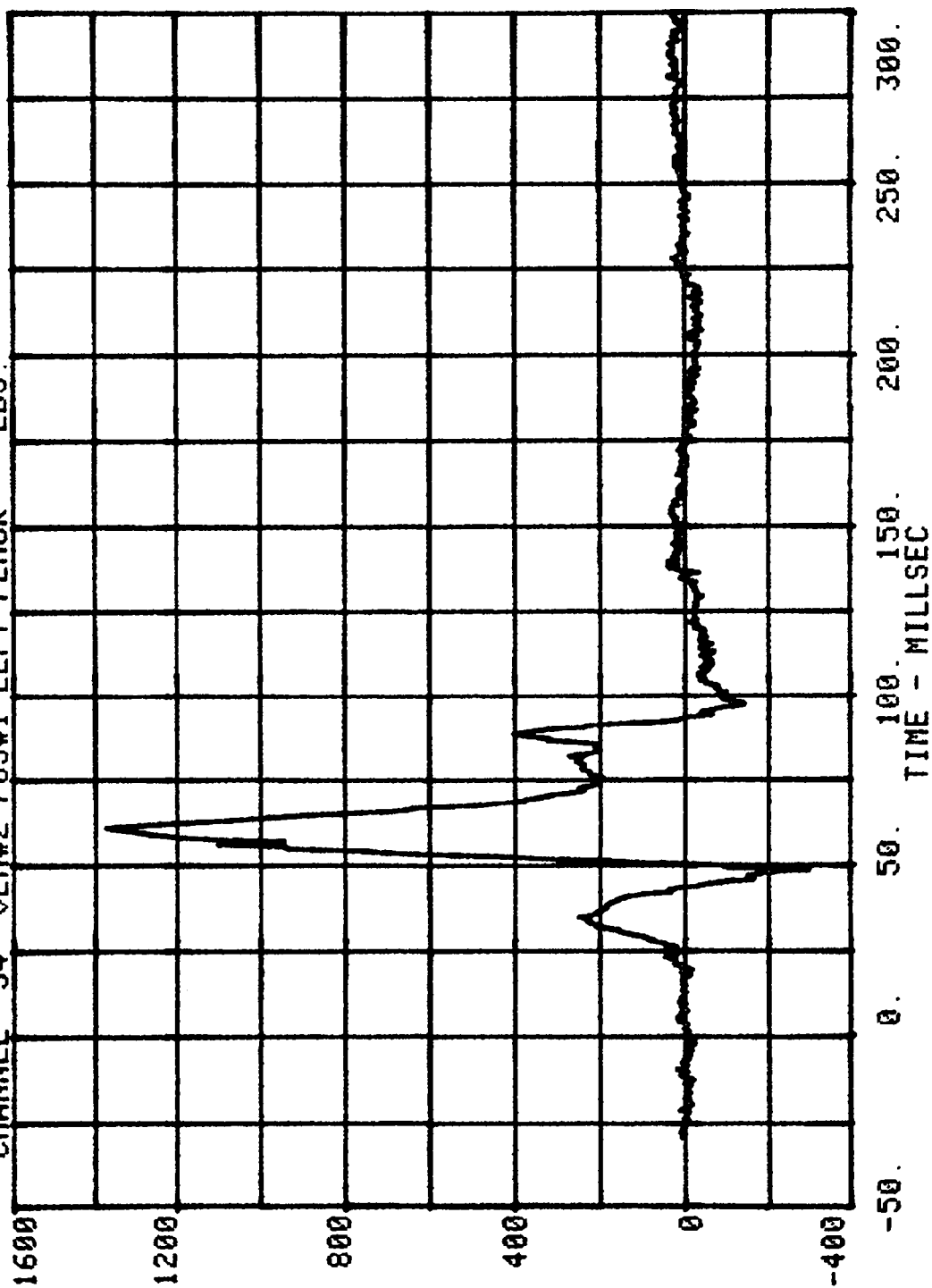


CHANNEL 33 RUN= 491 SERIES= 33  
VEH#2 POS#1 RIGHT FEMUR LBS.



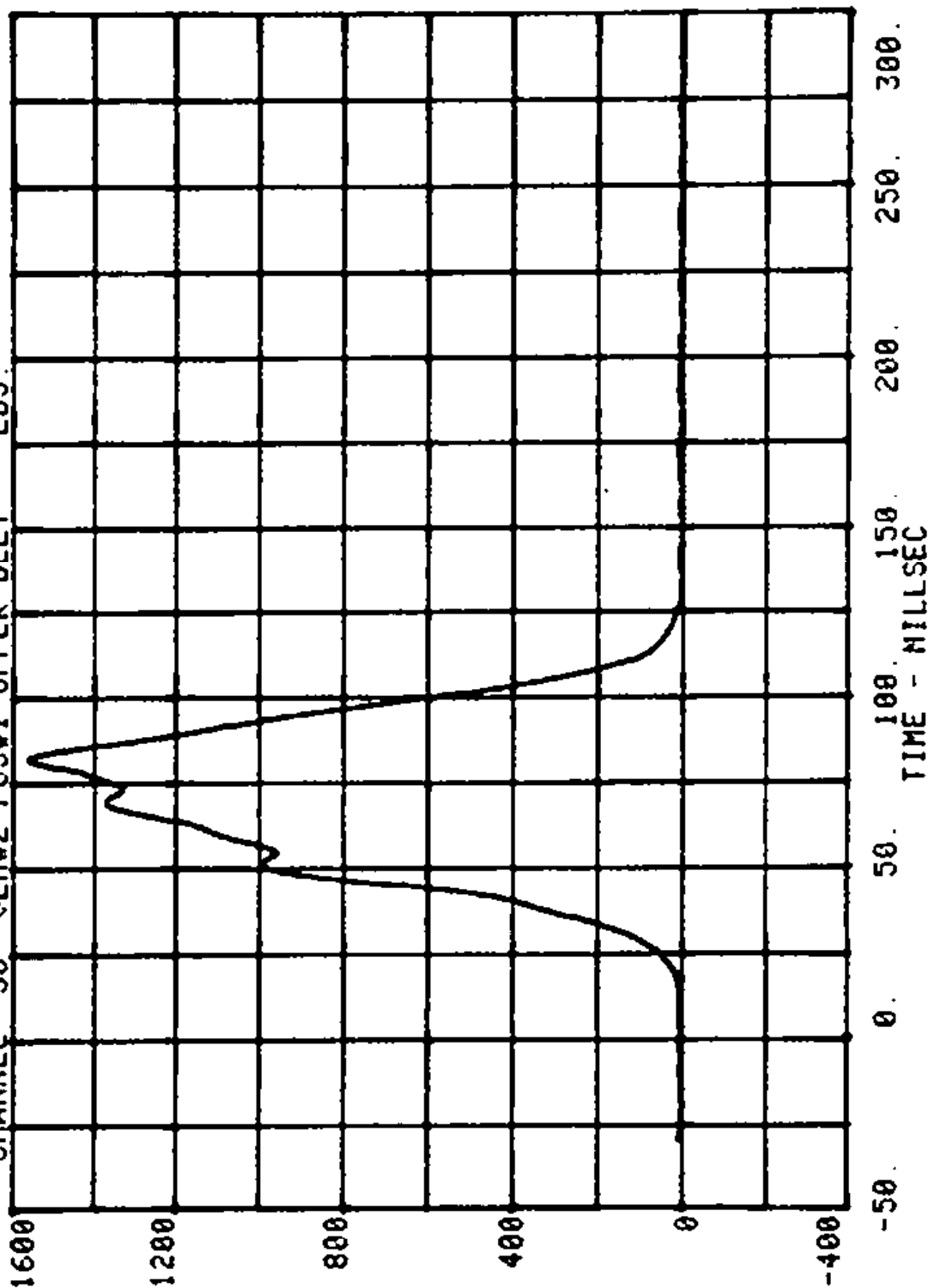
CHANNEL 34 VEH#2 POS#1 LEFT FEMUR LBS.

RUN= 491 SERIES= 33

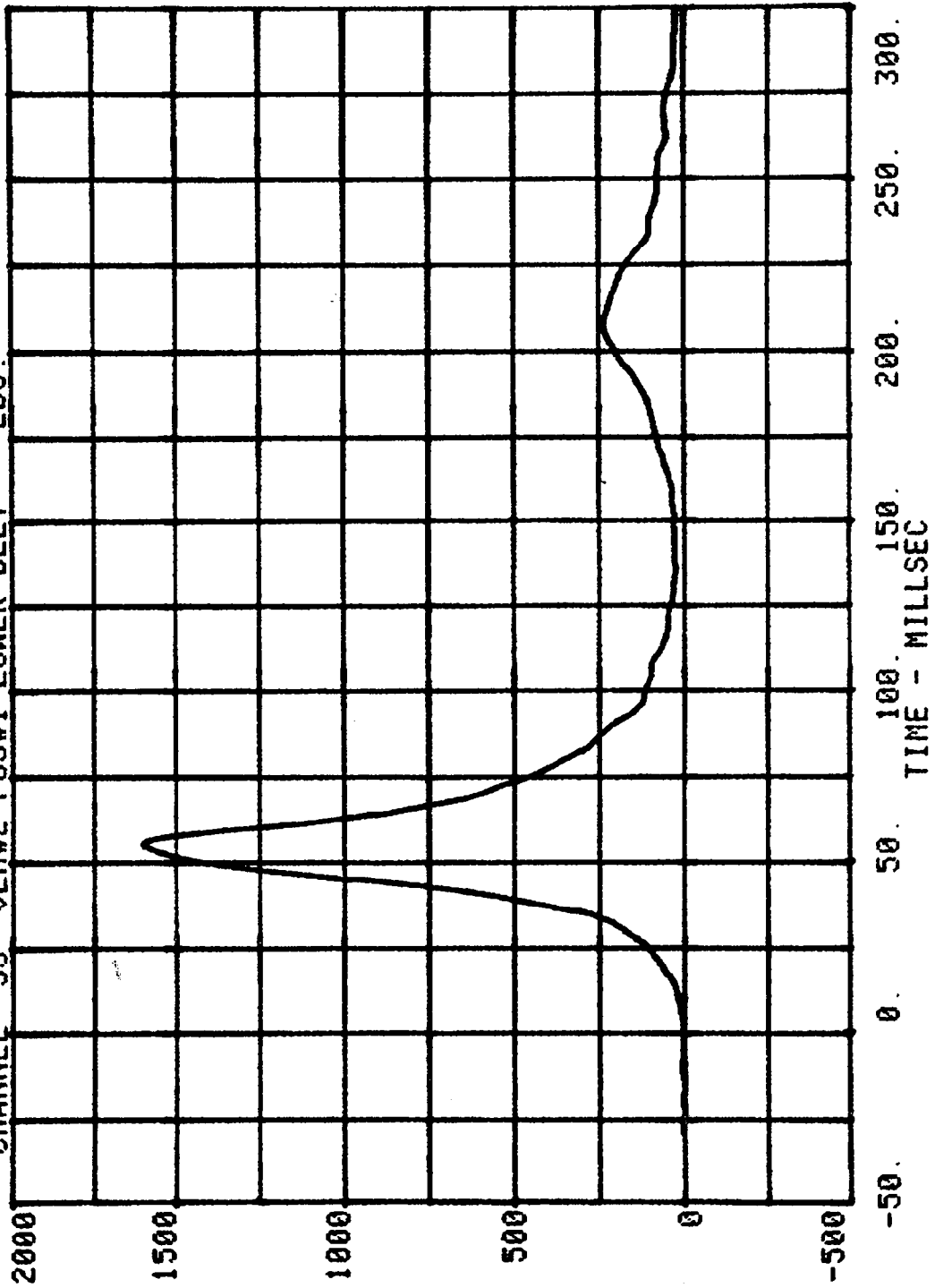


CHANNEL 36 UEH#2 POS#1 UPPER BELT LBS

RUN= 491 SERIES= 33



CHANNEL 35 RUN= 491 SERIES= 33  
VEH#2 POS#1 LOWER BELT LBS.



