

REPORT NO. MGA-90-N010

NEW CAR ASSESSMENT PROGRAM (NCAP)

FRONTAL BARRIER IMPACT TEST

Ford
1993 Ford Tempo
4 Door
NHTSA NO. MP0205

MGA PROVING GROUNDS
5000 WARREN ROAD
BURLINGTON, WI 53105



January 22, 1993

FINAL REPORT

Prepared For:

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF MARKET INCENTIVES
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16. Abstract <p>A 56 kph (35 mph) frontal barrier impact using a 30 load cell barrier was conducted on a 1993 Ford Tempo at the MGA Proving Grounds Crash Test Facility in Burlington, Wisconsin on January 14, 1993.</p> <p>The barrier impact velocity was 56.3 kph (34.96 mph), and the ambient temperature at the time of impact was 20° C. The post-test average crush was 475 mm.</p> <p>The test vehicle appeared to comply with the requirements of the following Federal Motor Vehicle Safety Standards.</p> <ol style="list-style-type: none"> 1. FMVSS 212 "Windshield Mounting" 2. FMVSS 219, (Partial), "Windshield Zone Intrusion" 3. FMVSS 301, "Fuel System Integrity". <p>With regard to FMVSS 208, "Occupant Crash Protection" injury criteria, the driver's HIC was 655 and the 3 msec Clip (Chest g's) was 51.3. The left and right femur maximum loads for the driver were 4971 N and 5939 N, respectively. The passenger's HIC was 772 and the 3 msec Clip (Chest g's) was 42.7. The left and right femur maximum loads for the passenger were 4444 N and 3341 N, respectively.</p>					
17. Key Words 35 mph Frontal Barrier Impact Test New Car Assessment Program (NCAP) FMVSS 212 Inducant Testing FMVSS 219 (Partial) Inducant Testing FMVSS 301 Inducant Testing				18. Distribution Statement Copies of this report are available from: Technical Reference Division National Highway Traffic Safety Adm NASSIF Building, Room 5108 400 Seventh St., SW, Wash. DC 20590	
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SECTION 1

PURPOSE AND TEST PROCEDURE

This 35 mph frontal barrier impact test is part of the Composite FY'93 Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-90-D-12121. 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 TEST NUMBER MP0205

A load cell barrier consisting of 30 load cells was impacted by a 1993 Ford Tempo 4 Door at a velocity of 56.3 kph (34.96 mph). The test was performed at the MGA Proving Grounds and Crash Test Center on January 14, 1993. 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 15 high speed cameras. Camera locations and other pertinent camera information can be found in this report.

Two Part 572, 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 and chest triaxial accelerometers and right/left femur load cells. Seat belt load cells were also on the driver's and passenger's lap and shoulder belts to measure dummy torso and pelvic section loading. The driver ATD (Serial No. 465) and the right-front passenger ATD (Serial No. 466) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C and D.

The 39 channels of data were recorded on 4 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 655.2 and maximum chest deceleration over 3 milliseconds was 51.3 g's. The left and right femur loads were 4971 and 5939 Newtons respectively.

The right front passenger's HIC was 772.3 and maximum chest deceleration over 3 milliseconds was 42.7 g's. The left and right femur loads were 4444 and 3341 Newtons respectively.

GENERAL TEST AND VEHICLE PARAMETER DATA

Vehicle Yr/Make/Model/Body Style: 1993 Ford Tempo 4 Door

NHTSA No.: MP0205 VIN.: 1FACP36X3PK116621

Body color: White Date of Manufacture: 9/92

Engine: 4 Cylinders; C.I.D.; 2.3 liters; CC

X Gas; Diesel; Turbocharged

 Longitudinal; X Transverse

Transmission: 3 Speed; Manual; X Automatic; Overdrive

Final Drive: X Front Wheel; Rear Wheel; Four Wheel

Date Received: 1-5-93 Odometer Reading: 95.8

X A/C; X P/S; P/B; P/wdo; Tilt Wheel

 P/seats; Cruise Control

Type of Occupant Restraint: The vehicle was equipped with active 3 point belts and driver side airbag.

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): Front 3.0 kg/cm² Rear 3.0 kg/cm²

Recommended Tire Size: P185/70R14

Recommended Cold Tire Pressure: Front 2.2 kg/cm² Rear 2.1 kg/cm²

Tires on Vehicle: P185/70R14; Manufacturer: Michelin

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

Type of Front Seats: X Bucket; Bench; Split Bench

Type of Front Seat Back: Fixed; X Adj. With X Level Rot. Knob

Vehicle Capacity Weight (VCW) = 385.7 kg. (A)

No. of Occupants x 67.5 kg. = 340 kg. (B)

Rated Cargo Weight (RCW) A-B = 45.7 kg.

GVWR 1735 kg. GAWR: Front 906.3 kg. Rear 837.8 kg.

GENERAL TEST AND VEHICLE PARAMETER DATA (Cont'd)

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

Right Front = 374.7 kg. Right Rear = 226.3 kg.
Left Front = 385.1 kg. Left Rear = 226.8 kg.
TOTAL FRONT WEIGHT = 759.8 kg. (62.6% of Total Vehicle Weight)
TOTAL REAR WEIGHT = 453.1 kg. (37.4% of Total Vehicle Weight)
TOTAL UNLOADED DELIVERED WEIGHT (UDW) = 1212.9 kg.

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight 1212.9 kg.
VCW = Vehicle Capacity Weight 385.7 kg.
DSC = Designated Seating Capacity 5
RCW = VCW - 68 (DSC) = 45.7 *kg.
Target Test Weight = UDW + RCW + (2 dummies x 74.4 kg./dummy)
Target Test Weight = 1407.4 kg.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND CARGO:

Right Front = 384.7 kg. Right Rear = 297.6 kg.
Left Front = 416.4 kg. Left Rear = 306.6 kg.
TOTAL FRONT WEIGHT = 801.1 kg. (57.0% of Total Vehicle Weight)
TOTAL REAR WEIGHT = 604.2 kg. (43.0% of Total Vehicle Weight)
TOTAL TEST WEIGHT = 1405.3 kg.
Weight of ballast secured in vehicle trunk area = 22.7 kgs.

Vehicle components removed for instrumentation installation :

Rear seat, spare tire, and jack

VEHICLE ATTITUDE (all dimensions in mm):

Delivered Attitude: RF 677 LF 677 RR 657 LR 658

Test Attitude: RF 646 LF 642 RR 604 LR 592

Wheel Base: 2535 mm.; C.G. = 1089 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: 0°
 Date of Test: January 14, 1992 Time of Test: 1:56 p.m.
 Ambient Temperature: 20°C (Spec. Range = 18.8 to 25.6°C)
 Temperature in Occupant Compartment: 23°C
 Windshield Molding Temperature: 23°C
 Required Impact Velocity Range: 55.5 to 57.1 kph
 Impact Velocity: primary = 56.3 kph, secondary = 56.5 kph
 Distance From Front Bumper to Barrier Face When
 Entering Speed Trap: 1204 mm
 Exiting Speed Trap: 204 mm

VEHICLE REBOUND AND CRUSH (mm):

Vehicle Length: Pre-test = R 4420 C_L 4540 L 4420
 Post-test = R 3945 C_L 4026 L 3955
 Crush = R 475 C_L 514 L 465

Distance from front of test vehicle to point of impact (rebound):
 R 790 mm C_L 710 mm L 755 mm

VISIBLE DUMMY CONTACT POINTS:

	<u>Driver</u>	<u>Passenger</u>
Head	<u>to airbag</u>	<u>Chin to Chest/Right Thigh</u>
Chest	<u>None</u>	<u>None</u>
Abdomen	<u>None</u>	<u>None</u>
Left Knee	<u>to instrument panel</u>	<u>to instrument panel</u>
Right Knee	<u>to instrument panel</u>	<u>to instrument panel</u>

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

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

	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
<u>Seat Movement</u>				
Seat Back Movement	<u>None</u>	<u>None</u>	<u>N/A</u>	<u>N/A</u>
Seat Shift (mm)	<u>None</u>	<u>None</u>	<u>N/A</u>	<u>N/A</u>

Glazing Damage

Backlight/Windshield None

Other Notable Impact Effects: None

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

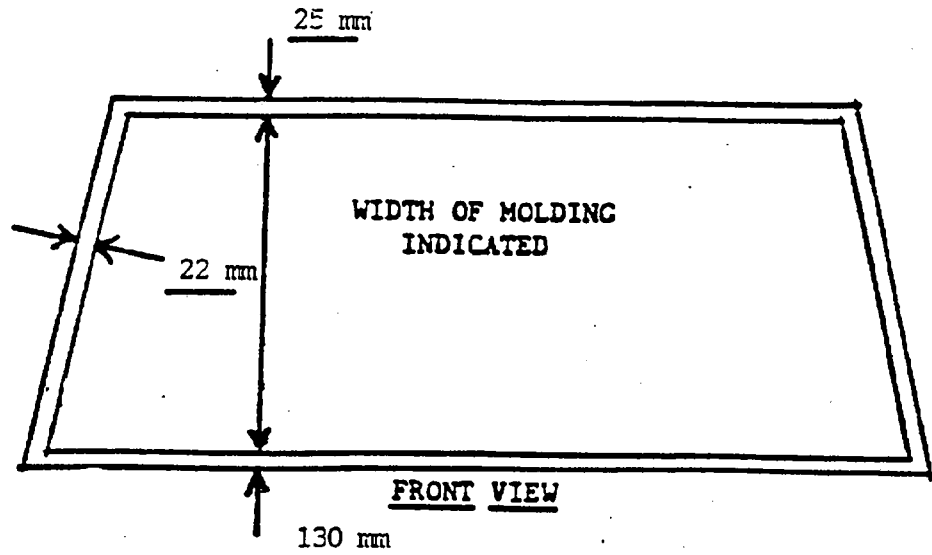
Details of windshield mounting such as retention method, trim type, etc.:
 Steel trim with glue retention

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		
	PRE-TEST (mm)	POST-TEST (mm)	PERCENT RETENTION
RIGHT SIDE	1895	1895	100%
LEFT SIDE	1895	1895	100%
TOTAL	3780	3780	100%

AREA OF RETENTION FAILURE:



FAILURE DETAILS:

NONE

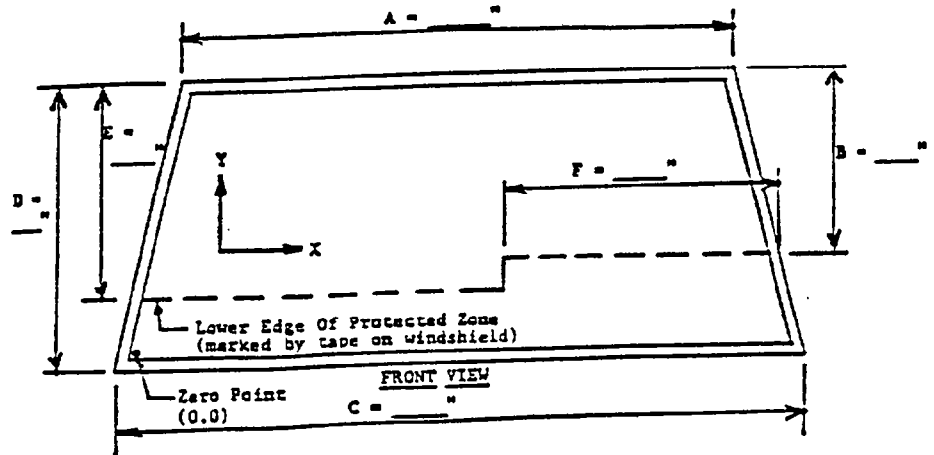
FMVSS NO. 219, "WINDSHIELD ZONE INTRUSION", DATA SHEET

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 contactable by the sphere across the width of the instrument panel. From the outermost contactable 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= 1090 mm
B= 440 mm
C= 1400 mm
D= 650 mm
E= 500 mm
F= 635 mm



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

NONE

FMVSS NO. 301-75, "FUEL SYSTEM INTEGRITY", DATA SHEETS

TEST VEHICLE NHTSA NO.: MP0205 TEST DATE: January 14, 1993

VEHICLE MAKE/MODEL/BODY STYLE: 1993 Ford Tempo

USABLE CAPACITY OF VEHICLE'S FUEL TANK: 58.3 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:

54.5 Liters Which is 93.5% of the Stated USABLE CAPACITY.

SOLVENT SPILLAGE MEASUREMENT AFTER 35 MPH FRONTAL BARRIER IMPACT TEST:

	<u>Actual</u>	<u>Maximum Allowable</u>
From impact until vehicle motion ceases-----	<u>0</u>	1 oz.
For 5 min. period after vehicle motion ceases	<u>0</u>	5 oz.
For next 25 minutes at barrier face-----	<u>0</u>	1 oz./1 minute

SOLVENT SPILLAGE DETAILS:

NONE

*STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range-1 to 3min.)

Time reqd. for machine to rotate 90° = N/A minutes, N/A seconds
FMVSS 301-75 Position Hold Time = 5 minutes, 0 seconds
TOTAL----- = N/A minutes, N/A seconds
Next Whole Minute Interval - - - - - = N/A minutes

* Not applicable - test not performed as per NHTSA COTR

FMVSS NO. 301-75 TEST DATA . . . Continued:

*VEHICLE STATIC ROLLOVER DATA:

	<u>First 5 Minutes</u> <u>FROM ONSET OF ROTATION</u>	<u>6th</u> <u>Minute</u>	<u>7th</u> <u>Minute</u>	<u>8th</u> <u>Minute</u>
Maximum Allowable Solvent Spillage	5 oz.	1 oz.	1 oz.	1 oz.
0° to 90° (filler cap down)	N/A	N/A	N/A	N/A
90° to 180°	N/A	N/A	N/A	N/A
180° to 270°	N/A	N/A	N/A	N/A
270° to 360°	N/A	N/A	N/A	N/A

Solvent Spillage Location(s):

N/A

* Not Applicable - test not performed as per NHTSA COTR

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. Driver Dummy to Steering Column Dimensions .
6. Camera Locations
7. 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: 1993 Ford Tempo

VEH. NHTSA NO.: MP0205 TEST DATE: January 14, 1993

MAXIMUM ACCELERATION VALUES: (g's)	DRIVER DUMMY #465	PASSENGER DUMMY #466
Head Channel X	-62.9	-98.4
Head Channel Y	5.8	-13.0
Head Channel Z	39.5	62.5
HEAD RESULTANT	72.6	116.6
Chest Channel X	-52.7	-45.4
Chest Channel Y	-8.5	5.7
Chest Channel Z	9.3	9.2
CHEST RESULTANT (CLIP)	51.3	42.7
TIME INTERVAL (msec) [0.003 seconds minimum]	t ₁ = 63.0 t ₂ = 66.0	t ₁ = 61.6 t ₂ = 64.6

HEAD INJURY CRITERIA (HIC)
VALUES:

HIC	655.2	772.3
t ₁ = (msec)	57.1	74.1
t ₂ = (msec)	85.1	110.1
Avg. Accel. t ₁ to t ₂ (g's)	55.9	54.0

[The maximum time interval from t₁ to t₂ is 36 milliseconds.]

MAXIMUM FEMUR FORCES:

Right Side (N)	-5939	-3341
Left Side (N)	-4971	-4444

MAXIMUM SEAT BELT FORCES:

Lap Belt (N)	3004	4754
Shoulder Belt (N)	7127	7611

NOTE: All values listed must occur during primary impact event.
(Head X,Y,Z and R listed must be during t₁ to t₂ HIC interval)

HYBRID III NECK AND CHEST DATA SHEET*

VEHICLE YR./MAKE/MODEL/BODY STYLE: 1993 Ford Tempo 4 Door

VEHICLE NHTSA NO.: MP0205 TEST DATE: January 14, 1993

MAXIMUM VALUES	DRIVER DUMMY #	PASSENGER DUMMY #
Neck Load X	N/A	N/A
Neck Load Y	N/A	N/A
Neck Load Z	N/A	N/A
Neck Moment X	N/A	N/A
Neck Moment Y	N/A	N/A
Neck Moment Z	N/A	N/A
Chest Deflection X (in.)	N/A	N/A
Time of Max. Occurrence	N/A	N/A

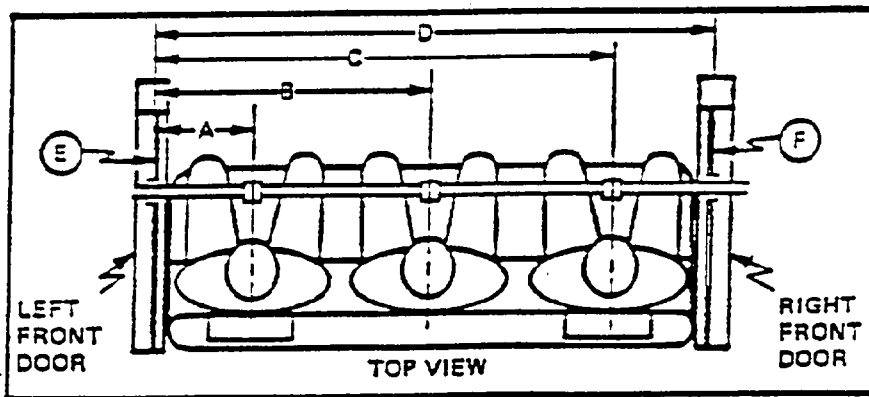
NOTE: All values listed must occur during primary impact event.
* For Hybrid III Dummy Application Only

PART 572 DUMMY IN-VEHICLE POSITION

Test No.: MP0205 Vehicle: 1993 Ford Tempo

<u>SEAT TYPE:</u>	<u>ADJUSTER TYPE:</u>	<u>BUCKET SEAT BACK TYPE:</u>
<u> </u> Bench	<u> X </u> Manual	<u> </u> Fixed
<u> X </u> Bucket	<u> </u> Power	<u> X </u> Adjustable Reclining
<u> </u> Split Bench		

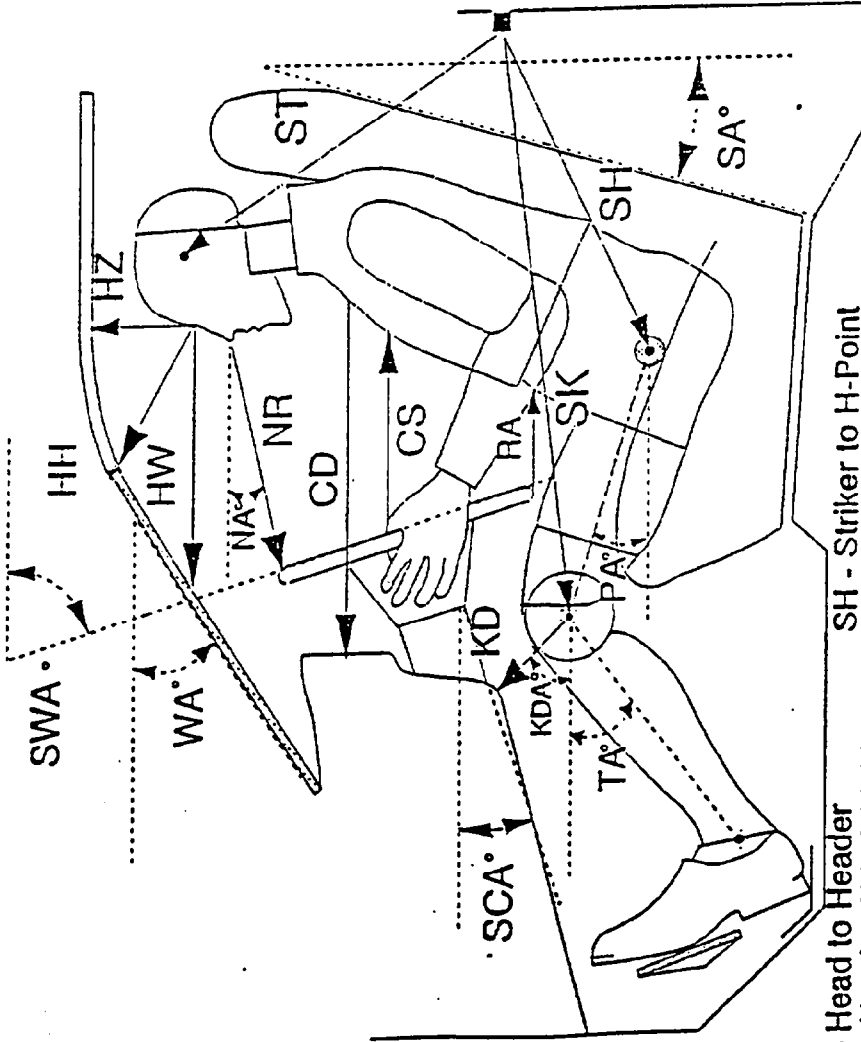
Driver Seat: Mid Position Passenger Seat: Mid Position



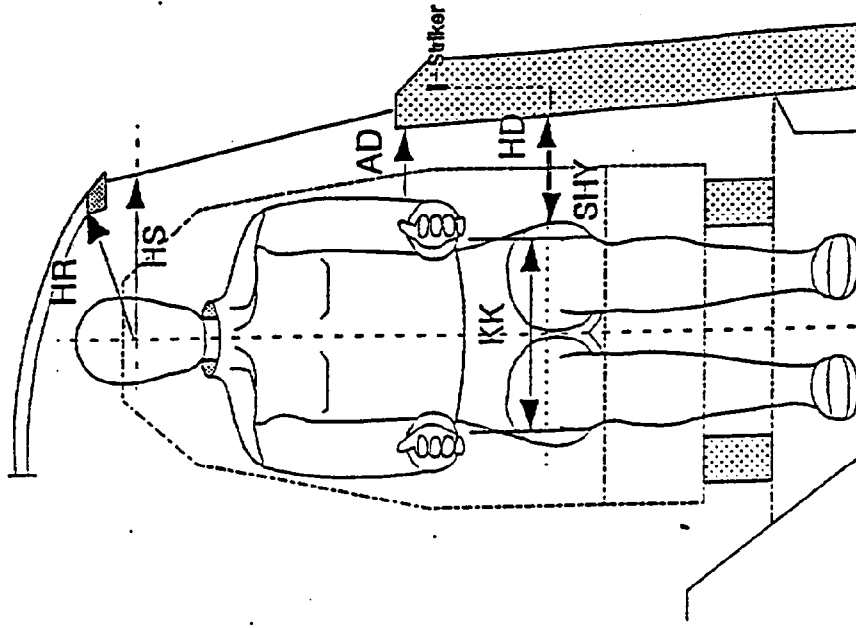
 465 DUMMY ID 466

- A = Left Door to Driver Centerline 390 mm
- B = Left Door to Center Passenger Centerline 730 mm
- C = Left Door to Right Passenger Centerline 1045 mm
- D = Left Door to Right Door 1460 mm
- E,F = Window Glass Height (Right and Left Must Be Equal)

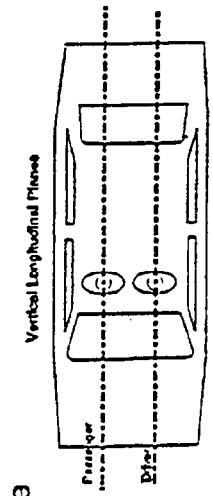
DUMMY MEASUREMENTS FOR FRONT SEAT PASSENGERS



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



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

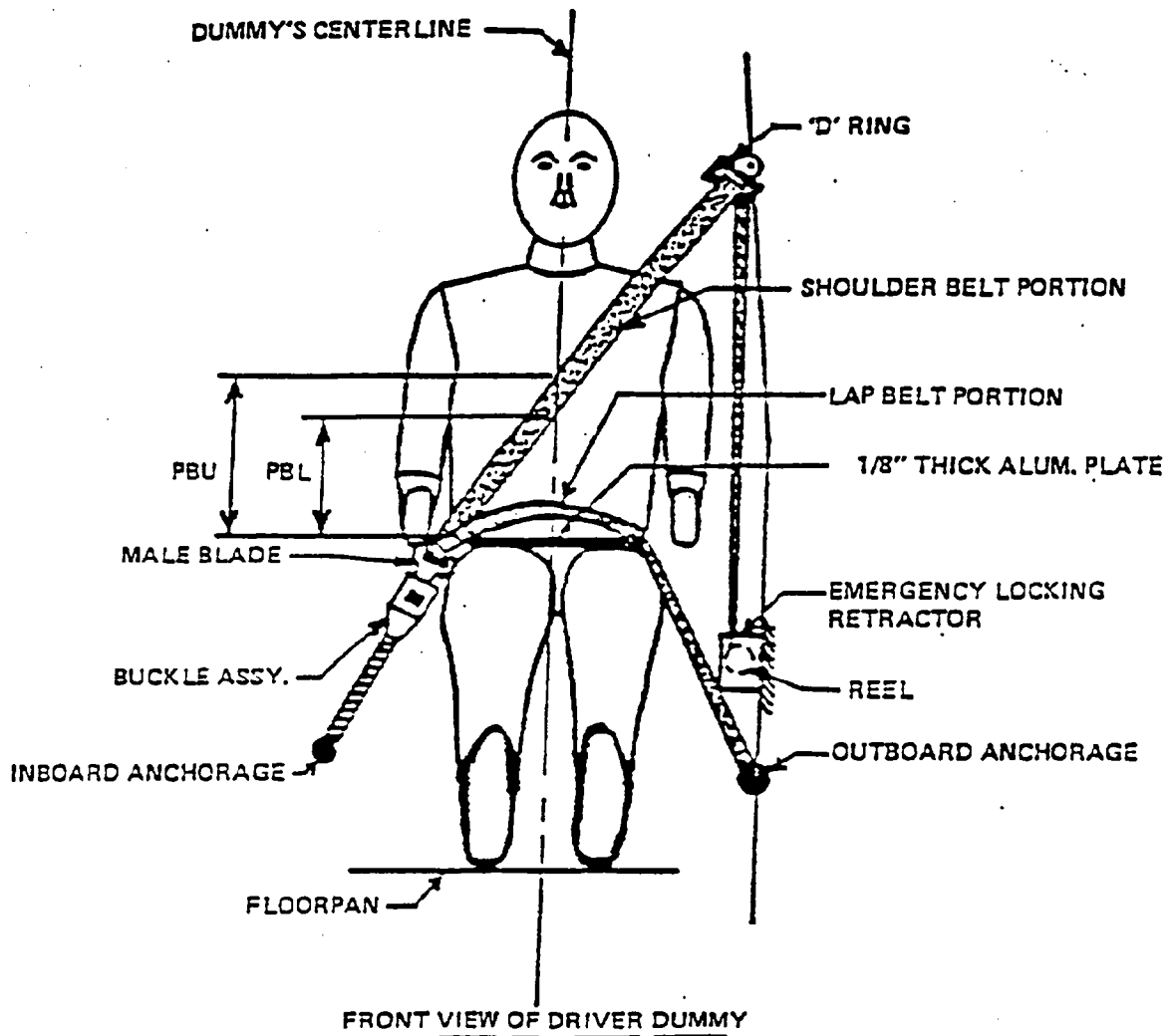


FRONT SEAT MEASUREMENT TABLE

Units (mm)

	DRIVER (Serial #) 465	PASSENGER (Serial #) 466
WA*	30.1	NA
SWA*	64.5	NA
SCA*	26	NA
SA*	21.0	21.7
HZ	114	124
HH	291	301
HW	422	458
HR	114	137
NR	397	Angle (NA) 20°
CD	531	551
CS	264	
RA	162	
KDL	138	Angle (KDA) 37.5° 141
KDR	160	145
PA*	9.5°	9°
TA*	42°	42°
KK	300	270
ST	572	Angle -9° 560
SK	541	Angle 88.2° 536
SH	182	Angle -3.1° 173
SHY	221	Angle 33.9° 236
HS	226	214
HD	159	185
AD	104	110

SEAT BELT POSITIONING DATA



	DRIVER DUMMY	PASSENGER DUMMY
<u>PBU</u> -- Top surface of alum. plate to upper edge	322 mm	360 mm
<u>PBL</u> -- Top surface of alum. plate to belt lower edge	232 mm	280 mm
<u>LAP BELT TENSION</u>	8.8 kg.	8.8 kg.
<u>SHOULDER BELT TENSION</u>	< 4 kg.	< 4 kg.

SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

BELT LENGTH DATA:

	<u>Driver</u>	<u>Passenger</u>
Belt length from trim panel exit to bolt hole anchor point for continuous webbing systems.	<u>2268 mm</u>	<u>2325 mm</u>
Shoulder belt length as measured on Part 572 Dummy.	<u>840 mm</u>	<u>861 mm</u>
Lap belt length as measured on Part 572 Dummy.	<u>885 mm</u>	<u>882 mm</u>

SHOULDER BELT SPOOL-OFF DATA:

As determined by film analysis	<u>57 mm</u>	<u>51 mm</u>
As determined mechanically	<u>53 mm</u>	<u>51 mm</u>
As determined electronically	<u>2</u>	<u>2</u>

BELT STRETCH DATA:

Measured electronically between shoulder belt load cell and the "D" ring.	<u>.01 mm/mm</u>	<u>.02 mm/mm</u>
Measured mechanically	<u>0</u>	<u>0</u>

RETRACTOR LOCK-UP TIME:

As determined by shoulder belt spool-off observed in on-board cameras	<u>48 msec</u>	<u>1</u>
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¹ Cannot determine from film analysis

² No room available for transducer mounting.

CAMERA LOCATIONS

VEH. NHTSA NO.: MP0205 ; TEST DATE: January 14, 1993; TIME: 1:56 pm
 VEH. YEAR/MAKE/MODEL/BODY STYLE: 1993 Ford Tempo 4 Door

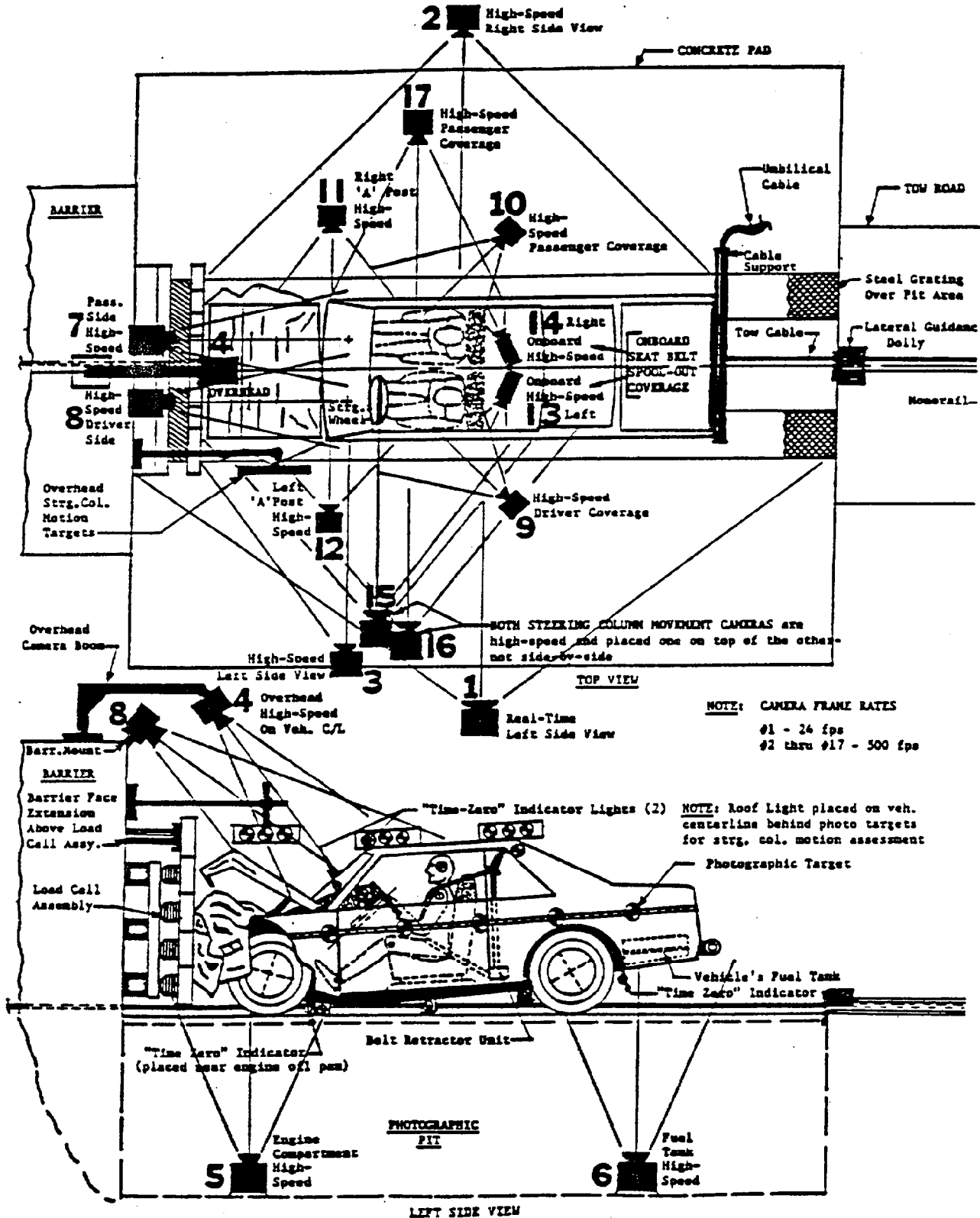
CAMERA NO.	VIEW	CAMERA POSITIONS (mm.)*			ANGLE (deg)	FILM PLANE TO HEAD TARGET (mm)	LENS (mm)	SPEED (fps)
		X	Y	Z				
	Real-Time Left Side View	-	-	-	-	N/A	10	24
17	Left Front View	400	700	1150	90°	345	25	943
10	Steering Column Top	2250	4600	1530	90°	4245	13	930
16	Steering Column Bottom	2250	4600	1020	90°	4245	13	935
5	Left Side-"A" Post	1550	4000	950	90°	3645	25	1026
13	Left Side-"B" Post	4400	5100	1750	50°	N/A	50	N/A
2	Driver Onboard					N/A	35	948
6	Passenger Onboard					N/A	35	935
14	Right Overall	2170	6540	1120	90°	6185	13	990
12	Right Front	860	7400	1160	90°	7045	25	1015
242	Right Side-"A" Post	1400	4700	1100	90°	4345	35	N/A
15	Left Side-"B" Post	4500	5530	1170	50°	N/A	50	1005
8	Top	480	0	4430	N/A	N/A	13	1015
9	Top Driver	-320	280	2320	N/A	N/A	13	1031
190	Top Passenger	-300	-390	2300	N/A	N/A	13	1216
325	Pit Front	1100	0	-3000	N/A	N/A	13	1176
241	Pit Rear	2530	0	-3140	N/A	N/A	13	1151

COORDINATES:

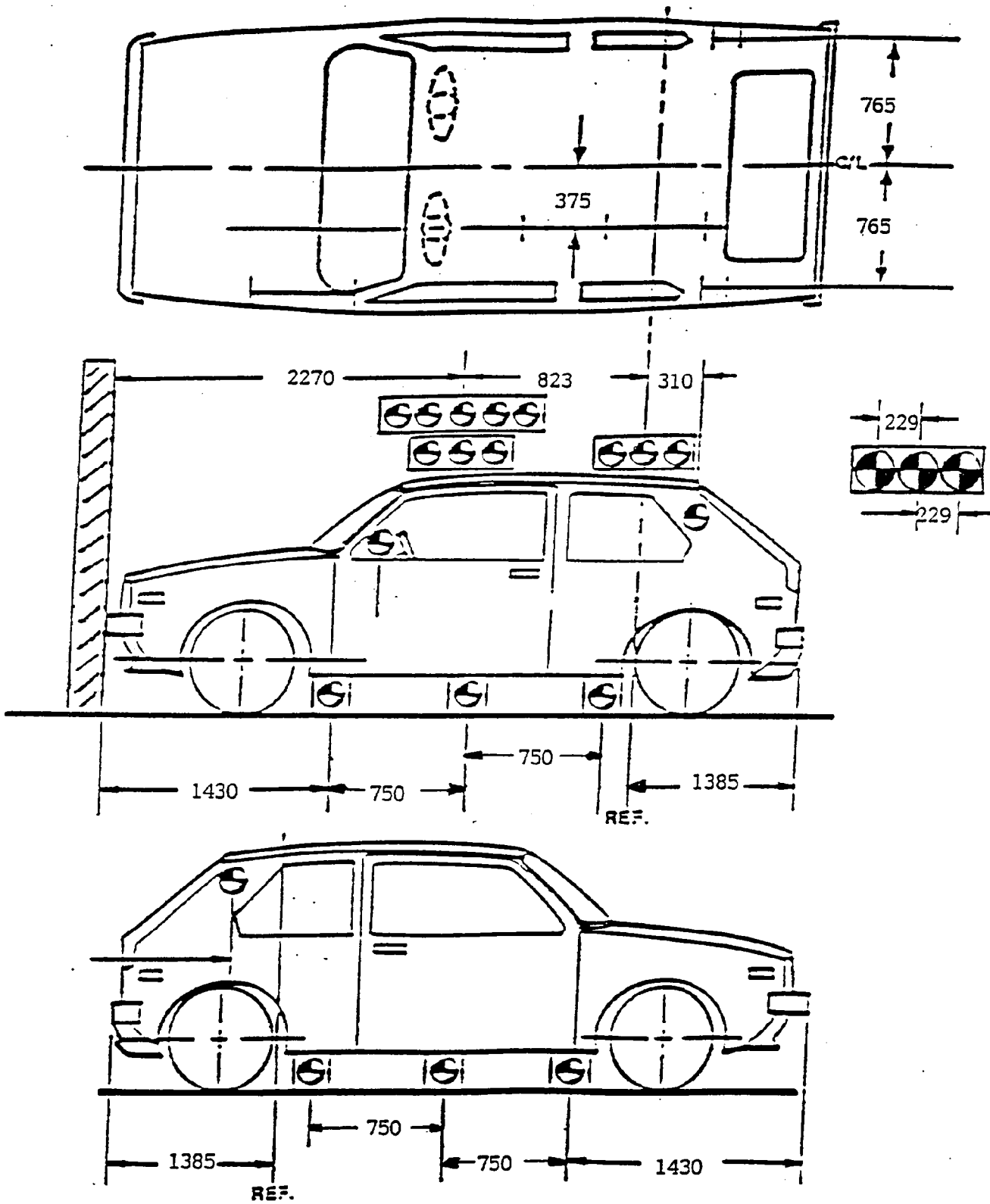
- X = film plane to monorail centerline
- Y = film plane to barrier face
- Z = film plane to ground

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

CAMERA REQUIREMENTS FOR 35 MPH FRONTAL BARRIER IMPACT ASSESSMENT PROGRAM TEST



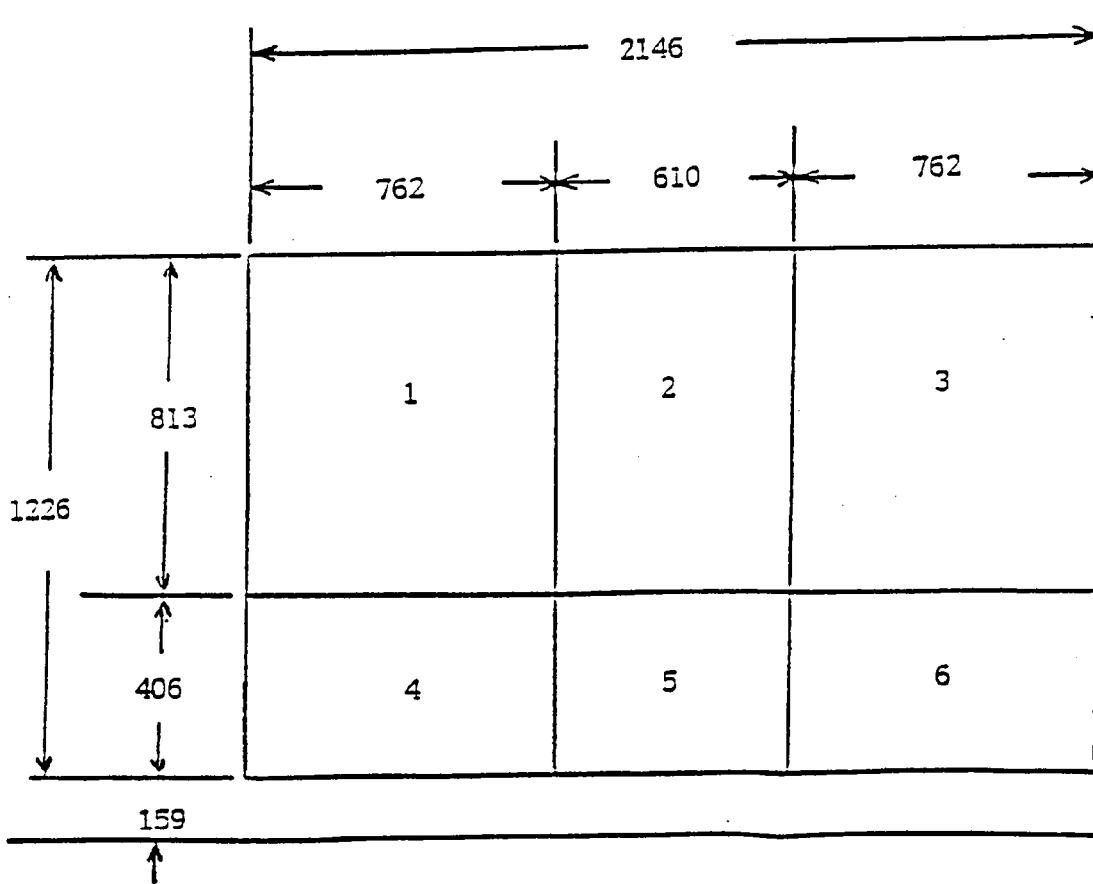
VEHICLE TARGET LOCATIONS



(DIMENSIONS IN MM)

LOAD CELL LOCATIONS ON FIXED BARRIER

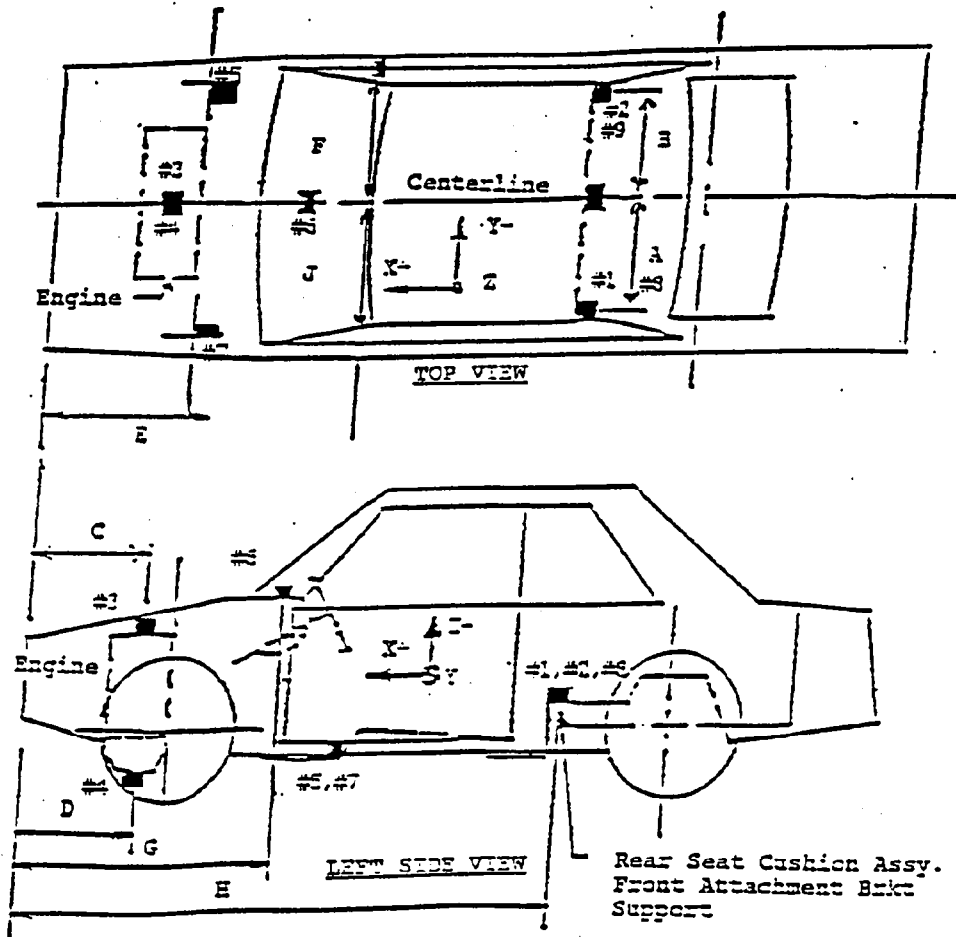
30 Load Cells
6 Rows
9 Columns
6 Groupings (5 cells/group)



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	590
B	565
C	770
D	625
E	900
F	625
G	1150
H	2625

ACCELEROMETER	ACCELEROMETER LOCATION	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

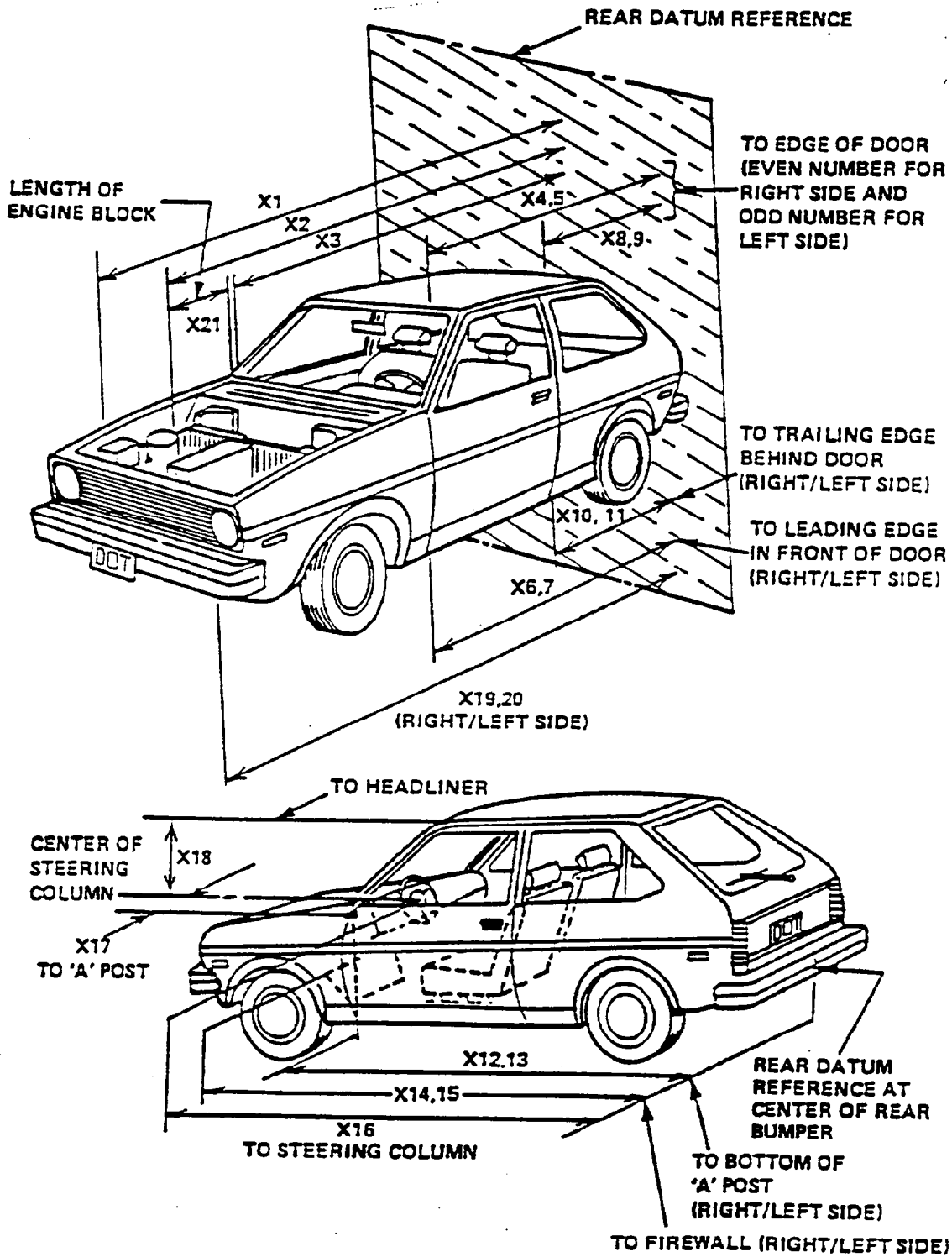
* The accelerometer pack number can be correlated with the vehicle response data traces in Appendix B.

TEST VEHICLE MEASUREMENTS

No.	MEASUREMENT DESCRIPTION:	Pre-Test (mm)	Post-Test (mm)	Diff. (mm)
X1	Total Length of Test Vehicle at Centerline	4540	4026	514
X2	Rear Surface of Vehicle to Front of Engine	3775	3456	319
X3	Rear Surface of Vehicle to Firewall	3487	3286	201
X4	Rear Surface to Upr. Leading Edge of Rt. Door	3110	3130	-20
X5	Rear Surface to Upr. Leading Edge of Left Door	3110	3110	0
X6	Rear Surface to Lwr. Leading Edge of Rt. Door	3060	3049	11
X7	Rear Surface to Lwr. Leading Edge of Left Door	3060	3040	20
X8	Rear Surface to Upr. Trailing Edge of Rt. Door	2109	2115	-6
X9	Rear Surface to Upr. Trailing Edge of Left Door	2115	2105	10
X10	Rear Surface to Lwr. Trailing Edge of Rt. Door	2110	2105	5
X11	Rear Surface to Lwr. Trailing Edge of Left Door	2114	2096	18
X12	Rear Surface to Bottom of 'A' Post on Rt. Side	3030	3021	9
X13	Rear Surface to Bottom of 'A' Post on Left Side	3027	3023	4
X14	Rear Surface to Firewall on Right Side	3490	3265	225
X15	Rear Surface to Firewall on Left Side	3489	3345	144
X16	Rear Surface to Steering Column	2635	---	*
X17	Center of Steering Column to 'A' Post	420	---	*
X18	Center of Steering Column to Headlining	415	---	*
X19	Rear Surface to Right Side of Front Bumper	4420	3945	475
X20	Rear Surface to Left Side of Front Bumper	4420	3955	465
X21	Length of Engine Block	455	455	0

*Airbag Deployment, No Post-Test Measurements

TEST VEHICLE MEASUREMENTS



ACCIDENT INVESTIGATION DIVISION DATA

FOR 35 MPH FRONTAL BARRIER IMPACT

VEHICLE MAKE/MODEL/BODY STYLE: 1993 FORD TEMPO

VEH. NHTSA NO.: MP0205 ; VIN: 1FACP36X3PK116621

MODEL YEAR: 1993 ; BUILD DATE: 9/92 ; TEST DATE: 1/14/93

VEH. SIZE CATEGORY: COMPACT ; TEST WEIGHT: 1405.3 kg.

VEH. WHEELBASE: 2535 mm ; FRONT OVERHANG: 760 mm ; OVERALL WIDTH: 1465 mm

ACCELEROMETER DATA:

LOCATION: As per measurements on pages 4-13

CALIBRATION PROCEDURE: As per MGA Calibration Procedure

LINEARITY: >99.9% ; INTEGRATION ALGORITHM: Trapezoidal

VEH: IMPACT SPEED: 56.3 kph ; TIME OF SEPARATION: 80 msec

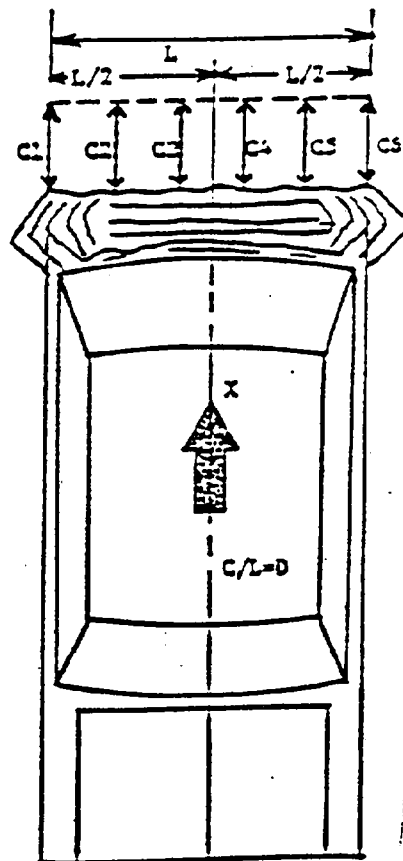
VELOCITY CHANGE: 64.1 kph

COLLISION DEFORMATION CLASSIFICATION (CDC) CODE:

	<u>F (Frontal)</u>	
CRUSH DEPTH	C1 =	<u>465</u> mm
DIMENSIONS:	C2 =	<u>487</u> mm
	C3 =	<u>452</u> mm
	C4 =	<u>462</u> mm
	C5 =	<u>485</u> mm
	C6 =	<u>475</u> mm

MIDPOINT OF DAMAGE: D = Vehicle Centerline (Longitud.)

