V2057

REPORT NO. MGA-94-NØØ7

NEW CAR ASSESSMENT PROGRAM (NCAP)

FRONTAL BARRIER IMPACT TEST

Jeep
1994 Jeep Wrangler
2 Door Soft Top
NHTSA NO. MRØ3Ø5

MGA PROVING GROUNDS
5ØØØ WARREN ROAD
BURLINGTON, WI 53105

Test Date: March 15, 1994

Report Date: March 31, 1994

FINAL REPORT

Prepared For:

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF MARKET INCENTIVES
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15. Supplementary Notes

16. Abstract

A 56 kph (35 mph) frontal barrier impact using a 30 load cell barrier was conducted on a 1994 Jeep Wrangler 2 Door at the MGA Proving Grounds and Crash Test Center in Burlington, WI. on March 15, 1994.

The barrier impact velocity was 56.5 kph (35.1 mph), and the ambient temperature at the time of impact was 21° C. The post-test average crush was 382 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 1260.0 and the 3 msec. Clip (Chest g's) was 48.1 g's. The left and right maximum femur loads for the driver were 4506 and 5265 Newtons, respectively. The passenger's HIC was 726 and the 3 msec Clip was 45.8 g's. The left and right femur maximum loads were 2725 and 2474 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 are available from: Technical Ref. Division, National Highway Traffic Safety Adm., NASSIF Building, Room 5108 400 Seventh Street, S.W. Washington, D.C. 20590		
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SECTION 1

PURPOSE AND TEST PROCEDURE

This 35 mph frontal barrier impact test is part of the Composite FY'94 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.

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SECTION 2

SUMMARY OF FRONTAL BARRIER IMPACT TEST

A load cell barrier consisting of 30 load cells was impacted by a 1994 Jeep Wrangler 2 Door Soft Top at a velocity of 56.5 kph (35.1 mph). The test was performed at the MGA Proving Grounds and Crash Test Center on March 15, 1994. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

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

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

Both ATDs were fully instrumented with head and chest triaxial accelerometers, neck tranducers, chest deflection guages, and right/left femur load cells. The driver was also instrumented with right and left lower leg sensors. 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. 36) and the right-front passenger ATD (Serial No. 37) were calibrated prior to this test. Certification details, along with instrumentation calibration data, are found in Appendix C and D.

The 62 channels of data were recorded on 6 computers. Appendix B contains the vehicle, load cell barrier and dummy response data traces.

The driver's head struck the steering wheel. The driver HIC was 1260. The maximum chest deceleration over 3 milliseconds was 48.1 G's. The left and right maximum femur loads were 4506 and 5265 Newtons respectively.

The right front passenger's HIC was 726 and maximum chest deceleration over 3 milliseconds was 45.8 g's. The left and right femur loads were 2725 and 2474 Newtons respectively.

GENERAL TEST AND VEHICLE PARAMETER DATA

Vehicle Yr/Make/Model/Body Style: 1994 Jeep Wrangler 2 Door

NHTSA No.: MR0305 VIN.: 1J4FY19P7RP422208

Body color: Red Date of Manufacture: 10-93

Engine: 4 Cylinders; __C.I.D.; 2.5Liters; __CC

X Gas; __Diesel; __Turbocharged

X Longitudinal; __Transverse

Transmission: 4 Speed; X Manual; __Automatic; __Overdrive

Final Drive: __Front Wheel; __Rear Wheel; X Four Wheel

Date Received: 2-4-94 Odometer Reading: 122

__A/C; __P/S; __P/B; __P/wdo;

__P/seats; X Tilt Wheel; __Cruise Control;

Type of Occupant Restraint: Type II - 3 point continuous webbing lap and shoulder belt

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): Front 2.1 kg/cm^2 28 Psi; Rear 2.1 kg/cm^2 32 Psi:

Recommended Tire Size: P205/75R15

Recommended Cold Tire Pressure: Front 2.1 kg/cm^2; Rear 2.1 kg/cm^2

Tires on Vehicle: P205/75R15 ; Manufacturer: Goodyear

Number of Occupants: 2 Front; 2 Rear; __3rd Seat; 4 TOTAL

Type of Front Seats: X Bucket; __Bench; __Split Bench

Type of Front Seat Back: X Fixed; __Adj. With; __Lever; __Rot. Knob

Vehicle Capacity Weight (VCW) = 362.9 kg. (A)

No. of Occupants x 68.0 kg. = 272 kg. (B)

Rated Cargo Weight (RCW) A-B = 90.9 kg.

GVWR 1950.5 kg. GAWR: Front 997.9 kg.; Rear 1134.0 kg.

GENERAL TEST AND VEHICLE PARAMETER DATA (Cont'd)

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

Right Front = 334.3 kg Right Rear = 318.8 kg

Left Front = 338.8 kg Left Rear = 321.5 kg

TOTAL FRONT WEIGHT = 673.1 kg (51.2% of Total Vehicle Weight)

TOTAL REAR WEIGHT = 640.3 kg (48.8% of Total Vehicle Weight)

TOTAL UNLOADED DELIVERED WEIGHT (UDW) = 1313.4 kg

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight 1313.4 kg

VCW = Vehicle Capacity Weight 362.9 kg DSC = Designated Seating Capacity 4

RCW = VCW - 68 (DSC) = 90.9 *kg

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

Target Test Weight = 1553.1 kg

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND CARGO:

Right Front = 381.9 kg Right Rear = 405.9 kg

Left Front = 337.0 kg Left Rear = 428.2 kg

TOTAL FRONT WEIGHT = 718.9 kg (46.3% of Total Vehicle Weight)

TOTAL REAR WEIGHT = 834.1 kg (53.7% of Total Vehicle Weight)

TOTAL TEST WEIGHT = 1553.0 kg

Weight of ballast secured in vehicle = 22.7 kg

Vehicle components removed to meet target weight: Spare, rear seat

VEHICLE ATTITUDE (all dimensions in mm):

Delivered Attitude: RF 768 LF 775 RR 819 LR 820

Test Attitude: RF 746 LF 762 RR 753 LR 769

Wheel Base: 2370 mm; C.G. = 1273 mm rearward of front wheel C/L

Remarks: None

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

GENERAL TEST AND VEHICLE PARAMETER DATA (Cont'd)

POST-IMPACT DATA:

Type of Test: 35 mph Frontal Impact Impact Angle: 90°

Date of Test: March 15, 1994 Time of Test: 3:21 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 = 56.9 kph

Distance From Front Bumper to Barrier Face When

Entering Speed Trap: 1229 mm

Exiting Speed Trap: 229 mm

VEHICLE REBOUND AND CRUSH (mm):

Vehicle Length: Pre-test = R 3655 C_L 3655 L 3655

Post-test = R 3538 C_L 3274 L 3006

Crush = R 117 C_L 381 L 649

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

R 1198 mm C_L 1342 mm L 1639 mm

VISIBLE DUMMY CONTACT POINTS:

	Driver	Passenger
Head	To top of steering/wheel/neck to rim	Dash panel
Chest	Steering Wheel	No visible contact
Abdomen	Steering Wheel	No visible contact
Left Knee	Dash panel	Dash panel
Right Knee	Dash panel	Dash panel

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

	Front		Rear	
Door Opening	Left	Right	Left	Right
(without use of tools)	No	No	N/A	N/A

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

Glazing Damage

Backlight/Windshield Windshield cracked

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.:

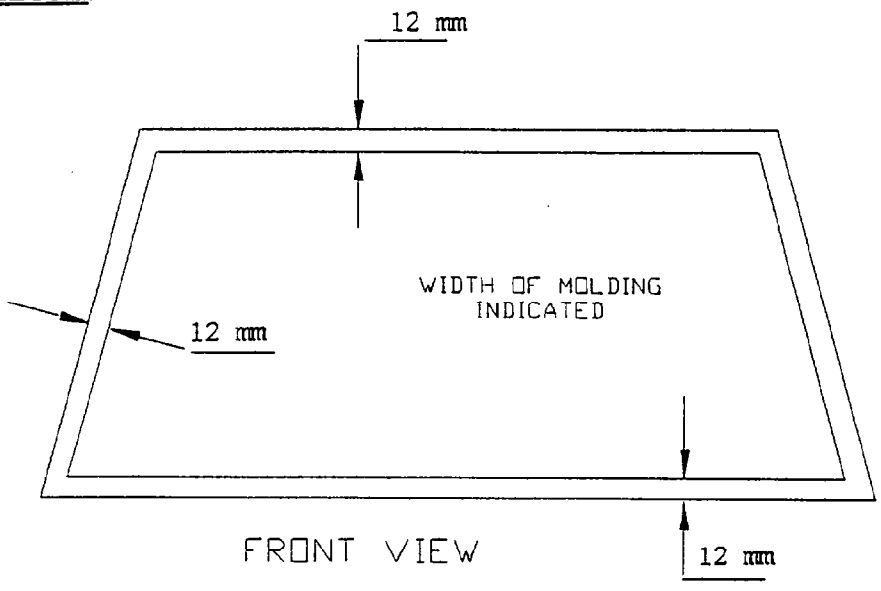
Windshield set in rubber molding within windshield frame

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	1797.5	1797.5	100%
LEFT SIDE	1797.5	1797.5	100%
TOTAL	3595.0	3595.0	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 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:

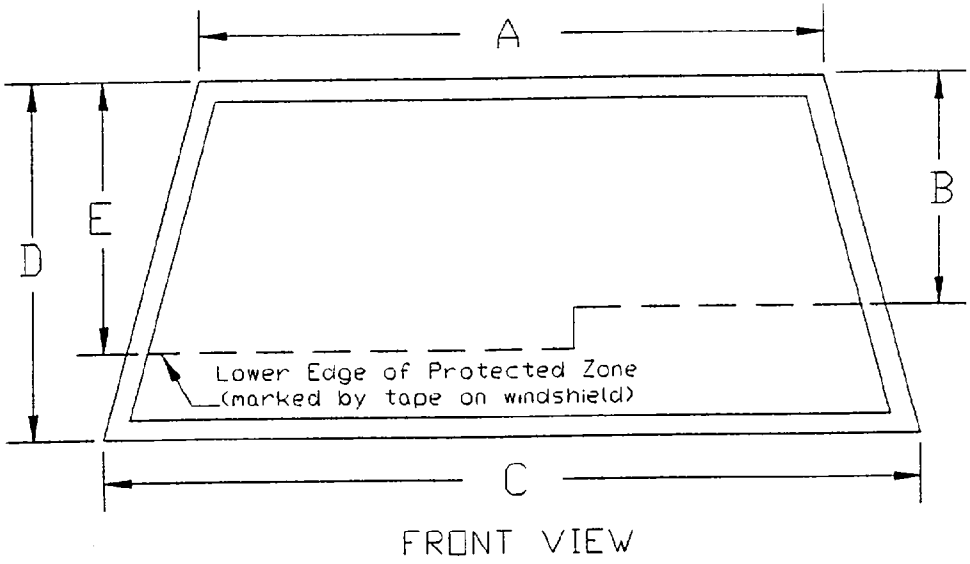
A= 1362 mm

B= 336 mm

C= 1393 mm

D= 420 mm

E= 336 mm



FRONT VIEW

DETAILS OF WINDSHIELD GLASS PENETRATION GREATER THAN 1/4":

(Show location of penetration)

NONE

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

FMVSS NO. 301

TEST VEHICLE NHTSA NO.: MR0305 Test Date: March 15, 1994

Vehicle Mfgr./Make/Model: Jeep/Wrangler/2 Door soft top

Usable Capacity of Vehicle's Fuel Tank: 54.9 Liters
(figure furnished by vehicle manufacturer)

TEST REQUIREMENTS:

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

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

51.0 Liters which is 93 % of the stated USABLE CAPACITY.

TEST VEHICLE IMPACT TYPE:

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

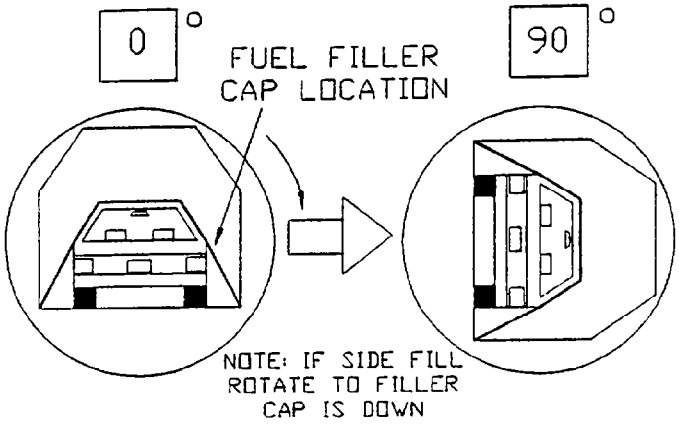
FUEL SPILLAGE MEASUREMENT:

	ACTUAL	MAX ALLOWED
1. From impact until vehicle motion ceases	0	1 OZ
2. For 5 minute period after vehicle motion ceases	0	5 OZ
3. For next 25 minutes	0	1 oz./1 MIN

SOLVENT SPILLAGE DETAILS: None

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

TEST PHASE: 0° - 90° Vehicle NHTSA ID No.: MR0305



I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time 2 minutes 46 seconds

(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time + 5 minutes 0 seconds

TOTAL 7 minutes 46 seconds

Next whole minute interval 8 minutes

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

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

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

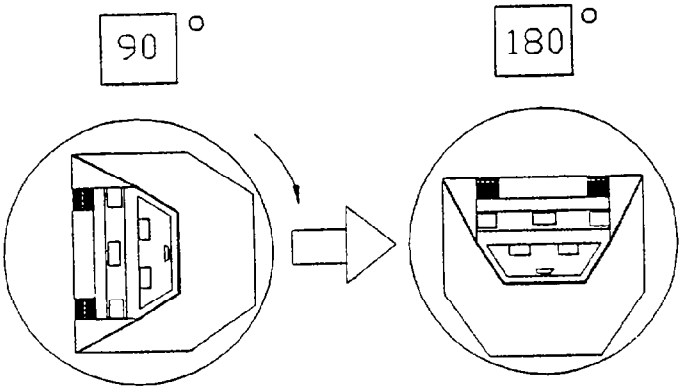
0	0	0	0

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

IV. SOLVENT SPILLAGE LOCATIONS(S): None

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

TEST PHASE: 90° - 180° Vehicle NHTSA ID No.: MR0305



I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time 2 minutes 24 seconds

(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time + 5 minutes 0 seconds

TOTAL 7 minutes 24 seconds

Next whole minute interval 8 minutes

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

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

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

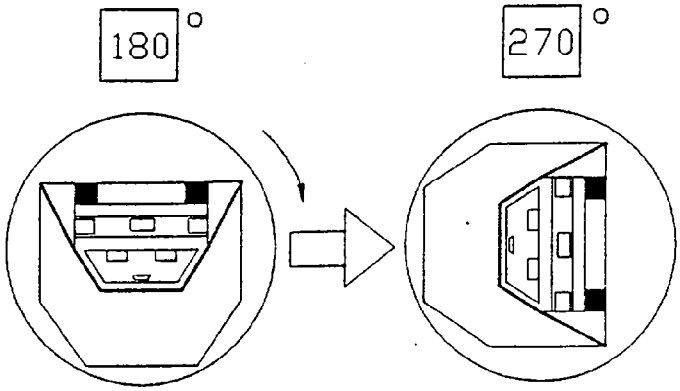
0	0	0	0

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

IV. SOLVENT SPILLAGE LOCATIONS(S): None

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

TEST PHASE: 180° - 270° Vehicle NHTSA ID No.: MR0305



I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time 2 minutes 29 seconds

(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time + 5 minutes 0 seconds

TOTAL 7 minutes 29 seconds

Next whole minute interval 8 minutes

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

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

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

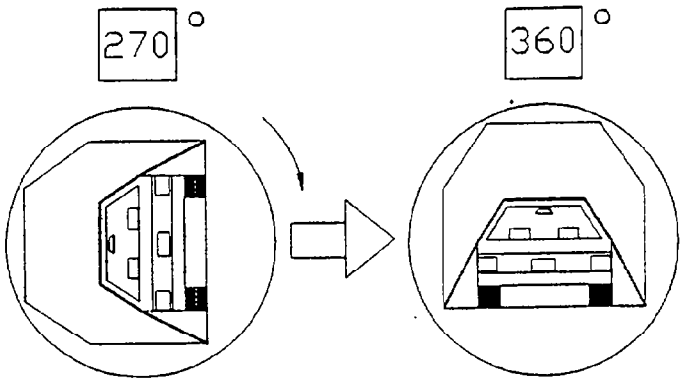
0	0	0	0

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

IV. SOLVENT SPILLAGE LOCATIONS(S): None

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

TEST PHASE: 270° - 360° Vehicle NHTSA ID No.: MR0305



I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time 2 minutes 40 seconds

(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time + 5 minutes 0 seconds

TOTAL 7 minutes 40 seconds

Next whole minute interval 8 minutes

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

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

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

0	0	0	0

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

IV. SOLVENT SPILLAGE LOCATIONS(S): None

SECTION 4
OMI FINAL DATA

Occupant and Vehicle Information

I. OMI DATA

1. "Occupant Crash Protection Data Sheet"
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: 1994/Jeep/Wrangler/2 Door soft top

VEH. NHTSA NO.: MR0305 TEST DATE: March 15, 1994

MAXIMUM ACCELERATION VALUES: (g's)	DRIVER DUMMY #36	PASSENGER DUMMY #37
Head Channel X	-63.9	-37.9
Head Channel Y	-12.6	6.5
Head Channel Z	79.5	55.3
HEAD RESULTANT	92.7	63.2
Chest Channel X	-53.1	-47.4
Chest Channel Y	-11.7	-9.3
Chest Channel Z	10.8	-8.1
CHEST RESULTANT (CLIP)	48.1	45.8
TIME INTERVAL (msec) [0.003 seconds minimum]	t_1 = 88.4 t_2 = 91.4	t_1 = 71.3 t_2 = 74.3

HEAD INJURY CRITERIA (HIC) VALUES:

HIC	1260.0	726.4
t_1 = (msec)	88.5	71.7
t_2 = (msec)	123.8	107.7
Avg. Accel. t_1 to t_2 (g's)	66.2	52.7

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

MAXIMUM FEMUR FORCES:

Right Side (N)	-5265	-2474
Left Side (N)	-4506	-2725

MAXIMUM SEAT BELT FORCES:

Lap Belt (N)	2108	4268
Shoulder Belt (N)	6416	8163

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: 1994/Jeep/Wrangler/2 Door

VEHICLE NHTSA NO.: MR0305 TEST DATE: March 15, 1994

MAXIMUM VALUES	DRIVER DUMMY # 36	PASSENGER DUMMY #37
Neck Load X (N)	-3106	1281
Neck Load Y (N)	481	-285
Neck Load Z (N)	-5695	-2555
Neck Moment X (N.M)	19.8	-14.9
Neck Moment Y (N.M)	68.5	-62.8
Neck Moment Z (N.M)	11.1	-7.6
Chest Deflection X (mm)	-50.8	-17.8
Time of Max. Occurrence	87 msec	86 msec

PART 572 DUMMY IN-VEHICLE POSITION

Test No.: MR0305 Vehicle: 1994 Jeep Wrangler 2 Door

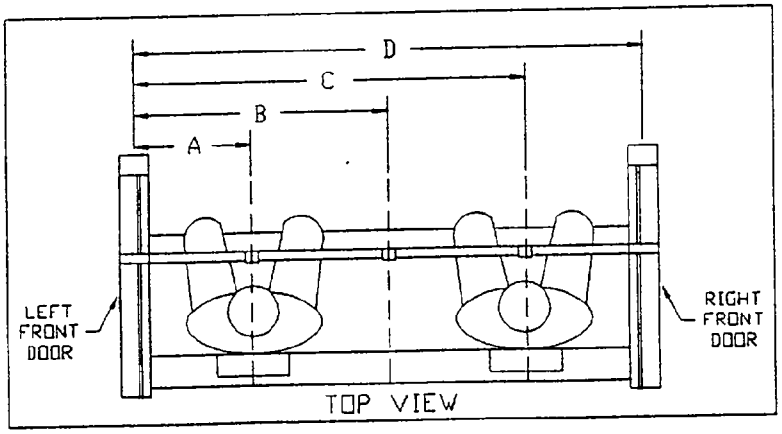
SEAT TYPE:	ADJUSTER TYPE:	BUCKET SEAT BACK TYPE:
	Driver	
____Bench	__X__Manual	__X__Fixed
__X__Bucket	____Power	____Adjustable Reclining
____Split Bench		
	Passenger	
	__X__Manual	
	____Power	

Driver

Seat notch 7th from rear

Passenger

Seat notch 7th from rear



36 DUMMY ID 37

A	= Left Door to Driver Centerline	372 mm
B	= Left Door to Vehicle Centerline	710 mm
C	= Left Door to Right Passenger Centerline	1084 mm
D	= Left Door to Right Door	1420 mm

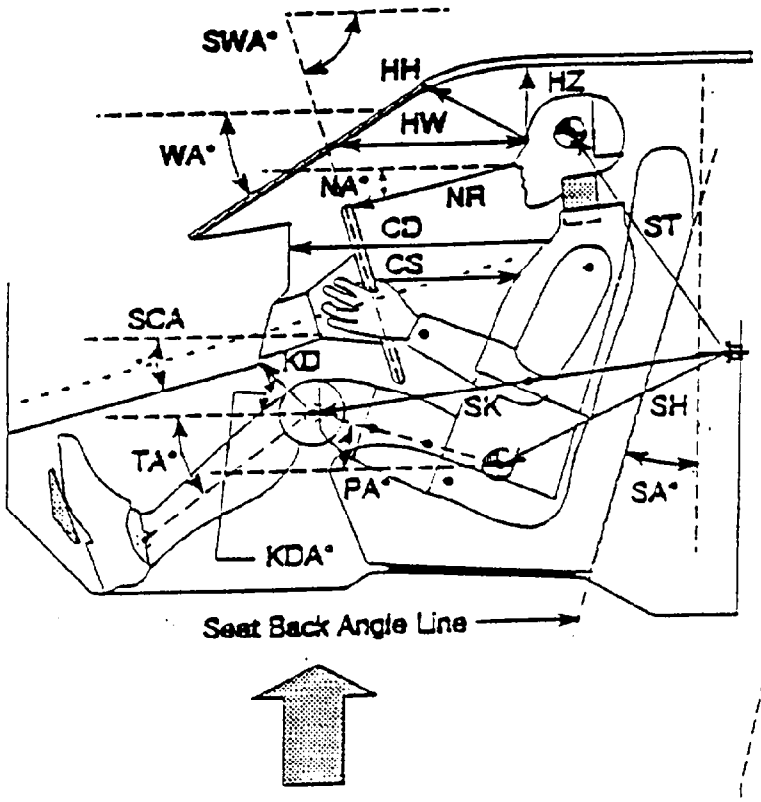
FRONT SEAT MEASUREMENT TABLE

Units (mm)

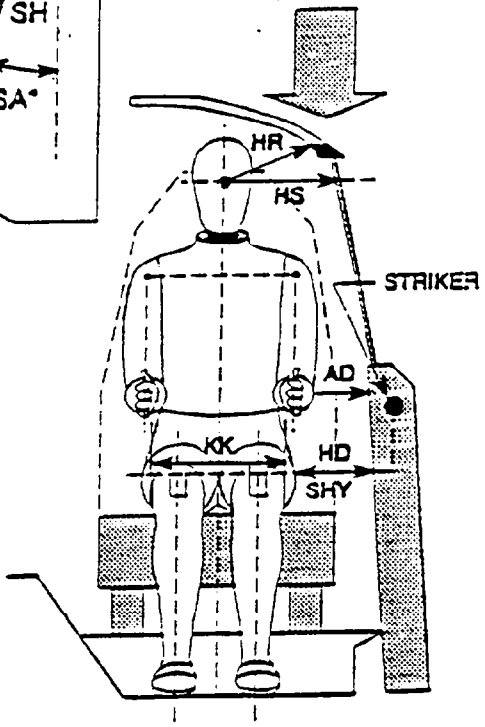
	DRIVER (Serial #36)	PASSENGER (Serial #37)
WA°	23.2°	23.2°
SWA°	26.3°	N/A
SCA°	25.6°	N/A
SA°	21.5°	21.5°
HZ	242	246
HH	498	524
HW	534	565
HR	354	357
NR	374 Angle 20.5°	N/A
CD	484	509
CS	320	N/A
RA	148	N/A
KDL	190 Angle 7.2°	221
KDR	164	214 Angle 17.2°
PA°	22.1°	20.5°
TA°	49°	54.2
KK	290	236
ST	570 Angle 12.8°	560 Angle 10°
SK	611 Angle 3.9°	600 Angle 3.4°
SH	235 Angle 8.8°	230 Angle 30.4°
SHY	192	170
HS	344	339
HD	124	120
AD	110	118

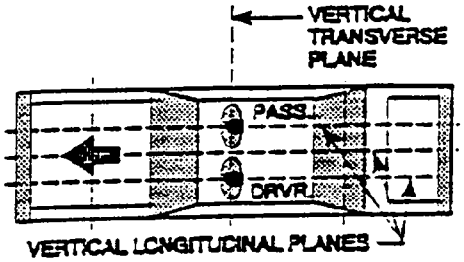
N/A = Not Applicable

FRONT SEAT MEASUREMENTS



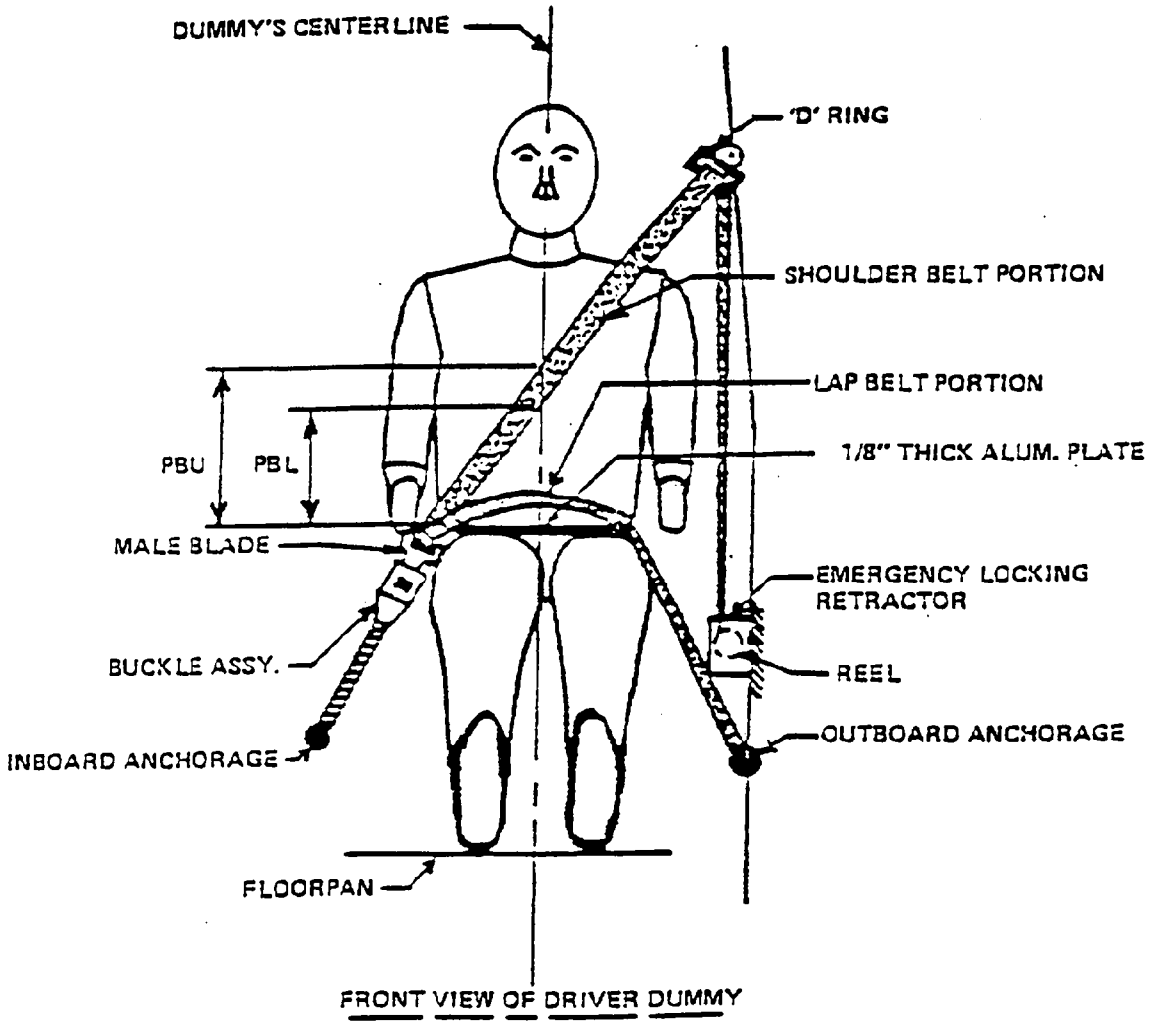
AD - Arm to Door
HD - H-Point to Door
HR - Head to Side Header
HS - Head to Side Window
KK - Knee to Knee
SHY- Striker to H-Point (Y Direction)





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

SEAT BELT POSITIONING DATA



(illustration)

		DRIVER DUMMY	PASSENGER DUMMY
PBU --	Top surface of alum. plate to upper edge (mm)	322	318
PBL --	Top surface of alum. plate to belt lower edge (mm)	250	238

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.	2700 mm	2598 mm
Shoulder belt length as measured on Part 572 Dummy.	988 mm	920 mm
Lap belt length as measured on Part 572 Dummy.	872 mm	848 mm

SHOULDER BELT SPOOL-OFF DATA:		
As determined by film analysis	25 mm	25 mm
As determined mechanically	41 mm	45 mm
As determined electronically	29 mm	27 mm

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

RETRACTOR LOCK-UP TIME:		
As determined by shoulder belt spool-off observed in on-board cameras	20 msec	20 msec

NR = Not Recorded

CAMERA LOCATIONS

VEH. NHTSA NO.: MR0305 ; TEST DATE: March 15, 1994 ; TIME: 3:14 p.m.

VEH. YEAR/MAKE/MODEL/BODY STYLE: 1994 Jeep Wrangler 2 Door

	VIEW	CAMERA POSITIONS (mm.)*			ANGLE (deg)	FILM PLANE TO HEAD TARGET	LENS (mm)	SPEED (fps)
		X	Y	Z				
1	Real-Time Left Side View						10	24
3	Left Front View	930	7700	1100	90°	7240	25	1005
15	Steering Column Top	1940	7850	1570	90°	7390	25	no timing
16	Steering Column Bottom	1940	7850	1040	90°	7390	25	1250
12	Left Driver Close-up	1300	8300	1100	90°	7840	50	1000
9	Left Angle	5300	6400	2240	50°		50	615
13	Driver Onboard Seat Belt						35	1111
14	Passenger Onboard Seat Belt						35	870
2	Right Overall	2000	-6100	1150	90°	5640	13	1111
17	Right Front	800	-7350	1100	90°	6890	25	no timing
11	Right Passenger Close-up	1350	-5800	1100	90°	5340	25	1010
10	Right Angle	4500	-5450	2250	50°		35	1026
4	Top View Wide	300	0	4370			13	1183
8	Top Driver	-400	300	2440			13	1015
7	Top Passenger	-400	-400	2440			13	1111
5*	Pit Engine	1000	0	-3150			13	N/A
6	Pit Fuel Tank	2300	0	-3150			13	1005

COORDINATES:

* X = film plane to monorail centerline

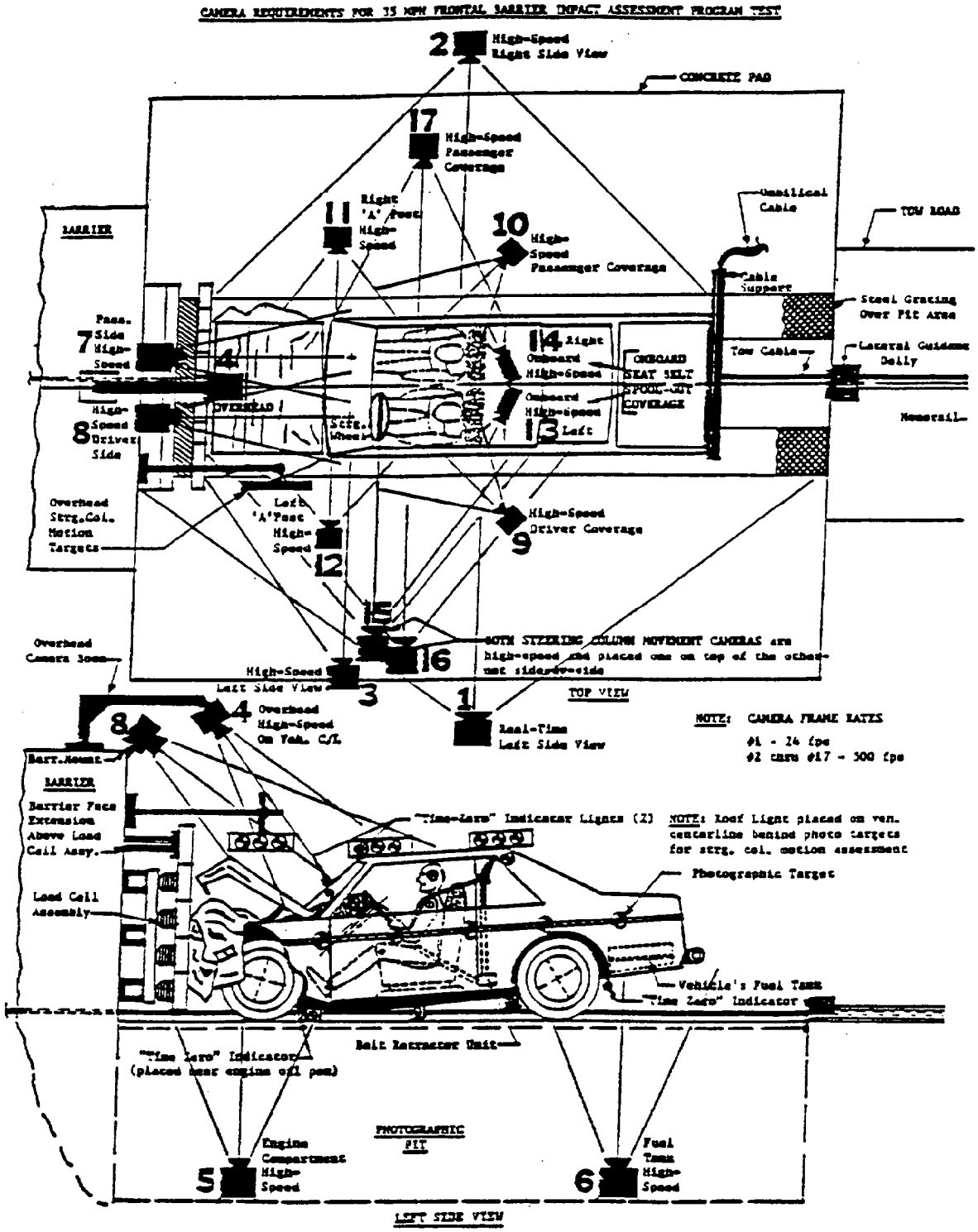
Y = film plane to barrier face

Z = film plane to ground

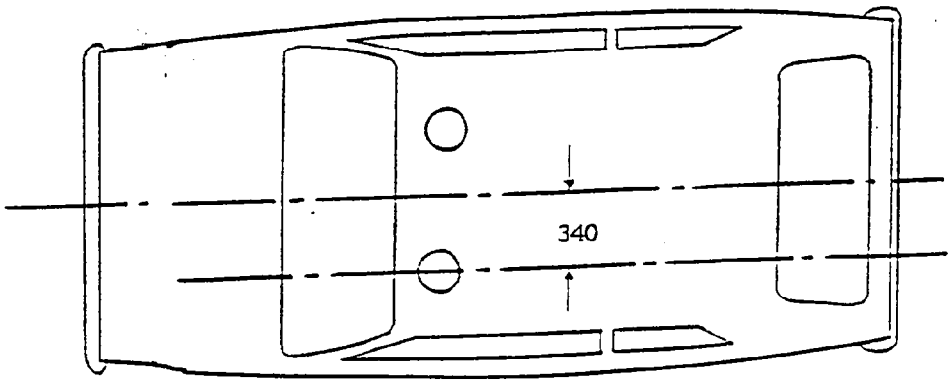
ORIGIN: For X and Y it is the Impact Point. For Z it is the Floor.

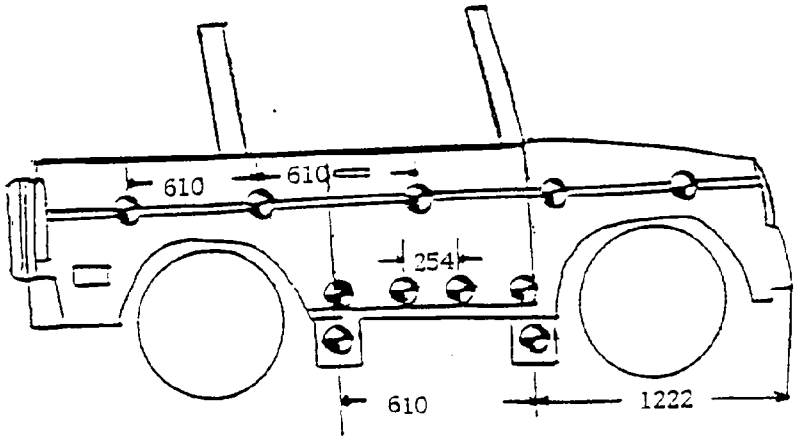
* The pit engine camera did not run during impact.

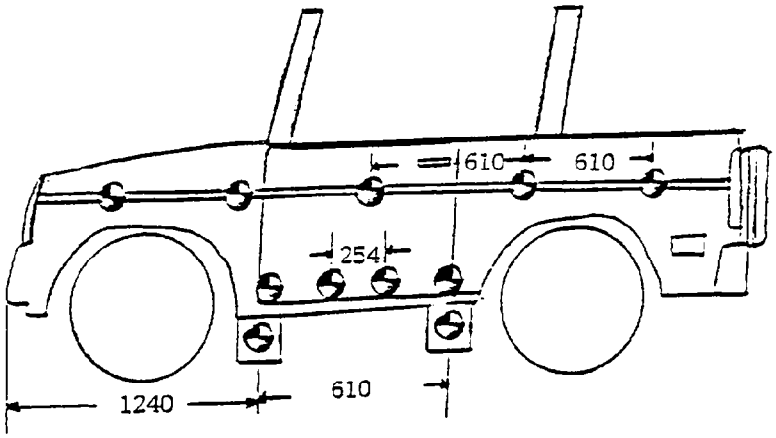
CAMERA LOCATIONS (CONTINUED)



VEHICLE TARGET LOCATIONS







(DIMENSIONS IN MM)

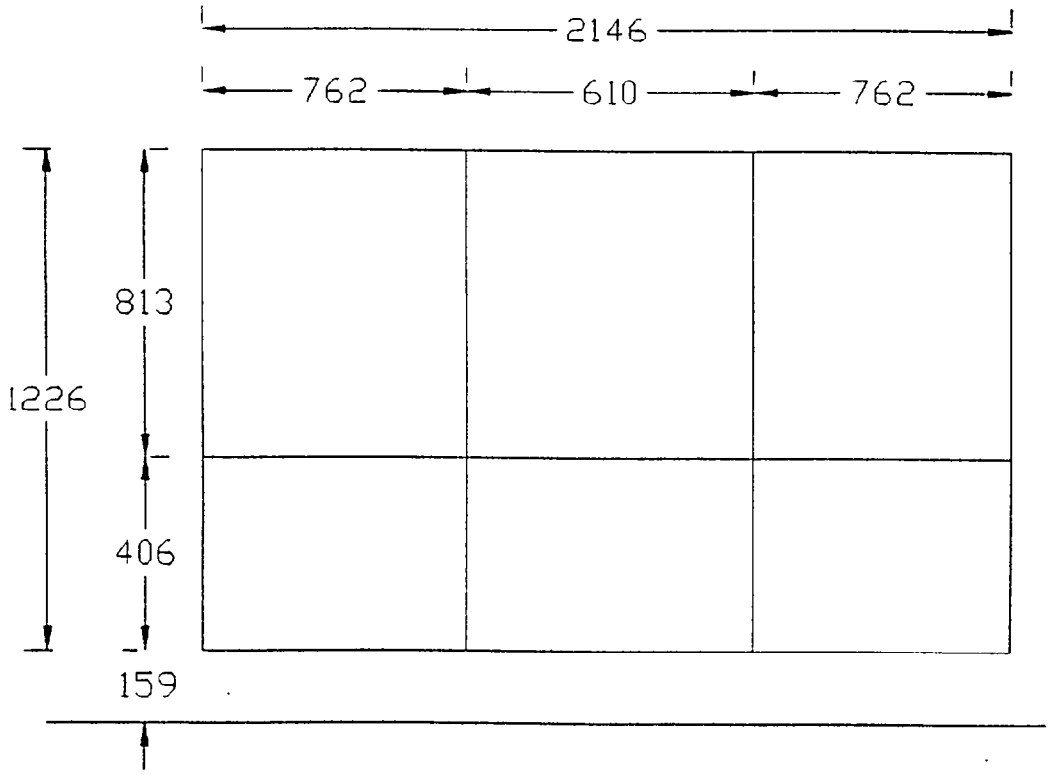
LOAD CELL LOCATIONS ON FIXED BARRIER

30 Load Cells

6 Rows

9 Columns

6 Groupings (5 cells/group)

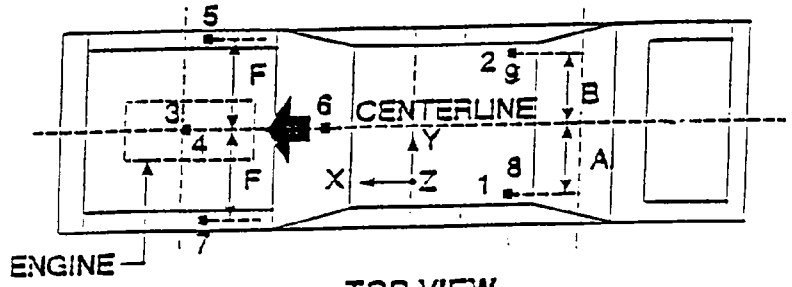


The following data is presented in Appendix B:

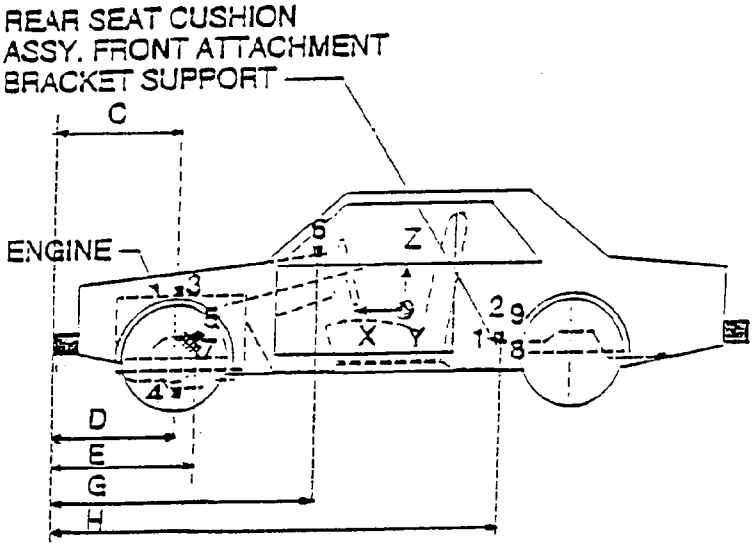
(1) Total or Sum of 30 individual load cells

(2) Data from 6 Groupings shown above (5 cells/group)

VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY



TOP VIEW



LEFT SIDE VIEW

Units: (mm)

Dimension	Length
A	-435
B	435
C	955
D	1035
E	790
F	440
G	1600
H	2450
J	-520

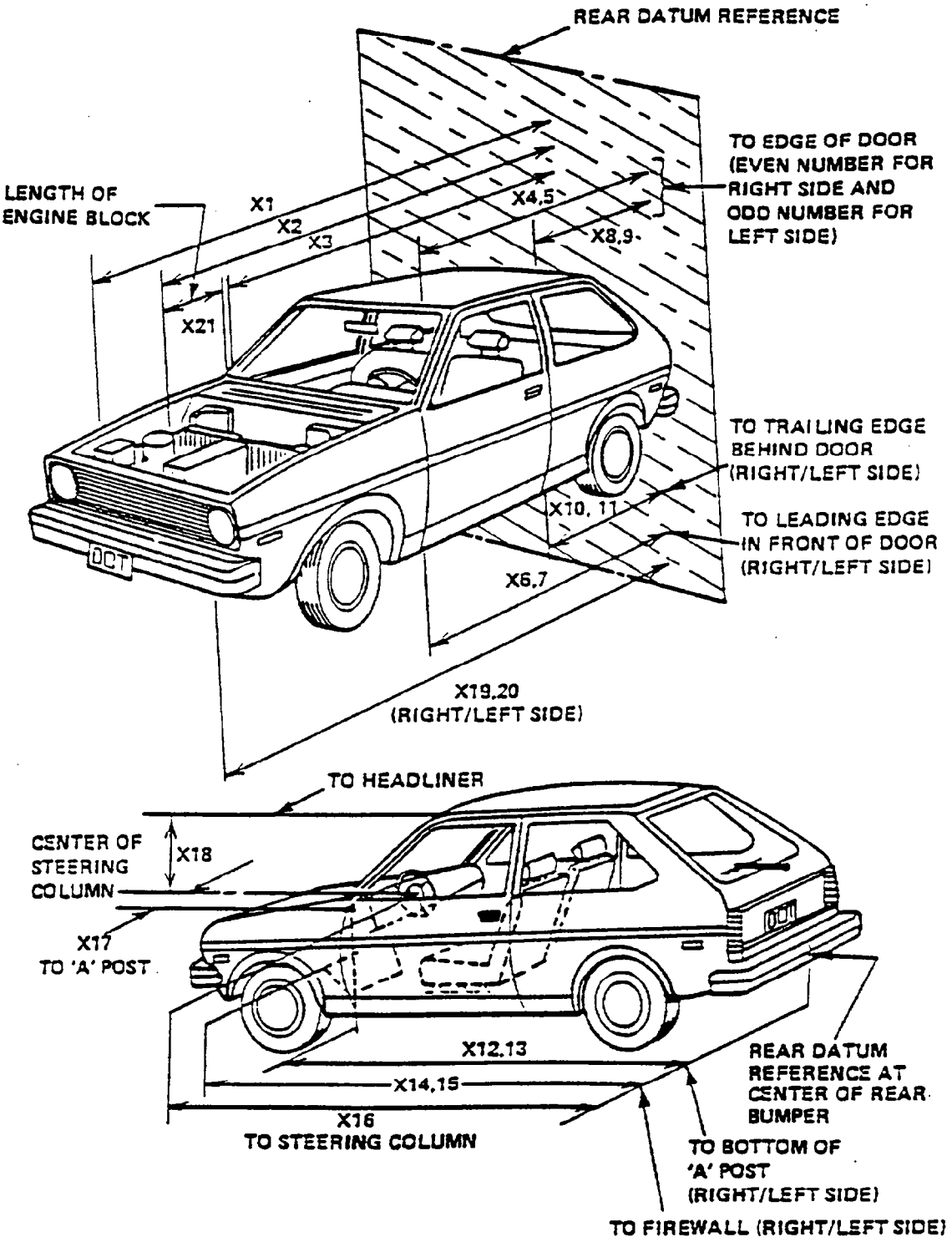
ACCELEROMETER	ACCELEROMETER LOCATION	DIRECTIO
1 and 8	Left Rear Seat Crossmember	X
2 and 9	Right Rear Seat Crossmember	X
3	Top of Engine	X
4	Bottom of Engine	X
5	Right Side Brake Caliper	X
6	Instrument Panel	X
7	Left Disc Brake Caliper	X

* 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	3655	3274	381
X2	Rear Surface of Vehicle to Front of Engine	2818	2723	95
X3	Rear Surface of Vehicle to Firewall	2387	2346	41
X4	Rear Surface to Upr. Leading Edge of Rt. Door	2010	2101	-91
X5	Rear Surface to Upr. Leading Edge of Left Door	2051	2107	-56
X6	Rear Surface to Lwr. Leading Edge of Rt. Door	2060	2059	1
X7	Rear Surface to Lwr. Leading Edge of Left Door	2059	2068	-9
X8	Rear Surface to Upr. Trailing Edge of Rt. Door	1164	1210	-46
X9	Rear Surface to Upr. Trailing Edge of Left Door	1154	1221	-67
X10	Rear Surface to Lwr. Trailing Edge of Rt. Door	2098	2127	-29
X11	Rear Surface to Lwr. Trailing Edge of Left Door	1216	1252	-36
X12	Rear Surface to Bottom of 'A' Post on Rt. Side	2045	2058	-13
X13	Rear Surface to Bottom of 'A' Post on Left Side	2064	2064	0
X14	Rear Surface to Firewall on Right Side	2385	2298	87
X15	Rear Surface to Firewall on Left Side	2390	2357	33
X16	Rear Surface to Steering Column	1762	1698	64
X17	Center of Steering Column to 'A' Post	431	535	-104
X18	Center of Steering Column to Headlining	964	638	326
X19	Rear Surface to Right Side of Front Bumper	3655	3538	117
X20	Rear Surface to Left Side of Front Bumper	3655	3006	649
X21	Length of Engine Block	510	510	0

TEST VEHICLE MEASUREMENTS



ACCIDENT INVESTIGATION DIVISION DATA

FOR 35 MPH FRONTAL BARRIER IMPACT

VEHICLE MAKE/MODEL/BODY STYLE: 1994 Jeep/Wrangler/2 Door

VEH. NHTSA NO.: MR0305 ; VIN: 1J4FY19P7RP422208

MODEL YEAR: 1994 ; BUILD DATE: 10-93 ; TEST DATE: 3-15-94

VEH. SIZE CATEGORY: MPV ; TEST WEIGHT: 1553 kg

VEH. WHEELBASE: 3813 mm ; FRONT OVERHANG: 635 mm ; OVERALL WIDTH: 1676 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: 56.5 kph ; TIME OF SEPARATION: 81 msec

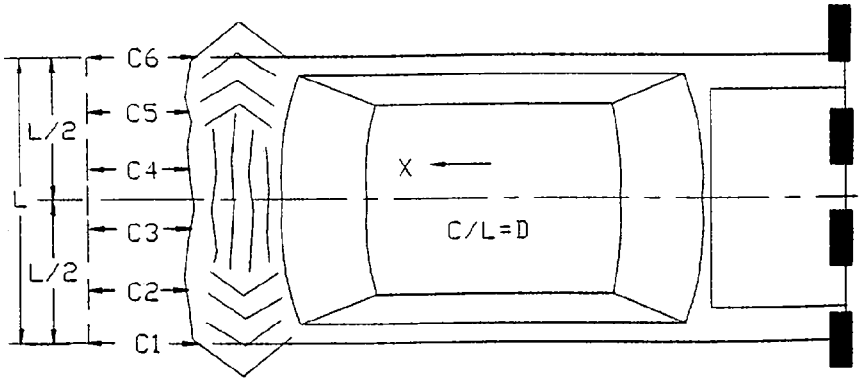
VELOCITY CHANGE: 68.5 kph

COLLISION DEFORMATION CLASSIFICATION (CDC) CODE:

F (Frontal)

CRUSH DEPTH DIMENSIONS:

C1 = 649 mm
C2 = 527 mm
C3 = 432 mm
C4 = 317 mm
C5 = 222 mm
C6 = 117 mm



MIDPOINT OF DAMAGE: D = Vehicle Centerline (Longitude)

LENGTH OF DAMAGED REGION: L = 1370 mm

APPENDIX A

PHOTOGRAPHS

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Photo No. 35 - Rollover 270°	A-35
Photo No. 36 - Rollover 360°	A-36
Photo No. 37 - Vehicle Certification	A-37

