

V2209



mga research corporation

**NEW CAR ASSESSMENT PROGRAM**  
**(NCAP)**

**FRONTAL BARRIER IMPACT TEST**

Volkswagen  
1995 Audi A6  
4 Door

MGA Reference No.: C94A-180

MGA PROVING GROUNDS  
5000 WARREN ROAD  
BURLINGTON, WI 53105

Test Date: November 21, 1994

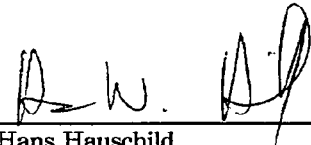
Report Date: December 14, 1994

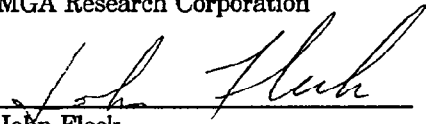
FINAL REPORT


Prepared For:

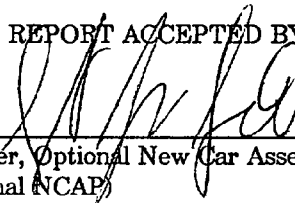
**Volkswagen Of America**  
**3800 Hamlin Road**  
**Auburn Hills, MI 48326**

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(Optional NCAP)

**MAR 07 1995**

Date of Report Acceptance

  
Contracting Officer's Tech. Rep. (COTR)

**MAR 07 1995**

Date of Report Acceptance

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## SECTION 1

### PURPOSE AND TEST PROCEDURE

This 35 mph frontal barrier impact test is part of the Composite FY'95 Vehicle Barrier Impact Testing Program sponsored by Volkswagen of America. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact speed in excess of the current 48 kph (30 mph) FMVSS 208/212/219/301-75 requirements.

The 56 kph (35 mph) frontal barrier impact test was conducted in accordance with the National Highway Traffic Safety Administration (NHTSA) Indicant Test Procedure for New Car Assessment Program (NCAP) dated January 1, 1990. Data for FMVSS No. 212, "Windshield Mounting", FMVSS No. 219 (Partial), "Windshield Zone Intrusion", FMVSS No. 301-75, "Fuel System Integrity," as well as occupant performance data are provided herein.

SECTION 2  
SUMMARY OF FRONTAL BARRIER IMPACT TEST

A load cell barrier consisting of 30 load cells was impacted by a 1995 Audi A6 4-Door at a velocity of 56.4 kph (35.0 mph). The test was performed at the MGA Proving Grounds and Crash Test Center on November 21, 1994. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

The frontal barrier impact event was documented by one real-time camera and 16 high speed cameras. Camera locations and other pertinent camera information can be found in this report.

Two Part 572E, 50th percentile male anthropomorphic test devices (ATDs) were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

Both ATDs were fully instrumented with head, chest triaxial accelerometers, neck load cell, and right/left femur load cells. Seat belt load cells were also on the driver's and passenger's shoulder and lap belts to measure dummy torso and pelvic section loading. The driver ATD (Serial No. 305) and the right-front passenger ATD (Serial No. 307) were calibrated prior to this test. Certification details, along with instrumentation calibration data, are found in Appendix C and D.

The 65 channels of data were recorded on 7 computers. Appendix B contains the vehicle, load cell barrier and dummy response data traces.

The driver's head struck the inflated airbag. The driver HIC was 406. The maximum chest deceleration over 3 milliseconds was 45 g's. The left and right femur loads were 4972 and 6273 Newtons respectively.

The right front passenger's HIC was 339 and maximum chest deceleration over 3 milliseconds was 45 g's. The left and right femur loads were 2887 and 3898 Newtons respectively.

GENERAL TEST AND VEHICLE PARAMETER DATA

Vehicle Yr/Make/Model/Body Style: 1995/Audi/A6/4 Door

VIN.: WAUFB84A2SN024129

Body color: Green Date of Manufacture: 8/94

Engine: 6 Cylinders;    C.I.D.;    Liters; 2771 CC

   Gas;    Diesel;    Turbocharged

   Longitudinal;    Transverse

Transmission: 5 Speed;    Manual;    Automatic;    Overdrive

Final Drive:    Front Wheel;    Rear Wheel;    Four Wheel

Odometer Reading: 86.8 miles

   A/C;    P/S;    P/B;    P/wdo;

   P/seats;    Tilt Wheel;    Cruise Control;

Type of Occupant Restraint: Type II belts with pretensioners and airbags

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): Front 2.81 kg/cm<sup>2</sup> (40 Psi) Rear 2.95 kg/cm<sup>2</sup> (42 Psi)

Recommended Tire Size: 195/65R15

Recommended Cold Tire Pressure: Lightly Loaded

Front 2.39 kg/cm<sup>2</sup> (34 Psi) Rear 2.39 kg/cm<sup>2</sup> (34 Psi)

Fully Loaded

Front 2.81 kg/cm<sup>2</sup> (40 Psi) Rear 2.95 kg/cm<sup>2</sup> (42 Psi)

Tires on Vehicle: 195/65R15 ; Manufacturer: Goodyear

Number of Occupants: 2 Front; 3 Rear;    3rd Seat; 5 TOTAL

Type of Front Seats:    Bucket;    Bench;    Split Bench

Type of Front Seat Back:    Fixed;    Adj. With;    Power (driver);    Lever (passenger)

Vehicle Capacity Weight (VCW) = 519.0 kg. (A)

No. of Occupants x 68.0 kg. = 340.0 kg. (B)

Rated Cargo Weight (RCW) A-B = 179.0 kg.

GVWR 2040 kg. GAWR: Front 1150 kg.; Rear 1050 kg.

GENERAL TEST AND VEHICLE PARAMETER DATA (Cont'd)

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

Right Front = 458 kg                      Right Rear = 301 kg

Left Front = 474 kg                      Left Rear = 297 kg

TOTAL FRONT WEIGHT = 932 kg (60.9% of Total Vehicle Weight)

TOTAL REAR WEIGHT = 598 kg (39.1% of Total Vehicle Weight)

TOTAL UNLOADED DELIVERED WEIGHT (UDW) = 1530 kg

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight 1530 kg

VCW = Vehicle Capacity Weight 519 kg      DSC = Designated Seating Capacity 5

RCW = VCW - 68 (DSC) = 179 \*kg

Target Test Weight = UDW + RCW + (2 dummies x 75.8 kg/dummy)

Calculated Target Test Weight = 1861 kg

Target Test Weight = 1837\*\* kg      \*\* supplied by manufacturer

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND CARGO:

Right Front = 496 kg                      Right Rear = 400 kg

Left Front = 519 kg                      Left Rear = 418 kg

TOTAL FRONT WEIGHT = 1015 kg (55.4% of Total Vehicle Weight)

TOTAL REAR WEIGHT = 818 kg (44.6% of Total Vehicle Weight)

TOTAL TEST WEIGHT = 1833 kg

Weight of ballast secured in vehicle trunk area = 91 kg

Vehicle components removed to meet target weight: None noted

VEHICLE ATTITUDE (all dimensions in mm):

Delivered Attitude:    RF 700    LF 700    RR 705    LR 697

Test Attitude:            RF 690    LF 684    RR 662    LR 656

Wheel Base: 2692 mm;      C.G. = 1201 mm rearward of front wheel C/L

Remarks: None

\*light trucks and MPVs RCW is 136 kgs or manufacturer's value, whichever is less

GENERAL TEST AND VEHICLE PARAMETER DATA (Cont'd)

POST-IMPACT DATA:

Type of Test: 35 mph Frontal Impact Impact Angle: 90°  
Scheduled Date of Test: November 21, 1994 Time of Test: 3:09 a.m.  
Date of Test: November 22, 1994  
Ambient Temperature: 22 °C (Spec. Range = 18.8 to 25.6°C)  
Temperature in Occupant Compartment: 22° C  
Windshield Molding Temperature: 22° C  
Required Impact Velocity Range: 55.5 to 57.1 kph  
Impact Velocity: primary = 56.4 kph; secondary = 56.4 kph  
Distance From Front Bumper to Barrier Face When  
Entering Speed Trap: 1279 mm  
Exiting Speed Trap: 279 mm

VEHICLE REBOUND AND CRUSH ( mm ):

Vehicle Length: Pre-test = R 4653 C<sub>L</sub> 4866 L 4662  
Post-test = R 4130 C<sub>L</sub> 4250 L 4085  
Crush = R 523 C<sub>L</sub> 616 L 577

Distance from front of test vehicle to point of impact (rebound):

R 464 mm C<sub>L</sub> 475 mm L 503 mm

VISIBLE DUMMY CONTACT POINTS:

	<u>Driver</u>	<u>Passenger</u>
Head	<u>To airbag</u>	<u>To airbag</u>
Chest	<u>None Noted</u>	<u>None Noted</u>
Abdomen	<u>None Noted</u>	<u>None Noted</u>
Left Knee	<u>To lower dash panel</u>	<u>To lower dash panel</u>
Right Knee	<u>To lower dash panel</u>	<u>To lower dash panel</u>

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

<u>Door Opening</u>	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
(without use of tools)	<u>opened</u>	<u>opened</u>	<u>opened</u>	<u>opened</u>

<u>Seat Movement</u>	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Seat Back Movement	<u>0</u>	<u>0</u>	<u>N/A</u>	<u>N/A</u>
Seat Shift (mm)	<u>4 forward</u>	<u>30 forward</u>	<u>N/A</u>	<u>N/A</u>

Glazing Damage

Backlight/Windshield Cracked windshield

Other Notable Impact Effects: None noted

SECTION 3

SUMMARY OF RESULTS FOR-----

FMVSS 212, "Windshield Mounting"

FMVSS 219 (Partial), "Windshield Zone Intrusion"

FMVSS 301-75, "Fuel System Integrity"

FMVSS NO. 212, "WINDSHIELD MOUNTING", DATA SHEET

Details of windshield mounting such as retention method, trim type, etc.:

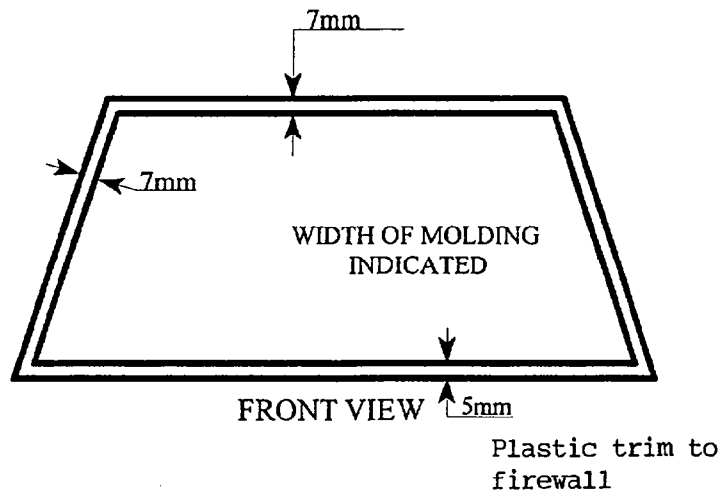
Windshield set in rubber with glue retention

FMVSS 212 Requirements: The Post-Test periphery retention amount must be at least 75% of the Pre-Test periphery measurement for vehicles NOT equipped with automatic restraints, and 50% for each side of windshield for vehicles equipped with automatic restraint systems for front occupants.

FMVSS 212 TEST DATA:

	WINDSHIELD PERIPHERY		PERCENT RETENTION
	PRE-TEST (mm)	POST-TEST (mm)	
RIGHT SIDE	2019	2019	100%
LEFT SIDE	2019	2019	100%
TOTAL	4038	4038	100%

AREA OF RETENTION FAILURE: None



FAILURE DETAILS: None

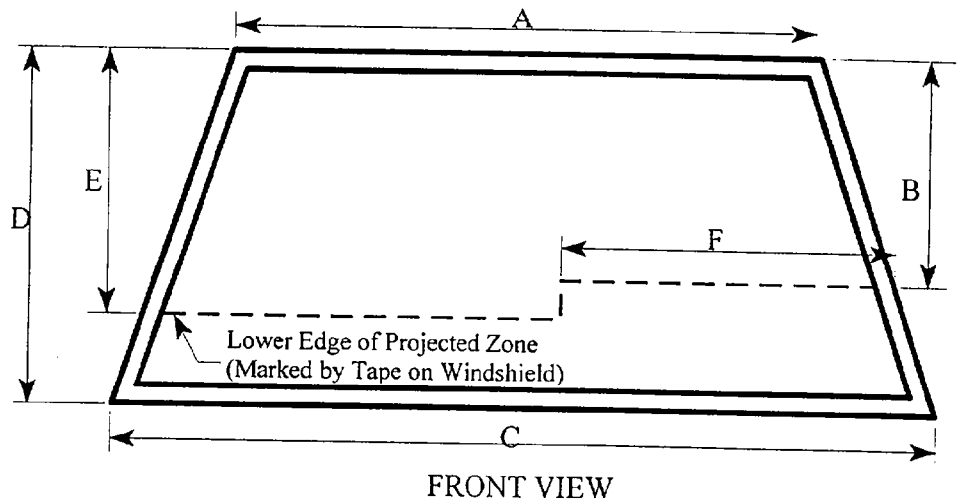
FMVSS NO. 219, "WINDSHIELD ZONE INTRUSION", DATA SHEET

PROTECTED ZONE LOWER EDGE REQUIREMENT:

The lower edge of the protected zone is determined by placing a 6.5" dia. rigid sphere weighing 15 pounds in a position such that it simultaneously contacts the inner surface of the windshield and the top surface of the instrument panel including padding. Draw the locus of points on the inner surface of the windshield contacted by the sphere across the width of the instrument panel. From the outermost contact points, extend the locus line horizontally to the edges of the windshield, and then draw a line on the inner surface of the windshield below and 1/2" distant from the locus line. The LOWER EDGE OF THE PROTECTED ZONE is the longitudinal projection onto the outer surface of the windshield of this line.

FMVSS 219 TEST DATA:

A= 1125 mm  
B= 520 mm  
C= 1572 mm  
D= 670 mm  
E= 408 mm  
F= 825 mm



DETAILS OF WINDSHIELD GLASS PENETRATION GREATER THAN 1/4":  
(Show location of penetration)

NONE

FMVSS NO. 301-75, FUEL SYSTEM INTEGRITY POST IMPACT TEST DATA

FMVSS NO. 301

Test Date: November 21, 1994

Vehicle Mfgr./Make/Model: 1995/Audi/A6/4 Door

Usable Capacity of Vehicle's Fuel Tank: 79.9 Liters  
(figure furnished by vehicle manufacturer)

TEST REQUIREMENTS:

Test vehicle's engine operated to "run dry" condition, and then a small amount of stoddard solvent which has been dyed red shall be added to the vehicle's fuel tank. Operate the fuel pump enough to completely fill the fuel system ahead of the fuel tank, and add 92 to 94% of the stated USABLE CAPACITY to the fuel tank.

AMOUNT OF STODDARD SOLVENT ADDED TO VEHICLE'S FUEL TANK:

73.8 Liters which is 92 % of the stated USABLE CAPACITY.

TEST VEHICLE IMPACT TYPE:

- Frontal (35 mph)  
 Oblique (30 mph) with \_\_\_° barrier face first  
    contacting (driver/passenger) side  
 Rear Moving Barrier (30 mph)  
 Side Impact MDB (33.2 mph)

FUEL SPILLAGE MEASUREMENT:

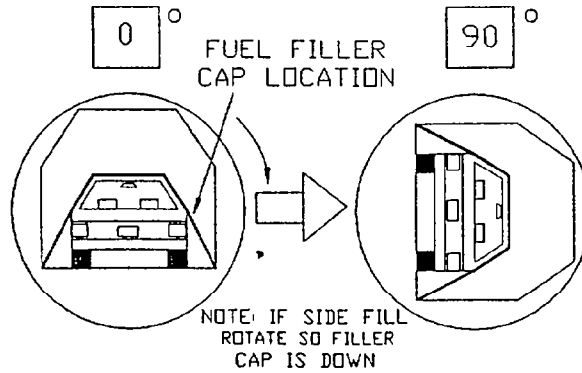
1. From impact until vehicle motion ceases
2. For 5 minute period after vehicle motion ceases
3. For next 25 minutes

ACTUAL	MAX ALLOWED
0	1 OZ
0	5 OZ
0	1 oz./1 MIN

SOLVENT SPILLAGE DETAILS: None

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

TEST PHASE: 0° - 90°



**I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:**

Rollover Fixture 90° Rotation Time      2   minutes  44  seconds  
 (Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time +      5   minutes   0   seconds  
 TOTAL                                      7   minutes  44  seconds  
 Next whole minute interval          8   minutes

**II. FMVSS 301 REQUIREMENTS:**

(1) Time Period

First 5 min FROM onset of rotation	6th min.	7th min.	8th min. if reqd.
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(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce
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**III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:**

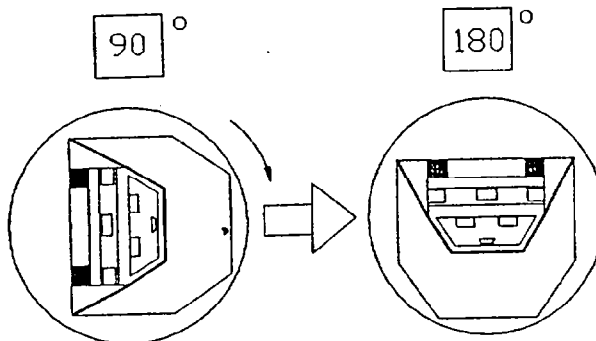
0	0	0	0
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Note: Record Spillage for whole minute intervals only as determined above.

**IV. SOLVENT SPILLAGE LOCATIONS(S): None**

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

TEST PHASE: 90° - 180°



**I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:**

Rollover Fixture 90° Rotation Time  2  minutes  34  seconds  
 (Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time +  5  minutes  0  seconds  
**TOTAL**  7  minutes  34  seconds  
 Next whole minute interval  8  minutes

**II. FMVSS 301 REQUIREMENTS:**

(1) Time Period

First 5 min FROM onset of rotation	6th min.	7th min.	8th min. if reqd.
------------------------------------	----------	----------	-------------------

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce
----------	---------	---------	---------

**III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:**

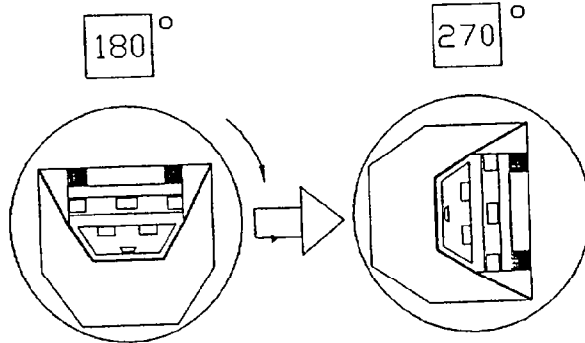
0	0	0	0
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Note: Record Spillage for whole minute intervals only as determined above.

**IV. SOLVENT SPILLAGE LOCATIONS(S): None**

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

TEST PHASE: 180° - 270°



**I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:**

Rollover Fixture 90° Rotation Time   2   minutes  10  seconds  
(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time +   5   minutes   0   seconds  
**TOTAL**   7   minutes  10  seconds  
 Next whole minute interval   8   minutes

**II. FMVSS 301 REQUIREMENTS:**

(1) Time Period

First 5 min FROM onset of rotation	6th min.	7th min.	8th min. if reqd.
------------------------------------	----------	----------	-------------------

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce
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**III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:**

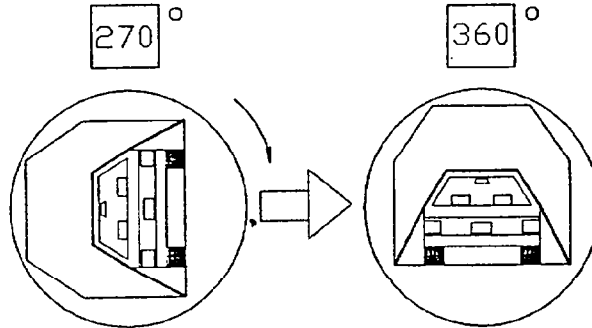
0	0	0	0
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Note: Record Spillage for whole minute intervals only as determined above.

**IV. SOLVENT SPILLAGE LOCATIONS(S): None**

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

TEST PHASE: 270° - 360°



**I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:**

Rollover Fixture 90° Rotation Time  2  minutes  42  seconds  
 (Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time +  5  minutes  0  seconds  
**TOTAL**  7  minutes  42  seconds  
 Next whole minute interval  8  minutes

**II. FMVSS 301 REQUIREMENTS:**

(1) Time Period

First 5 min FROM onset of rotation	6th min.	7th min.	8th min. if reqd.
------------------------------------	----------	----------	-------------------

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce
----------	---------	---------	---------

**III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:**

0	0	0	0
---	---	---	---

Note: Record Spillage for whole minute intervals only as determined above.

**IV. SOLVENT SPILLAGE LOCATIONS(S): None**

SECTION 4  
OMI FINAL DATA

Occupant and Vehicle Information

I. OMI DATA

1. Dummy Injury Criteria Data Summary
2. Dummy Positioning Data
3. Seat Belt Positioning Data
4. Seat Belt Performance Assessment Data
5. Camera Locations
6. Vehicle Target Locations

II. OVR DATA

1. Load Cell Barrier Data
2. Vehicle Accelerometer Data
3. Test Vehicle Measurements

III. AID DATA

1. Accident Investigation Damage Data Summary

**FMVSS NO. 208, "OCCUPANT CRASH PROTECTION", DATA SHEET**

VEH. YR./MAKE/MODEL/BODY STYLE: 1995/Audi/4 Door

TEST DATE: November 21, 1994

MAX. ACCELERATION VALUES: (g's)	DRIVER # <u>305</u>	PASSENGER # <u>307</u>
Head Channel X	-54.0	-45.1
Head Channel Y	-8.5	-6.1
Head Channel Z	23.8*	28.2
HEAD RESULTANT	55.8**	48.6
Chest Channel X	-44.9	-46.0
Chest Channel Y	-4.9	-4.9
Chest Channel Z	14.5	14.0
CHEST RESULTANT (CLIP)	45.3	44.9
TIME INTERVAL (msec) [0.003 seconds minimum]	t <sub>1</sub> = 62.87 t <sub>2</sub> = 65.93	t <sub>1</sub> = 76.45 t <sub>2</sub> = 99.51

\* Secondary Head Z

\*\* Secondary Head Z used to  
calculate resultant

**HEAD INJURY CRITERIA (HIC) VALUES:**

HIC	405.8	339.3
t <sub>1</sub> = (msec)	50.26	59.68
t <sub>2</sub> = (msec)	86.24	95.67
Avg. Accel. t <sub>1</sub> to t <sub>2</sub> (g's)	41.8	38.9

[The maximum time interval from t<sub>1</sub> to t<sub>2</sub> is 36 milliseconds.]

**MAX. COMPRESSIVE FEMUR FORCES:**

Left Side (N)	4972	2887
Right Side (N)	6273	3898

**MAXIMUM SEAT BELT FORCES:**

Lap Belt (N)	6023	5774
Shoulder Belt (N)	6314	8836

NOTE: All values listed must occur during primary impact event.  
(Head X,Y,Z and R listed must be during t<sub>1</sub> to t<sub>2</sub> HIC interval)

HYBRID III NECK AND CHEST DATA SHEET

VEHICLE YR./MAKE/MODEL/BODY STYLE: 1995/Audi/A6/4 Door

TEST DATE: November 21, 1994

MAXIMUM VALUES	DRIVER DUMMY #305	PASSENGER DUMMY #307
Neck Load X (N)	-562	956.0
Neck Load Y (N)	311	-209.0
Neck Load Z (N)	-1841	-1714.0
Neck Moment X (N.M)	-13.4	10.0
Neck Moment Y (N.M)	-26.4	-34.0
Neck Moment Z (N.M)	-11.5	11.4
Chest Deflection X (mm)	8.0	11.0
Time of Max. Occurrence	76 msec.	82 msec.

PART 572 DUMMY IN-VEHICLE POSITION

Vehicle: 1995/Audi A6 4 Door

SEAT TYPE:

Bench  
 Bucket  
 Split Bench

ADJUSTER TYPE:

Driver:  Manual  
 Power  
 Passenger:  Manual  
 Power

BUCKET SEAT BACK TYPE:

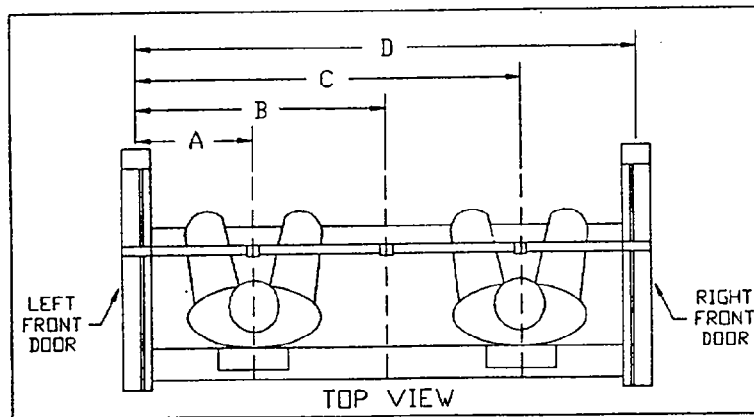
Fixed  
 Adjustable Reclining

Driver

Passenger

Seat adjusted to mid position  
 105 mm of 210 mm of adjustment  
 forward and backward

Seat adjusted to 7th notch from front of 12 notches



305 DUMMY ID 307

- |  |                |
|--|----------------|
| A = Left Door to Driver Centerline           | <u>418</u> mm  |
| B = Left Door to Center Passenger Centerline | <u>760</u> mm  |
| C = Left Door to Right Passenger Centerline  | <u>1115</u> mm |
| D = Left Door to Right Door                  | <u>1520</u> mm |

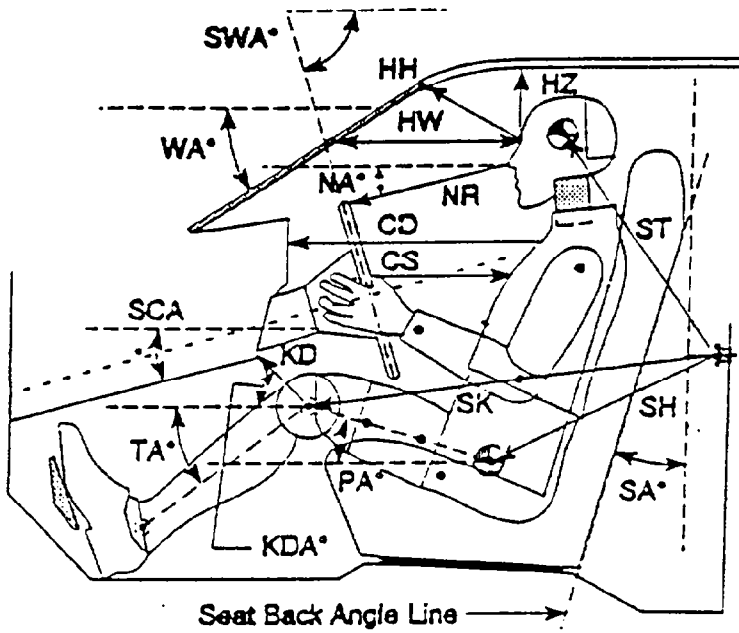
FRONT SEAT MEASUREMENT TABLE

Units (mm)

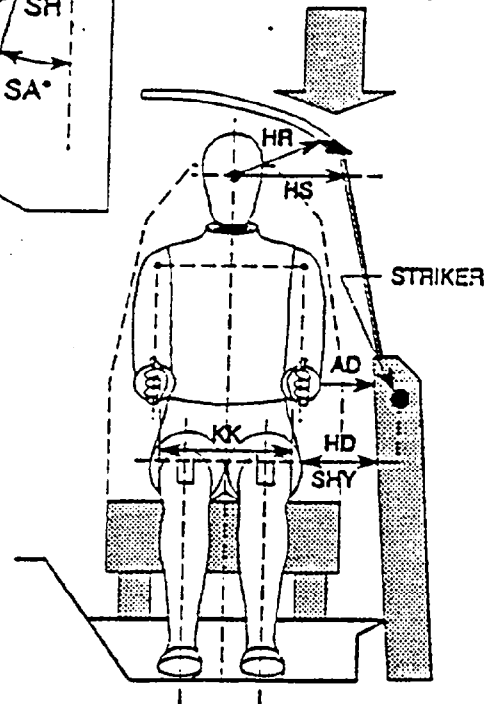
	DRIVER (Serial #305)	PASSENGER (Serial #307)
WA°	29.5°	
SWA°	21.1°	N/A
SCA°	25.6°	N/A
SA°	13.0°	13.0°
HZ	160	161
HH	307	332
HW	529	560
HR	240	253
NR	397	N/A
CD	497	512
CS	322	N/A
RA	212	N/A
KDL	175 Angle 18.8°	163
KDR	189	174 Angle 35.4°
PA°	22.2°	21.0°
TA°	47.0°	39.9°
KK	310	251
ST	517 Angle 13.0°	492 Angle 13.0°
SK	570 Angle .3°	589 Angle 4.8°
SH	259 Angle 126.6°	245 Angle 41.4°
SHY	281	282
HS	308	315
HD	204	197
AD	130	69

N/A = Not Applicable

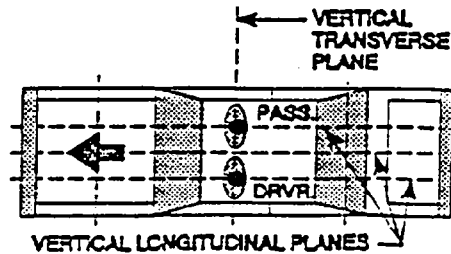
# FRONT SEAT MEASUREMENTS



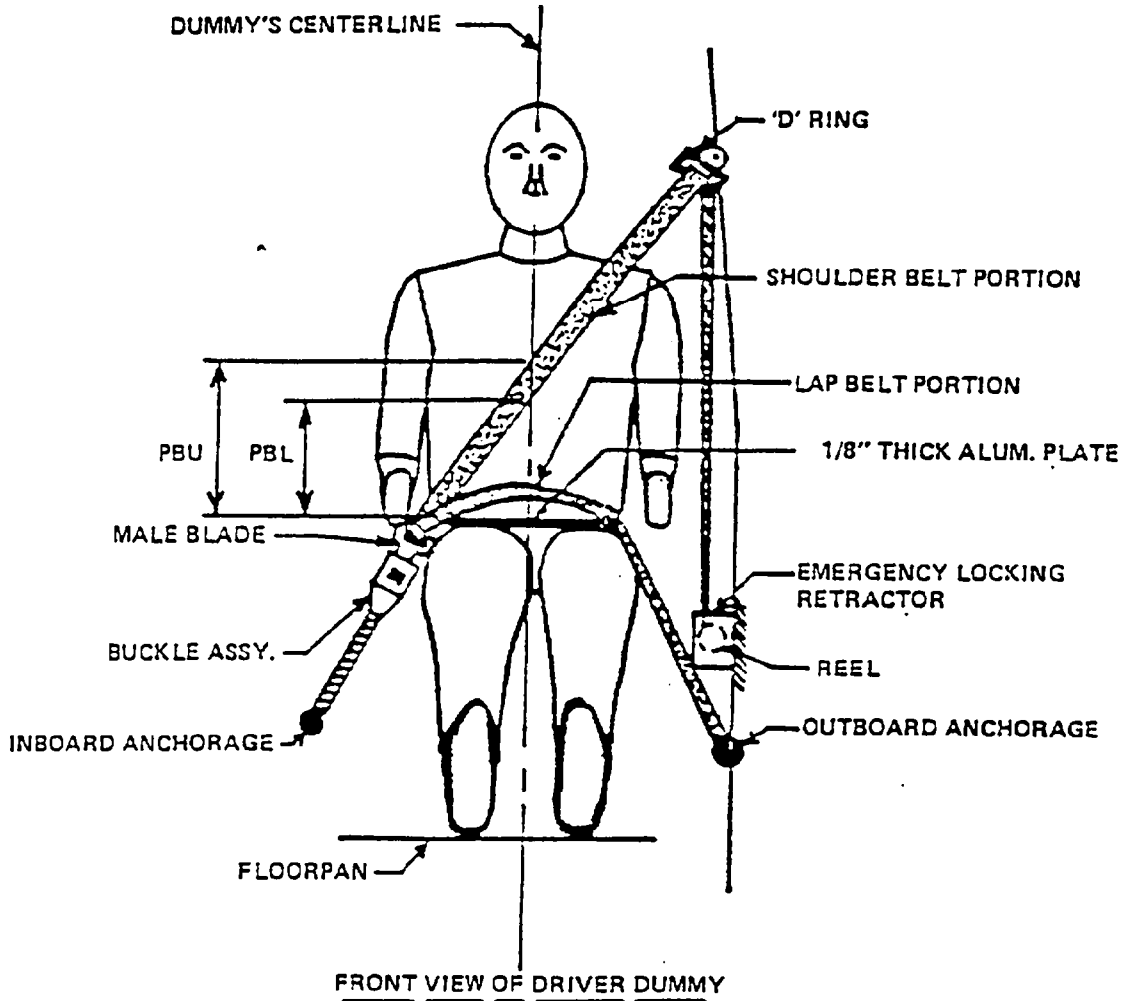
- AD - Arm to Door
- HD - H-Point to Door
- HR - Head to Side Header
- HS - Head to Side Window
- KK - Knee to Knee
- SHY - Striker to H-Point (Y Direction)



- CD - Chest to Dash
- CS - Steering Wheel to Chest
- HH - Head to Header
- HW - Head to Windshield
- HZ - Head to Roof
- KDA - Knee to Dash Angle
- KDL - Left Knee to Dash
- KDR - Right Knee to Dash
- NA - Nose to Rim Angle
- NR - Nose to Rim
- PA - Pelvic Angle
- RA - Rim to Abdomen
- SA - Seat Back Angle
- SCA - Steering Column Angle
- SH - Striker to H-Point
- SK - Striker to Knee
- ST - Striker to Head
- SWA - Steering Wheel Angle
- TA - Tibial Angle
- WA - Windshield Angle



### SEAT BELT POSITIONING DATA



(illustration)

		Dimension = mm	
		DRIVER DUMMY	PASSENGER DUMMY
<u>PBU</u> --	Top surface of alum. plate to upper edge	330	335
<u>PBL</u> --	Top surface of alum. plate to belt lower edge	260	245

Note: Adjustable "D" ring set in the fourth position for the highest.

SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

<u>BELT LENGTH DATA:</u>	<u>Driver</u>	<u>Passenger</u>
Belt length from trim panel exit to bolt hole anchor point for continuous webbing systems.	<u>685 mm</u>	<u>690 mm</u>
Shoulder belt length as measured on Part 572 Dummy.	<u>940 mm</u>	<u>940 mm</u>
Lap belt length as measured on Part 572 Dummy.	<u>790 mm</u>	<u>770 mm</u>

SHOULDER BELT SPOOL-OFF DATA:

As determined by film analysis	<u>0**</u>	<u>0**</u>
As determined mechanically Lap	<u>3 mm</u>	<u>50 mm</u>
Shoulder	<u>3 mm</u>	<u>0 mm</u>
As determined electronically*	<u>N/A</u>	<u>N/A</u>

\* Transducers not mounted due to interference with belt system

BELT STRETCH DATA:

Measured electronically between shoulder belt load cell and the "D" ring.	<u>NR</u>	<u>NR</u>
Measured mechanically	<u>NR</u>	<u>NR</u>

RETRACTOR LOCK-UP TIME:

As determined by shoulder belt spool-off observed in on-board cameras	<u>N/A**</u>	<u>N/A**</u>
---	--------------	--------------

NR = Not Recorded

\*\* Belts equipped with pretensioners. Belts retract on impact.

CAMERA LOCATIONS

TEST DATE: November 21, 1994; TIME: 3:09 a.m.

VEH. YEAR/MAKE/MODEL/BODY STYLE: 1995/Audi/A6/4 Door

CAMERA POSITION NO.	VIEW	CAMERA POSITIONS (mm.)*			ANGLE (deg)	FILM PLANE TO HEAD TARGET (mm)	LENS (mm)	SPEED (fps)
		X	Y	Z				
1	Real-Time Left Side View	-	-	-	-	-	10	24
2	Left Front View	1880	8020	1150	90°	7608	25	909
3	Steering Column Top	2140	7260	1540	90°	6848	25	943
4	Steering Column Bottom	2140	7260	1060	90°	6848	25	948
5	Left Driver Close-up	1540	7720	1170	90°	7308	35	877
6	Left Angle	4520	4400	1910	50°		50	1205
7	Driver Onboard						35	1000
9	Right Overall	2330	-7470	1050	90°	7045	13	1205
10	Right Front		-8120	1125	90°	7705	25	935
11	Right Passenger Close-up	1320	-7510	1160	90°	7085	50	725
12	Right Angle	4000	-5100	2010	50°		35	no timing
13	Top View Wide	446	0	4360			13	no timing
14	Top Driver	-320	360	2380			13	1124
15	Top Passenger	-320	-400	2435			13	1099
16	Pit Front	1120	0	-3165			13	1005
17	Pit Rear	2300	0	-3155			13	1282

\* COORDINATES:

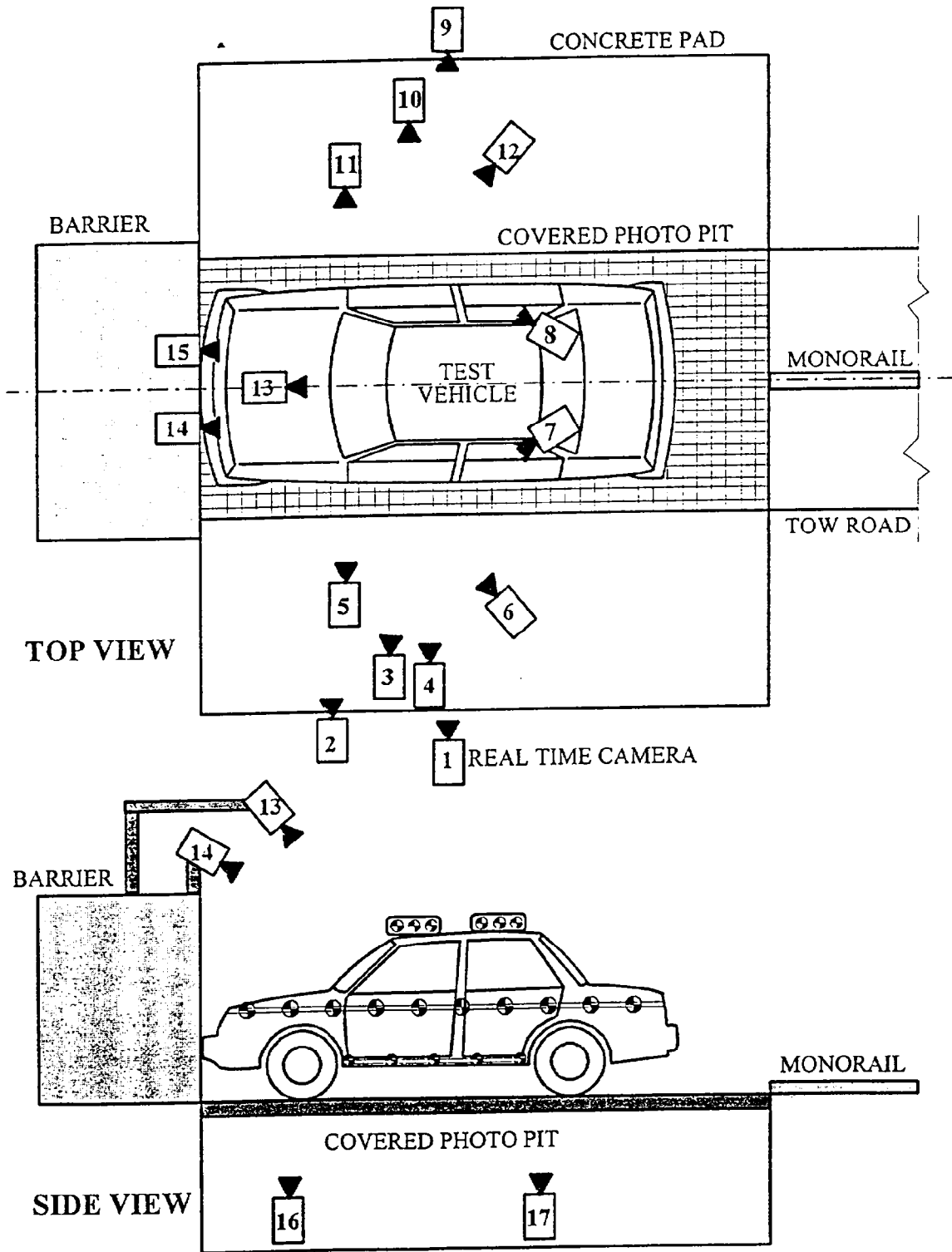
+X = film plane rearward of barrier

+Y = film plane to left of monorail centerline

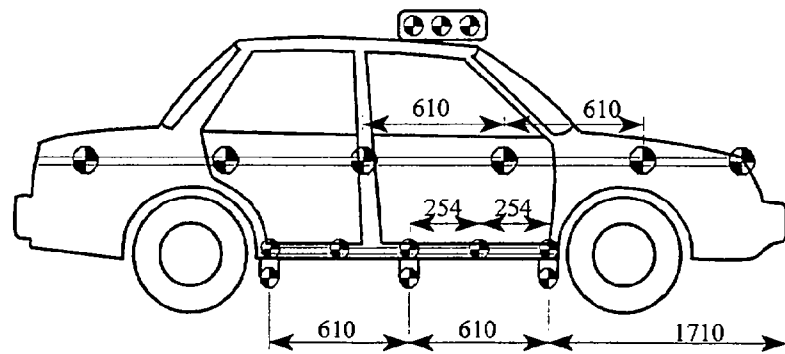
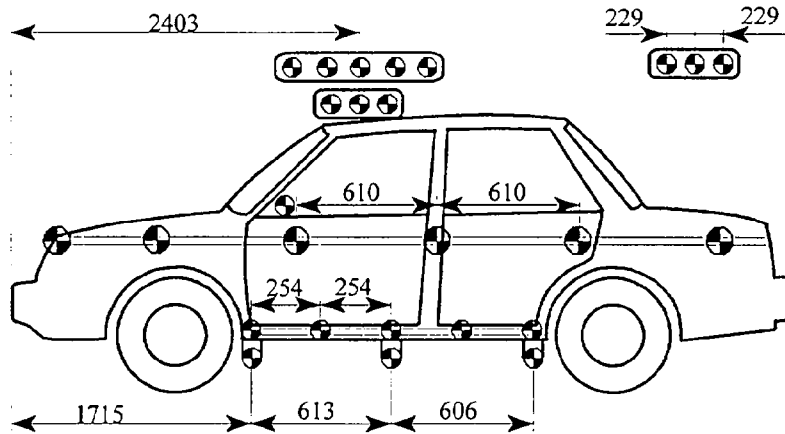
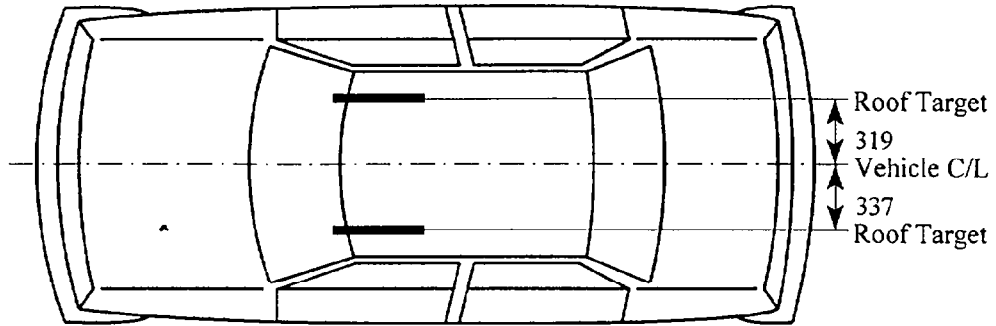
+Z = film plane to above ground level

ORIGIN: For X and Y it is the Impact Point. For Z it is the Floor.

CAMERA LOCATIONS (Cont'd)



# VEHICLE TARGET LOCATIONS



(DIMENSIONS IN MM)

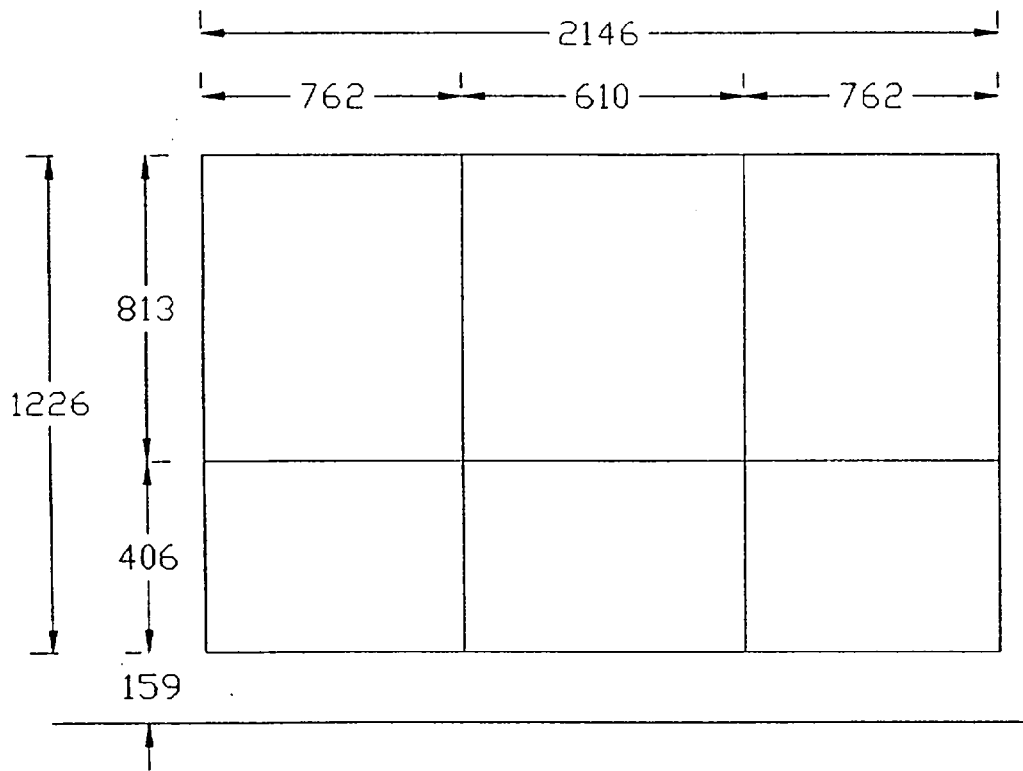
## LOAD CELL LOCATIONS ON FIXED BARRIER

30 Load Cells

6 Rows

9 Columns

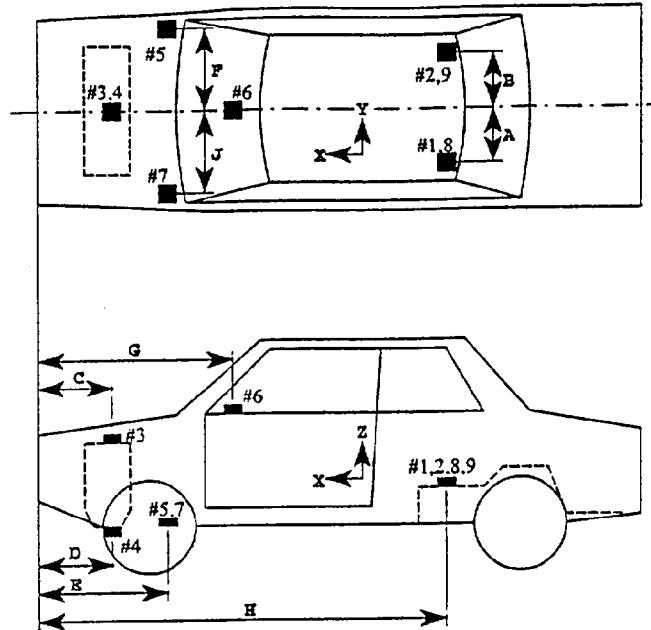
6 Groupings (5 cells/group)



The following data is presented in Appendix B:

- (1) Total or Sum of 30 individual load cells
- (2) Data from 6 Groupings shown above (5 cells/group)

VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY



Units: (mm)

Dimension	Length
A	655
B	655
C	741
D	628
E	966
F	690
G	1666
H	3208
J	690

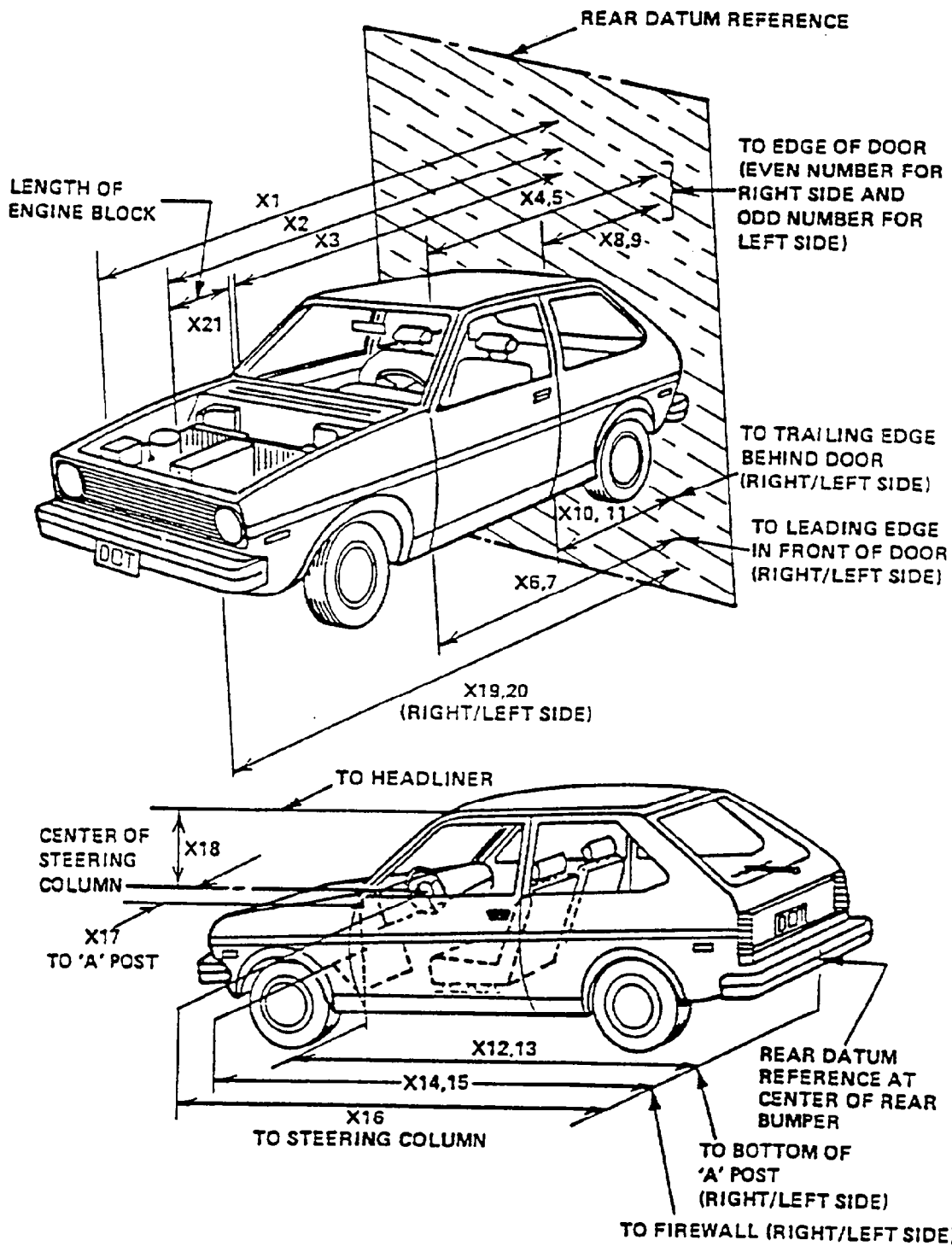
ACCEL. NO.	ACCELEROMETER	DIRECTION
1 and 8	Left Rear Seat Crossmember	X
2 and 9	Right Rear Seat Crossmember	X
3	Top of Engine	X
4	Bottom of Engine	X
5	Right Side Brake Caliper	X
6	Instrument Panel	X
7	Left Disc Brake Caliper	X

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

TEST VEHICLE MEASUREMENTS

No.	MEASUREMENT DESCRIPTION:	Pre-Test (mm)	Post-Test (mm)	Diff. (mm)
X1	Total Length of Test Vehicle at Centerline	4866	4250	616
X2	Rear Surface of Vehicle to Front of Engine	4364	4010	354
X3	Rear Surface of Vehicle to Firewall	3800	3540	260
X4	Rear Surface to Upr. Leading Edge of Rt. Door	3204	3200	4
X5	Rear Surface to Upr. Leading Edge of Left Door	3196	3192	4
X6	Rear Surface to Lwr. Leading Edge of Rt. Door	3267	3251	16
X7	Rear Surface to Lwr. Leading Edge of Left Door	3257	3260	-3
X8	Rear Surface to Upr. Trailing Edge of Rt. Door	2205	2204	1
X9	Rear Surface to Upr. Trailing Edge of Left Door	2219	2195	24
X10	Rear Surface to Lwr. Trailing Edge of Rt. Door	2222	2214	8
X11	Rear Surface to Lwr. Trailing Edge of Left Door	2219	2222	-3
X12	Rear Surface to Bottom of 'A' Post on Rt. Side	3270	3260	10
X13	Rear Surface to Bottom of 'A' Post on Left Side	3264	3265	-1
X14	Rear Surface to Firewall on Right Side	3666	3604	62
X15	Rear Surface to Firewall on Left Side	3661	3515	146
X16	Rear Surface to Steering Column	2823	2797	26
X17	Center of Steering Column to 'A' Post	383	263	120
X18	Center of Steering Column to Headlining	413	290	123
X19	Rear Surface to Right Side of Front Bumper	4653	4130	523
X20	Rear Surface to Left Side of Front Bumper	4662	4085	577
X21	Length of Engine Block	390	390	0

# TEST VEHICLE MEASUREMENTS



ACCIDENT INVESTIGATION DIVISION DATA  
FOR 35 MPH FRONTAL BARRIER IMPACT

VEHICLE MAKE/MODEL/BODY STYLE: 1995/Audi/A6/4 Door

VIN: WAUFB84A2SN024129

MODEL YEAR: 1995 ; BUILD DATE: 8/94 ; TEST DATE: November 21, 1994

VEH. SIZE CATEGORY: Mid Size ; TEST WEIGHT: 1833 kg

VEH. WHEELBASE: 2692 mm ; FRONT OVERHANG: 1067 mm ; OVERALL WIDTH: 1777 mm

ACCELEROMETER DATA:

LOCATION: As per measurements on pages 4-12

CALIBRATION PROCEDURE: As per MGA Calibration Procedure

LINEARITY: >99.9% ; INTEGRATION ALGORITHM: Trapezoidal

VEH: IMPACT SPEED: 56.4 kph ; TIME OF SEPARATION: 97 msec

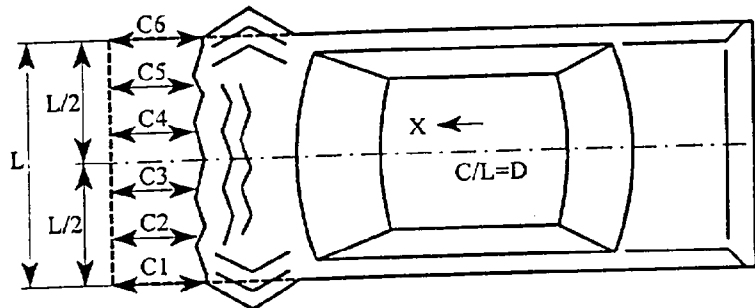
VELOCITY CHANGE: 65.6 kph

COLLISION DEFORMATION CLASSIFICATION (CDC) CODE:

F (Frontal)

CRUSH DEPTH DIMENSIONS:

C1 = 577 mm  
 C2 = 573 mm  
 C3 = 600 mm  
 C4 = 582 mm  
 C5 = 538 mm  
 C6 = 523 mm



MIDPOINT OF DAMAGE: D = Vehicle Centerline (Longitude)

LENGTH OF DAMAGED REGION: L = 1450 mm

APPENDIX A  
PHOTOGRAPHS

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Photo No. A-40 - Post-Test Passenger Knee Contact	A-40
Photo No. A-41 - Vehicle Certification Label	A-41
Photo No. A-42 - Impact	A-42

