V1877

REPORT NO. MGA-90-N011

NEW CAR ASSESSMENT PROGRAM (NCAP)

FRONTAL BARRIER IMPACT TEST

Ford
1993 Ford Bronco
4 X 4
NHTSA NO. MP0201

MGA PROVING GROUNDS
5000 WARREN ROAD
BURLINGTON, WI 53105

February 5, 1993

FINAL REPORT

Prepared For:

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF MARKET INCENTIVES
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Washington, D.C. 20590

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Contracting Officer's Tech. Rep. (COTR)

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TECHNICAL REPORT STANDARD TITLE PAGE

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4. Title and Subtitle	5. Report Date
NHTSA New Car Assessment Program (NCAP) 1993 Frontal Barrier Impact Test on a 1993 Ford Bronco 4 X 4 to indicant requirements FMVSS No. 208, 212, 219 (partial) and 301.	February 5, 1993
	6. Performing Organization Code: MGA
7. Author(s): John Fleck	8. Performing Organization Report No.: MGA-OMI-011
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15. Supplementary Notes

16. Abstract

A 56 kph (35 mph) frontal barrier impact using 30 load cell barrier was conducted on a 1993 Ford Bronco 4 X 4 at the MGA Proving Grounds Crash Test Facility in Burlington, Wisconsin on January 27, 1993.

The barrier impact velocity was 56.6 kph (35.2 mph), and the ambient temperature at the time of impact was 21° C. The post-test average crush was 553 mm.

The test vehicle appeared to comply with the requirements of the following Federal Motor Vehicle Safety Standards:

1. FMVSS 212, "Windshield Mounting"
2. FMVSS 219 (Partial), "Windshield Zone Intrusion"
3. FMVSS 301, "Fuel System Integrity"

With regard to FMVSS 208, "Occupant Crash Protection" injury criteria, the driver's HIC was 694.0 and the 3 msec Clip (Chest g's) was 37.5. The left and right femur maximum loads for the driver were 4251 and 1940 Newtons, respectively. The passenger's HIC was 304.2 and the 3 msec Clip (Chest g's) was 38.8. The left and right femur maximum loads for the passenger were 857 and 917 Newtons respectively.

17. Key Words	18. Distribution Statement
35 mph Frontal Barrier Impact Test New Car Assessment Program (NCAP) FMVSS 212 Indicant Testing FMVSS 219 (Partial) Indicant Testing FMVSS 301 Indicant Testing	Copies of this report available from: Technical Ref. Division, National Highway Traffic Safety Adm., NASSIF Building, Room 5108, 400 Seventh Street, SW Washington, 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 MPØ2Ø1

A load cell barrier consisting of 3Ø load cells was impacted by a 1993 Ford Bronco 4 X 4 at a velocity of 56.6 kph (35.17 mph). The test was performed at the MGA Proving Grounds and Crash Test Center on January 27, 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 16 high speed cameras. Camera locations and other pertinent camera information can be found in this report.

Two Part 572, 5Øth 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 steering wheel rim and hub. The driver HIC was 694.Ø and maximum chest deceleration over 3 milliseconds was 37.5 g's. The left and right femur loads were 4251 and 194Ø Newtons respectively.

The right front passenger's HIC was 3Ø4.2 and maximum chest deceleration over 3 milliseconds was 38.8 g's. The left and right femur loads were 857 and 917 Newtons respectively.

GENERAL TEST AND VEHICLE PARAMETER DATA

Vehicle Yr/Make/Model/Body Style: 1993 Ford Bronco 4 X 4

NHTSA No.: MP0201 VIN.: 1FMEU15H6PLA34656

Body color: Black Date of Manufacture: 11/92

Engine: 8 Cylinders; ___C.I.D.; 5.8 L; ___CC

X Gas; ___Diesel; ___Turbocharged

X Longitudinal; ___Transverse

Transmission: 3 Speed; ___ Manual; X Automatic; X Overdrive

Final Drive: ___Front Wheel; ___Rear Wheel; X Four Wheel

Odometer Reading: 57.1

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

___P/seats; ___Cruise Control

Type of Occupant Restraint: 3 Point Type II

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): Front 2.7 kg/cm^2 Rear 2.7 kg/cm^2

Recommended Tire Size: P235/75R15 X 4

Recommended Cold Tire Pressure: Front 2.7 kg/cm^2 Rear 2.8 kg/cm^2

Tires on Vehicle: Radial ATX ; Manufacturer: Firestone

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) = N/A kg. (A)

No. of Occupants x 67.5 kg. = 337.5 kg. (B)

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

GVWR 2744 kg. GAWR: Front 1270 kg. Rear 1710 kg.

GENERAL TEST AND VEHICLE PARAMETER DATA (Cont'd)

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

Right Front = 578.0 kg. Right Rear = 534.9 kg.

Left Front = 560.8 kg. Left Rear = 546.3 kg.

TOTAL FRONT WEIGHT = 1138.8 kg. (51.3% of Total Vehicle Weight)

TOTAL REAR WEIGHT = 1081.2 kg. (48.7% of Total Vehicle Weight)

TOTAL UNLOADED DELIVERED WEIGHT (UDW) = 2220.0 kg.

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight 2220.0 kg.

VCW = Vehicle Capacity Weight N/A kg.

DSC = Designated Seating Capacity 5

RCW = VCW - 68 (DSC) = 136 *kg.

Target Test Weight = UDW + RCW + (2 dummies x 74.4 kg./dummy)

Target Test Weight = 2504.8 kg.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND CARGO:

Right Front = 615.3 kg. Right Rear = 653.4 kg.

Left Front = 588.9 kg. Left Rear = 643.8 kg.

TOTAL FRONT WEIGHT = 1204.2 kg. (48.1% of Total Vehicle Weight)

TOTAL REAR WEIGHT = 1297.2 kg. (51.9% of Total Vehicle Weight)

TOTAL TEST WEIGHT = 2501.4 kg.

Weight of ballast secured in vehicle trunk area = 79.4 kgs.

Vehicle components removed for instrumentation installation:

Rear Seat

VEHICLE ATTITUDE (all dimensions in mm):

Delivered Attitude: RF 914 LF 930 RR 927 LR 914

Test Attitude: RF 898 LF 892 RR 898 LR 886

Wheel Base: 2667 mm.; C.G. = 1381 mm rearward of front wheel C/L

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

POST-IMPACT DATA:

Type of Test: 35 mph Frontal Impact Impact Angle: Ø °

Date of Test: January 27, 1993 Time of Test: 1:3Ø p.m.

Ambient Temperature: 21 °C (Spec. Range = 18.8 to 25.6°C)

Temperature in Occupant Compartment: 21 °C

Windshield Molding Temperature: 21 °C

Required Impact Velocity Range: 55.5 to 57.1 kph

Impact Velocity: primary = 56.5 kph, secondary = 56.5 kph

Distance From Front Bumper to Barrier Face When

Entering Speed Trap: 1180 mm

Exiting Speed Trap: 180 mm

VEHICLE REBOUND AND CRUSH (mm):

Vehicle Length: Pre-test = R 4362 C_L 4680 L 4341

Post-test = R 3867 C_L 4054 L 3868

Crush = R 495 C_L 626 L 473

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

R 331 mm C_L 362 mm L 362 mm

VISIBLE DUMMY CONTACT POINTS:

	Driver	Passenger
Head	to steering wheel rim/hub	Chin to Chest/Right Thigh
Chest	to steering wheel hub	None
Abdomen	to steering wheel rim	None
Left Knee	to instrument panel	to instrument panel
Right Knee	to instrument panel	to instrument panel

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

	Front		Rear	
	Left	Right	Left	Right
Door Opening (without use of tools)	Opened	Opened	N/A	N/A

	Front		Rear	
Seat Movement	Left	Right	Left	Right
Seat Back Movement	None	None	N/A	N/A
Seat Shift	42 mm forward	8 mm forward	N/A	N/A

Glazing Damage

Backlight/Windshield Separated for 76 mm; 660 mm in from passenger side lower corner and separated for 51 mm; 432 mm in from driver side lower corner

Other Notable Impact Effects: Severe cracking

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

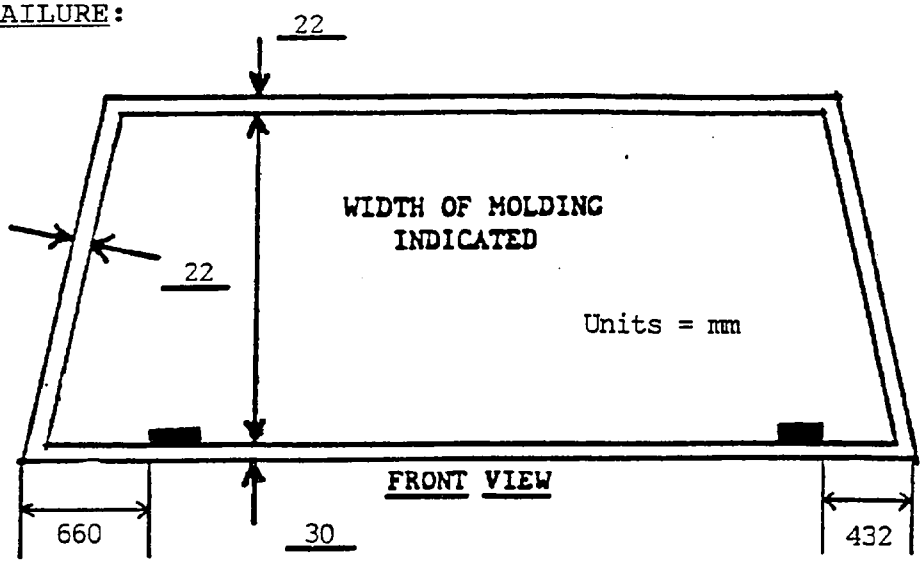
Details of windshield mounting such as retention method, trim type, etc.:
Steel trim with glue retention

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	2262	2211	98%
LEFT SIDE	2262	2186	97%
TOTAL	4524	4397	97%

AREA OF RETENTION FAILURE:



FAILURE DETAILS:

Both failures occurred at the lower windshield mounting at cowl. The driver side failure was approximately 51 mm in length and occurred approximately 432 mm in from the lower outside corner. The passenger side failure was approximately 76 mm in length and occurred approximately 660 mm inboard of the lower corner on the passenger side.

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= 1500 mm

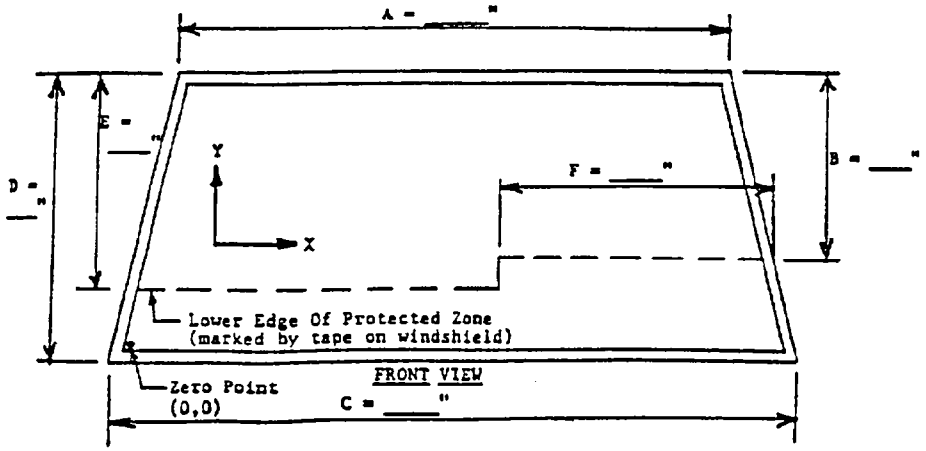
B= 356 mm

C= 1794 mm

D= 615 mm

E= 448 mm

F= 665 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.: MP0201 TEST DATE: January 27, 1993

VEHICLE MAKE/MODEL/BODY STYLE: 1993 Ford Bronco 4 X 4

USABLE CAPACITY OF VEHICLE'S FUEL TANK: 123 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:

113.8 Liters Which is 93 % of the Stated USABLE CAPACITY.

SOLVENT SPILLAGE MEASUREMENT AFTER 35 MPH FRONTAL BARRIER IMPACT TEST:

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

	First 5 Minutes FROM ONSET OF ROTATION	6th Minute	7th Minute	8th Minute
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

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III. AID DATA
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FMVSS NO. 208, "OCCUPANT CRASH PROTECTION", DATA SHEET

VEH. YR./MAKE/MODEL/BODY STYLE: 1993 Ford Bronco 4 X 4

VEH. NHTSA NO.: MP0201 TEST DATE: January 27, 1993

MAXIMUM ACCELERATION VALUES: (g's)	DRIVER DUMMY #465	PASSENGER DUMMY #466
Head Channel X	-97.6	-41.6
Head Channel Y	-18.5	28.8
Head Channel Z	65.0	40.1
HEAD RESULTANT	111.3	57.5
Chest Channel X	-38.0	-38.7
Chest Channel Y	-9.1	19.1
Chest Channel Z	20.5	17.4
CHEST RESULTANT (CLIP)	37.5	38.8
TIME INTERVAL (msec) [0.003 seconds minimum]	t_1 = 62.5 t_2 = 65.5	t_1 = 69.1 t_2 = 72.1

HEAD INJURY CRITERIA (HIC) VALUES:

HIC	694.0	304.2
t_1 = (msec)	67.3	61.6
t_2 = (msec)	103.3	97.6
Avg. Accel. t_1 to t_2 (g's)	51.8	37.2

[The maximum time interval from t_1 to t_2 is 36 milliseconds.]

MAXIMUM FEMUR FORCES:

Right Side (N)	-1939.6	-917.2
Left Side (N)	-4250.7	-857.1

MAXIMUM SEAT BELT FORCES:

Lap Belt (N)	5026.6	8375.1
Shoulder Belt (N)	9796.8	8005.4

NOTE: All values listed must occur during primary impact event. (Head X,Y,Z and R listed must be during t_1 to t_2 HIC interval)

HYBRID III NECK AND CHEST DATA SHEET*

VEHICLE YR./MAKE/MODEL/BODY STYLE: 1993 Ford Bronco 4 X 4

VEHICLE NHTSA NO.: MP0201 TEST DATE: January 27, 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

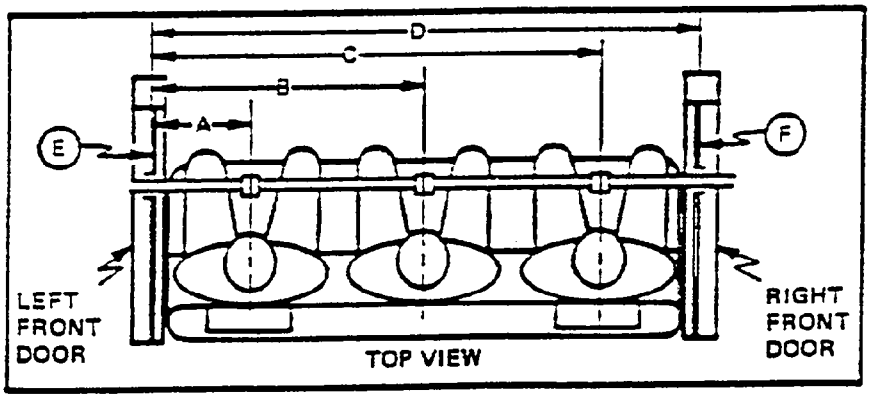
PART 572 DUMMY IN-VEHICLE POSITION

Test No.: MP0201 Vehicle: 1993 Ford Bronco 4 X 4

SEAT TYPE:	ADJUSTER TYPE:	BUCKET SEAT BACK TYPE:
_____Bench	___X___Manual	_____Fixed
___X___Bucket	_____Power	___X___Adjustable Reclining
_____Split Bench		

Driver Seat: Mid Position (10th Notch)

Passenger Seat: Mid Position (10th Notch)



___465___ **DUMMY ID** ___466___

A = Left Door to Driver Centerline ___390___ mm

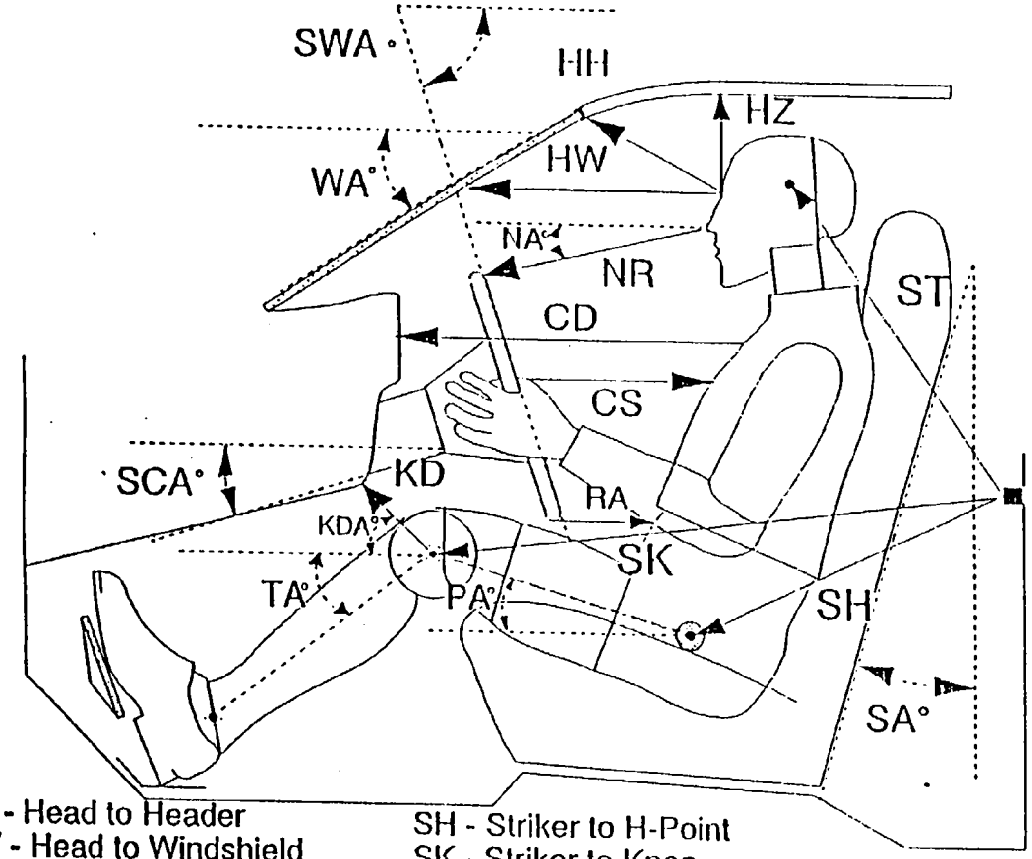
B = Left Door to Center Passenger Centerline ___888___ mm

C = Left Door to Right Passenger Centerline ___1345___ mm

D = Left Door to Right Door ___1775___ mm

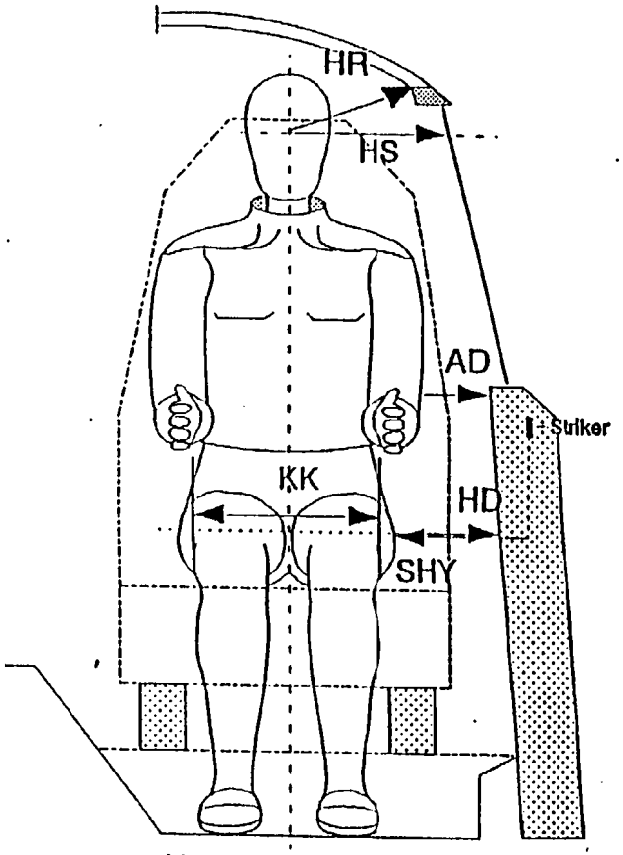
E,F = Window Glass Height (Right and Left Must Be Equal)

DUMMY MEASUREMENTS FOR FRONT SEAT PASSENGERS

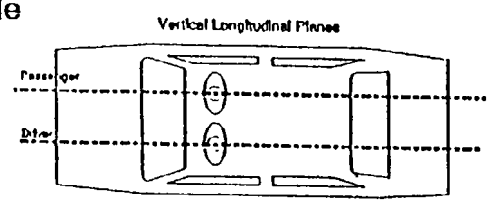


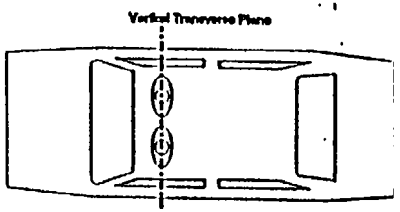
HH - Head to Header
HW - Head to Windshield
HZ - Head to Roof
NR - Nose to Rim
CS - Steering Wheel to Chest
CD - Chest to Dash
RA - Rim to Abdomen
KDL/KDR - Knee to Dash
KDA - Knee to Dash Angle

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





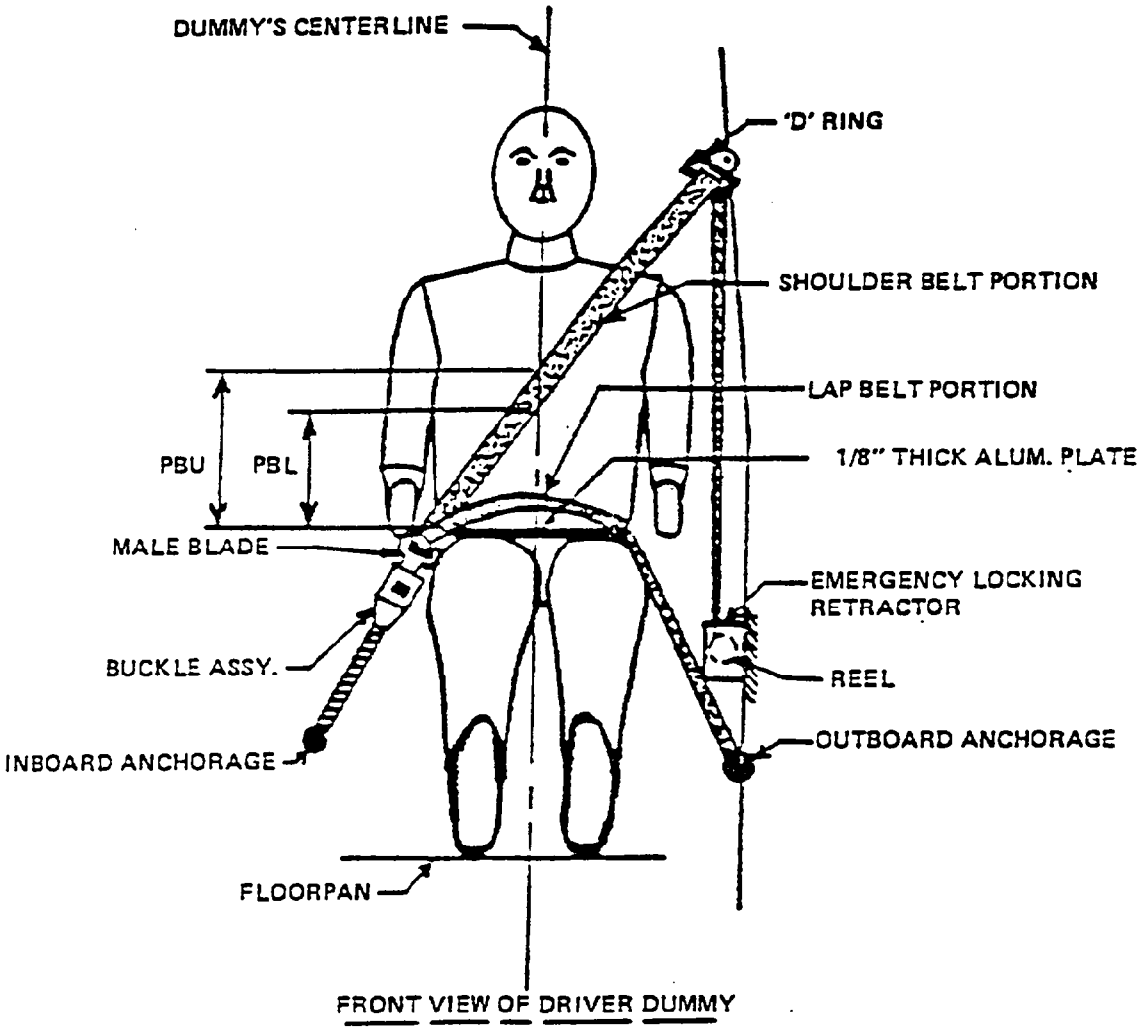
FRONT SEAT MEASUREMENT TABLE

Units (mm)

	DRIVER (Serial #465)	PASSENGER (Serial #466)
WA°	46	NA
SWA°	26.2	NA
SCA°	25.8	NA
SA°	24.0	24.2
HZ	204	208
HH	558	560
HW	667	669
HR	177	199
NR	465 Angle 16.8°	NA
CD	611	622
CS	315	NA
RA	179	NA
KDL	187 Angle (KDA) 18.5°	204
KDR	203	208 Angle (KDA) 36.5°
PA°	9°	6°
TA°	46°	48°
KK	350	295
ST	685 Angle -10.4°	665 Angle 10.4°
SK	692 Angle 3.8°	688 Angle 2.9°
SH	295 Angle 3.3°	298 Angle 1.3°
SHY	248	256
HS	231	240
HD	161	171
AD	99	107

NA = Not Applicable

SEAT BELT POSITIONING DATA



(illustration)

	DRIVER DUMMY	PASSENGER DUMMY
PBU -- Top surface of alum. plate to upper edge	363 mm	345 mm
PBL -- Top surface of alum. plate to belt lower edge	283 mm	257 mm
LAP BELT TENSION	1.8 kg.	1.8 kg.
SHOULDER BELT TENSION	<.9 kg.	<.9 kg.

SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

BELT LENGTH DATA:	Driver	Passenger
Belt length from trim panel exit to bolt hole anchor point for continuous webbing systems.	2643 mm	2634 mm
Shoulder belt length as measured on Part 572 Dummy.	858 mm	862 mm
Lap belt length as measured on Part 572 Dummy.	1005 mm	987 mm

SHOULDER BELT SPOOL-OFF DATA:		
As determined by film analysis	* mm	44 mm
As determined mechanically	47 mm	46 mm
As determined electronically	41.4 mm	43 mm

BELT STRETCH DATA:		
Measured electronically between shoulder belt load cell and the "D" ring.	.01 mm/mm	.02 mm/mm
Measured mechanically	0 mm/mm	0 mm/mm

RETRACTOR LOCK-UP TIME:		
As determined by shoulder belt load	30 msec	30 msec

* Driver seat belt spool-out camera did not run during test.

CAMERA LOCATIONS

VEH. NHTSA NO.: MP0201 ; TEST DATE: January 27, 1993; TIME: 1:30 pm

VEH. YEAR/MAKE/MODEL/BODY STYLE: 1993 Ford Bronco 4 X 4

CAMERA 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	-	-	-	-	N/A	10	24
2	Left Front View	760	7660	1030	90°	7305	25	995
3	Steering Column Top	2500	7630	1550	90°	7275	25	985
4	Steering Column Bottom	2500	7630	1050	90°	7275	25	1010
5	Left Side-"A" Post	1570	5000	1340	90°	4645	35	1031
6	Left Side-"B" Post	4480	6110	1750	50°	N/A	50	1042
7	Driver Onboard					N/A	13	512
8	Passenger Onboard					N/A	13	500
9	Right Overall	2400	6930	1180	90°	6575	13	*
10	Right Front	1130	5970	1360	90°	5615	25	*
11	Right Side-"A" Post	1560	5000	1380	90°	4645	35	1031
12	Left Side-"B" Post	4510	6040	1780	50°	N/A	50	995
13	Top	380	0	4340	N/A	N/A	13	*
14	Top Driver	-320	330	2350	N/A	N/A	13	990
15	Top Passenger	-360	-430	2460	N/A	N/A	13	*
16	Pit Front	1000	0	-3000	N/A	N/A	13	1176
17	Pit Rear	2950	0	-2470	N/A	N/A	13	1000

COORDINATES:

X = film plane to monorail centerline

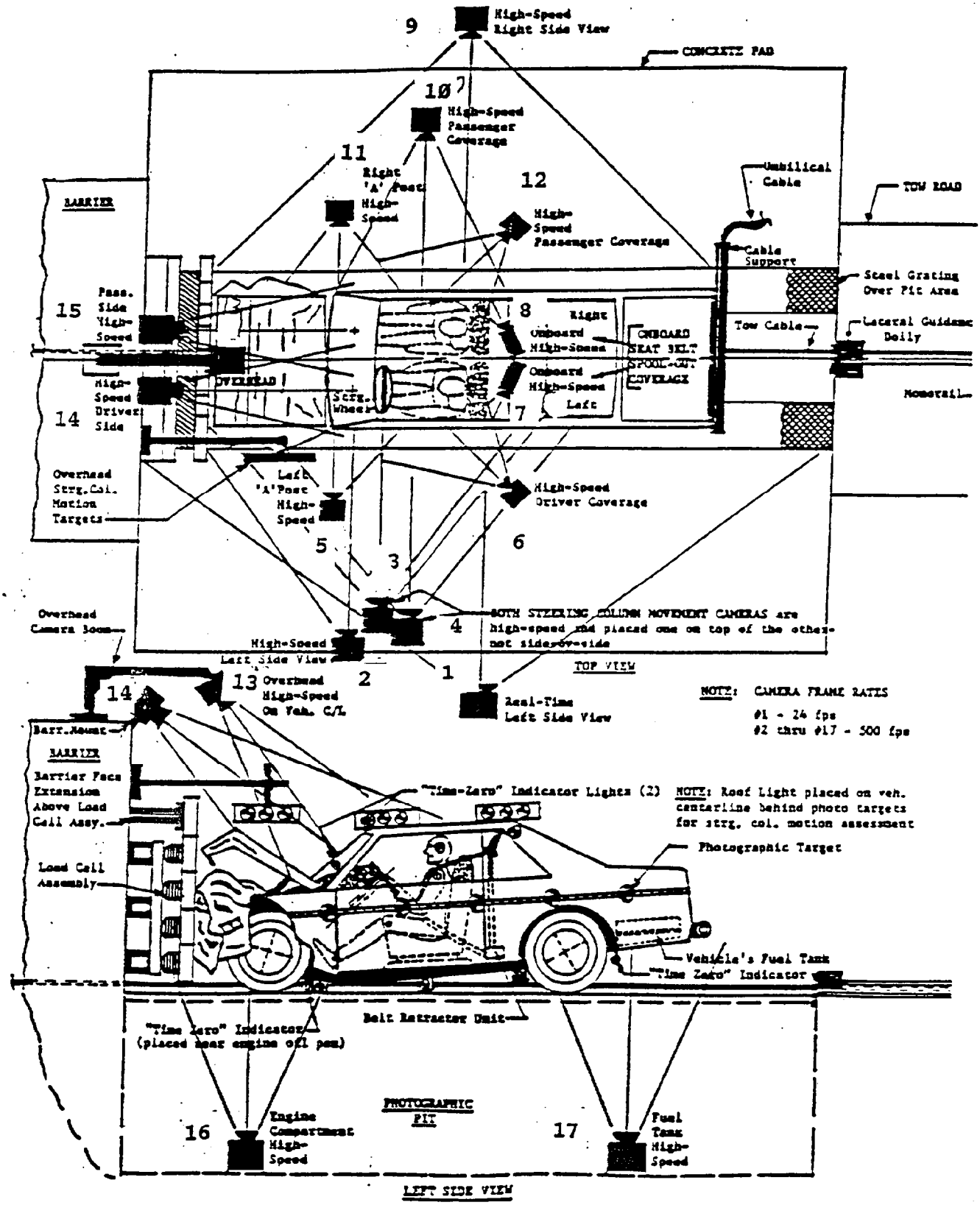
Y = film plane to barrier face

Z = film plane to ground

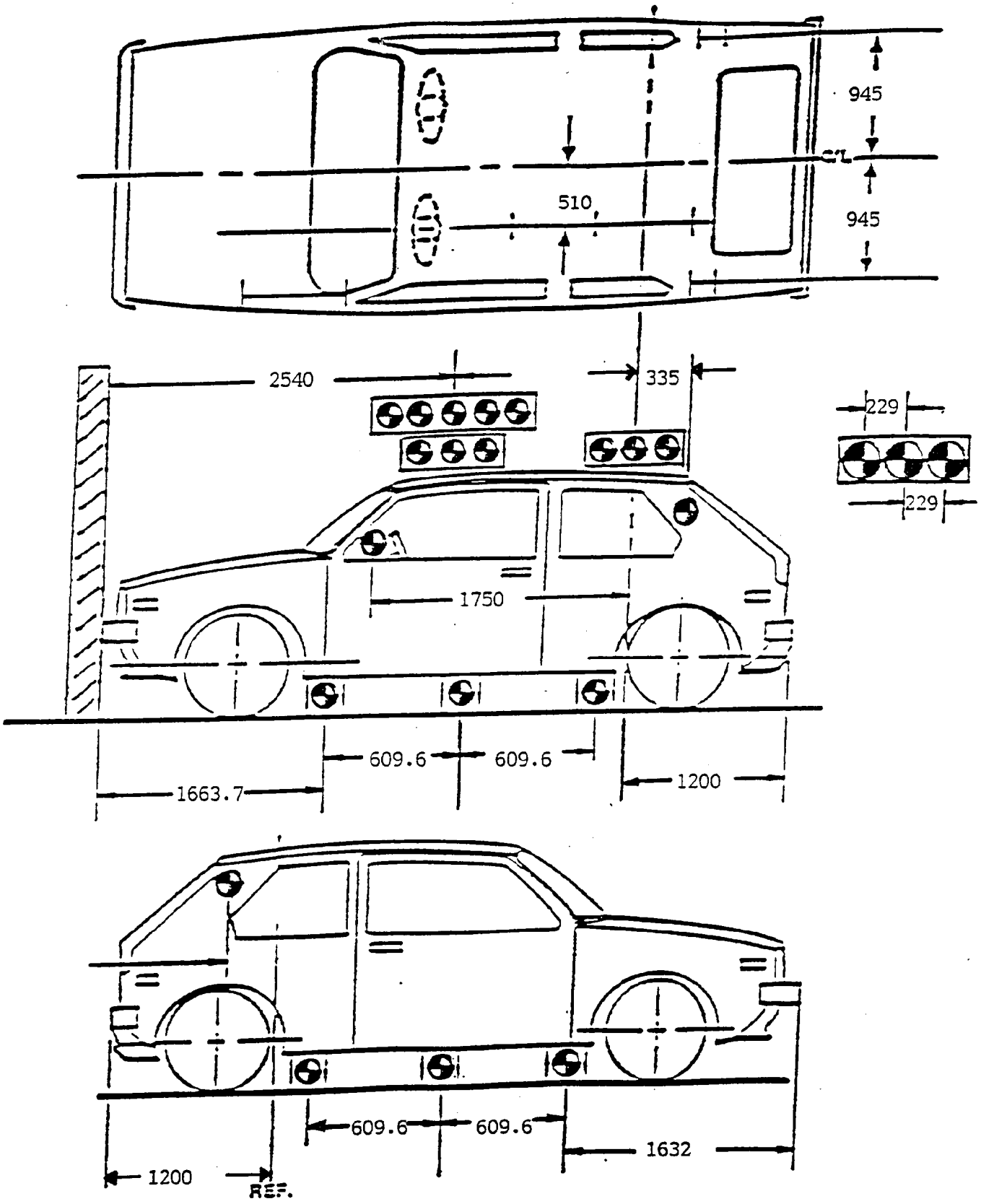
ORIGIN: For X and Y it is the Impact Point. For Z it is the Floor.

No timing lights on film

CAMERA REQUIREMENTS FOR 35 MPH FRONTAL BARRIER IMPACT ASSESSMENT PROGRAM TEST



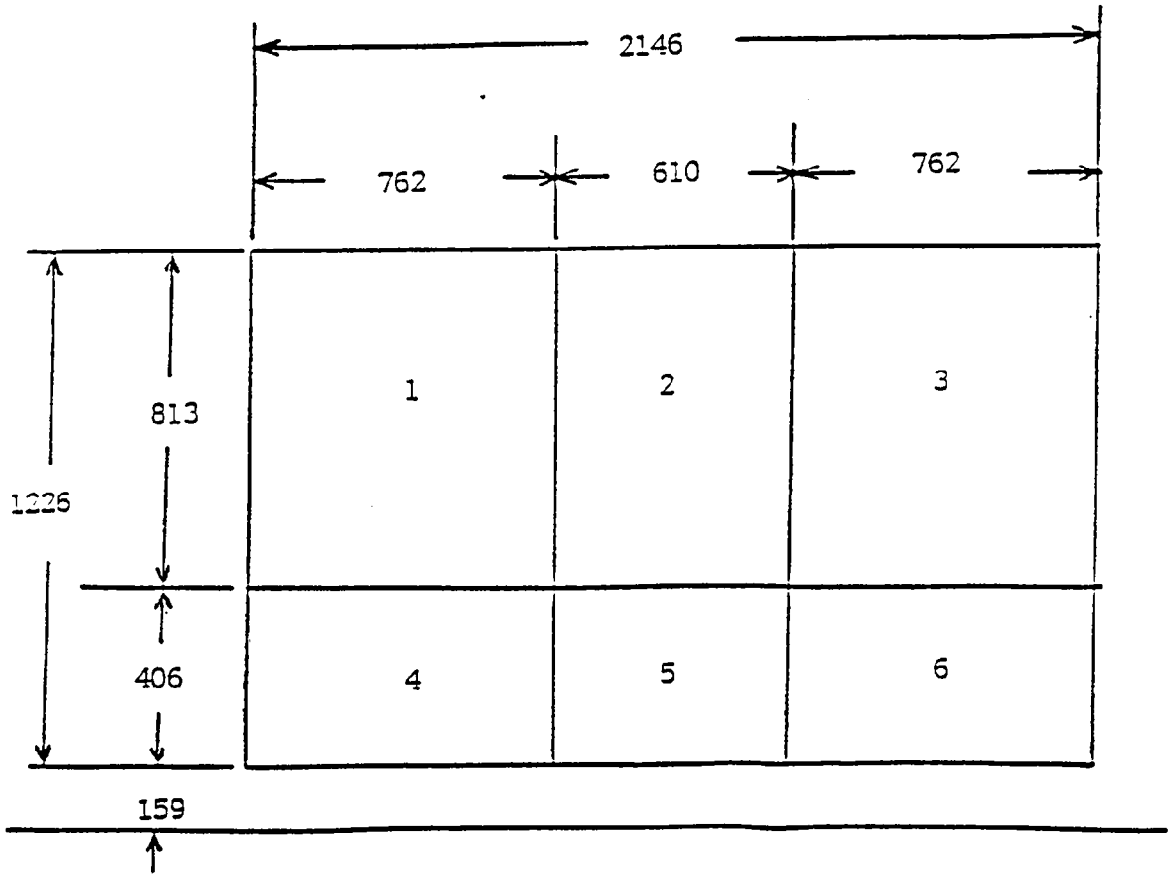
VEHICLE TARGET LOCATIONS



(DIMENSIONS IN MM)

LOAD CELL LOCATIONS ON FIXED BARRIER

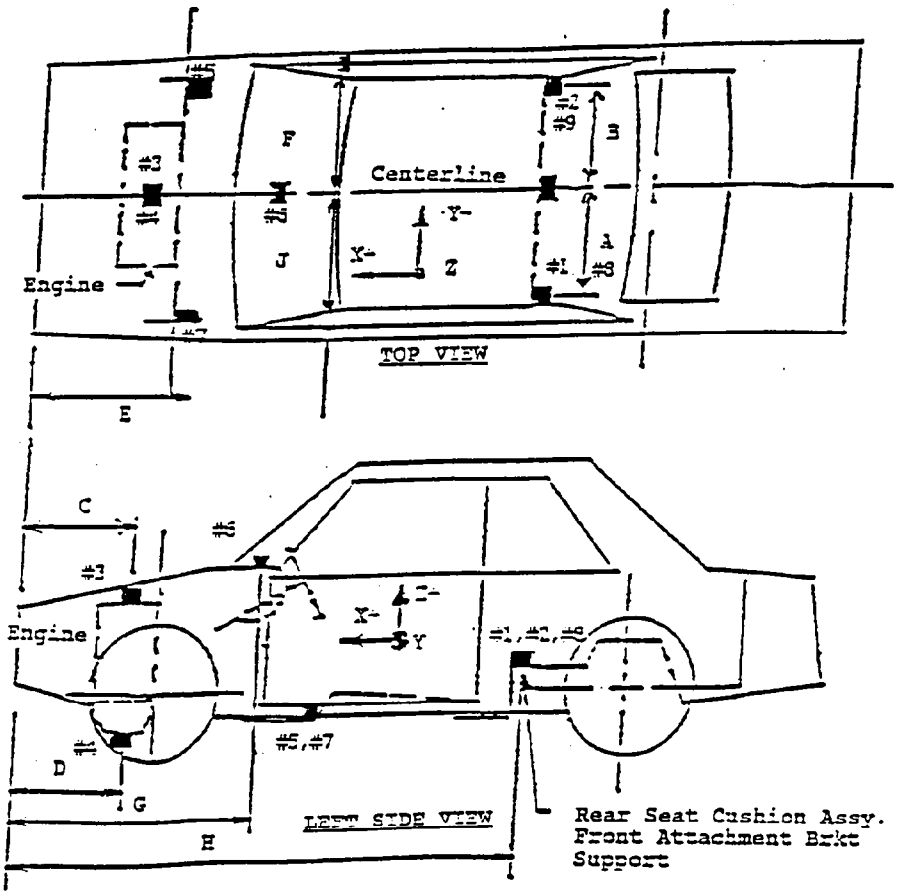
30 Load Cells
6 Rows
9 Columns
6 Groupings (5 cells/group)



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	646
B	640
C	1015
D	1060
E	930
F	875
G	1565
H	3028
J	875

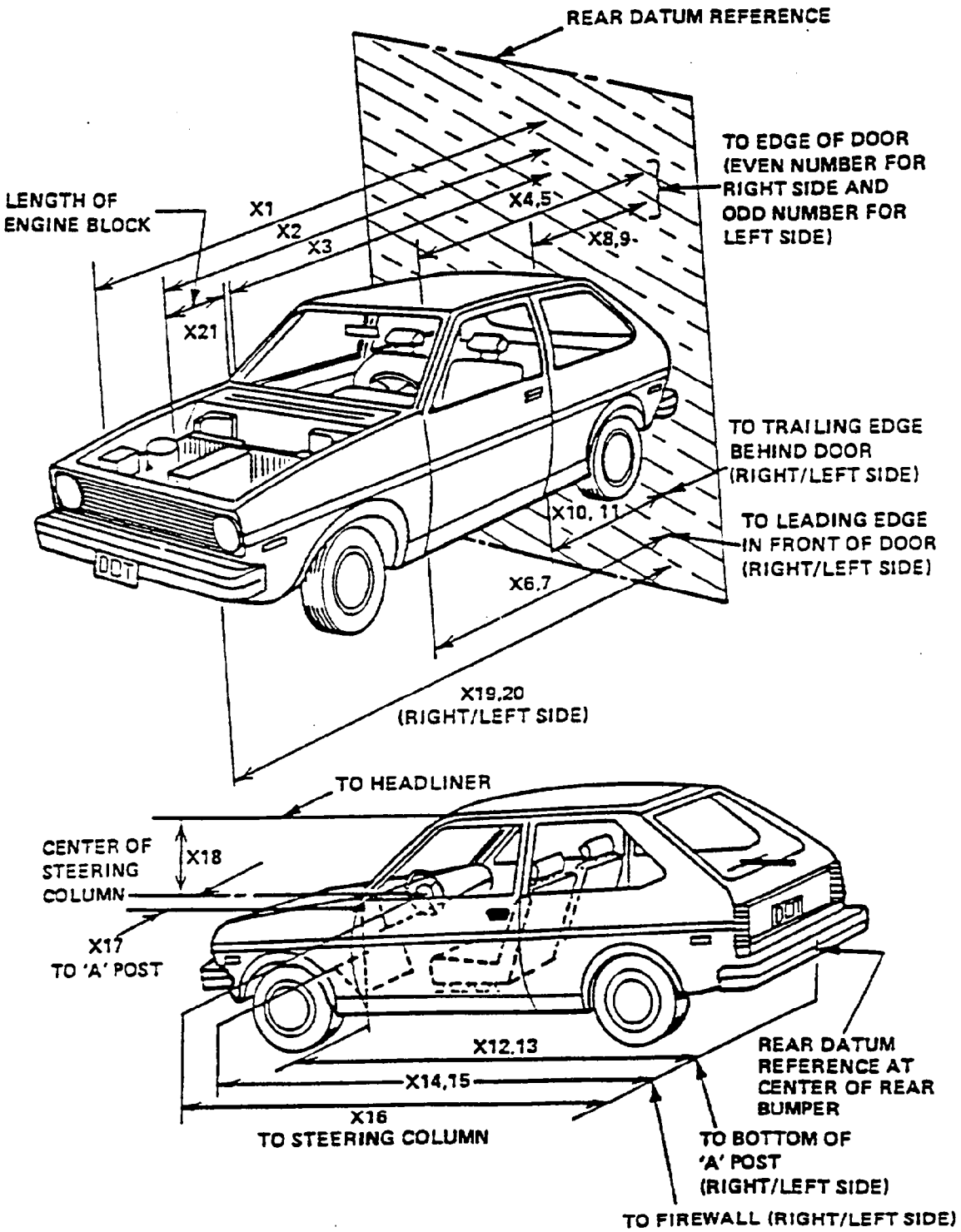
ACCELEROMETER	ACCELEROMETER LOCATION	DIRECTION
1 and 8	Left Rear Seat Crossmember	X
2 and 9	Right Rear Seat Crossmember	X
3	Top of Engine	X
4	Bottom of Engine	X
5	Right Side Brake Caliper	X
6	Instrument Panel	X
7	Left Disc Brake Caliper	X

* 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	4680	4054	626
X2	Rear Surface of Vehicle to Front of Engine	3702	3570	132
X3	Rear Surface of Vehicle to Firewall	3444	3427	17
X4	Rear Surface to Upr. Leading Edge of Rt. Door	3053	3104	-51
X5	Rear Surface to Upr. Leading Edge of Left Door	3046	3038	8
X6	Rear Surface to Lwr. Leading Edge of Rt. Door	3036	3074	-38
X7	Rear Surface to Lwr. Leading Edge of Left Door	3033	3023	10
X8	Rear Surface to Upr. Trailing Edge of Rt. Door	2005	2060	-55
X9	Rear Surface to Upr. Trailing Edge of Left Door	2004	2012	-8
X10	Rear Surface to Lwr. Trailing Edge of Rt. Door	1980	2027	-47
X11	Rear Surface to Lwr. Trailing Edge of Left Door	1977	1968	9
X12	Rear Surface to Bottom of `A' Post on Rt. Side	3025	3049	-24
X13	Rear Surface to Bottom of `A' Post on Left Side	3018	3045	-27
X14	Rear Surface to Firewall on Right Side	3354	3350	4
X15	Rear Surface to Firewall on Left Side	3375	3360	15
X16	Rear Surface to Steering Column	2625	2674	-49
X17	Center of Steering Column to `A' Post	393	433	-40
X18	Center of Steering Column to Headlining	435	510	-75
X19	Rear Surface to Right Side of Front Bumper	4362	3867	495
X20	Rear Surface to Left Side of Front Bumper	4341	3868	473
X21	Length of Engine Block	455	455	0

TEST VEHICLE MEASUREMENTS



ACCIDENT INVESTIGATION DIVISION DATA

FOR 35 MPH FRONTAL BARRIER IMPACT

VEHICLE MAKE/MODEL/BODY STYLE: 1993 Ford Bronco 4 X 4

VEH. NHTSA NO.: MP0201 ; VIN: 1FMEU15HGPLA34656

MODEL YEAR: 1993 ; BUILD DATE: 11/92 ; TEST DATE: 1/27/93

VEH. SIZE CATEGORY: Truck ; TEST WEIGHT: 2501.4 kg.

