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FILE

**REPORT NO.: MGA-93-21406**
**NHTSA NO: MP0105**

# OFFICE OF MARKET INCENTIVES SIDE IMPACT PROTECTION STUDY

## PASSENGER CARS

1993 OLDSMOBILE ACHIEVA
2-Door

Film # F-003648

MGA PROVING GROUNDS
5000 WARREN ROAD
BURLINGTON, WI 53105



MGA Ref. No.: G93A-02

Test Date: May 20, 1993

FINAL REPORT

Prepared For:

**U.S. DEPARTMENT OF TRANSPORTATION**
**NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION**
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15. Supplementary Notes

16. Abstract

A 48/24 kph (30/15 mph) 90° Impact (Moving Deformable Barrier) Test was conducted on the subject 1993 Oldsmobile Achieva 2-Door in accordance with the specifications of the Office of Market Incentives Test Procedure. The test was conducted at the MGA Proving Grounds and crash Test Facility in Burlington, WI on May 20, 1993.

The impact velocity of the Moving Deformable Barrier (MDB) was 53.5 kph (33.15 mph), and the ambient temperature of the struck side (driver's) of the target vehicle at the time of impact was 68° F. The target vehicle post-test maximum crush was 384 mm.

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

| | Driver's SID | Left Rear SID |
|---|---|---|
| Left Upper Rib Acceleration | 110.6 g's | 101.8 g's |
| Left Lower Rib Acceleration | 98.4 g's | 124.0 g's |
| Lower Spine Acceleration | 104.2 g's | 83.1 g's |
| Thoracic Trauma Index (TTI) | 107.4 g's | 103.6 g's |
| Pelvis Acceleration | 98.5 g's | 112.8 g's |


| 17. Key Words | 18. Distribution Statement |
|---|---|
| OMI Side Impact Protection Study<br>Side Impact Dummy (SID) | Copies of this report are available from:<br>National Highway Traffic Safety Adm<br>Technical Reference Division<br>Docket Section, Room 5108<br>400 Seventh St., SW., Washington DC 20590 |

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09/28/93

Data of Report Acceptance

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## Section 1
## PURPOSE AND TEST PROCEDURE

This side impact test is part of the Composite FY93 Side Impact Protection Study 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 1993 Oldsmobile Achieva.

The side impact test was conducted in accordance with the Office of Market Incentive (OMI) Laboratory Indicant Test Procedure.

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 1993 Oldsmobile Achieva 2-Door 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 53.5 kph (33.15mph) on May 20, 1993. 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 OMI Side Impact Protection Laboratory Test Procedure which is dated March 1992. The side impact event was documented by ten high speed cameras. Camera locations and other pertinent camera information can be found in this report.

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. Upper Thoracic spine ($T_{34}$) uniaxial accelerometer (Y direction)
5. Pelvic (PEV) section uniaxial accelerometer (Y-direction)

A summary of the side impact dummy (SID) configuration and performance verification test data can be found in Appendix C.

A total of 46 channels of data were recorded. Appendix B contains the vehicle and dummy response data traces.

The driver's Thoracic Trauma Index (TTI) was 107.4 g's. Maximum pelvic Y acceleration was 98.5 g's.

The left rear passenger's TTI was 103.6 g's. Maximum pelvic Y acceleration was 112.8 g's.

# SECTION 3
# SUMMARY OF TEST DATA

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 1993 Oldsmobile Achieva 2-Door

Vehicle NHTSA No.: MP0105 VIN: 1G3NL1439PM017809

Vehicle Body Color: Aqua Month & Year of Manufacture: 1-93

Engine Data: 4 cylinders; ____ CID; 2.3 Liter; ____cc

Placement ____ Longitudinal; or X Lateral

Transmission: 3 speed; ____ Manual; X Automatic; ____ Overdrive

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

Odometer Reading 83 miles

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

DATA FROM TIRE PLACARD:

Tire Pressure (at capacity): 35 psi FRONT

35 psi REAR

Recommended Tire Size: P185/75R14

Tires on Test Vehicle: P185/75R14 Manufacturer: Michelin

Vehicle Capacity Data:

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

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

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

Vehicle Maximum Capacity Loading = 400.0 kg. (A)

No. of Occupants x 150 lbs. = 340.2 kg. (B)

Cargo Capacity (A-B) = 59.9 kg.

WEIGHT OF TEST VEHICLE WITH MAXIMUM FLUIDS:

| | | | |
|---|---|---|---|
| Right Front = | 411.0 kg. | Right Rear = | 216.8 kg. |
| Left Front = | 395.1 kg. | Left Rear = | 235.4 kg. |
| TOTAL FRONT = | 806.1 kg. | TOTAL REAR = | 452.2 kg. |

% of Total Vehicle Weight = 64.1 ; % of Total Weight = 35.9

TOTAL WEIGHT = 1258.3 kg.

Table 2

TEST VEHICLE DATA

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Test Vehicle Delivered Weight with Maximum Fluids = 1258.3 kg.
Maximum Cargo Carrying Capacity of Test Vehicle = 59.9 kg.
Weight of 2 Side Impact Dummies (2 x 76.2 kg.) = 152.4 kg.
TEST VEHICLE TARGET WEIGHT: = 1470.6 kg.

ACTUAL WEIGHT OF TEST VEHICLE WITH 2 DUMMIES AND CARGO:

Right Front = 408.7 kg. Right Rear = 283.0 kg.
Left Front = 455.0 kg. Left Rear = 324.8 kg.
TOTAL FRONT = 863.7 kg. TOTAL REAR = 607.8 kg.
% of Total Weight = 58.7 kg. % of Total Weight = 41.3 kg.

TEST VEHICLE ATTITUDE (all dimensions in mm):

AS DELIVERED:

Right Front 691 Left Front 691 Right Rear 713 Left Rear 712

READY FOR TEST:

Right Front 686 Left Front 670 Right Rear 675 Left Rear 650

Test Vehicle Wheelbase: 2620 mm

C.G. = 1082 mm rearward of front wheel centerline

TOTAL VEHICLE LENGTH:

Right Side = 4337 mm
Left Side = 4337 mm
Centerline = 4729 mm

Figure 1

PRE-TEST CONDITIONS

VEHICLE IDENTIFICATION:

Vehicle: 1993 Oldsmobile Achieva 2-Door

NHTSA No. MP0105

FRONT SEAT CUSHION PLACEMENT:

Total Length of Adjustment Travel: 212 mm

Total Number of Adjustment Positions or Detents: 22

FRONT SEAT BACK ADJUSTMENT POSITION: *

Seat Back Torso Angle = 20 degrees

SECOND POSITION SEAT:

Total Length of Fore/Aft Adjustment Travel: Non Adjustable

Seat Back Adjustment Position: N/A

ADJUSTABLE STEERING COLUMN POSITION:

N/A

WINDOW POSITIONS: Left Front closed Left Rear closed

Right Front open 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:

14.1 gallons

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

Wheelbase: = 2620 mm

Impact Point is 370 mm rearward of front axle centerline (which is 37 inches forward of the wheelbase midpoint)

* Adjusted by placing inclinometer against headrest bracket

Figure 6

VEHICLE EXTERIOR STATIC CRUSH (Continued)

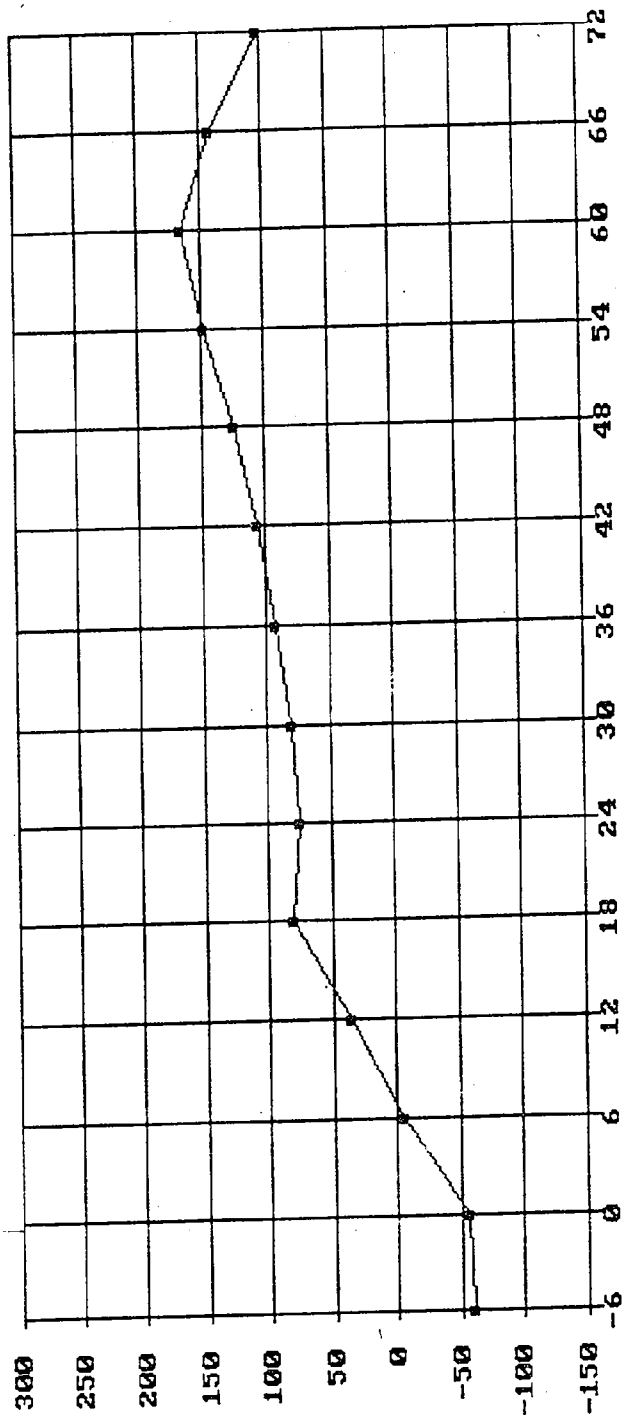

Figure 6

VEHICLE EXTERIOR STATIC CRUSH (Continued)

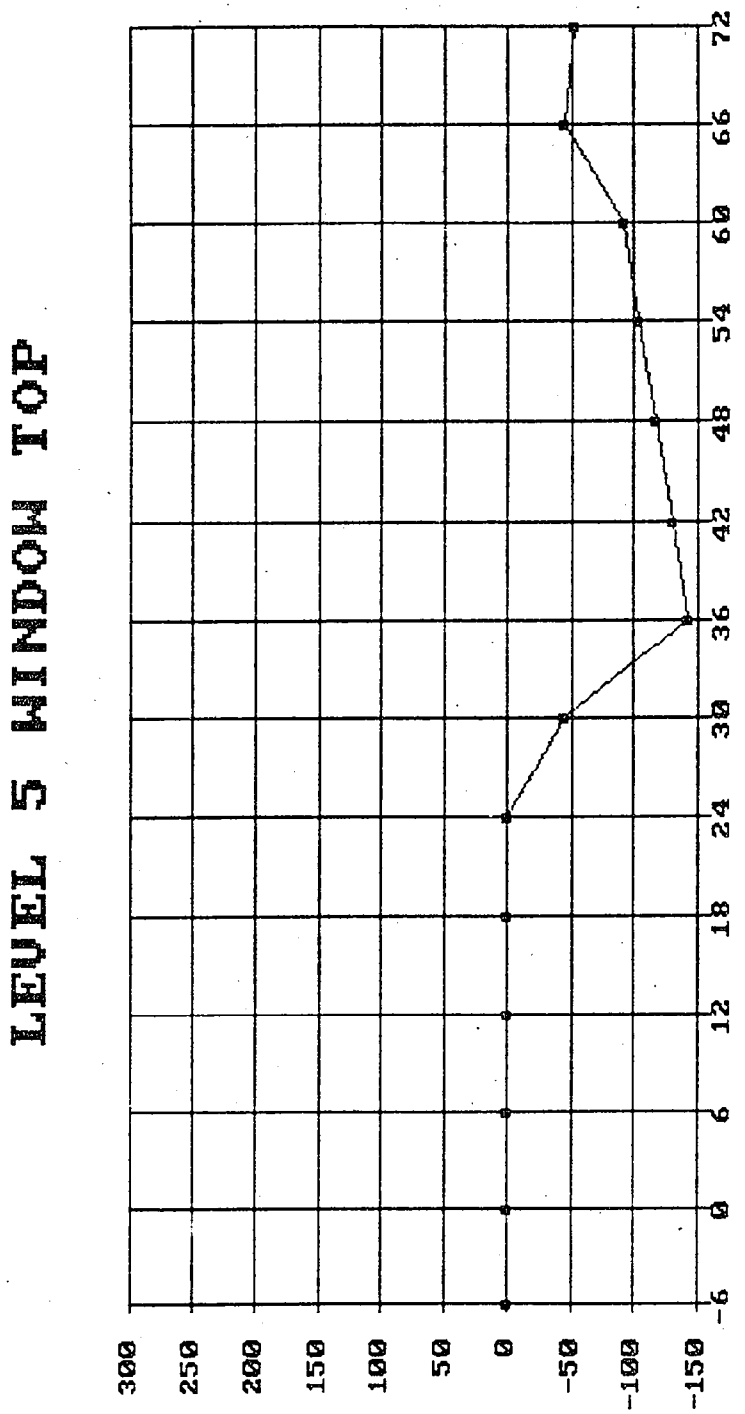




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Table 3

CRASH TEST SUMMARY FOR TEST VEHICLE

VEHICLE IDENTIFICATION:

Vehicle Year/Make/Model: 1993 Oldsmobile Achieva

Body Style: 2-Door VIN: 1G3N61439PM017809

NHTSA No.: MP0105 Test Date: 5-20-93

Overall Length = 4729 mm; Overall Width = 1720 mm

TEST WEIGHT:

| | | | |
|---|---|---|---|
| Left Front | = 455.0 kg. | Left Rear | = 324.8 kg. |
| Right Front | = 408.7 kg. | Right Rear | = 283.0 kg. |
| TOTAL FRONT | = 863.7 kg. | TOTAL REAR | = 607.8 kg. |

TOTAL VEHICLE WEIGHT 1471.5 kg.

Wheelbase = 2620 mm

Longitudinal C.G. front Center of Front Axle = 1082 mm

Impact Angle with Respect to Impactor = 90 degrees

MAXIMUM EXTERIOR STATIC CRUSH:

| | | | |
|---|---|---|---|
| 1. | LEVEL 1 ( 265 mm above ground) | = * | mm |
| 2. | LEVEL 2 ( 458 mm above ground) | = 281 | mm |
| 3. | LEVEL 3 ( 587 mm above ground) | = 292 | mm |
| 4. | LEVEL 4 ( 902 mm above ground) | = 165 | mm |
| 5. | LEVEL 5 ( 1322 mm above ground) | = -44 | mm |

Maximum Post-Test Intrusion = 292 mm

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

INSTRUMENTATION:

| | | |
|---|---|---|
| Number of Vehicle Data Channels: | = | 17 |
| Number of Cameras: Onboard | = | 3 |
| Offboard | = | 7 |
| TOTAL | = | 10 |

* Post-test crush not available

Table 4

CRASH TEST SUMMARY FOR SIDE IMPACTOR

POSITION OF IMPACT (MDB) ON MONORAIL:

Crabbed 27° to left

MDB DETAILS:

| | | |
|---|---|---|
| Overall Width of Framework Carriage | = 1251 | mm |
| Overall Length of MDB (incl. honeycomb impact face) | = 4115 | mm |
| Wheelbase of Framework Carriage | = 2591 | mm |
| Tread of Framework Carriage (Front & Rear) | = 1879 | mm |
| C.G. Location Rearward of Front Axle | = 1122 | mm |

MDB WEIGHT:

| | | | |
|---|---|---|---|
| Left Front | = 516.2 kg. | Left Rear | = 175.1 kg. |
| Right Front | = 256.3 kg. | Right Rear | = 415.0 kg. |
| TOTAL FRONT | = 772.5 kg. | TOTAL REAR | = 590.1 kg. |
| TOTAL MDB WEIGHT | 1362.6 kg. | | |

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

Impact Speed = 33.15 mph (53.3 kph)

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE:

| | | |
|---|---|---|
| 1. Row A at Bumper Level (432) | = 90 | mm |
| 2. Row B at Mid-Stack Level (559) | = 63 | mm |
| 3. Row C at Top of Stack Level (813) | = 143 | mm |

INSTRUMENTATION:

Number of MDB Data Channels = 5

Table 5

POST-TEST OBSERVATIONS

TEST VEHICLE: 1993 Oldsmobile Achieva 2-Door NHTSA No. MP0105

VISIBLE DUMMY CONTACT POINTS:

| | LEFT FRONT SID | LEFT REAR SID |
|---|---|---|
| Head | None | C-Pillar Trim Panel |
| Chest | --- | N/A |
| Abdomen | --- | N/A |
| Left Knee | Door Trim Panel | Trim Panel |
| Right Knee | --- | --- |

DOOR OPENING:

| | LEFT SIDE | RIGHT SIDE |
|---|---|---|
| Front | Closed | Closed |
| Rear | N/A | N/A |

MDB DISTANCE FROM TARGET IMPACT POINT: 38 mm rearward

ARM REST LOCATIONS:

Front:

Rear:

SEAT MOVEMENT:

Cushion crushed approx. 112 mm

Cushion crushed approx. 80 mm

GLAZING DAMAGE:

Windows on LH side broke

Windshield cracked

PILLAR PERFORMANCE:

None

SILL SEPARATION:

Seperated on LH side for 50 mm starting 890 mm behind front spindle

OTHER NOTABLE IMPACT EFFECTS:

None

Section 4

OCCUPANT AND VEHICLE INFORMATION

Table 6
SIDE IMPACT DUMMY (SID) TEST DATA SUMMARY

Vehicle: 1993 Oldsmobile Achieva 2-Door Test Date: 5-20-93

| | Front Dummy ID # 136 | | | | | Rear Dummy ID # 137 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 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 | 110.6 | 30.6 | -18.5 | 71.8 | | 101.8 | 37.5 | -11.3 | 62.5 |
| Upper Rib Lateral....Y(R) | 112.2 | 30.6 | -19.3 | 72.5 | | 102.7 | 37.5 | -11.2 | 62.5 |
| Lower Rib Lateral.....Y | 98.4 | 31.2 | -14.0 | 87.5 | | 124.0 | 37.5 | -30.0 | 61.8 |
| Lower Rib Lateral.....Y(R) | 99.1 | 31.2 | -14.2 | 87.5 | | 139.7 | 37.5 | -33.4 | 62.5 |
| SPINE ACCELERATIONS: | | | | | | | | | |
| Upper Lateral.....Y | 81.4 | 36.8 | -24.8 | 64.3 | | 93.4 | 43.1 | -23.5 | 68.7 |
| Upper Lateral.....Y(R) | 83.5 | 36.8 | -25.1 | 64.3 | | 93.1 | 43.1 | -22.0 | 68.7 |
| Lower Lateral.....Y | 104.2 | 34.3 | -14.8 | 65.0 | | 83.1 | 40.6 | -24.3 | 67.5 |
| Lower Lateral.....Y(R) | 102.7 | 34.3 | -14.5 | 65.0 | | 83.8 | 40.6 | -23.8 | 67.5 |
| PELVIC ACCELERATIONS: | | | | | | | | | |
| Lateral.....Y | 98.5 | 31.2 | -16.5 | 56.2 | | 112.8 | 32.5 | -12.6 | 22.5 |
| Lateral.....Y(R) | 100.2 | 31.2 | -15.6 | 56.8 | | 113.9 | 32.5 | -12.3 | 22.5 |

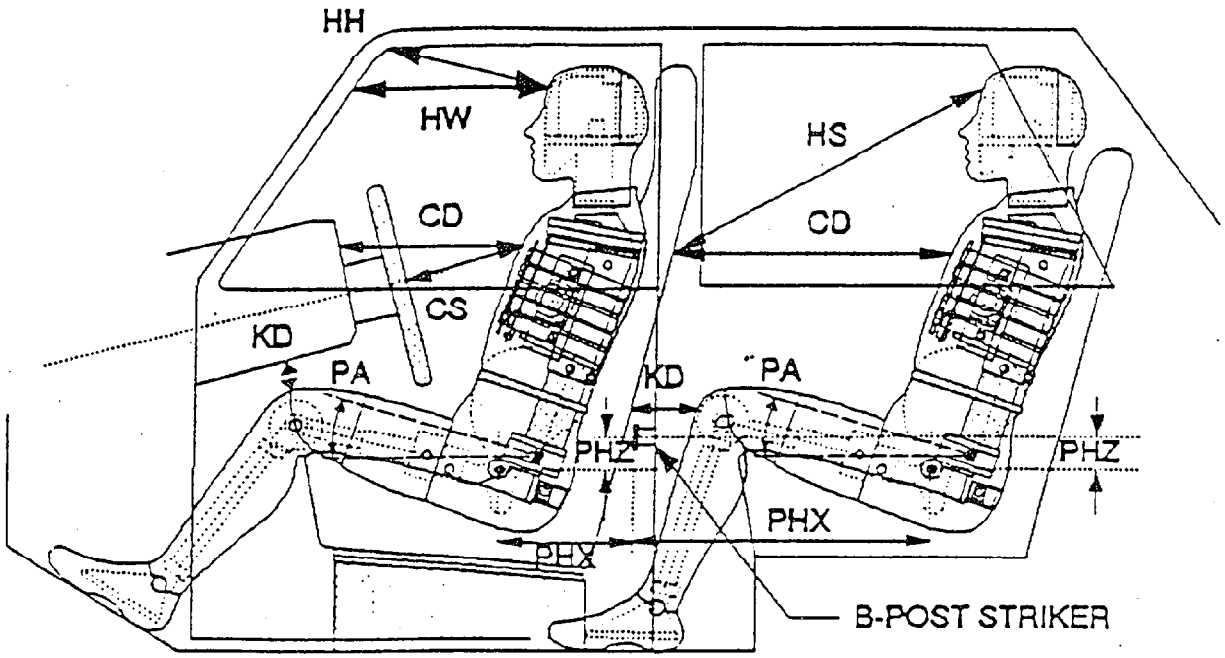
REFERENCE:

Positive Direction - Longitudinal (X) = forward  Negative Direction - Longitudinal (X) = rearward
Lateral (Y) = to right  Lateral (Y) = to left
Vertical (Z) = up  Vertical (Z) = down

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

Figure 3

SIDE IMPACT DUMMY (SID) LONGITUDINAL CLEARANCE DIMENSIONS




LEFT SIDE VIEW

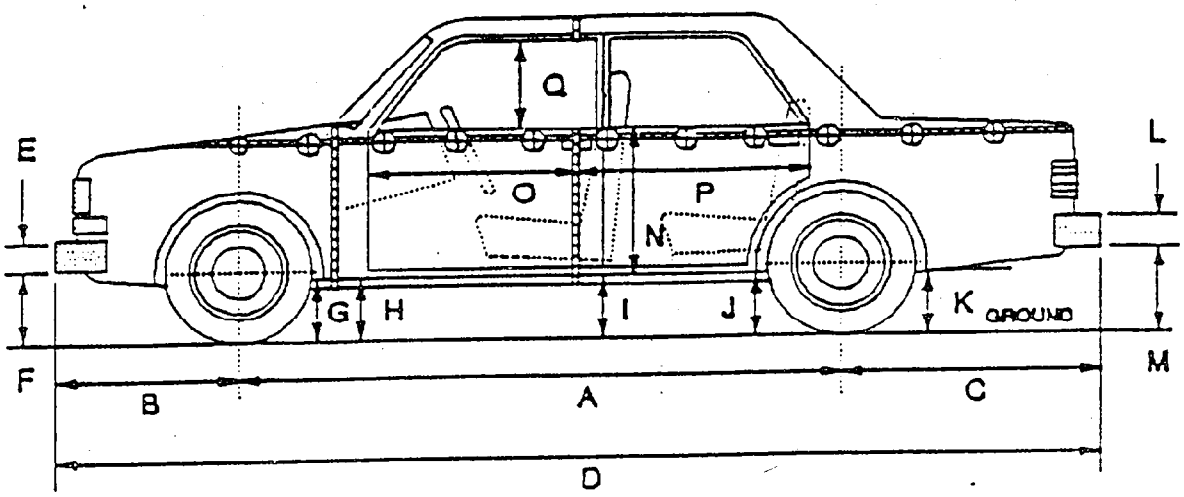
NOTE: All dimensions are in mm

| | DRIVER ID #136 | LEFT REAR PASSENGER ID #137 |
|---|---|---|
| HH | 318 | --- |
| HW | 578 | --- |
| HS | --- | 629 |
| CD | 470 | 521 |
| CS | 314 | --- |
| KDL | 143 | 178 |
| KDR | 168 | 187 |
| PA | 25.0° | 13.6° |
| PHX | 533 | 337 |
| PHZ | 102 | 110 |

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

Figure 2

PRE- AND POST-TEST MEASUREMENTS




LEFT SIDE VIEW

R = Length Right Side

S = Length Left Side

T = Width at B-Post

Units: mm

| | PRE-TEST | POST-TEST | Δ CHANGE |
|---|---|---|---|
| A | 2619 | 2605 | 14 |
| B | 1040 | 1070 | -30 |
| C | 1070 | 1074 | -4 |
| D | 4729 | 4749 | -20 |
| E | 270 | 195 | 75 |
| F | 400 | 400 | 0 |
| G | 242 | 331 | -89 |
| H | 239 | 257 | -18 |
| I | 212 | 300 | -88 |
| J | 211 | 300 | -89 |
| K | 272 | 315 | -43 |
| L | 280 | 180 | 100 |
| M | 317 | 480 | -163 |
| N | N/A | N/A | --- |
| O | 700 | 695 | 5 |
| P | N/A | N/A | --- |
| Q | 365 | 438 | -73 |
| R | 4337 | 4250 | 87 |
| S | 4337 | 4296 | 41 |
| T | 1720 | 1351 | 369 |



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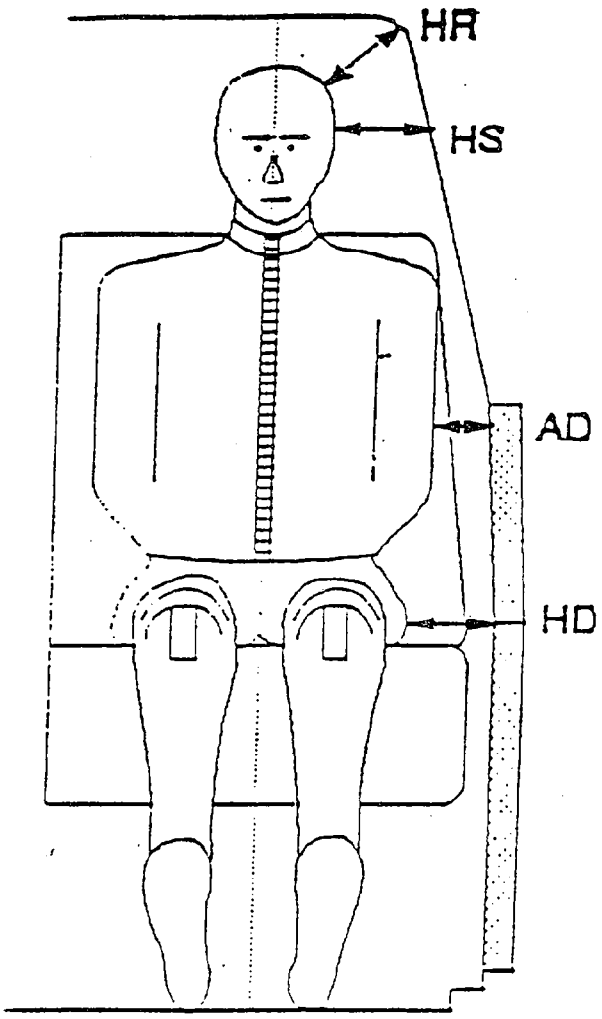
Figure 4

SIDE IMPACT DUMMY (SID) LATERAL CLEARANCE DIMENSIONS

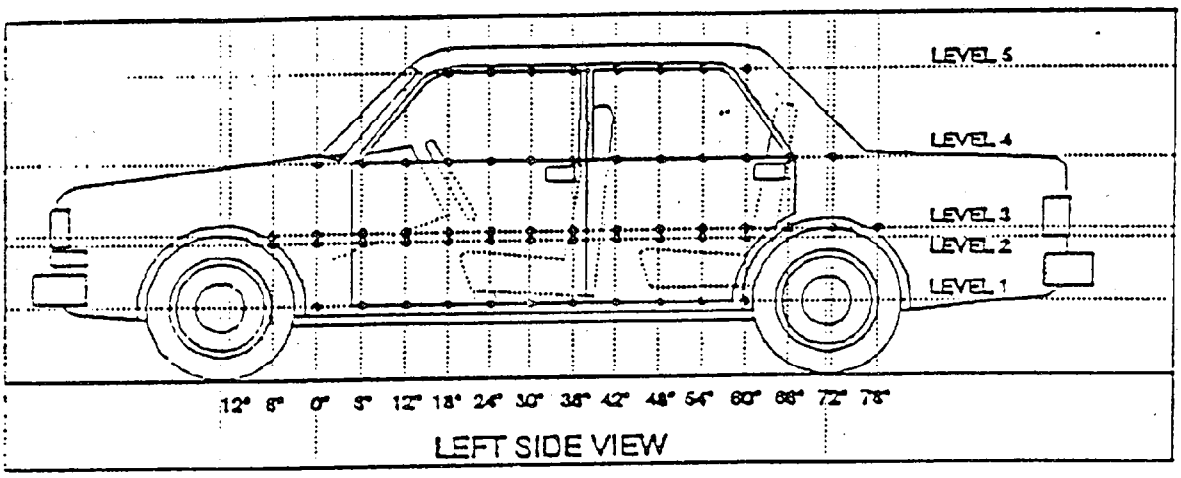



NOTE: All dimensions are in mm

| | DRIVER ID #136 | LEFT REAR PASSENGER ID #137 |
|---|---|---|
| HR | 83 | 73 |
| HS | 213 | 86 |
| AD | 95 | 86 |
| HD | 98 | 127 |

Figure 5

VEHICLE SIDE MEASUREMENTS




Measurements Along the Vertical 30" Line Shown Above:

| | 30" Side Profile | |
|---|---|---|
| Level 5 @ Window Top | = 1322 | mm |
| Level 4 @ Window Sill | = 902 | mm |
| Level 3 @ Mid Door | = 587 | mm |
| Level 2 @ Occupant H-Point | = 458 | mm |
| Level 1 @ Axle Centerline Height (or Sill Top Height) | = 265 | mm |



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Table 7
TEST VEHICLE EXTERIOR PROFILES FROM REFERENCE PLANE AND STATIC CRUSH
Test Date: 5-20-93 Vehicle: 1993 Oldsmobile Achieva 2-Door

| | Location | Level 1 Side Sill | Level 2 H-Point | Level 3 Mid-Door | Level 4 Window Sill | Level 5 Window Top |
|---|---|---|---|---|---|---|
| | Height (mm) | 265 | 458 | 587 | 902 | 1322 |
| | | PRE/POST/CRUSH (mm) | PRE/POST/CRUSH (mm) | PRE/POST/CRUSH (mm) | PRE/POST/CRUSH (mm) | PRE/POST/CRUSH (mm) |
| INCHES FROM IMPACT POINT | -6 | N/A | N/A | N/A | 771/710/-61 | N/A |
| | 0 | 775/ * /* | 720/722/2 | 719/725/6 | 768/712/-56 | N/A |
| | 6 | 772/ * /* | 713/816/103 | 716/873/157 | 762/756/-6 | N/A |
| | 12 | 770/ * /* | 710/924/214 | 714/904/190 | 762/797/35 | N/A |
| | 18 | 770/ * /* | 708/929/221 | 714/914/200 | 762/842/80 | N/A |
| | 24 | 770/ * /* | 708/937/229 | 708/925/217 | 762/838/76 | N/A |
| | 30 | 770/ * /* | 705/948/243 | 704/944/240 | 761/842/81 | 1030/986/-44 |
| | 36 | 771/ * /* | 704/955/251 | 700/952/252 | 759/851/92 | 1024/880/-144 |
| | 42 | 772/ * /* | 701/963/262 | 698/957/259 | 758/856/98 | 1024/892/-132 |
| | 48 | 772/ * /* | 702/971/269 | 696/963/267 | 760/884/124 | 1024/907/-117 |
| | 54 | 772/ * /* | 701/982/281 | 696/950/254 | 760/907/147 | 1024/921/-103 |
| | 60 | 771/ * /* | 704/974/270 | 698/990/292 | 760/925/165 | 1029/937/-92 |
| | 66 | 769/ * /* | 702/952/250 | 698/947/249 | 762/904/142 | 1030/986/-44 |
| | 72 | 767/ * /* | 700/886/186 | 695/903/208 | 758/860/102 | 1040/987/-53 |

Reference plane is parallel to and 48 inches from test vehicle longitudinal centerline
Given dimensions = reference plane to car body

* Sill trim separated during impact, post-test dimensions not available

Figure 6

VEHICLE EXTERIOR STATIC CRUSH

# LEVEL 1 SIDE SILL

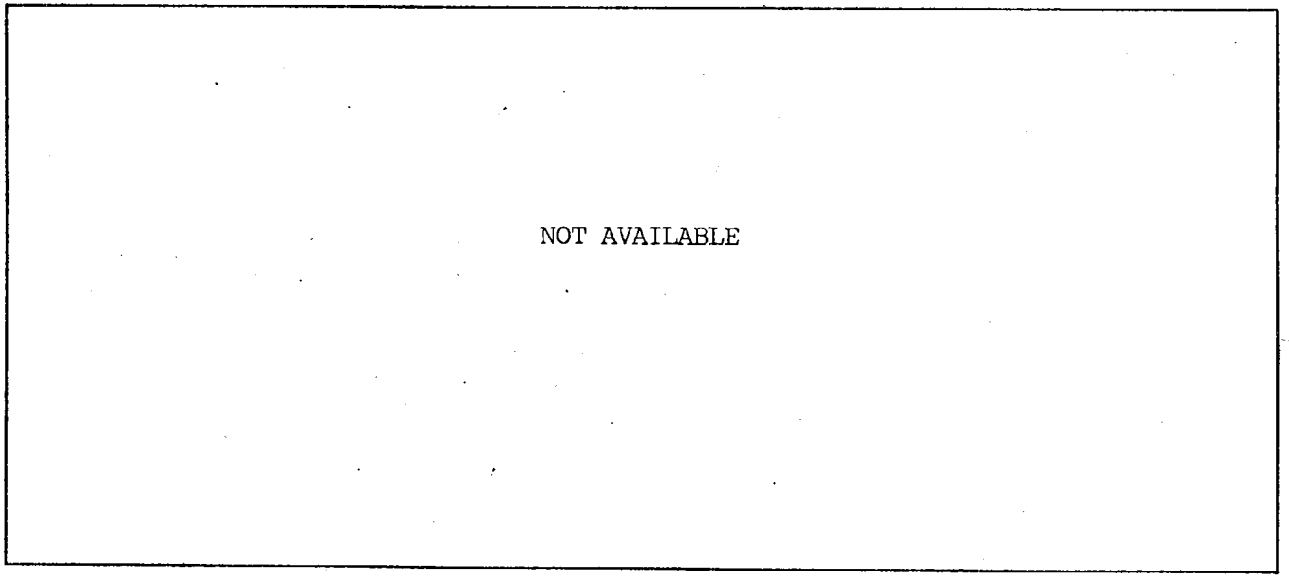

Figure 6

VEHICLE EXTERIOR STATIC CRUSH (Continued)

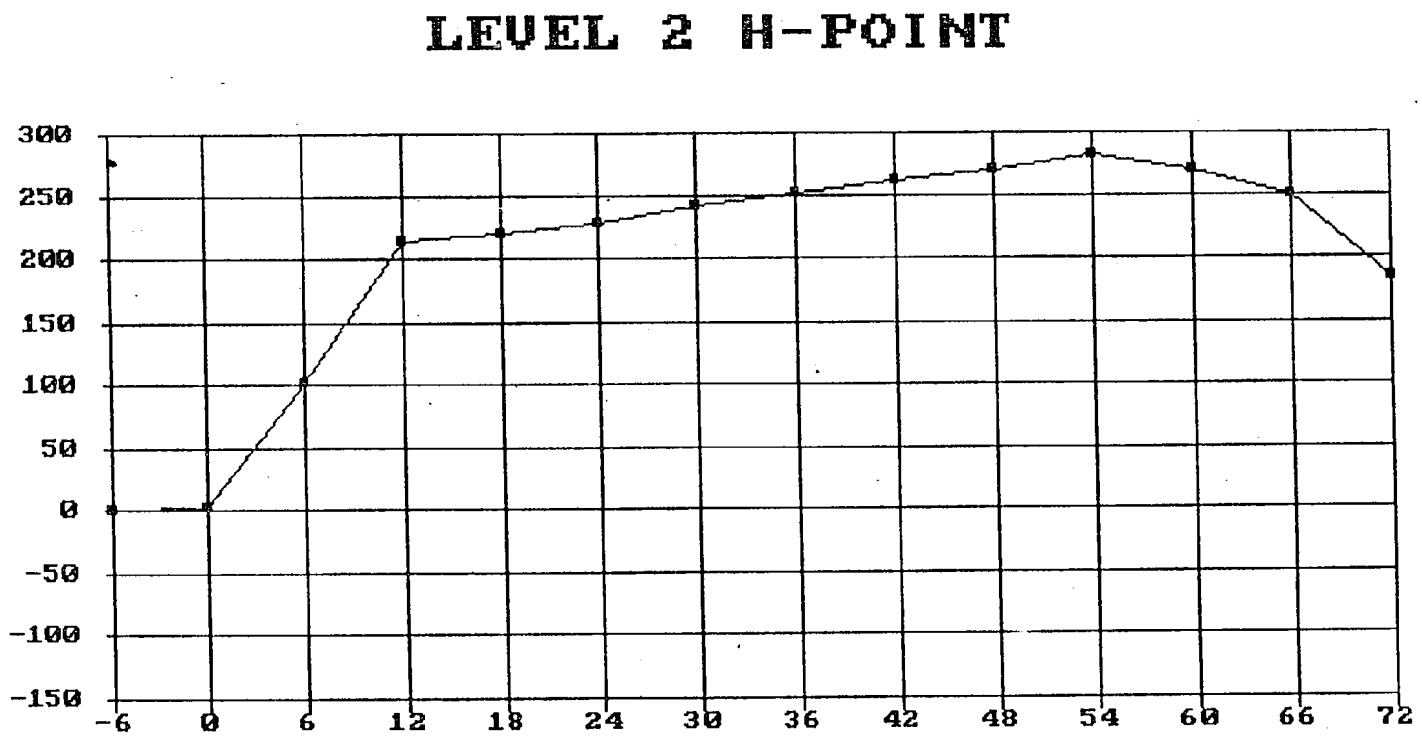

Figure 6

VEHICLE EXTERIOR STATIC CRUSH (Continued)

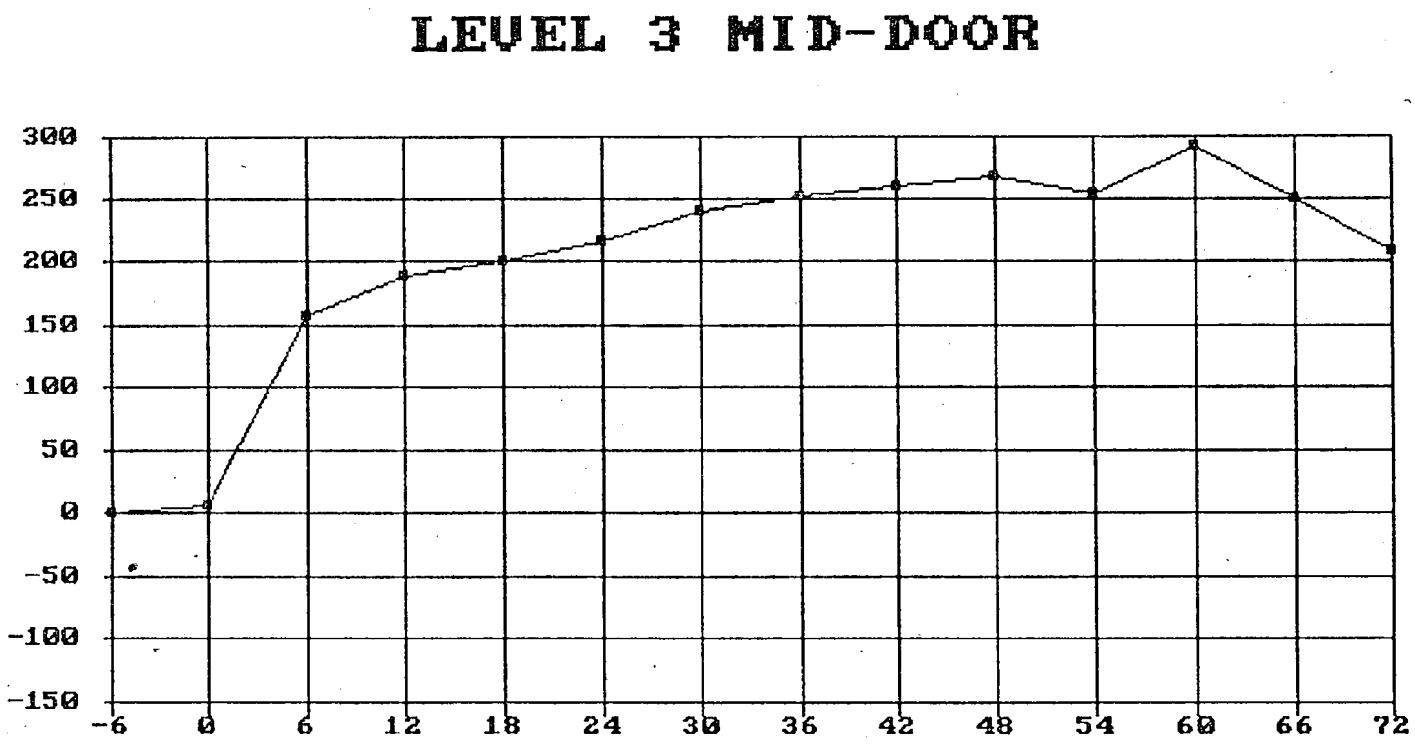

Figure 7

TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 1993 Oldsmobile Achieva 2-Door NHTSA No.: MP0105

Test Date: 5-20-93



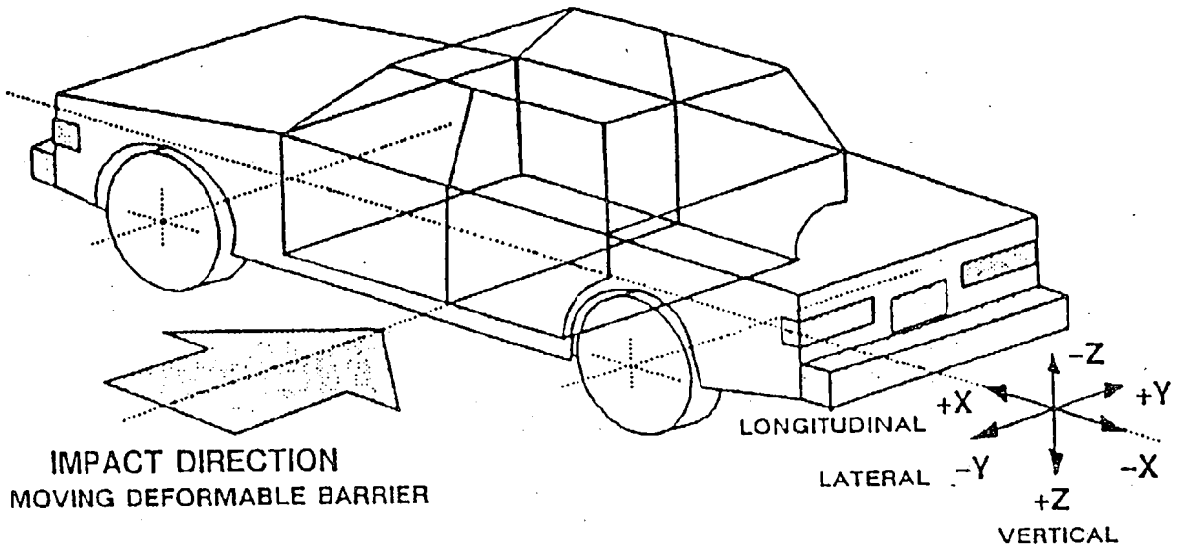

Table 8

EXTERIOR STATIC CRUSH FOR SIDE IMPACTOR

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Test Date: 5-20-93 Vehicle: 1993 Oldsmobile Achieva

| Location | Top of Stack Level | Mid-Stack Level | Bumper Level | |
|---|---|---|---|---|
| Height at $C_L$* | 32" | 22" | 17" | Left Side as viewed from front |
| 32" | 143 | 63 | 90 | |
| 28" | 86 | 44 | 68 | |
| 24" | 44 | 33 | 48 | |
| 20" | 24 | 25 | 37 | |
| 16" | 16 | 45 | 29 | |
| 12" | 50 | 9 | 20 | |
| 8" | 4 | 2 | 9 | |
| 4" | 1 | 1 | 0 | |
| 0" | -2 | -3 | -8 | |
| 4" | -5 | -3 | -14 | Right Side as viewed from front |
| 8" | -15 | -5 | -16 | |
| 12" | -6 | -6 | -16 | |
| 16" | 0 | -9 | -12 | |
| 20" | -5 | -11 | -4 | |
| 24" | -15 | -2 | 5 | |
| 28" | 10 | 15 | 16 | |
| 32" | 59 | 10 | 40 | |

Crush measured in mm.
Heights measured above ground level
-indicates forward movement

Table 9

TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

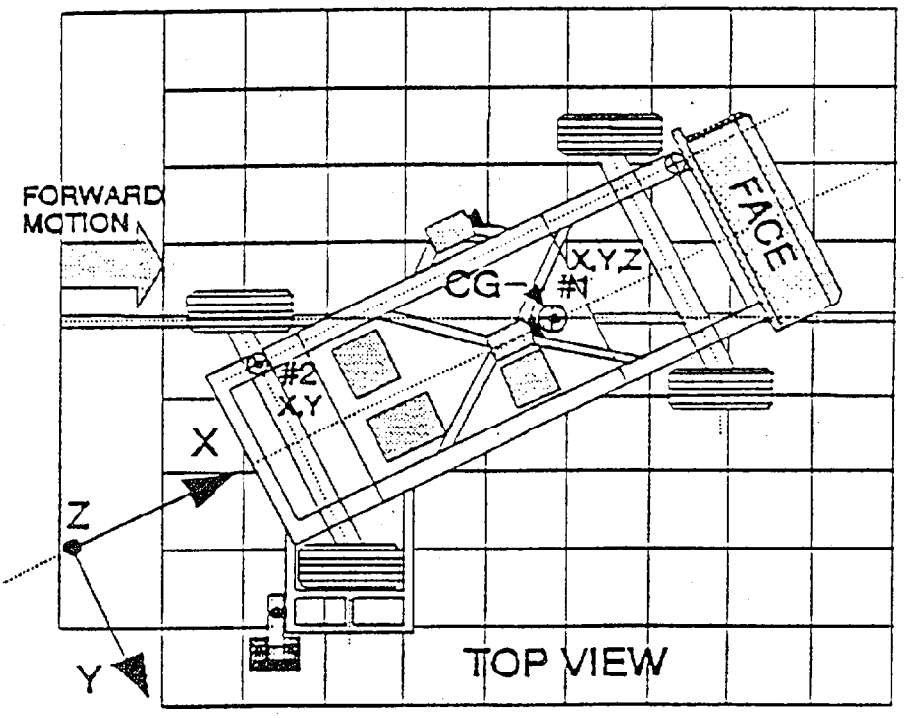
| Accel. Time No. | Location | Coordinates (mm) | | | Long. (X) Pos./Neg. | | Lat. (Y) Pos./Neg. | | Vert. (Z) Pos./Neg. | | Resultant Pos./Neg. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | X | Y | Z | | | | | | | | |
| 1 | Rt. Side Sill @ Front Seat | 2800 | -550 | 230 | 2.6 | -5.3 | 15.2 | -2.4 | 8.0 | -3.6 | 15.4 | 0 |
| 2 | Rt. Side Sill @ Rear Seat | 1800 | -660 | 340 | 3.8 | -4.4 | 17.3 | -2.1 | 4.6 | -4.1 | 17.3 | 0 |
| 3 | Rr. Floorpan Above Axle | 1200 | 0 | 470 | 3.8 | -12.7 | 23.8 | -1.8 | 11.4 | -13.0 | 28.2 | 0 |
| 4 | Left Side Sill @ Rr. Seat | 1600 | -680 | 380 | --- | --- | 57.4 | -44.7 | --- | --- | --- | --- |
| 5 | Left Side Sill @ Frt. Seat | 288 | -560 | 250 | --- | --- | 30.8 | -5.1 | --- | --- | --- | --- |
| 6 | Left Frt. Door On Centerline* | 2300 | -710 | 650 | --- | --- | 242.0 | -52.8 | --- | --- | --- | --- |
| 7 | Right Rear Occupant Compartment | 1400 | 600 | 450 | --- | --- | 19.4 | -2.6 | --- | --- | --- | --- |
| 8 | Midrear of Left Frt. Door | 1900 | -710 | 715 | --- | --- | 117.3 | -84.7 | --- | --- | --- | --- |
| 9 | Left Frt. Door Upper Centerline | 2270 | -700 | 835 | --- | --- | 80.5 | -67.5 | --- | --- | --- | --- |
| 10 | Midrear of Left Rear Door | N/A | N/A | N/A | --- | --- | --- | --- | --- | --- | --- | --- |
| 11 | Left Rear Door Upper Centerline | N/A | N/A | N/A | --- | --- | --- | --- | --- | --- | --- | --- |

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

* Data shift at approx. .011 msec.

Figure 8
MOVING DEFORMABLE BARRIER (MDB) ACCELEROMETER LOCATIONS

Test Vehicle: 1993 Oldsmobile Achieva 2-Door Test Date: 5-20-93




| Accel. No. | Location | Coordinates (mm) | | | Pos. Direct. | | Neg. Direct. | |
|---|---|---|---|---|---|---|---|---|
| | | X* | Y* | Z* | Max (g) | Time (msec) | Max (g) | Time (msec) |
| 1 | MDB Center of Gravity | 1854 | Ø | 353 | | | | |
| | Longitudinal ... X | | | | 1.6 | 16Ø | -15.8 | 38.4 |
| | Lateral ..... Y | | | | 6.2 | 36.6 | -1.5 | 58.7 |
| | Vertical ..... Z | | | | 9 | 52 | -6.Ø | 3Ø.6 |
| | Resultant ..... R | | | | 18.1 | 38.8 | .1 | Ø |
| 2 | Rear Frame Member | | | | | | | |
| | Longitudinal ... X | 4ØØ | -629 | 622 | 2.1 | 21Ø | -22.8 | 38.8 |
| | Lateral ..... Y | | | | 5.5 | 38.9 | -1.3 | 2Ø4 |

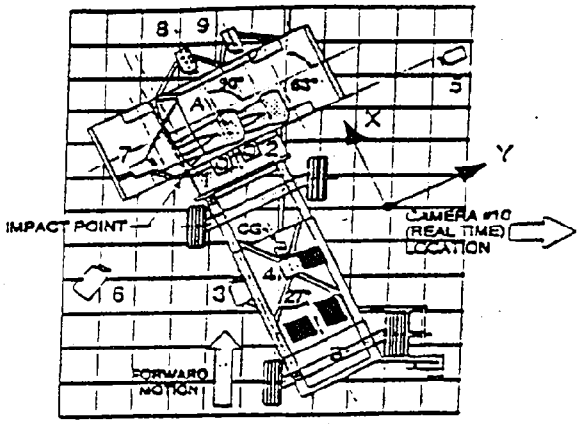
* Reference: X = Rear Bumper (+Forward)
Y = Vehicle Centerline (+ To Right)
Z = Ground Level (+ Up)



044

Figure 9

HIGH SPEED CAMERA LOCATIONS AND DATA




| Camera No. | View | Coordinates (mm) | | | Angle | Film Plane To Head Target | Lens (mm) | Film Speed (fps) |
|---|---|---|---|---|---|---|---|---|
| | | X* | Y* | Z* | | | | |
| 10 | Real Time | | | | | | | |
| 1 | Overhead Overall View | 0 | 0 | 5060 | | | 13 | 1031 |
| 2 | Overhead Closeup View of Impact | 250 | 1450 | 4210 | | | 25 | 1020 |
| 3 | MDB Onboard Closeup of Impact | | | | | | 35 | 1015 |
| 4 | MDB Onboard View of Dummy | | | | | | 13 | 1020 |
| 5 | Right Side Ground Overall View | 3870 | 7810 | 1305 | | | 13 | 917 |
| 6 | Left Side Ground Overall View | 4800 | 3820 | 2100 | | | 13 | 1031 |
| 7 | Test Vehicle Onboard Driver Front View | | | | | | 7.5 | 1020 |
| 8 | Test Vehicle Onboard Driver Side View | 4800 | 3820 | 2100 | | | 13 | 1031 |
| 9 | Test Vehicle Onboard Passenger Side View | | | | | | | |
| | Right Overall | 2430 | 7180 | 1200 | 90° | 6825 | 13 | 1195 |

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

Table 10

FUEL SYSTEM INTEGRITY POST IMPACT TEST DATA

FMVSS NO. 301

TEST VEHICLE NHTSA NO.: MP0105 Test Date: 5-20-93

Vehicle Mfgr./Make/Model: 1993 Oldsmobile Achieva 2-Door

Test vehicle fuel tank filled to 92% to 94% of manufacturer's "useable" capacity and with electric fuel pump operating (if it will operate without engine operation). Part 572 test dummies located at each front designated seating position.

TEST VEHICLE IMPACT TYPE: _____ Frontal (35 mph)

_____ Oblique (30 mph) with ____° barrier face first contacting _____ (driver/passenger) side

_____ Rear Moving Barrier (30 mph)

__X__ Side Impact MDB (33.2 mph)

FUEL SPILLAGE MEASUREMENT:

1. From impact until vehicle motion ceases

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

2. For 5 minute period after vehicle motion ceases

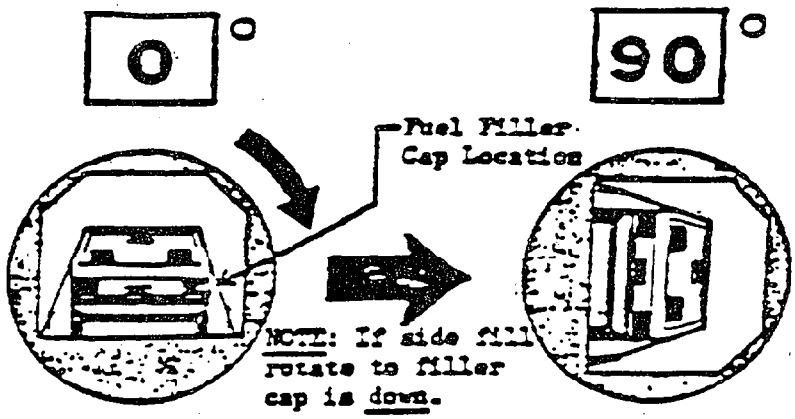
3. For next 25 minutes

SOLVENT SPILLAGE DETAILS:

Table 11

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

TEST PHASE: Vehicle NHTSA ID No.: MP0105




I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time 2 minutes 47 seconds

(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time + 5 minutes 0 seconds

TOTAL 7 minutes 47 seconds

Next whole minute interval 8 minutes

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

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

(2) Maximum Allowable Solvent Spillage

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

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

| 0 | 0 | 0 | 0 |
|---|---|---|---|

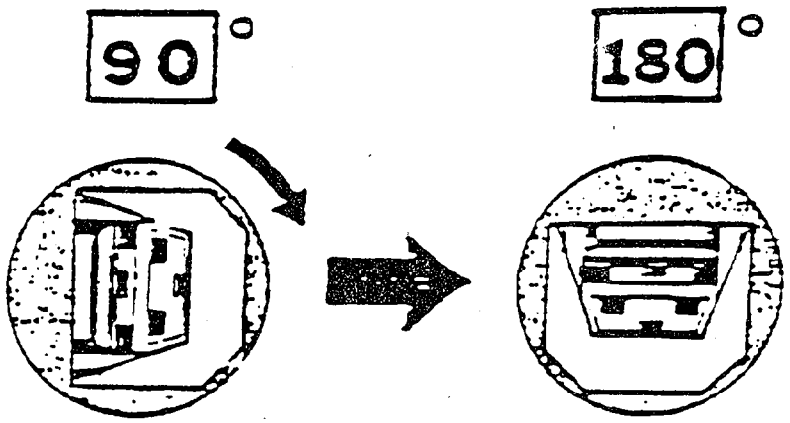
Note: Record Spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATIONS(S):

Table 11

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET (cont.)

TEST PHASE: Vehicle NHTSA ID No.: MP0105




I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time 2 minutes 27 seconds
(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time + 5 minutes 0 seconds

TOTAL 7 minutes 27 seconds

Next whole minute interval 8 minutes

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

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

(2) Maximum Allowable Solvent Spillage

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

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

| 0 | 0 | 0 | 0 |
|---|---|---|---|

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

IV. SOLVENT SPILLAGE LOCATIONS(S):



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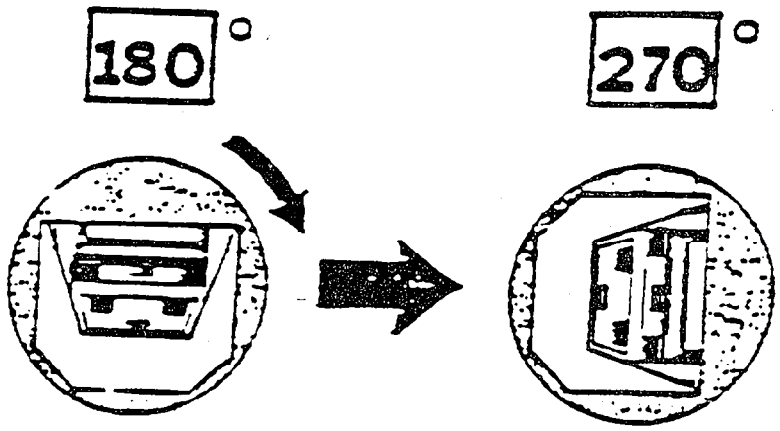
Table 11

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET (cont.)

TEST PHASE: Vehicle NHTSA ID No.: MP0105




I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time 2 minutes 35 seconds

(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time + 5 minutes 0 seconds

TOTAL 7 minutes 55 seconds

Next whole minute interval 8 minutes

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

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

(2) Maximum Allowable Solvent Spillage

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

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

| 0 | 0 | 0 | 0 |
|---|---|---|---|

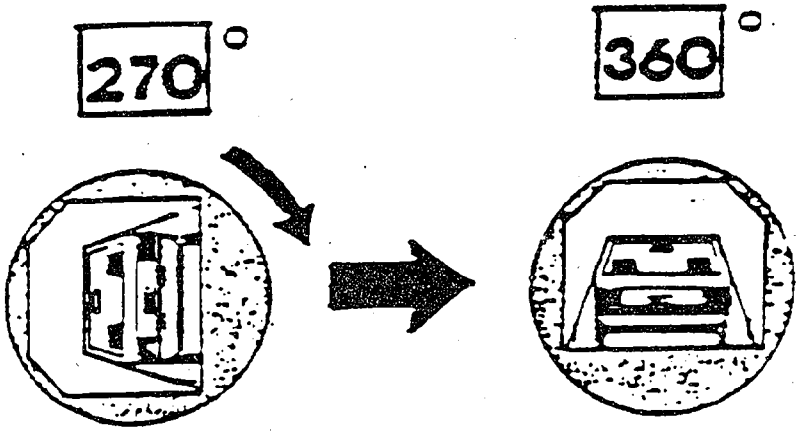
Note: Record Spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATIONS(S):

Table 11

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET (cont.)

