V2093

# REPORT NO.: MGA-93-21416

# SAFETY COMPLIANCE TESTING FOR FMVSS 214 "SIDE IMPACT PROTECTION - PASSENGER CARS"

SUBARU MOTORS
1994 SUBARU IMPREZA 4 DOOR SEDAN
NHTSA NO: CR0505

MGA PROVING GROUNDS
5000 WARREN ROAD
BURLINGTON, WI 53105

MGA Ref. No.: G93A-02

Test Date: July 19, 1994

Report Date: August 15, 1994

FINAL REPORT

Prepared For:

**U.S. DEPARTMENT OF TRANSPORTATION**
**NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION**
**ENFORCEMENT**
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Approved by:

John Fleck Date:_____

John Fleck, Project Engineer

FINAL REPORT ACCEPTED BY:

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**16. Abstract**


Compliance tests were conducted on the subject 1994 Subaru Impreza 4 Door Sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure for the determination of FMVSS 214 compliance. The test was conducted at the MGA Research Proving Grounds and crash Test Center in Burlington, Wisconsin on July 19, 1994.

The impact velocity of the Moving Barrier (MDB) was 32.8 mph and the ambient temperature of the struck side (driver's) of the target vehicle at the time of impact was 71°F. The maximum static crush of 12.7 inches occurred at the mid-door level of the struck vehicle.

The test or target vehicle's performance is given below:

| | Driver's SID | Left Rear SID |
|---|---|---|
| Thoracic Trauma Index (TTI) | 60 g's | 100 g's |
| Pelvis Acceleration | 76 g's | 79 g's |
| Upper Rib Acceleration | 55.8 g's | 105.0 g's |
| Lower Rib | 48.5 g's | 114.7 g's |
| Lower Spine | 65.0 g's | 84.3 g's |

The data recorded seems to indicate that the 1994 Subaru Impreza does not comply with the requirements for FMVSS 214 which were set forth by the National Highway Traffic Safety Administration.


**17. Key Words**

Compliance Testing
FMVSS 214
Side Impact Protection
Side Impact Dummy (SID)

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TABLE OF CONTENTS


| Section | | Page No. |
|---|---|---|
| 1 | PURPOSE AND TEST PROCEDURE | 1-1 |
| 2 | SUMMARY OF SIDE IMPACT TEST | 2-1 |
| 3 | SUMMARY OF TEST DATA | 3-1 |
| 4 | OCCUPANT AND VEHICLE INFORMATION | 4-1 |
| APPENDIX A | PHOTOGRAPHS | |
| APPENDIX B | DATA PLOTS | |
| APPENDIX C | SID CONFIGURATION AND PERFORMANCE VERIFICATION | |
| APPENDIX D | DUMMY AND VEHICLE CALIBRATION DATA | |

LIST OF FIGURES


| Figure No. | | Page No. |
|---|---|---|
| 1 | PRE-TEST CONDITIONS | 3-4 |
| 2 | PRE- AND POST-TEST MEASUREMENTS | 4-3 |
| 3 | SIDE IMPACT DUMMY (SID) LONGITUDINAL CLEARANCE DIMENSIONS | 4-4 |
| 4 | SIDE IMPACT DUMMY (SID) LATERAL CLEARANCE DIMENSIONS | 4-5 |
| 5 | VEHICLE SIDE MEASUREMENT | 4-6 |
| 6 | VEHICLE EXTERIOR STATIC CRUSH | 4-8 |
| 7 | TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY | 4-17 |
| 8 | MDB FACE DIMENSIONS | 4-18 |
| 9 | MOVING DEFORMABLE BARRIER (MDB) ACCELEROMETER LOCATIONS | 4-21 |
| 10 | HIGH SPEED CAMERA LOCATIONS AND DATA | 4-22 |

LIST OF TABLES


| Table No. | | Page No. |
|---|---|---|
| 1 | GENERAL TEST AND VEHICLE PARAMETER DATA | 3-2 |
| 2 | TEST VEHICLE DATA | 3-3 |
| 3 | CRASH TEST SUMMARY FOR TEST VEHICLE | 3-5 |
| 4 | CRASH TEST SUMMARY FOR SIDE IMPACTOR | 3-6 |
| 5 | POST-TEST OBSERVATIONS | 3-7 |
| 6 | SIDE IMPACT DUMMY (SID) TEST DATA SUMMARY | 4-2 |
| 7 | TEST VEHICLE EXTERIOR PROFILES FROM REFERENCE PLANE AND STATIC CRUSH | 4-7 |
| 8 | EXTERIOR STATIC CRUSH FOR SIDE IMPACTOR | 4-19 |
| 9 | TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY | 4-20 |

SECTION 1

PURPOSE AND TEST PROCEDURE

This side impact test is part of the FY 94 FMVSS 214 "Dynamic" compliance test program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-93-C-02047. The purpose of this test was to evaluate side impact protection in a 1994 Subaru Impreza 4 Door Sedan.

This test was conducted using the Office of Vehicle Safety Compliance's FMVSS 214 test procedure (TP-214D-03, dated May 17, 1993).

MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes only.

SECTION 2

SUMMARY OF SIDE IMPACT TEST

A stationary 1994 Subaru Impreza 4 Door Sedan was impacted on the left or driver's side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the monorail at a velocity of 32.8 mph on July 19, 1994. The orientation angle of the striking vehicle was 90° counterclockwise with respect to the longitudinal axis of the struck vehicle. Pre- and post-test photographs of the test vehicle, the moving deformable barrier (MDB), and the side impact dummies (SIDs) are shown in Appendix A.

Two restrained Side Impact Dummies (SIDs) were placed in the driver (Pos. #1) and left rear (Pos. #4) designated seating positions according to instructions specified in the Laboratory Test Procedure which is dated May 17, 1993. The side impact event was documented by nine high speed cameras. Camera locations and other pertinent camera information can be found in this report. Appendix B contains the vehicle and dummy response data traces.

The SIDs were instrumented with the following accelerometers.

1. Left Upper Rib (LUR) uniaxial accelerometer (Y-direction)
2. Left Lower Rib (LLR) uniaxial accelerometer (Y-direction)
3. Lower Thoracic Spine ($T_{12}$) uniaxial accelerometer (Y-direction)
4. Pelvic (PEV) section uniaxial accelerometer (Y-direction)

The summary of the side impact dummy (SID) configuration and performance verification test data are shown in Appendix C.

The driver's Thoracic Trauma Index (TTI) was 60 g's. Maximum pelvic Y acceleration was 76 g's.

The left rear passenger's TTI was 100 g's. Maximum pelvic Y acceleration was 79 g's.

## TEST NOTES

Due to the apparent non-compliance, the FMVSS 301 Static Rollover test on the 1994 Subaru Impreza 4 Door was not conducted.

# SECTION 3
# SUMMARY OF TEST DATA

TABLE 1

GENERAL TEST AND VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

Vehicle NHTSA No.: CR0505 VIN: JF1GC235XRB541413

Vehicle Body Color: White Month & Year of Manufacture: 03-94

Engine Data: 4 cylinders; __ CID; 1.8 Liter; __cc

Placement __ Longitudinal; or X Lateral

Transmission: 5 speed; X Manual; __ Automatic; X Overdrive

Final Drive: __ Rear Wheel Drive; X Frt. Wheel Drive; __ Four Wheel Drive

Odometer Reading 14 miles

Options: X A/C; X Pwr. Steering.; X Pwr. Brakes; X Pwr. Windows

__Power Seats; X Tilt Wheel; X Power Door Locks; __Self Leveling System

DATA FROM TIRE PLACARD:

Tire Pressure (at capacity): 32 psi FRONT

29 psi REAR

Recommended Tire Size: P165/80R13

Tires on Test Vehicle: P165/80R13 Manufacturer: Yokohama

Vehicle Capacity Data:

Number of Occupants: 2 Front; 3 Rear; N/A 3rd Seat 5 Total

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

Type of Front Seat Back: __ Fixed; X Adjustable with X Lever

| | | |
|---|---|---|
| Vehicle Maximum Capacity Loading* | = 800 lbs | (A) |
| No. of Occupants x 150 lbs. | = 750 lbs | (B) |
| Cargo Capacity (A-B) | = 50 lbs | |

WEIGHT OF TEST VEHICLE WITH MAXIMUM FLUIDS:

| | | | |
|---|---|---|---|
| Right Front | = 722 lbs | Right Rear | = 442 lbs |
| Left Front | = 743 lbs | Left Rear | = 466 lbs |
| TOTAL FRONT | = 1465 lbs | TOTAL REAR | = 908 lbs |
| % of Total Vehicle Weight | = 61.7 %; | % of Total Weight | = 38.3 % |
| TOTAL WEIGHT | = 2373 lbs | | |

* Supplied by manufacturer

TABLE 2

TEST VEHICLE DATA

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

Vehicle NHTSA No.: CRØ5Ø5 TEST DATE: July 19, 1994

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

| | |
|---|---|
| Total Test Vehicle Delivered Weight with Maximum Fluids | = 2373 lbs |
| Maximum Cargo Carrying Capacity of Test Vehicle | = 5Ø lbs |
| Weight of 2 Side Impact Dummies (2 x 178 lbs.) | = 356 lbs |
| TEST VEHICLE TARGET WEIGHT: | = 2779 lbs |

ACTUAL WEIGHT OF TEST VEHICLE WITH 2 DUMMIES AND CARGO:

| | | | |
|---|---|---|---|
| Right Front | = 748 lbs | Right Rear | = 559 lbs |
| Left Front | = 838 lbs | Left Rear | = 621 lbs |
| TOTAL FRONT | = 1586 lbs | TOTAL REAR | = 1180 lbs |
| % of Total Weight | = 57.3 % | % of Total Weight | = 42.7 % |

TOTAL TEST WEIGHT = 2766 lbs

TEST VEHICLE ATTITUDE (all dimensions in inches):

CURB WEIGHT ATTITUDE: (in)

Right Front 27.4 Left Front 27.1 Right Rear 27.Ø Left Rear 26.7

FULLY LOADED WEIGHT ATTITUDE: (in)

Right Front 26.8 Left Front 25.7 Right Rear 25.8 Left Rear 24.6

TEST ATTITUDE: (in)

Right Front 26.5 Left Front 25.6 Right Rear 25.4 Left Rear 24.6

Test Vehicle Wheelbase: 99 inches

C.G. = 42.2 inches rearward of front wheel centerline

TOTAL VEHICLE LENGTH:

| | |
|---|---|
| Right Side | = 161.4 in |
| Centerline | = 172.6 in |
| Left Side | = 161.4 in |

FIGURE 1

PRE-TEST CONDITIONS

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

Vehicle NHTSA No.: CRØ5Ø5 TEST DATE: July 19, 1994

FRONT SEAT CUSHION PLACEMENT:

Total Length of Adjustment Travel: 8.5 in

Total Number of Adjustment Positions or Detents: 18

Test Position: 9th detent (mid position)

FRONT SEAT BACK ADJUSTMENT POSITION:

Seat Back Angle = 25.Ø° degrees (4th latch position)

SECOND POSITION SEAT:

Total Length of Fore/Aft Adjustment Travel: Non Adjustable

Seat Back Adjustment Position: Non Adjustable

ADJUSTABLE STEERING COLUMN POSITION:

Adjusted to mid position

WINDOW POSITIONS: Left Front closed Left Rear closed

Right Front removed Right Rear removed

Note: Windows will be in closed position on struck side of test vehicle and in open position on opposite side.

AMOUNT OF STODDARD SOLVENT IN FUEL TANK: Fuel system usable capacity = 13.2 gallons

Test Volume: 12.3 gallons (93.2% of capacity)

LOCATIONS OF IMPACT POINT ON TEST VEHICLE SIDE TO BE IMPACTED:

Wheelbase: = 99 in

Impact Point is 12.5 in rearward of front axle centerline (which is 37 inches forward of the wheelbase midpoint)

TABLE 3

CRASH TEST SUMMARY FOR TEST VEHICLE

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

Vehicle NHTSA No.: CR0505 TEST DATE: July 19, 1994

Overall Length = 172.6 in; Overall Width = 66.5 in

TEST WEIGHT:

| | | | |
|---|---|---|---|
| Right Front | = 748 lbs | Right Rear | = 559 lbs |
| Left Front | = 838 lbs | Left Rear | = 621 lbs |
| TOTAL FRONT | = 1586 lbs | TOTAL REAR | = 1180 lbs |

TOTAL VEHICLE WEIGHT 2766 lbs

Wheelbase = 99 in

Longitudinal C.G. front Center of Front Axle = 42.2 in

Impact Angle with Respect to Impactor = 90° degrees

MAXIMUM EXTERIOR STATIC CRUSH:

1. LEVEL 1 ( 8.5 in above ground) = 5.4 in
2. LEVEL 2 ( 18.4 in above ground) = 12.6 in
3. LEVEL 3 ( 22.0 in above ground) = 12.7 in
4. LEVEL 4 ( 34.3 in above ground) = 9.1 in
5. LEVEL 5 ( 50.0 in above ground) = 2.3 in

Maximum Post-Test Intrusion = 12.7 in

| OCCUPANTS: | Left Front Passenger | Left Rear Passenger |
|---|---|---|
| Type of Dummy | SID | SID |
| Restraints Used | 3 pt. lap & shoulder belt with airbag | 3 pt. lap & shoulder belt |

INSTRUMENTATION:

| | | |
|---|---|---|
| Number of Vehicle Data Channels: | | = 16 |
| Number of Cameras: | Onboard Vehicle | = 3 |
| | Offboard Vehicle | = 4 |
| | Deformable Barrier | = 2 |
| | TOTAL | = 9 |

TABLE 4

CRASH TEST SUMMARY FOR SIDE IMPACTOR

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

Vehicle NHTSA No.: CR0505 TEST DATE: July 19, 1994

POSITION OF IMPACT (MDB) ON MONORAIL:

Crabbed 27° to left

MDB DETAILS:

| | |
|---|---|
| Overall Width of Framework Carriage | = 49.3 in |
| Overall Length of MDB (incl. honeycomb impact face) | = 162 in |
| Wheelbase of Framework Carriage | = 102 in |
| Tread of Framework Carriage (Front & Rear) | = 74 in |
| C.G. Location Rearward of Front Axle | = 43.4 in |
| C.G. Location From Center Line | = -.3 in |
| C.G. Location Above Ground Level | = 19.2 in |

MDB WEIGHT:

| | | | |
|---|---|---|---|
| Left Front | = 1095 lbs | Left Rear | = 413 lbs |
| Right Front | = 624 lbs | Right Rear | = 858 lbs |
| TOTAL FRONT | = 1719 lbs | TOTAL REAR | = 1271 lbs |

TOTAL MDB WEIGHT = 2990 lbs

Impact Angle (MDB C/L to Target Vehicle C/L) = 90° degrees

Impact Speed = Primary: 32.80 mph Secondary: 32.79 mph

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE:

| | | |
|---|---|---|
| 1. | Row A Top of Stack (33 in) | = 3.8 in |
| 2. | Row B Mid Stack (27 in) | = 4.1 in |
| 3. | Row C Top of Bumper (21 in) | = 2.3 in |
| 4. | Row D Center of Bumper (17 in) | = 3.2 in |

INSTRUMENTATION:

Number of MDB Data Channels = 7

TABLE 5

POST-TEST OBSERVATIONS

Year/Make/Model/Body Style: 1995/Subaru/Impreza/4 Door Sedan

Vehicle NHTSA No.: CR0505 TEST DATE: July 19, 1994

VISIBLE DUMMY CONTACT POINTS:

| | LEFT FRONT SID | LEFT REAR SID |
|---|---|---|
| Head | to "D" Ring & Door | to "C" Post |
| Arm | to door trim panel | to door trim panel & armrest |
| Pelvis | to door trim panel | to door trim panel |
| Left Knee | to door trim panel | to door trim panel |
| Right Knee | to left knee | to left knee |

DOOR OPENING:

| | LEFT SIDE | RIGHT SIDE |
|---|---|---|
| Front | remained closed | remained closed |
| Rear | remained closed | remained closed |

MDB DISTANCE FROM TARGET IMPACT POINT:

Horizontal: 0.6 inches rearward Vertical: 0.5 inches high

ARM REST LOCATIONS:

Front: 9.6 inches below window opening

Rear: 10.0 inches below window opening

SEAT CRUSH:

Driver Seat Back: 1.6 inches Driver Seat Cushion: 1.9 inches

Left Rear Seat Back: 5.8 inches Left Rear Seat Cushion: 5.9 inches

GLAZING DAMAGE:

Left side door windows broken and windshield cracked

PILLAR PERFORMANCE:

No separation evident

SILL SEPARATION:

No sill separation noted

OTHER NOTABLE IMPACT EFFECTS:

Driver and passenger airbags deployed

# SECTION 4
# OCCUPANT AND VEHICLE INFORMATION

TABLE 6

SIDE IMPACT DUMMY (SID) TEST DATA SUMMARY

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

Vehicle NHTSA No.: CR0505 TEST DATE: July 19, 1994

| | Front Dummy ID # 272 | | | | | Rear Dummy ID # 271 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pos. Direct. | | Neg. Direct | | | Pos. Direct. | | Neg. Direct | |
| | Max (g) | Time (msec) | Max (g) | Time (msec) | | Max (g) | Time (msec) | Max (g) | Time (msec) |
| RIB ACCELERATIONS: | | | | | | | | | |
| Upper Rib Lateral.....Y | 55.8 | 28 | -11.5 | 79 | | 105.0 | 41 | -4.7 | 156 |
| Upper Rib Lateral....Y(R) | 56.5 | 28 | -11.5 | 79 | | 104.9 | 41 | -4.6 | 158 |
| Lower Rib Lateral.....Y | 48.5 | 30 | -12.6 | 80 | | 114.7 | 40 | -26.0 | 67 |
| Lower Rib Lateral.....Y(R) | 46.6 | 30 | -12.0 | 92 | | 111.9 | 40 | -25.5 | 68 |
| SPINE ACCELERATIONS: | | | | | | | | | |
| Lower Lateral.....Y | 65.0 | 32 | -19.0 | 68 | | 84.3 | 45 | -22.1 | 73 |
| Lower Lateral.....Y(R) | 65.2 | 32 | -19.0 | 68 | | 85.2 | 45 | -23.0 | 73 |
| PELVIC ACCELERATIONS: | | | | | | | | | |
| Lateral.....Y | 76.2 | 30 | -10.3 | 93 | | 78.6 | 35 | -10.8 | 90 |
| Lateral.....Y(R) | 77.5 | 30 | -10.1 | 88 | | 78.6 | 35 | -10.4 | 90 |

REFERENCE:

Positive Direction - Longitudinal (X) = forward

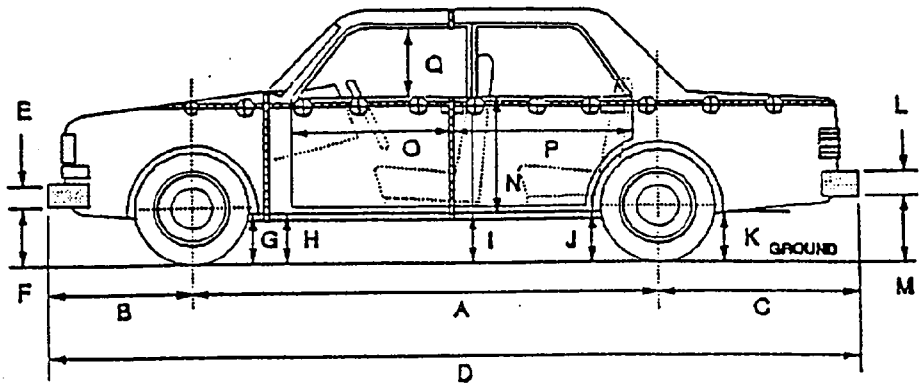
Lateral (Y) = to right

Vertical (Z) = up

Note: Y(R) denotes redundant Y direction accelerometer.

FIGURE 2

PRE- AND POST-TEST MEASUREMENTS




LEFT SIDE VIEW

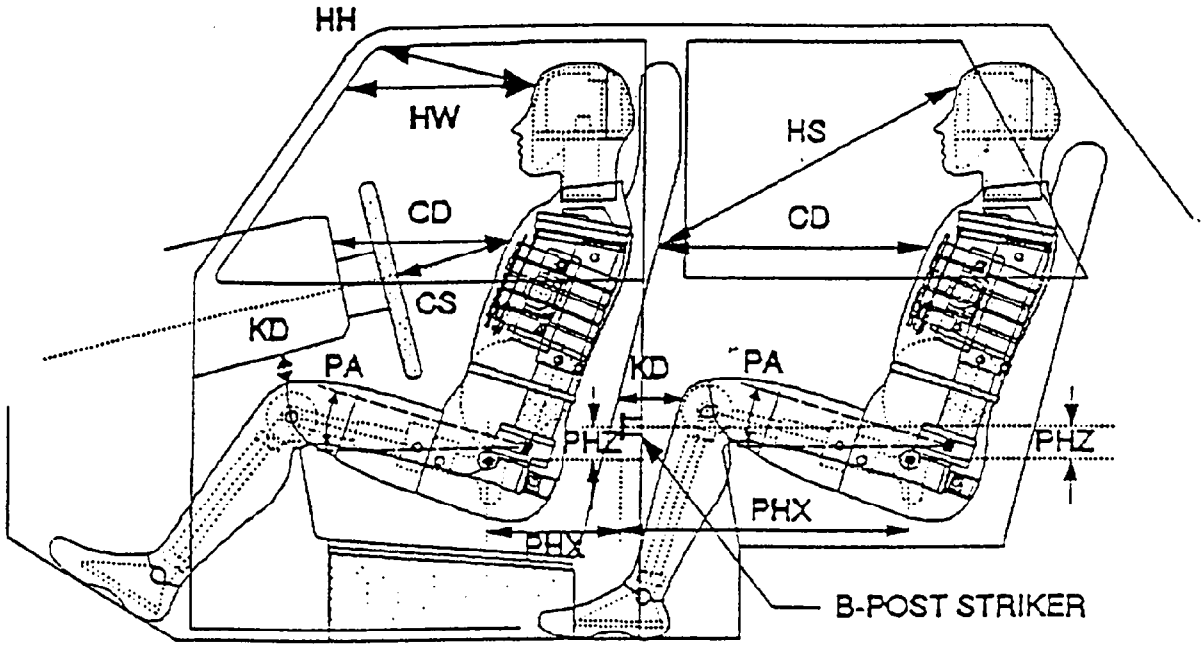
D = Length at Centerline
R = Right Side Length
S = Left Side Length
T = Width at B Post
E & L = Bumper Thickness
J1 = To Pinch Weld
J2 = To Sill

Units: in

| LOCATION | PRE-TEST | POST-TEST | Δ CHANGE |
|---|---|---|---|
| A | 99.Ø | 98.Ø | 1.Ø |
| B | 35.5 | 33.1 | 2.4 |
| C | 38.1 | 34.8 | 3.3 |
| D | 172.6 | 165.9 | 6.7 |
| E | 7.2 | 7.1 | Ø.1 |
| F | 14.3 | 15.Ø | Ø.7 |
| G | 7.8 | 8.1 | Ø.3 |
| H | 6.Ø | 7.2 | 1.2 |
| I | 5.6 | 7.1 | 1.5 |
| J1/J2 | 5.4/5.5 | 6.6/6.8 | 1.2/1.3 |
| K | 8.9 | 8.7 | Ø.2 |
| L | 11.8 | 12.Ø | Ø.2 |
| M | 1Ø.9 | 1Ø.6 | Ø.3 |
| N | 25.Ø | 21.9 | 3.1 |
| O | 28.2 | 27.8 | Ø.4 |
| P | 46.2 | 42.8 | 3.4 |
| Q | 17.6 | 17.8 | Ø.2 |
| R | 161.4 | 162.Ø | Ø.6 |
| S | 161.4 | 16Ø.Ø | 1.4 |
| T | 66.5 | 54.4 | 12.1 |

FIGURE 3

SIDE IMPACT DUMMY (SID) LONGITUDINAL CLEARANCE DIMENSIONS




# LEFT SIDE VIEW

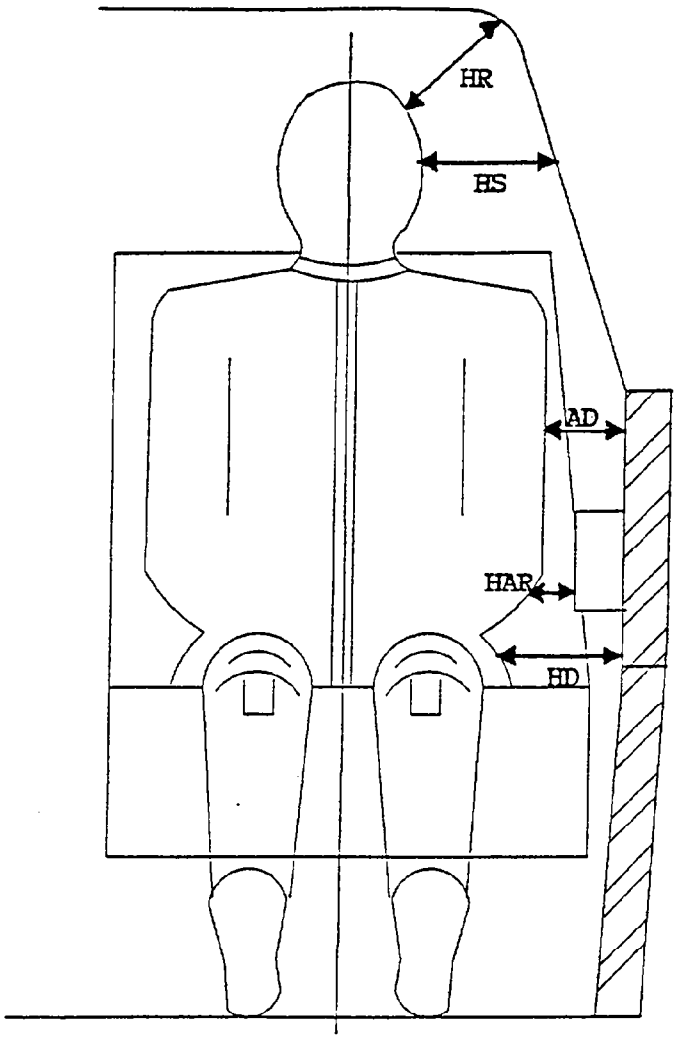
NOTE: All dimensions are in inches

| | DRIVER ID #272 | LEFT REAR PASSENGER ID #271 |
|---|---|---|
| HH | 14.9 | --- |
| HW | 24.8 | --- |
| HS | --- | 23.9 |
| CD | 21.8 | 17.9 |
| CS | 12.9 | --- |
| KDL | 7.1 | 6.5 |
| KDR | 6.1 | 5.9 |
| PA° | 23.5° | 23.3° |
| PHX | 5.9 | 11.2 |
| PHZ | 4.5 | 11.1 |

NOTE: 2-door vehicle shown. Rear dummy PHX & PHZ measurements for 4-door vehicle would use the C-post striker as reference point.

FIGURE 4

SIDE IMPACT DUMMY (SID) LATERAL CLEARANCE DIMENSIONS




NOTE: All dimensions are in inches

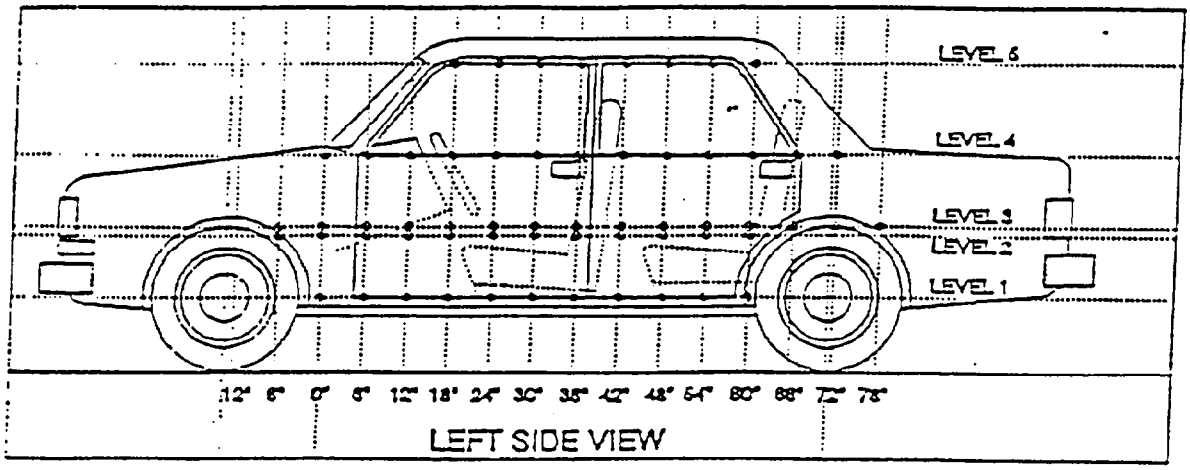
| | DRIVER ID #272 | LEFT REAR PASSENGER ID #271 |
|---|---|---|
| HR | 4.8 | 3.5 |
| HS | 8.5 | 5.6 |
| AD | 3.1 | 2.9 |
| HD | 6.6 | 6.1 |

FIGURE 5

VEHICLE SIDE MEASUREMENTS

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

Vehicle NHTSA No.: CR0505 TEST DATE: July 19, 1994




Height measurements are with respect to ground along the vertical 33" line shown above:

| | 33" Side Profile |
|---|---|
| Level 5 @ Window Top | = 50.0 in |
| Level 4 @ Window Sill | = 34.3 in |
| Level 3 @ Mid Door | = 22.0 in |
| Level 2 @ Occupant H-Point | = 18.4 in |
| Level 1 @ Axle Centerline Height (or Sill Top Height | = 8.5 in |

TABLE 7

TEST VEHICLE EXTERIOR PROFILES FROM REFERENCE PLANE AND STATIC CRUSH

LEVEL 1 AT AXLE CENTER LINE

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

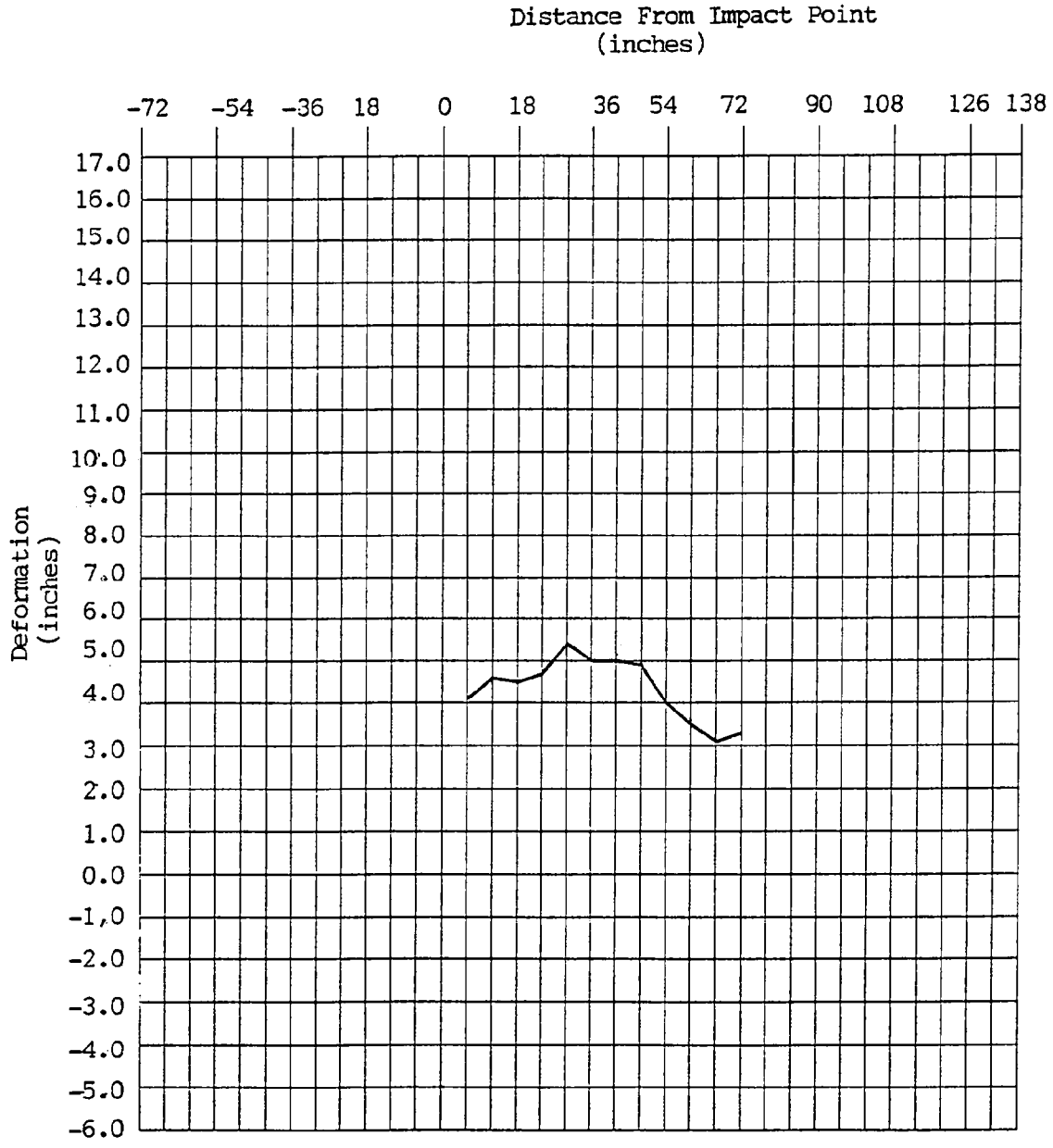
Vehicle NHTSA No.: CR0505 TEST DATE: July 19, 1994

| Longitudinal Distance (in) | PRE-TEST (in) | POST-TEST (in) | STATIC CRUSH (in) | |
|---|---|---|---|---|
| -72 | --- | --- | --- | |
| -66 | --- | --- | --- | |
| -60 | --- | --- | --- | |
| -54 | --- | --- | --- | |
| -48 | --- | --- | --- | |
| -42 | --- | --- | --- | |
| -36 | --- | --- | --- | |
| -30 | --- | --- | --- | |
| -24 | --- | --- | --- | |
| -18 | --- | --- | --- | |
| -12 | --- | --- | --- | |
| -6 | --- | --- | --- | (impact point) |
| 0 | --- | --- | 4.1 | |
| 6 | 34.7 | 38.8 | 4.6 | |
| 12 | 34.7 | 39.3 | 4.5 | |
| 18 | 34.7 | 39.2 | 4.7 | |
| 24 | 34.6 | 39.3 | 5.4 | |
| 30 | 34.4 | 39.8 | 5.0 | |
| 36 | 34.4 | 39.4 | 5.0 | |
| 42 | 34.3 | 39.3 | 4.9 | |
| 48 | 34.3 | 39.2 | 4.0 | |
| 54 | 34.3 | 38.3 | 3.5 | |
| 60 | 34.3 | 37.8 | 3.1 | |
| 66 | 34.3 | 37.4 | 3.3 | |
| 72 | 34.2 | 37.5 | --- | |
| 78 | --- | --- | --- | |
| 84 | --- | --- | --- | |
| 90 | --- | --- | --- | |
| 96 | --- | --- | --- | |
| 102 | --- | --- | --- | |
| 108 | --- | --- | --- | |
| 114 | --- | --- | --- | |
| 120 | --- | --- | --- | |
| 126 | --- | --- | --- | |
| 132 | --- | --- | --- | |
| 138 | --- | --- | --- | |

Reference plane is parallel to test vehicle longitudinal centerline
Given dimensions = reference plane to car body

FIGURE 6

VEHICLE EXTERIOR STATIC CRUSH




LEVEL 1 AT AXLE CENTER LINE

TABLE 7

TEST VEHICLE EXTERIOR PROFILES FROM REFERENCE PLANE AND STATIC CRUSH

LEVEL 2 AT OCCUPANT H-POINT

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

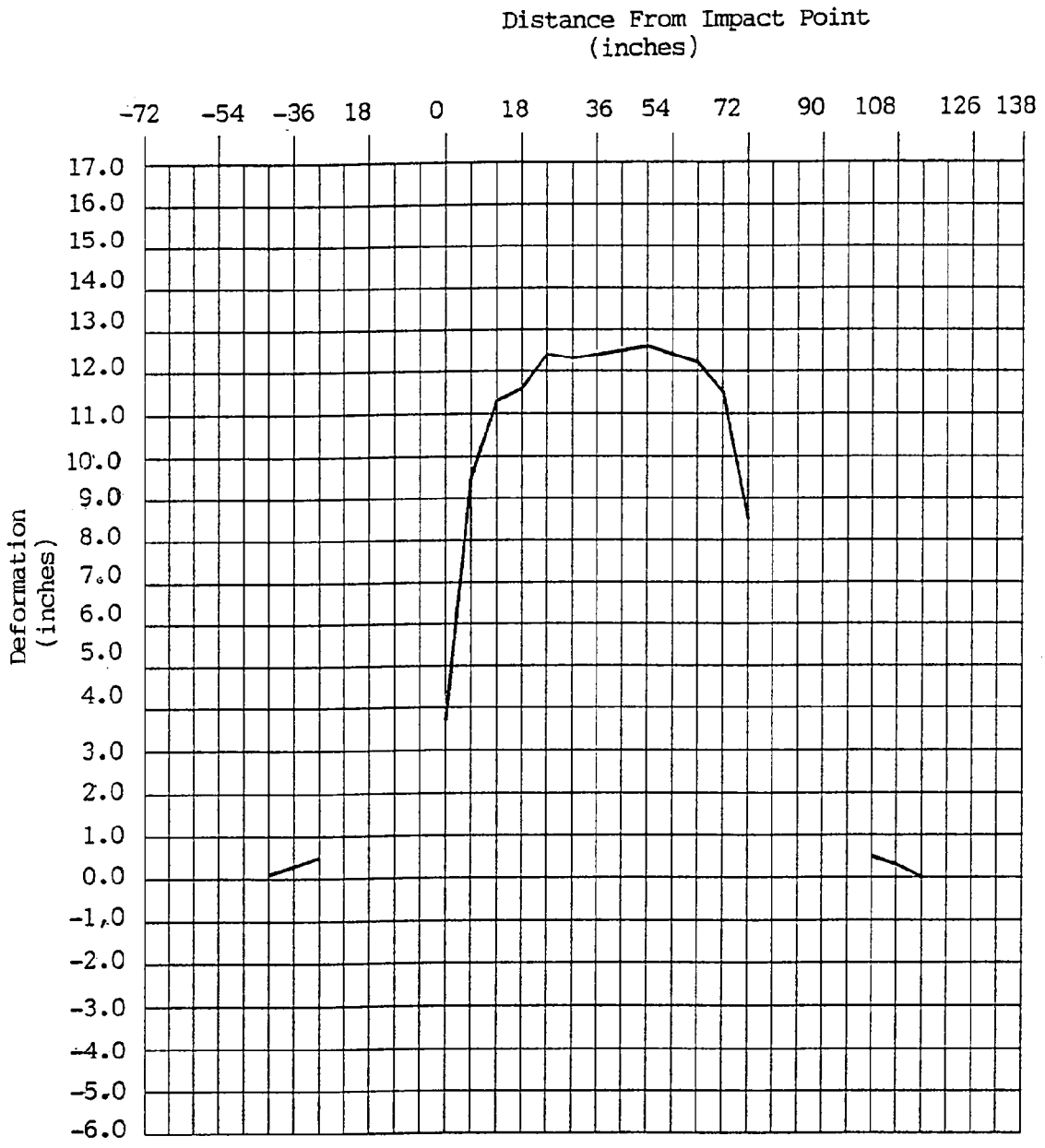
Vehicle NHTSA No.: CR0505 TEST DATE: July 19, 1994

| Longitudinal Distance (in) | PRE-TEST (in) | POST-TEST (in) | STATIC CRUSH (in) | |
|---|---|---|---|---|
| -72 | --- | --- | --- | |
| -66 | --- | --- | --- | |
| -60 | --- | --- | --- | |
| -54 | --- | --- | --- | |
| -48 | --- | --- | --- | |
| -42 | 36.1 | 36.2 | 0.1 | |
| -36 | 34.1 | 34.4 | 0.3 | |
| -30 | 33.2 | 33.7 | 0.5 | |
| -24 | --- | --- | --- | |
| -18 | --- | --- | --- | |
| -12 | --- | --- | --- | |
| -6 | --- | --- | --- | |
| 0 | 32.6 | 36.3 | 3.7 | (impact point) |
| 6 | 32.7 | 42.2 | 9.5 | |
| 12 | 32.8 | 44.1 | 11.3 | |
| 18 | 32.8 | 44.4 | 11.6 | |
| 24 | 32.7 | 45.1 | 12.4 | |
| 30 | 32.6 | 44.9 | 12.3 | |
| 36 | 32.6 | 45.0 | 12.4 | |
| 42 | 32.5 | 45.0 | 12.5 | |
| 48 | 32.5 | 45.1 | 12.6 | |
| 54 | 32.5 | 44.9 | 12.4 | |
| 60 | 32.5 | 44.7 | 12.2 | |
| 66 | 32.6 | 44.1 | 11.5 | |
| 72 | 32.6 | 41.1 | 8.5 | |
| 78 | --- | --- | --- | |
| 84 | --- | --- | --- | |
| 90 | --- | --- | --- | |
| 96 | --- | --- | --- | |
| 102 | 33.5 | 34.0 | 0.5 | |
| 108 | 34.4 | 34.7 | 0.3 | |
| 114 | 35.6 | 35.6 | 0 | |
| 120 | --- | --- | --- | |
| 126 | --- | --- | --- | |
| 132 | --- | --- | --- | |
| 138 | --- | --- | --- | |

Reference plane is parallel to test vehicle longitudinal centerline
Given dimensions = reference plane to car body

FIGURE 6 (Cont'd)

VEHICLE EXTERIOR STATIC CRUSH




LEVEL 2 AT OCCUPANT H-POINT

TABLE 7

TEST VEHICLE EXTERIOR PROFILES FROM REFERENCE PLANE AND STATIC CRUSH

LEVEL 3 AT MID-DOOR

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

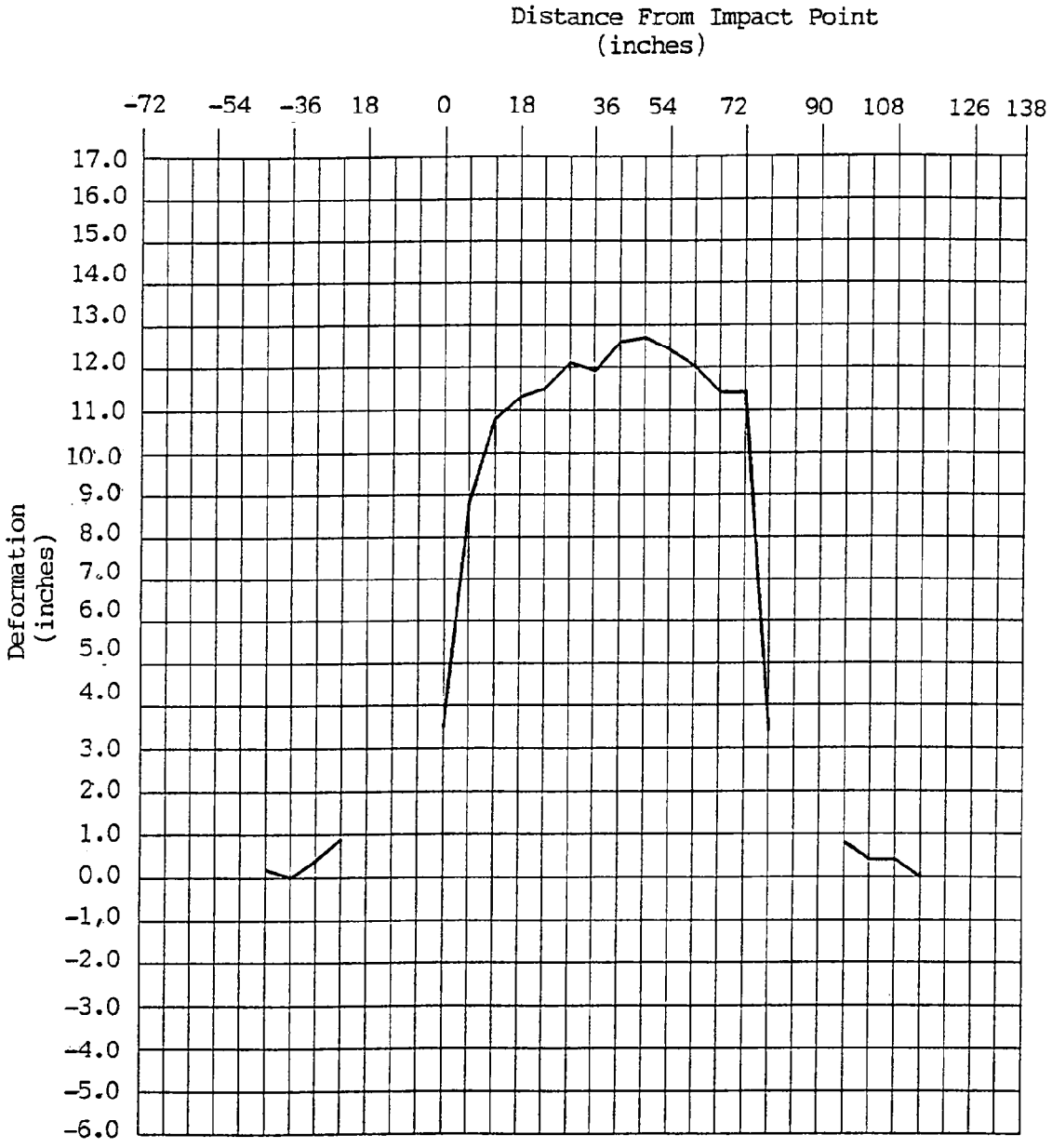
Vehicle NHTSA No.: CR0505 TEST DATE: July 19, 1994

| Longitudinal Distance (in) | PRE-TEST (in) | POST-TEST (in) | STATIC CRUSH (in) | |
|---|---|---|---|---|
| -72 | --- | --- | --- | |
| -66 | --- | --- | --- | |
| -60 | --- | --- | --- | |
| -54 | --- | --- | --- | |
| -48 | --- | --- | | |
| -42 | 36.7 | 36.9 | 0.2 | |
| -36 | 35.0 | 35.0 | 0 | |
| -30 | 33.6 | 34.2 | 0.6 | |
| -24 | 32.6 | 33.5 | 0.9 | |
| -18 | --- | --- | --- | |
| -12 | --- | --- | --- | |
| -6 | --- | --- | --- | |
| 0 | 32.4 | 35.9 | 3.5 | (impact point) |
| 6 | 32.5 | 41.3 | 8.8 | |
| 12 | 32.5 | 43.3 | 10.8 | |
| 18 | 32.6 | 43.9 | 11.3 | |
| 24 | 32.6 | 44.1 | 11.5 | |
| 30 | 32.5 | 44.6 | 12.1 | |
| 36 | 32.5 | 44.4 | 11.9 | |
| 42 | 32.5 | 45.1 | 12.6 | |
| 48 | 32.5 | 45.2 | 12.7 | |
| 54 | 32.5 | 44.9 | 12.4 | |
| 60 | 32.5 | 44.5 | 12.0 | |
| 66 | 32.5 | 43.9 | 11.4 | |
| 72 | 32.5 | 43.9 | 11.4 | |
| 78 | 32.6 | 36.0 | 3.4 | |
| 84 | --- | --- | --- | |
| 90 | --- | --- | --- | |
| 96 | 33.0 | 33.8 | 0.8 | |
| 102 | 34.2 | 34.6 | 0.4 | |
| 108 | 35.2 | 35.6 | 0.4 | |
| 114 | 37.3 | 37.3 | 0 | |
| 120 | --- | --- | --- | |
| 126 | --- | --- | --- | |
| 132 | --- | --- | --- | |
| 138 | --- | --- | --- | |

Reference plane is parallel to test vehicle longitudinal centerline
Given dimensions = reference plane to car body

FIGURE 6

VEHICLE EXTERIOR STATIC CRUSH




LEVEL 3 AT MID-DOOR

TABLE 7

TEST VEHICLE EXTERIOR PROFILES FROM REFERENCE PLANE AND STATIC CRUSH

LEVEL 4 AT WINDOW SILL

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

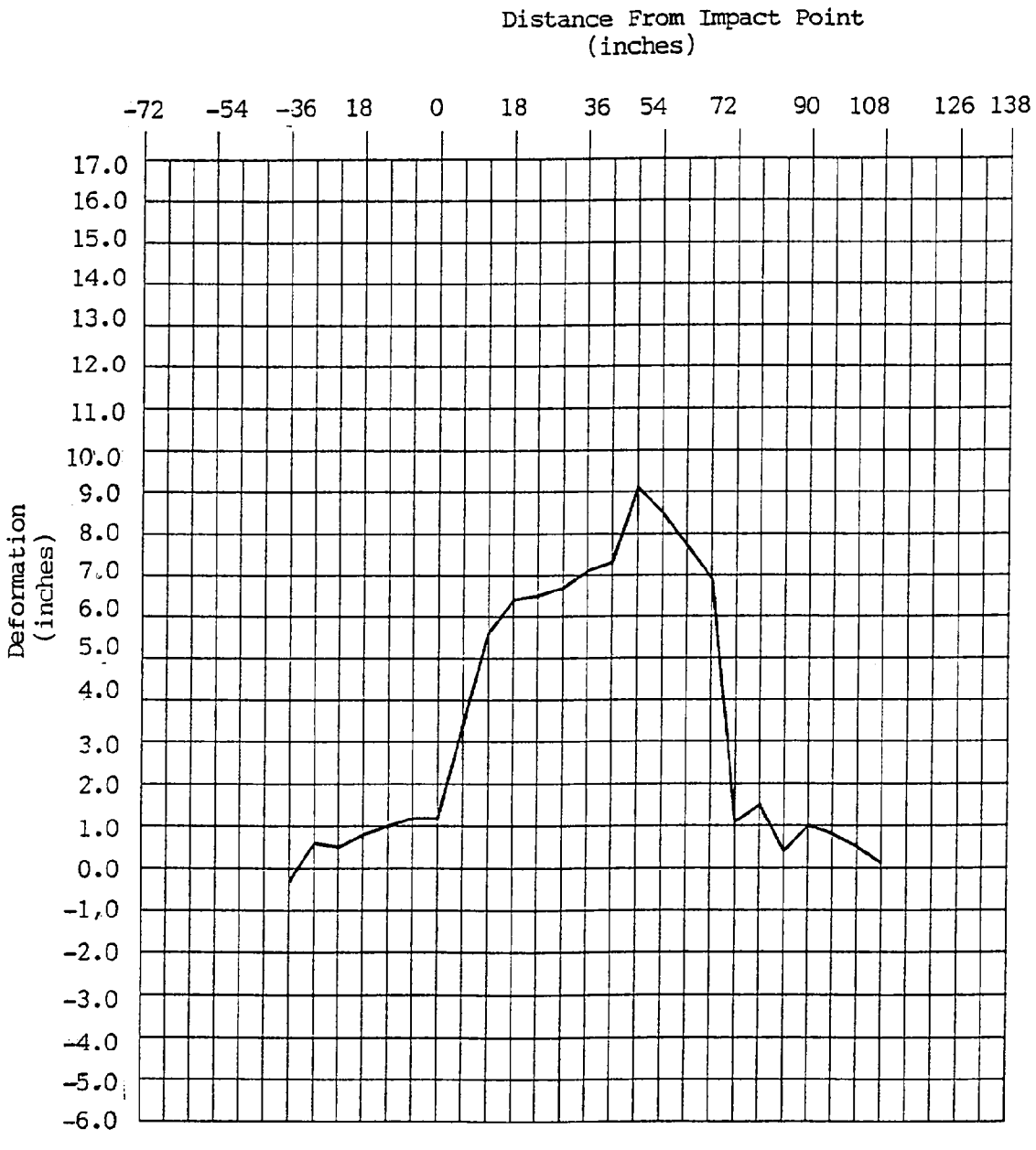
Vehicle NHTSA No.: CR0505 TEST DATE: July 19, 1994

| Longitudinal Distance (in) | PRE-TEST (in) | POST-TEST (in) | STATIC CRUSH (in) | |
|---|---|---|---|---|
| -72 | --- | --- | --- | |
| -66 | --- | --- | --- | |
| -60 | --- | --- | --- | |
| -54 | --- | --- | --- | |
| -48 | --- | --- | --- | |
| -42 | --- | --- | --- | |
| -36 | 39.6 | 39.3 | -0.3 | |
| -30 | 38.5 | 39.1 | 0.6 | |
| -24 | 37.8 | 38.3 | 0.5 | |
| -18 | 37.2 | 38.0 | 0.8 | |
| -12 | 36.7 | 37.7 | 1.0 | |
| -6 | 36.1 | 37.3 | 1.2 | |
| 0 | 35.9 | 37.1 | 1.2 | (impact point) |
| 6 | 35.8 | 39.2 | 3.4 | |
| 12 | 35.8 | 41.4 | 5.6 | |
| 18 | 35.8 | 42.2 | 6.4 | |
| 24 | 35.8 | 42.3 | 6.5 | |
| 30 | 35.7 | 42.4 | 6.7 | |
| 36 | 35.6 | 42.7 | 7.1 | |
| 42 | 35.8 | 43.1 | 7.3 | |
| 48 | 35.8 | 44.9 | 9.1 | |
| 54 | 35.8 | 44.3 | 8.5 | |
| 60 | 35.9 | 43.6 | 7.7 | |
| 66 | 36.1 | 43.0 | 6.9 | |
| 72 | 36.3 | 37.4 | 1.1 | |
| 78 | 36.5 | 38.0 | 1.5 | |
| 84 | 36.6 | 37.0 | 0.4 | |
| 90 | 36.9 | 37.9 | 1.0 | |
| 96 | 37.4 | 38.2 | 0.8 | |
| 102 | 38.0 | 38.5 | 0.5 | |
| 108 | 39.0 | 39.1 | 0.1 | |
| 114 | --- | --- | --- | |
| 120 | --- | --- | --- | |
| 126 | --- | --- | --- | |
| 132 | --- | --- | --- | |
| 138 | --- | --- | --- | |

Reference plane is parallel to test vehicle longitudinal centerline
Given dimensions = reference plane to car body

FIGURE 6

VEHICLE EXTERIOR STATIC CRUSH




LEVEL 4 AT WINDOW SILL

TABLE 7

TEST VEHICLE EXTERIOR PROFILES FROM REFERENCE PLANE AND STATIC CRUSH

LEVEL 5 AT WINDOW TOP

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

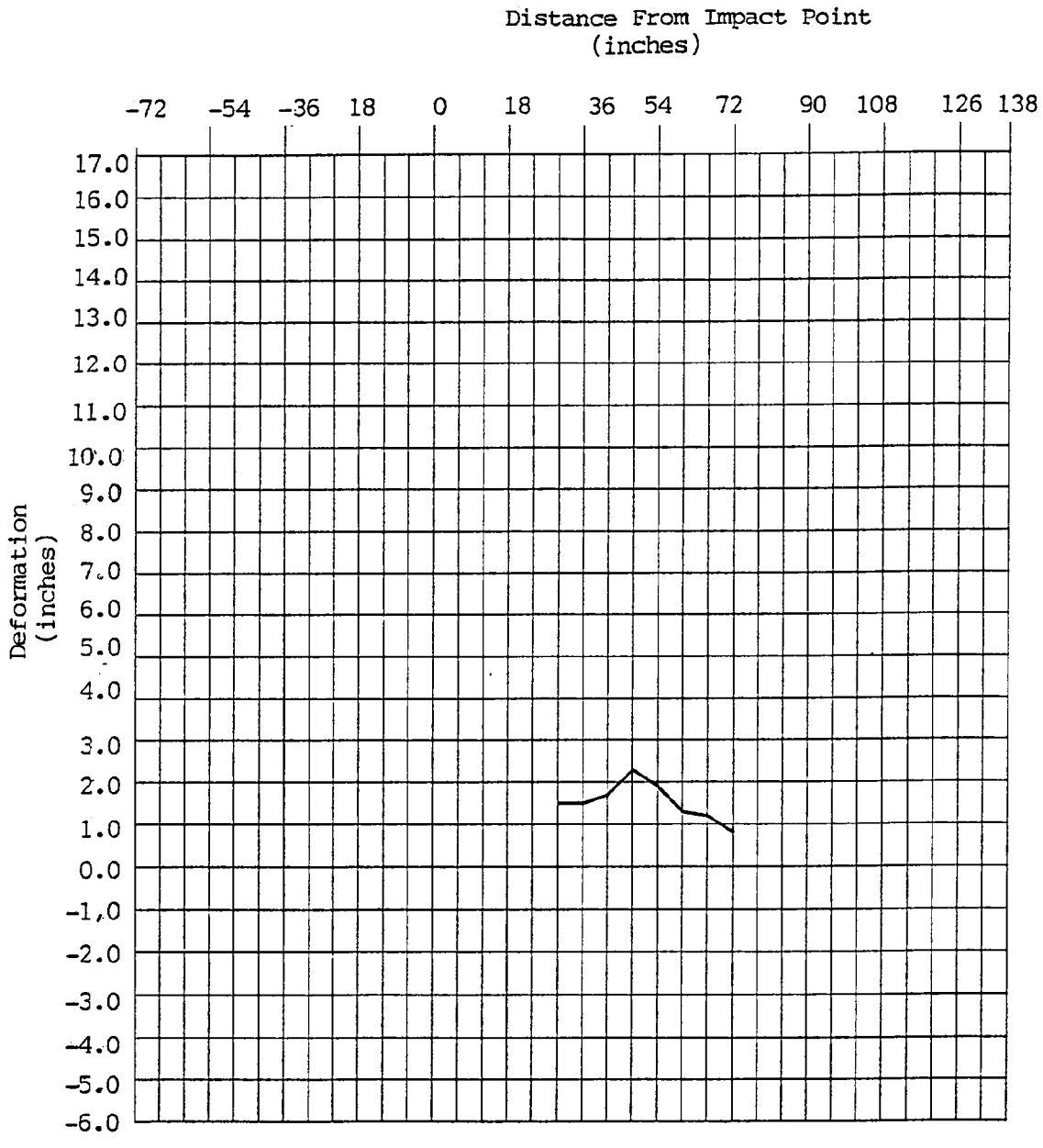
Vehicle NHTSA No.: CR0505 TEST DATE: July 19, 1994

| Longitudinal Distance (in) | PRE-TEST (in) | POST-TEST (in) | STATIC CRUSH (in) | |
|---|---|---|---|---|
| -72 | --- | --- | --- | |
| -66 | --- | --- | --- | |
| -60 | --- | --- | --- | |
| -54 | --- | --- | --- | |
| -48 | --- | --- | --- | |
| -42 | --- | --- | --- | |
| -36 | --- | --- | --- | |
| -30 | --- | --- | --- | |
| -24 | --- | --- | --- | |
| -18 | --- | --- | --- | |
| -12 | --- | --- | --- | |
| -6 | --- | --- | --- | |
| 0 | --- | --- | --- | (impactpoint) |
| 6 | --- | --- | --- | |
| 12 | --- | --- | --- | |
| 18 | --- | --- | --- | |
| 24 | --- | --- | --- | |
| 30 | 45.5 | 47.0 | 1.5 | |
| 36 | 45.2 | 46.7 | 1.5 | |
| 42 | 45.2 | 46.9 | 1.7 | |
| 48 | 45.3 | 47.6 | 2.3 | |
| 54 | 45.4 | 47.3 | 1.9 | |
| 60 | 45.9 | 47.2 | 1.3 | |
| 66 | 46.0 | 47.2 | 1.2 | |
| 72 | 46.4 | 47.2 | 0.8 | |
| 78 | --- | --- | --- | |
| 84 | --- | --- | --- | |
| 90 | --- | --- | --- | |
| 96 | --- | --- | --- | |
| 102 | --- | --- | --- | |
| 108 | --- | --- | --- | |
| 114 | --- | --- | --- | |
| 120 | --- | --- | --- | |
| 126 | --- | --- | --- | |
| 132 | --- | --- | --- | |
| 138 | --- | --- | --- | |

Reference plane is parallel to test vehicle longitudinal centerline
Given dimensions = reference plane to car body

FIGURE 6

VEHICLE EXTERIOR STATIC CRUSH




LEVEL 5 AT WINDOW TOP

FIGURE 7

TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

Vehicle NHTSA No.: CR0505 TEST DATE: July 19, 1994

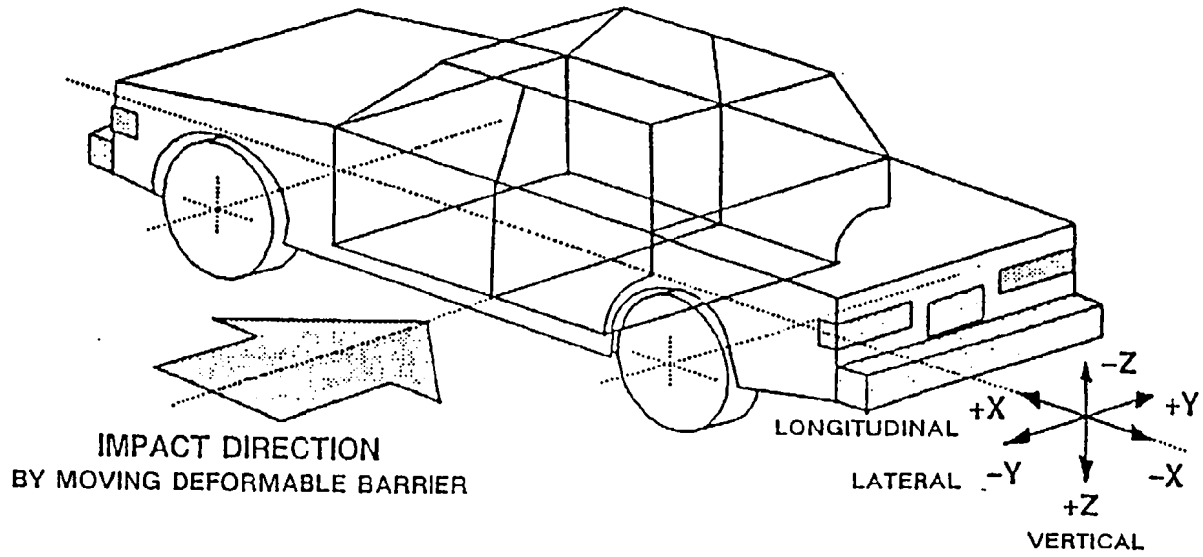


FIGURE 8

MDB FACE DIMENSIONS

Measurements in inches

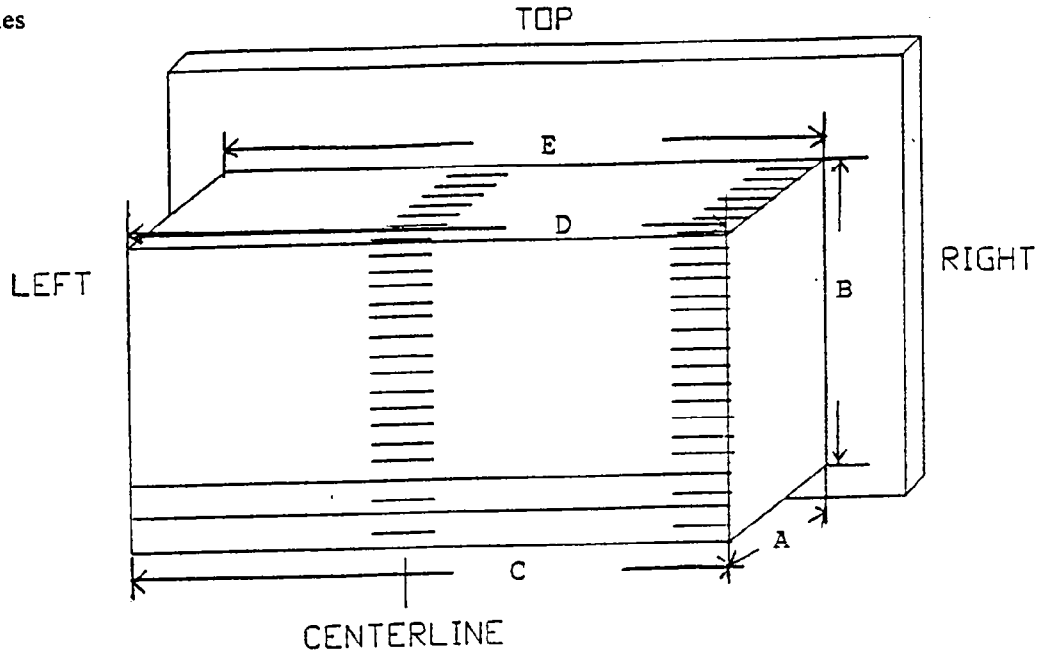
A = 15.Ø

B = 22.1

C = 66.3

D = 66.1

E = 66.1




Measurements in inches

| | Right | Left |
|---|---|---|
| A = | 11.Ø | 11.Ø |
| B = | 13.1 | 13.1 |
| C = | 21.1 | 21.1 |
| D = | 33.1 | 33.1 |

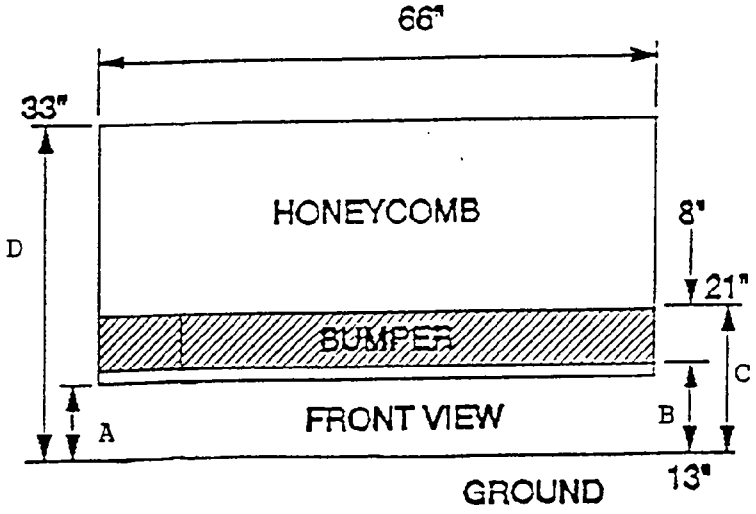


TABLE 8

EXTERIOR STATIC CRUSH FOR SIDE IMPACTOR

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

Vehicle NHTSA No.: CRØ5Ø5 TEST DATE: July 19, 1994

| Location | Top of Stack (33 inches) | Mid-Stack (27 inches) | Top of Bumper (21 inches) | Center of Bumper (17 inches) | |
|---|---|---|---|---|---|
| Horizontal Distance From Center | Crush (inches) | Crush (inches) | Crush (inches) | Crush (inches) | |
| 32" | 1.Ø | Ø.5 | Ø.9 | 2.8 | Right Side |
| 28" | Ø | Ø.1 | Ø.6 | 2.8 | |
| 24" | -Ø.1 | -Ø.1 | Ø.4 | 2.Ø | |
| 2Ø" | -Ø.1 | -Ø.1 | Ø.3 | 1.7 | |
| 16" | Ø | -Ø.1 | Ø.3 | 1.8 | |
| 12" | Ø | Ø | Ø.3 | 1.6 | |
| 8" | Ø | Ø | Ø.4 | 1.6 | |
| 4" | Ø | Ø.1 | Ø.3 | 1.5 | |
| Ø" | Ø | Ø.1 | Ø.4 | 1.5 | |
| 4" | Ø | Ø.1 | Ø.5 | 1.5 | Left Side |
| 8" | Ø | Ø.1 | Ø.6 | 1.5 | |
| 12" | Ø.1 | Ø.1 | Ø.6 | 1.6 | |
| 16" | Ø.2 | Ø.1 | Ø.8 | 1.6 | |
| 2Ø" | Ø.3 | Ø.2 | Ø.8 | 1.6 | |
| 24" | Ø.8 | Ø.4 | 1.1 | 2.Ø | |
| 28" | 2.Ø | 1.8 | 1.5 | 2.Ø | |
| 32" | 3.8 | 4.1 | 2.3 | 3.2 | |

TABLE 9

TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

Vehicle NHTSA No.: CRØ5Ø5 TEST DATE: July 19, 1994

| Accel. No. | Description | Coordinates (in) | | | Long. (X) Maximums | | Lat. (Y) Maximums | | Vert. (Z) Maximums | | Resultant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | X | Y | Z | Pos. | Neg. | Pos. | Neg. | Pos. | Neg. | Max. |
| 1 | Rt. Side Sill @ Front Seat | 1ØØ.3 | 25.5 | 9.5 | 5.7 | -4.Ø | 2Ø.1 | -2.6 | 4.9 | -5.Ø | 2Ø.3 |
| 2 | Rt. Side Sill @ Rear Seat | 73.6 | 25.8 | 1Ø.Ø | 5.5 | -4.8 | 23.5 | -2.9 | 5.6 | -6.2 | 23.7 |
| 3 | Rr. Floorpan Above Axle | 36.Ø | Ø | 19.5 | 3.8 | -9.3 | 26.Ø | -3.3 | 1Ø.Ø | -7.2 | 28.1 |
| 4 | Left Side Sill @ Rr. Seat | 69.Ø | -26.5 | 7.4 | --- | --- | 6Ø.2 | -1Ø.9 | --- | --- | --- |
| 5 | Left Side Sill @ Frt. Seat | 1Ø6.9 | -26.5 | 7.3 | --- | --- | 46.6 | -19.1 | --- | --- | --- |
| 6 | Driver Left Seat Track | 117.Ø | -26.3 | 15.Ø | --- | --- | 52.2 | -15.9 | --- | --- | --- |
| 7 | Right Rear Occupant Compartment | 77.Ø | -28.Ø | 14.5 | --- | --- | 24.7 | -2.7 | --- | --- | --- |
| 8 | Left A-Post Lower | 78.5 | -28.3 | 26.Ø | --- | --- | 124.6 | -24.5 | --- | --- | --- |
| 9 | Left B-Post Lower | 7Ø.3 | 13.Ø | 1Ø.3 | --- | --- | 137.2 | -65.4 | --- | --- | --- |
| 1Ø | Left B-Post Mid | 82.4 | -21.4 | 11.5 | --- | --- | 21Ø.5 | -55.3 | --- | --- | --- |

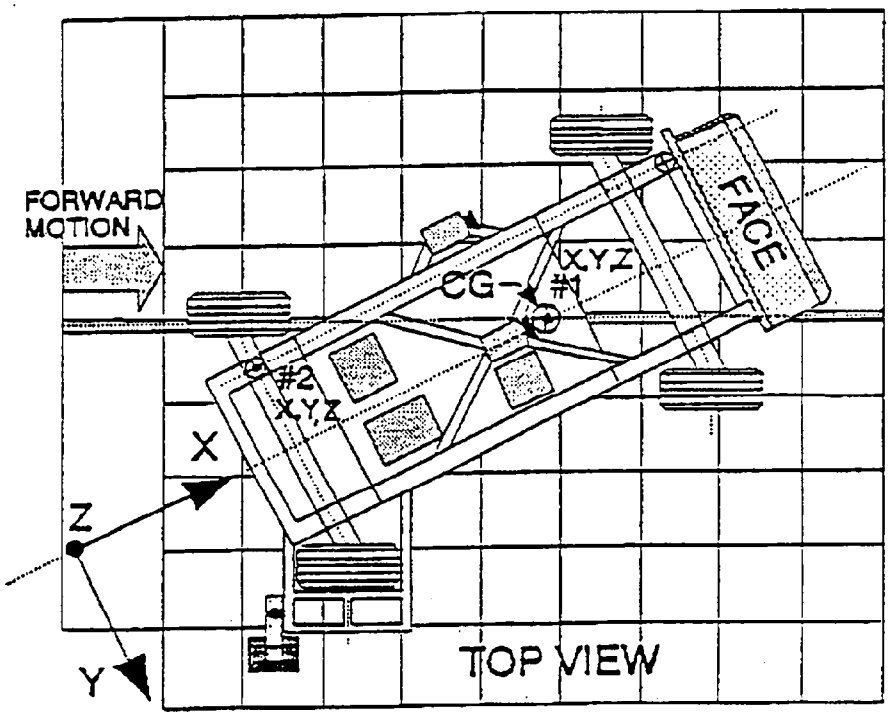
*Reference: X - Rear Bumper (+ Forward)
Y - Vehicle Centerline (+ To right)
Z - Ground Level (+ Up)

FIGURE 9

MOVING DEFORMABLE BARRIER (MDB) ACCELEROMETER LOCATIONS

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

Vehicle NHTSA No.: CR0505 TEST DATE: July 19, 1994




| Accel. No. | Location | Coordinates (in) | | | Pos. Direct. | | Neg. Direct. | |
|---|---|---|---|---|---|---|---|---|
| | | X | Y | Z | Max (g) | Time (msec) | Max (g) | Time (msec) |
| 1 | MDB Center of Gravity<br>Longitudinal ... X<br>Lateral ..... Y<br>Vertical ..... Z<br>Resultant ..... R | -43.0 | 0 | 19.0 | 1.2<br>2.5<br>6.5<br>18.3 | 93<br>62<br>47<br>41 | -15.0<br>-7.2<br>-10.3<br>--- | 39<br>35<br>41<br>--- |
| 2 | Rear Frame Member<br>Longitudinal ... X<br>Lateral ..... Y | -102.0 | -24.6 | 24.5 | 1.3<br>5.3 | 184<br>33 | -20.3<br>-1.4 | 35<br>60 |

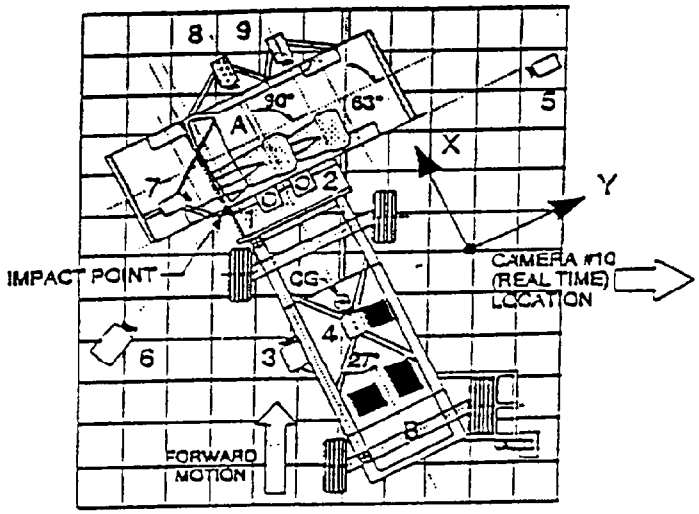
* Reference: X = Front Axle (+Forward)
Y = Vehicle Centerline (+ To Right)
Z = Ground Level (+ Up)

FIGURE 10

HIGH SPEED CAMERA LOCATIONS AND DATA

Year/Make/Model/Body Style: 1994/Subaru/Impreza/4 Door Sedan

Vehicle NHTSA No.: CR0505 TEST DATE: July 19, 1994




| Camera No. | View | Coordinates (in) | | | Angle | Lens (mm) | Film Speed (fps) |
|---|---|---|---|---|---|---|---|
| | | X* | Y* | Z* | | | |
| | Real Time | | | | | 10 | 24 |
| 1 | Top Pointer | 0 | 15.0 | 193.7 | | 13 | 1100 |
| 2 | Top Wide | 15.7 | 0 | 211.0 | | 8 | 1053 |
| 3 | Cart Pointer | | | | | 35 | 1000 |
| 4 | Cart | | | | | 13 | 1010 |
| 5 | Right Impact | 22.0 | 328.7 | 30.9 | 45° | 35 | 740 |
| 6 | Left Impact | -92.5 | 98.4 | 51.2 | 45° | 13 | 909 |
| 7 | Onboard Hood | | | | | 13 | 1000 |
| 8 | Onboard Driver | | | | | 7.5 | 671 |
| 9 | Onboard Passenger | | | | | 8 | 1000 |

* Reference: (from point of impact)
+X = Forward
+Y = To Right
+Z = Upward

# APPENDIX A - PHOTOGRAPHS

TABLE OF PHOTOGRAPHS


| | Page No. |
|---|---|
| Photo No. A-1 - Pre-Test Front View of Test Vehicle | A-1 |
| Photo No. A-2 - Post-Test Front View of Test Vehicle | A-2 |
| Photo No. A-3 - Pre-Test Rear View of Test Vehicle | A-3 |
| Photo No. A-4 - Post-Test Rear View of Test Vehicle | A-4 |
| Photo No. A-5 - Pre-Test Left Side View of Test Vehicle | A-5 |
| Photo No. A-6 - Post-Test Left Side View of Test Vehicle | A-6 |
| Photo No. A-7 - Pre-Test MDB Positioned Against Vehicle (left side) | A-7 |
| Photo No. A-8 - Pre-Test MDB Positioned Against Vehicle (right side) | A-8 |
| Photo No. A-9 - Pre-Test MDB Position Against Vehicle Overhead View | A-9 |
| Photo No. A-10 - Post-Test MDB and Vehicle Left Side Front View | A-10 |
| Photo No. A-11 - Post-Test MDB and Vehicle Right Side Rear View | A-11 |
| Photo No. A-12 - Pre-Test MDB Top View | A-12 |
| Photo No. A-13 - Post-Test MDB Top View | A-13 |
| Photo No. A-14 - Pre-Test MDB Front View | A-14 |
| Photo No. A-15 - Post-Test MDB Front View | A-15 |
| Photo No. A-16 - Pre-Test MDB Left Side View | A-16 |
| Photo No. A-17 - Post-Test MDB Left Side View | A-17 |
| Photo No. A-18 - Pre-Test MDB Right Side View | A-18 |
| Photo No. A-19 - Post-Test MDB Right Side View | A-19 |
| Photo No. A-20 - Post-Test MDB and Vehicle Overhead View | A-20 |
| Photo No. A-21 - Pre-Test Driver Dummy Right Side View | A-21 |
| Photo No. A-22 - Post-Test Driver Dummy Right Side View | A-22 |
| Photo No. A-23 - Pre-Test Driver Dummy Left Side View | A-23 |
| Photo No. A-24 - Post-Test Driver Dummy Left Side View | A-24 |
| Photo No. A-25 - Pre-Test Driver Dummy Front View | A-25 |
| Photo No. A-26 - Post-Test Driver Dummy Front View | A-26 |
| Photo No. A-27 - Pre-Test Driver Dummy Left Side View (Door Open) | A-27 |
| Photo No. A-28 - Post-Test Driver Dummy Impact Point | A-28 |
| Photo No. A-29 - Pre-Test Passenger Dummy Right Side View | A-29 |
| Photo No. A-30 - Post-Test Passenger Dummy Right Side View | A-30 |
| Photo No. A-31 - Pre-Test Passenger Dummy Left Side View | A-31 |
| Photo No. A-32 - Post-Test Passenger Dummy Left Side View | A-32 |

TABLE OF PHOTOGRAPHS


| | Page No. |
|---|---|
| Photo No. A-33 - Pre-Test Passenger Dummy Left Side View (Door Open) | A-33 |
| Photo No. A-34 - Post-Test Passenger Dummy Impact Point | A-34 |
| Photo No. A-35 - Impact | A-35 |
| Photo No. A-36 - Left Front Impact Point on Vehicle | A-36 |
| Photo No. A-37 - Right Rear Impact Point on Vehicle | A-37 |
| Photo No. A-38 - Vehicle Certification Label | A-38 |
| Photo No. A-39 - Tire Placard | A-39 |