LENGTH OF DAMAGED REGION: L = 1465 mm



APPENDIX A
PHOTOGRAPHS

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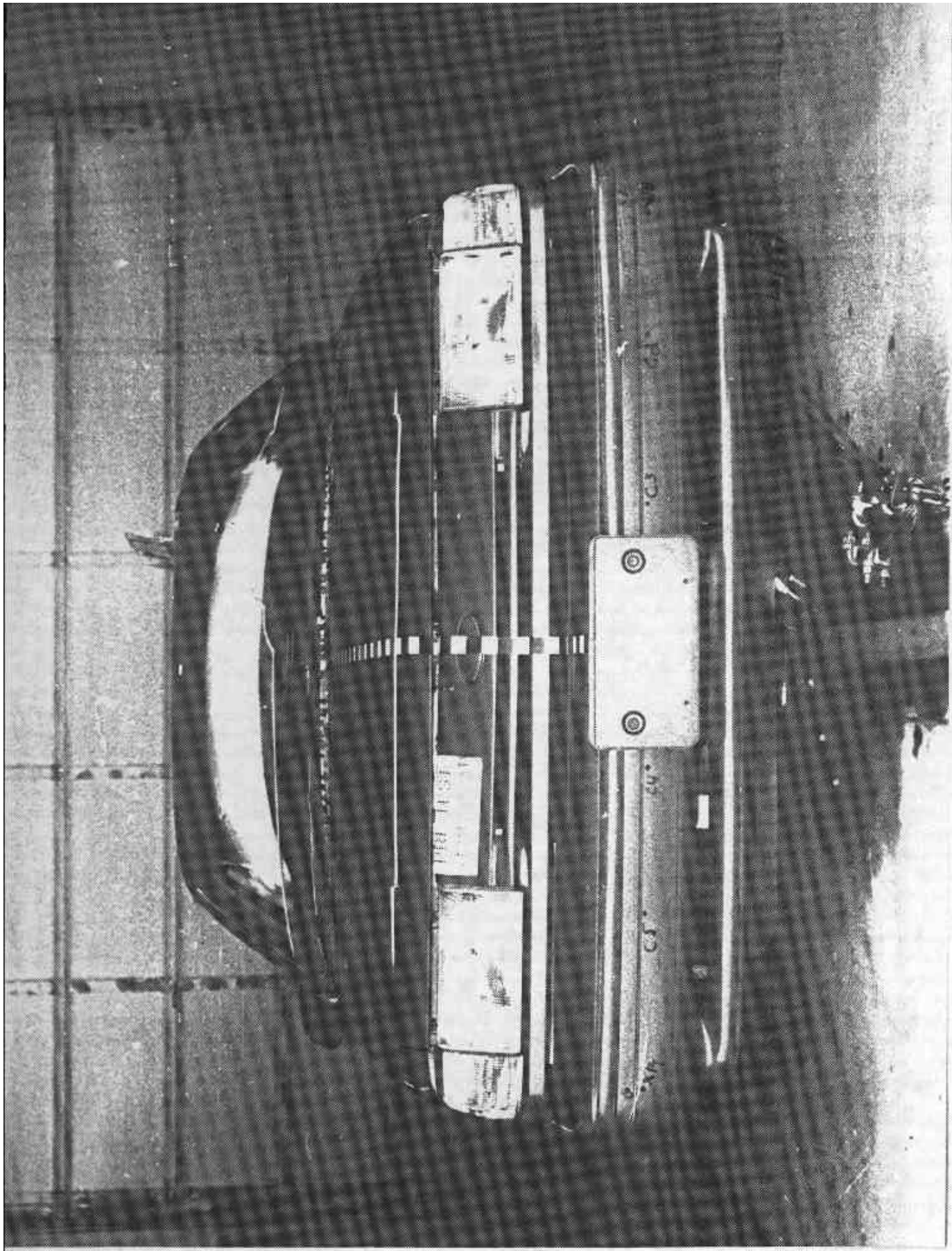


Photo No. 1 - Pre-Test Front View

A-1

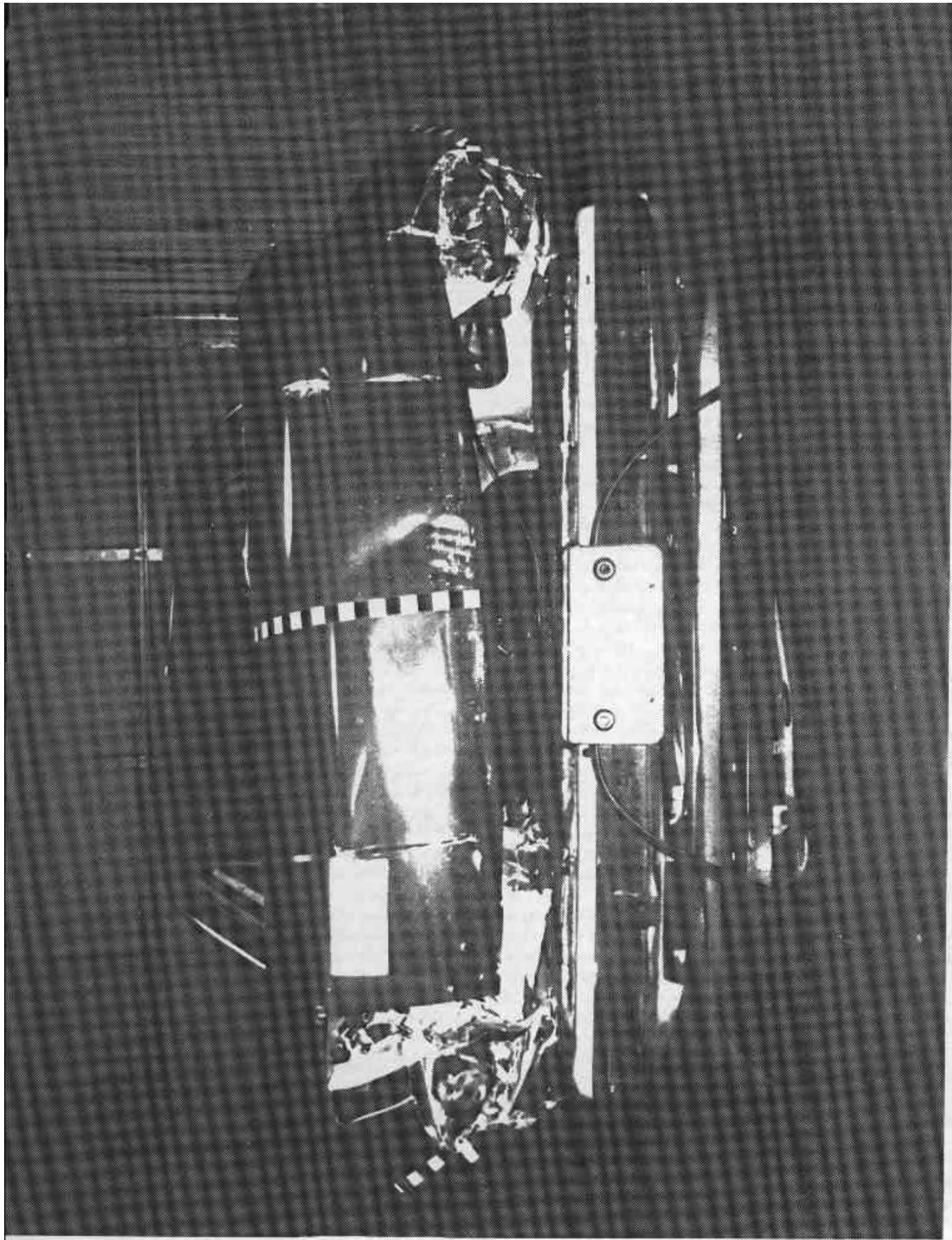


Photo No. 2 - Post-Test Front View

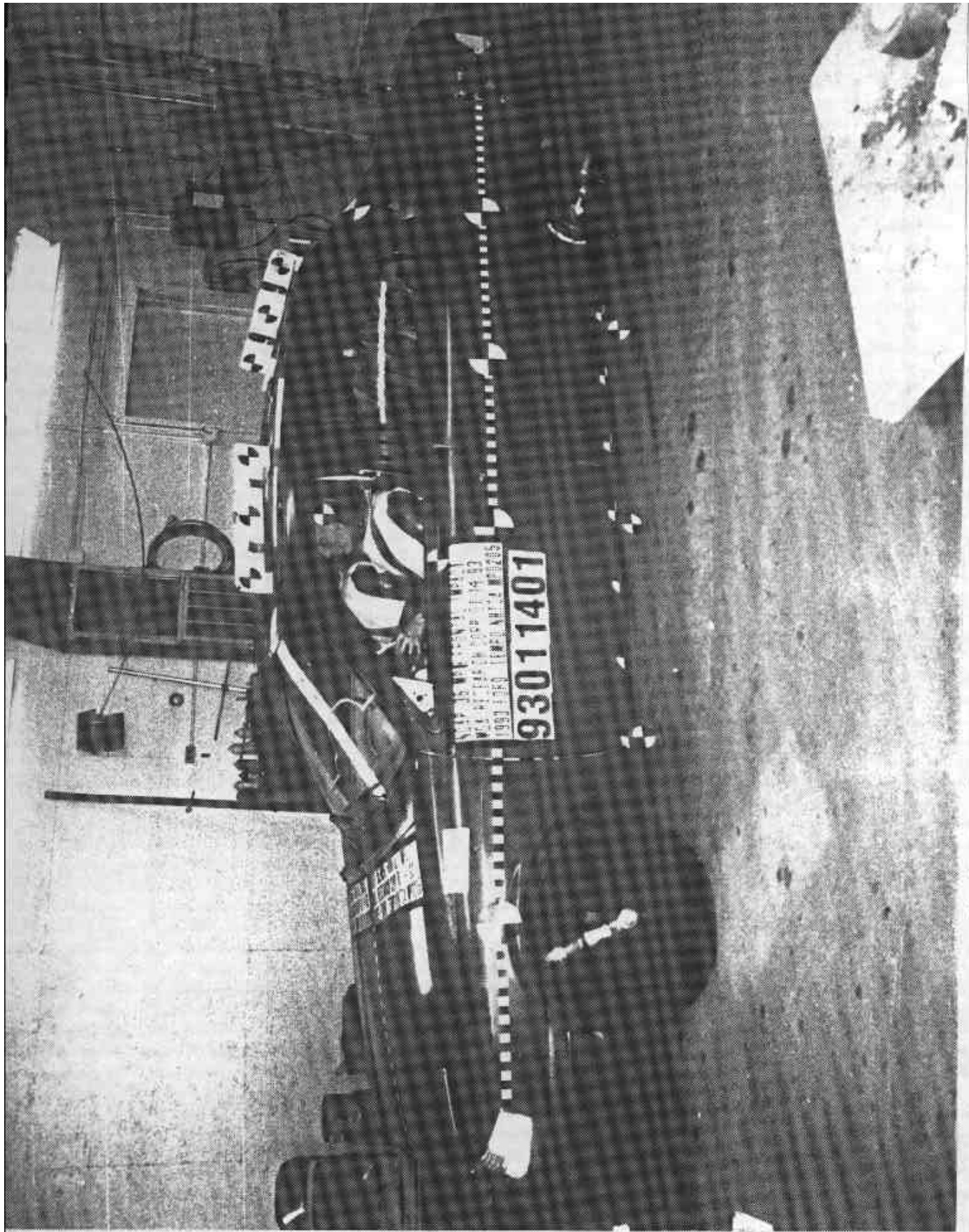


Photo No. 3 - Pre-Test Left Side View

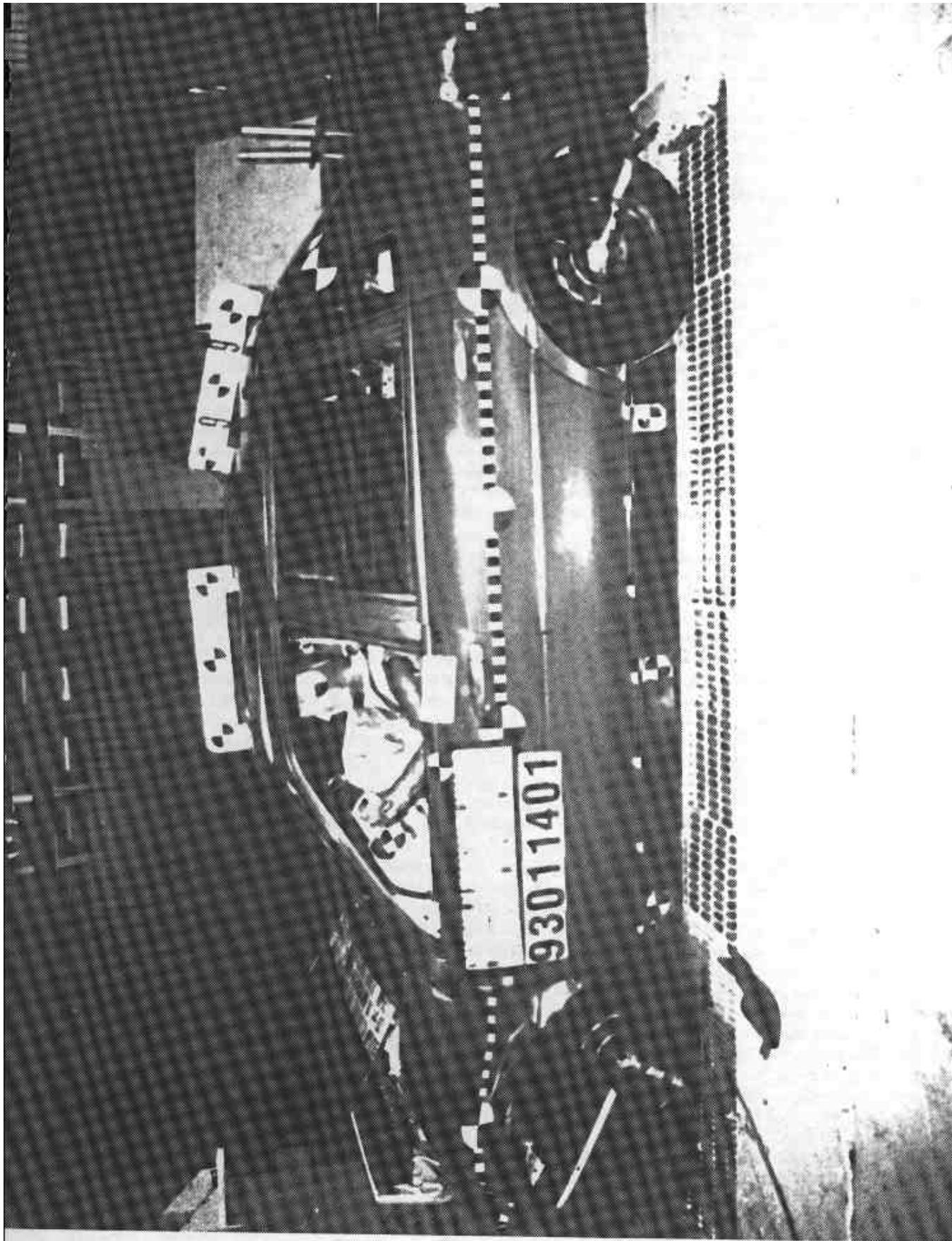


Photo No. 4 - Post-Test Left Side View

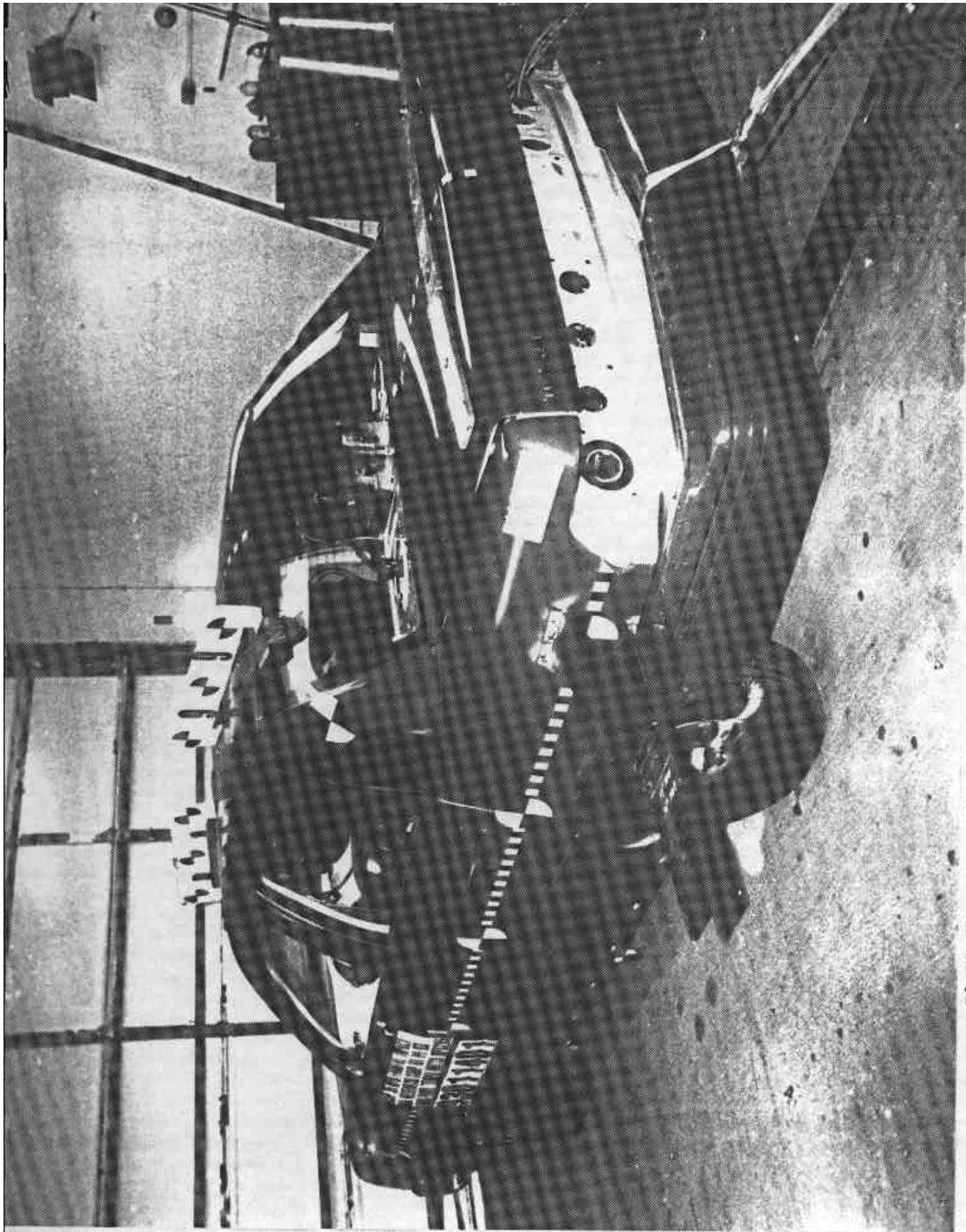


Photo No. 5 - Pre-Test Left Rear Three-Quarter View

A-5

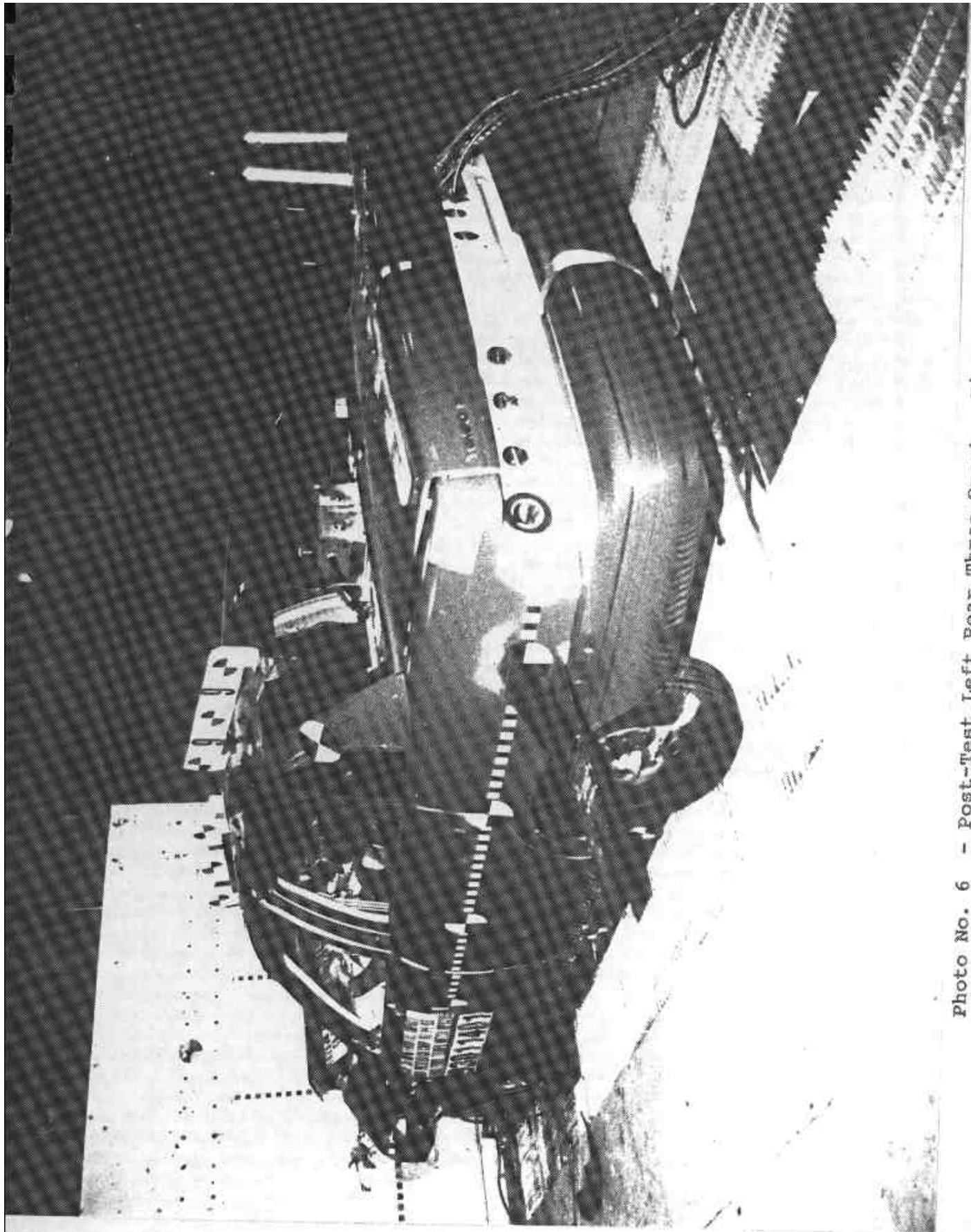


Photo No. 6 - Post-Test Left Rear Three-Quarter View

A-6

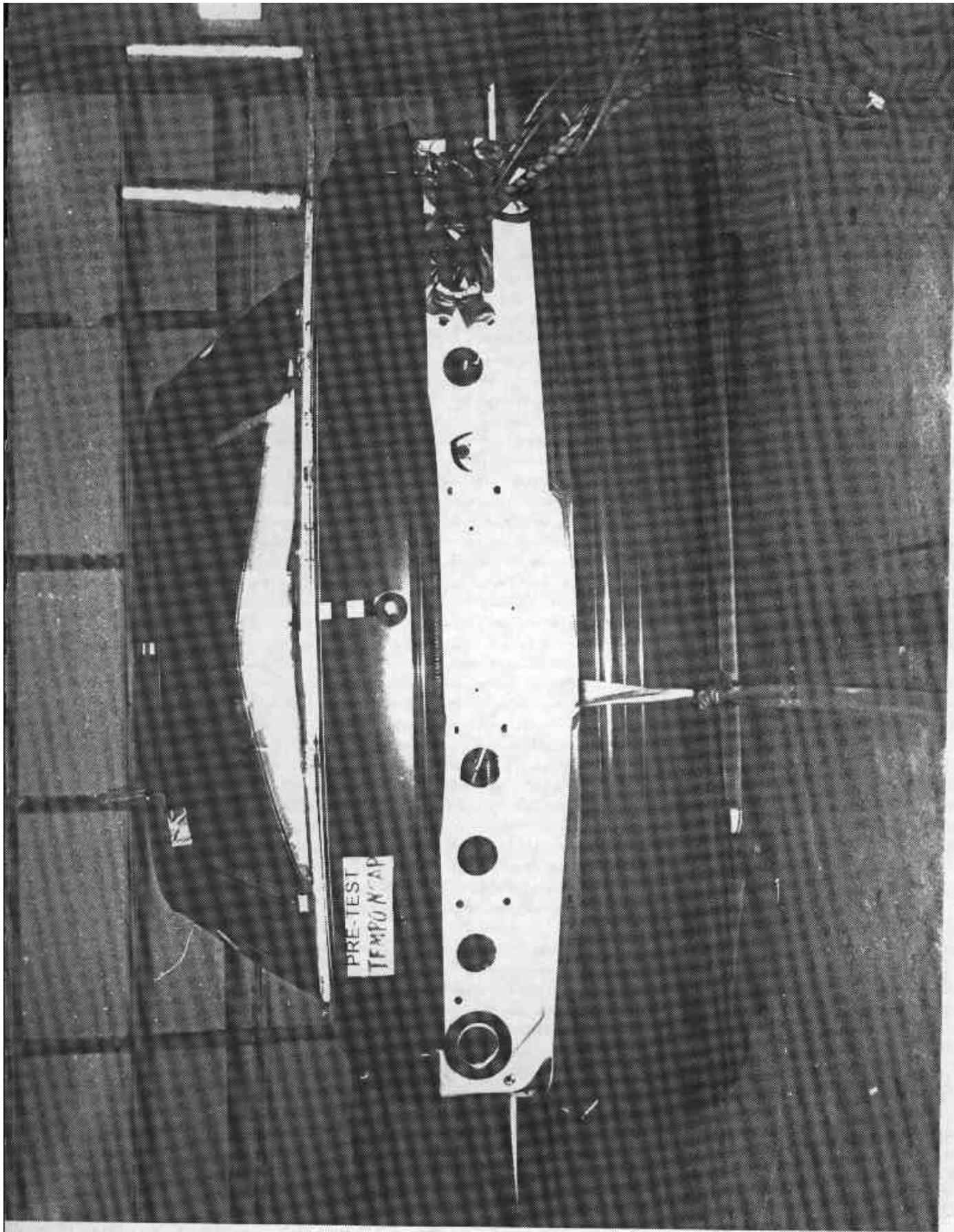


Photo No. 7 - Pre-Test Rear View

A-7

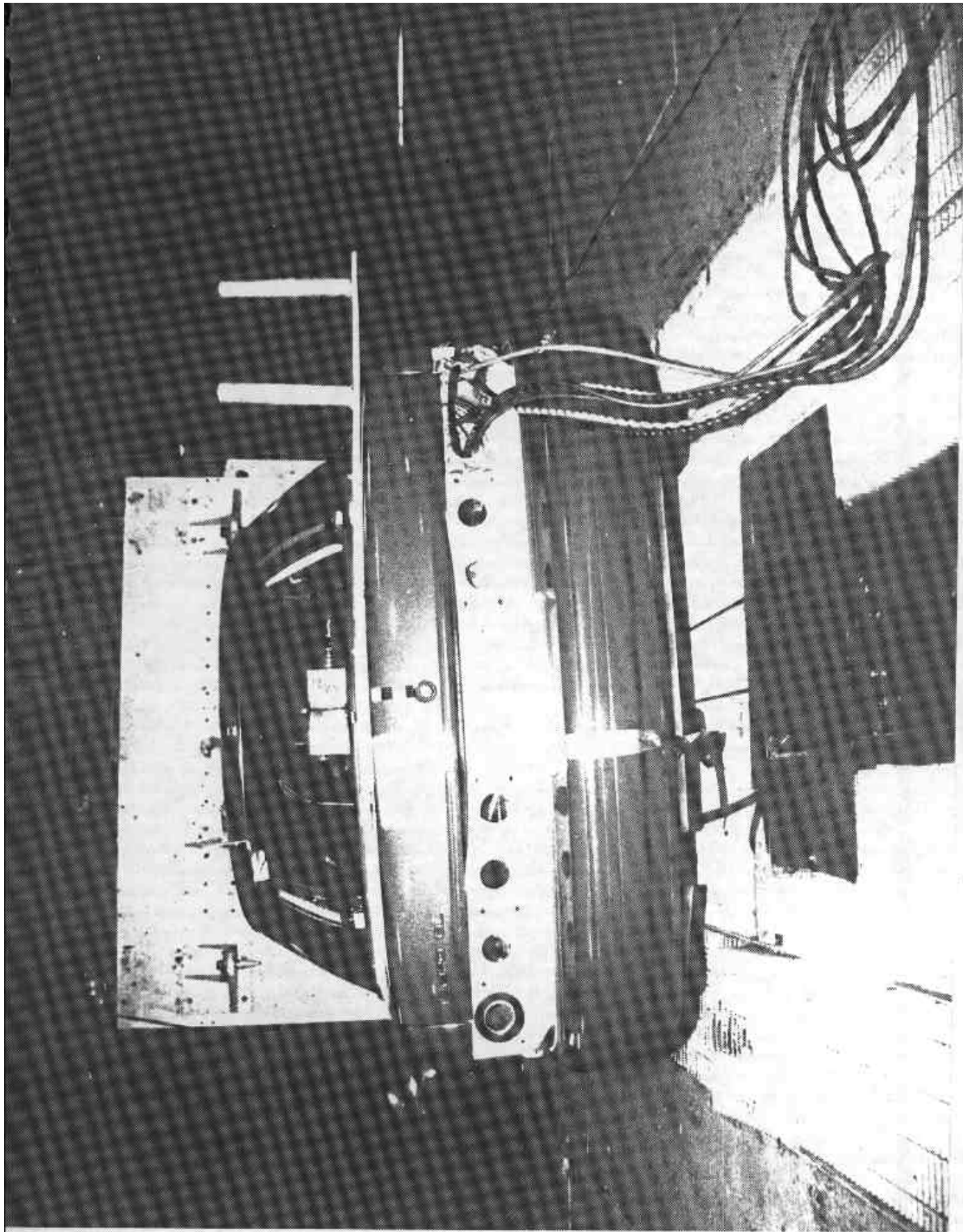


Photo No. 8 - Post-Test Rear View

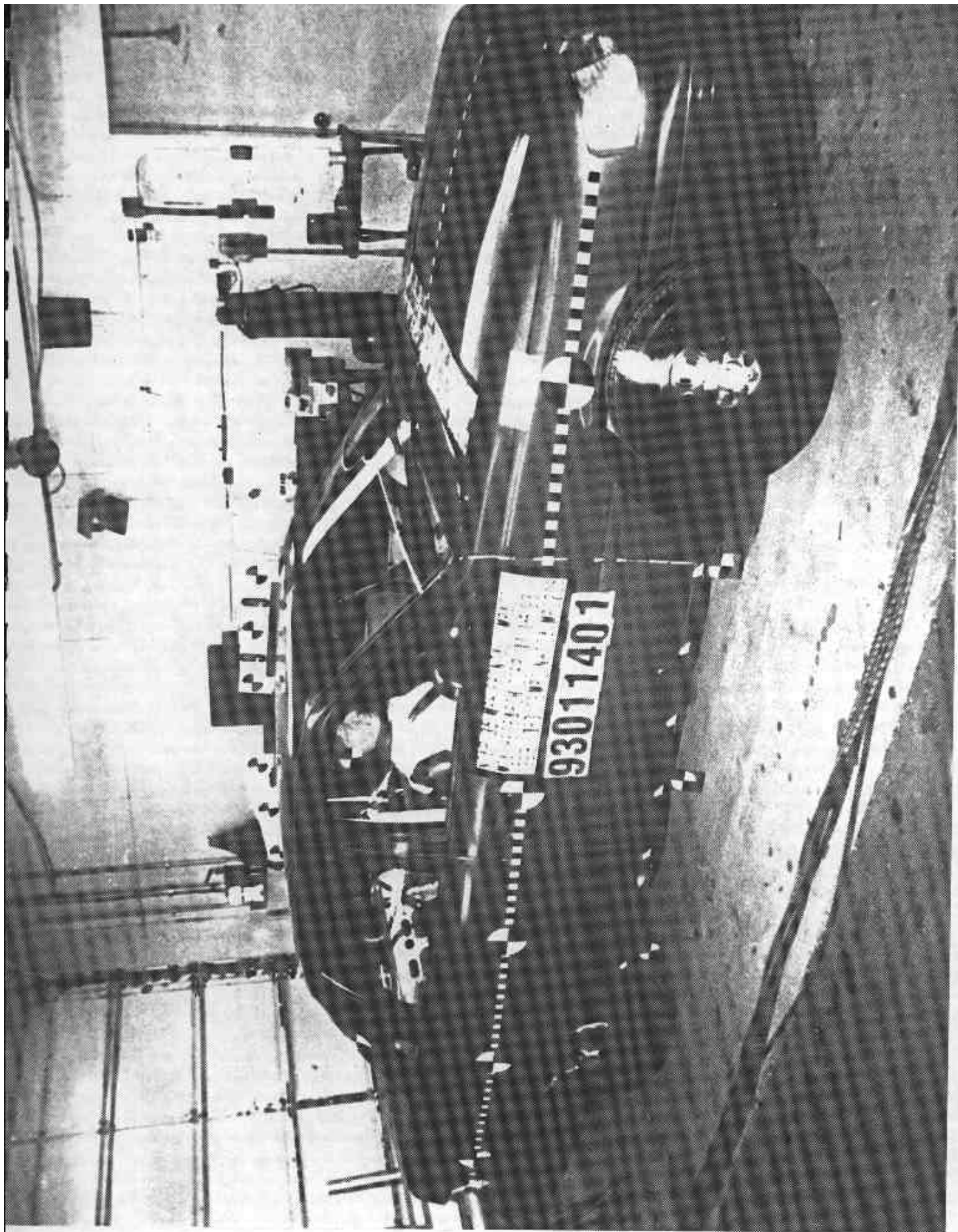


Photo No. 9 - Pre-Test Right Side View

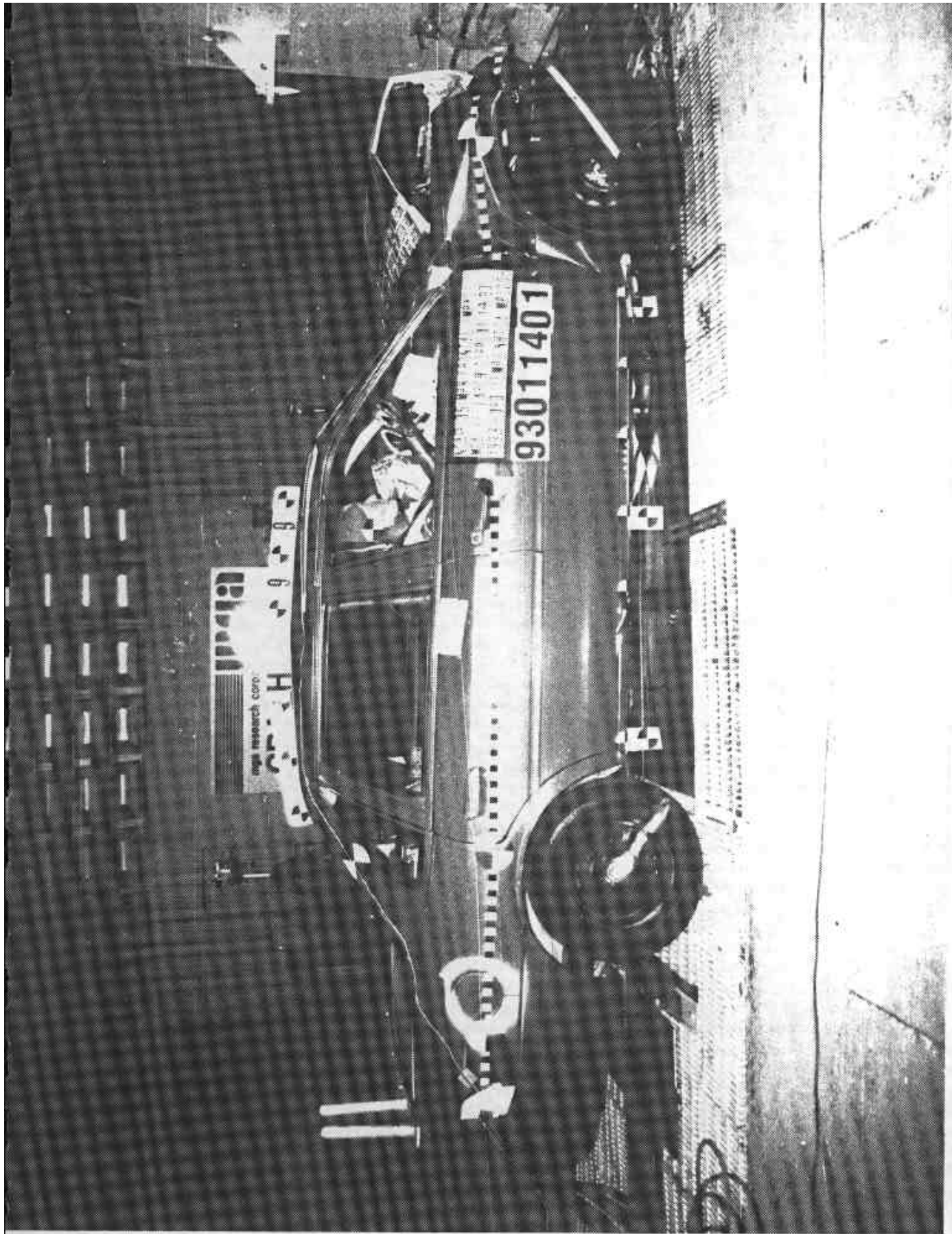


Photo No. 10 - Post-Test Right Side View

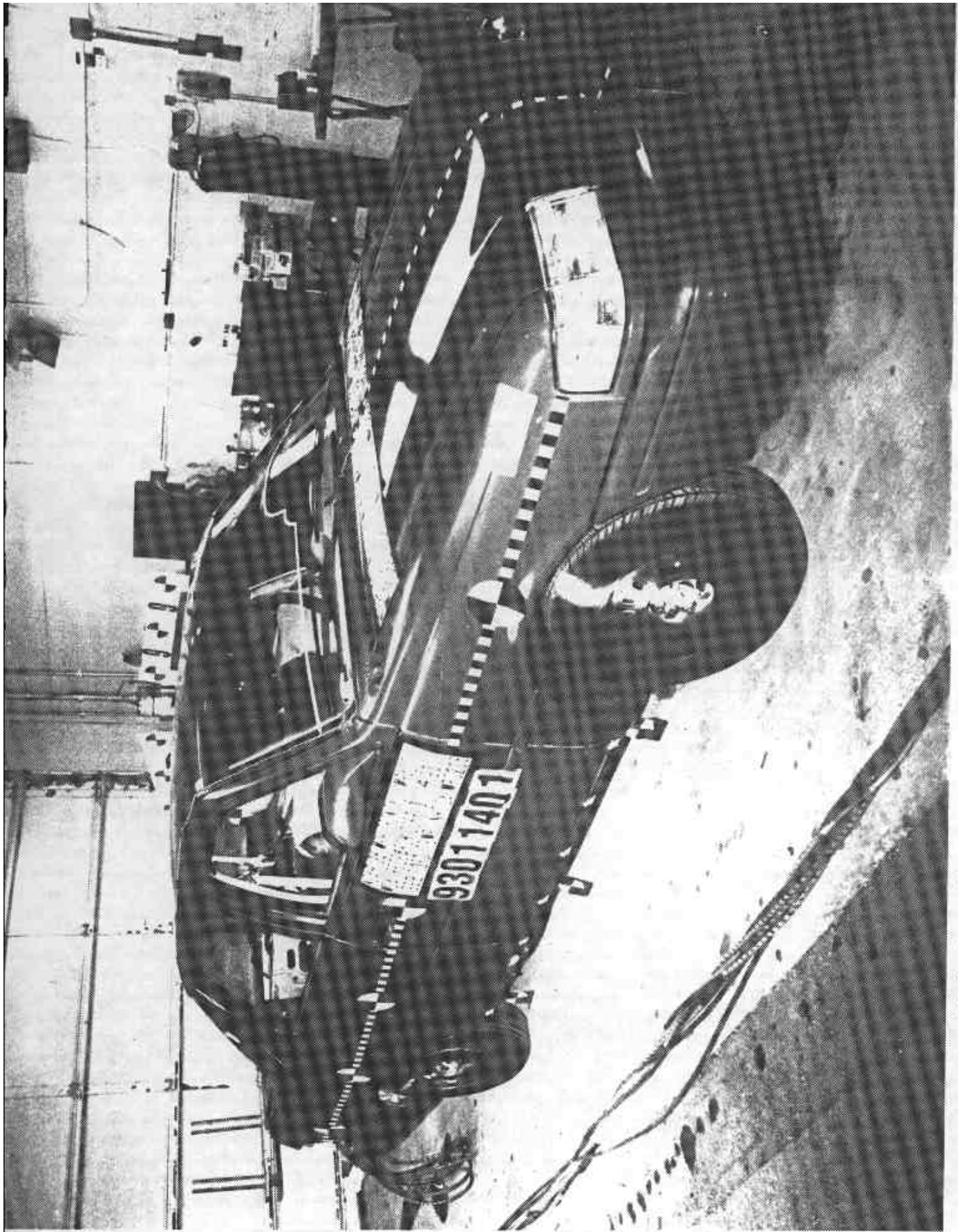


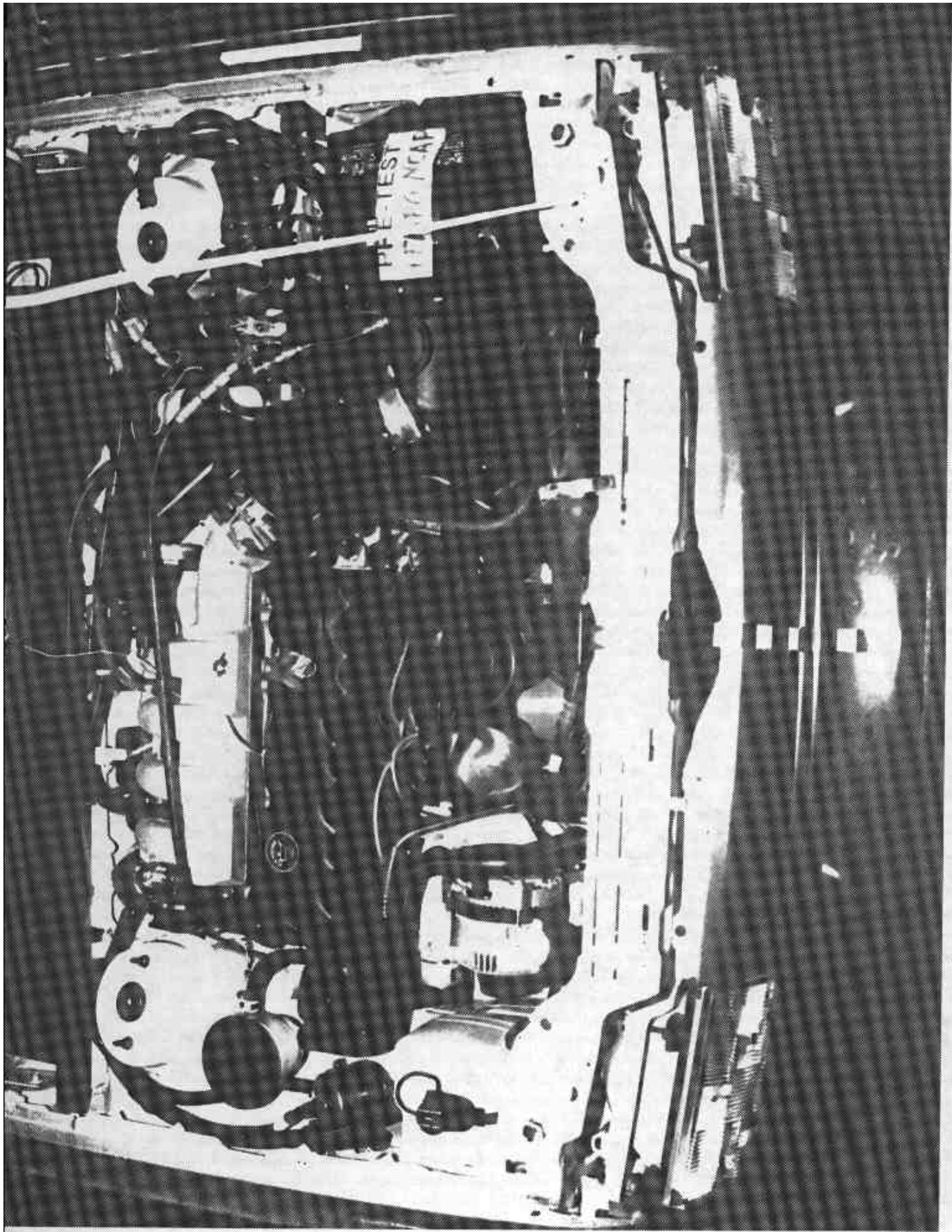
Photo No. 11 - Pre-Test Right Front Three-Quarter View

A-11



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

A-12



PRE-TEST
171016 NCAF

Photo No. 13 - Pre-Test Engine Compartment View

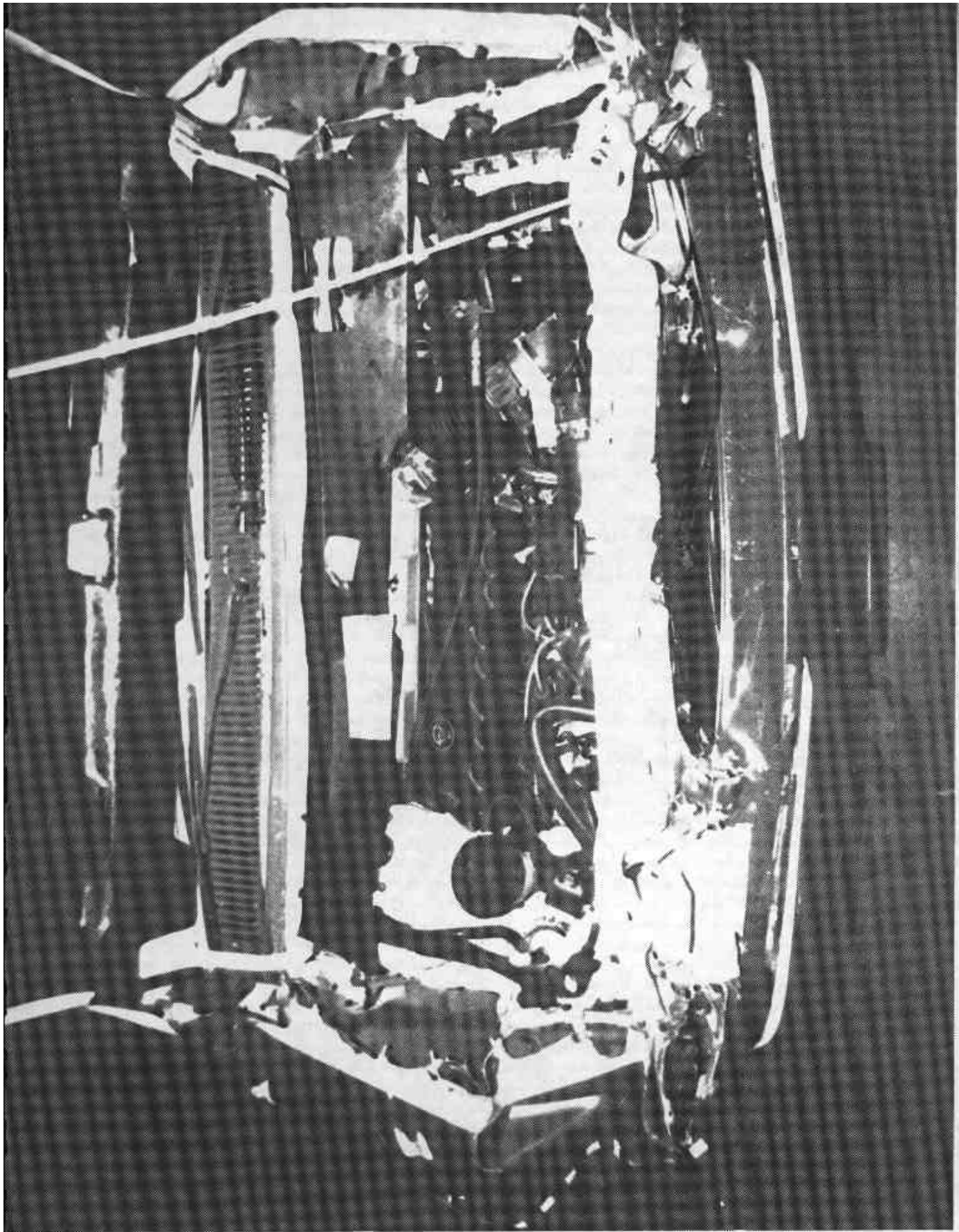


Photo No. 14 - Post-Test Engine Compartment View

A-14

PRE-TEST
TEMPO IN CAP

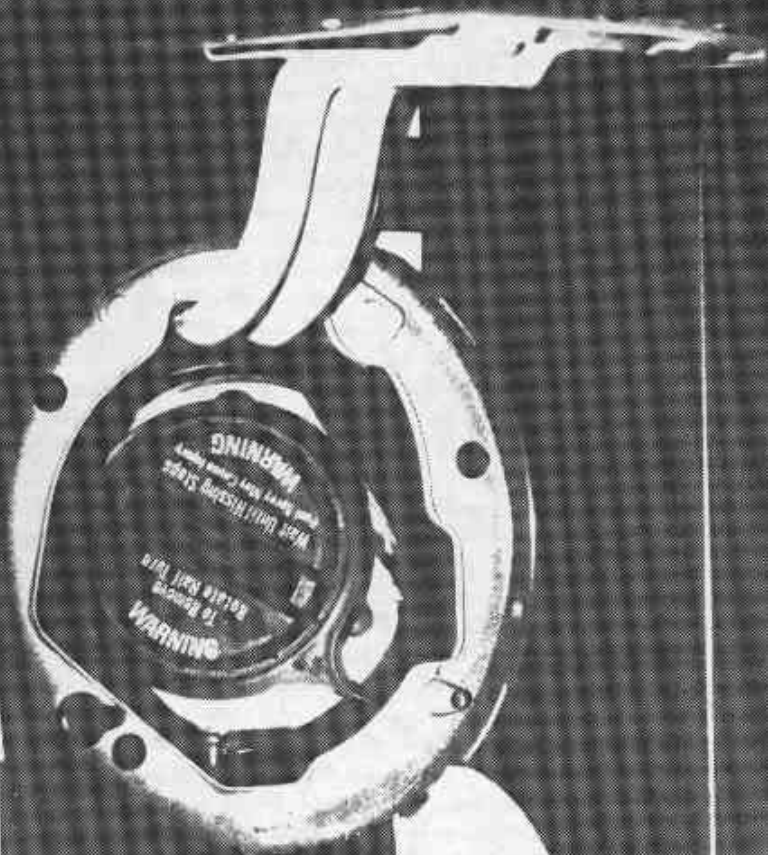


Photo No. 15 - Pre-Test Fuel Filler Cap View

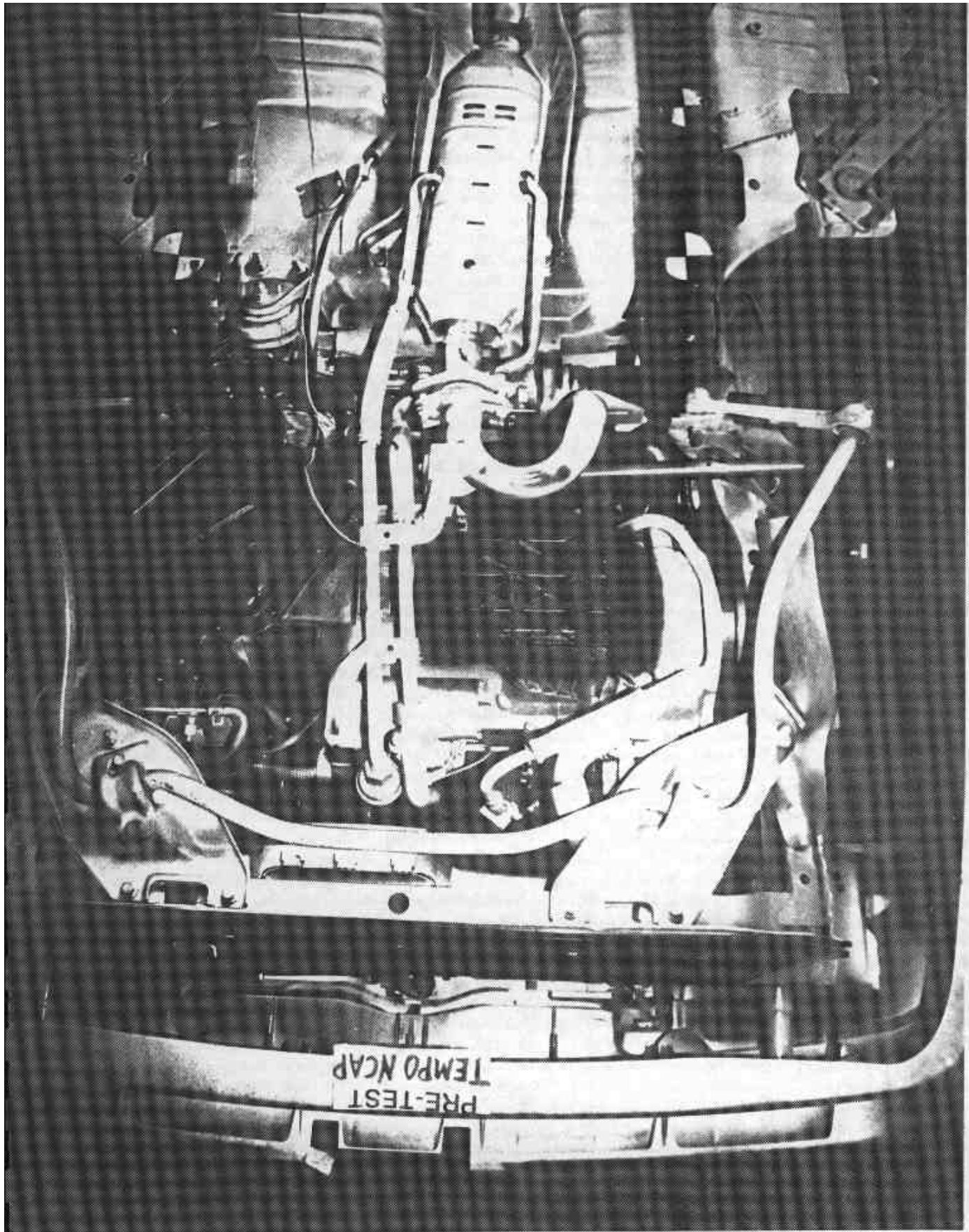


Photo No. 16 - Pre-Test Front Underbody View

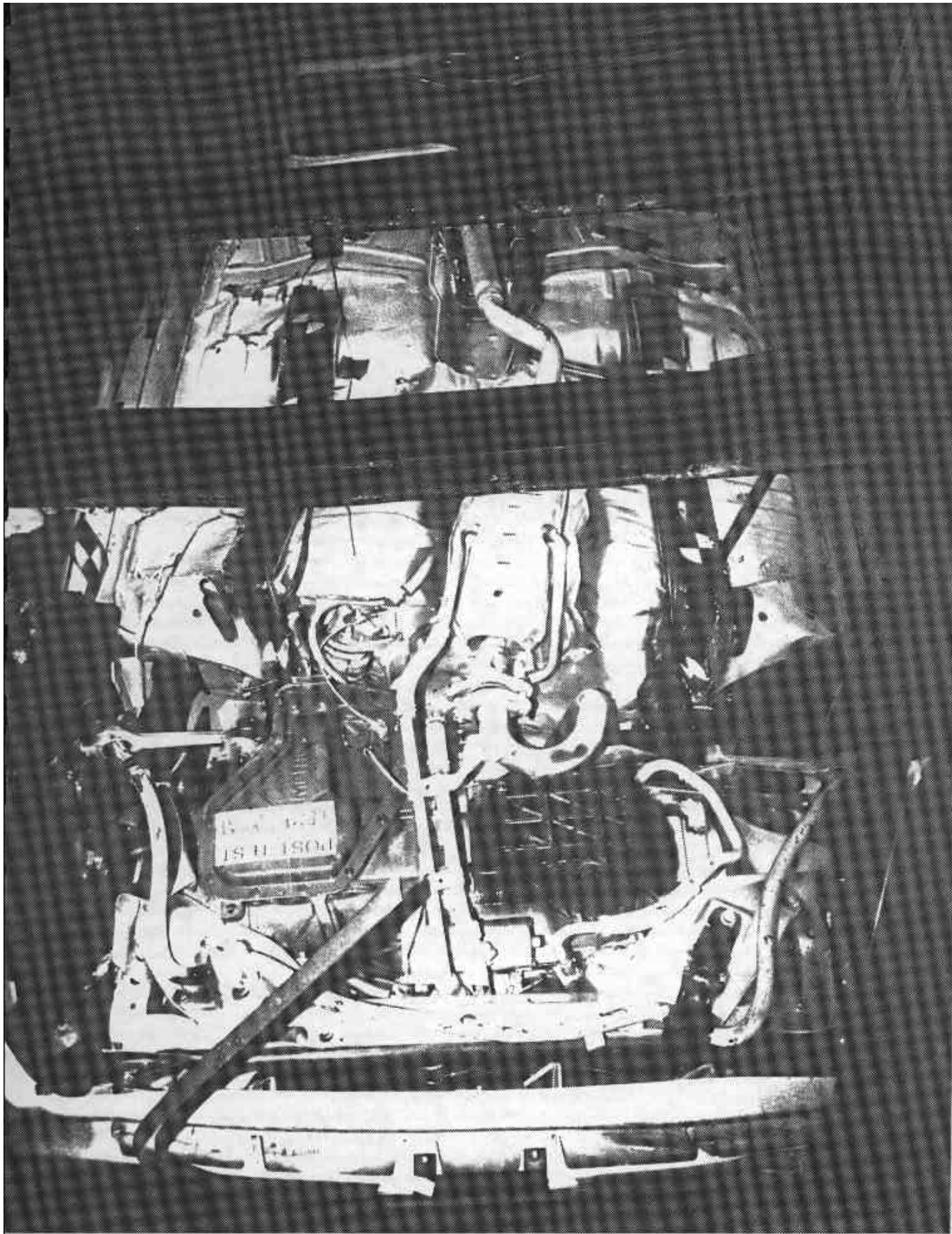


Photo No. 17 - Post-Test Front Underbody View

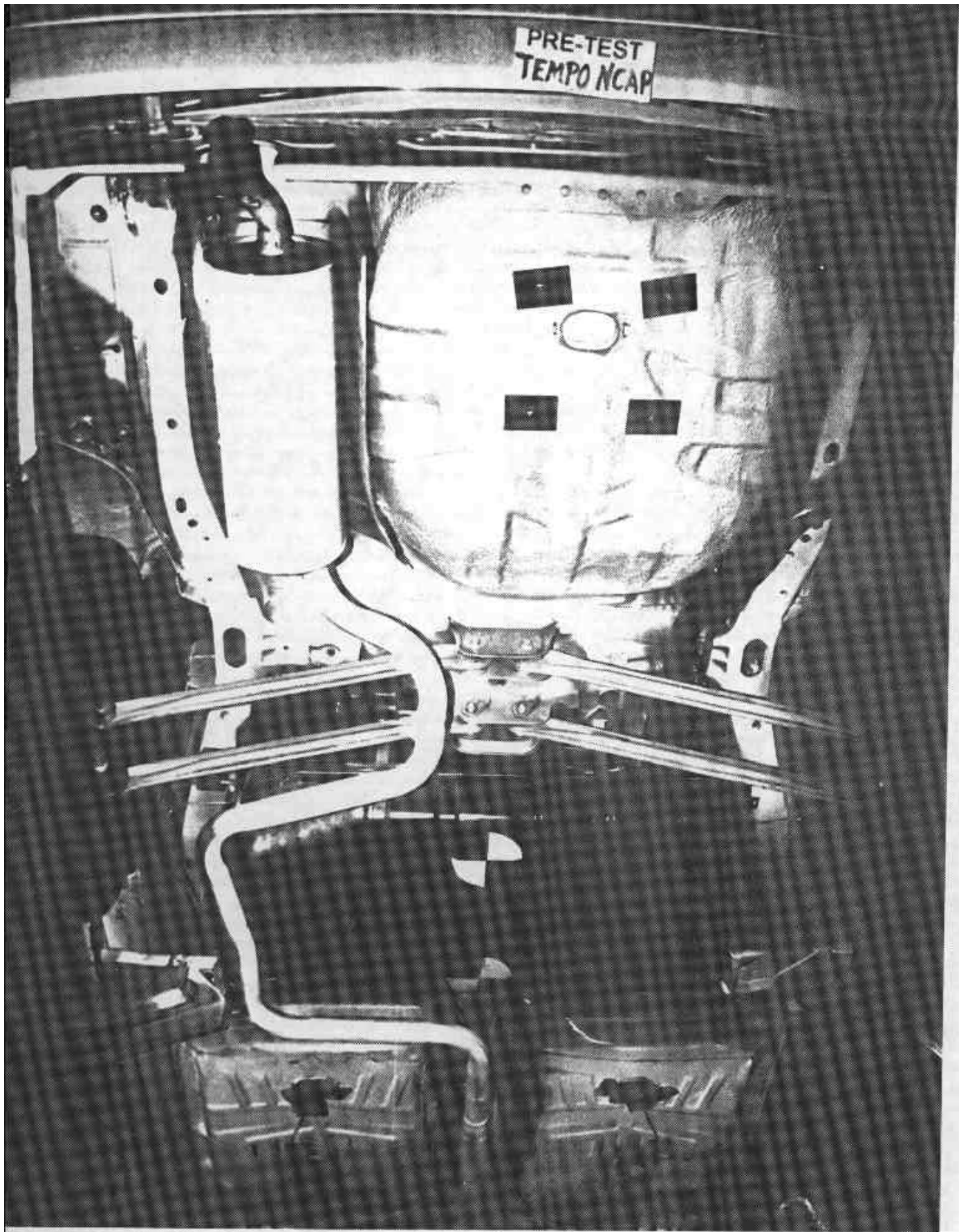
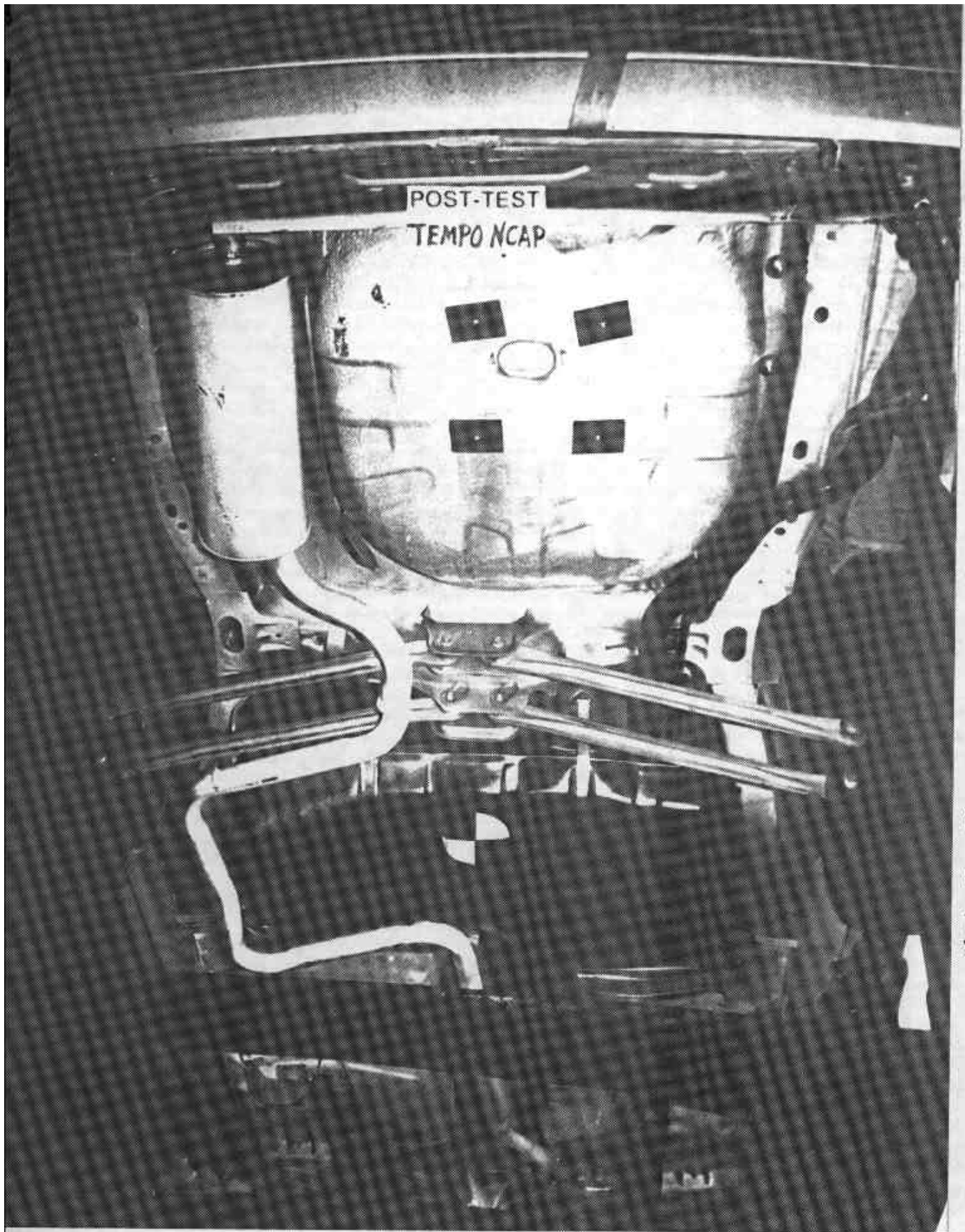