TEST PHASE: Vehicle NHTSA ID No.: MP0105




I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time 2 minutes 35 seconds
(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time + 5 minutes 0 seconds

TOTAL 7 minutes 35 seconds

Next whole minute interval 8 minutes

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

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

(2) Maximum Allowable Solvent Spillage

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

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

| 0 | 0 | 0 | 0 |
|---|---|---|---|

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

IV. SOLVENT SPILLAGE LOCATIONS(S):



050

APPENDIX A - PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

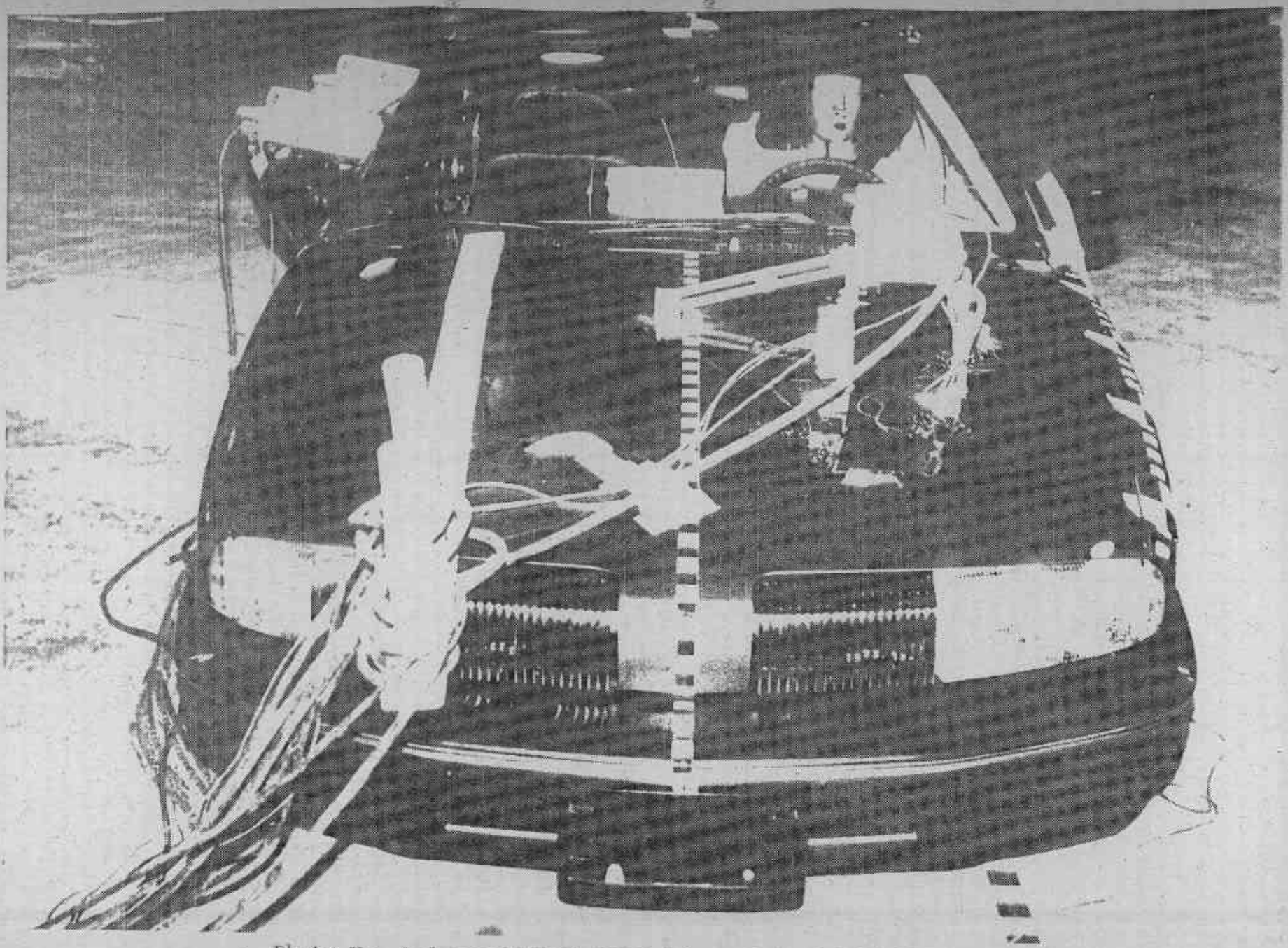


Photo No. A-1 - Pre-Test Front View of Test Vehicle

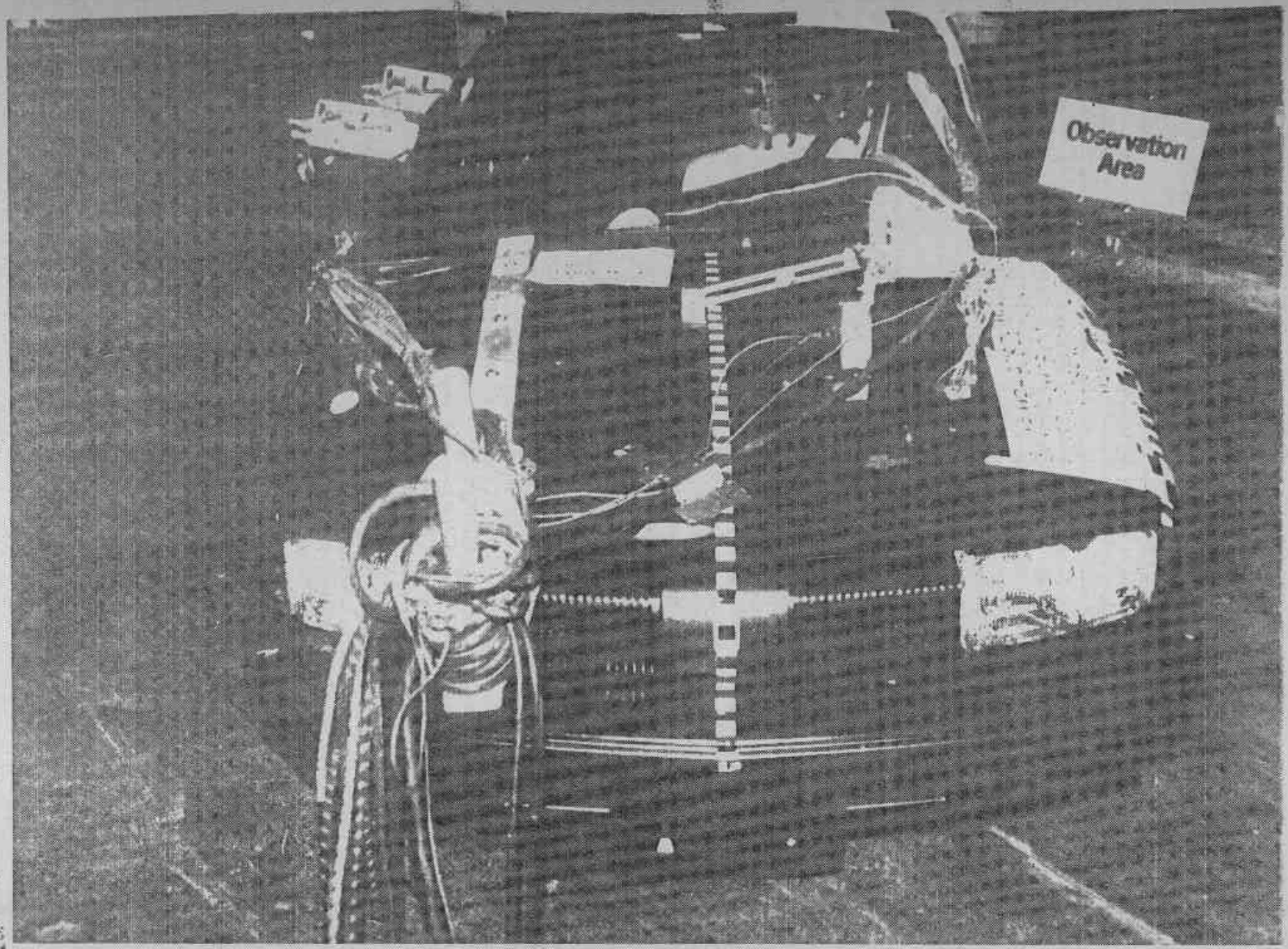



Photo No. A-2 - Post-Test Front View of Test Vehicle

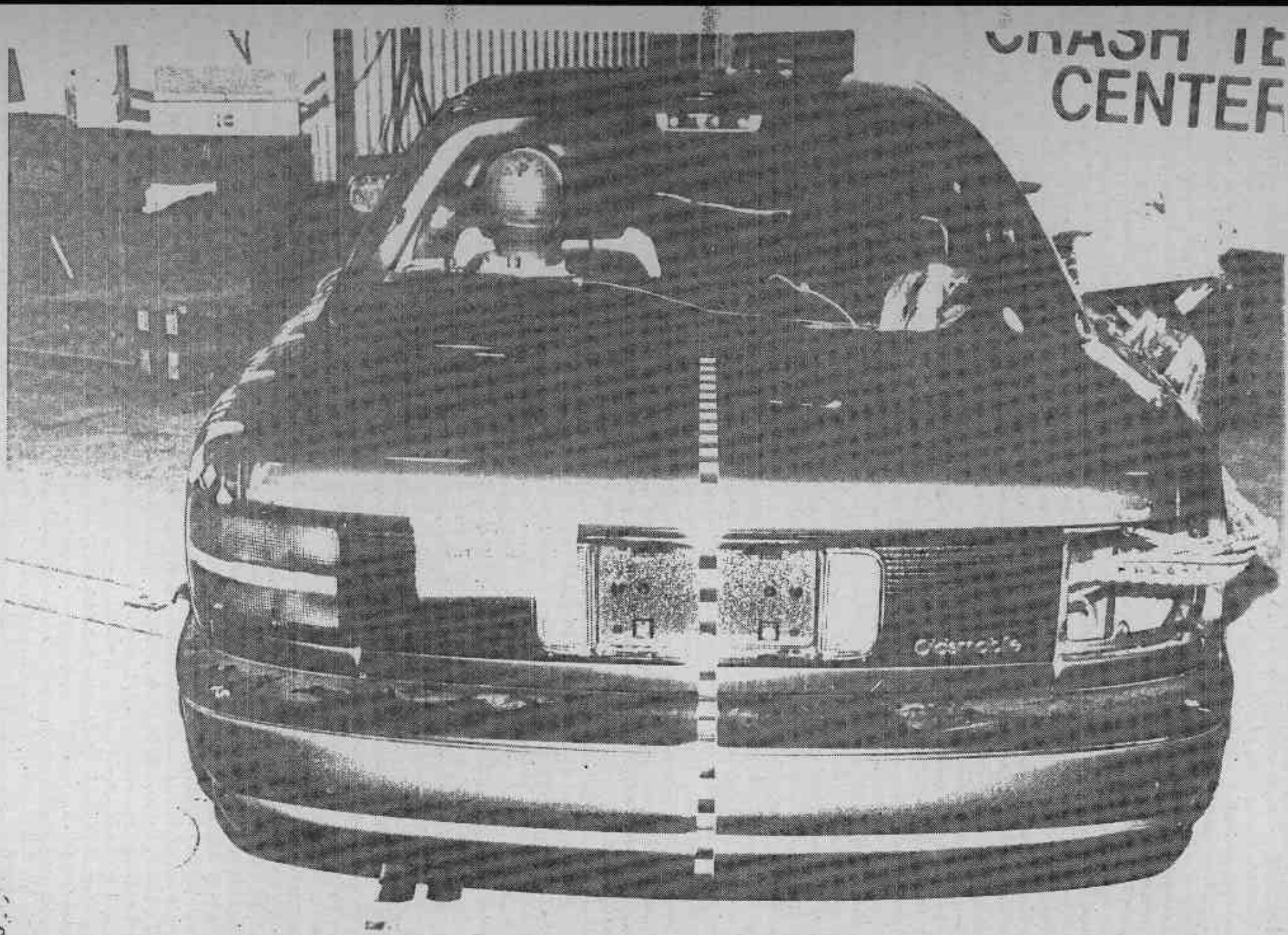


Photo No. A-3 - Pre-Test Rear View of Test Vehicle

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 and Vehicle Left Side Front View


A-8

Photo No. A-8 - Pre-Test MDB and Vehicle Left Side Rear View

Photo No. A-9 - Pre-Test MDB Top View

Photo No. A-10 - Post-Test MDB Top View

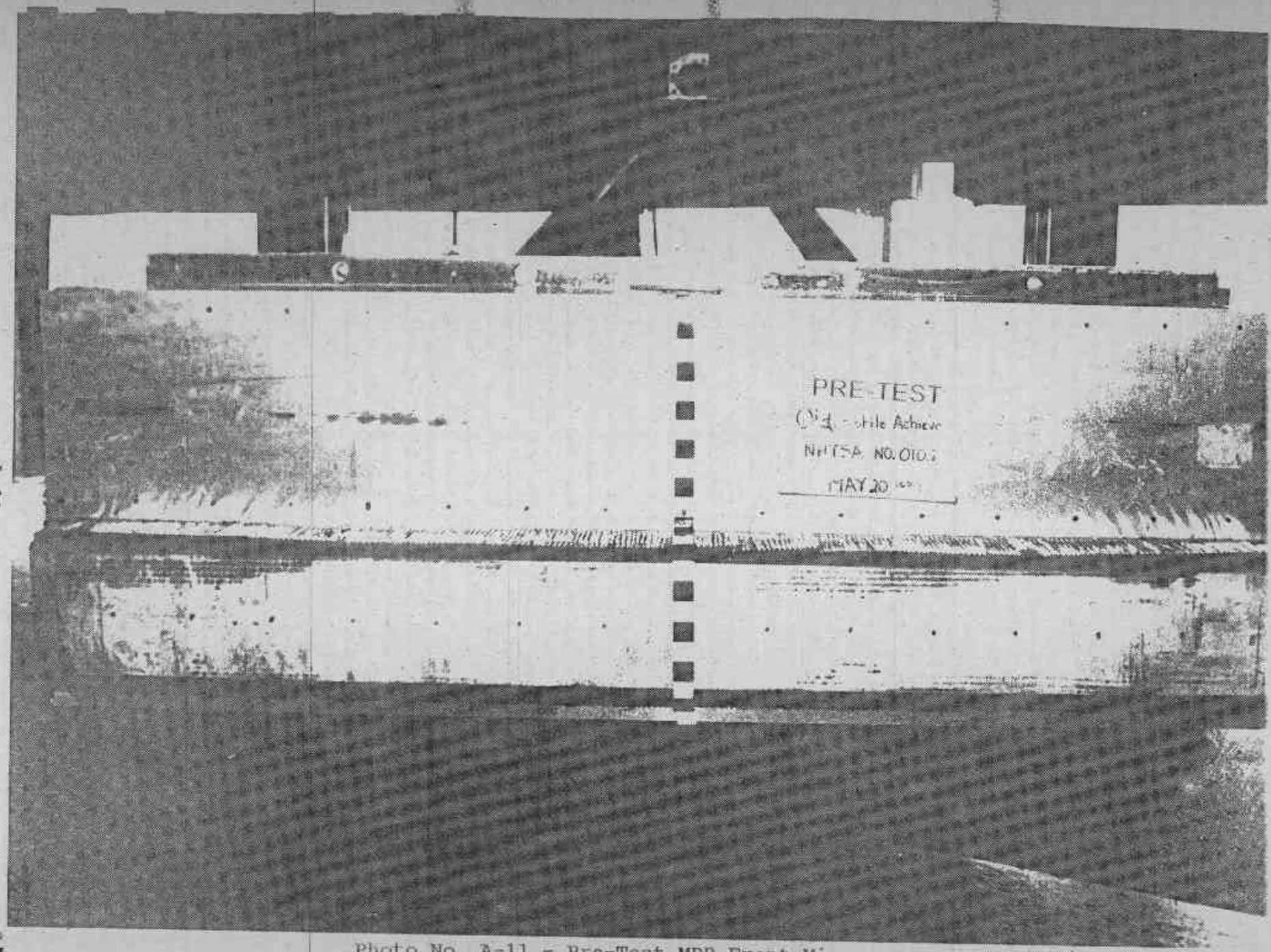



Photo No. A-11 - Pre-Test MDB Front View

Photo No. A-12 - Post-Test MDB Front View

Photo No. A-13 - Pre-Test MDB Left Side View

Photo No. A-14 - Post-Test MDB Left Side View

Photo No. A-15 - Pre-Test MDB Right Side View

Photo No. A-16 - Post-Test MDB Right Side View

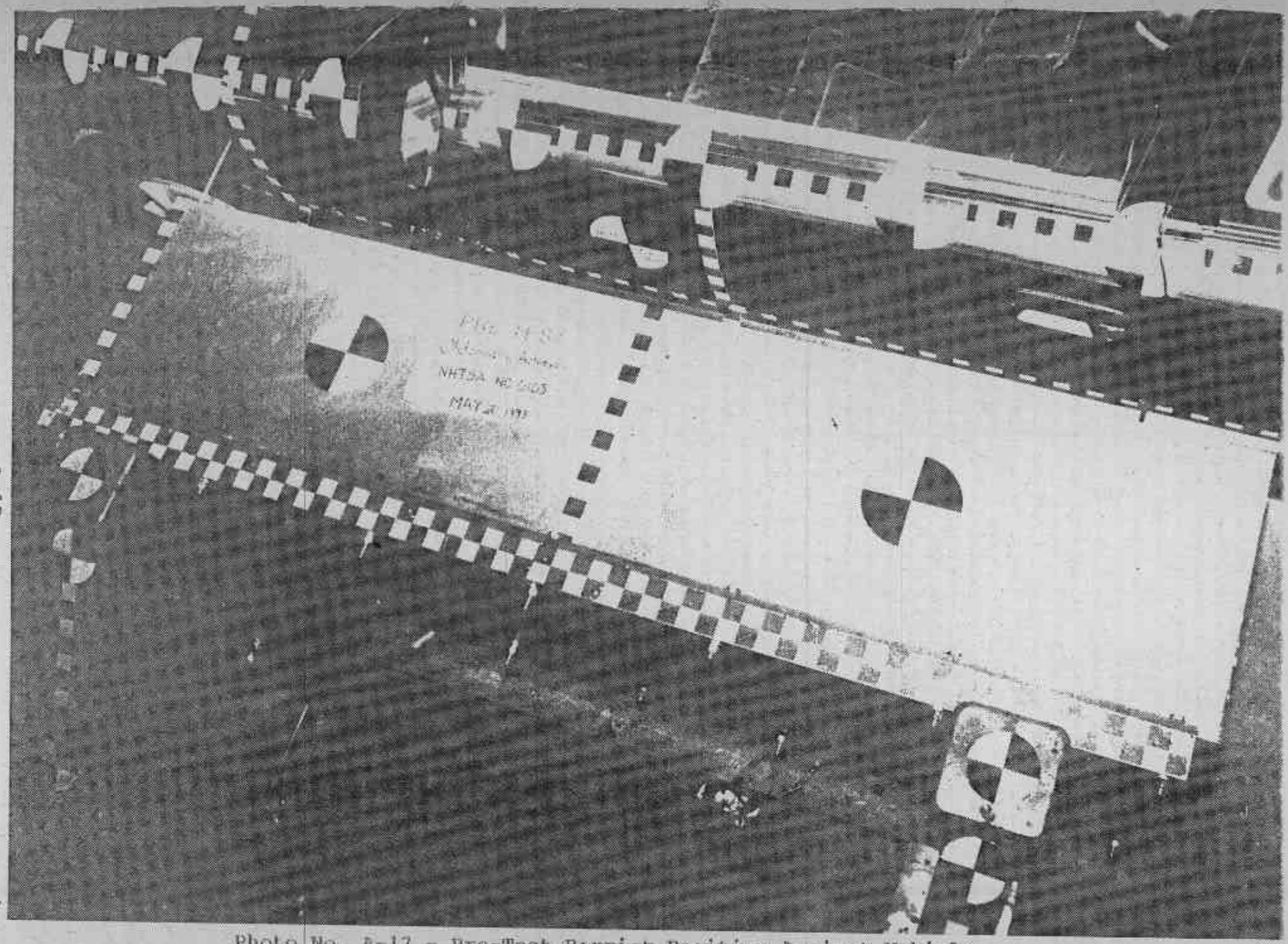


Photo No. A-17 - Pre-Test Barrier Position Against Vehicle
Overhead View

Photo No. A-18 - Post-Test Overhead View of Test Vehicle


Photo No. A-19 - Pre-Test Driver Dummy Right Side View

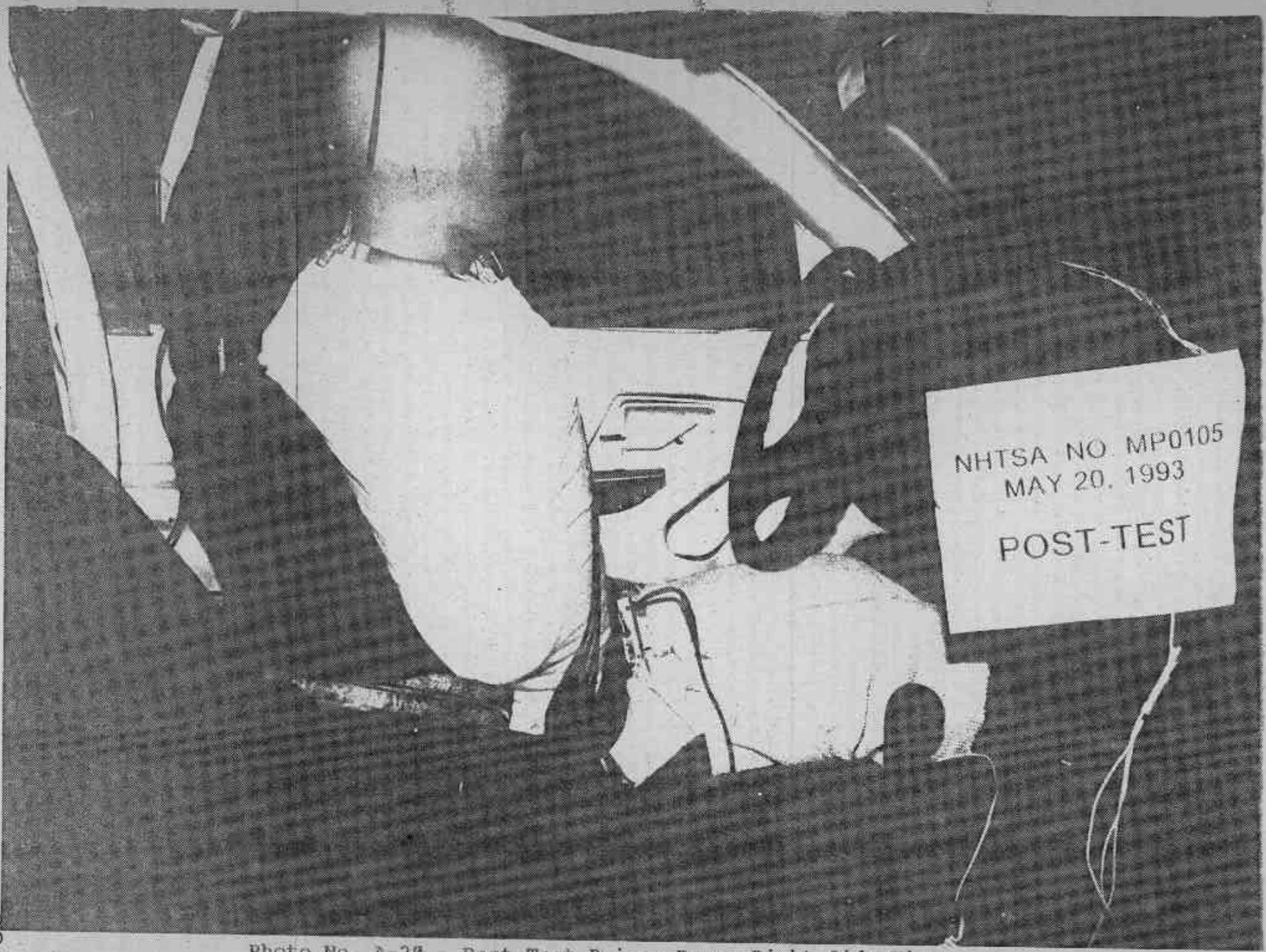
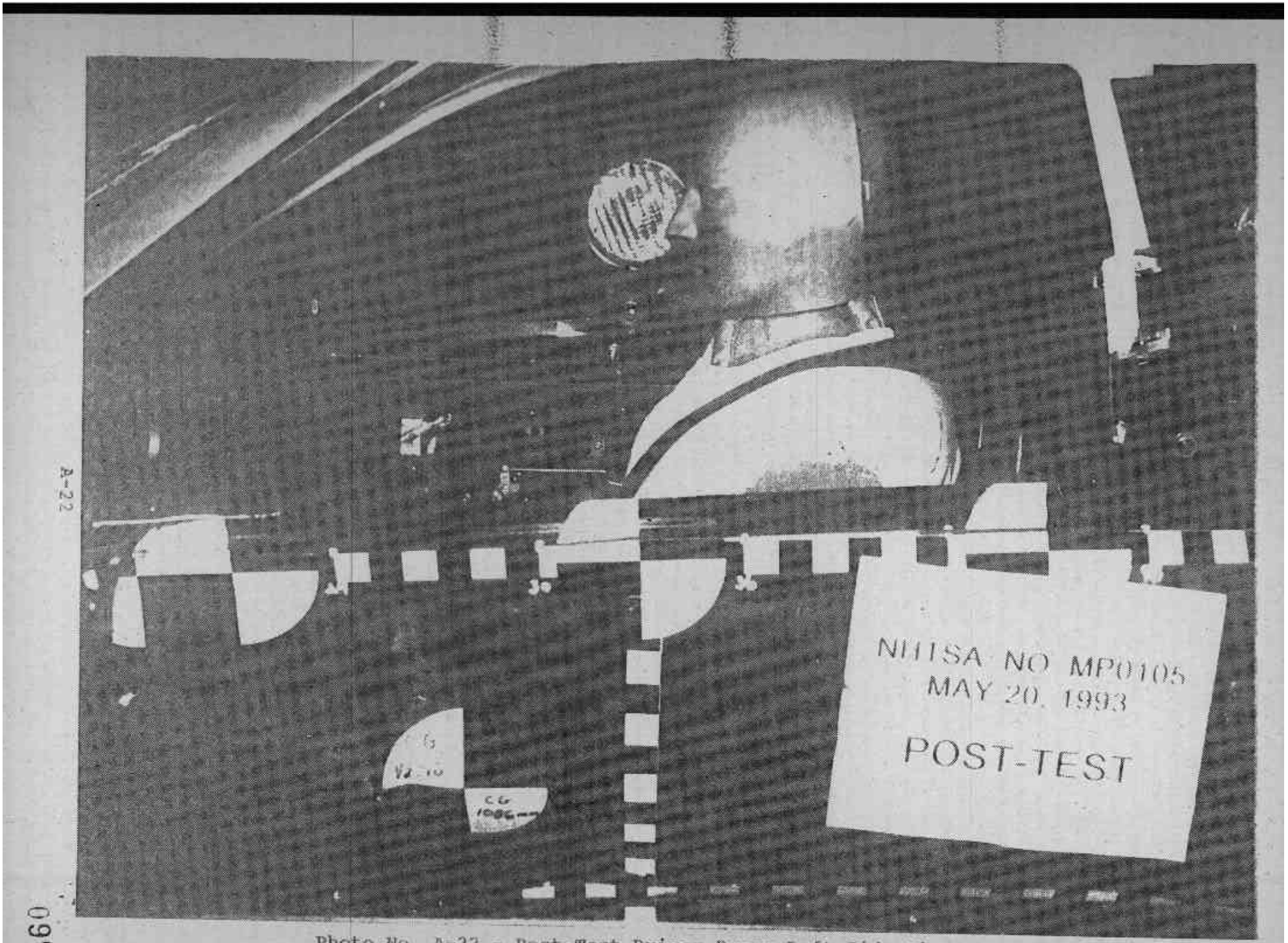



Photo No. A-20 - Post-Test Driver Dummy Right Side View

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




A-22

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

Photo No. A-23 - Pre-Test Driver Dummy Left Side View (Door Open)

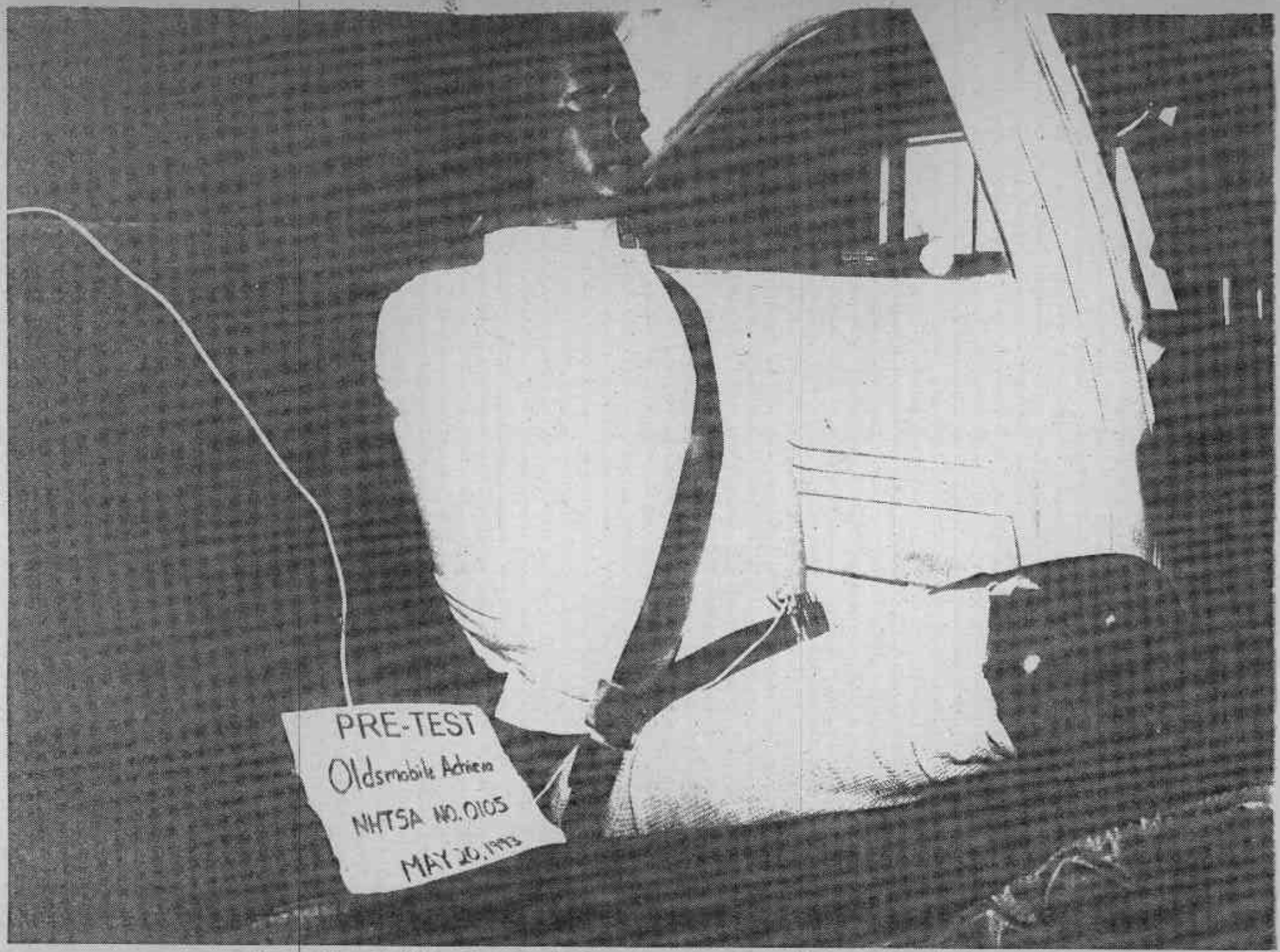
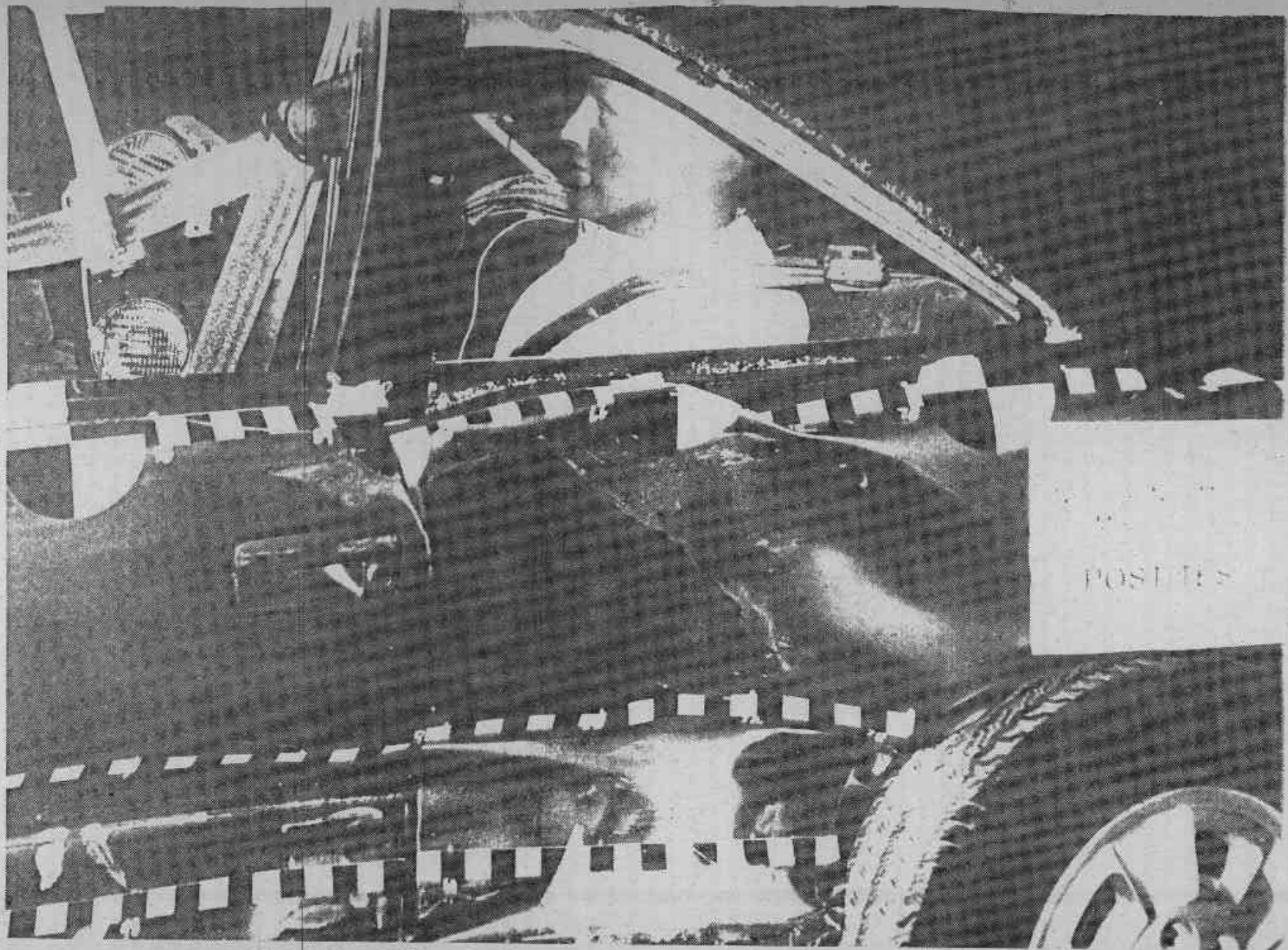



Photo No. A-24 - Pre-Test Passenger Dummy Right Side View

Photo No. A-25 - Post-Test Passenger Dummy Right Side View

Photo No. A-26 - Pre-Test Passenger Dummy Left Side View



A-27

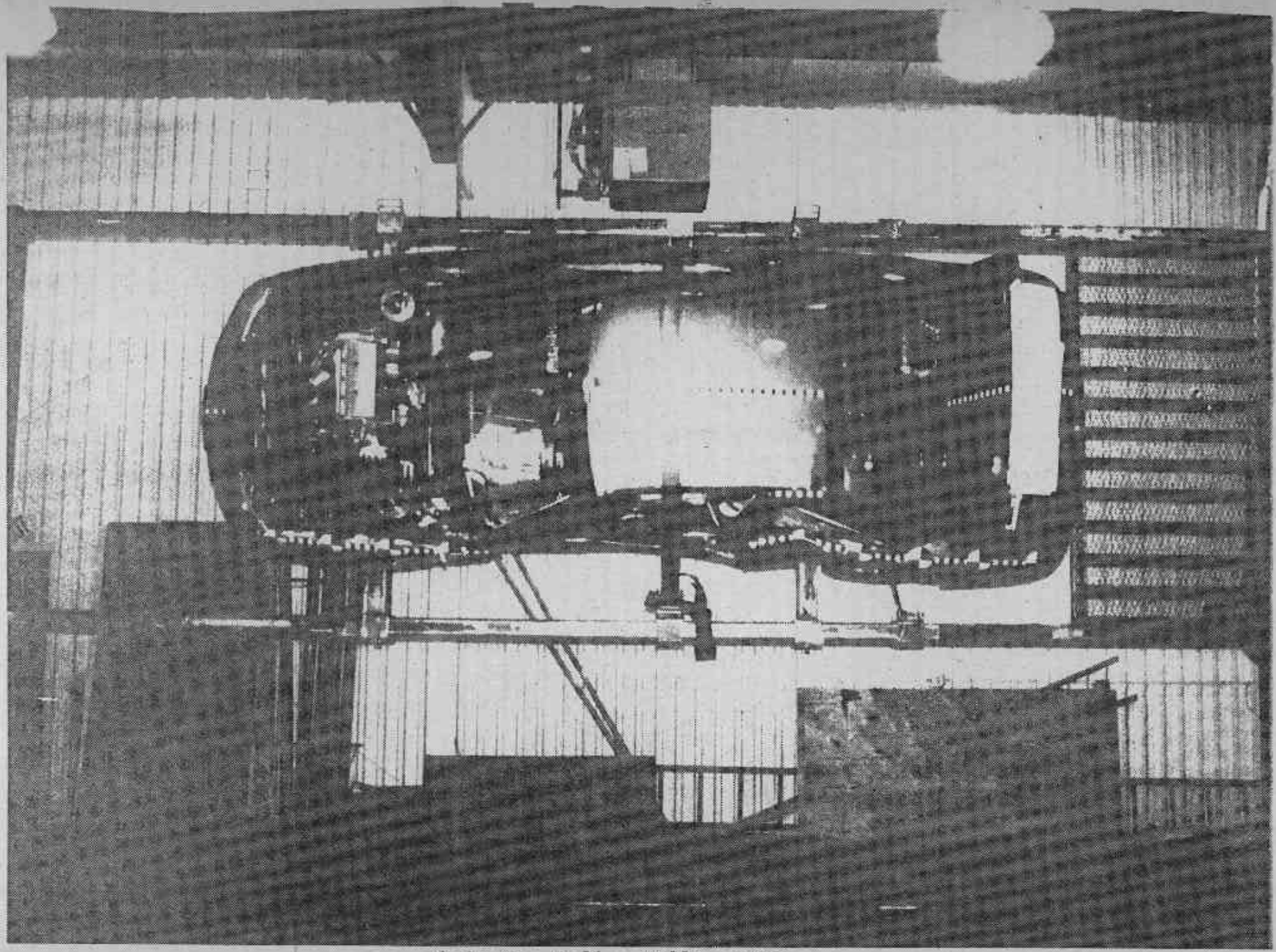
Photo No. A-27 - Post-Test Passenger Dummy Left Side View

Photo No. A-28 - Vehicle Impact

Photo No. A-29 - Vehicle Certification Label

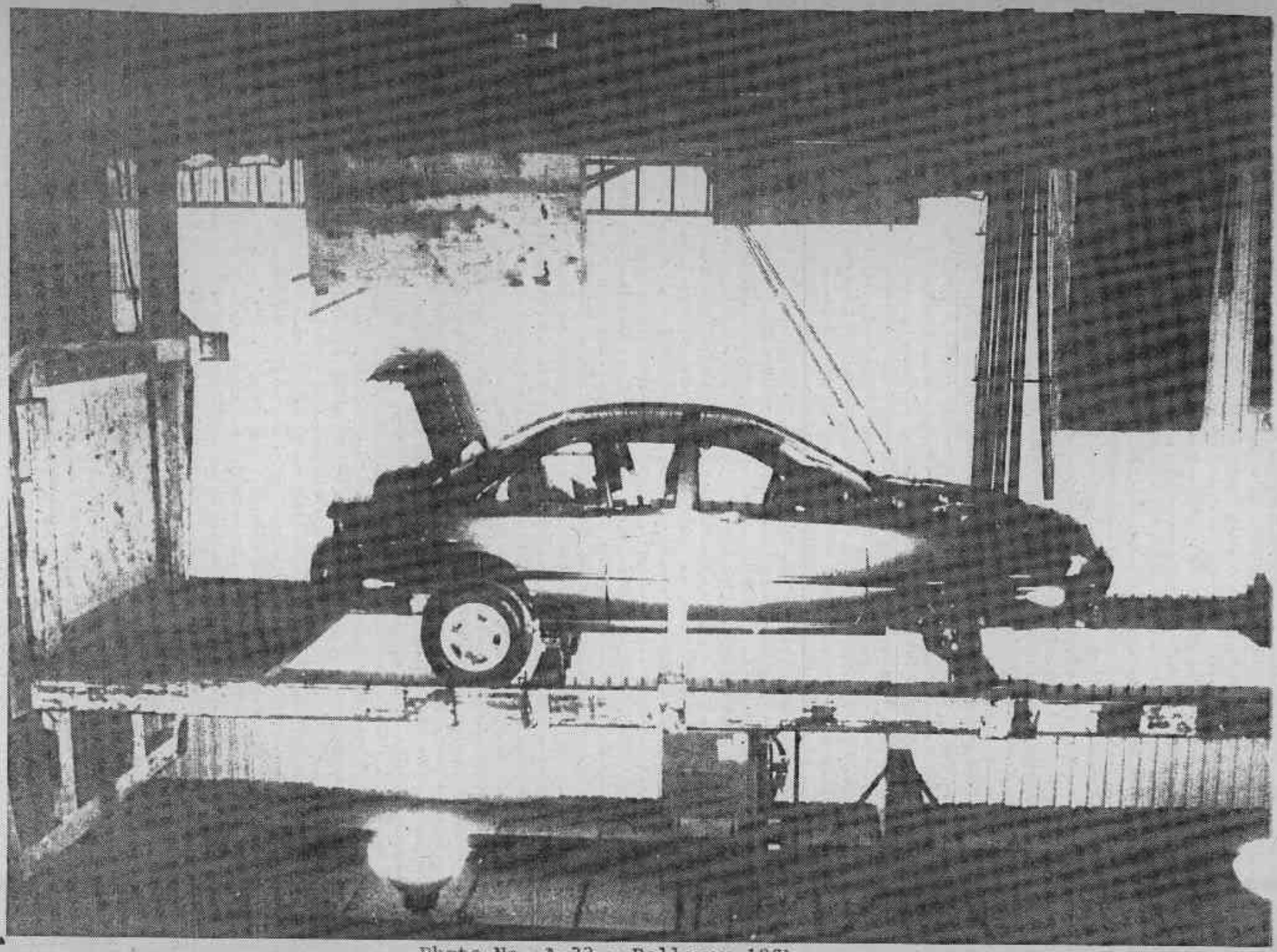
Photo No. A-30 - Rollover Ø.

A-30



A-31

Photo No. A-31 - Rollover 90°



A-32

Photo No. A-32 - Rollover 180°

Photo No. A-33 - Rollover 270°

# APPENDIX B - DATA PLOTS

Table of Data Plots

Table of Data Plots (continued)



* Questionable data after 13 msec.

Table of Data Plots (continued)

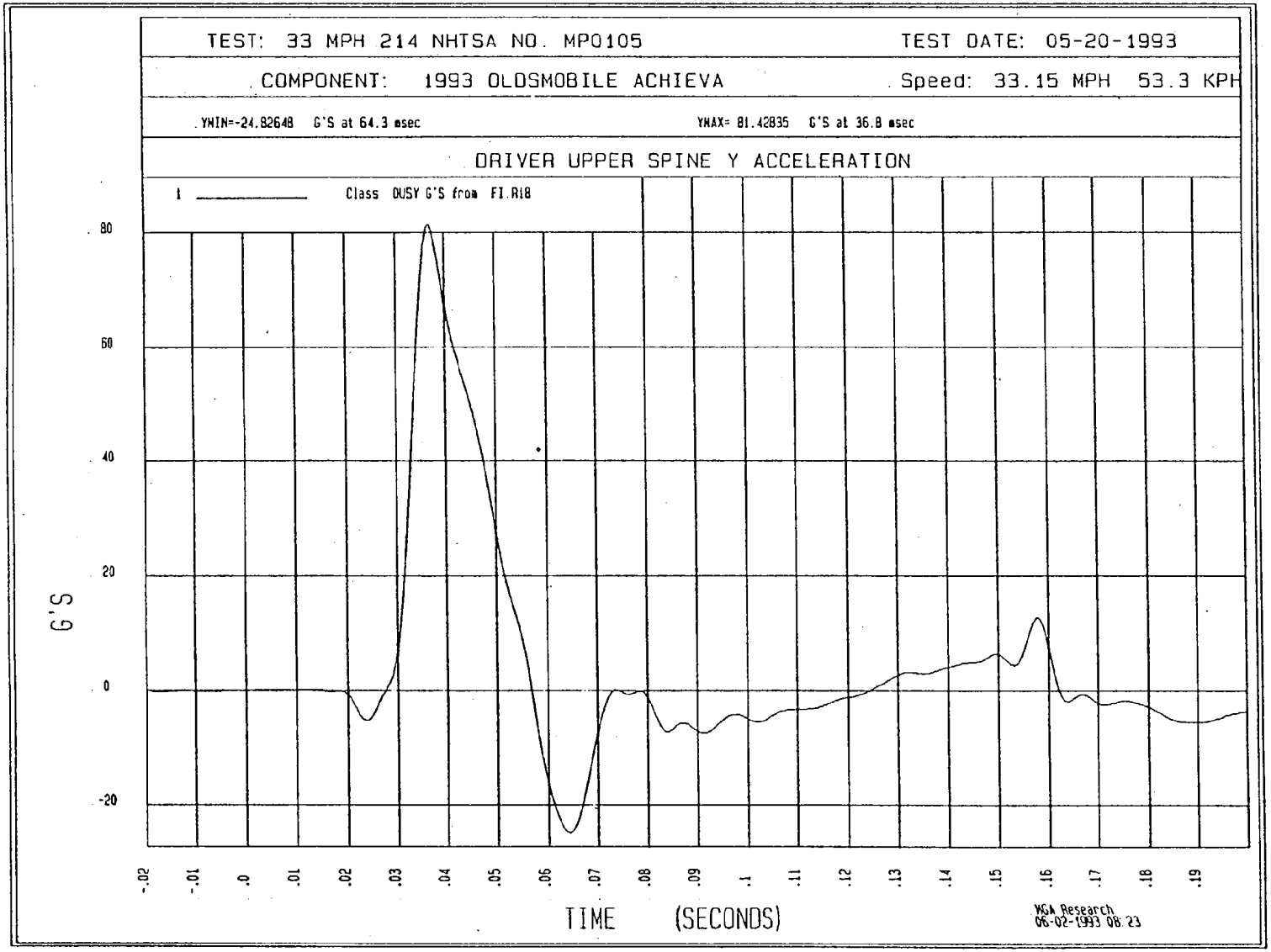
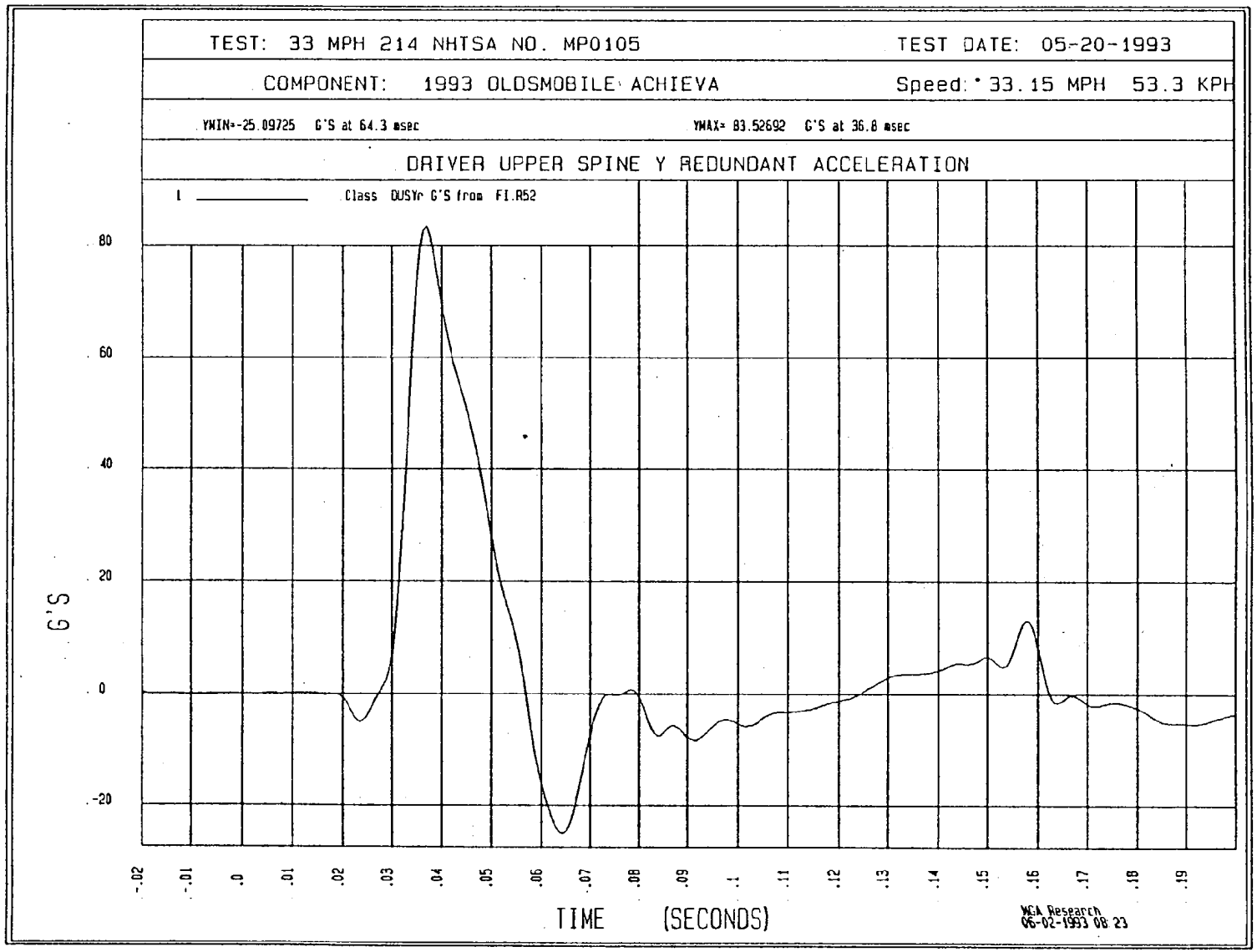



Figure B-1 - Driver Upper Spine Y Acceleration vs. Time




B-2

Figure B-2 - Driver Upper Spine Y Redundant Acceleration vs. Time

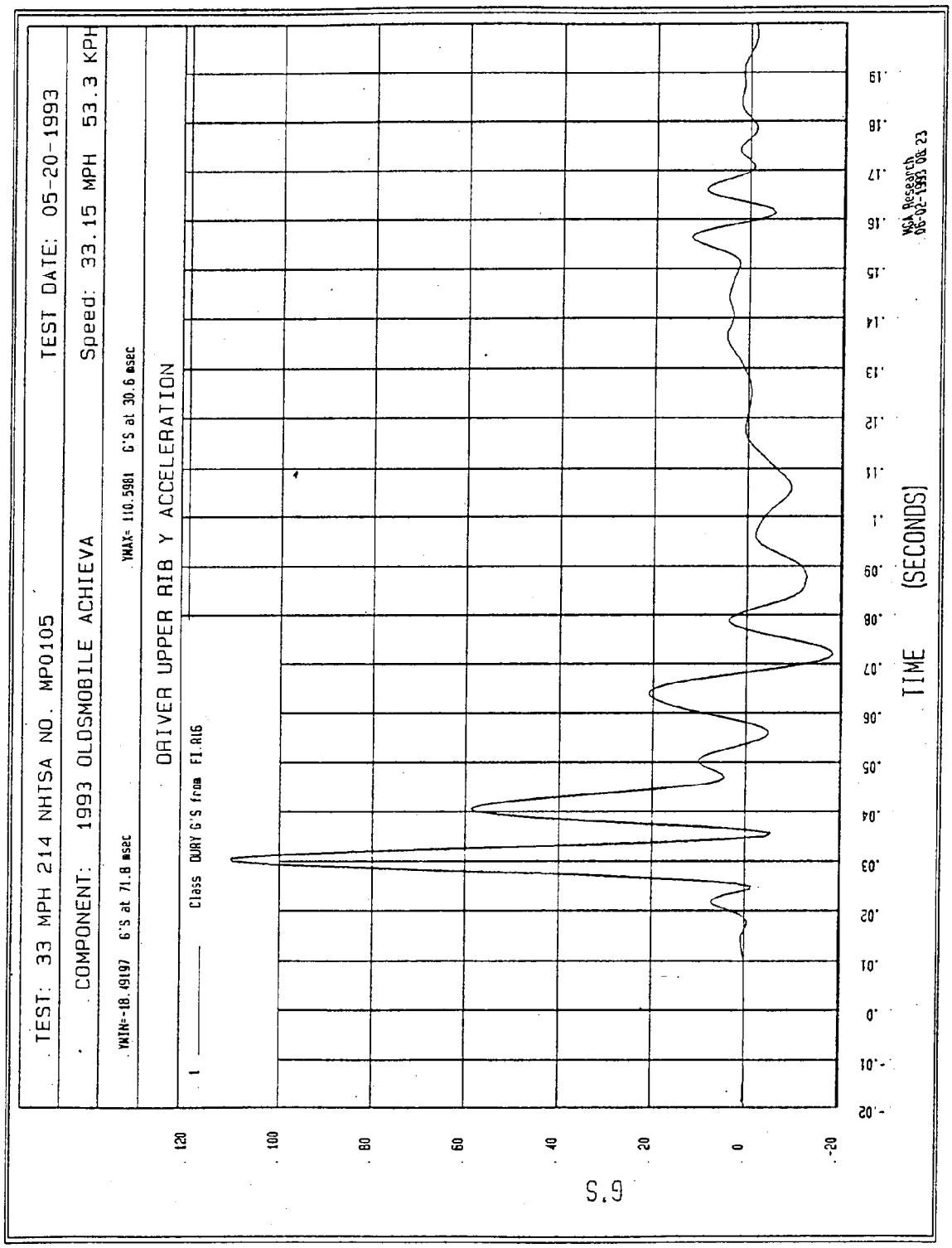



Figure B-3 - Driver Upper Rib Y Acceleration vs. Time

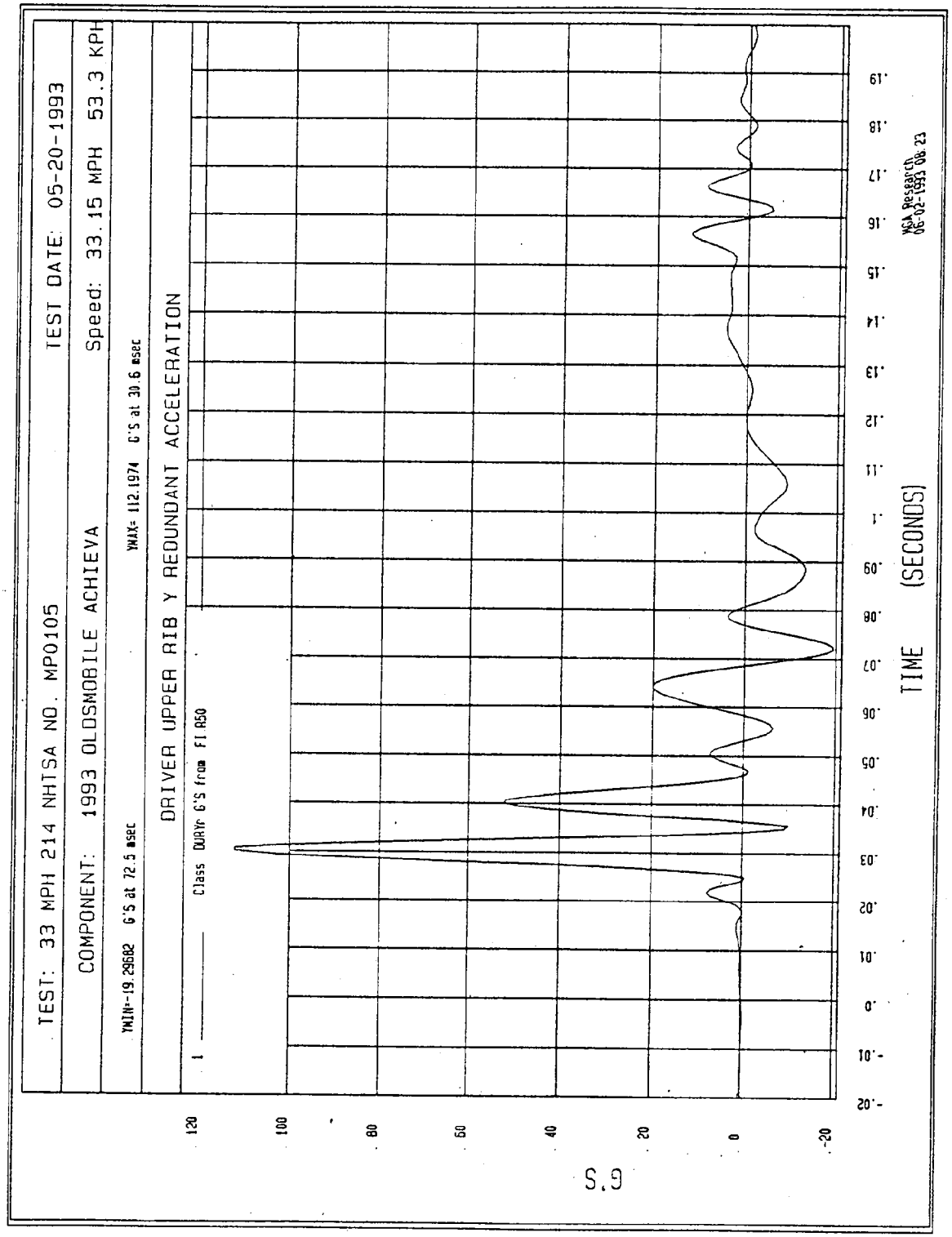



Figure B-4 - Driver Upper Rib Y Redundant Acceleration vs. Time

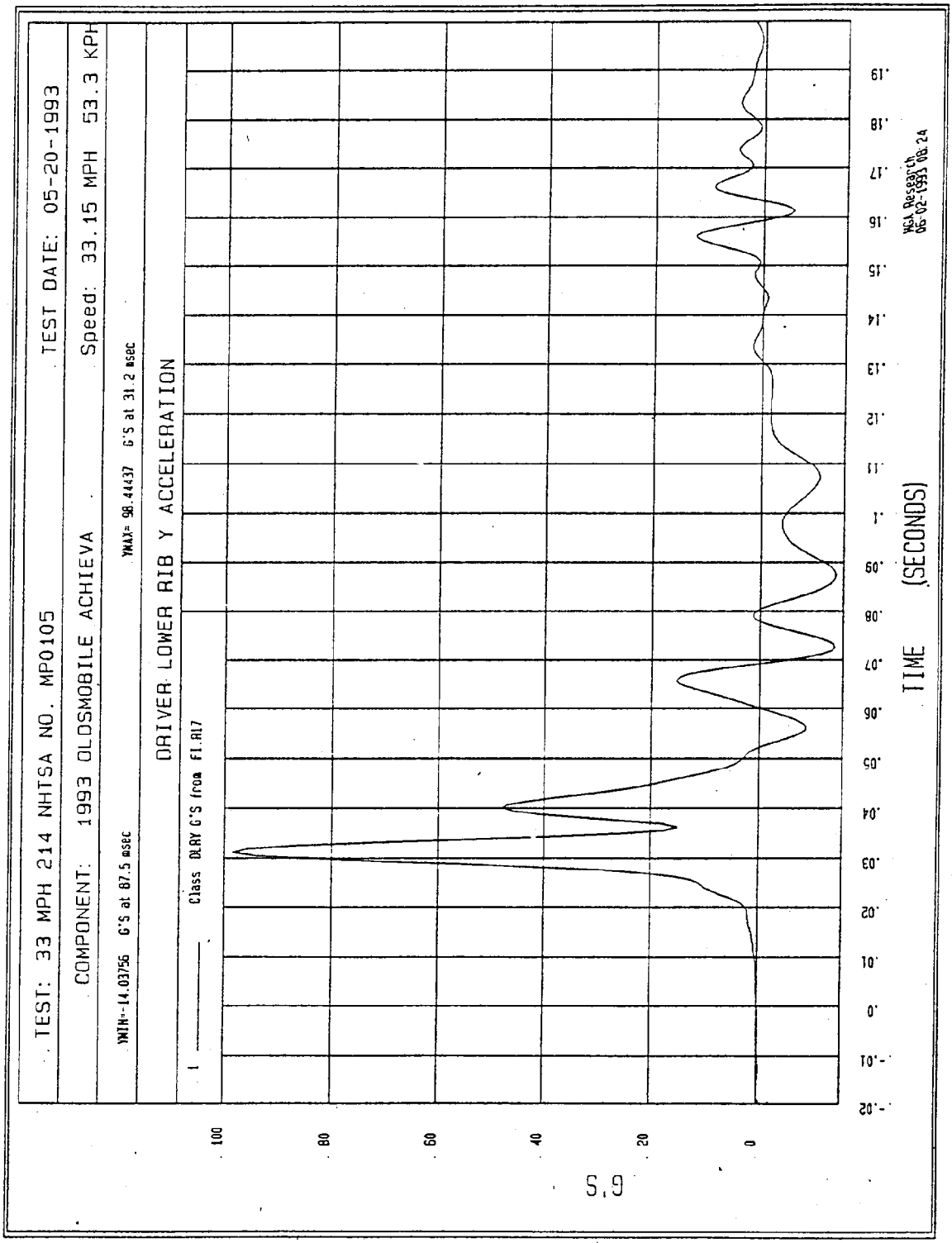
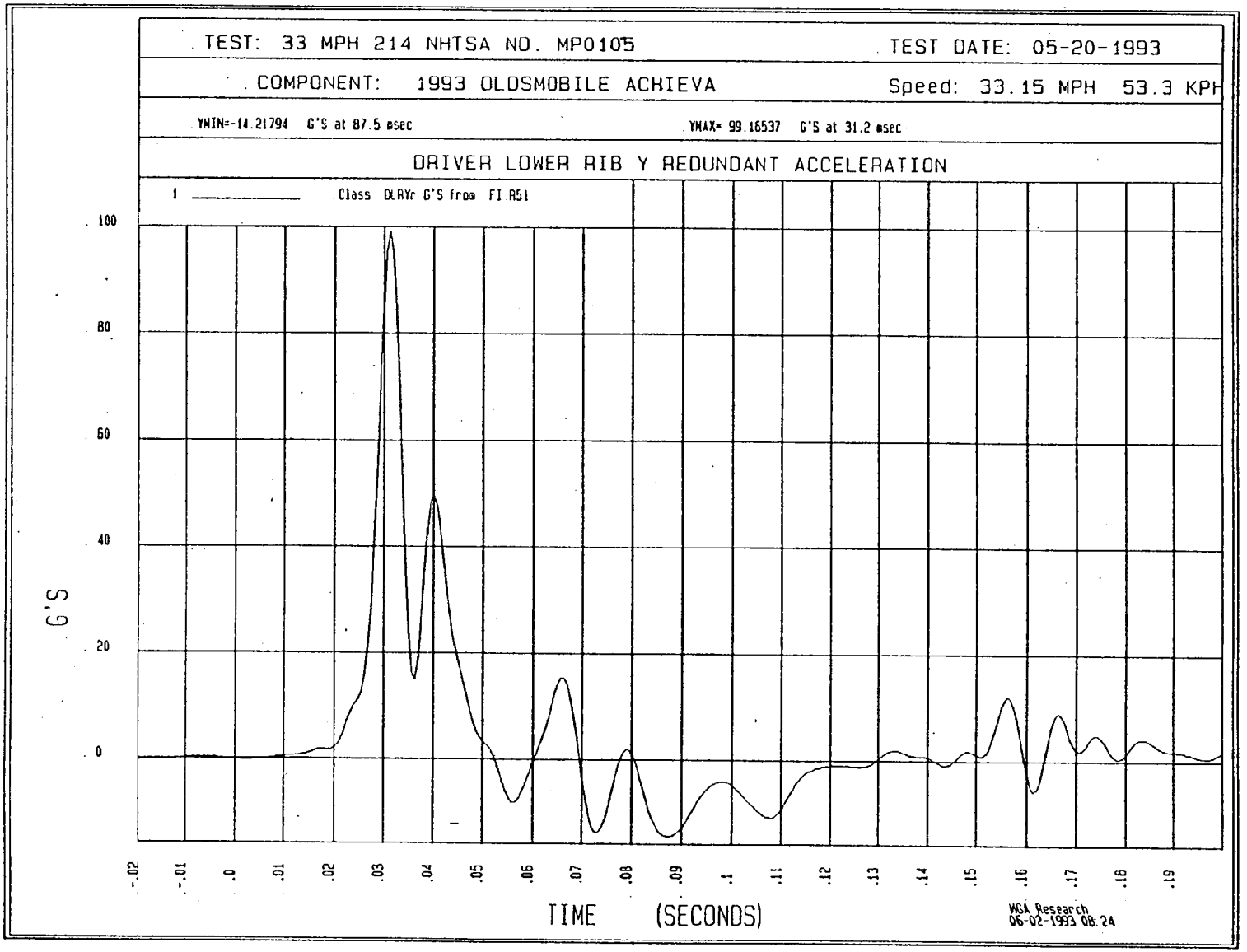