Photo No. 1 - Pre-Test Front View

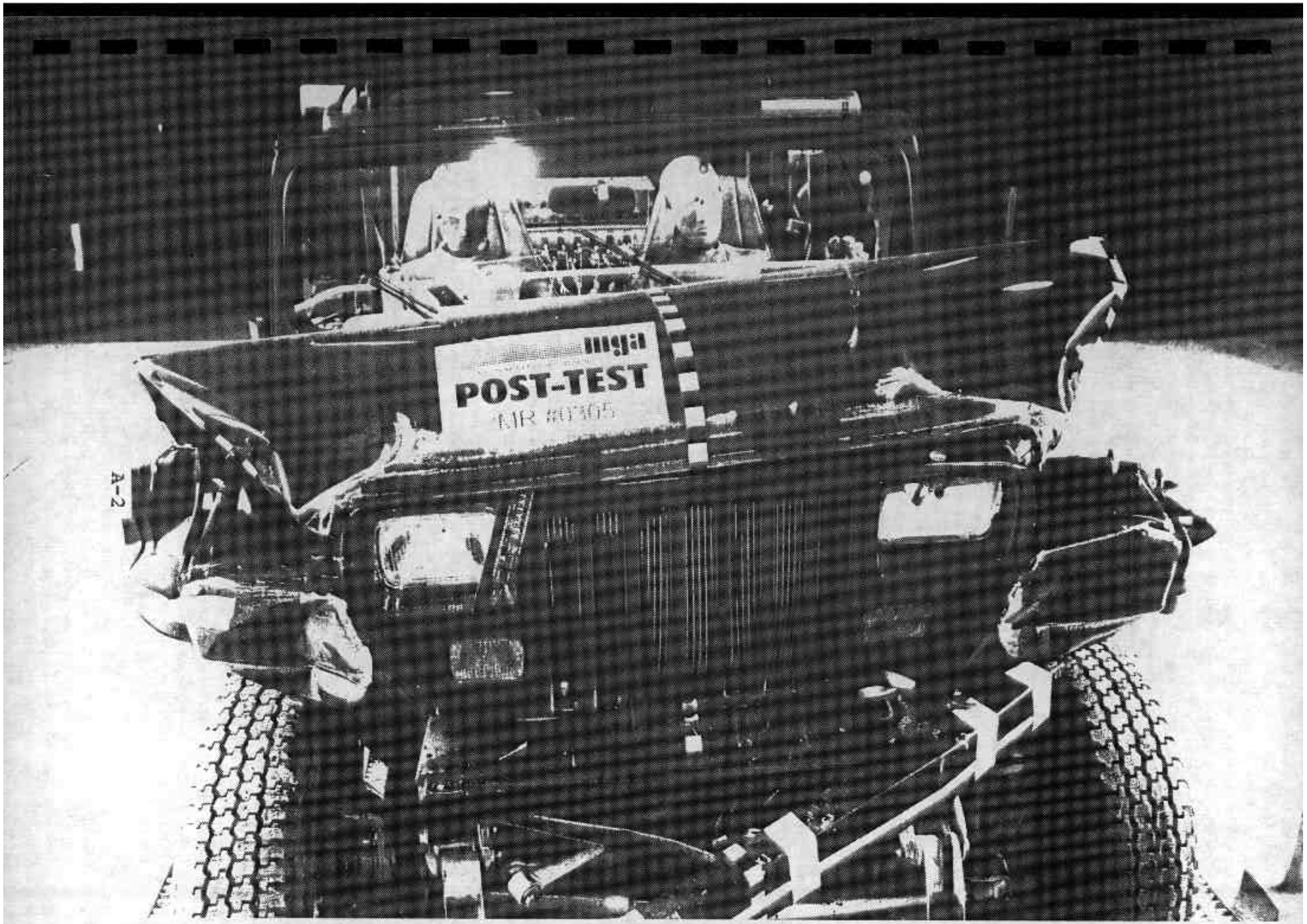


Photo No. 2 - Post-Test Front View

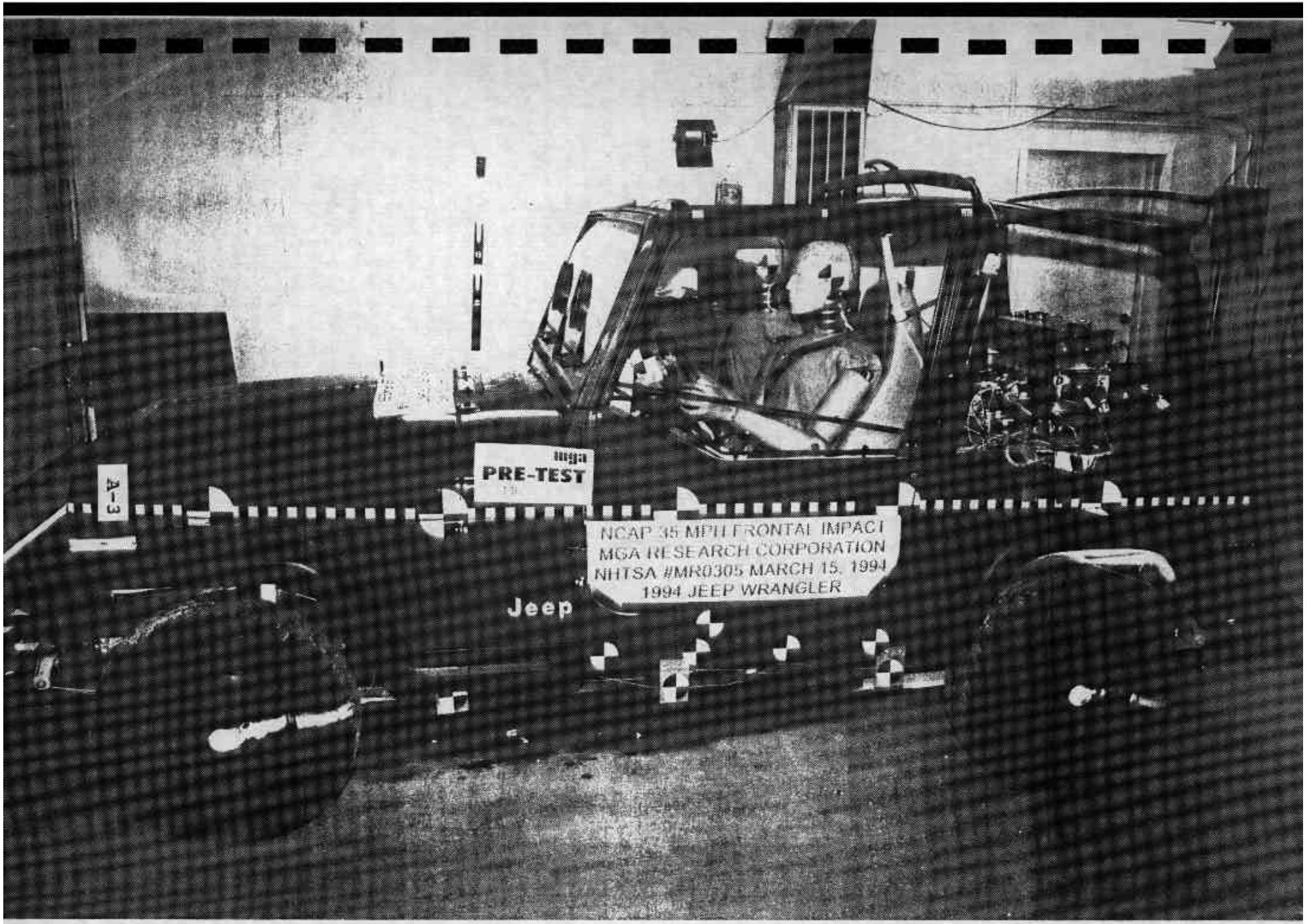


Photo No. 3 - Pre-Test Left Side View

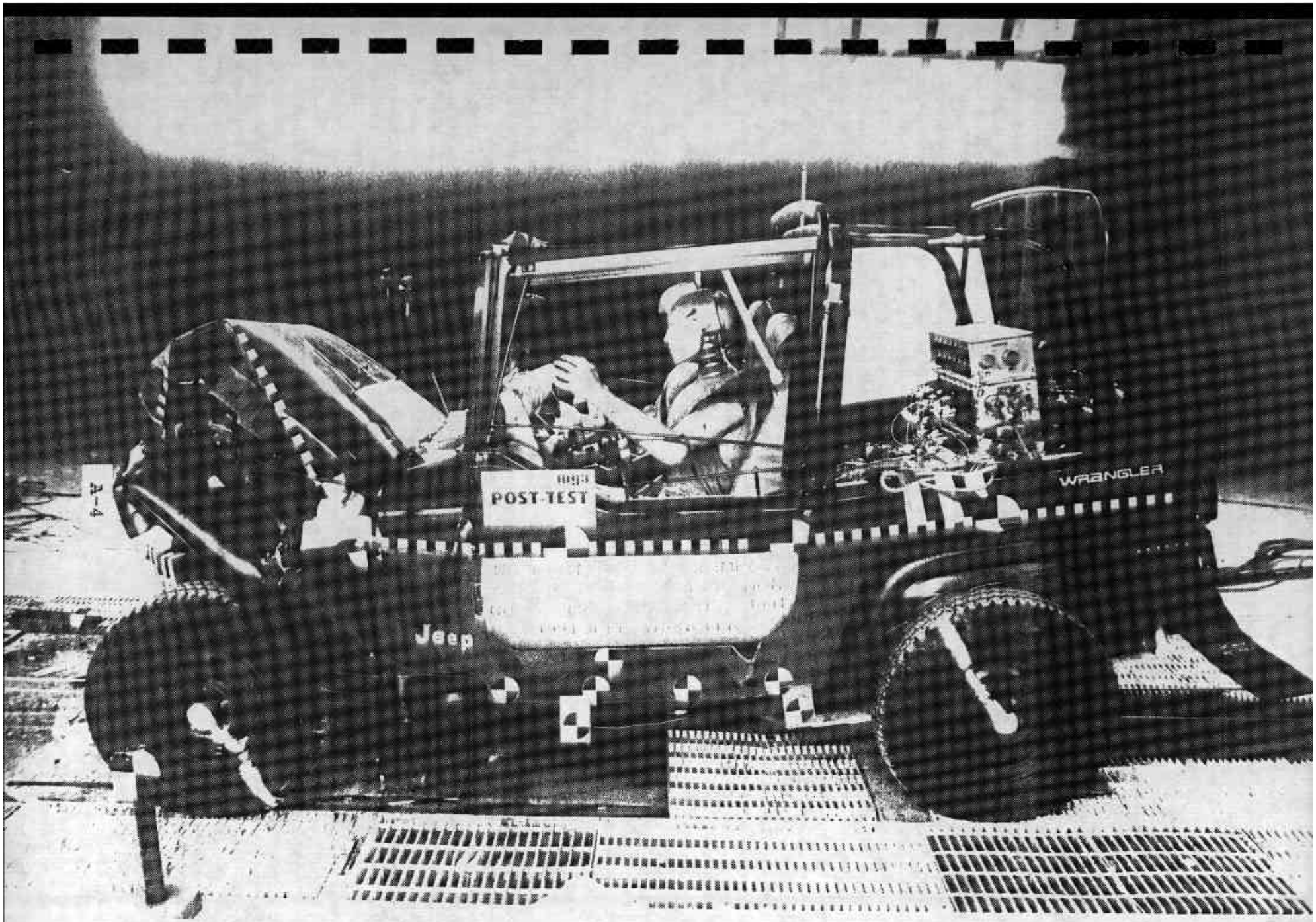


Photo No. 4 - Post-Test Left Side View

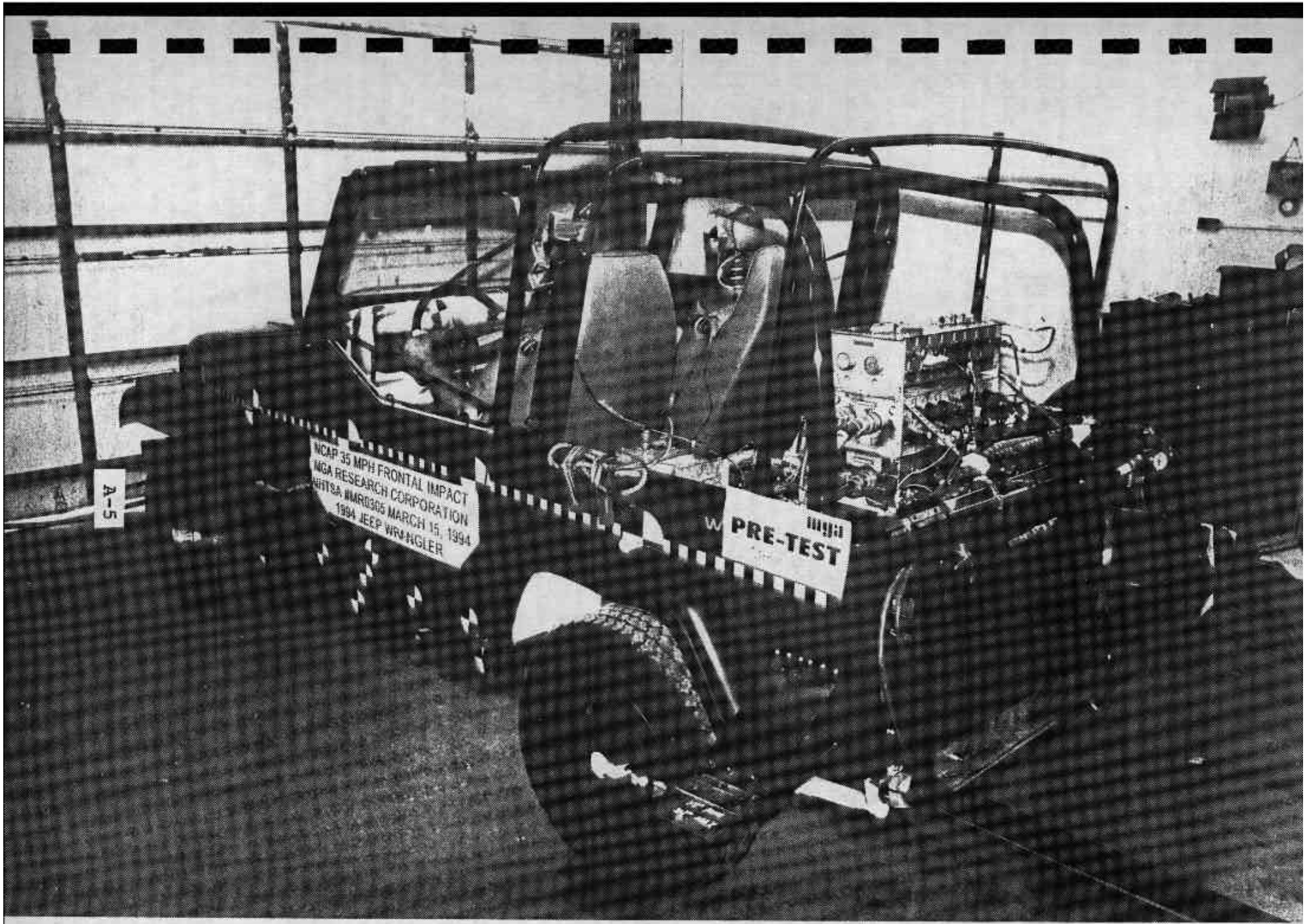


Photo No. 5 - Pre-Test Left Rear Three-Quarter View

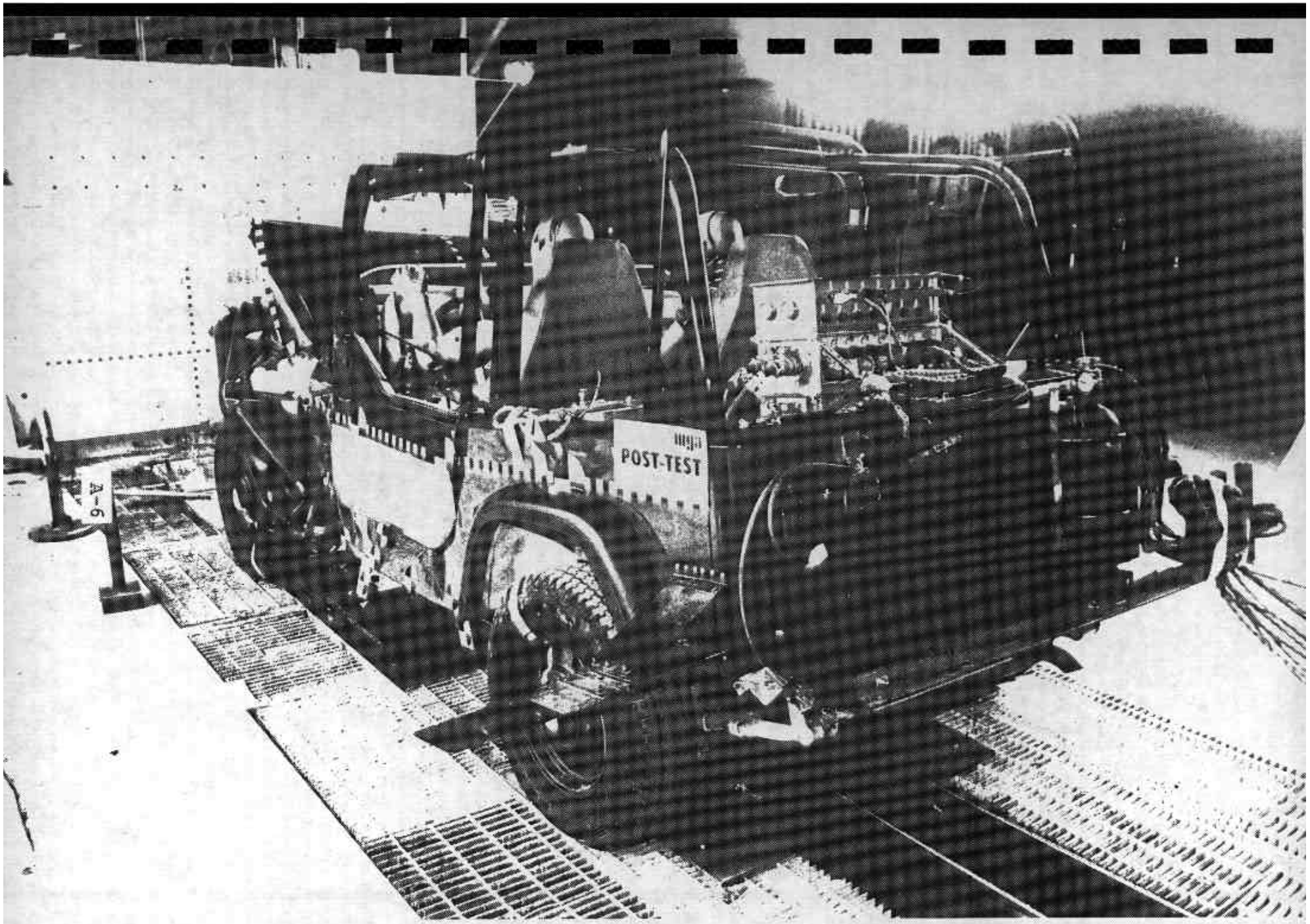


Photo No. 6 - Post-Test Left Rear Three-Quarter View

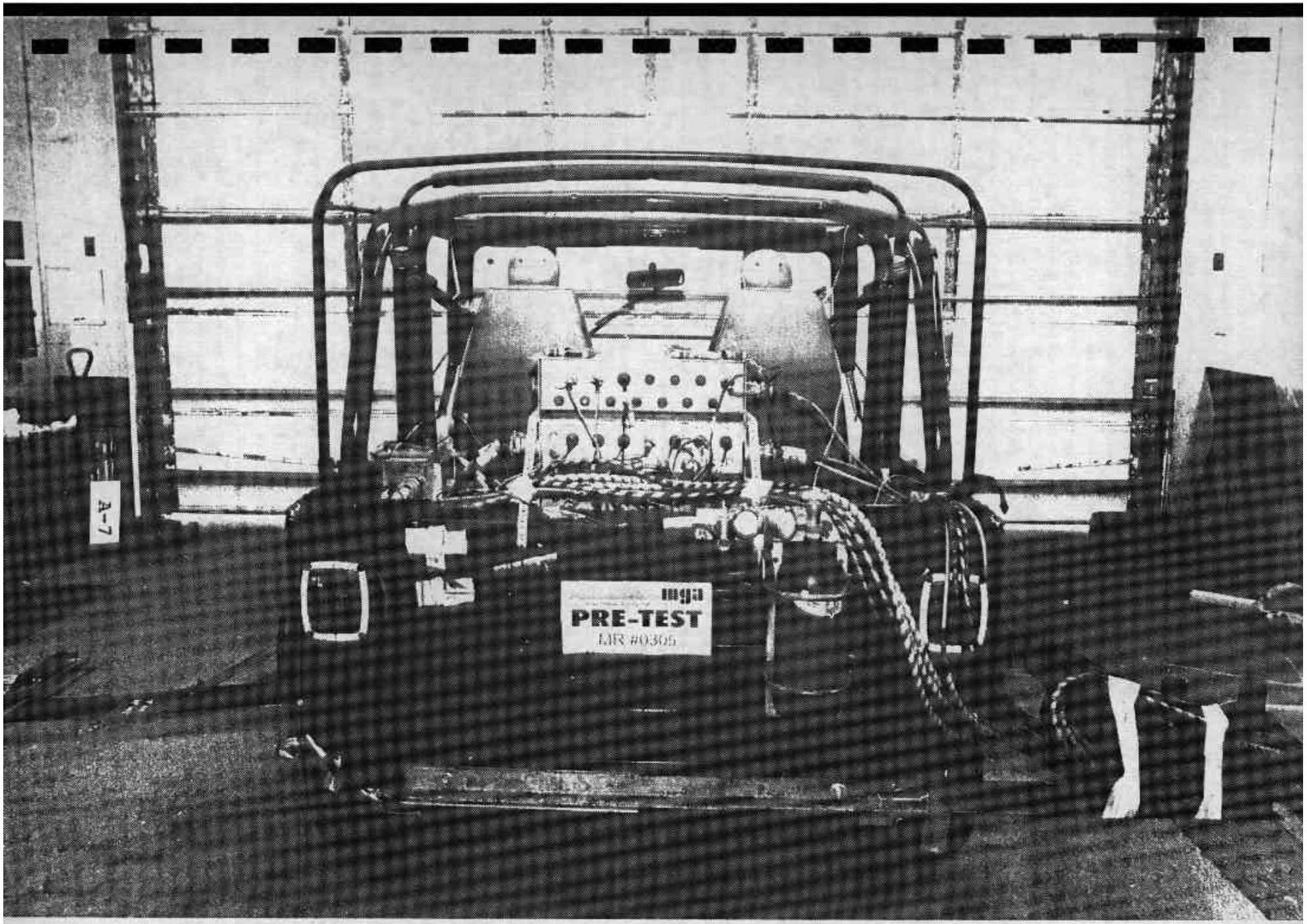
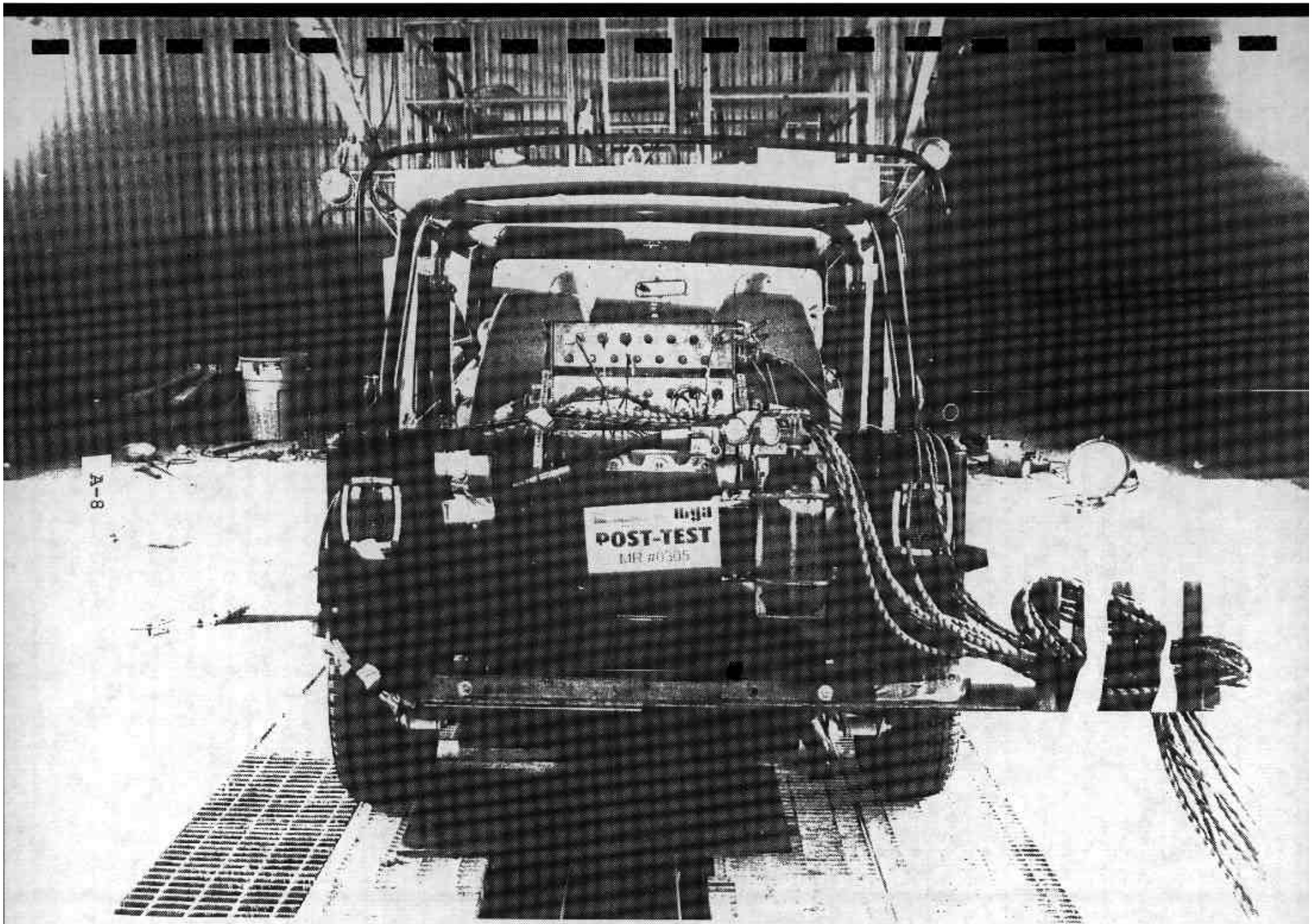


Photo No. 7 - Pre-Test Rear View



A-8

Photo No. 8 - Post-Test Rear View

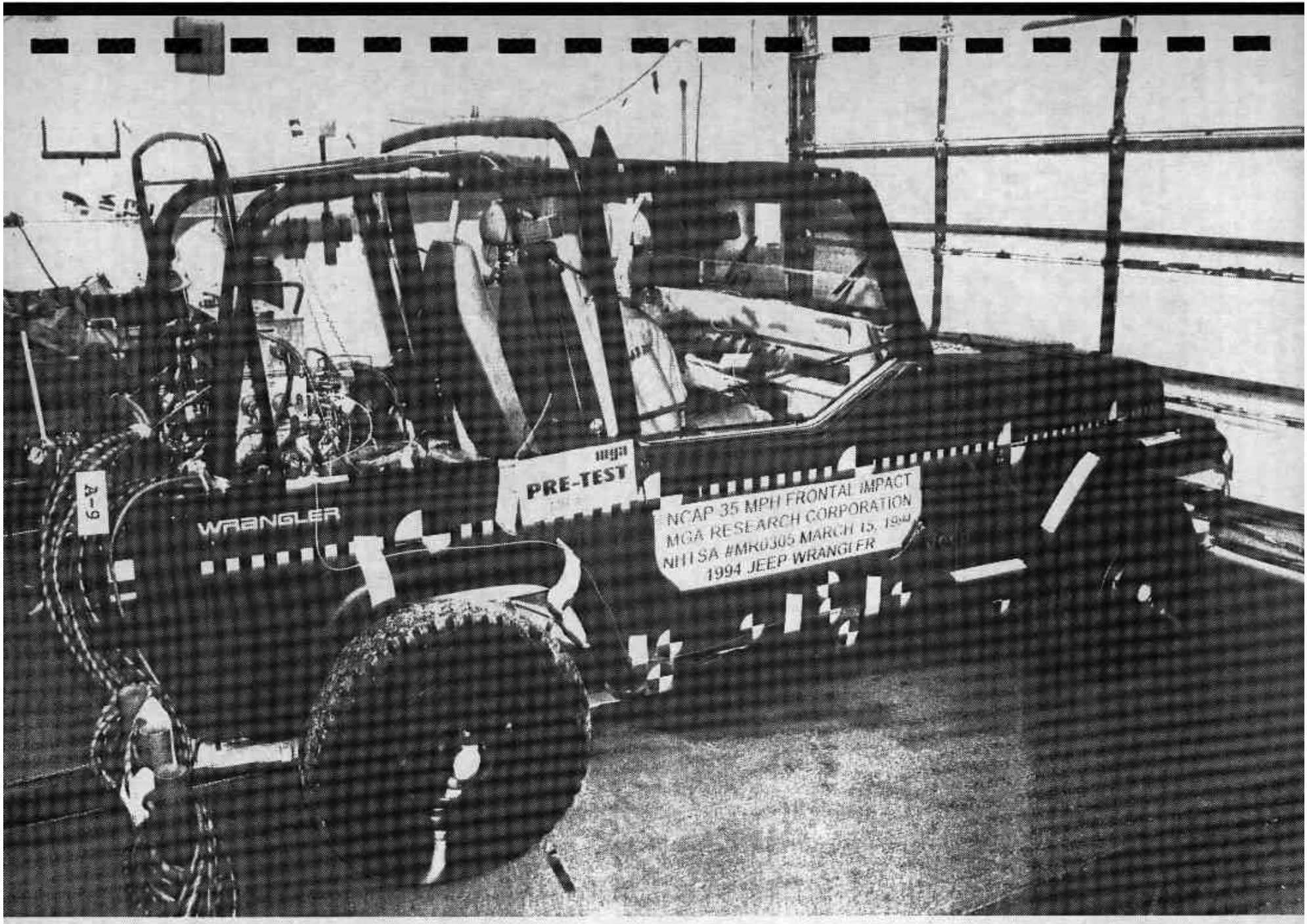


Photo No. 9 - Pre-Test Right Side View

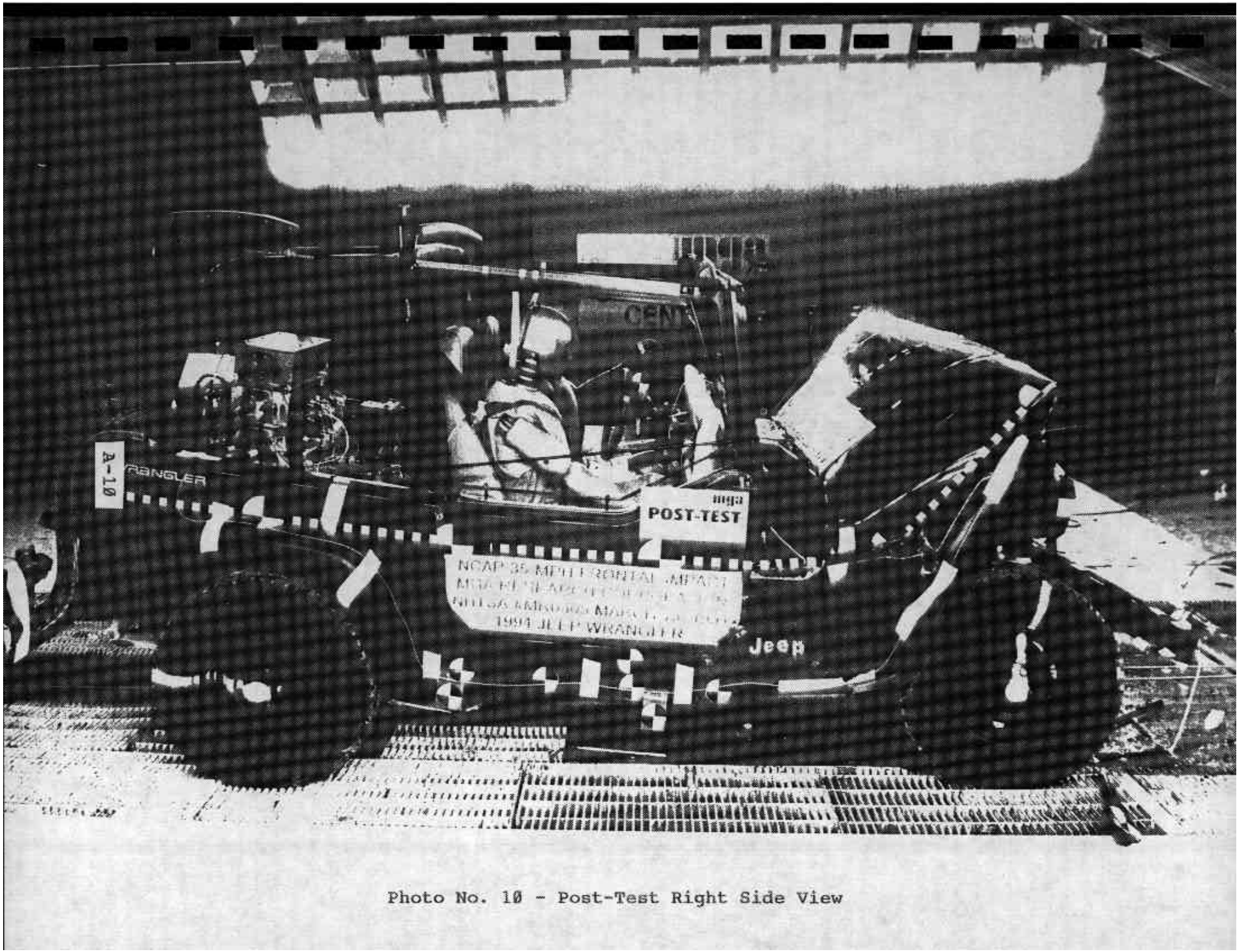
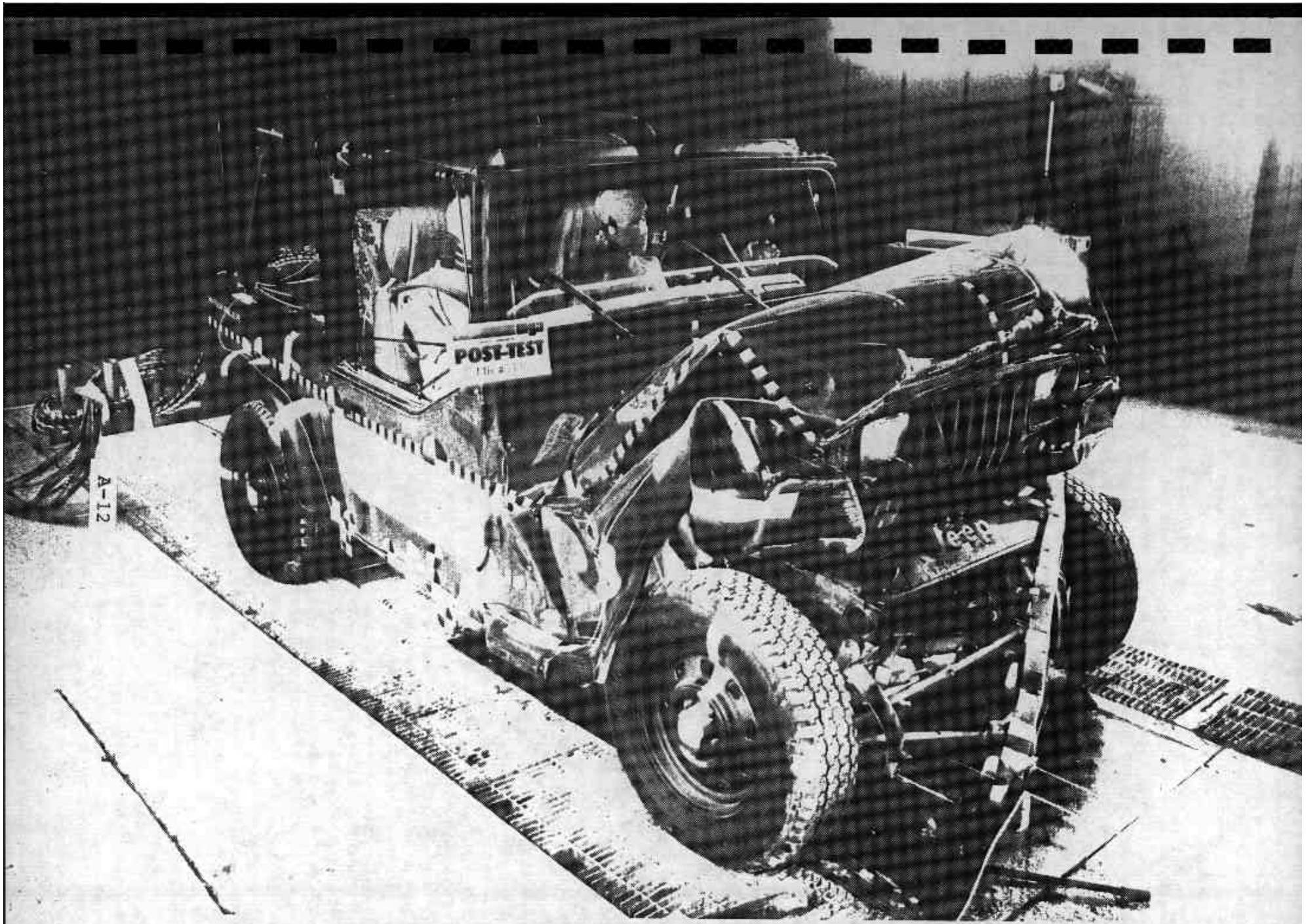


Photo No. 10 - Post-Test Right Side View

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



A-12

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

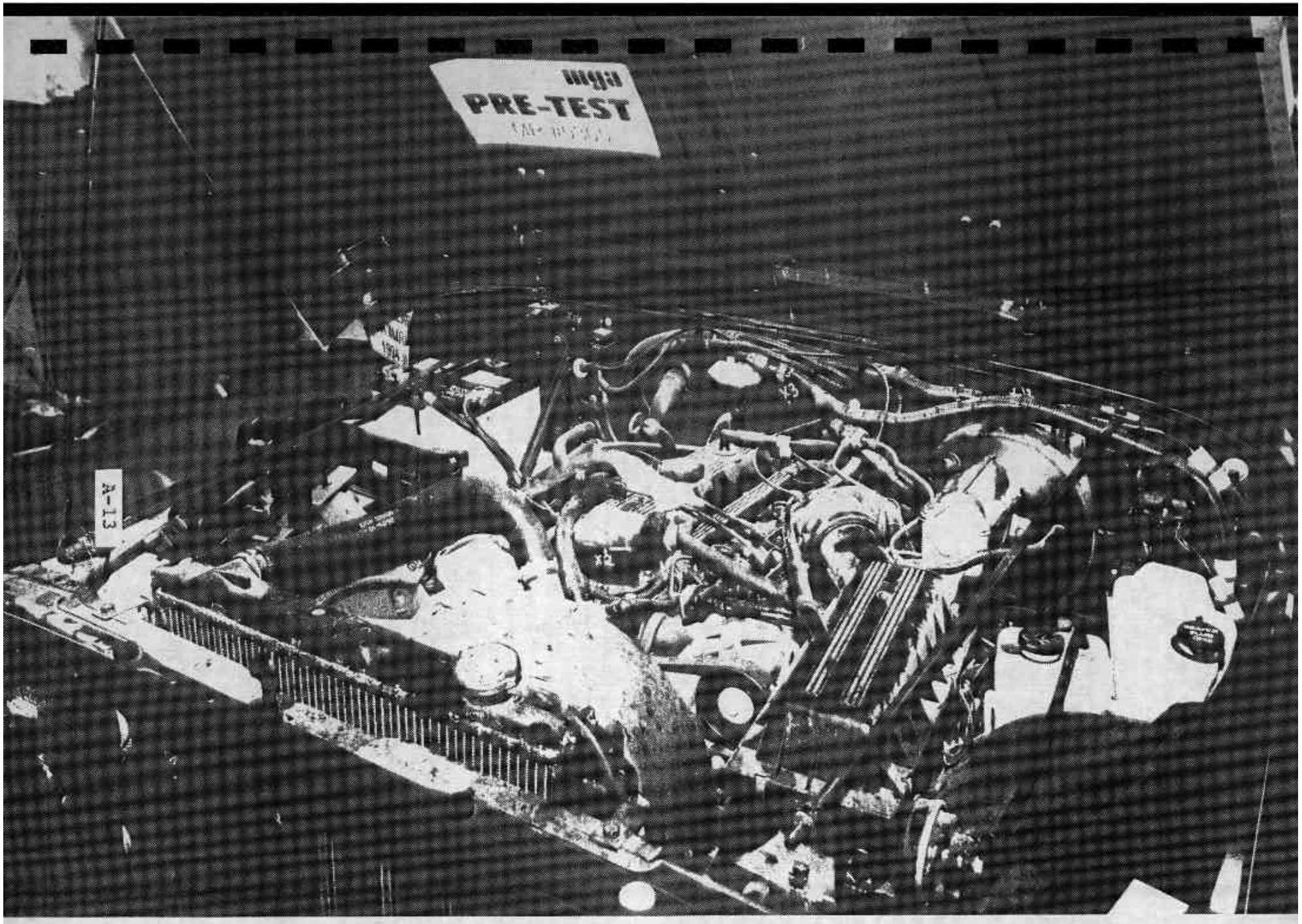


Photo No. 13 - Pre-Test Engine Compartment View

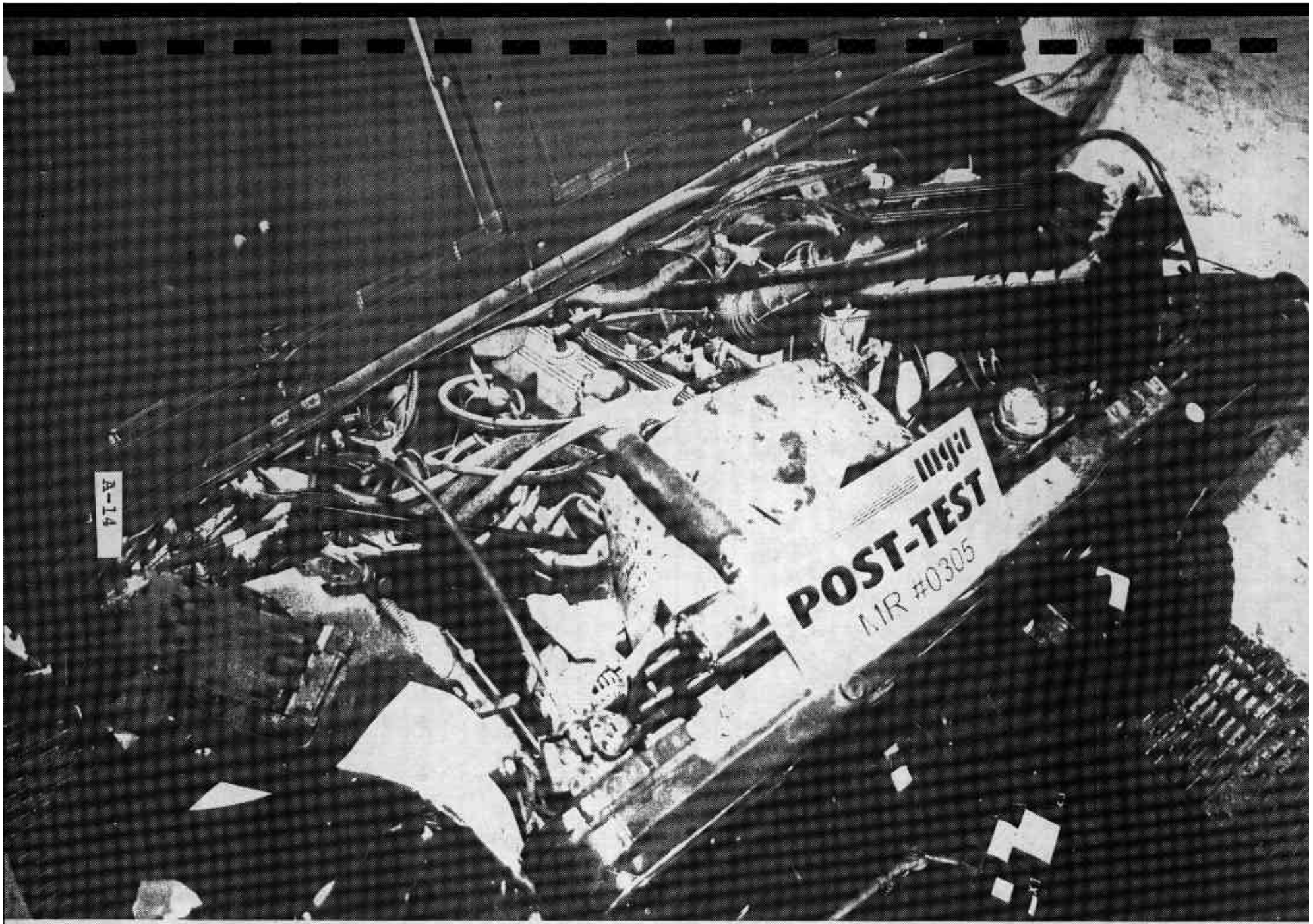


Photo No. 14 - Post-Test Engine Compartment View

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

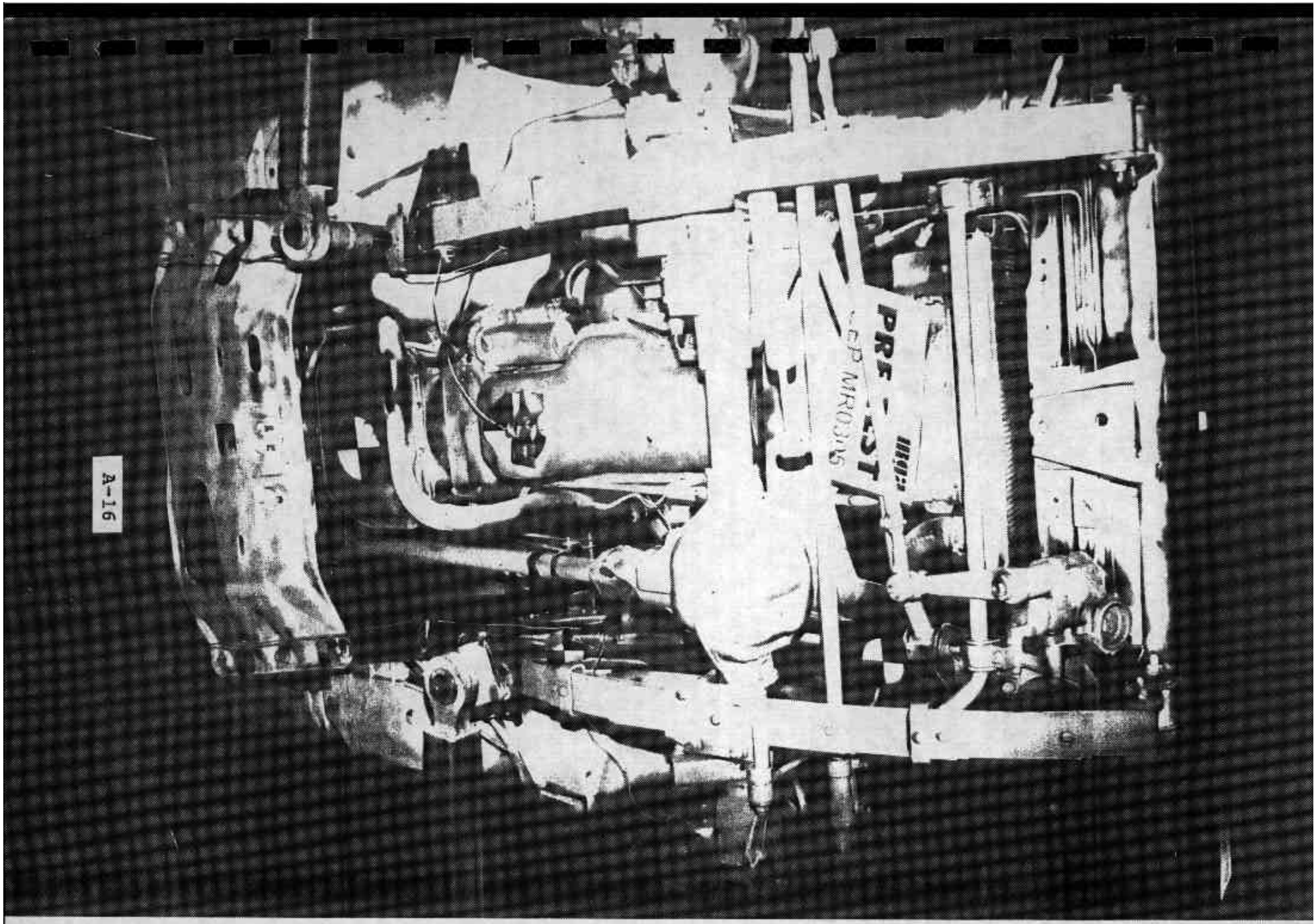


Photo No. 16 - Pre-Test Front Underbody View

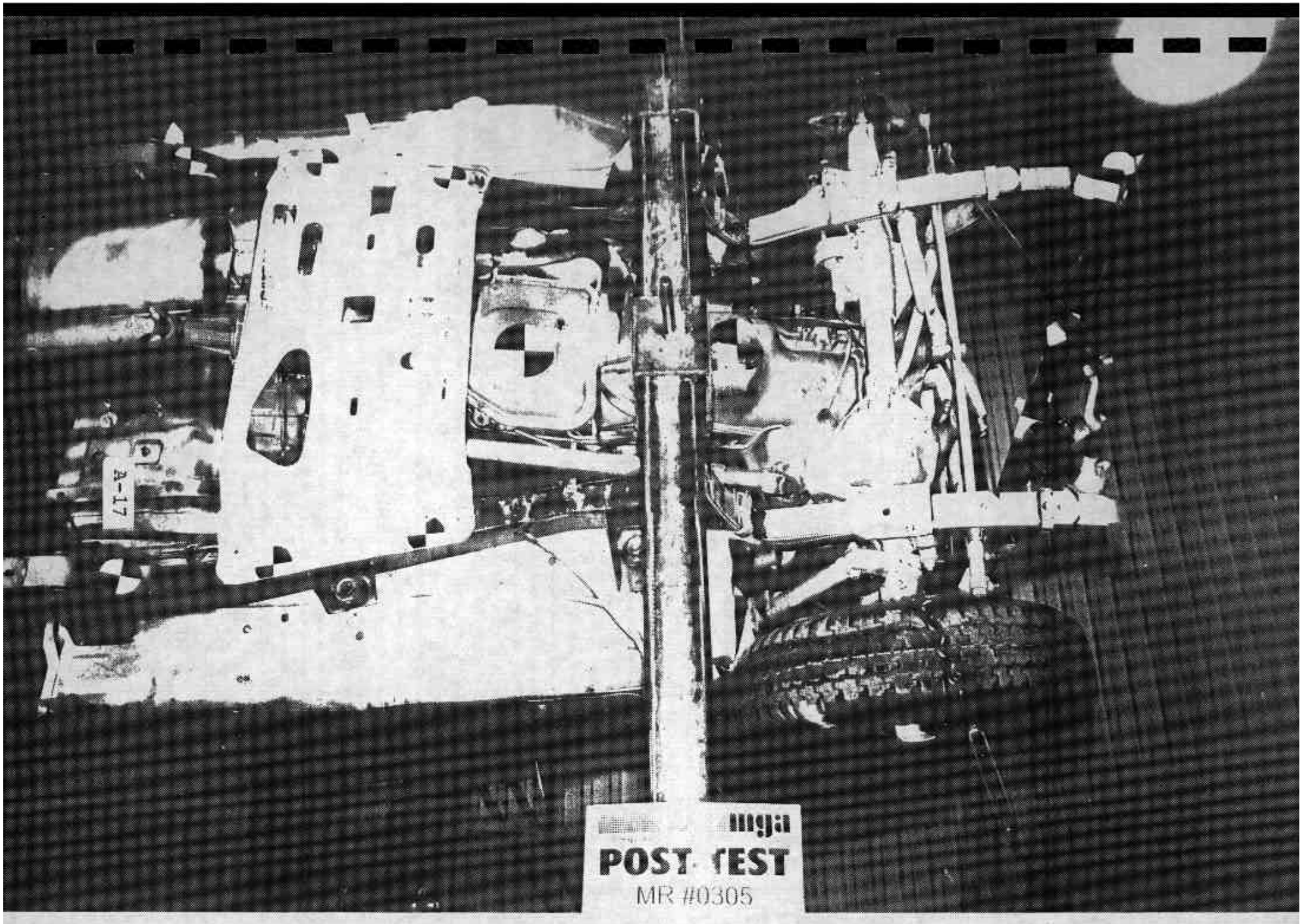


Photo No. 17 - Post-Test Front Underbody View

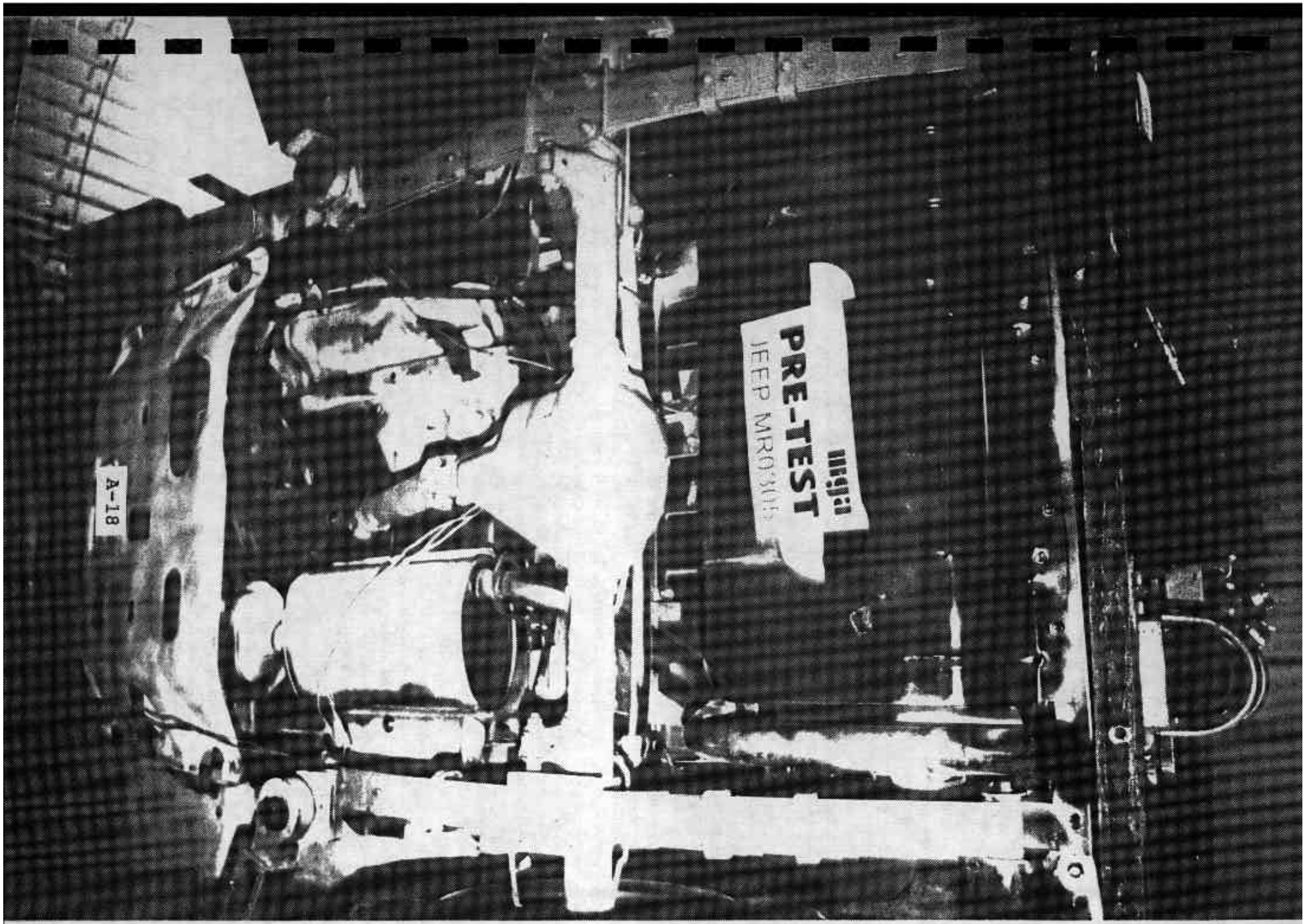


Photo No. 18 - Pre-Test Rear Underbody View

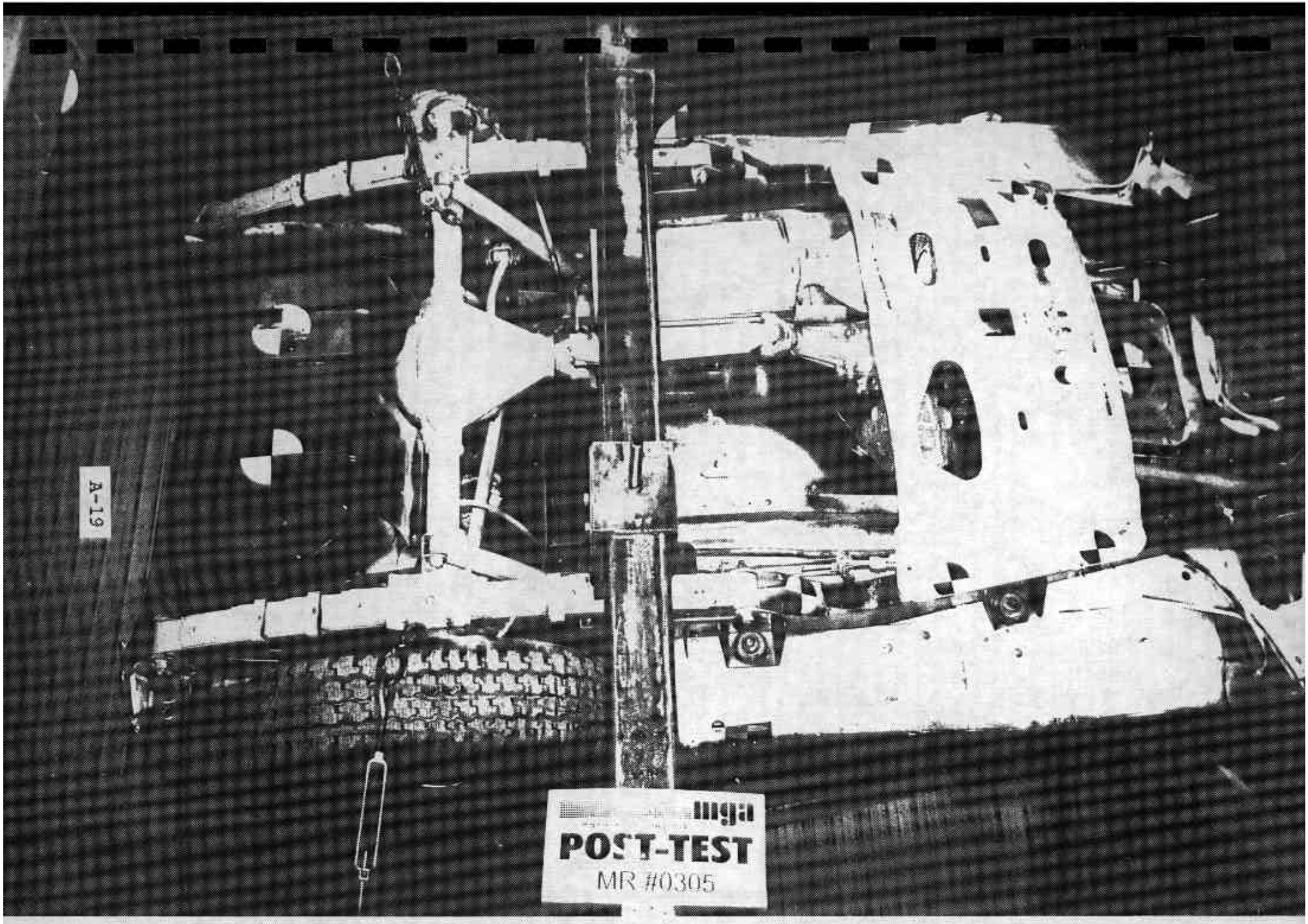


Photo No. 19 - Post-Test Rear Underbody View

Photo No. 20 - Pre-Test Windshield View

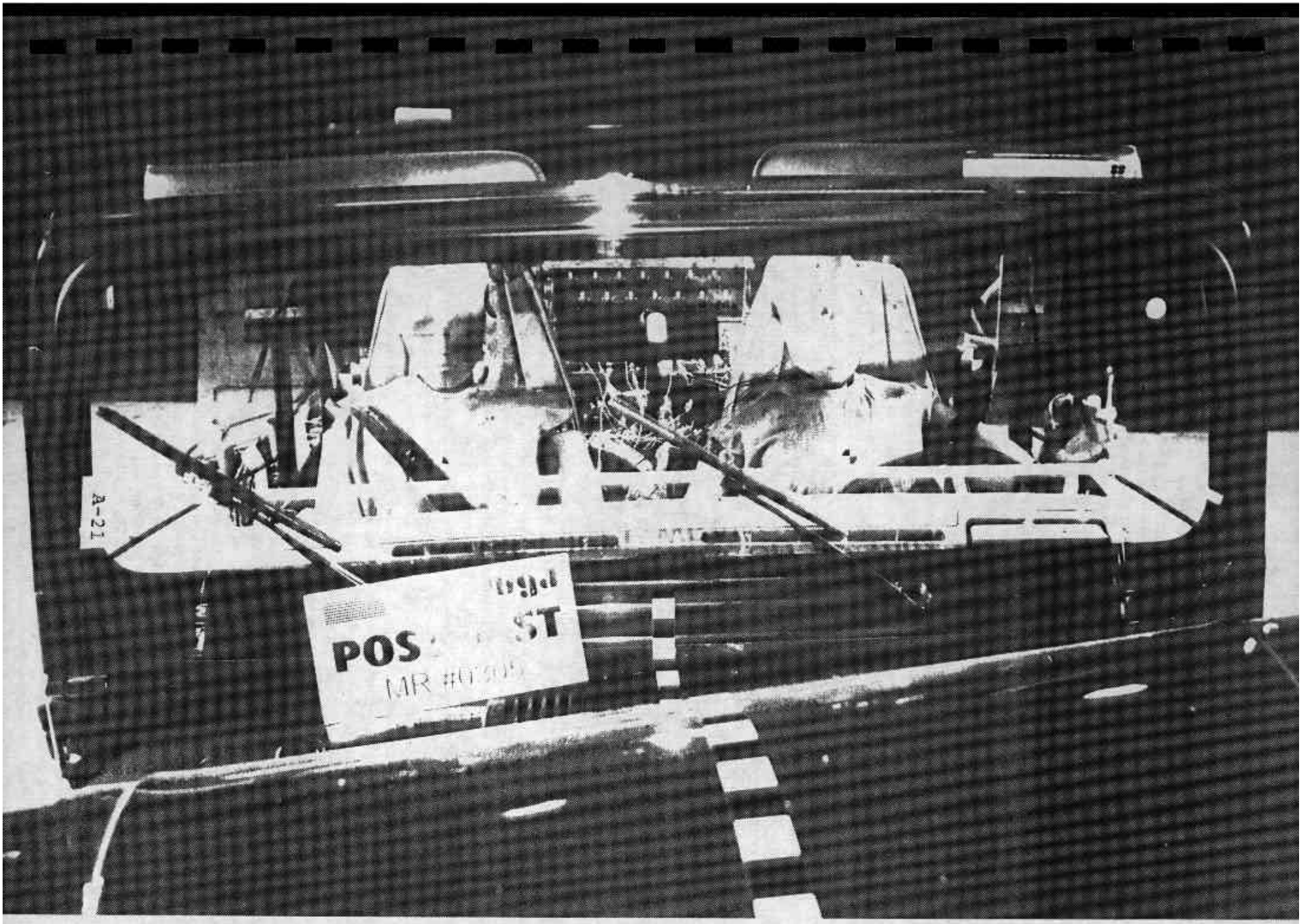


Photo No. 21 - Post-Test Windshield View

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

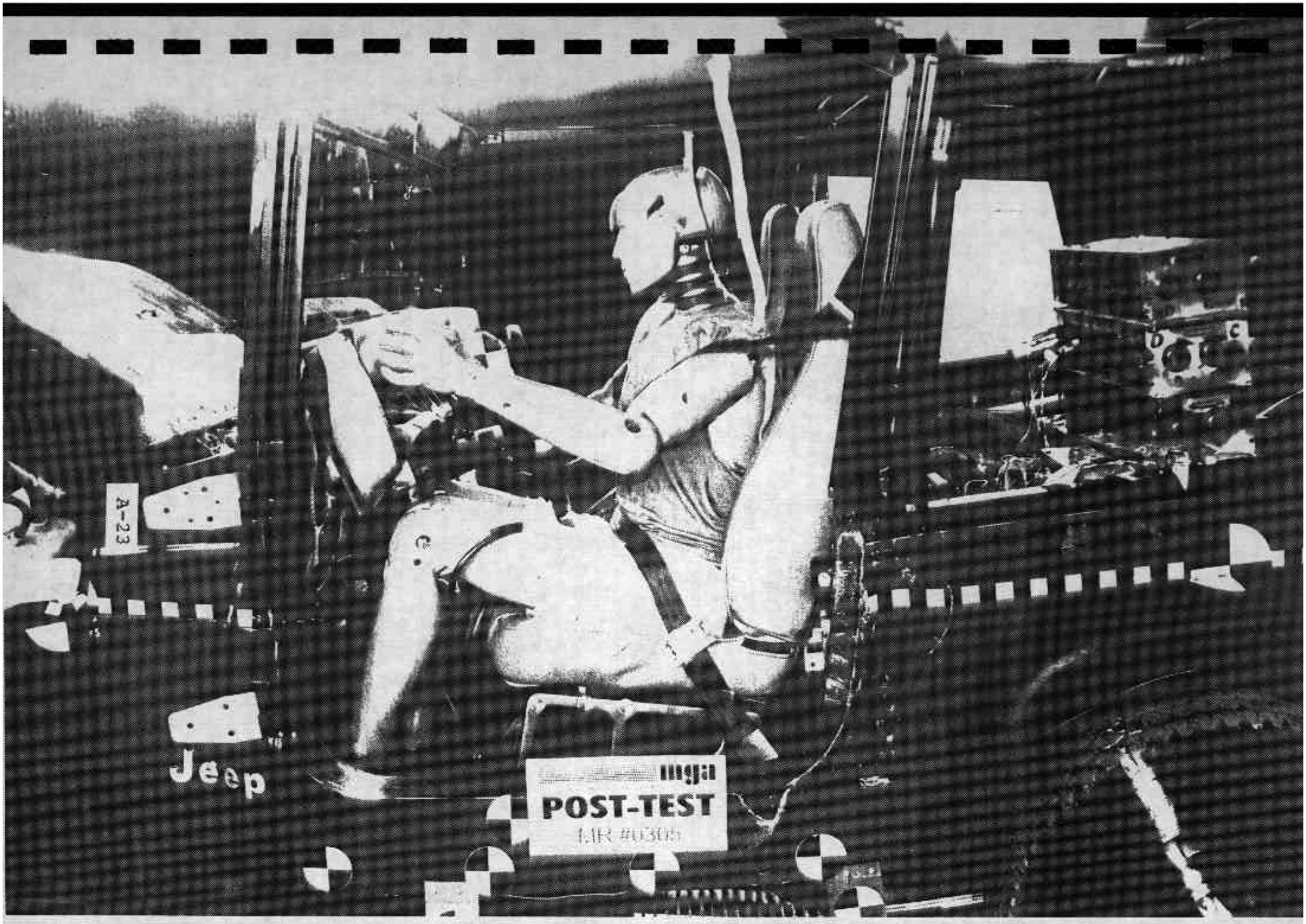


Photo No. 23 - Post-Test Driver Dummy Position View (Door Open)

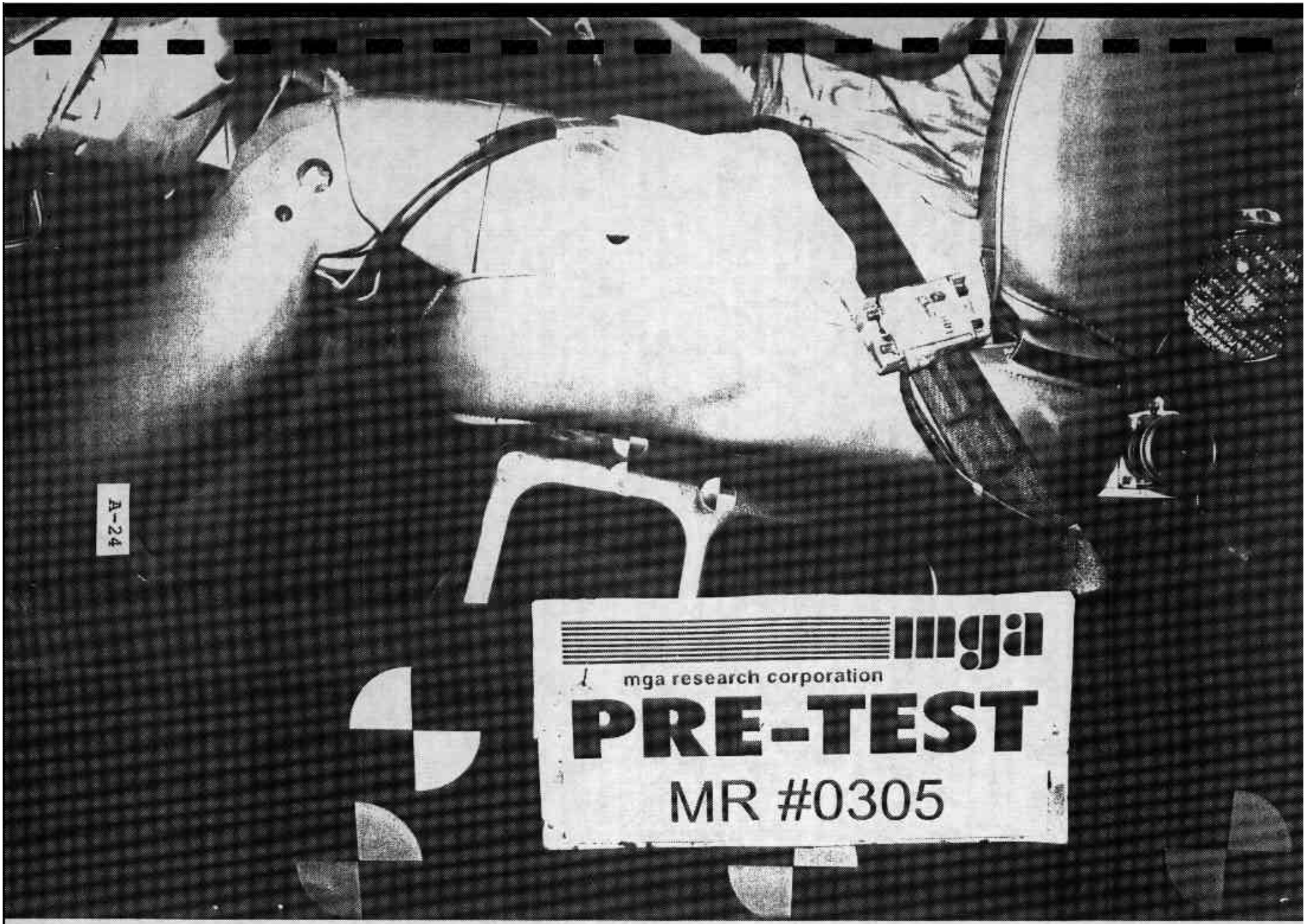


Photo No. 24 - Pre-Test Driver Seat Position View

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

Photo No. 26 - Pre-Test Passenger Dummy Position View

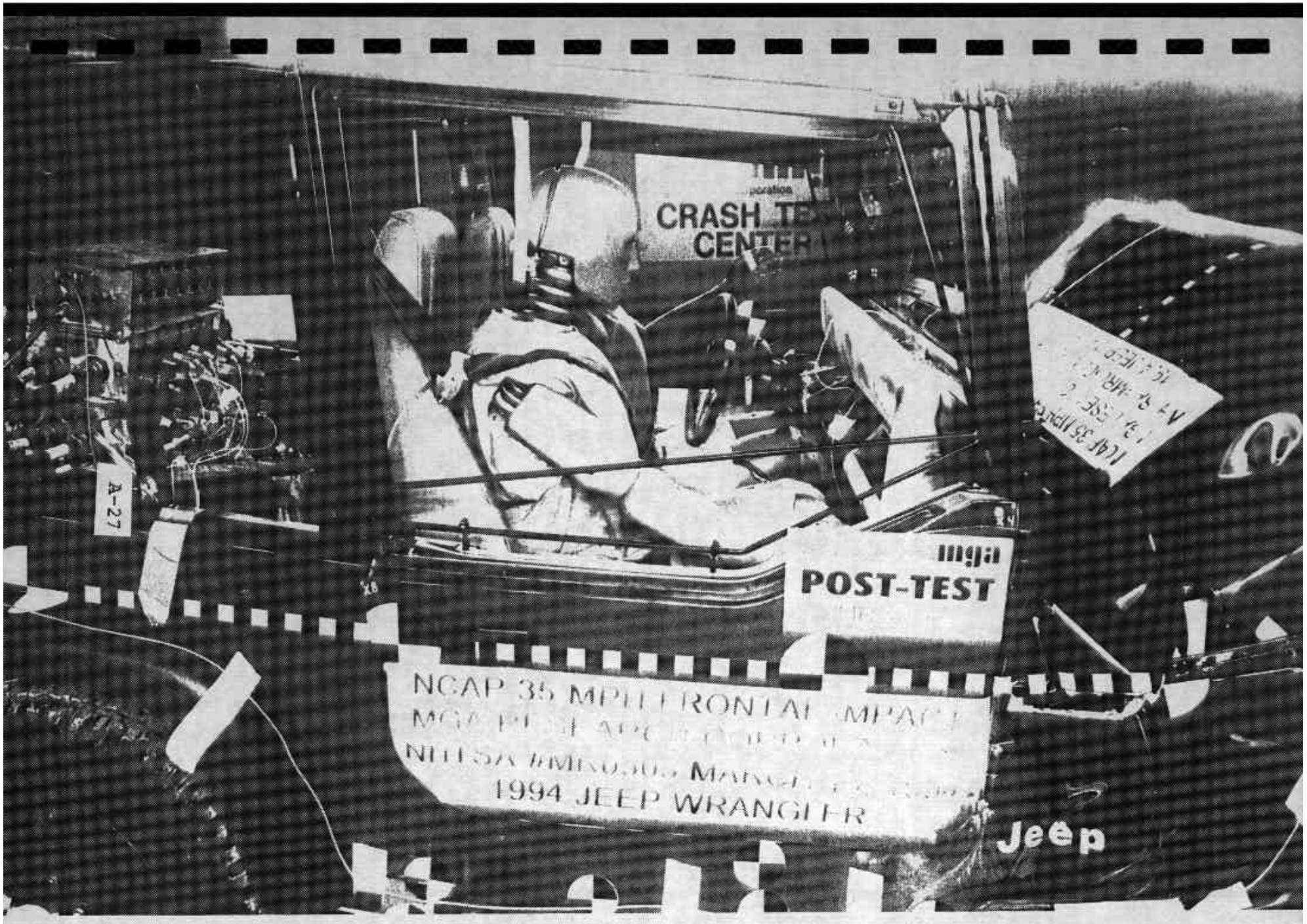


Photo No. 27 - Post-Test Passenger Dummy Position View

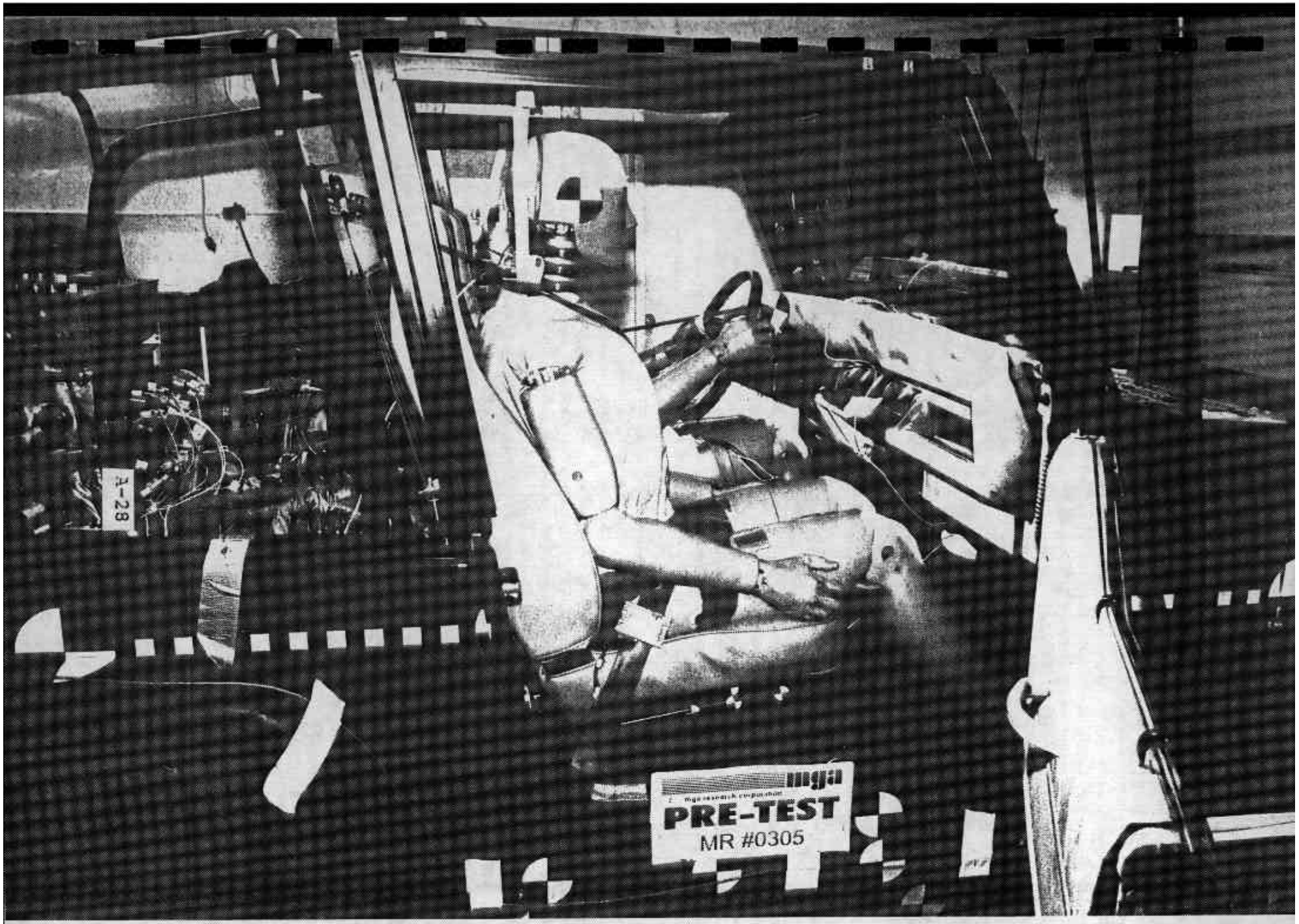


Photo No. 28 - Pre-Test Passenger Dummy Position View (Door Open)