HEAD INJURY CRITERION  
HEAD SEVERITY INDEX

BOA TASK 3 TEST #33 CAR-T0-CAR

RUN= 491

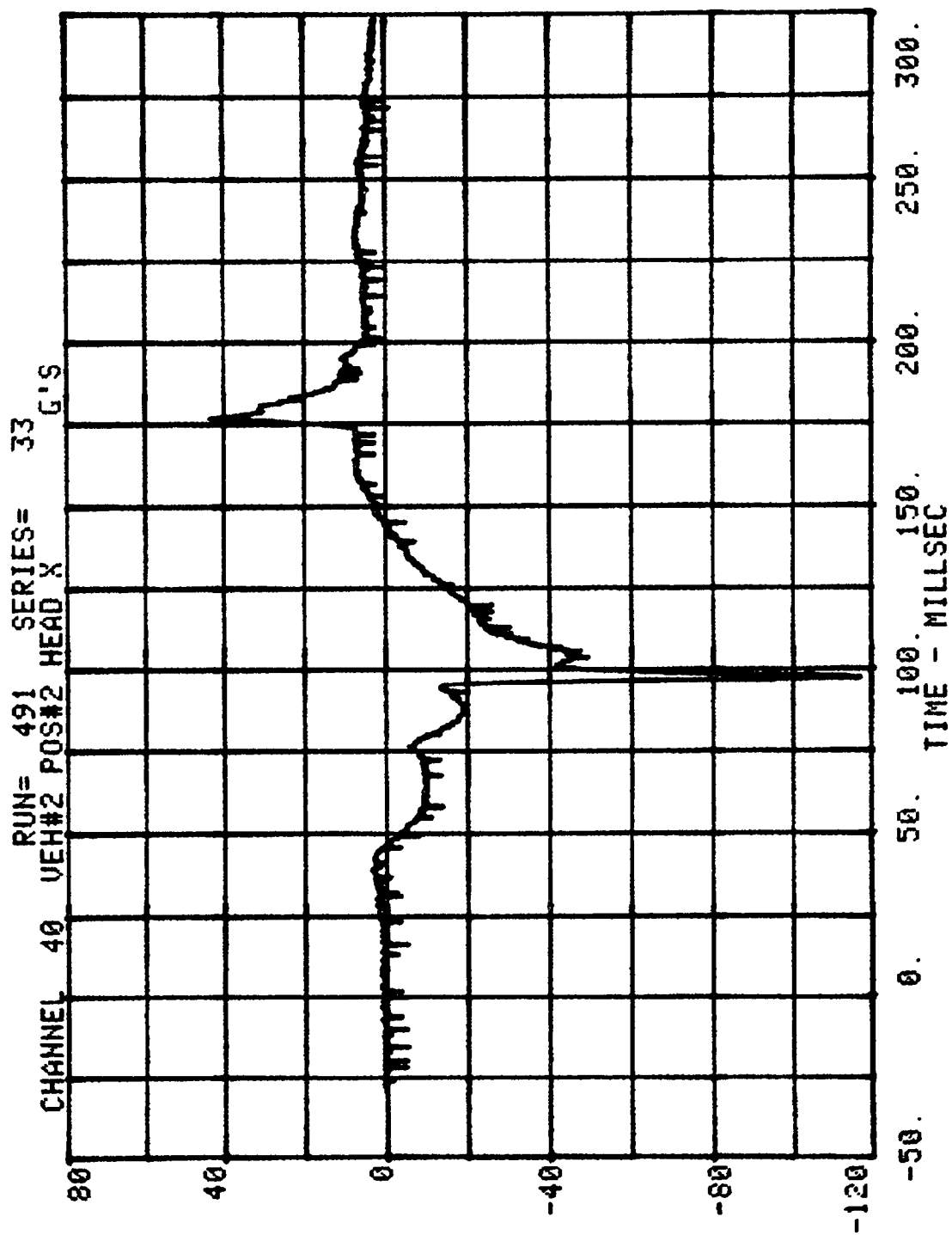
VEH#2 POS#2 HEAD R

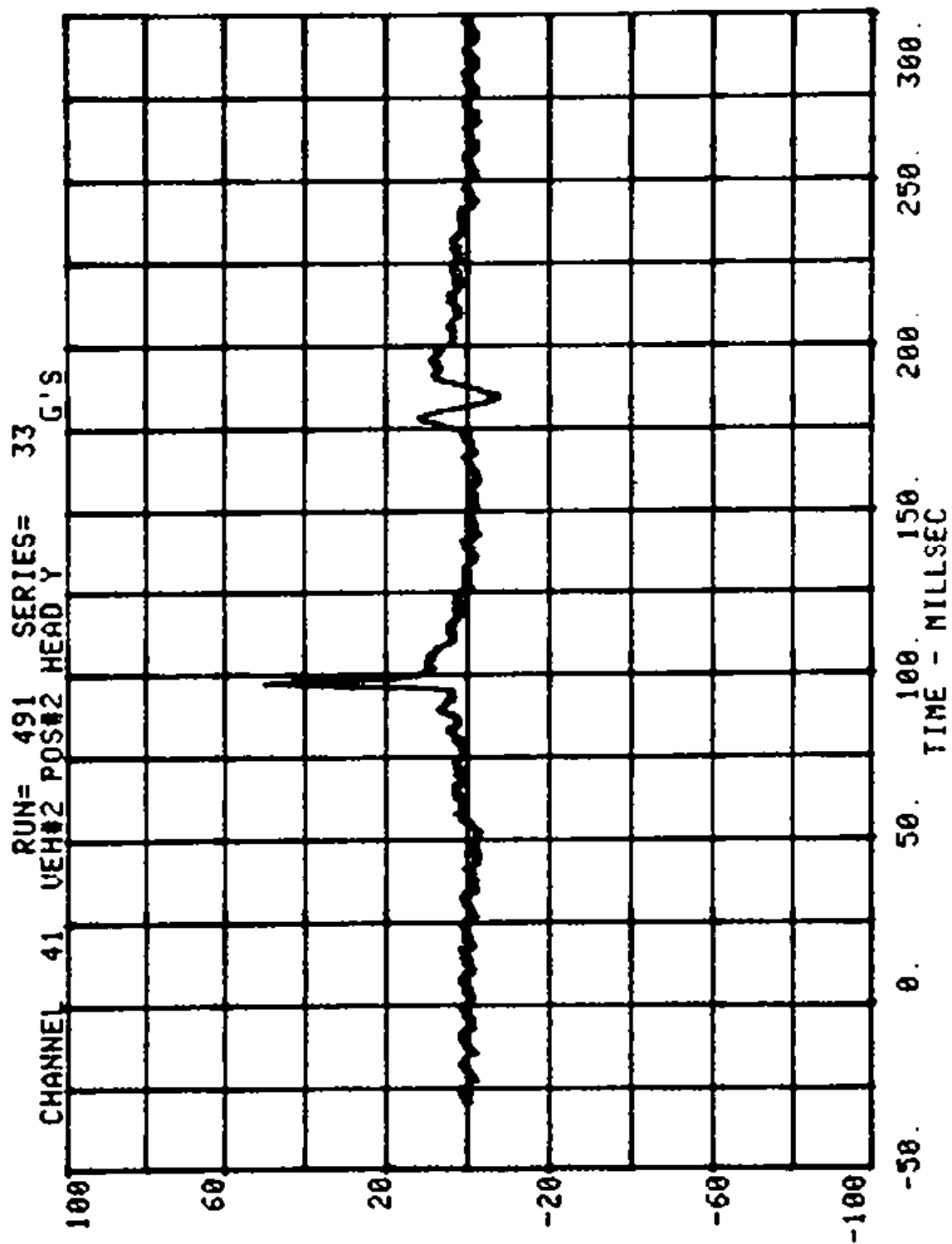
HIC=1218.6 FROM T1= .06900 TO T2= .11370