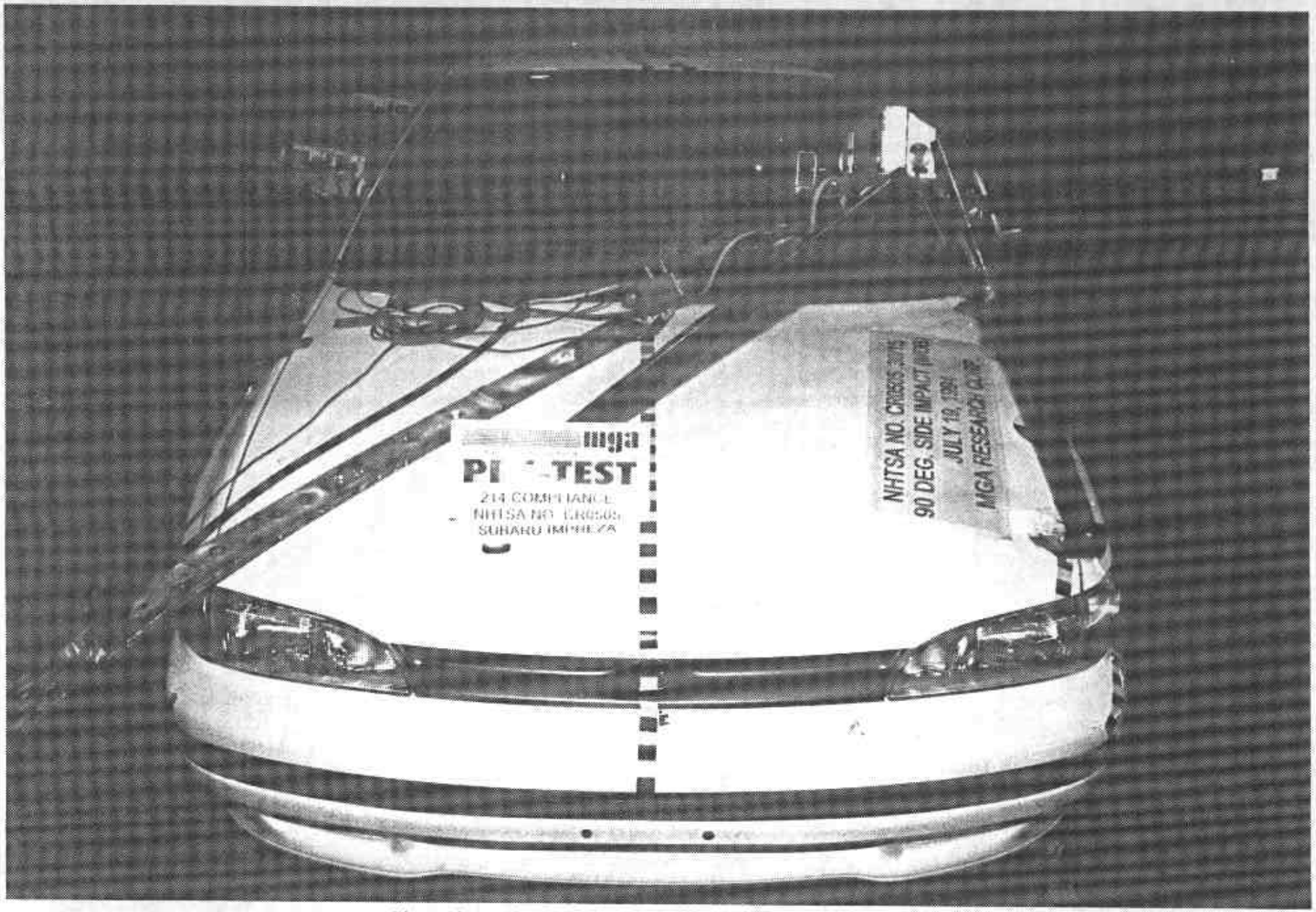



Photo No. A-1 - Pre-Test Front View of Test Vehicle

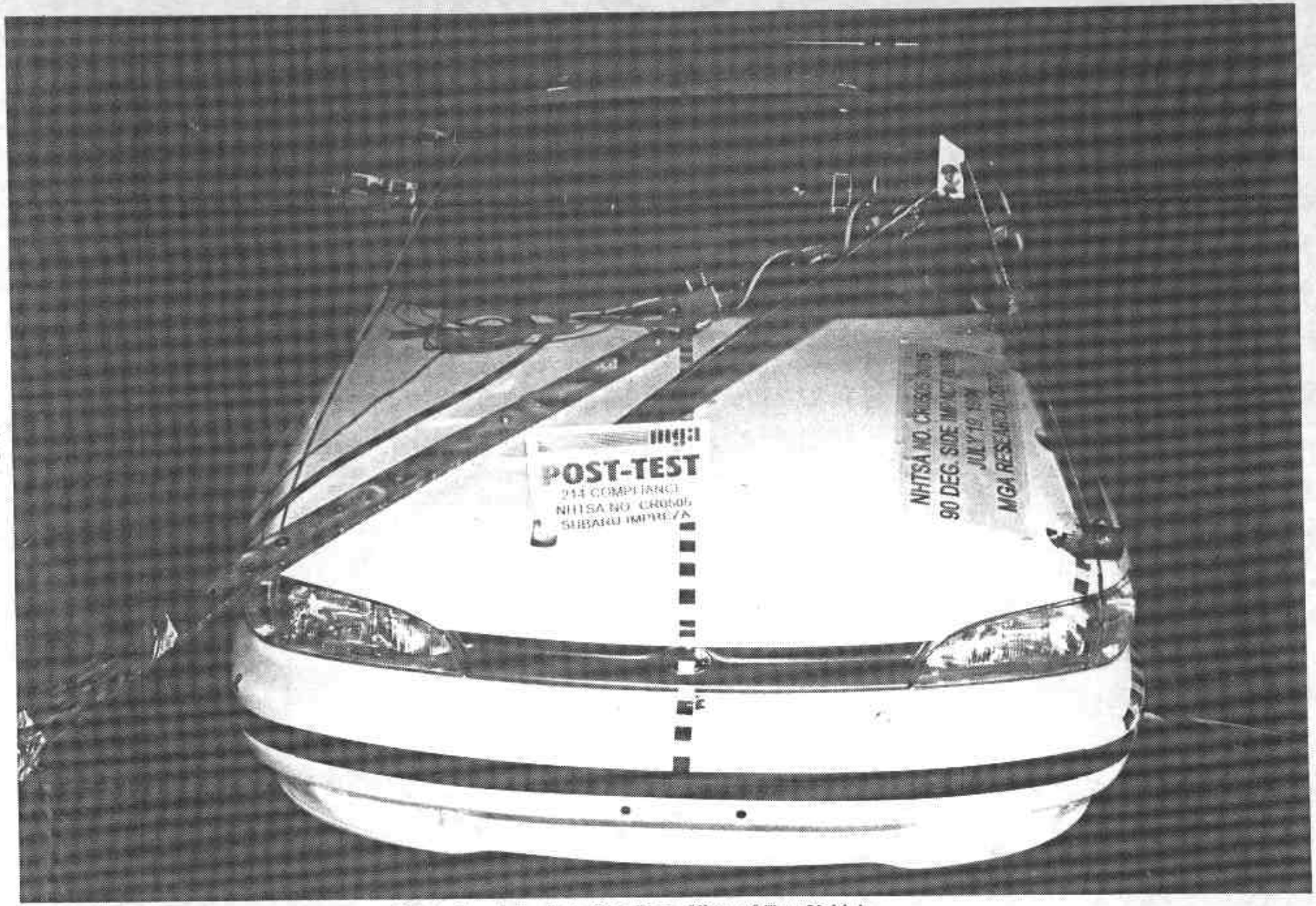



Photo No. A-2 - Post-Test Front View of Test Vehicle

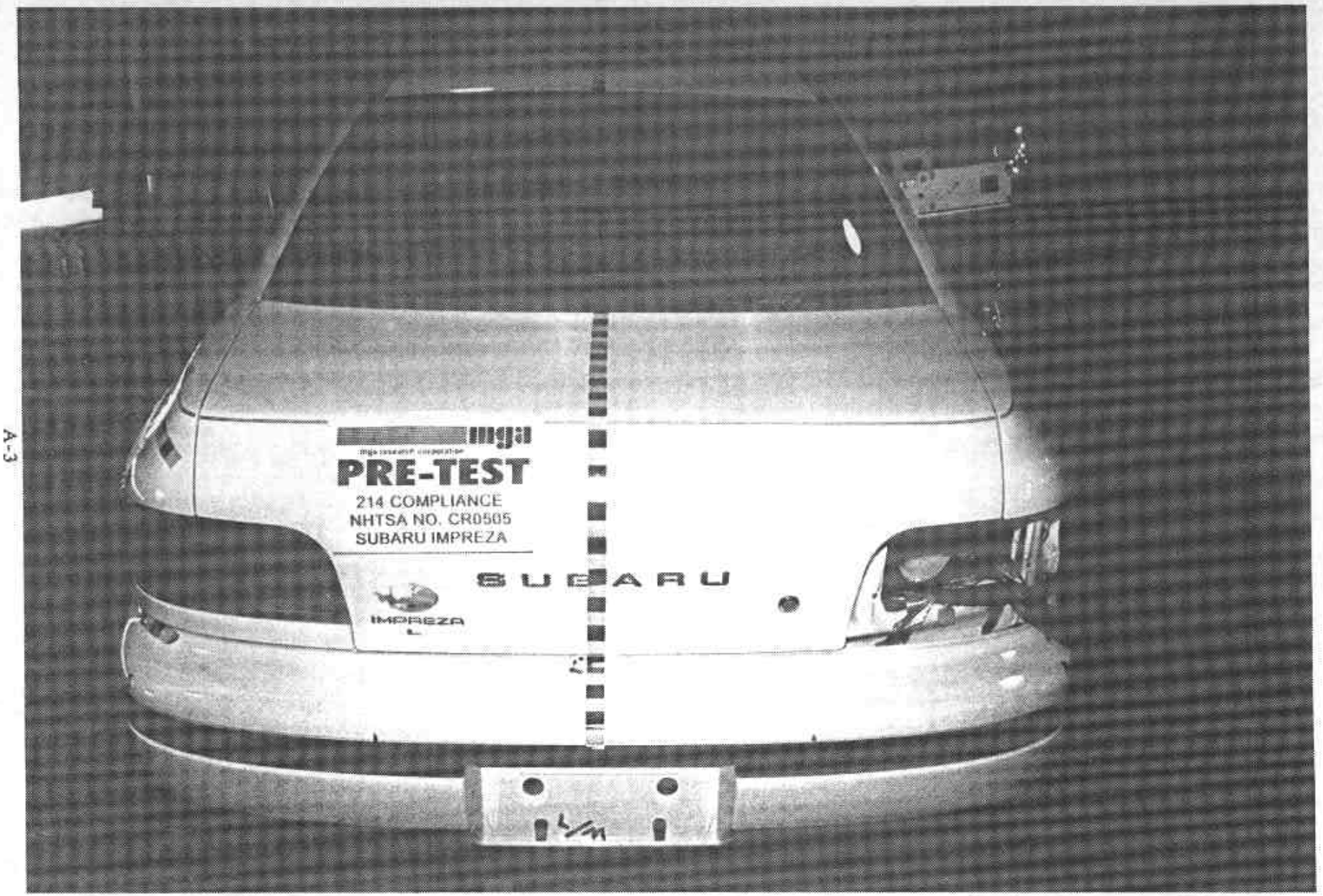



Photo No. A-3 - Pre-Test Rear View of Test Vehicle

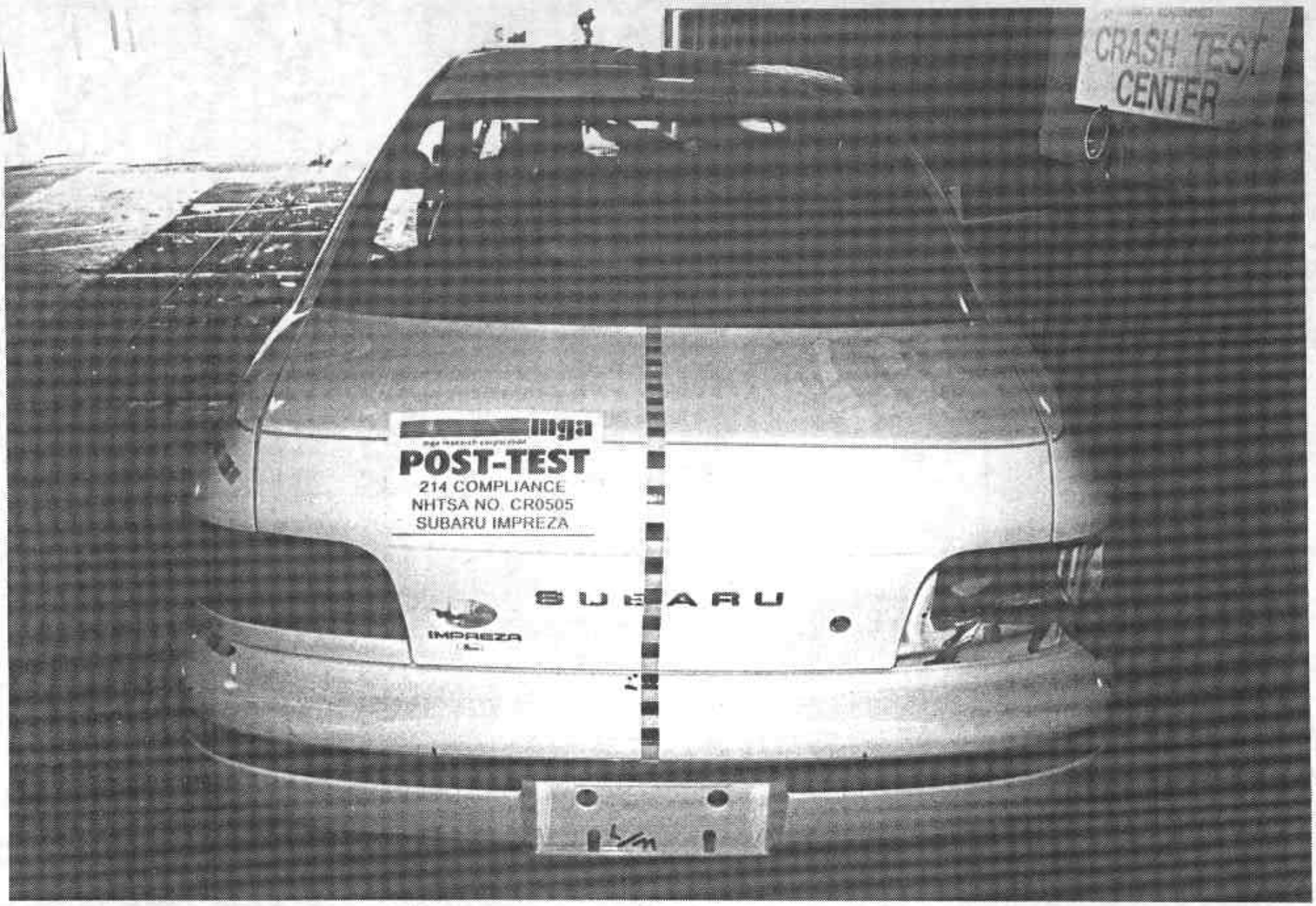



Photo No. A-4 - Post-Test Rear View of Test Vehicle

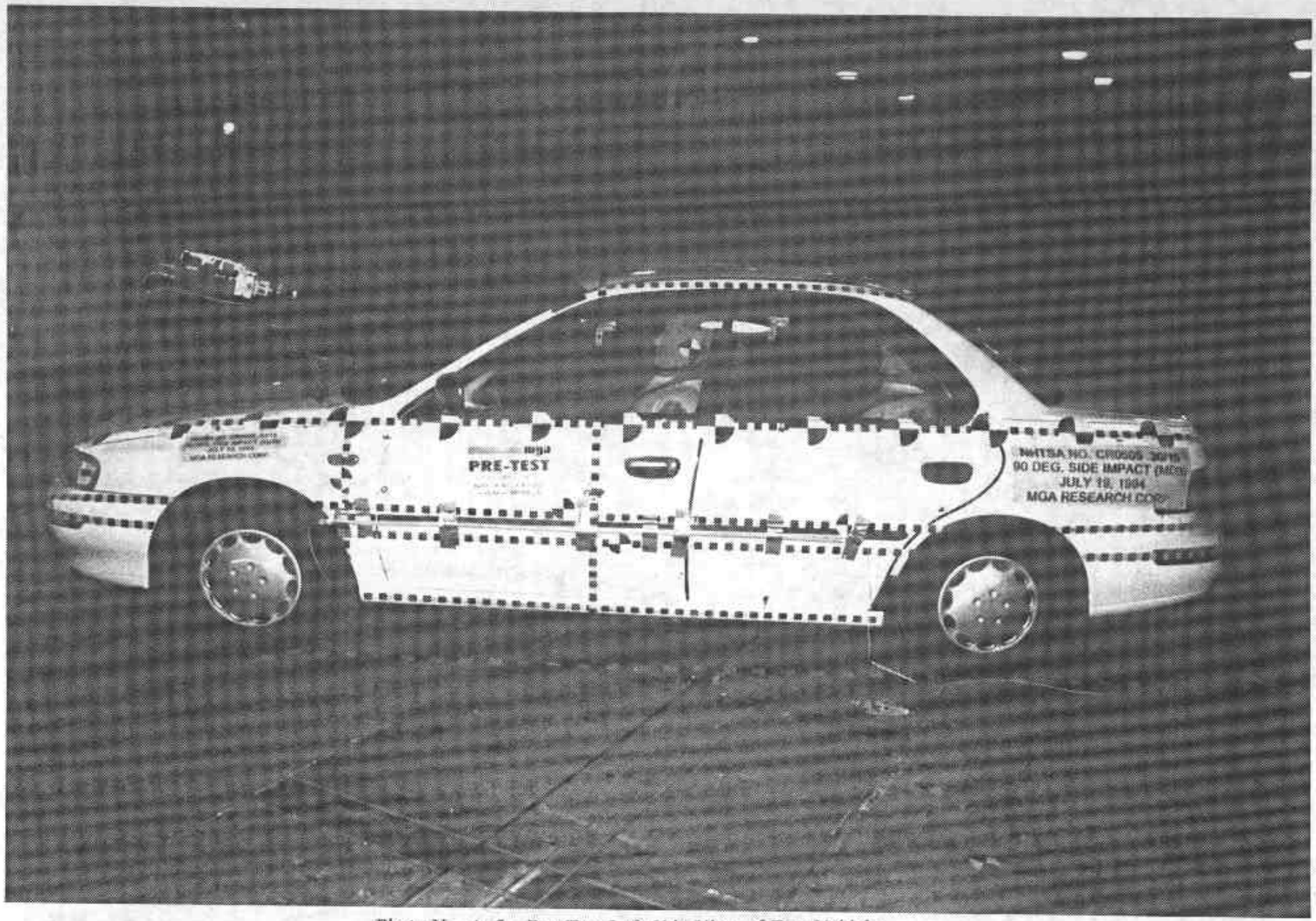



Photo No. A-5 - Pre-Test Left Side View of Test Vehicle

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

Photo No. A-7 - Pre-Test MDB Positioned Against Vehicle (left side)

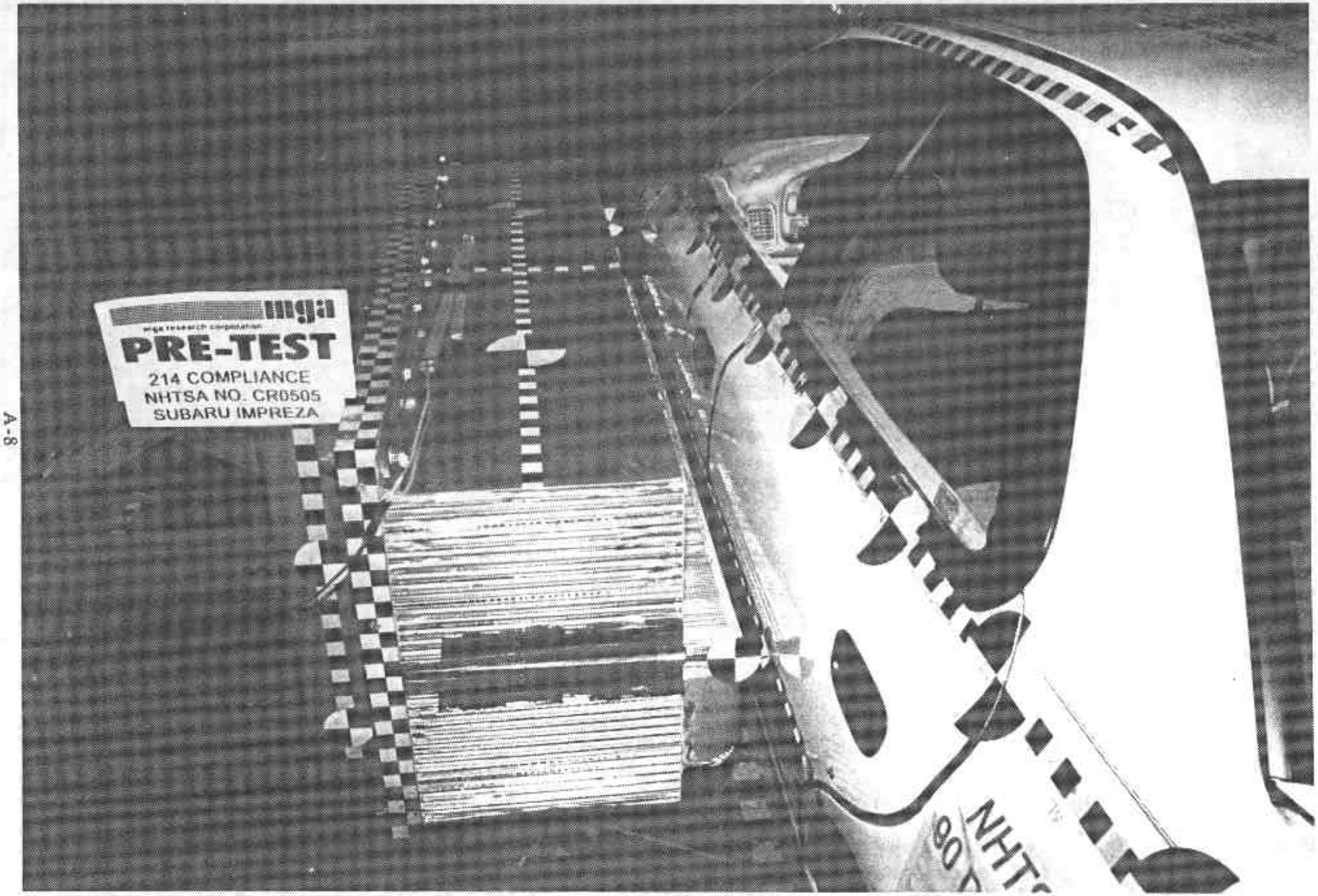



Photo No. A-8 - Pre-Test MDB Positioned Against Vehicle (right side)

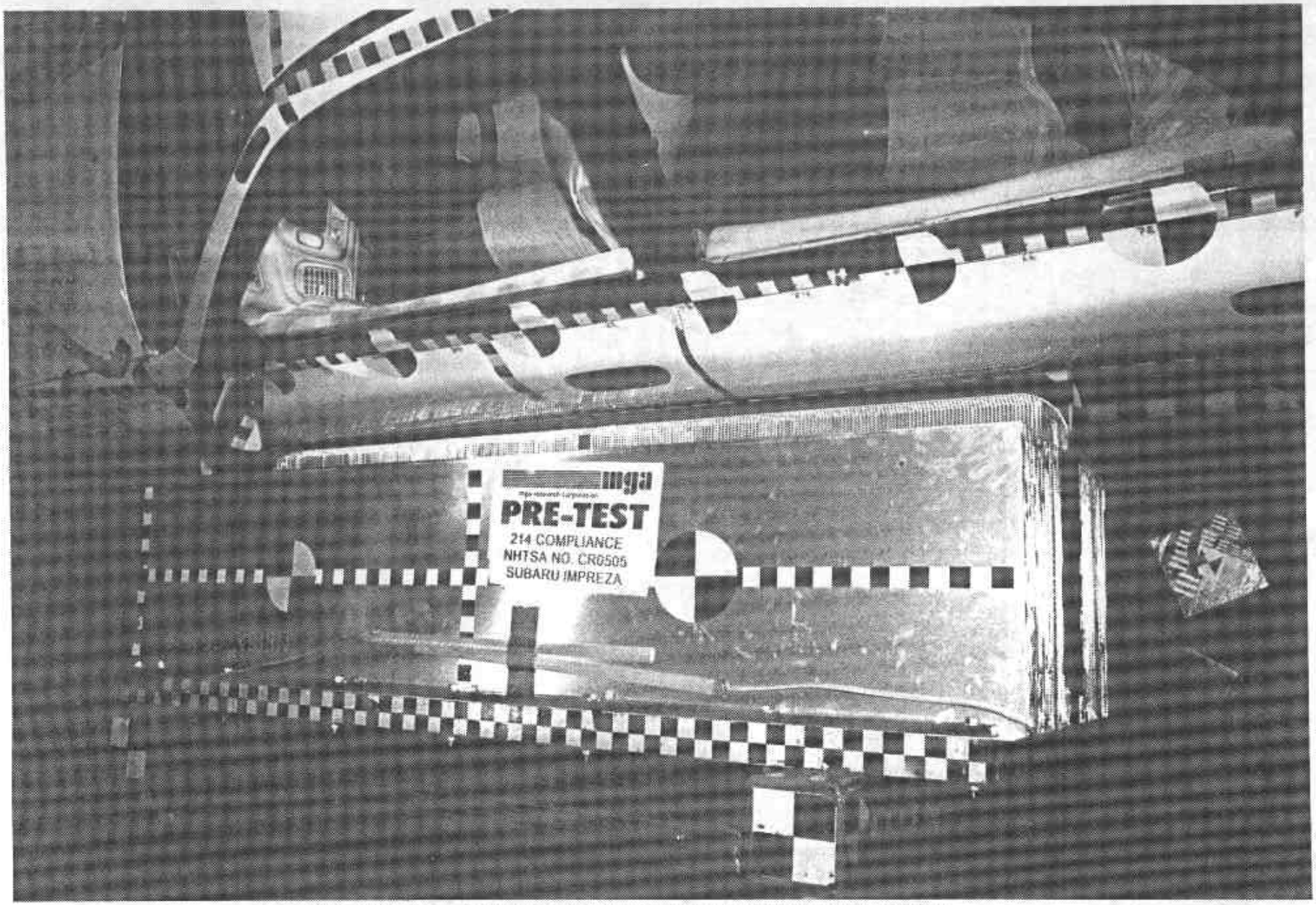



Photo No. A-9 - Pre-Test MDB Position Against Vehicle Overhead View

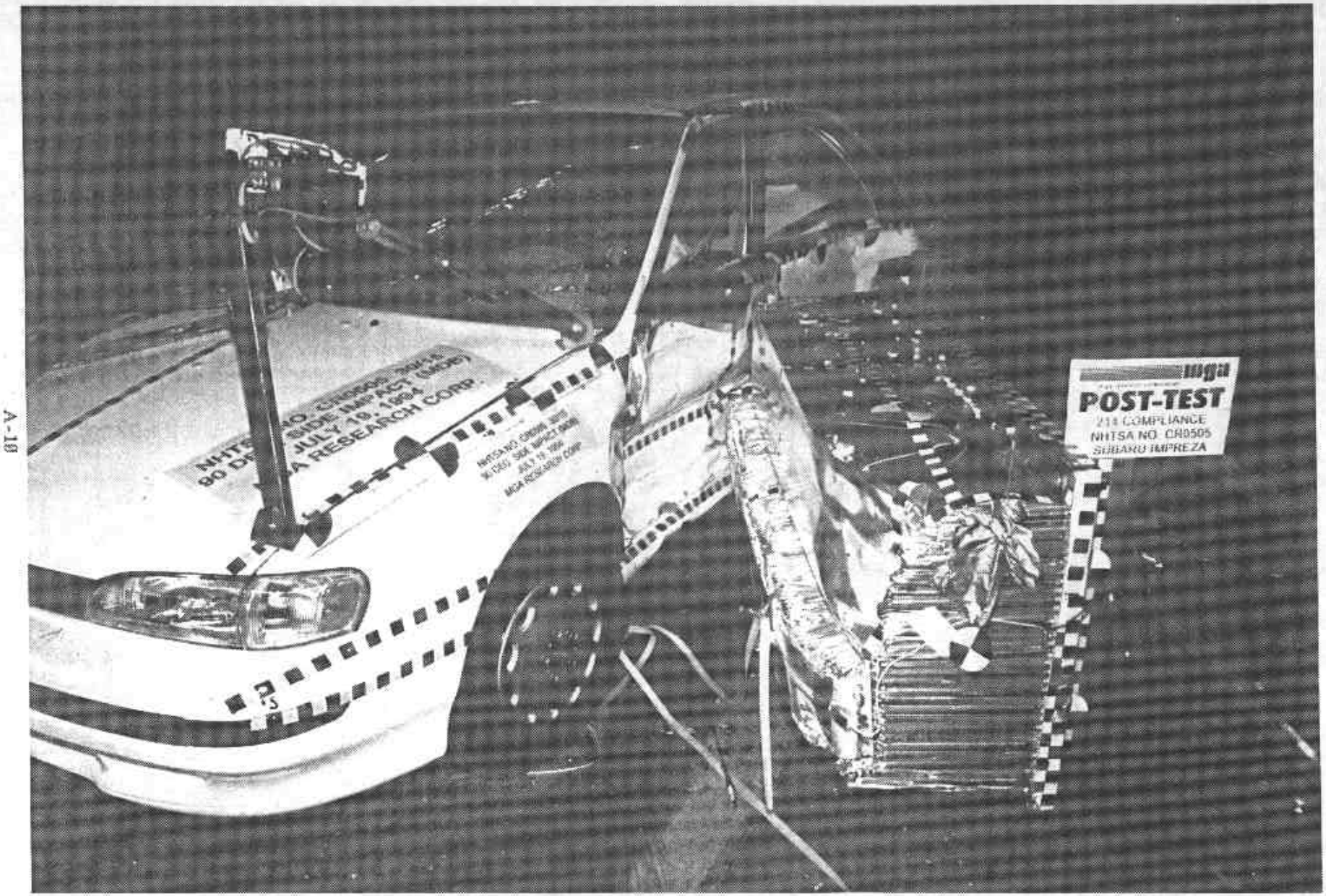



Photo No. A-10 - Post-Test MDB and Vehicle Left Side Front View

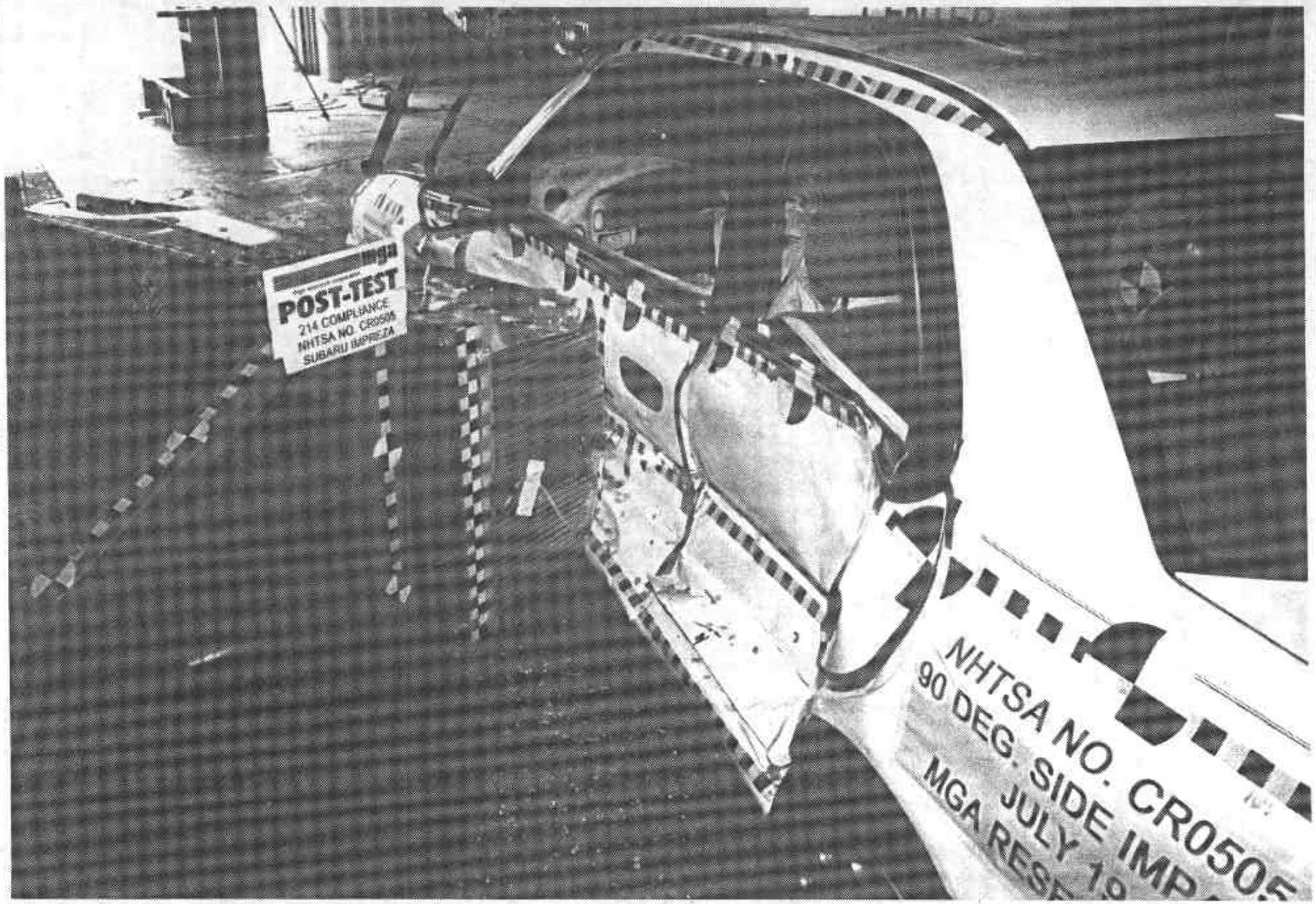



Photo No. A-11 - Post-Test MDB and Vehicle Right Side Rear View

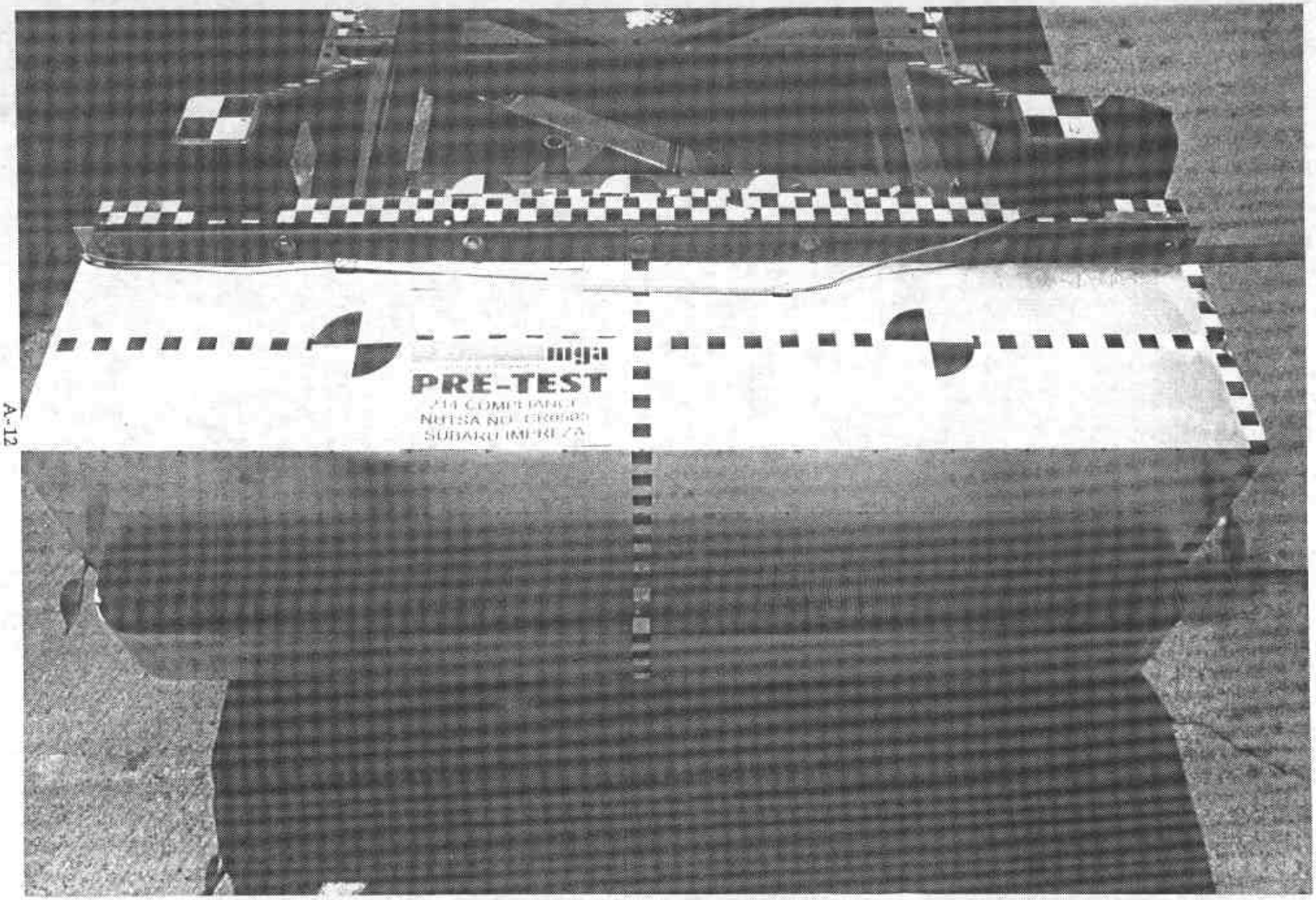



Photo No. A-12 - Pre-Test MDB Top View

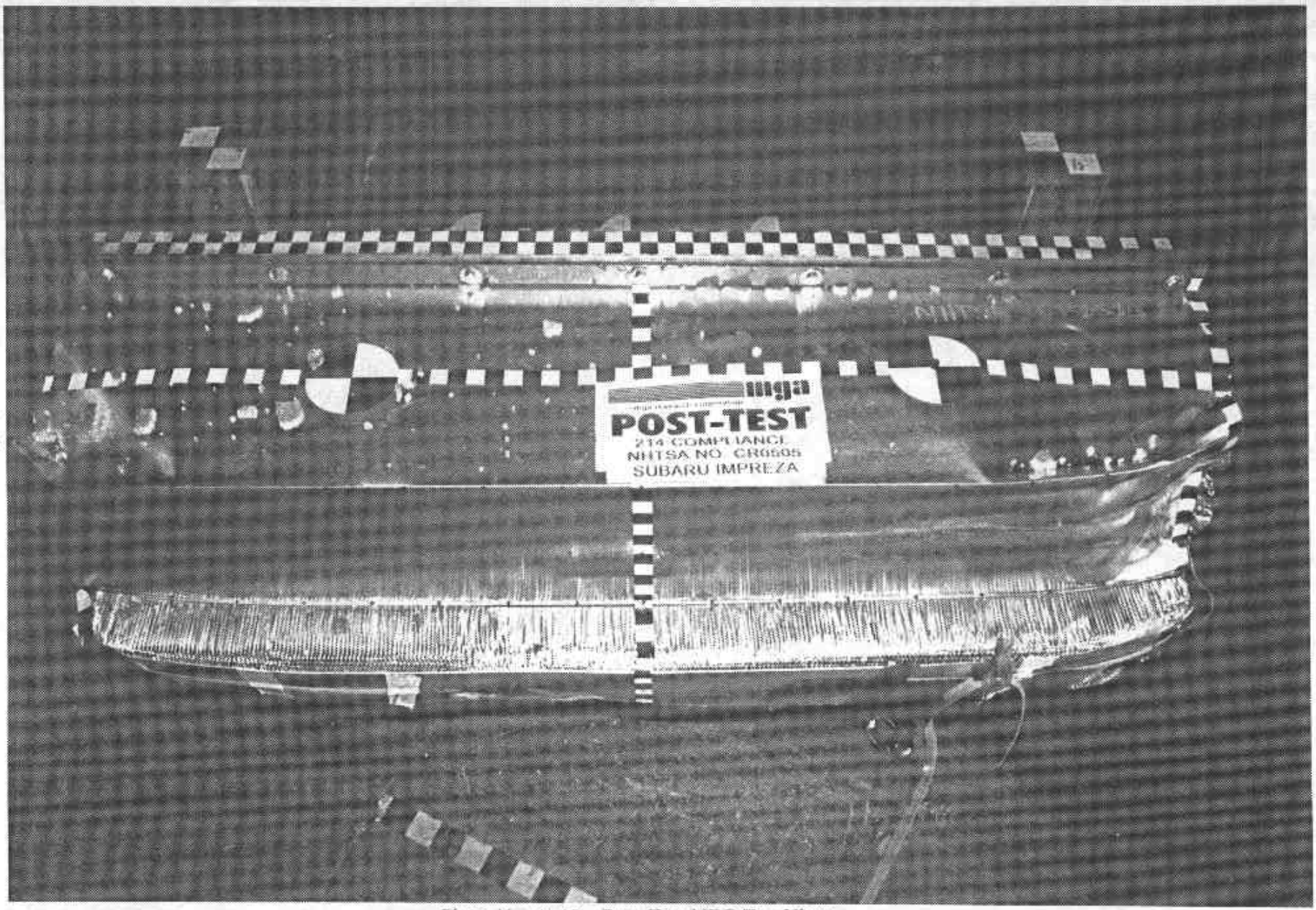



Photo No. A-13 - Post-Test MDB Top View

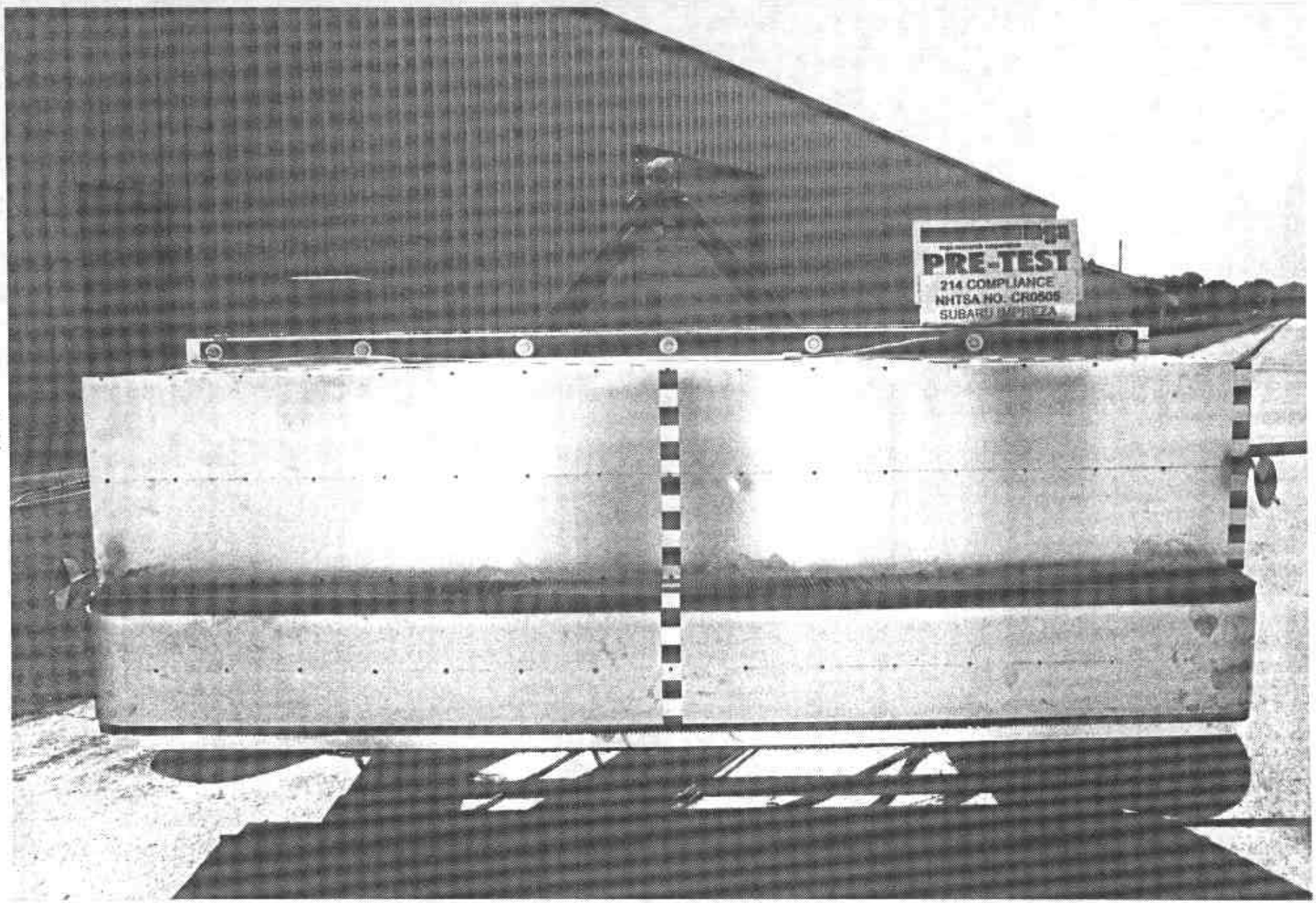



Photo No. A-14 - Pre-Test MDB Front View

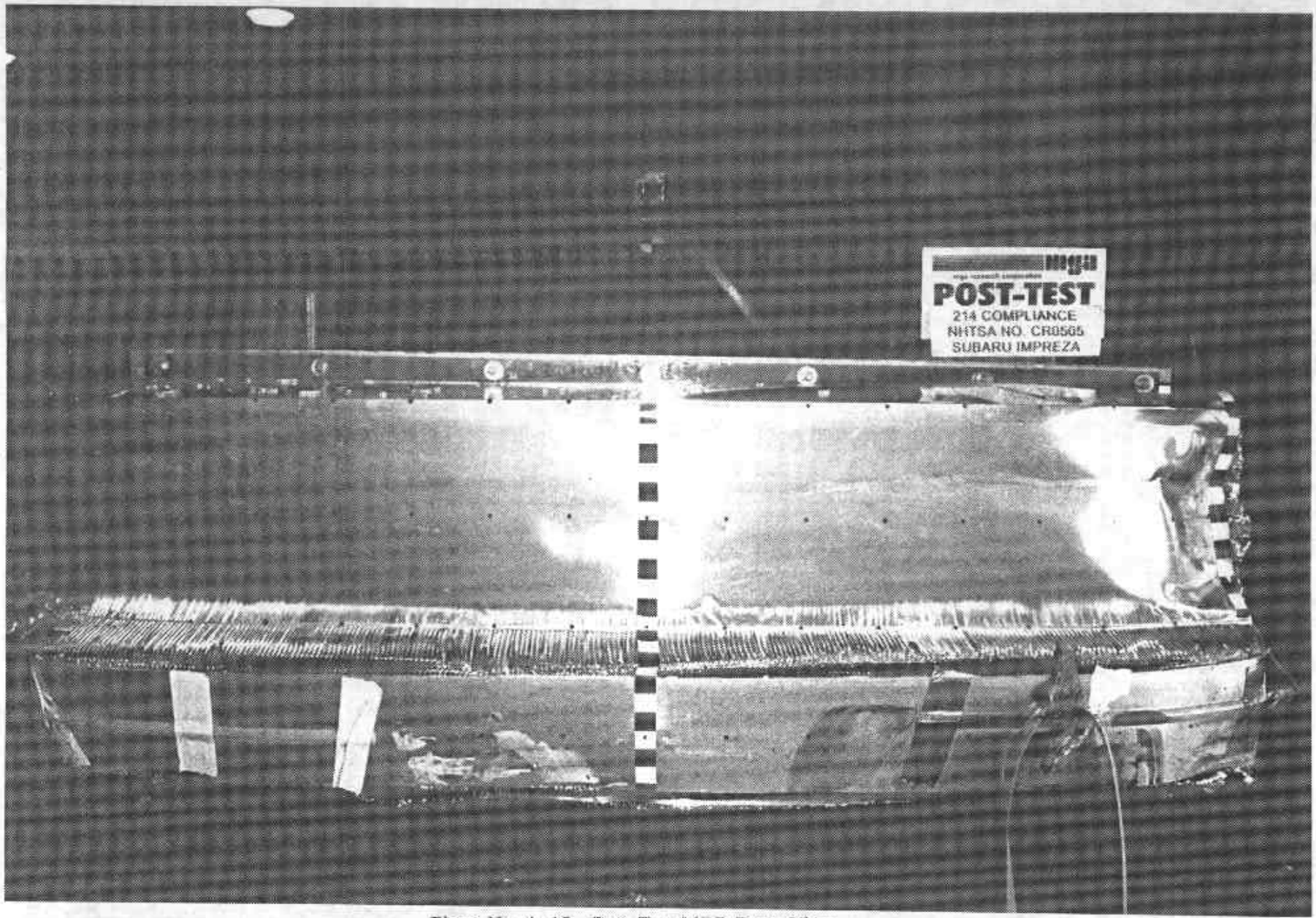



Photo No. A-15 - Post-Test MDB Front View

Photo No. A-16 - Pre-Test MDB Left Side View

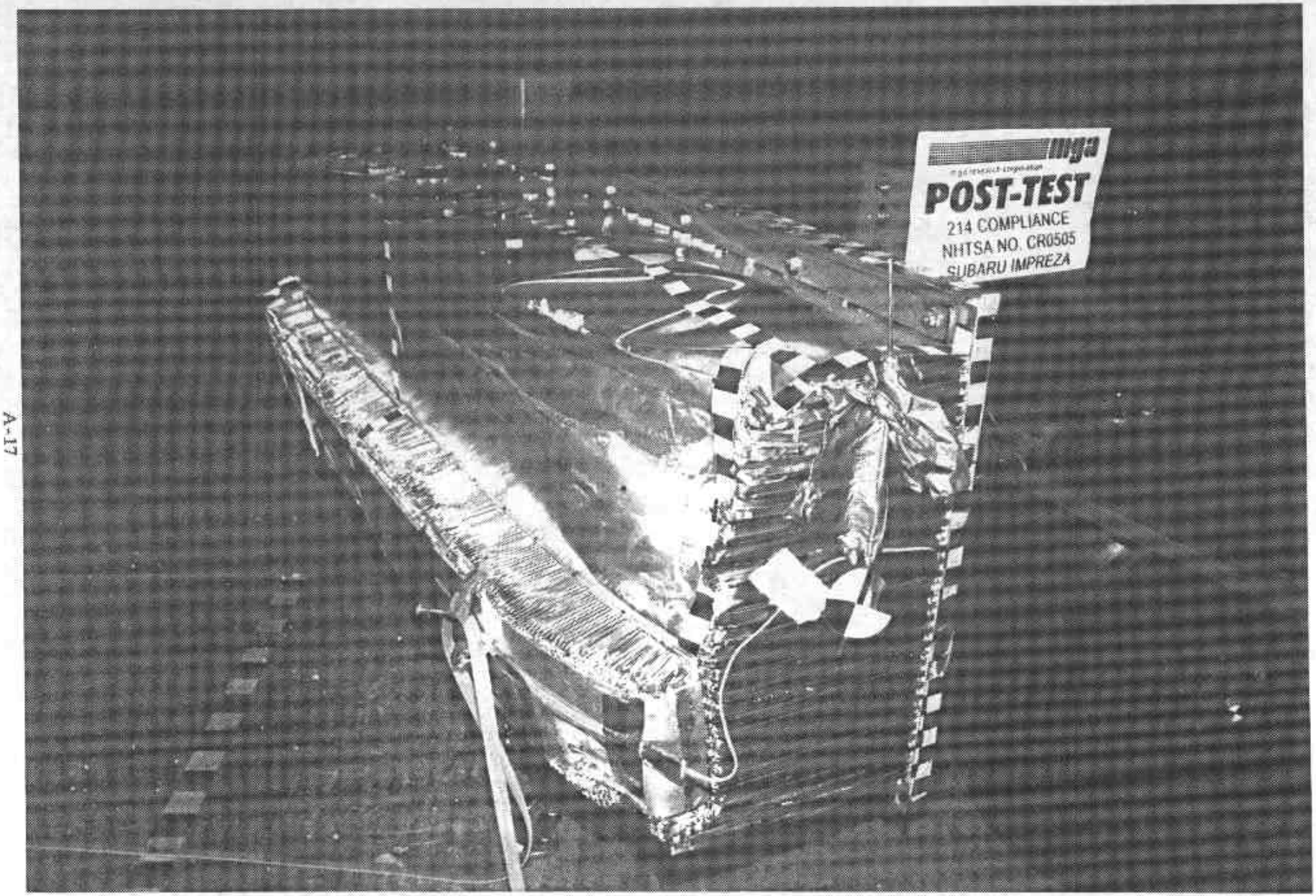



Photo No. A-17 - Post-Test MDB Left Side View

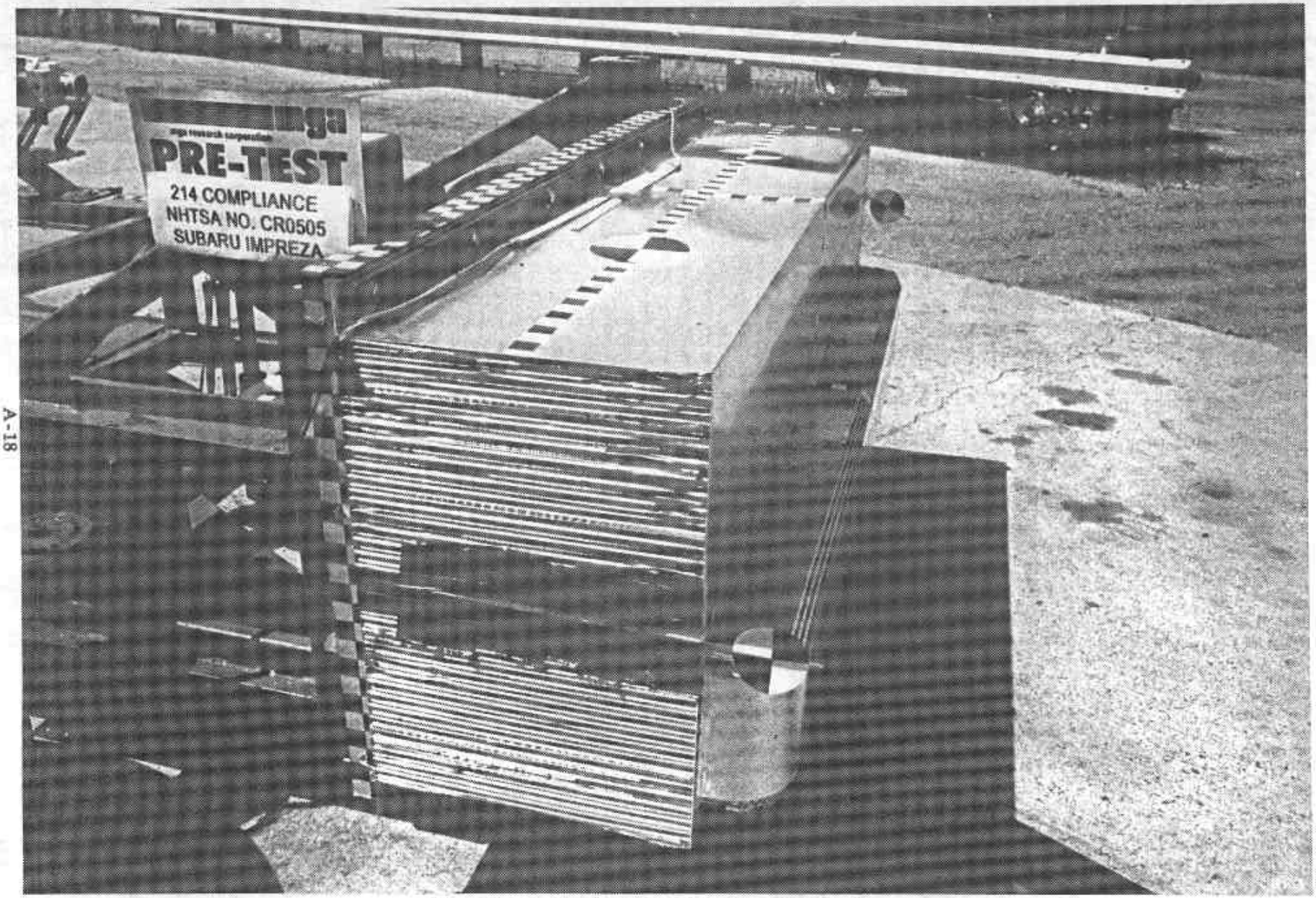



Photo No. A-18 - Pre-Test MDB Right Side View

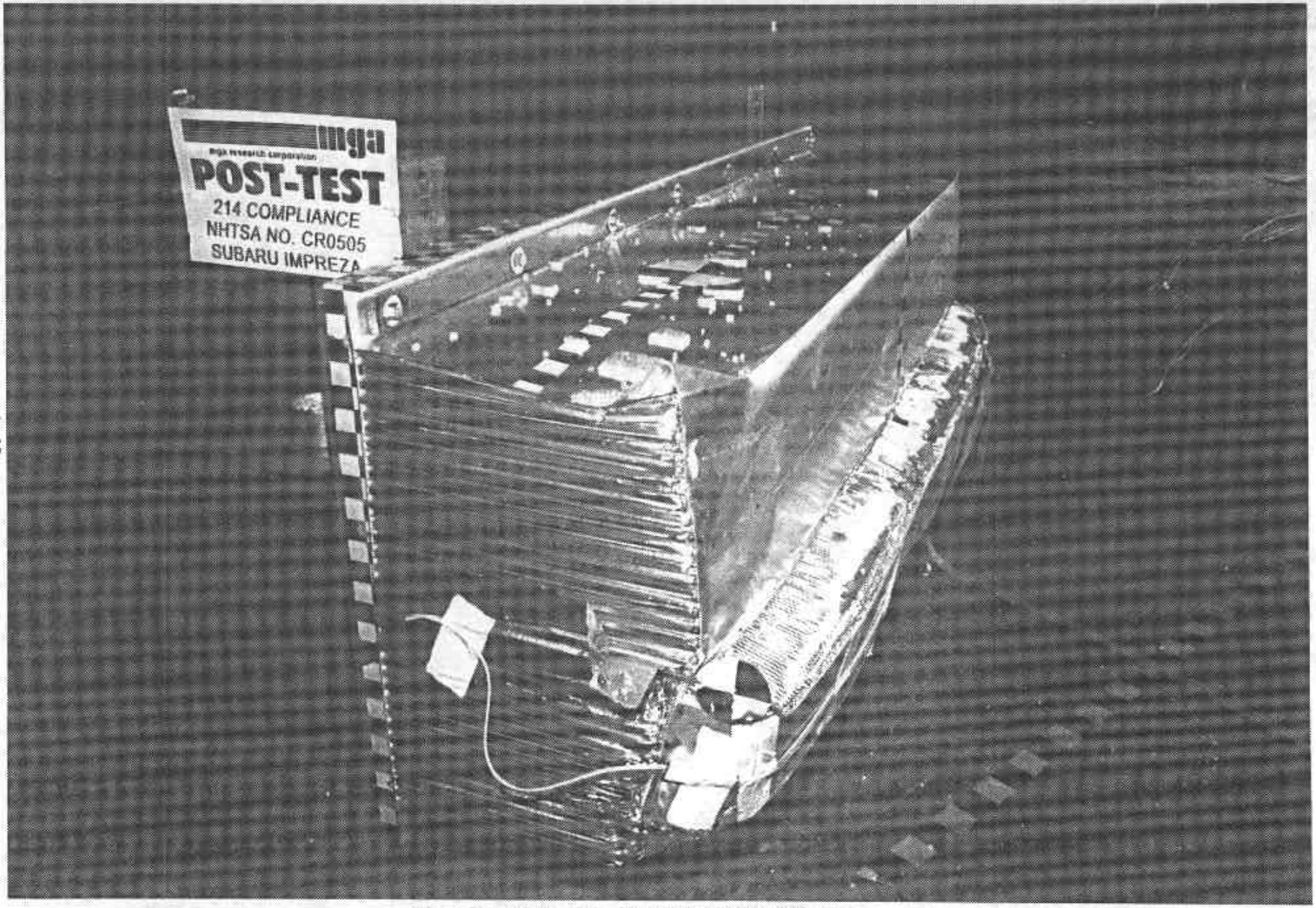



Photo No. A-19 - Post-Test MDB Right Side View

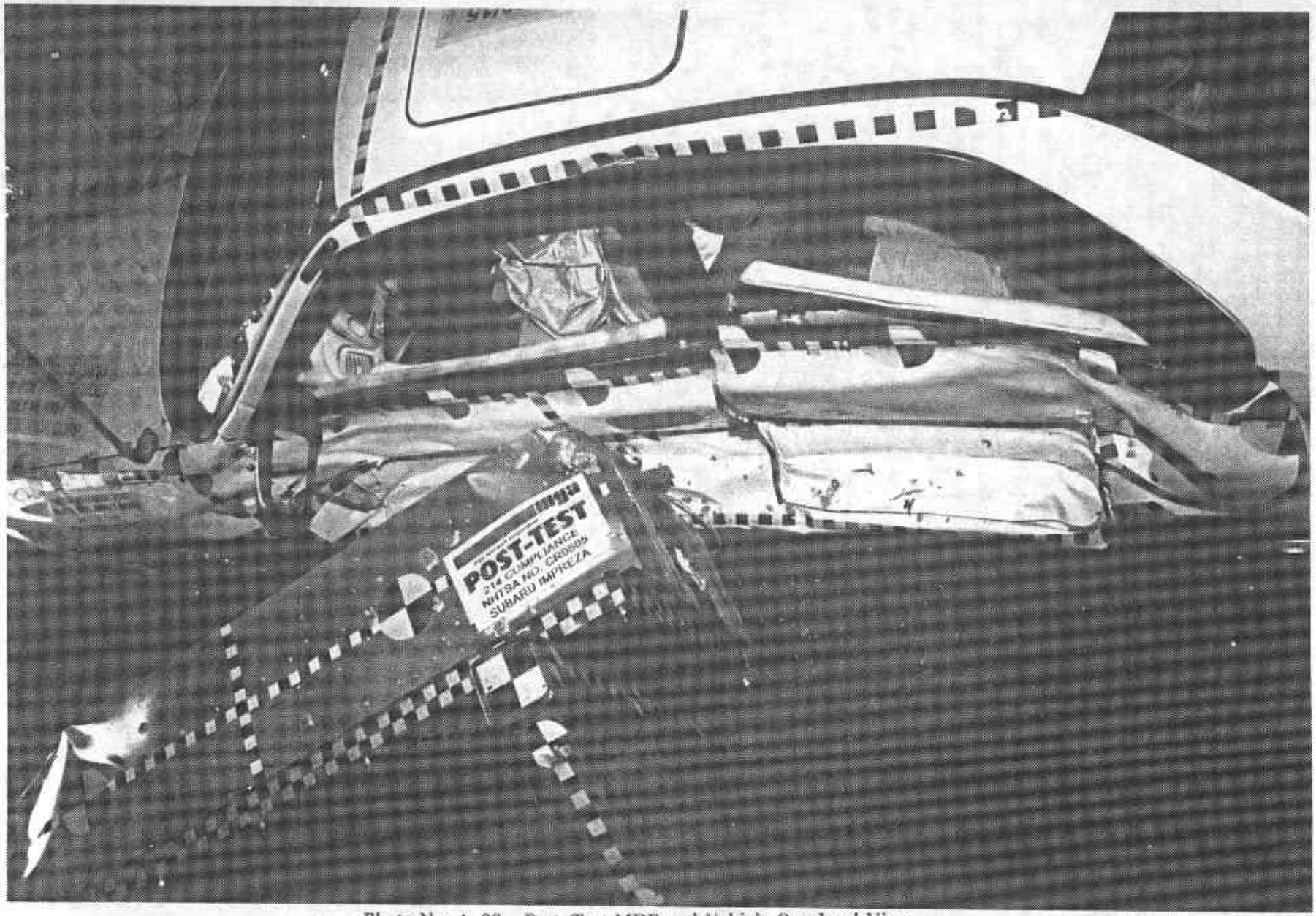



Photo No. A-28 - Post-Test MDB and Vehicle Overhead View

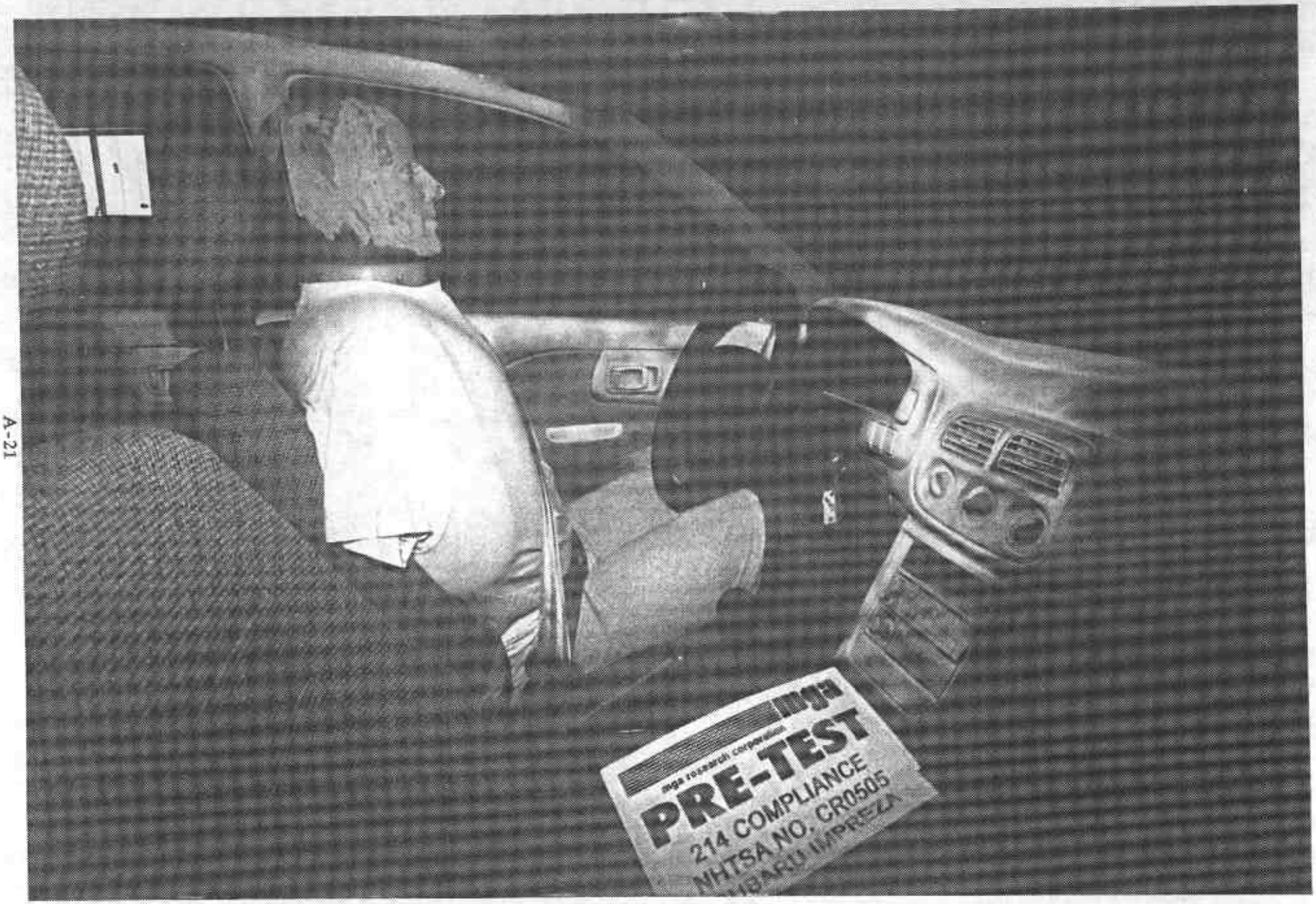



Photo No. A-21 - Pre-Test Driver Dummy Right Side View

Photo No. A-22 - Post-Test Driver Dummy Right Side View

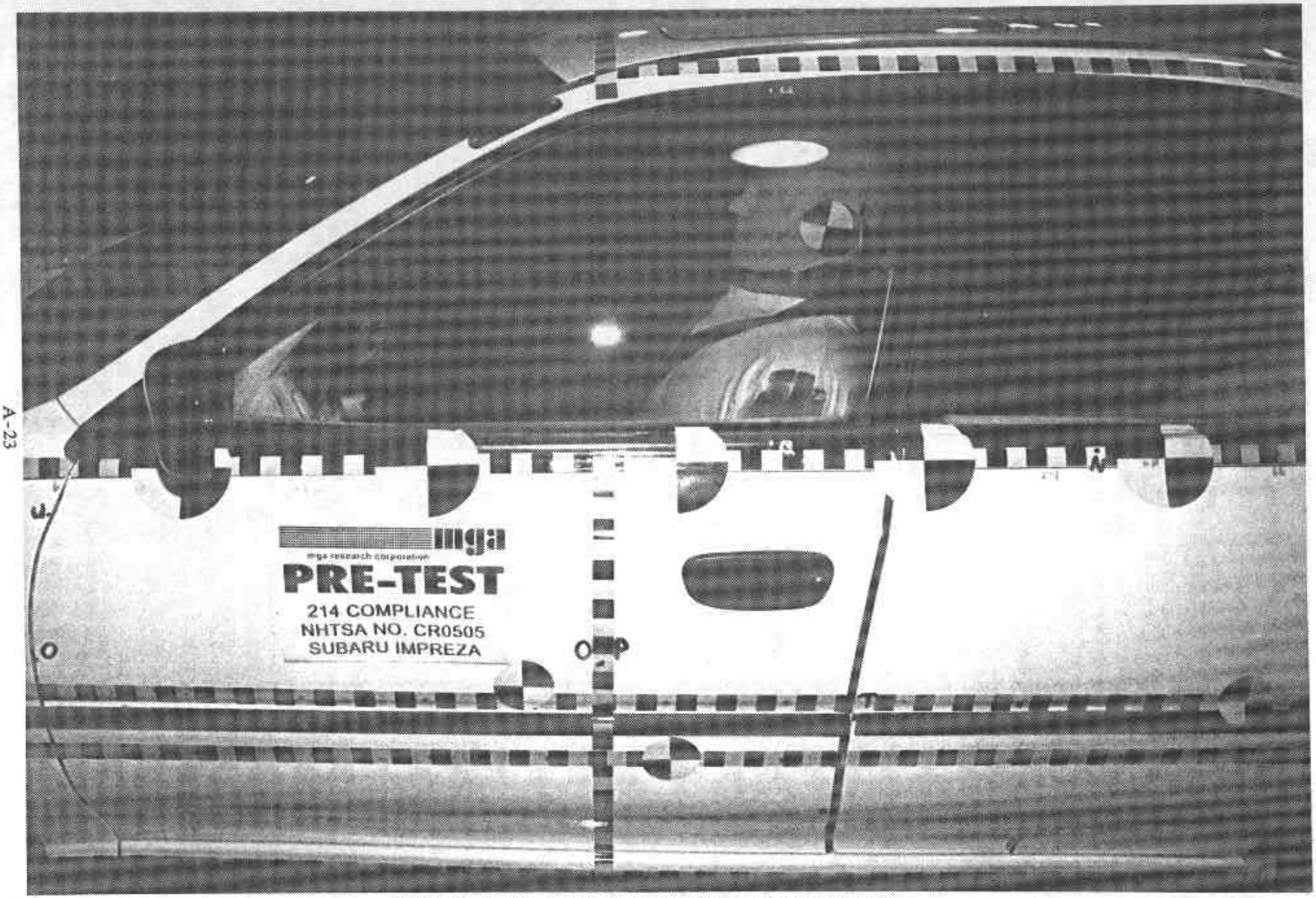



Photo No. A-23 - Pre-Test Driver Dummy Left Side View

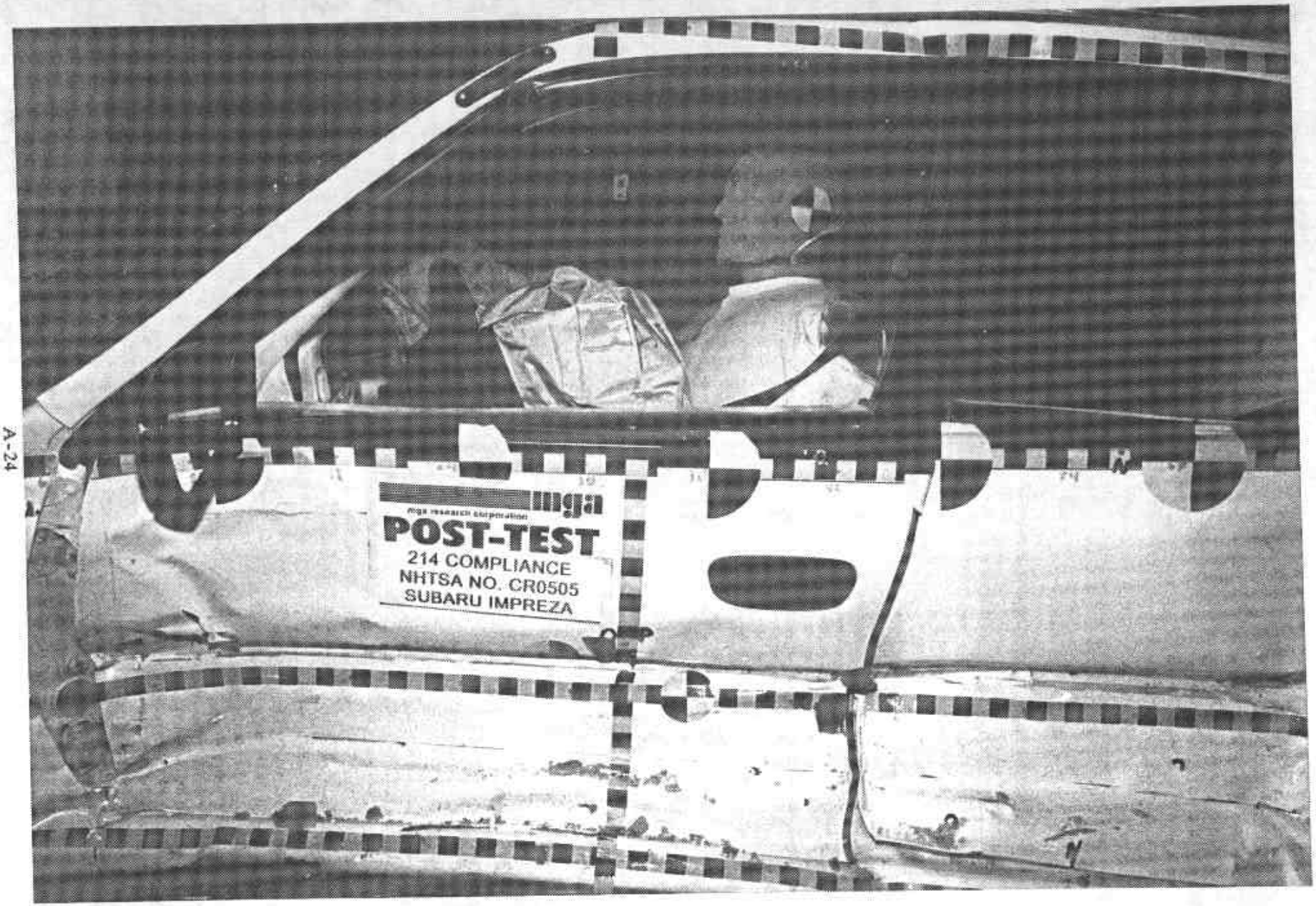



Photo No. A-24 - Post-Test Driver Dummy Left Side View

Photo No. A-25 - Pre-Test Driver Dummy Front View

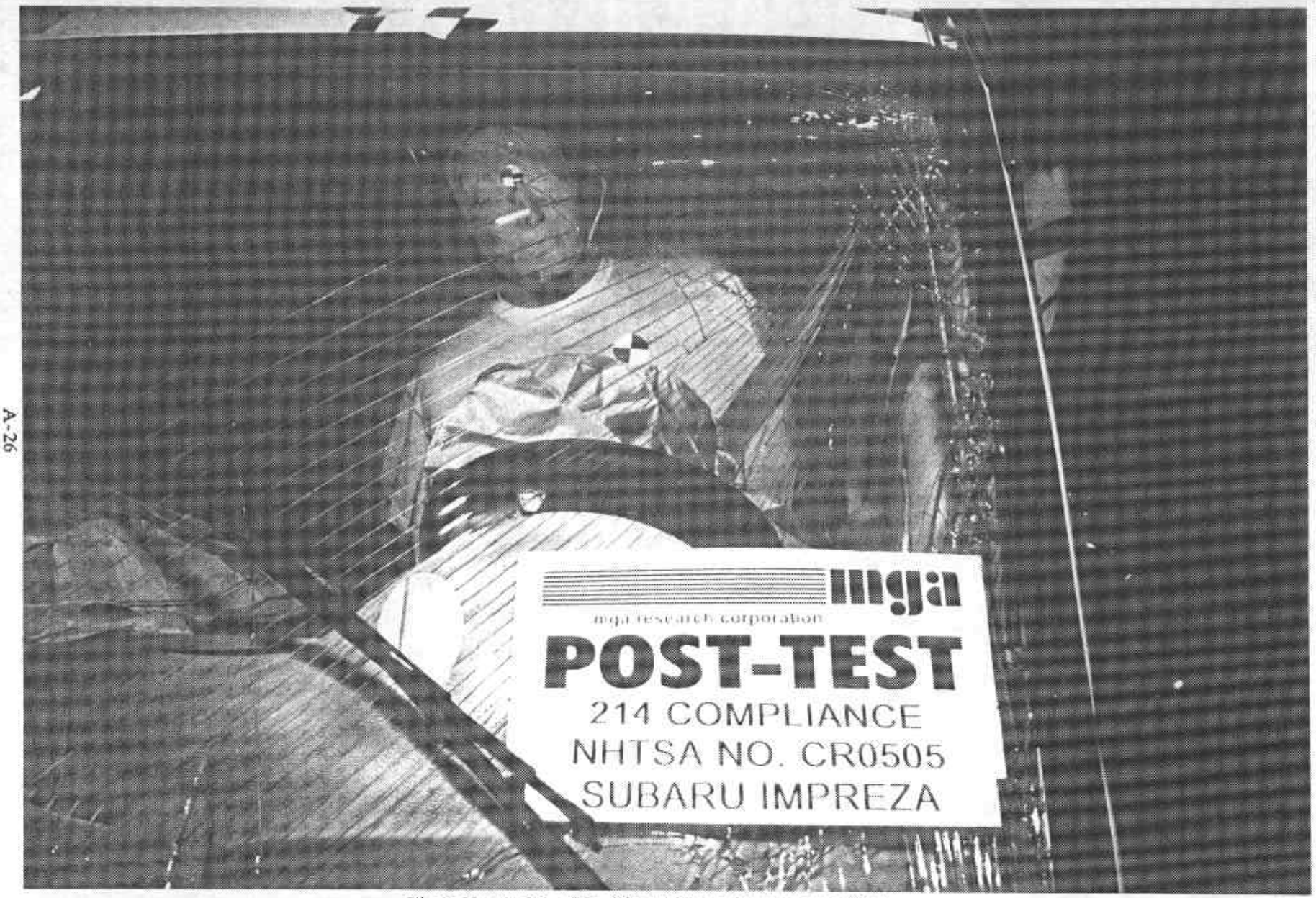



Photo No. A-26 - Post-Test Driver Dummy Front View

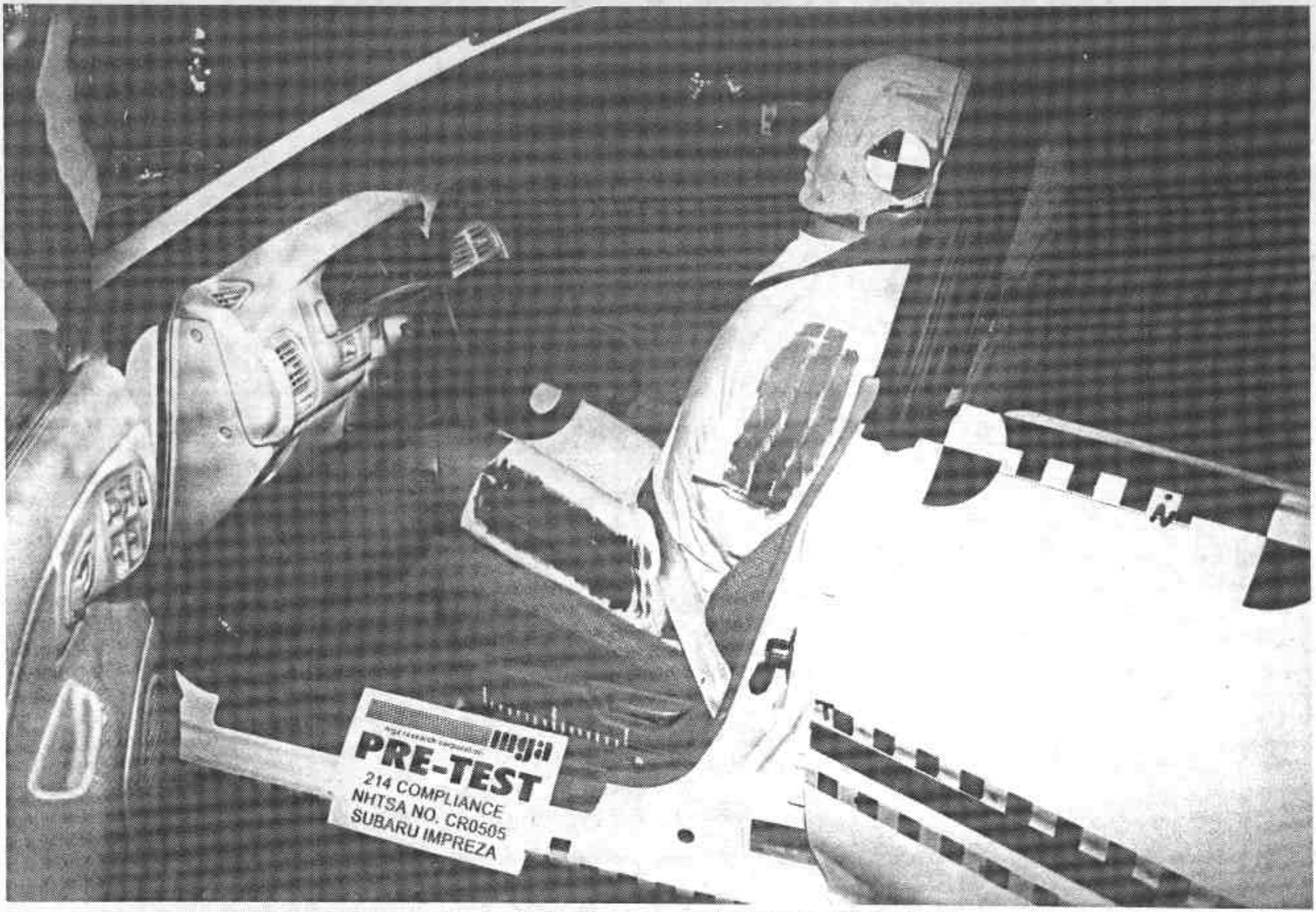



Photo No. A-27 - Pre-Test Driver Dummy Left Side View (Door Open)