VEH. WHEELBASE: 2667 mm ; FRONT OVERHANG: 885 mm ; OVERALL WIDTH: 1193 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: 56.6 kph ; TIME OF SEPARATION: 96 msec

VELOCITY CHANGE: 63.2 kph

COLLISION DEFORMATION CLASSIFICATION (CDC) CODE:

F (Frontal)

CRUSH DEPTH DIMENSIONS:

C1 = 473 mm

C2 = 598 mm

C3 = 644 mm

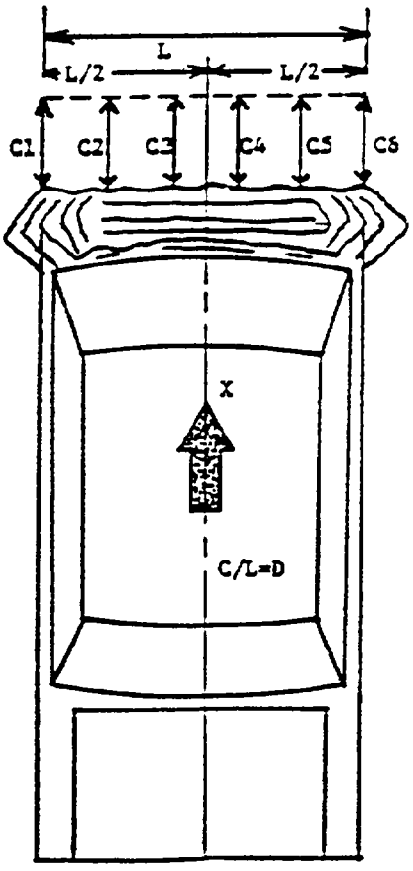
C4 = 574 mm

C5 = 533 mm

C6 = 495 mm

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

LENGTH OF DAMAGED REGION: L = 2228 mm



APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

TABLE OF PHOTOGRAPHS (Cont'd)

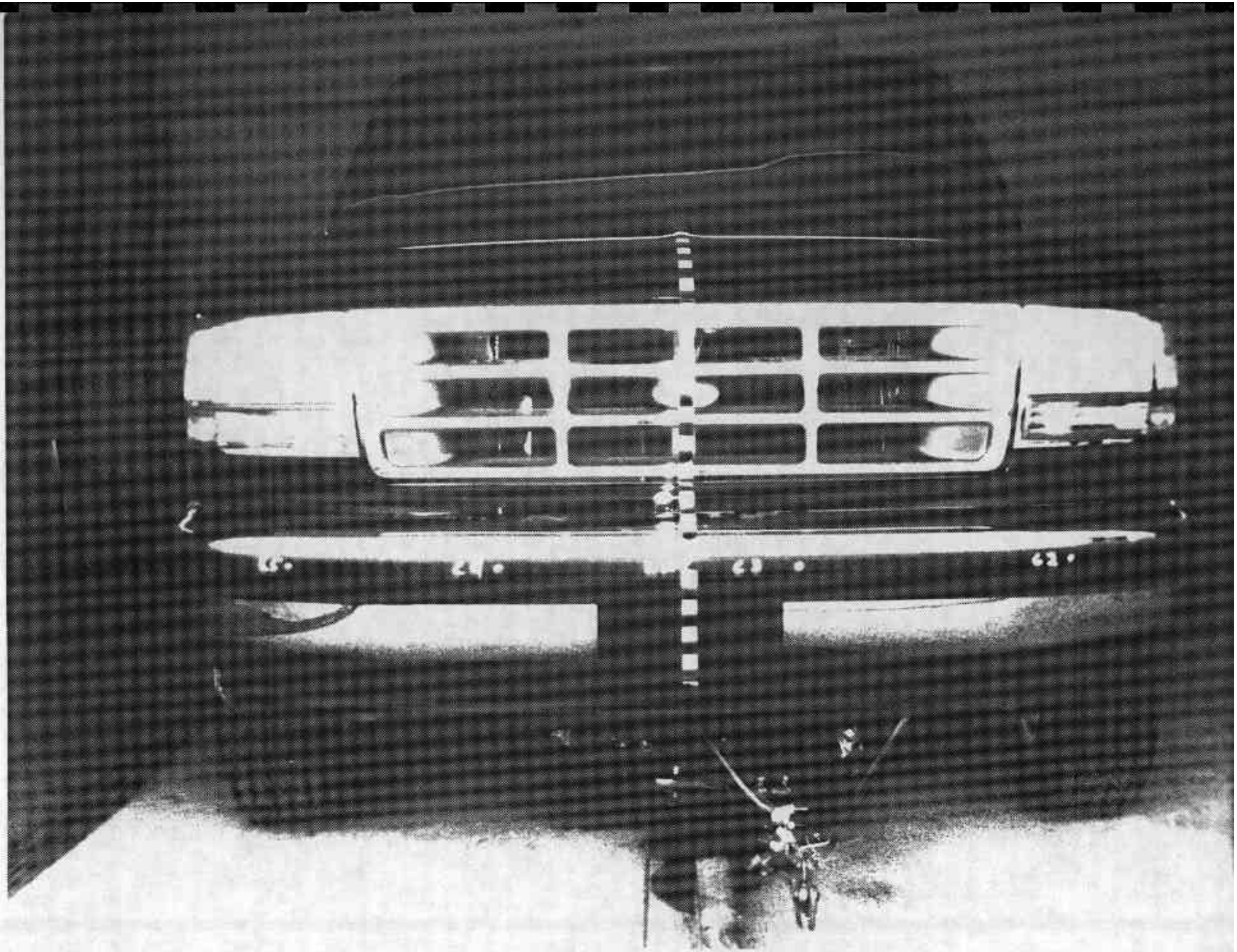


Photo No. 1 - Pre-Test Front View

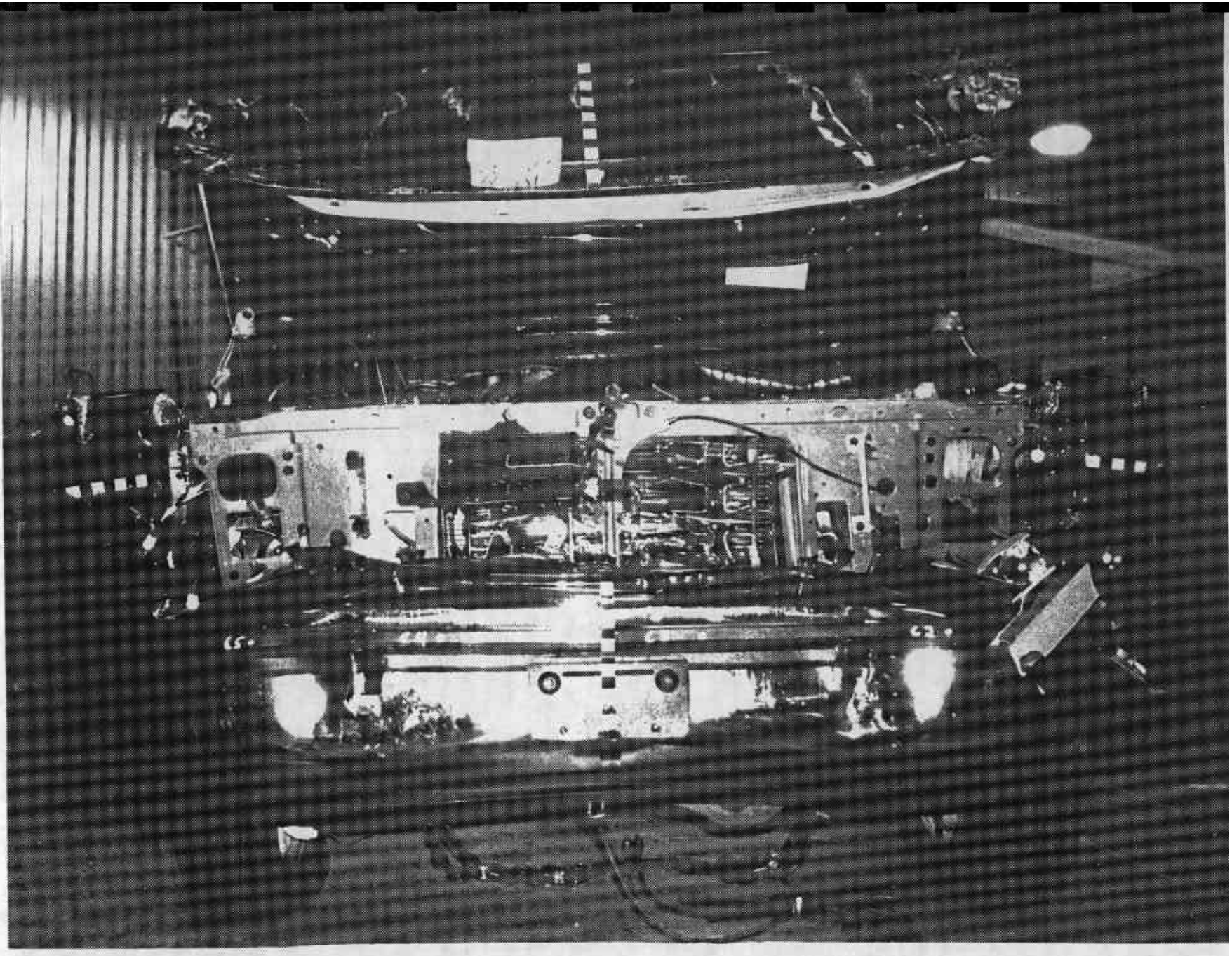


Photo No. 2 - Post-Test Front View

Photo No. 3 - Pre-Test Left Side View

Photo No. 4 - Post-Test Left Side View

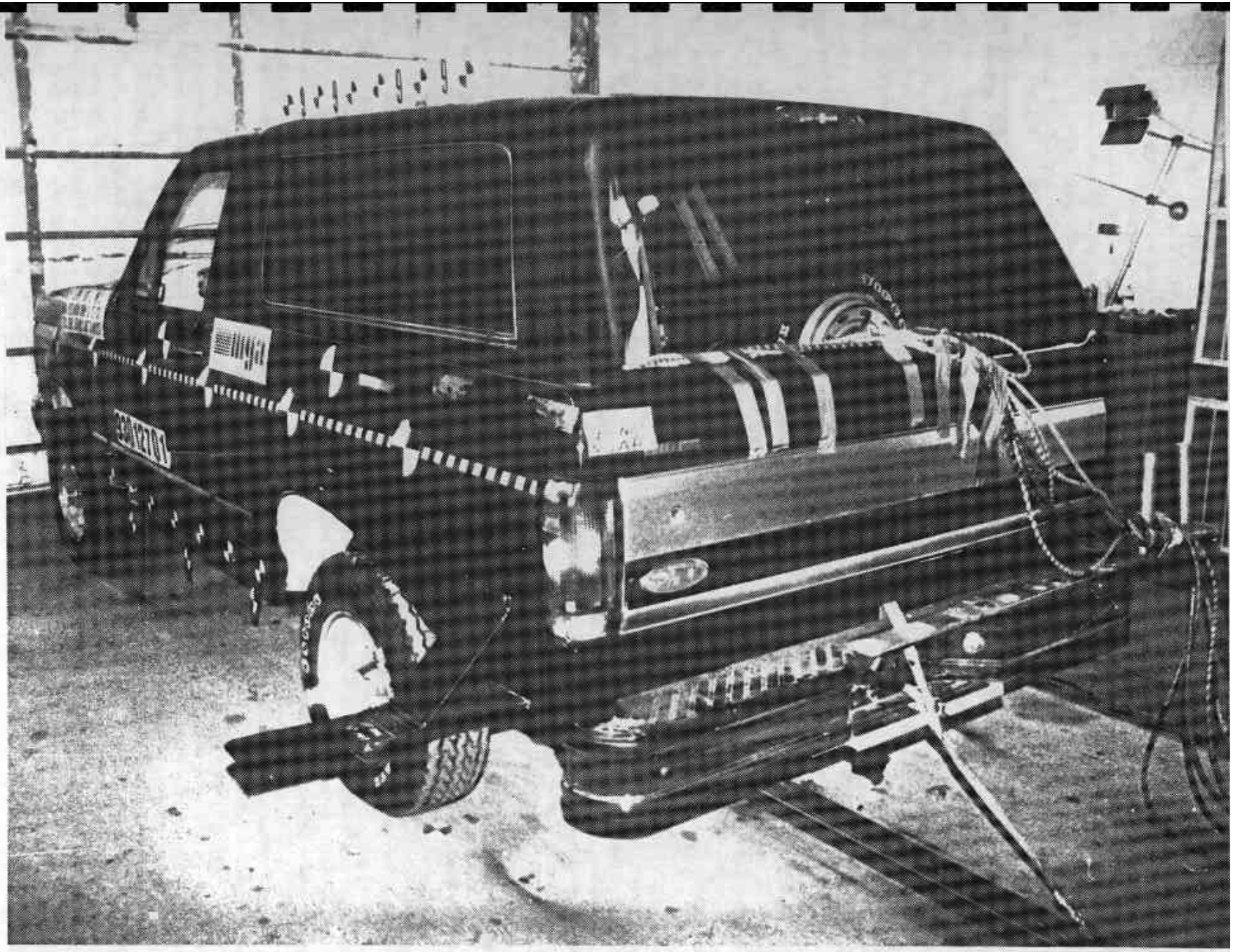


Photo No. 5 - Pre-Test Left Rear Three-Quarter View

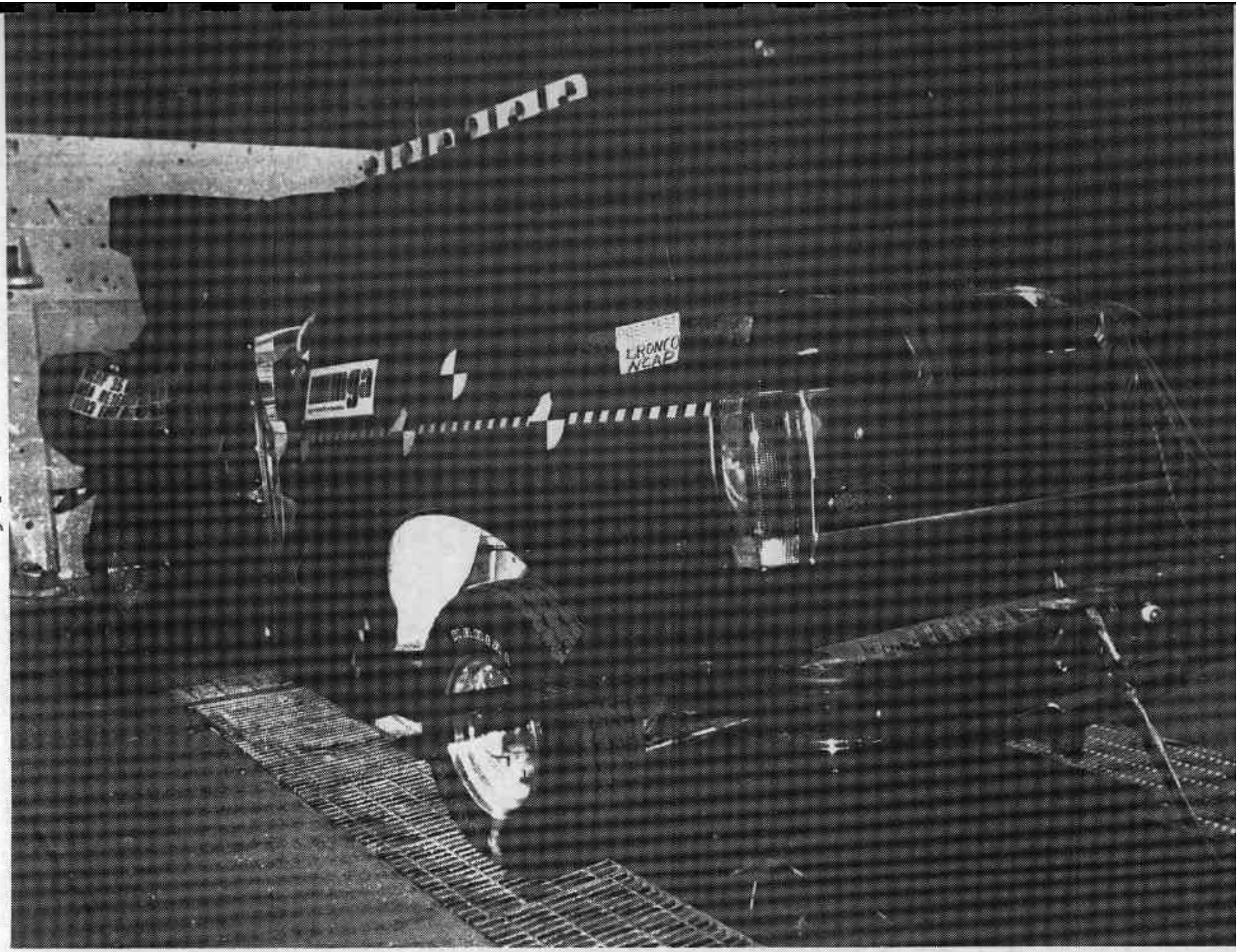


Photo No. 6 - Post-Test Left Rear Three-Quarter View

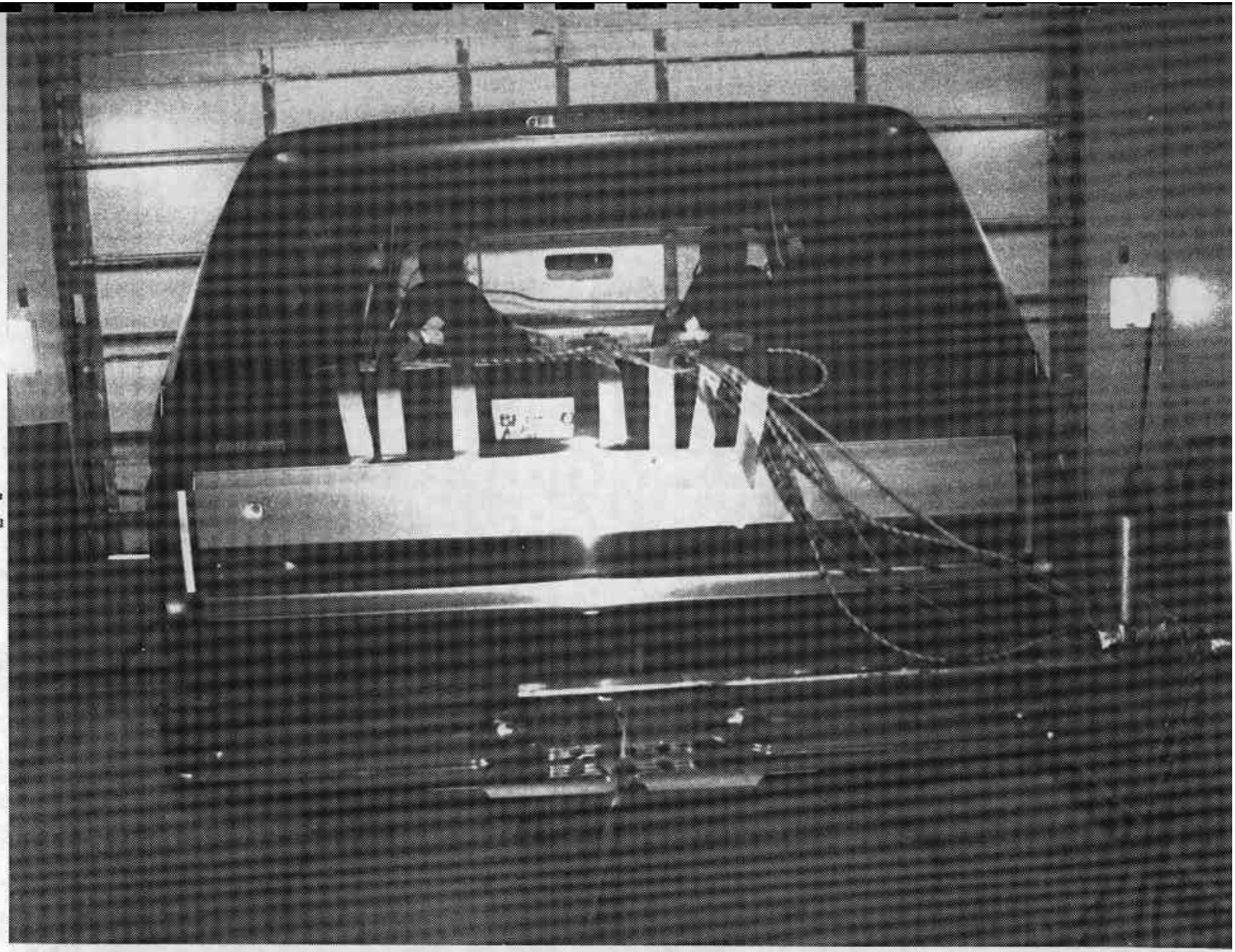


Photo No. 7 - Pre-Test Rear View

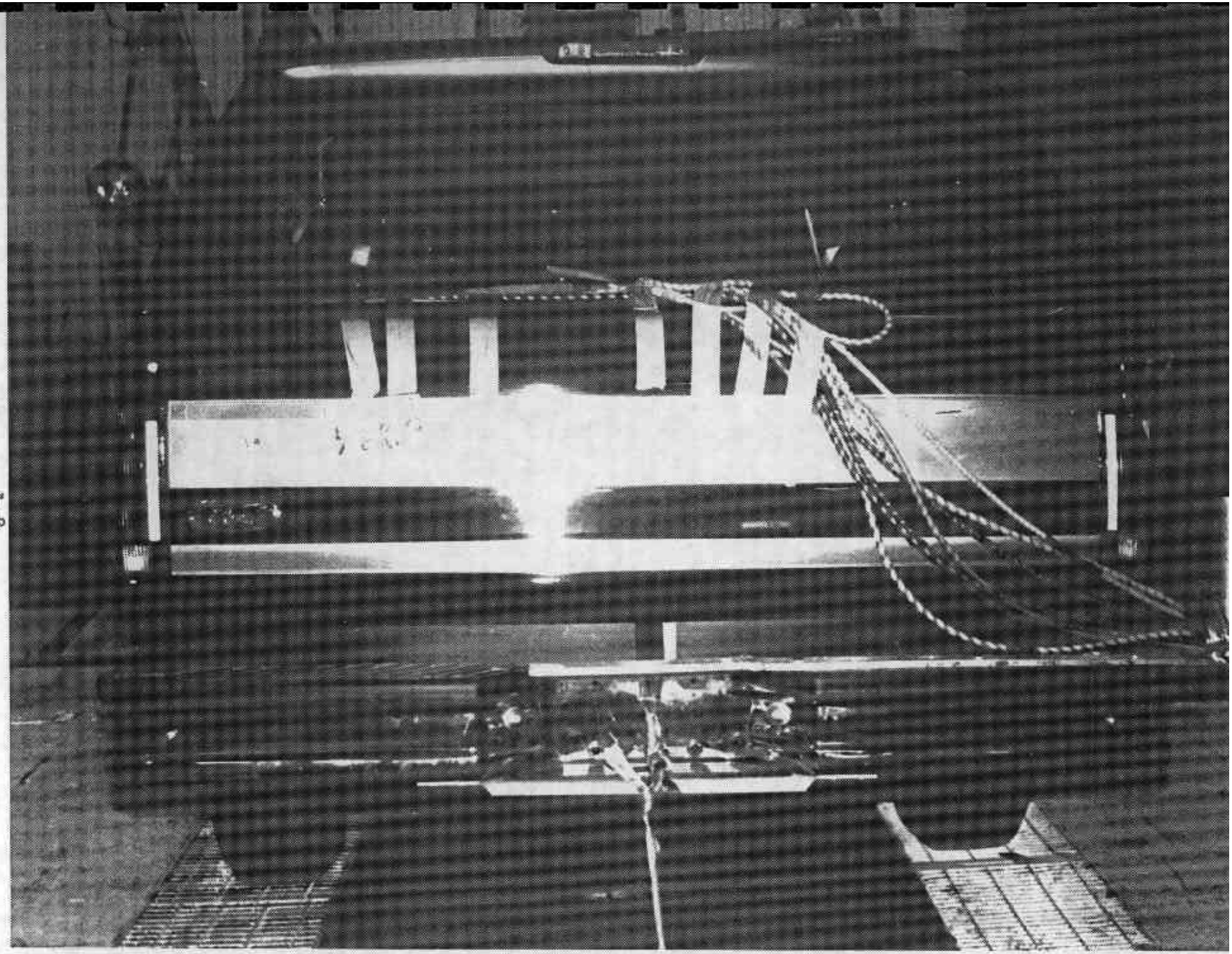


Photo No. 8 - Post-Test Rear View

Photo No. 9 - Pre-Test Right Side View

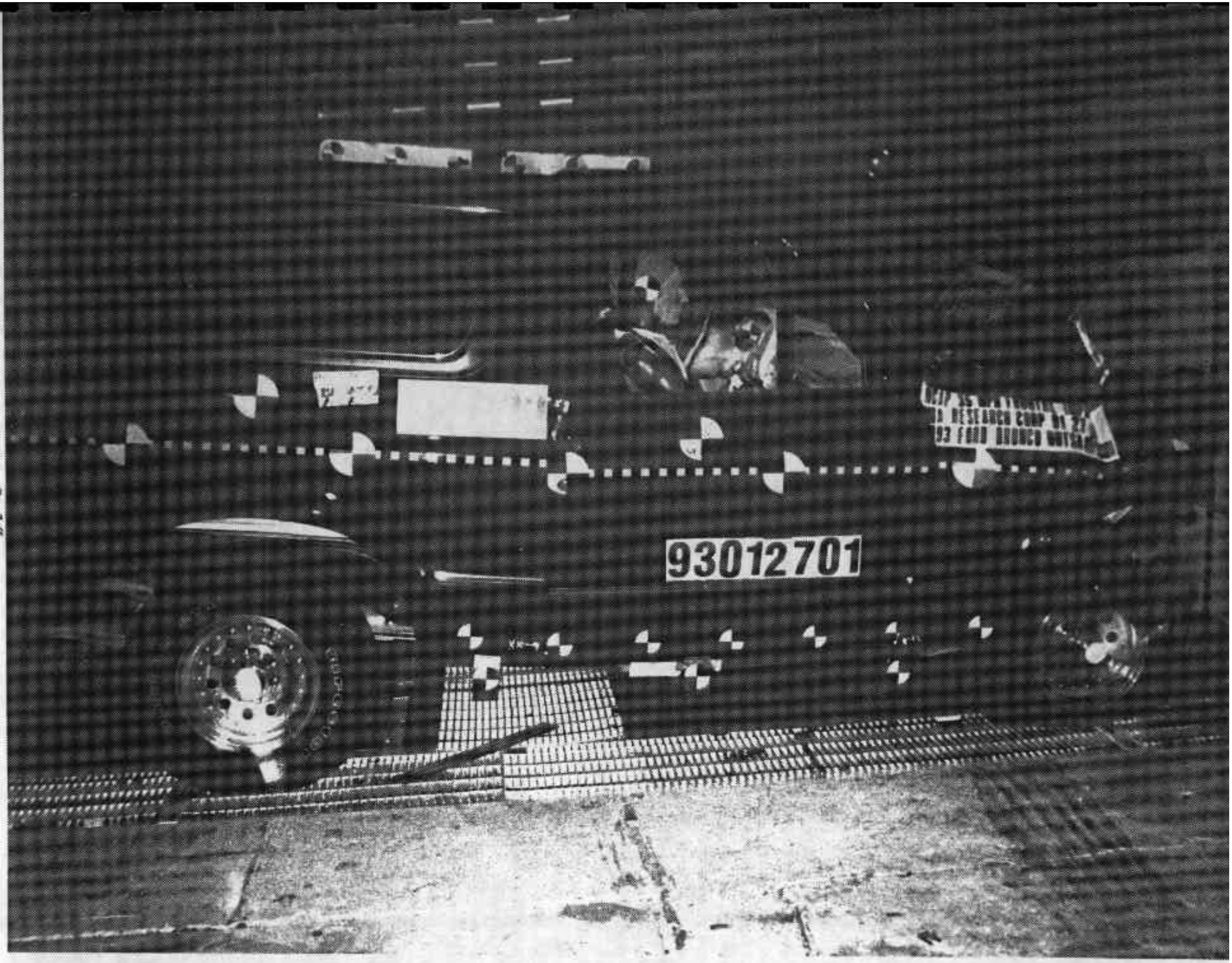


Photo No. 10 - Post-Test Right Side View

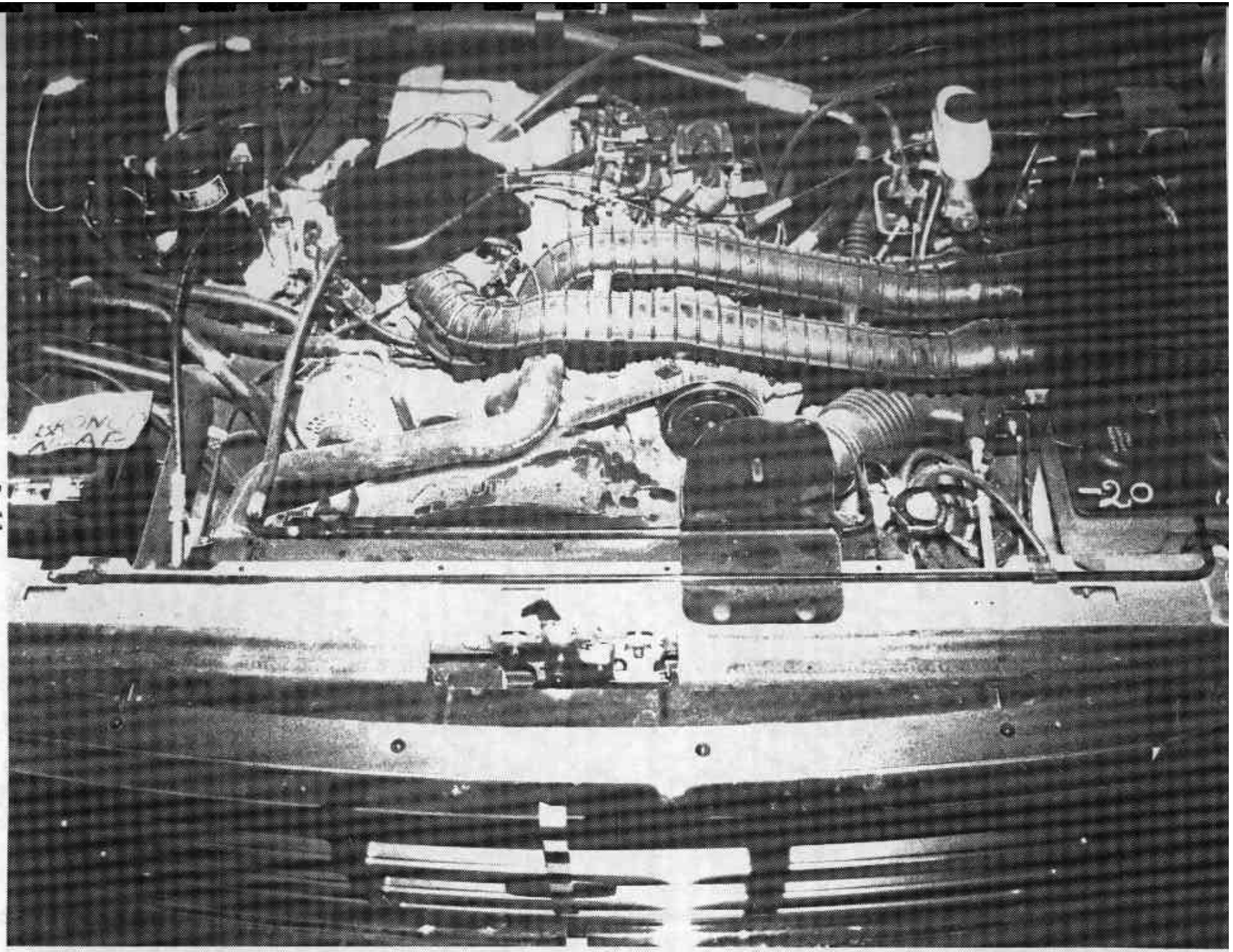


Photo No. 11 - Pre-Test Engine Compartment View

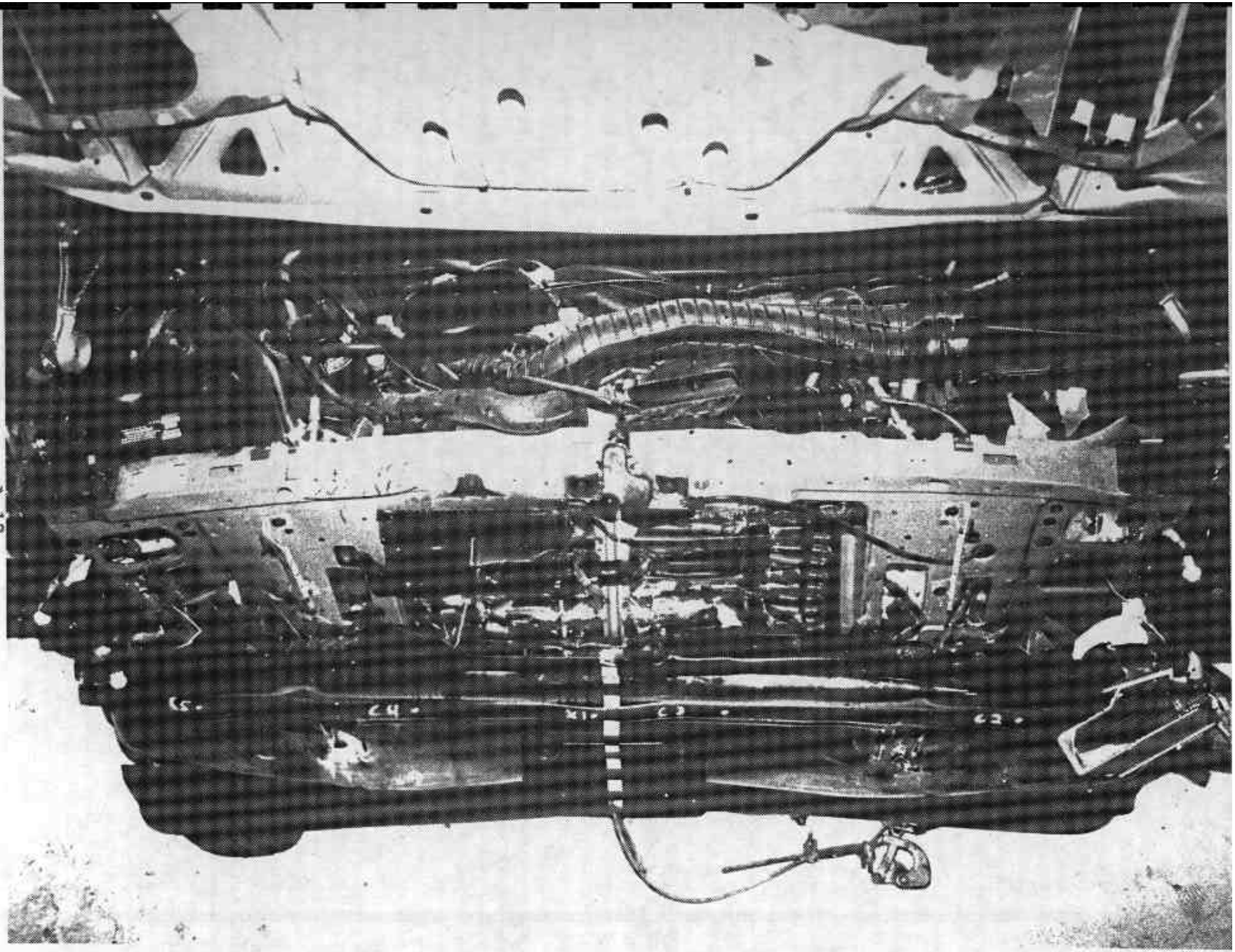


Photo No. 12 - Post-Test Engine Compartment View

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

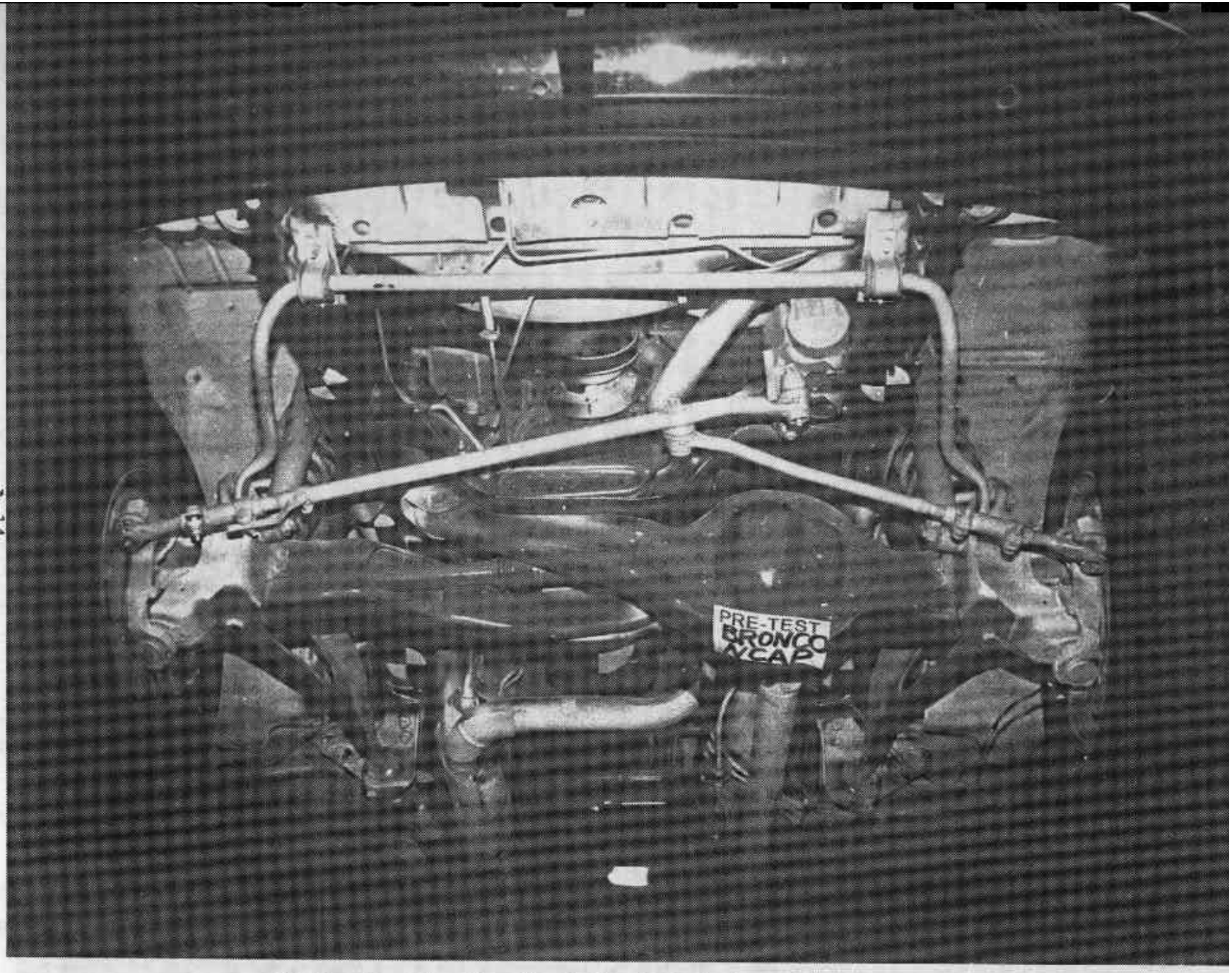


Photo No. 14 - Pre-Test Front Underbody View

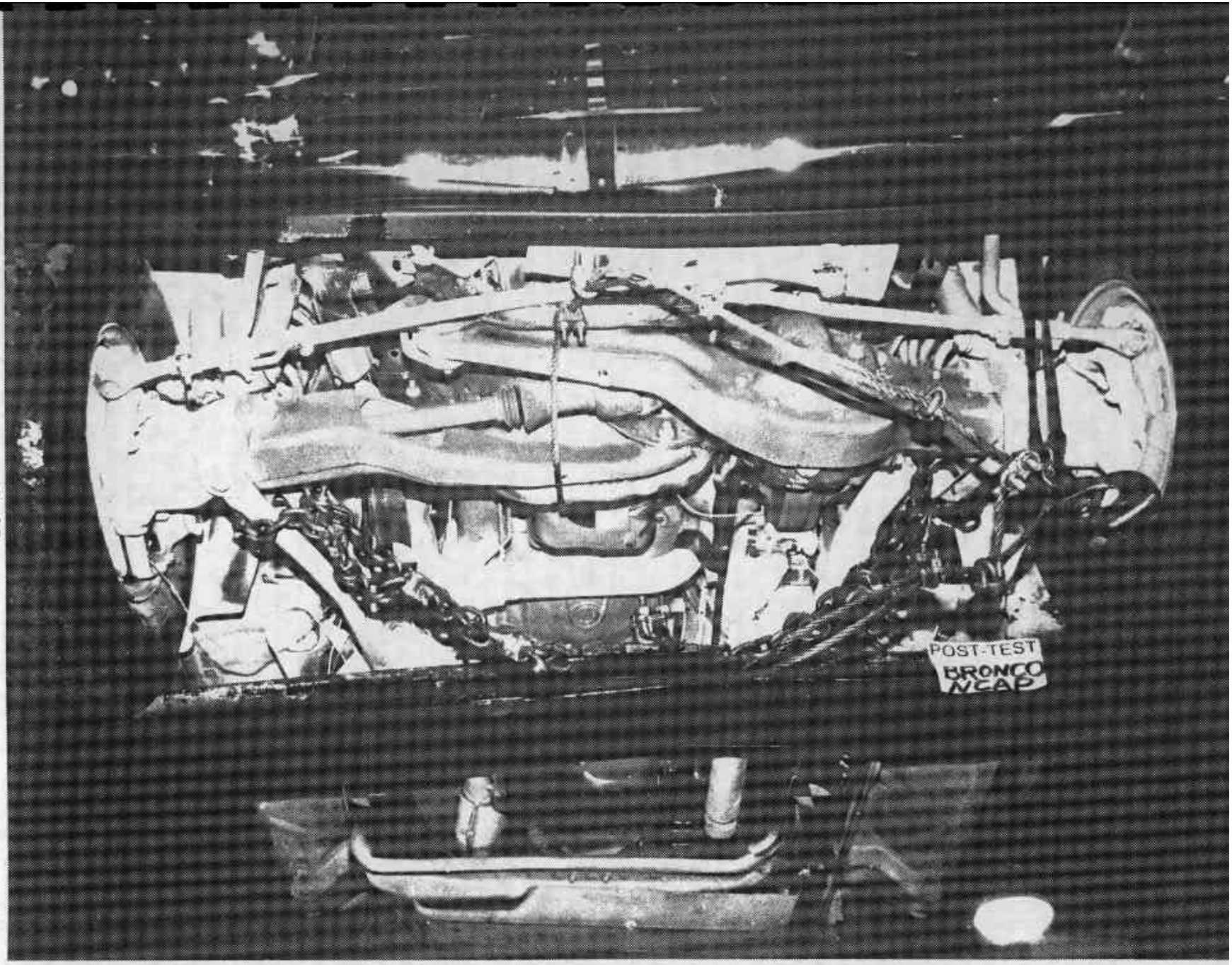


Photo No. 15 - Post-Test Front Underbody View

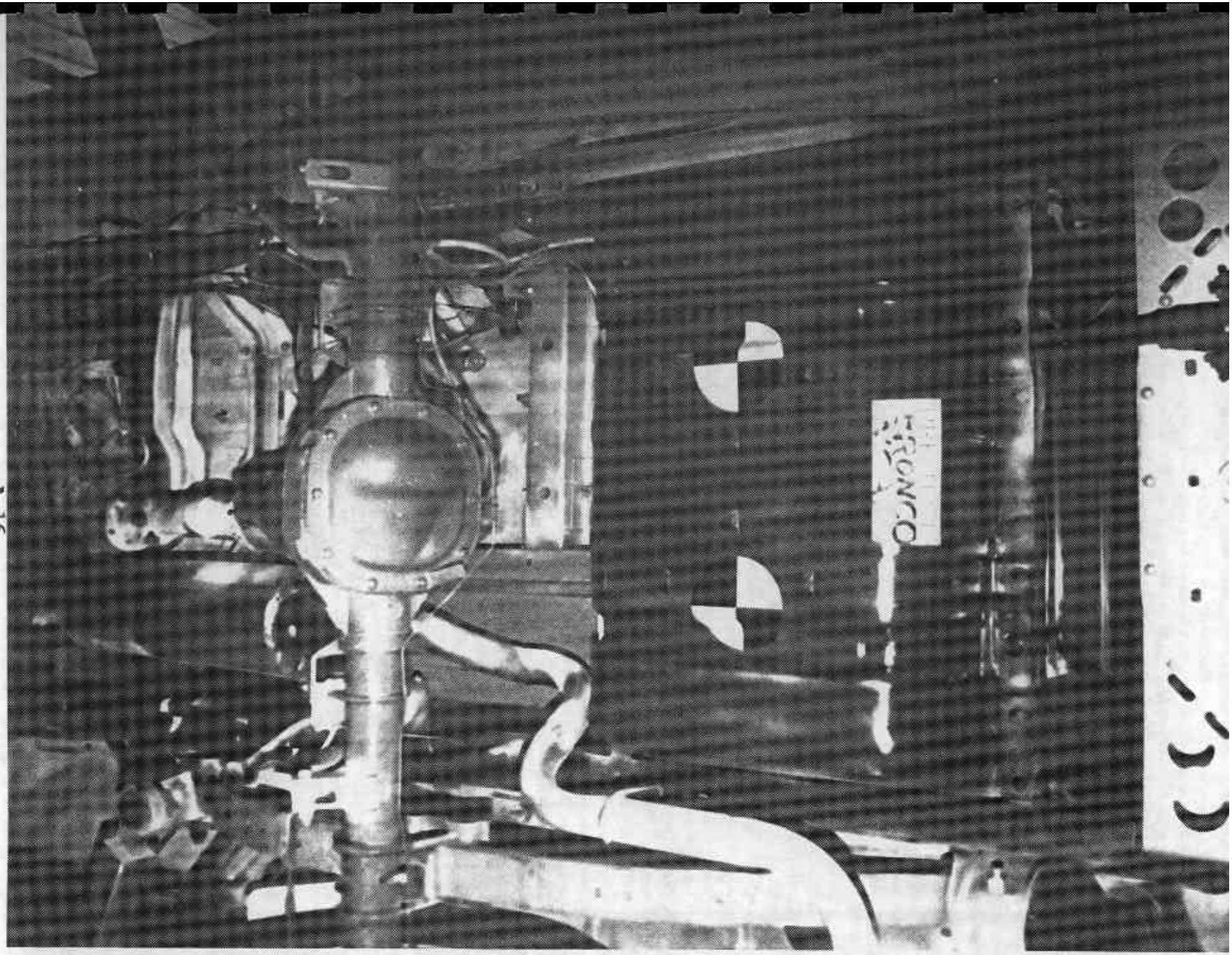


Photo No. 16 - Pre-Test Rear Underbody View

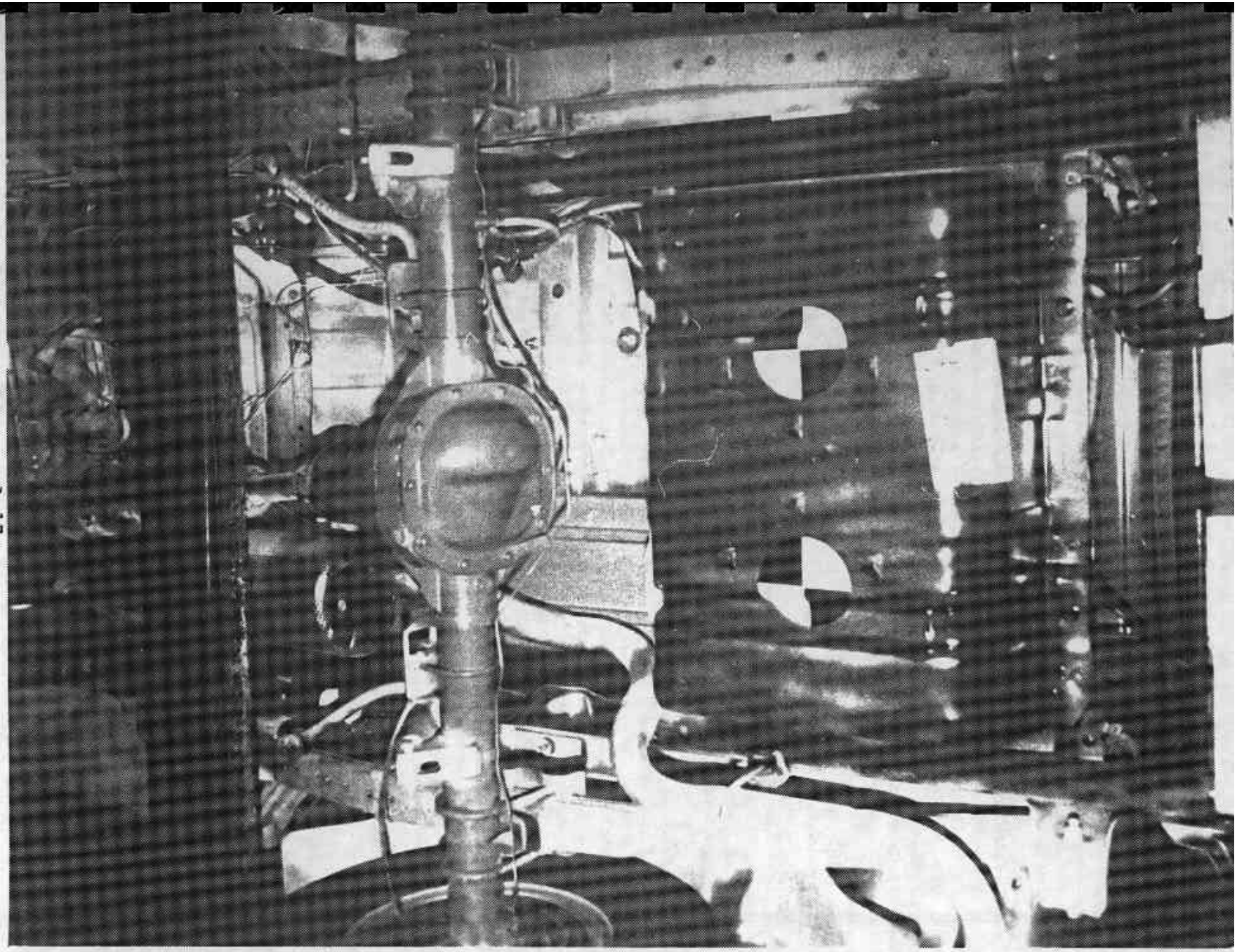


Photo No. 17 - Post-Test Rear Underbody View

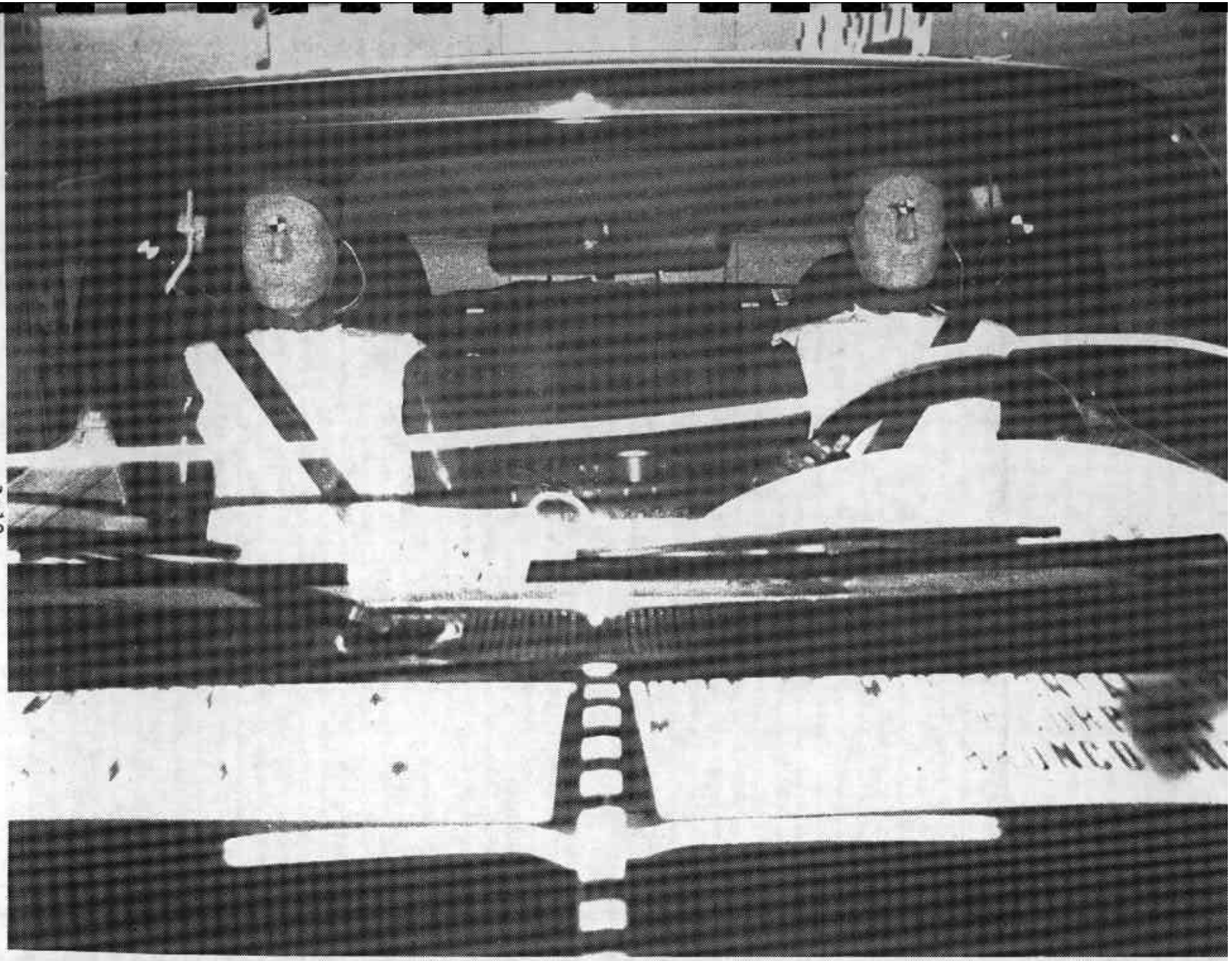


Photo No. 18 - Pre-Test Windshield View

Photo No. 19 - Post-Test Windshield View

Photo No. 20 - Pre-Test Driver Dummy Position View

Photo No. 21 - Post-Test Driver Dummy Position View

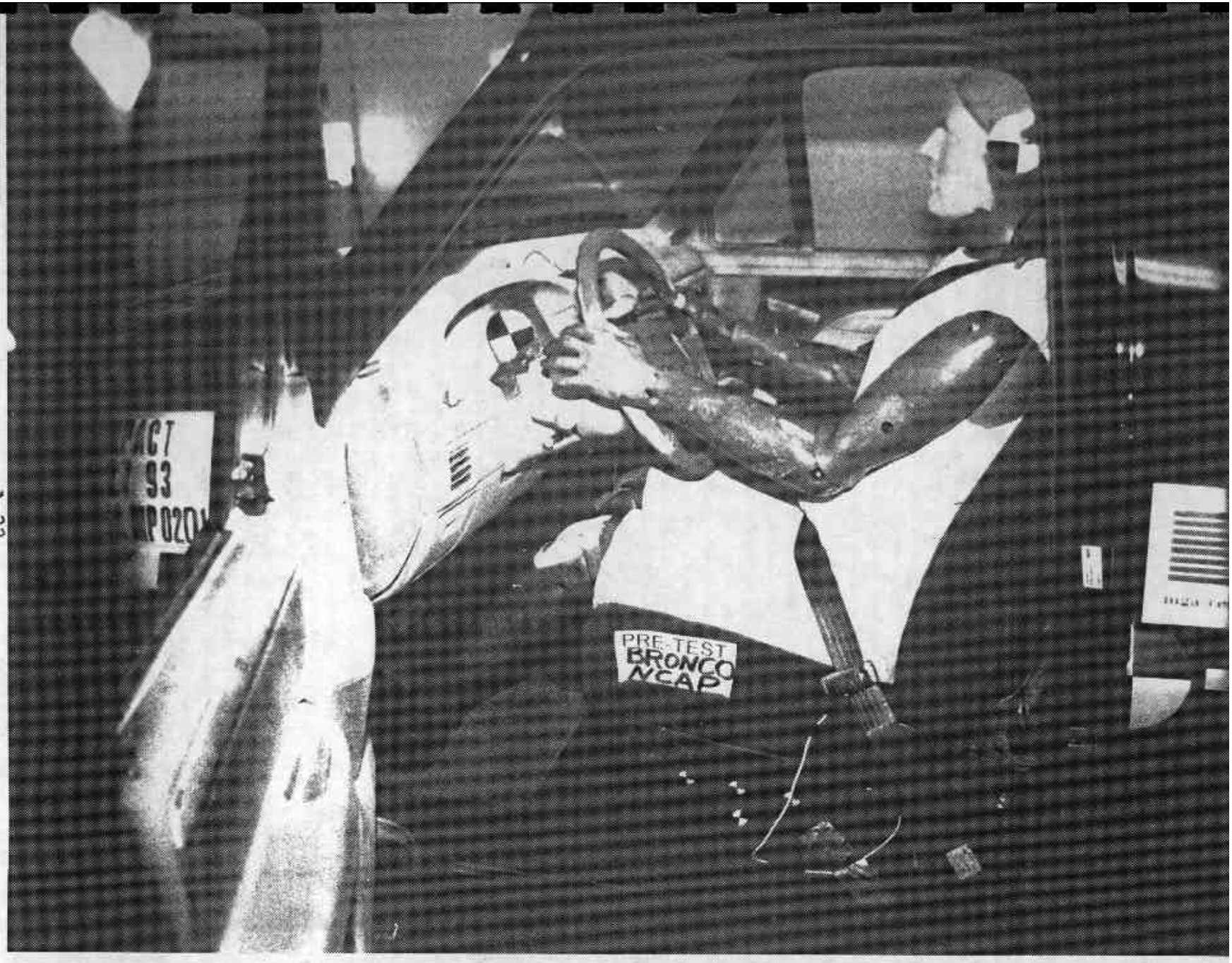


Photo No. 22 - Pre-Test Driver Dummy Position View (Door Open)