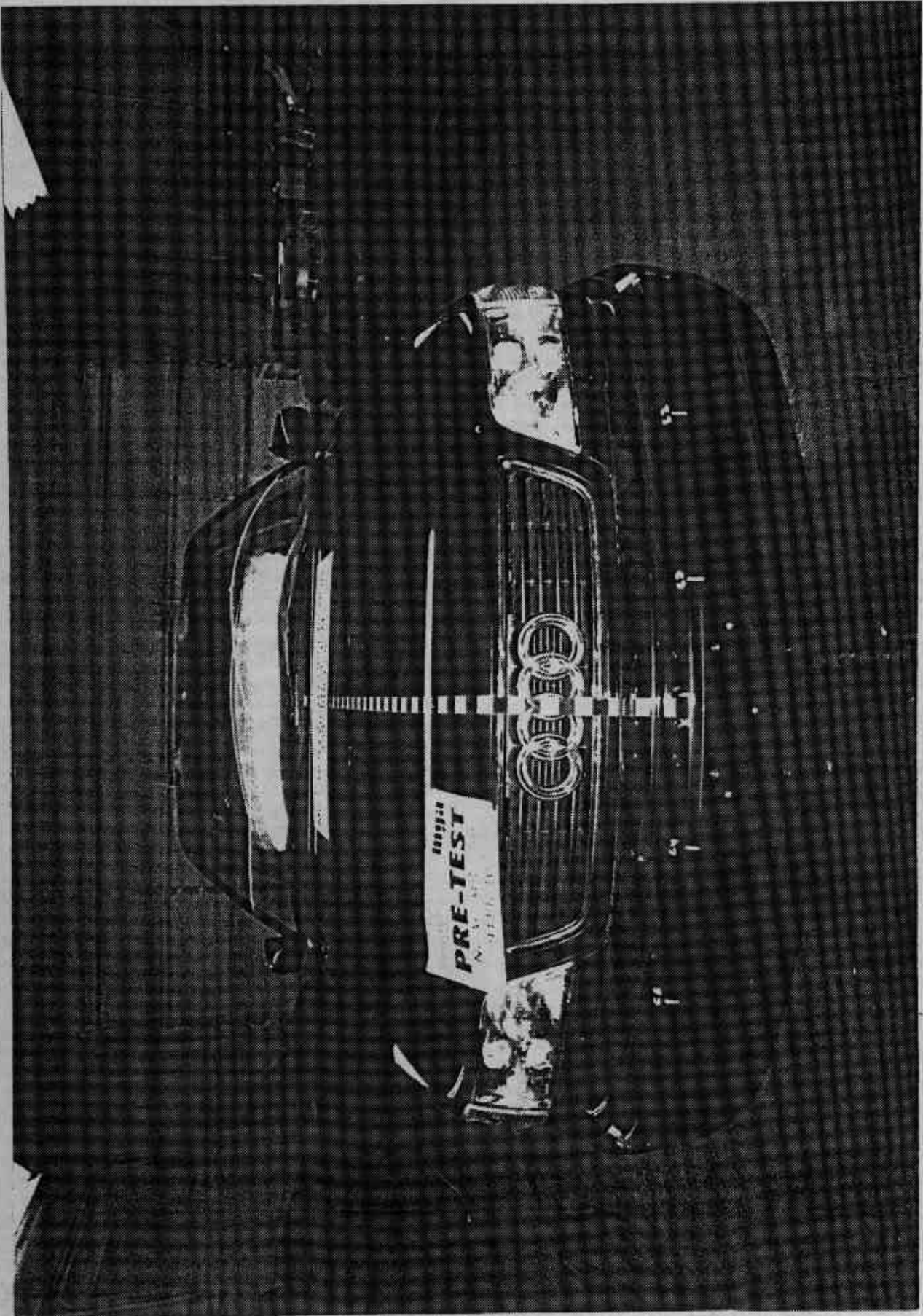


Photo No. A-1 - Pre-Test Front View of Test Vehicle

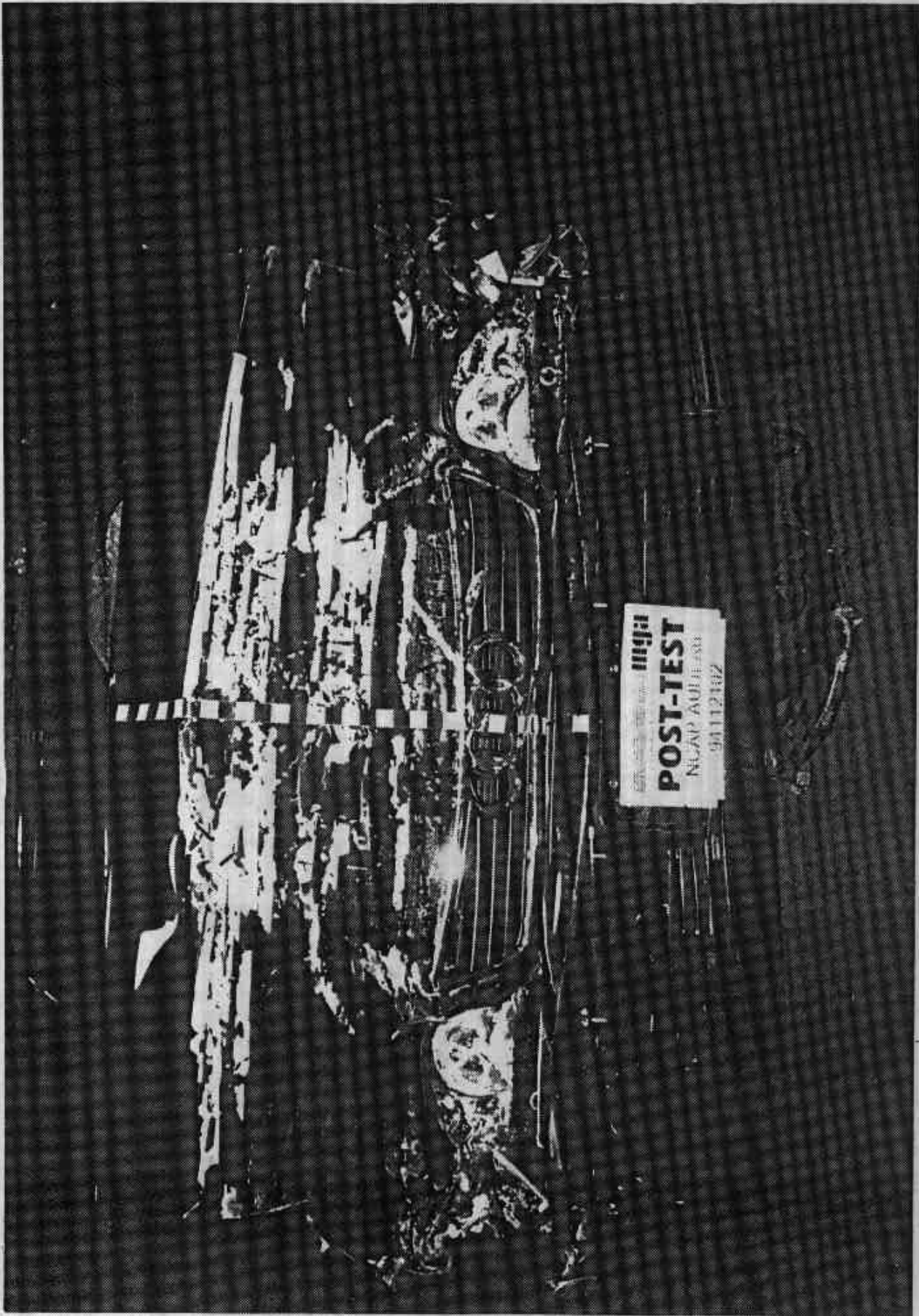


Photo No. A-2 - Post-Test Front View of Test Vehicle

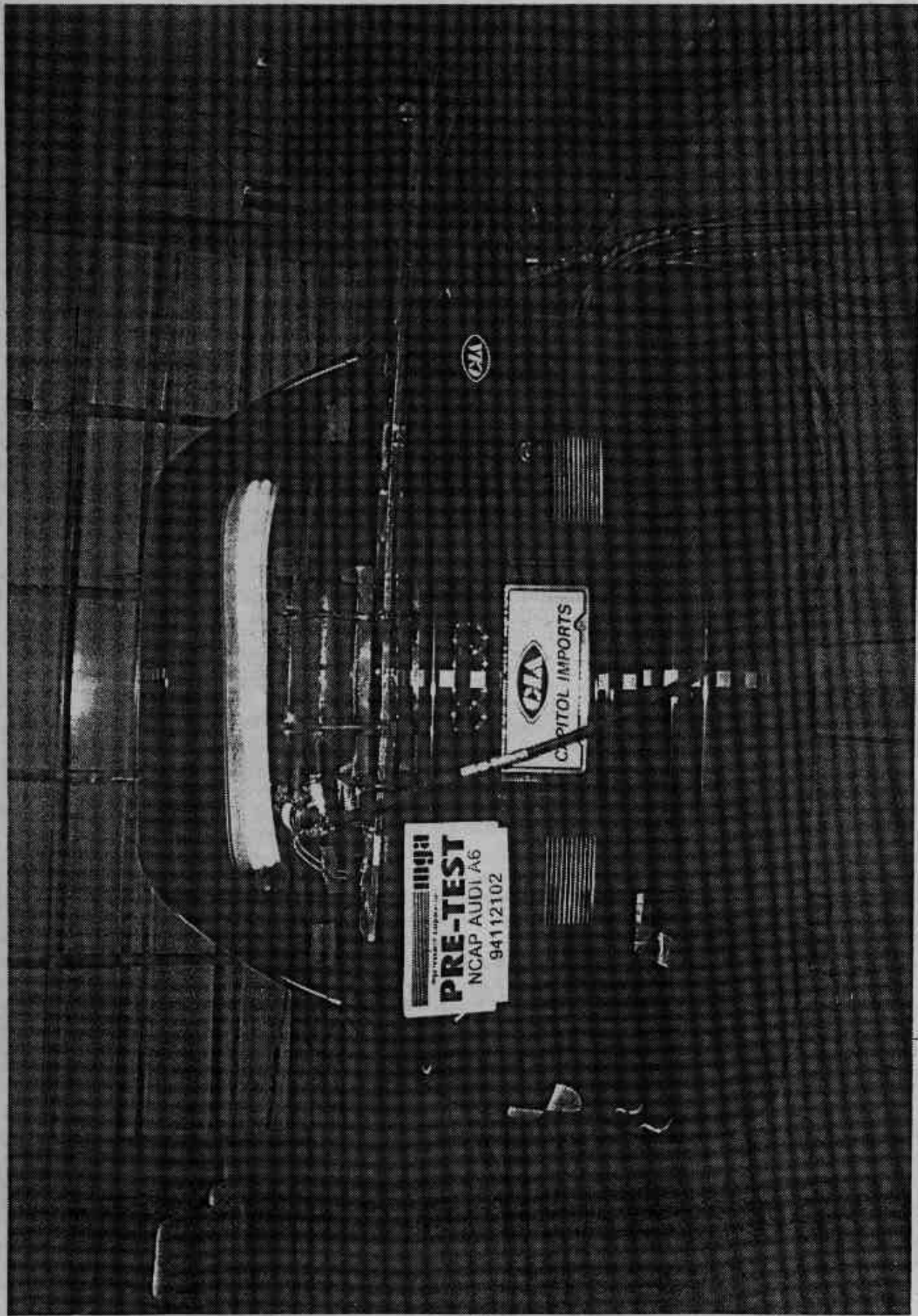


Photo No. A-3 - Pre-Test Rear View of Test Vehicle

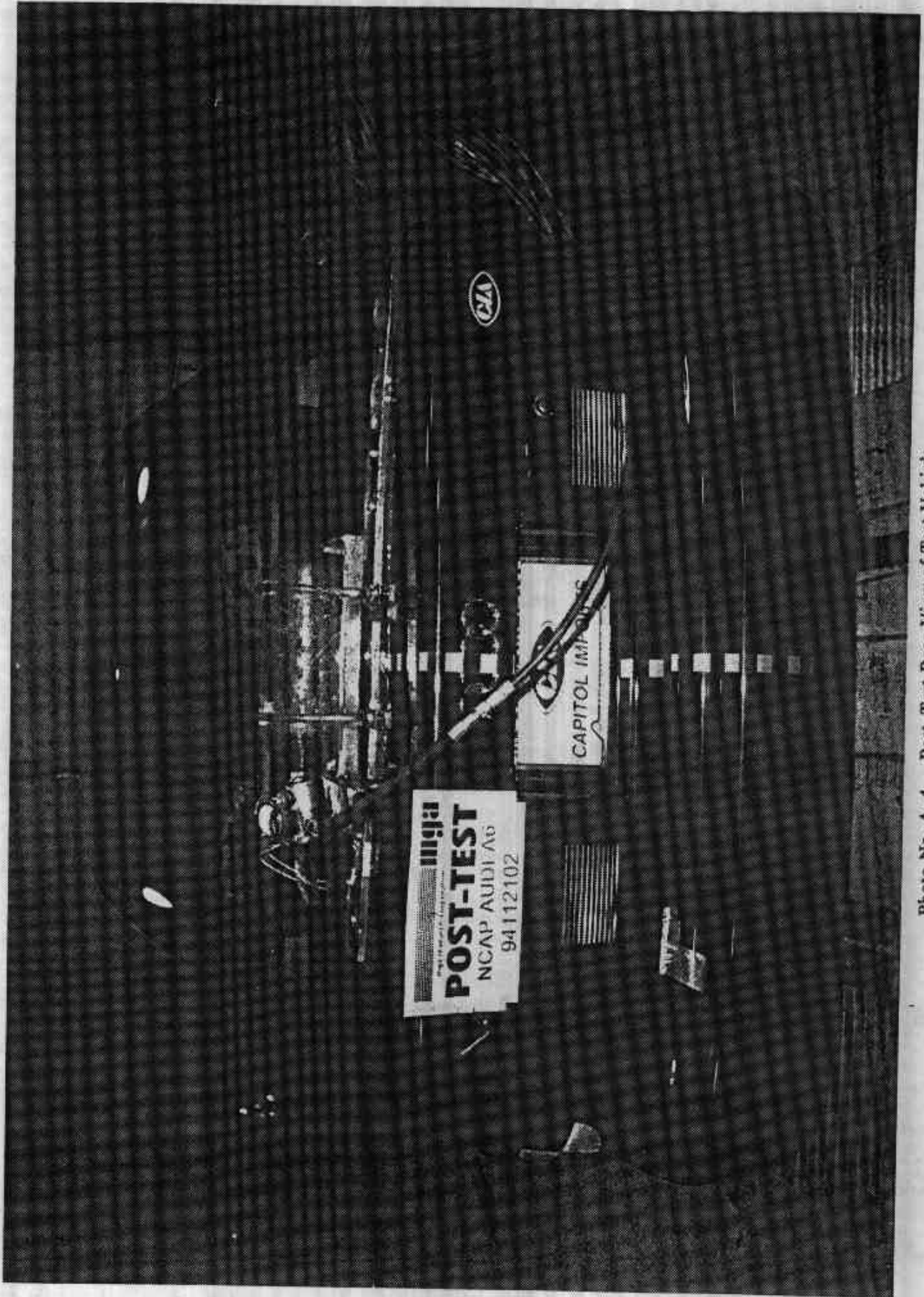


Photo No. A-4 - Post-Test Rear View of Test Vehicle

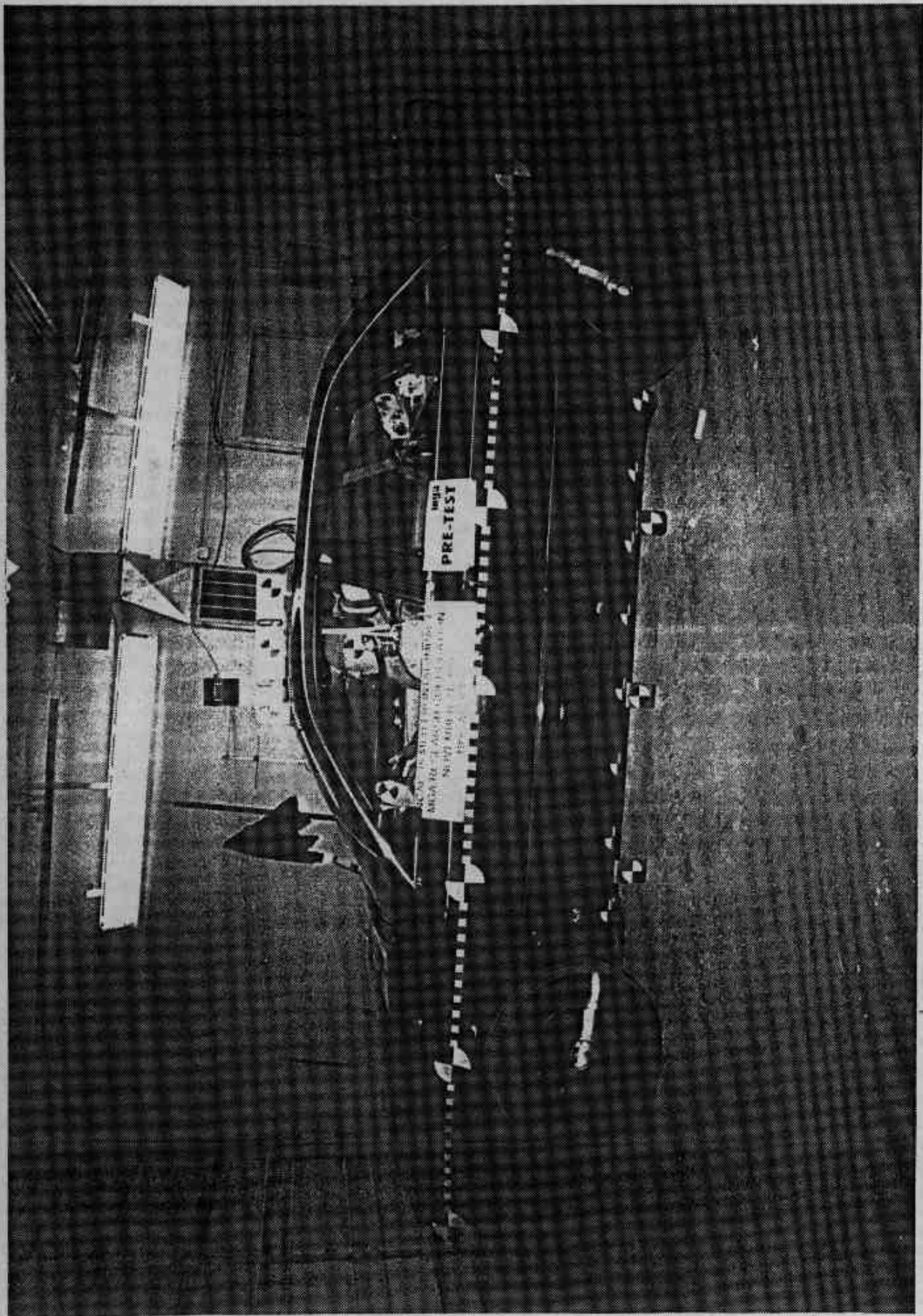


Photo No. A-5 - Pre-Test Left Side View of Test Vehicle

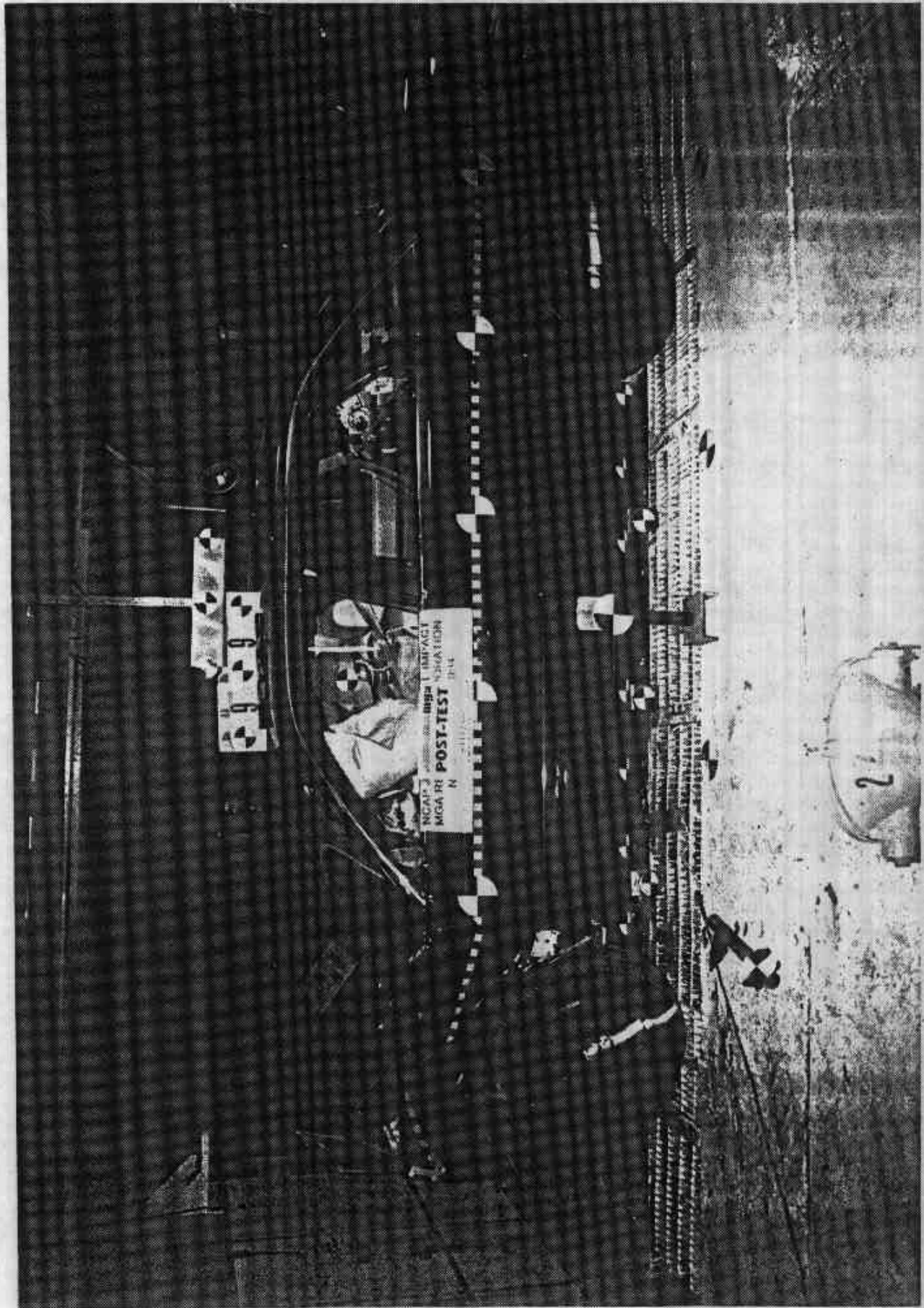


Photo No. A-6 - Post-Test Left Side View of Test Vehicle



Photo No. A-7 - Pre-Test Left Rear Three-Quarter View of Test Vehicle

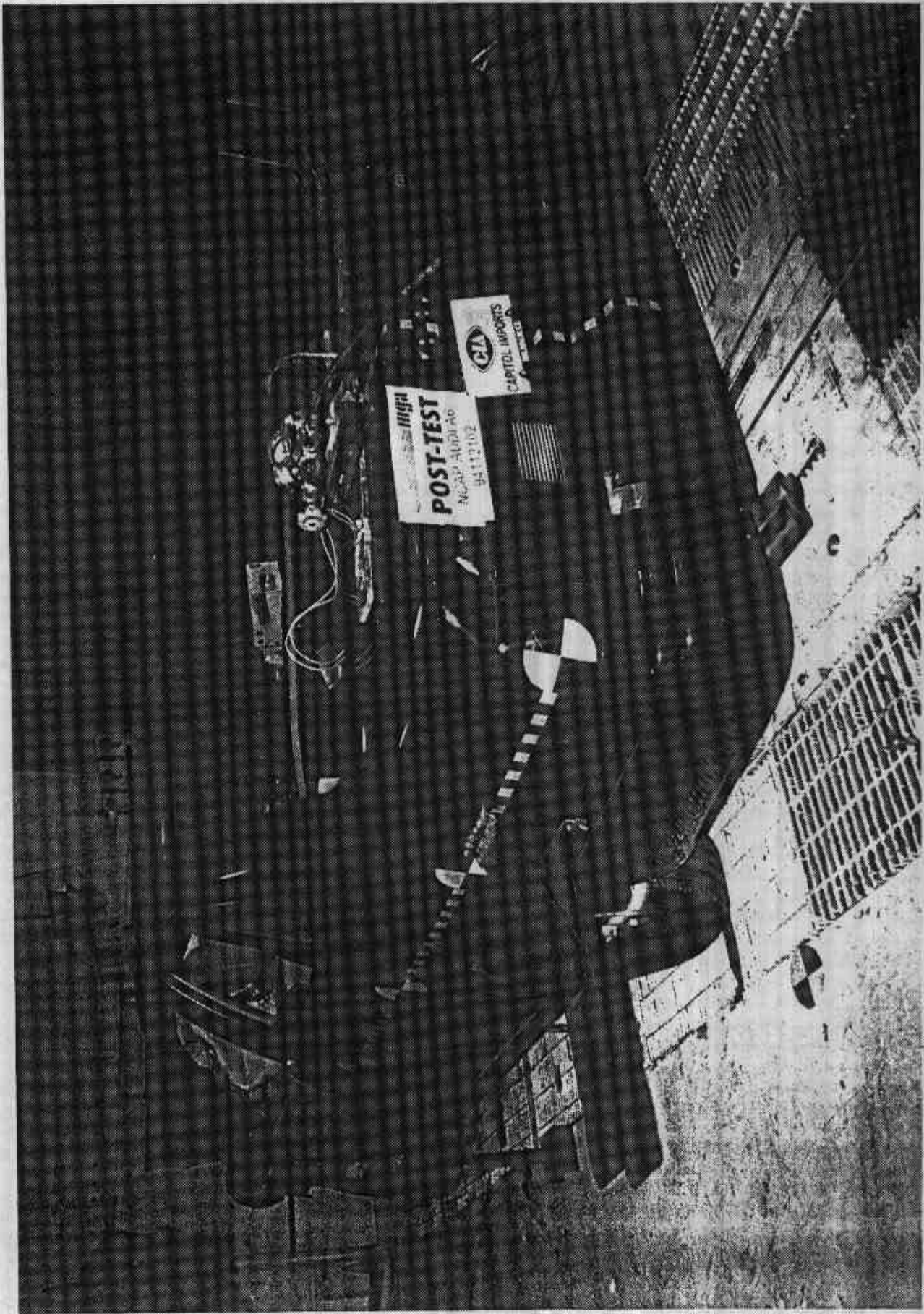


Photo No. A-8 - Post-Test Left Rear Three-Quarter View of Test Vehicle

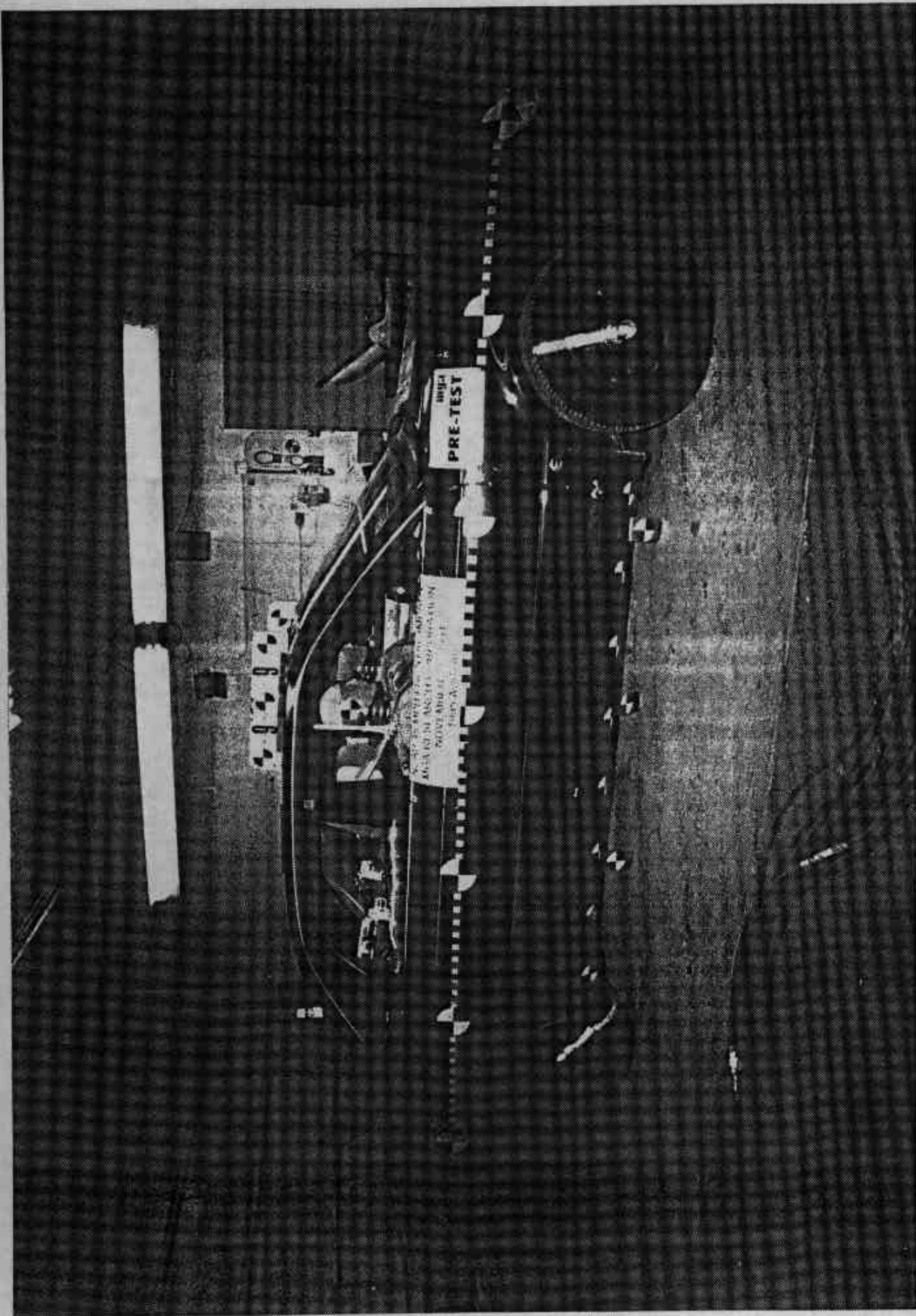


Photo No. A-9 - Pre-Test Right Side View of Test Vehicle

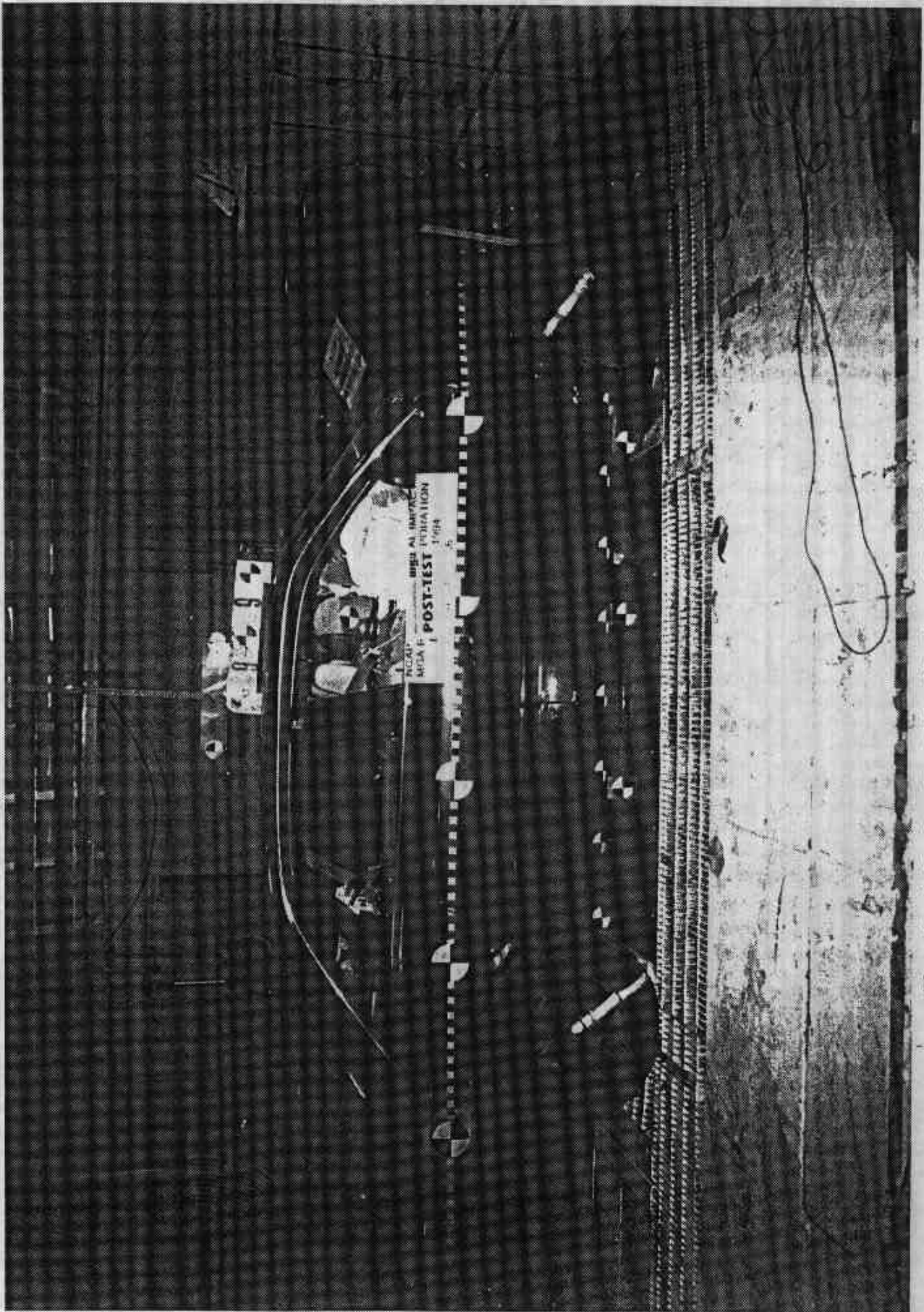


Photo No. A-10 - Post-Test Right Side View of Test Vehicle

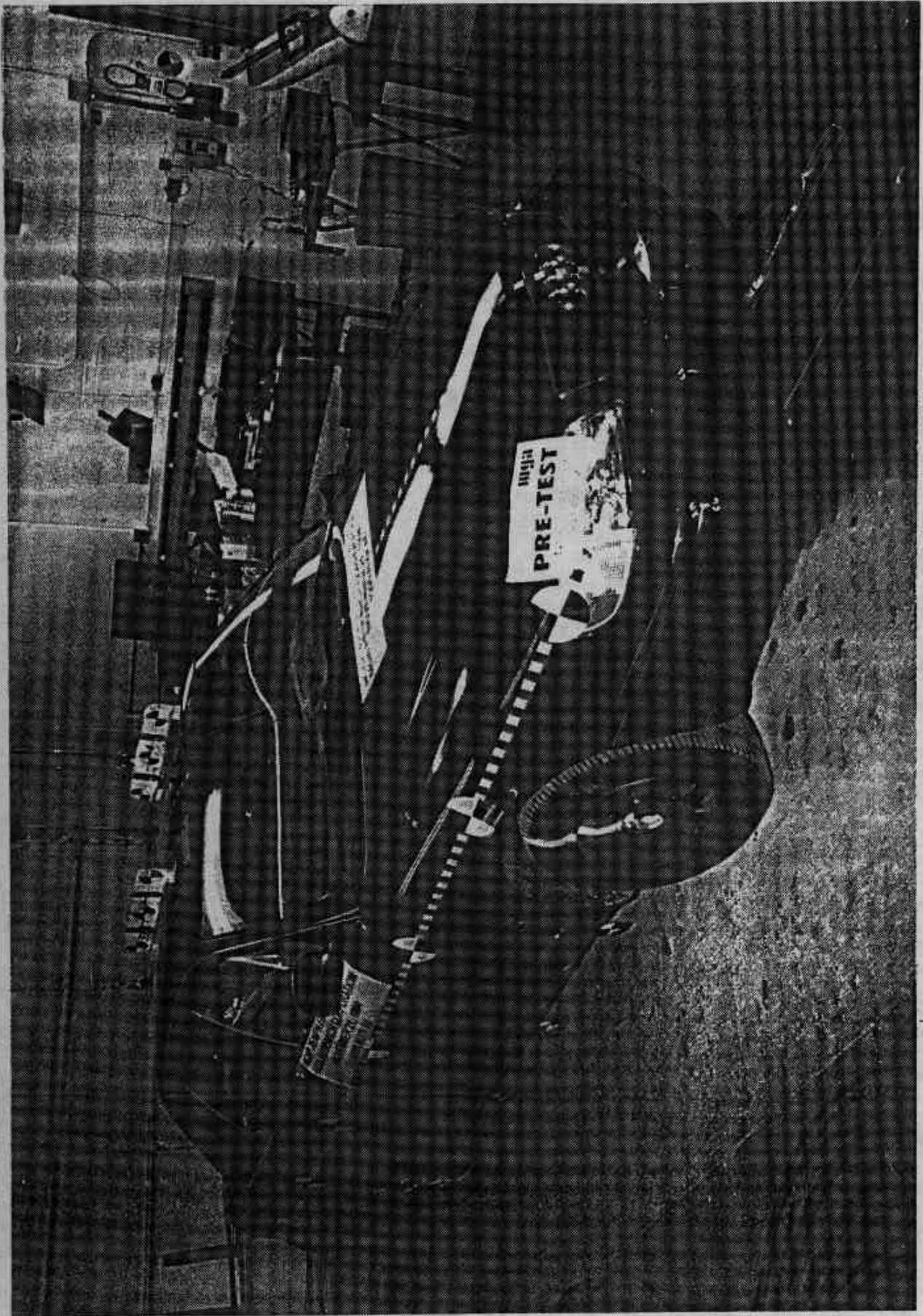


Photo No. A-11 - Pre-Test Right Front Three-Quarter View of Test Vehicle

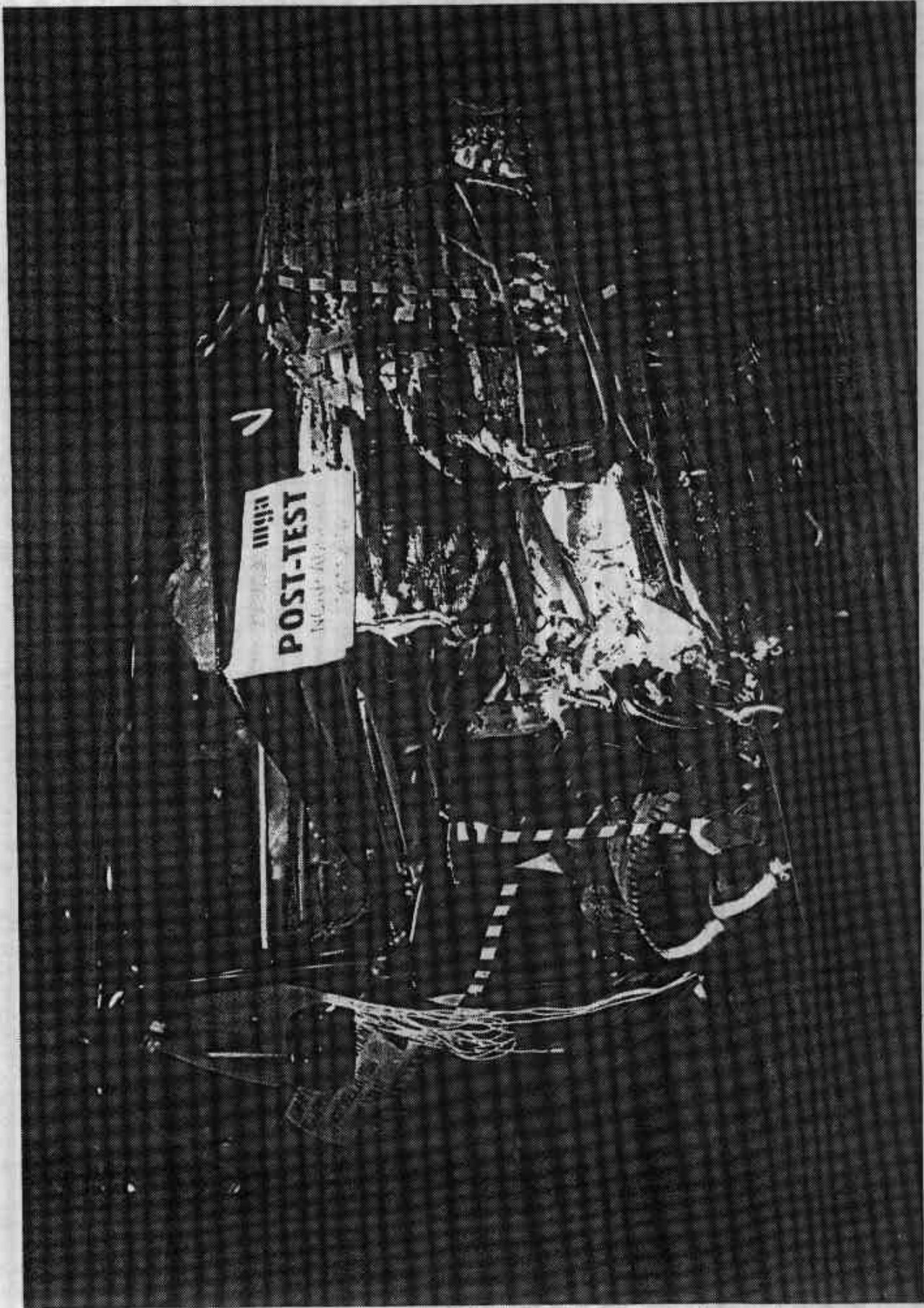
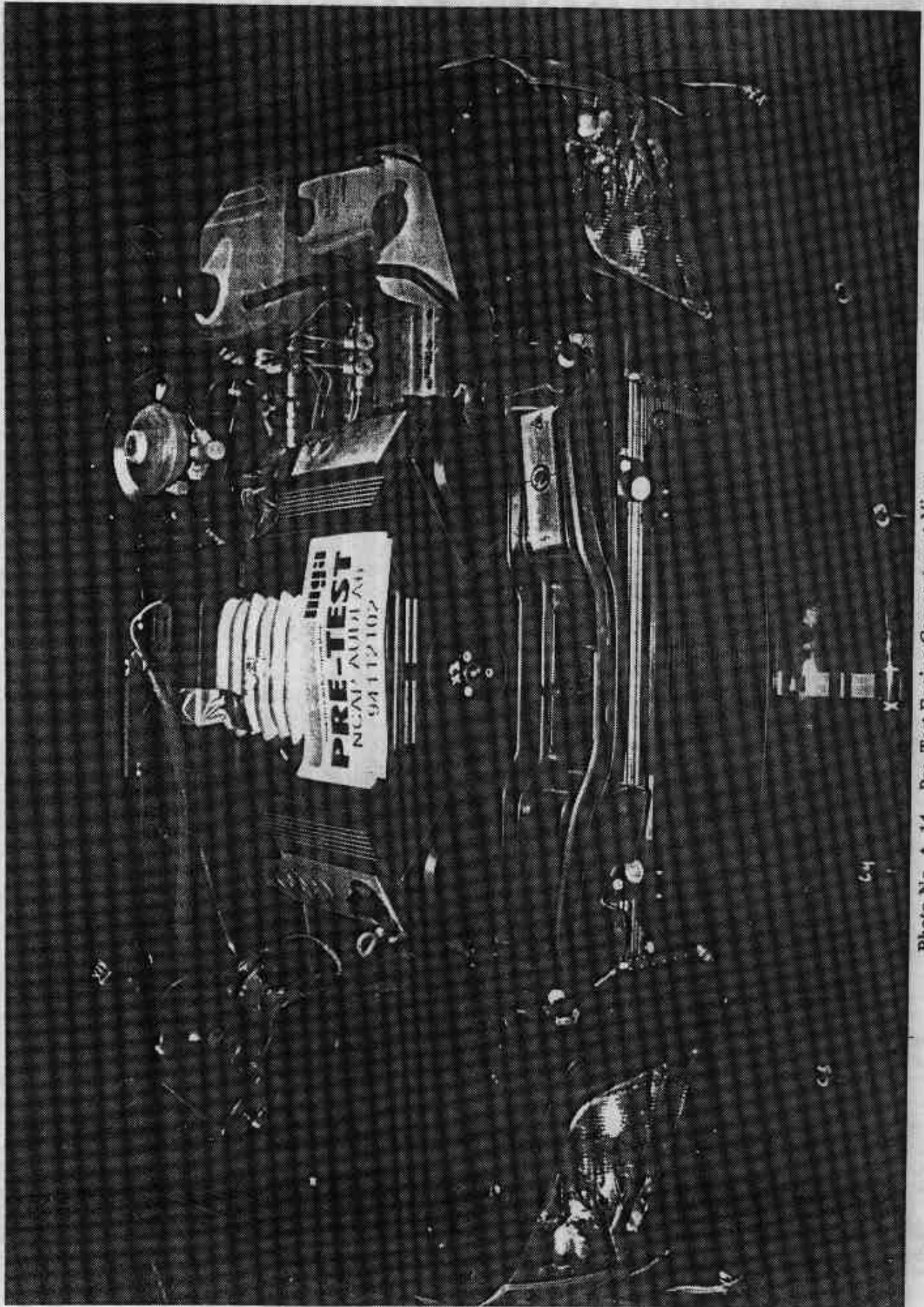


Photo No. A-12 - Post-Test Right Front Three-Quarter View of Test Vehicle

  
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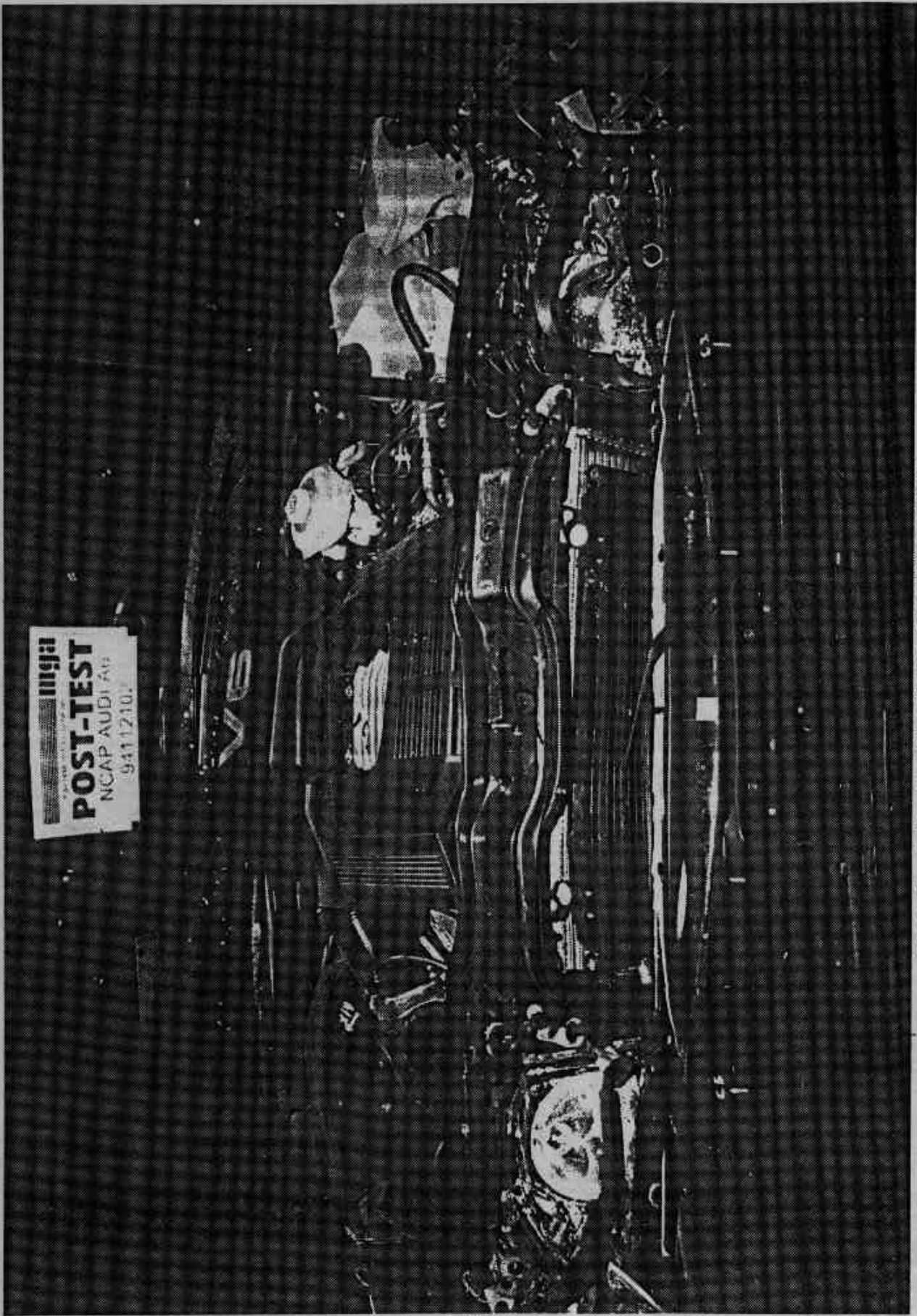


Photo No. A-13 - Pre-Test Fuel Filler Cap View



A-14

Photo No. A-14 - Pre-Test Engine Compartment View



**POST-TEST**  
NCAP AUDI A8  
9411210

Photo No. A-15 - Post-Test Engine Compartment View

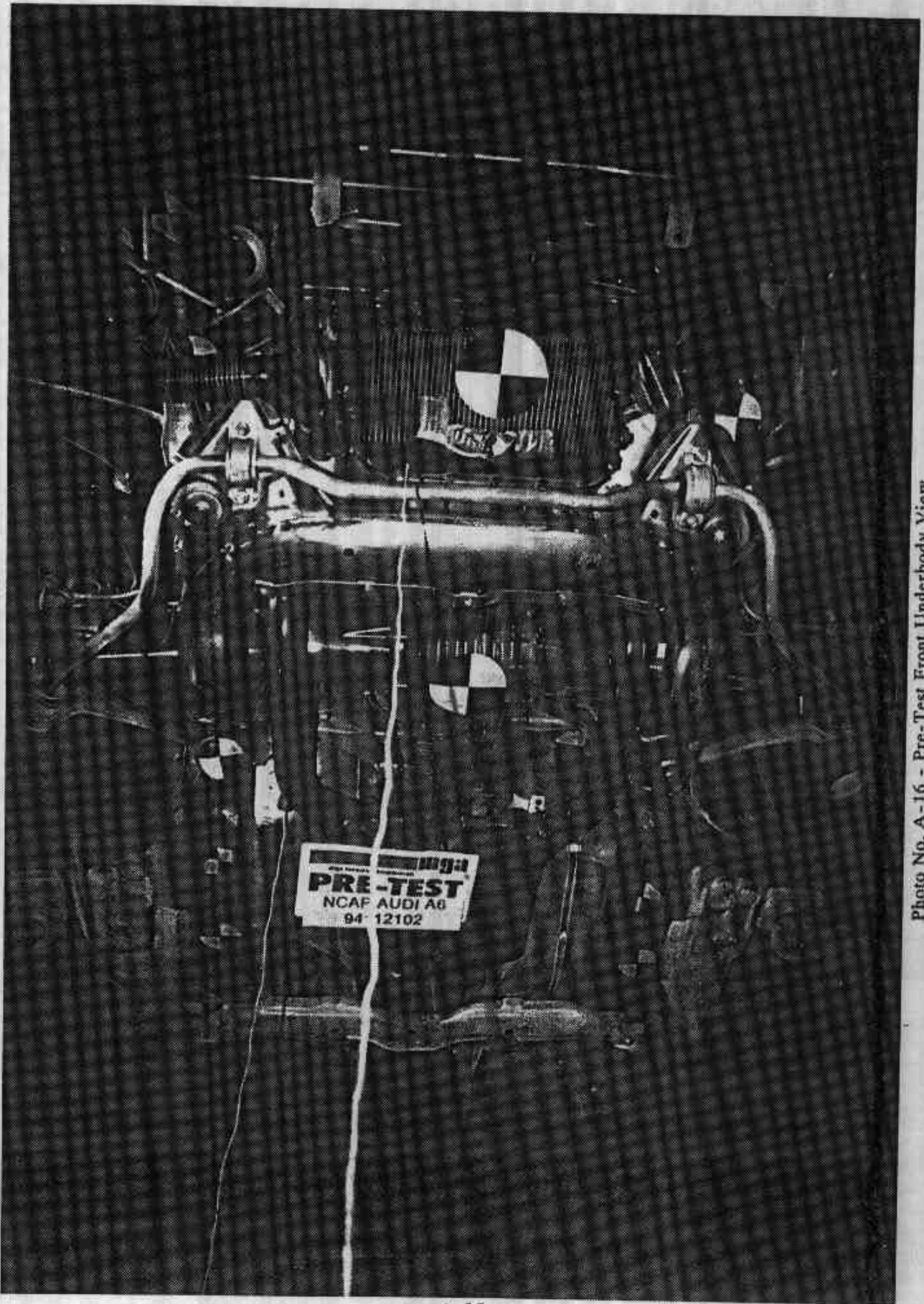


Photo No. A-16 - Pre-Test Front Underbody View

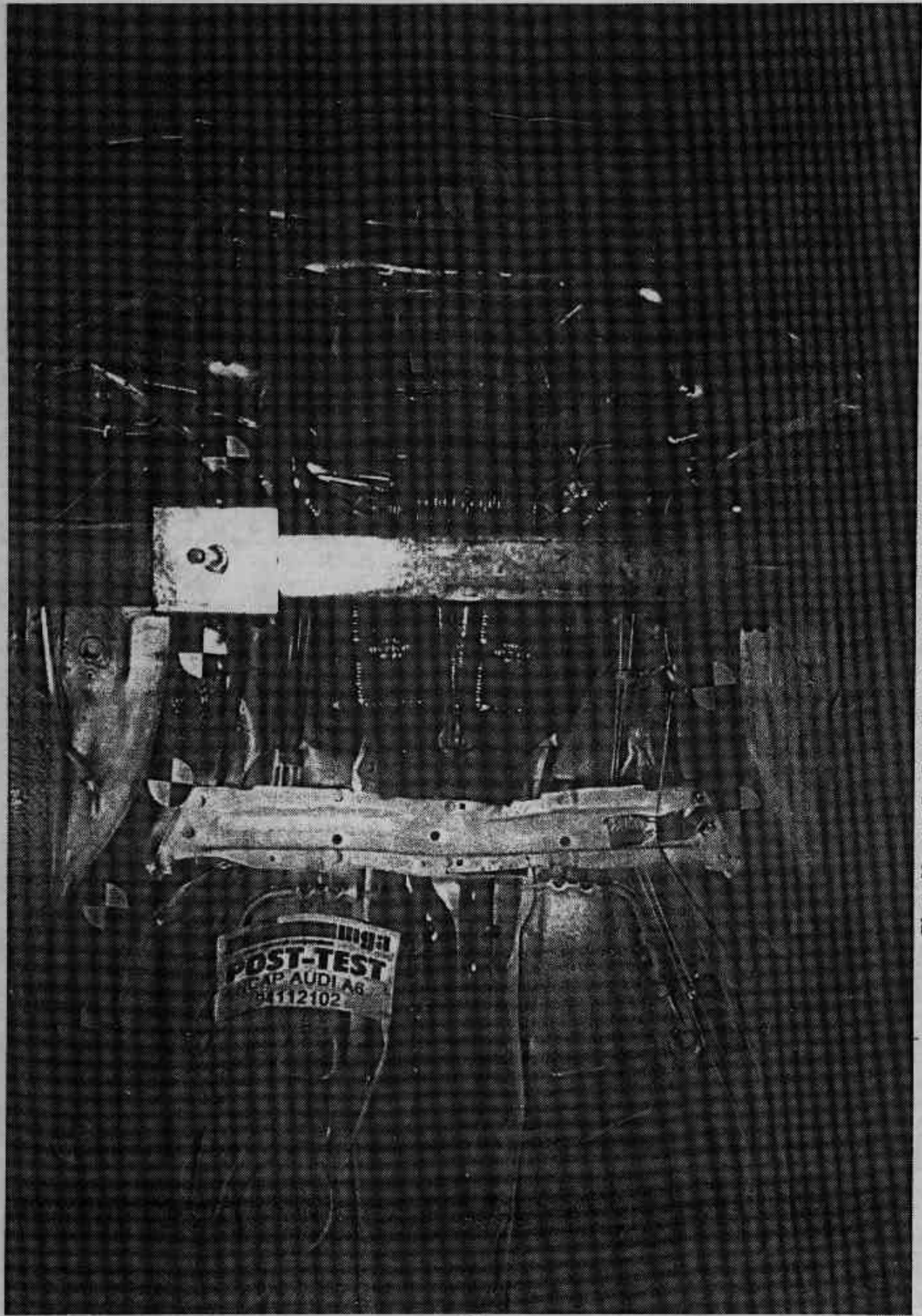


Photo No. A-17 - Post-Test Front Underbody View

A-17

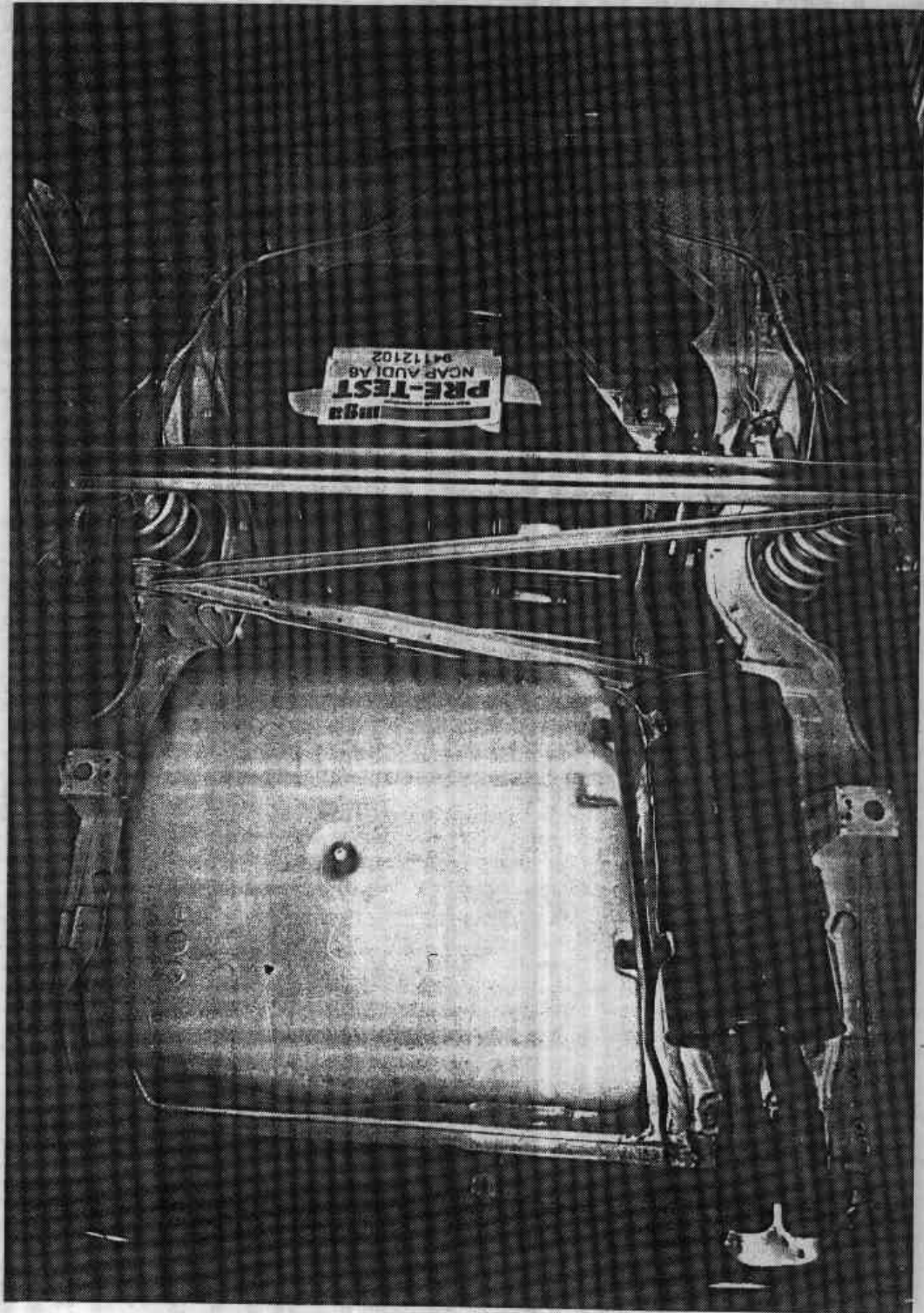


Photo No. A-18 - Pre-Test Rear Underbody View

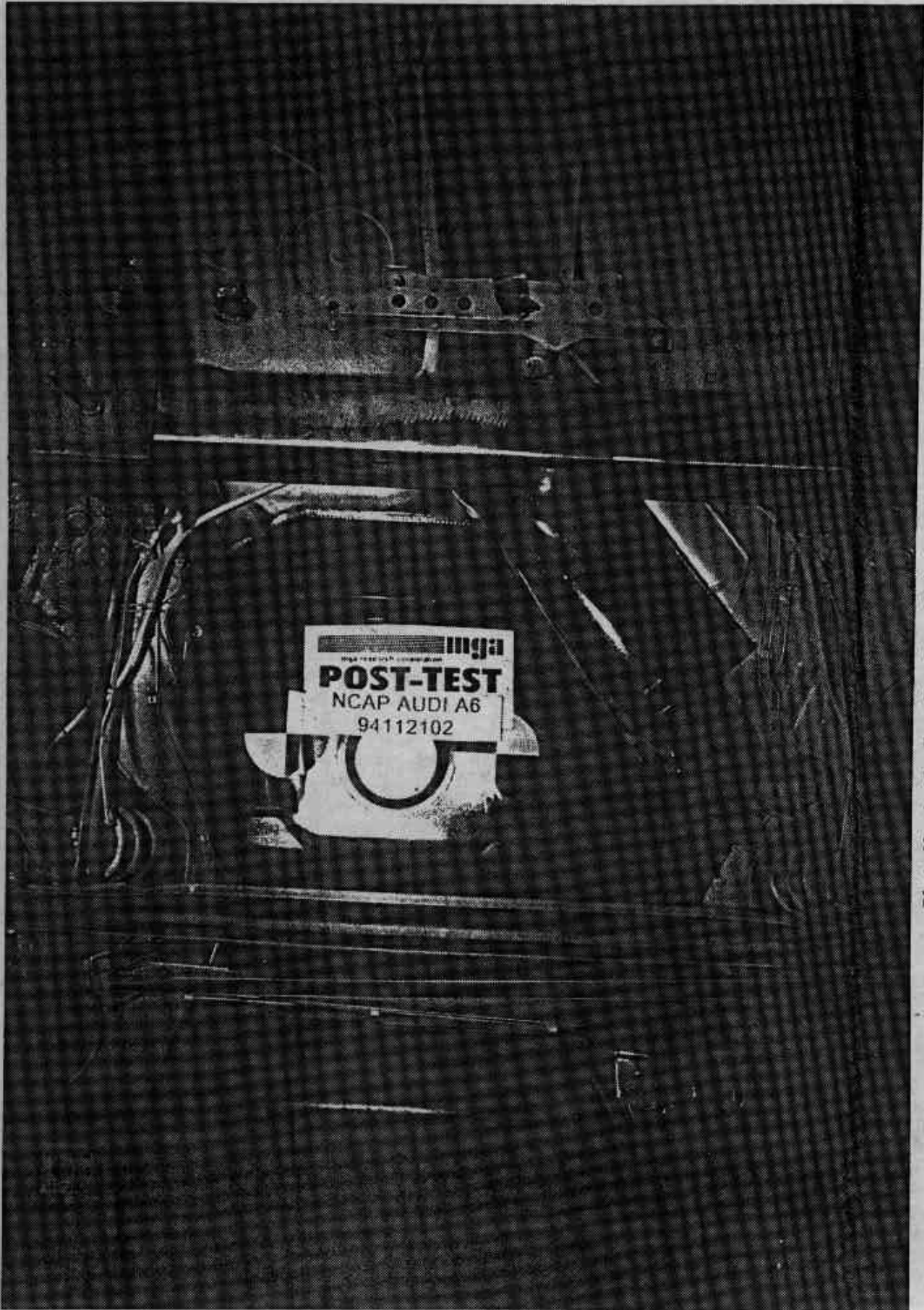
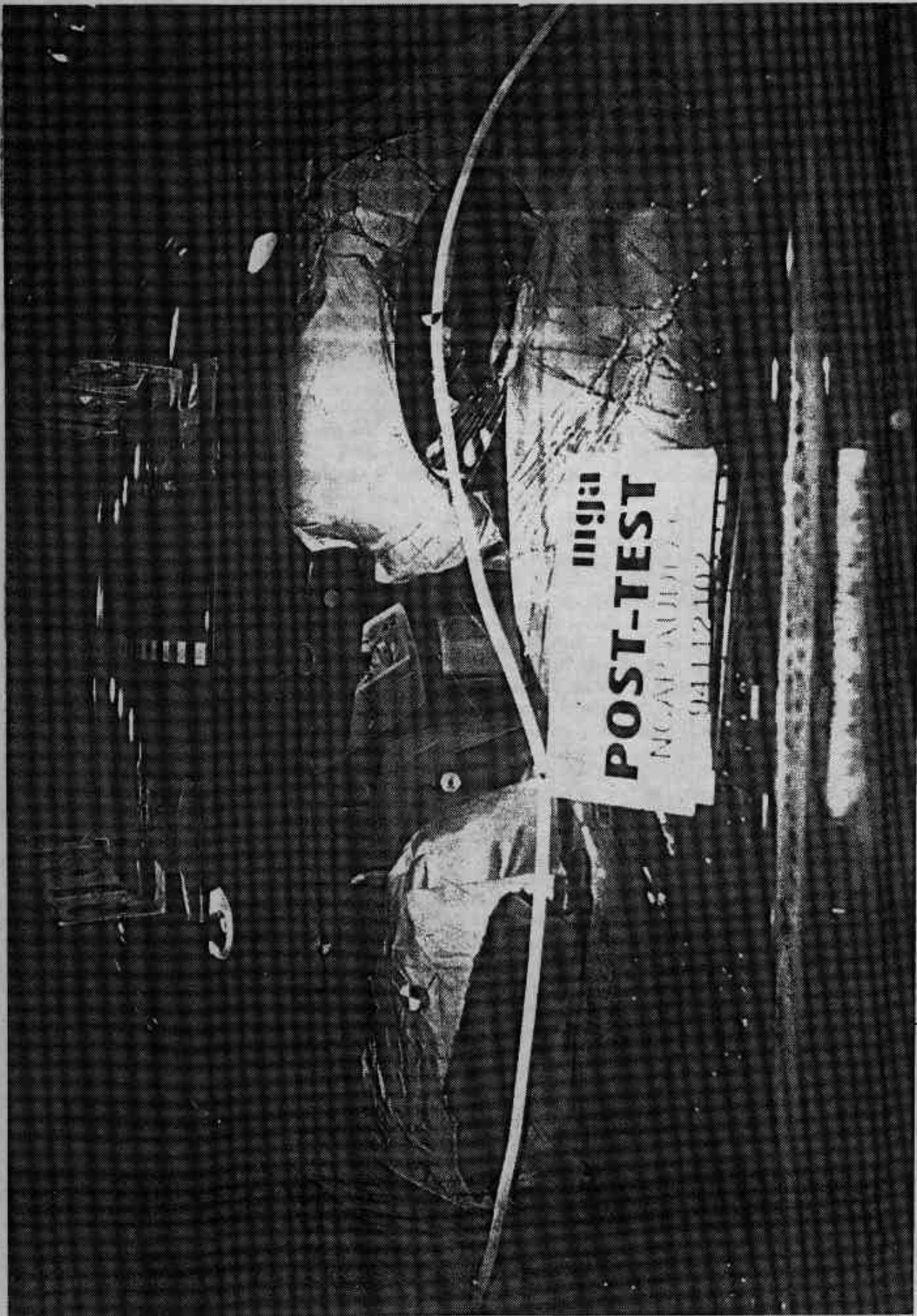


Photo No. A-19 - Post-Test Rear Underbody View



Photo No. A-20 - Pre-Test Windshield View



A-21

Photo No. A-21 - Post-Test Windshield View

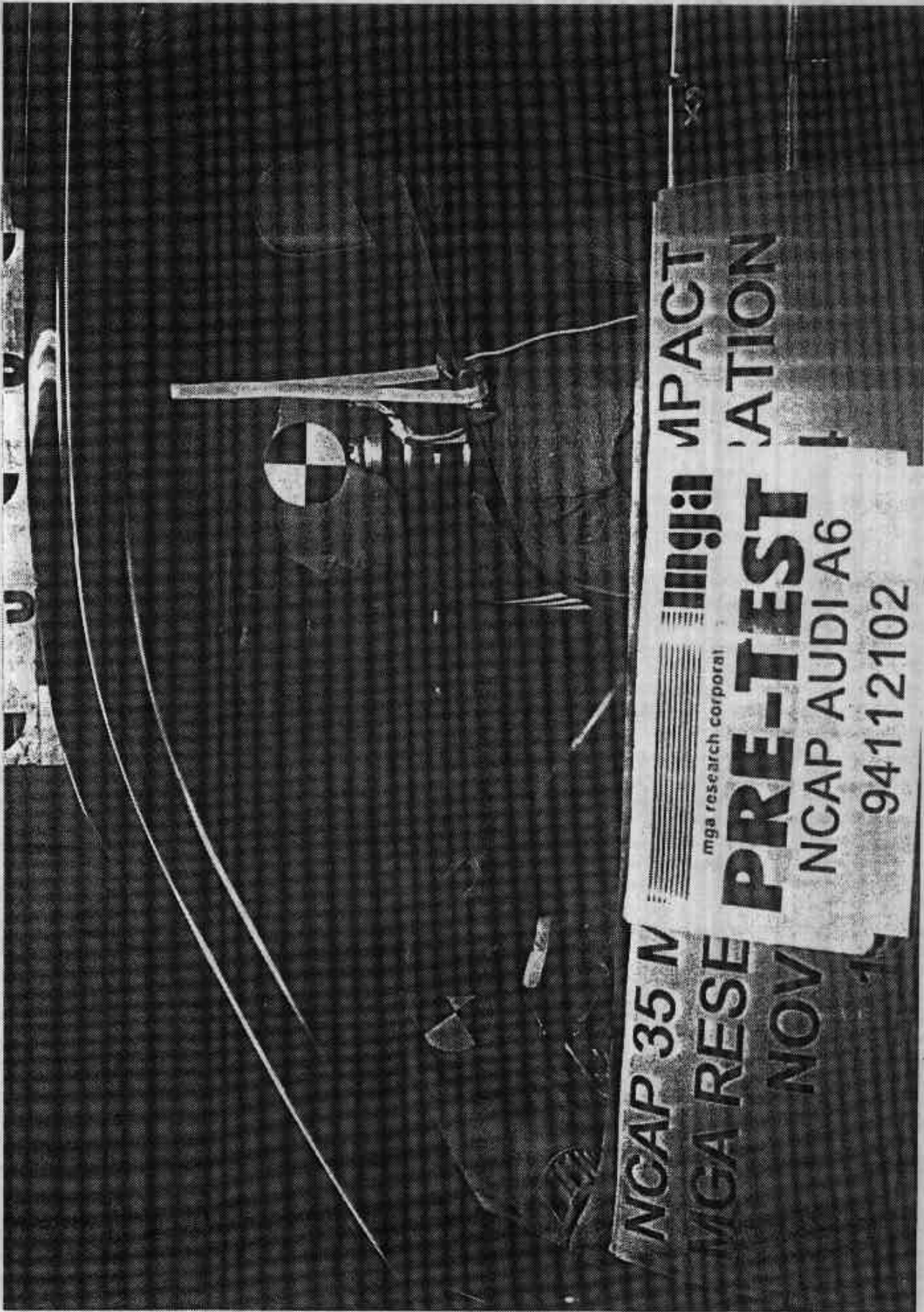
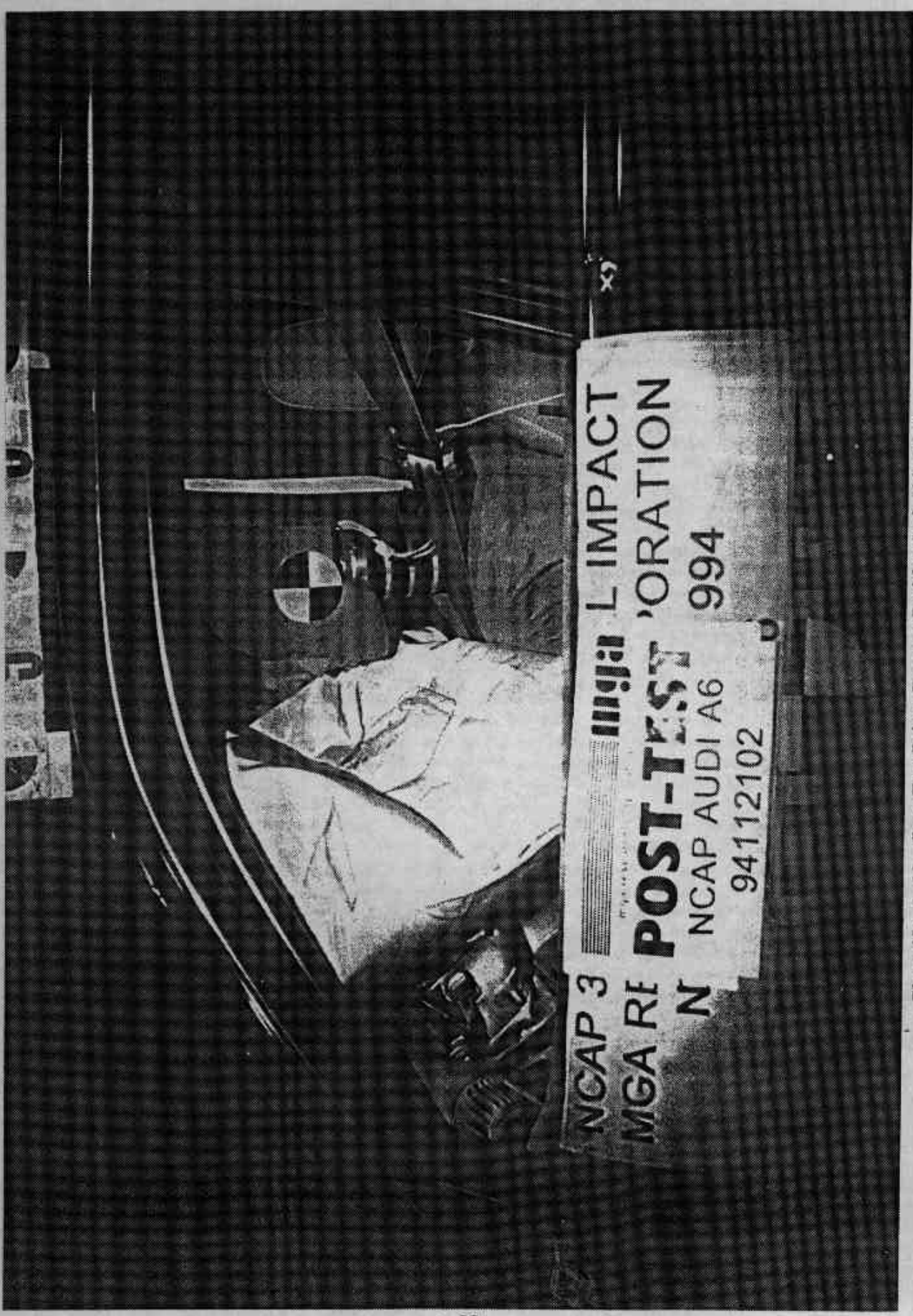


Photo No. A-22 - Pre-Test Driver Dummy Position Left Side View



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Photo No. A-23 - Post-Test Driver Dummy Position Left Side View



Photo No. A-24 - Pre-Test Driver Dummy Position Left Side View (Door Open)

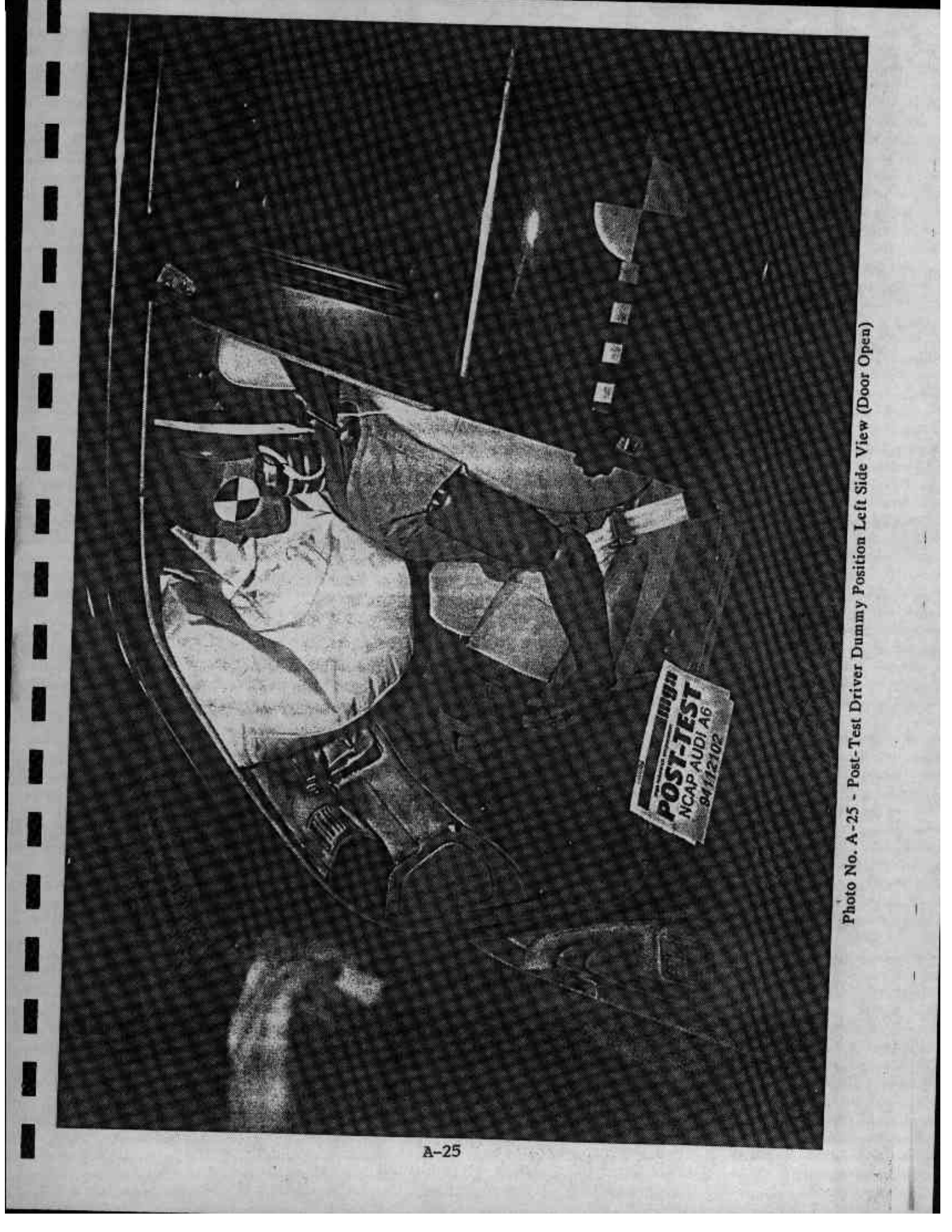


Photo No. A-25 - Post-Test Driver Dummy Position Left Side View (Door Open)