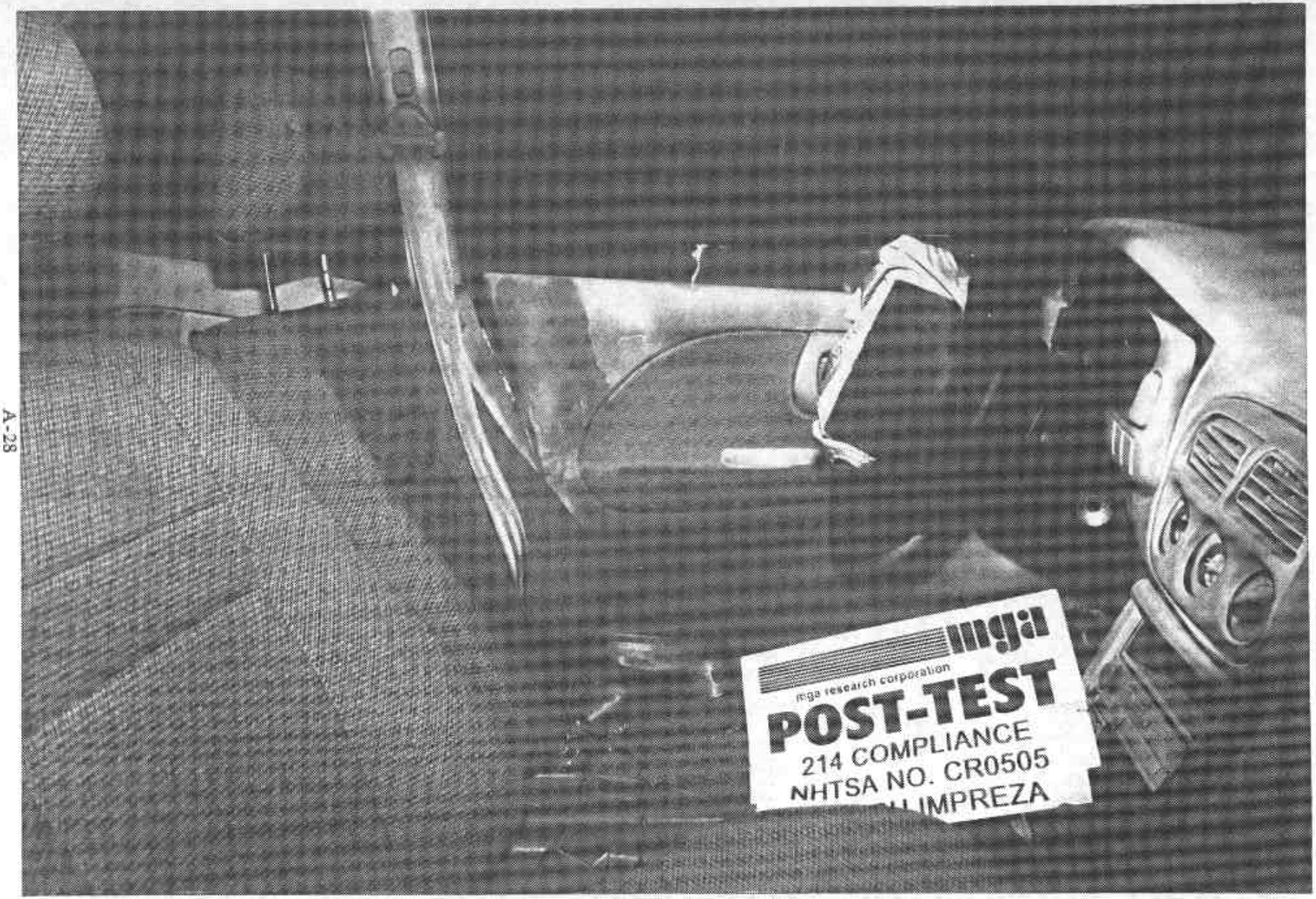



Photo No. A-28 - Post-Test Driver Dummy Impact Point

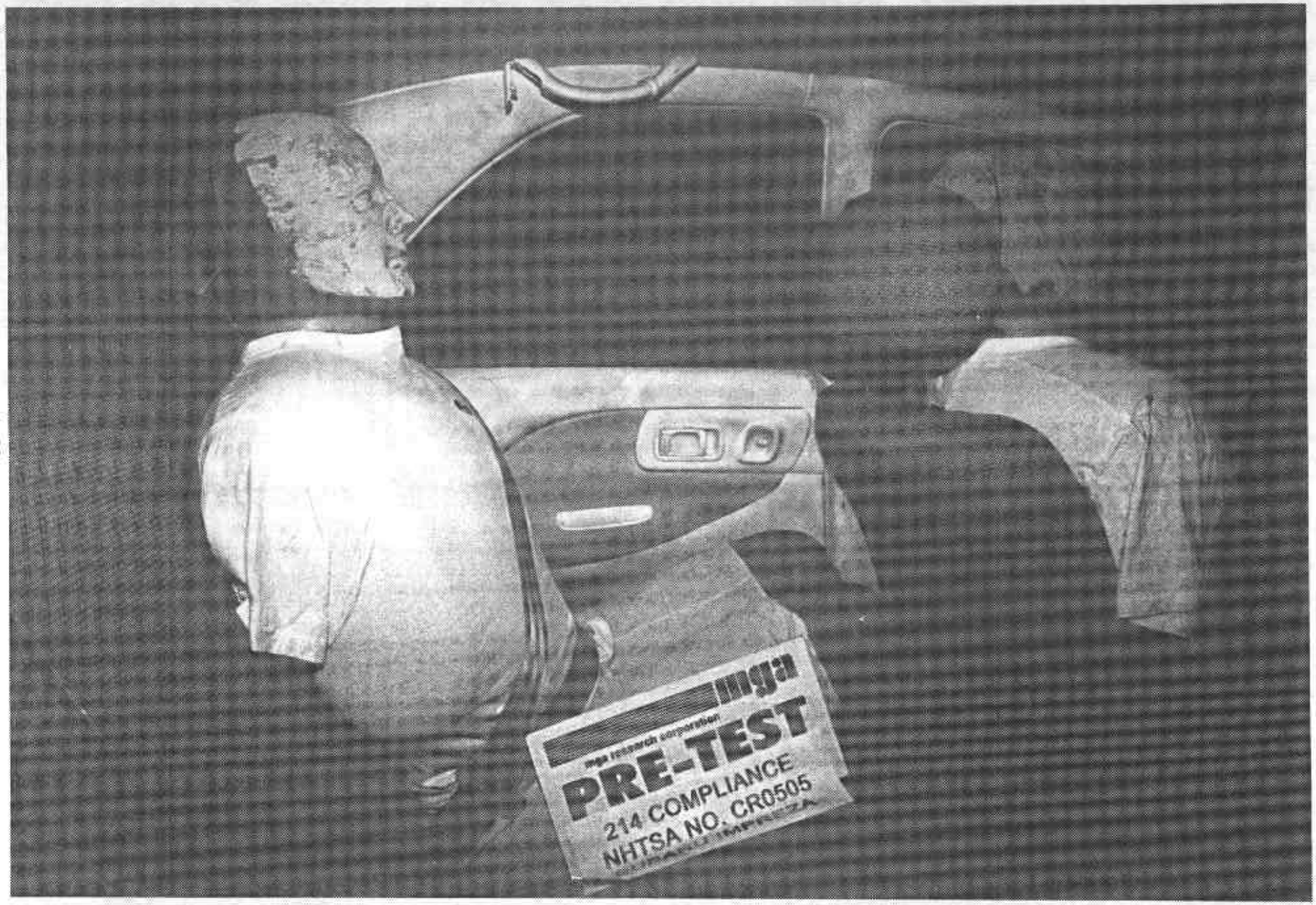



Photo No. A-29 - Pre-Test Passenger Dummy Right Side View

Photo No. A-30 - Post-Test Passenger Dummy Right Side View

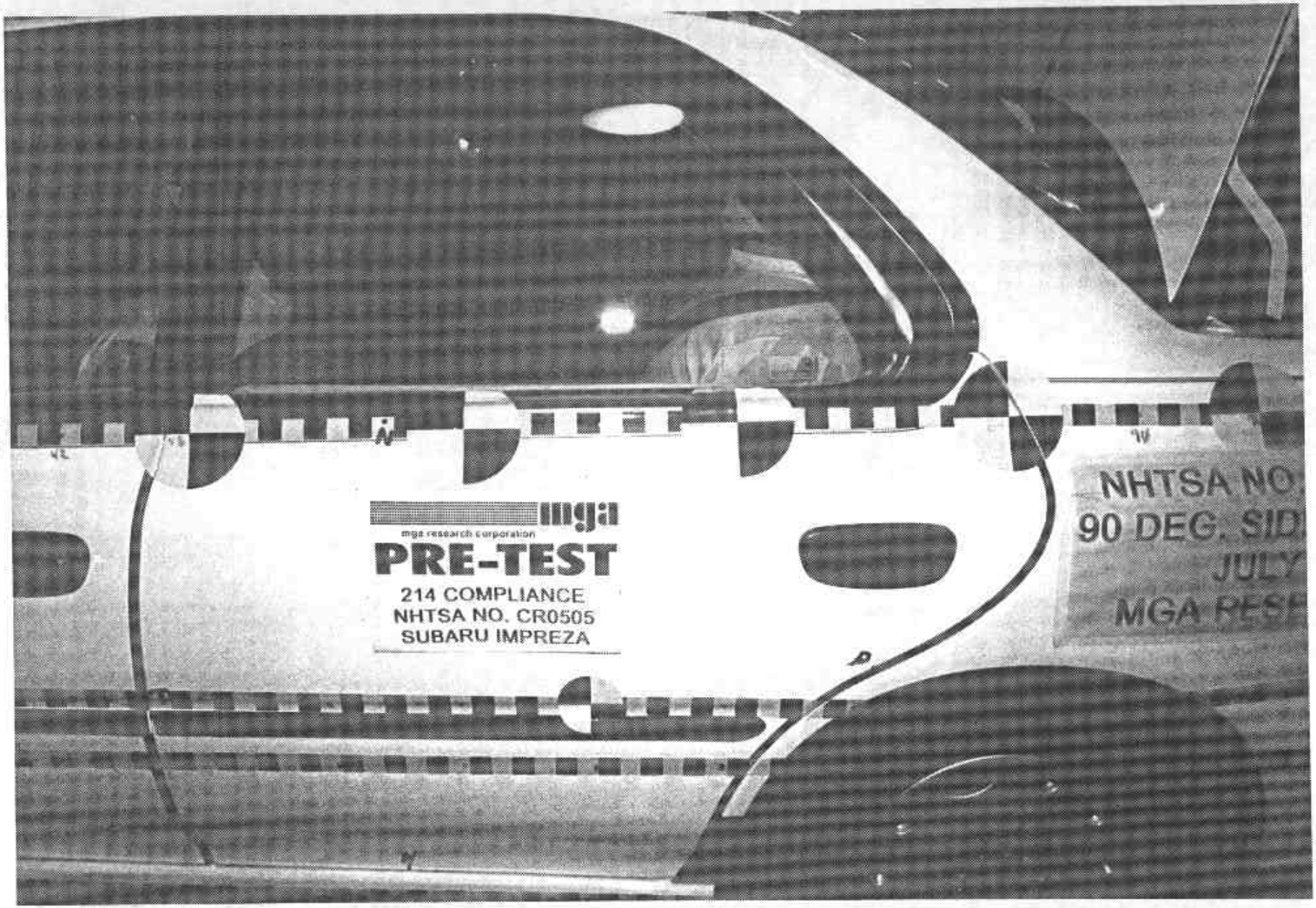



Photo No. A-31 - Pre-Test Passenger Dummy Left Side View

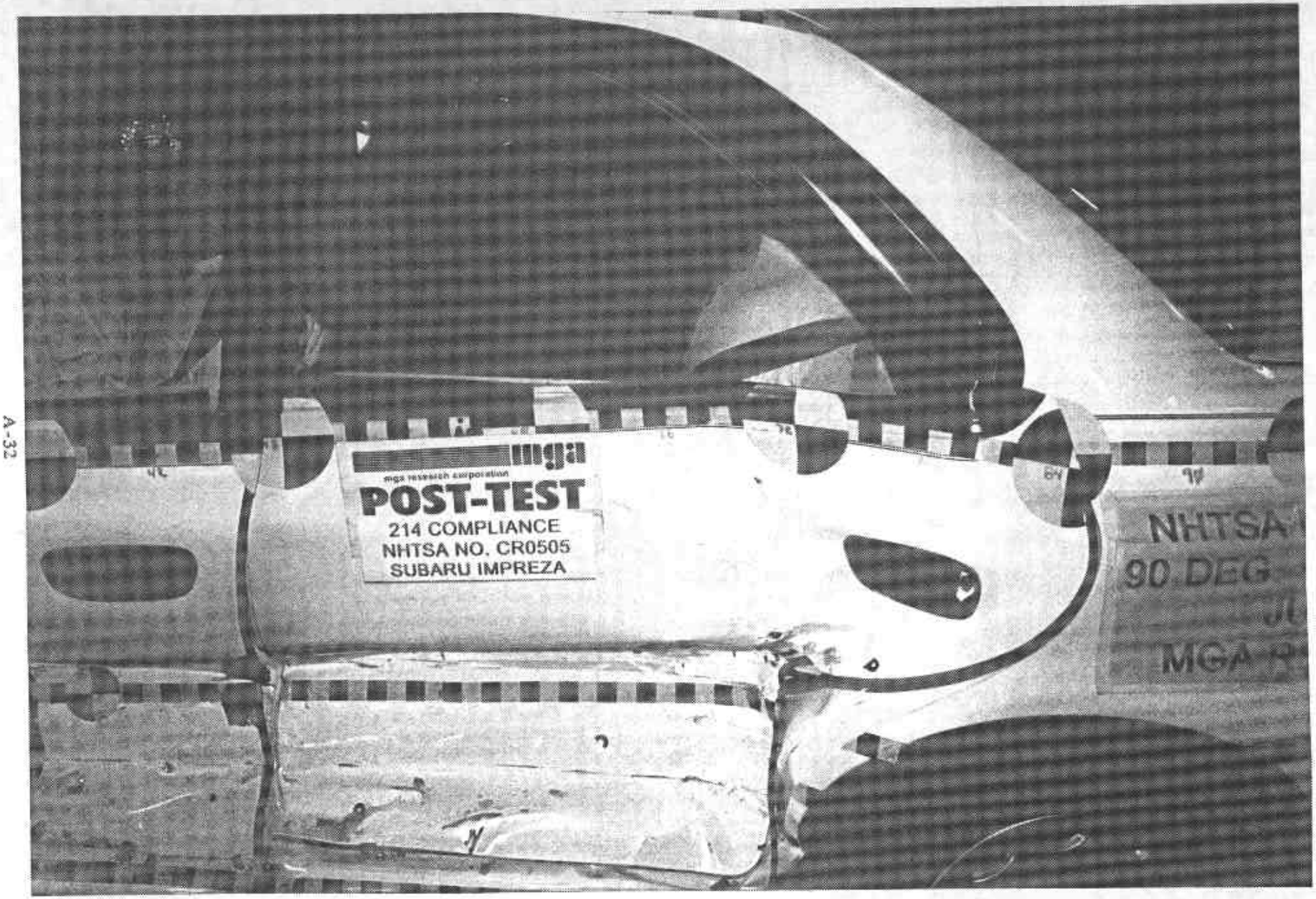



Photo No. A-32 - Post-Test Passenger Dummy Left Side View

Photo No. A-33 - Pre-Test Passenger Dummy Left Side View (Door Open)

Photo No. A-34 - Post-Test Passenger Dummy Impact Point

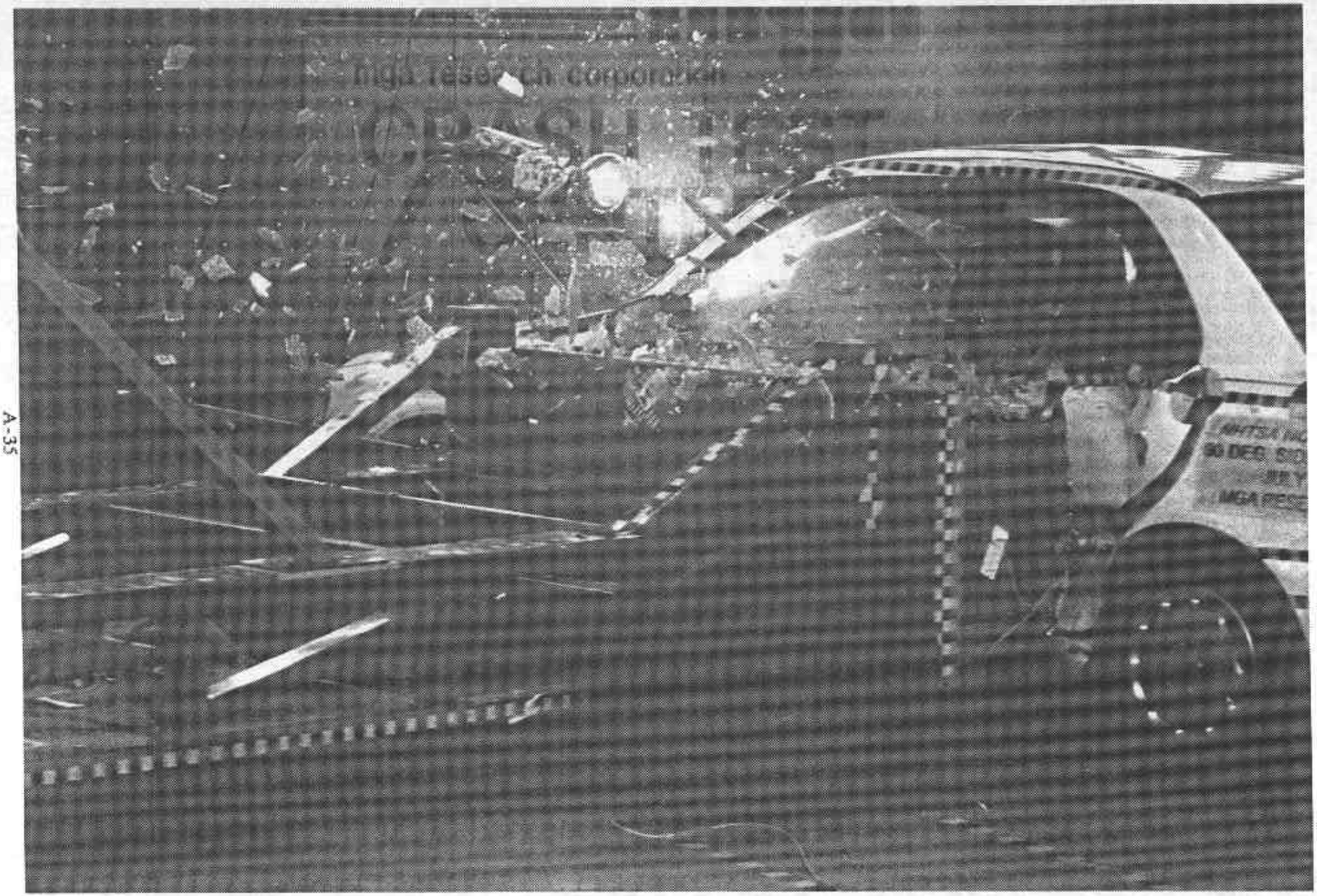


Photo No. A-35 - Impact

Photo No. A-36 - Left Front Impact Point on Vehicle

Photo No. A-37 - Right Rear Impact Point on Vehicle

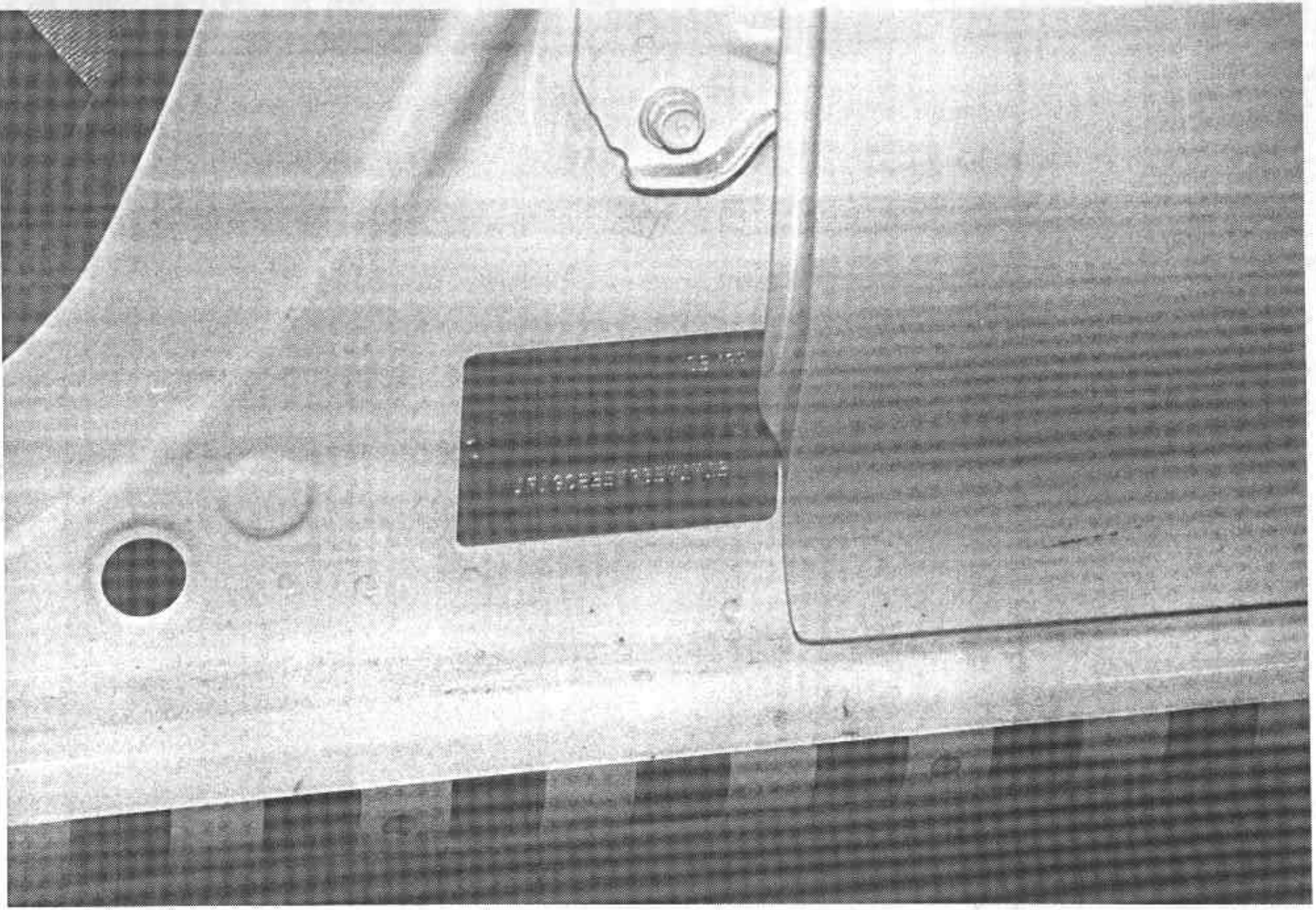


Photo No. A-38 - Vehicle Certification Label

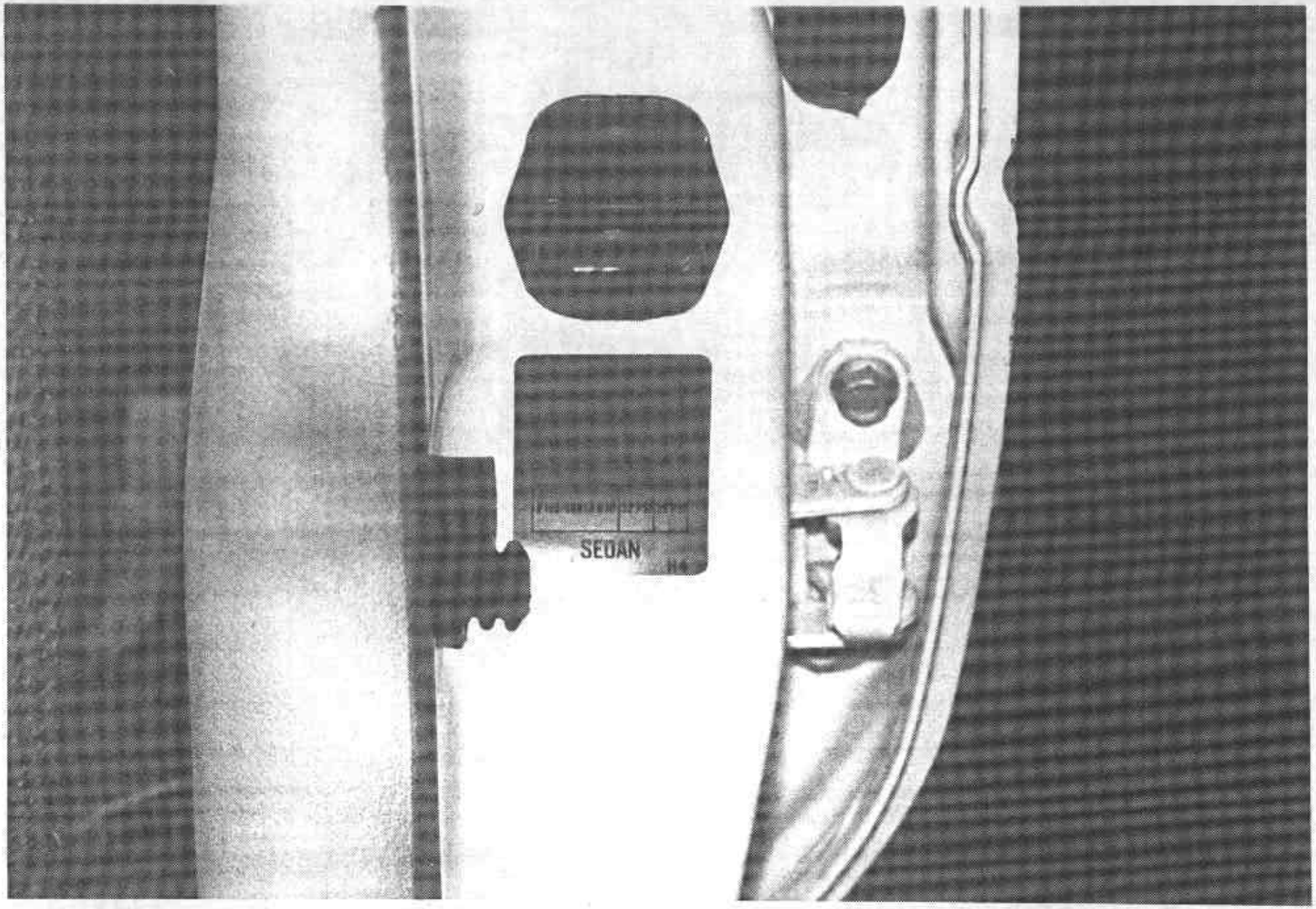



Photo No. A-39 - Tire Placard

# APPENDIX B - DATA PLOTS

Table of Data Plots


| Occupant: | Page No. |
|---|---|
| Figure B-1 - Driver Upper Rib Y Acceleration vs. Time | B-1 |
| Figure B-2 - Driver Upper Rib Y Velocity vs. Time | B-2 |
| Figure B-3 - Driver Lower Rib Y Acceleration vs. Time | B-3 |
| Figure B-4 - Driver Lower Rib Y Velocity vs. Time | B-4 |
| Figure B-5 - Driver Lower Spine Y Acceleration vs. Time | B-5 |
| Figure B-6 - Driver Lower Spine Y Velocity vs. Time | B-6 |
| Figure B-7 - Driver Pelvis Y Acceleration vs. Time | B-7 |
| Figure B-8 - Driver Pelvis Y Velocity vs. Time | B-8 |
| Figure B-9 - Passenger Upper Rib Y Acceleration vs. Time | B-9 |
| Figure B-10 - Passenger Upper Rib Y Velocity vs. Time | B-10 |
| Figure B-11 - Passenger Lower Rib Y Acceleration vs. Time | B-11 |
| Figure B-12 - Passenger Lower Rib Y Velocity vs. Time | B-12 |
| Figure B-13 - Passenger Lower Spine Y Acceleration vs. Time | B-13 |
| Figure B-14 - Passenger Lower Spine Y Velocity vs. Time | B-14 |
| Figure B-15 - Passenger Pelvis Y Acceleration vs. Time | B-15 |
| Figure B-16 - Passenger Pelvis Y Velocity vs. Time | B-16 |
| Vehicle: | |
| Figure B-17 - Left Front Sill Y Acceleration vs. Time | B-17 |
| Figure B-18 - Left Front Sill Y Velocity vs. Time | B-18 |
| Figure B-19 - Left Rear Sill Y Acceleration vs. Time | B-19 |
| Figure B-20 - Left Rear Sill Y Velocity vs. Time | B-20 |
| Figure B-21 - Right Front Sill X Acceleration vs. Time | B-21 |
| Figure B-22 - Right Front Sill X Velocity vs. Time | B-22 |
| Figure B-23 - Right Front Sill Y Acceleration vs. Time | B-23 |
| Figure B-24 - Right Front Sill Y Velocity vs. Time | B-24 |
| Figure B-25 - Right Front Sill Z Acceleration vs. Time | B-25 |
| Figure B-26 - Right Front Sill Z Velocity vs. Time | B-26 |
| Figure B-27 - Right Front Sill at Front Seat Resultant vs. Time | B-27 |
| Figure B-28 - Right Rear Sill X Acceleration vs. Time | B-28 |
| Figure B-29 - Right Rear Sill X Velocity vs. Time | B-29 |
| Figure B-30 - Right Rear Sill Y Acceleration vs. Time | B-30 |
| Figure B-31 - Right Rear Sill Y Velocity vs. Time | B-31 |

Table of Data Plots


| | Page No. |
|---|---|
| Vehicle (Cont'd): | |
| Figure B-32 - Right Rear Sill Z Acceleration vs. Time | B-32 |
| Figure B-33 - Right Rear Sill Z Velocity vs. Time | B-33 |
| Figure B-34 - Right Rear Sill at Rear Seat Resultant vs. Time | B-34 |
| Figure B-35 - Driver Seat Track Y Acceleration vs. Time | B-35 |
| Figure B-36 - Driver Seat Track Y Velocity vs. Time | B-36 |
| Figure B-37 - Rear Floorpan at Axle X Acceleration vs. Time | B-37 |
| Figure B-38 - Rear Floorpan at Axle X Velocity vs. Time | B-38 |
| Figure B-39 - Rear Floorpan at Axle Y Acceleration vs. Time | B-39 |
| Figure B-40 - Rear Floorpan at Axle Y Velocity vs. Time | B-40 |
| Figure B-41 - Rear Floorpan at Axle Z Acceleration vs. Time | B-41 |
| Figure B-42 - Rear Floorpan at Axle Z Velocity vs. Time | B-42 |
| Figure B-43 - Rear Floorpan at Axle Centerline Resultant vs. Time | B-43 |
| Figure B-44 - Rear Seat Occupant Compartment Y Acceleration vs. Time | B-44 |
| Figure B-45 - Rear Seat Occupant Compartment Y Velocity vs. Time | B-45 |
| Figure B-46 - Left A Post Lower Y Acceleration vs. Time | B-46 |
| Figure B-47 - Left A Post Lower Y Velocity vs. Time | B-47 |
| Figure B-48 - Left B Post Mid Y Acceleration vs. Time | B-48 |
| Figure B-49 - Left B Post Mid Y Velocity vs. Time | B-49 |
| Figure B-50 - Left B Post Lower Y Acceleration vs. Time | B-50 |
| Figure B-51 - Left B Post Lower Y Velocity vs. Time | B-51 |
| Figure B-52 - Moving Barrier Center of Gravity X Acceleration vs. Time | B-52 |
| Figure B-53 - Moving Barrier Center of Gravity X Velocity vs. Time | B-53 |
| Figure B-54 - Moving Barrier Center of Gravity Y Acceleration vs. Time | B-54 |
| Figure B-55 - Moving Barrier Center of Gravity Y Velocity vs. Time | B-55 |
| Figure B-56 - Moving Barrier Center of Gravity Z Acceleration vs. Time | B-56 |
| Figure B-57 - Moving Barrier Center of Gravity Z Velocity vs. Time | B-57 |
| Figure B-58 - Moving Barrier Center of Gravity Resultant vs. Time | B-58 |
| Figure B-59 - Moving Barrier Rear Axle X Acceleration vs. Time | B-59 |
| Figure B-60 - Moving Barrier Rear Axle X Velocity vs. Time | B-60 |
| Figure B-61 - Moving Barrier Rear Axle Y Acceleration vs. Time | B-61 |
| Figure B-62 - Moving Barrier Rear Axle Y Velocity vs. Time | B-62 |
| Figure B-63 - Right Hand Barrier Contact | B-63 |
| Figure B-64 - Left Hand Barrier Contact | B-64 |

Table of Data Plots


| | Page No. |
|---|---|
| Redundant: | |
| Figure B-65 - Driver Upper Rib Y Redundant Acceleration vs. Time | B-65 |
| Figure B-66 - Driver Upper Rib Y Redundant Velocity vs. Time | B-66 |
| Figure B-67 - Driver Lower Rib Y Redundant Acceleration vs. Time | B-67 |
| Figure B-68 - Driver Lower Rib Y Redundant Velocity vs. Time | B-68 |
| Figure B-69 - Driver Lower Spine Y Redundant Acceleration vs. Time | B-69 |
| Figure B-70 - Driver Lower Spine Y Redundant Velocity vs. Time | B-70 |
| Figure B-71 - Driver Pelvis Y Redundant Acceleration vs. Time | B-71 |
| Figure B-72 - Driver Pelvis Y Redundant Velocity vs. Time | B-72 |
| Figure B-73 - Passenger Upper Rib Y Redundant Acceleration vs. Time | B-73 |
| Figure B-74 - Passenger Upper Rib Y Redundant Velocity vs. Time | B-74 |
| Figure B-75 - Passenger Lower Rib Y Redundant Acceleration vs. Time | B-75 |
| Figure B-76 - Passenger Lower Rib Y Redundant Velocity vs. Time | B-76 |
| Figure B-77 - Passenger Lower Spine Y Redundant Acceleration vs. Time | B-77 |
| Figure B-78 - Passenger Lower Spine Y Redundant Velocity vs. Time | B-78 |
| Figure B-79 - Passenger Pelvis Y Redundant Acceleration vs. Time | B-79 |
| Figure B-80 - Passenger Pelvis Y Redundant Velocity vs. Time | B-80 |

Filter: Class 180 (300 Hz)

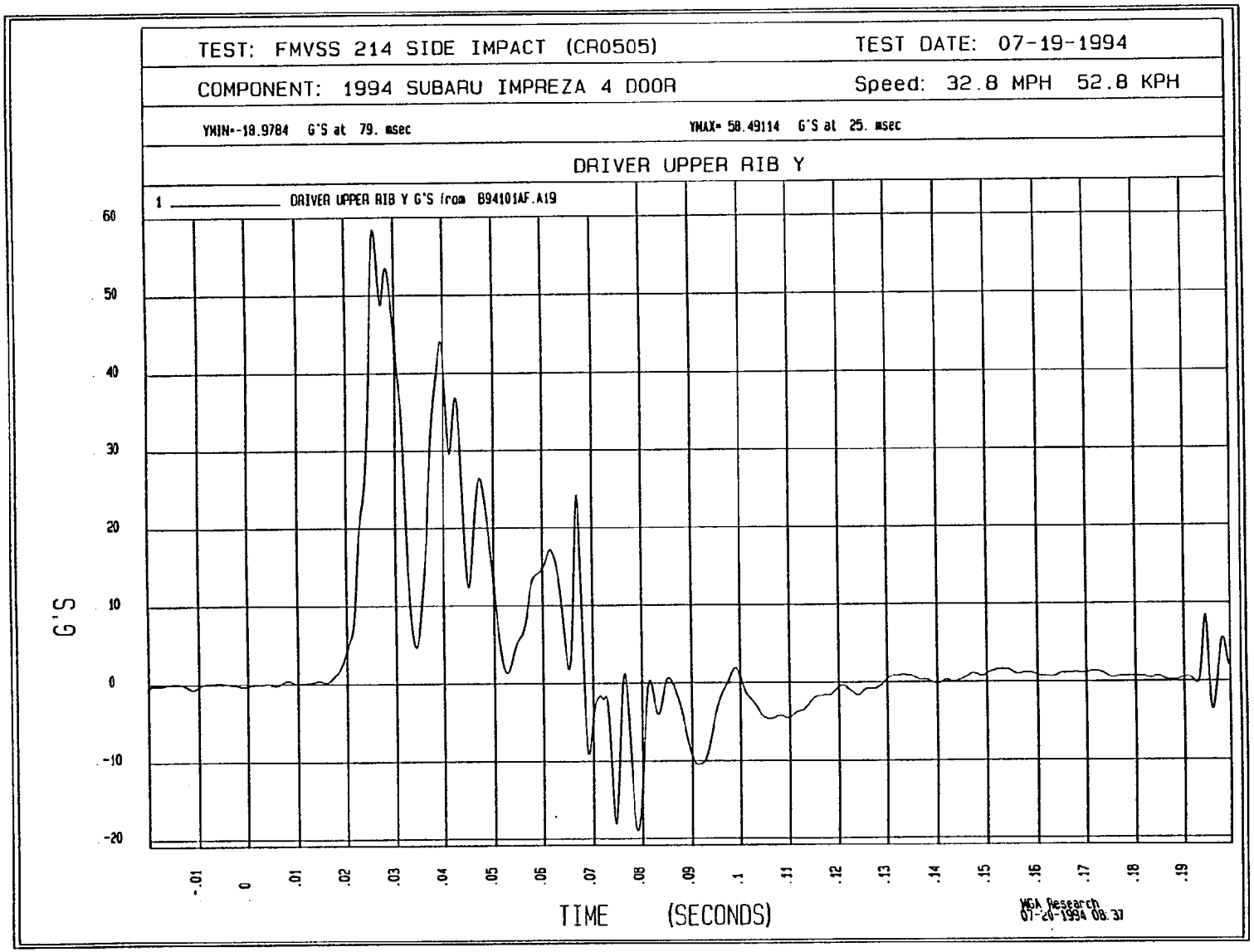



Figure B-1 - Driver Upper Rib Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

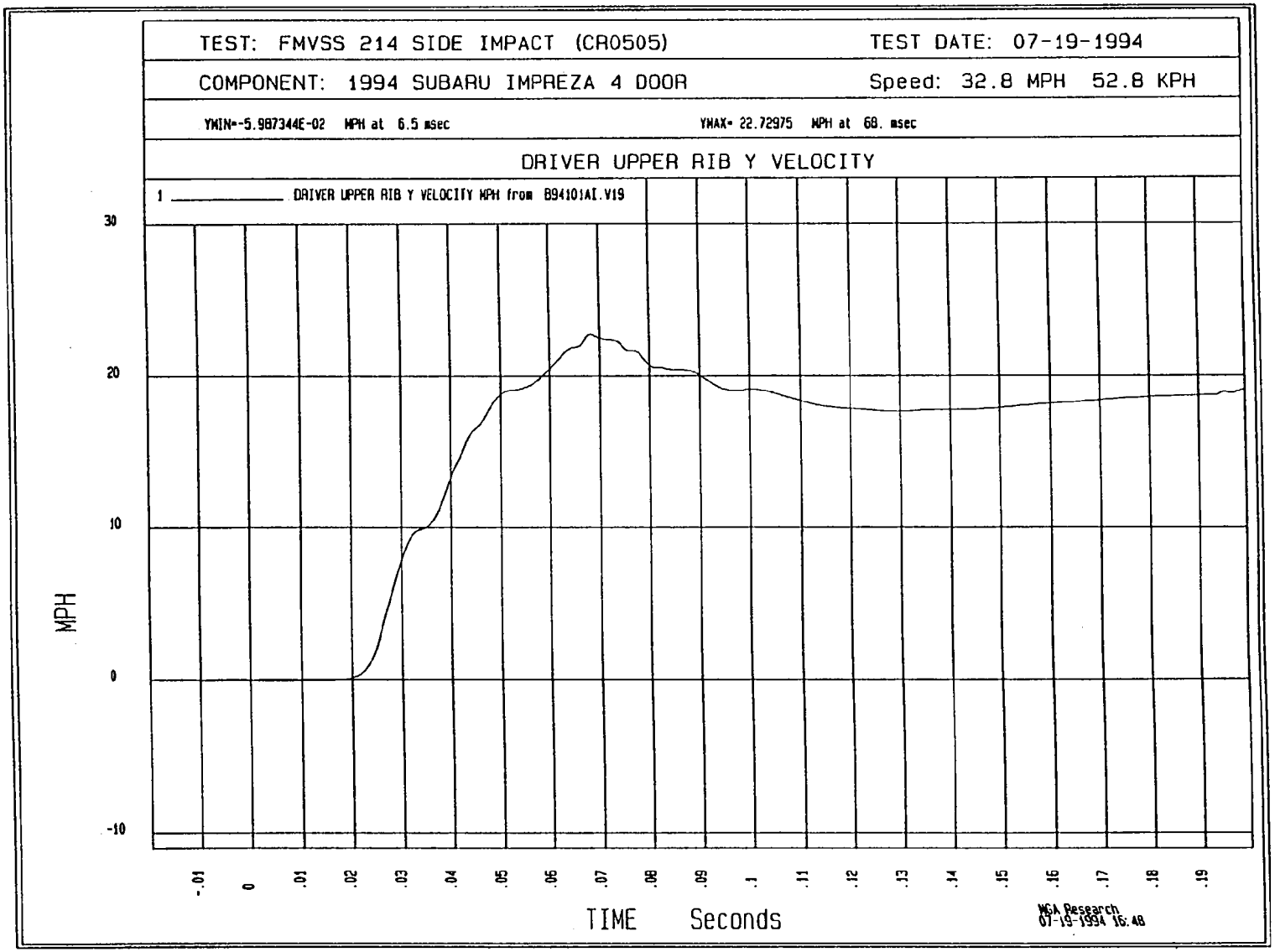



Figure B-2 - Driver Upper Rib Y Velocity vs. Time

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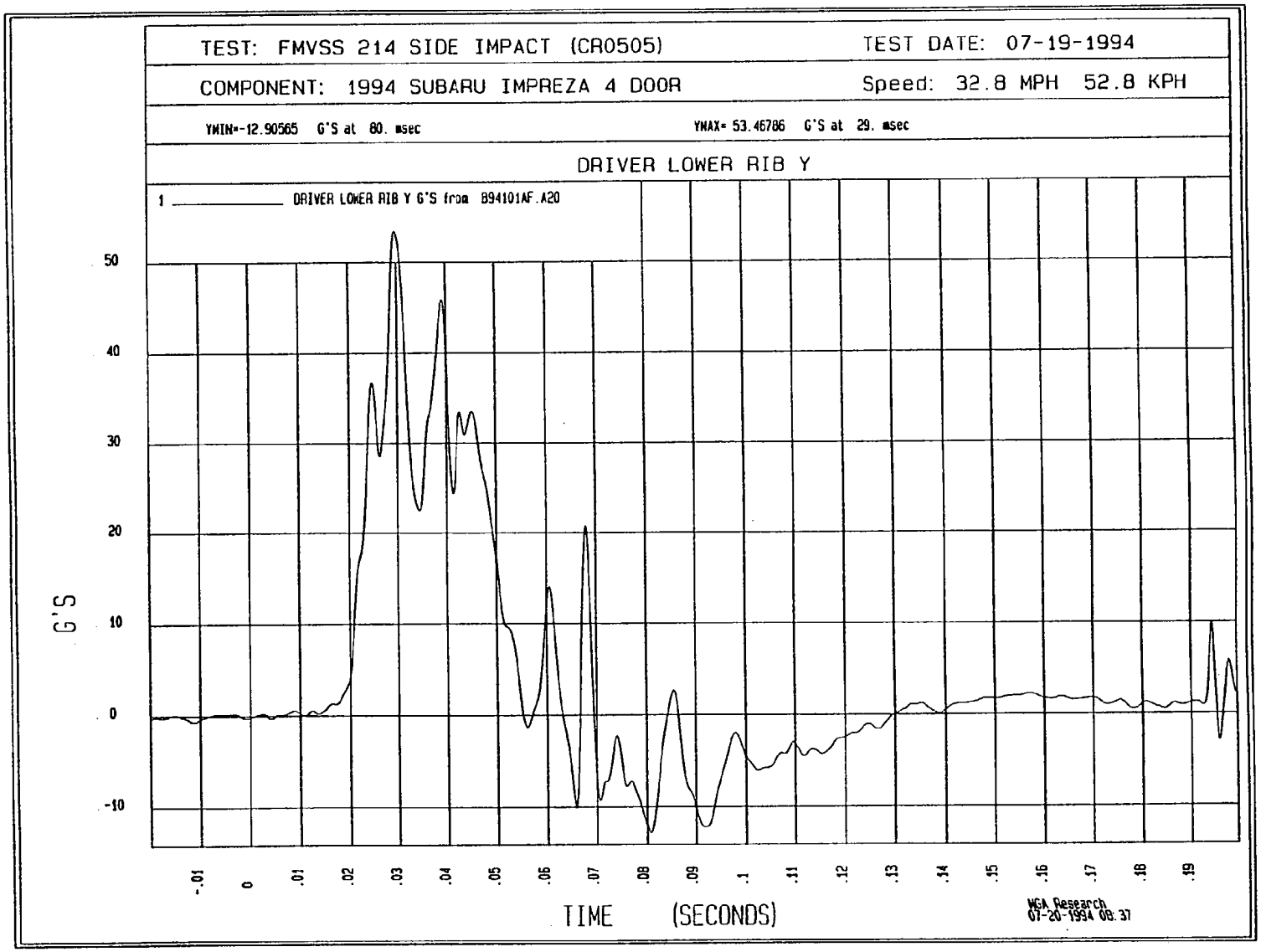


Figure B-3 - Driver Lower Rib Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

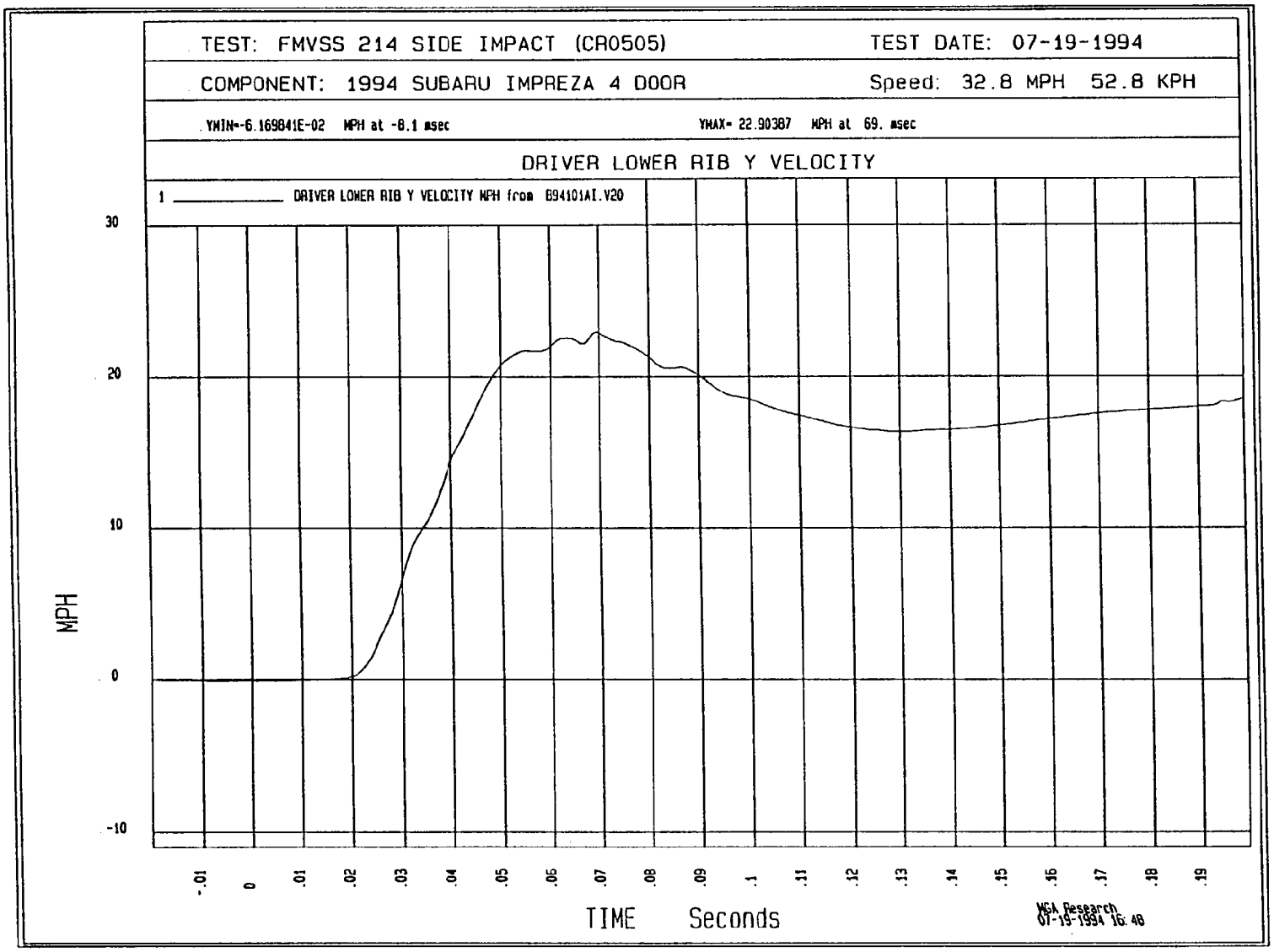


Figure B-4 - Driver Lower Rib Y Velocity vs. Time

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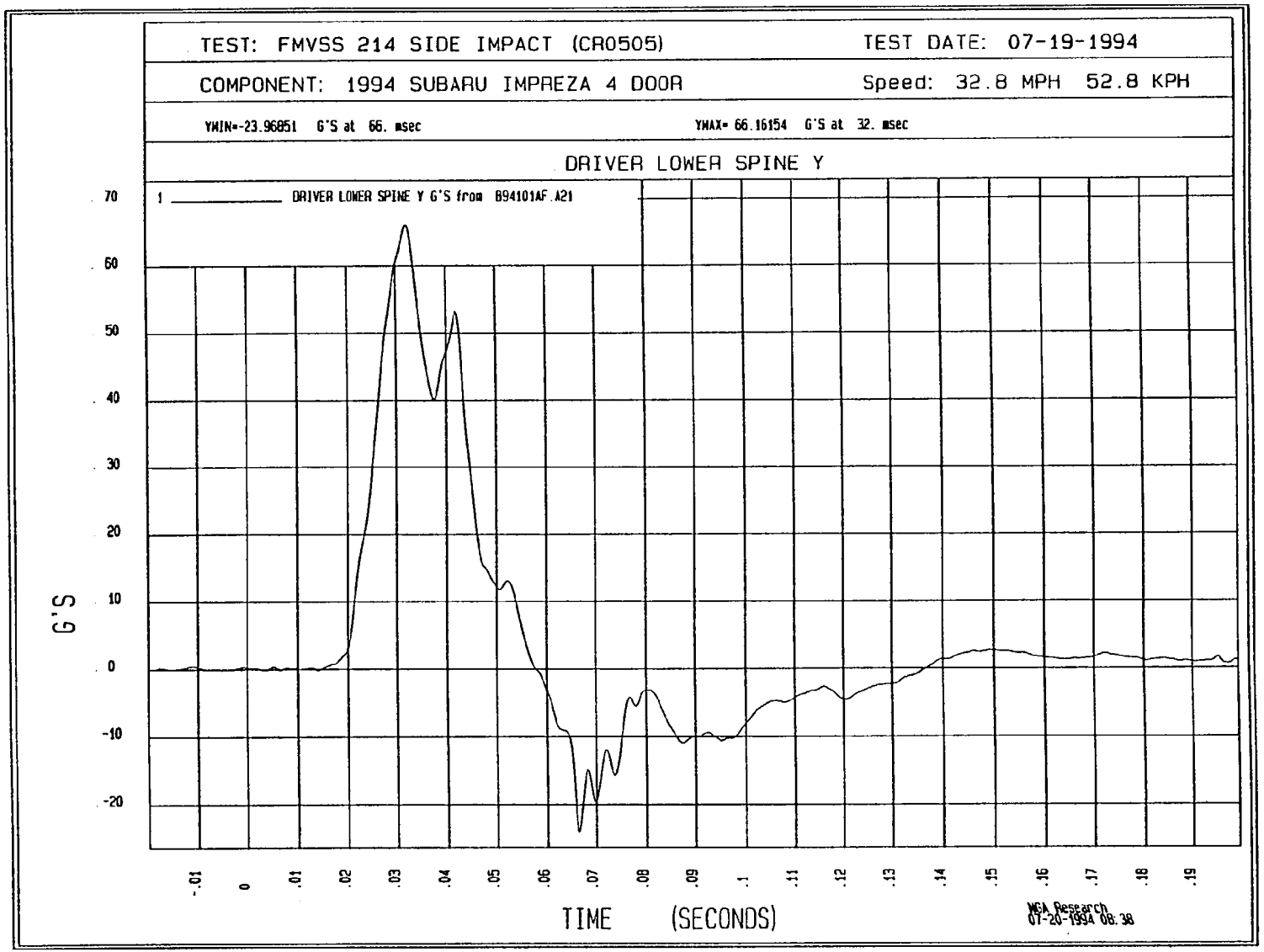


Figure B-5 - Driver Lower Spine Y Acceleration vs. Time

**Filter: Class 180 (300 Hz)**

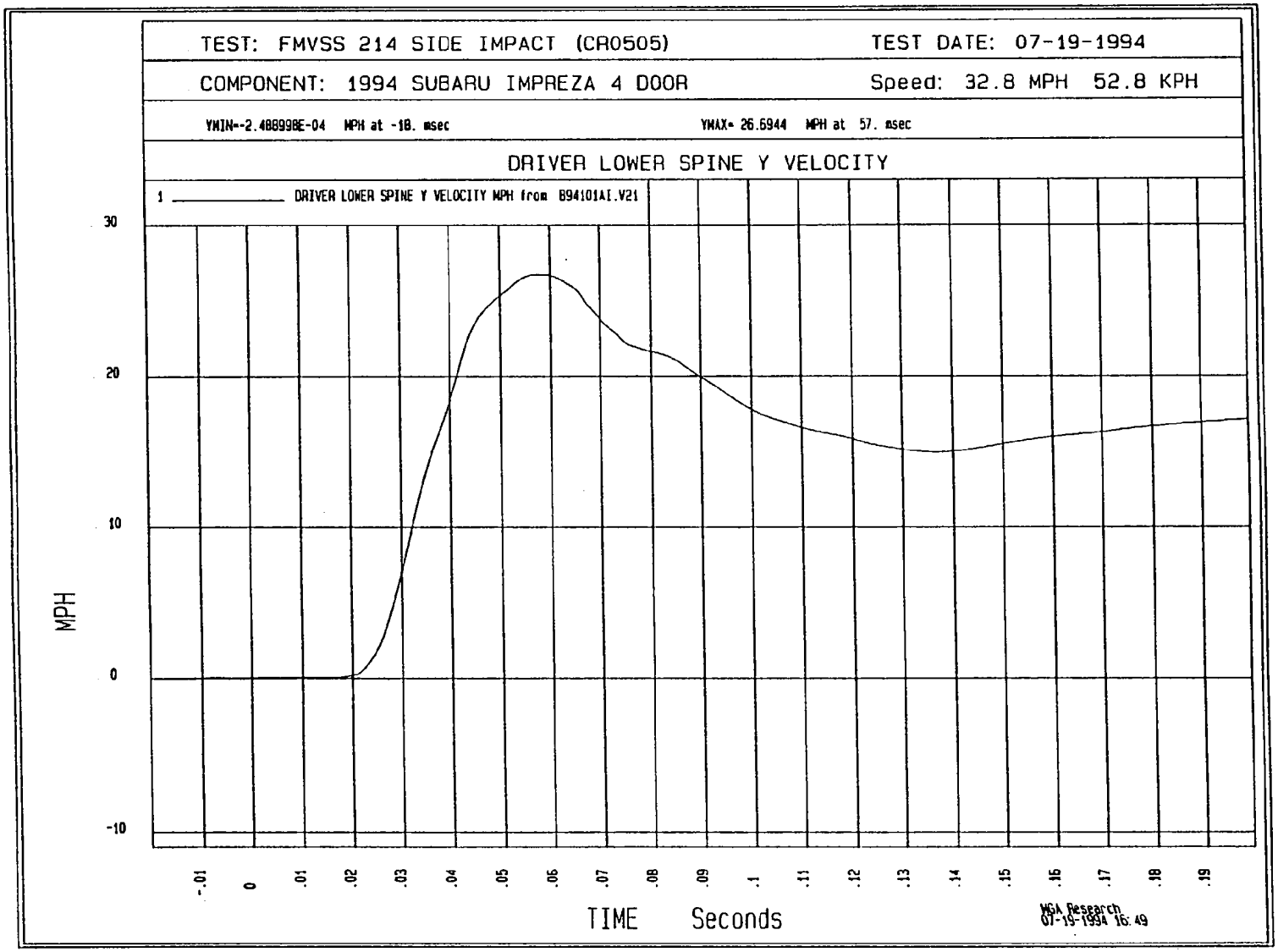


**Figure B-6 - Driver Lower Spine Y Velocity vs. Time**

Filter: Class 180 (300 Hz)

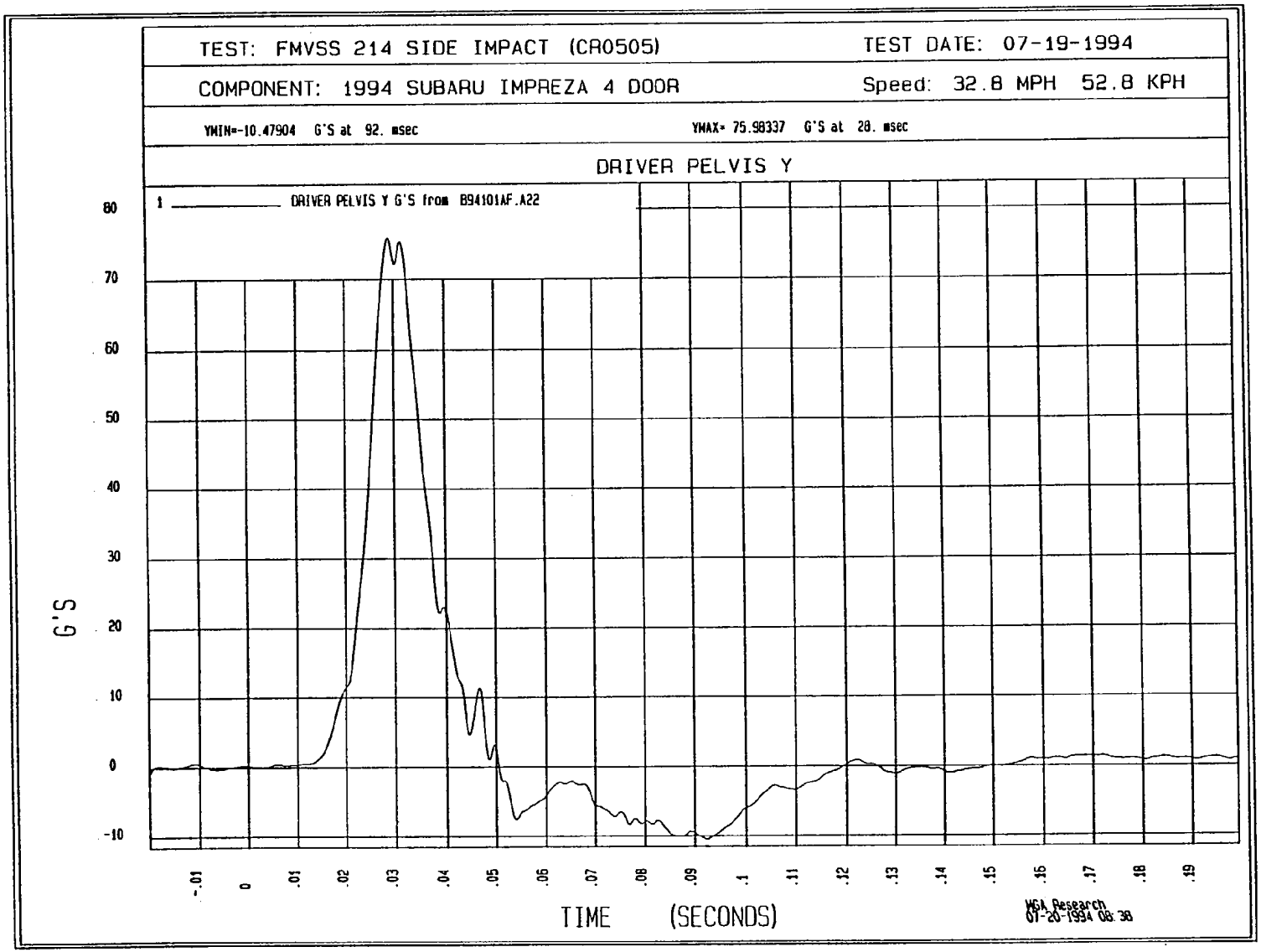


Figure B-7 - Driver Pelvis Y Acceleration vs. Time

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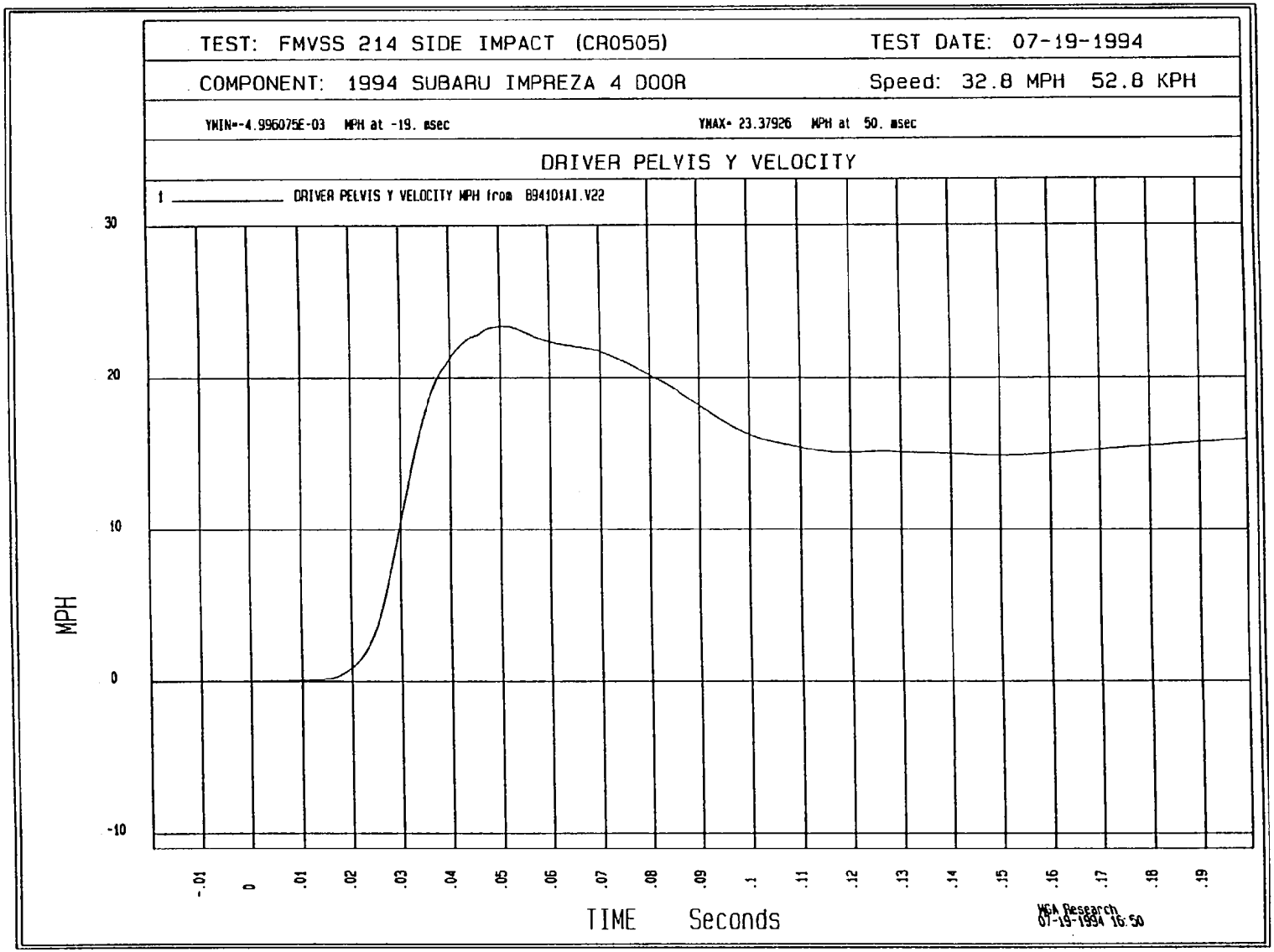


Figure B-8 - Driver Pelvis Y Velocity vs. Time

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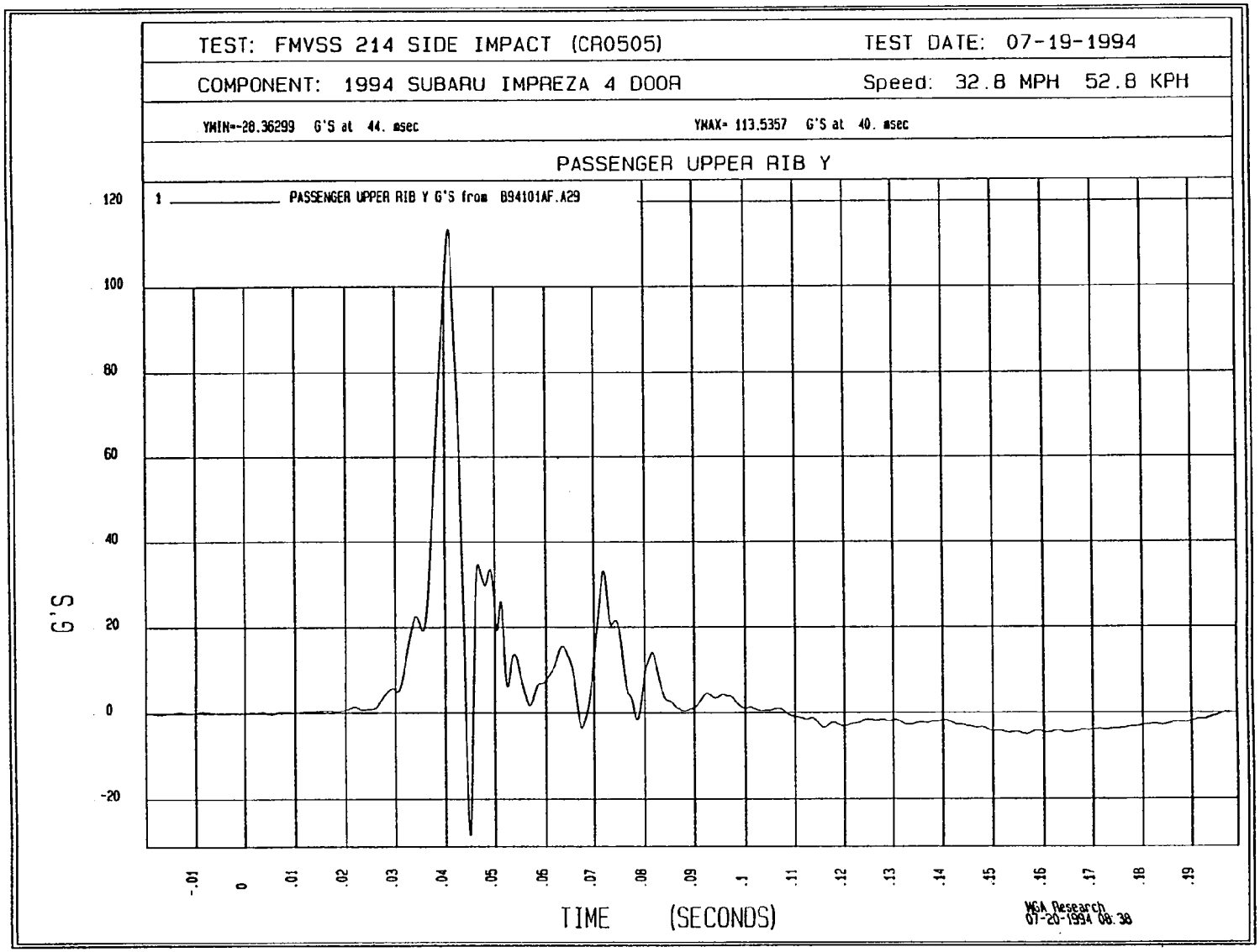



Figure B-9 - Passenger Upper Rib Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

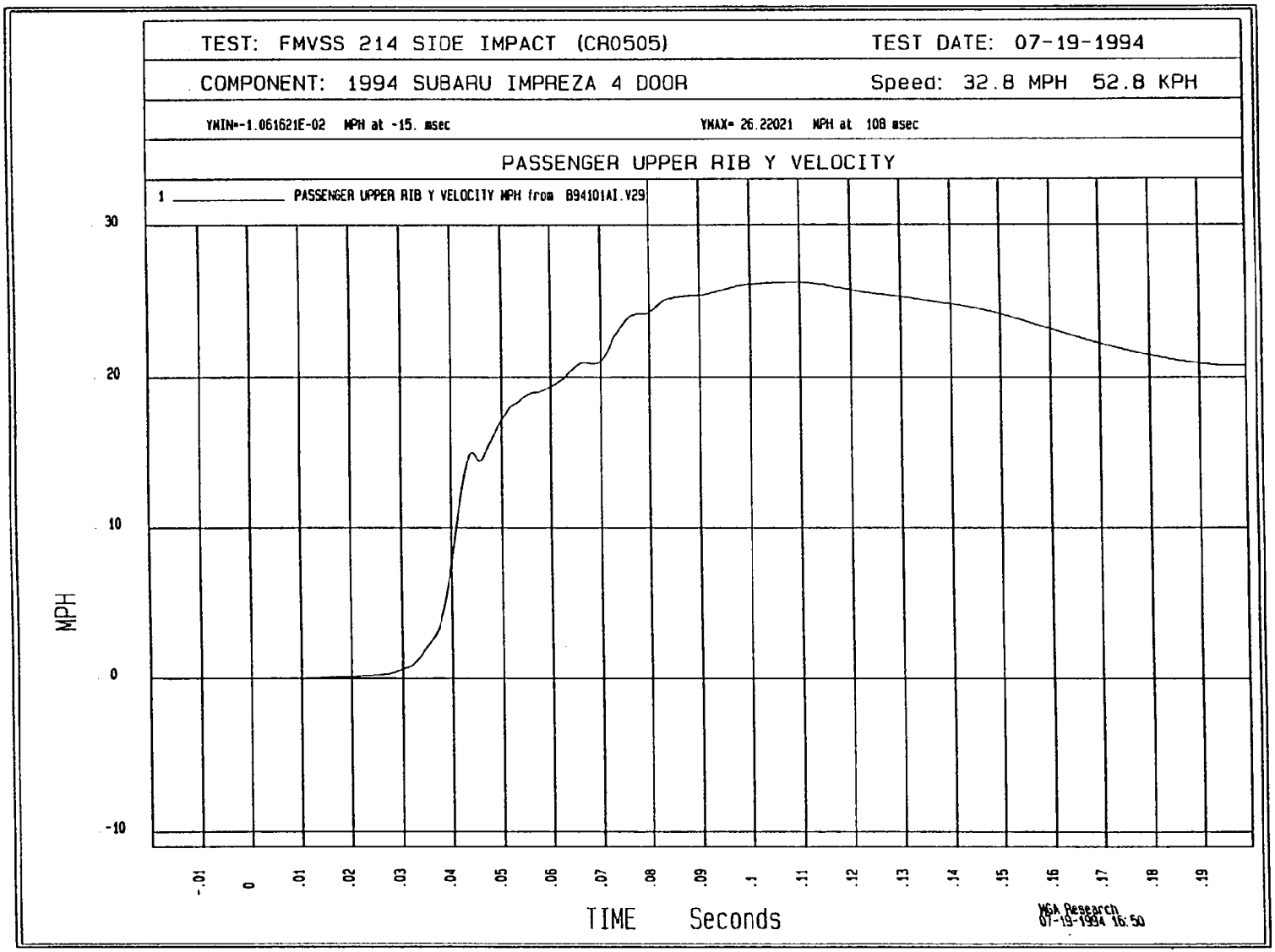



Figure B-10 - Passenger Upper Rib Y Velocity vs. Time

Filter: Class 180 (300 Hz)

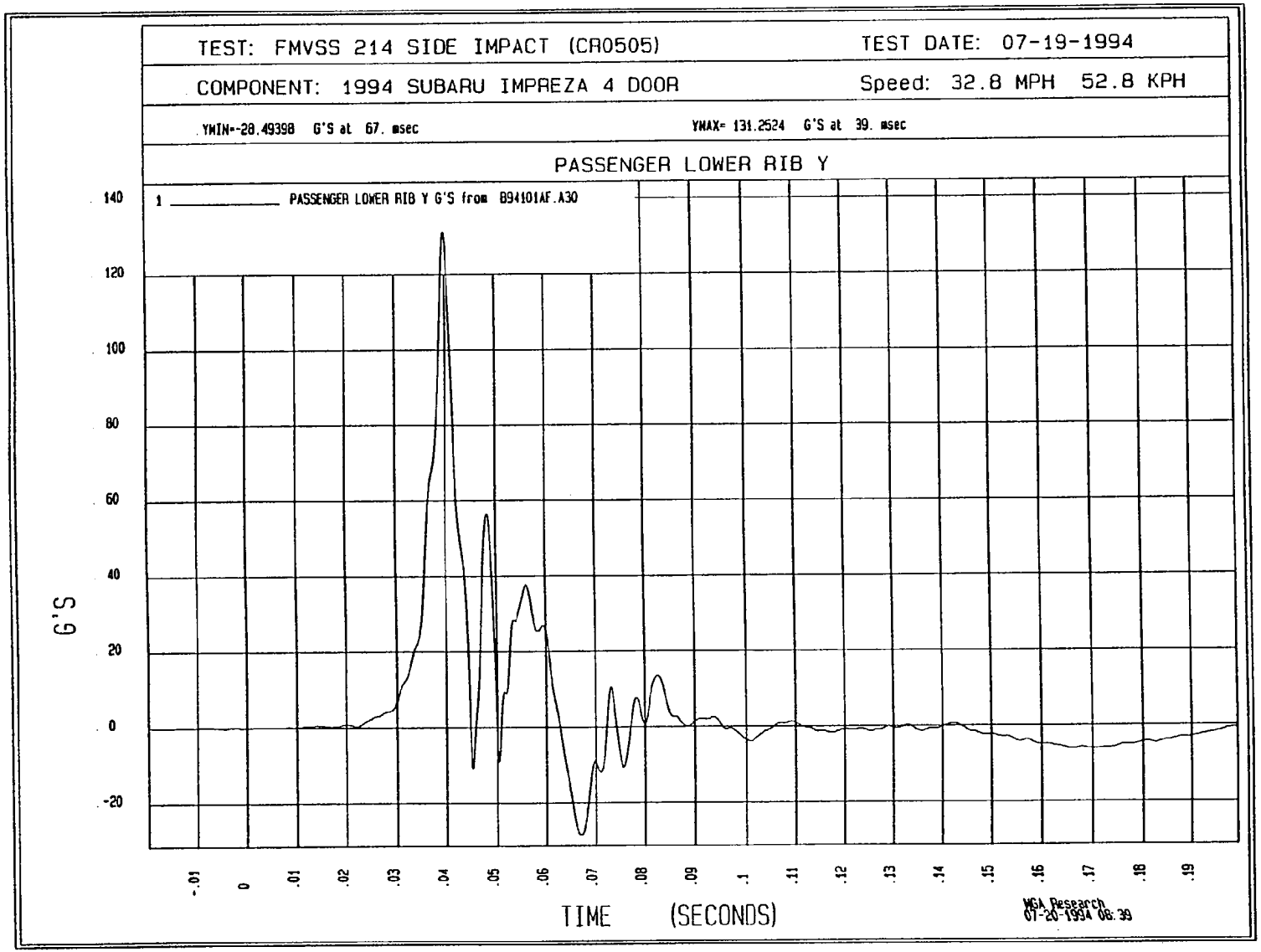



Figure B-11 - Passenger Lower Rib Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

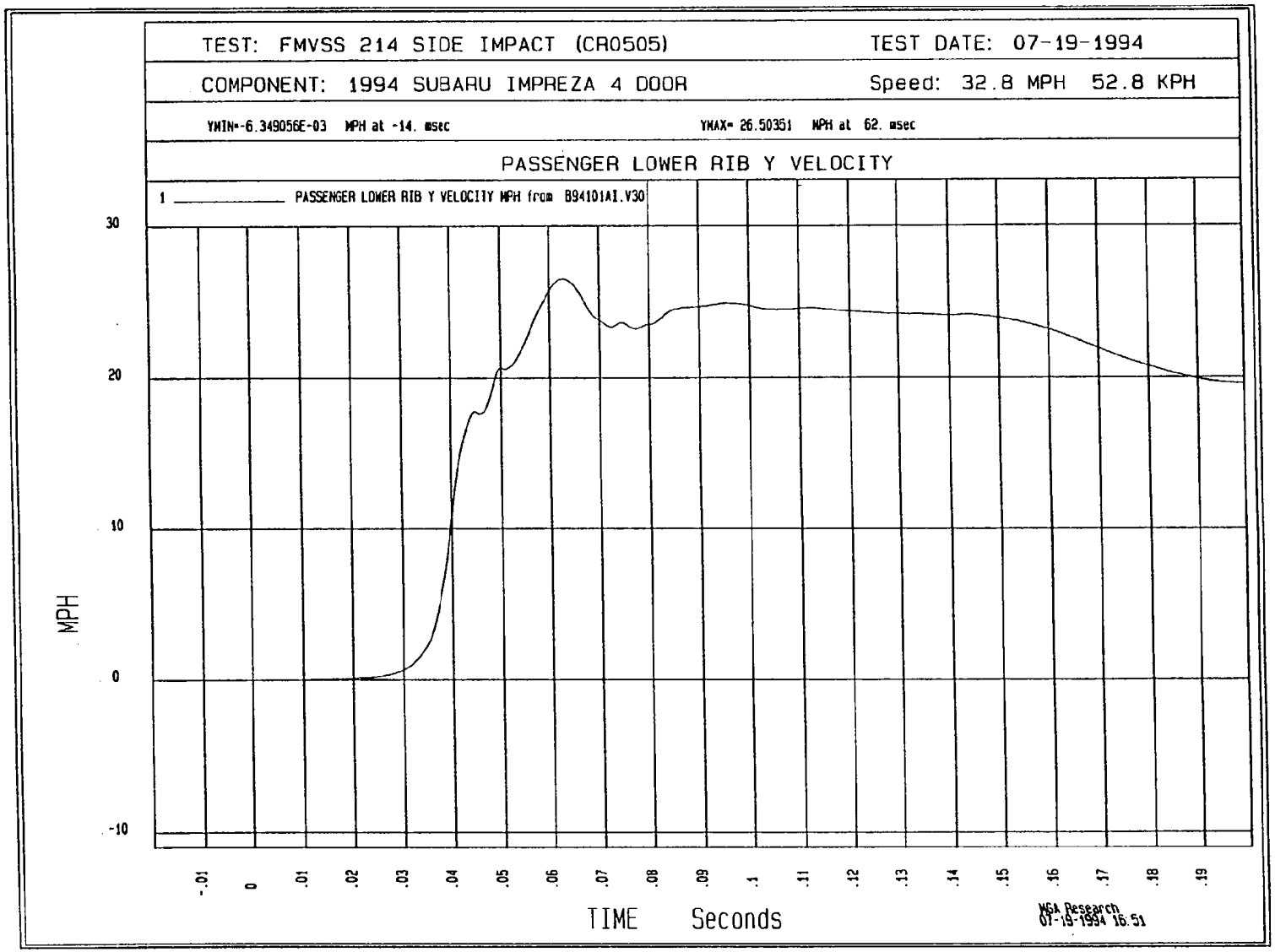



Figure B-12 - Passenger Lower Rib Y Velocity vs. Time

Filter: Class 180 (300 Hz)

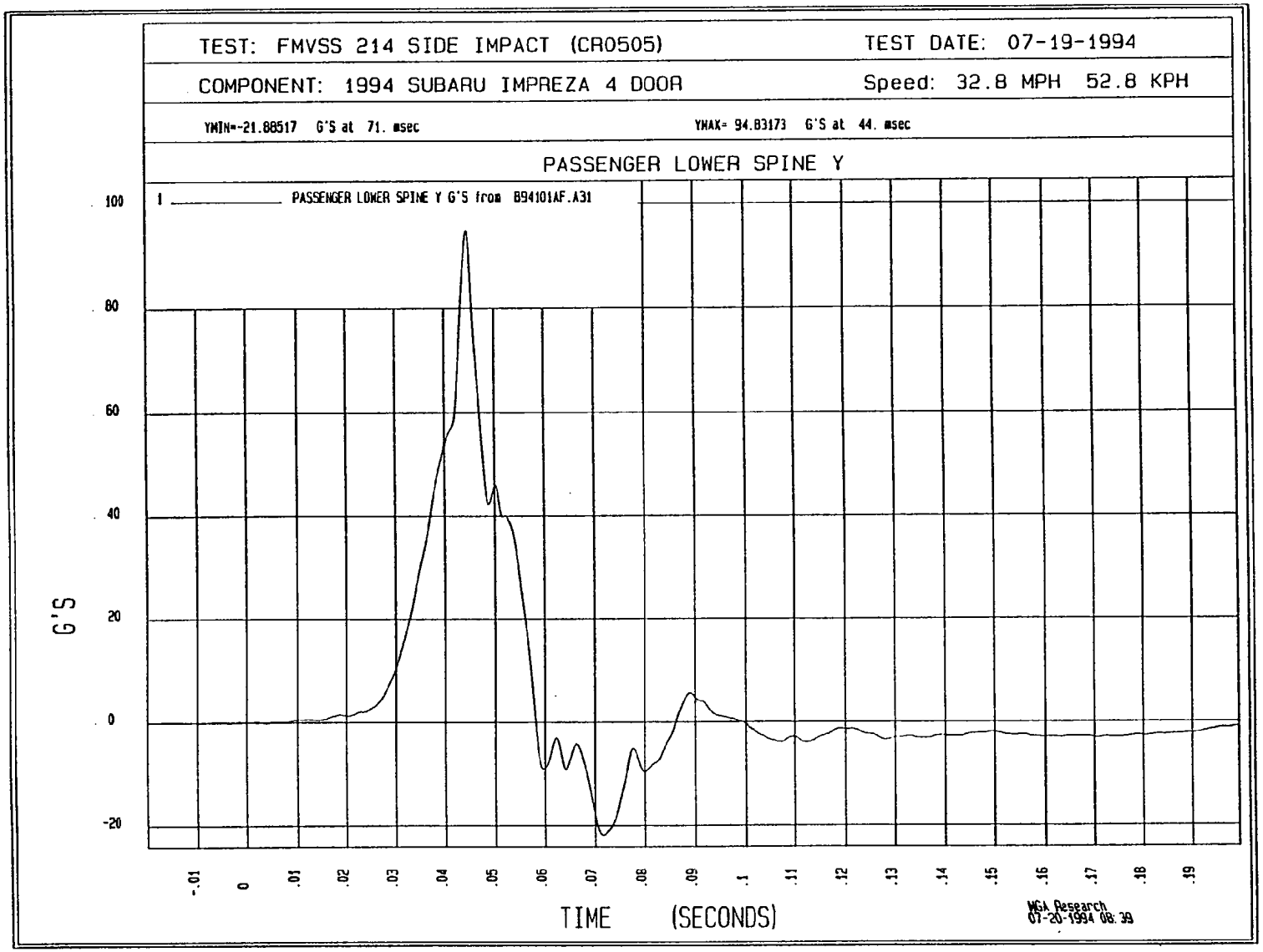



Figure B-13 - Passenger Lower Spine Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

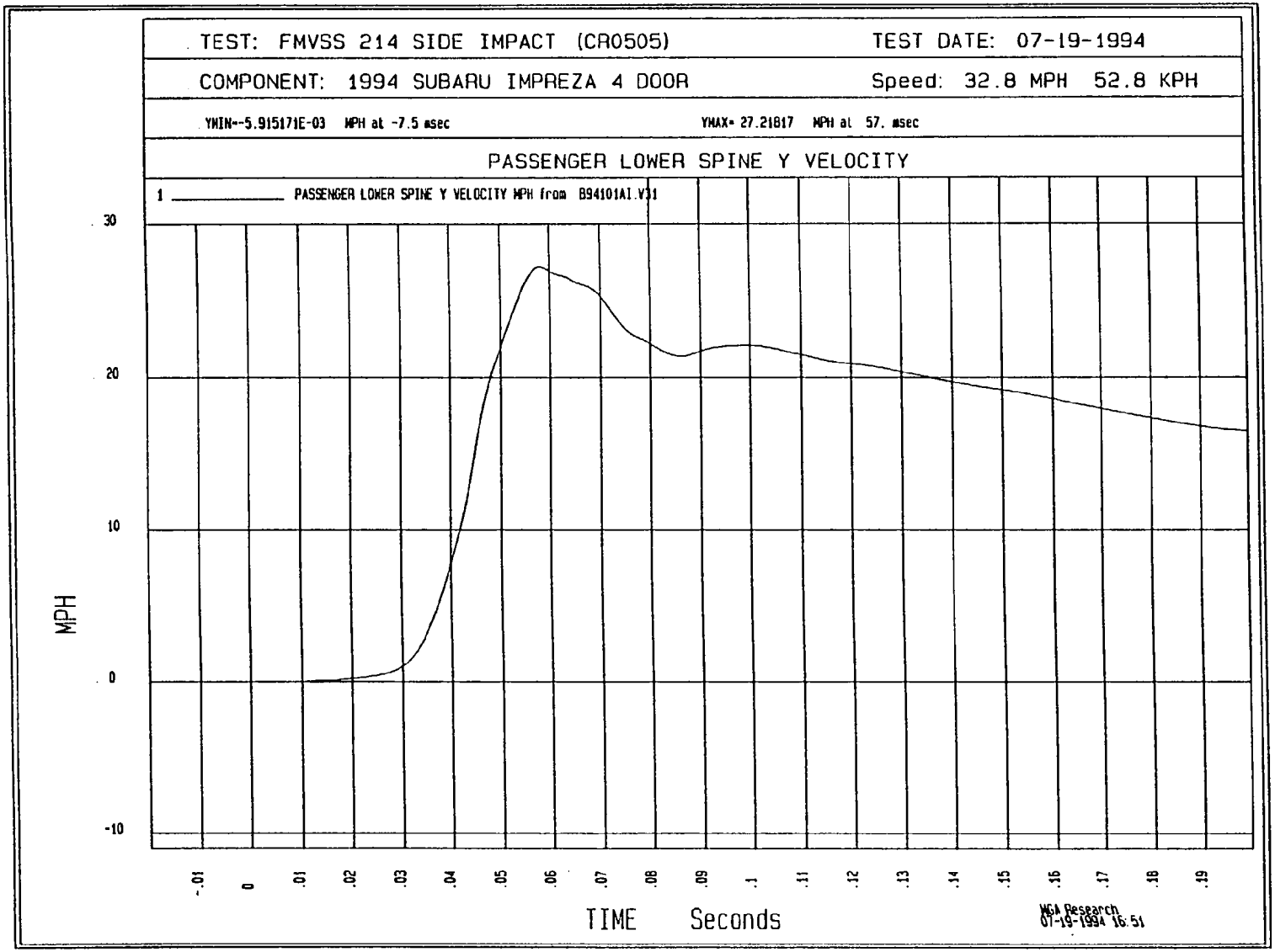



Figure B-14 - Passenger Lower Spine Y Velocity vs. Time

Filter: Class 180 (300 Hz)

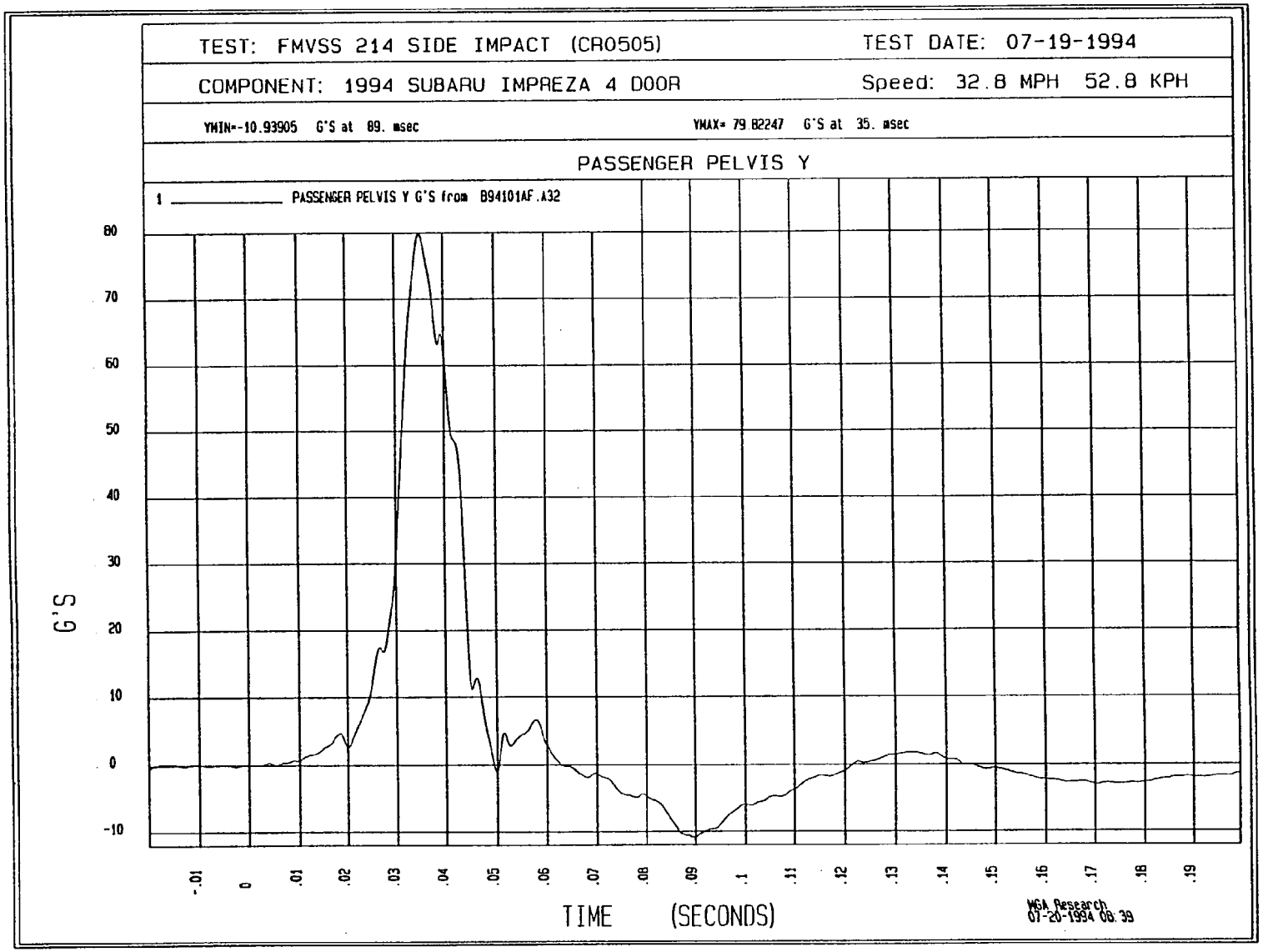



Figure B-15 - Passenger Pelvis Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