Photo No. 18 - Pre-Test Rear Underbody View

A-18



POST-TEST
TEMPO NCAP

Photo No. 19 - Post-Test Rear Underbody View

A-19

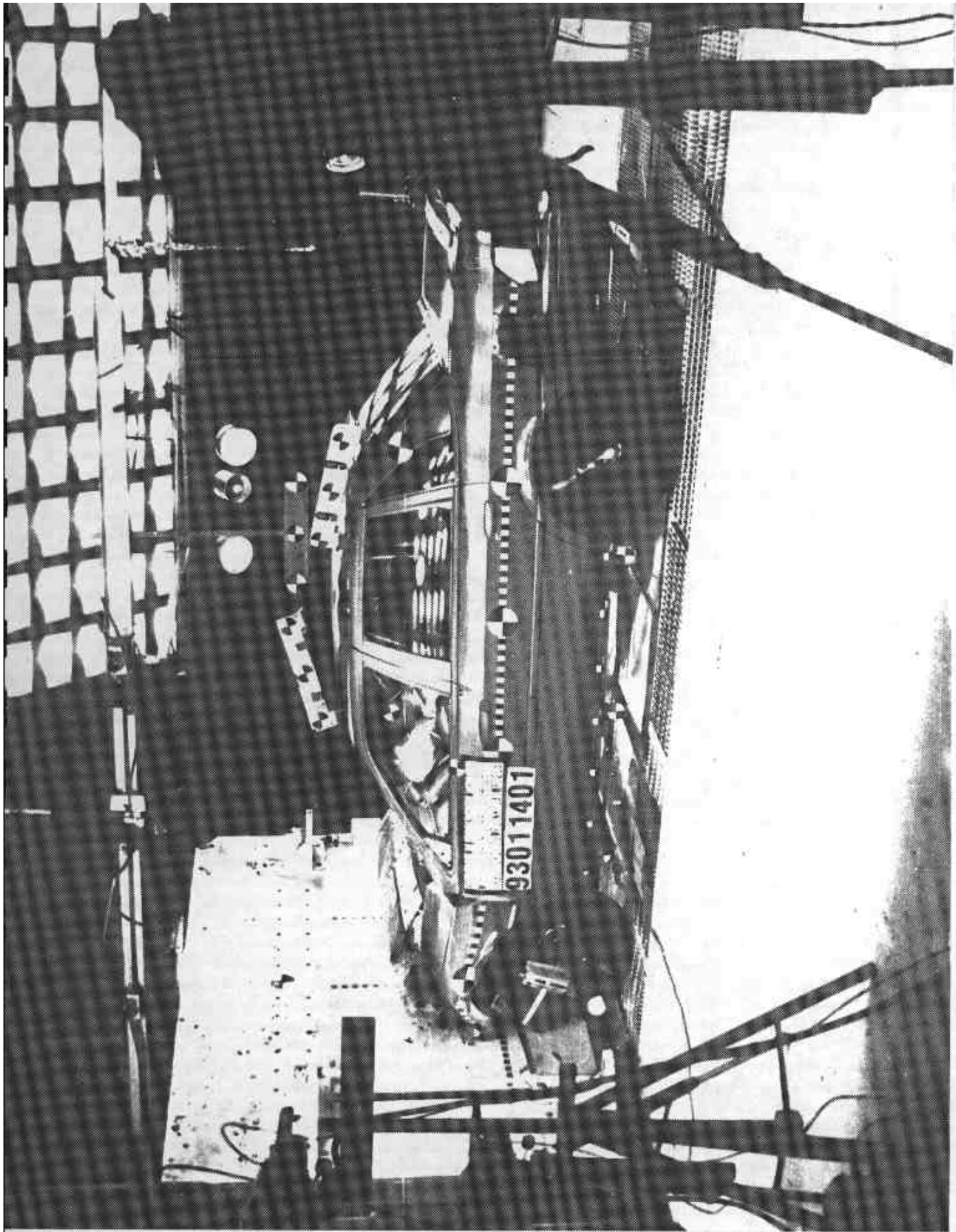


Photo No. 20 - Vehicle Impact

A-20

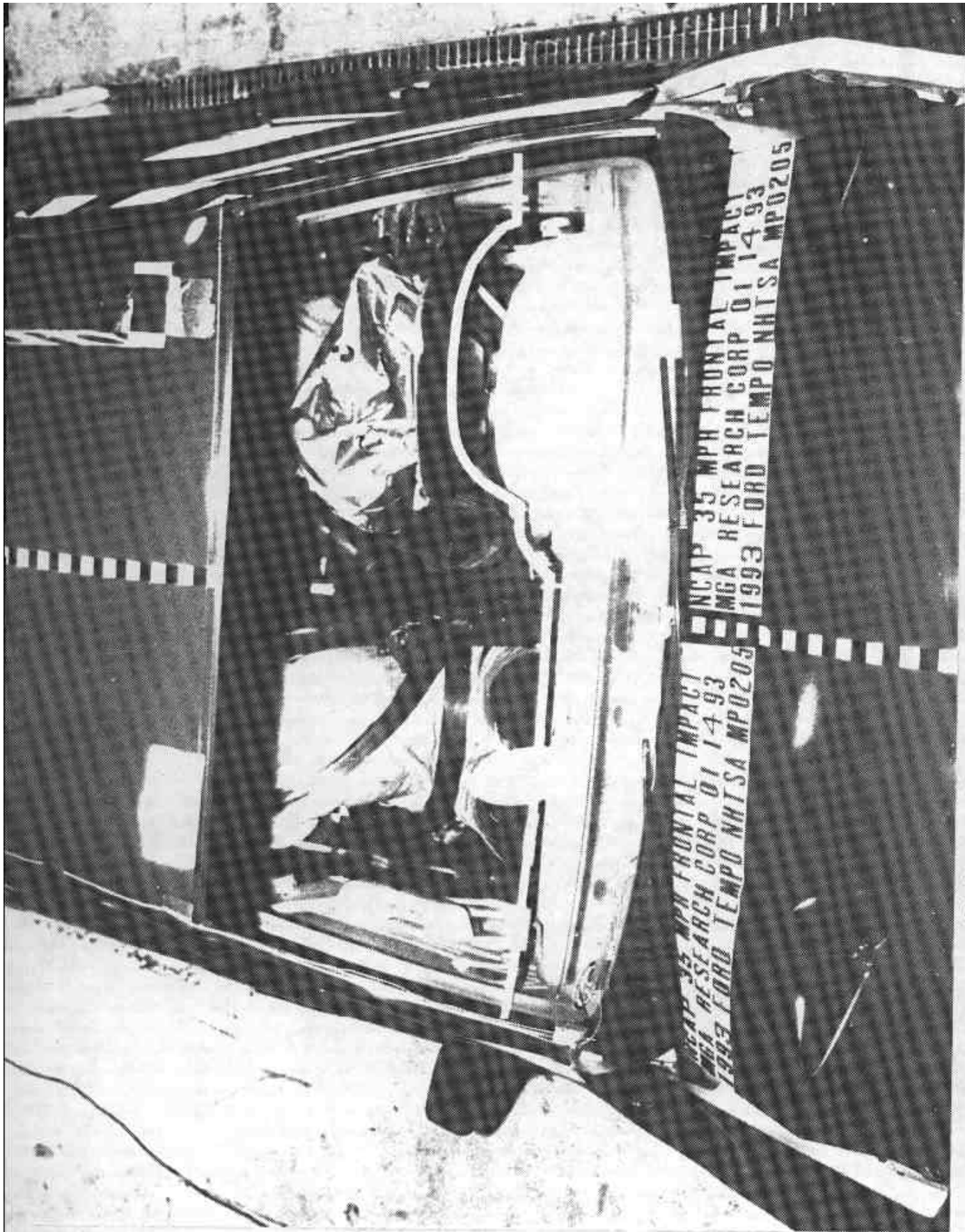


Photo No. 21 - Post-Test Front Top View

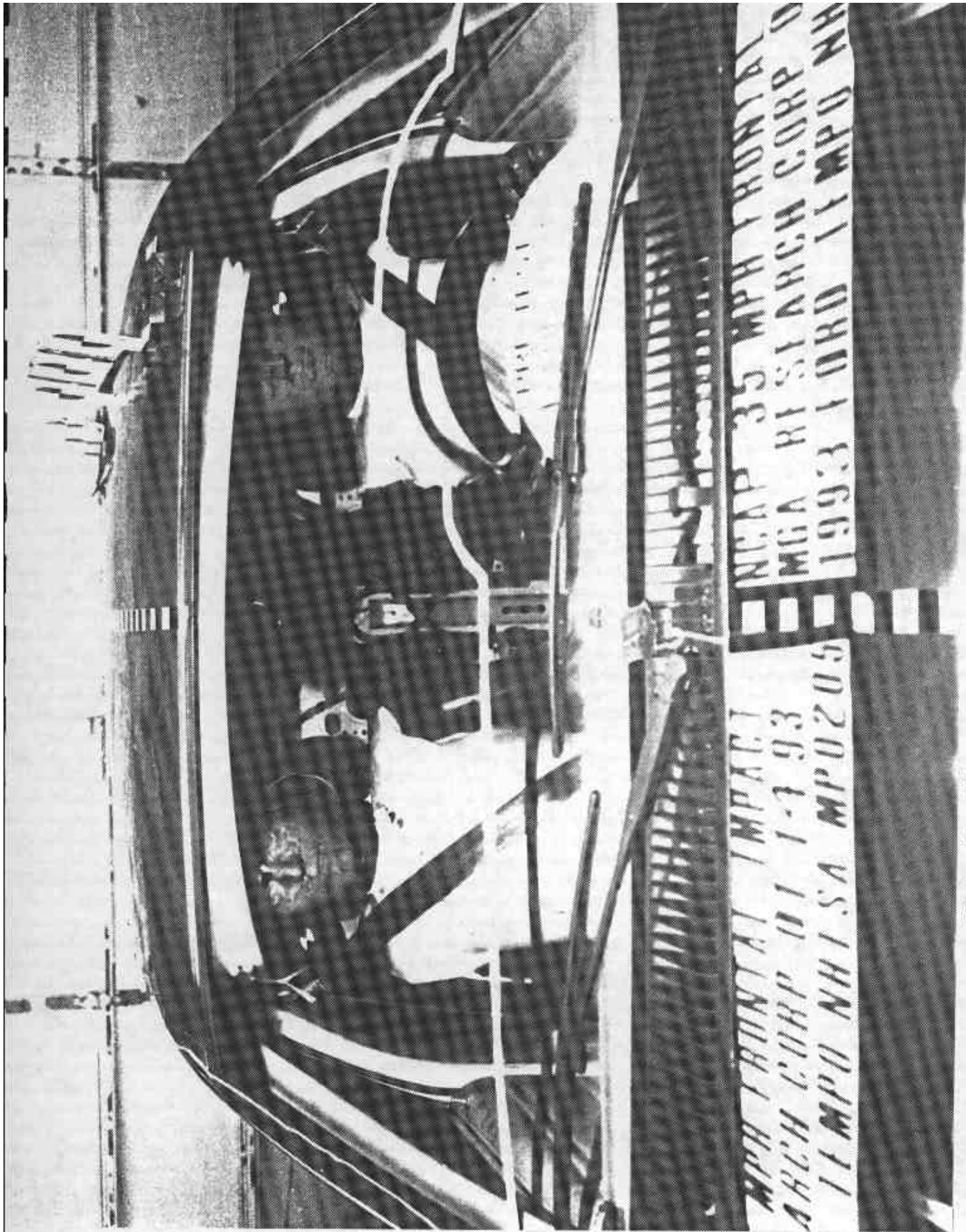
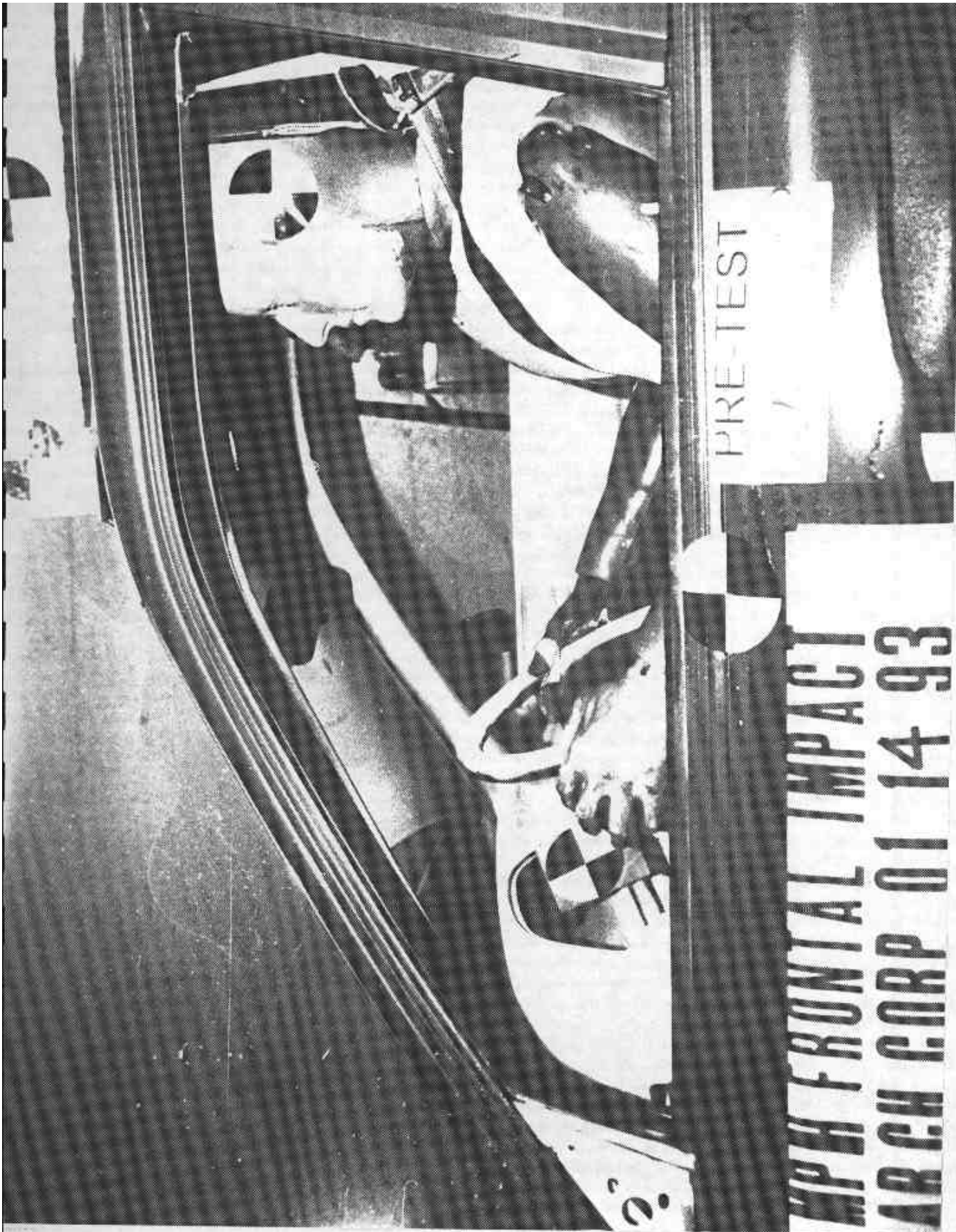


Photo No. 22 - Pre-Test Windshield View



Photo No. 23 - Post-Test Windshield View



PRE-TEST

MPH FRONTAL IMPACT
ARCH CORP 01 14 93

Photo No. 24 - Pre-Test Driver Dummy Position View

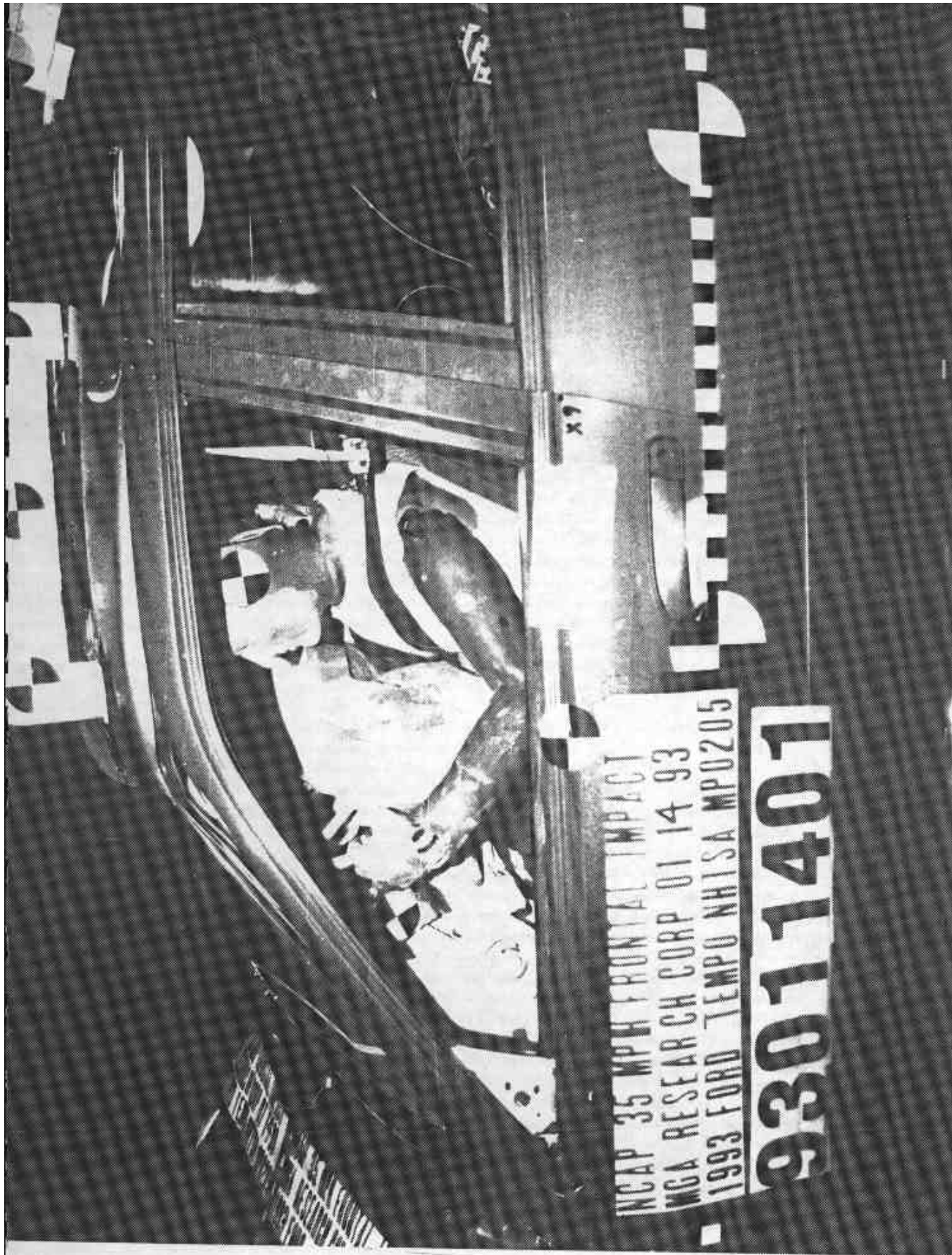


Photo No. 25 - Post-Test Driver Dummy Position View

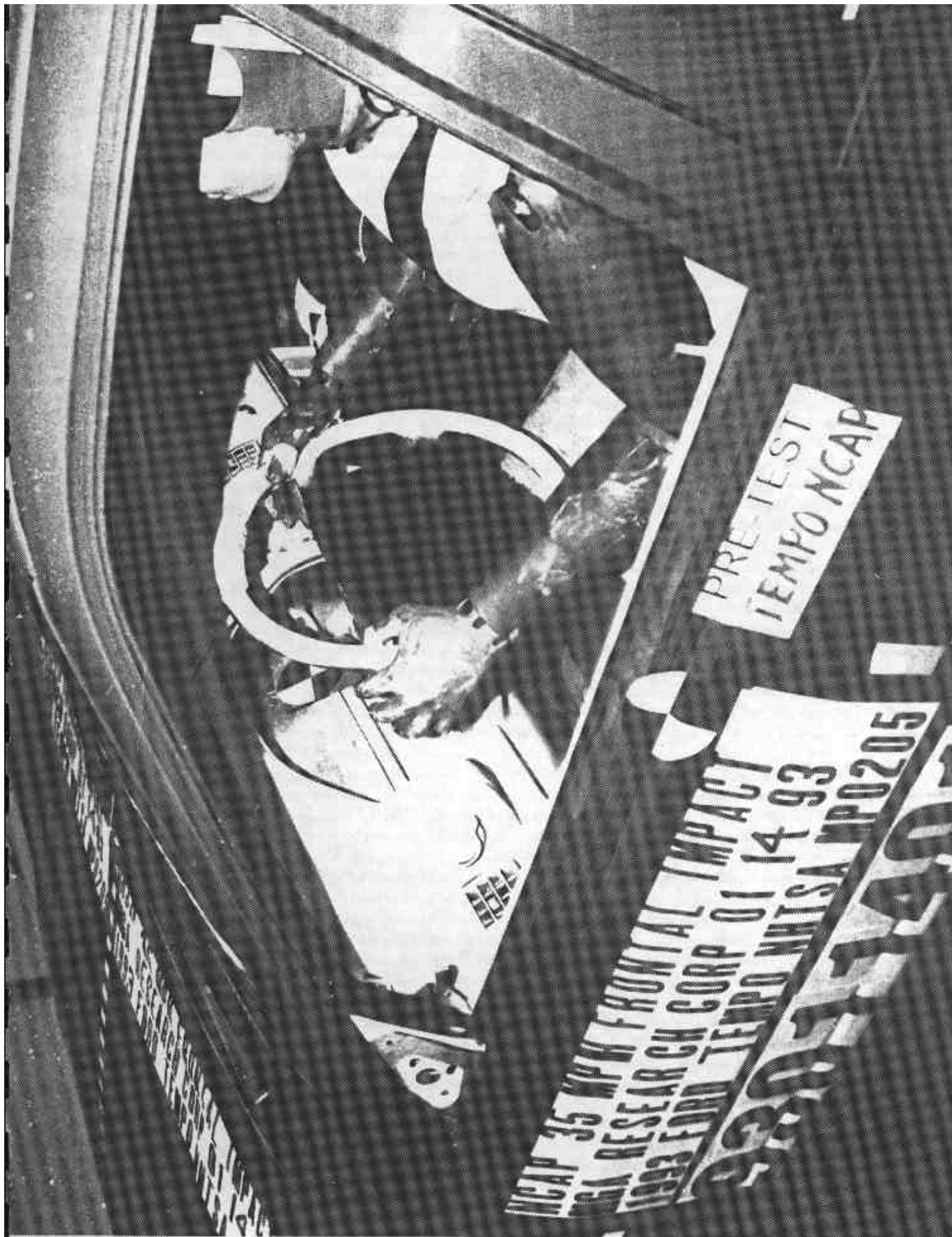


Photo No. 26 - Pre-Test Driver Dummy Three-Quarter View



Photo No. 27 - Post-Test Driver Dummy Three-Quarter View

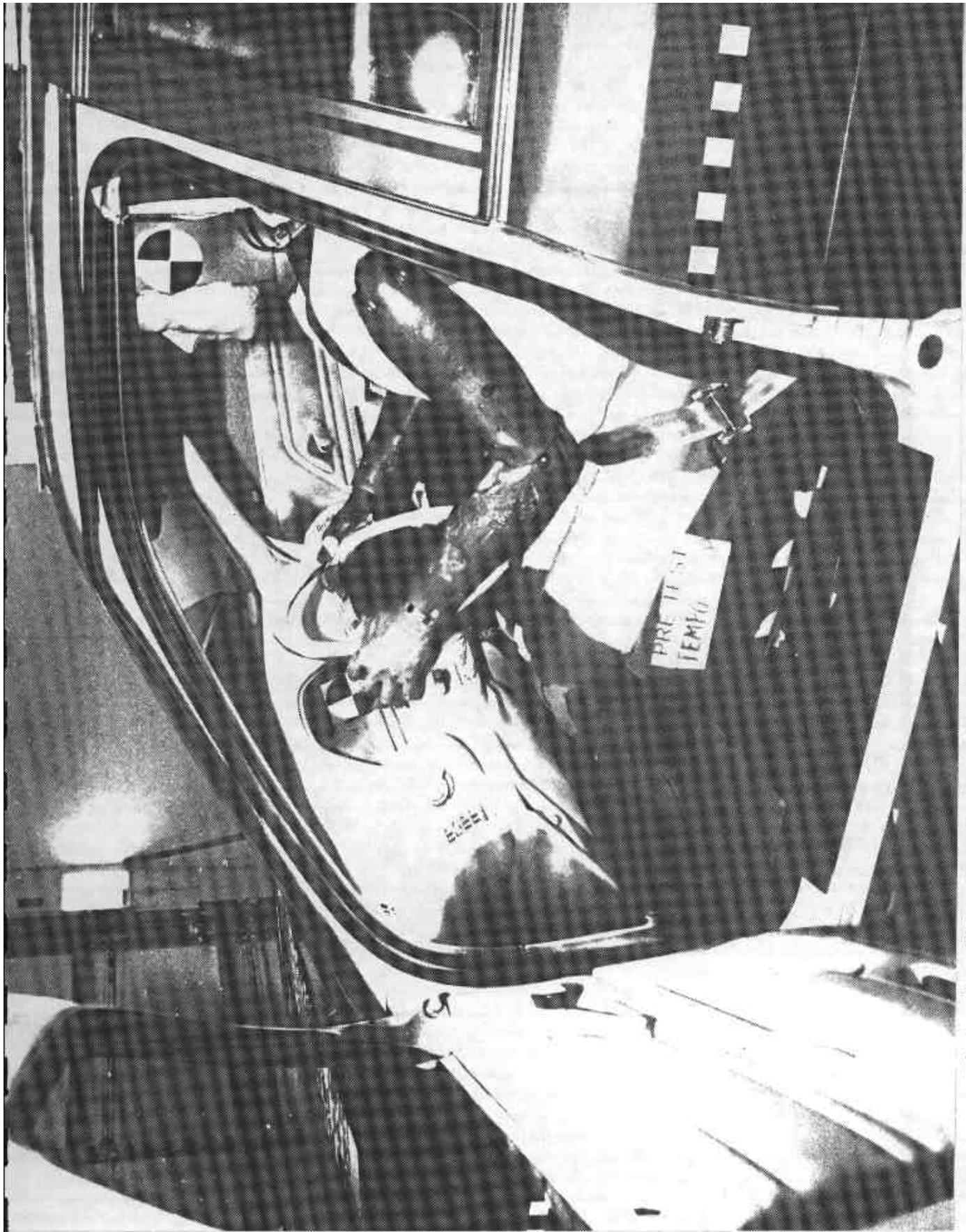


Photo No. 28 - Pre-Test Driver Dummy Position View (Door Open)

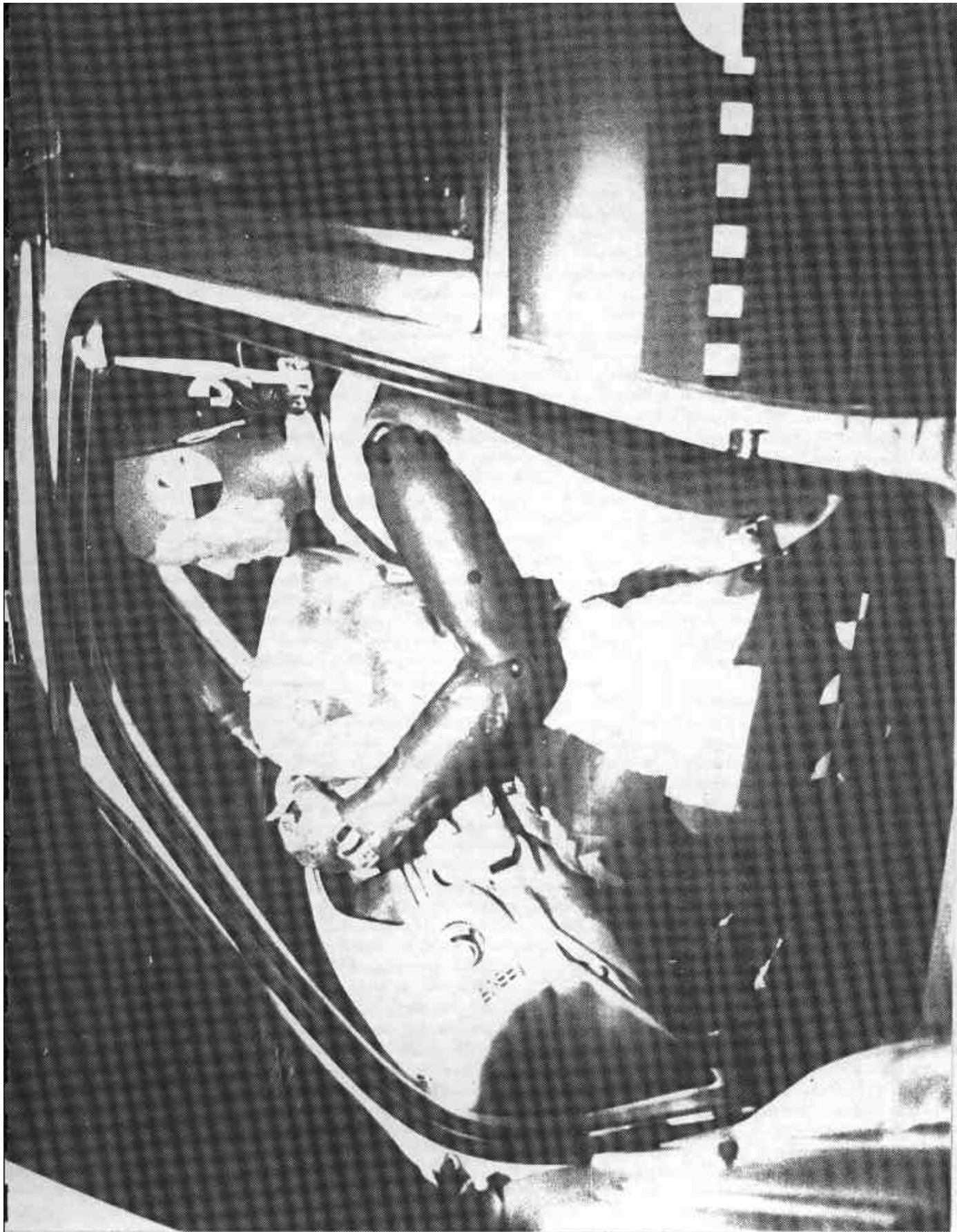


Photo No. 29 - Post-Test Driver Dummy Position View (Door Open)

A-29



Photo No. 30 - Post-Test Driver Dummy Three-Quarter View
(Door Open)



Photo No. 31 - Post-Test Airbag Contact

A-31

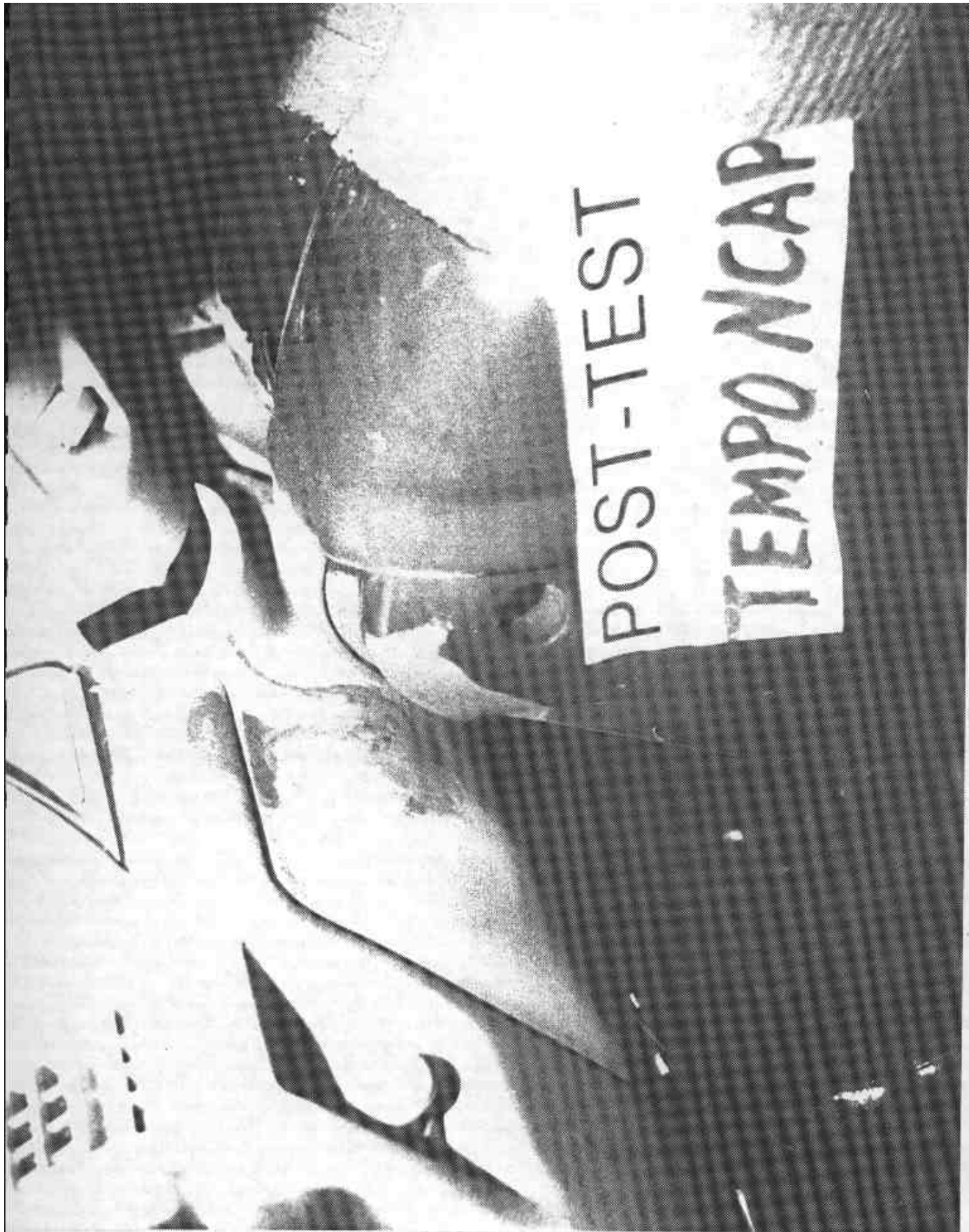


Photo No. 32 - Post-Test Left Driver Knee Contact



Photo No. 33 - Post-Test Right Driver Knee Contact



Photo No. 34 - Post-Test Driver Seat Position View

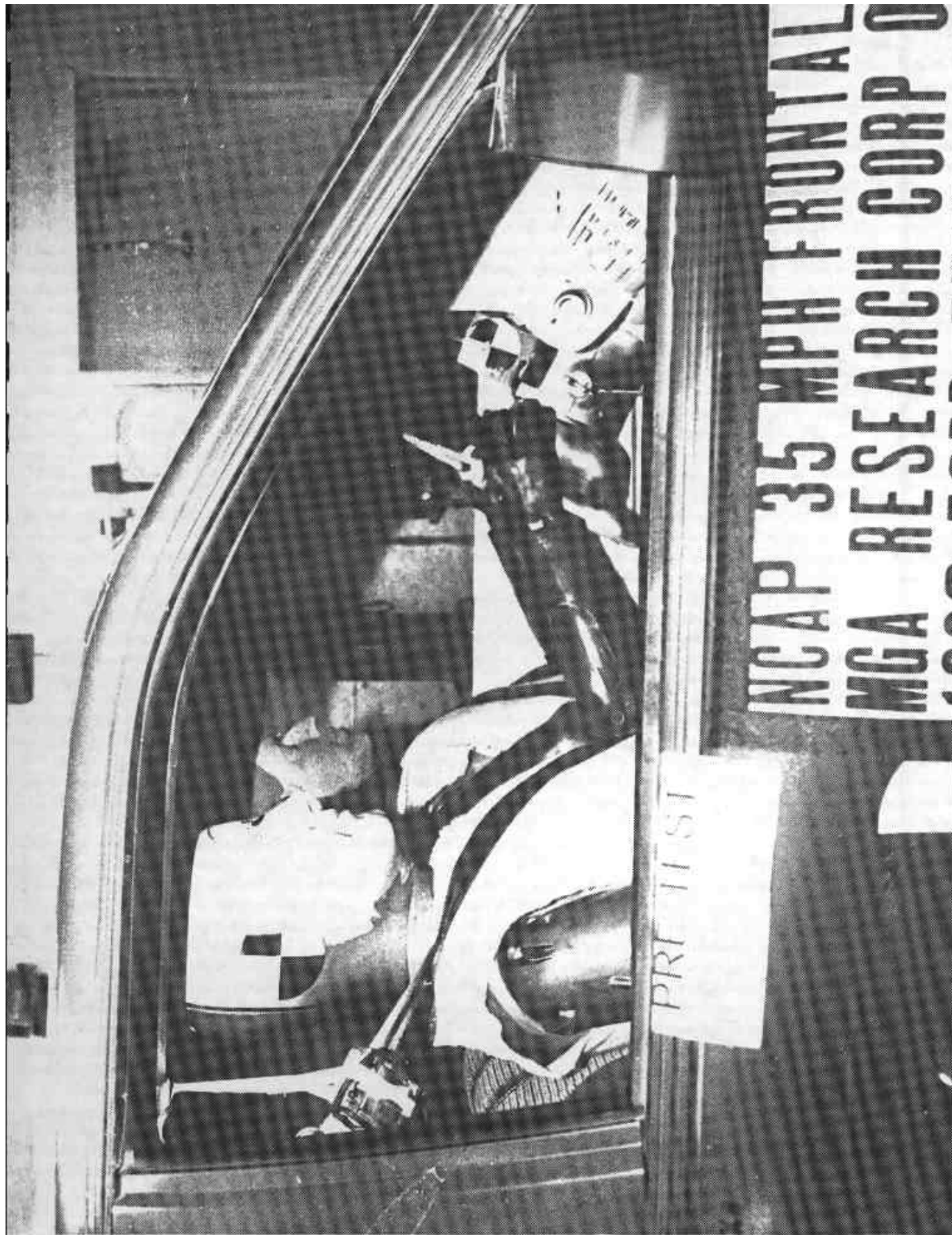


Photo No. 35 - Pre-Test Passenger Dummy Position View



Photo No. 36 - Post-Test Passenger Dummy Position View

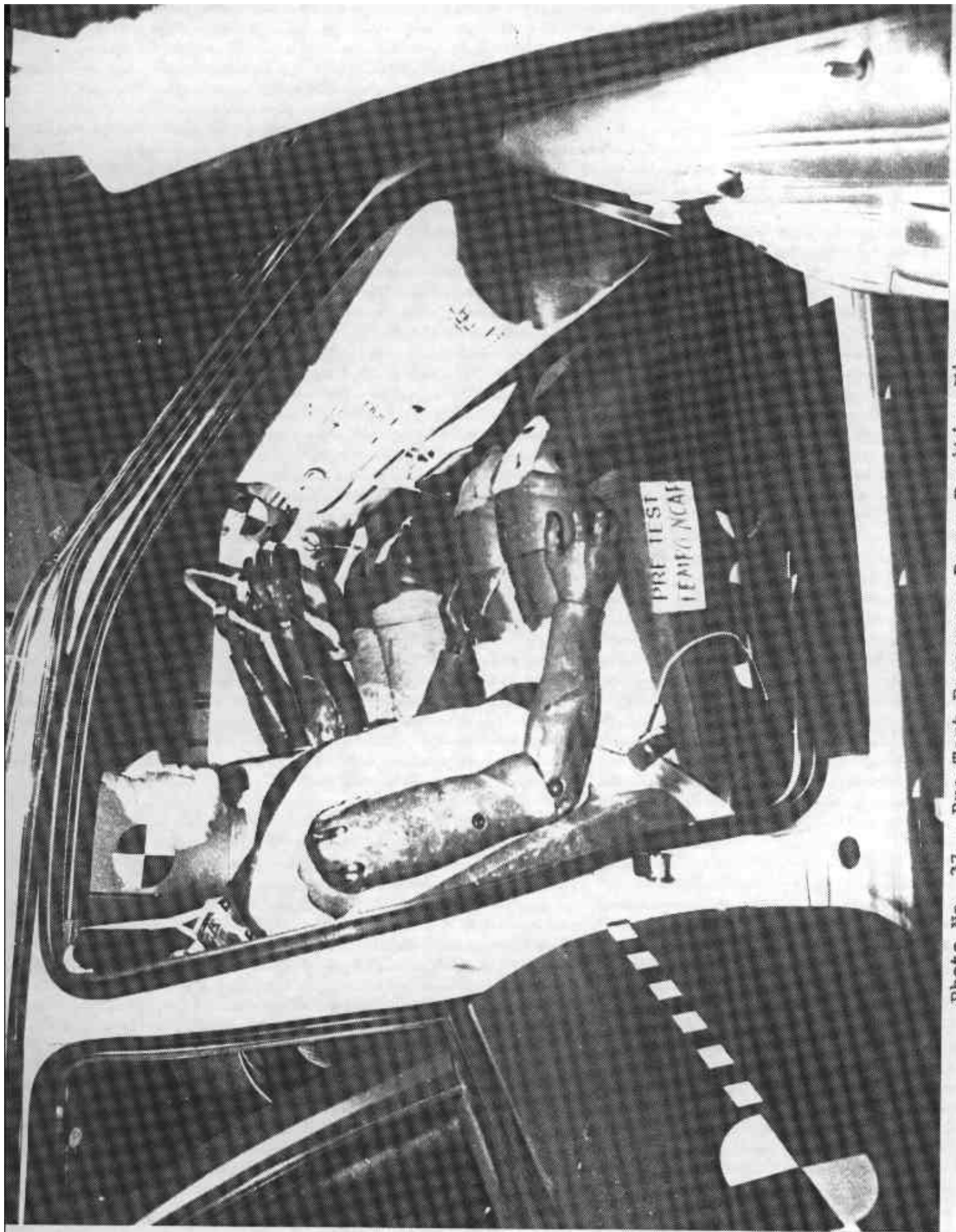


Photo No. 37 - Pre-Test Passenger Dummy Position View
(Door Open)

A-37



Photo No. 38 - Post-Test Passenger Dummy Position View
(Door Open)

A-38

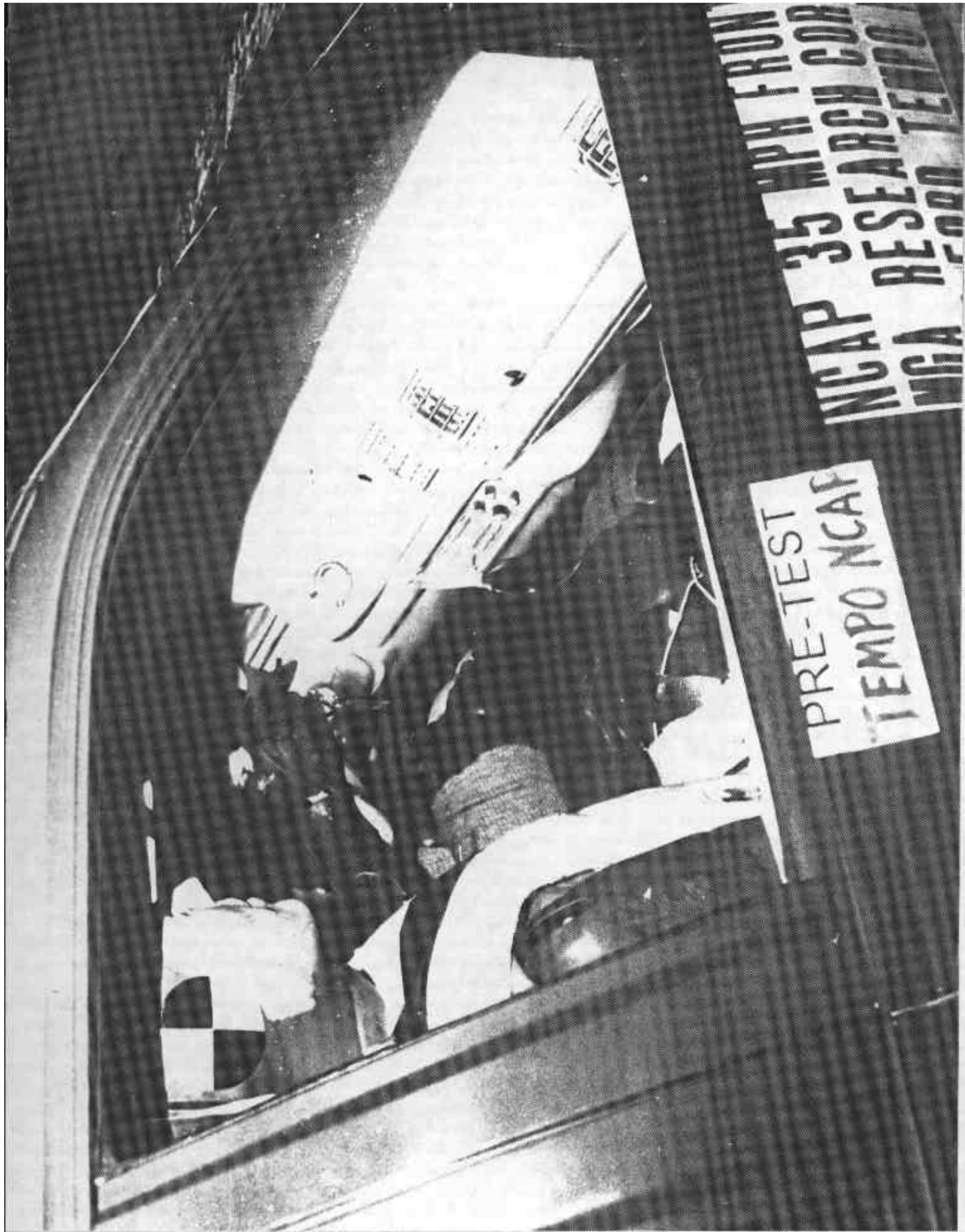


Photo No. 39 - Pre-Test Passenger Dummy Three-Quarter View

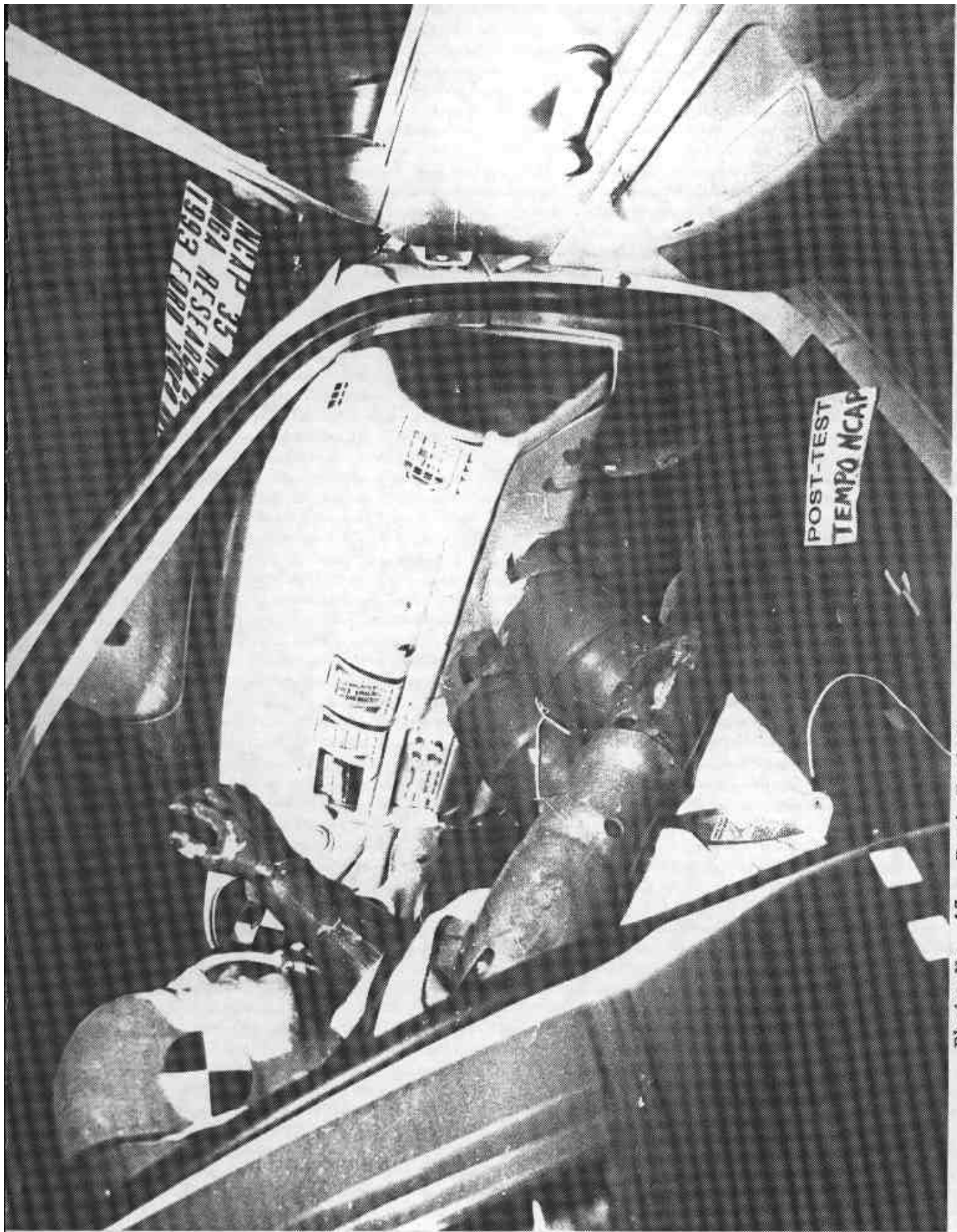


Photo No. 40 - Post-Test Passenger Dummy Three-Quarter View
(Door Open)

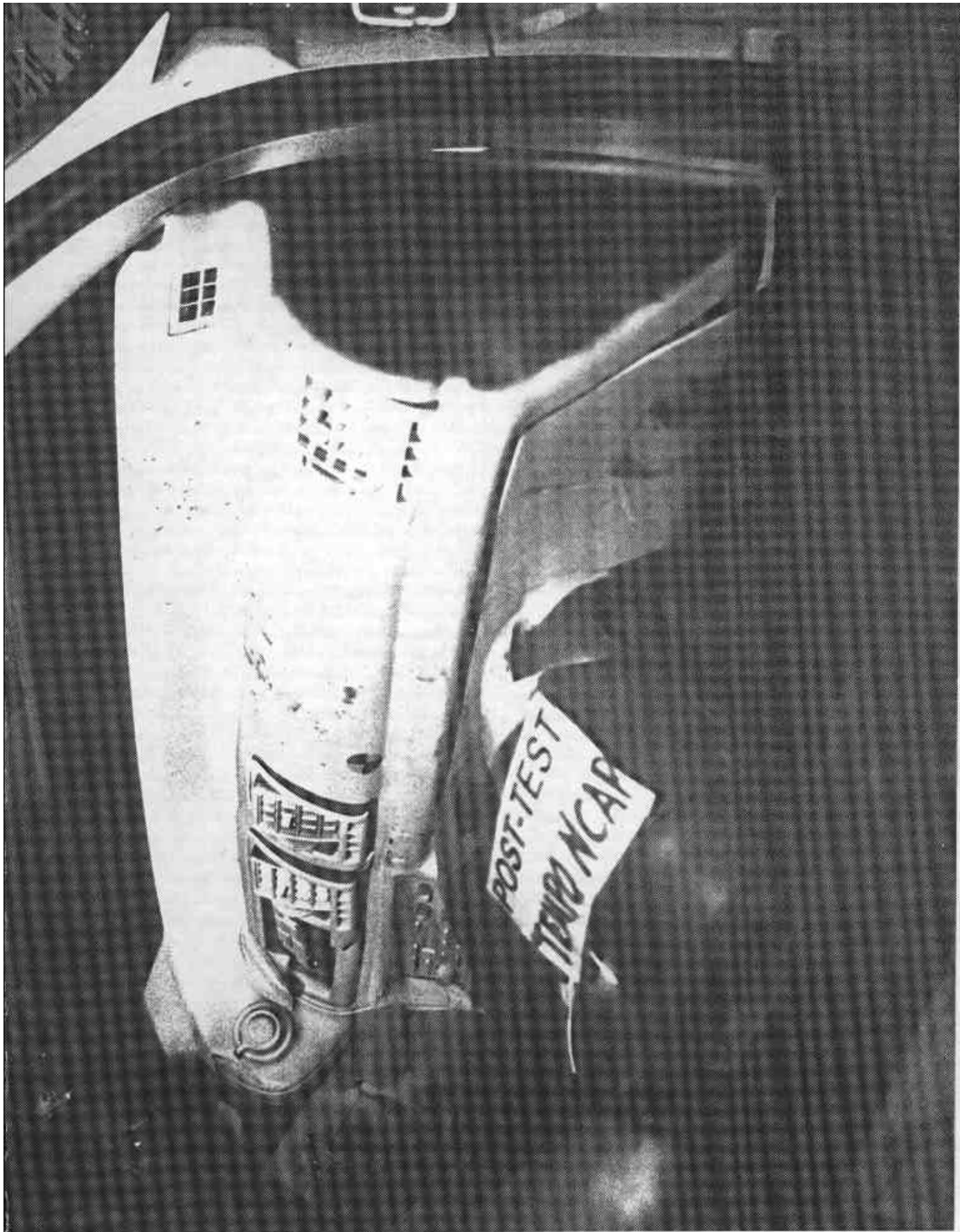


Photo No. 41 - Post-Test Passenger Dummy Knee Contact Area



Photo No. 42 - Post-Test Passenger Seat Position View

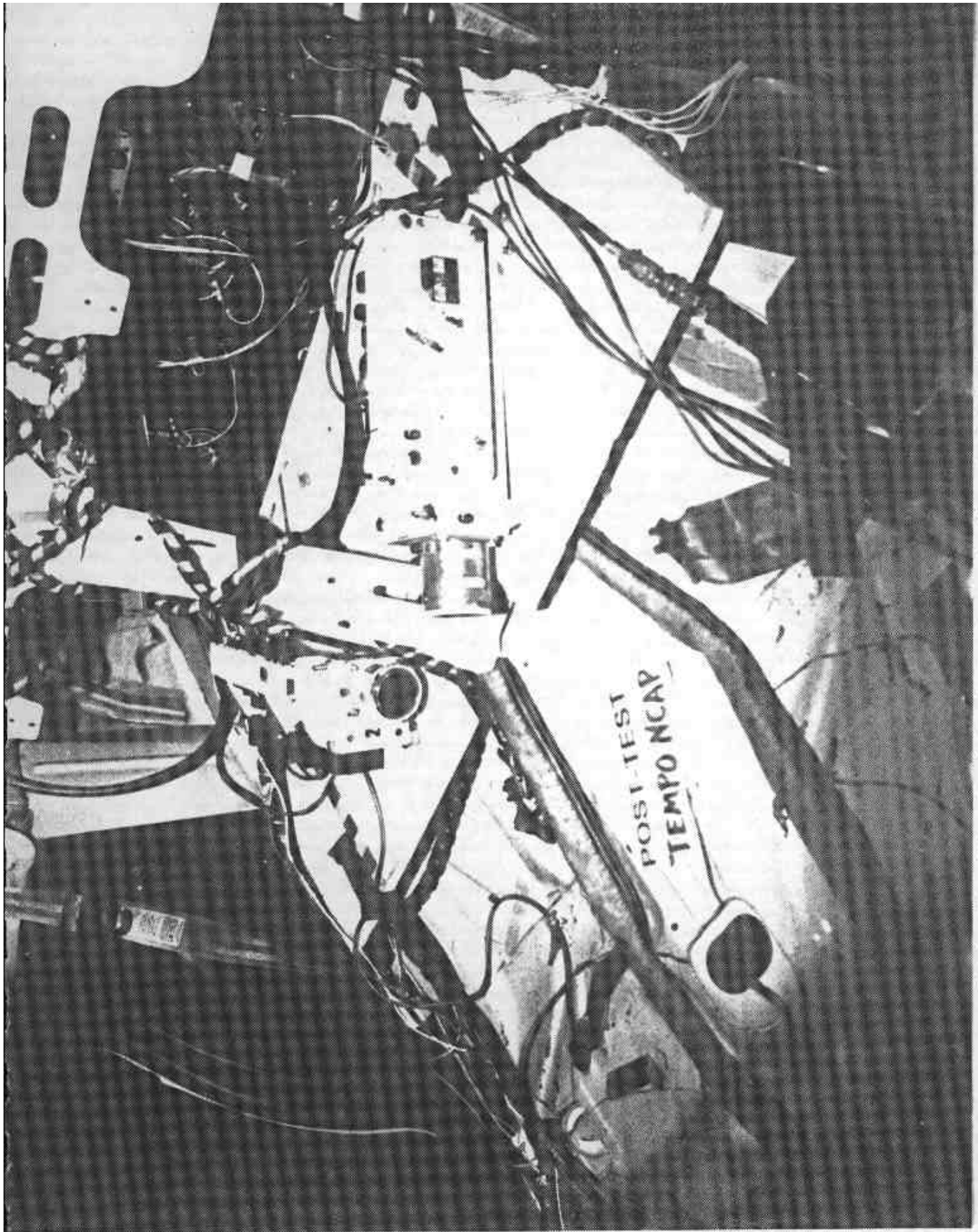


Photo No. 43 - Post-Test Instrumentation & Ballast

APPENDIX B

Vehicle, Load Cell Barrier and Dummy Response Data

<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-57 - Passenger Chest X Velocity vs. Time	B-57
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¹ Data Wire Cut During Impact, No Data Available

² Data Wire Cut During Impact at Approx. 70 msec.

