

V1596

**SIDE IMPACT PROTECTION
IN PRODUCTION VEHICLES**

**MDB-TO-CAR SIDE IMPACT TEST OF
A 27° CRABBED MOVING DEFORMABLE BARRIER
TO A 1991 TOYOTA PICKUP
AT 33.5 MPH**

**MOBILITY SYSTEMS AND EQUIPMENT COMPANY
9920 LA CIENEGA BOULEVARD SUITE 708
INGLEWOOD, CALIFORNIA 90301**



APRIL 1991

TEST REPORT

Prepared Under Contract No. DTNH22-87-C-07168, D.O. #2

For

**U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Research
400 Seventh Street, S.W.
Washington, DC 20590**

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Date

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16. Abstract This test report documents a crash test to evaluate side impact protection. Testing was conducted on a 1991 Toyota Pickup at Mobility Systems and Equipment Company Test Facility, Mira Loma, California. The test vehicle was impacted on the left side by a moving deformable barrier, crabbled to 27°, at 33.49 mph. The test was a simulation of a 90° intersection collision with the striking vehicle traveling at 30 mph and the struck vehicle traveling at 15 mph. Occupant response of one side impact dummy was measured. The dummy was located in driver's designated seating position. The test date was April 5, 1991. The Injury Measure results are summarized below:															
<table border="1"> <thead> <tr> <th>PARAMETER</th> <th>INJURY MEASURE DRIVER</th> <th>VALUE PASSENGER</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criterion (HIC)</td> <td>134.42</td> <td>N/A</td> </tr> <tr> <td>Thoracic Trauma Index (TTI), G's (d)</td> <td>55.25</td> <td>N/A</td> </tr> <tr> <td>Peak Pelvic Acceleration, G's</td> <td>52.69</td> <td>N/A</td> </tr> </tbody> </table>				PARAMETER	INJURY MEASURE DRIVER	VALUE PASSENGER	Head Injury Criterion (HIC)	134.42	N/A	Thoracic Trauma Index (TTI), G's (d)	55.25	N/A	Peak Pelvic Acceleration, G's	52.69	N/A
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METRIC CONVERSION FACTORS

APPROXIMATE CONVERSIONS FROM METRIC MEASURES

SYMBOL WHEN YOU KNOW MULTIPLY BY TO FIND SYMBOL

LENGTH

in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km

AREA

in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha

MASS (weight)

oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t

VOLUME

tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
fl ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³

TEMPERATURE (exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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APPROXIMATE CONVERSIONS FROM METRIC MEASURES

SYMBOL WHEN YOU KNOW MULTIPLY BY TO FIND SYMBOL

LENGTH

mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi

AREA

cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10,000 m ²)	2.5	acres	

MASS (weight)

g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	

VOLUME

ml	milliliters	8.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m ³	cubic meters	36	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³

TEMPERATURE (exact)

°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F
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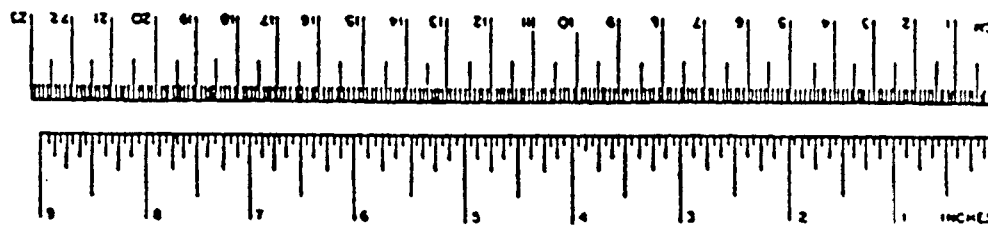


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SECTION 1

PURPOSE AND INTRODUCTION

This testing program is a part of an investigation and evaluation of side impact protection in production light trucks and vans. The test is specifically intended to simulate a 90 deg. intersection collision with the striking vehicle moving at 30 mph. This is accomplished by towing a Moving Deformable Barrier (MDB) crabbed at a 27° angle into the struck test vehicle which is placed in a stationary position. The velocity of the MDB is to be 33.5 ± 0.5 mph.

The subject vehicle for this test was a 1991 Toyota Pickup. The test was performed on April 5, 1991 at an actual impact speed of 33.49 mph. The leading left-hand edge of the MDB contacted the test vehicle 34 inches forward of the midpoint of the wheelbase.

Section 2 contains a general test summary and vehicle information data sheets. Section 3 contains the test results. Appendix A contains pretest and posttest vehicle and dummy photographs and Appendix B contains data plots for transducers. Appendix C contains side impact dummy certification data and Appendix D has the side impact dummy positioning procedure.

SECTION 2

TEST SUMMARY AND VEHICLE INFORMATION

The 1991 Toyota Pickup, Test No. 3, was tested on 05 April 1991. General test vehicle information and pretest conditions are given in Tables 2-1 and 2-2. A crash test summary is shown in Table 2-3. The vehicle was instrumented with 10 accelerometer channels and three onboard high-speed movie cameras. Accelerometer locations and peak values are shown in Table 2-4. All pretest measurements were made detailing the left side vehicle profile. The impact point was marked on the vehicle 37 inches forward of the midpoint of the wheelbase.

One side impact anthropomorphic dummy (SID) was placed in the vehicle's driver seat and positioned using the side impact dummy seating procedure (Appendix D). SID position measurements are shown in Table 2-5. The SID was instrumented with 12 accelerometers and one displacement transducer. A summary of the SID accelerometer data is given in Table 2-6. Colored chalk was applied to the SID's head, left shoulder, left hip and his knees to help determine dummy contact points during the test.

The MDB was crabbed at 27° and instrumented with five (5) accelerometers and two (2) high-speed movie cameras. A general crash test summary and accelerometer locations with peak values for the MDB are shown in Tables 2-7 and 2-8.

Additional film coverage of the test was also provided by two (2) overhead and two (2) ground high-speed movie cameras and one real-time camera. Camera locations are given in Table 2-9. A total of 30 channels of information was recorded on two (2) FM data tape recorders.

TABLE 2-1 TEST VEHICLE DATA

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1991/TOYOTA/PICKUP
 VEHICLE NHTSA NO.: RM5101 VIN: JT4RN81A4M0060867
 VEHICLE BODY COLOR: WHITE; MONTH & YEAR OF MANUFACTURE: 09/90
 ENGINE: Cyl. 4; DISPLACEMENT: 2.4 Liters; PLACEMENT:
X Longitudinal Lateral; X Gas Diesel; Turbocharged
 TRANSMISSION: 5 Speed; X Manual; Automatic; Overdrive
 FINAL DRIVE: Front Wheel Drive; X Rear Wheel Drive;
Four Wheel Drive
 DATE VEHICLE AVAILABLE FOR SIDE IMPACT TESTING: 01/25/91
 ODOMETER READING: 57.0 miles; OPTIONS: A/C; X P/S; P/Wdo;
 Tilt Whl.; Cruise Control

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): 29 psi Front; 35 psi Rear
 Recommended Tire Size: P235/75R 15XL
 Tires On Vehicle: 195/75R14; Manufacturer: DUNLOP
 Number Of Occupants: 3 Front; 0 Rear; 0 3rd Seat; 3 TOTAL
 Type Of Front Seats: Bucket; X Bench; Split Bench
 Type Of Front Seat Back: X Fixed; Adjustable With Lever
 Rotating Knob
 Vehicle Maximum Capacity Loading = 1831 lb (A)
 No. Of Occupants x 150 lb - - - = 450 lb (B)
 Cargo Capacity (A - B) - - - - = 1381 lb
 *GVWR - Delivered Weight

TEST VEHICLE DELIVERED WEIGHT WITH MAXIMUM FLUIDS:

Right Front = <u>728</u> lb	TOTAL FRONT = <u>1464</u> lb (57.0% of TOTAL)
Left Front = <u>736</u> lb	
Right Rear = <u>586</u> lb	TOTAL REAR = <u>1105</u> lb (43.0% of TOTAL)
Left Rear = <u>519</u> lb	
TOTAL WEIGHT = <u>2569</u> lb	

TABLE 2-1 TEST VEHICLE DATA (Cont'd)

CALCULATION OF TEST VEHICLE TARGET WEIGHT:

Total Test Vehicle Delivered Weight With Maximum Fluids	=	<u>2569</u>	lb
Maximum Cargo Carrying Capacity Of Test Vehicles* - - -	=	<u>300</u>	lb
Weight Of One P.572 SID (1 x 174 lb) - - - - -	=	<u>174</u>	lb
TEST VEHICLE TARGET WEIGHT- - - - -	=	<u>3043</u>	lb

* 300 lb for light trucks and MPVs

ACTUAL WEIGHT OF TEST VEHICLE WITH 1 DUMMY AND CARGO:

Right Front	=	<u>899</u>	lb	
Left Front	=	<u>797</u>	lb	TOTAL FRONT = <u>1696</u> lb (56.1% of TOTAL)
Right Rear	=	<u>719</u>	lb	
Left Rear	=	<u>607</u>	lb	TOTAL REAR = <u>1326</u> lb (43.9% of TOTAL)
TOTAL WEIGHT = <u>3022</u> lb (which includes <u>100</u> lb of cargo ballast weigh				

TEST VEHICLE ATTITUDE:

As Delivered -----Right Front = 29.5 in

Left Front = 29.4 in

Right Rear = 29.1 in

Left Rear = 29.0 in

Test Vehicle Wheelbase: 103.0 in; C.G.= 44.3 in rearward of front wheel centerline

Ready For Test -- Right Front = 28.7 in

Left Front = 28.8 in

Right Rear = 27.7 in

Left Rear = 28.8 in

TOTAL VEHICLE LENGTH:

Right Side = 172.0 in

Left Side = 172.0 in

Centerline = 175.0 in

TABLE 2-2 PRETEST CONDITIONS

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1991/TOYOTA/PICKUP

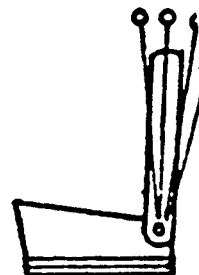
VEH. NHTSA NO. RM5101; TEST DATE: 04/05/91

FRONT SEAT CUSHION PLACEMENT: Midpoint of forward/aft travel
(6th notch rearward)

TOTAL NUMBER OF ADJUSTMENT POSITIONS OR DETENTS: 11 notches

FRONT SEAT BACK ADJUSTMENT POSITION: Not Adjustable

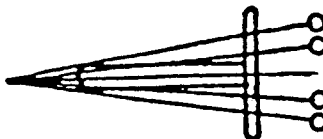
(latch position, knob rotations, etc.)



TORSO ANGLE 25°

ADJUSTABLE STEERING COLUMN POSITION:

X Not Applicable



Midpoint of swing

WINDOW POSITIONS: Left Front -- closed
 Left Rear --- n/a
 Right Front - open
 Right Rear -- n/a

NOTE: Window 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: Front Standard Tank 12.7 Gal
 Rear Optional Tank n/a Gal
 (92 to 94% of USABLE CAPACITY)

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

Wheelbase = 103.0 in
 Impact point is 14.5 inches rearward of front axle centerline (which is 37 inches forward of the wheelbase midpoint).

TABLE 2-3 CRASH TEST SUMMARY FOR TEST VEHICLE

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1991/TOYOTA/PICKUP

VEH. NHTSA NO. RM5101; VIN: JT4RN81A4M0060867

TEST DATE: 04/05/91 BUILD DATE: 09/90

OVERALL LENGTH = 175.0 inches; OVERALL WIDTH = 66.5 inches

TEST WEIGHT: Left Front = 797 lb; Left Rear = 607 lb

Right Front = 899 lb; Right Rear = 719 lb

SUBTOTALS - - - Front = 1696 lb Rear = 1326 lb

TOTAL VEHICLE WEIGHT - - - - - 3022 lb

WHEELBASE = 103.0 inches

LONGITUDINAL C.G. FROM CENTER OF FRONT AXLE = 44.3 inches

IMPACT ANGLE WITH RESPECT TO IMPACTOR = 90 degrees

MAXIMUM EXTERIOR STATIC CRUSH:

1. LEVEL 1 (12.4" above ground) = N/A inches

2. LEVEL 2 (25.5" above ground) = 6.8 inches

3. LEVEL 3 (28.0" above ground) = 5.8 inches

4. LEVEL 4 (42.0" above ground) = 3.2 inches

5. LEVEL 5 (58.0" above ground) = -20.2 inches

MAXIMUM POSTTEST INTRUSION = 6.8 inches

OCCUPANTS:

DRIVER

LEFT REAR

TYPE OF DUMMY - - - - SID (S/N 137) N/A

RESTRAINT USED- - - - 3-POINT BELT N/A

INSTRUMENTATION:

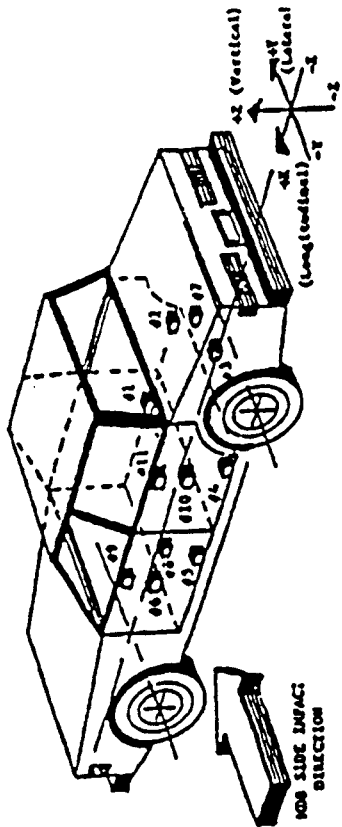
NUMBER OF DATA CHANNELS = 30

NUMBER OF CAMERAS: ONBOARD = 2 High-speed

OFFBOARD = 4 High-speed, 1 Real-time

TABLE 2-4 TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST VEHICLE: 1991 TOYOTA PICKUP NHTSA NO.: RM5101 TEST DATE: 04/05/91



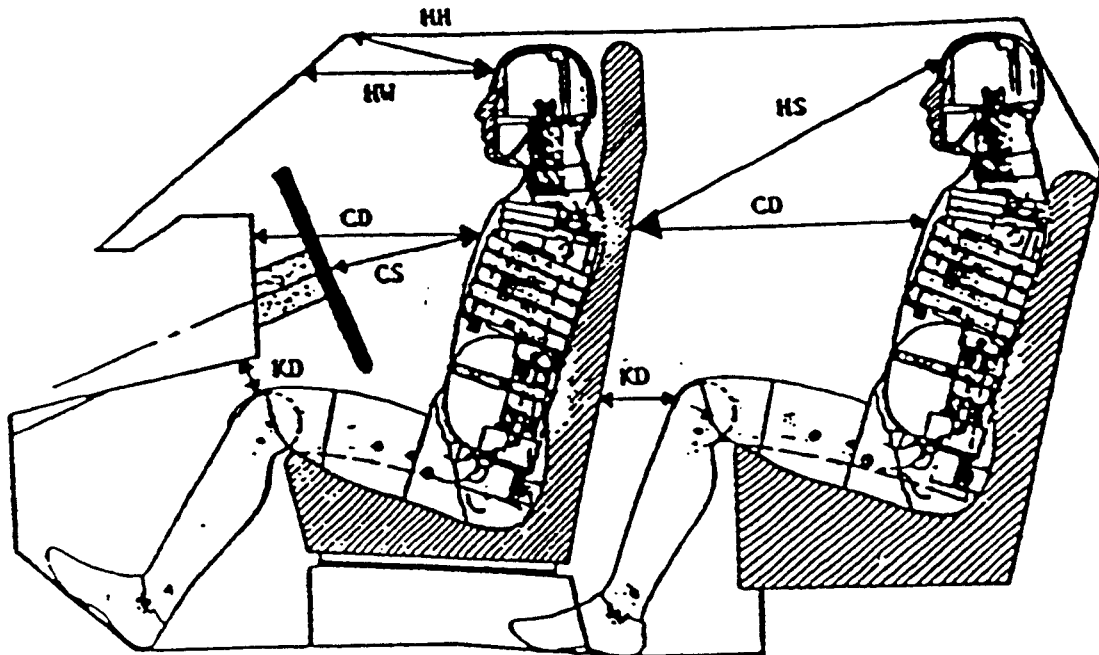
ACCEL. NO.	LOCATION	COORDINATES (")			LONG. (X)		LAT. (Y)		VERT. (Z)		RESULTANT	
		X*	Y*	Z*	POS. / NEG.	TIME (msec)	MAX (g)	POS. / NEG.	TIME (msec)	MAX (g)	POS. / NEG.	TIME (msec)
1	Right Side Sill	61.0	23.5	17.3	-15.32	30.20	35.94	12.70	-21.5	7.90	37.7	12.90
2	At Front Seat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Right Floorpan	130.5	0.0	25.0	-10.89	13.40	+21.8	14.30	-36.5	31.70	40.7	31.80
4	Above Axle	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Right Side Sill	53.9	25.4	17.3	NA	NA	117.3	6.00	NA	NA	NA	NA
6	At Front Seat	68.9	27.4	29.0	NA	NA	+140.9	7.80	NA	NA	NA	NA
7	Right Front Door on Centerline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Occ. Compartment	88.5	27.4	28.0	NA	NA	+198.6	5.80	NA	NA	NA	NA
9	Right Front Door	68.9	27.4	34.9	NA	NA	+106.4	11.10	NA	NA	NA	NA
10	Upper Centerline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	Right Rear Door	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Upper Centerline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

* Reference: X - Rear Bumper (+ Forward)

Y - Vehicle Centerline (+ To Right)

Z - Ground Level (+ Up)

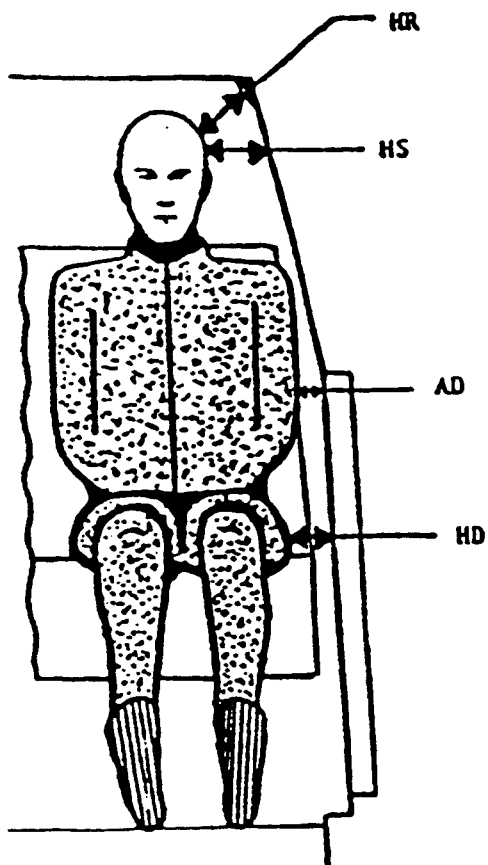
TABLE 2-5 SIDE IMPACT DUMMY (SID) LONGITUDINAL CLEARANCE DIMENSIONS



	DRIVER ID # 319	REAR PASSENGER ID # N/A
HH	18.0 in	NA in
HW	20.0 in	NA in
HS	NA in	NA in
CD	23.3 in	NA in
CS	15.8 in	NA in
KDL	4.5 in	NA in
KDR	5.8 in	NA in

1991 TOYOTA PICKUP, RM5101

TABLE 2-5 SIDE IMPACT DUMMY (SID) LONGITUDINAL CLEARANCE DIMENSIONS
(Cont'd)



	DRIVER ID # 319	REAR PASSENGER ID # N/A
HR	4.8 in	NA in
HS	6.5 in	NA in
AD	4.5 in	NA in
HD	6.3 in	NA in

1991 TOYOTA PICKUP, RM5101

TABLE 2-6 SIDE IMPACT DUMMY (SID) TEST DATA SUMMARY

TEST DATE: 04/05/91

TEST DATE: 04/05/91	FRONT DUMMY -- ID # 137				REAR DUMMY -- ID # NA			
	POS.	DIRECT	NEG.	DIRECT	POS.	DIRECT	NEG.	DIRECT
	MAX	TIME	MAX	TIME	MAX	TIME	MAX	TIME
	(g)	(msec)	(g)	(msec)	(g)	(msec)	(g)	(msec)
HEAD ACCELERATIONS:								
Longitudinal --- X	14.607	212.90	-10.7	64.70				
Lateral ----- Y	36.11	61.90	-23.4	212.00				
Vertical ----- Z	41.08	70.30	- 5.0	215.50				
RESULTANT ----- R	46.28	61.90	0.0	20.00	N/A	N/A	N/A	N/A
HIC -----*	134.42				N/A			
(TIME INTERVAL, SEC.)	(0.056 TO 0.092)							
RIB ACCELERATIONS:								
1.Upper Rib Lateral Y*	40.15	49.38	-9.22	76.88				
2.Upper Rib Lateral Y*	38.03	49.38	-8.23	77.50	N/A	N/A	N/A	N/A
1.Lower Rib Lateral Y*	54.27	36.88	-6.53	96.88				
2.Lower Rib Lateral Y*	53.99	36.88	-5.78	96.88	N/A	N/A	N/A	N/A
SPINE ACCELERATIONS:								
1.Upper Rib Lateral Y*	40.58	52.50	-5.46	70.00				
2.Upper Rib Lateral Y*	37.94	52.50	-5.06	70.00	N/A	N/A	N/A	N/A
1.Lower Rib Lateral Y*	56.22	41.88	-7.12	73.75				
2.Lower Rib Lateral Y*	55.41	41.25	-7.37	73.13	N/A	N/A	N/A	N/A
PELVIS ACCELERATIONS:								
Lateral Y*	52.69	35.00	-14.4	57.50	N/A	N/A	N/A	N/A
RIB DEFLECTION: **								
Lateral	0.40	190.30	-1.12	97.80	N/A	N/A	N/A	N/A
THORACIC TRAUMA INDEX (TTI), G's (d)	55.25				N/A			

* Data Required (other data to be used by R & D)

REFERENCE: Positive Direction -- Longitudinal (X) = forward
Lateral (Y) = to right
Vertical (Z) = downNegative Direction -- Longitudinal (X) = rearward
Lateral (Y) = to left
Vertical (Z) = up** Approximate measurement
for research purposes.

TABLE 2-7 CRASH TEST SUMMARY FOR SIDE IMPACTOR

TYPE OF TEST: 90°, 30 MPH/15 MPH SIMULATION TEST DATE 04/05/91
NHTSA NO. FOR TARGET VEHICLE: RM5101
POSITION OF IMPACTOR (MDB) ON MONORAIL: CRABBED 27° TO RIGHT (CLOCKWISE)

MDB DETAILS: Overall Width of Framework Carriage = 49.35 in.
Overall Length of MDB=162 in. (including honeycomb impact face)
Wheelbase of Framework Carriage = 102 in.
Tread of Framework Carriage (Front & Rear) = 72 in.
C.G. location rearward of front axle = 44.5 in.
MDB Weight -- Left Front = 1013 lb; Left Rear = 442 lb
Right Front = 638 lb; Right Rear = 838 lb
SUBTOTAL: Front = 1651 lb; Rear = 1280 lb
TOTAL MDB WEIGHT = 2931 lb

IMPACT ANGLE (MDB C/L to Target Vehicle C/L) = 90

IMPACT SPEED = 33.49 MPH

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE:

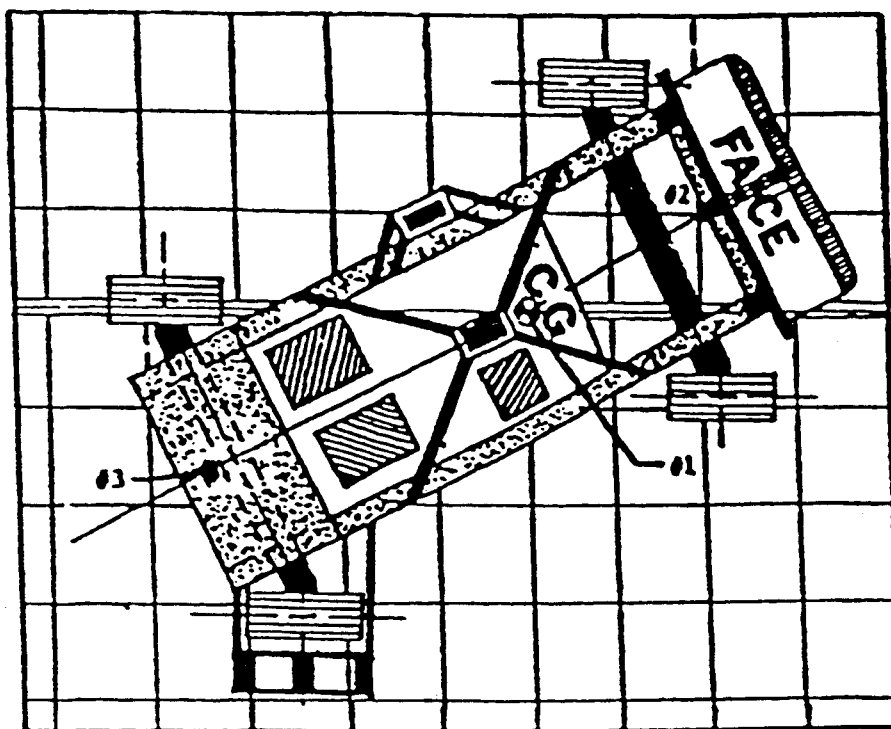
1. ROW A at bumper level = 3.33 in.
2. ROW B at mid-stack level = -1.74 in.
3. ROW C at top of stack level = 2.06 in.

INSTRUMENTATION:

Number of MDB Data Channels = 5 accelerometer channels

Number of Onboard Cameras = 2 high speed

TABLE 2-8 MOVING DEFORMABLE BARRIER (MDB) ACCELEROMETER LOCATIONS AND DATA SUMMARY



1991 TOYOTA PICKUP, RM5101

ACCEL. NO.	LOCATION	Coordinates			POS. MAX (g)	DIRECT. TIME (msec)	NEG. MAX (g)	DIRECT. TIME (msec)
		X*	Y*	Z*				
1	MDB Center of Gravity							
	Longitudinal X	74.0	0.0	14.0	4.5	94.40	-23.9	36.50
	Lateral Y				9.2	36.60	- 2.7	31.20
	Vertical Z				36.9	47.40	-46.9	22.20
	Resultant R				25.7	36.50	126.0	219.00
2	Front Frame Member							
	Longitudinal X	131.0	0.0	26.5	0.0	127.60	-25.5	69.70
3	Rear Frame Member							
	Longitudinal X	13.0	0.0	17.0	3.8	118.50	-20.0	13.80

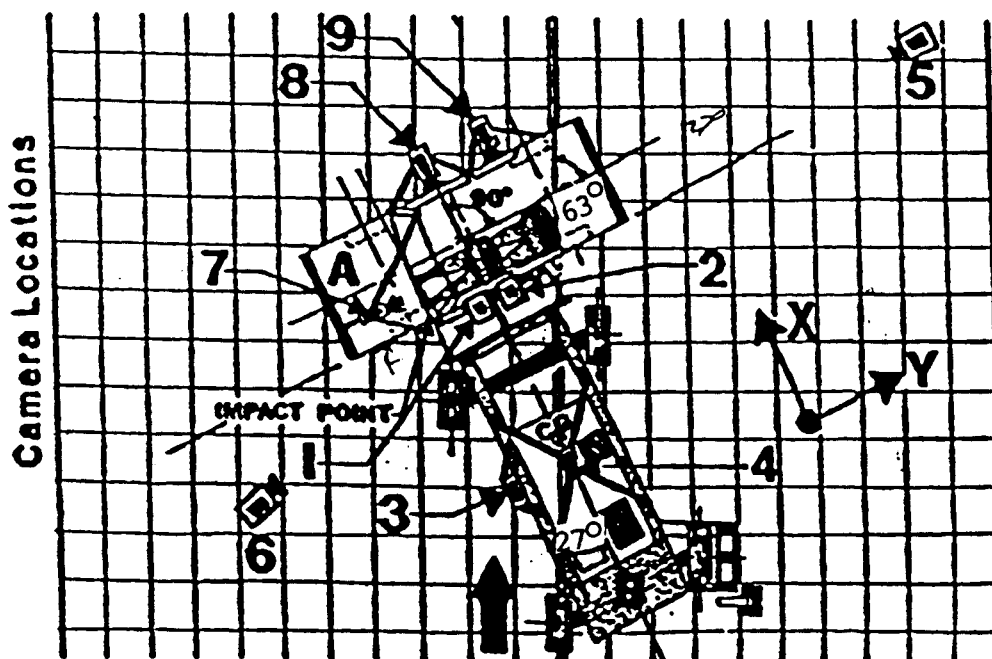
*Reference: X - Rearmost Frame Point (+ Forward)
Y - Centerline of MDB (+ Right)
Z - ground Level (+Up)

TABLE 2-9 HIGH-SPEED CAMERA LOCATIONS AND DATA

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	COORDINATES (in)		
					X*	Y*	Z*
1	Overhead view of test vehicle dynamics	Fastex	28	600	2	70	191
2	Overhead Closeup view of impact plane	Fastex	16	600	12	18	191
3	MDB Onboard Closeup view of impact point	Himac	16	600	-121	0	29.5
4	MDB Onboard view of driver dummy kinematics	Himac	16	600	-150	37	54
5	Overhead view of test Level--Overall View	Fastex	28	600	85	432	19
6	Left Side Ground Level--Overall View	Fastex	28	600	12	-264	21.5
7	Test Vehicle Onboard-driver dummy front view kinematics	Fastex	16	600	22	47	30
8	Test Vehicle Onboard-pass. dummy side view kinematics	Fastex	16	600	89	35	23.5
9	Test Vehicle Onboard-pass. dummy side view kinematics	NA	NA	NA	NA	NA	NA

NOTE: Real time (24 fps)
film coverage of pre-test
and post-test event
included in final print

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



1991 TOYOTA PICKUP, RM5101

SECTION 3

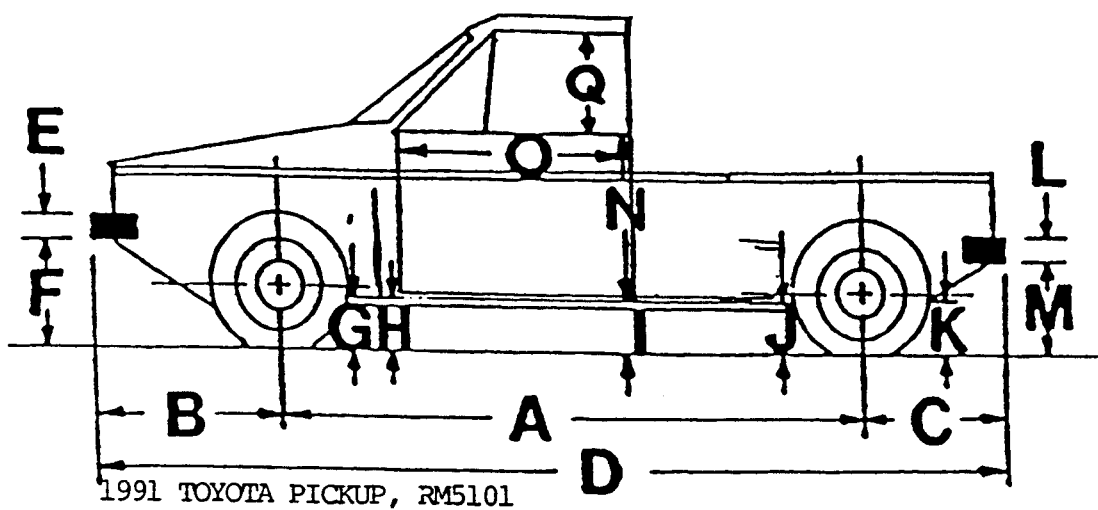
TEST RESULTS

The 1991 Toyota Pickup was impacted at 33.49 mph by the 27° crabbed MDB on 05 April 1991. The MDB's left edge contacted the test vehicle 3.0 inches rearward of the impact line. The test vehicle slightly spun around counterclockwise and pushed back due to impact with barrier. The vehicle driver side door and bed were crushed inwards a maximum of 6.8 inches. Pretest and posttest vehicle dimensions are shown in Tables 3-1 to 3-5.

The SID did not impact the driver door. The left knee, impacted the driver side door. The neck and body were rotated far enough by the impact force to allow the SID head to go through the driver side window. The SID head did not contact the aluminum barrier or any objects during this action. It appeared that the top of the SID head slightly impacted the top trim part of the driver side window. The SID remained in the driver position as it was restrained by the seat belts. SID contact is documented in Table 3-6

The MDB impacted the test vehicle and was stopped by the remote brake system to prevent a second impact. The aluminum deformable barrier received minor damage with a maximum crush of 3.33 inches on the left-hand corner of bumper level. The crush details for the MDB are given in Table 3-7.

TABLE 3-1 PRE AND POSTTEST MEASUREMENTS



NOTE: All dimensions are in inches

	PRETEST	POSTTEST	CHANGE
A	103.0	102.2	+ 0.8
B	29.625	28.6	+ 1.025
C	42.375	47.8	- 5.425
D	175.0	178.0	- 3.0
E	23.875	23.9	- 0.025
F	14.125	14.0	+ 0.125
G	14.375	14.1	+ 0.275
H	13.0	13.8	- 0.8
I	13.5	14.3	- 0.8
J	15.5625	20.1	- 4.54
K	18.5625	20.0	- 1.44
L	N/A	N/A	N/A
M	N/A	N/A	N/A
N	26.5	23.2	+ 3.3
O	44.25	44.0	+ 0.25
P	N/A	N/A	N/A
Q	17.0	16.0	+ 1.0

TABLE 3-2 VEHICLE SIDE MEASUREMENT

TEST VEHICLE NHTSA NO.: RM5101 1991 TOYOTA PICKUP

LEVEL 5 @ Window Top - - - - - 58.0 in

LEVEL 4 @ Window Sill - - - - - 42.0 in

LEVEL 3 @ Mid Door - - - - - 28.0 in

LEVEL 2 @ Occupant H-Point - - - - 24.5 in

LEVEL 1 @ Axle Centerline Height - - 12.3 in

(or Sill Top Height)

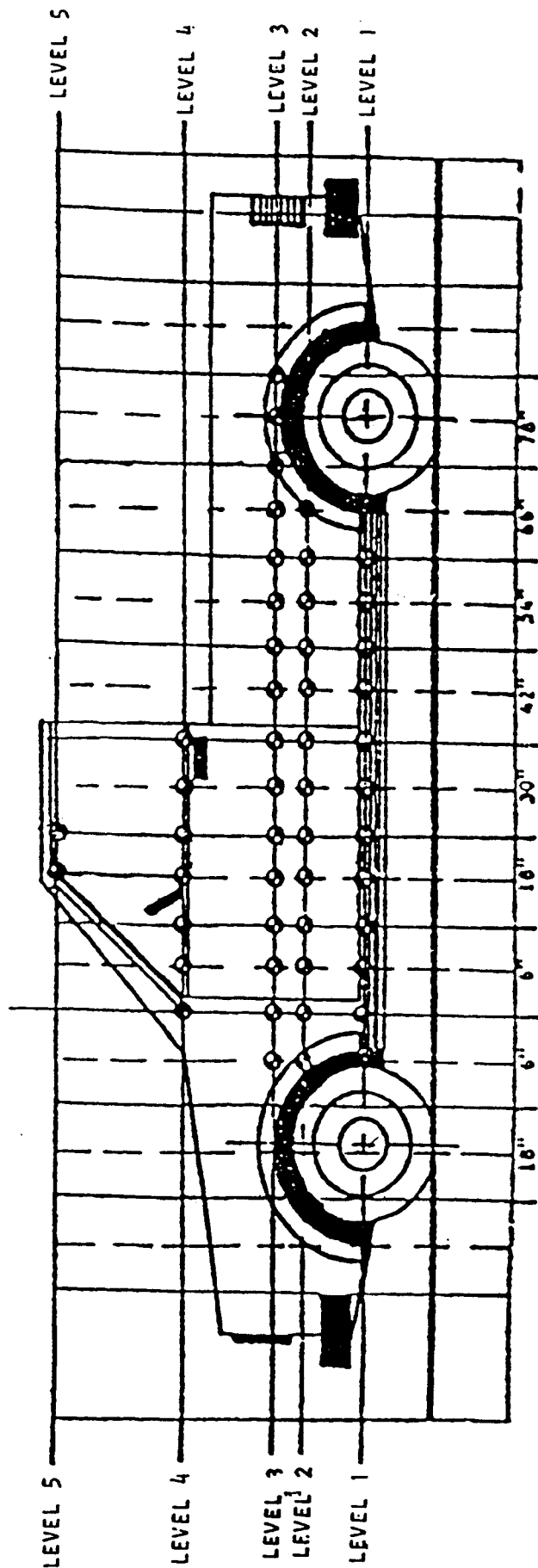
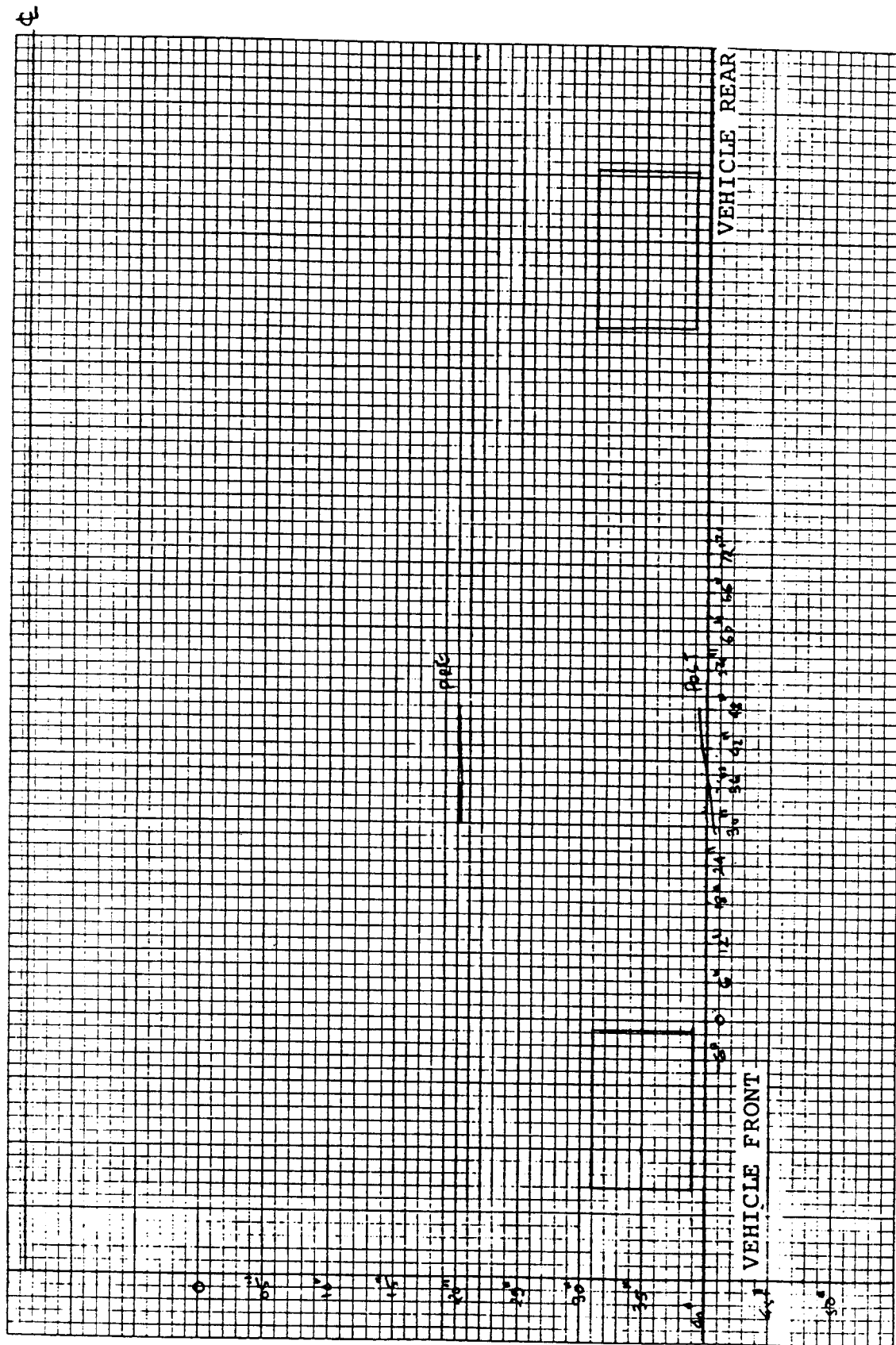


TABLE 3-3 TEST VEHICLE EXTERIOR PROFILES FROM REFERENCE PLANE* AND STATIC CRUSH DATA
1991 TOYOTA PICKUP, RM5101

TEST DATE 04-05/91			IMPACT POINT															
LOCATION:		HEIGHT (in)	FORWARD/REARWARD															
PROFILES/ CRUSH		6"	0" ***	6"	12"	18"	24"	30"	36"	42"	48"	54"	60"	66"	72"			
1.Window Top		58.0	Posttest- - - Pretest - - - Static Crush-	NA NA NA	NA NA NA	NA NA NA	NA NA NA	7.5 27.7 20.2	7.8 27.7 19.9	8.2 27.8 19.6	8.5 27.8 19.3	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA		
2.Window Sill		42.0	Posttest- - - Pretest - - - Static Crush-	NA NA NA	22.0 21.9 0.1	24.8 21.6 0.2	22.6 21.2 1.4	23.0 21.2 1.8	23.3 21.2 2.1	23.2 21.3 0.9	22.0 21.3 0.7	21.9 21.3 0.6	24.5 21.3 3.2	24.5 21.3 3.2	23.0 21.3 1.7	23.0 21.3 1.7		
3.Mid-Door		28.0	Posttest- - - Pretest - - - Static Crush-	NA NA NA	21.2 18.0 3.2	22.7 18.0 4.7	23.4 18.1 5.3	24.0 18.2 5.8	24.3 18.5 5.8	24.2 18.6 5.6	23.0 18.6 4.4	21.8 18.7 3.1	24.0 18.5 5.5	20.0 18.4 1.6	17.6 18.3 -0.7	17.6 18.3 -0.7		
4.H-Point		24.5	Posttest- - - Pretest - - - Static Crush-	NA NA NA	21.2 18.0 3.2	22.7 18.0 4.7	23.5 18.1 5.4	25.0 18.2 6.8	24.2 18.5 5.7	24.0 18.6 5.4	23.2 18.6 4.6	22.0 18.7 3.3	24.3 18.5 5.8	20.1 18.4 1.7	17.7 18.3 -0.6	17.7 18.3 -0.6		
5.Axle Centerline		12.3	Posttest- - - Pretest - - - Static Crush-	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA		

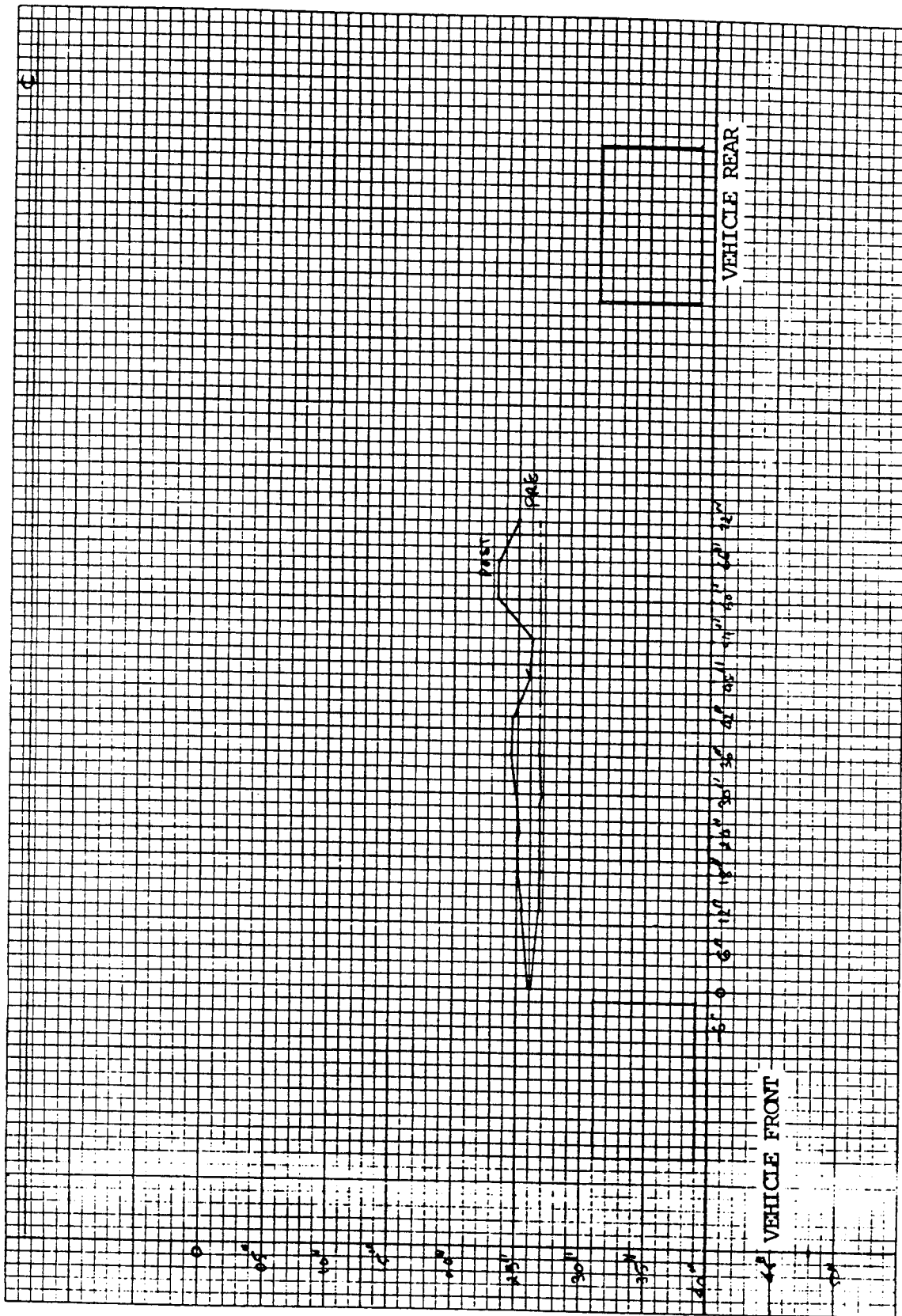
*Reference Plane is parallel to and 48 inches from test vehicle longitudinal centerline.
**Measured from ground.
***Impact point.