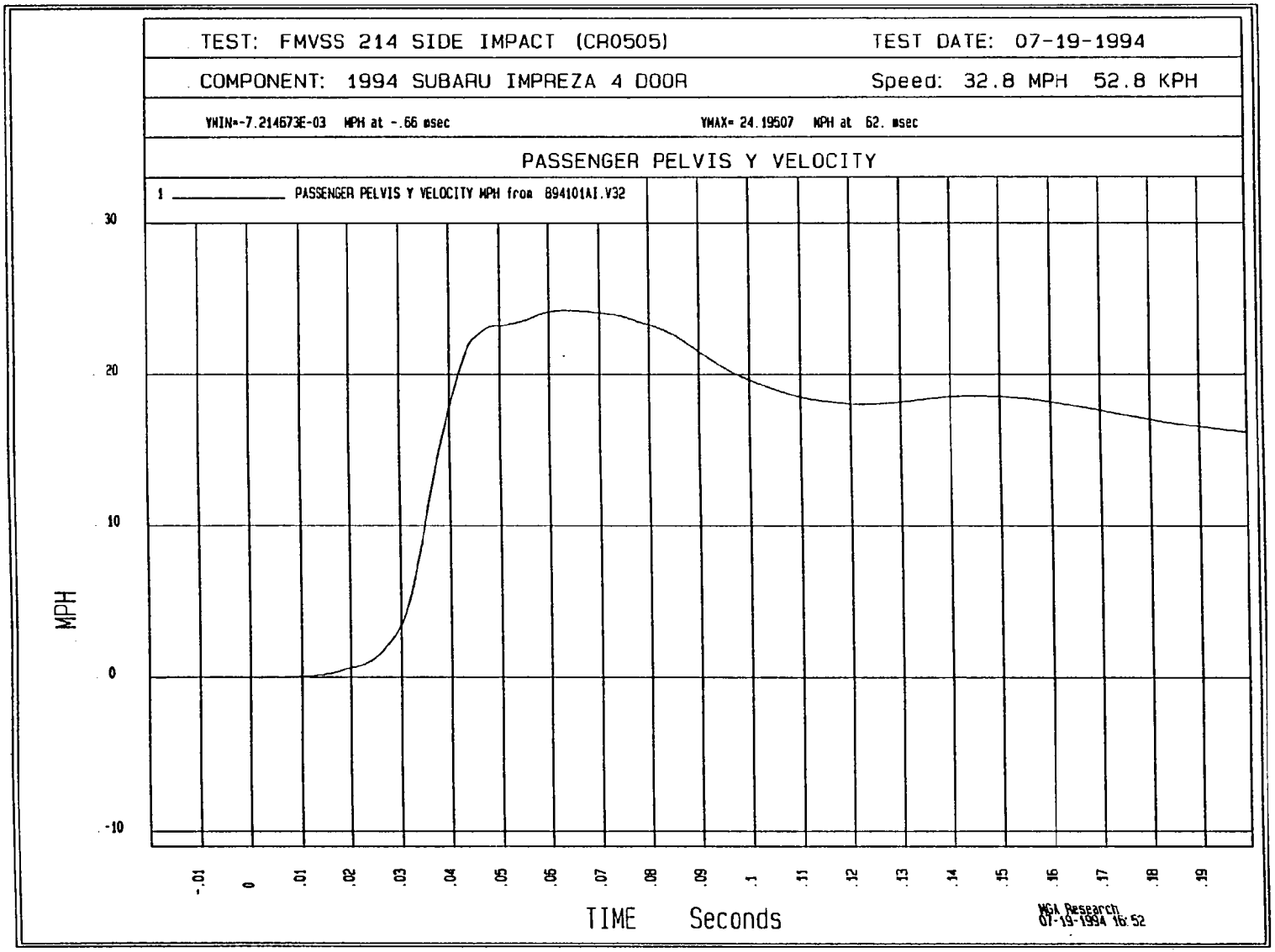



Figure B-16 - Passenger Pelvis Y Velocity vs. Time

Filter: Class 60 (100 Hz)

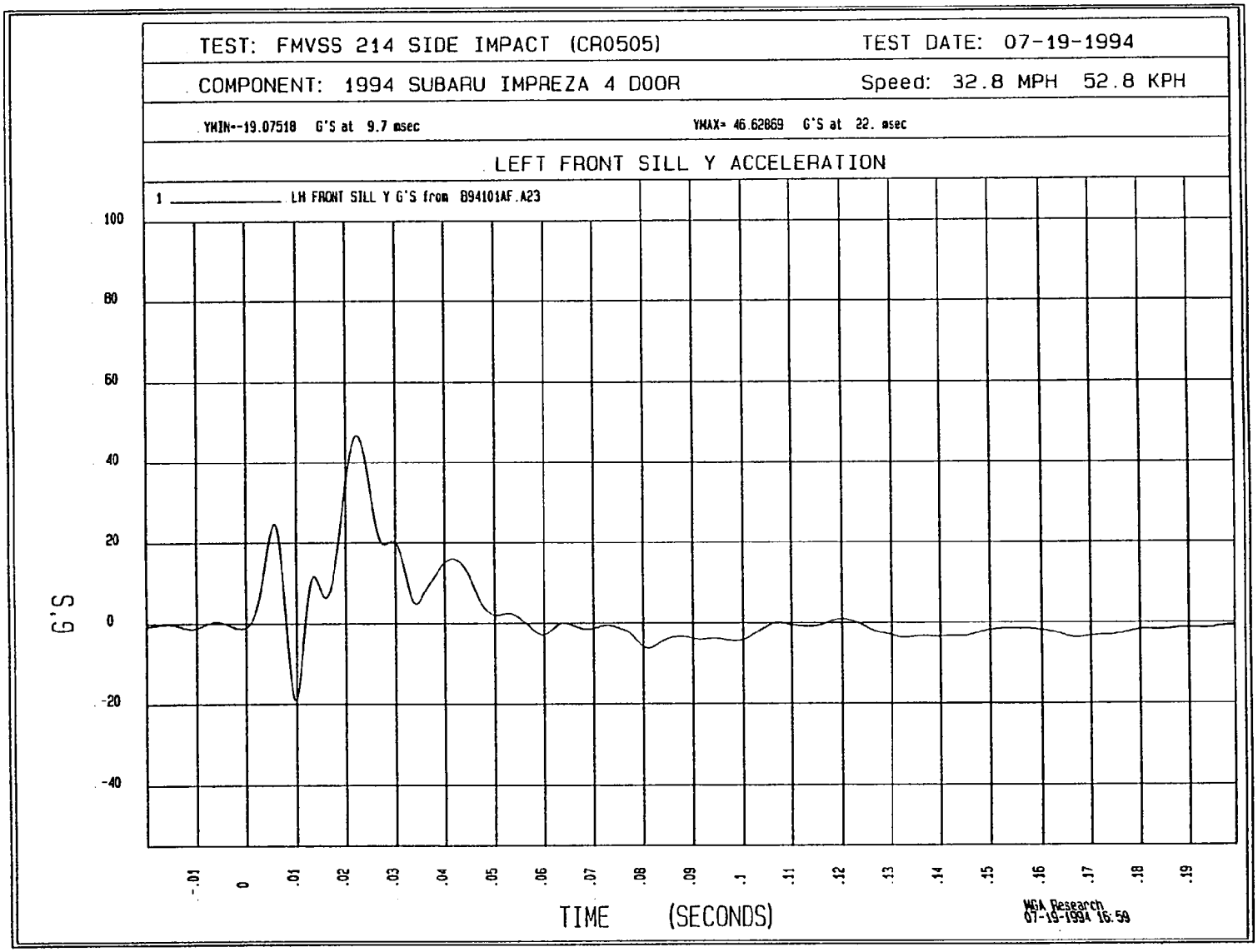



Figure B-17 - Left Front Sill Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

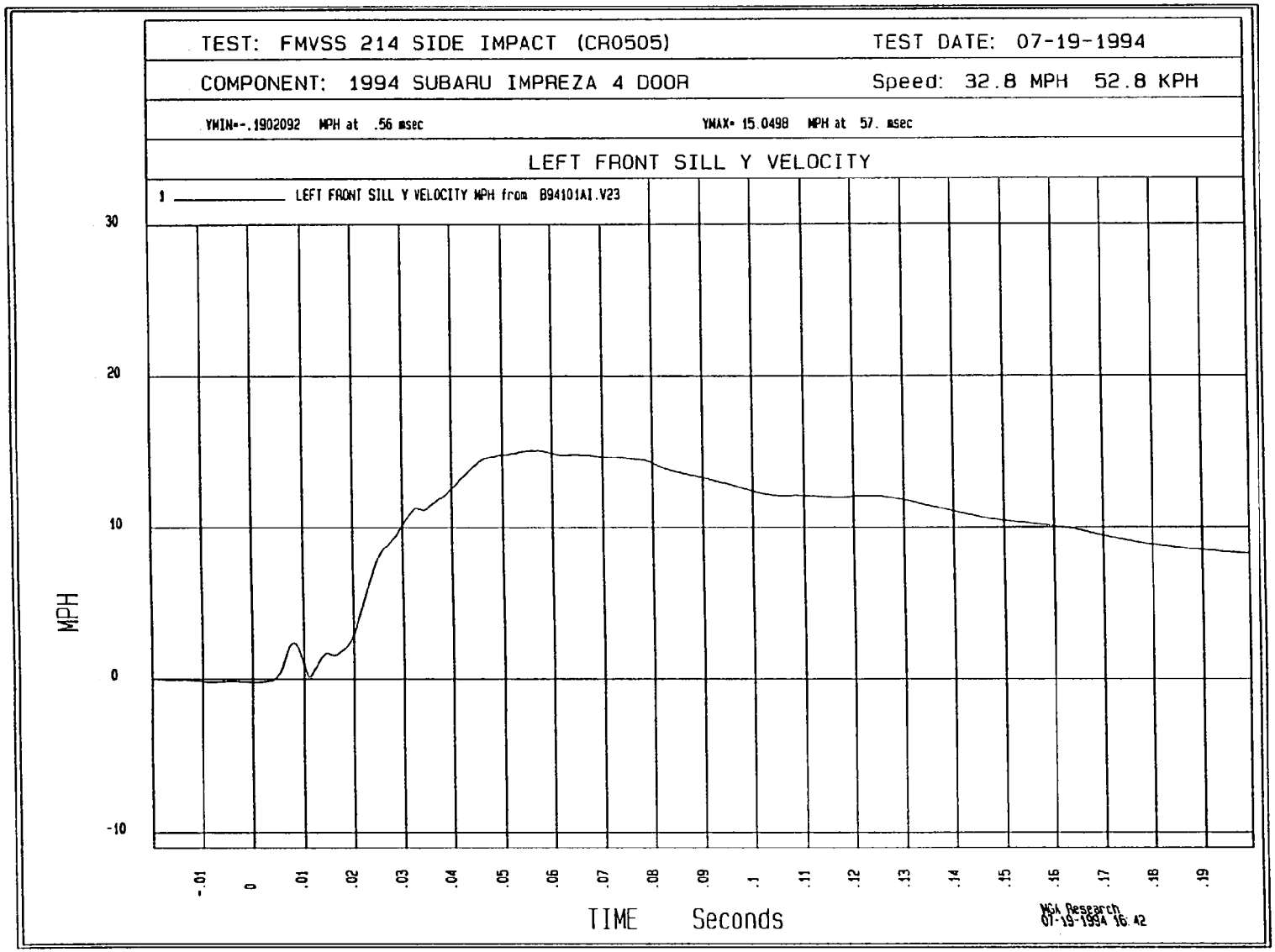



Figure B-18 - Left Front Sill Y Velocity vs. Time

Filter: Class 60 (100 Hz)

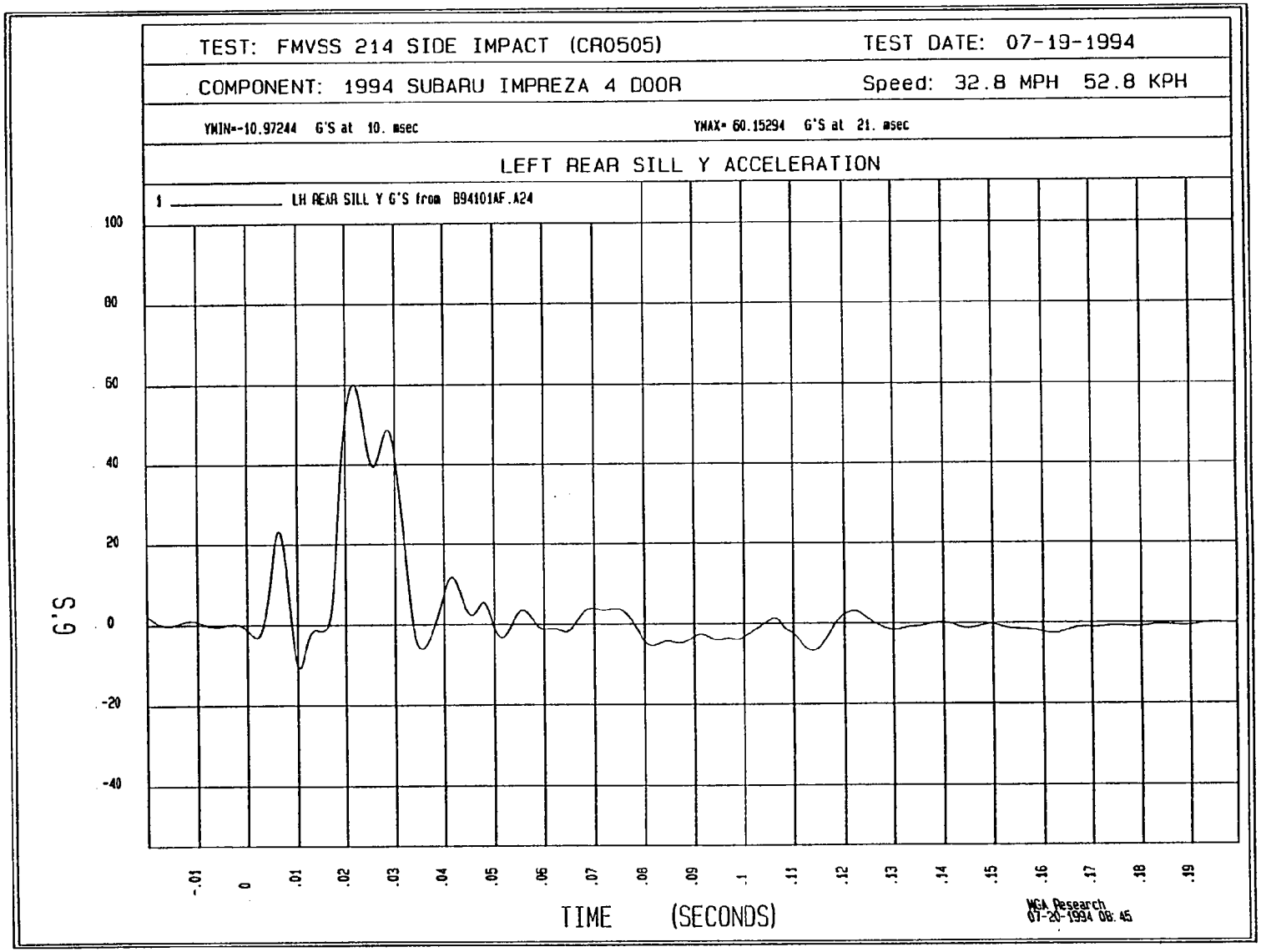



Figure B-19 - Left Rear Sill Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

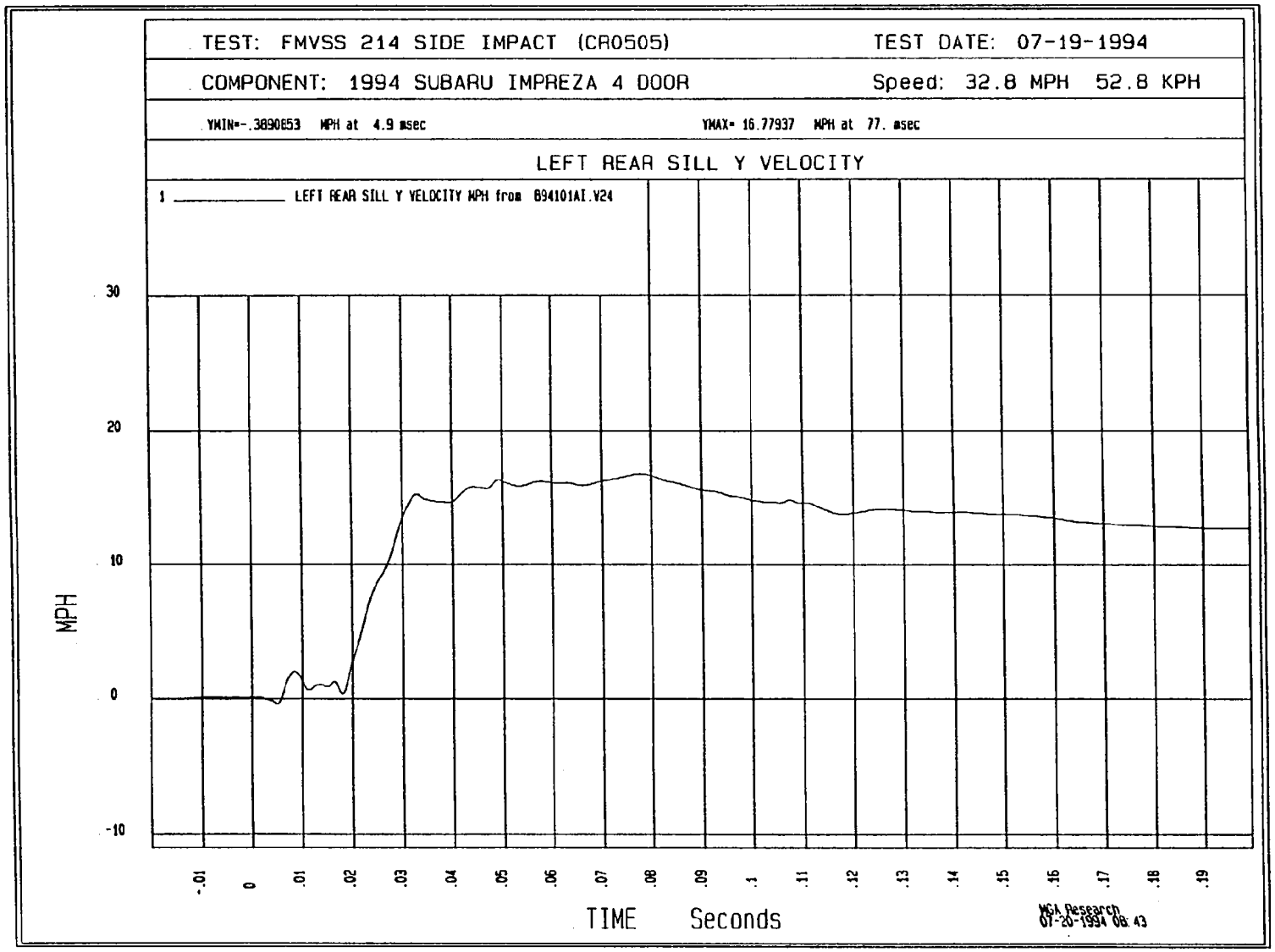



Figure B-20 - Left Rear Sill Y Velocity vs. Time

**Filter: Class 60 (100 Hz)**

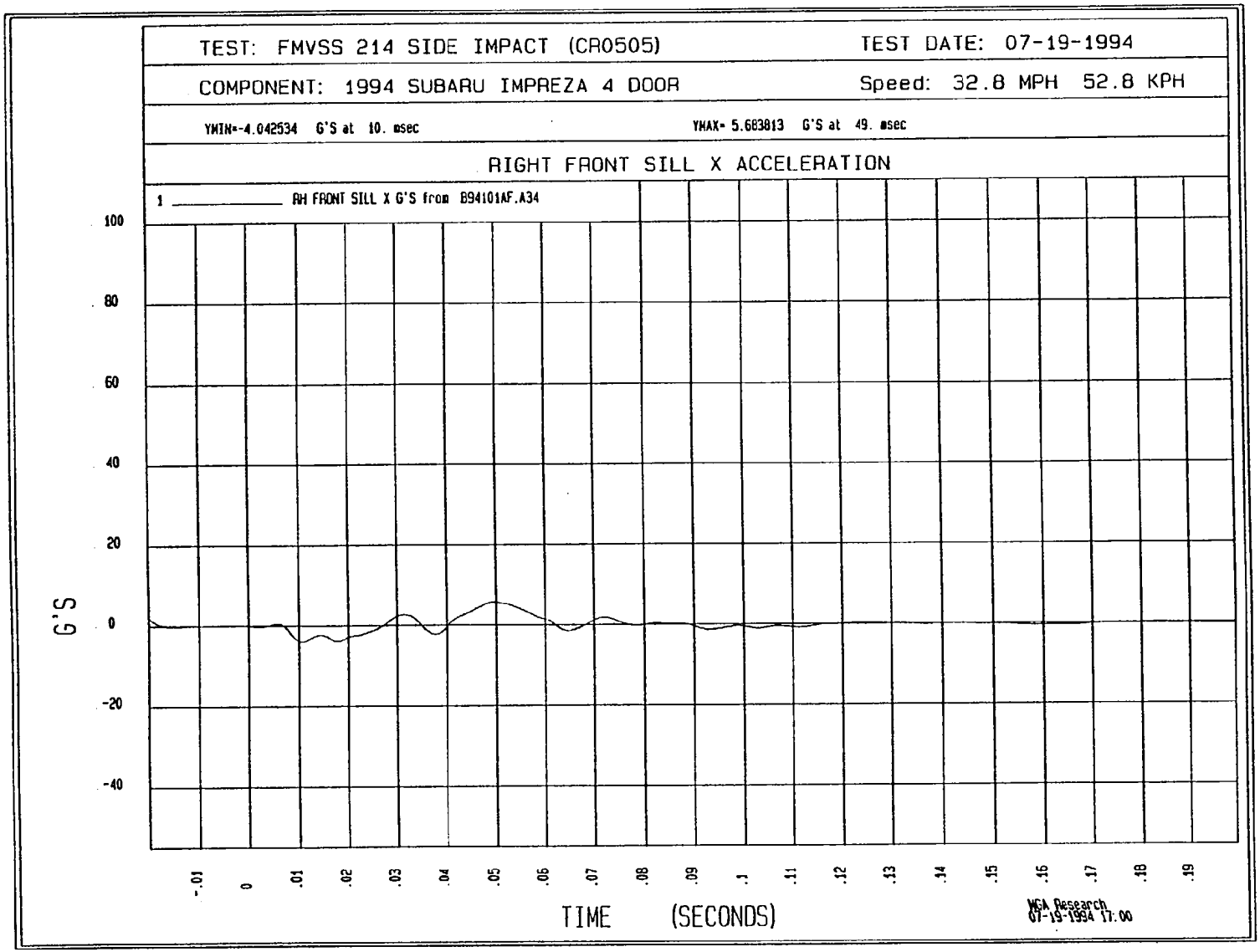



Figure B-21 - Right Front Sill X Acceleration vs. Time

Filter: Class 180 (300 Hz)

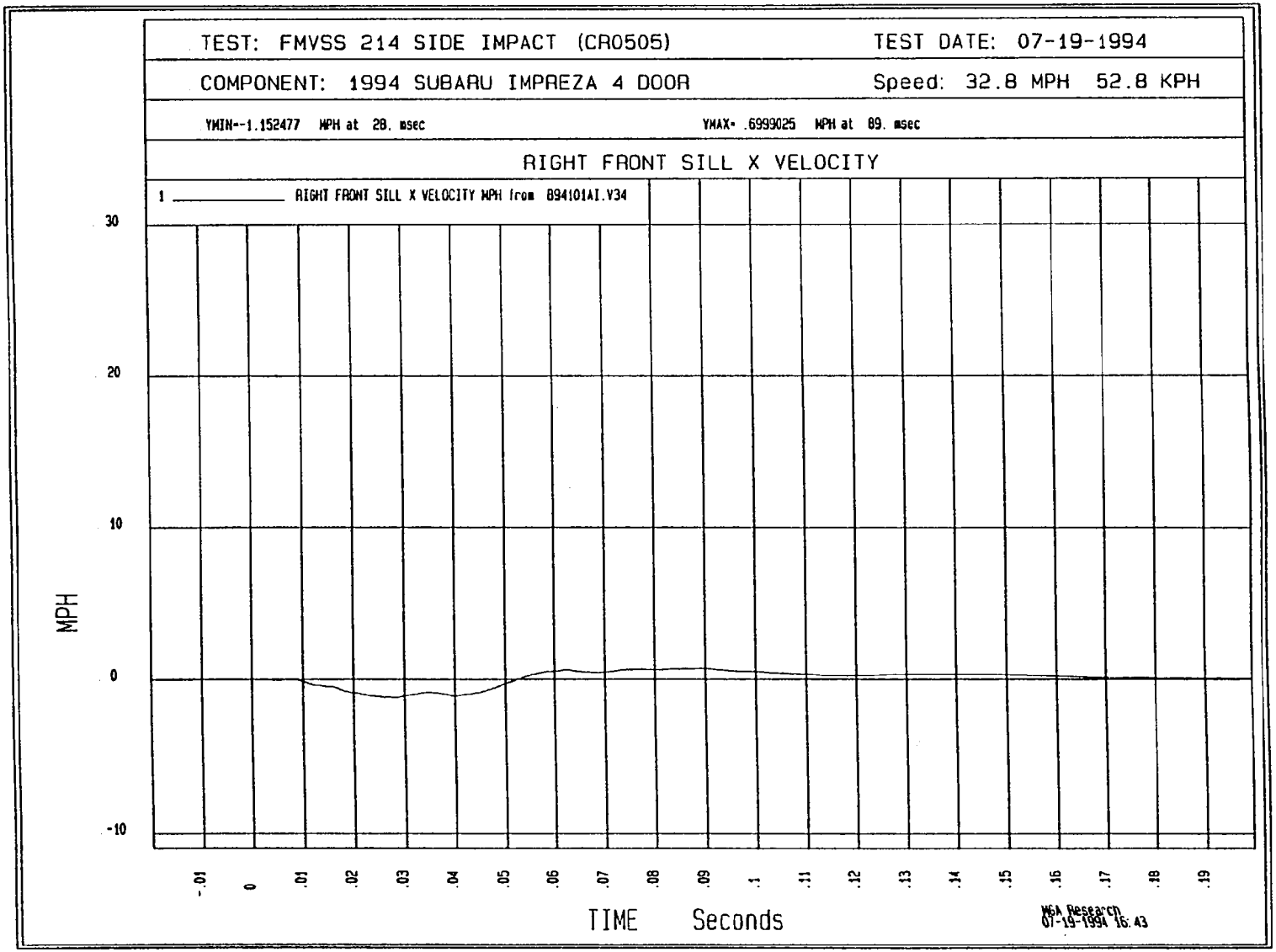



Figure B-22 - Right Front Sill X Velocity vs. Time

Filter: Class 60 (100 Hz)

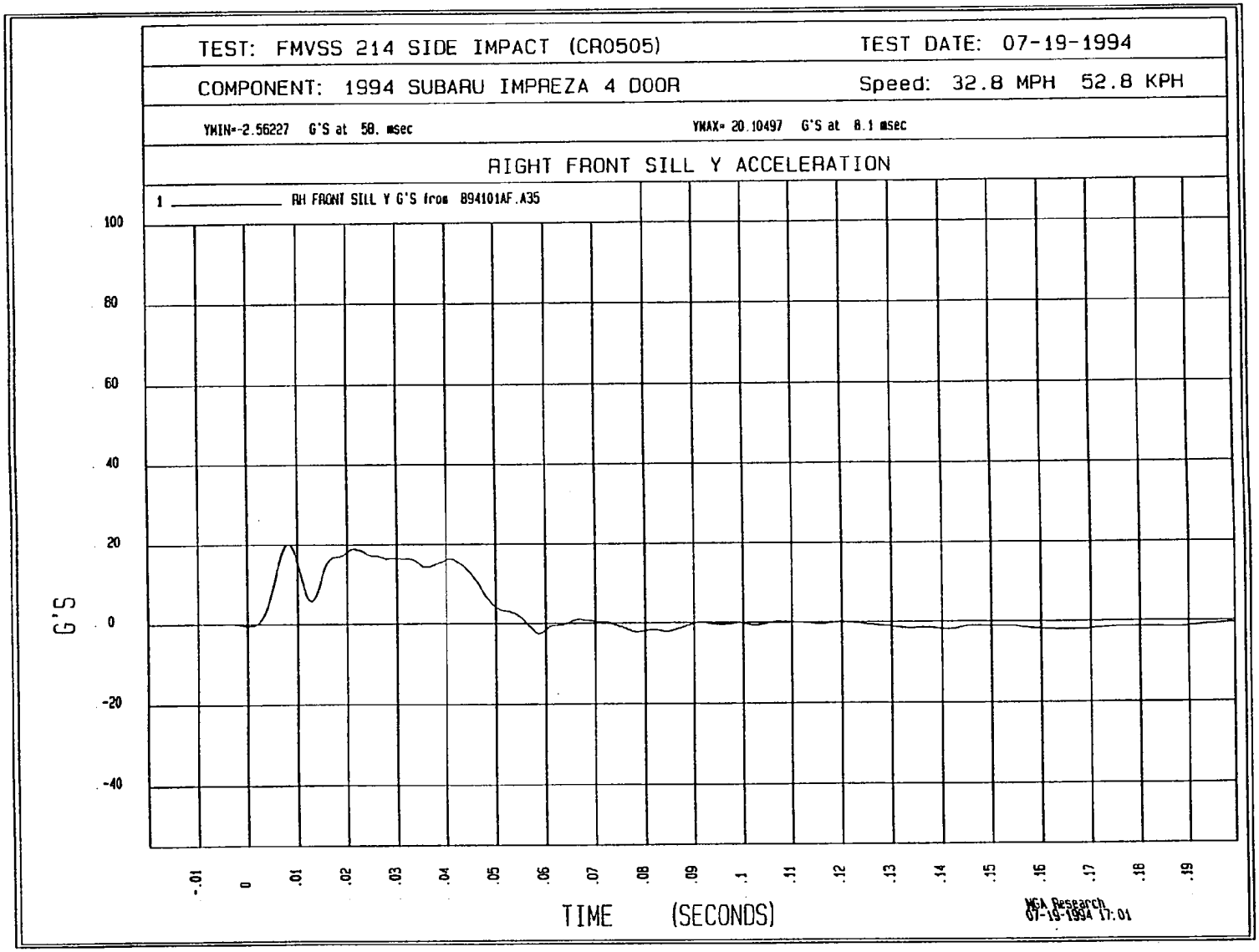



Figure B-23 - Right Front Sill Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

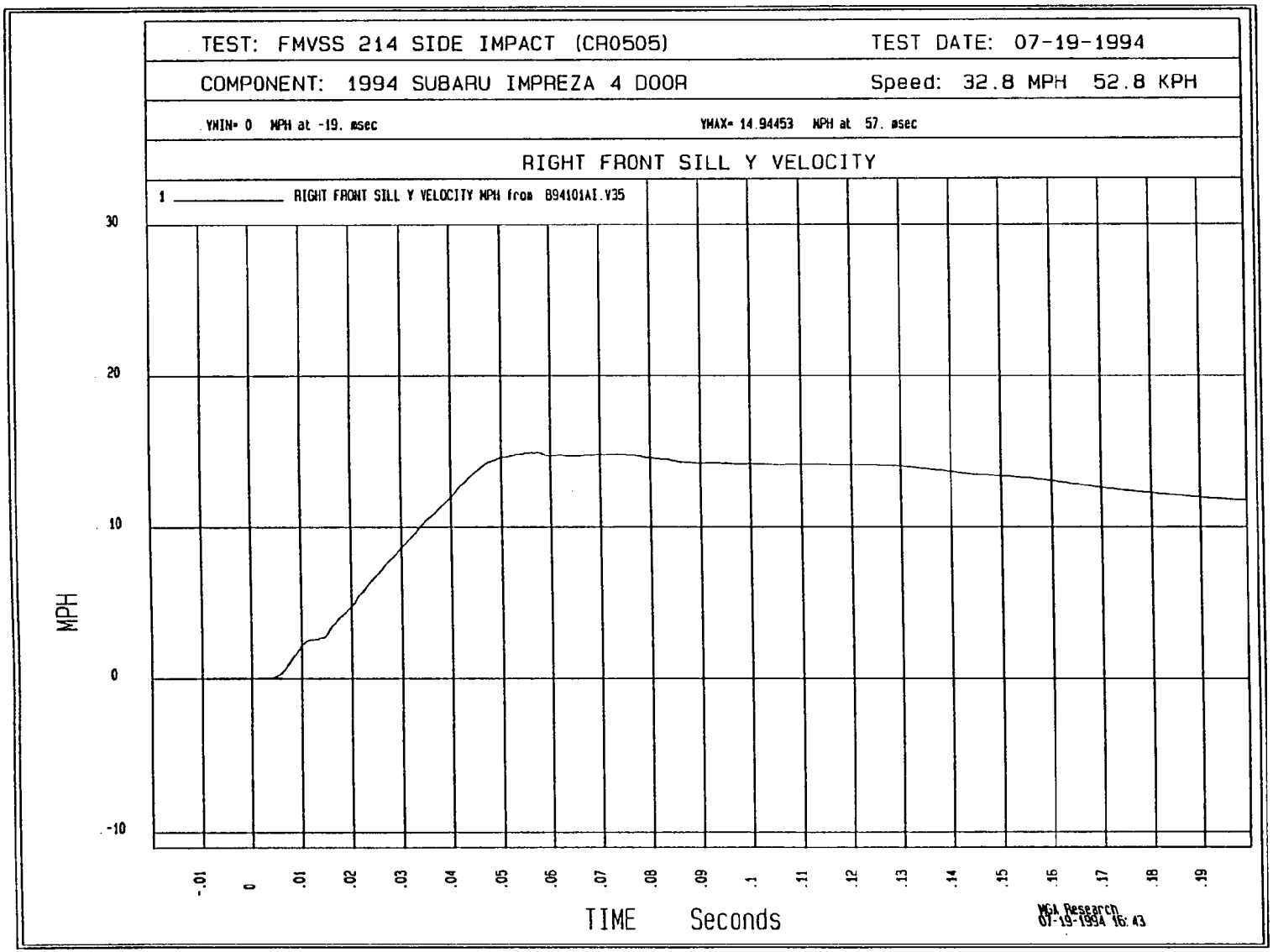



Figure B-24 - Right Front Sill Y Velocity vs. Time

Filter: Class 60 (100 Hz)

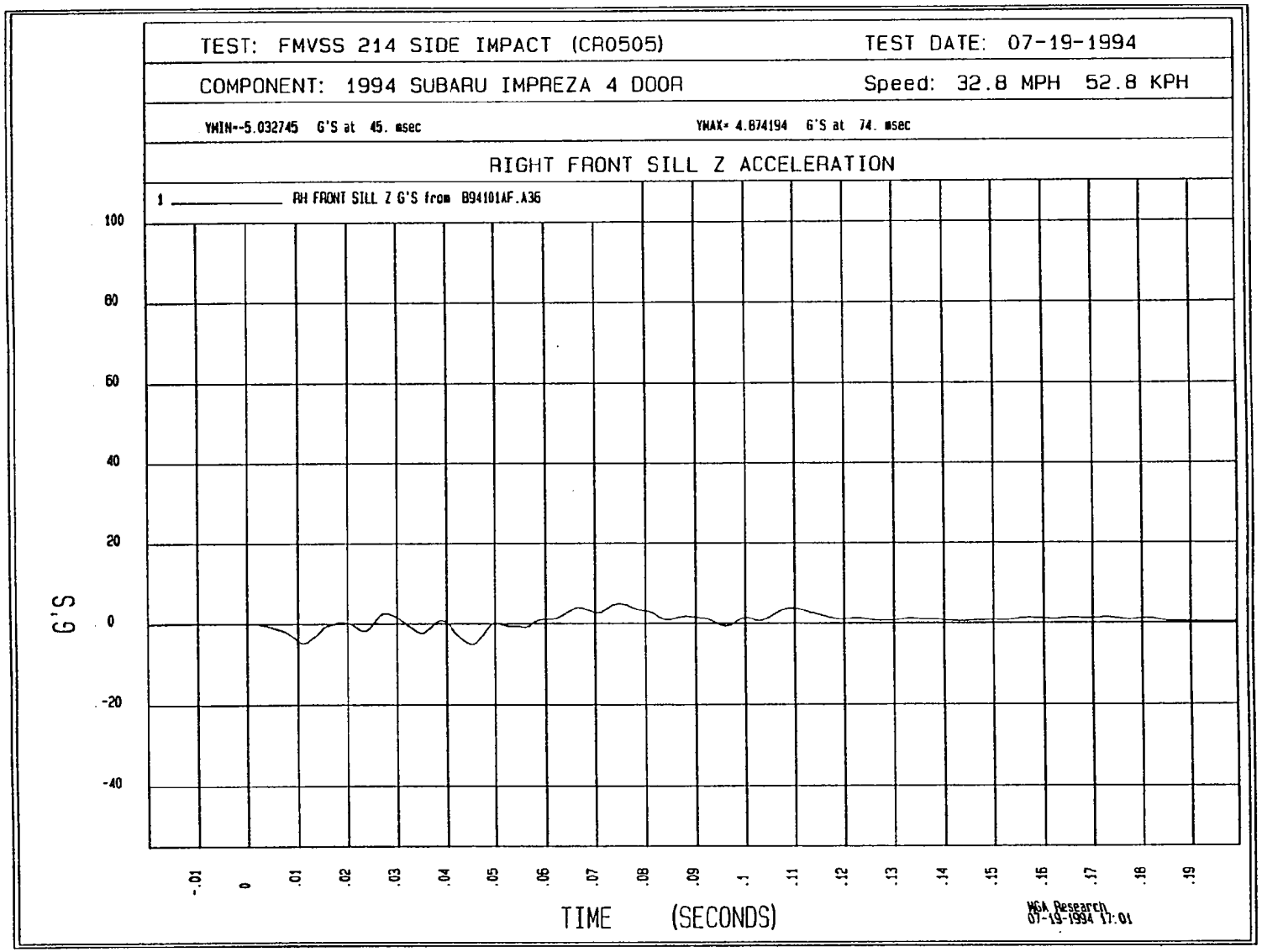



Figure B-25 - Right Front Sill Z Acceleration vs. Time

Filter: Class 180 (300 Hz)

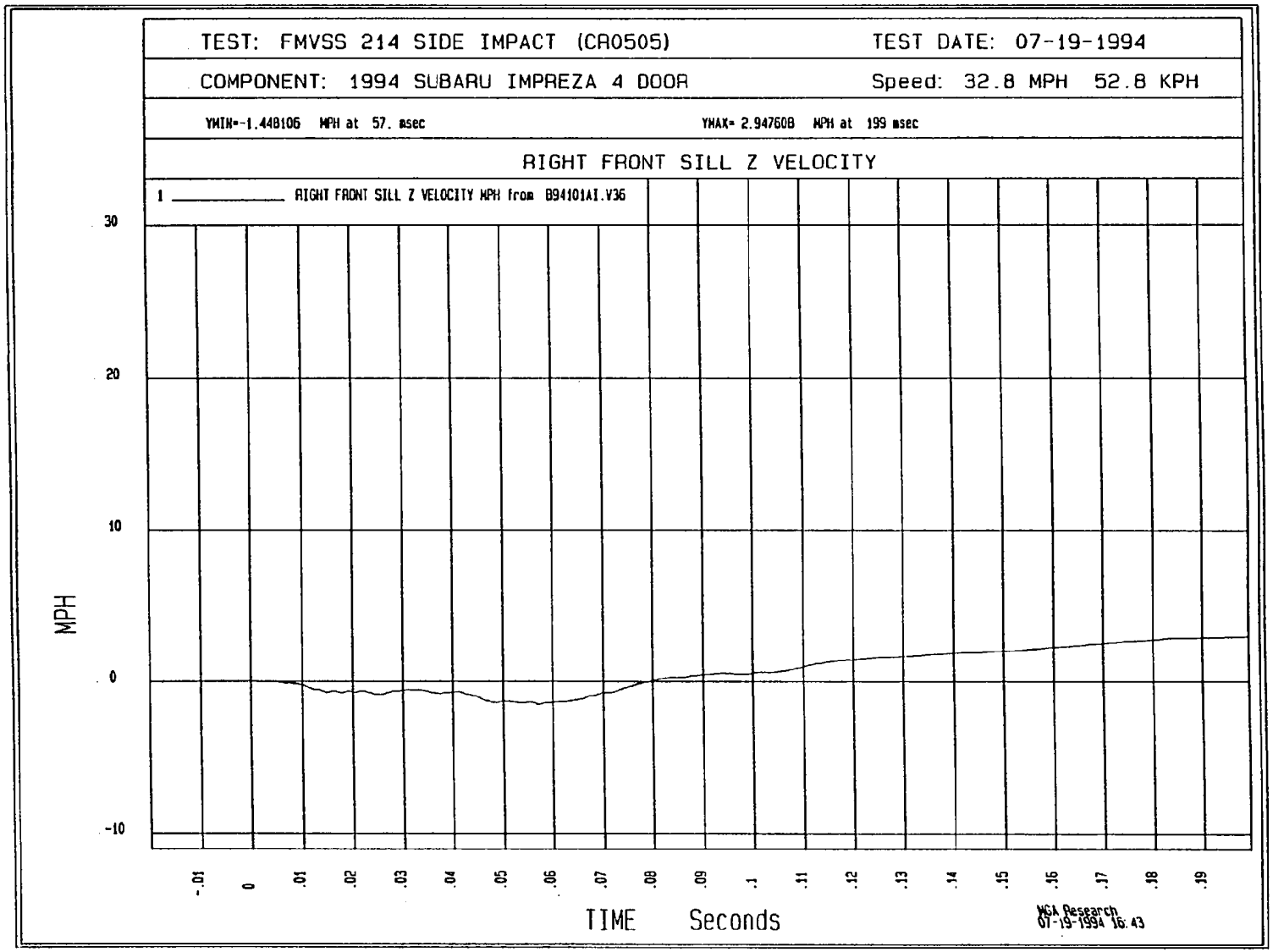



Figure B-26 - Right Front Sill Z Velocity vs. Time

Filter: Class 60 (100 Hz)

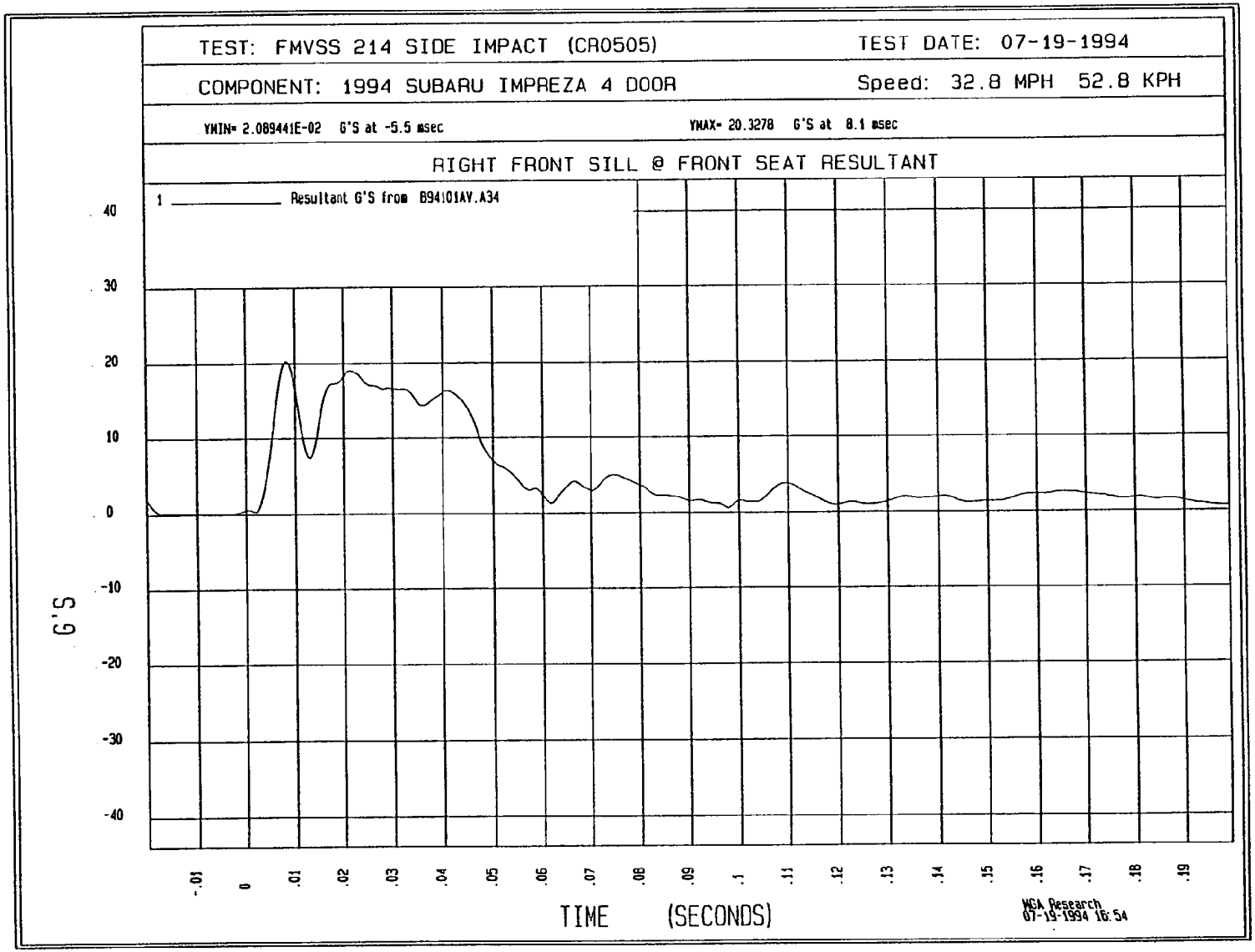



Figure B-27 - Right Front Sill at Front Seat Resultant vs. Time

**Filter: Class 60 (100 Hz)**

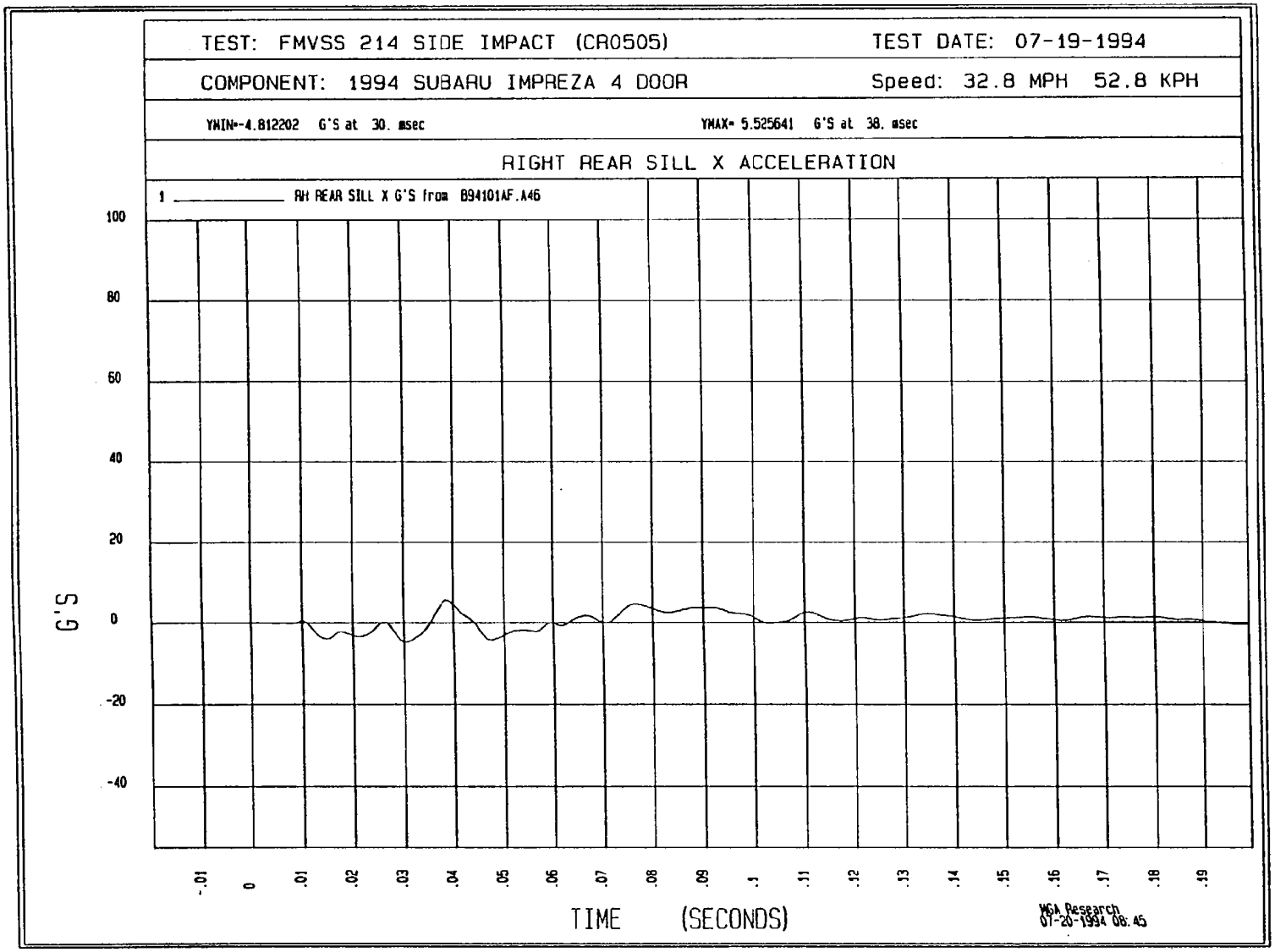



Figure B-28 - Right Rear Sill X Acceleration vs. Time

Filter: Class 180 (300 Hz)

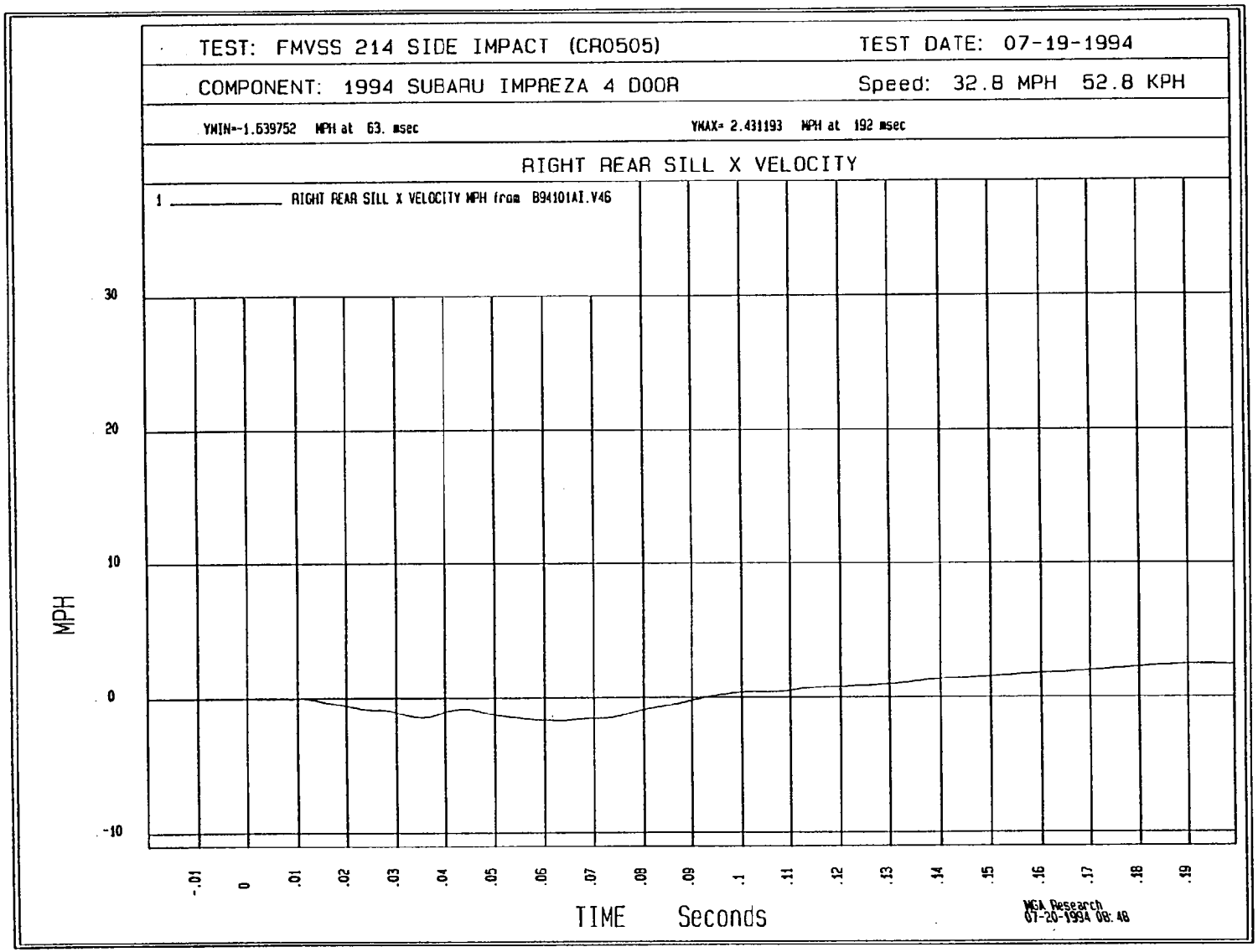



Figure B-29 - Right Rear Sill X Velocity vs. Time

Filter: Class 60 (100 Hz)

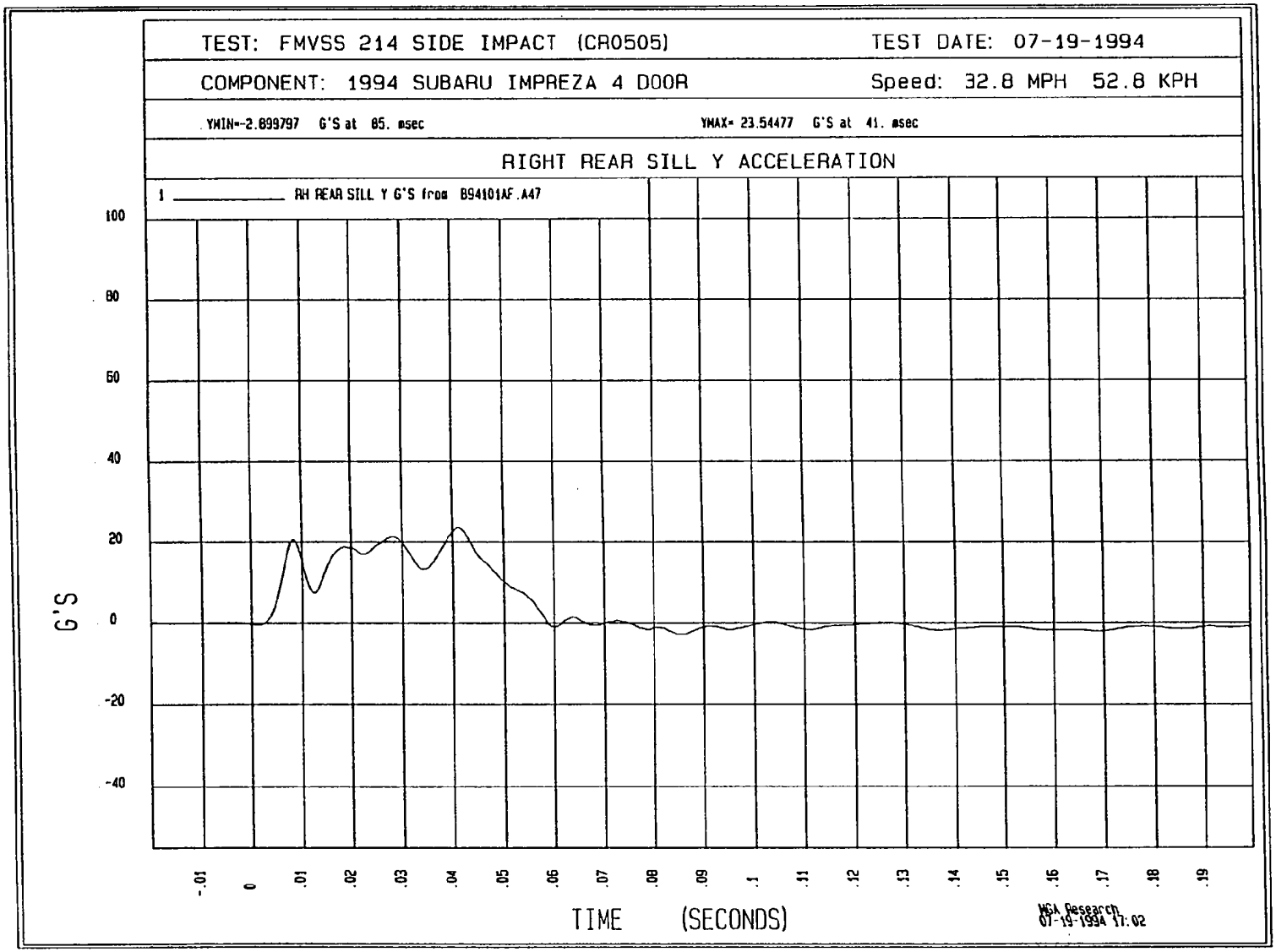



Figure B-30 - Right Rear Sill Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

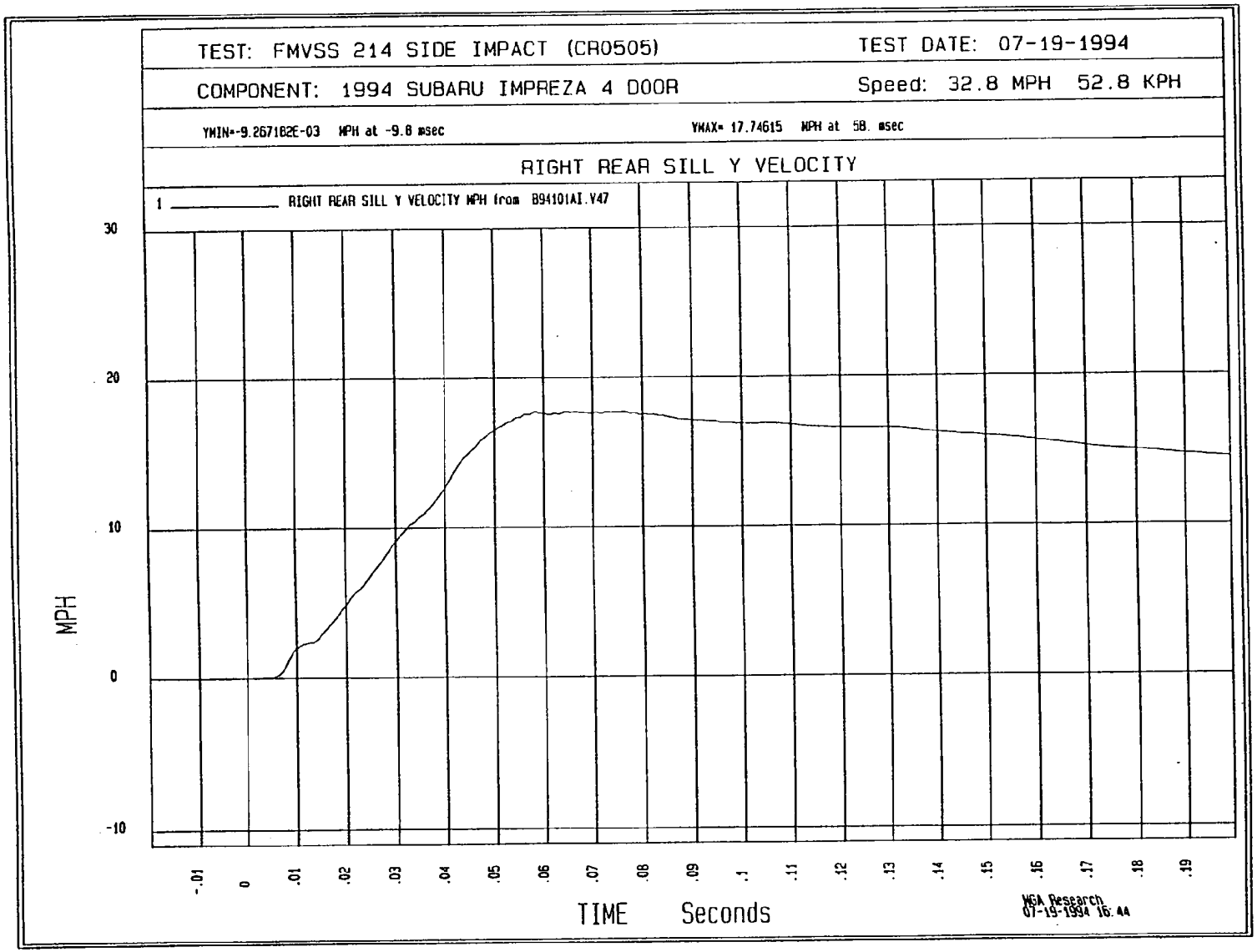



Figure B-31 - Right Rear Sill Y Velocity vs. Time

Filter: Class 60 (100 Hz)

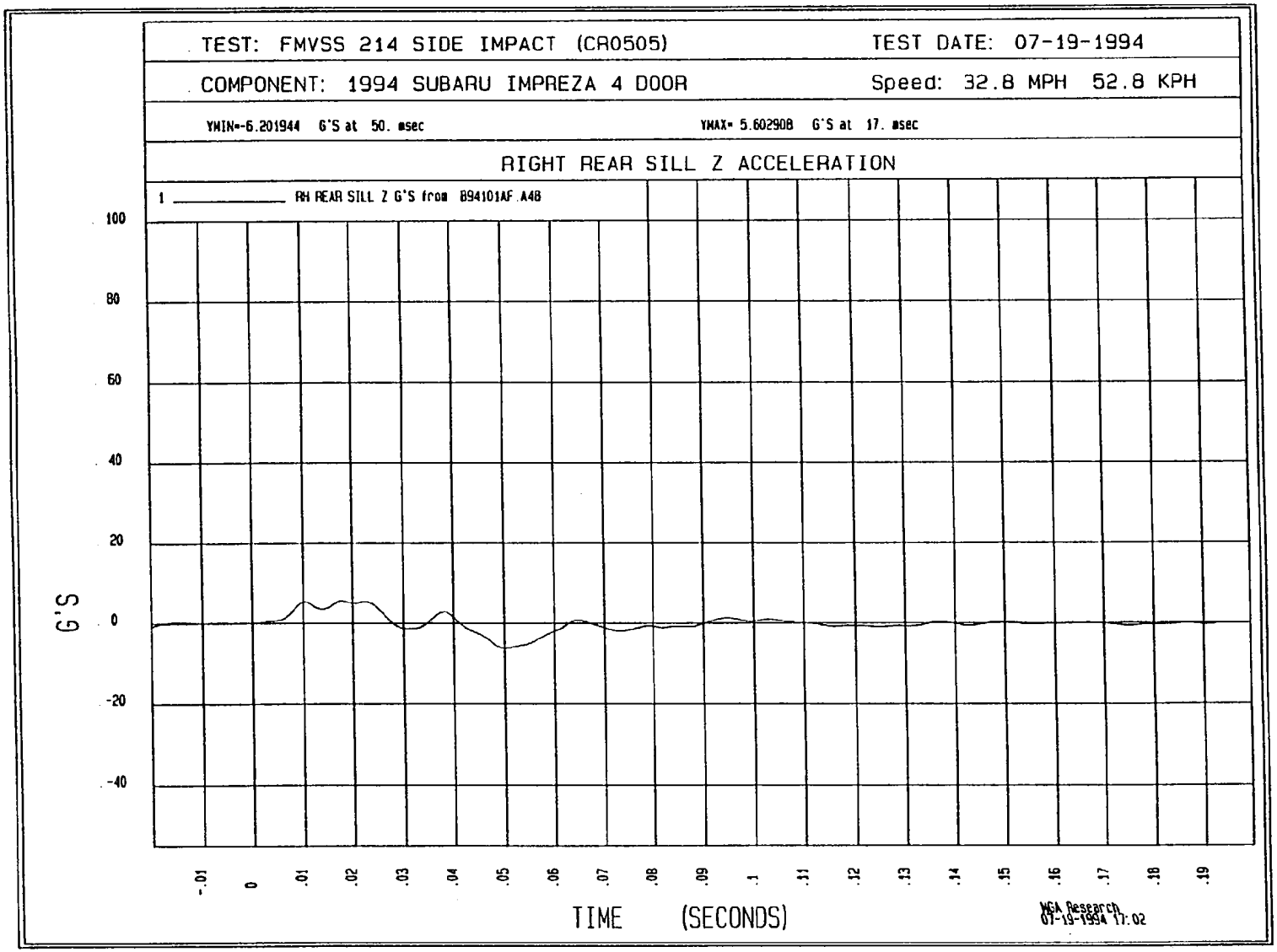



Figure B-32 - Right Rear Sill Z Acceleration vs. Time

Filter: Class 180 (300 Hz)

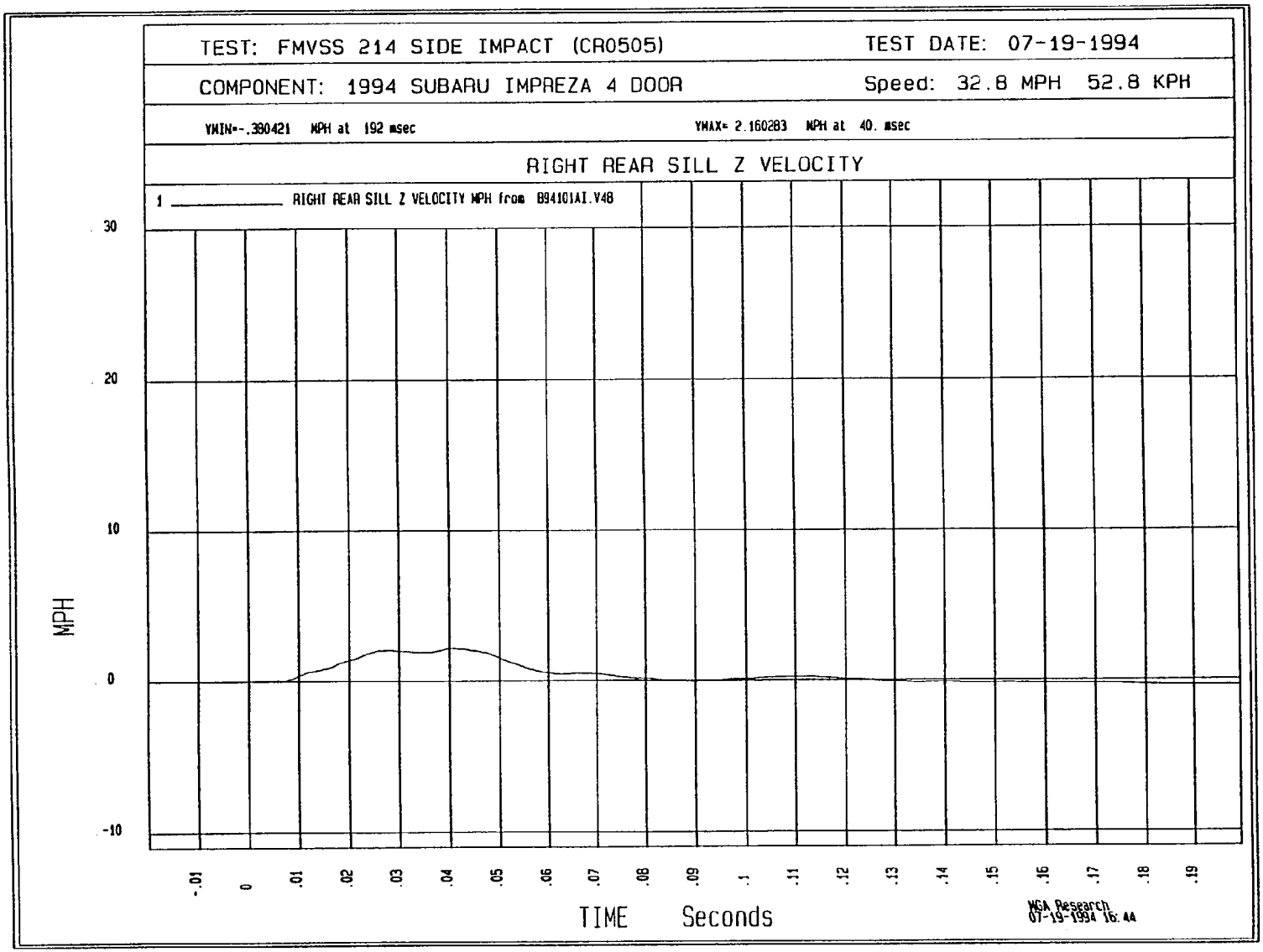



Figure B-33 - Right Rear Sill Z Velocity vs. Time

Filter: Class 60 (100 Hz)

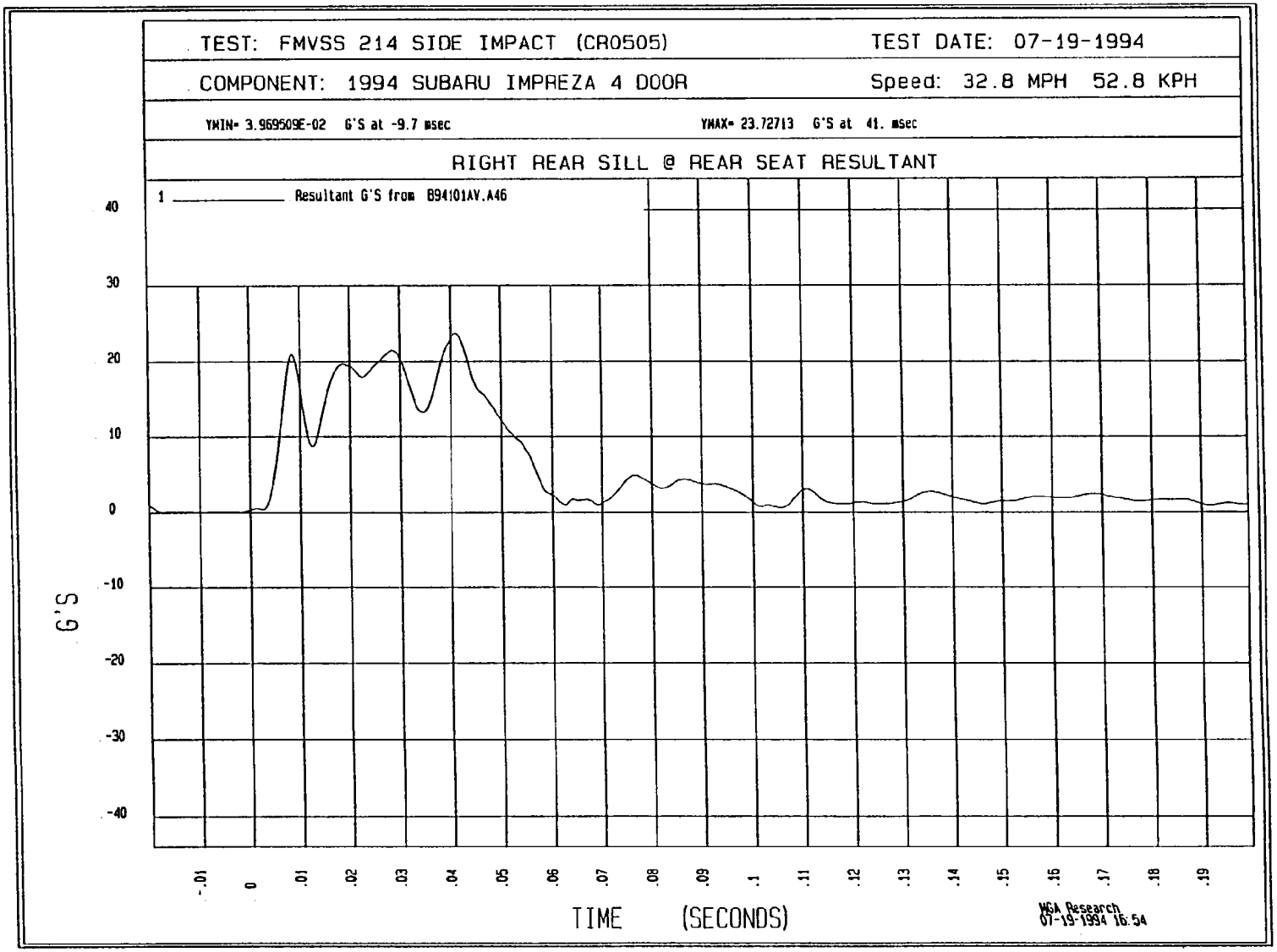



Figure B-34 - Right Rear Sill at Rear Seat Resultant vs. Time

Filter: Class 60 (100 Hz)

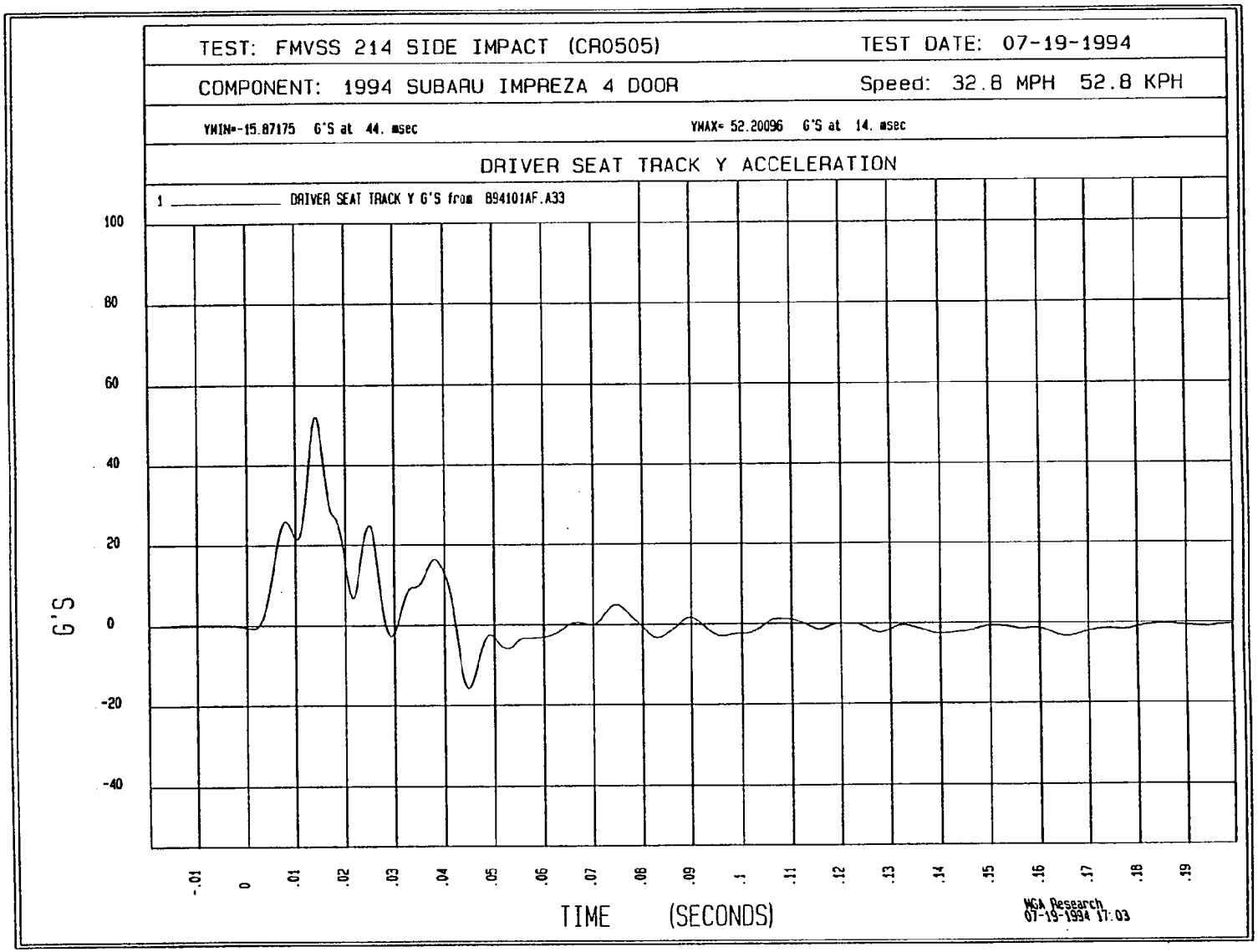



Figure B-35 - Driver Seat Track Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

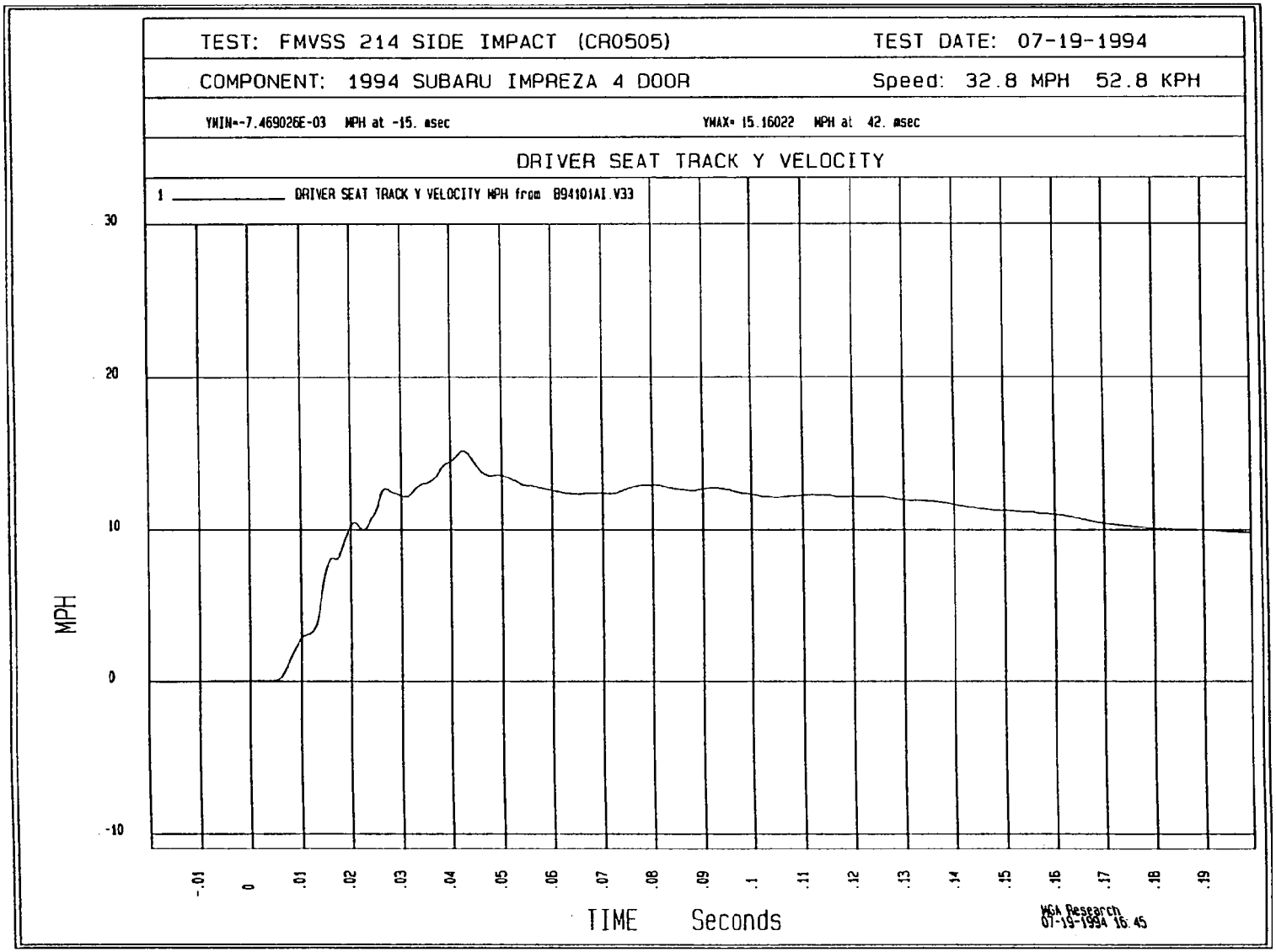



Figure B-36 - Driver Seat Track Y Velocity vs. Time

Filter: Class 60 (100 Hz)

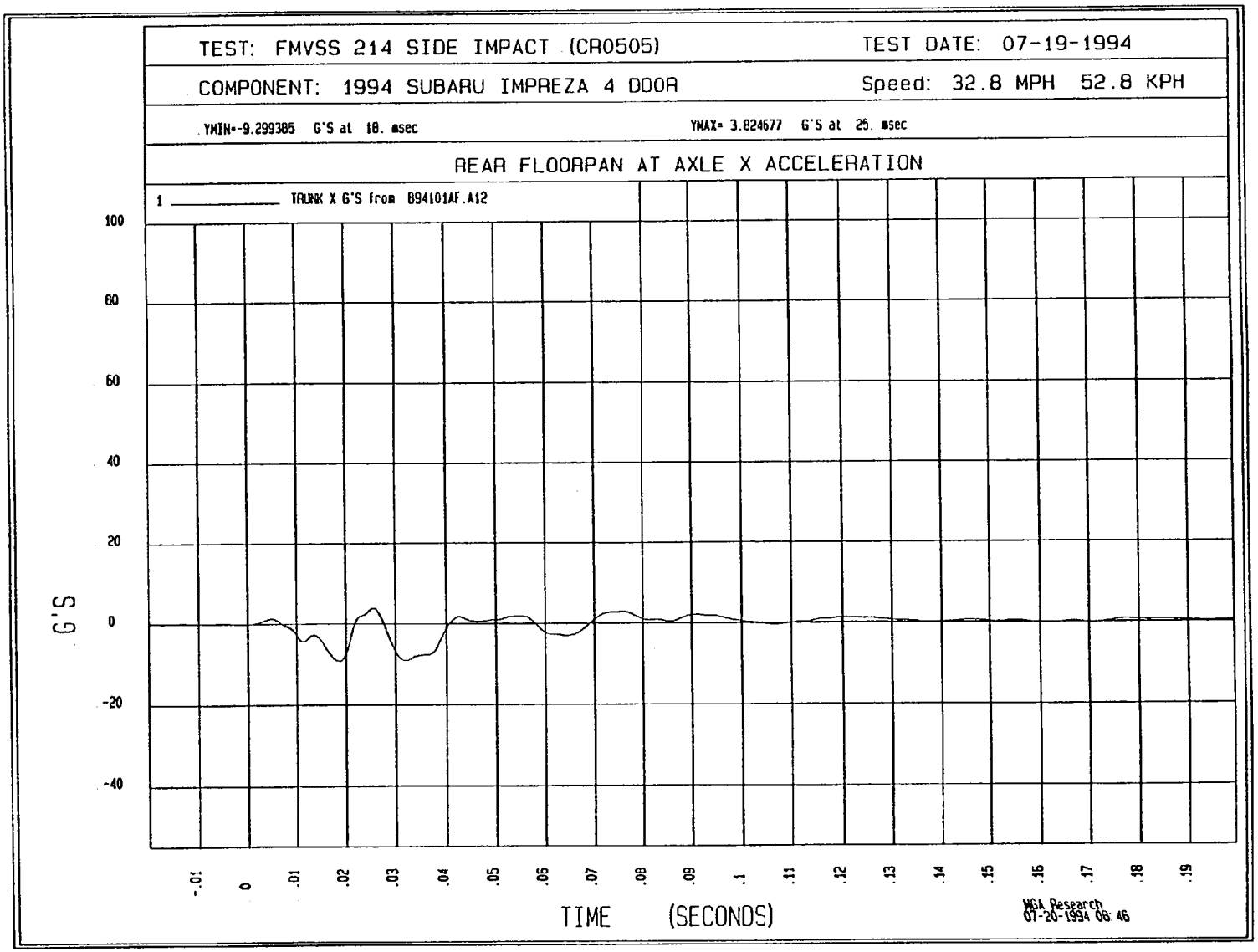



Figure B-37 - Rear Floorpan at Axle X Acceleration vs. Time

Filter: Class 180 (300 Hz)