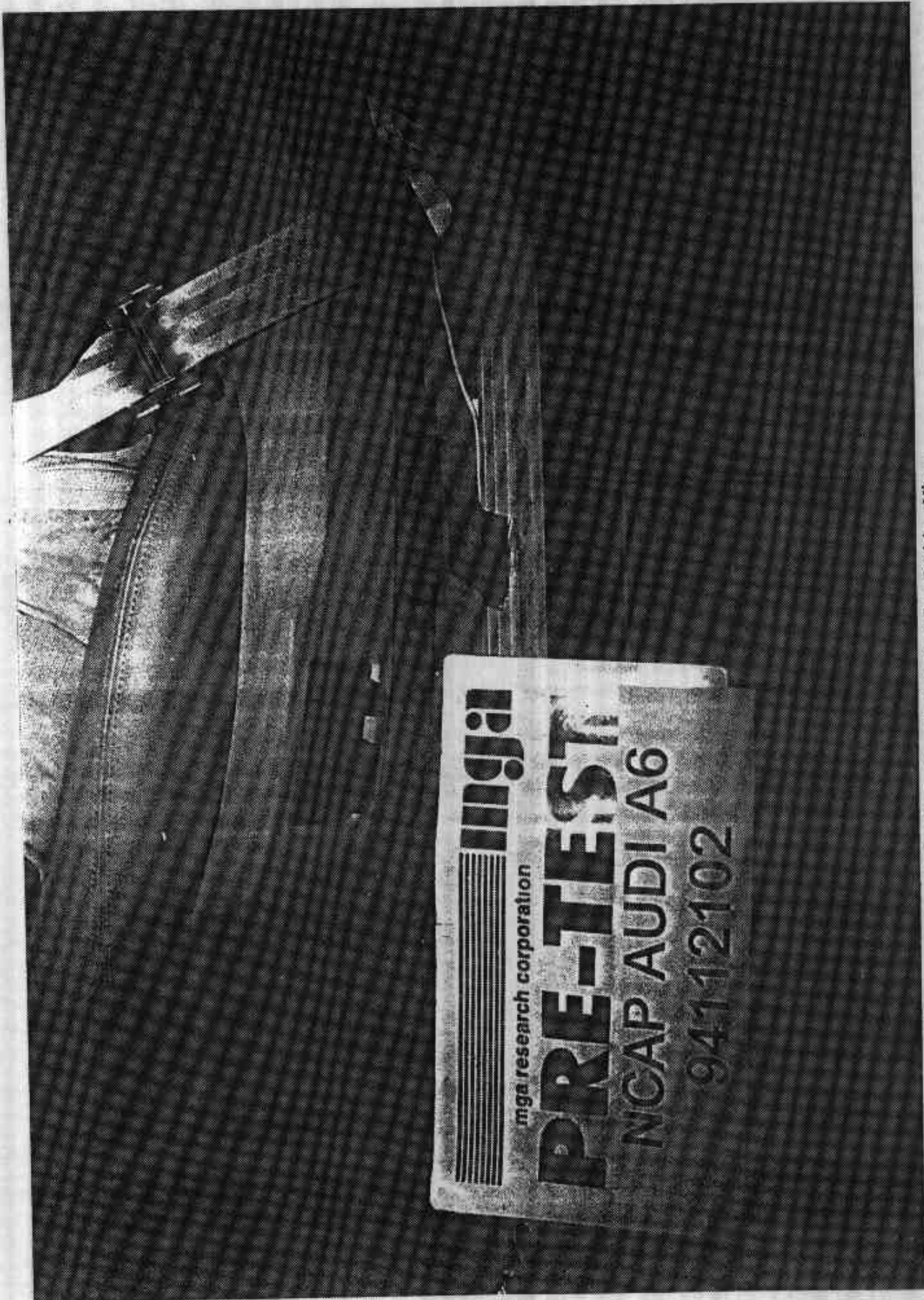


Photo No. A-26 - Pre-Test Driver Seat Position View



Photo No. A-27 - Post-Test Driver Seat Position View



Photo No. A-28 - Pre-Test Driver Dummy Knee Position



Photo No. A-29 - Post-Test Driver Dummy Knee Position



Photo No. A-30 - Post-Test Driver Airbag Contact

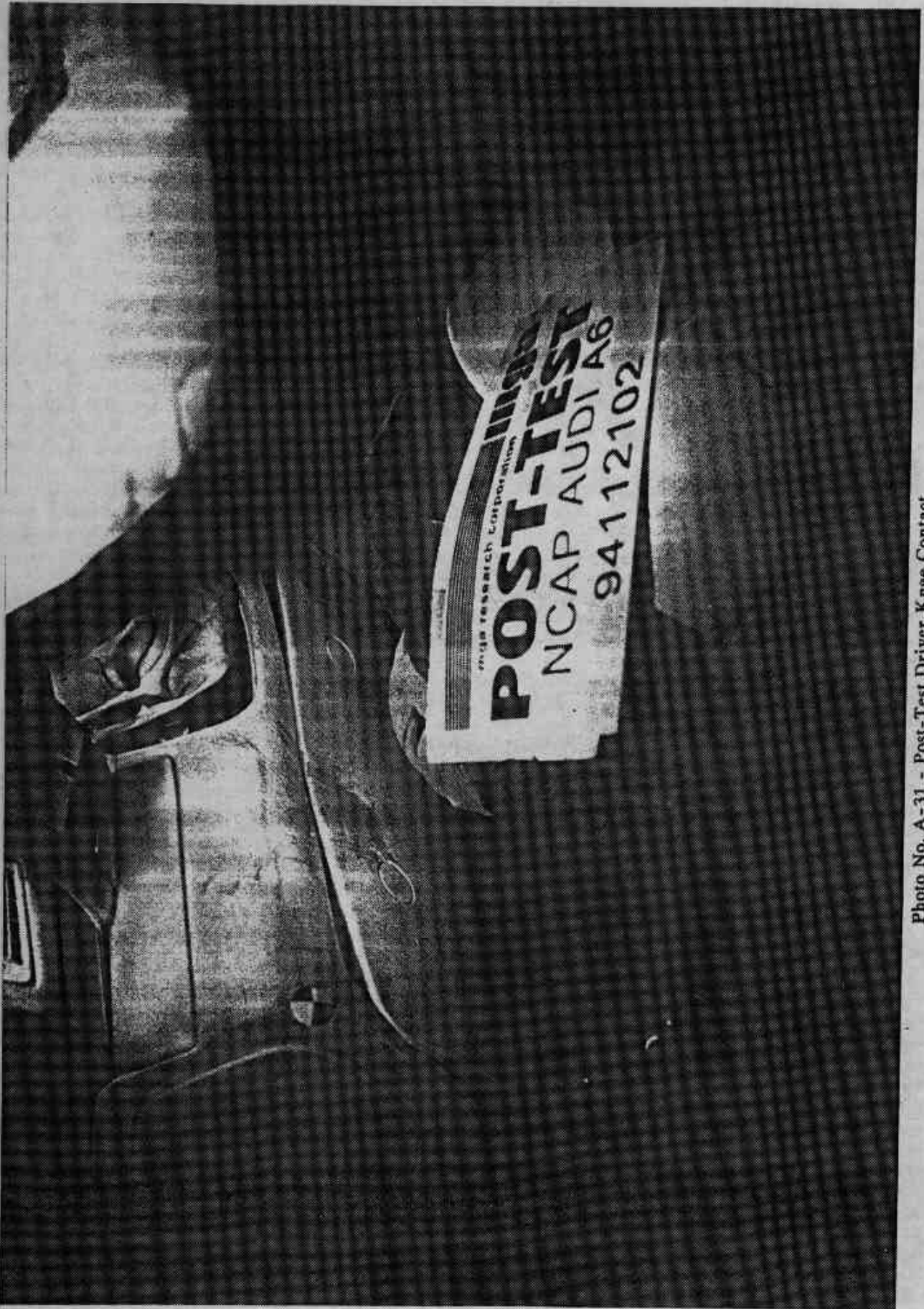


Photo No. A-31 - Post-Test Driver Knee Contact

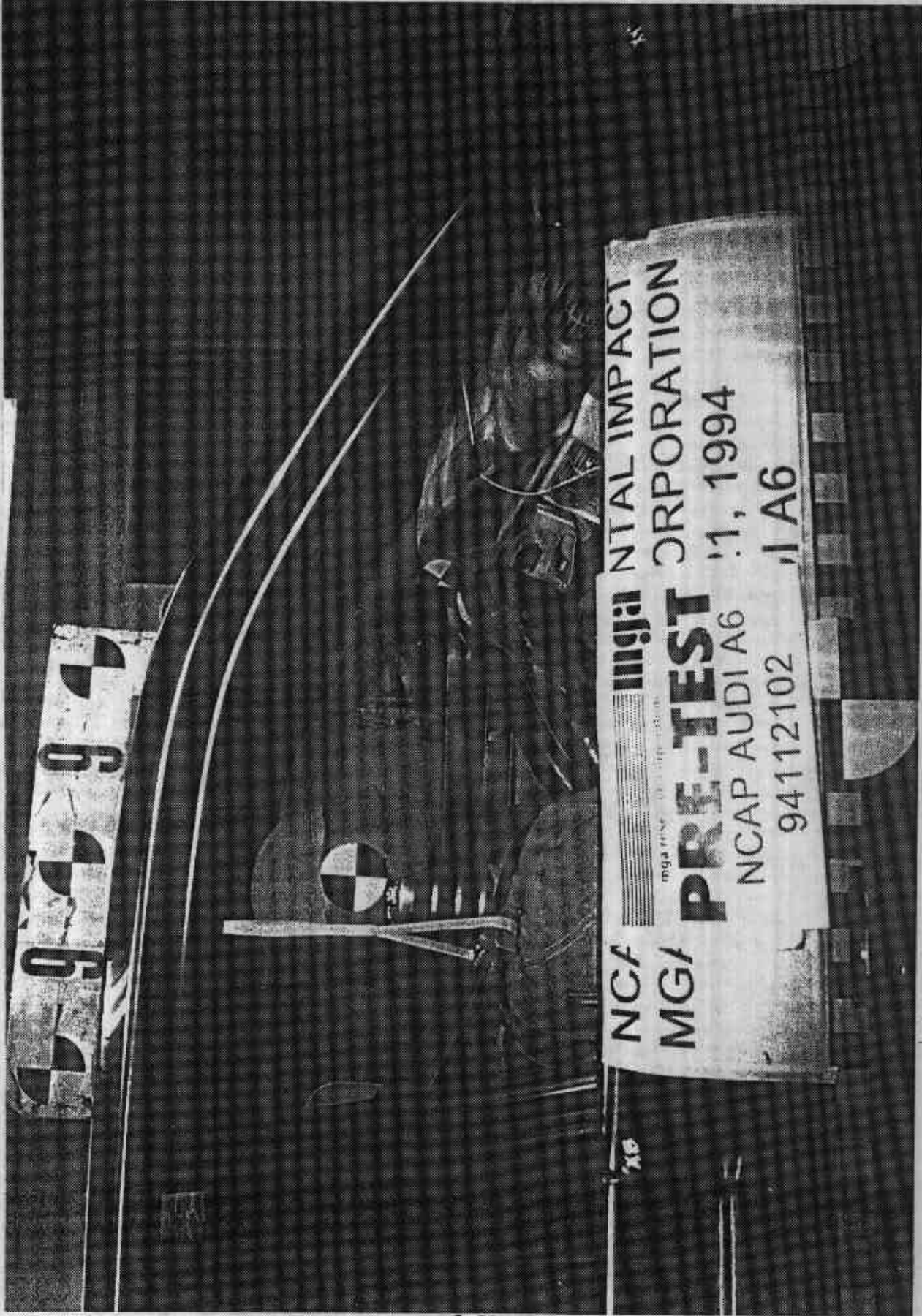
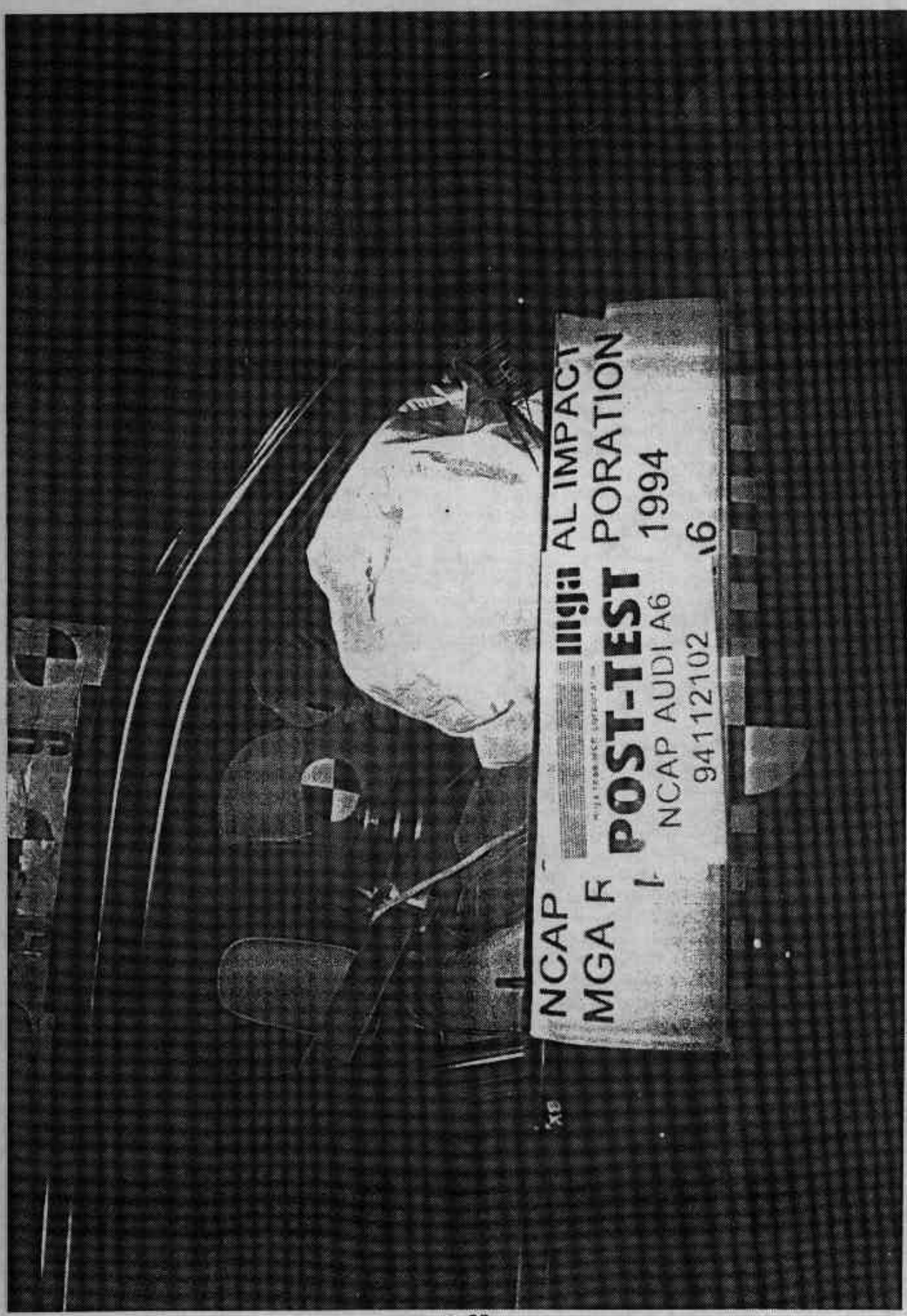


Photo No. A-32 - Pre-Test Passenger Dummy Position Right Side View



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A-33

Photo No. A-33 - Post-Test Passenger Dummy Position Right Side View



Photo No. A-34 - Pre-Test Passenger Dummy Position Right Side View (Door Open)



A-35

Photo No. A-35 - Pre-Test Passenger Seat Position View



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Photo No. A-36 - Post-Test Passenger Seat Position View



Photo No. A-37 - Pre-Test Passenger Dummy Knee Position



Photo No. A-38 - Post-Test Passenger Dummy Knee Position



Photo No. A-39 - Post-Test Passenger Dummy Airbag Contact



Photo No. A-48 - Post-Test Passenger Knee Contact



Photo No. A-41 - Vehicle Certification Label

A-41

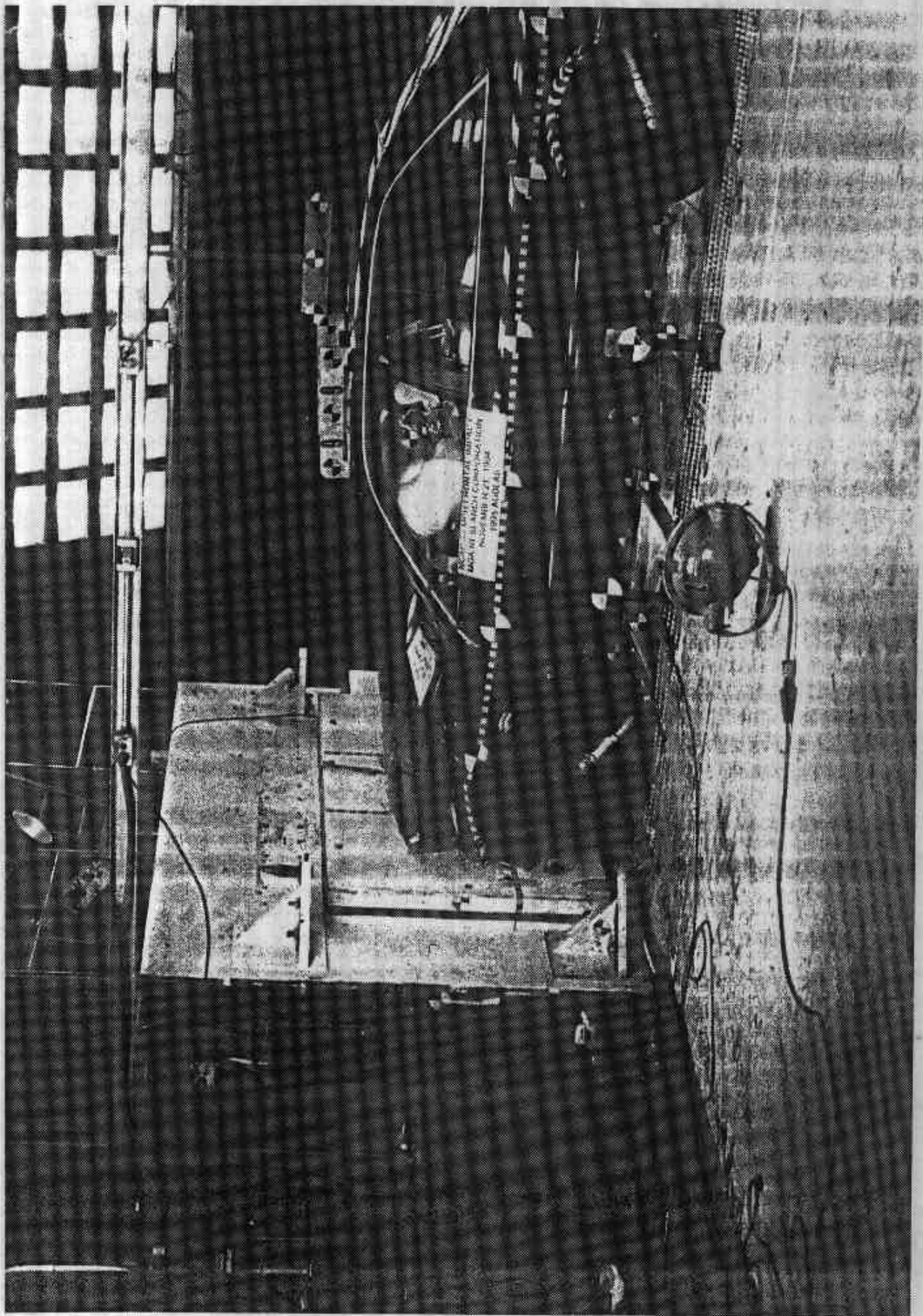


Photo No. A-42 - Impact

**APPENDIX B**  
**Vehicle, Load Cell Barrier and Dummy Response Data**

1995 Audi A6 4-Door

<u>VEHICLE DATA</u>	<u>FILTER CHANNEL CLASS</u>	
Head Accelerations	1000	(1650 Hz)
Chest Accelerometers	180	( 300 Hz)
Vehicle Accelerometers	60	( 100 Hz)
Barrier Load Cells	60	( 100 Hz)
Femur Load Cells	600	(1000 Hz)
Lap and Torso Belts	60	( 100 Hz)

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Figure B-19 - Center Rear Tunnel X Velocity vs. Time	B-19

\* No valid data collected

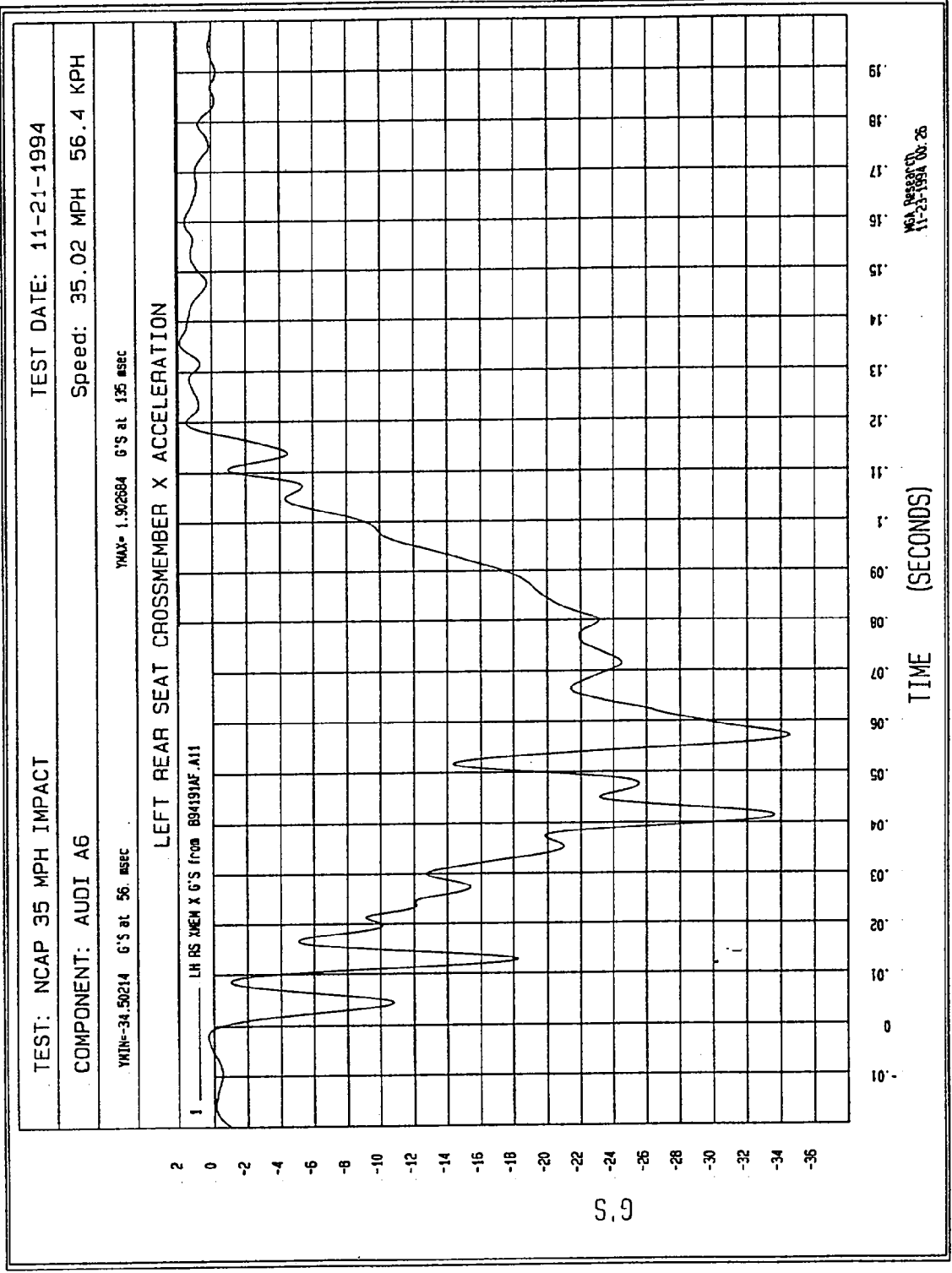
<u>Data Plot</u>	<u>Page No.</u>
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B-1

Figure B-1 - Left Rear Seat Crossmember X Acceleration vs. Time

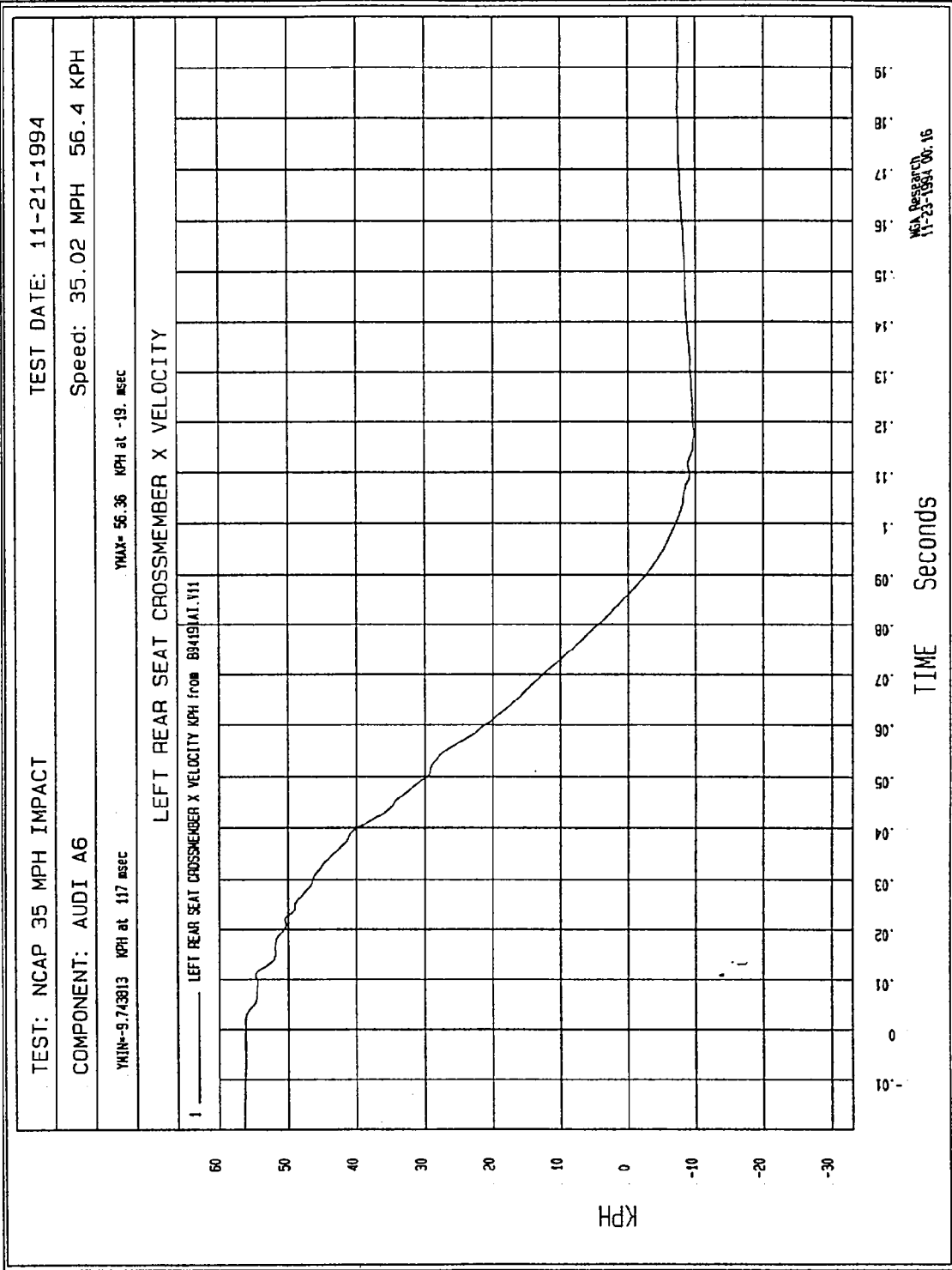
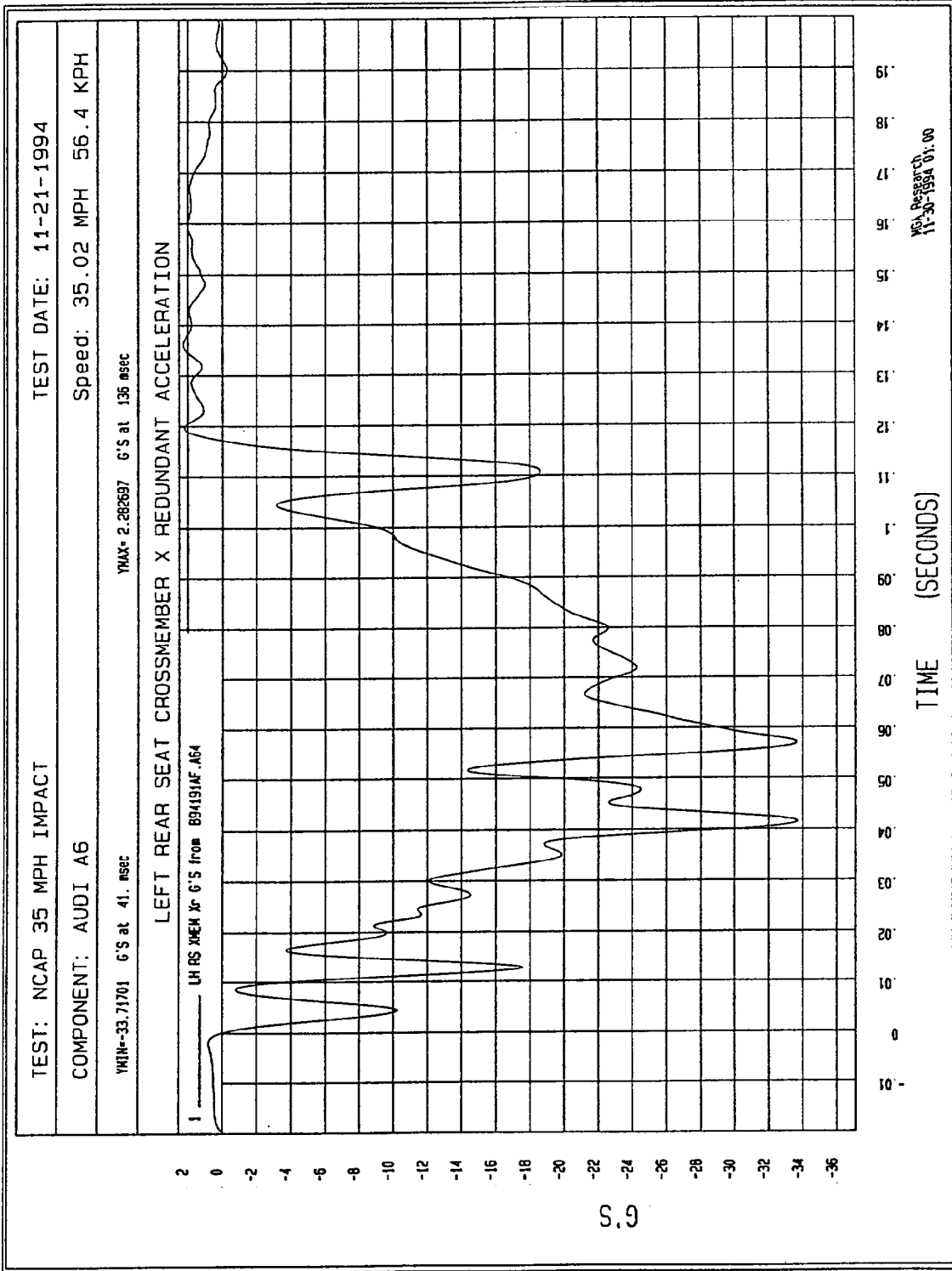


Figure B-2 - Left Rear Seat Crossmember X Velocity vs. Time



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Figure B-3 - Left Rear Seat Crossmember X Redundant Acceleration vs. Time

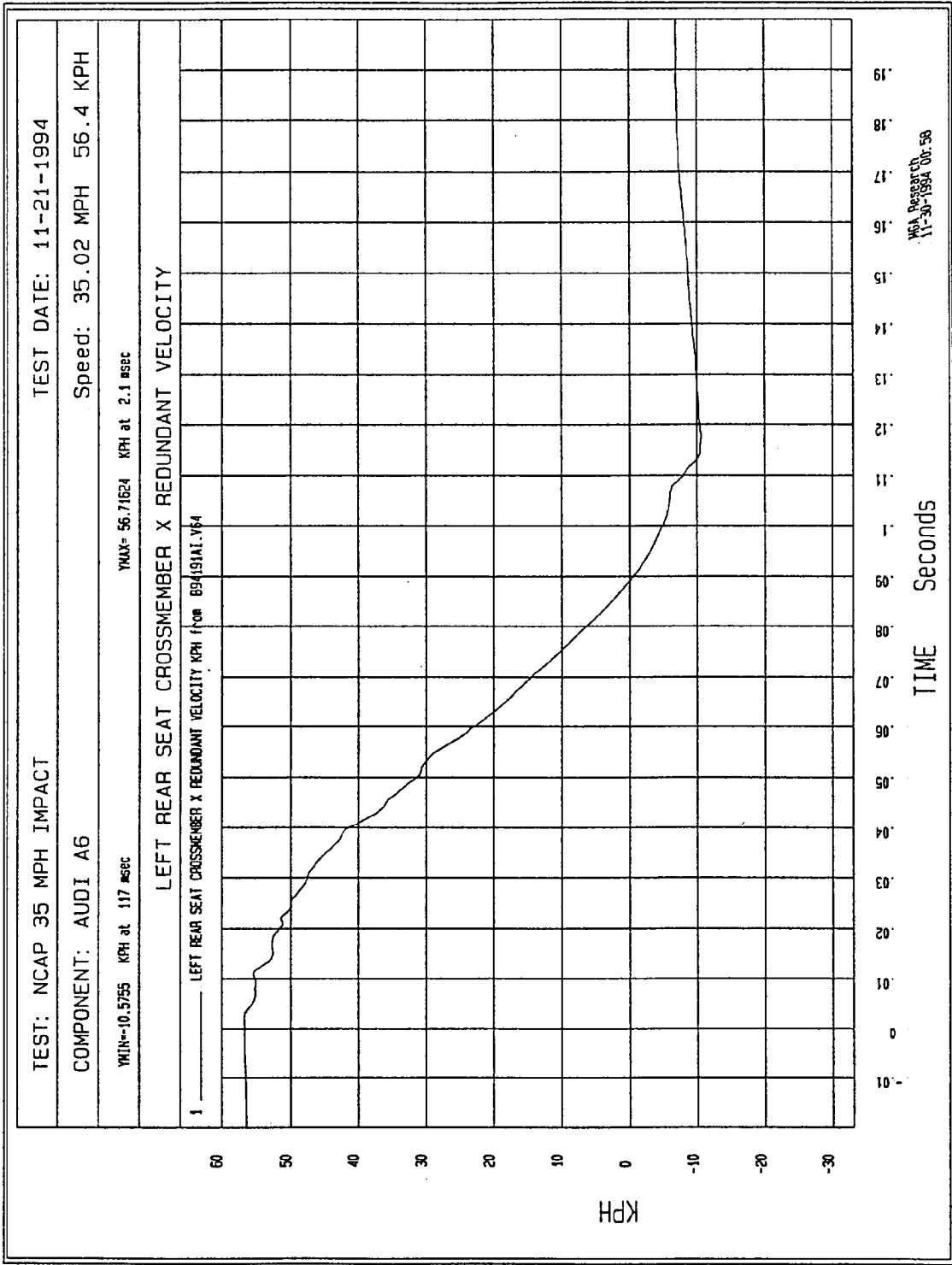


Figure B-4 - Left Rear Seat Crossmember X Redundant Velocity vs. Time

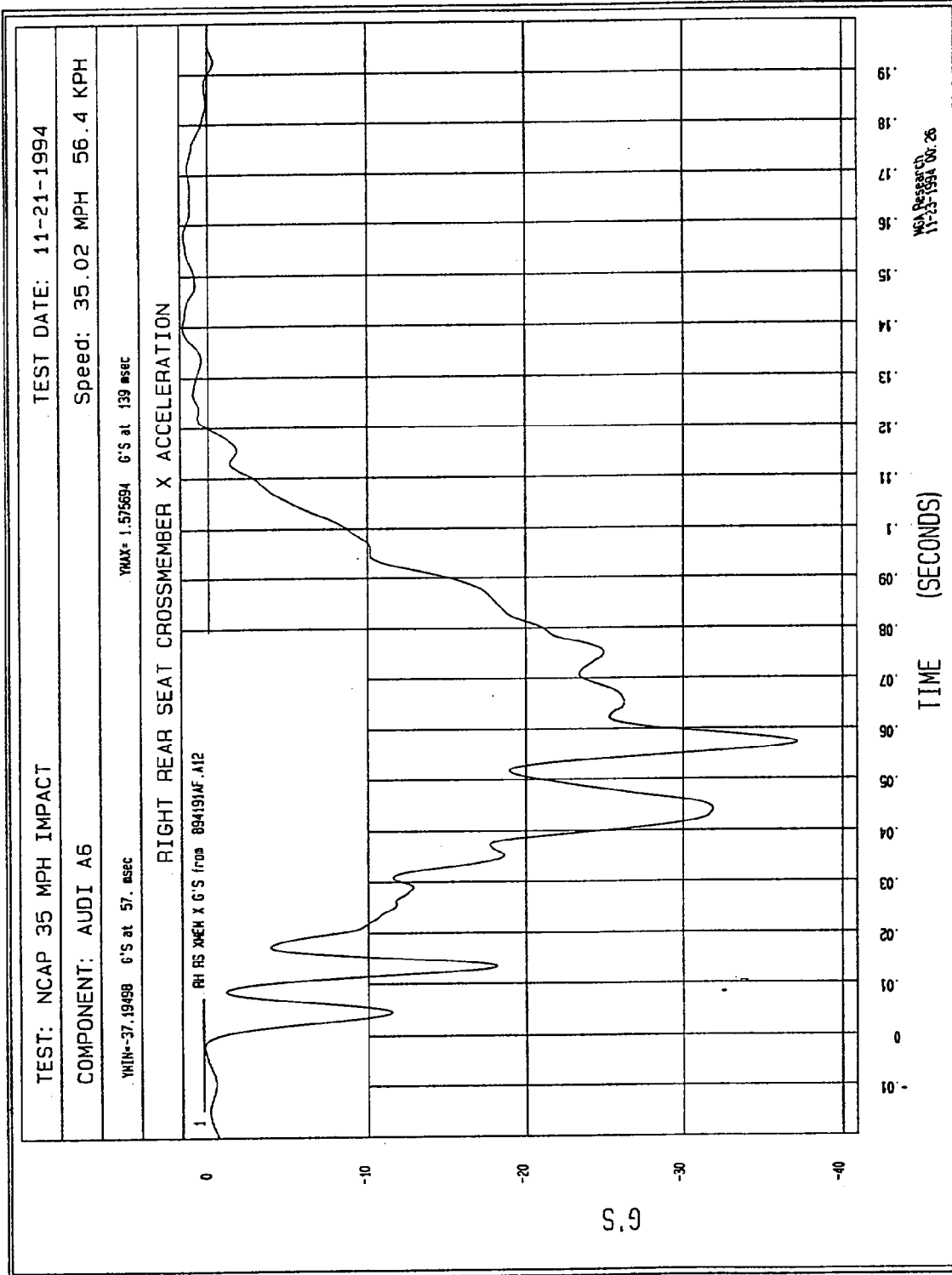


Figure B-5 - Right Rear Seat Crossmember X Acceleration vs. Time

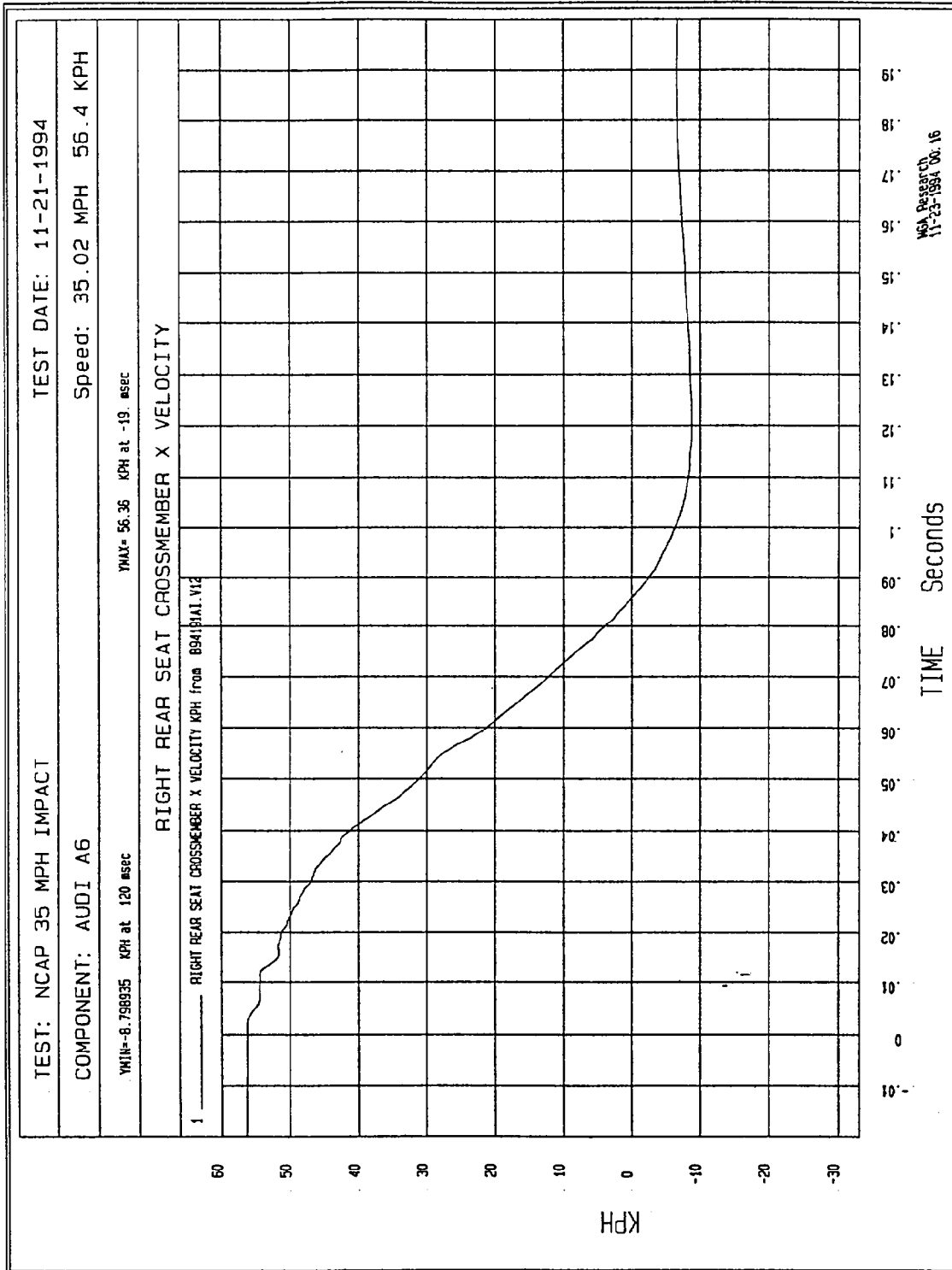


Figure B-6 - Right Rear Seat Crossmember X Velocity vs. Time

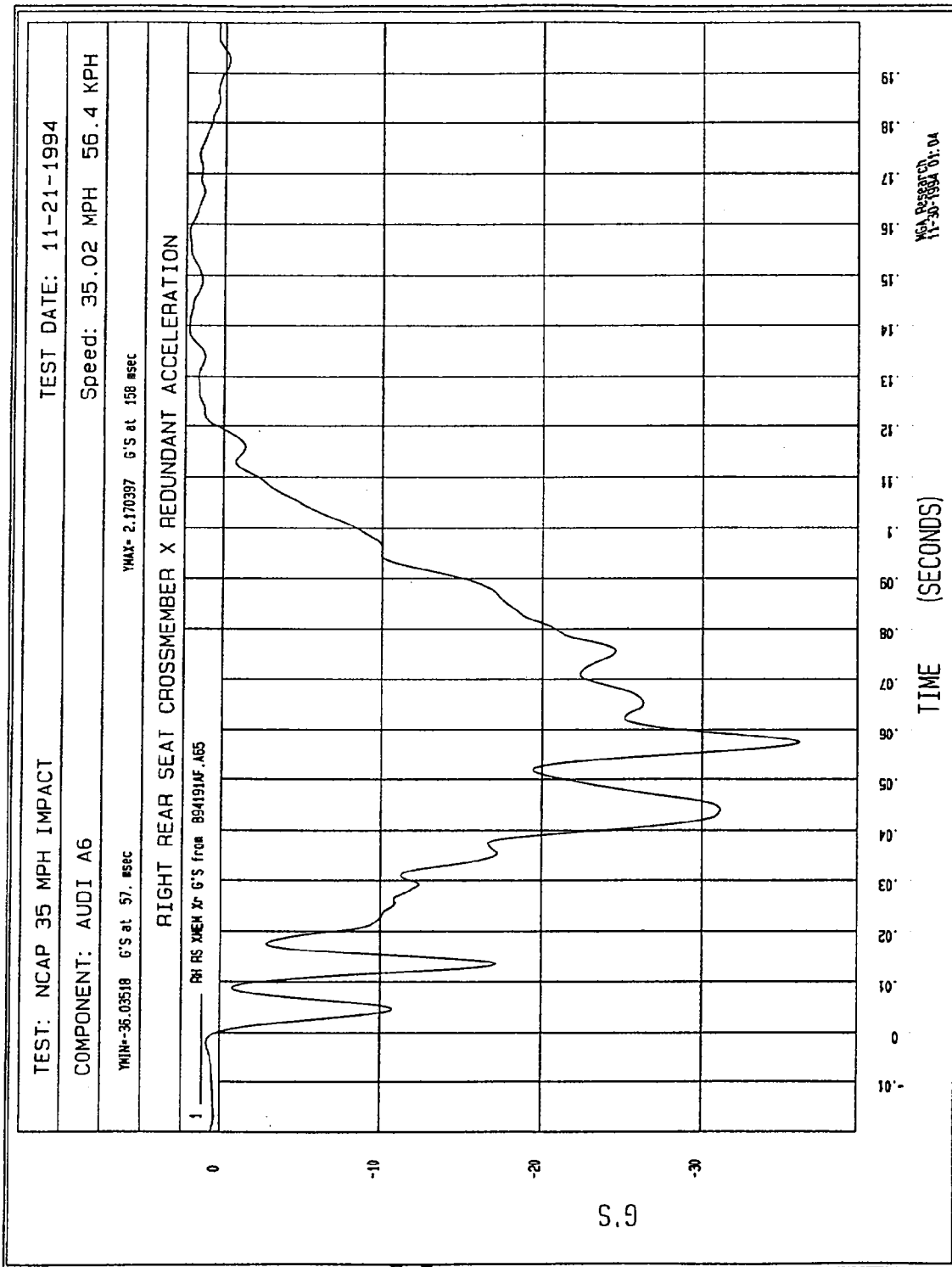


Figure B-7 - Right Rear Seat Crossmember X Redundant Acceleration vs. Time

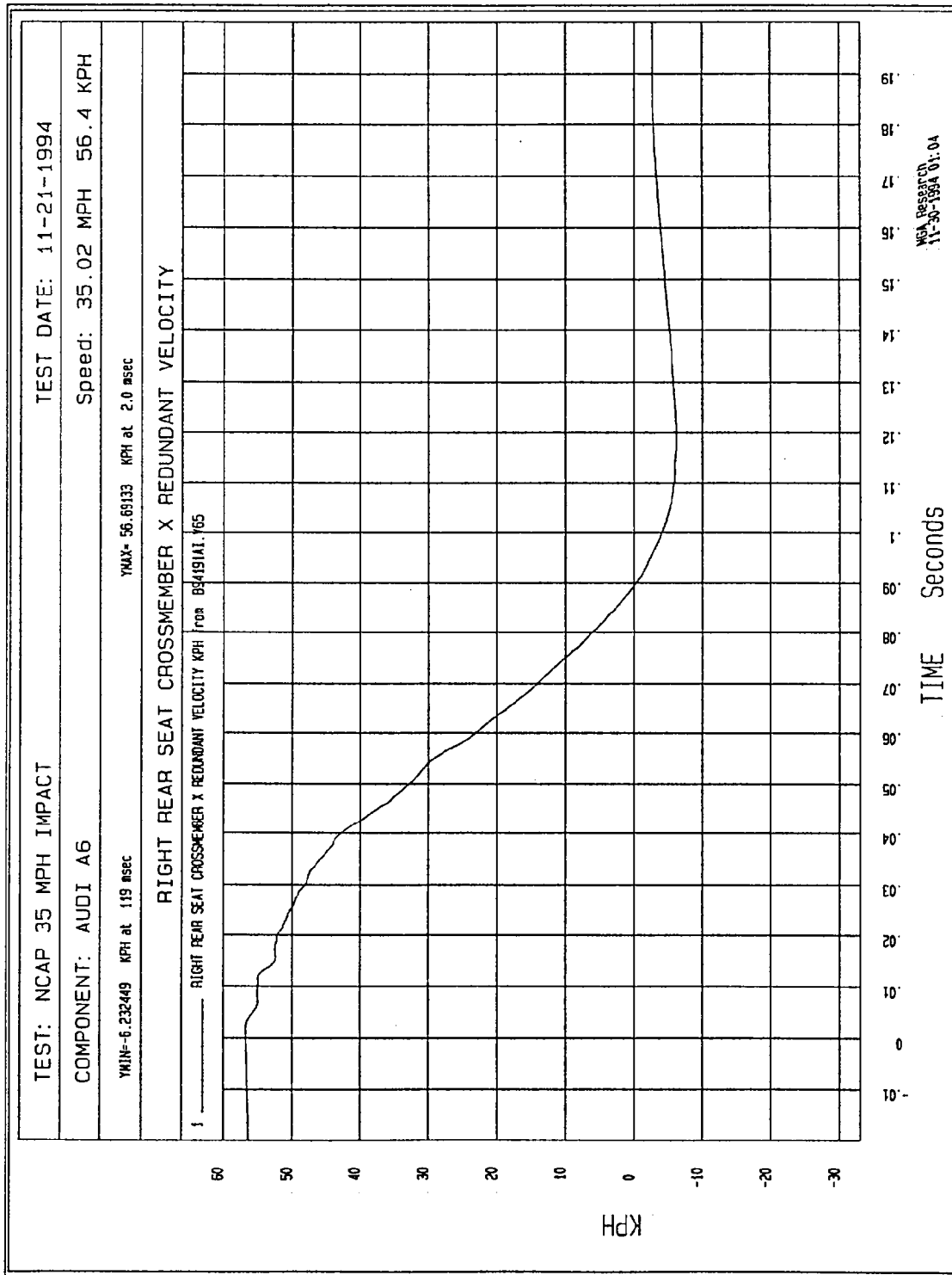
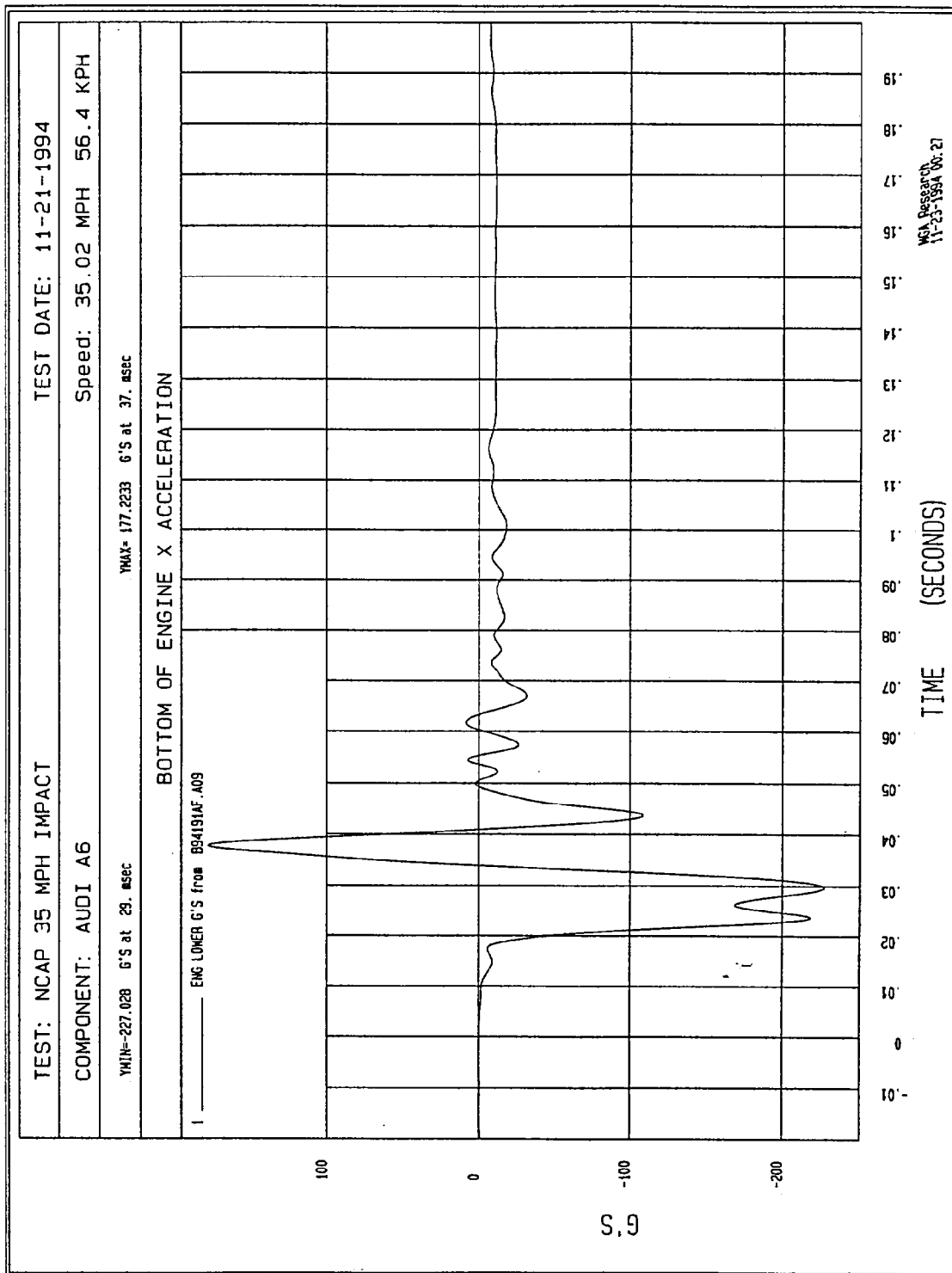


Figure B-8 - Right Rear Seat Crossmember X Redundant Velocity vs. Time

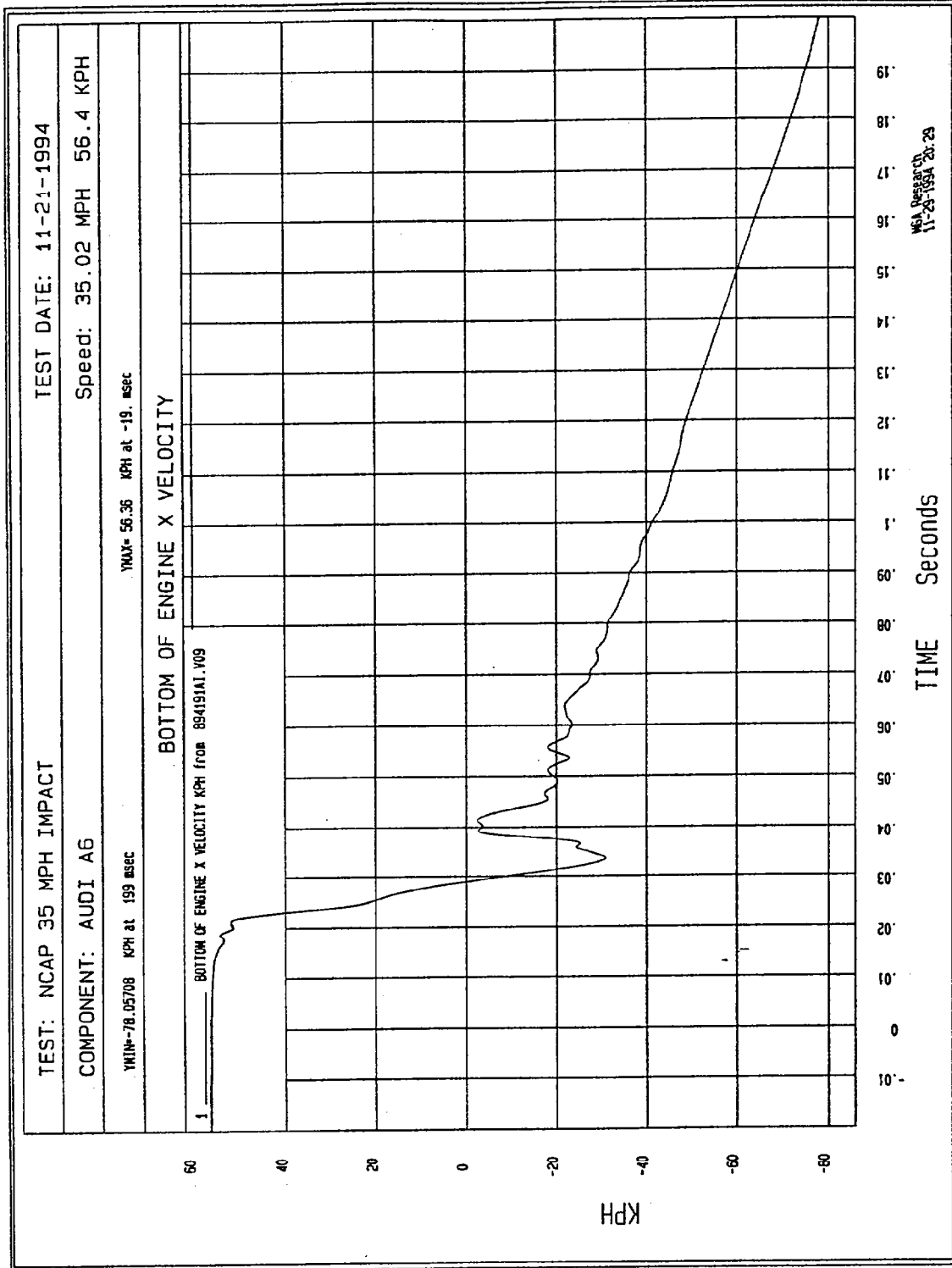
NO VALID DATA COLLECTED

Figure B-9 - Top of Engine Block X Acceleration vs. Time



B-10

Figure B-10 - Bottom of Engine X Acceleration vs. Time



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Figure B-11 - Bottom of Engine X Velocity vs. Time