Photo No. 23 - Post-Test Driver Dummy Position View (Door Open)

Photo No. 24 - Post-Test Steering Wheel

Photo No. 25 - Post-Test Driver Instr. Panel Knee Contact Area

Photo No. 26 - Post-Test Driver Dummy Head Contact View

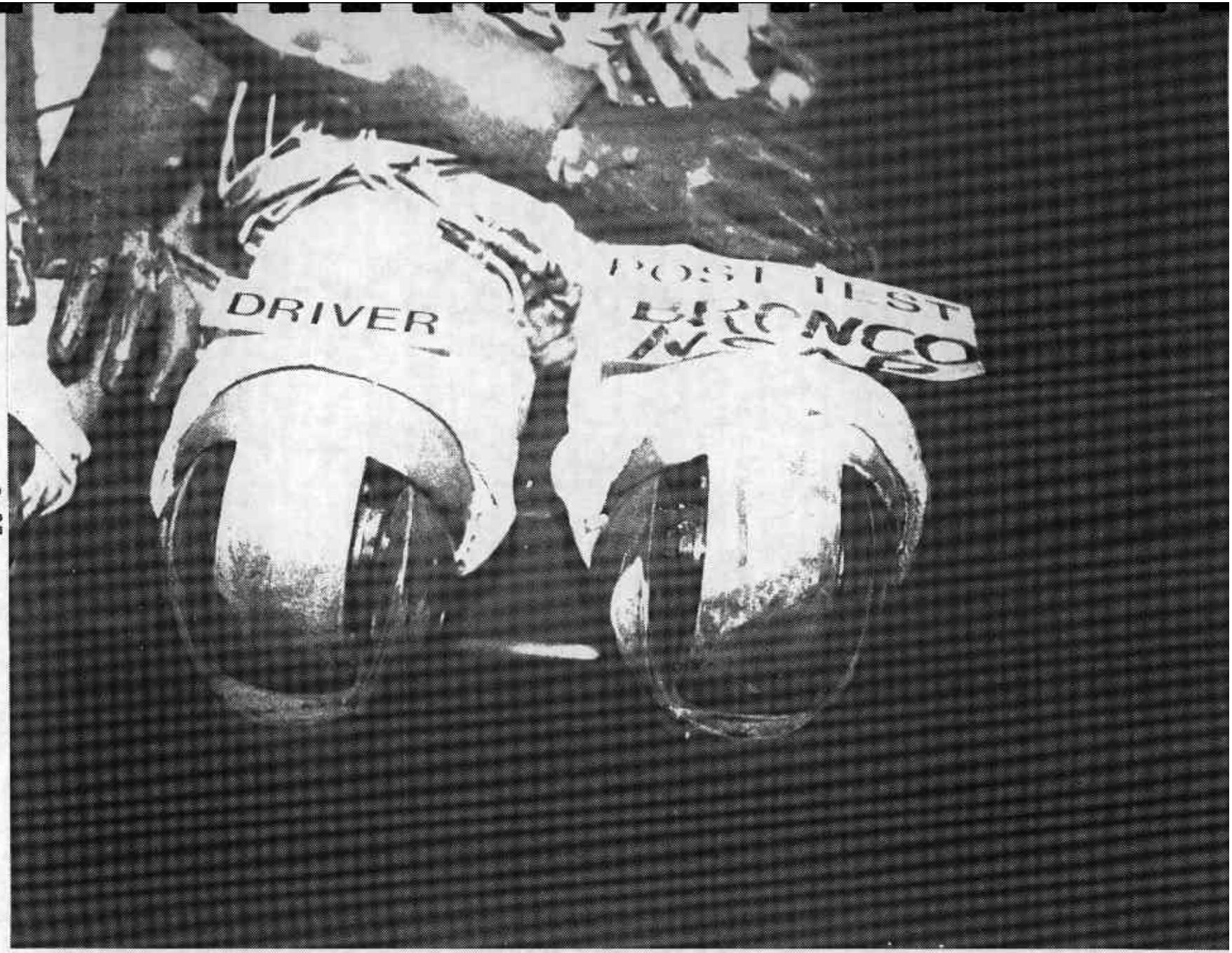


Photo No. 27 - Post-Test Driver Dummy Knee Contact

Photo No. 28 - Post-Test Driver Seat Movement

Photo No. 29 - Pre-Test Passenger Dummy Position View

Photo No. 30 - Post-Test Passenger Dummy Position View

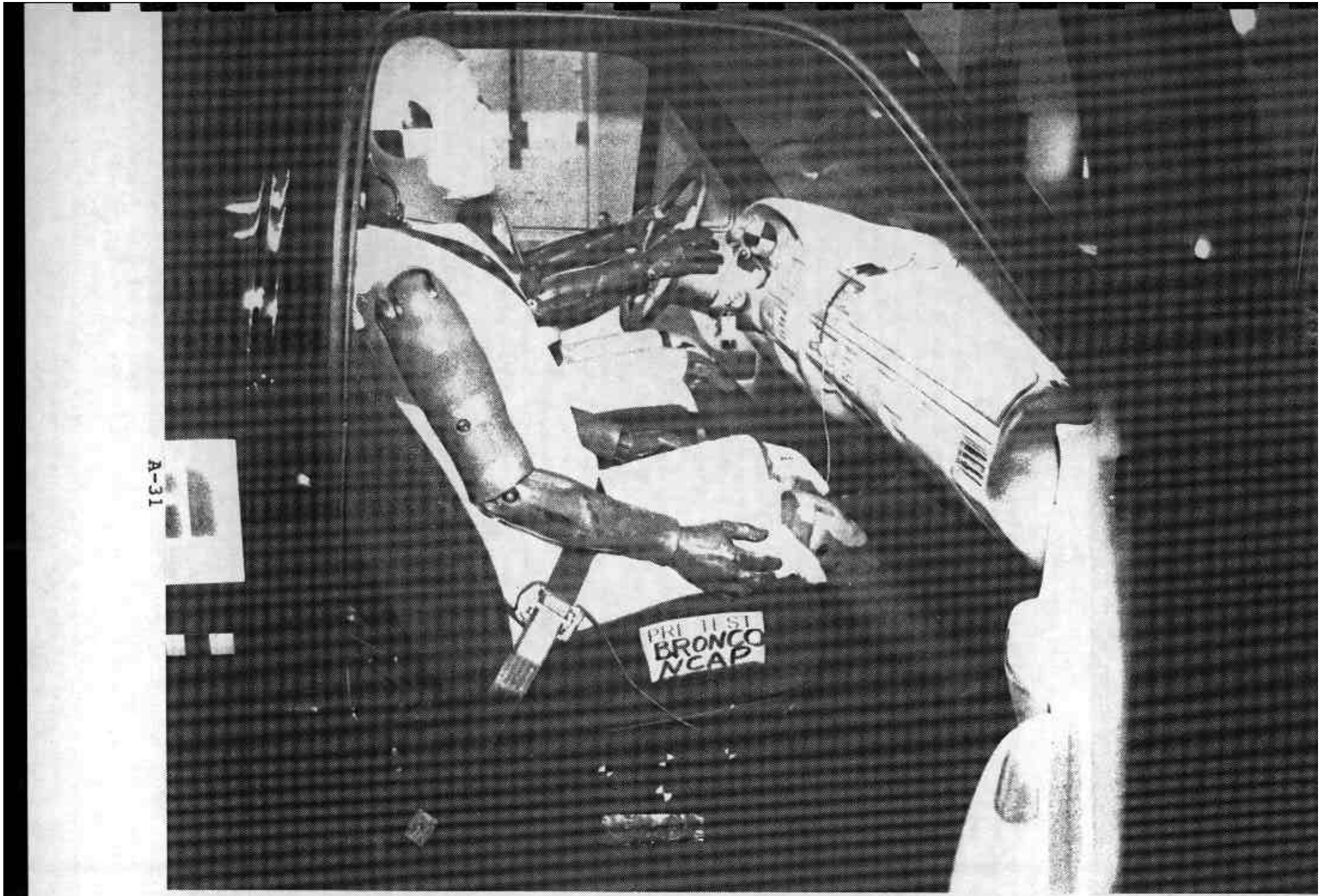


Photo No. 31 - Pre-Test Passenger Dummy Position View (Door Open)

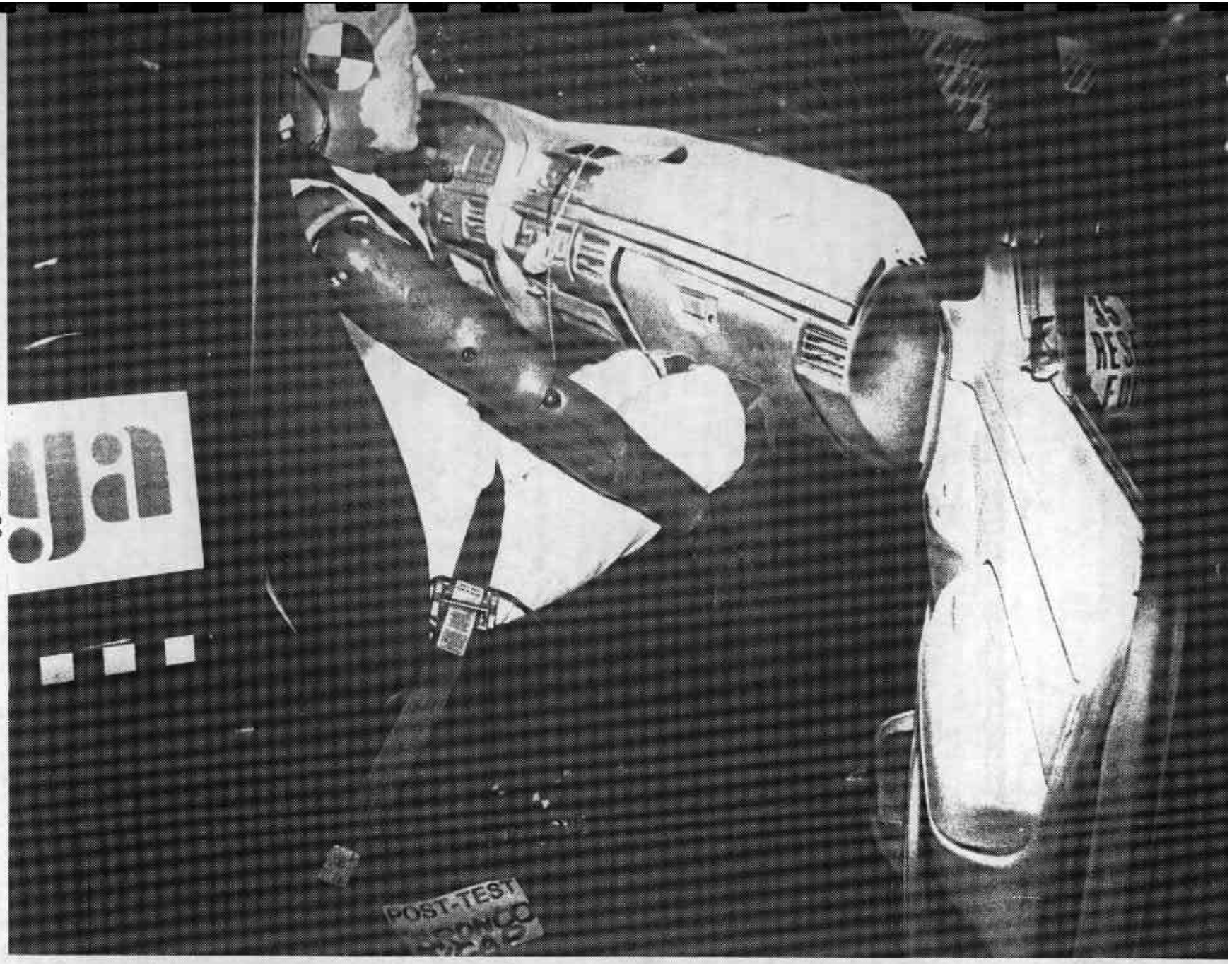


Photo No. 32 - Post-Test Passenger Dummy Position View (Door Open)

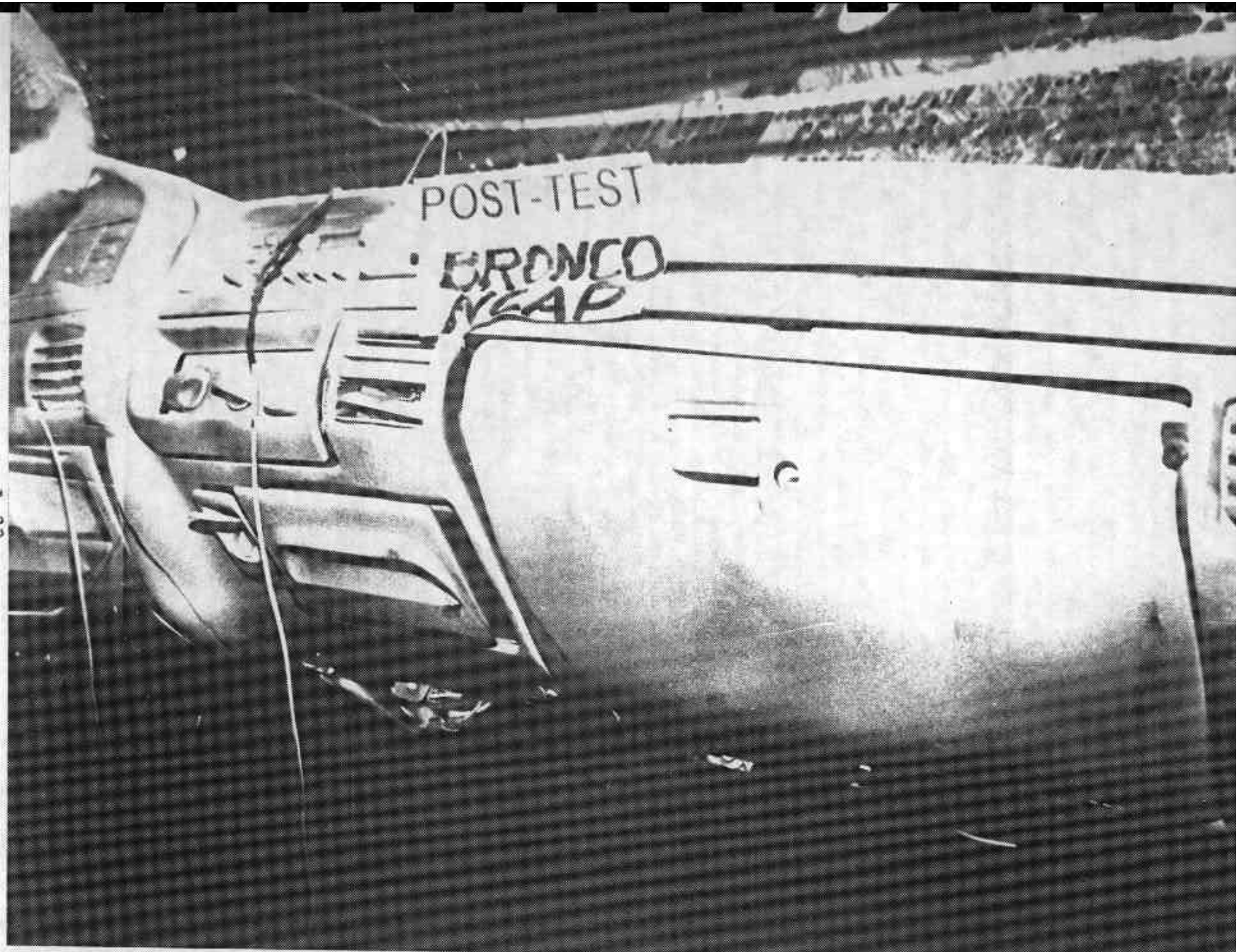


Photo No. 33 - Post-Test Passenger Instr. Panel Contact Area

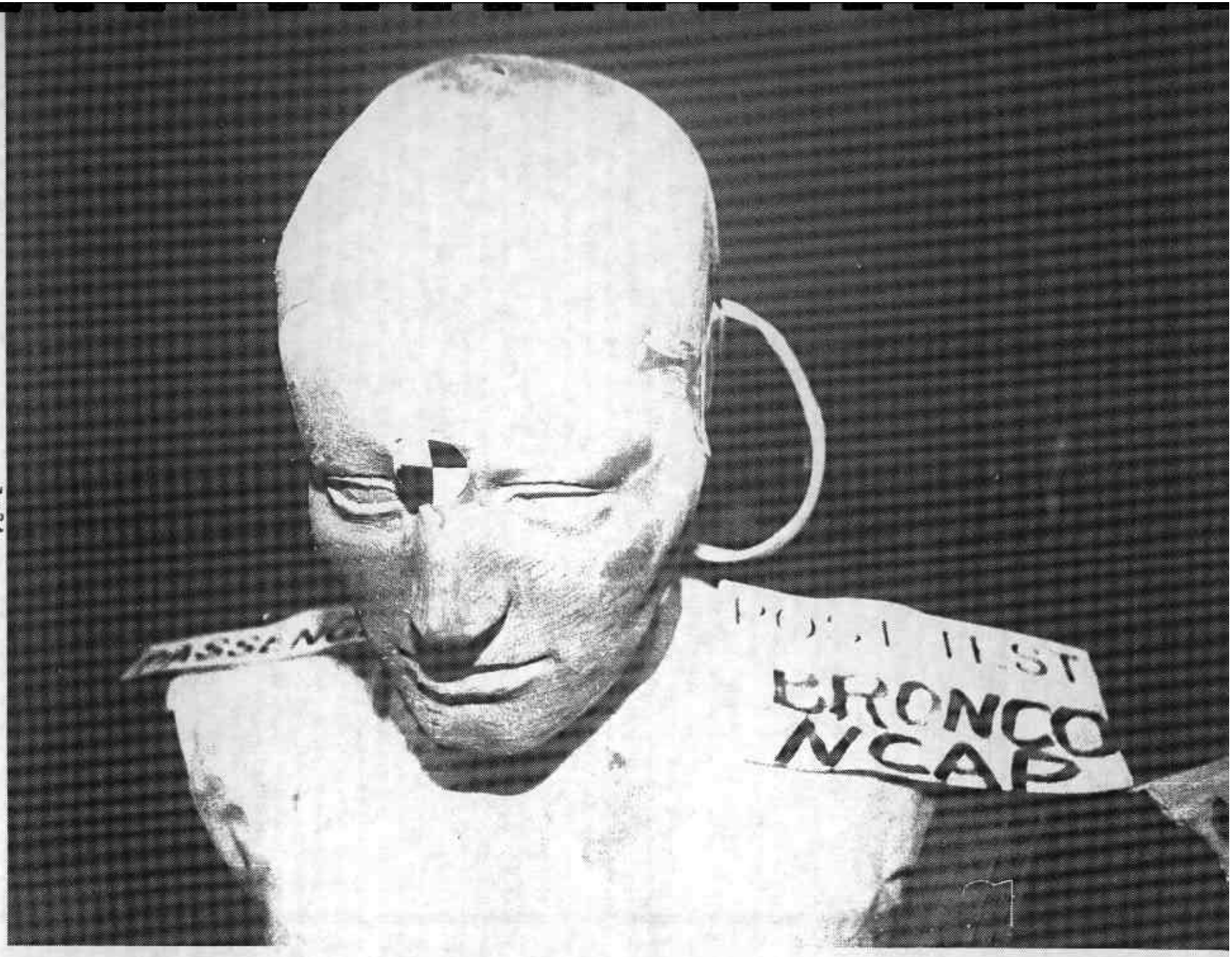


Photo No. 34 - Post-Test Passenger Dummy Head Contact Area

Photo No. 35 - Post-Test Passenger Dummy Knee Contact Area

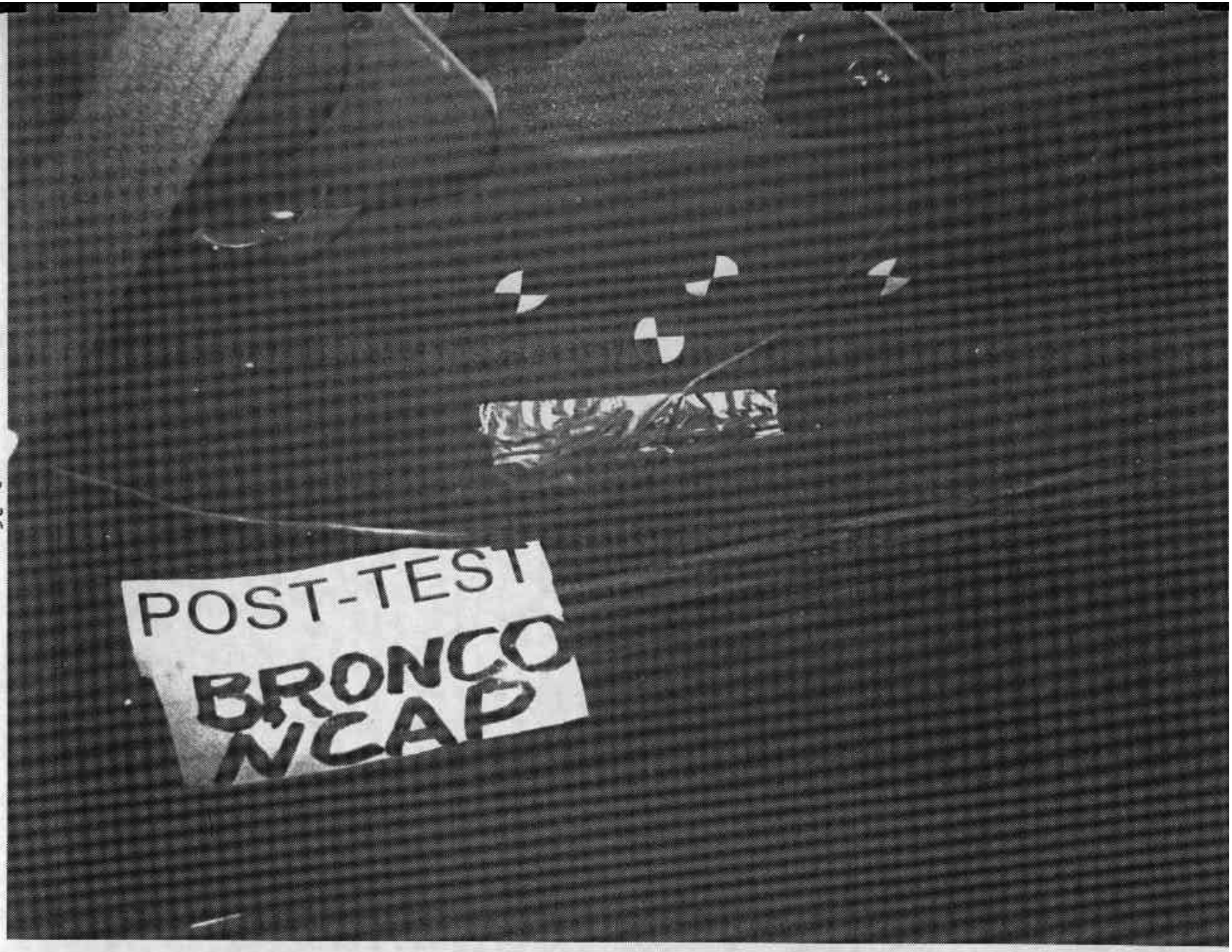


Photo No. 36 - Post-Test Passenger Seat Movement

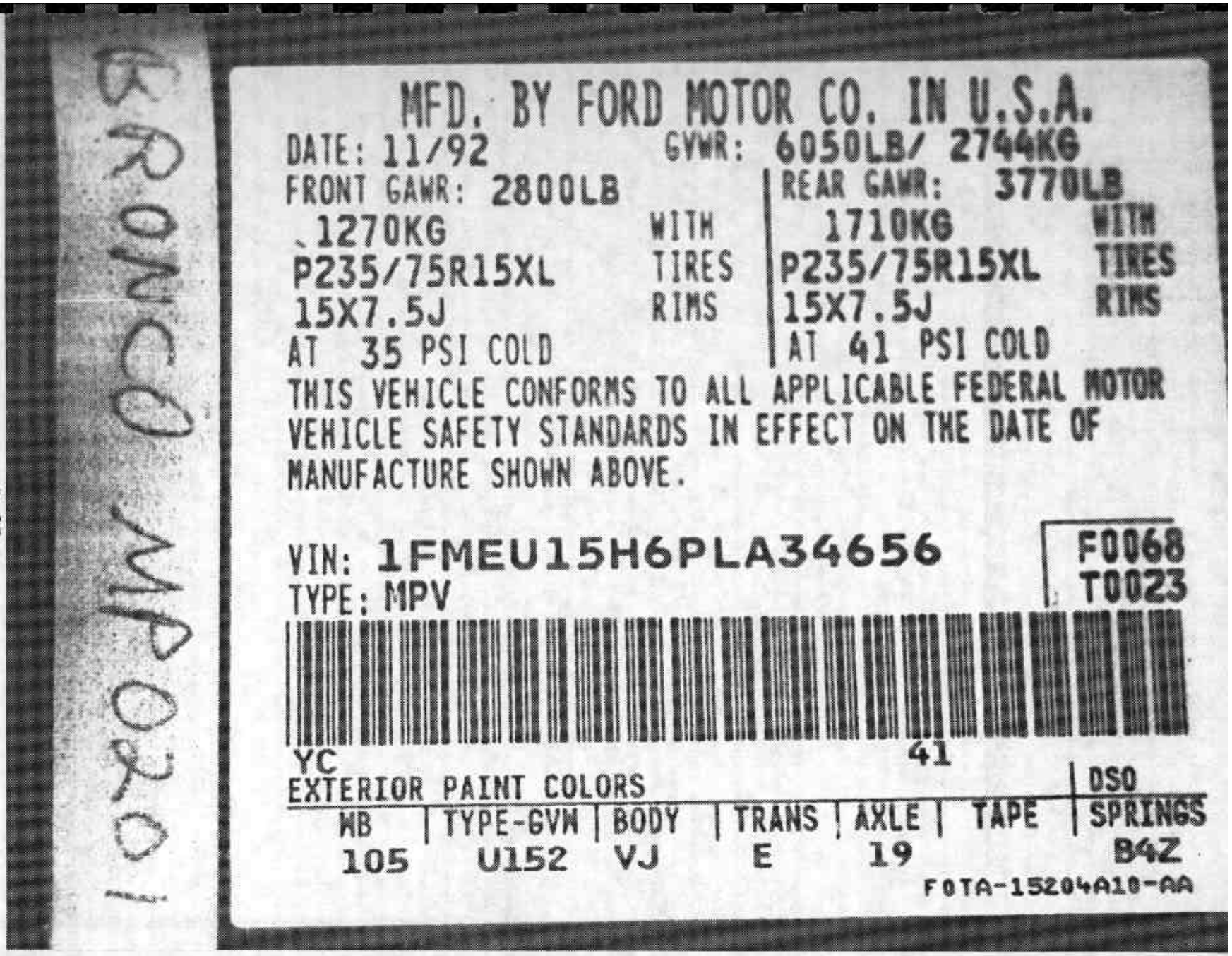


Photo No. 37 - Vehicle Tire Placard

APPENDIX B

Vehicle, Load Cell Barrier and Dummy Response Data

1993 FORD BRONCO 4 X 4

NHTSA NO.: MP0201

VEHICLE DATA	FILTER CHANNEL CLASS	
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)

[1] Accelerometer Mounting Separated During Impact

[2] Data Loss at 100 msec.