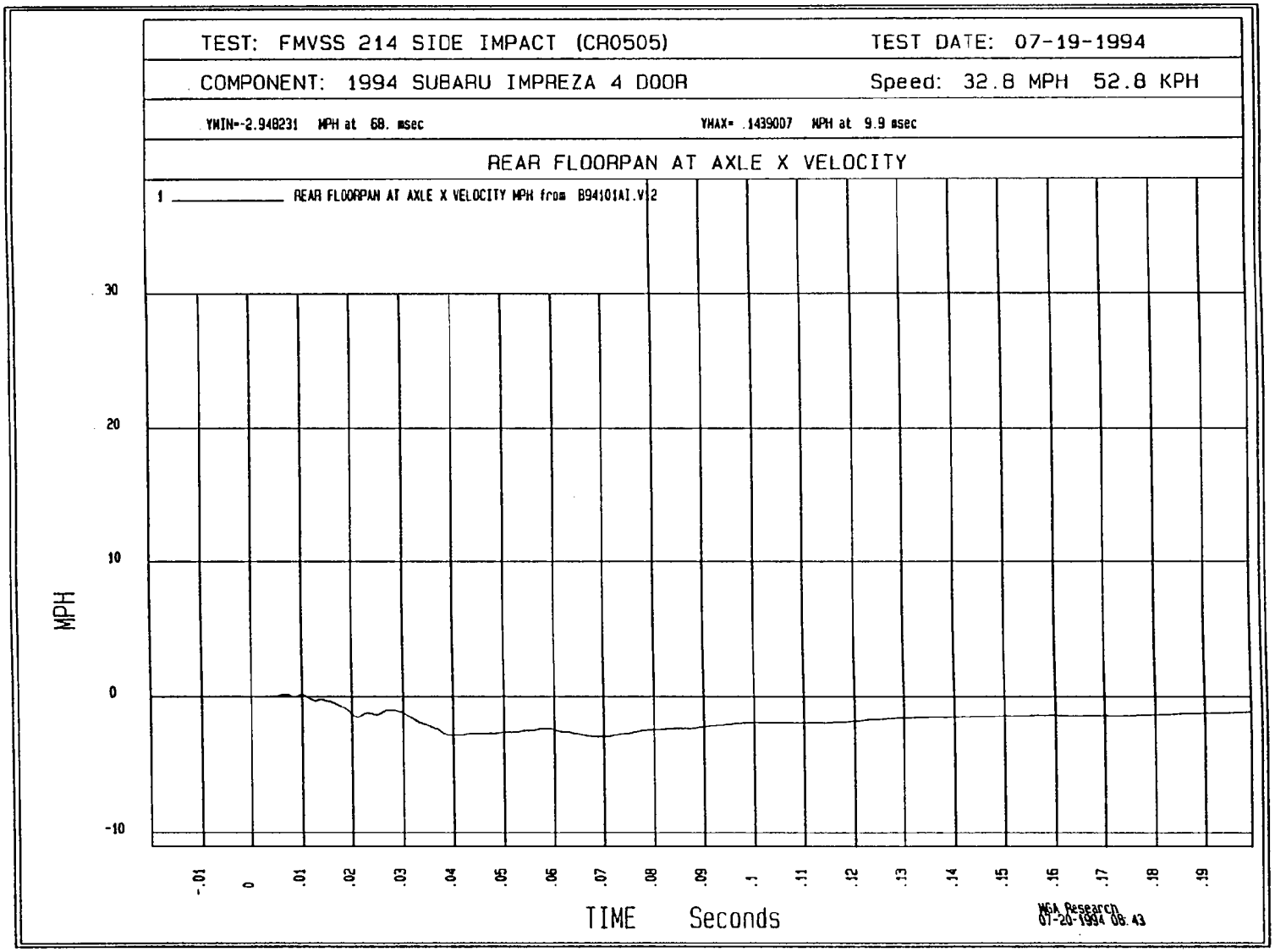



Figure B-38 - Rear Floorpan at Axle X Velocity vs. Time

Filter: Class 60 (100 Hz)

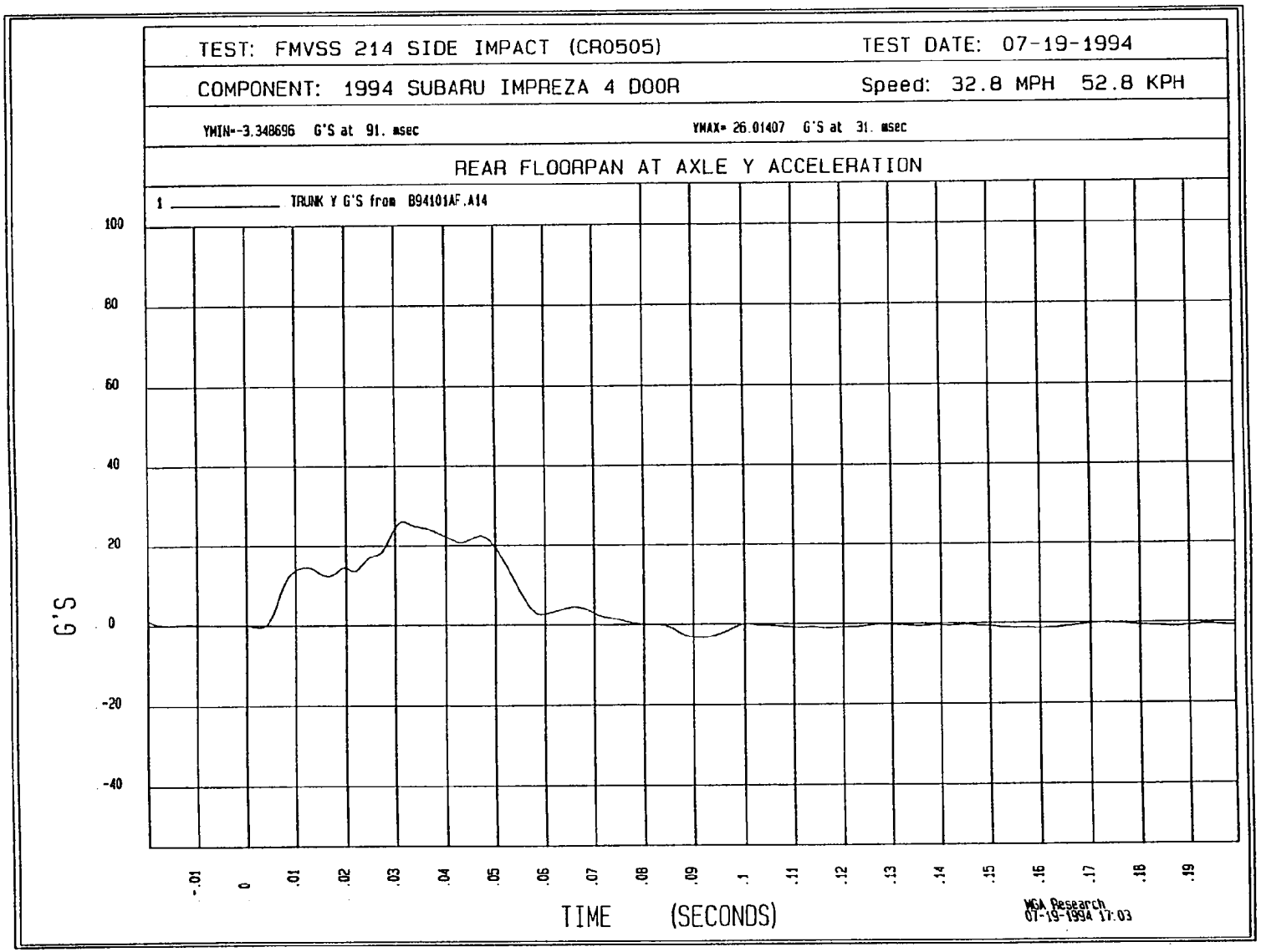



Figure B-39 - Rear Floorpan at Axle Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

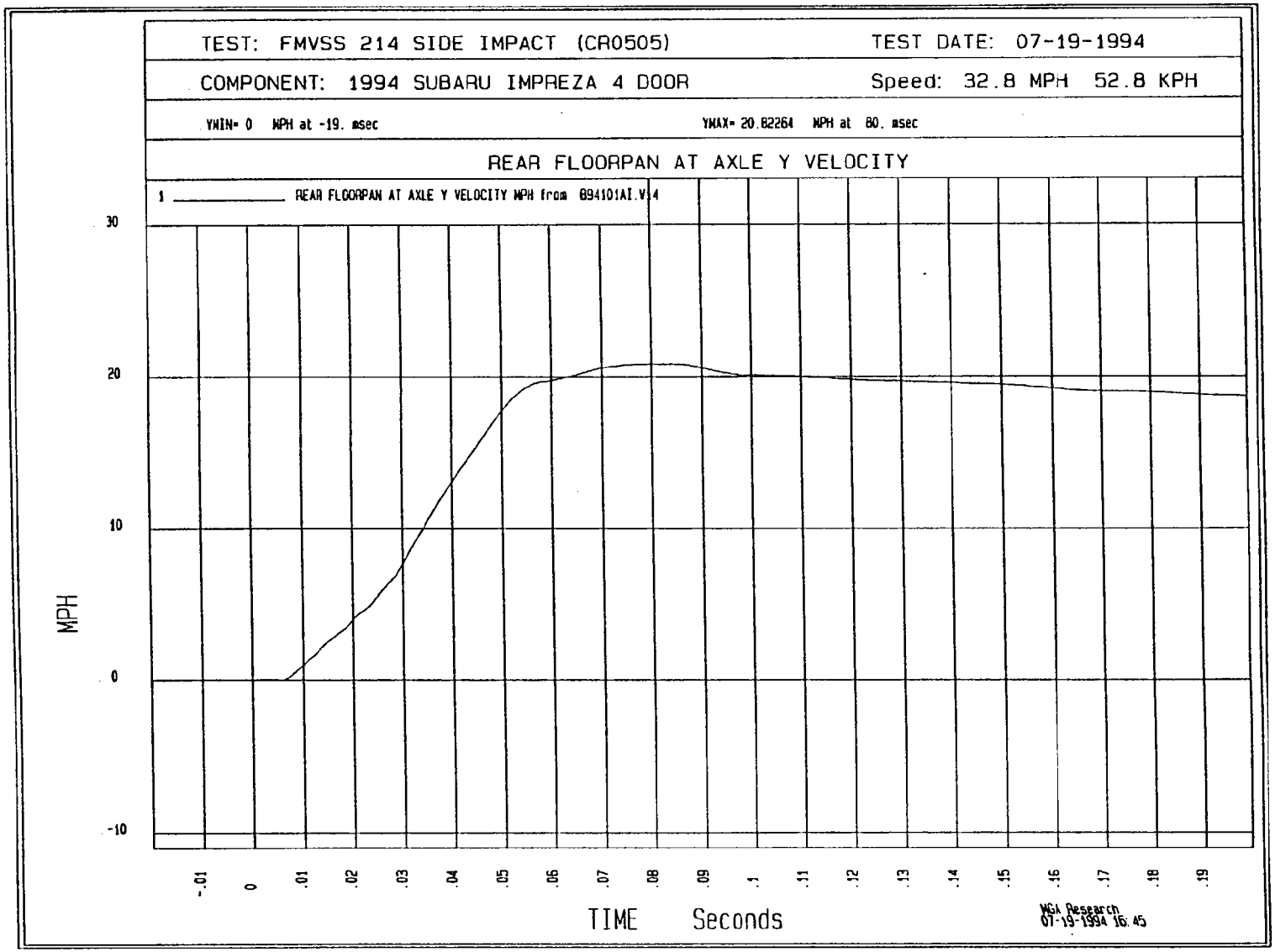



Figure B-40 - Rear Floorpan at Axle Y Velocity vs. Time

Filter: Class 60 (100 Hz)

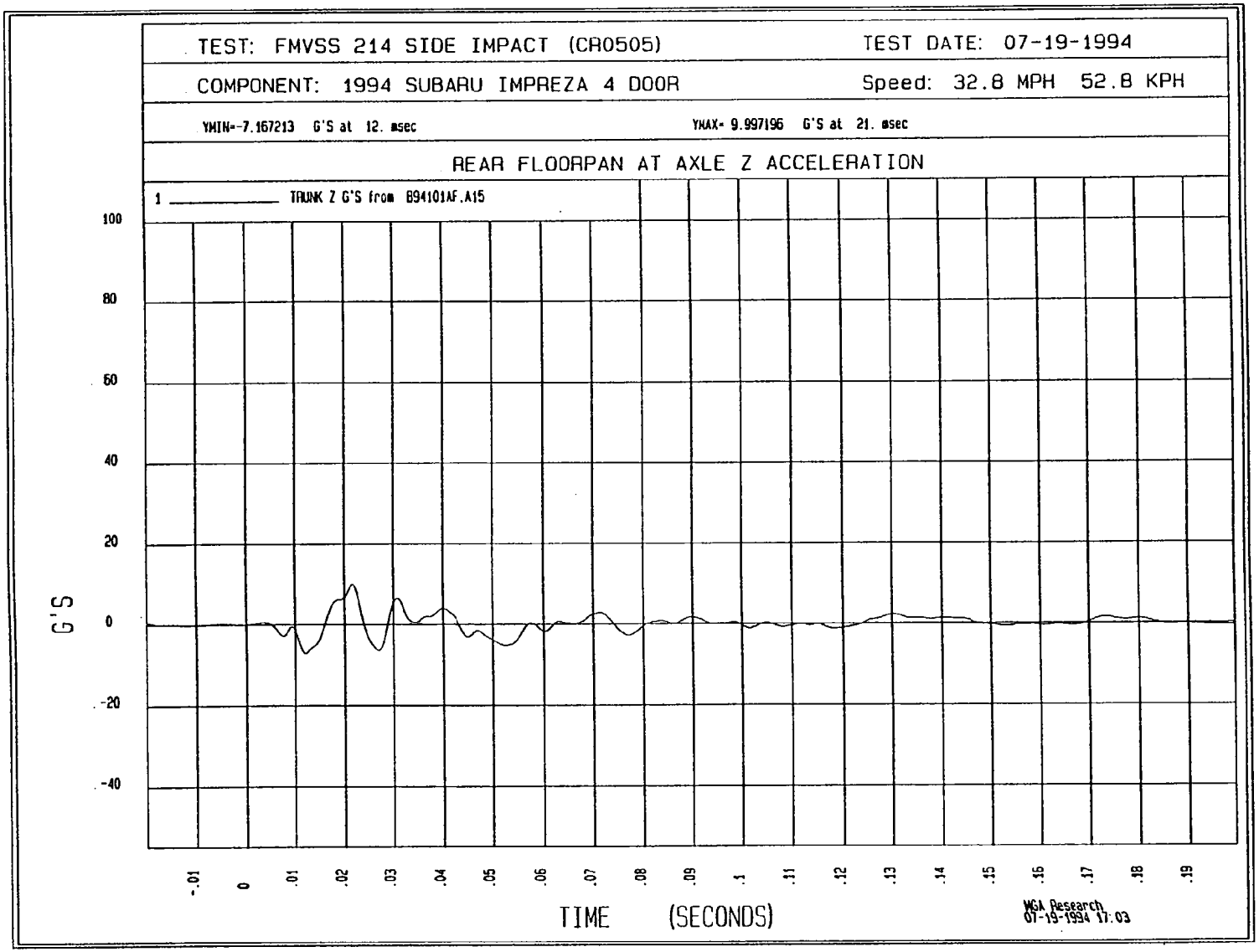



Figure B-41 - Rear Floorpan at Axle Z Acceleration vs. Time

Filter: Class 180 (300 Hz)

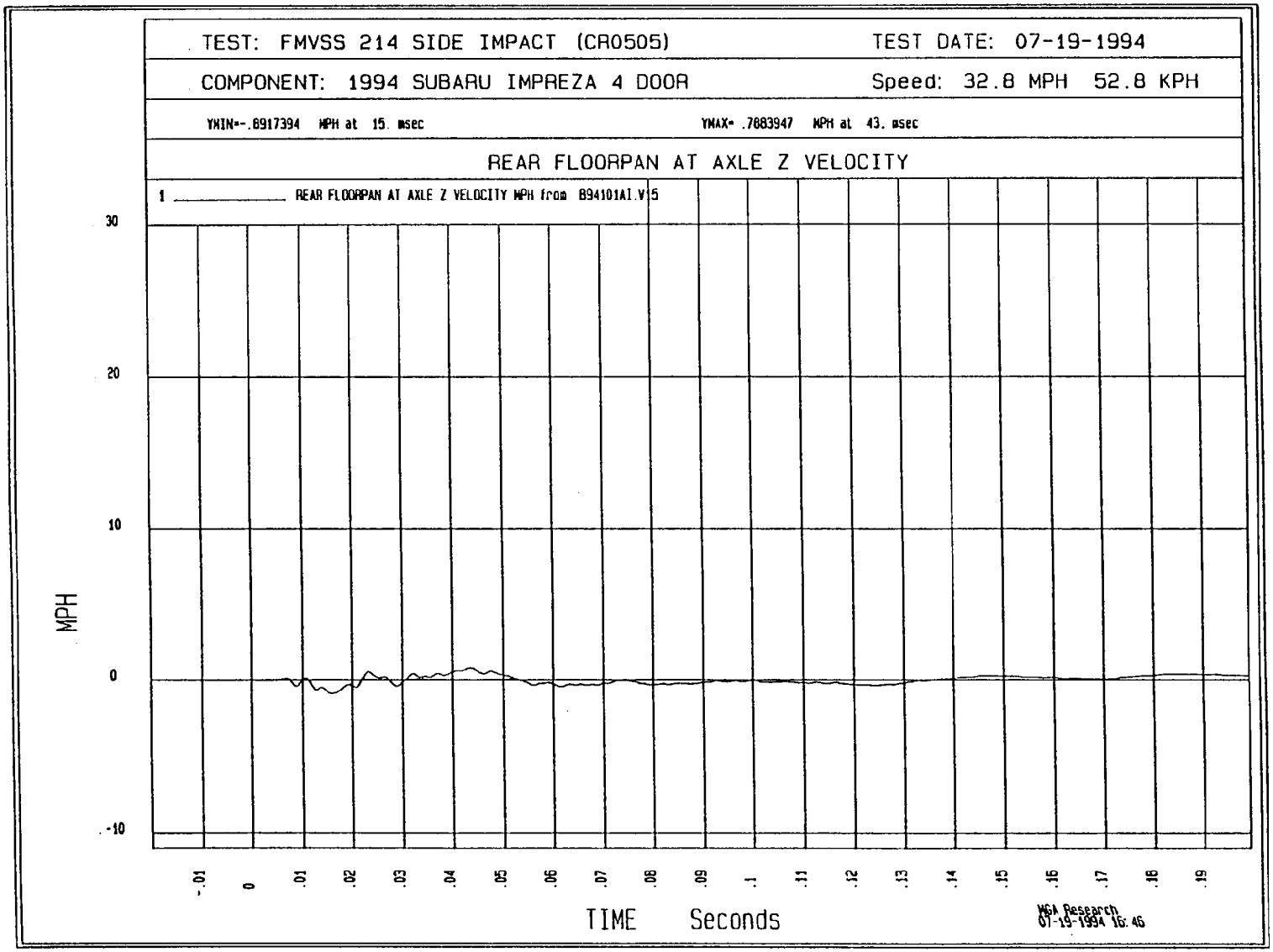



Figure B-42 - Rear Floorpan at Axle Z Velocity vs. Time

Filter: Class 60 (100 Hz)

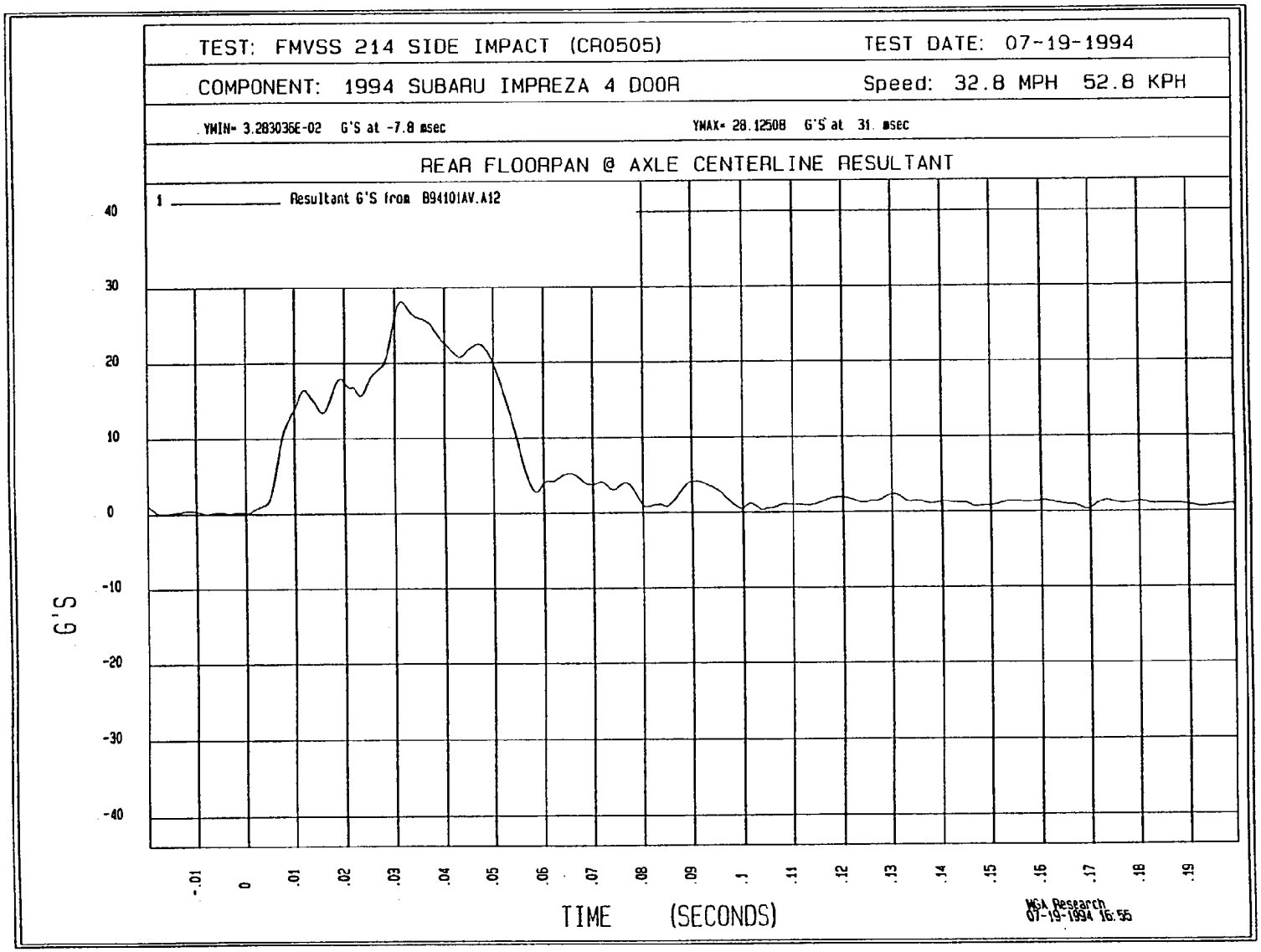



Figure B-43 - Rear Floorpan at Axle Centerline Resultant vs. Time

Filter: Class 60 (100 Hz)

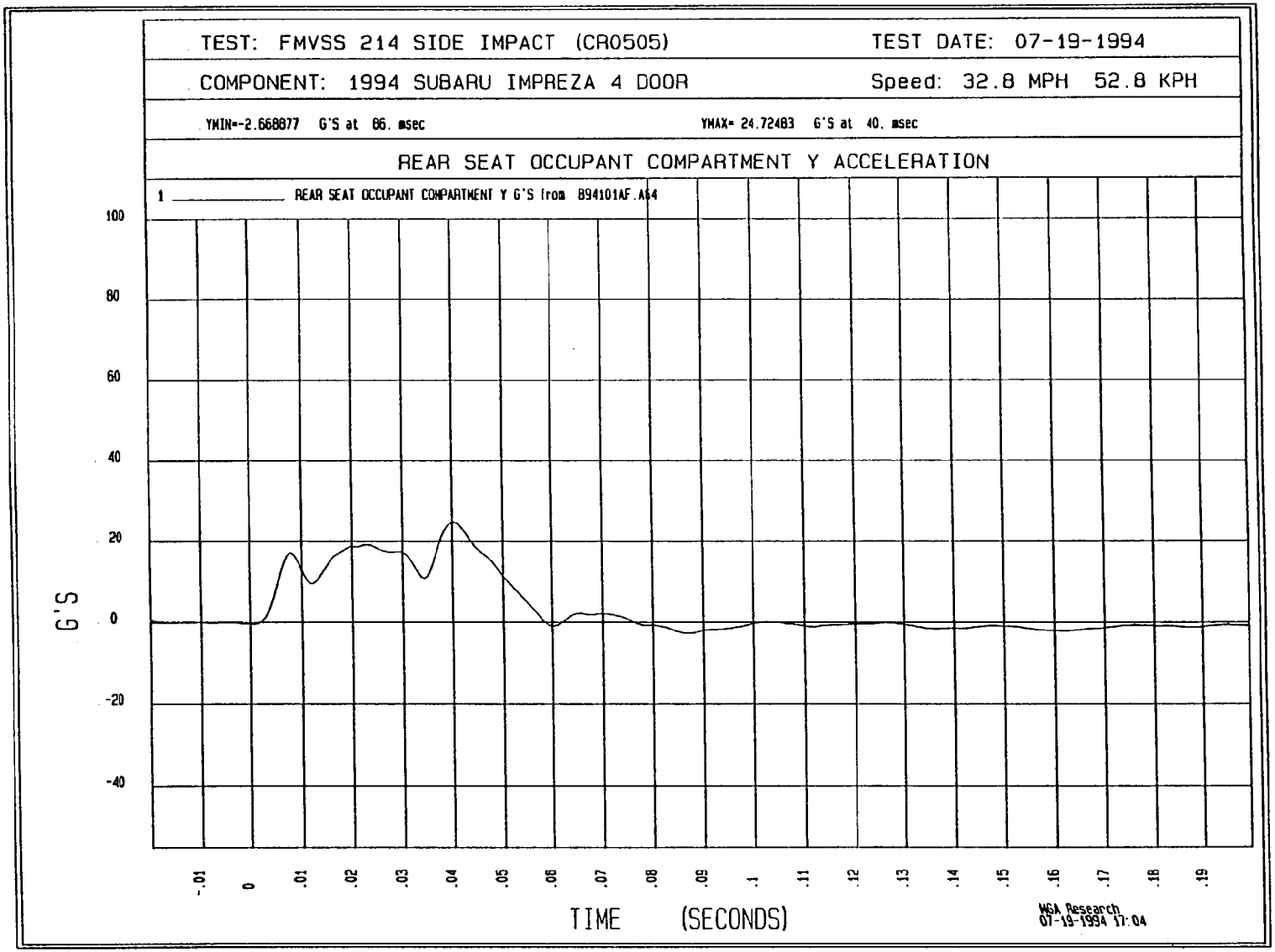



Figure B-44 - Rear Seat Occupant Compartment Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

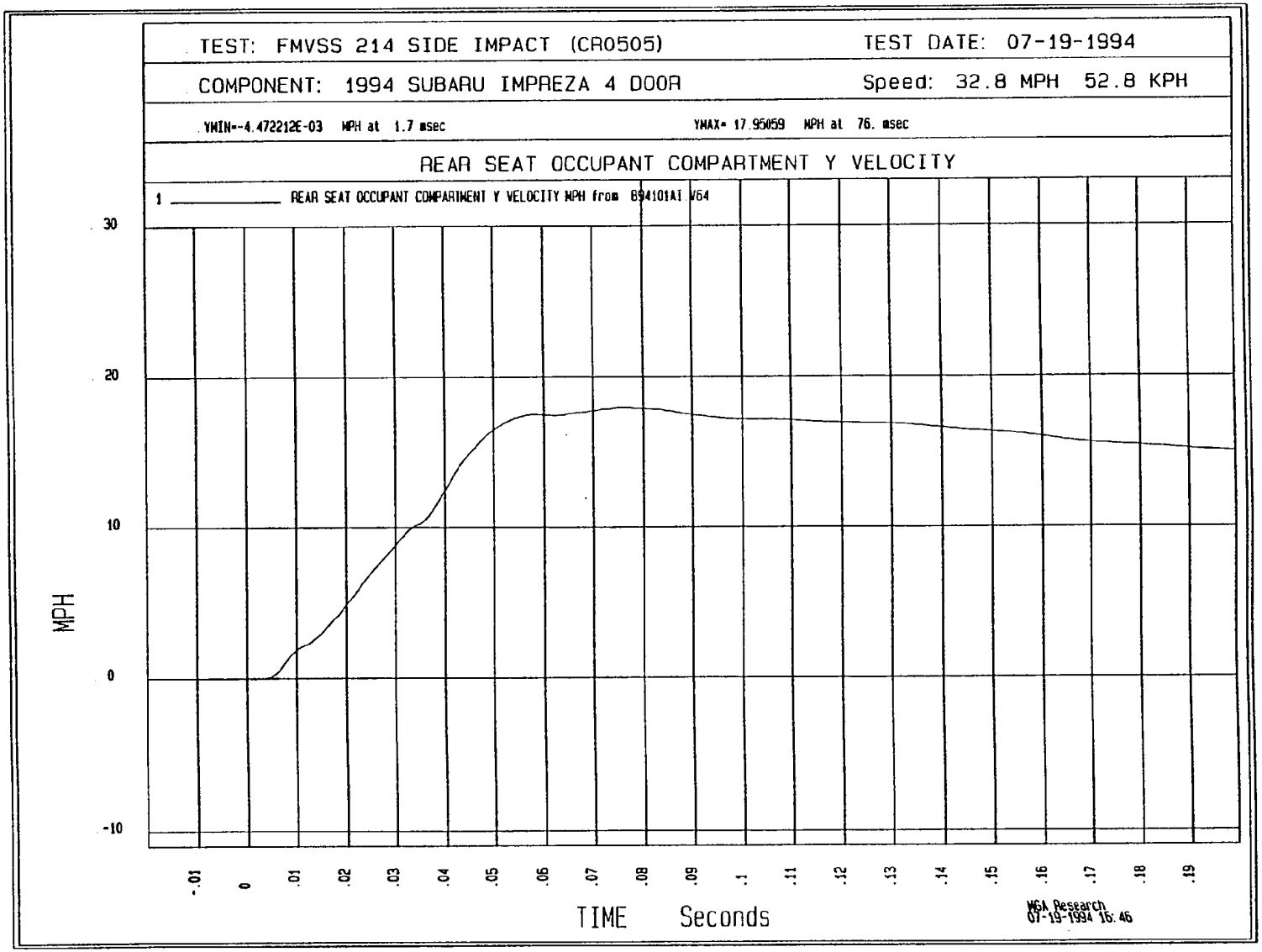



Figure B-45 - Rear Seat Occupant Compartment Y Velocity vs. Time

Filter: Class 60 (100 Hz)

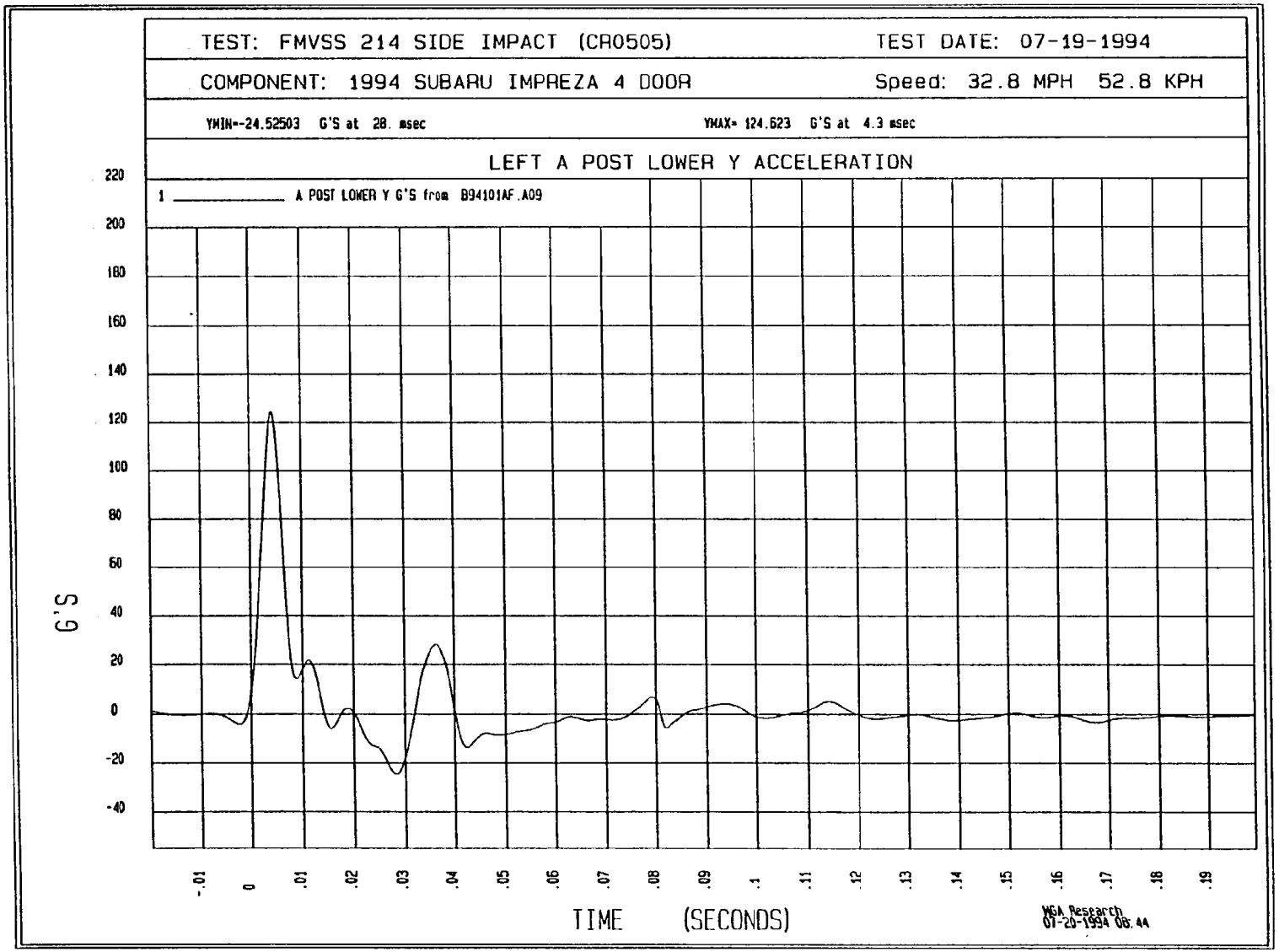



Figure B-46 - Left A Post Lower Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

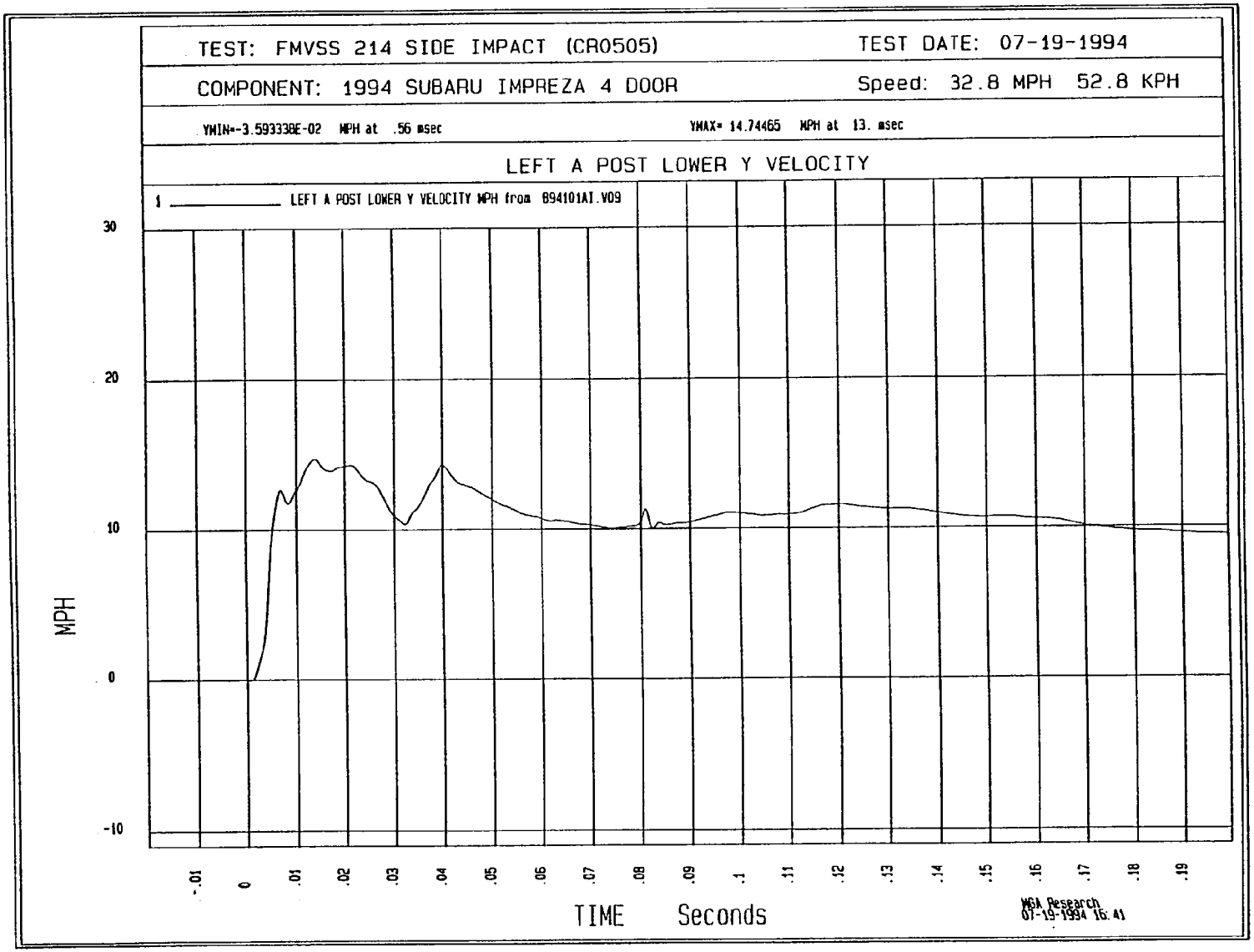



Figure B-47 - Left A Post Lower Y Velocity vs. Time

**Filter: Class 60 (100 Hz)**

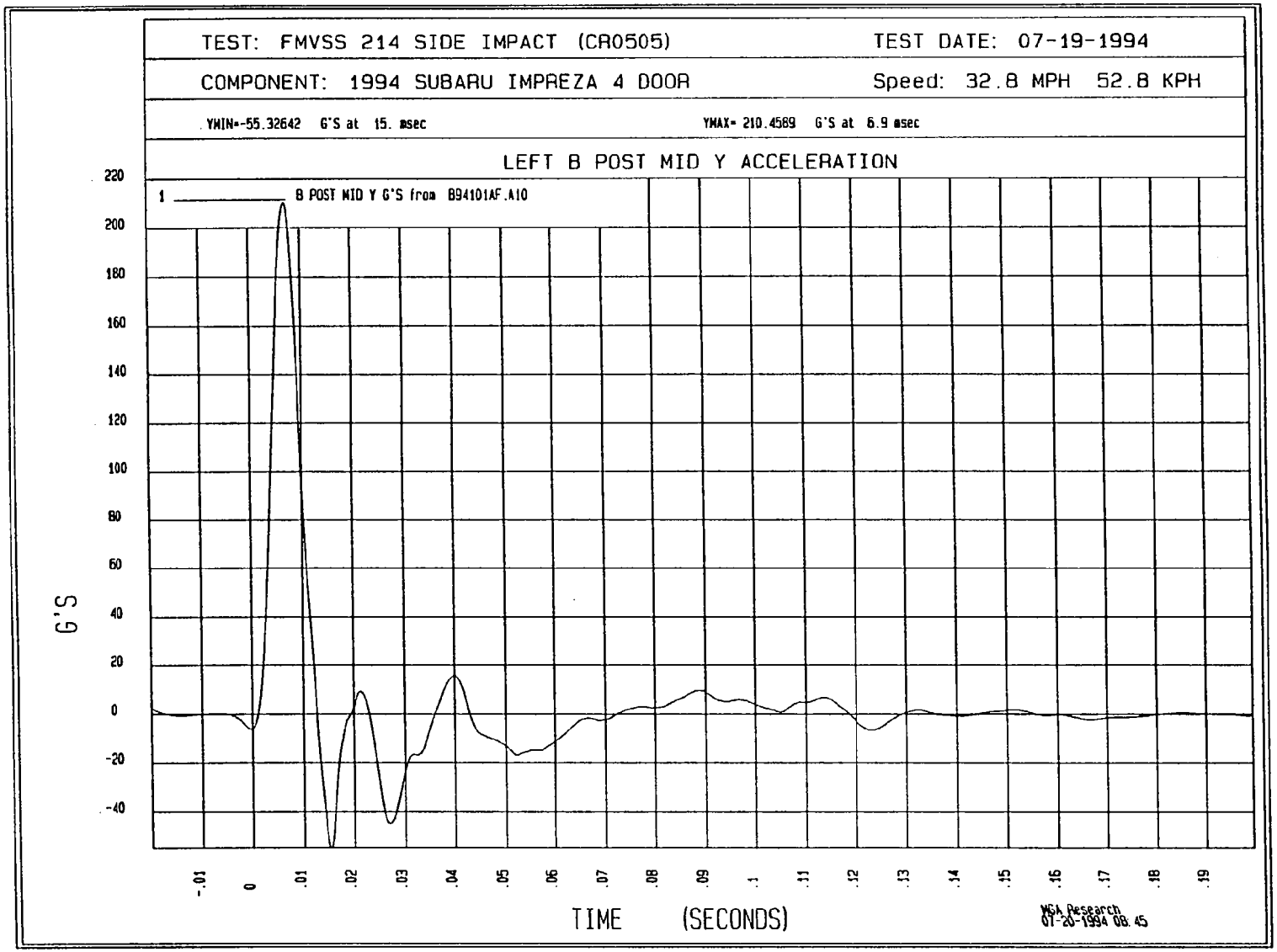



**Figure B-48 - Left B Post Mid Y Acceleration vs. Time**

Filter: Class 180 (300 Hz)

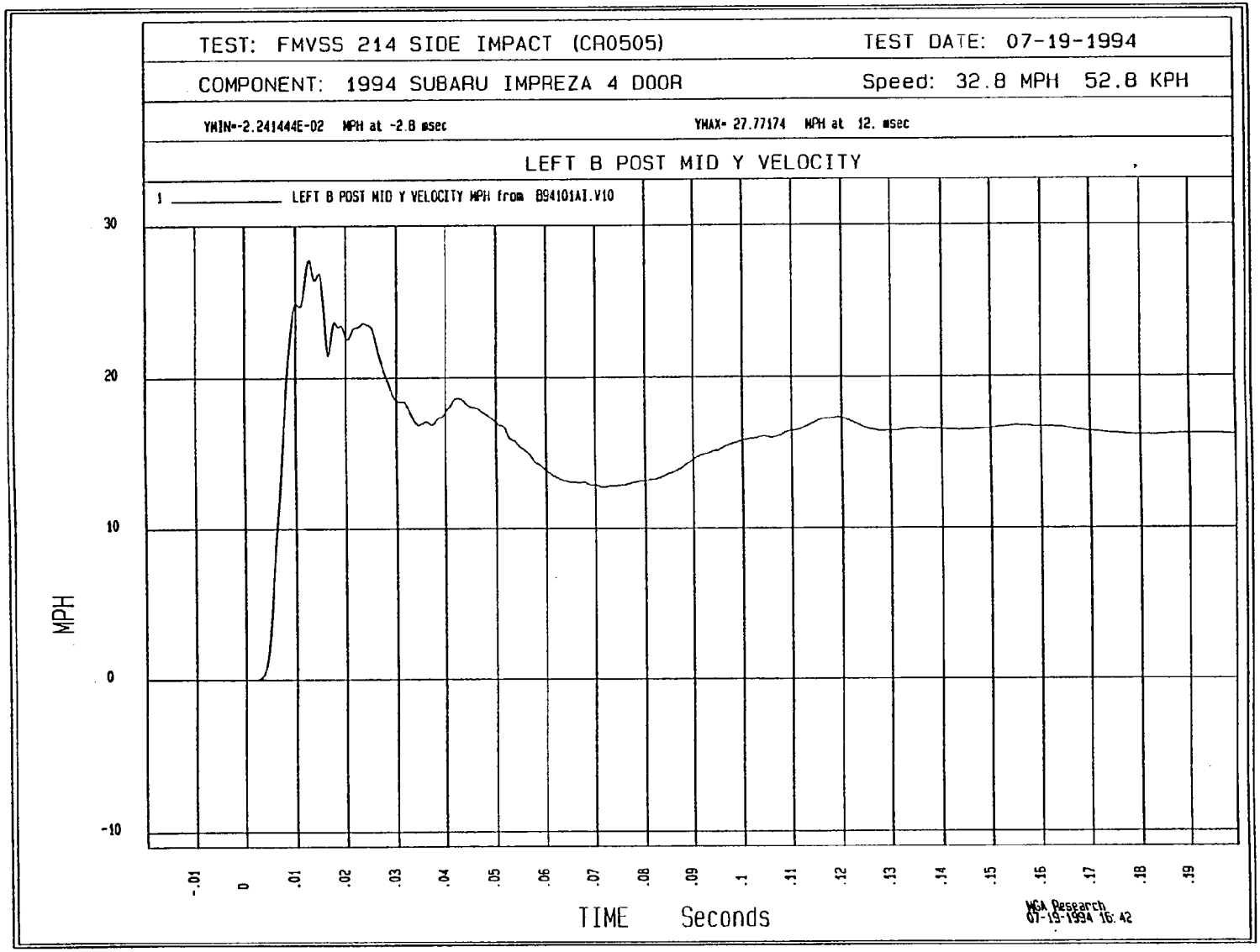



Figure B-49 - Left B Post Mid Y Velocity vs. Time

Filter: Class 60 (100 Hz)

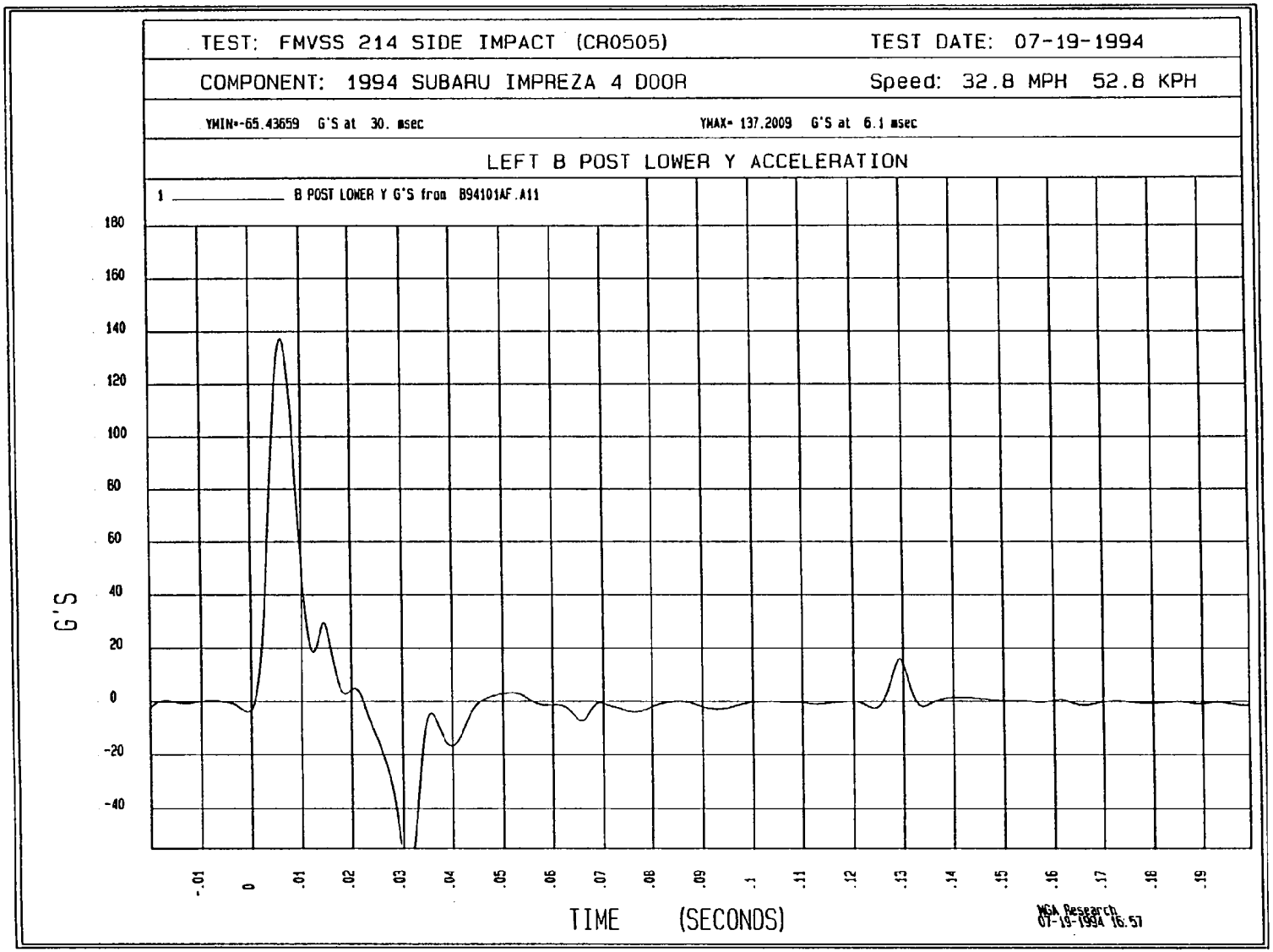



Figure B-50 - Left B Post Lower Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

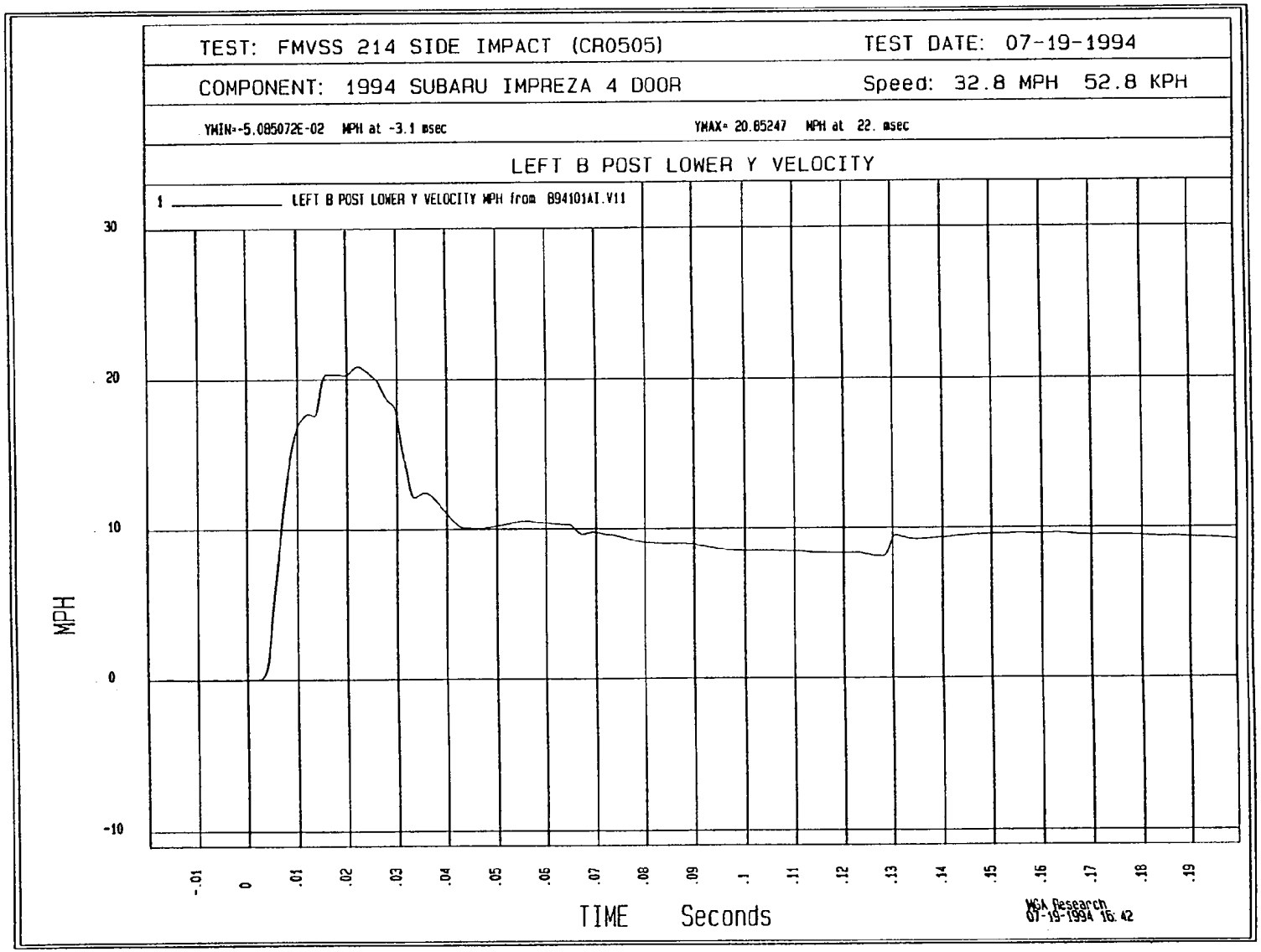



Figure B-51 - Left B Post Lower Y Velocity vs. Time

Filter: Class 60 (100 Hz)

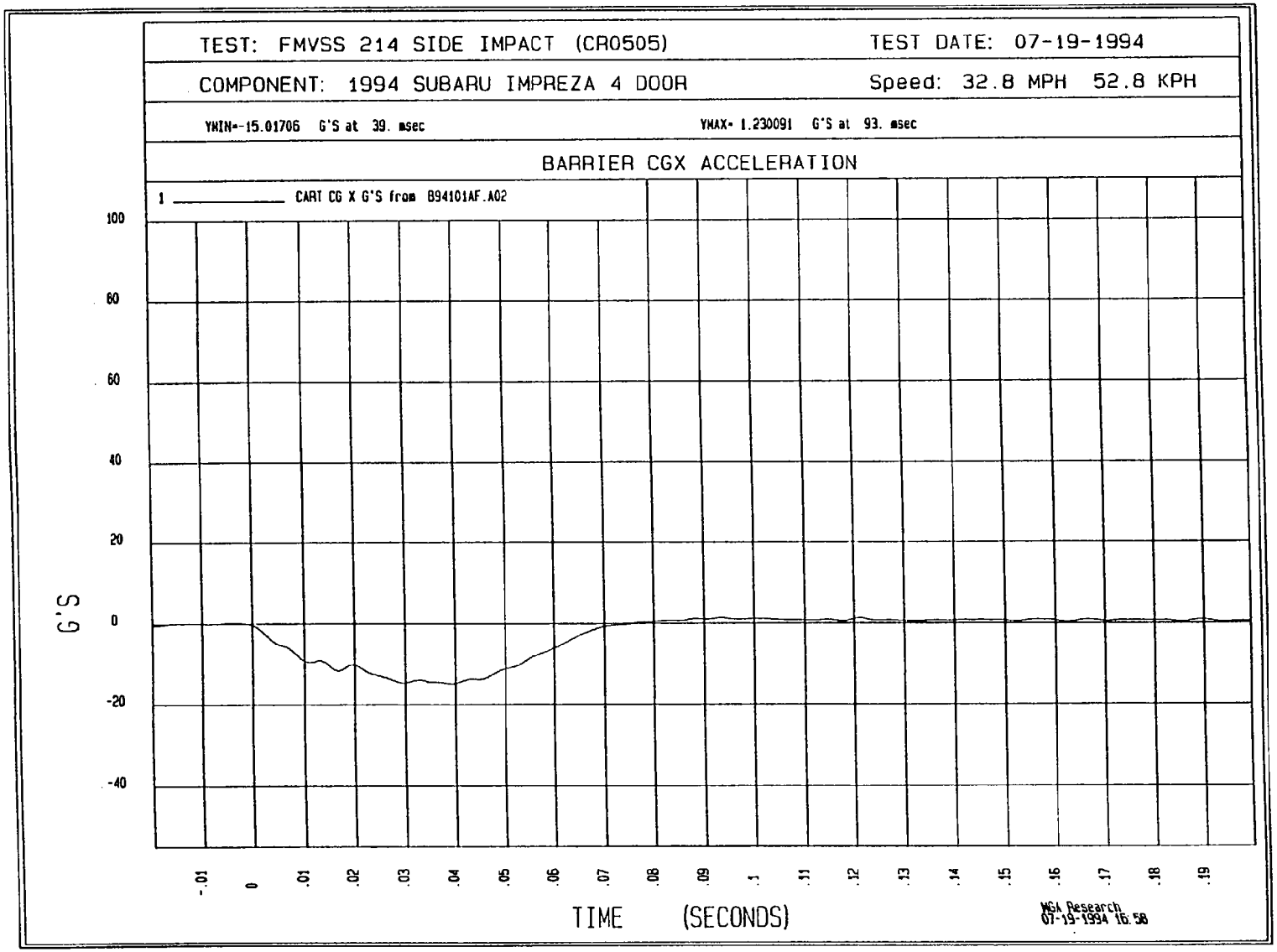



Figure B-52 - Moving Barrier Center of Gravity X Acceleration vs. Time

Filter: Class 180 (300 Hz)

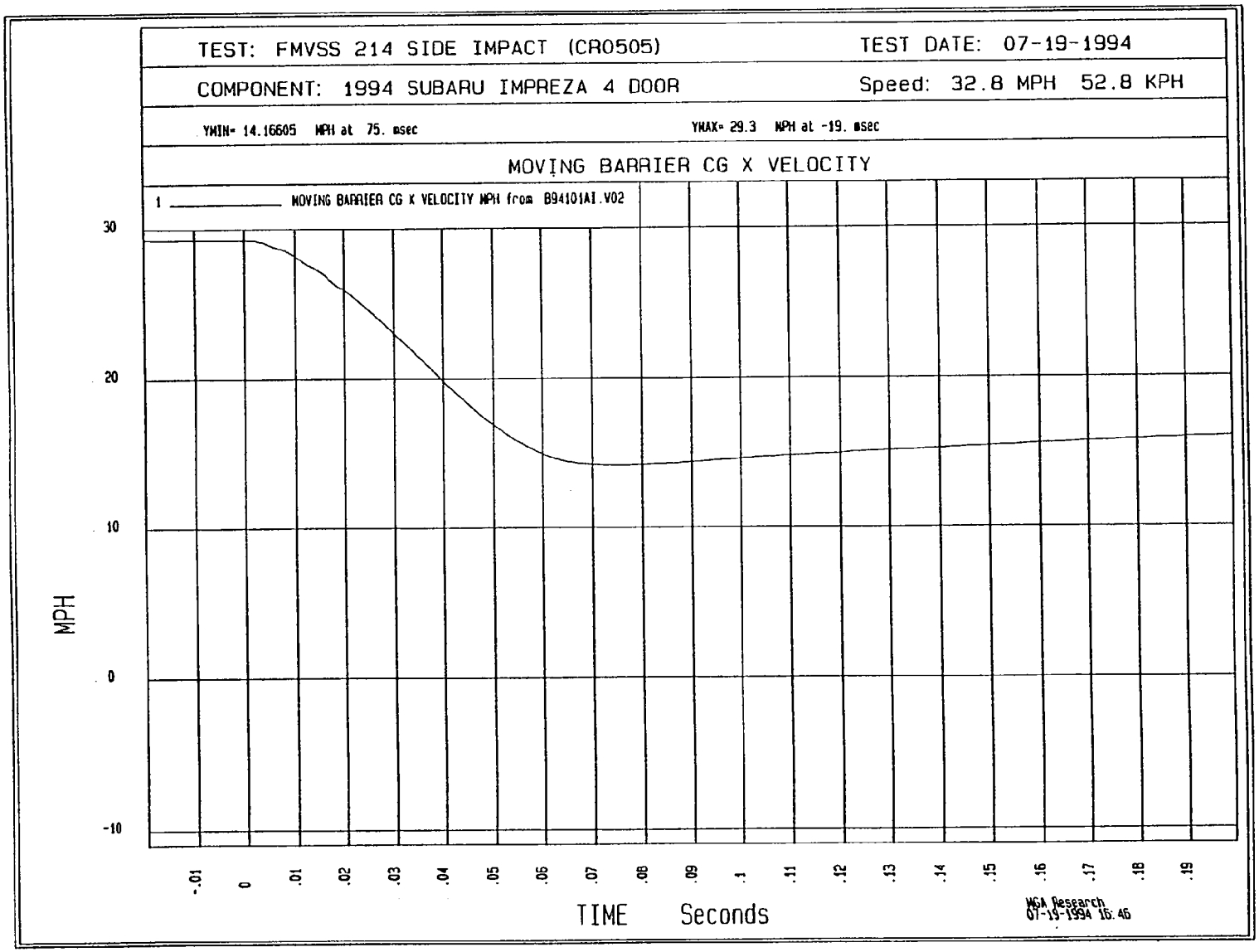



Figure B-53 - Moving Barrier Center of Gravity X Velocity vs. Time

Filter: Class 60 (100 Hz)

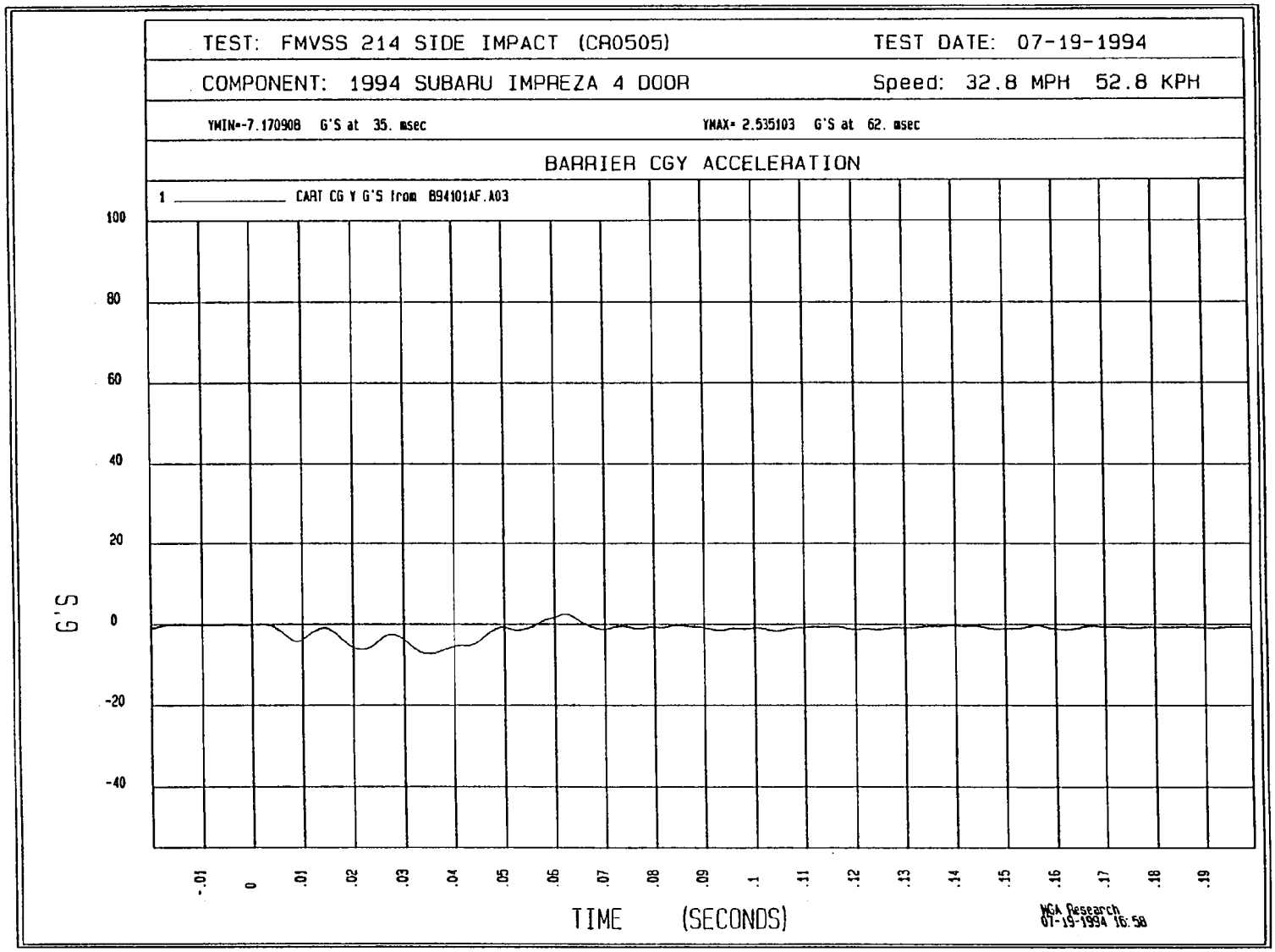



Figure B-54 - Moving Barrier Center of Gravity Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

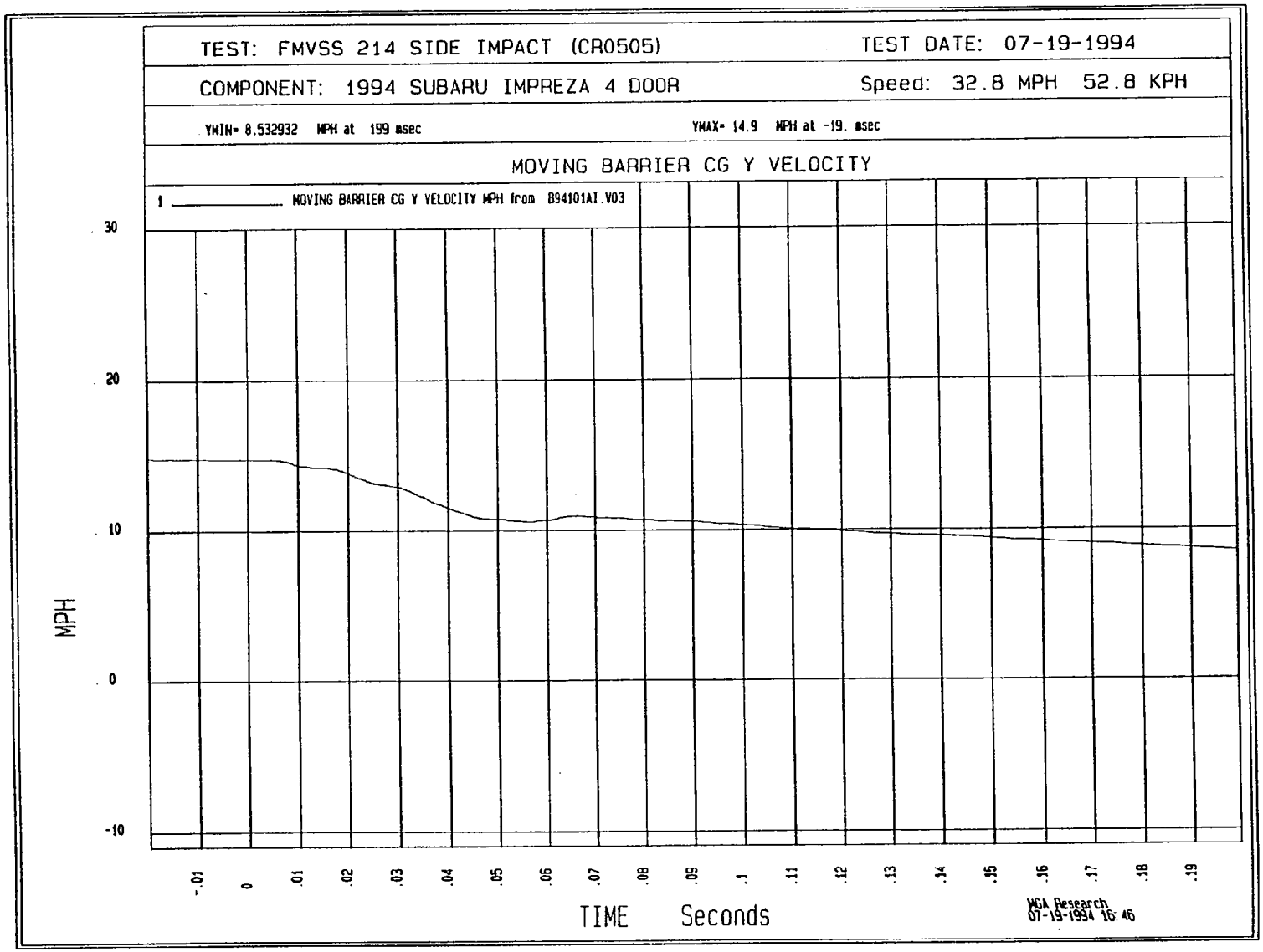



Figure B-55 - Moving Barrier Center of Gravity Y Velocity vs. Time

Filter: Class 60 (100 Hz)

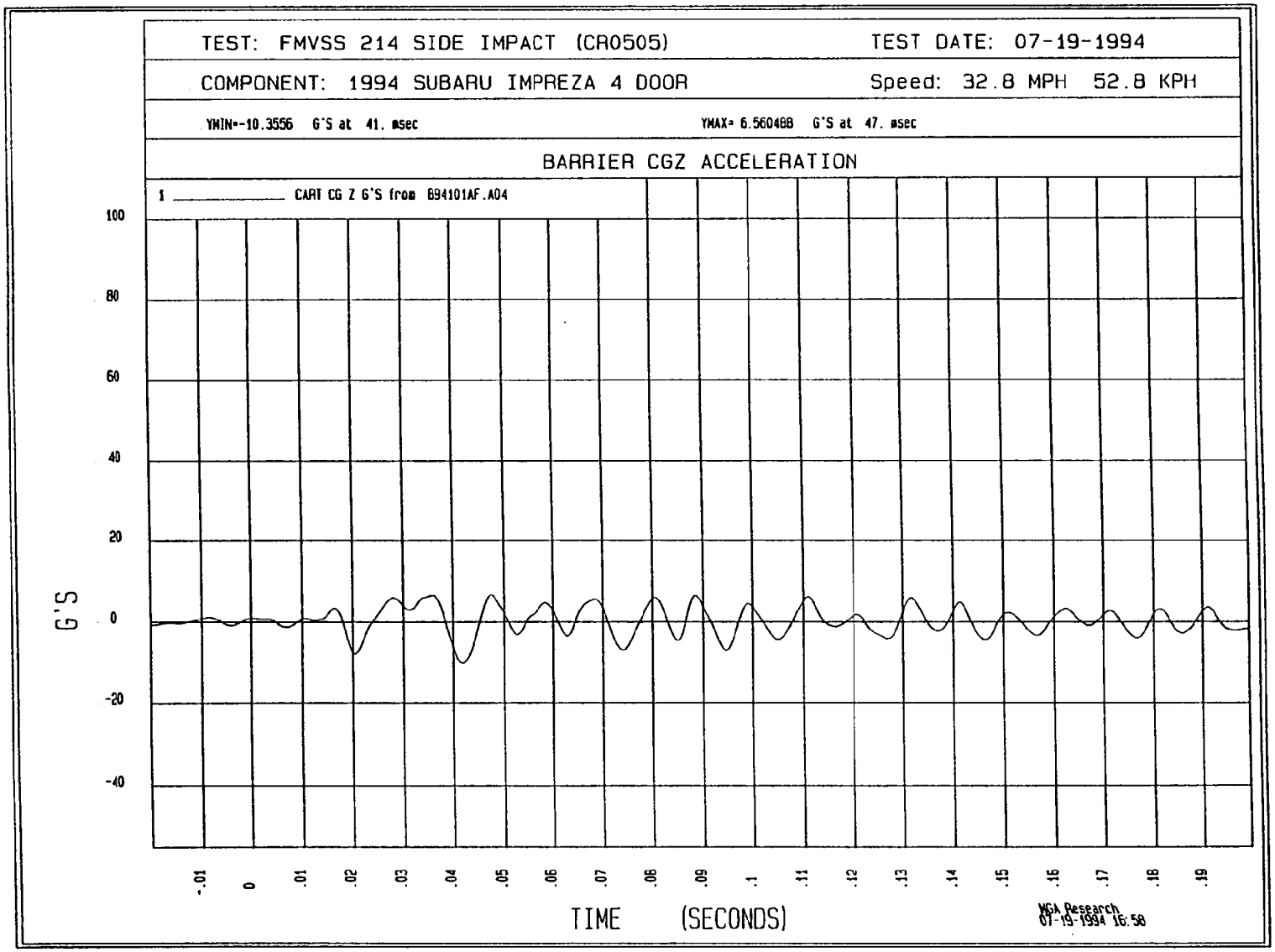



Figure B-56 - Moving Barrier Center of Gravity Z Acceleration vs. Time

Filter: Class 180 (300 Hz)

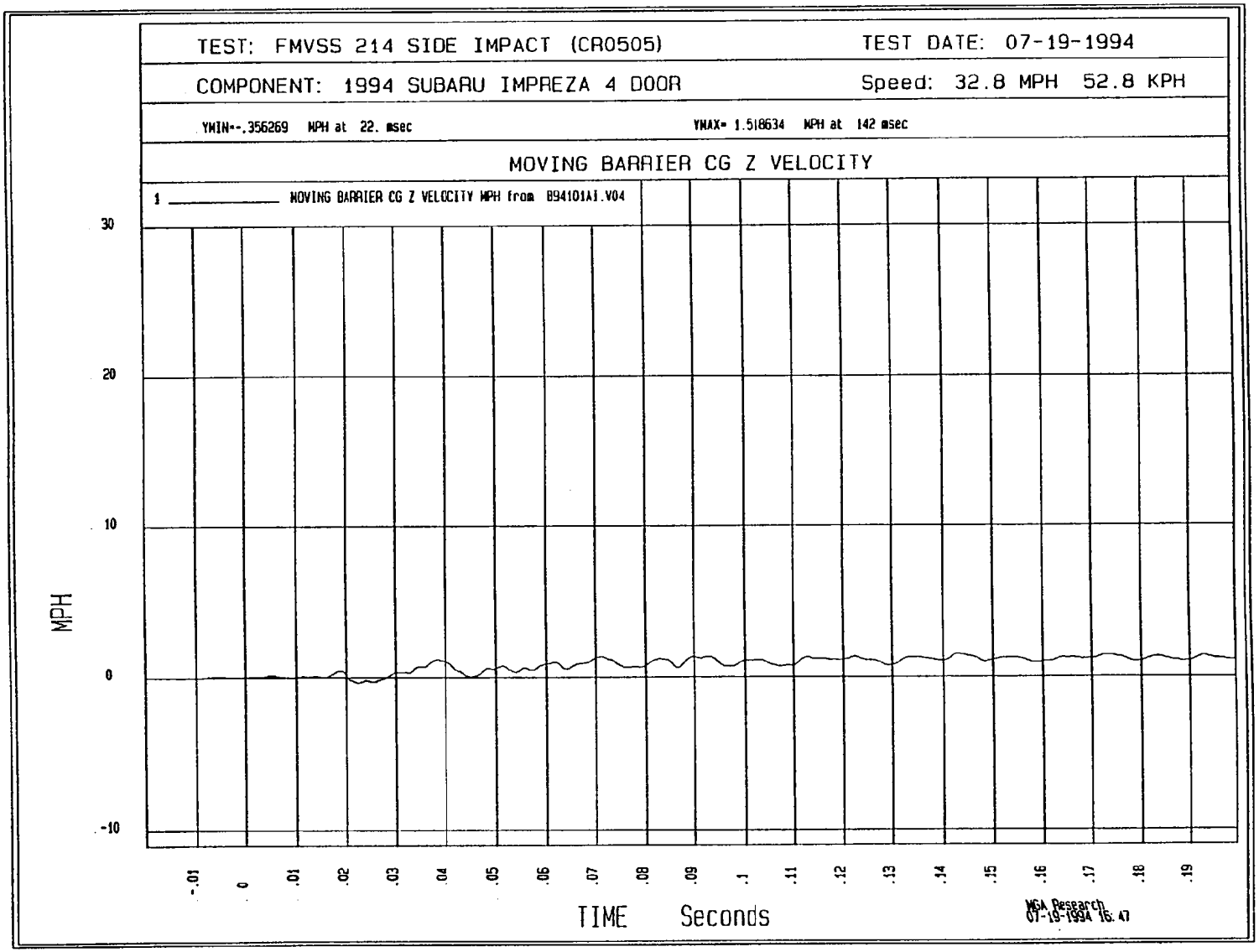



Figure B-57 - Moving Barrier Center of Gravity Z Velocity vs. Time

Filter: Class 60 (100 Hz)

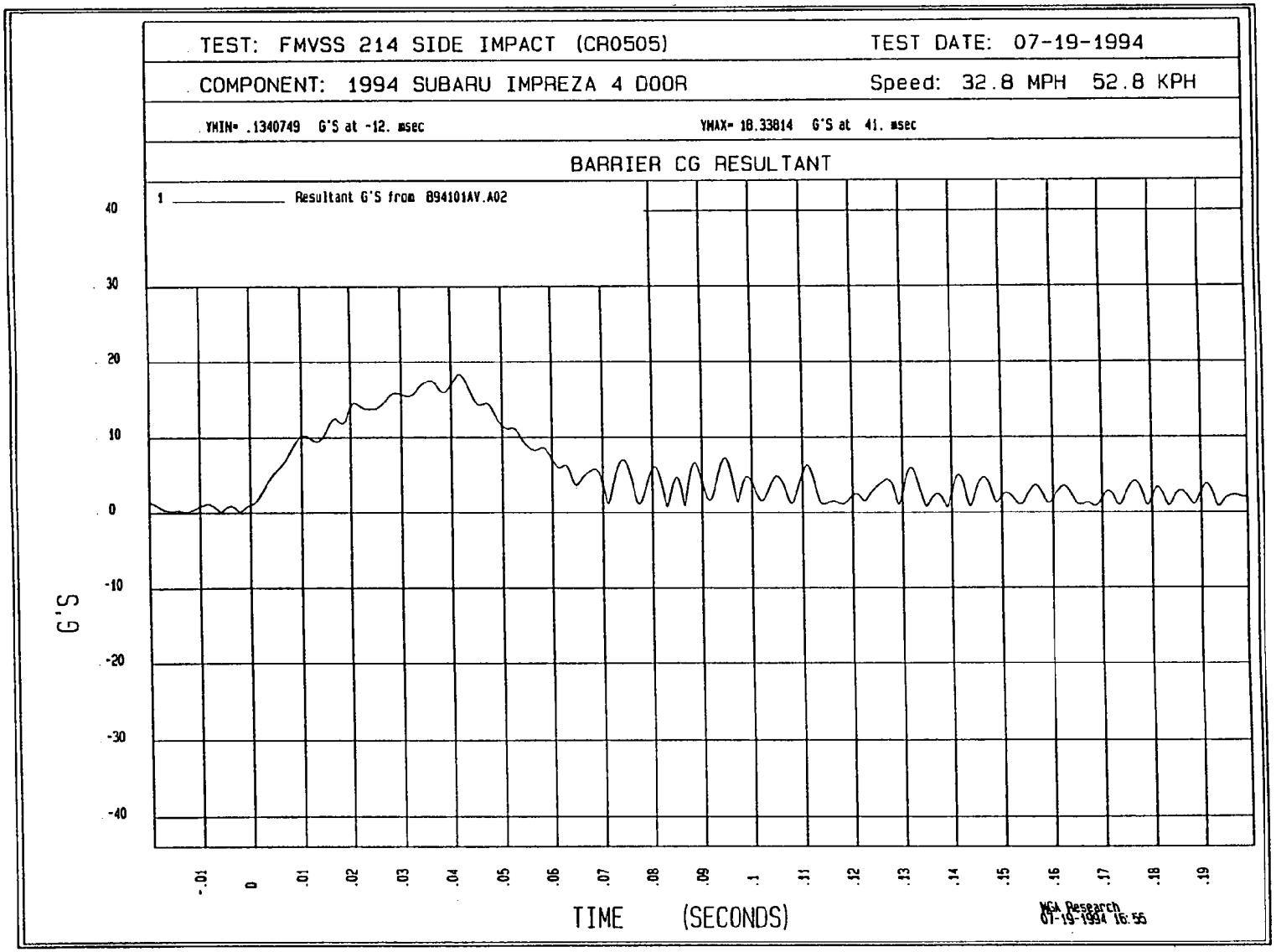



Figure B-58 - Moving Barrier Center of Gravity Resultant vs. Time

Filter: Class 60 (100 Hz)

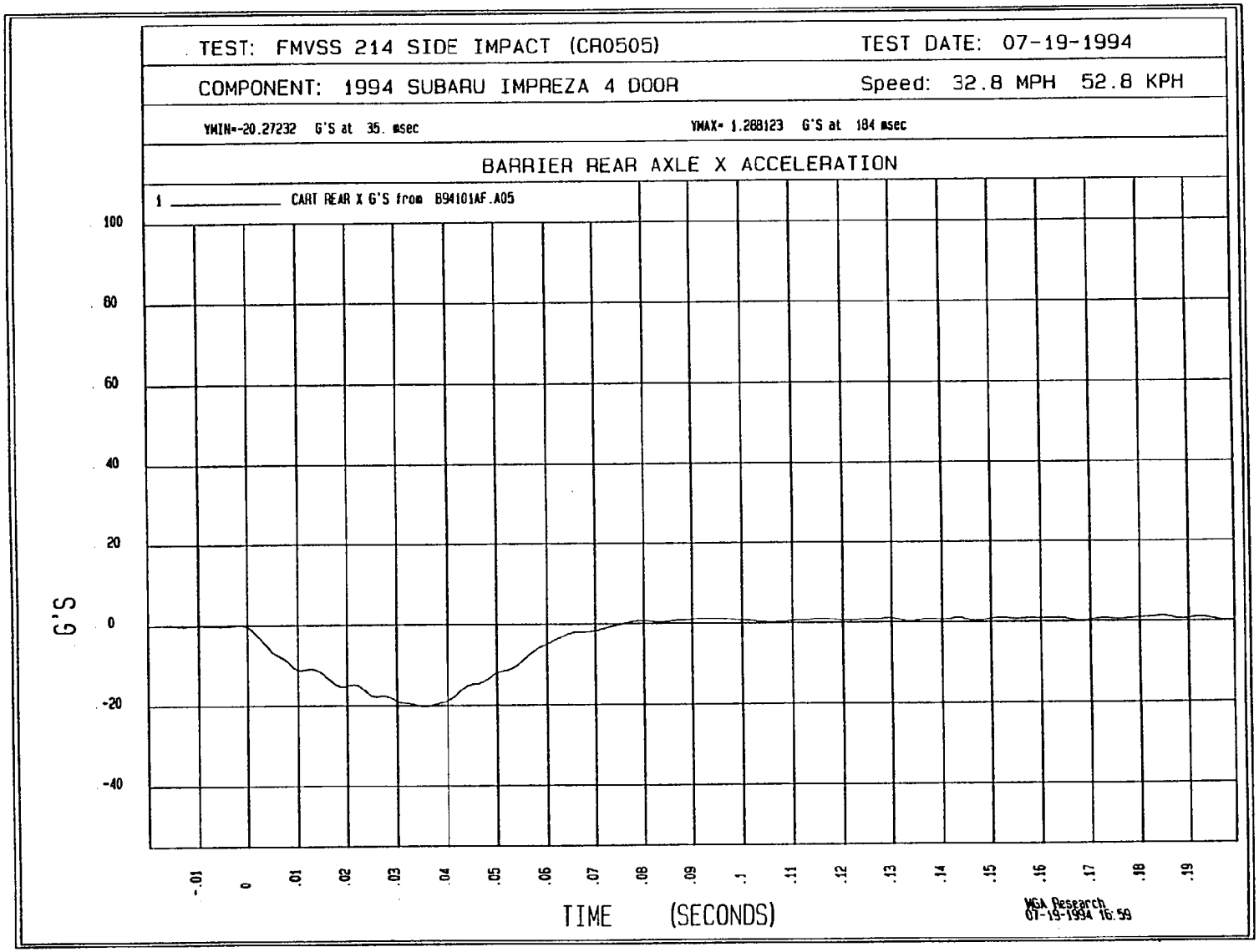



Figure B-59 - Moving Barrier Rear Axle X Acceleration vs. Time

Filter: Class 180 (300 Hz)