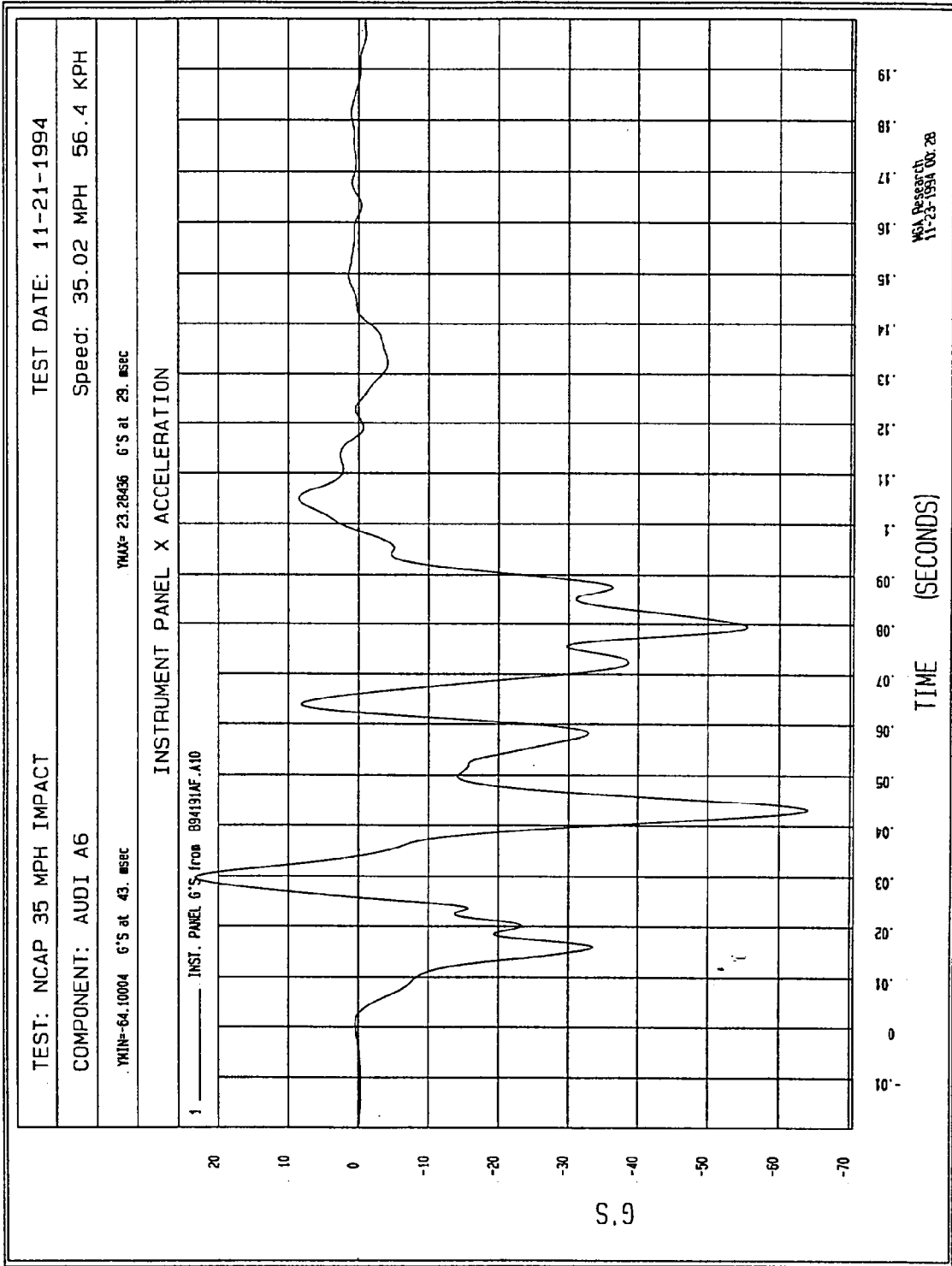


Figure B-12 - Instrument Panel X Acceleration vs. Time

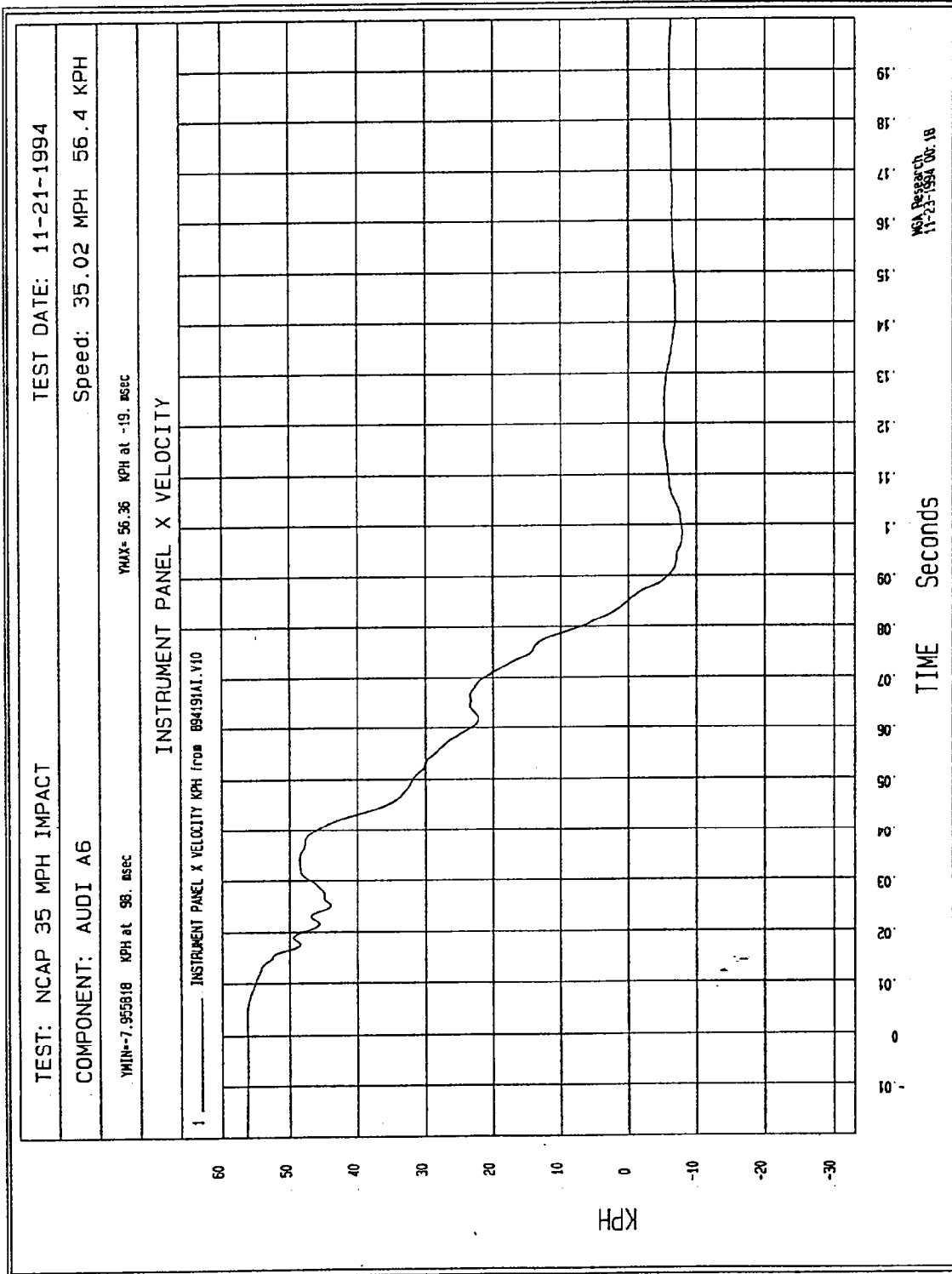


Figure B-13 - Instrument Panel X Velocity vs. Time

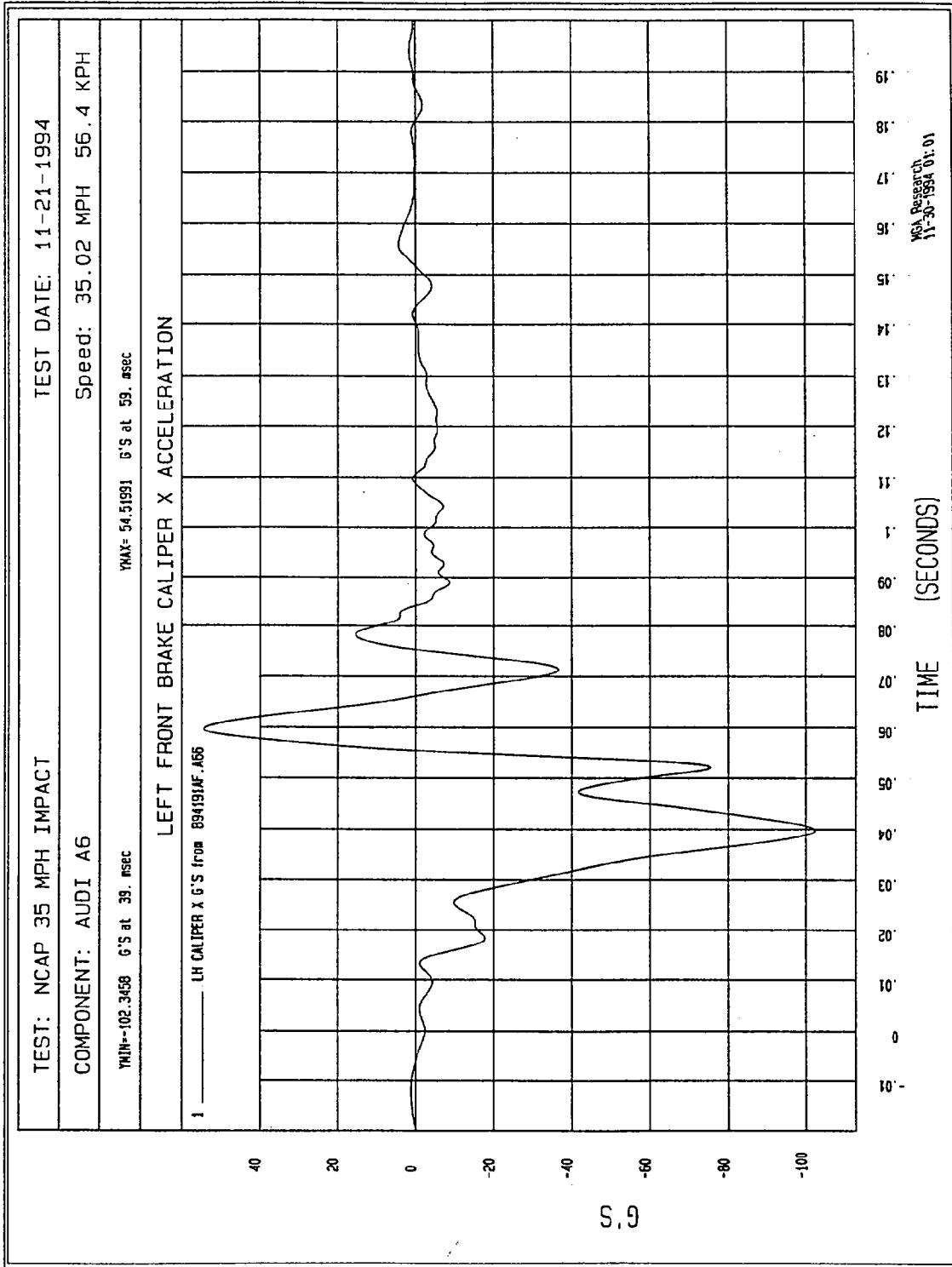


Figure B-14 - Left Brake Caliper X Acceleration vs. Time

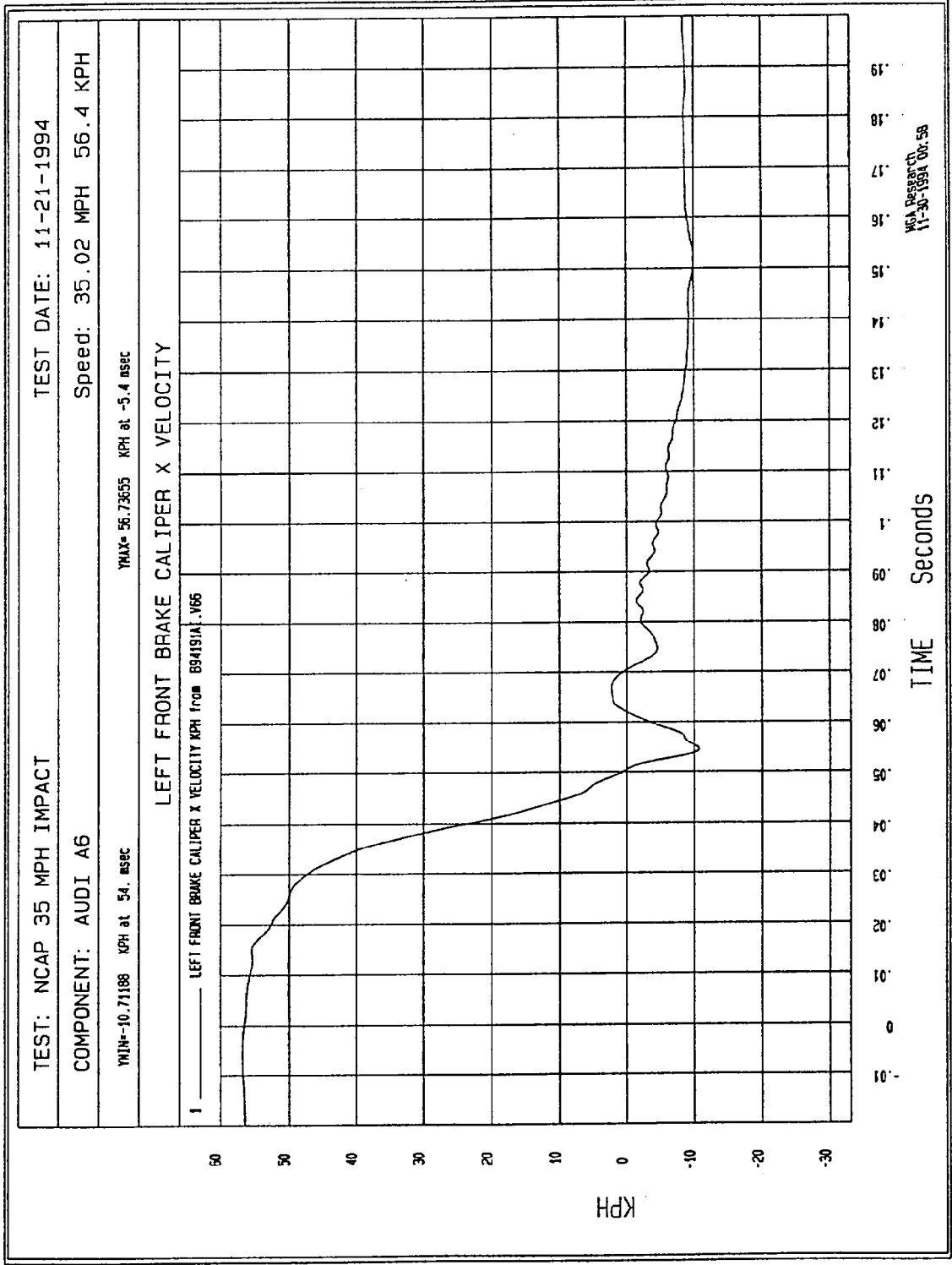


Figure B-15 - Left Brake Caliper X Velocity vs. Time

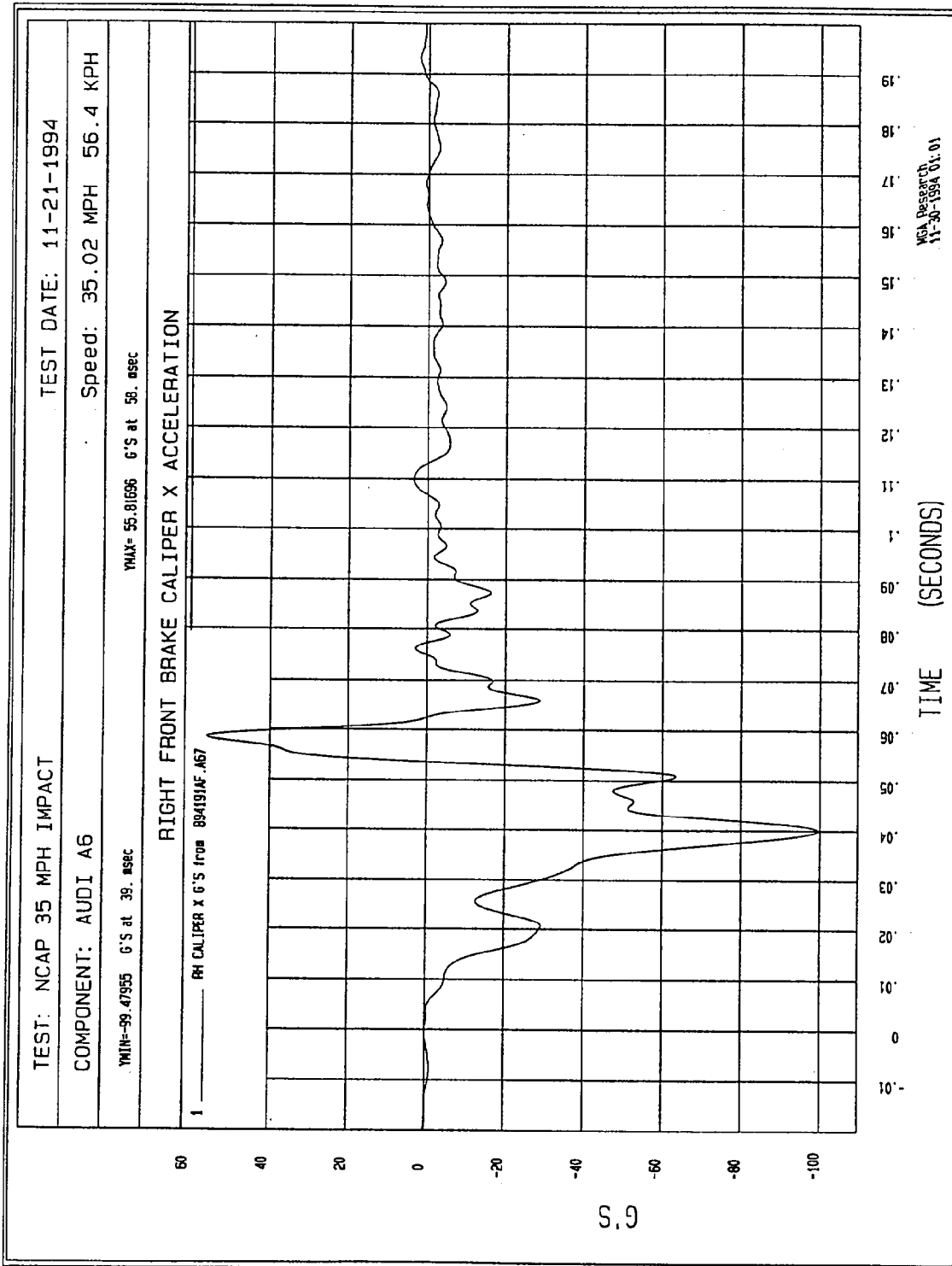


Figure B-16 - Right Brake Caliper X Acceleration vs. Time

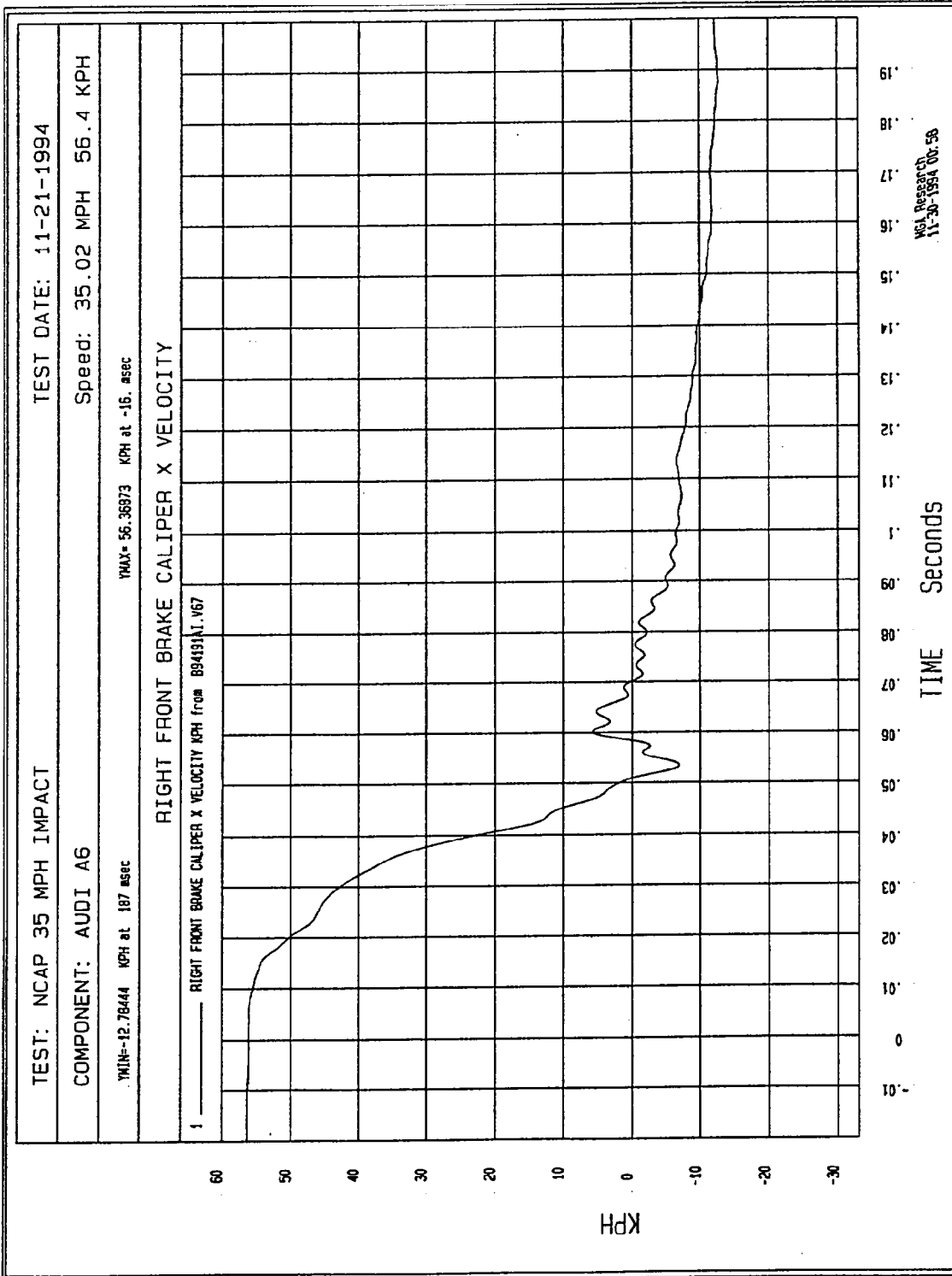
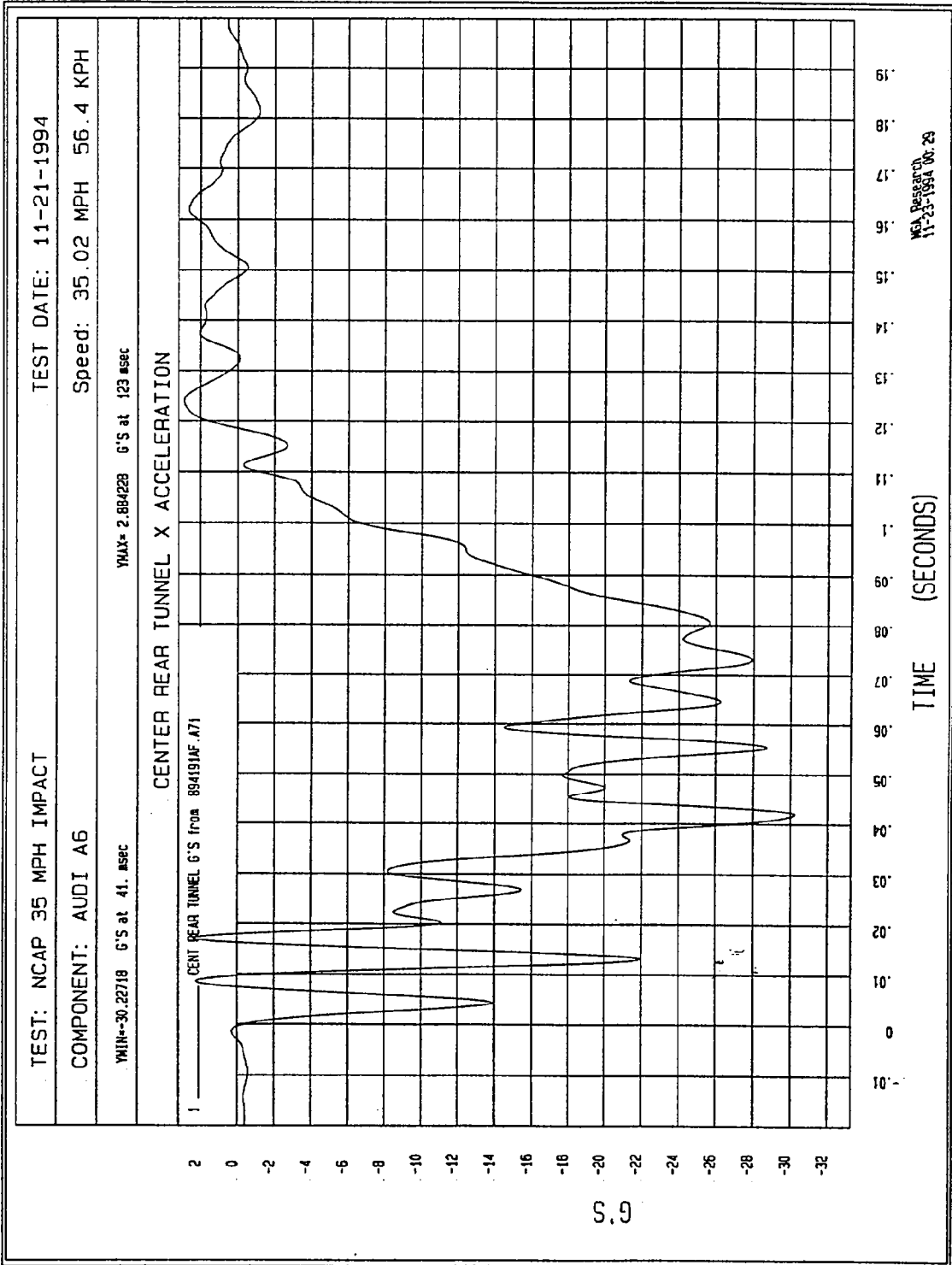
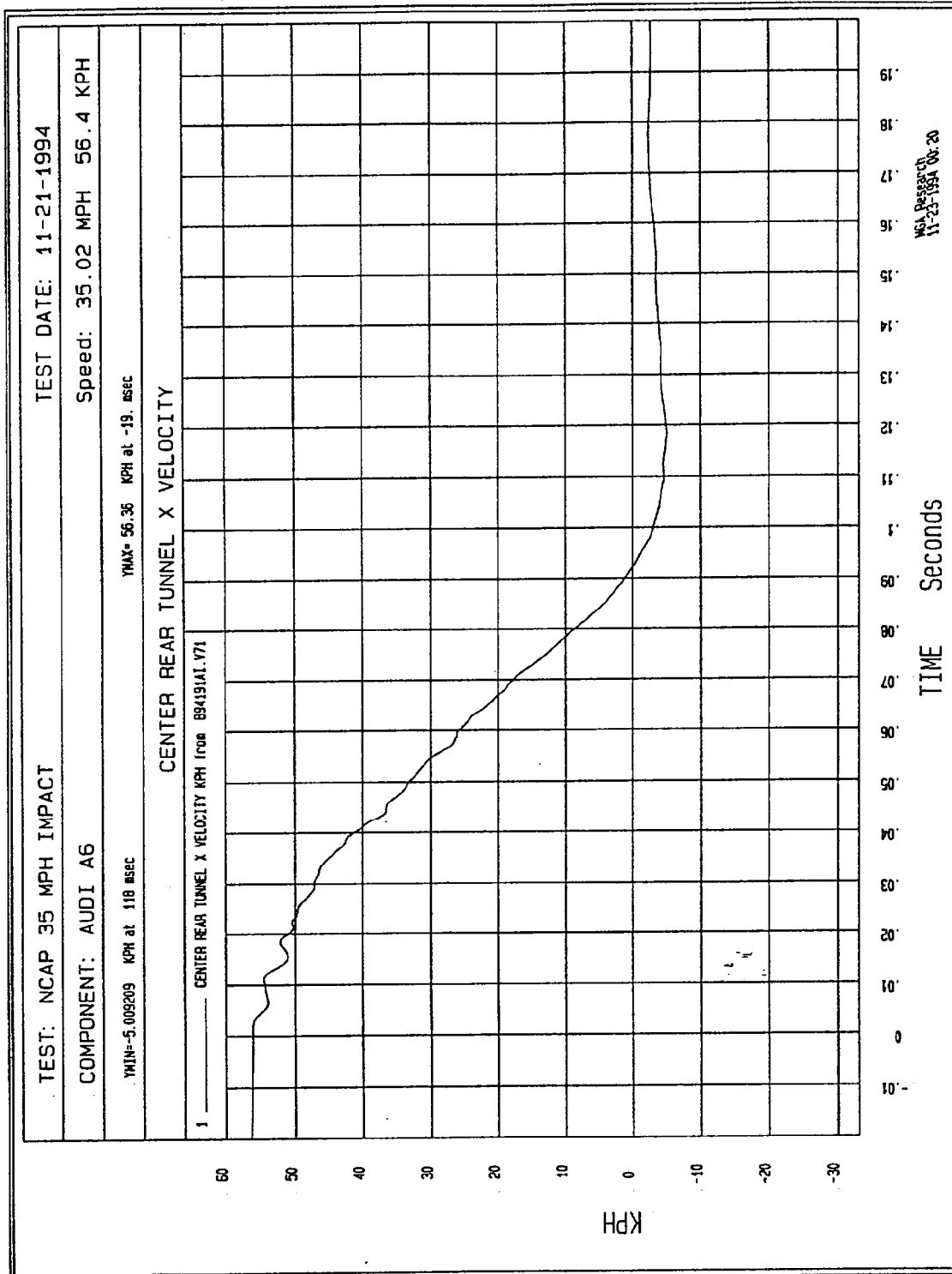


Figure B-17 - Right Brake Caliper X Velocity vs. Time



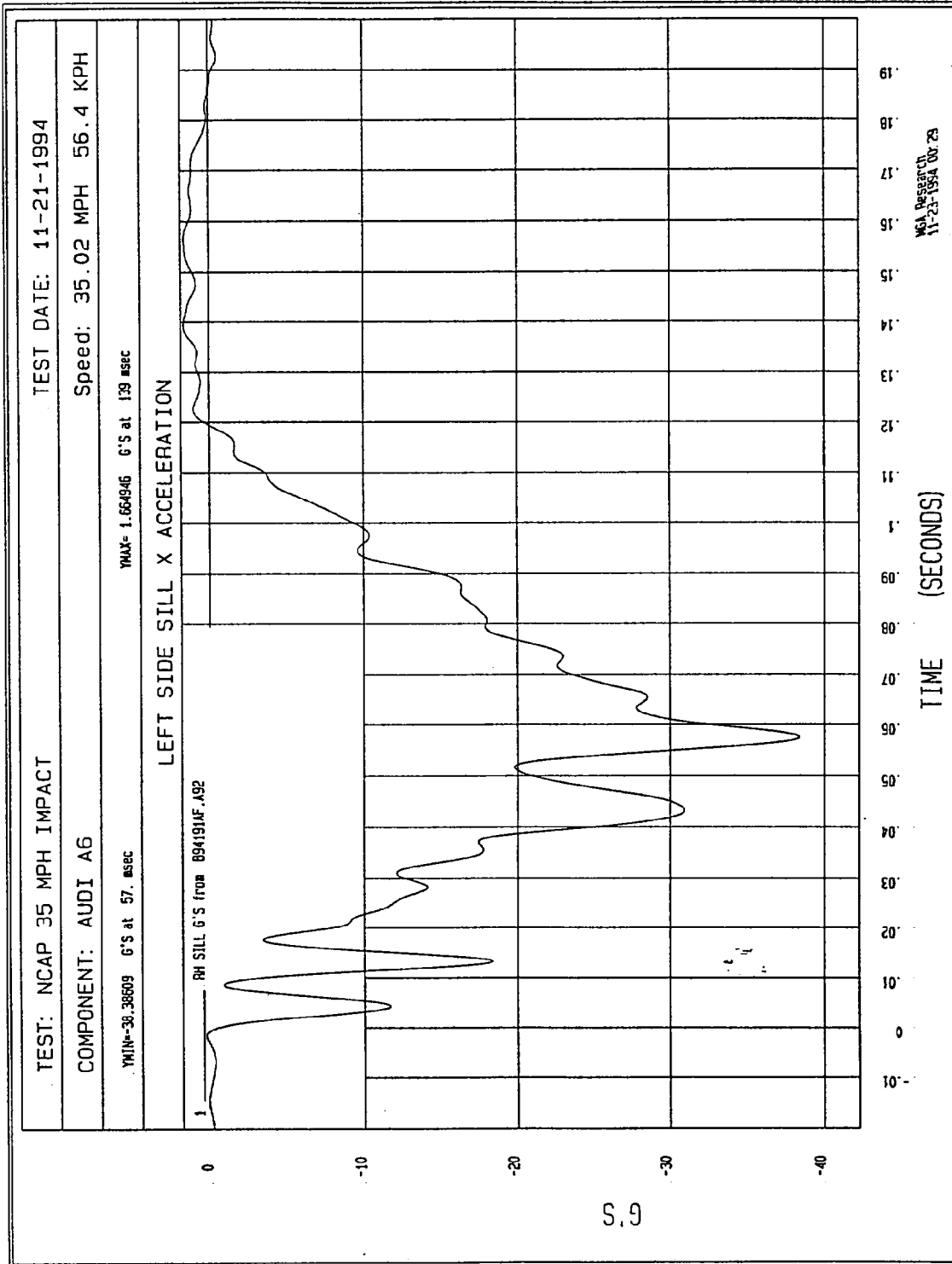
B-18

Figure B-18 - Center Rear Tunnel X Acceleration vs. Time



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Figure B-19 - Center Rear Tunnel X Velocity vs. Time



B-20

Figure B-20 - Left Side Sill X Acceleration vs. Time

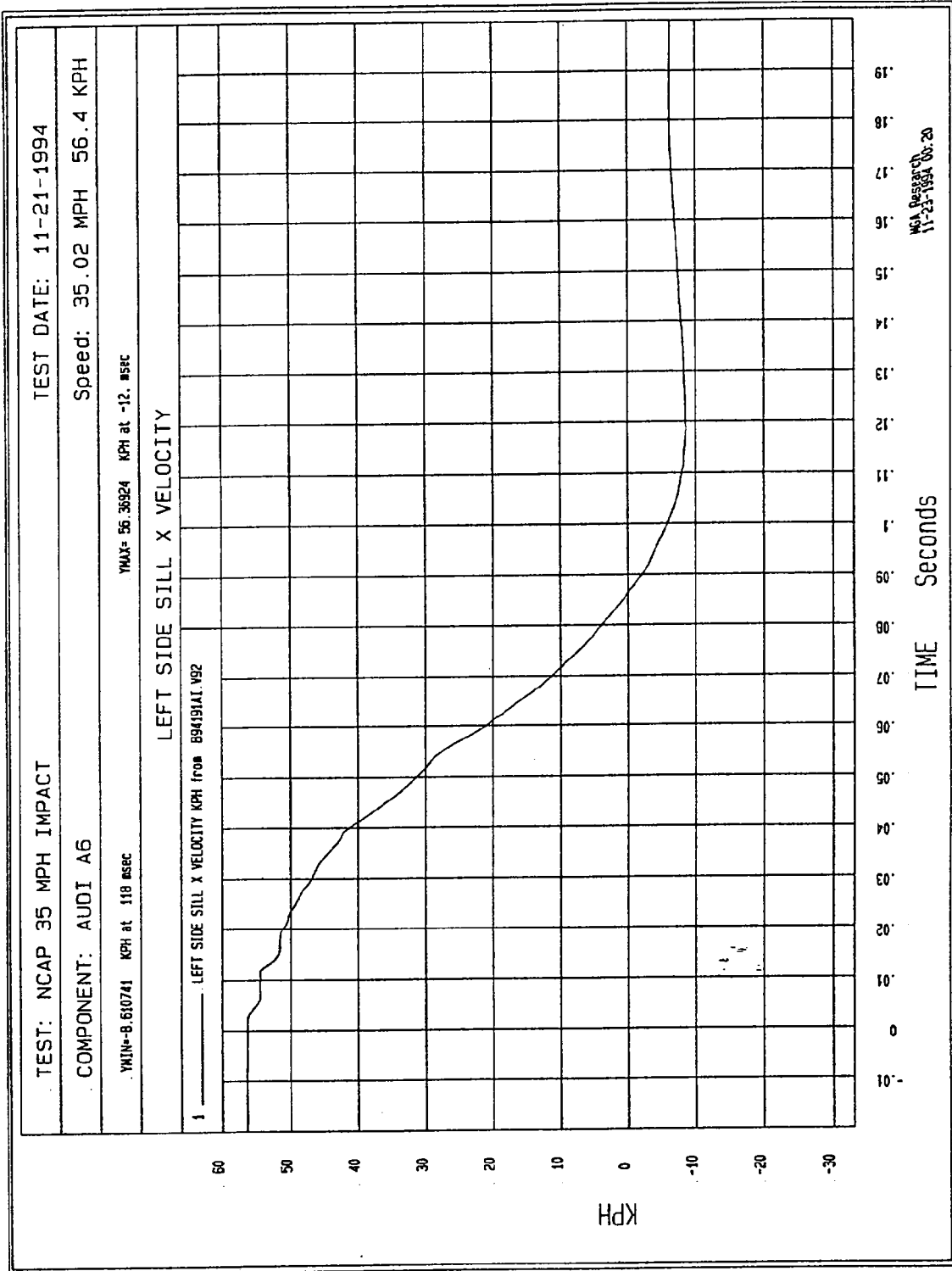


Figure B-21 - Left Side Sill X Velocity vs. Time

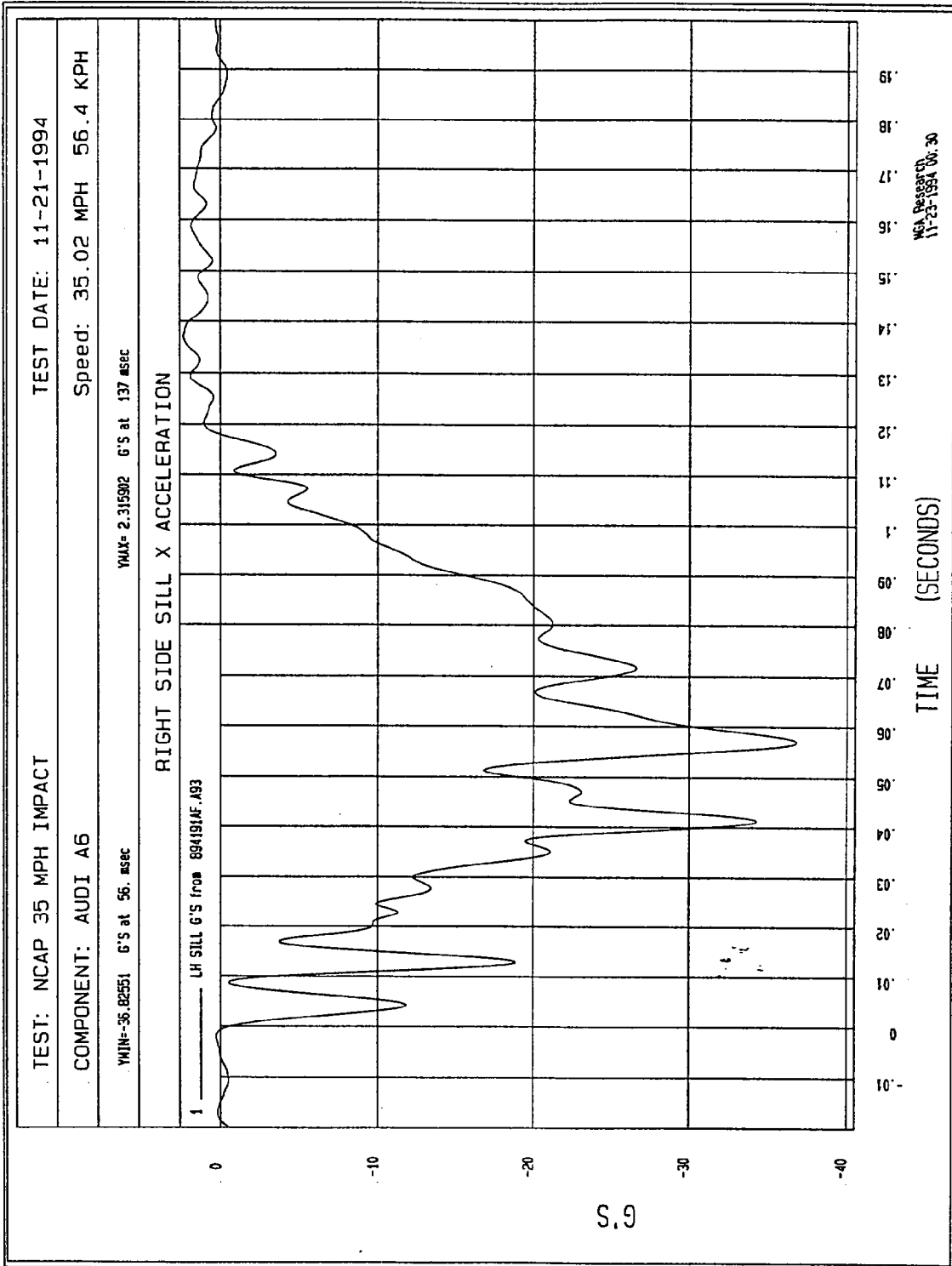
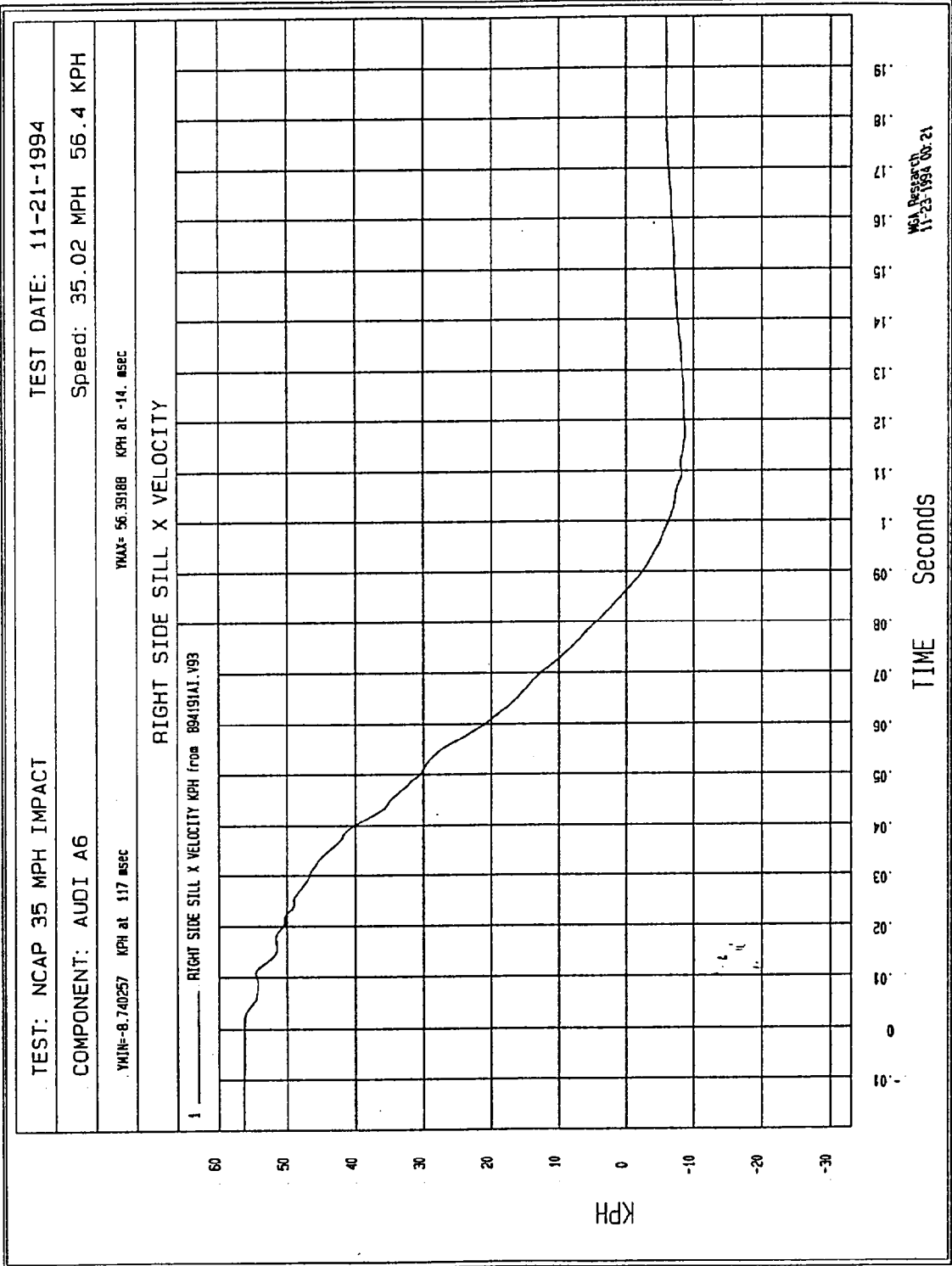


Figure B-22 - Right Side Sill X Acceleration vs. Time



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Figure B-23 - Right Side Sill X Velocity vs. Time

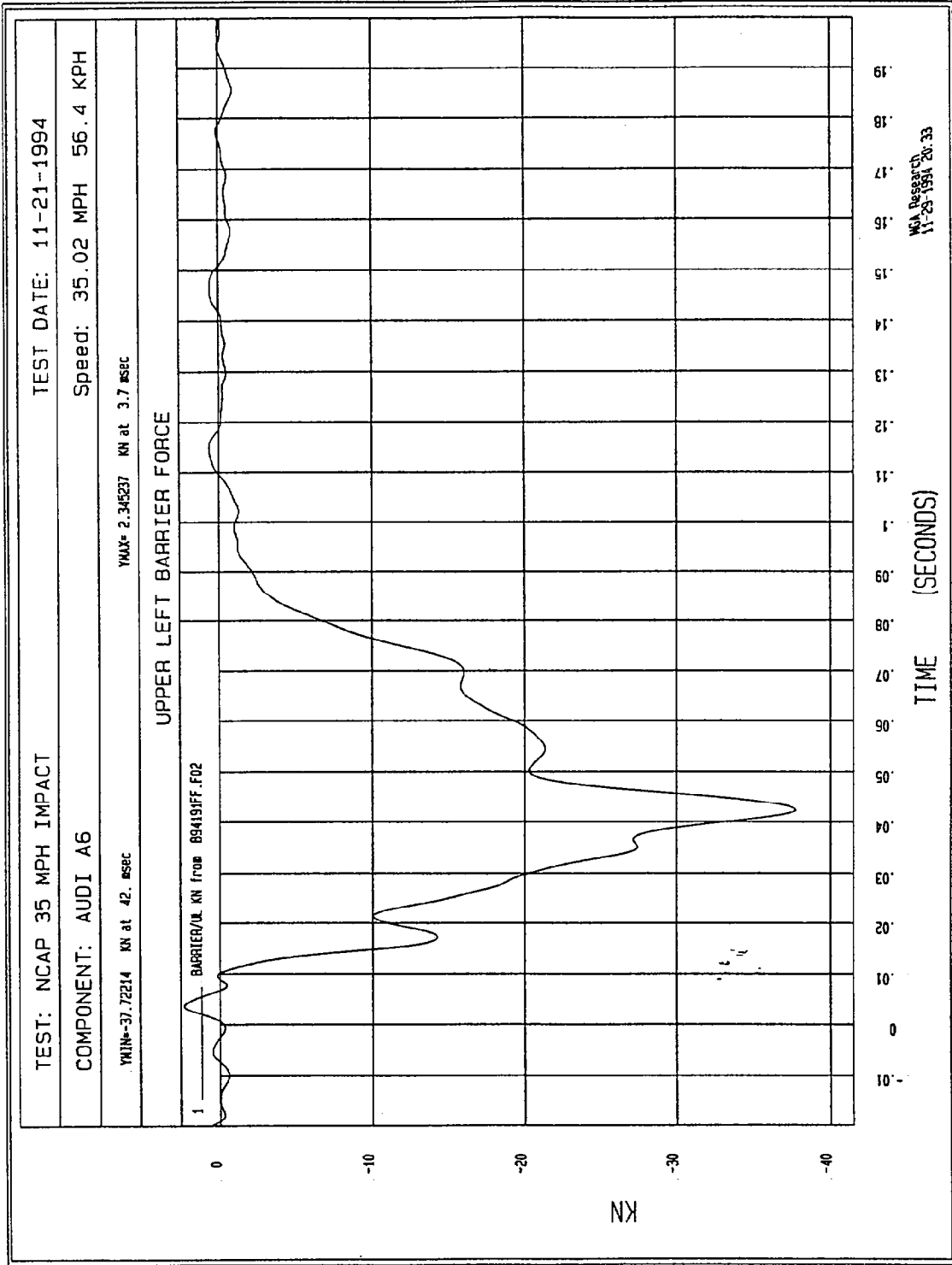
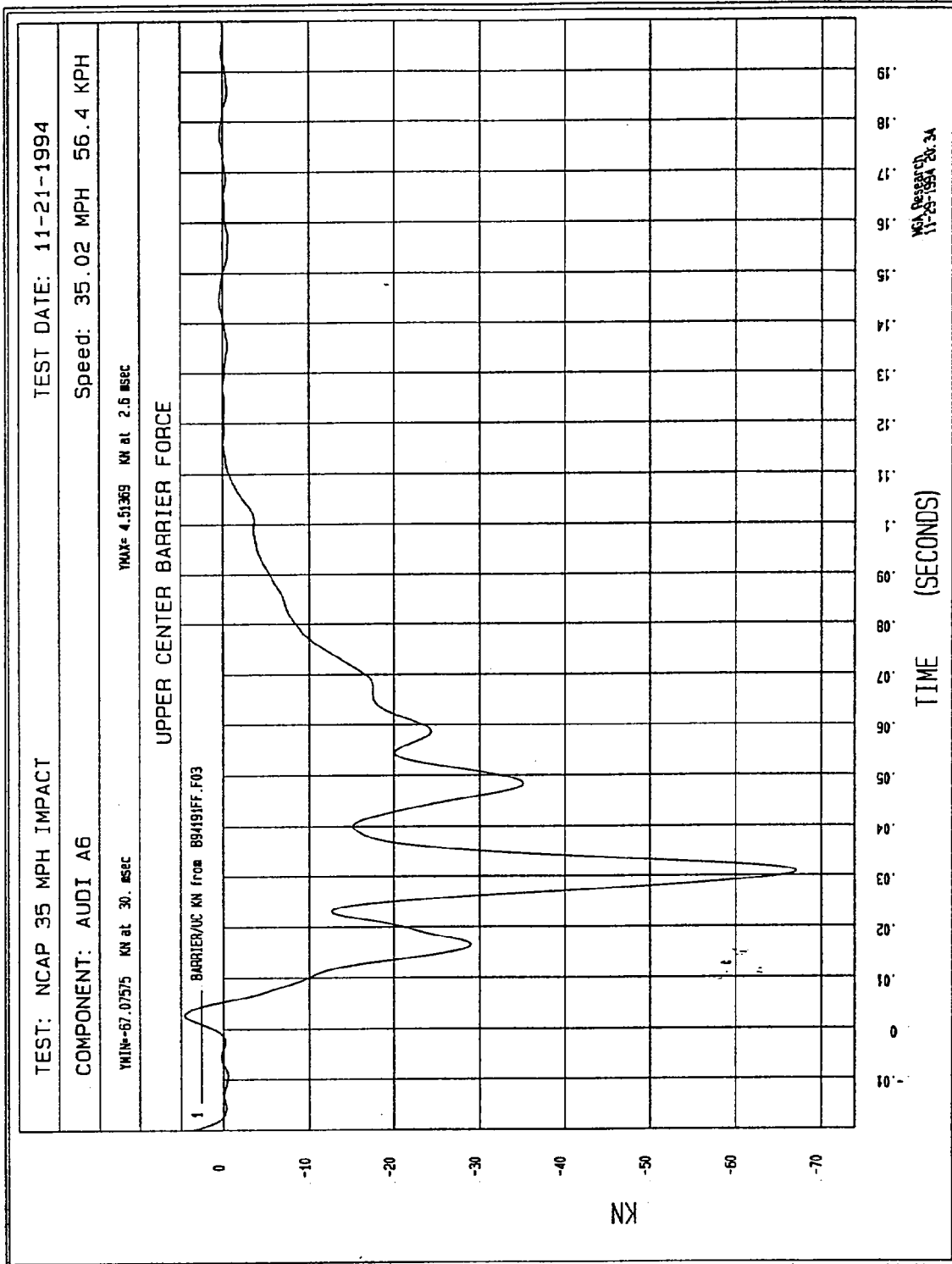
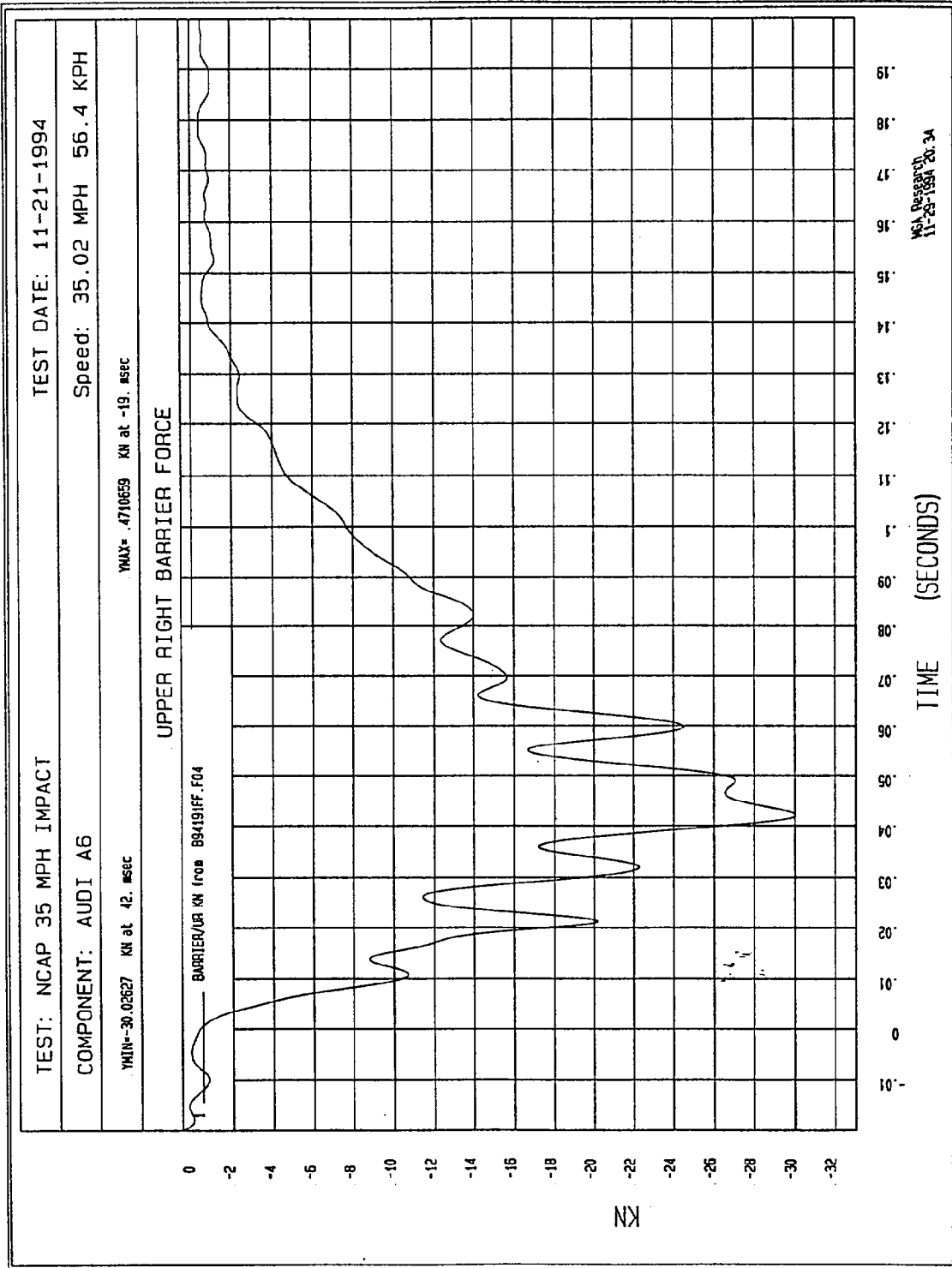


Figure B-24 - Upper Left Barrier Force vs. Time



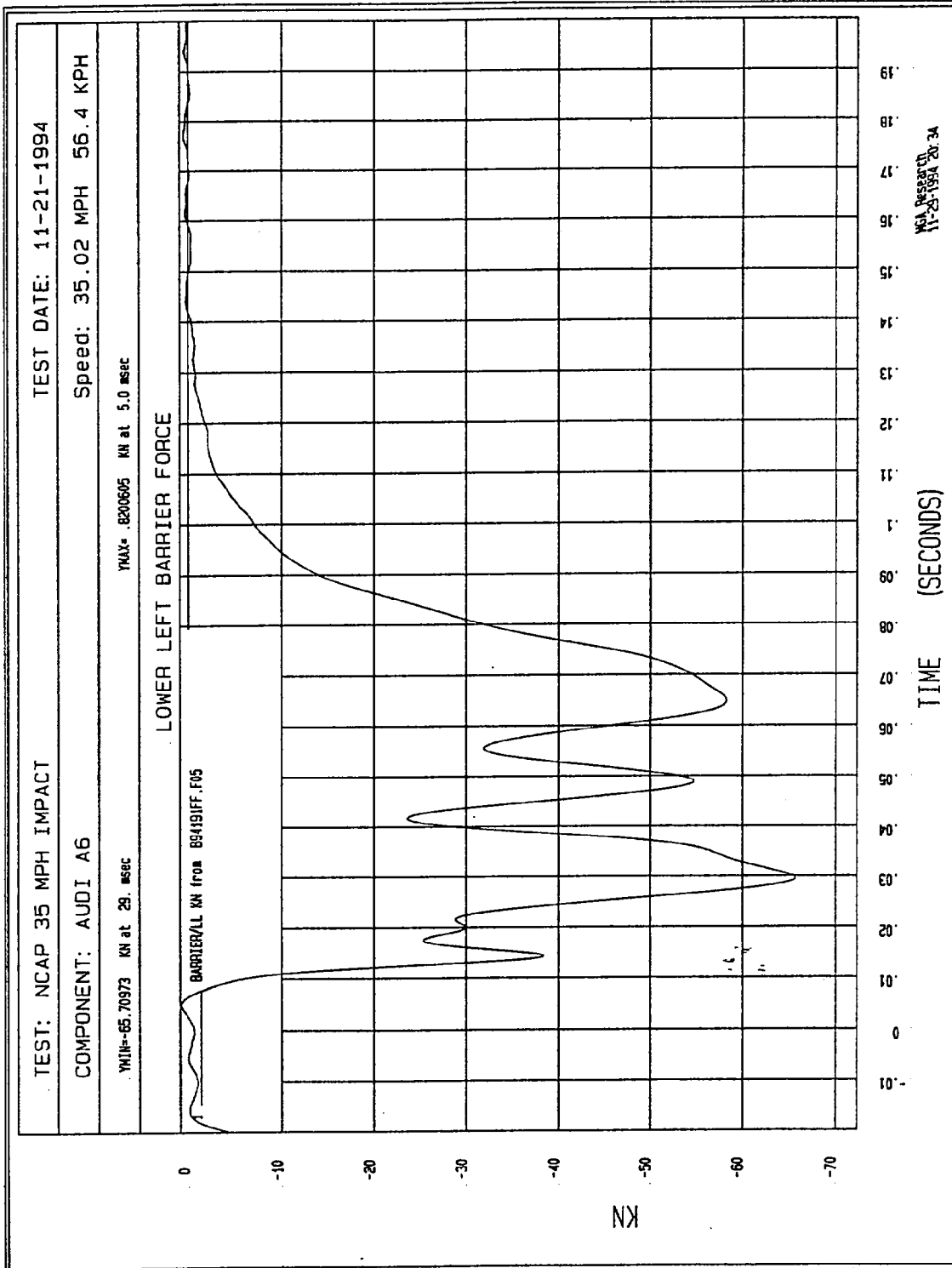
MSA Research  
11-25-1994 20.34

Figure B-25 - Upper Center Barrier Force vs. Time



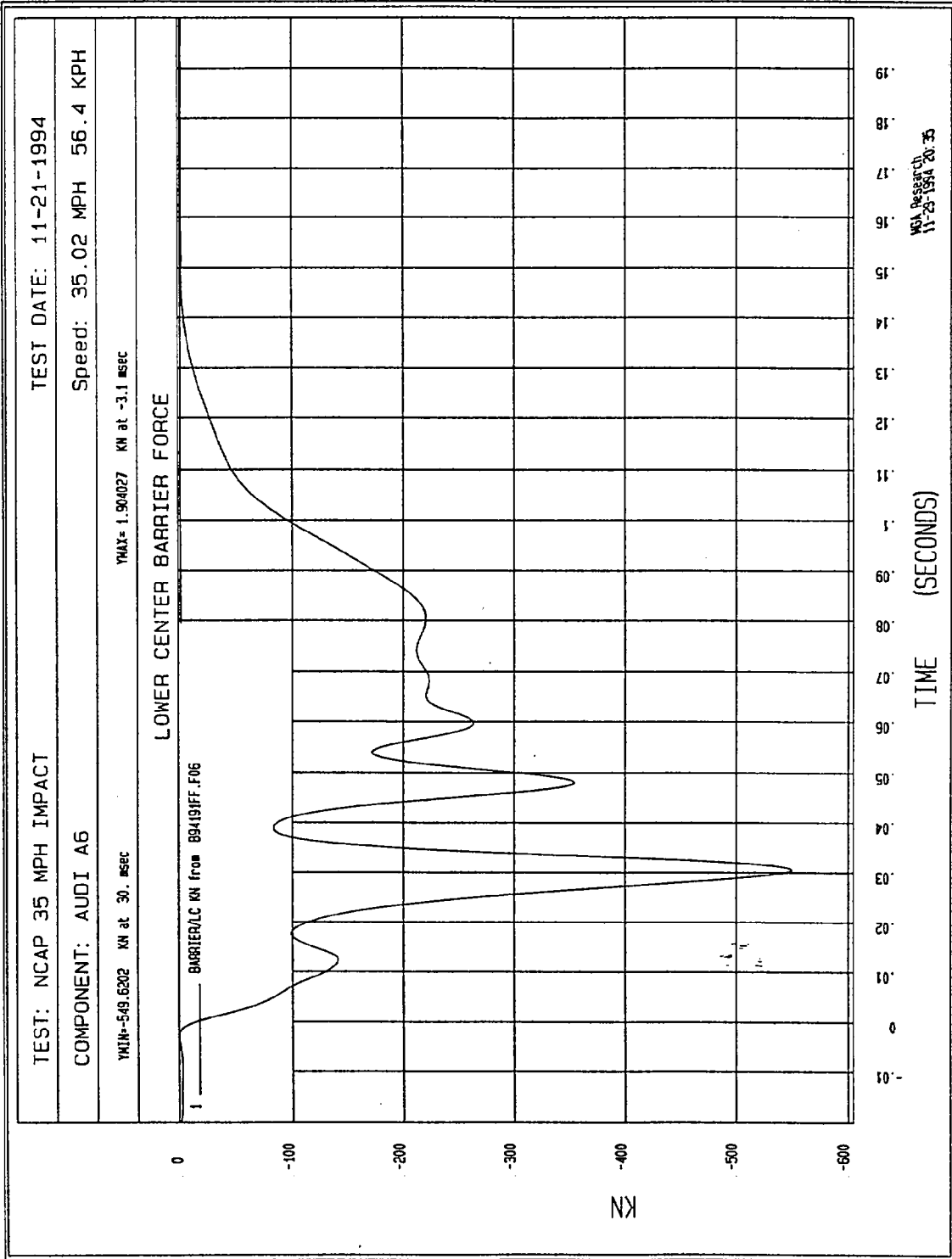
B-26

Figure B-26 - Upper Right Barrier Force vs. Time



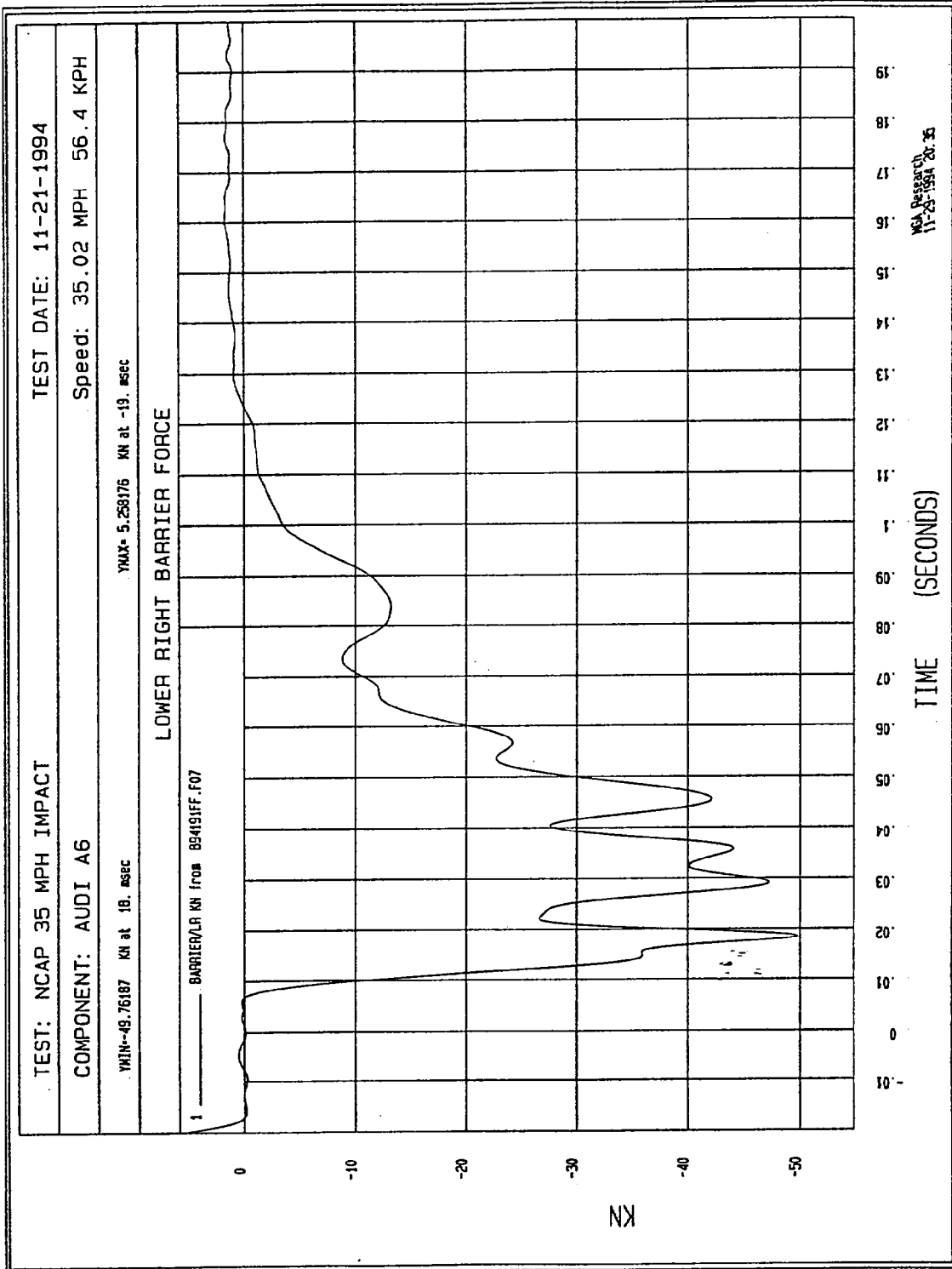
B-27

Figure B-27 - Lower Left Barrier Force vs. Time



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Figure B-28 - Lower Center Barrier Force vs. Time



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Figure B-29 - Lower Right Barrier Force vs. Time

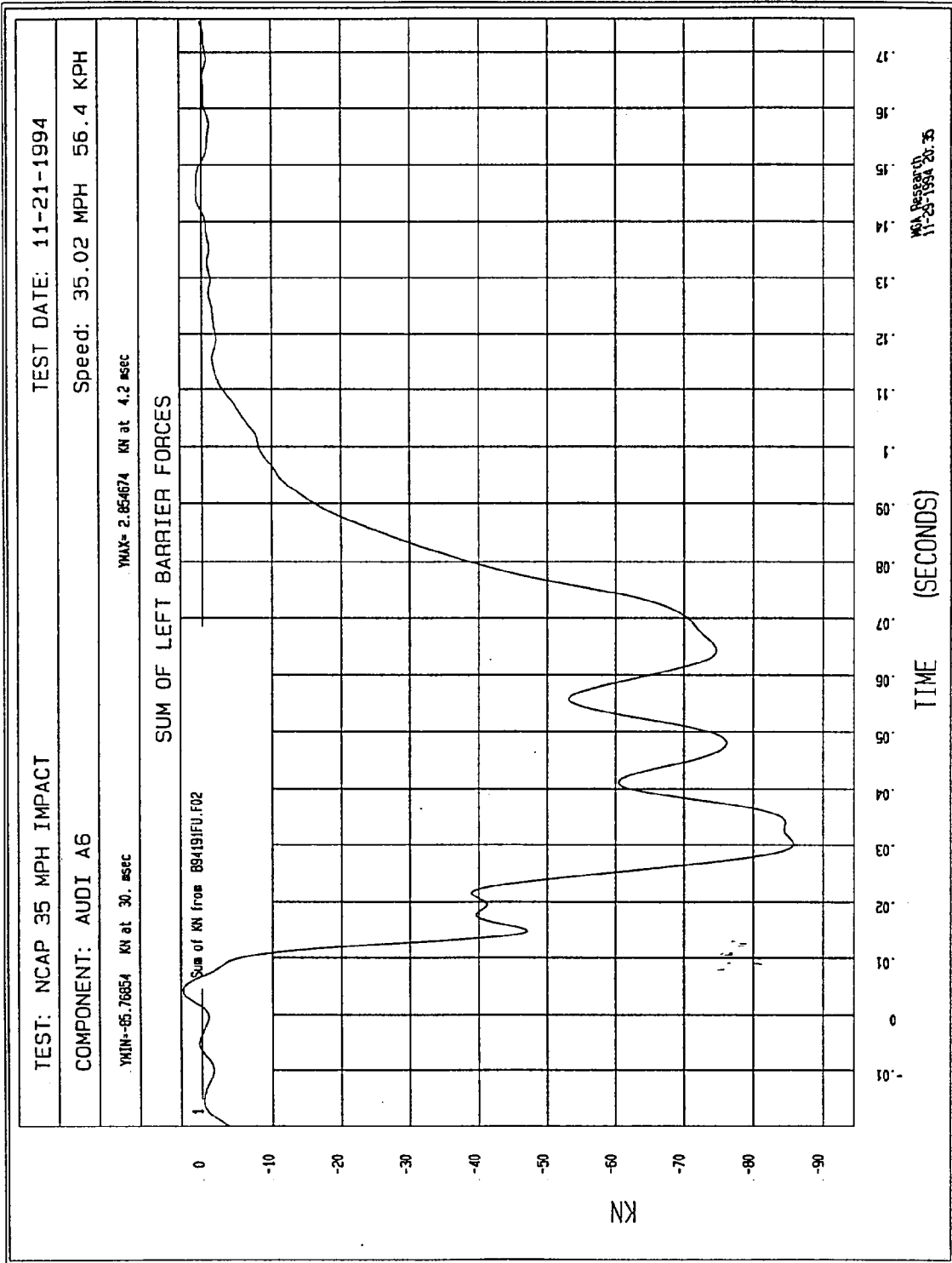
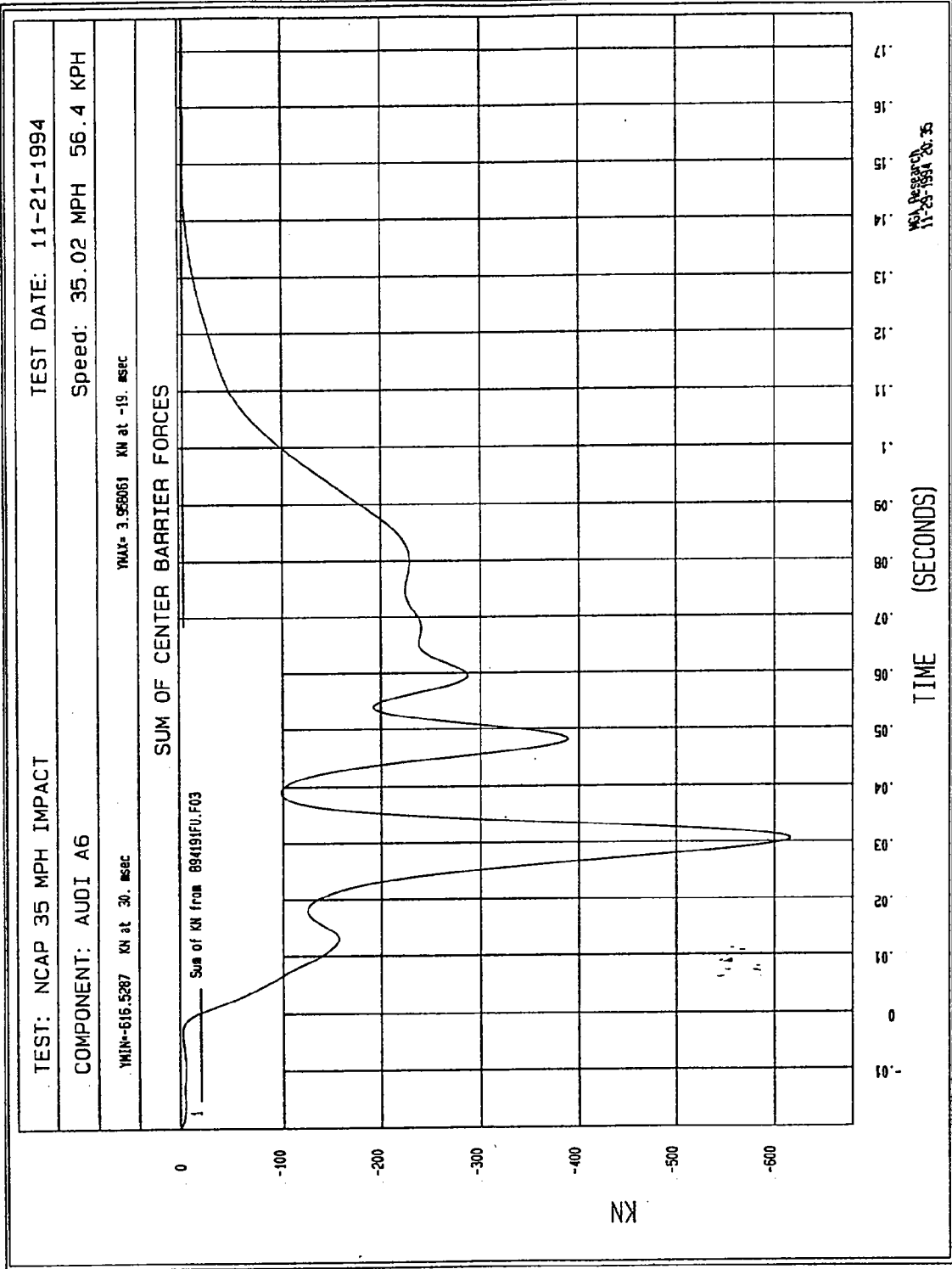
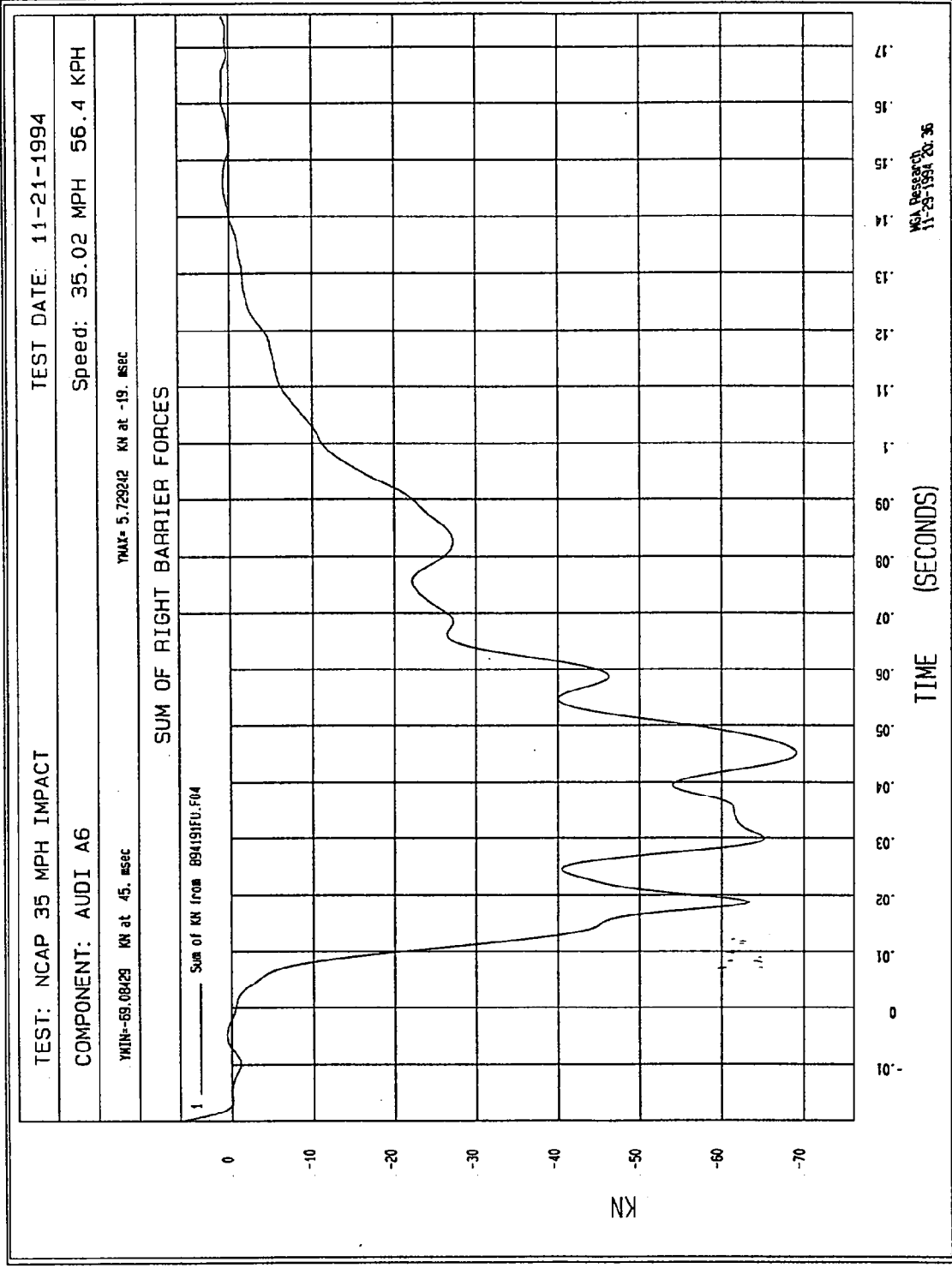