³ Data Spike at 150 msec. _____ v

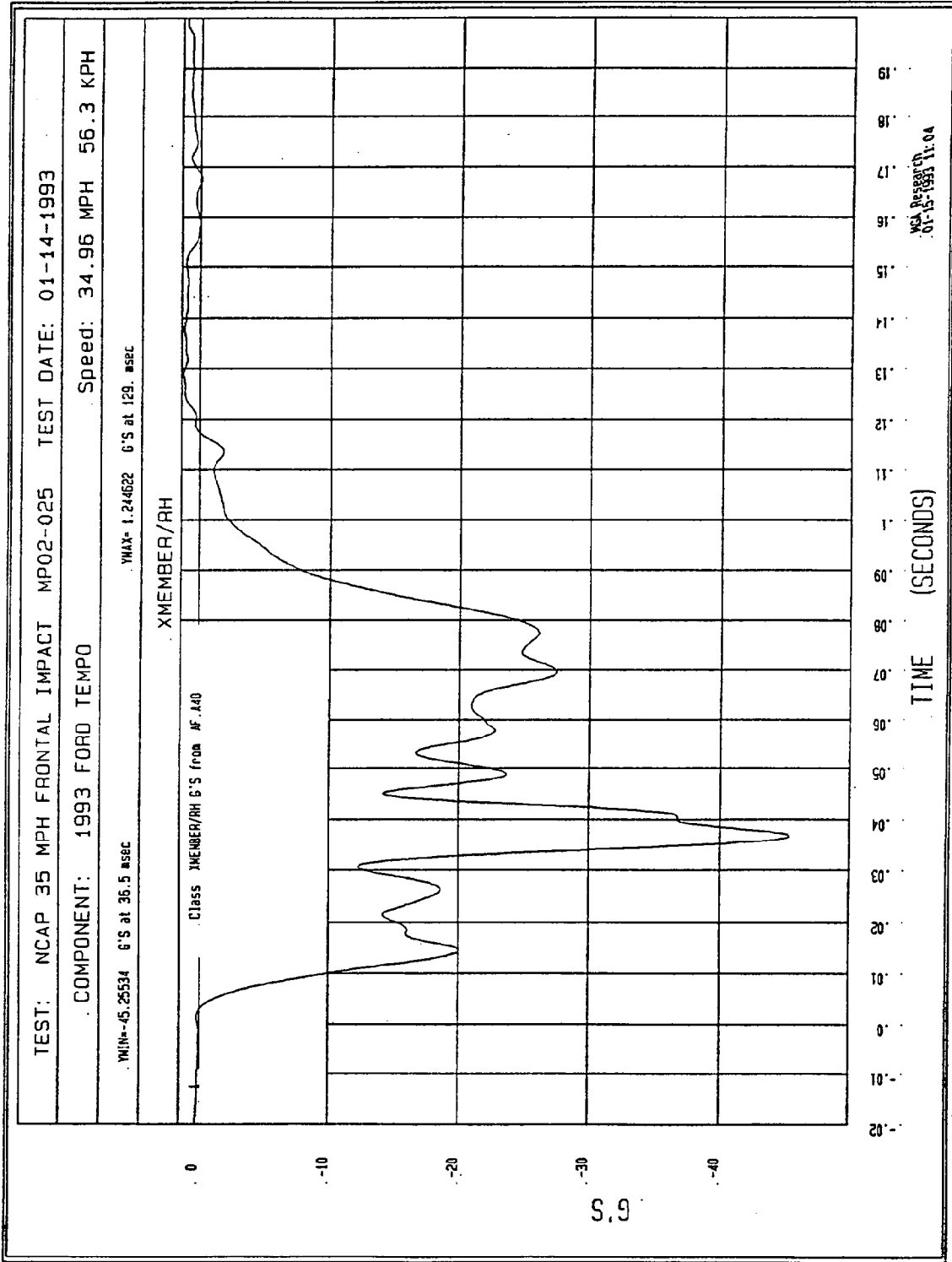


Figure B-1 - Right Rear Seat Crossmember X Acceleration vs. Time

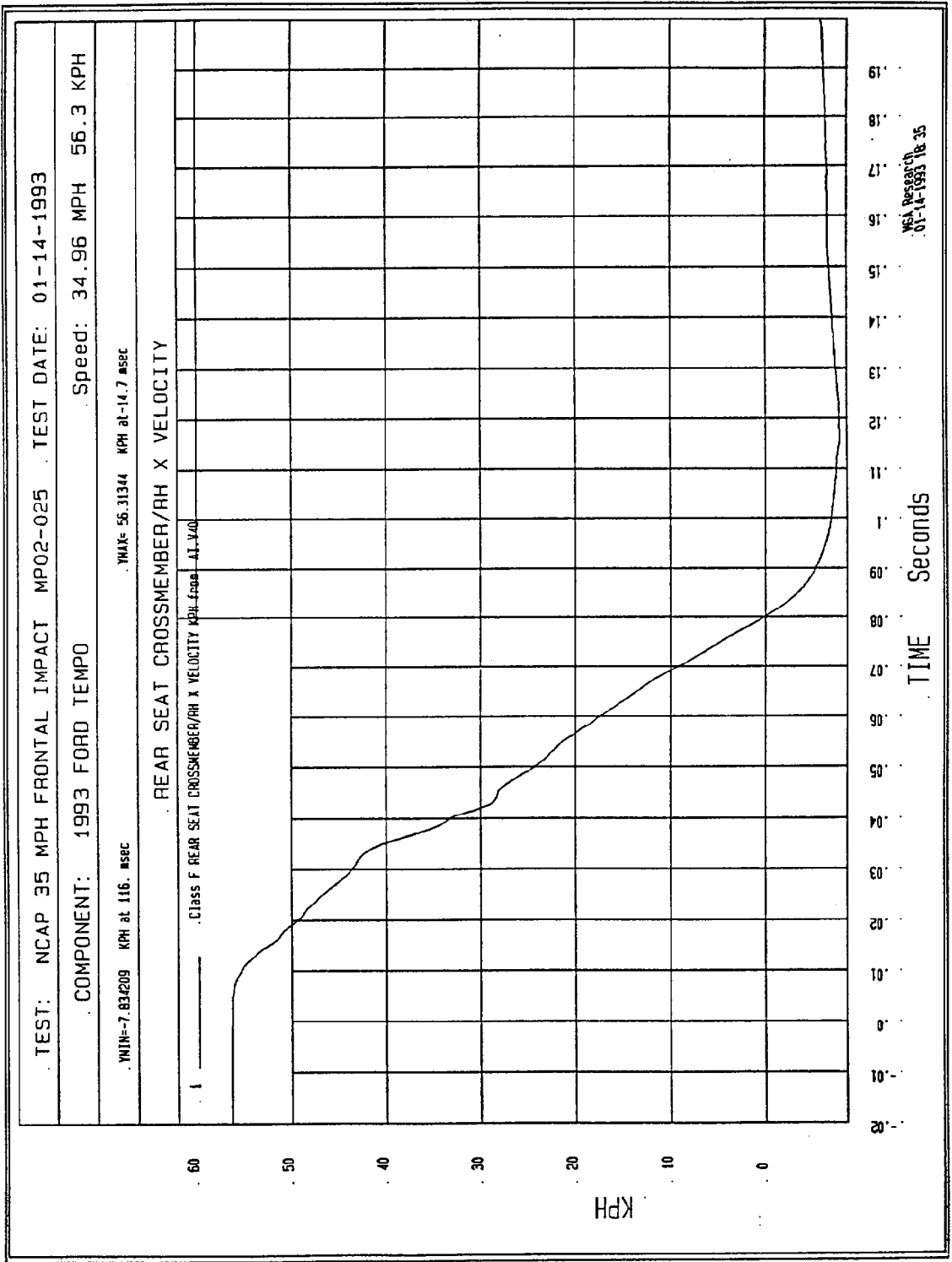


Figure B-2 - Right Rear Seat Crossmember X Velocity vs. Time

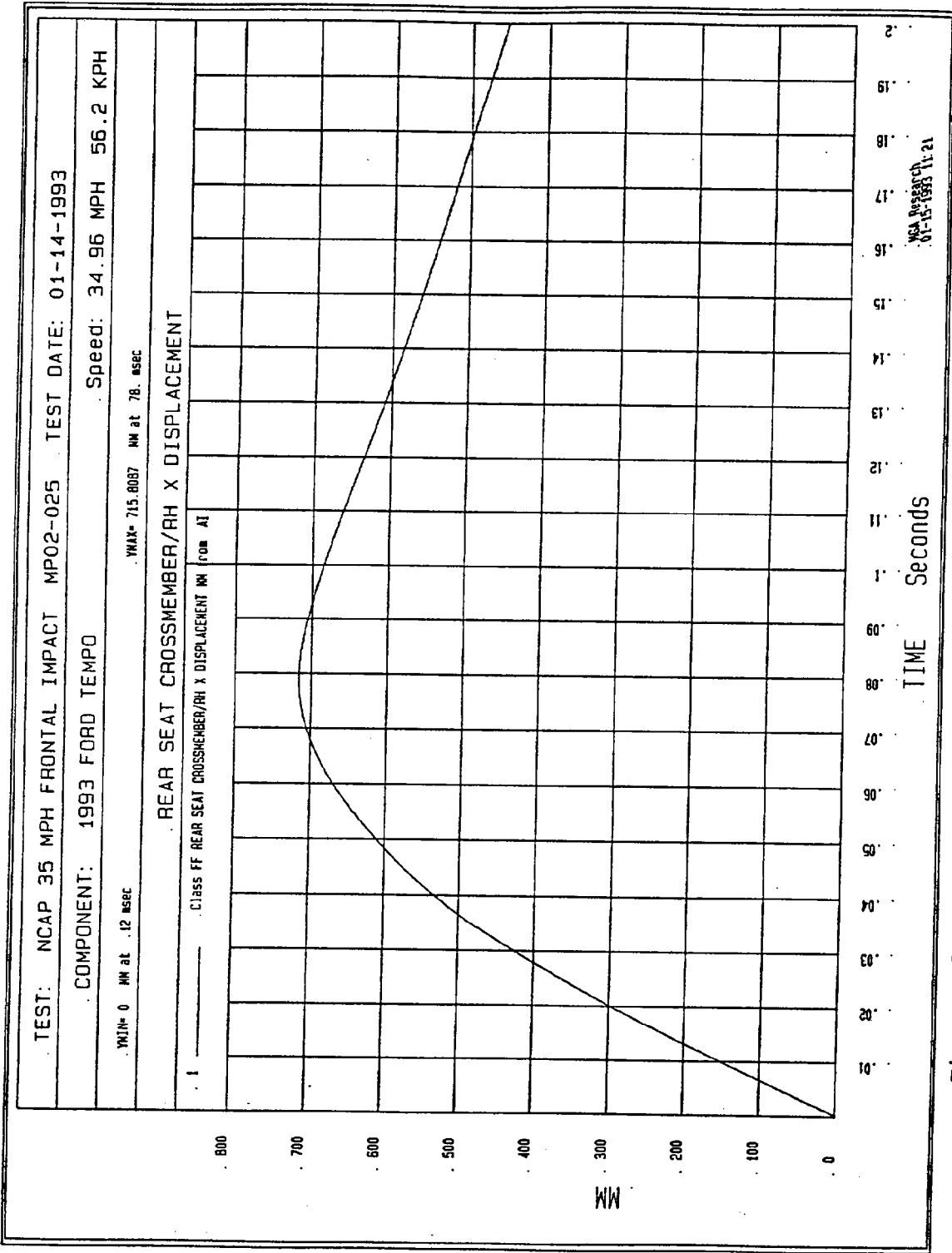


Figure B-3 - Right Rear Seat Crossmember X Displacement vs. Time

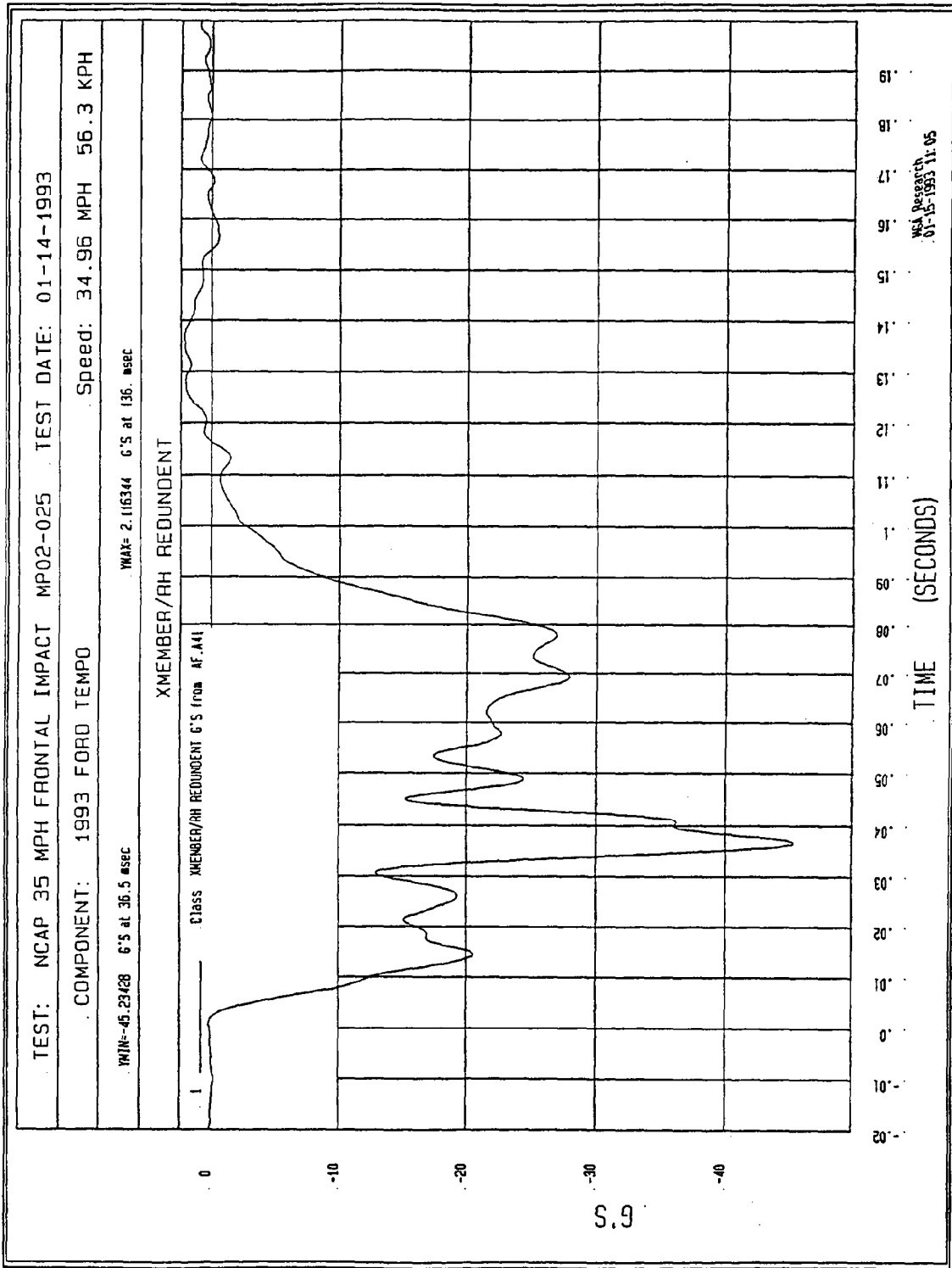


Figure B-4 - Right Rear Seat Crossmember X Redundant Acceleration vs. Time

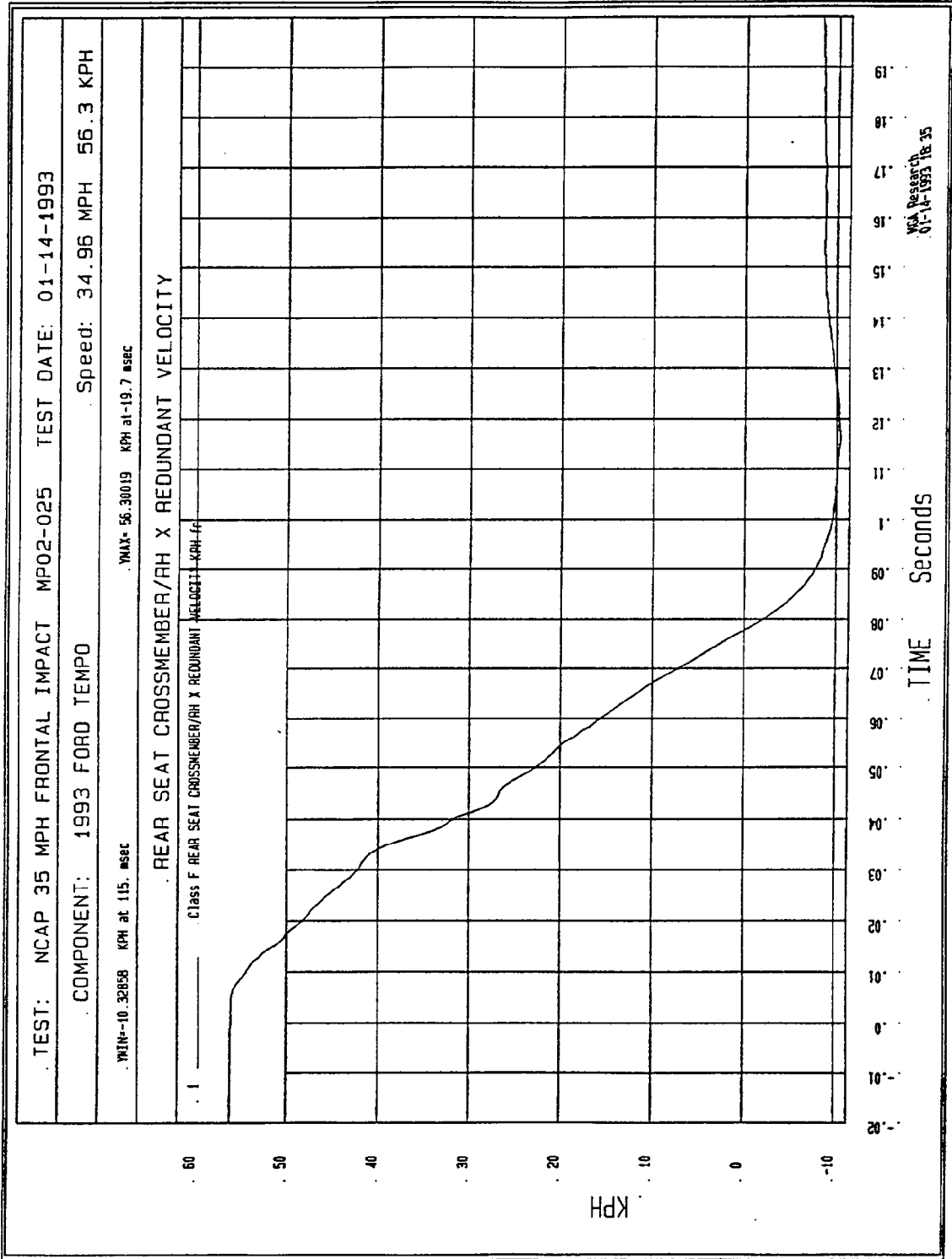


Figure B-5 - Right Rear Seat Crossmember X Redundant Velocity vs. Time

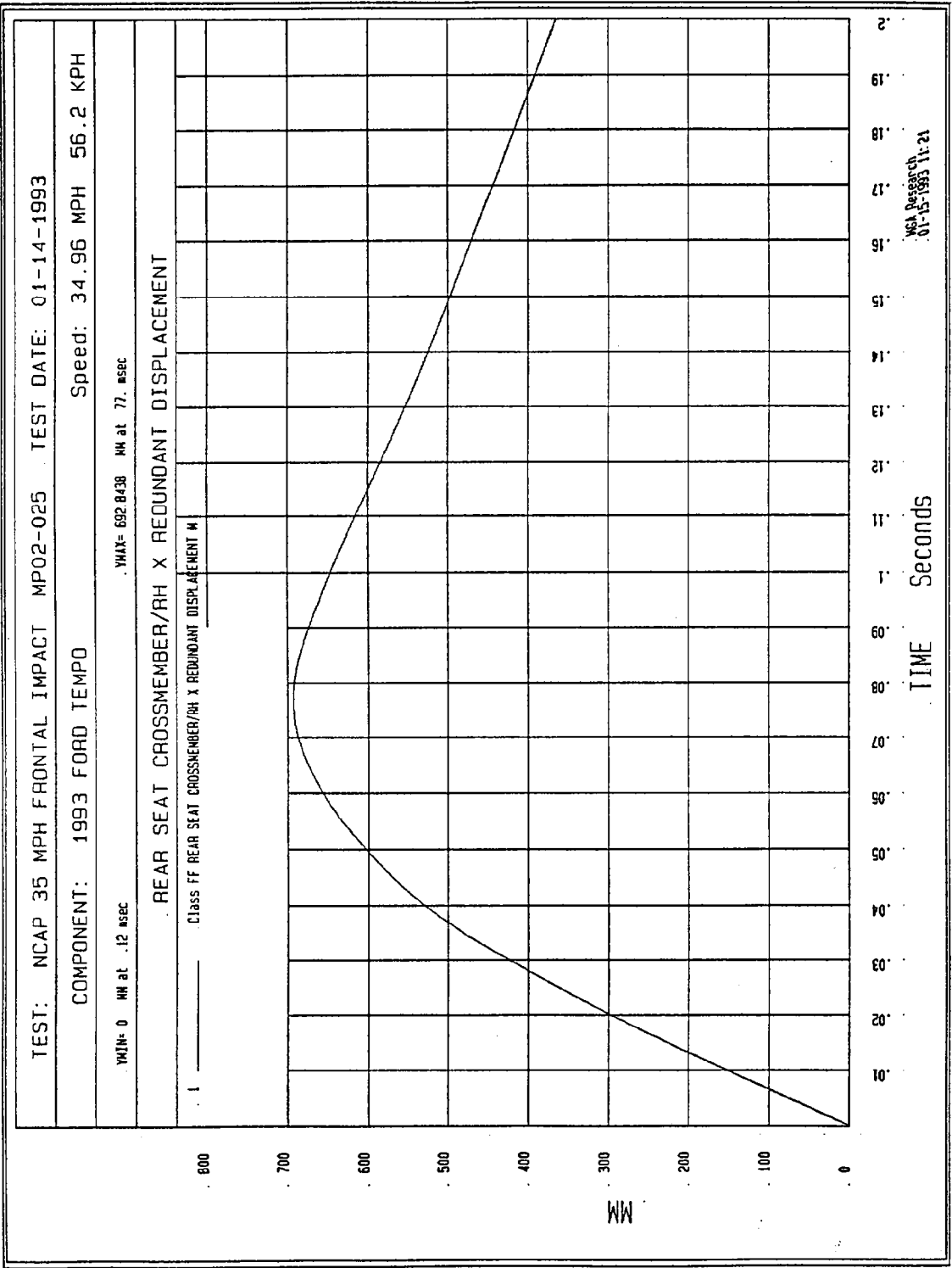
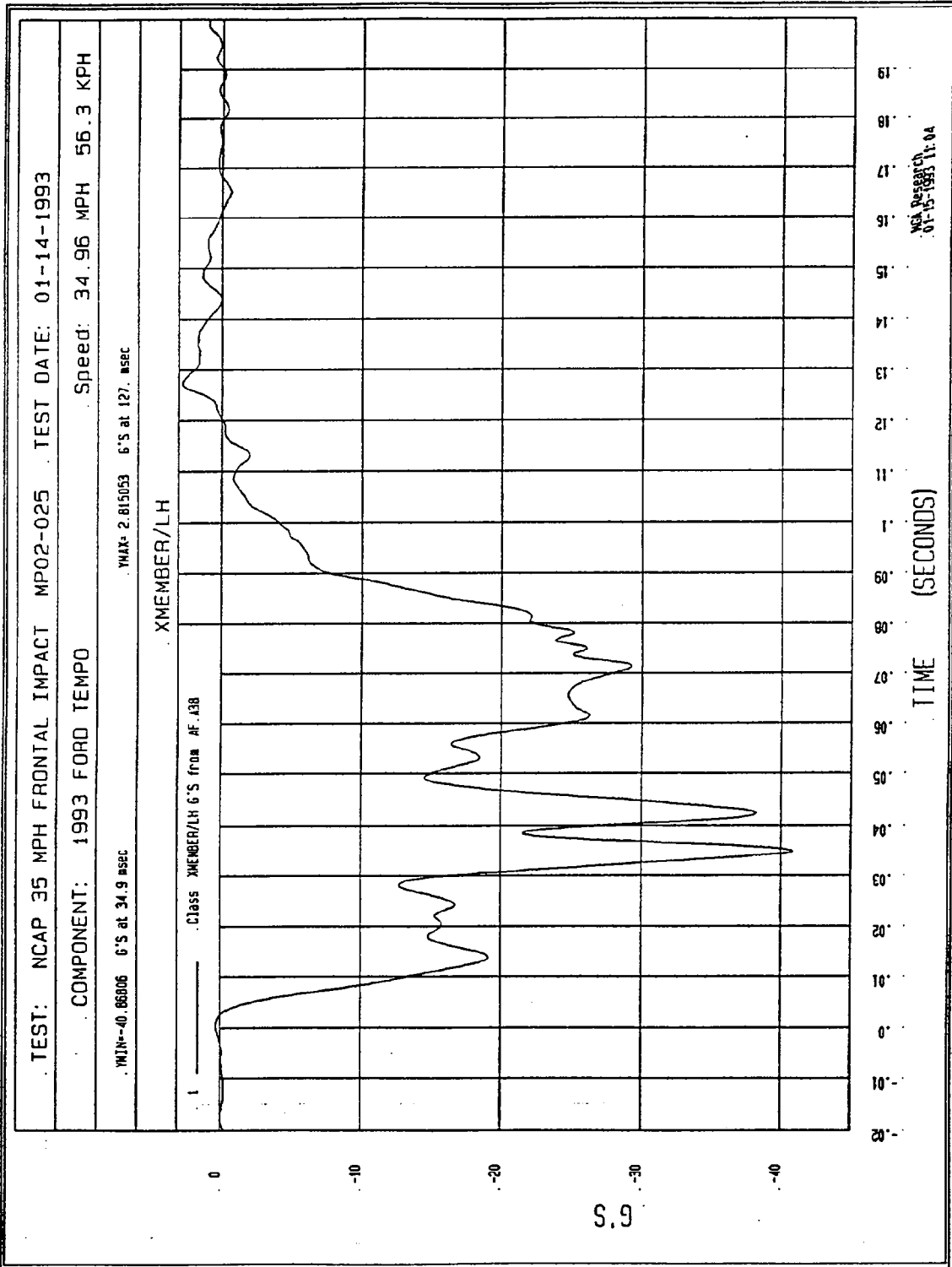


Figure B-6 - Right Rear Seat Crossmember X Redundant Displacement vs. Time



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

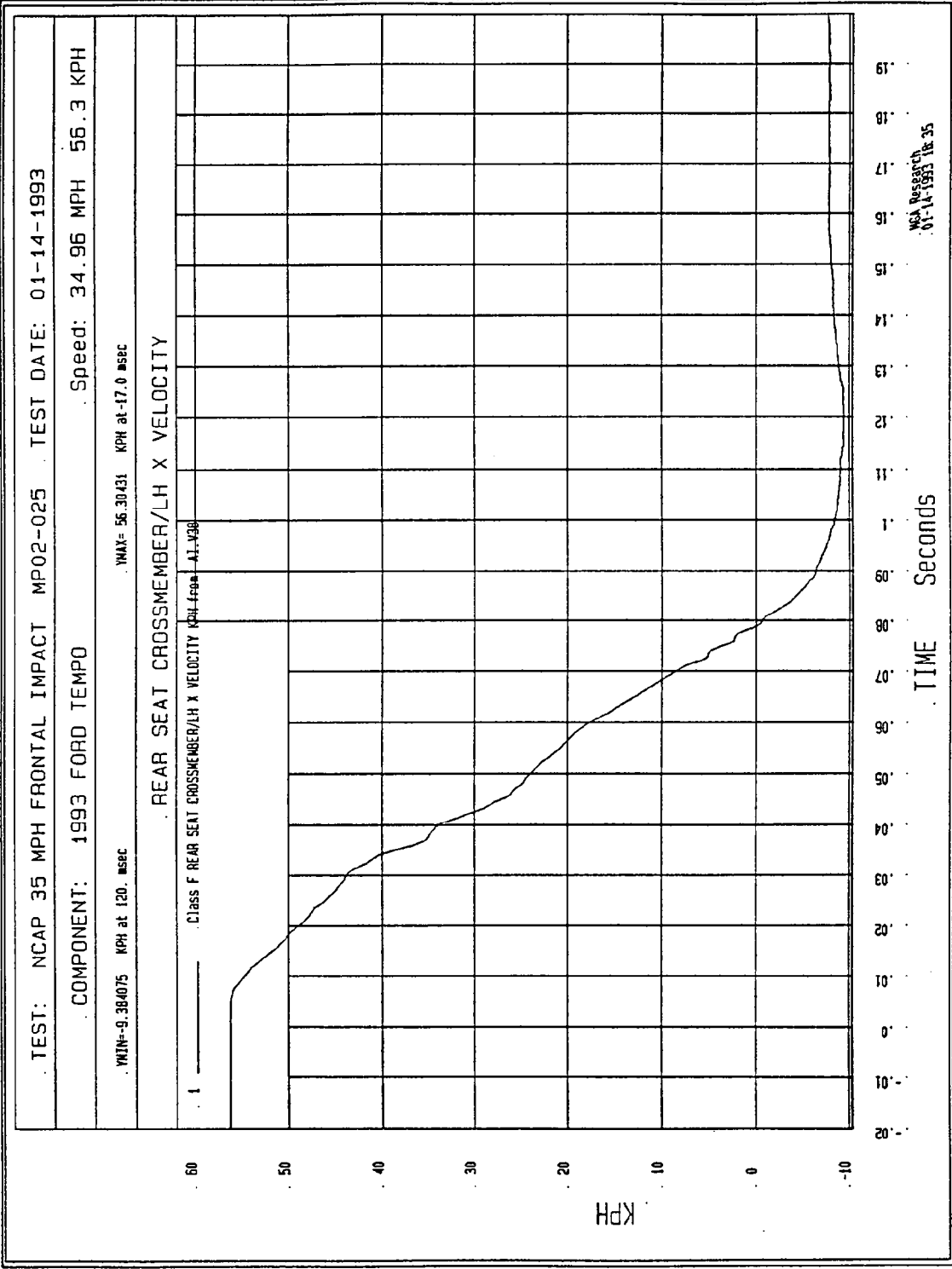


Figure B-8 - Left Rear Seat Crossmember X Velocity vs. Time

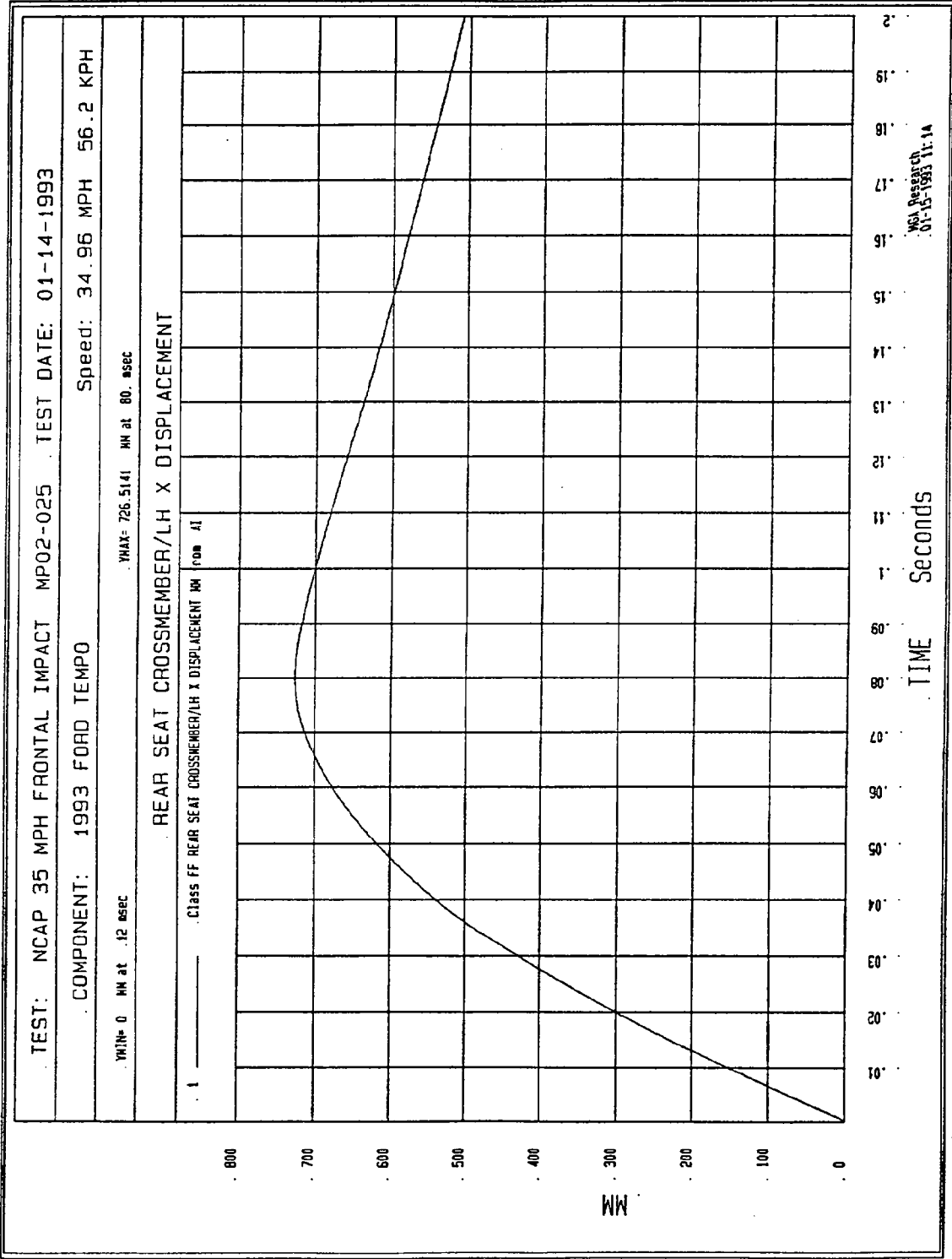


Figure B-9 - Left Rear Seat Crossmember X Displacement vs. Time

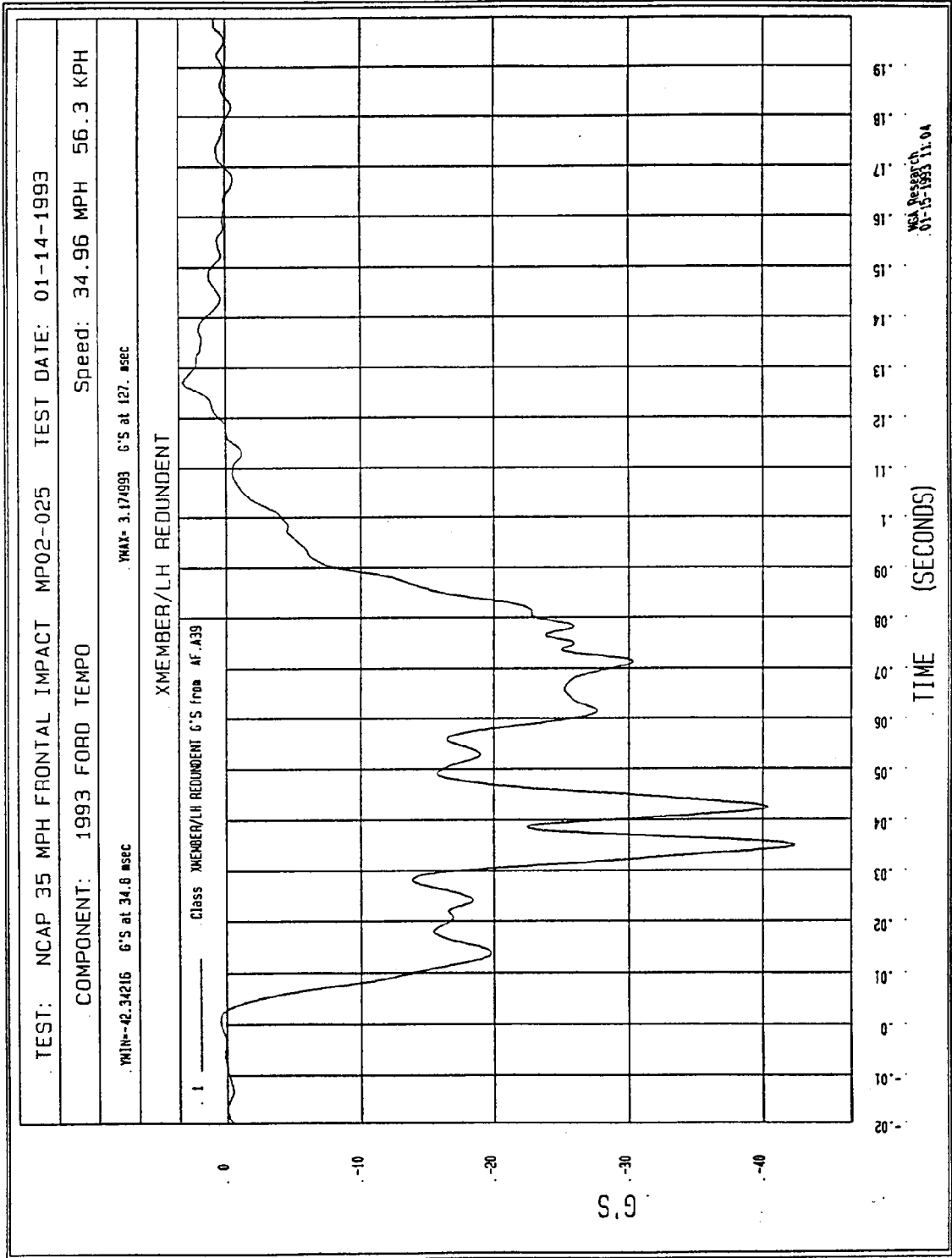


Figure B-10 - Left Rear Seat Crossmember X Redundant Acceleration vs. Time

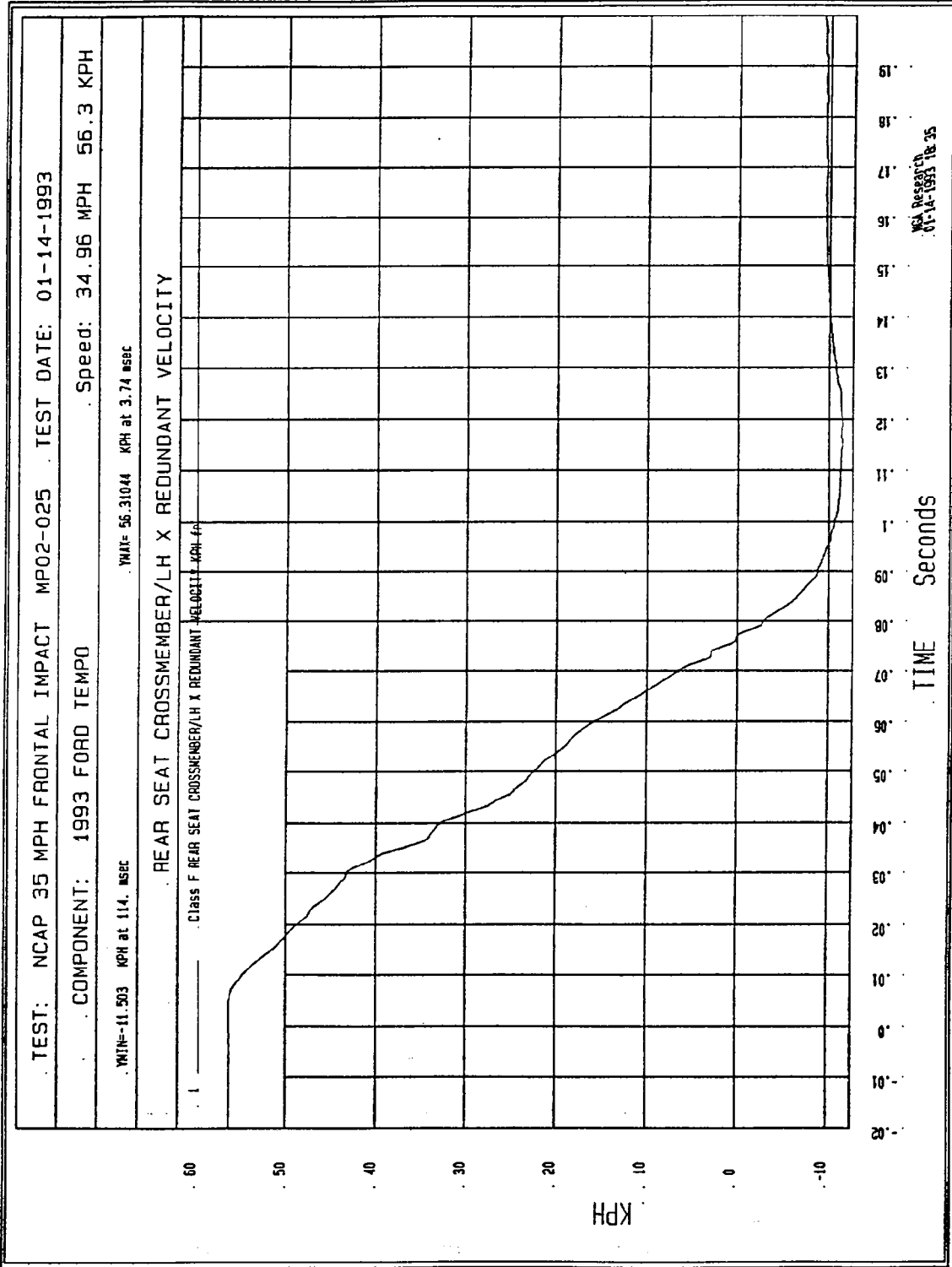


Figure B-11 - Left Rear Seat Crossmember X Redundant Velocity vs. Time

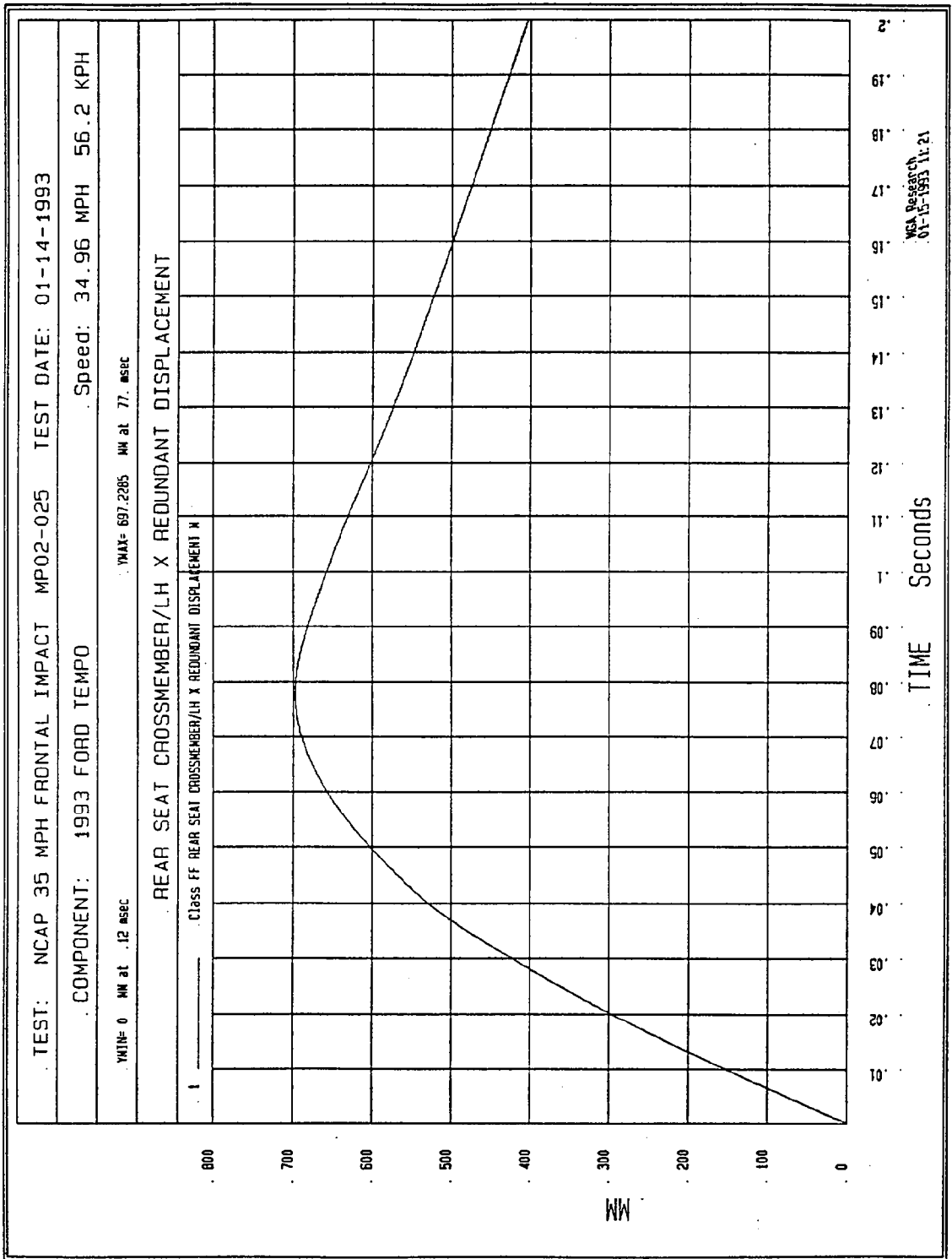


Figure B-12 - Left Rear Seat Crossmember X Redundant Displacement vs. Time

NO VALID DATA RECORDED

B-13

Figure B-13 - Upper Engine Block X Acceleration vs. Time

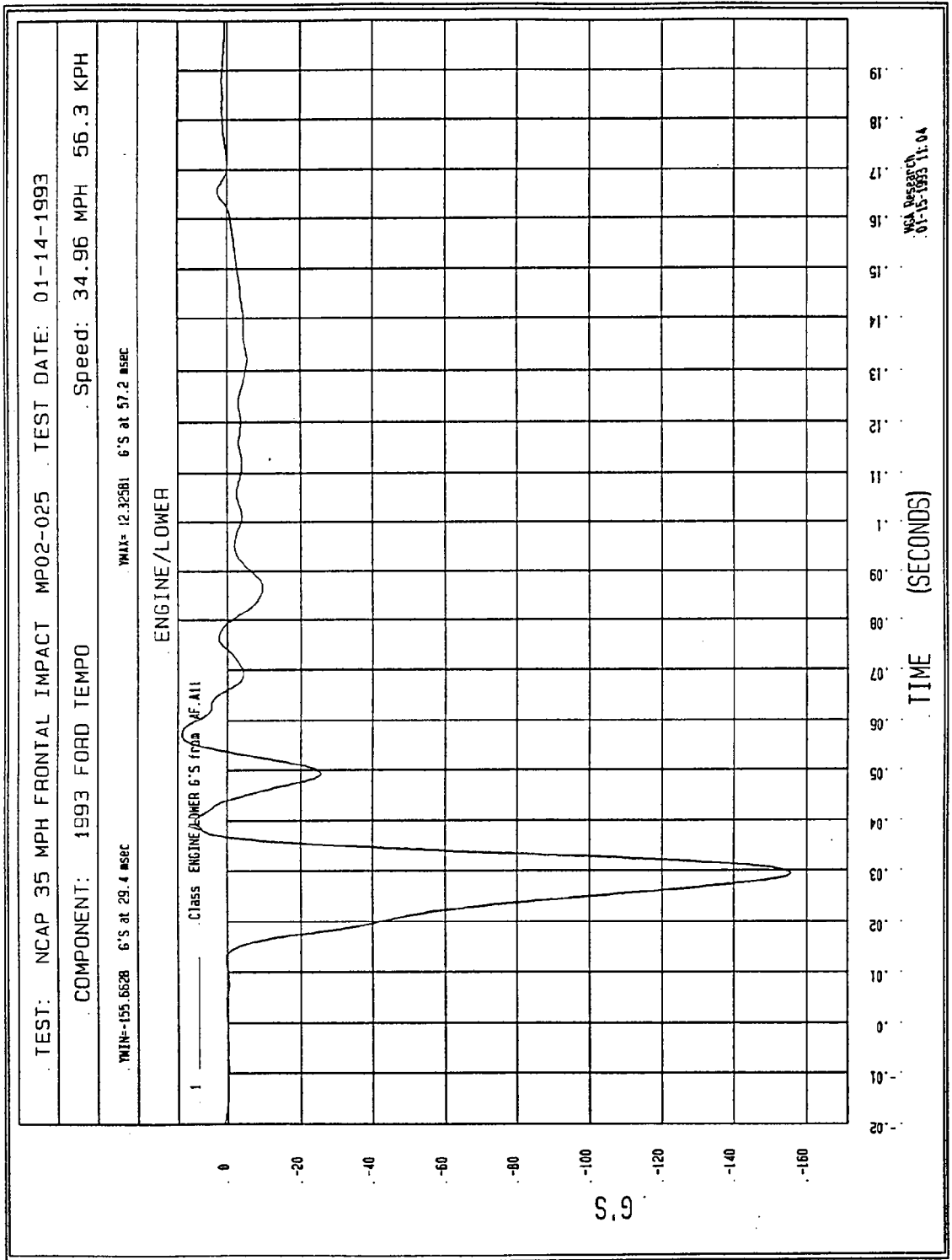


Figure B-14 - Bottom Engine Block X Acceleration vs. Time

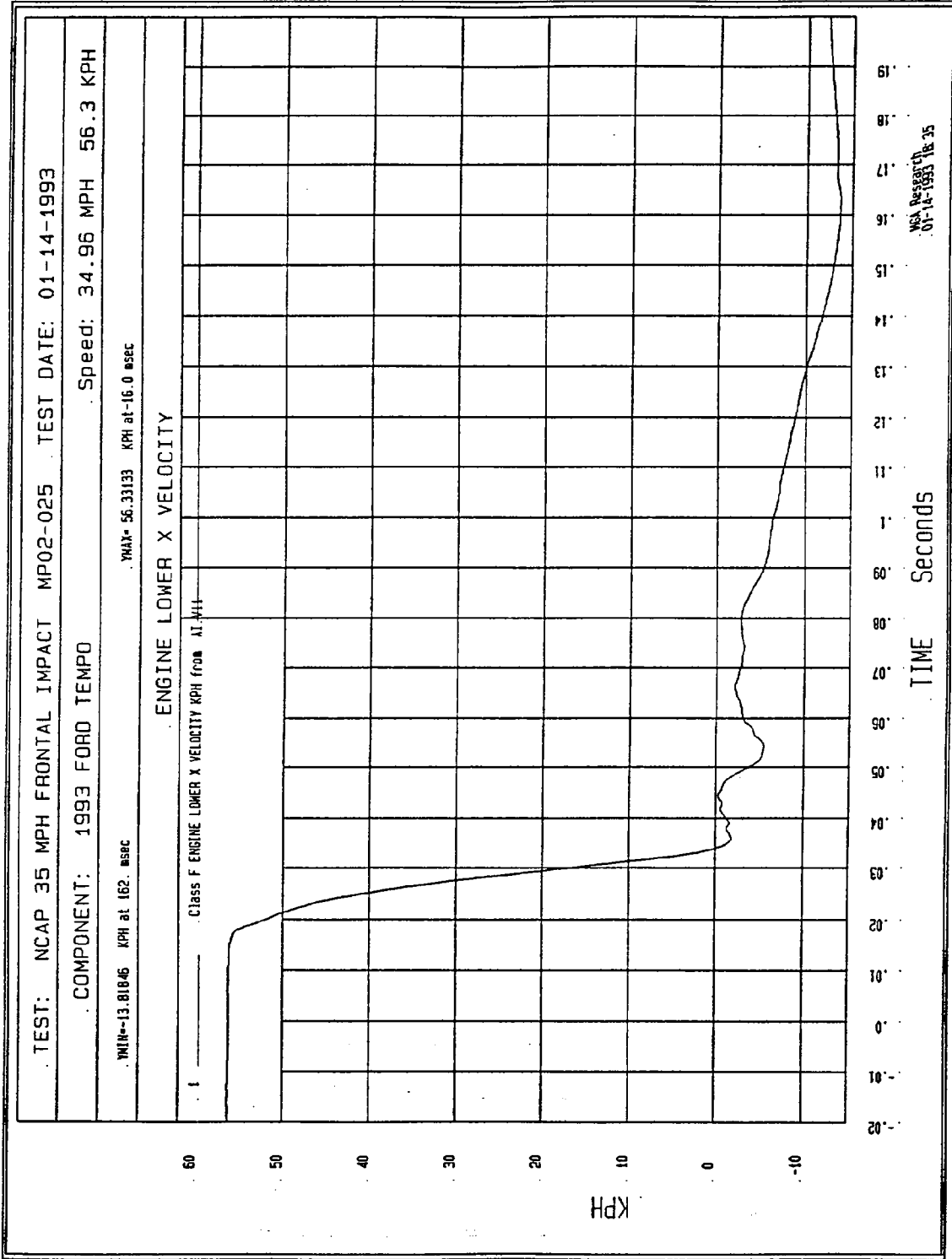


Figure B-15 - Bottom of Engine Block X Velocity vs. Time

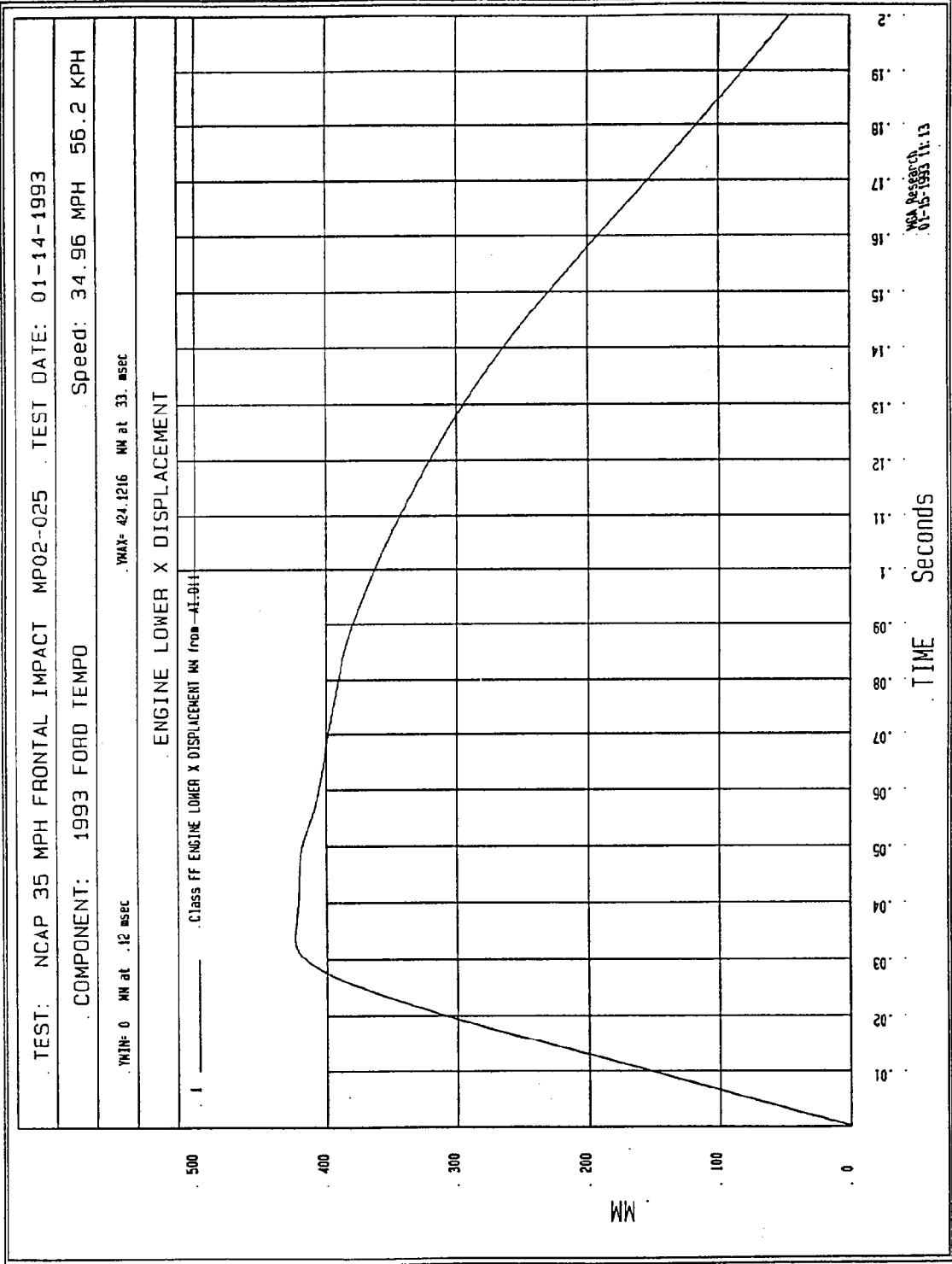


Figure B-16 - Bottom of Engine Block X Displacement vs. Time

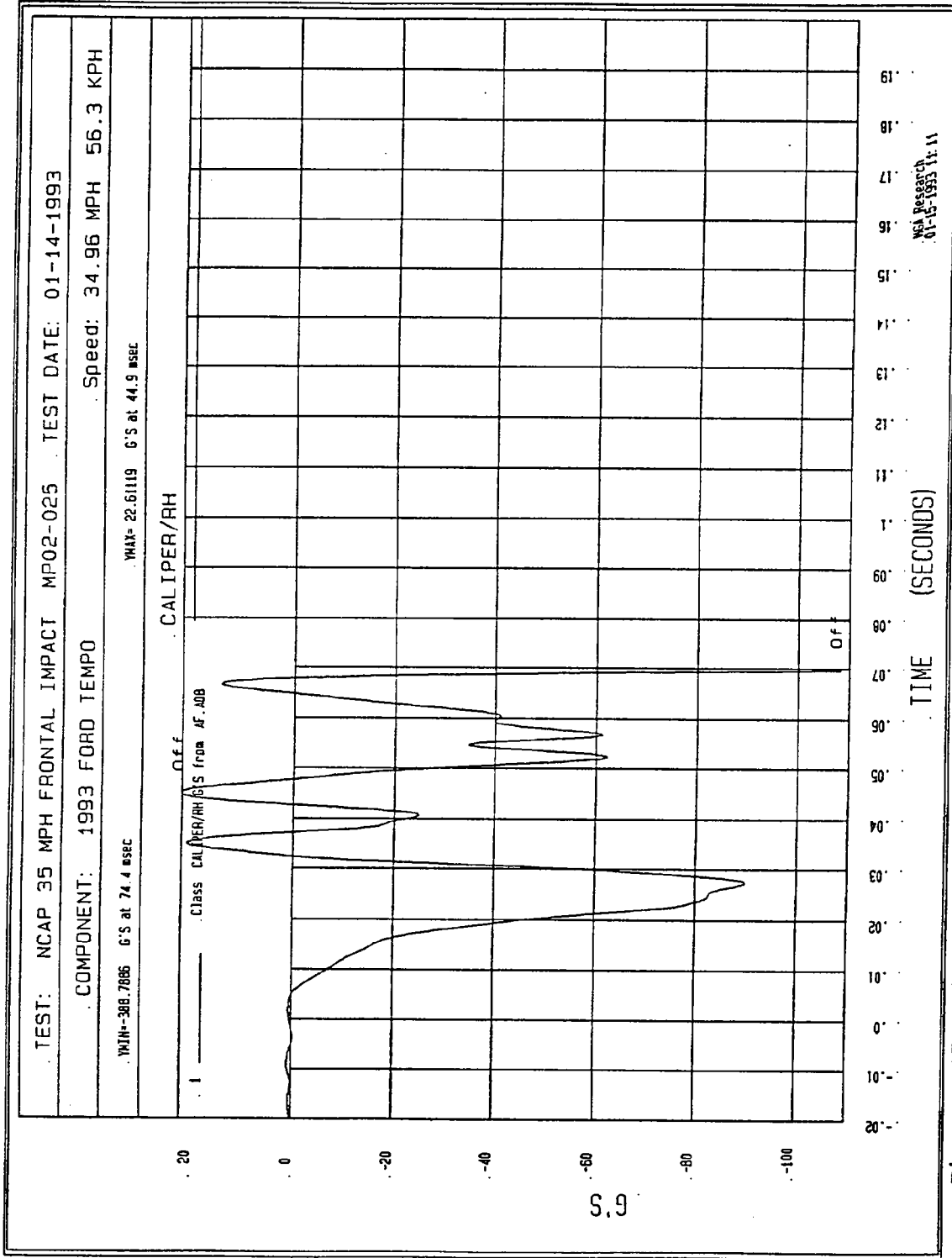


Figure B-17 - Right Front Disc Brake Caliper X Acceleration vs. Time
Data Wire Cut During Impact at Approx. 70 msec.