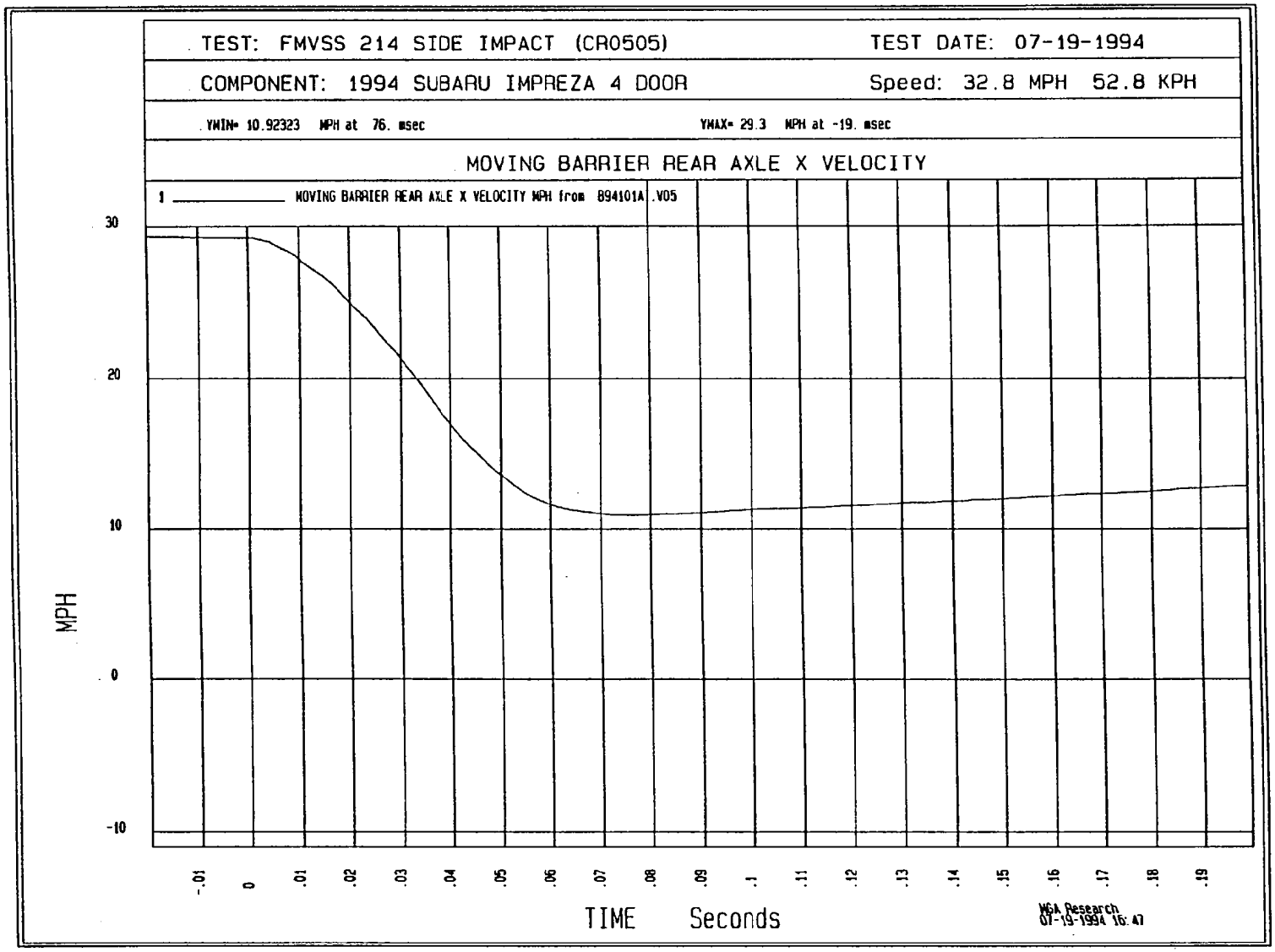



Figure B-60 - Moving Barrier Rear Axle X Velocity vs. Time

Filter: Class 60 (100 Hz)

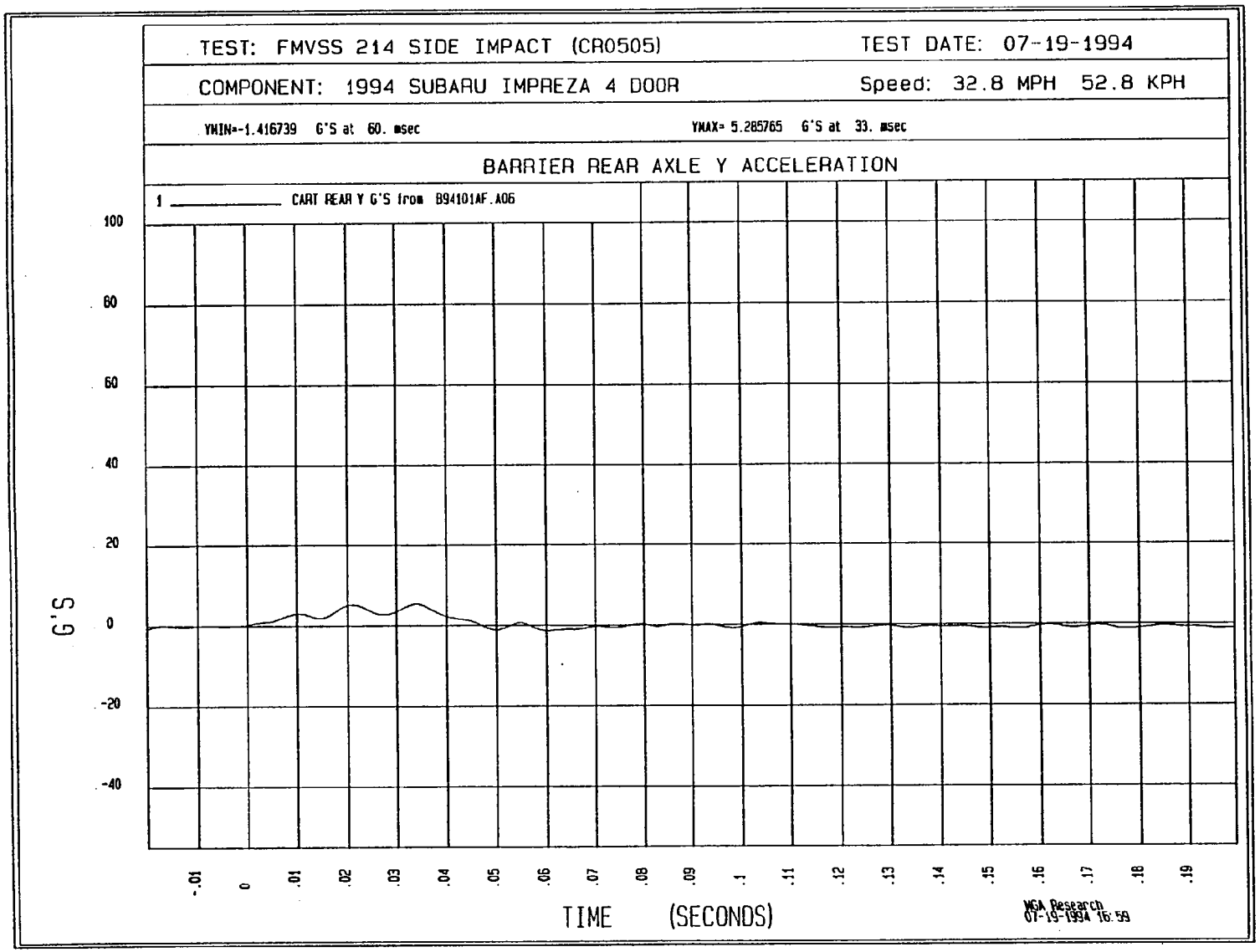



Figure B-61 - Moving Barrier Rear Axle Y Acceleration vs. Time

Filter: Class 180 (300 Hz)

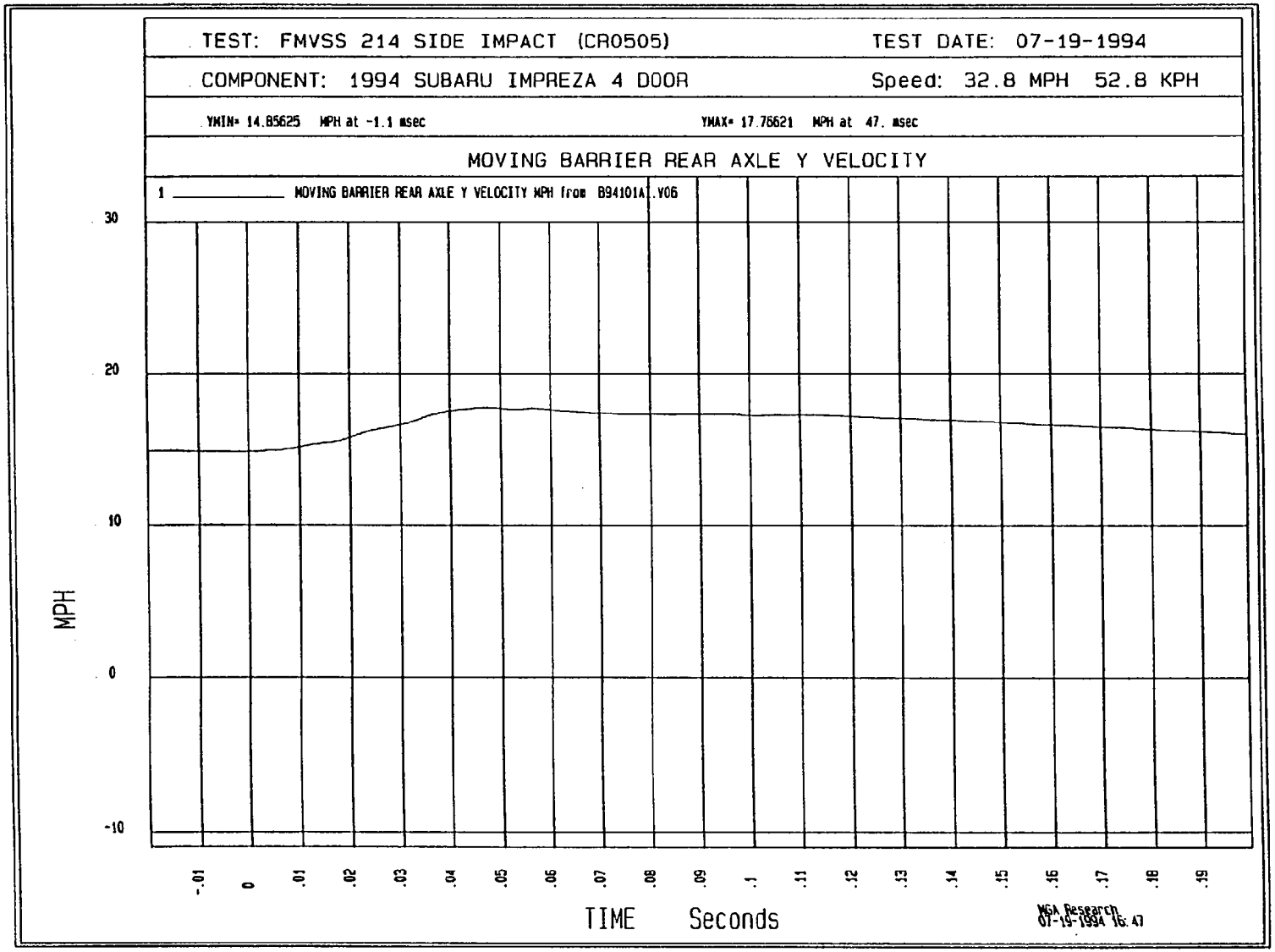



Figure B-62 - Moving Barrier Rear Axle Y Velocity vs. Time

Filter: Class 1000 (1650 Hz)

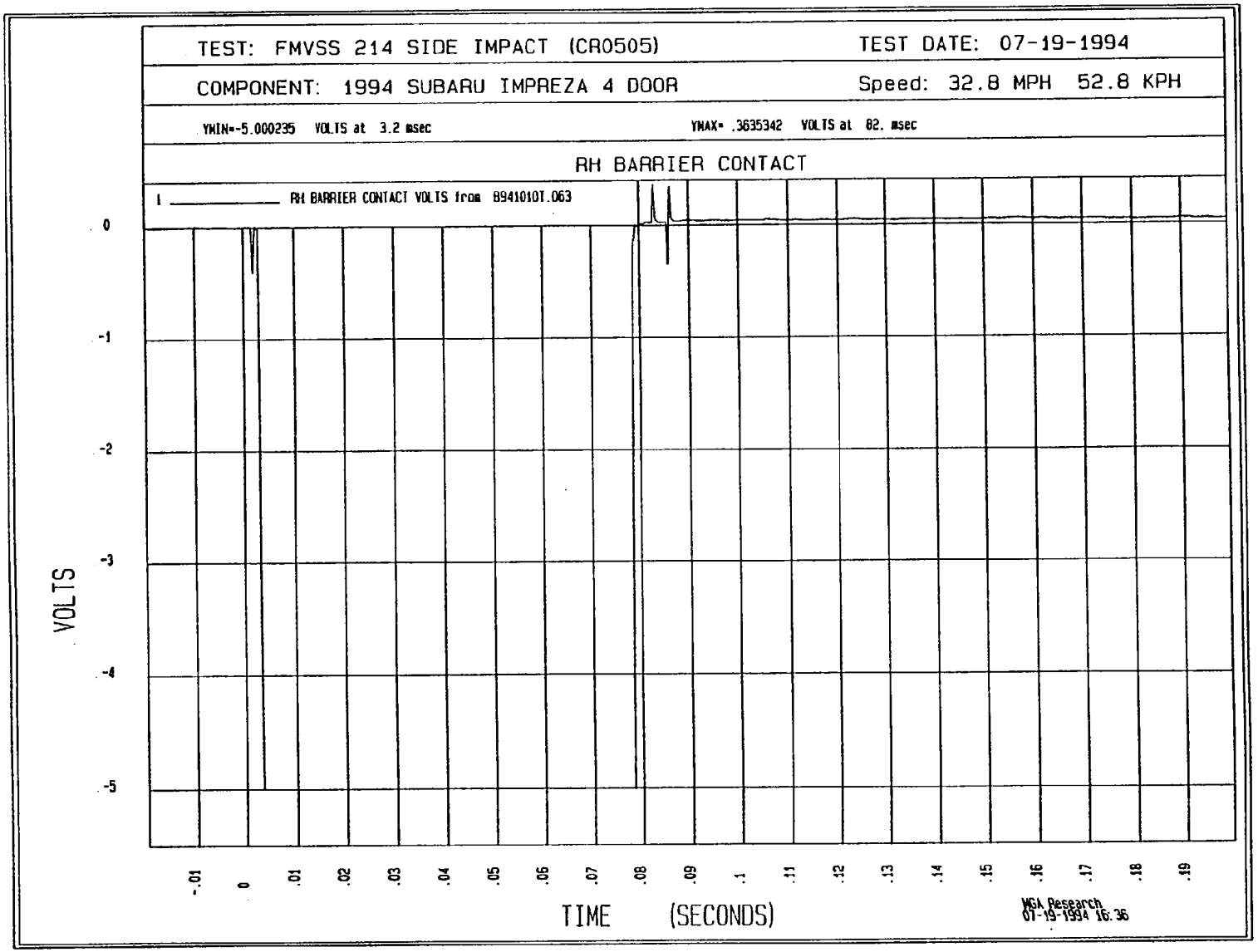



Figure B-63 - Right Hand Barrier Contact

Filter: Class 1000 (1650 Hz)

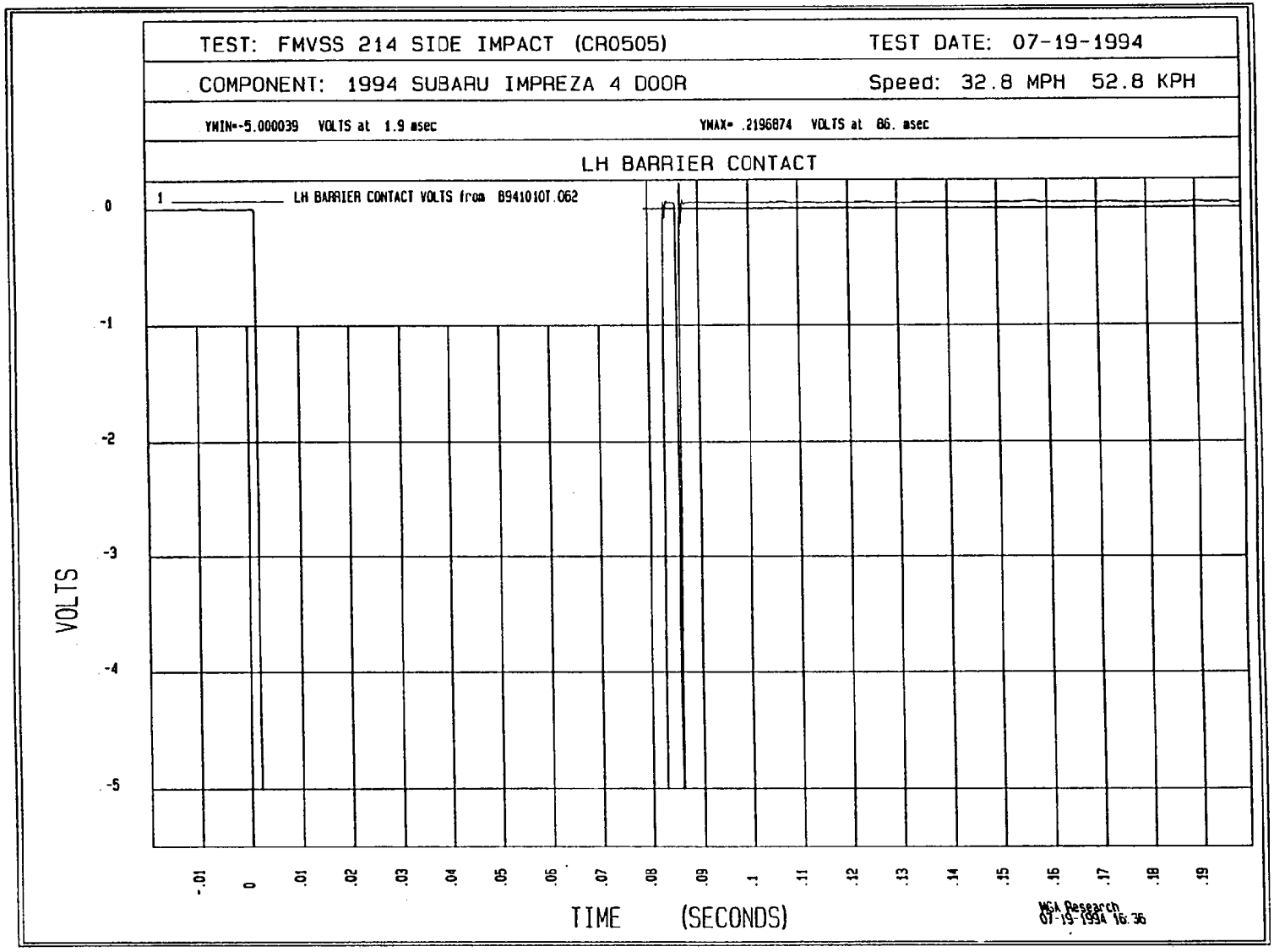



Figure B-64 - Left Hand Barrier Contact

Filter: Class 180 (300 Hz)

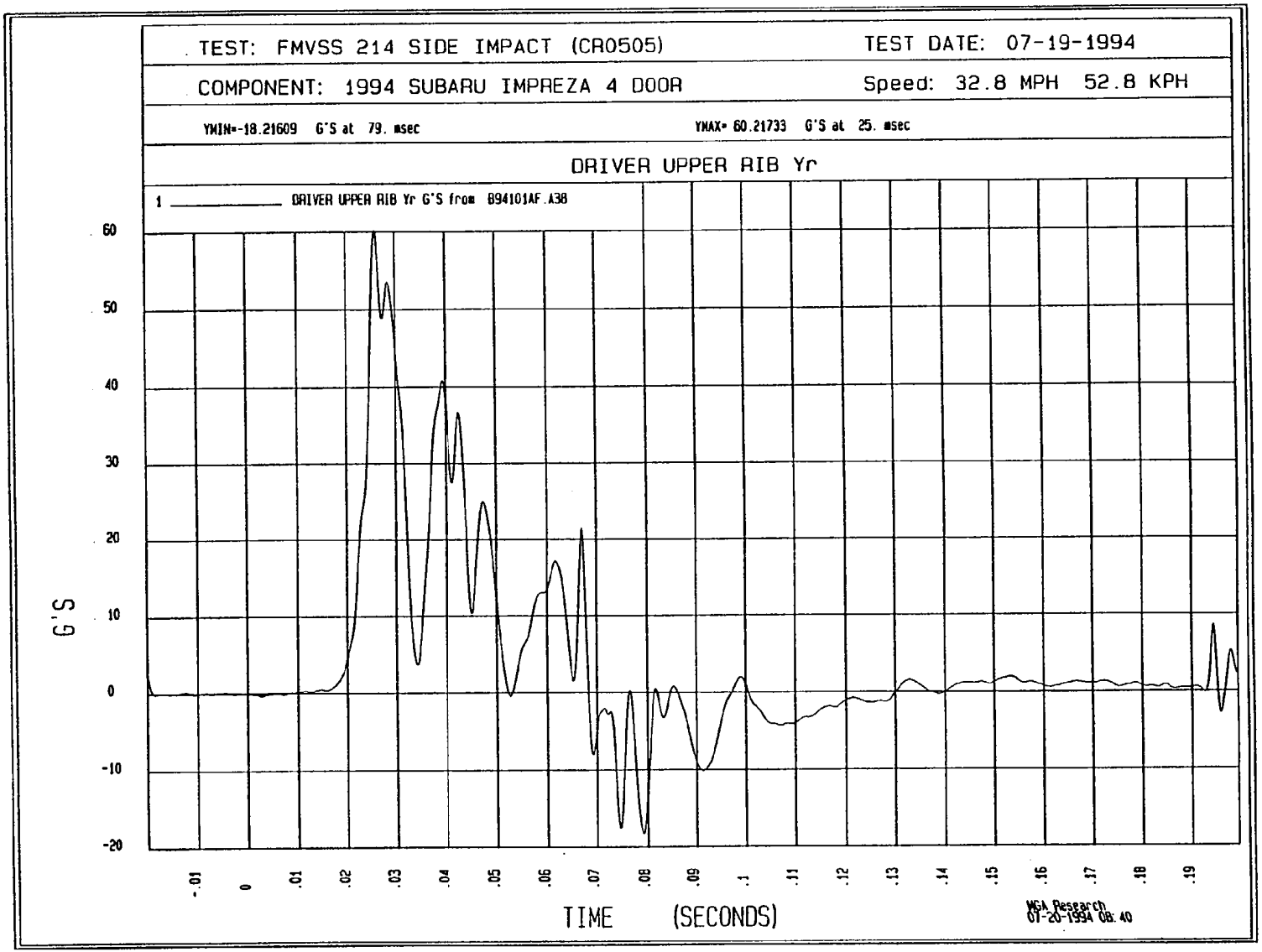



Figure B-65 - Driver Upper Rib Y Redundant Acceleration vs. Time

Filter: Class 180 (300 Hz)

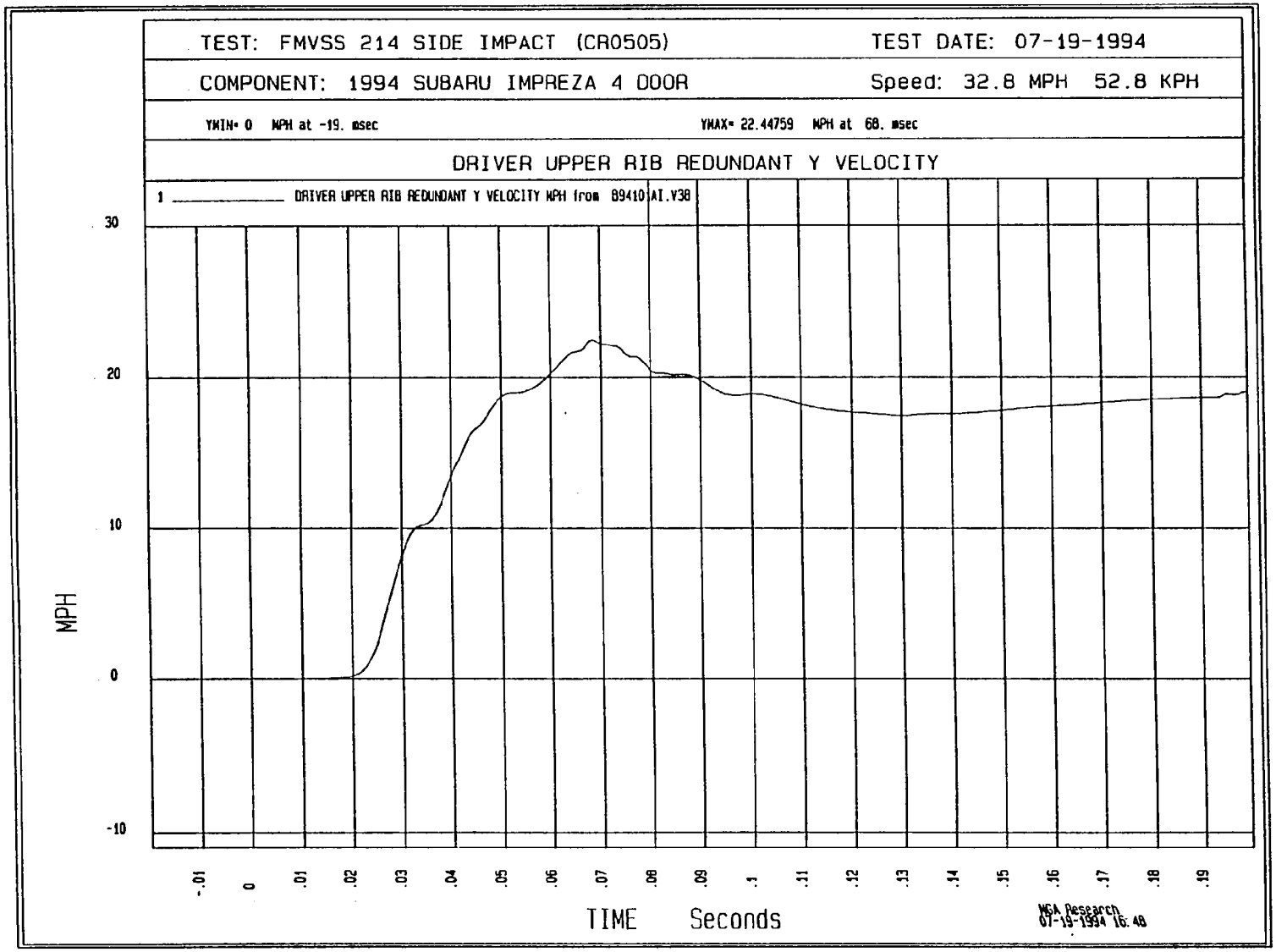



Figure B-66 - Driver Upper Rib Y Redundant Velocity vs. Time

Filter: Class 180 (300 Hz)

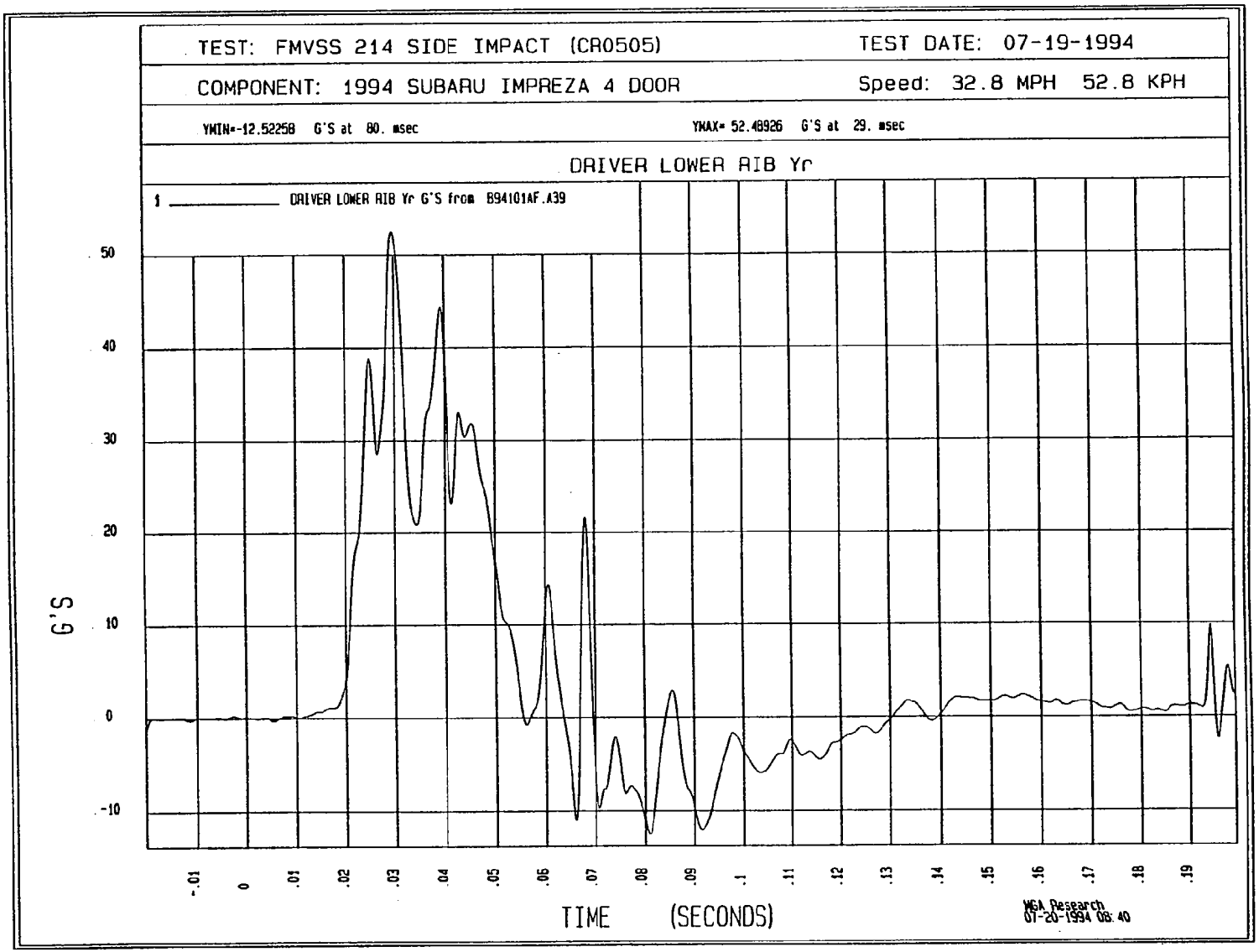



Figure B-67 - Driver Lower Rib Y Redundant Acceleration vs. Time

Filter: Class 180 (300 Hz)

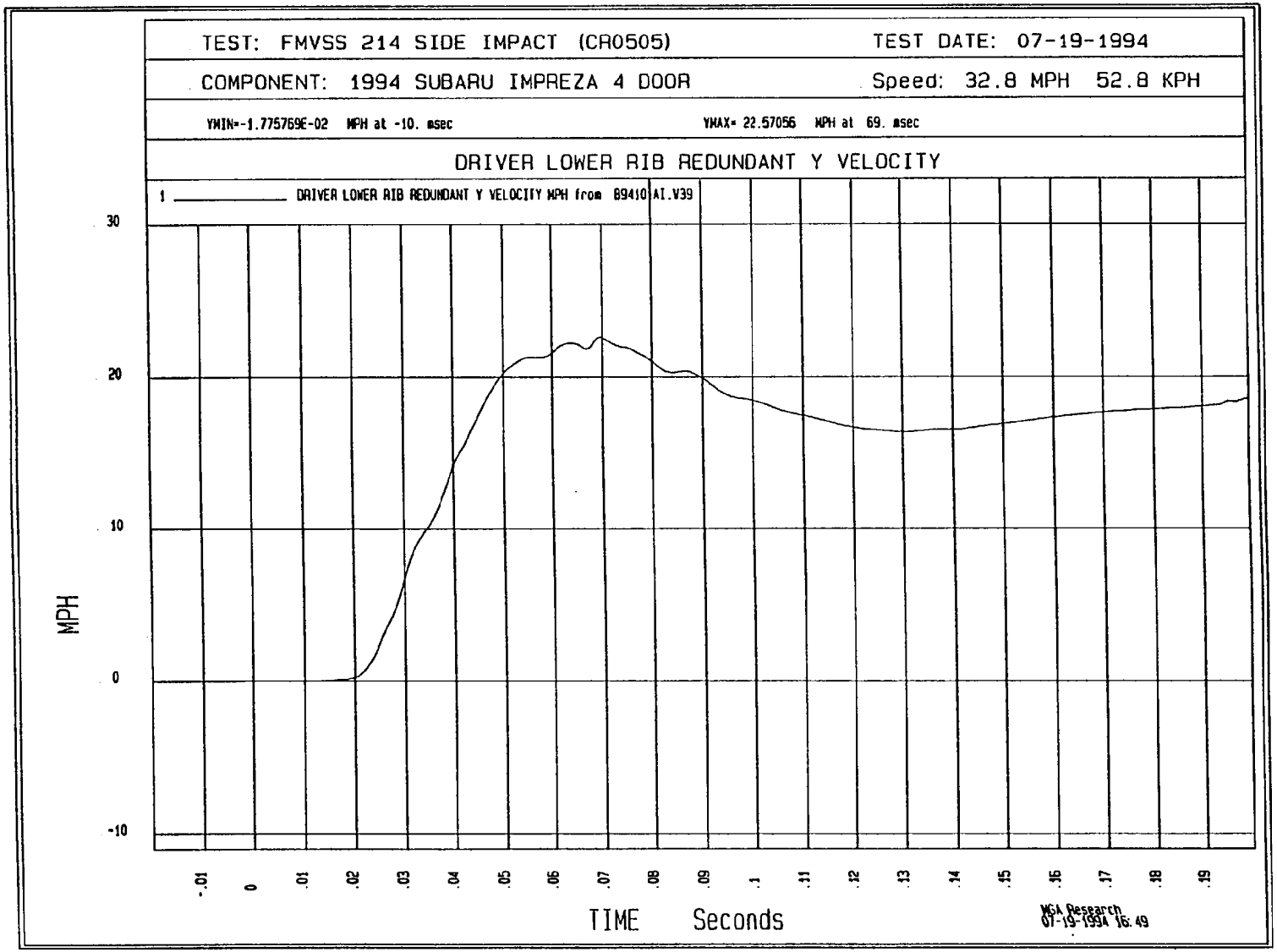



Figure B-68 - Driver Lower Rib Y Redundant Velocity vs. Time

Filter: Class 180 (300 Hz)

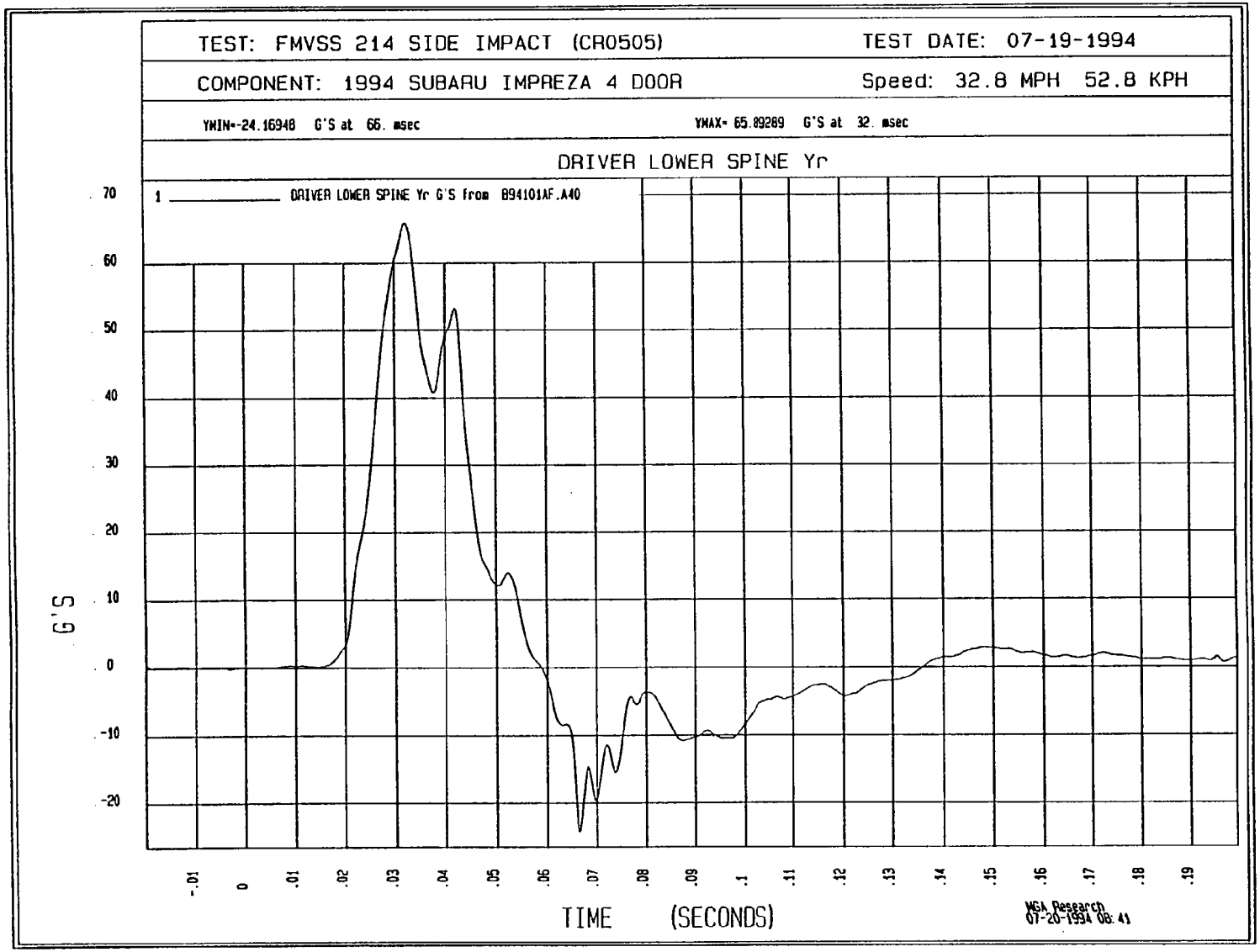



Figure B-69 - Driver Lower Spine Y Redundant Acceleration vs. Time

Filter: Class 180 (300 Hz)

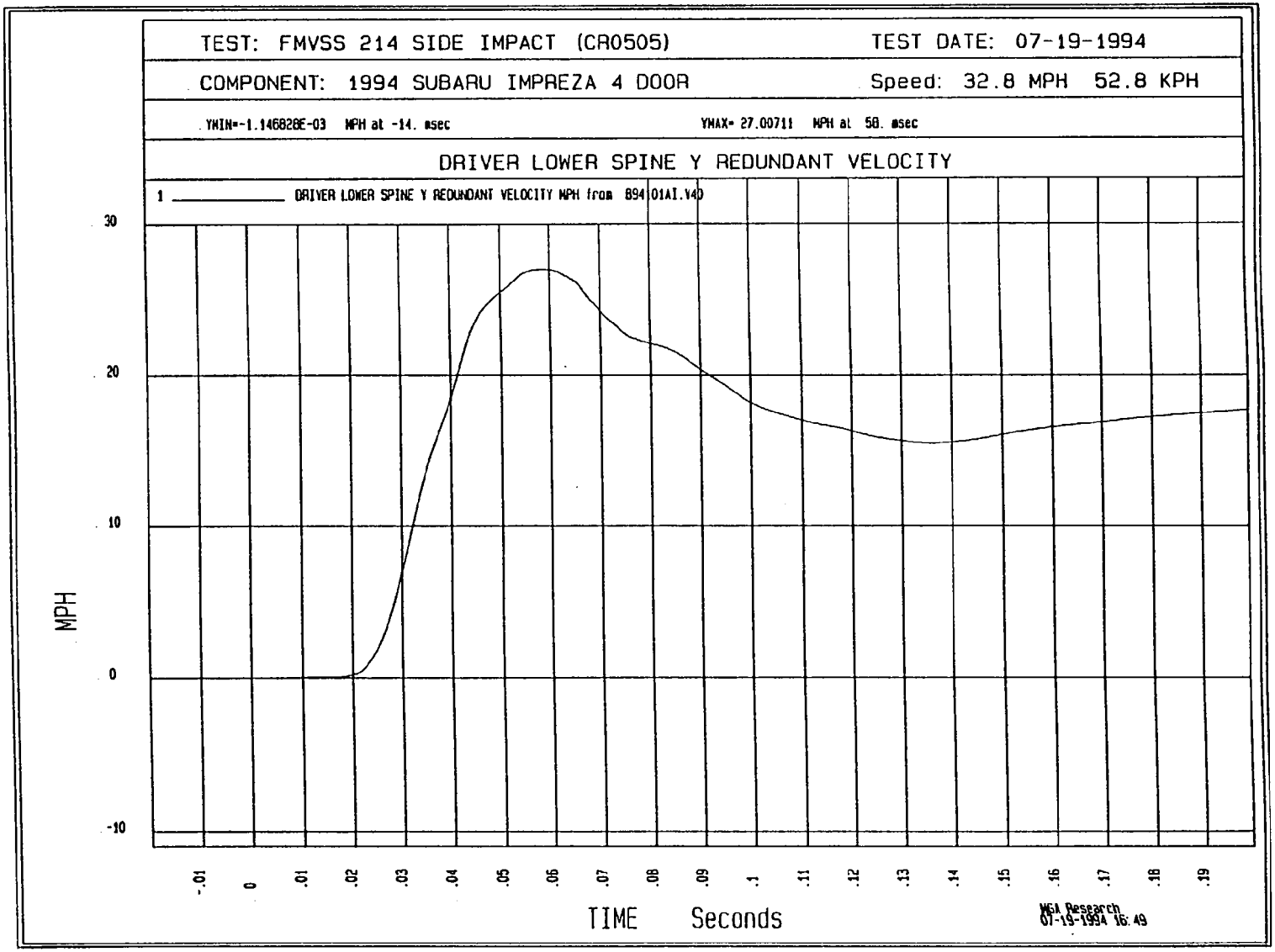



Figure B-70 - Driver Lower Spine Y Redundant Velocity vs. Time

Filter: Class 180 (300 Hz)

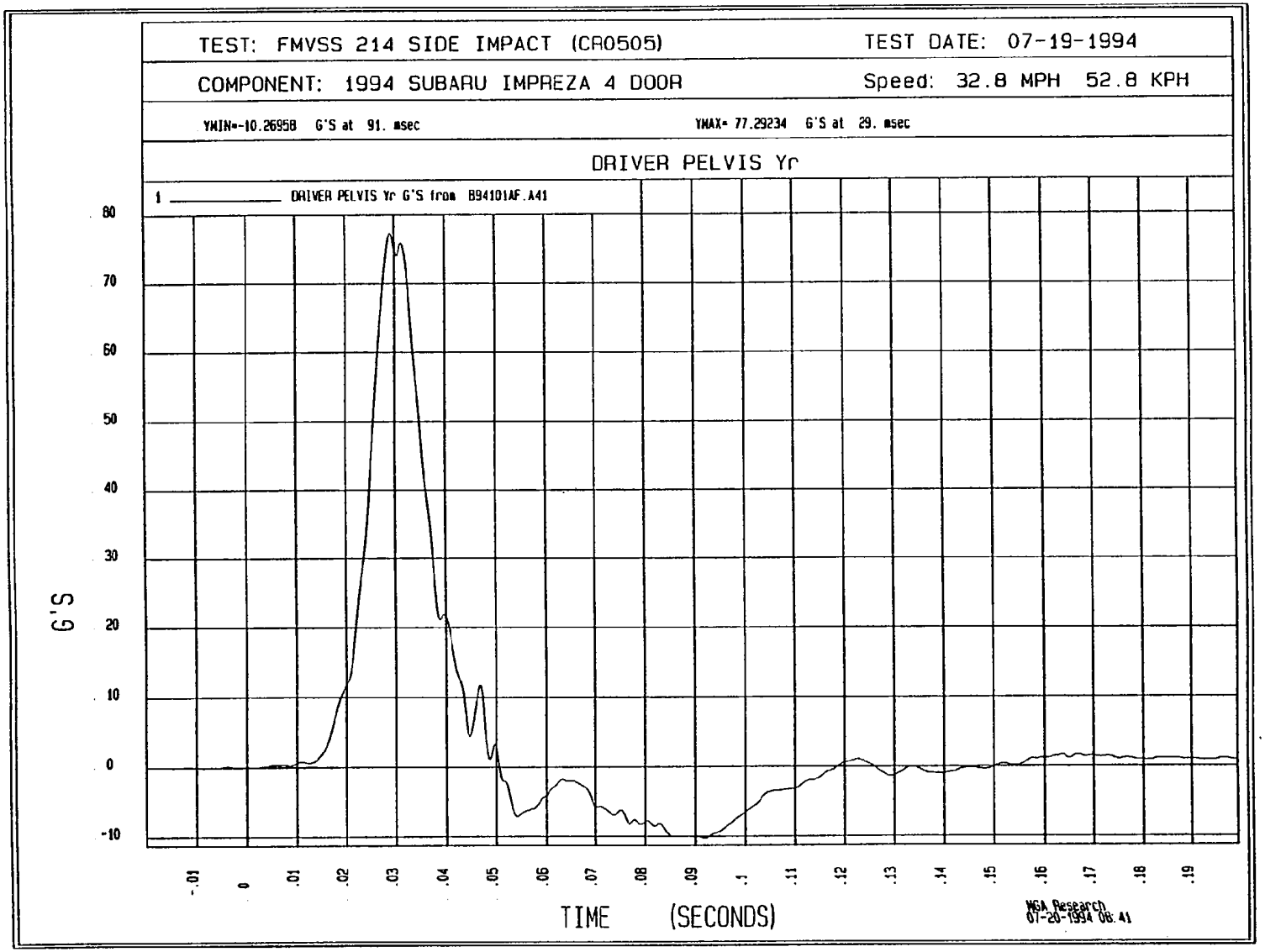



Figure B-71 - Driver Pelvis Y Redundant Acceleration vs. Time

Filter: Class 180 (300 Hz)

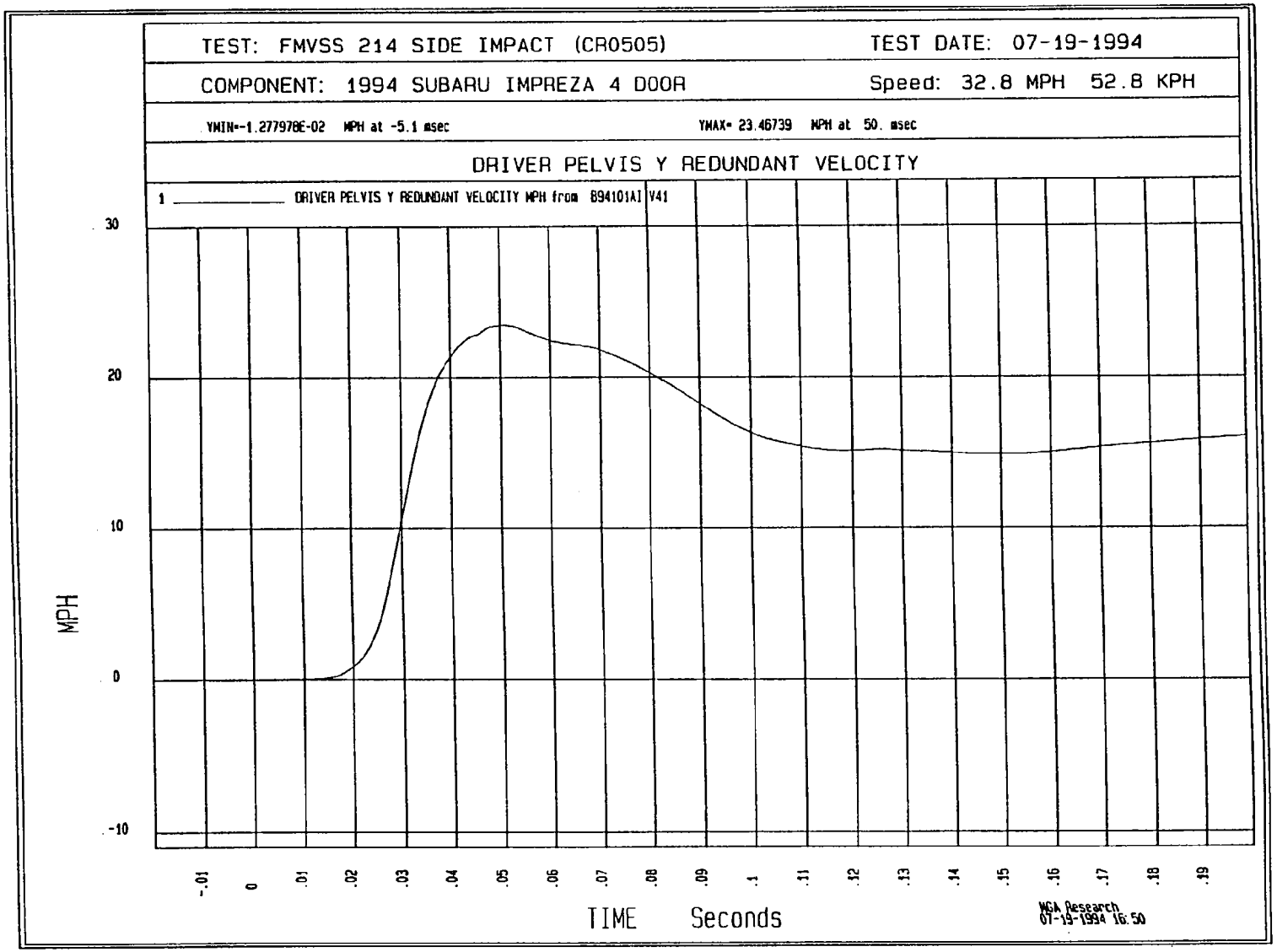



Figure B-72 - Driver Pelvis Y Redundant Velocity vs. Time

Filter: Class 180 (300 Hz)

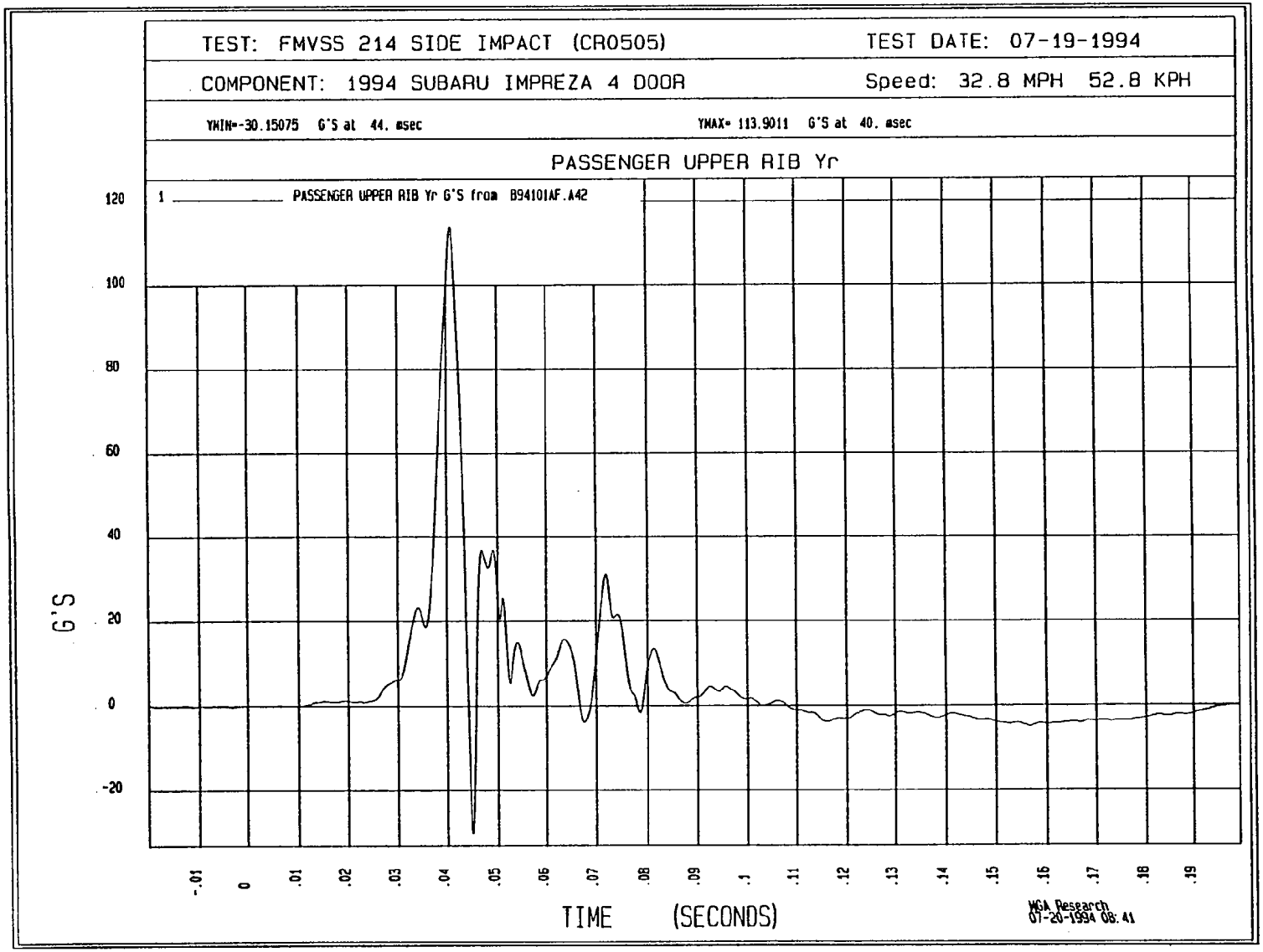



Figure B-73 - Passenger Upper Rib Y Redundant Acceleration vs. Time

Filter: Class 180 (300 Hz)

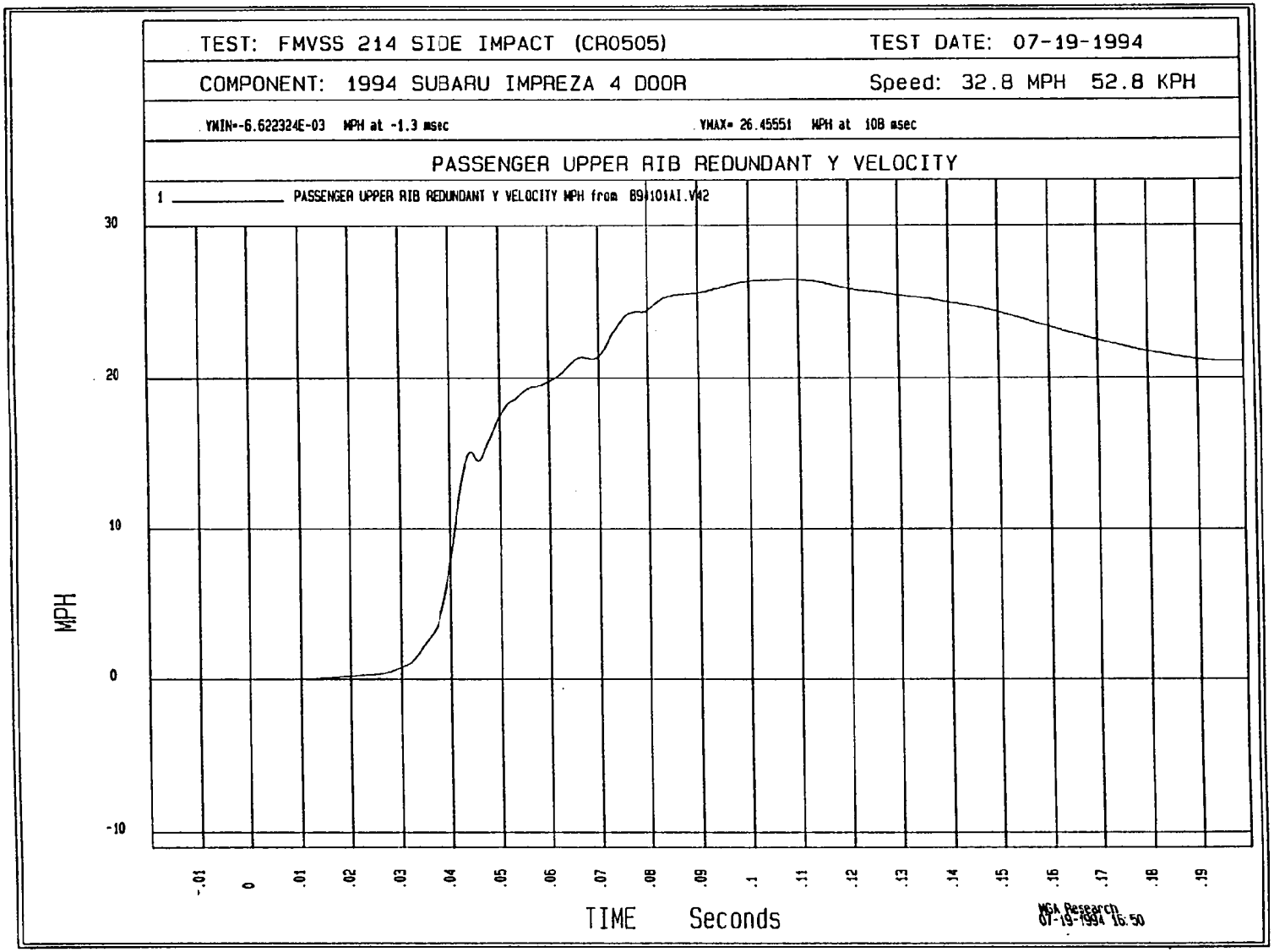



Figure B-74 - Passenger Upper Rib Y Redundant Velocity vs. Time

Filter: Class 180 (300 Hz)

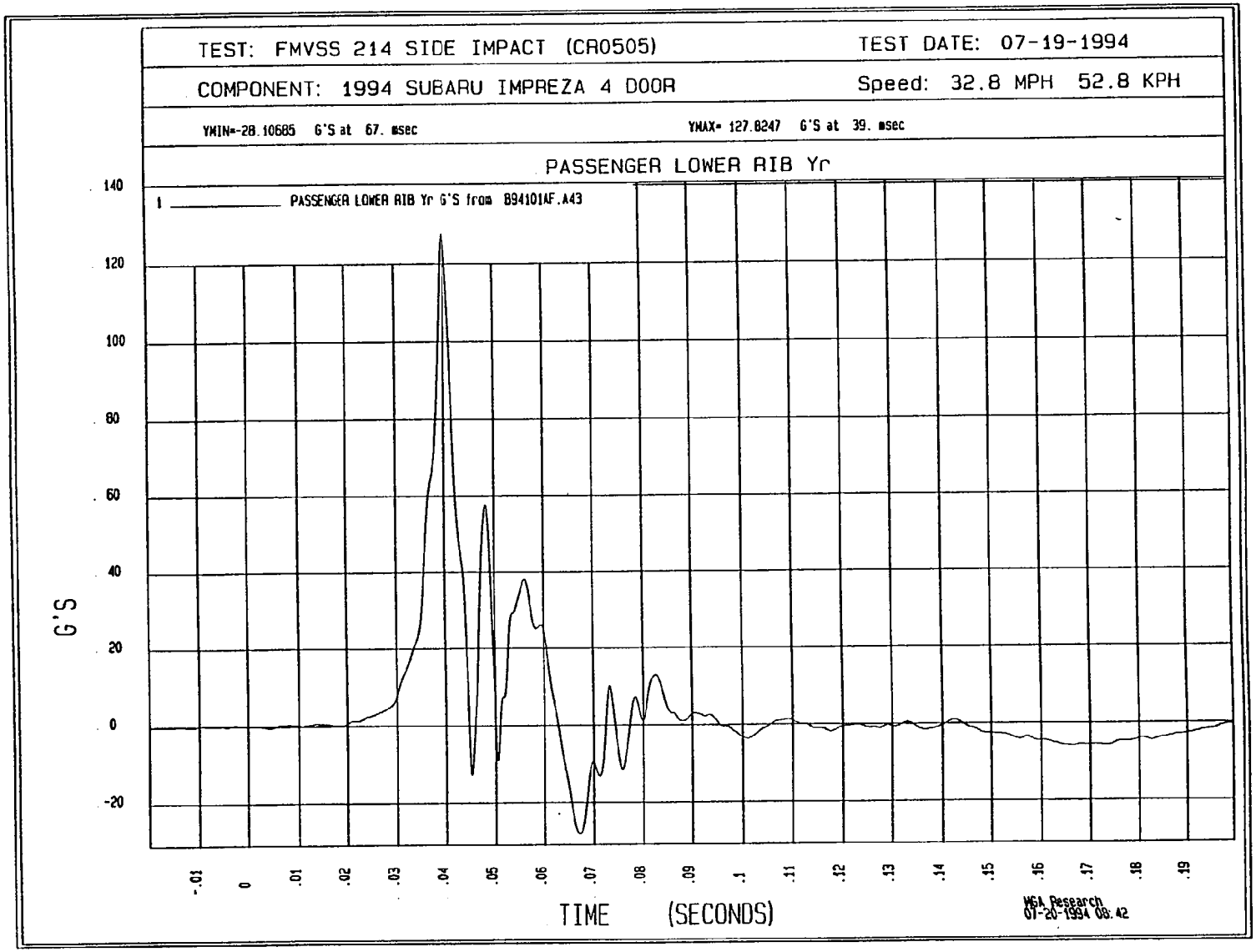



Figure B-75 - Passenger Lower Rib Y Redundant Acceleration vs. Time

Filter: Class 180 (300 Hz)

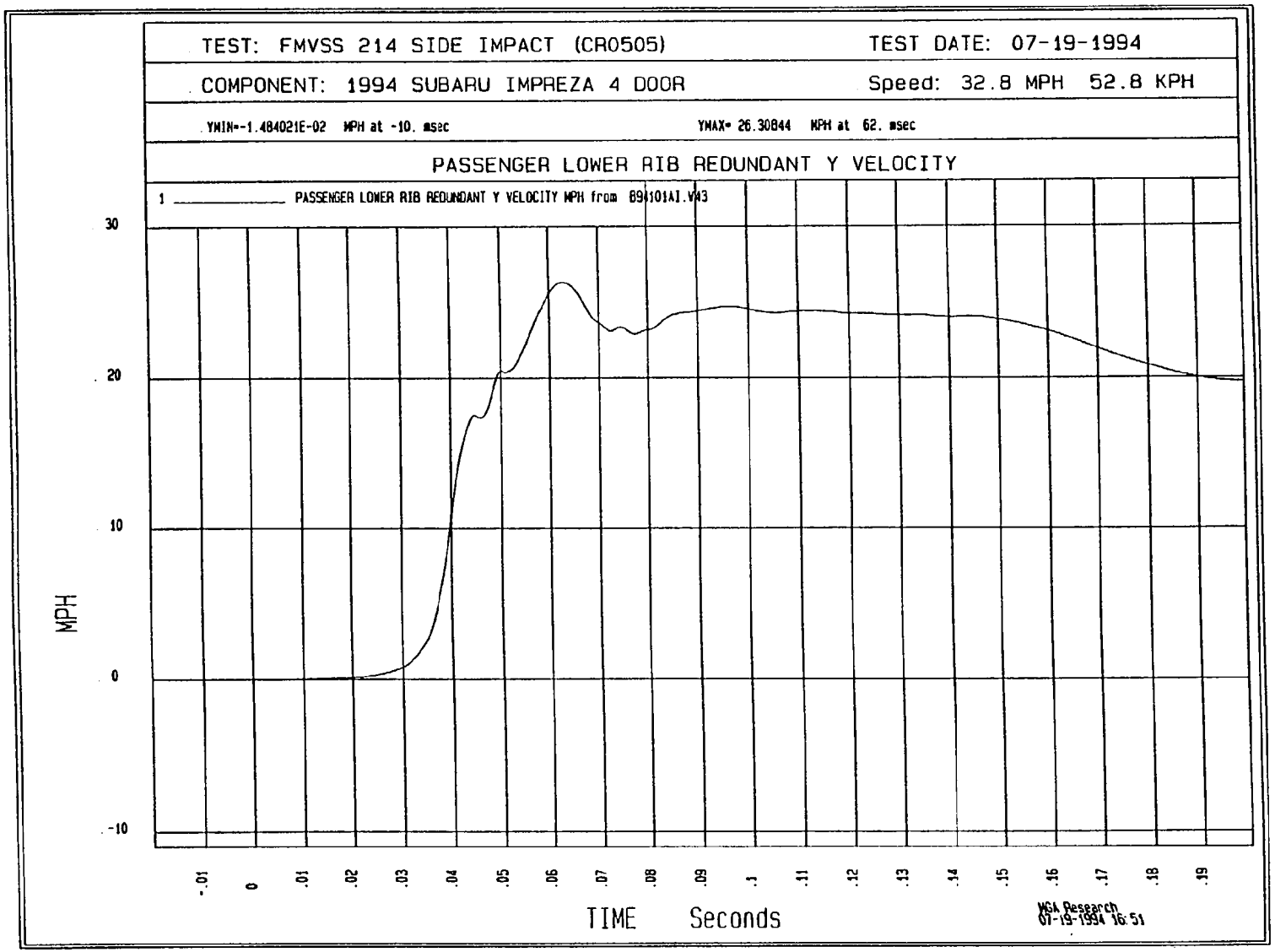



Figure B-76 - Passenger Lower Rib Y Redundant Velocity vs. Time

Filter: Class 180 (300 Hz)

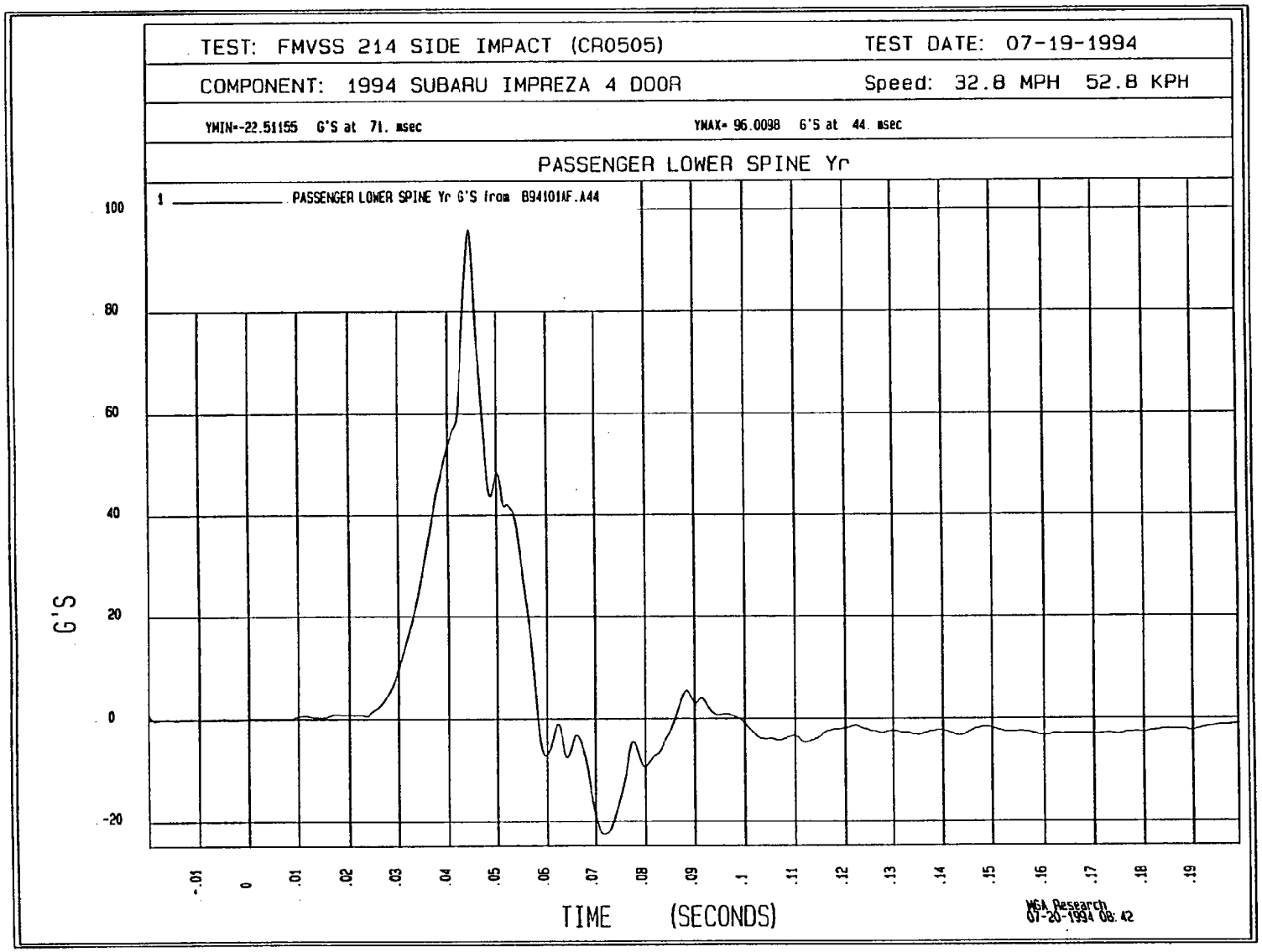



Figure B-77 - Passenger Lower Spine Y Redundant Acceleration vs. Time

Filter: Class 180 (300 Hz)

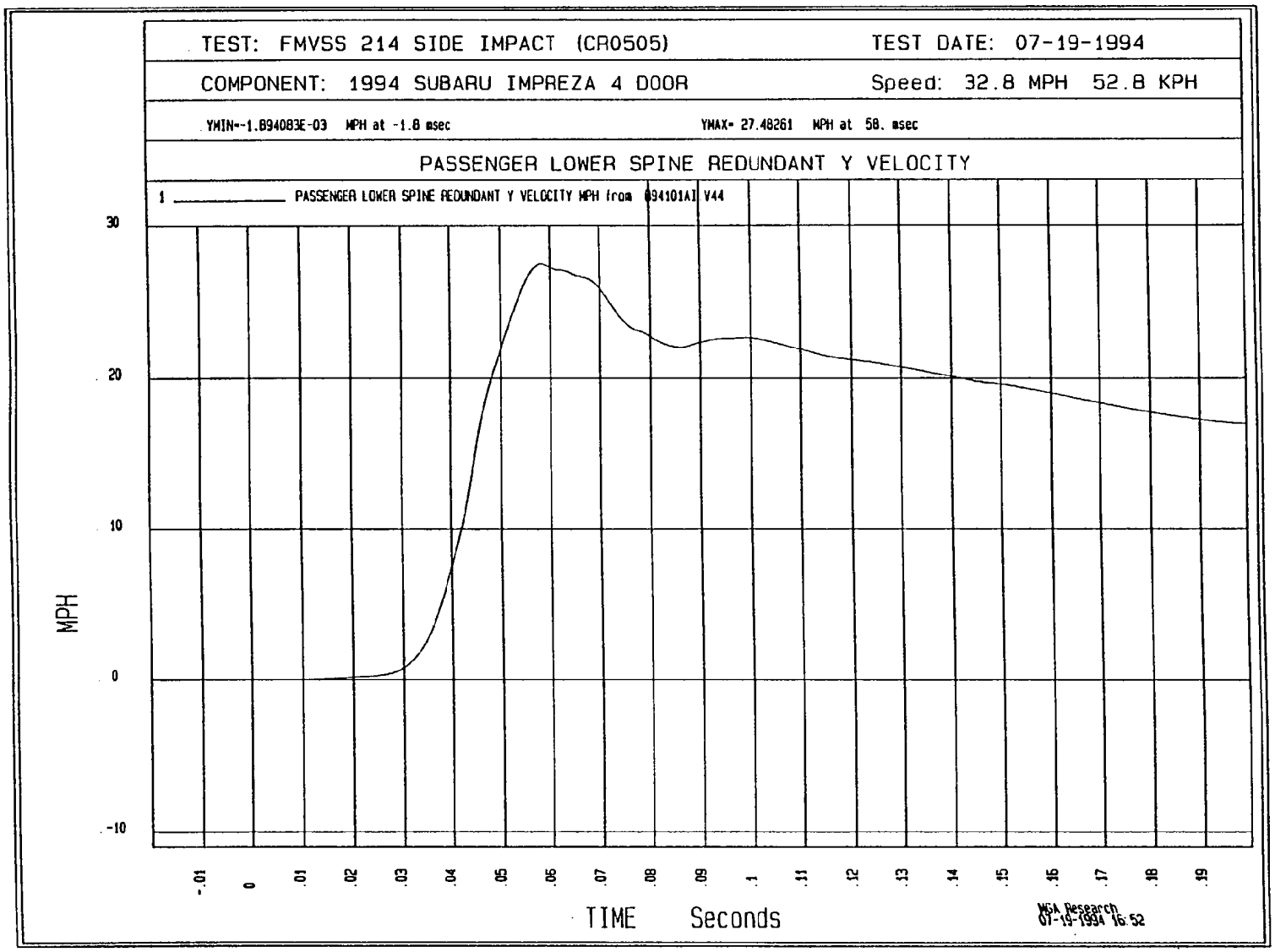



Figure B-78 - Passenger Lower Spine Y Redundant Velocity vs. Time

Filter: Class 180 (300 Hz)

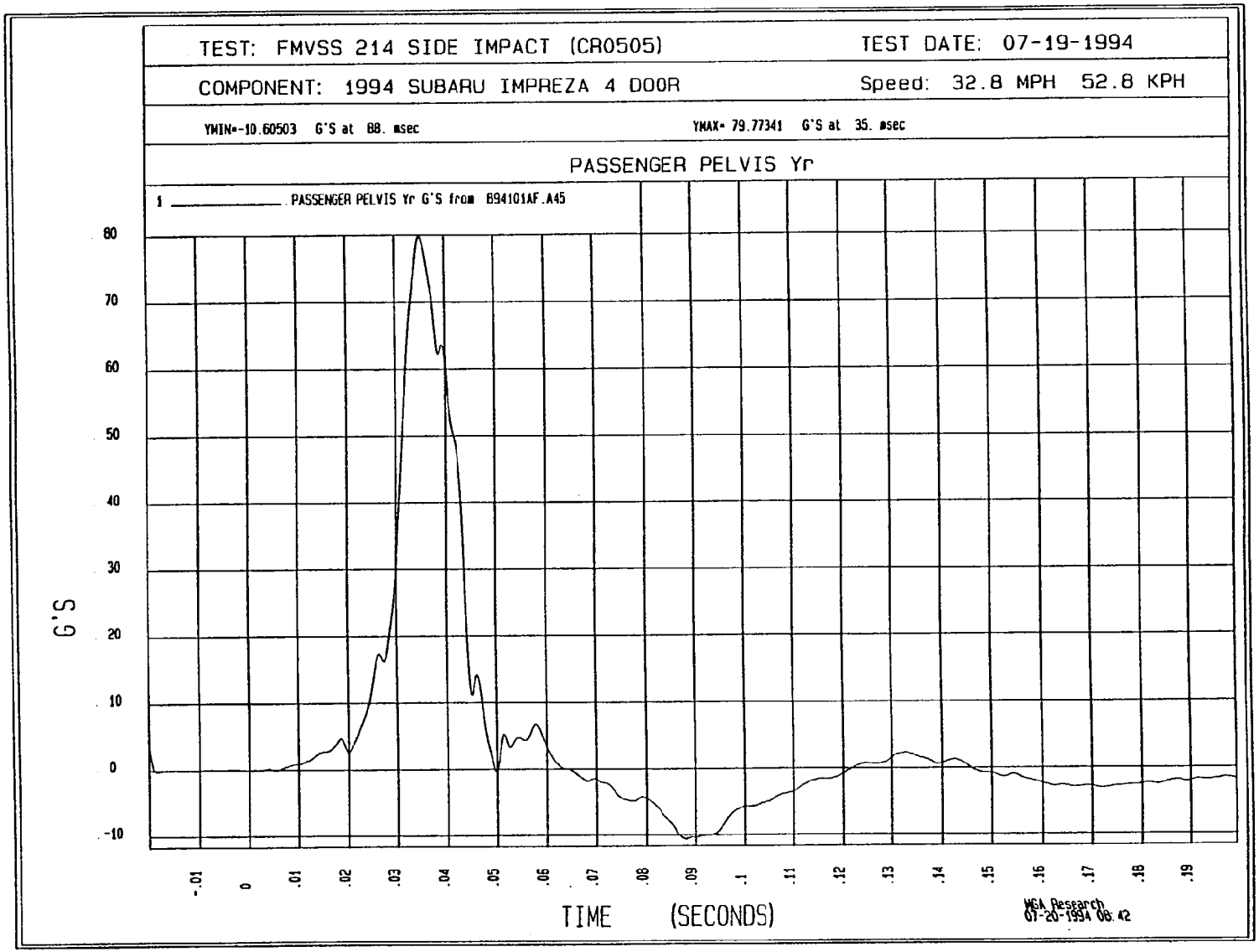



Figure B-79 - Passenger Pelvis Y Redundant Acceleration vs. Time

Filter: Class 180 (300 Hz)

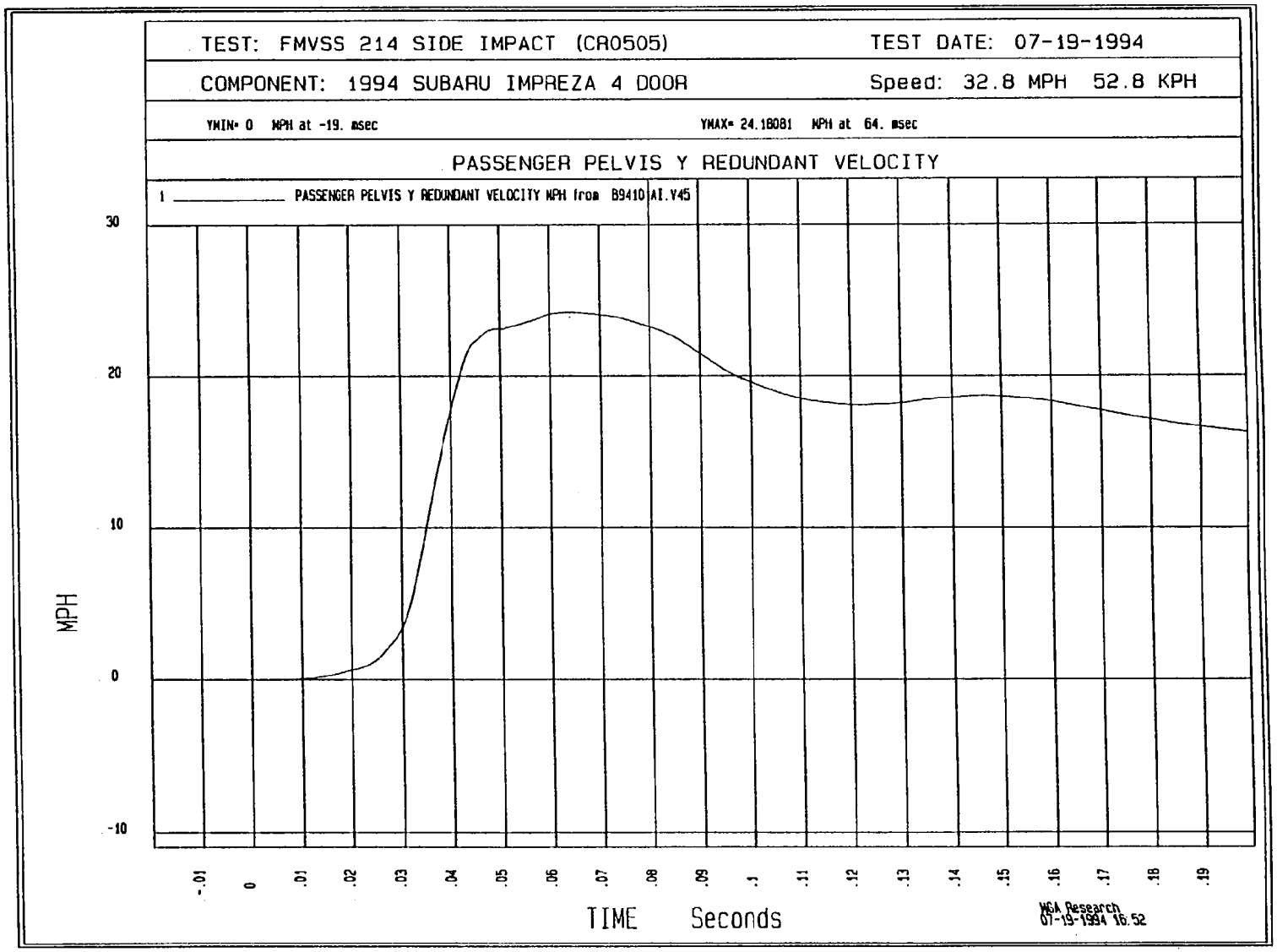



Figure B-80 - Passenger Pelvis Y Redundant Velocity vs. Time

FINITE IMPULSE RESPONSE (FIR) FILTERED DATA

Table of Data Plots


| | Page No. |
|---|---|
| Figure B-81 - Driver Upper Rib Y Acceleration vs. Time | B-81 |
| Figure B-82 - Driver Upper Rib Y Redundant Acceleration vs. Time | B-82 |
| Figure B-83 - Driver Lower Rib Y Acceleration vs. Time | B-83 |
| Figure B-84 - Driver Lower Rib Y Redundant Acceleration vs. Time | B-84 |
| Figure B-85 - Driver Lower Spine Y Acceleration vs. Time | B-85 |
| Figure B-86 - Driver Lower Spine Y Redundant Acceleration vs. Time | B-86 |
| Figure B-87 - Driver Pelvis Y Acceleration vs. Time | B-87 |
| Figure B-88 - Driver Pelvis Y Redundant Acceleration vs. Time | B-88 |
| Figure B-89 - Passenger Upper Rib Y Acceleration vs. Time | B-89 |
| Figure B-90 - Passenger Upper Rib Y Redundant Acceleration vs. Time | B-90 |
| Figure B-91 - Passenger Lower Rib Y Acceleration vs. Time | B-91 |
| Figure B-92 - Passenger Lower Rib Y Redundant Acceleration vs. Time | B-92 |
| Figure B-93 - Passenger Lower Spine Y Acceleration vs. Time | B-93 |
| Figure B-94 - Passenger Lower Spine Y Redundant Acceleration vs. Time | B-94 |
| Figure B-95 - Passenger Pelvis Y Acceleration vs. Time | B-95 |
| Figure B-96 - Passenger Pelvis Y Redundant Acceleration vs. Time | B-96 |