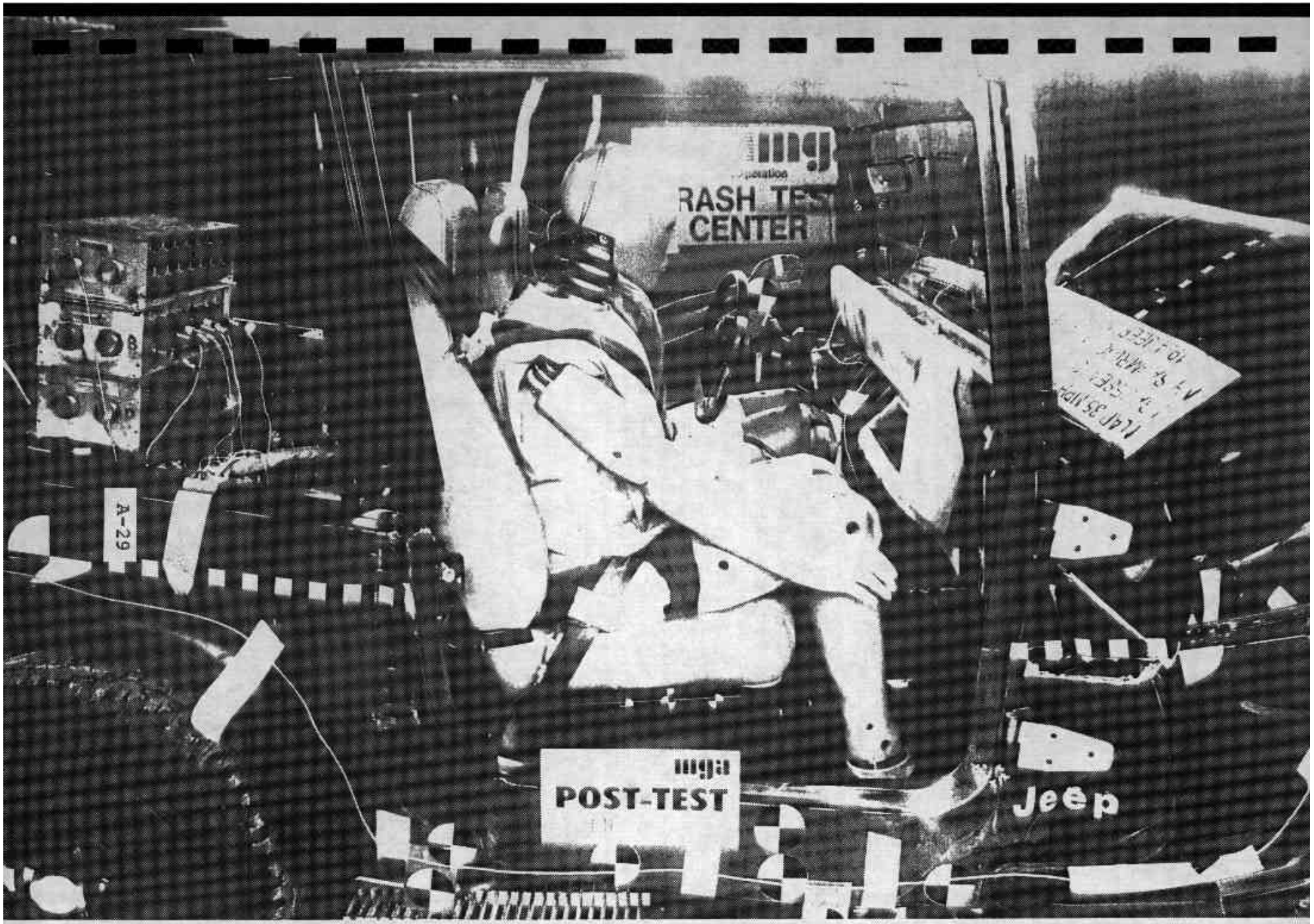


Photo No. 29 - Post-Test Passenger Dummy Position View
(Door Open)

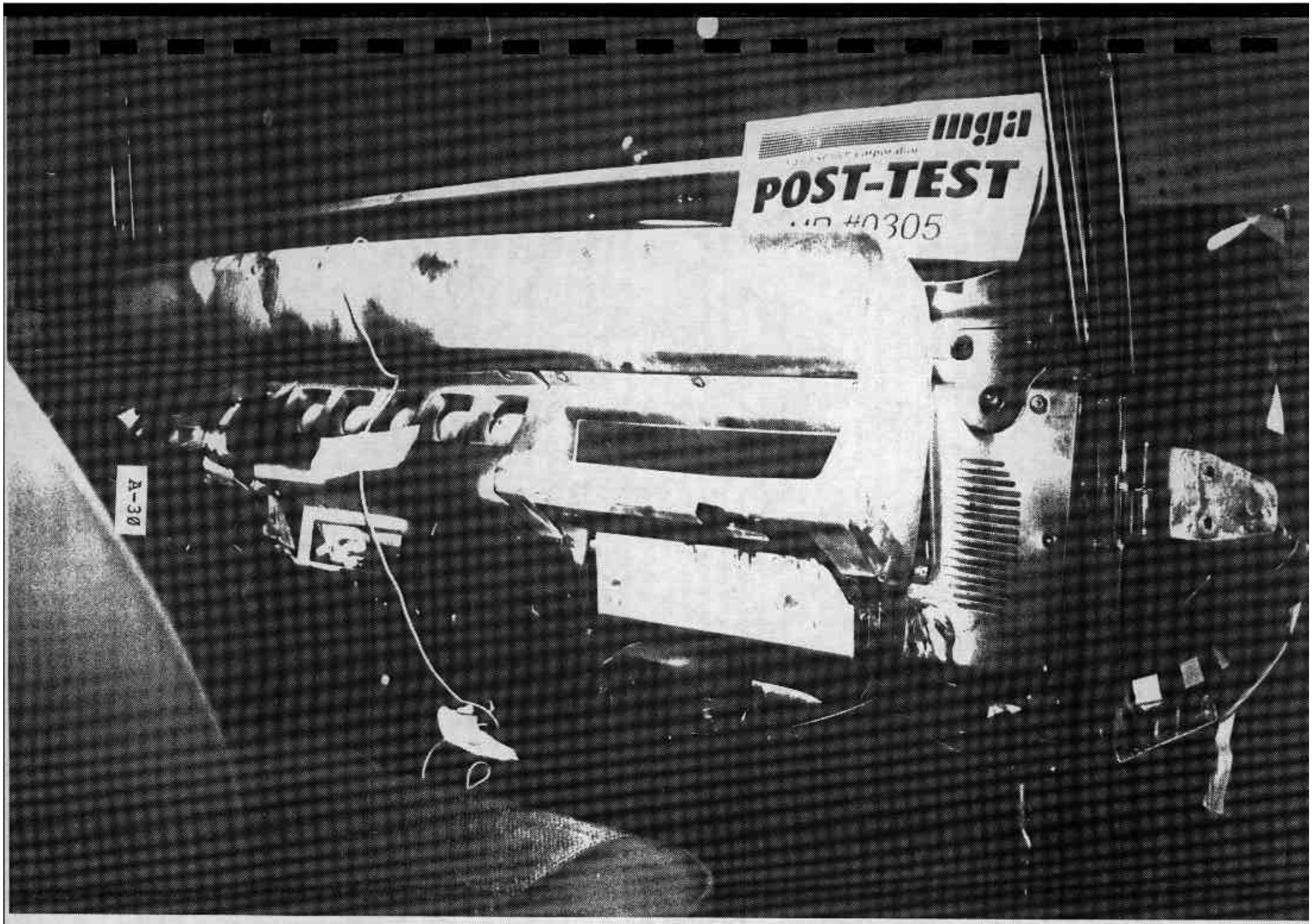


Photo No. 30 - Post-Test Passenger Dash

Photo No. 31 - Pre-Test Passenger Seat Position View

Photo No. 32 - Post-Test Passenger Seat Position View

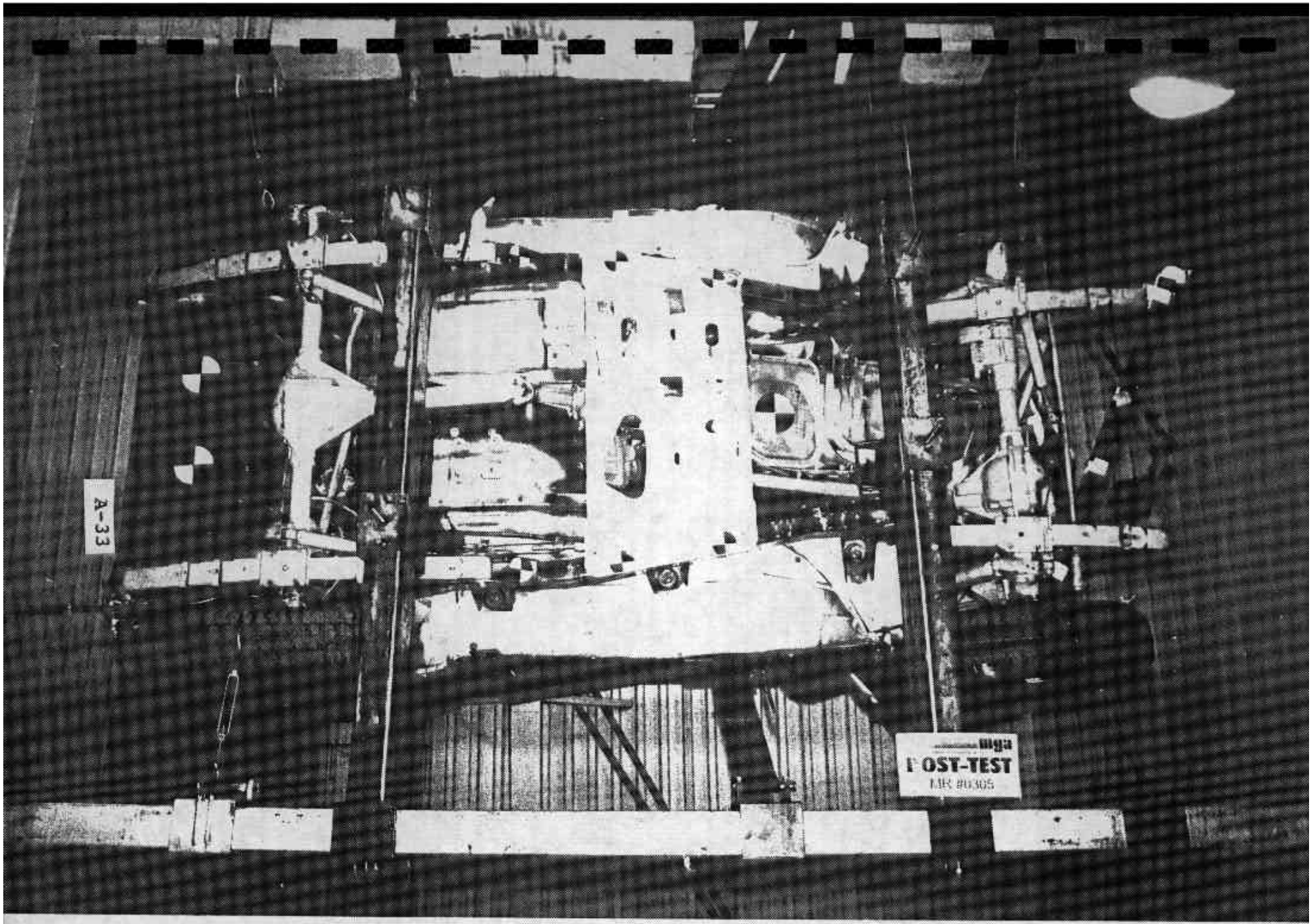


Photo No. 33 - Rollover 90°

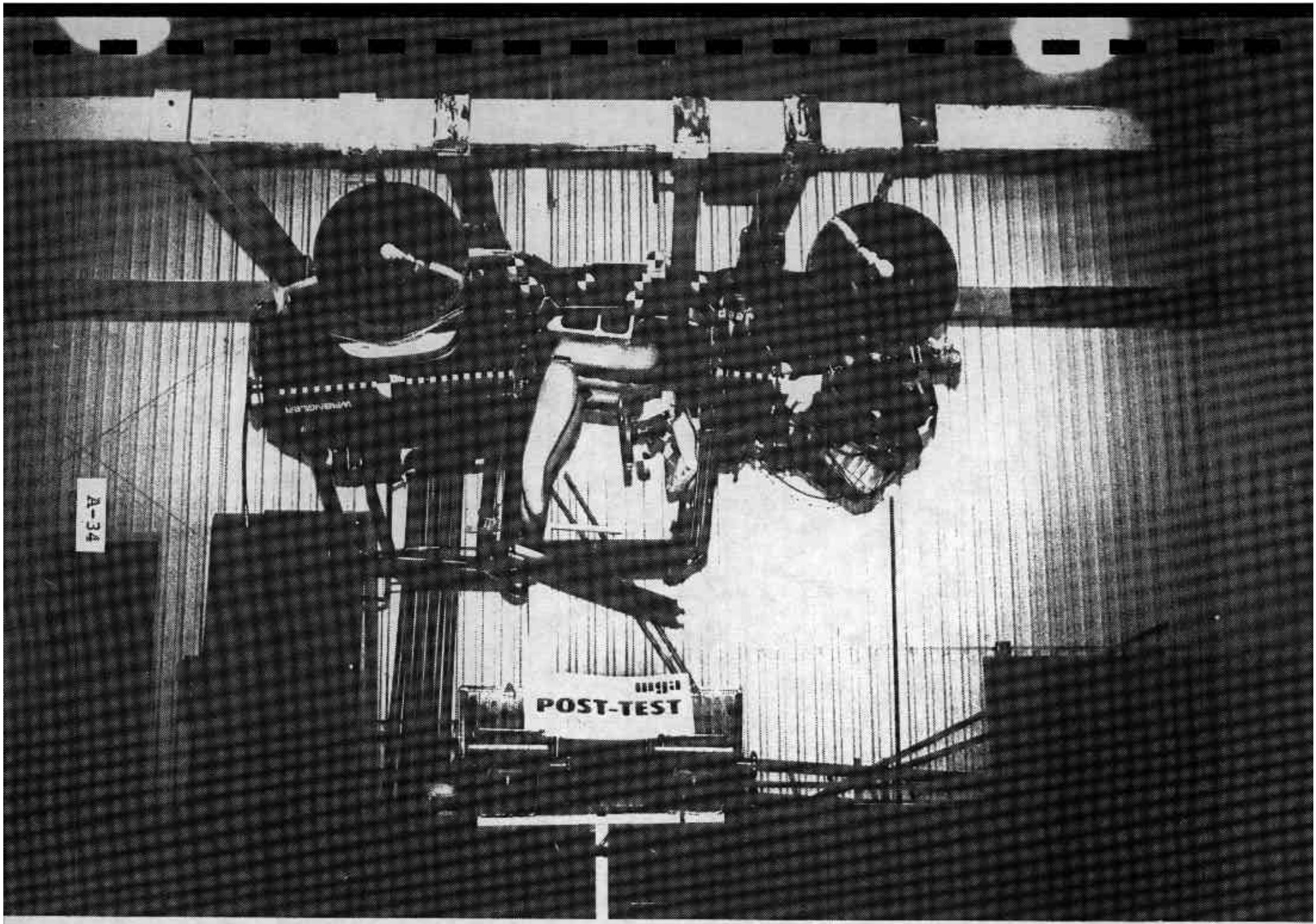


Photo No. 34 - Rollover 180°

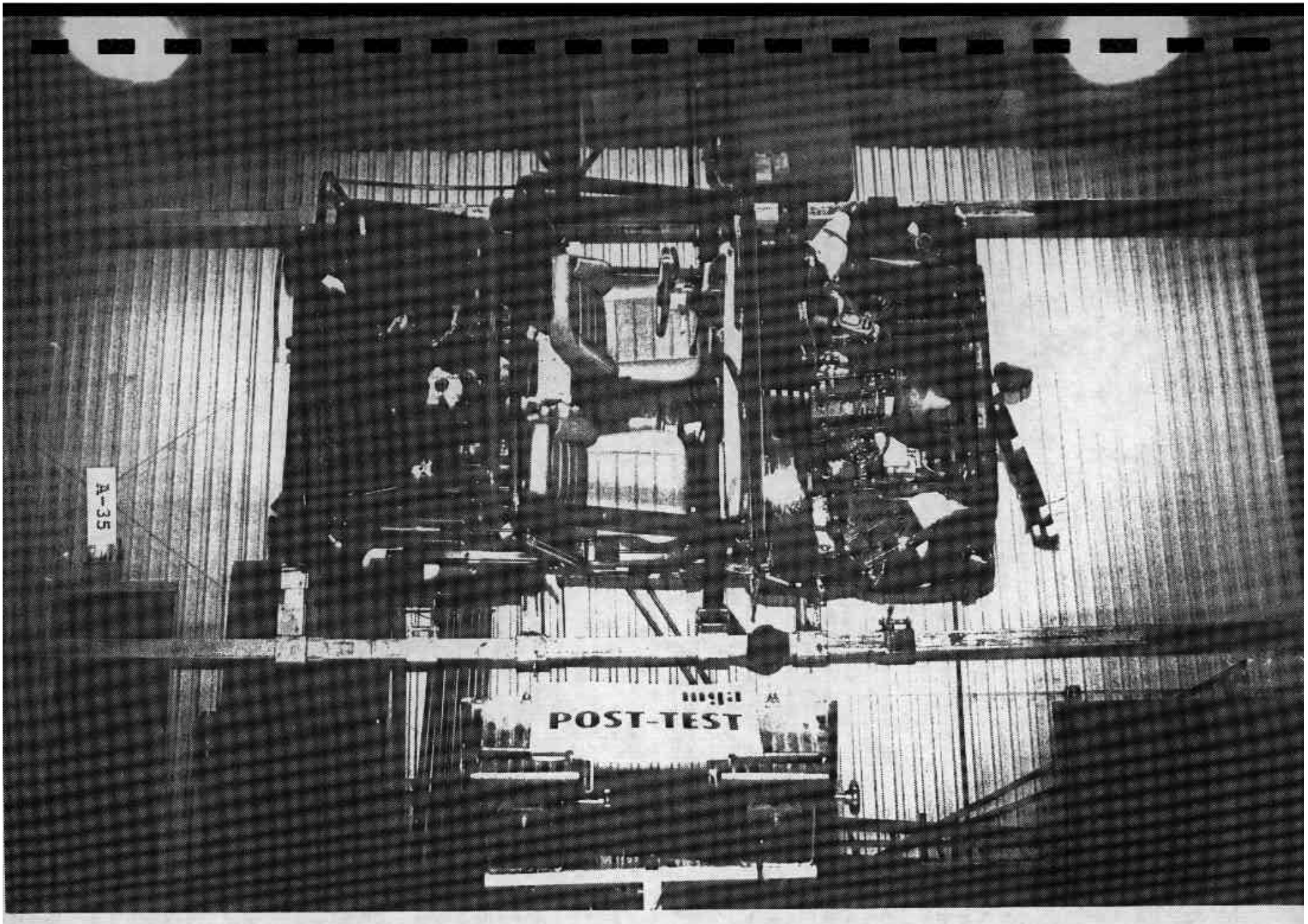


Photo No. 35 - Rollover 270°

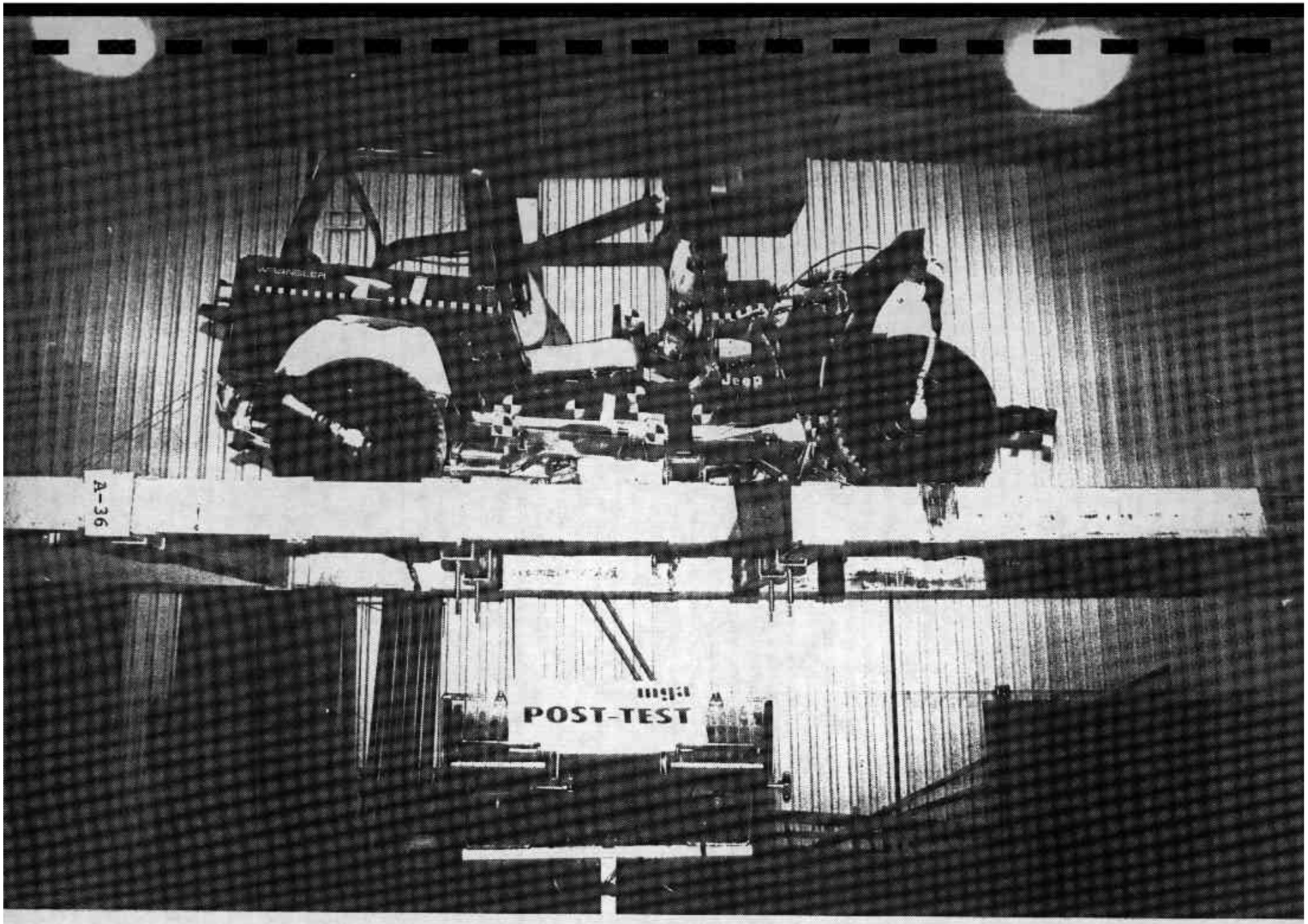


Photo No. 36 - Rollover 360°

Photo No. 37 - Vehicle Certification

APPENDIX B

Vehicle, Load Cell Barrier and Dummy Response Data

1994 JEEP WRANGLER 2 DOOR

NHTSA NO.: MR0305

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)

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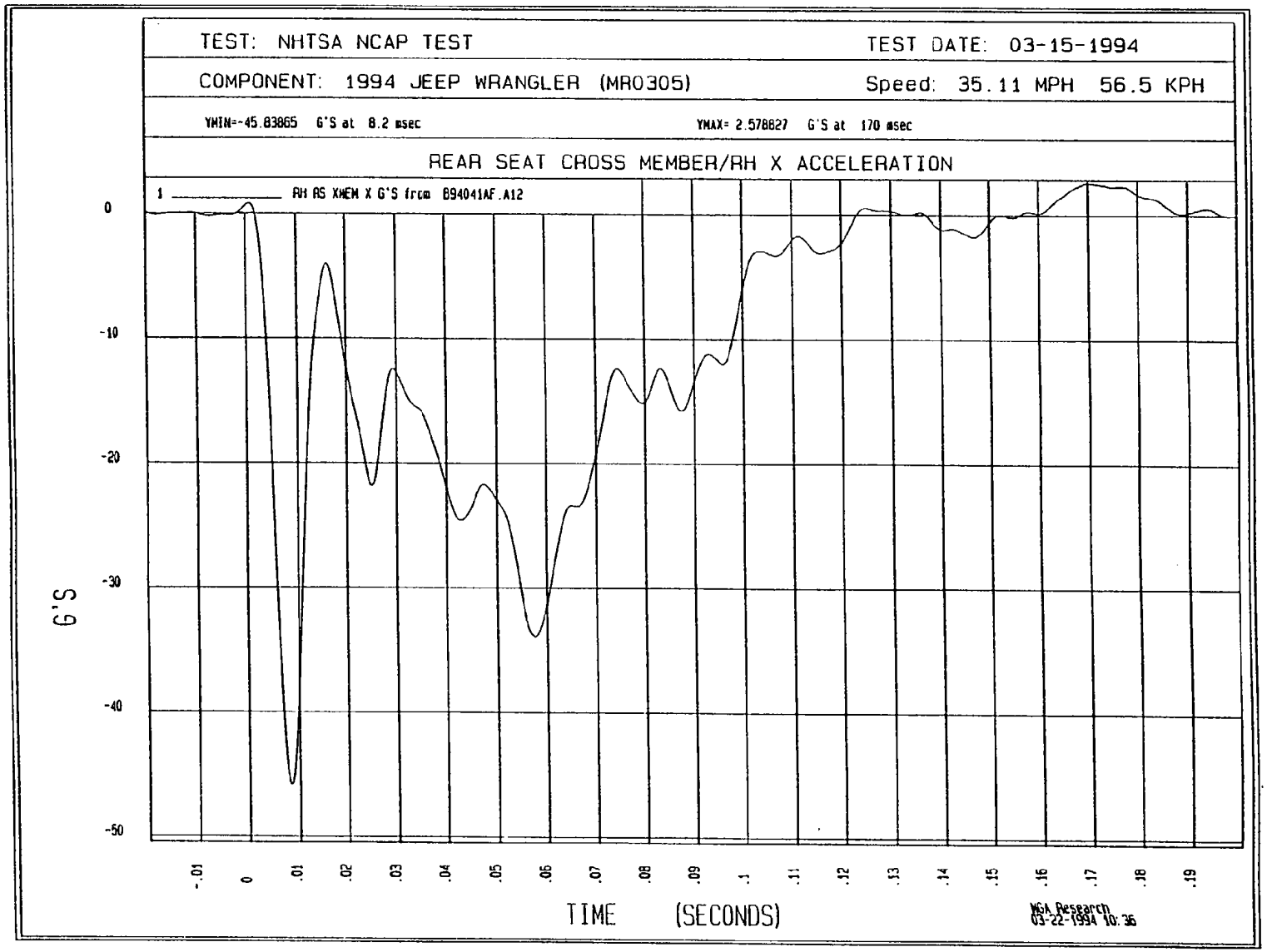
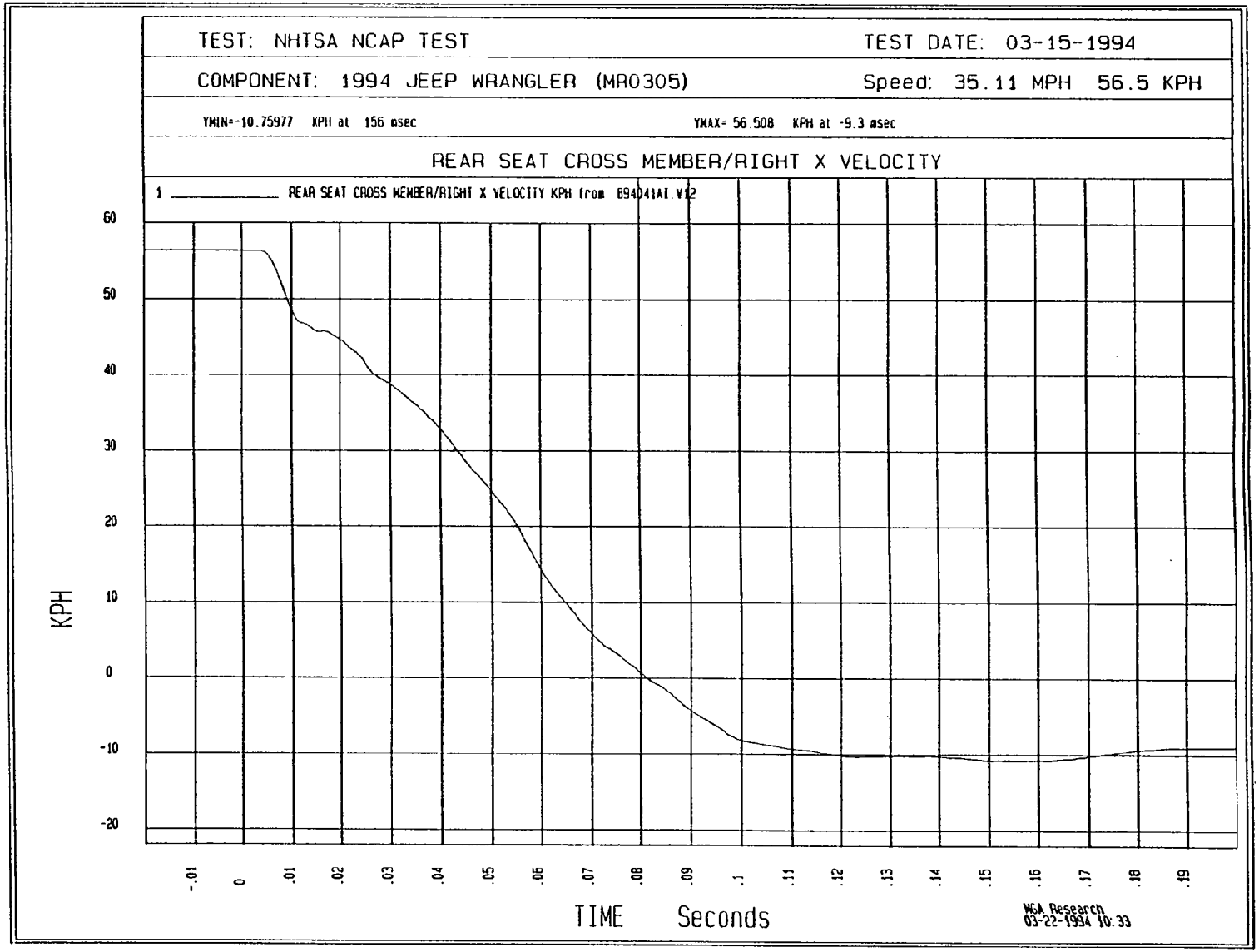