TABLE 3-4 A PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL I - WINDOW TOP 58.10" ABOVE GROUND LEVEL



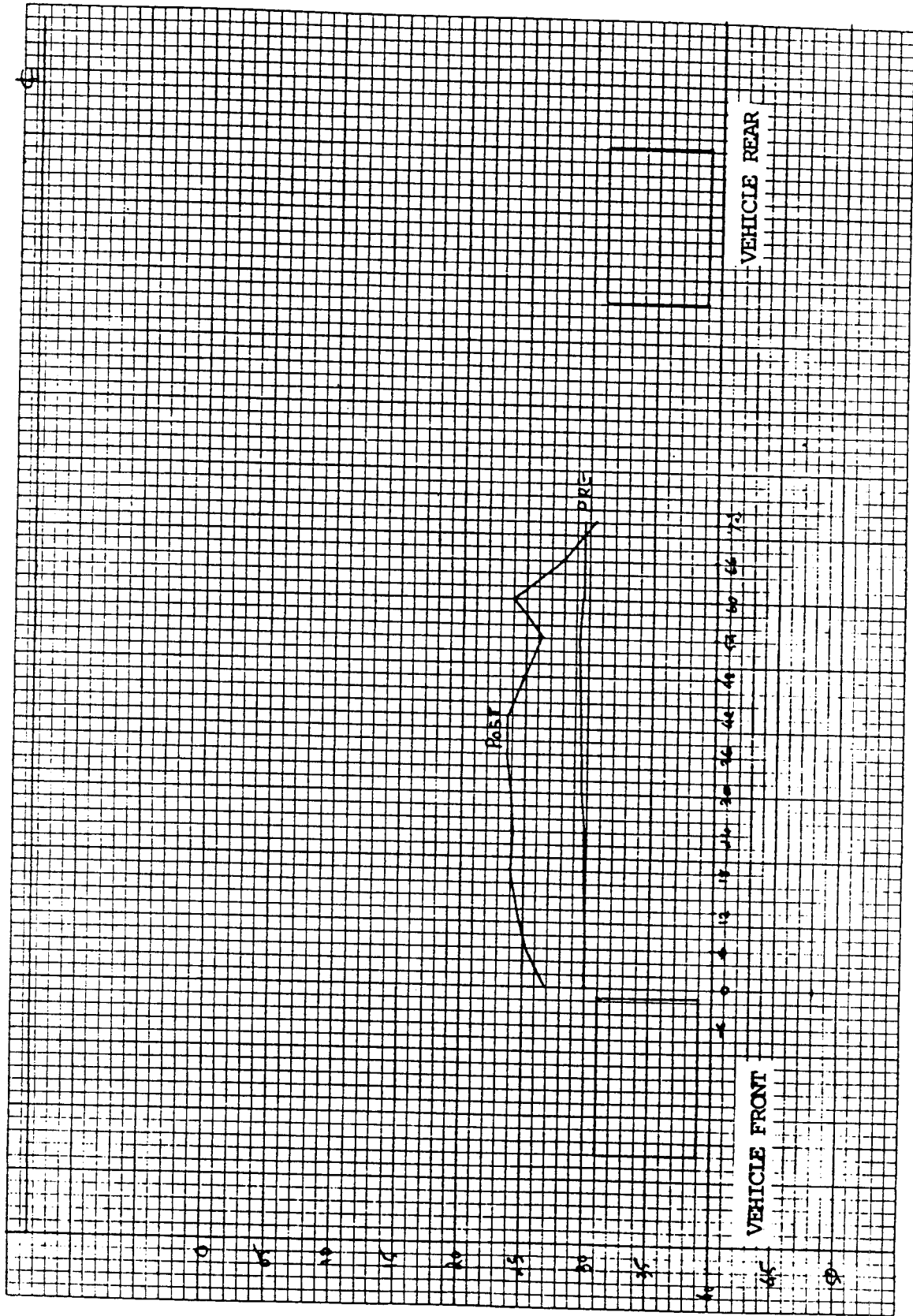
1991 1991 TOYOTA PICKUP RM5101

TABLE 3-4 B PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 2 - WINDOW SILL 42.0" ABOVE GROUND LEVEL



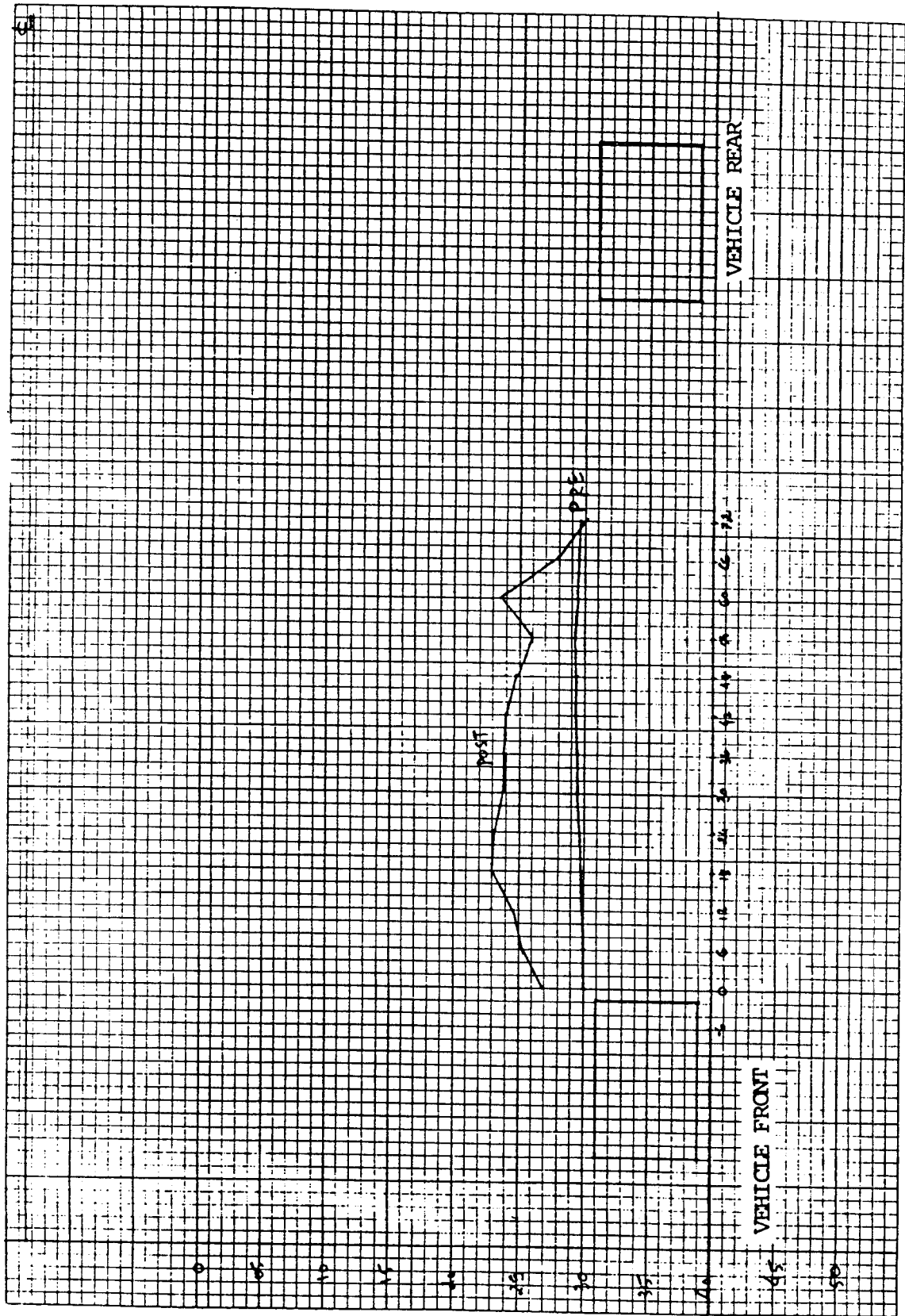
1991 TOYOTA PICKUP, RM5101

TABLE 3-4 C PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 3 - MID DOOR 33.0" ABOVE GROUND LEVEL



1991 TOYOTA PICKUP, RM5101

TABLE 3-4 D PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 4 - H POINT 24.5" ABOVE GROUND LEVEL



1991 TOYOTA PICKUP, RM5101

TABLE 3-5 TEST VEHICLE MEASUREMENTS

1991 TOYOTA PICKUP, RM5101

NO.	MEASUREMENT DESCRIPTION	Pre-Test (in.)	Post-Test (in.)	Diff. (in.)
X1	Total Length of Test Vehicle at Centerline	175.0	177.2	-2.2
X2	Rear Surface of Vehicle to Front of Engine	157.0	157.0	0.0
X3	Rear Surface of Vehicle to Firewall	134.5	134.5	0.0
X4	Rear Surface to Upr. Leading Edge of Right Door	123.5	125.2	-1.7
X5	Rear Surface to Upr. Leading Edge of Left Door	123.5	125.7	-2.2
X6	Rear Surface to Lwr. Leading Edge of Right Door	122.5	123.6	-1.1
X7	Rear Surface to Lwr. Leading Edge of Left Door	122.5	122.7	-0.2
X8	Rear Surface to Upr. Trailing Edge of Right Door	81.0	82.6	-1.6
X9	Rear Surface to Upr. Trailing Edge of Left Door	81.0	83.7	-2.7
X10	Rear Surface to Lwr. Trailing Edge of Right Door	81.5	83.0	-1.5
X11	Rear Surface to Lwr. Trailing Edge of Left Door	81.5	82.0	-0.5
X12	Rear Surface to Bottom 'A' Post on Right Side	123.3	123.1	0.2
X13	Rear Surface to Bottom 'A' Post on Left Side	123.3	123.1	0.2
X14	Rear Surface to Firewall on Right Side	137.5	137.5	0.0
X15	Rear Surface to Firewall on Left Side	135.0	135.0	0.0
X16	Rear Surface to Steering Column	105.5	109.2	-3.7
X17	Center of Steering Column to 'A' Post	17.0	17.0	0.0
X18	Center Steering Column to Headlining	20.0	17.5	2.5
X19	Rear Surface to Right Side of Front Bumper	172.0	174.2	-2.2
X20	Rear Surface to Left Side of Front Bumper	172.0	174.2	-2.2
X21	Length of Engine Block	21.0	21.0	0.0
X22	Strg. Whl. Hub C/L to W/Shld. Header Interior Moulding	16.0	16.5	-0.5
X23	Strg. Whl. Hub C/L to Rr.Wdo. Upper Int. Trim Moulding	34.5	34.2	0.3

TABLE 3-6 POSTTEST OBSERVATIONS

TEST VEHICLE: 1991 TOYOTA PICKUP ; NHTSA NO.: RM5101

<u>VISIBLE DUMMY CONTACT POINT:</u>	<u>FRONT SID</u>	<u>REAR SID</u>
HEAD - - - - -	<u>Slight contact on the upper side door trim</u>	<u>N/A</u>
CHEST- - - - -	<u>None</u>	<u>N/A</u>
ABDOMEN- - - - -	<u>None</u>	<u>N/A</u>
LEFT KNEE- - - - -	<u>Driver side door</u>	<u>N/A</u>
RIGHT KNEE - - - - -	<u>None</u>	<u>N/A</u>

<u>DOOR OPENING:</u>	<u>LEFT SIDE</u>	<u>RIGHT SIDE</u>
FRONT - - - - -	<u>No</u>	<u>N/A</u>
REAR - - - - -	<u>N/A</u>	<u>N/A</u>

SEAT MOVEMENT:

None

GLAZING DAMAGE:

Driver side window broke due to dummy head impact with the window.

OTHER NOTABLE IMPACT EFFECTS:

- Minor separation of pickup bed from frame on impact side
- There is no structural damage further inwards than the left frame rail.
- No fuel tank damage or leakage was detected.

TABLE 3-7 EXTERIOR STATIC CRUSH FOR SIDE IMPACTOR

1991 TOYOTA PICKUP, RM5101

DISTANCE RIGHT OF CENTER										DISTANCE LEFT OF CENTER**								
LOCATION	HEIGHT at CL*	32"	28"	24"	20"	16"	12"	8"	4"	0"	4"	8"	12"	16"	20"	24"	28"	32"
Top of Stack Level	32"	1.7	0.3	0.2	1.4	1.5	0.2	1.1	1.7	1.7	1.9	1.9	1.7	1.5	0.8	0.0	2.0	1.8
Mid-Stack Level	22"	1.6	0.1	0.7	0.8	1.4	1.6	1.7	1.7	1.6	1.6	1.3	1.4	1.2	1.0	0.8	0.0	0.6
Bumper Level	17"	0.4	0.2	0.1	0.0	0.2	0.3	0.1	0.0	0.0	0.1	0.3	0.5	0.6	0.8	1.3	2.0	3.3

* Heights measured above ground level.