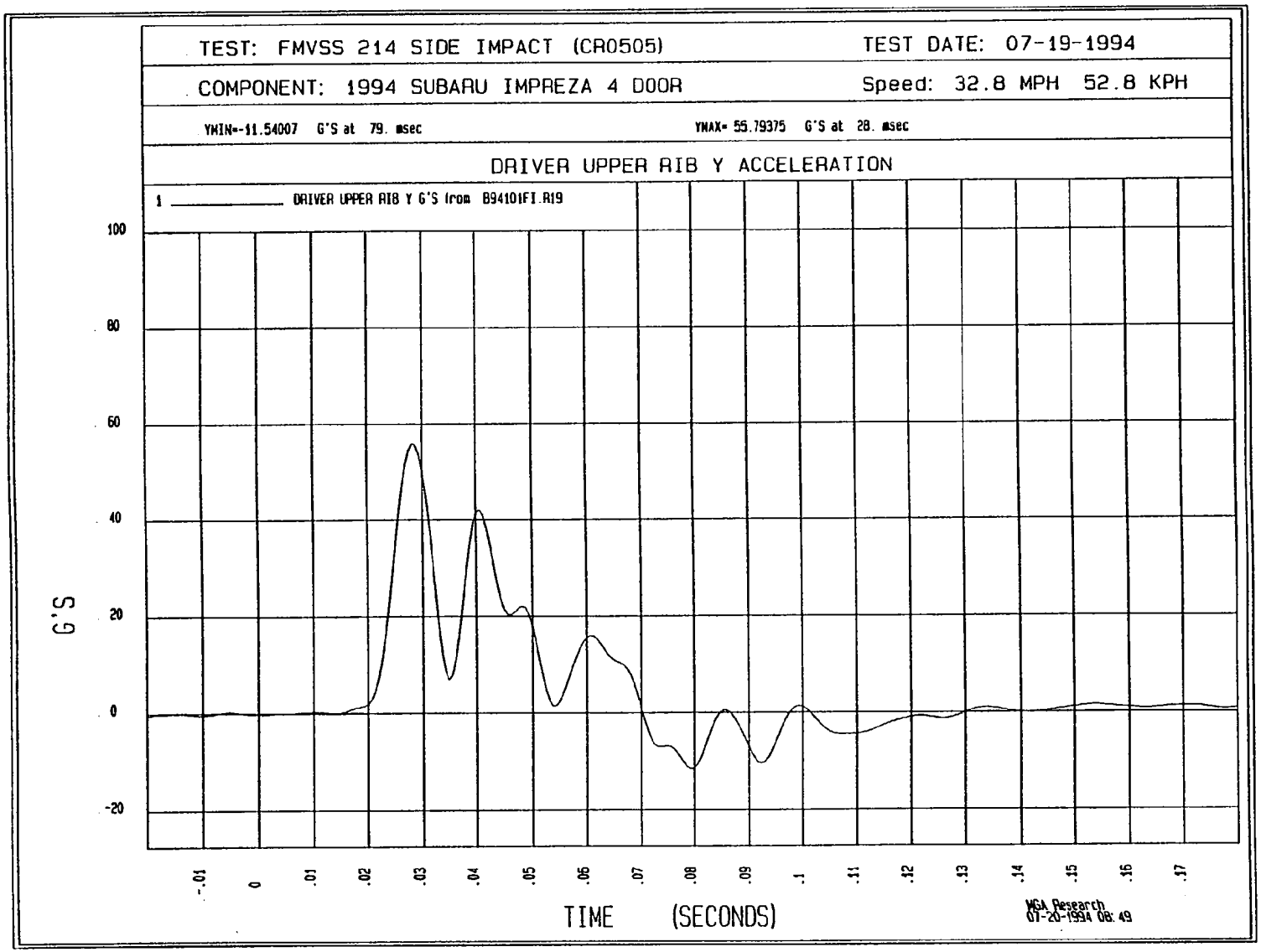



Figure B-81 - Driver Upper Rib Y Acceleration vs. Time

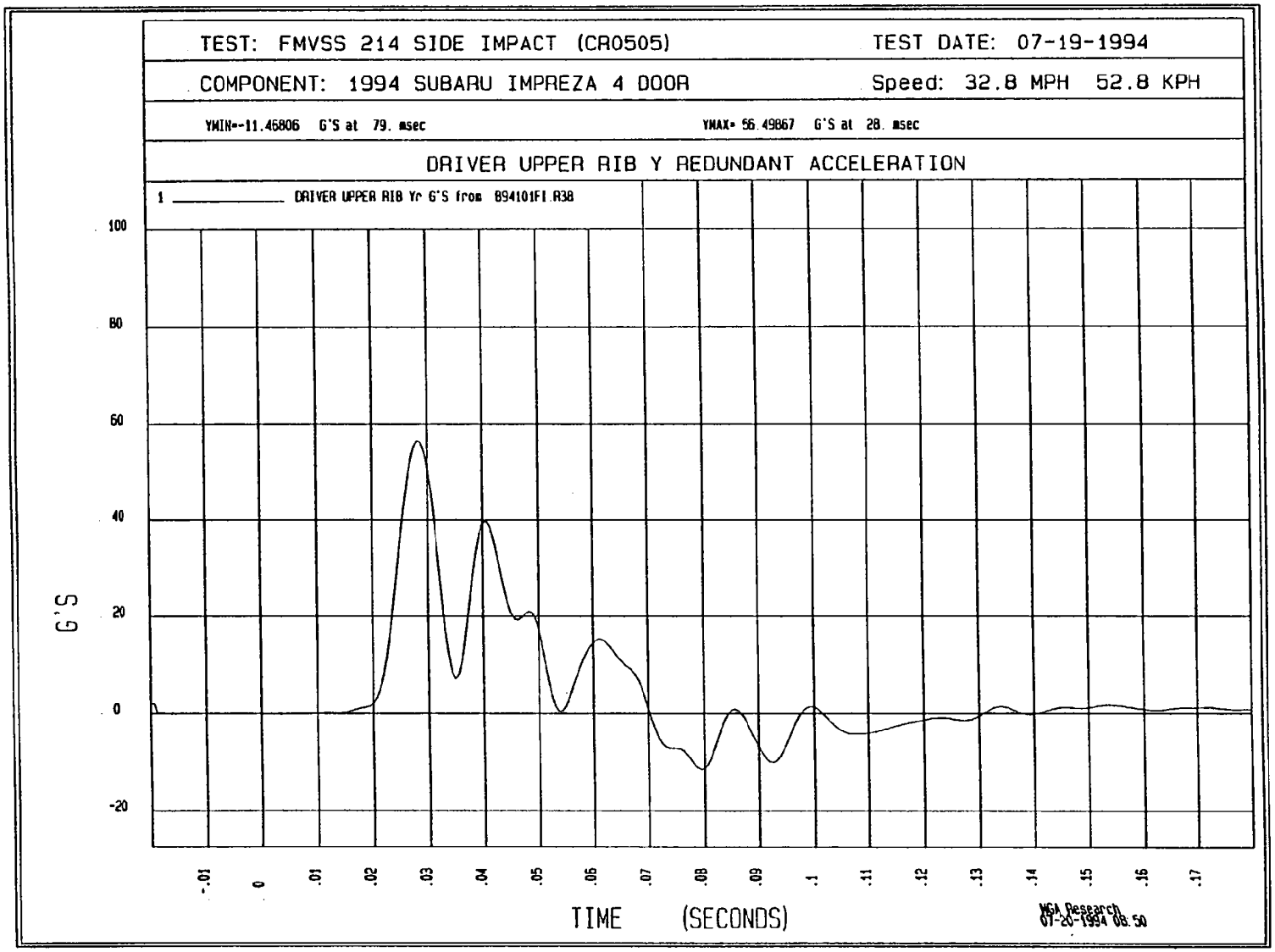



Figure B-82 - Driver Upper Rib Y Redundant Acceleration vs. Time

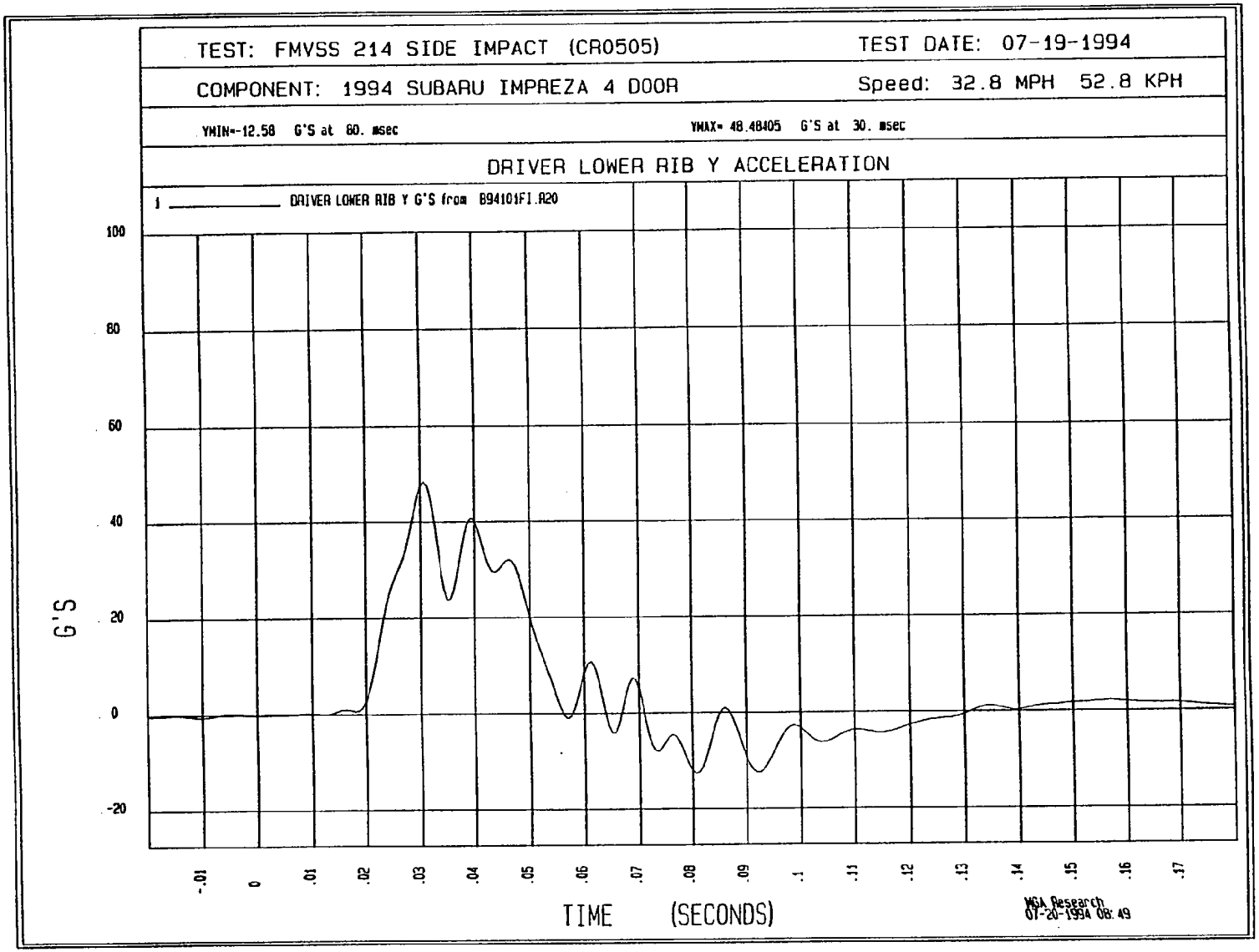



Figure B-83 - Driver Lower Rib Y Acceleration vs. Time

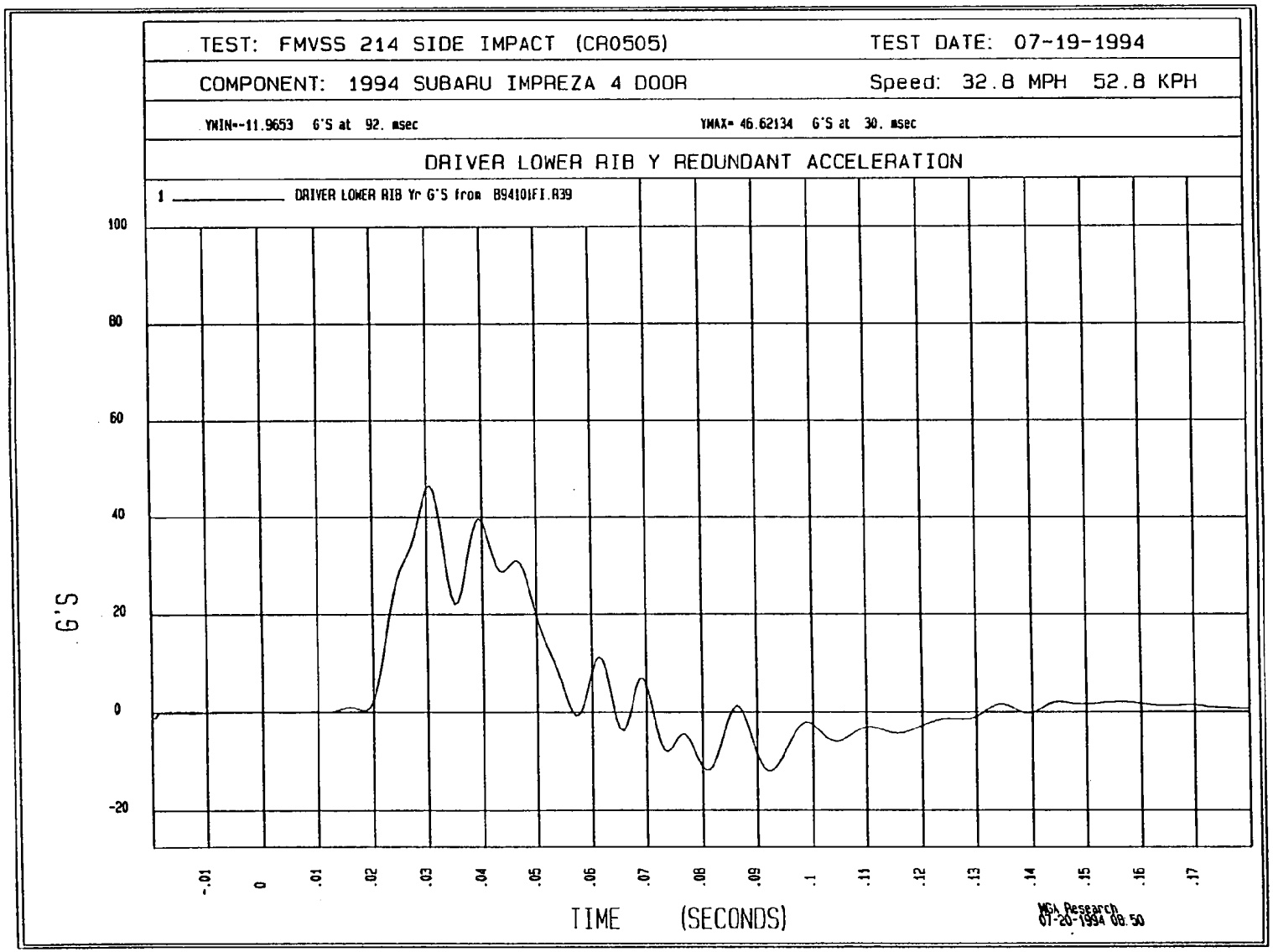



Figure B-84 - Driver Lower Rib Y Redundant Acceleration vs. Time

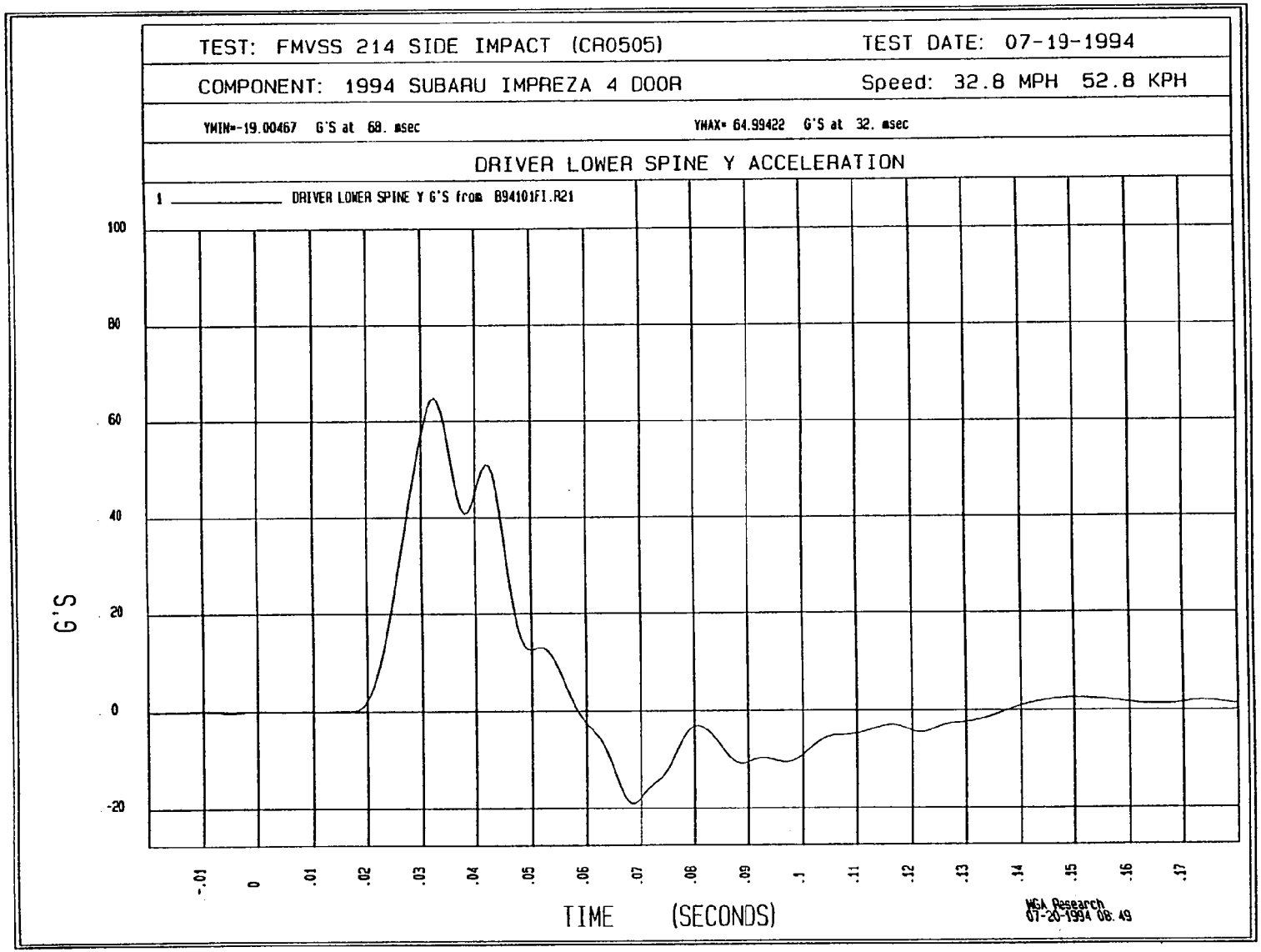



Figure B-85 - Driver Lower Spine Y Acceleration vs. Time

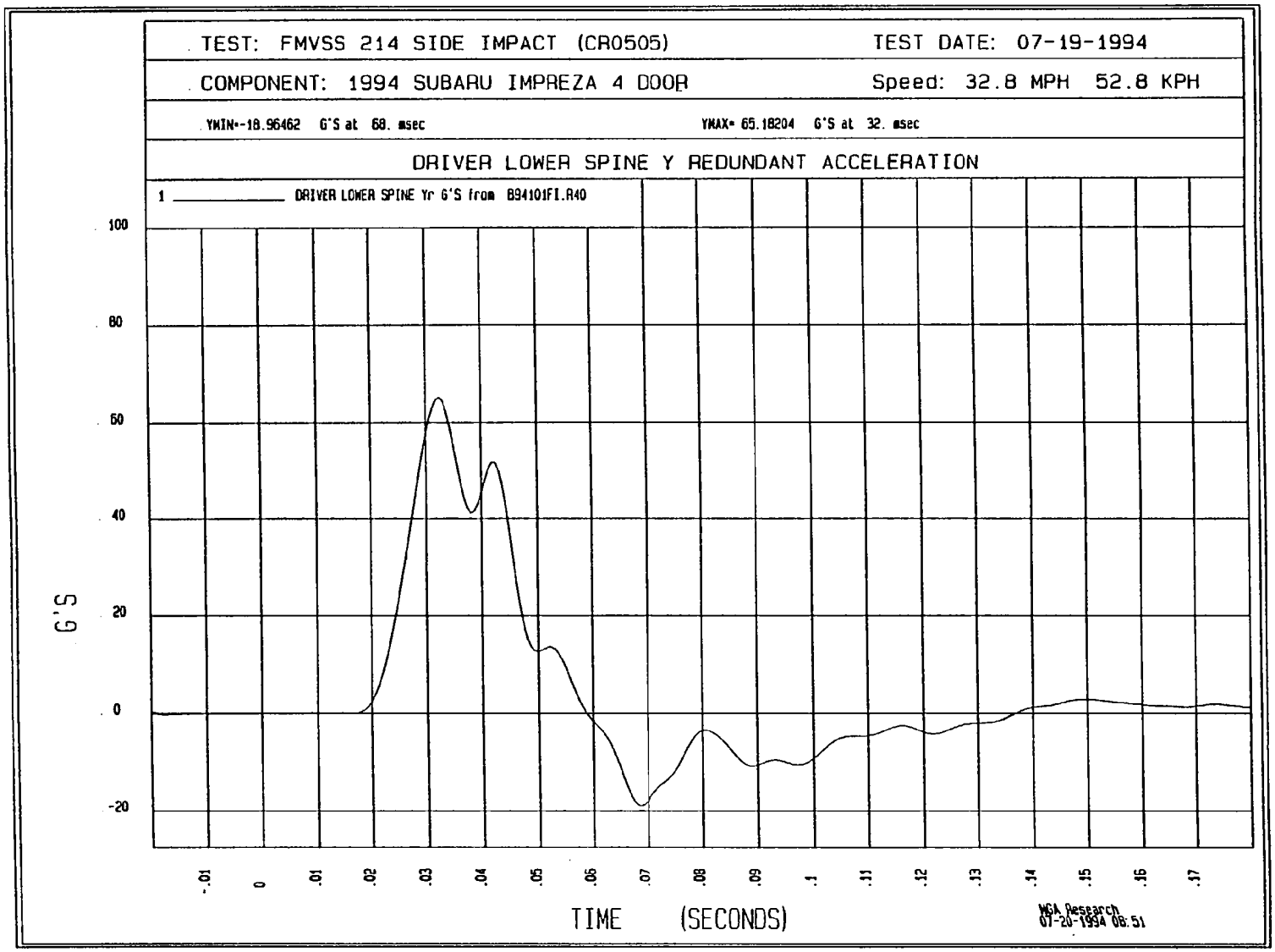



Figure B-86 - Driver Lower Spine Y Redundant Acceleration vs. Time

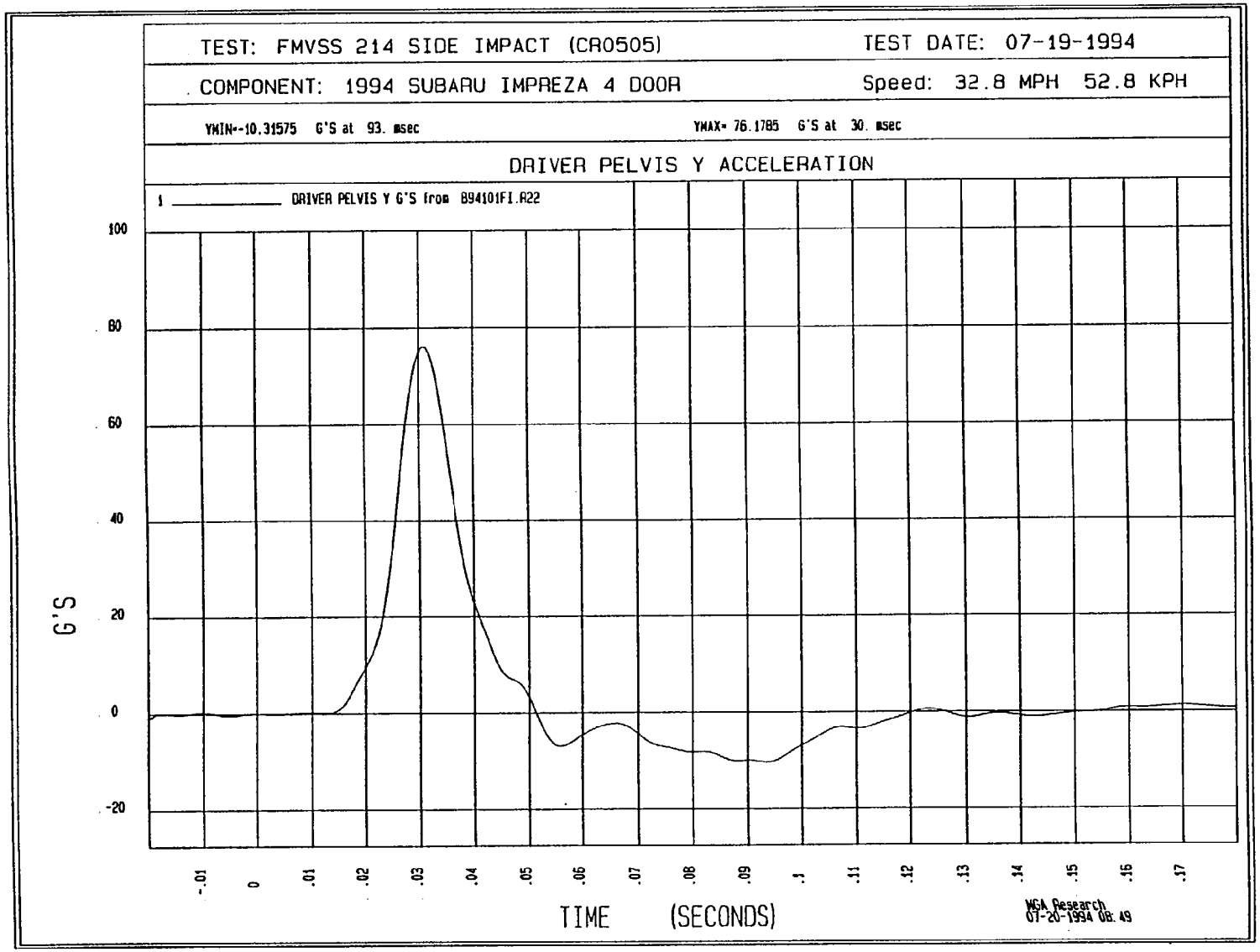



Figure B-87 - Driver Pelvis Y Acceleration vs. Time

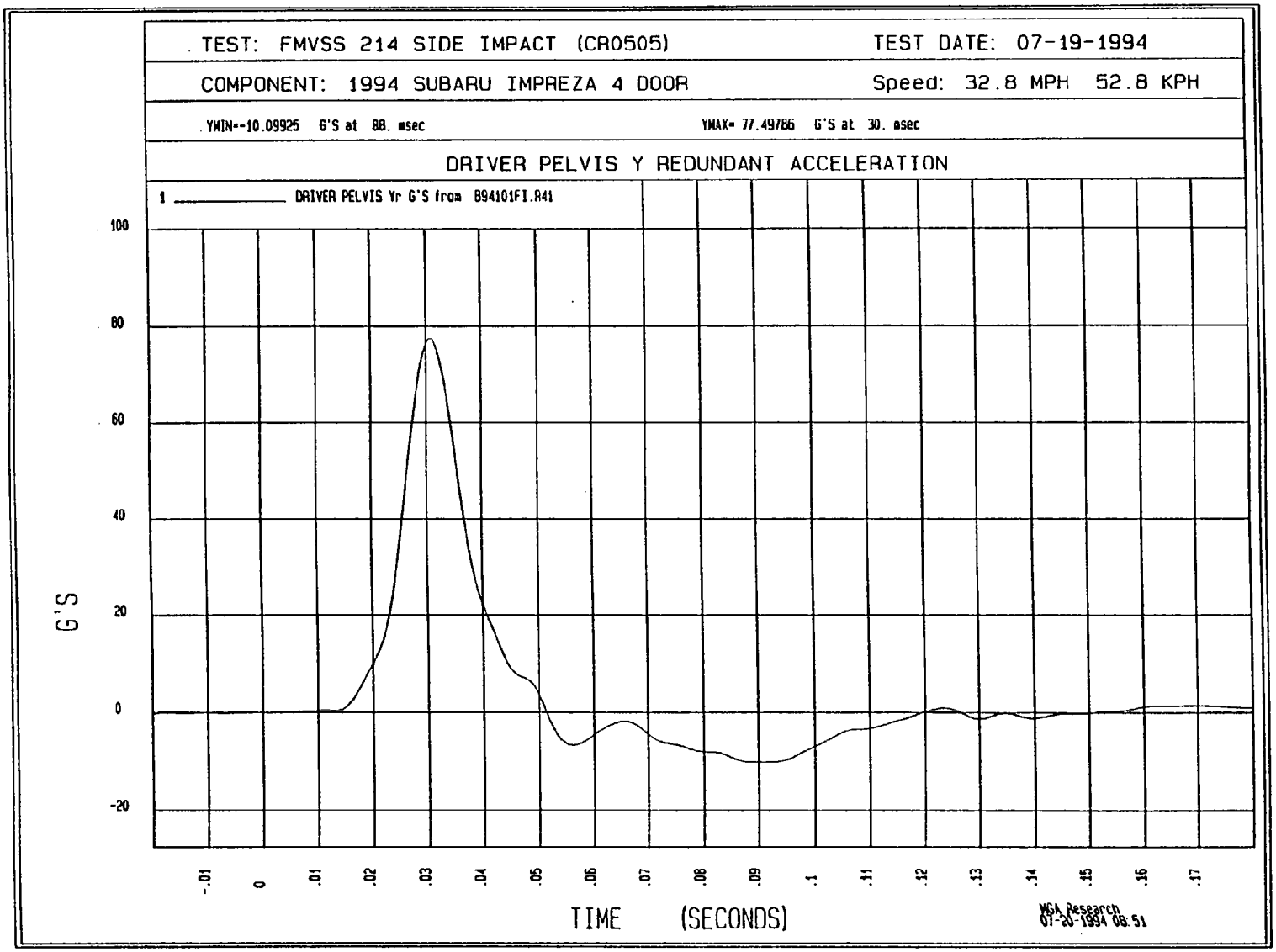



Figure B-88 - Driver Pelvis Y Redundant Acceleration vs. Time

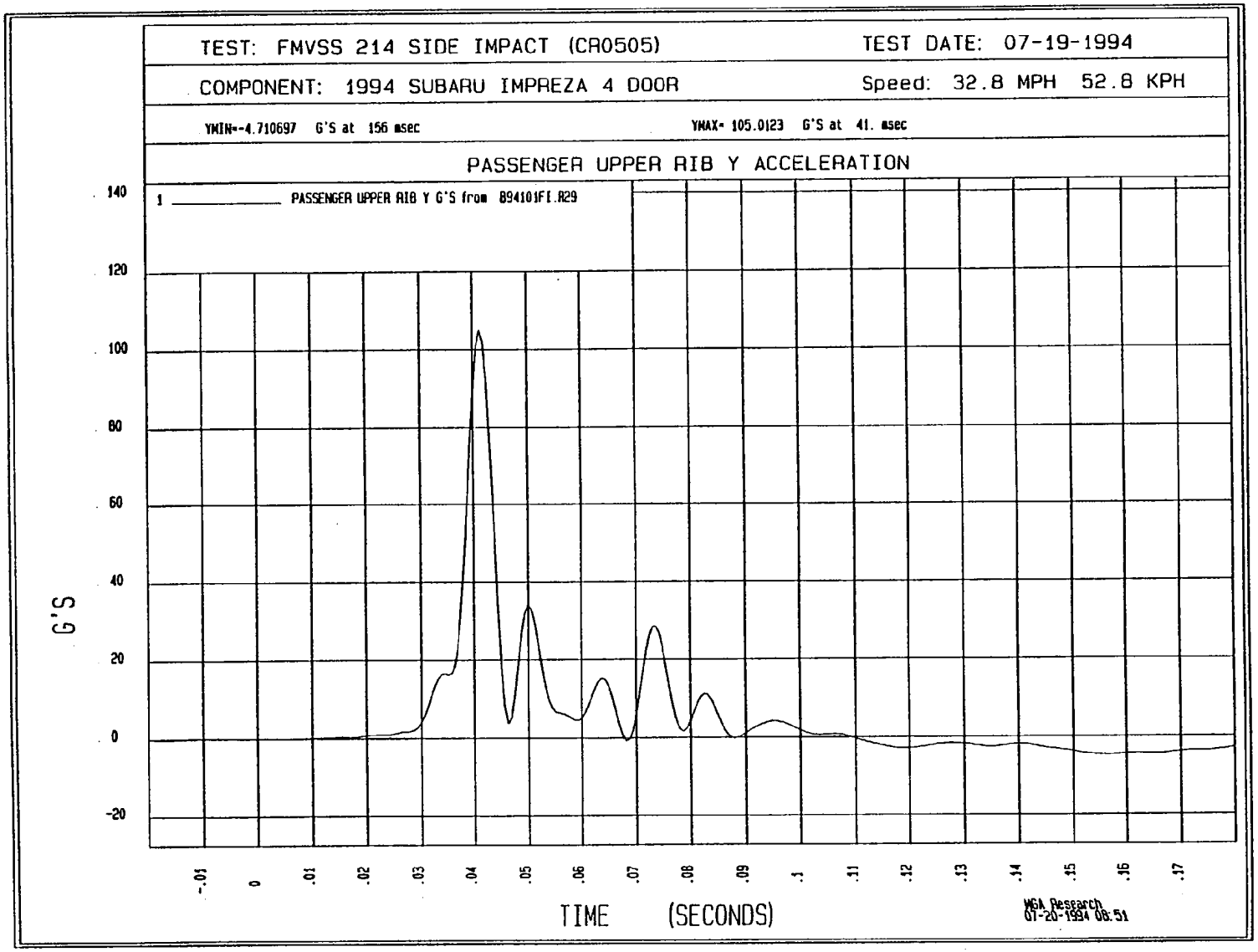



Figure B-89 - Passenger Upper Rib Y Acceleration vs. Time

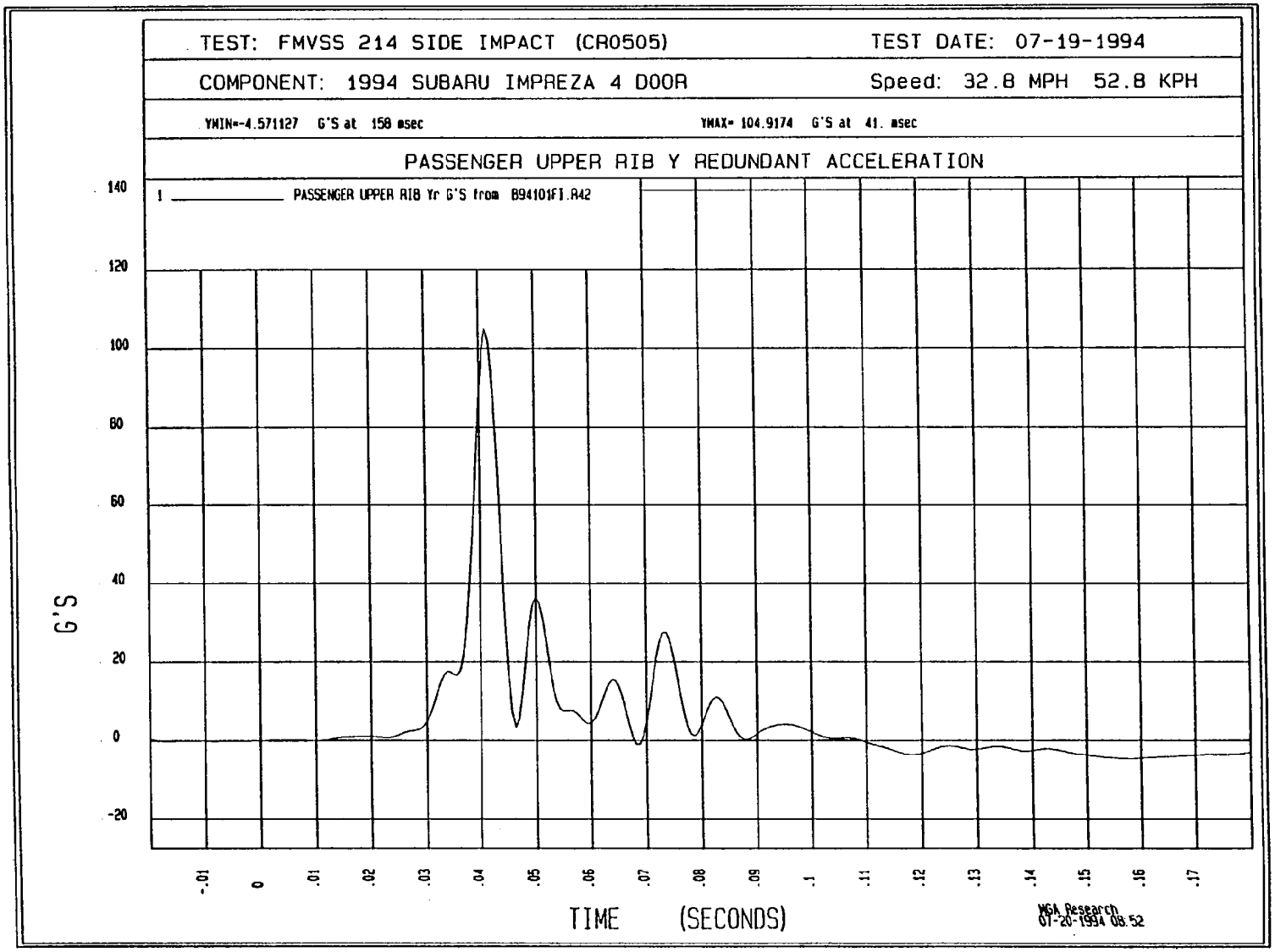



Figure B-90 - Passenger Upper Rib Y Redundant Acceleration vs. Time

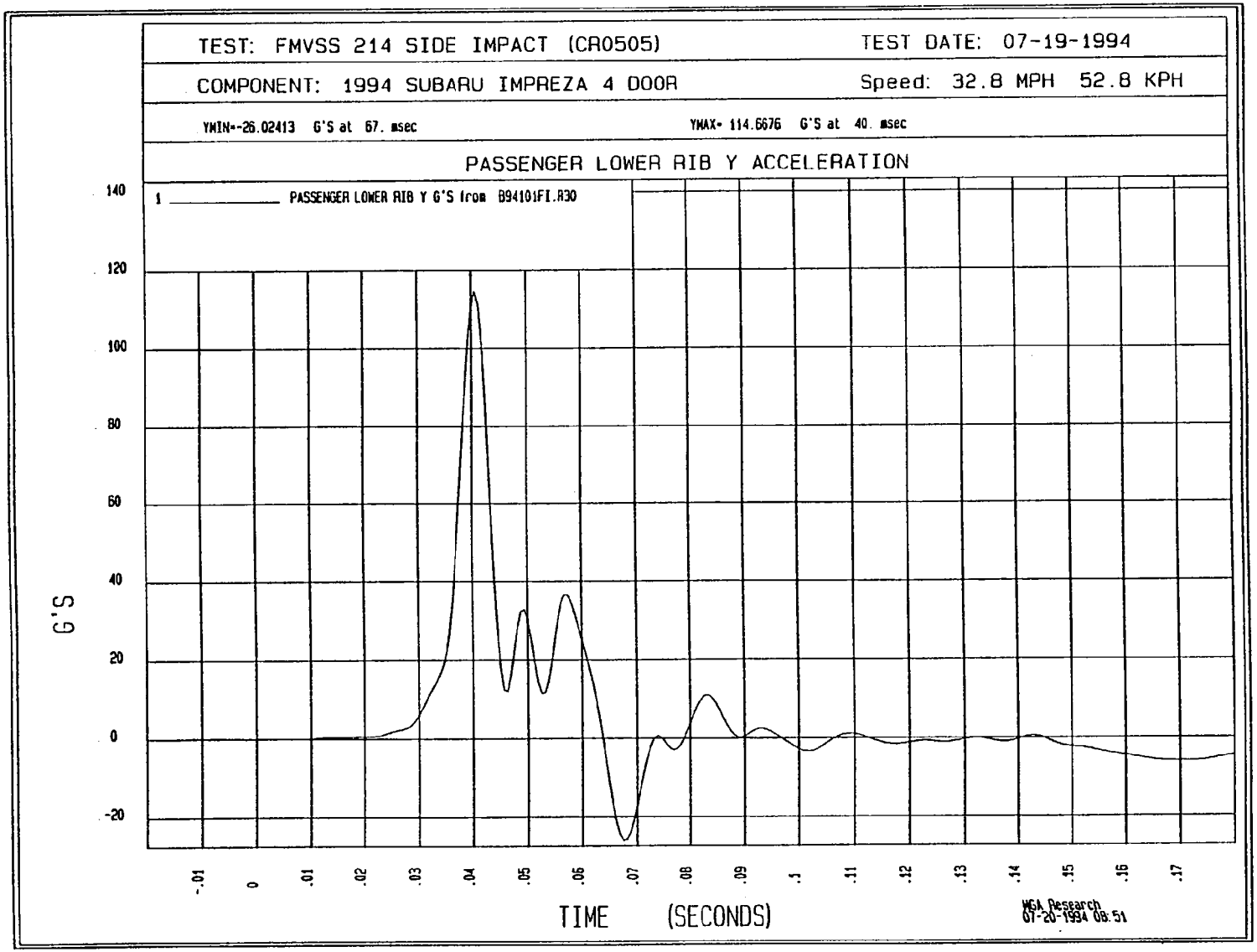



Figure B-91 - Passenger Lower Rib Y Acceleration vs. Time

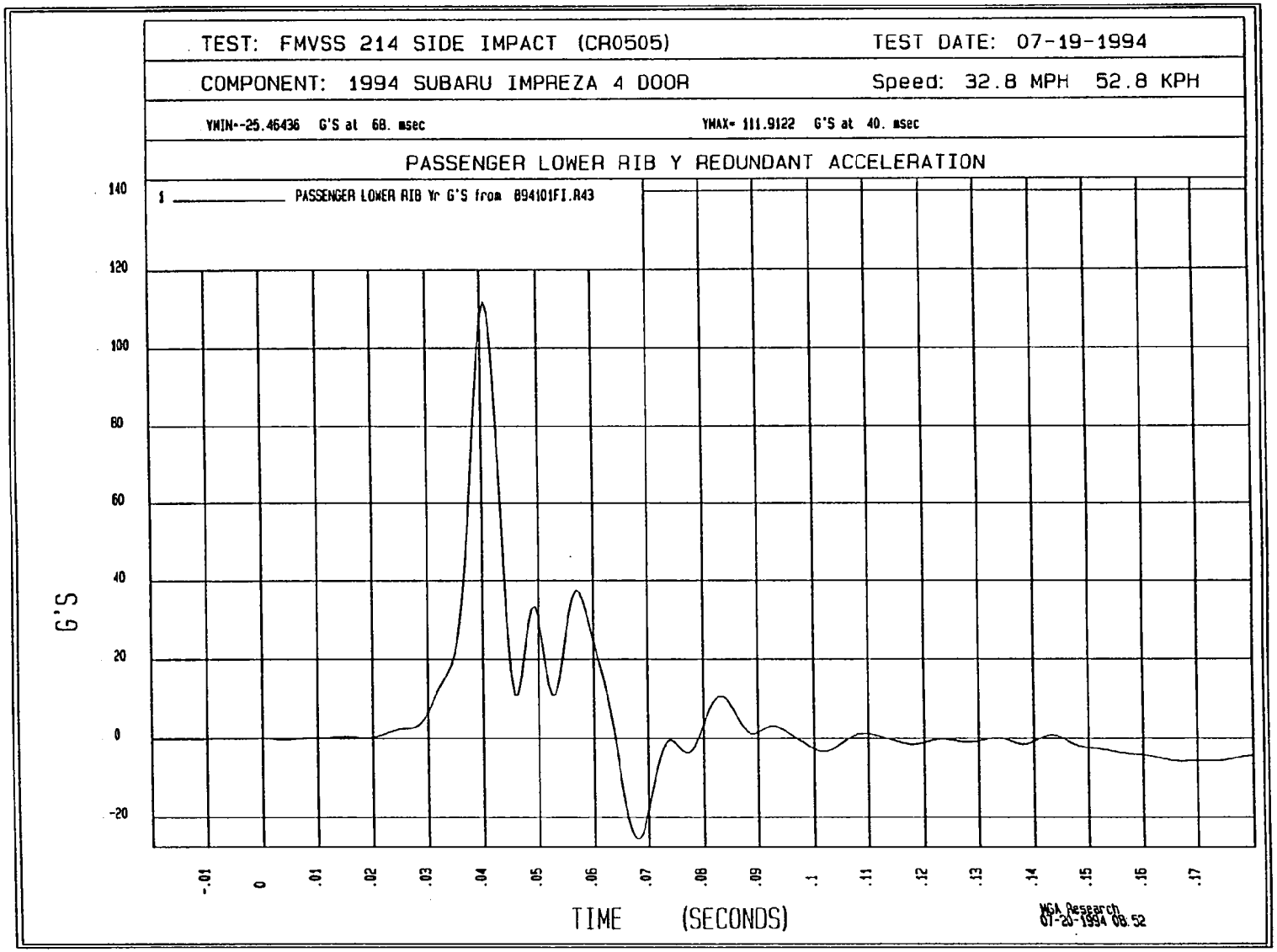



Figure B-92 - Passenger Lower Rib Y Redundant Acceleration vs. Time

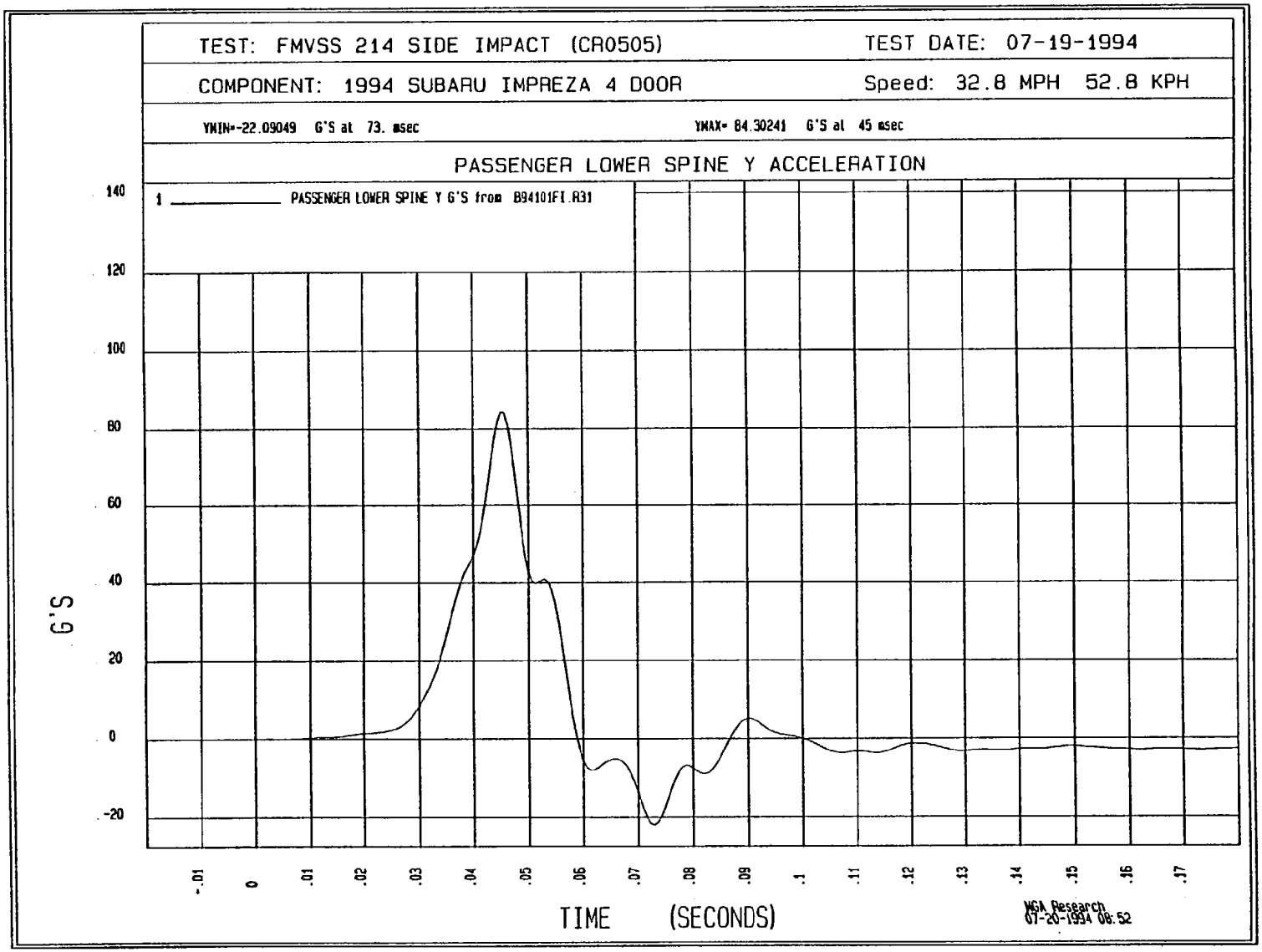



Figure B-93 - Passenger Lower Spine Y Acceleration vs. Time

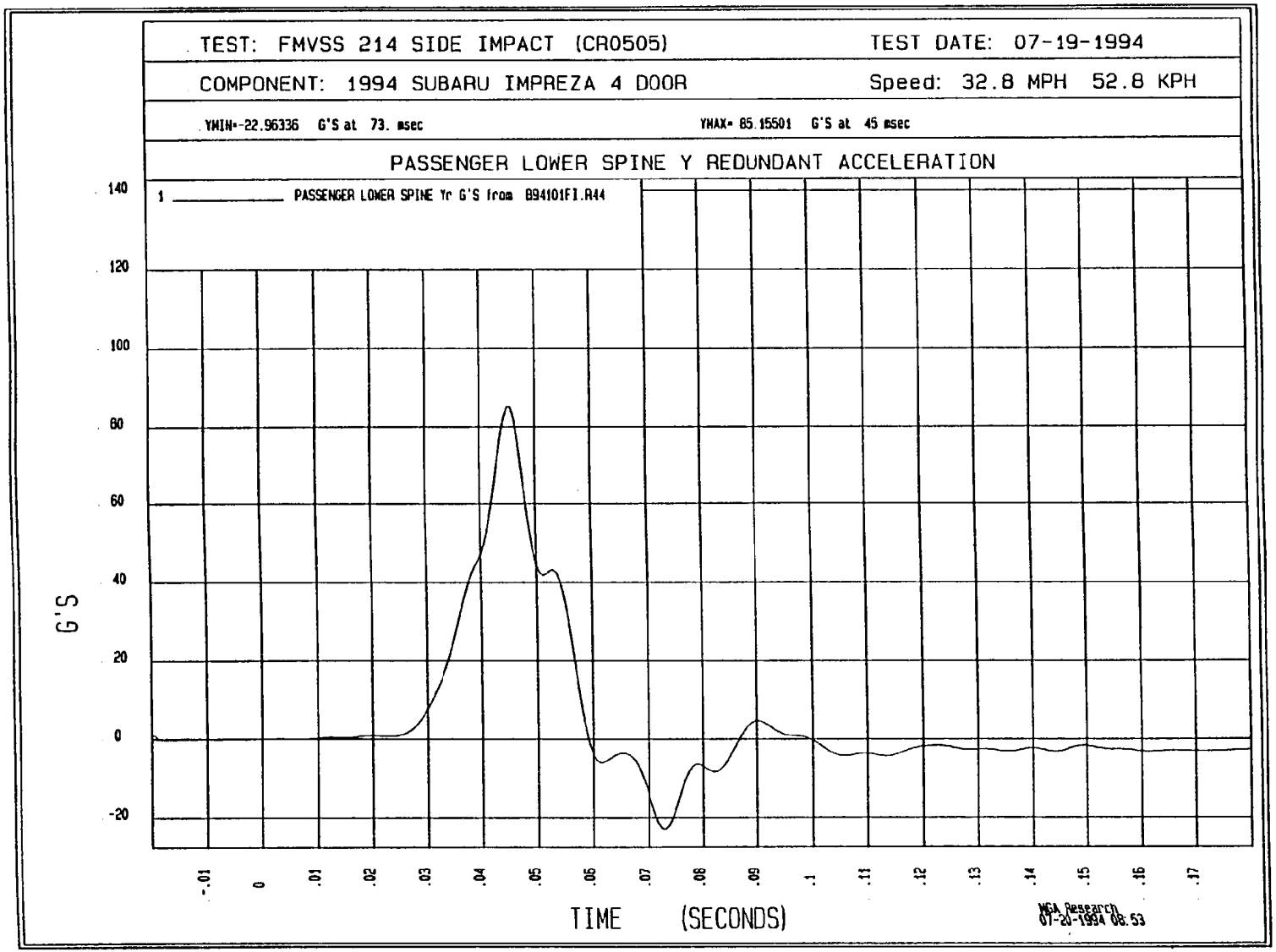



Figure B-94 - Passenger Lower Spine Y Redundant Acceleration vs. Time

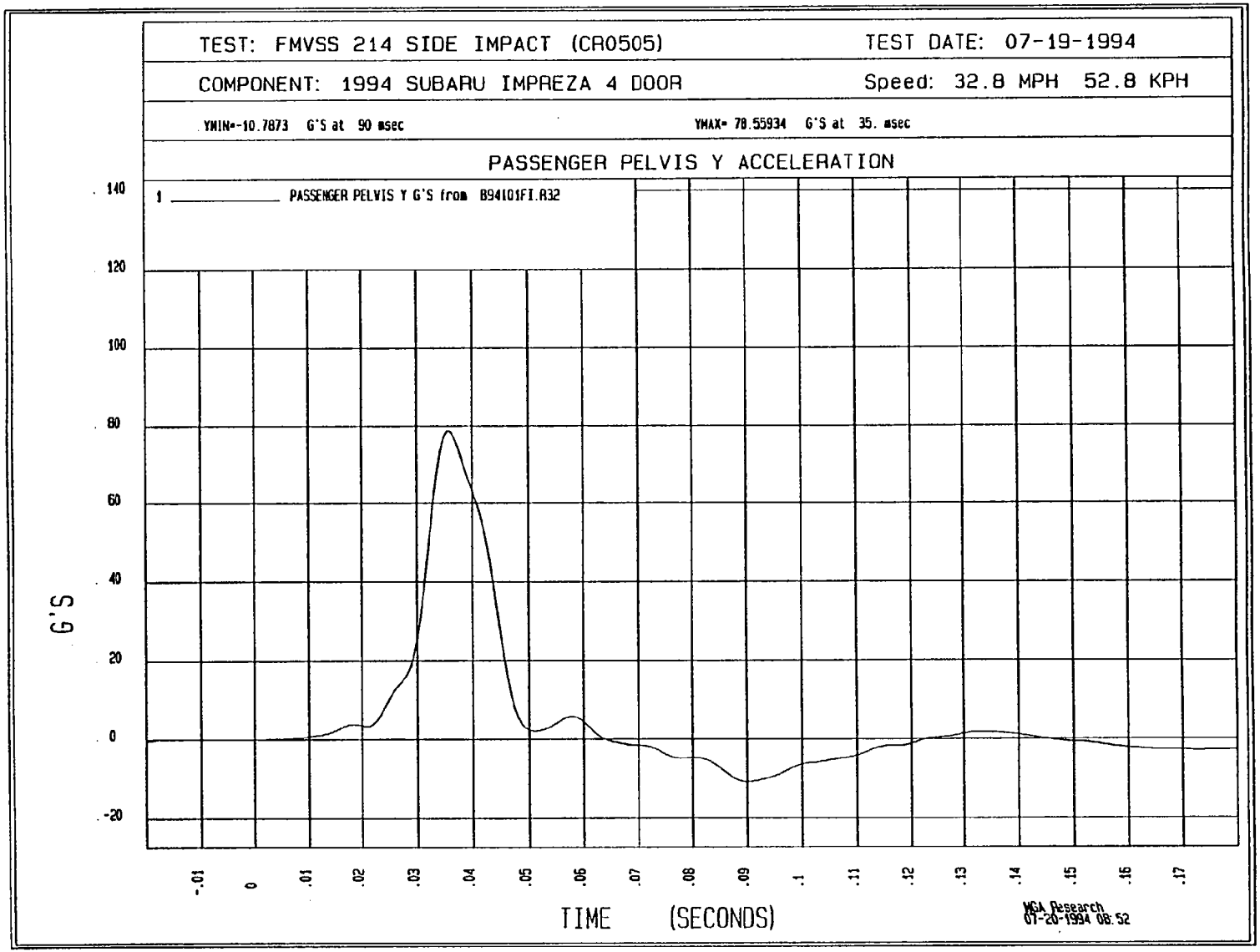



Figure B-95 - Passenger Pelvis Y Acceleration vs. Time

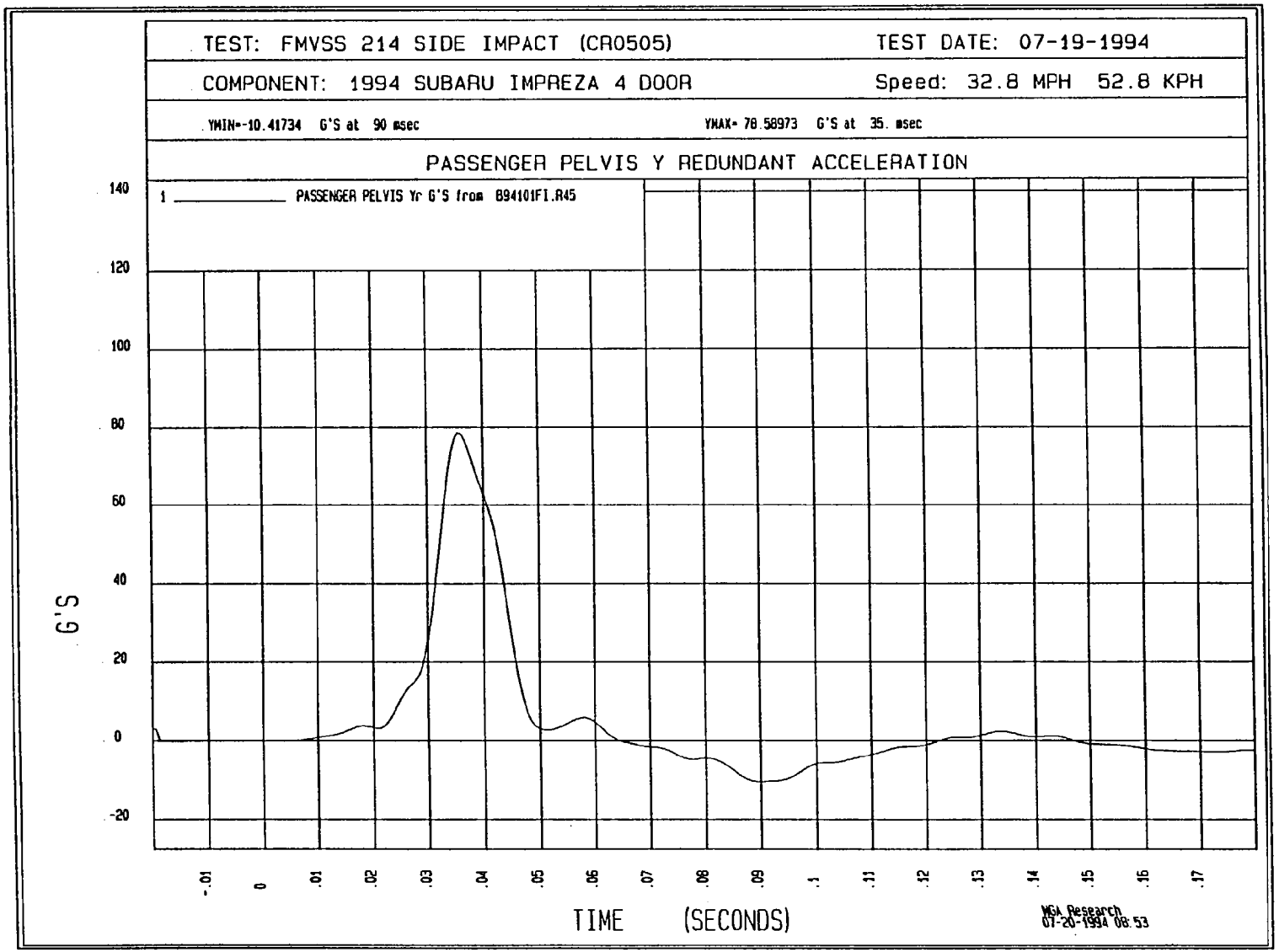



Figure B-96 - Passenger Pelvis Y Redundant Acceleration vs. Time

# APPENDIX C

# SID CONFIGURATION AND PERFORMANCE VERIFICATION

# REPORT NO. MGA-94-DCØ16

# DUMMY PERFORMANCE CALIBRATIONS

# FMVSS 214 - SIDE IMPACT TEST

SUBARU MOTORS
1994 SUBARU IMPREZA 4 DOOR SEDAN
NHTSA NO. CRØ5Ø5

MGA PROVING GROUNDS
5ØØØ WARREN ROAD
BURLINGTON, WI 53105

Test Date: June 19, 1994

Report Date: August 15, 1994

FINAL REPORT

Prepared For:

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
MAIL CODE: NEF-3Ø
4ØØ SEVENTH STREET, S.W., ROOM 6115
Washington, D.C. 2Ø59Ø

TABLE OF CONTENTS


| | | Page No. |
|---|---|---|
| DUMMY S/N: 272 | PRE-TEST CERTIFICATION DATA | 1-1 |
| DUMMY S/N: 271 | PRE-TEST CERTIFICATION DATA | 2-1 |
| DUMMY S/N: 272 | POST-TEST CERTIFICATION DATA | 3-1 |
| DUMMY S/N: 271 | POST-TEST CERTIFICATION DATA | 4-1 |
| DUMMY S/N: 272 | POST-TEST INSPECTION CHECKLIST | 5-1 |
| DUMMY S/N: 271 | POST-TEST INSPECTION CHECKLIST | 6-1 |
| | VEHICLE AND DUMMY TEMPERATURE | 7-1 |

PRE-TEST CERTIFICATION DATA

Driver Dummy Serial Number: 272

## Calibration Test Results Summary

Dummy Serial Number: 272

Pre-Test Calibration

| | |
|---|---|
| External Dimensions: | The dummy passed all external dimension requirements. |
| Thorax Impact Test: | The thorax passed all impact test requirements. |
| Pelvic Impact Test: | The pelvis passed all impact test requirements. |
| Abdominal Compression Test: | The abdomen passed all compression test requirements |
| Lumbar Flexion Test: | The lumbar passed all flexion test requirements |

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY NO.: 272

DATE OF VERIFICATION: July 6, 1994

| DESCRIPTION | SPECIFICATION | TEST RESULTS |
|---|---|---|
| SH - Seated Height | 35.0" - 35.8" | 35.4 |
| RH - Rib Height | 19.75 - 20.5" | 20.1 |
| HP - Hip Pivot Height | 3.9" ref. | 3.9 |
| RD - Rib From Back Line | 9.0" to 9.5" | 9.4 |
| KV - Knee Pivot From Back Line | 20.1" - 20.7" | 20.4 |
| SW - Knee Pivot to Floor | 19.3" - 19.9" | 19.5 |
| HW - Hip Width | 14.0" - 15.4" | 15.0 |

MEASUREMENTS BY: _____

APPROVED BY: _____

MGA RESEARCH CORPORATION

THORAX IMPACT TEST

SIDE IMPACT DUMMY (SID)

DATE: July 6, 1994

DUMMY NUMBER: 272 TEST NUMBER: D94482

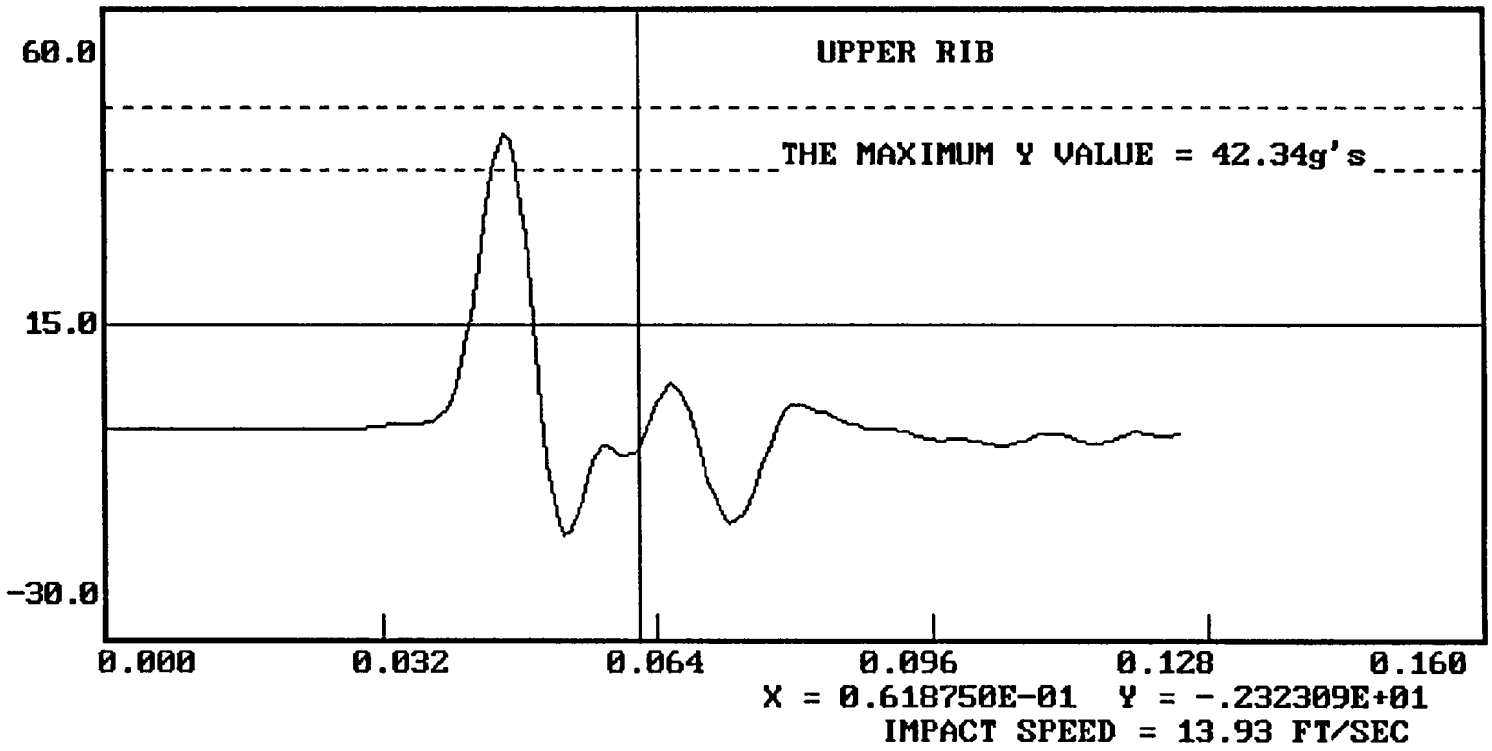
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 72° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| PROBE SPEED | 13.8 - 14.2 fps | 13.9 |
| UPPER RIB | 37 - 46 g's | 42 |
| LOWER RIB | 37 - 46 g's | 40 |
| LOWER SPINE | 15 - 22 g's | 20 |

TEST MEETS SPECIFICATIONS

TECHNICIAN

APPROVED BY

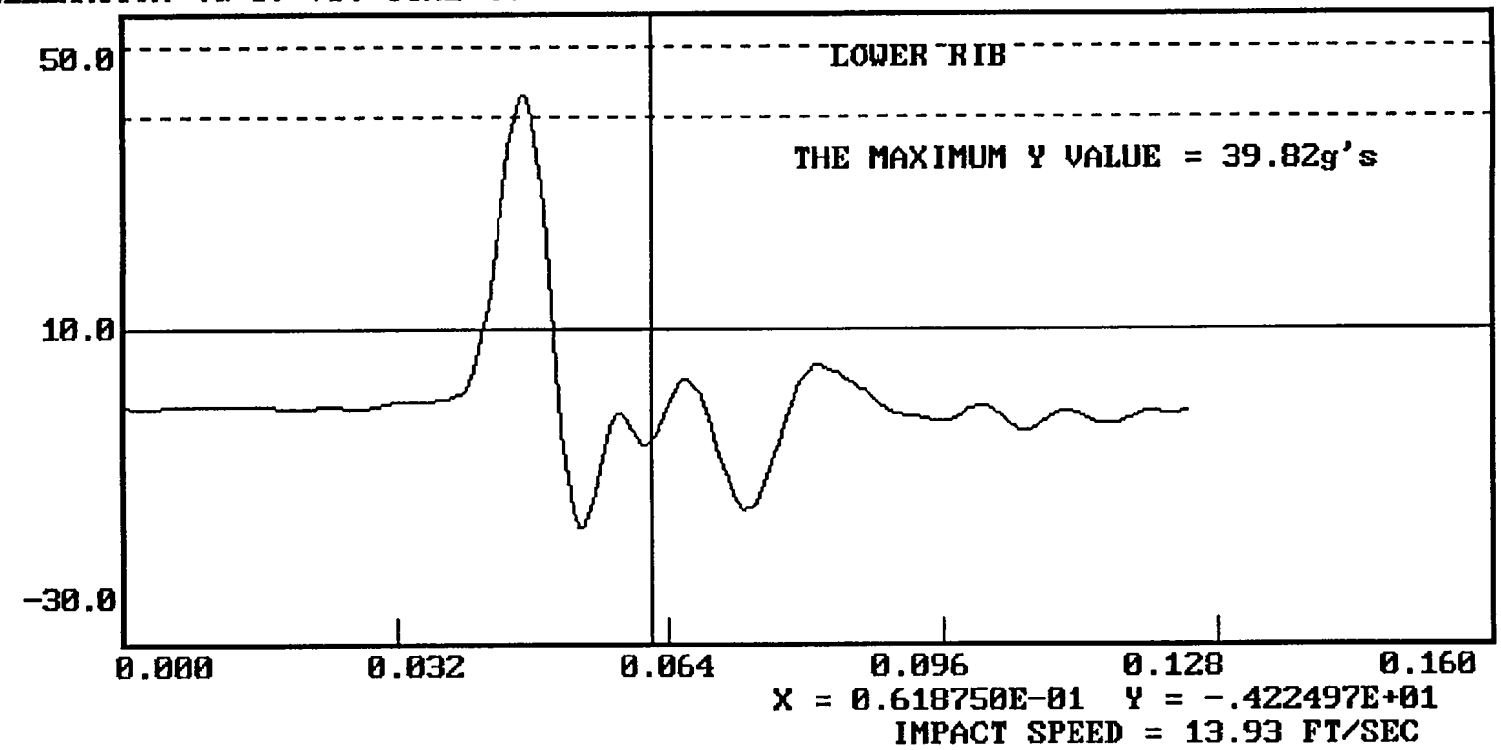
DUMMY CALIBRATION - THORAX IMPACT 07-06-1994 14:23
DUMMY # 272
ACCELERATION (G'S) VS. TIME ((SECONDS))




X = 0.618750E-01 Y = -.232309E+01
IMPACT SPEED = 13.93 FT/SEC

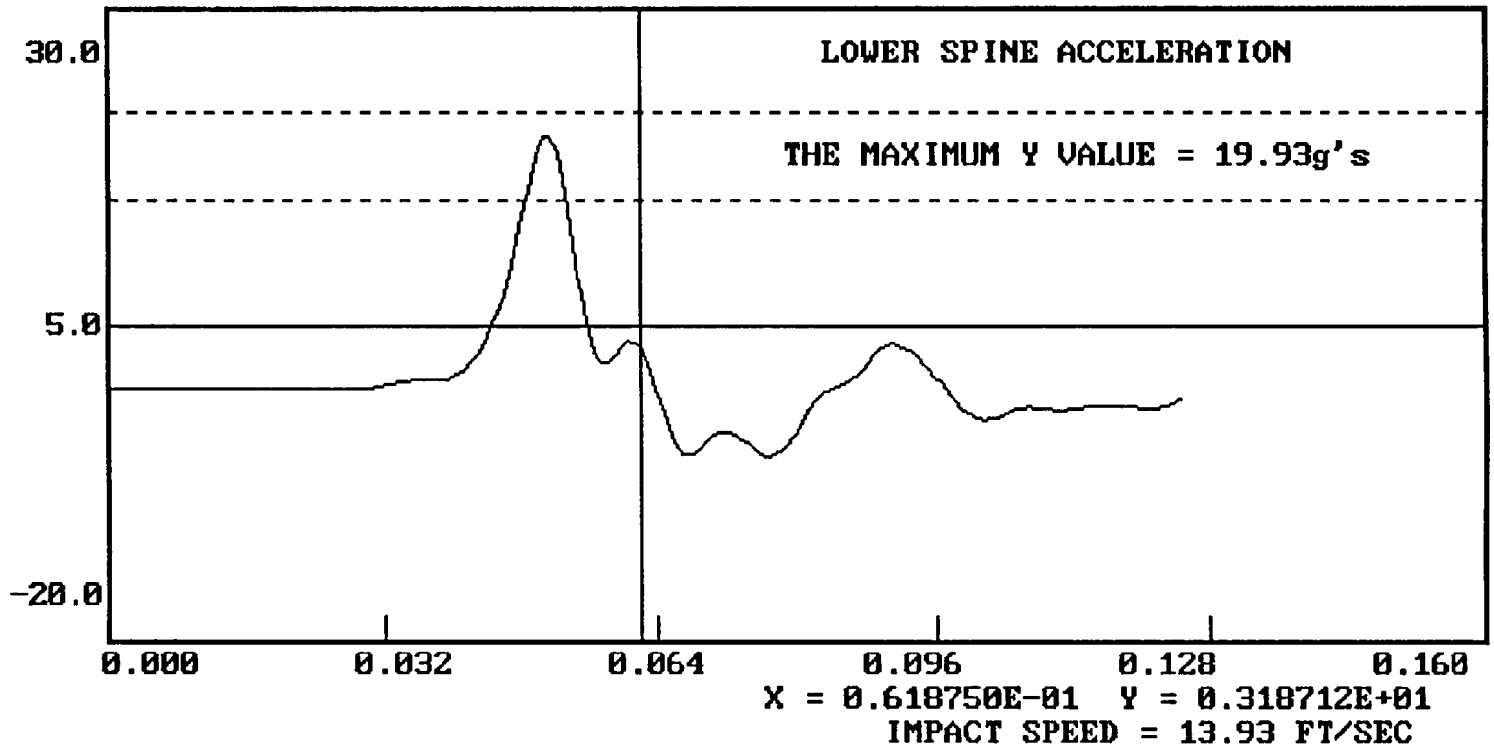
DUMMY CALIBRATION - THORAX IMPACT
DUMMY # 272
ACCELERATION (G'S) VS. TIME ((SECONDS))

07-06-1994 14:23




X = 0.618750E-01 Y = -.422497E+01
IMPACT SPEED = 13.93 FT/SEC

DUMMY CALIBRATION - THORAX IMPACT 07-06-1994 14:23
DUMMY # 272
ACCELERATION (G'S) VS. TIME ((SECONDS))




X = 0.618750E-01 Y = 0.318712E+01
IMPACT SPEED = 13.93 FT/SEC

MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SIDE IMPACT DUMMY (SID)

DATE: July 6, 1994

DUMMY NUMBER: 272 TEST NUMBER: D94483

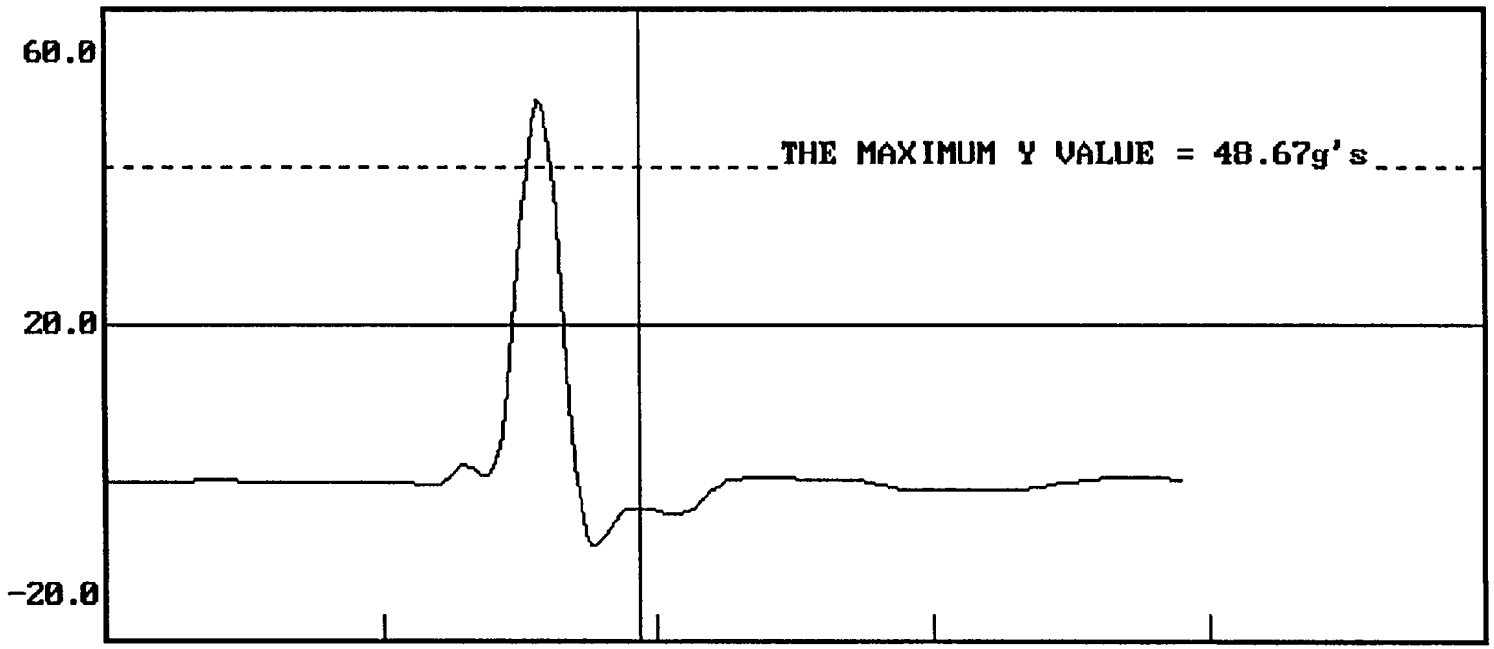
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 72° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| PROBE SPEED | 13.8 - 14.2 fps | 13.9 |
| PELVIS ACCELERATION | 40 - 60 g's | 49 |

TEST MEETS SPECIFICATIONS

TECHNICIAN

APPROVED BY

DUMMY CALIBRATION - PELVIS IMPACT 07-06-1994 15:22
DUMMY # 272
ACCELERATION (G'S) VS. TIME ((SECONDS))




X = 0.618750E-01 Y = -.333476E+01
IMPACT SPEED = 13.86 FT/SEC

MGA RESEARCH CORPORATION

ABDOMINAL COMPRESSION TEST
(PRELOAD = 10 LBS)

SIDE IMPACT DUMMY (SID)

DATE: July 7, 1994

DUMMY NUMBER: 272 TEST NUMBER: D94484

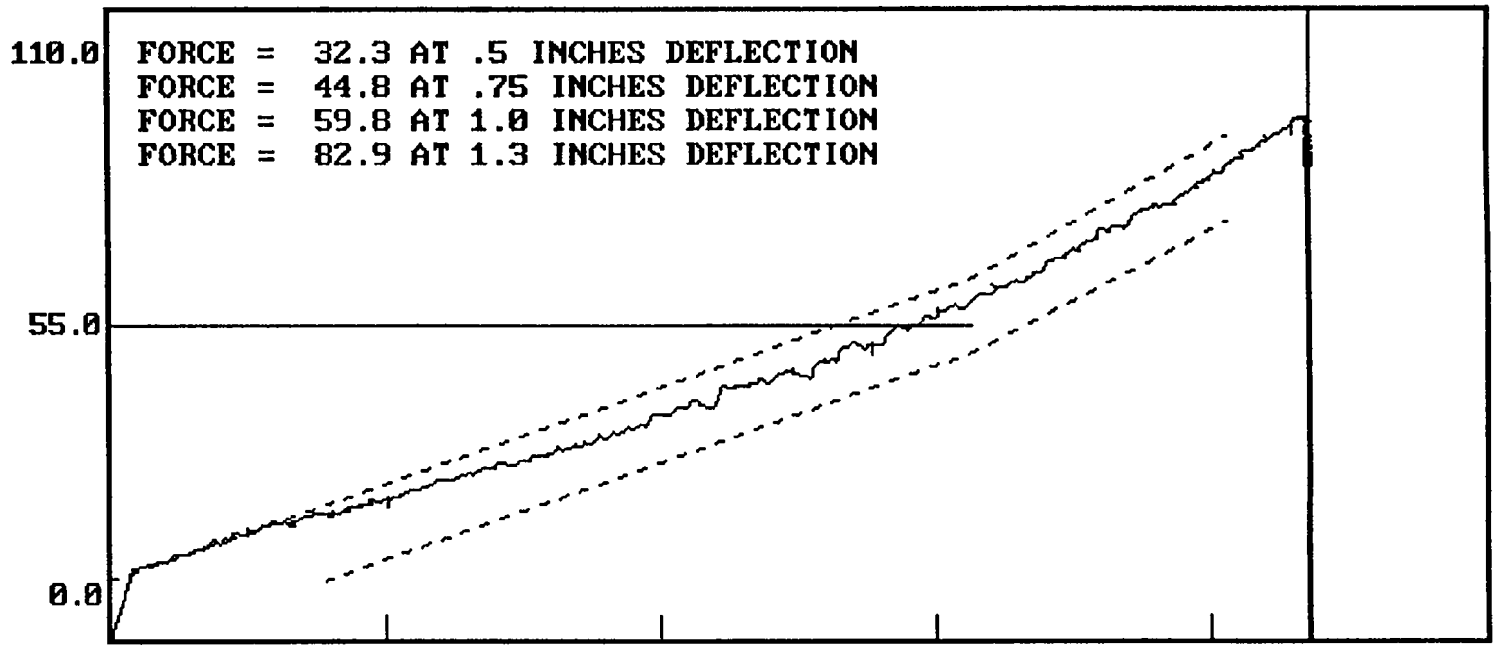
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 68° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| FORCE @ 0.5 in | 23.3 - 36.5 lbs | 32.3 |
| FORCE @ 0.75 in | 36.7 - 49.8 lbs | 44.8 |
| FORCE @ 1.0 in | 50 - 63 lbs | 60 |
| FORCE @ 1.3 in | 73 - 88 lbs | 83 |

TEST MEETS SPECIFICATIONS

TECHNICIAN _____

APPROVED BY _____

DUMMY CALIBRATION - ABDOMEN COMPRESSION 07-07-1994 09:52
DUMMY # 272
ABDOMEN FORCE () VS. ABDOMEN DISPLACEMENT (INCHES)




X = 0.139491E+01 Y = 0.865248E+02
IMPACT SPEED = 0.00 FT/SEC

MGA RESEARCH CORPORATION

LUMBAR FLEXION TEST

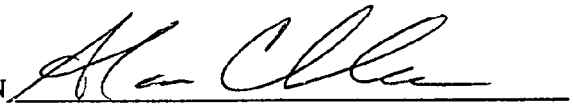
SIDE IMPACT DUMMY (SID)

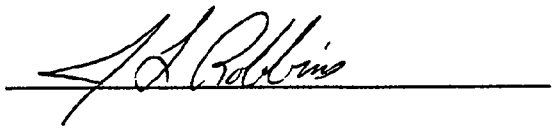
DATE: July 7, 1994

DUMMY NUMBER: 272 TEST NUMBER: D94485

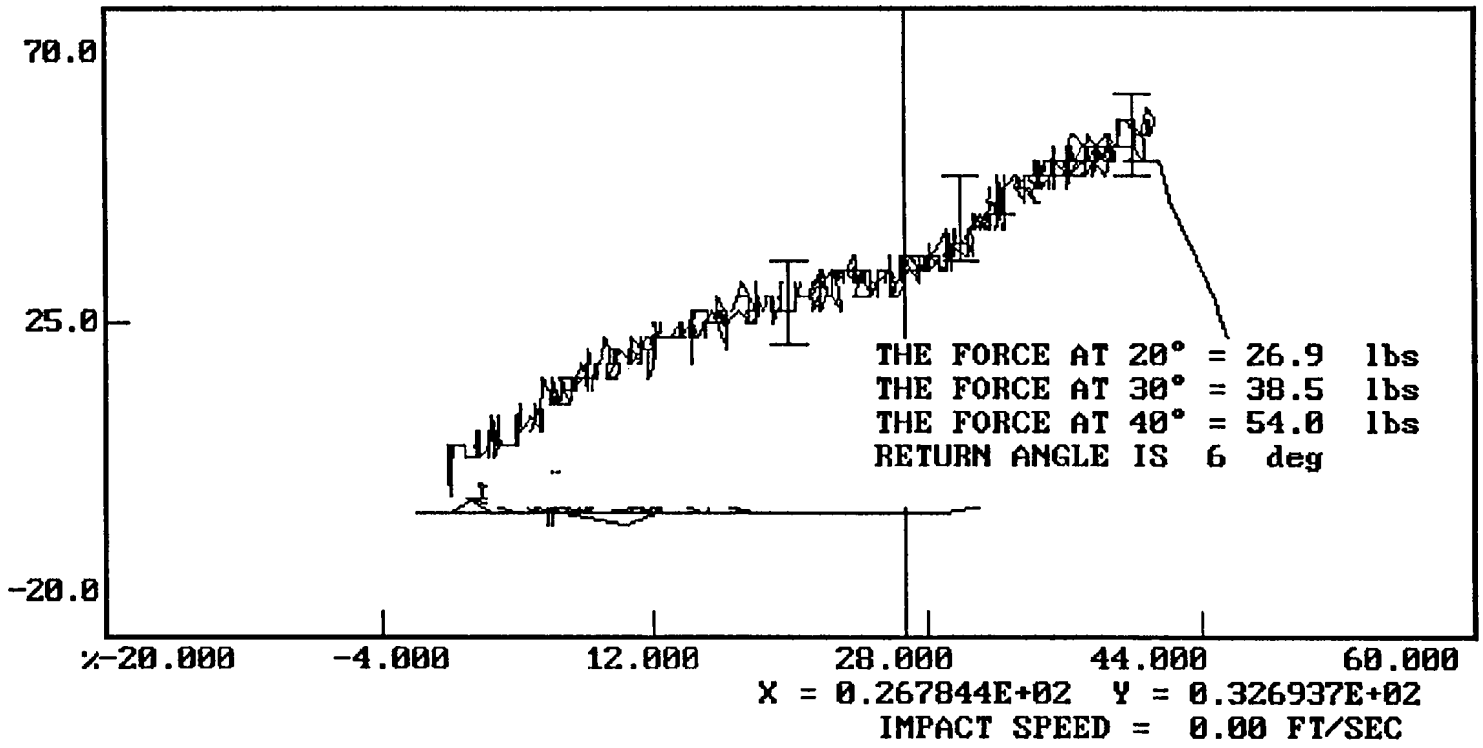
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 70° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| FORCE @ 0° | 0 - 6 lbs | 0 |
| FORCE @ 20° | 22 - 34 lbs | 27 |
| FORCE @ 30° | 34 - 46 lbs | 39 |
| FORCE @ 40° | 46 - 58 lbs | 54 |
| RETURN ANGLE | 12° maximum | 6° |

TEST MEETS SPECIFICATIONS

TECHNICIAN 

APPROVED BY 

DUMMY CALIBRATION - LUMBAR FLEXION 07-07-1994 11:37
DUMMY # 272
FORCE () VS. TORSO ROTATION (DEGREES)



## PRE-TEST CERTIFICATION DATA

Passenger Dummy Serial Number: 271

## Calibration Test Results Summary

Passenger Serial Number: 271

Pre-Test Calibration

| | |
|---|---|
| External Dimensions: | The dummy passed all external dimension requirements. |
| Thorax Impact Test: | The thorax passed all impact test requirements. |
| Pelvic Impact Test: | The pelvis passed all impact test requirements. |
| Abdominal Compression Test: | The abdomen passed all compression test requirements |
| Lumbar Flexion Test: | The lumbar passed all flexion test requirements |

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY NO.: 271

DATE OF VERIFICATION: July 6, 1994

| DESCRIPTION | SPECIFICATION | TEST RESULTS |
|---|---|---|
| SH - Seated Height | 35.0" - 35.8" | 35.4 |
| RH - Rib Height | 19.75 - 20.5" | 19.8 |
| HP - Hip Pivot Height | 3.9" ref. | 3.9 |
| RD - Rib From Back Line | 9.0" to 9.5" | 9.3 |
| KV - Knee Pivot From Back Line | 20.1" - 20.7" | 20.3 |
| SW - Knee Pivot to Floor | 19.3" - 19.9" | 19.4 |
| HW - Hip Width | 14.0" - 15.4" | 15.3 |