Figure B-5 - Driver Lower Rib Y Acceleration vs. Time




B-6

Figure B-6 - Driver Lower Rib Y Redundant Acceleration vs. Time

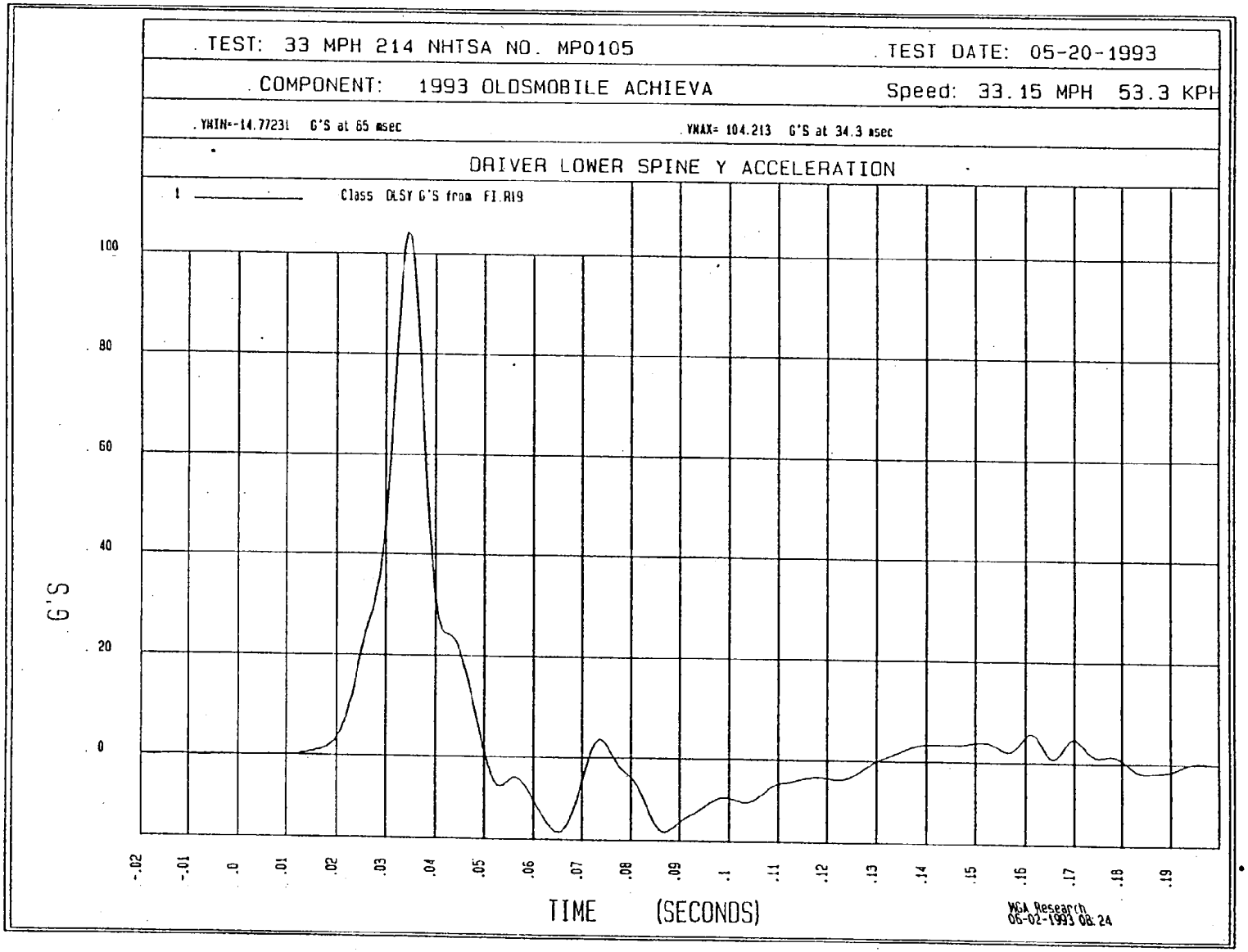



Figure B-7 - Driver Lower Spine Y Acceleration vs. Time

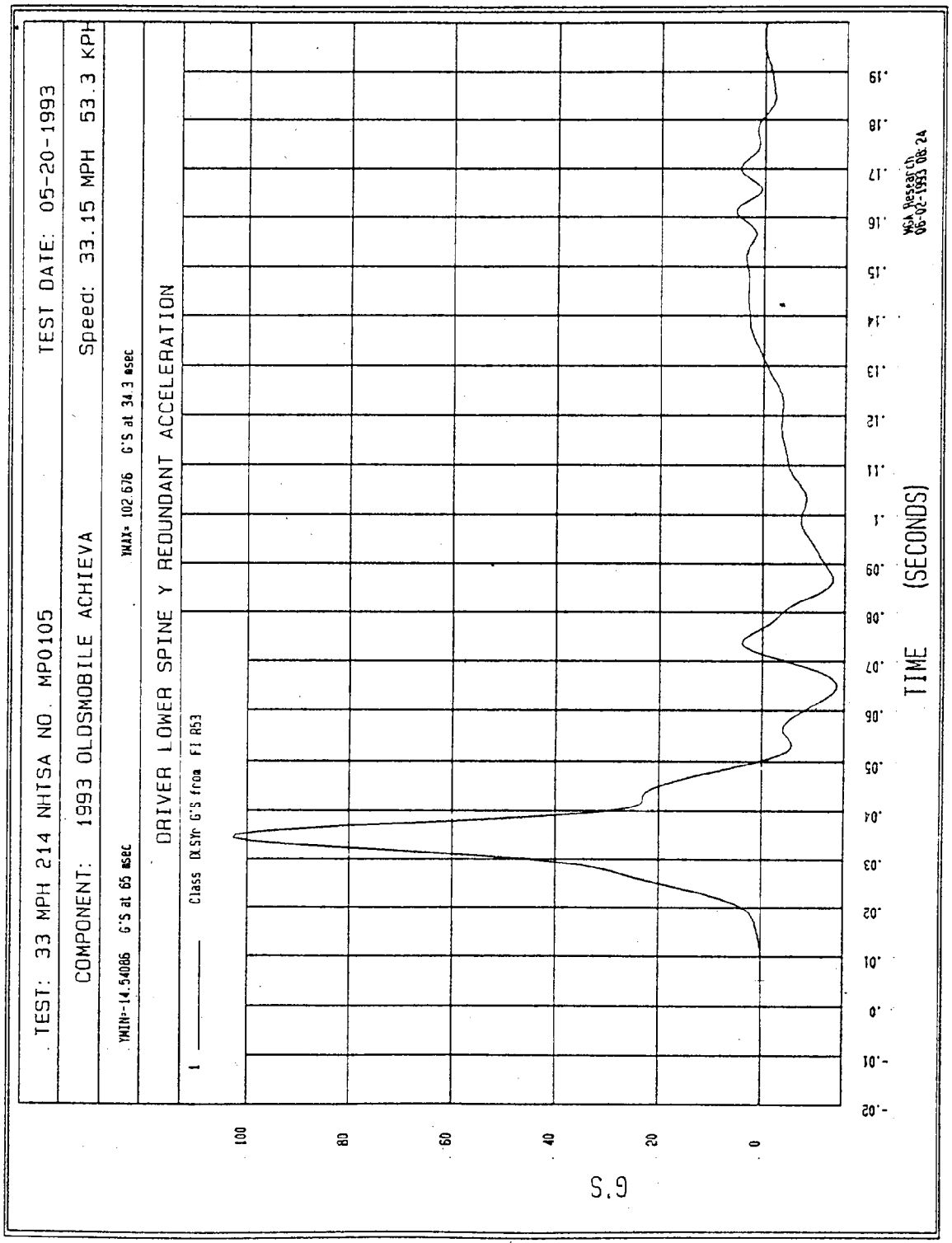



Figure B-8 - Driver Lower Spine Y Redundant Acceleration vs. Time

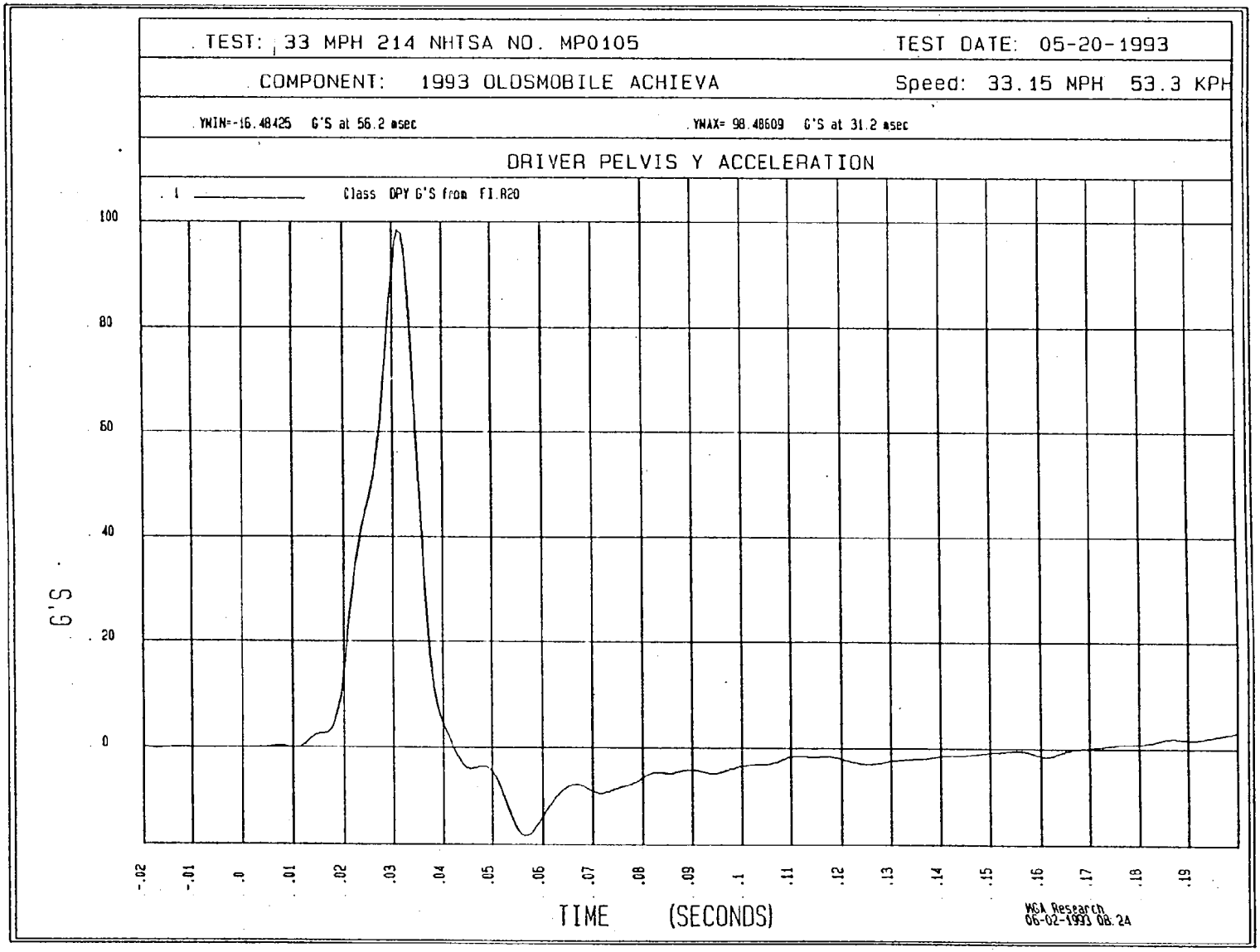



Figure B-9 - Driver Pelvis Y Acceleration vs. Time

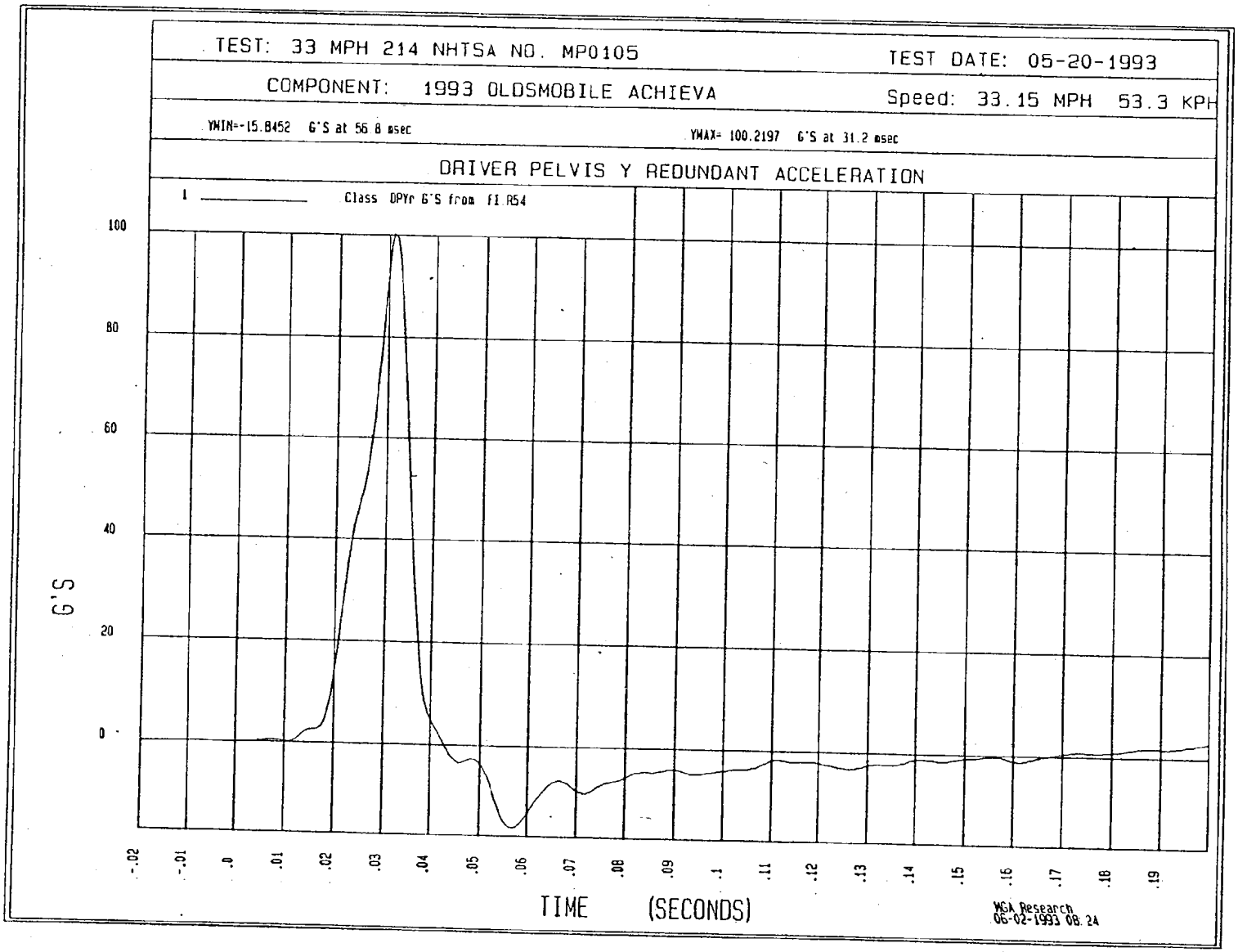



Figure B-10 - Driver Pelvis Y Redundant Acceleration vs. Time

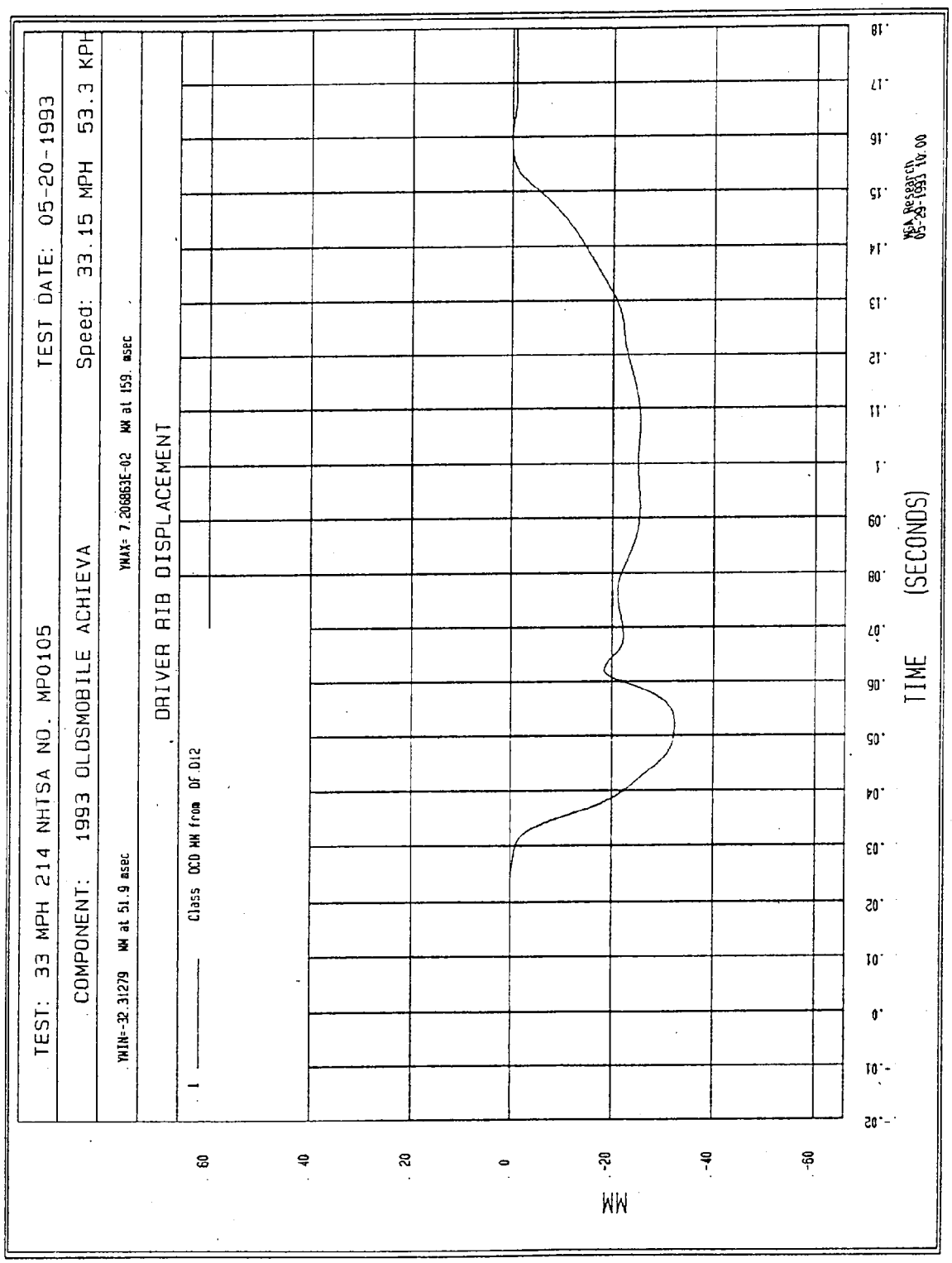



Figure B-11 - Driver Rib Displacement vs. Time

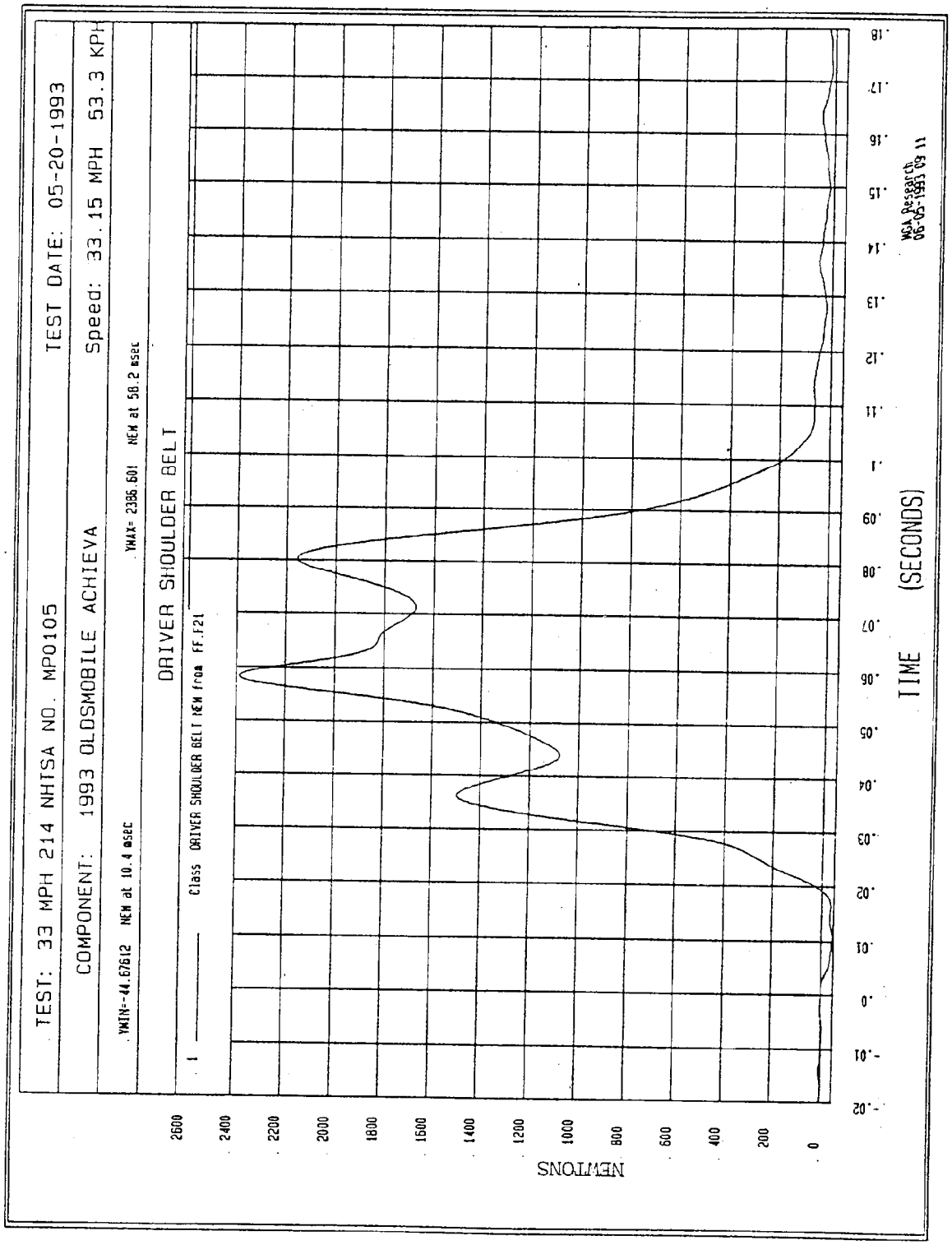



Figure B-12 - Driver Shoulder Belt

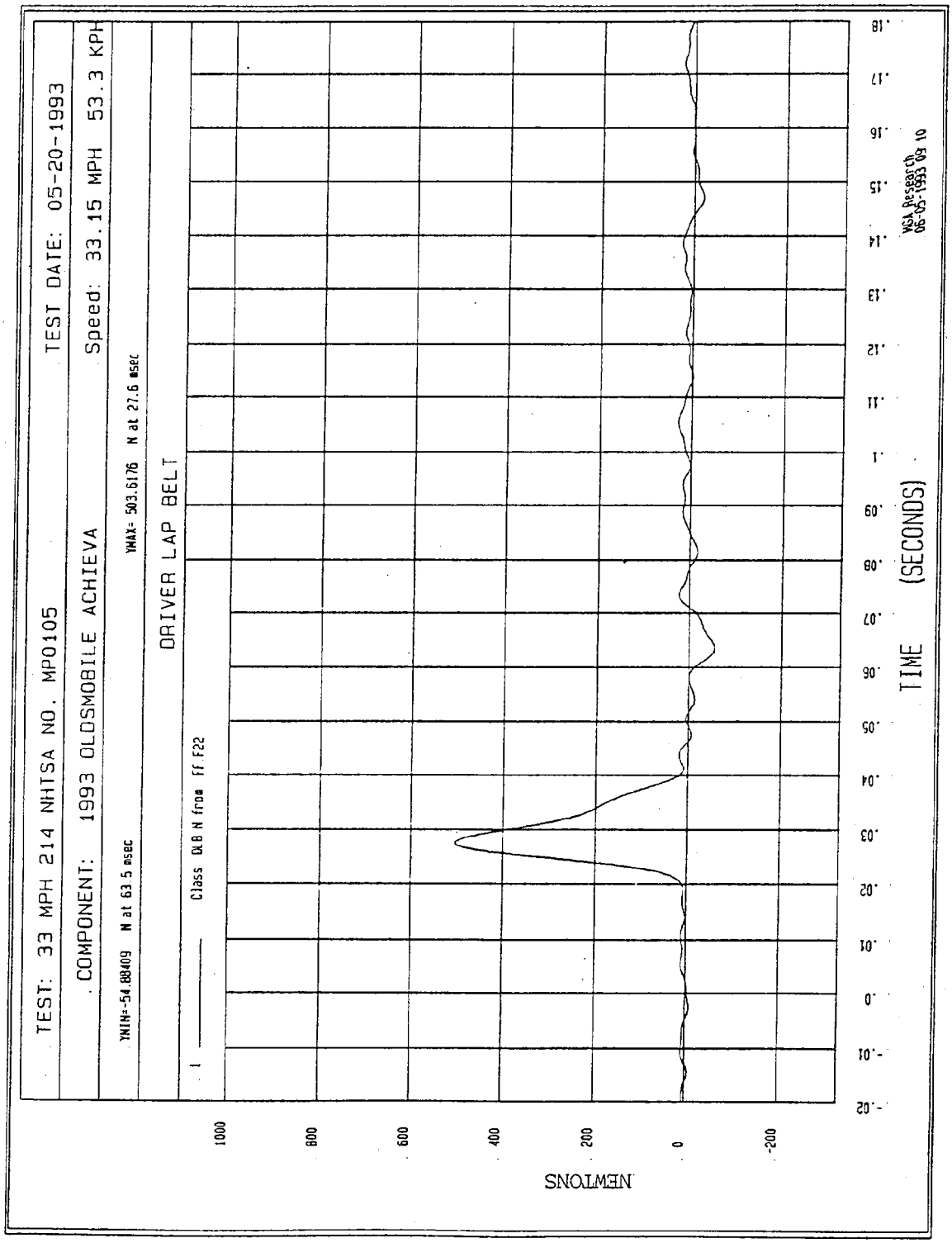



Figure B-13 - Driver Lap Belt

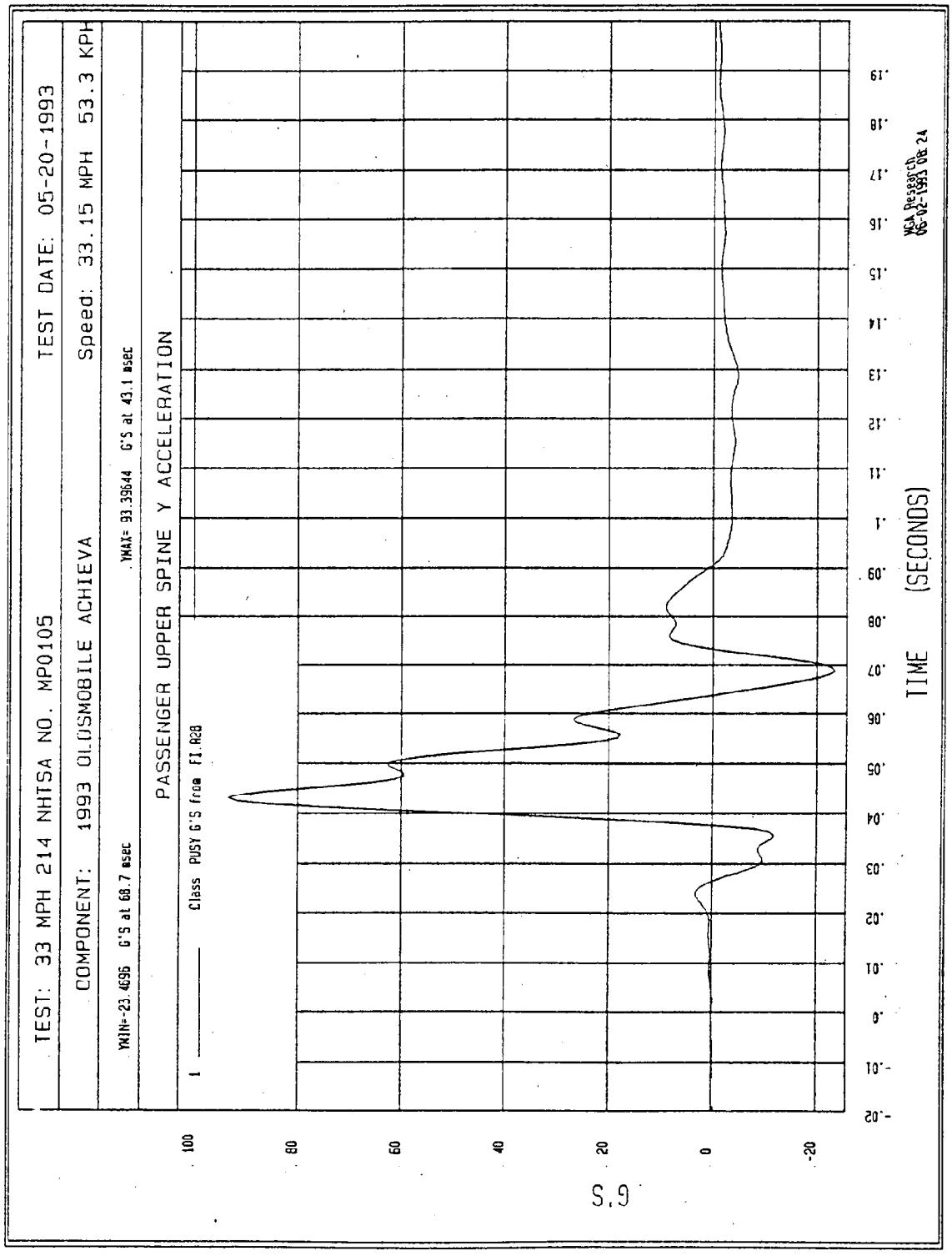



Figure B-14 - Passenger Upper Spine Y Acceleration vs. Time

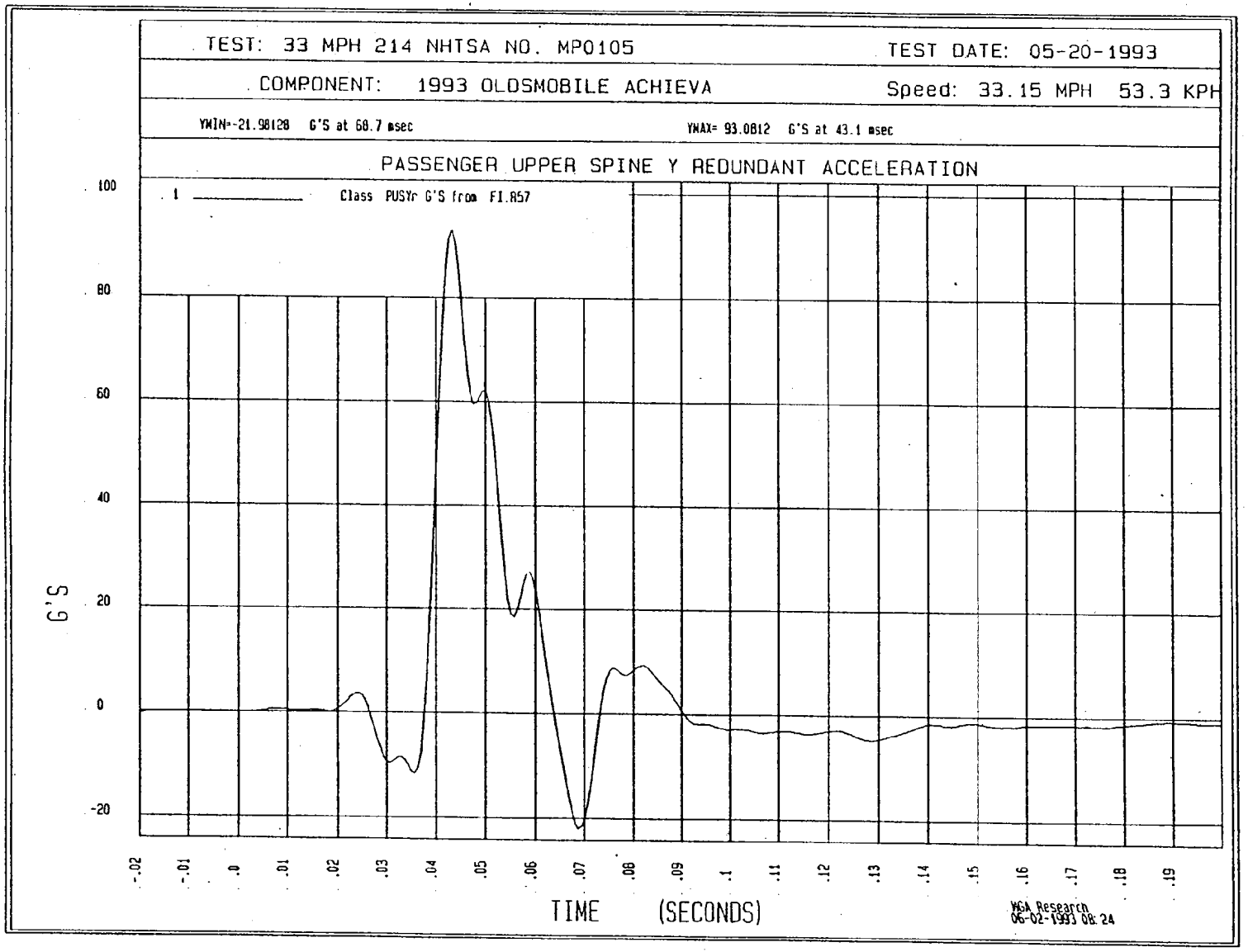



Figure B-15 - Passenger Upper Spine Y Redundant Acceleration vs. Time

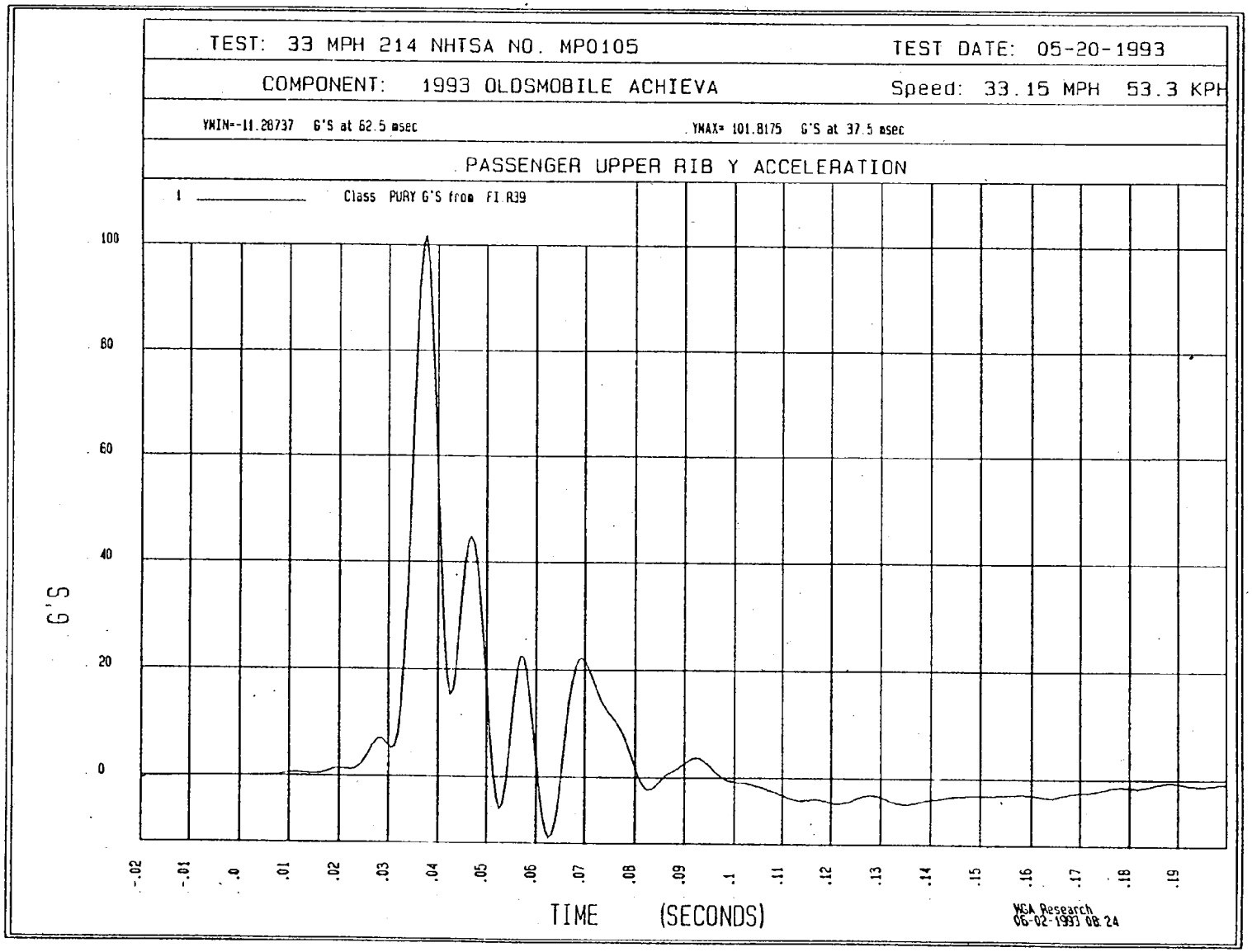



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**Figure B-16 - Passenger Upper Rib Y Acceleration vs. Time**