AVERAGE ACCELERATION BETWEEN T1 AND T2= 59.5G'S

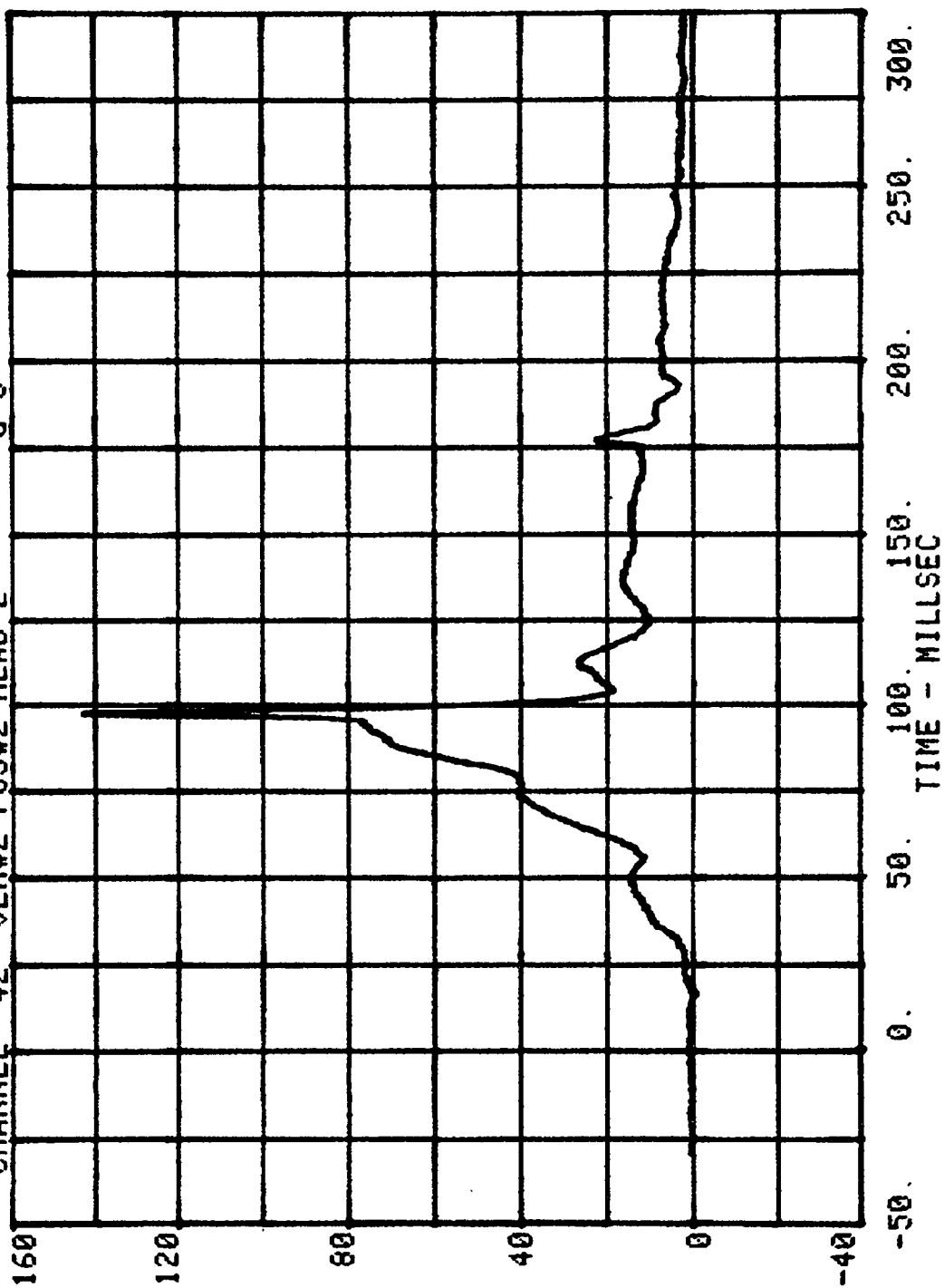
EVENT TIME= 300.0 MSEC

SEVERITY INDEX=2092.4

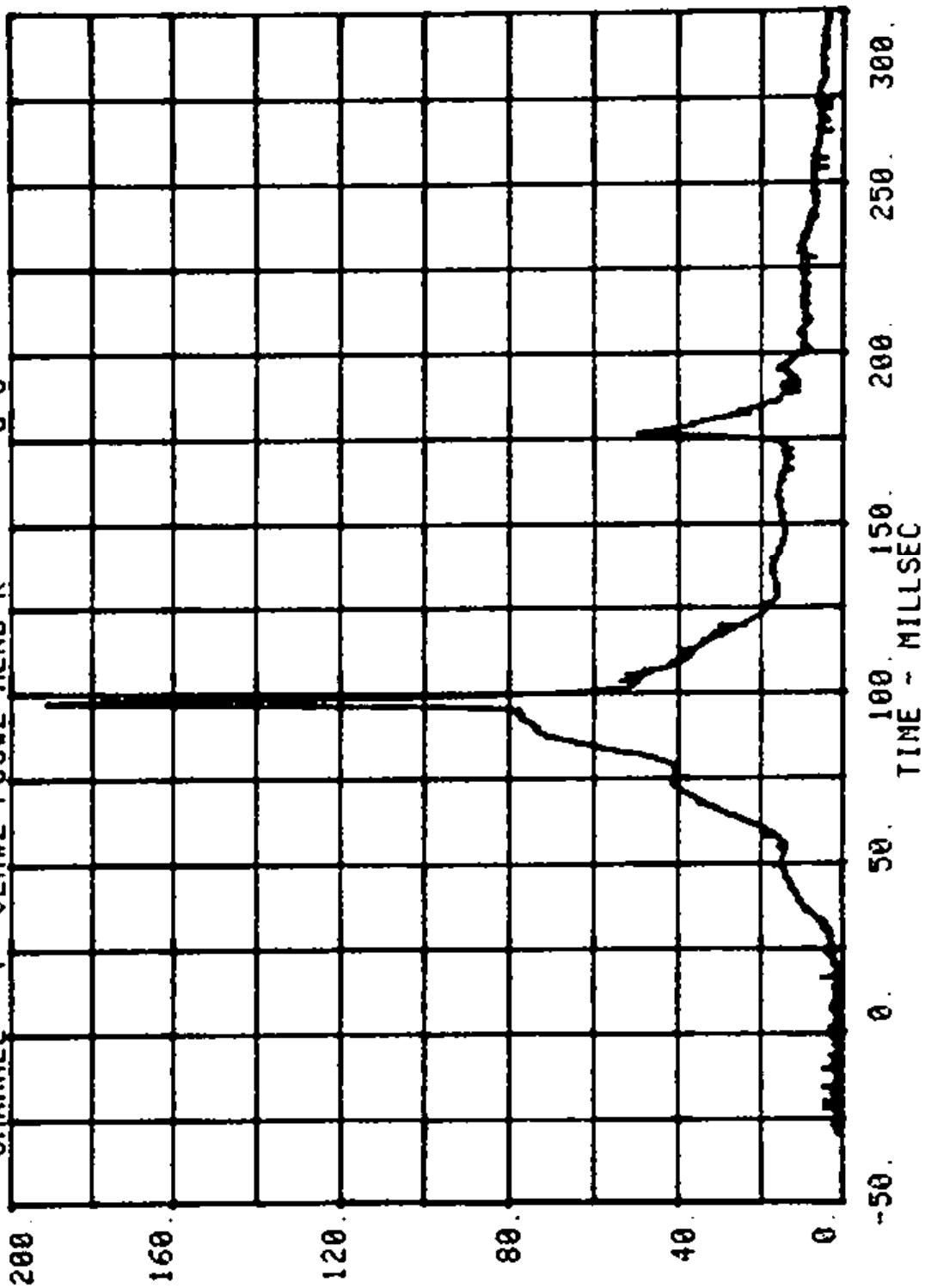


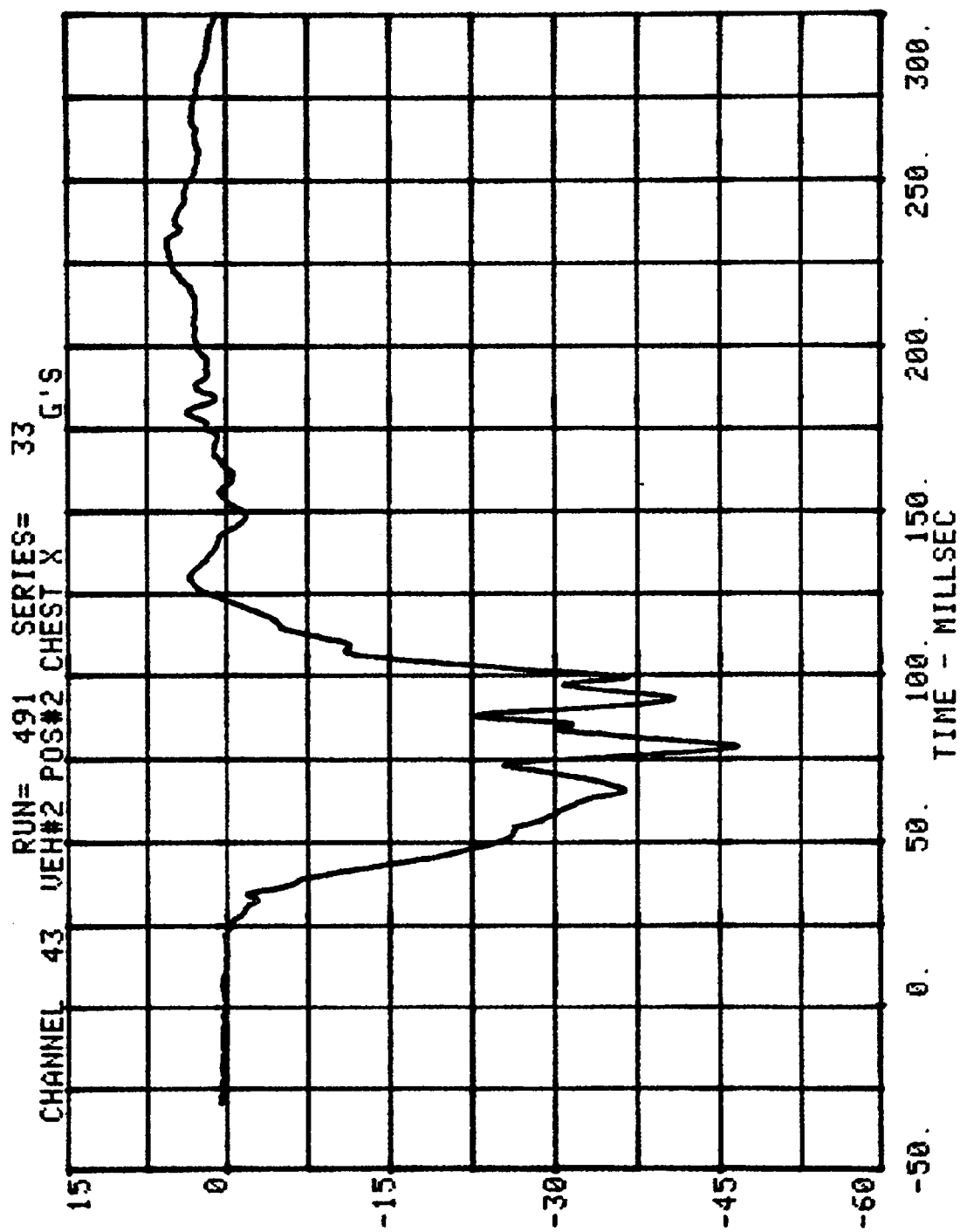


CHANNEL 42 RUN= 491 SERIES= 33  
VEH#2 POS#2 HEAD 2 G'S