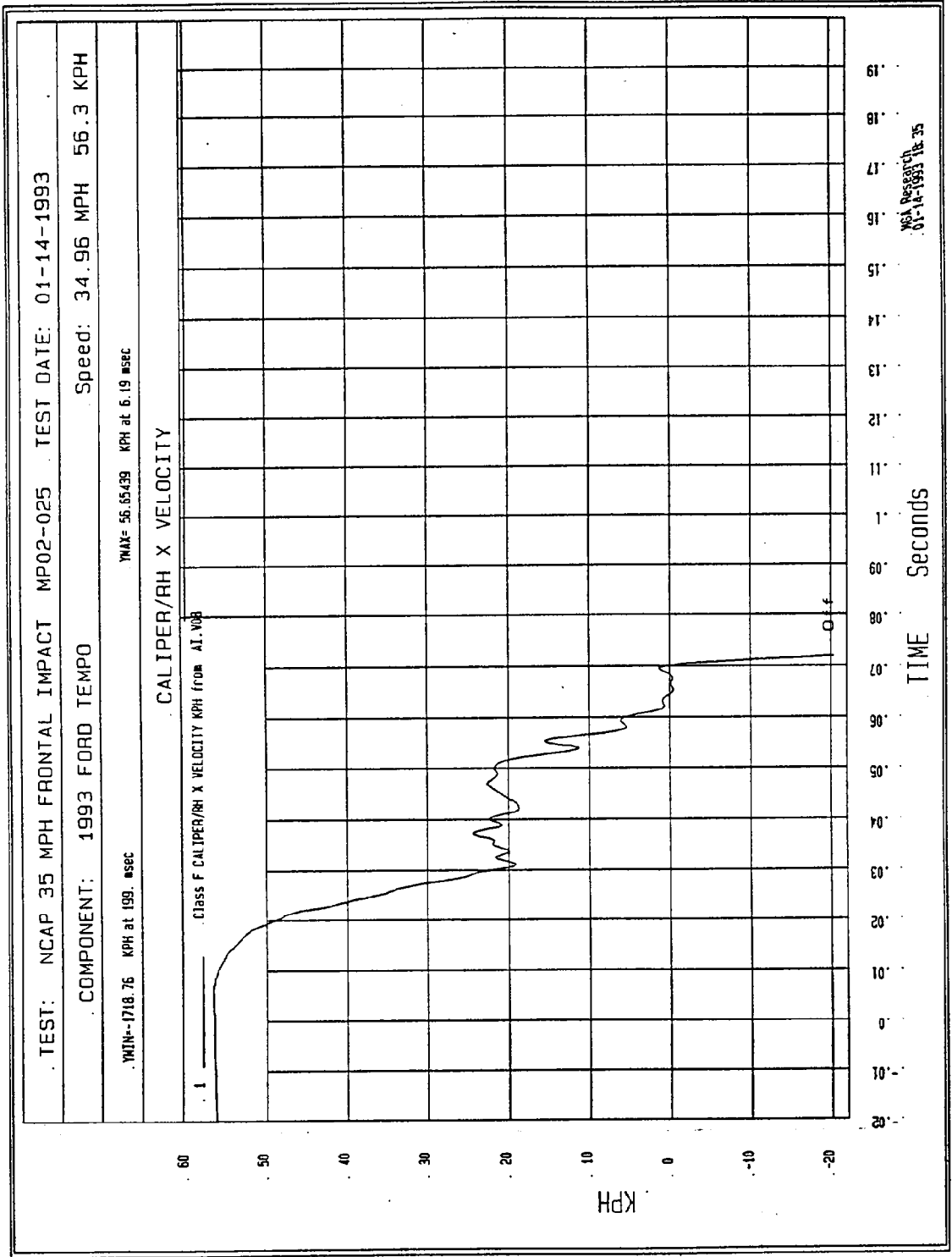


Figure B-18 - Right Front Disc Brake Caliper X Velocity vs. Time
Data Wire Cut During Impact at Approx. 70 msec.

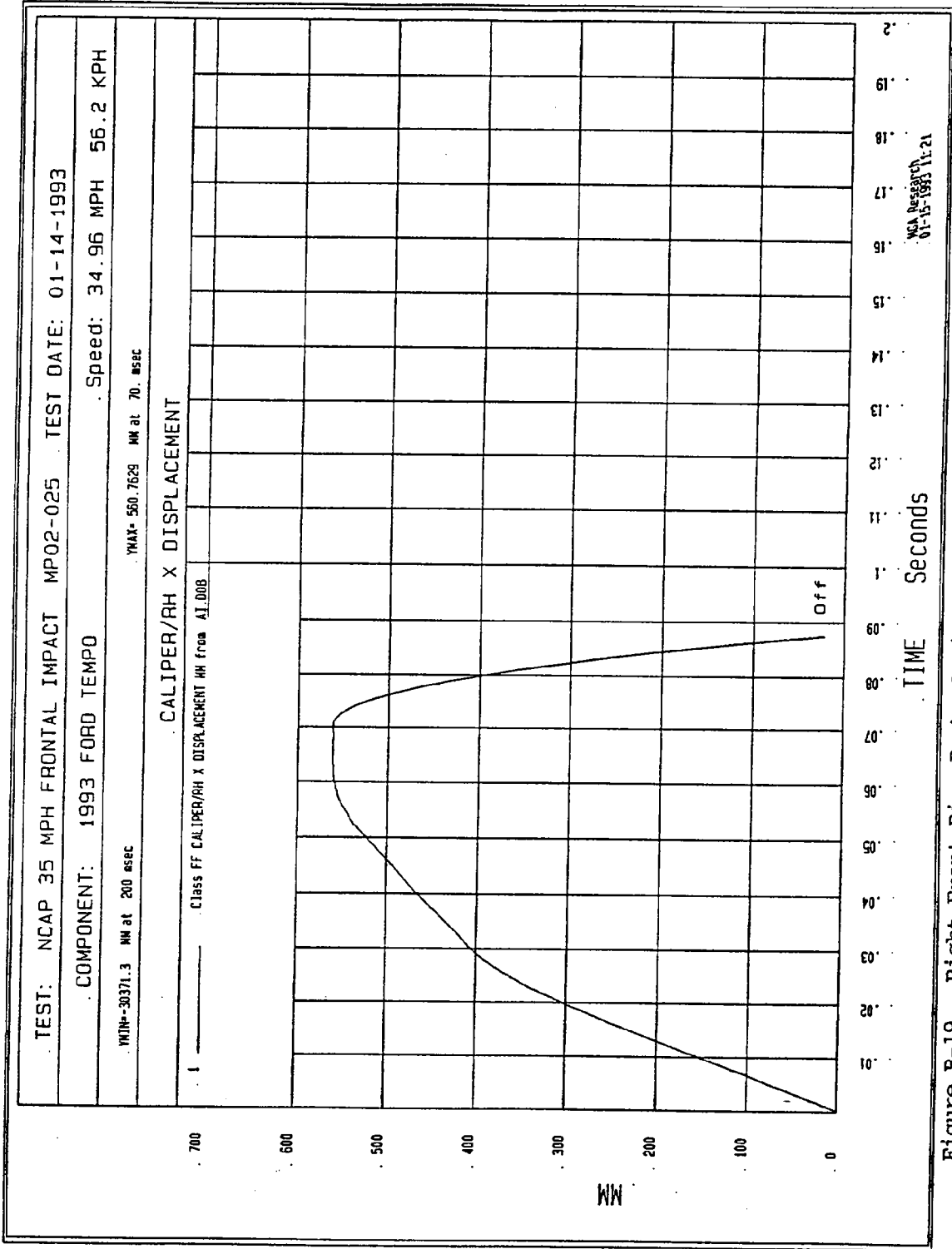
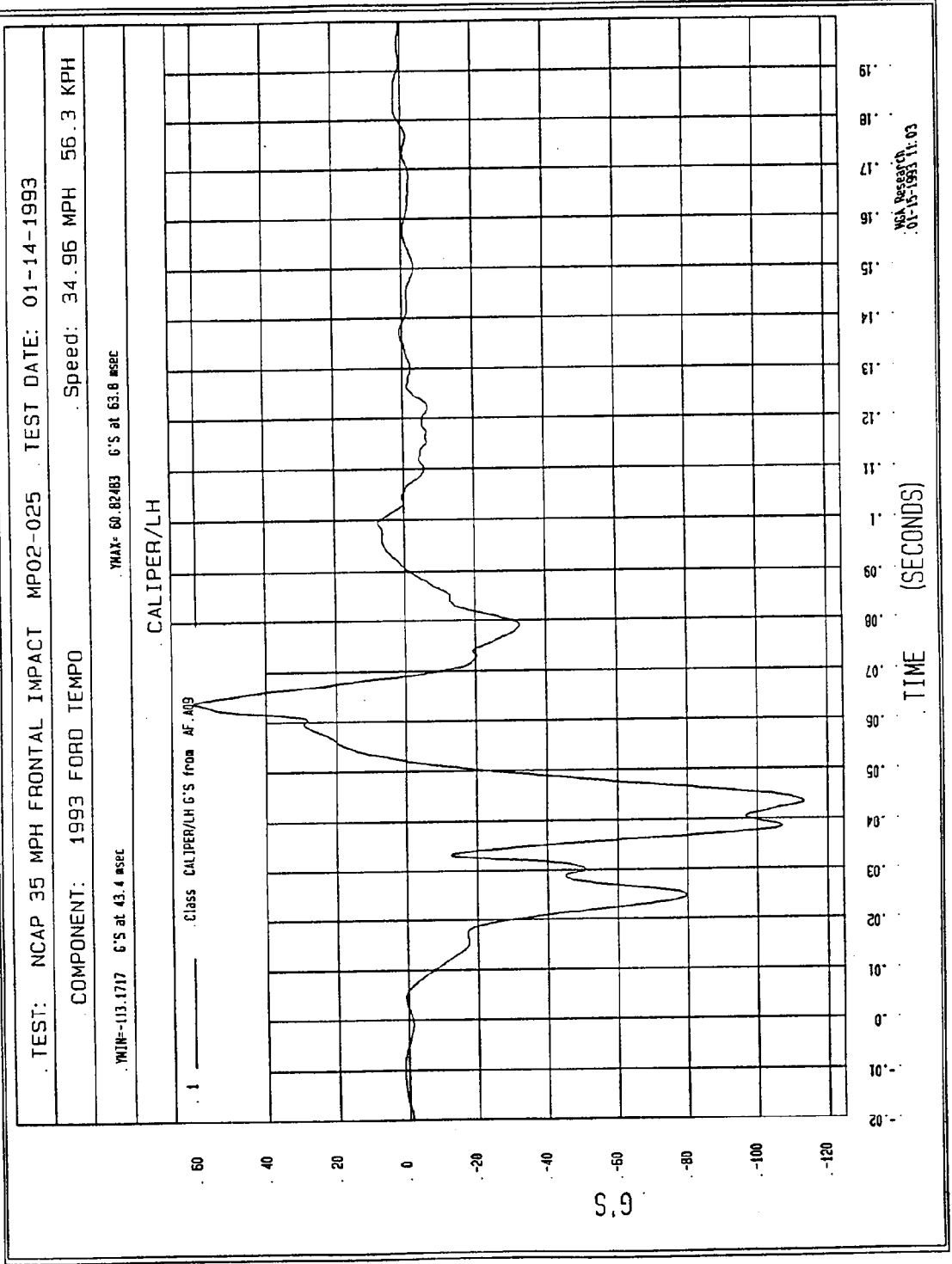


Figure B-19 - Right Front Disc Brake Caliper X Displacement vs. Time
Data Wire Cut During Impact at Approx. 70 msec.



B-20

Figure B-20 - Left Front Disc Brake Caliper X Acceleration vs. Time

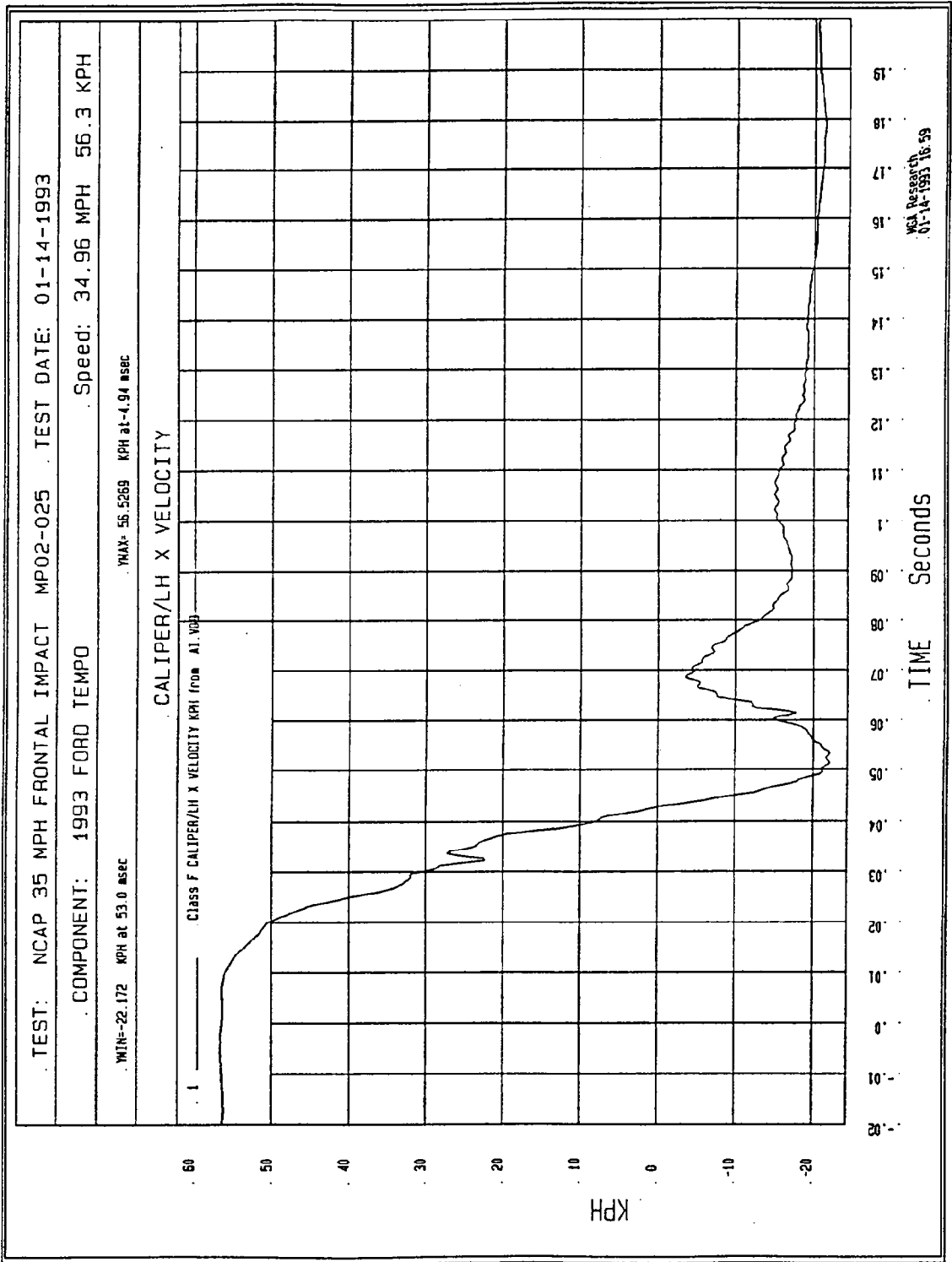


Figure B-21 - Left Front Disc Brake Caliper X Velocity vs. Time

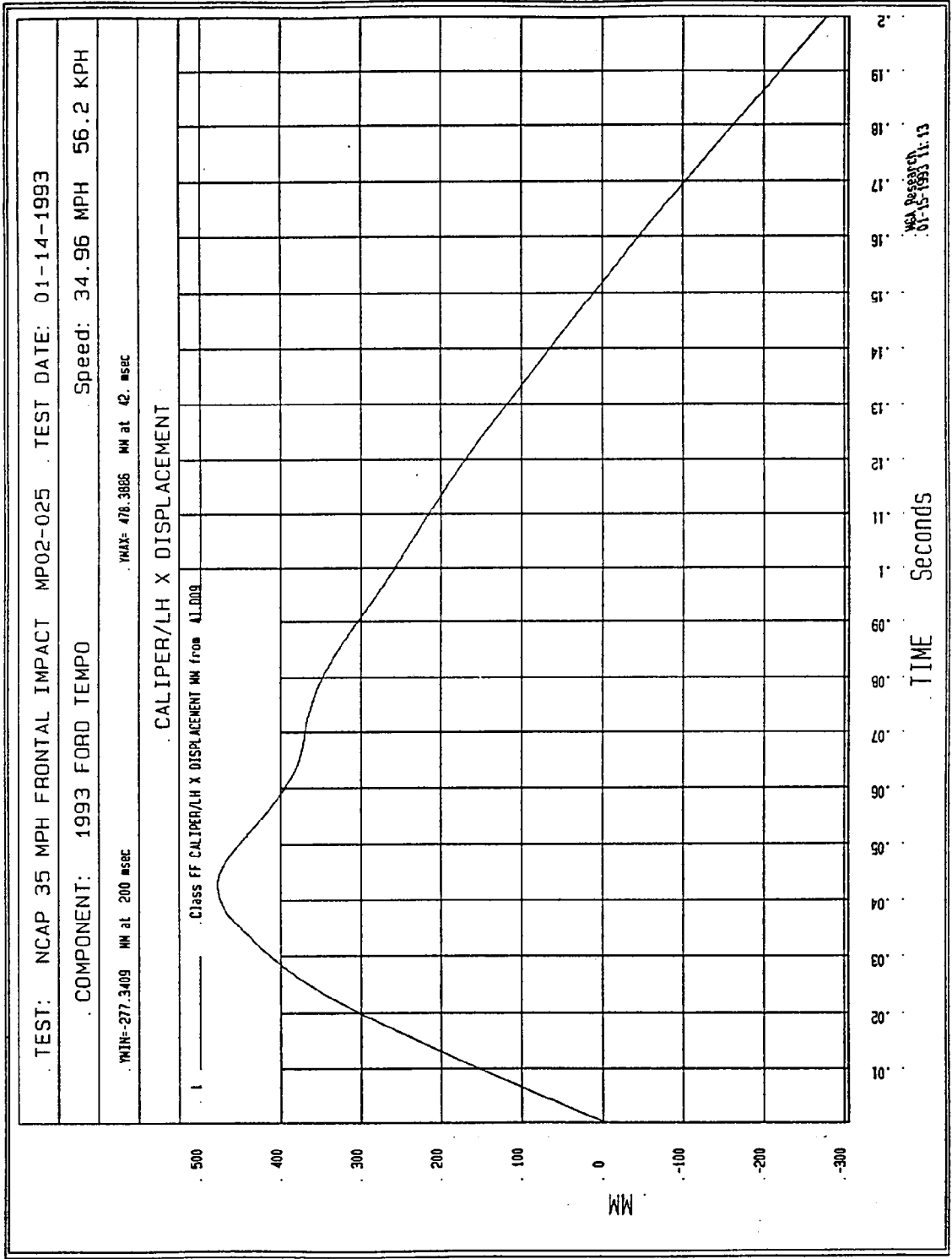


Figure B-22 - Left Front Disc Brake Caliper X Displacement vs. Time

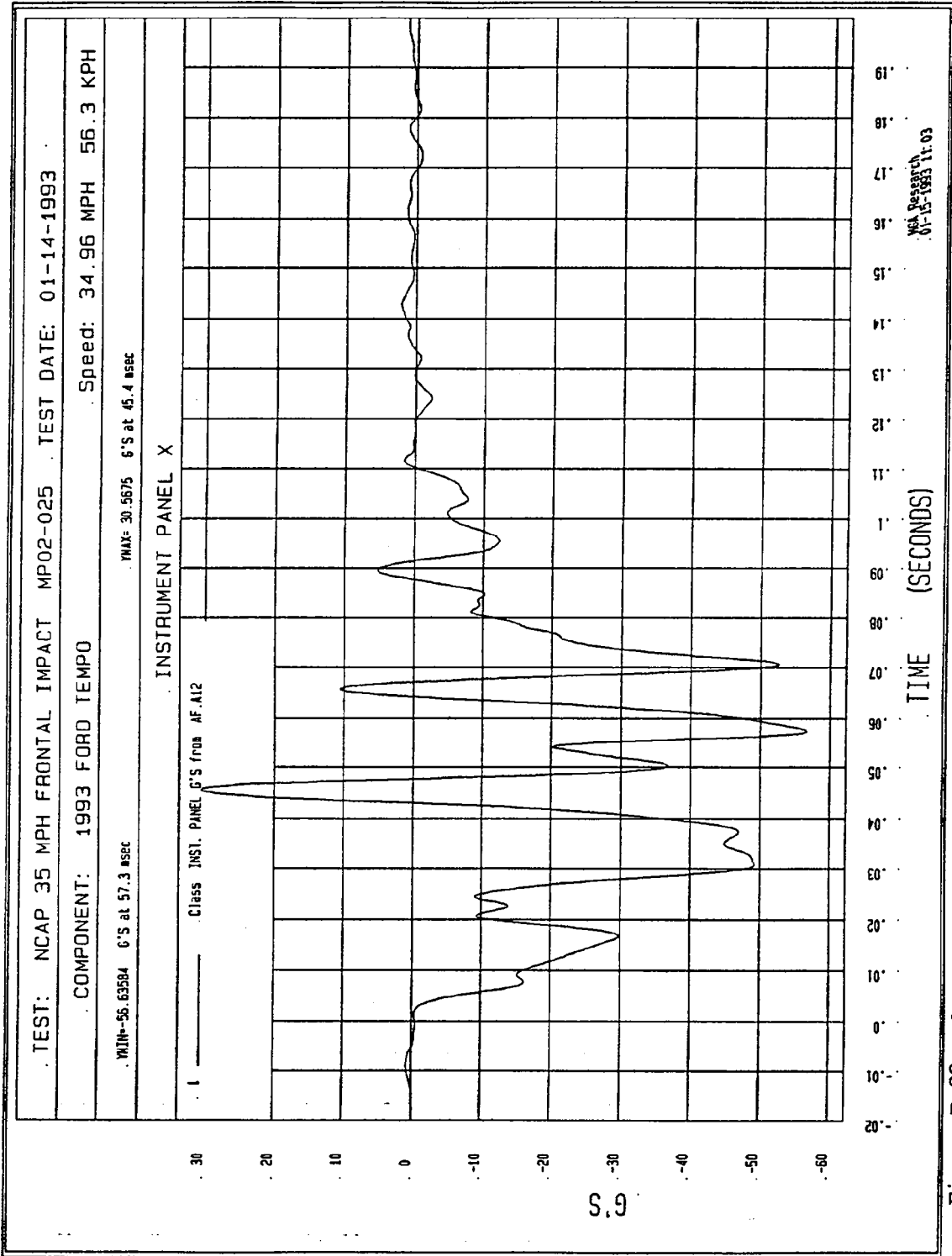
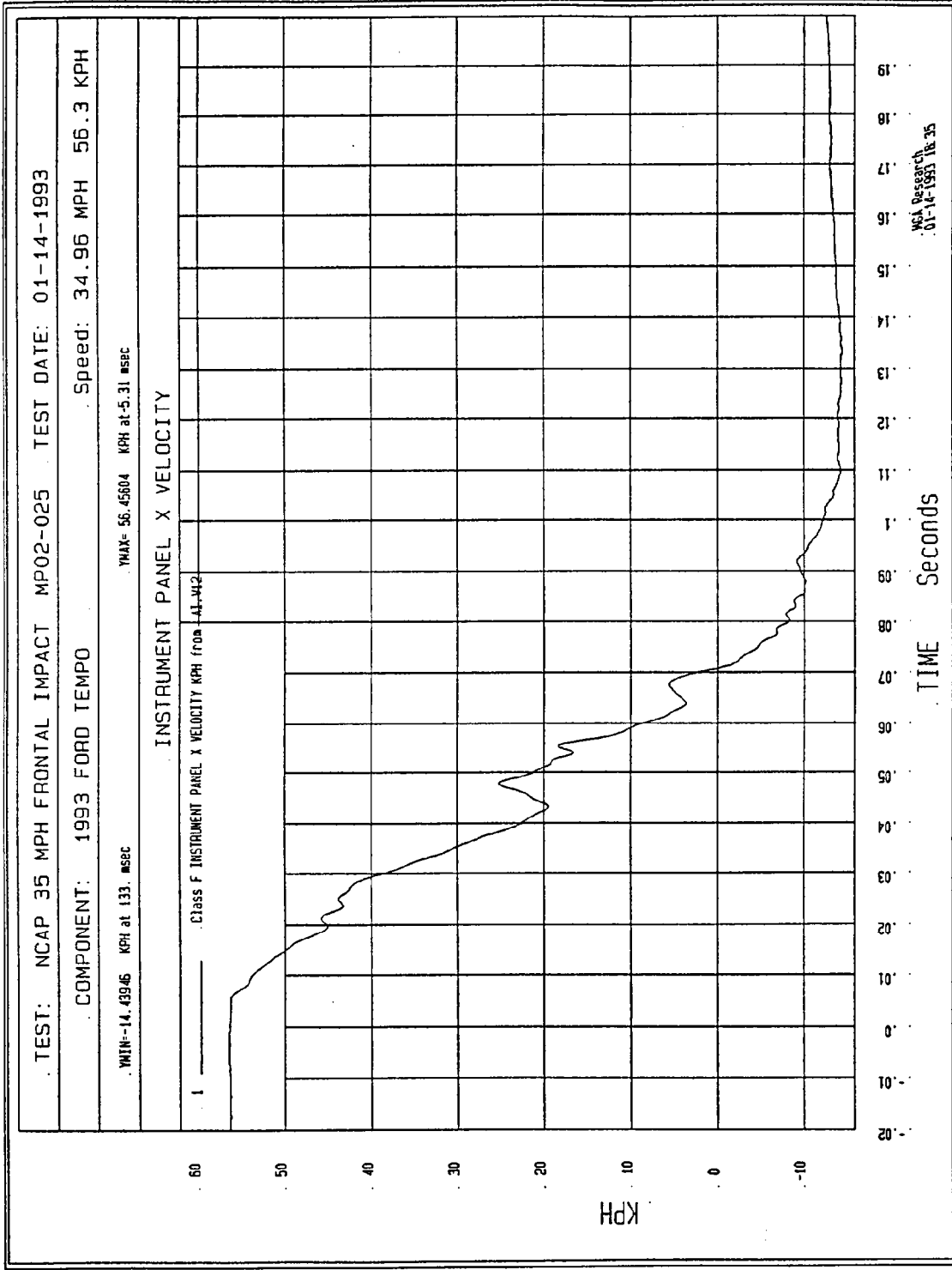


Figure B-23 - Center of Instrument Panel Top Surface X Acceleration vs. Time



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Figure B-24 - Center of Instrument Panel Top Surface X Velocity vs. Time