Figure B-1 - Right Rear Seat Crossmember X Accel. vs. Time



B-2

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

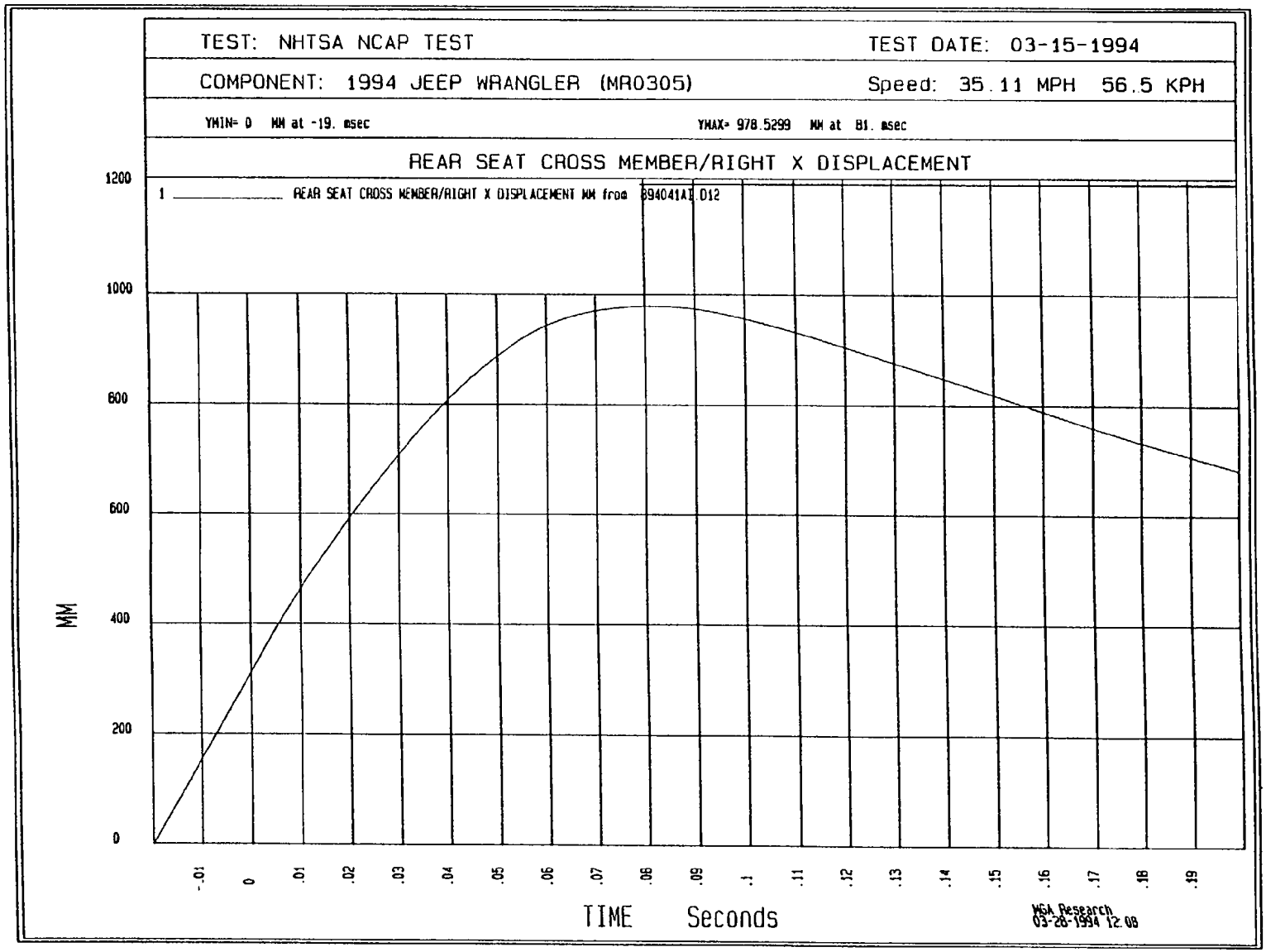


Figure B-3 - Right Rear Seat Crossmember X Displacement vs.Time

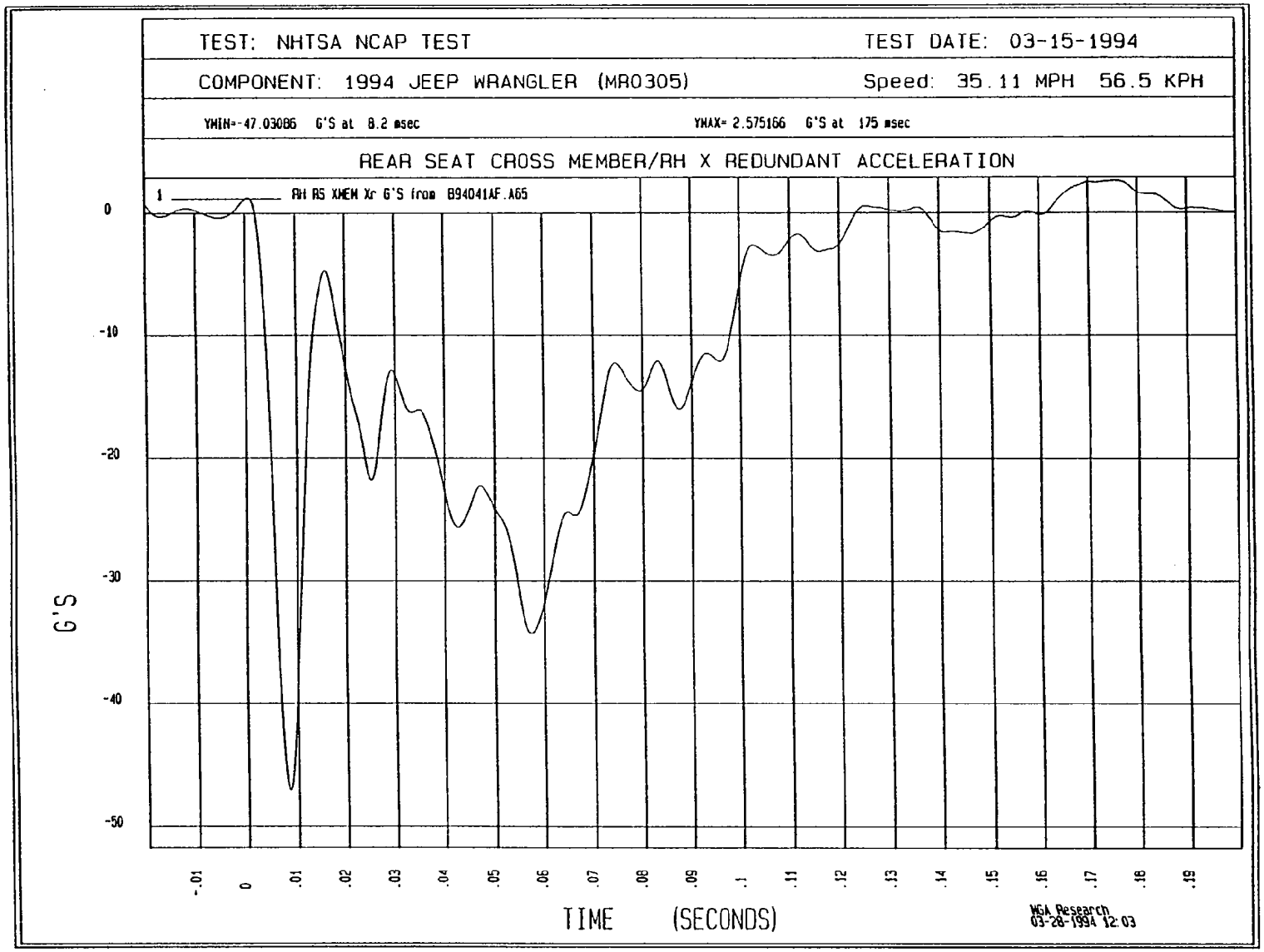


Figure B-4 - Right Rear Seat Crossmember X Redundant Acceleration vs. Time

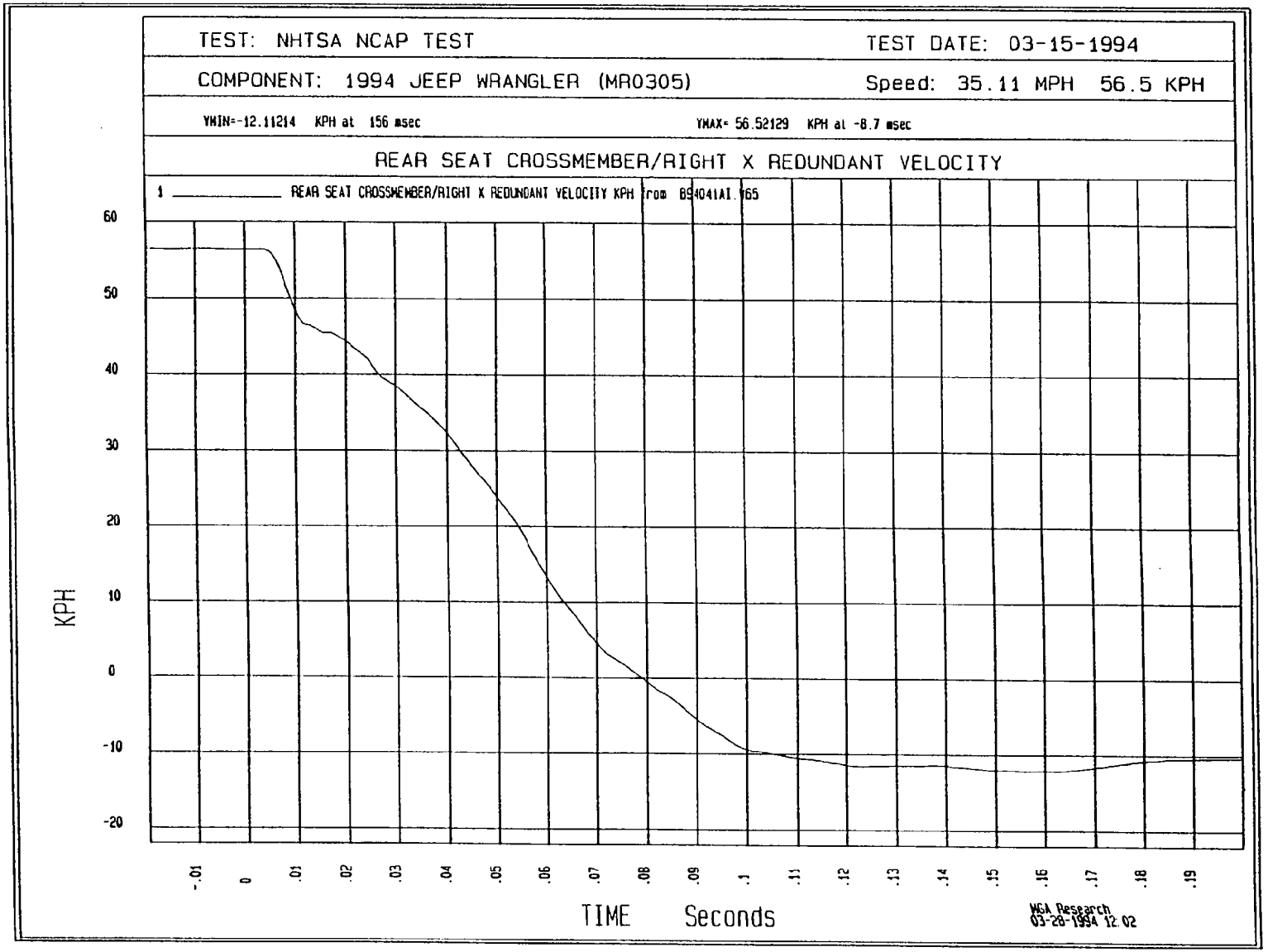


Figure B-5 - Right Rear Seat Crossmember X Redundant Velocity vs. Time

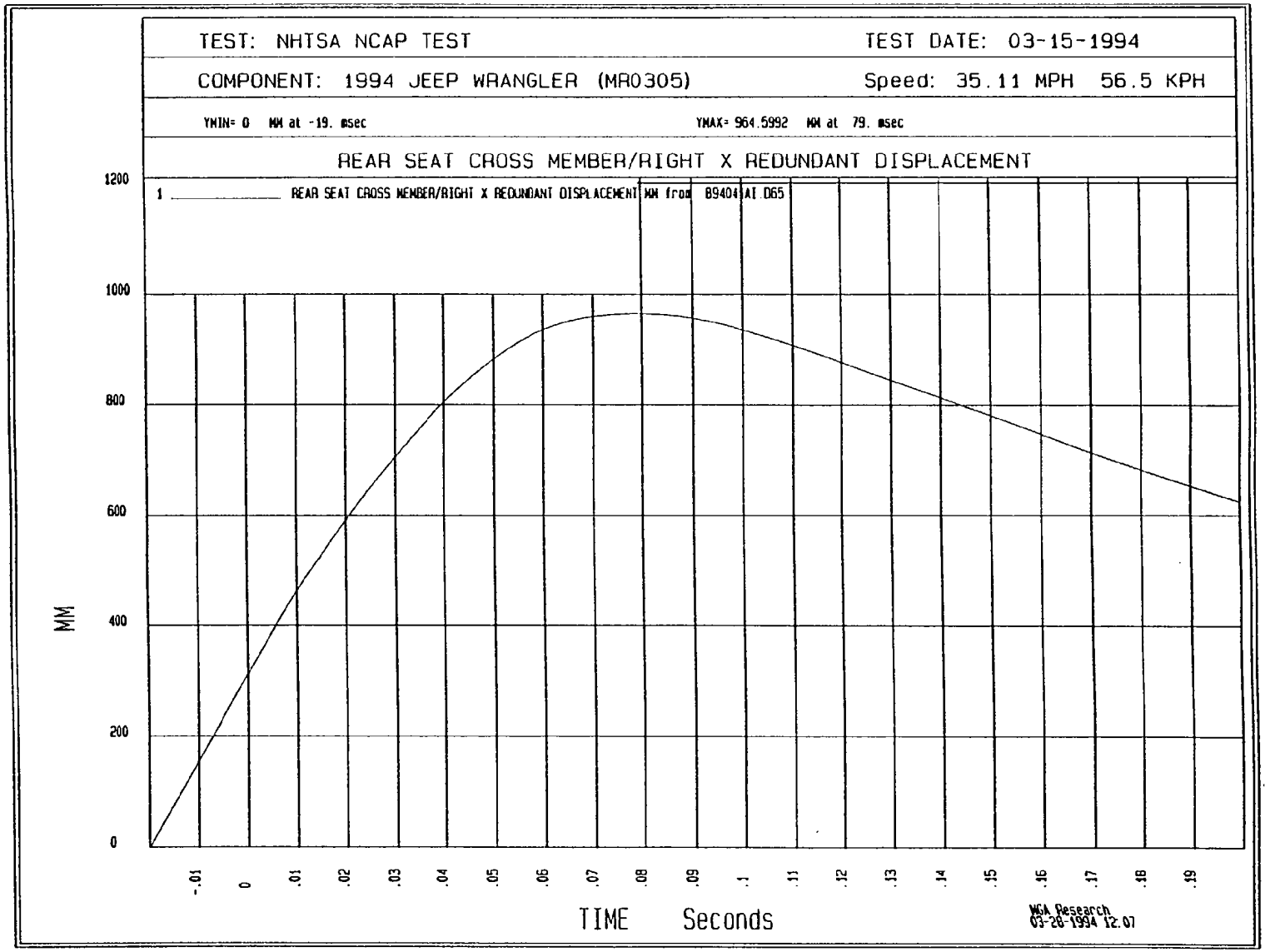


Figure B-6 - Right Rear Seat Crossmember X Redundant Displacement vs. Time

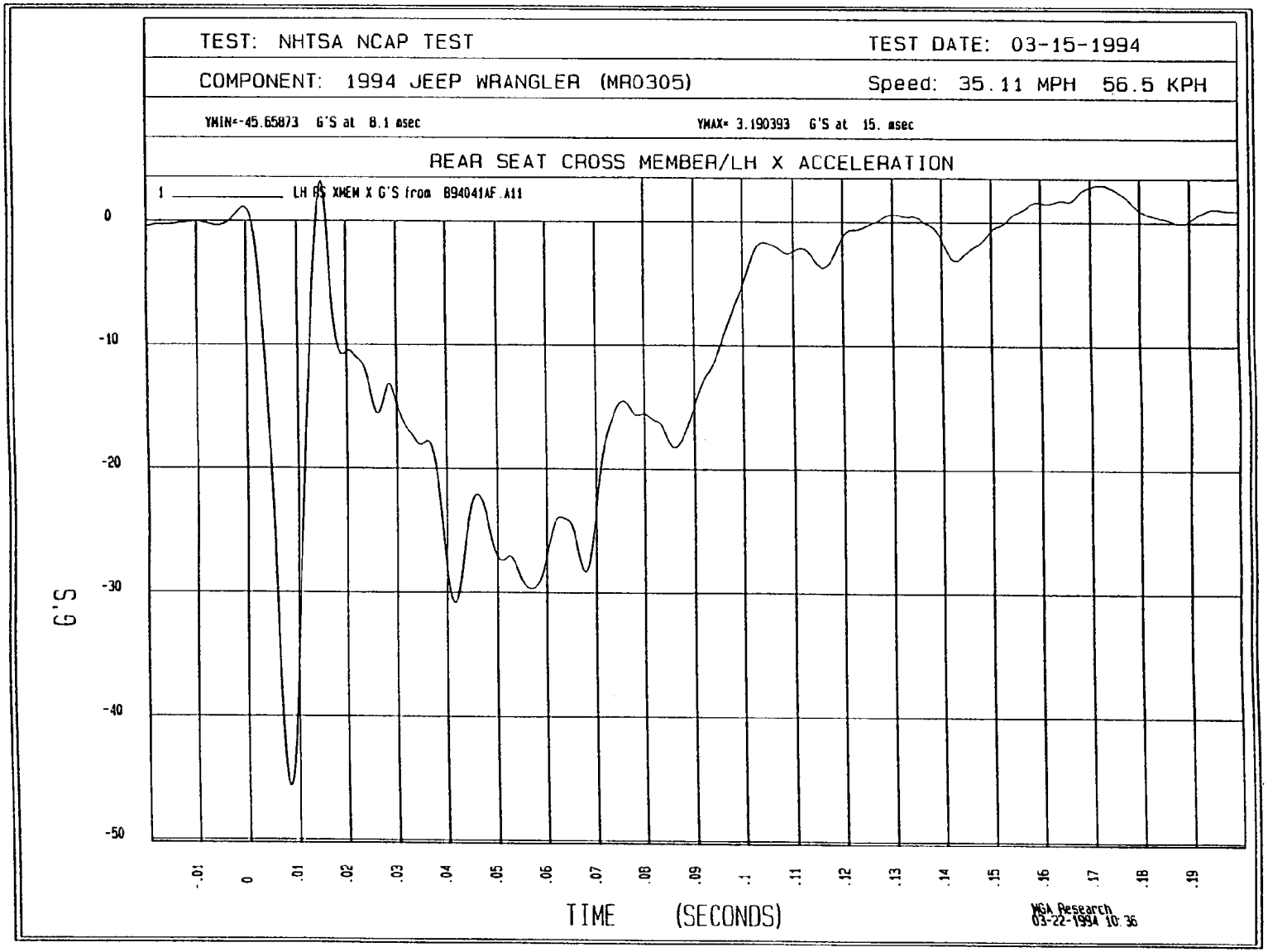


Figure B-7 - Left Rear Seat Crossmember X Acceleration vs. Time

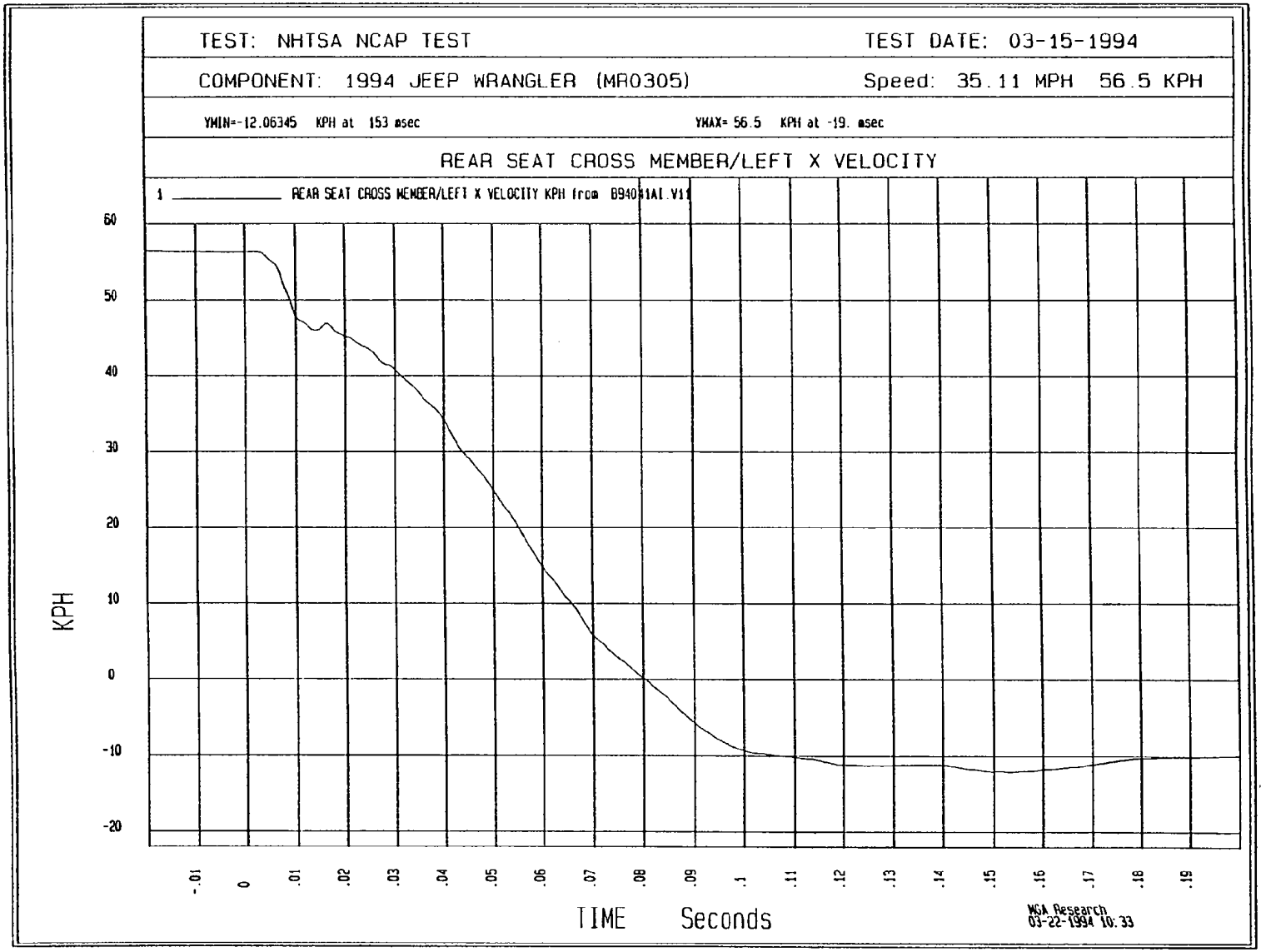


Figure B-8 - Left Rear Seat Crossmember X Velocity vs. Time

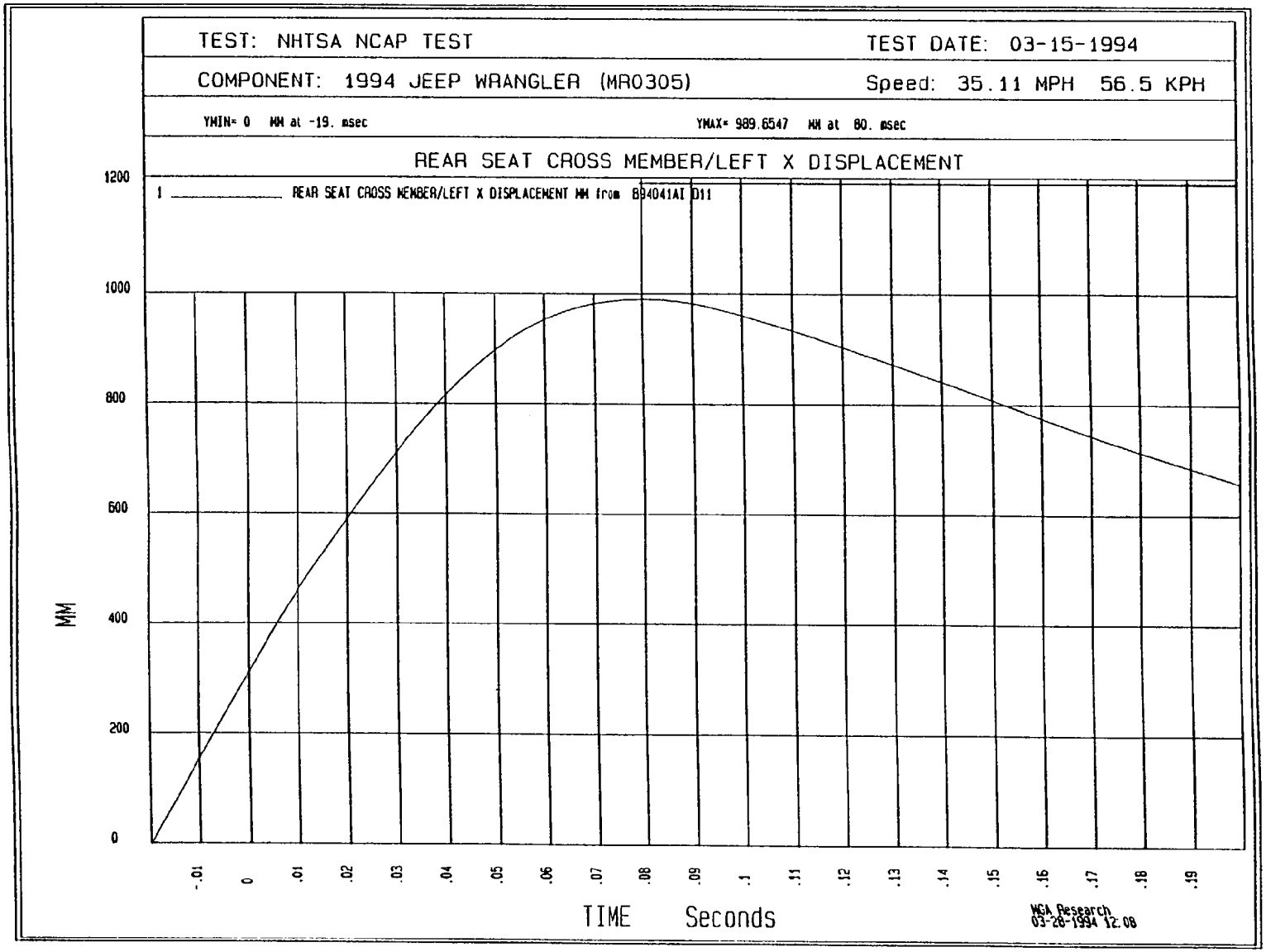


Figure B-9 - Left Rear Seat Crossmember X Displacement vs. Time

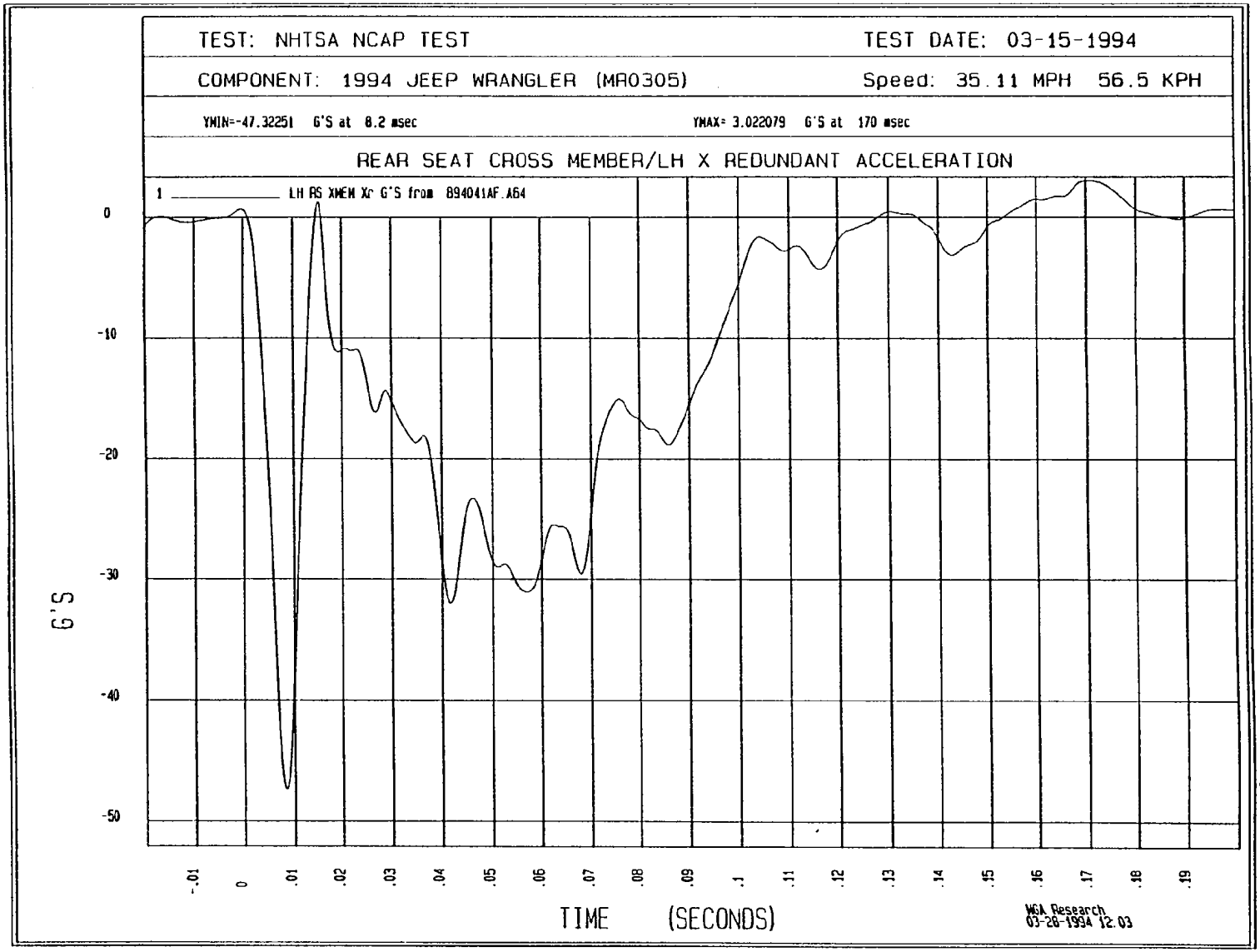


Figure B-10 - Left Rear Seat Crossmember X Redundant Acceleration vs. Time

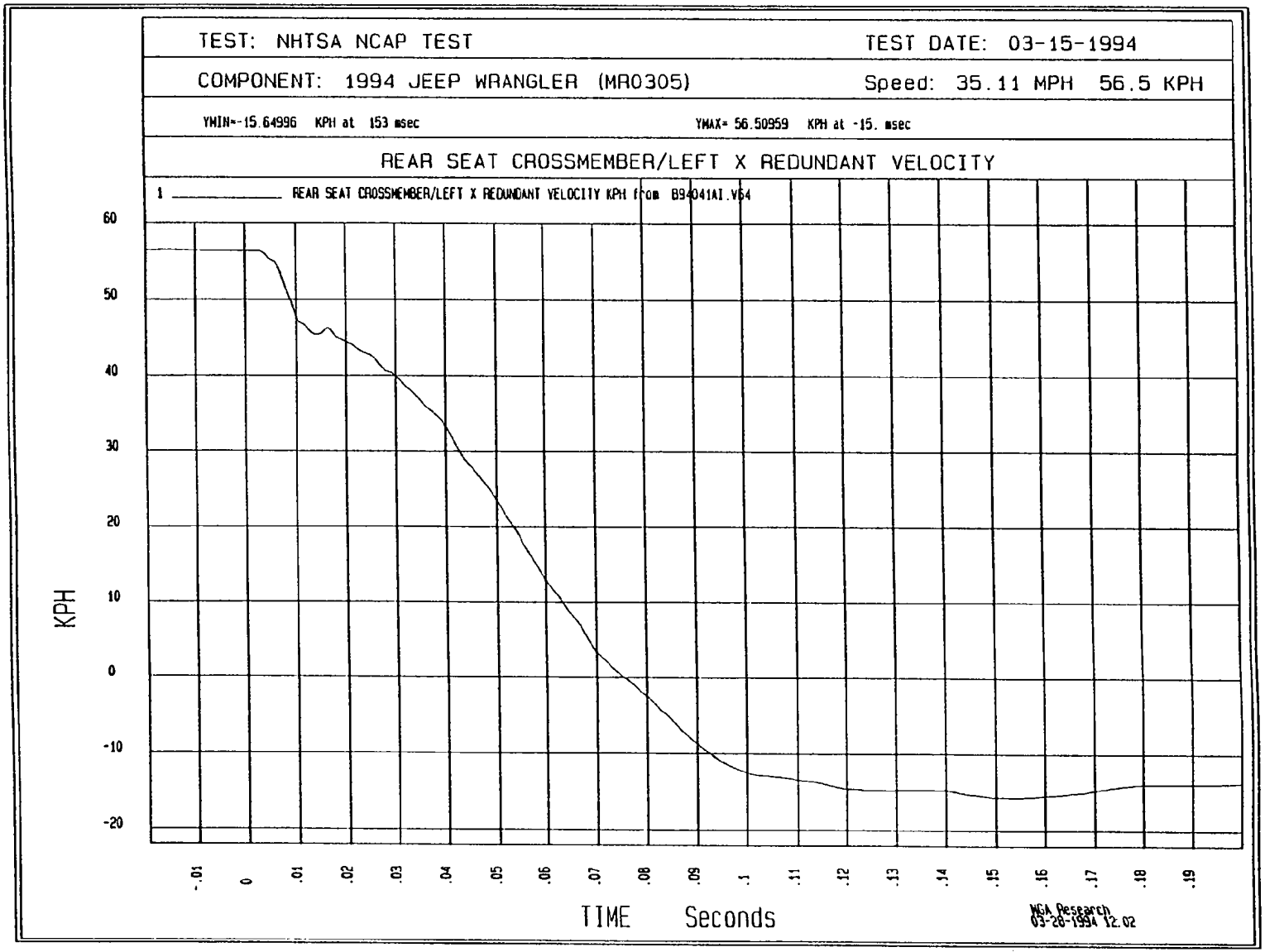


Figure B-11 - Left Rear Seat Crossmember X Redundant Velocity vs. Time

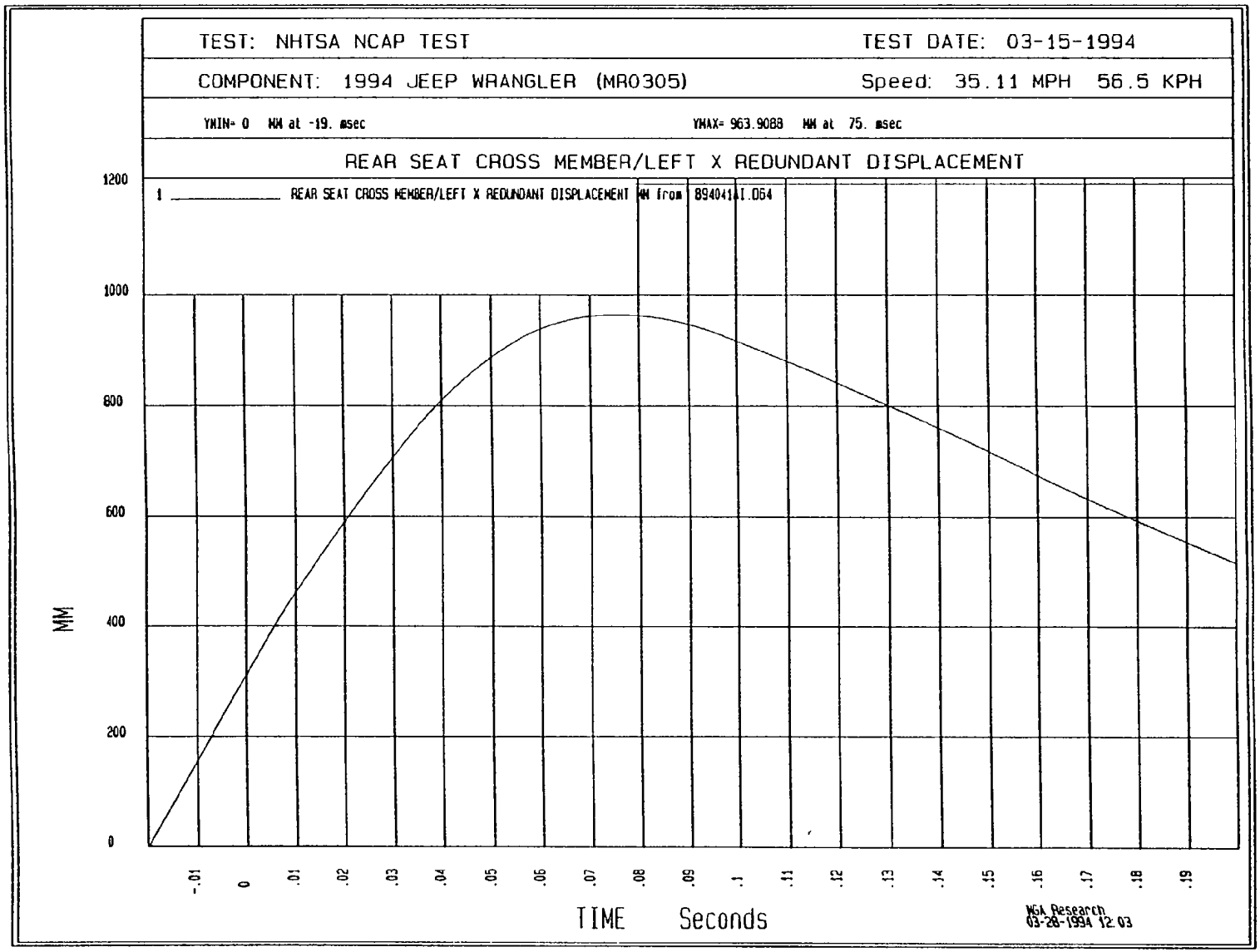


Figure B-12 - Left Rear Seat Crossmember X Redundant Displacement vs. Time

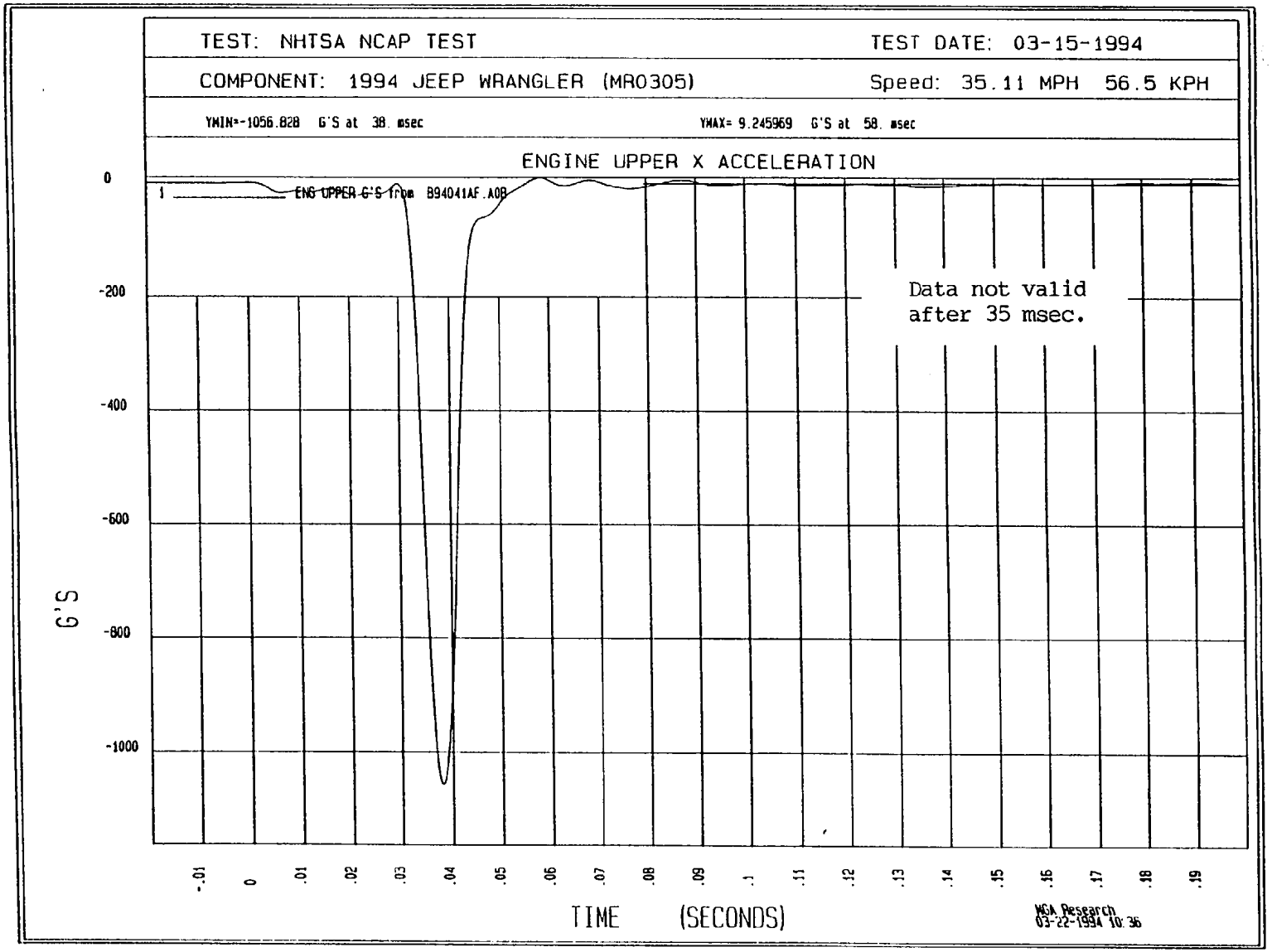


Figure B-13 - Upper Engine Block X Acceleration vs. Time

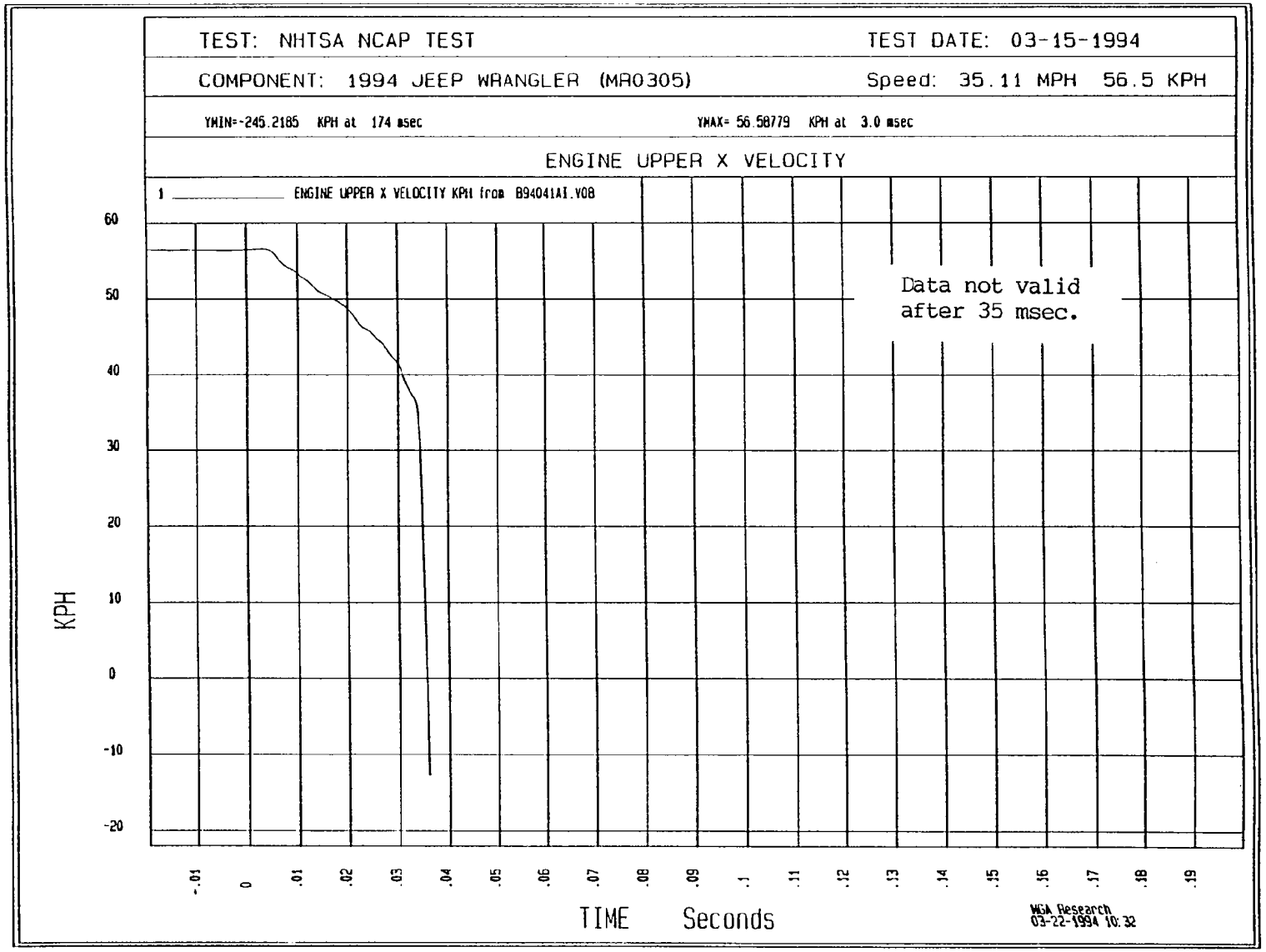


Figure B-14 - Upper Engine Block X Velocity vs. Time

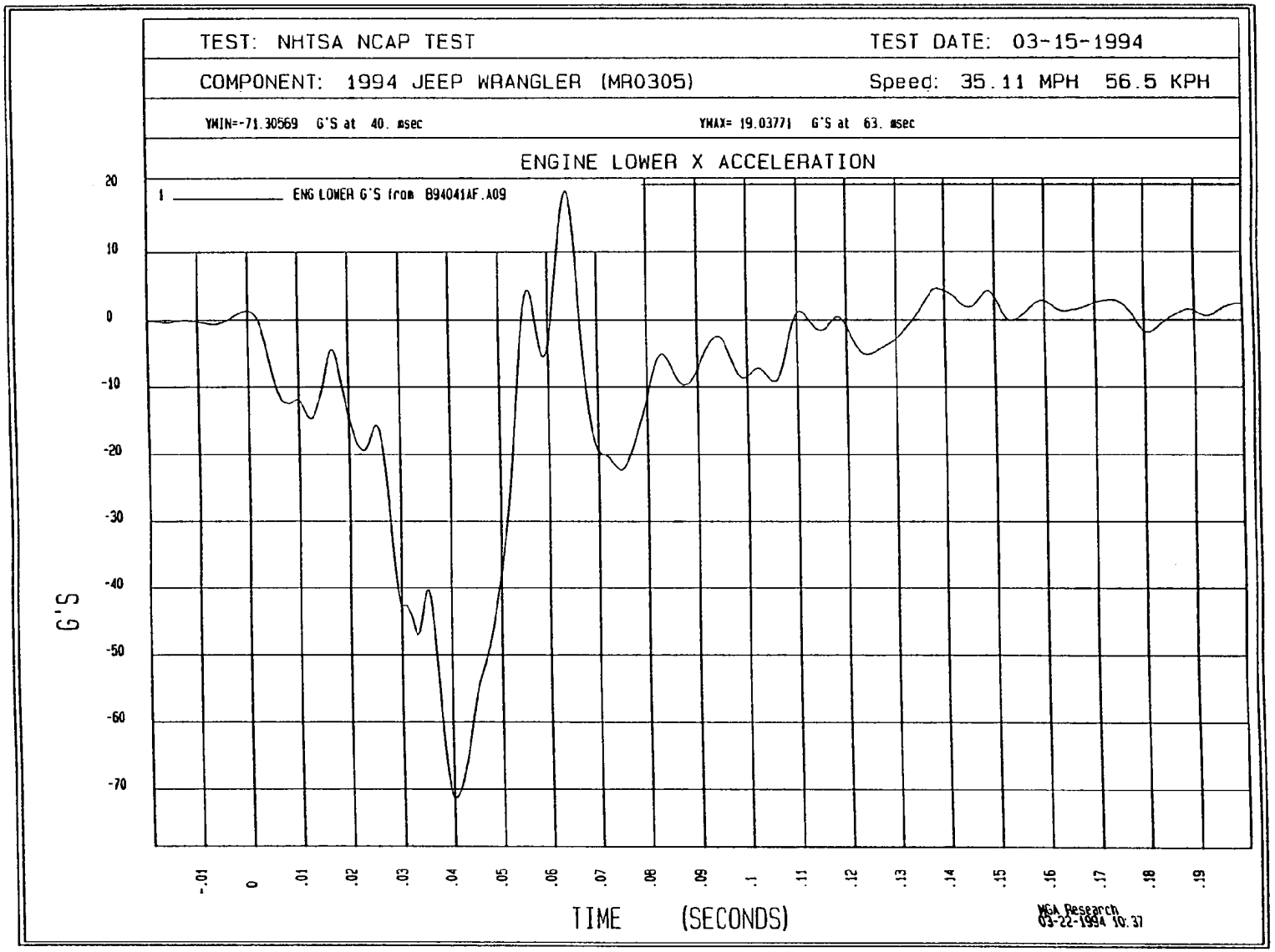


Figure B-15 - Bottom of Engine Block X Acceleration vs. Time

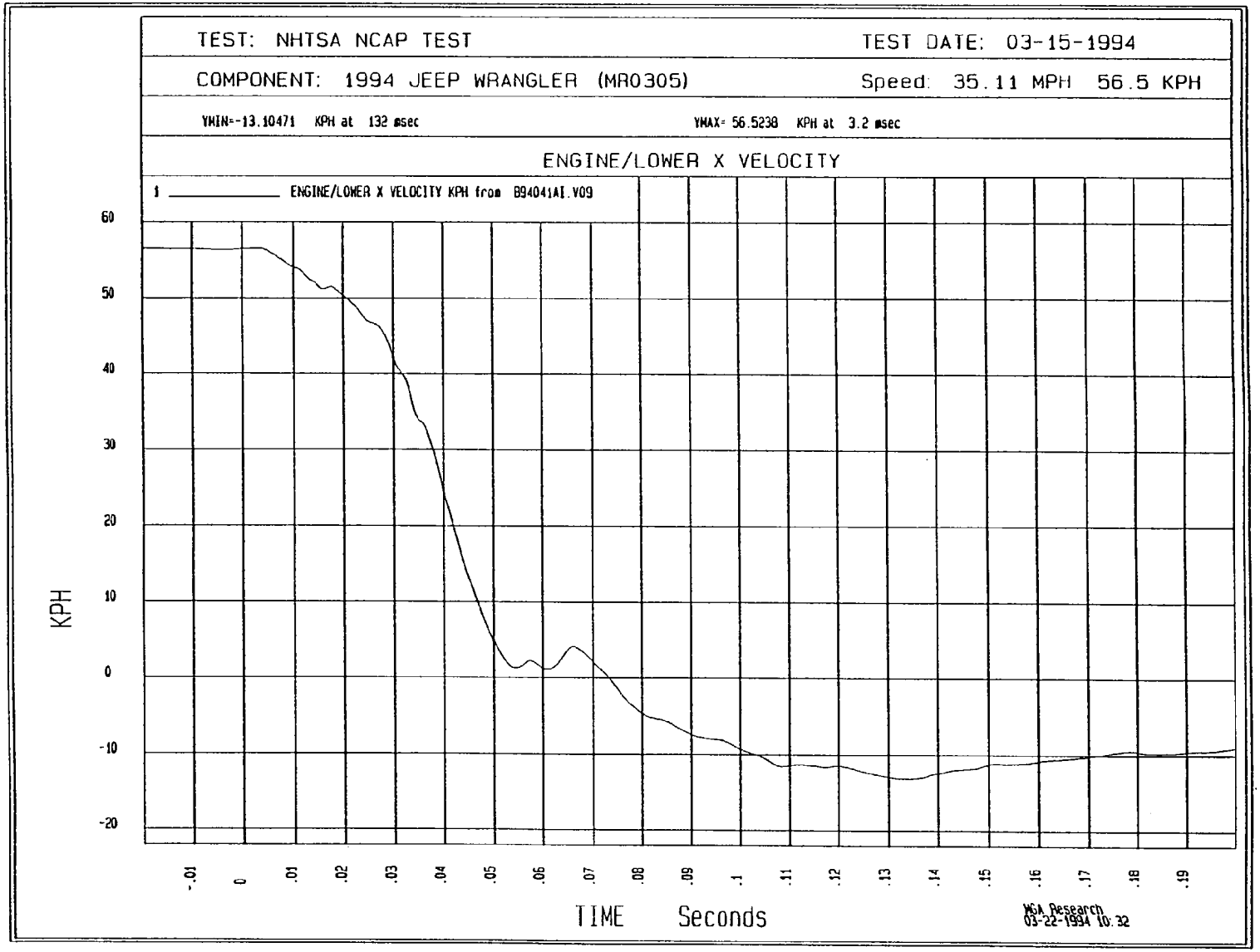


Figure B-16 - Bottom of Engine Block X Velocity vs. Time

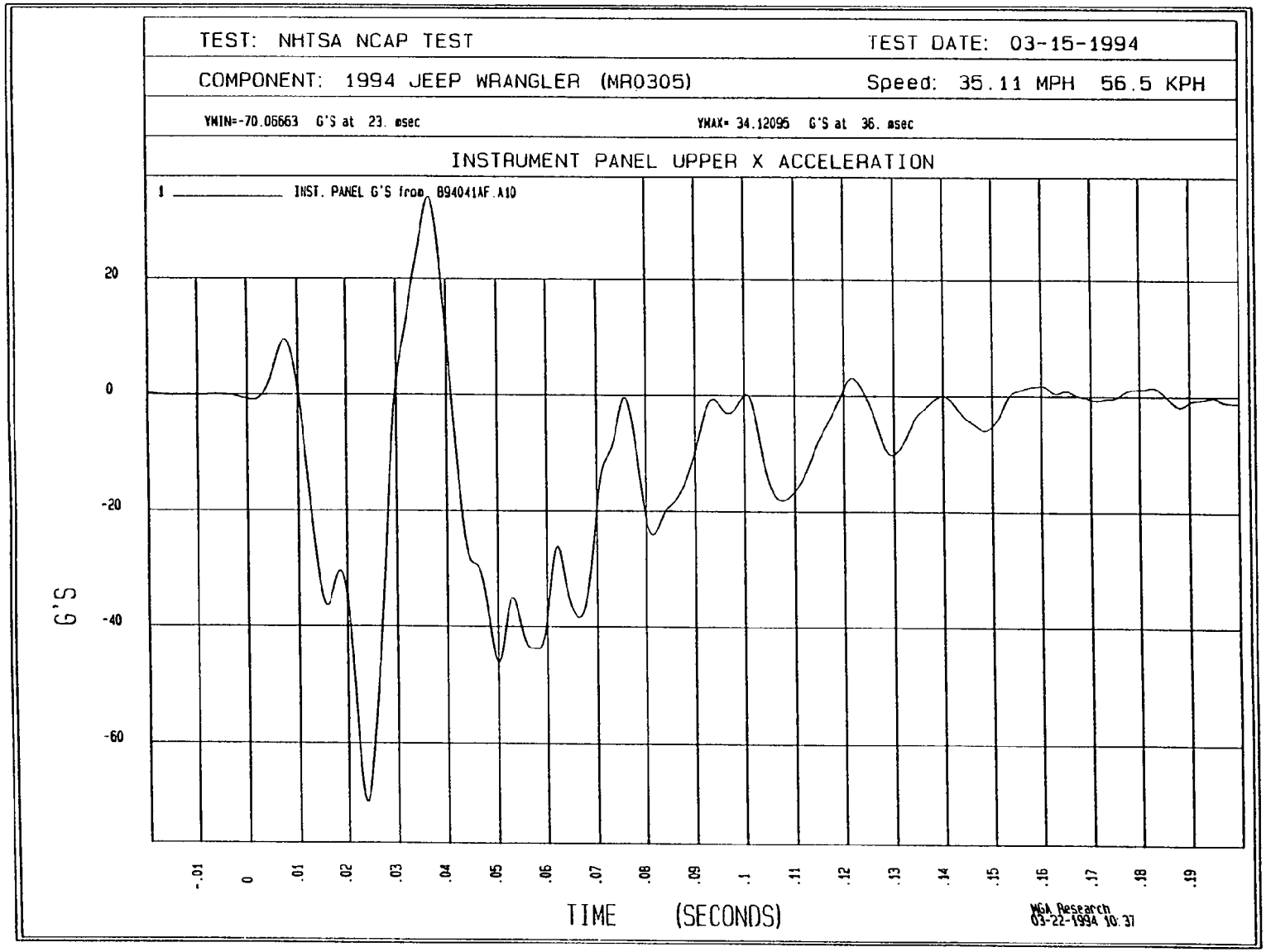


Figure B-17 - Instrument Panel X Acceleration vs. Time

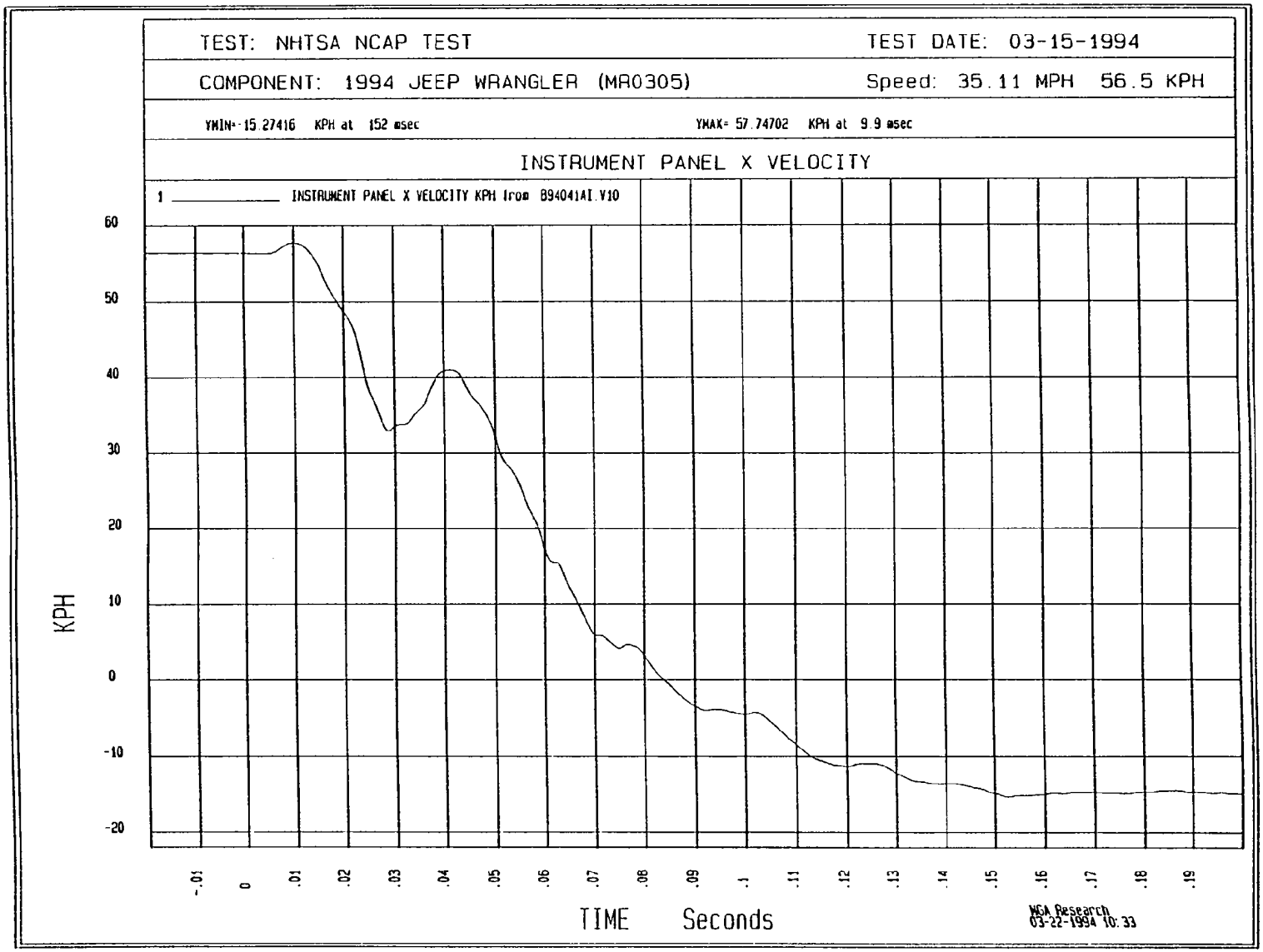


Figure B-18 - Instrument Panel X Velocity vs. Time

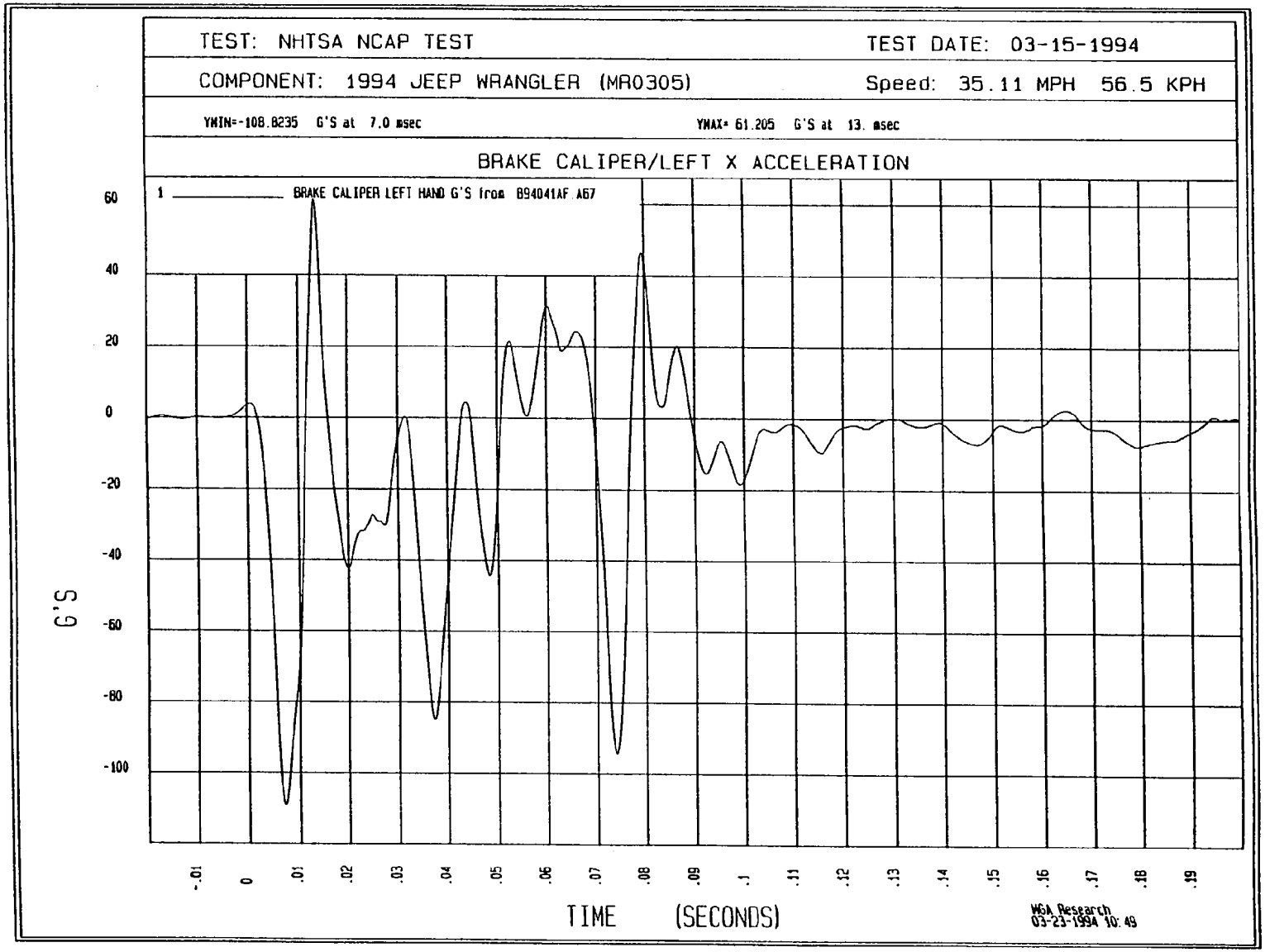


Figure B-19 - Left Brake Caliper X Acceleration vs. Time

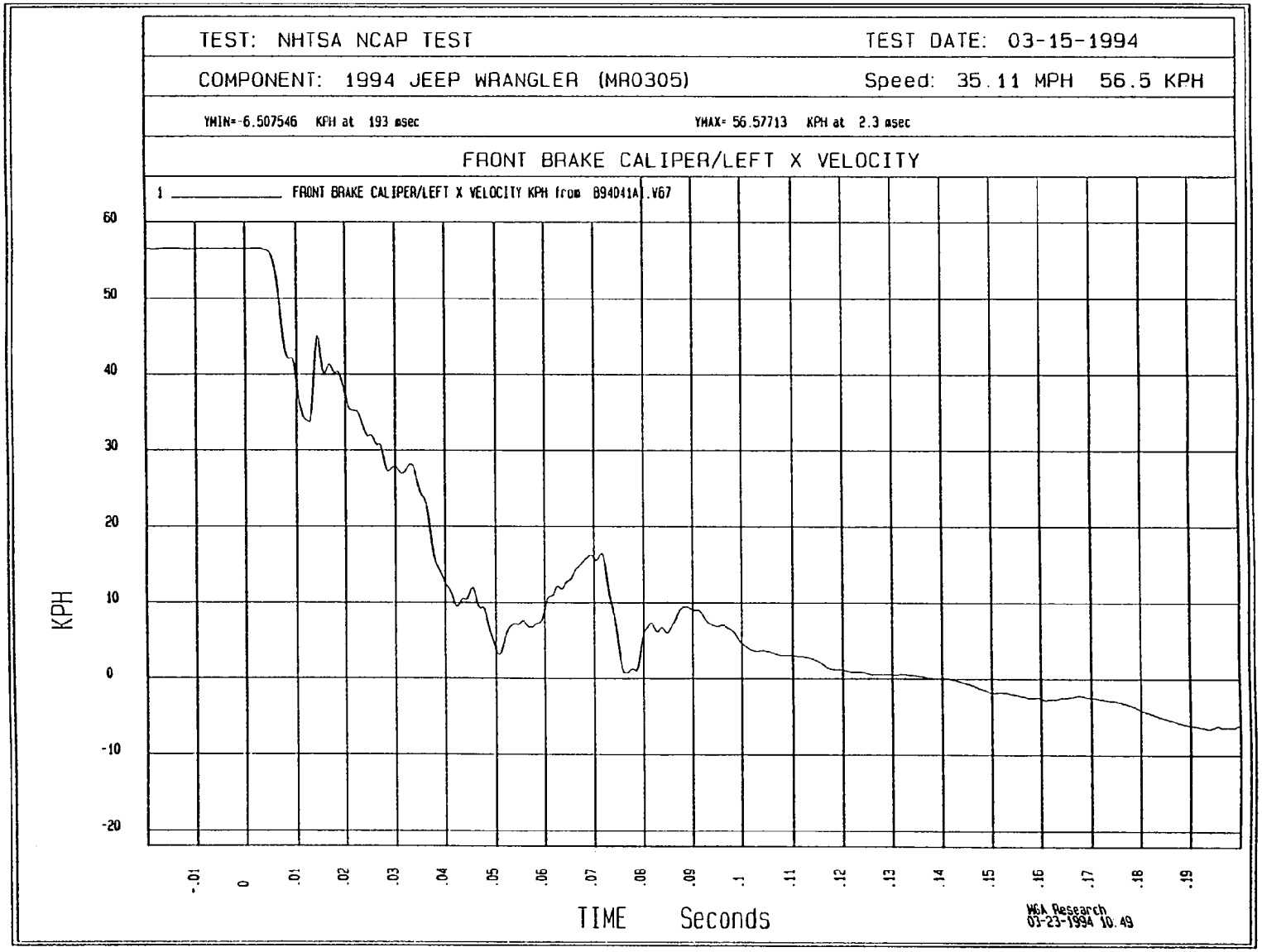


Figure B-20 - Left Brake Caliper X Velocity vs. Time

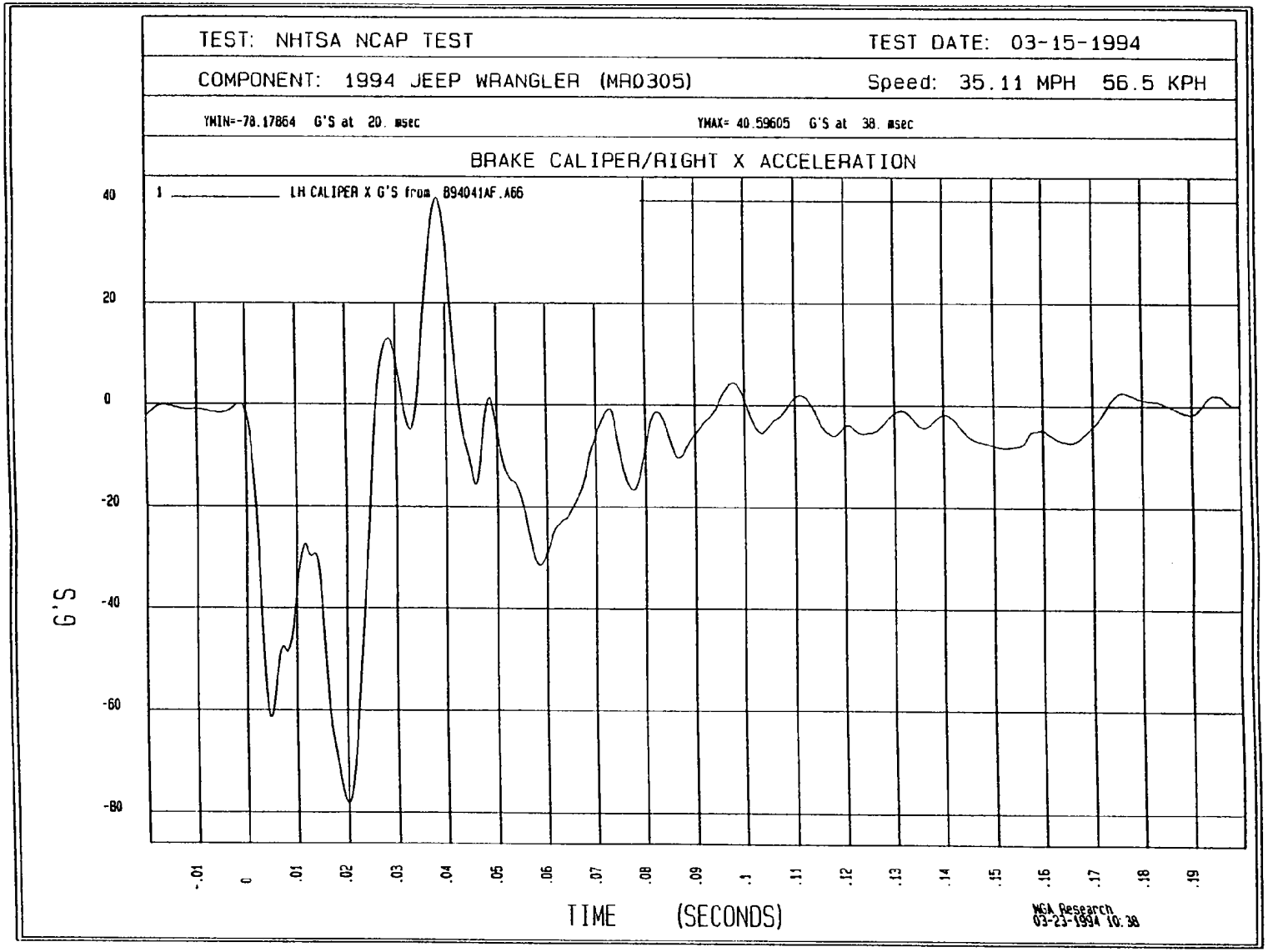


Figure B-21 - Right Brake Caliper X Acceleration vs. Time

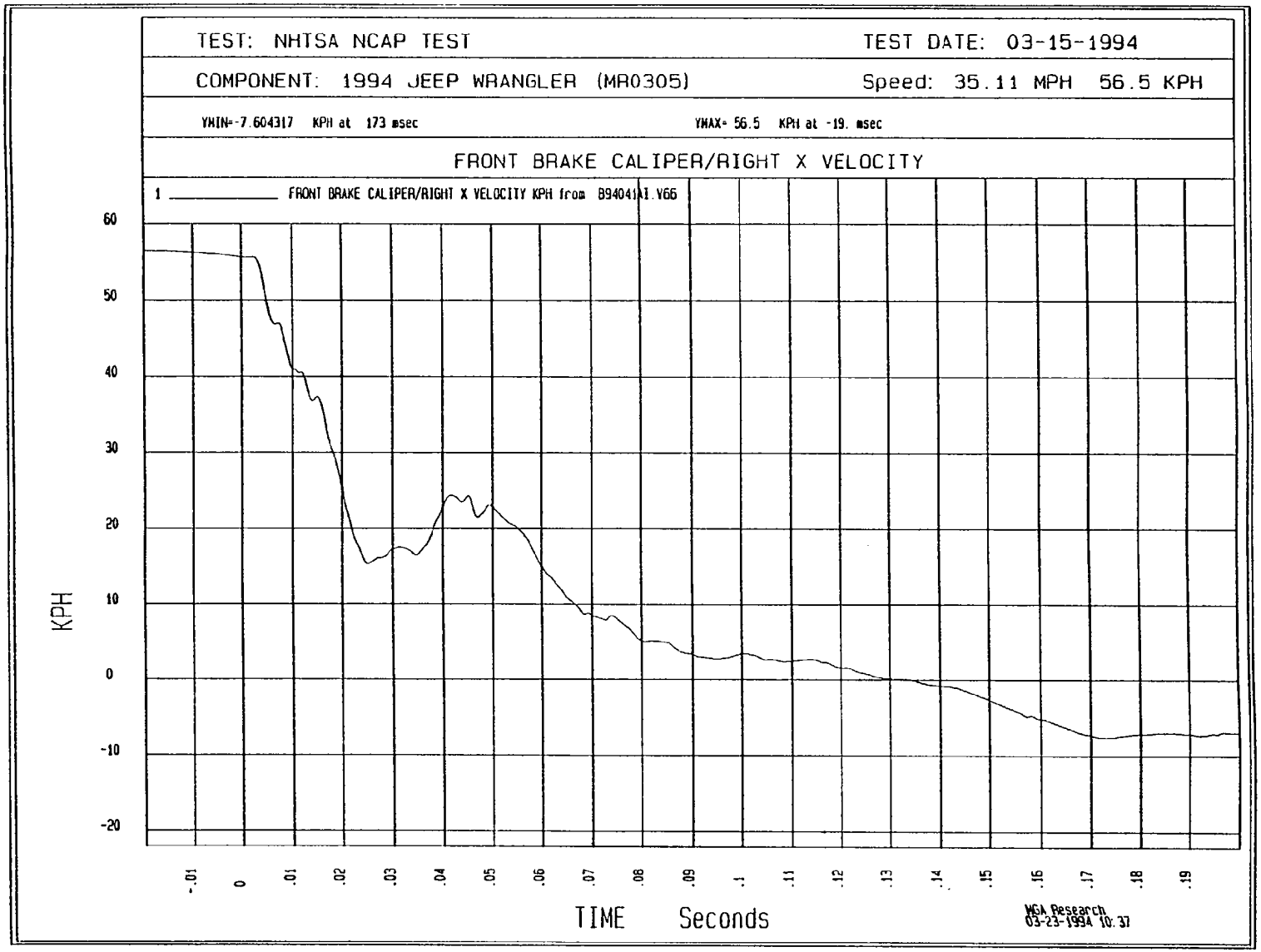


Figure B-22 - Right Brake Caliper X Velocity vs. Time

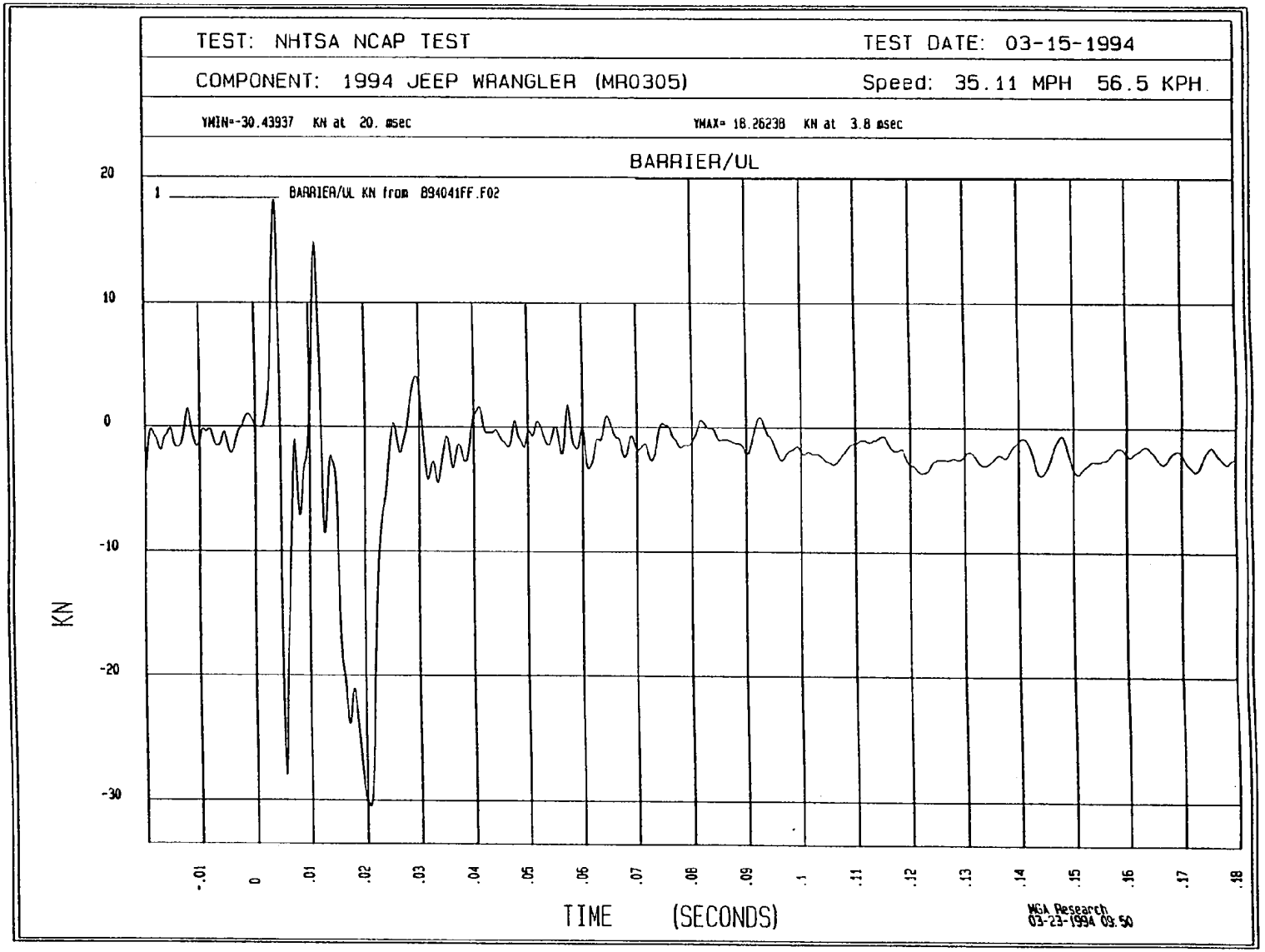


Figure B-23 - Upper Left Barrier Force vs. Time

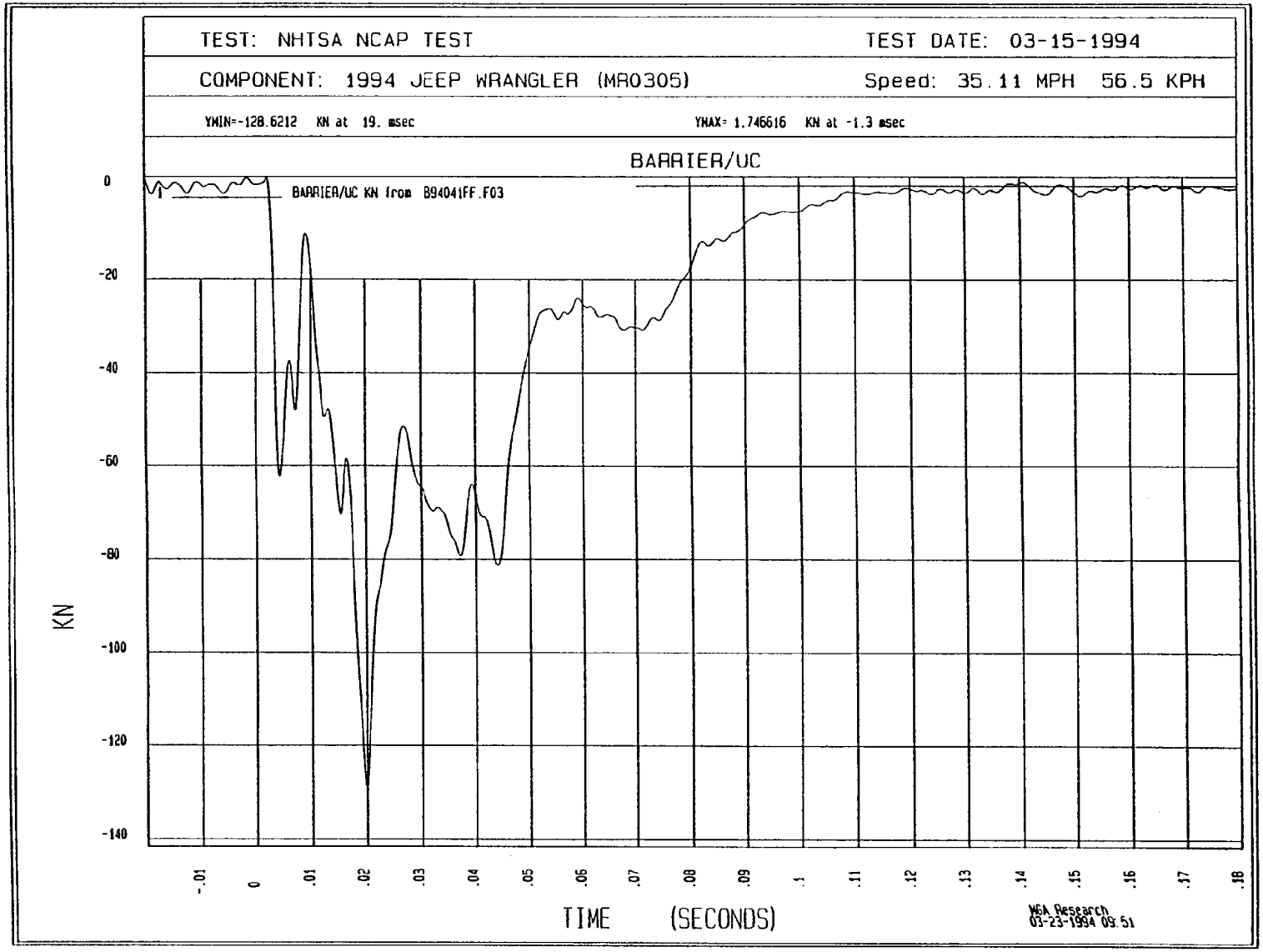


Figure B-24 - Upper Center Barrier Force vs. Time

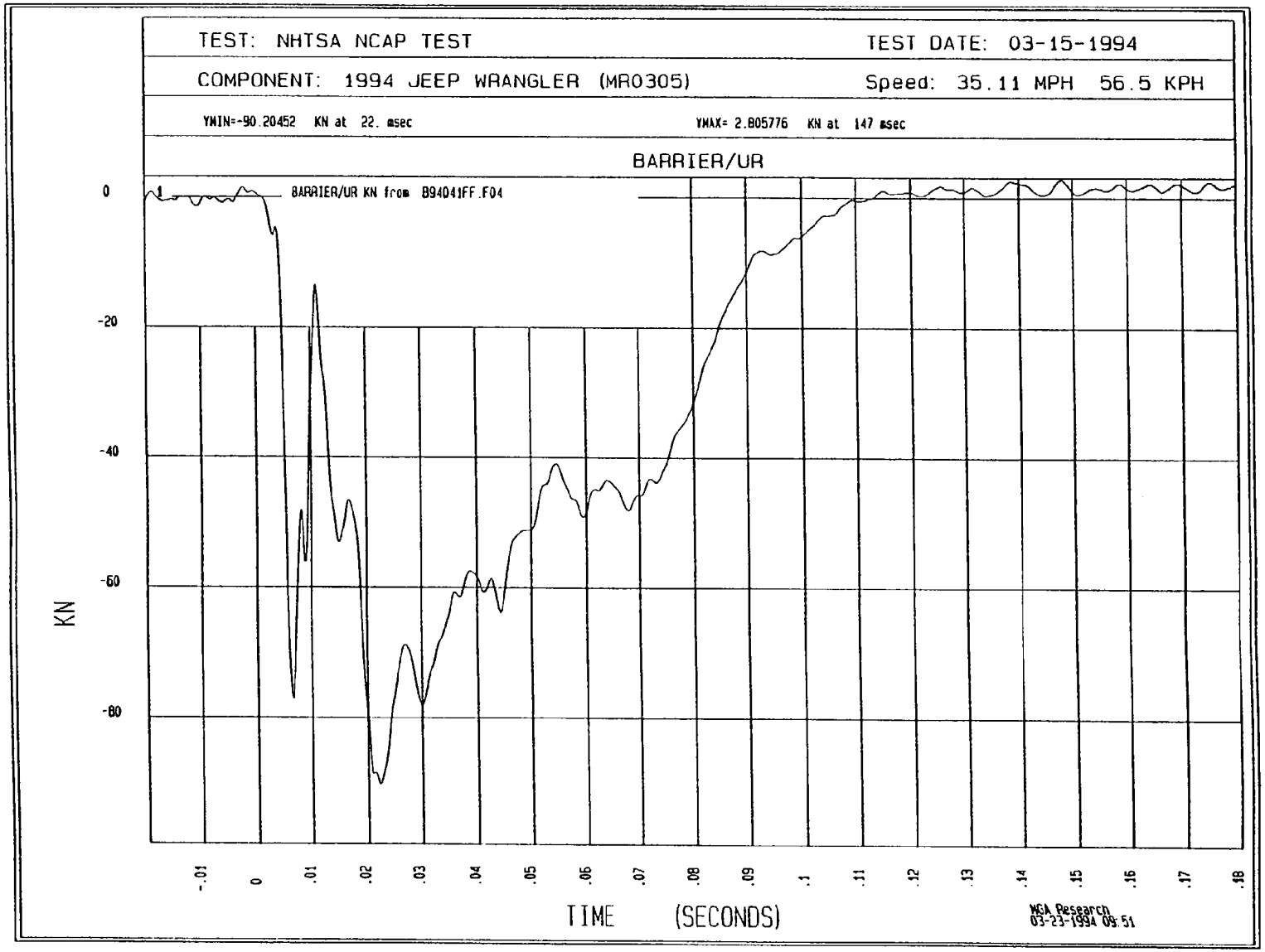


Figure B-25 - Upper Right Barrier Force vs. Time

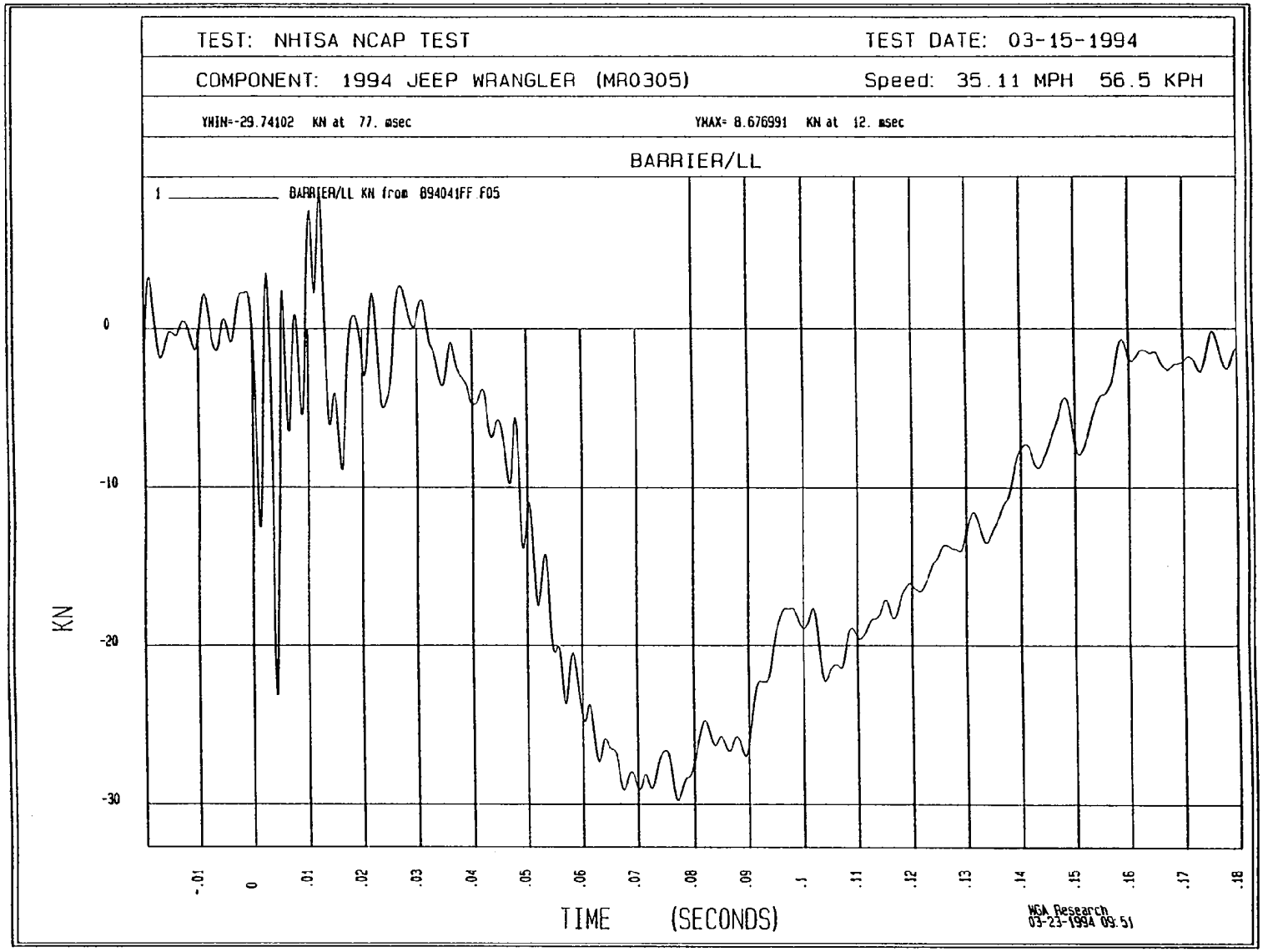


Figure B-26 - Lower Left Barrier Force vs. Time

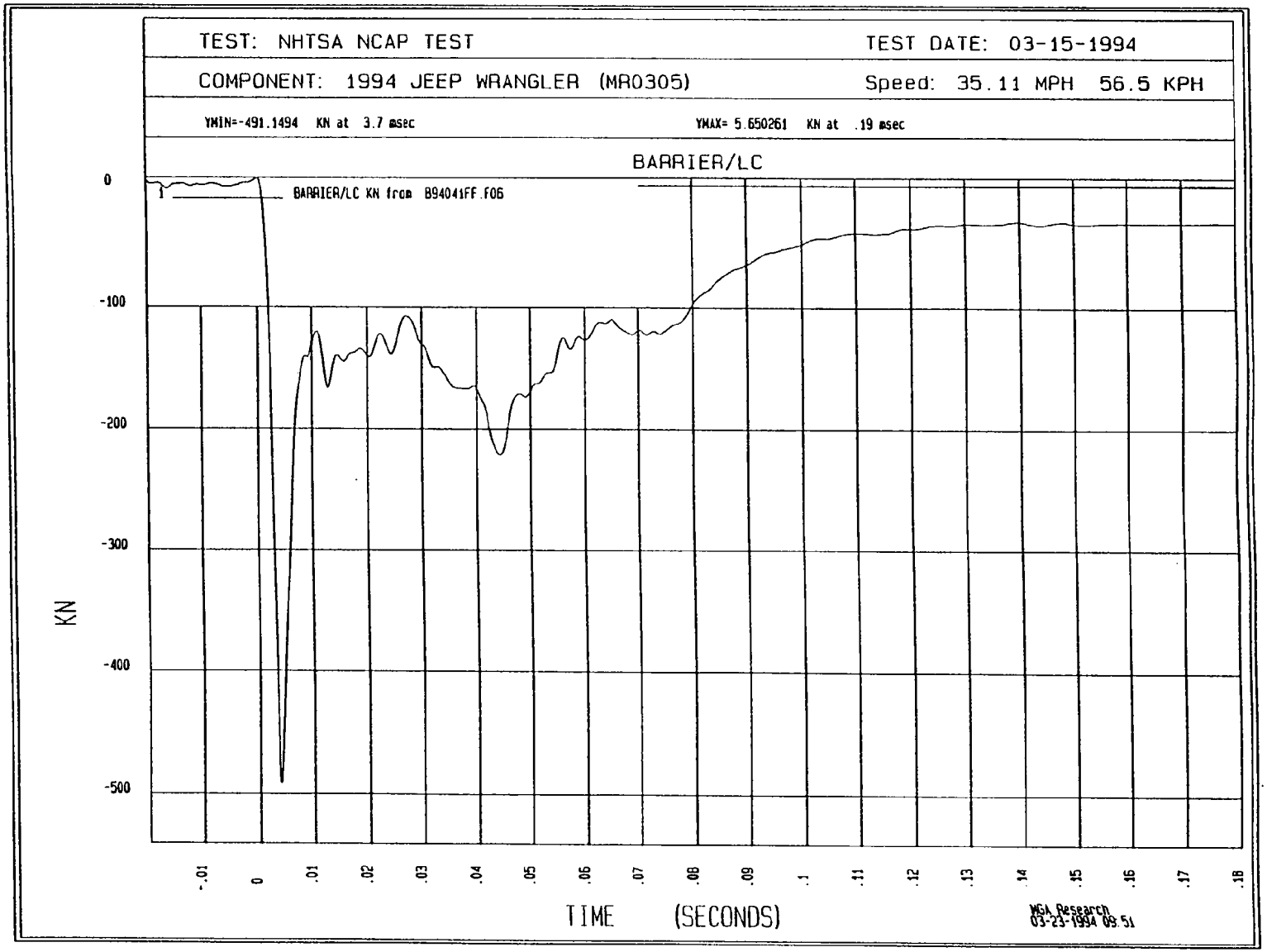


Figure B-27 - Lower Center Barrier Force vs. Time

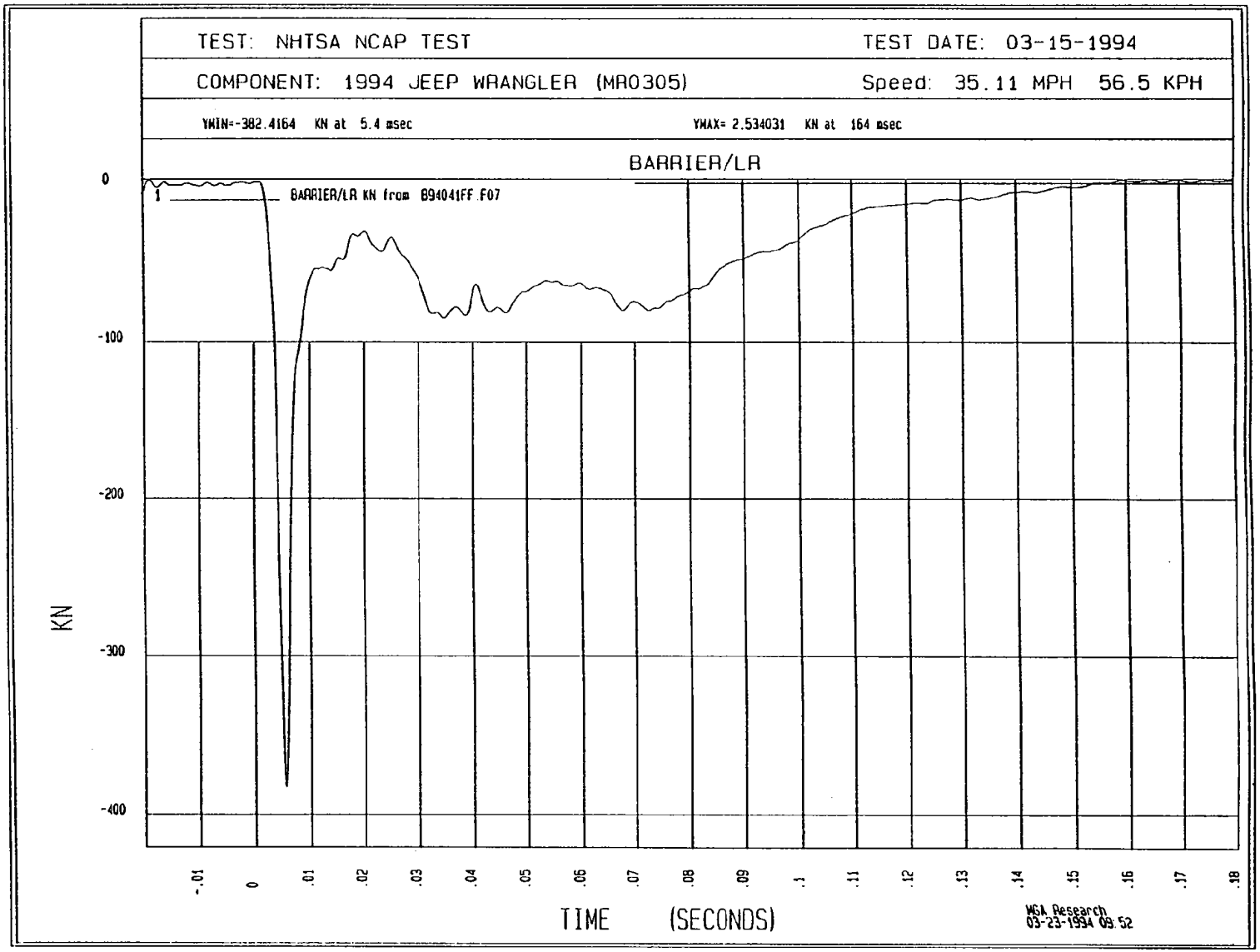


Figure B-28 - Lower Right Barrier Force vs. Time

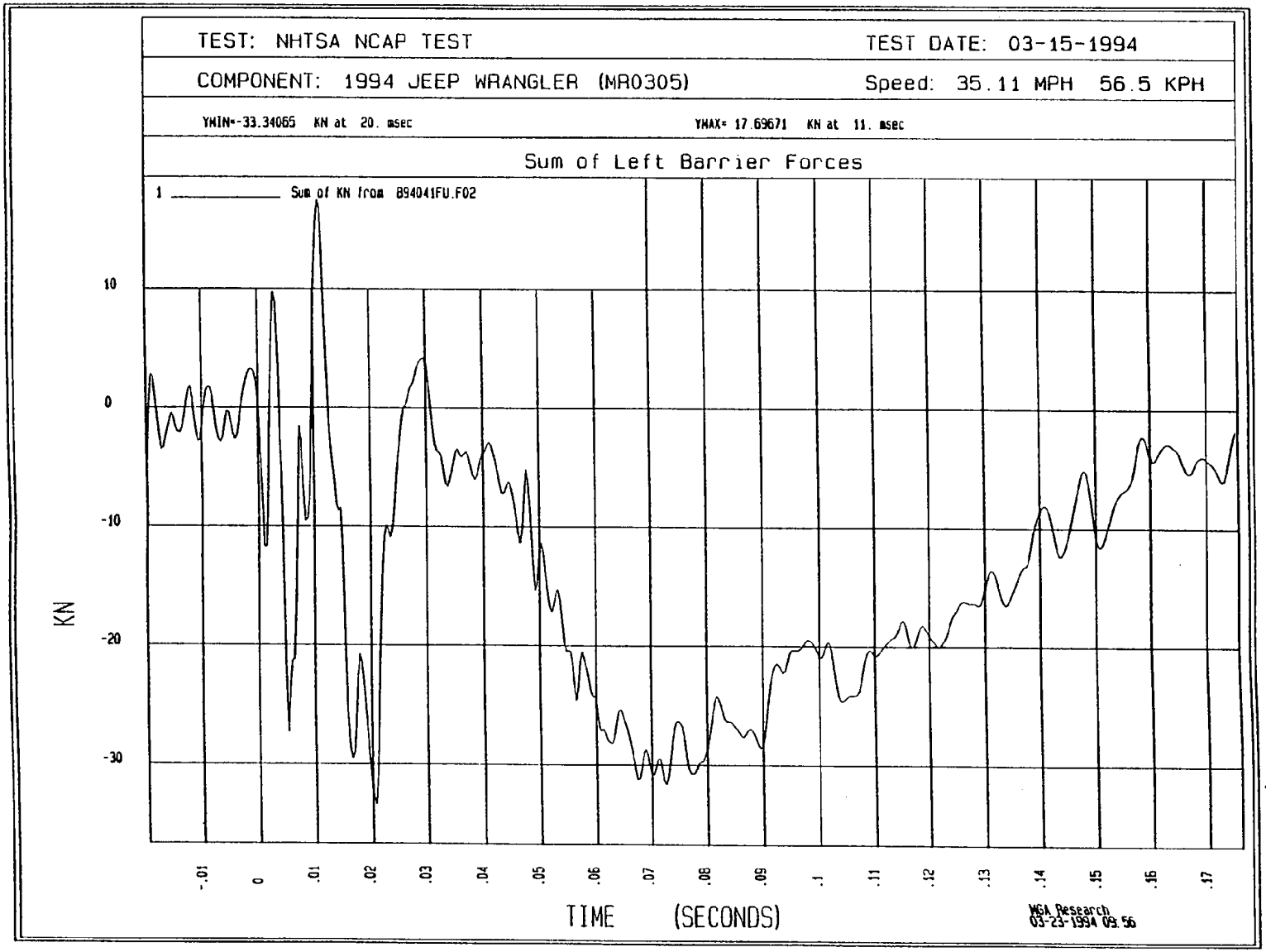


Figure B-29 - Sum of Left Barrier Forces vs. Time

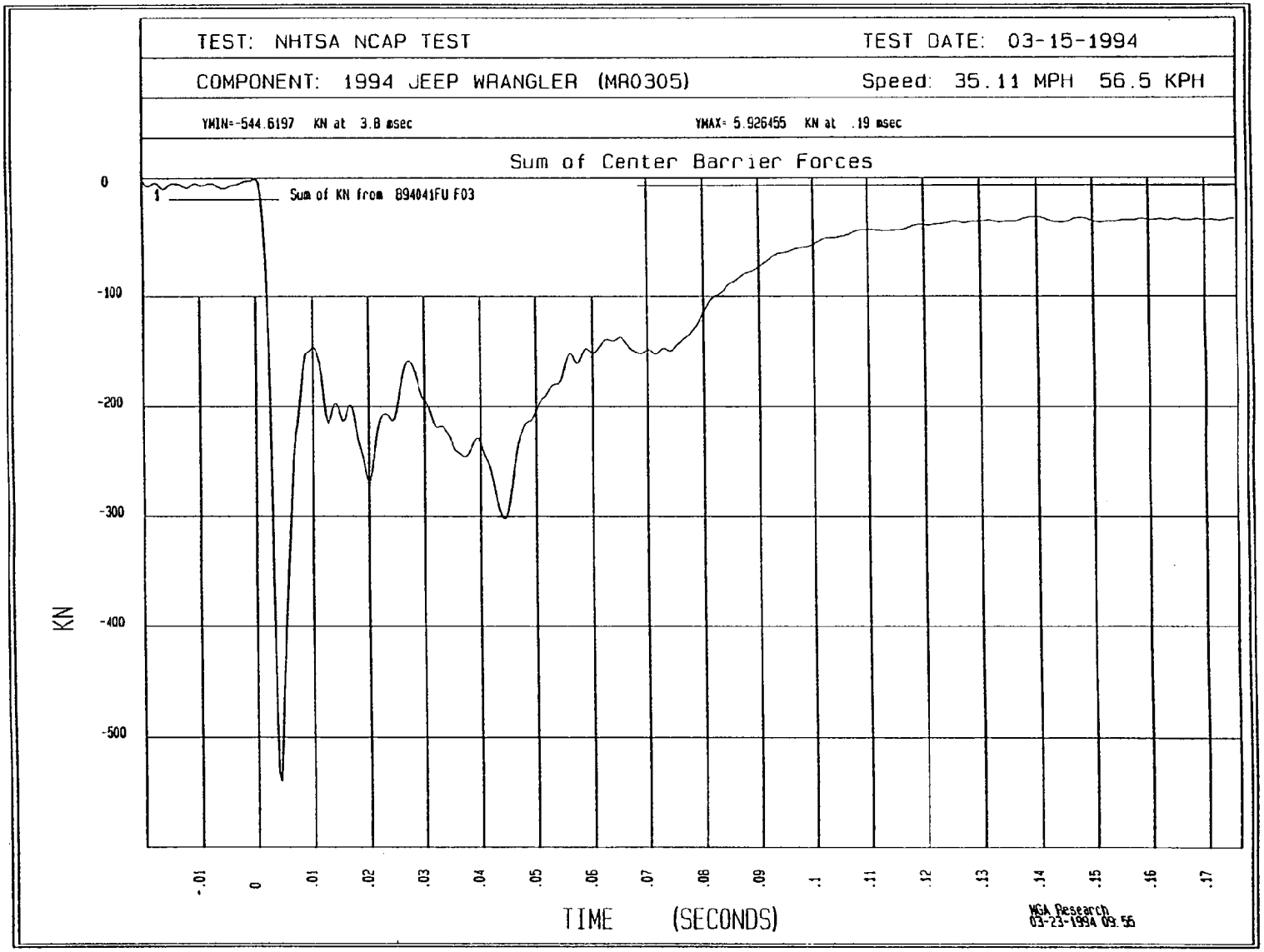


Figure B-30 - Sum of Center Barrier Forces vs. Time

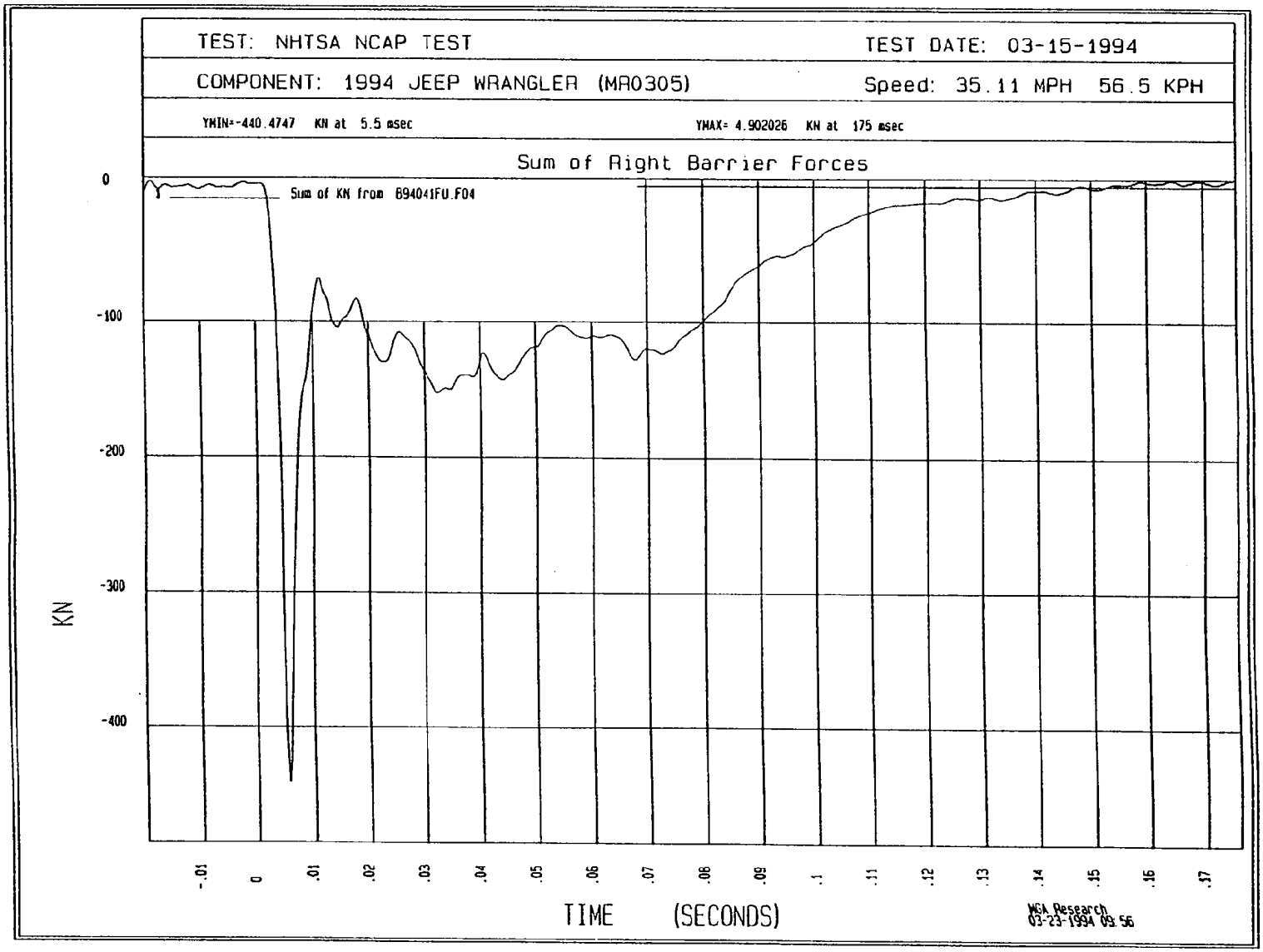


Figure B-31 - Sum of Right Barrier Forces vs. Time

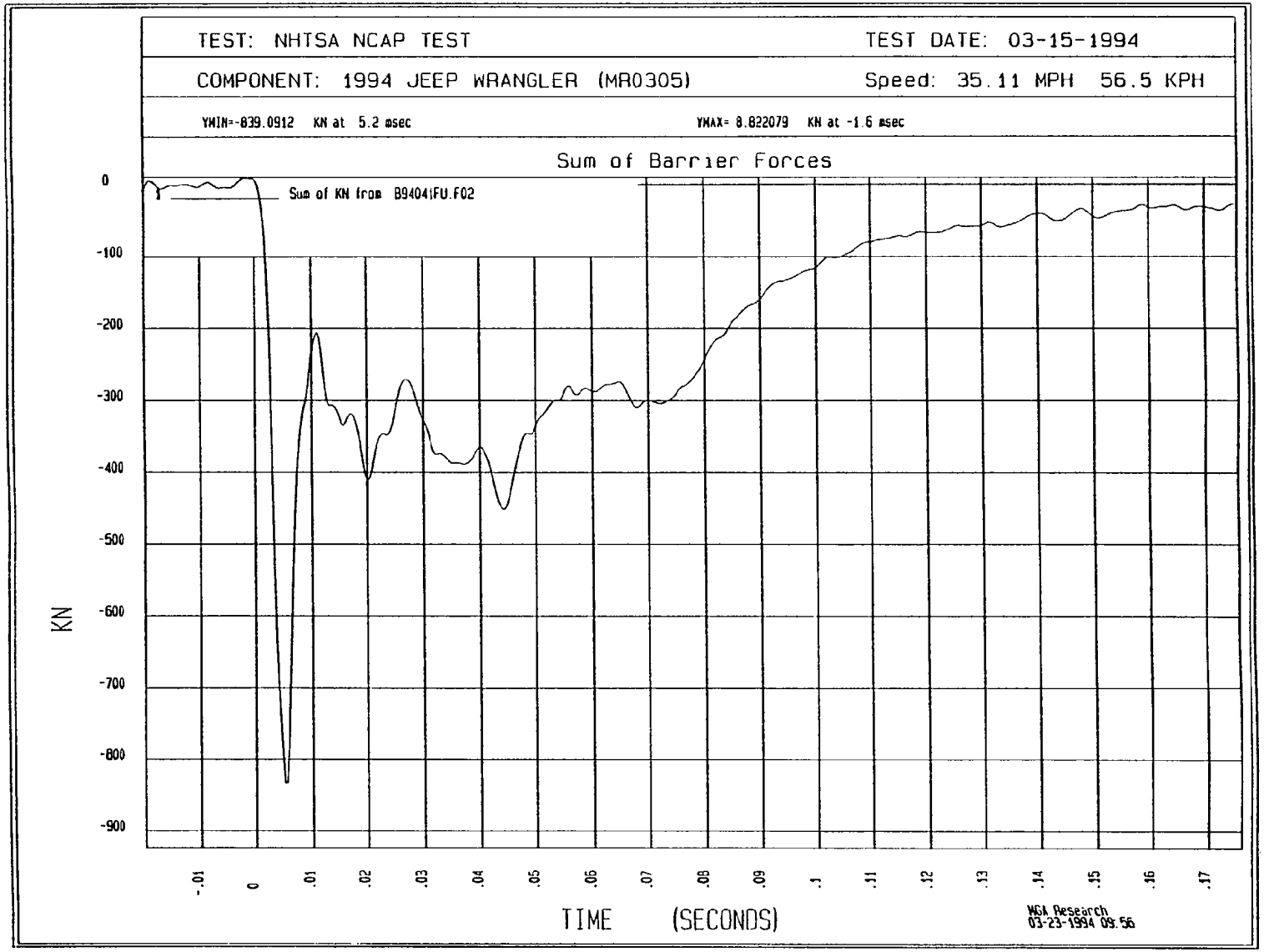


Figure B-32 - Sum of Barrier Forces vs. Time

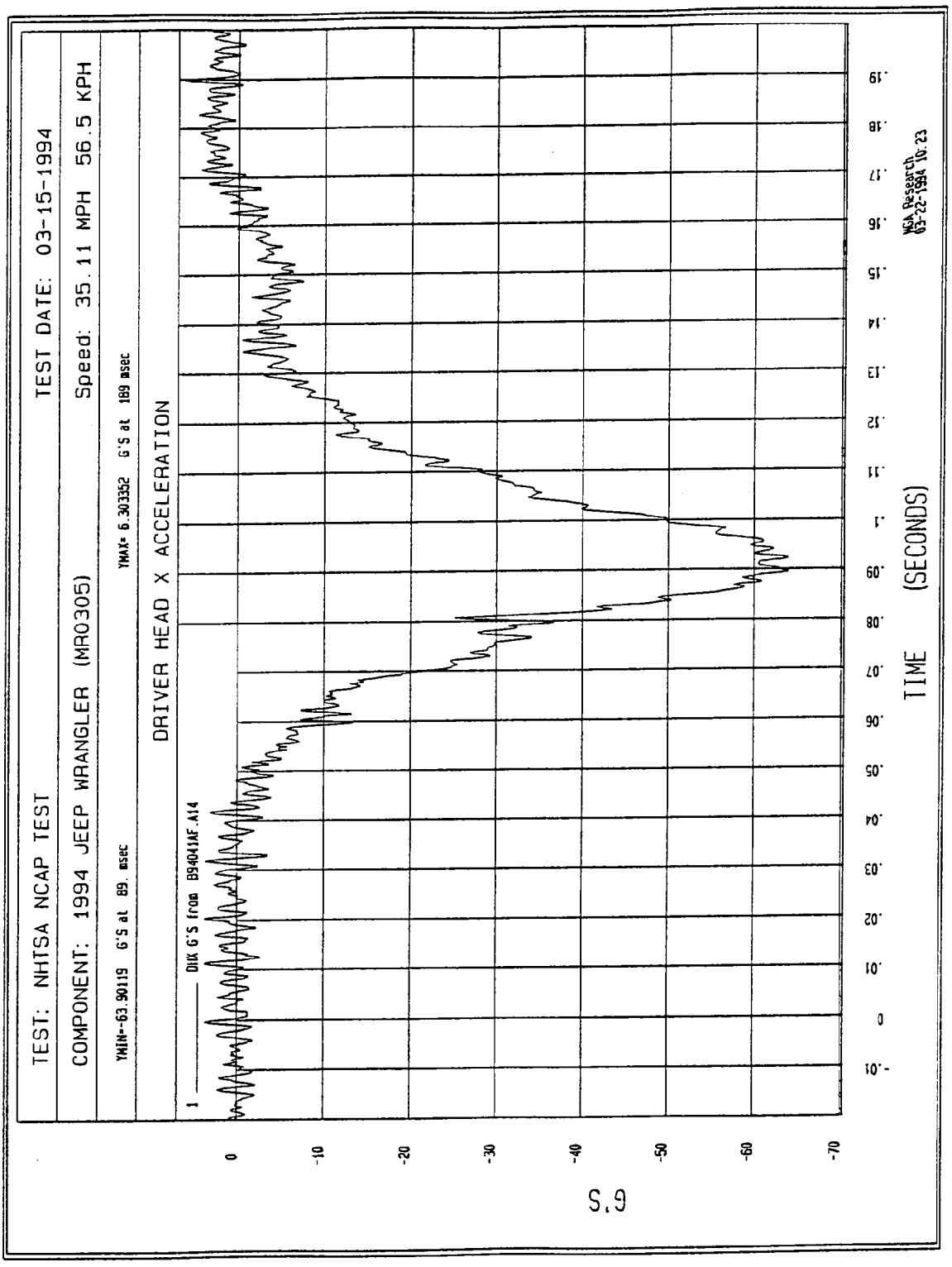


Figure B-33 - Driver Head X Acceleration vs. Time

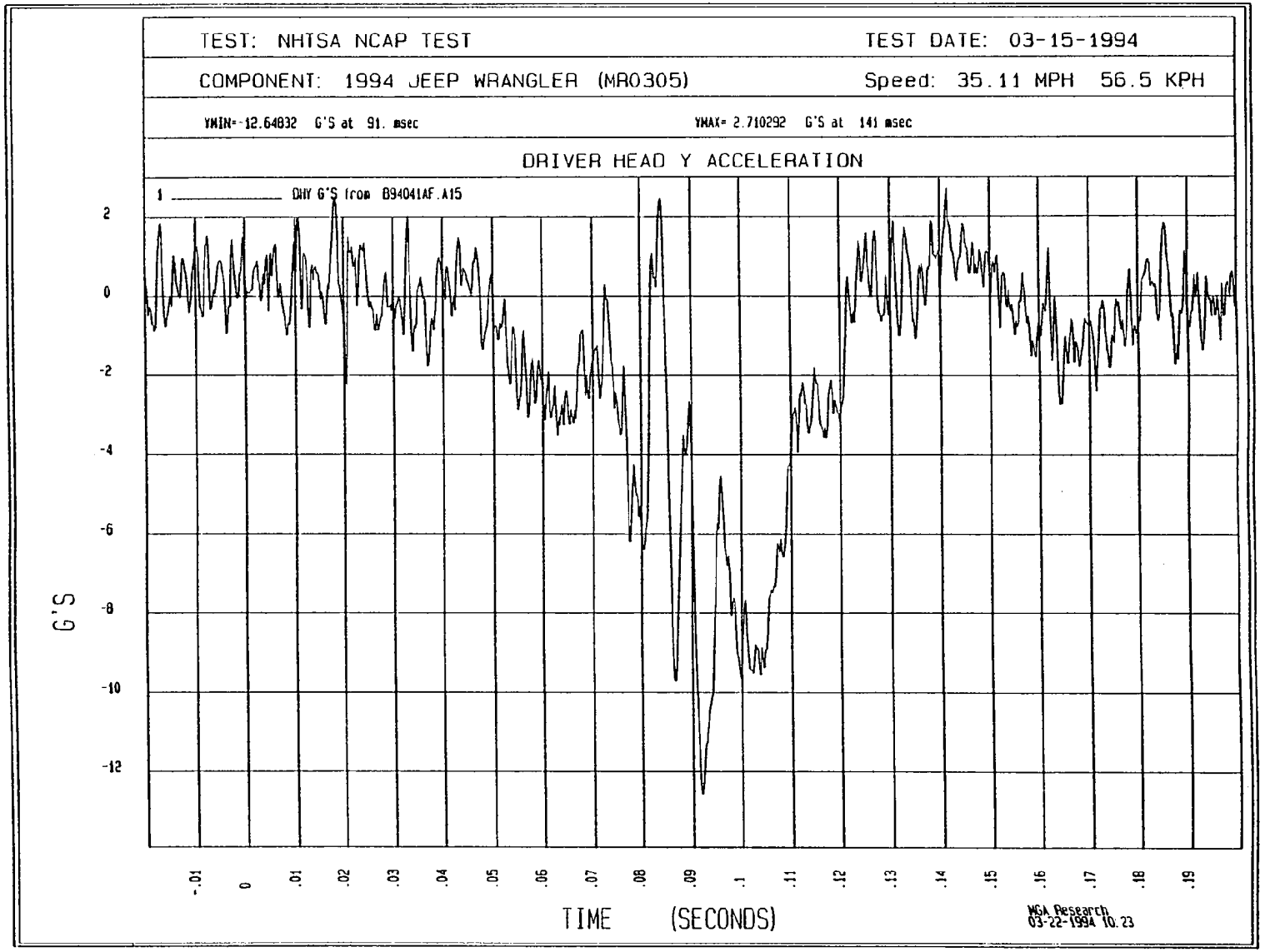


Figure B-34 - Driver Head Y Acceleration vs. Time

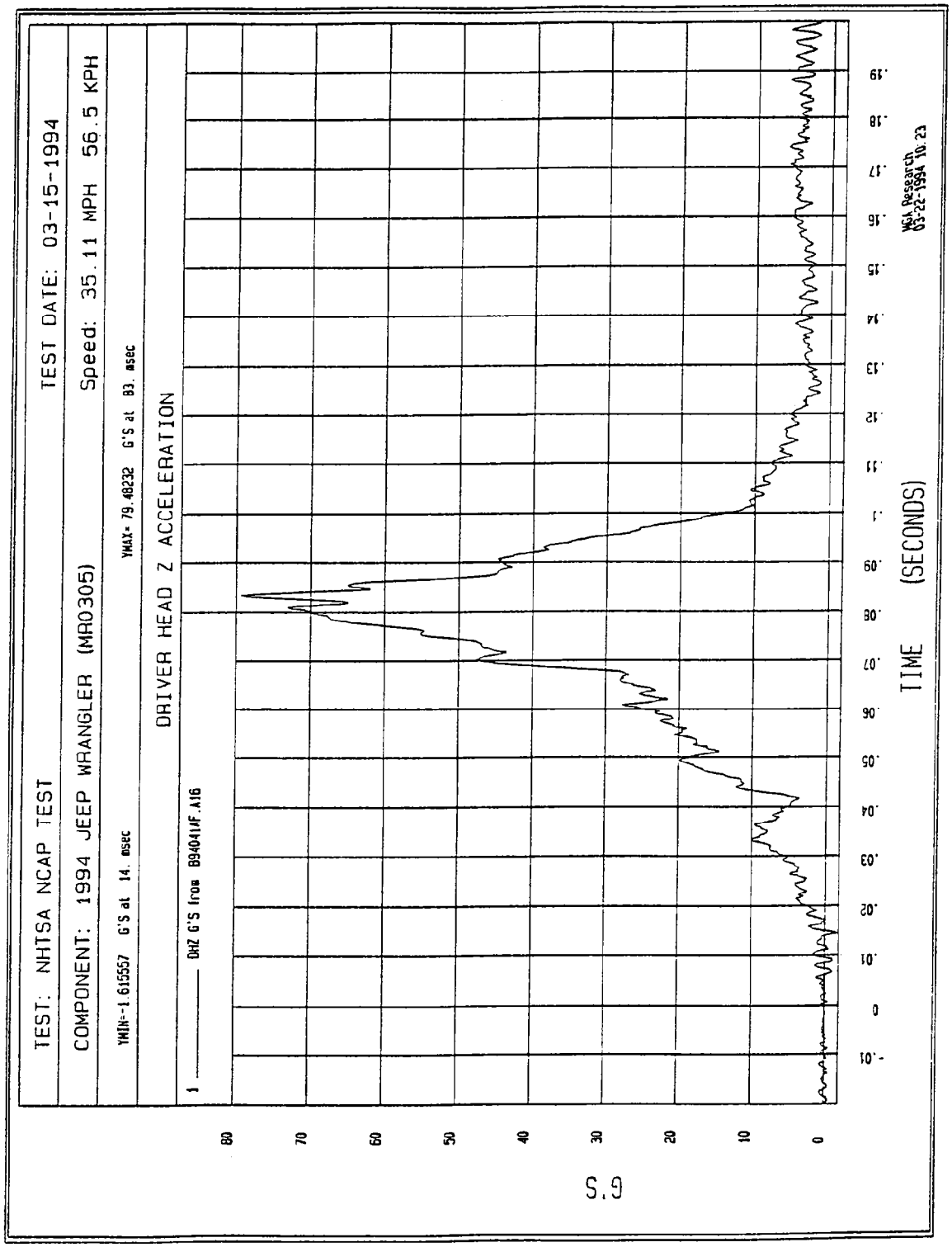


Figure B-35 - Driver Head Z Acceleration vs. Time

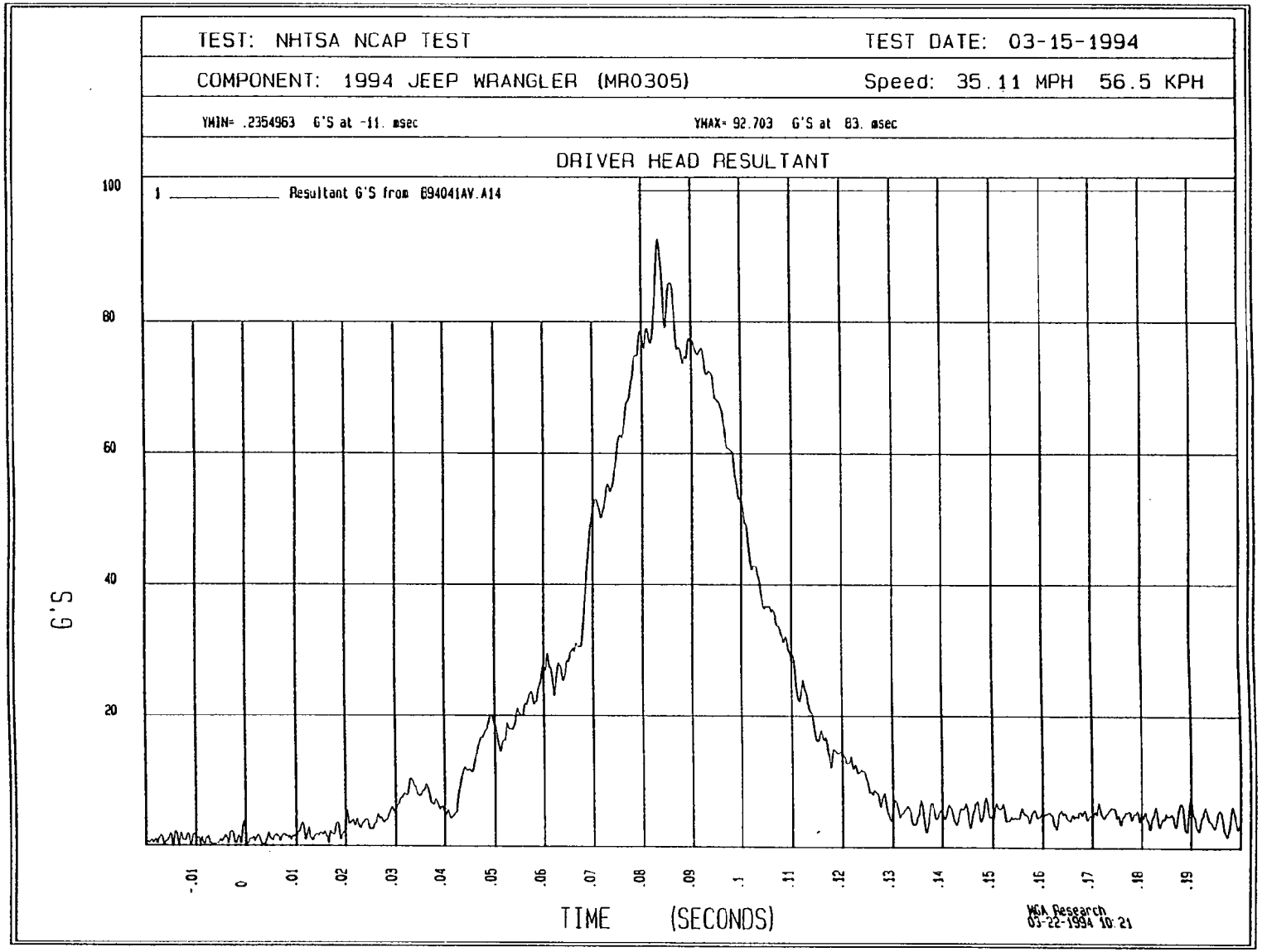


Figure B-36 - Driver Head Resultant Acceleration vs. Time

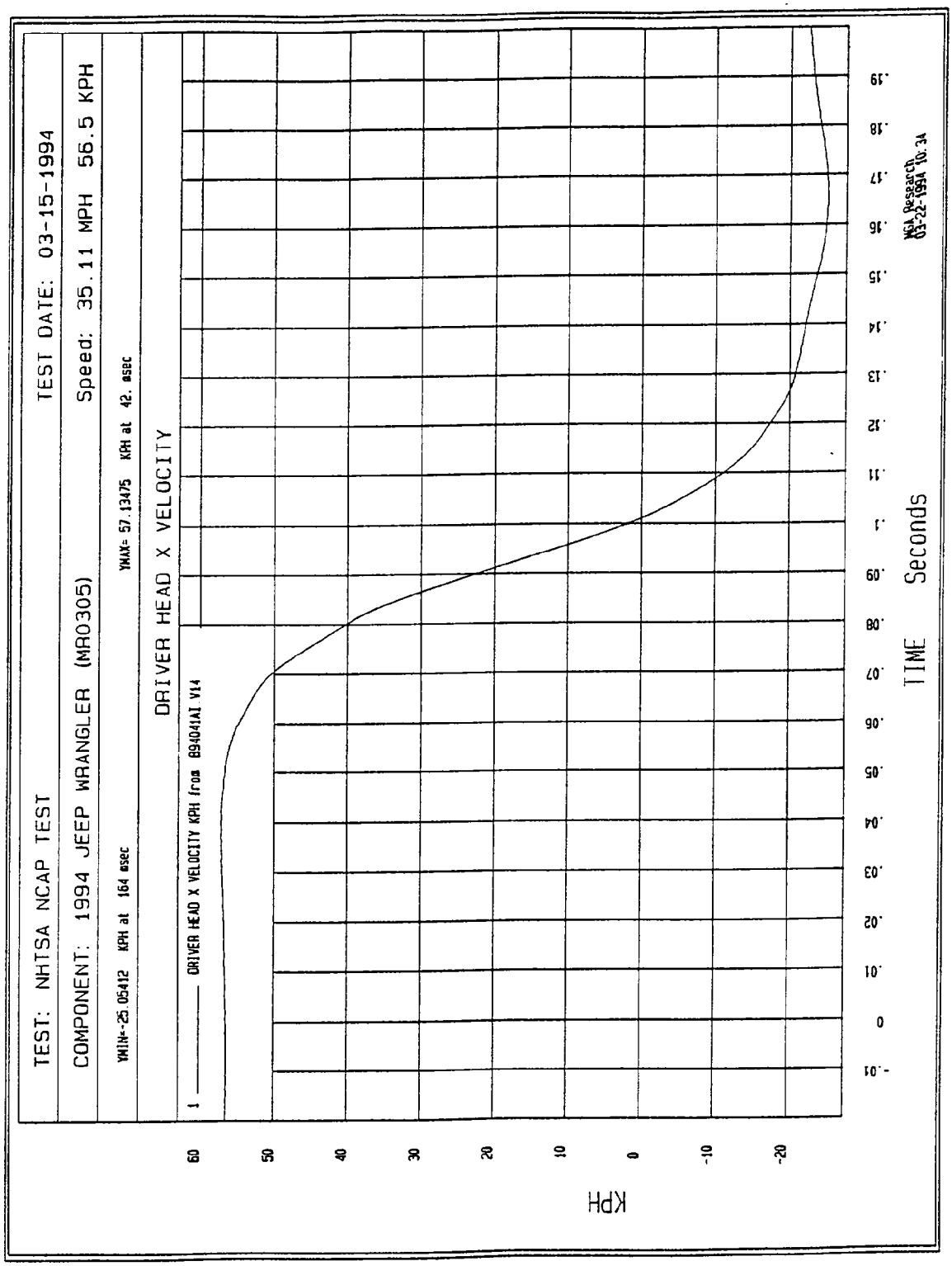


Figure B-37 - Driver Head X Velocity vs. Time

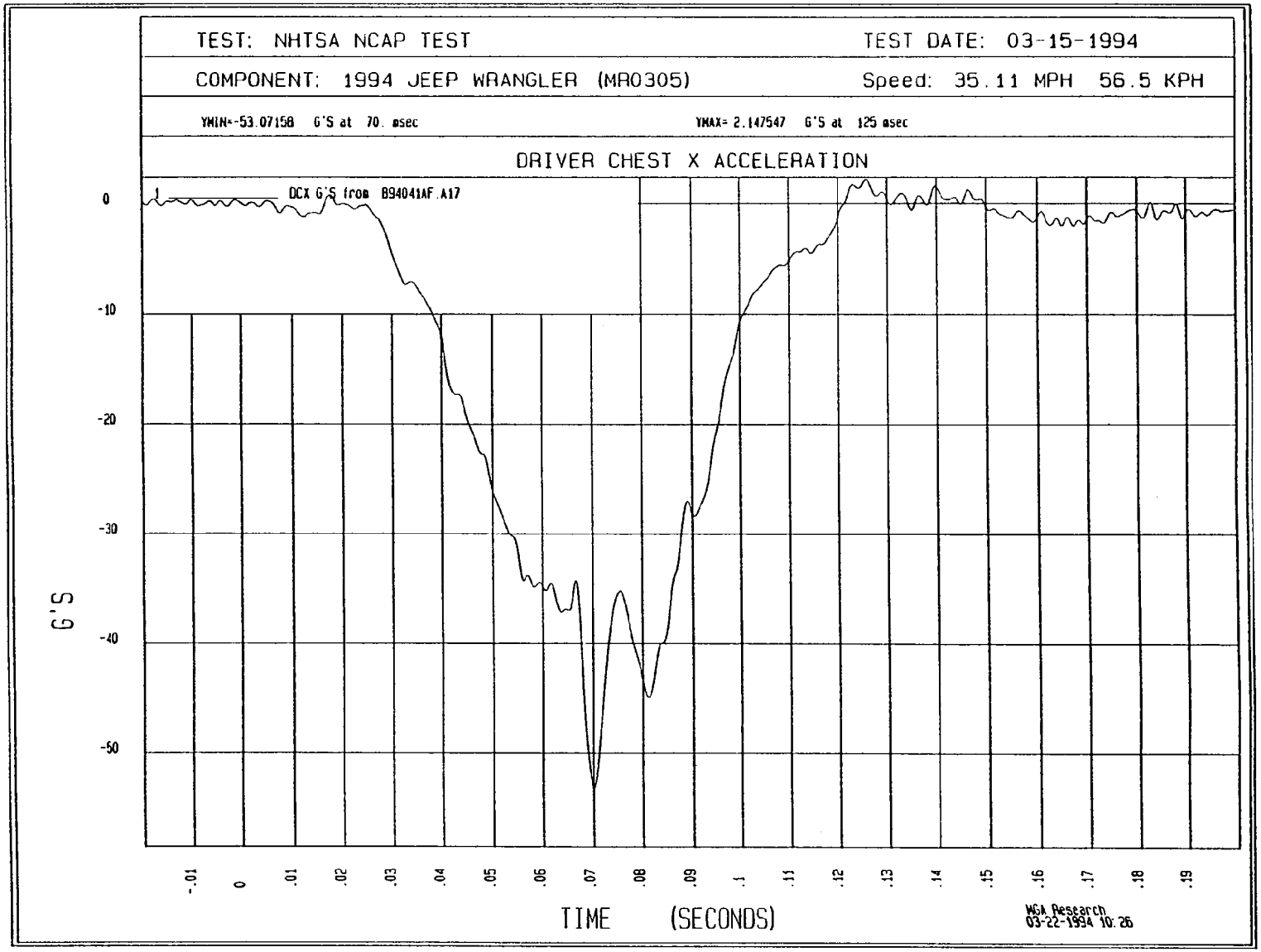


Figure B-38 - Driver Chest X Acceleration vs. Time

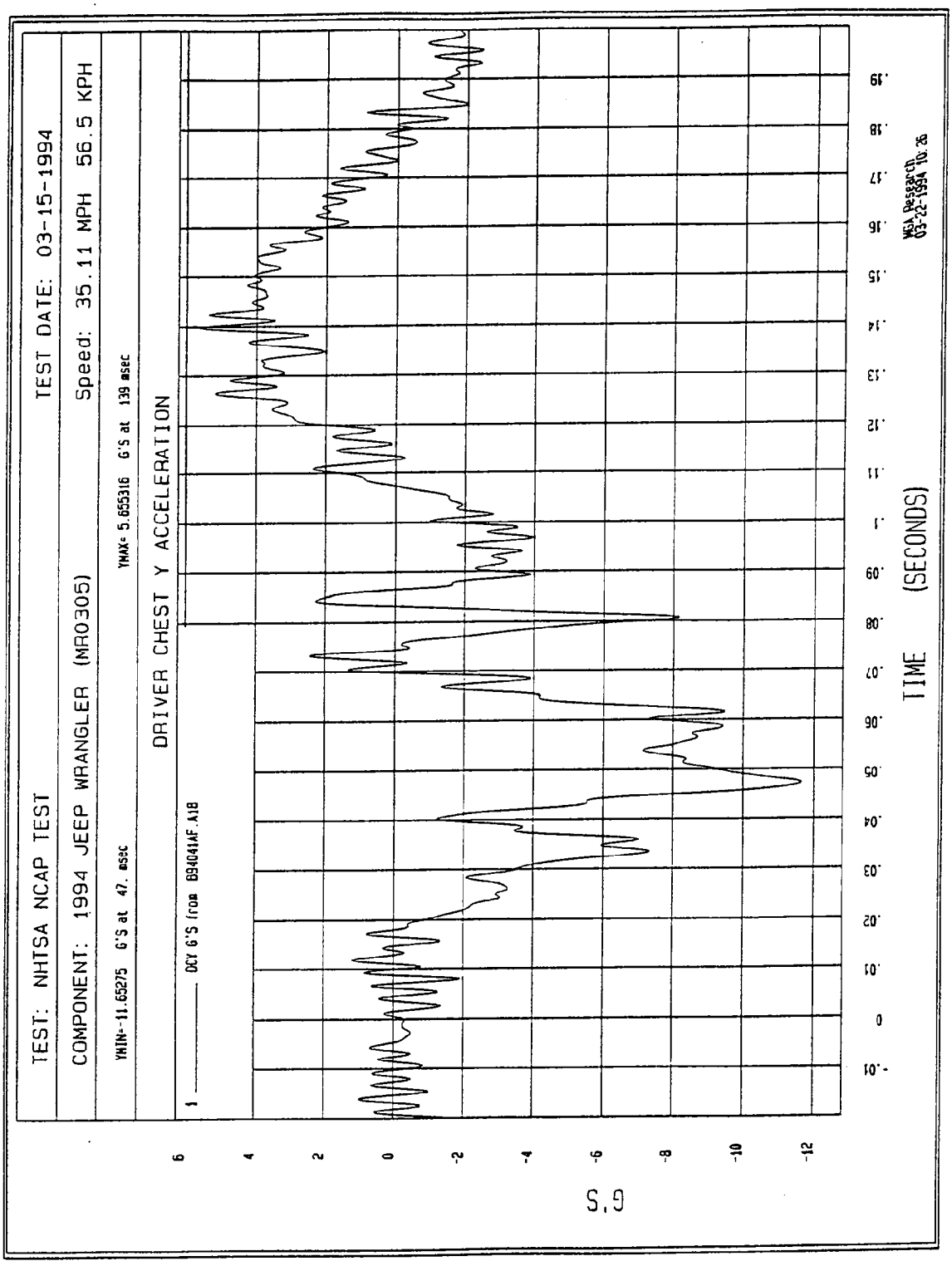


Figure B-39 - Driver Chest Y Acceleration vs. Time

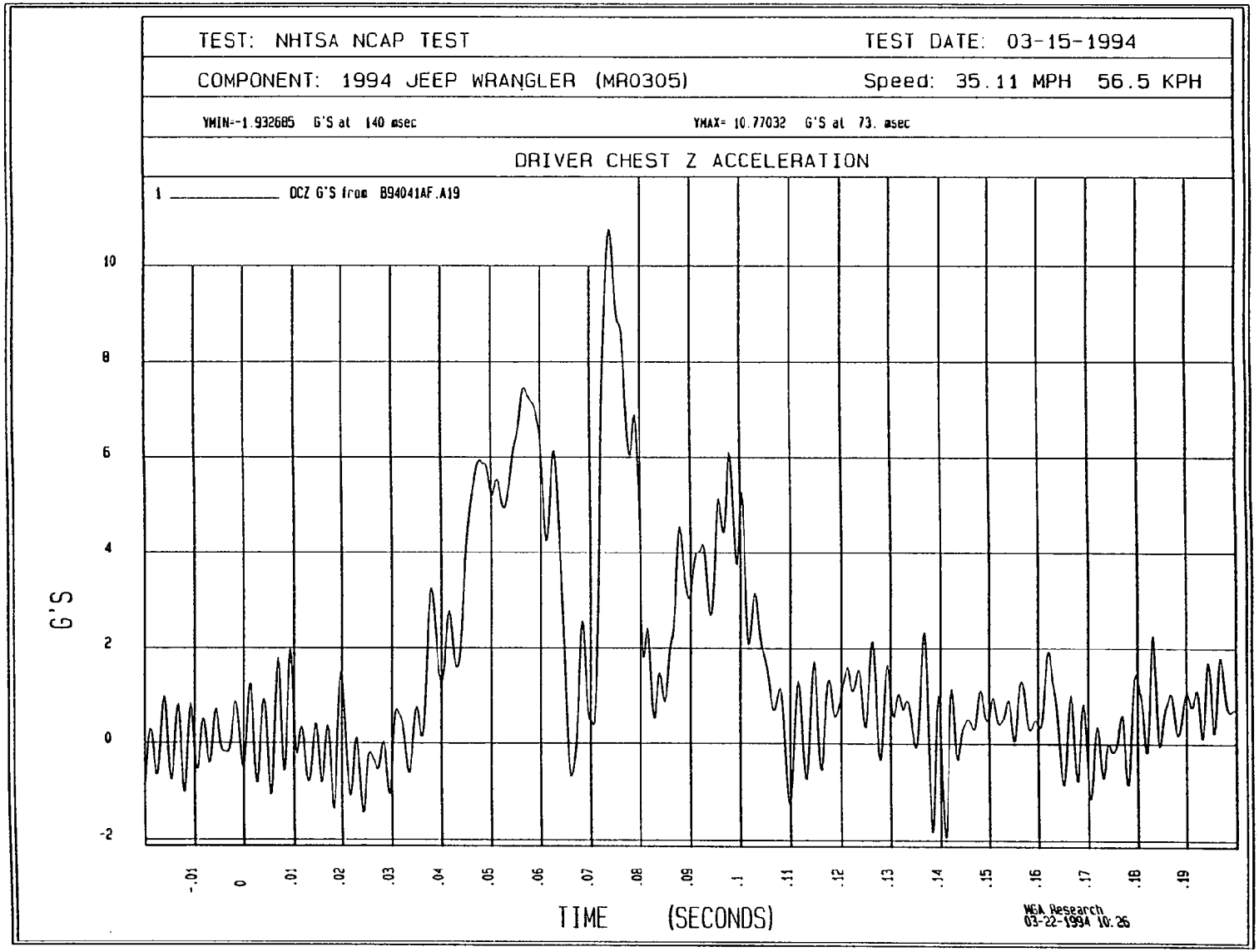


Figure B-40 - Driver Chest Z Acceleration vs. Time

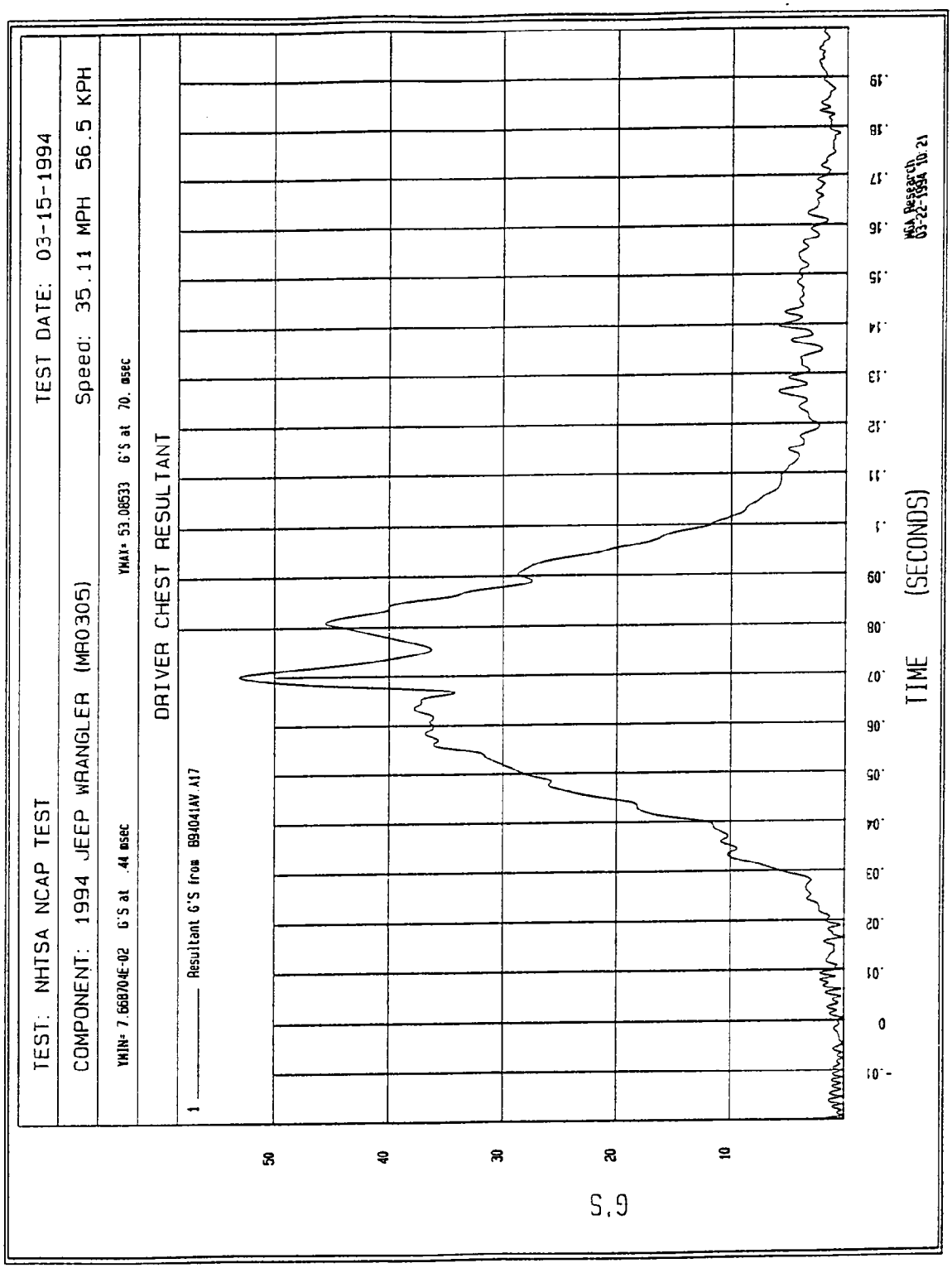


Figure B-41 - Driver Chest Resultant vs. Time

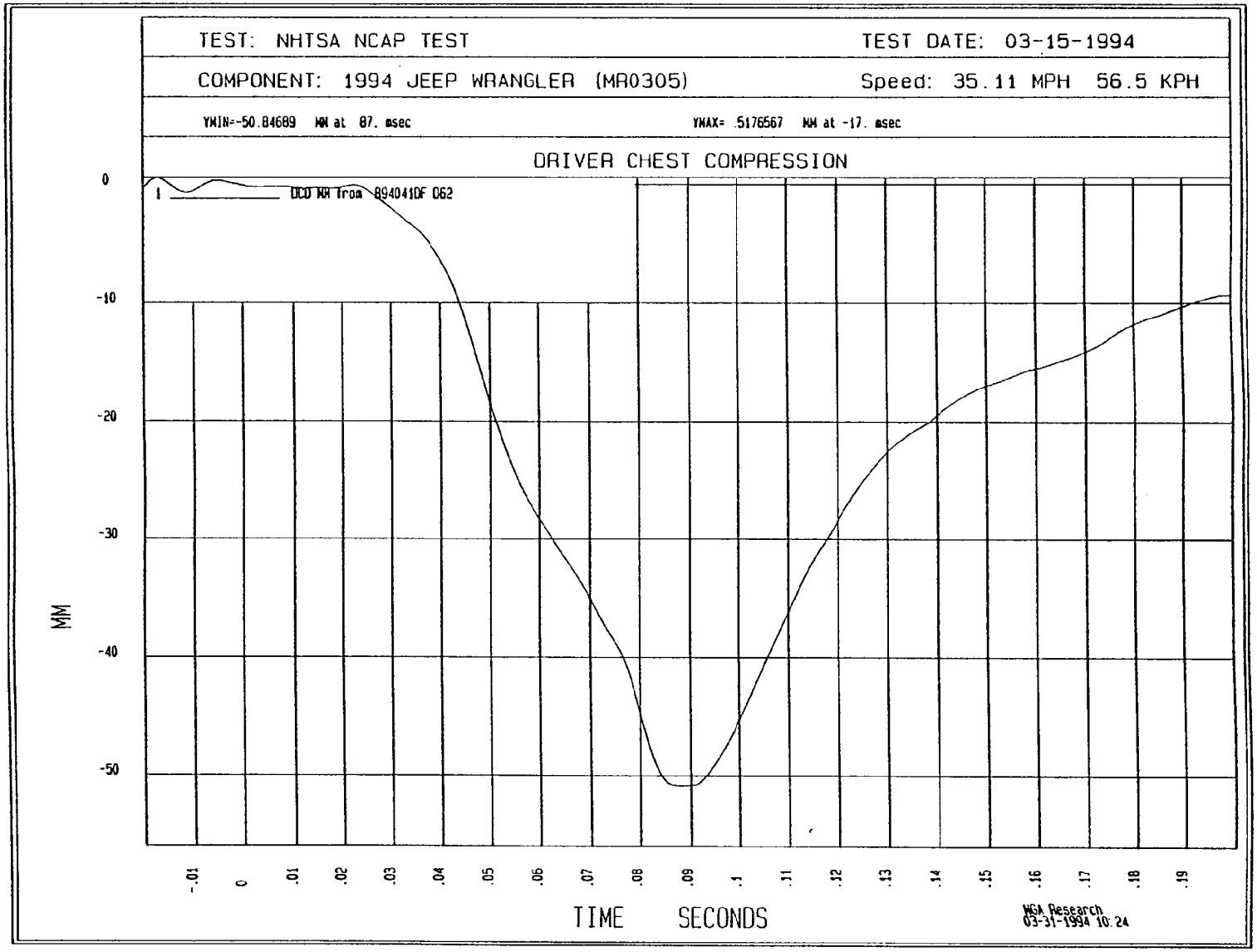


Figure B-42 - Driver Chest Compression vs. Time

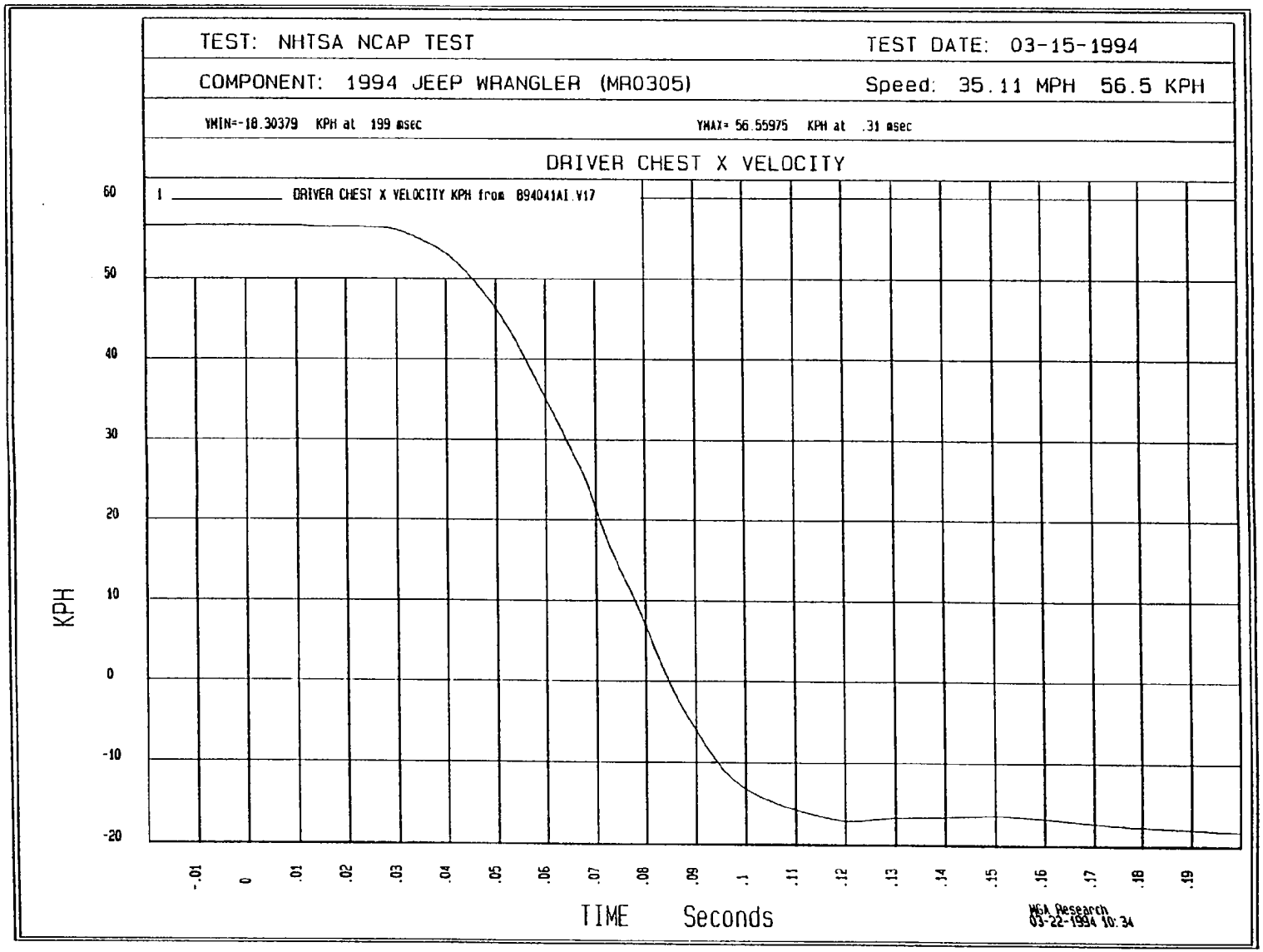


Figure B-43 - Driver Chest X Velocity vs. Time

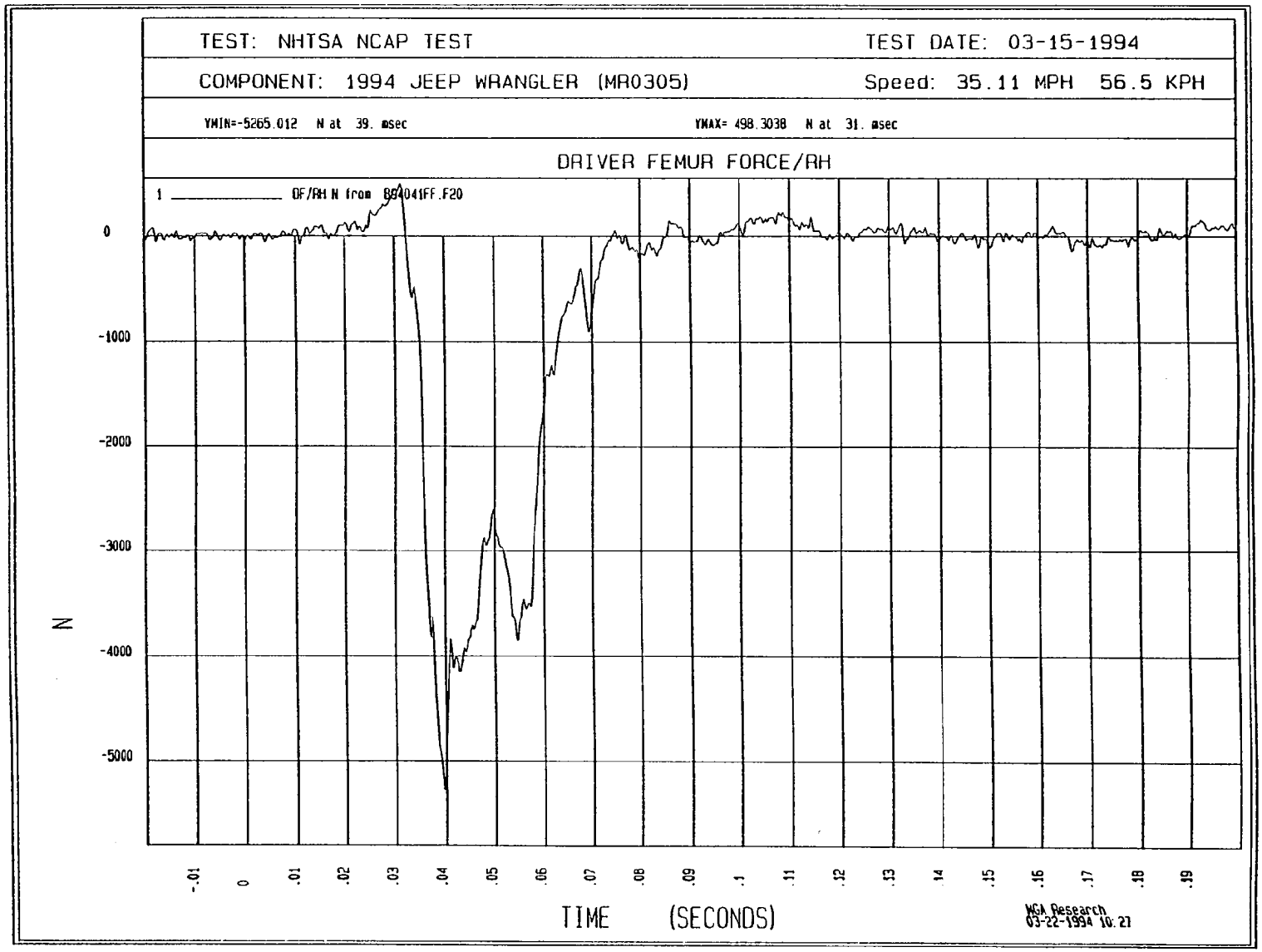


Figure B-44 - Driver Right Femur Force vs. Time

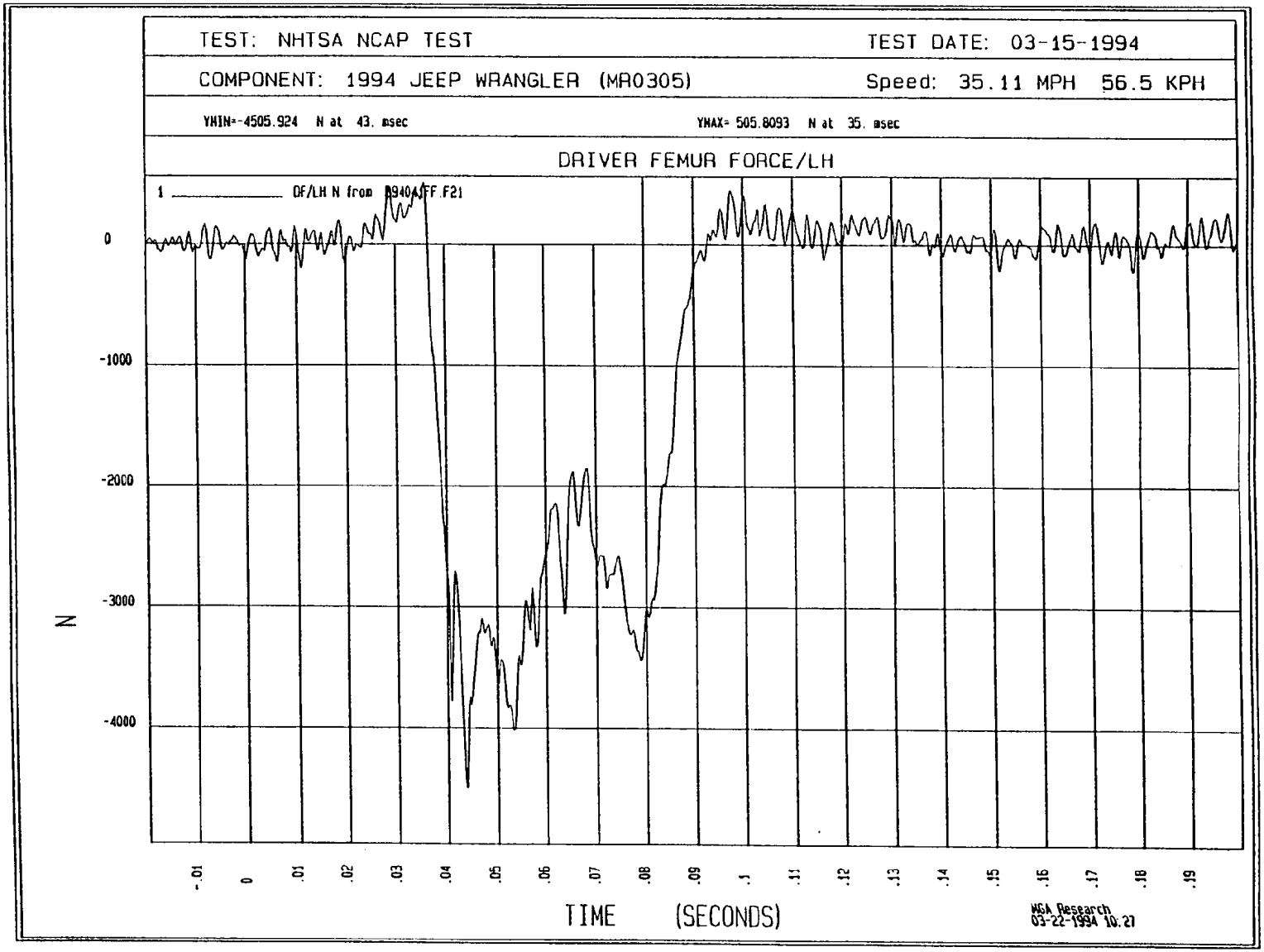


Figure B-45 - Driver Left Femur Force vs. Time

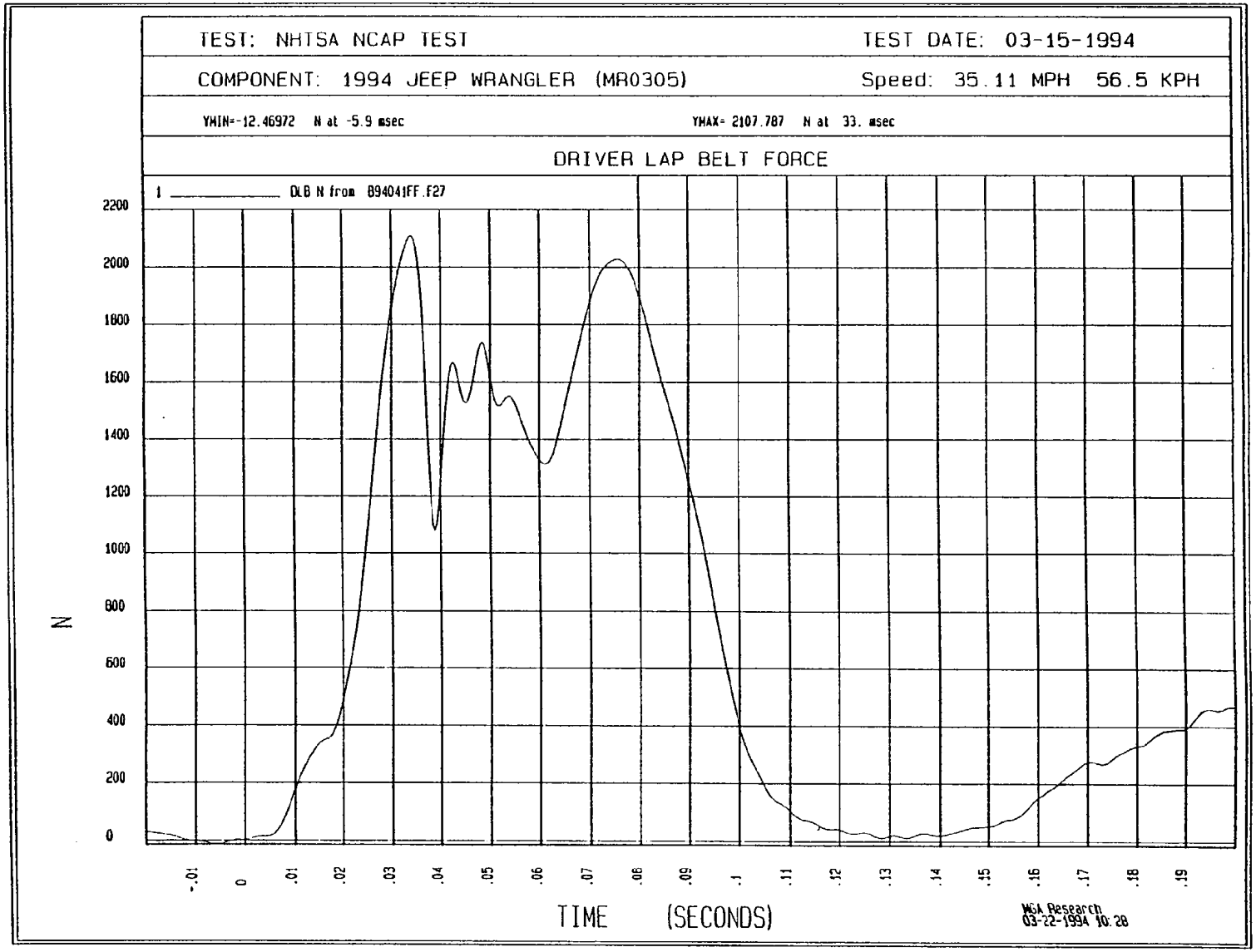


Figure B-46 - Driver Lap Belt Force vs. Time

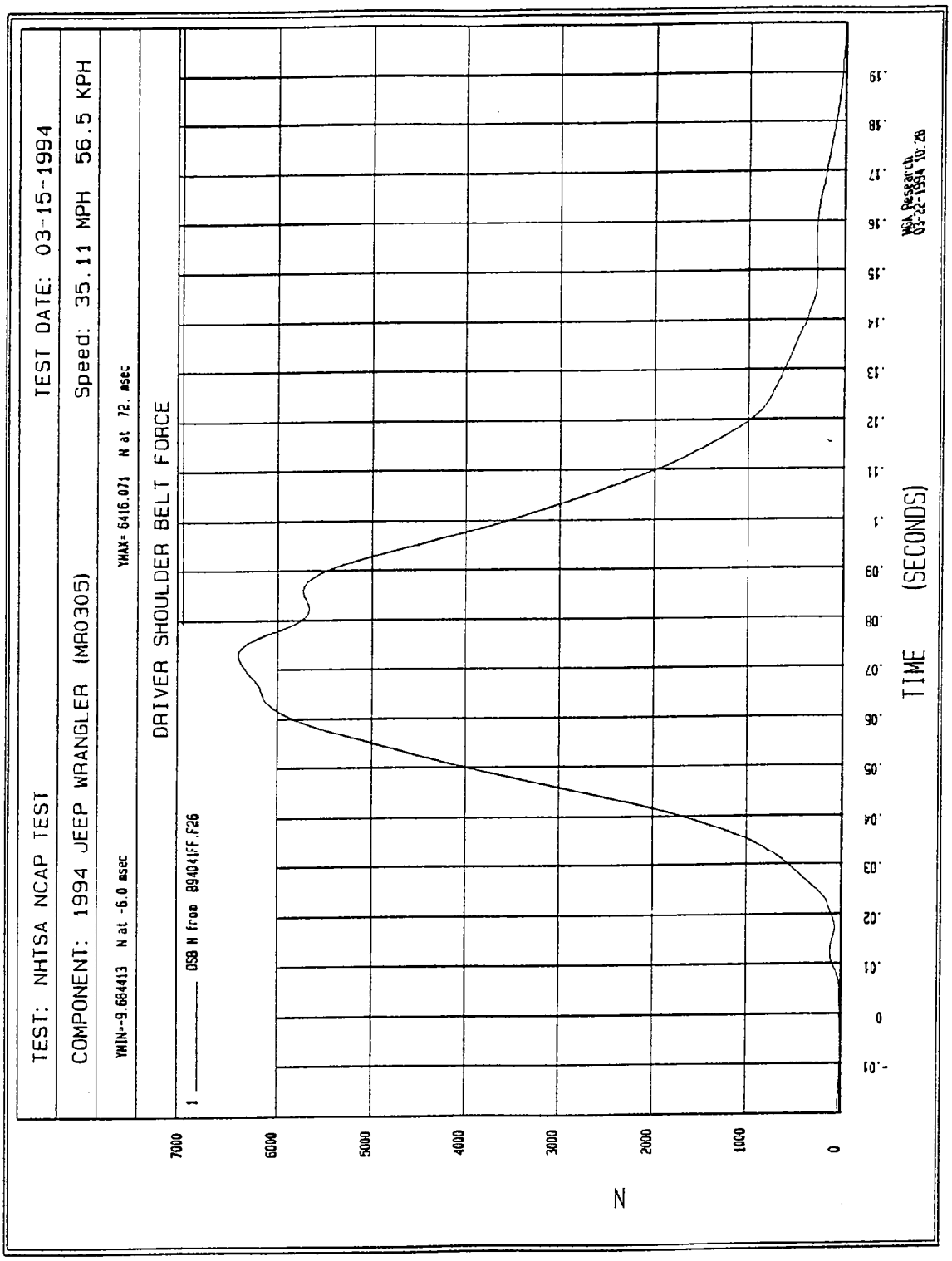


Figure B-47 - Driver Shoulder Belt Force vs. Time

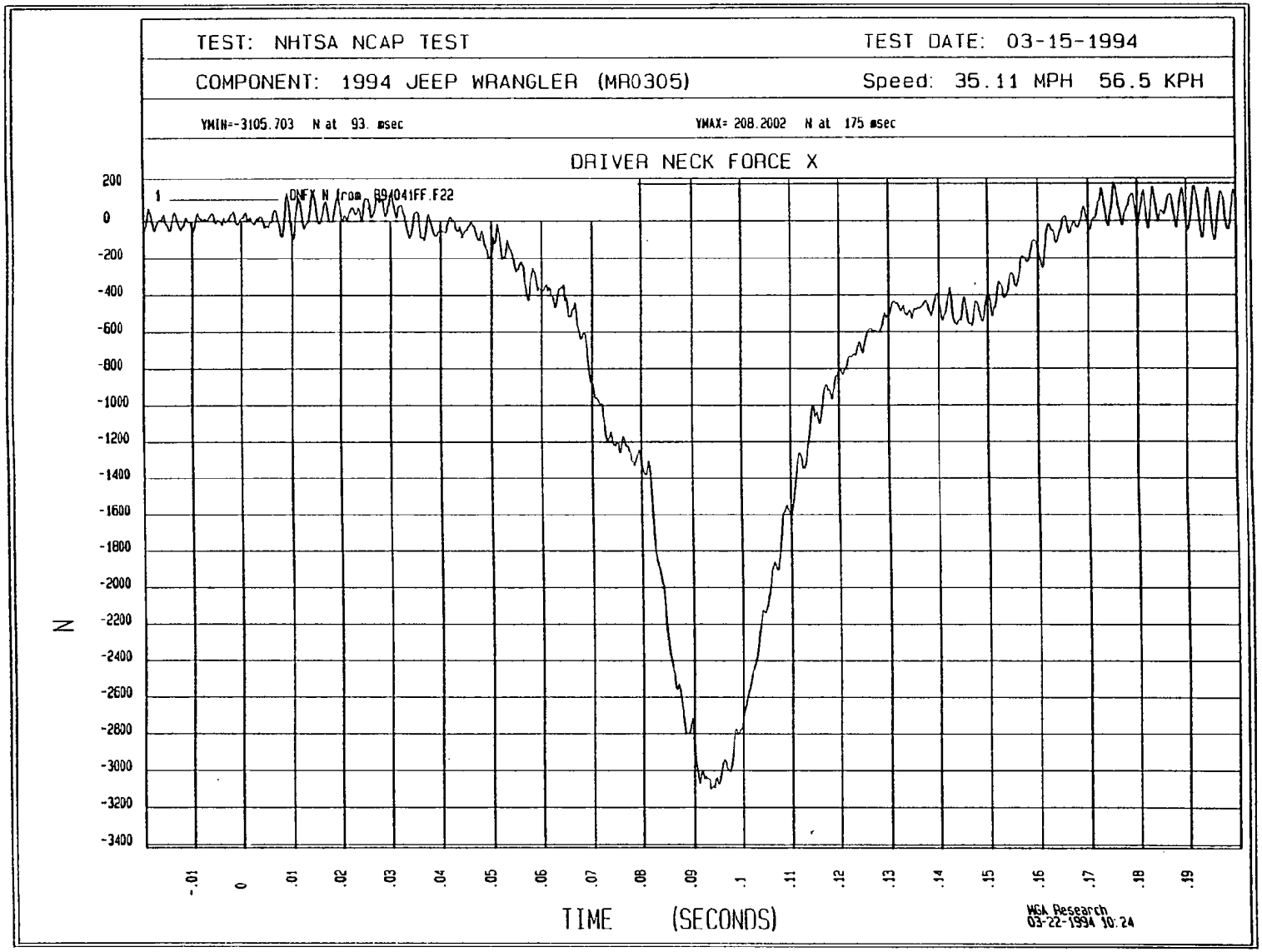


Figure B-48 - Driver Neck Force X vs. Time

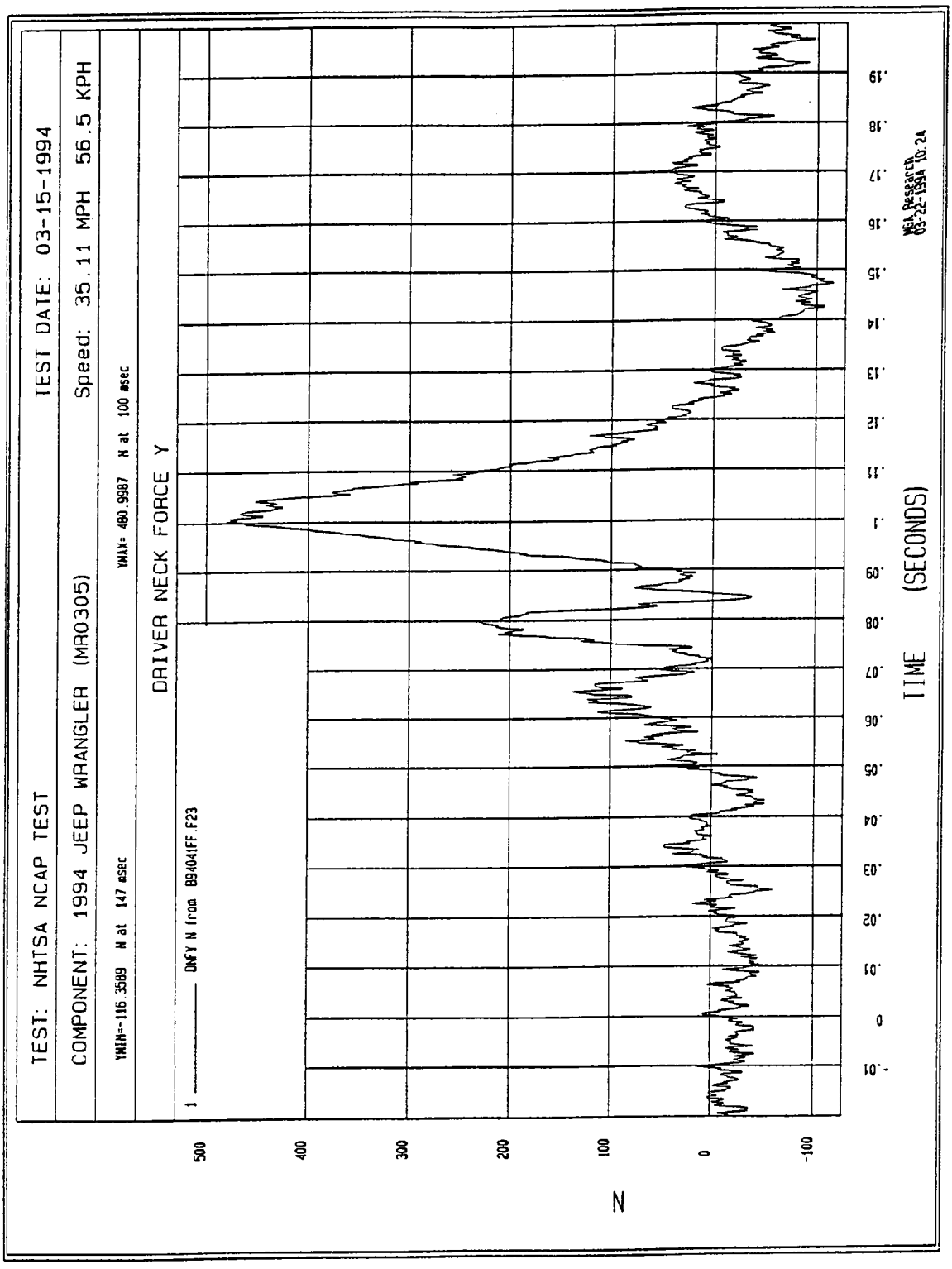


Figure B-49 - Driver Neck Force Y vs. Time

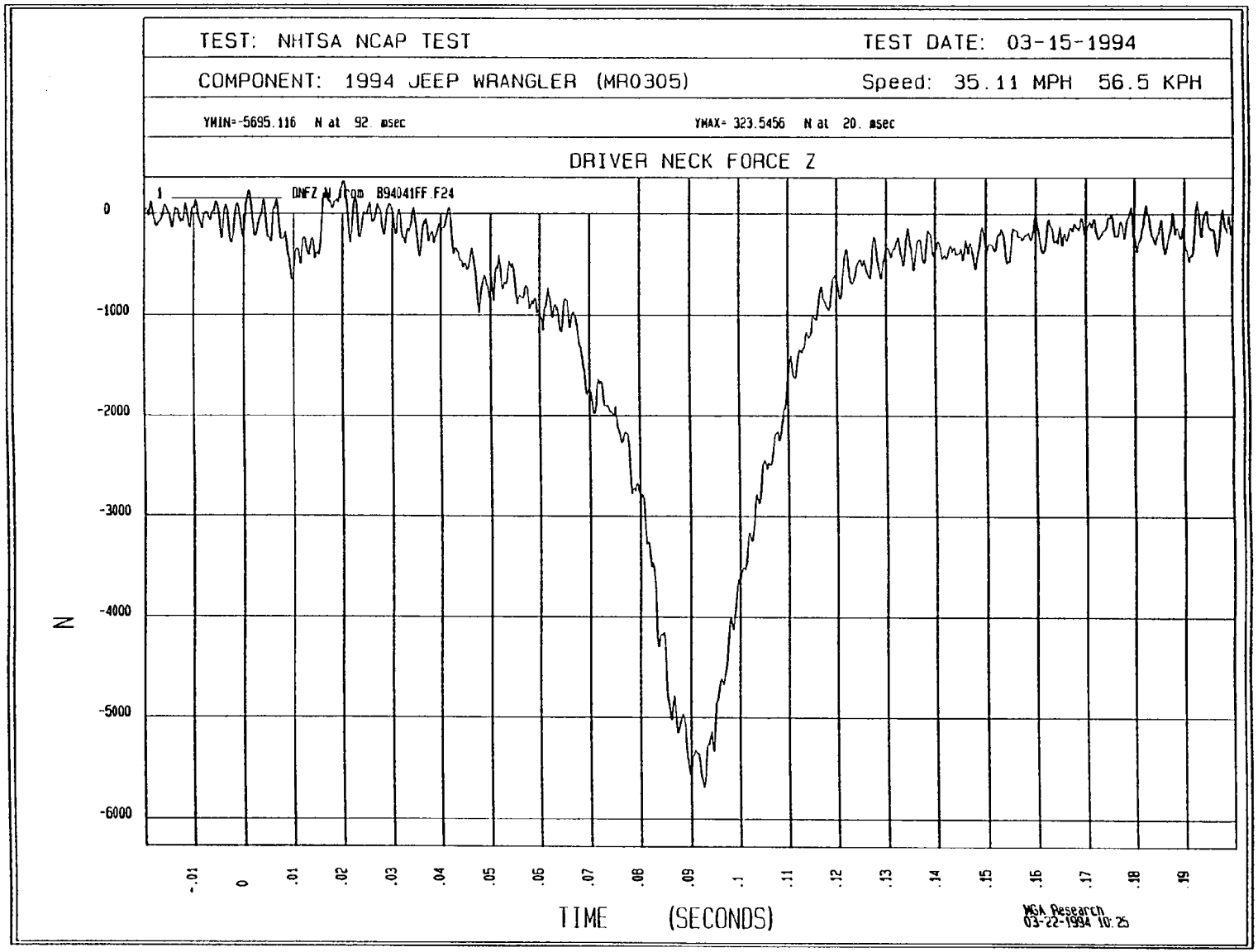


Figure B-5Ø - Driver Neck Force Z vs. Time

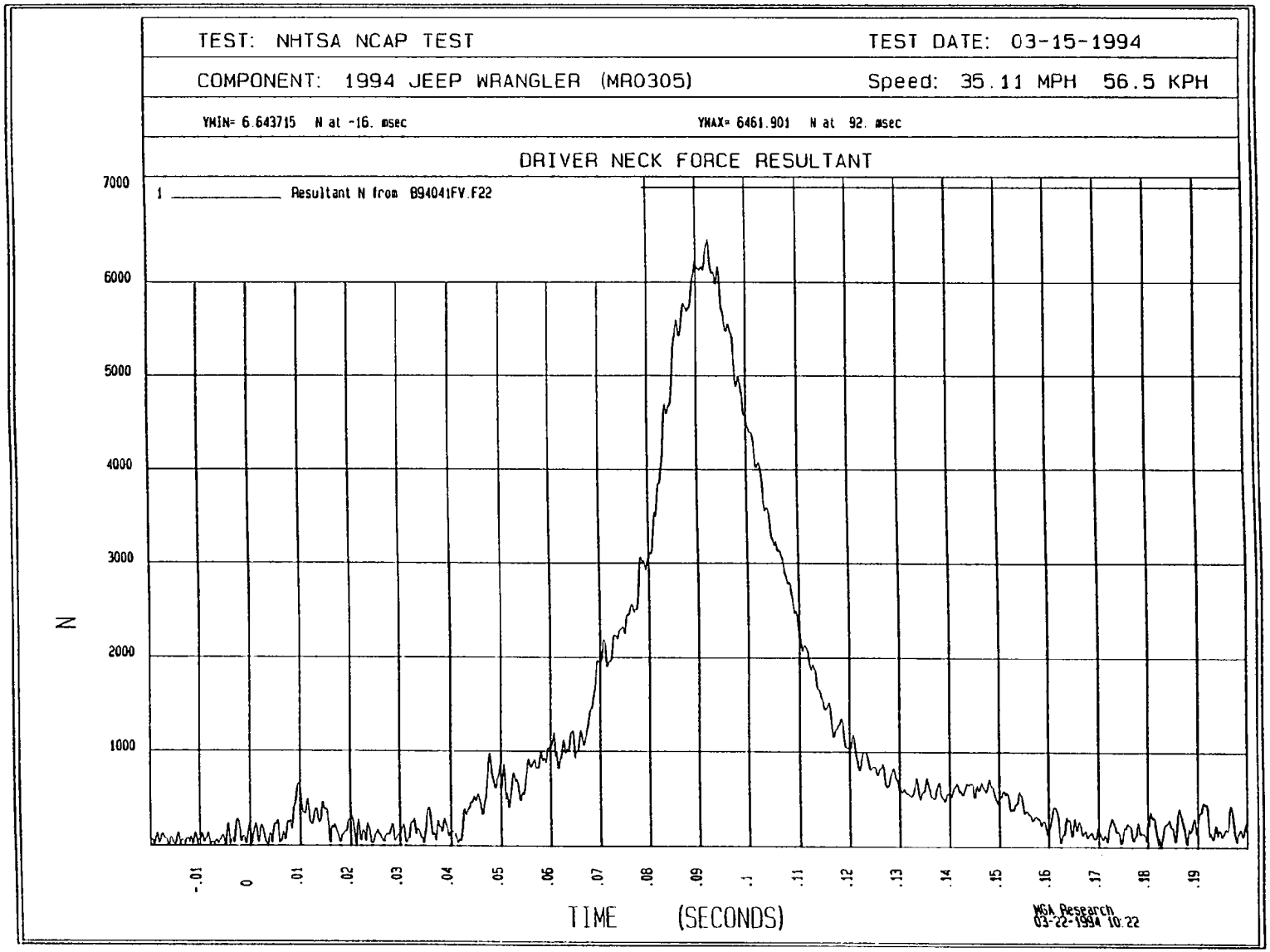


Figure B-51 - Driver Neck Force Resultant vs. Time

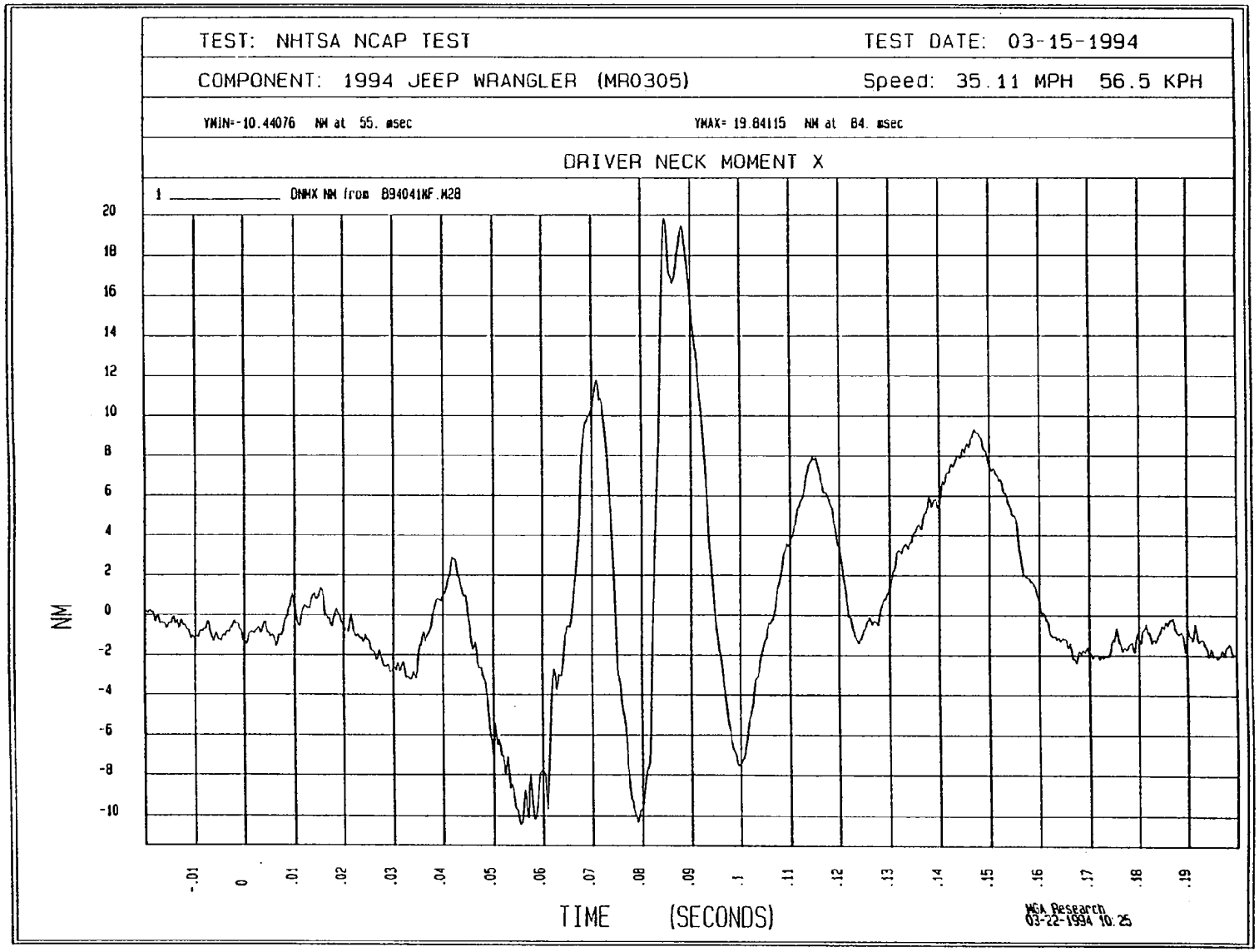


Figure B-52 - Driver Neck Moment X vs. Time

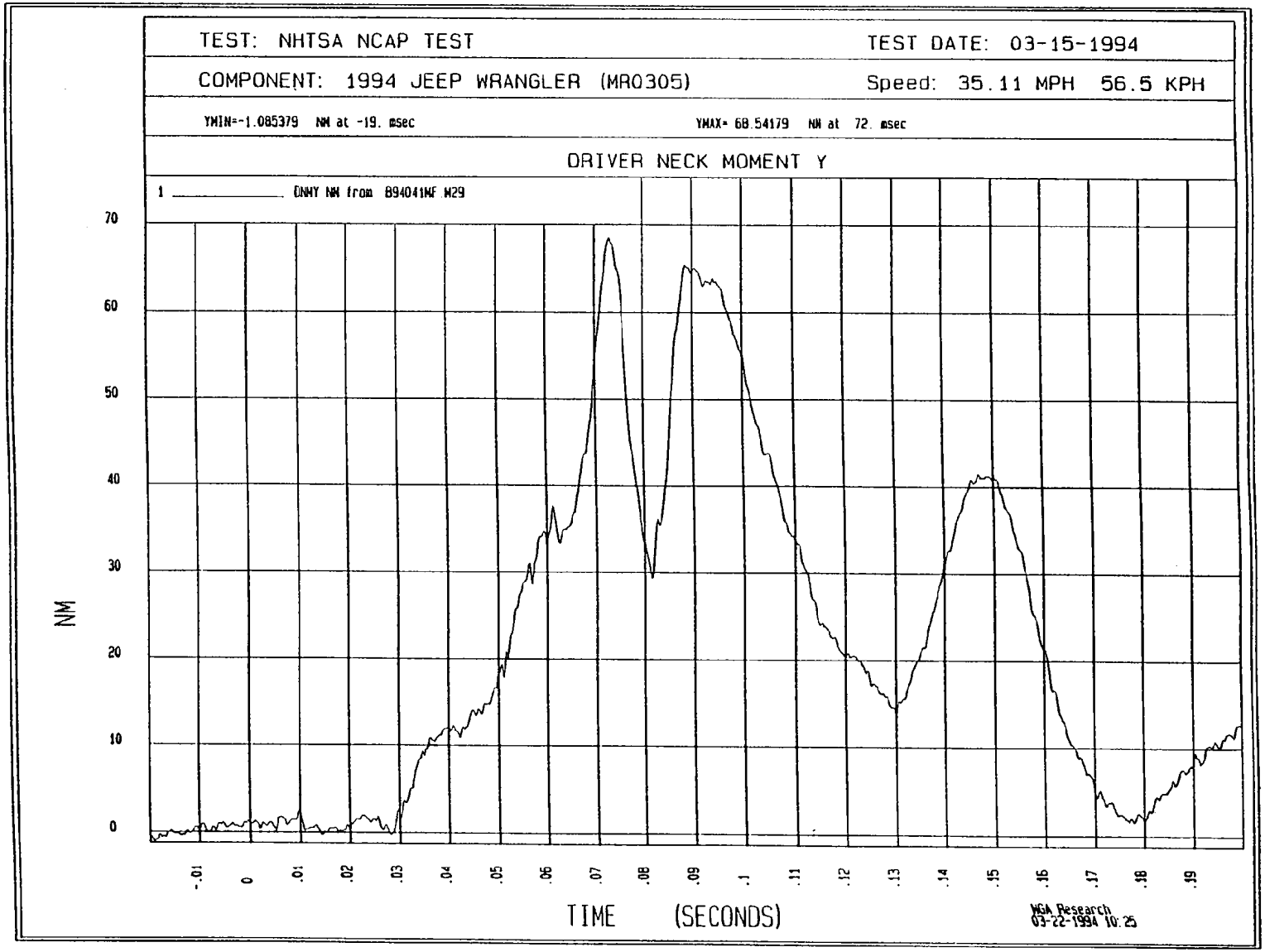


Figure B-53 - Driver Neck Moment Y vs. Time

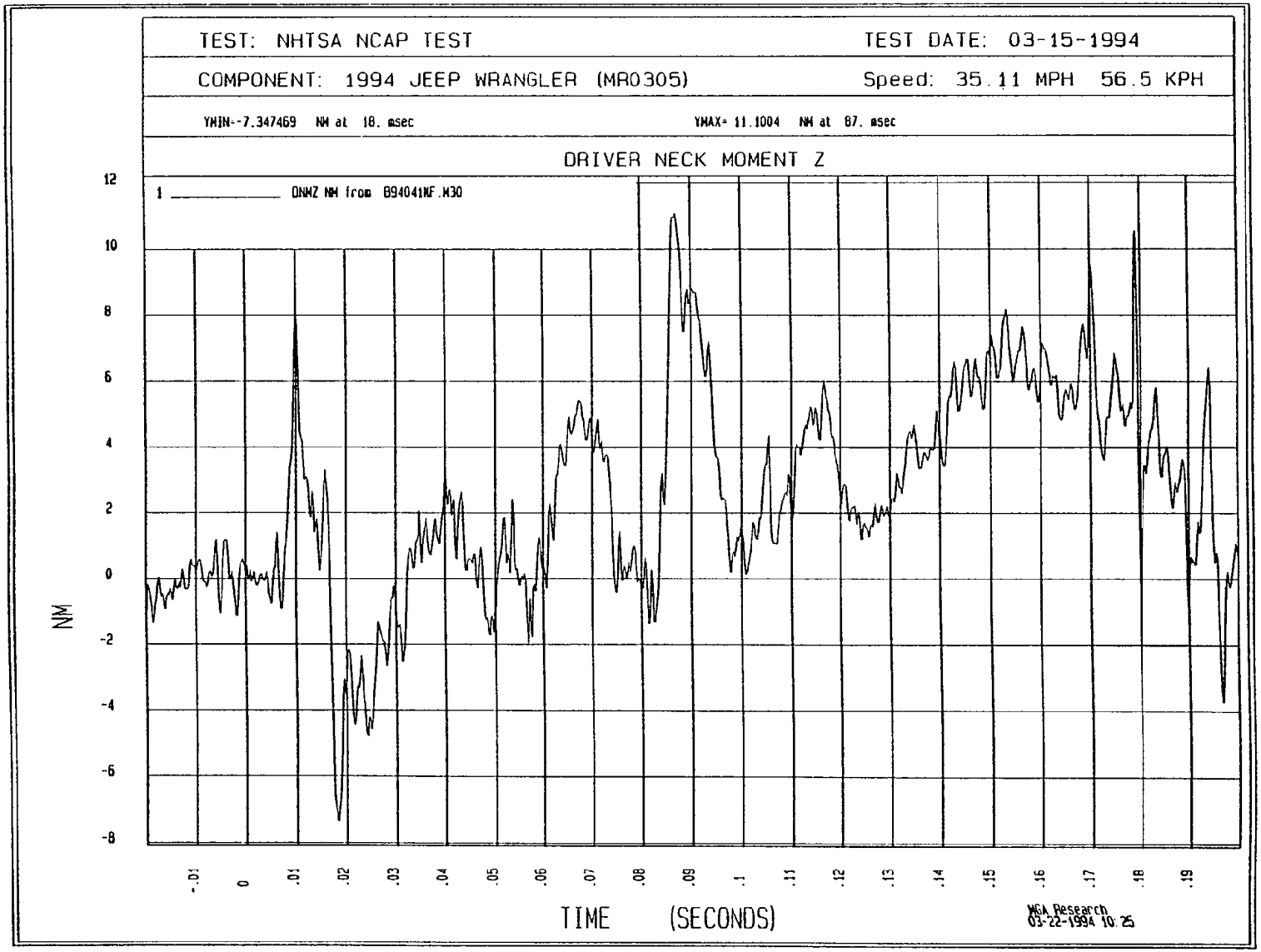


Figure B-54 - Driver Neck Moment Z vs. Time

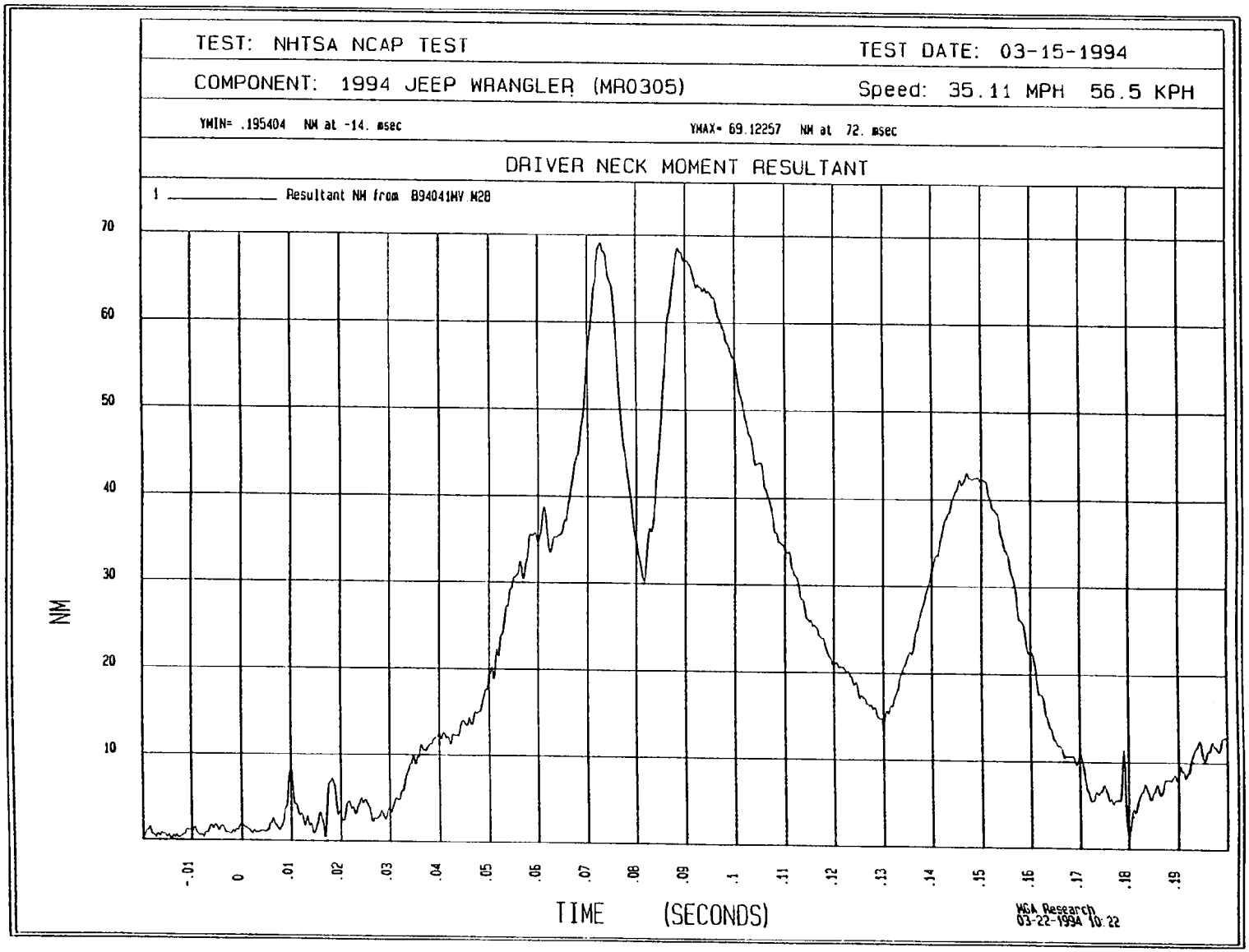


Figure B-55 - Driver Neck Moment Resultant vs. Time

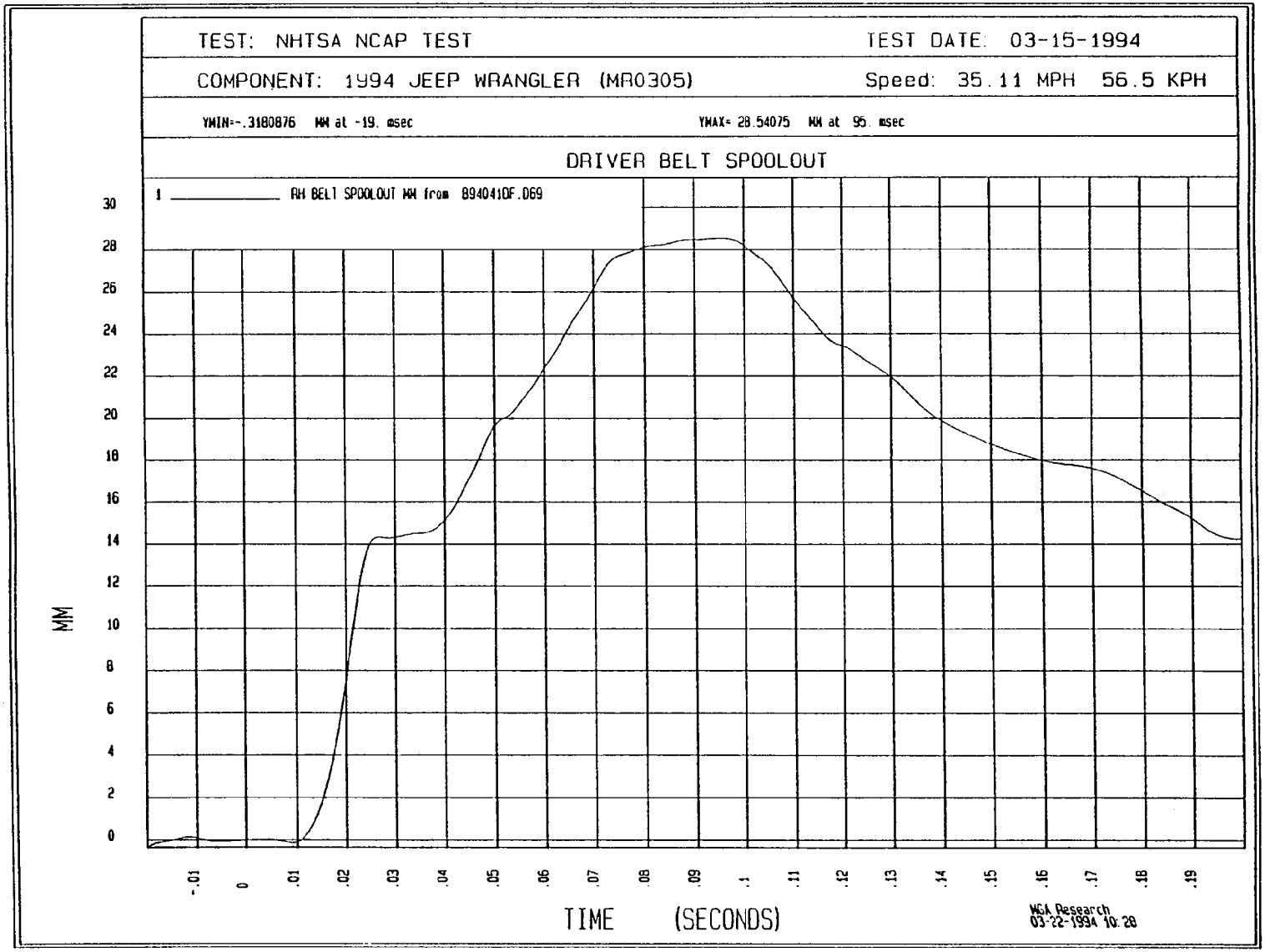


Figure B-56 - Driver Belt Spoolout vs. Time

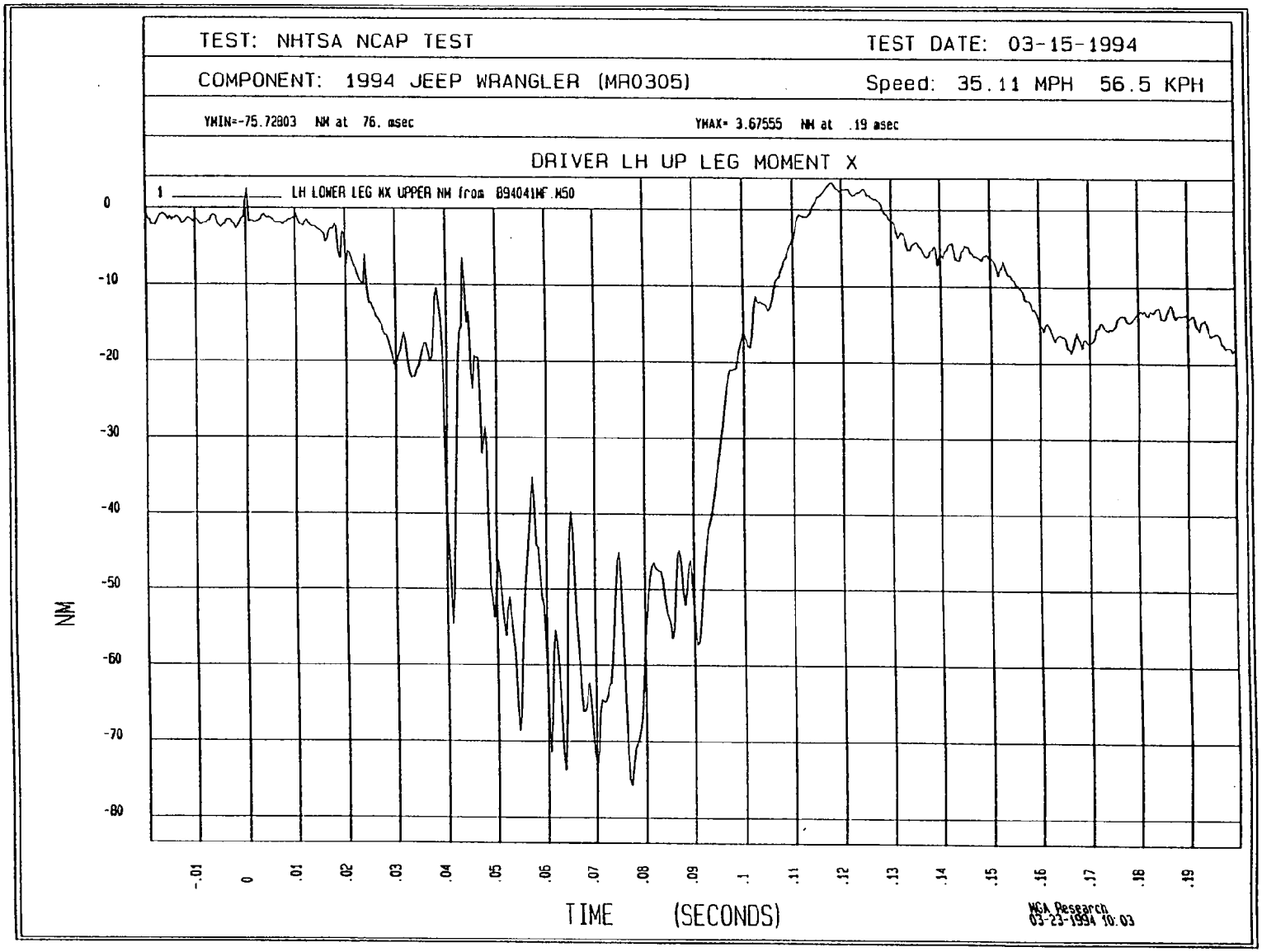


Figure B-57 - Driver Left Upper Leg Moment X vs. Time

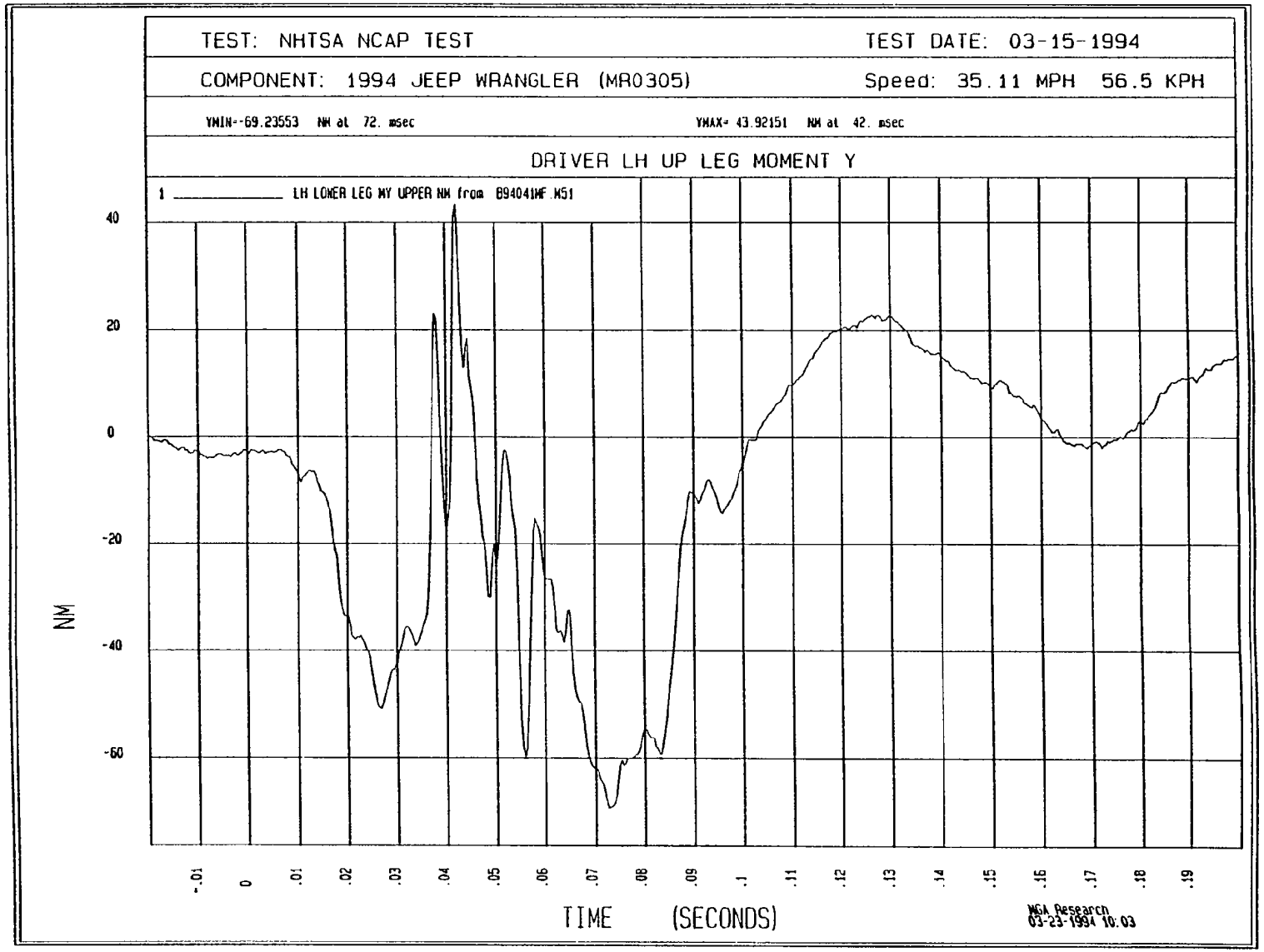


Figure B-58 - Driver Left Upper Leg Moment Y vs. Time