Figure B-30 - Sum of Left Barrier Forces vs. Time



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Figure B-31 - Sum of Center Barrier Forces vs. Time



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Figure B-32 - Sum of Right Barrier Forces vs. Time

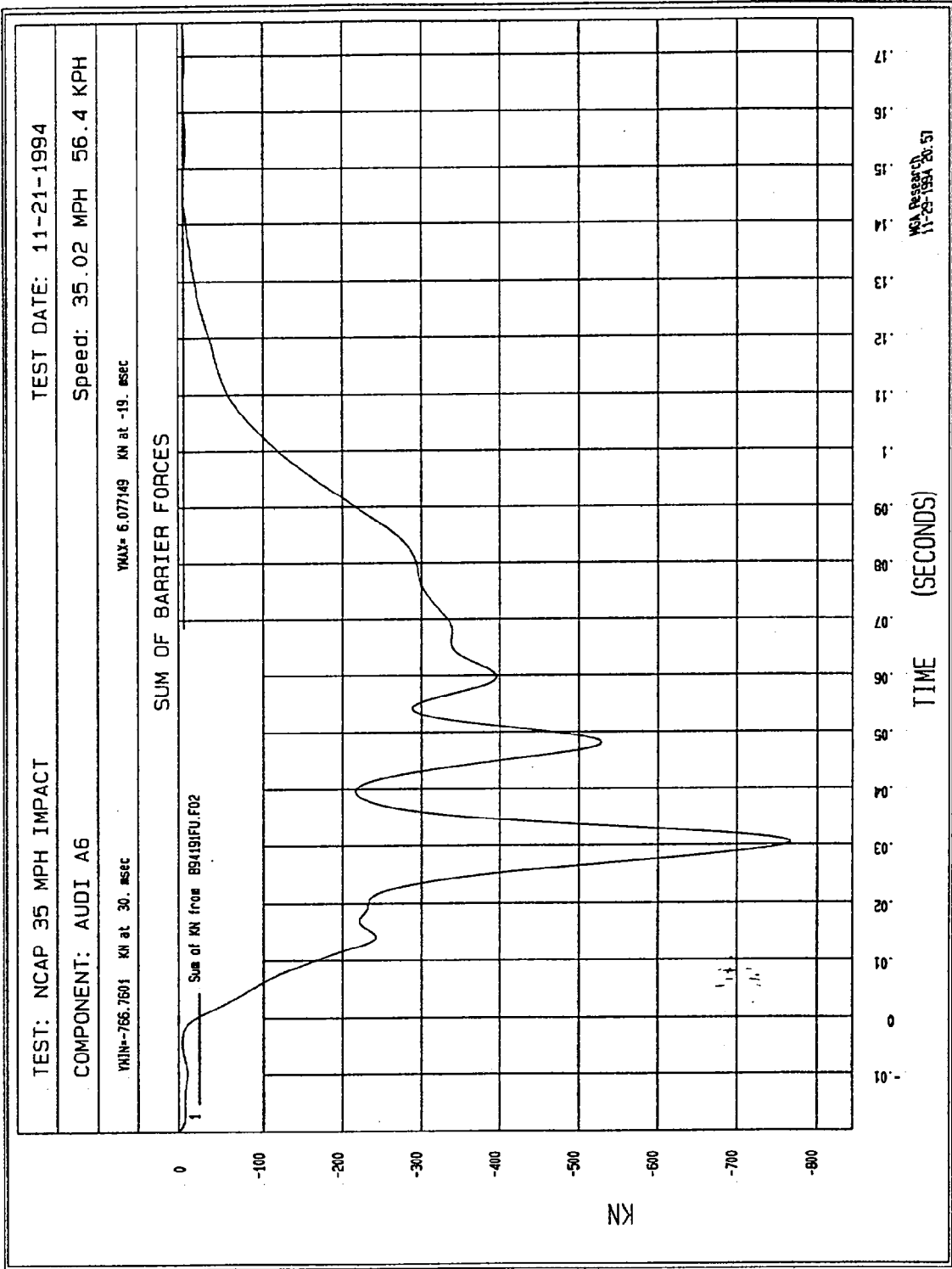


Figure B-33 - Sum of Barrier Forces vs. Time

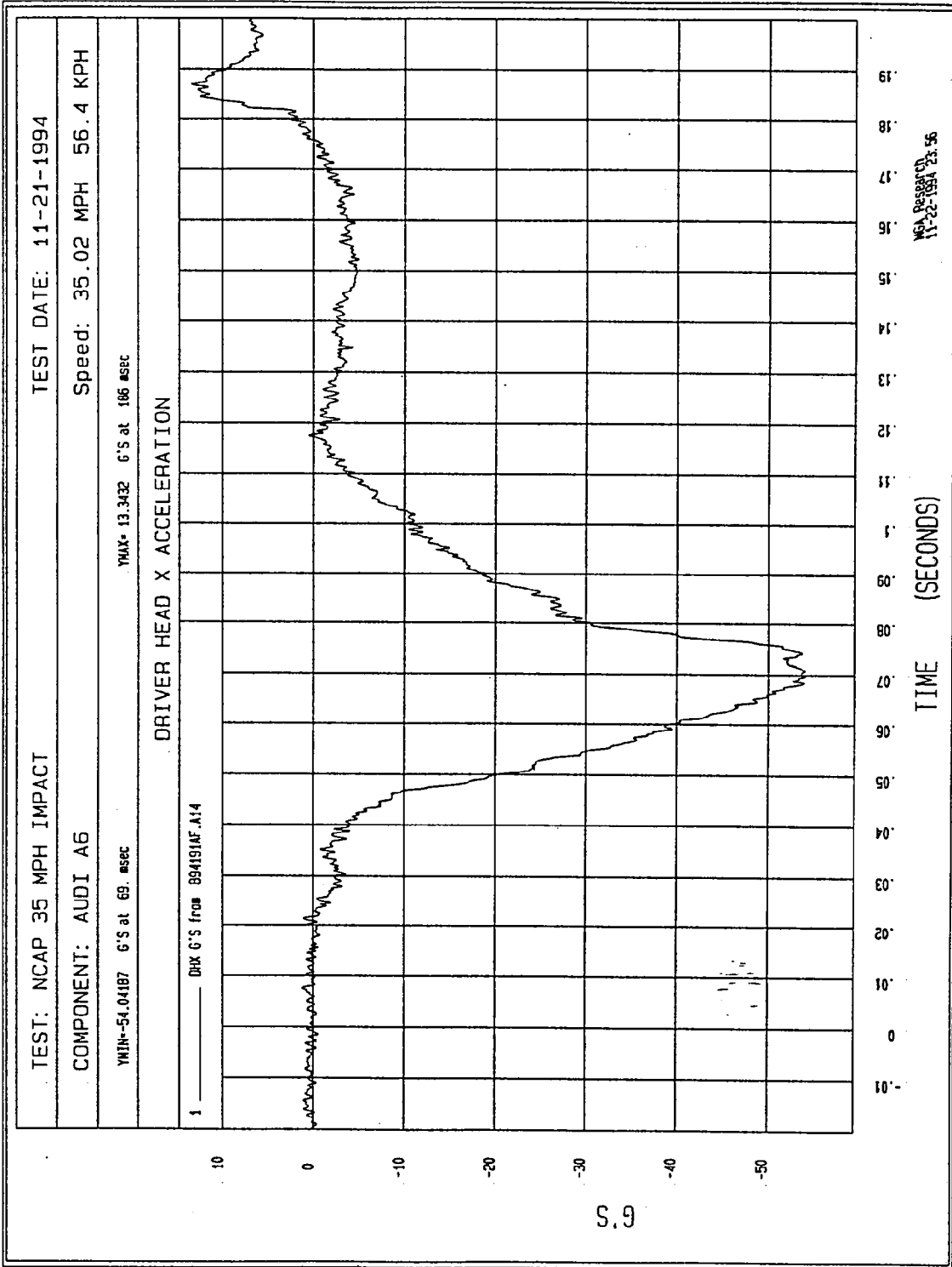


Figure B-34 - Driver Head X Acceleration vs. Time

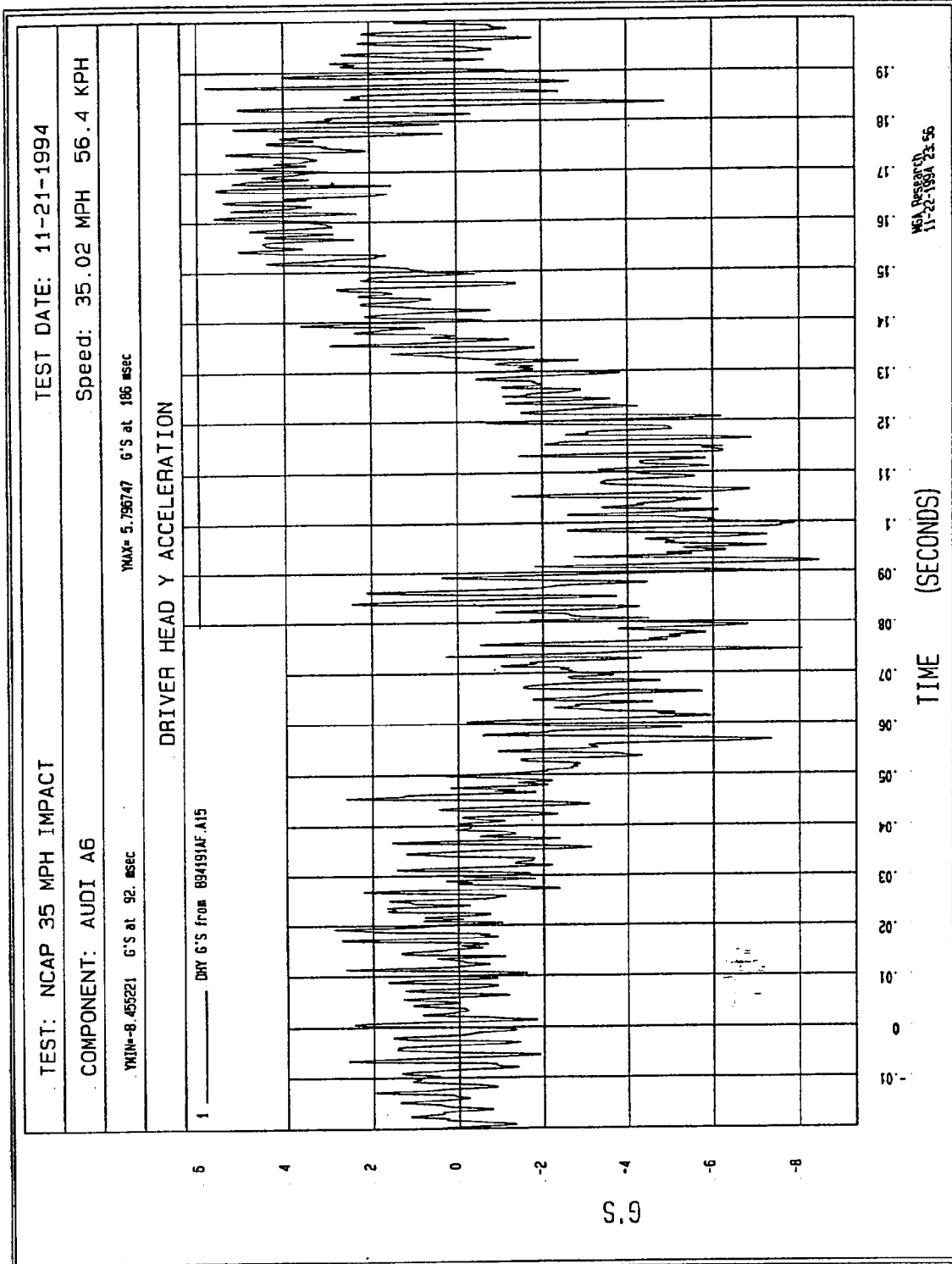


Figure B-35 - Driver Head Y Acceleration vs. Time

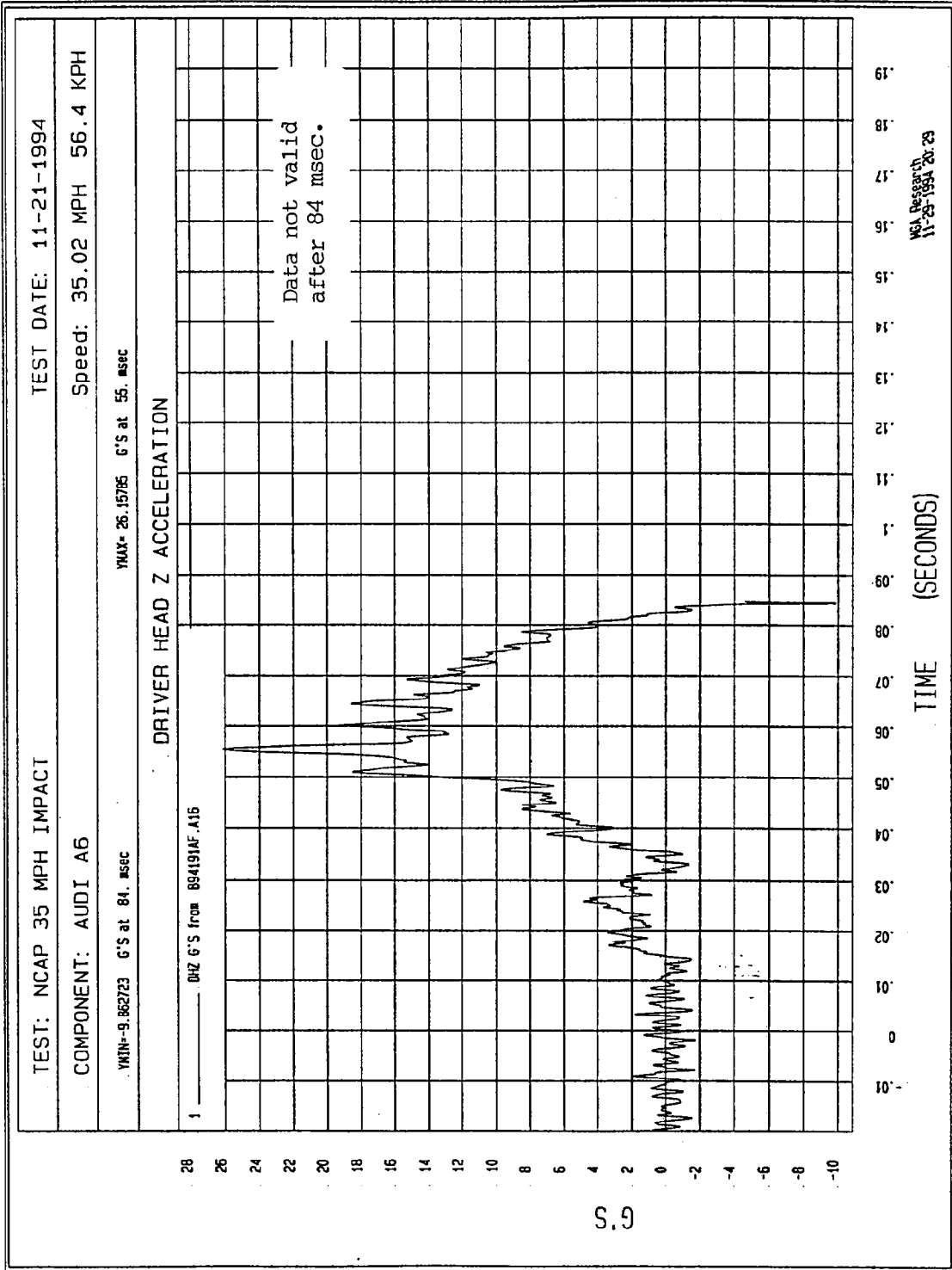


Figure B-36 - Driver Head Z Acceleration vs. Time

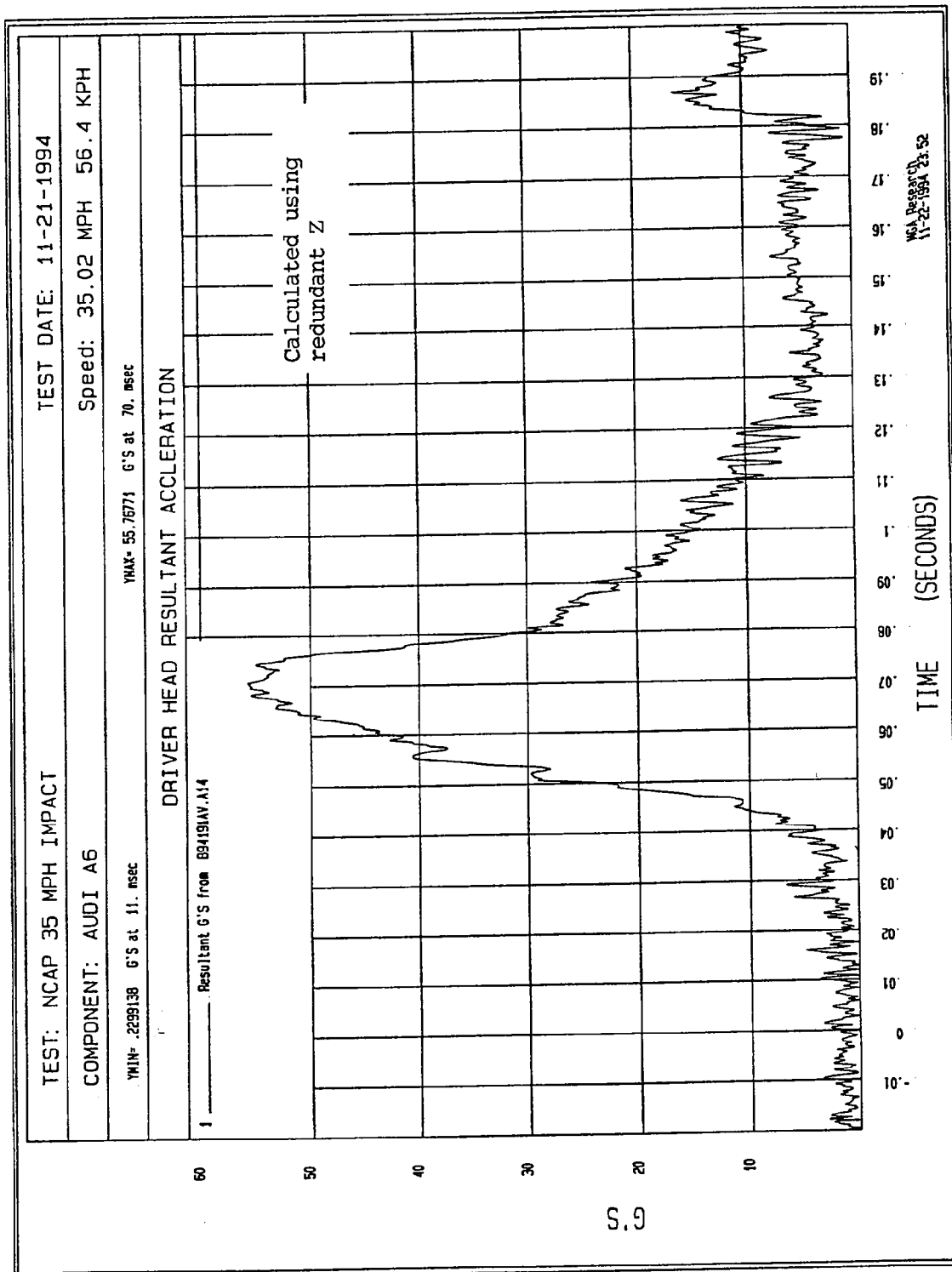


Figure B-37 - Driver Head Resultant Acceleration vs. Time

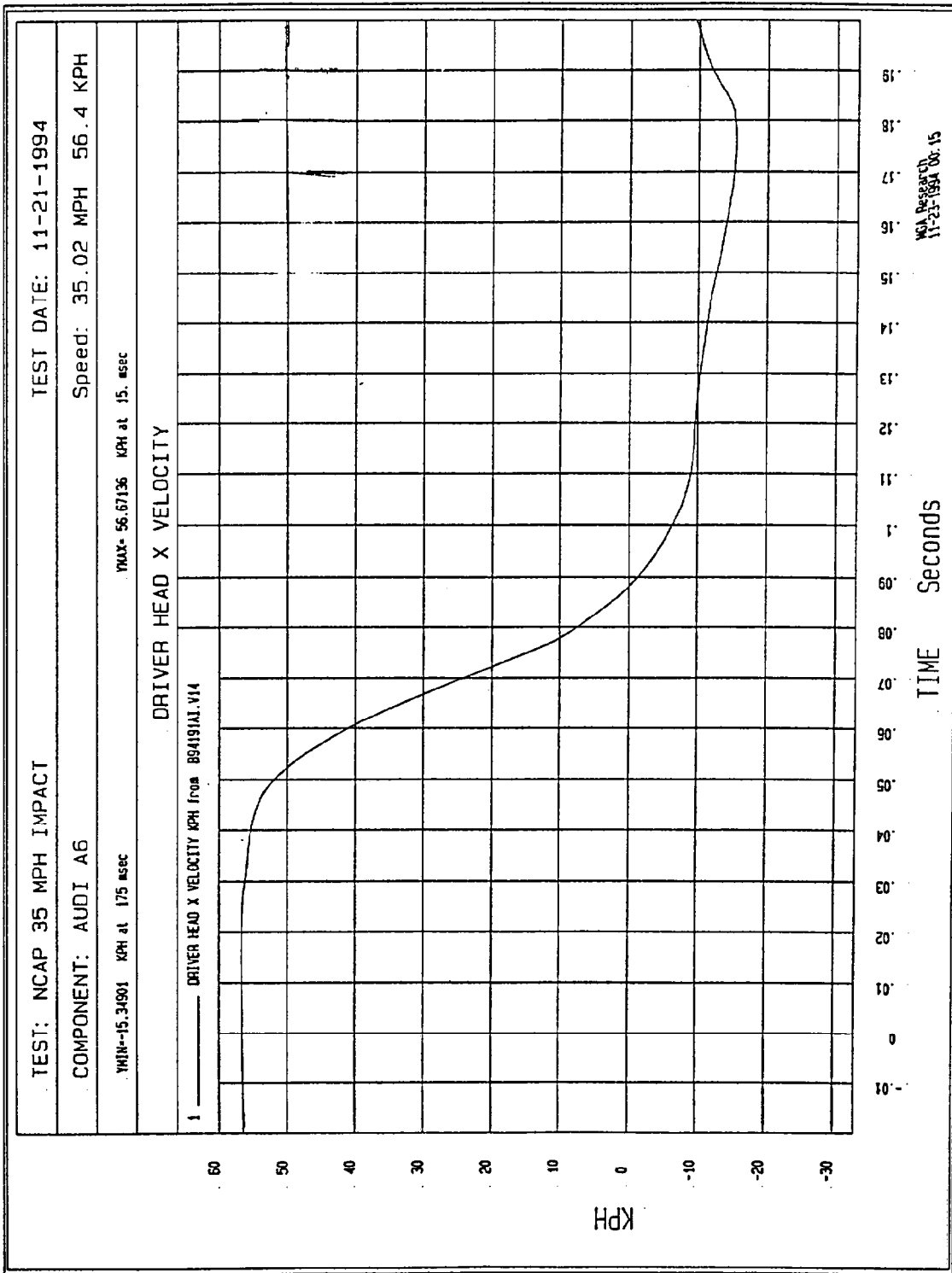


Figure B-38 - Driver Head X Velocity vs. Time

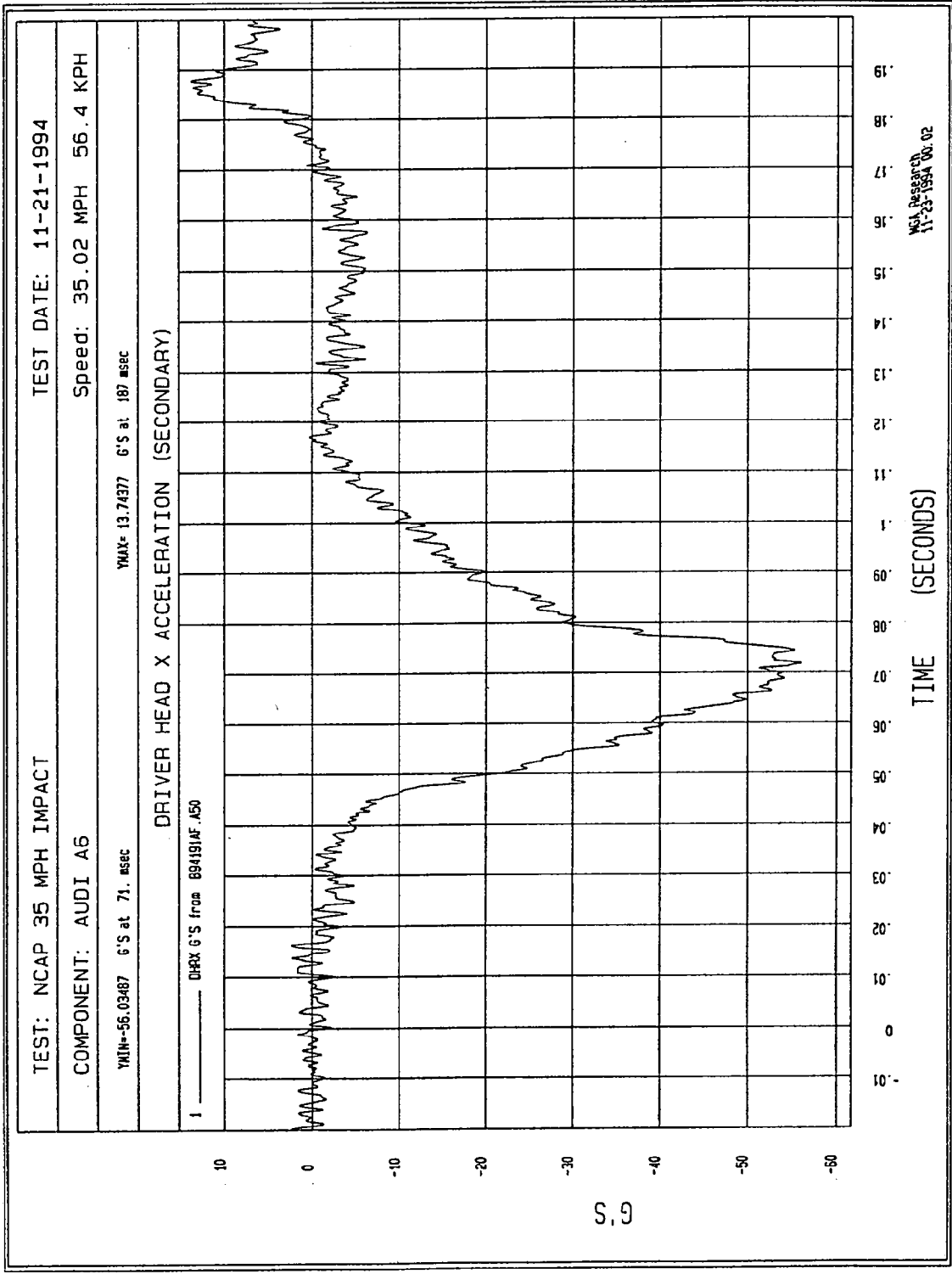


Figure B-39 - Driver Head X Redundant Acceleration vs. Time

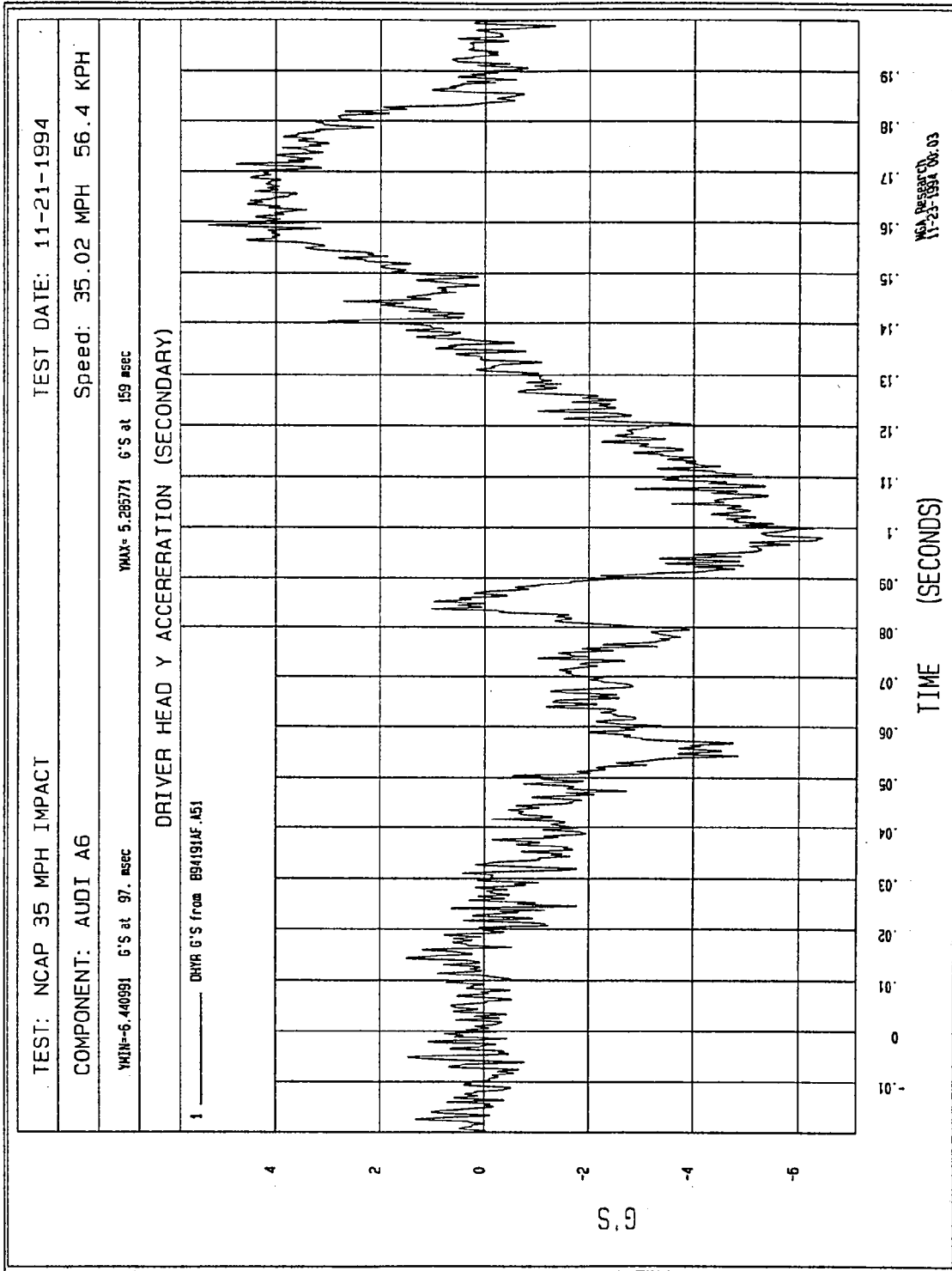


Figure B-40 - Driver Head Y Redundant Acceleration vs. Time

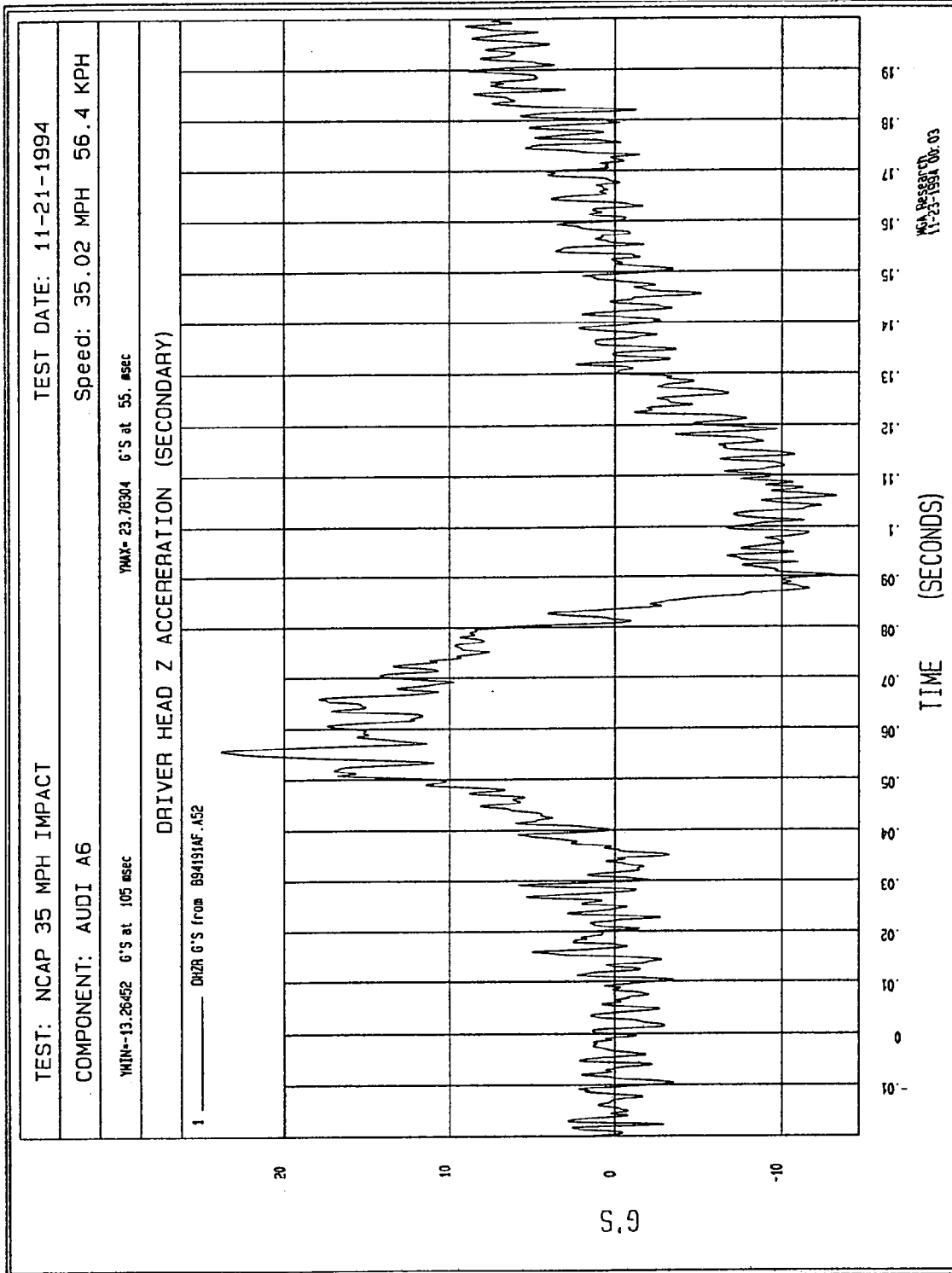


Figure B-41 - Driver Head Z Redundant Acceleration vs. Time

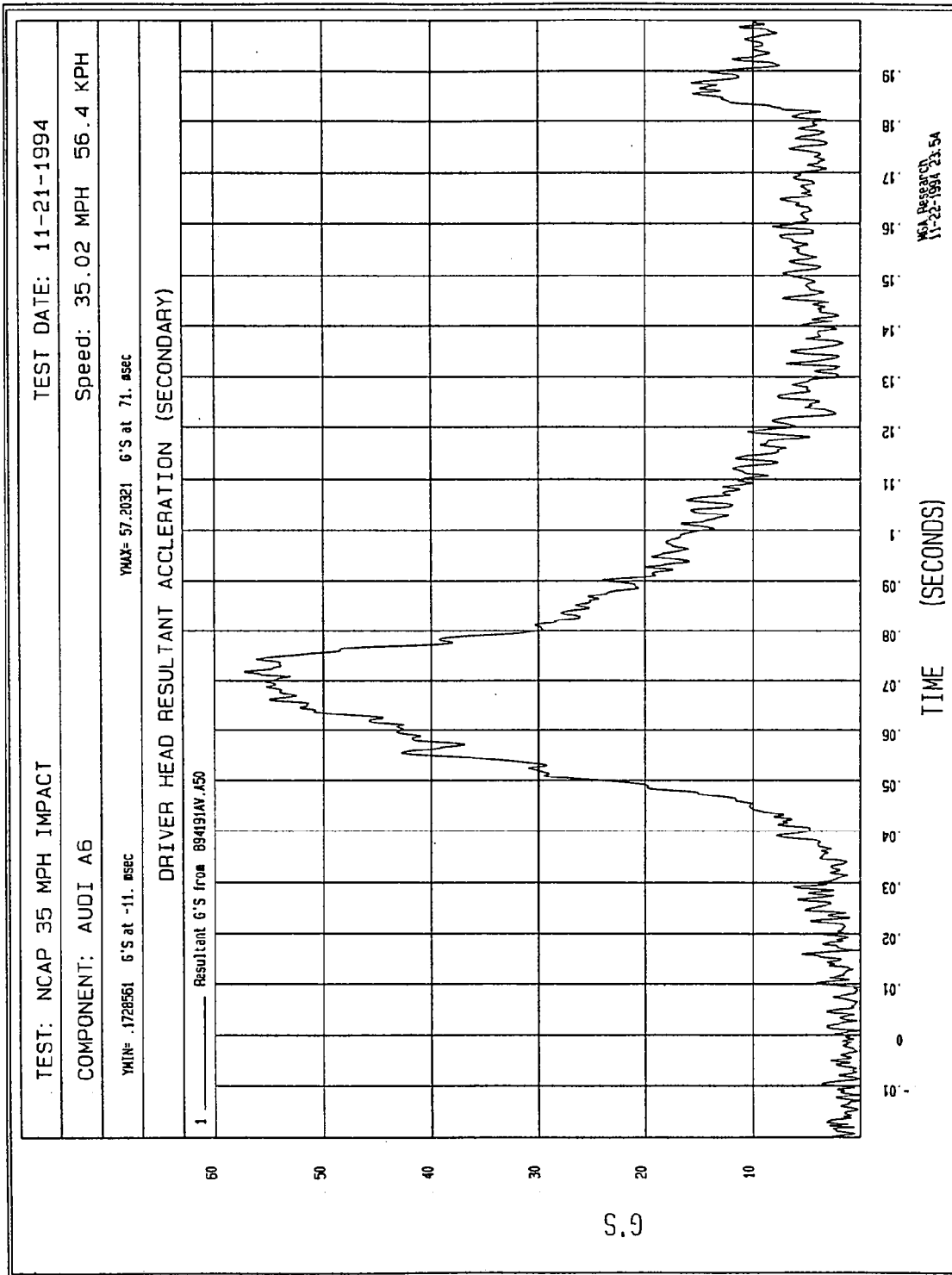


Figure B-42 - Driver Head Redundant Resultant Acceleration vs. Time

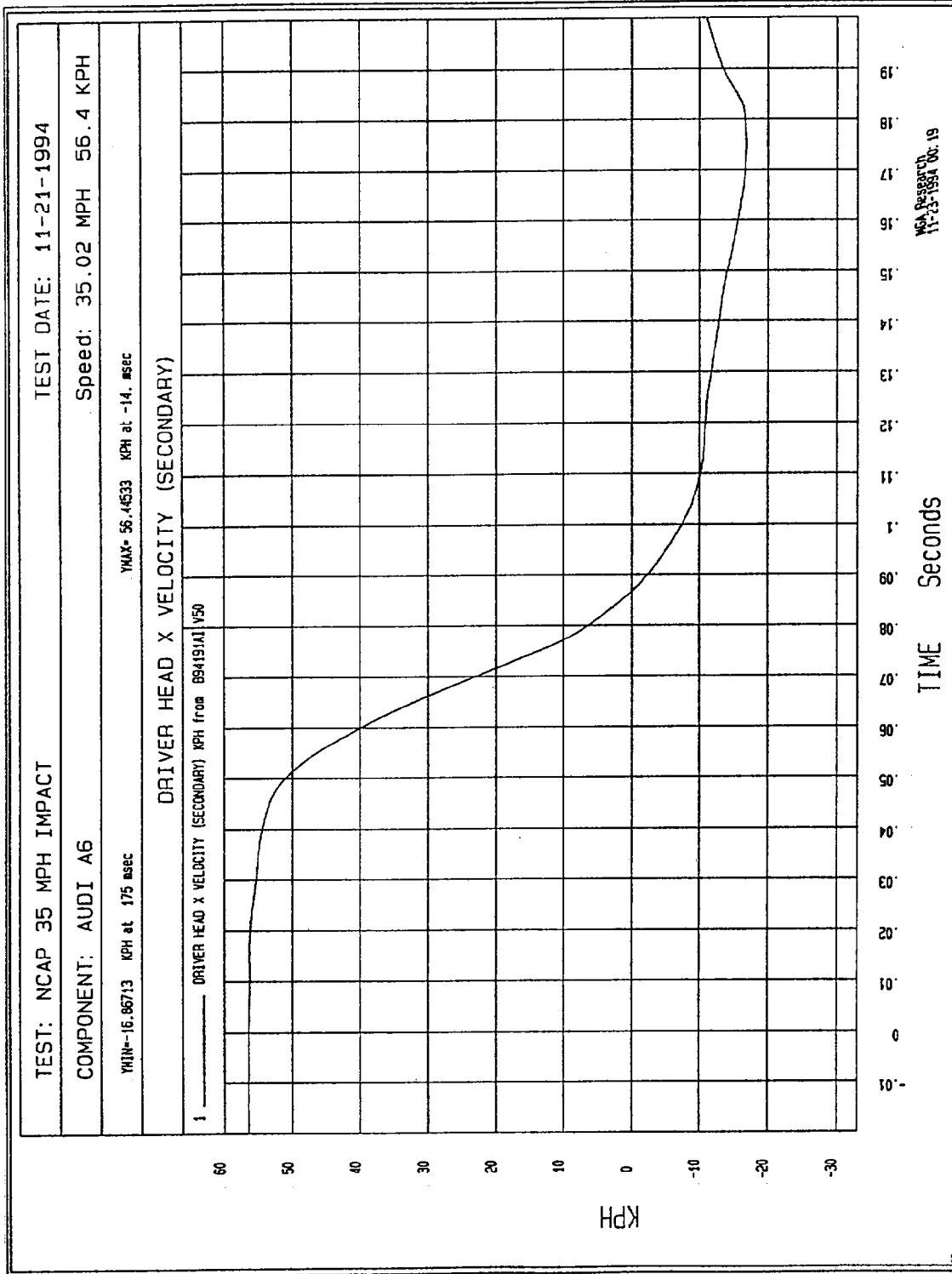


Figure B-43 - Driver Head X Redundant Velocity vs. Time

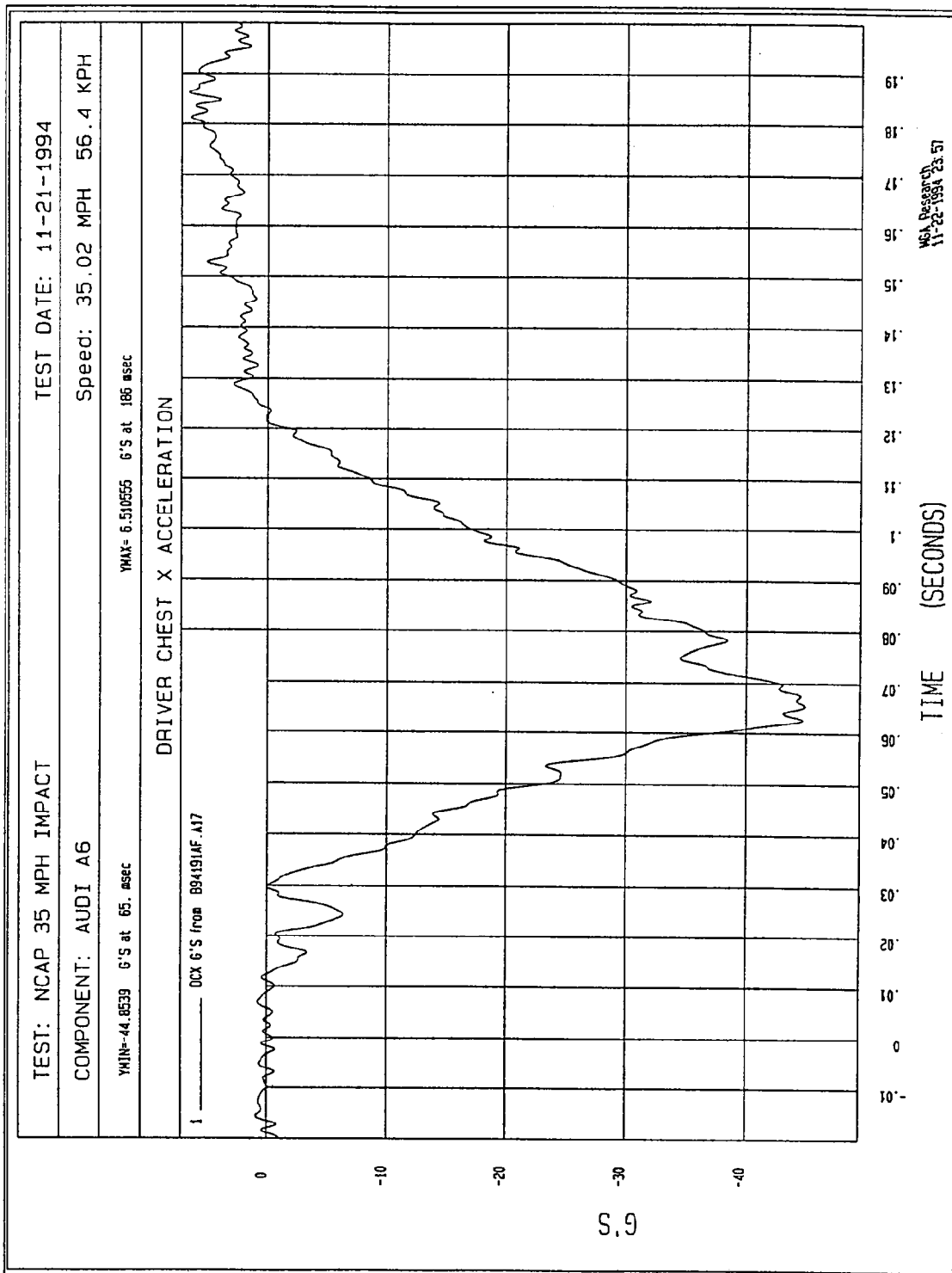


Figure B-44 - Driver Chest X Acceleration vs. Time

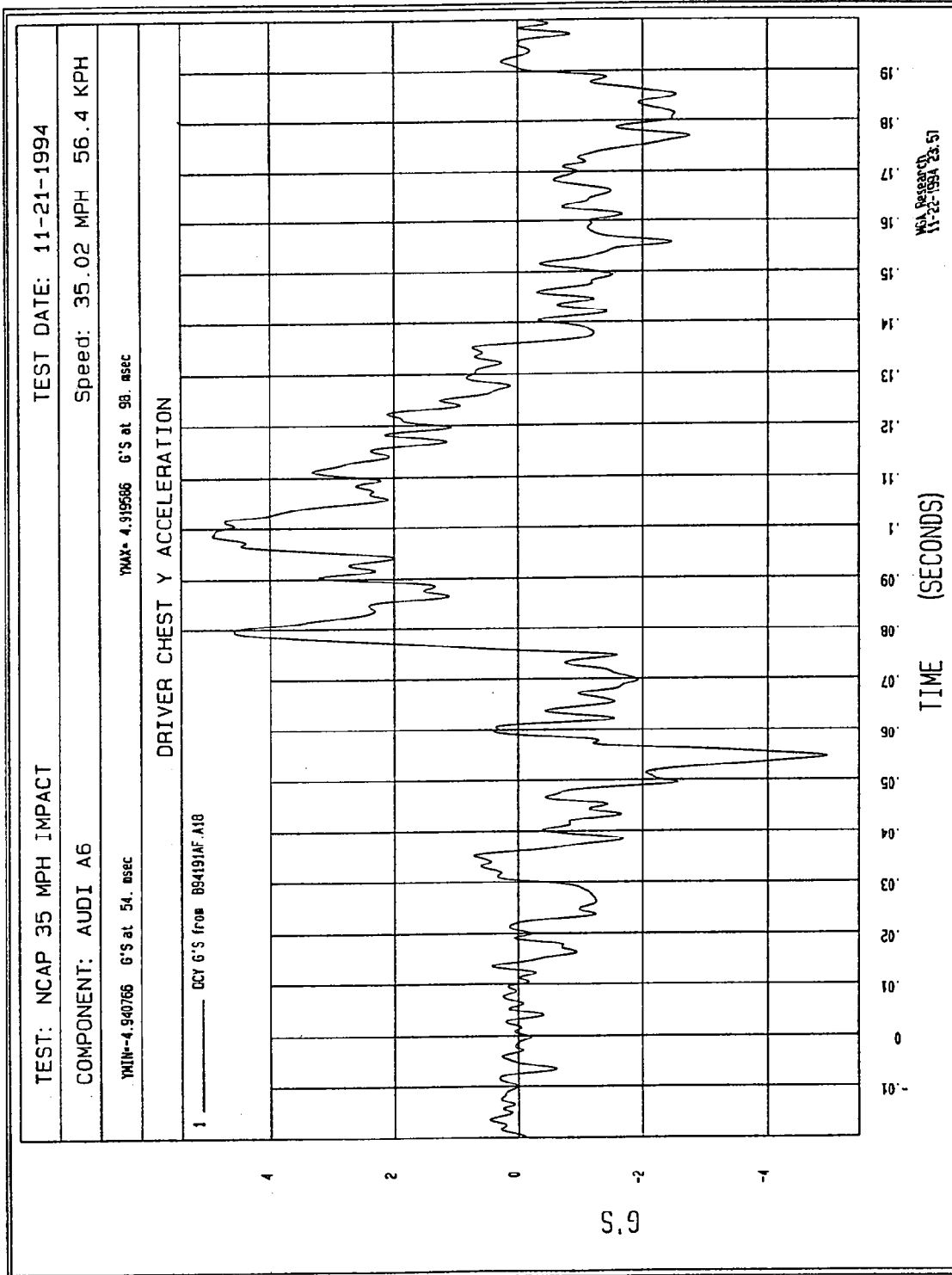
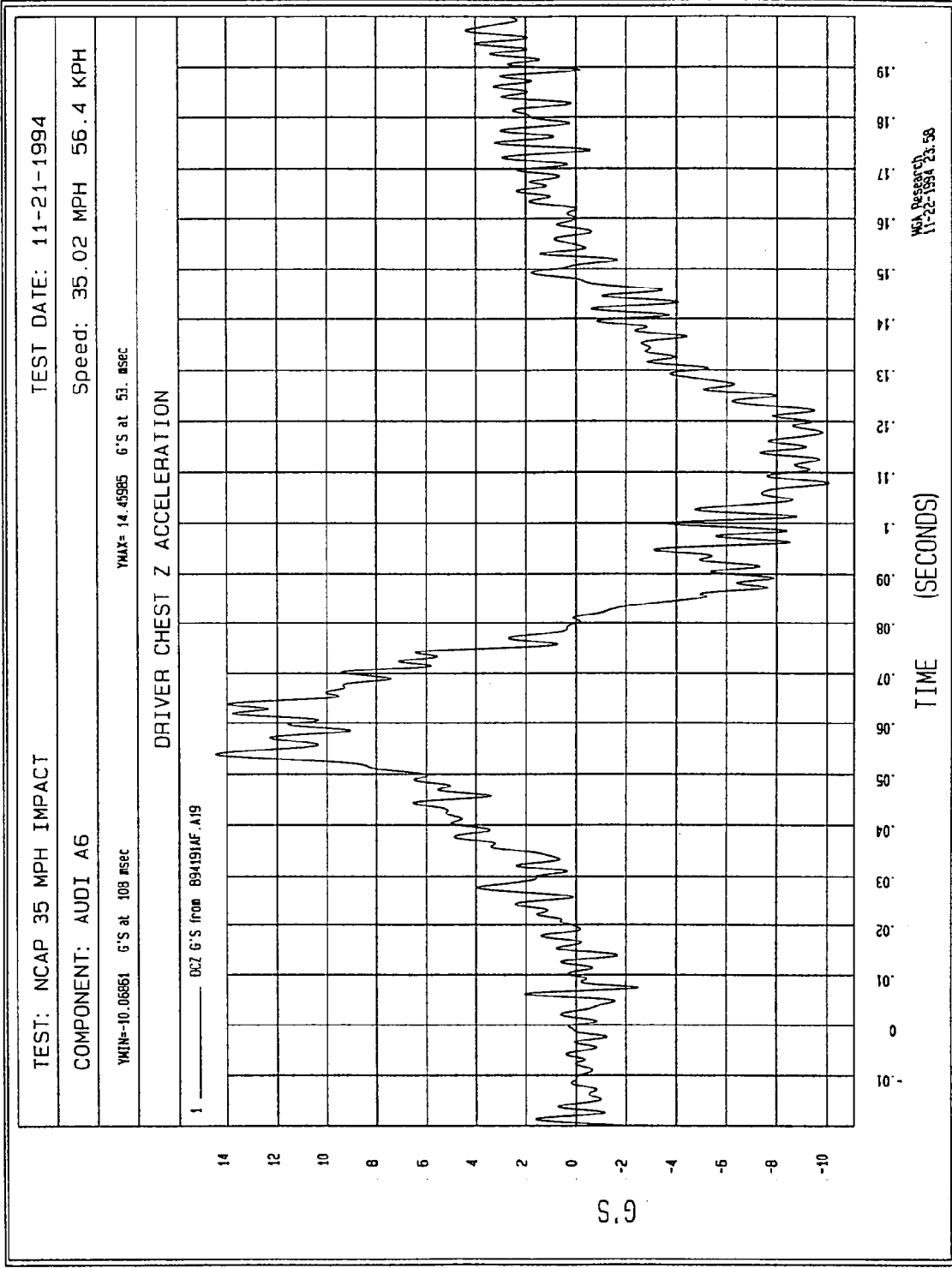


Figure B-45 - Driver Chest Y Acceleration vs. Time



B-46

Figure B-46 - Driver Chest Z Acceleration vs. Time

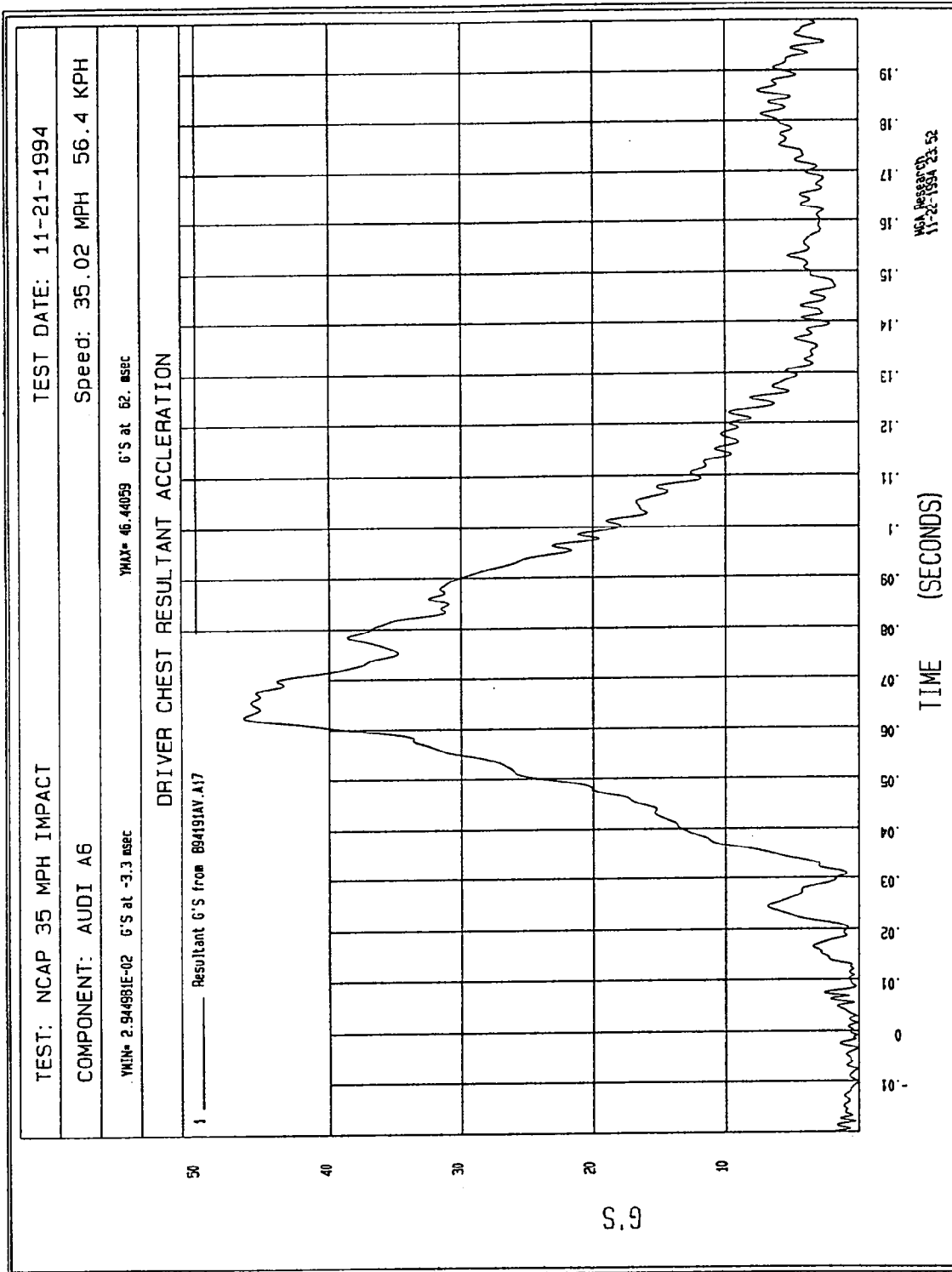


Figure B-47 - Driver Chest Resultant vs. Time

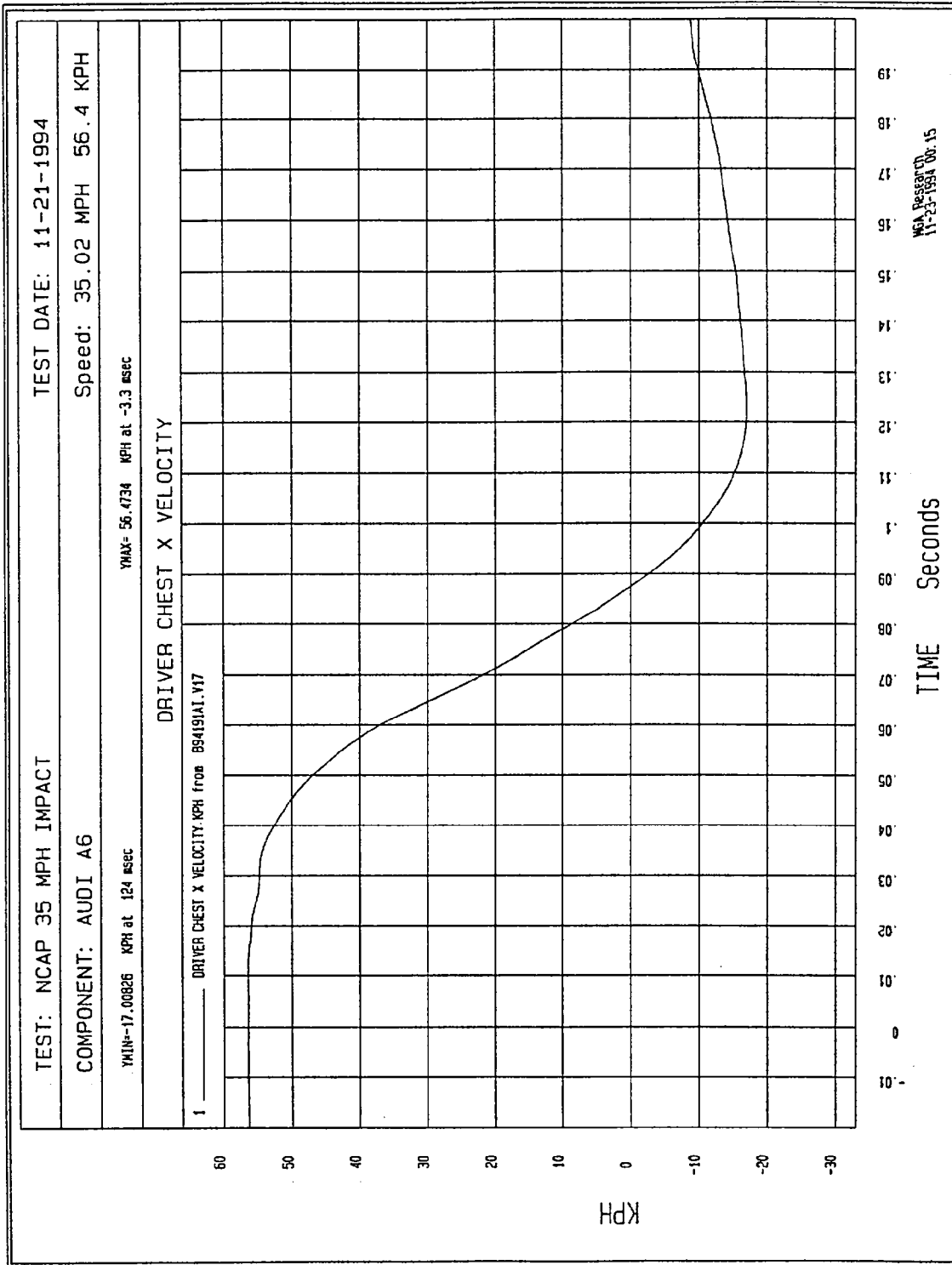
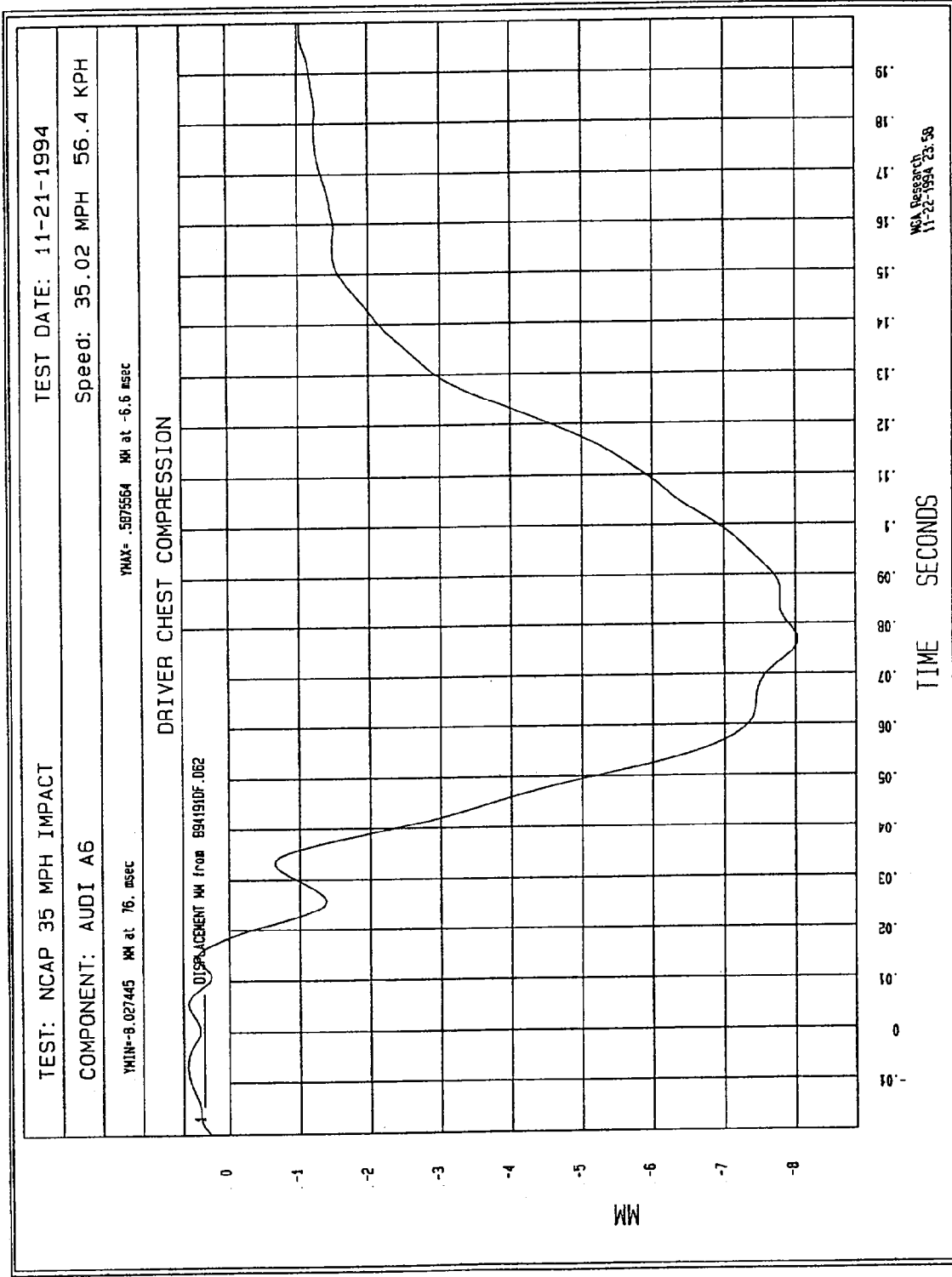