** Impact Side

APPENDIX A
PHOTOGRAPHIC COVERAGE

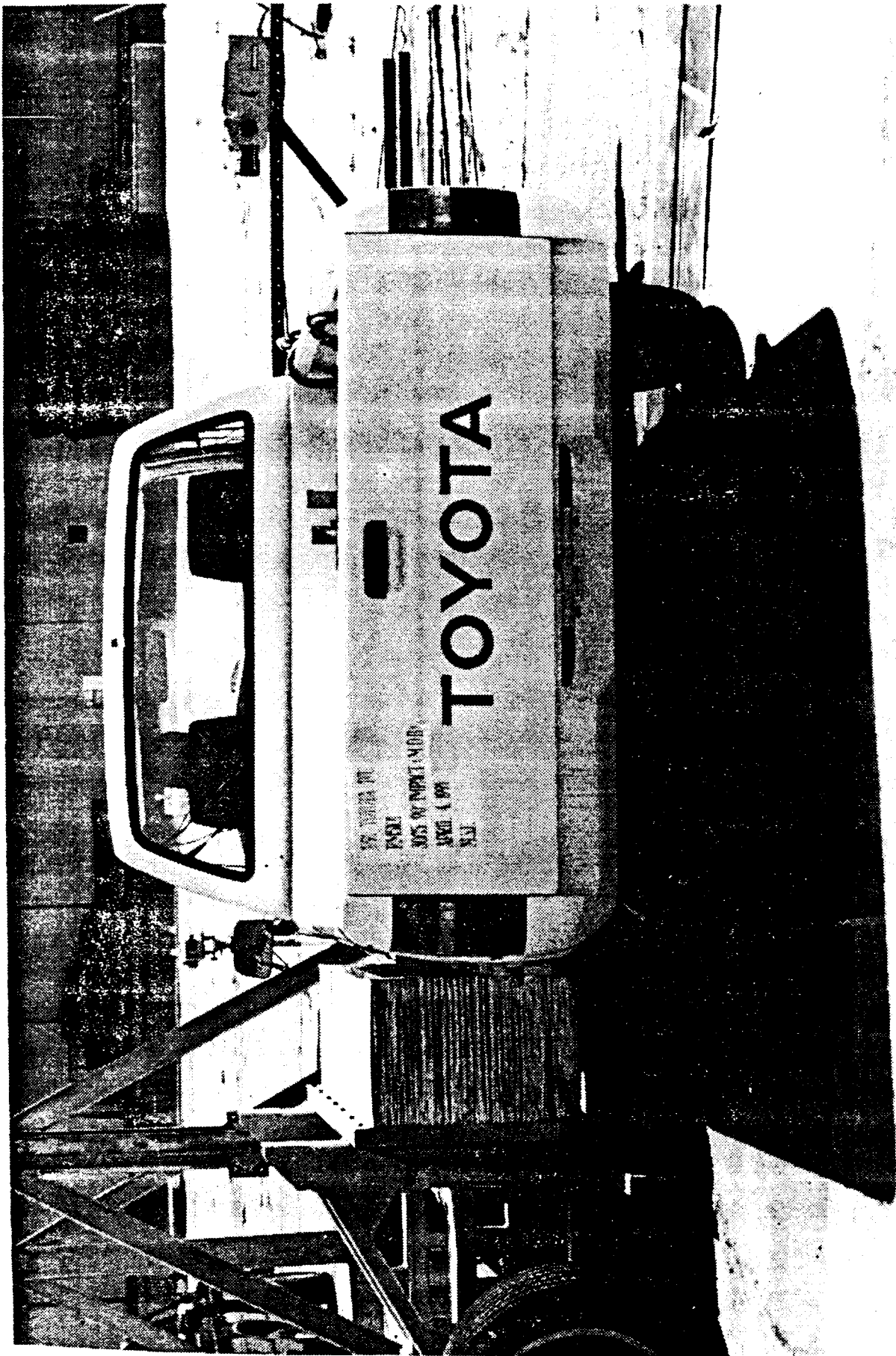


FIGURE A-1 MDB AT TEST VEHICLE, OVERALL VIEW PRETEST

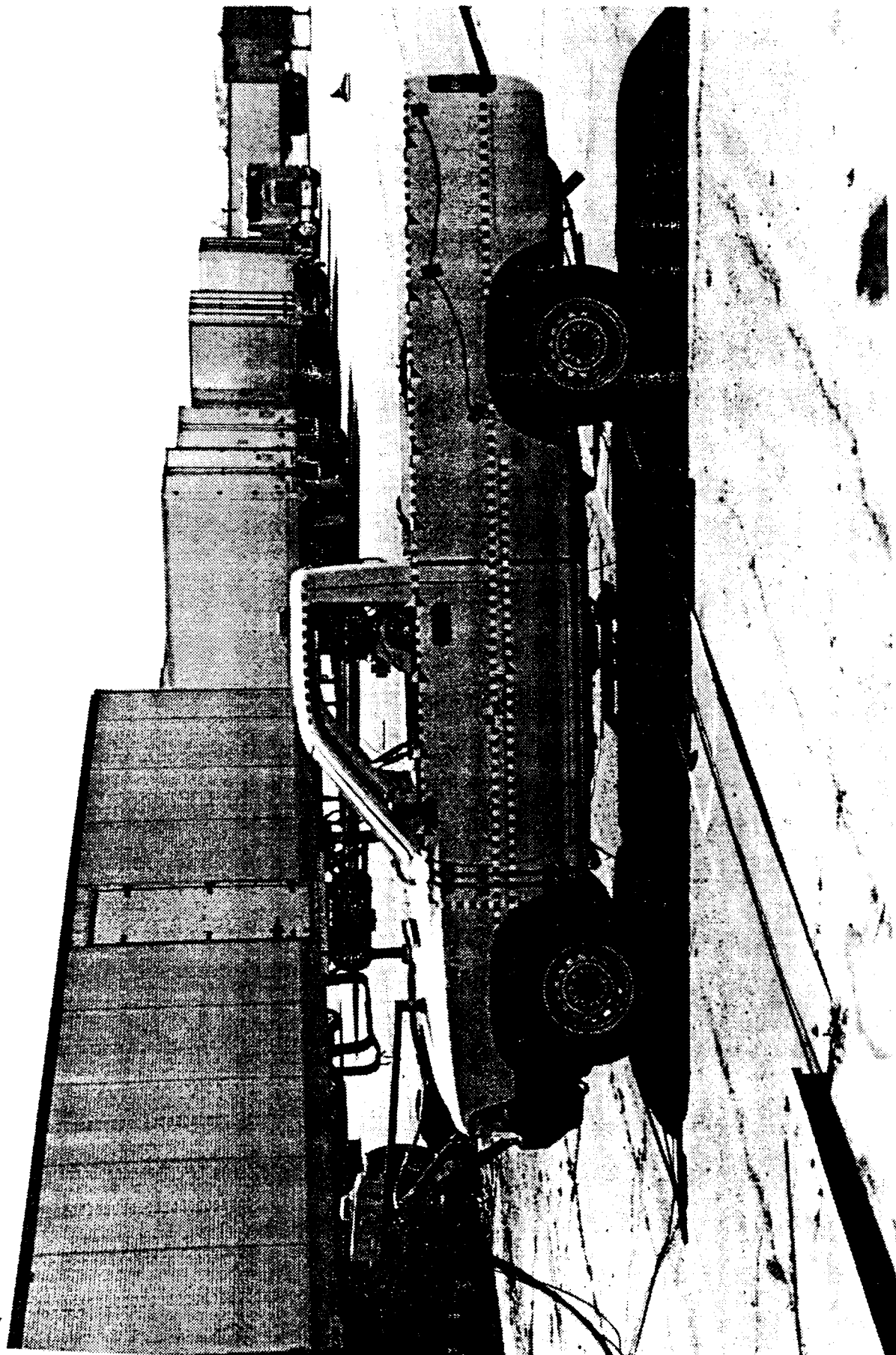


FIGURE A-2 TEST VEHICLE, LEFT SIDE VIEW - PRETEST

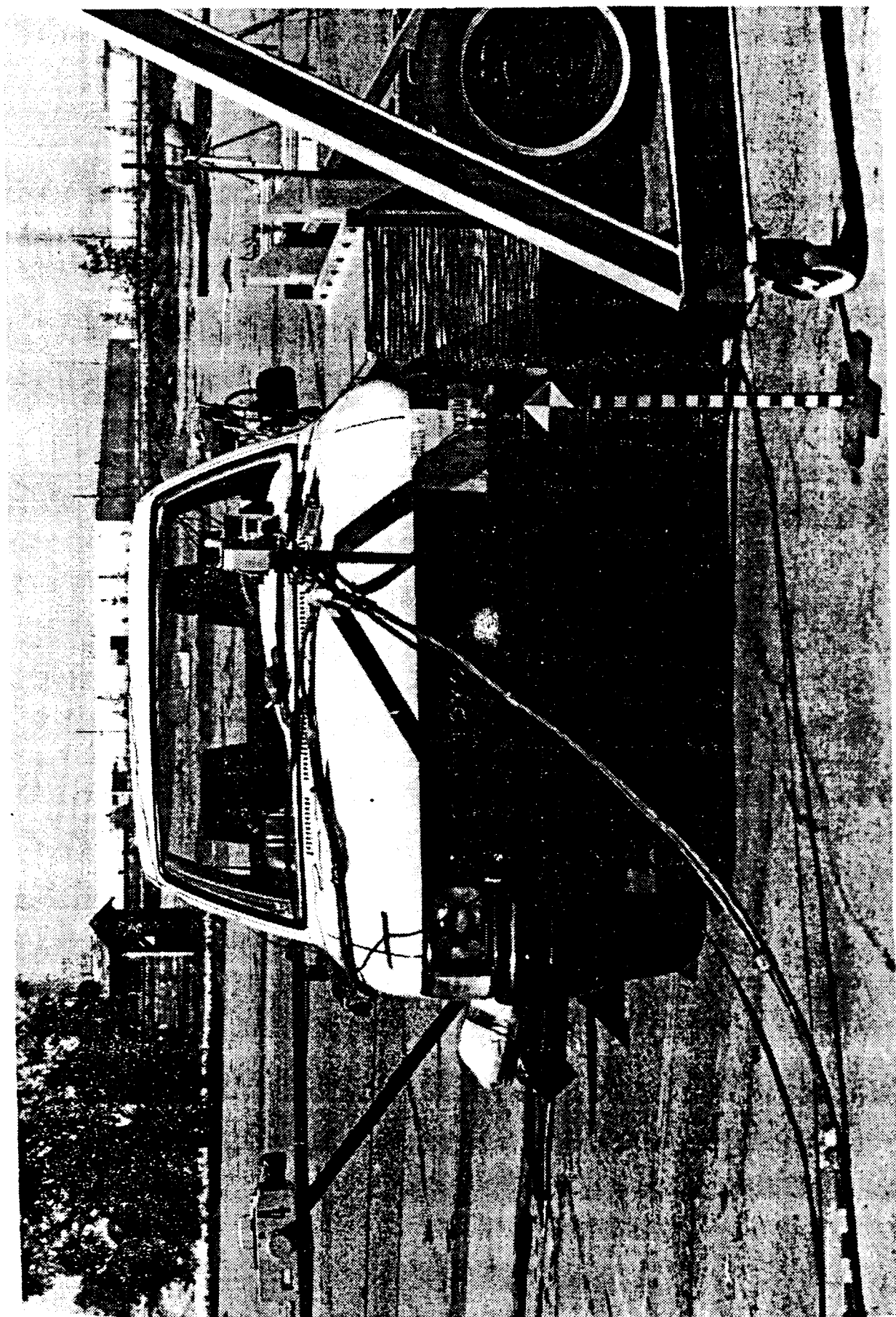


FIGURE A-3 TEST VEHICLE AND MDB, FRONT VIEW - PRETEST

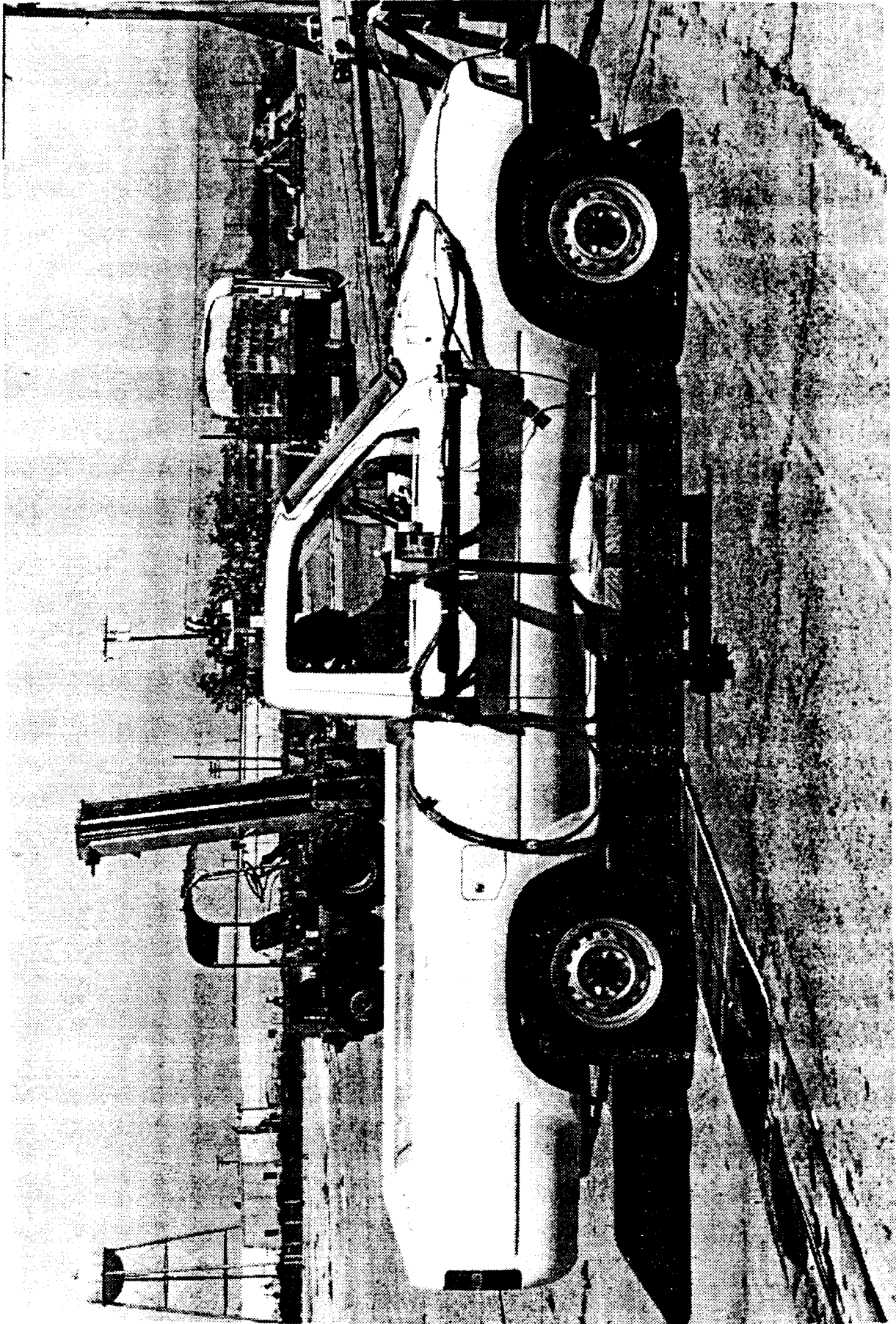


FIGURE A-4 TEST VEHICLE, RIGHT SIDE VIEW - PRETEST

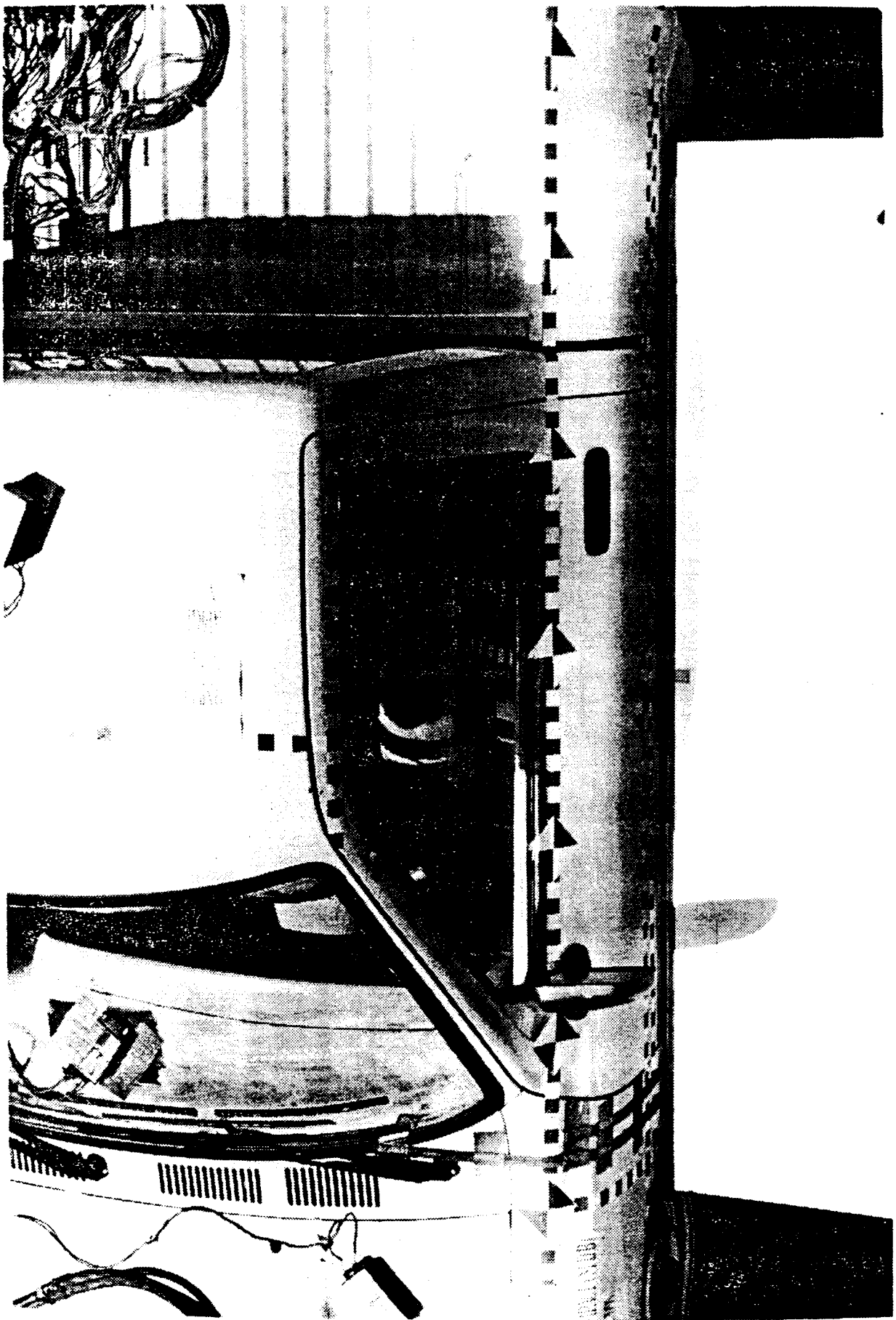


FIGURE A-5 TEST VEHICLE AND MDB, OVERHEAD VIEW - PRETEST

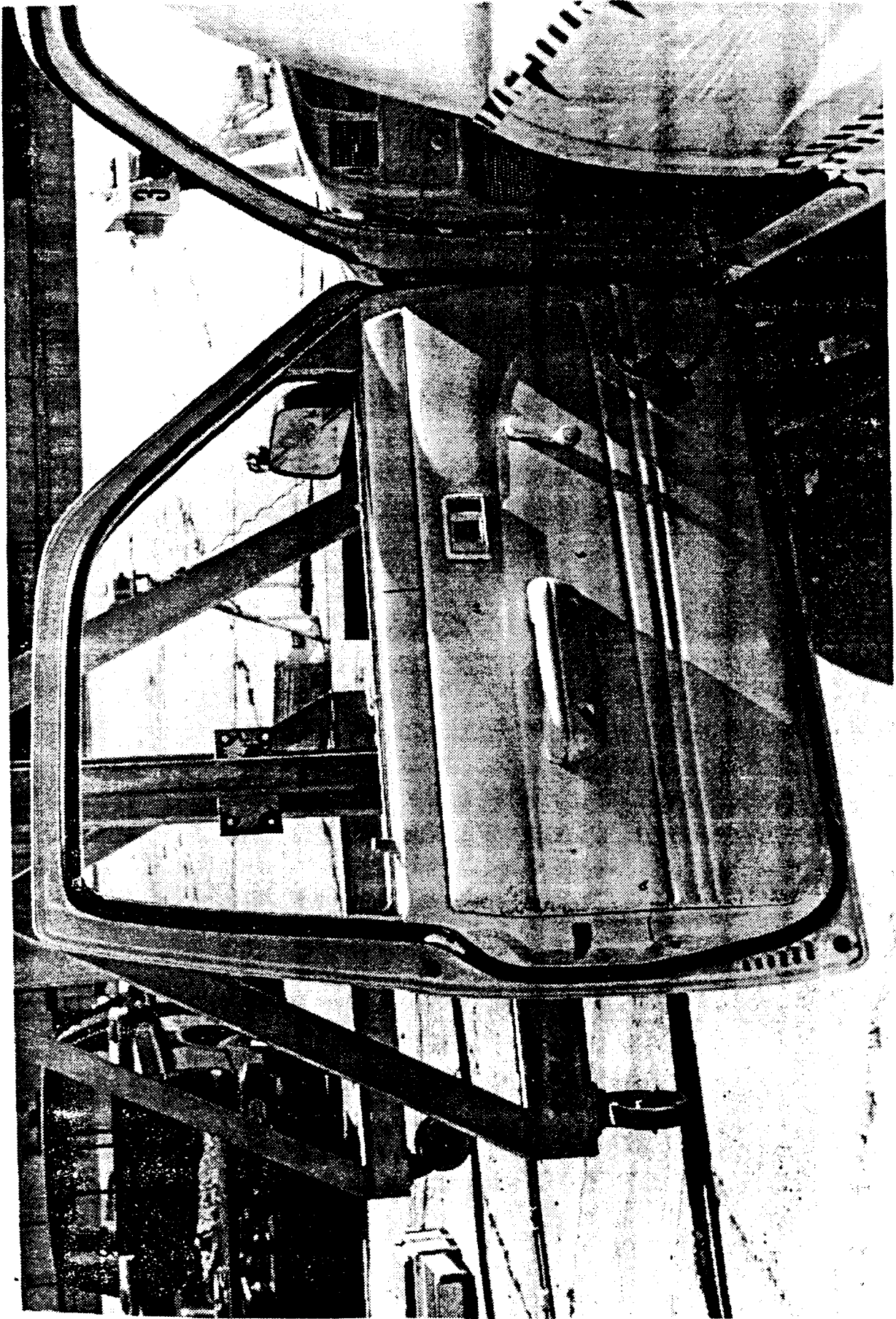


FIGURE A-6 TEST VEHICLE, DRIVER SIDE DOOR, PRETEST



FIGURE A-7 SID IN DRIVER POSITION, PRETEST
A-7

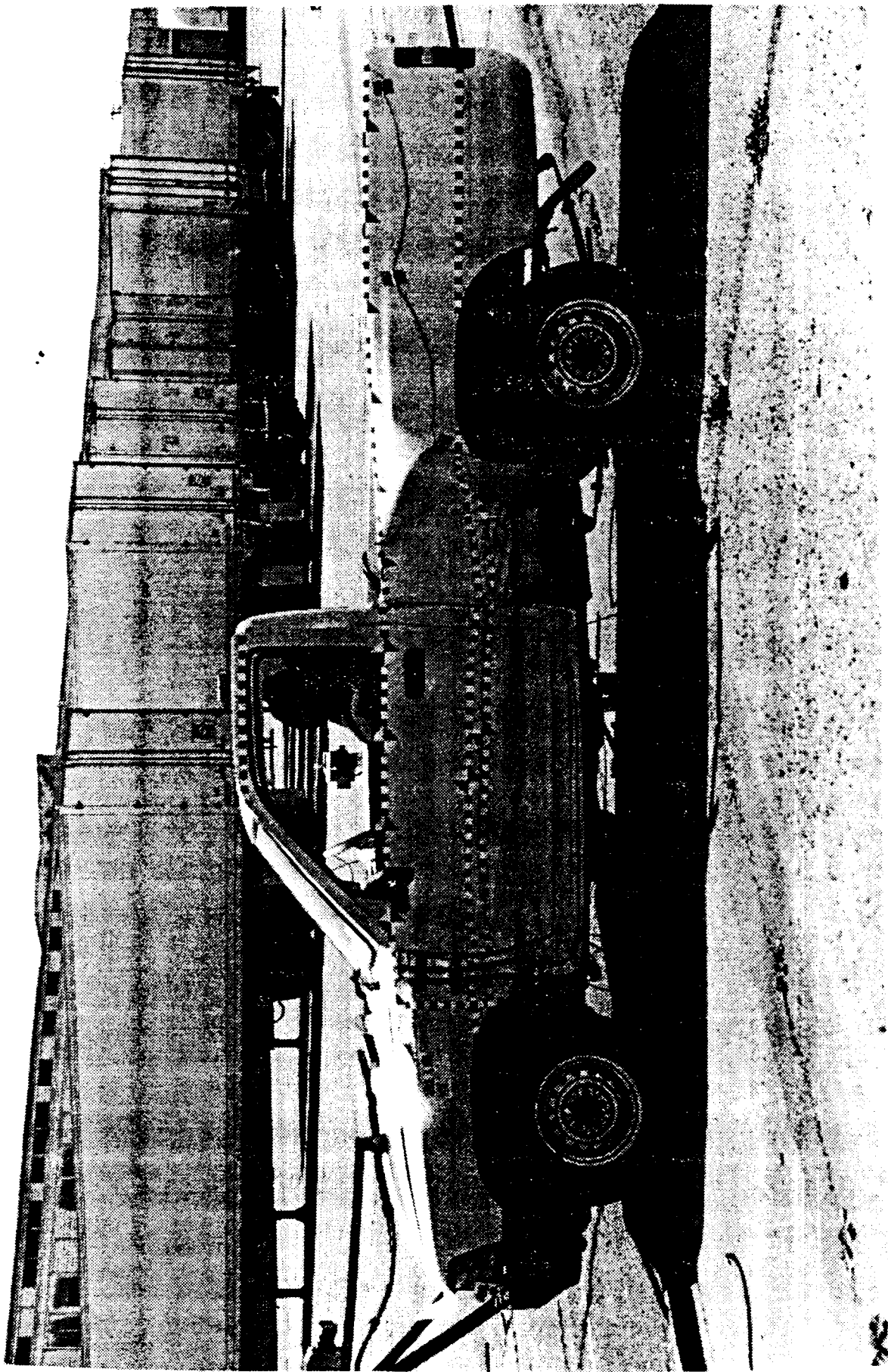


FIGURE A-8 TEST VEHICLE, LEFT SIDE VIEW - POSTTEST

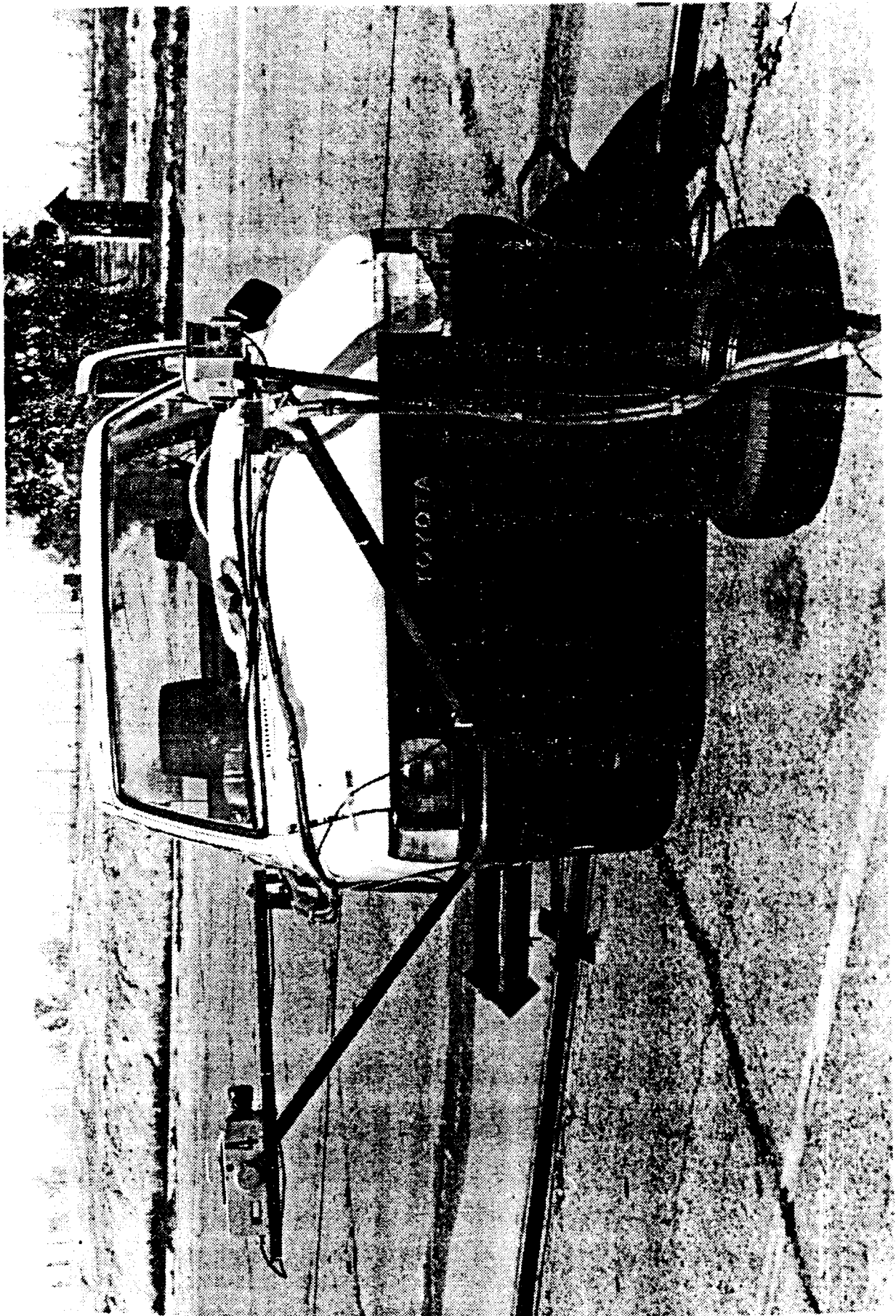


FIGURE A-9 TEST VEHICLE AND MDB, FRONT VIEW - POSTTEST

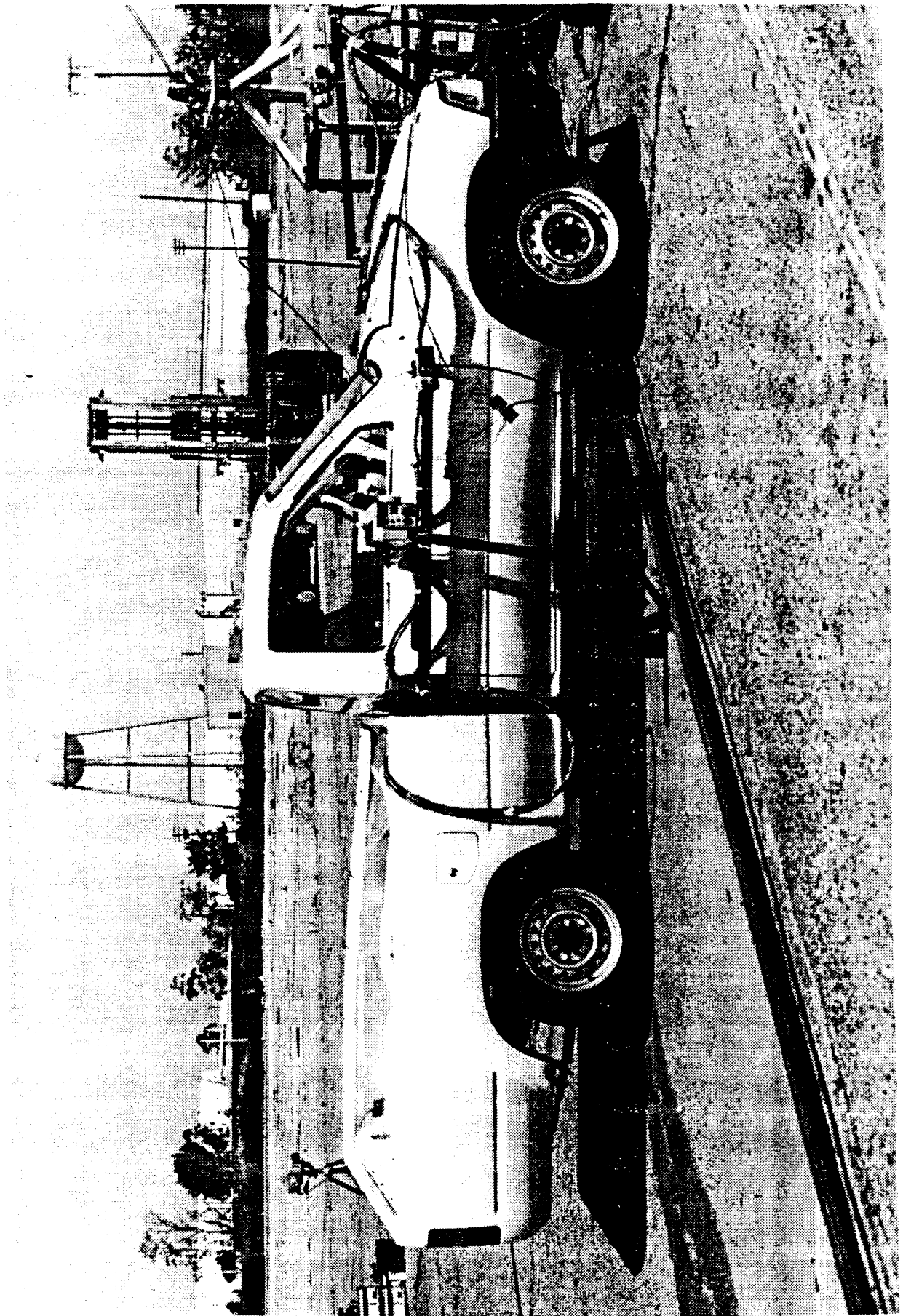


FIGURE A-10 TEST VEHICLE, RIGHT SIDE VIEW - POSTTEST



FIGURE A-11 MDE AND TEST VEHICLE, REAR VIEW - POSTTEST

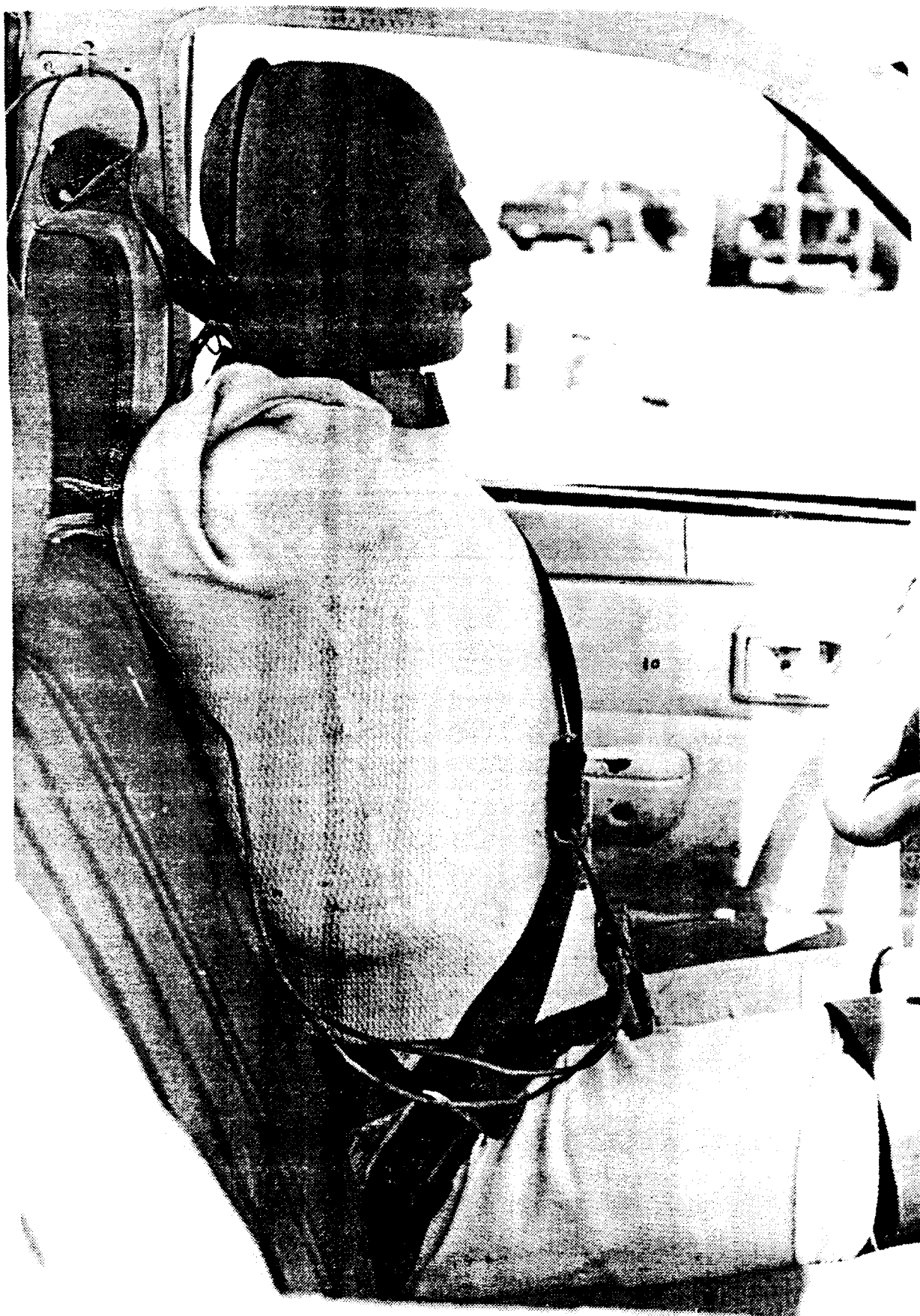


FIGURE A-12 SID FINAL POSITION - POSTTEST

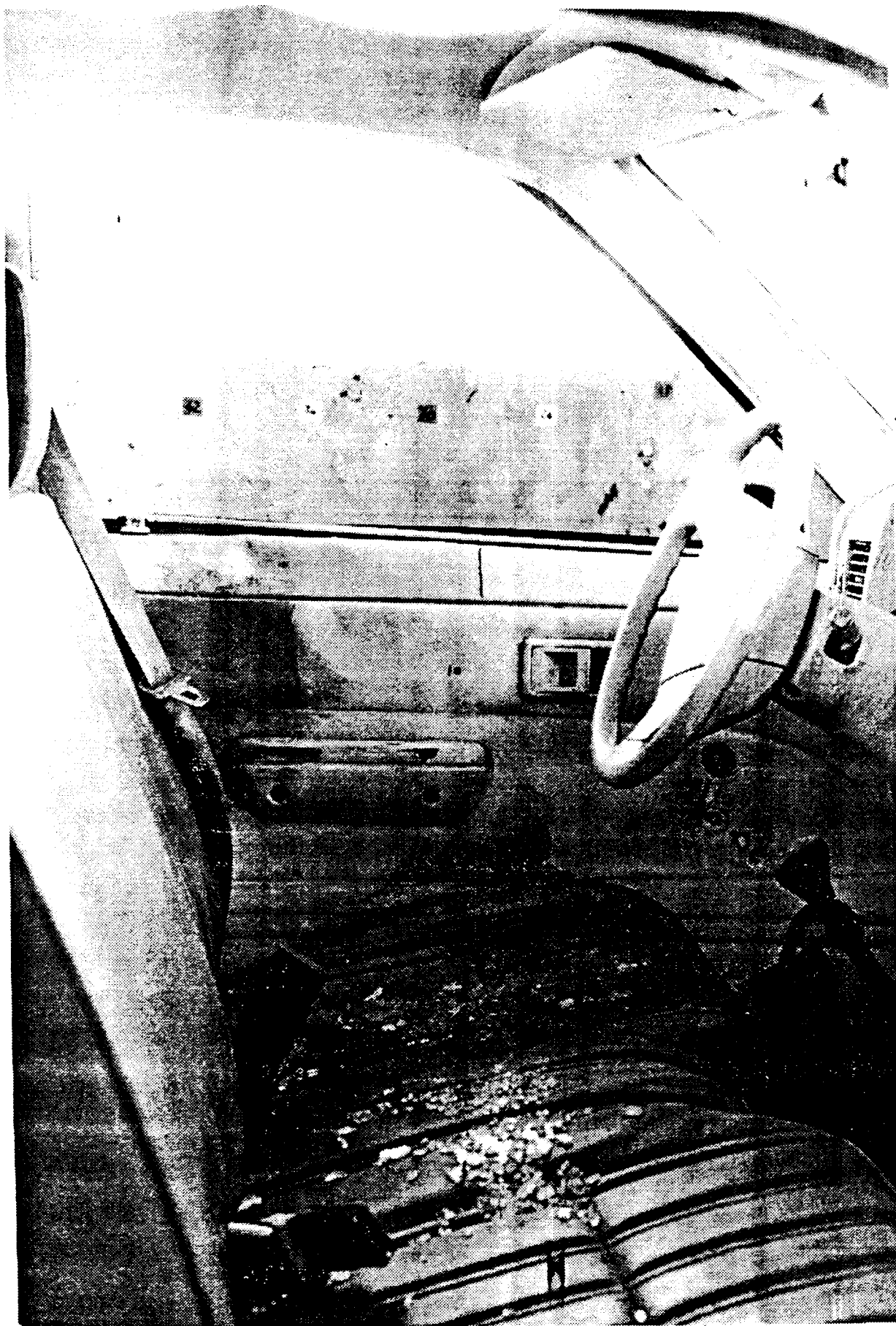


FIGURE A-13 OCCUPANT COMPARTMENT INTERIOR - POSTTEST

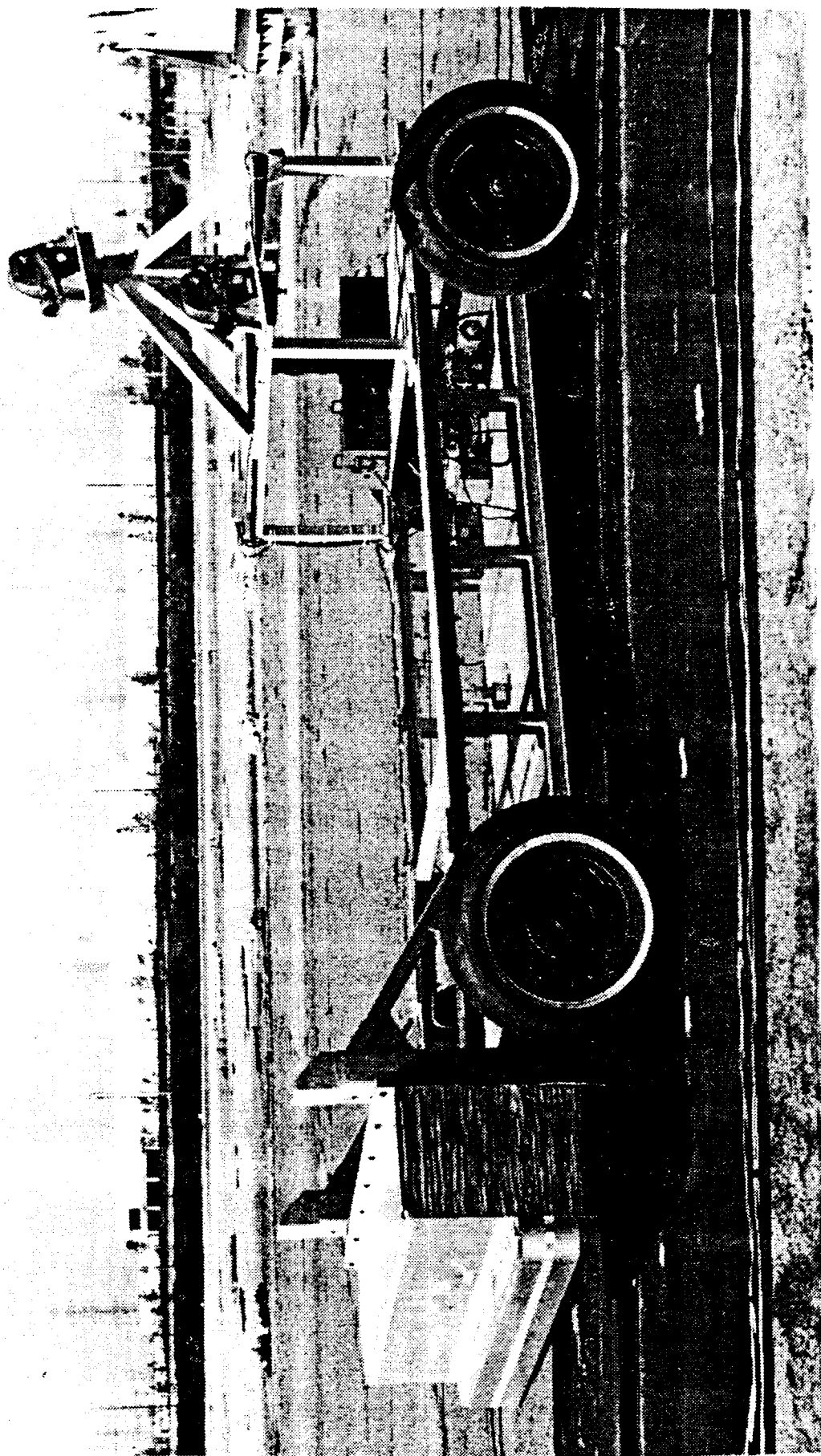


FIGURE A-14 MDB, VIEW NO. 1 - PRETEST

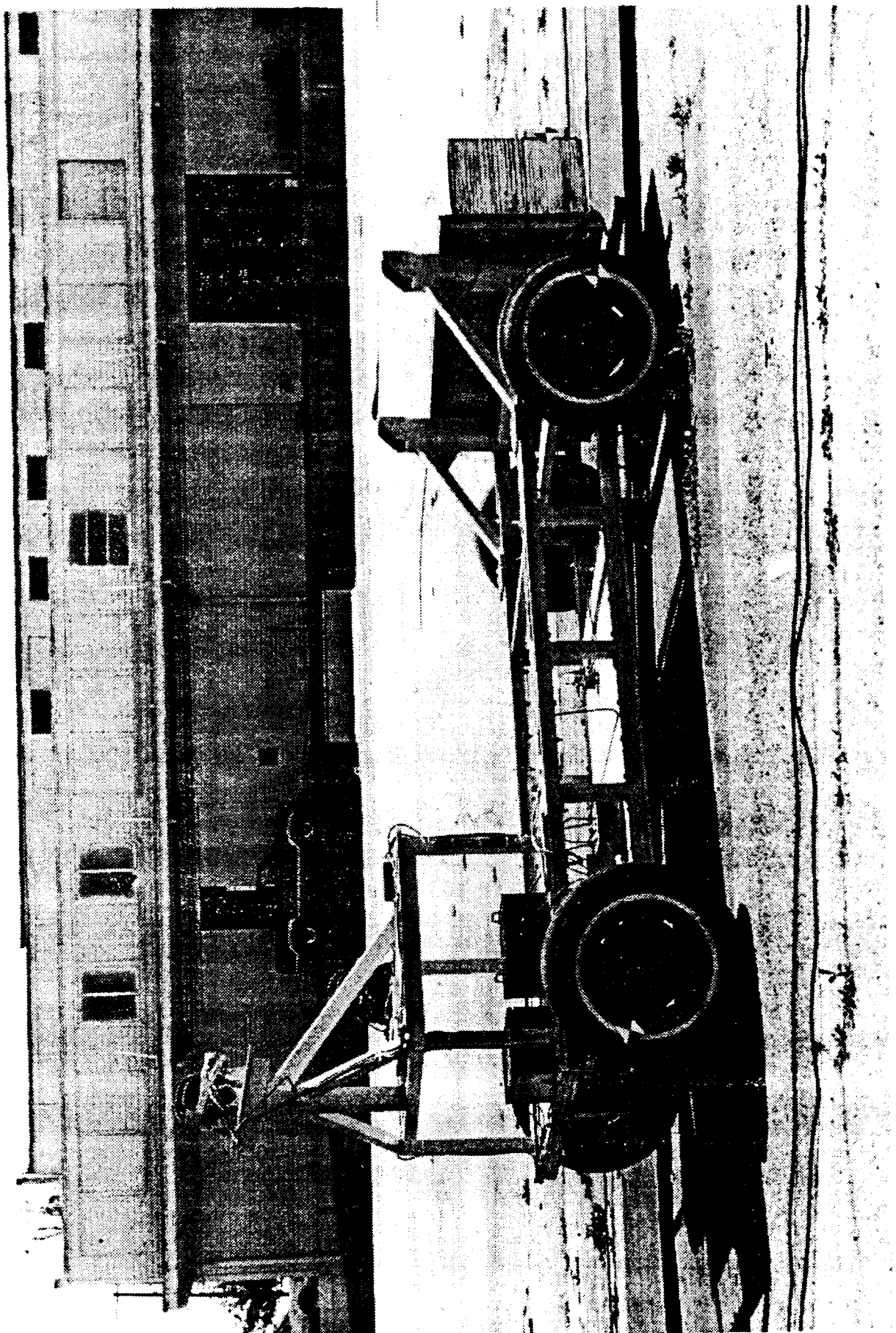


FIGURE A-15 MDB, VIEW NO. 2 - PRETEST

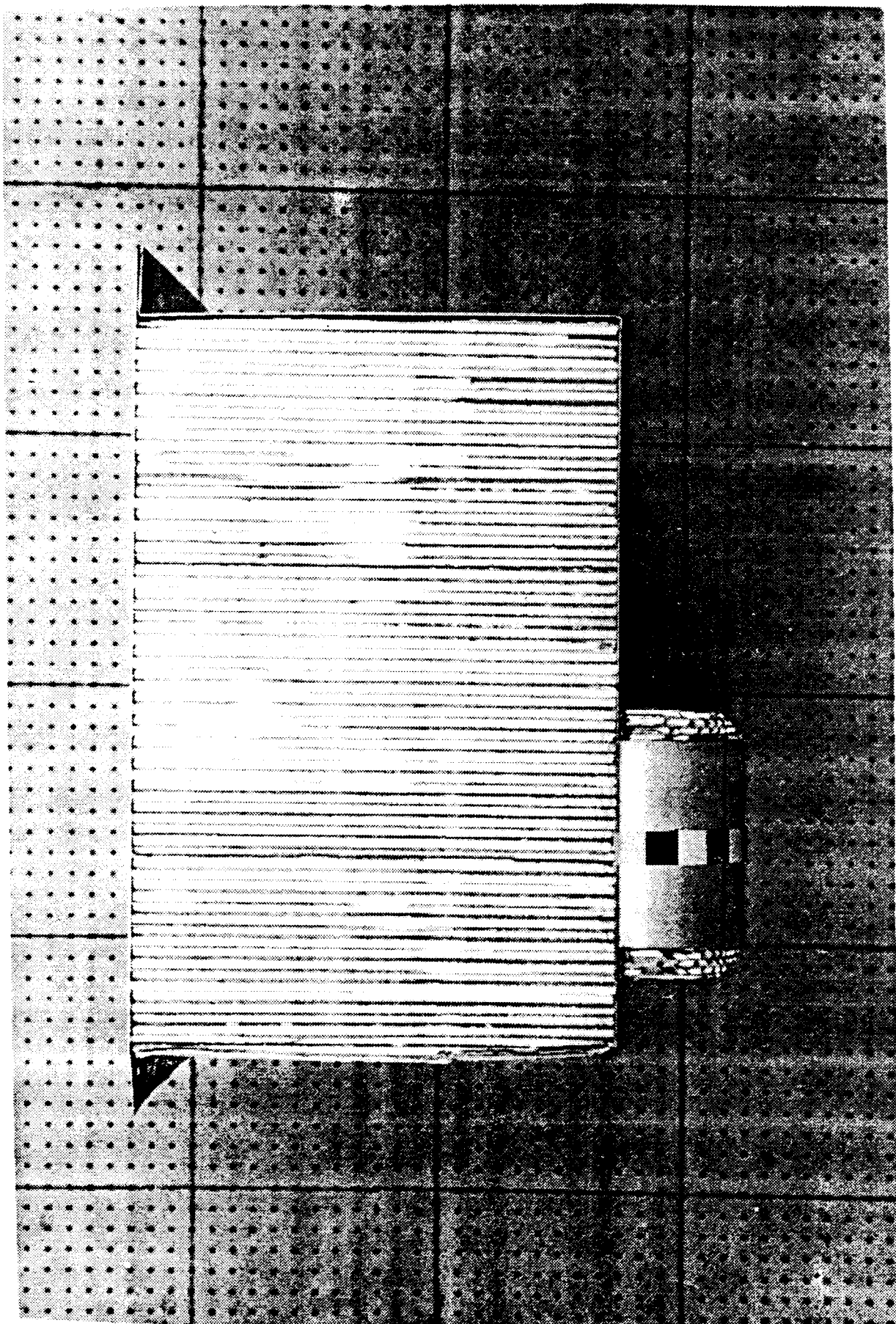


FIGURE A-16 MDB FACE, VIEW NO. 1 - PRETEST

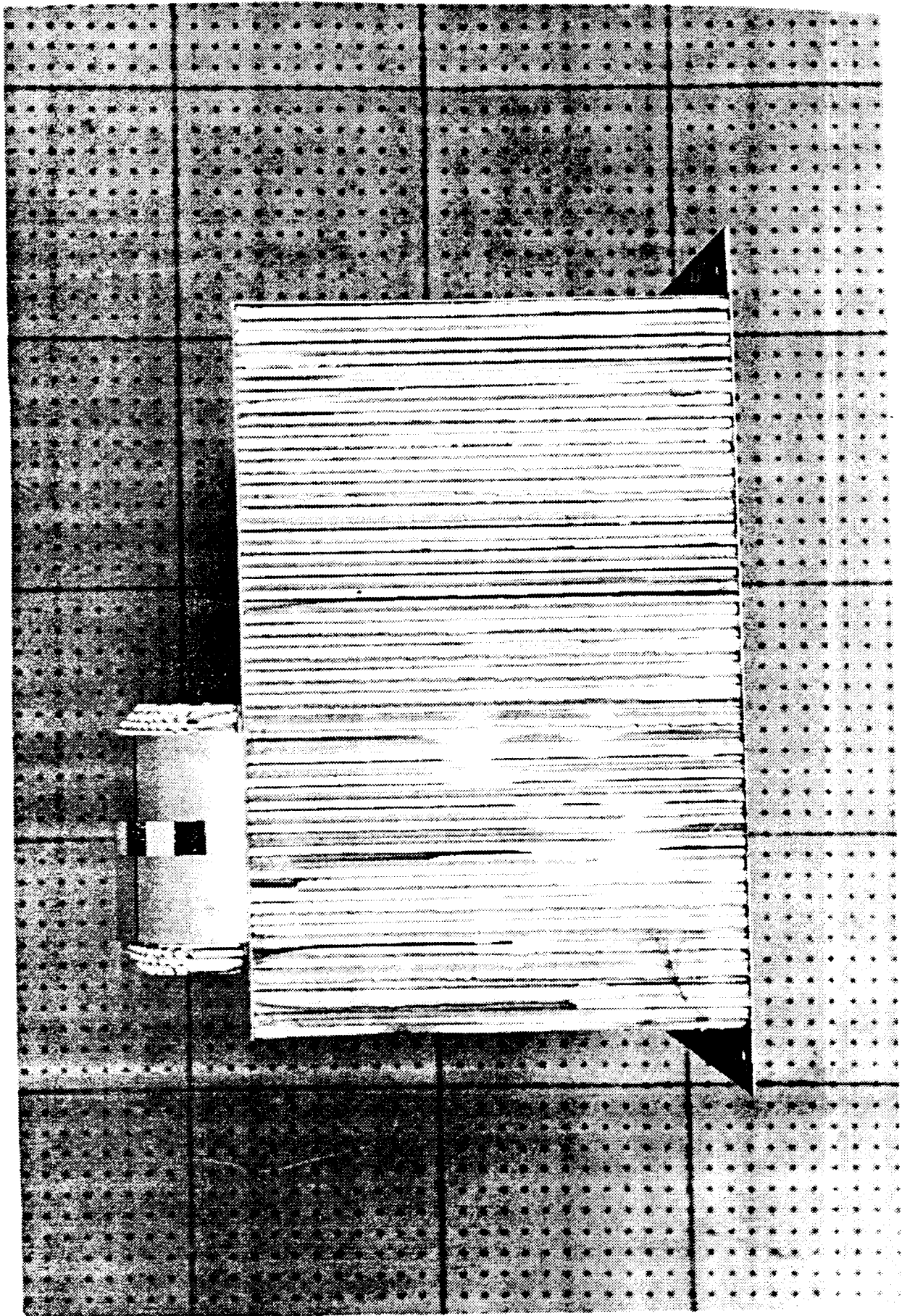


FIGURE A-17 MD3 FACE, VIEW NO. 2 - PRETEST

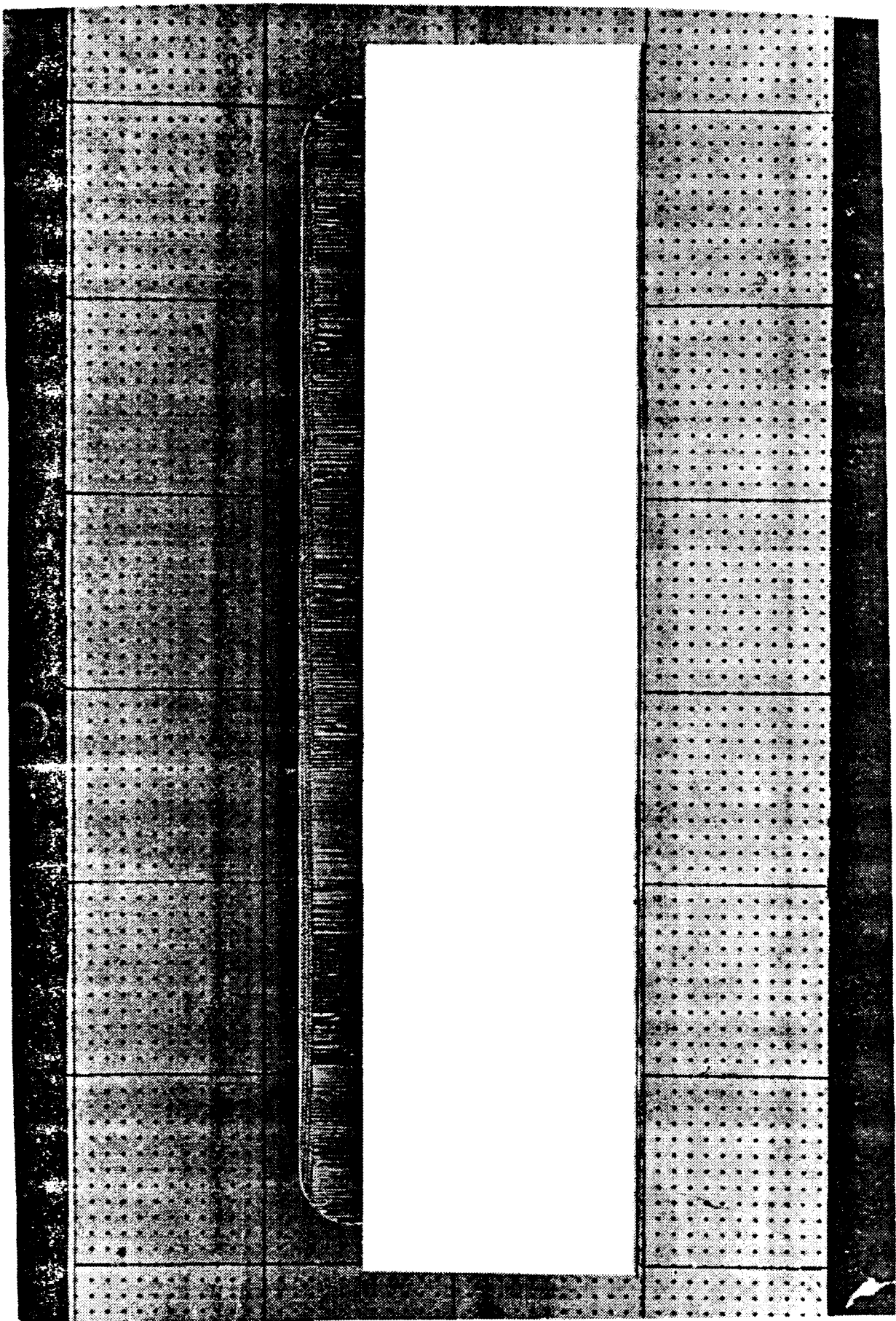


FIGURE A-18 MDB FACE, VIEW NO. 3 - PRETEST