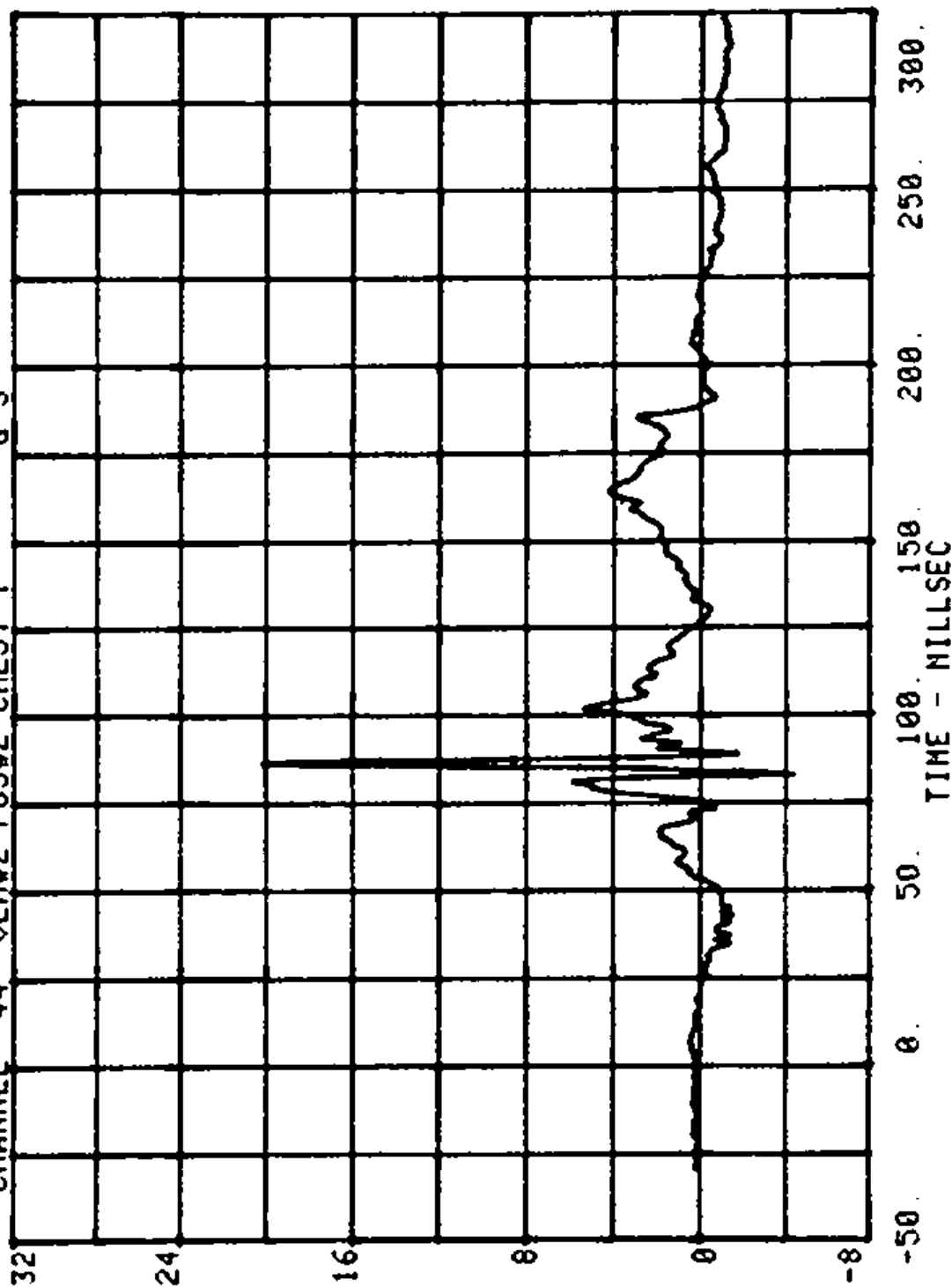


CHANNEL 7 VEH#2 POS#2 HEAD R SERIES= 33 G'S

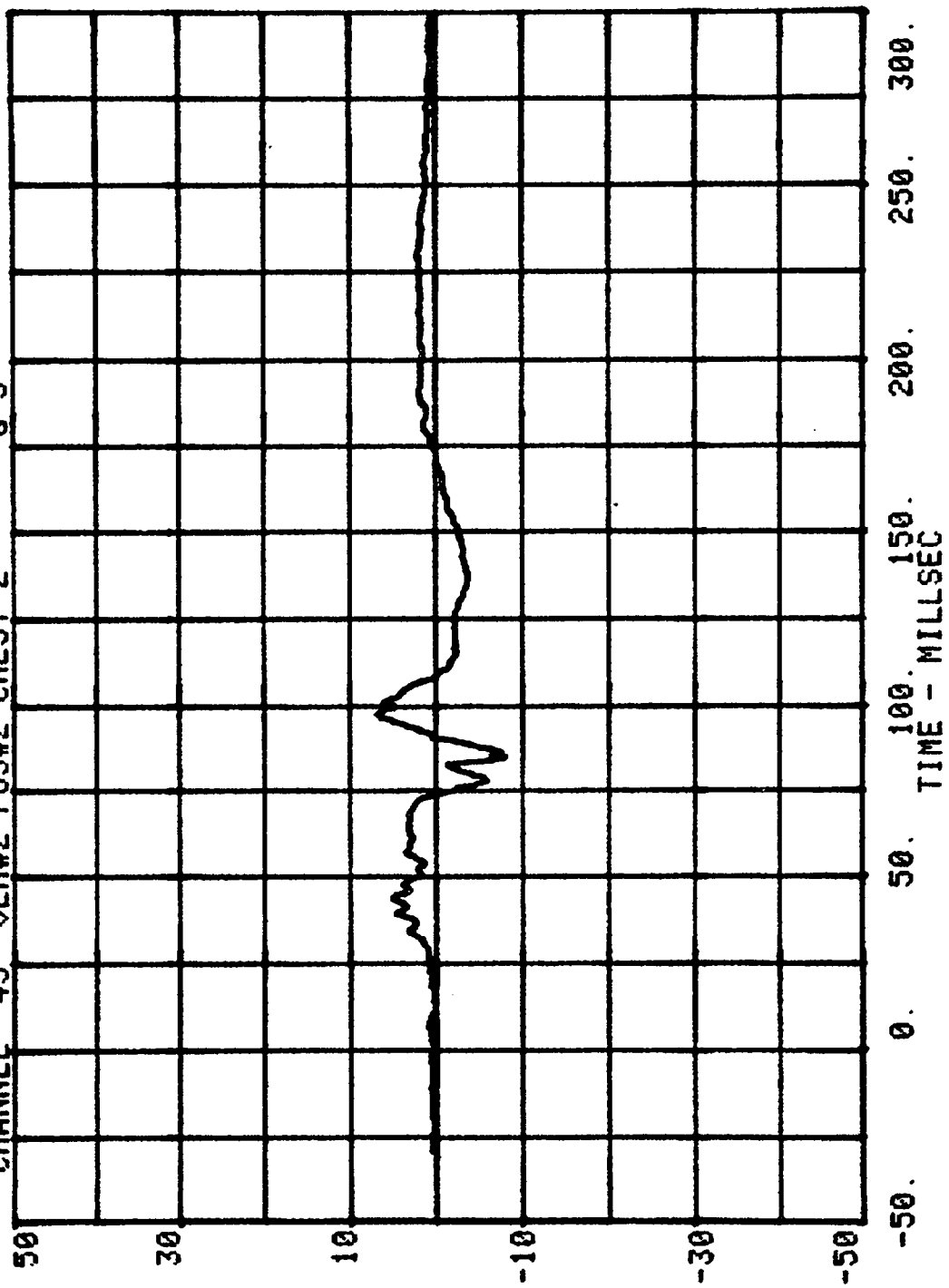




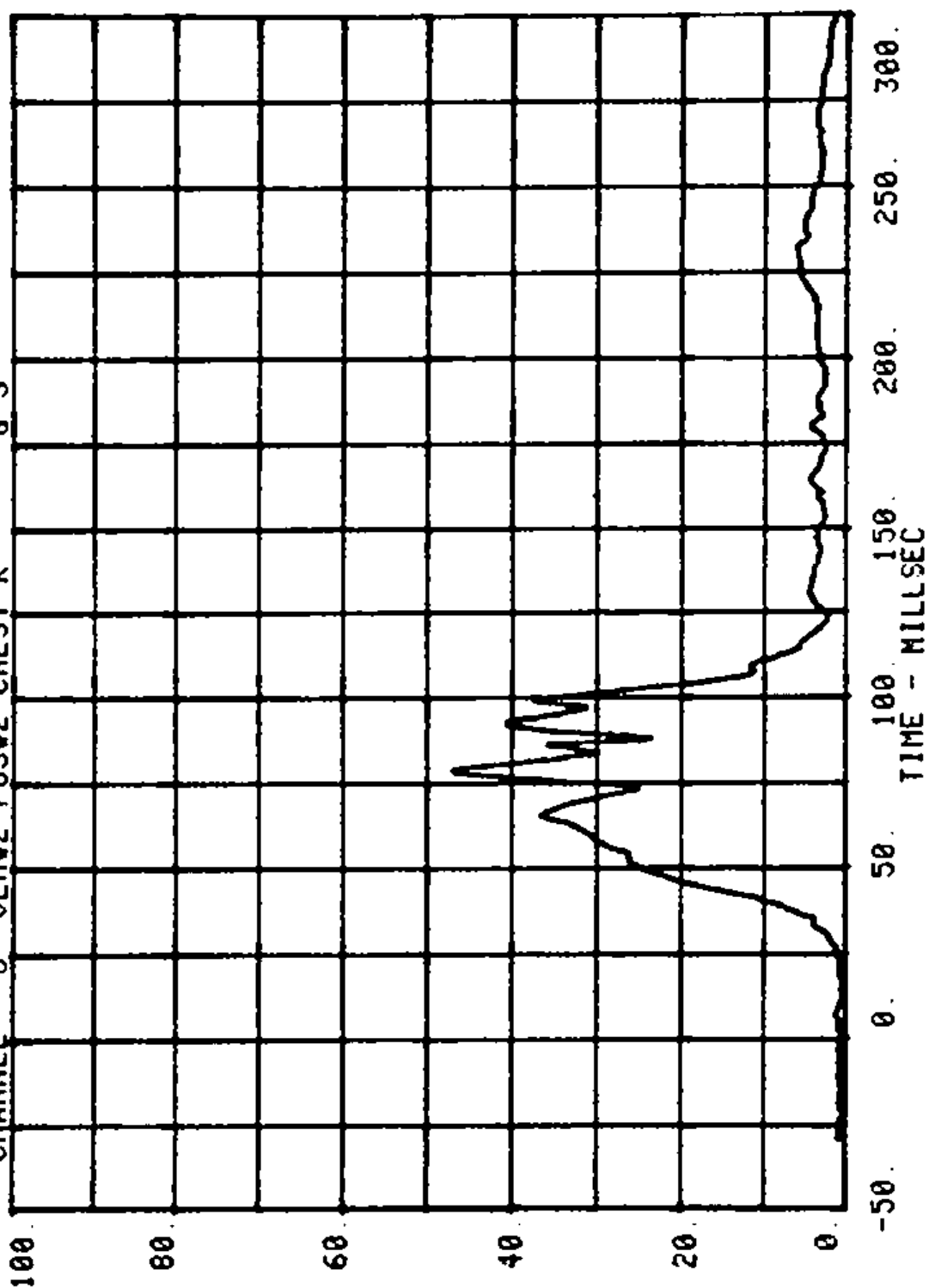
CHANNEL 44 VEH#2 POS#2 CHEST Y 33 G'S



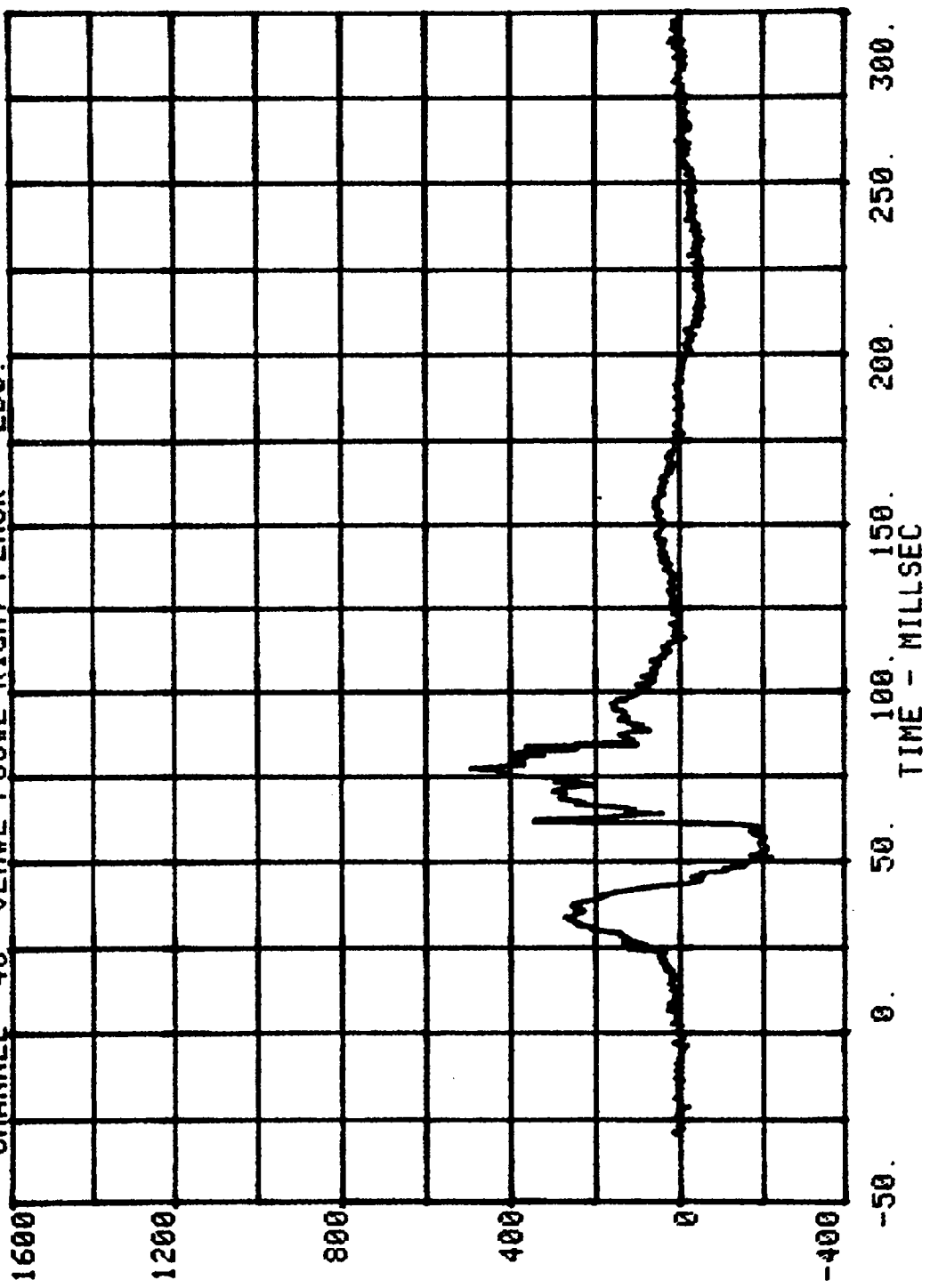
CHANNEL 45 RUN= 491 SERIES= 33  
VEH#2 POS#2 CHEST Z G'S