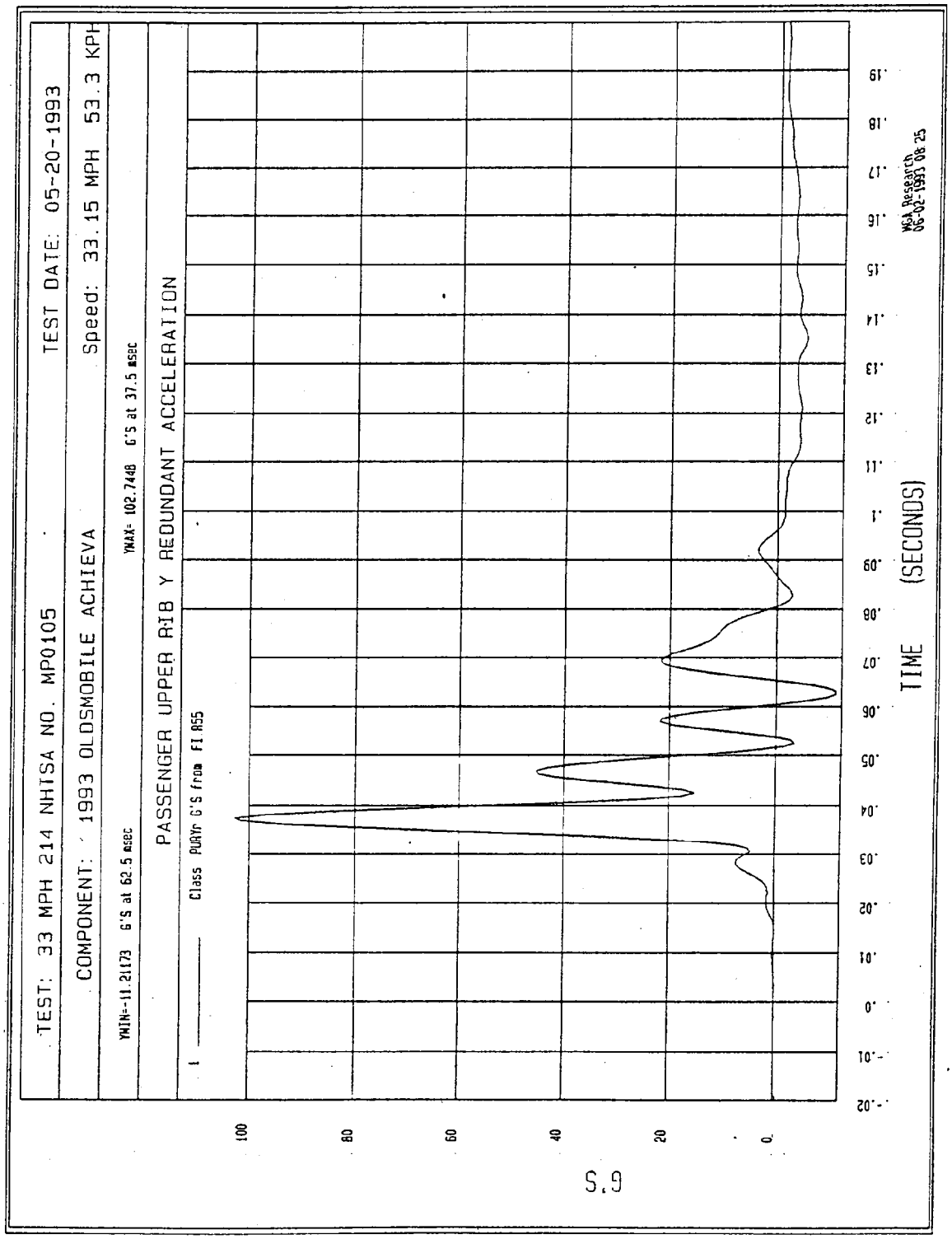


Figure B-17 - Passenger Upper Rib Y Redundant Acceleration vs. Time

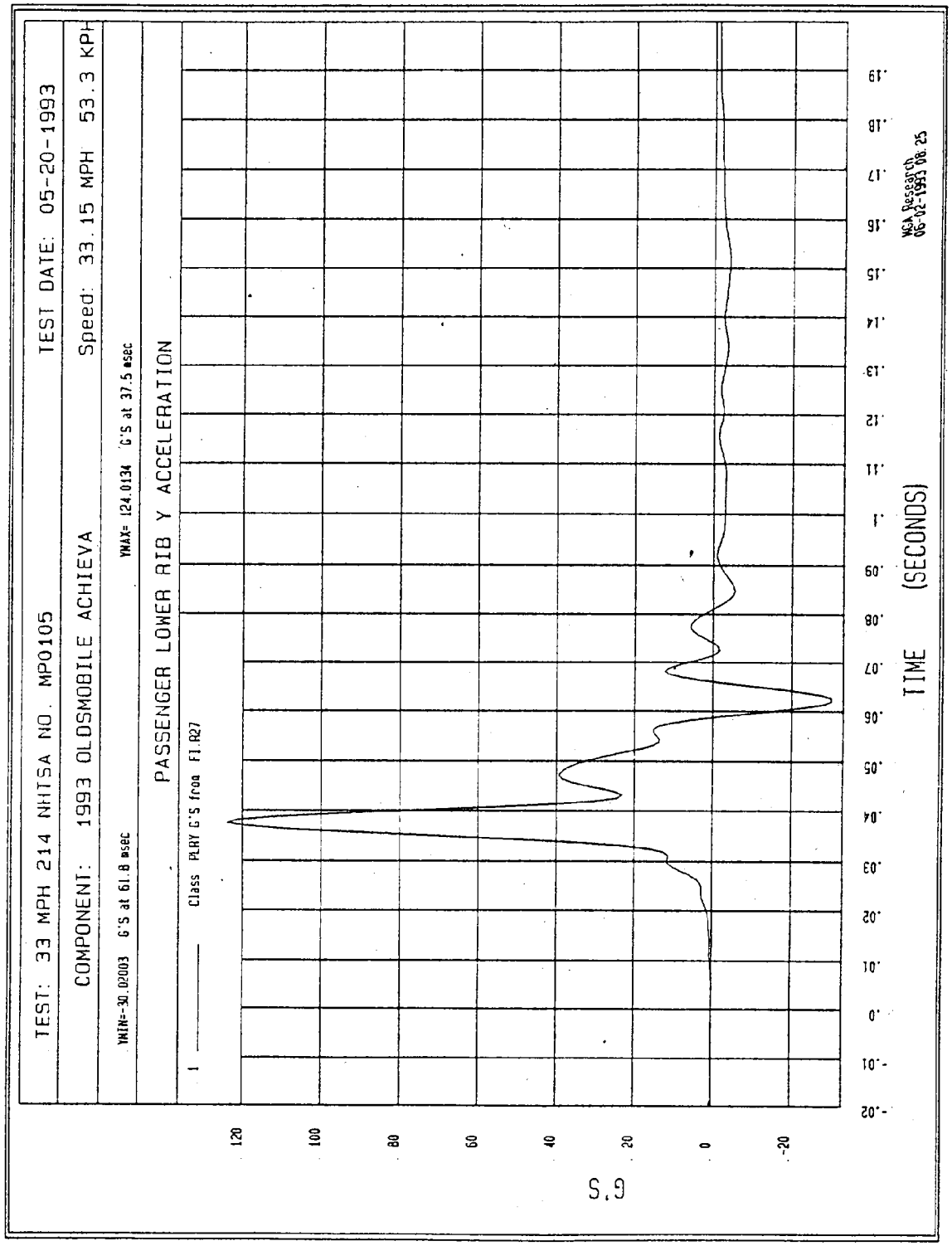


Figure B-18 - Passenger Lower Rib Y Acceleration vs. Time

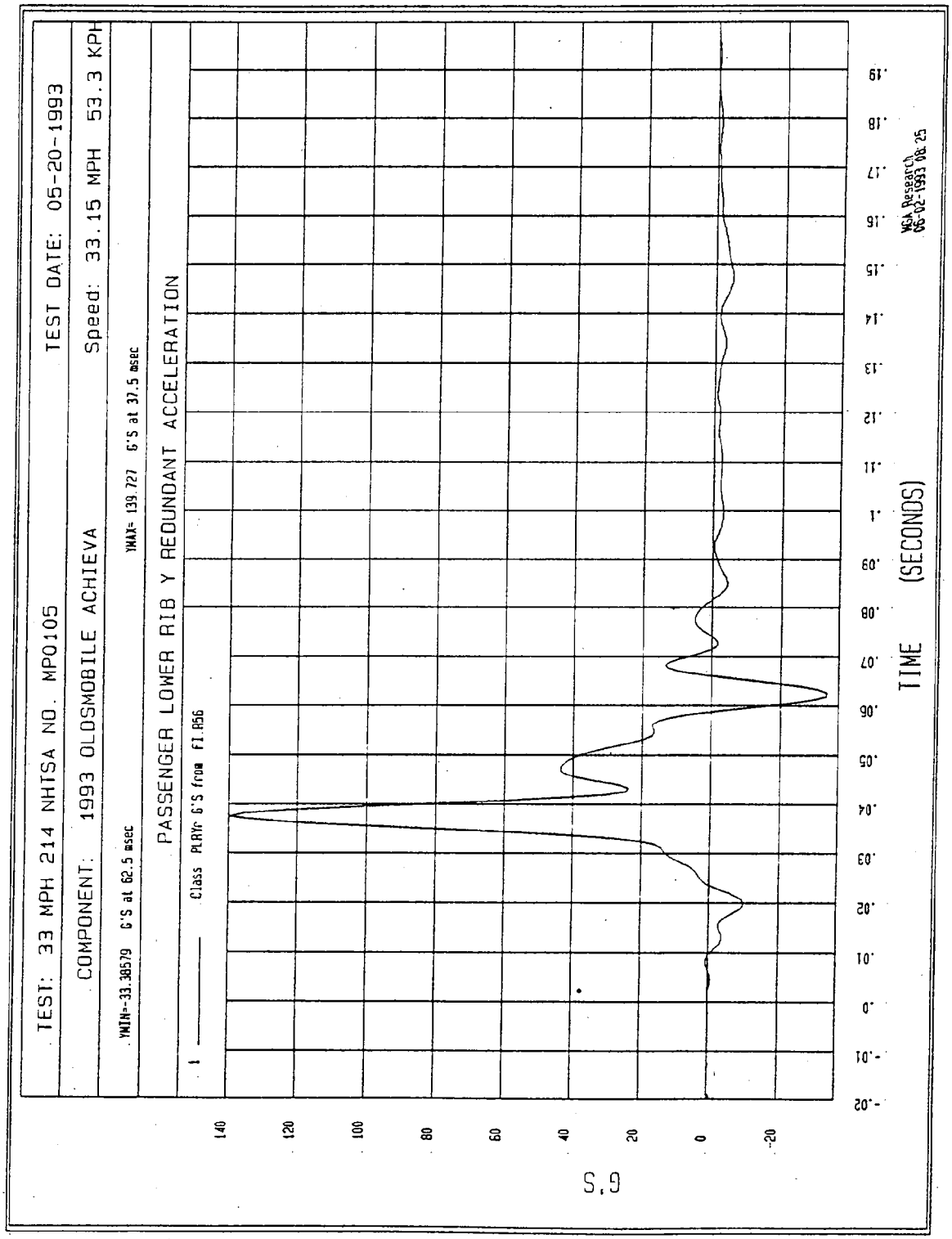


Figure B-19 - Passenger Lower Rib Y Redundant Acceleration

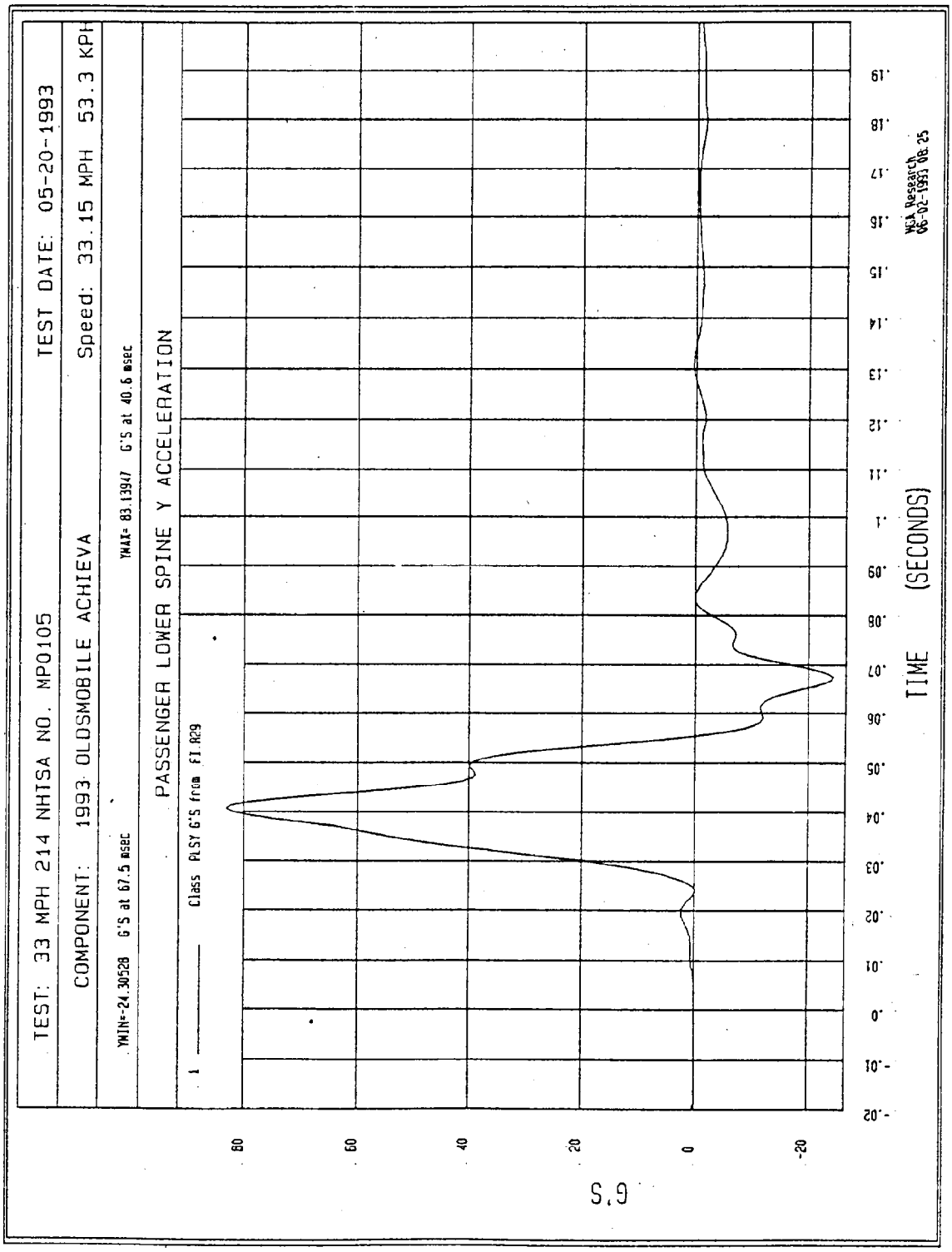


Figure B-20 - Passenger Lower Spine Y Acceleration vs. Time

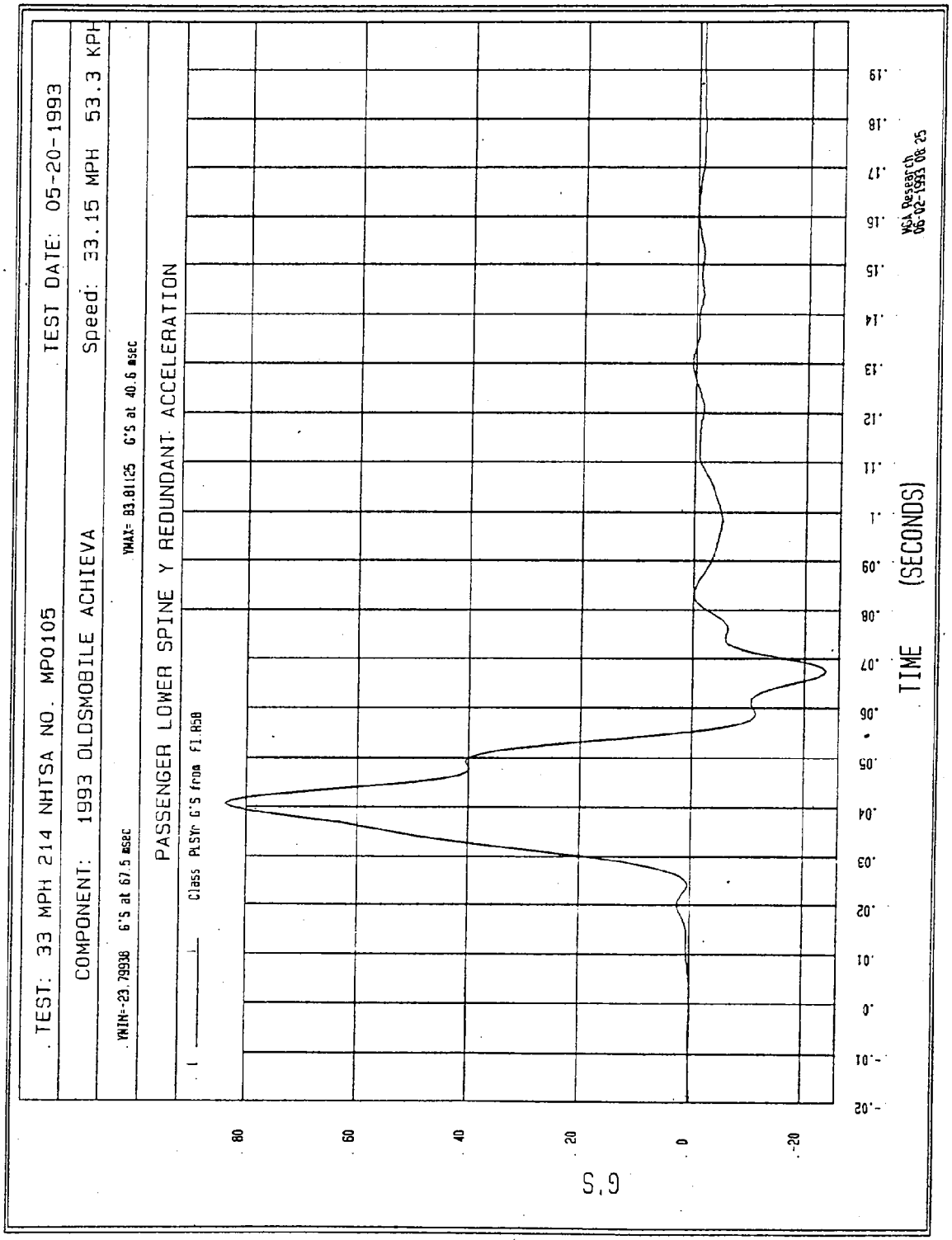


Figure B-21 - Passenger Lower Spine Y Redundant Acceleration vs. Time

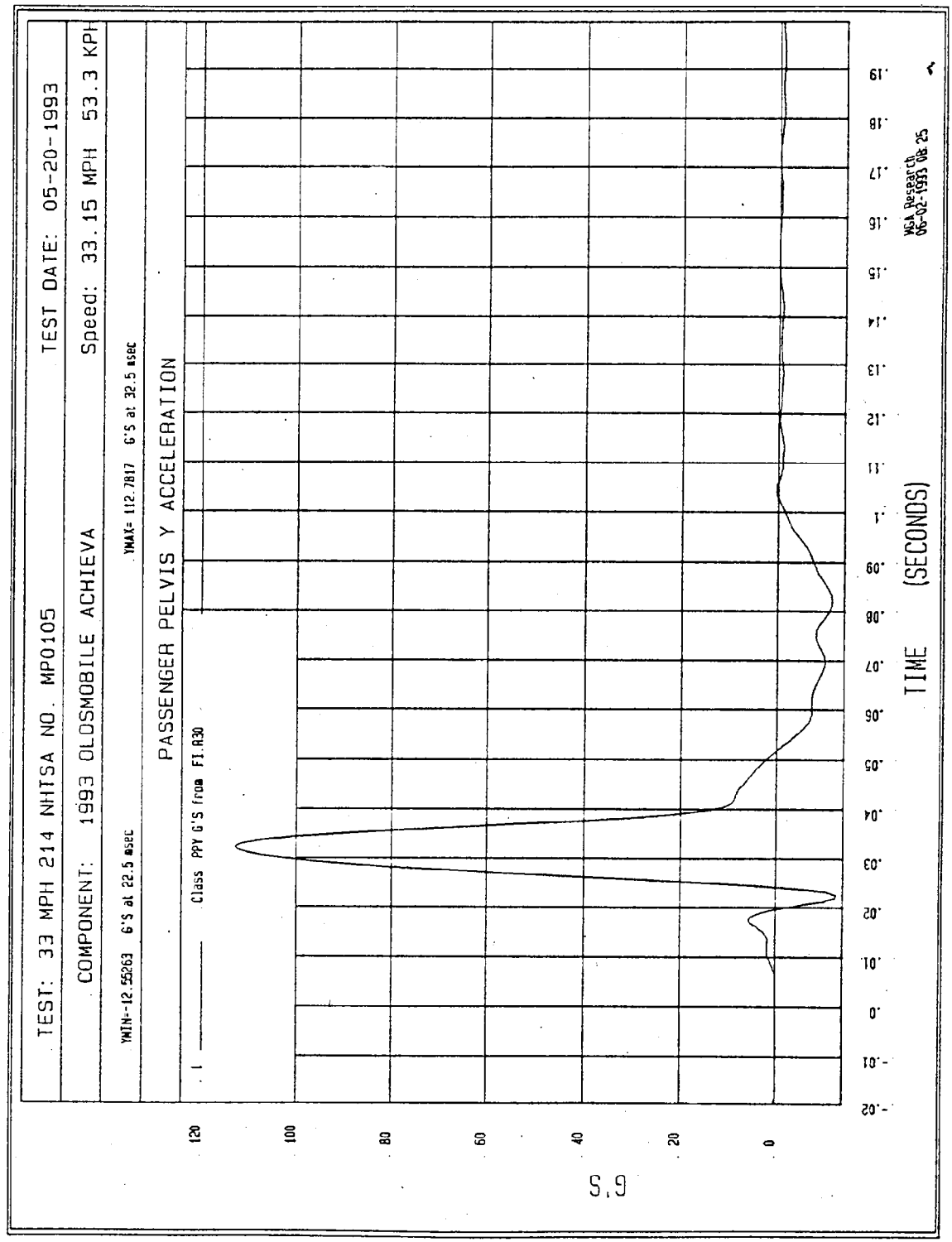


Figure B-22 - Passenger Pelvis Y Acceleration vs. Time

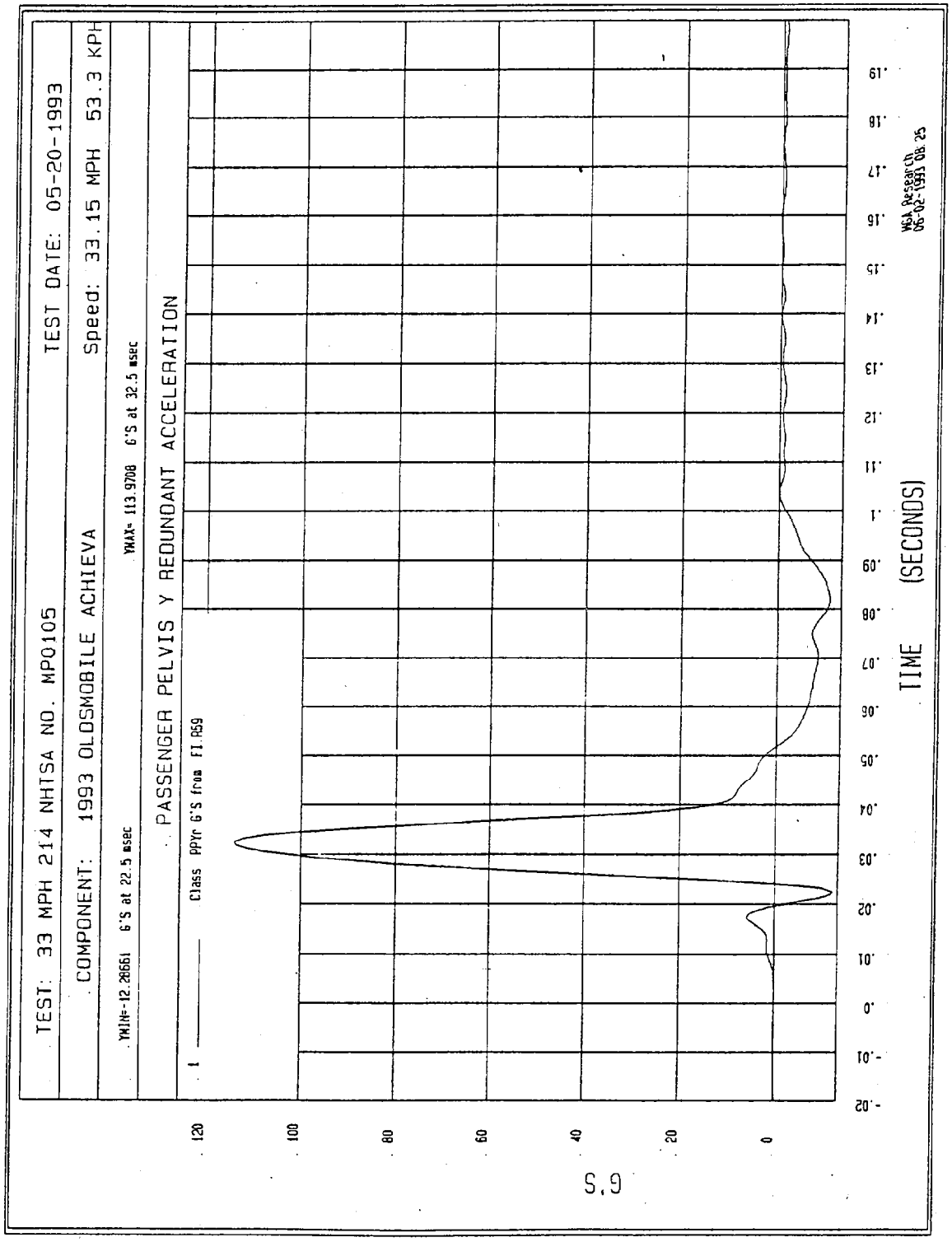


Figure B-23 - Passenger Pelvis Y Redundant Acceleration vs. Time

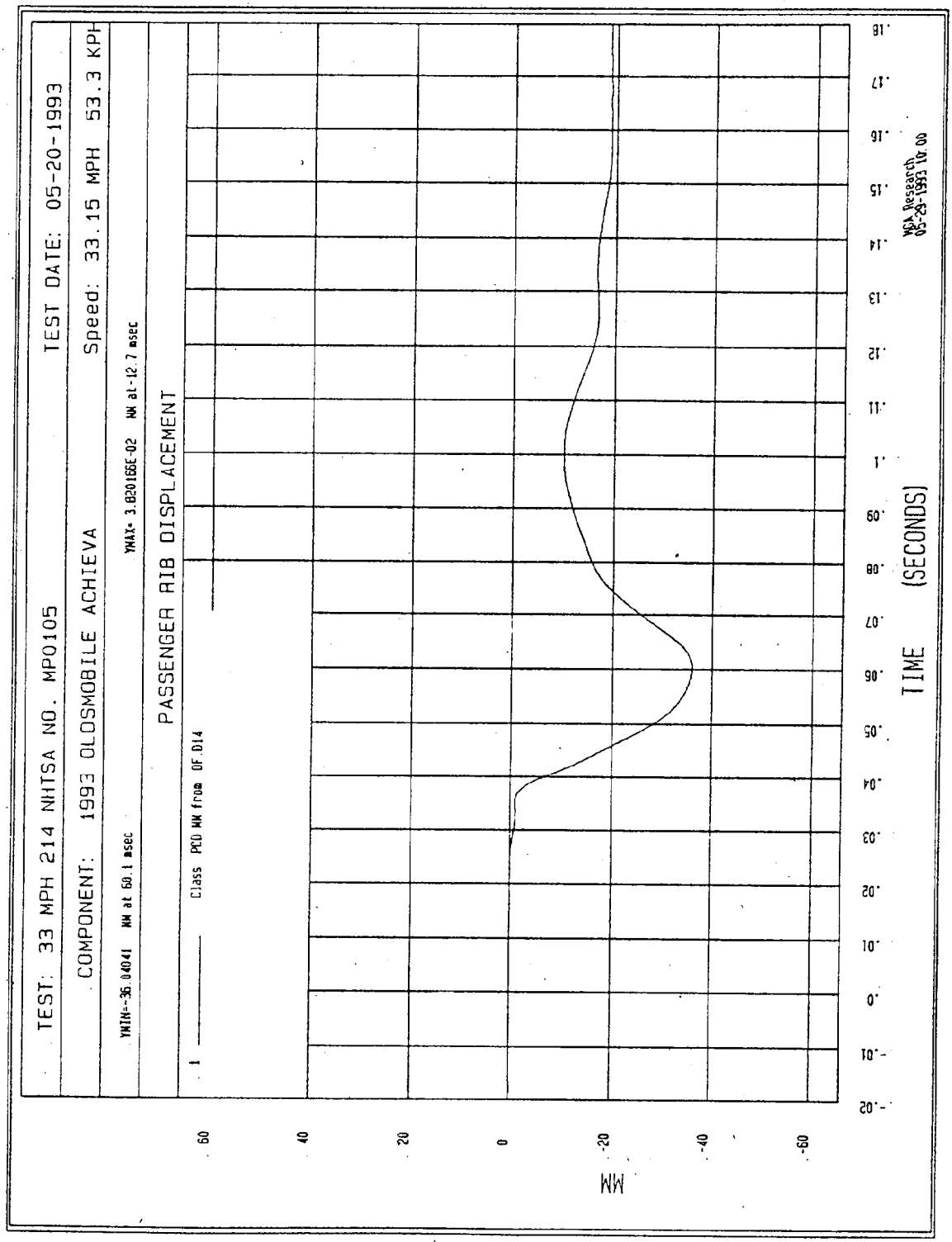


Figure B-24 - Passenger Rib Displacement vs. Time

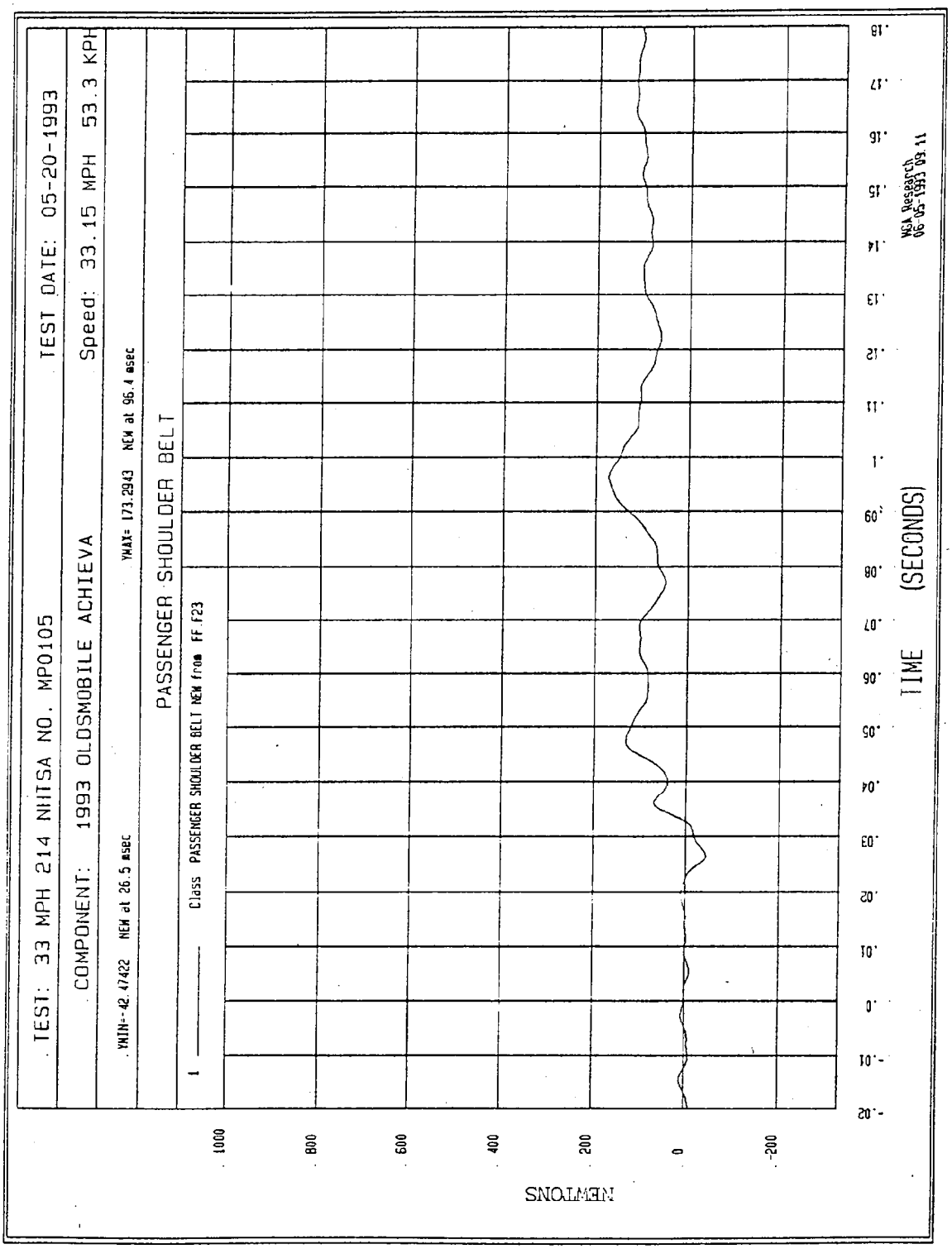


Figure B-25 - Passenger Shoulder Belt

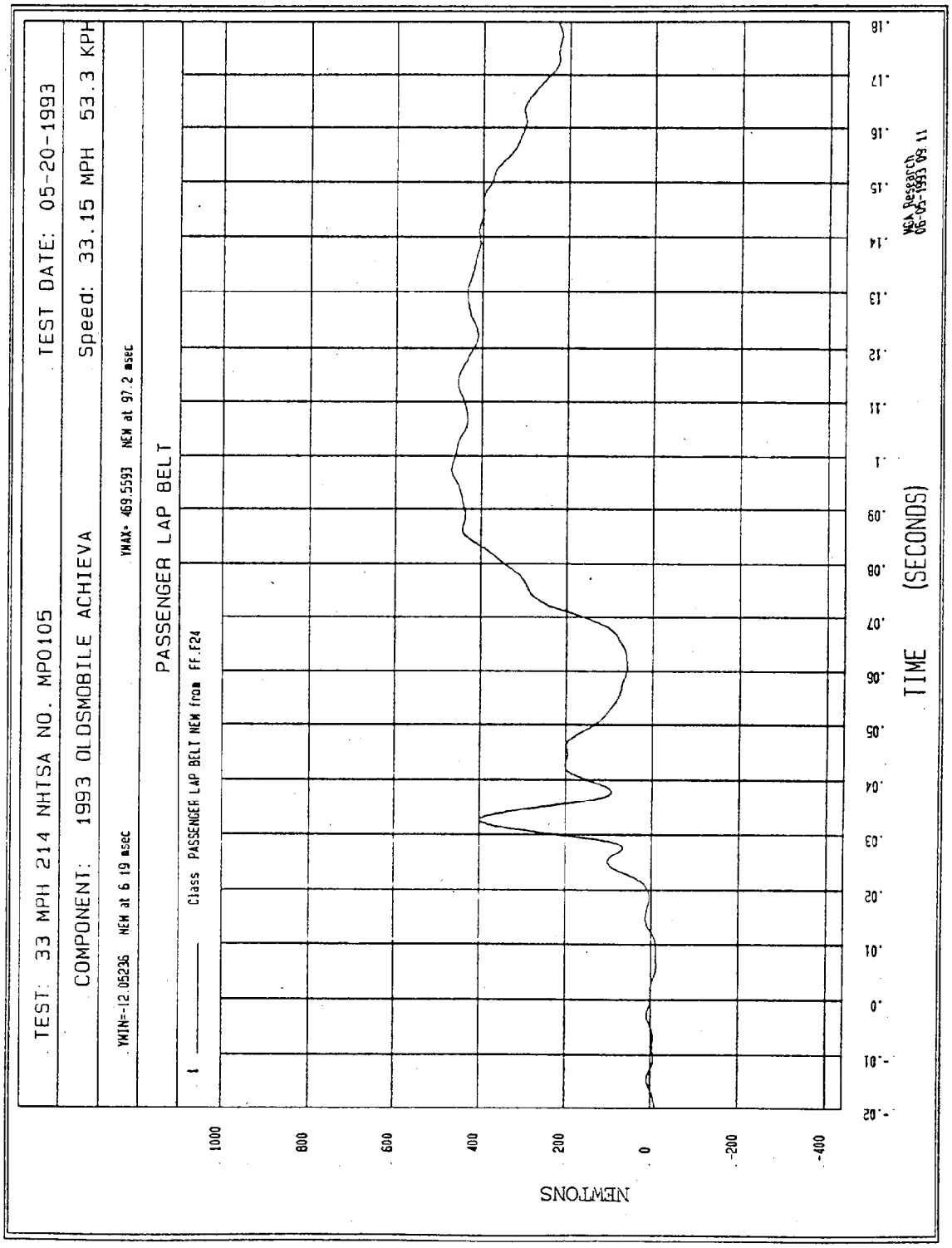


Figure B-26 - Passenger Lap Belt

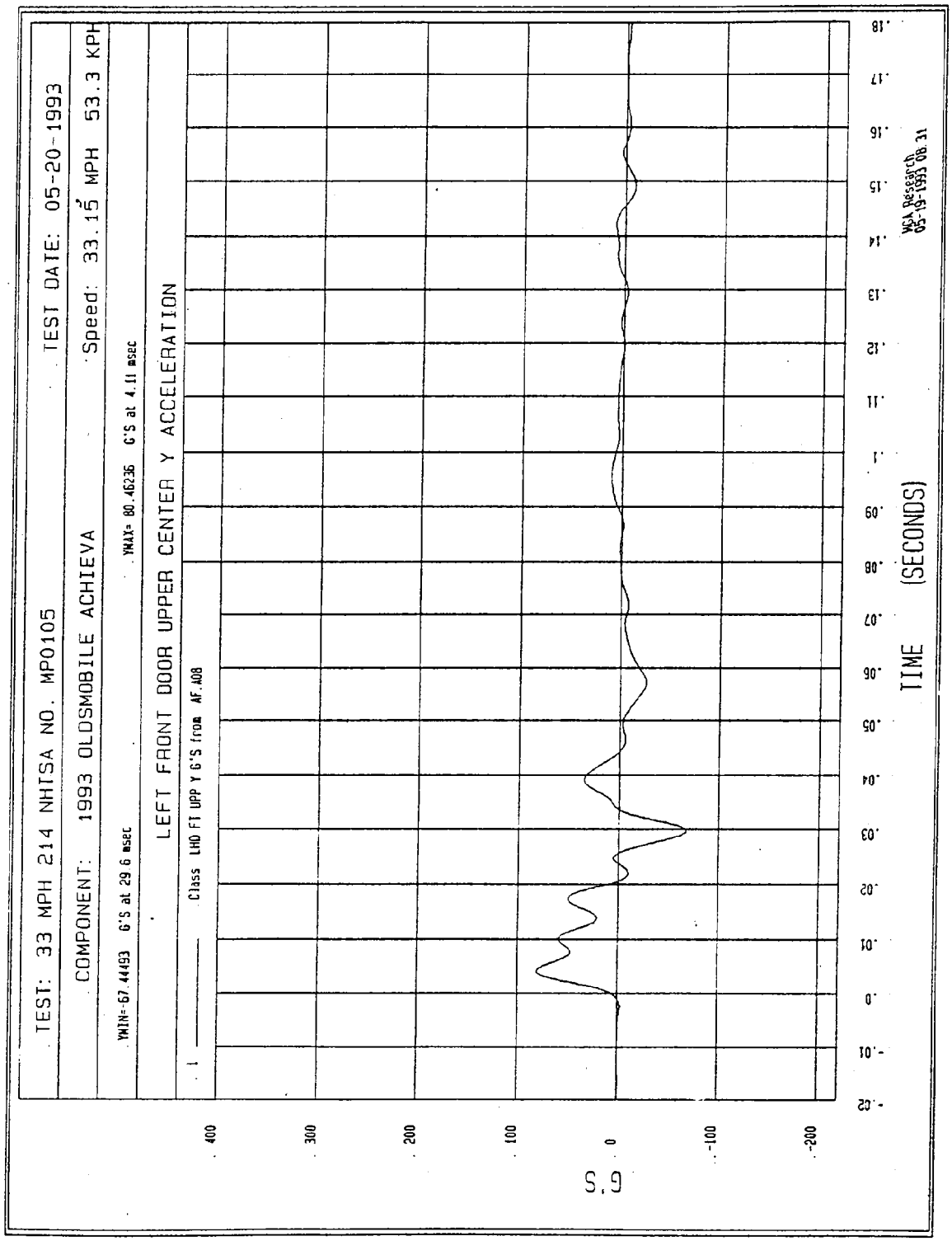


Figure B-27 - Front Door Upper Center Y Acceleration vs. Time

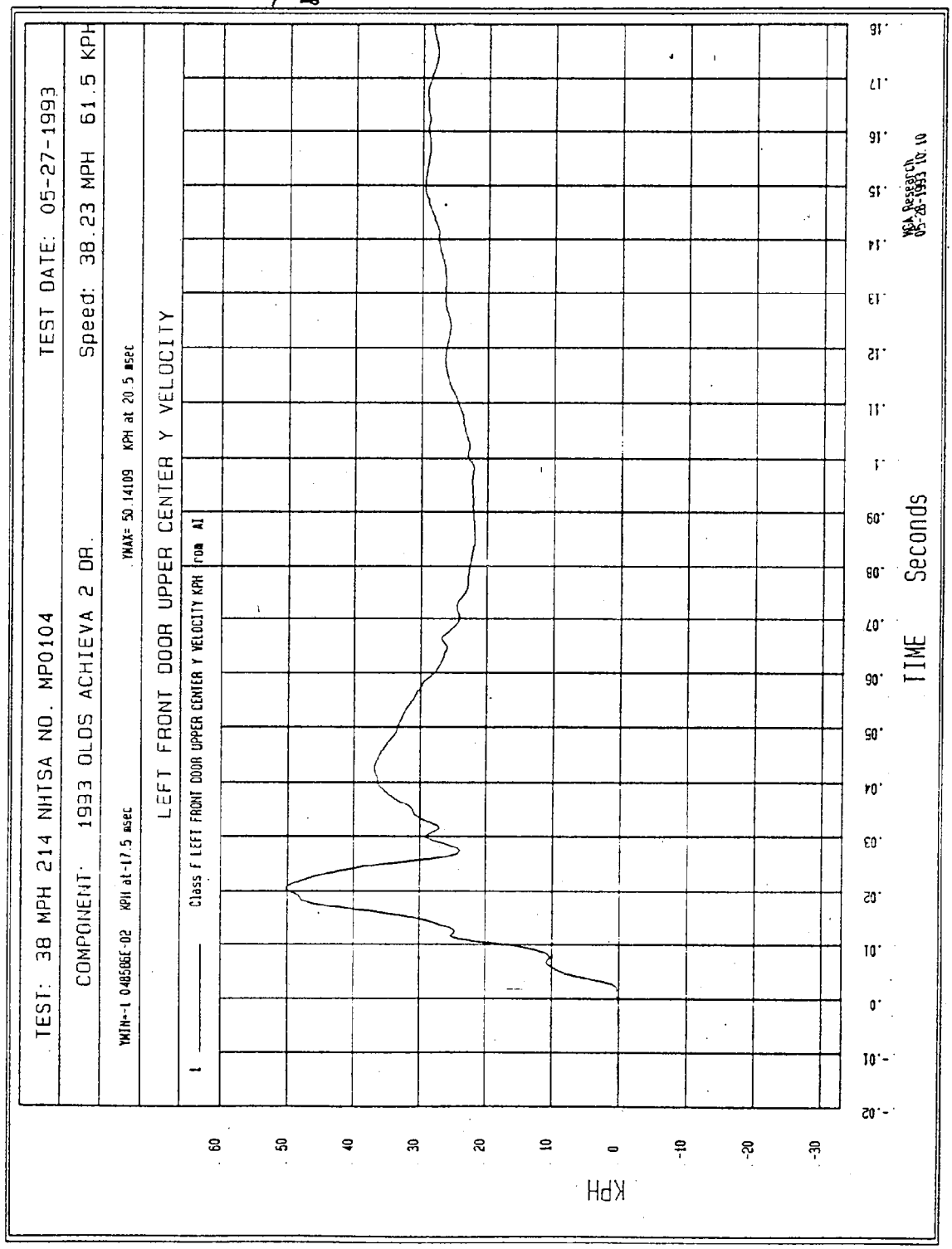


Figure B-28 - Front Door Upper Center Y Velocity vs. Time

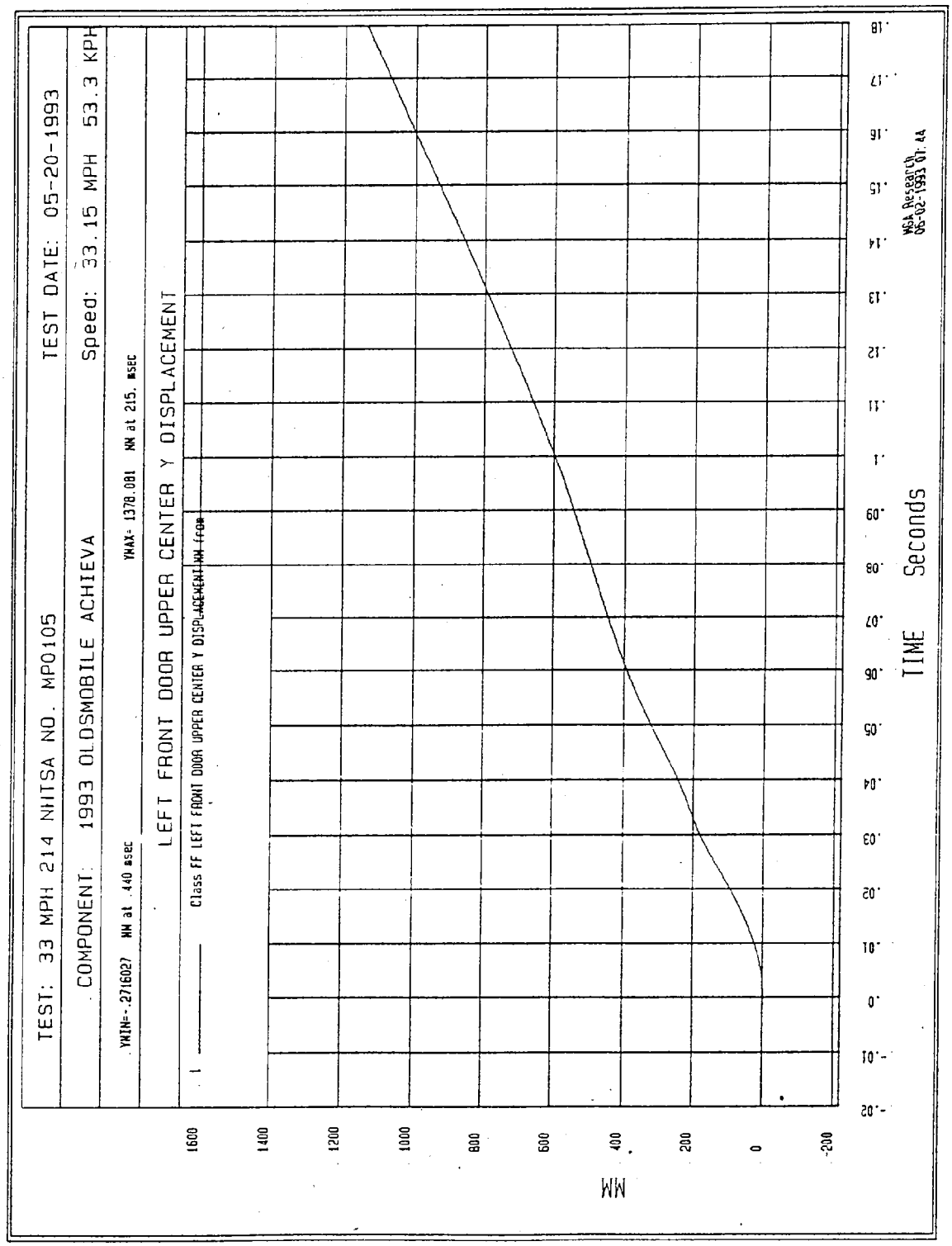


Figure B-29 - Front Door Upper Center Y Displacement vs. Time

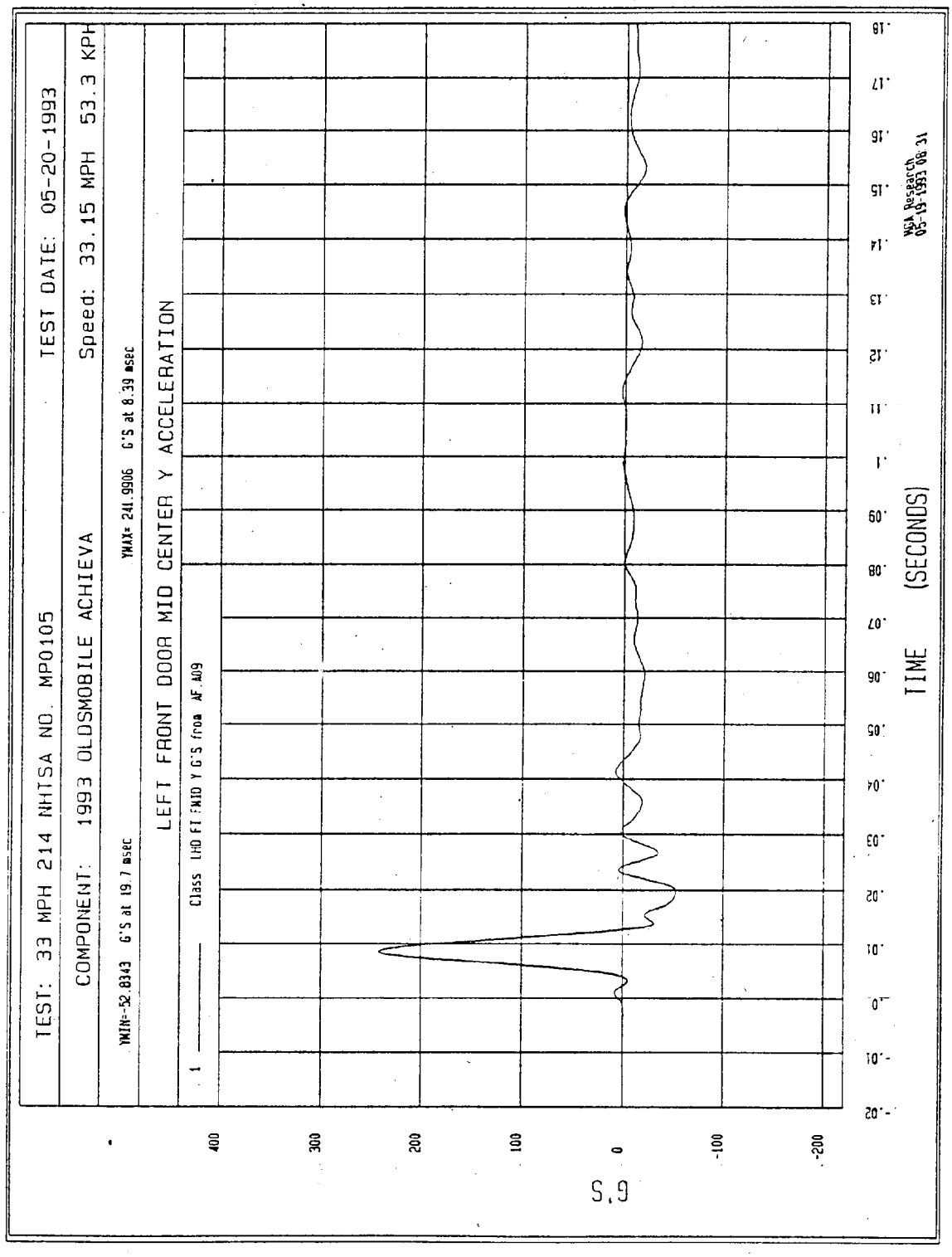


**Figure B-30 - Front Door Mid Center Y Acceleration vs. Time**
Questionable data after 13 msec.

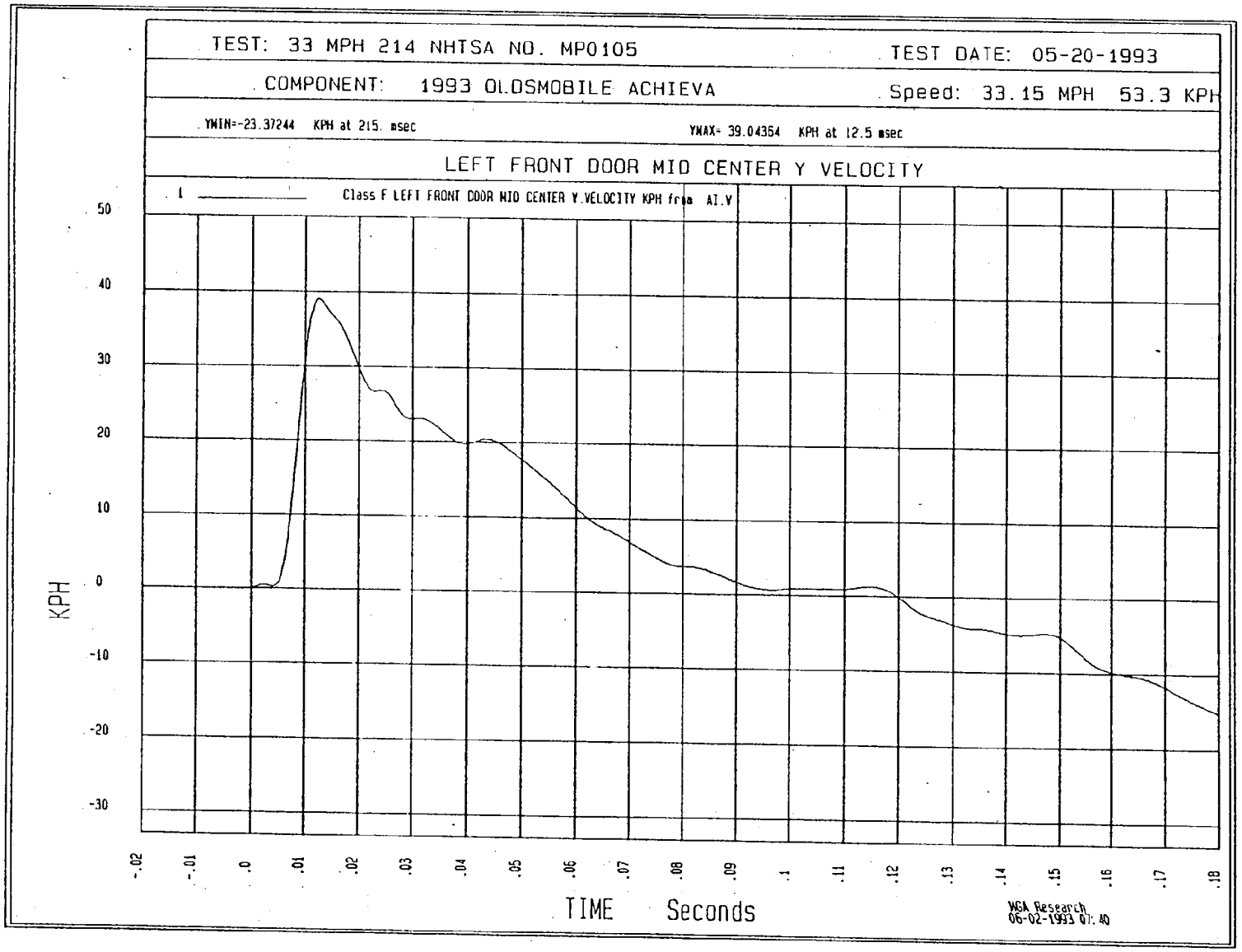


**Figure B-31 - Front Door Mid Center Y Velocity vs. Time**
Questionable data after 13 msec.

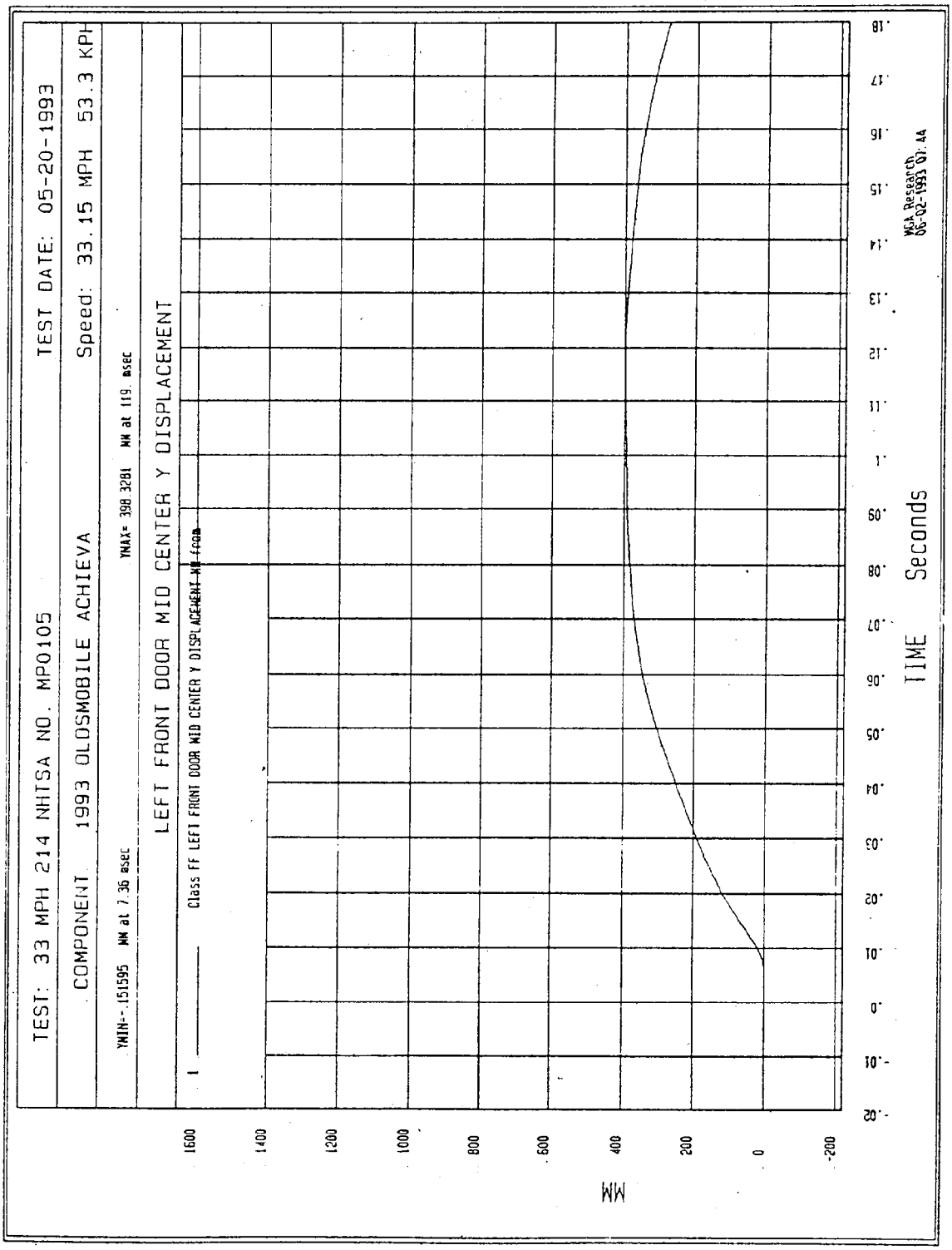


Figure B-32 - Front Door Mid Center Y Displacement vs. Time

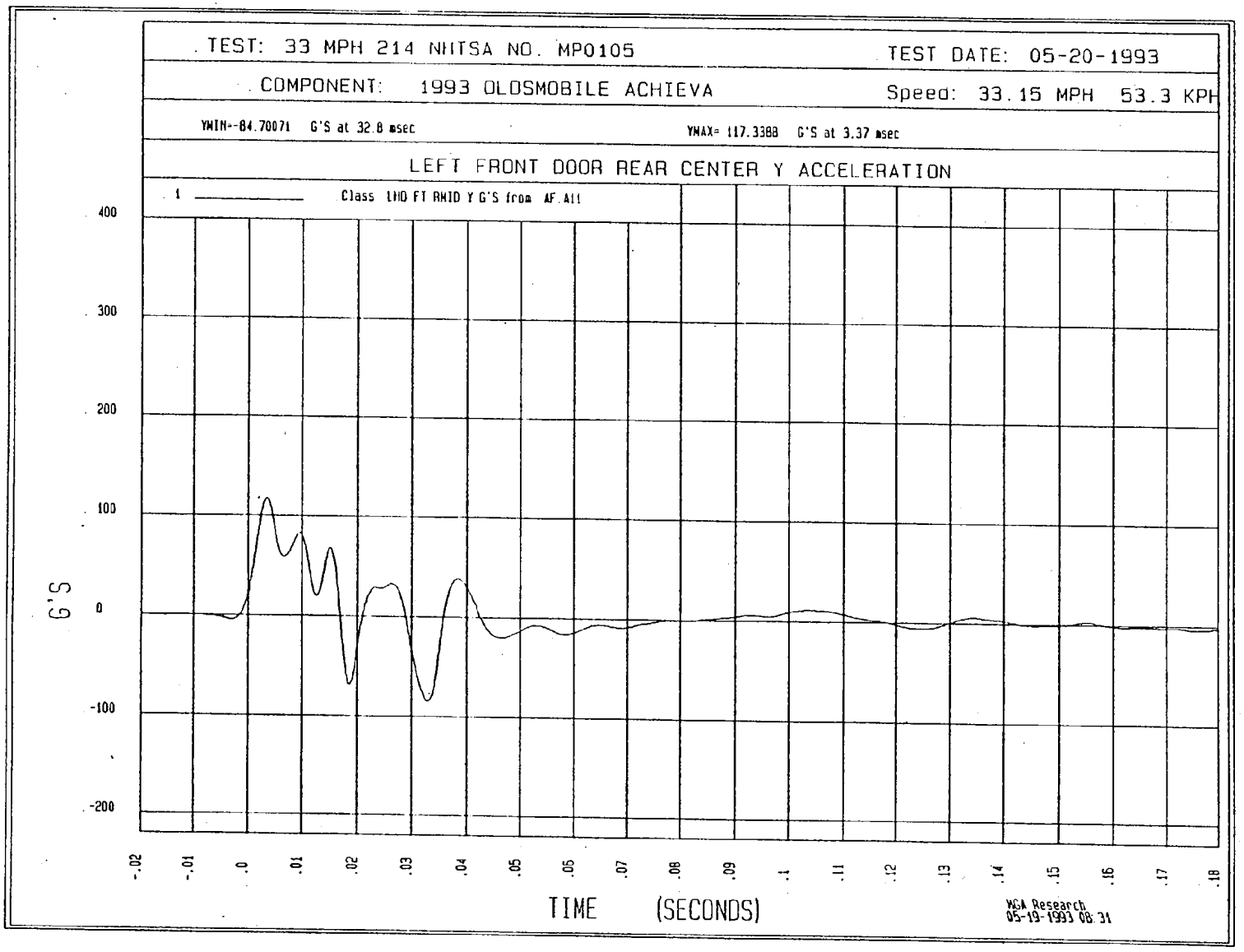