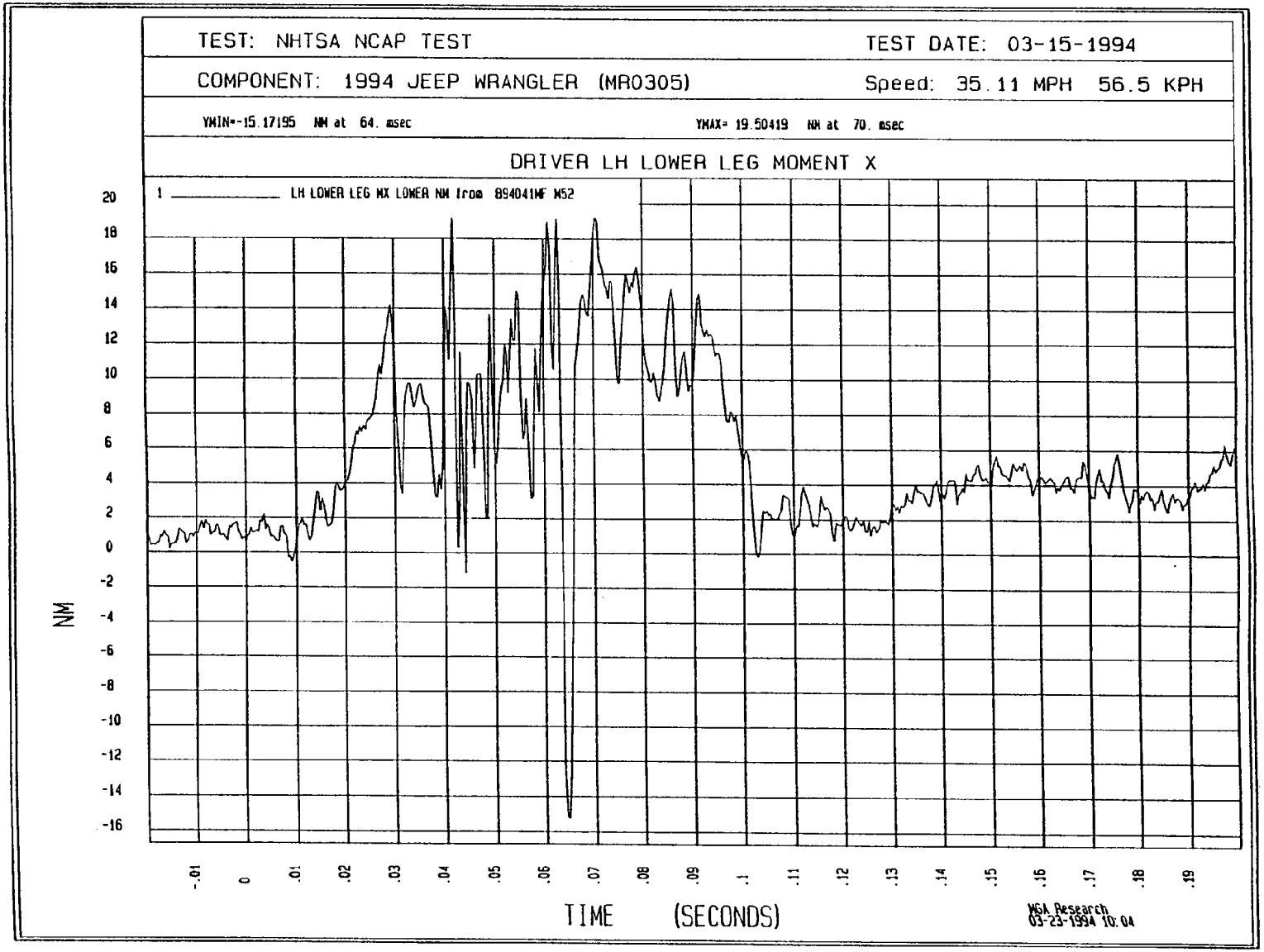


Figure B-59 - Driver Left Lower Leg Moment X vs. Time

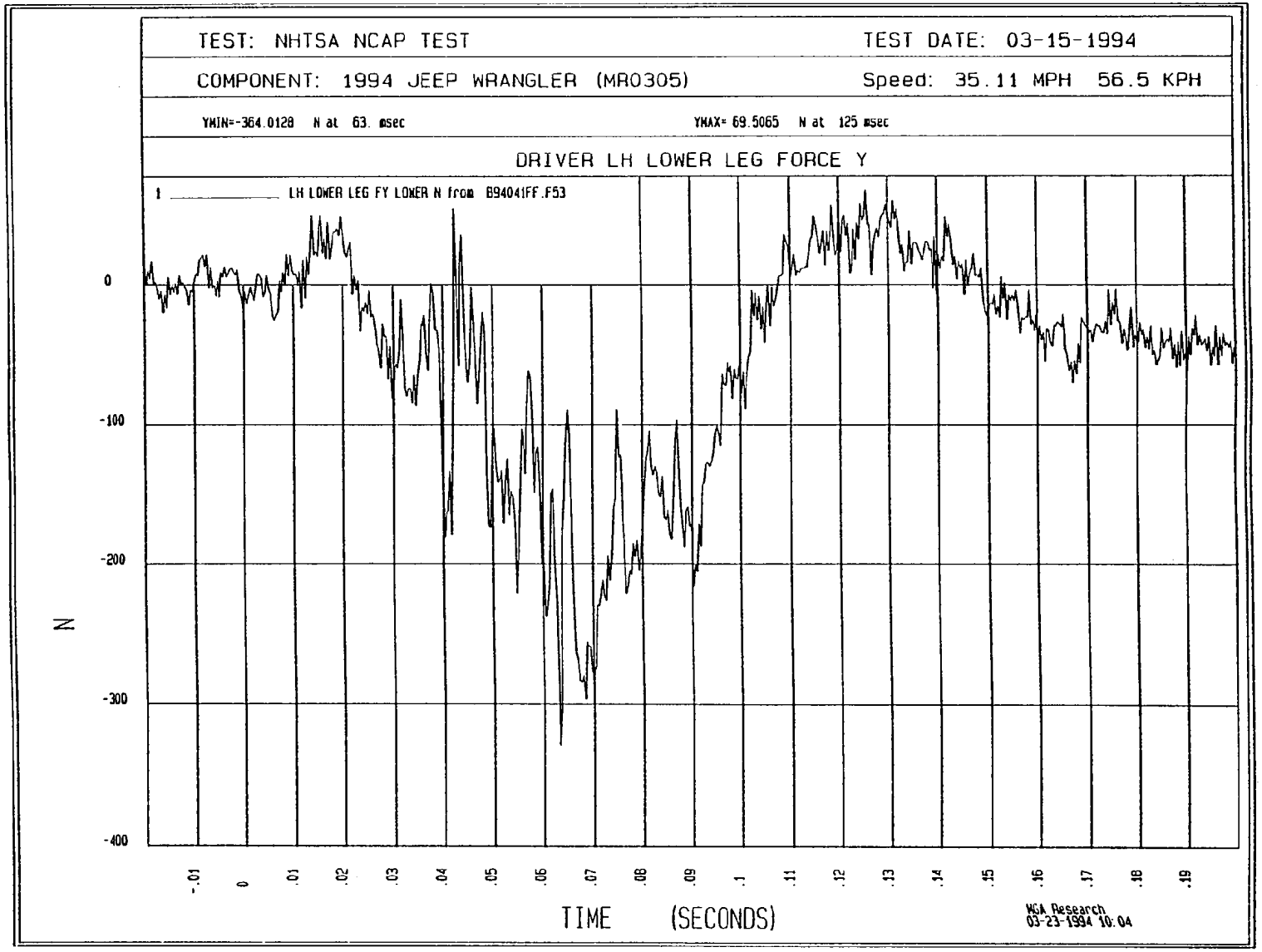


Figure B-60 - Driver Left Lower Leg Force Y vs. Time

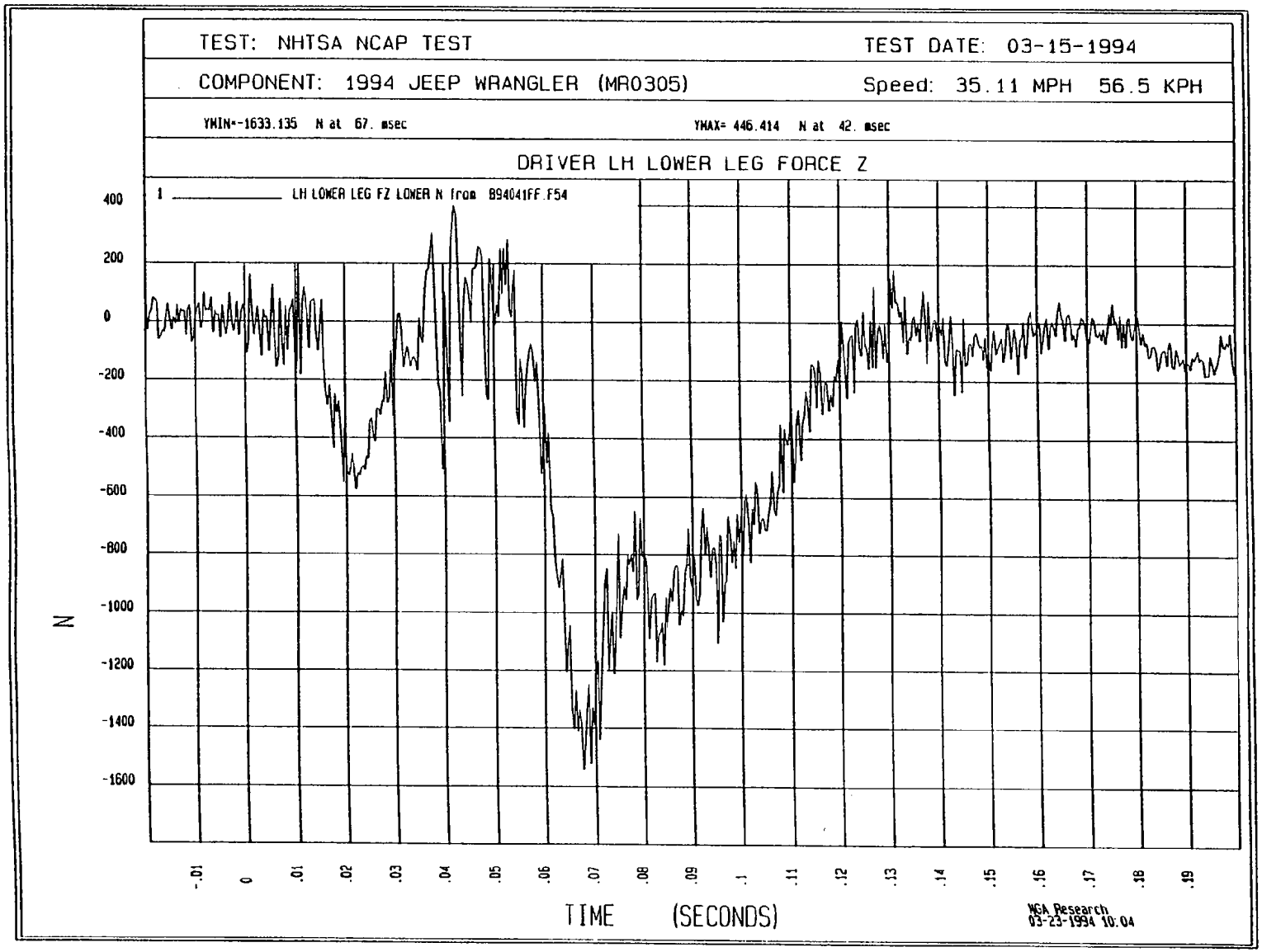


Figure B-61 - Driver Left Lower Leg Force Z vs. Time

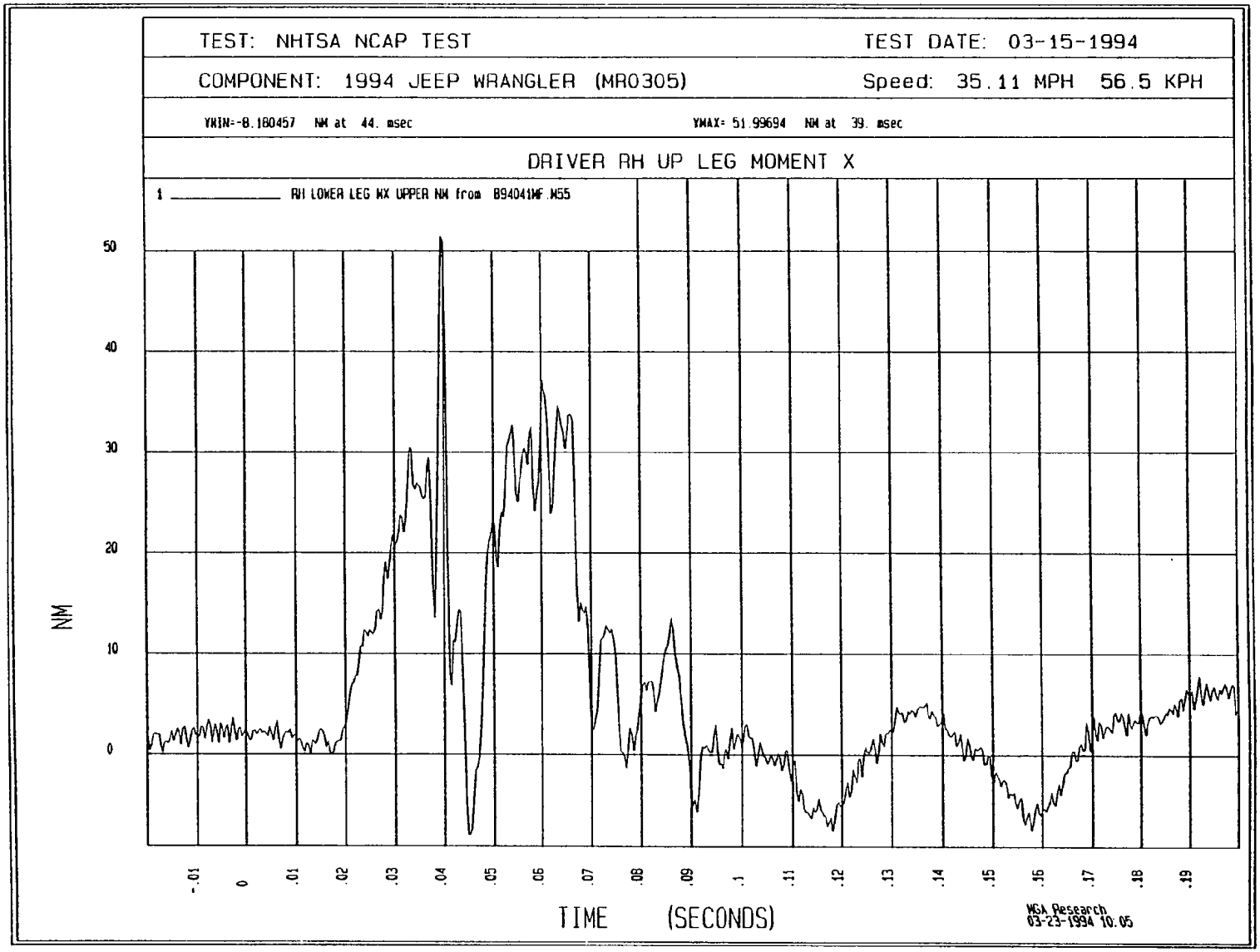


Figure B-62 - Driver Right Upper Leg Moment X vs. Time

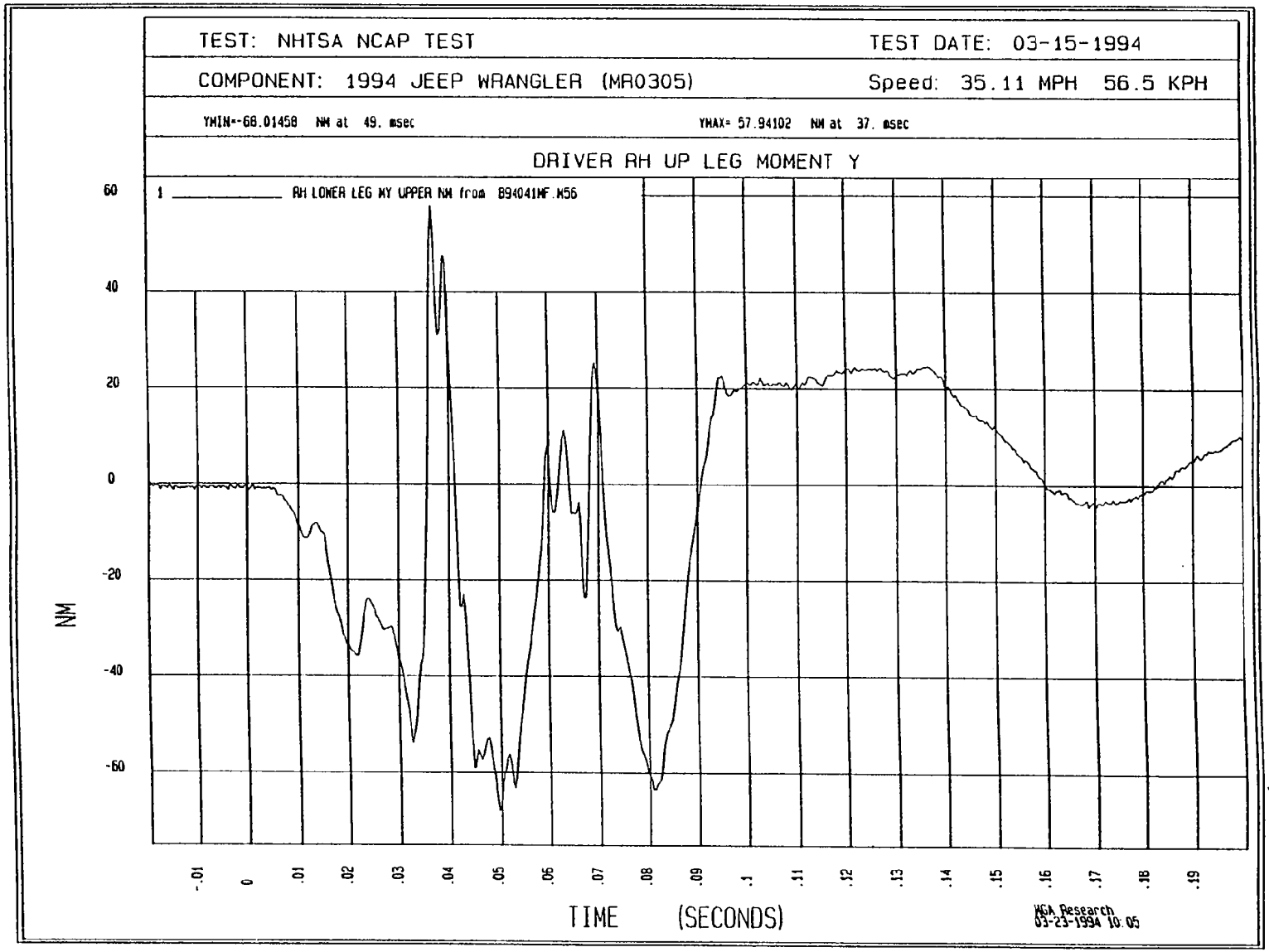


Figure B-63 - Driver Right Upper Leg Moment Y vs. Time

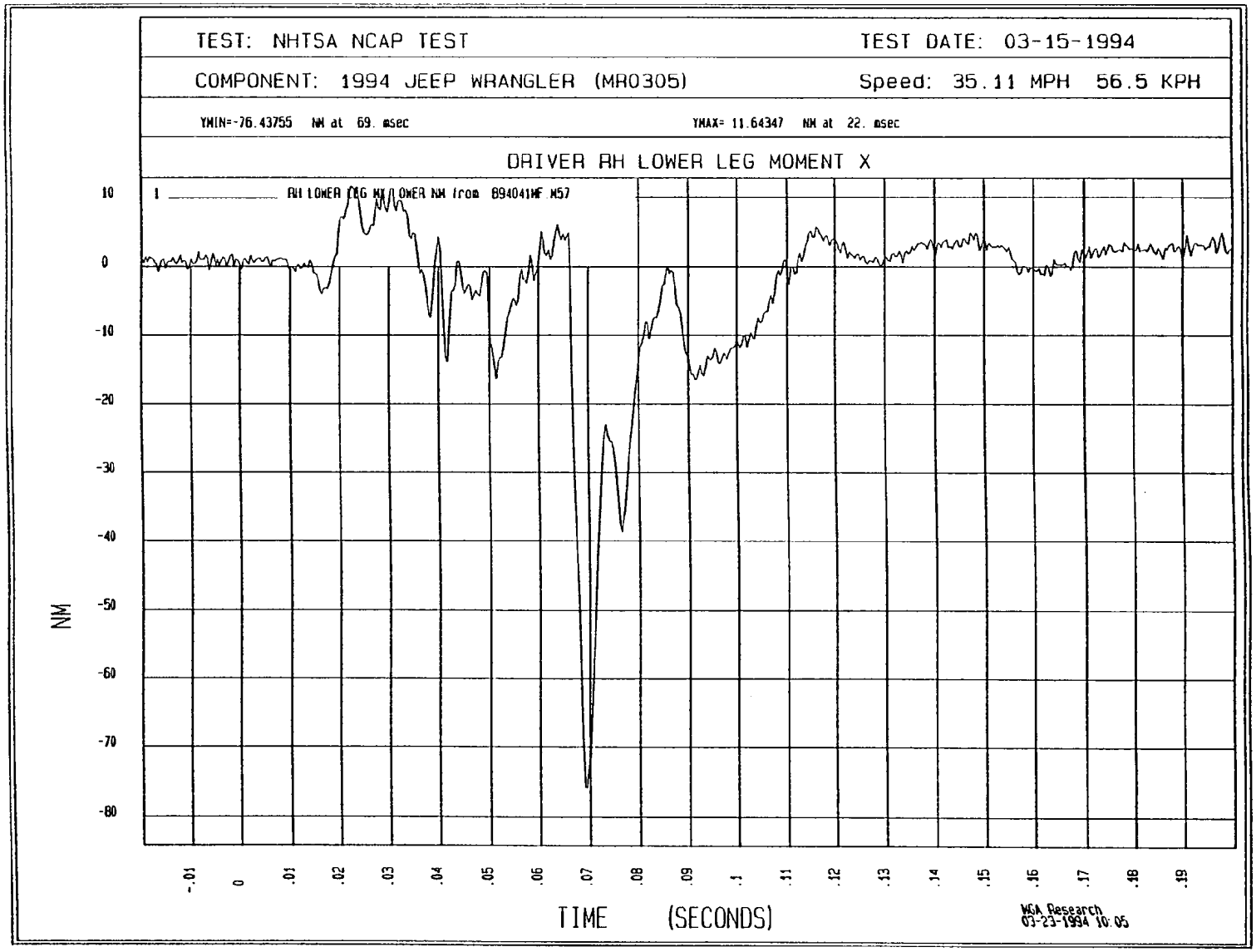


Figure B-64 - Driver Right Lower Leg Moment X vs. Time

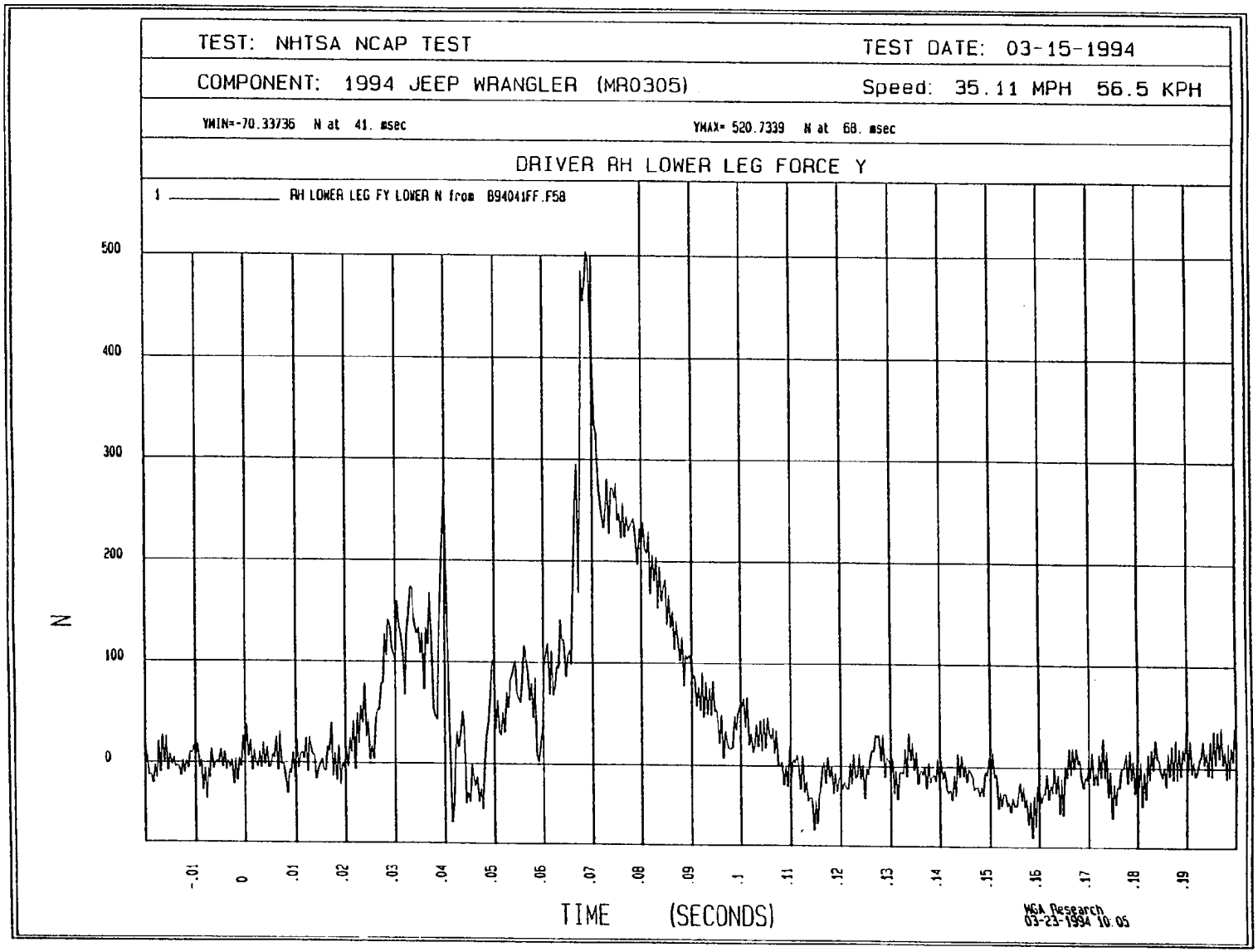


Figure B-65 - Driver Right Lower Leg Force Y vs. Time

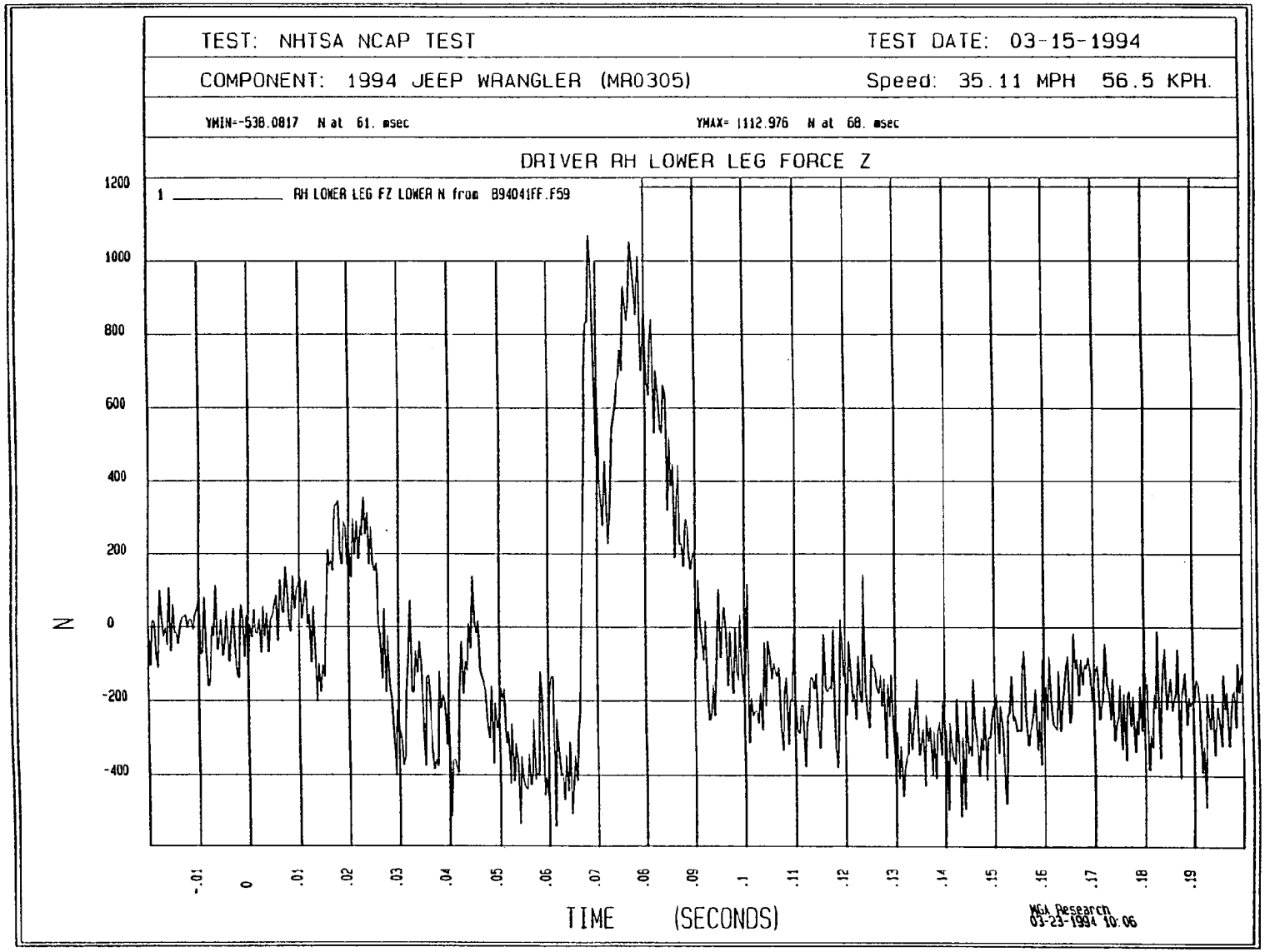


Figure B-66 - Driver Right Lower Leg Force Z vs. Time

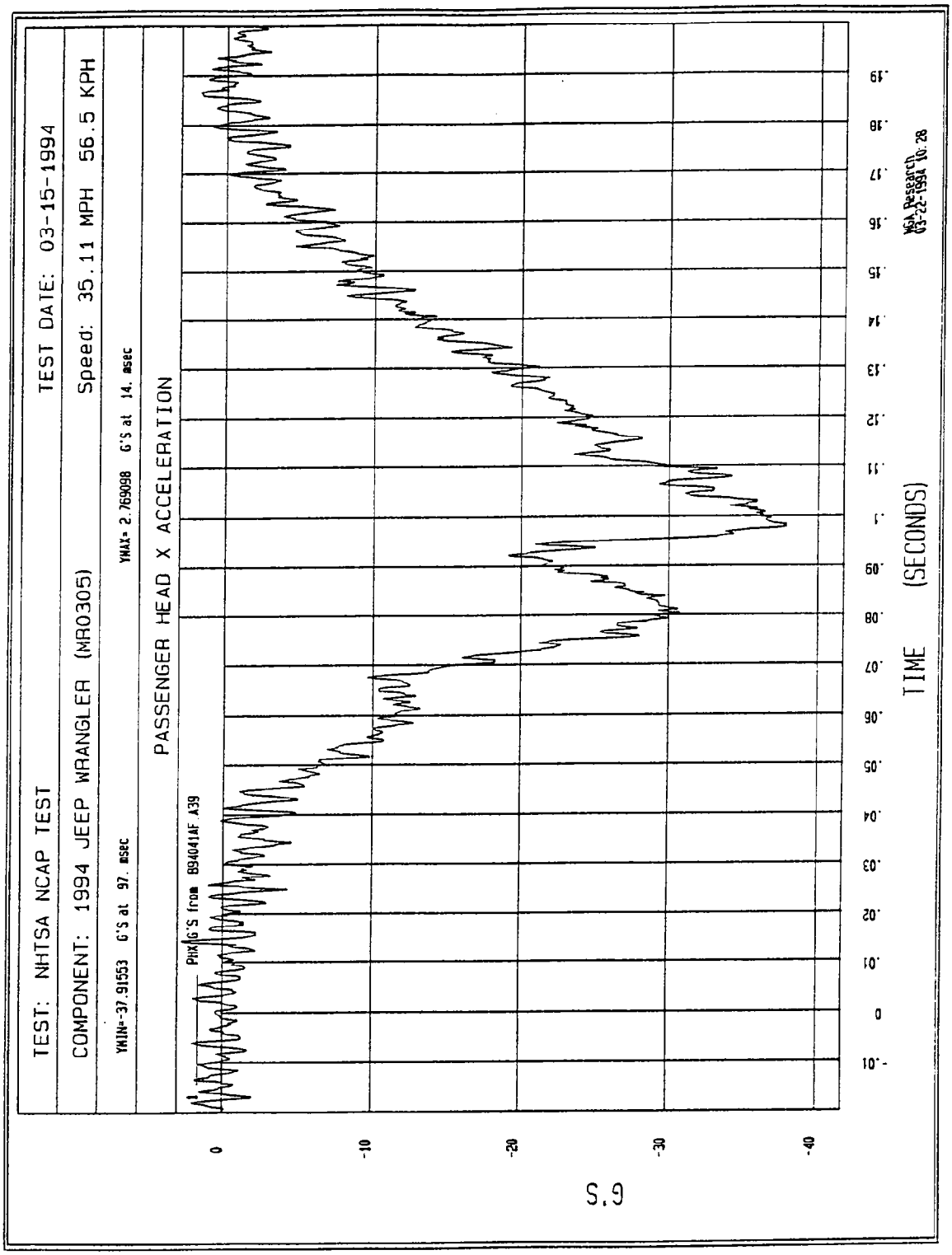


Figure B-67 - Passenger Head X Acceleration vs. Time

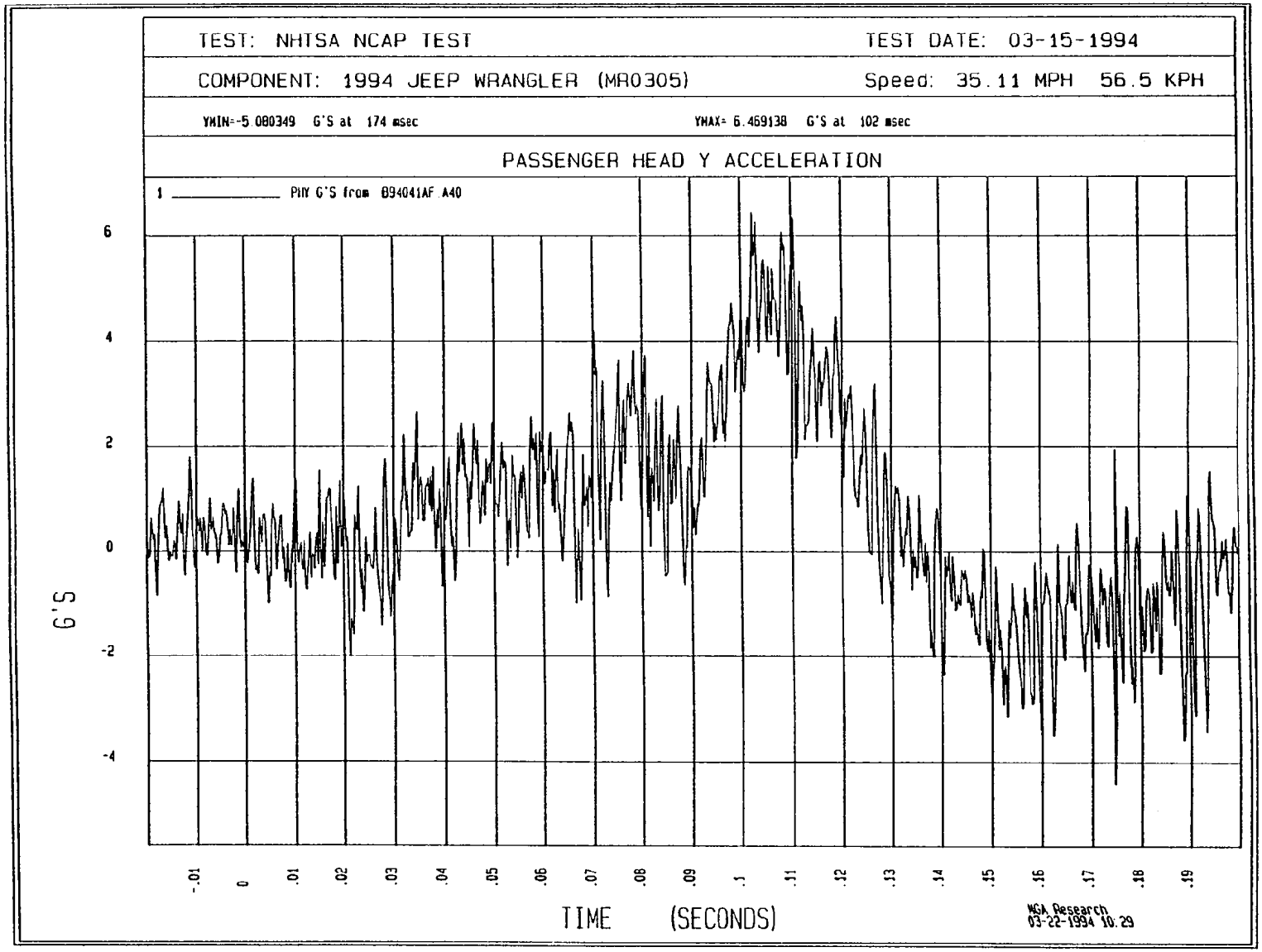


Figure B-68 - Passenger Head Y Acceleration vs. Time

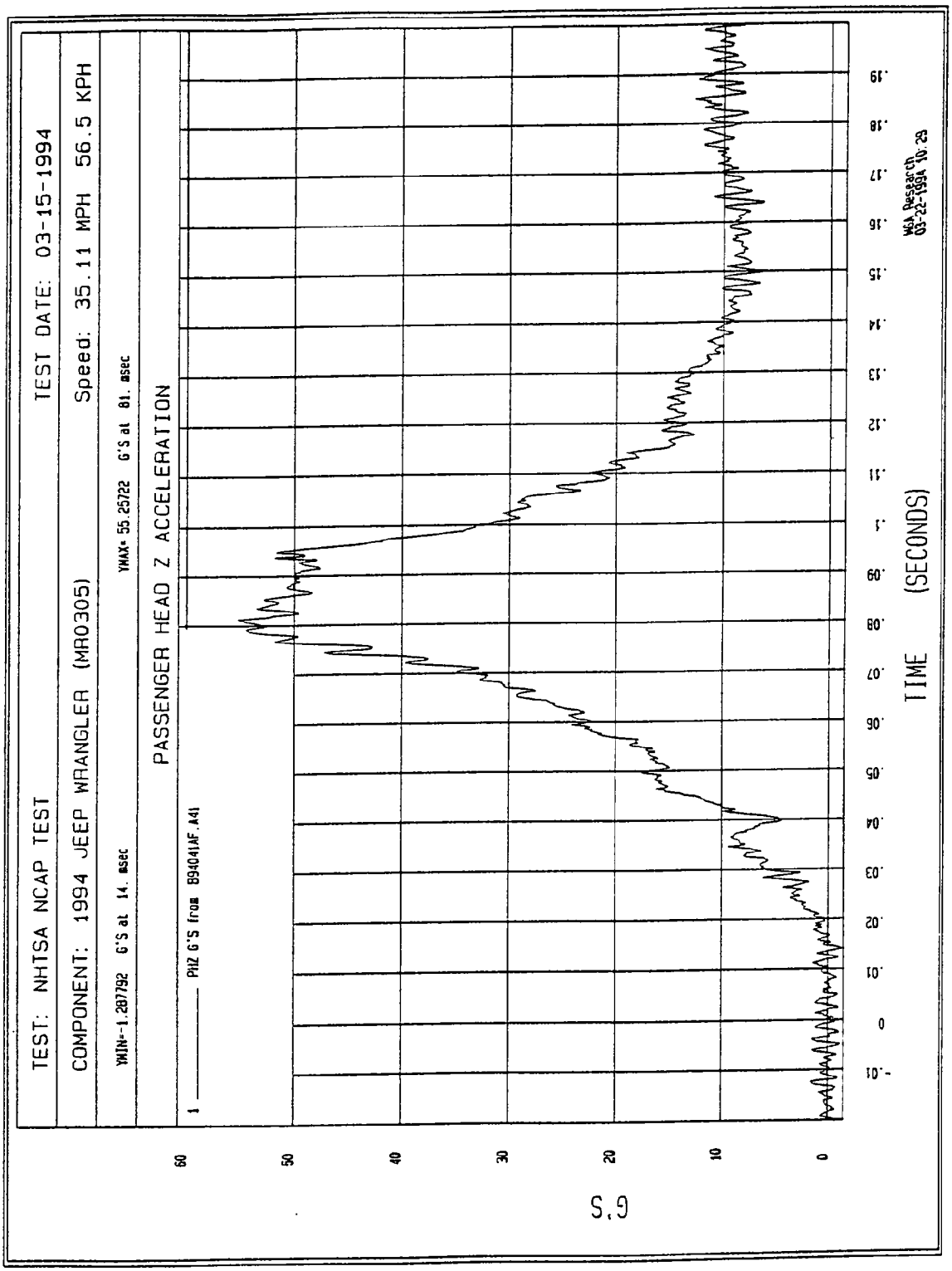


Figure B-69 - Passenger Head Z Acceleration vs. Time

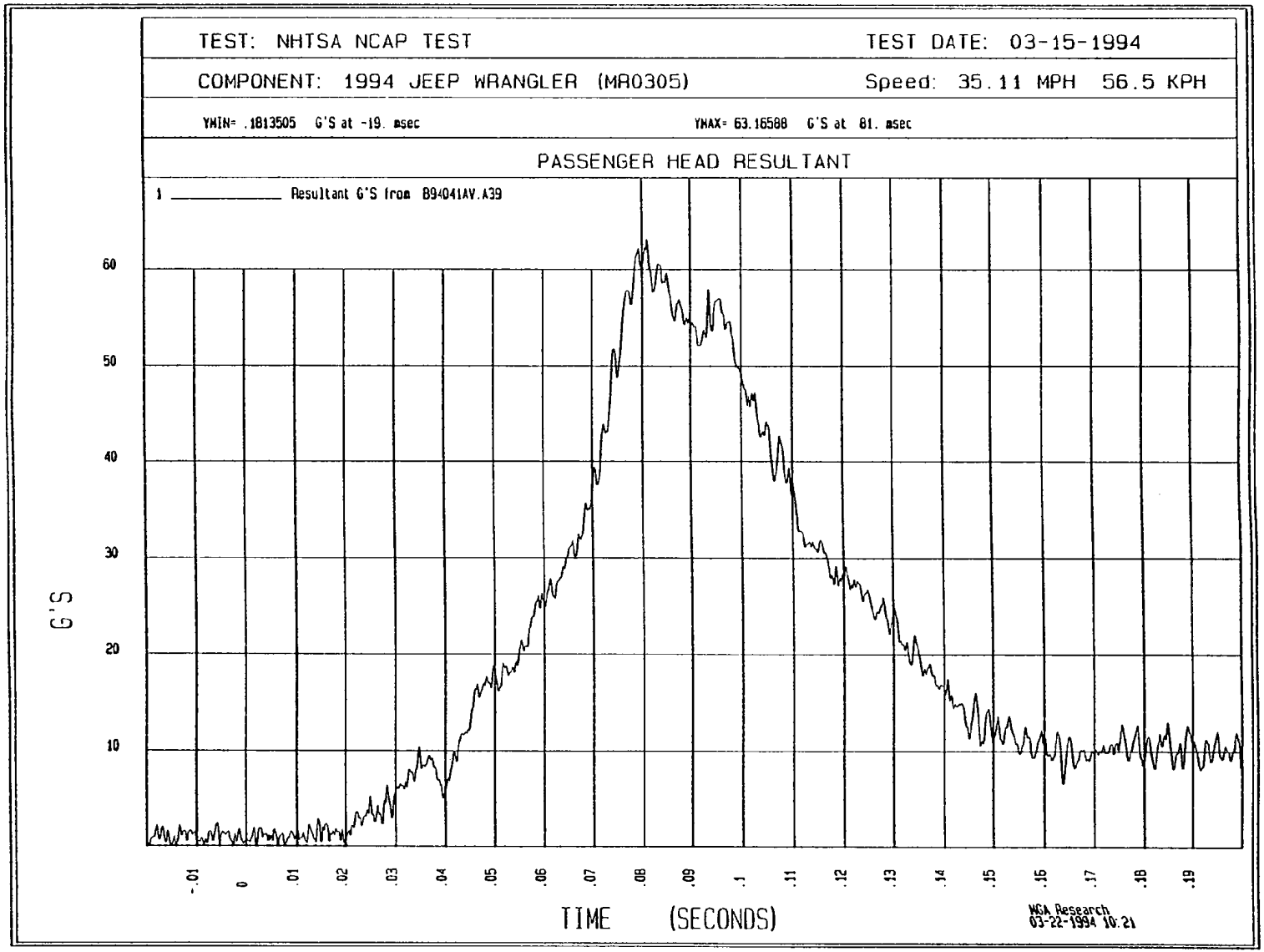


Figure B-70 - Passenger Head Resultant Acceleration vs. Time

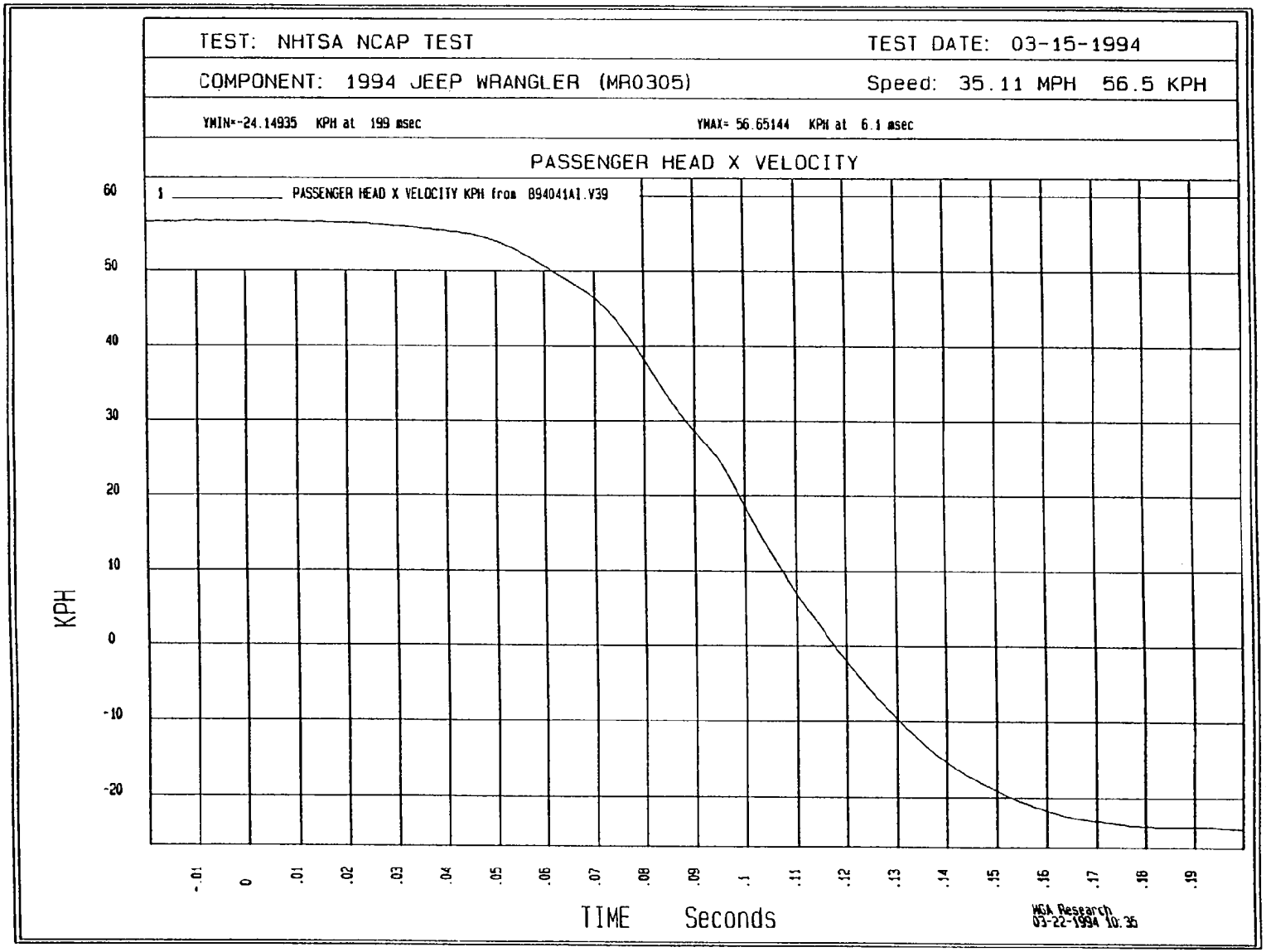


Figure B-71 - Passenger Head X Velocity vs. Time

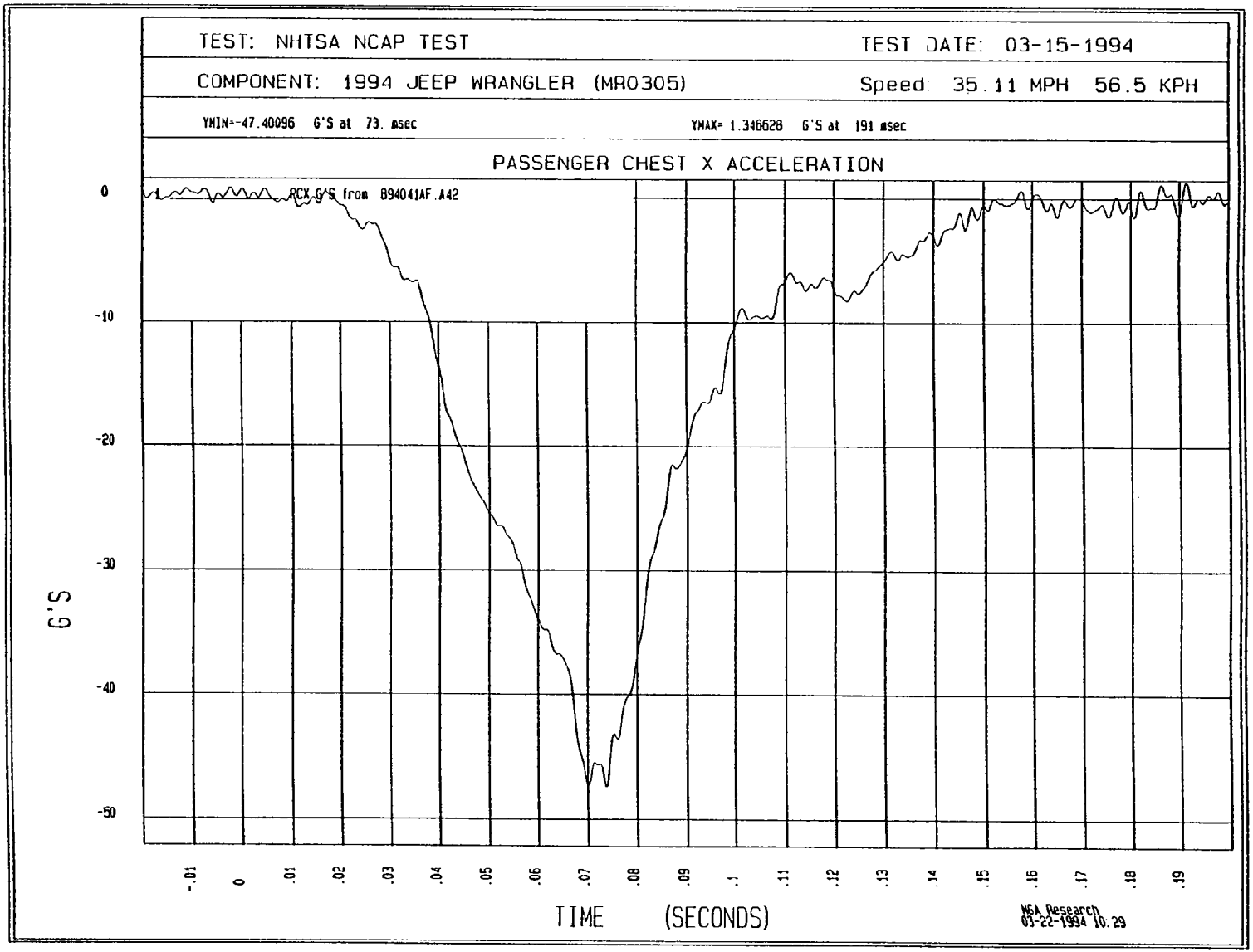


Figure B-72 - Passenger Chest X Acceleration vs. Time

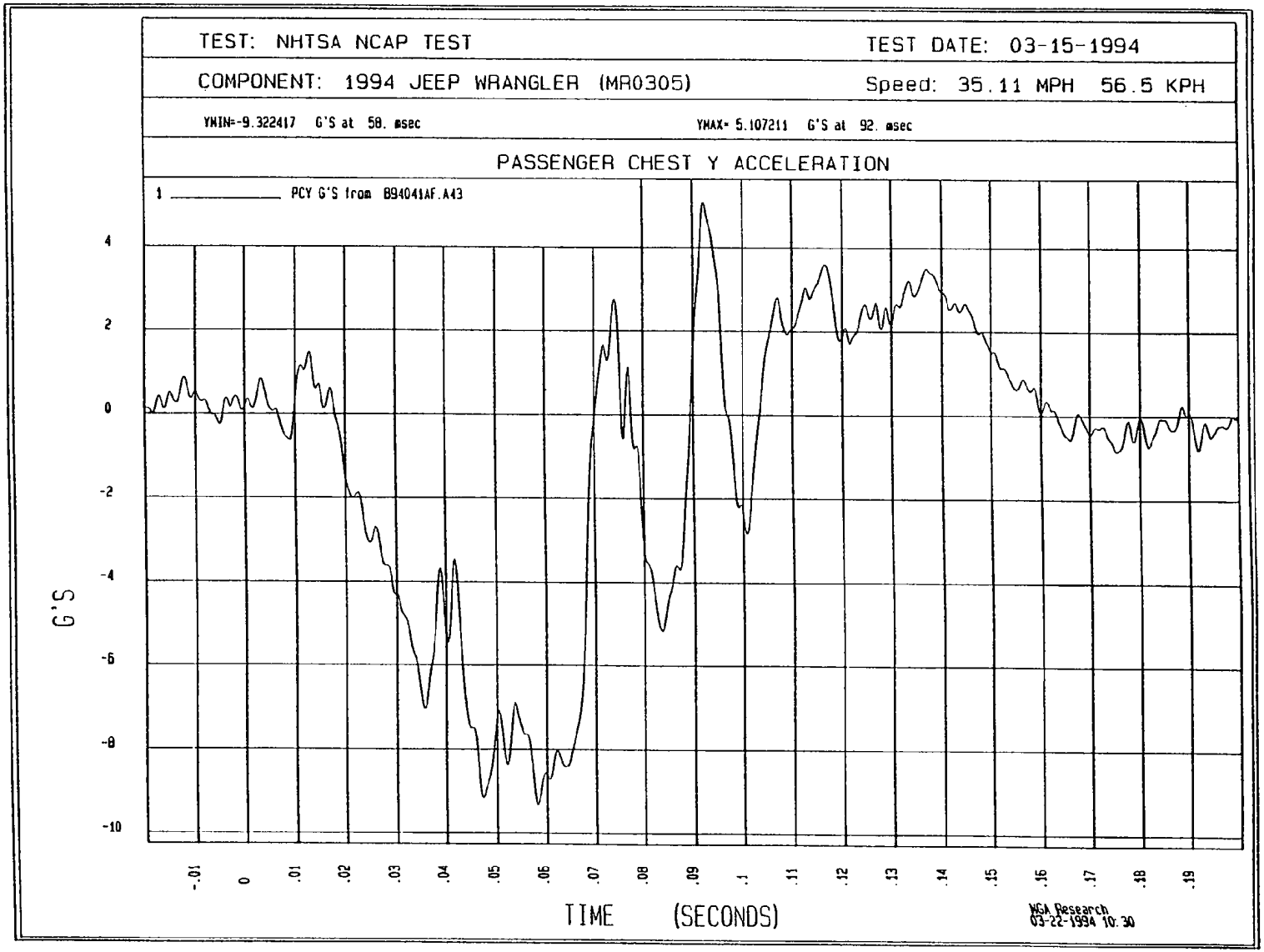


Figure B-73 - Passenger Chest Y Acceleration vs. Time

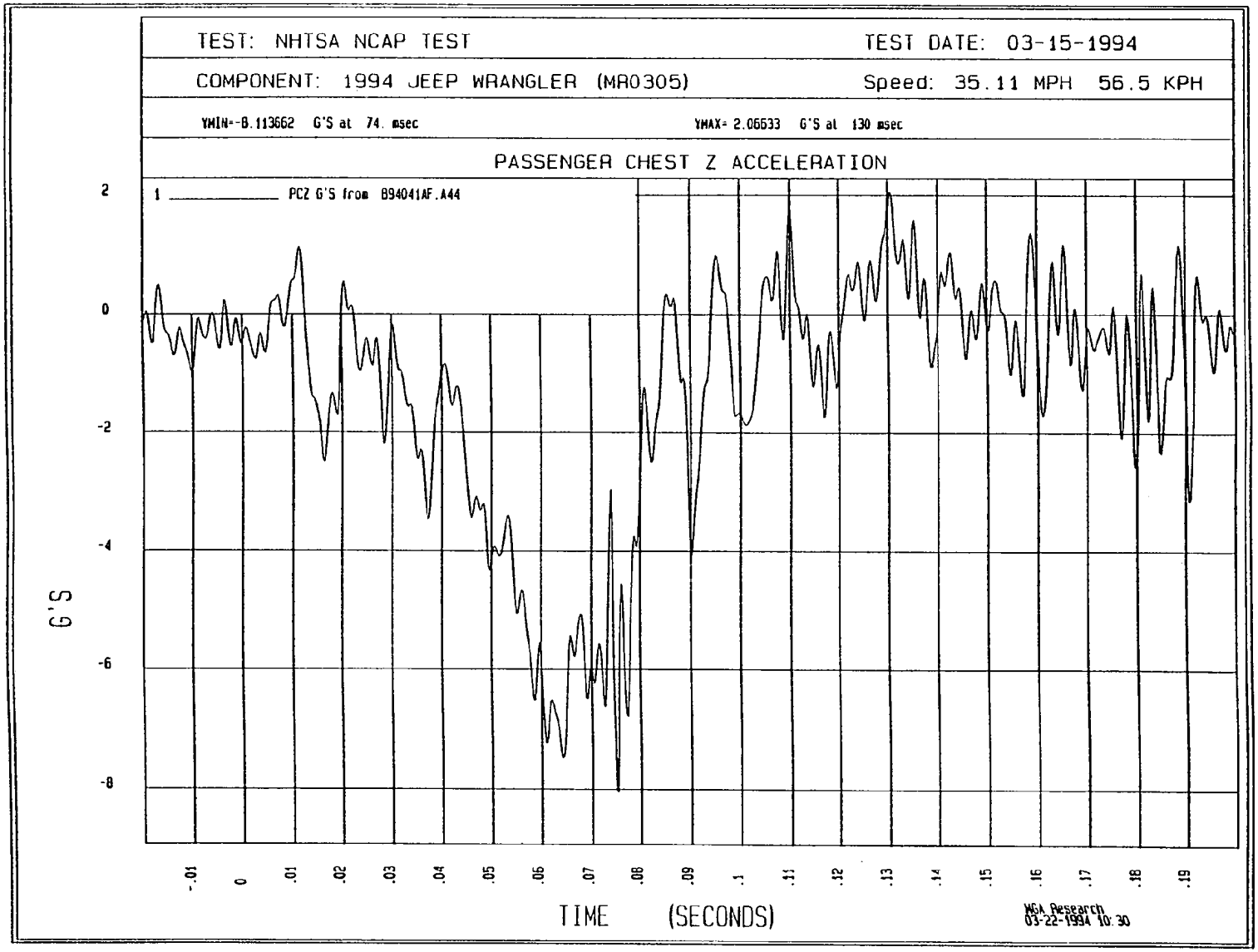


Figure B-74 - Passenger Chest Z Acceleration vs. Time

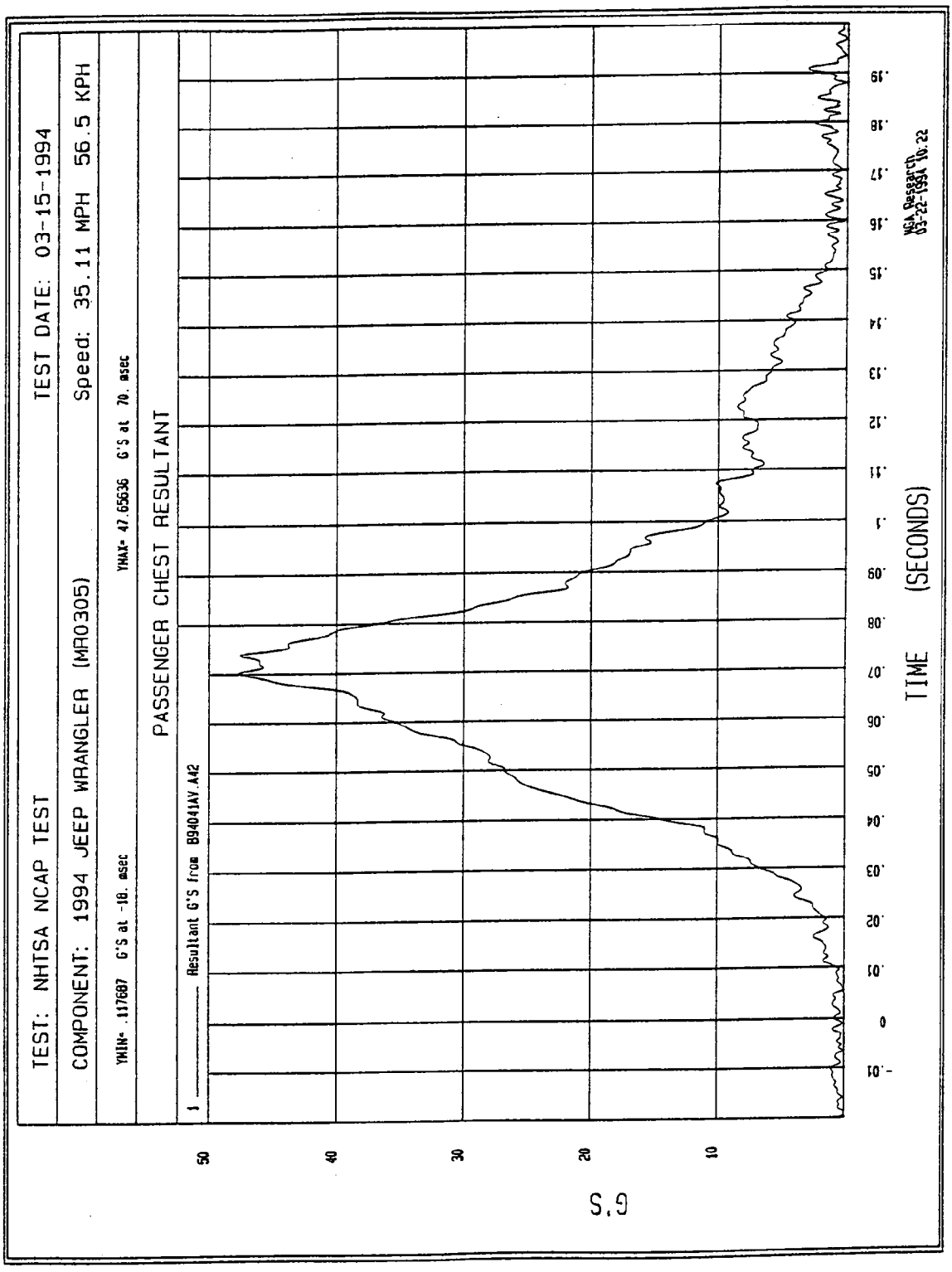


Figure B-75 - Passenger Chest Resultant vs. Time

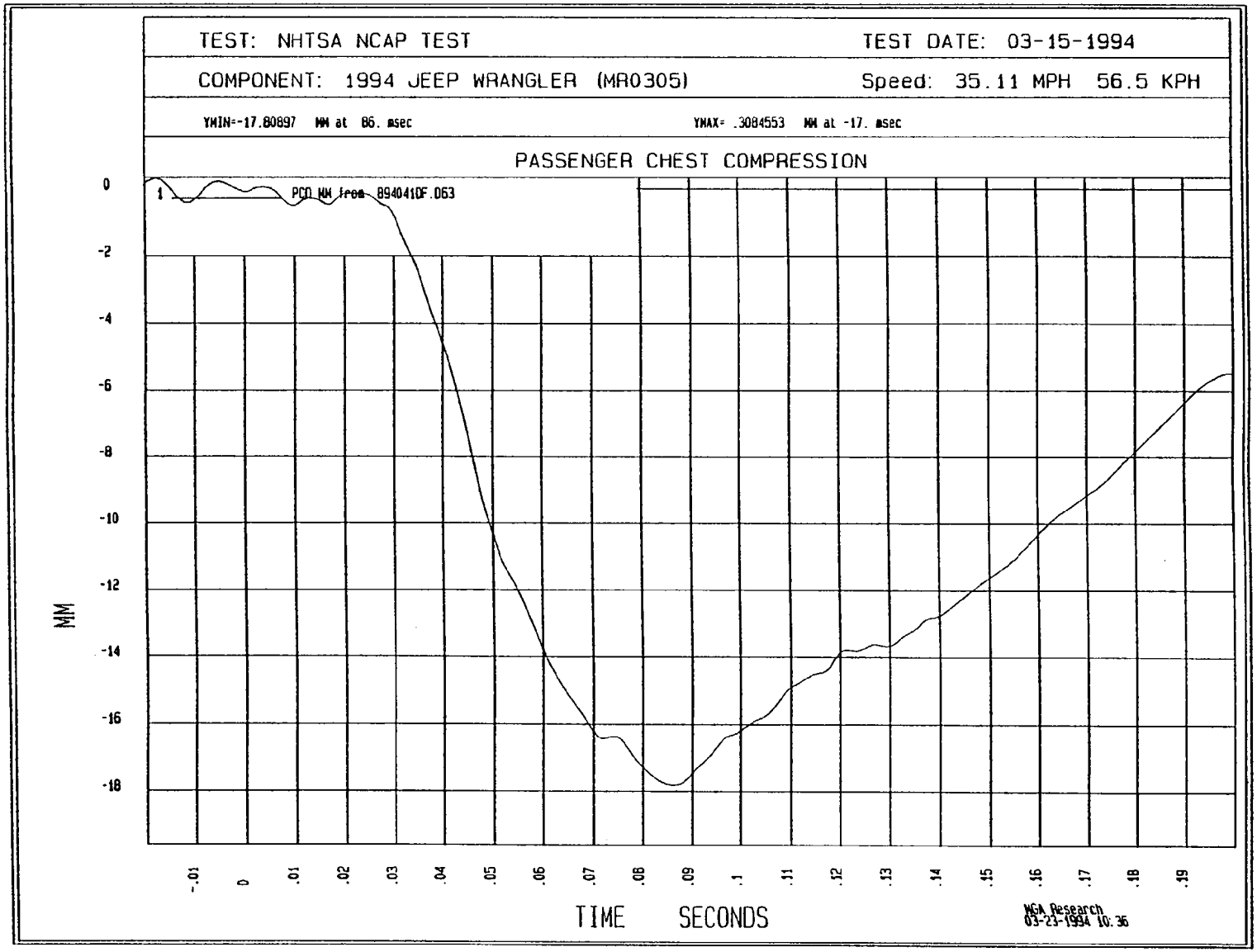


Figure B-76 - Passenger Chest Compression vs. Time

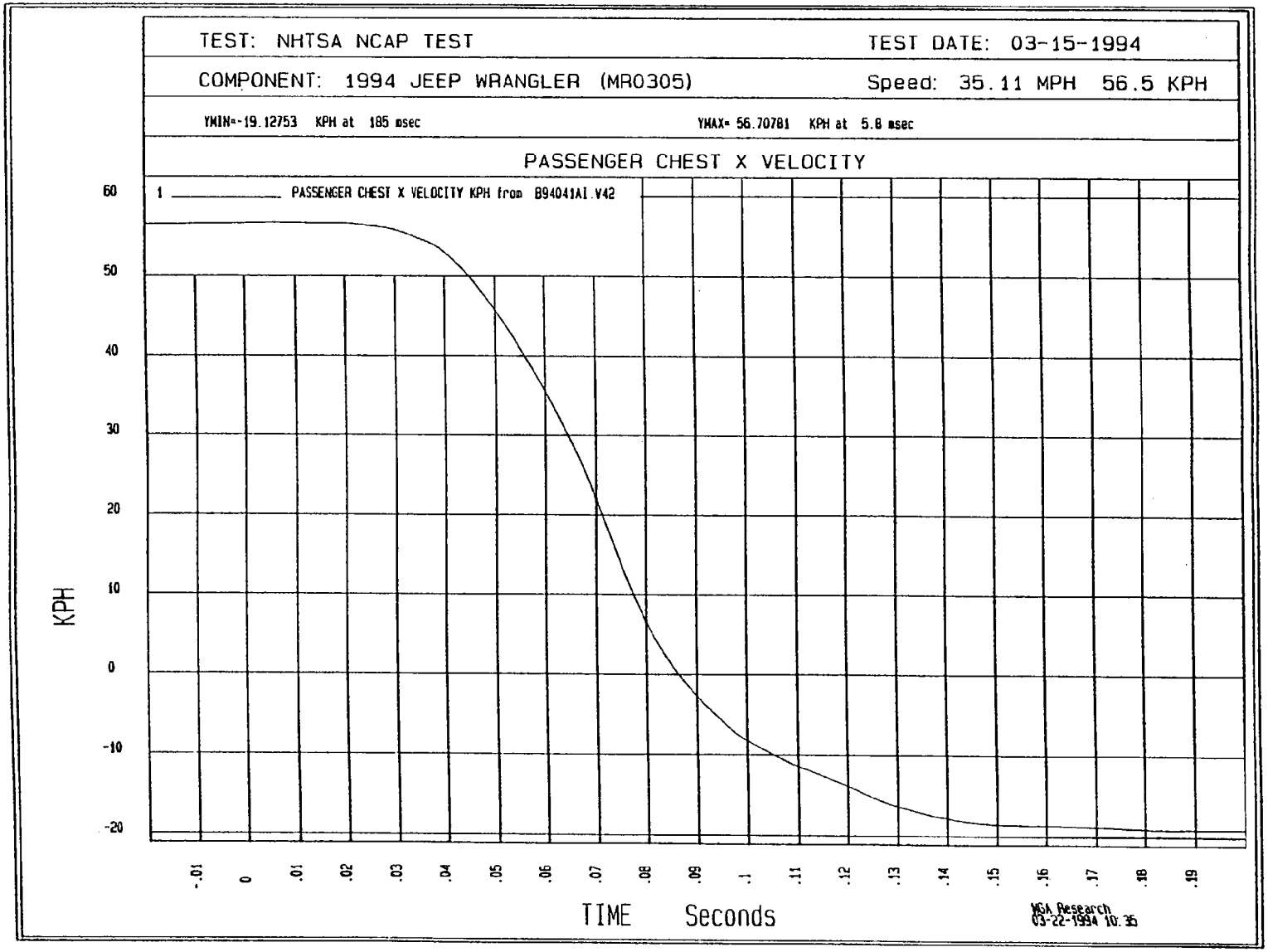


Figure B-77 - Passenger Chest X Velocity vs. Time

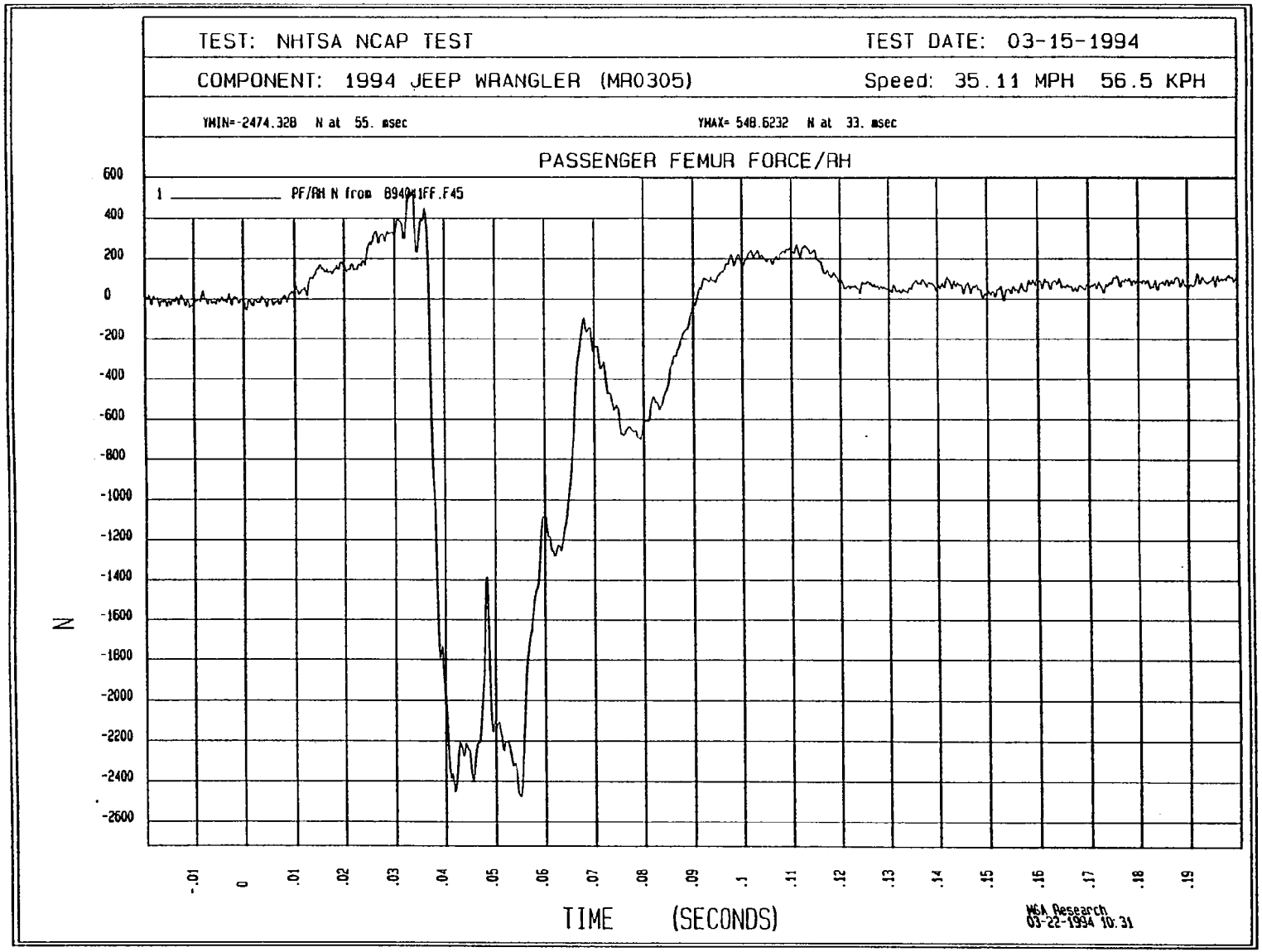


Figure B-78 - Passenger Right Femur Force vs. Time

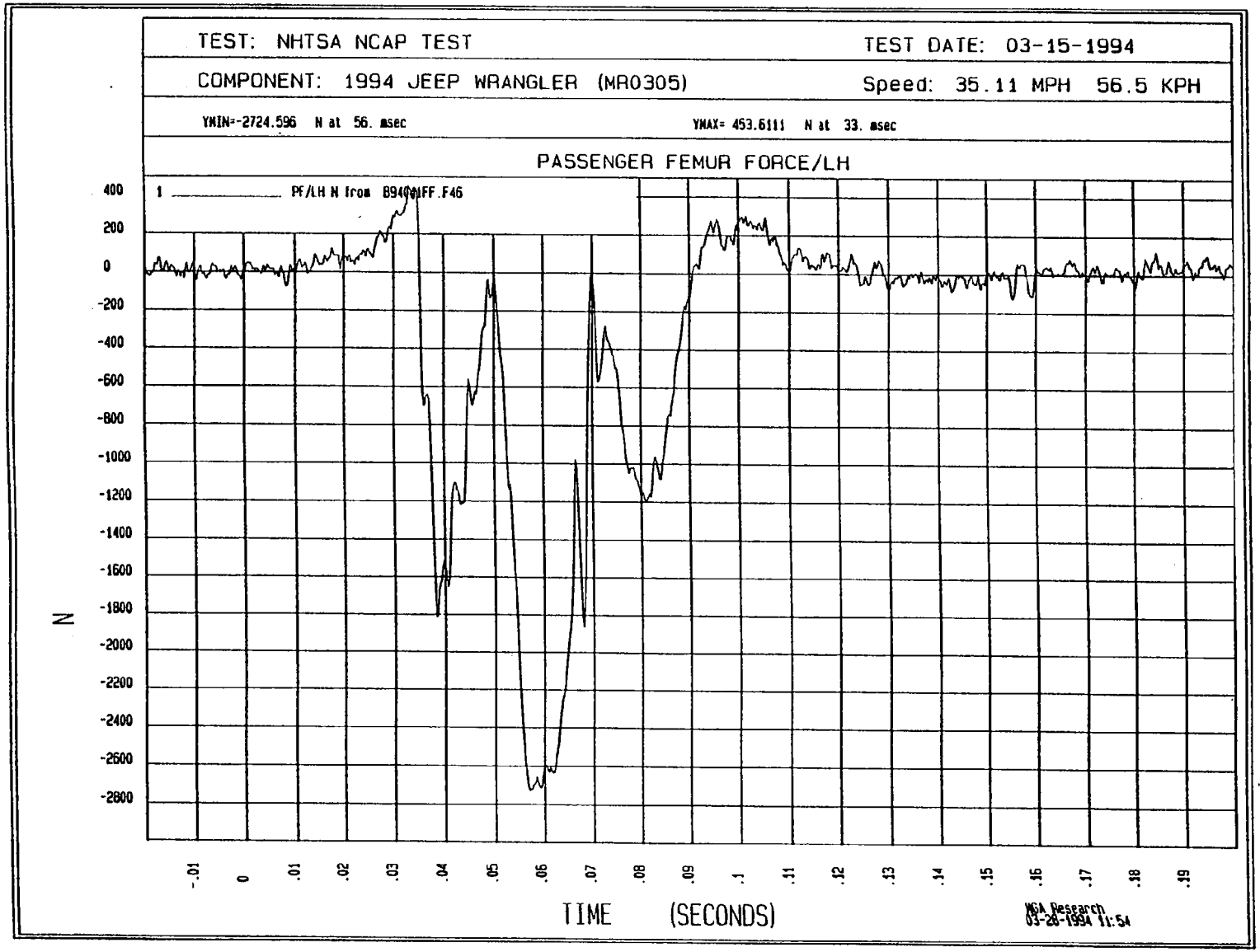


Figure B-79 - Passenger Left Femur Force vs. Time

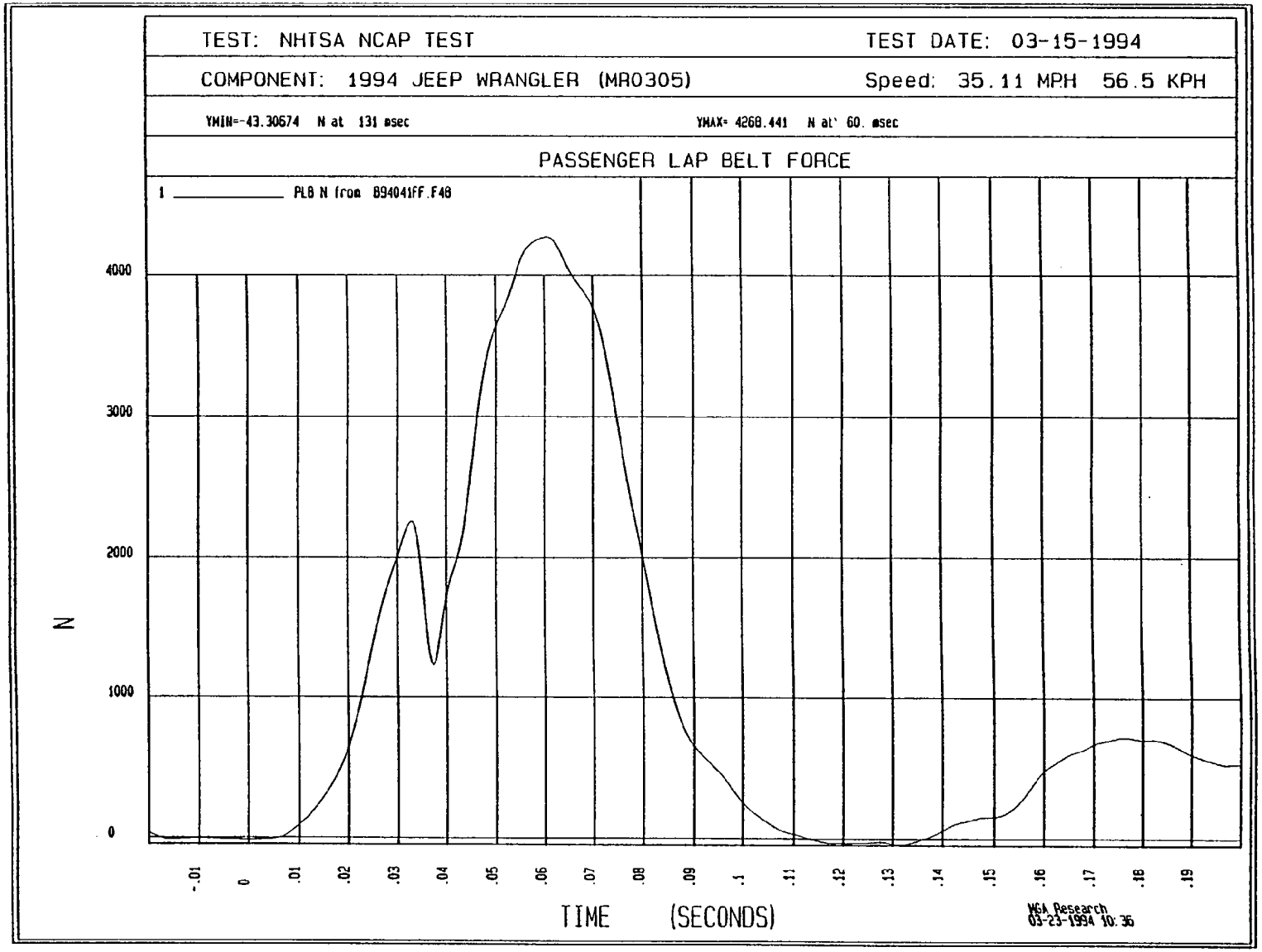


Figure B-80 - Passenger Lap Belt Force vs. Time

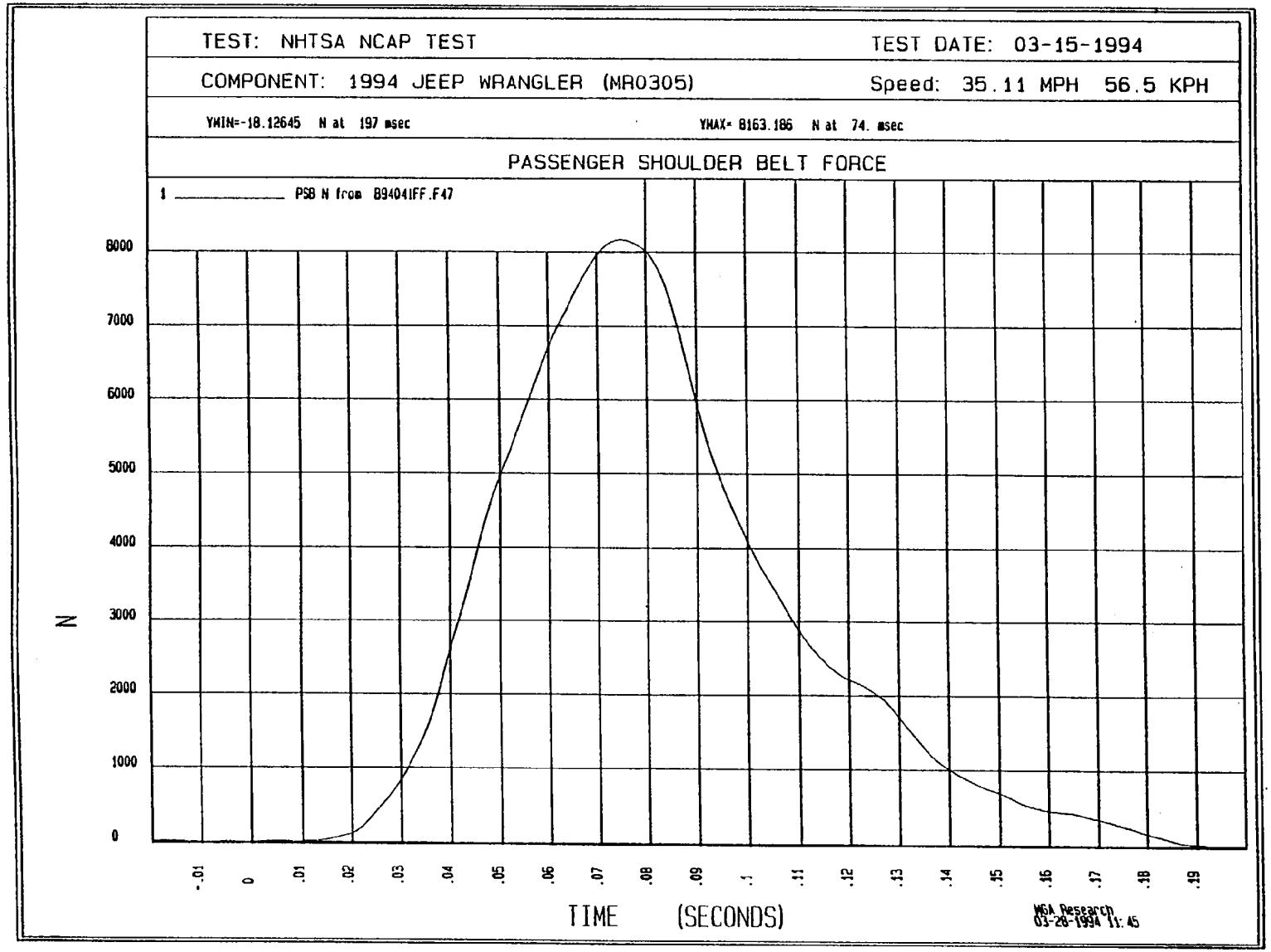


Figure B-81 - Passenger Shoulder Belt Force vs. Time

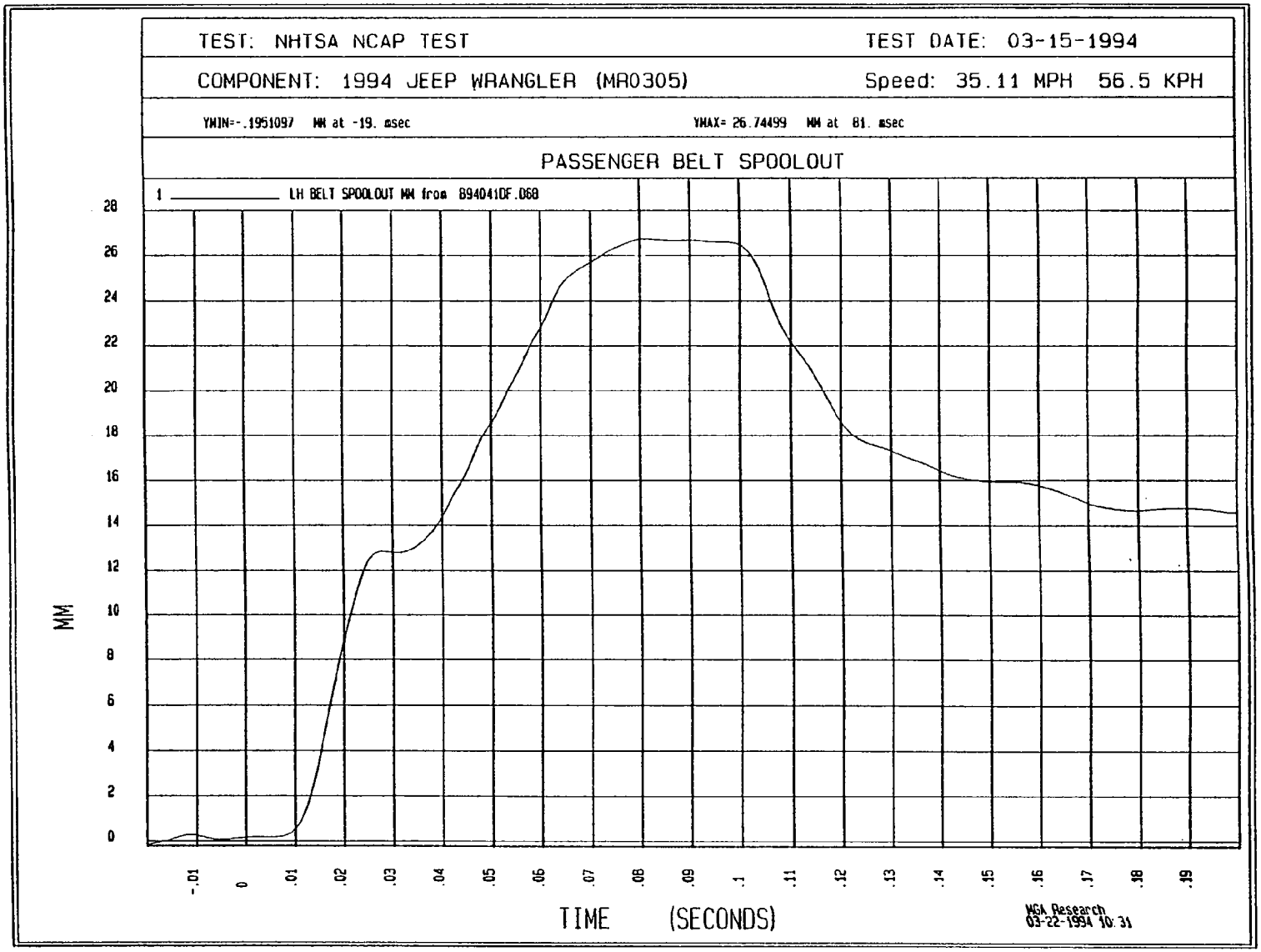


Figure B-82 - Passenger Belt Spoolout vs. Time

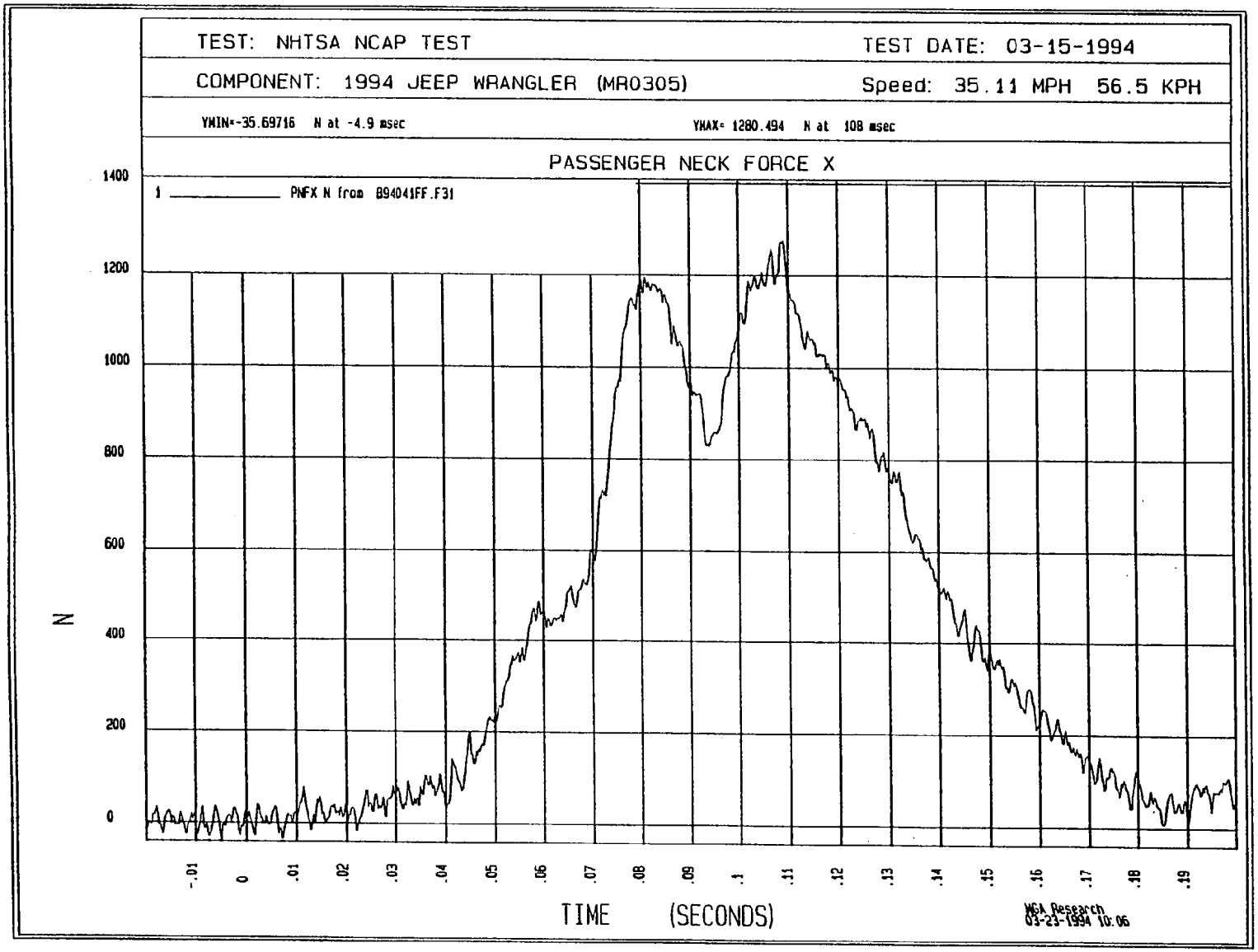


Figure B-83 - Passenger Neck Force X vs. Time

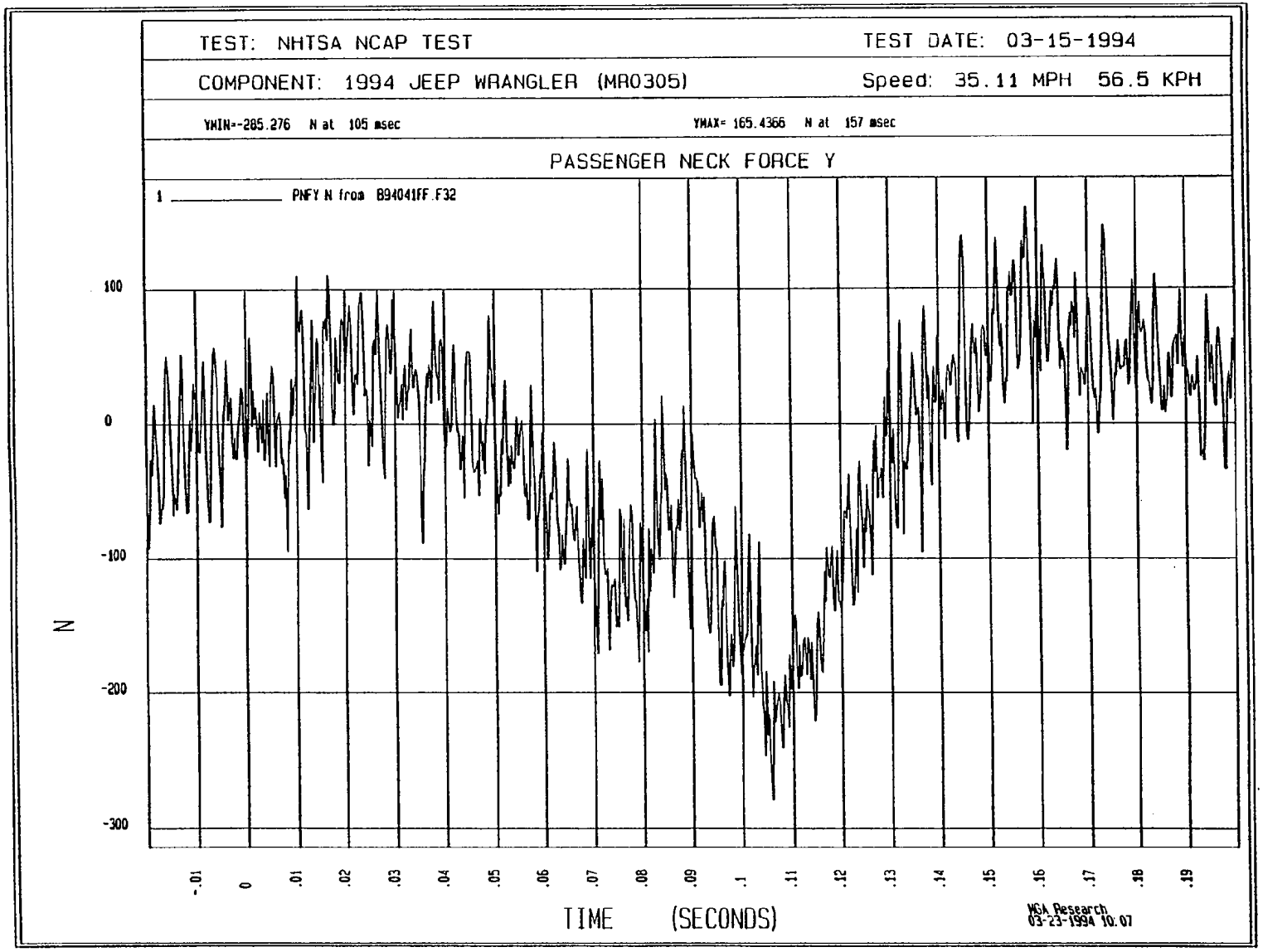


Figure B-84 - Passenger Neck Force Y vs. Time

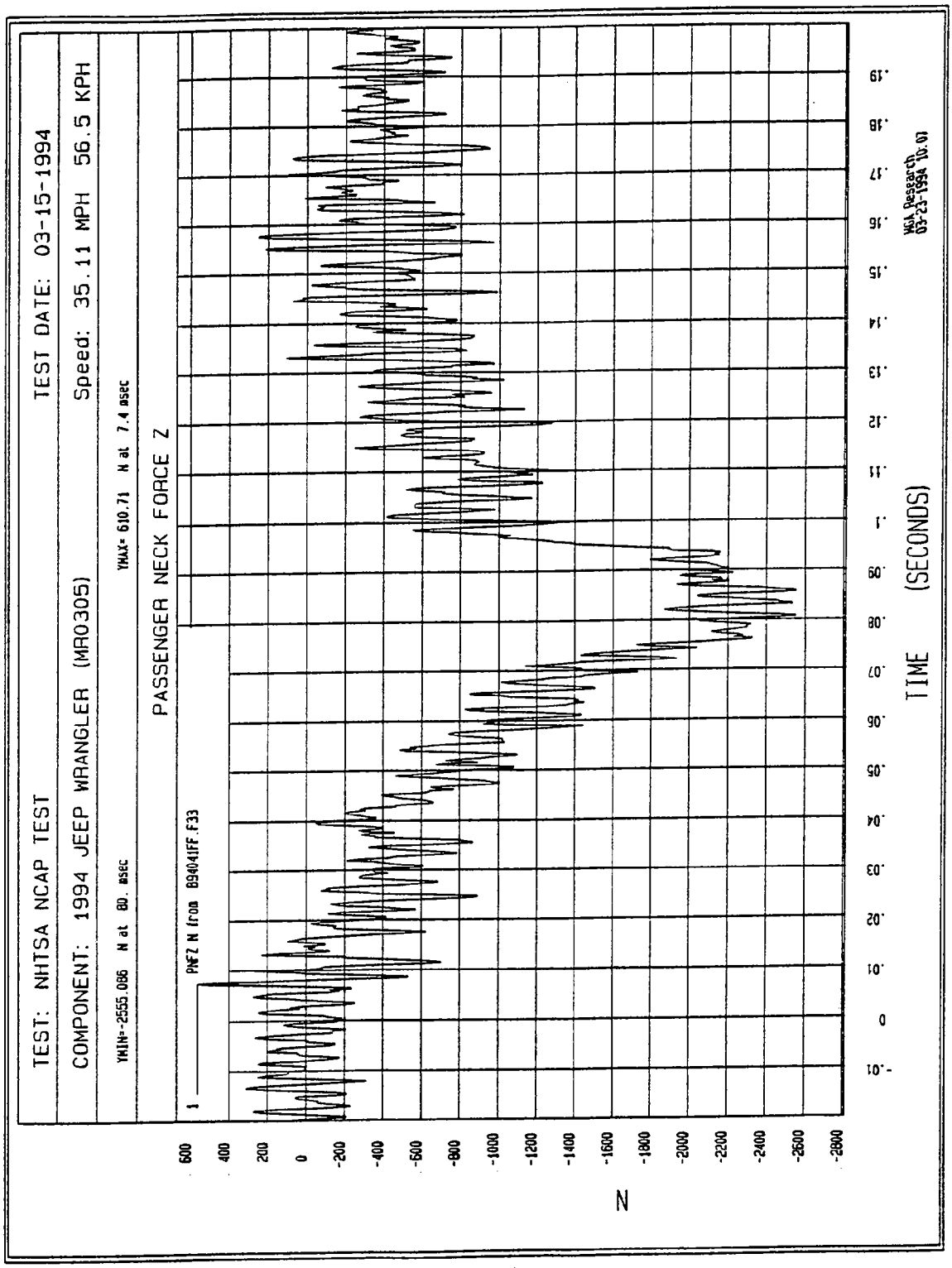


Figure B-85 - Passenger Neck Force Z vs. Time

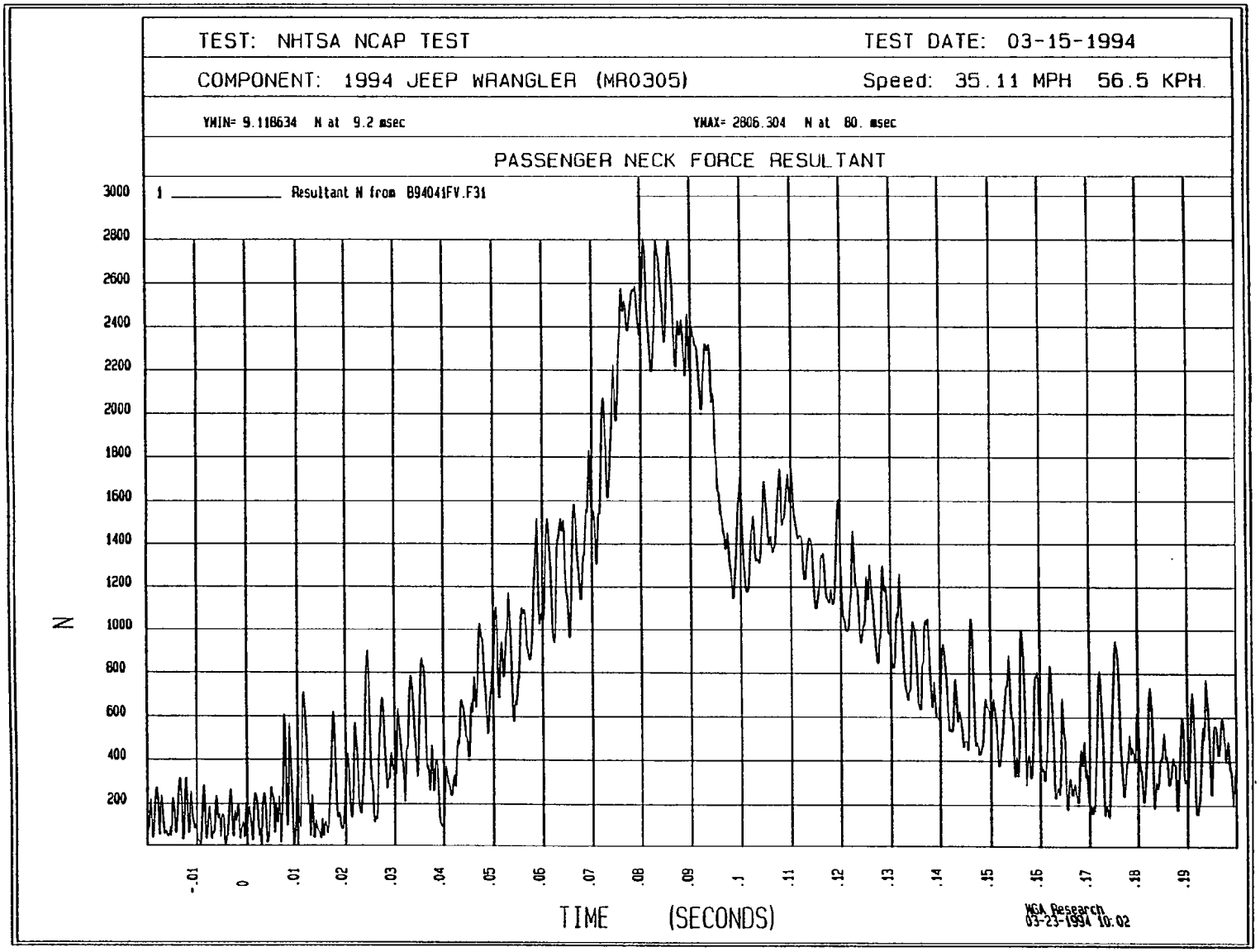


Figure B-86 - Passenger Neck Force Resultant vs. Time

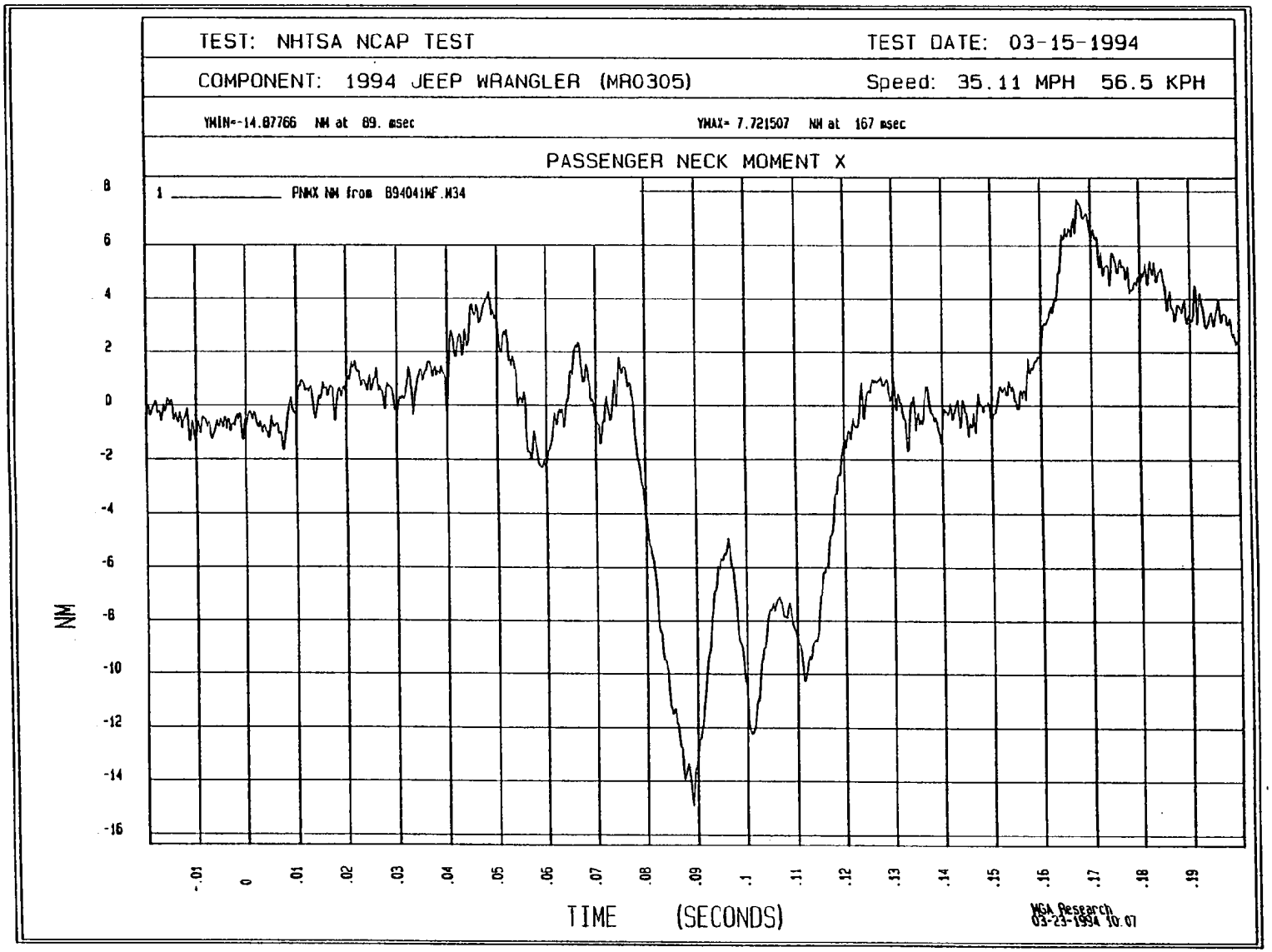


Figure B-87 - Passenger Neck Moment X vs. Time

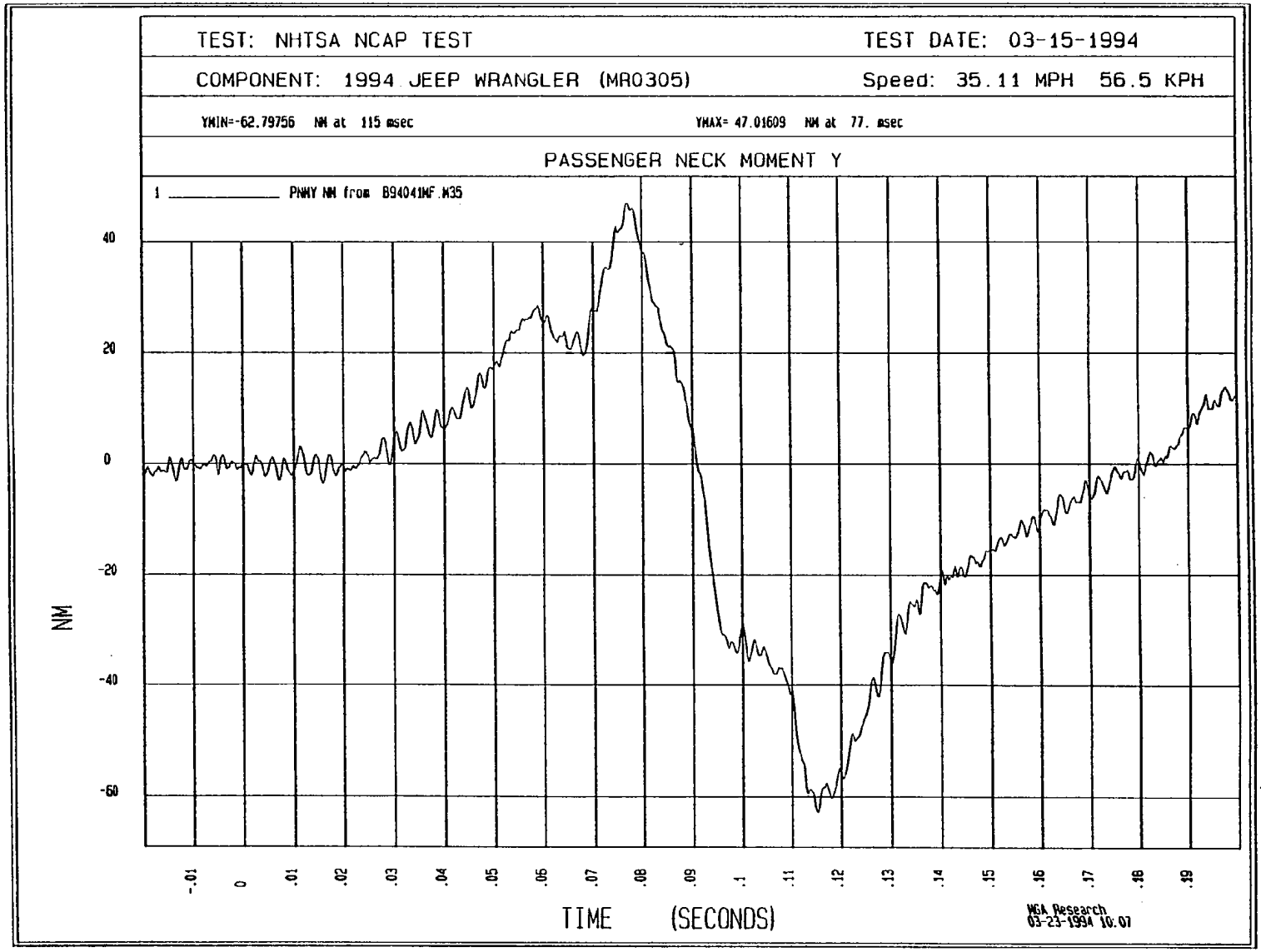


Figure B-88 - Passenger Neck Moment Y vs. Time

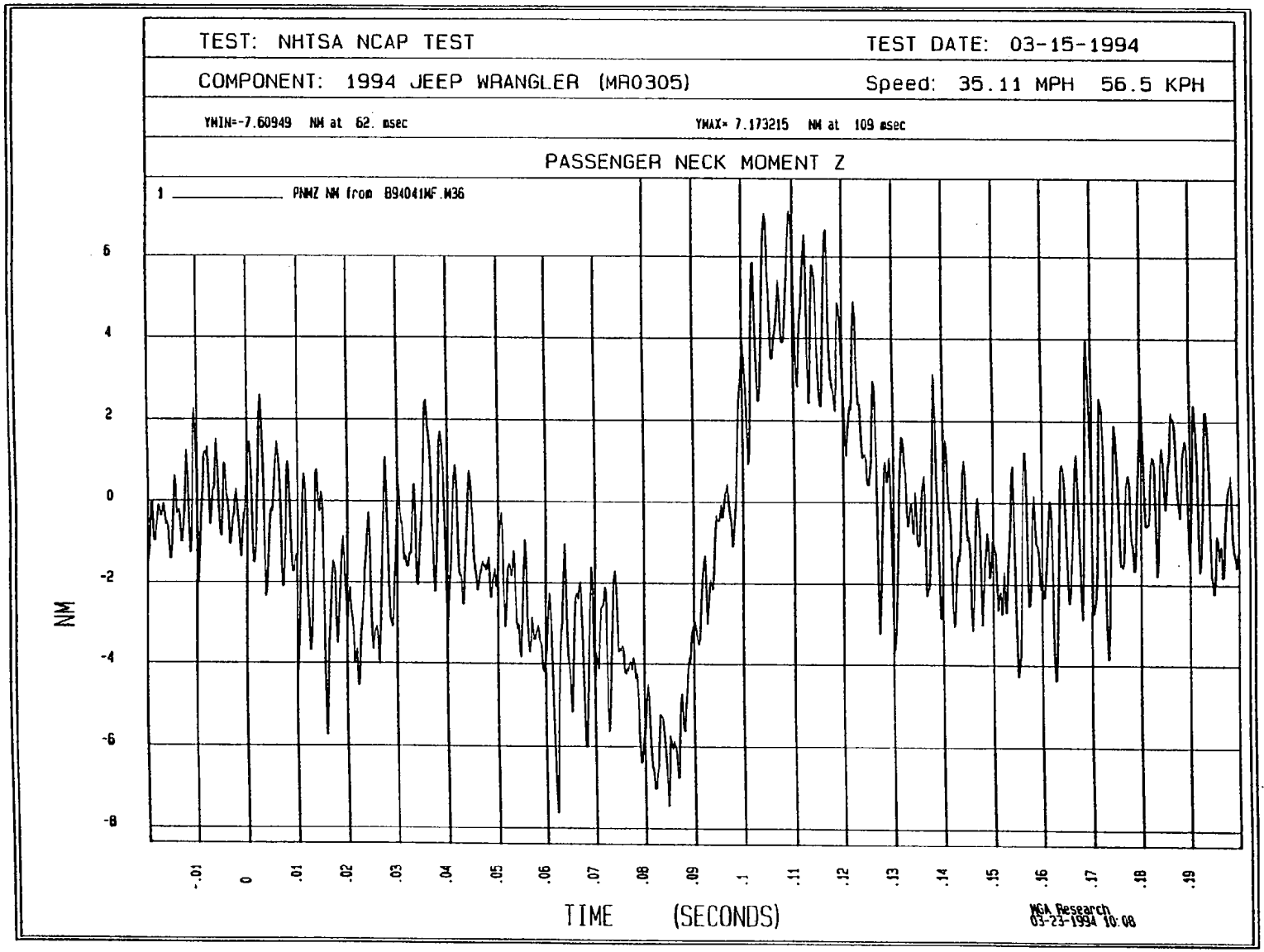


Figure B-89 - Passenger Neck Moment Z vs. Time

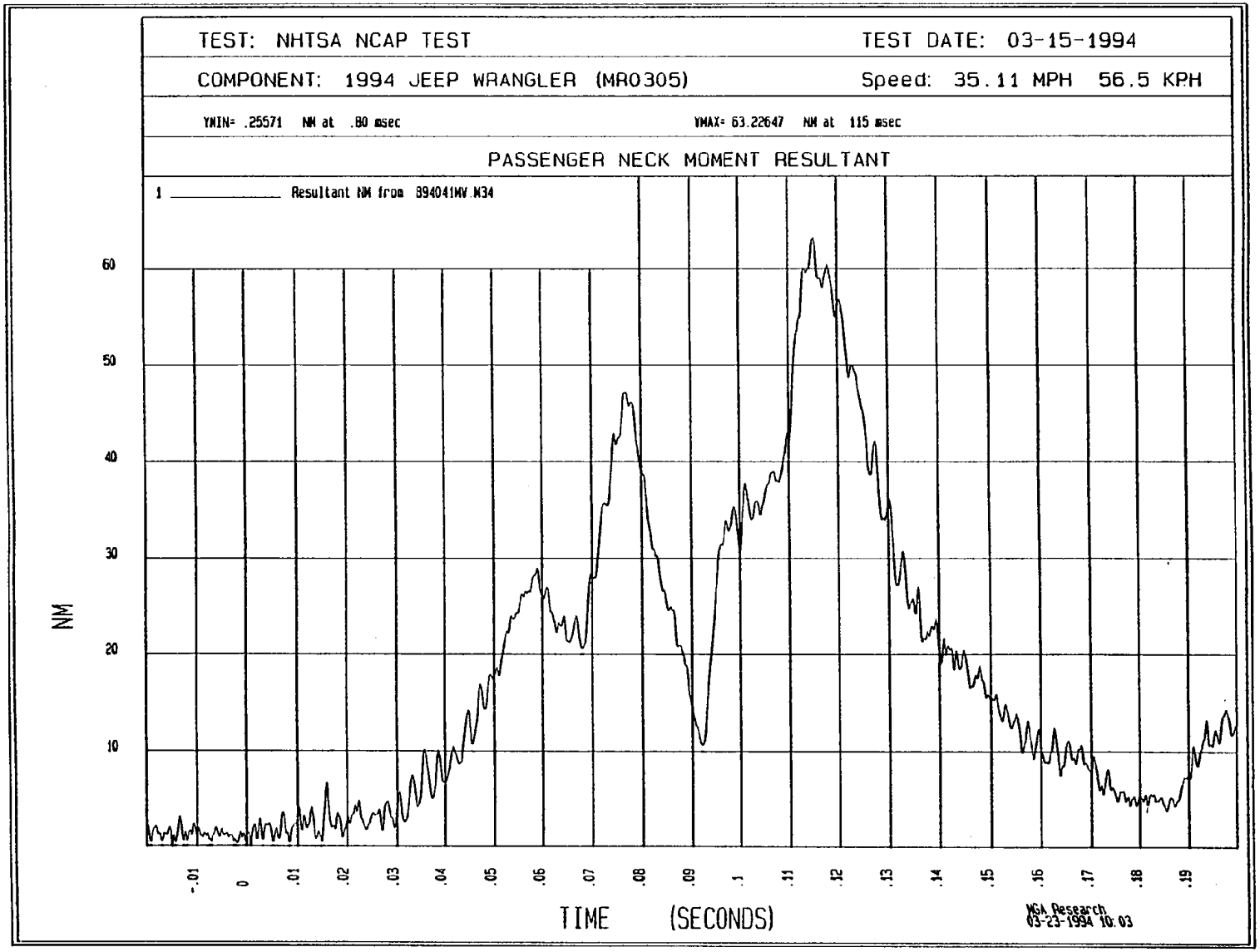


Figure B-90 - Passenger Neck Moment Resultant vs. Time

APPENDIX C

Dummy Configuration & Performance Verification Data

HYBRID III DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY NO.: 36 DUMMY CALIBRATION BY: Rod McClelland

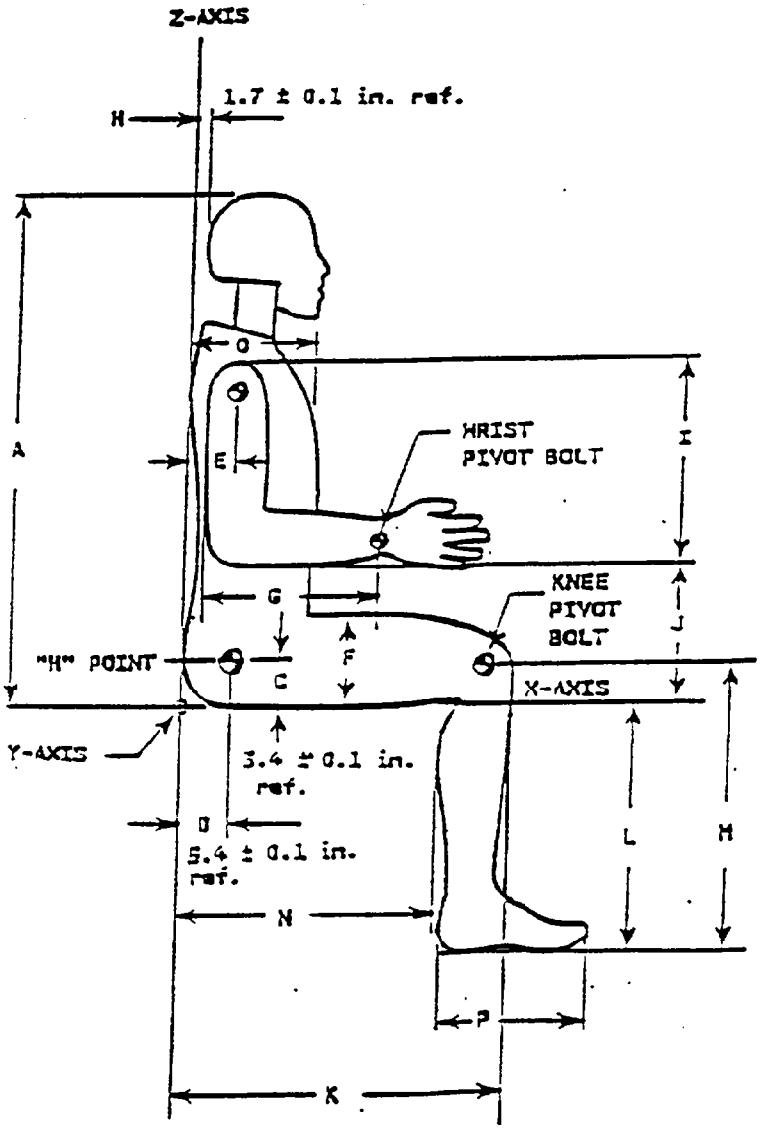
I. CONFIGURATION VERIFICATION DATA

DATE OF VERIFICATION: 03-10-94

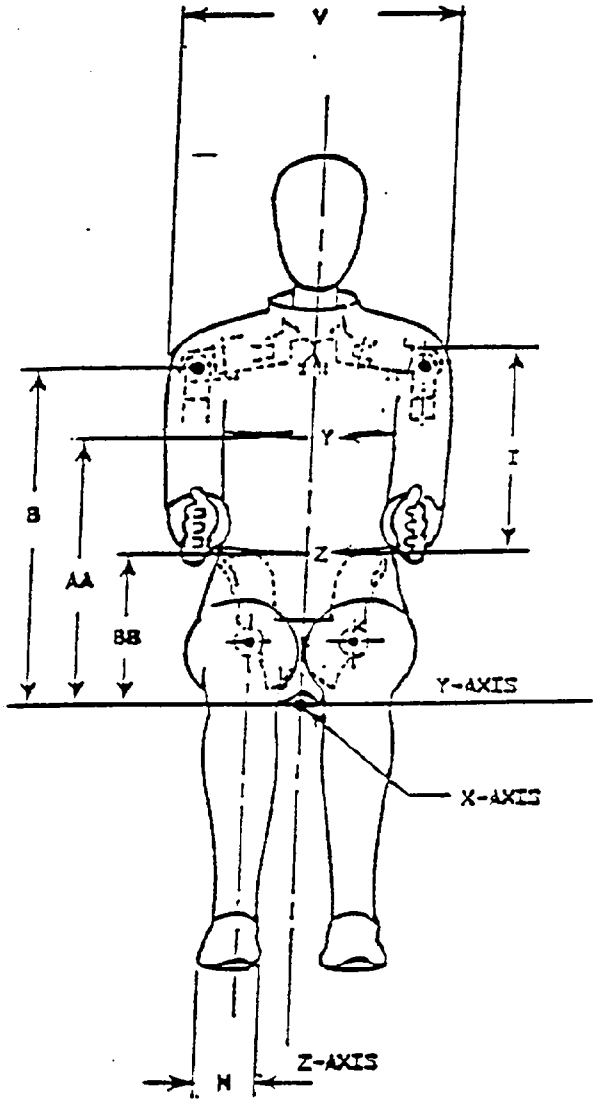
DESCRIPTION	SPECIFICATION (inches)	ACTUAL MEASUREMENT (inches)
A - Total Sitting Height	34.6 - 35.0	34.8
B - Shoulder Pivot Height	19.9 - 20.5	20.5
C - "H" Point Height	3.3 - 3.5	3.5
D - "H" Point from Seat Back	5.3 - 5.5	5.5
E - Shoulder Pivot From Backline	3.3 - 3.7	3.5
F - Thigh Clearance	5.5 - 6.1	6.1
G - Back of Elbow to Wrist Pivot	11.4 - 12.0	11.5
H - Skull Cap Skin to Backline	1.6 - 1.8	1.7
I - Shoulder - Elbow Length	13.0 - 13.6	13.0
J - Elbow Rest Height	7.5 - 8.3	8.0
K - Buttock to Knee Length	22.8 - 23.8	23.5
L - Popliteal Height	16.9 - 17.9	17.0
M - Knee Pivot Height	19.1 - 19.9	19.5
N - Buttock Popliteal Length	17.8 - 18.8	18.5
O - Chest Depth at 3rd Rib	8.4 - 9.0	8.8
P - Foot Length	9.9 - 10.5	10.3
V - Shoulder Breadth	16.6 - 17.2	16.8
W - Foot Breadth	3.6 - 4.2	4.0
Y - Chest Circumference	38.2 - 39.4	39.0
Z - Waist Circumference	32.9 - 34.1	33.5

Note: (See next page for external dimensions)

HYBRID III EXTERNAL DIMENSIONS



SIDE VIEW



FRONT VIEW

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

HYBRID III DUMMY CALIBRATION DATA SUMMARY SHEET

DUMMY NO.: 36 DUMMY CALIBRATION BY: Jeff Robbins

VERIFICATION DATE: 03-10-94

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

1.0 HEAD DROP TEST

	SPECIFICATION	MEASUREMENT
Peak Resultant Acceleration	225 - 275 G	227
Peak Lateral Acceleration	15 G. MAX	14
Is Acceleration Curve Unimodel	within 10% of peak	Yes

2.0 NECK FLEXION TEST

		SPECIFICATION	MEASUREMENT
Pendulum Speed		22.6 - 23.4 FT/SEC	22.84
Pendulum Deceleration	10 MS	22.50 - 27.50 G	25.03
	20 MS	17.60 - 22.60 G	19.49
	30 MS	12.50 - 18.50 G	14.94
Max. Pendulum G Above 30 MS		29.0 G MAX	14.9
Deceleration - Time Curve Decay Time to 5 G		34 - 42 MS	39
D Plane Rotation	MAX	64 - 78 DEG.	77
	TIME	57 - 64 MS	57
Rotation Angle - Time Curve Decay Time to Zero		113 - 128 MS	114
Moment About Occipital Condyle	MIN.	65 - 80 FT.LBS	72
	TIME	47 - 58 MS	53
Positive Moment - Time Curve Decay Time to Zero		97 - 107 MS	100

HYBRID III DUMMY CALIBRATION DATA SUMMARY SHEET (CONT.)

3.0 NECK EXTENSION TEST

		SPECIFICATION	MEASUREMENT
Pendulum Speed		19.50 - 20.30 F/S	19.95
Pendulum Deceleration	10 MS	17.20 - 21.20 G	18.58
	20 MS	14.00 - 19.00 G	15.71