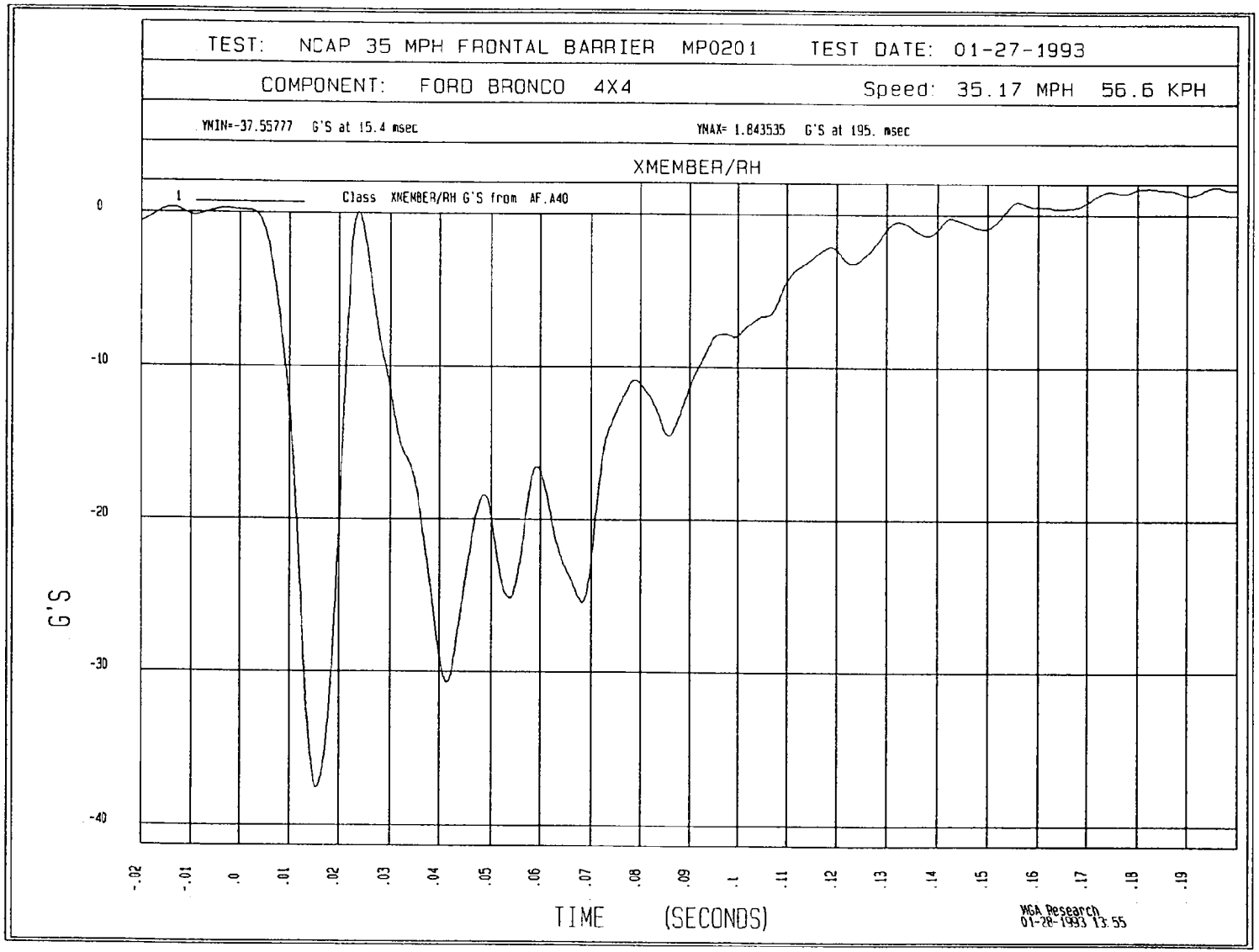


Figure B-1 - Right Rear Seat Crossmember X Acceleration vs. Time

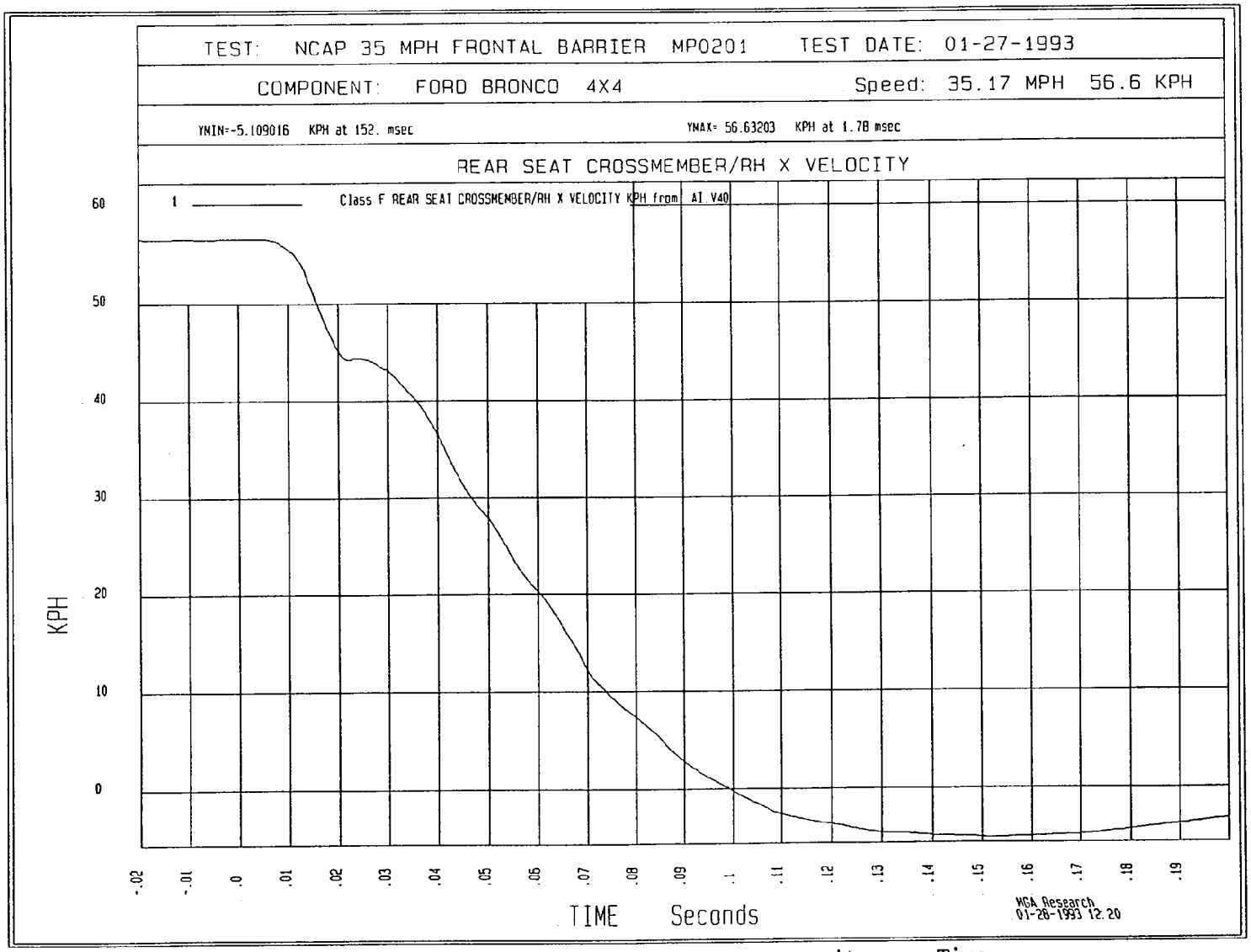


Figure B-2 - Right Rear Seat Crossmember X Velocity vs. Time

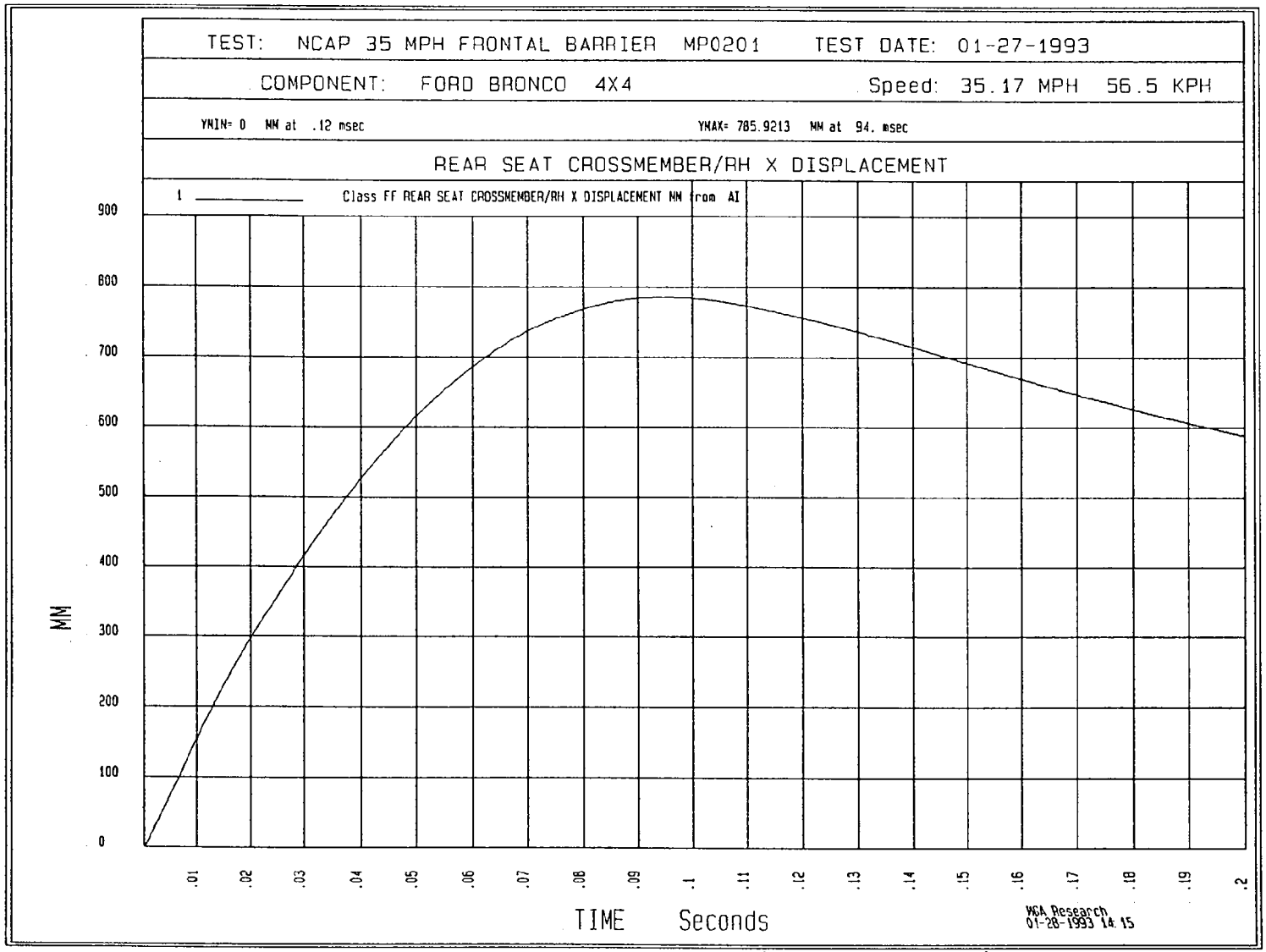


Figure B-3 - Right Rear Seat Crossmember X Displacement vs. Time

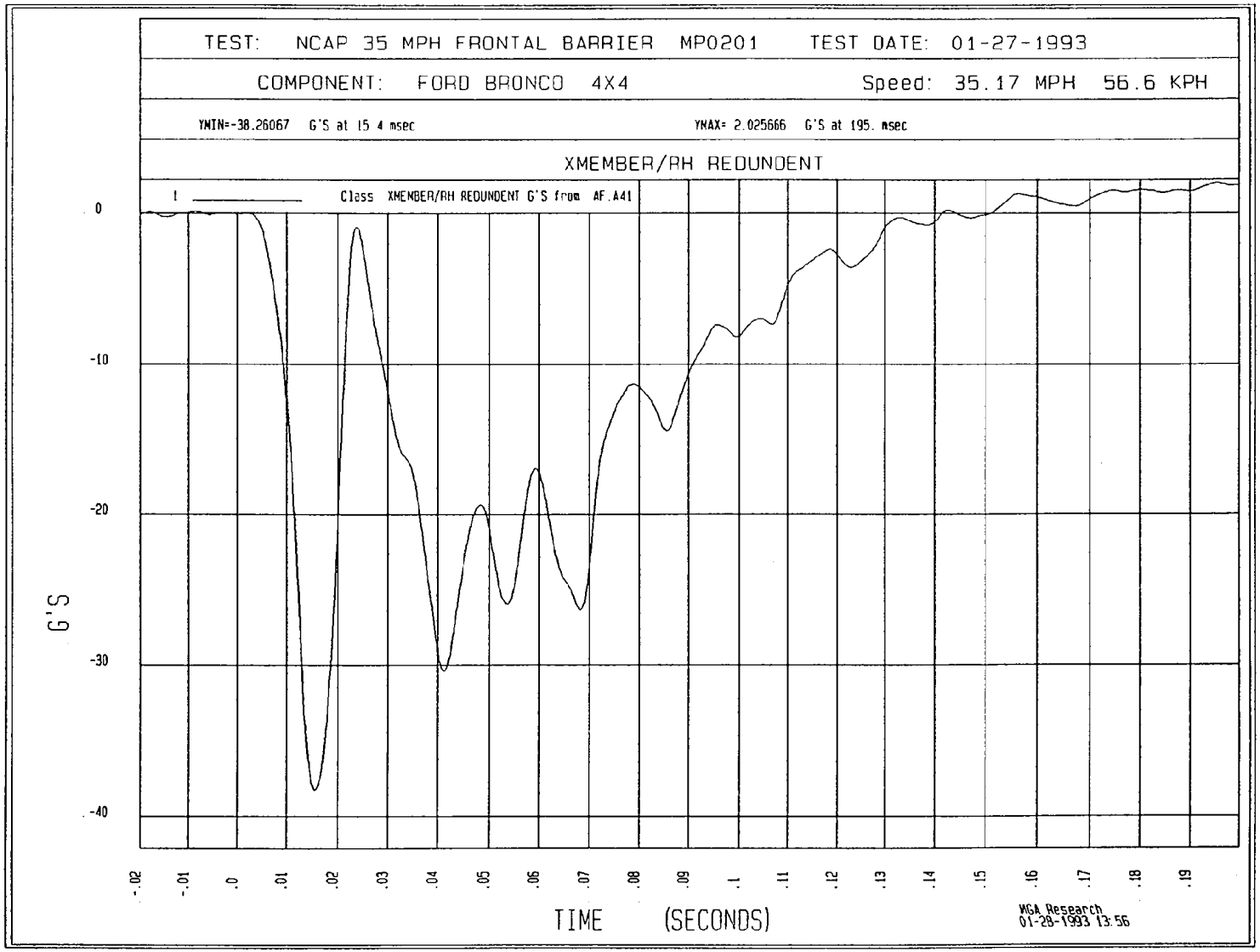


Figure B-4 - Right Rear Seat Crossmember X Redundant Acceleration vs. Time

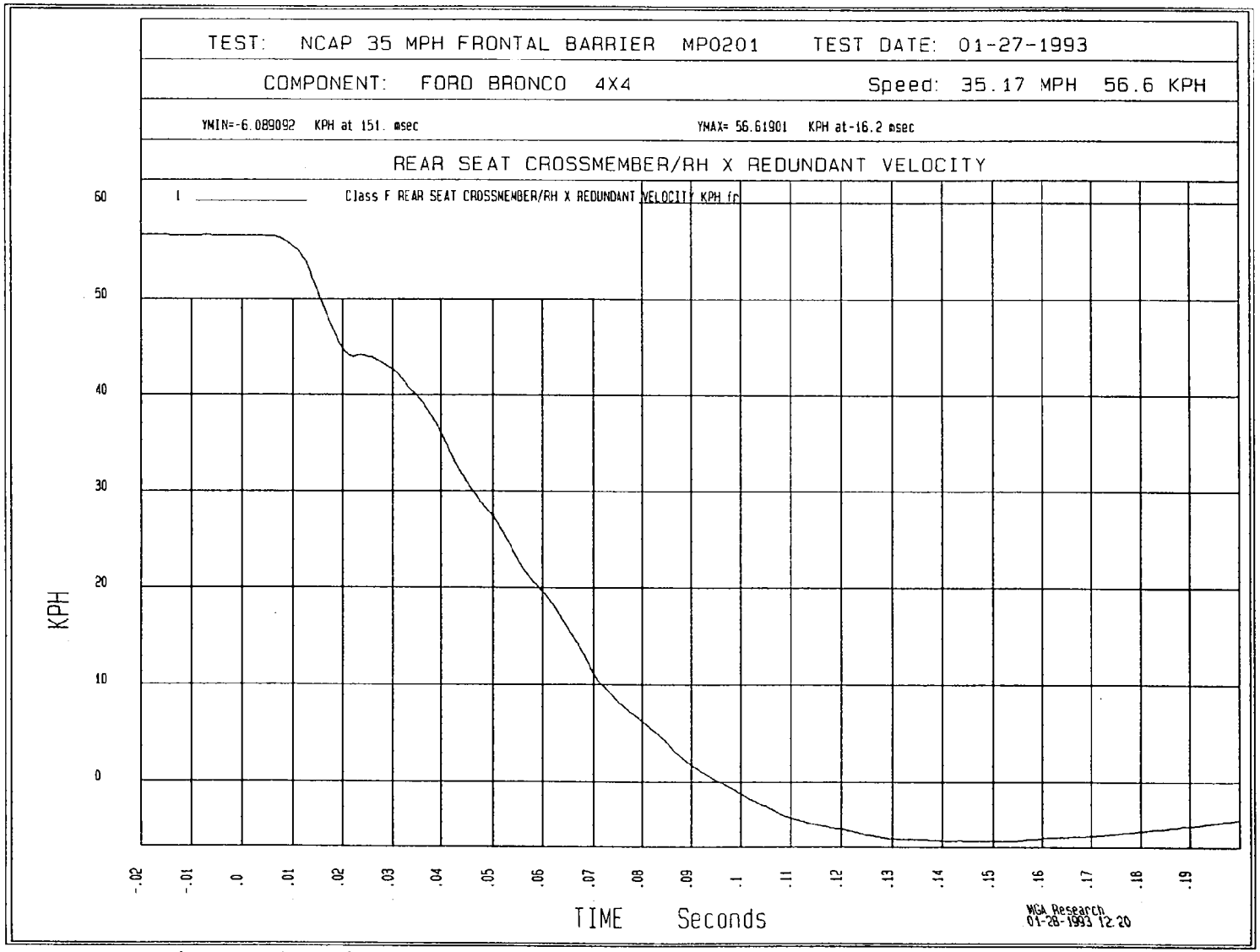


Figure B-5 - Right Rear Seat Crossmember X Redundant Velocity vs. Time

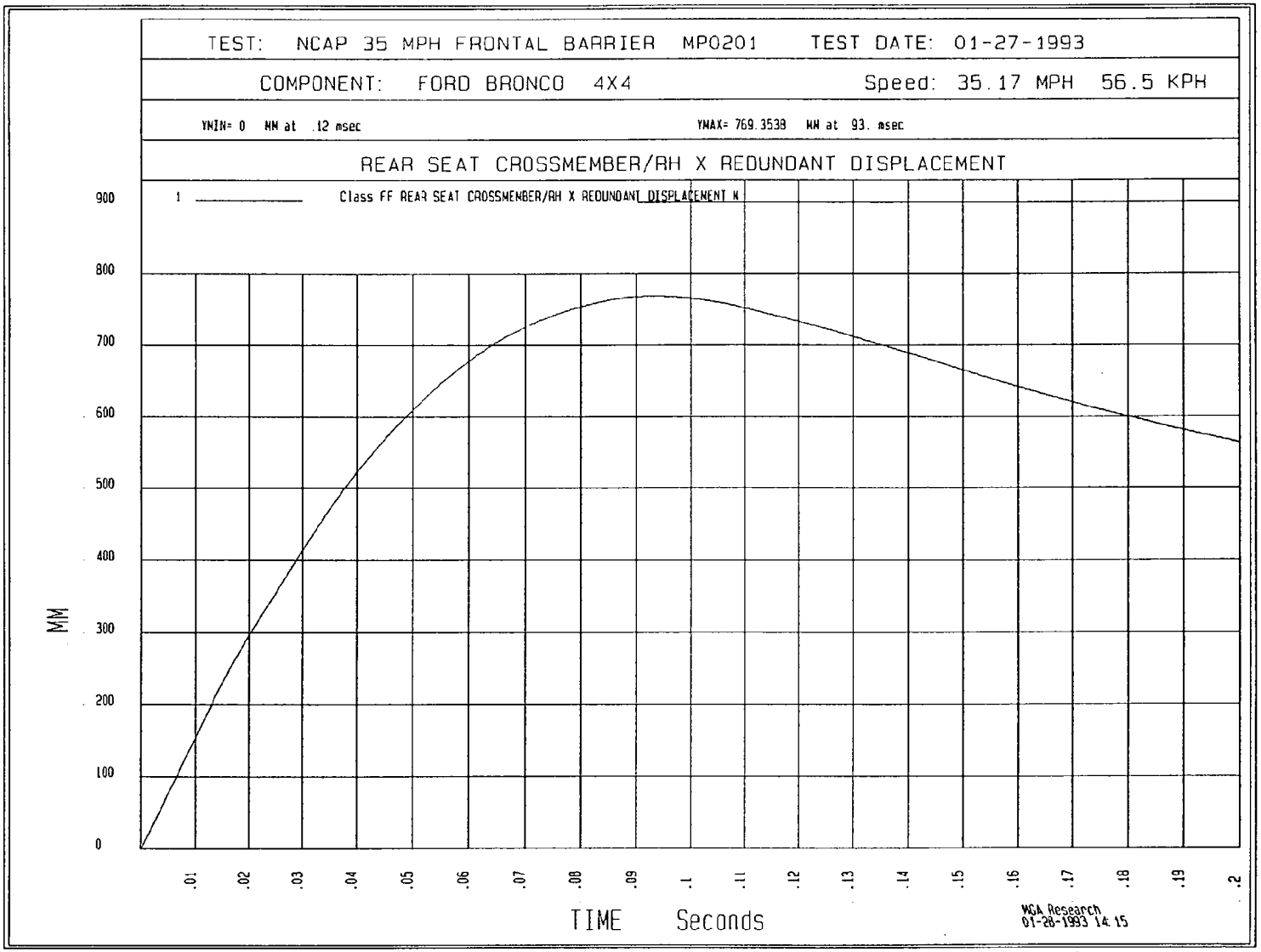


Figure B-6 - Right Rear Seat Crossmember X Redundant Displacement vs. Time

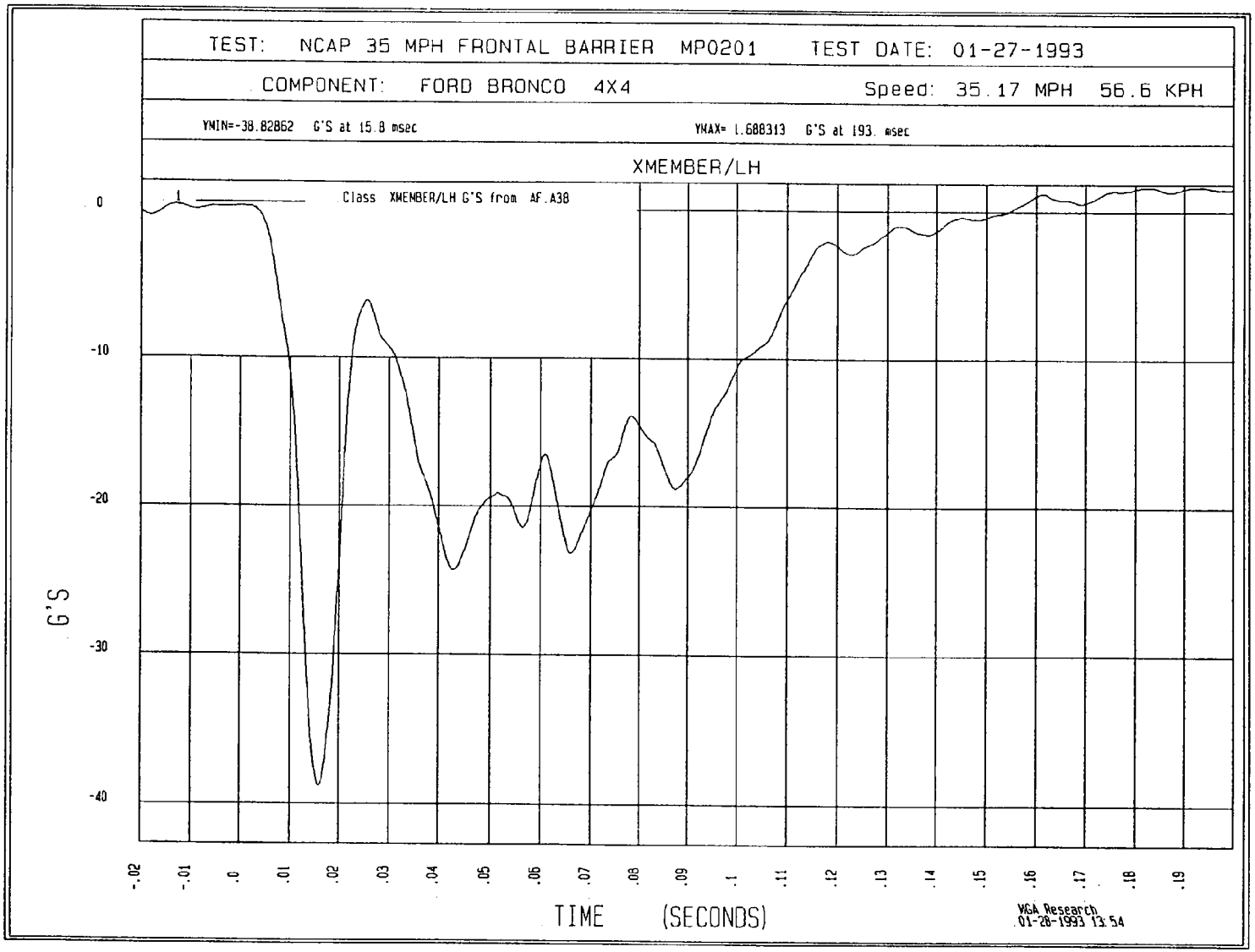


Figure B-7 - Left Rear Seat Crossmember X Acceleration vs. Time

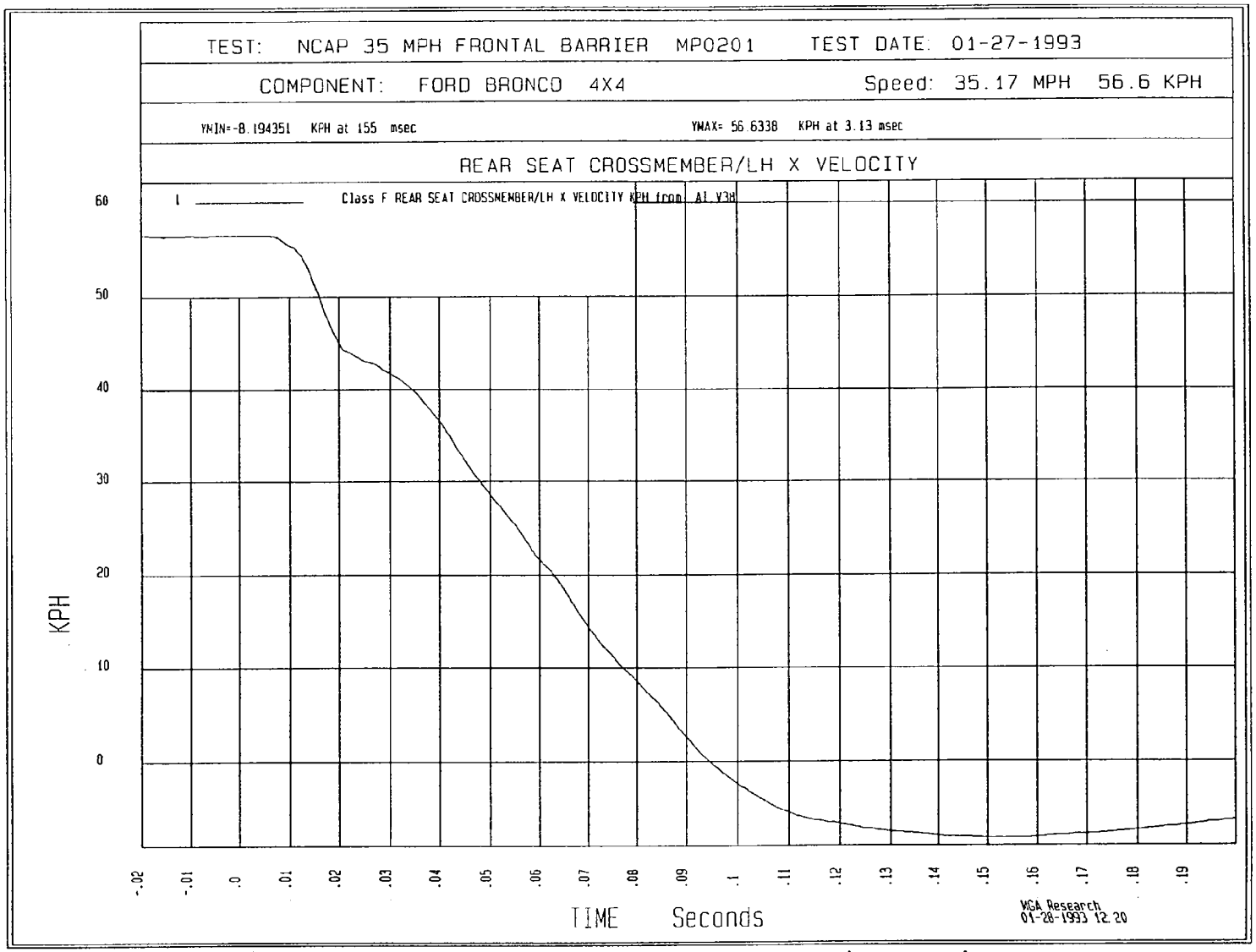


Figure B-8 - Left Rear Seat Crossmember X Velocity vs. Time

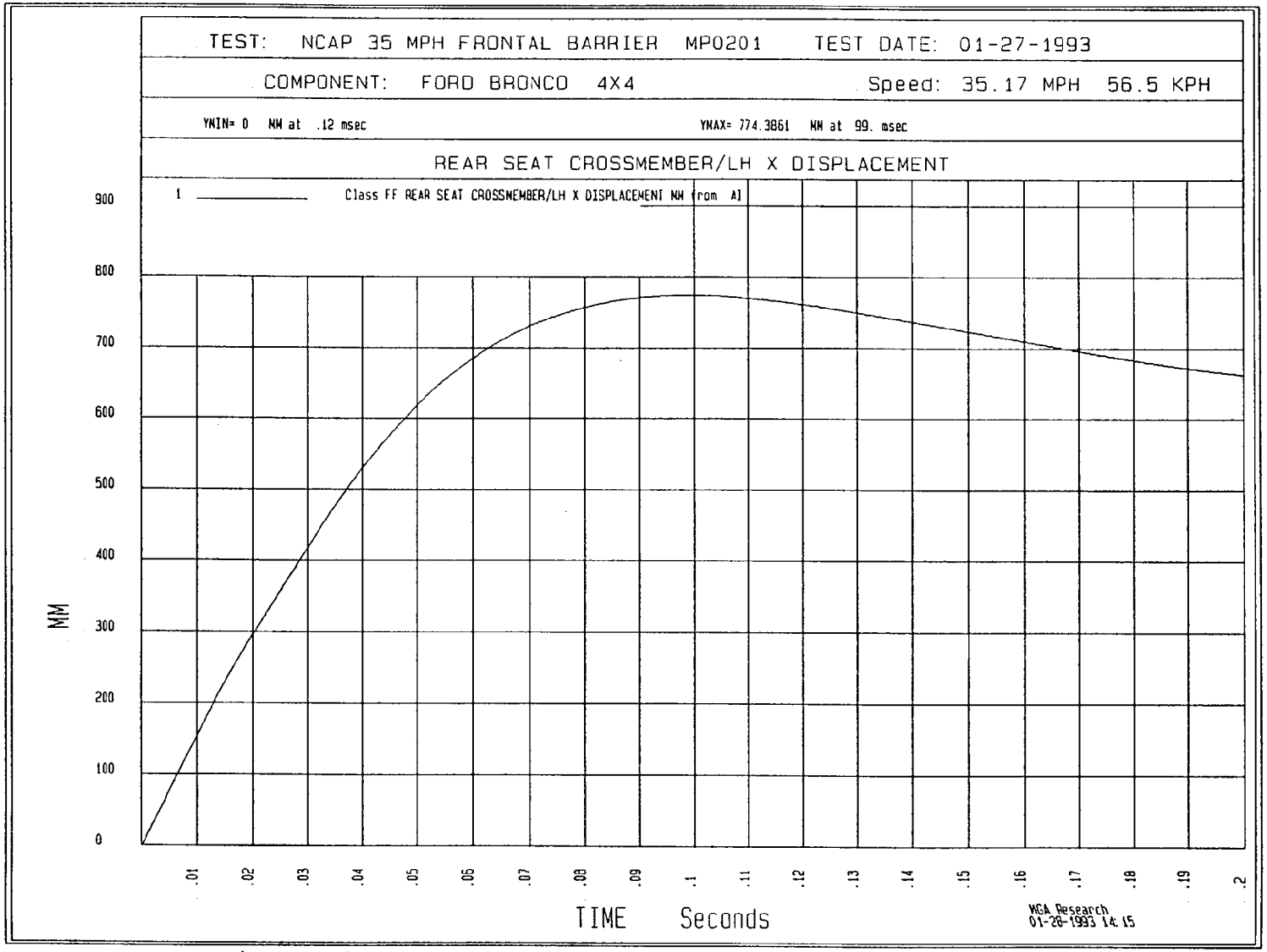


Figure B-9 - Left Rear Seat Crossmember X Displacement vs. Time

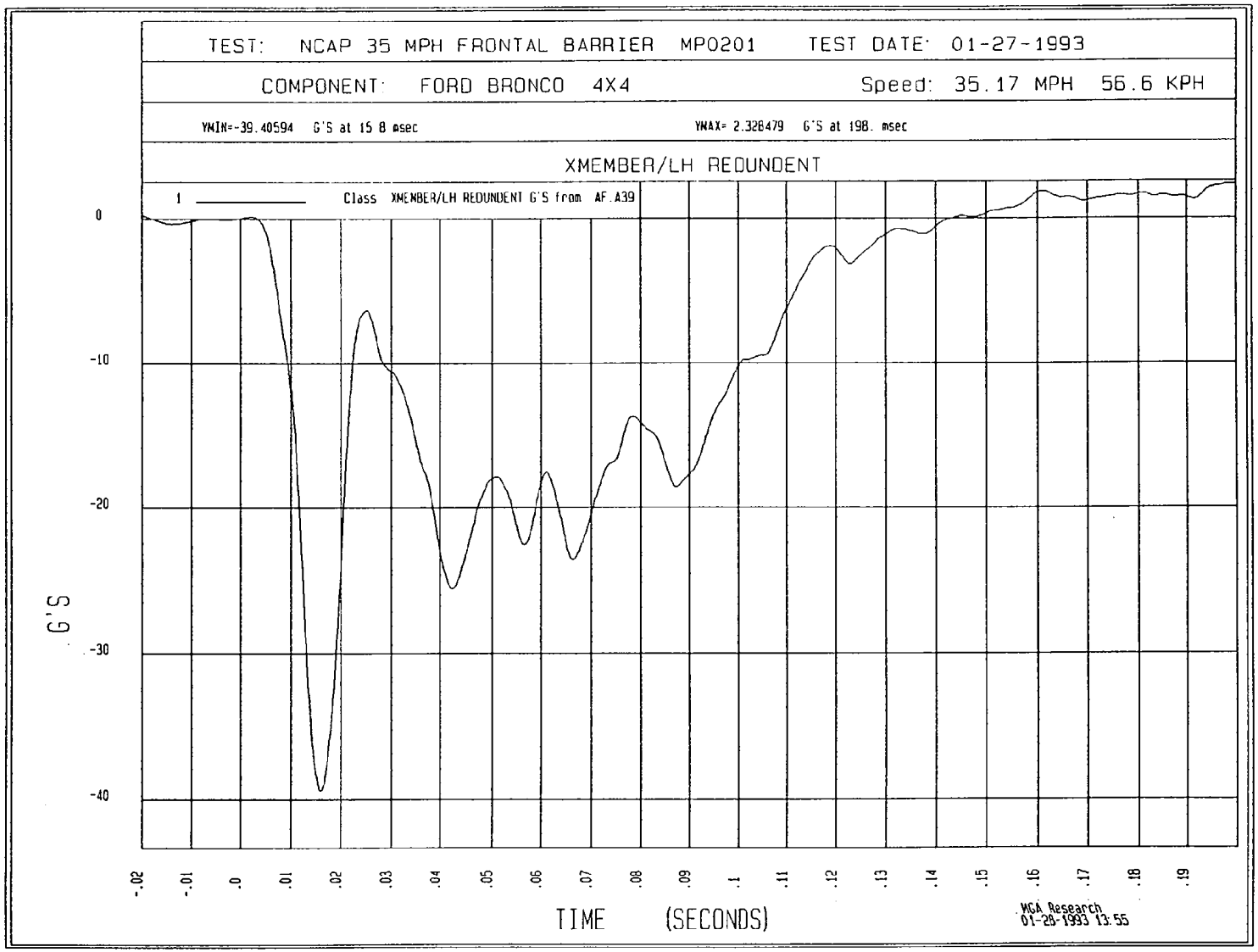


Figure B-10 - Left Rear Seat Crossmember X Redundant Acceleration vs. Time

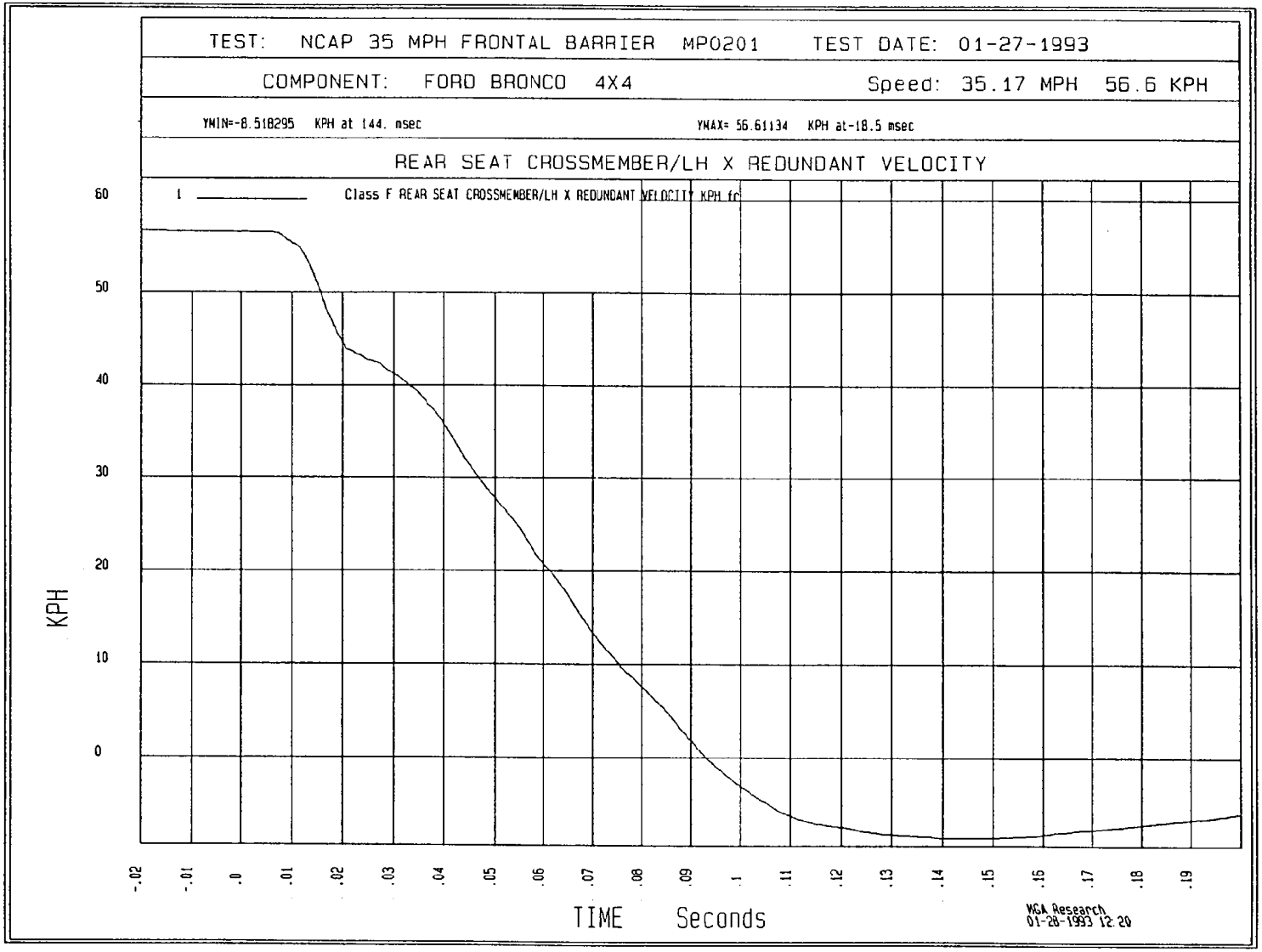


Figure B-11 - Left Rear Seat Crossmember X Redundant Velocity vs. Time

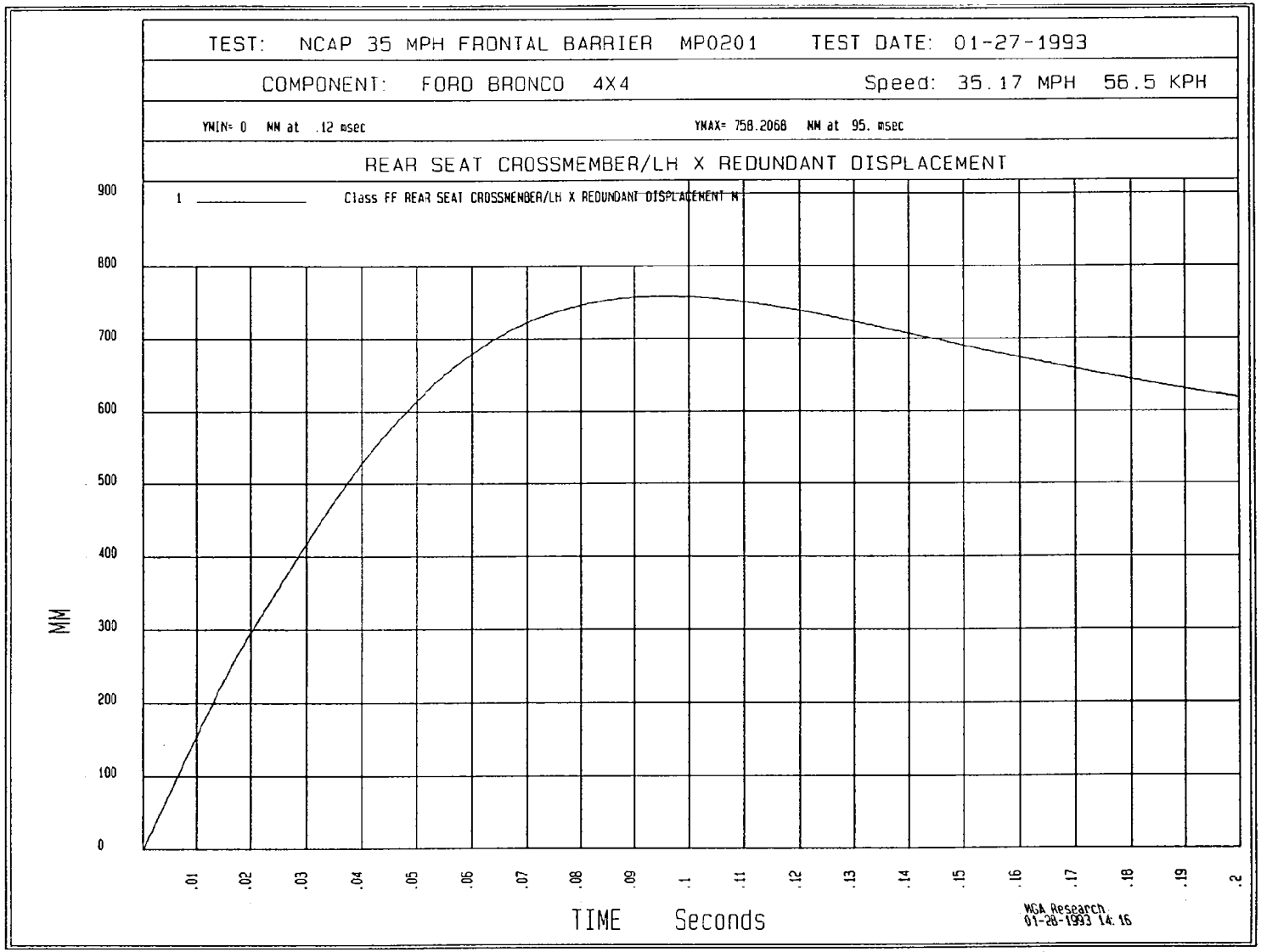


Figure B-12 - Left Rear Seat Crossmember X Redundant Displacement vs. Time

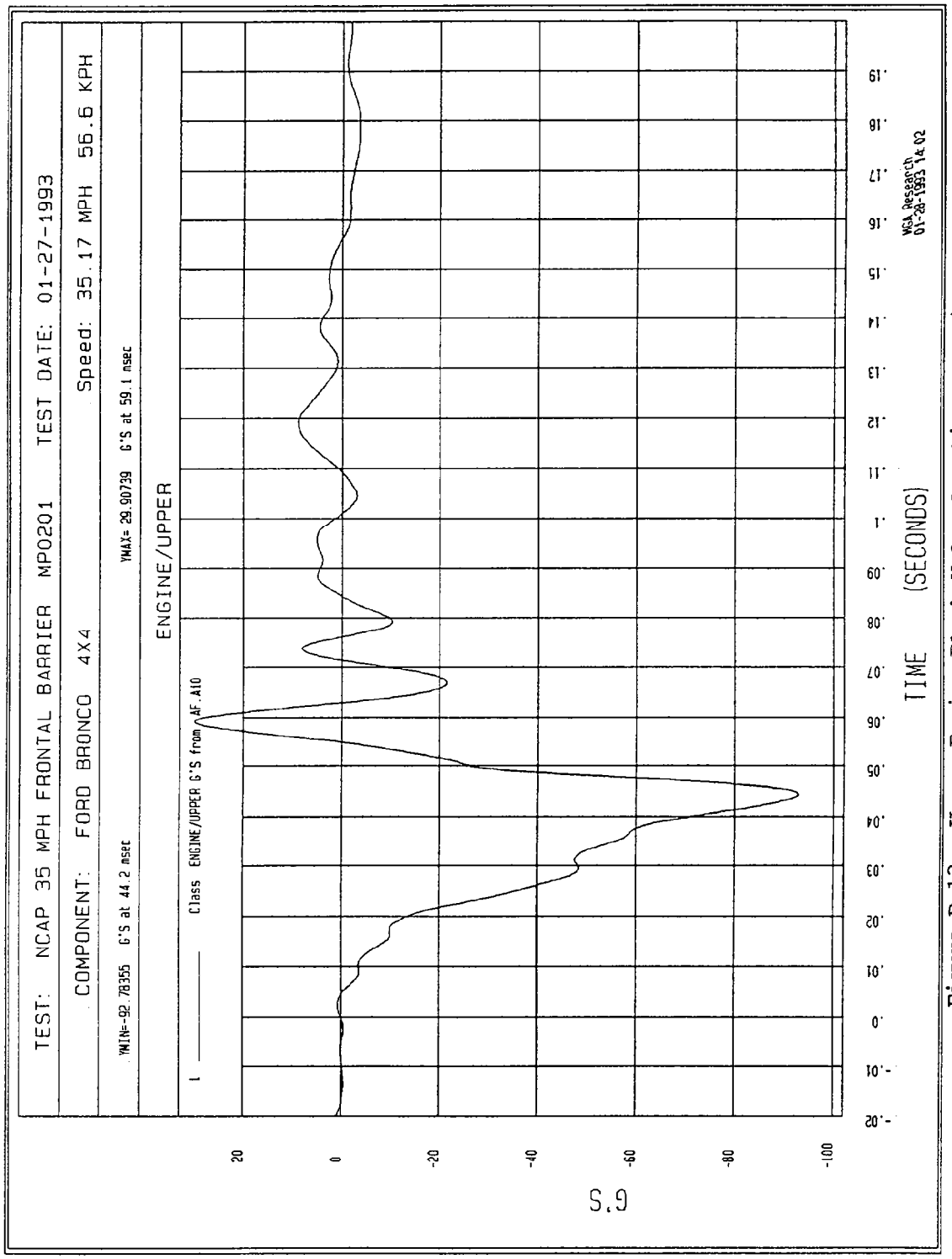