A-18

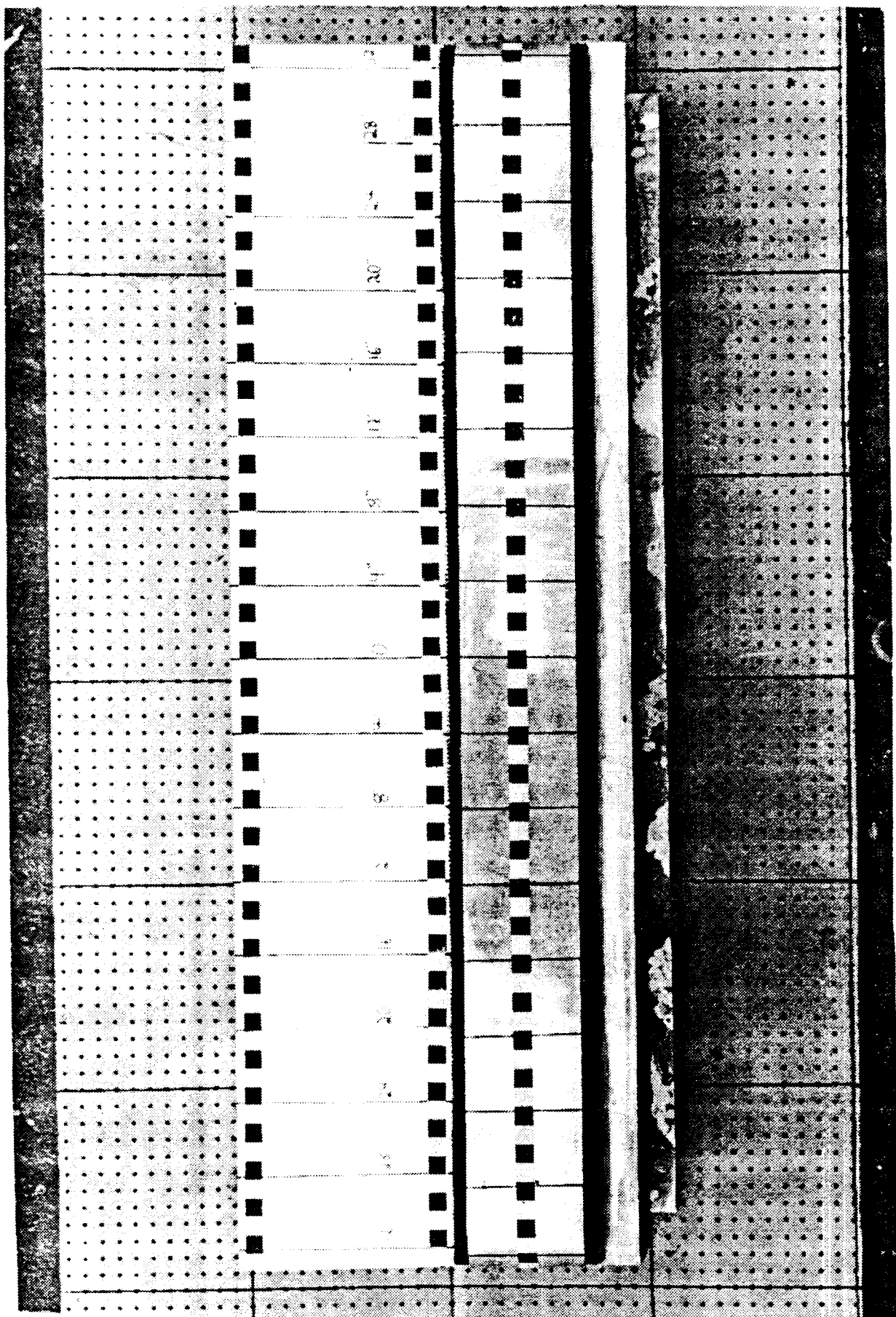


FIGURE A-19 MDB FACE, VIEW NO. 4 - PRETEST



FIGURE A-20 MDB FACE, VIEW NO. 1 - POSTTEST



FIGURE A-21 MDB FACE, VIEW NO. 2 -.POSTTEST

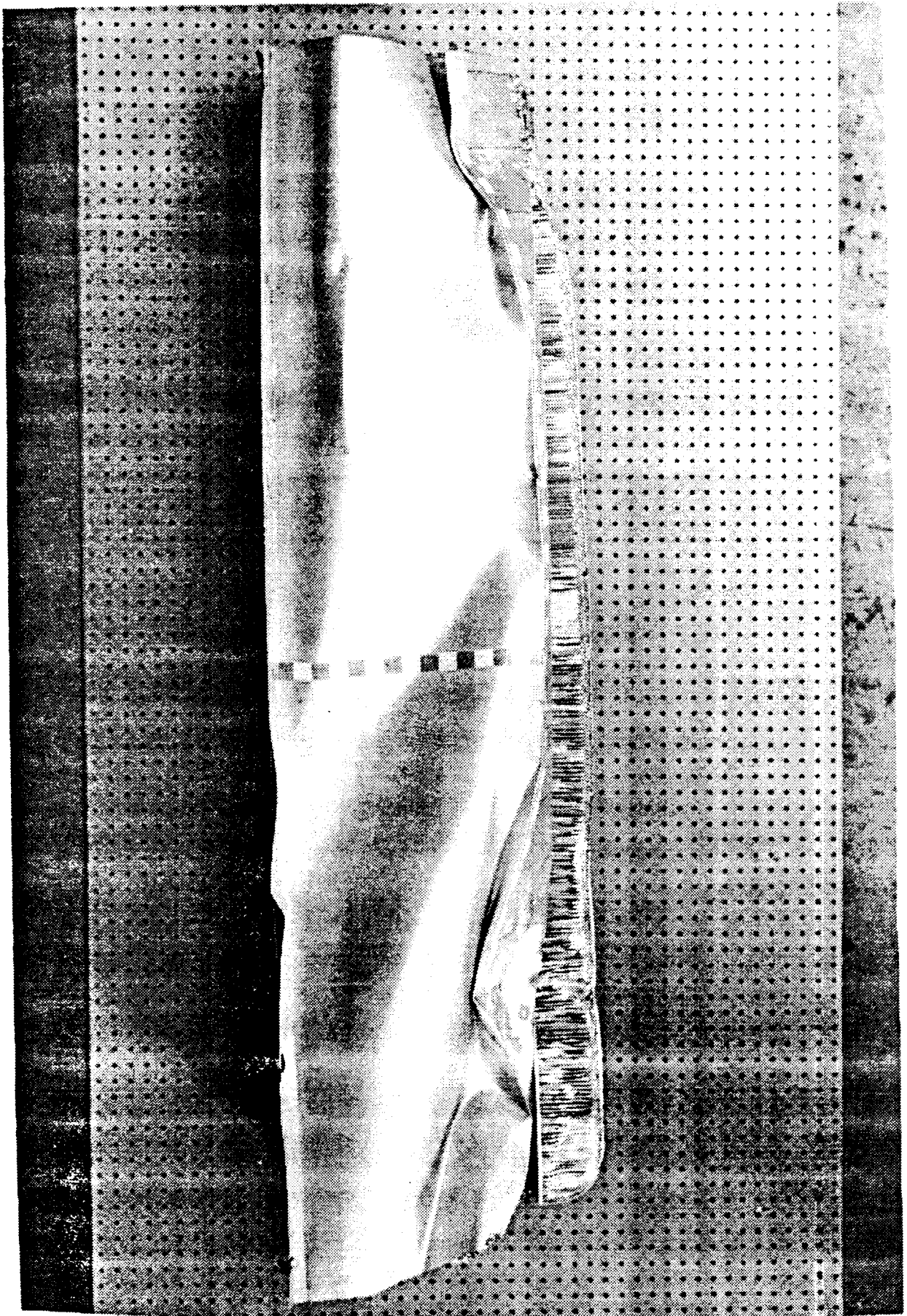


FIGURE A-22 MDB FACE, VIEW NO. 3 - POSTTEST

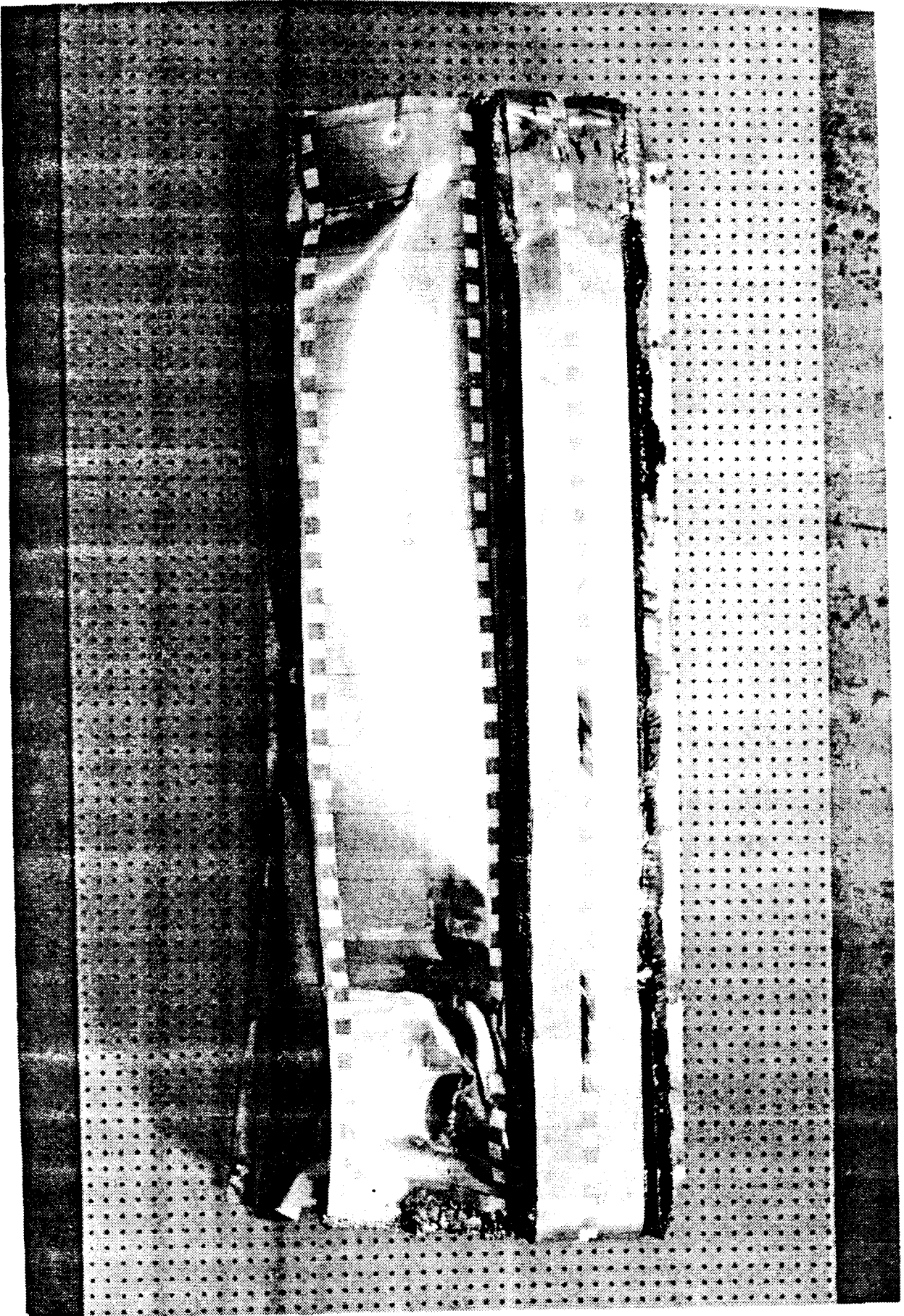
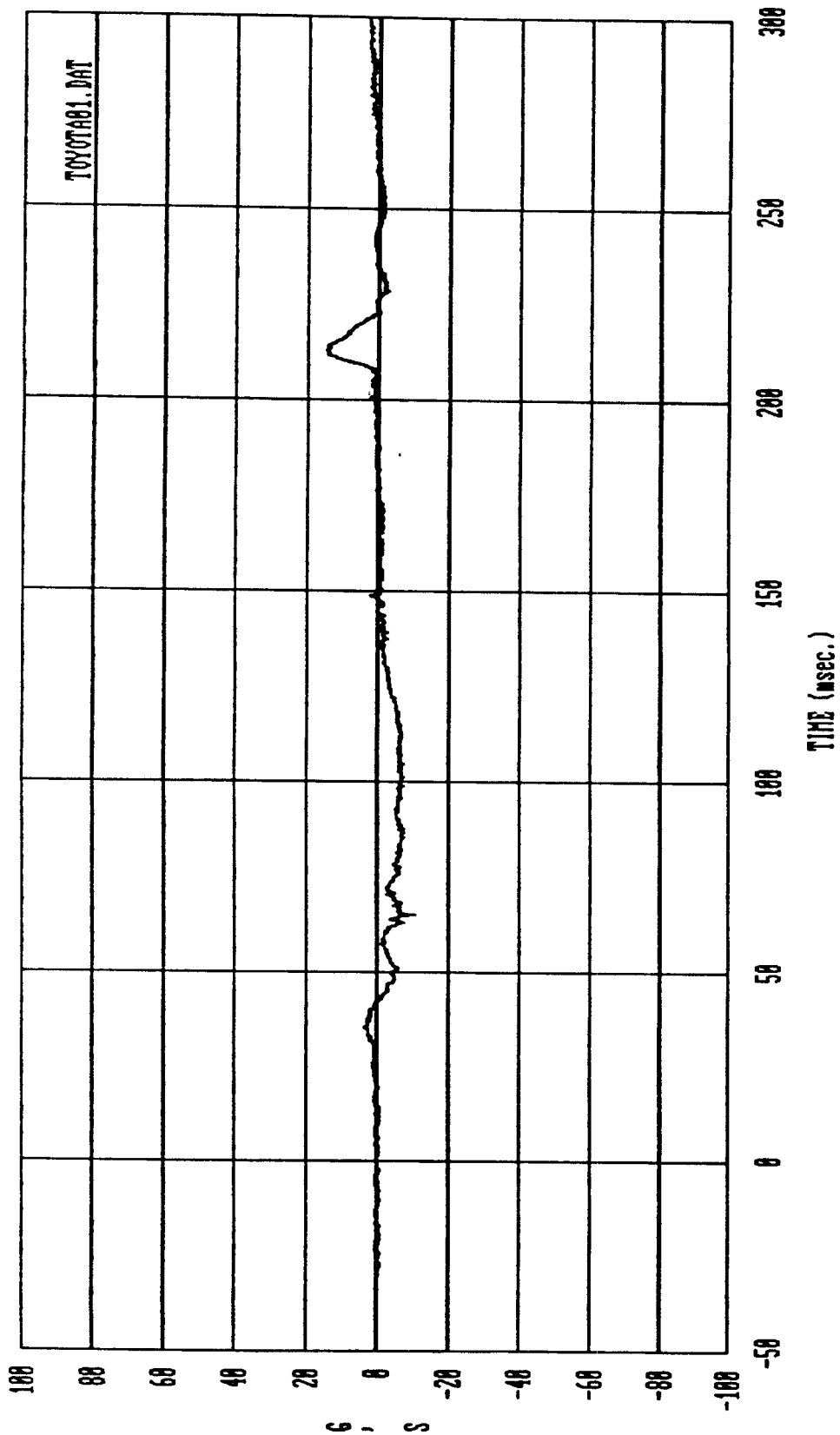


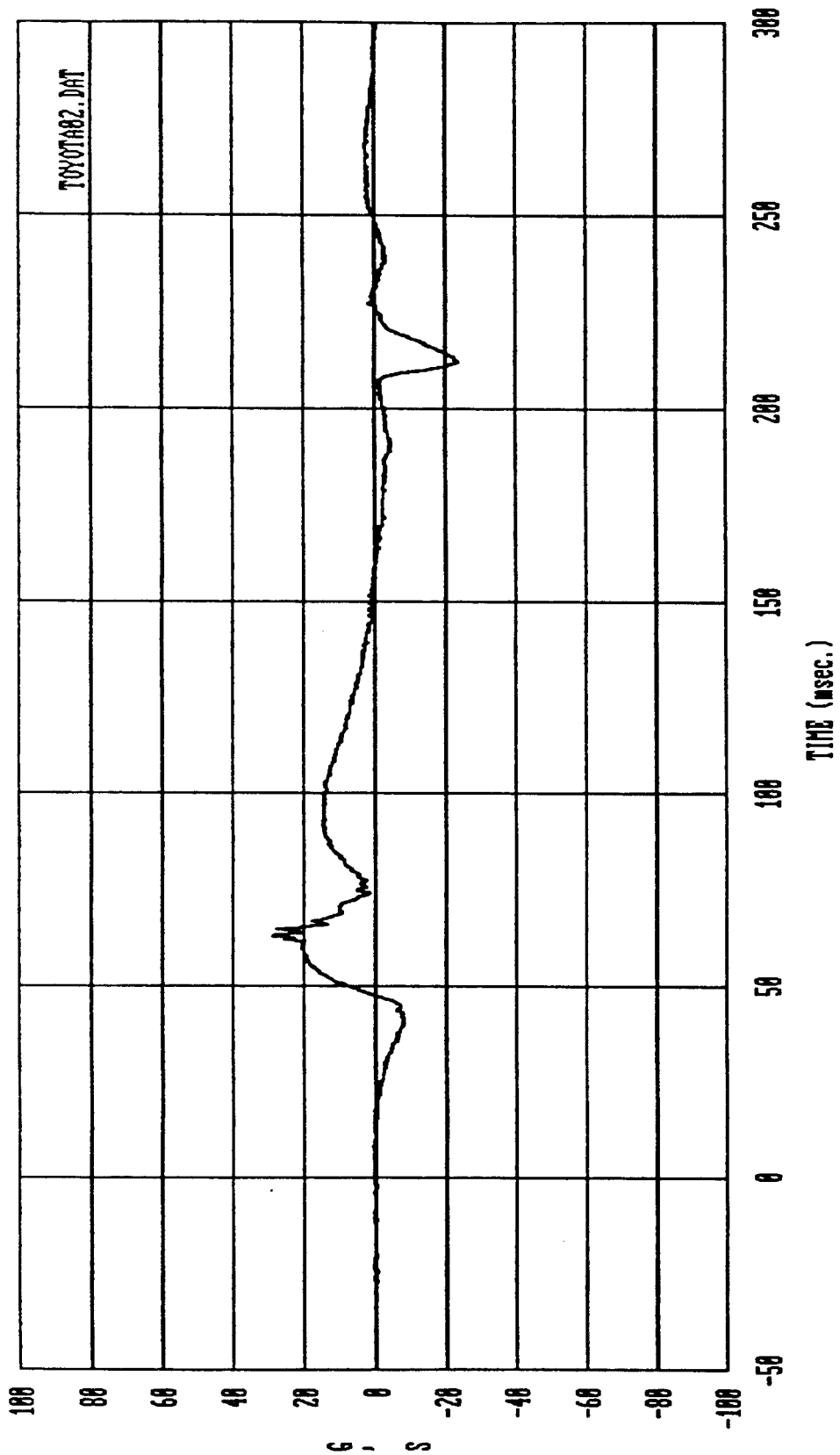
FIGURE A-23 MDB FACE, VIEW NO. 4 - POSTTEST

APPENDIX B
DATA PLOTS

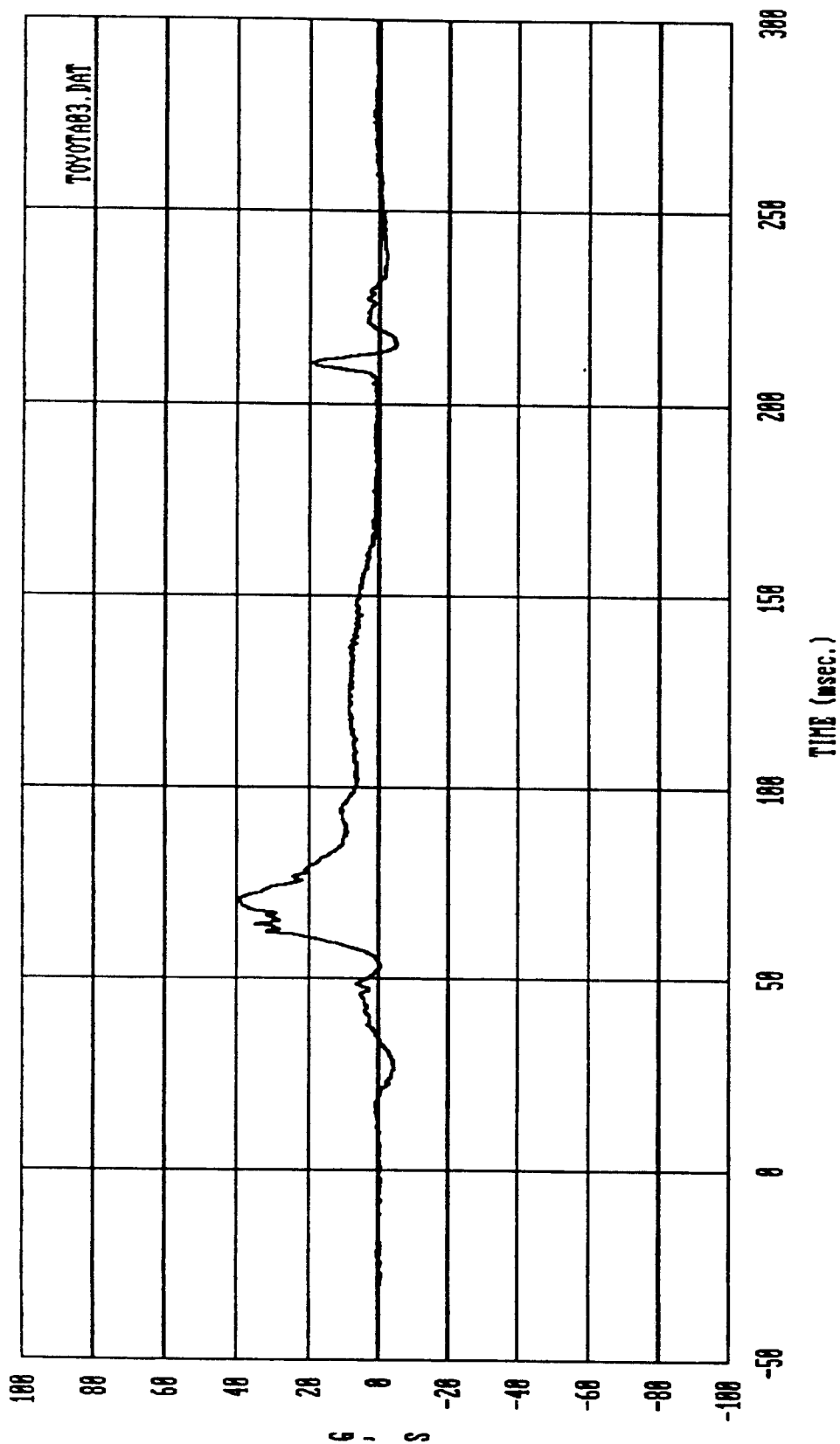


Curve: Driver Head acceleration -- X axis Filter: SAE CLASS 1000 Max = 14.607 Min = -10.675

NSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup

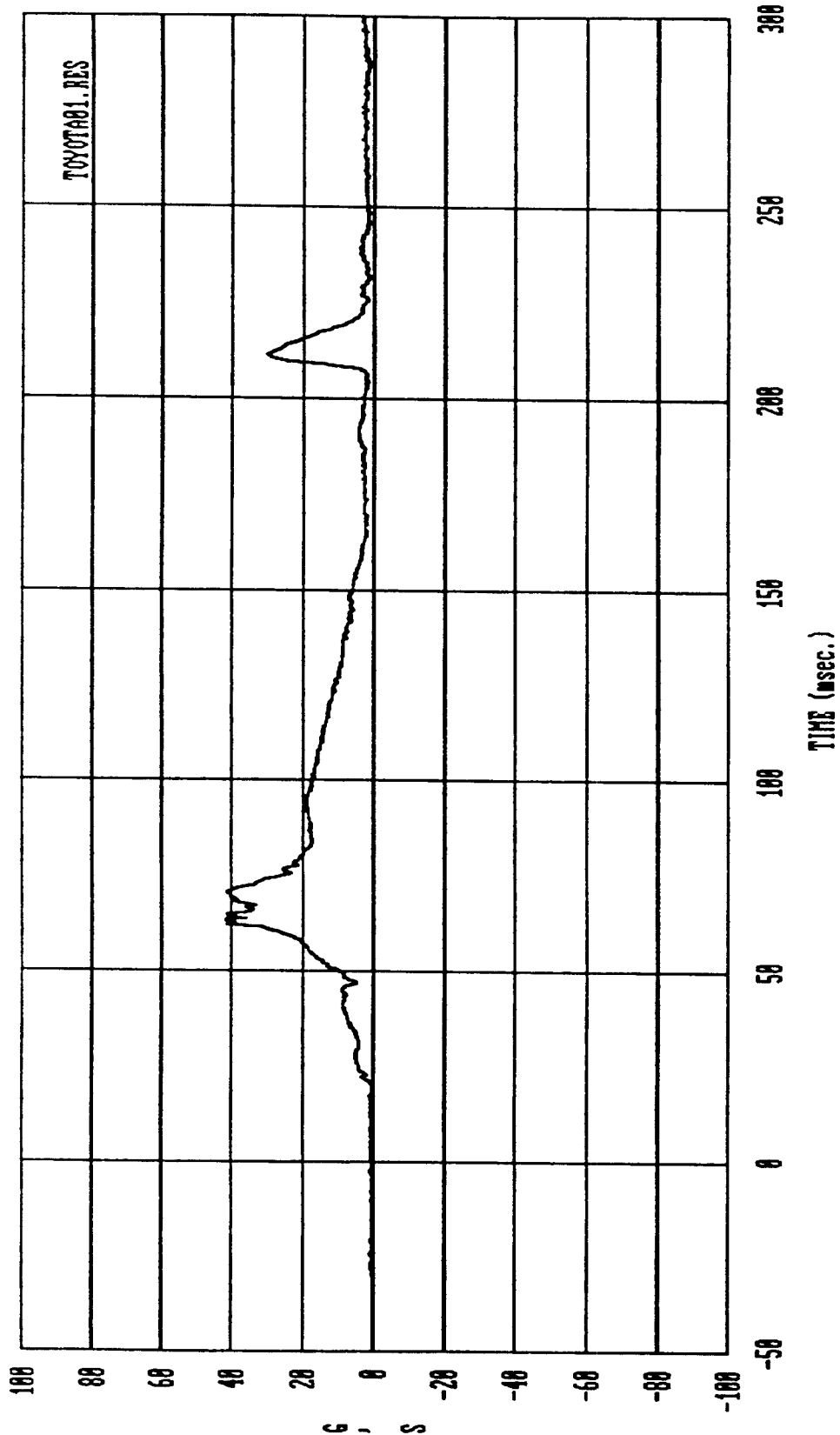


Curve: Driver Head acceleration -- Y axis Filter: SAE CLASS 1000 Max = 36.113 Min = -23.436
 MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



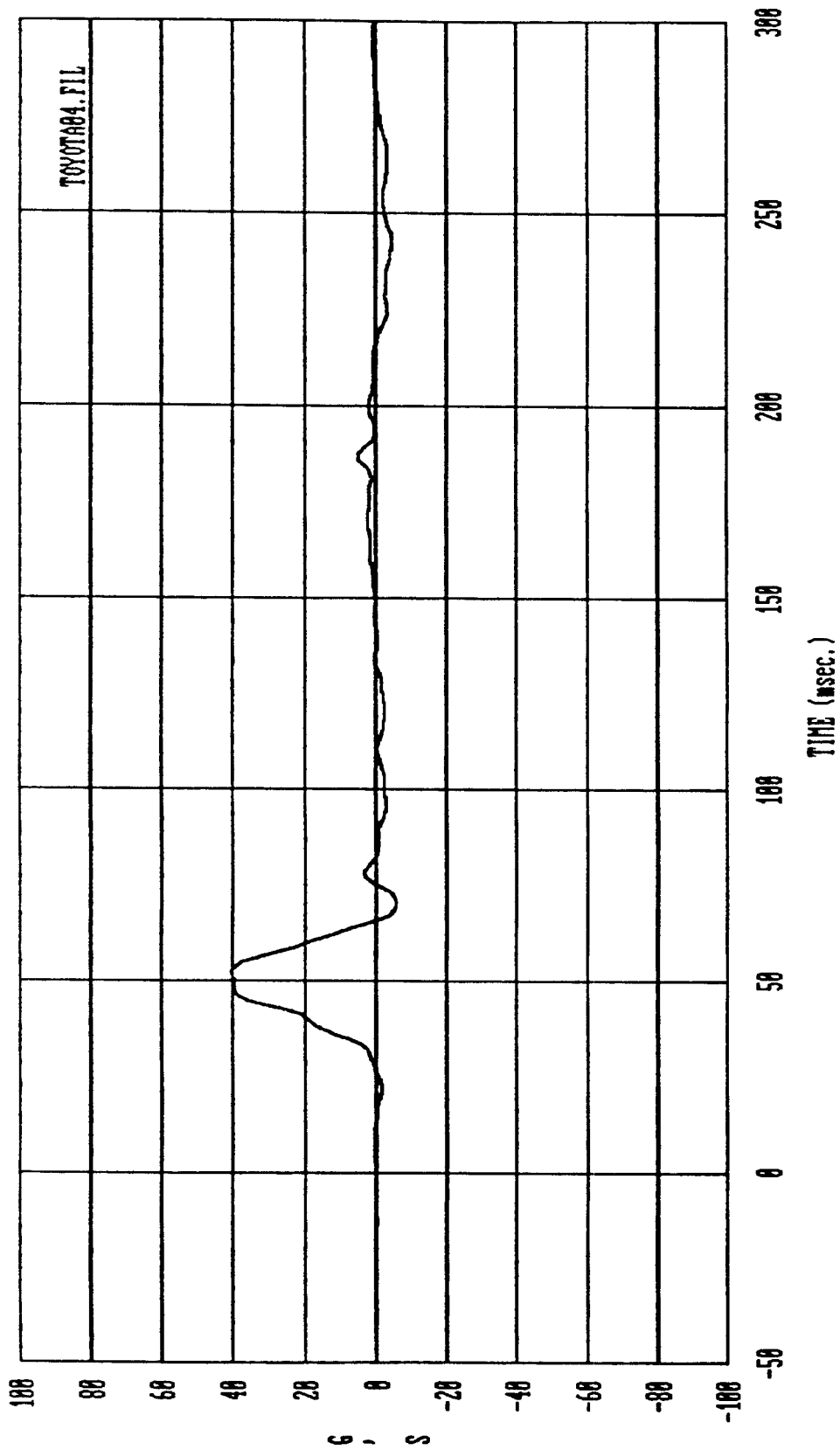
Curve: Driver Head acceleration — Z axis Filter: SAE CLASS 1000 Max = 41.879 Min = -4.9793

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



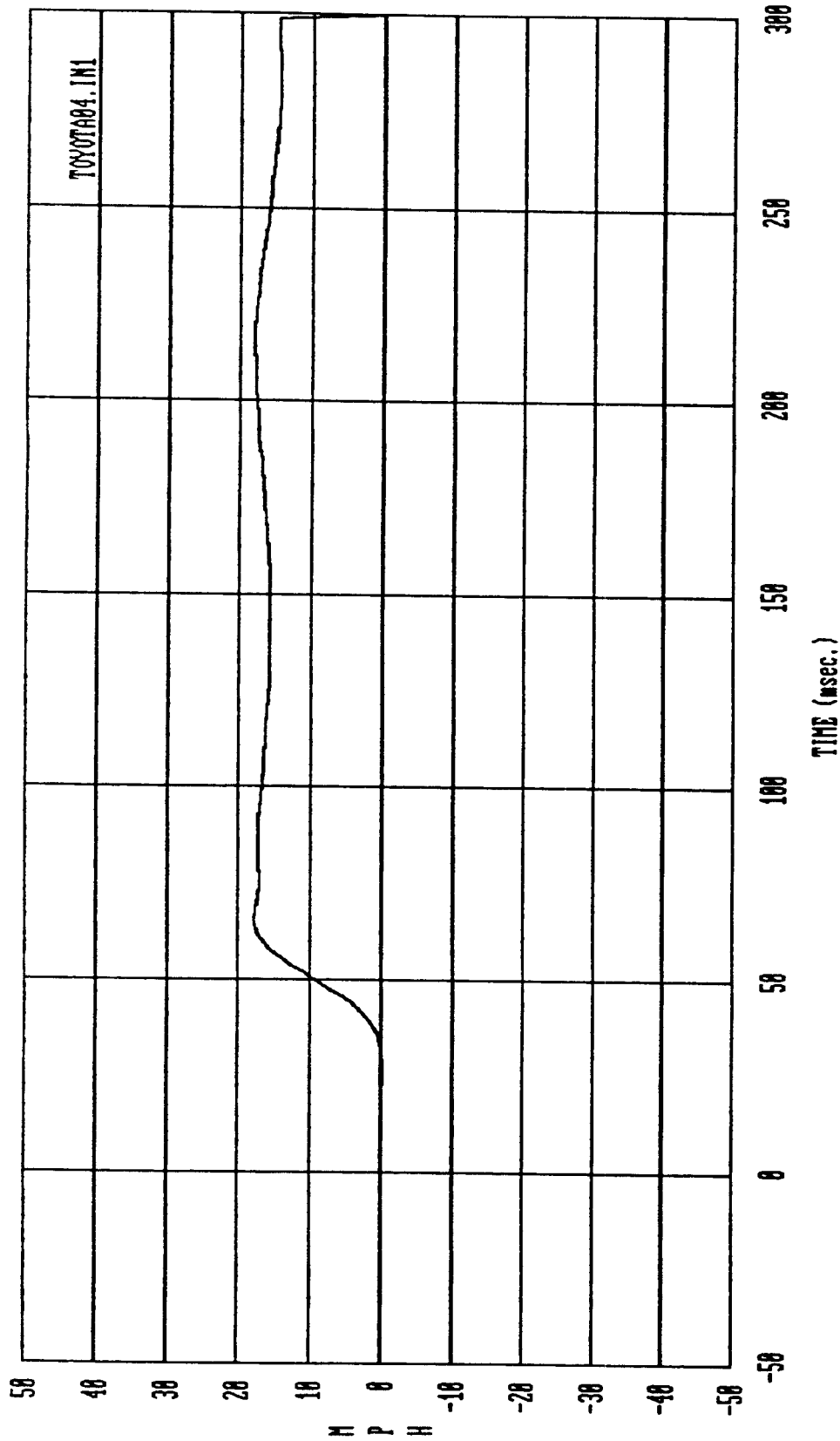
Curve: Driver Head resultant acceleration Filter: SAE CLASS 1000 Max = 46.276 Min = .00000

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup

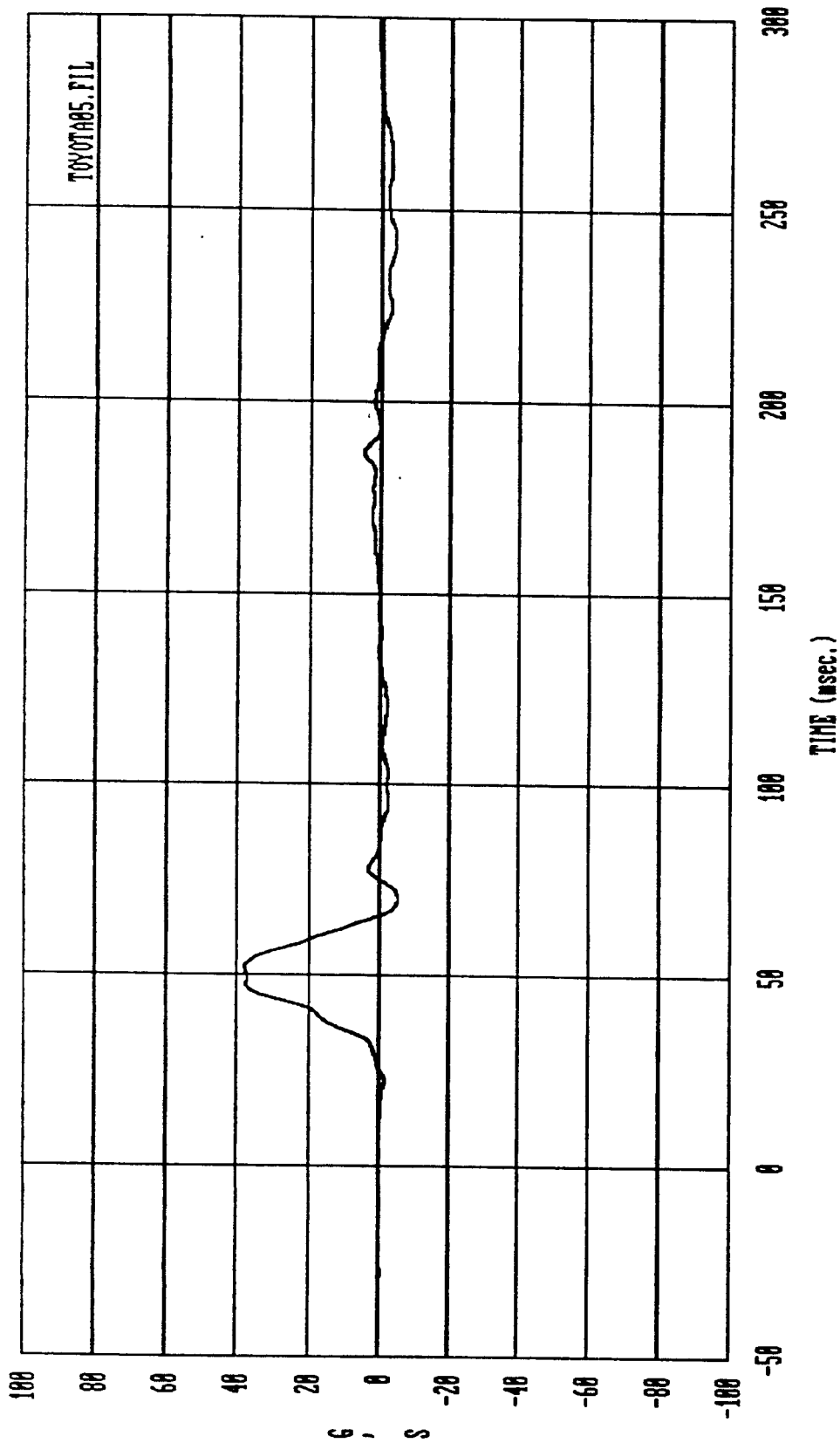


Curve: Driver Upper Spine 1 acceleration -- Primary Filter: FIR 100 Max = 40.580 Min = -5.4589

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup

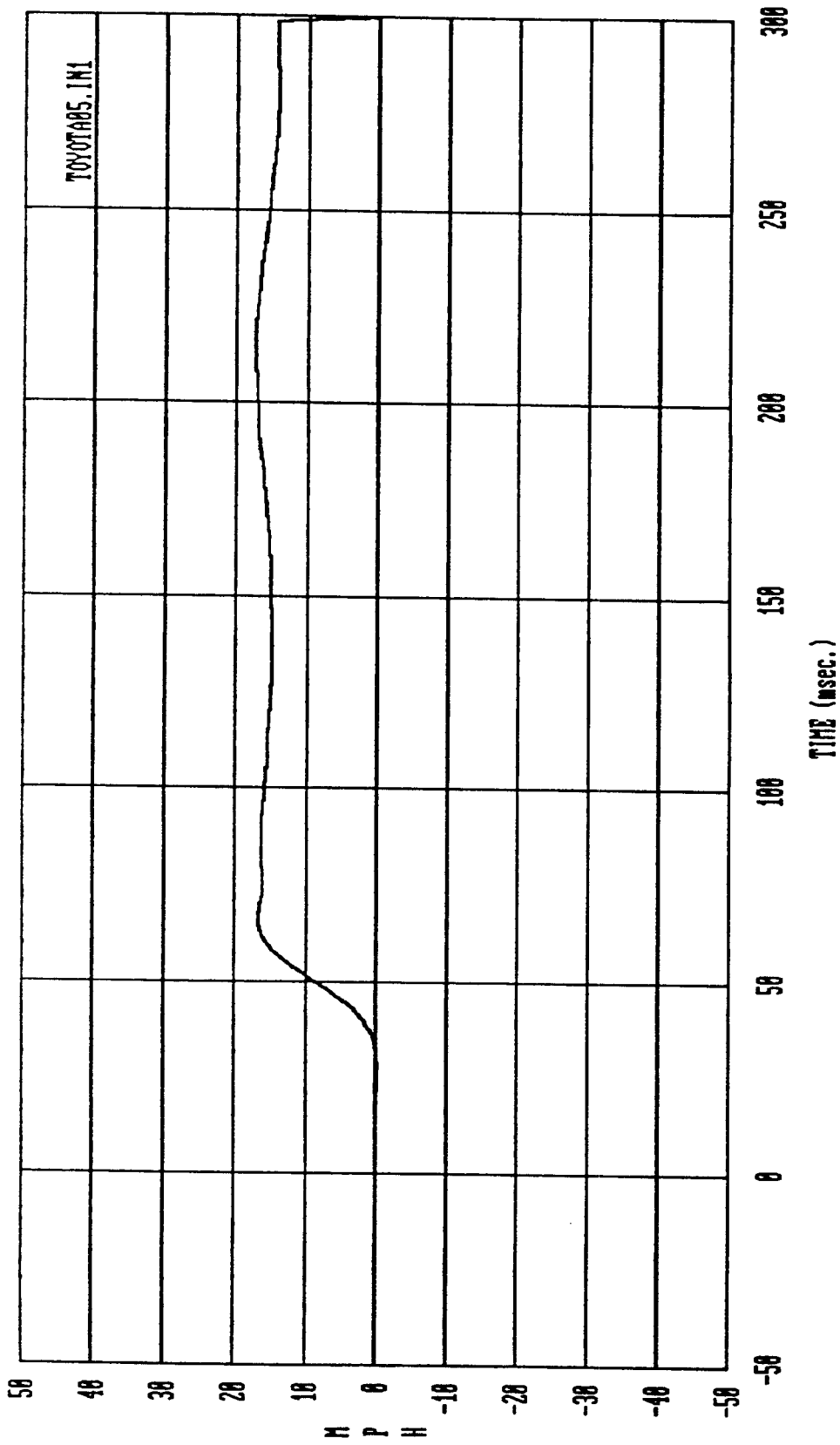


Curve: Driver Upper Spine 1 delta V -- Primary Filter: FIR 100 Max = 18.843 Min = -11.942
 MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