Figure B-33 - Front Door Rear Center Y Acceleration vs. Time

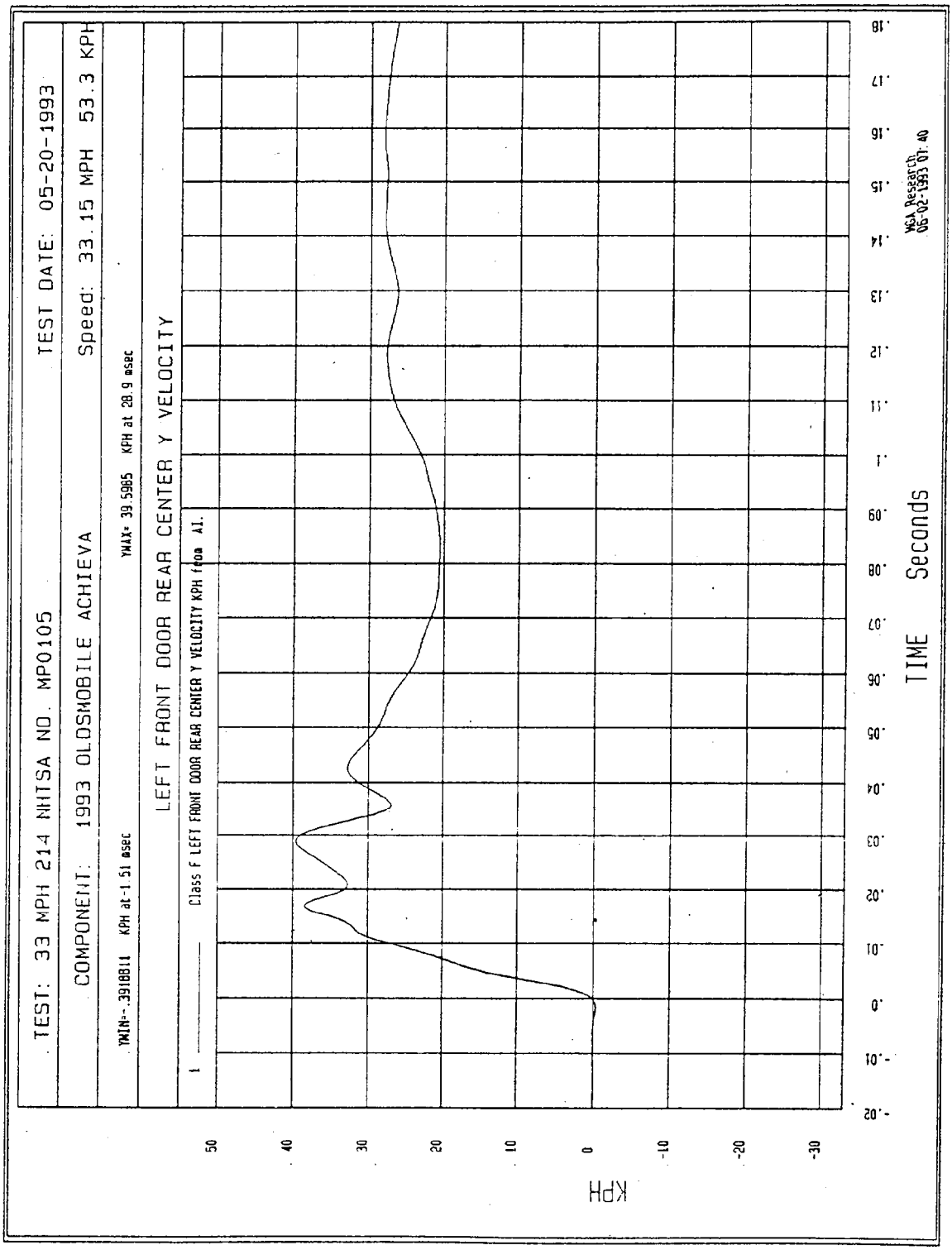


Figure B-34 - Front Door Rear Center Y Velocity vs. Time

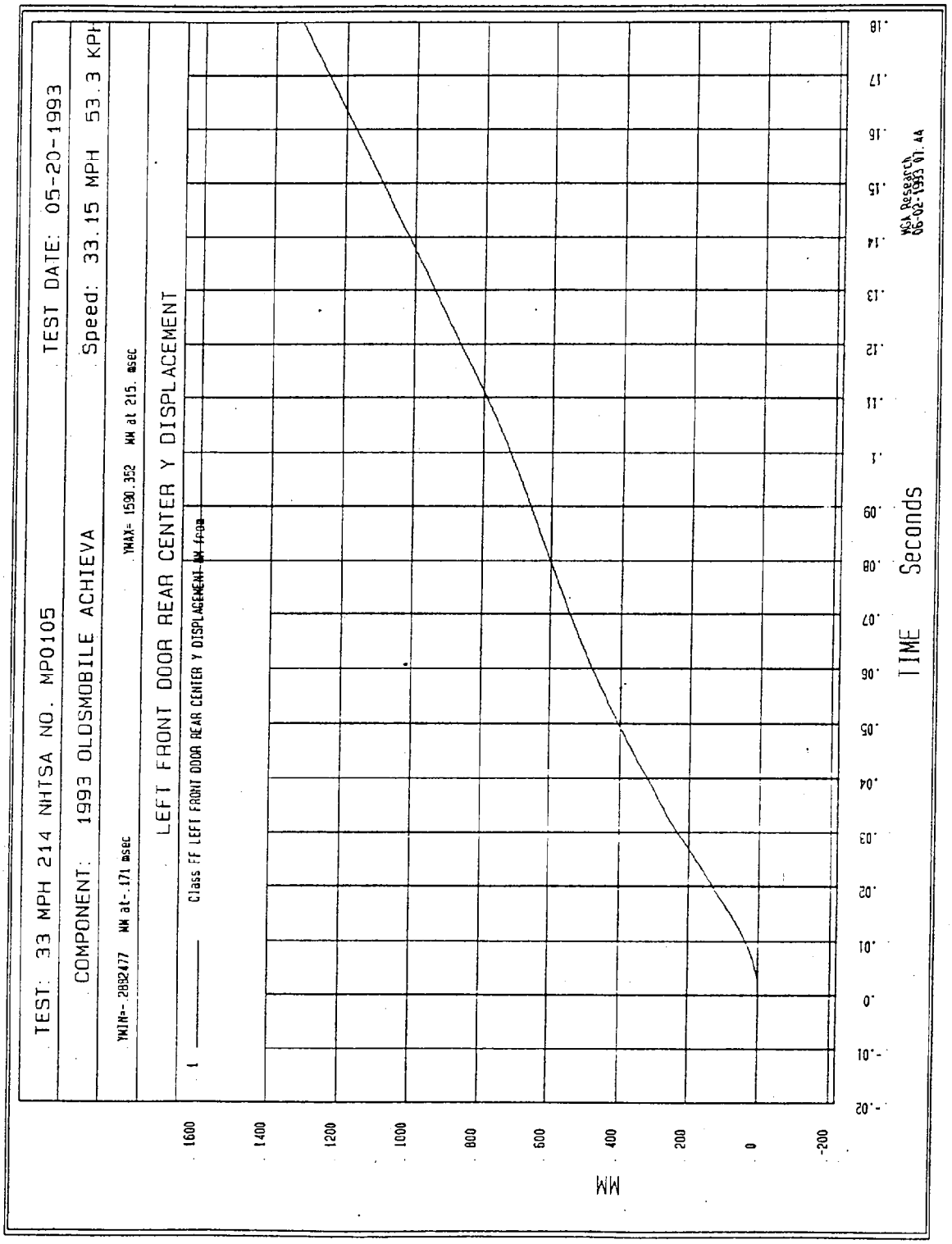


Figure B-35 - Front Door Rear Center Y Displacement vs. Time

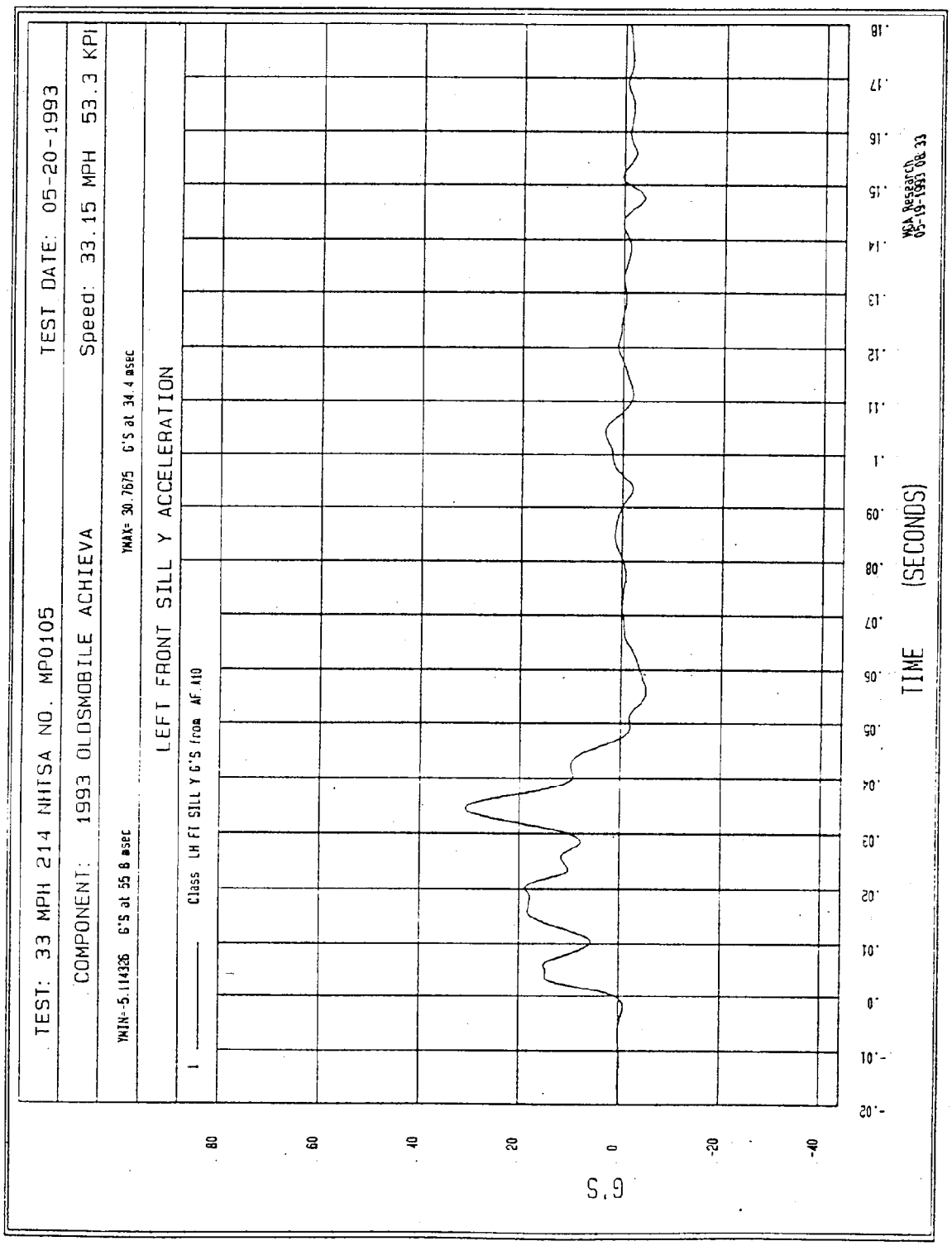


Figure B-36 - Left Front Sill Y Acceleration vs. Time

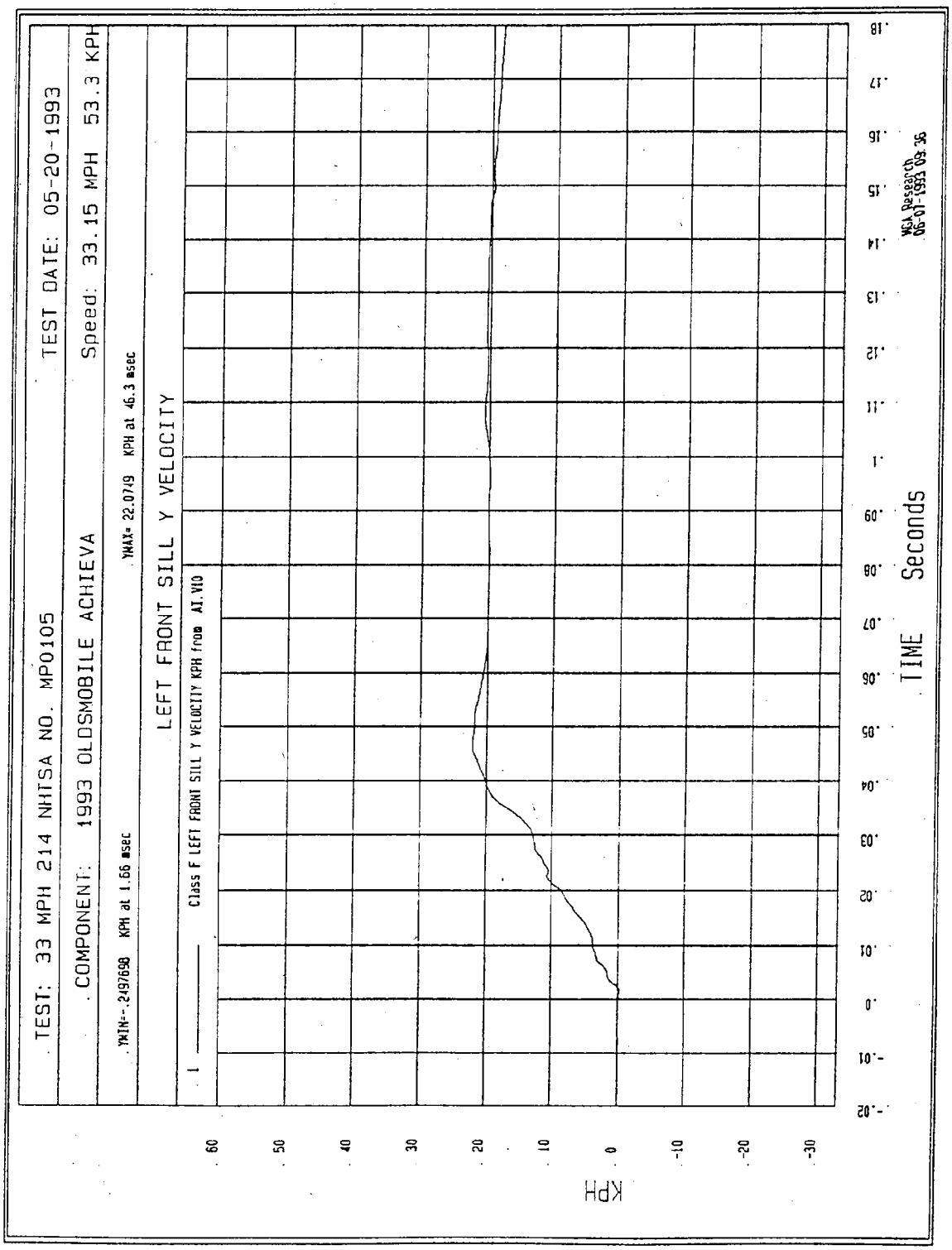


Figure B-37 - Left Front Sill Y Velocity vs. Time

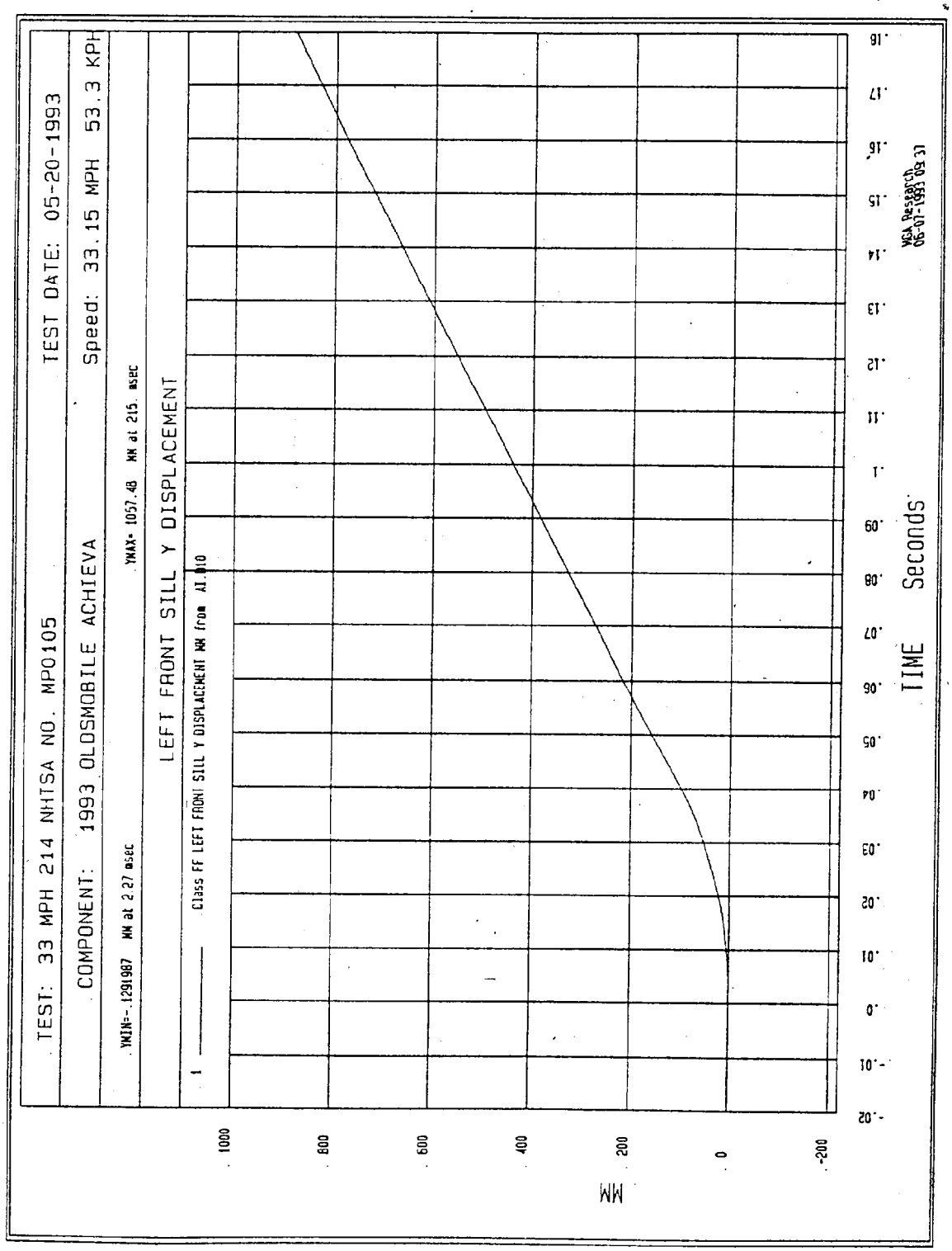


Figure B-38 - Left Front Sill Y Displacement vs. Time

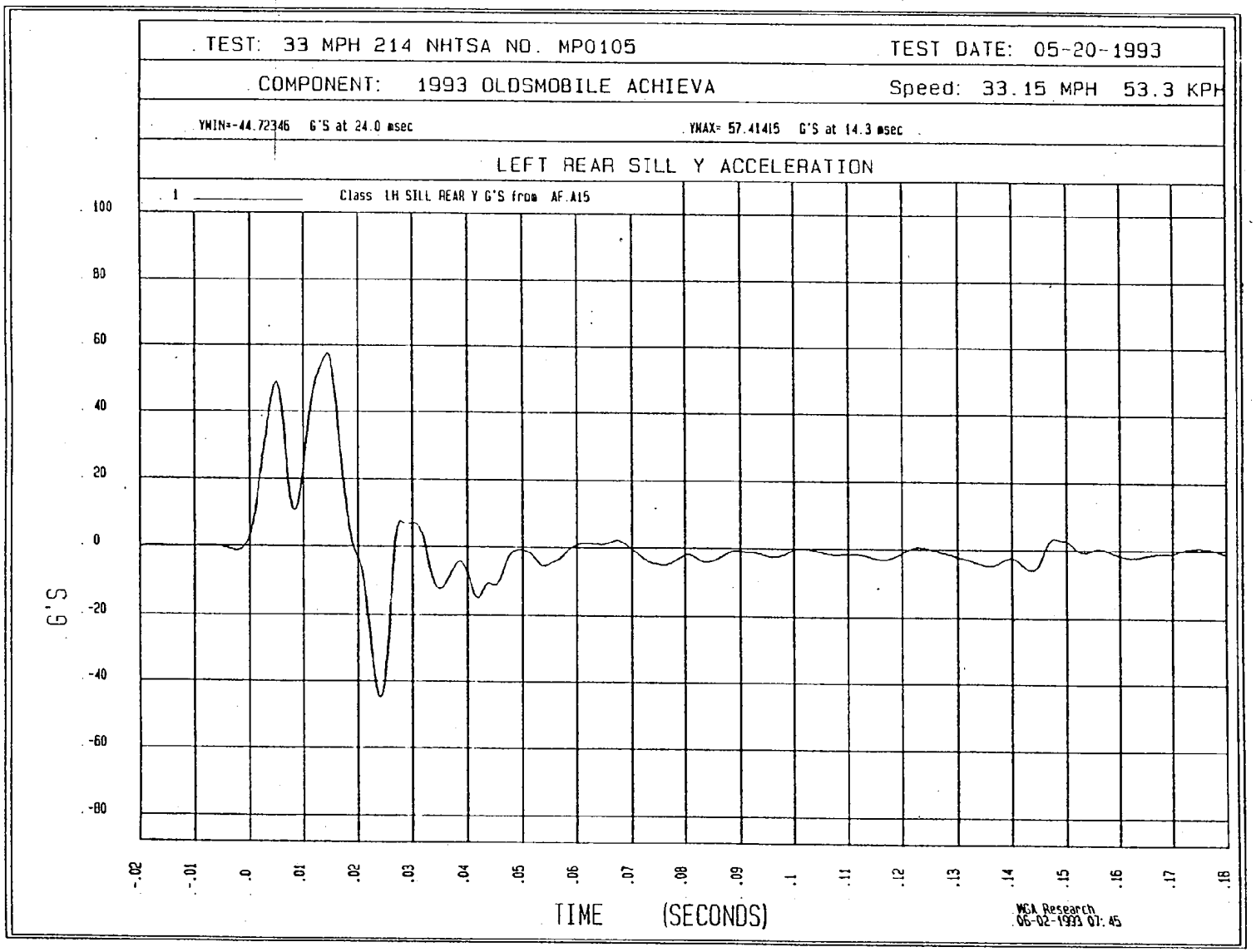


Figure B-39 - Left Rear Sill Y Acceleration vs. Time

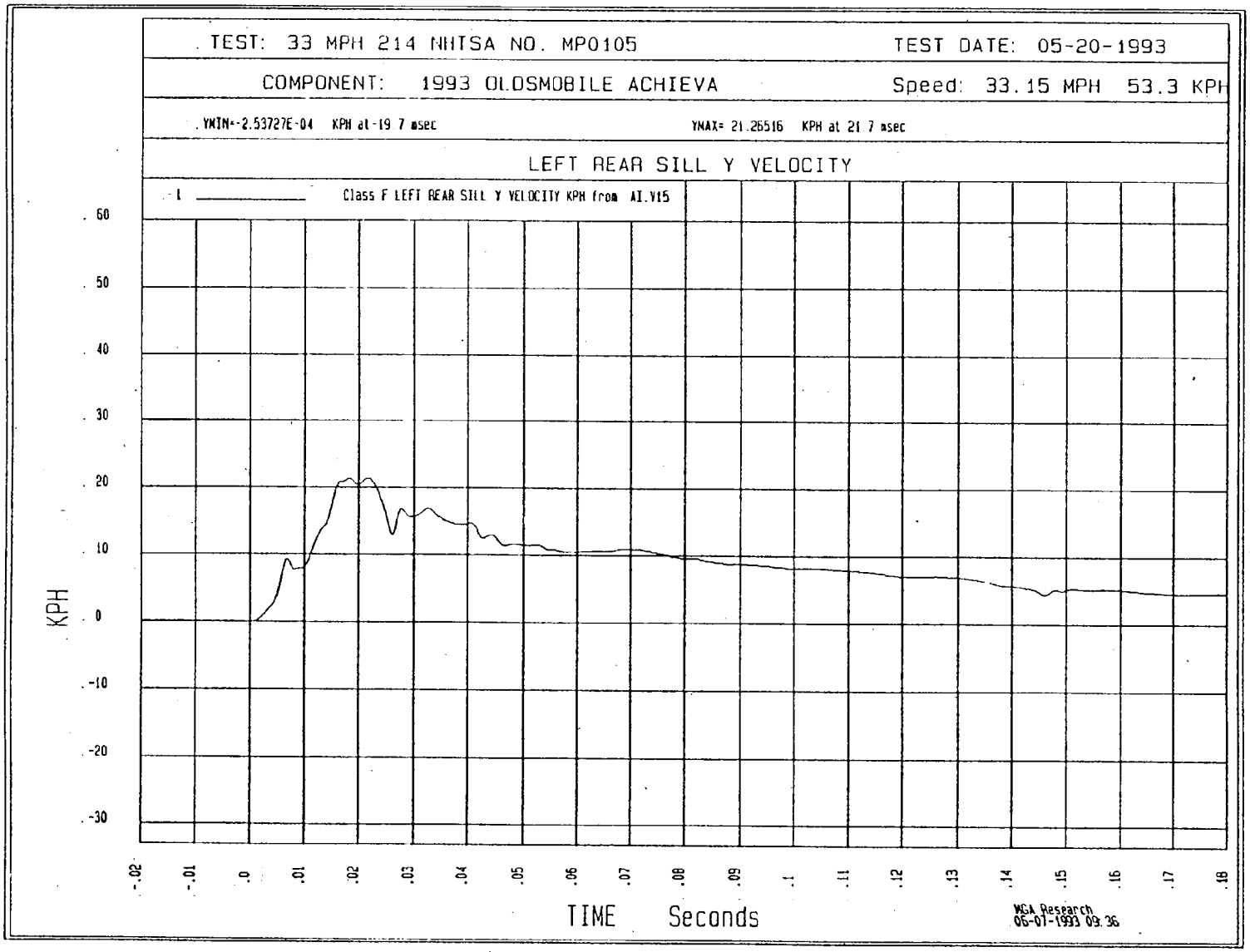


Figure B-40 - Left Rear Sill Y Velocity vs. Time

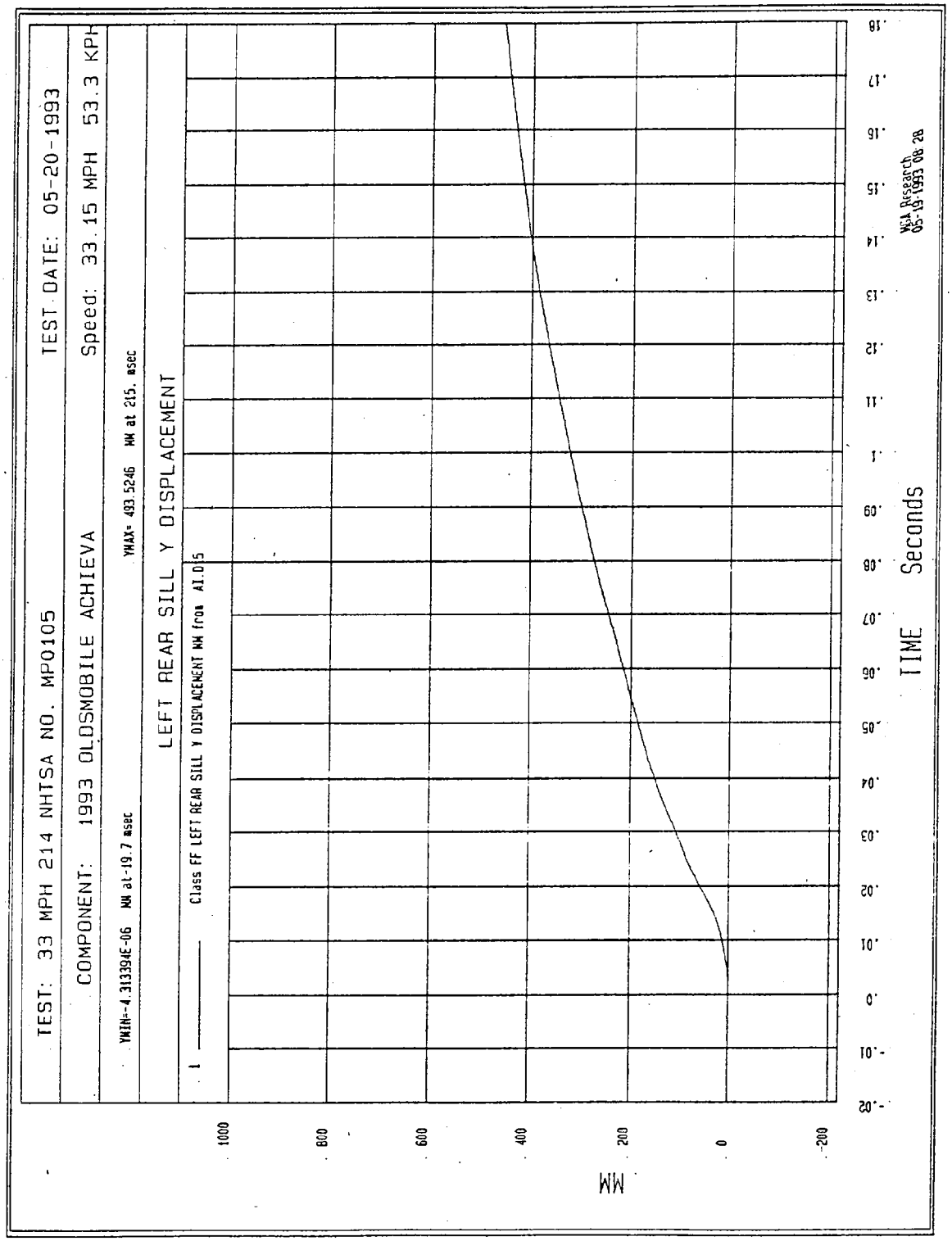


Figure B-41 - Left Rear Sill Y Displacement vs. Time

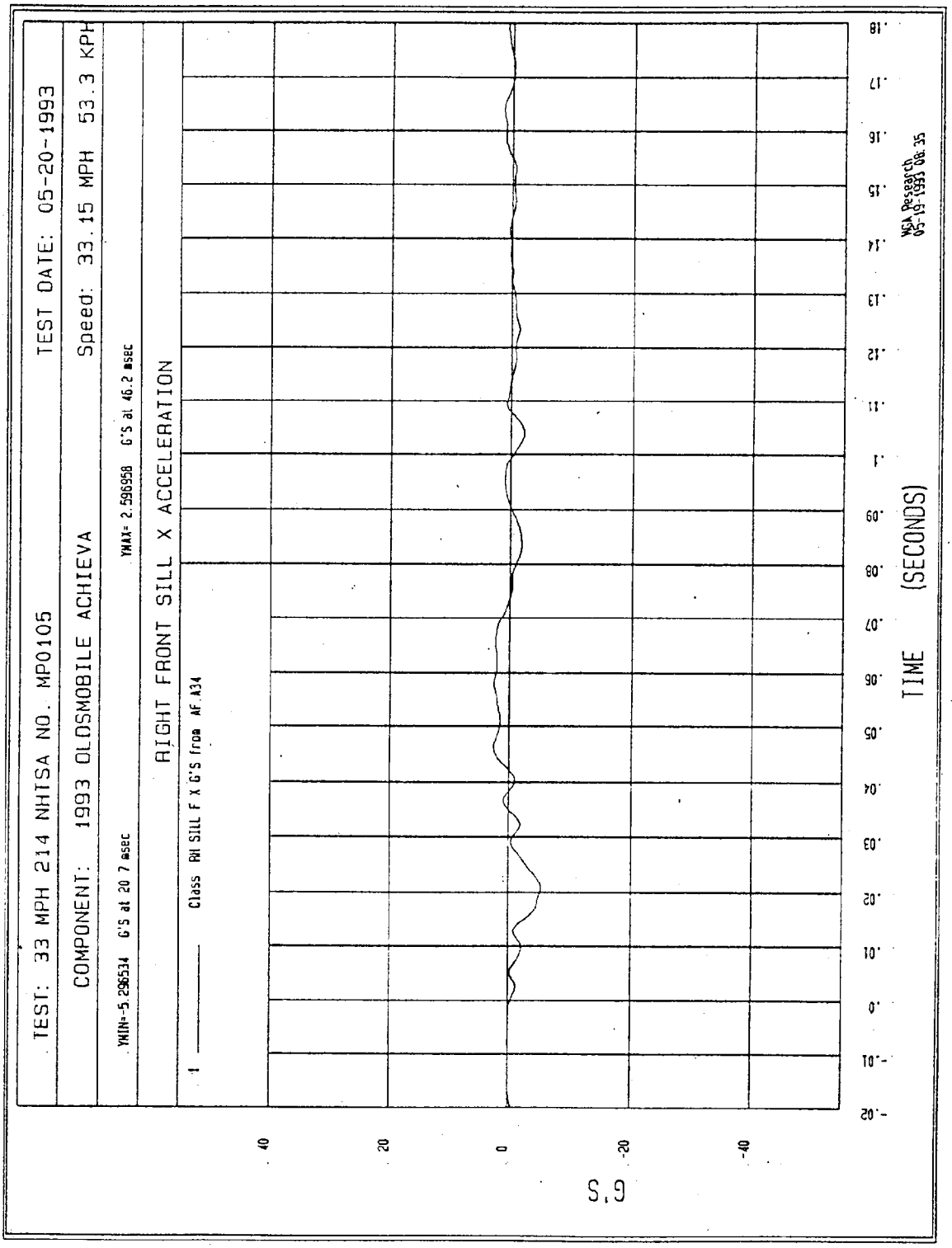


Figure B-42 - Right Front Sill X Acceleration vs. Time

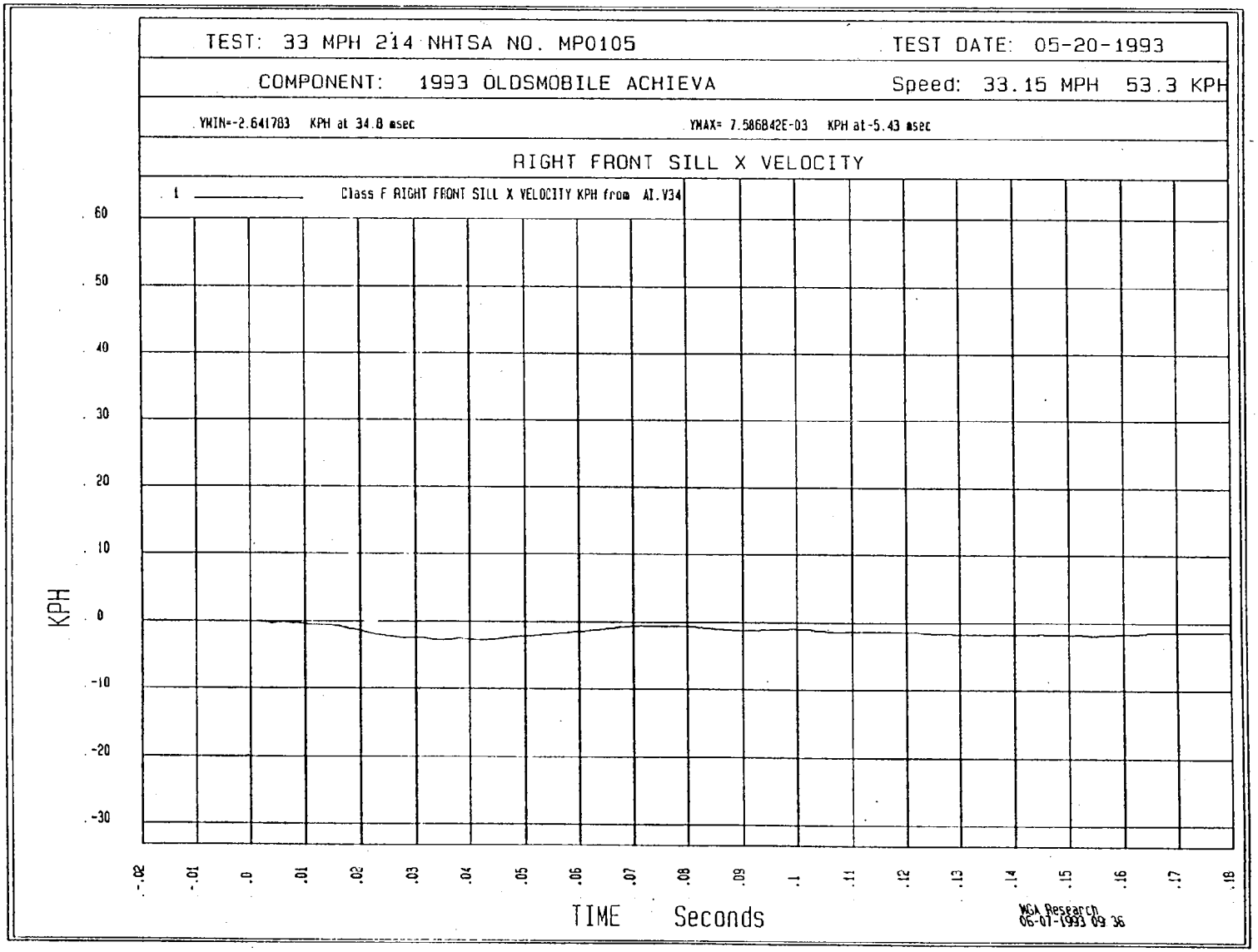


Figure B-43 - Right Front Sill X Velocity vs. Time

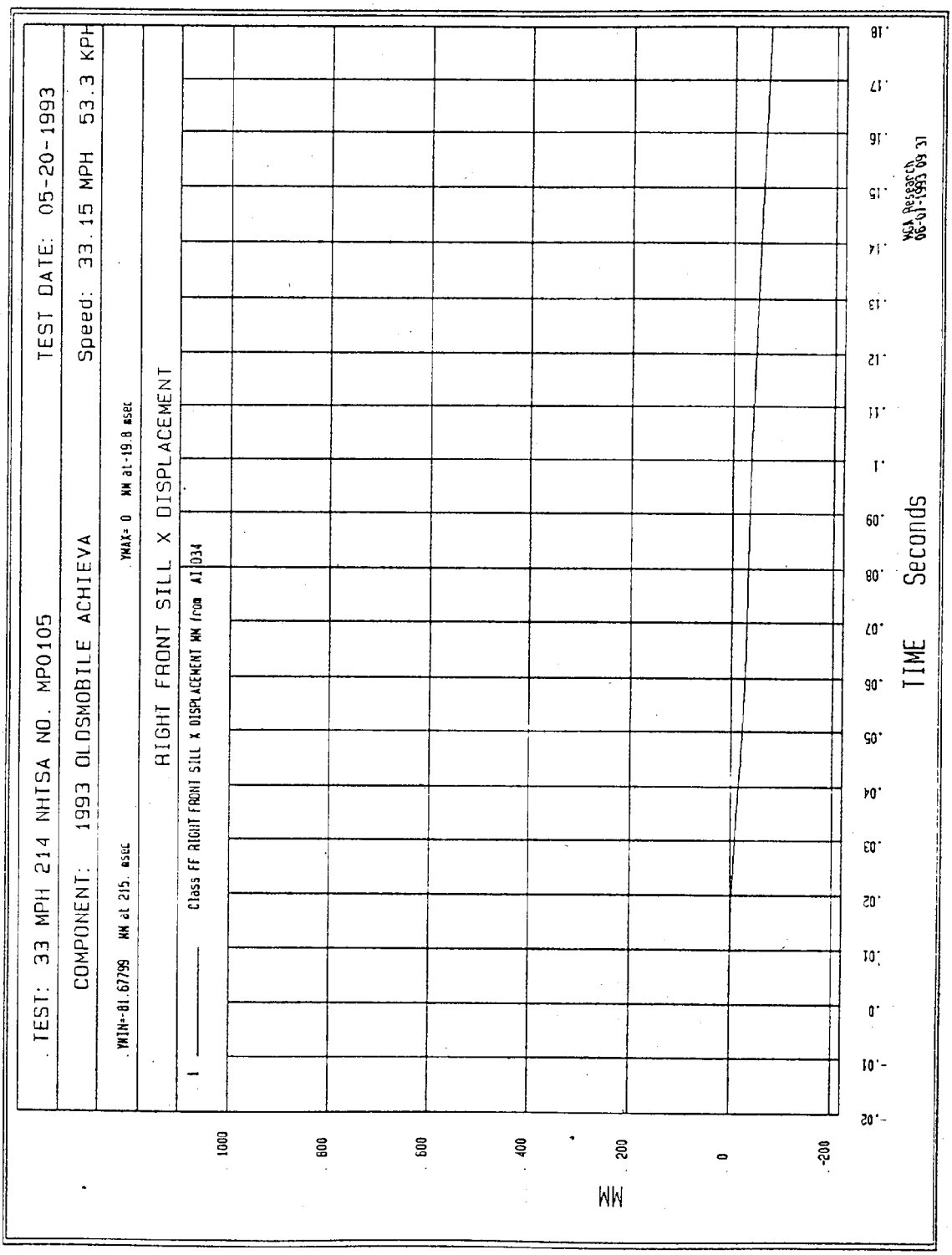


Figure B-44 - Right Front Sill X Displacement vs. Time

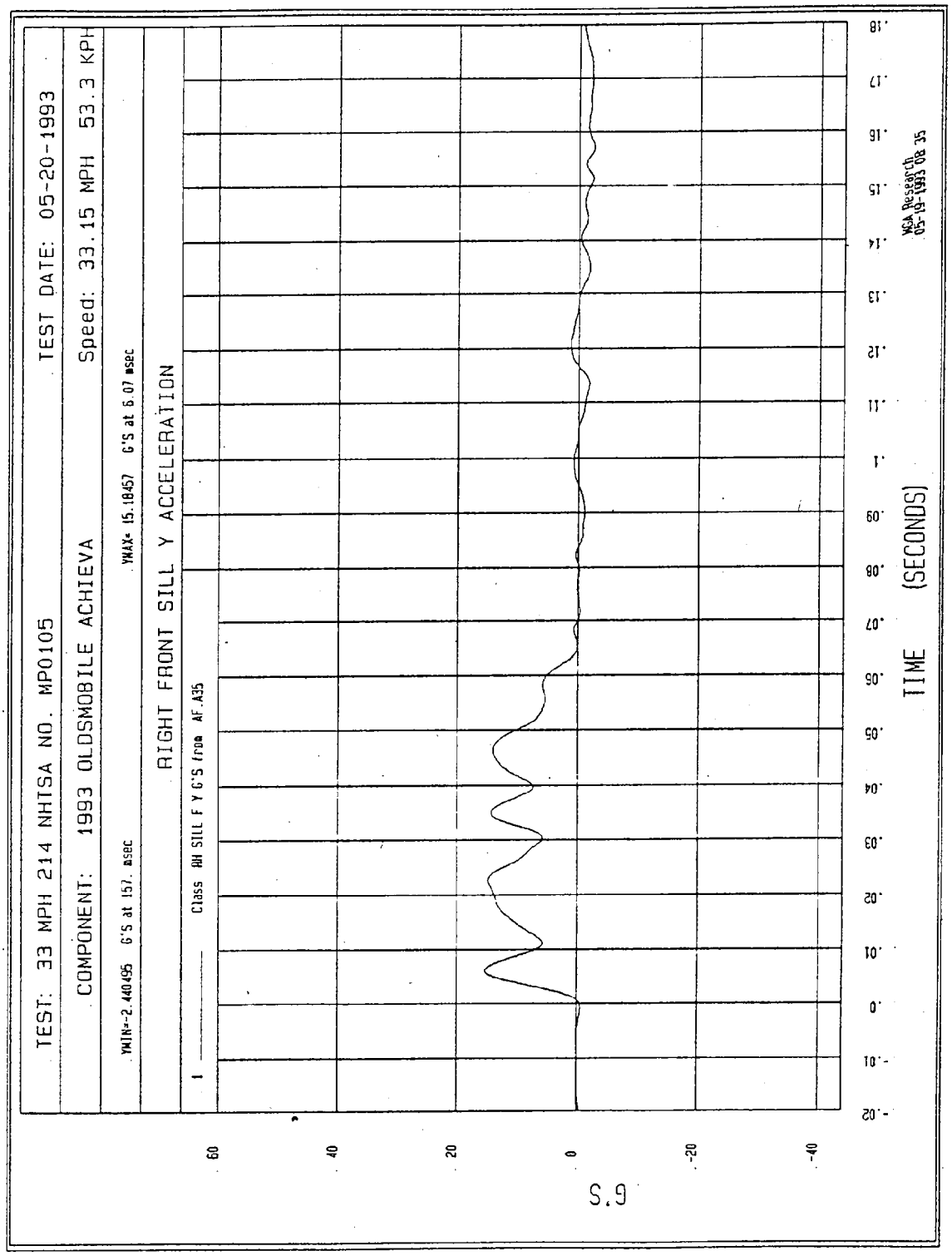


Figure B-45 - Right Front Sill Y Acceleration vs. Time

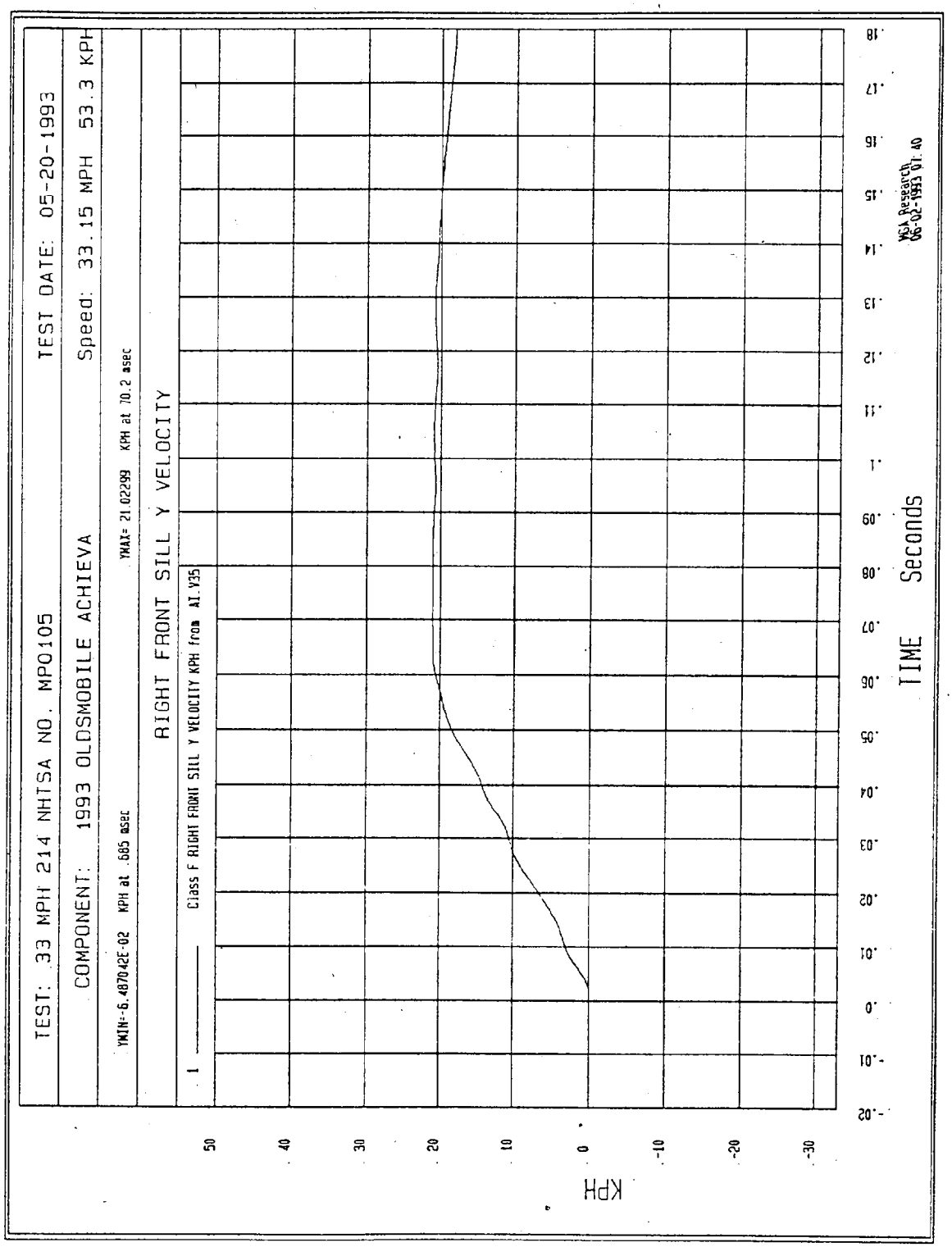


Figure B-46 - Right Front Sill Y Velocity vs. Time

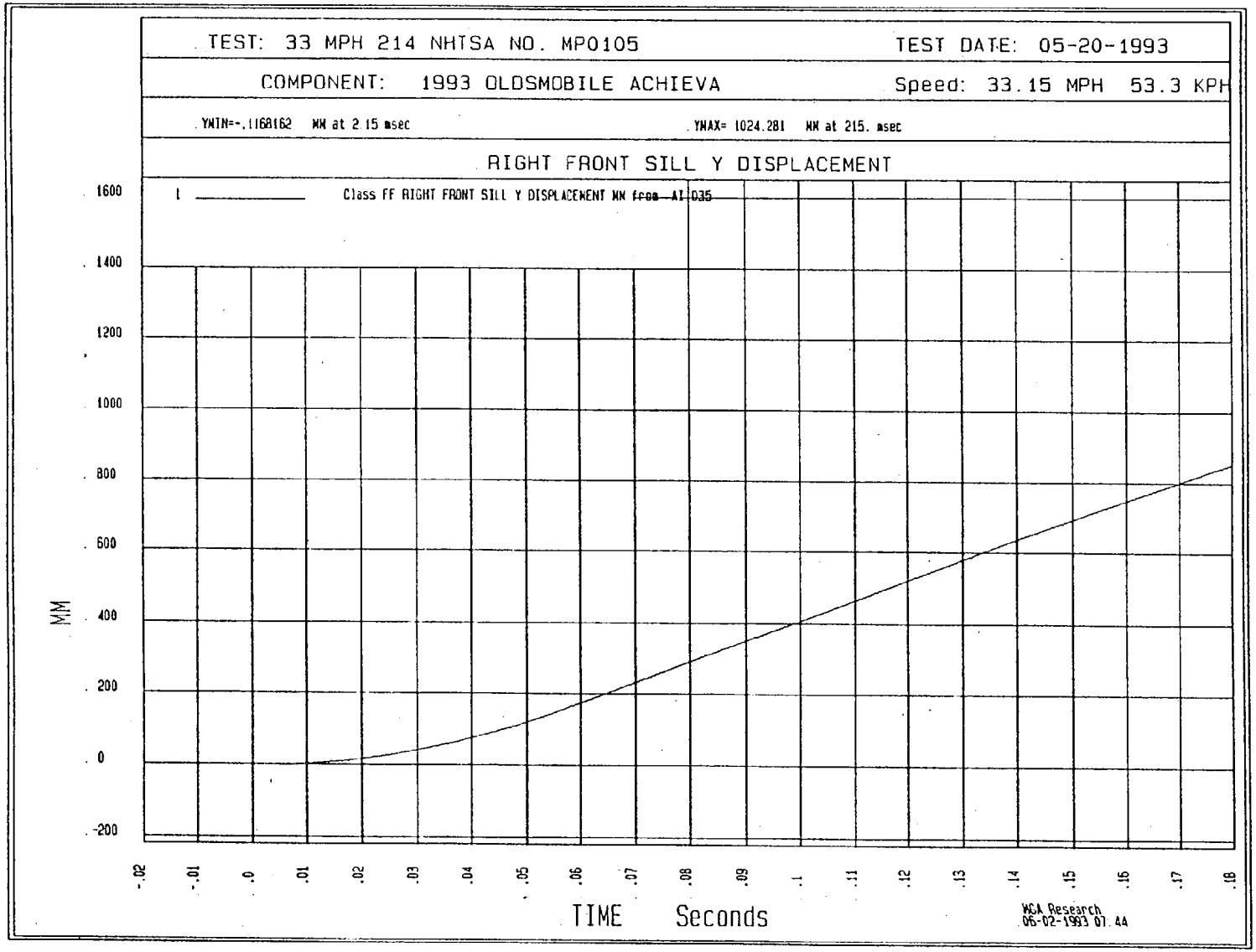


Figure B-47 - Right Front Sill Y Displacement vs. Time

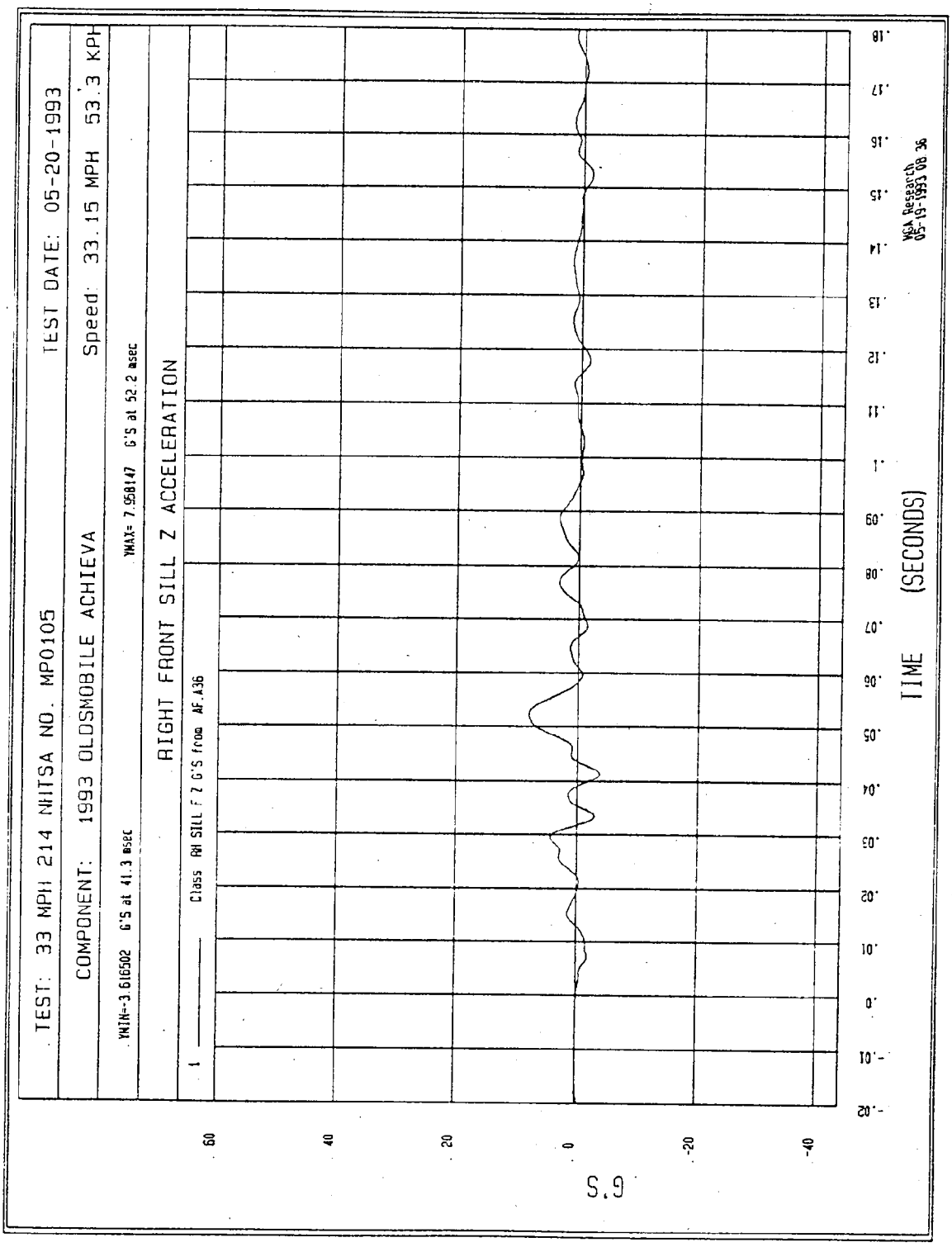


Figure B-48 - Right Front Sill Z Acceleration vs. Time

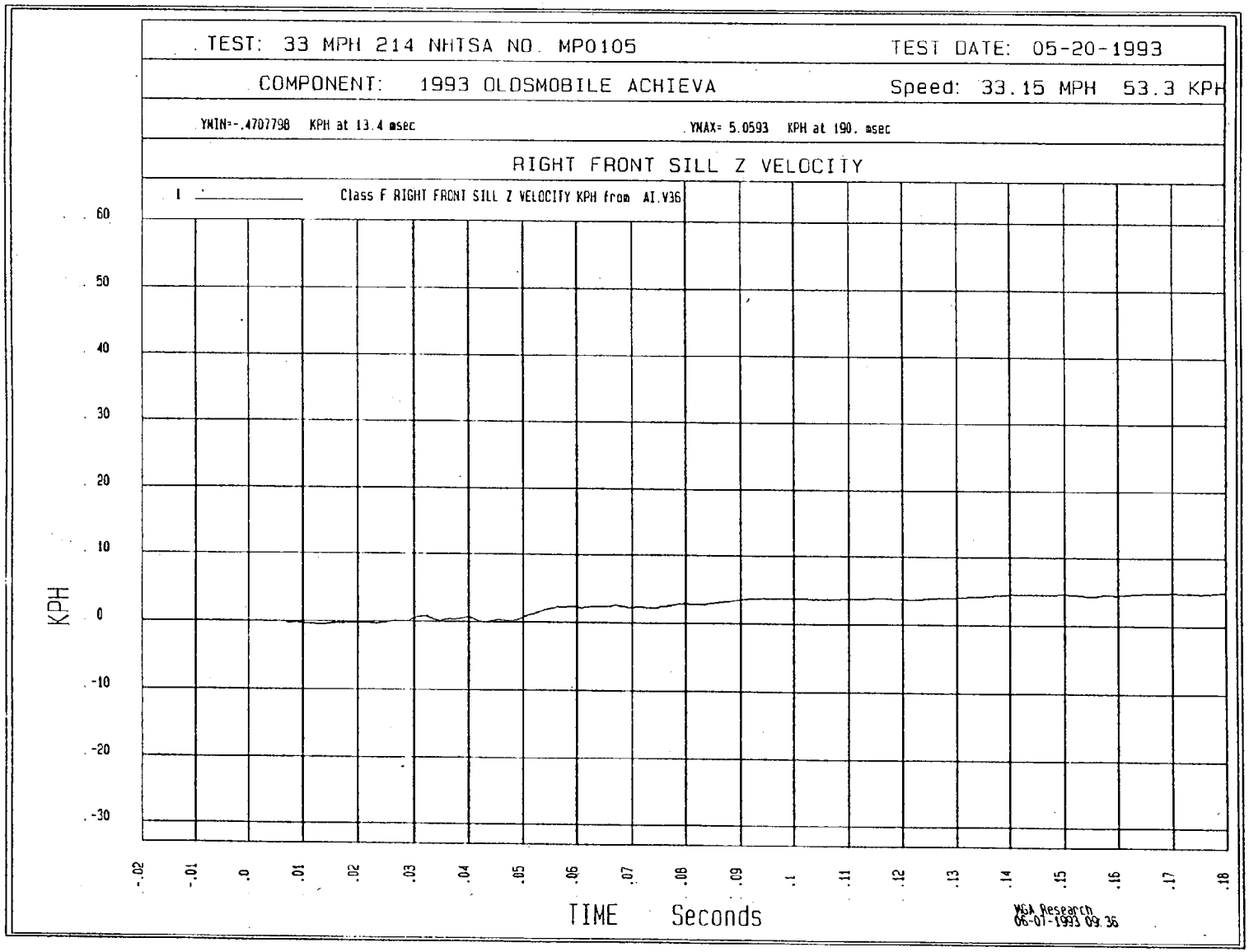


Figure B-49 - Right Front Sill Z Velocity vs. Time

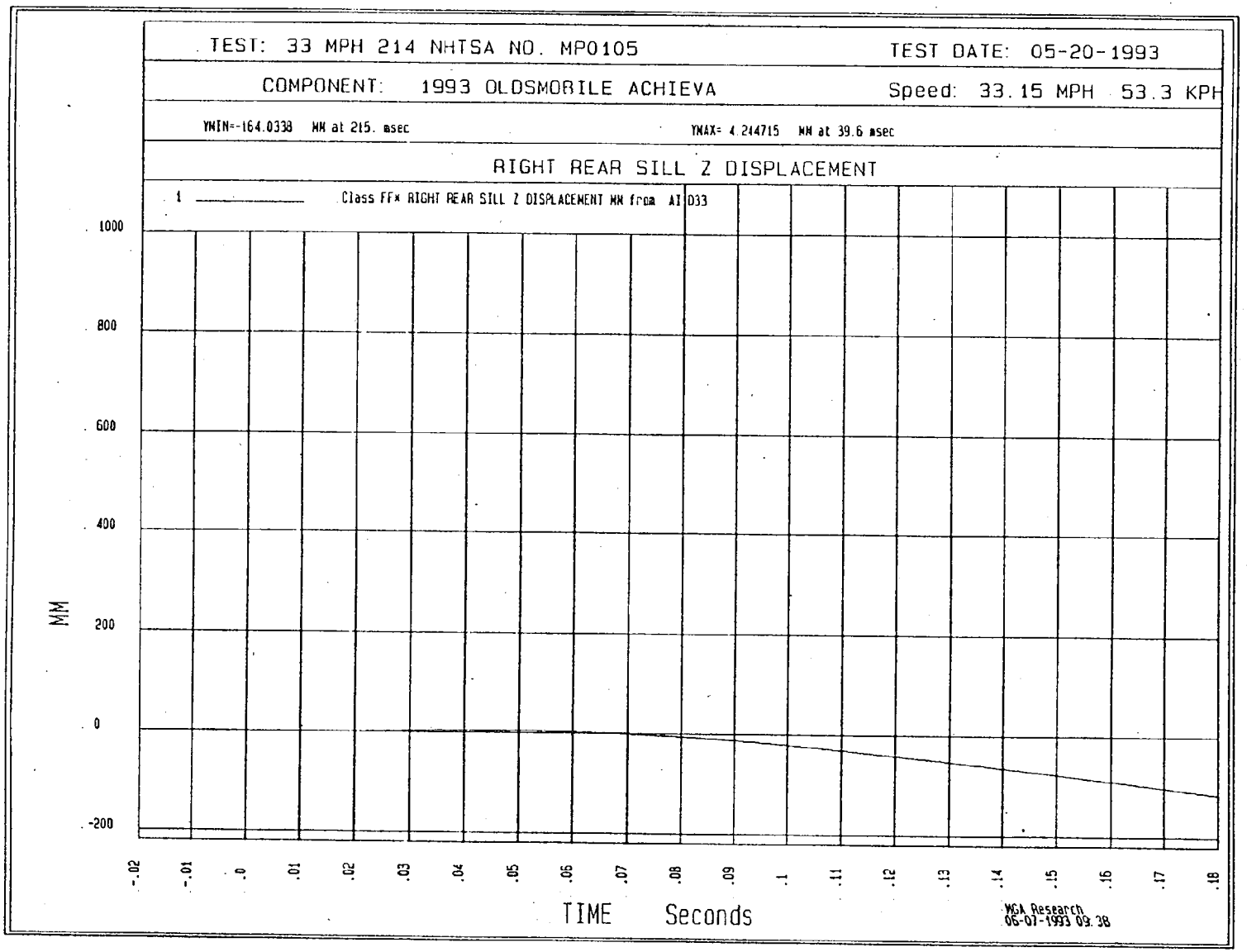


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Figure B-5Ø - Right Front Sill Z Displacement vs. Time