CHANNEL 8 VEH#2 POS#2 CHEST R 33 G'S



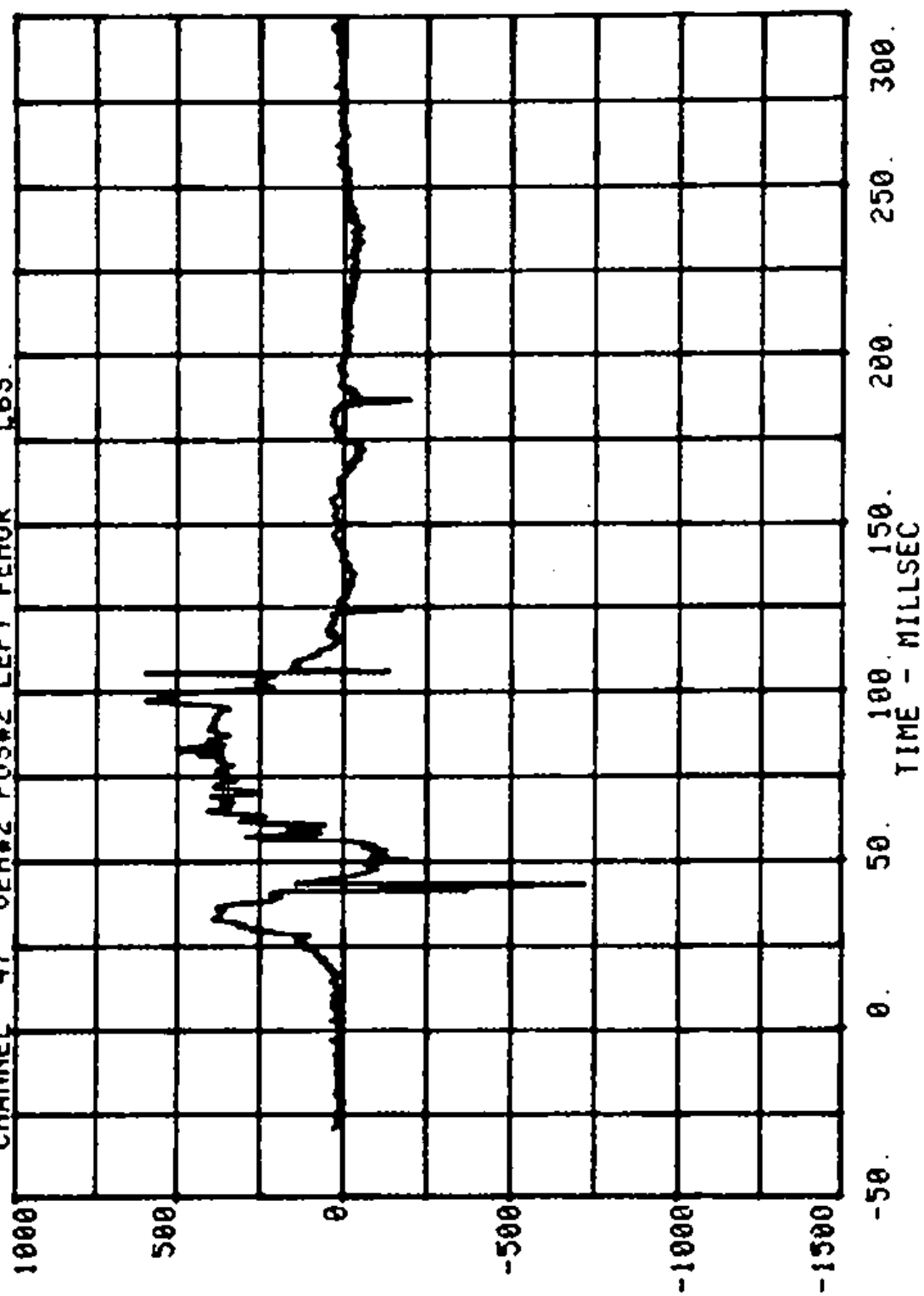
RUN= 491 SERIES= 33  
CHANNEL 46 VEH#2 POS#2 RIGHT FEMUR LBS.



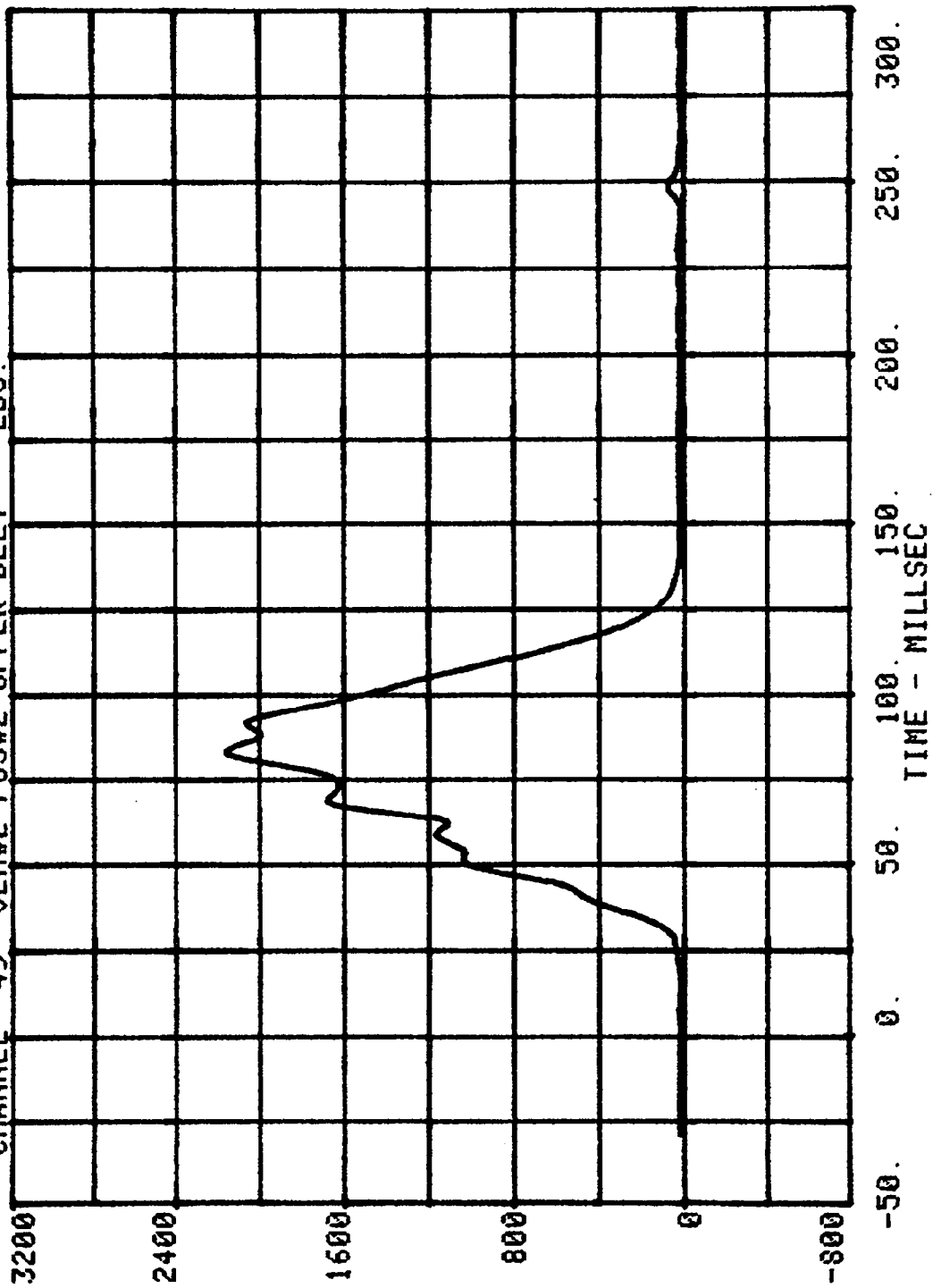
CHANNEL 47 UEH#2 POS#2 LEFT FEMUR LBS

RUN= 491

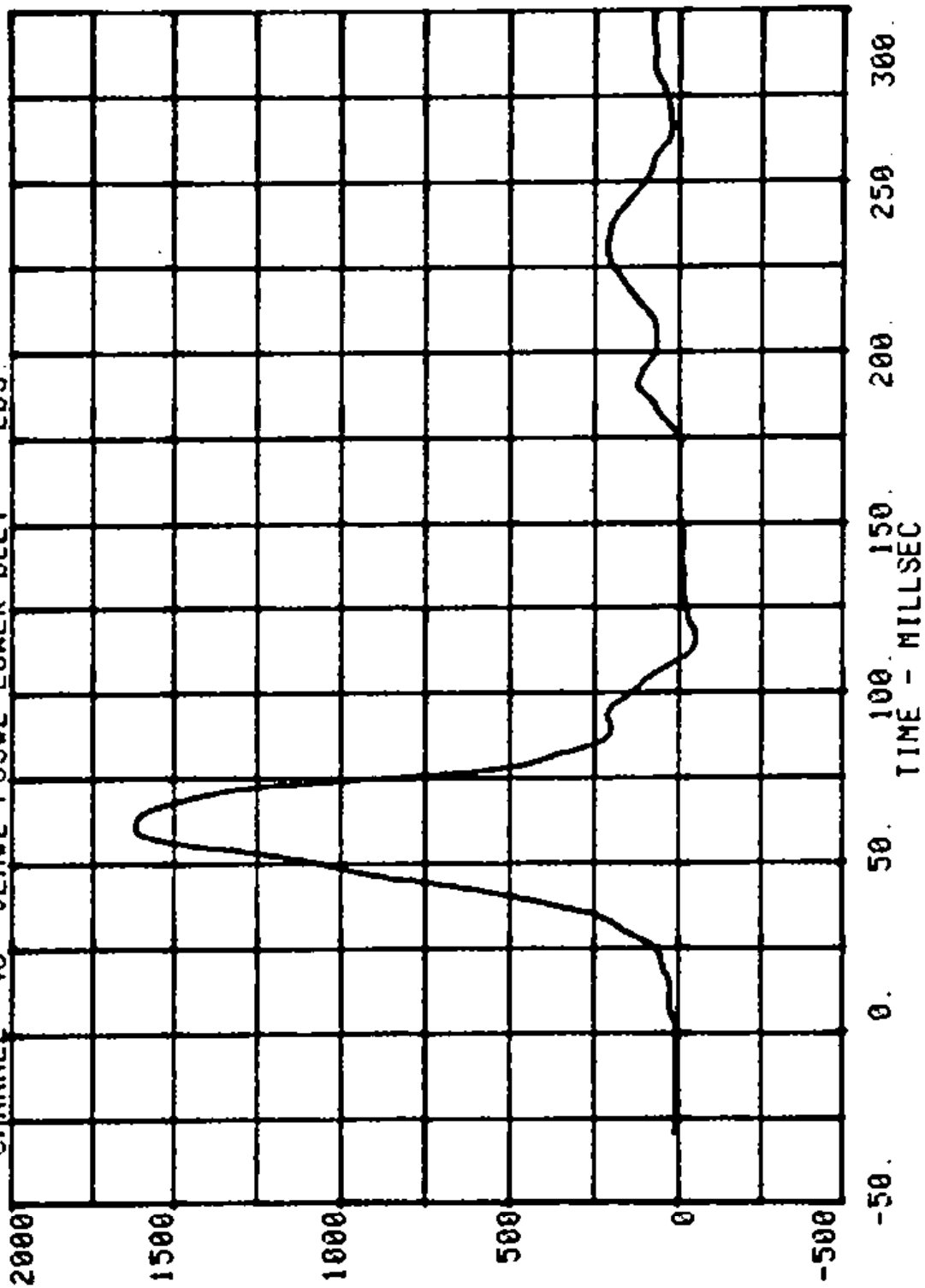
SERIES= 33



CHANNEL 49 RUN= 491 SERIES= 33 LBS.  
VEH#2 POS#2 UPPER BELT



CHANNEL 48 RUN= 491 SERIES= 33  
VEH#2 POS#2 LOWER BELT LBS



APPENDIX C  
DUMMY CERTIFICATION TESTS

Appendix C contains the results from certification tests performed on the Alderson Research Laboratories Model ATD 30034, 50th percentile male anthropometric test devices utilized for this crash test. The results indicate that the dummies meet all of the performance requirements of the six standard tests as specified in 49 CFR Part 572, Federal Register, Vol. 42, No. 25, dated February 7, 1977.