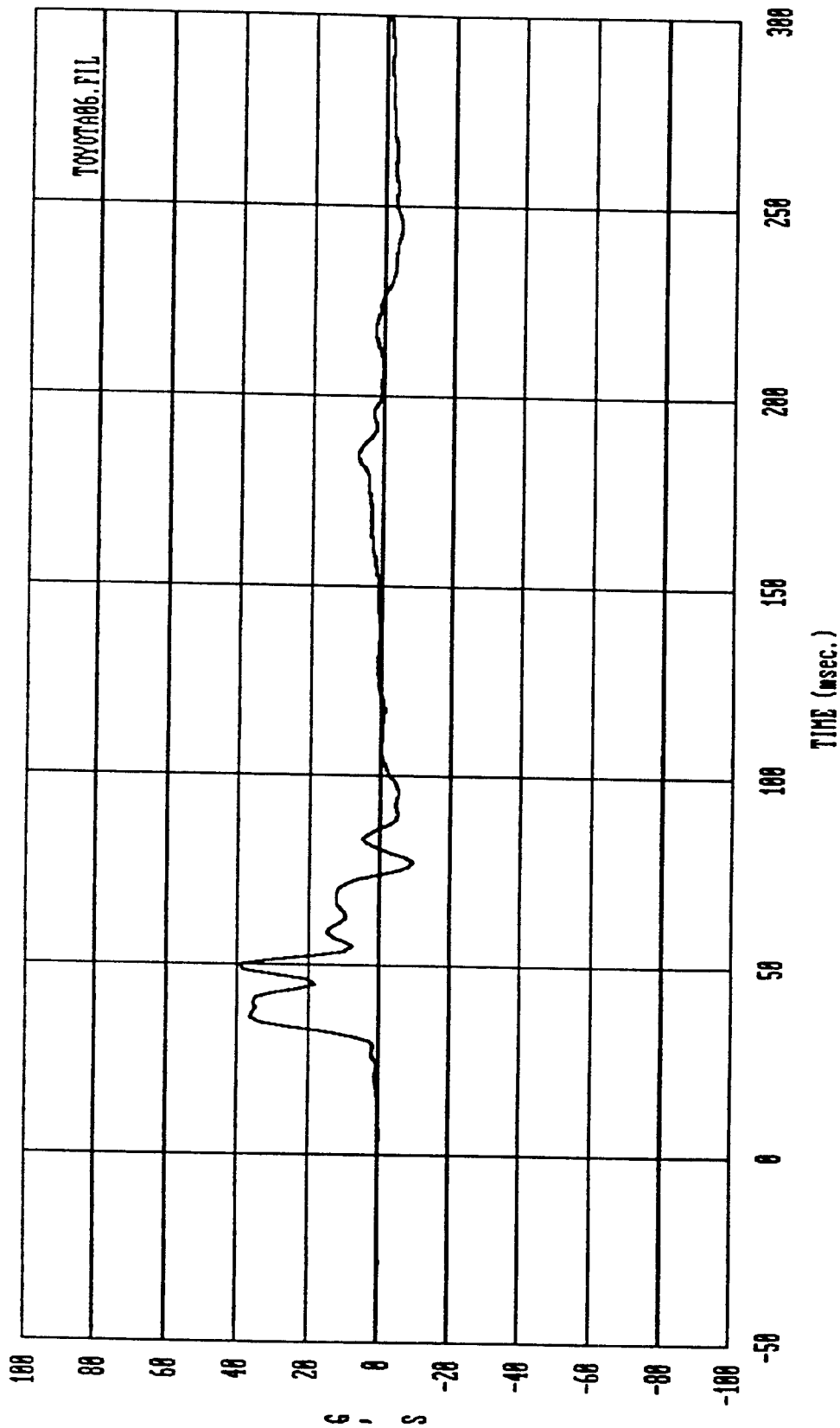
Curve: Driver Upper Spine 2 acceleration -- Redundant Filter: FIR 100 Max = 37.944 Min = -5.8652

MSE Date: 84/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



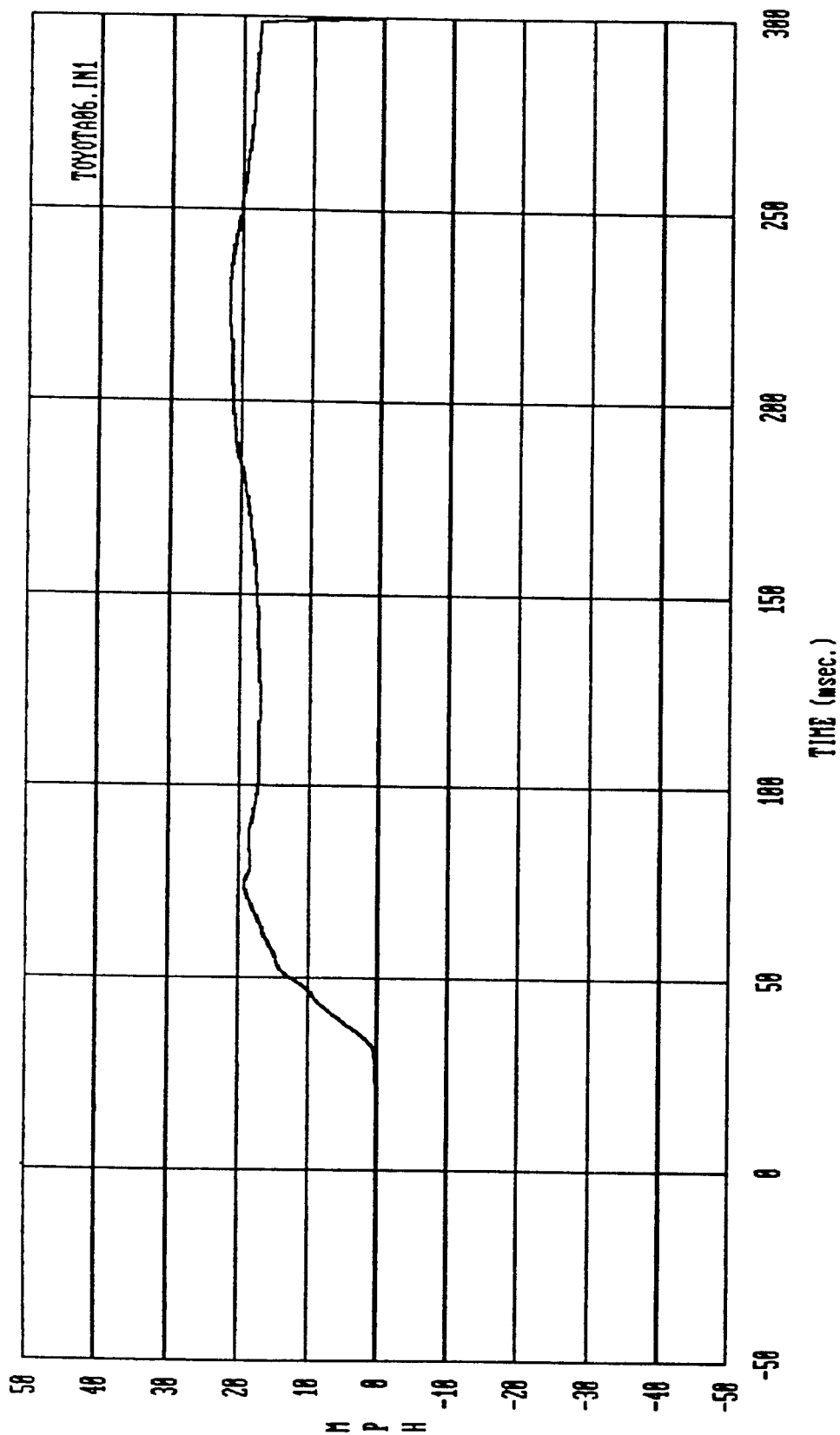
Curve: Driver Upper Spine 2 delta V -- Redundant Filter: FIR 100 Max = 17.307 Min = -.16846

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



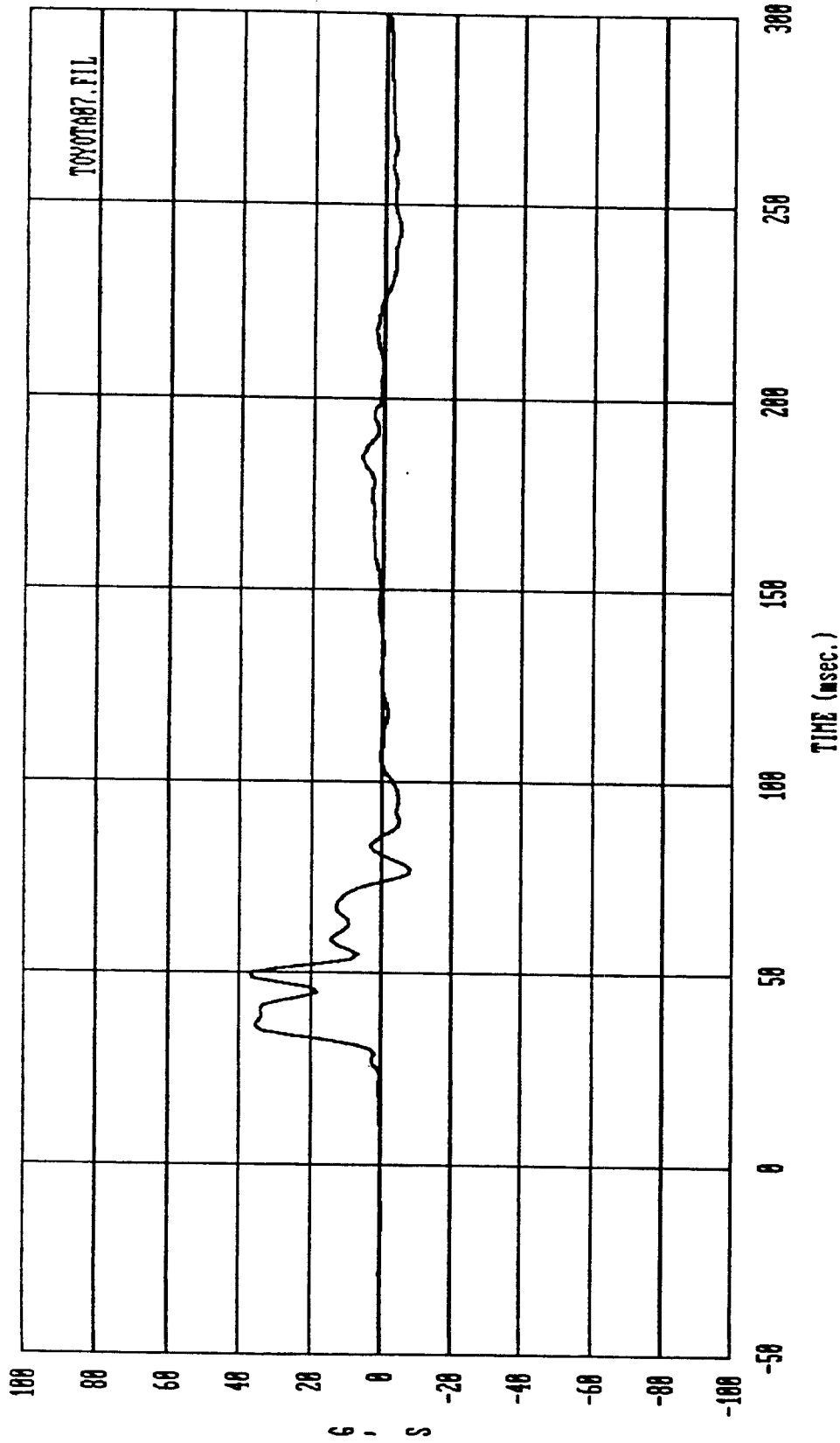
Curve: Driver Upper Rib 1 acceleration -- Primary Filter: FIR 100 Max = 40.148 Min = -9.2158

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



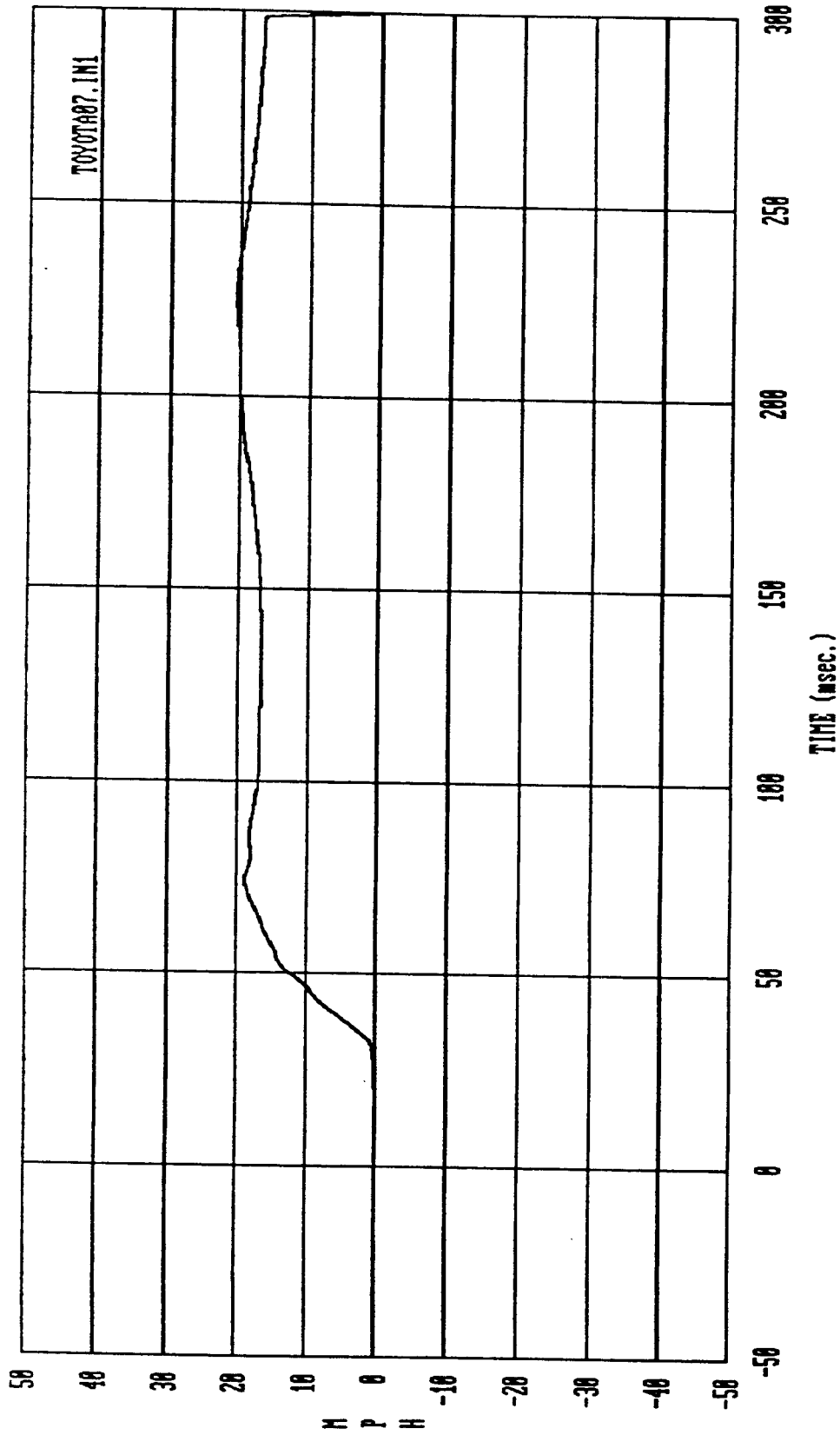
Curve: Driver Upper Rib 1 delta V -- Primary Filter: FIR 100 Max = 21.982 Min = -.21162E-01

NSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



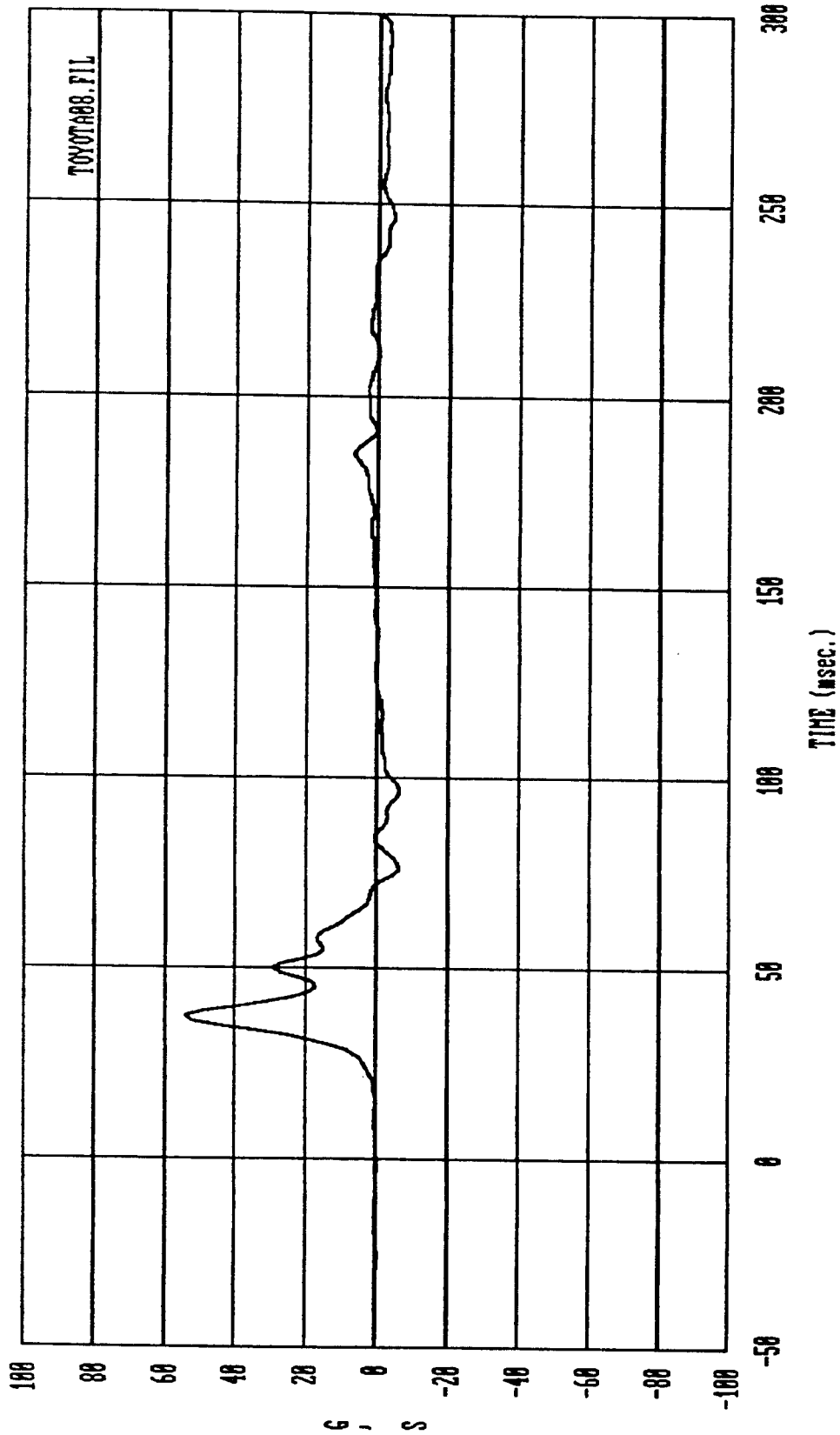
Curve: Driver Upper Rib 2 acceleration -- Redundant Filter: PIR 100 Max = 38.028 Min = -8.2262

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



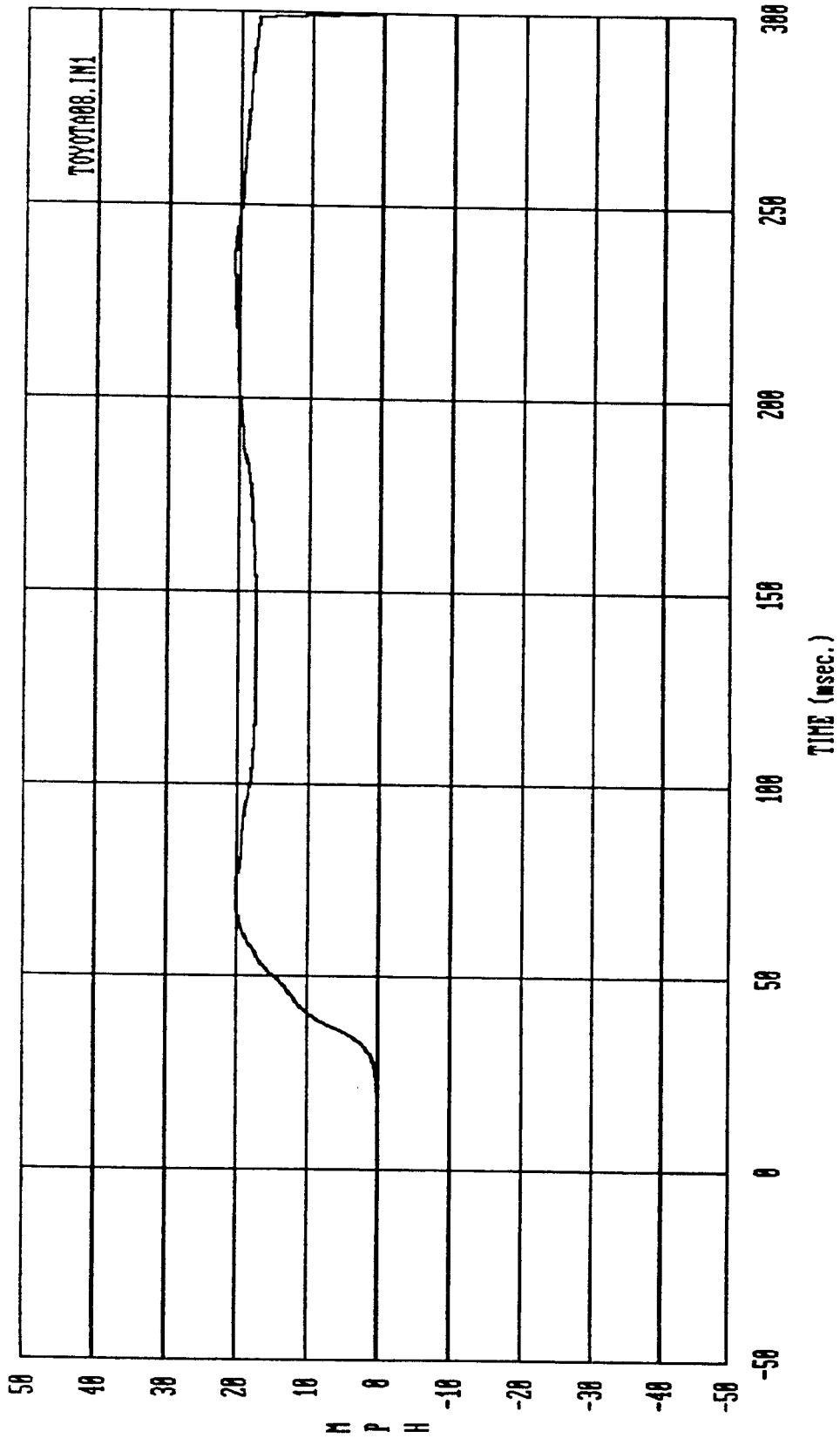
Curve: Driver Upper Rib 2 delta V — Redundant Filter: FIR 100 Max = 20.594 Min = 16.728

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



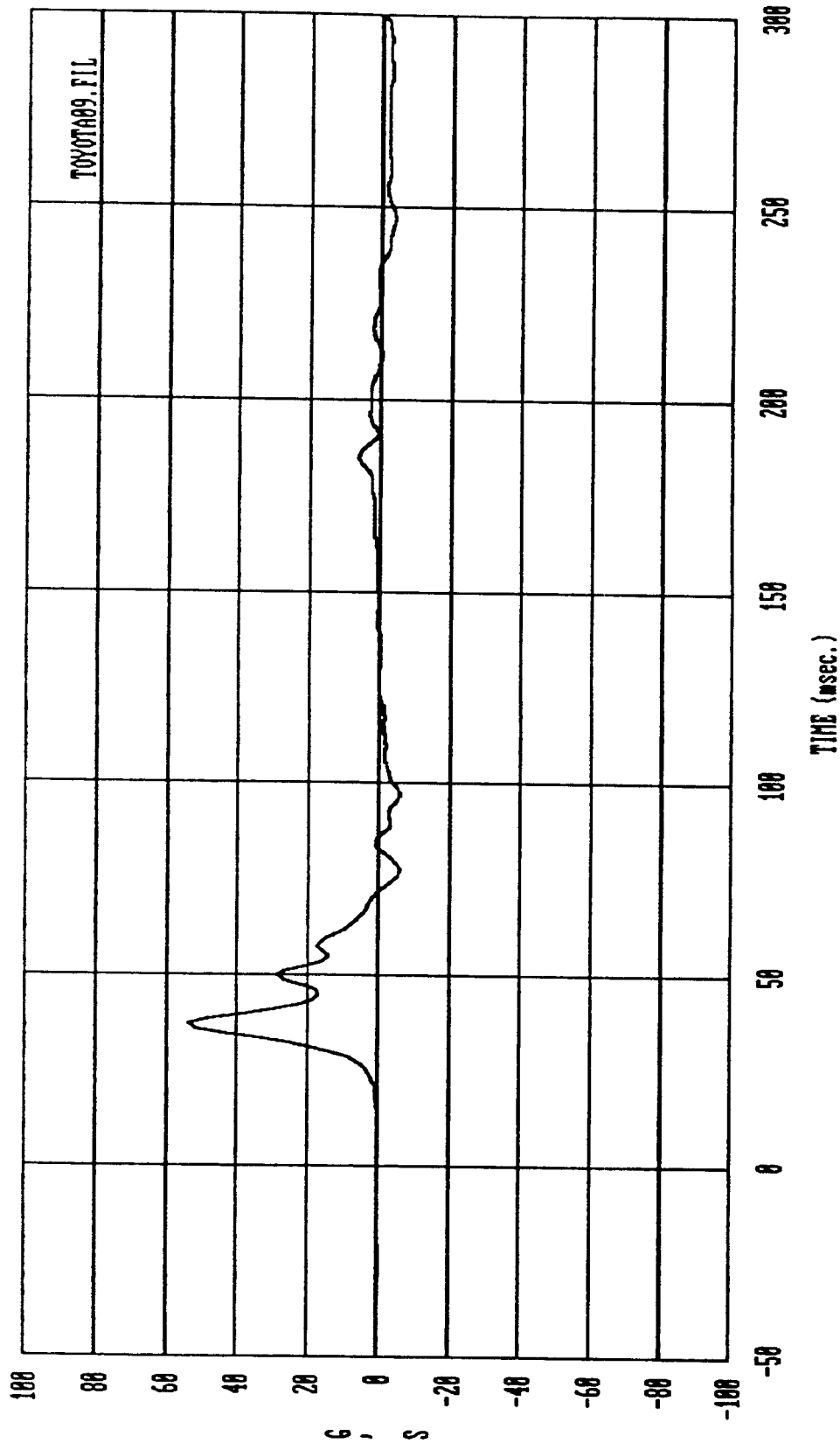
Curve: Driver Lower Rib 1 acceleration — Primary Filter: FIR 100 Max = 54.271 Min = -6.5324

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



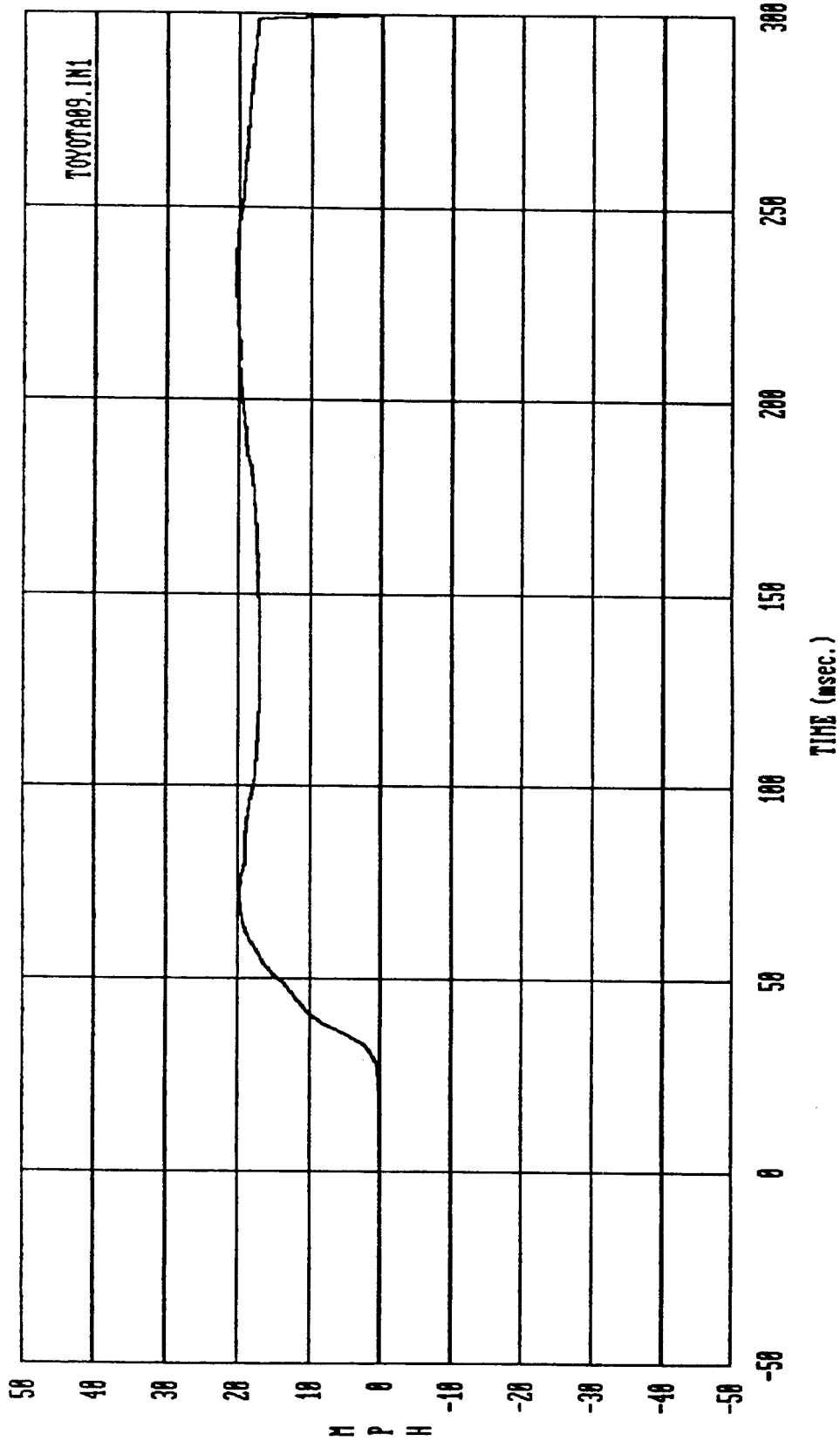
Curve: Driver Lower Rib 1 delta V -- Primary Filter: FIR 100 Max = 20.783 Min = -.42746E-02

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup

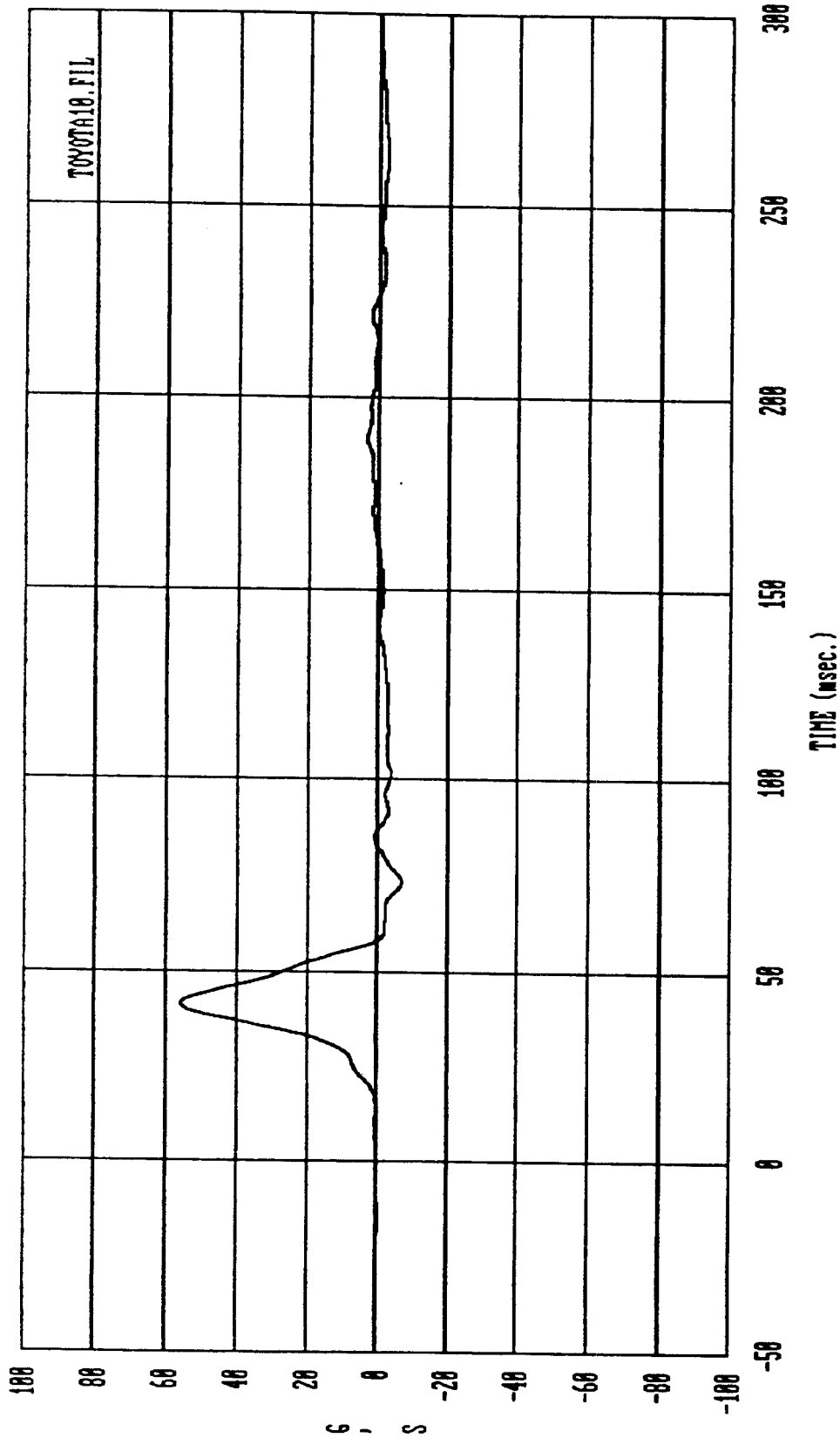


Curve: Driver Lower Rib 2 acceleration -- Redundant Filter: FIR 100 Max = 53.990 Min = -5.7854

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup

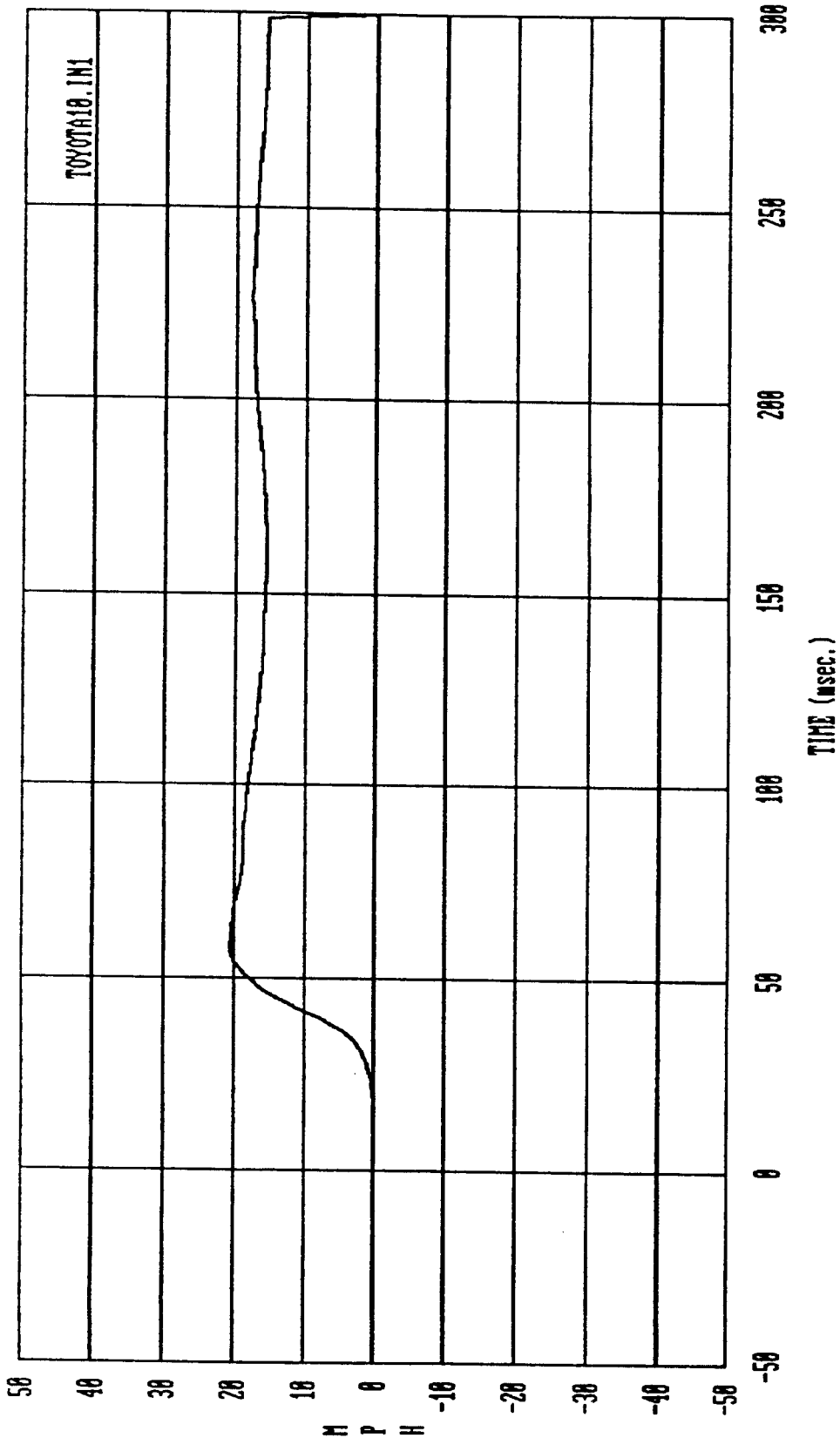


Curve: Driver Lower Rib 2 delta V -- Redundant Filter: FIR 100 Max = 28.462 Min = .10674E-01
 HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



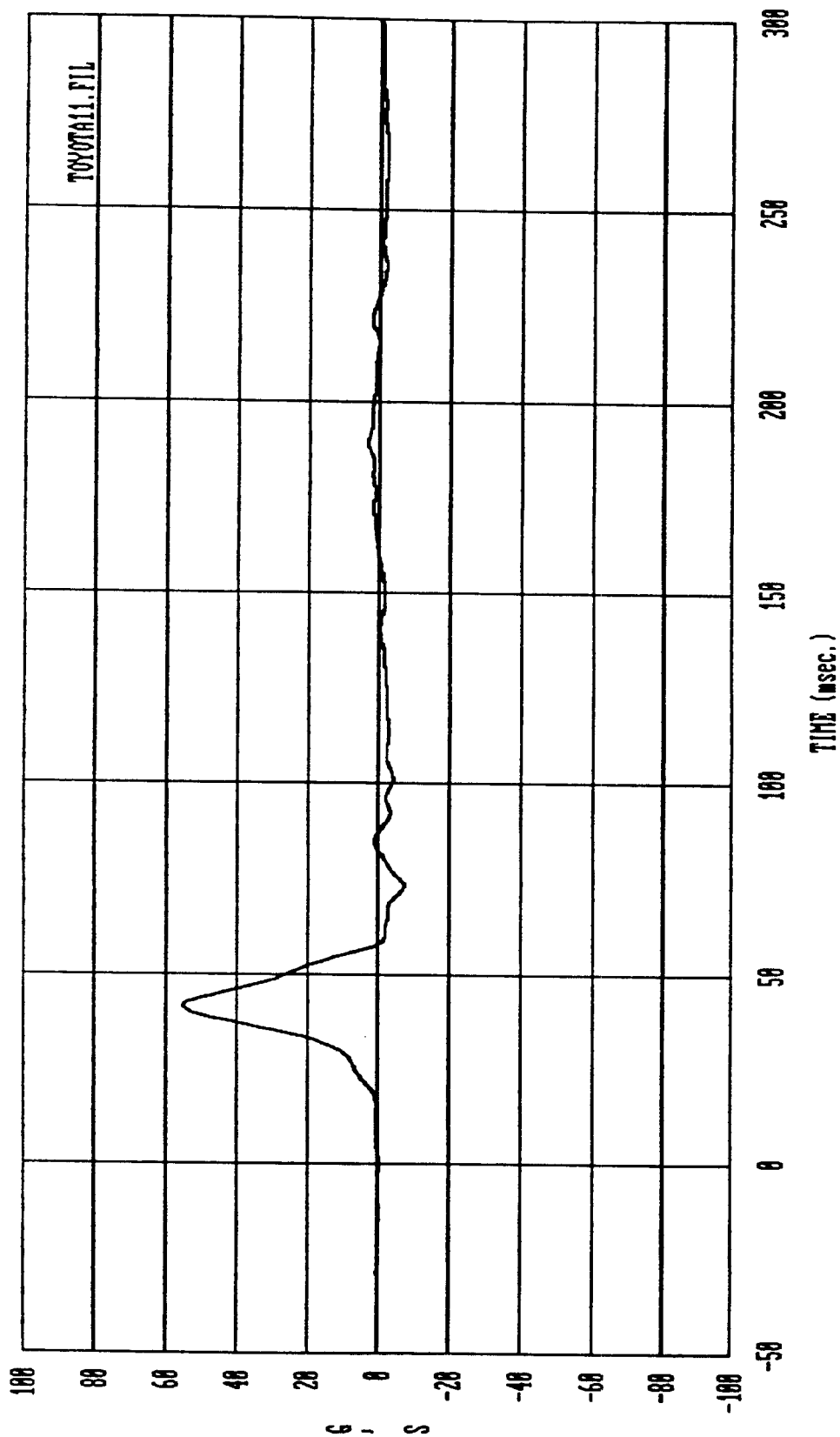
Curve: Driver Lower Spine 1 acceleration -- Primary Filter: FIR 100 Max = 56.218 Min = -7.1243

NSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



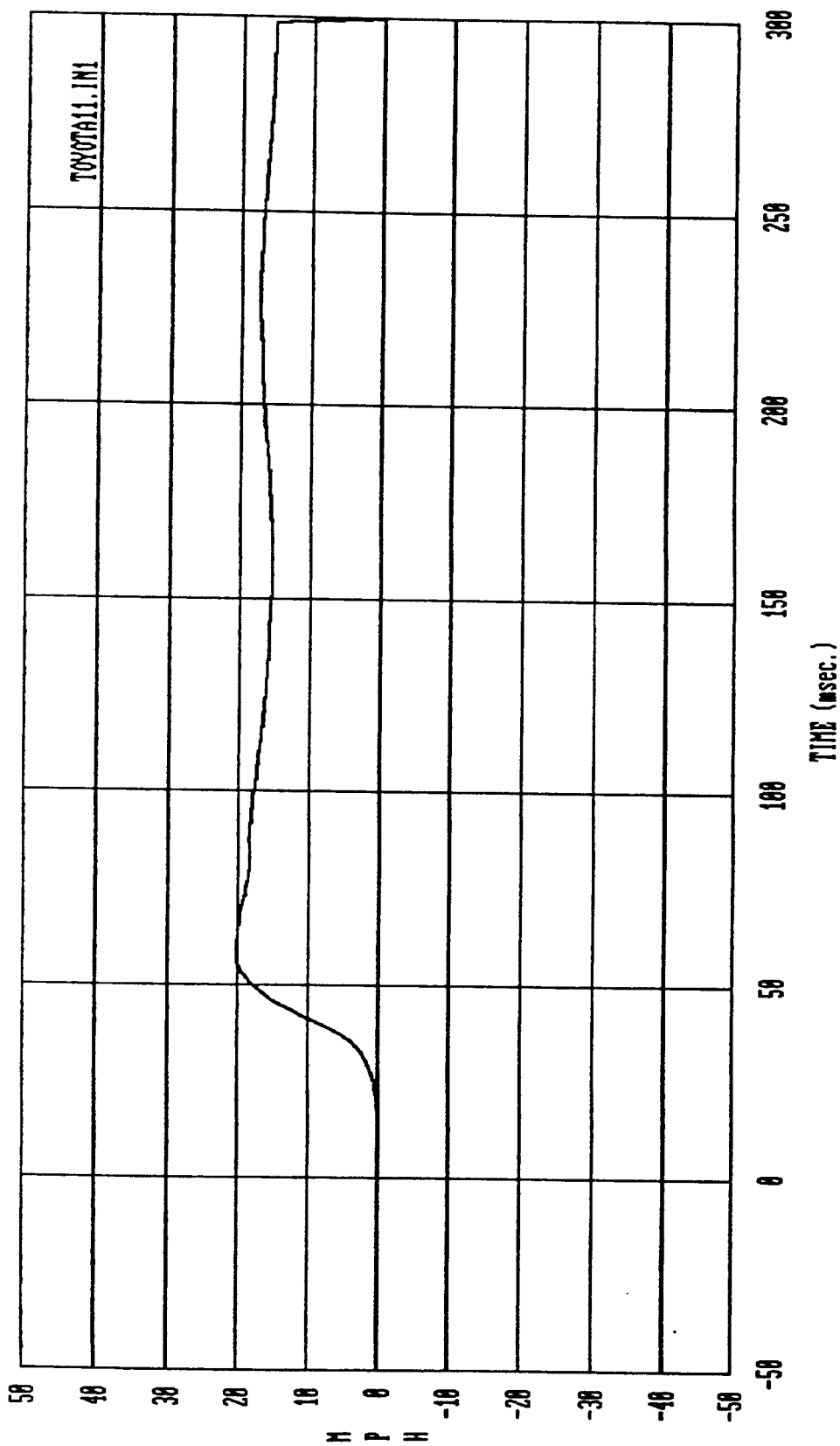
Curve: Driver Lower Spine 1 delta V -- Primary Filter: FIR 100 Max = 28.578 Min = 15.786

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



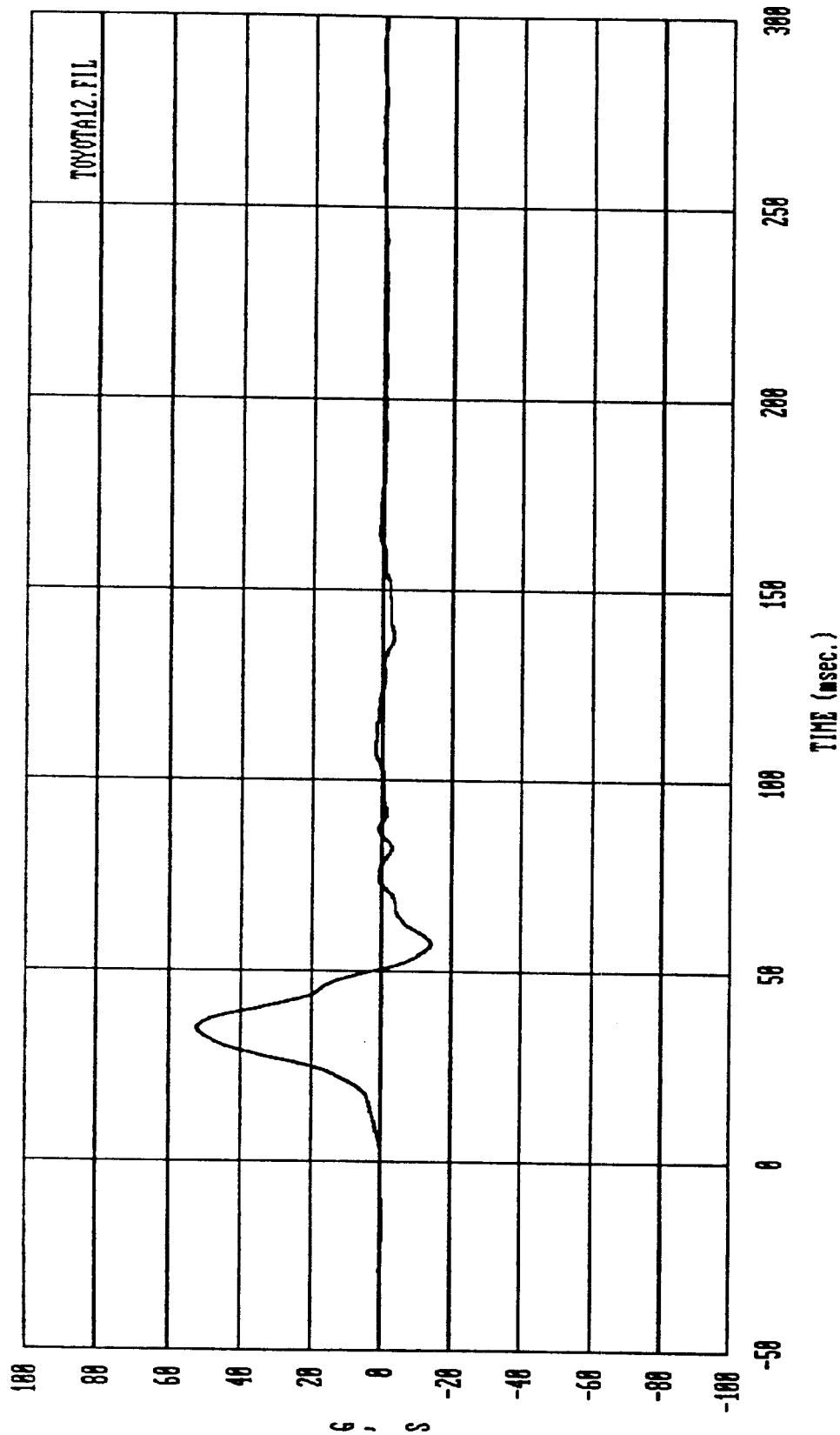
Curve: Driver Lower Spine 2 acceleration — Redundant Filter: PIR 100 Max = 55.410 Min = -7.3748

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup

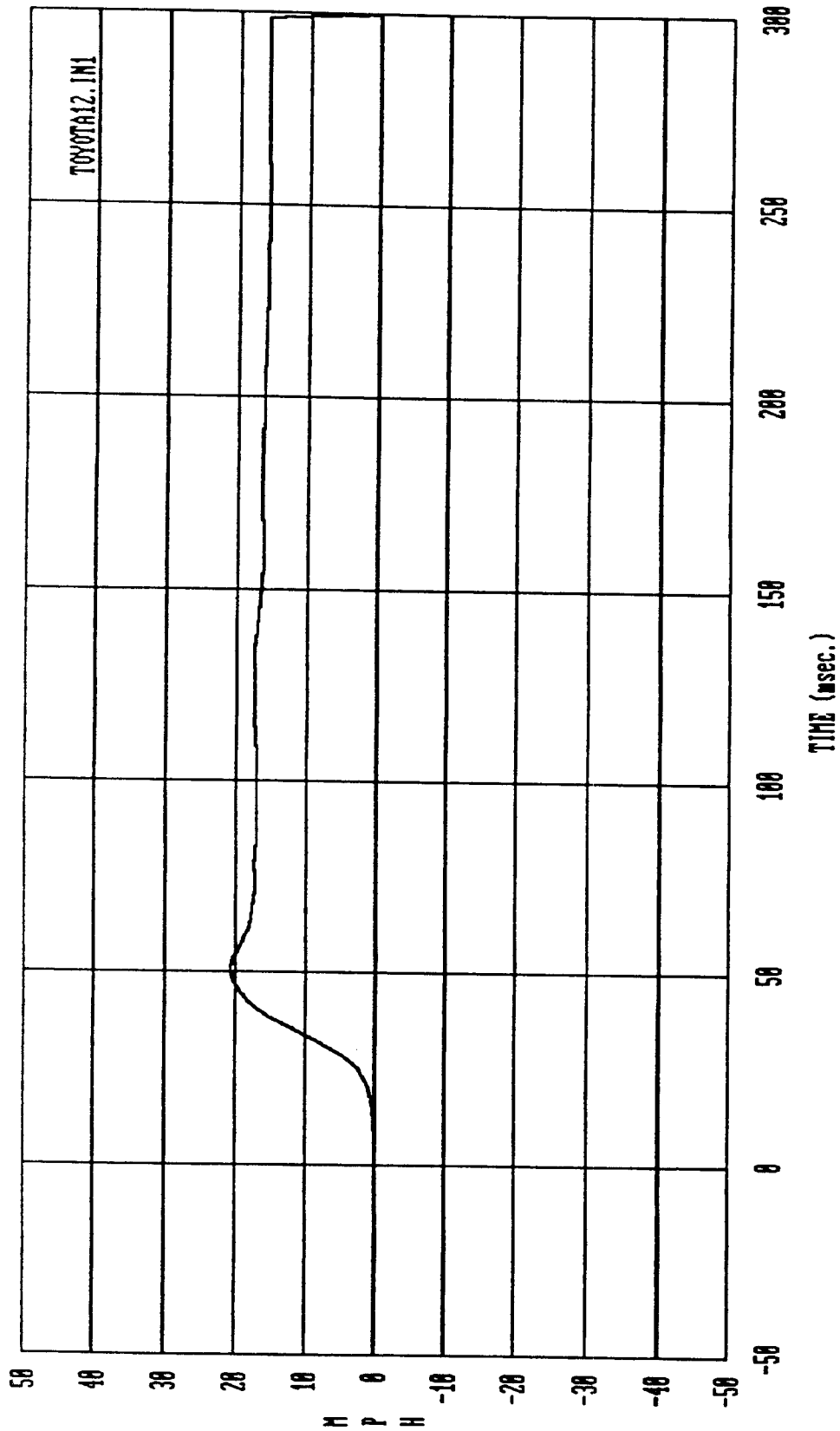


Curve: Driver Lower Spine 2 delta V -- Redundant Filter: FIR 100 Max = 28.285 Min = -.87446E-02

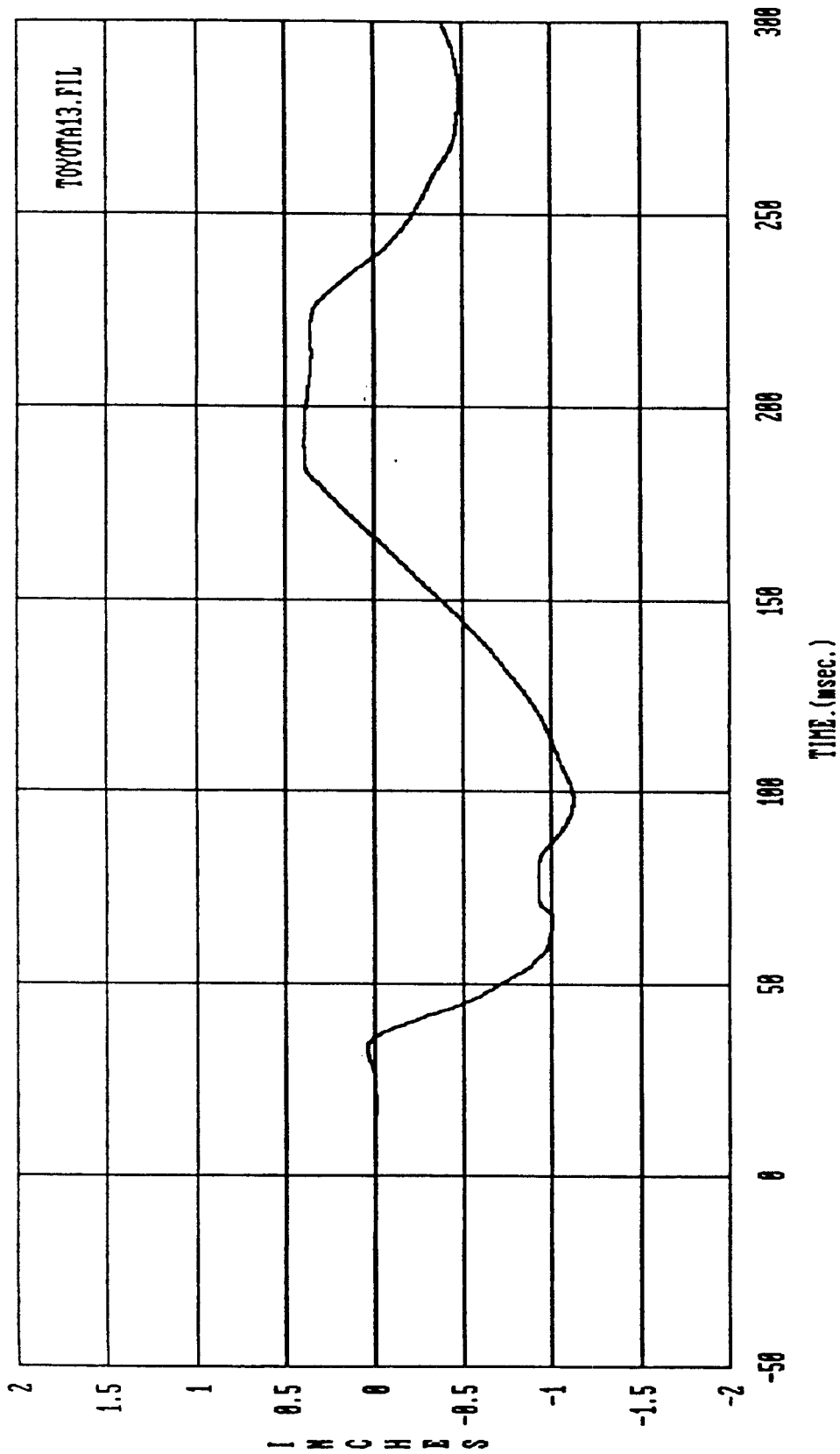
HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



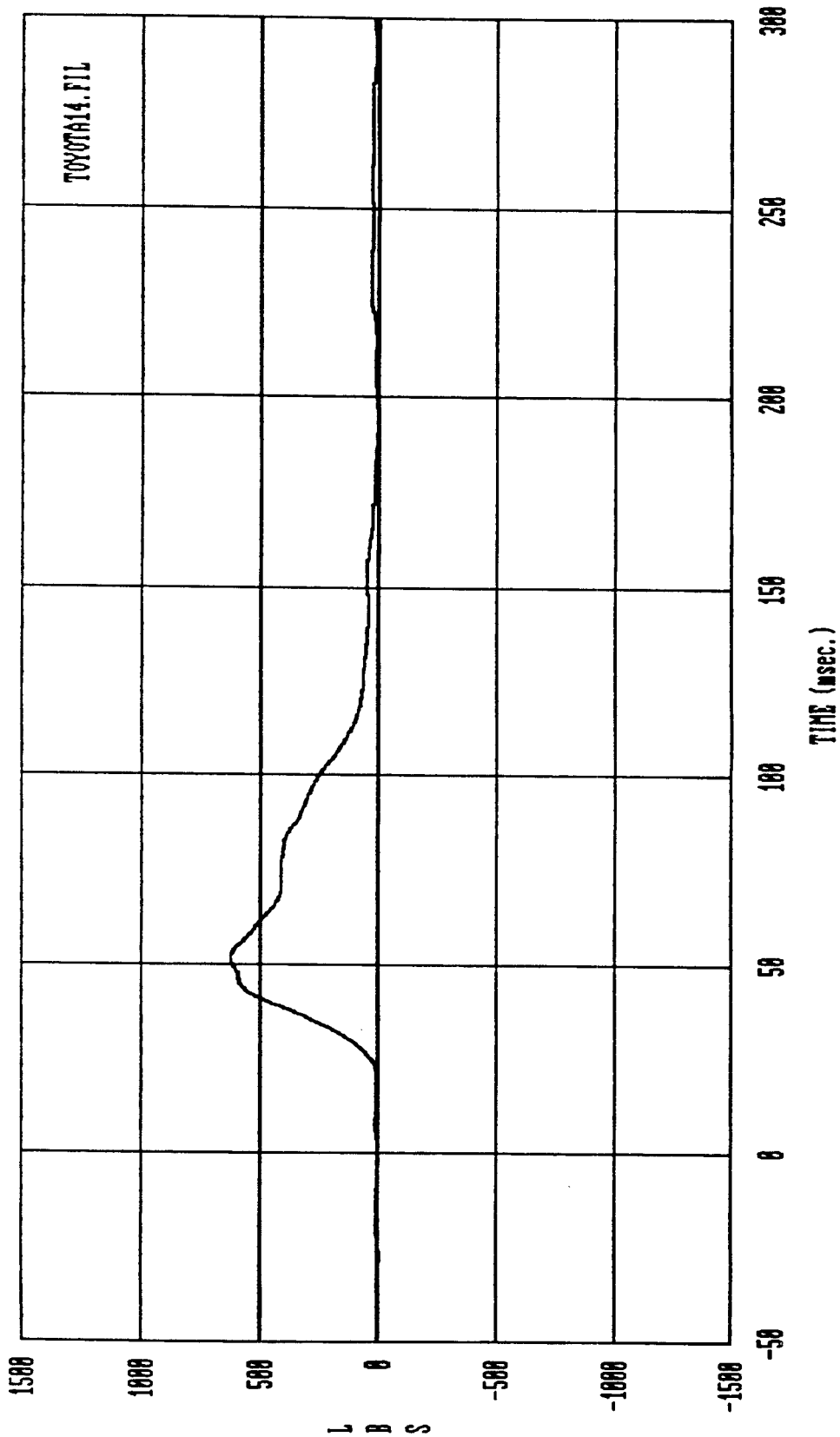
Curve: Driver Pelvis acceleration Filter: PIR 100 Max = 52.691 Min = -14.415
 HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



Curve: Driver Pelvis delta V Filter: FIR 100 Max = 20.761 Min = 15.779
 MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup

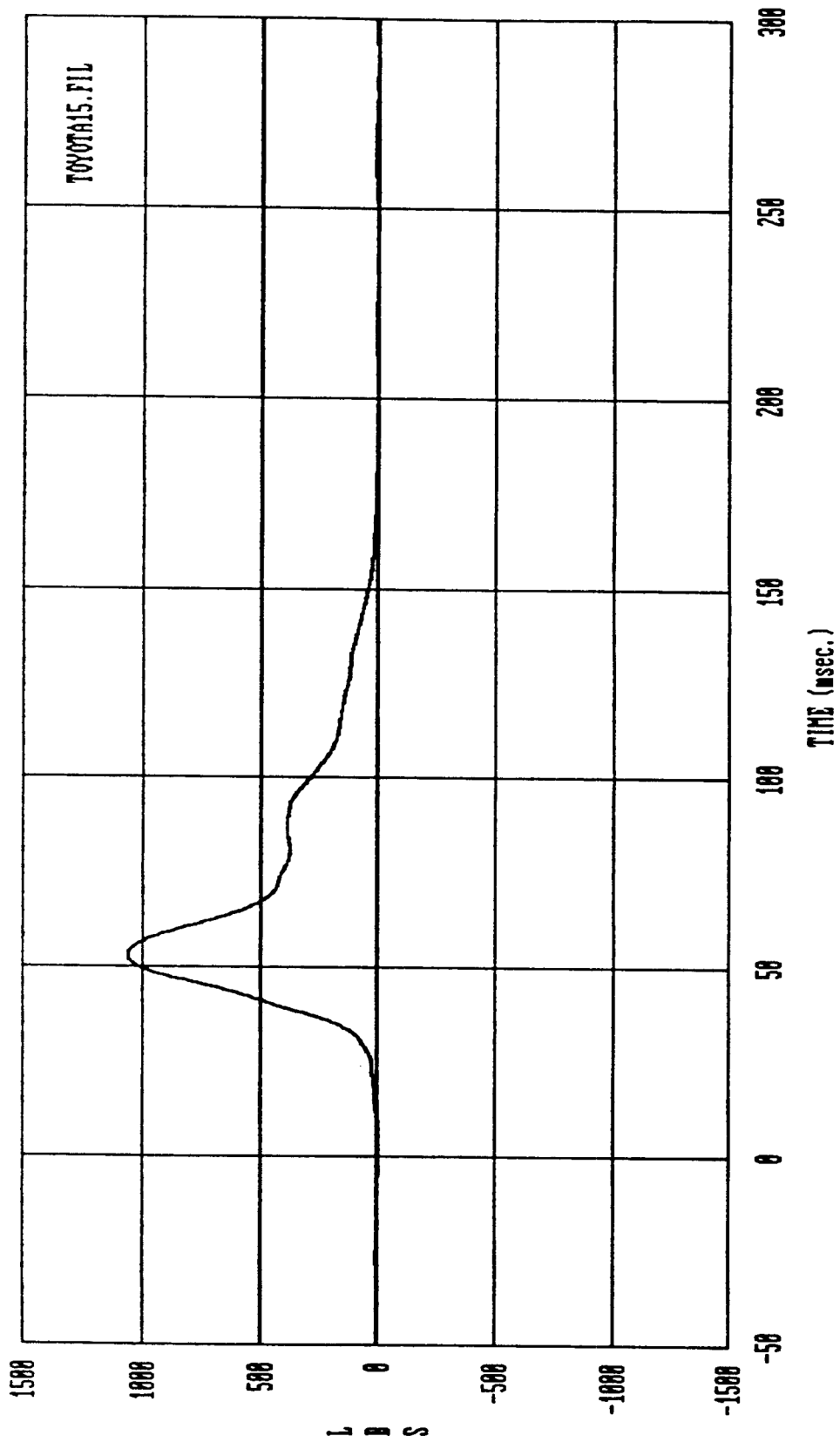


Curve: Driver Rib deflection
 Filter: SAE CLASS 180
 Max = .39916
 Min = -1.1218
 Date: 04/05/91
 Program: 1991 Side Impact
 Vehicle: 1991 Toyota pickup



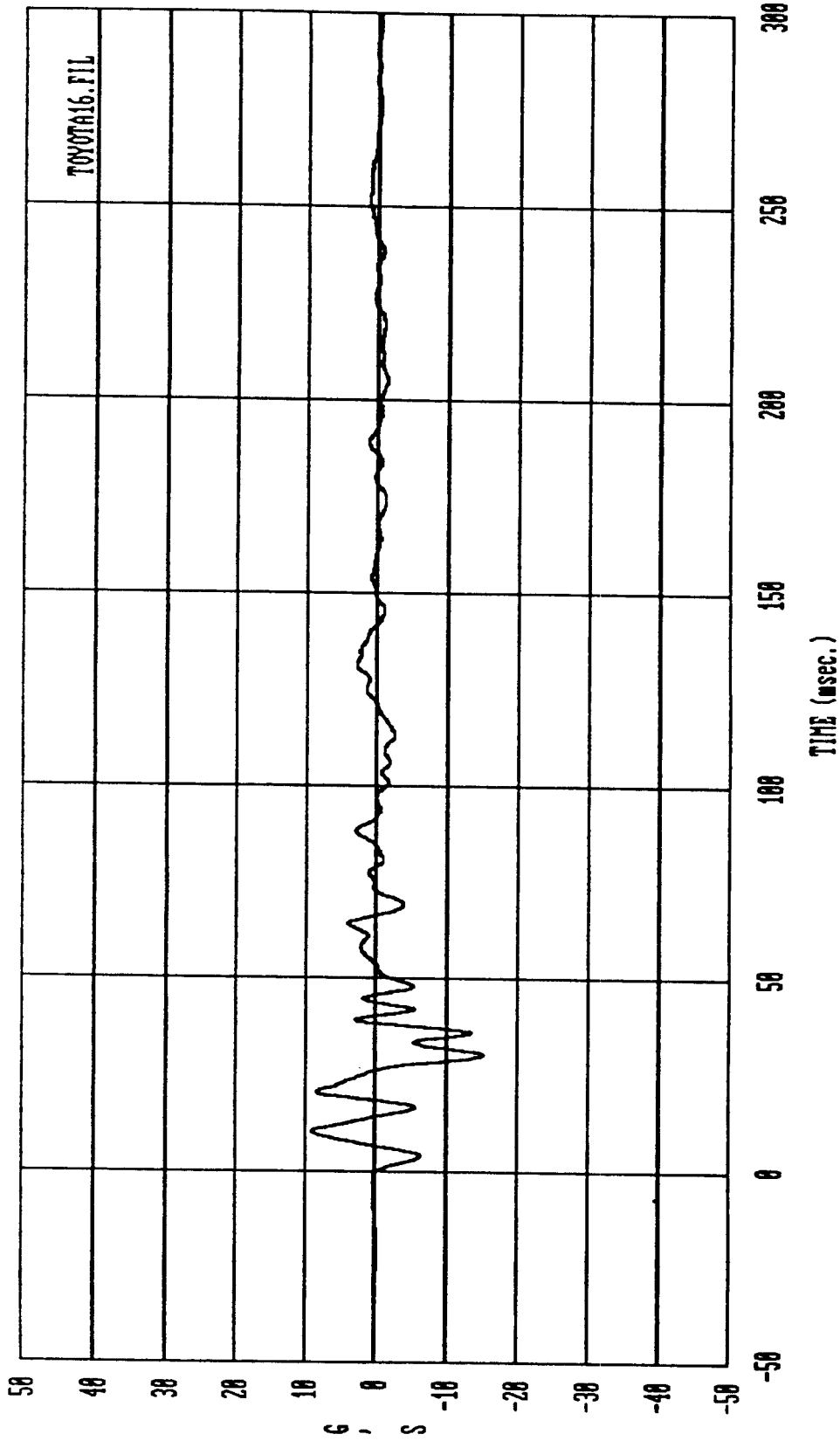
Curve: Driver lap belt load Filter: SAE CLASS 60 Max = 627.45 Min = .22330

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



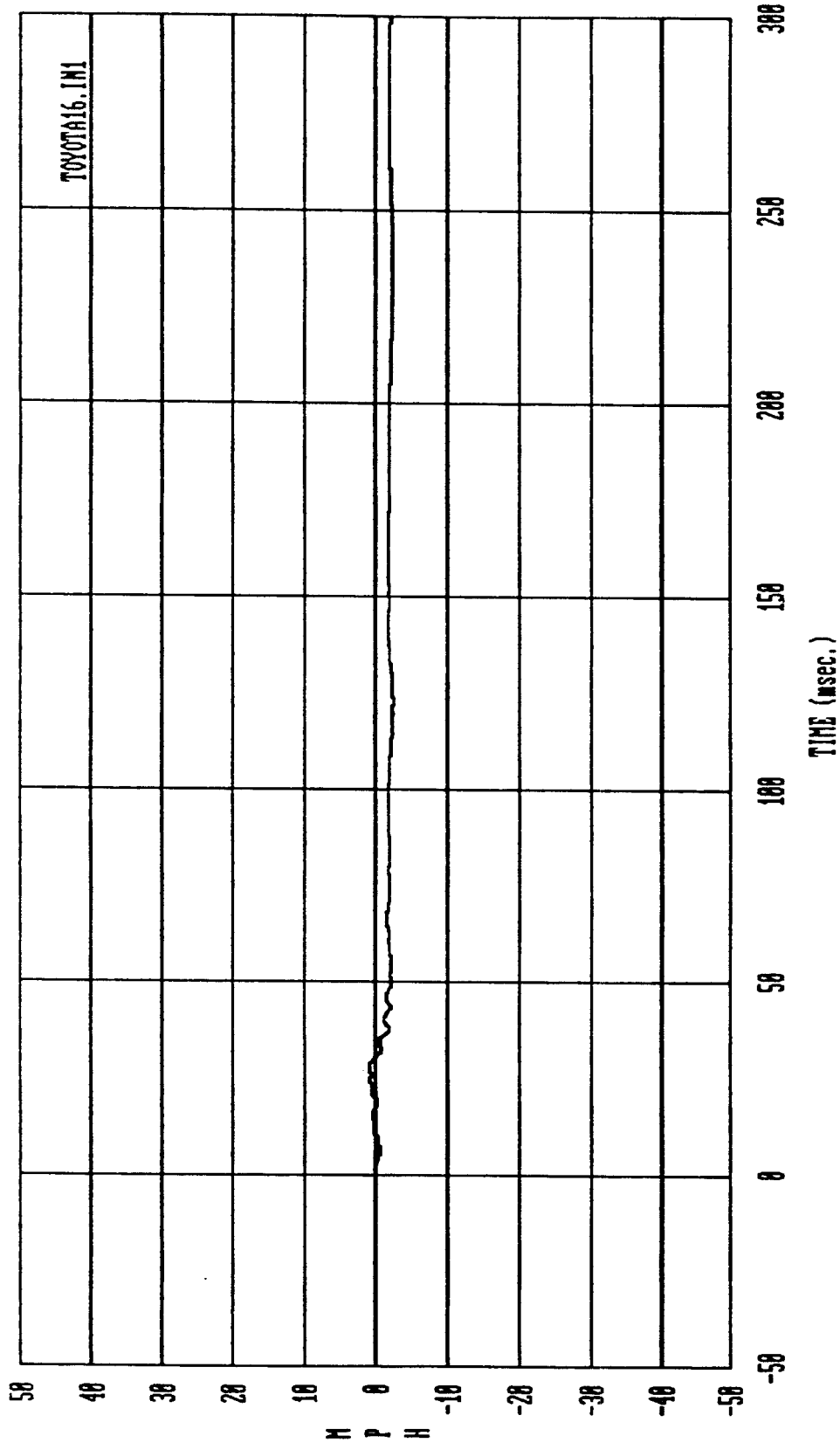
Curve: Driver shoulder belt load Filter: SAE CLASS 60 Max = 1063.6 Min = -7.9131

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



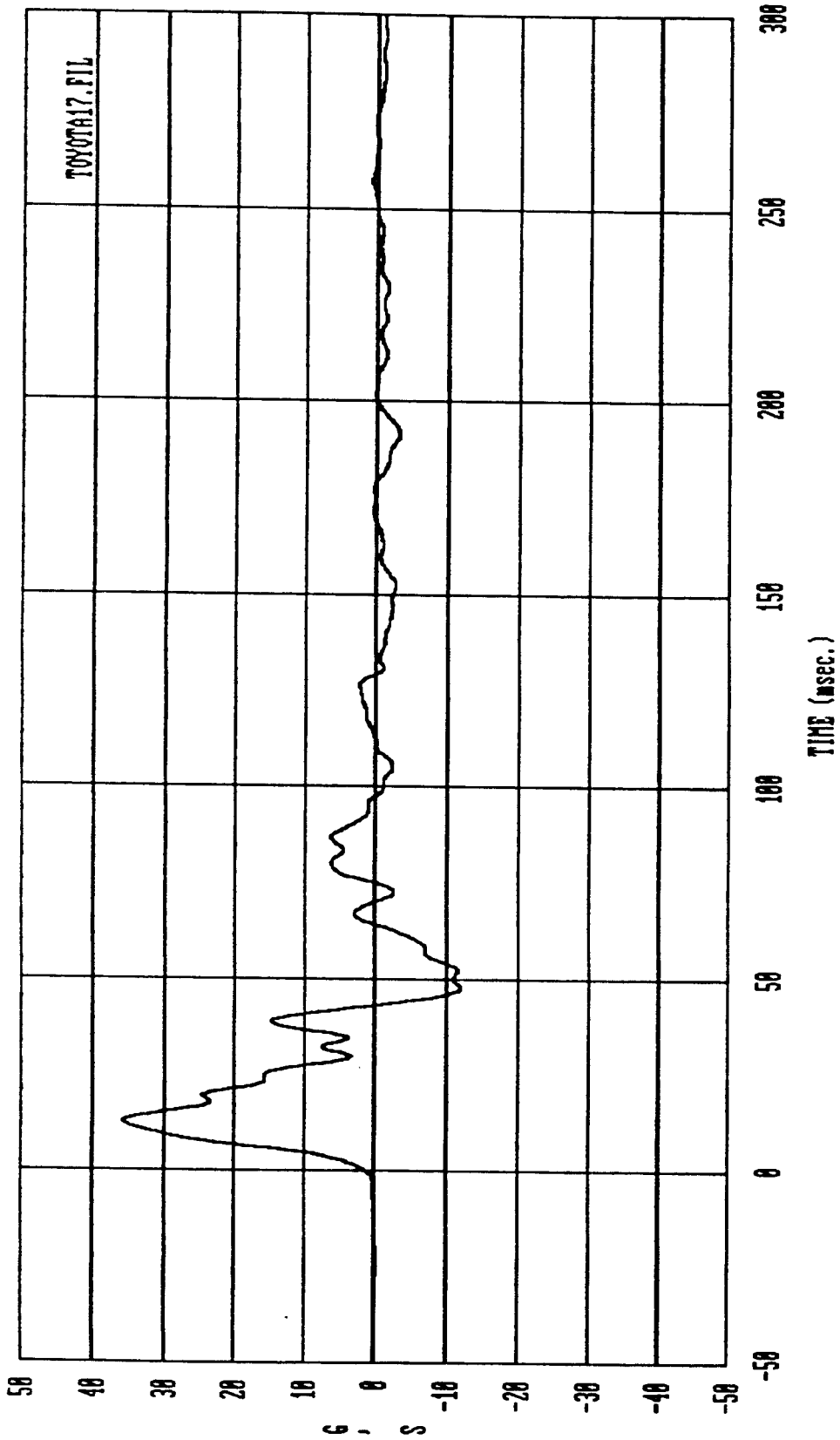
Curve: Front Seat Right sill acceleration — X axis Filter: SAE CLASS 60 Max = 9.2619 Min = -15.323

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



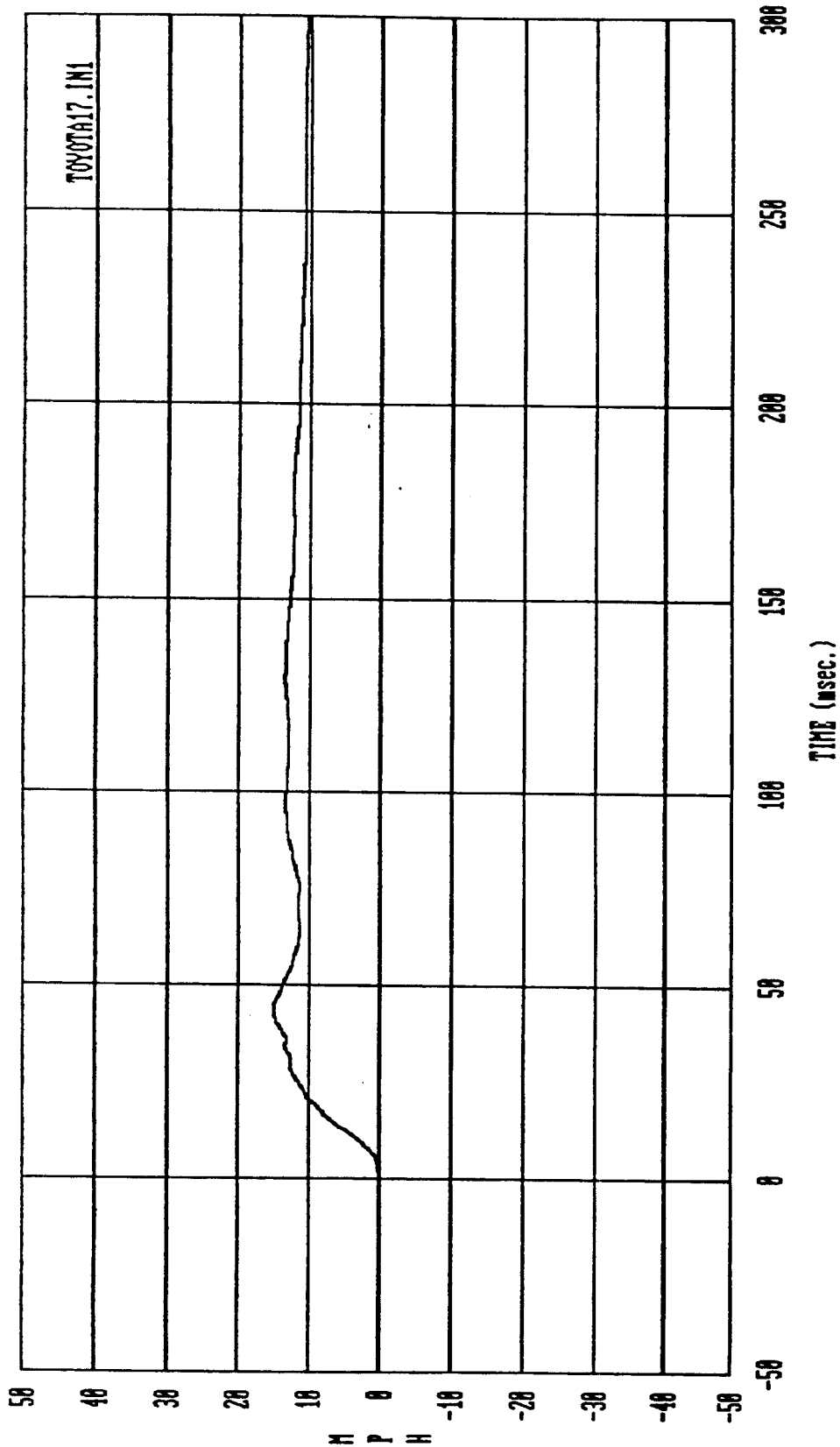
Curve: Front Seat Right sill delta V — X axis Filter: SAE CLASS 180 Max = .83576 Min = -2.4601