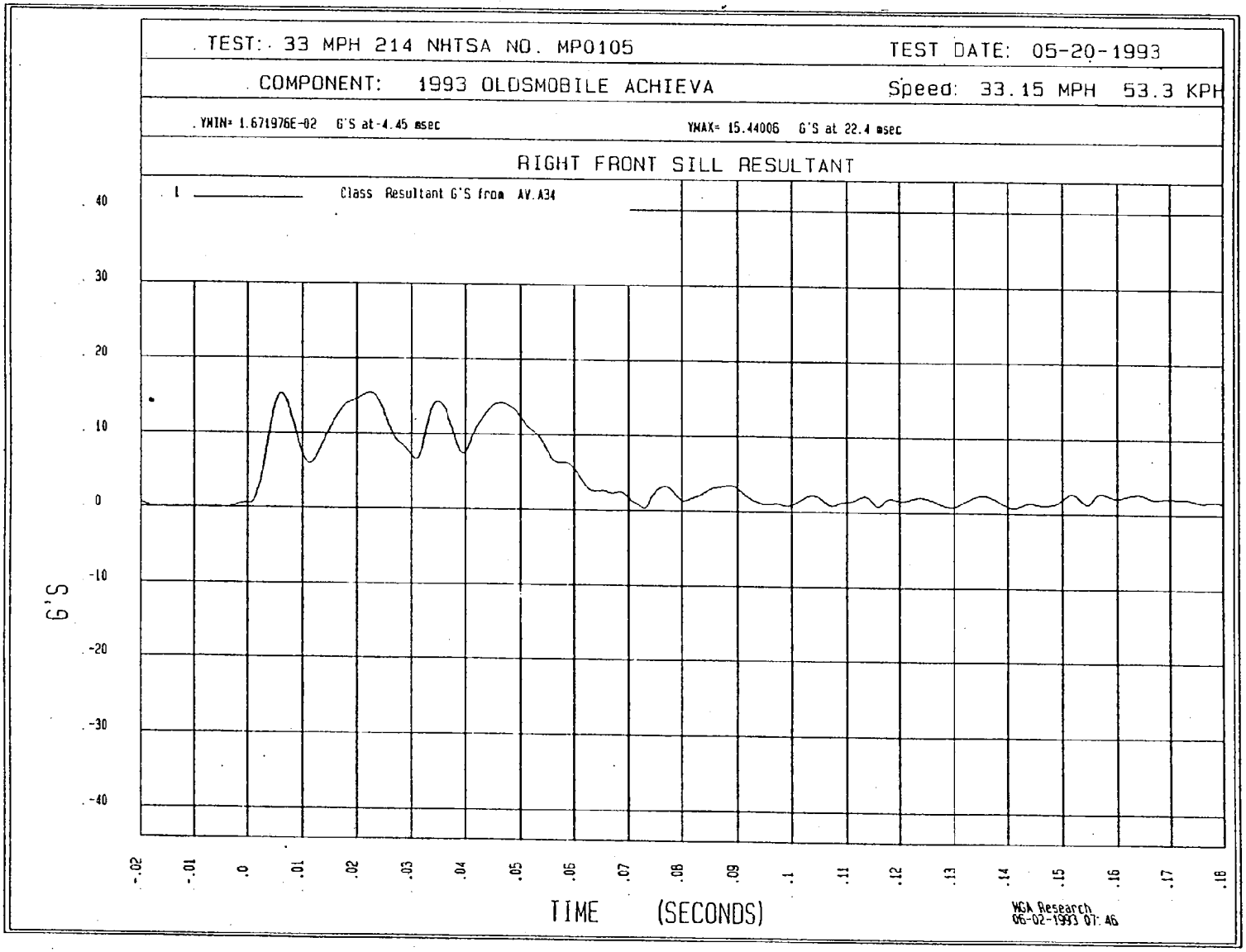



Figure B-51 - Right Front Sill at Front Seat Resultant vs. Time

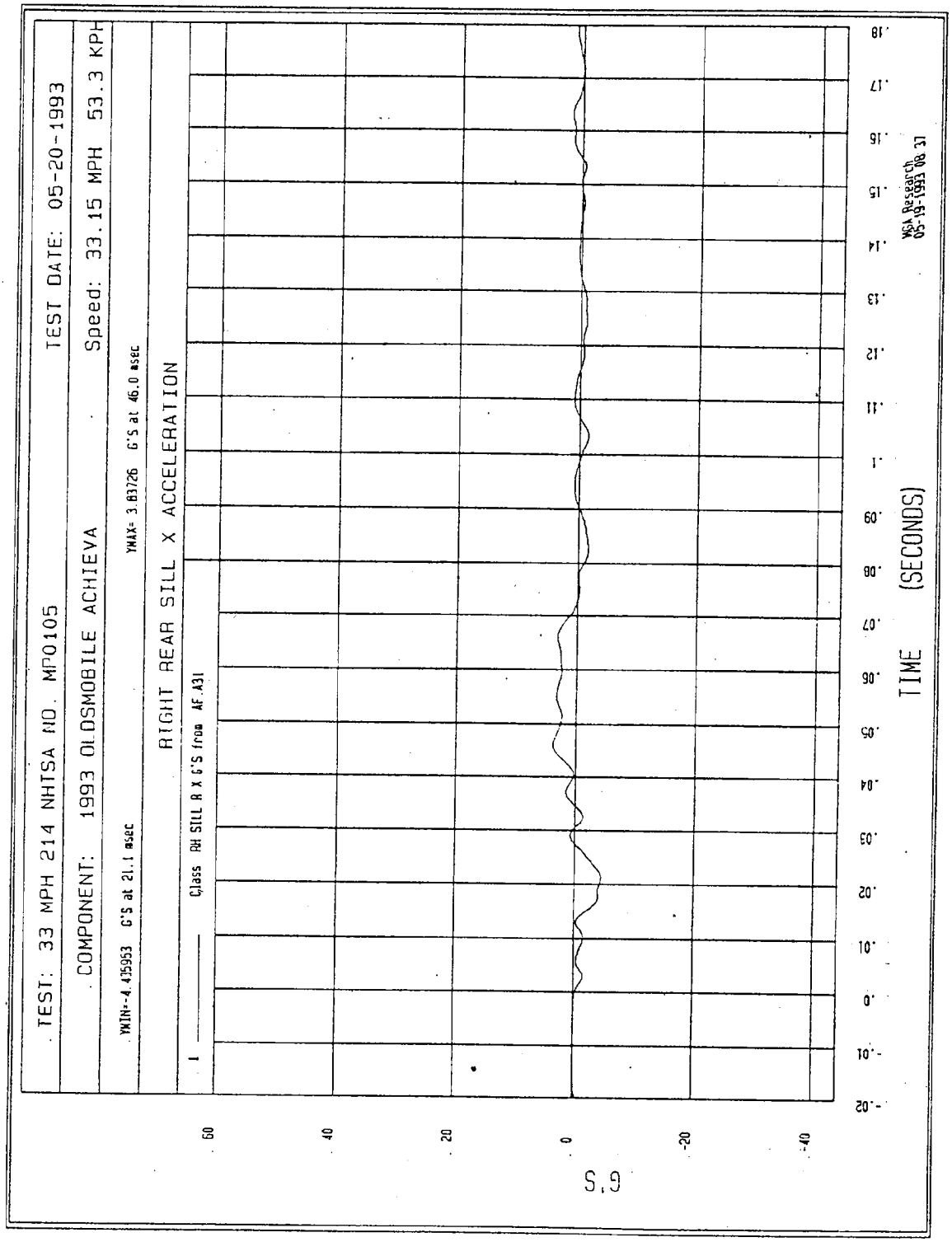



Figure B-52 - Right Rear Sill X Acceleration vs. Time

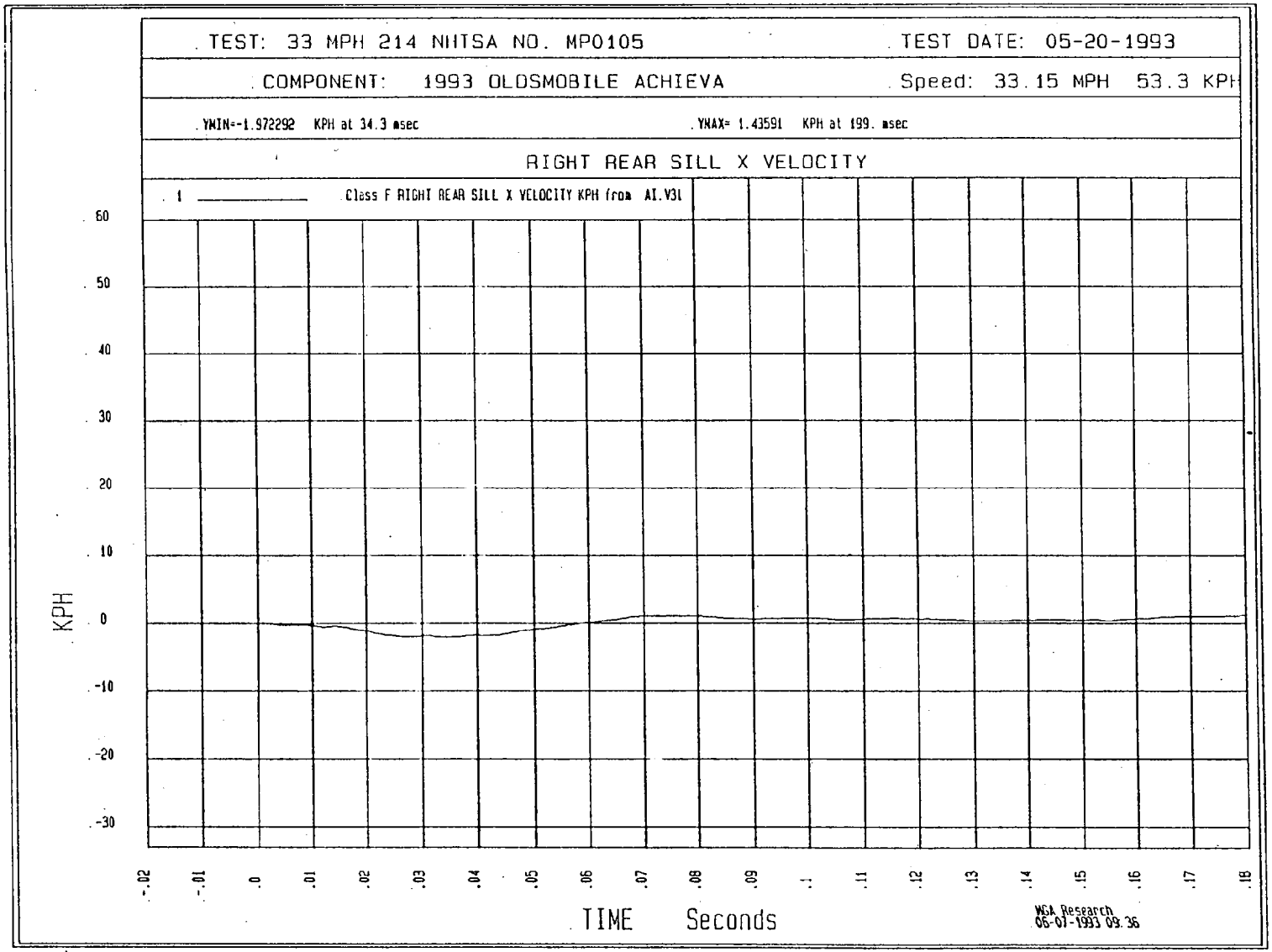



Figure B-53 - Right Rear Sill X Velocity vs. Time

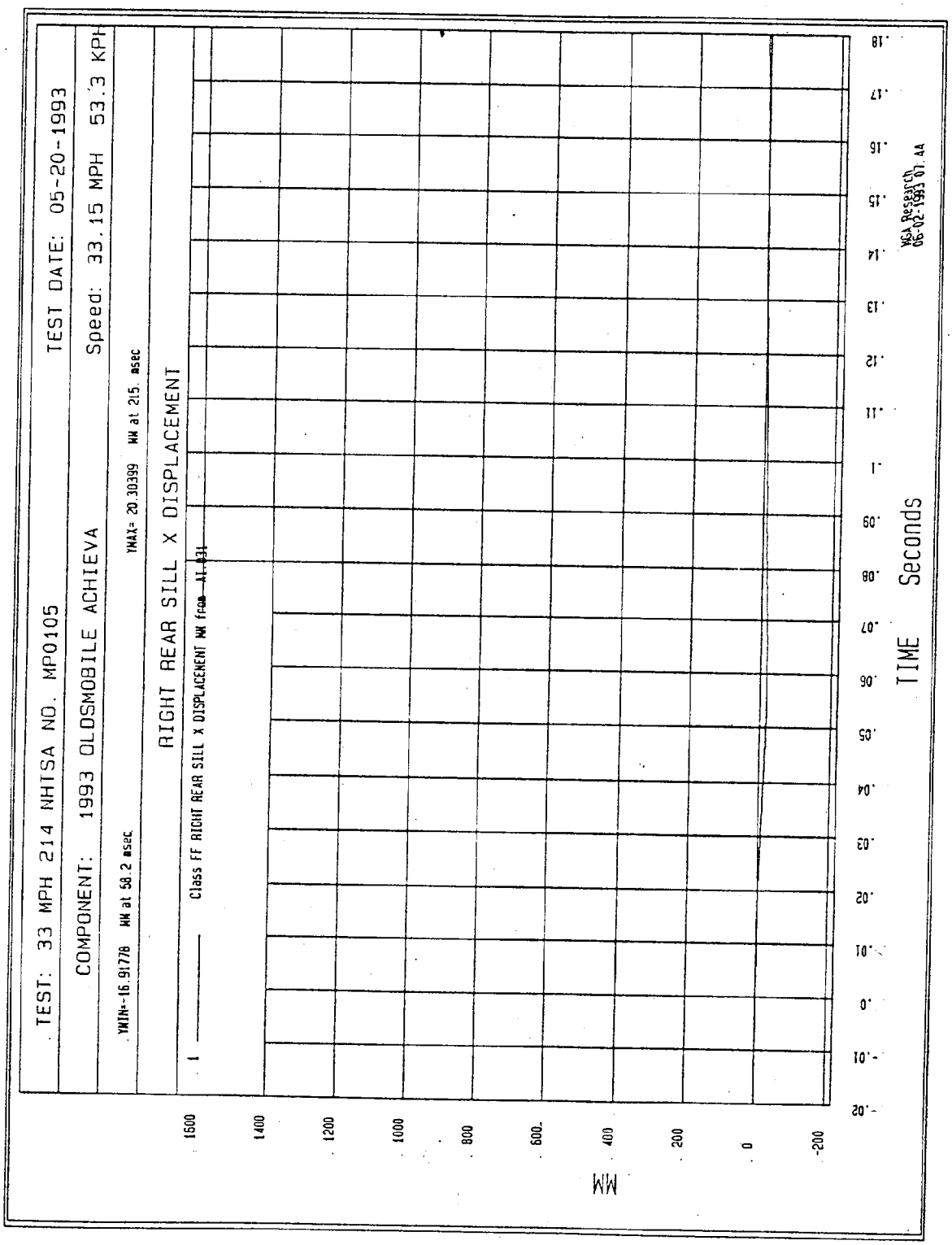



Figure B-54 - Right Rear Sill X Displacement vs. Time

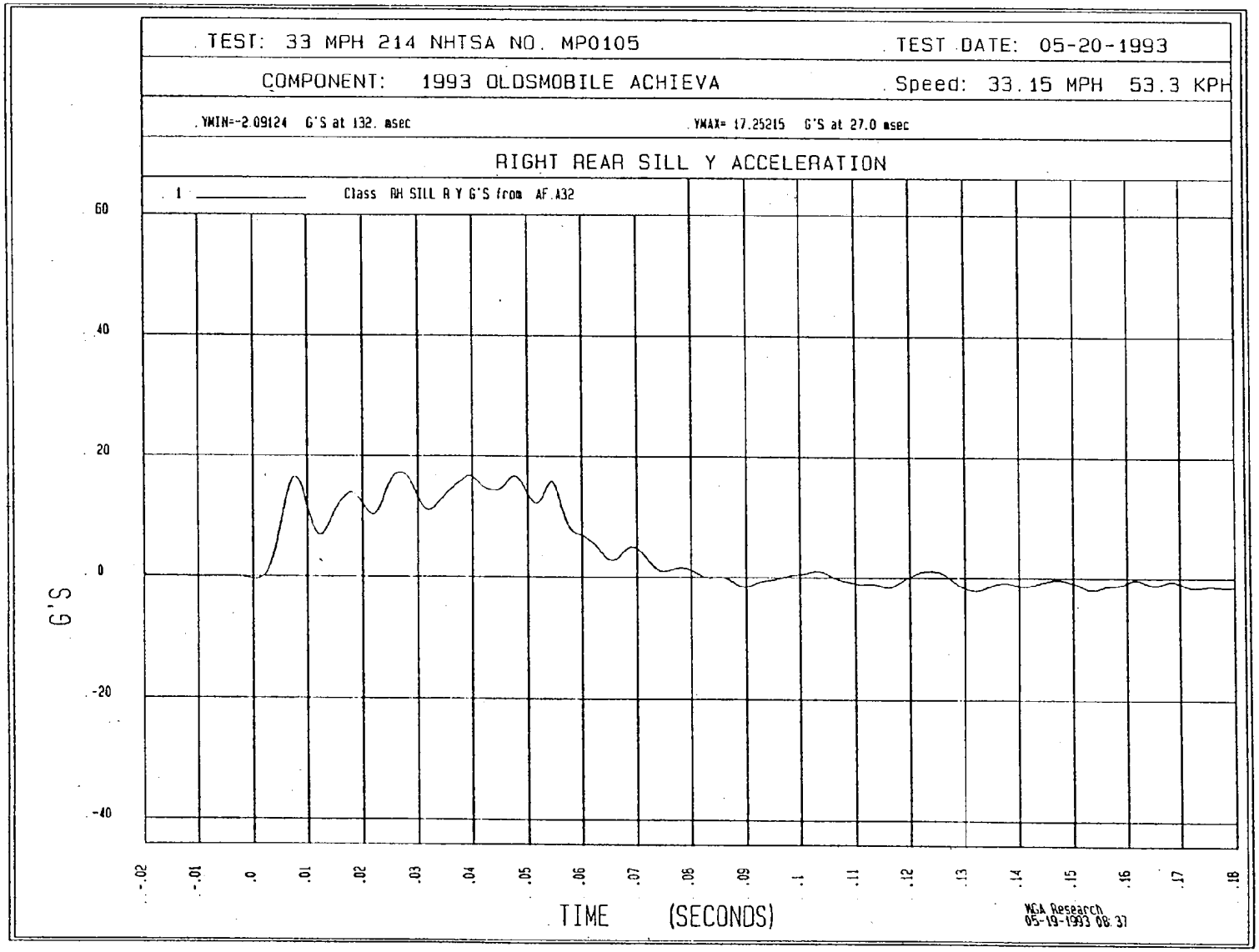



Figure B-55 - Right Rear Sill Y Acceleration vs. Time

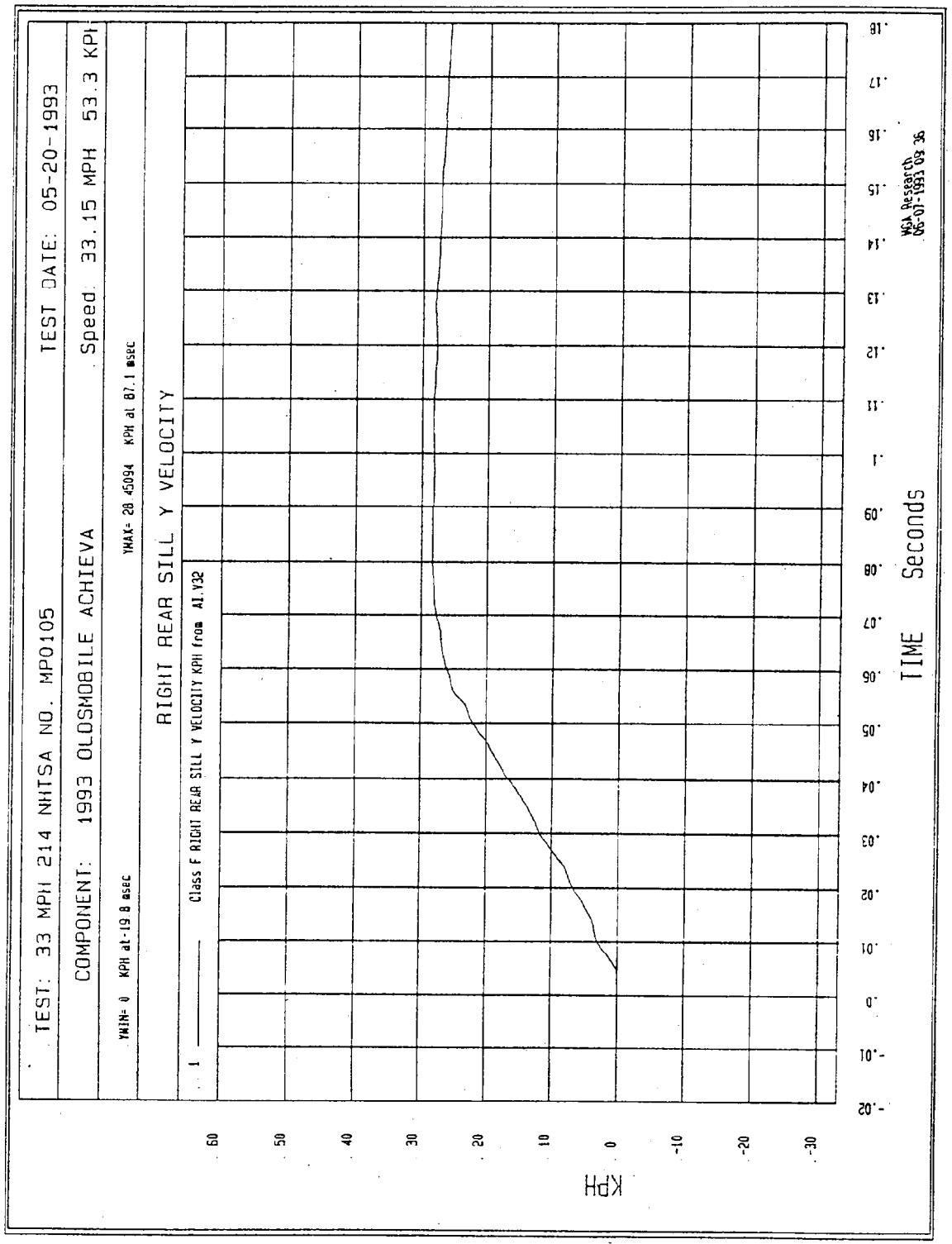



Figure B-56 - Right Rear Sill Y Velocity vs. Time

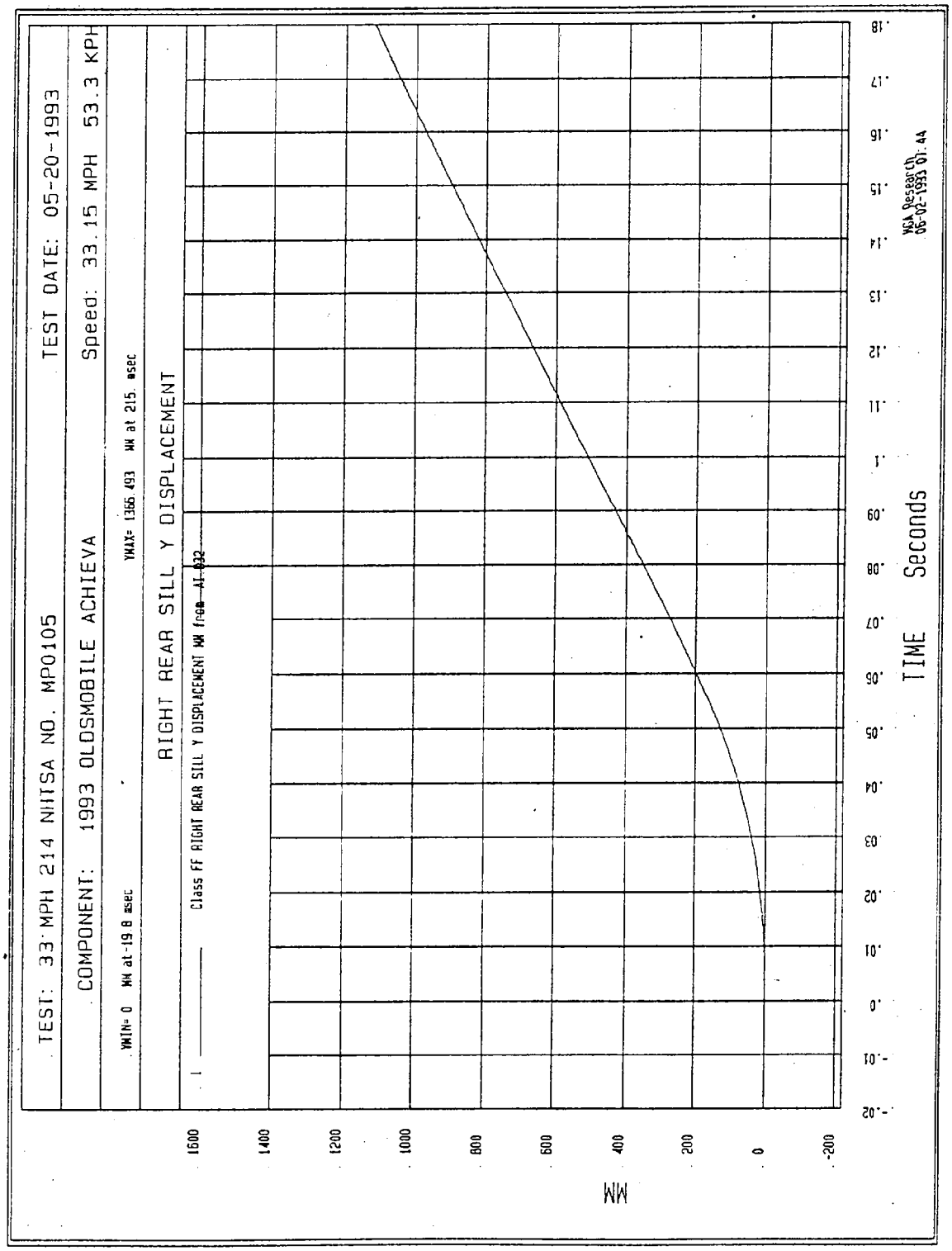



Figure B-57 - Right Rear Sill Y Displacement vs. Time

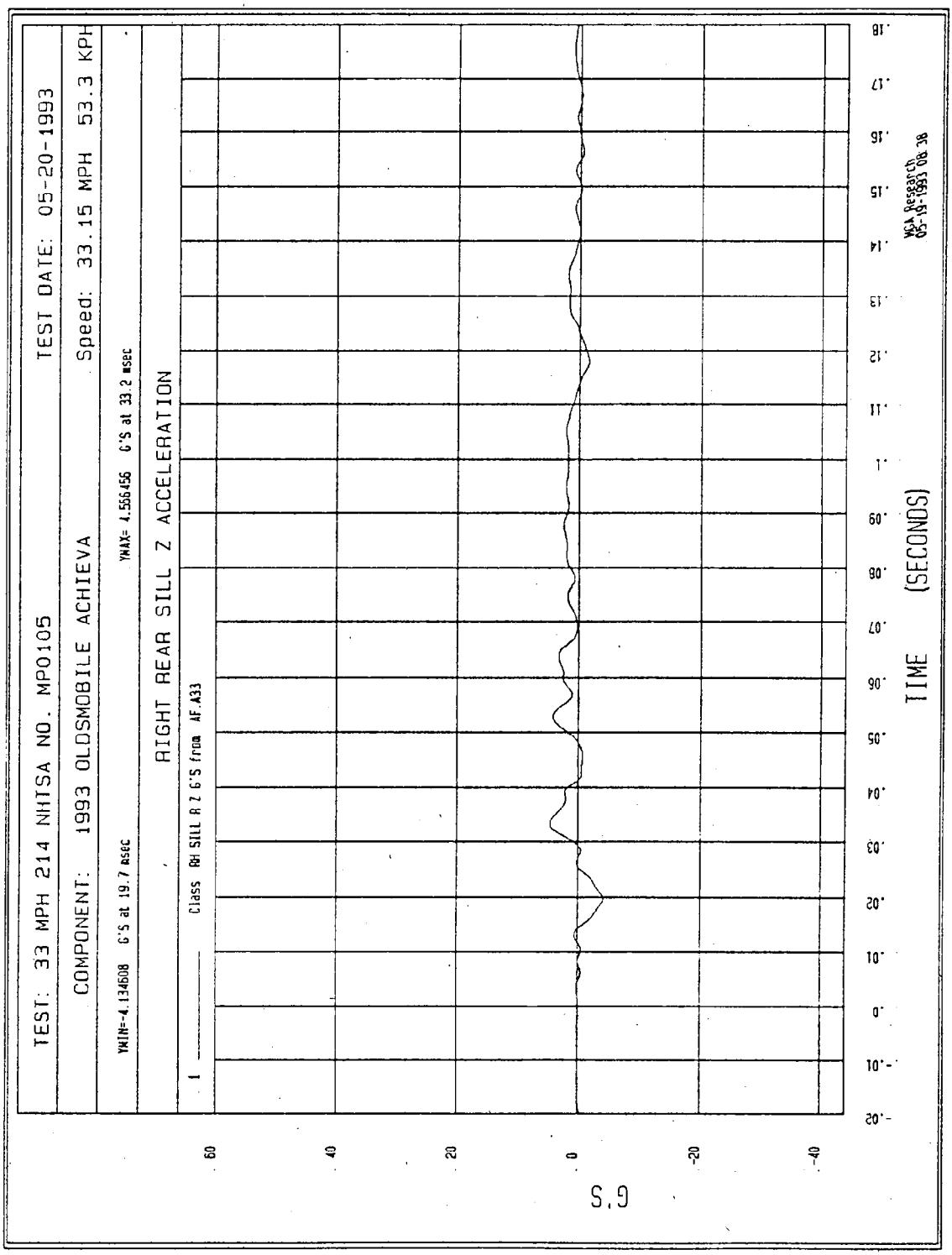



Figure B-58 - Right Rear Sill Z Acceleration vs. Time

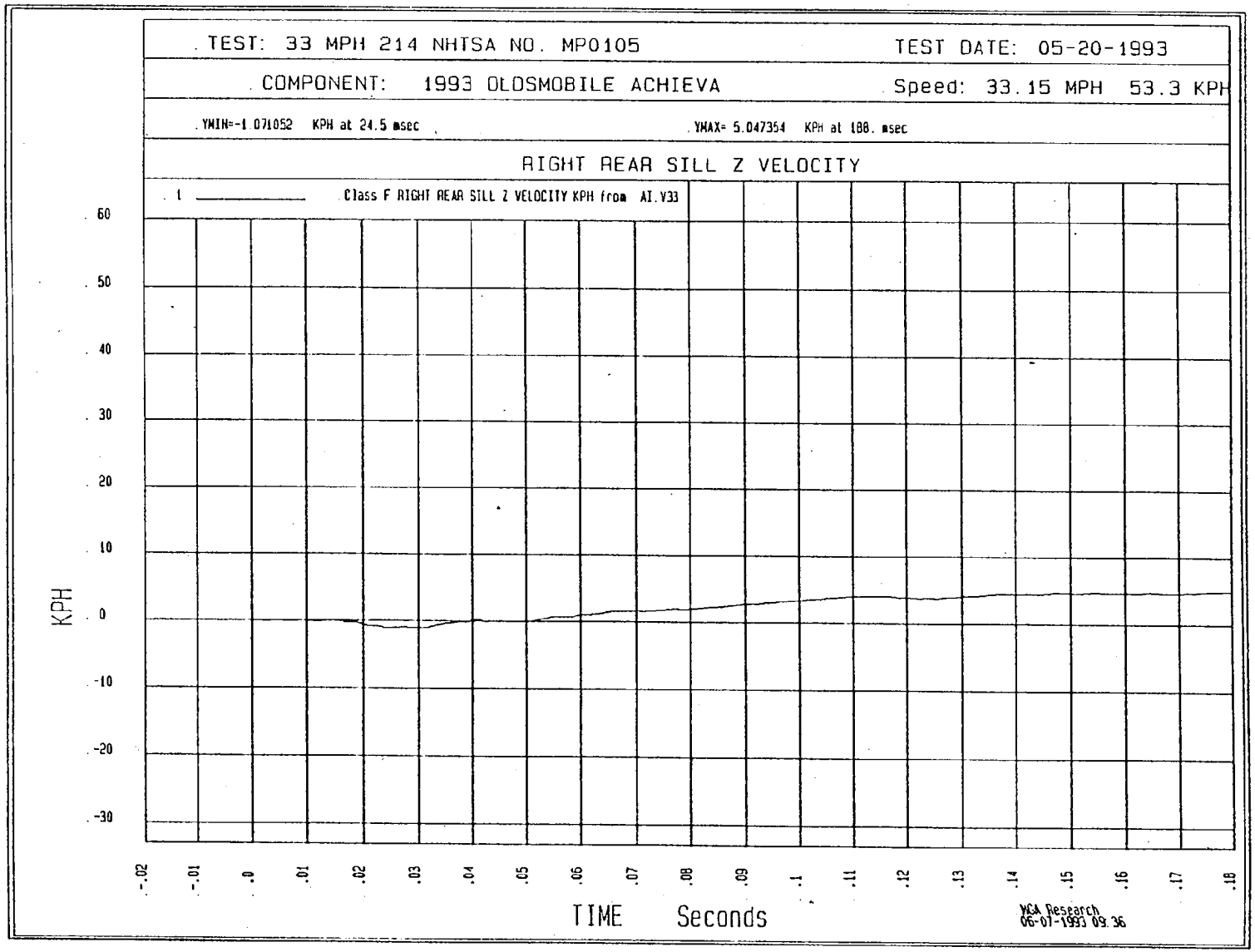



Figure B-59 - Right Rear Sill Z Velocity vs. Time

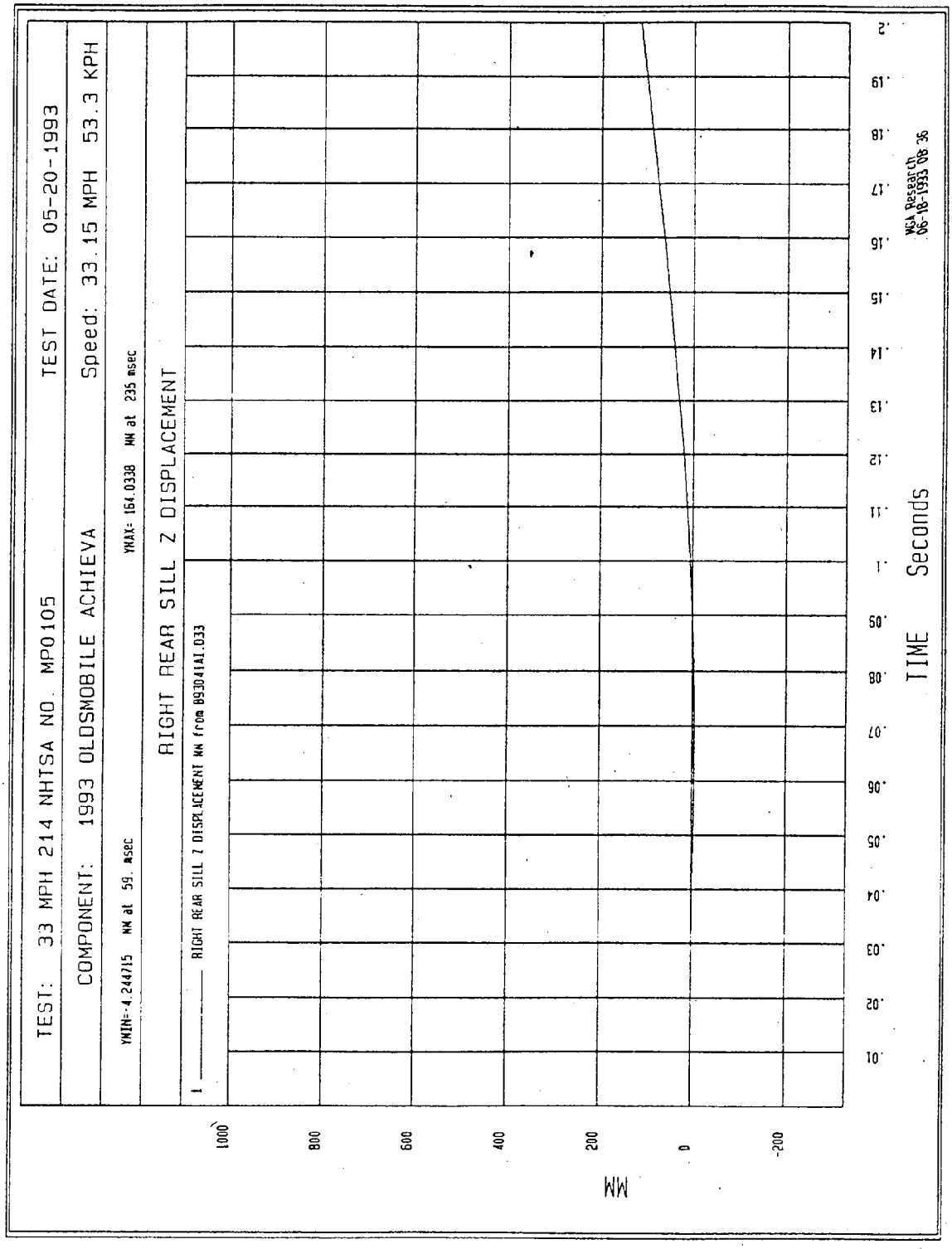



Figure B-60 - Right Rear Sill z Displacement vs. Time

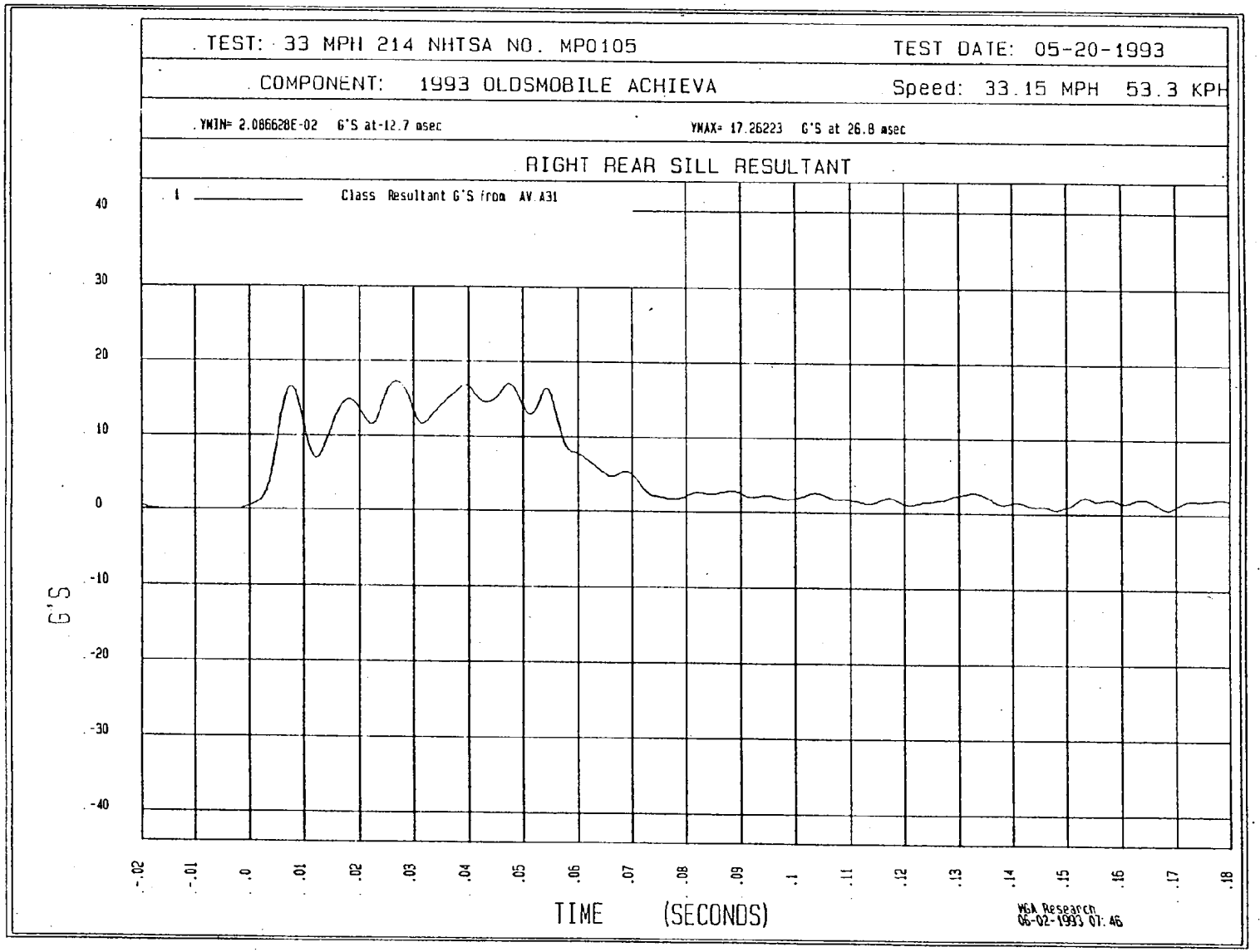



Figure B-61 - Right Rear Sill at Rear Seat Resultant vs. Time

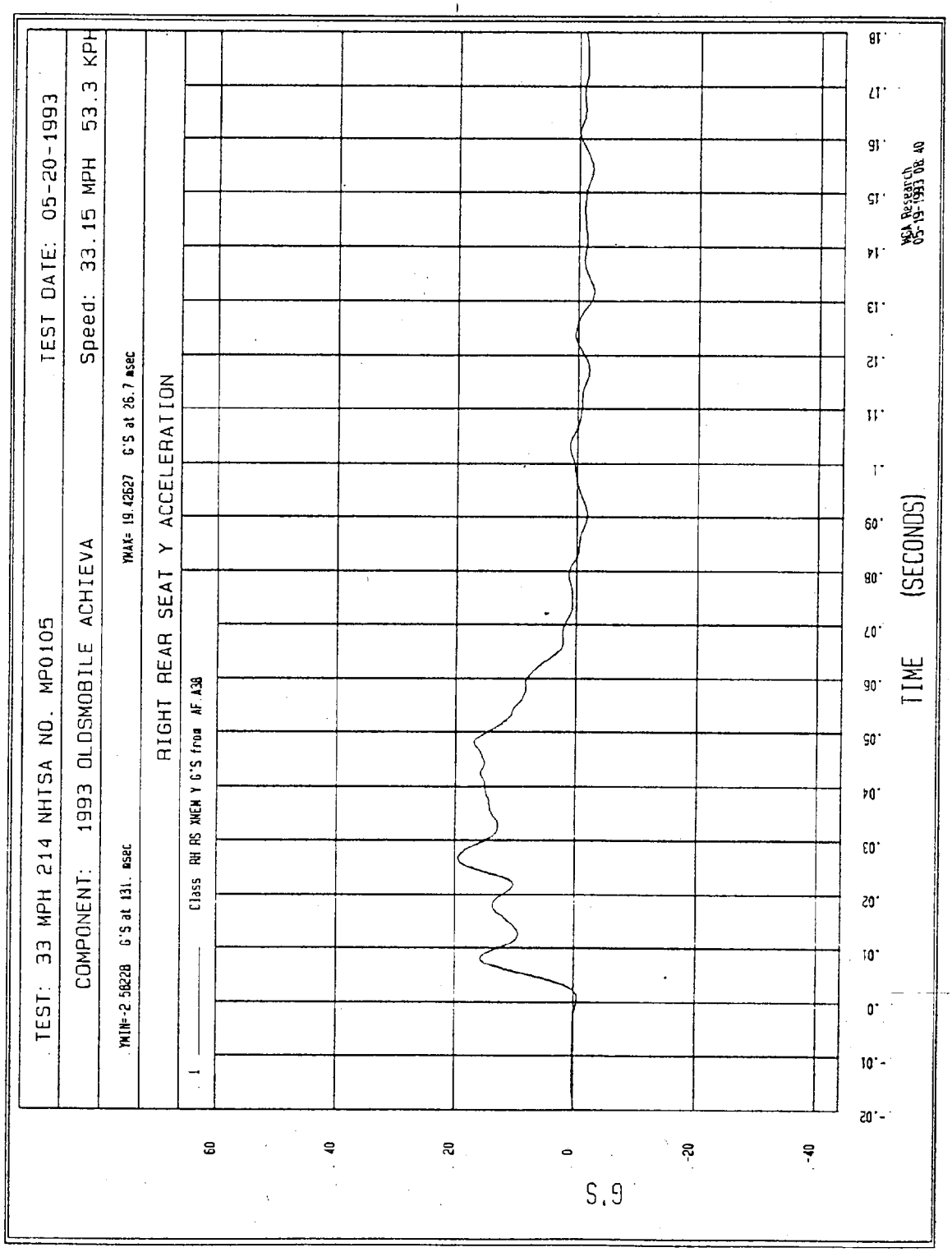



Figure B-62 - Right Rear Seat Y Acceleration vs. Time

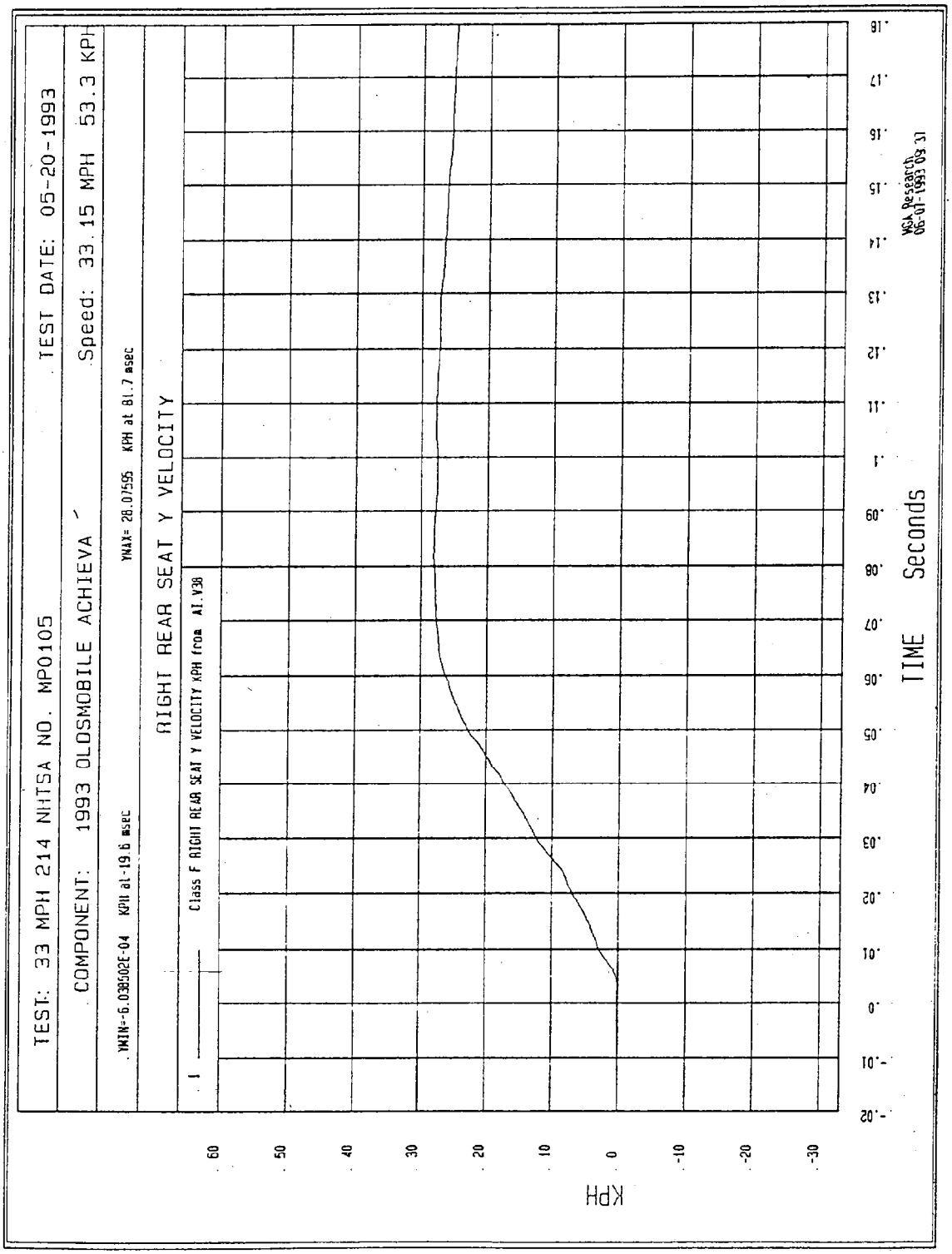



Figure B-63 - Right Rear Seat Y Velocity vs. Time

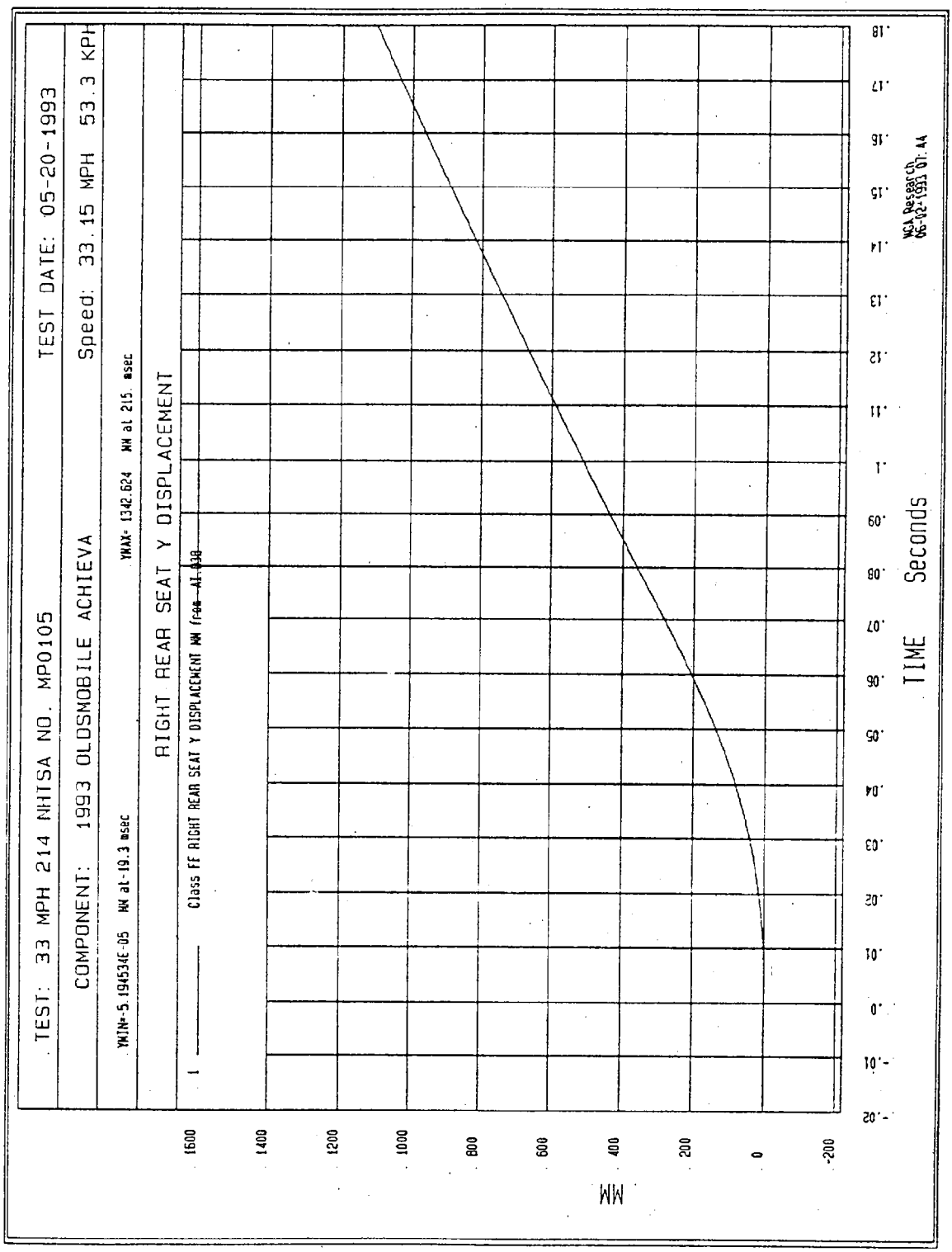



Figure B-64 - Right Rear Seat Y Displacement vs. Time

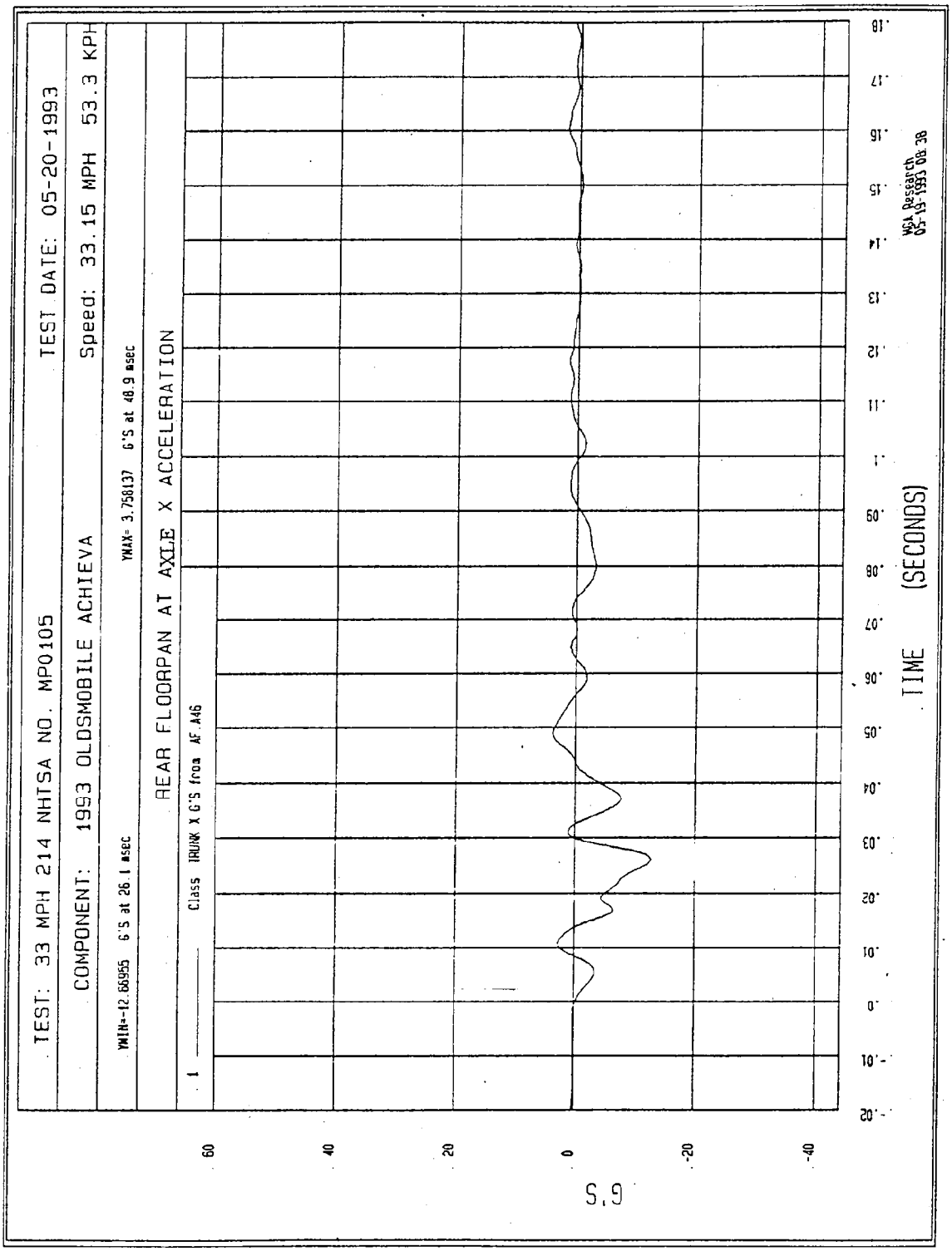



Figure B-65 - Rear Floorpan at Axle X Acceleration vs. Time

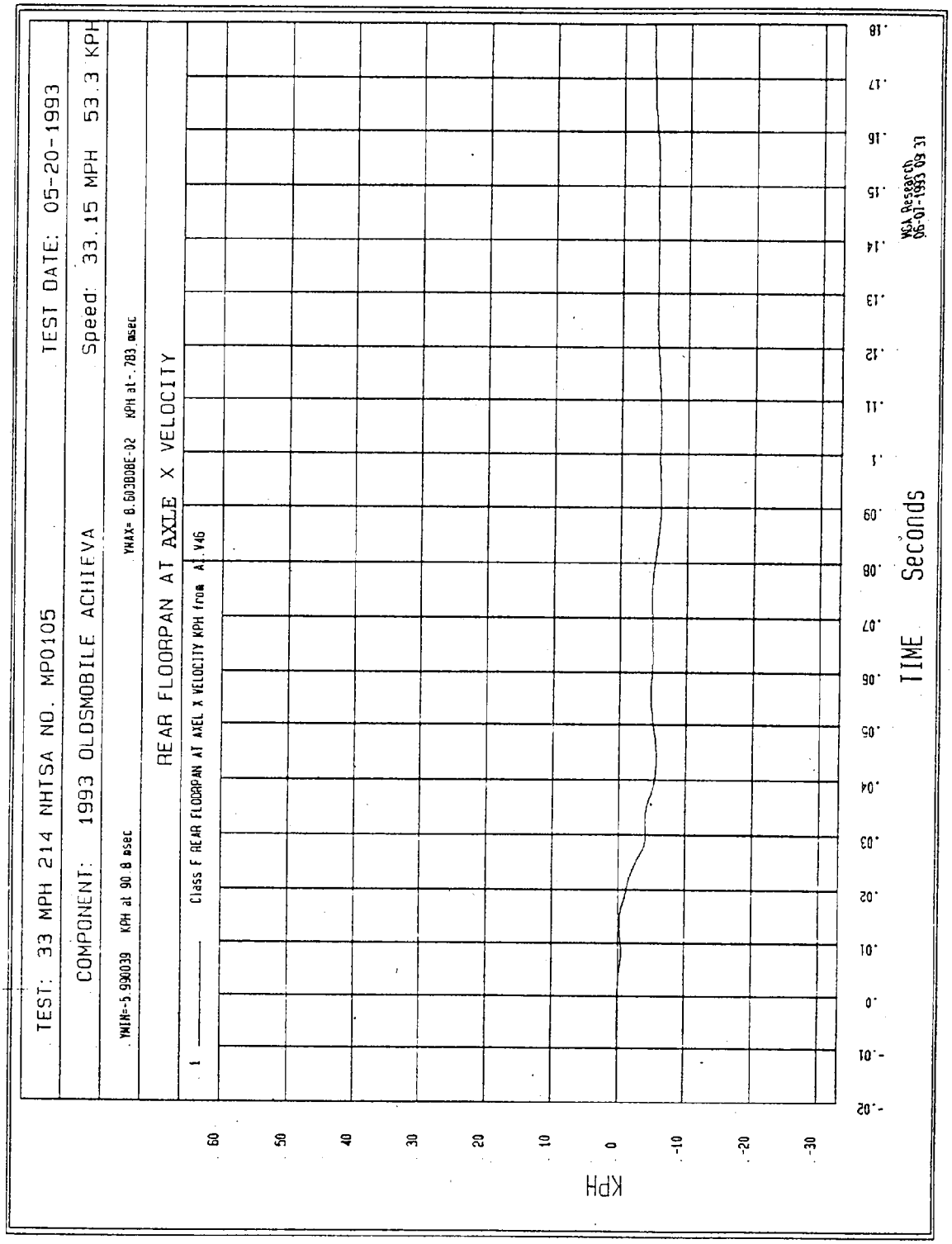



Figure B-66 - Rear Floorpan at Axle X Velocity vs. Time

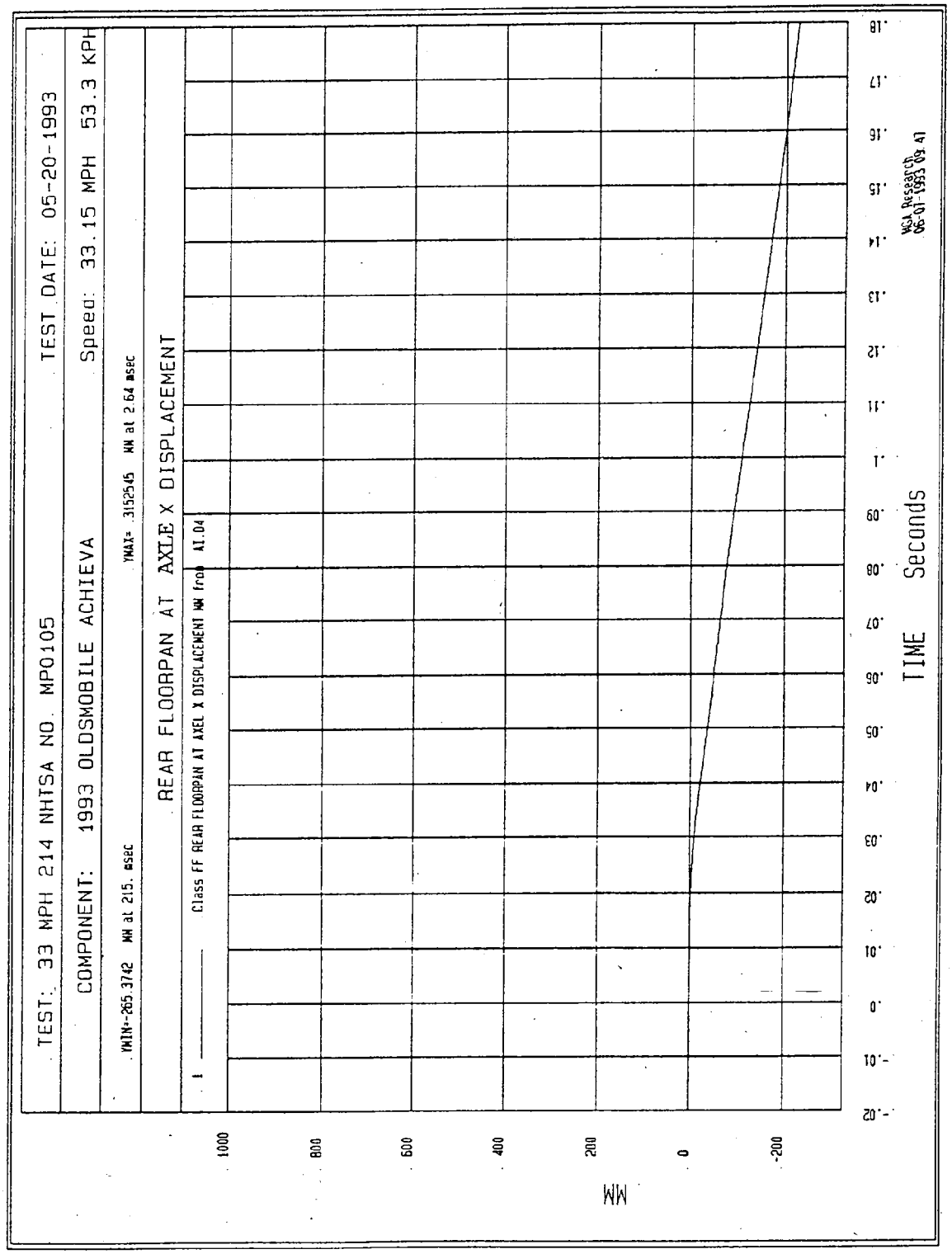



Figure B-67 - Rear Floorpan at Axle X Displacement vs. Time

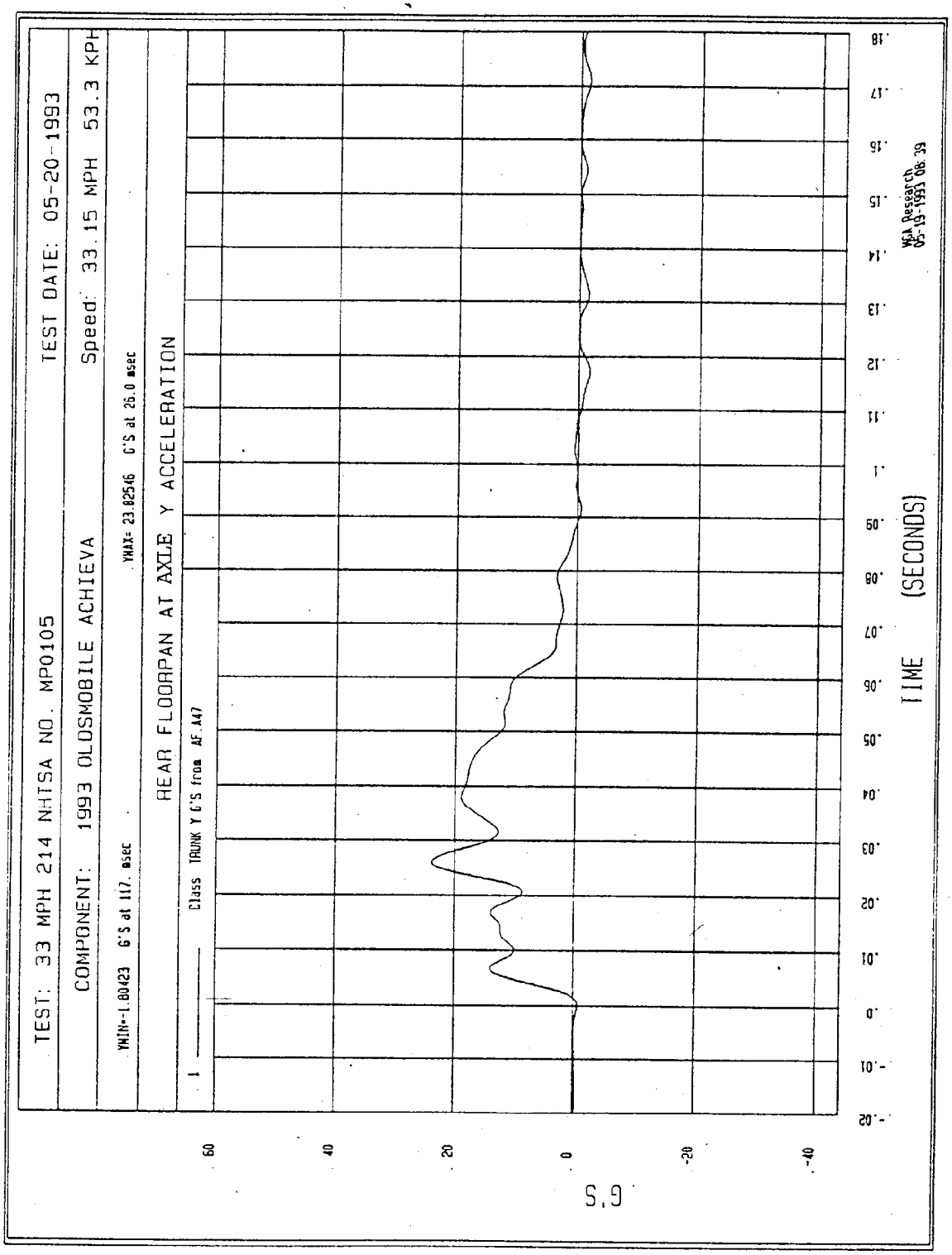



Figure B-68 - Rear Floorpan at Axle Y Acceleration vs. Time

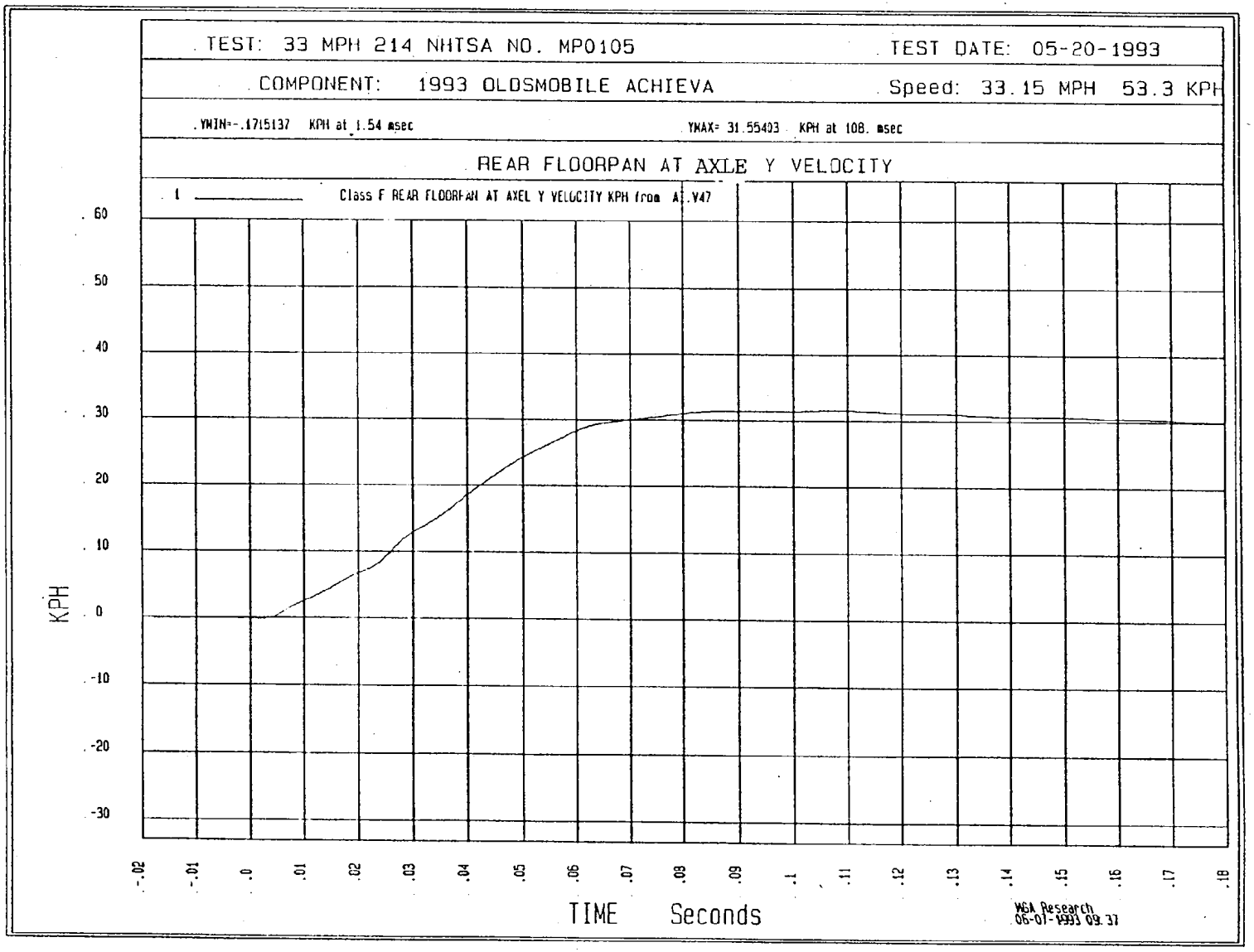



Figure B-69 - Rear Floorpan at Axle Y Velocity vs. Time

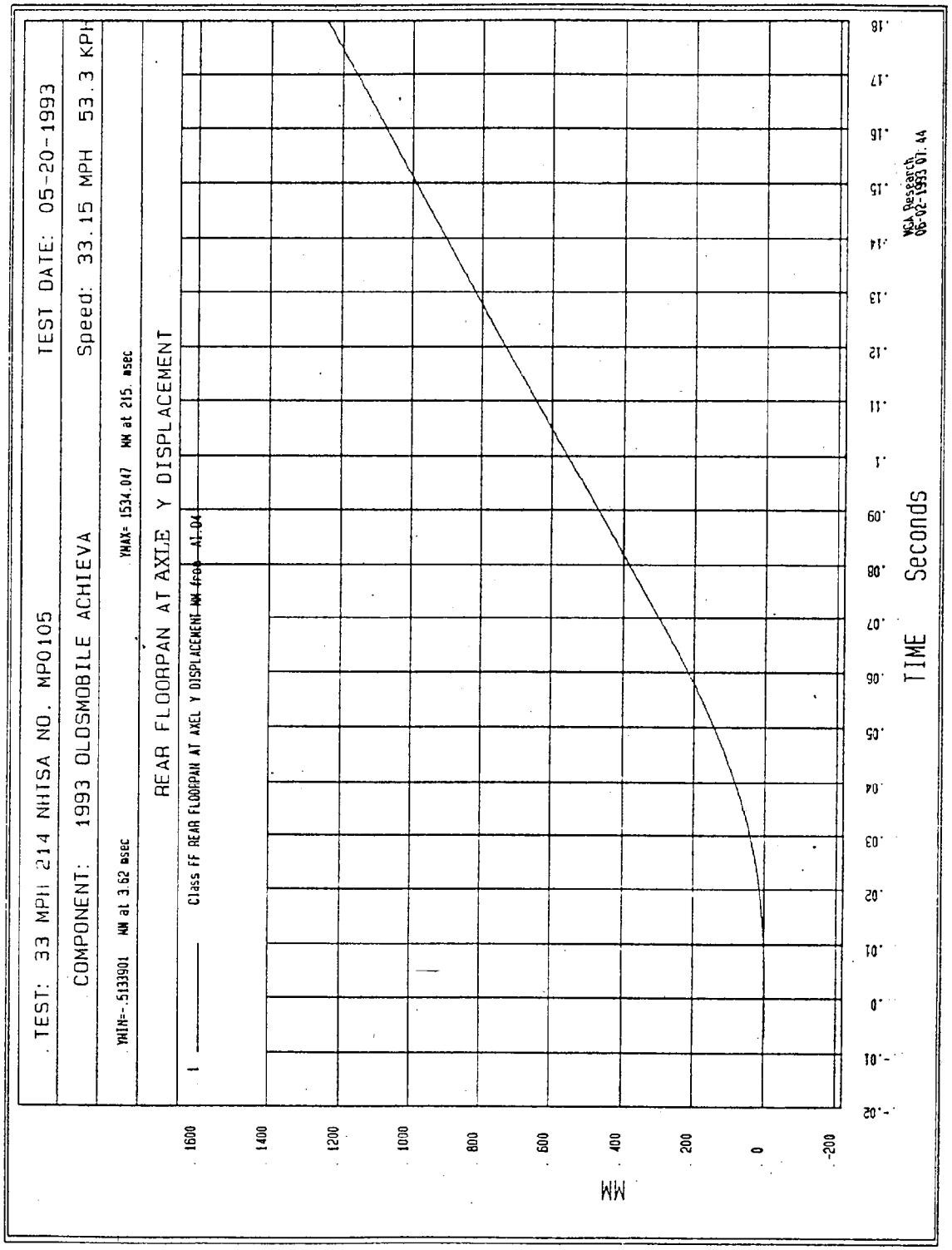



Figure B-7Ø - Rear Floorpan at Axle Y Displacement vs. Time

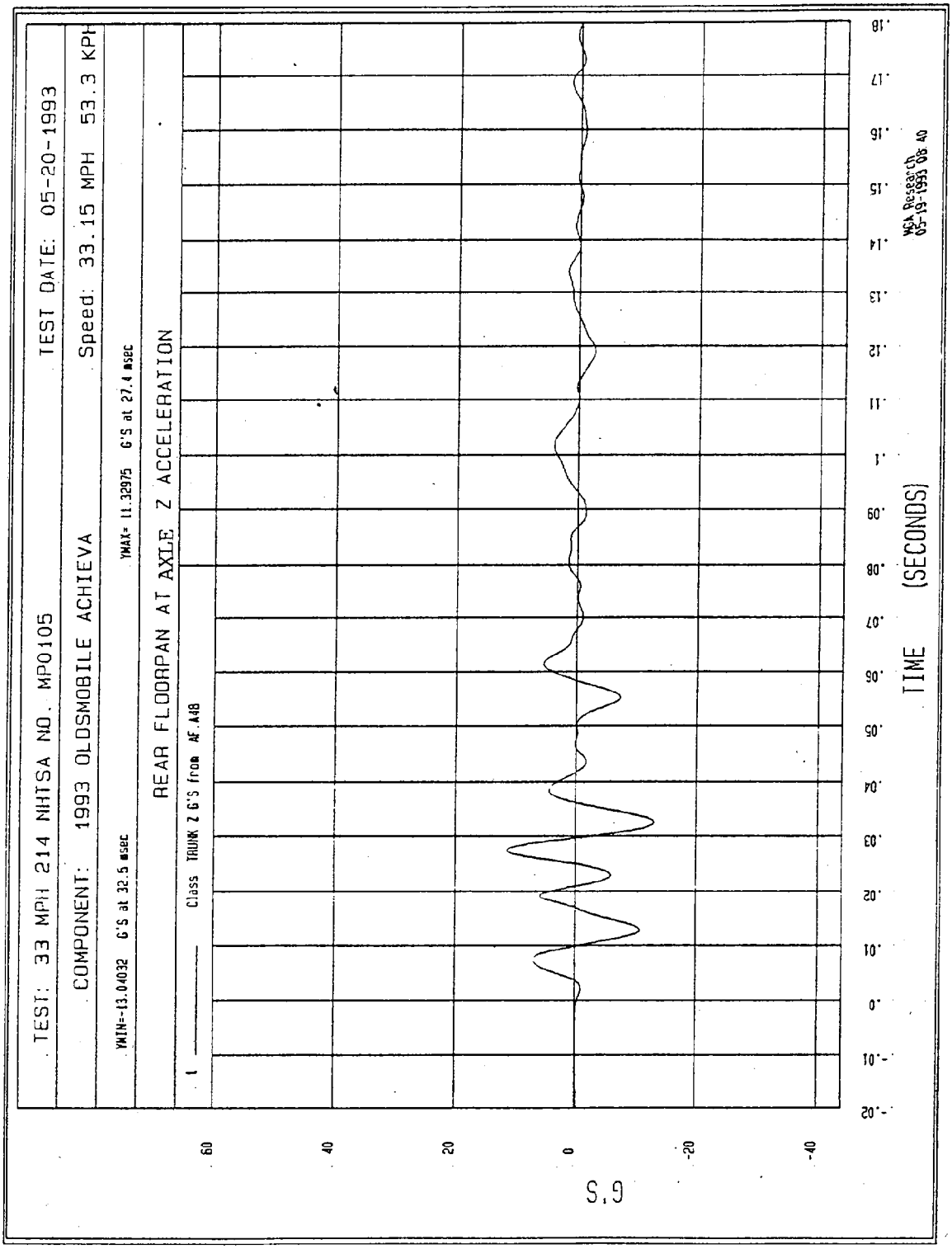



Figure B-71 - Rear Floorpan at Axle Z Acceleration vs. Time