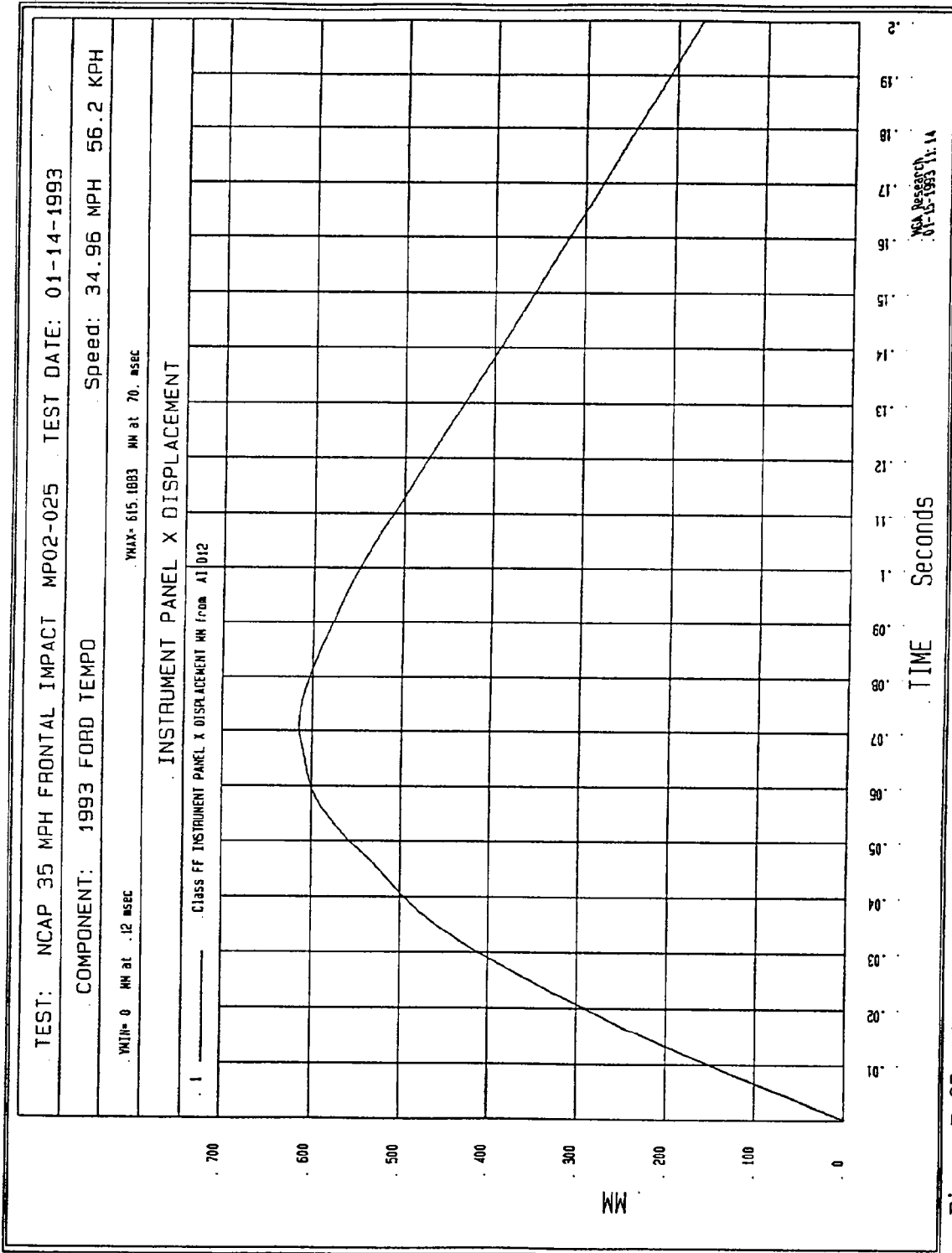


Figure B-25 - Center of Instrument Panel Top Surface X Displacement vs. Time

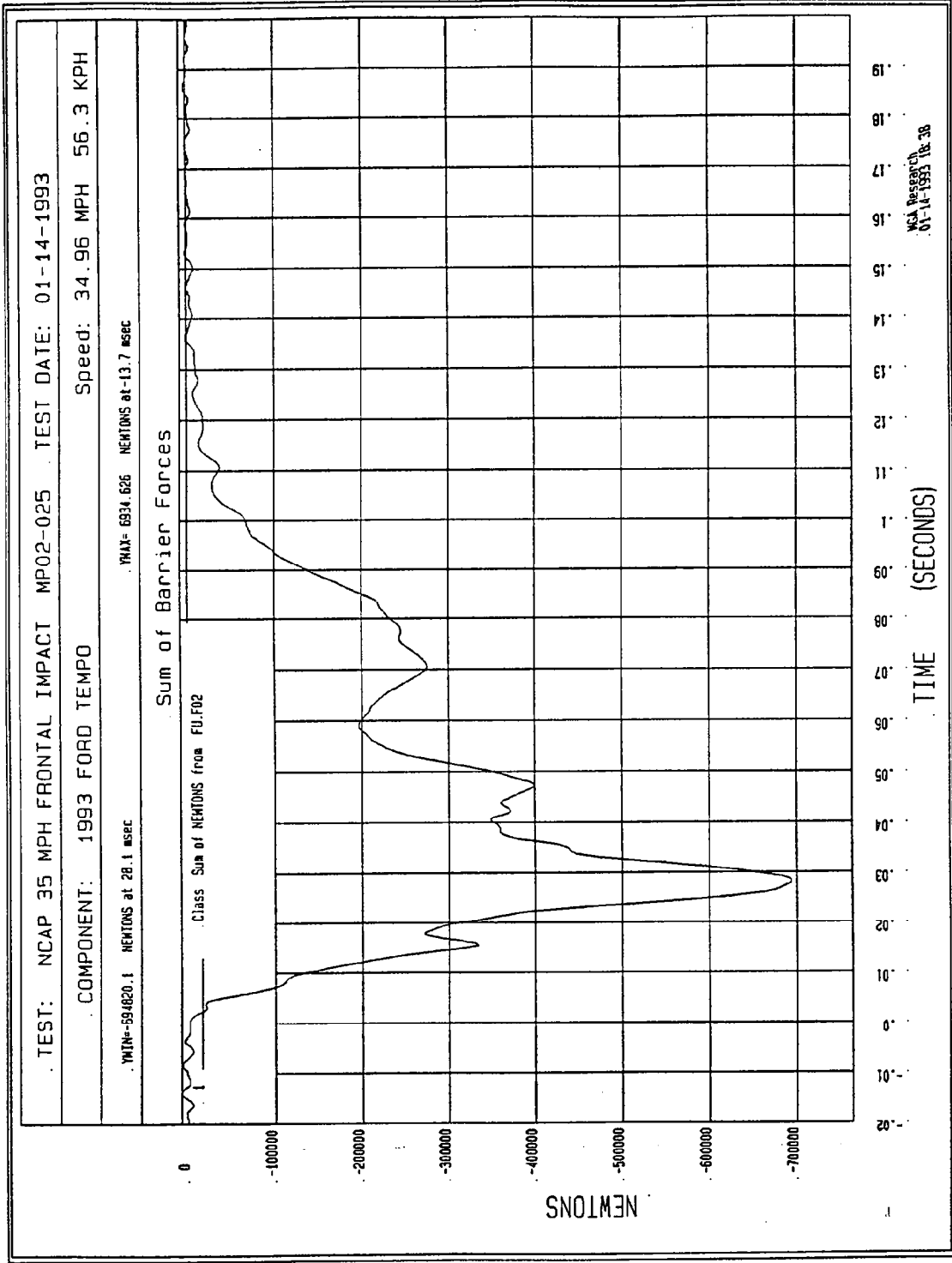


Figure B-26 - Sum of Barrier 6 Load Cells Force vs. Time

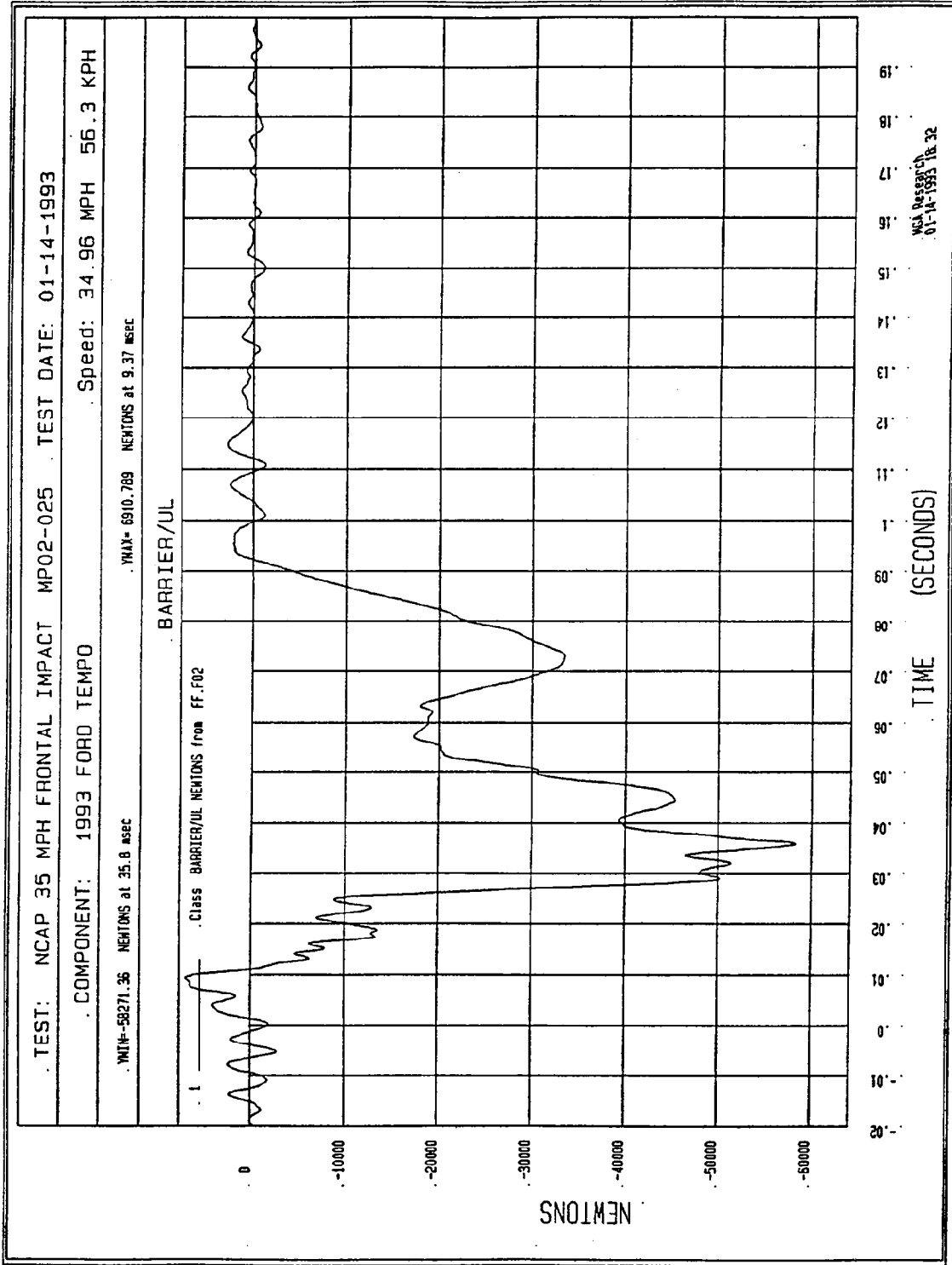


Figure B-27 - Sum of Load Cells Al-B3 Force vs. Time

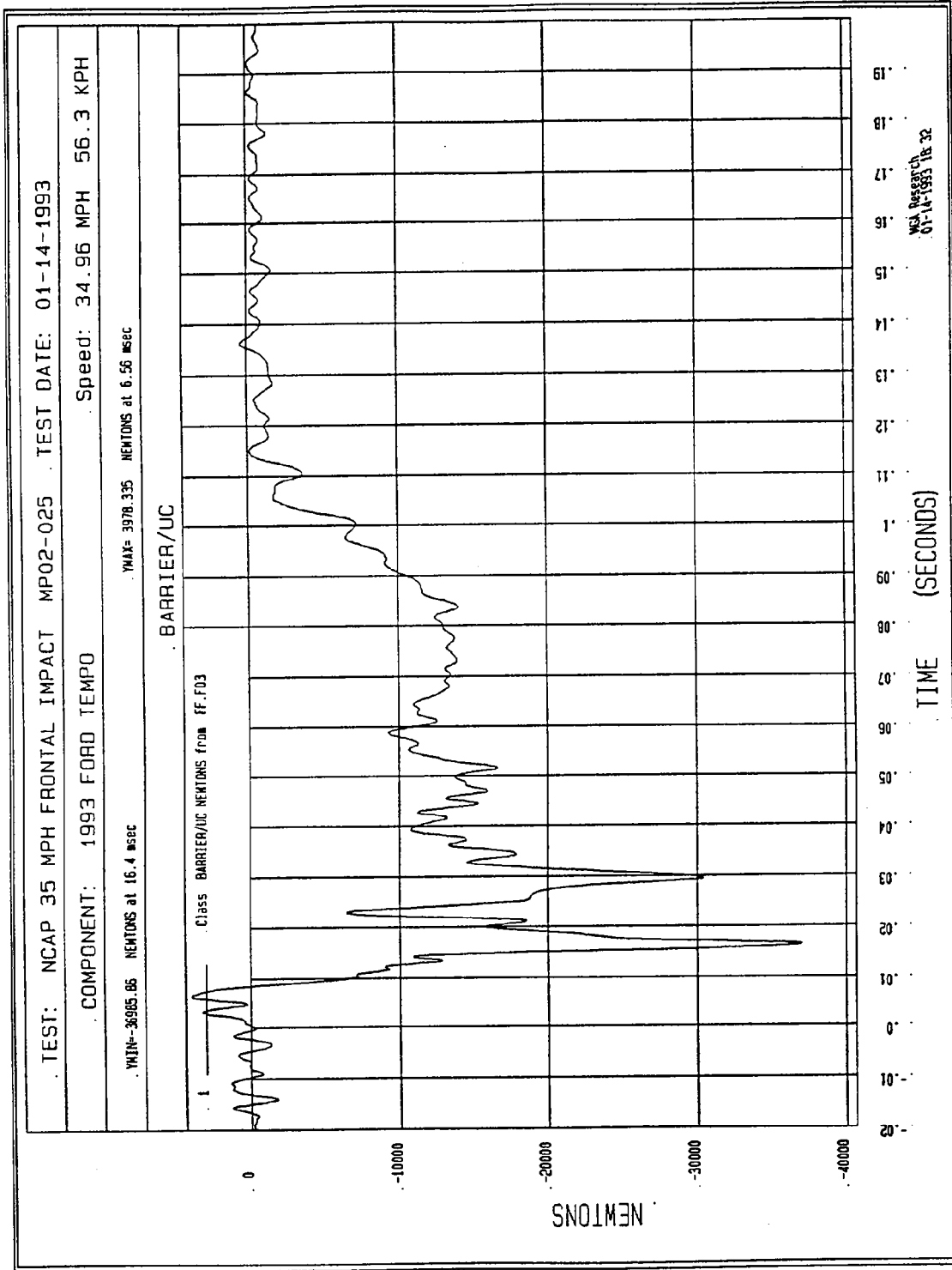


Figure B-28 - Sum of Load Cells A4-B6 Force vs. Time

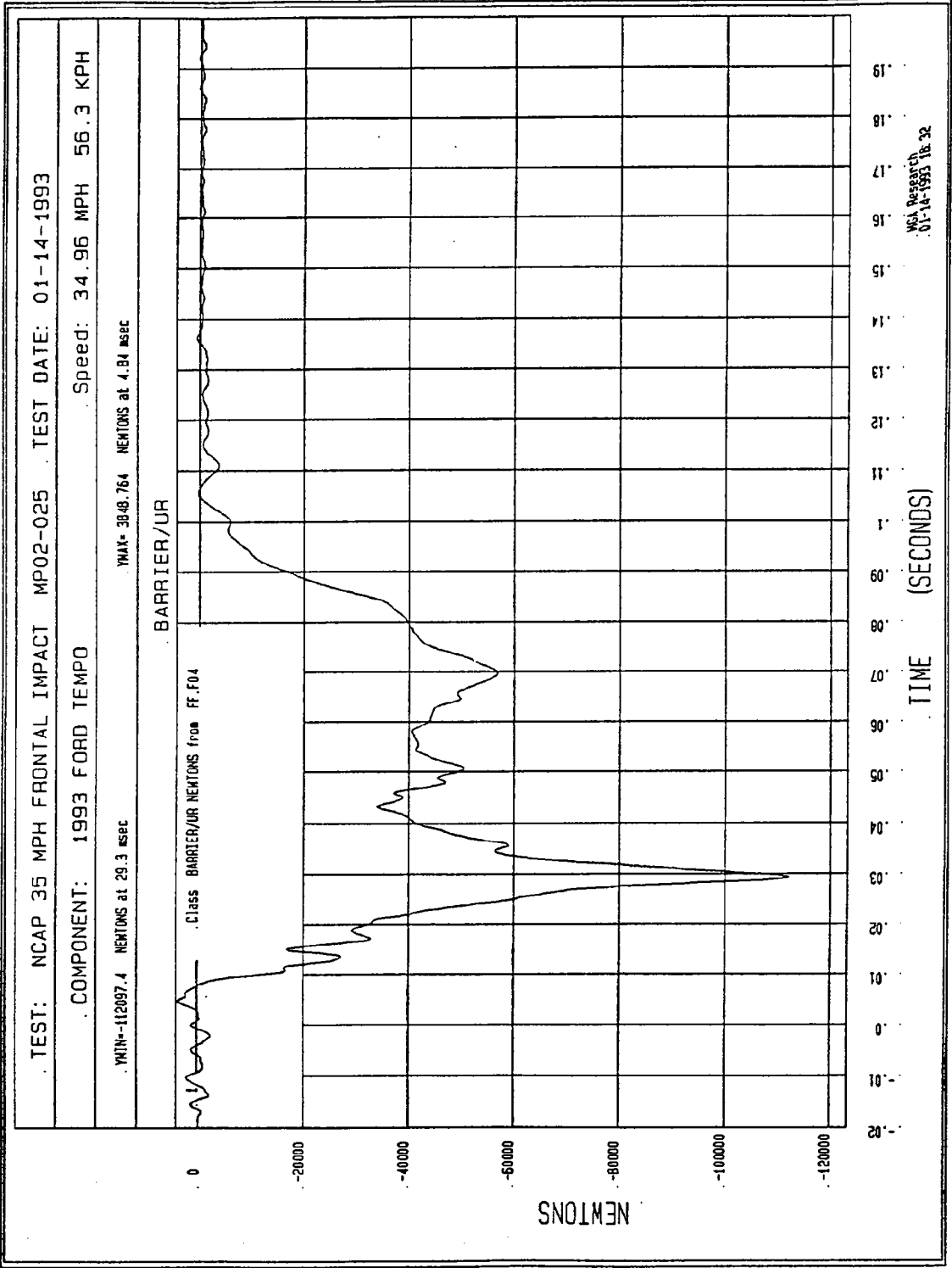


Figure B-29 - Sum of Load Cells A7-B9 Force vs. Time

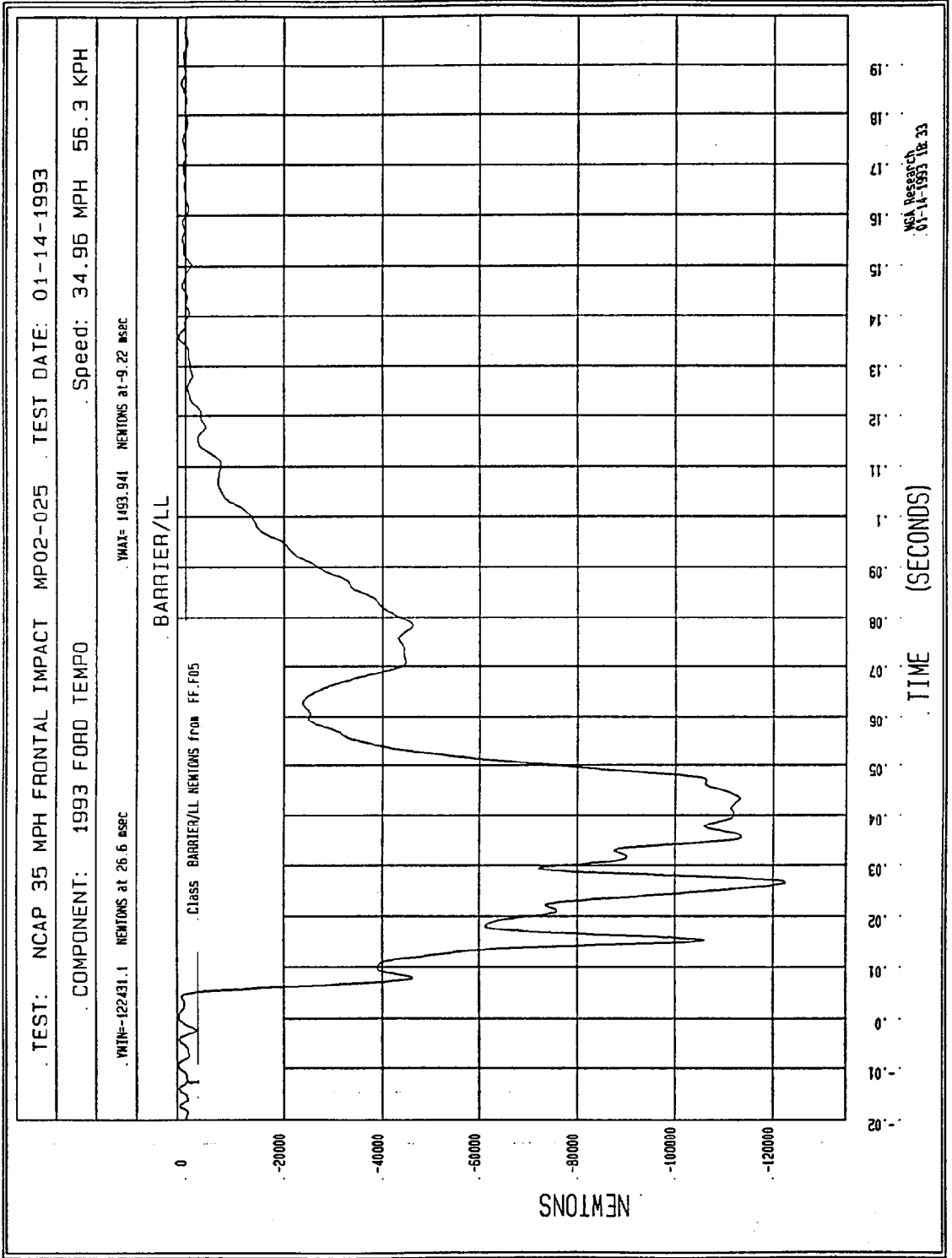


Figure B-30 - Sum of Load Cells CI-D3 Force vs. Time

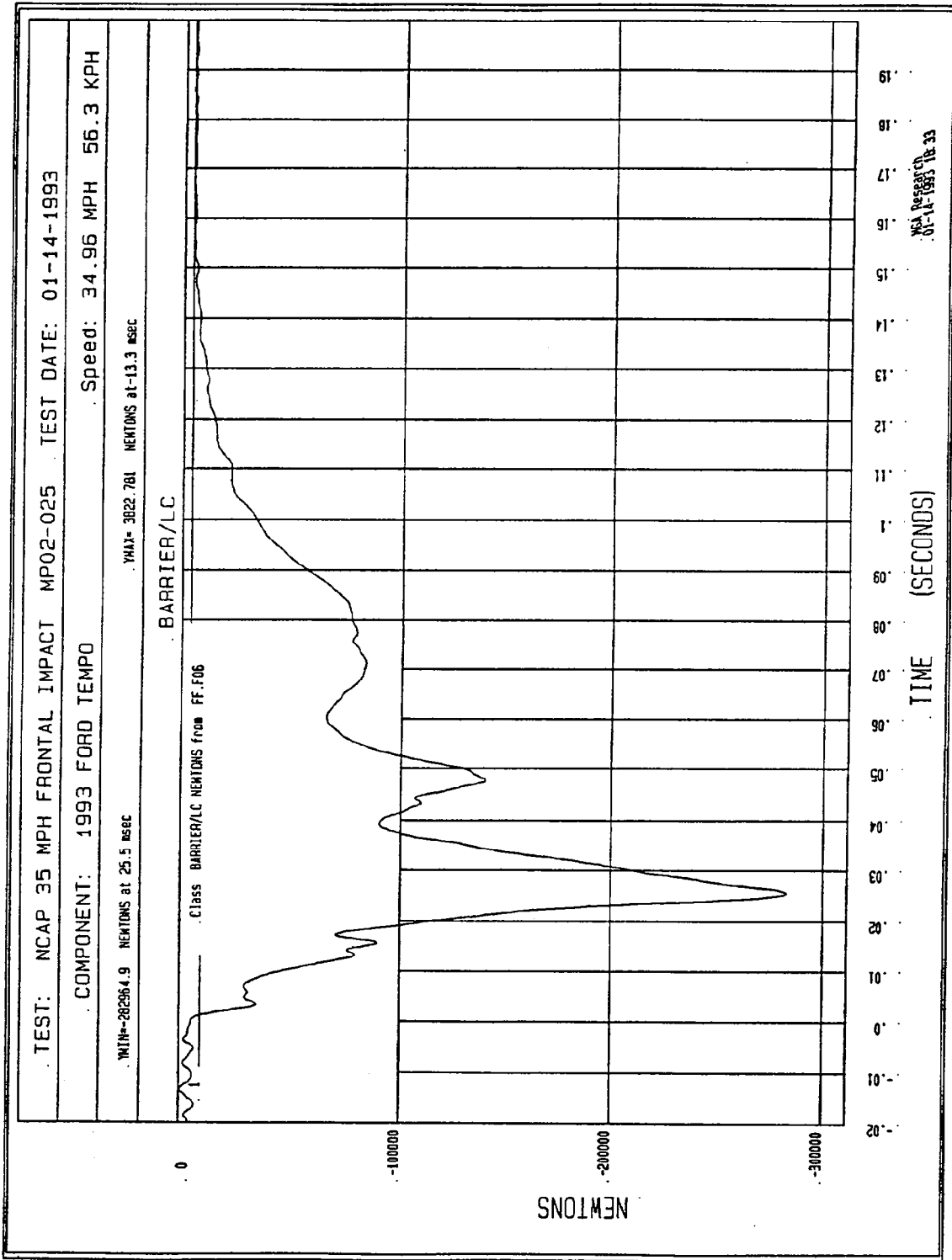


Figure B-31 - Sum of Load Cells C4-D6 Force vs. Time

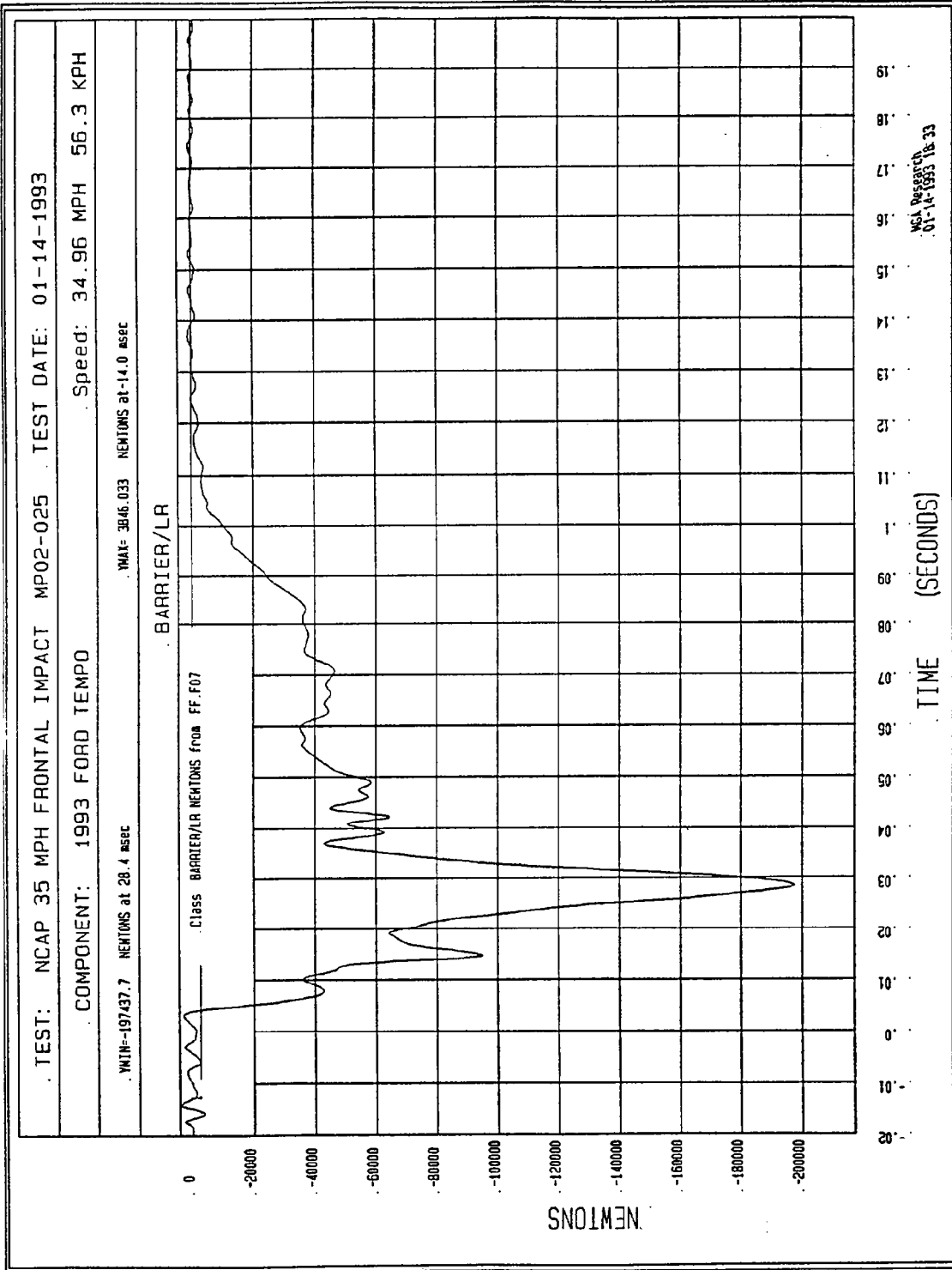


Figure B-32 - Sum of Load Cells C7-D9 Force vs. Time

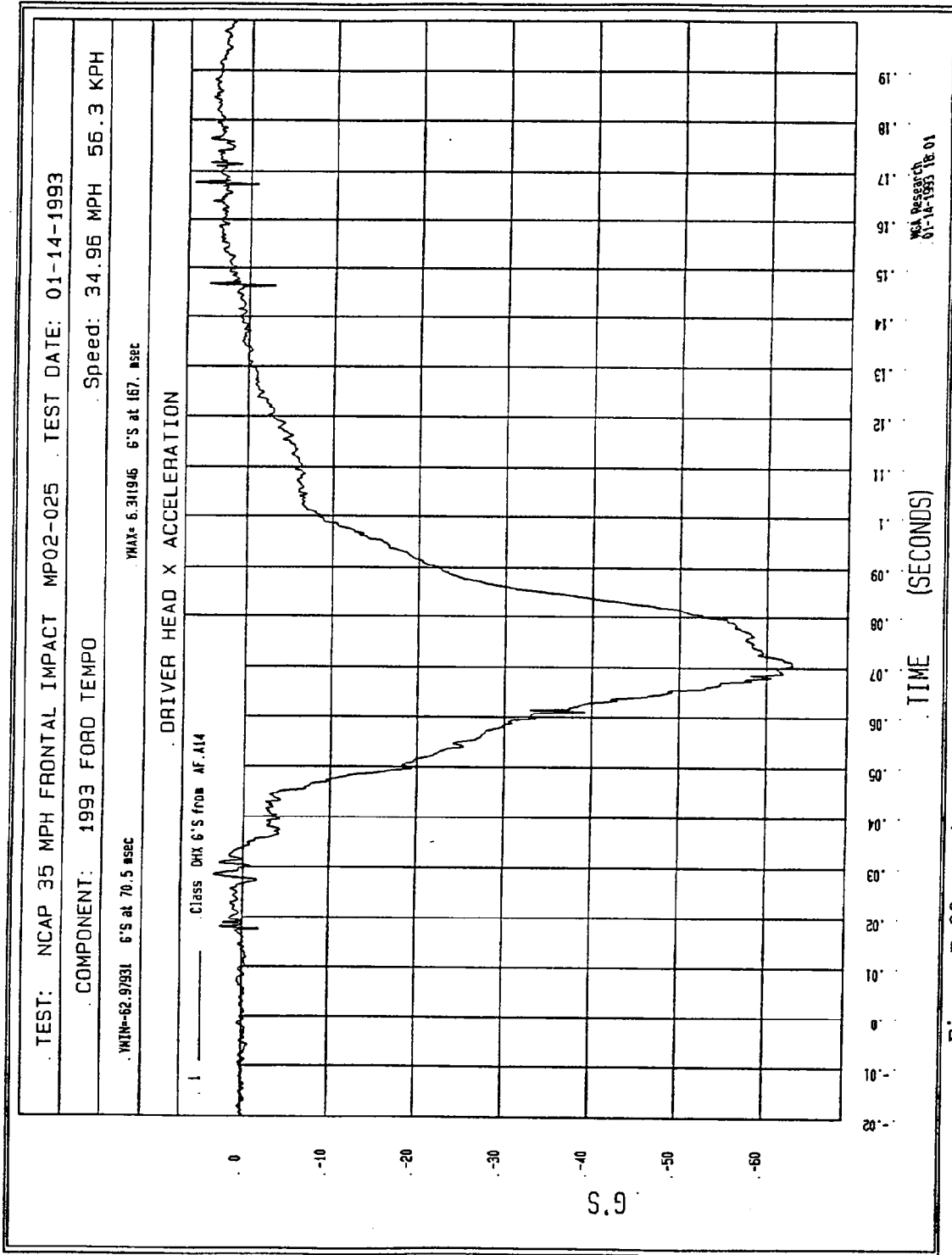


Figure B-33 - Driver Head X Acceleration vs. Time

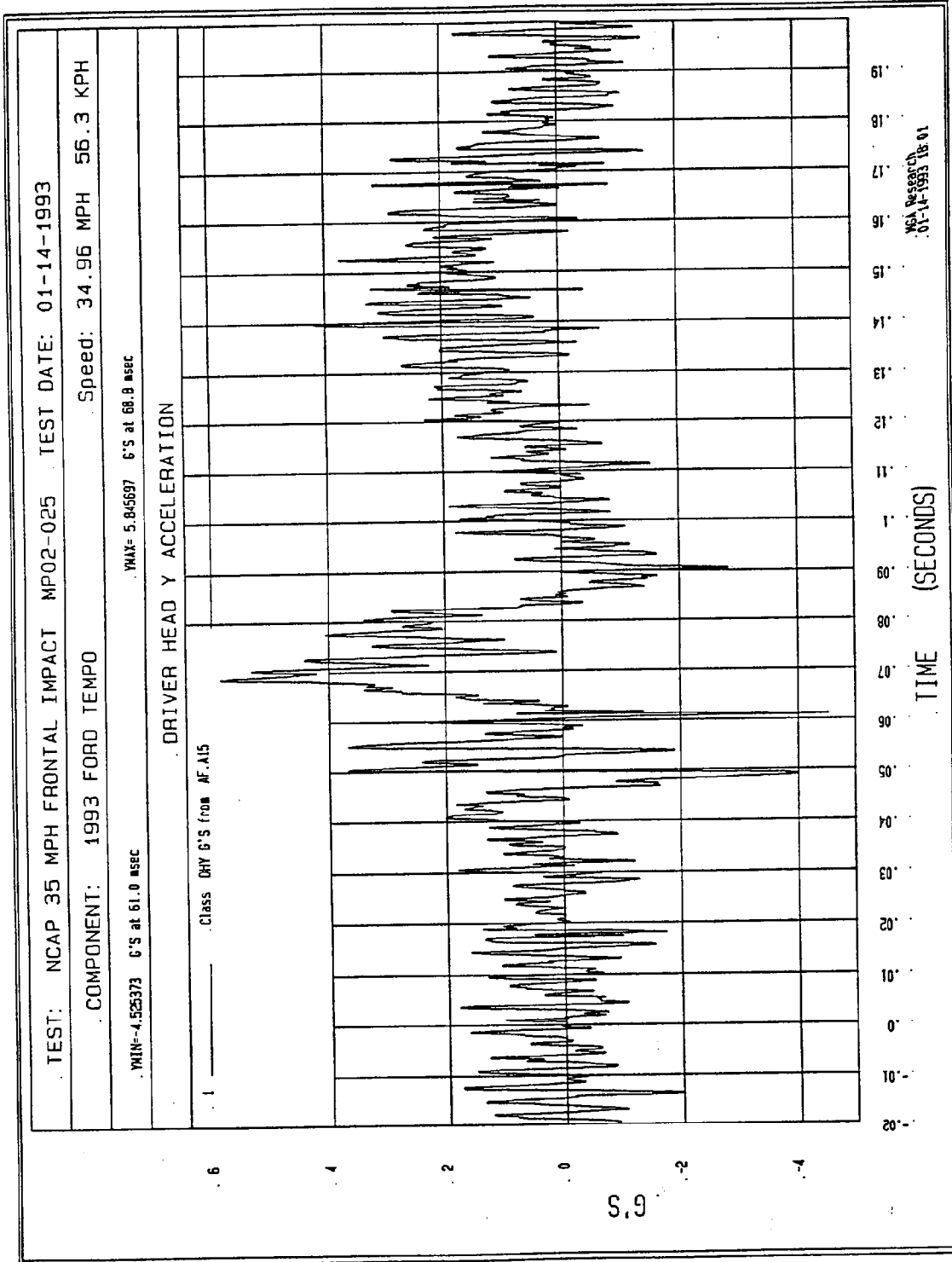


Figure B-34 - Driver Head Y Acceleration vs. Time

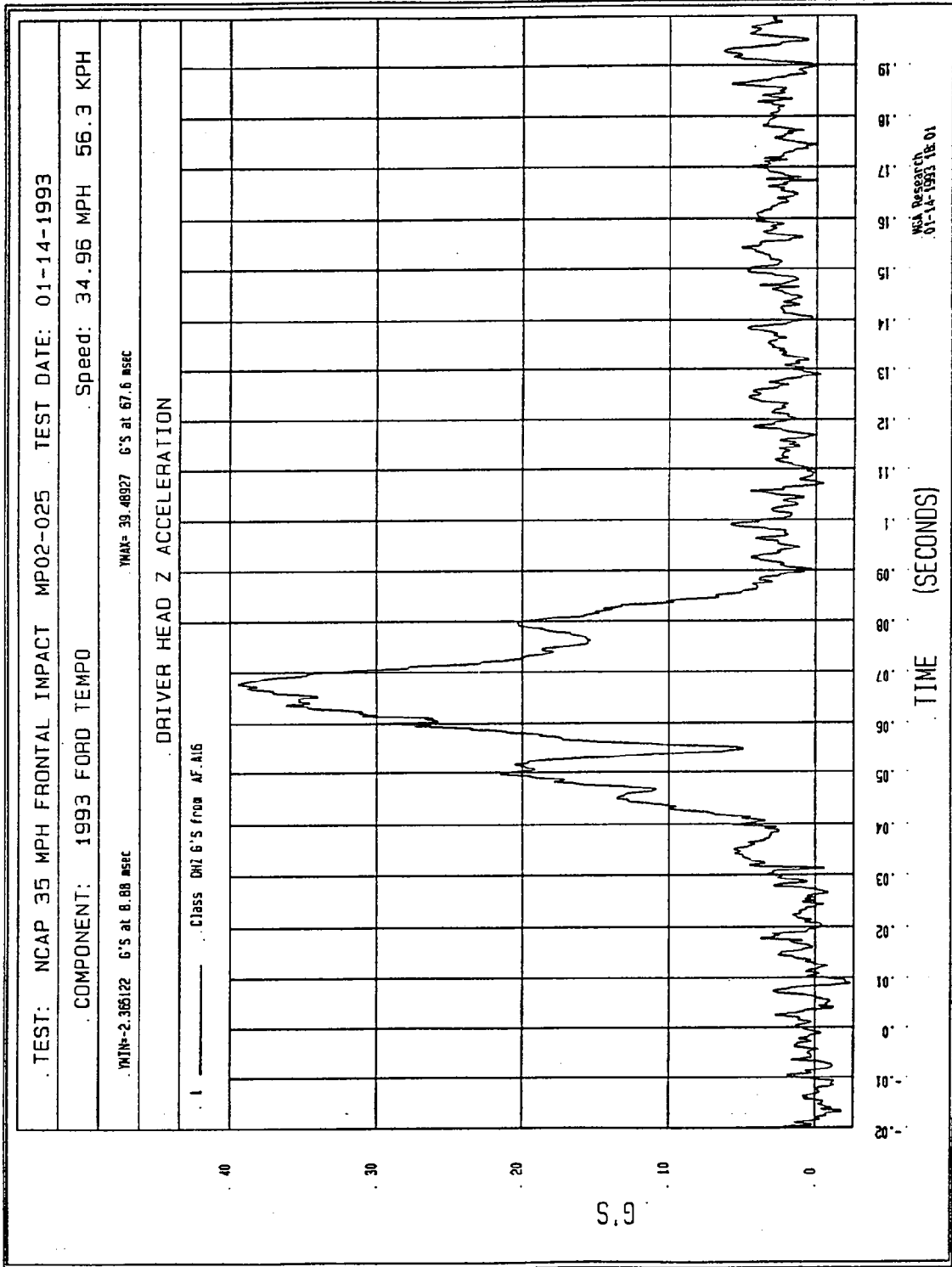


Figure B-35 - Driver Head Z Acceleration vs. Time

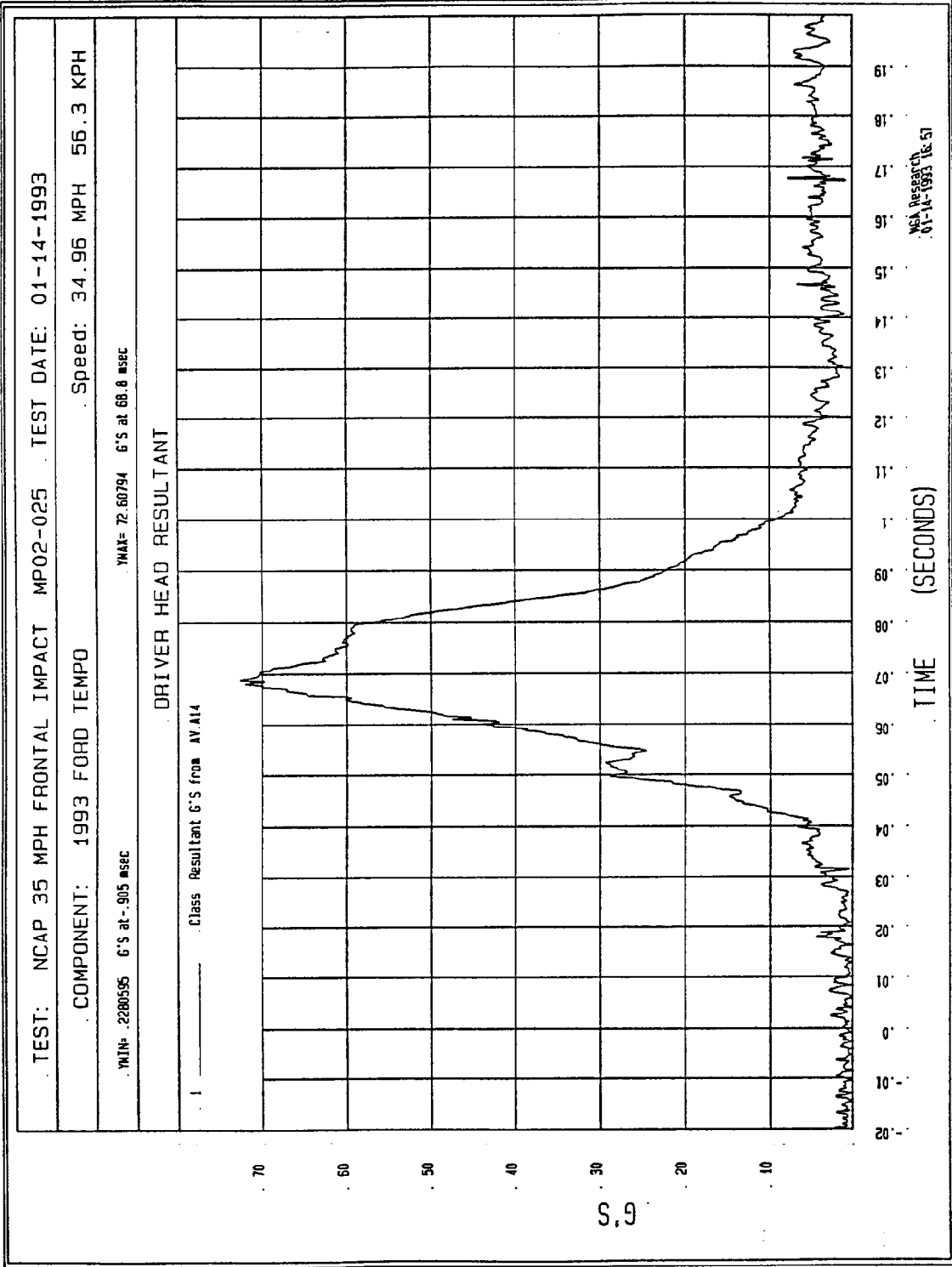


Figure B-36 - Driver Head Resultant Acceleration vs. Time

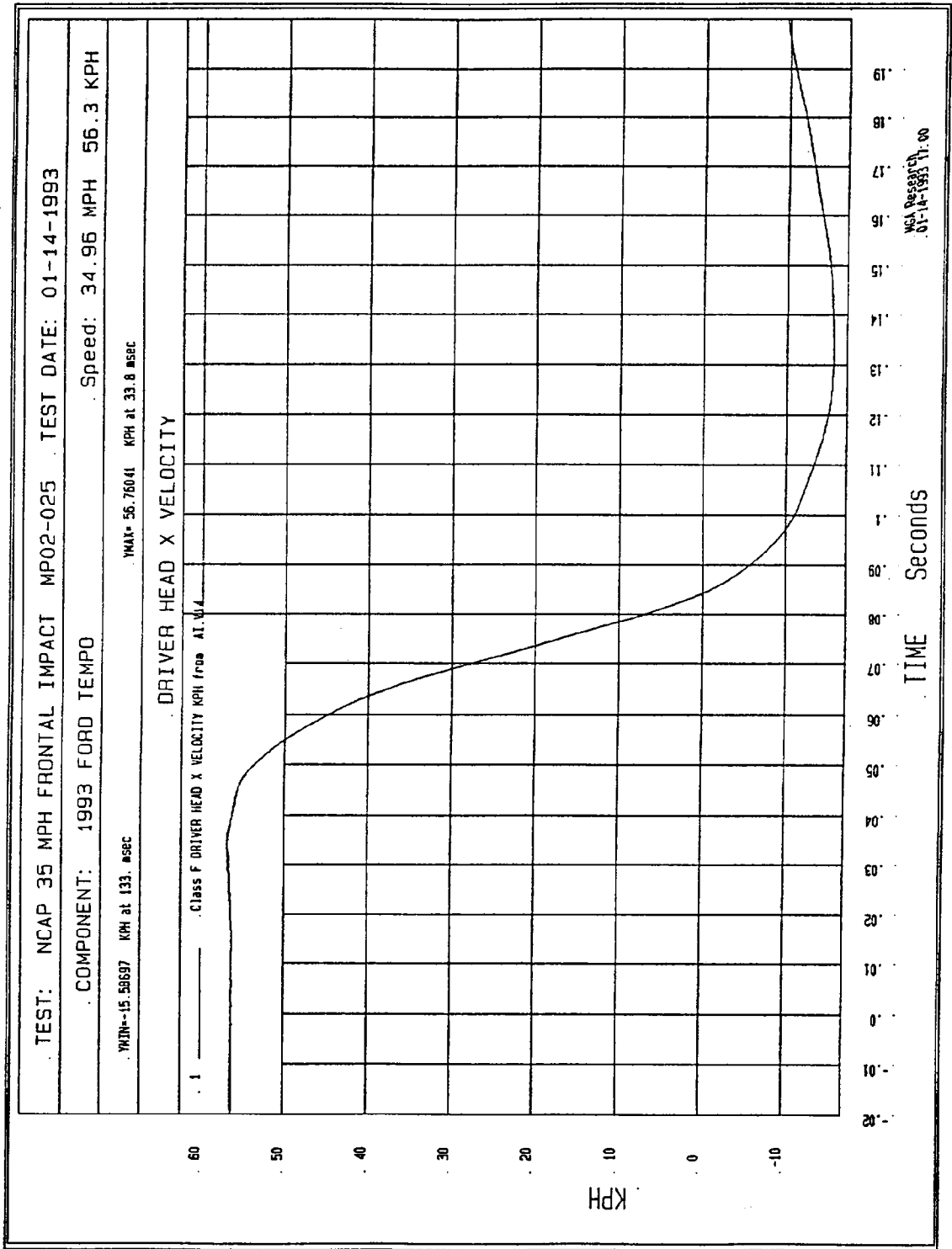


Figure B-37 - Driver Head X Velocity vs. Time

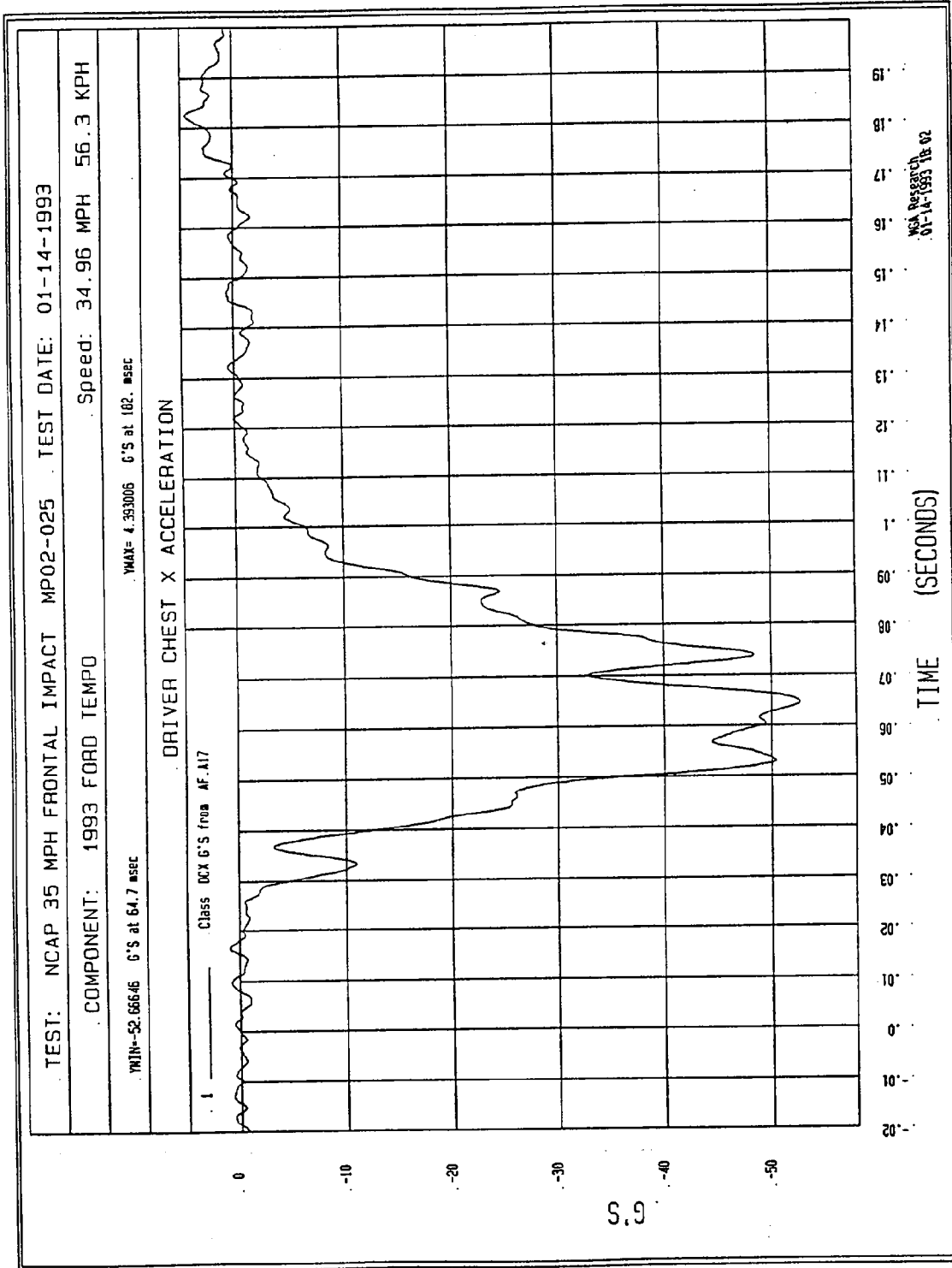


Figure B-38 - Driver Chest X Acceleration vs. Time

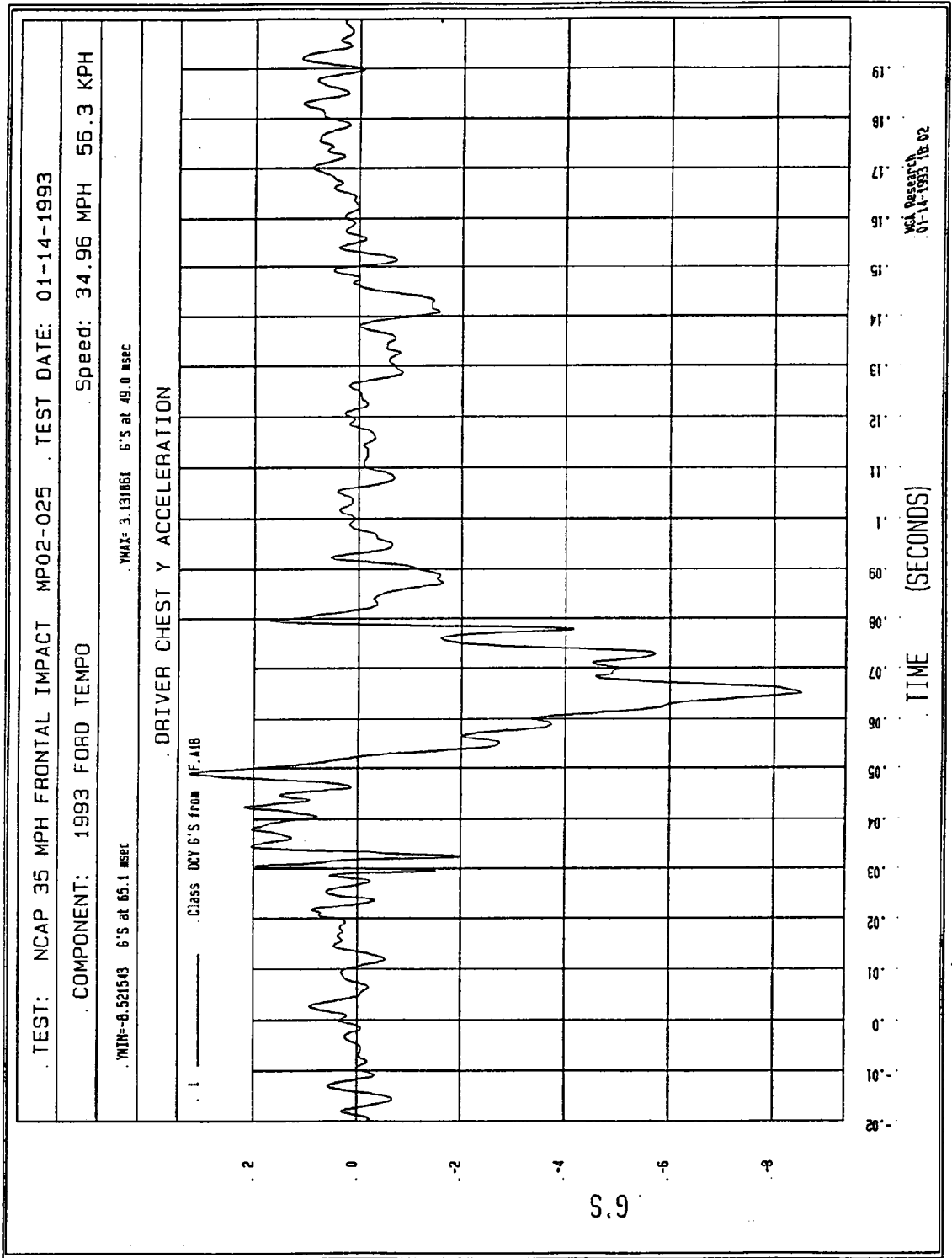


Figure B-39 - Driver Chest Y Acceleration vs. Time

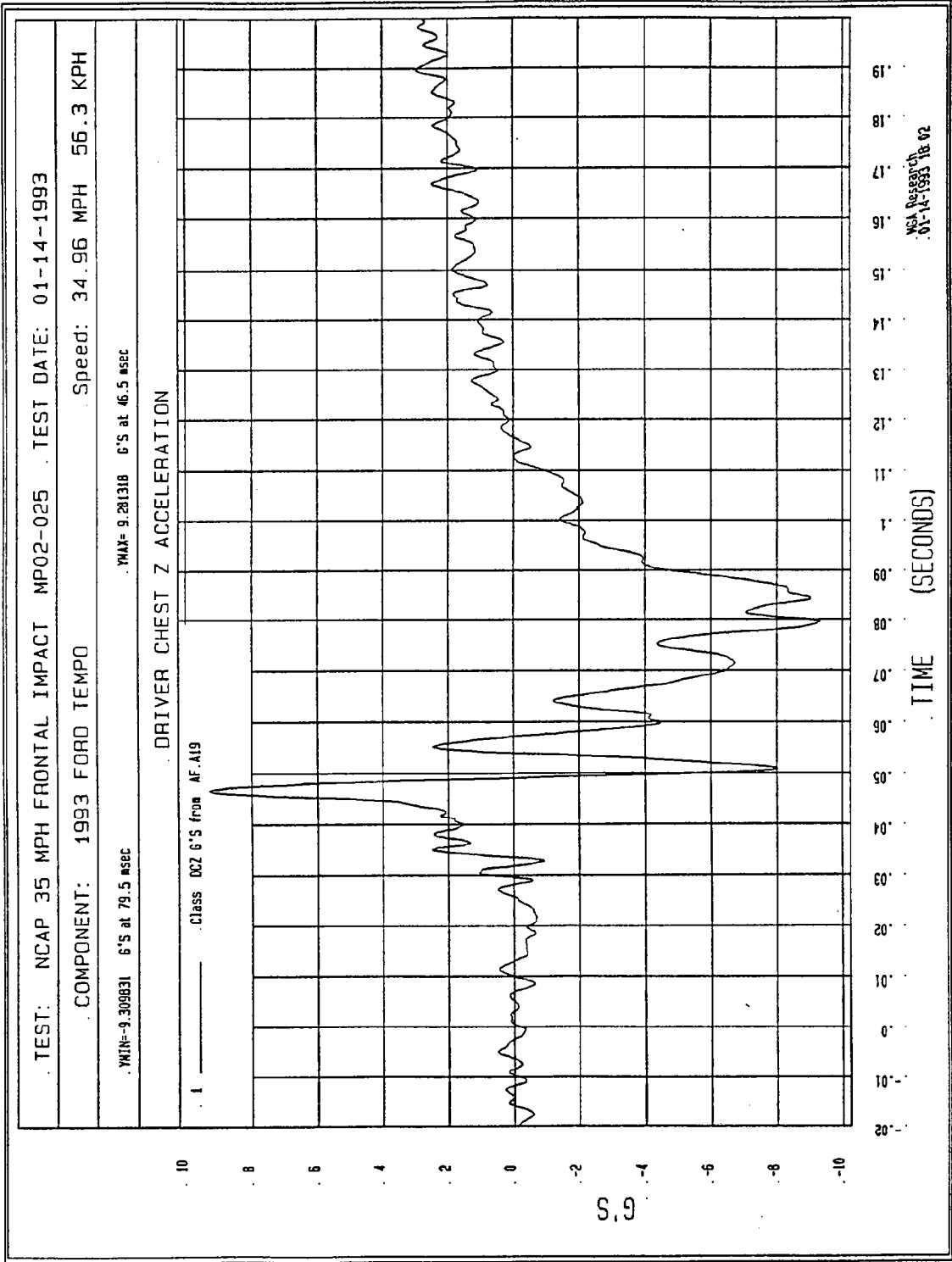


Figure B-40 - Driver Chest Z Acceleration vs. Time

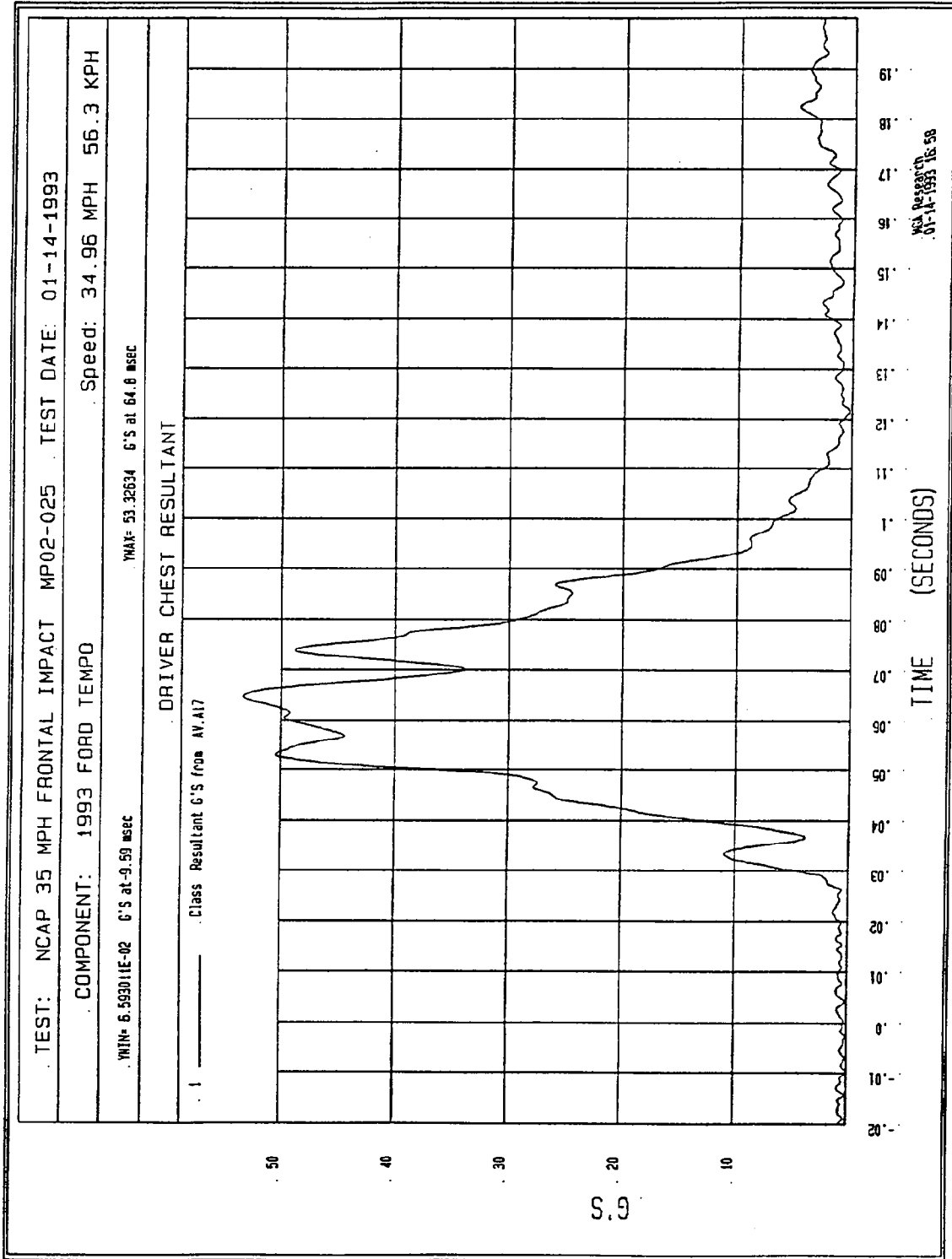
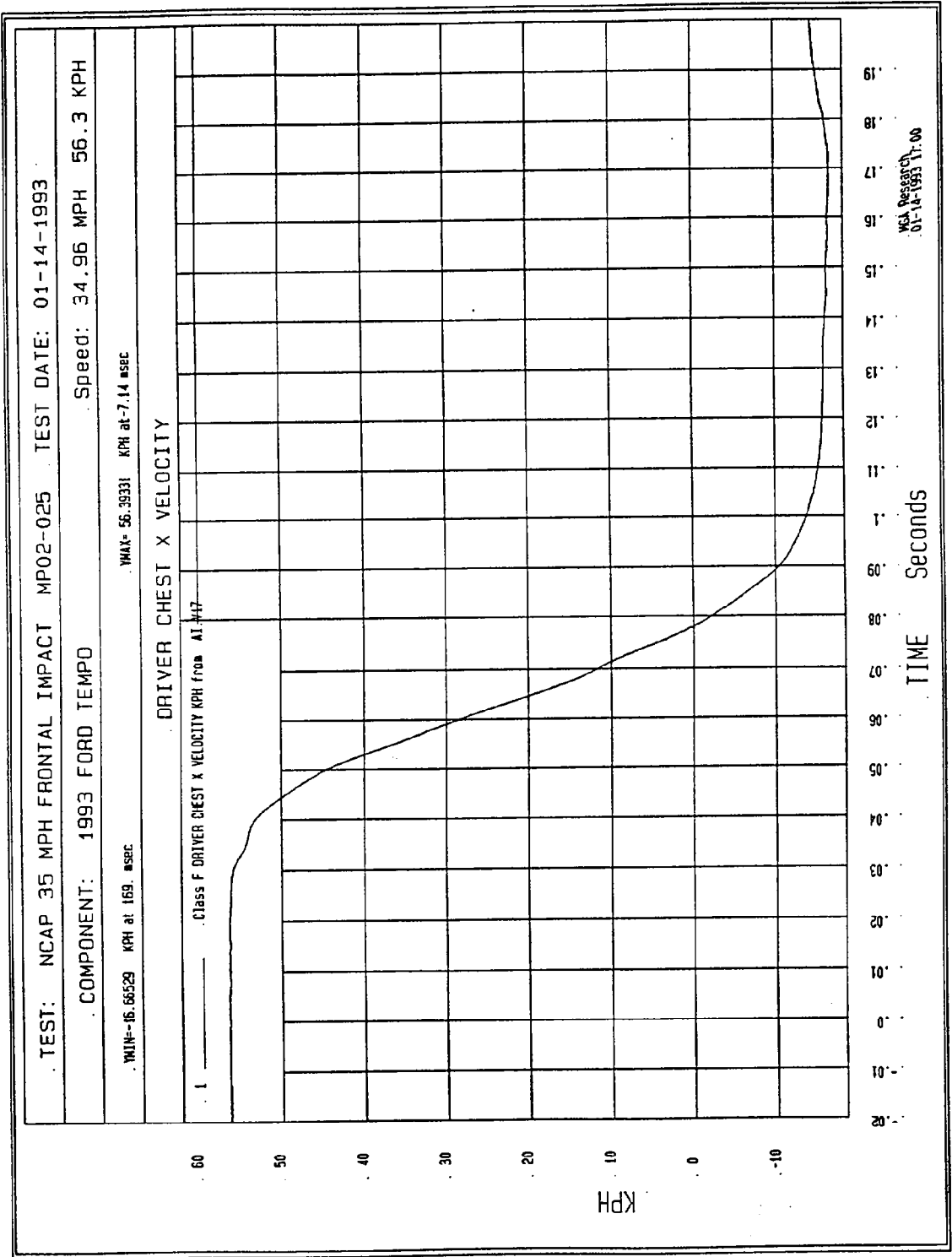


Figure B-41 - Driver Chest Resultant Acceleration vs. Time



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Figure B-42 - Driver Chest X Velocity vs. Time