The tests were conducted at the Dummy Certification Test Facility of Calspan Corporation, Advanced Technology Center. A summary of the test results, Part 572 specifications, instrument calibration information and the electronic test equipment is included in this Appendix.

Dummy serial numbers and certification dates are:

| <u>Serial No.</u> | <u>Completion Date</u> |
|-------------------|------------------------|
| 320               | 4/25/80                |
| 163               | 4/25/80                |
| 162               | 4/25/80                |
| 109               | 4/25/80                |

#### Electronic Test Equipment

The complement of signal conditioning recording and display equipment used in conjunction with dummy certification testing can be found in New Car Assessment and Standards Indicant Testing Final Report, Report Number 6525-V-1.

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.D. NO.:

3 2 0

LABORATORY TECHNICIAN: Fred F. Juliano and Gary Gestwick

APPROVED BY: B Kelleher

Pre-Test  
Calibration

Post-Test  
Calibration

Date of Dummy Calibration - - - - -  
Calibration Sequential Number for Dummy - - - -  
Temperature in Lab. (Spec. = 66 to 78°F) - - - -  
Relative Humidity in Lab. (Spec. = 10 to 70%) -

4/23 - 4/25

10

67-74

38-40

TEST PARAMETER

SPECIFICATION

1. HEAD DROP TEST:

- a. Peak Resultant Accel. -
- b. Peak Lateral Accel. -
- c. Time above 100G -

210 to 260G

225

≤10G

8

0.9 to 1.5 ms

1.15

2. NECK BENDING TEST:

- a. Pendulum Speed -
- b. Pendulum Avg. Decel.  
(over  $t_3 - t_2$ ) -
- c. Peak Resultant Head  
Acceleration -
- d. Pendulum Decel. ( $t_2 - t_1$ ) -
- e. Pendulum Decel. ( $t_3 - t_2$ ) -
- f. Pendulum Decel. ( $t_4 - t_3$ ) -
- g. Pendulum Direction  
Reversal Time -
- h. Max. Head Rotation -
- i. Chordal Displacement:

21.5 to 25.5 fps

21.96

20 to 24G

23

26G maximum

21

≤3 ms

2.5

25 to 30 ms

25

≤10 ms

5

≥123 ms

110

63 to 73°

69°

Head Rotation Angle -

0°

Time

-2 to 2 ms

0

Displ.

-.5 to .5 in

0

30°

Time

25.6 to 34.4 ms

27

Displ.

2.1 to 3.1 in.

2.8

60°

Time

40.3 to 51.7 ms

42

Displ.

4.3 to 5.3 in.

4.8

Maximum

Time

53.2 to 66.8 ms

62

( °)

Displ.

5.0 to 6.0 in.

5.7

Continued

C-3

6525-V-33

P. 572 DUMMY CALIBRATION TEST DATA .... Continued:

Dummy I.D. No.:

|   |   |   |
|---|---|---|
| 3 | 2 | 0 |
|---|---|---|

| TEST PARAMETER                        | SPECIFICATION     | Pre-Test Calibration | Post-Test Calibration |
|---------------------------------------|-------------------|----------------------|-----------------------|
| <b>2. NECK BENDING TEST ....</b>      |                   |                      |                       |
| <u>Continued</u>                      |                   |                      |                       |
| i. Chordal Displacement:              |                   |                      |                       |
| Head Rotation Angle --                |                   |                      |                       |
| 60°                                   | Time              | 67.0 to 83.0 ms      | 74                    |
|                                       | Displ.            | 4.3 to 5.3 in.       | 4.9                   |
| 30°                                   | Time              | 85.4 to 104.6 ms     | 93                    |
|                                       | Displ.            | 2.1 to 3.1 in.       | 2.3                   |
| 0°                                    | Time              | 101.0 to 123.0 ms    | 107                   |
|                                       | Displ.            | -.5 to 0.5 in.       | 0                     |
| <b>3. ABDOMINAL COMPRESSION TEST:</b> |                   |                      |                       |
| (Preload = 10 pounds)                 |                   |                      |                       |
| a. Force @ 1" - - - -                 | 50 to 63 lbs.     | 52                   |                       |
| b. Force @ 1.3" - - - -               | 73 to 88 lbs.     | 73.2                 |                       |
| <b>4. LUMBAR FLEXION TEST:</b>        |                   |                      |                       |
| a. Force @ 20° - - - -                | 22 to 34 lbs.     | 30.5                 |                       |
| b. Force @ 30° - - - -                | 34 to 46 lbs.     | 44                   |                       |
| c. Force @ 40° - - - -                | 46 to 58 lbs.     | 57.5                 |                       |
| d. Return Angle - - -                 | 12° maximum       | 7                    |                       |
| <b>5. CHEST IMPACT TESTS:</b>         |                   |                      |                       |
| a. High Speed                         |                   |                      |                       |
| (1) Probe Speed - -                   | 21.78-22.22 fps   | 21.90                |                       |
| (2) Peak Deflection -                 | 1.7" maximum      | 1.22                 |                       |
| (3) Peak Resistive Force - - - - -    | 2250 lbs. maximum | 1813                 |                       |
| (4) Internal Hysteresis - - - -       | 50 to 70%         | 70%                  |                       |
| b. Low Speed                          |                   |                      |                       |
| (1) Probe Speed - - -                 | 13.86-14.14 fps   | 14.0                 |                       |
| (2) Peak Deflection -                 | 1.1" maximum      | 1.05                 |                       |
| (3) Peak Resistive Force - - - - -    | 1450 lbs. maximum | 1087                 |                       |
| (4) Internal Hysteresis- - - -        | 50 to 70%         | 67%                  |                       |

P.572 DUMMY CALIBRATION TEST DATA .....Continued:

Dummy I.D. No.:

|   |   |   |
|---|---|---|
| 3 | 2 | 0 |
|---|---|---|

| TEST PARAMETER               | SPECIFICATION     | Pre-Test Calibration | Post-Test Calibration |
|------------------------------|-------------------|----------------------|-----------------------|
| 6. <u>KNEE IMPACT TESTS:</u> |                   |                      |                       |
| a. Right Side --             |                   |                      |                       |
| (1) Probe Speed - - -        | 6.76 to 7.04 fps  | 6.99                 |                       |
| (2) Maximum Force - -        | 1850 to 2500 lbs  | 2250                 |                       |
| (3) Time Above 1000#         | 1.7 ms minimum    | 1.9                  |                       |
| b. Left Side --              |                   |                      |                       |
| (1) Probe Speed - - -        | 6.76 to 7.04 fps  | 7.03                 |                       |
| (2) Maximum Force - -        | 1850 to 2500 lbs. | 1855                 |                       |
| (3) Time Above 1000#         | 1.7 ms minimum    | 2.1                  |                       |

# INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.:

|   |   |   |
|---|---|---|
| 3 | 2 | 0 |
|---|---|---|

CALIB. SEQ. NOS. FOR DUMMY: \_\_\_\_\_ & \_\_\_\_\_

## A. DUMMY INSTRUMENTS:

### 1. Head Accelerometers--

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal ( $A_x$ ) -

(2) Lateral ( $A_y$ ) - - -

(3) Vertical ( $A_z$ ) - - -

### 2. Chest Accelerometers--

(Vehicle Crash Test Usage)

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal ( $A_x$ ) -

(2) Lateral ( $A_y$ ) - - -

(3) Vertical ( $A_z$ ) - - -

### 3. Chest Potentiometer - - -

### 4. Femur Load Cells--

a. Right Side - - - - -

b. Left Side

## B. CALIB. LAB. INSTRUMENTS:

1. Pendulum Accelerometer - -

2. Test Probe Accelerometer -

3. Lumbar Flexion Test Push  
Force Gauge - - - - -

4. Abdominal Compression Test  
Force Gauge - - - - -

5. Abdominal Compression Test  
Displacement Gauge - - - -

| MANUFACTURER        | SERIAL<br>NUMBER | DATE LAST<br>CALIBRATED | DATE OF<br>NEXT<br>CALIBRATION |
|---------------------|------------------|-------------------------|--------------------------------|
|                     |                  |                         |                                |
| Endevco             | CK78             | 1/80                    |                                |
| Endevco             | CG34             | 1/80                    |                                |
| Endevco             | CN24             | 1/80                    |                                |
|                     |                  |                         |                                |
| CEC                 | A514<br>17816    | 1/80                    |                                |
| Endevco             | CK11             | 1/80                    |                                |
| CEC                 | A115<br>17839    | 1/80                    |                                |
| Humanoid<br>Special | --               | 4/80                    |                                |
| DJ<br>Instr.        | 1926             | 1/80                    |                                |
| DJ<br>Instr.        | 1707             | 1/80                    |                                |
| CEC                 | 2437             | 1/80                    |                                |
| CEC                 | 22960            | 1/80                    |                                |
| Transducers<br>Inc. | 20051            | 4/80                    |                                |
| BLH                 | 72952            | 8/79                    |                                |
| CIC                 | 567-11           | 8/79                    |                                |
| C-6                 |                  | 6525-V-33               |                                |

P. 572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.D. NO.:

|   |   |   |
|---|---|---|
| 1 | 6 | 3 |
|---|---|---|

LABORATORY TECHNICIAN: Fred J. Juliano and Gary Gestwick

APPROVED BY:

*B Kelleher*

Pre-Test  
Calibration

Post-Test  
Calibration

Date of Dummy Calibration - - - - -  
Calibration Sequential Number for Dummy - - - -  
Temperature in Lab. (Spec. = 66 to 78°F) - - - -  
Relative Humidity in Lab. (Spec. = 10 to 70%) -

4/23 - 4/25  
1  
66-74  
29-40

TEST PARAMETER

SPECIFICATION

1. HEAD DROP TEST:

- a. Peak Resultant Accel. -
- b. Peak Lateral Accel. -
- c. Time above 100G -

210 to 260G  
≤10G  
0.9 to 1.5 ms

245  
2.5  
1.1

2. NECK BENDING TEST:

- a. Pendulum Speed -
- b. Pendulum Avg. Decel.  
(over  $t_3 - t_2$ ) -
- c. Peak Resultant Head  
Acceleration -
- d. Pendulum Decel. ( $t_2 - t_1$ ) -
- e. Pendulum Decel. ( $t_3 - t_2$ ) -
- f. Pendulum Decel. ( $t_4 - t_3$ ) -
- g. Pendulum Direction  
Reversal Time -
- h. Max. Head Rotation -
- i. Chordal Displacement:  
Head Rotation Angle -

21.5 to 25.5 f/s  
20 to 24G  
26G maximum  
≤3 ms  
25 to 30 ms  
≤10 ms  
≥123 ms  
63 to 73°

21.69  
24  
22  
1.25  
28  
4  
105  
69

0°

Time

-2 to 2 ms

0

Displ.

-.5 to .5 in

0

30°

Time

25.6 to 34.4 ms

27

Displ.

2.1 to 3.1 in.

2.5

60°

Time

40.3 to 51.7 ms

41

Displ.

4.3 to 5.3 in.

4.6

Maximum

Time

53.2 to 66.8 ms

62

( °)

Displ.

5.0 to 6.0 in.