Figure B-13 - Upper Engine Block X Acceleration vs. Time

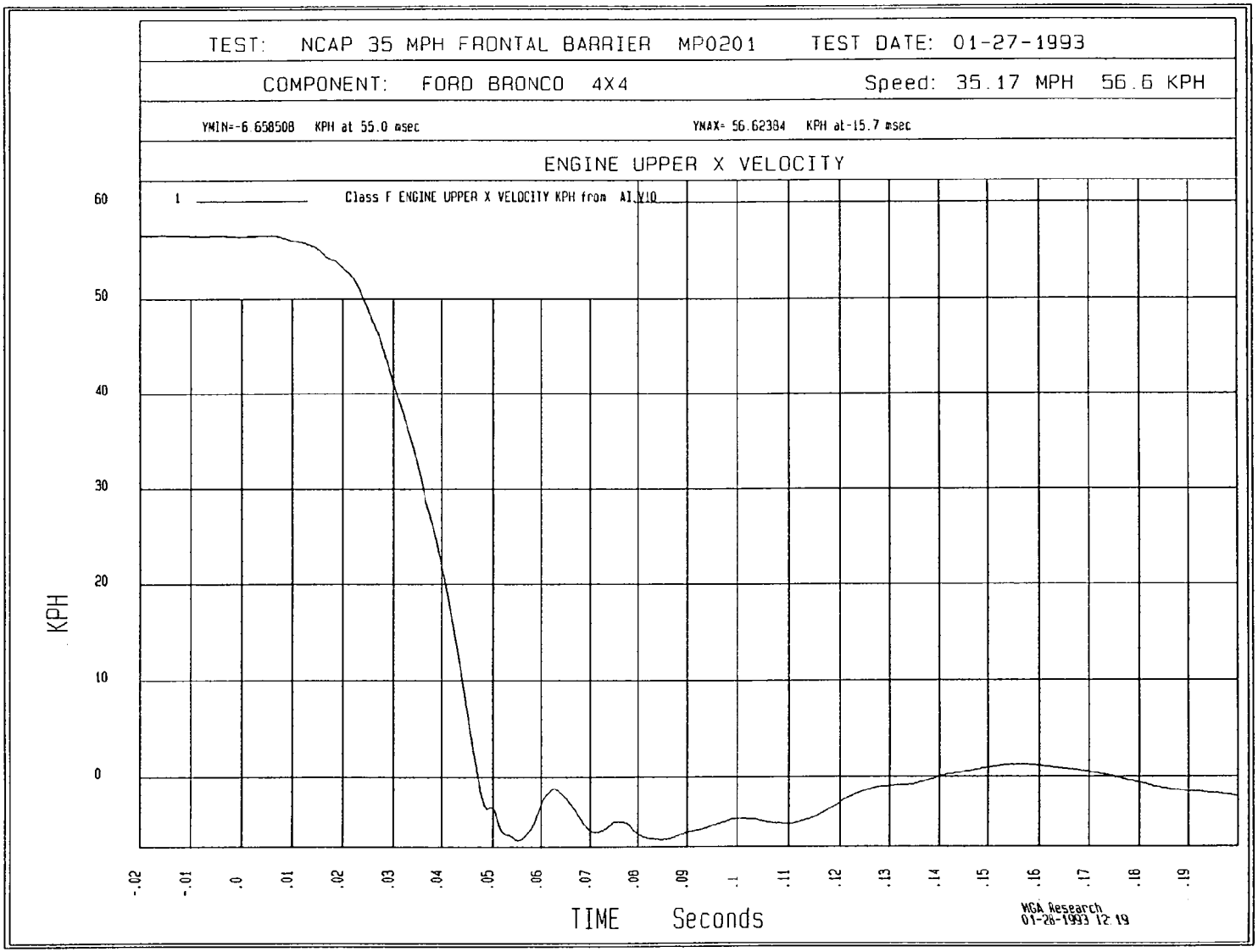


Figure B-14 - Upper Engine Block X Velocity vs. Time

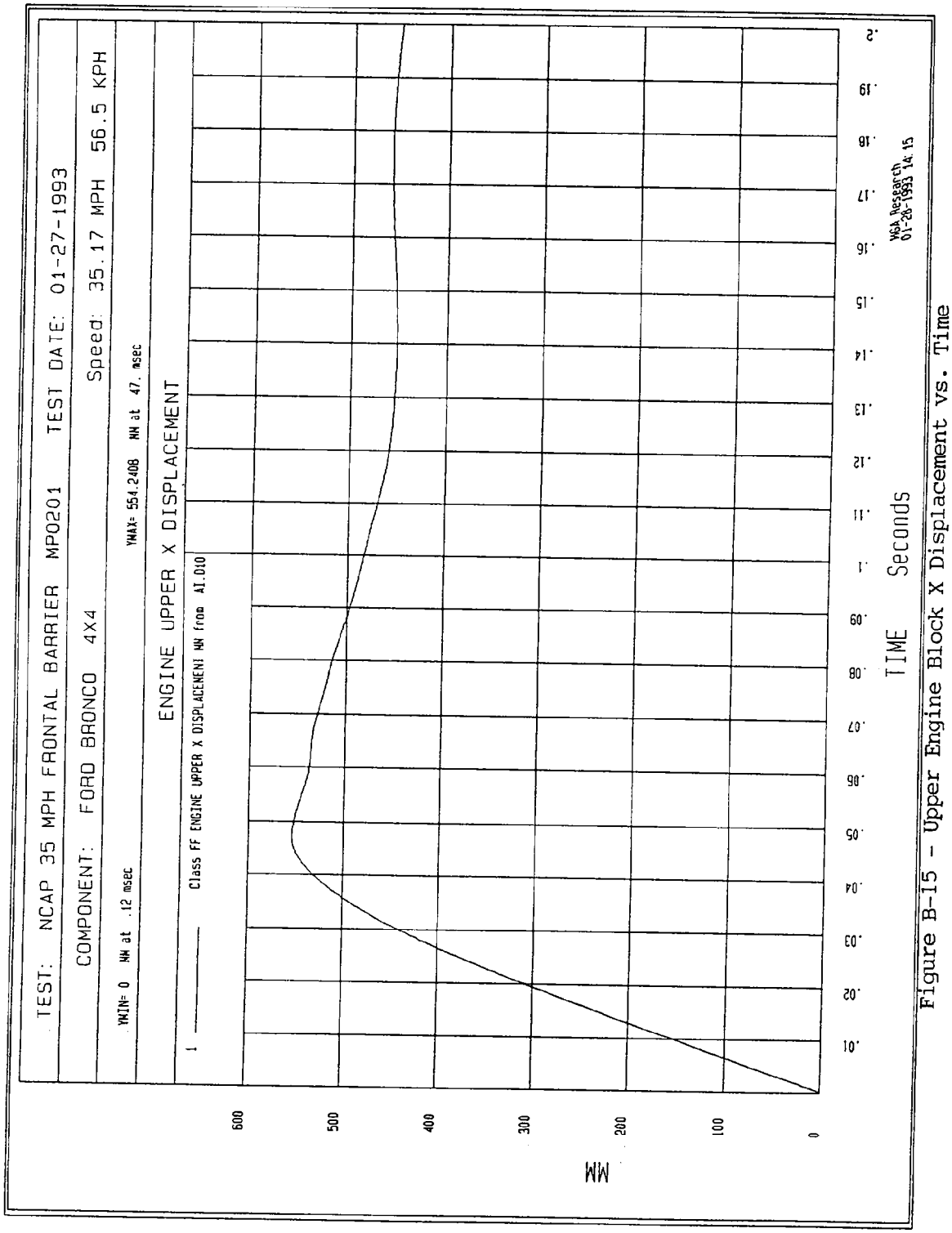


Figure B-15 - Upper Engine Block X Displacement vs. Time

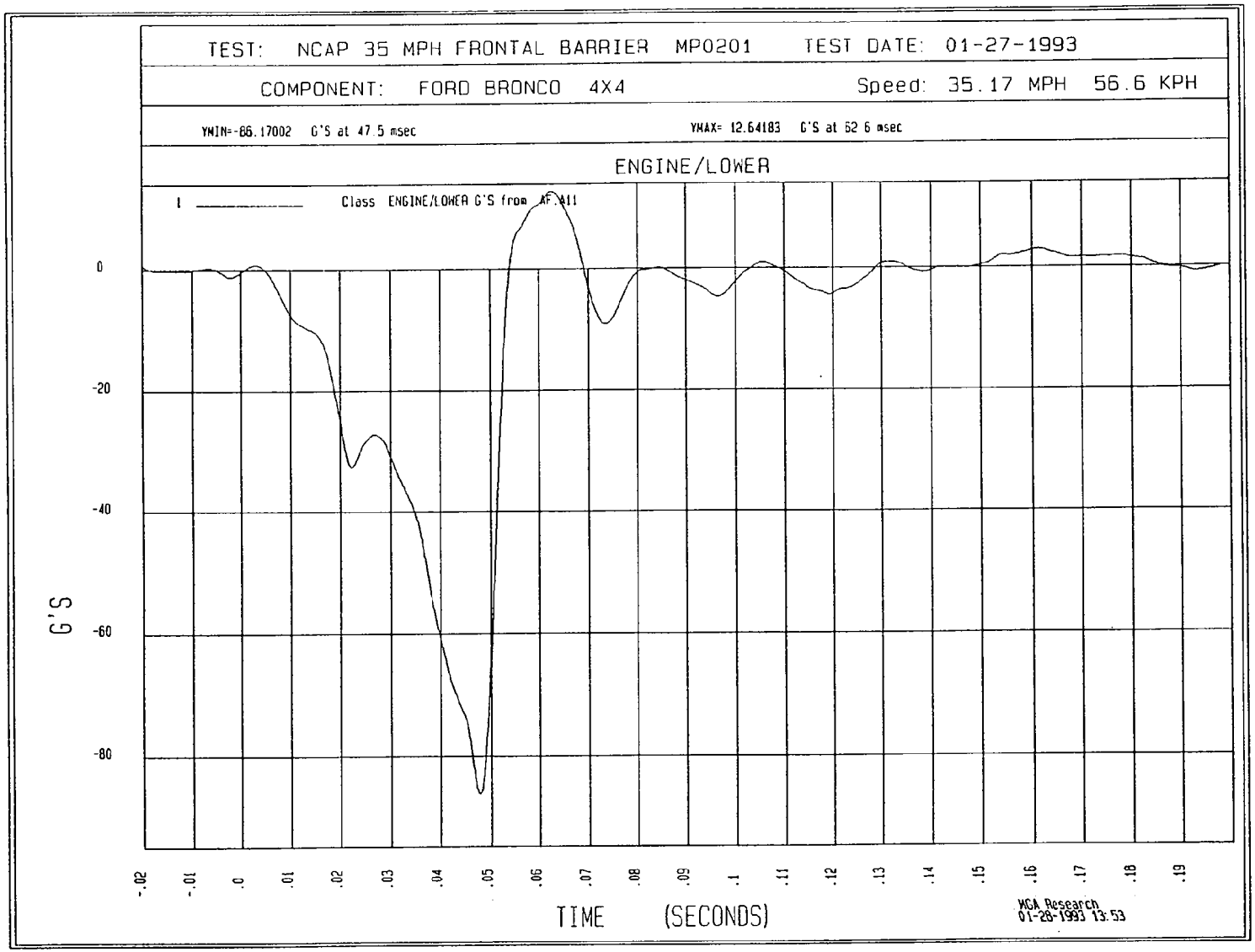


Figure B-16 - Bottom of Engine Block X Acceleration vs. Time

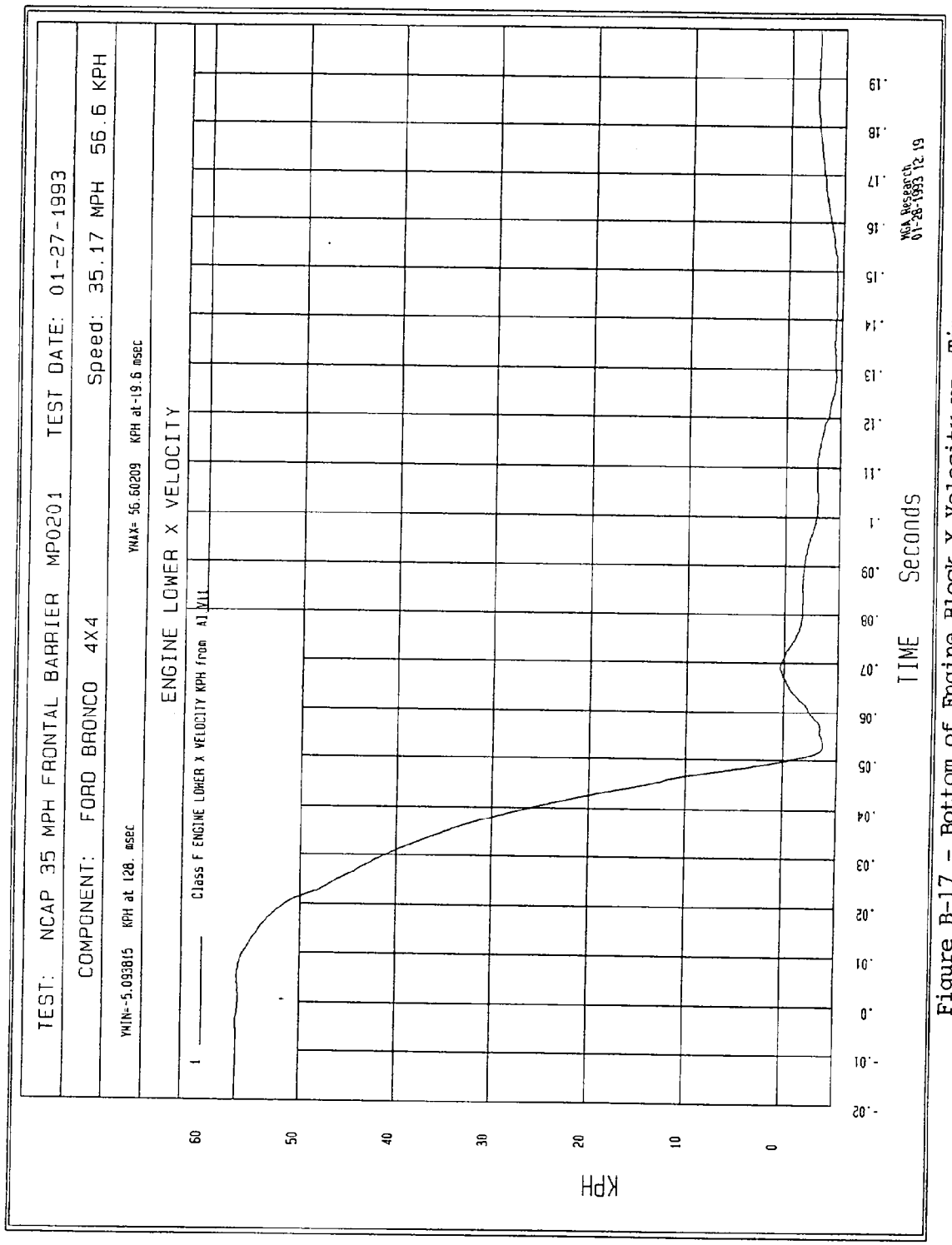


Figure B-17 - Bottom of Engine Block X Velocity vs. Time

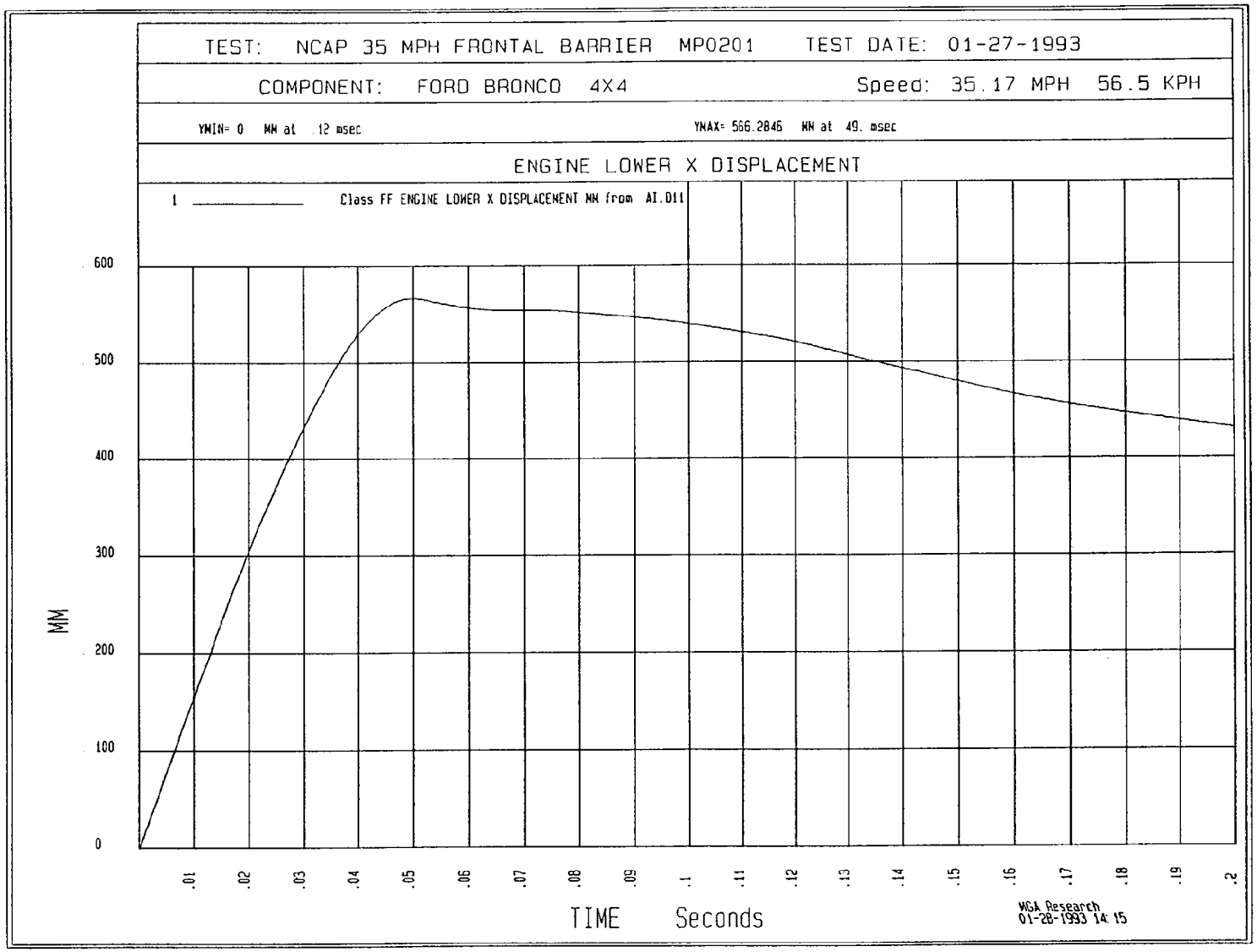


Figure B-18 - Bottom of Engine X Displacement vs. Time

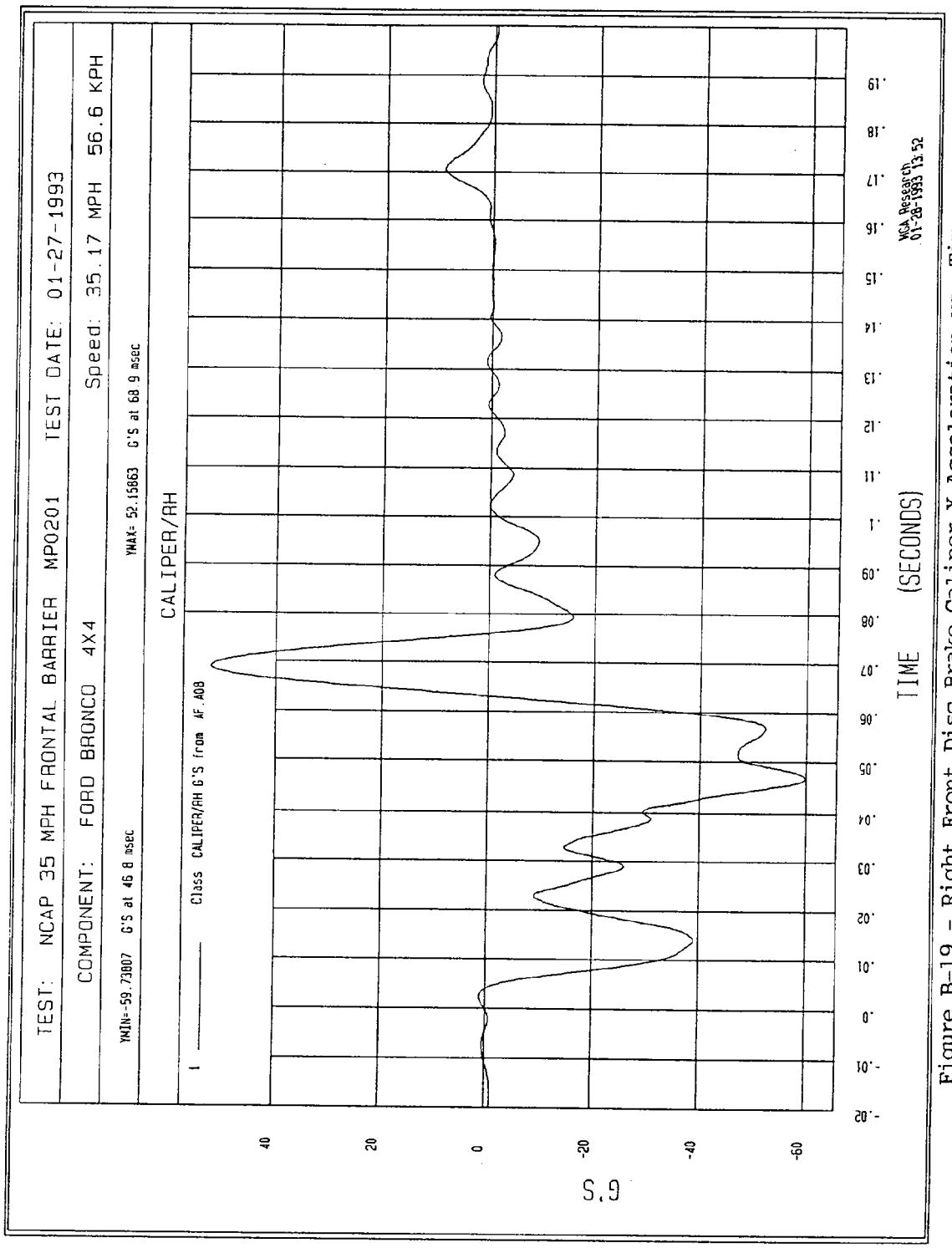


Figure B-19 - Right Front Disc Brake Caliper X Acceleration vs. Time

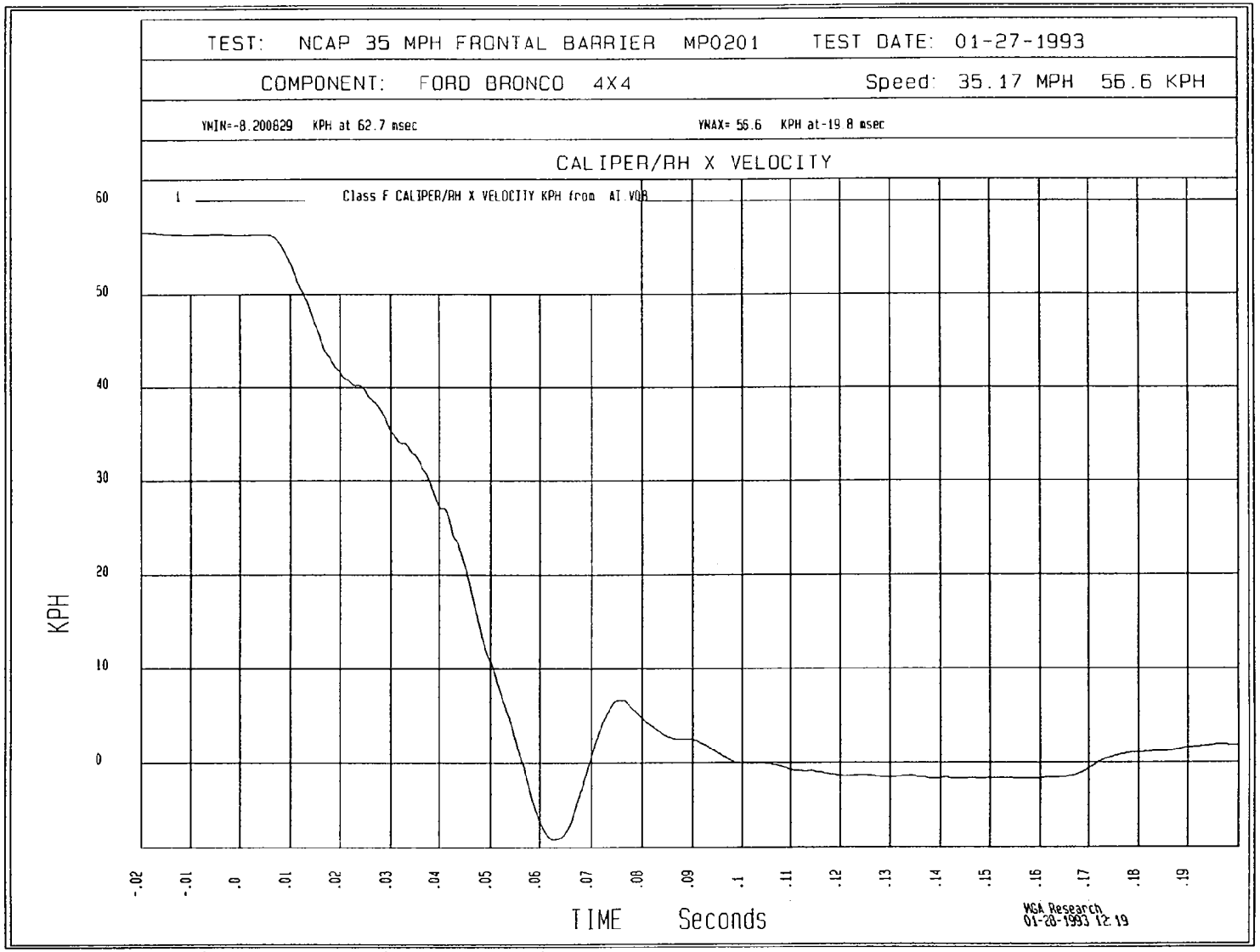


Figure B-20 - Right Front Disc Brake Caliper X Velocity vs. Time

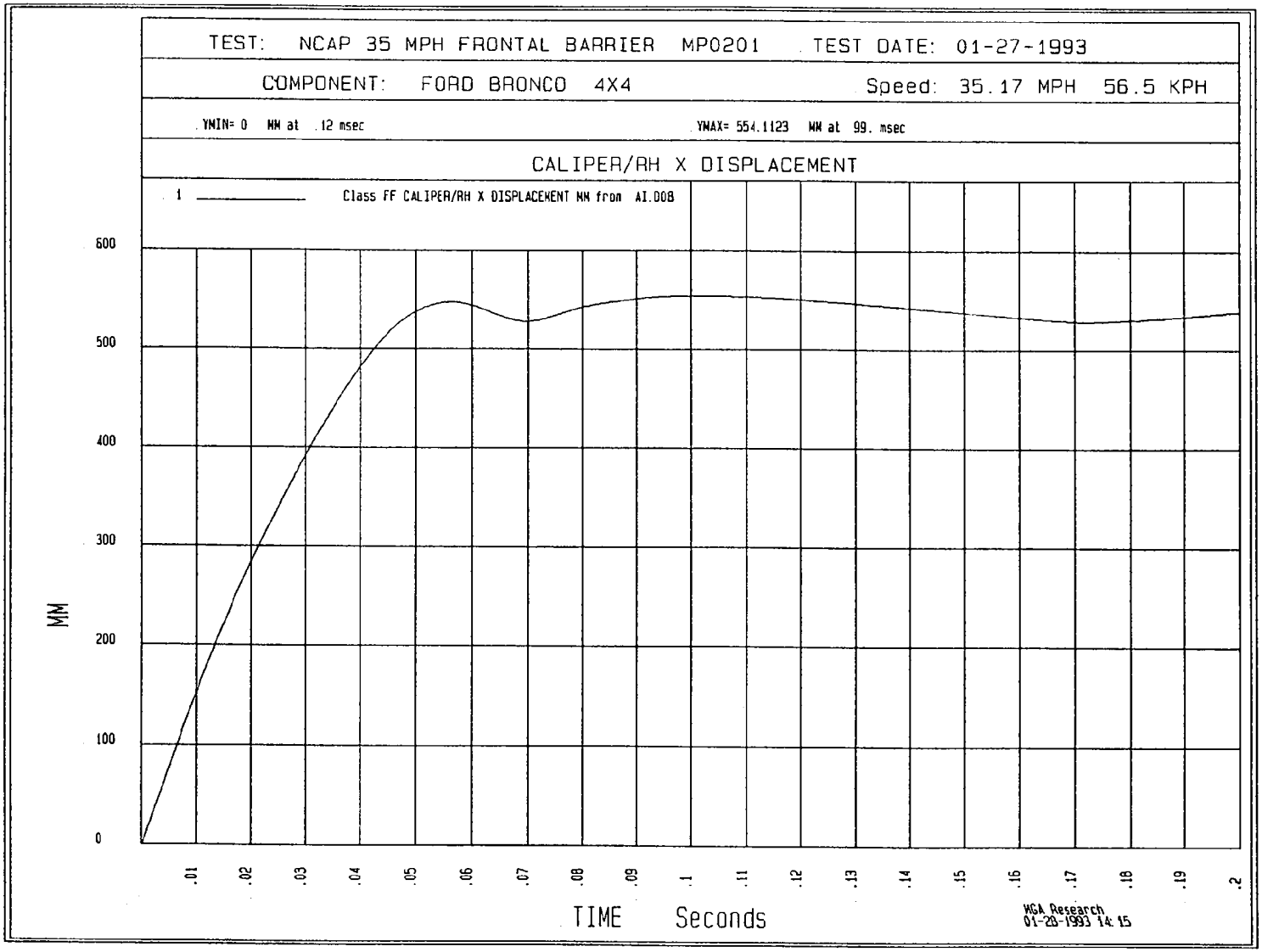


Figure B-21 - Right Front Disc Brake Caliper X Displacement vs. Time

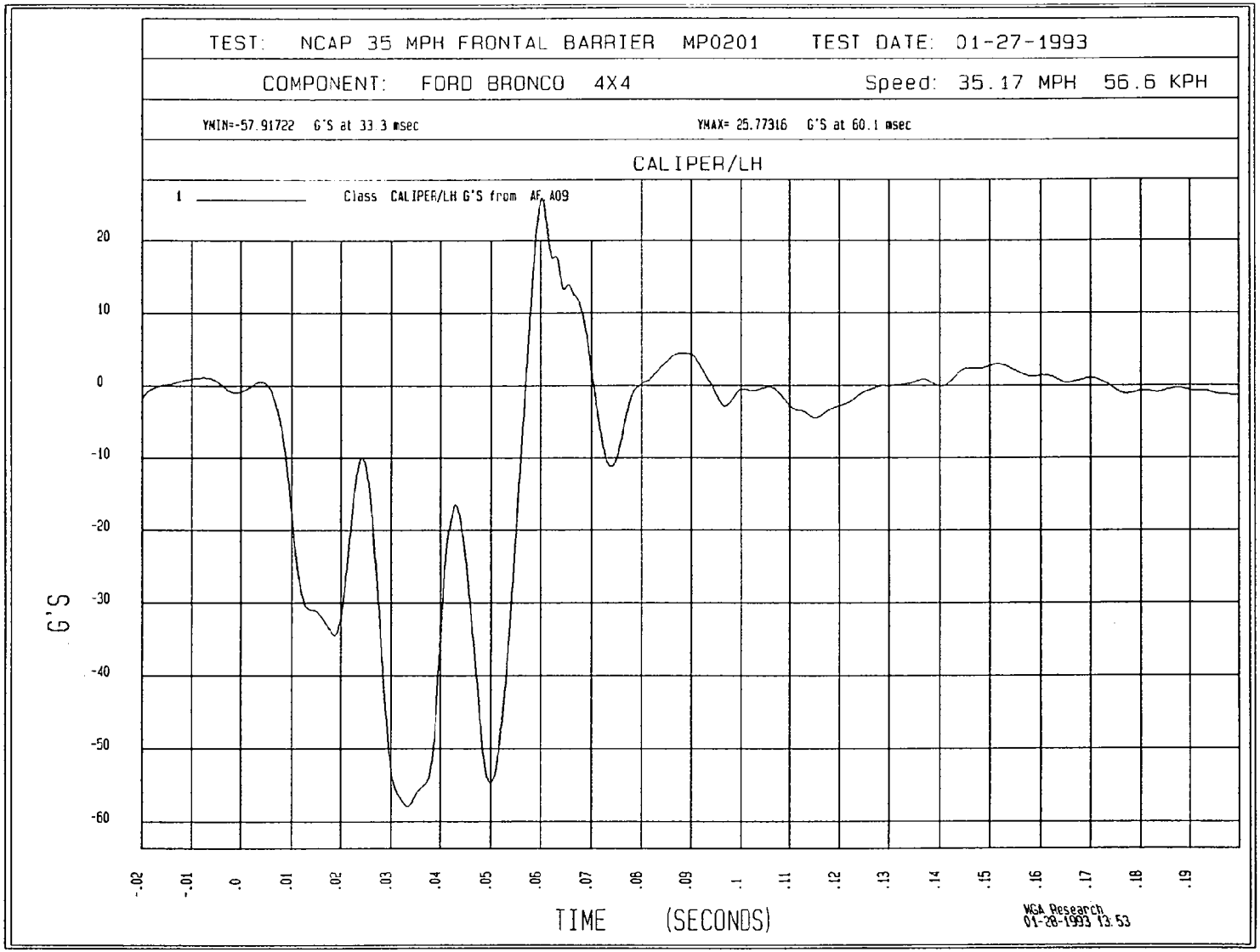


Figure B-22 - Left Front Disc Brake Caliper X Acceleration vs. Time

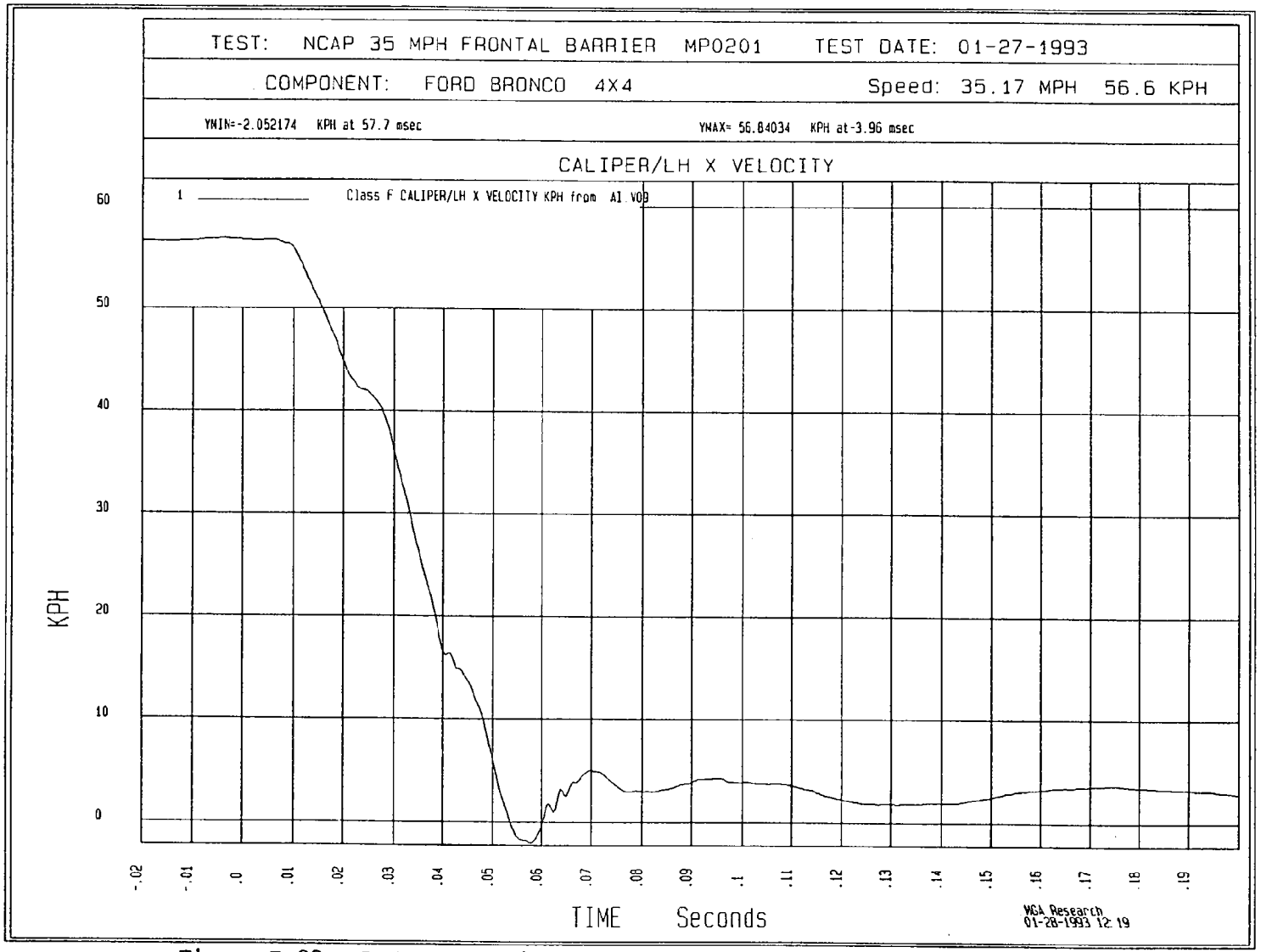


Figure B-23 - Left Front Disc Brake Caliper X Velocity vs. Time

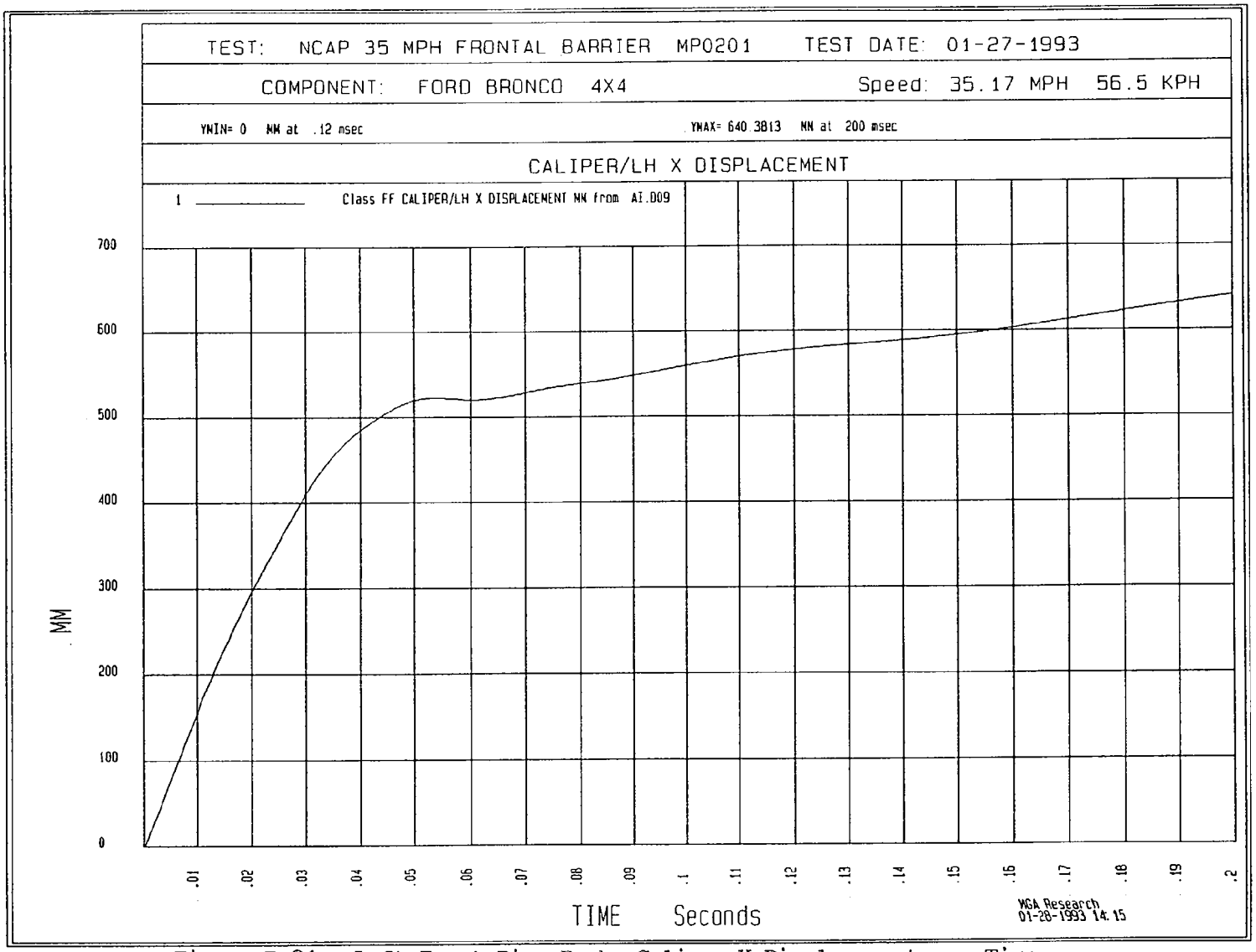
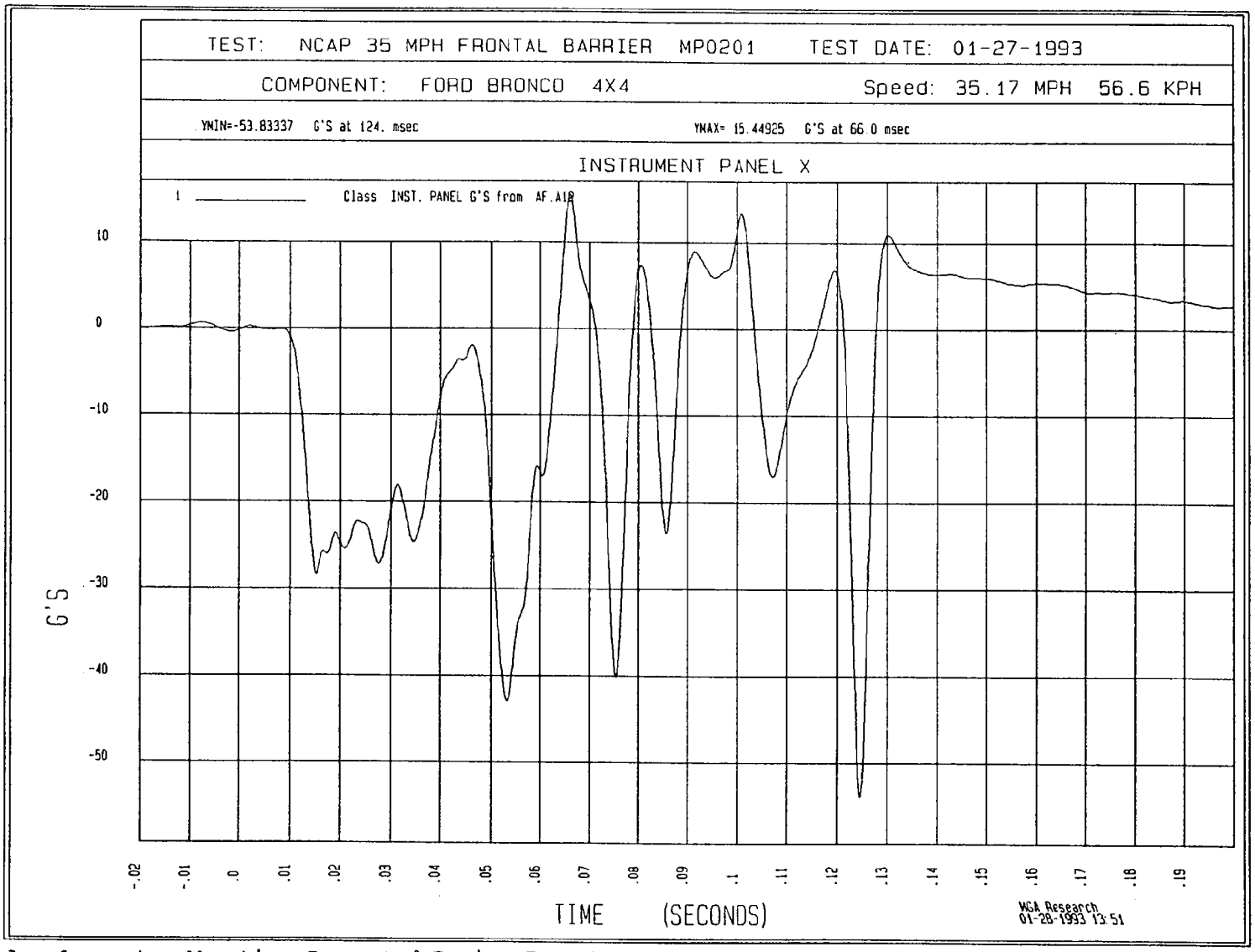
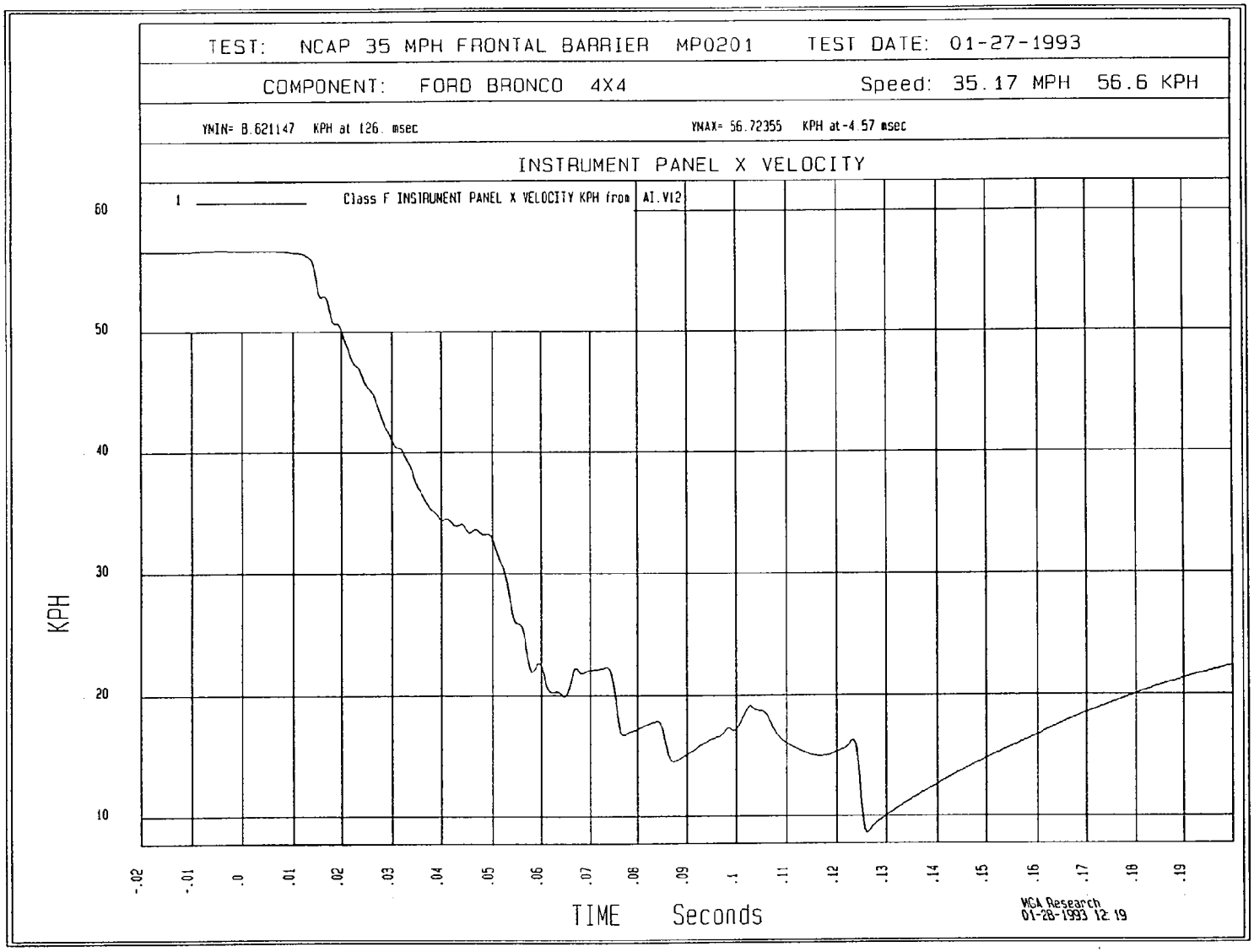


Figure B-24 - Left Front Disc Brake Caliper X Displacement vs. Time



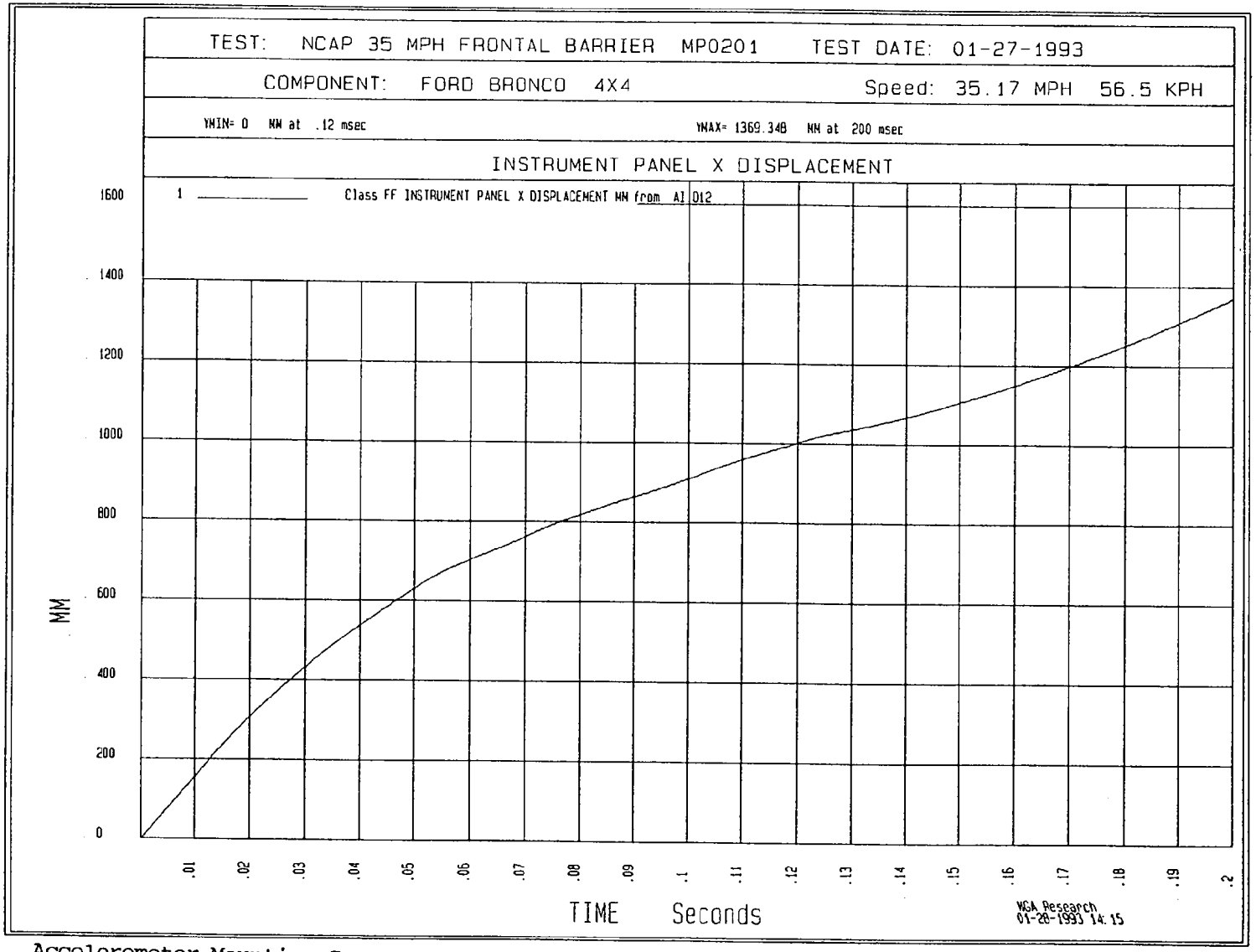
Accelerometer Mounting Separated During Impact