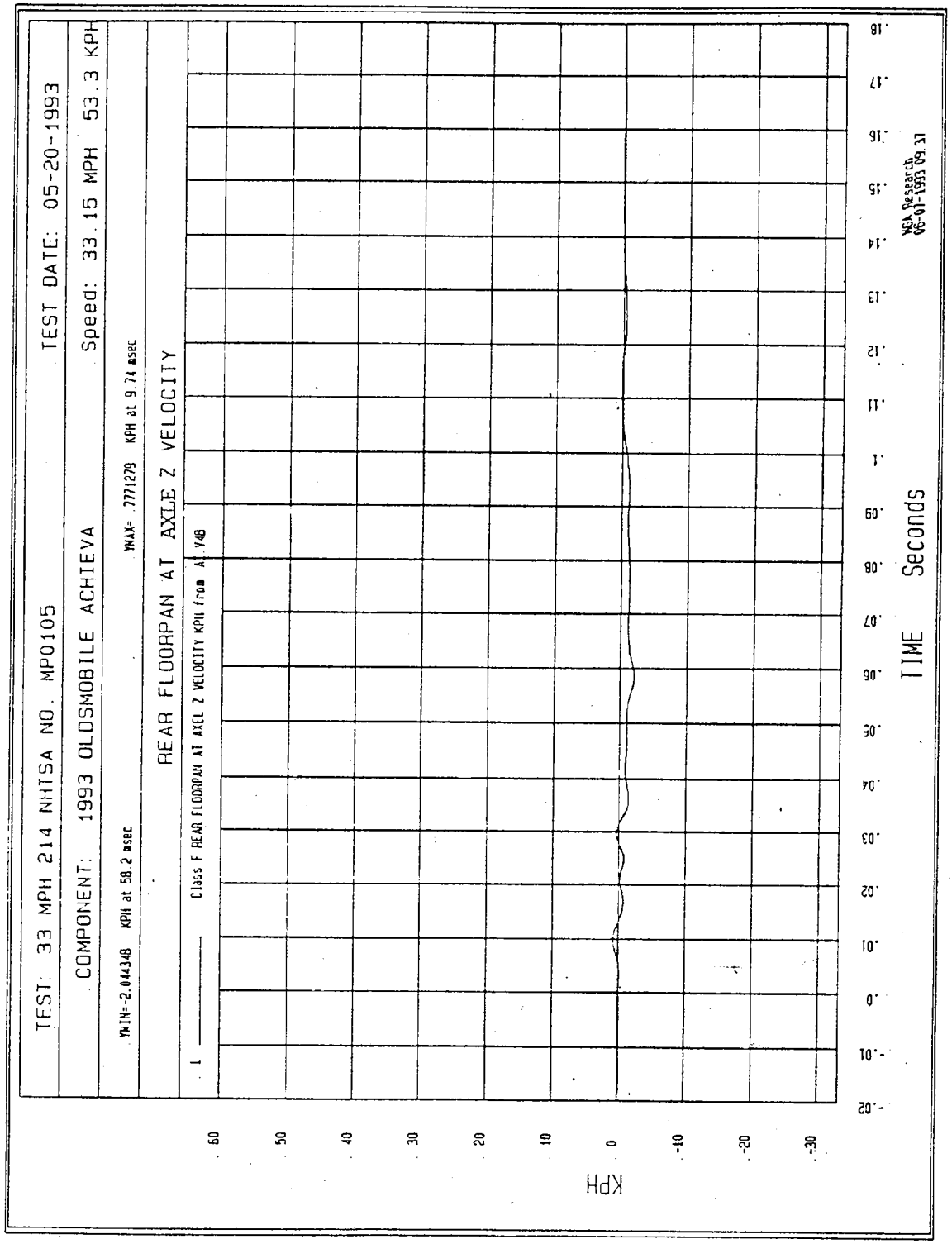



Figure B-72 - Rear Floorpan at Axle Z Velocity vs. Time

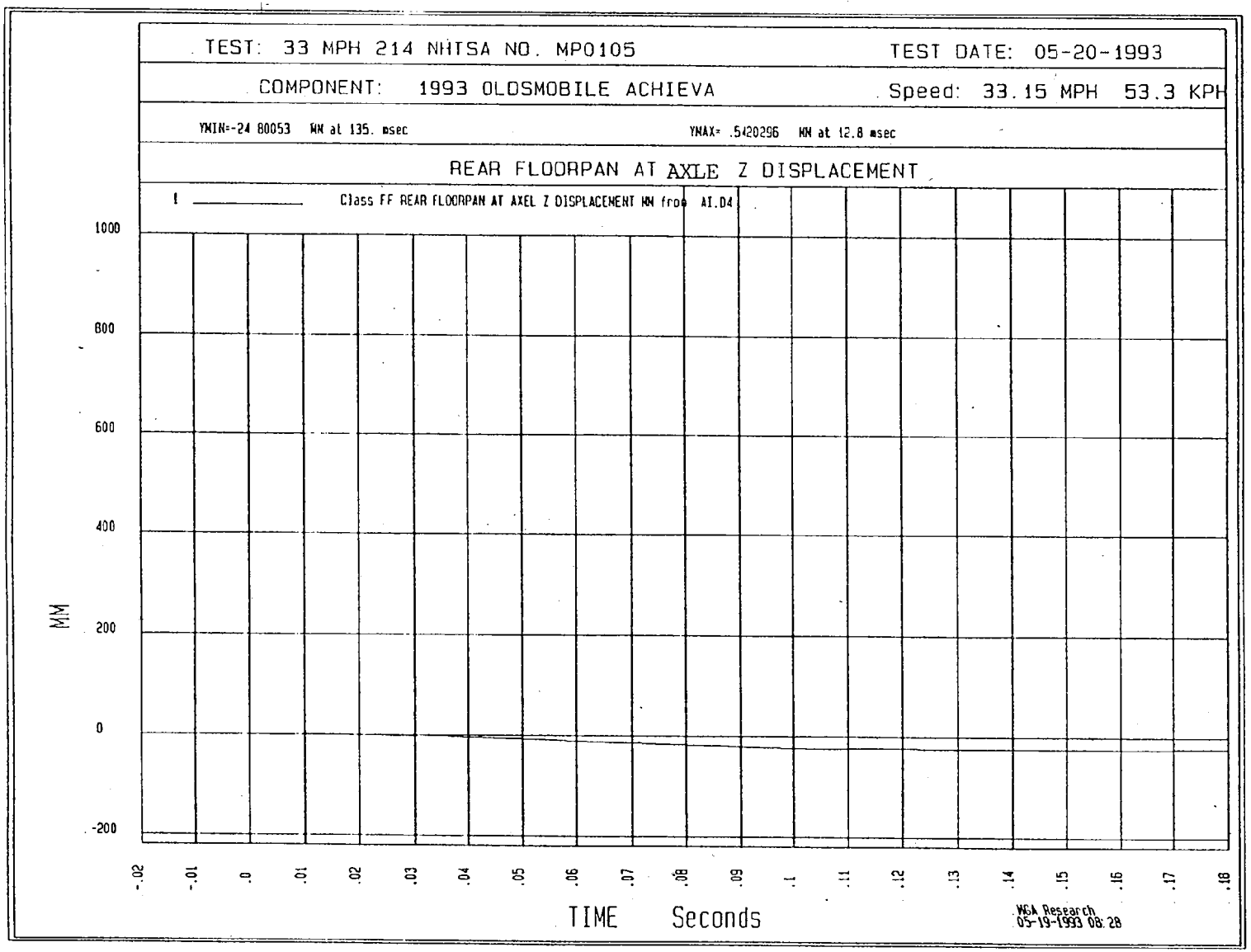



Figure B-73 - Rear Floorpan at Axle Z Displacement vs. Time

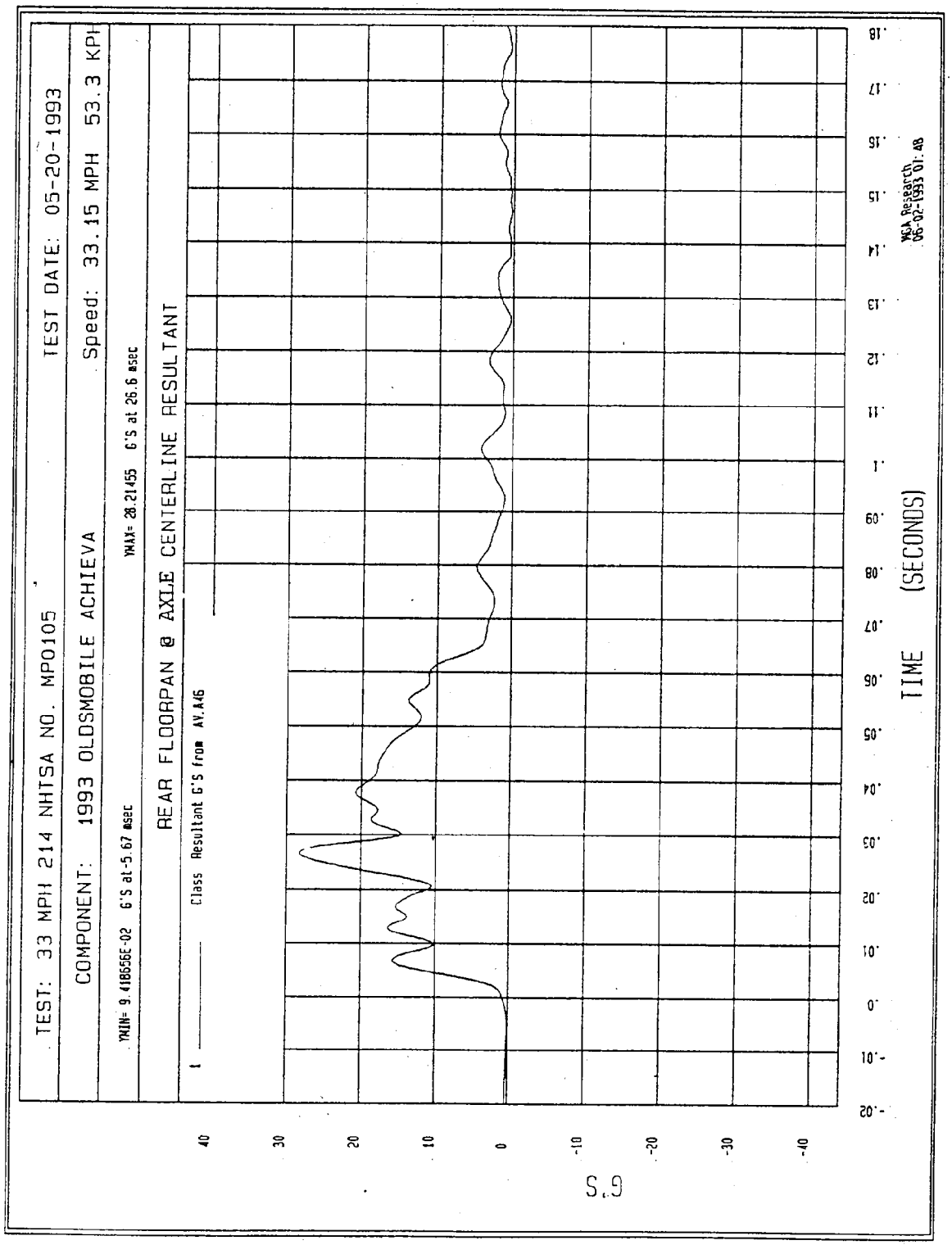



Figure B-74 - Rear Floorpan at Axel Centerline Resultant

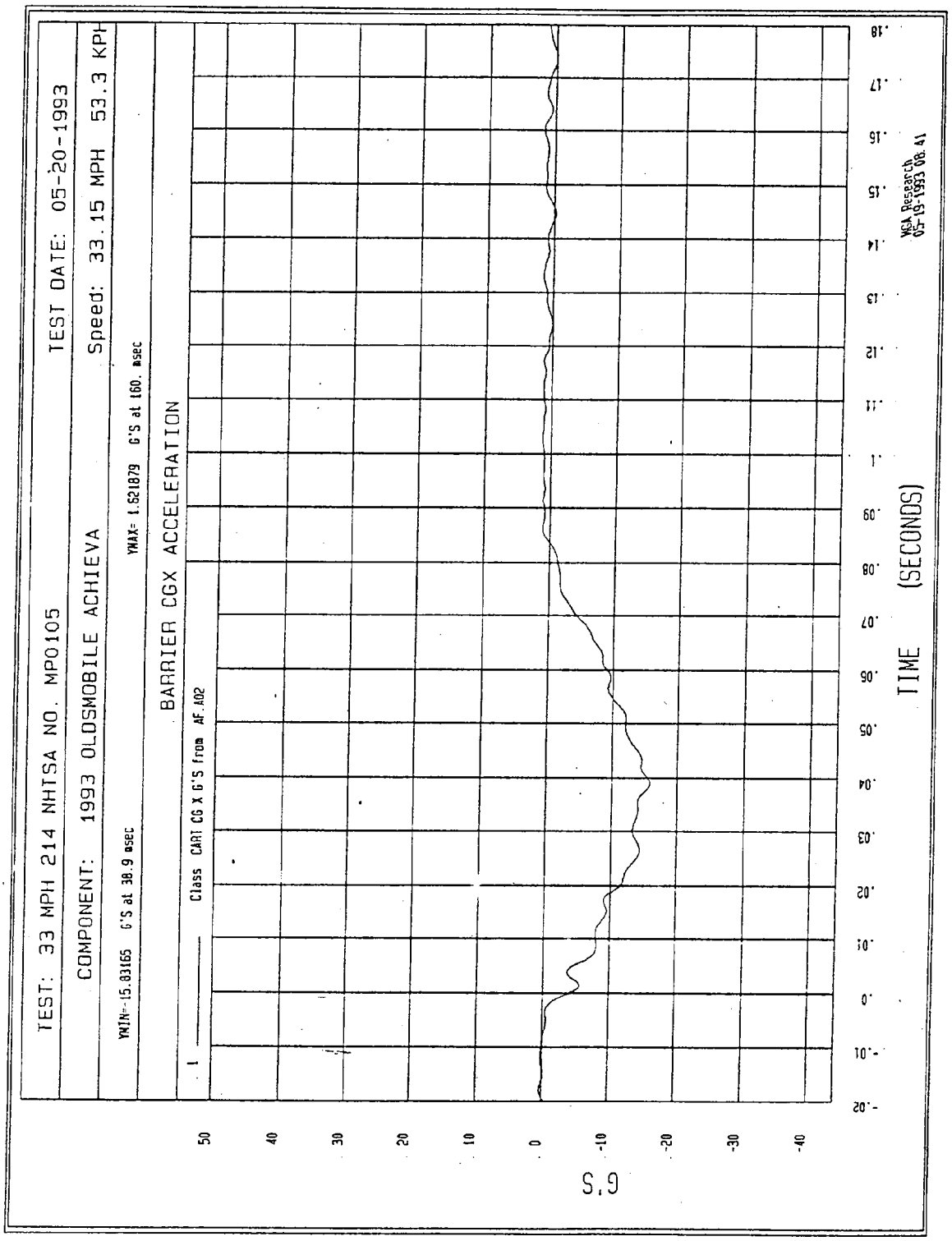



Figure B-75 - MDB Center of Gravity X Accel. vs. Time

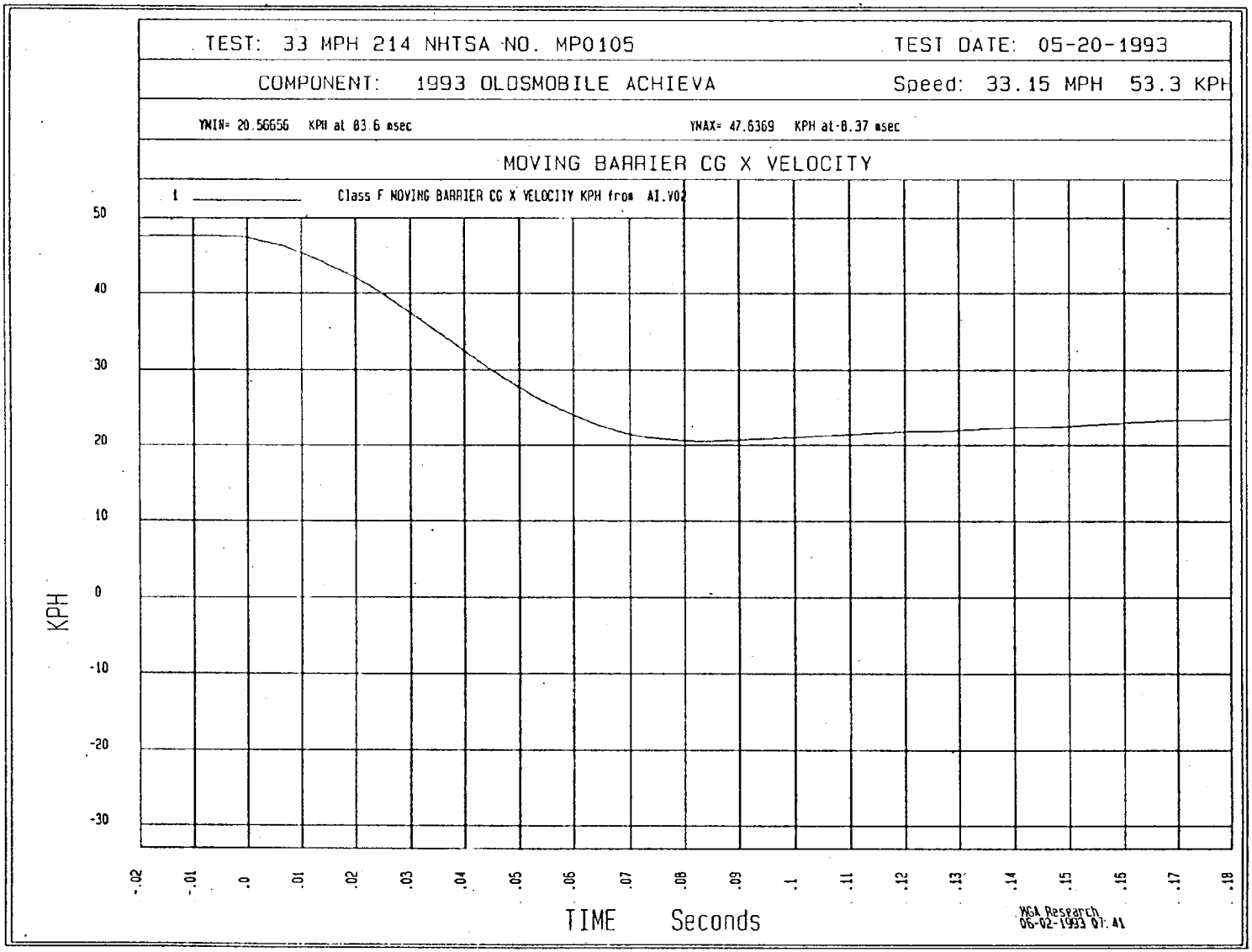



Figure B-76 - MDB Center of Gravity X Velocity vs. Time

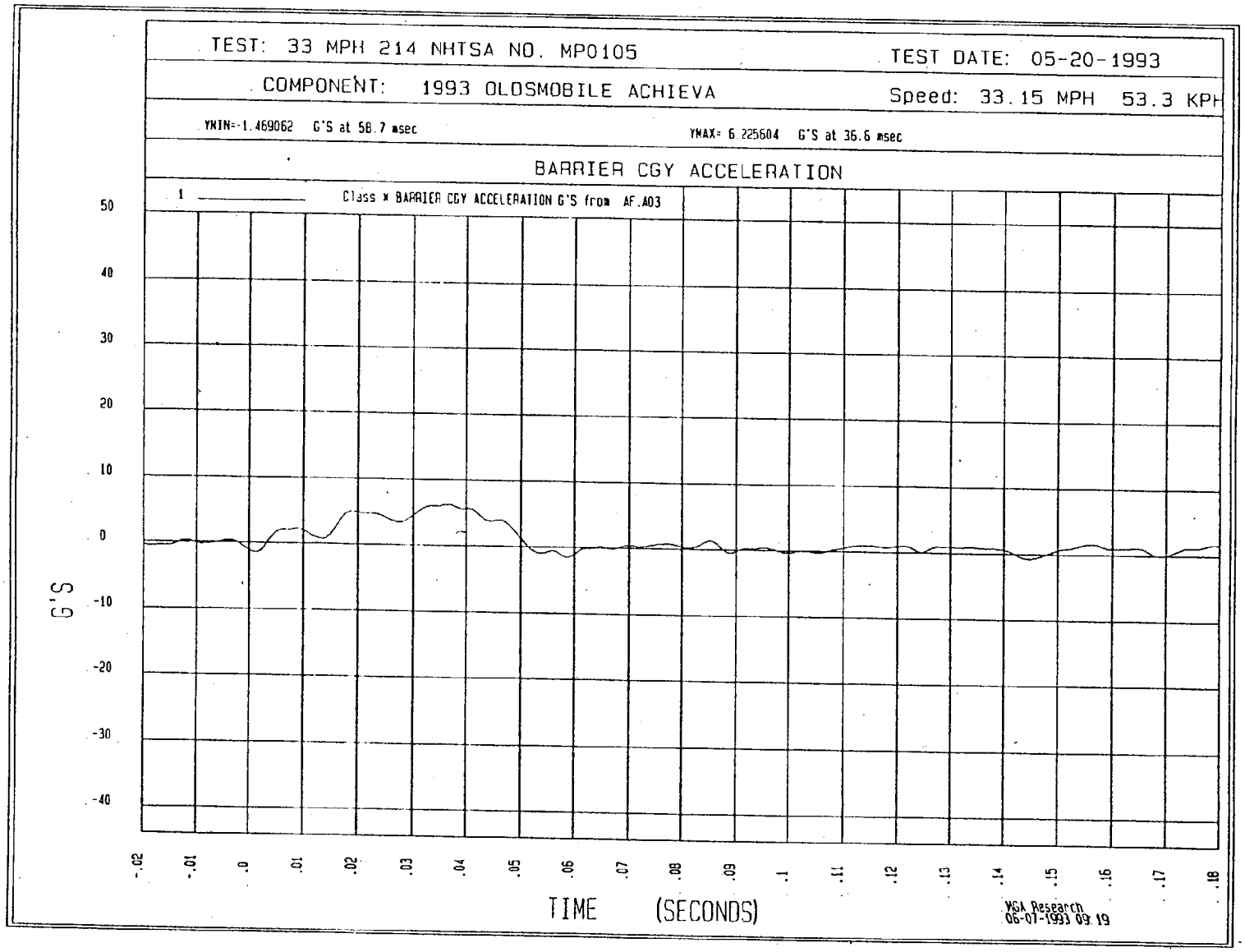



Figure B-77 - MDB Center of Gravity Y Accel. vs. Time

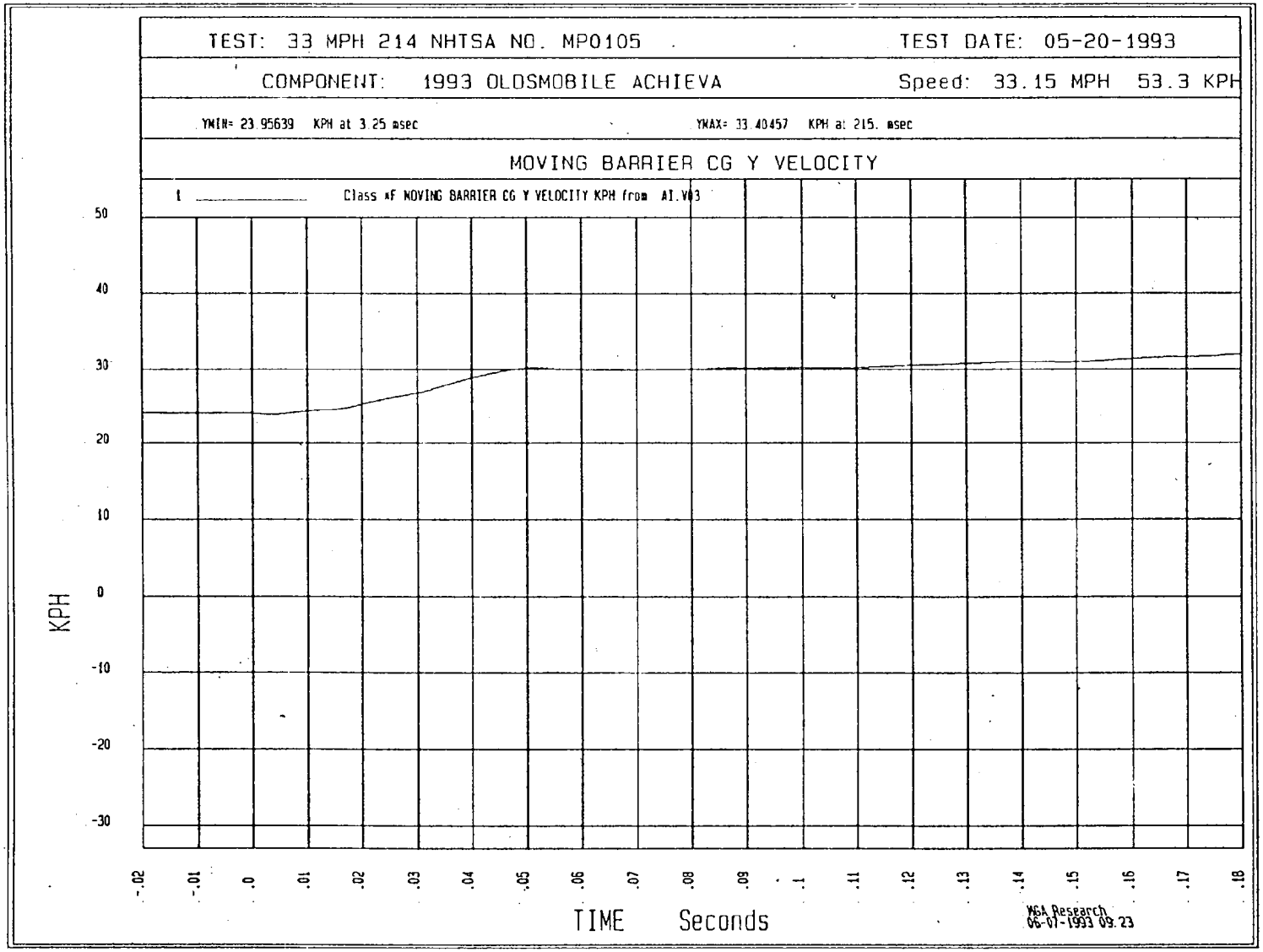



Figure B-78 - MDB Center of Gravity Y Velocity vs. Time

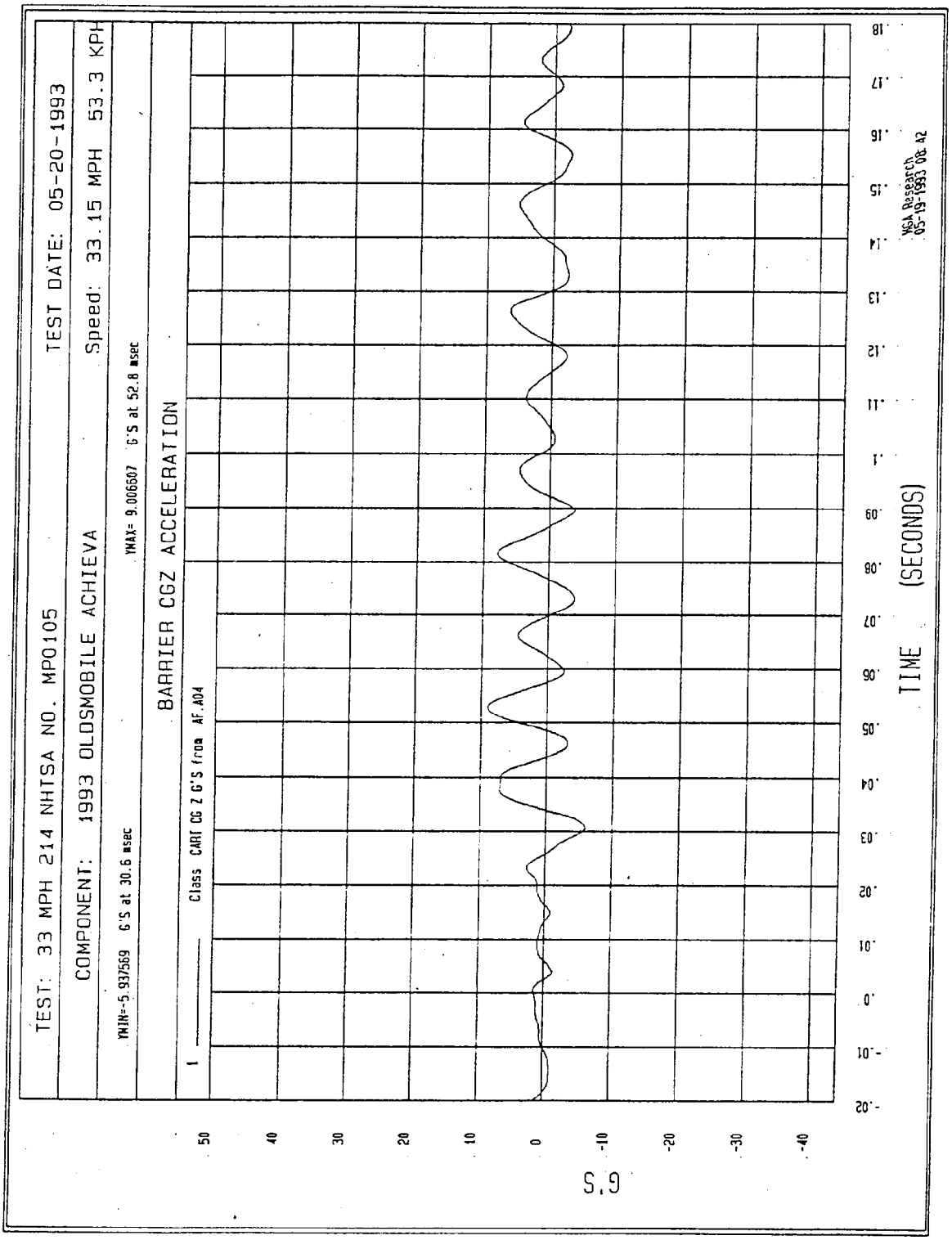



Figure B-79 - MDB Center of Gravity Z Accel. vs. Time

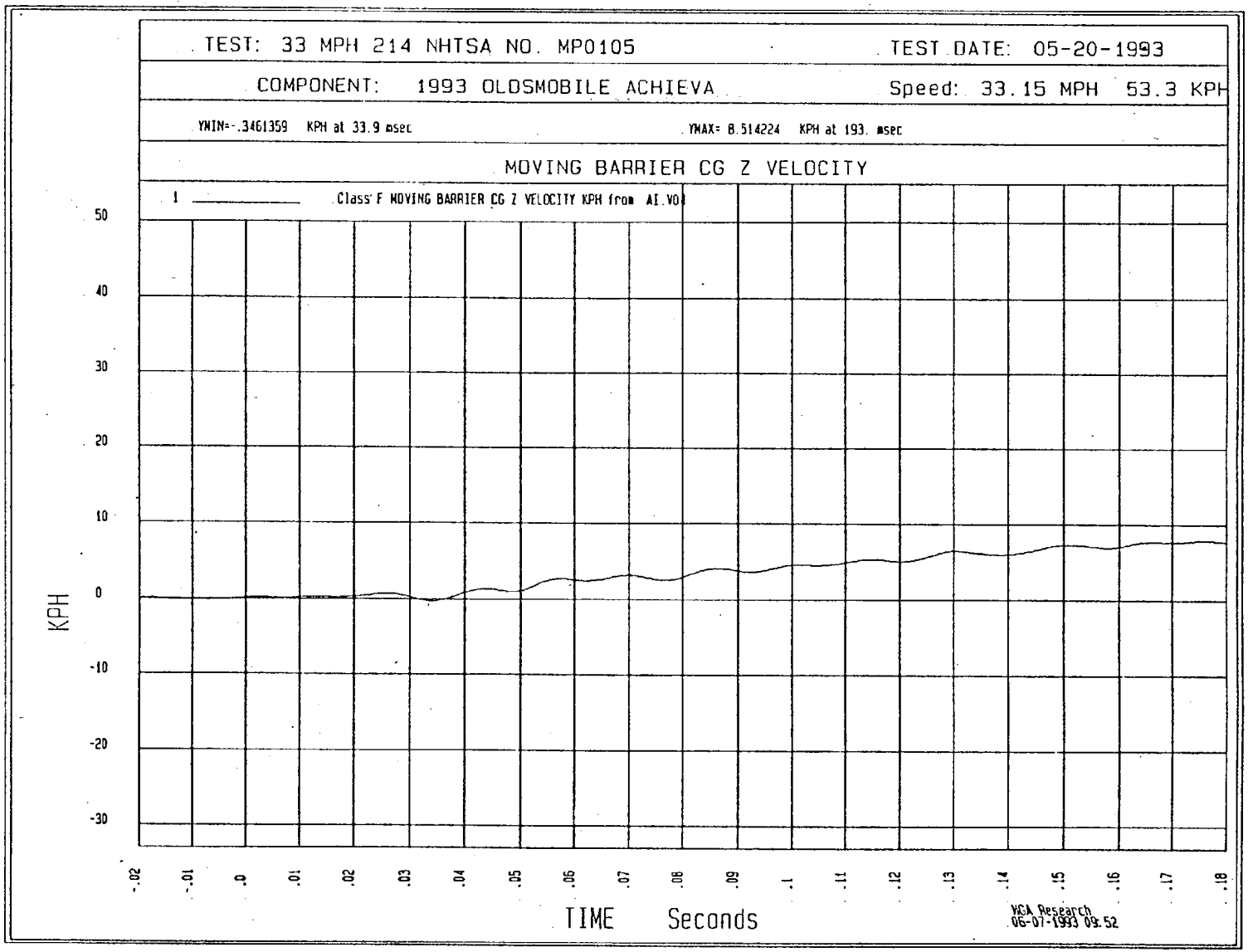



Figure B-8Ø - MDB Center of Gravity Z Velocity vs. Time

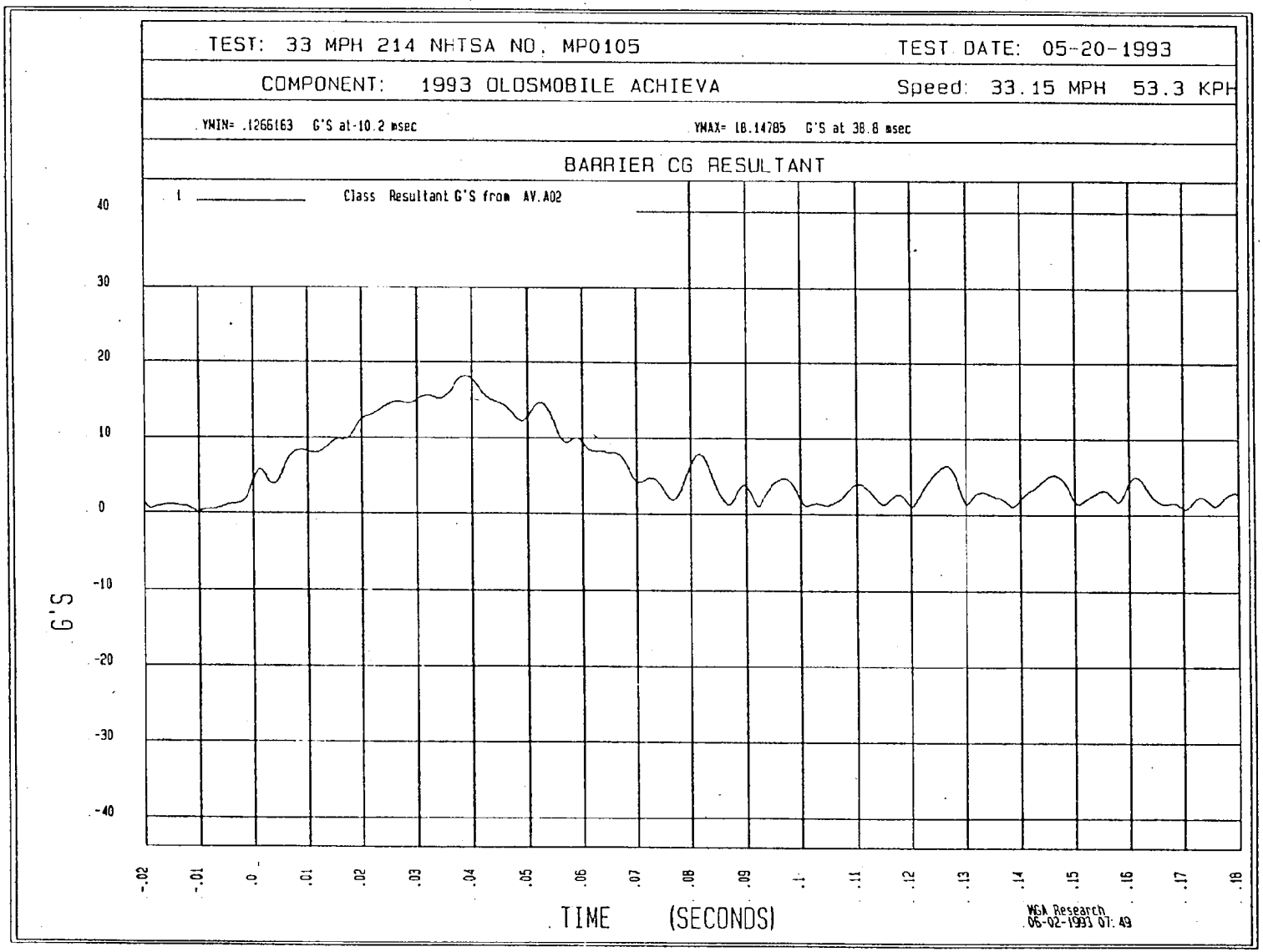



Figure B-81 - MDB Center of Gravity Resultant vs. Time

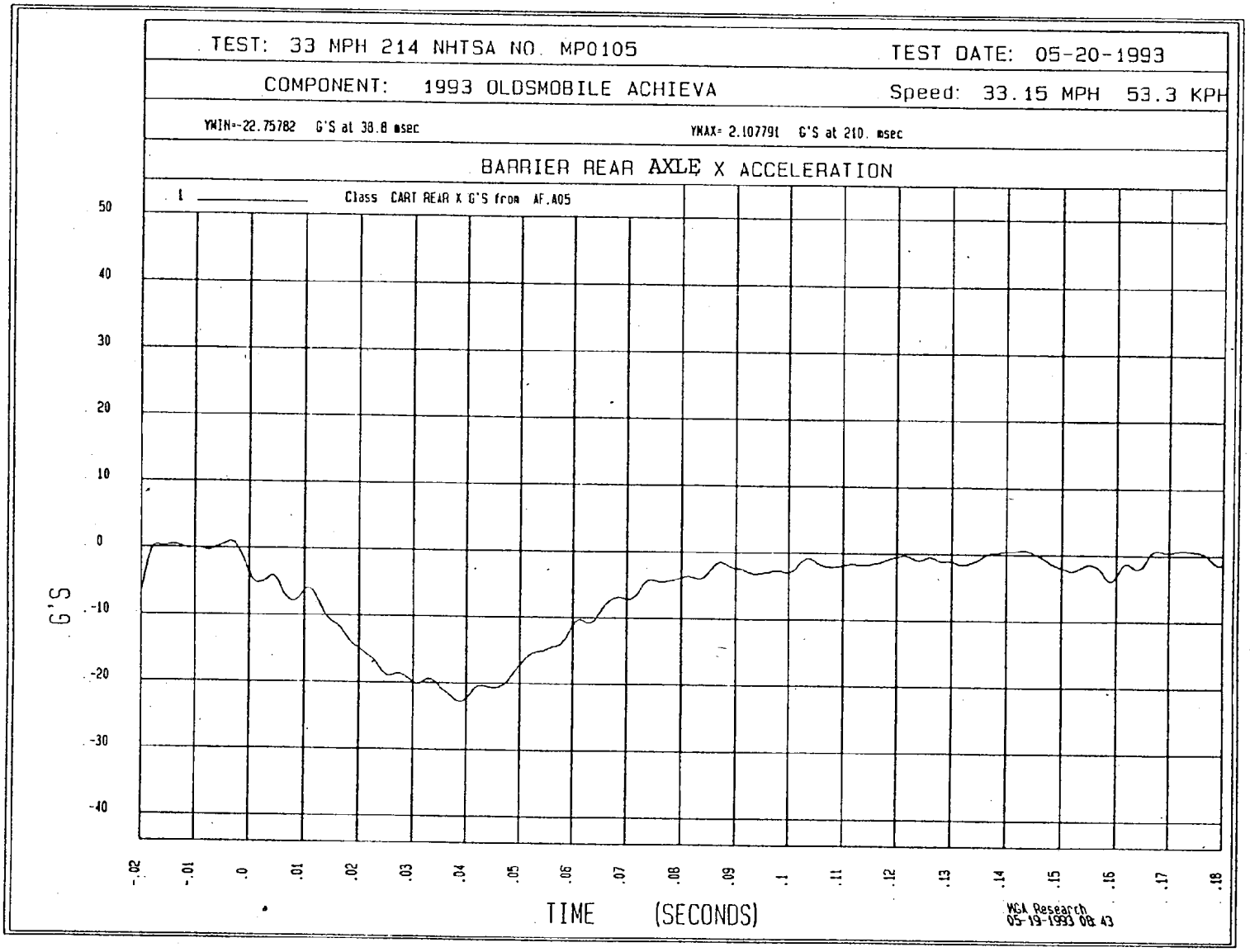



Figure B-82 - MDB Rear X Acceleration vs. Time

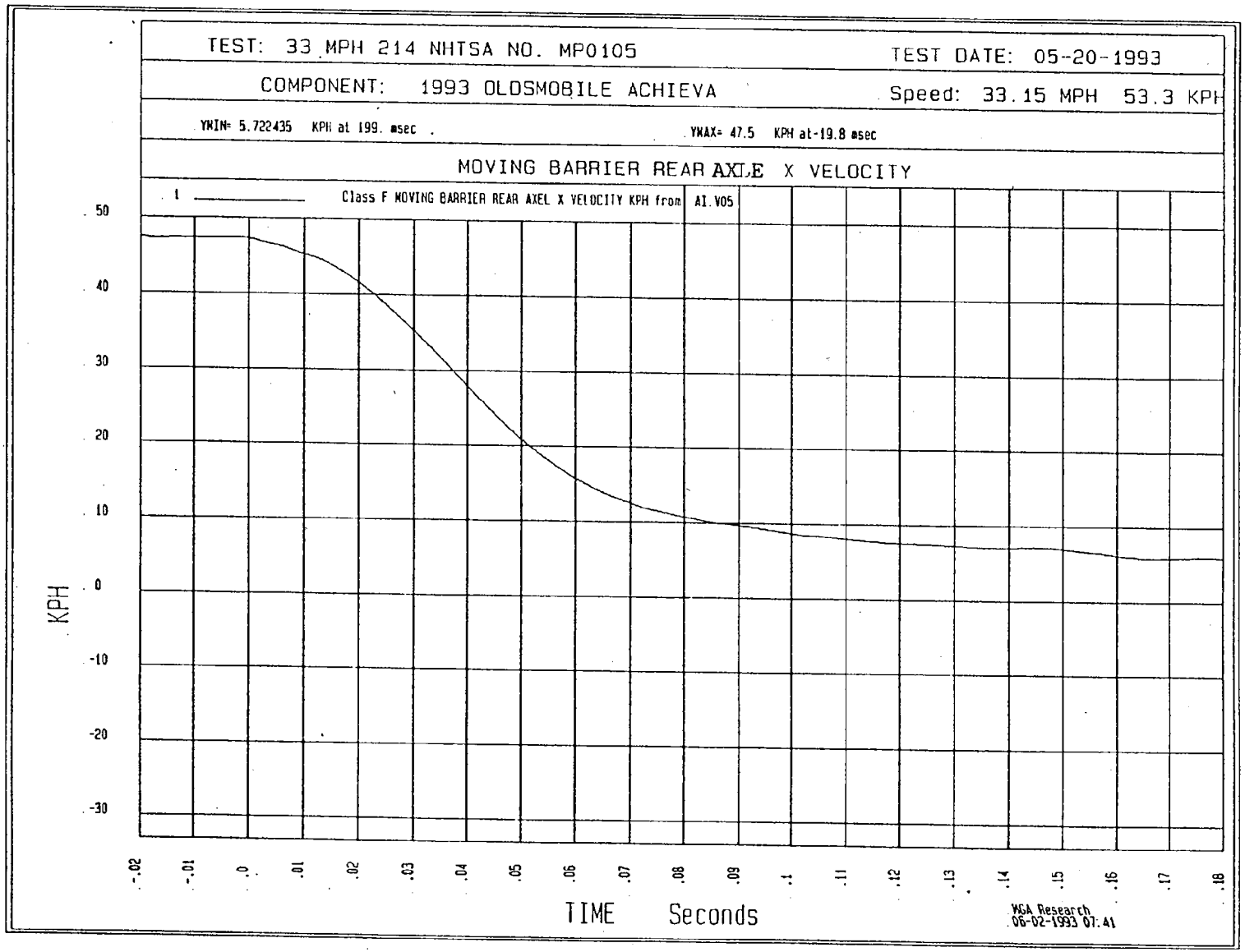
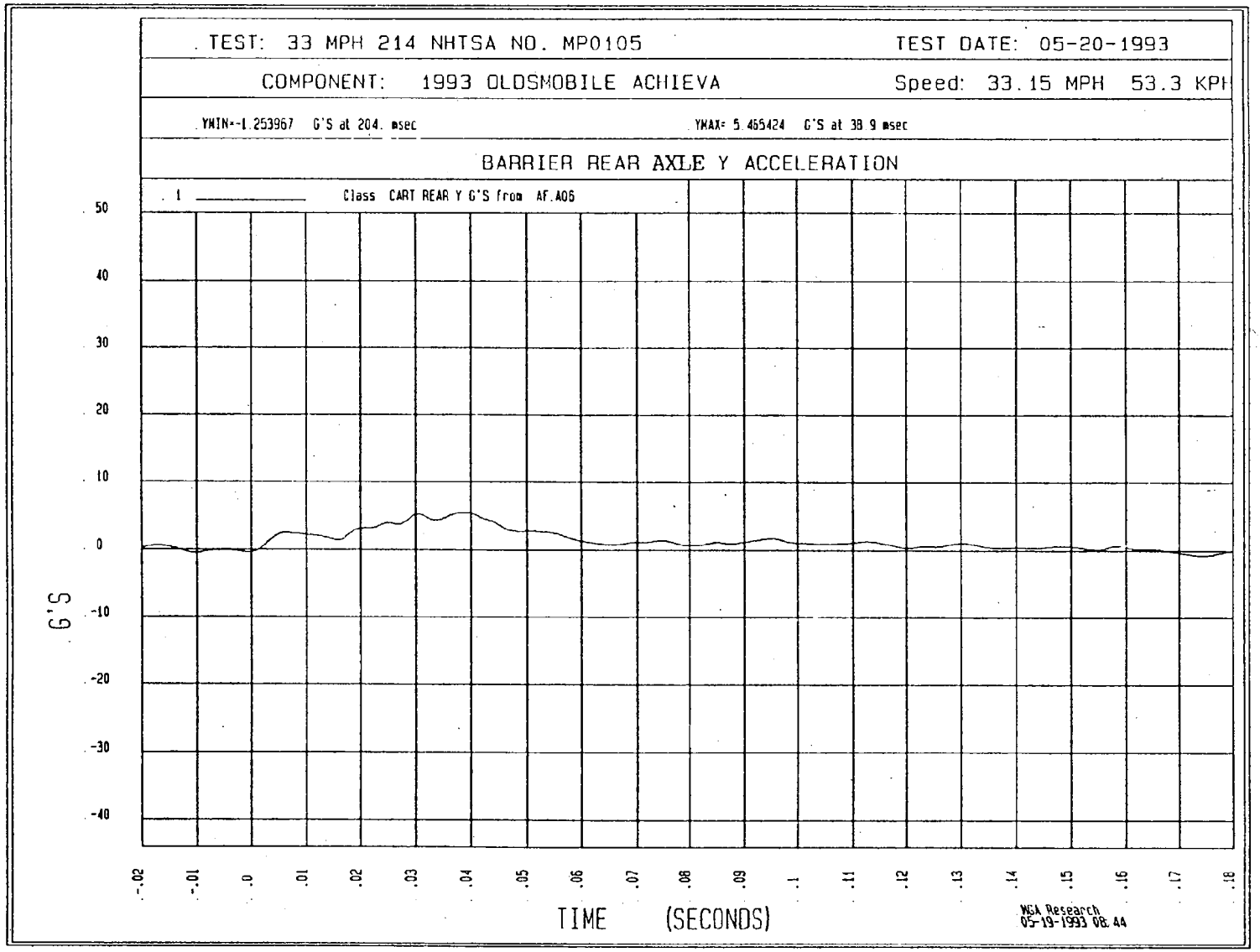



Figure B-83 - MDB Rear X Velocity vs. Time




B-84

Figure B-84 - MDB Rear Y Acceleration vs. Time

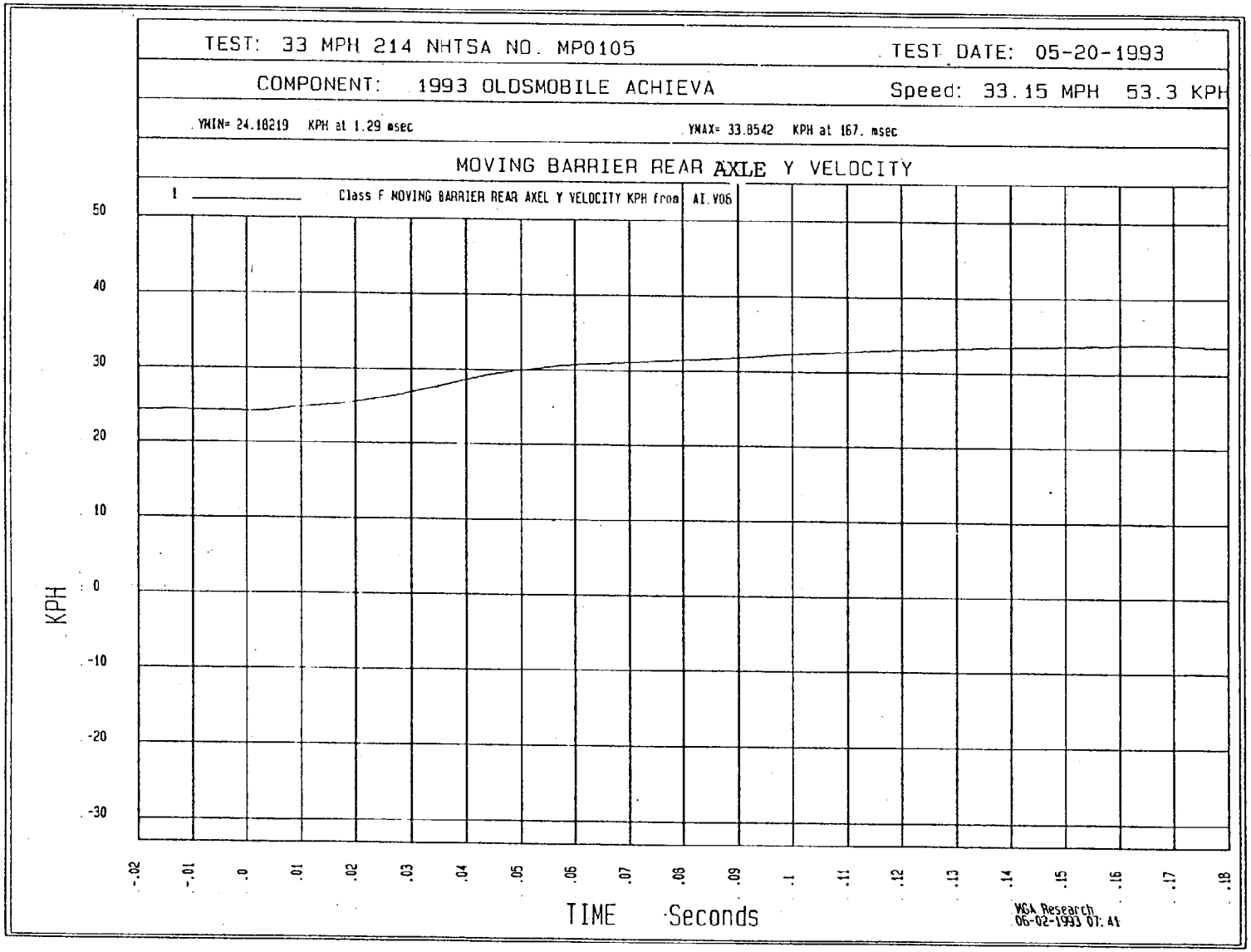
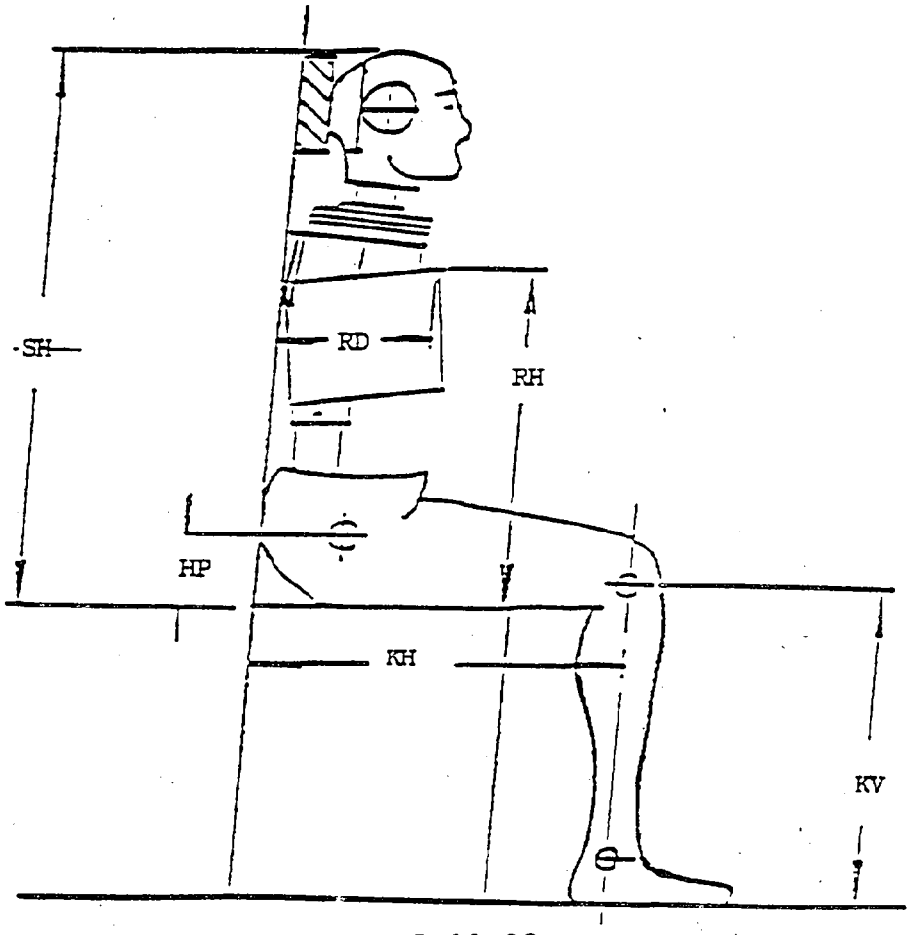



Figure B-85 - MDB Rear Y Velocity vs. Time

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY NO.: 136 DUMMY CALIBRATION BY: Rod McClelland

I. CONFIGURATION VERIFICATION DATA




DATE OF CONFIGURATION VERIFICATION: 5-19-93

| DESCRIPTION | SPECIFICATION | ACTUAL MEASUREMENT |
|---|---|---|
| SH - Seated Height | 35.6" to 35.8" | 35.7 |
| RH - Rib Height | 19.75" to 20.5" | 20.5 |
| HP - Hip Pivot Height | 3.9" ref. | 3.8 |
| RD - Rib From Backline | 9.0" to 9.5" | 9.0 |
| KH - Knee Pivot From Backline | 20.1" to 20.7" | 20.5 |
| KV - Knee Pivot to Floor | 19.3" to 19.9" | 19.5 |
| HW - Hip Width | 14.0" to 15.4" | 15.4 |

# APPENDIX C

# SID CONFIGURATION AND PERFORMANCE VERIFICATION DATA

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE (CONT.)