	30 MS	11.00 - 16.00 G	12.29
Max. Pendulum G Above 30 MS		22 G Max	12
Deceleration - Time Curve Decay Time to 5 G		38 - 46 MS	46
D Plane Rotation	MAX	81 - 106 DEG.	96
	TIME	72 - 82 MS	82
Rotation Angle - Time Curve Decay Time to Zero		147 - 174 MS	154
Moment About Occipital Condyle	MIN.	-59.0/-39.0 FT LBS	-48.9
	TIME	65 - 79 MS	70
Positive Moment - Time Curve Decay Time to Zero		120 - 148 MS	143

4.0 CHEST IMPACT TESTS

	SPECIFICATION	MEASUREMENT
Probe Speed	21.6 to 22.4 F/S	22.1
Peak Deflection	2.50 to 2.86 IN.	2.77
Peak Resistive Force	1160 to 1325 LBS.	1248
Internal Hysteresis	69 to 85%	70

5.0 KNEE IMPACT TESTS

LEFT KNEE	SPECIFICATION	MEASUREMENT
Probe Speed	6.8 to 7.0 F/S	7.0
Maximum Force	1060 - 1300 LBS.	1164

RIGHT KNEE	SPECIFICATION	MEASUREMENT
Probe Speed	6.8 to 7.0 F/S	7.0
Maximum Force	1060 - 1300 LBS.	1146

HYBRID III DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY NO.: 37 DUMMY CALIBRATION BY: Jeff Robbins

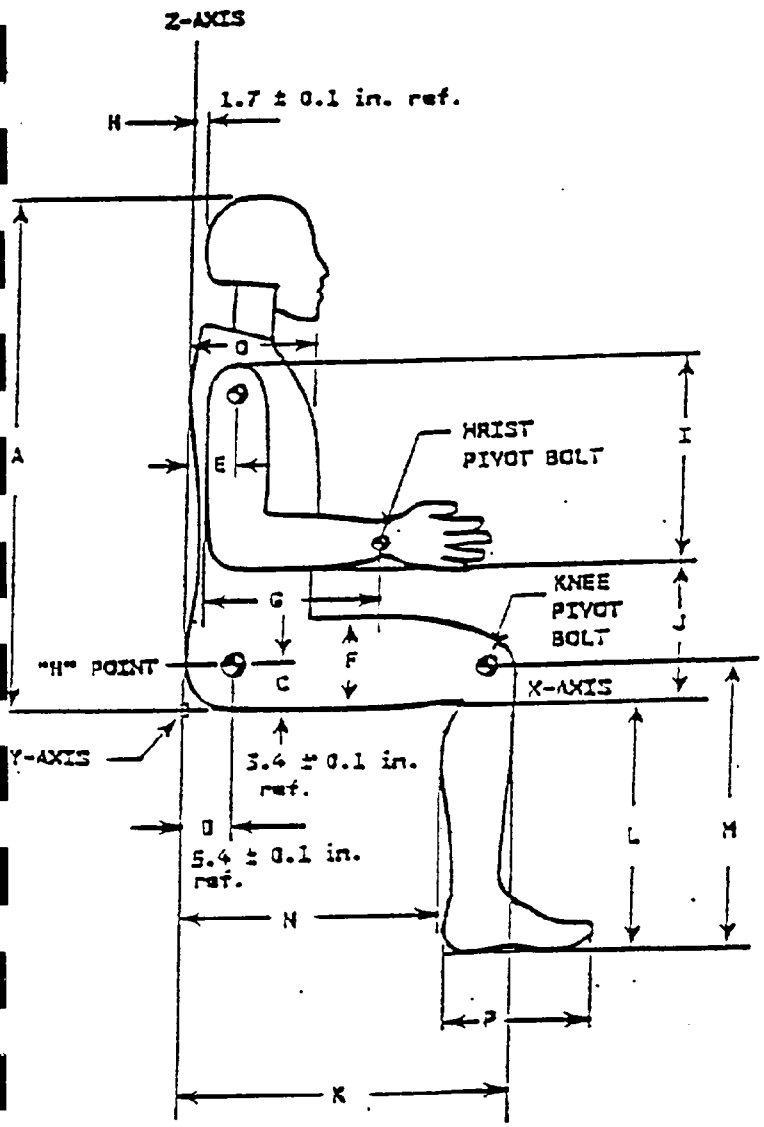
I. CONFIGURATION VERIFICATION DATA

DATE OF VERIFICATION: 03-10-94

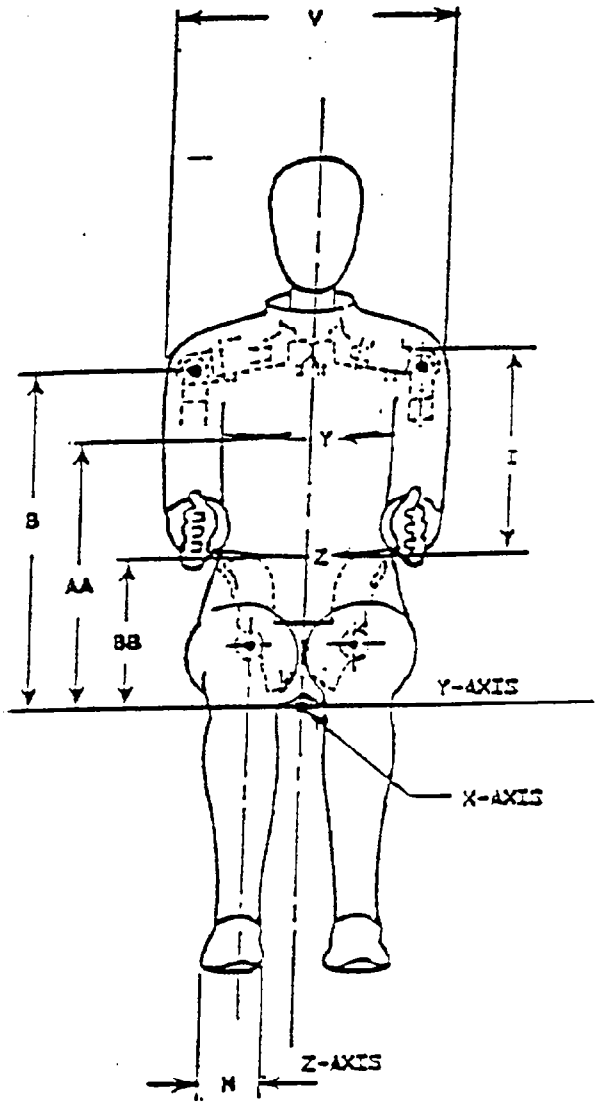
DESCRIPTION	SPECIFICATION (Inches)	ACTUAL MEASUREMENT (inches)
A - Total Sitting Height	34.6 - 35.0	34.9
B - Shoulder Pivot Height	19.9 - 20.5	20.5
C - "H" Point Height	3.3 - 3.5	3.5
D - "H" Point from Seat Back	5.3 - 5.5	5.5
E - Shoulder Pivot From Backline	3.3 - 3.7	3.5
F - Thigh Clearance	5.5 - 6.1	6.1
G - Back of Elbow to Wrist Pivot	11.4 - 12.0	11.5
H - Skull Cap Skin to Backline	1.6 - 1.8	1.7
I - Shoulder Elbow Length	13.0 - 13.6	13.0
J - Elbow Rest Height	7.5 - 8.3	8.0
K - Buttock Knee Length	22.8 - 23.8	23.5
L - Popliteal Height	16.9 - 17.9	17.0
M - Knee Pivot Height	19.1 - 19.9	19.5
N - Buttock Popliteal Length	17.8 - 18.8	18.5
O - Chest Depth at 3rd Rib	8.4 - 9.0	8.8
P - Foot Length	9.9 - 10.5	10.3
V - Shoulder Breadth	16.6 - 17.2	16.8
W - Foot Breadth	3.5 - 4.2	4.0
Y - Chest Circumference	38.2 - 39.4	39.0
Z - Waist Circumference	32.9 - 34.1	33.5

Note: (See next page for external dimensions)

HYBRID III EXTERNAL DIMENSIONS



SIDE VIEW



FRONT VIEW

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

HYBRID III DUMMY CALIBRATION DATA SUMMARY SHEET (CONT.)

DUMMY NO.: 37 DUMMY CALIBRATION BY: Jeff Robbins

VERIFICATION DATE: 03-10-94

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

1.0 HEAD DROP TEST

	SPECIFICATION	MEASUREMENT
Peak Resultant Acceleration	225 - 275 G	236
Peak Lateral Acceleration	-15 G. MAX	12
Is Acceleration Curve Unimodel	within 10% of peak	Yes

2.0 NECK FLEXION TEST

		SPECIFICATION	MEASUREMENT
Pendulum Speed		22.6 - 23.4 FT/SEC	23.0
Pendulum Deceleration	10 MS	22.50 - 27.50 G	24.34
	20 MS	17.60 - 22.60 G	19.59
	30 MS	12.50 - 18.50 G	13.68
Max. Pendulum G Above 30 MS		29.0 G MAX	13.6
Deceleration - Time Curve Decay Time to 5 G		34 - 42 MS	41
D Plane Rotation	MAX	64 - 78 DEG.	78
	TIME	57 - 64 MS	59
Rotation Angle - Time Curve Decay Time to Zero		113 - 128 MS	119
Moment About Occipital Condyle	MIN.	65 - 80 FT.LBS	67
	TIME	47 - 58 MS	55
Positive Moment - Time Curve Decay Time to Zero		97 - 107 MS	107

HYBRID III DUMMY CALIBRATION DATA SUMMARY SHEET (CONT.)

3.0 NECK EXTENSION TEST

		SPECIFICATION	MEASUREMENT
Pendulum Speed		19.50 - 20.30 F/S	20.01
Pendulum Deceleration	10 MS	17.20 - 21.20 G	20.83
	20 MS	14.00 - 19.00 G	17.44
	30 MS	11.00 - 16.00 G	12.47
Max. Pendulum G Above 30 MS		22 G Max	12
Deceleration - Time Curve Decay Time to 5 G		38 - 46 MS	42
D Plane Rotation	MAX	81 - 106 DEG.	99
	TIME	72 - 82 MS	74
Rotation Angle - Time Curve Decay Time to Zero		147 - 174 MS	155
Moment About Occipital Condyle	MIN.	-59.0/-39.0 FT LBS	-52.6
	TIME	65 - 79 MS	70
Positive Moment - Time Curve Decay Time to Zero		120 - 148 MS	144

4.0 CHEST IMPACT TESTS

	SPECIFICATION	MEASUREMENT
Probe Speed	21.6 to 22.4 F/S	22.0
Peak Deflection	2.50 to 2.86 IN.	2.75
Peak Resistive Force	1160 to 1325 LBS.	1266
Internal Hysteresis	69 to 85%	76

5.0 KNEE IMPACT TESTS

LEFT KNEE	SPECIFICATION	MEASUREMENT
Probe Speed	6.8 to 7.0 F/S	7.0
Maximum Force	1060 - 1300 LBS.	1083

RIGHT KNEE	SPECIFICATION	MEASUREMENT
Probe Speed	6.8 to 7.0 F/S	6.9
Maximum Force	1060 - 1300 LBS.	1158

APPENDIX D

Dummy, Vehicle and Laboratory Calibration Data

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

INSTRUMENTS FOR DUMMY NO. 36

	DRIVER		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	ACDE7	Endevco	1/25/94
Head Y	ACC7Ø	Endevco	1/25/94
Head Z	ACCW9	Endevco	1/25/94
Chest X	ACC78	Endevco	1/25/94
Chest Y	ACCE6	Endevco	1/25/94
Chest Z	ACC93	Endevco	1/25/94
Right Femur Load Cell	259	GSE	1/27/94
Left Femur Load Cell	26Ø	GSE	1/27/94
Neck Load Cell X	442	Denton	2/9/94
Neck Load Cell Y	442	Denton	2/9/94
Neck Load Cell Z	442	Denton	2/9/94
Neck Moment X	442	Denton	2/9/94
Neck Moment Y	442	Denton	2/9/94
Neck Moment Z	442	Denton	2/9/94
Chest Deflection Gauge	36G	Bourns	2/21/94
Lap Belt Load Cell	661	Lebow	11/22/93
Torso Belt Load Cell	211	Lebow	11/22/93

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

INSTRUMENTS FOR DUMMY NO. 37

	PASSENGER		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	ACCY6	Endevco	1/25/94
Head Y	ACCH1	Endevco	1/25/94
Head Z	AAMW5	Endevco	1/25/94
Chest X	ACCY1	Endevco	1/25/94
Chest Y	ACCC8	Endevco	1/25/94
Chest Z	ACCT7	Endevco	1/25/94
Right Femur Load Cell	261	GSE	1/27/94
Left Femur Load Cell	262	GSE	1/27/94
Neck Load Cell X	443	Denton	2/9/94
Neck Load Cell Y	443	Denton	2/9/94
Neck Load Cell Z	443	Denton	2/9/94
Neck Moment X	443	Denton	2/9/94
Neck Moment Y	443	Denton	2/9/94
Neck Moment Z	443	Denton	2/9/94
Chest Deflection Gauge	37G	Bourns	2/22/94
Lap Belt Load Cell	691	Lebow	11/22/93
Torso Belt Load Cell	212	Lebow	11/22/93