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



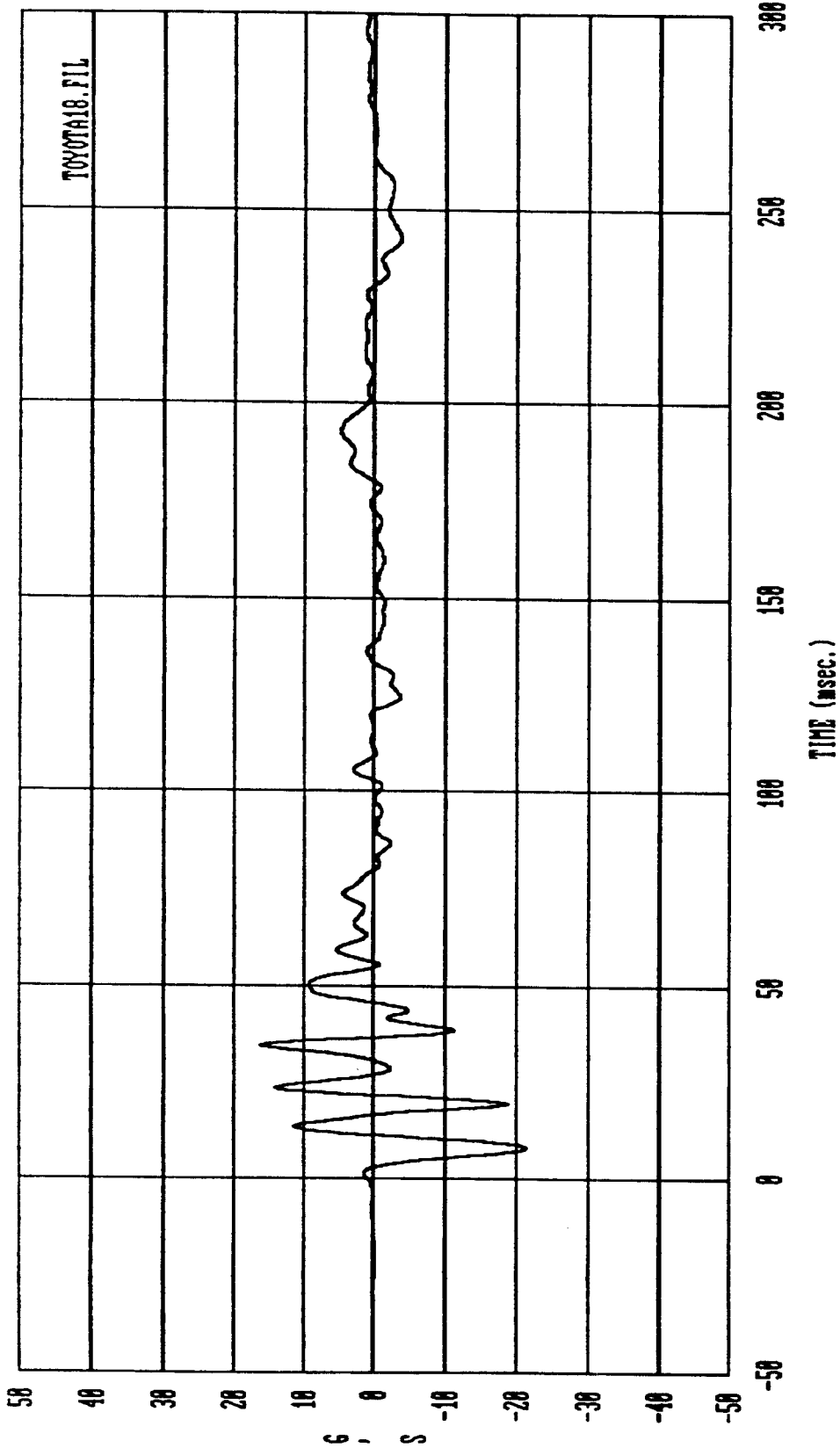
Curve: Front Seat Right sill acceleration -- Y axis Filter: SAE CLASS 60 Max = 35.936 Min = -11.901

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



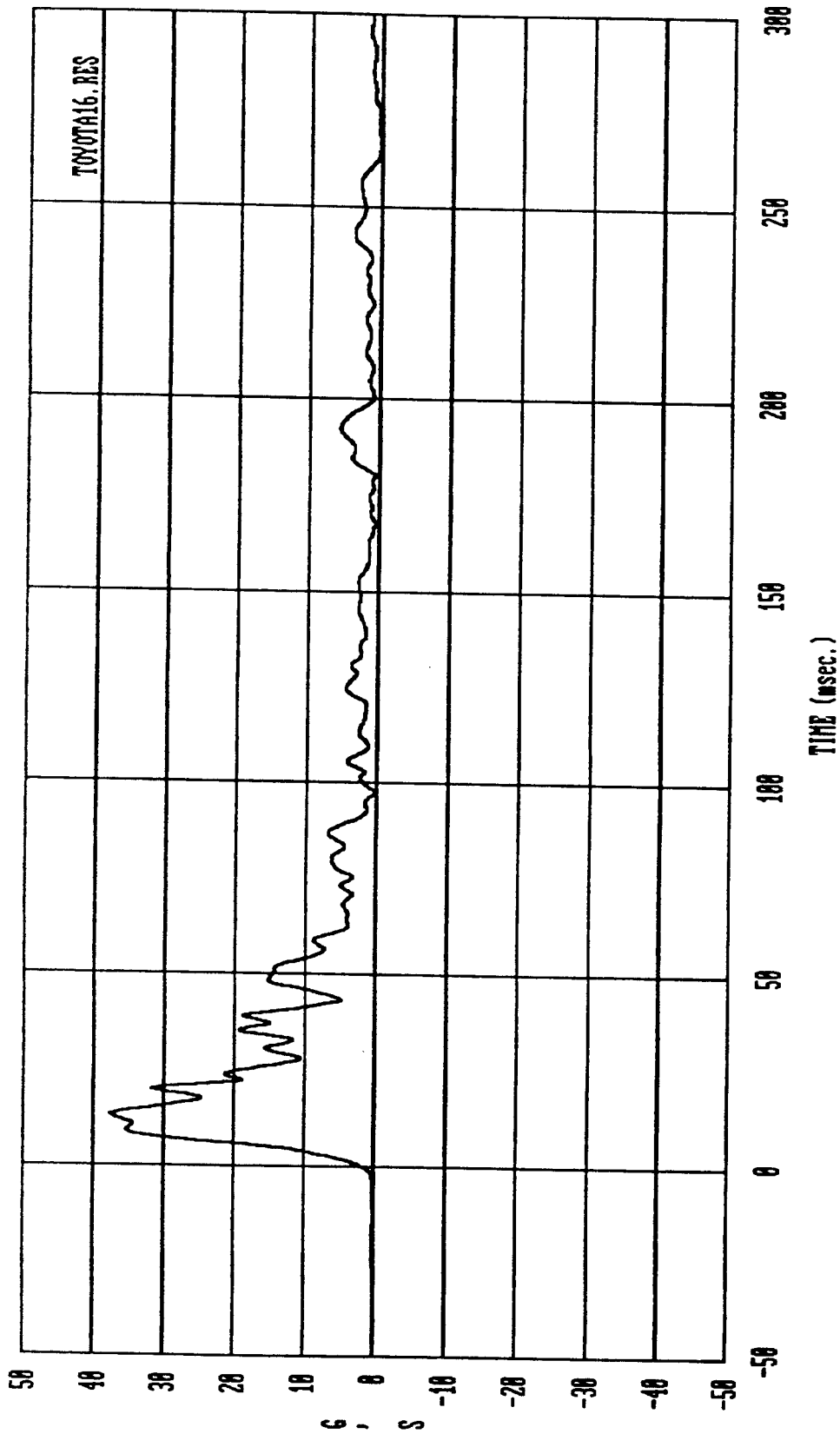
Curve: Front Seat Right sill delta V — Y axis Filter: SAE CLASS 100 Max = 15.003 Min = 10.443

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



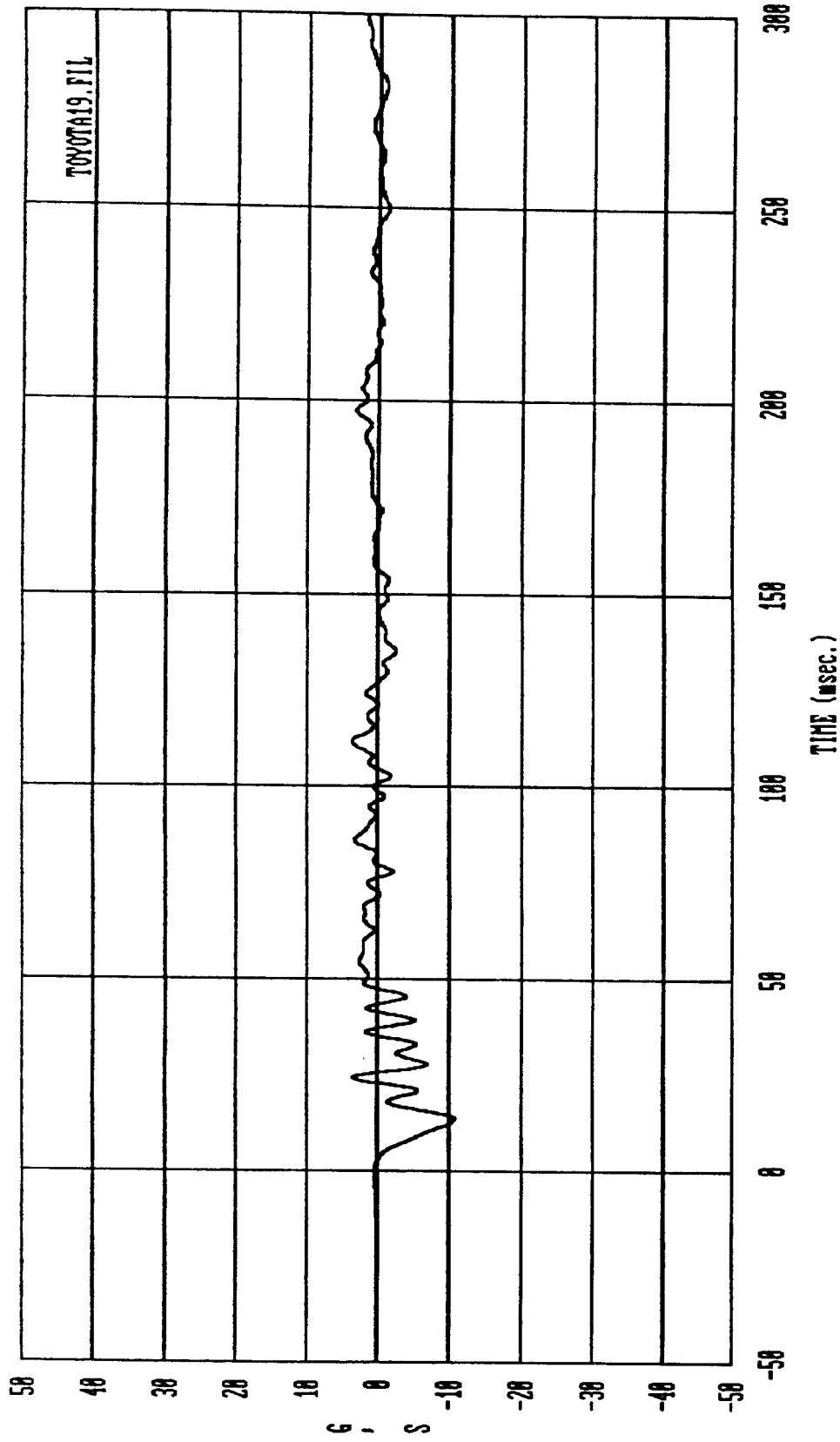
Curve: Front Seat Right sill acceleration — Z axis Filter: SAE CLASS 60 Max = 16.299 Min = -21.478

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



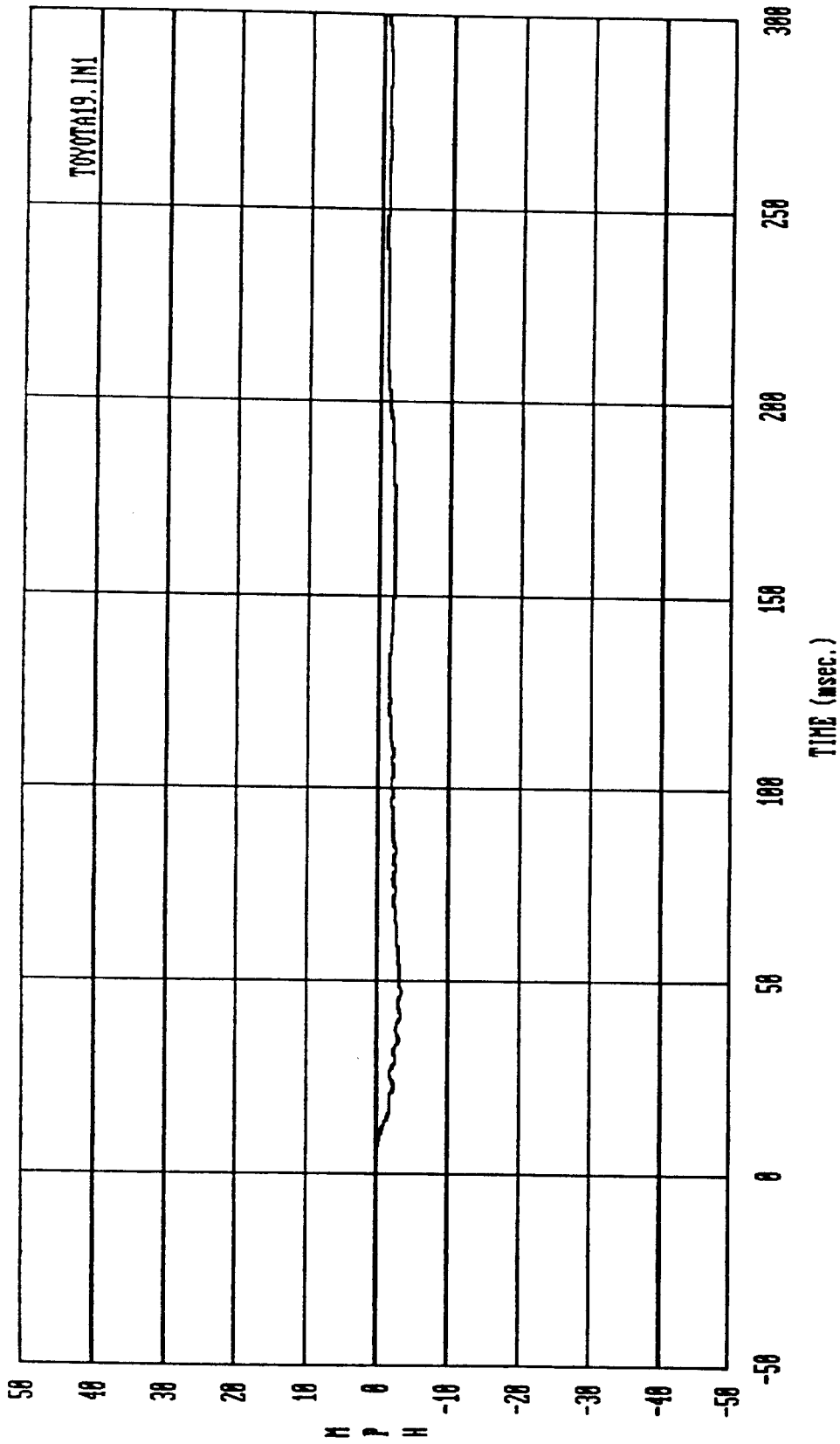
Curve: Front Seat Right sill resultant acceleration Filter: SAE CLASS 60 Max = 37.685 Min = .17724

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



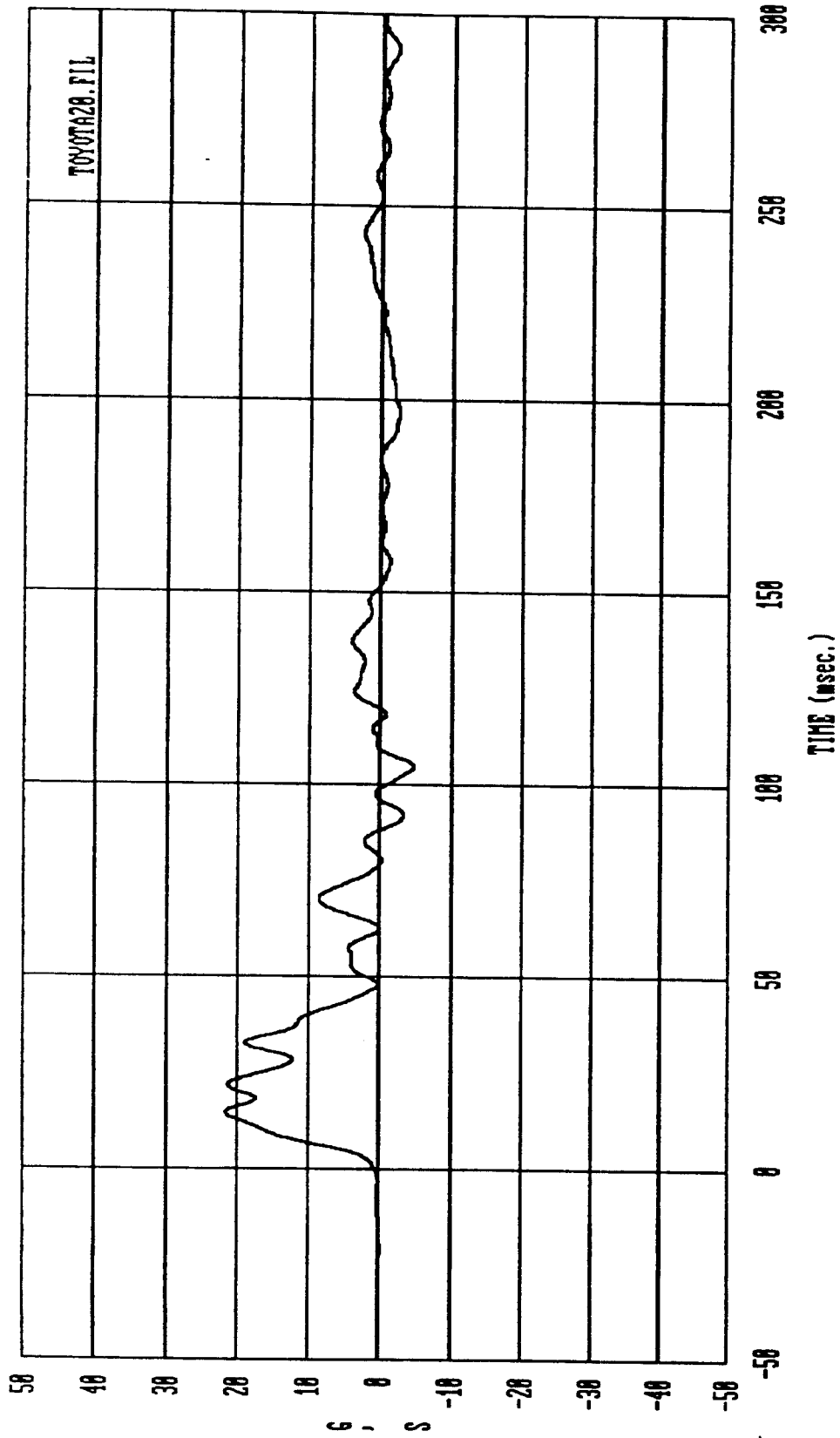
Curve: Rear Floor above axle acceleration -- X axis Filter: SAE CLASS 60 Max = 3.6232 Min = -10.887

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



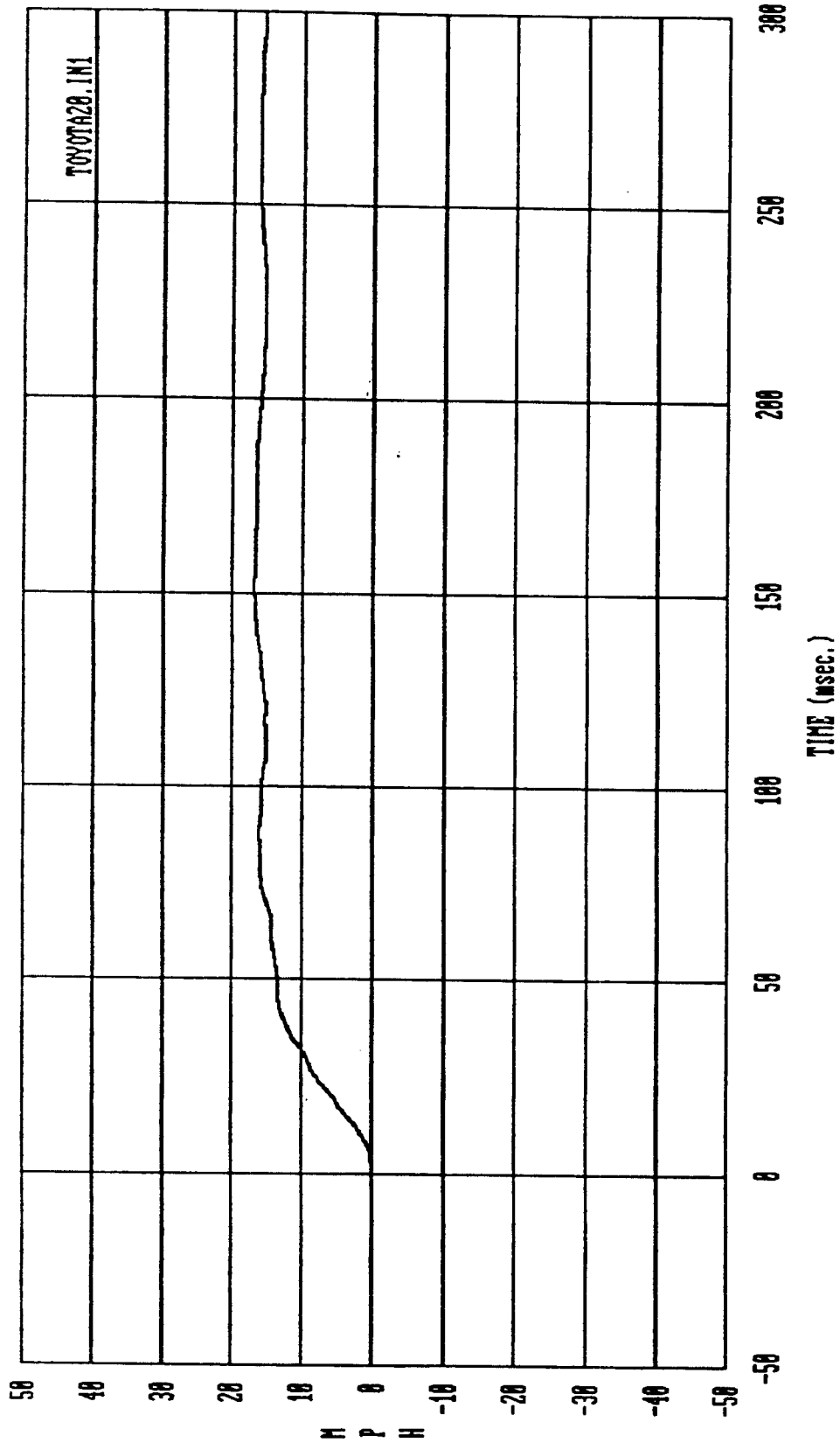
Curve: Rear Floor above axle delta V -- X axis Filter: SAE CLASS 180 Max = .26528E-01 Min = -3.4389

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



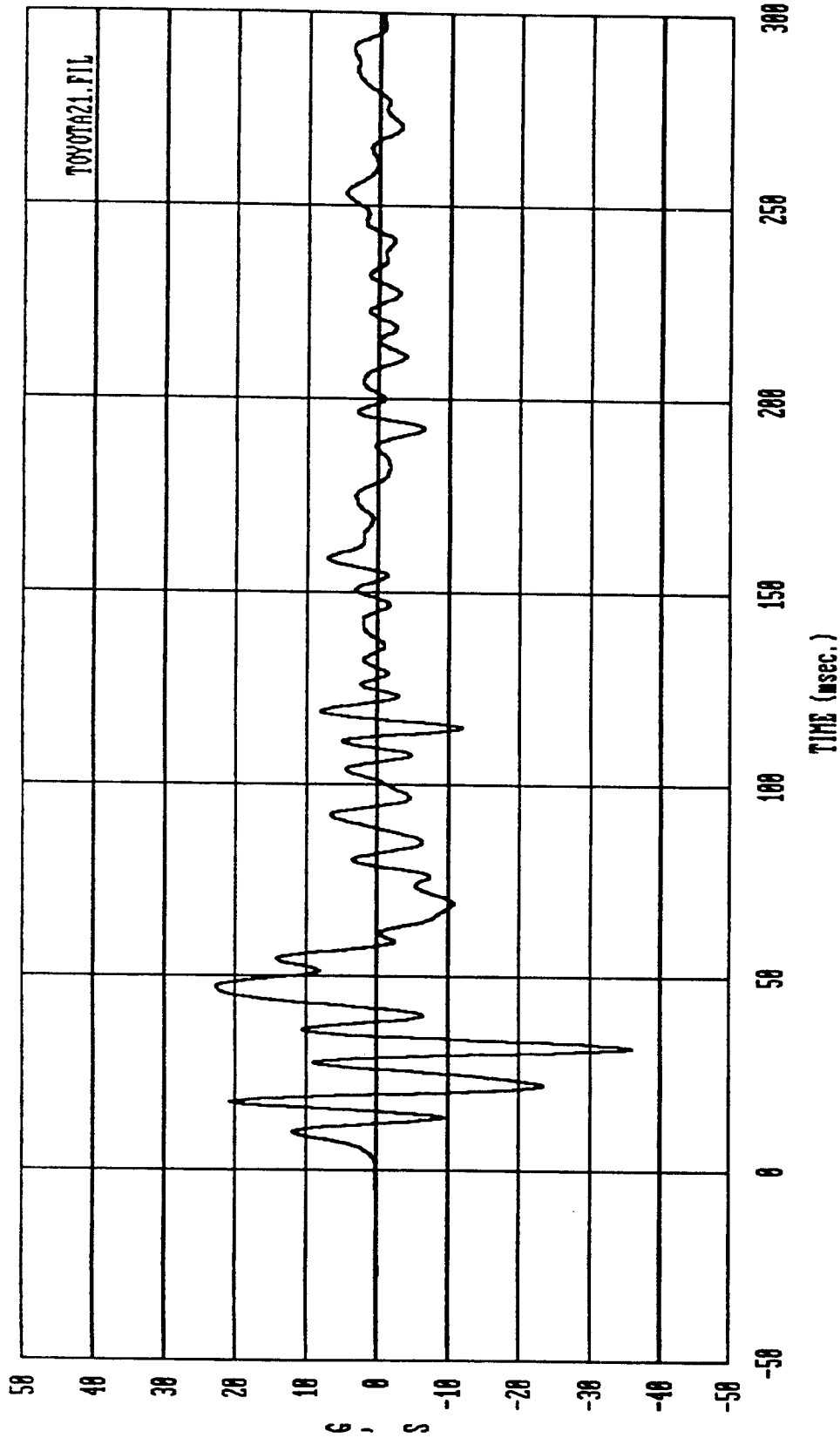
Curve: Rear Floor above axle acceleration -- Y axis Filter: SAE CLASS 60 Max = 21.767 Min = -4.7785

MSB Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



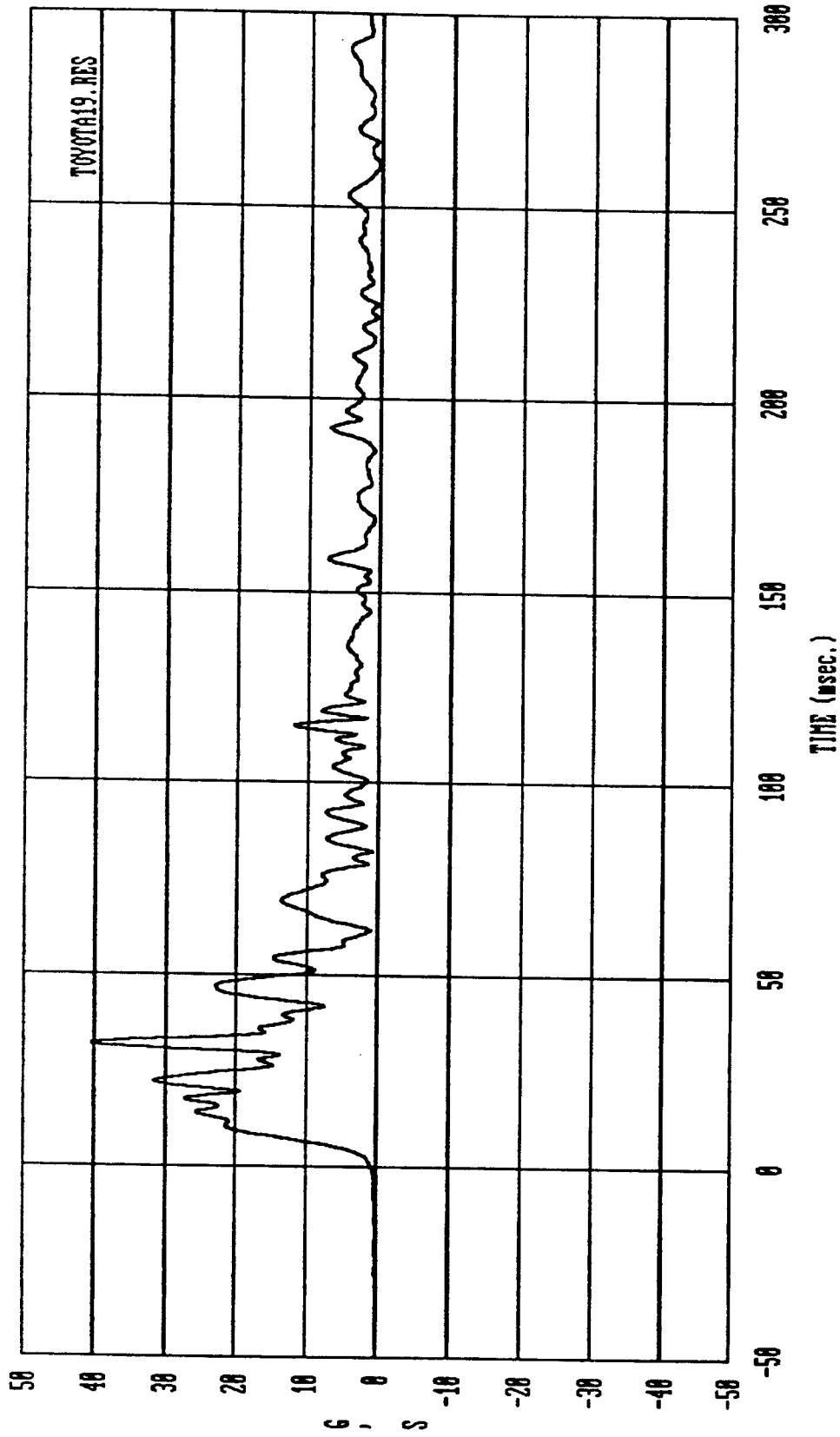
Curve: Near Floor above axle delta V -- Y axis Filter: SAE CLASS 180 Max = 16.838 Min = 13.373

MSR Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



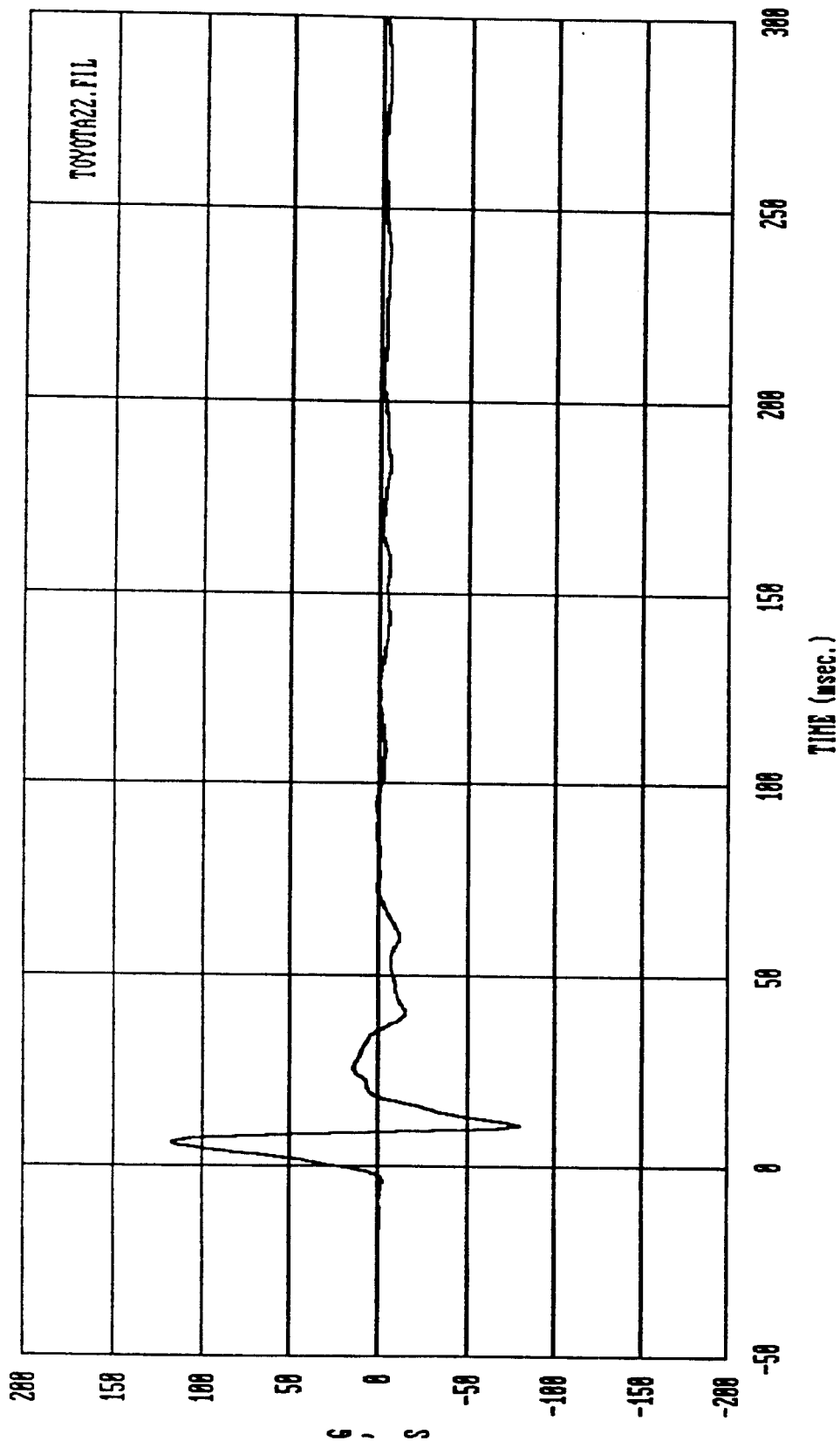
Curve: Rear Floor above axle acceleration — Z axis Filter: SAE CLASS 60 Max = 22.826 Min = -36.050

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



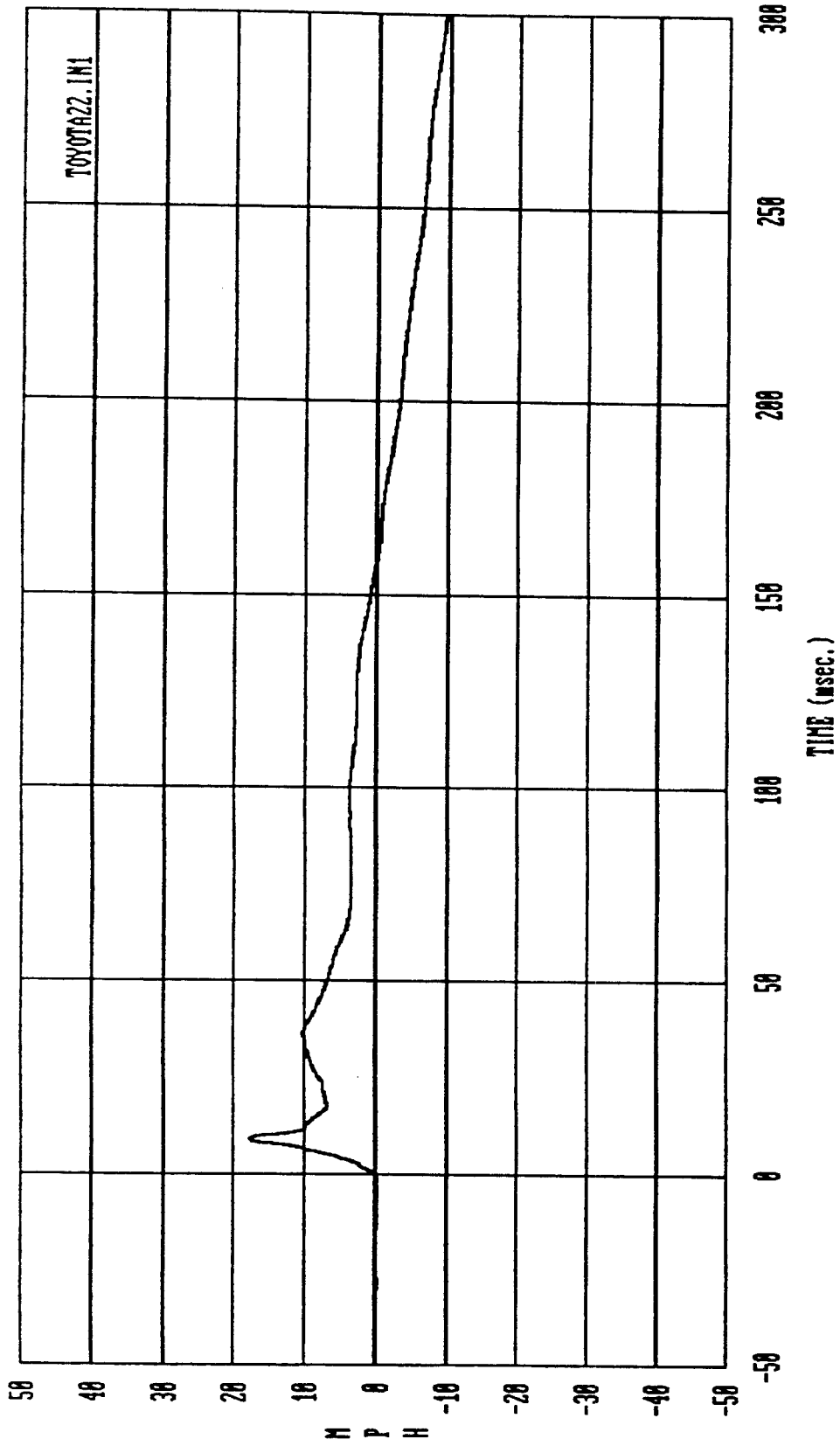
Curve: Near Floor above axle resultant acceleration Filter: SAE CLASS 60 Max = 40.691 Min = .41878

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



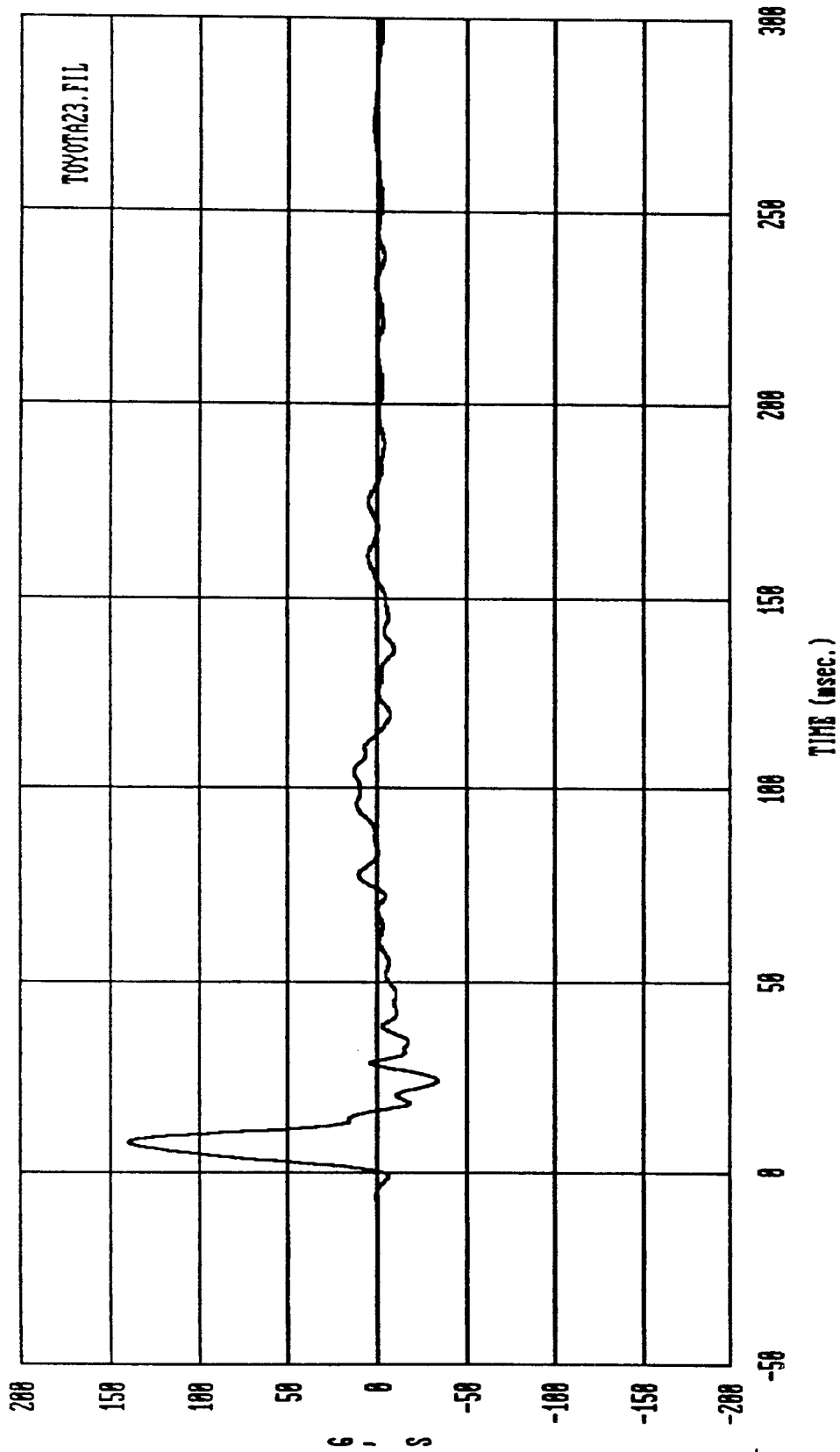
Curve: Front Seat Left Sill acceleration -- Y axis Filter: SH8 CLASS 60 Max = 117.24 Min = -88.24