5.2

Continued

P. 572 DUMMY CALIBRATION TEST DATA .... Continued:

Dummy I.D. No.:

1 6 3

| TEST PARAMETER                        |        | SPECIFICATION     | Pre-Test Calibration | Post-Test Calibration |
|---------------------------------------|--------|-------------------|----------------------|-----------------------|
| 2. <u>NECK BENDING TEST</u> ....      |        |                   |                      |                       |
| <u>Continued</u>                      |        |                   |                      |                       |
| i. Chordal Displacement:              |        |                   |                      |                       |
| Head Rotation Angle --                |        |                   |                      |                       |
| 60°                                   | Time   | 67.0 to 83.0 ms   | 74                   |                       |
|                                       | Displ. | 4.3 to 5.3 in.    | 4.6                  |                       |
| 30°                                   | Time   | 85.4 to 104.6 ms  | 92                   |                       |
|                                       | Displ. | 2.1 to 3.1 in.    | 2.2                  |                       |
| 0°                                    | Time   | 101.0 to 123.0 ms | 106                  |                       |
|                                       | Displ. | -.5 to 0.5 in.    | 0                    |                       |
| 3. <u>ABDOMINAL COMPRESSION TEST:</u> |        |                   |                      |                       |
| (Preload = 10 pounds)                 |        |                   |                      |                       |
| a. Force @ 1" - - - - -               |        | 50 to 63 lbs.     | 53.5                 |                       |
| b. Force @ 1.3" - - - - -             |        | 73 to 88 lbs.     | 78                   |                       |
| 4. <u>LUMBAR FLEXION TEST:</u>        |        |                   |                      |                       |
| a. Force @ 20° - - - - -              |        | 22 to 34 lbs.     | 30.5                 |                       |
| b. Force @ 30° - - - - -              |        | 34 to 46 lbs.     | 38                   |                       |
| c. Force @ 40° - - - - -              |        | 46 to 58 lbs.     | 48                   |                       |
| d. Return Angle - - - - -             |        | 12° maximum       | 8                    |                       |
| 5. <u>CHEST IMPACT TESTS:</u>         |        |                   |                      |                       |
| a. High Speed                         |        |                   |                      |                       |
| (1) Probe Speed - - - - -             |        | 21.78-22.22 fps   | 21.89                |                       |
| (2) Peak Deflection - - - - -         |        | 1.7" maximum      | 1.68                 |                       |
| (3) Peak Resistive Force - - - - -    |        | 2250 lbs. maximum | 1968                 |                       |
| (4) Internal Hysteresis - - - - -     |        | 50 to 70%         | 51.7%                |                       |
| b. Low Speed                          |        |                   |                      |                       |
| (1) Probe Speed - - - - -             |        | 13.86-14.14 fps   | 14.07                |                       |
| (2) Peak Deflection - - - - -         |        | 1.1" maximum      | 1.05                 |                       |
| (3) Peak Resistive Force - - - - -    |        | 1450 lbs. maximum | 1228                 |                       |
| (4) Internal Hysteresis - - - - -     |        | 50 to 70%         | 55.4%                |                       |

P.572 DUMMY CALIBRATION TEST DATA .....Continued:

Dummy I.D. No.:

|   |   |   |
|---|---|---|
| 1 | 6 | 3 |
|---|---|---|

| TEST PARAMETER               | SPECIFICATION     | Pre-Test Calibration | Post-Test Calibration |
|------------------------------|-------------------|----------------------|-----------------------|
| 6. <u>KNEE IMPACT TESTS:</u> |                   |                      |                       |
| a. Right Side --             |                   |                      |                       |
| (1) Probe Speed - - -        | 6.76 to 7.04 fps  | 6.98                 |                       |
| (2) Maximum Force - -        | 1850 to 2500 lbs  | 1850                 |                       |
| (3) Time Above 1000#         | 1.7 ms minimum    | 2                    |                       |
| b. Left Side --              |                   |                      |                       |
| (1) Probe Speed - - -        | 6.76 to 7.04 fps  | 6.99                 |                       |
| (2) Maximum Force - -        | 1850 to 2500 lbs. | 2000                 |                       |
| (3) Time Above 1000#         | 1.7 ms minimum    | 2.0                  |                       |

# INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.:

1 6 3

CALIB. SEQ. NOS. FOR DUMMY: \_\_\_\_\_ & \_\_\_\_\_

## A. DUMMY INSTRUMENTS:

### 1. Head Accelerometers--

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal ( $A_x$ ) -

(2) Lateral ( $A_y$ ) - - -

(3) Vertical ( $A_z$ ) - - -

### 2. Chest Accelerometers-- (Vehicle Crash Test Usage)

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal ( $A_x$ ) -

(2) Lateral ( $A_y$ ) - - -

(3) Vertical ( $A_z$ ) - - -

### 3. Chest Potentiometer - - -

### 4. Femur Load Cells--

a. Right Side - - - - -

b. Left Side

## B. CALIB. LAB. INSTRUMENTS:

1. Pendulum Accelerometer - -

2. Test Probe Accelerometer -

3. Lumbar Flexion Test Push  
Force Gauge - - - - -

4. Abdominal Compression Test  
Force Gauge - - - - -

5. Abdominal Compression Test  
Displacement Gauge - - - -

| MANUFACTURER        | SERIAL<br>NUMBER | DATE LAST<br>CALIBRATED | DATE OF<br>NEXT<br>CALIBRATION |
|---------------------|------------------|-------------------------|--------------------------------|
|                     |                  |                         |                                |
| Endevco             | DB47             | 1/80                    |                                |
| Endevco             | CX05             | 1/80                    |                                |
| Endevco             | CJ54             | 2/80                    |                                |
|                     |                  |                         |                                |
| CEC                 | A128<br>18259    | 1/80                    |                                |
| Endevco             | CE06             | 1/80                    |                                |
| CEC                 | A512<br>17811    | 1/80                    |                                |
| Humanoid<br>Special | --               | 4/80                    |                                |
| GSE                 | 549              | 1/80                    |                                |
| GSE                 | 548              | 1/80                    |                                |
| CEC                 | 2437             | 1/80                    |                                |
| CEC                 | 22960            | 1/80                    |                                |
| Transducers<br>Inc. | 20051            | 4/80                    |                                |
| BLH                 | 72952            | 8/79                    |                                |
| BLH                 | 567-11           | 8/79                    |                                |
| C-10                |                  | 6525-V-33               |                                |

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.O. NO.:

|   |   |   |
|---|---|---|
| 1 | 6 | 2 |
|---|---|---|

LABORATORY TECHNICIAN: Fred F. Juliano and Gary Gestwick

APPROVED BY: B Kelleher

|                                                  | Pre-Test Calibration | Post-Test Calibration |
|--------------------------------------------------|----------------------|-----------------------|
| Date of Dummy Calibration - - - - -              | 4/23-4/25/80         |                       |
| Calibration Sequential Number for Dummy - - - -  | 1                    |                       |
| Temperature in Lab. (Spec. = 66 to 78°F) - - - - | 66-71                |                       |
| Relative Humidity in Lab. (Spec. = 10 to 70%) -  | 29-38                |                       |

| TEST PARAMETER                                         | SPECIFICATION    |                 |     |
|--------------------------------------------------------|------------------|-----------------|-----|
| 1. <u>HEAD DROP TEST:</u>                              |                  |                 |     |
| a. Peak Resultant Accel. -                             | 210 to 260G      | 240             |     |
| b. Peak Lateral Accel. - -                             | ≤10G             | 5               |     |
| c. Time above 100G - - - -                             | 0.9 to 1.5 ms    | 1.2             |     |
| 2. <u>NECK BENDING TEST:</u>                           |                  |                 |     |
| a. Pendulum Speed - - - -                              | 21.5 to 25.5 fps | 22.9            |     |
| b. Pendulum Avg. Decel.<br>(over $t_3 - t_2$ ) - - - - | 20 to 24G        | 23              |     |
| c. Peak Resultant Head<br>Acceleration - - - -         | 26G maximum      | 25.5            |     |
| d. Pendulum Decel. ( $t_2 - t_1$ )                     | ≤3 ms            | 2.5             |     |
| e. Pendulum Decel. ( $t_3 - t_2$ )                     | 25 to 30 ms      | 30              |     |
| f. Pendulum Decel. ( $t_4 - t_3$ )                     | ≤10 ms           | 4               |     |
| g. Pendulum Direction<br>Reversal Time - - - -         | ≥123 ms          | 101             |     |
| h. Max. Head Rotation - -                              | 63 to 73°        | 65.8            |     |
| i. Chordal Displacement:                               |                  |                 |     |
| Head Rotation Angle - -                                |                  |                 |     |
| 0°                                                     | Time             | -2 to 2 ms      | 0   |
|                                                        | Displ.           | -.5 to .5 in    | 0   |
| 30°                                                    | Time             | 25.6 to 34.4 ms | 29  |
|                                                        | Displ.           | 2.1 to 3.1 in.  | 2.4 |
| 60°                                                    | Time             | 40.3 to 51.7 ms | 47  |
|                                                        | Displ.           | 4.3 to 5.3 in.  | 4.8 |
| Maximum                                                | Time             | 53.2 to 66.8 ms | 59  |
| ( °)                                                   | Displ.           | 5.0 to 6.0 in.  | 5.1 |

Continued

P. 572 DUMMY CALIBRATION TEST DATA .... Continued:

Dummy I.D. No.:

1 6 2

| TEST PARAMETER                        | SPECIFICATION     | Pre-Test Calibration | Post-Test Calibration |
|---------------------------------------|-------------------|----------------------|-----------------------|
| 2. <u>NECK BENDING TEST</u> ....      |                   |                      |                       |
| <u>Continued</u>                      |                   |                      |                       |
| i. Chordal Displacement:              |                   |                      |                       |
| Head Rotation Angle --                |                   |                      |                       |
| 60°                                   | Time              | 67.0 to 83.0 ms      | 67                    |
|                                       | Displ.            | 4.3 to 5.3 in.       | 4.8                   |
| 30°                                   | Time              | 85.4 to 104.6 ms     | 87                    |
|                                       | Displ.            | 2.1 to 3.1 in.       | 2.4                   |
| 0°                                    | Time              | 101.0 to 123.0 ms    | 103                   |
|                                       | Displ.            | -.5 to 0.5 in.       | -.2                   |
| 3. <u>ABDOMINAL COMPRESSION TEST:</u> |                   |                      |                       |
| (Preload = 10 pounds)                 |                   |                      |                       |
| a. Force @ 1" - - - - -               | 50 to 63 lbs.     | 58                   |                       |
| b. Force @ 1.3" - - - - -             | 73 to 88 lbs.     | 87                   |                       |
| 4. <u>LUMBAR FLEXION TEST:</u>        |                   |                      |                       |
| a. Force @ 20° - - - - -              | 22 to 34 lbs.     | 25                   |                       |
| b. Force @ 30° - - - - -              | 34 to 46 lbs.     | 38                   |                       |
| c. Force @ 40° - - - - -              | 46 to 58 lbs.     | 52                   |                       |
| d. Return Angle - - - - -             | 12° maximum       | 10°                  |                       |
| 5. <u>CHEST IMPACT TESTS:</u>         |                   |                      |                       |
| a. High Speed                         |                   |                      |                       |
| (1) Probe Speed - - -                 | 21.78-22.22 fps   | 21.98                |                       |
| (2) Peak Deflection - -               | 1.7" maximum      | 1.55                 |                       |
| (3) Peak Resistive Force - - - - -    | 2250 lbs. maximum | 1942                 |                       |
| (4) Internal Hysteresis - - - - -     | 50 to 70%         | 65.2%                |                       |
| b. Low Speed                          |                   |                      |                       |
| (1) Probe Speed - - -                 | 13.86-14.14 fps   | 13.98                |                       |
| (2) Peak Deflection - -               | 1.1" maximum      | .97                  |                       |
| (3) Peak Resistive Force - - - - -    | 1450 lbs. maximum | 1217                 |                       |
| (4) Internal Hysteresis - - - - -     | 50 to 70%         | 68.5%                |                       |

P.572 DUMMY CALIBRATION TEST DATA .....Continued:

Dummy I.D. No.:

|   |   |   |
|---|---|---|
| 1 | 6 | 2 |
|---|---|---|

| TEST PARAMETER               | SPECIFICATION     | Pre-Test Calibration | Post-Test Calibration |
|------------------------------|-------------------|----------------------|-----------------------|
| 6. <u>KNEE IMPACT TESTS:</u> |                   |                      |                       |
| a. Right Side --             |                   |                      |                       |
| (1) Probe Speed - - -        | 6.76 to 7.04 fps  | 7.03                 |                       |
| (2) Maximum Force - -        | 1850 to 2500 lbs  | 2200                 |                       |
| (3) Time Above 1000#         | 1.7 ms minimum    | 2.0                  |                       |
| b. Left Side --              |                   |                      |                       |
| (1) Probe Speed - - -        | 6.76 to 7.04 fps  | 6.98                 |                       |
| (2) Maximum Force - -        | 1850 to 2500 lbs. | 2300                 |                       |
| (3) Time Above 1000#         | 1.7 ms minimum    | 1.9                  |                       |

# INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.:

|   |   |   |
|---|---|---|
| 1 | 6 | 2 |
|---|---|---|

CALIB. SEQ. NOS. FOR DUMMY: \_\_\_\_\_ & \_\_\_\_\_

## A. DUMMY INSTRUMENTS:

### 1. Head Accelerometers--

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal ( $A_x$ ) -

(2) Lateral ( $A_y$ ) - - -

(3) Vertical ( $A_z$ ) - - -

### 2. Chest Accelerometers-- (Vehicle Crash Test Usage)

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal ( $A_x$ ) -

(2) Lateral ( $A_y$ ) - - -

(3) Vertical ( $A_z$ ) - - -

### 3. Chest Potentiometer - - -

### 4. Femur Load Cells--

a. Right Side - - - - -

b. Left Side

## B. CALIB. LAB. INSTRUMENTS:

1. Pendulum Accelerometer - -

2. Test Probe Accelerometer -

3. Lumbar Flexion Test Push  
Force Gauge - - - - -

4. Abdominal Compression Test  
Force Gauge - - - - -

5. Abdominal Compression Test  
Displacement Gauge - - - -

| MANUFACTURER        | SERIAL<br>NUMBER | DATE LAST<br>CALIBRATED | DATE OF<br>NEXT<br>CALIBRATION |
|---------------------|------------------|-------------------------|--------------------------------|
|                     |                  |                         |                                |
| Endevco             | CJ22             | 1/80                    |                                |
| Endevco             | CS41             | 1/80                    |                                |
| Endevco             | CH21             | 1/80                    |                                |
|                     |                  |                         |                                |
| CEC                 | A23<br>22290     | 1/80                    |                                |
| Endevco             | CJ92             | 1/80                    |                                |
| Endevco             | A69<br>22722     | 1/80                    |                                |
| Humanoid<br>Special | --               | 4/80                    |                                |
| GSE                 | 77               | 1/80                    |                                |
| GSE                 | 76               | 1/80                    |                                |
| CEC                 | 2437             | 1/80                    |                                |
| CEC                 | 22960            | 1/80                    |                                |
| Transducers<br>Inc. | 20051            | 4/80                    |                                |
| BLH                 | 72952            | 8/79                    |                                |
| BLH                 | 567-11           | 8/79                    |                                |
| C-14                |                  | 6525-V-33               |                                |

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.D. NO.:

|   |   |   |
|---|---|---|
| 1 | 0 | 9 |
|---|---|---|

LABORATORY TECHNICIAN: Fred J. Juliano and Gary Gestwick

APPROVED BY: B. Kelleher

|                                                  | Pre-Test Calibration | Post-Test Calibration |
|--------------------------------------------------|----------------------|-----------------------|
| Date of Dummy Calibration - - - - -              | 4/23 - 4/25/80       |                       |
| Calibration Sequential Number for Dummy - - - -  | 7                    |                       |
| Temperature in Lab. (Spec. = 66 to 78°F) - - - - | 67-72                |                       |
| Relative Humidity in Lab. (Spec. = 10 to 70%) -  | 38-40                |                       |

| TEST PARAMETER                                         | SPECIFICATION    |                 |     |
|--------------------------------------------------------|------------------|-----------------|-----|
| 1. <u>HEAD DROP TEST:</u>                              |                  |                 |     |
| a. Peak Resultant Accel. -                             | 210 to 260G      | 250             |     |
| b. Peak Lateral Accel. -                               | ≤10G             | 4               |     |
| c. Time above 100G - - - -                             | 0.9 to 1.5 ms    | 1.15            |     |
| 2. <u>NECK BENDING TEST:</u>                           |                  |                 |     |
| a. Pendulum Speed - - - -                              | 21.5 to 25.5 fps | 21.54           |     |
| b. Pendulum Avg. Decel.<br>(over $t_3 - t_2$ ) - - - - | 20 to 24G        | 22              |     |
| c. Peak Resultant Head<br>Acceleration - - - -         | 26G maximum      | 20              |     |
| d. Pendulum Decel. ( $t_2 - t_1$ )                     | ≤3 ms            | 2               |     |
| e. Pendulum Decel. ( $t_3 - t_2$ )                     | 25 to 30 ms      | 26              |     |
| f. Pendulum Decel. ( $t_4 - t_3$ )                     | ≤10 ms           | 8               |     |
| g. Pendulum Direction<br>Reversal Time - - - -         | ≥123 ms          | 107             |     |
| h. Max. Head Rotation - -                              | 63 to 73°        | 63              |     |
| i. Chordal Displacement:                               |                  |                 |     |
| Head Rotation Angle - -                                |                  |                 |     |
| 0°                                                     | Time             | -2 to 2 ms      | 0   |
|                                                        | Displ.           | -.5 to .5 in    | 0   |
| 30°                                                    | Time             | 25.6 to 34.4 ms | 28  |
|                                                        | Displ.           | 2.1 to 3.1 in.  | 2.4 |
| 60°                                                    | Time             | 40.3 to 51.7 ms | 48  |
|                                                        | Displ.           | 4.3 to 5.3 in.  | 4.8 |
| Maximum                                                | Time             | 53.2 to 66.8 ms | 60  |
| ( °)                                                   | Displ.           | 5.0 to 6.0 in.  | 5.2 |

Continued

C-15

6525-V-33

P. 572 DUMMY CALIBRATION TEST DATA .... Continued:

Dummy I.D. No.:

|   |   |   |
|---|---|---|
| 1 | 0 | 9 |
|---|---|---|

| TEST PARAMETER                                       | SPECIFICATION     | Pre-Test Calibration | Post-Test Calibration |
|------------------------------------------------------|-------------------|----------------------|-----------------------|
| 2. <u>NECK BENDING TEST</u> ....<br><u>Continued</u> |                   |                      |                       |
| i. Chordal Displacement:                             |                   |                      |                       |
| Head Rotation Angle --                               |                   |                      |                       |
| 60°                                                  | Time              | 67.0 to 83.0 ms      | 68                    |
|                                                      | Displ.            | 4.3 to 5.3 in.       | 4.9                   |
| 30°                                                  | Time              | 85.4 to 104.6 ms     | 90                    |
|                                                      | Displ.            | 2.1 to 3.1 in.       | 2.3                   |
| 0°                                                   | Time              | 101.0 to 123.0 ms    | 104                   |
|                                                      | Displ.            | -.5 to 0.5 in.       | 0                     |
| 3. <u>ABDOMINAL COMPRESSION TEST:</u>                |                   |                      |                       |
| (Preload = 10 pounds)                                |                   |                      |                       |
| a. Force @ 1" - - - - -                              | 50 to 63 lbs.     | 55                   |                       |
| b. Force @ 1.3" - - - - -                            | 73 to 88 lbs.     | 81                   |                       |
| 4. <u>LUMBAR FLEXION TEST:</u>                       |                   |                      |                       |
| a. Force @ 20° - - - - -                             | 22 to 34 lbs.     | 23                   |                       |
| b. Force @ 30° - - - - -                             | 34 to 46 lbs.     | 34                   |                       |
| c. Force @ 40° - - - - -                             | 46 to 58 lbs.     | 47.5                 |                       |
| d. Return Angle - - - - -                            | 12° maximum       | 10.5                 |                       |
| 5. <u>CHEST IMPACT TESTS:</u>                        |                   |                      |                       |
| a. High Speed                                        |                   |                      |                       |
| (1) Probe Speed - -                                  | 21.78-22.22 fps   | 21.85                |                       |
| (2) Peak Deflection -                                | 1.7" maximum      | 1.7                  |                       |
| (3) Peak Resistive Force - - - - -                   | 2250 lbs. maximum | 1823.4               |                       |
| (4) Internal Hysteresis - - - - -                    | 50 to 70%         | 55.8                 |                       |
| b. Low Speed                                         |                   |                      |                       |
| (1) Probe Speed - - -                                | 13.86-14.14 fps   | 14.03                |                       |
| (2) Peak Deflection -                                | 1.1" maximum      | .85                  |                       |
| (3) Peak Resistive Force - - - - -                   | 1450 lbs. maximum | 1213                 |                       |
| (4) Internal Hysteresis- - - -                       | 50 to 70%         | 63                   |                       |

P.572 DUMMY CALIBRATION TEST DATA .....Continued:

Dummy I.D. No.:

|   |   |   |
|---|---|---|
| 1 | 0 | 9 |
|---|---|---|

| TEST PARAMETER               | SPECIFICATION     | Pre-Test Calibration | Post-Test Calibration |
|------------------------------|-------------------|----------------------|-----------------------|
| 6. <u>KNEE IMPACT TESTS:</u> |                   |                      |                       |
| a. Right Side --             |                   |                      |                       |
| (1) Probe Speed - - -        | 6.76 to 7.04 fps  | 6.77                 |                       |
| (2) Maximum Force - -        | 1850 to 2500 lbs  | 2000                 |                       |
| (3) Time Above 1000#         | 1.7 ms minimum    | 1.7                  |                       |
| b. Left Side --              |                   |                      |                       |
| (1) Probe Speed - - -        | 6.76 to 7.04 fps  | 7.02                 |                       |
| (2) Maximum Force - -        | 1850 to 2500 lbs. | 2400                 |                       |
| (3) Time Above 1000#         | 1.7 ms minimum    | 1.8                  |                       |

# INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.:

1 0 9

CALIB. SEQ. NOS. FOR DUMMY: \_\_\_\_\_ & \_\_\_\_\_

## A. DUMMY INSTRUMENTS:

### 1. Head Accelerometers--

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal ( $A_x$ ) -

(2) Lateral ( $A_y$ ) - - -

(3) Vertical ( $A_z$ ) - - -

### 2. Chest Accelerometers-- (Vehicle Crash Test Usage)

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal ( $A_x$ ) -

(2) Lateral ( $A_y$ ) - - -

(3) Vertical ( $A_z$ ) - - -

### 3. Chest Potentiometer - - -

### 4. Femur Load Cells--

a. Right Side - - - - -

b. Left Side

## B. CALIB. LAB. INSTRUMENTS:

1. Pendulum Accelerometer - -

2. Test Probe Accelerometer -

3. Lumbar Flexion Test Push  
Force Gauge - - - - -

4. Abdominal Compression Test  
Force Gauge - - - - -

5. Abdominal Compression Test  
Displacement Gauge - - - -

| MANUFACTURER        | SERIAL<br>NUMBER | DATE LAST<br>CALIBRATED | DATE OF<br>NEXT<br>CALIBRATION |
|---------------------|------------------|-------------------------|--------------------------------|
|                     |                  |                         |                                |
| Endevco             | CM86             | 1/80                    |                                |
| Endevco             | CL60             | 1/80                    |                                |
| Endevco             | CN64             | 1/80                    |                                |
|                     |                  |                         |                                |
| CEC                 | A510<br>17814    | 1/80                    |                                |
| Endevco             | DA87             | 1/80                    |                                |
| CEC                 | A122<br>17932    | 1/80                    |                                |
| Humanoid<br>Special | --               | 4/80                    |                                |
| GSE                 | 81               | 1/80                    |                                |
| GSE                 | 80               | 1/80                    |                                |
| CEC                 | 2437             | 1/80                    |                                |
| CEC                 | 22960            | 1/80                    |                                |
| Transducers<br>Inc. | 20051            | 4/80                    |                                |
| BLH                 | 72952            | 8/79                    |                                |
| BLH                 | 567-11           | 8/79                    |                                |
| C-18                |                  | 6525-V-33               |                                |