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

	VEHICLE ACCELEROMETERS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Rear Seat Crossmember X	MGA155	Entran	11/4/93
Right Rear Seat Crossmember X	MGAØ78	Entran	2/3/94
Top of Engine X	EGØ5	Endevco	12/22/93
Bottom of Engine X	MGAØØ4	Entran	1/25/94
Left Brake Caliper X	AC895	Endevco	1/1Ø/94
Right Brake Caliper X	AN47	Endevco	12/27/93
Instrument Panel X	MGA136	Entran	12/22/93
Redundant Left Rear Seat Crossmember X	MGAØ68	Entran	1/25/94
Redundant Right Rear Seat Crossmember X	MGAØØ3	Entran	11/4/93

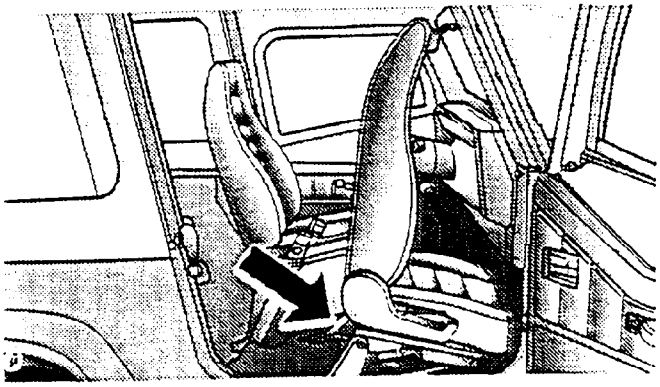
	LABORATORY INSTRUMENTS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Neck Bending Pendulum Accelerometer	MGA126	Entran	1Ø/22/93
Neck Bending Rotary Potentiometer	N/A	Bourns	Prior to use
Neck Bending Linear Potentiometer	N/A	Bourns	Prior to use
Femur/Chest/Thorax Probe Accelerometer	AC913	Endevco	12/22/93
Abdomen Compression Force Gauge	N/A	Transducers Inc.	N/A

APPENDIX E

Vehicle Owner's Occupant Restraint System Instructions

WARNING!

Do not ride with the seatback reclined so that the shoulder belt is no longer resting against your chest. In a collision you could slide under the seat belt and be seriously or even fatally injured. Use the recliner only when the vehicle is parked.



Tilting Front Seats

Lift the latch release beneath the passenger seat and push the seat forward. The entire seat will tilt forward.

OCCUPANT RESTRAINTS

One of the most important safety features in your vehicle is the restraint system. This system includes the front and rear seat belts. Your seat belts can also be used to hold infant and child restraint systems if you will be carrying children too small for adult-size belts.

Please pay close attention to the information in this section. It tells you how to use your restraint system properly to keep you and your passengers as safe as possible.

WARNING!

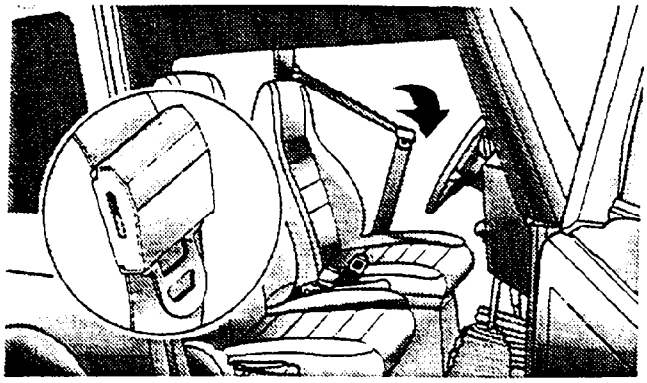
In a collision you and your passengers can suffer much greater injuries if your are not properly buckled up. You can strike parts of the inside of the vehicle or other passengers, or you can be thrown out of the vehicle. Always be sure you and others in your vehicle are buckled up properly.

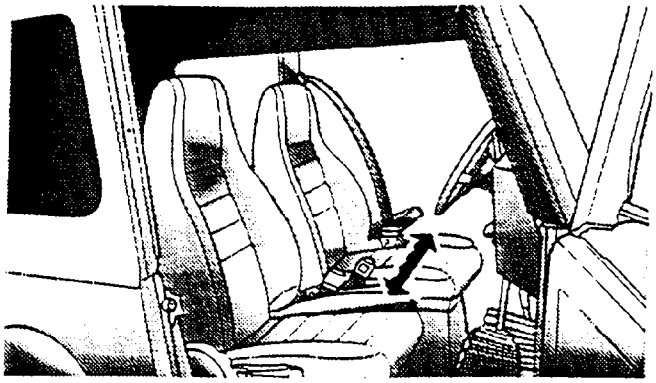
Buckle up even though you are an excellent driver, even on short trips. Someone else on the road may be a poor driver and cause a collision which involves you. And this can happen far from home or on your own street.

Research has shown that safety belts save lives. And they can reduce the seriousness of injuries in a collision. Some of the worst injuries happen when people are thrown from the vehicle. Seat belts provide protection against that, and they reduce the risk of injury caused by striking the inside of the vehicle. Everyone in a motor vehicle needs to be buckled up all the time.

Unibelts

The outboard front and rear seats of your vehicle have combination lap/shoulder belts, or unibelts. The retractor is designed to lock during very sudden stops or impacts. This feature allows the shoulder part of the belt to move freely with you under normal conditions. But in a collision, the belt will lock and reduce the risk of your striking the inside of the vehicle or being thrown out.





Seat Belt Operating Instructions

1. Enter the vehicle and close the door. Sit back and adjust the seat.
2. The latch plate of the belt is above the back of your seat. Grasp the latch plate and pull out the belt. Slide the latch plate up the webbing as far as necessary to make the belt go around your lap.
3. When the belt is long enough to fit, insert the latch plate into the buckle until you notice a "click."

BEFORE STARTING YOUR VEHICLE

WARNING!

A belt buckled into the wrong buckle will not protect you properly. The lap portion could ride too high on your body, possibly causing internal injuries. Always buckle your belt into the buckle nearest you.

WARNING!

- A belt that is too loose will not protect you as well. In a sudden stop you could move too far forward, increasing the possibility of injury. Wear your seat belt snugly.
- A shoulder belt worn under your arm is very dangerous. Your body could fall into the inside surfaces of the vehicle in a crash, increasing head and neck injury. And a belt worn under the arm can cause internal injuries. Ribs aren't as strong as shoulder bones. Wear the belt over your shoulder so that your strongest bones will take the force in a collision.

4. Position the lap belt across your thighs, below your abdomen. If you need the lap portion tighter, pull up a bit on the shoulder part, as shown. A snug belt reduces the risk of sliding under the belt in a collision.

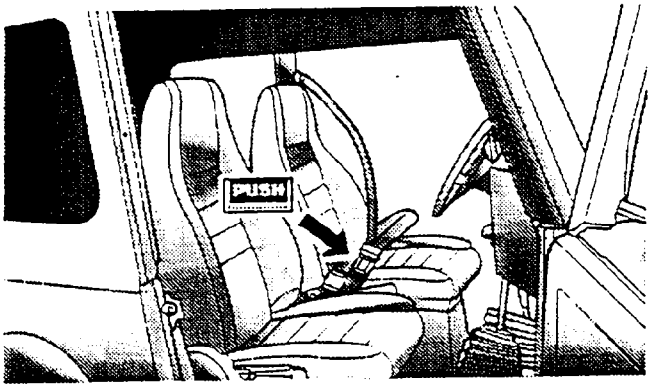
WARNING!

A lap belt worn too high can increase the risk of internal injury in a collision. The belt forces won't be at the strong hip and pelvic bones, but across your abdomen. Always wear the lap part of your seat belt as low as possible, and keep it snug.

5. Position the shoulder belt on your chest so that it is comfortable and not resting on your neck. The retractor will withdraw any slack in the belt.

WARNING!

A twisted belt can't do its job as well. In a collision it could even cut into you. Be sure your belt is straight. If you can't straighten a belt in your vehicle, take it to your dealer and have it fixed.



6. To release the belt, push the red button marked "Press" on the buckle. The belt will automatically retract to its stowed position.