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



Accelerometer Mounting Separated During Impact

Figure B-26 - Center of Instrument Panel Top Surface X Velocity vs. Time



Accelerometer Mounting Separated During Impact

Figure B-27 - Center of Instrument Panel Top Surface X Displacement vs. Time

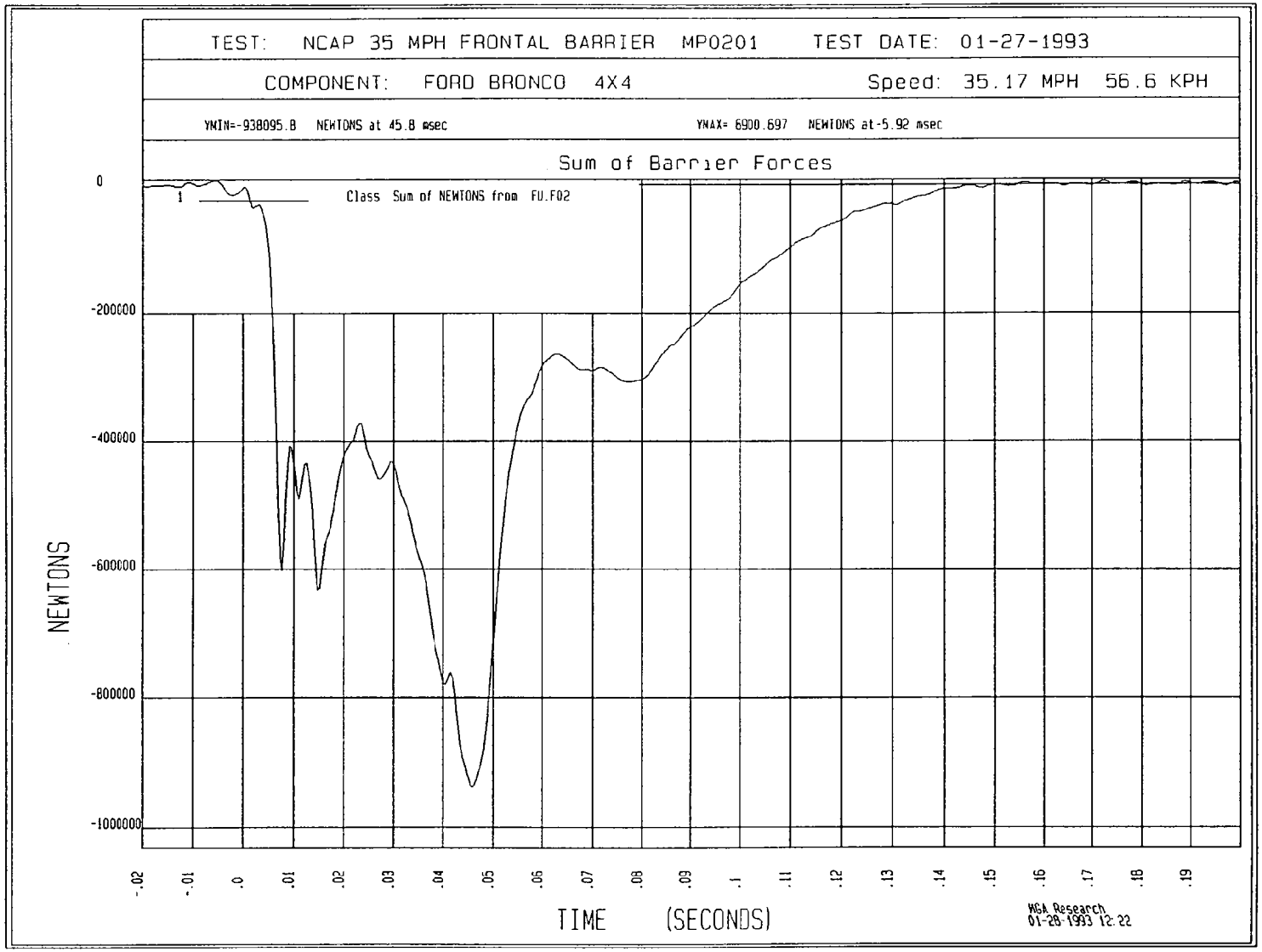


Figure B-28 - Sum of Barrier 6 Load Cells Force vs. Time

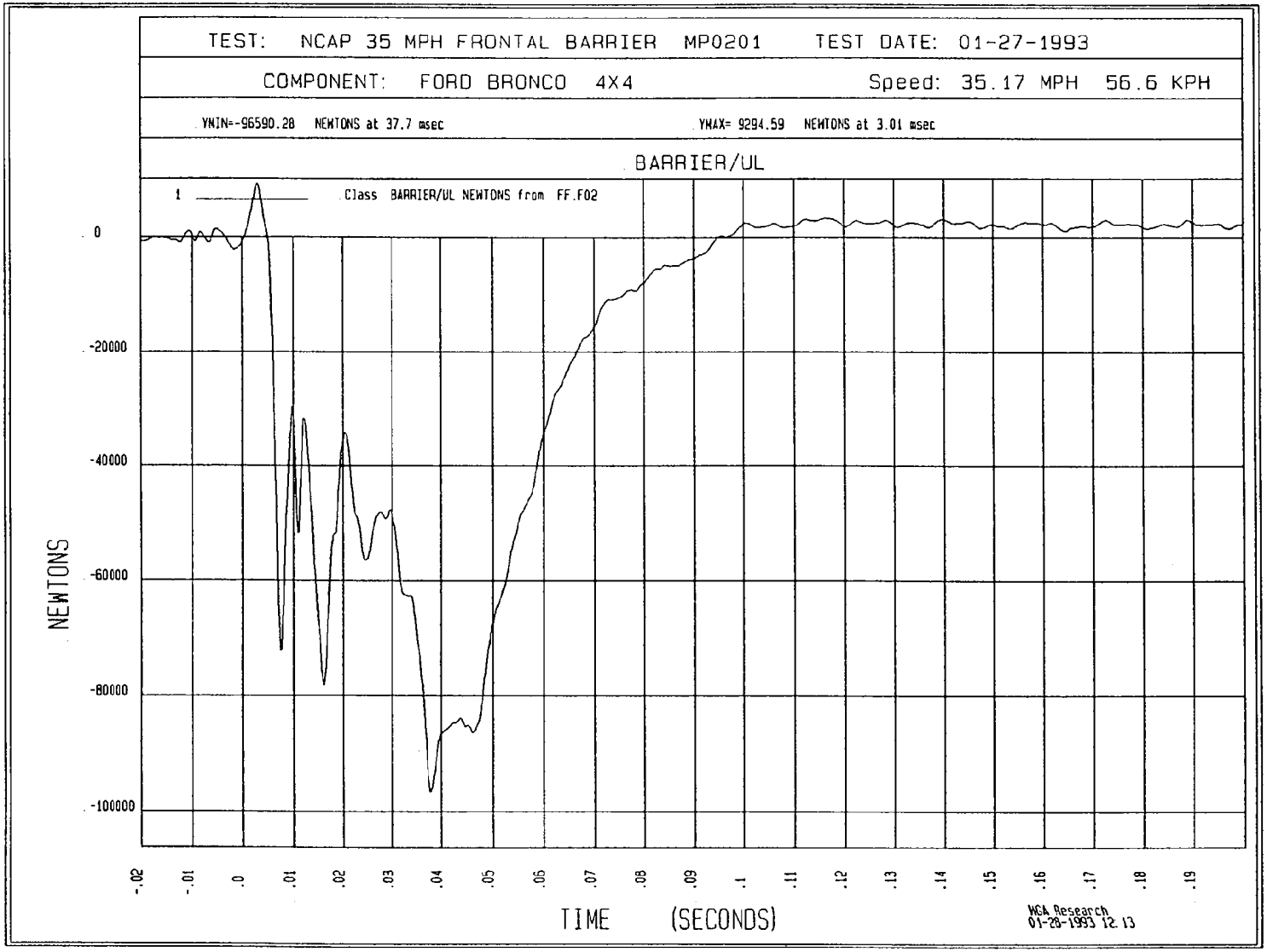


Figure B-29 - Sum of Load Cells A1-B3 Force vs. Time

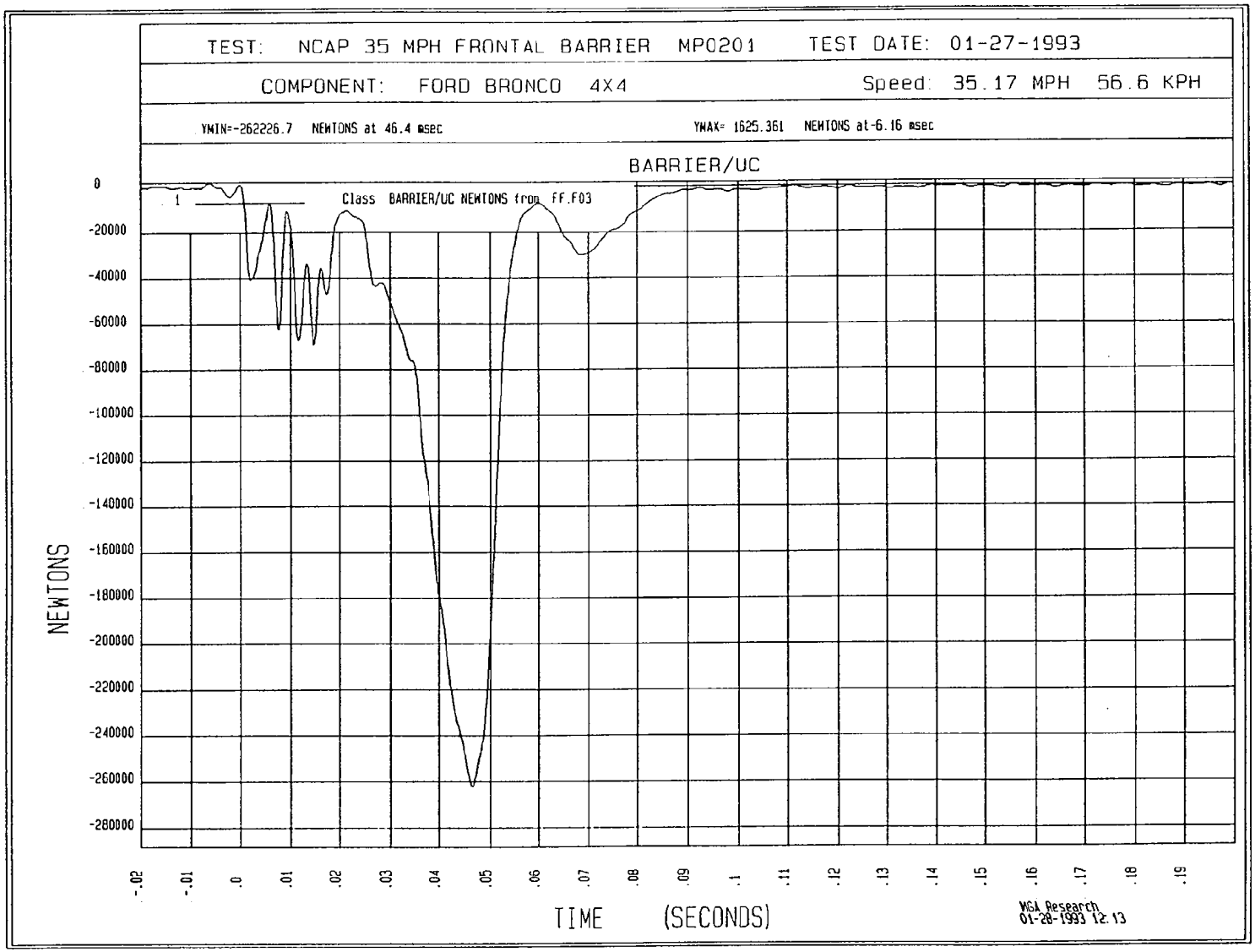


Figure B-30 - Sum of Load Cells A4-B6 Force vs. Time

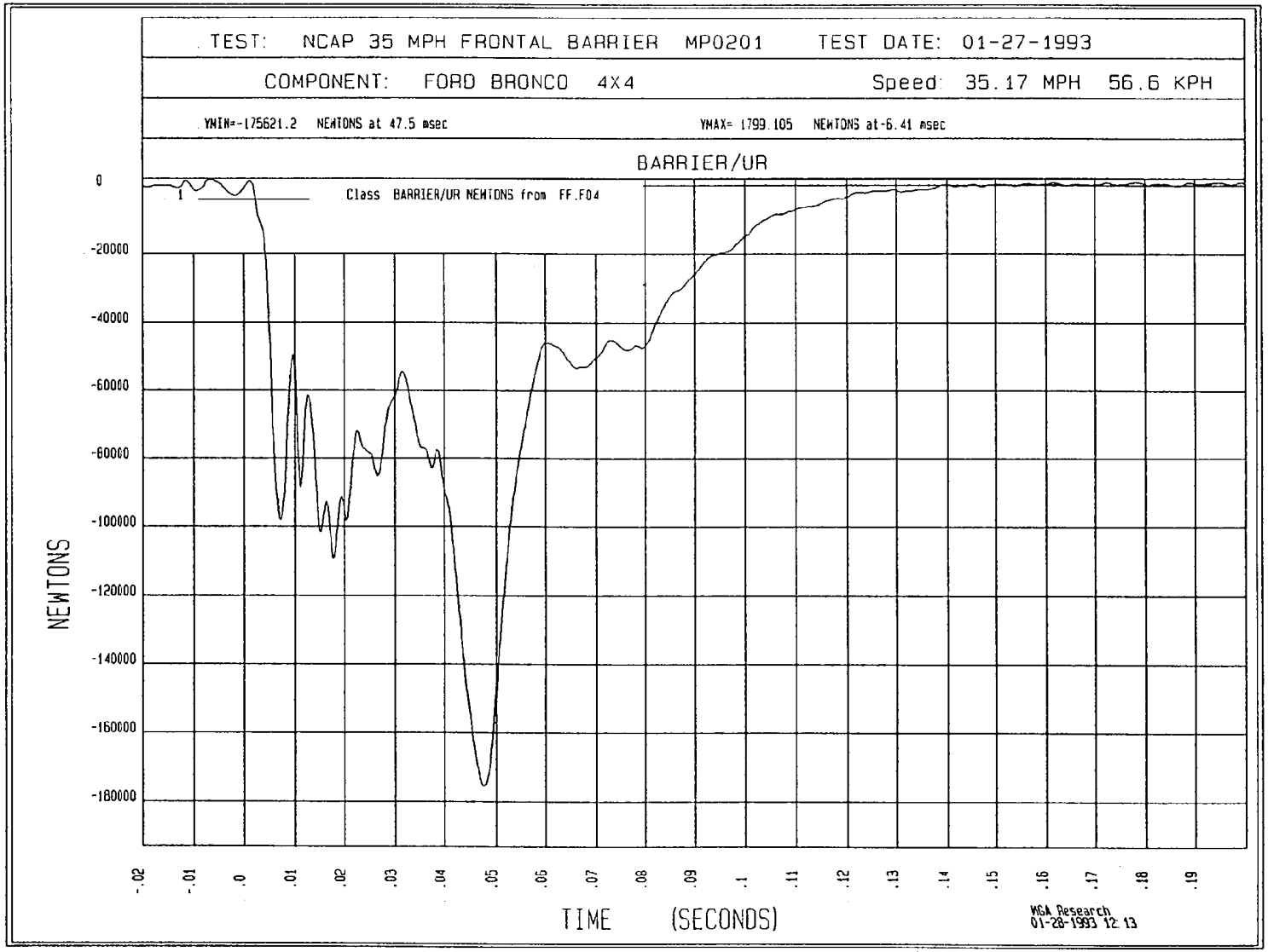


Figure B-31 - Sum of Load Cells A7-B9 Force vs. Time

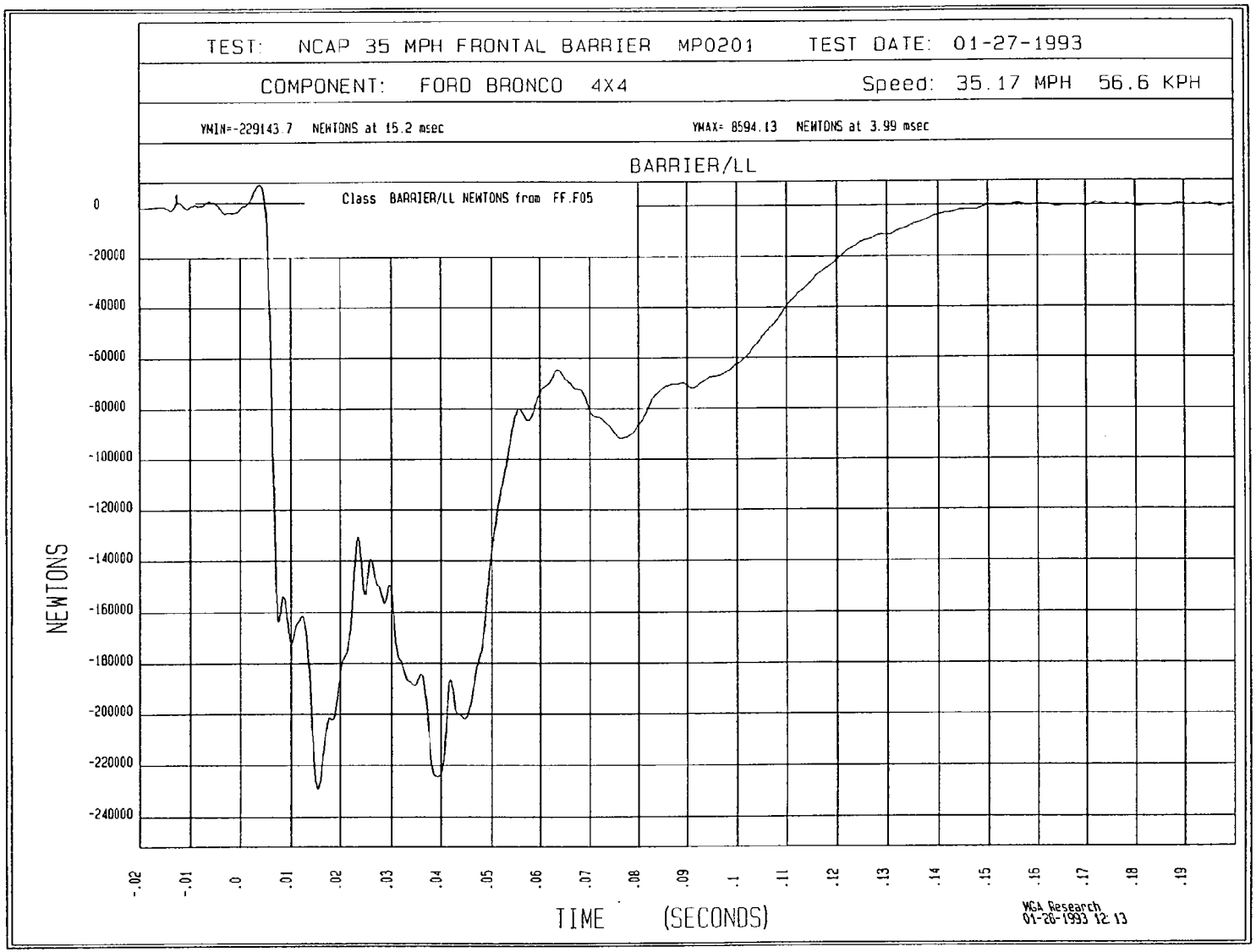


Figure B-32 - Sum of Load Cells C1-D3 Force vs. Time

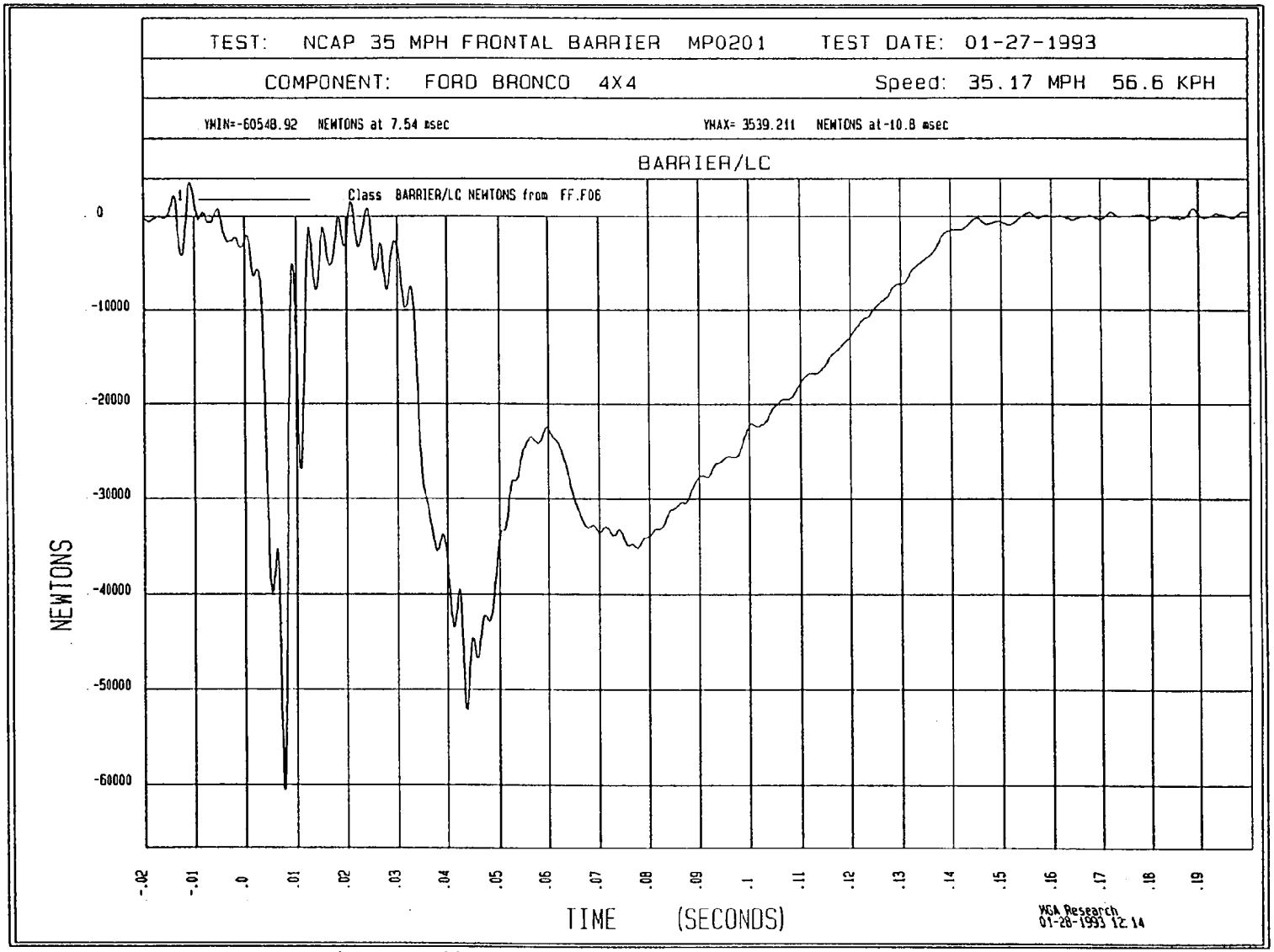


Figure B-33 - Sum of Load Cells C4-D6 Force vs. Time

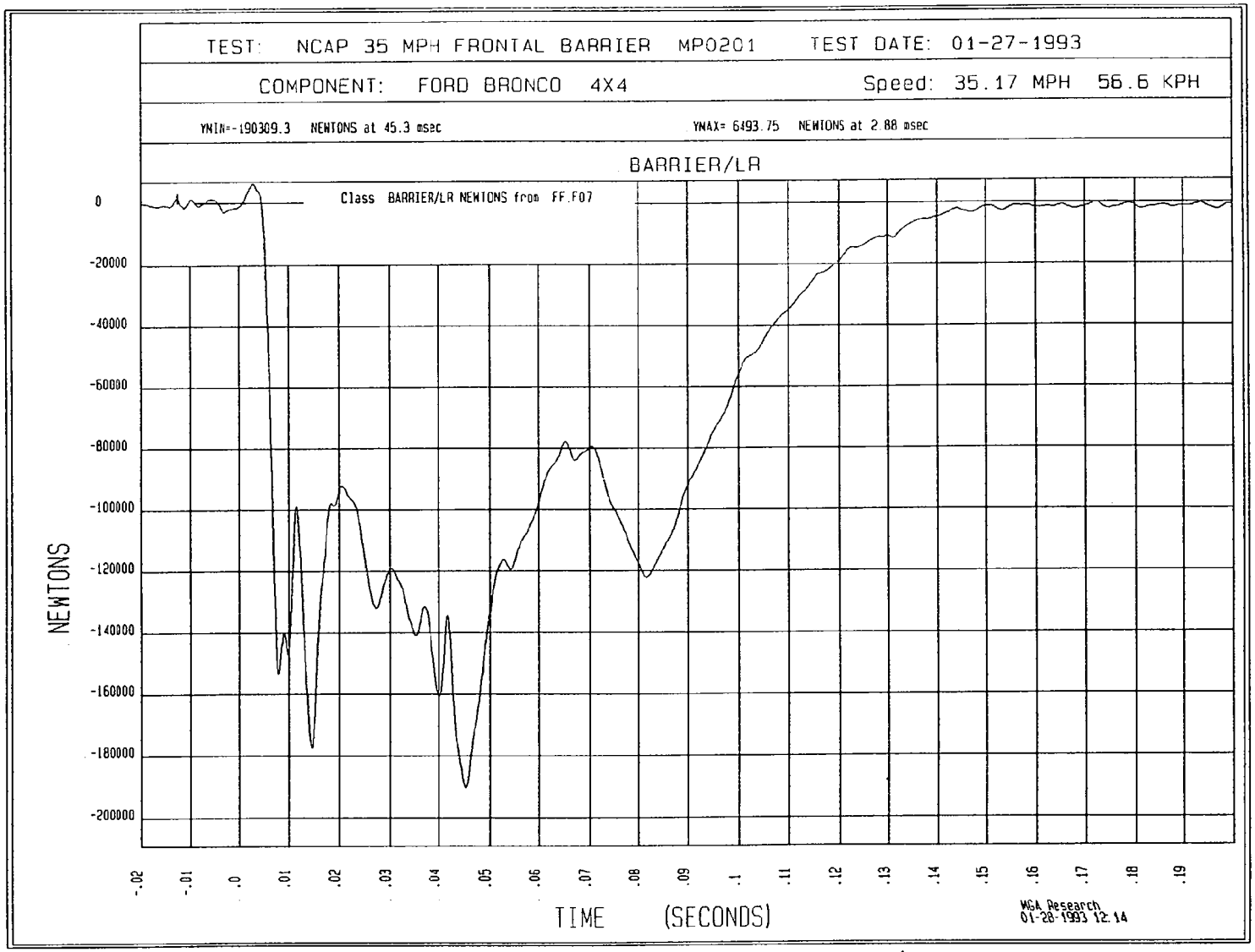


Figure B-34 - Sum of Load Cells C7-D9 Force vs. Time

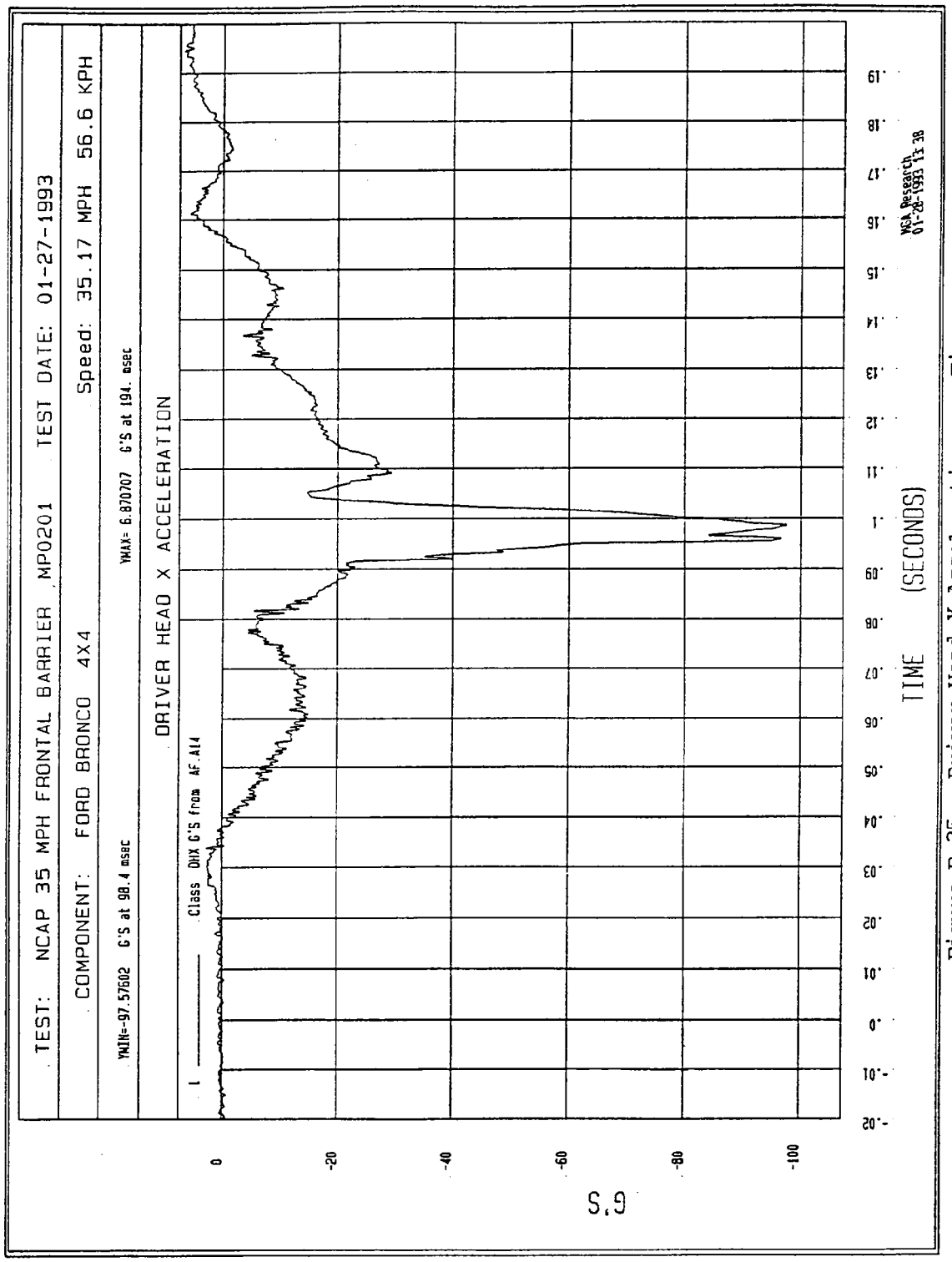


Figure B-35 - Driver Head X Acceleration vs. Time

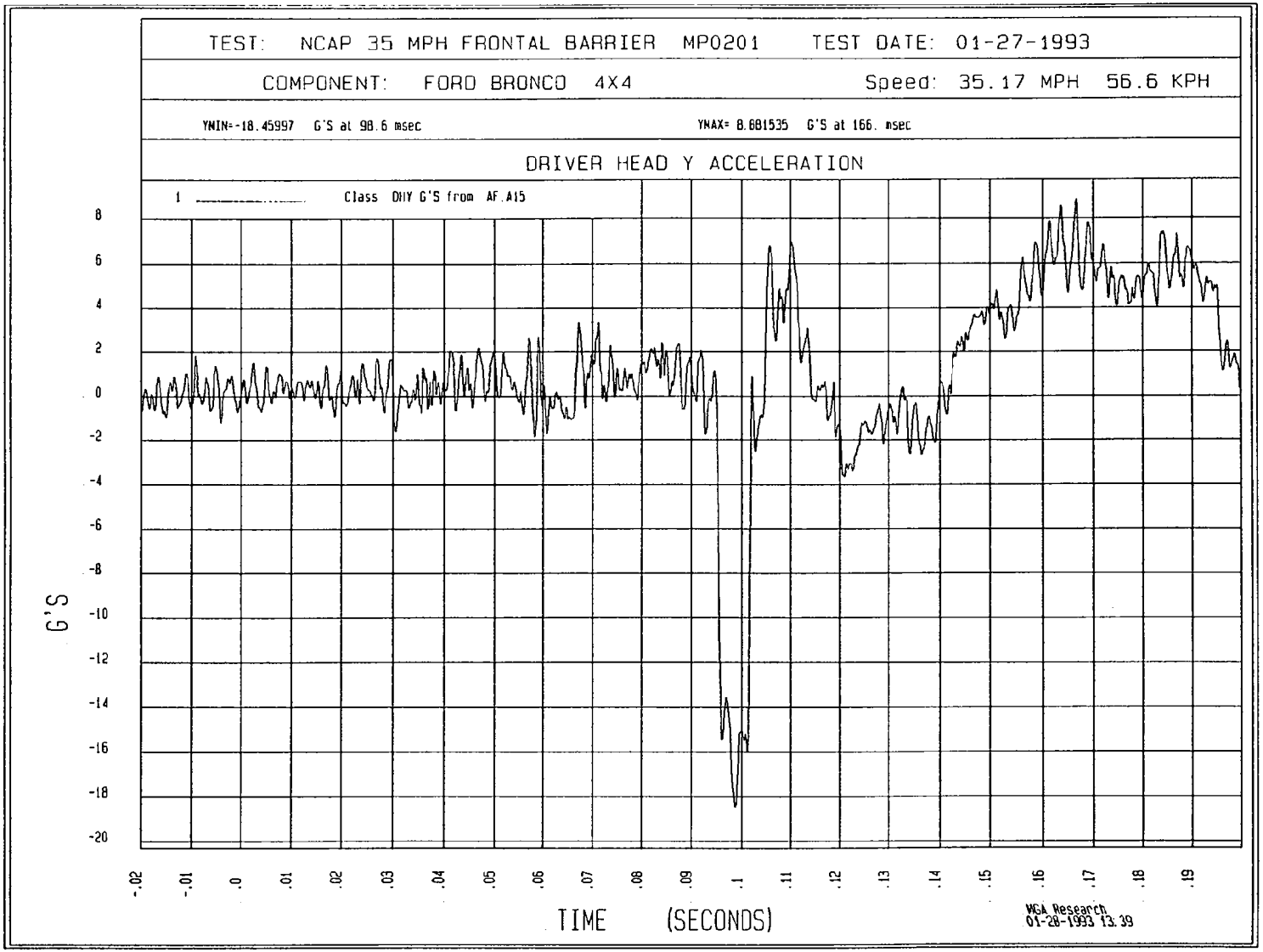


Figure B-36 - Driver Head Y Acceleration vs. Time

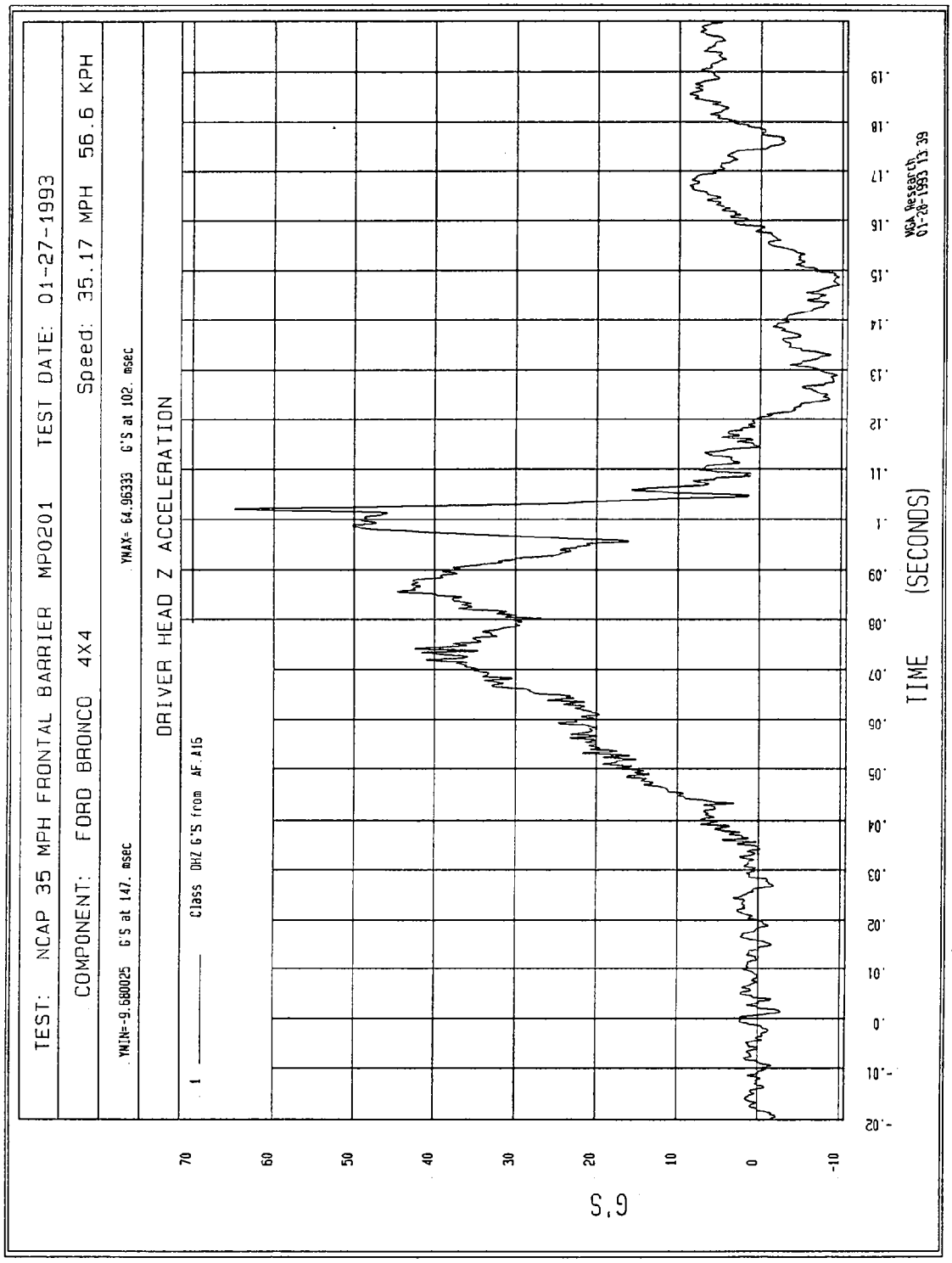


Figure B-37 - Driver Head Z Acceleration vs. Time

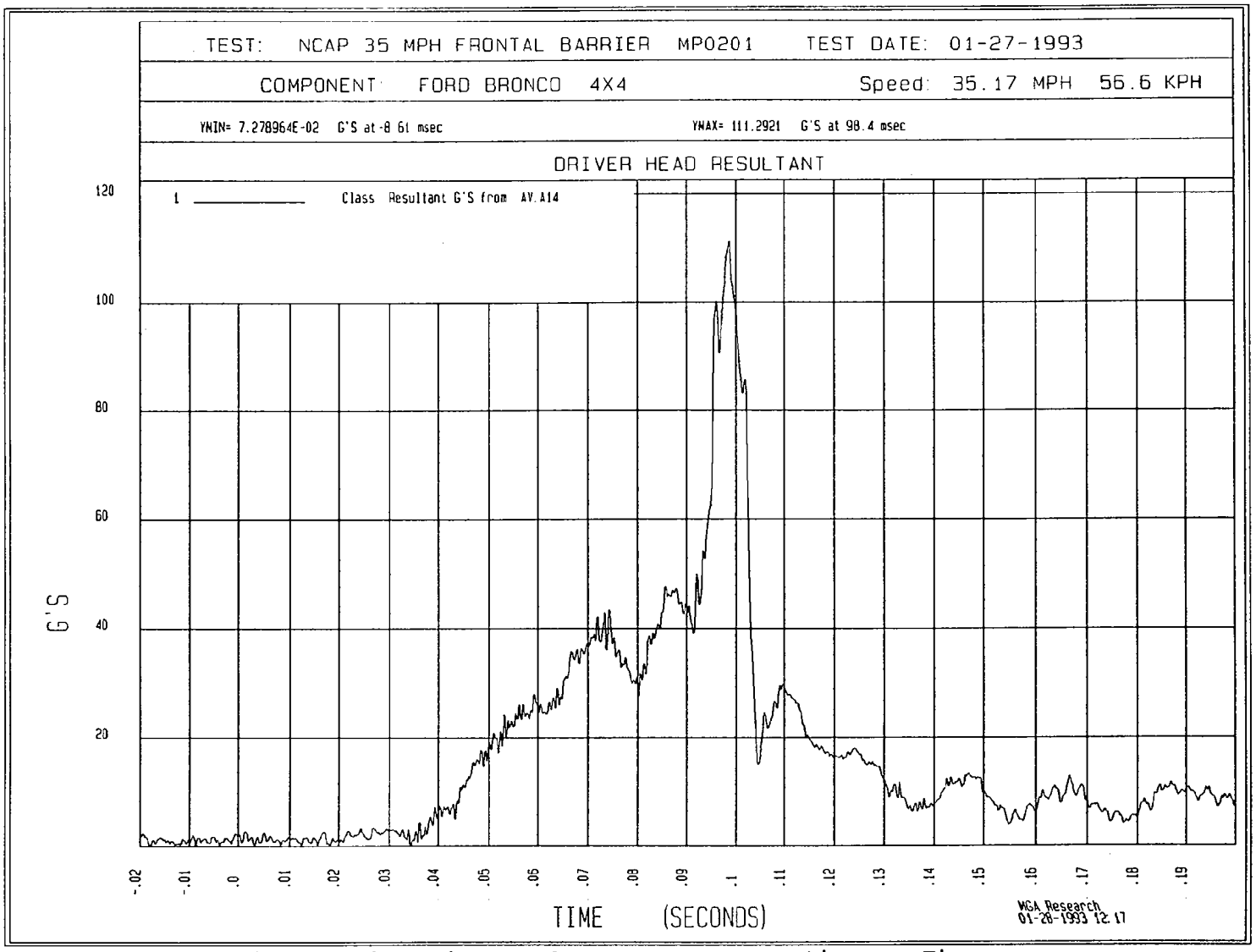


Figure B-38 - Driver Head Resultant Acceleration vs. Time

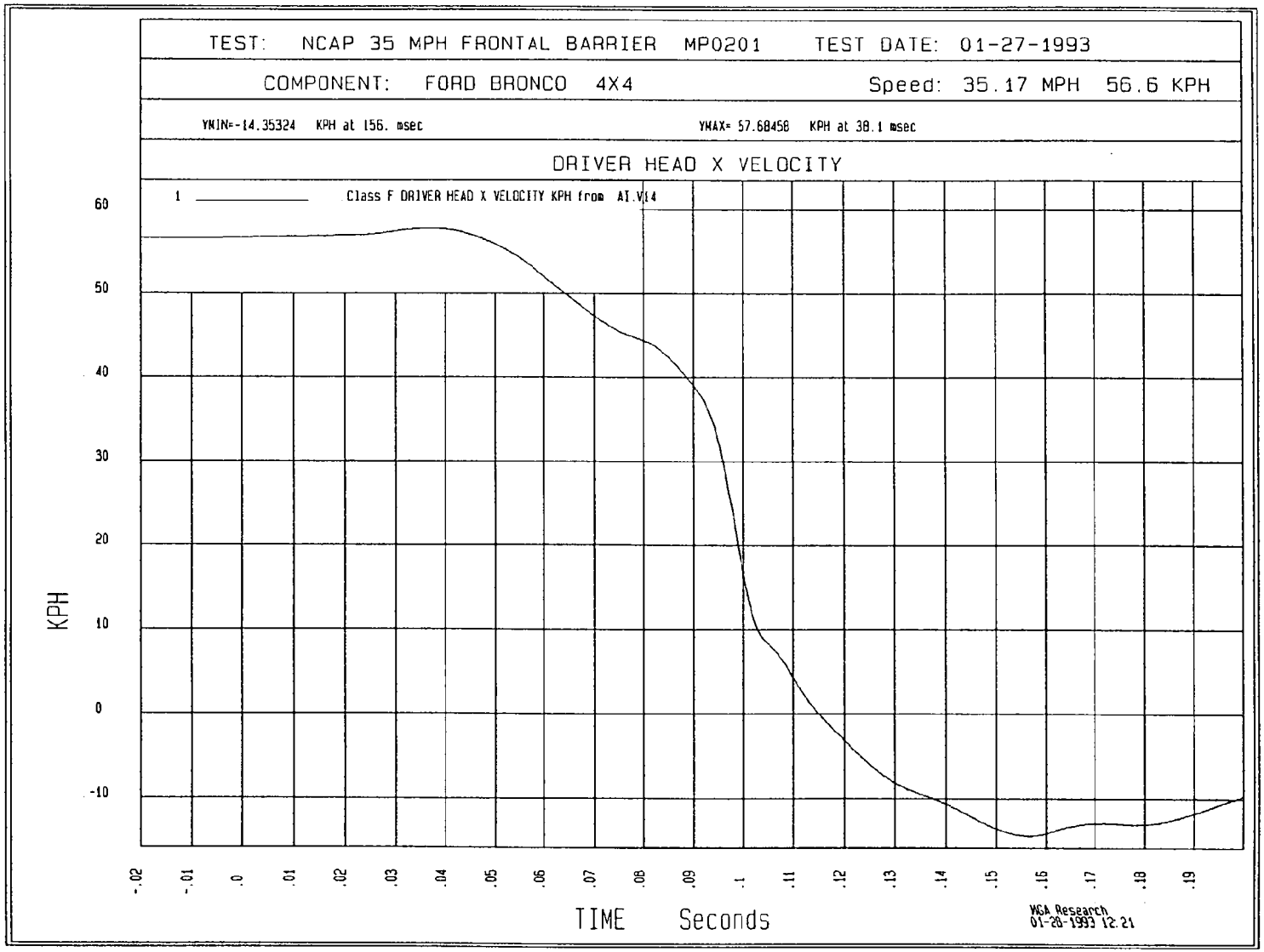


Figure B-39 - Driver Head X Velocity vs. Time

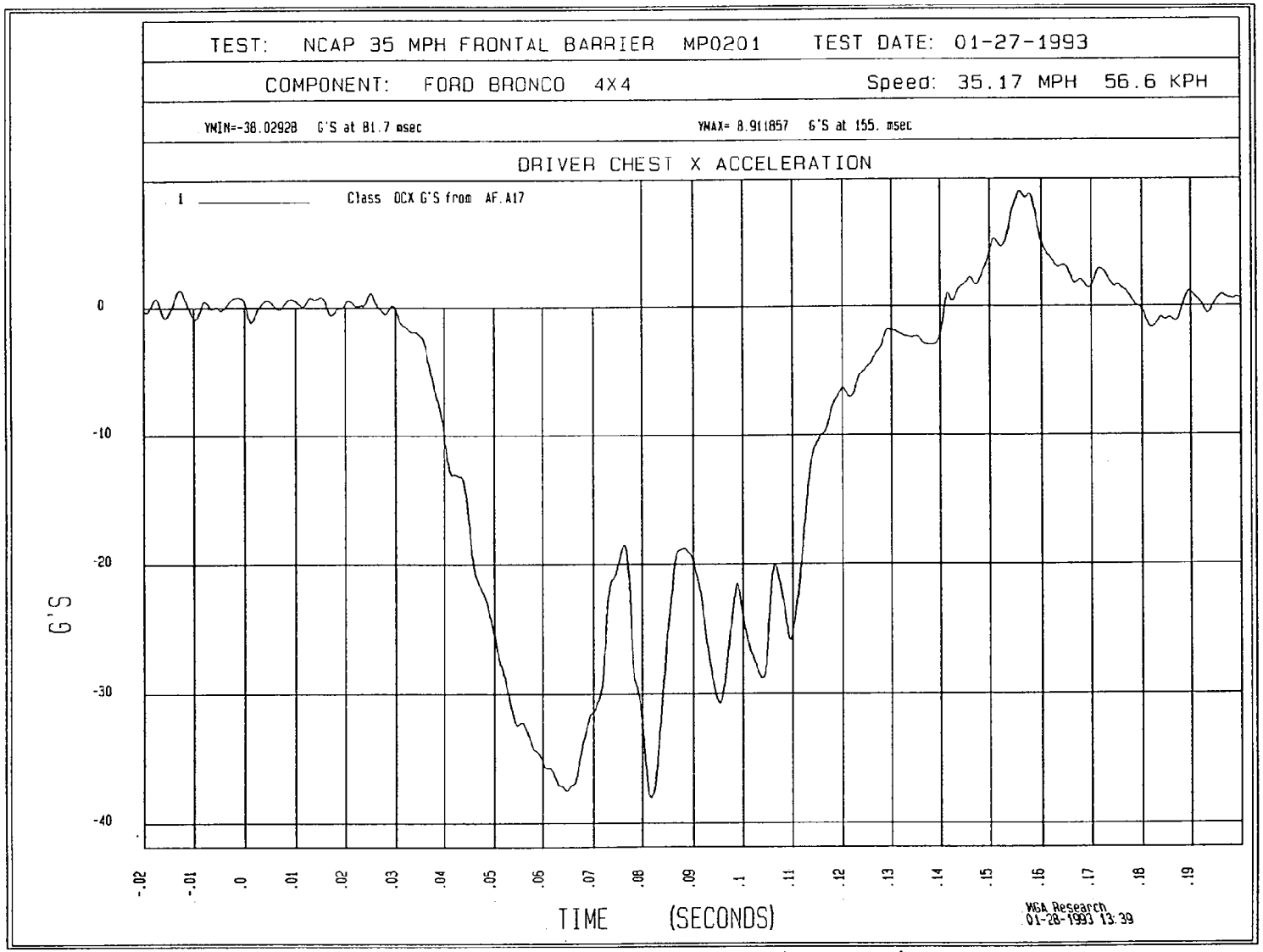


Figure B-40 - Driver Chest X Acceleration vs. Time

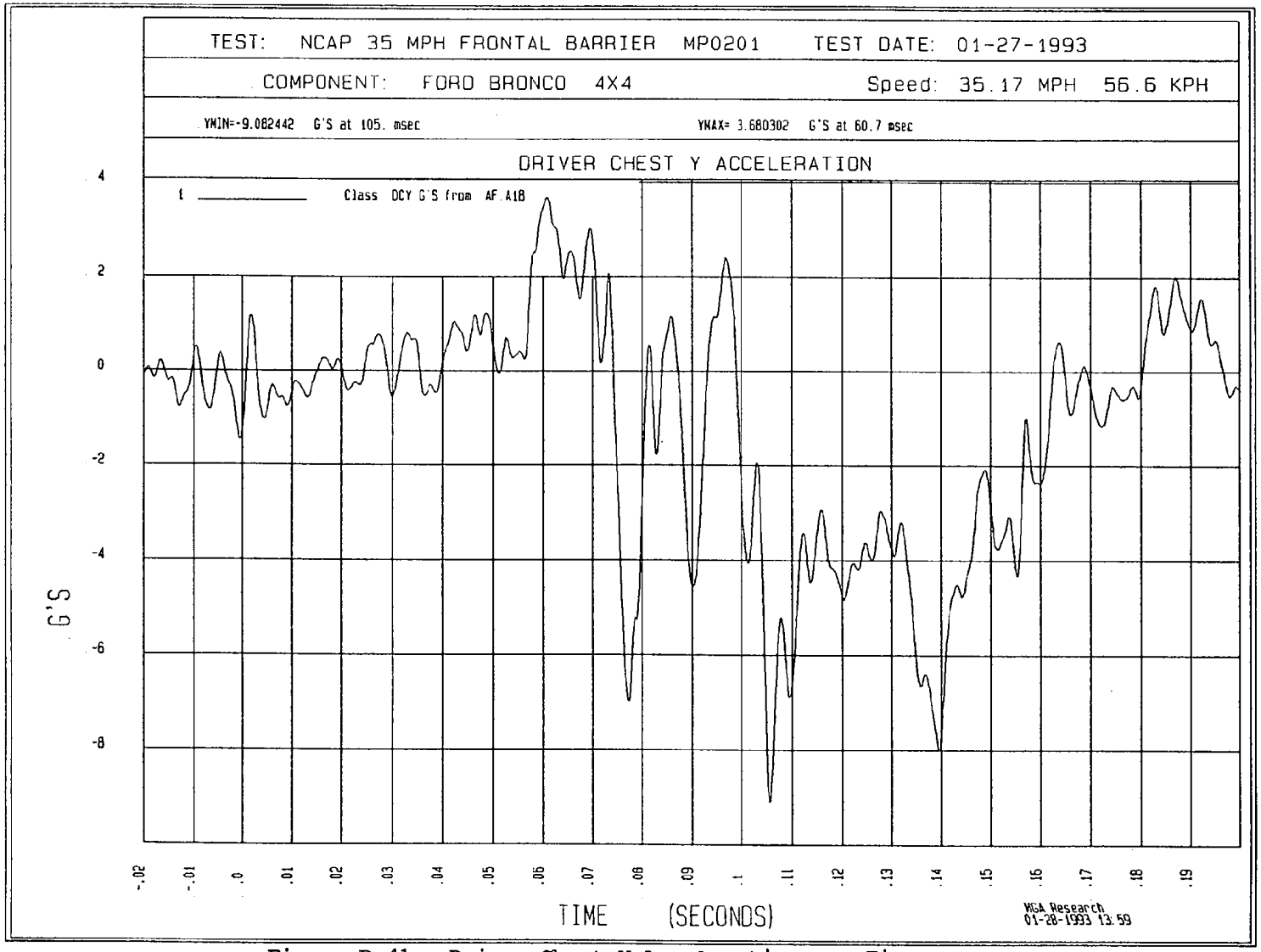


Figure B-41 - Driver Chest Y Acceleration vs. Time

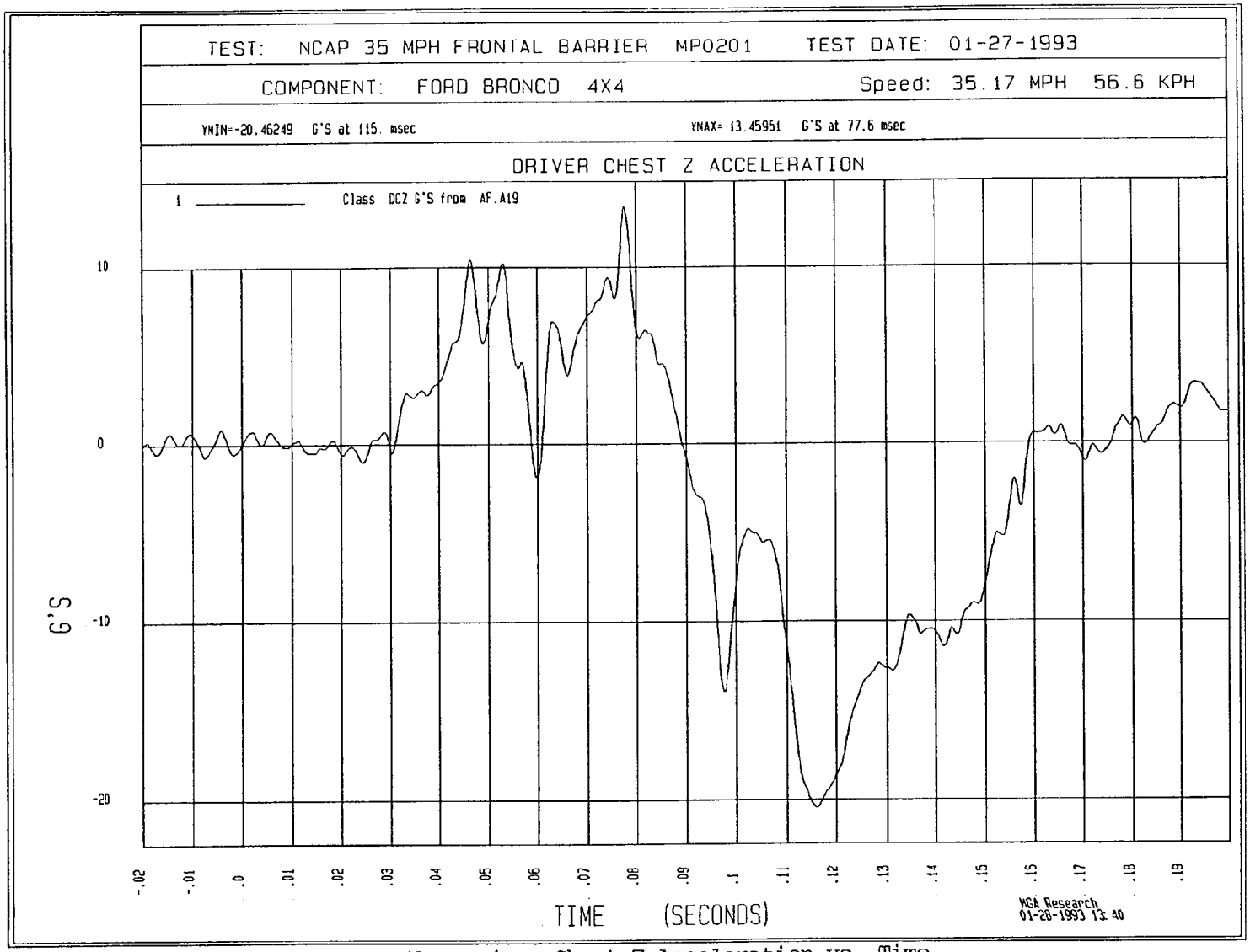


Figure B-42 - Driver Chest Z Acceleration vs. Time

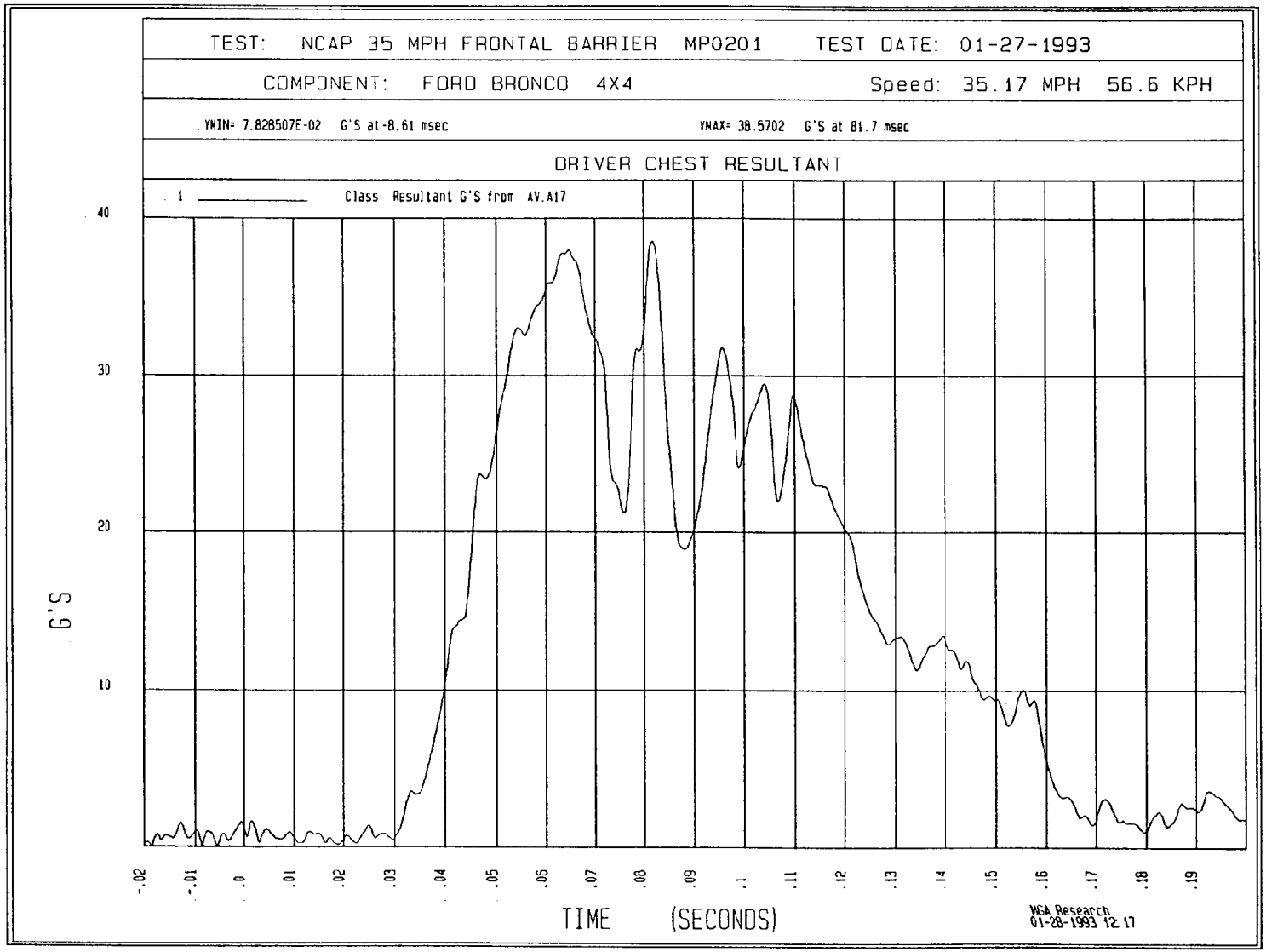


Figure B-43 - Driver Chest Resultant Acceleration vs. Time

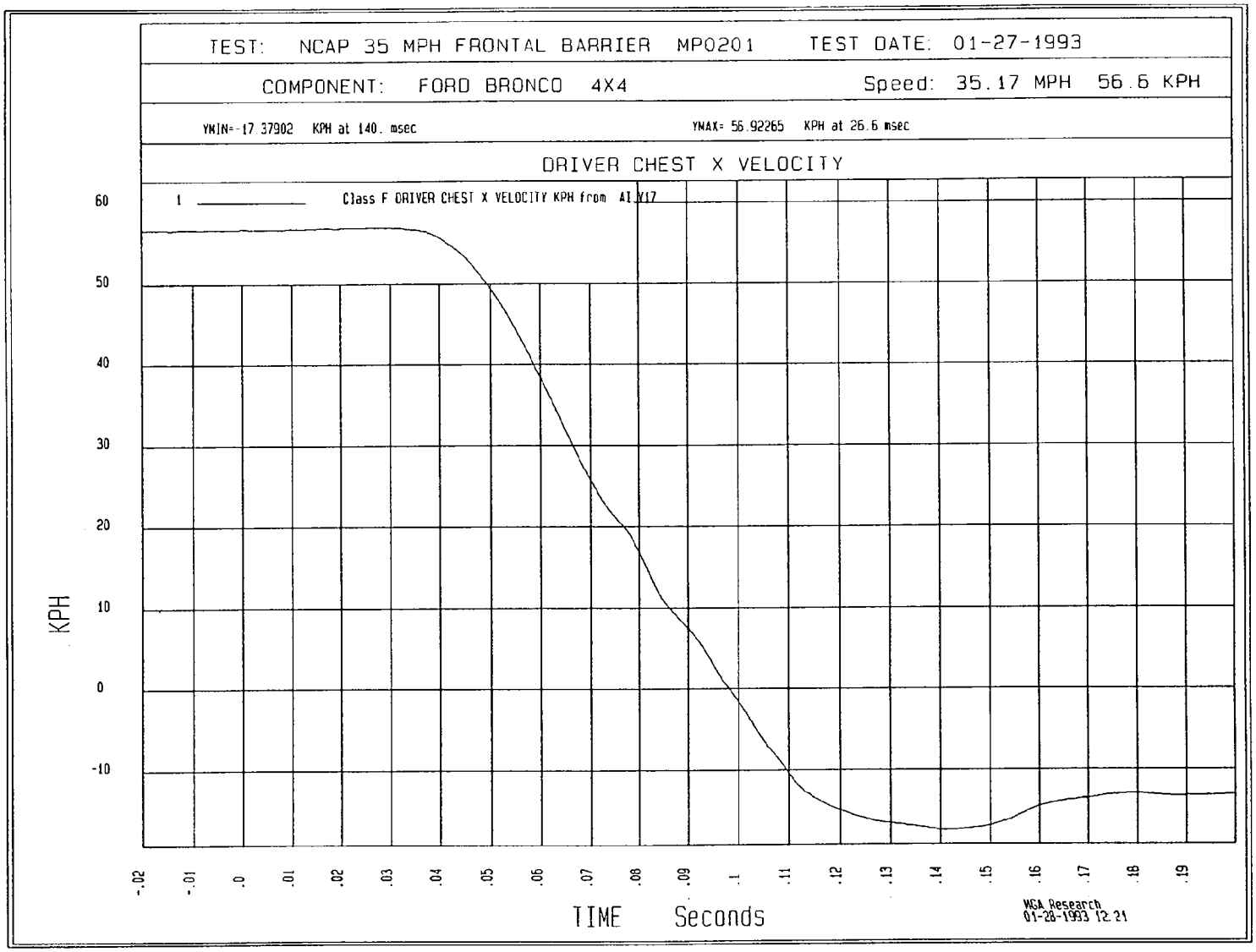


Figure B-44 - Driver Chest X Velocity vs. Time

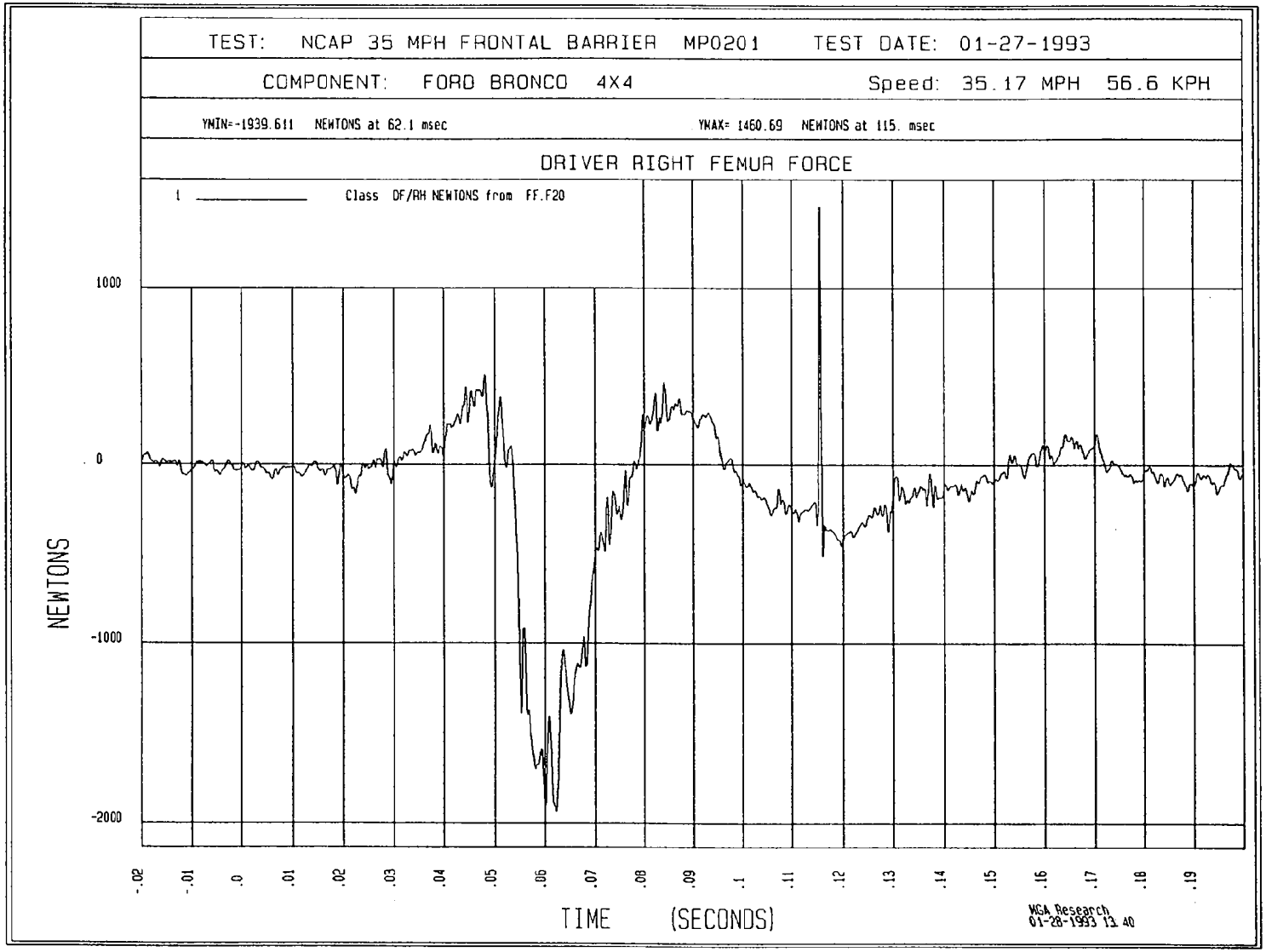


Figure B-45 - Driver Right Femur Force vs. Time

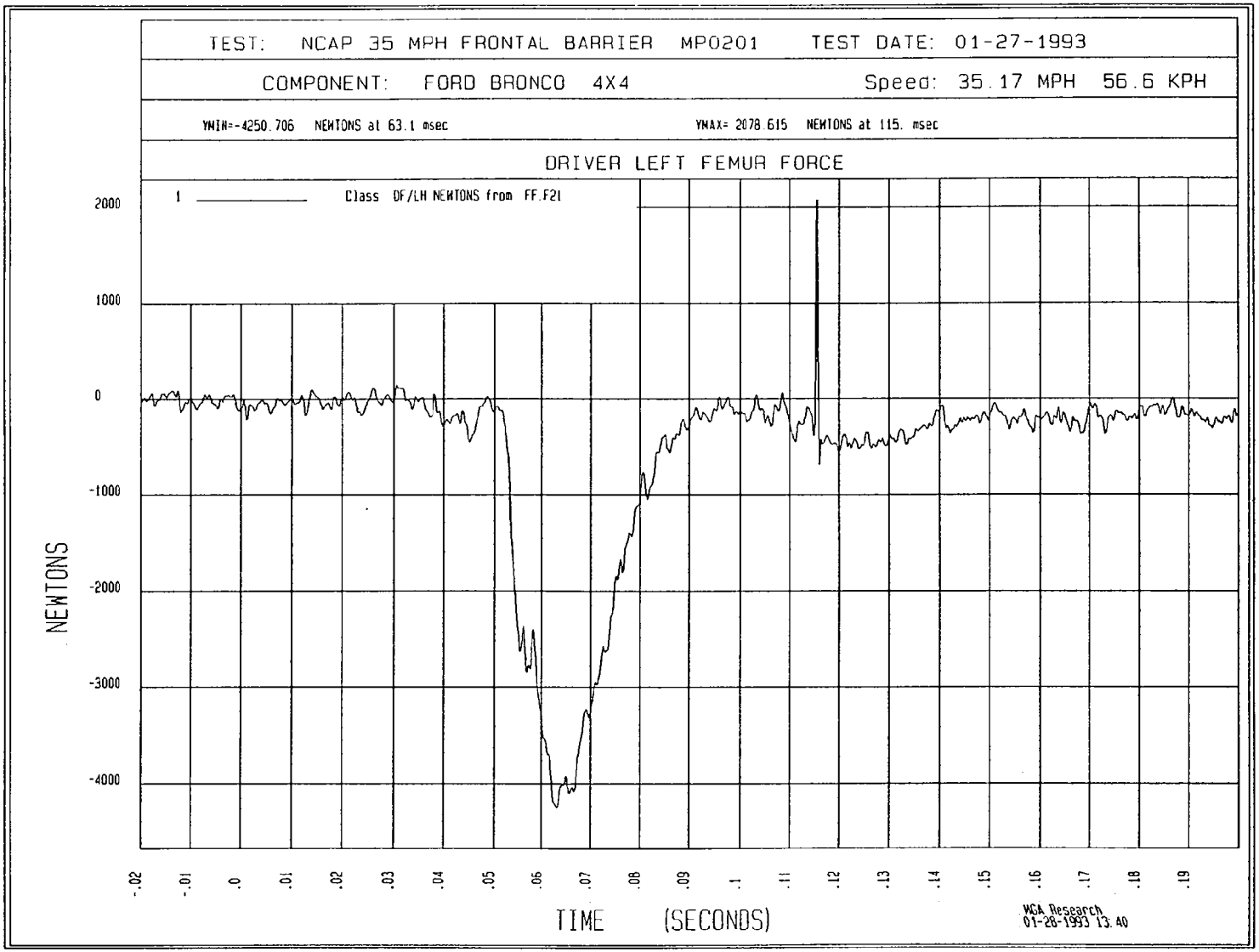


Figure B-46 - Driver Left Femur Force vs. Time

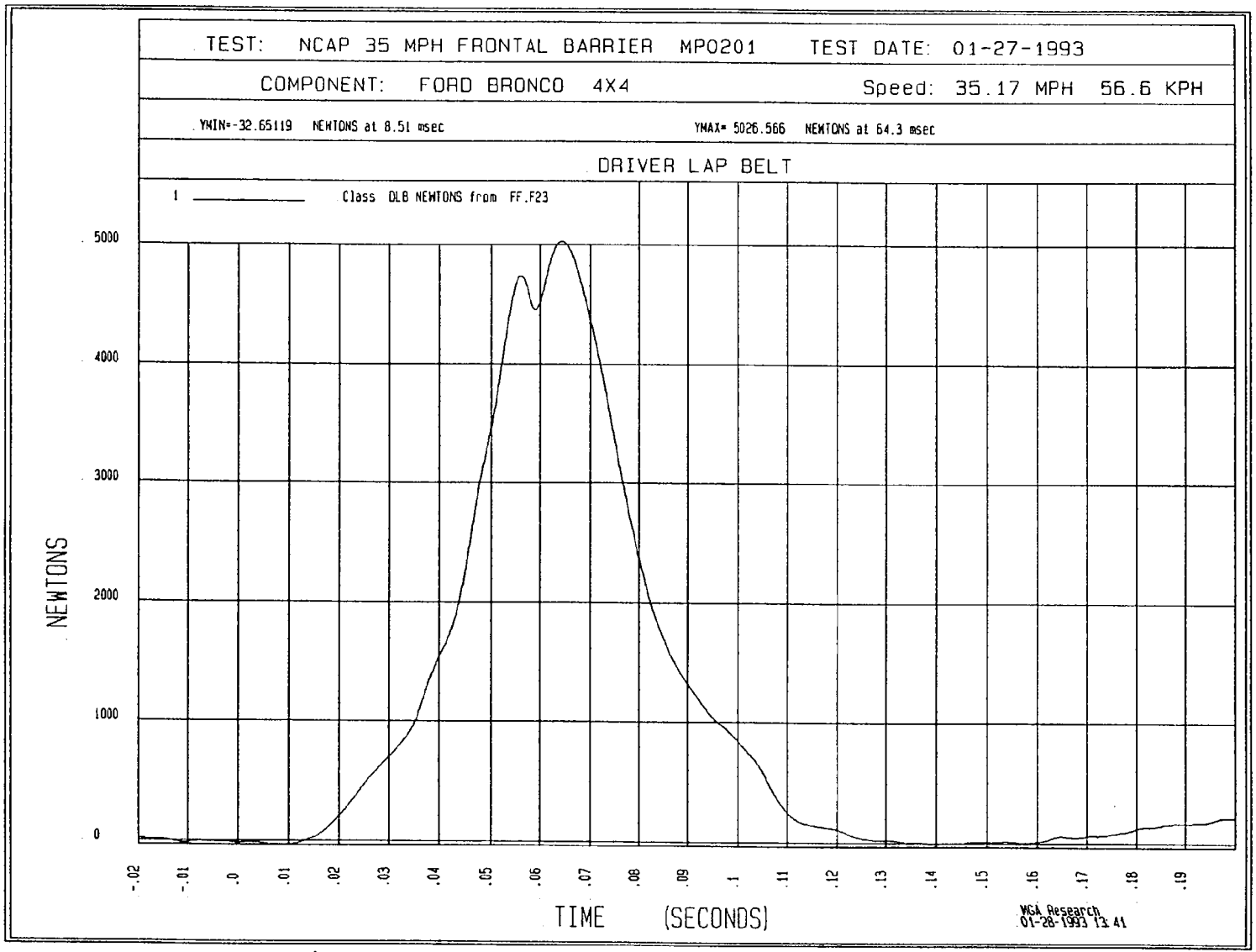


Figure B-47 - Driver Lap Belt Force vs. Time

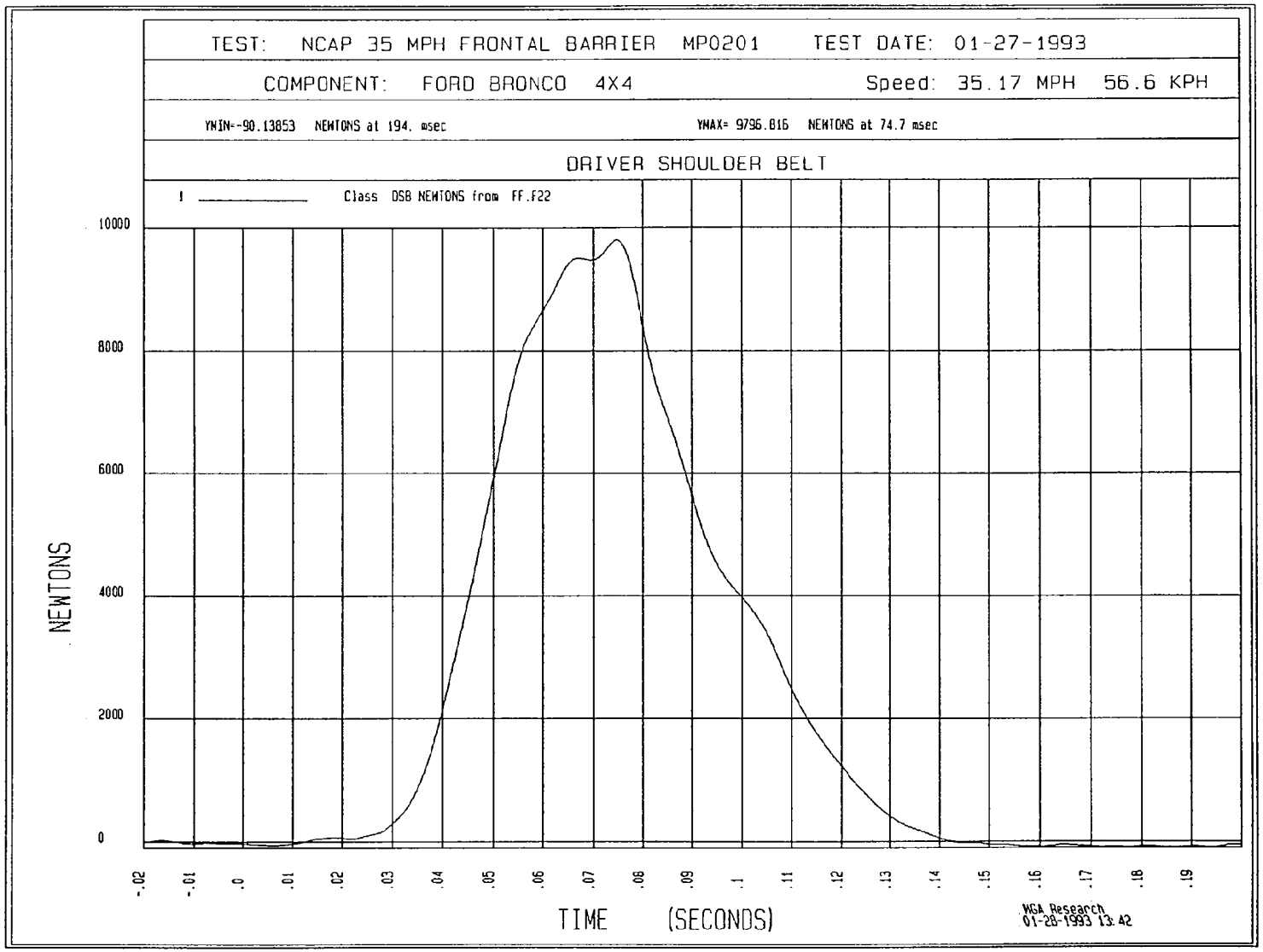


Figure B-48 - Driver Torso Belt Force vs. Time

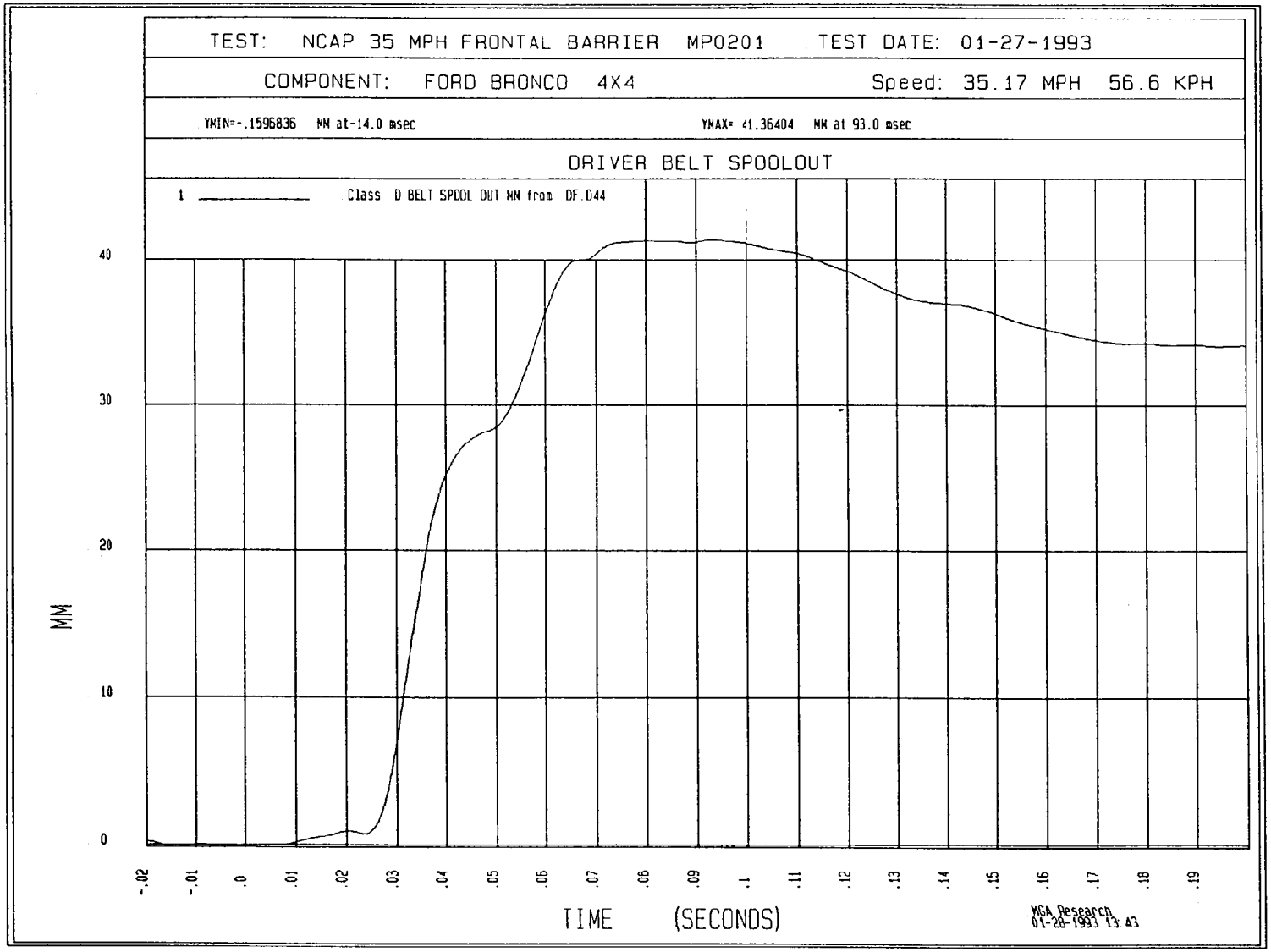


Figure B-49 - Driver Belt Spool-Out vs. Time

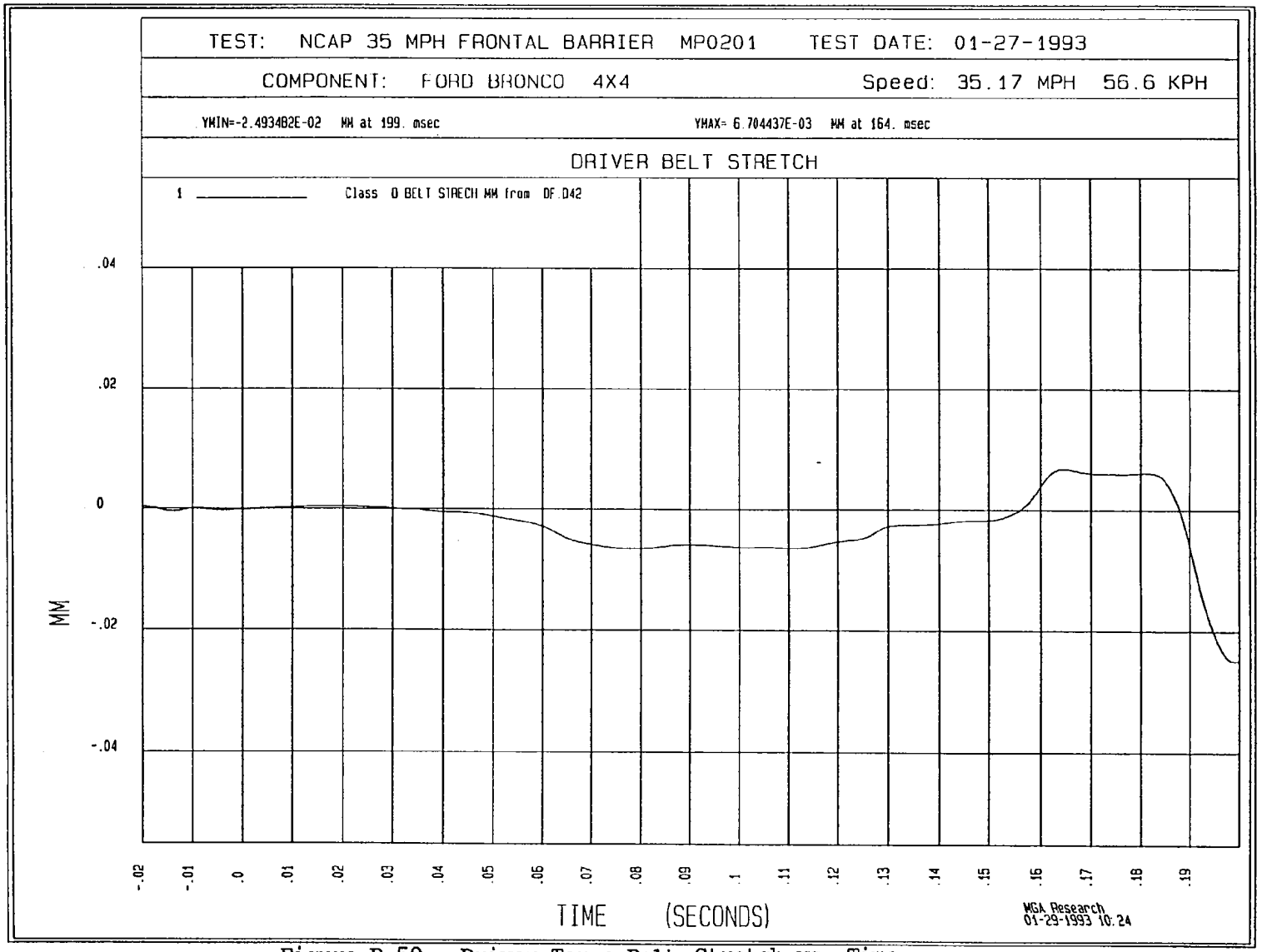


Figure B-50 - Driver Torso Belt Stretch vs. Time

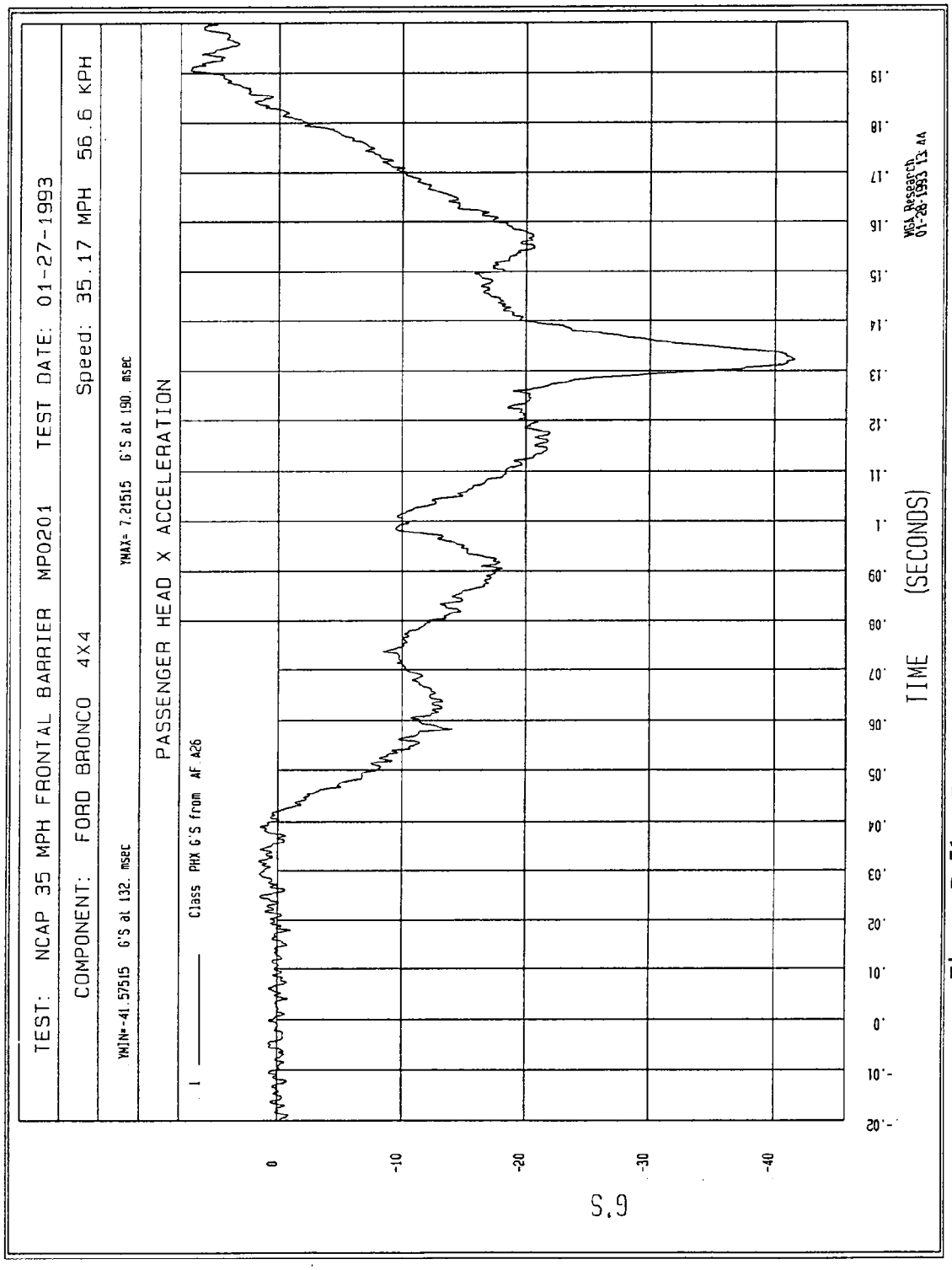


Figure B-51 - Passenger Head X Acceleration vs. Time

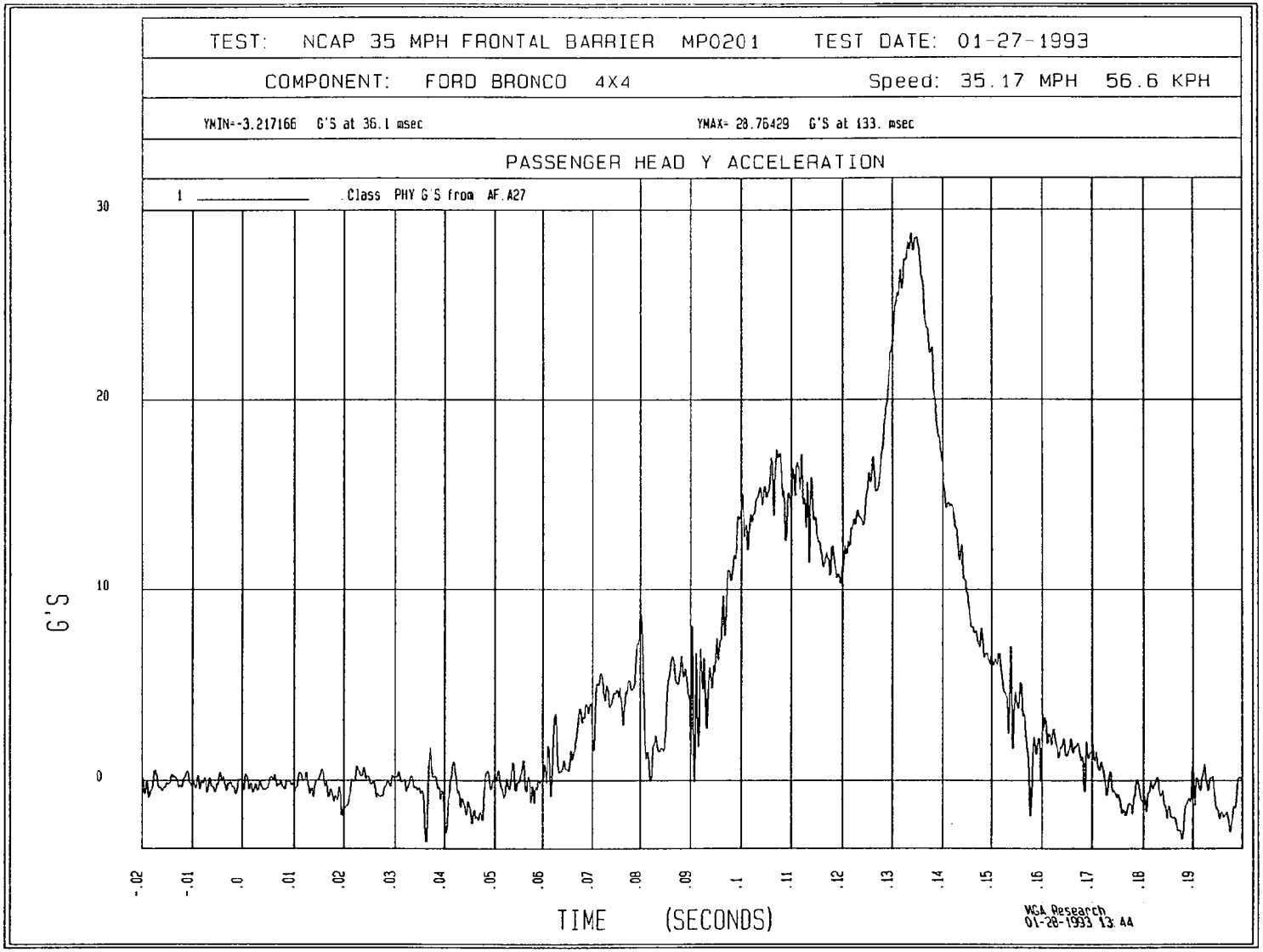


Figure B-52 - Passenger Head Y Acceleration vs. Time

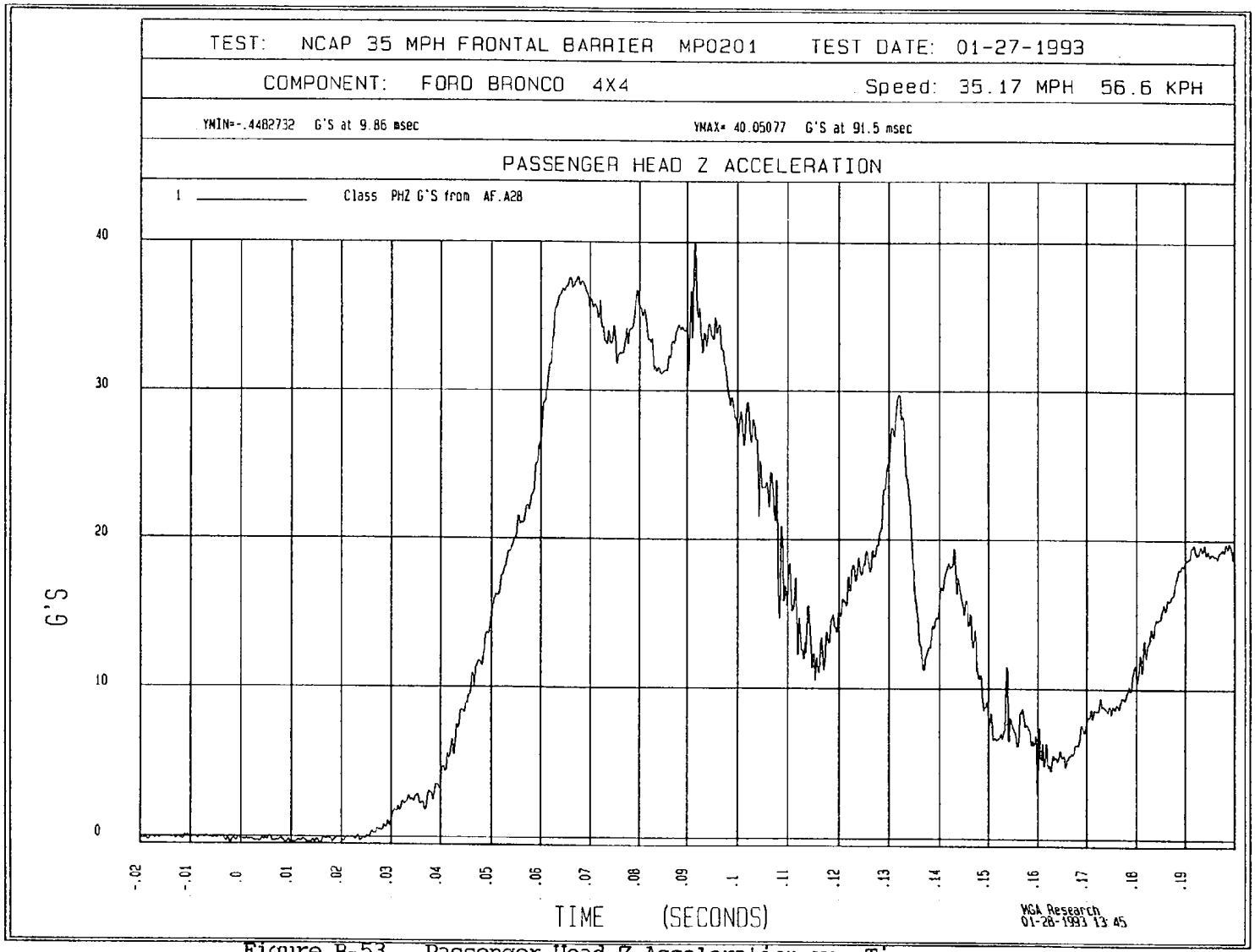


Figure B-53 - Passenger Head Z Acceleration vs. Time

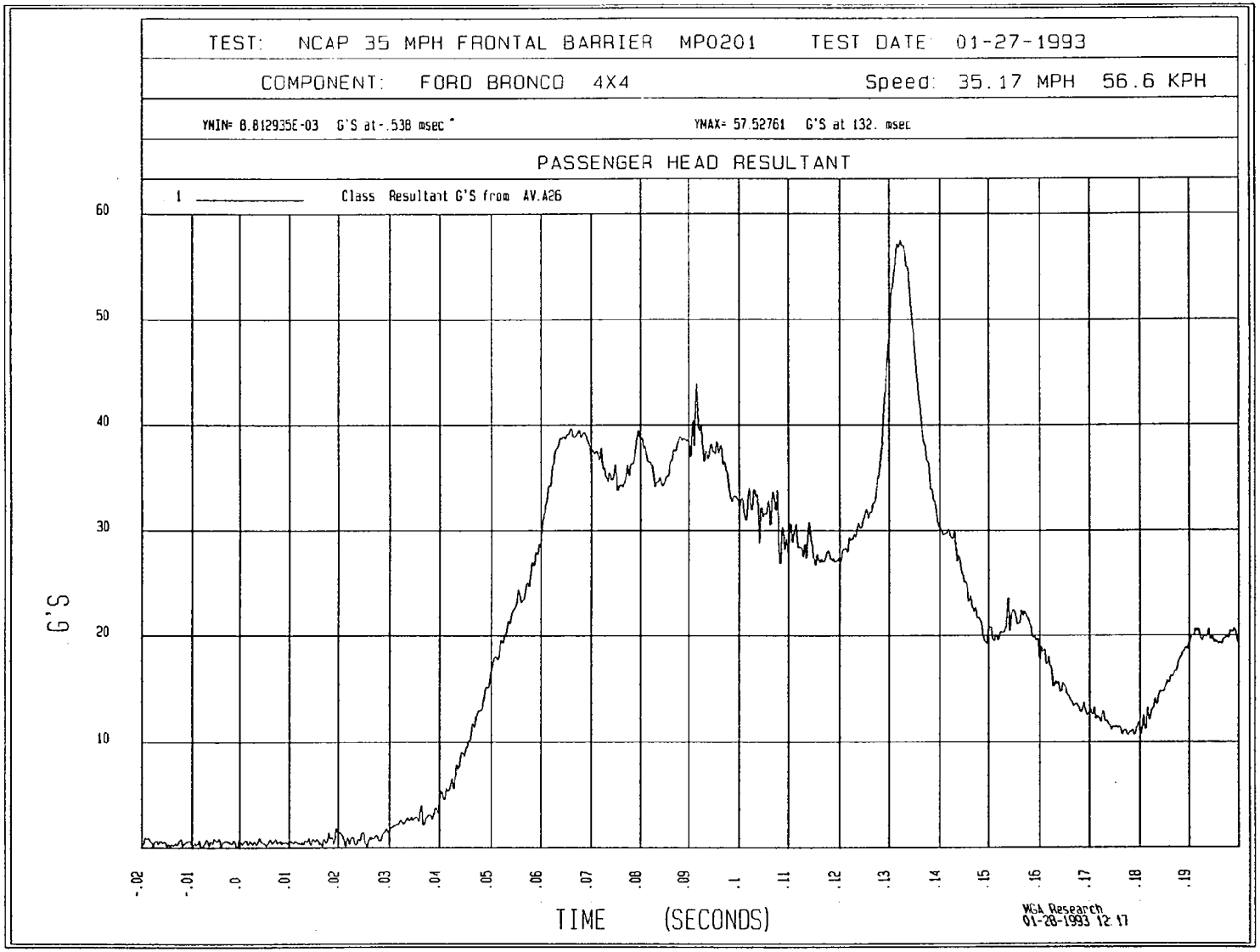


Figure B-54 - Passenger Head Resultant Acceleration vs. Time

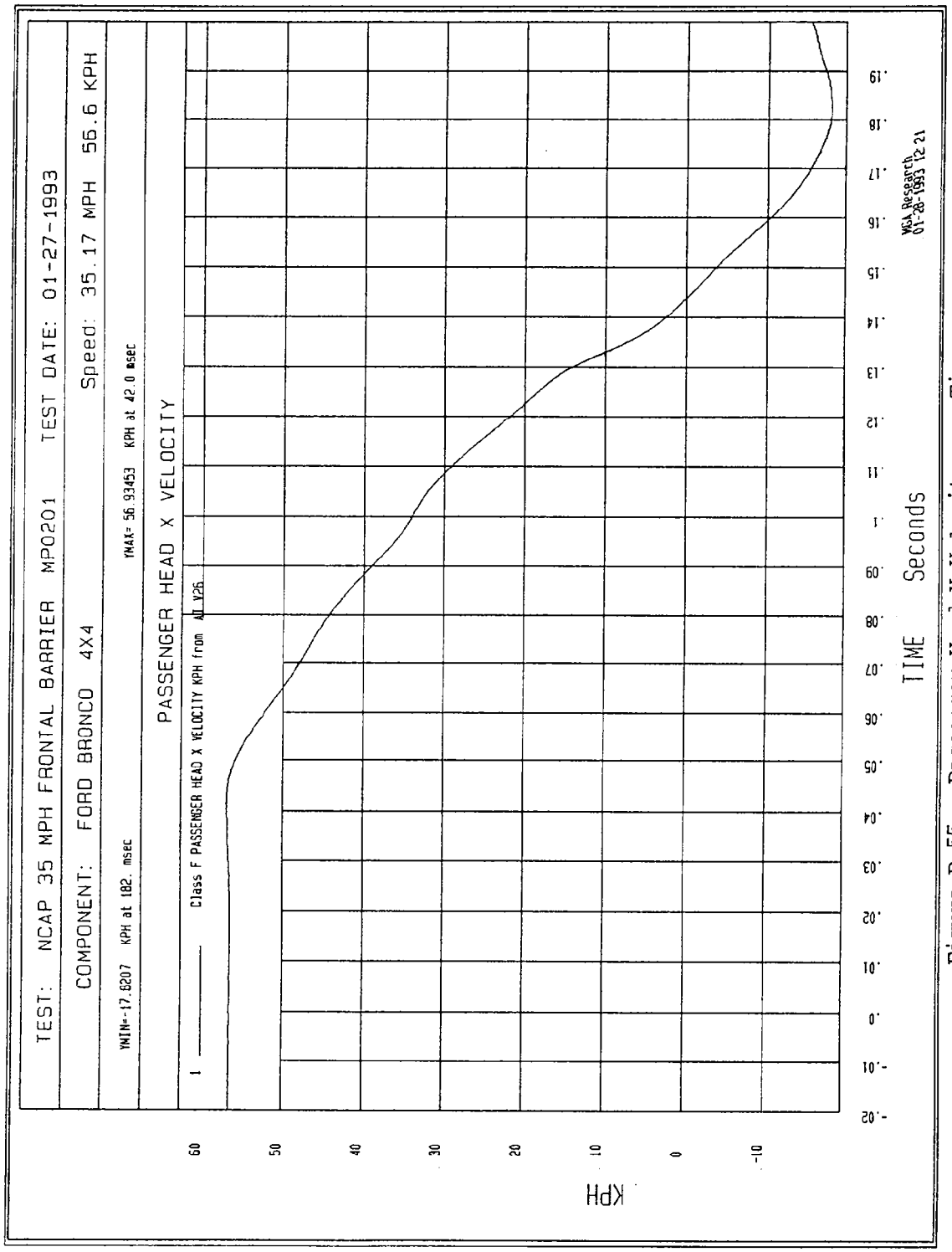


Figure B-55 - Passenger Head X Velocity vs. Time

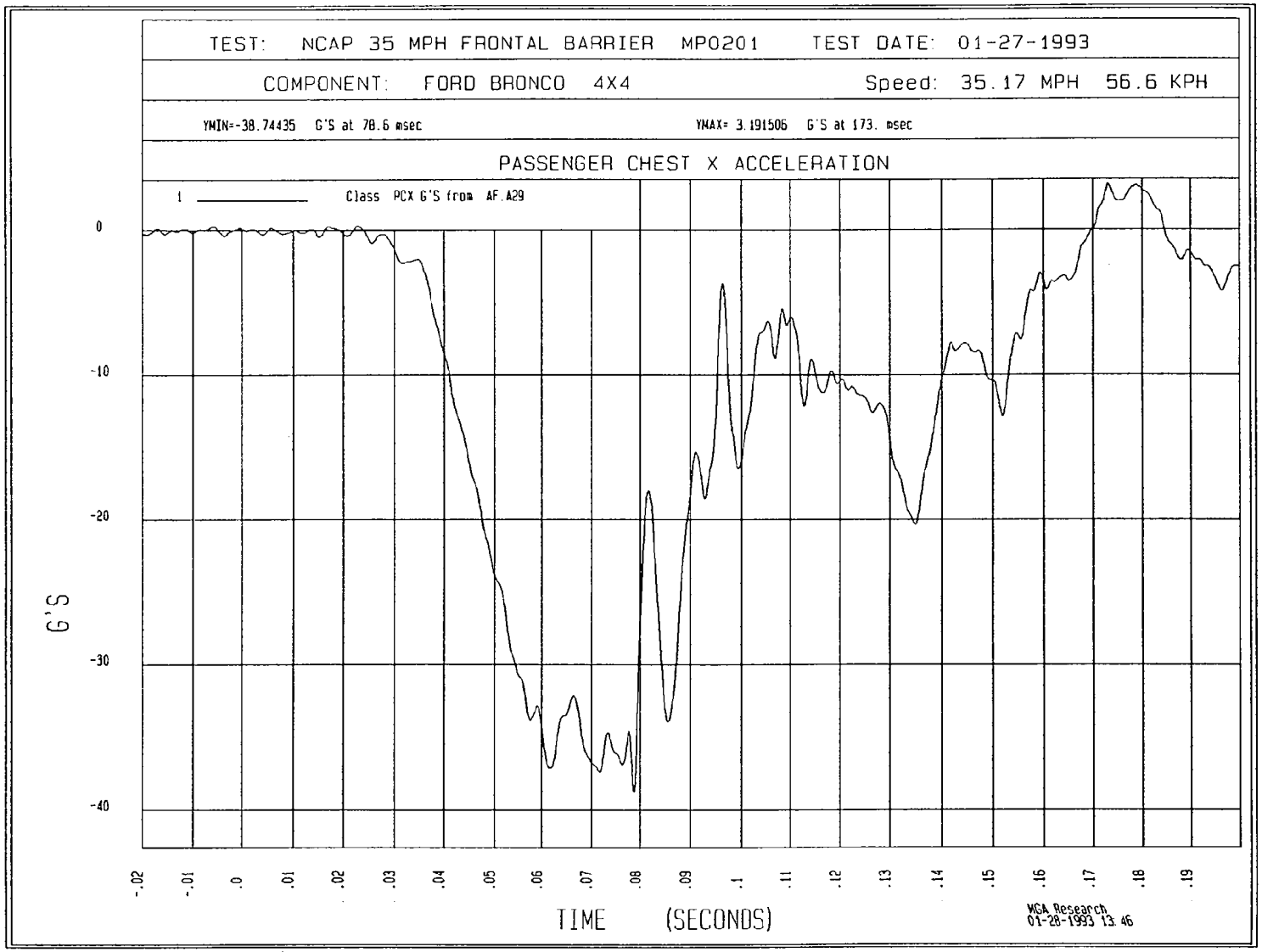


Figure B-56 - Passenger Chest X Acceleration vs. Time

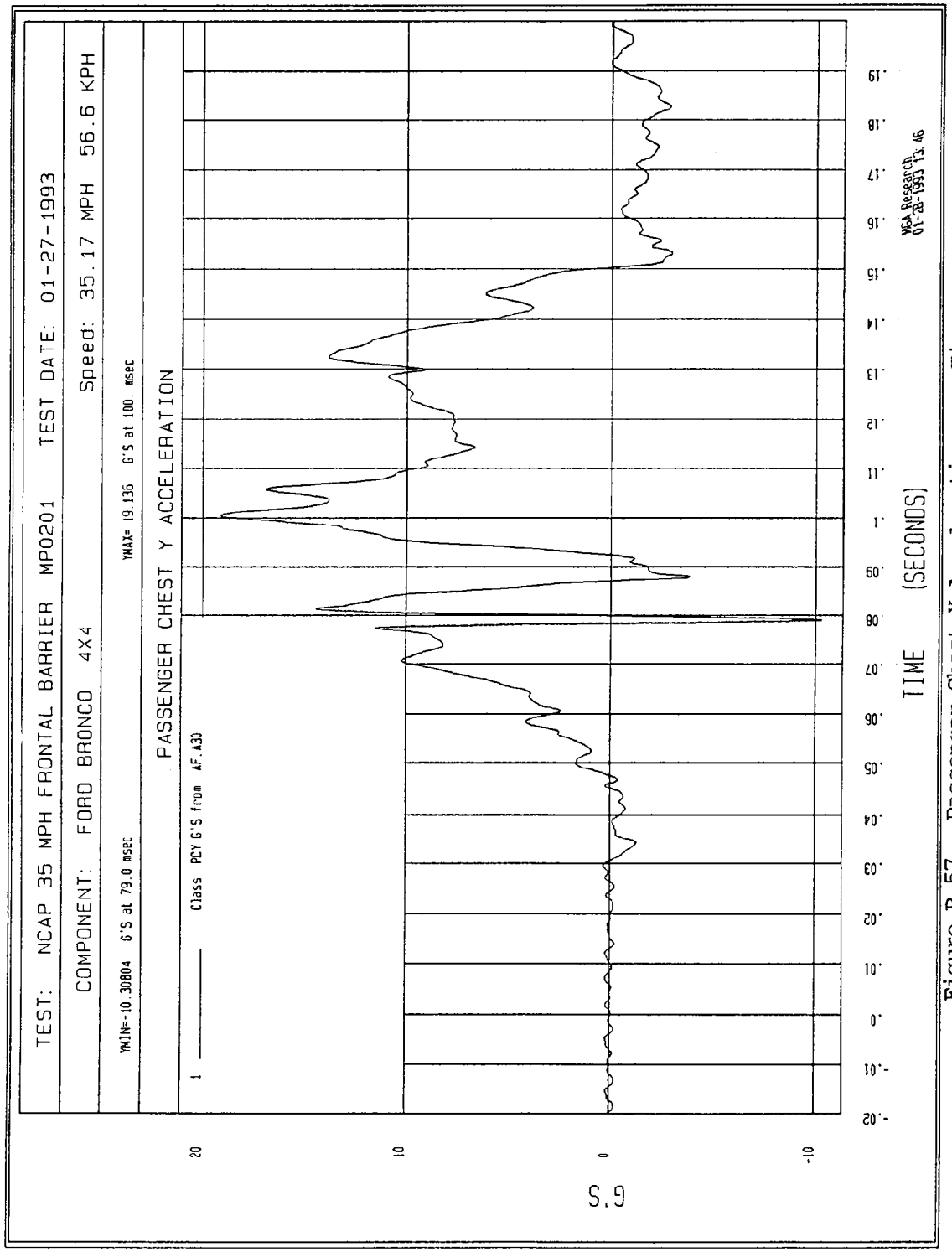


Figure B-57 - Passenger Chest Y Acceleration vs. Time

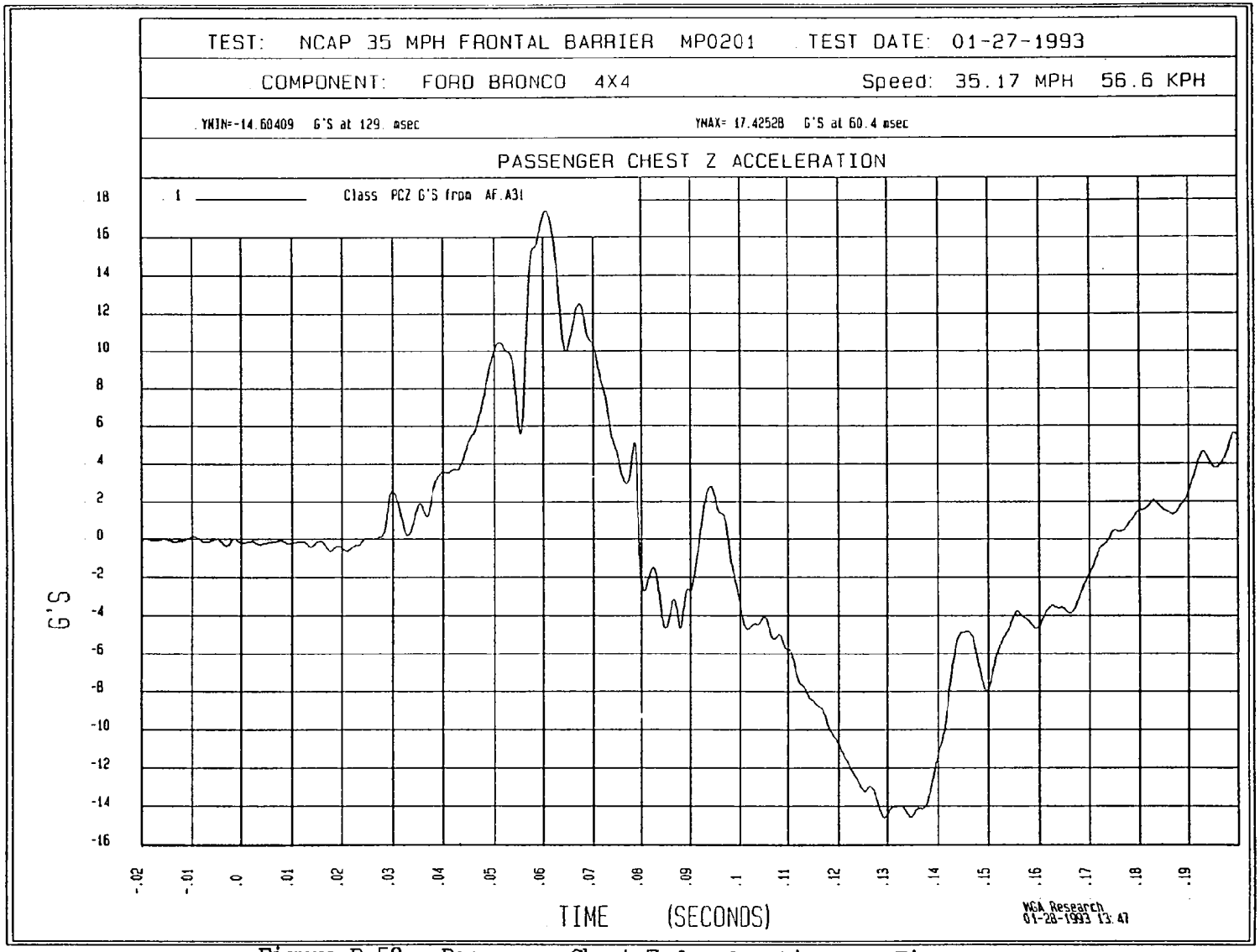


Figure B-58 - Passenger Chest Z Acceleration vs. Time

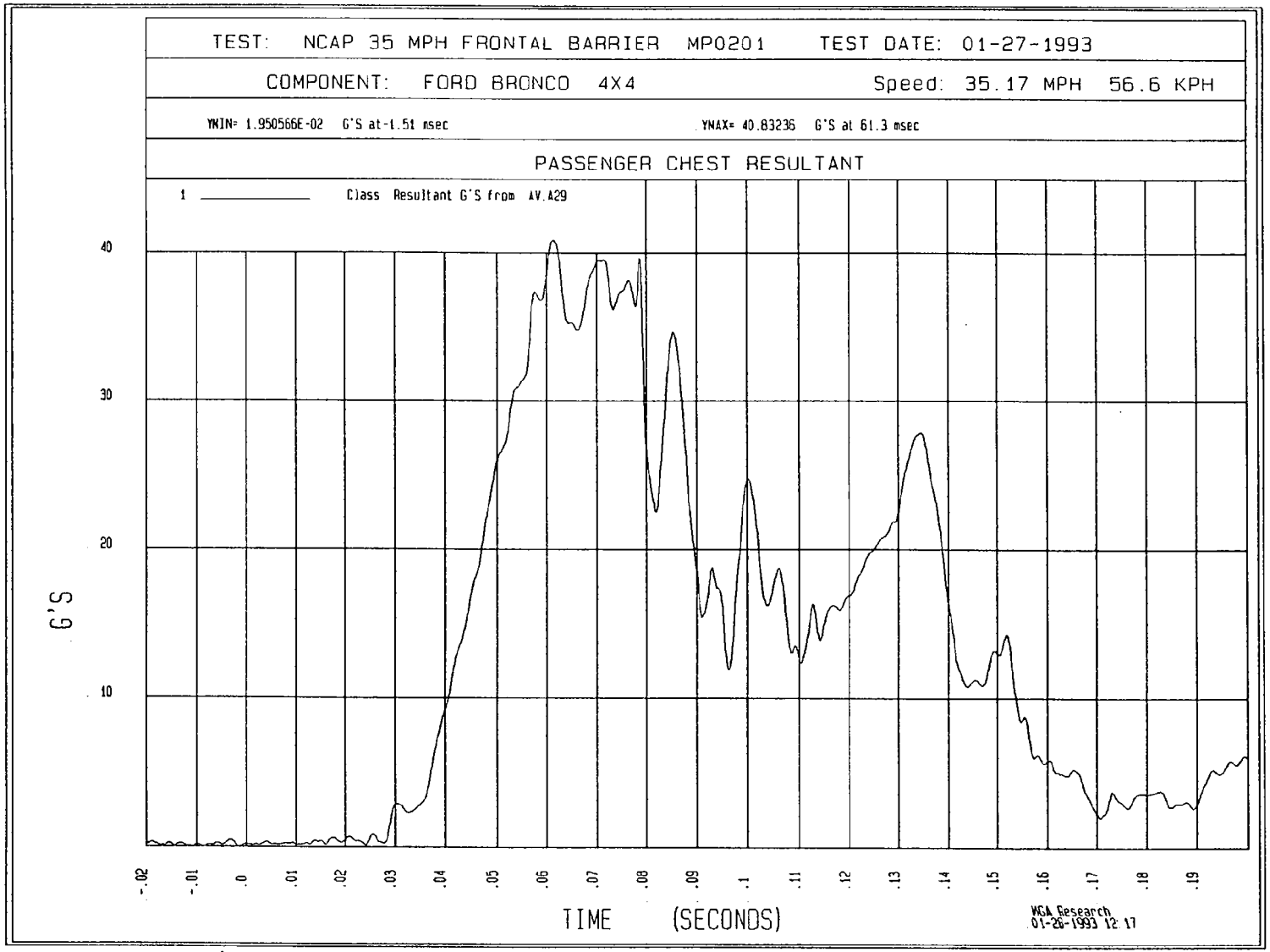


Figure B-59 - Passenger Chest Resultant Acceleration vs. Time

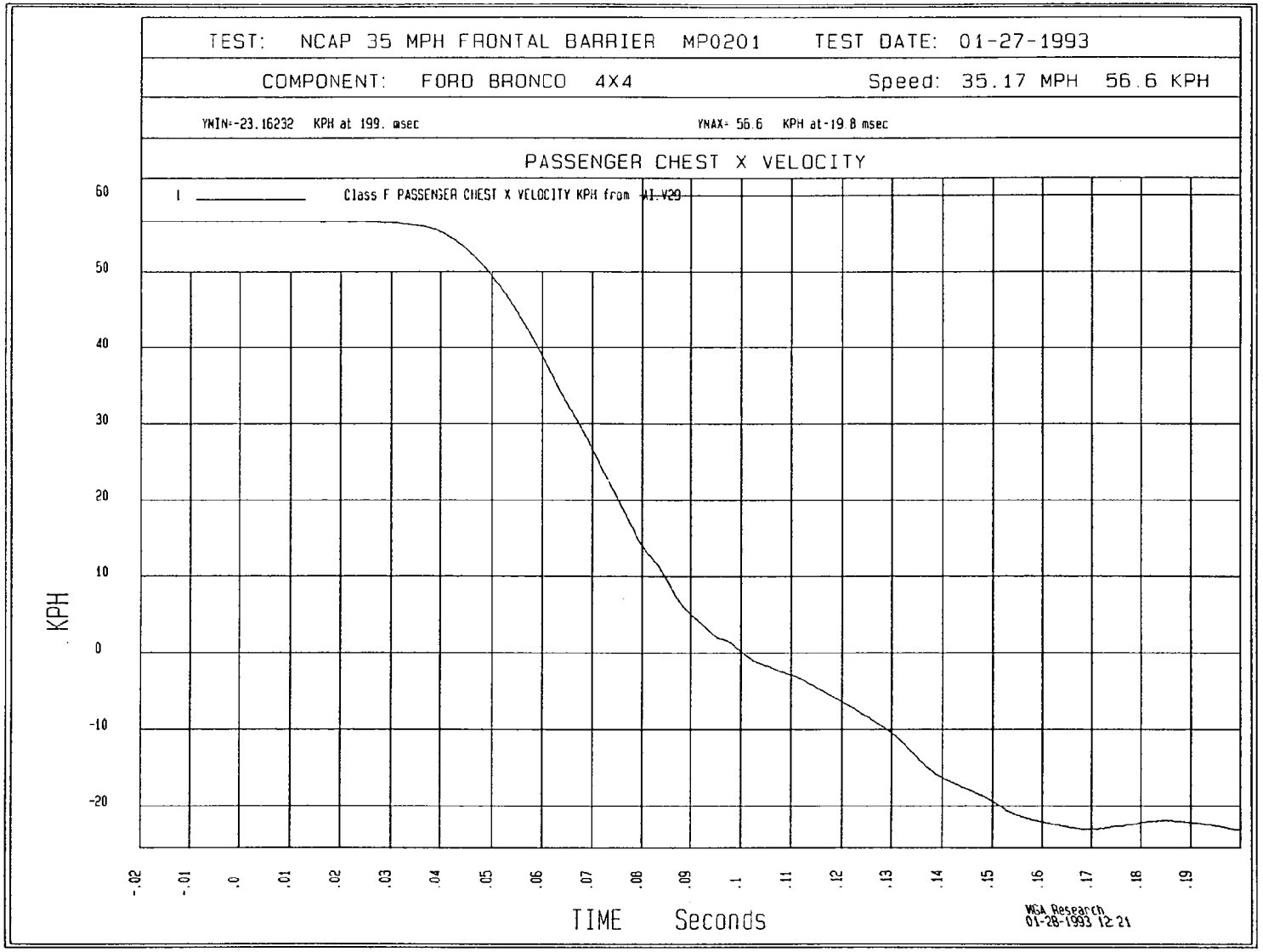
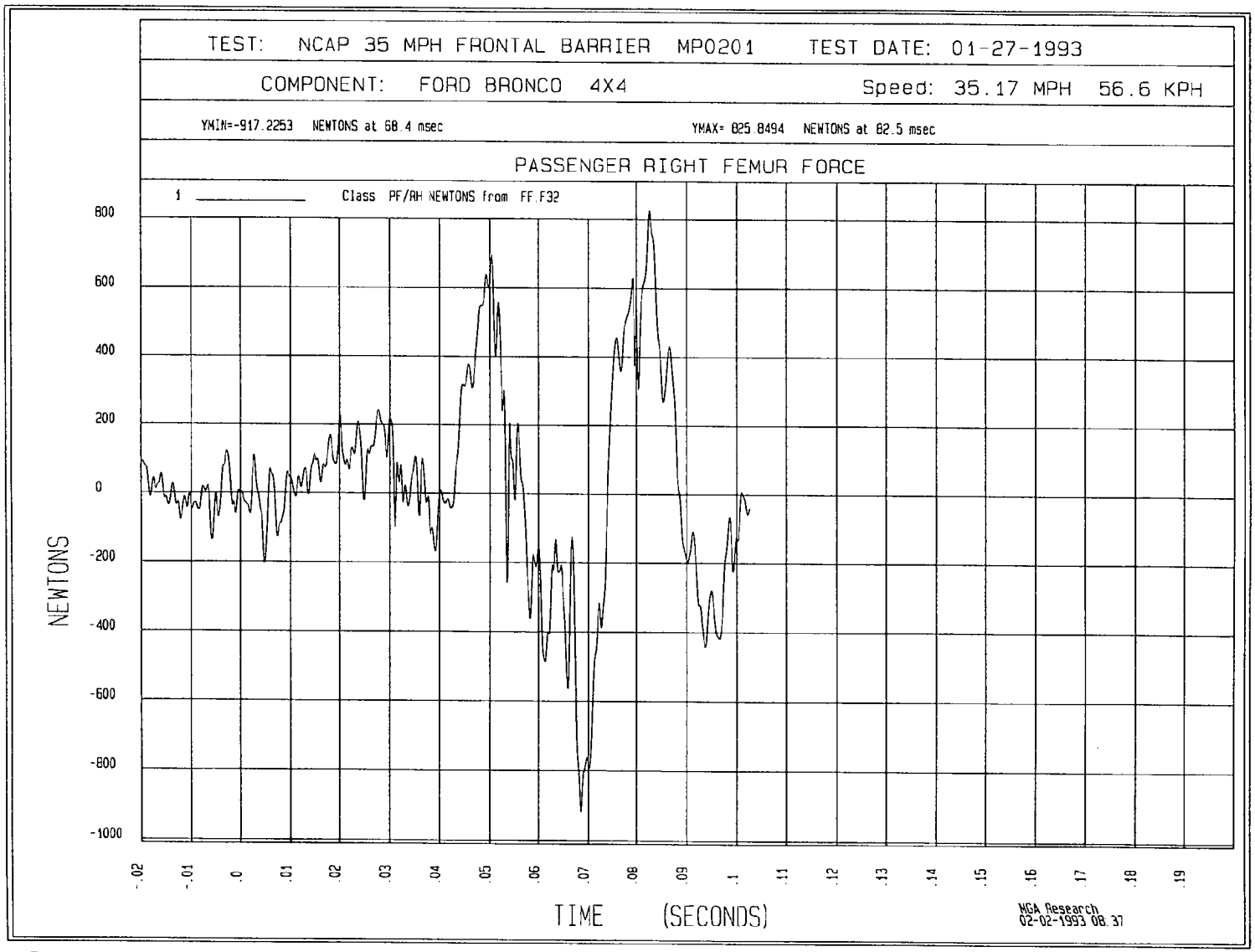


Figure B-60 - Passenger Chest X Velocity vs. Time



Data Loss at 100 msec.

Figure B-61 - Passenger Right Femur Force vs. Time

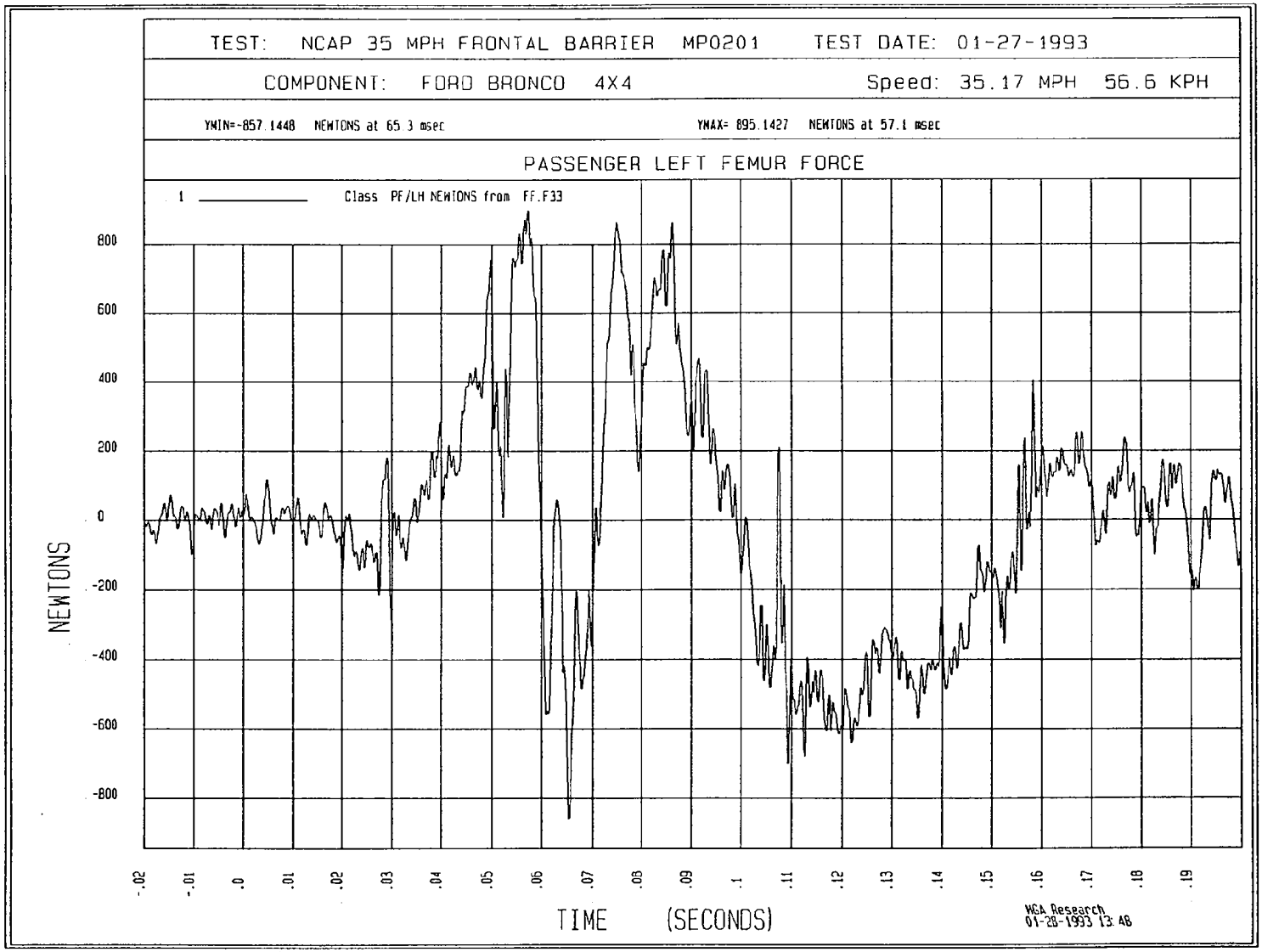


Figure B-62 - Passenger Left Femur Force vs. Time

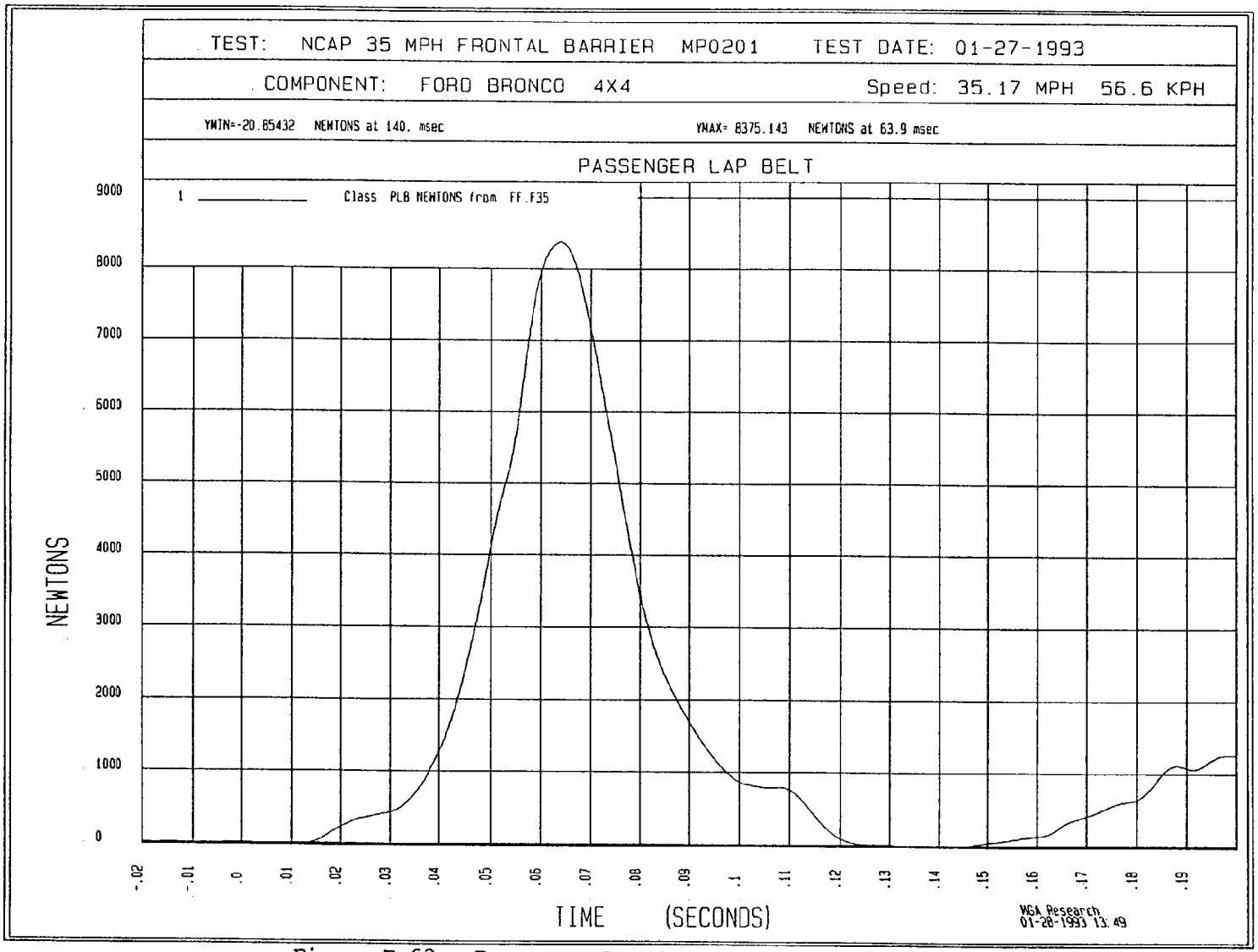


Figure B-63 - Passenger Lap Belt Force vs. Time

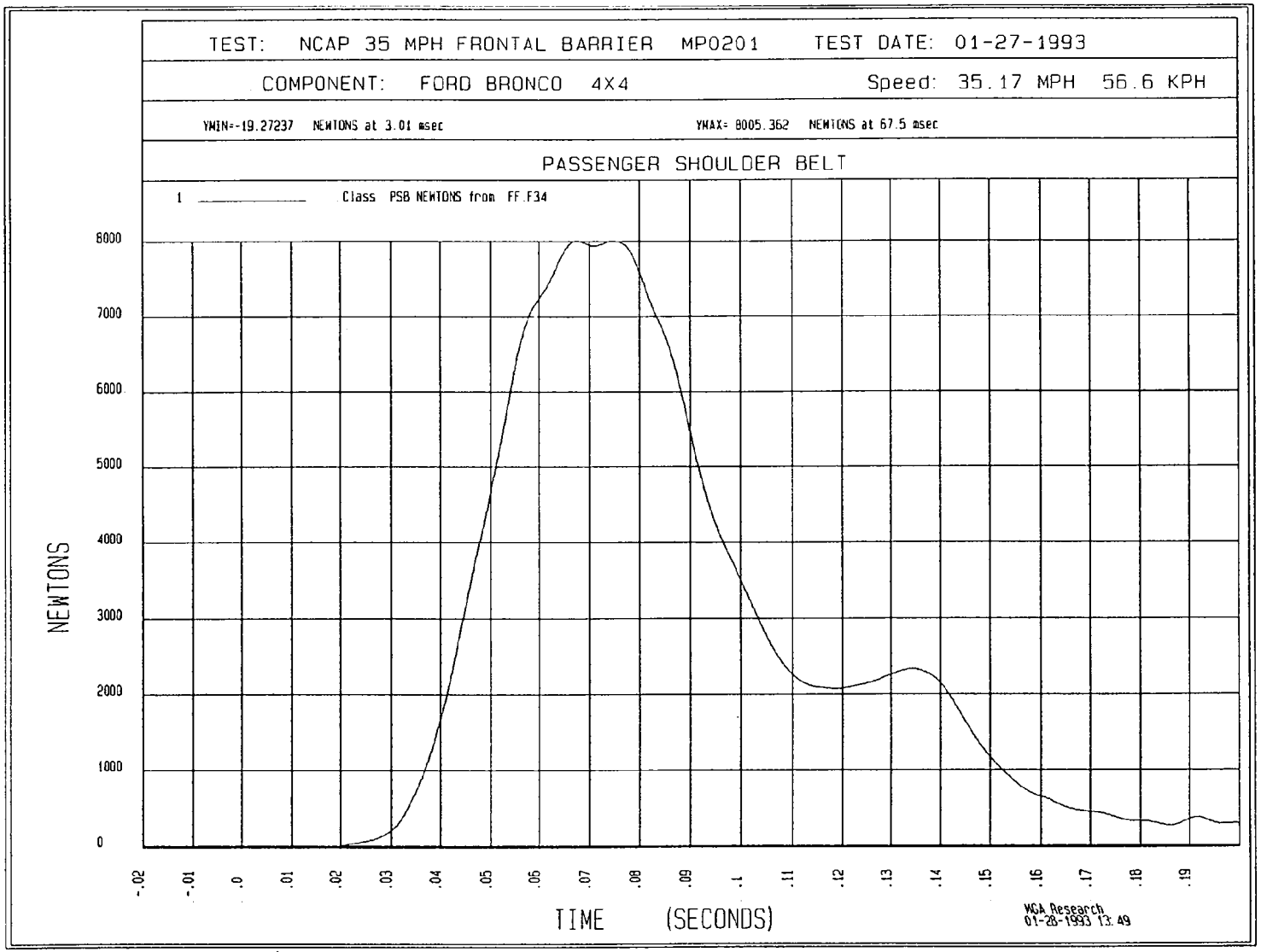


Figure B-64 - Passenger Torso Belt Force vs. Time

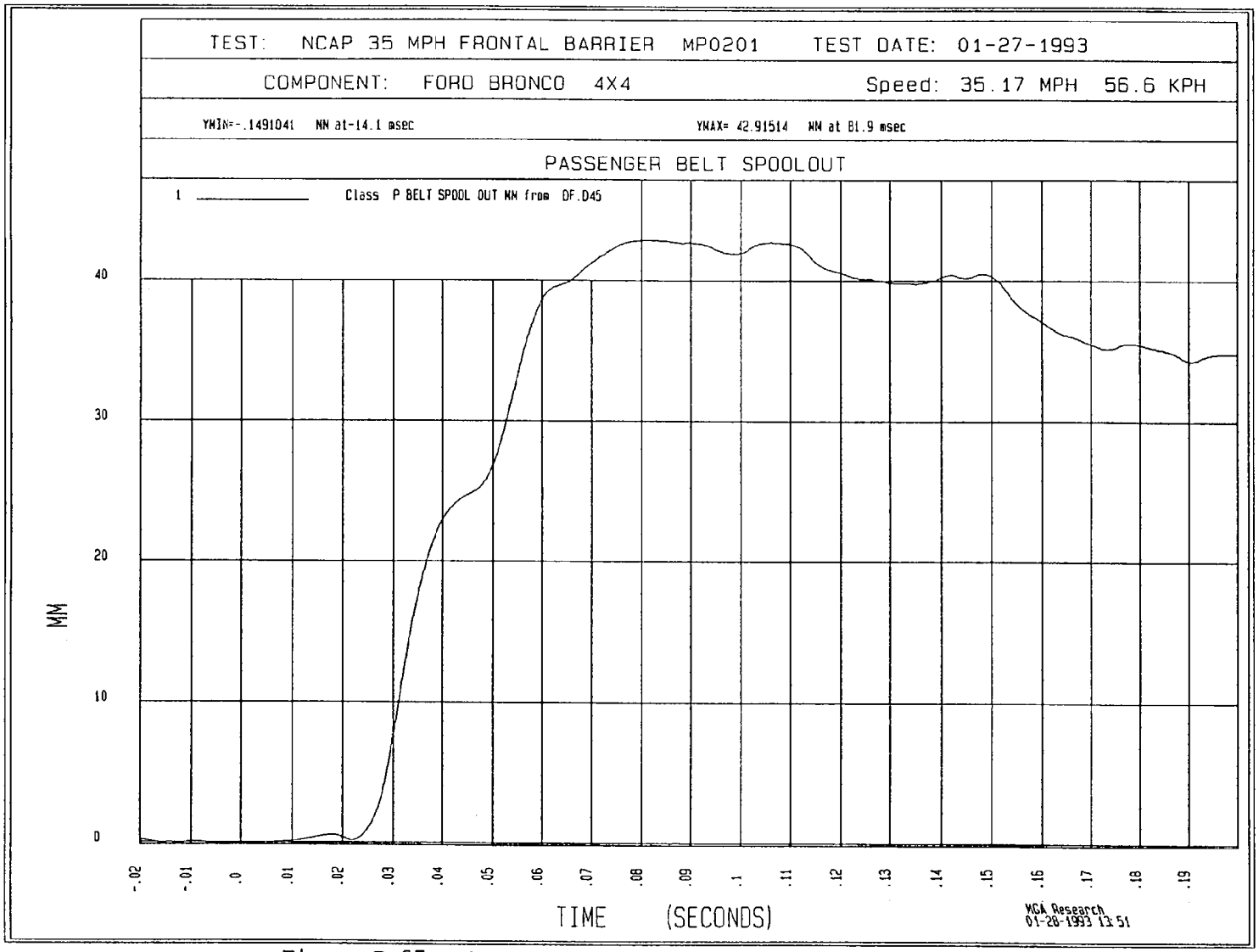


Figure B-65 - Passenger Belt Spool-Out vs. Time