Figure B-48 - Driver Chest X Velocity vs. Time



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B-49

Figure B-49 - Driver Chest Compression vs. Time

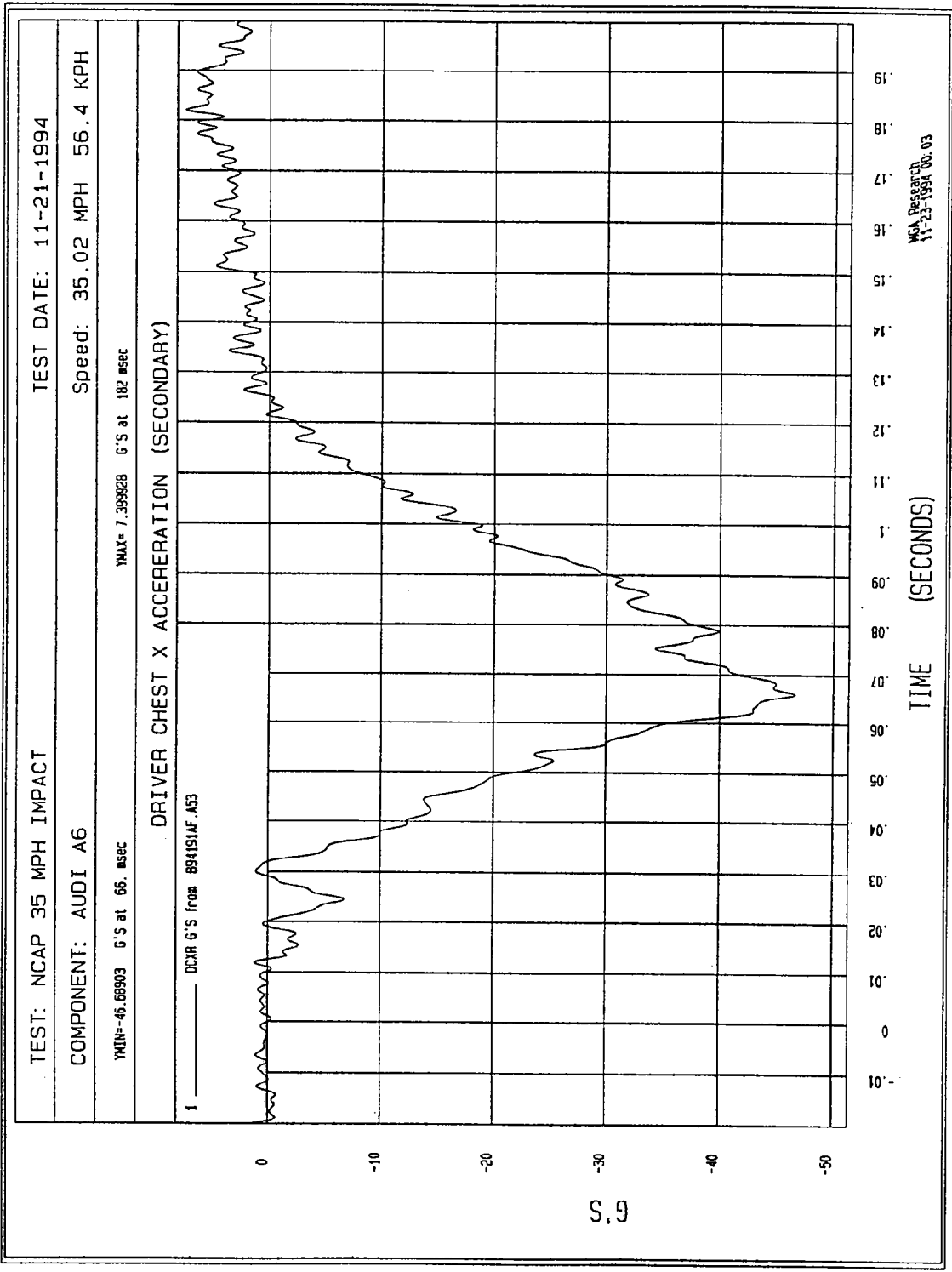


Figure B-50 - Driver Chest X Redundant Acceleration vs. Time

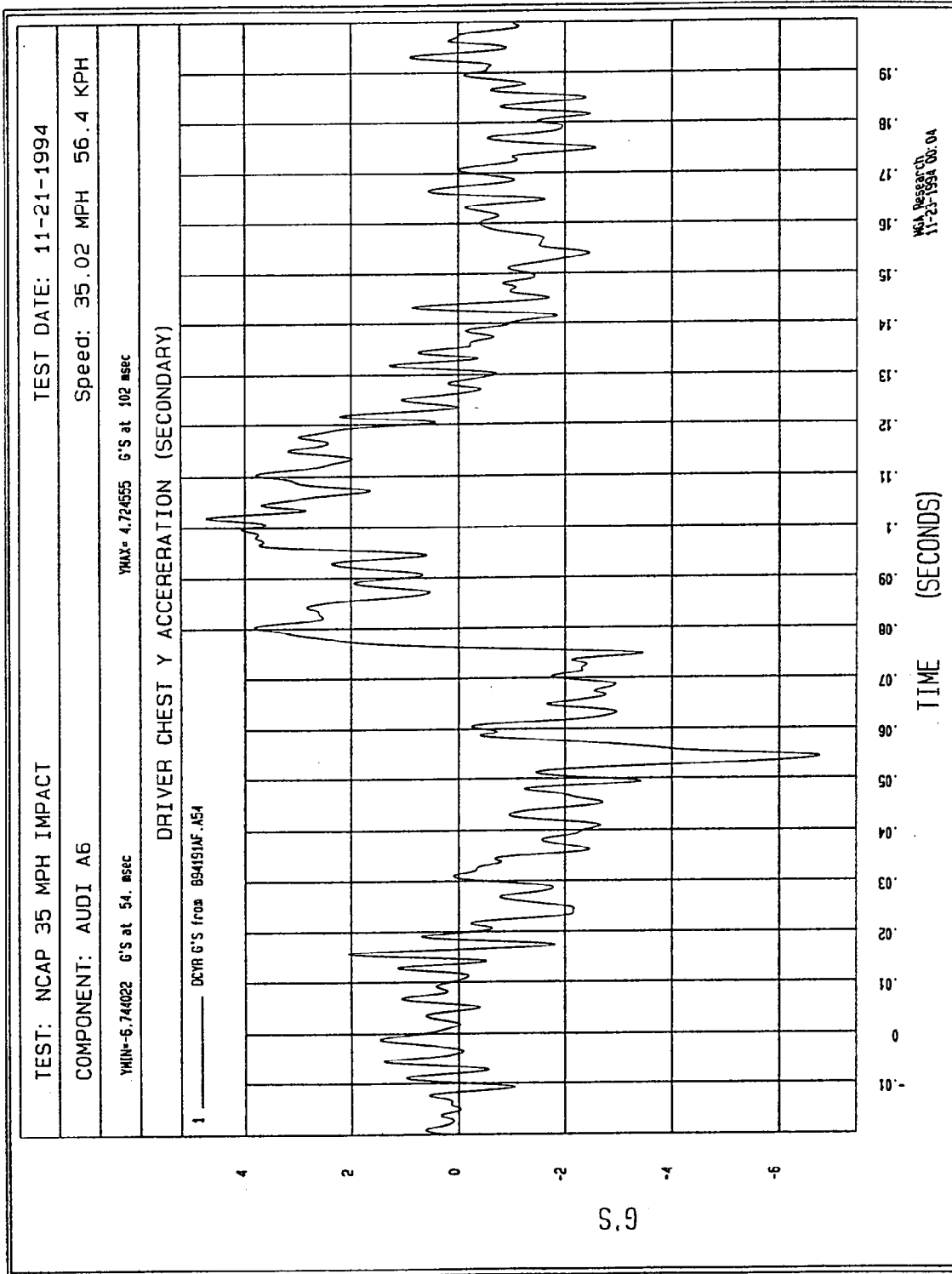


Figure B-51 - Driver Chest Y Redundant Acceleration vs. Time

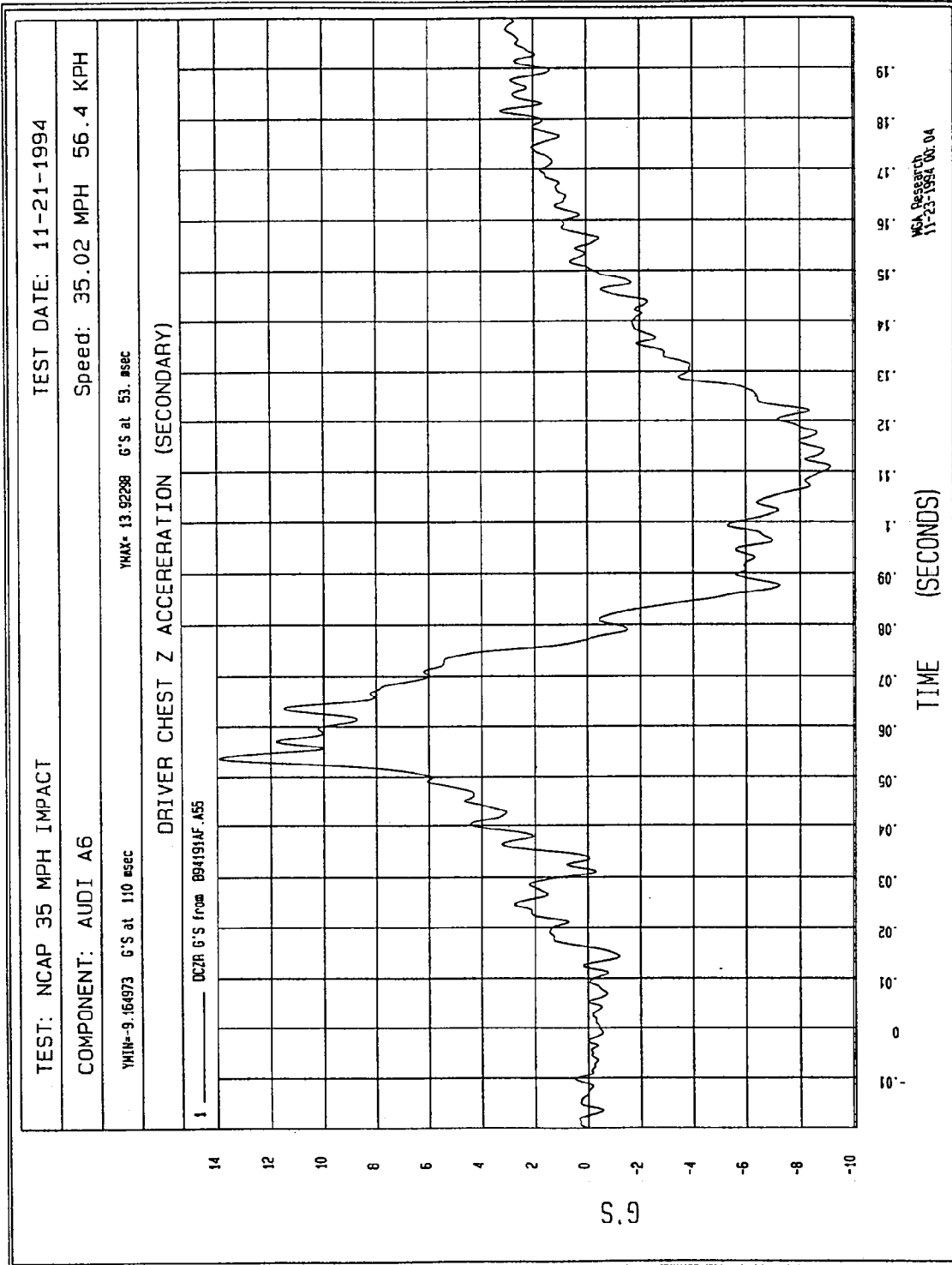


Figure B-52 - Driver Chest Z Redundant Acceleration vs. Time

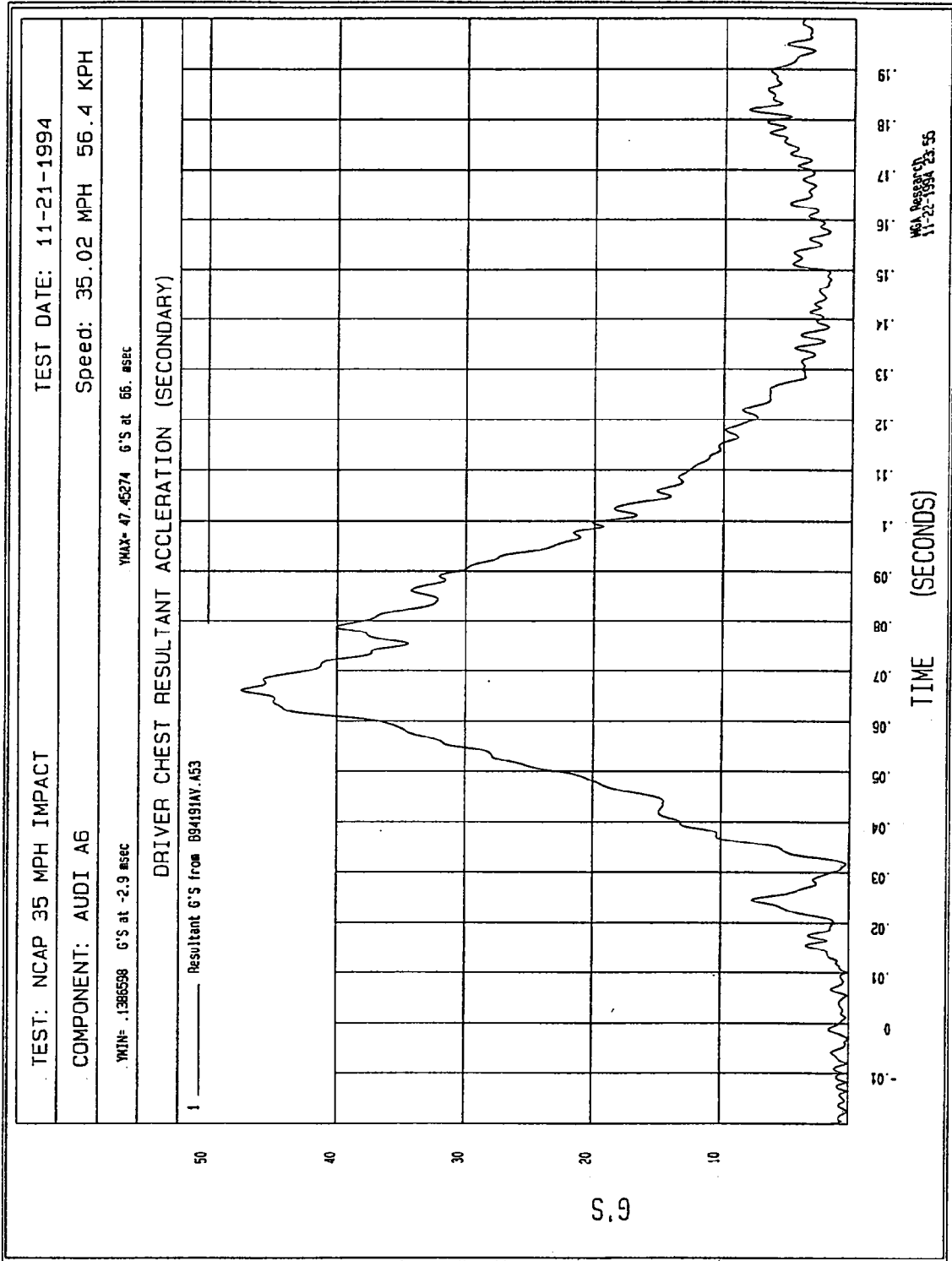


Figure B-53 - Driver Chest Redundant Resultant Acceleration vs. Time

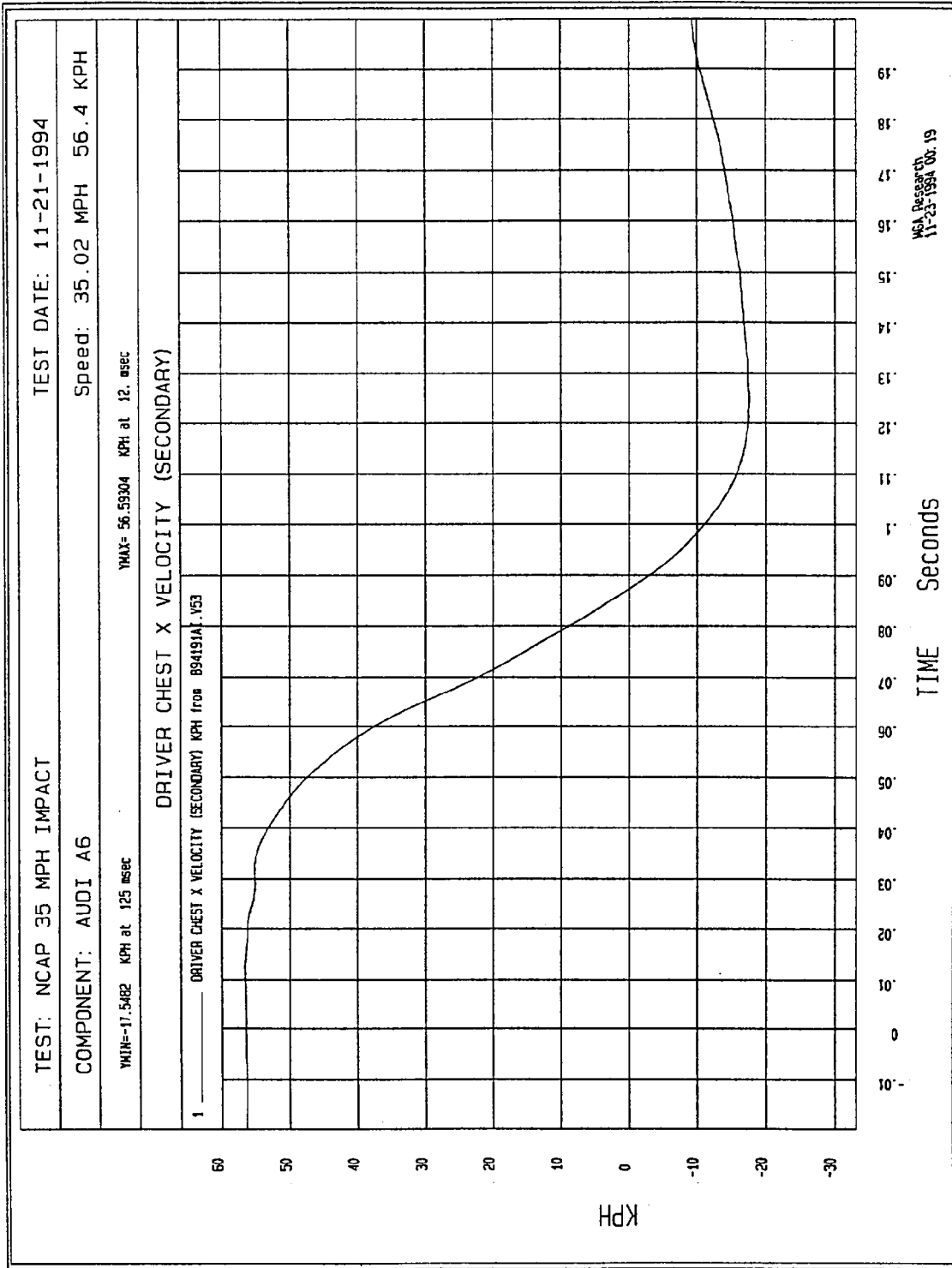


Figure B-54 - Driver Chest X Velocity vs. Time

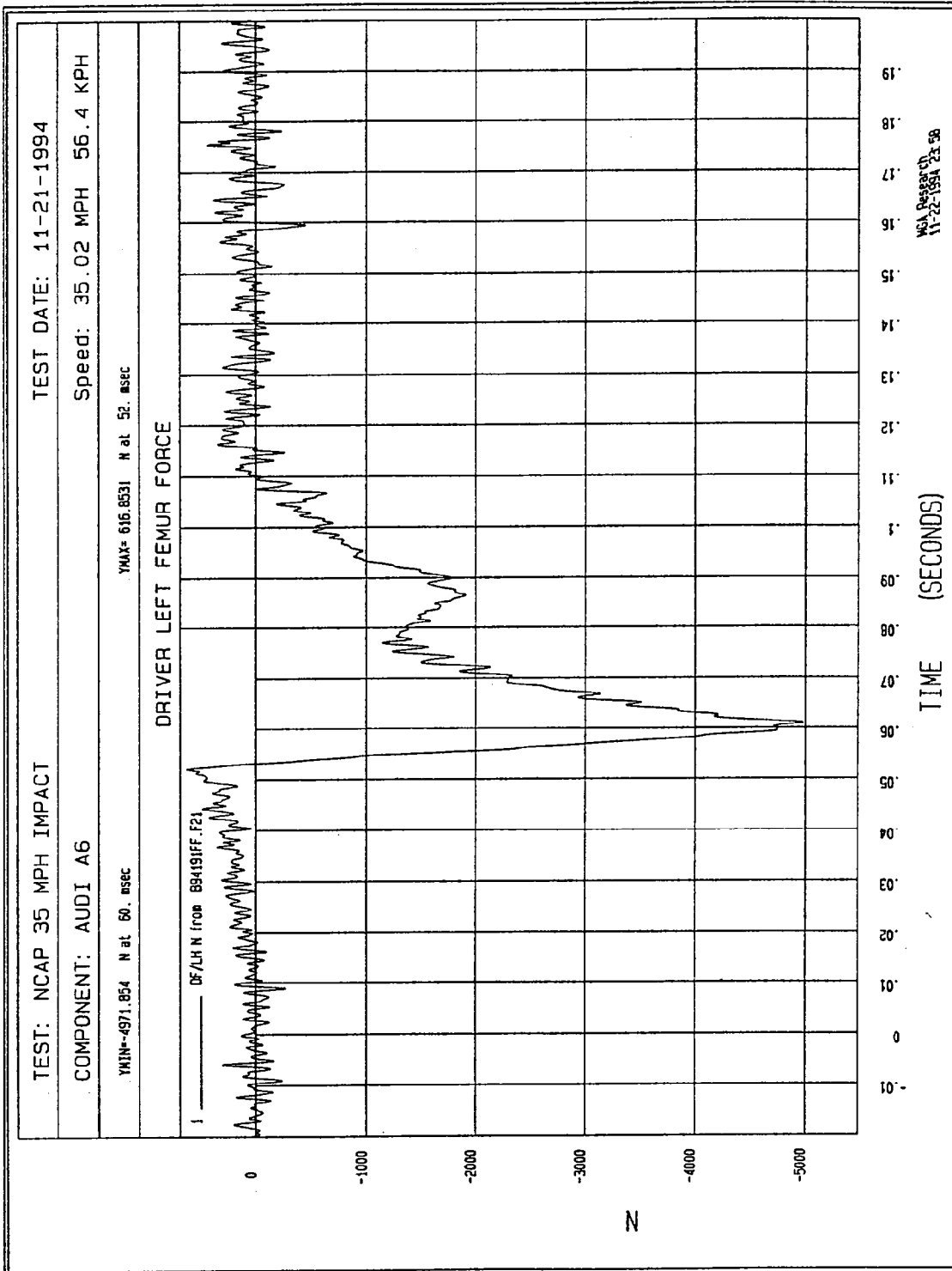
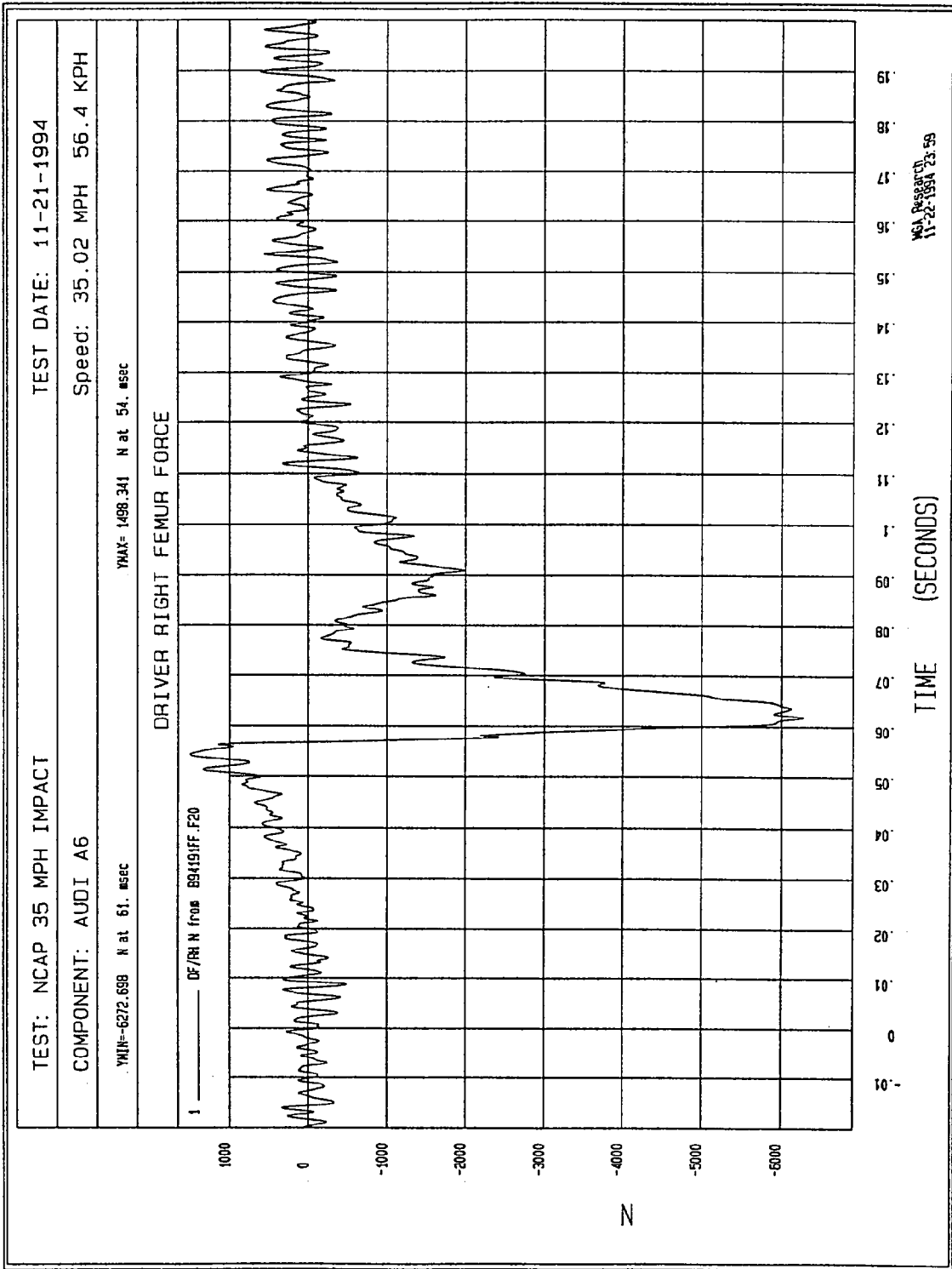
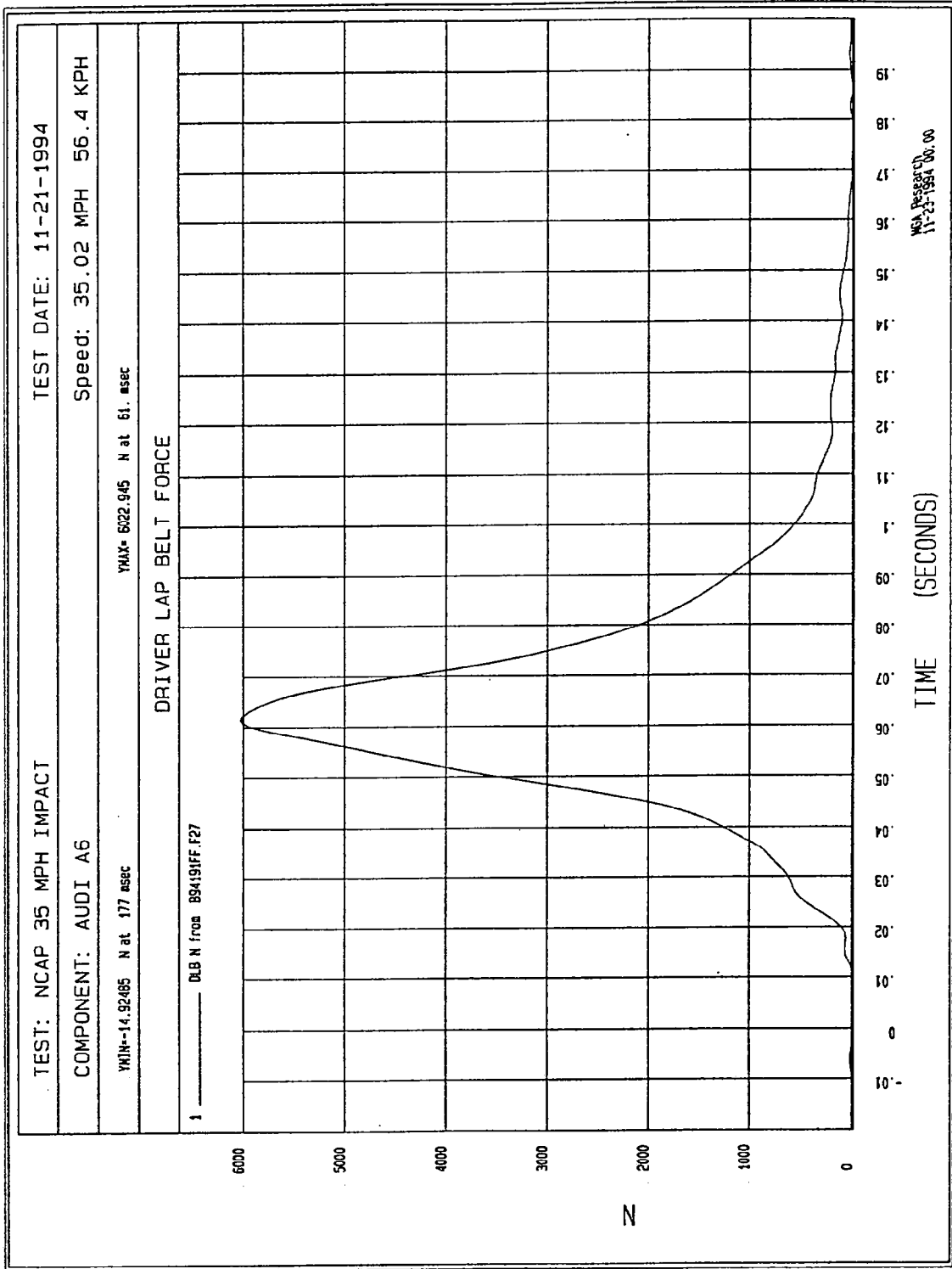


Figure B-55 - Driver Left Femur Force vs. Time



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11-22-1994 23:59

Figure B-56 - Driver Right Femur Force vs. Time



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11-23-1994 06:00

Figure B-57 - Driver Lap Belt Force vs. Time

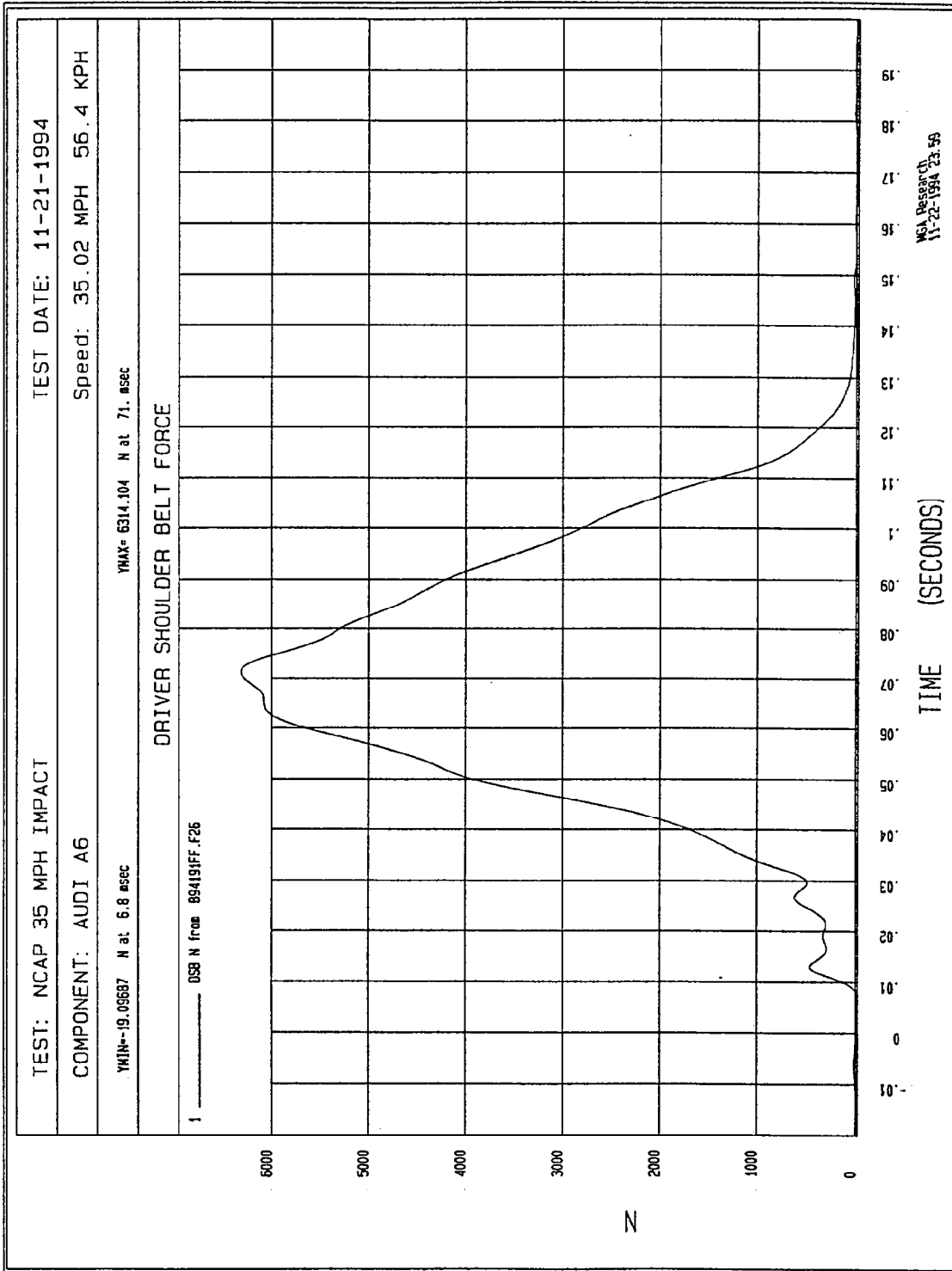


Figure B-58 - Driver Shoulder Belt Force vs. Time

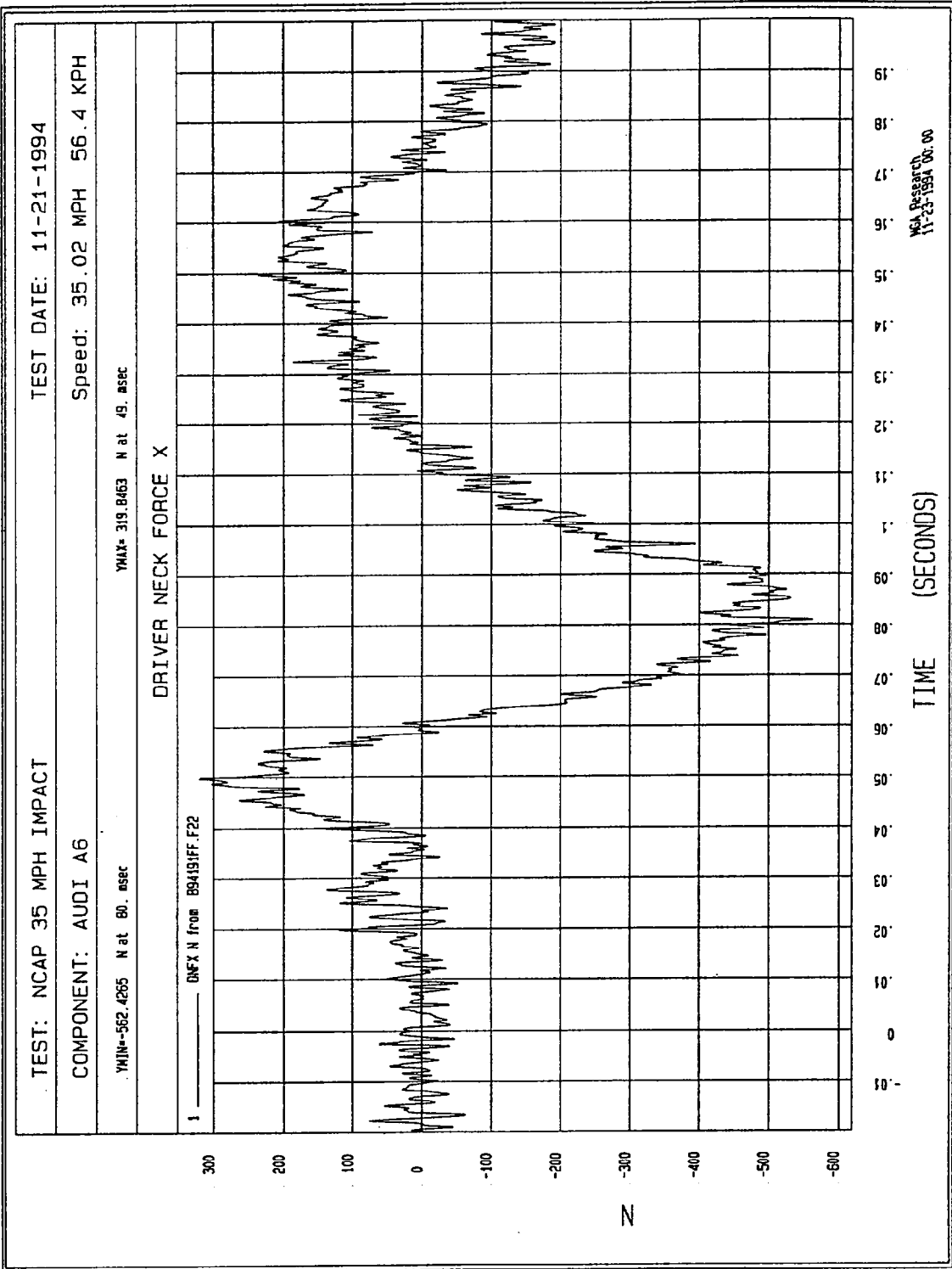


Figure B-59 - Driver Neck Force X vs. Time

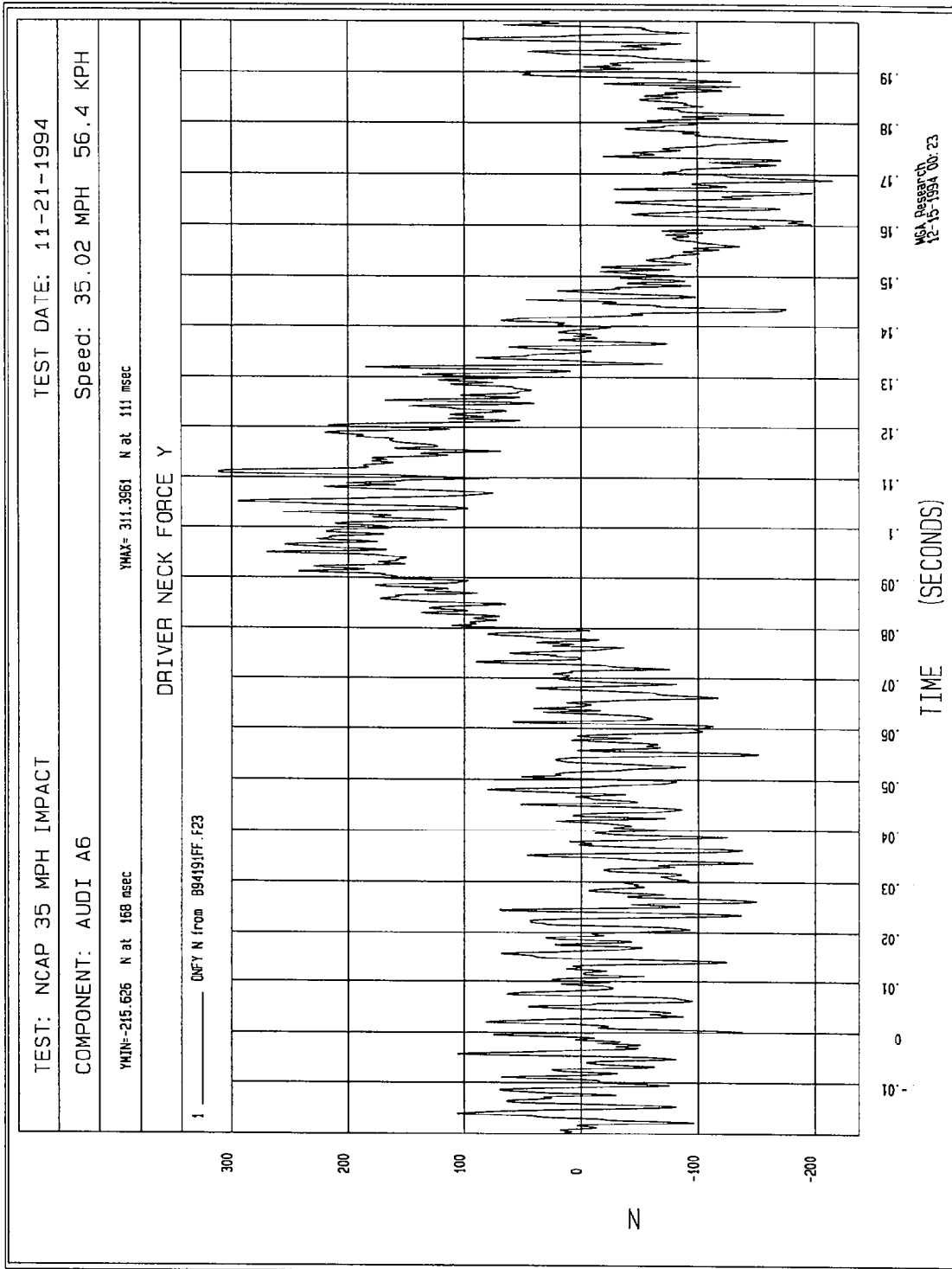
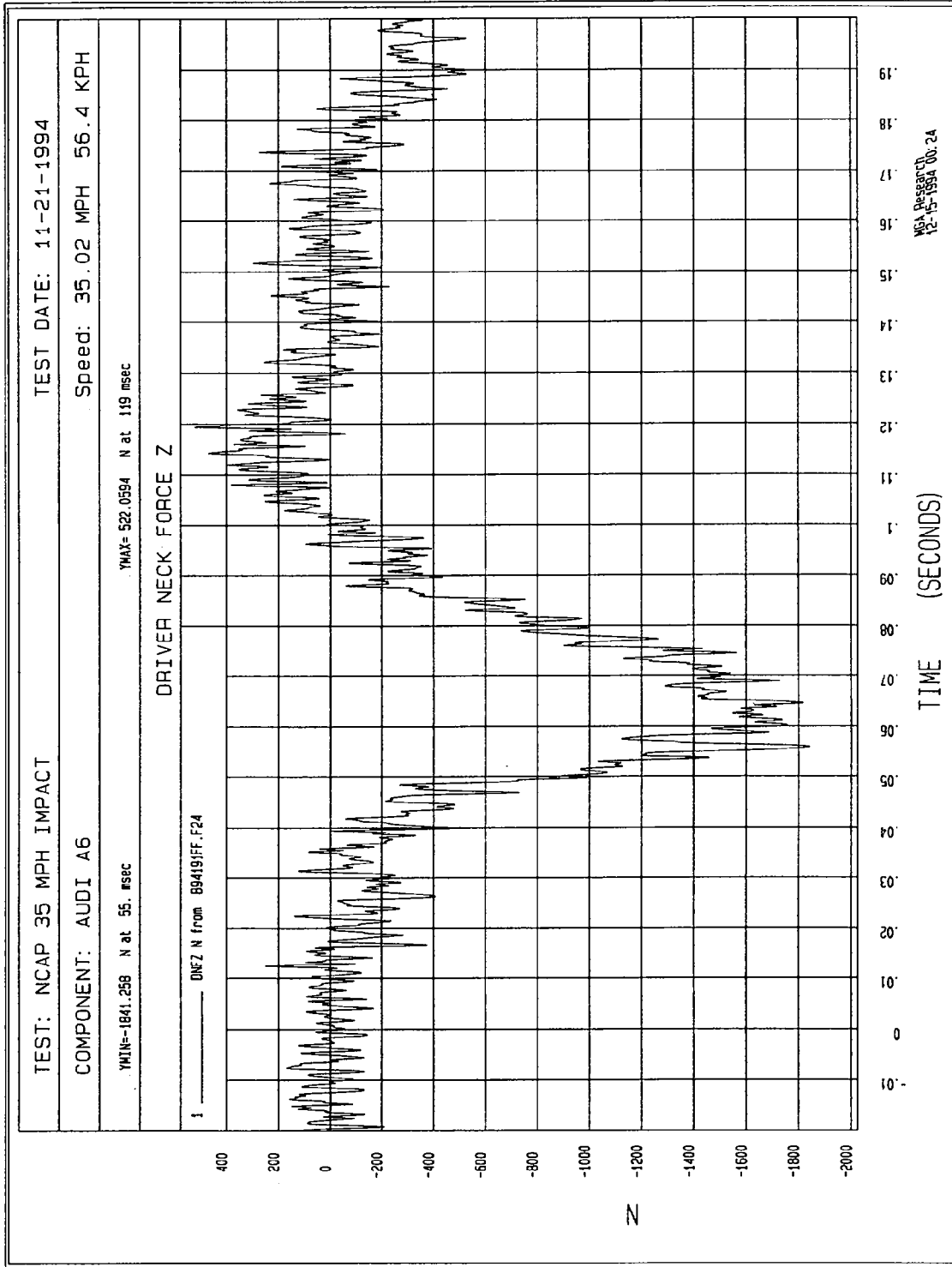


Figure B-60 - Driver Neck Force Y vs. Time



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Figure B-61 - Driver Neck Force Z vs. Time

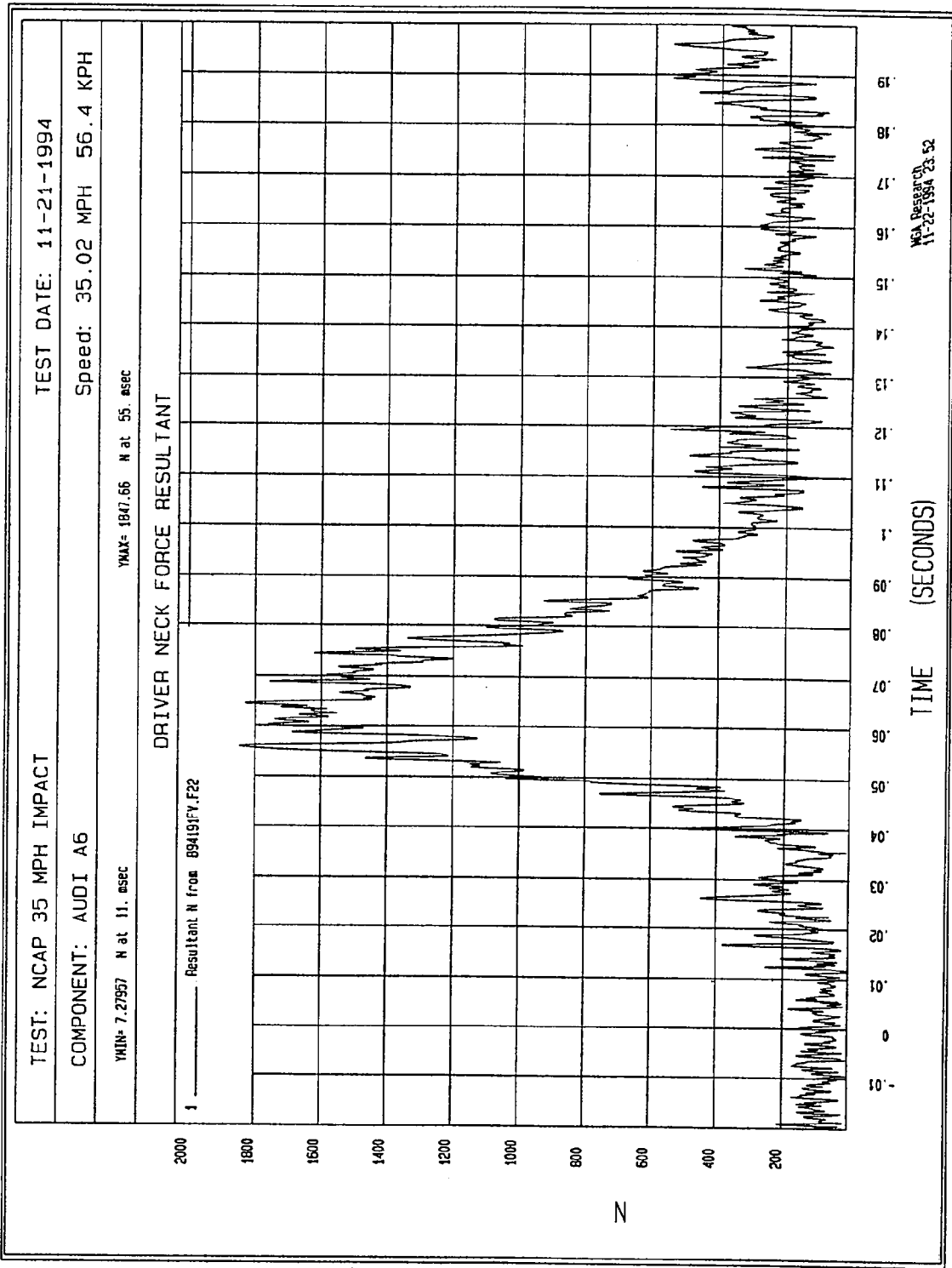
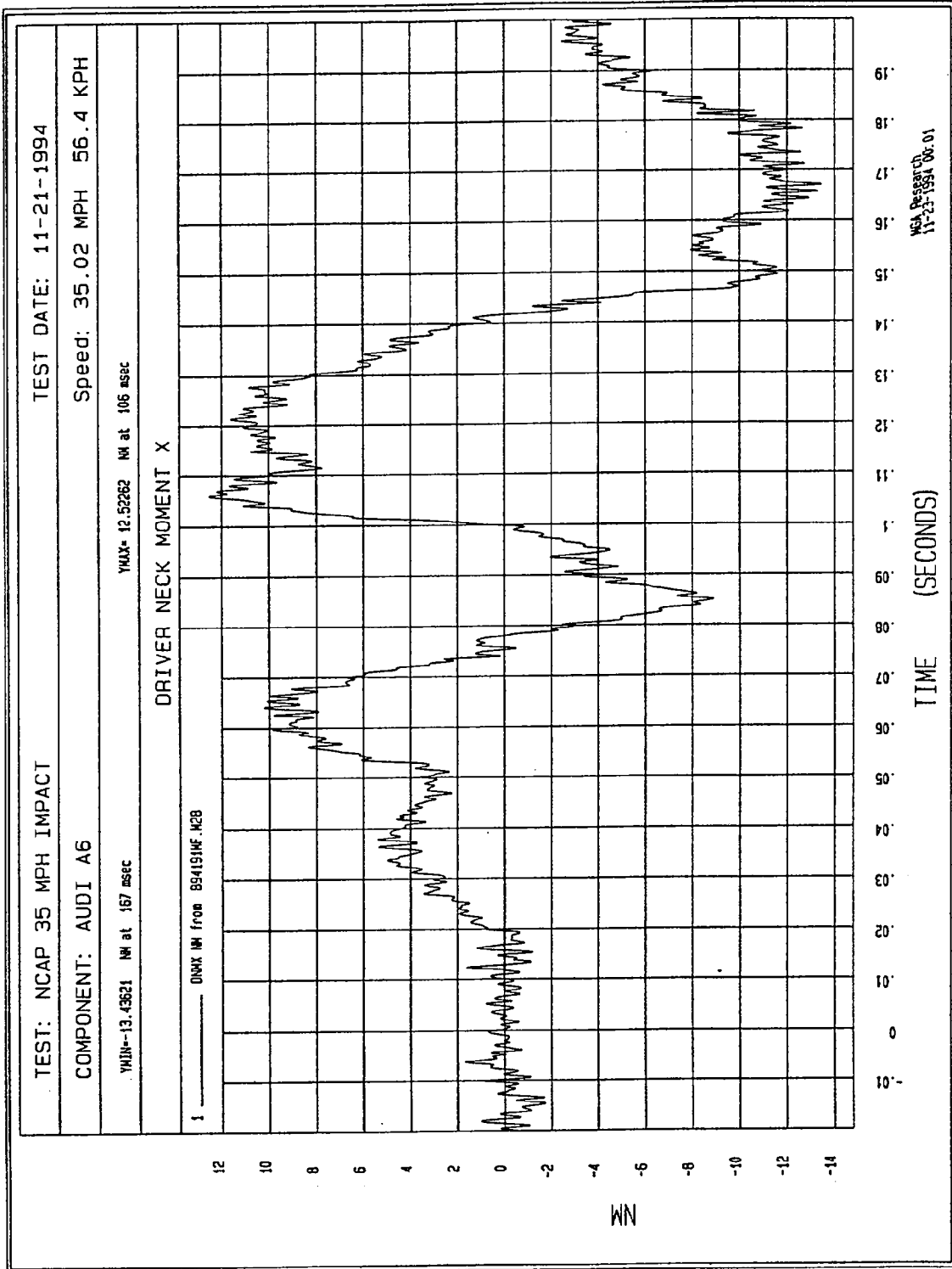