If necessary, slide the latch plate down the webbing to allow the belt to retract fully.

WARNING!

A frayed or torn belt could rip apart in a collision and leave you with no protection. Inspect your belts periodically, checking for cuts, frays, and loose parts. Damaged parts must be replaced immediately. Do not disassemble or modify the system. Seat belt assemblies must be replaced after an accident if they have been damaged (bent retractor, torn webbing, etc.).

WARNING!

Belting two people into one seat belt can lead to greater injury. People belted together can crash into one another in an accident, hurting one another badly. Never use a belt for more than one person, no matter what their size.

Seat Belts and Pregnant Women

We recommend that pregnant women use seat belts throughout their pregnancies. Keeping the mother safe is the best way to keep the baby safe.

Pregnant women should wear the lap part of the belt across the thighs and as snug against the hips as possible. Keep the belt low so that it does not come across the abdomen. That way the strong bones of the hips will take the force if there is a collision.

Seat Belt Extender

If a seat belt is too short, even when fully extended, your dealer can provide you with a seat belt extender. This extender should be used only if the existing belt is not long enough. When it is not required, remove the extender and stow it.

Child Restraint

When we say that everyone in your vehicle needs to be buckled up all the time, we mean babies and children, too.

WARNING!

In a collision, an unrestrained child, even a tiny baby, can become a missile inside the vehicle. The force required to hold even an infant on your lap could become so great that you could not hold the child, no matter how strong you are. The child and others could be badly injured. Any child riding in your vehicle should be in a proper restraint for the child's size.

Every state in the United States and all Canadian provinces require small children to ride in proper restraint systems. This is the law, and you can be prosecuted for ignoring it.

Infants and Small Children

There are different sizes and types of restraints for children from newborn size to the bigger child almost large enough for an adult safety belt. Use the restraint that is correct for your child.

Two different child restraint systems are generally available.

- The infant carrier for babies weighing up to 20 lbs. (9 kg.)
- The child seat for small children over 20 lbs.

In addition, some manufacturers make systems that can be used first as an infant carrier, and then converted to a child seat as the child grows.

Here are some tips on getting the most out of your child restraint:

- Before buying any restraint system, make sure that it has a label certifying that it meets Motor Vehicle Safety Standard 213. We also recommend that before you buy a child restraint, you try it in the vehicle in the seats where you will use it.
- The restraint must be appropriate for your child's weight and height. Check the label on the restraint for this, too.

- If possible, install the restraint in the rear seat. According to accident statistics, children are safer when properly restrained in the rear seats rather than in the front.
- Carefully follow the instructions that come with the restraint. If you install the restraint improperly, it may not work when you need it.

WARNING!

Improper installation can lead to failure of an infant or child restraint. It could come loose in a collision. The child could be badly injured or killed. Follow the manufacturer's directions exactly when installing an infant or child restraint.

- Infant and child restraints are secured in vehicle seats by the lap belt or the lap part of the lap/shoulder belt.

In the rear seat, you may have trouble tightening the belt on the child restraint because the buckle or latch plate interferes with the belt path opening on the restraint. Disconnect the latch plate from the buckle end and twist the short buckle-end belt several turns to shorten it. Reassemble the latch plate to the buckle with the release button turned so that it is facing out.

In the front seat, move the seat forward to re-position the buckle against the side of the child restraint.

- Buckle the child into the restraint exactly as the seat manufacturer's directions tell you.
- When your infant carrier or child restraint is not in use, secure it with the seat belt or remove it from the vehicle. Don't leave it loose in the vehicle. In a sudden stop or collision it could strike occupants and injure them.

Children Too Large for Child Seats

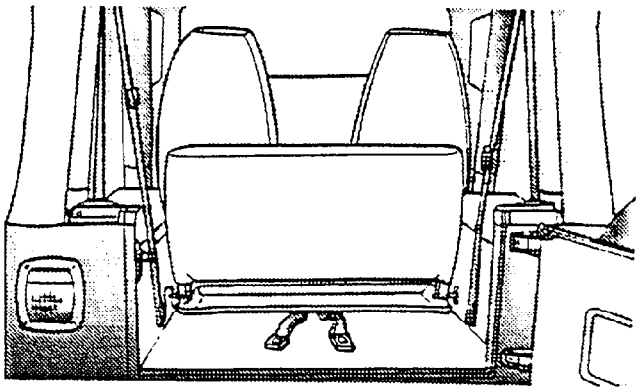
Children who are too large for child seats and who can sit upright by themselves should use the available lap/shoulder belts for best protection.

- Make sure that the child is seated upright in the seat.

- The lap belt should be fastened low on the hips and as snug as possible.
- Check belt fit periodically. A child's squirming or slouching can move the belt out of position.

If the shoulder belt contacts the face or neck, move the child closer to the middle of the vehicle. If this doesn't solve the problem, move the child to a rear seat lap belt.

Booster seats that may help overcome this problem are also available for use with lap/shoulder belts. Before buying a booster seat, make sure it has a label certifying that it meets applicable Motor Vehicle Safety Standards. Make sure it is satisfactory for use in this vehicle.



FOLD AND TUMBLE REAR SEAT

To expand the cargo area:

1. Slide seat belts through the seat cushions into the cargo area.