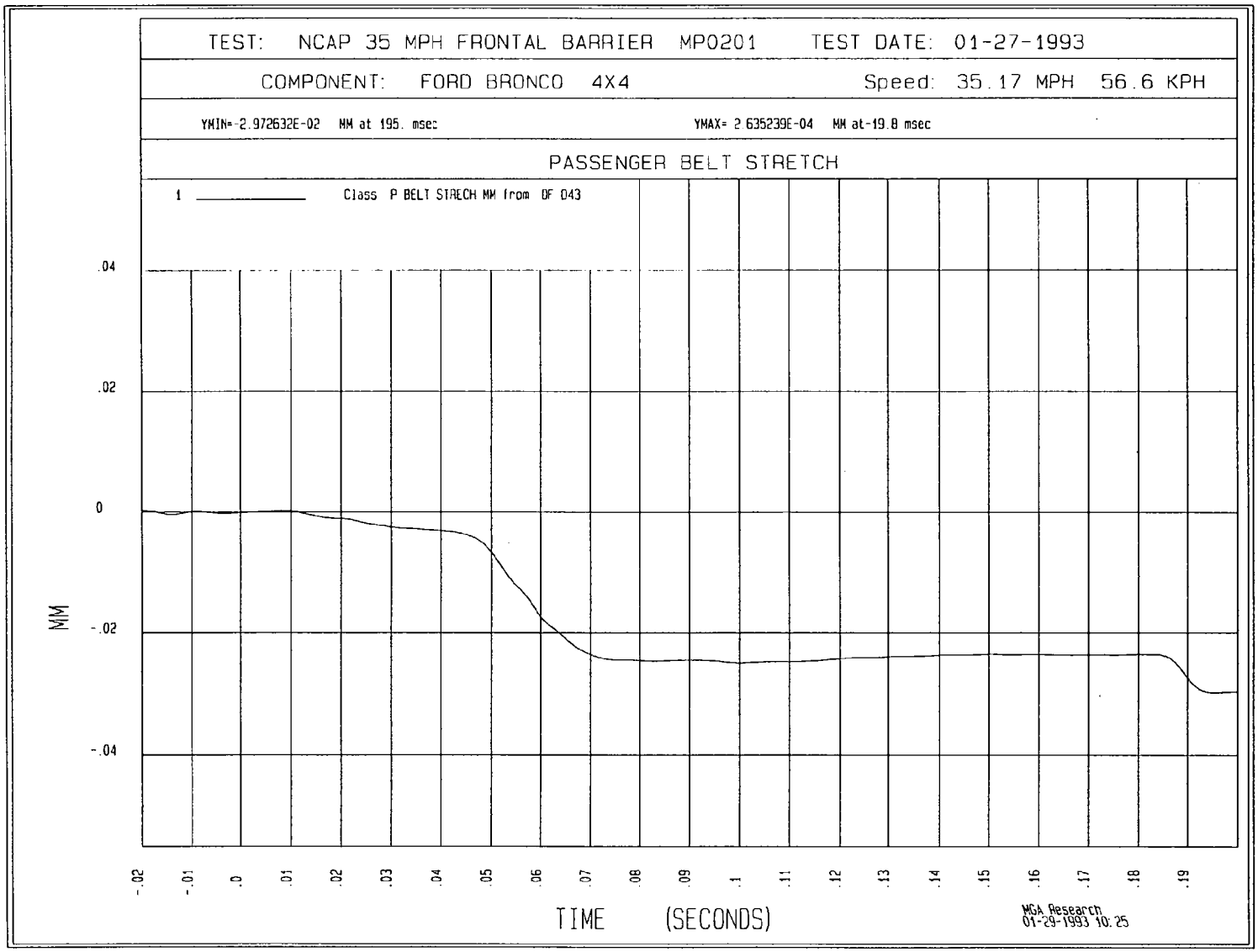


Figure B-66 - Passenger Torso Belt Stretch vs. Time

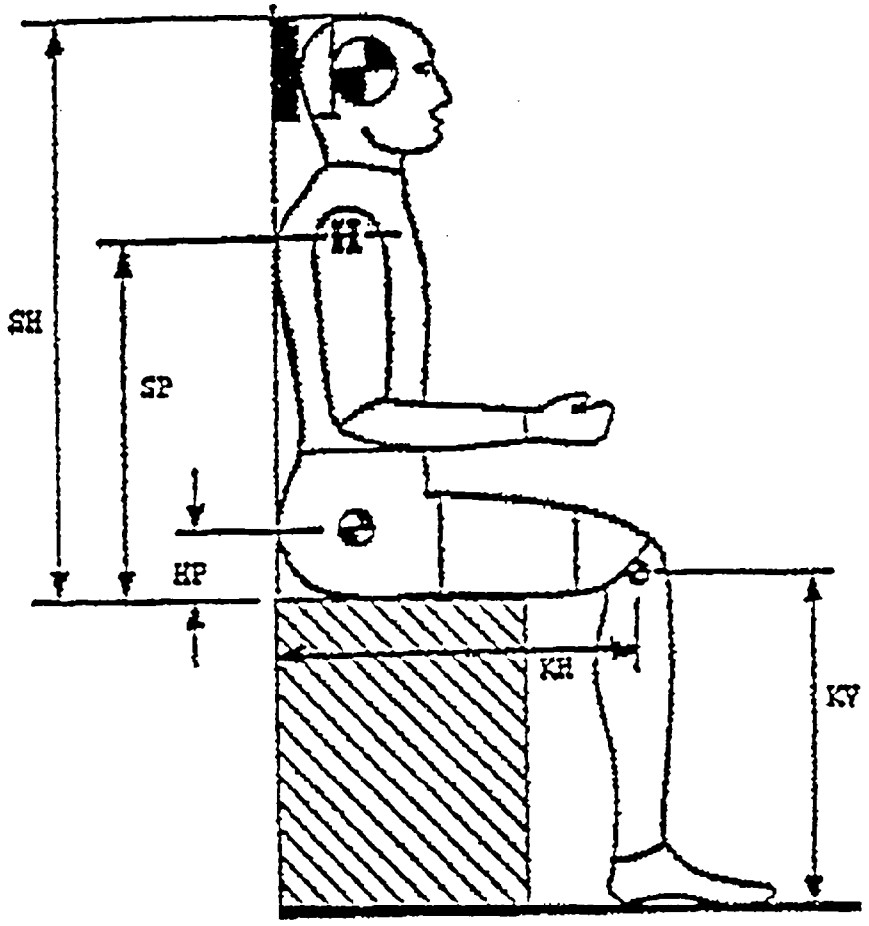
APPENDIX C

Dummy Configuration & Performance Verification Data

PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY NO.: 465 DUMMY CALIBRATION BY: Rod McClelland

I. CONFIGURATION VERIFICATION DATA



DATE OF VERIFICATION: 1-25-93

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

II. PERFORMANCE VERIFICATION DATA

DUMMY NO.: 465 DUMMY CALIBRATION BY: Rod McClelland
VERIFICATION LABORATORY TEMPERATURE (66° - 78°F): 67°

		SPECIFICATION	MEASUREMENT
HEAD DROP TEST			
A. Peak Resultant Acc.		210 to 260 g's	224
B. Peak Lateral Acc.		< 10 g's	2
C. Time above 100 g.		0.9 to 1.5 msec.	1.4
NECK BENDING TEST			
A. Pendulum Speed		21.5 to 25.5 fps	23.4
B. Pendulum Average Decel. Over $t_3 - t_2$		20 to 24 g's	23
C. Peak Resultant Head Acc.		26 g maximum	25
D. Pendulum Decel ($t_2 - t_1$)		$\leq$ = 3 ms	2.62
E. Pendulum Decel ($t_3 - t_2$)		25 to 30 ms	29
F. Pendulum Decel ($t_4 - t_3$)		$\leq$ = 10 ms	5
G. Max Head Rotation		63° to 73°	64
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	29.7
	Displ.	2.1 to 3.1 in	2.6
60°	Time	40.3 to 51.7 ms	47.6
	Displ.	4.3 to 5.3 in	5.0
Maximum (64°)	Time	53.2 to 66.8 ms	58.3
	Displ.	5.0 to 6.0 in	5.4
60°	Time	67.0 to 83.0 ms	67.2
	Displ.	4.3 to 5.3 in	5.0
30°	Time	85.4 to 104.6 ms	87.5
	Displ.	2.1 to 3.1 in	2.5
0°	Time	101.0 to 123.0 ms	101.9
	Displ.	0 to 0.5 in	0.1

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	31.5
Force @ 0.75 in	36.7 to 49.8 lbs	44.3
Force @ 1.0 in	50 to 63 lbs	59
Force @ 1.3 in	73 to 88 lbs	84

	SPECIFICATION	MEASUREMENT
LUMBAR FLEXION TEST		
A. Force @ 20°	22 to 34 lbs	24
B. Force @ 30°	34 to 46 lbs	38
C. Force @ 40°	46 to 58 lbs	50
D. Return Angle	12° Maximum	10

	SPECIFICATION	MEASUREMENT
CHEST IMPACT TESTS		
A. High Speed		
(1) Probe Speed	21.78 to 22.22 fps	21.97
(2) Peak Deflection	1.7 in. (maximum)	1.4
(3) Peak Resistive Force	2250 lbs. (maximum)	1841
(4) Internal Hysterisis	50% to 70%	59
B. Low Speed		
(1) Probe Speed	13.86 to 14.14 fps	14.14
(2) Peak Deflection	1.1 in. (maximum)	.90
(3) Peak Resistive Force	1450 lbs. (maximum)	1344
(4) Internal Hysteresis	50% to 70%	55

PART 572 DUMMY CONFIGURATION AND PERFORMANCE (CONT.)

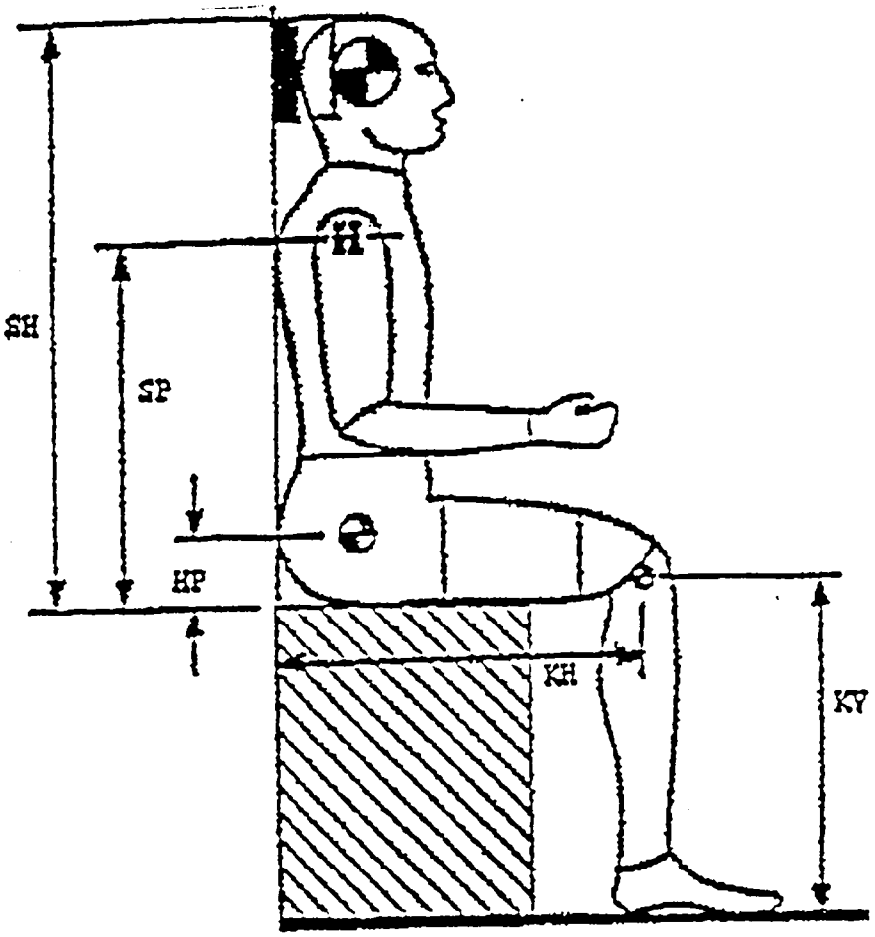
	SPECIFICATION	MEASUREMENT
KNEE IMPACT TESTS		
A. Right Side		
(1) Probe Speed	6.67 to 7.04 fps	6.9
(2) Maximum Force	1850 to 2500 lbs.	2145
(3) Time Above 1000 lbs.	1.7 msec. (minimum)	1.82
B. Left Side		
(1) Probe Speed	6.67 to 7.04 fps	6.9
(2) Maximum Force	1850 to 2500 lbs.	2013
(3) Time Above 1000 lbs.	1.7 msec. (minimum)	1.81

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

II. PERFORMANCE VERIFICATION DATA

DUMMY NO.: 466 DUMMY CALIBRATION BY: Rod McClelland
VERIFICATION LABORATORY TEMPERATURE (66° - 78°F): 68°

		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	2.2
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 (68°)	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	25.6
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
(2) Peak Deflection	1.7 in. (maximum)	1.5
(3) Peak Resistive Force	2250 lbs. (maximum)	2210
(4) Internal Hysterisis	50% to 70%	56
B. Low Speed		
(1) Probe Speed	13.86 to 14.14 fps	13.96
(2) Peak Deflection	1.1 in. (maximum)	0.8
(3) Peak Resistive Force	1450 lbs. (maximum)	1409
(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.Ø4 fps	6.89
(2) Maximum Force	185Ø to 25ØØ lbs.	2447
(3) Time Above 1ØØØ lbs.	1.7 msec. (minimum)	1.9
B. Left Side		
(1) Probe Speed	6.67 to 7.Ø4 fps	6.97
(2) Maximum Force	185Ø to 25ØØ lbs.	188Ø
(3) Time Above 1ØØØ 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	EA71	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	A99L	Endevco	11/6/92
Right Femur Load Cell	950	GSE	1/26/93
Left Femur Load Cell	947	GSE	1/26/93
*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	GSE	11/04/92
Torso Belt Load Cell	657	Lebow	1/22/93