Figure B-62 - Driver Neck Force Resultant vs. Time



B-63

Figure B-63 - Driver Neck Moment X vs. Time

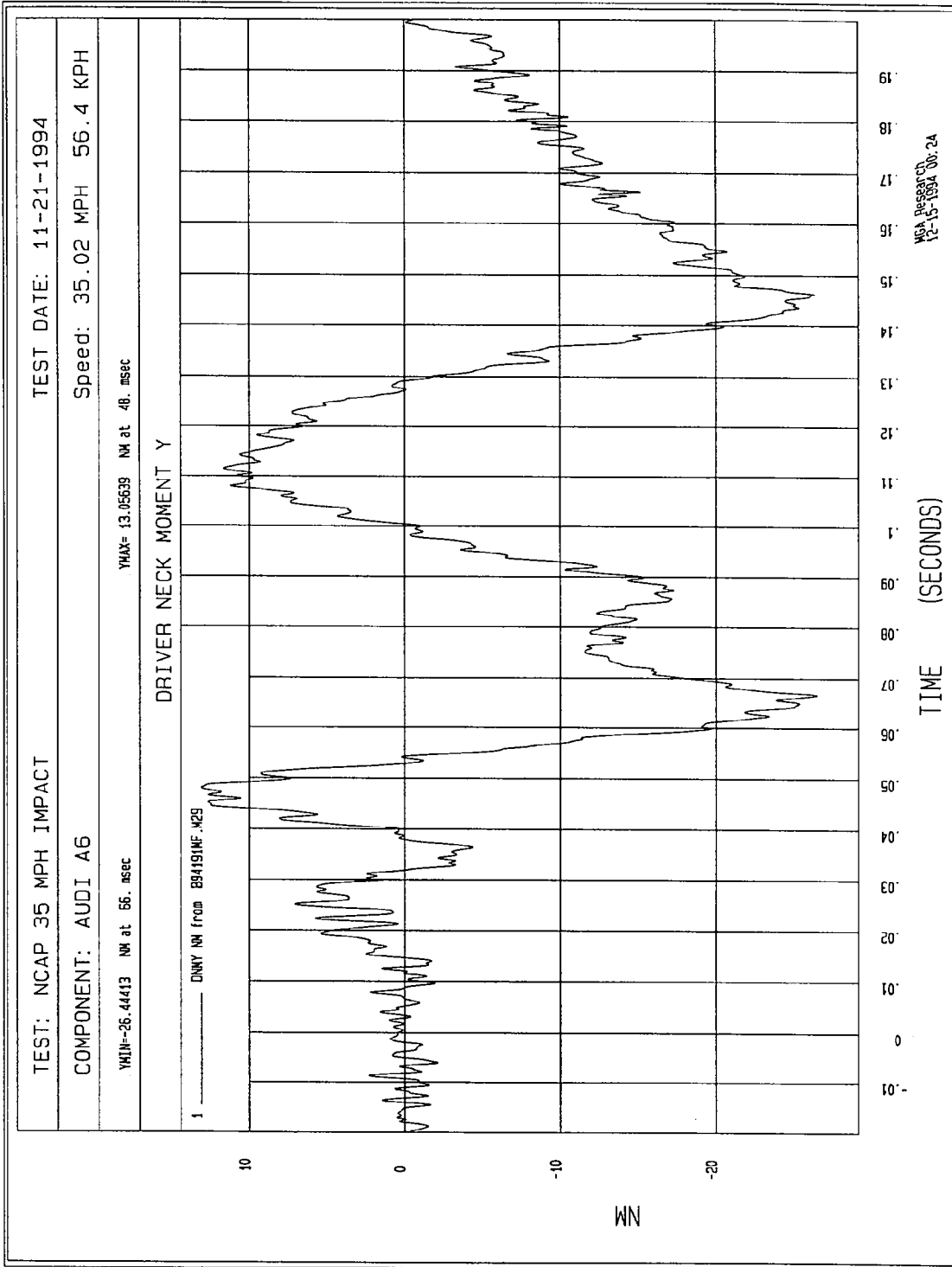


Figure B-64 - Driver Neck Moment Y vs. Time

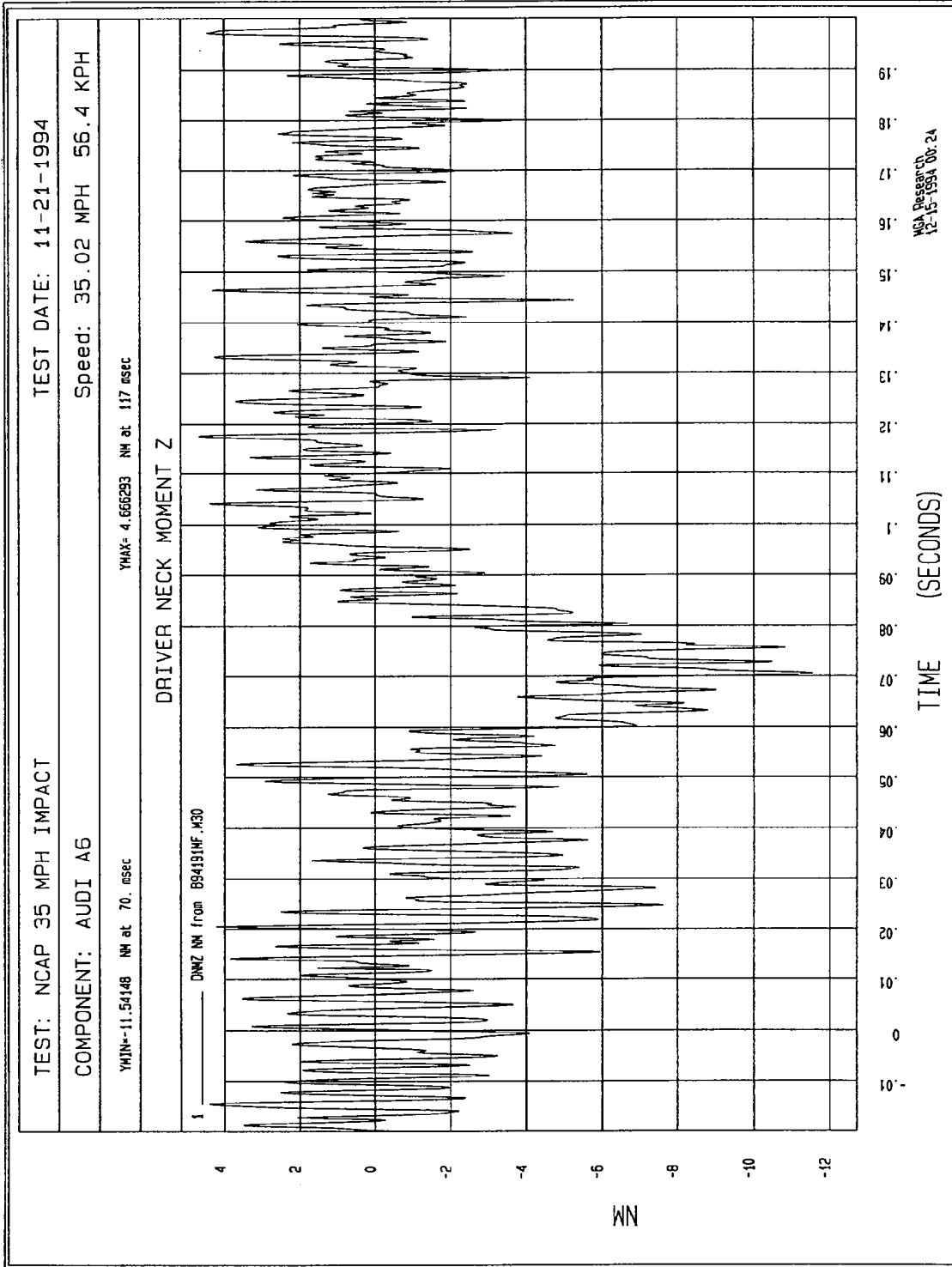


Figure B-65 - Driver Neck Moment Z vs. Time

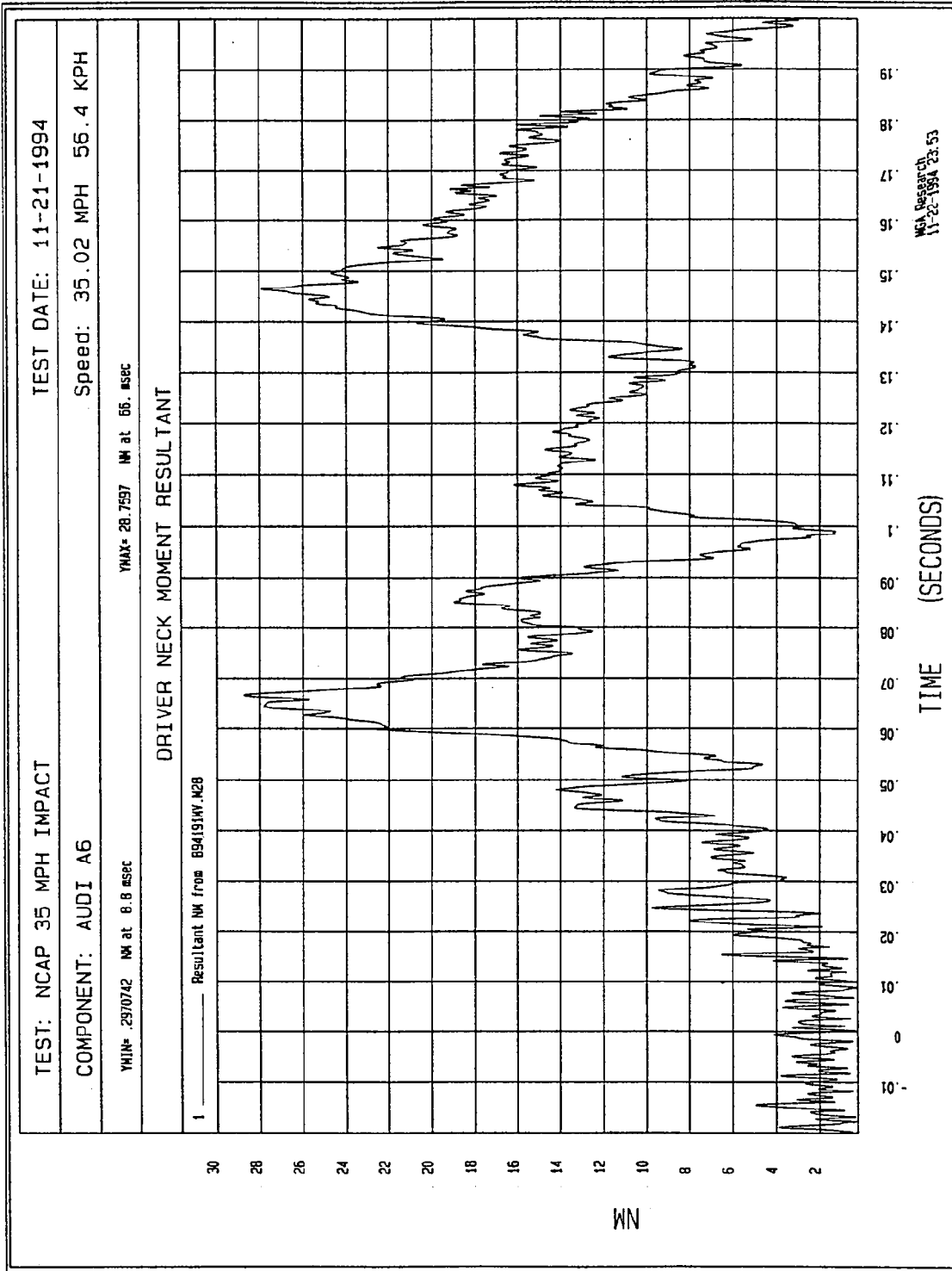


Figure B-66 - Driver Neck Moment Resultant vs. Time

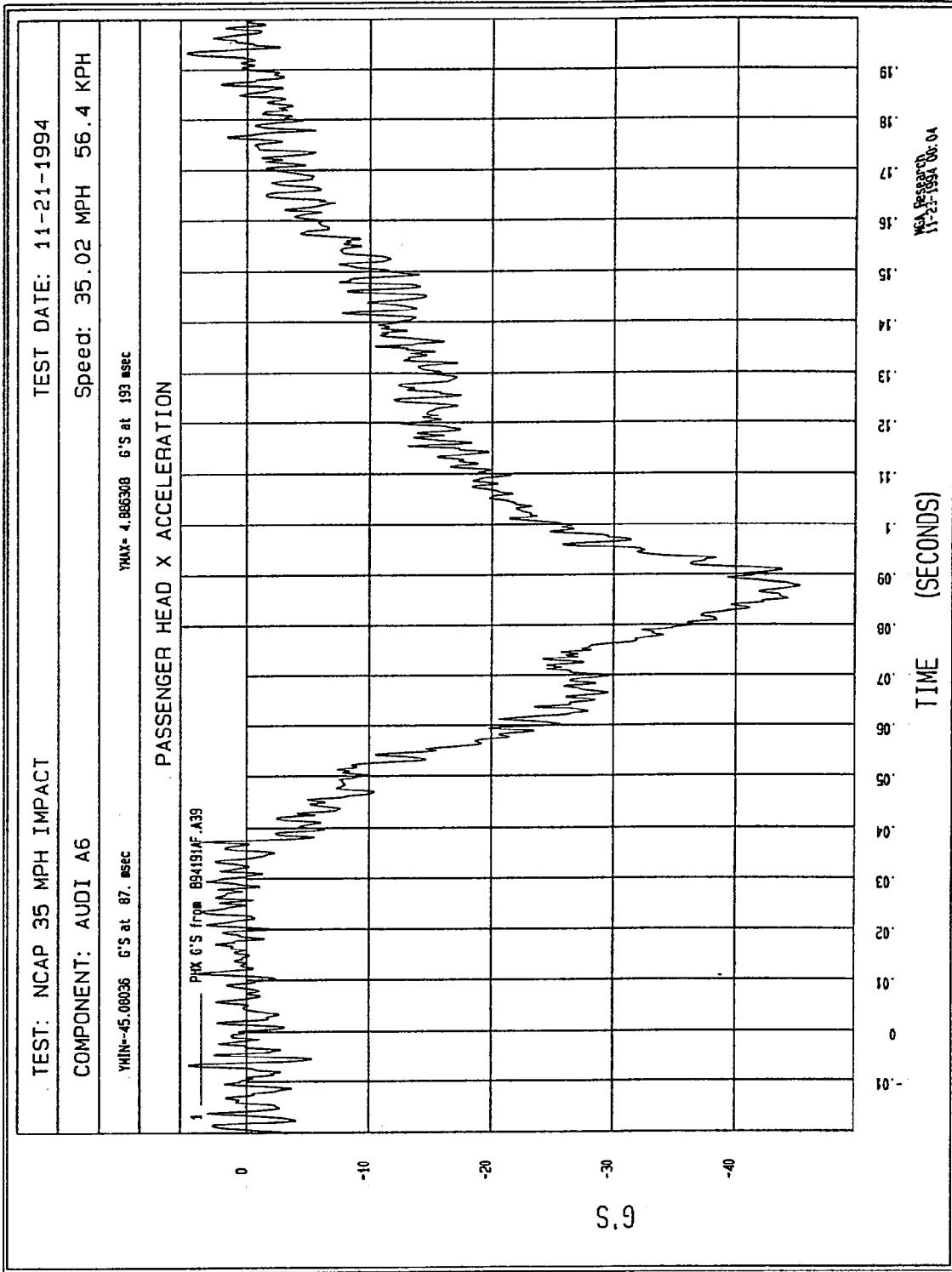


Figure B-67 - Passenger Head X Acceleration vs. Time

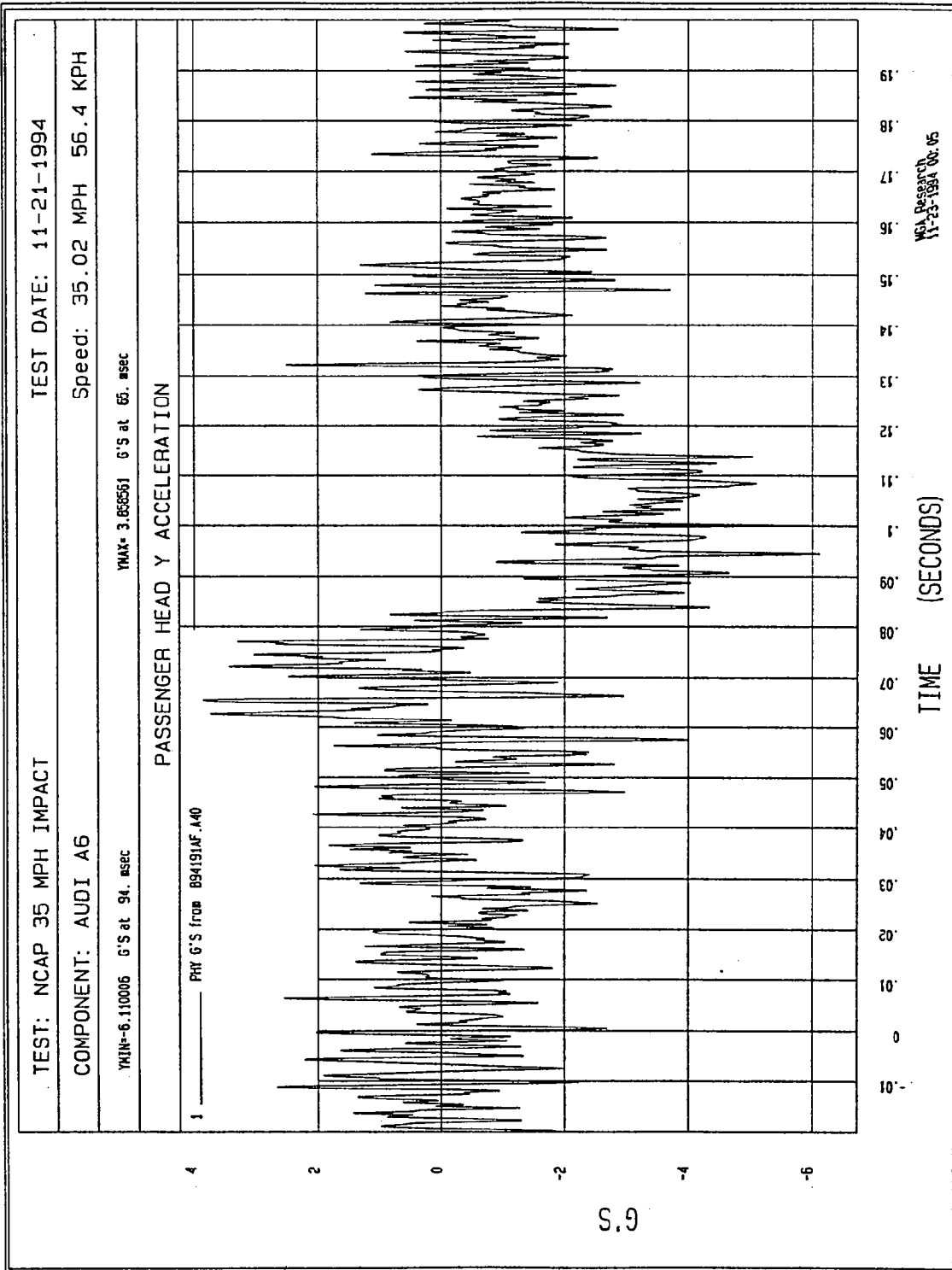


Figure B-68 - Passenger Head Y Acceleration vs. Time

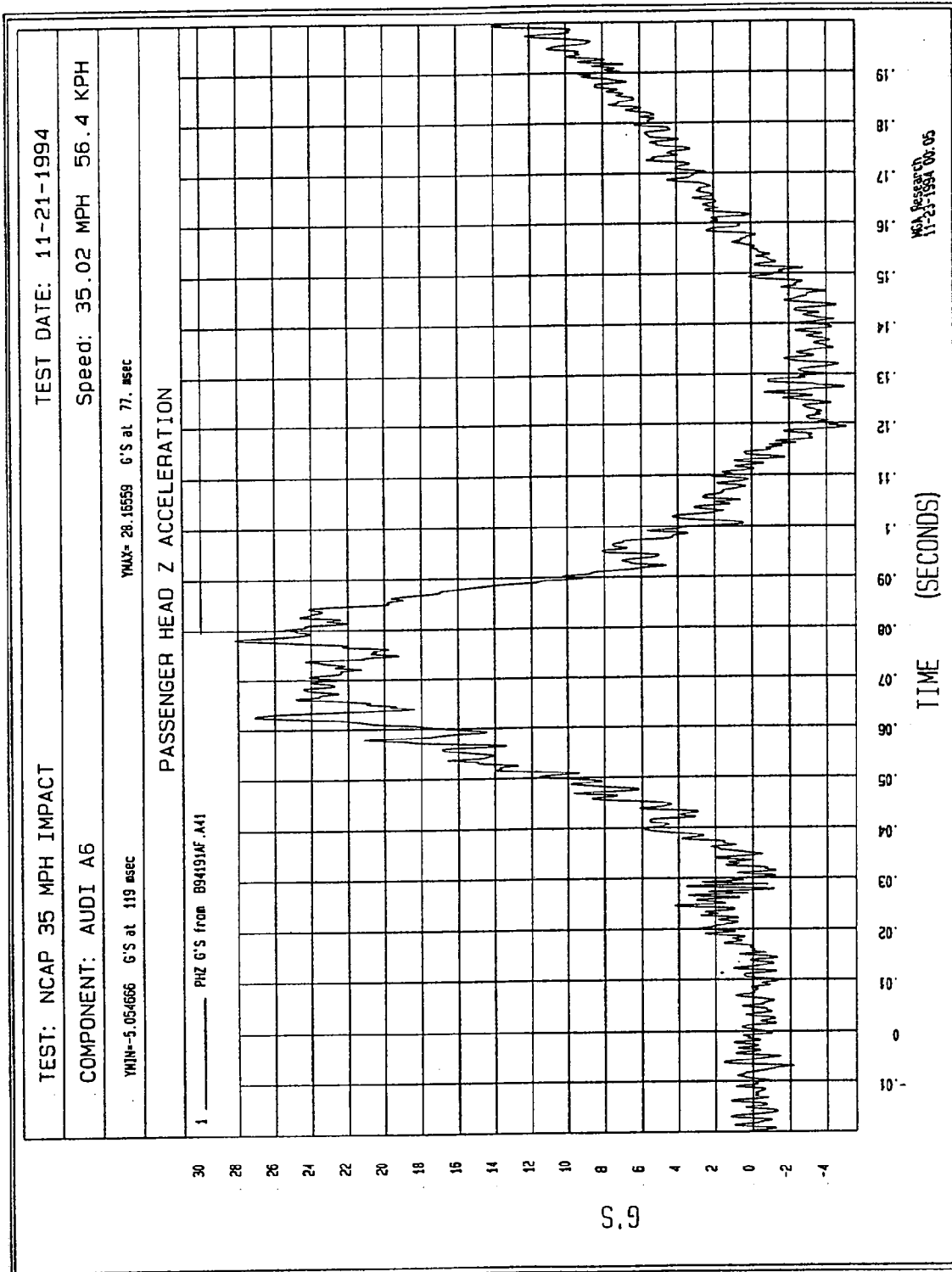


Figure B-69 - Passenger Head Z Acceleration vs. Time

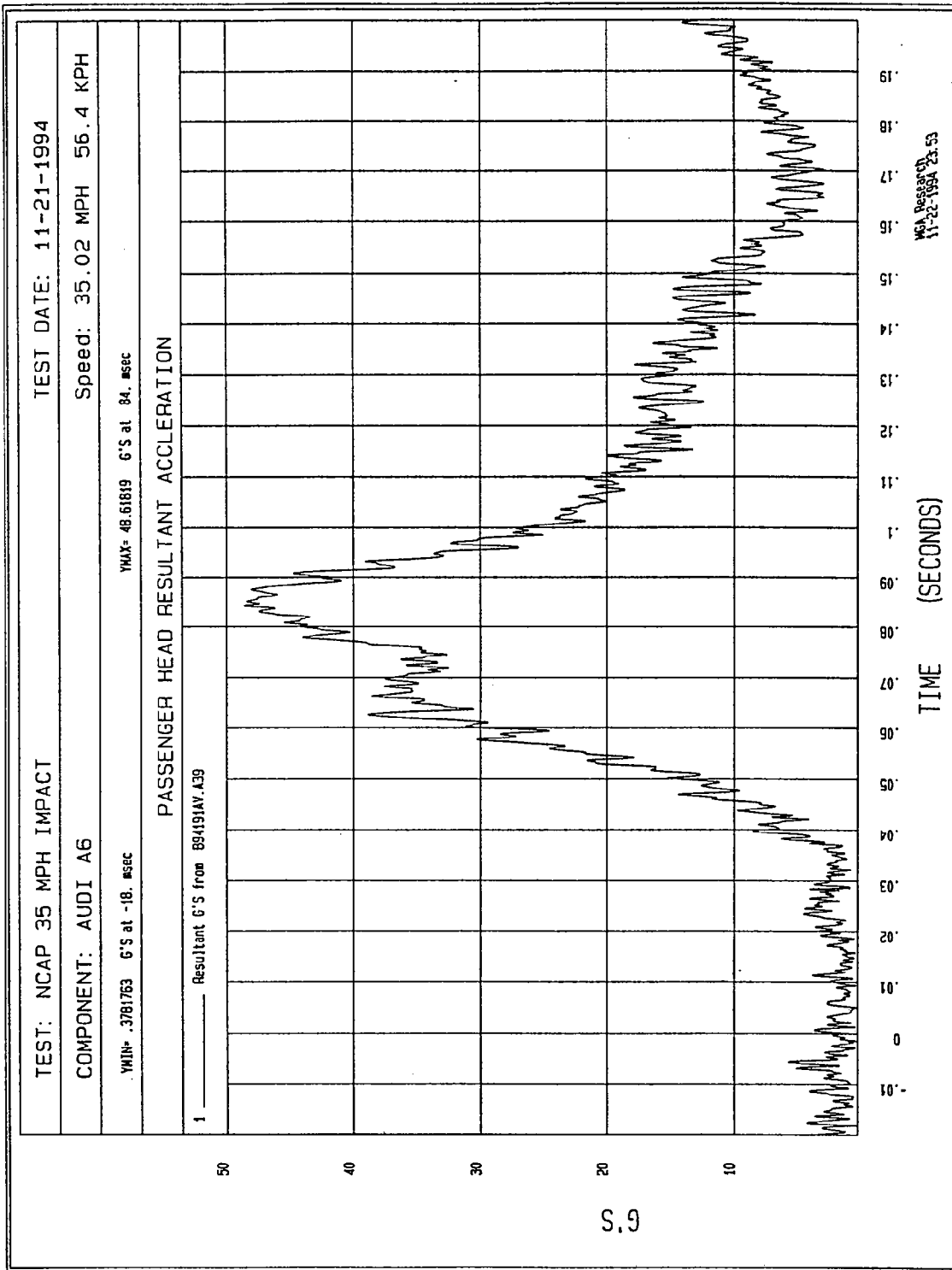


Figure B-70 - Passenger Head Resultant Acceleration vs. Time

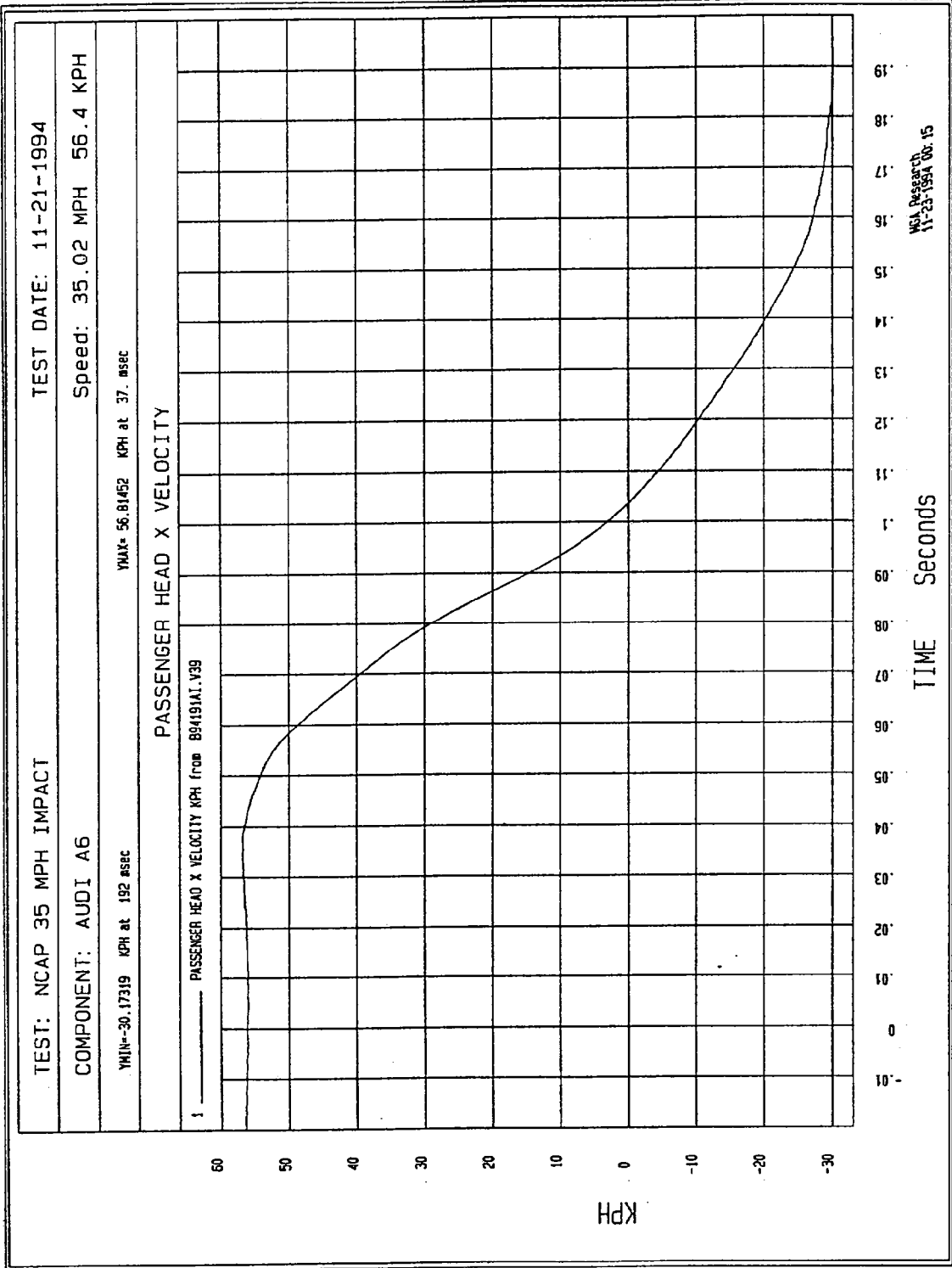


Figure B-71 - Passenger Head X Velocity vs. Time

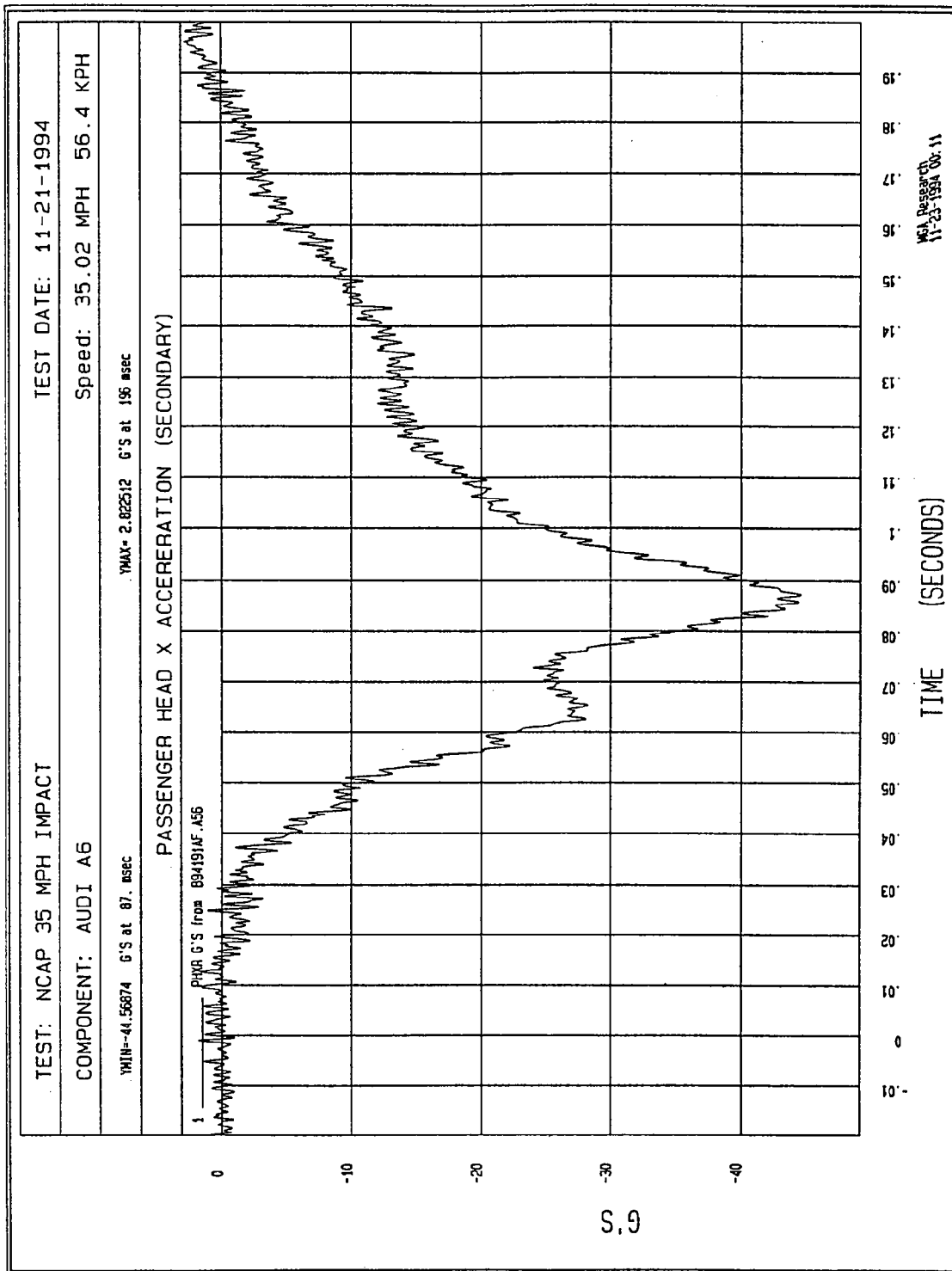


Figure B-72 - Passenger Head X Redundant Acceleration vs. Time

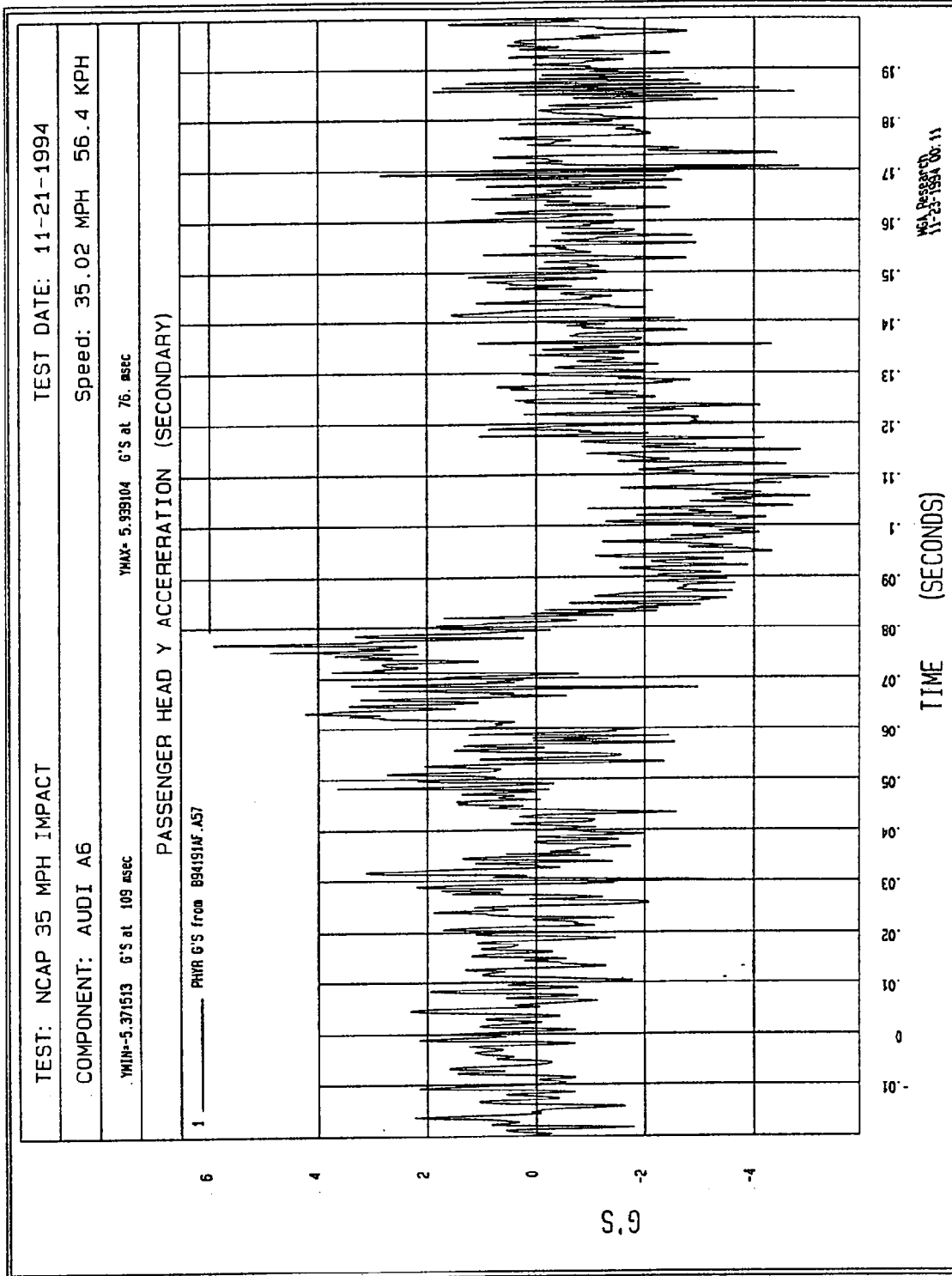


Figure B-73 - Passenger Head Y Redundant Acceleration vs. Time

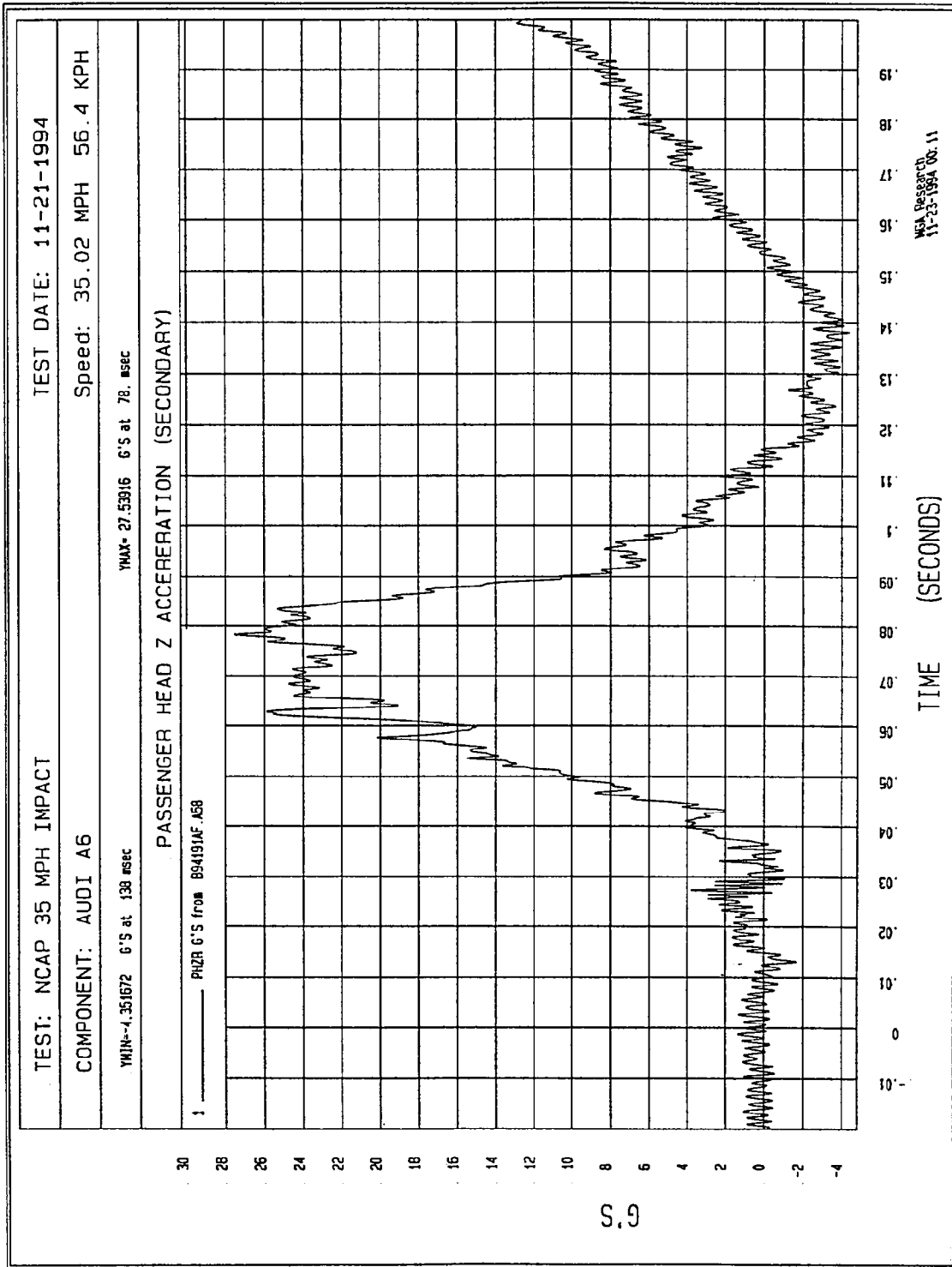


Figure B-74 - Passenger Head Z Redundant Acceleration vs. Time

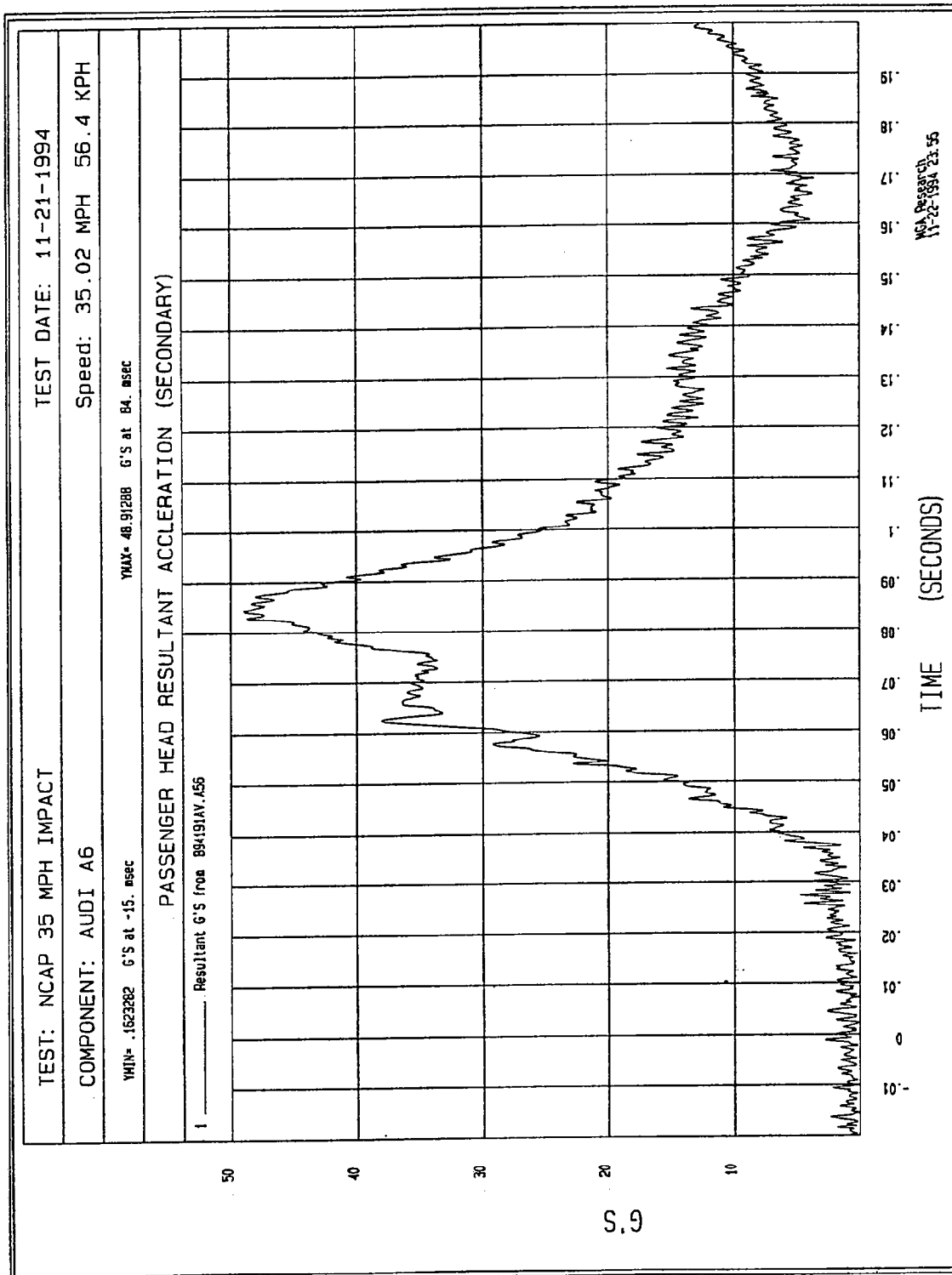


Figure B-75 - Passenger Head Redundant Resultant Acceleration vs. Time

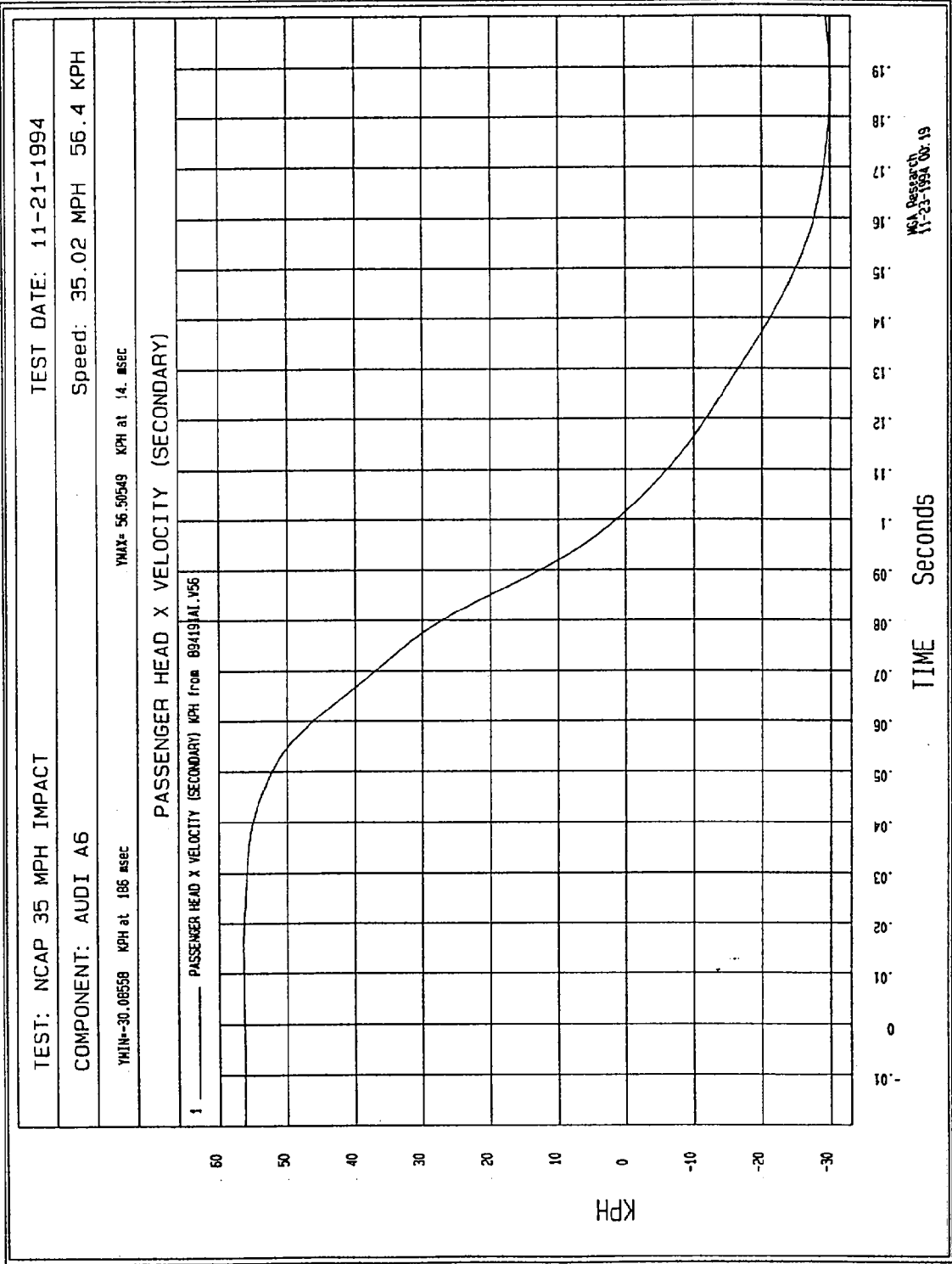


Figure B-76 - Passenger Head X Redundant Velocity vs. Time

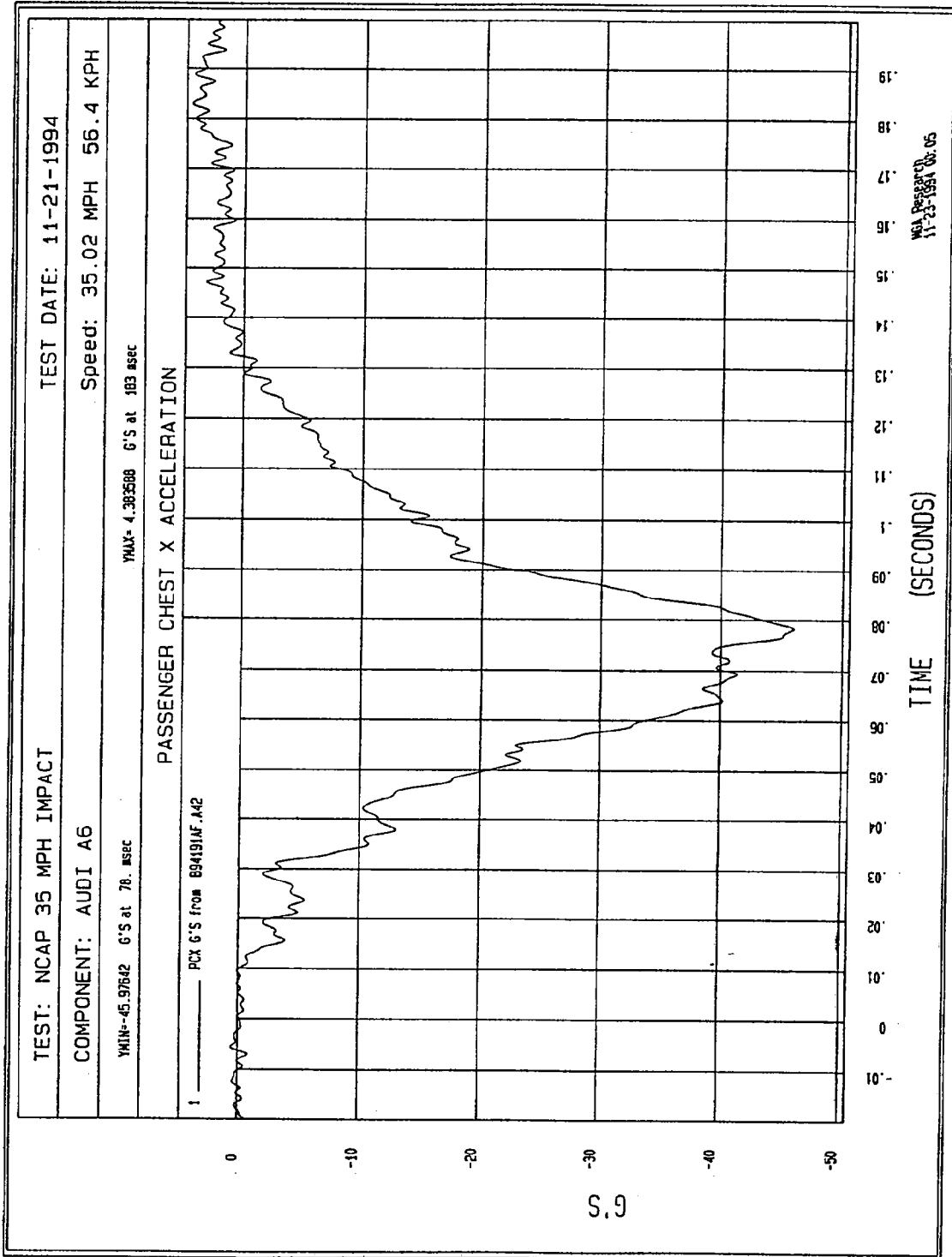
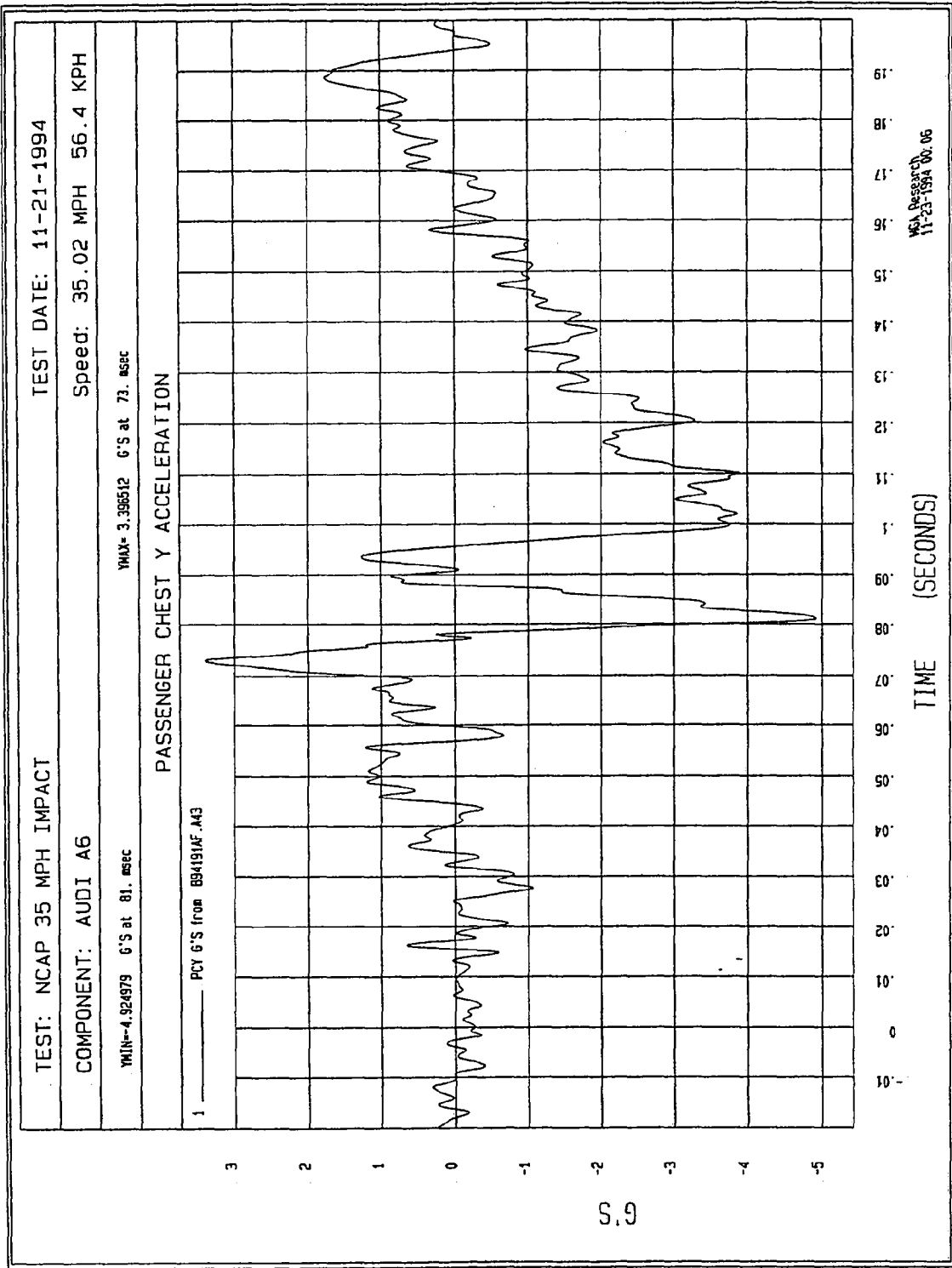


Figure B-77 - Passenger Chest X Acceleration vs. Time



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Figure B-78 - Passenger Chest Y Acceleration vs. Time



Figure B-79 - Passenger Chest Z Acceleration vs. Time

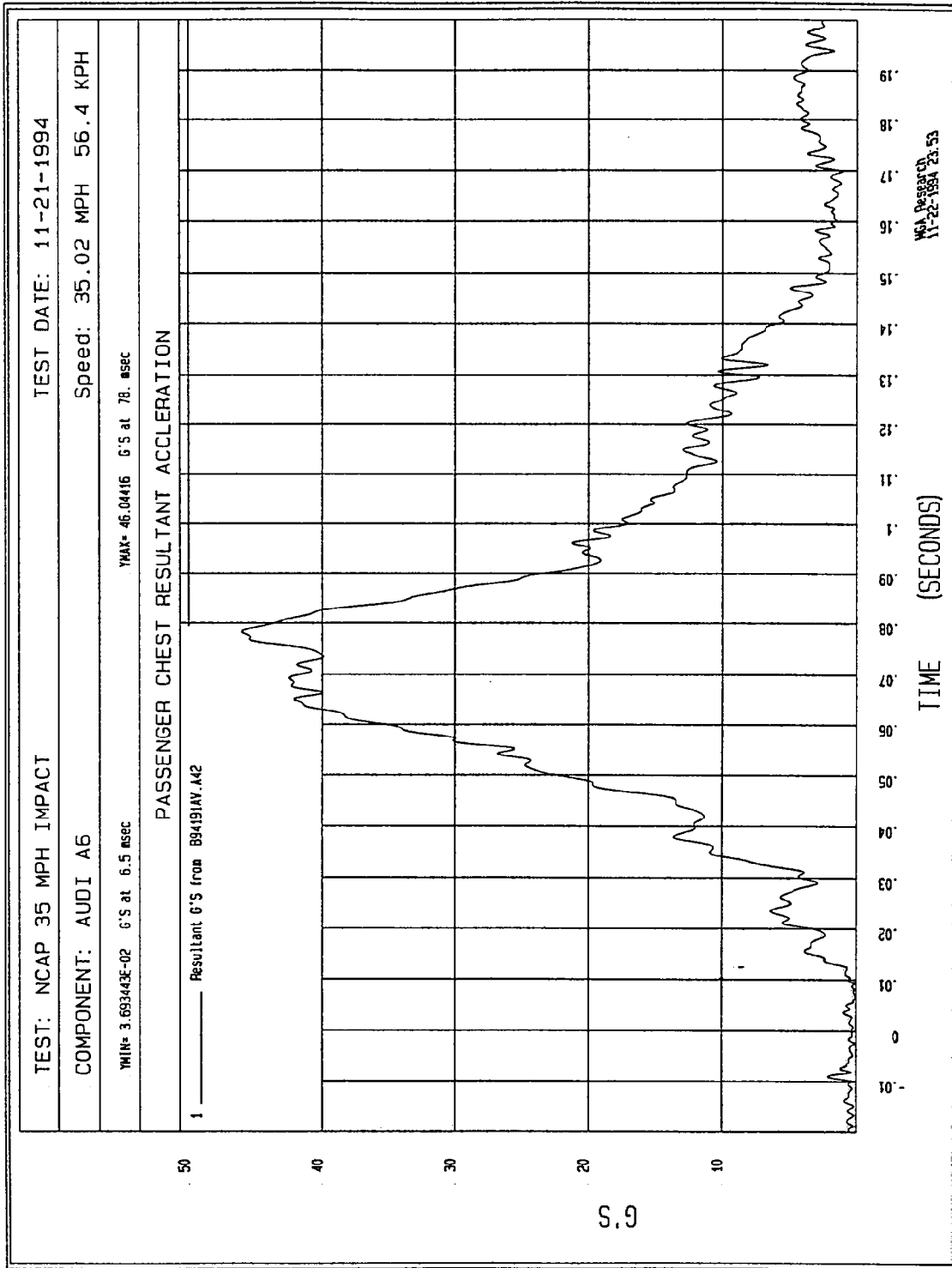


Figure B-80 - Passenger Chest Resultant vs. Time

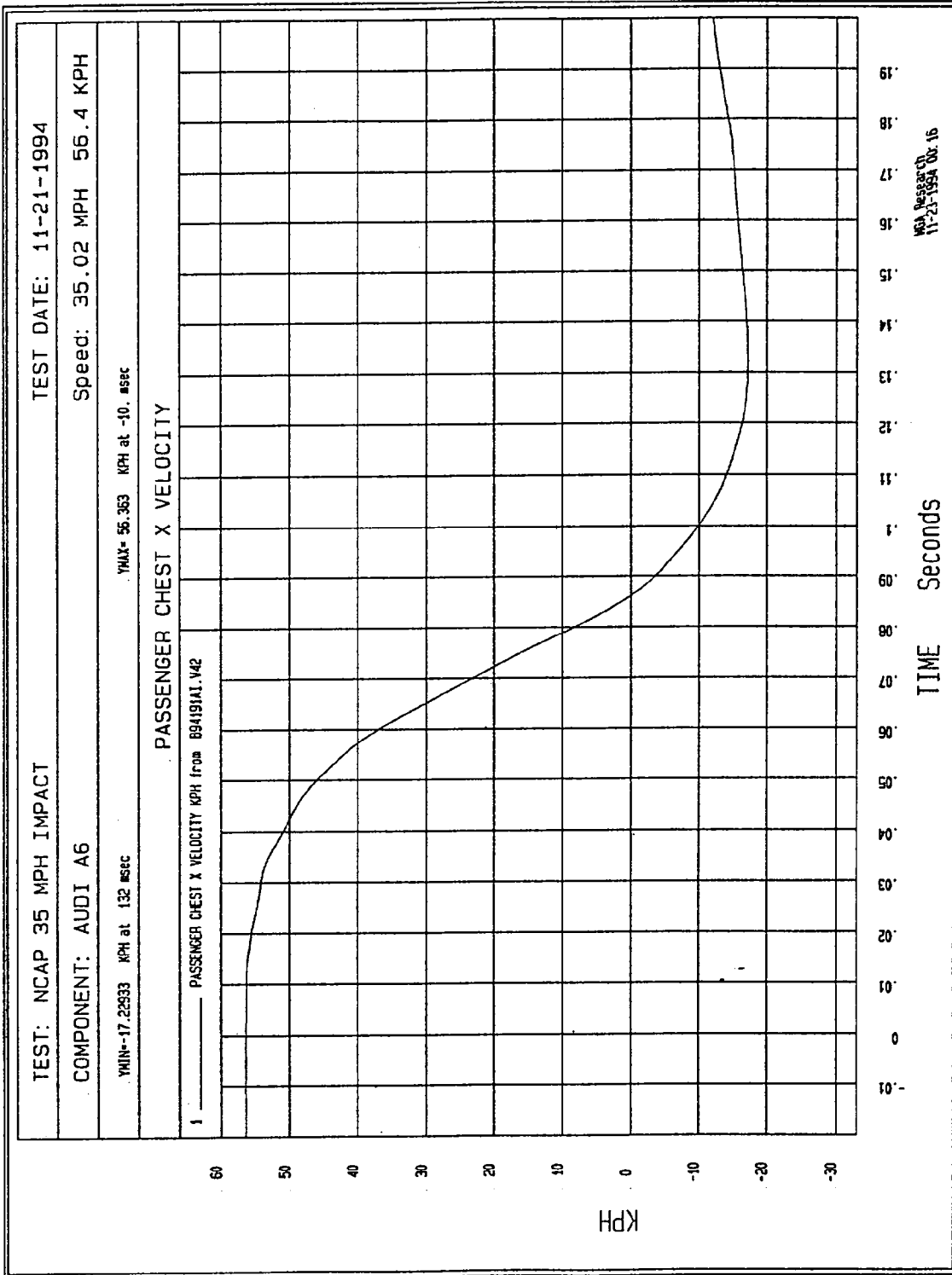


Figure B-81 - Passenger Chest X Velocity vs. Time

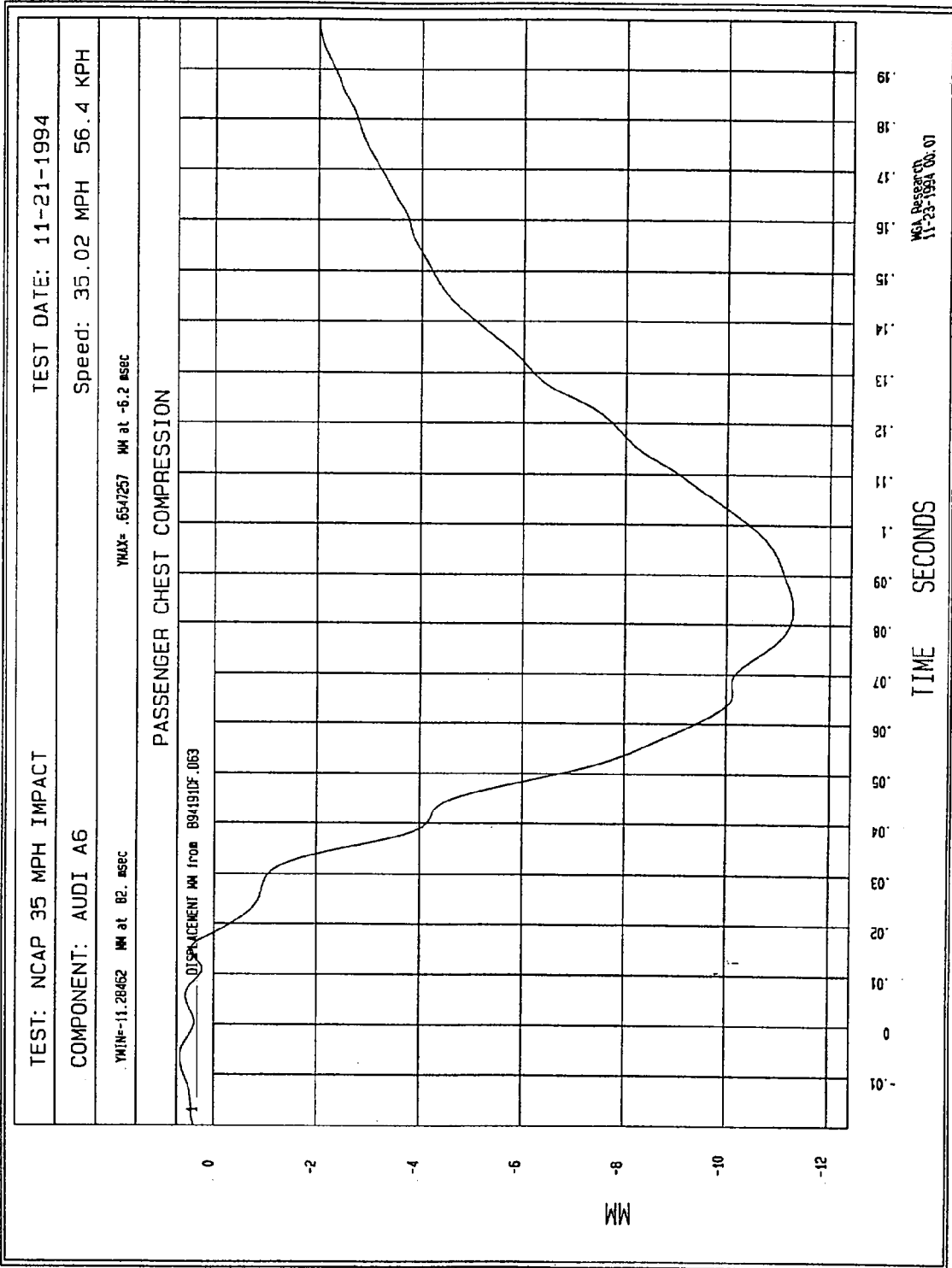


Figure B-82 - Passenger Chest Compression vs. Time

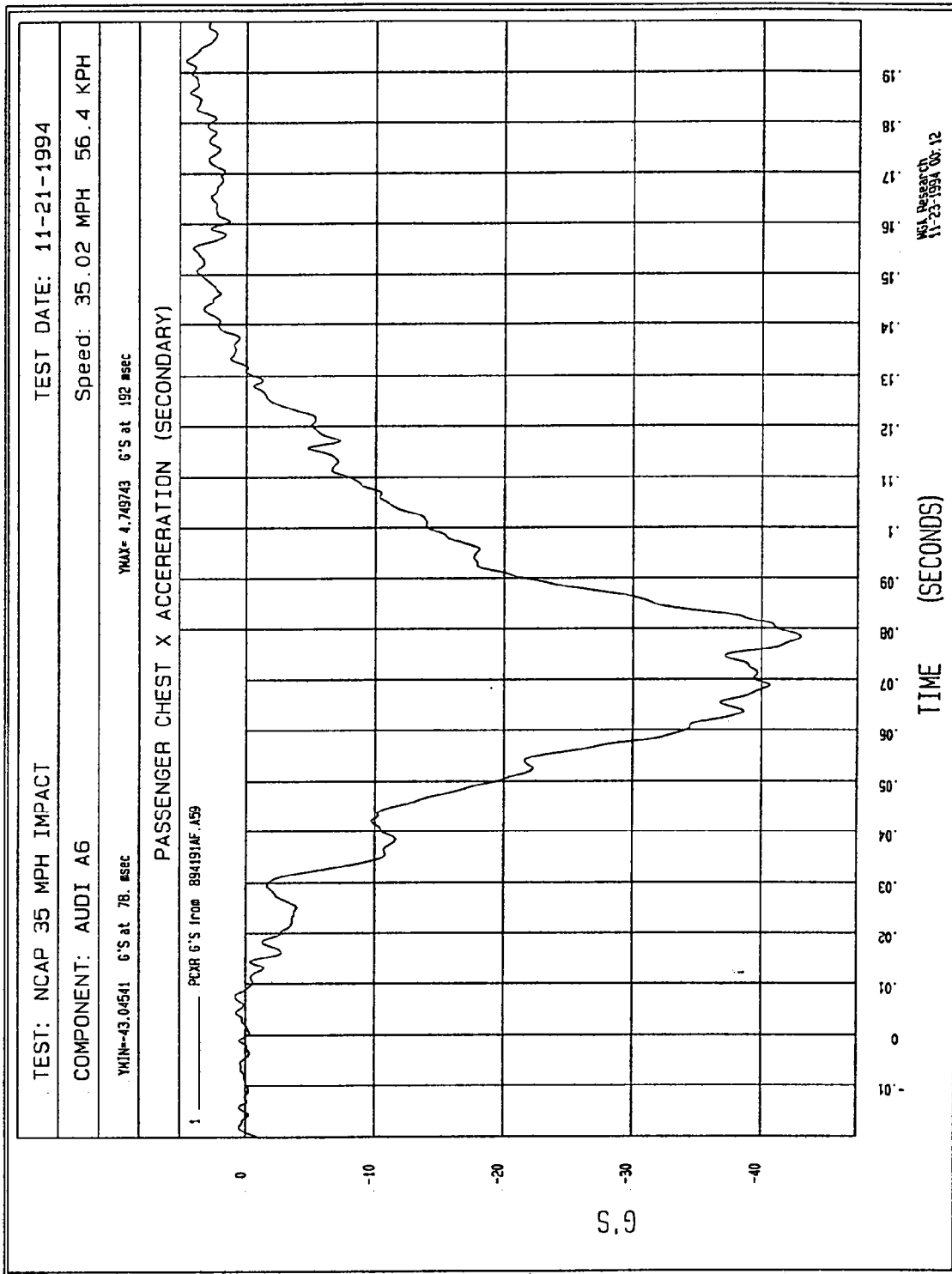


Figure B-83 - Passenger Chest X Redundant Acceleration vs. Time

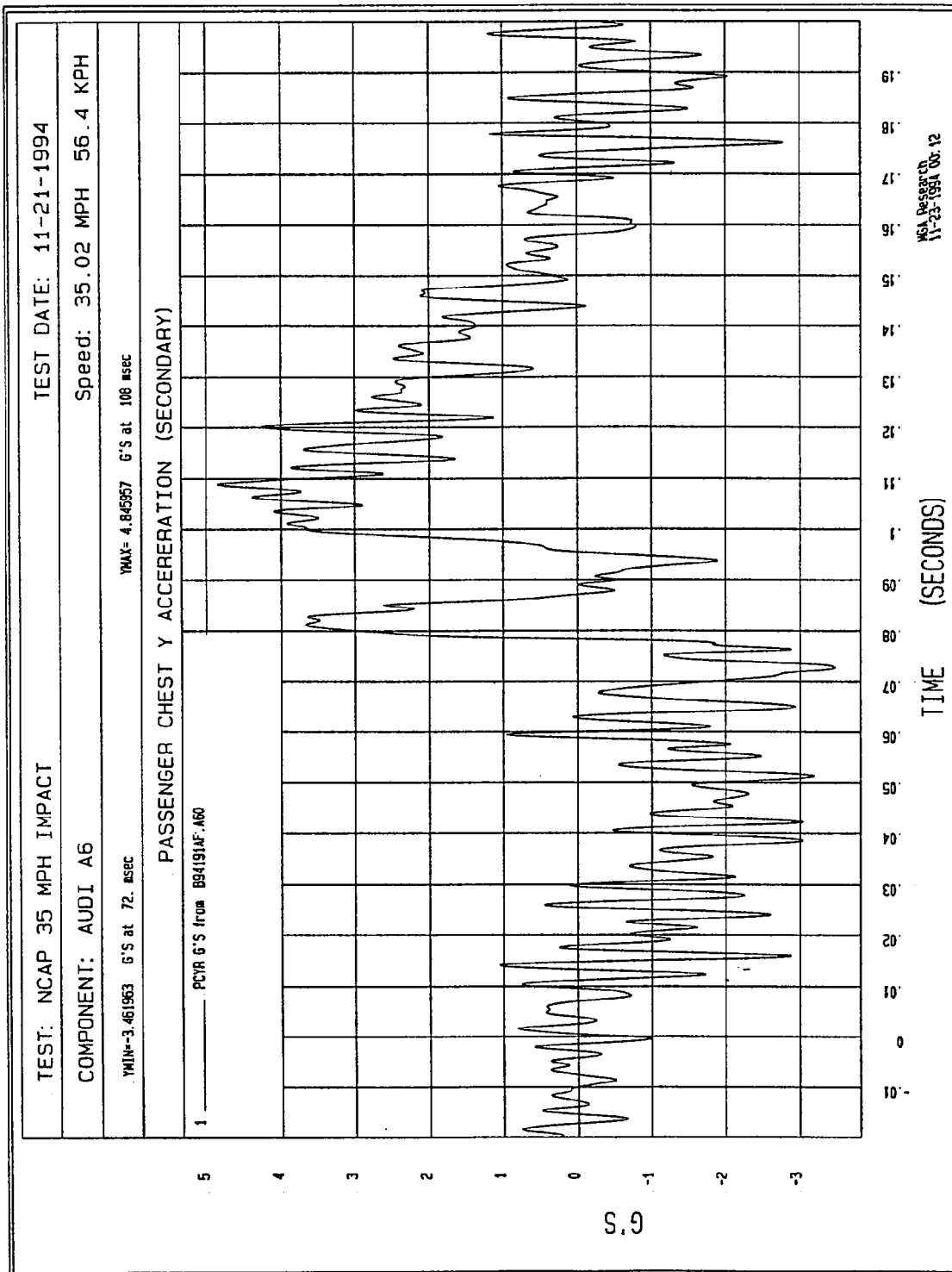


Figure B-84 - Passenger Chest Y Redundant Acceleration vs. Time

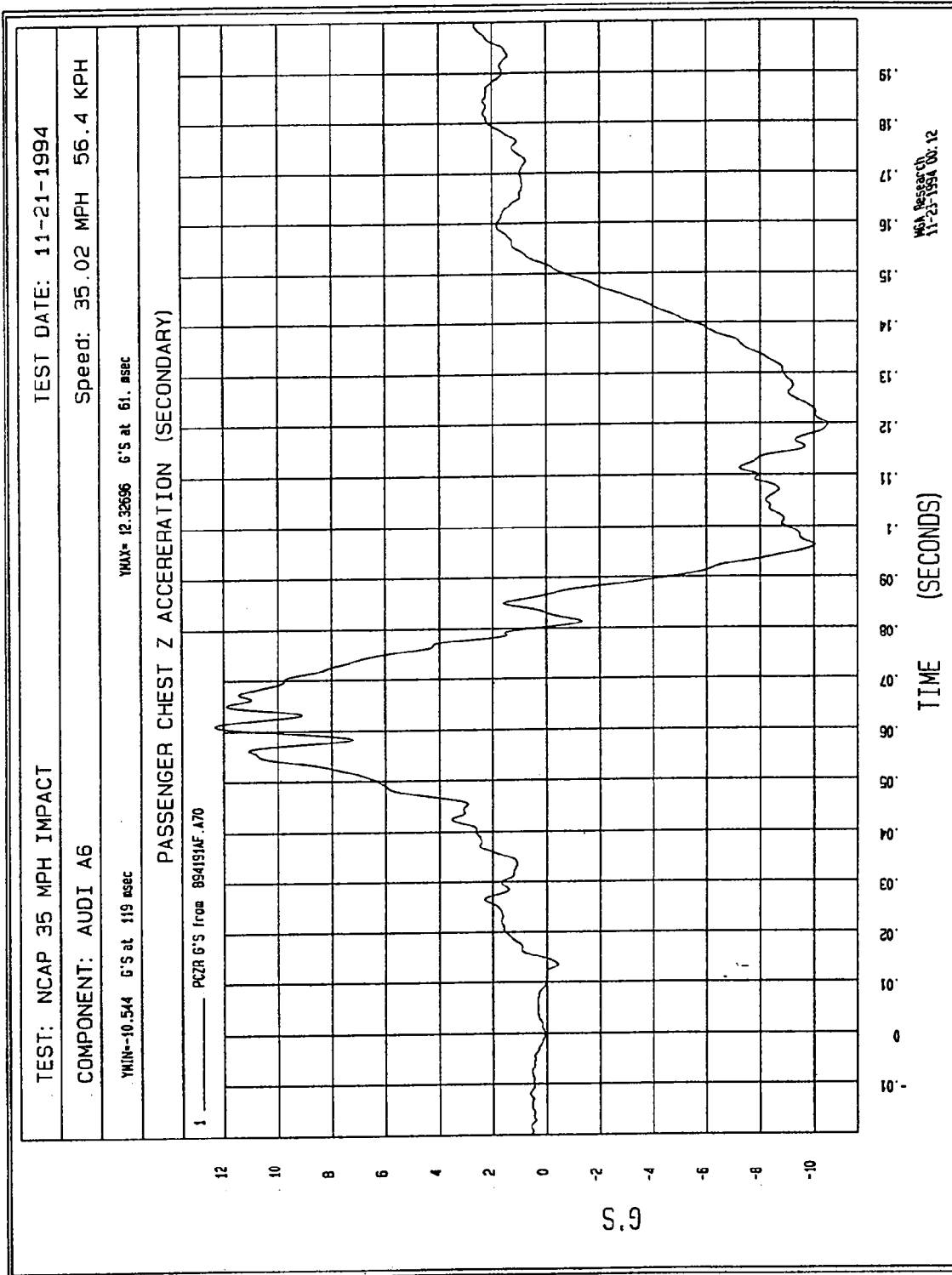


Figure B-85 - Passenger Chest Z Redundant Acceleration vs. Time

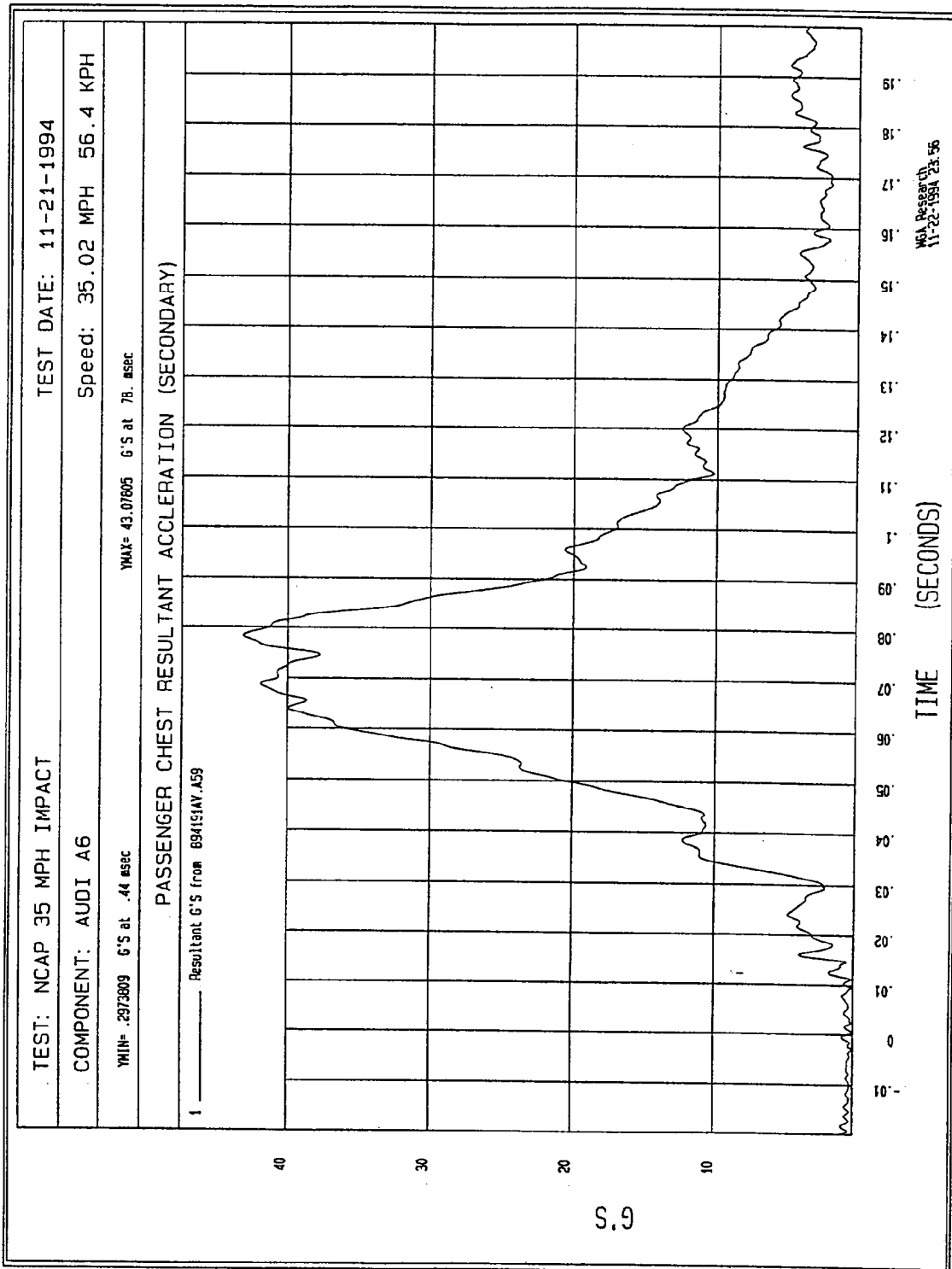
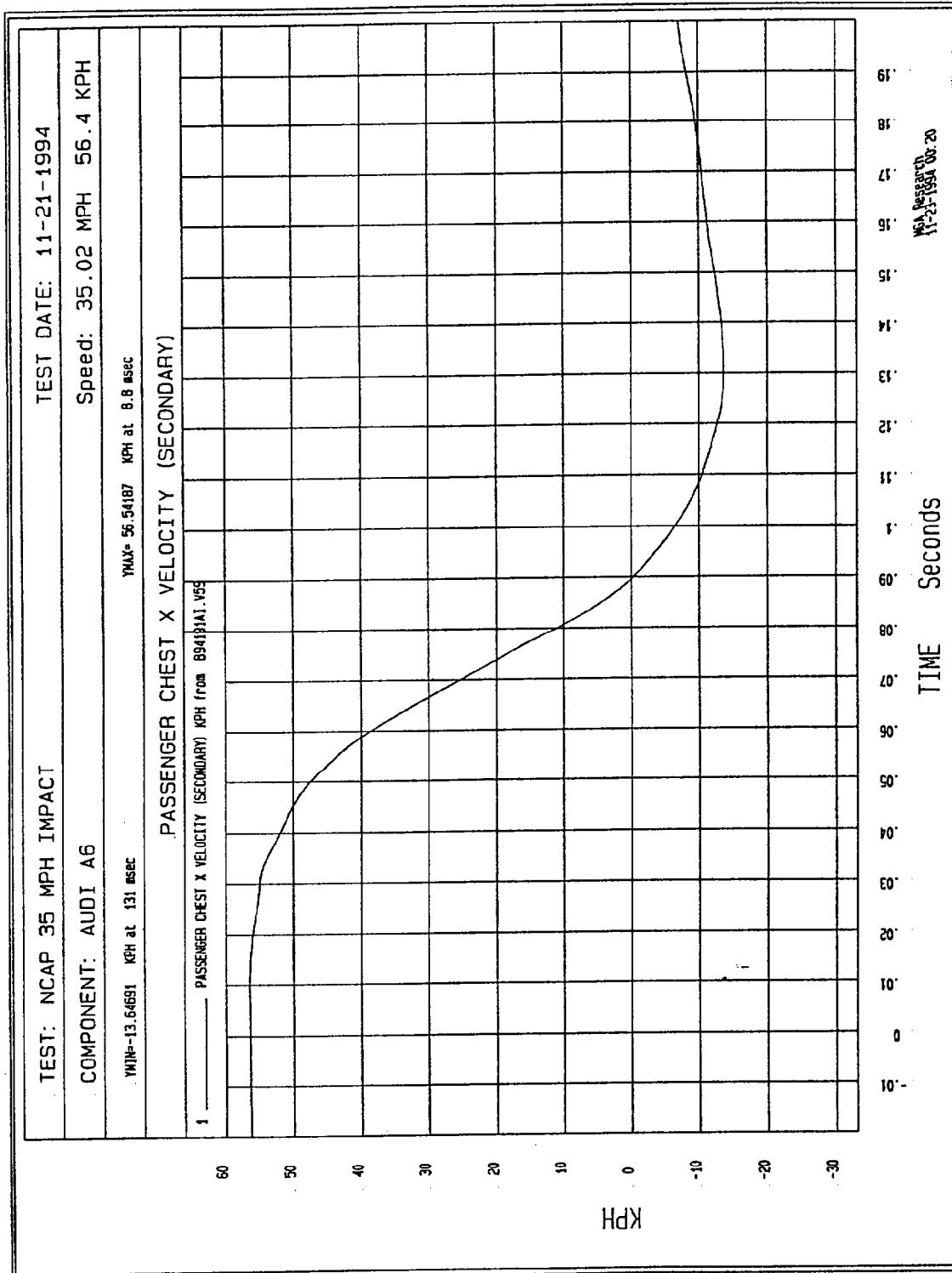
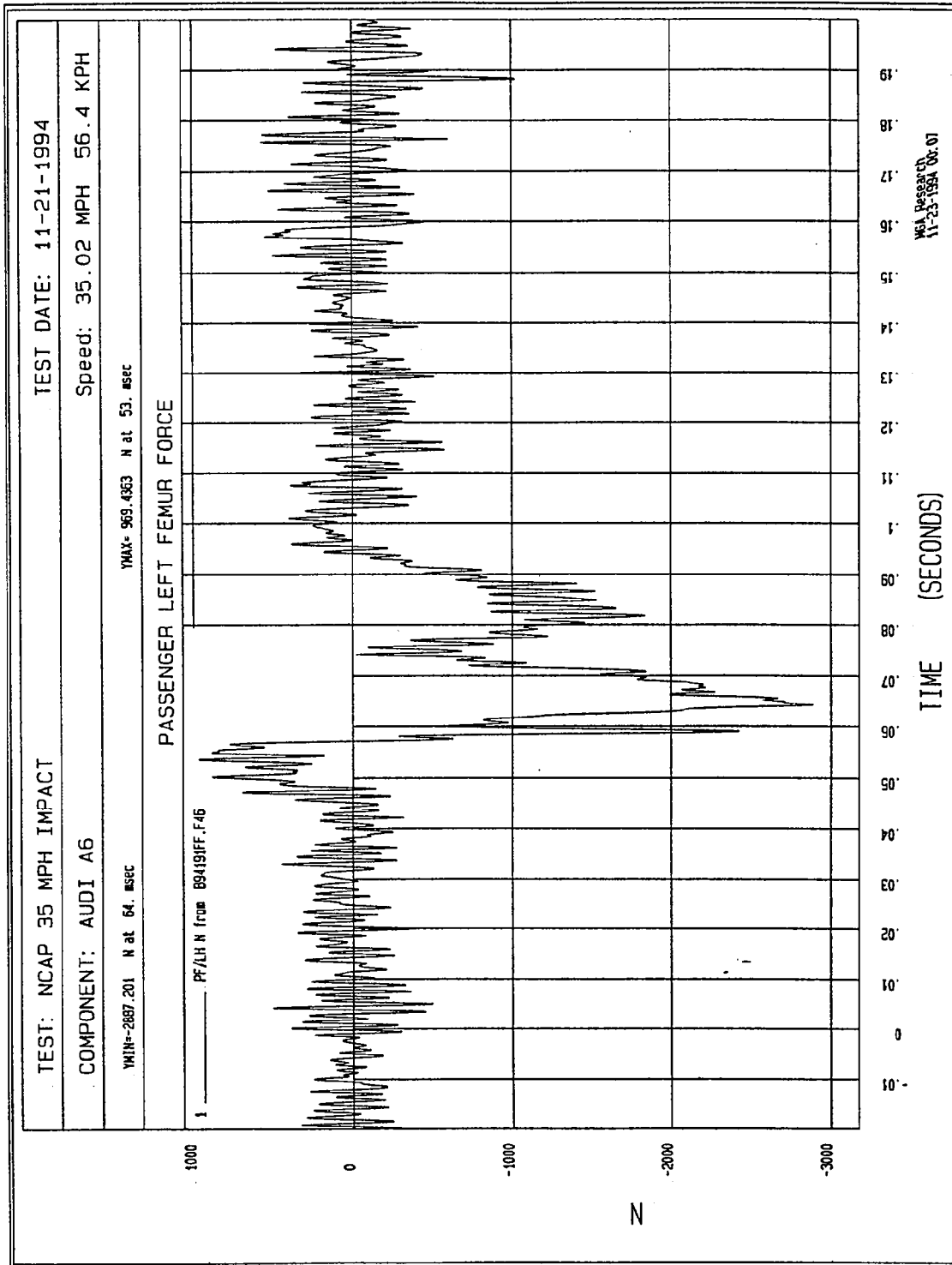