MEASUREMENTS BY: _____

APPROVED BY: _____

MGA RESEARCH CORPORATION

THORAX IMPACT TEST

SIDE IMPACT DUMMY (SID)

DATE: July 6, 1994

DUMMY NUMBER: 271 TEST NUMBER: D94472

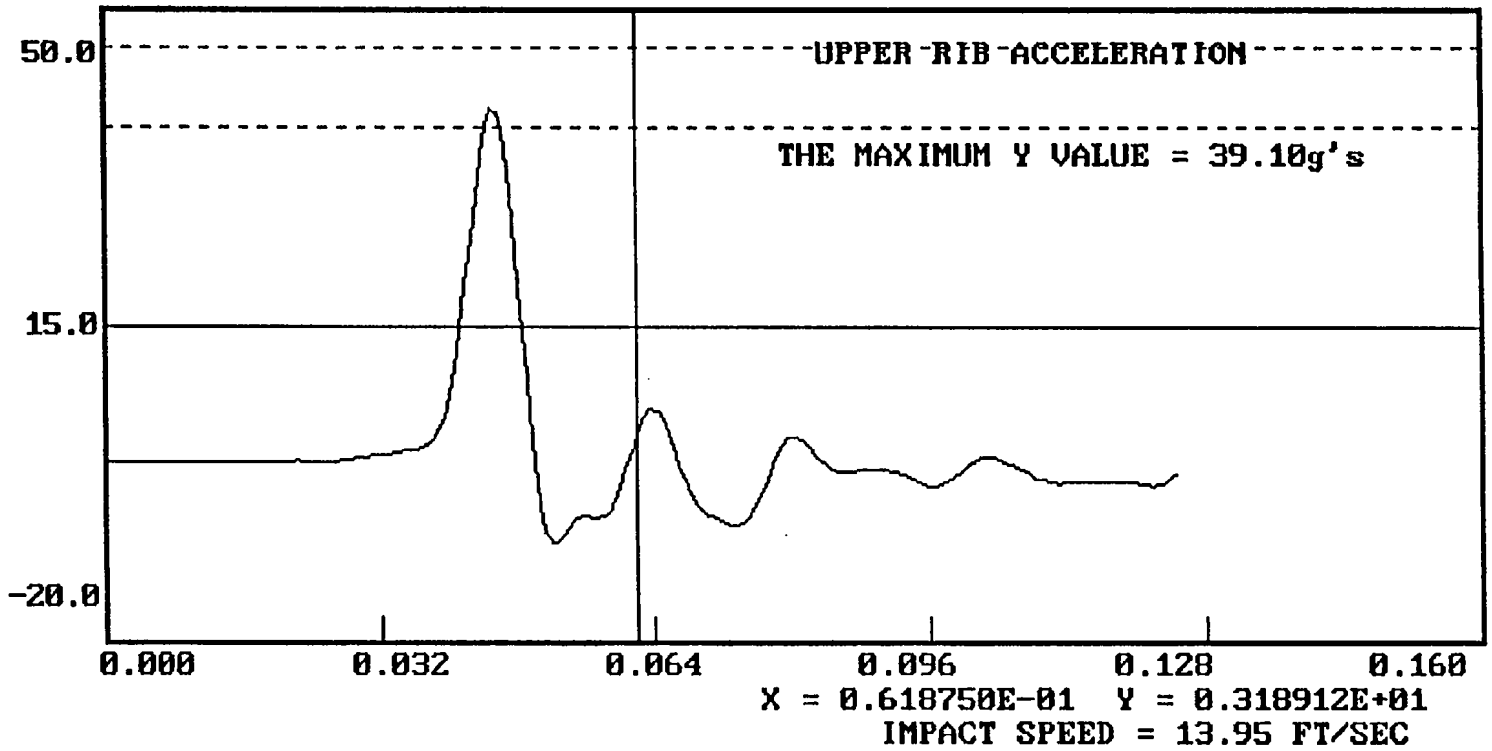
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 70° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| PROBE SPEED | 13.8 - 14.2 fps | 14.0 |
| UPPER RIB | 37 - 46 g's | 39 |
| LOWER RIB | 37 - 46 g's | 40 |
| LOWER SPINE | 15 - 22 g's | 19 |

TEST MEETS SPECIFICATIONS

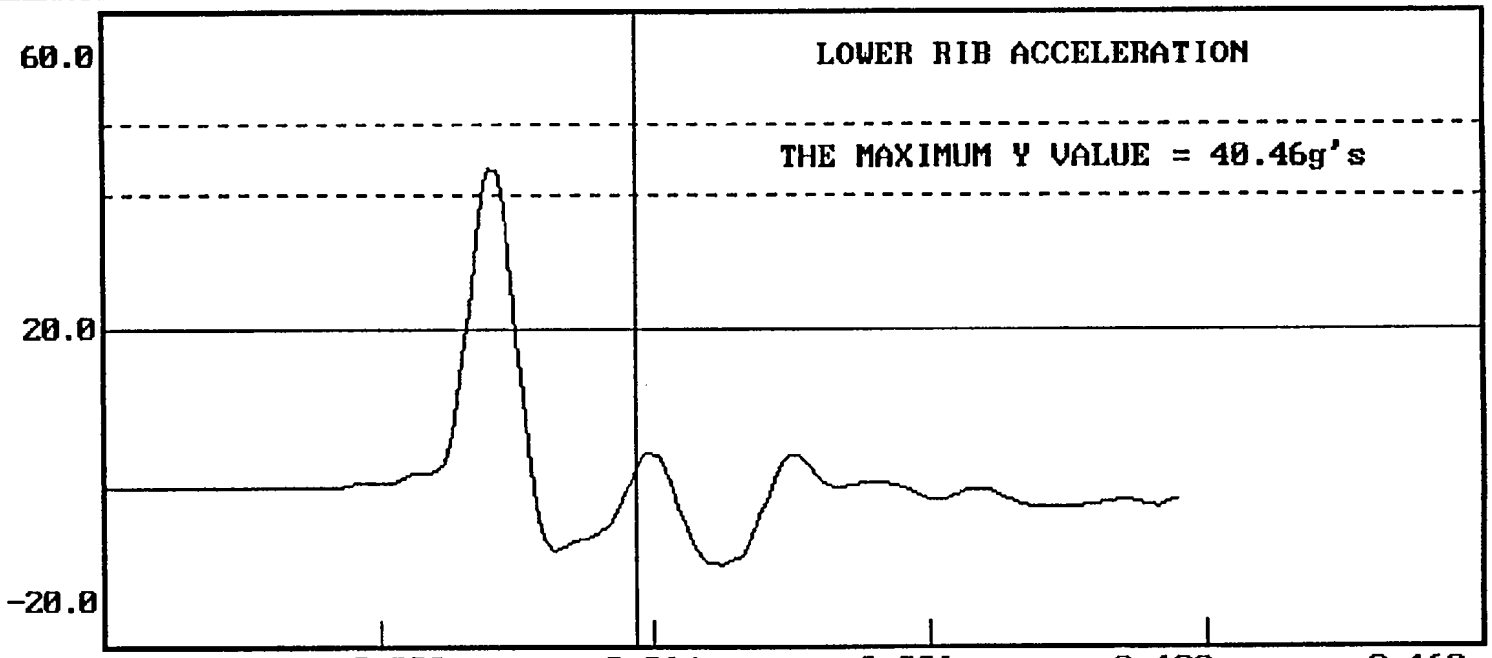
TECHNICIAN _____

APPROVED BY _____

DUMMY CALIBRATION - THORAX IMPACT 07-06-1994 14:04
DUMMY # 271
ACCELERATION (G'S) VS. TIME ((SECONDS))

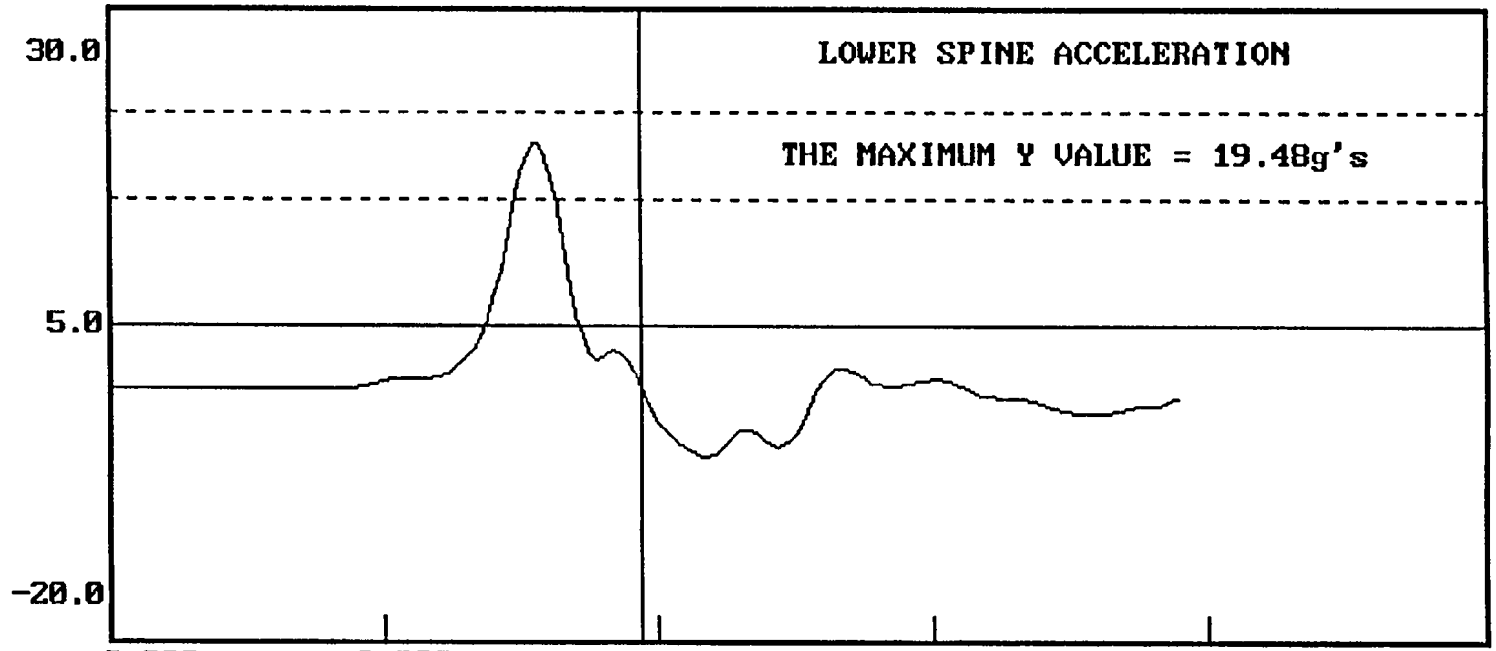


DUMMY CALIBRATION - THORAX IMPACT 07-06-1994 14:04
DUMMY # 271
ACCELERATION (G'S) VS. TIME ((SECONDS))




X = 0.618750E-01 Y = 0.240756E+01
IMPACT SPEED = 13.95 FT/SEC

DUMMY CALIBRATION - THORAX IMPACT 07-06-1994 14:04
DUMMY # 271
ACCELERATION (G'S) VS. TIME ((SECONDS))




X = 0.618750E-01 Y = 0.723196E-01
IMPACT SPEED = 13.95 FT/SEC

MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SIDE IMPACT DUMMY (SID)

DATE: July 6, 1994

DUMMY NUMBER: 271 TEST NUMBER: D94473

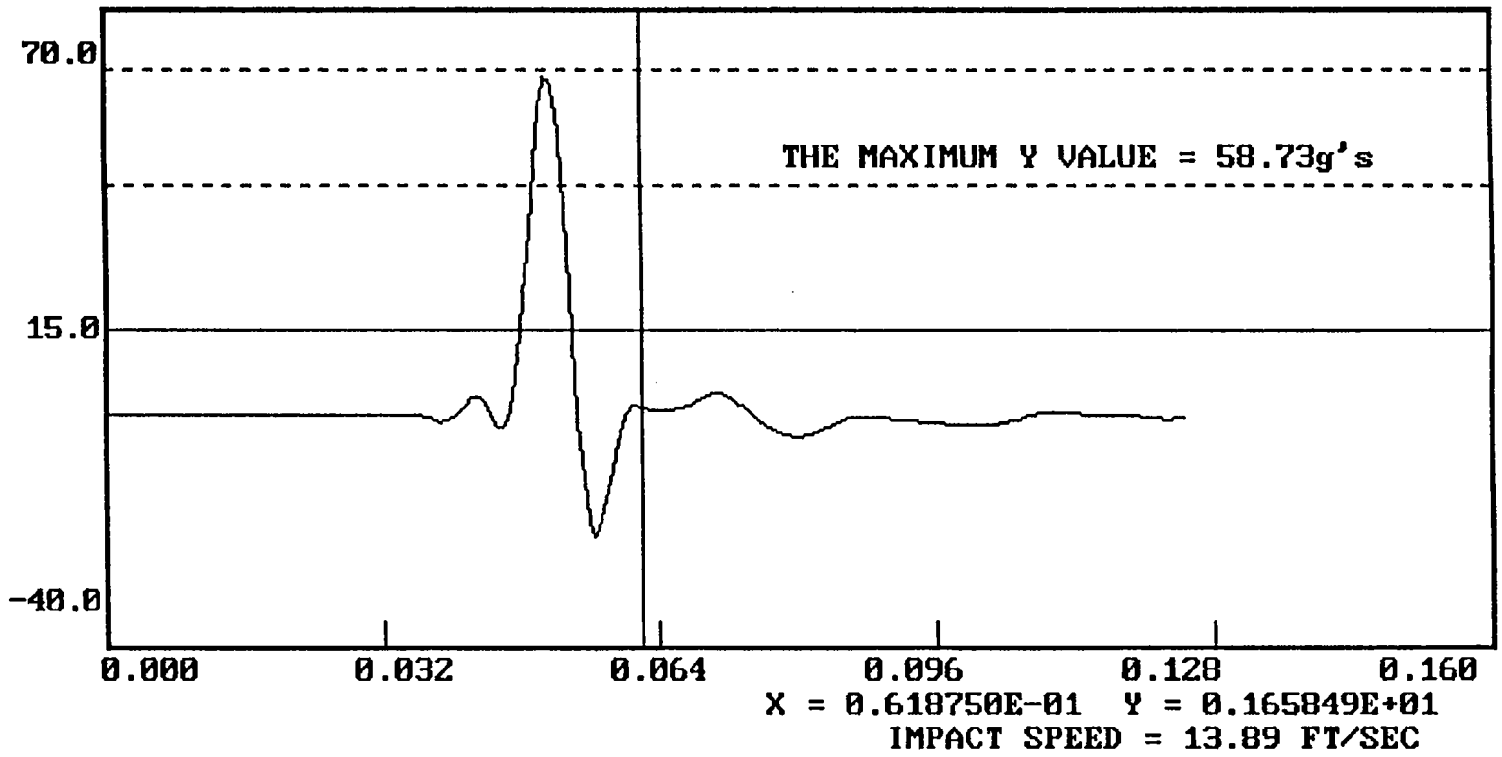
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 72° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| PROBE SPEED | 13.8 - 14.2 fps | 13.9 |
| PELVIS ACCELERATION | 40 - 60 g's | 59 |

TEST MEETS SPECIFICATIONS

TECHNICIAN

APPROVED BY

DUMMY CALIBRATION - PELVIS IMPACT 07-06-1994 15:38
DUMMY # 271
ACCELERATION (G'S) VS. TIME ((SECONDS))




X = 0.618750E-01 Y = 0.165849E+01
IMPACT SPEED = 13.89 FT/SEC

MGA RESEARCH CORPORATION

ABDOMINAL COMPRESSION TEST
(PRELOAD = 10 LBS)

SIDE IMPACT DUMMY (SID)

DATE: July 7, 1994

DUMMY NUMBER: 271 TEST NUMBER: D94474

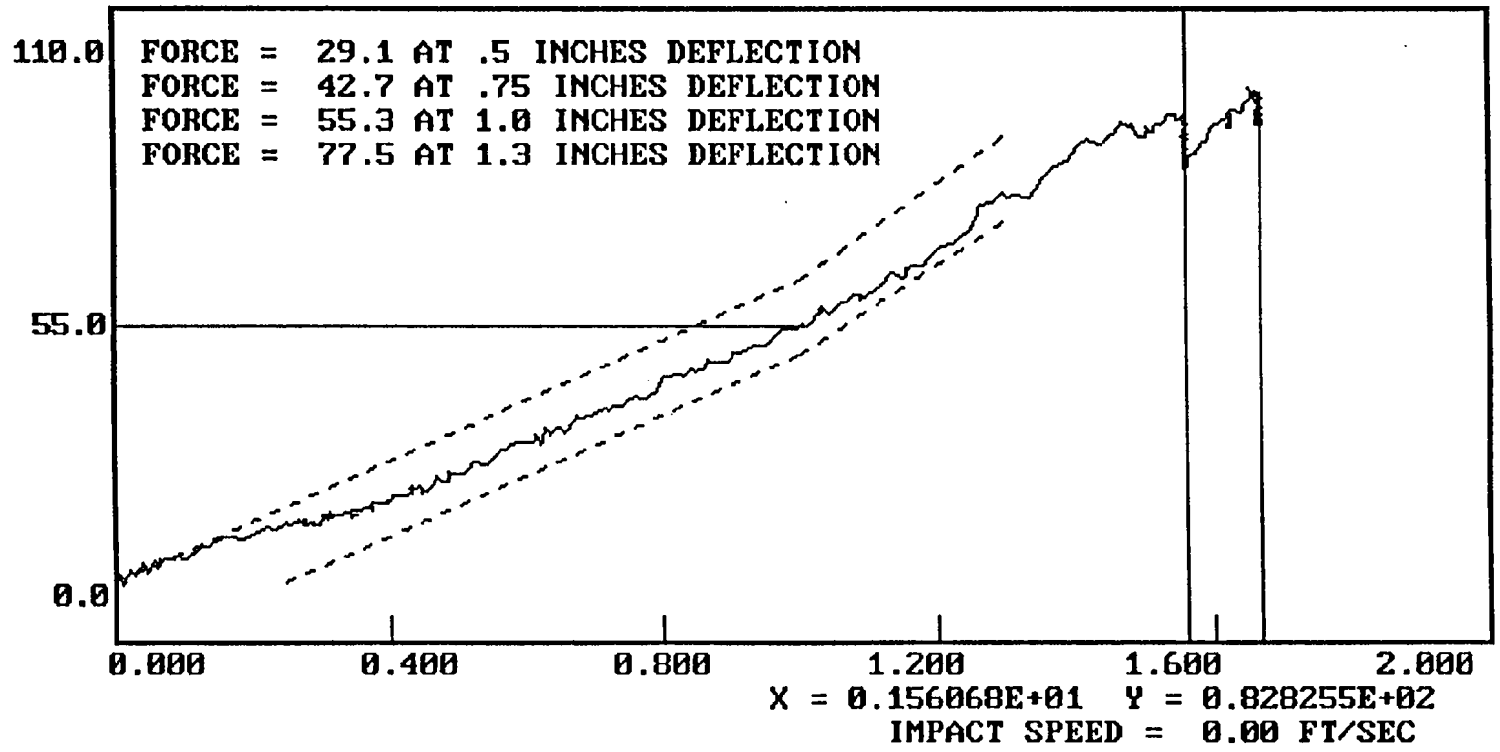
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 70° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| FORCE @ 0.5 in | 23.3 - 36.5 lbs | 29.1 |
| FORCE @ 0.75 in | 36.7 - 49.8 lbs | 42.7 |
| FORCE @ 1.0 in | 50 - 63 lbs | 55 |
| FORCE @ 1.3 in | 73 - 88 lbs | 78 |

TEST MEETS SPECIFICATIONS

TECHNICIAN _____

APPROVED BY _____

DUMMY CALIBRATION - ABDOMEN COMPRESSION 07-07-1994 10:42
DUMMY # 271
ABDOMEN FORCE () VS. ABDOMEN DISPLACEMENT (INCHES)



MGA RESEARCH CORPORATION

LUMBAR FLEXION TEST

SIDE IMPACT DUMMY (SID)

DATE: July 7, 1994

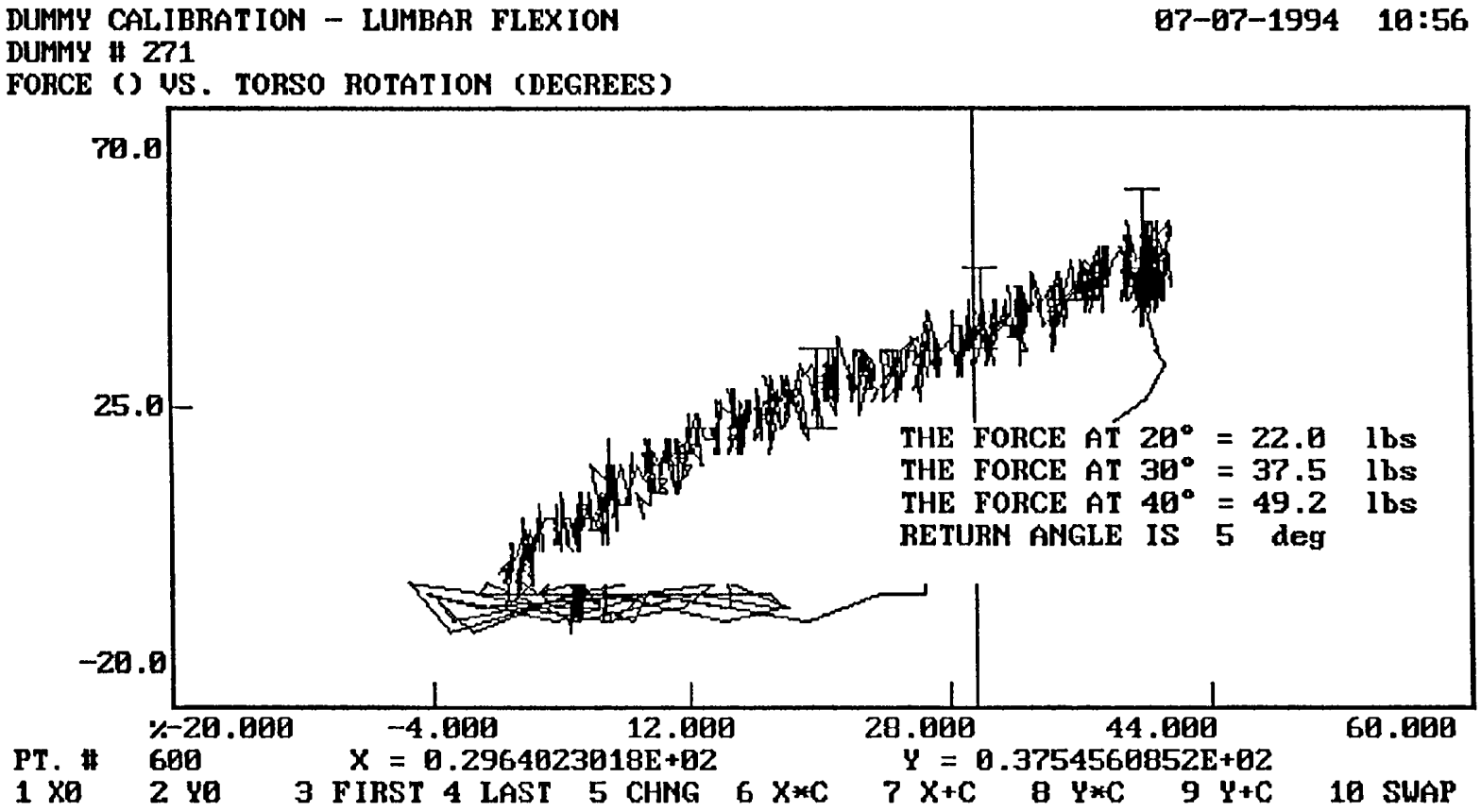
DUMMY NUMBER: 271 TEST NUMBER: D94475

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 70° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| FORCE @ 0° | 0 - 6 lbs | 0 |
| FORCE @ 20° | 22 - 34 lbs | 22 |
| FORCE @ 30° | 34 - 46 lbs | 38 |
| FORCE @ 40° | 46 - 58 lbs | 49 |
| RETURN ANGLE | 12° maximum | 5° |

TEST MEETS SPECIFICATIONS

TECHNICIAN

APPROVED BY


DUMMY CALIBRATION - LUMBAR FLEXION
07-07-1994 10:56
DUMMY # 271
FORCE () VS. TORSO ROTATION (DEGREES)
70.0
25.0
-20.0
THE FORCE AT 20° = 22.0 lbs
THE FORCE AT 30° = 37.5 lbs
THE FORCE AT 40° = 49.2 lbs
RETURN ANGLE IS 5 deg
-20.000
-4.000
12.000
28.000
44.000
60.000
PT. # 600
X = 0.2964023018E+02
Y = 0.3754560852E+02
1 X0 2 Y0 3 FIRST 4 LAST 5 CHNG 6 X*C 7 X+C 8 Y*C 9 Y+C 10 SWAP

POST-TEST CERTIFICATION DATA

Driver Dummy Serial Number: 272

Calibration Test Results Summary

Dummy Serial Number: 272

Post-Test Calibration

| | |
|---|---|
| External Dimensions: | The dummy passed all external dimension requirements. |
| Thorax Impact Test: | The thorax passed all impact test requirements. |
| Pelvis Impact Test: | The pelvis passed all impact test requirements. |
| Abdominal Compression Test: | The abdomen passed all compression test requirements. |
| Lumbar Flexion Test: | The lumbar passed all flexion test requirements. |

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY NO.: 272

DATE OF VERIFICATION: July 20, 1994

| DESCRIPTION | SPECIFICATION | TEST RESULTS |
|---|---|---|
| SH - Seated Height | 35.0" - 35.8" | 35.3 |
| RH - Rib Height | 19.75 - 20.5" | 20.0 |
| HP - Hip Pivot Height | 3.9" ref. | 3.8 |
| RD - Rib From Back Line | 9.0" to 9.5" | 9.4 |
| KV - Knee Pivot From Back Line | 20.1" - 20.7" | 20.5 |
| SW - Knee Pivot to Floor | 19.3" - 19.9" | 19.5 |
| HW - Hip Width | 14.0" - 15.4" | 15.1 |

MEASUREMENTS BY: _____

APPROVED BY: _____

MGA RESEARCH CORPORATION

THORAX IMPACT TEST

SIDE IMPACT DUMMY (SID)

DATE: July 20, 1994

DUMMY NUMBER: 272 TEST NUMBER: D94572

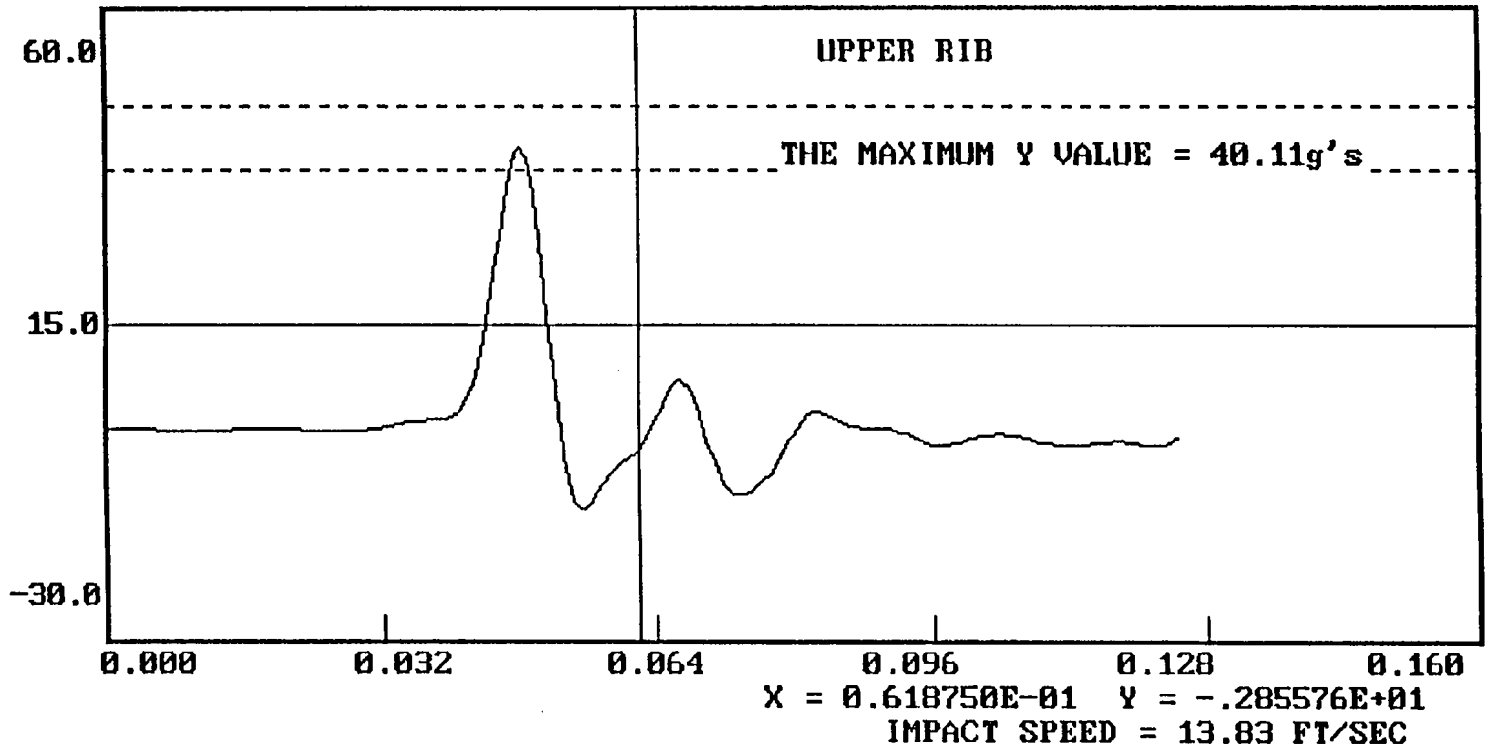
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 70° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| PROBE SPEED | 13.8 - 14.2 fps | 13.8 |
| UPPER RIB | 37 - 46 g's | 40 |
| LOWER RIB | 37 - 46 g's | 39 |
| LOWER SPINE | 15 - 22 g's | 19 |

TEST MEETS SPECIFICATIONS

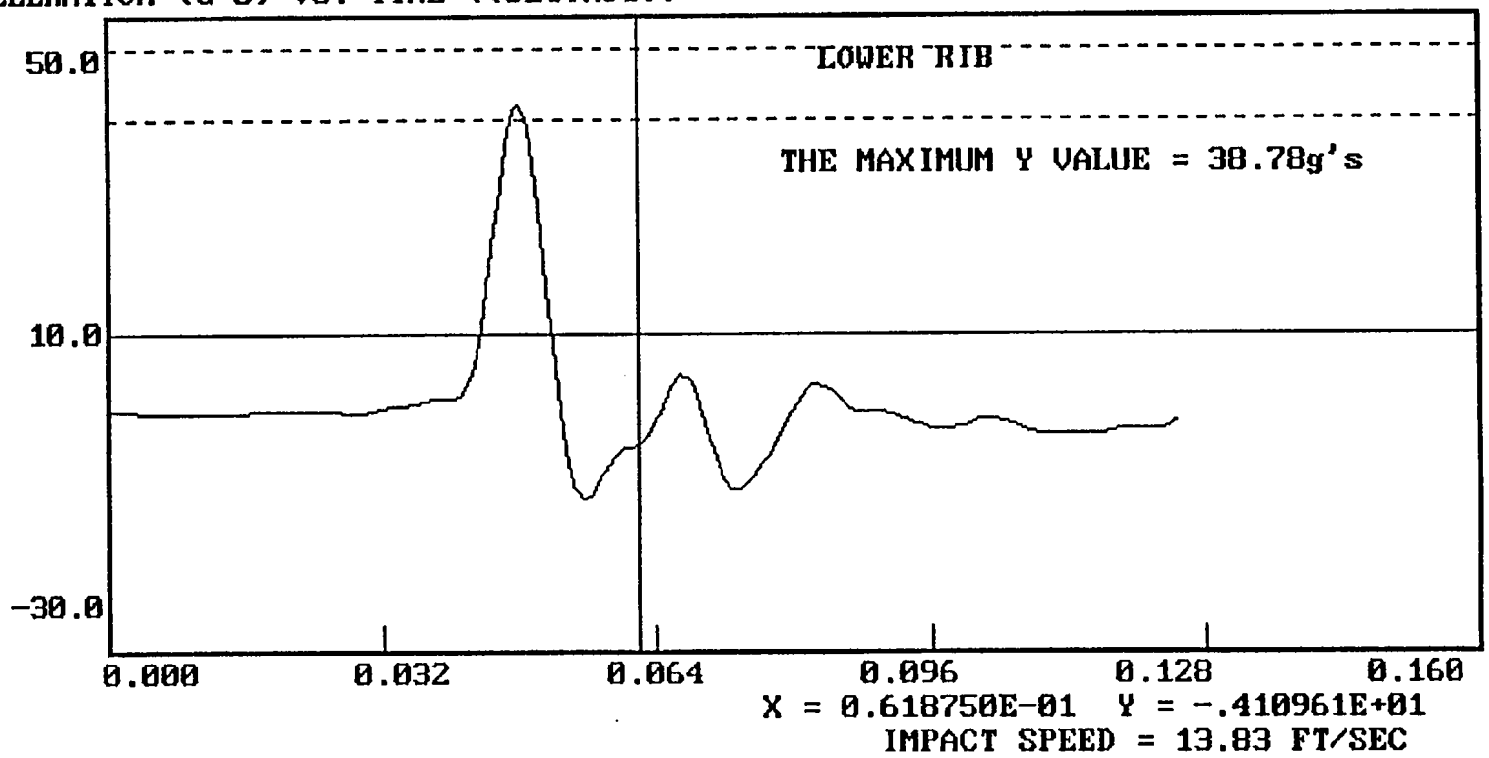
TECHNICIAN _____

APPROVED BY _____

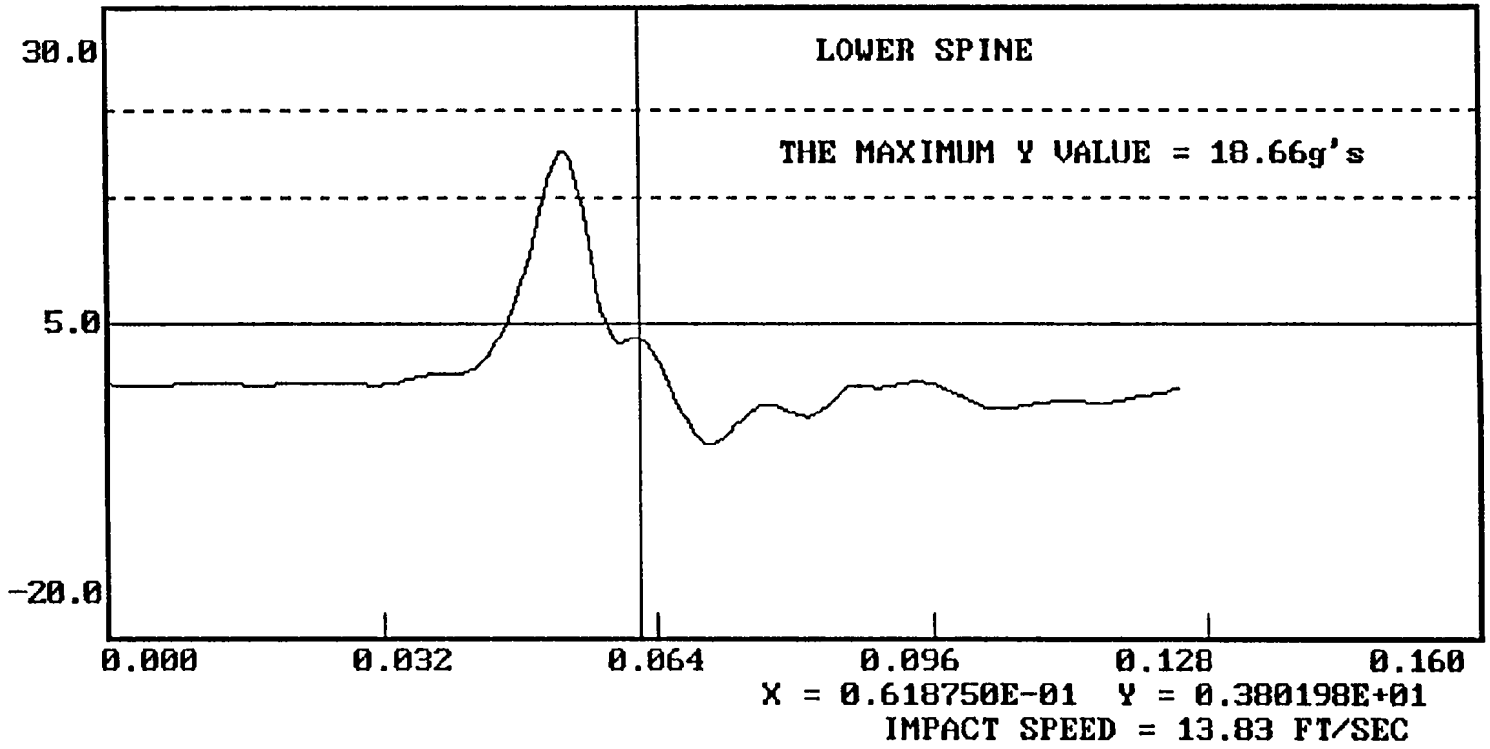
DUMMY CALIBRATION - THORAX IMPACT 07-20-1994 12:59
DUMMY # 272
ACCELERATION (G'S) VS. TIME ((SECONDS))



DUMMY CALIBRATION - THORAX IMPACT 07-20-1994 12:59
DUMMY # 272
ACCELERATION (G'S) VS. TIME ((SECONDS))



DUMMY CALIBRATION - THORAX IMPACT 07-20-1994 12:59
DUMMY # 272
ACCELERATION (G'S) VS. TIME ((SECONDS))



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SIDE IMPACT DUMMY (SID)

DATE: July 20, 1994

DUMMY NUMBER: 272 TEST NUMBER: D94573

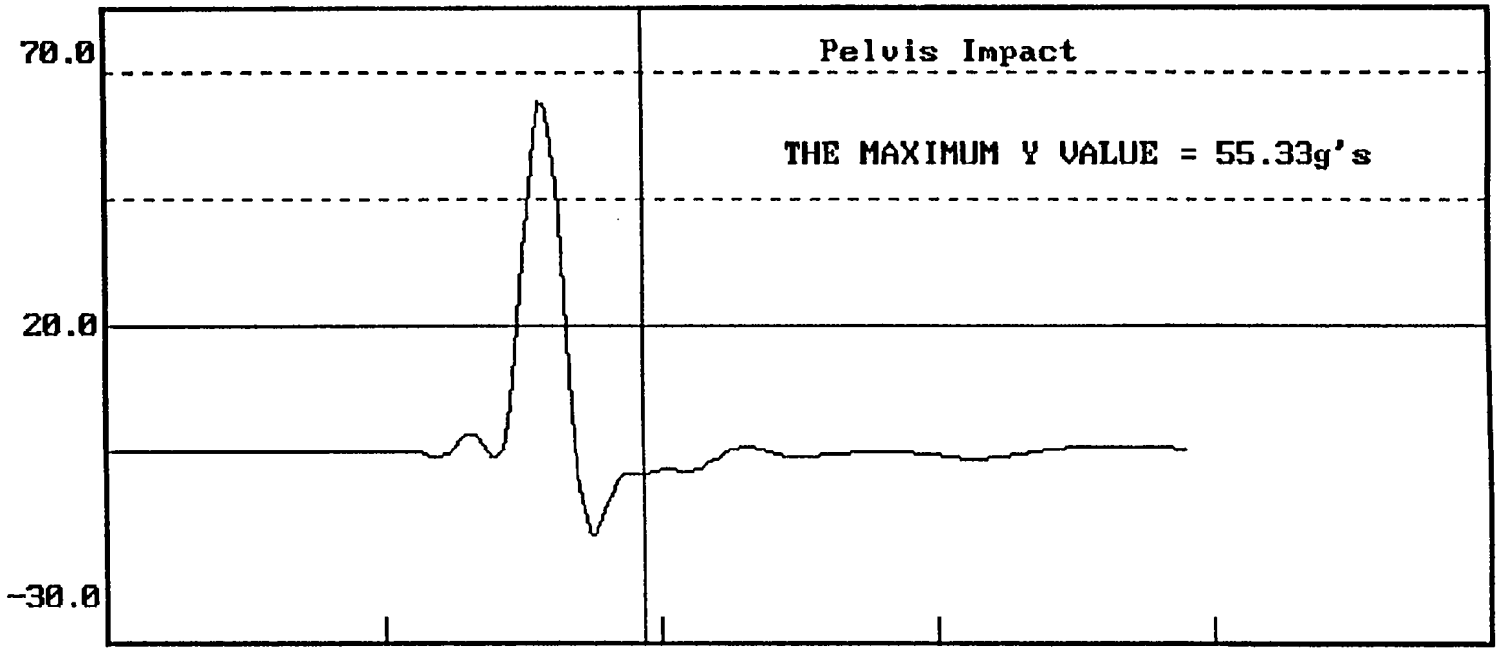
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 70° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| PROBE SPEED | 13.8 - 14.2 fps | 13.8 |
| PELVIS ACCELERATION | 40 - 60 g's | 55 |

TEST MEETS SPECIFICATIONS

TECHNICIAN

APPROVED BY

DUMMY CALIBRATION - PELVIS IMPACT 07-20-1994 11:36
DUMMY # 272
ACCELERATION (G'S) VS. TIME ((SECONDS))




X = 0.618750E-01 Y = -.347444E+01
IMPACT SPEED = 13.83 FT/SEC

MGA RESEARCH CORPORATION

ABDOMINAL COMPRESSION TEST
(PRELOAD = 10 LBS)

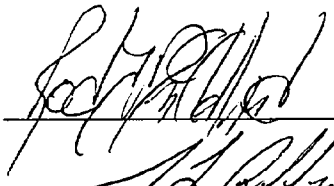
SIDE IMPACT DUMMY (SID)

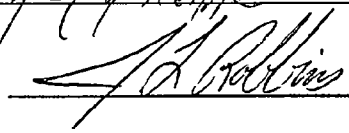
DATE: July 22, 1994

DUMMY NUMBER: 272 TEST NUMBER: D94574

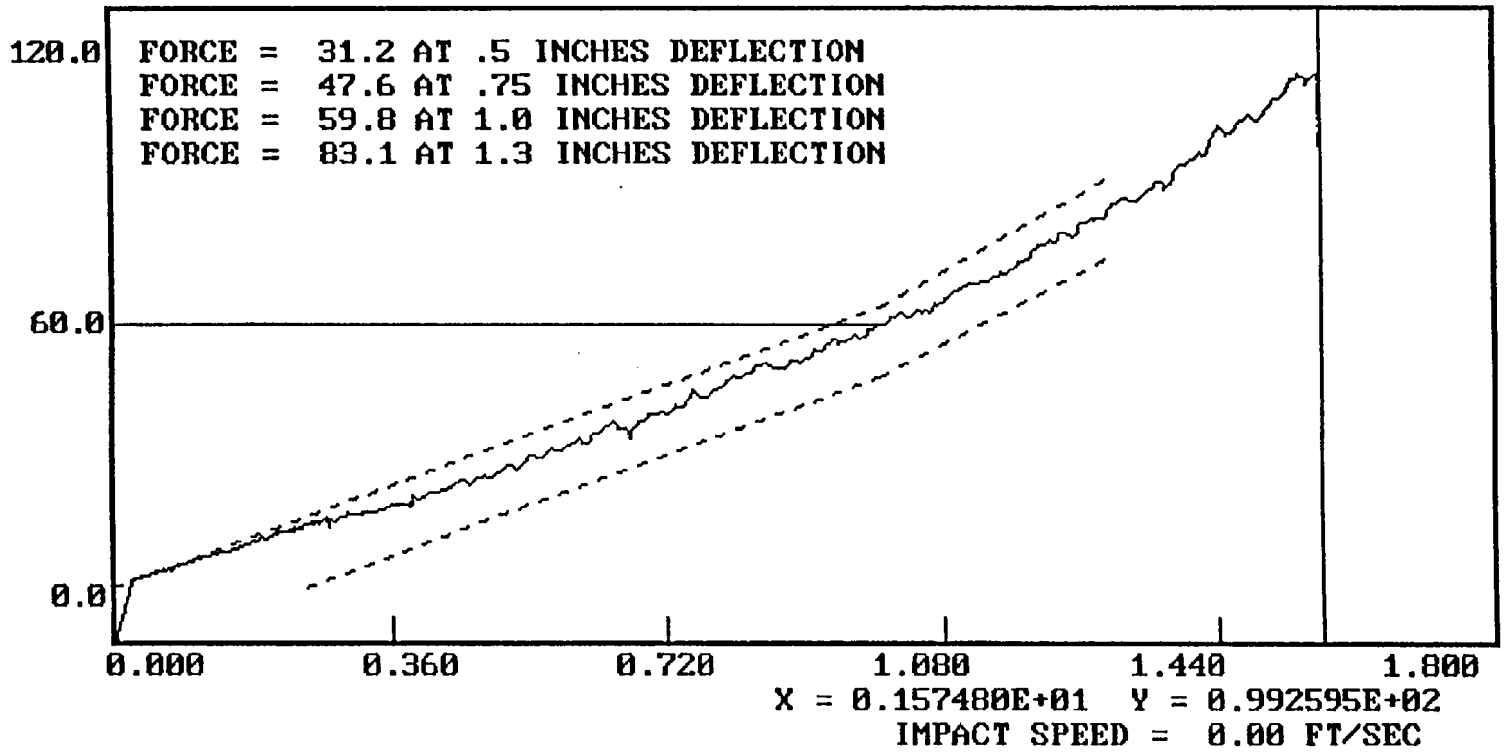
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 70° |
| RELATIVE HUMIDITY | 10 - 70% | 60% |
| FORCE @ 0.5 in | 23.3 - 36.5 lbs | 31.2 |
| FORCE @ 0.75 in | 36.7 - 49.8 lbs | 47.6 |
| FORCE @ 1.0 in | 50 - 63 lbs | 60 |
| FORCE @ 1.3 in | 73 - 88 lbs | 83 |

TEST MEETS SPECIFICATIONS

TECHNICIAN 

APPROVED BY 

DUMMY CALIBRATION - ABDOMEN COMPRESSION 07-22-1994 11:07
DUMMY # 272
ABDOMEN FORCE () VS. ABDOMEN DISPLACEMENT (INCHES)




X = 0.157480E+01 Y = 0.992595E+02
IMPACT SPEED = 0.00 FT/SEC

MGA RESEARCH CORPORATION

LUMBAR FLEXION TEST

SIDE IMPACT DUMMY (SID)

DATE: July 20, 1994

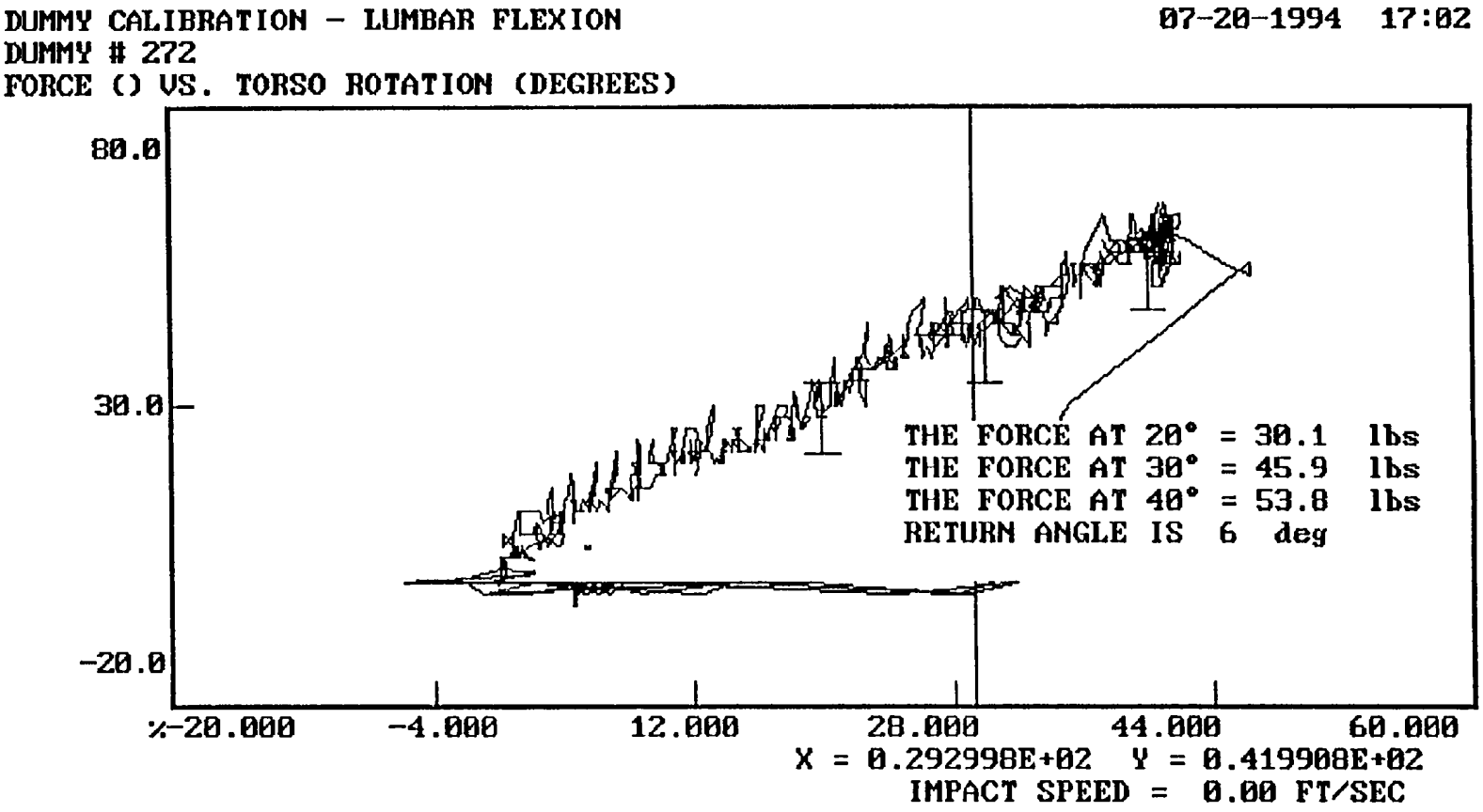
DUMMY NUMBER: 272 TEST NUMBER: D94575

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 70° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| FORCE @ 0° | 0 - 6 lbs | 0 |
| FORCE @ 20° | 22 - 34 lbs | 30 |
| FORCE @ 30° | 34 - 46 lbs | 46 |
| FORCE @ 40° | 46 - 58 lbs | 54 |
| RETURN ANGLE | 12° maximum | 6° |

TEST MEETS SPECIFICATIONS

TECHNICIAN _____

APPROVED BY _____


DUMMY CALIBRATION - LUMBAR FLEXION
07-20-1994 17:02
DUMMY # 272
FORCE () VS. TORSO ROTATION (DEGREES)
80.0
30.0
-20.0
-20.000
-4.000
12.000
28.000
44.000
60.000
THE FORCE AT 20° = 30.1 lbs
THE FORCE AT 30° = 45.9 lbs
THE FORCE AT 40° = 53.8 lbs
RETURN ANGLE IS 6 deg
X = 0.292998E+02 Y = 0.419908E+02
IMPACT SPEED = 0.00 FT/SEC

POST-TEST CERTIFICATION DATA

Passenger Dummy Serial Number: 271

## Calibration Test Results Summary

Dummy Serial Number: 271

Post-Test Calibration

| | |
|---|---|
| External Dimensions: | The dummy passed all external dimension requirements. |
| Thorax Impact Test: | The thorax passed all impact test requirements. |
| Pelvis Impact Tests: | The pelvis would not pass post-test impact test requirements. |
| Adbominal Compression Test: | The abdomen passed all compression test requirements. |
| Lumbar Flexion Test: | The lumbar passed all flexion test requirements. |

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY NO.: 271

DATE OF VERIFICATION: July 20, 1994

| DESCRIPTION | SPECIFICATION | TEST RESULTS |
|---|---|---|
| SH - Seated Height | 35.0" - 35.8" | 35.4 |
| RH - Rib Height | 19.75 - 20.5" | 19.8 |
| HP - Hip Pivot Height | 3.9" ref. | 3.9 |
| RD - Rib From Back Line | 9.0" to 9.5" | 9.3 |
| KV - Knee Pivot From Back Line | 20.1" - 20.7" | 20.2 |
| SW - Knee Pivot to Floor | 19.3" - 19.9" | 19.5 |
| HW - Hip Width | 14.0" - 15.4" | 15.1 |

MEASUREMENTS BY: _____

APPROVED BY: _____

MGA RESEARCH CORPORATION

THORAX IMPACT TEST

SIDE IMPACT DUMMY (SID)

DATE: July 20, 1994

DUMMY NUMBER: 271 TEST NUMBER: D94562

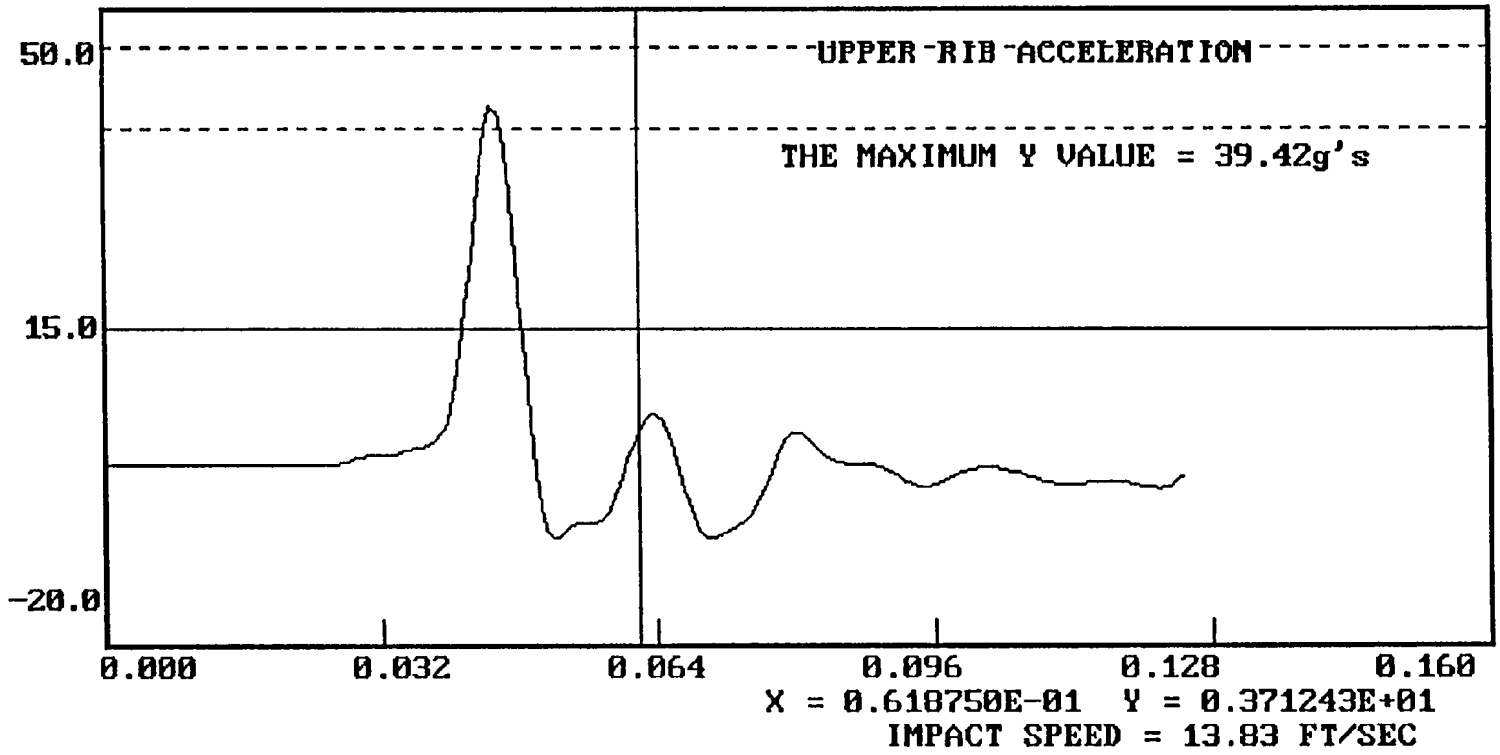
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 72° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| PROBE SPEED | 13.8 - 14.2 fps | 13.8 |
| UPPER RIB | 37 - 46 g's | 39 |
| LOWER RIB | 37 - 46 g's | 41 |
| LOWER SPINE | 15 - 22 g's | 19 |

TEST MEETS SPECIFICATIONS

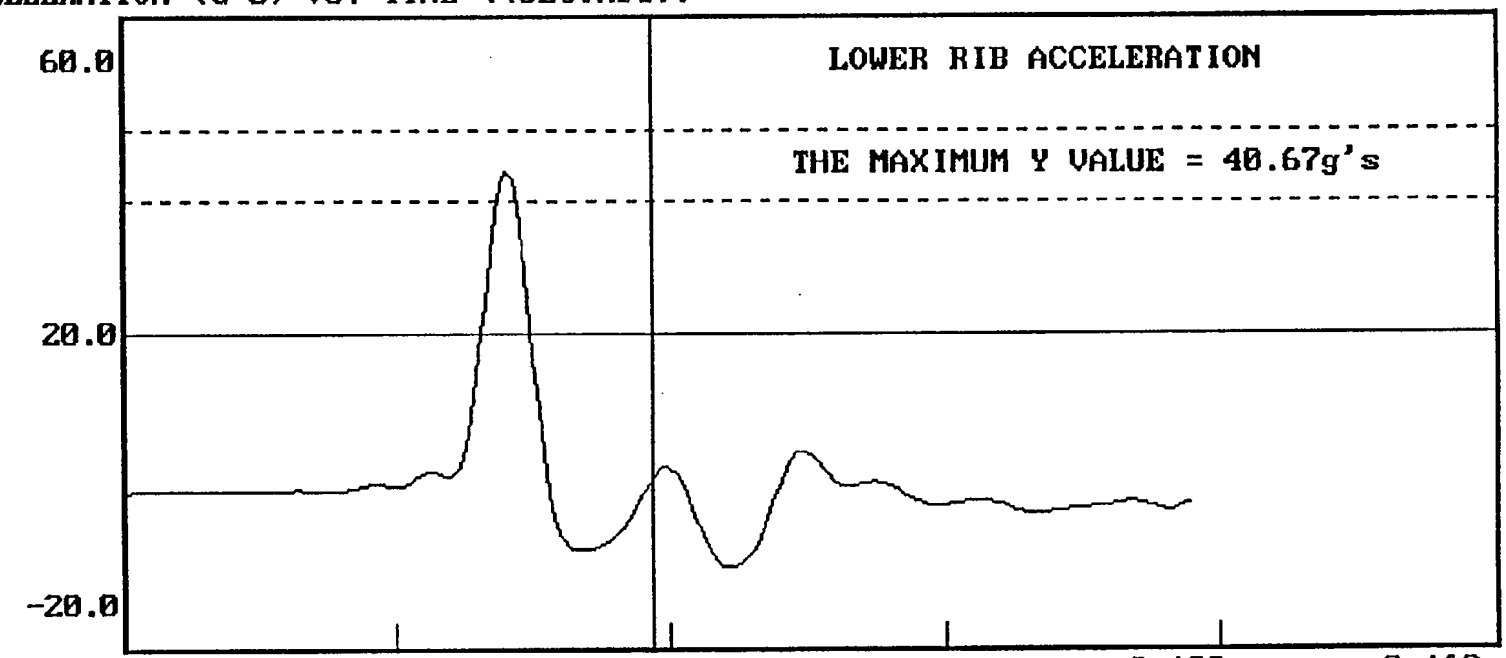
TECHNICIAN _____

APPROVED BY _____

DUMMY CALIBRATION - THORAX IMPACT 07-20-1994 12:21
DUMMY # 271
ACCELERATION (G'S) VS. TIME ((SECONDS))

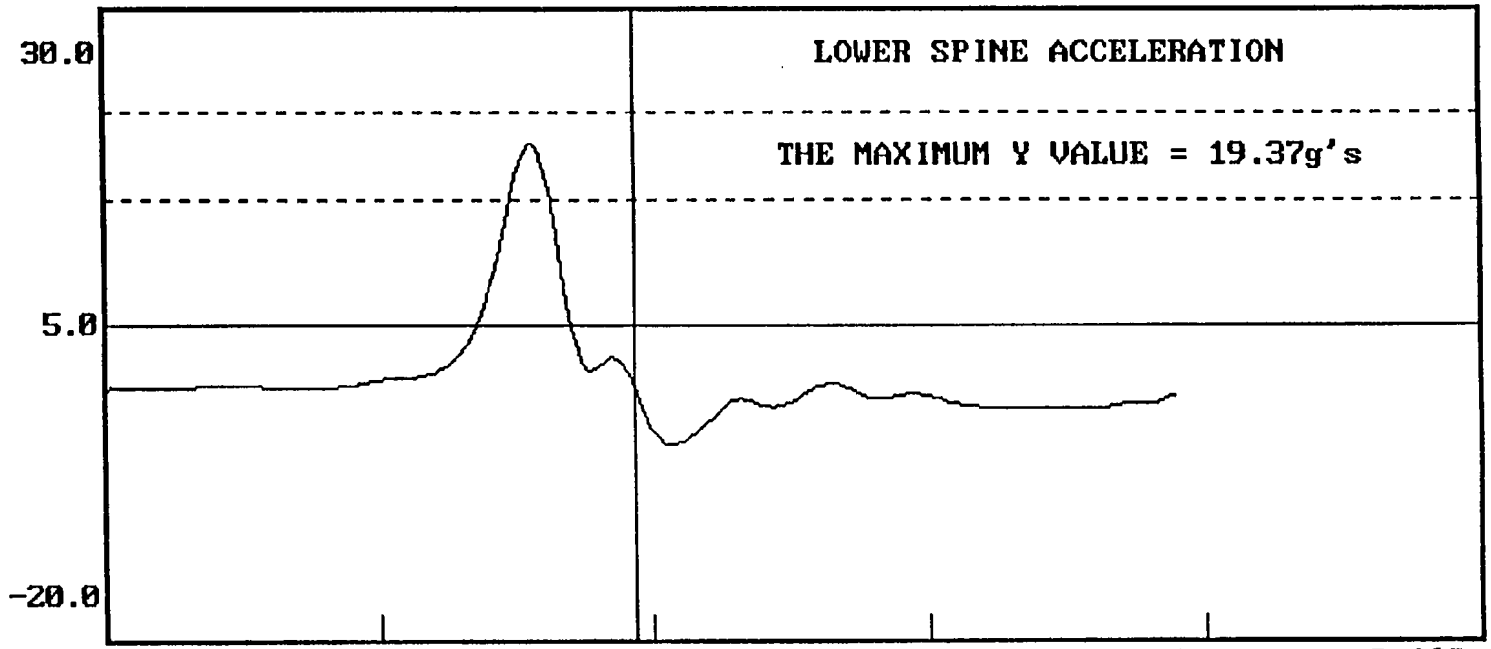


DUMMY CALIBRATION - THORAX IMPACT 07-20-1994 12:21
DUMMY # 271
ACCELERATION (G'S) VS. TIME ((SECONDS))




X = 0.618750E-01 Y = 0.168815E+01
IMPACT SPEED = 13.83 FT/SEC

DUMMY CALIBRATION - THORAX IMPACT 07-20-1994 12:21
DUMMY # 271
ACCELERATION (G'S) VS. TIME ((SECONDS))




X = 0.618750E-01 Y = 0.401983E-02
IMPACT SPEED = 13.83 FT/SEC

MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SIDE IMPACT DUMMY (SID)

DATE: July 20, 1994

DUMMY NUMBER: 271 TEST NUMBER: D94563

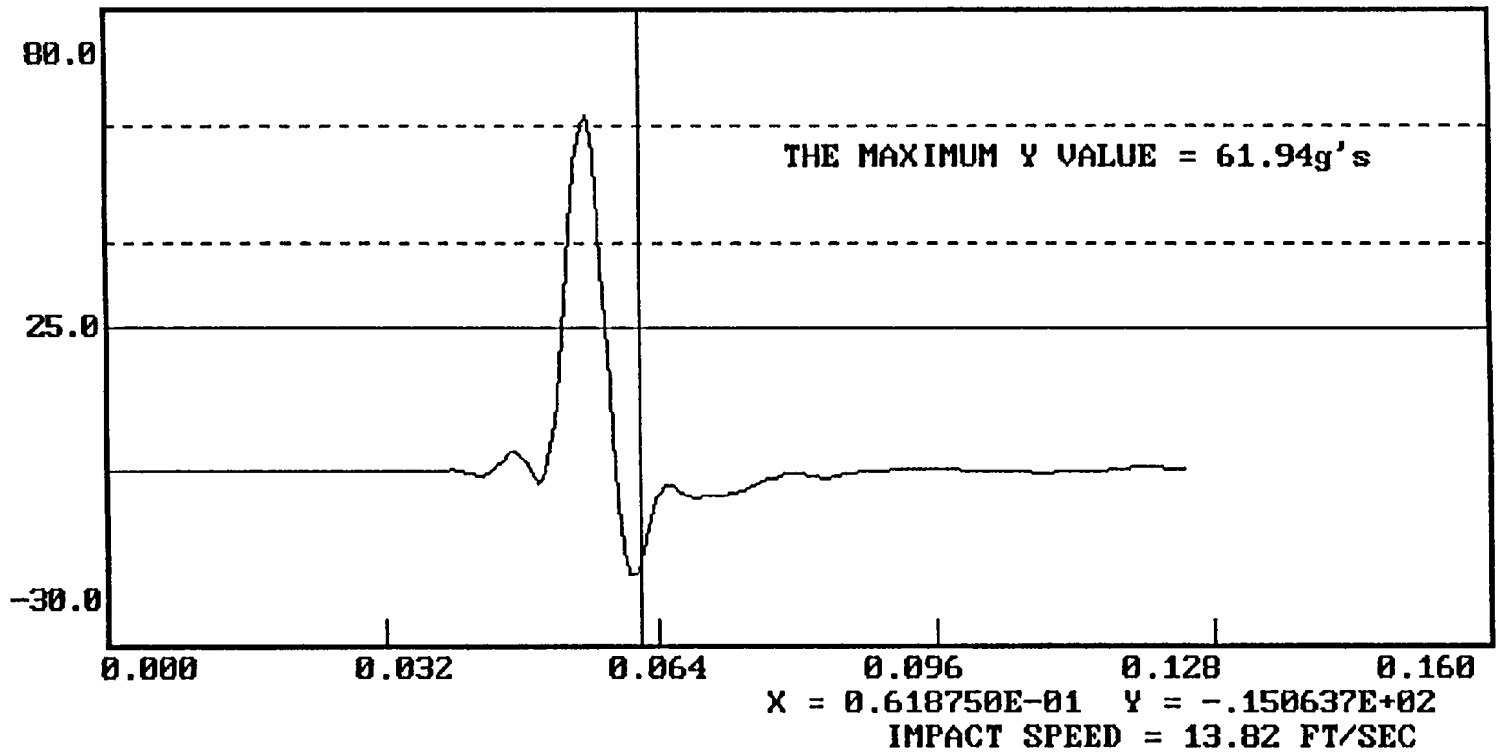
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 72° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| PROBE SPEED | 13.8 - 14.2 fps | 13.8 |
| PELVIS ACCELERATION | 40 - 60 g's | 62* |

*TEST DOES NOT MEETS REQUIRED SPECIFICATIONS

TECHNICIAN

APPROVED BY

DUMMY CALIBRATION - PELVIS IMPACT 07-20-1994 09:28
DUMMY # 271
ACCELERATION (G'S) VS. TIME ((SECONDS))



MGA RESEARCH CORPORATION

ABDOMINAL COMPRESSION TEST
(PRELOAD = 10 LBS)

SIDE IMPACT DUMMY (SID)

DATE: July 22, 1994

DUMMY NUMBER: 271 TEST NUMBER: D94564

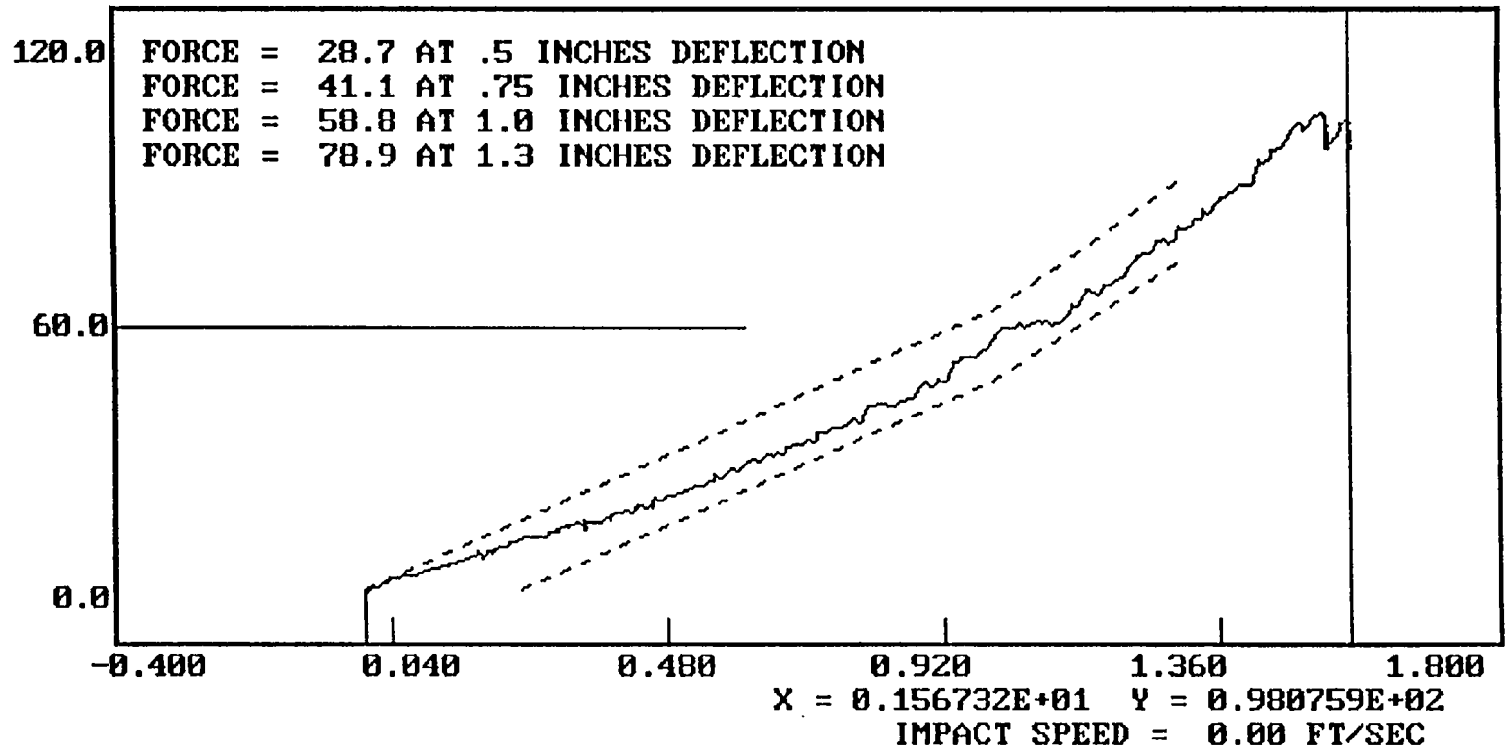
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 70° |
| RELATIVE HUMIDITY | 10 - 70% | 60% |
| FORCE @ 0.5 in | 23.3 - 36.5 lbs | 28.7 |
| FORCE @ 0.75 in | 36.7 - 49.8 lbs | 41.1 |
| FORCE @ 1.0 in | 50 - 63 lbs | 59 |
| FORCE @ 1.3 in | 73 - 88 lbs | 79 |

TEST MEETS SPECIFICATIONS

TECHNICIAN _____

APPROVED BY _____

DUMMY CALIBRATION - ABDOMEN COMPRESSION 07-22-1994 11:01
DUMMY # 271
ABDOMEN FORCE () VS. ABDOMEN DISPLACEMENT (INCHES)



MGA RESEARCH CORPORATION

LUMBAR FLEXION TEST

SIDE IMPACT DUMMY (SID)

DATE: July 20, 1994

DUMMY NUMBER: 271 TEST NUMBER: D94565

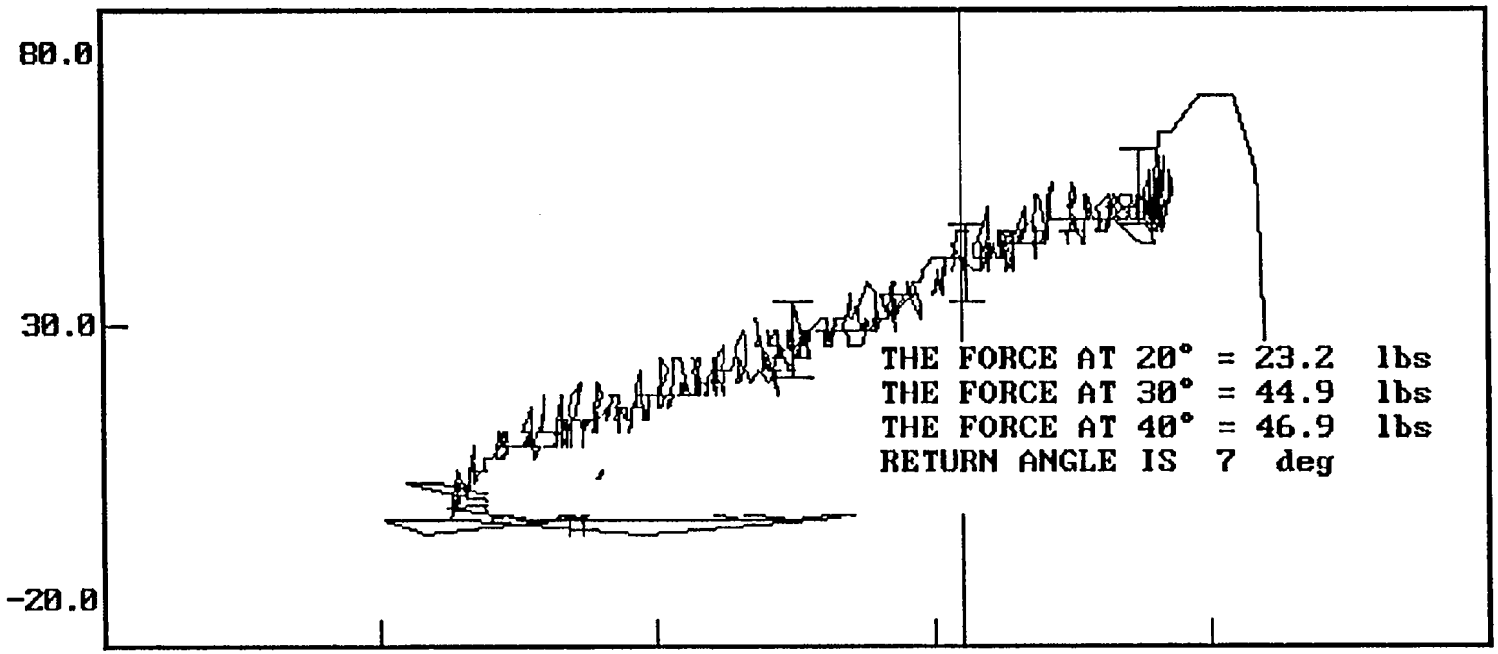
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 66 - 78° F | 70° |
| RELATIVE HUMIDITY | 10 - 70% | 50% |
| FORCE @ 0° | 0 - 6 lbs | 0 |
| FORCE @ 20° | 22 - 34 lbs | 23 |
| FORCE @ 30° | 34 - 46 lbs | 45 |
| FORCE @ 40° | 46 - 58 lbs | 47 |
| RETURN ANGLE | 12° maximum | 7° |

TEST MEETS SPECIFICATIONS

TECHNICIAN

APPROVED BY

DUMMY CALIBRATION - LUMBAR FLEXION 07-20-1994 16:05
DUMMY # 271
FORCE () VS. TORSO ROTATION (DEGREES)




X = 0.296725E+02 Y = 0.409342E+02
IMPACT SPEED = 0.00 FT/SEC

## POST-TEST DRIVER DUMMY INSPECTION CHECKLIST

Type: Side Impact Dummy

Serial Number: 272

Inspected By: Jeff Robbins

Date: July 2Ø, 1994

| Part | Items Checked | Comments |
|---|---|---|
| Skin | visual inspection | OK |
| Head | visual, ballast, accelerometer mount | OK |
| Neck | visual, cable torque | OK |
| Spine box | visual, ballast, weldment, accelerometer mount | OK |
| Rib cage | visual, measure, stiffeners | OK |
| Sternum | visual | OK |
| Lumbar spine | visual | OK |
| Abdomen | visual | OK |
| Pelvis | visual, palpate, accelerometer mount | OK |
| Upper legs | visual | OK |
| Knees | visual, stops, inserts | OK |
| Lower legs | visual, range of motion | OK |
| Ankles | visual, range of motion | OK |
| Feet | visual, range of motion | OK |
| Joints | 1 to 2 g range | OK |
| Other | | |

NOTES: (include component/problem/action/reason):

## POST-TEST PASSENGER DUMMY INSPECTION CHECKLIST

Type: Side Impact Dummy

Serial Number: 271

Inspected By: Jeff Robbins

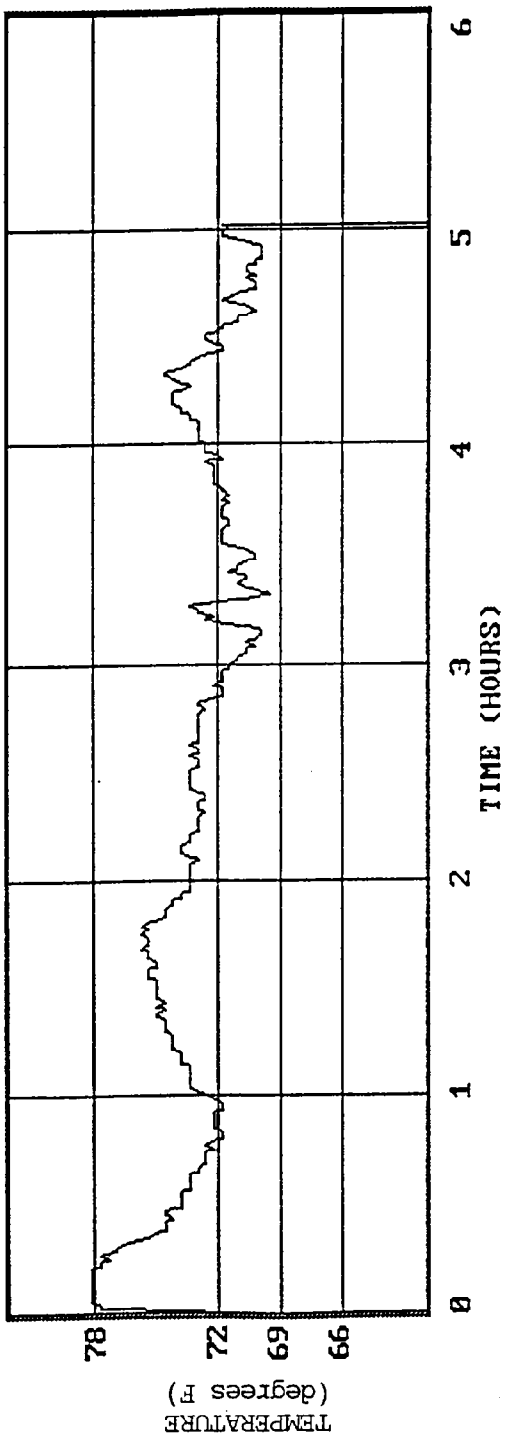
Date: July 2Ø, 1994

| Part | Items Checked | Comments |
|---|---|---|
| Skin | visual inspection | OK |
| Head | visual, ballast, accelerometer mount | OK |
| Neck | visual, cable torque | OK |
| Spine box | visual, ballast, weldment, accelerometer mount | OK |
| Rib cage | visual, measure, stiffeners | OK |
| Sternum | visual | OK |
| Lumbar spine | visual | OK |
| Abdomen | visual | OK |
| Pelvis | visual, palpate, accelerometer mount | DAMAGED |
| Upper legs | visual | OK |
| Knees | visual, stops, inserts | OK |
| Lower legs | visual, range of motion | OK |
| Ankles | visual, range of motion | OK |
| Feet | visual, range of motion | OK |
| Joints | 1 to 2 g range | OK |
| Other | | |

NOTES: (include component/problem/action/reason):

The passenger's pelvis would not meet the post-test calibration requirements. A small tear in the pelvis skin was noted in the corner of the pelvic accelerometer mounting location. Additionally, there was a tear approximately one inch in length, located above the shoulder bolt insertion hole on the impact side of the pelvis assembly. The pelvis was replaced with a new pelvic assembly. The new assembly did meet pre-test calibration requirements.

## VEHICLE AND DUMMY TEMPERATURE



# APPENDIX D

# DUMMY AND VEHICLE CALIBRATION DATA

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

INSTRUMENTS FOR DRIVER DUMMY NO. 272

| | DRIVER | | |
|---|---|---|---|
| | SERIAL NO. | MANUFACTURER | CALIBRATION DATE |
| Upper Rib | AGTM2 | Endevco | June 27, 1994 |
| Lower Rib | AGT81 | Endevco | June 27, 1994 |
| Lower Spine | AGR57 | Endevco | June 27, 1994 |
| Pelvis | AHWK8 | Endevco | June 27, 1994 |
| Upper Rib Redundant | AGTB5 | Endevco | June 27, 1994 |
| Lower Rib Redundant | AHTP3 | Endevco | June 27, 1994 |
| Lower Spine Redundant | AGTG8 | Endevco | June 27, 1994 |
| Pelvis Redundant | AGTR3 | Endevco | June 27, 1994 |



INSTRUMENTS FOR PASSENGER DUMMY NO. 271

| | LEFT REAR PASSENGER | | |
|---|---|---|---|
| | SERIAL NO. | MANUFACTURER | CALIBRATION DATE |
| Upper Rib | AHY21 | Endevco | June 21, 1994 |
| Lower Rib | AHY71 | Endevco | July Ø1, 1994 |
| Lower Spine | AHR15 | Endevco | July Ø1, 1994 |
| Pelvis | AH1G2 | Endevco | June 2Ø, 1994 |
| Upper Rib Redundant | AHW86 | Endevco | June 21, 1994 |
| Lower Rib Redundant | AGPO7 | Endevco | July Ø1, 1994 |
| Lower Spine Redundant | AHOA7 | Endevco | July Ø1, 1994 |
| Pelvis Redundant | AHOMØ | Endevco | June 2Ø, 1994 |

VEHICLE INSTRUMENT CALIBRATION

| | VEHICLE ACCELEROMETERS | | |
|---|---|---|---|
| | SERIAL NO. | MANUFACTURER | CALIBRATION DATE |
| MDB CG X | MGA135 | Entran | June 13, 1994 |
| MDB CG Y | MGA126 | Entran | June 13, 1994 |
| MDB CG Z | AZØ2 | Endevco | June 13, 1994 |
| MDB Rear Axle X | MGAØ54 | Entran | June 13, 1994 |
| MDB Rear Axle Y | AØ6M | Endevco | June 13, 1994 |
| Lower Left A-Post | MGAØ45 | Entran | June 2, 1994 |
| Lower Left B-Post | MGA145 | Entran | June 3Ø, 1994 |
| Upper Left B-Post | MGAØ9Ø | Entran | April 25, 1994 |
| Trunk Centerline X | AHTA5 | Endevco | July 12, 1994 |
| Trunk Centerline Y | AHYB7 | Endevco | July 12, 1994 |
| Trunk Centerline Z | AGWA8 | Endevco | July 12, 1994 |
| Driver Seat Track | AALL9 | Endevco | June 2, 1994 |
| Right Front Sill X | AC9K7 | Endevco | July 12, 1994 |
| Right Front Sill Y | AHTE5 | Endevco | July 12, 1994 |
| Right Front Sill Z | AHT42 | Endevco | July 12, 1994 |
| Right Rear Sill X | AHY57 | Endevco | July 12, 1994 |
| Right Rear Sill Y | AHY51 | Endevco | July 12, 1994 |
| Right Rear Sill Z | AHYC7 | Endevco | July 12, 1994 |
| Right Rear Seat Occupant Compartment | AHYD5 | Endevco | July 12, 1994 |
| Left Front Sill Y | A99L | Endevco | June 2, 1994 |
| Left Rear Sill Y | AY1Ø | Endevco | June 14, 1994 |

Note: All Endevco accelerometers are Model No. 7264-2ØØØ
All Entran accelerometers are Model No. EGE-72