Spool-Out Potentiometer	N/A	Bourns	1/27/93
Belt Stretch Transducer	02	Bourns	1/27/93

*Hybrid III use only.

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

INSTRUMENTS FOR DUMMY NO. 466

	PASSENGER		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	EH45	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	AØ7M	Endevco	11/6/92
Right Femur Load Cell	932	GSE	1/25/93
Left Femur Load Cell	957	GSE	1/26/93
*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	691	Lebow	11/3/92
Torso Belt Load Cell	657	Lebow	1/22/93
Spool-Out Potentiometer	ØØ2	Bourns	1/27/93
Belt Stretch Transducer	ØØ2	Bourns	1/27/93

*Hybrid III use only.

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

	VEHICLE ACCELEROMETERS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Rear Seat Crossmember X	MGA041	Entran	9/15/92
Right Rear Seat Crossmember X	MGA042	Entran	9/15/92
Top of Engine X	MGA075	Entran	10/15/92
Bottom of Engine X	MGA012	Entran	8/21/92
Left Brake Caliper X	EA04	Endevco	8/05/92
Right Brake Caliper X	A31M	Endevco	7/15/92
Instrument Panel X	MGA067	Entran	9/29/92
Redundant Left Rear Seat Crossmember X	MGA070	Entran	10/15/92
Redundant Right Rear Seat Crossmember X	MGA026	Entran	9/15/92

	LABORATORY INSTRUMENTS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Neck Bending Pendulum Accelerometer	1740084	Kyowa	9/22/92
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	282396	Sensotec	11/23/92
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	CS7347	Revere	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:

- ❑ Combination lap and shoulder belts - for people who sit next to the side windows in either front or rear seats
- ❑ Lap belts without retractors

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.

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.

Do not allow any people to ride in the cargo area of your vehicle. People who are not riding in seats with their safety belts fastened are much more likely to be 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.

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 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: 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.

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

Combination Lap and Shoulder Belts

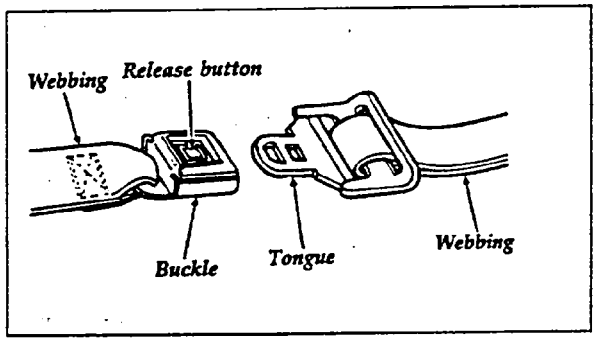
While your vehicle is in motion, the combination lap and shoulder belts adjusts to your movement. However, if you brake hard, corner hard or if your vehicle receives an impact of 5 mph (8 km/h) or more, the lap and shoulder belt locks and helps reduce your forward movement. The front seat belt systems can also be made to lock by jerking on the belt.

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 at the buckle.

Warning: Use the shoulder belt only on the shoulder that is closest to the side of the vehicle. Never wear the belt under your arm. Never swing it around your neck over the inside shoulder. If you do not use the shoulder belt properly, the chances of your being injured in a collision greatly increase.

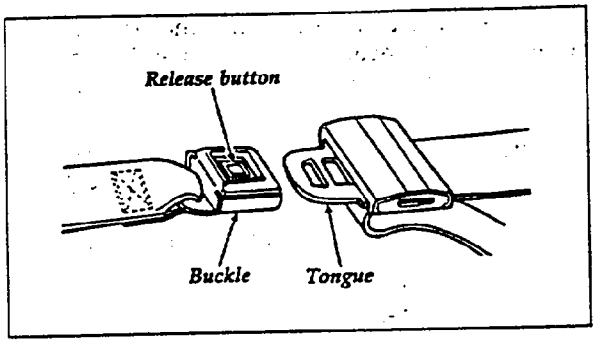
To tighten the lap portion of the belt, pull up on the shoulder belt until it fits you snugly. The belt should rest as low on your hips as possible.



Unfastening the outboard lap/shoulder belts

Lap Belts Without Retractors

On the center seat of the front and rear three-passenger bench seat you will find a lap-belt without a retractor. Shorten this belt and fasten it when you are not using it. To lengthen the belt, tip the tongue at a right angle to the belt and pull the belt over your lap until the tongue reaches the buckle.



Fastening and unfastening rear occupant safety belts

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 and as low as possible around the 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 Safety Belts with Retractors:

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

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.