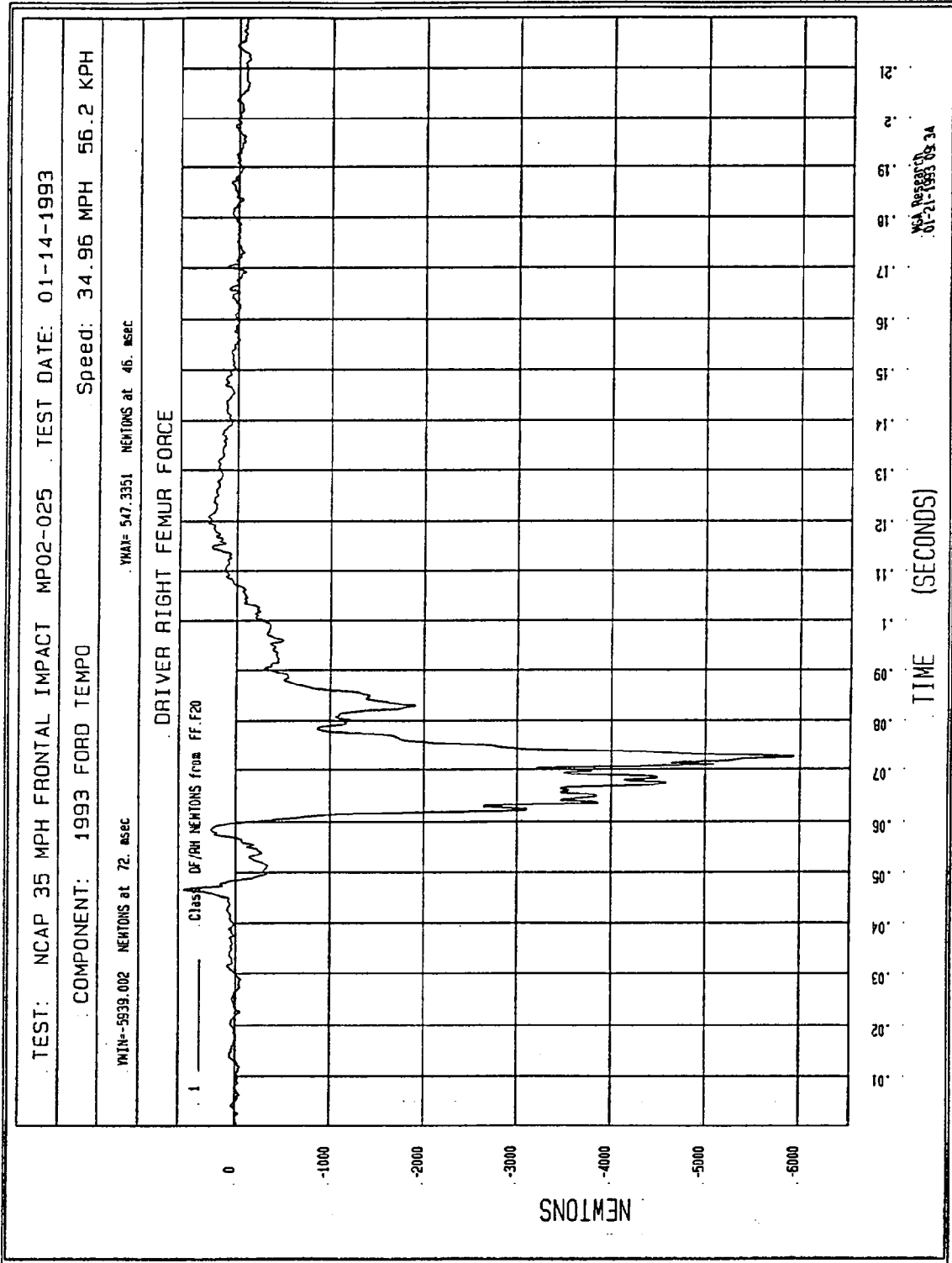


Figure B-43 - Driver Right Femur Force vs. Time

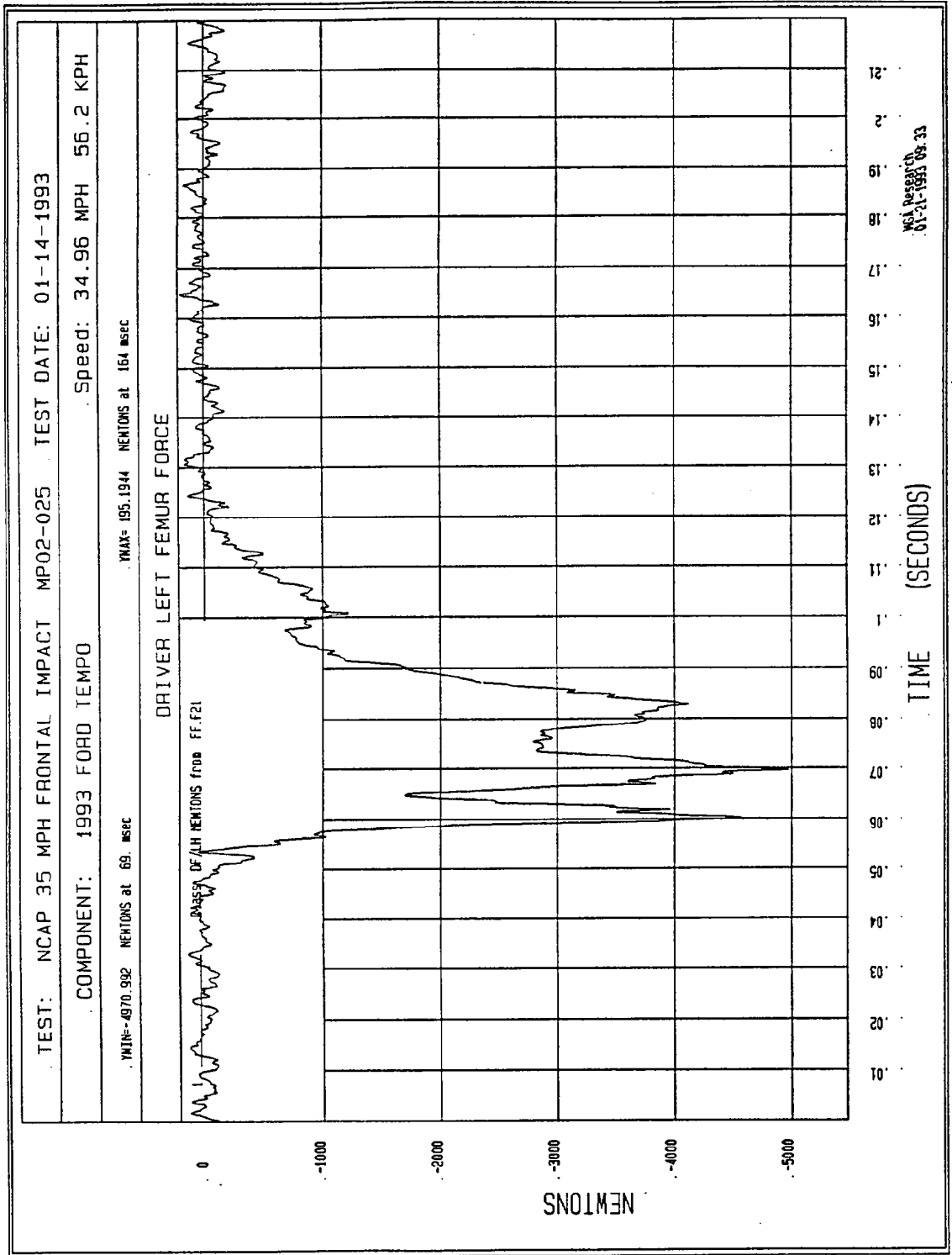


Figure B-44 - Driver Left Femur Force vs. Time

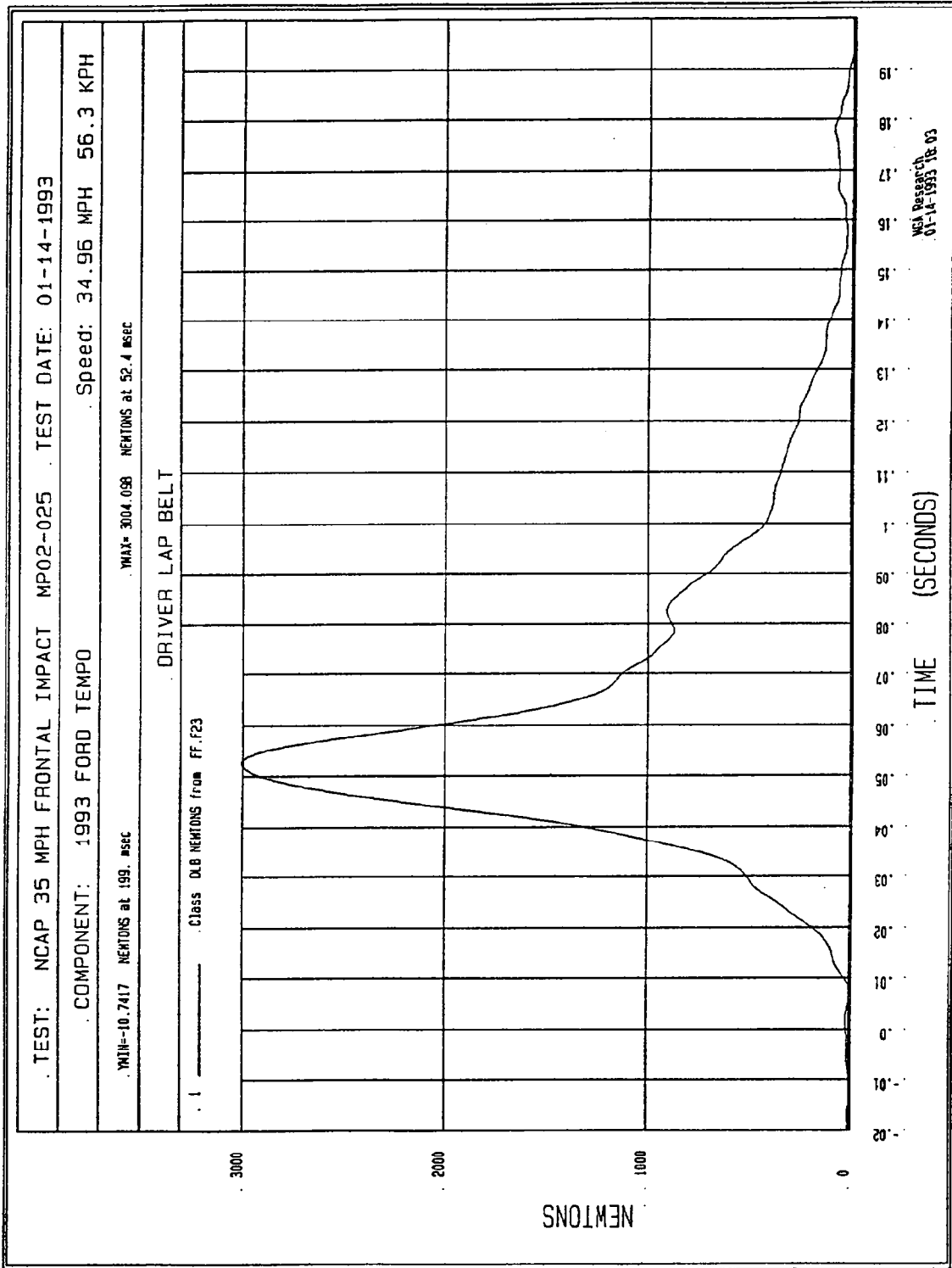


Figure B-45 - Driver Lap Belt Force vs. Time

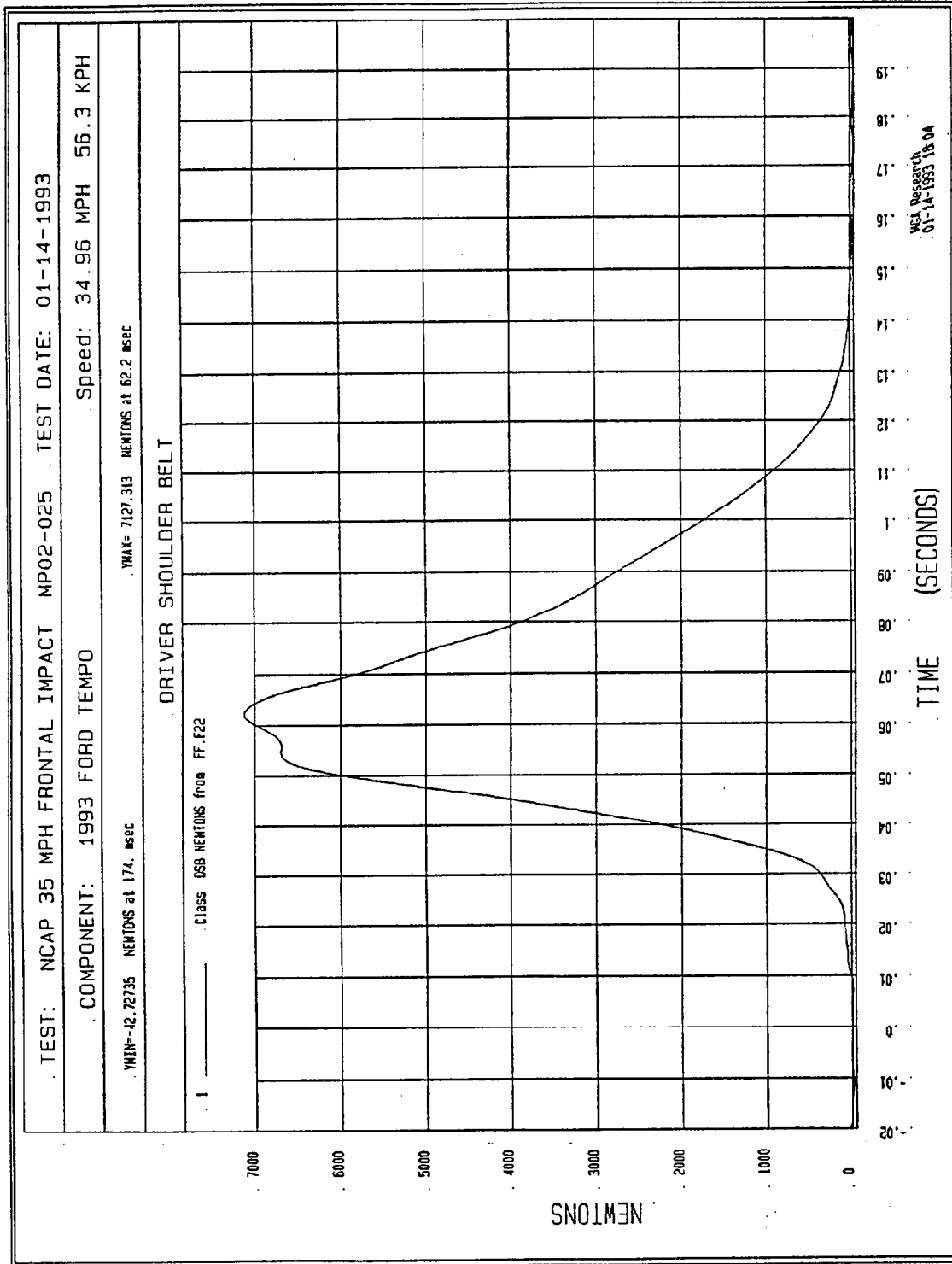


Figure B-46 - Driver Torso Belt Force vs. Time

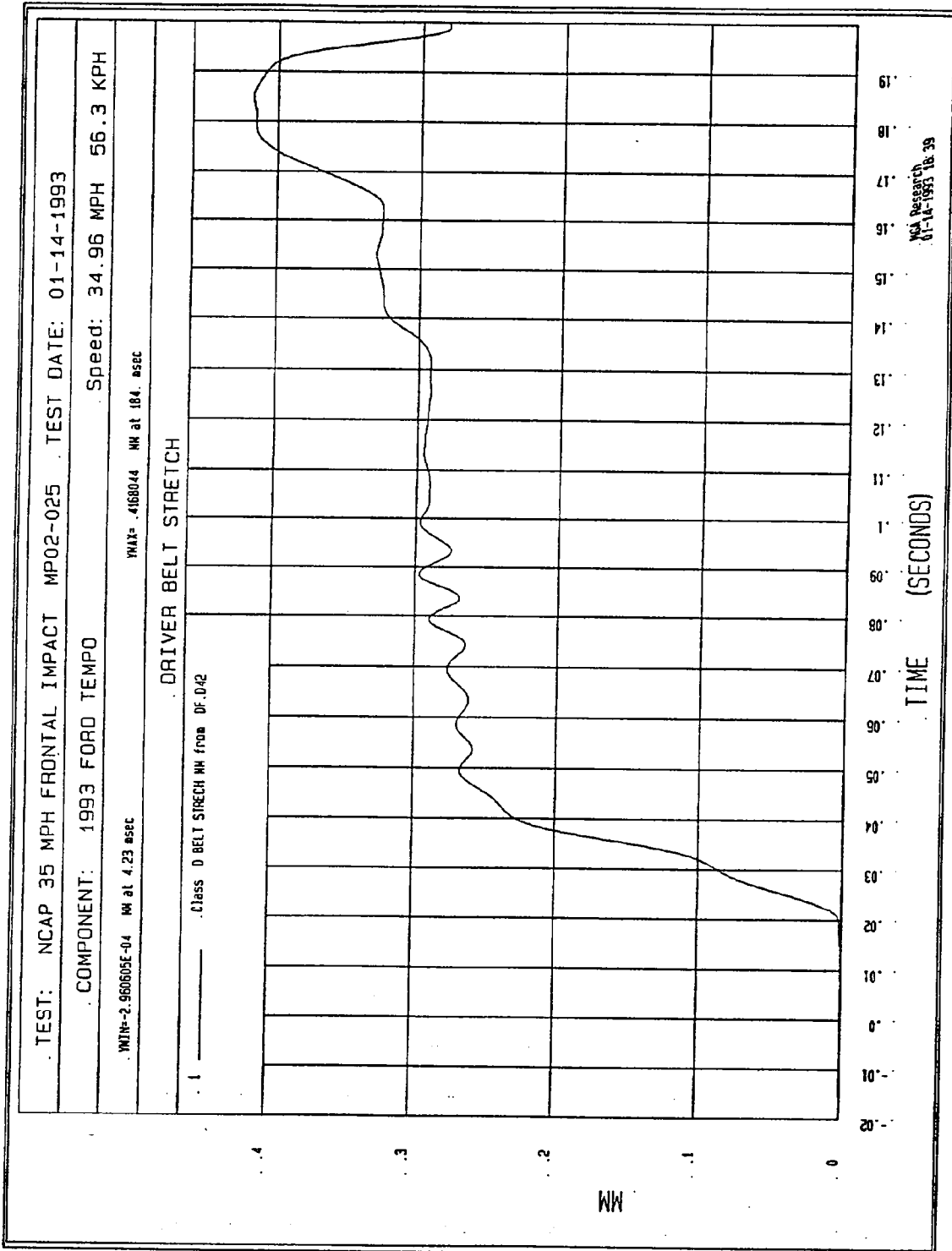


Figure B-47 - Driver Torso Belt Stretch vs. Time

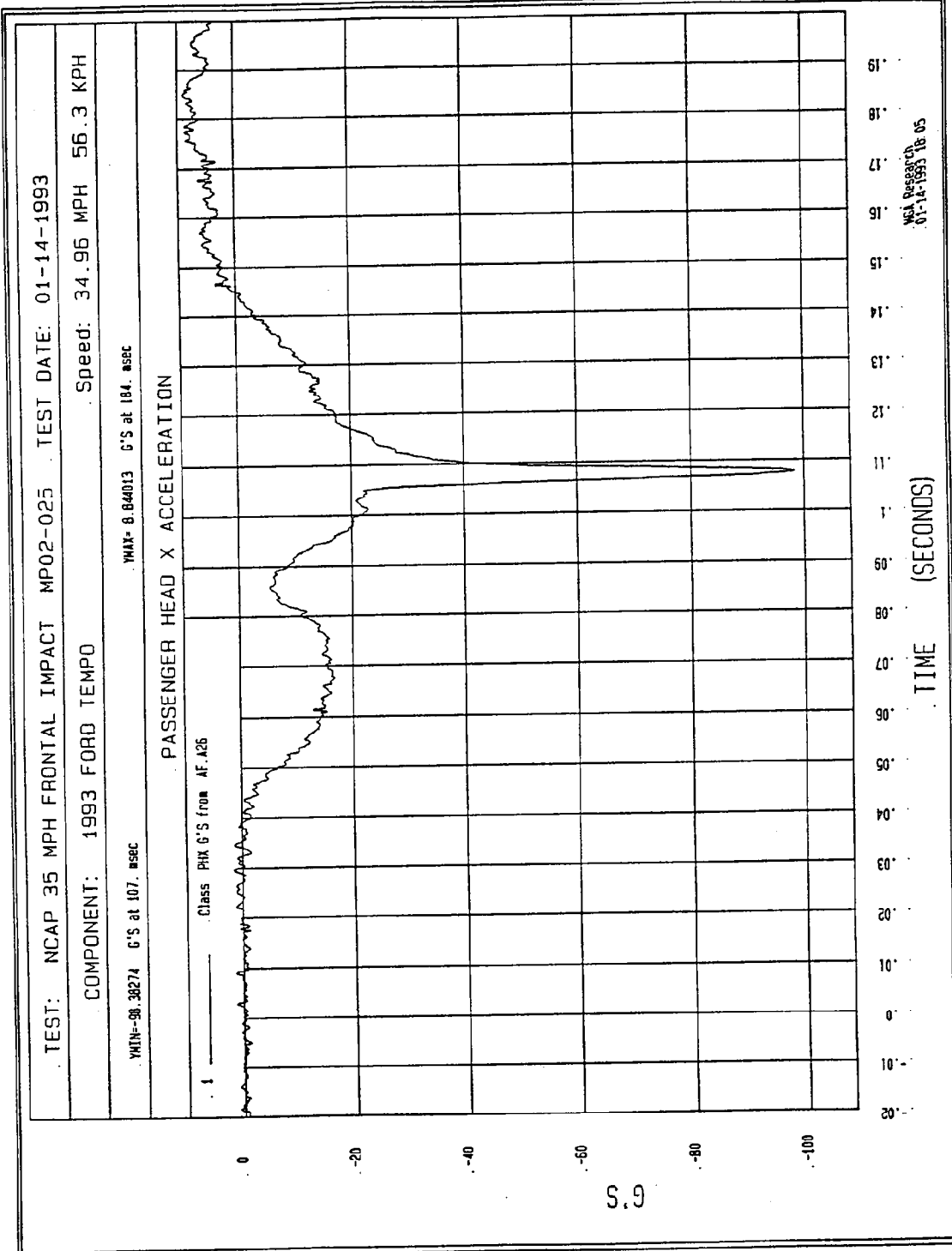


Figure B-48 - Passenger Head X Acceleration vs. Time

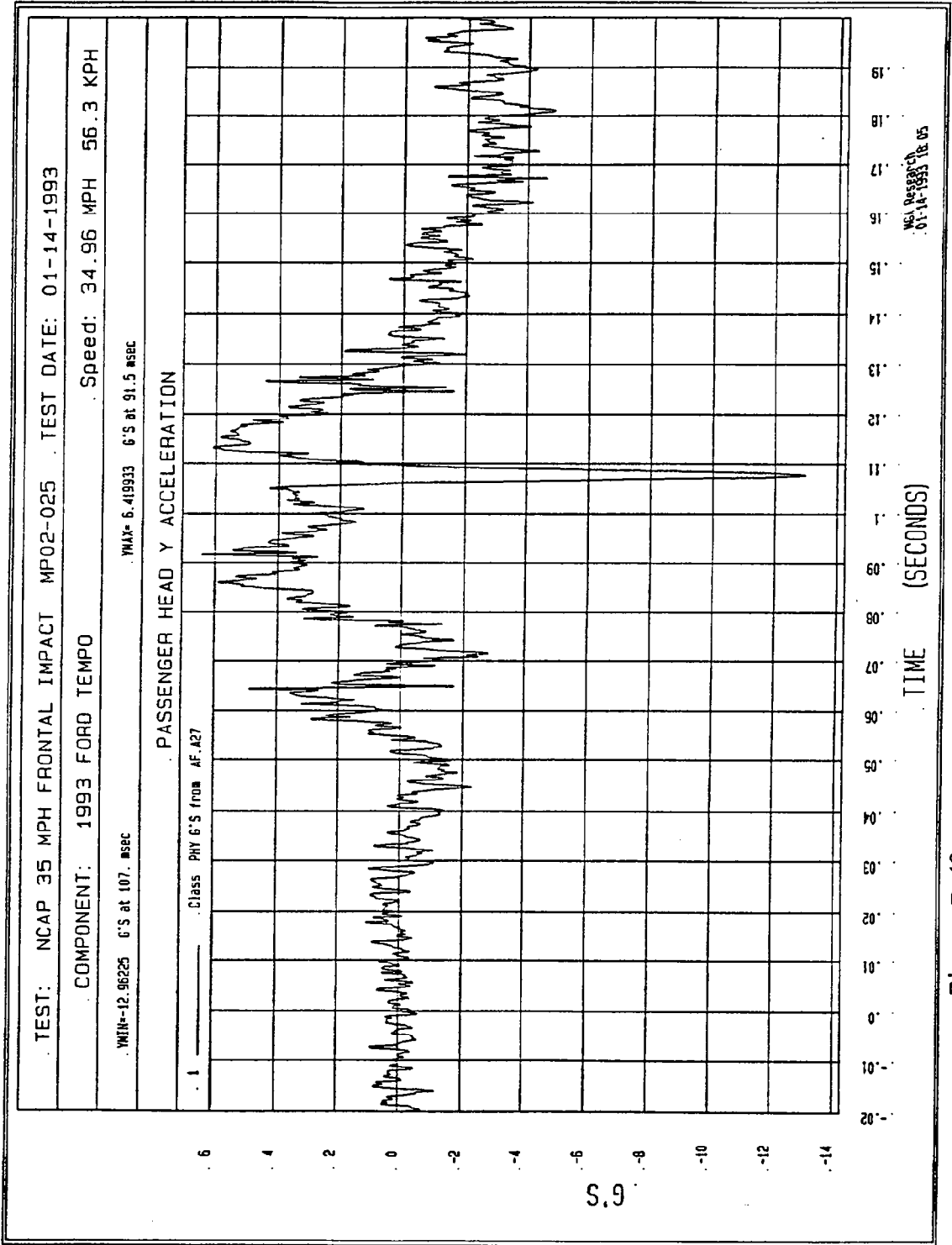
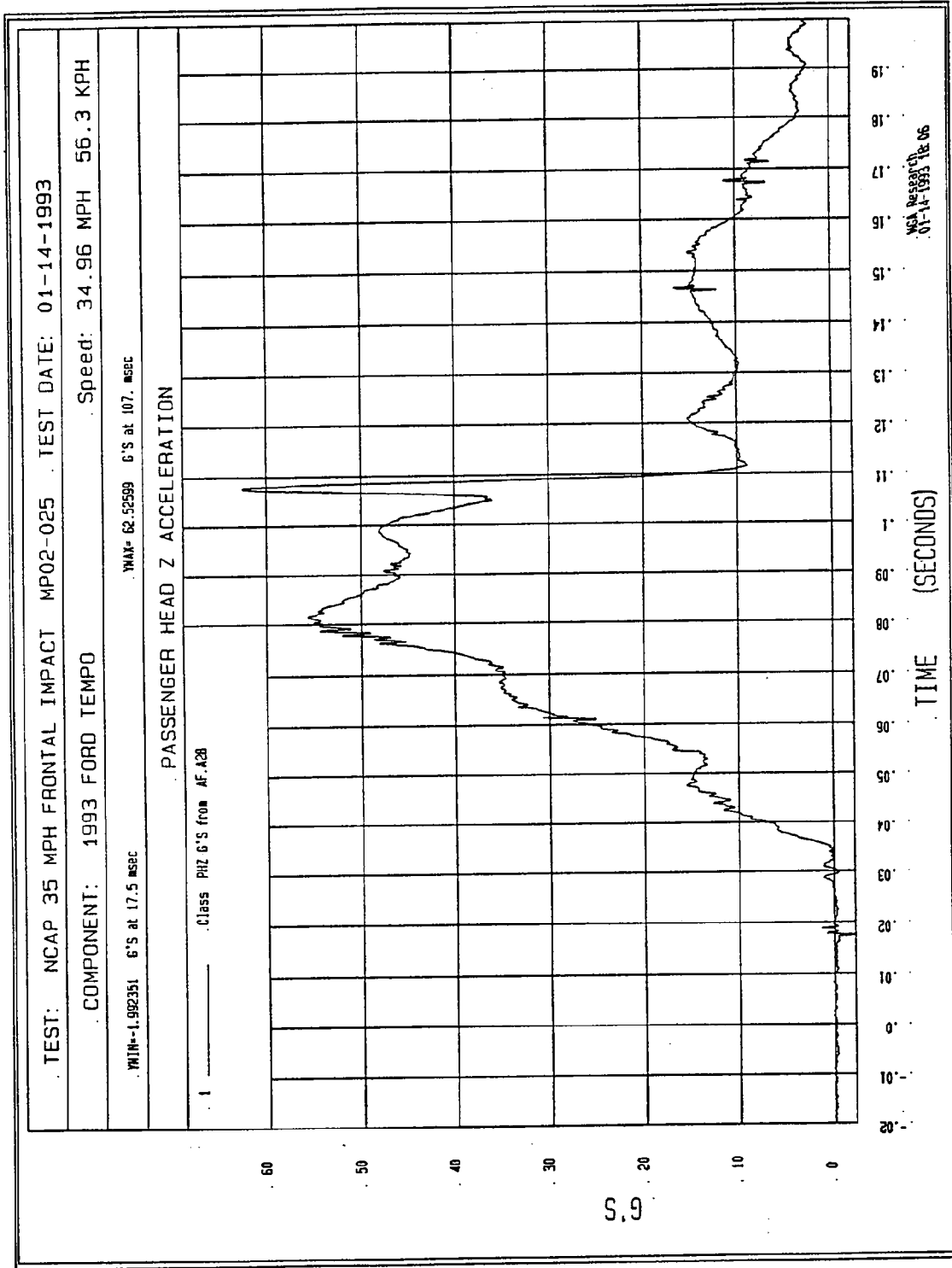


Figure B-49 - Passenger Head Y Acceleration vs. Time



B-50

Figure B-50 - Passenger Head Z Acceleration vs. Time

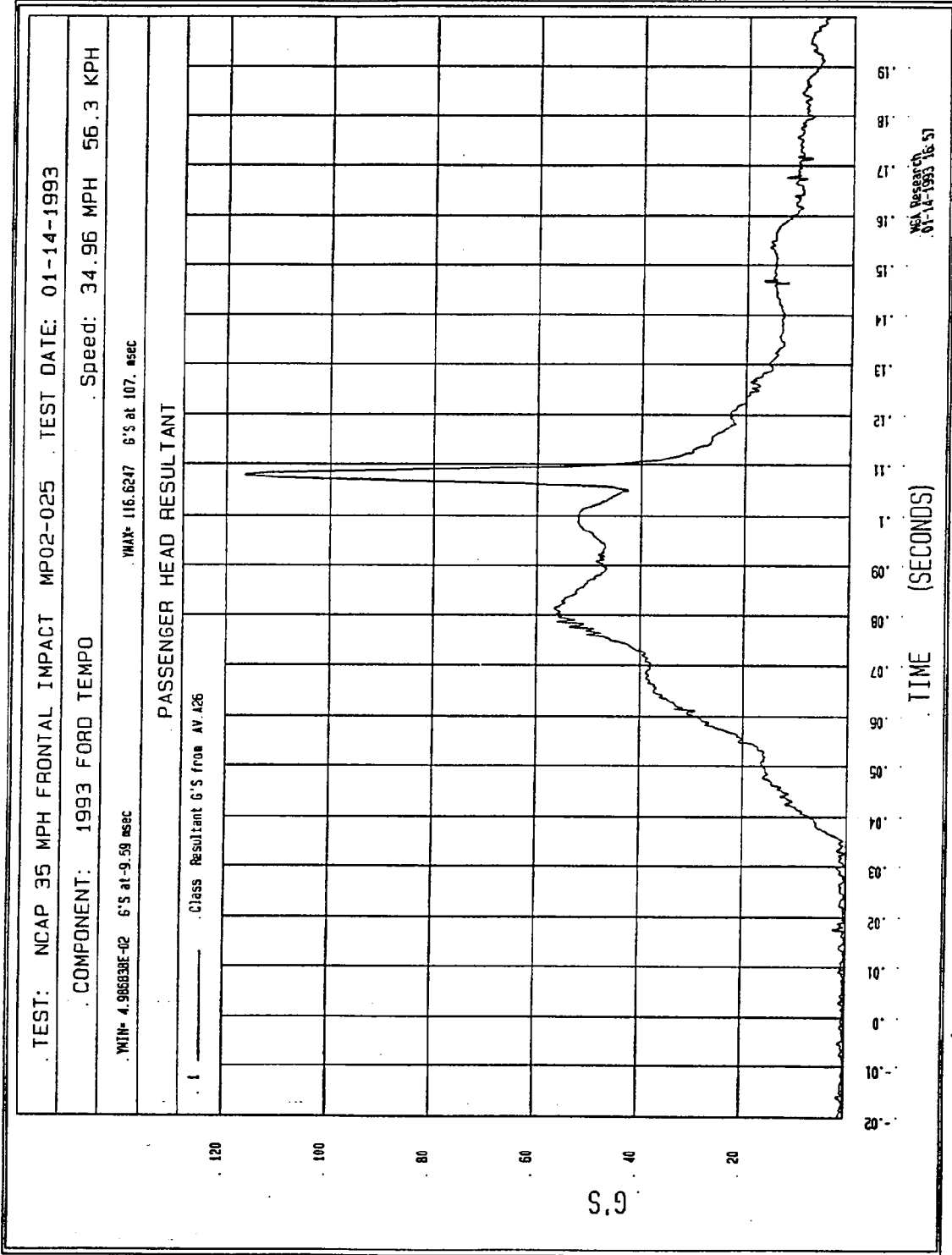


Figure B-51 - Passenger Head Resultant Acceleration vs. Time

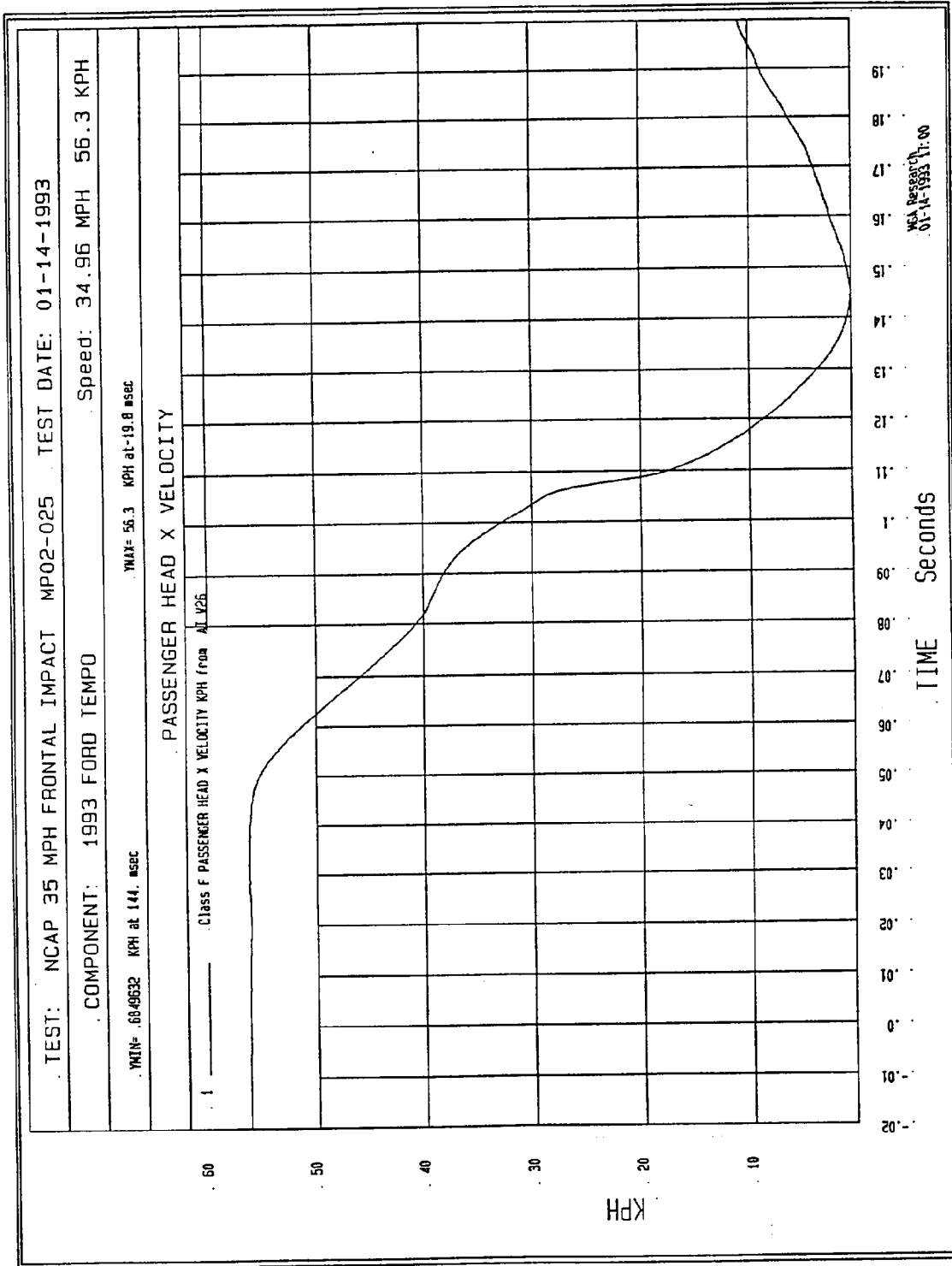


Figure B-52 - Passenger Head X Velocity vs. Time

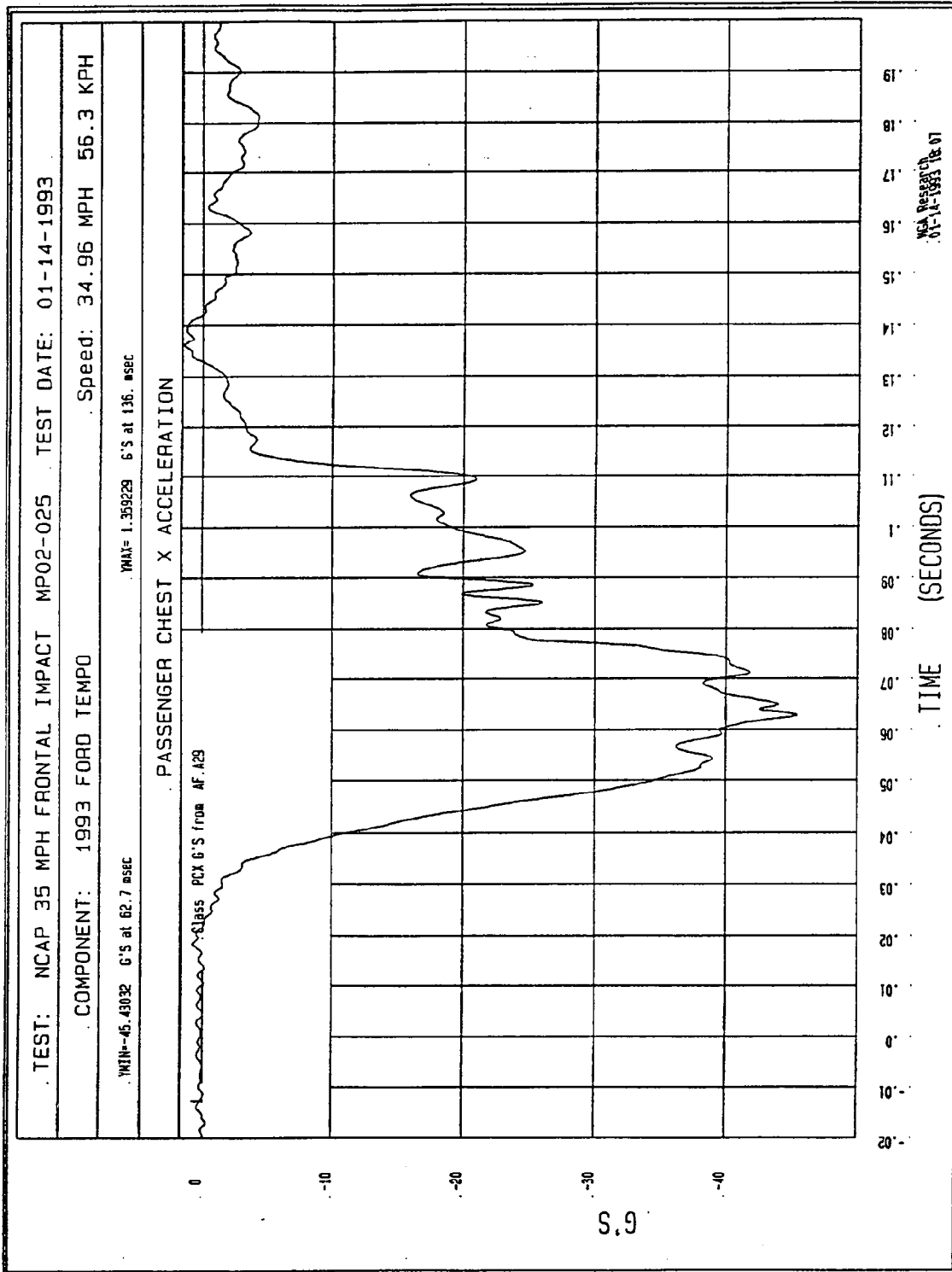


Figure B-53 - Passenger Chest X Acceleration vs. Time

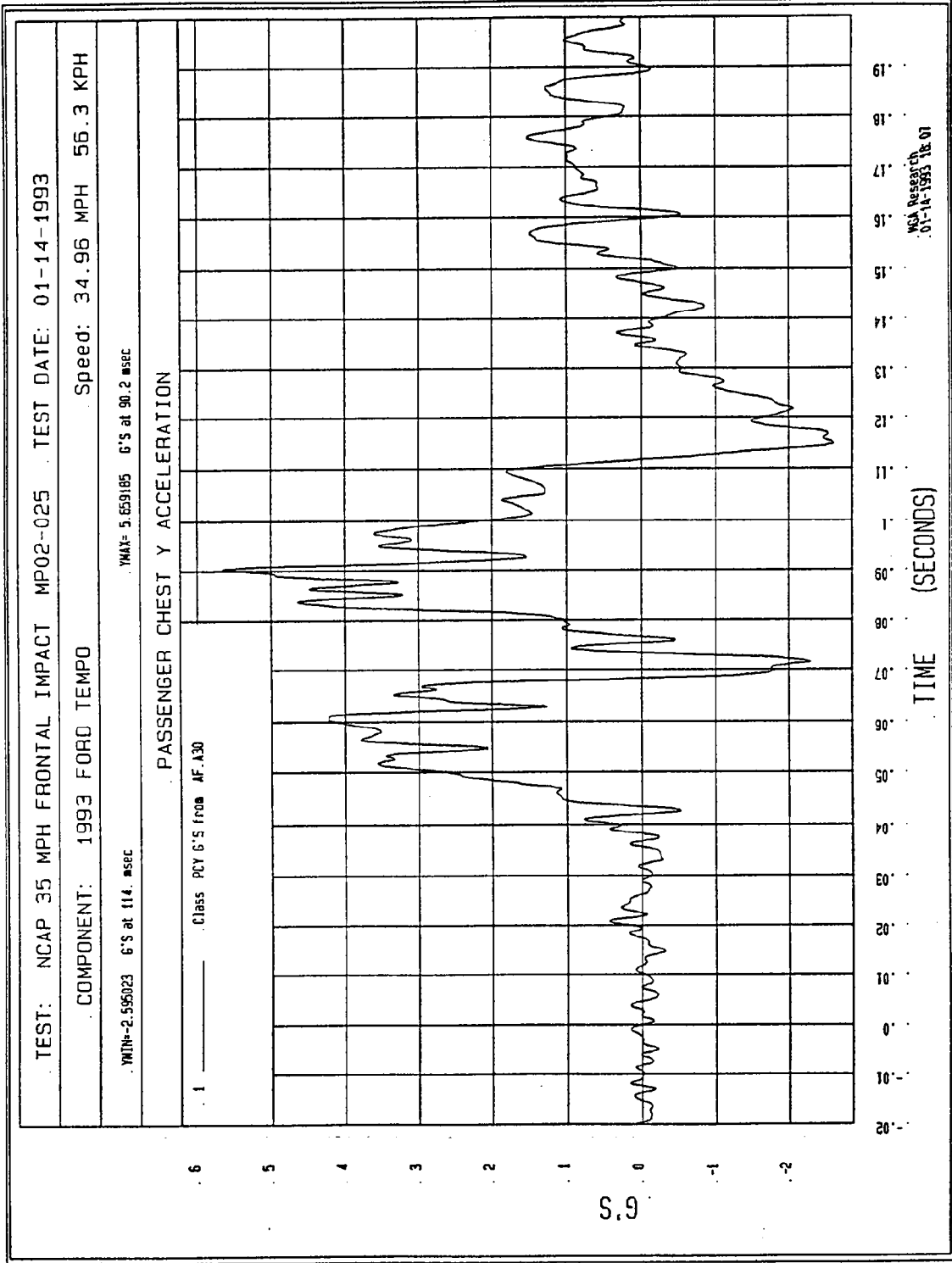


Figure B-54 - Passenger Chest Y Acceleration vs. Time

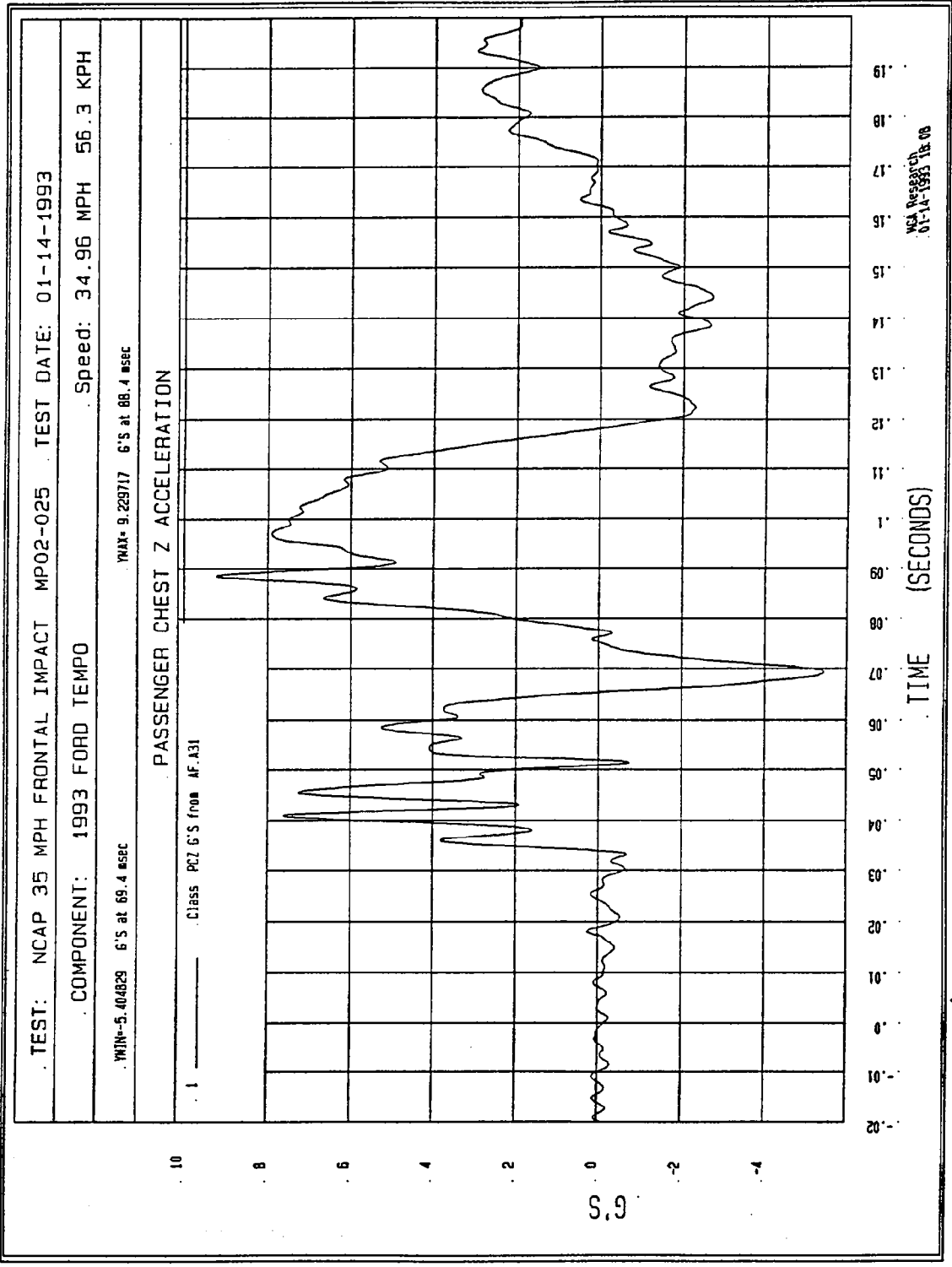


Figure B-55 - Passenger Chest Z Acceleration vs. Time

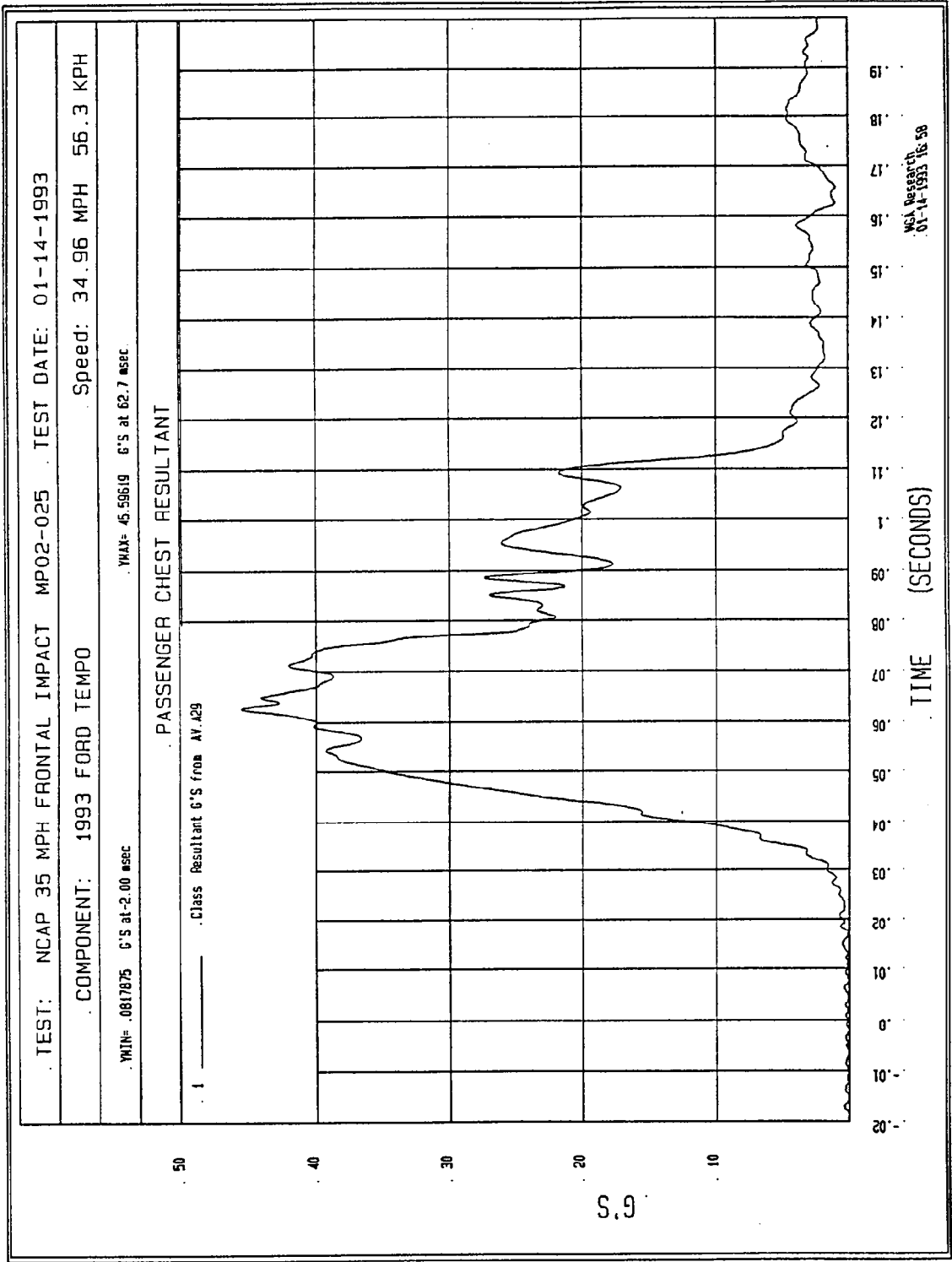


Figure B-56 - Passenger Chest Resultant Acceleration vs. Time

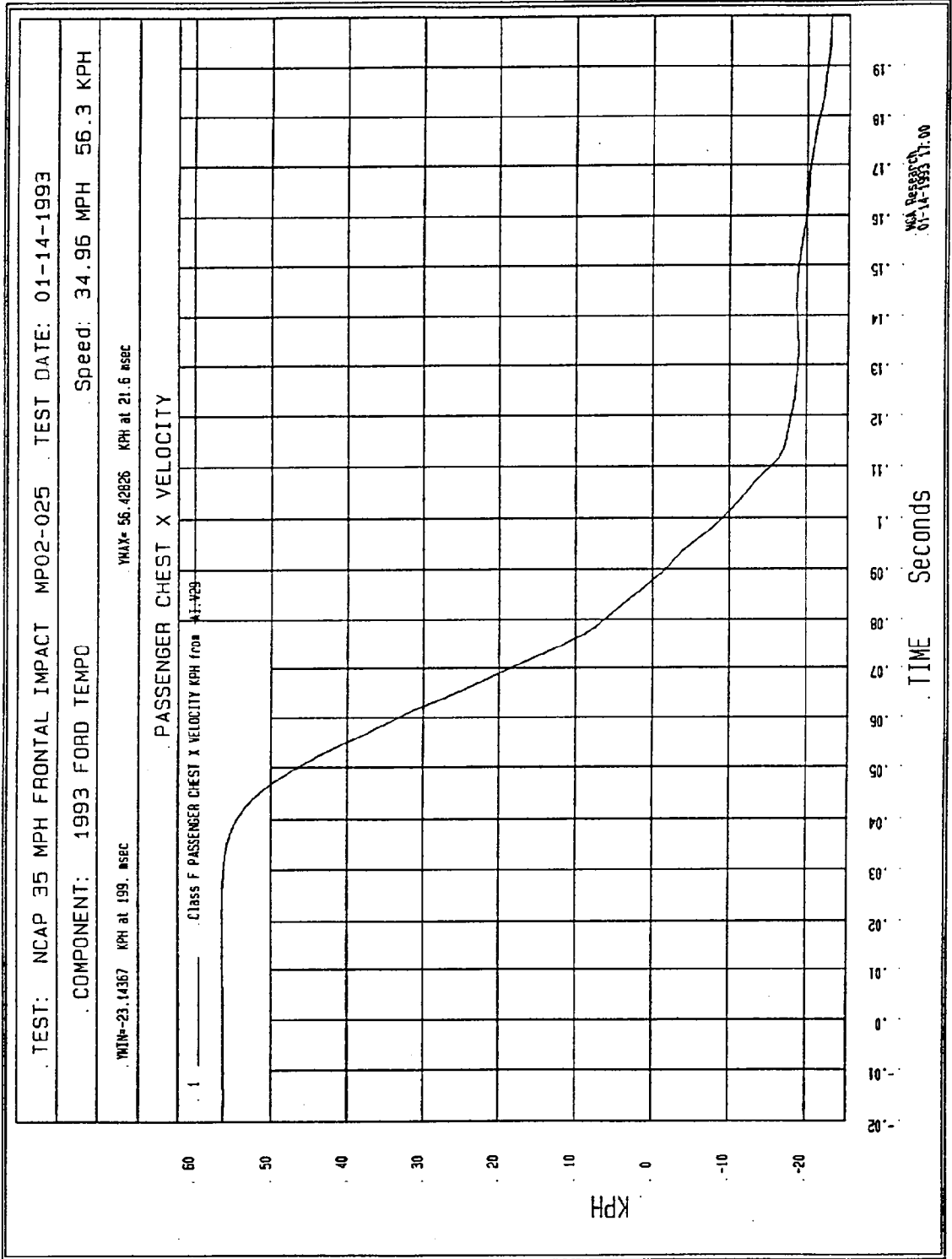
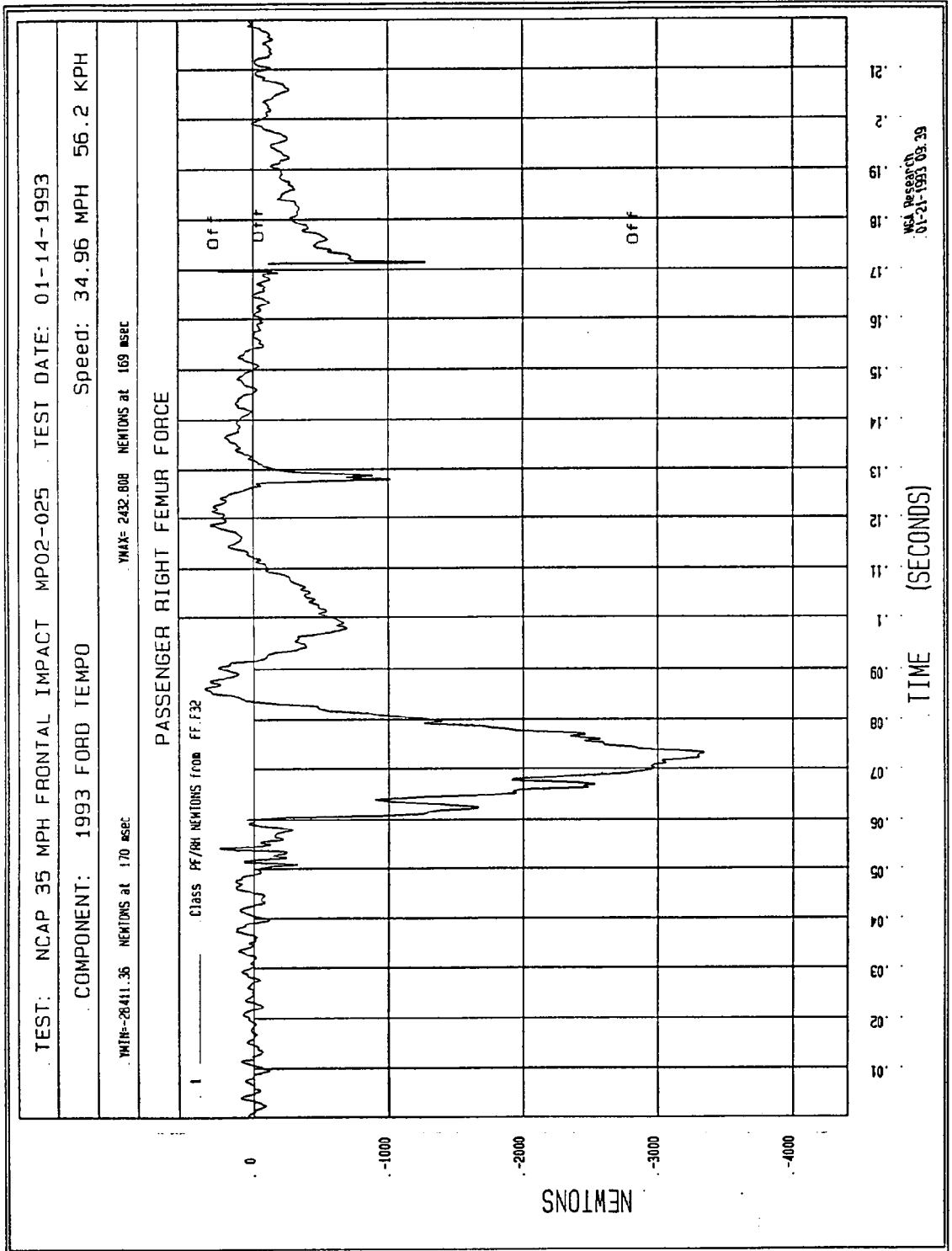


Figure B-57 - Passenger Chest X Velocity vs. Time



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Figure B-58 - Passenger Right Femur Force vs. Time

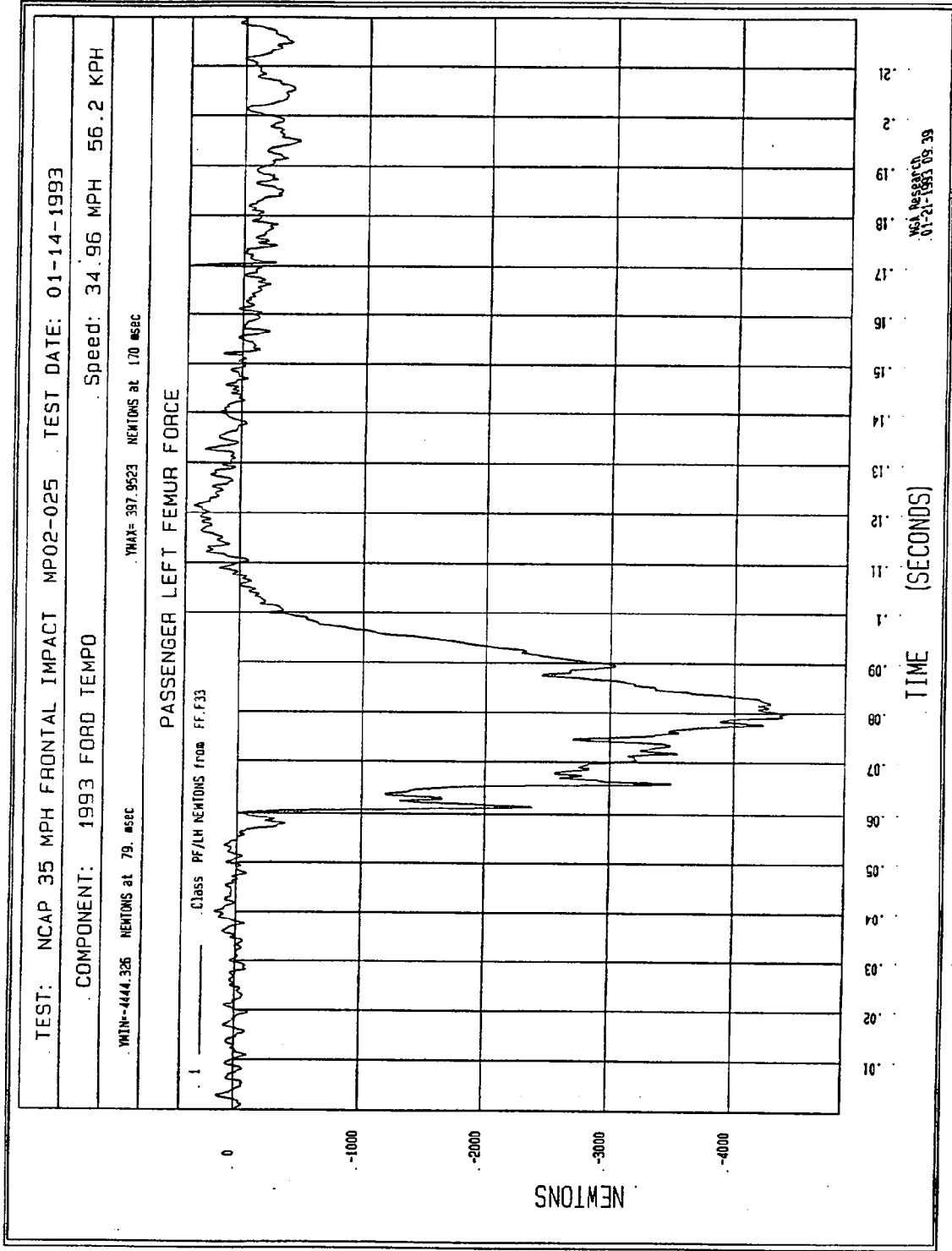


Figure B-59 - Passenger Left Femur Force vs. Time
Data Spike at 150 msec.