II. PERFORMANCE VERIFICATION DATA

DUMMY NO.: 136 DUMMY CALIBRATION BY: Rod McClelland

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

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE (CONT.)

1.0 LUMBAR FLEXION TEST

| | SPECIFICATION | MEASUREMENT |
|---|---|---|
| Force @ 20° | 22 to 34 lbs | 32 |
| Force @ 30° | 34 to 46 lbs | 46 |
| Force @ 40° | 46 to 58 lbs | 48 |
| Return Angle | 12° Maximum | 3 |

2.0 ABDOMINAL COMPRESSION TEST
(Preload = 10 lbs)

| | SPECIFICATION | MEASUREMENT |
|---|---|---|
| Force @ 0.5 in | 23.3 to 36.5 lbs | 30 |
| Force @ 0.75 in | 36.7 to 49.8 lbs | 42 |
| Force @ 1.0 in | 50 to 63 lbs | 58 |
| Force @ 1.3 in | 73 to 88 lbs | 84 |

3.0 THORAX IMPACT TEST

| | SPECIFICATION | MEASUREMENT |
|---|---|---|
| Probe Speed | 13.8 TO 14.2 f/s | 13.8 |
| Upper Rib | 37 to 46 g | 42 |
| Lower Rib | 37 to 46 g | 41 |
| Lower Spine | 15 to 22 g | 21.87 |

4.0 PELVIC IMPACT TEST

| | SPECIFICATION | MEASUREMENT |
|---|---|---|
| Probe Speed | 13.8 to 14.2 f/s | 13.9 |
| Pelvis Acceleration | 40 to 60 g | 53 |

# SIDE IMPACT DUMMY DATA SHEET

DUMMY #: 136

TEST DATE: 5-20-93

| DRIVER | PASSENGER |
|---|---|
| X | |

| EXPOSURE | DATE | TYPE OF TEST |
|---|---|---|
| 1st | 4-22-93 | NHTSA |

1) RIB ACCELEROMETERS:

| | MANUFACTURER | SERIAL NO. | CAL. DATE | DLR | CHECKED |
|---|---|---|---|---|---|
| UR | Endevco | ACCL3 | 5-11-93 | 100.79 | X |
| URR | Endevco | AC764 | 5-11-93 | 103.31 | X |
| LR | Endevco | AC8E9 | 5-17-93 | 92.56 | X |
| LRR | Endevco | A43M | 5-17-93 | 121.71 | X |

2) SPINE ACCELEROMETERS

| | MANUFACTURER | SERIAL NO. | CAL. DATE | DLR | CHECKED |
|---|---|---|---|---|---|
| USY | Endevco | AC815 | 5-17-93 | 86.96 | X |
| USRY | Endevco | A82D | 5-17-93 | 87.19 | X |
| LSY | Endevco | AC8J4 | 5-17-93 | 103.27 | X |
| LSRY | Endevco | A07M | 5-17-93 | 86.33 | X |

3) PELVIS ACCELEROMETERS

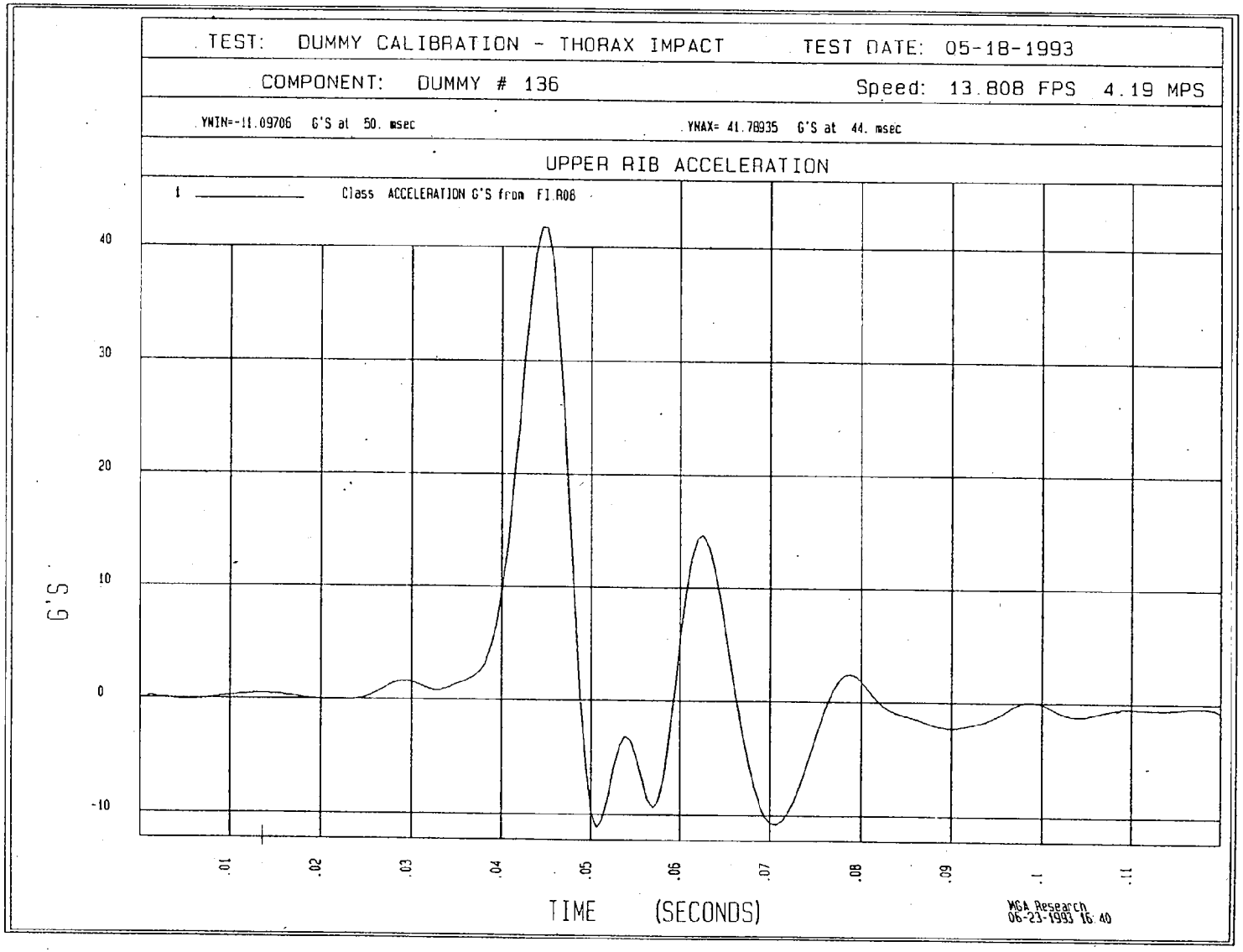
| | MANUFACTURER | SERIAL NO. | CAL. DATE | DLR | CHECKED |
|---|---|---|---|---|---|
| Y | Endevco | EH45 | 5-17-93 | 125.07 | X |
| RY | Endevco | A99L | 5-17-93 | 100.15 | X |

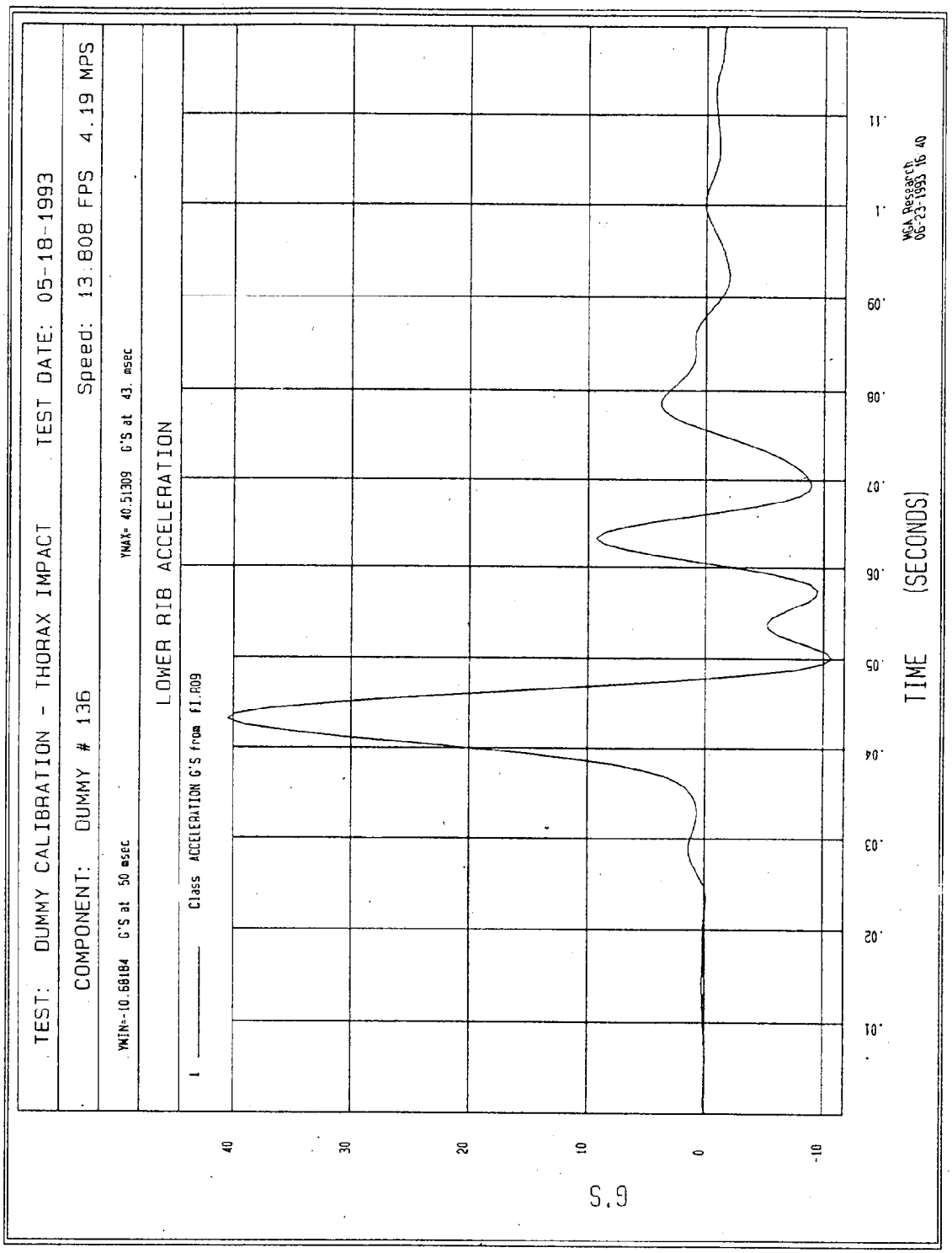
4) OTHER ACCELEROMETERS

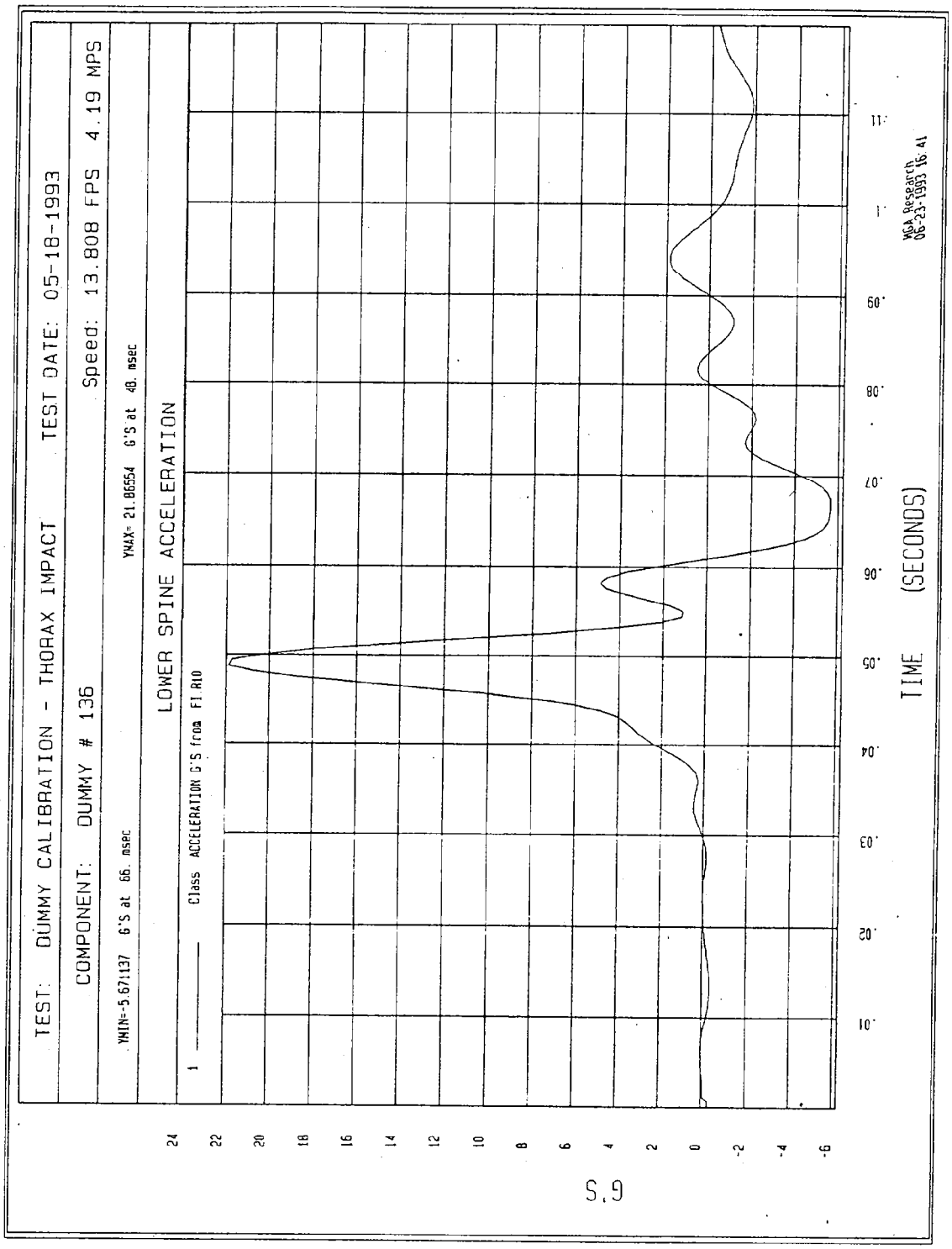
| MANUFACTURER | SERIAL NO. | CAL. DATE | DLR | CHECKED |
|---|---|---|---|---|
| | | | | |

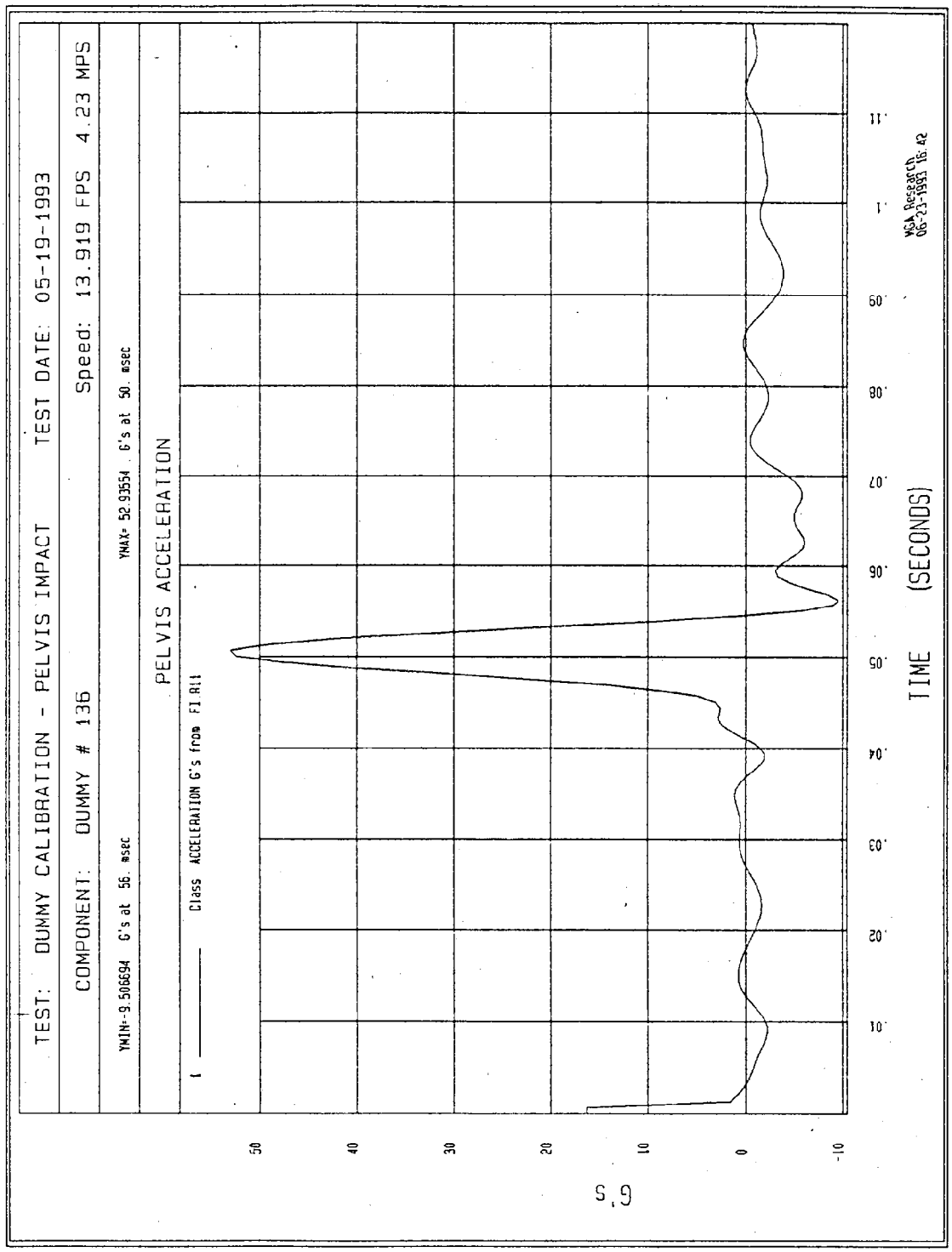
DUMMY INSTRUMENTED BY: Rod McClelland

APPROVED BY: Rod McClelland

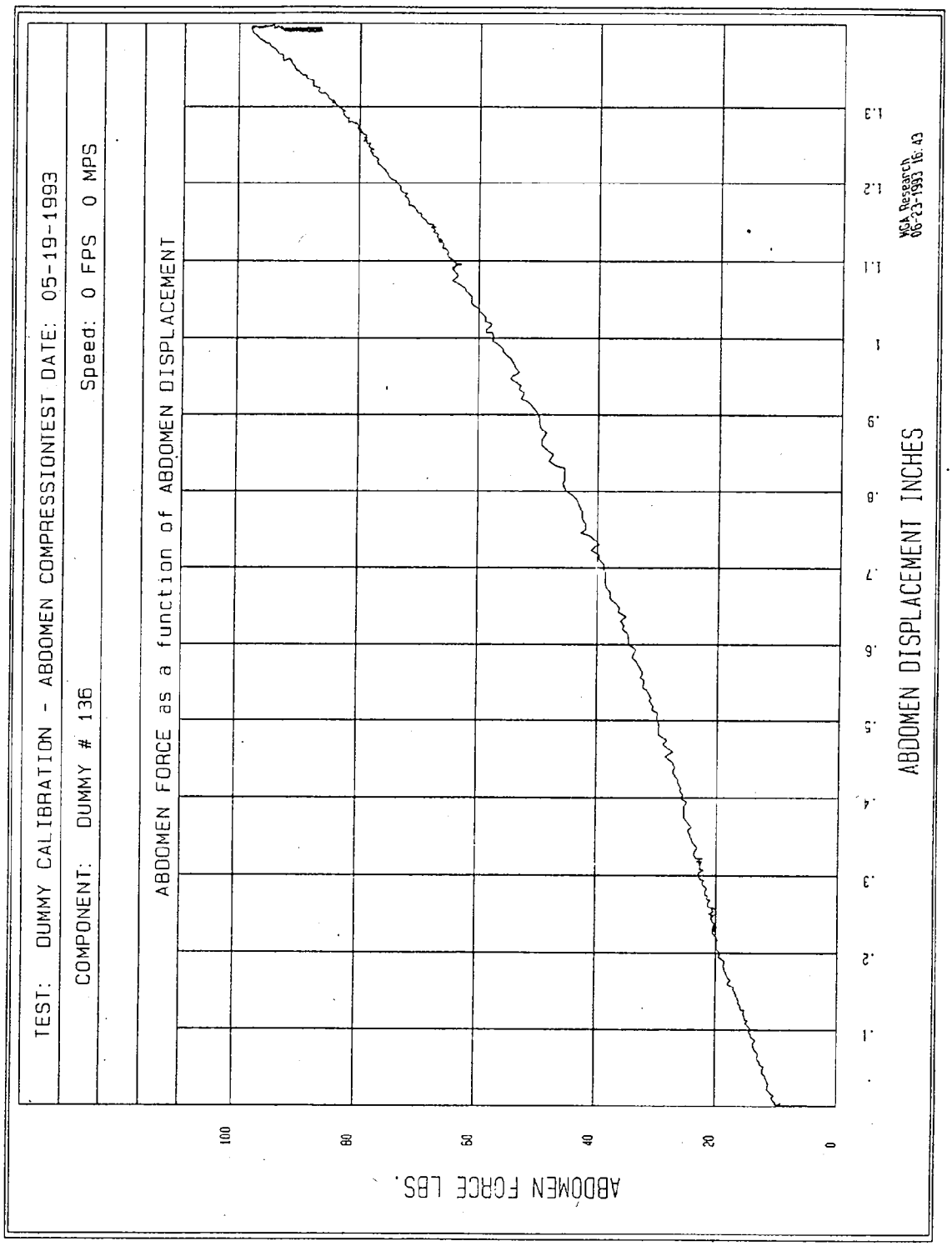

TEST: DUMMY CALIBRATION - THORAX IMPACT
TEST DATE: 05-18-1993
COMPONENT: DUMMY # 136
Speed: 13.808 FPS 4.19 MPS
YMIN=-11.09706 G'S at 50. msec
YMAX= 41.78935 G'S at 44. msec
UPPER RIB ACCELERATION
1 Class ACCELERATION G'S from F1.A08
40
30
20
10
0
-10
G'S
.01
.02
.03
.04
.05
.06
.07
.08
.09
.1
.11
TIME (SECONDS)
MGA Research
06-23-1993 16:40


TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 05-18-1993
COMPONENT: DUMMY # 136 Speed: 13.808 FPS 4.19 MPS
YMIN=-10.68184 G'S at 50 msec YMAX= 40.51309 G'S at 43. msec
LOWER RIB ACCELERATION
1 Class ACCELERATION G'S from F1.809
40
30
20
10
0
-10
G'S
.01
.02
.03
.04
.05
.06
.07
.08
.09
.1
.11
TIME (SECONDS)
WSA Research
06-23-1993 16 40

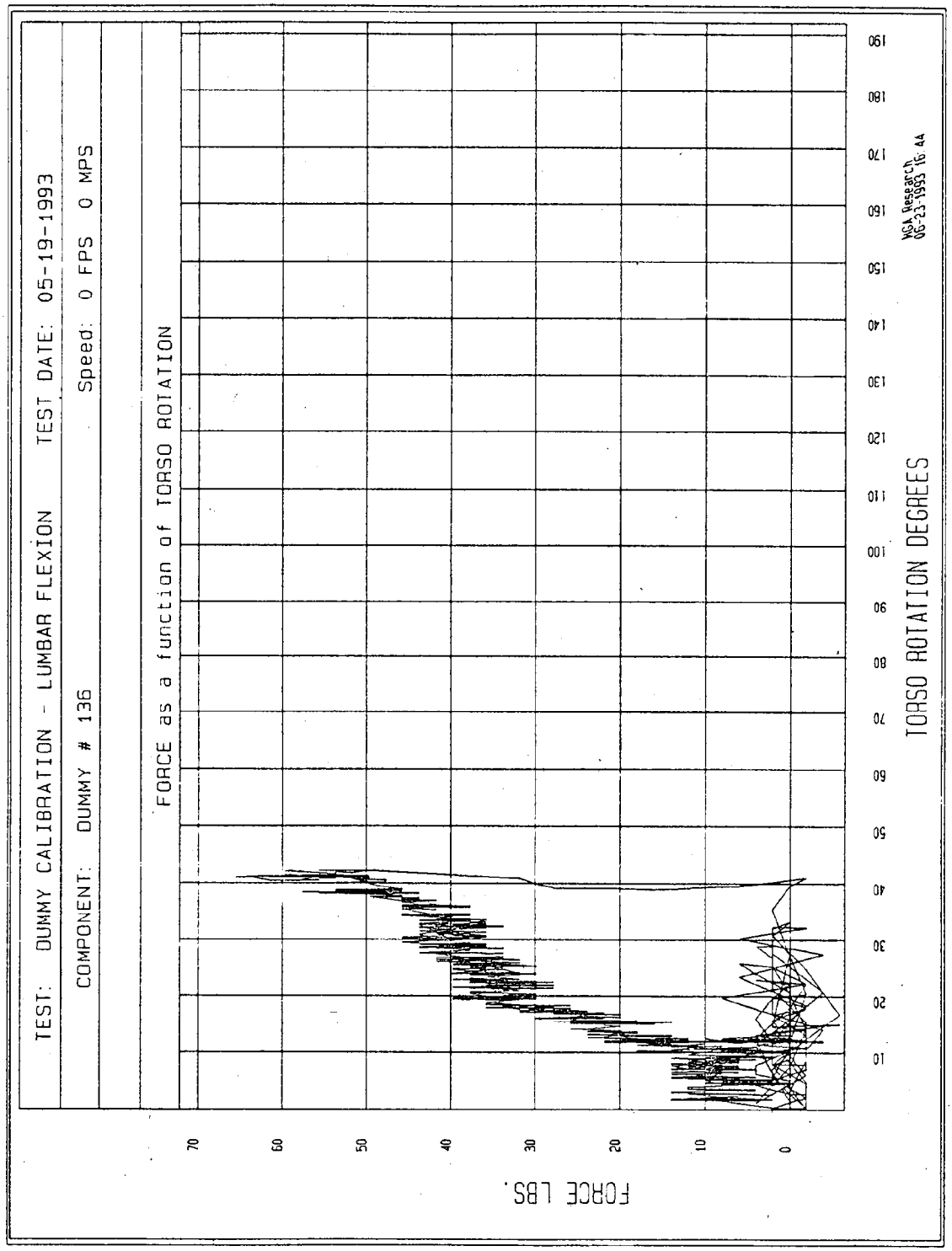

TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 05-18-1993
COMPONENT: DUMMY # 136 Speed: 13.808 FPS 4.19 MPS
YMIN=-5.67:137 G'S at 66. msec YMAX= 21.86554 G'S at 48. msec
LOWER SPINE ACCELERATION
1 Class ACCELERATION G'S from FI R10
24 22 20 18 16 14 12 10 8 6 4 2 0 -2 -4 -6
G'S
.01 .02 .03 .04 .05 .06 .07 .08 .09 .1 .11
TIME (SECONDS)
MGA Research 06-23-1993 16 41


TEST: DUMMY CALIBRATION - PELVIS IMPACT TEST DATE: 05-19-1993
COMPONENT: DUMMY # 136 Speed: 13.919 FPS 4.23 MPS
YMIN=-9.506694 G's at 56. msec YMAX= 52.93554 G's at 50. msec
PELVIS ACCELERATION
1 Class ACCELERATION G's from F1A11
50
40
30
20
10
0
-10
G's
10
20
30
40
50
60
70
80
90
1
11
TIME (SECONDS)
MGA Research
06-23-1993 16:42

C-8


TEST: DUMMY CALIBRATION - ABDOMEN COMPRESSIONTEST DATE: 05-19-1993
COMPONENT: DUMMY # 136 Speed: 0 FPS 0 MPS
ABDOMEN FORCE as a function of ABDOMEN DISPLACEMENT
ABDOMEN FORCE LBS.
100
80
60
40
20
0
ABDOMEN DISPLACEMENT INCHES
.1
.2
.3
.4
.5
.6
.7
.8
.9
1
1.1
1.2
1.3
WSA Research
06-23-1993 16:43

C-9

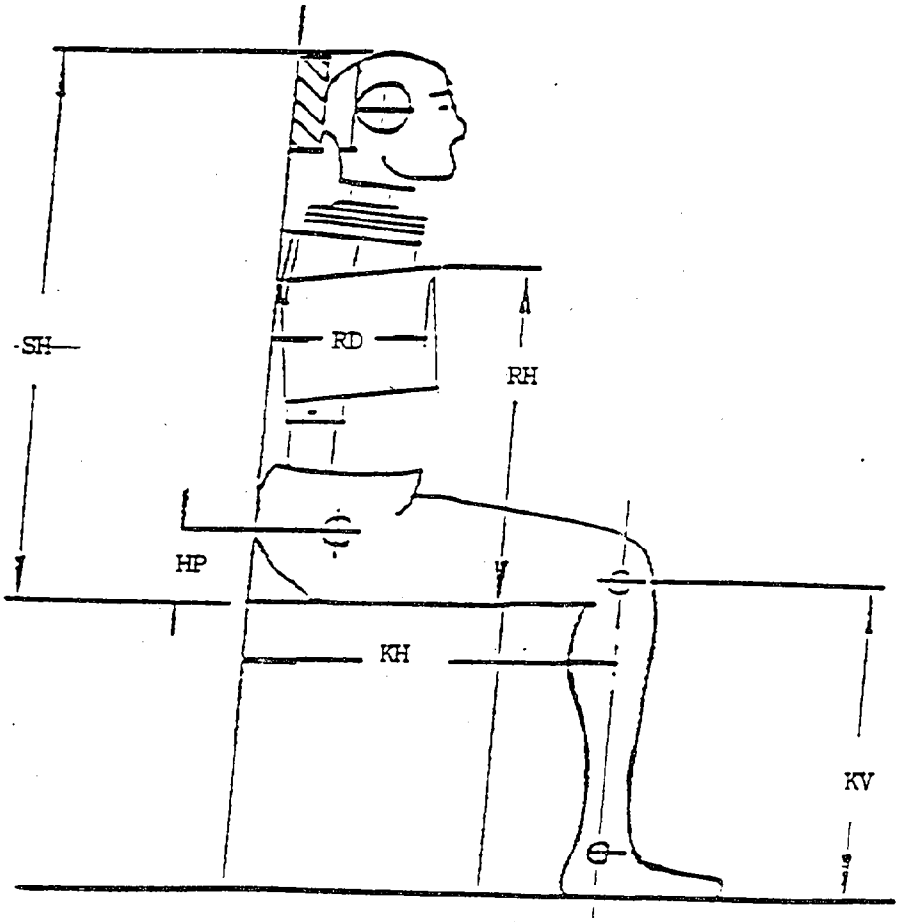

TEST: DUMMY CALIBRATION - LUMBAR FLEXION TEST DATE: 05-19-1993
COMPONENT: DUMMY # 136 Speed: 0 FPS 0 MPS
FORCE as a function of TORSO ROTATION
FORCE LBS.
TORSO ROTATION DEGREES
NGA Research 05-25-1993 16: 44

C-10

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

DUMMY NO.: 137 DUMMY CALIBRATION BY: Rod McClelland

I. CONFIGURATION VERIFICATION DATA




DATE OF CONFIGURATION VERIFICATION: 5-19-93

| DESCRIPTION | SPECIFICATION | ACTUAL MEASUREMENT |
|---|---|---|
| SH - Seated Height | 35.6" to 35.8" | 35.7 |
| RH - Rib Height | 19.75" to 20.5" | 20.5 |
| HP - Hip Pivot Height | 3.9" ref. | 3.9 |
| RD - Rib From Backline | 9.0" to 9.5" | 9.2 |
| KH - Knee Pivot From Backline | 20.1" to 20.7" | 20.2 |
| KV - Knee Pivot to Floor | 19.3" to 19.9" | 19.5 |
| HW - Hip Width | 14.0" to 15.4" | 14.5 |

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE (CONT.)

II. PERFORMANCE VERIFICATION DATA

DUMMY NO.: 137 DUMMY CALIBRATION BY: Rod McClelland

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

SIDE IMPACT DUMMY CONFIGURATION AND PERFORMANCE (CONT.)

1.0 LUMBAR FLEXION TEST

| | SPECIFICATION | MEASUREMENT |
|---|---|---|
| Force @ 20° | 22 to 34 lbs | 28 |
| Force @ 30° | 34 to 46 lbs | 44 |
| Force @ 40° | 46 to 58 lbs | 54 |
| Return Angle | 12° Maximum | 8 |

2.0 ABDOMINAL COMPRESSION TEST
(Preload = 10 lbs)

| | SPECIFICATION | MEASUREMENT |
|---|---|---|
| Force @ 0.5 in | 23.3 to 36.5 lbs | 26 |
| Force @ 0.75 in | 36.7 to 49.8 lbs | 39 |
| Force @ 1.0 in | 50 to 63 lbs | 53 |
| Force @ 1.3 in | 73 to 88 lbs | 87 |

3.0 THORAX IMPACT TEST

| | SPECIFICATION | MEASUREMENT |
|---|---|---|
| Probe Speed | 13.8 TO 14.2 f/s | 13.9 |
| Upper Rib | 37 to 46 g | 42 |
| Lower Rib | 37 to 46 g | 43 |
| Lower Spine | 15 to 22 g | 20.4 |

4.0 PELVIC IMPACT TEST

| | SPECIFICATION | MEASUREMENT |
|---|---|---|
| Probe Speed | 13.8 to 14.2 f/s | 13.8 |
| Pelvis Acceleration | 40 to 60 g | 46 |

# SIDE IMPACT DUMMY DATA SHEET

DUMMY #: 137

TEST DATE: 5-20-93

| DRIVER | PASSENGER |
|---|---|
| | X |

| EXPOSURE | DATE | TYPE OF TEST |
|---|---|---|
| 1st | 5-20-93 | NHTSA |

1) RIB ACCELEROMETERS:

| | MANUFACTURER | SERIAL NO. | CAL. DATE | DLR | CHECKED |
|---|---|---|---|---|---|
| UR | Endevco | ACC68 | 5-11-93 | 107.87 | X |
| URR | Endevco | AC8A4 | 5-11-93 | 90.96 | X |
| LR | Endevco | AC8R2 | 5-11-93 | 109.97 | X |
| LRR | Endevco | ACC99 | 5-11-93 | 104.95 | X |

2) SPINE ACCELEROMETERS

| | MANUFACTURER | SERIAL NO. | CAL. DATE | DLR | CHECKED |
|---|---|---|---|---|---|
| USY | Endevco | AAKM9 | 5-11-93 | 99.93 | X |
| USRY | Endevco | A67M | 5-11-93 | 86.92 | X |
| LSY | Endevco | ACC58 | 5-11-93 | 124.55 | X |
| LSRY | Endevco | AALL9 | 5-11-93 | 81.91 | X |

3) PELVIS ACCELEROMETERS

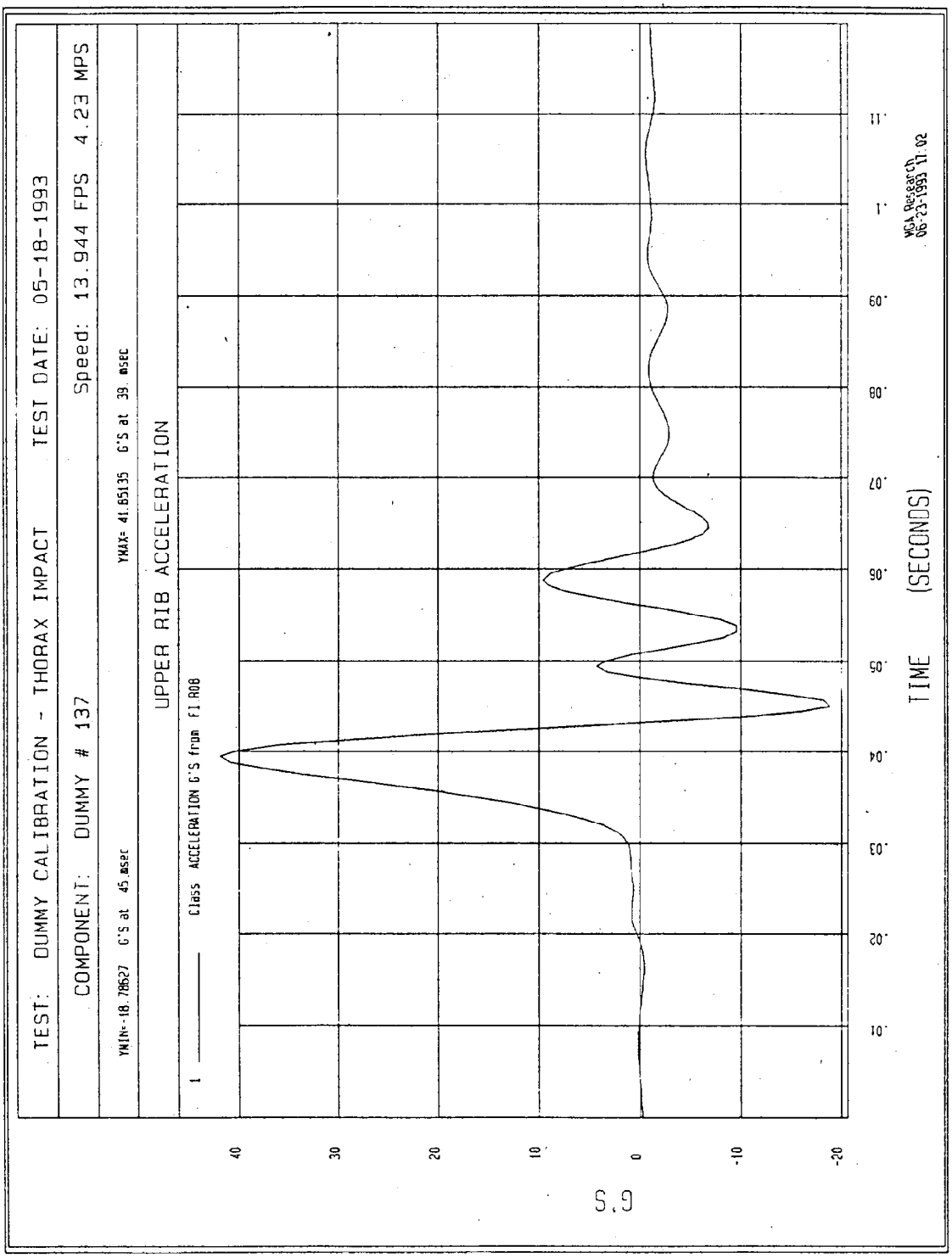
| | MANUFACTURER | SERIAL NO. | CAL. DATE | DLR | CHECKED |
|---|---|---|---|---|---|
| Y | Endevco | AC758 | 5-11-93 | 95.20 | X |
| RY | Endevco | AC8R7 | 5-11-93 | 120.89 | X |

4) OTHER ACCELEROMETERS

| MANUFACTURER | SERIAL NO. | CAL. DATE | DLR | CHECKED |
|---|---|---|---|---|
| Servco | 137 | 4-20-93 | .61 in/v | X |

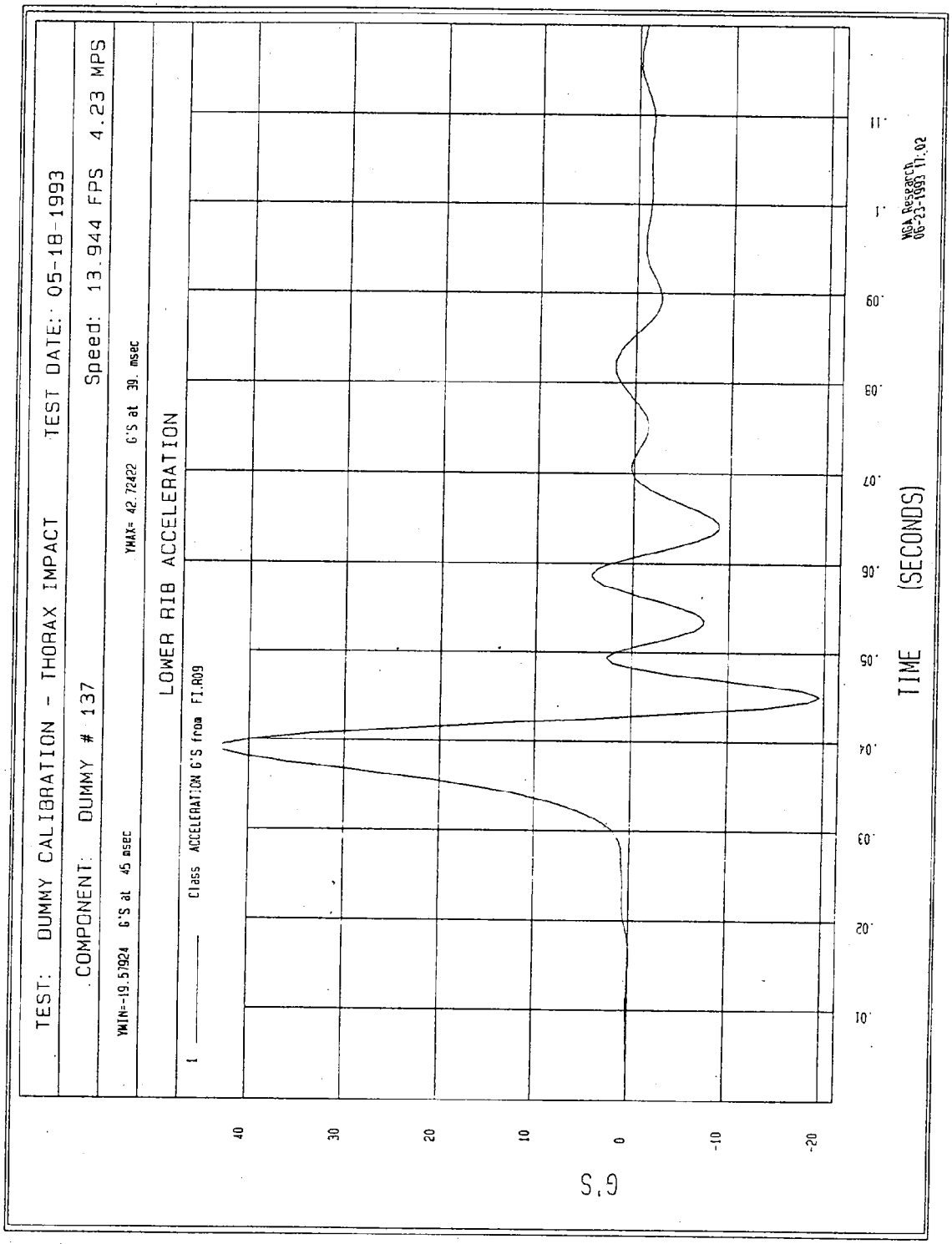
DUMMY INSTRUMENTED BY: Rod McClelland

APPROVED BY: Rod McClelland

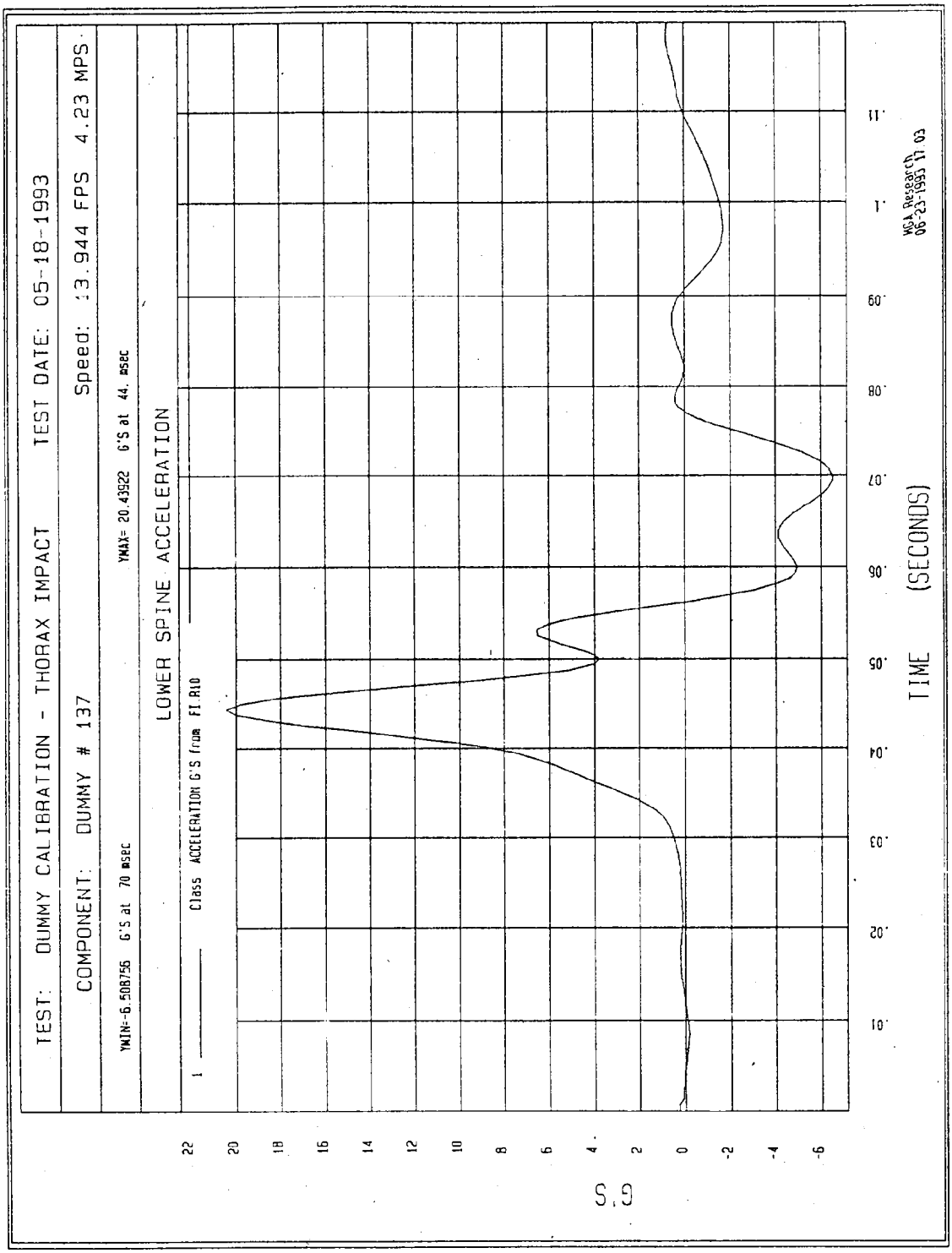

TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 05-18-1993
COMPONENT: DUMMY # 137 Speed: 13.944 FPS 4.23 MPS
YMIN=-18.78627 G'S at 45 msec YMAX= 41.85135 G'S at 39. msec
UPPER RIB ACCELERATION
1 Class ACCELERATION G'S from F1 R08
40
30
20
10
0
-10
-20
G'S
.01
.02
.03
.04
.05
.06
.07
.08
.09
.1
.11
TIME (SECONDS)
MGA Research
06-23-1993 11:02

C-14

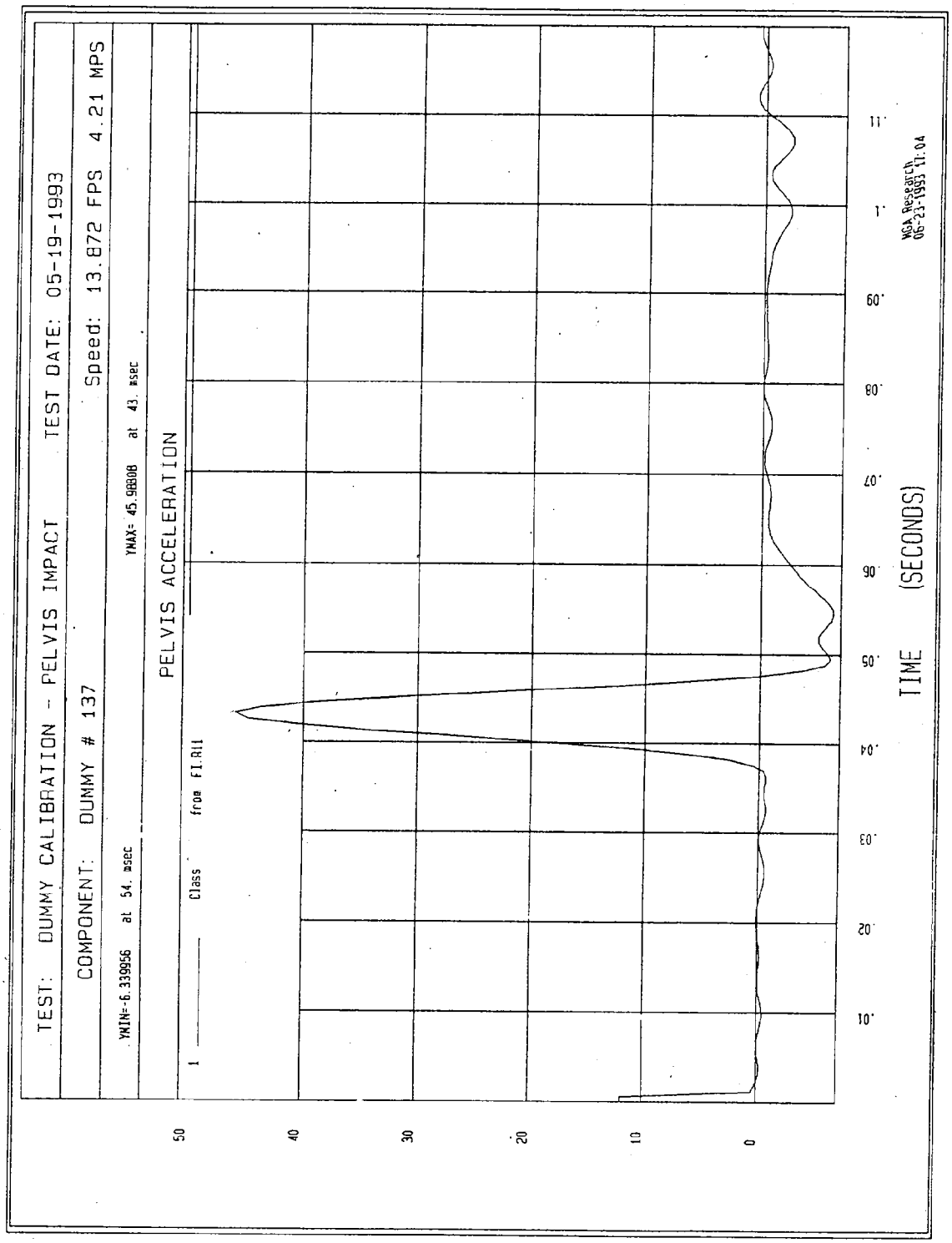
224

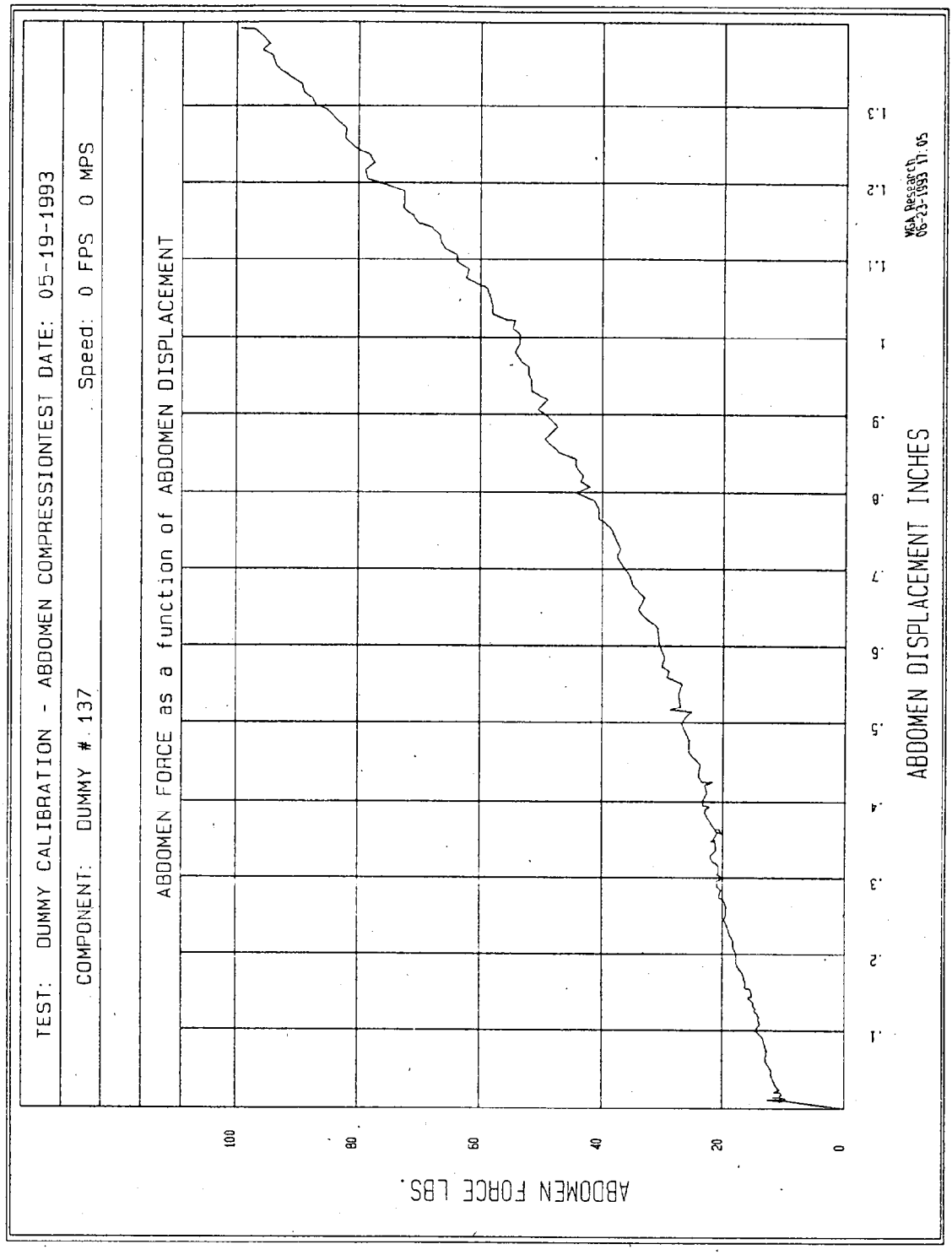

TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 05-18-1993
COMPONENT: DUMMY # 137 Speed: 13.944 FPS 4.23 MPS
YMIN=-19.57924 G'S at 45 msec YMAX= 42.72422 G'S at 39. msec
LOWER RIB ACCELERATION
1 Class ACCELERATION G'S from F1.R09
G'S
40
30
20
10
0
-10
-20
.01
.02
.03
.04
.05
.06
.07
.08
.09
.1
.11
TIME (SECONDS)
MGA Research 06-23-1993 11:02

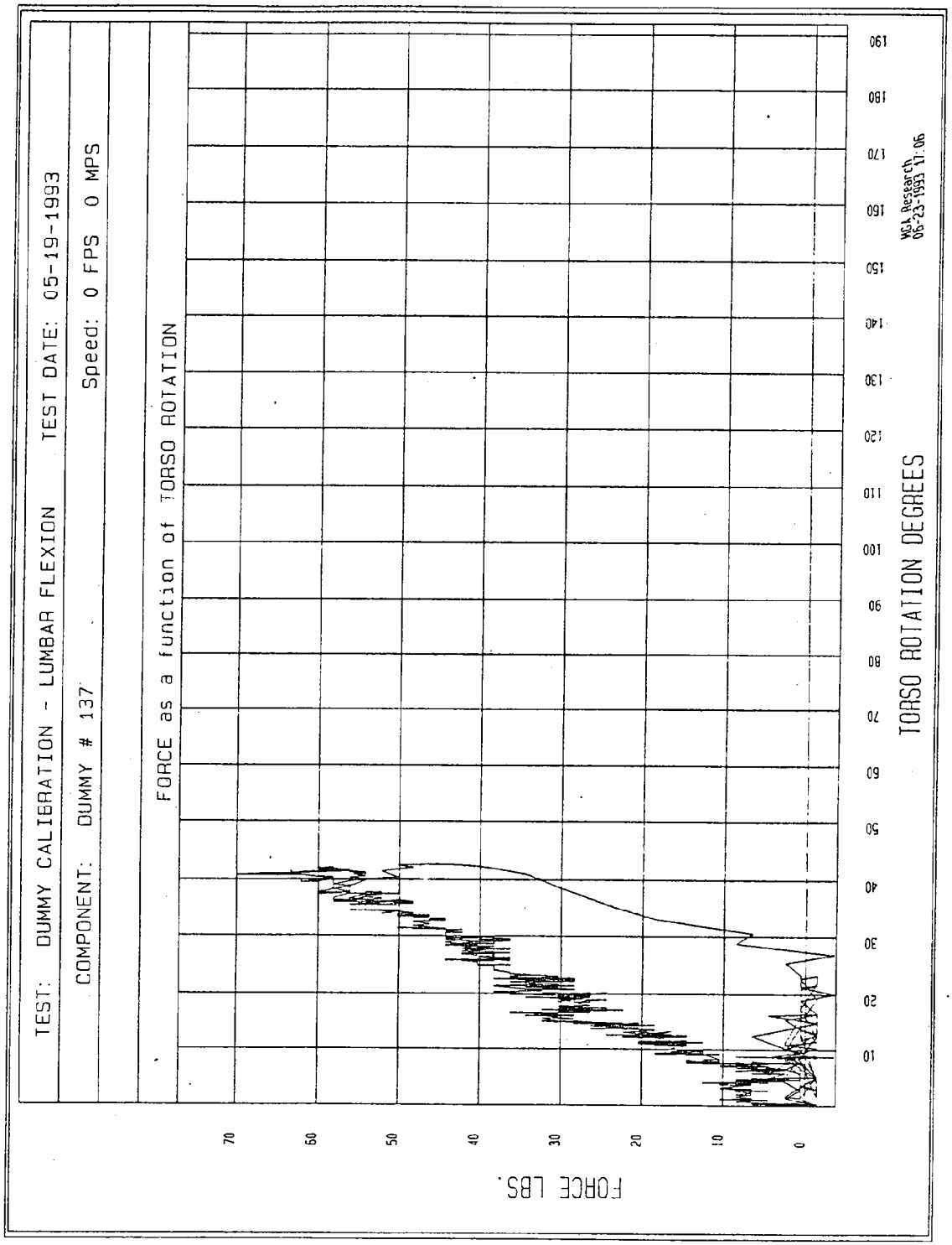
C-15


TEST: DUMMY CALIBRATION - THORAX IMPACT TEST DATE: 05-18-1993
COMPONENT: DUMMY # 137 Speed: 13.944 FPS 4.23 MPS
YMIN=-6.508756 G'S at 70 msec
YMAX= 20.43922 G'S at 44. msec
LOWER SPINE ACCELERATION
1 Class ACCELERATION G'S from FI.R10
G's
TIME (SECONDS)
MGA Research 06-23-1993 17:03

C-16


TEST: DUMMY CALIBRATION - PELVIS IMPACT TEST DATE: 05-19-1993
COMPONENT: DUMMY # 137 Speed: 13.872 FPS 4.21 MPS
YMIN=-6.339956 at 54. msec YMAX= 45.98808 at 43. msec
PELVIS ACCELERATION
1 Class from F1.R11
TIME (SECONDS)
MGA Research 06-23-1993 11:04
50
40
30
20
10
0
.10
.02
.03
.04
.05
.06
.07
.08
.09
.1
.11


TEST: DUMMY CALIBRATION - ABDOMEN COMPRESSIONTEST DATE: 05-19-1993
COMPONENT: DUMMY # 137 Speed: 0 FPS 0 MPS
ABDOMEN FORCE as a function of ABDOMEN DISPLACEMENT
ABDOMEN FORCE LBS.
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
1.1
1.2
1.3
ABDOMEN DISPLACEMENT INCHES
MGA Research
06-23-1993 11:05


TEST: DUMMY CALIBRATION - LUMBAR FLEXION TEST DATE: 05-19-1993
COMPONENT: DUMMY # 137 Speed: 0 FPS 0 MPS
FORCE as a function of TORSO ROTATION
FORCE LBS.
70
60
50
40
30
20
10
0
TORSO ROTATION DEGREES
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
MGA Research
05-23-1993 11:06