Figure B-86 - Passenger Chest Redundant Resultant Acceleration vs. Time



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Figure B-87 - Passenger Chest X Redundant Velocity vs. Time



B-88

Figure B-88 - Passenger Left Femur Force vs. Time

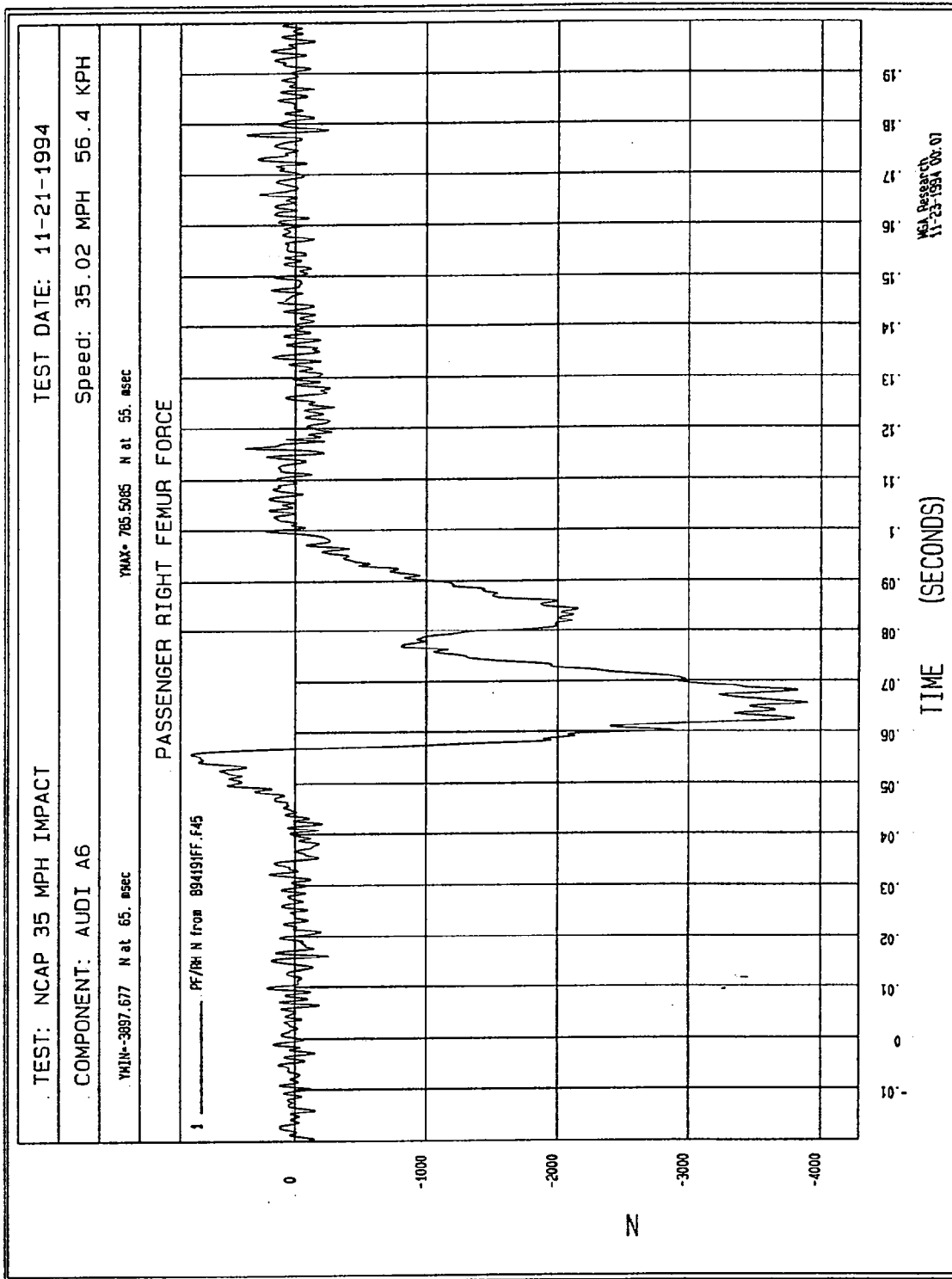


Figure B-89 - Passenger Right Femur Force vs. Time

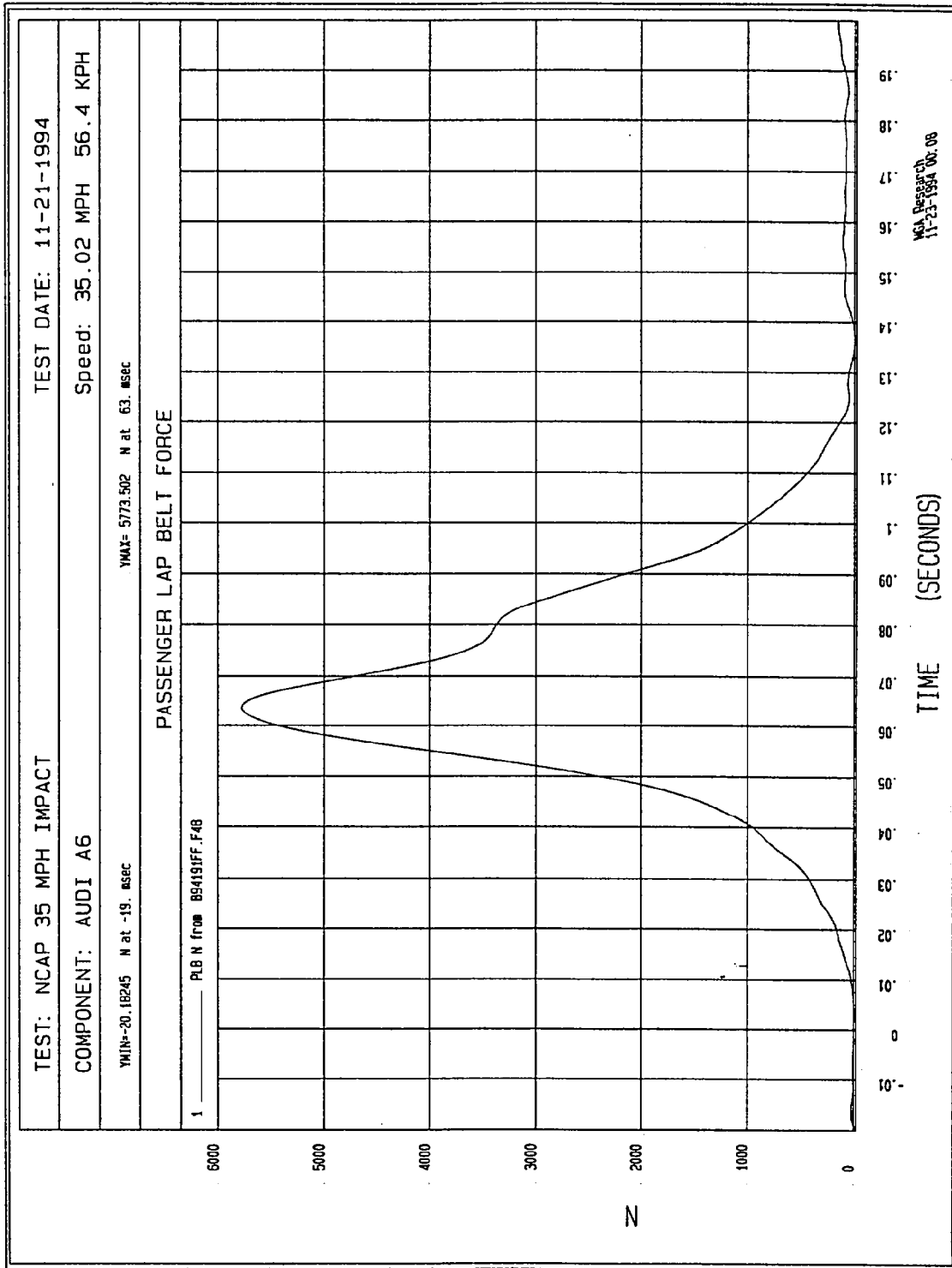


Figure B-90 - Passenger Lap Belt Force vs. Time

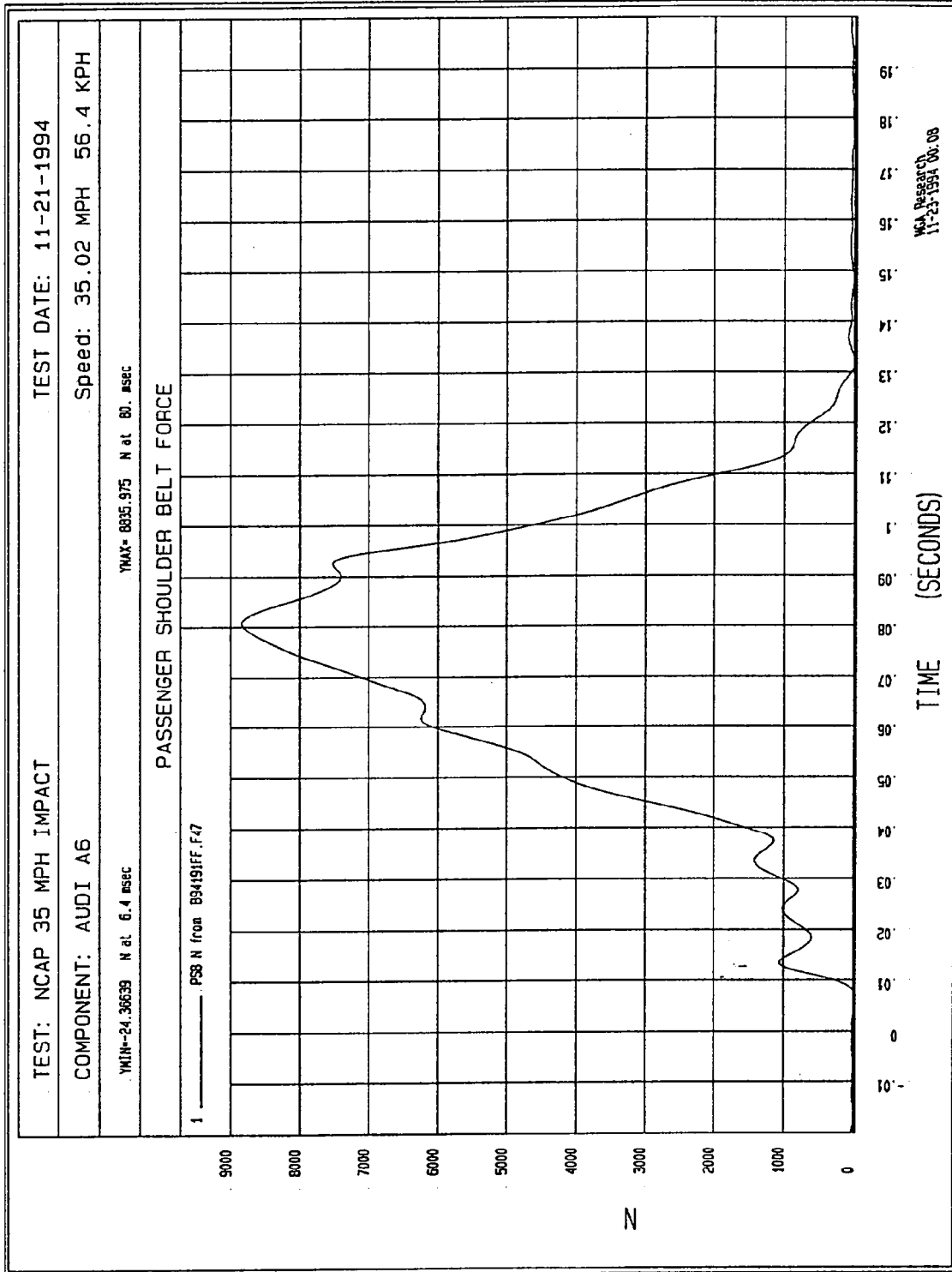


Figure B-91 - Passenger Shoulder Belt Force vs. Time

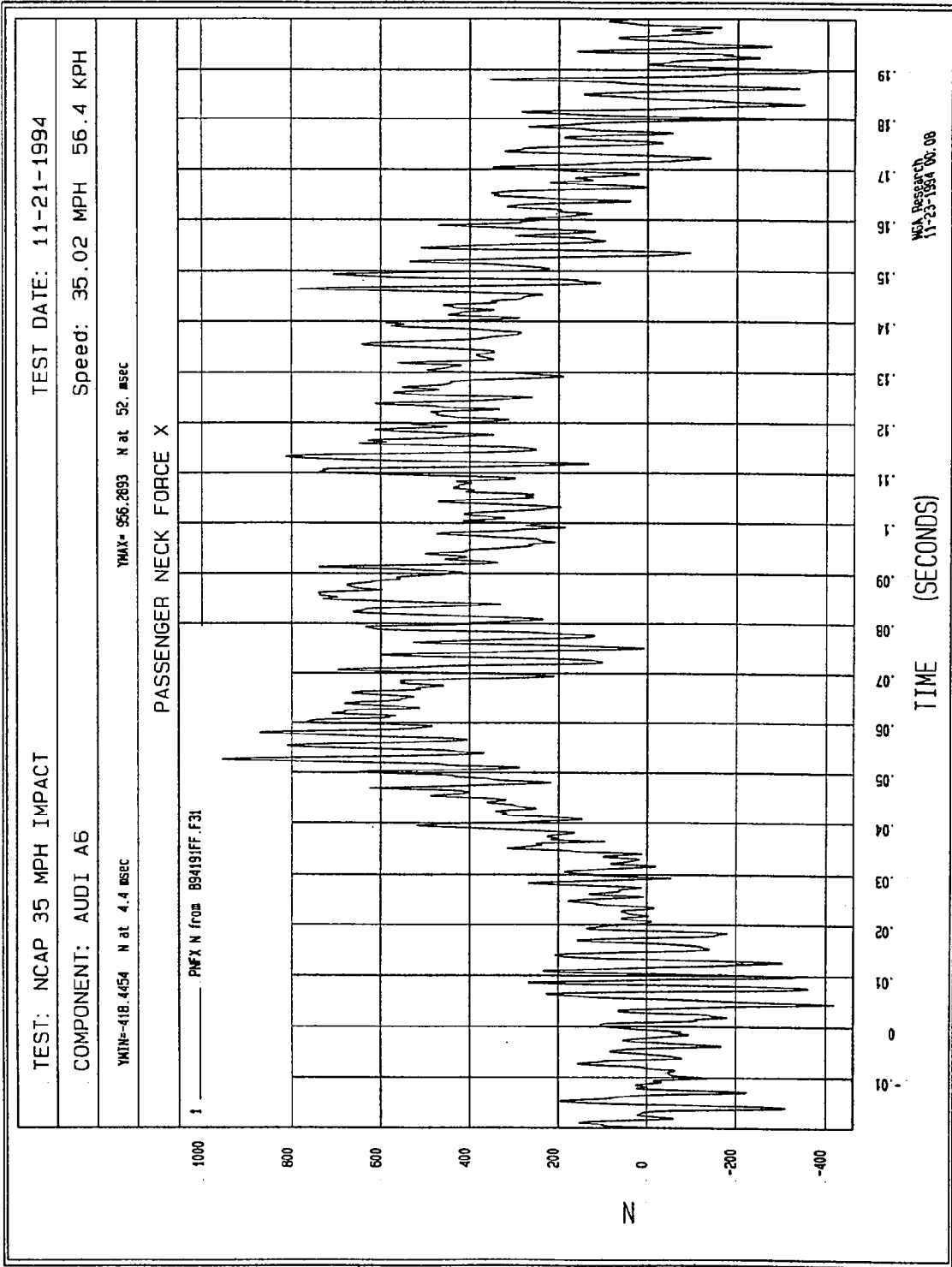


Figure B-92 - Passenger Neck Force X vs. Time

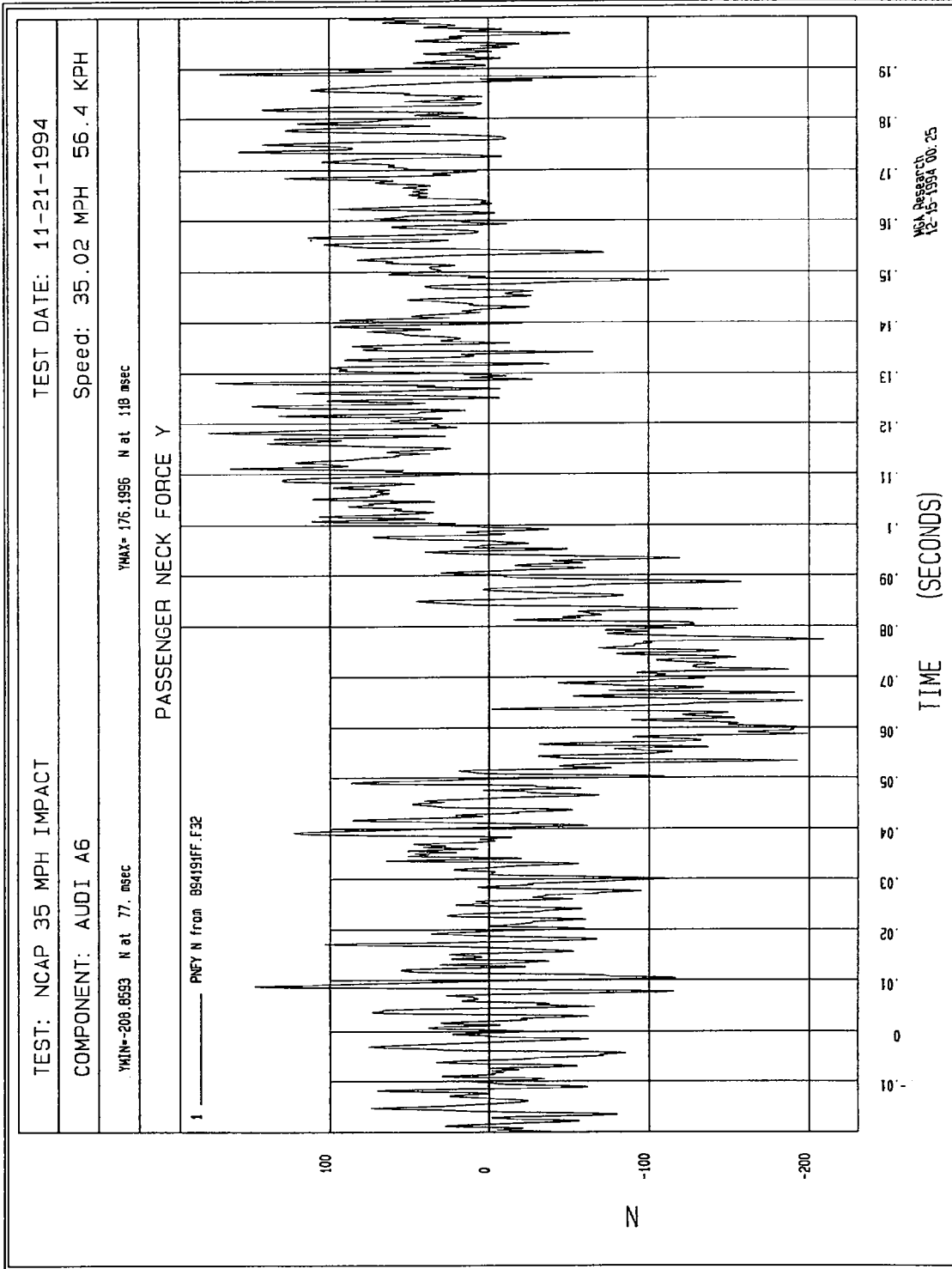
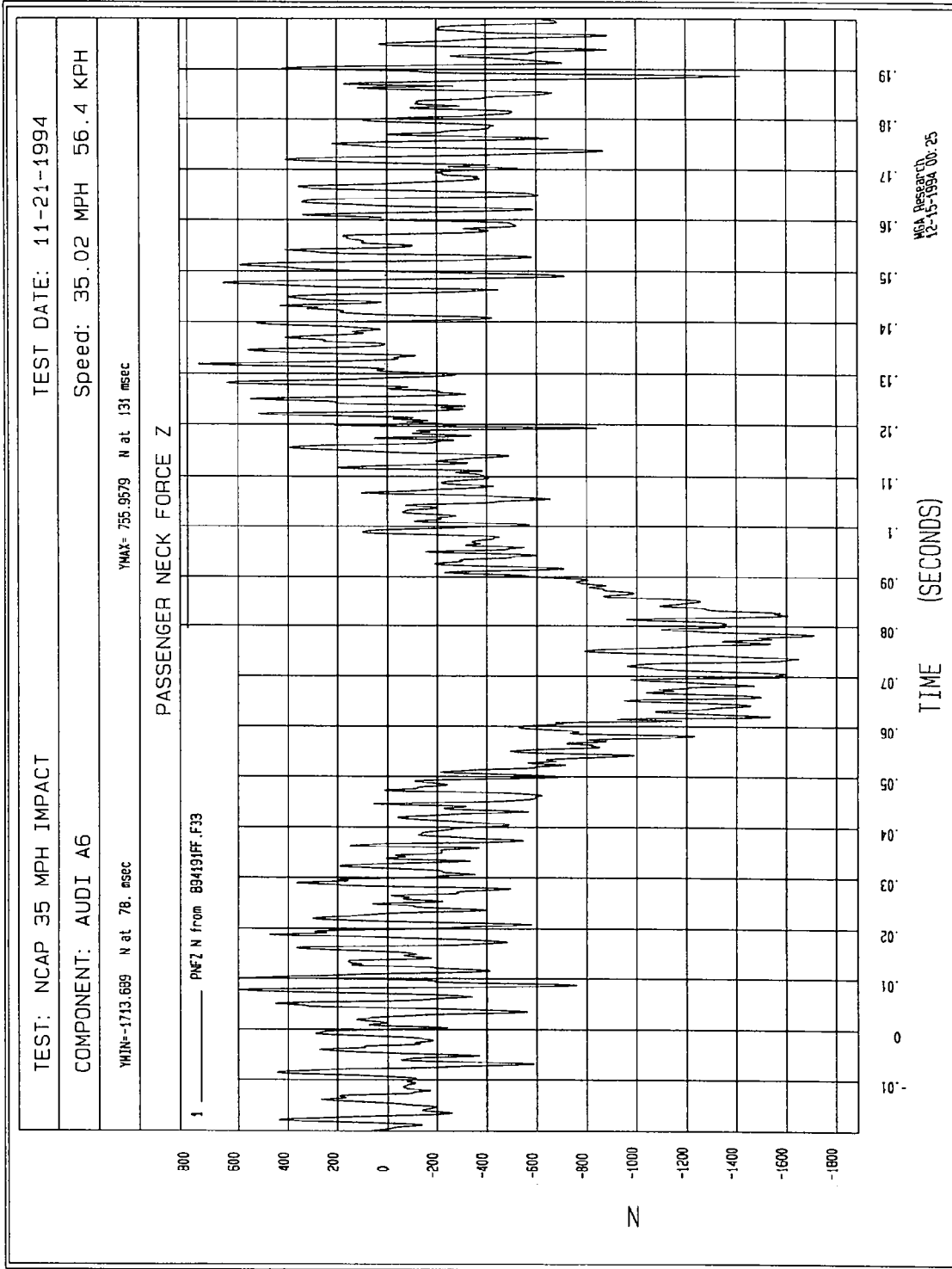


Figure B-93 - Passenger Neck Force Y vs. Time



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Figure B-94 - Passenger Neck Force Z vs. Time

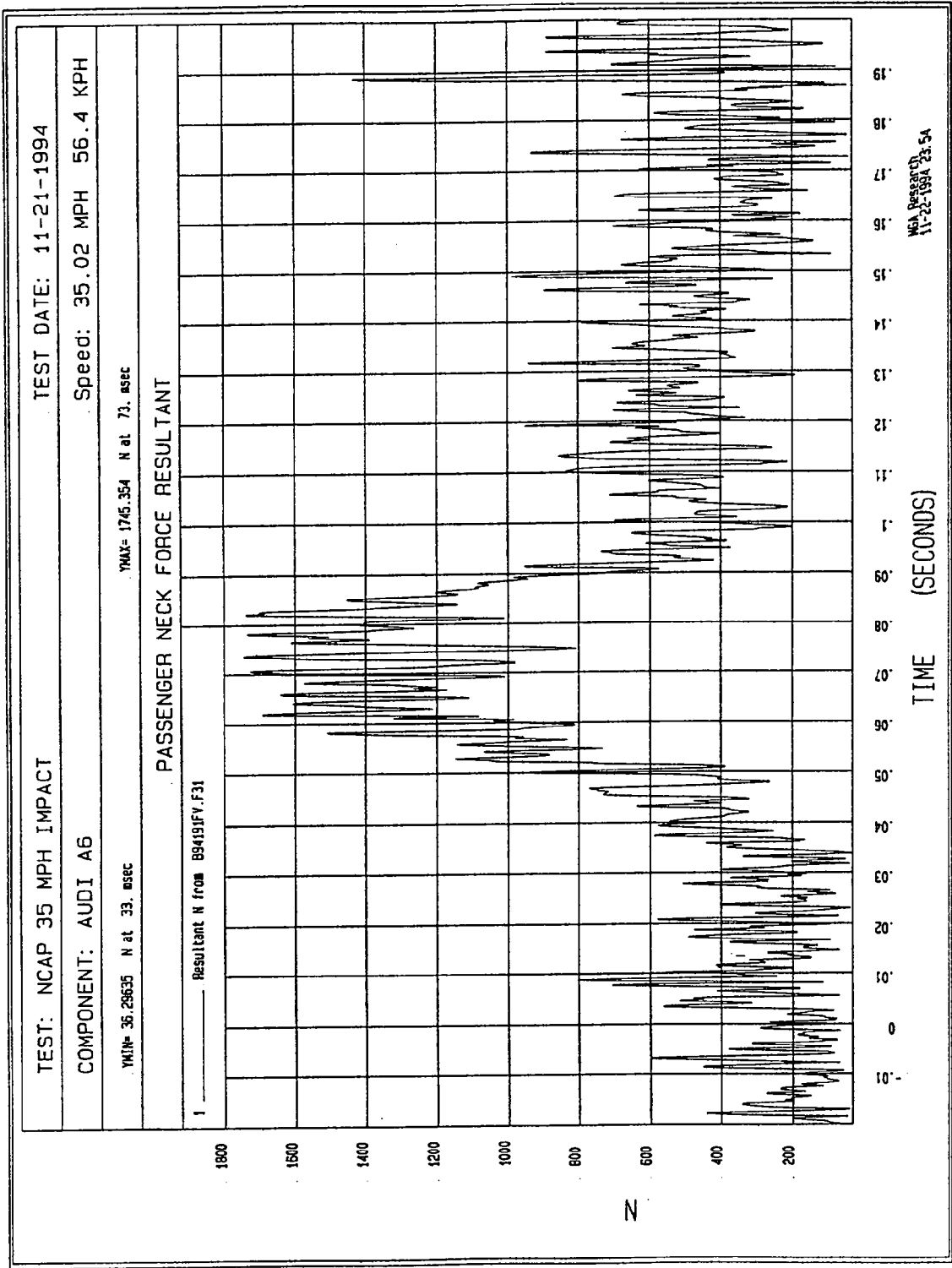


Figure B-95 - Passenger Neck Force Resultant Acceleration vs. Time

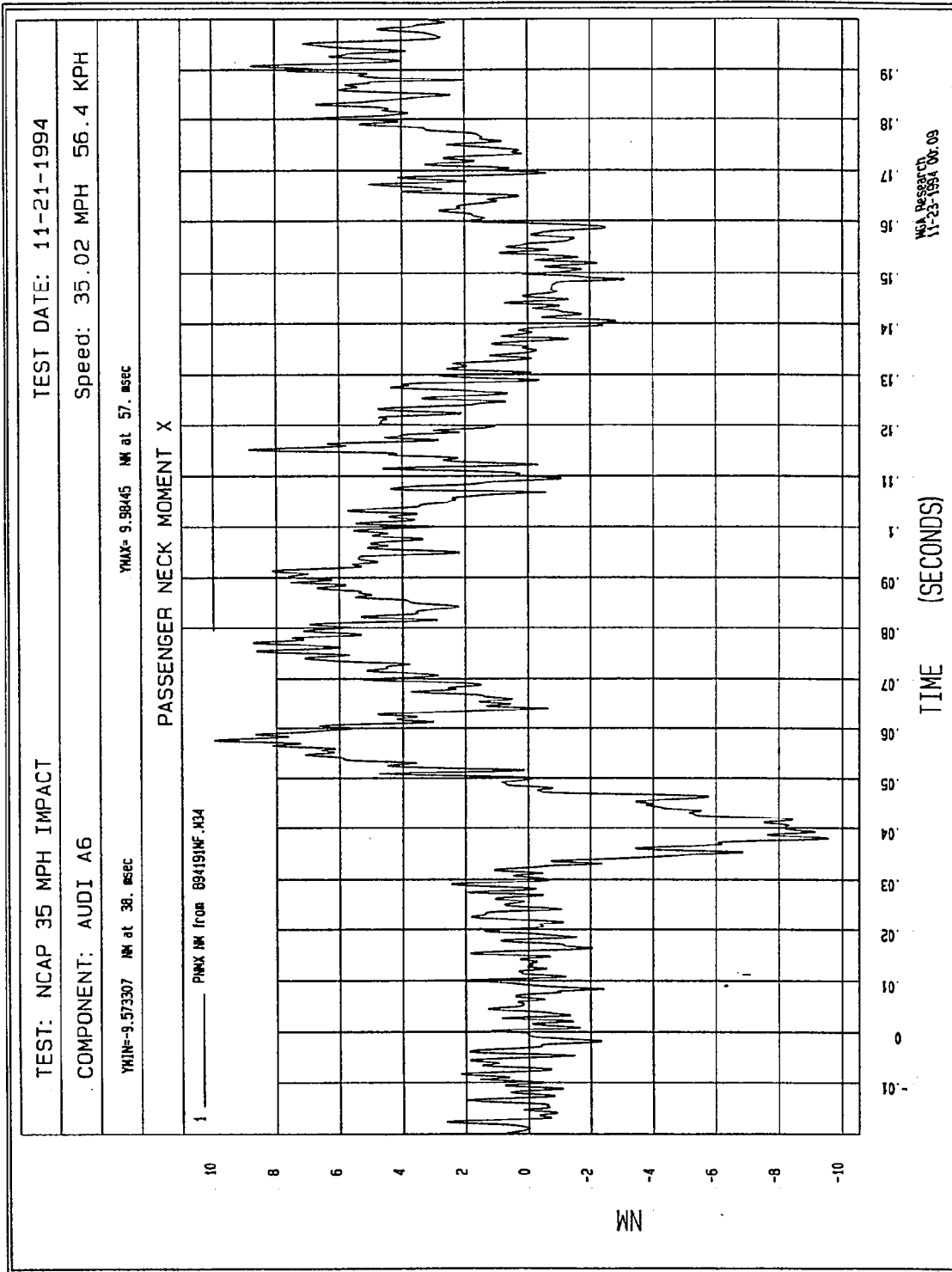


Figure B-96 - Passenger Neck Moment X vs. Time

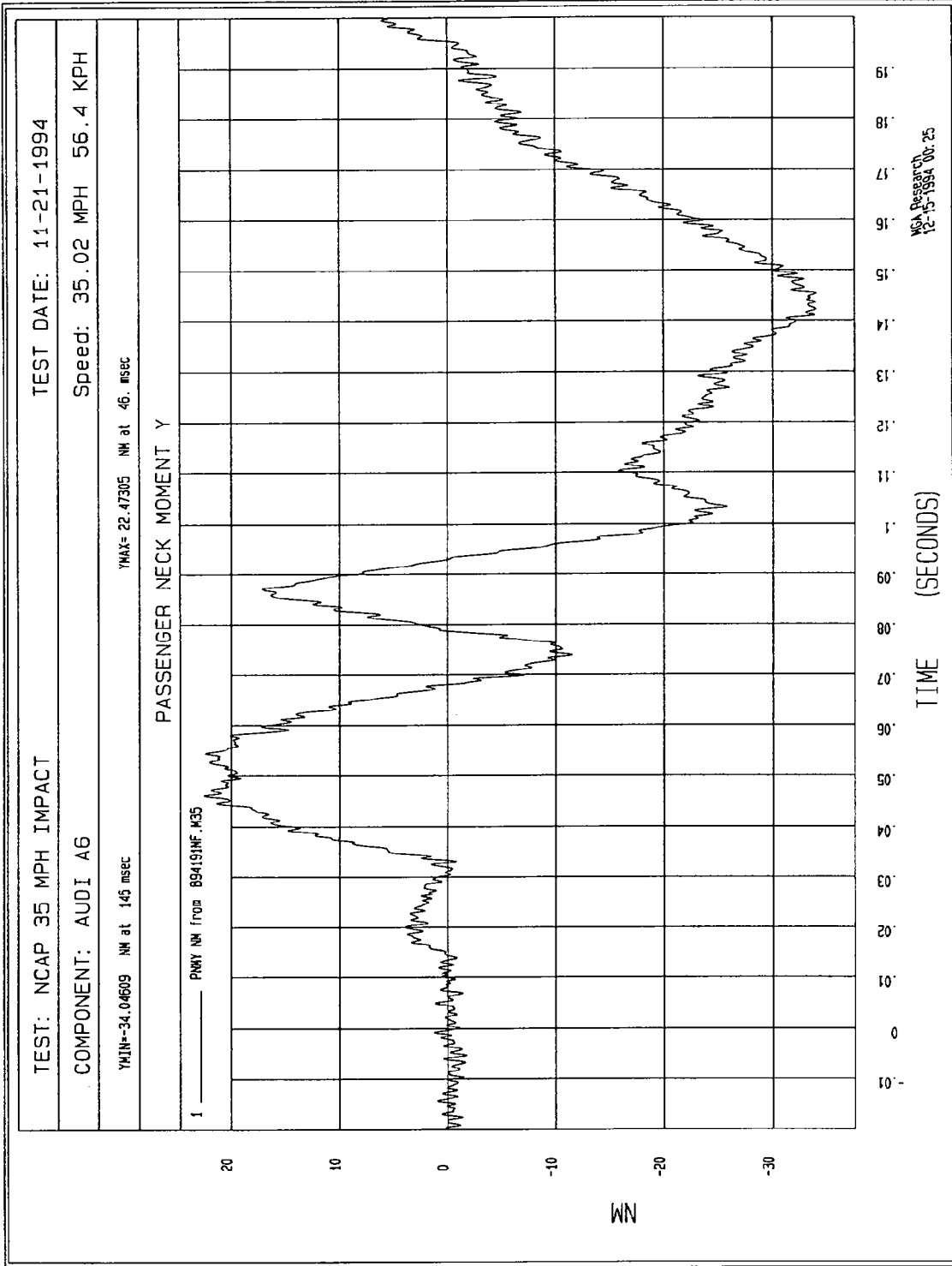
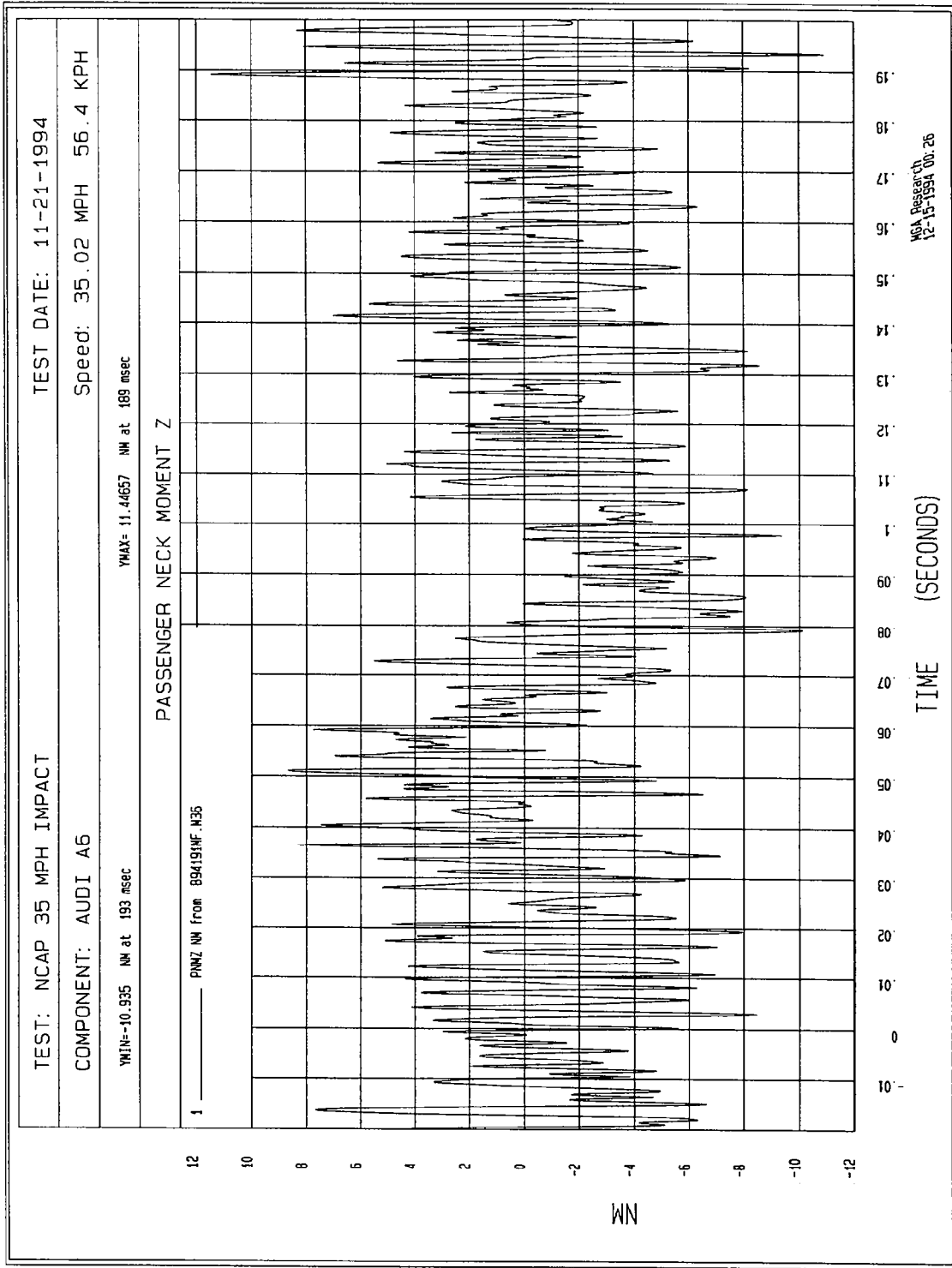


Figure B-97 - Passenger Neck Moment Y vs. Time



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Figure B-98 - Passenger Neck Moment Z vs. Time

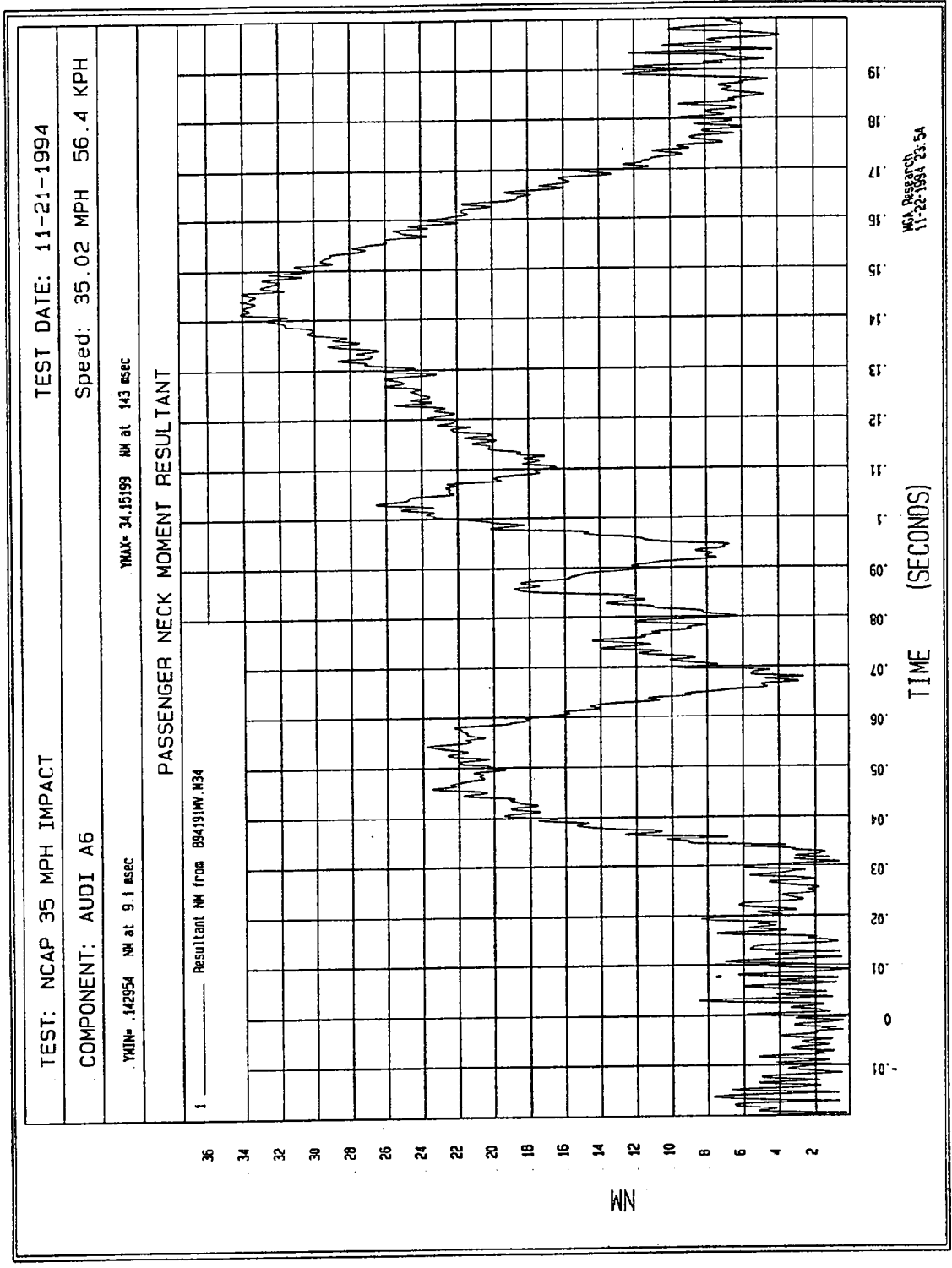


Figure B-99 - Passenger Neck Moment Resultant Acceleration vs. Time

**APPENDIX C**  
**Dummy Configuration & Performance Verification Data**

HYBRID III DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY NO.: 305 DUMMY CALIBRATION BY: Rod McClelland & Al Chalmers

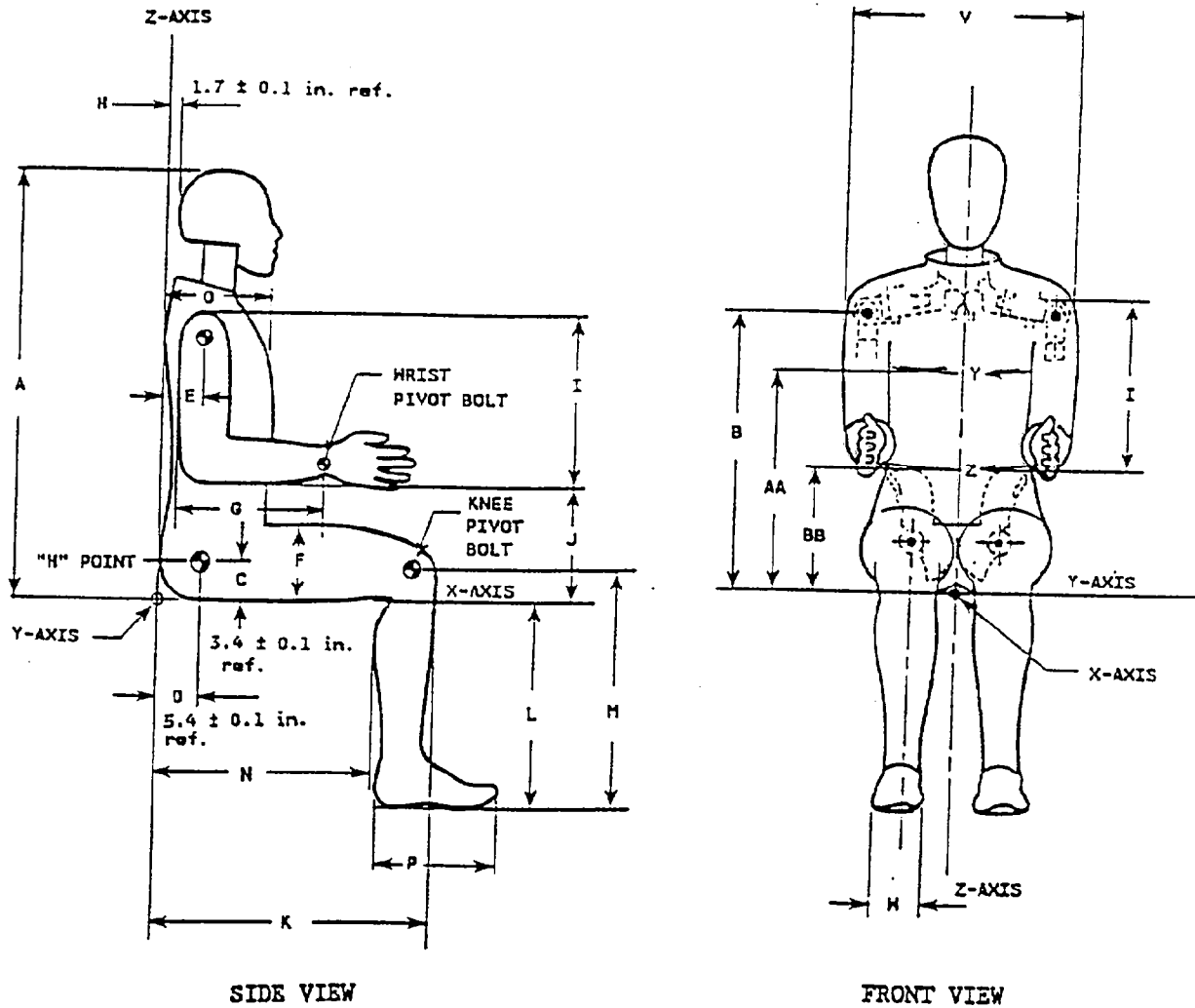
I. CONFIGURATION VERIFICATION DATA

DATE OF VERIFICATION: 10-17-94

DESCRIPTION	SPECIFICATION (inches)	ACTUAL MEASUREMENT (inches)
A - Total Sitting Height	34.6 - 35.0	35.0
B - Shoulder Pivot Height	19.9 - 20.5	20.0
C - "H" Point Height	3.3 - 3.5	3.5
D - "H" Point from Seat Back	5.3 - 5.5	5.5
E - Shoulder Pivot From Backline	3.3 - 3.7	3.5
F - Thigh Clearance	5.5 - 6.1	6.0
G - Back of Elbow to Wrist Pivot	11.4 - 12.0	11.5
H - Skull Cap Skin to Backline	1.6 - 1.8	1.7
I - Shoulder - Elbow Length	13.0 - 13.6	13.0
J - Elbow Rest Height	7.5 - 8.3	8.0
K - Buttock to Knee Length	22.8 - 23.8	23.5
L - Popliteal Height	16.9 - 17.9	17.0
M - Knee Pivot Height	19.1 - 19.9	19.5
N - Buttock Popliteal Length	17.8 - 18.8	18.5
O - Chest Depth at 3rd Rib	8.4 - 9.0	8.5
P - Foot Length	9.9 - 10.5	10.3
V - Shoulder Breadth	16.6 - 17.2	16.8
W - Foot Breadth	3.6 - 4.2	4.0
Y - Chest Circumference	38.2 - 39.4	39.0
Z - Waist Circumference	32.9 - 34.1	33.5

Note: (See next page for external dimensions)

## HYBRID III EXTERNAL DIMENSIONS



**Note:** Figure is referenced to the erect seated position. The curved lumbar does not allow the hybrid III to be positioned in a perfect erect attitude.

**HYBRID III DUMMY CALIBRATION DATA SUMMARY SHEET**

DUMMY NO.: 305      DUMMY CALIBRATION BY: Rod McClelland & Al Chalmers

VERIFICATION DATE: 10-17-94

VERIFICATION LABORATORY TEMPERATURE (66° - 78°): 70°

**1.0 HEAD DROP TEST**

	SPECIFICATION	MEASUREMENT
Peak Resultant Acceleration	225 - 275 G	269
Peak Lateral Acceleration	15 G. MAX	10
Is Acceleration Curve Unimodal	within 10% of peak	Yes

**2.0 NECK FLEXION TEST**

		SPECIFICATION	MEASUREMENT
Pendulum Speed		22.6 - 23.4 FT/SEC	22.9
Pendulum Deceleration	10 MS	22.50 - 27.50 G	24.65
	20 MS	17.60 - 22.60 G	21.61
	30 MS	12.50 - 18.50 G	16.10
Max. Pendulum G Above 30 MS		29.0 G MAX	16.1
Deceleration - Time Curve Decay Time to 5 G		34 - 42 MS	38
D Plane Rotation	MAX	64 - 78 DEG.	71
	TIME	57 - 64 MS	59
Rotation Angle - Time Curve Decay Time to Zero		113 - 128 MS	115
Moment About Occipital Condyle	MIN.	65 - 80 FT.LBS	67
	TIME	47 - 58 MS	51
Positive Moment - Time Curve Decay Time to Zero		97 - 107 MS	97

HYBRID III DUMMY CALIBRATION DATA SUMMARY SHEET (CONT.)

3.0 NECK EXTENSION TEST

		SPECIFICATION	MEASUREMENT
Pendulum Speed		19.50 - 20.30 F/S	19.99
Pendulum Deceleration	10 MS	17.20 - 21.20 G	20.55
	20 MS	14.00 - 19.00 G	17.25
	30 MS	11.00 - 16.00 G	15.47
Max. Pendulum G Above 30 MS		22 G Max	15
Deceleration - Time Curve Decay Time to 5 G		38 - 46 MS	38
D Plane Rotation	MAX	81 - 106 DEG.	95
	TIME	72 - 82 MS	74
Rotation Angle - Time Curve Decay Time to Zero		147 - 174 MS	152
Moment About Occipital Condyle	MIN.	-59.0/-39.0 FT LBS	-47.4
	TIME	65 - 79 MS	70
Positive Moment - Time Curve Decay Time to Zero		120 - 148 MS	136

4.0 CHEST IMPACT TESTS

	SPECIFICATION	MEASUREMENT
Probe Speed	21.6 to 22.4 F/S	21.8
Peak Deflection	2.50 to 2.86 IN.	2.51
Peak Resistive Force	1160 to 1325 LBS.	1315
Internal Hysteresis	69 to 85%	73

5.0 KNEE IMPACT TESTS

LEFT KNEE	SPECIFICATION	MEASUREMENT
Probe Speed	6.8 to 7.0 F/S	7.0
Maximum Force	1060 - 1300 LBS.	1066

RIGHT KNEE	SPECIFICATION	MEASUREMENT
Probe Speed	6.8 to 7.0 F/S	7.0
Maximum Force	1060 - 1300 LBS.	1074

## HYBRID III DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY NO.: 307      DUMMY CALIBRATION BY: Rod McClelland & Al Chalmers

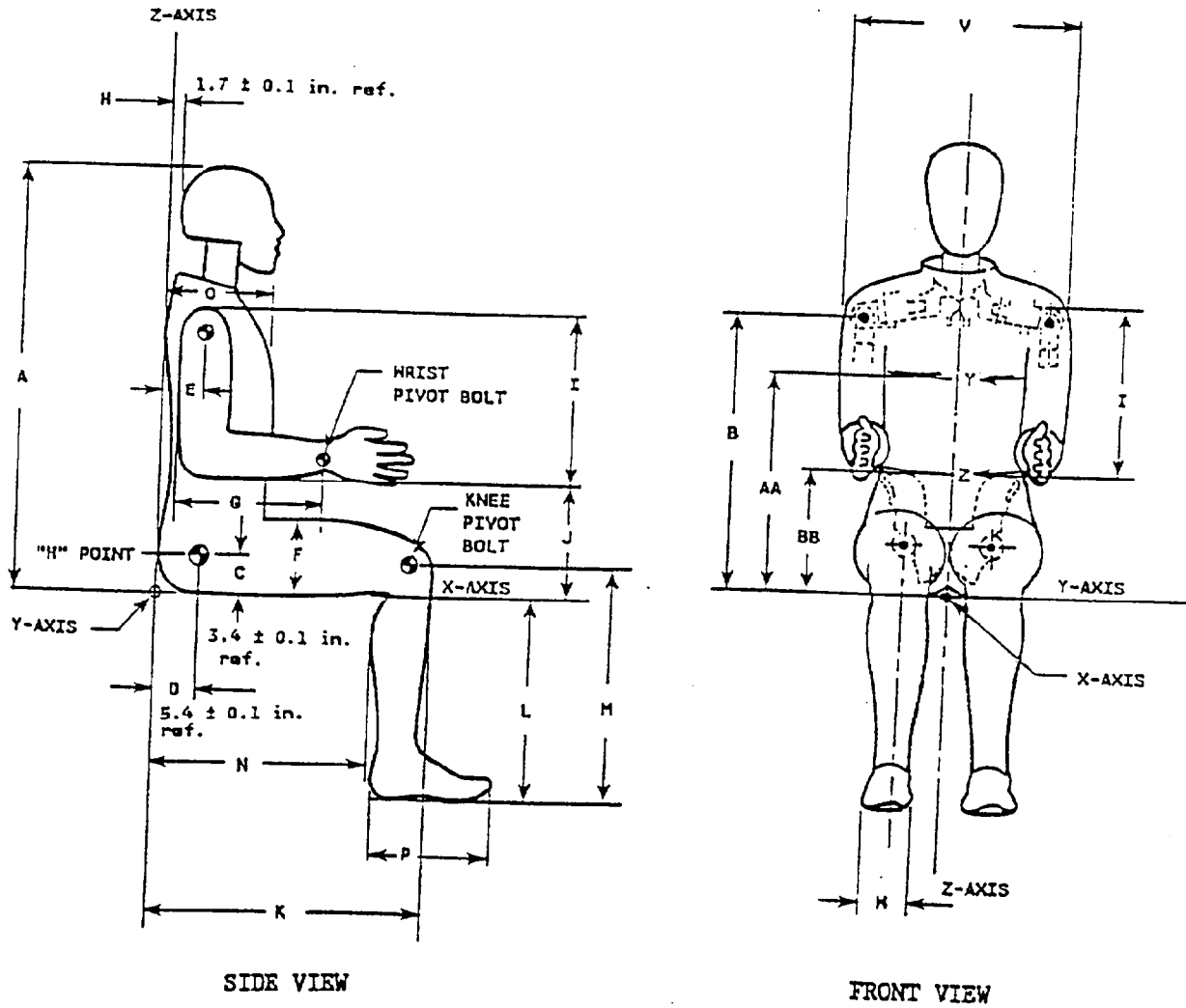
### I. CONFIGURATION VERIFICATION DATA

DATE OF VERIFICATION: 10-17-94

DESCRIPTION	SPECIFICATION (Inches)	ACTUAL MEASUREMENT (inches)
A - Total Sitting Height	34.6 - 35.0	34.8
B - Shoulder Pivot Height	19.9 - 20.5	20.5
C - "H" Point Height	3.3 - 3.5	3.4
D - "H" Point from Seat Back	5.3 - 5.5	5.5
E - Shoulder Pivot From Backline	3.3 - 3.7	3.5
F - Thigh Clearance	5.5 - 6.1	6.0
G - Back of Elbow to Wrist Pivot	11.4 - 12.0	11.5
H - Skull Cap Skin to Backline	1.6 - 1.8	1.7
I - Shoulder Elbow Length	13.0 - 13.6	13.0
J - Elbow Rest Height	7.5 - 8.3	8.0
K - Buttock Knee Length	22.8 - 23.8	23.5
L - Popliteal Height	16.9 - 17.9	17.0
M - Knee Pivot Height	19.1 - 19.9	19.5
N - Buttock Popliteal Length	17.8 - 18.8	18.5
O - Chest Depth at 3rd Rib	8.4 - 9.0	8.5
P - Foot Length	9.9 - 10.5	10.3
V - Shoulder Breadth	16.6 - 17.2	16.8
W - Foot Breadth	3.5 - 4.2	4.0
Y - Chest Circumference	38.2 - 39.4	39.0
Z - Waist Circumference	32.9 - 34.1	33.5

Note: (See next page for external dimensions)

## HYBRID III EXTERNAL DIMENSIONS



**Note:** Figure is referenced to the erect seated position. The curved lumbar does not allow the hybrid III to be positioned in a perfect erect attitude.

HYBRID III DUMMY CALIBRATION DATA SUMMARY SHEET (CONT.)

DUMMY NO.: 307      DUMMY CALIBRATION BY: Rod McClelland & Al Chalmers

VERIFICATION DATE: 10-17-93

VERIFICATION LABORATORY TEMPERATURE (66° - 78°): 70°

1.0 HEAD DROP TEST

	SPECIFICATION	MEASUREMENT
Peak Resultant Acceleration	225 - 275 G	246
Peak Lateral Acceleration	15 G. MAX	6
Is Acceleration Curve Unimodal	within 10% of peak	Yes

2.0 NECK FLEXION TEST

		SPECIFICATION	MEASUREMENT
Pendulum Speed		22.6 - 23.4 FT/SEC	22.9
Pendulum Deceleration	10 MS	22.50 - 27.50 G	23.23
	20 MS	17.60 - 22.60 G	20.91
	30 MS	12.50 - 18.50 G	15.20
Max. Pendulum G Above 30 MS		29.0 G MAX	15.2
Deceleration - Time Curve Decay Time to 5 G		34 - 42 MS	38
D Plane Rotation	MAX	64 - 78 DEG.	75
	TIME	57 - 64 MS	58
Rotation Angle - Time Curve Decay Time to Zero		113 - 128 MS	115
Moment About Occipital Condyle	MIN.	65 - 80 FT.LBS	65
	TIME	47 - 58 MS	51
Positive Moment - Time Curve Decay Time to Zero		97 - 107 MS	100

HYBRID III DUMMY CALIBRATION DATA SUMMARY SHEET (CONT.)

3.0 NECK EXTENSION TEST

		SPECIFICATION	MEASUREMENT
Pendulum Speed		19.50 - 20.30 F/S	20.01
Pendulum Deceleration	10 MS	17.20 - 21.20 G	20.37
	20 MS	14.00 - 19.00 G	16.80
	30 MS	11.00 - 16.00 G	14.00
Max. Pendulum G Above 30 MS		22 G Max	14
Deceleration - Time Curve Decay Time to 5 G		38 - 46 MS	40
D Plane Rotation	MAX	81 - 106 DEG.	99
	TIME	72 - 82 MS	72
Rotation Angle - Time Curve Decay Time to Zero		147 - 174 MS	152
Moment About Occipital Condyle	MIN.	-59.0/-39.0 FT LBS	-50.2
	TIME	65 - 79 MS	67
Positive Moment - Time Curve Decay Time to Zero		120 - 148 MS	137

4.0 CHEST IMPACT TESTS

	SPECIFICATION	MEASUREMENT
Probe Speed	21.6 to 22.4 F/S	21.82
Peak Deflection	2.50 to 2.86 IN.	2.55
Peak Resistive Force	1160 to 1325 LBS.	1262
Internal Hysteresis	69 to 85%	71

5.0 KNEE IMPACT TESTS

LEFT KNEE	SPECIFICATION	MEASUREMENT
Probe Speed	6.8 to 7.0 F/S	7.0
Maximum Force	1060 - 1300 LBS.	1161

RIGHT KNEE	SPECIFICATION	MEASUREMENT
Probe Speed	6.8 to 7.0 F/S	7.0
Maximum Force	1060 - 1300 LBS.	1266

APPENDIX D

Dummy, Vehicle and Laboratory Calibration Data

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

INSTRUMENTS FOR DUMMY NO. 305

	DRIVER		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	ACC81	Endevco	06/10/94
Head Y	AJ404	Endevco	07/12/94
Head Z	AHRP6	Endevco	07/12/94
Chest X	AH0A2	Endevco	07/01/94
Chest Y	AHRP5	Endevco	07/01/94
Chest Z	AGM32	Endevco	07/01/94
Right Femur Load Cell	956	GSE	11/11/94
Left Femur Load Cell	945	GSE	11/11/94
Neck Load Cell X	252	Denton	08/10/94
Neck Load Cell Y	252	Denton	08/10/94
Neck Load Cell Z	252	Denton	08/10/94
Neck Moment X	252	Denton	08/10/94
Neck Moment Y	252	Denton	08/10/94
Neck Moment Z	252	Denton	08/10/94
Chest Deflection Gauge	305	Servo	07/13/94
Lap Belt Load Cell	625	Lebow	05/31/94
Torso Belt Load Cell	691	Lebow	10/26/94

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

INSTRUMENTS FOR DUMMY NO. 307

	PASSENGER		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	AH0A5	Endevco	06/20/94
Head Y	AHY91	Endevco	06/20/94
Head Z	AHTY4	Endevco	06/10/94
Chest X	AJ621	Endevco	11/07/94
Chest Y	AJ619	Endevco	11/07/94
Chest Z	AHY54	Endevco	11/07/94
Right Femur Load Cell	958	GSE	09/06/94
Left Femur Load Cell	961	GSE	09/02/94
Neck Load Cell X	253	Denton	11/02/94
Neck Load Cell Y	253	Denton	11/02/94
Neck Load Cell Z	253	Denton	11/02/94
Neck Moment X	253	Denton	11/02/94
Neck Moment Y	253	Denton	11/02/94
Neck Moment Z	253	Denton	11/02/94
Chest Deflection Gauge	307	Servo	08/13/94
Lap Belt Load Cell	690	Lebow	10/26/94
Torso Belt Load Cell	657	Lebow	05/31/94

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

VEHICLE ACCELEROMETERS		
SERIAL NO.	MANUFACTURER	CALIBRATION DATE
AHT35	Endevco	07/12/94
AJ7T5	Endevco	10/14/94
MGA484	Entran	08/04/94
MGA155	Entran	06/30/94
MGA130	Entran	06/14/94
MGA119	Entran	11/04/94
A12	Entran	10/30/94
AJ638	Endevco	10/14/94
AH067	Endevco	10/14/94
X05	Entran	11/10/94
AHTA5	Endevco	11/12/94
A07	Entran	10/30/94

LABORATORY INSTRUMENTS		
SERIAL NO.	MANUFACTURER	CALIBRATION DATE
AGH90	Endevco	09/01/94
019	Lebow	08/29/94
018	Lebow	08/29/94
403069	Spectrol	10/24/94
N/A	Transducers Inc.	N/A