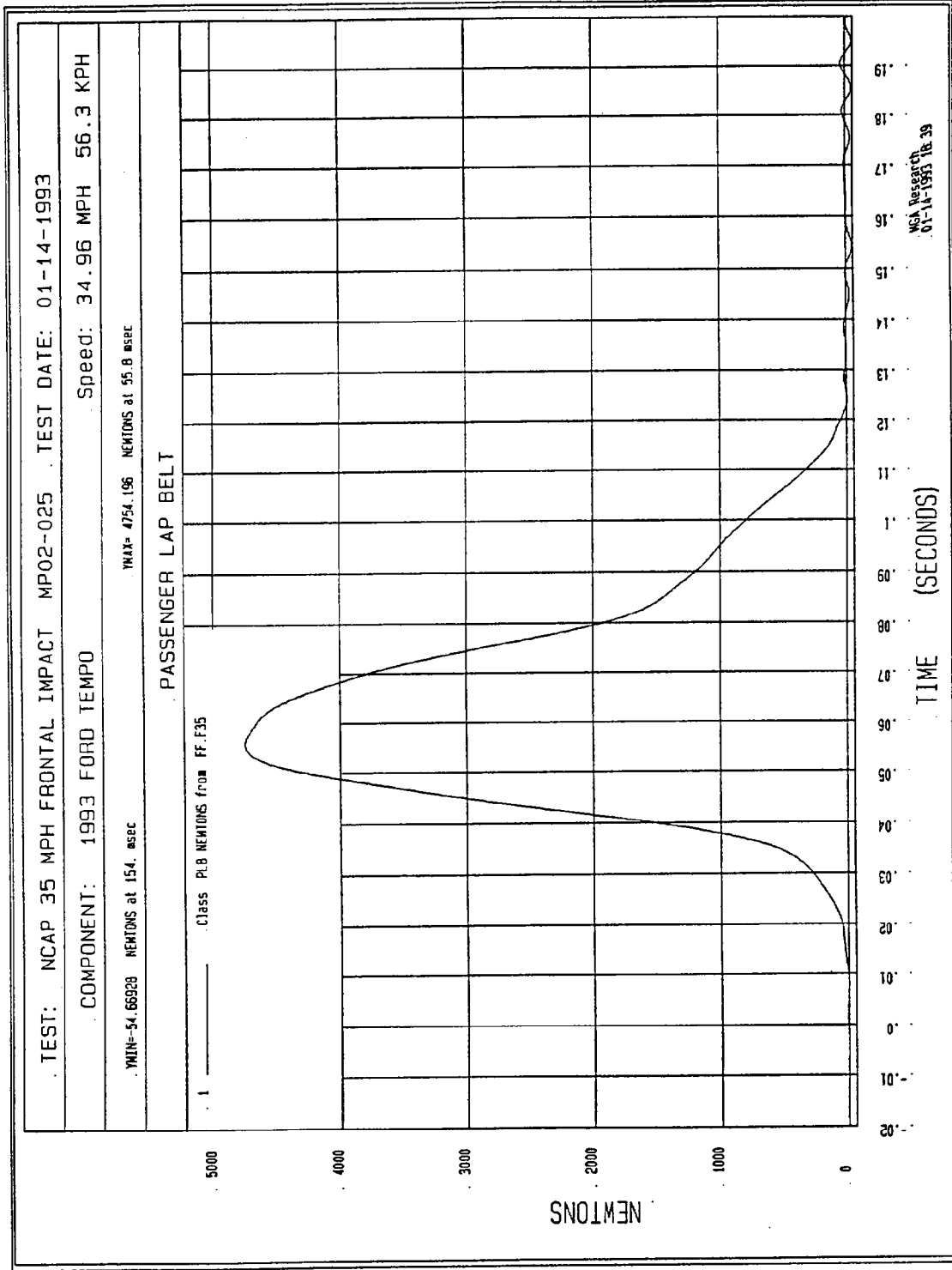


Figure B-60 - Passenger Lap Belt Force vs. Time

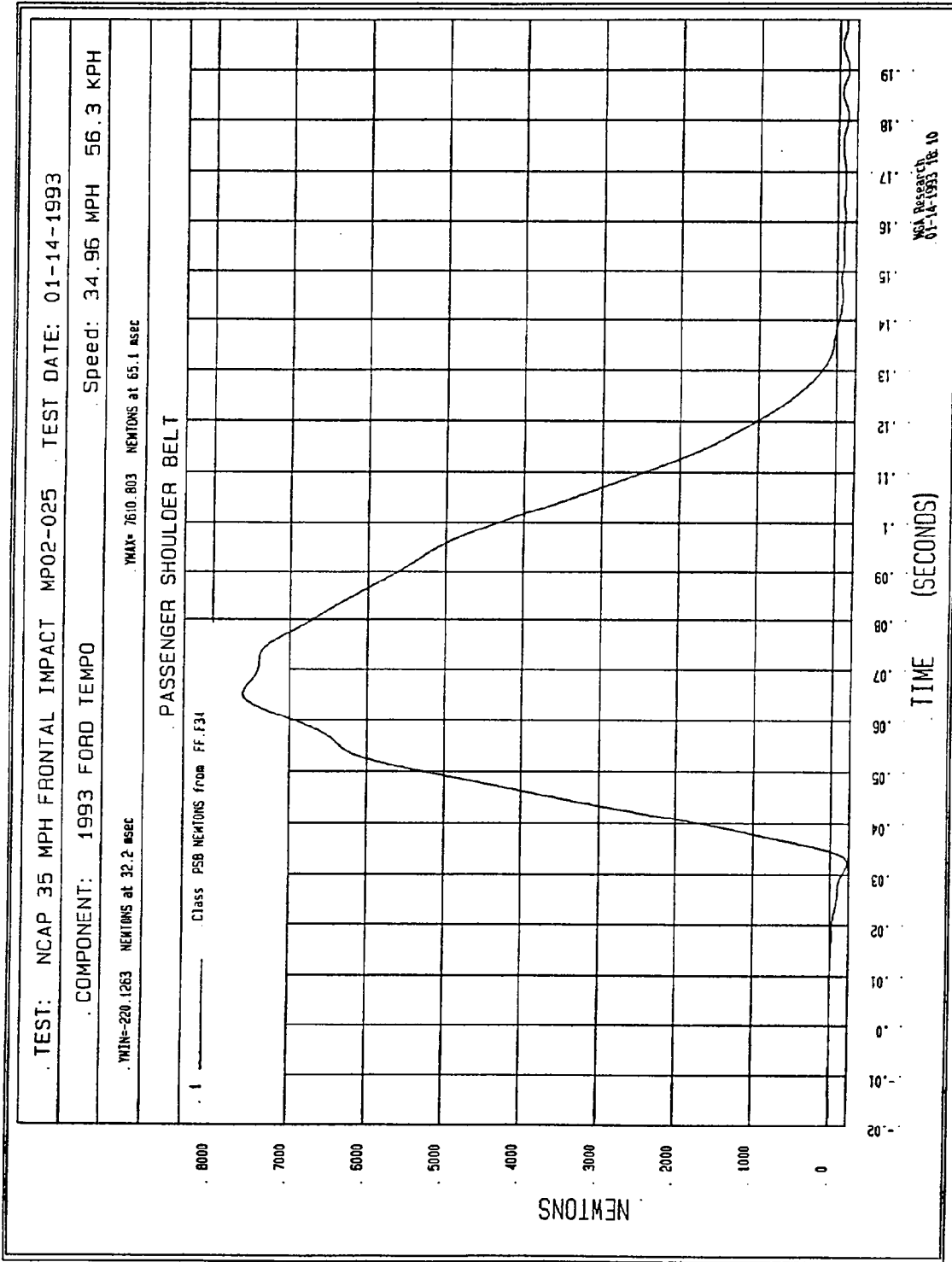


Figure B-61 - Passenger Torso Belt Force vs. Time

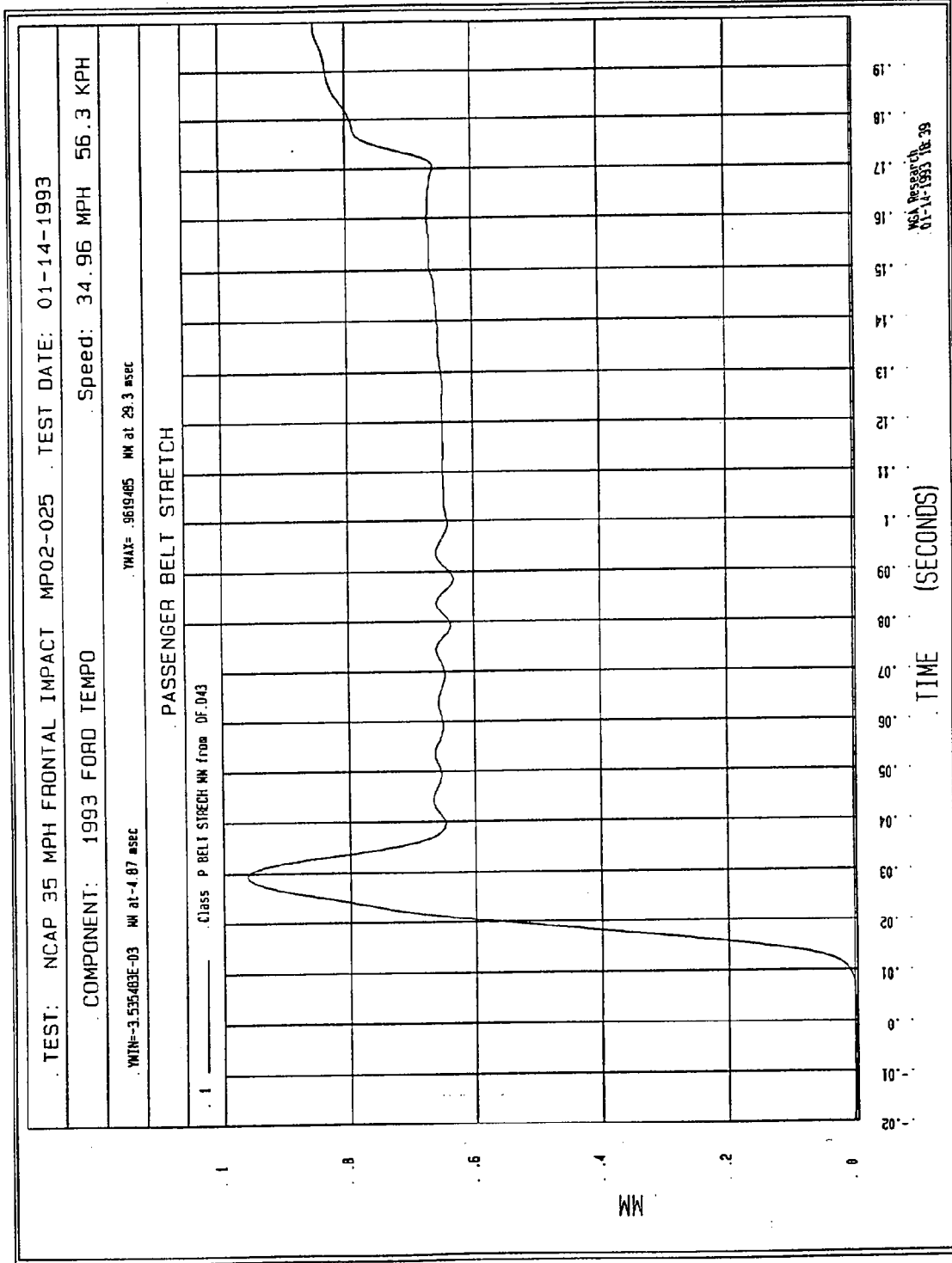


Figure B-62 - Passenger Torso Belt Stretch vs. Time

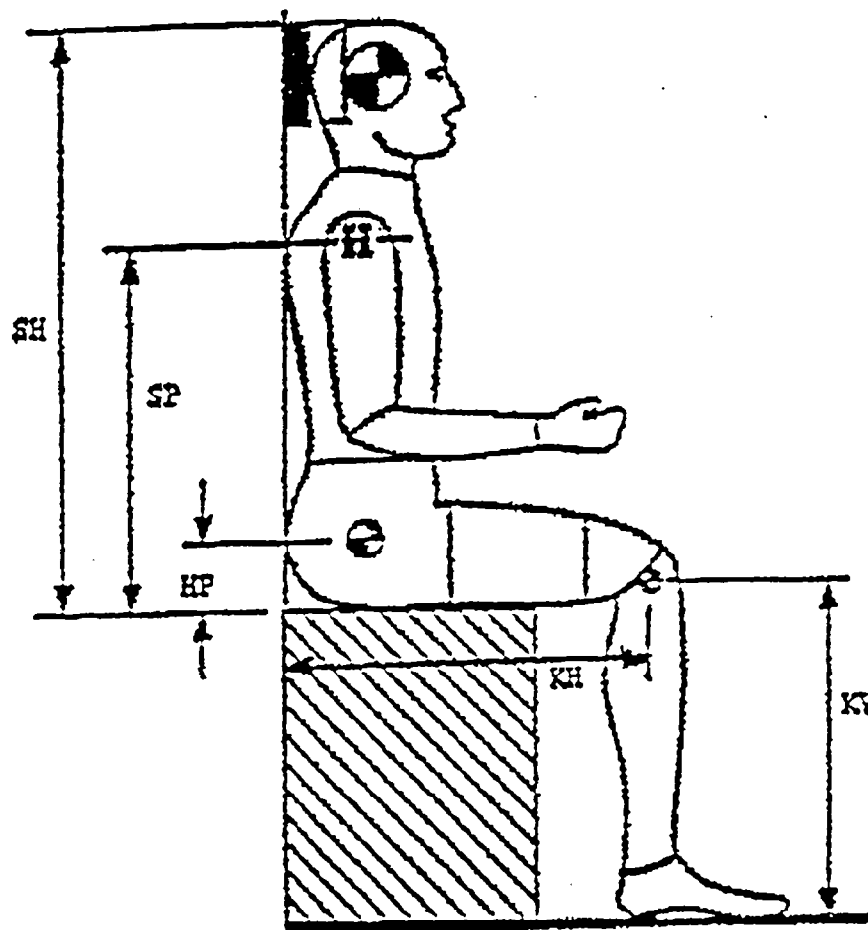
APPENDIX C

Dummy Configuration & Performance Verification Data

PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY NO.: 465 DUMMY CALIBRATION BY: Roni Dermer

I. CONFIGURATION VERIFICATION DATA



DATE OF VERIFICATION: 11-03-92

DESCRIPTION	SPECIFICATION	ACTUAL MEASUREMENT
SH - Seated Height	35.6" to 35.8"	35.6
SP - Shoulder Pivot Height	21.8" to 22.4"	21.9
HP - Hip Pivot Height	3.9" ref.	3.9
KH - Knee Pivot From Back Line	20.1" to 20.7"	20.6
KV - Knee Pivot From Floor	19.3" to 19.9"	19.5
SW - Shoulder Width	17.8" to 18.4"	18.1
HW - Hip Width	14.0" to 15.4"	14.8

PART 572 DUMMY CONFIGURATION AND PERFORMANCE (CONT.)

II. PERFORMANCE VERIFICATION DATA

DUMMY NO.: 465 DUMMY CALIBRATION BY: R.D & G.B
 VERIFICATION LABORATORY TEMPERATURE (66° - 78°F): 67°

		SPECIFICATION	MEASUREMENT
HEAD DROP TEST			
A. Peak Resultant Acc.		210 to 260 g's	234
B. Peak Lateral Acc.		< 10 g's	6
C. Time above 100 g.		0.9 to 1.5 msec.	1.3
NECK BENDING TEST			
A. Pendulum Speed		21.5 to 25.5 fps	23.5
B. Pendulum Average Decel. Over $t_3 - t_2$		20 to 24 g's	23.3
C. Peak Resultant Head Acc.		26 g maximum	25.6
D. Pendulum Decel ($t_2 - t_1$)		$\leq = 3$ ms	2.6
E. Pendulum Decel ($t_3 - t_2$)		25 to 30 ms	28.2
F. Pendulum Decel ($t_4 - t_3$)		$\leq = 10$ ms	3.7
G. Max Head Rotation		63° to 73°	69
H. Chordal Displacement Head Rotation Angle			
0°	Time	-2 to 2 ms	0
	Displ.	-0.5 to 0.5 in	0
30°	Time	25.6 to 34.4 ms	27.6
	Displ.	2.1 to 3.1 in	2.5
60°	Time	40.3 to 51.7 ms	41.9
	Displ.	4.3 to 5.3 in	4.8
Maximum (68°)	Time	53.2 to 66.8 ms	56.3
	Displ.	5.0 to 6.0 in	5.6
60°	Time	67.0 to 83.0 ms	68.8
	Displ.	4.3 to 5.3 in	4.9
30°	Time	85.4 to 104.6 ms	87.9
	Displ.	2.1 to 3.1 in	2.4
0°	Time	101.0 to 123.0 ms	101.5
	Displ.	0 to 0.5 in	0.3

PART 572 DUMMY CONFIGURATION AND PERFORMANCE (CONT.)

	SPECIFICATION	MEASUREMENT
ABDOMINAL COMPRESSION TEST (Preload = 10 lbs.)		
Force @ 0.5 in	23.3 to 36.5 lbs	26.7
Force @ 0.75 in	36.7 to 49.8 lbs	39.5
Force @ 1.0 in	50 to 63 lbs	58.1
Force @ 1.3 in	73 to 88 lbs	82.7

	SPECIFICATION	MEASUREMENT
LUMBAR FLEXION TEST		
A. Force @ 20°	22 to 34 lbs	30.3
B. Force @ 30°	34 to 46 lbs	42.2
C. Force @ 40°	46 to 58 lbs	56.2
D. Return Angle	12° Maximum	8.6

	SPECIFICATION	MEASUREMENT
CHEST IMPACT TESTS		
A. High Speed		
(1) Probe Speed	21.78 to 22.22 fps	21.83
(2) Peak Deflection	1.7 in. (maximum)	1.08"
(3) Peak Resistive Force	2250 lbs. (maximum)	2,187.2 lbs.
(4) Internal Hysteresis	50% to 70%	55.5%
B. Low Speed		
(1) Probe Speed	13.86 to 14.14 fps	13.94 ft/sec.
(2) Peak Deflection	1.1 in. (maximum)	.79"
(3) Peak Resistive Force	1450 lbs. (maximum)	1381.7 lbs.
(4) Internal Hysteresis	50% to 70%	59.6%

PART 572 DUMMY CONFIGURATION AND PERFORMANCE (CONT.)

	SPECIFICATION	MEASUREMENT
KNEE IMPACT TESTS		
A. Right Side		
(1) Probe Speed	6.67 to 7.04 fps	7.02
(2) Maximum Force	1850 to 2500 lbs.	2090.2
(3) Time Above 1000 lbs.	1.7 msec. (minimum)	2.122
B. Left Side		
(1) Probe Speed	6.67 to 7.04 fps	7.02
(2) Maximum Force	1850 to 2500 lbs.	2190.9
(3) Time Above 1000 lbs.	1.7 msec. (minimum)	1.981

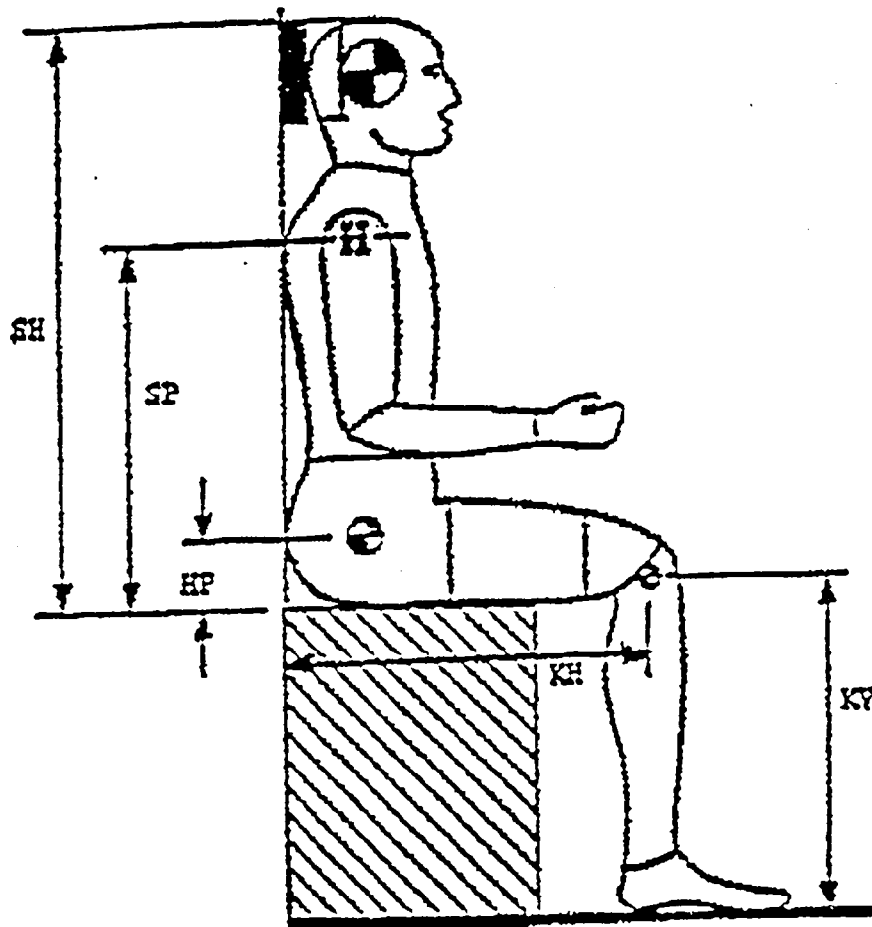
RD#1.P572/dmd

PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY NO.: 466

DUMMY CALIBRATION BY: Rod McClelland

I. CONFIGURATION VERIFICATION DATA



DATE OF VERIFICATION: 1-07-93

DESCRIPTION	SPECIFICATION	ACTUAL MEASUREMENT
SH - Seated Height	35.6" to 35.8"	35.6
SP - Shoulder Pivot Height	21.8" to 22.4"	22.2
HP - Hip Pivot Height	3.9" ref.	3.9
KH - Knee Pivot From Back Line	20.1" to 20.7"	20.4
KV - Knee Pivot From Floor	19.3" to 19.9"	19.4
SW - Shoulder Width	17.8" to 18.4"	18.0
HW - Hip Width	14.0" to 15.4"	14.9

PART 572 DUMMY CONFIGURATION AND PERFORMANCE (CONT.)

II. PERFORMANCE VERIFICATION DATA

DUMMY NO.: 466 DUMMY CALIBRATION BY: Rod McClelland
 VERIFICATION LABORATORY TEMPERATURE (66° - 78°F): 69°

		SPECIFICATION	MEASUREMENT
HEAD DROP TEST			
A.	Peak Resultant Acc.	210 to 260 g's	250
B.	Peak Lateral Acc.	< 10 g's	3
C.	Time above 100 g.	0.9 to 1.5 msec.	1.3
NECK BENDING TEST			
A.	Pendulum Speed	21.5 to 25.5 fps	23.5
B.	Pendulum Average Decel. Over $t_3 - t_2$	20 to 24 g's	22
C.	Peak Resultant Head Acc.	26 g maximum	25
D.	Pendulum Decel ($t_2 - t_1$)	$\leq = 3$ ms	2.23
E.	Pendulum Decel ($t_3 - t_2$)	25 to 30 ms	28
F.	Pendulum Decel ($t_4 - t_3$)	$\leq = 10$ ms	4.8
G.	Max Head Rotation	63 to 73°	68°
H.	Chordal Displacement Head Rotation Angle		
0°	Time	-2 to 2 ms	0
	Displ.	-0.5 to 0.5 in	0
30°	Time	25.6 to 34.4 ms	27.1
	Displ.	2.1 to 3.1 in	2.6
60°	Time	40.3 to 51.7 ms	42.2
	Displ.	4.3 to 5.3 in	4.9
Maximum (69°)	Time	53.2 to 66.8 ms	56.7
	Displ.	5.0 to 6.0 in	5.6
60°	Time	67.0 to 83.0 ms	69.0
	Displ.	4.3 to 5.3 in	4.9
30°	Time	85.4 to 104.6 ms	87.5
	Displ.	2.1 to 3.1 in	2.4
0°	Time	101.0 to 123.0 ms	101.1
	Displ.	0 to 0.5 in	0.2

PART 572 DUMMY CONFIGURATION AND PERFORMANCE (CONT.)

	SPECIFICATION	MEASUREMENT
ABDOMINAL COMPRESSION TEST (Preload = 10 lbs.)		
Force @ 0.5 in	23.3 to 36.5 lbs	26.6
Force @ 0.75 in	36.7 to 49.8 lbs	41.8
Force @ 1.0 in	50 to 63 lbs	59
Force @ 1.3 in	73 to 88 lbs	85

	SPECIFICATION	MEASUREMENT
LUMBAR FLEXION TEST		
A. Force @ 20°	22 to 34 lbs	27
B. Force @ 30°	34 to 46 lbs	41
C. Force @ 40°	46 to 58 lbs	47
D. Return Angle	12° Maximum	8°

	SPECIFICATION	MEASUREMENT
CHEST IMPACT TESTS		
A. High Speed		
(1) Probe Speed	21.78 to 22.22 fps	21.90 ft/sec.
(2) Peak Deflection	1.7 in. (maximum)	1.5"
(3) Peak Resistive Force	2250 lbs. (maximum)	2110 lbs.
(4) Internal Hysterisis	50% to 70%	56%
B. Low Speed		
(1) Probe Speed	13.86 to 14.14 fps	13.96 ft/sec
(2) Peak Deflection	1.1 in. (maximum)	0.8"
(3) Peak Resistive Force	1450 lbs. (maximum)	1409 lbs.
(4) Internal Hysteresis	50% to 70%	57%

PART 572 DUMMY CONFIGURATION AND PERFORMANCE (CONT.)

	SPECIFICATION	MEASUREMENT
KNEE IMPACT TESTS		
A. Right Side		
(1) Probe Speed	6.67 to 7.04 fps	6.89
(2) Maximum Force	1850 to 2500 lbs.	2,447
(3) Time Above 1000 lbs.	1.7 msec. (minimum)	1.9
B. Left Side		
(1) Probe Speed	6.67 to 7.04 fps	6.97
(2) Maximum Force	1850 to 2500 lbs.	1880
(3) Time Above 1000 lbs.	1.7 msec. (minimum)	1.8

RD#1.P572/dmd

APPENDIX D

Dummy, Vehicle and Laboratory Calibration Data

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

INSTRUMENTS FOR DUMMY NO. 465

	DRIVER		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	ED71	Endevco	11/6/92
Head Y	A06M	Endevco	11/9/92
Head Z	A55D	Endevco	11/6/92
Chest X	ACC00	Endevco	11/6/92
Chest Y	A82D	Endevco	11/6/92
Chest Z	A996	Endevco	11/6/92
Right Femur Load Cell	949	GSE	11/4/92
Left Femur Load Cell	961	GSE	11/4/92
*Neck Load Cell X			
*Neck Load Cell Y			
*Neck Load Cell Z			
*Neck Moment X			
*Neck Moment Y			
*Neck Moment Z			
*Chest Deflection Gauge			
Lap Belt Load Cell	211		11/3/92
Torso Belt Load Cell	657		12/20/92
Spool-Out Potentiometer	N/A		
Belt Stretch Transducer	02	Bourns	11/23/92

*Hybrid III use only.

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

INSTRUMENTS FOR DUMMY NO. 466

	PASSENGER		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	FH45	Endevco	11/9/92
Head Y	A11M	Endevco	11/9/92
Head Z	DR22	Endevco	11/6/92
Chest X	A43M	Endevco	11/6/92
Chest Y	A87M	Endevco	11/6/92
Chest Z	A07M	Endevco	11/6/92
Right Femur Load Cell	932	GSE	11/3/92
Left Femur Load Cell	957	GSE	11/3/92
*Neck Load Cell X			
*Neck Load Cell Y			
*Neck Load Cell Z			
*Neck Moment X			
*Neck Moment Y			
*Neck Moment Z			
*Chest Deflection Gauge			
Lap Belt Load Cell	625	Eaton	11/3/92
Torso Belt Load Cell	690	GSE	11/3/92
Spool-Out Potentiometer	N/A		
Belt Stretch Transducer	01	Bourns	11/23/92

*Hybrid III use only.

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

VEHICLE ACCELEROMETERS			
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Rear Seat Crossmember X	MGA032	Entran	9/15/92
Right Rear Seat Crossmember X	MGA038	Entran	10/2/92
Top of Engine X	BA26	Endevco	8/14/92
Bottom of Engine X	MGA033	Entran	8/15/92
Left Brake Caliper X	MGA063	Entran	10/1/92
Right Brake Caliper X	AA1H9	Endevco	11/15/92
Instrument Panel X	MGA067	Entran	8/29/92
Redundant Left Rear Seat Crossmember X	MGA076	Entran	9/15/92
Redundant Right Rear Seat Crossmember X	MGA064	Entran	9/29/92

LABORATORY INSTRUMENTS			
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Neck Bending Pendulum Accelerometer	1740035	Kyowa	6/15/92
Neck Bending Rotary Potentiometer	N/A	Bourns	PRIOR TO USE
Neck Bending Linear Potentiometer	N/A	Bourns	PRIOR TO USE
Femur/Chest/Thorax Probe Accelerometer	MGA077	Entran	10/1/92
Lumbar Flexion Force Gauge	Custom Fab.	-	PRIOR TO USE
Lumbar Flexion Rotation Gauge	Custom Fab.	-	PRIOR TO USE
Abdomen Compression Displacement Gauge	4856160	CIC	10/1/92
Abdomen Compression Force Gauge	49710	Transducers Inc.	10/1/92

APPENDIX E

Vehicle Owner's Occupant Restraint System Instructions

Safety Restraints

Using Safety Restraints Properly

Safety Belts

The use of safety belts help to restrain you and your passengers in case of a collision. In most states, the law requires their use. We strongly recommend that you use them every time you travel in your vehicle.

Safety belts provide best restraint when:

- the seatback is upright
- the occupant is sitting upright (not slouched)
- the lap belt is snug and low on the hips
- the shoulder belt is snug against the chest
- the knees are straight forward

For your safety, your vehicle has different types of safety belts:

- Manual Front Seat Lap and Shoulder Belts**
– for people who sit in the driver's seat or the right front passenger seat. (Available only on Canadian vehicles and vehicles equipped with the Supplemental Driver Side Air Bag Restraint System.)
- Motorized Shoulder Belt Passive Restraints**
– an automatic shoulder belt for people who sit in the front seat.
- Manual Front Lap Belts** – for people who sit in the front seat and have an automatic shoulder belt.

- Rear Seat Lap and Shoulder Belts**
people who sit next to the side window.
- Lap Belts** – For people who sit in the middle position in the rear seat.

See the following sections for directions on how to properly use these safety belts. Also see *Safety Restraints for Children* in this chapter for special instructions about using safety belts for children.

Warning: Make sure that you and your passengers, including pregnant women, wear safety belts. Be sure that the lap belt portion of your safety belts fit snugly and as low as possible around the hips. If safety belts are not used properly, the risk of you or your passengers being injured in a collision greatly increases.

Do not allow any people to ride in your vehicle's trunk. People who are not riding in seats, with their safety belts fastened, are much more likely to be injured in a collision.

Warning: Use the shoulder belt on the outside shoulder only. Never wear the shoulder belt under the arm. Never swing it around your neck over the inside shoulder. Never use a single belt for more than one person. Failure to follow these precautions could increase the risk and/or severity of injury in a collision.

Warning: Always drive and ride with your seatback upright and the lap belt portion of your safety belt snug and low across the hips. This will reduce the risk of serious injury to the abdomen or neck that could be caused by sliding under the safety belts in a collision.

Children should always ride with the seatback in the fully upright position. When the seatback is not fully upright, there is a greater risk that the child will slide under the safety belt and be seriously injured in a collision.

Never let a passenger hold a child on his or her lap while the vehicle is moving. The passenger cannot protect the child from injury in a collision.

Never use a single belt for more than one person or across more than one seating position. This greatly increases the risk that one or both of the people will be injured in a collision. Each seating position in your vehicle has a specific safety belt assembly which is made up of one buckle and one tongue that are designed to be used as a pair.

Warning: Lock the doors of your vehicle before driving to lessen the risk of the door coming open in a collision.

Safety Belt Maintenance

Check the safety belt systems periodically to make sure that they work properly and are not damaged.

Warning: All safety belt assemblies, including retractors and attaching hardware, should be inspected after any collision. Ford recommends that all safety belt assemblies used in vehicles involved in a collision be replaced. However, if the collision was minor and a qualified technician finds that the belts do not show damage and continue to operate properly, they do not need to be replaced. Safety belt assemblies not in use during a collision should also be inspected and replaced if either damage or improper operation is noted.

Combination Lap and Shoulder Belts

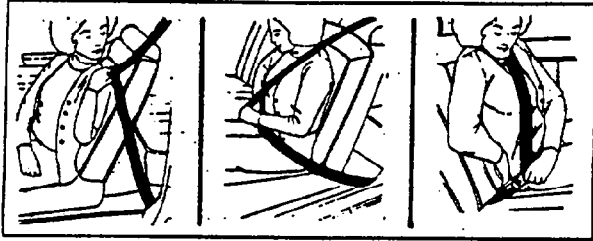
Rear seat lap and shoulder belts are standard for all outboard seating positions. Front seat lap and shoulder belts are available only on Canadian vehicles and vehicles equipped with the Supplemental Driver Side Air Bag Restraint System.

While in motion, the combination lap and shoulder belt adjusts to your movement. However, if you brake hard, turn hard, or if your vehicle receives an impact of 5 mph (8 km/h) or more, the lap and shoulder belt locks and helps reduce your forward movement.

After you get into your vehicle, close the door and lock it. Then adjust the seat to the position that suits you best.

To fasten the belt, pull the lap/shoulder belt from the retractor so that the shoulder portion of the belt crosses your shoulder and chest. Be sure the belt is not twisted. If it is, remove the twist. Insert the belt tongue into the proper buckle until you hear a snap and feel it latch.

Make sure the tongue is securely fastened to the buckle.



Fastening the front seat lap and shoulder belt (Canadian vehicles only)

Warning: Make sure that the lap belt is as low around your hips as possible. Do not wear the lap belt around your waist. If you do not use the lap belts properly, the risk of being injured in a collision greatly increases.

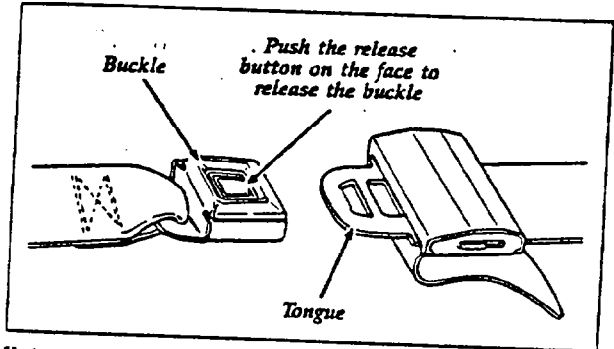
Warning: Front and rear seat outboard occupants (including pregnant women) should wear safety belts, for optimum protection in a collision.

Warning: Use the shoulder belt on the outside shoulder only. Never wear the shoulder belt under the arm. Never swing it around the neck over the inside shoulder. Failure to follow these precautions could increase the risk and/or severity of injury in a collision.

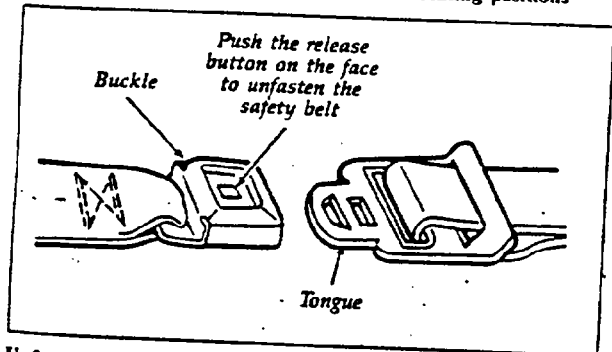
Adjust the lap part of the belt by pulling up on the shoulder belt until the lap belt fits snugly and as low as possible around your hips.

To unfasten the belt:

1. Push the release button on the buckle. This allows the tongue to unlatch from the buckle.



Unfastening the safety belts in center rear seating positions



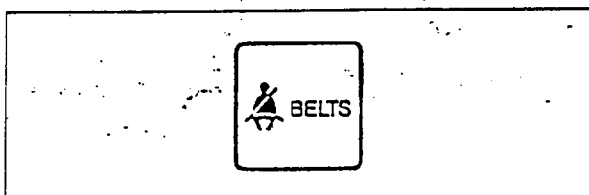
Unfastening the safety belts

2. While the belt retracts, guide the tongue to its original position. If you do not guide the tongue, it may strike you or part of the vehicle.

Safety Belt Light/Chime

If your car has front combination lap-shoulder belts (Canadian vehicles only)

This warning light comes on for at least one minute and the chime sounds for about six seconds if the driver doesn't fasten the safety belt before turning the ignition ON. The light and chime turn off as soon as the belt is buckled.

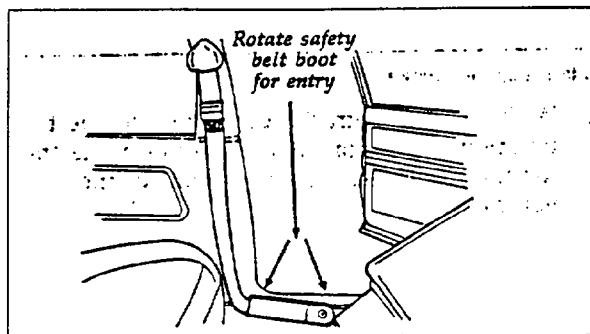


The safety belt light in the standard cluster



The safety belt light in the sport cluster

Rear Seat Entry (Canadian 2-Door Models)



Rear seat entry

The rotating boot on the lap belt system is designed to make it easier to enter and exit from the rear seat and to help front seat passengers reach the belt. To enter the rear seat:

- Rotate safety belt boot rearward.
- Enter rear seat in front of safety belts.
- Return the rotating safety belt boot to forward position to help front seat passengers reach the belt.

Lap Belts

The lap belt in the center of the rear seat does not adjust automatically. You must adjust it to fit snugly around your hips. Do not wear it around your waist.

Before you fasten your lap belt, you may need to lengthen it.

To lengthen the belt, tip the belt tongue at a right angle to the belt. Pull the belt tongue over your lap until it reaches the buckle.

To fasten the belt, pull the belt across your hips and insert the tongue into the correct buckle on your seat until you hear a snap and feel it lock. Make sure the buckle is securely fastened.

Adjust the belt so that it fits snugly around your hips:

- If you need to lengthen the belt, unfasten it and repeat the procedure above.
- If you need to shorten the belt, pull on the loose end of the webbing.

To unfasten the belt, push the release button on the face of the buckle. This allows the tongue to unlatch from the buckle.

Safety Belt Extension Assembly

For some people, the safety belt may be too short even when it is fully extended. You can add about eight inches (20 cm) to the belt length with a safety belt extension assembly. Safety belt extensions are available from your dealer.

Warning: To ensure that the safety belt extension assembly will hold in the event of a collision, only safety belt extensions manufactured by the same supplier as the safety belt should be used. Manufacturer identification is located at the end of the webbing on a label.

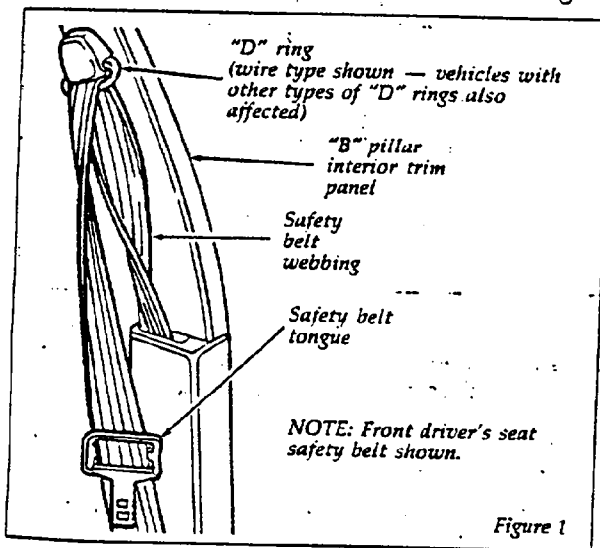
How to Untwist or Unjam a Safety Belt Retractor

If you should jam the lap belt retractor by allowing the belt to retract when it is twisted, you can free the webbing with this procedure:

1. Pull on the belt with both hands to tighten it on the retractor spool.
2. Feed the belt back into the retractor until it is completely retracted. Repeat previous step if necessary.
3. Pull the belt out of its holder as far as it will go and untwist the belt or remove the object that is jamming the belt. Let the belt retract.
4. Then, pull the belt out and let it retract several times to make sure that the belt works properly.

Procedure to Correct a Twisted Safety Belt at the "D" Ring (if so equipped) Front and/or Rear Outboard Seating Positions

NOTE: The restraint system shown in the following figures may be different than your vehicle. However, use these figures and this procedure to correct a twisted safety belt at any outboard seating position that has a "D" ring.



1. Grasp the belt webbing at the "D" ring. See Figure 2.

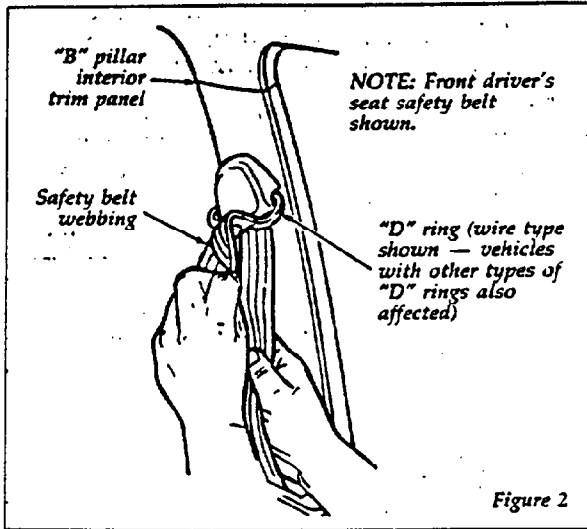


Figure 2

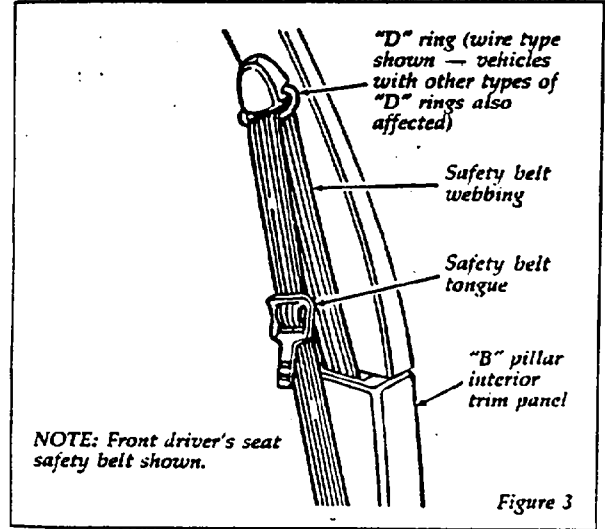


Figure 3

2. Rotate and fold the belt webbing over itself as required to remove the twist.
3. Feed the folded portion of the belt through the "D" ring.
4. When completed, safety belt should look like Figure 3.

Procedure to Correct a Rotated Tongue on the Safety Belt (Front and/or rear outboard seating positions)

NOTE: The restraint system shown in the following figures may be different than your vehicle. However, use these figures and this procedure to correct a rotated tongue on the safety belt at any outboard seating position that has a "D" ring.

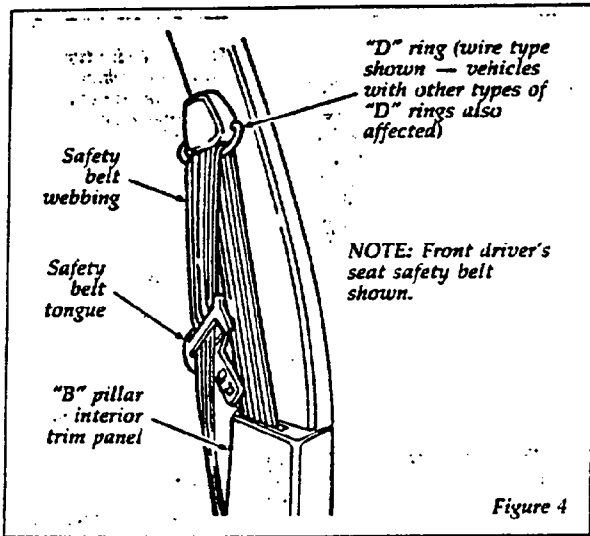


Figure 4

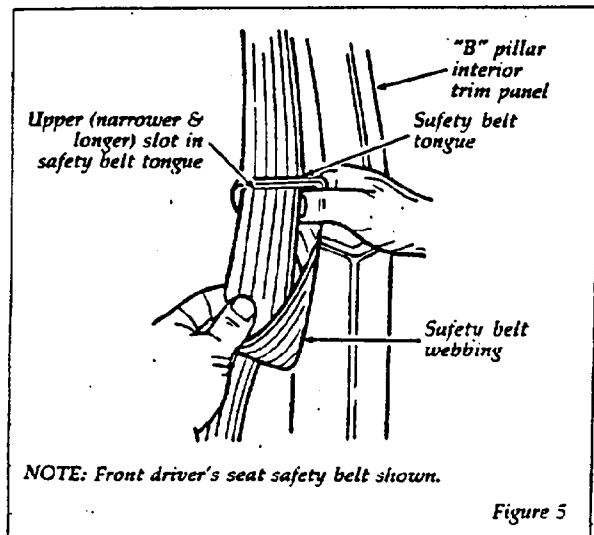
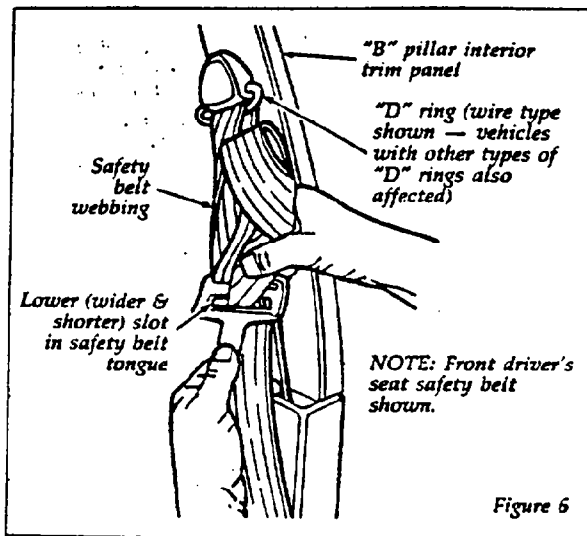


Figure 5

1. Grasp the belt tongue and pull down on the belt webbing closest to you to form a loop through the upper (narrow and longer) slot in the tongue. See Figure 5.
2. Working within the upper slot, rotate and fold the belt webbing over itself as required to remove the twist.
3. Pull the excess belt webbing back through the upper slot in the tongue.
4. Repeat the above steps to complete the removal of the twist at the lower (wider and larger) slot in the tongue. See Figure 6.



To operate the motorized shoulder belt:

1. Get into your car and close the door. Check to be sure the shoulder belt emergency release levers, located in the floor console, are in the full down position.
2. With the door closed and fully latched, insert the ignition key and turn it to the ON position. A motor will slide the shoulder belt along its track starting at the front "A" pillar and moving rearward to its locked position at the "B" pillar.

Note: If the shoulder belt does not move rearward to the "B" pillar, turn the ignition key to the OFF position and open and close the door; the belt will not move if the door is not fully latched. If the shoulder belt still does not move rearward to the "B" pillar or stops before reaching the "B" pillar, refer to the Manual Override Procedure contained in the "Important For Your Safety" portion of this Owner Guide.

5. When completed, the safety belt should look like Figure 3.

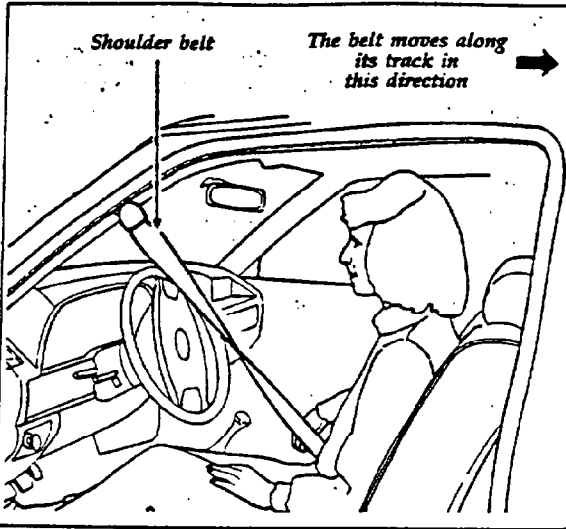
Motorized Shoulder Belt Passive Restraint System

Not available on Canadian vehicles

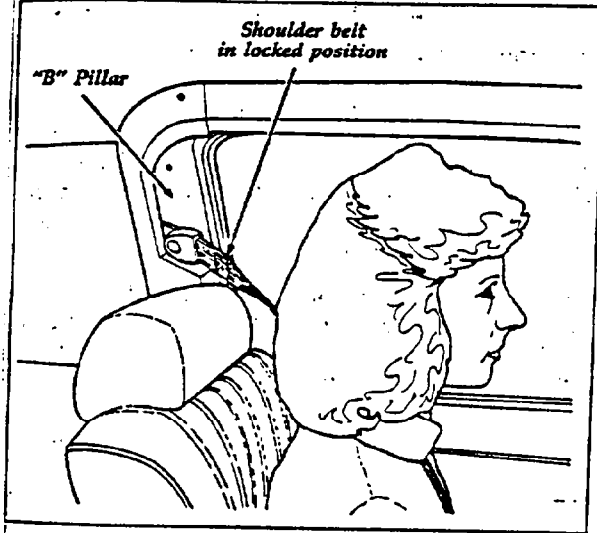
The front seat shoulder belts automatically adjust and, together with the manual lap belt, help to provide added restraint in the event of a collision.

Warning: The lap safety belt is to be manually buckled by the driver/passenger and should always be worn with the shoulder belt. Be sure the lap belt is on your hips as low as possible.

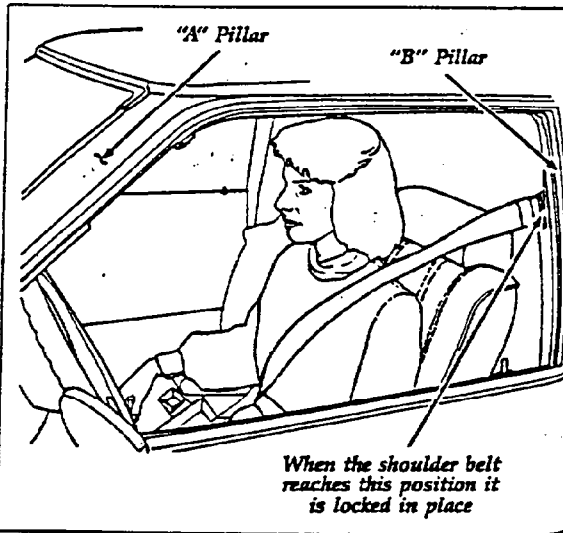
Warning: For the shoulder belt to function properly and restrain the occupant in the event of a collision, the respective shoulder belt emergency release lever must be in the full down position.



The shoulder belt sliding along its track



The shoulder belt in the locked position



The shoulder belt in the locked position

Safety Belt Light/Chime

If your car has motorized shoulder belts

This warning light comes on for at least one minute and the chime sounds for about six seconds if the driver doesn't fasten the lap belt before turning the ignition ON. This light and chime also warn you if either of the shoulder belt emergency release levers are RAISED, or if the shoulder belt stalls before reaching its locked position at the B pillar:

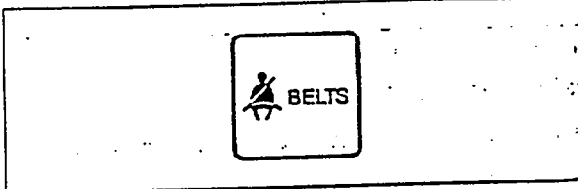
Warning indicator for shoulder belt emergency release

If either one or both shoulder belt emergency release levers are RAISED, the warning light will FLASH and the chime will sound until both levers are full DOWN. The warning light in the console that says "PUSH SHOULDER BELT RELEASE LEVER DOWN" will flash also.

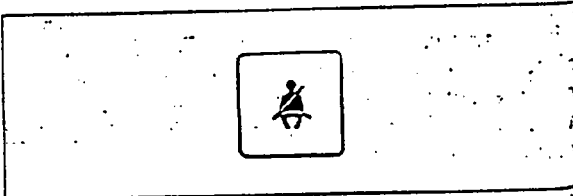
Warning indicator for stalled shoulder belt

After the door is closed and the ignition is turned ON, the shoulder belt automatically travels from the A pillar to the B pillar. If the shoulder belt stalls before reaching the B pillar locked position, the safety belt warning light will come on after a delay of eight seconds and will continue to FLASH until the shoulder belt is locked at the B pillar.

If the light keeps FLASHING, and both shoulder belt emergency release levers are FULL DOWN, the shoulder belt has not reached its locked position. See the instructions for *What To Do If Your Shoulder Belt Does Not Engage Properly* in the section on motorized passive restraints before driving.



The safety belt light in the standard cluster



The safety belt light in the sport cluster

For more information on your passive restraint system, read the section titled *Emergency Release Levers*.

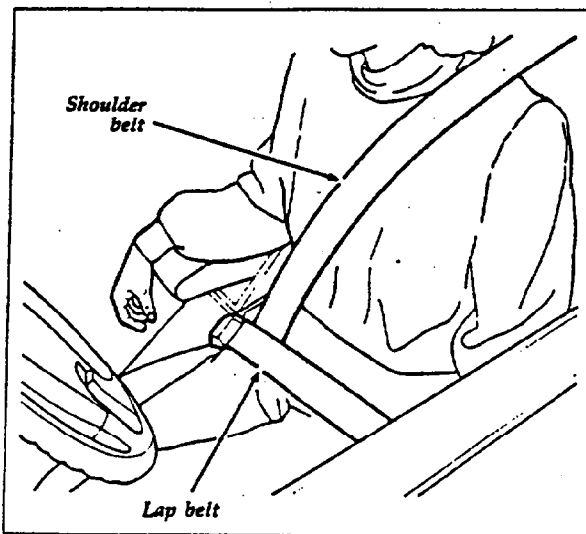
Warning: Always drive and ride with your seatback upright and the lap belt portion of your safety belt snug and low across the hips. This will reduce the risk of serious injury to the abdomen or neck that could be caused by sliding under the safety belts in a collision.

Children should always ride with the seatback in the fully upright position. When the seatback is not fully upright, there is a greater risk that the child will slide under the safety belt and be seriously injured in a collision.

Safety belts provide best restraint when:

- the seatback is upright
- the occupant is sitting upright (not slouched)
- the lap belt is snug and low on the hips
- the shoulder belt is snug against the chest
- the knees are straight forward

When the vehicle ignition is turned to the OFF position and the door is opened, the shoulder belt will move forward to the "A" pillar. This will allow ample room for the driver or passenger to exit the car. **DO NOT USE** the belt as an assist handle when entering or exiting the car.



The lap and shoulder belts in place

Air Bag Supplemental Restraint System (SRS)

Your car may be equipped with an optional air bag for the driver, located in the steering wheel. This air bag is a supplemental restraint system. It is designed to be used in addition to the safety belt to help protect against head and chest injuries in certain moderate to severe frontal collisions.

The Importance of Wearing Safety Belts

Warning: Safety belts must be worn by all vehicle occupants to be properly restrained and help reduce the risk of injury in a collision.

There are four very important reasons to use safety belts even with an air bag system. Use your safety belts to:

- help keep you in the proper position when the air bag inflates
- reduce the risk of harm in rollover, side or rear impact collisions, because an air bag is not designed to inflate in such situations
- reduce the risk of harm in frontal collisions that are not severe enough to activate the air bag
- reduce the risk of being thrown from your vehicle

The Importance of Being Properly Seated

In a collision, the air bag must inflate extremely fast to help provide additional protection for you. In order to do this, the air bag must inflate with considerable force. If you are not seated in a normal riding position with your back against the seatback, the air bag may not protect you properly and could possibly hurt you as it inflates.

Warning: Do not put objects in front of the air bag system storage area that might restrict inflation or that might increase personal injury.

How the Air Bag Supplemental Restraint System Operates

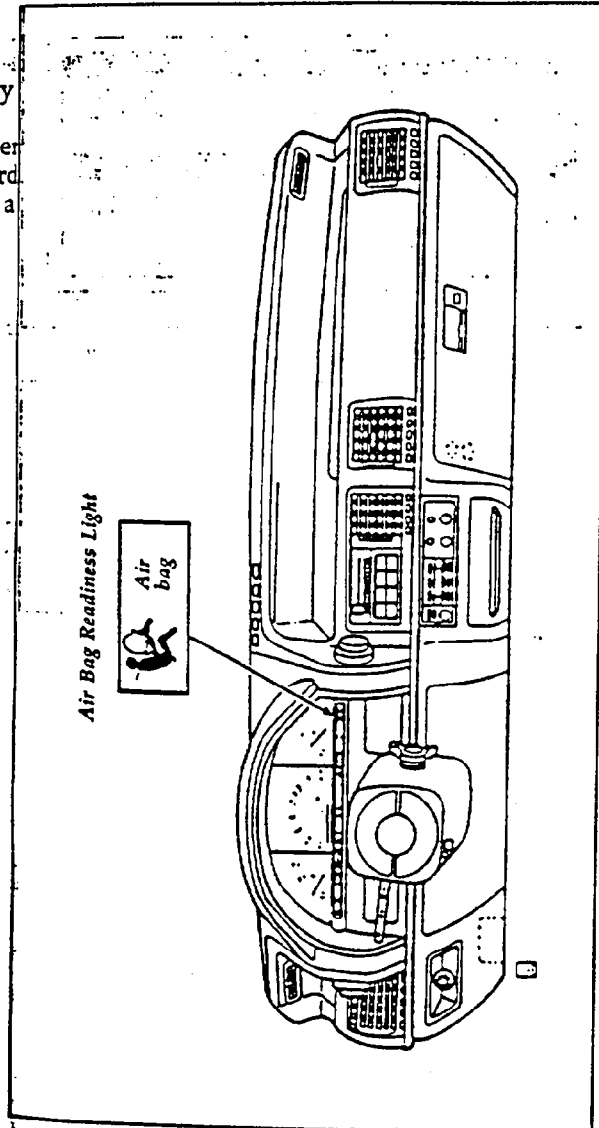
The driver Air Bag Supplemental Restraint System has two main parts. One part is the air bag system with the air bag and inflator located in the center of the steering wheel. The second part is the electrical system which has impact sensors and a diagnostic module. The diagnostic module monitors its own internal circuits and

Disposal of Air Bag Equipped Vehicles

For disposal of air bags or air bag equipped vehicles, see your local Ford or Lincoln-Mercury dealer, or refer to the procedures in the 1993 Ford Shop Manual. Information on how to order a shop manual is available at an authorized Ford or Lincoln-Mercury Dealer. You can also order a shop manual using the order form in the back of your Owner's Guide.

Service and Information Labels

Service and information labels are attached to the sun visor and near the radiator support in the engine compartment.



Air bag information on the instrument panel

WARNING

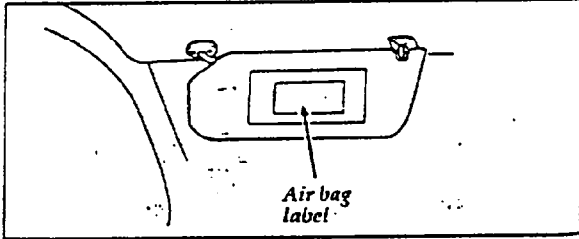
DO NOT TAMPER WITH OR DISCONNECT THE AIR BAG SYSTEM WIRING. You could inflate the bag(s) or make it inoperative which may result in injury. See Shop Manual.

AVERTISSEMENT

NE PAS MANIPULER NI DEBRANCHER LE CADRAGE ELECTRIQUE DU DISPOSITIF D'UN COUSSIN DE SECURITE. Cela pourrait gonfler le coussin de sécurité ou le mettre hors service et entraîner des blessures. Voir le manuel de réparation.

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Label on the radiator support in the engine compartment



Location of air bag label on driver's side

This vehicle has a DRIVER AIR BAG Supplemental Restraint System (SRS). The SRS supplements the driver's seat belt by inflating in moderate or severe frontal collisions. It is not designed to inflate in side or rear crashes, rollovers, or minor frontal collisions, so ALWAYS WEAR YOUR SEAT BELT.

AIR BAG lamp normally lights briefly when Ignition key is turned on.
NO SRS MAINTENANCE IS NEEDED unless:

- *AIR BAG* lamp flashes or stays lit.
- *AIR BAG* lamp does not light when key is turned on.
- Groups of five beeps are heard.

SEE OWNER GUIDE FOR MORE AIR BAG INFORMATION.

Label located on the back of driver's sun visor