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



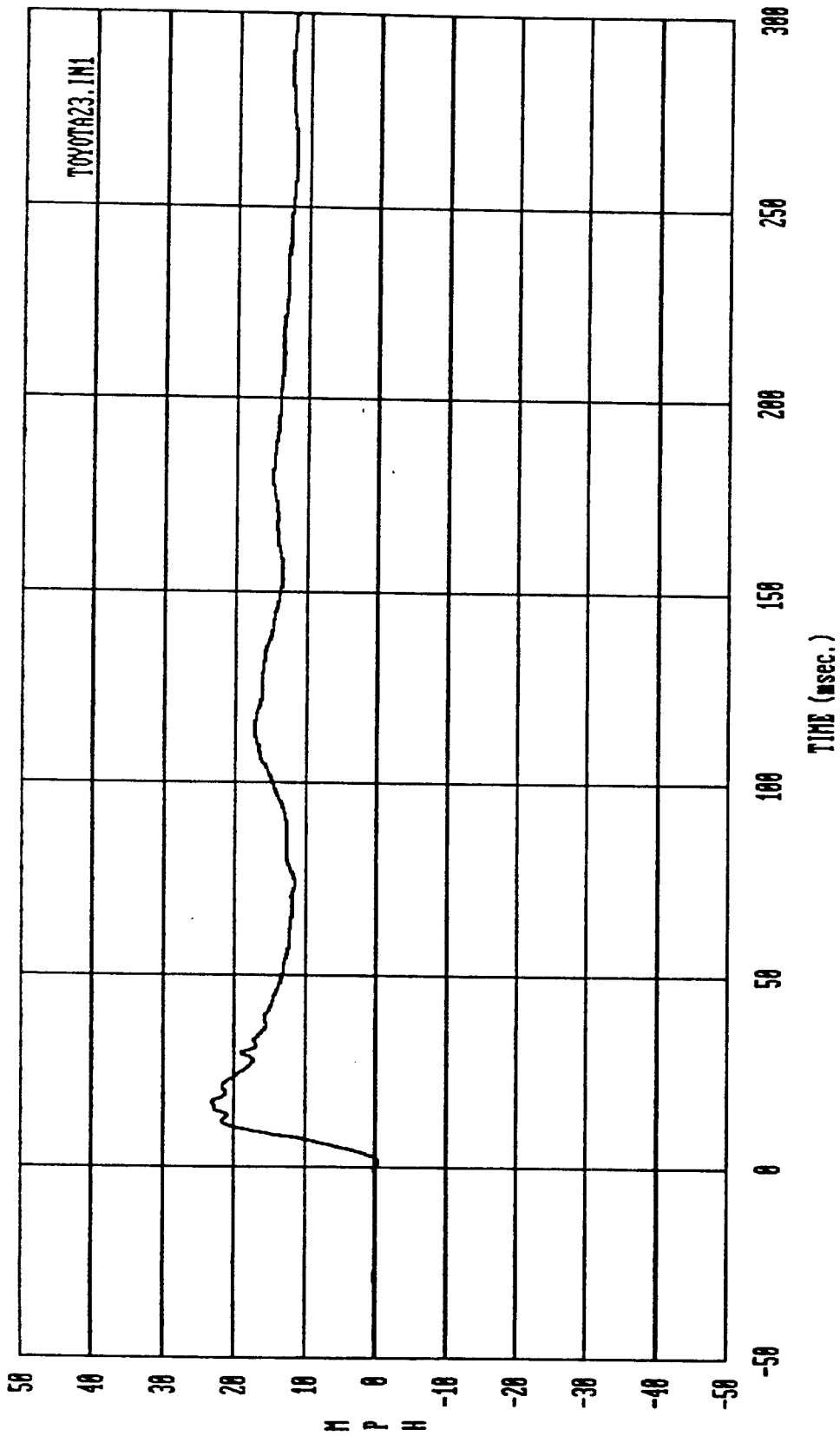
Curve: Front Seat Left Sill delta V — Y axis Filter: SAE CLASS 180 Max = 17.984 Min = -9.3777

MSE Date: 84/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



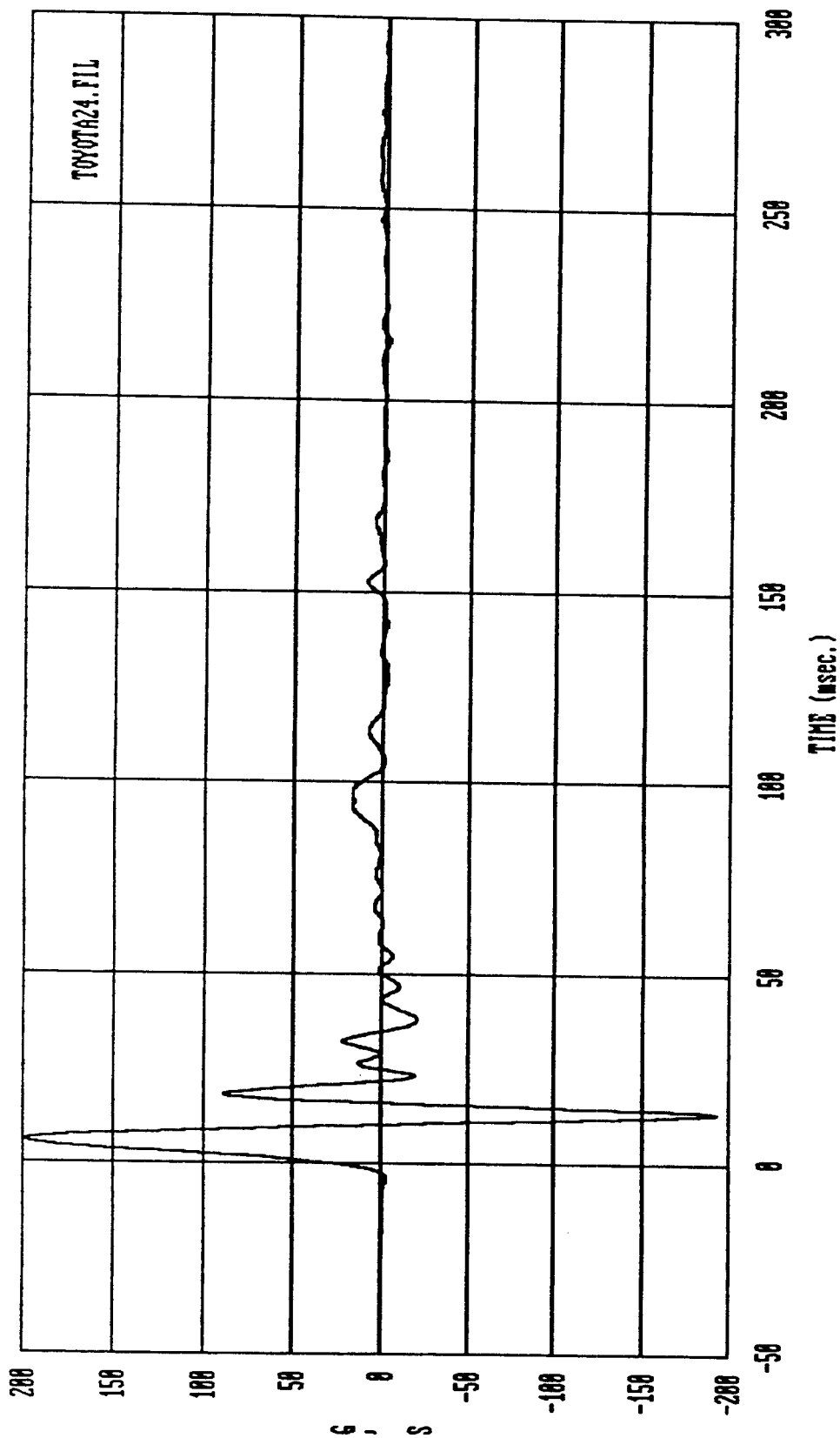
Curve: Left Front Door at centerline -- Y axis Filter: SAE CLASS 60 Max = 140.91 Min = -33.908

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



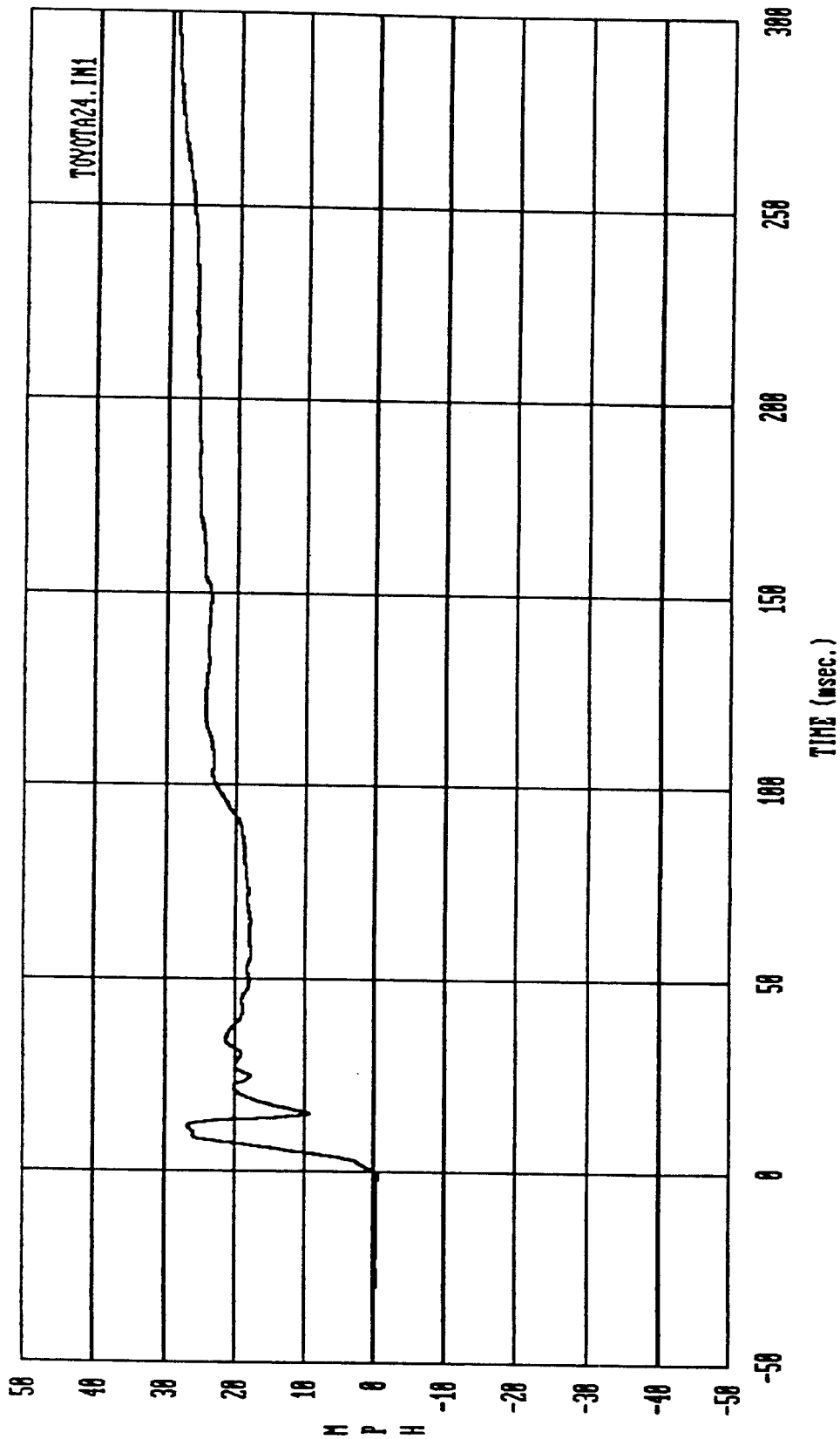
Curve: Left Front Door at centerline delta V Filter: SAE CLASS 180 Max = 23.280 Min = -.45419

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



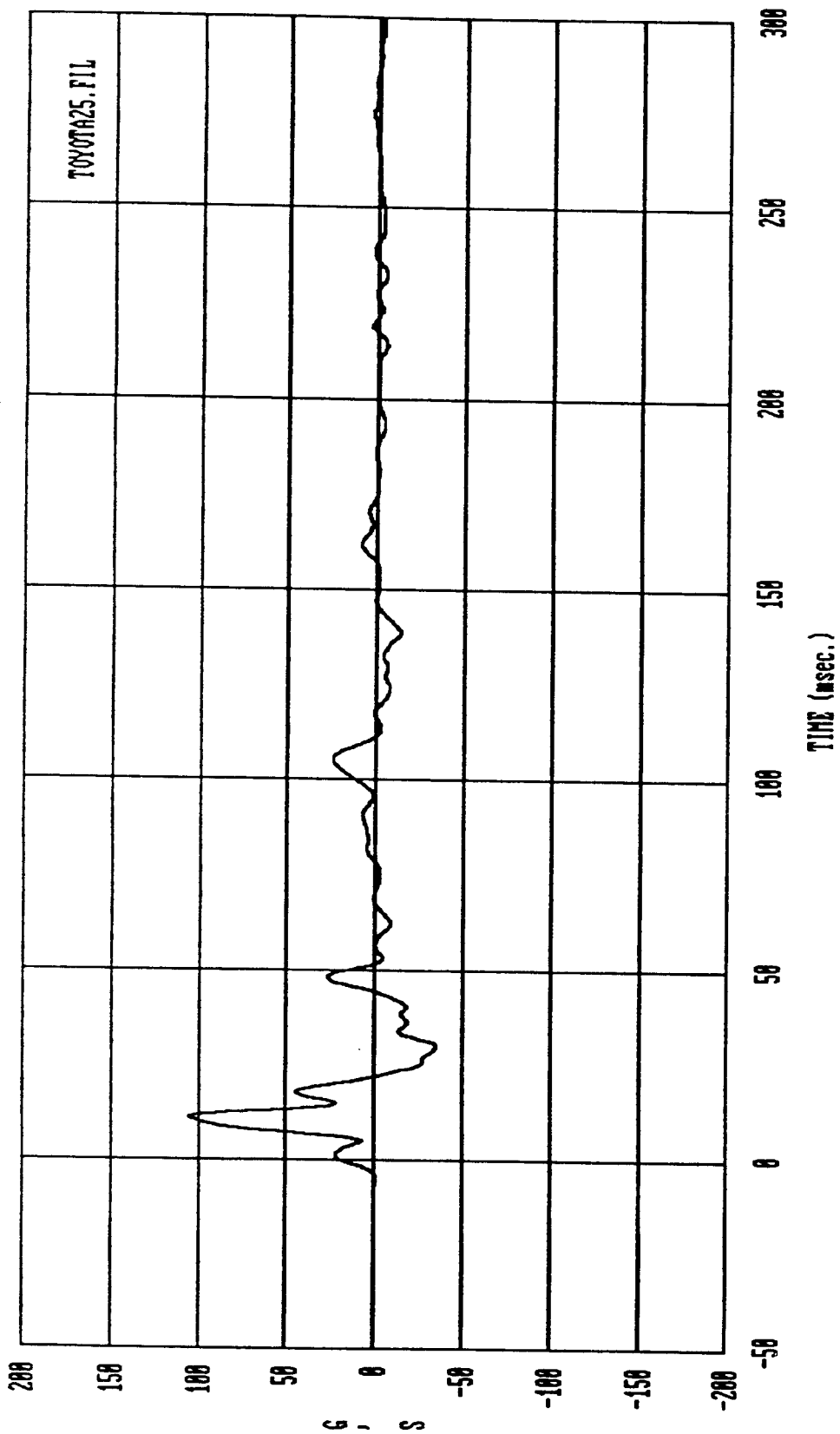
Curve: Left Front Door at mid-rear — Y axis Filter: SAE CLASS 60 Max = 198.64 Min = -192.89

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



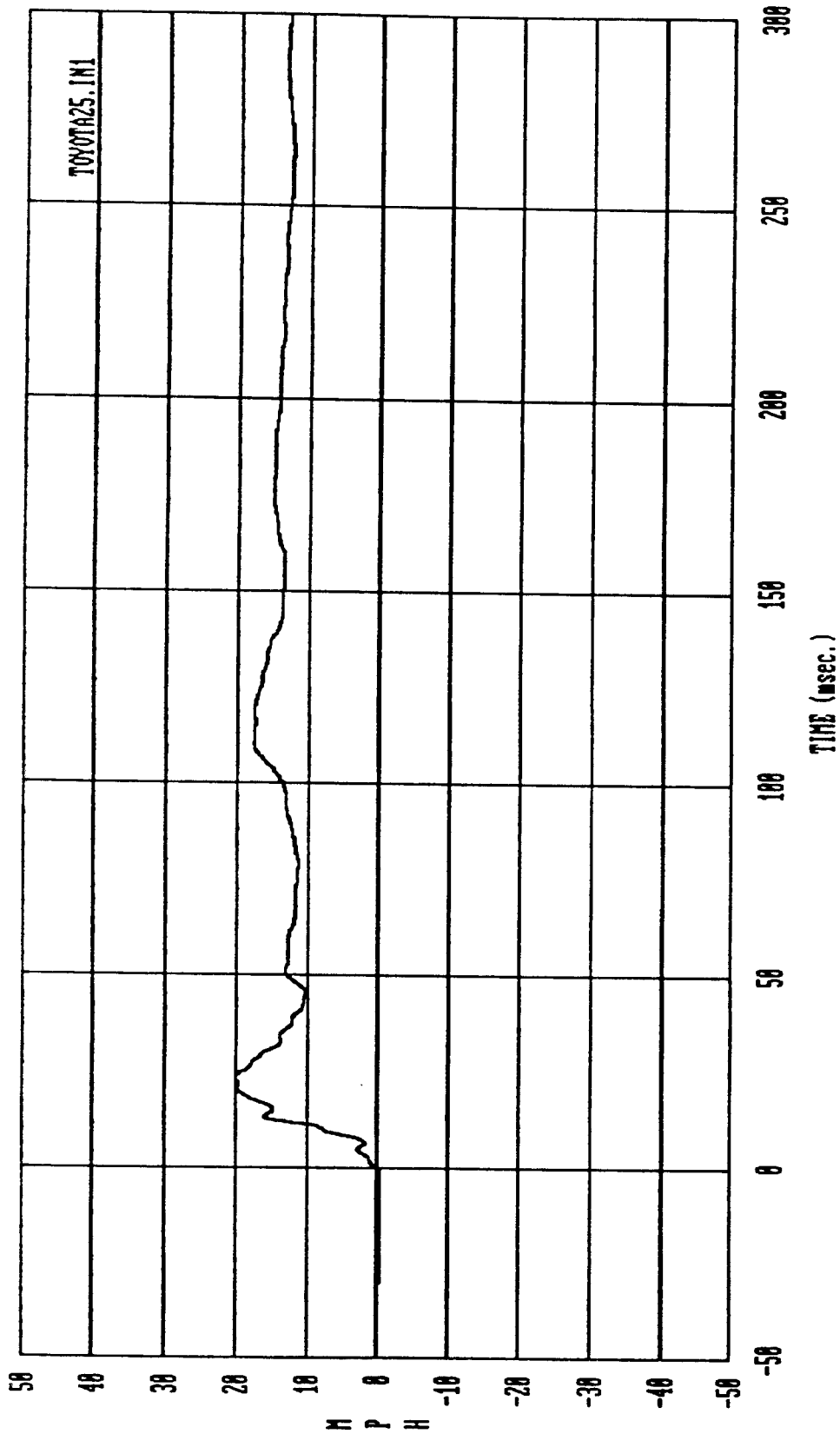
Curve: Left Front Door at mid-rear delta V Filter: SAE CLASS 180 Max = 29.837 Min = 9.3858

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



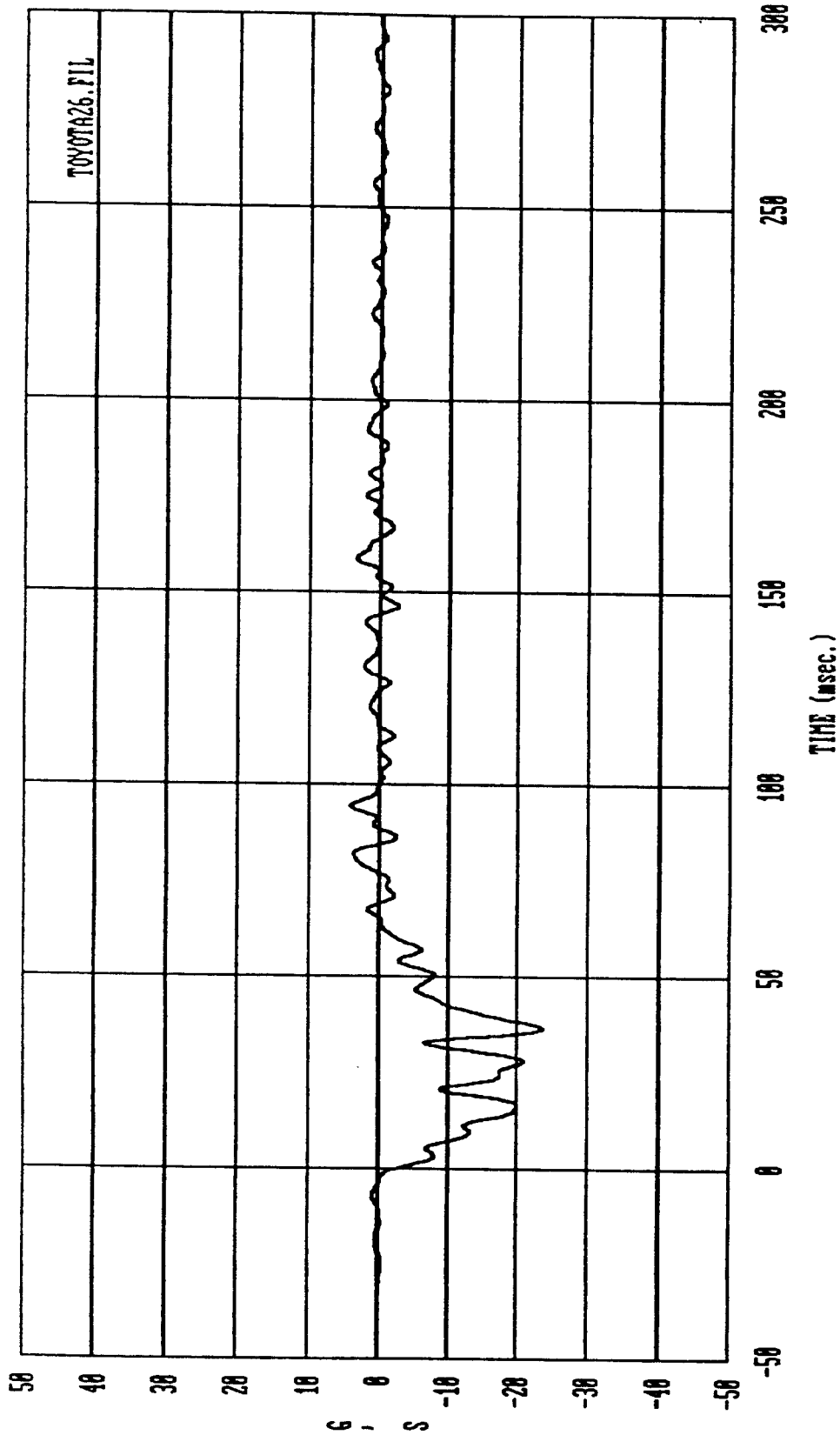
Curve: Left Front Door at upper centerline -- Y axis Filter: SAE CLASS 60 Max = 106.04 Min = -35.136

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



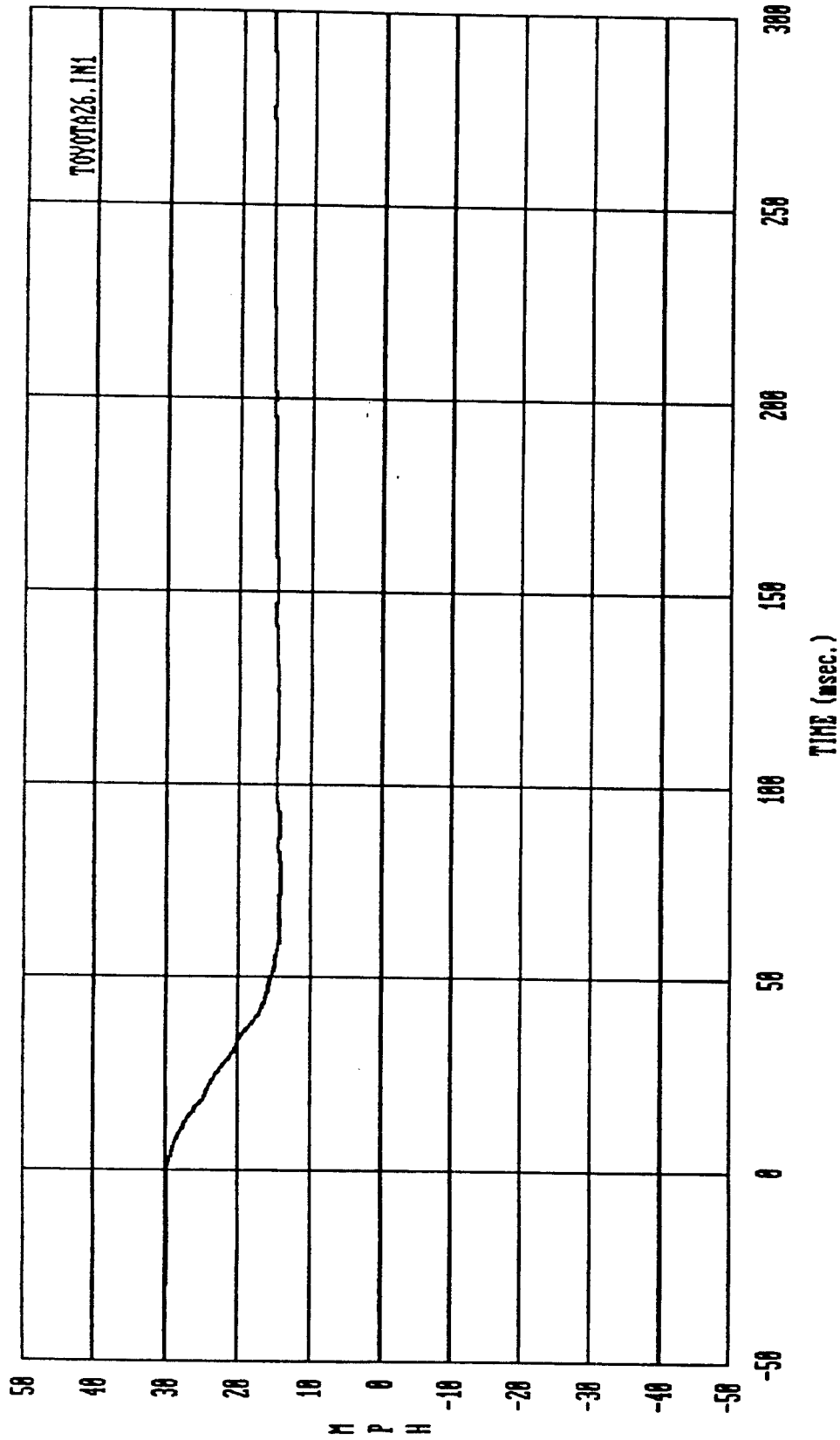
Curve: Left Front Door at upper centerline delta V Filter: SAE CLASS 180 Max = 20.885 Min = 1.7699

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



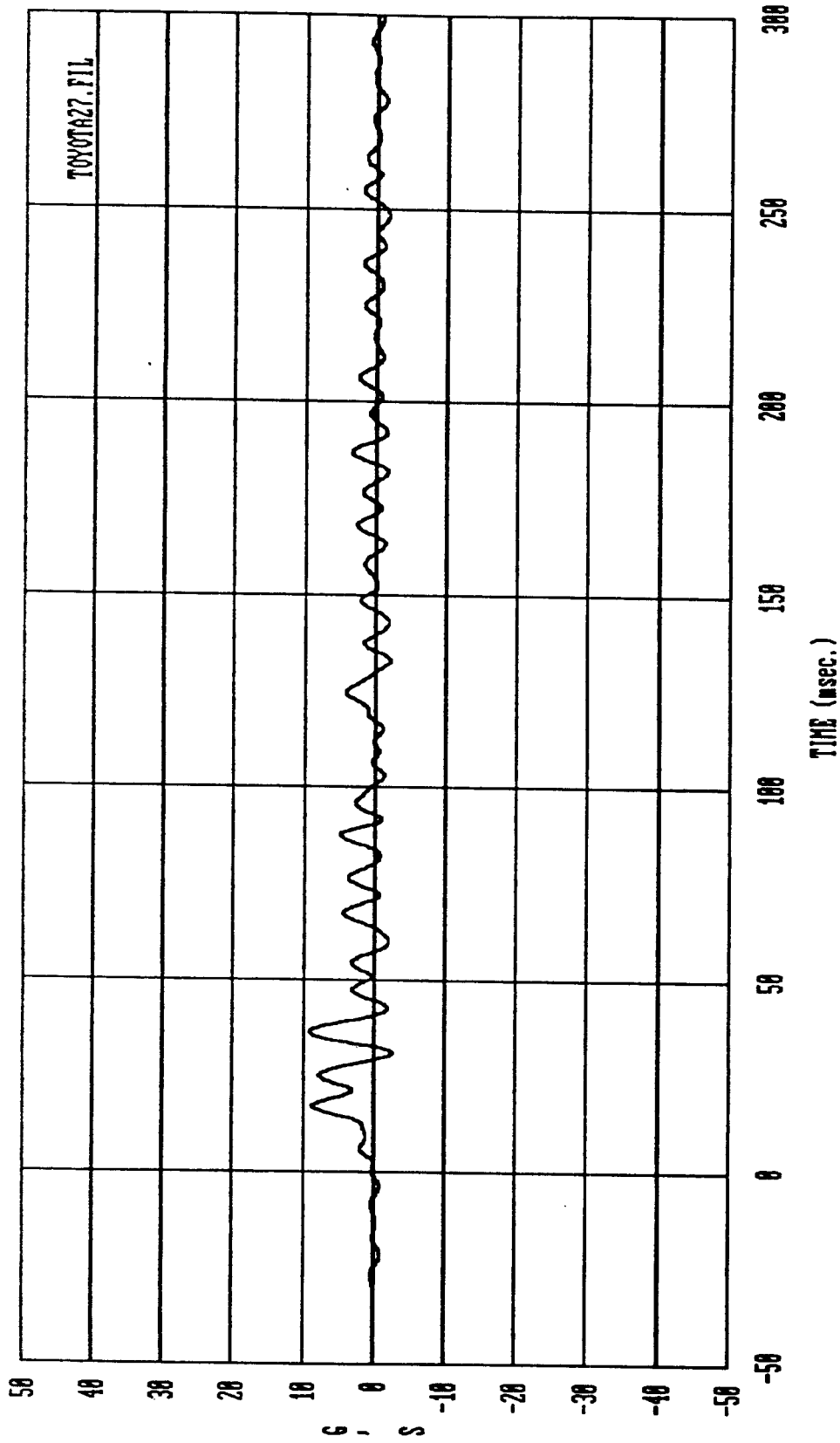
Curve: Movable Deformable Barrier C/G accel. — X axis Filter: SAE CLASS 60 Max = 4.8480 Min = -23.980

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



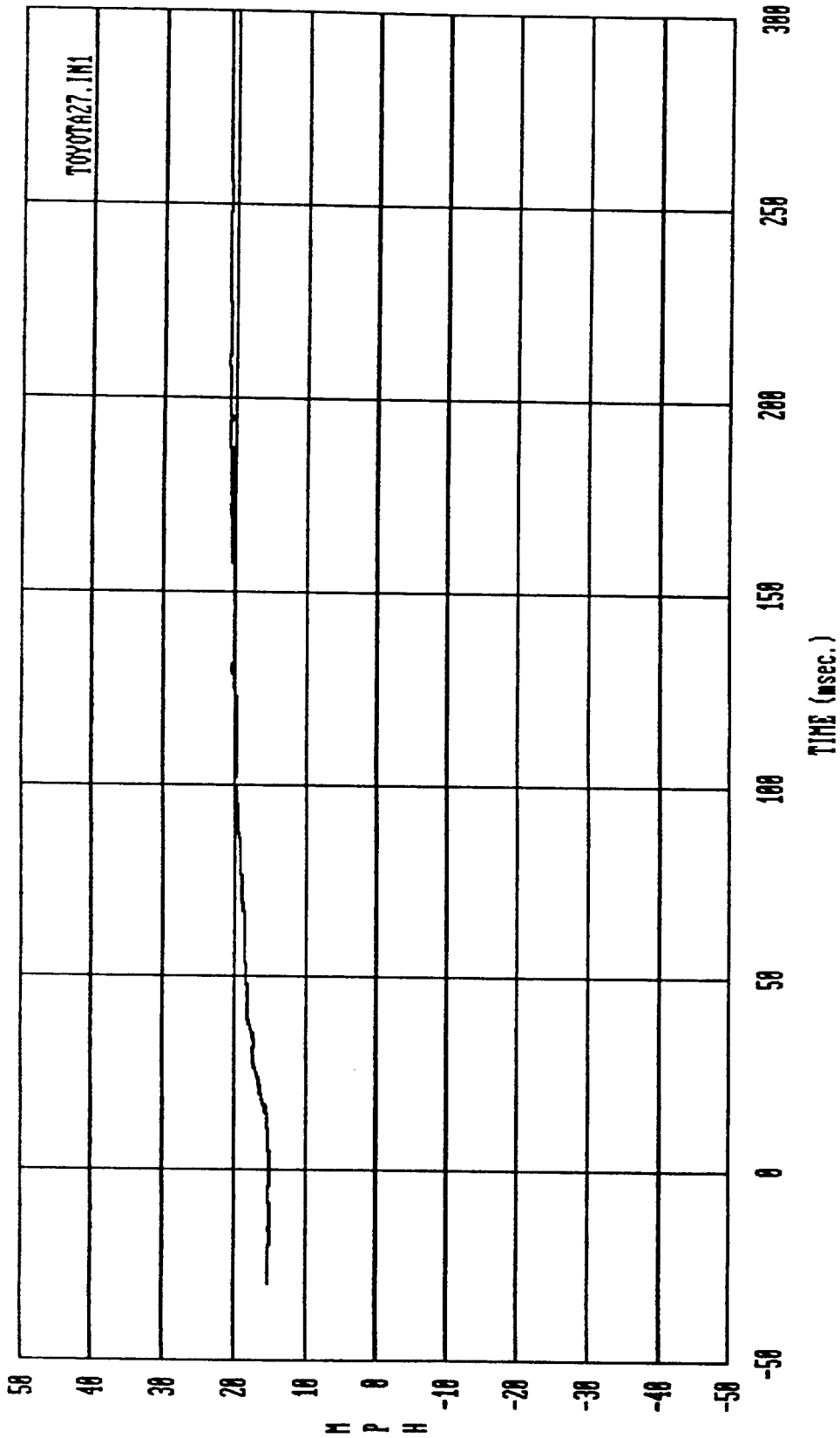
Curve: Movable Deformable Barrier C/G delta V - X axis Filter: SAE CLASS 100 Max = 29.834 Min = 14.116

MSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



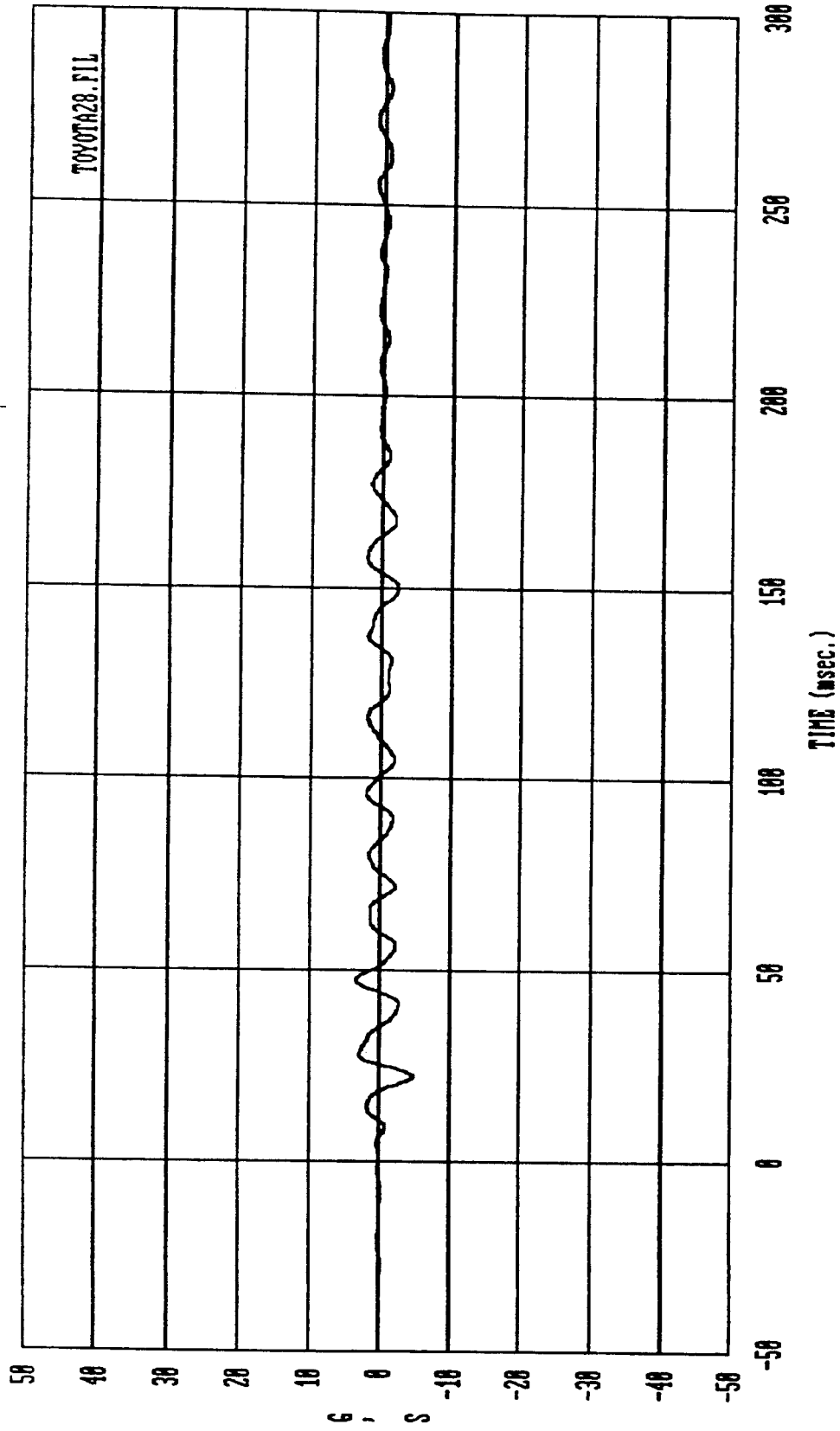
Curve: Movable Deformable Barrier C/G accel. — Y axis Filter: SAE CLASS 60 Max = 9.2791 Min = -2.6582

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



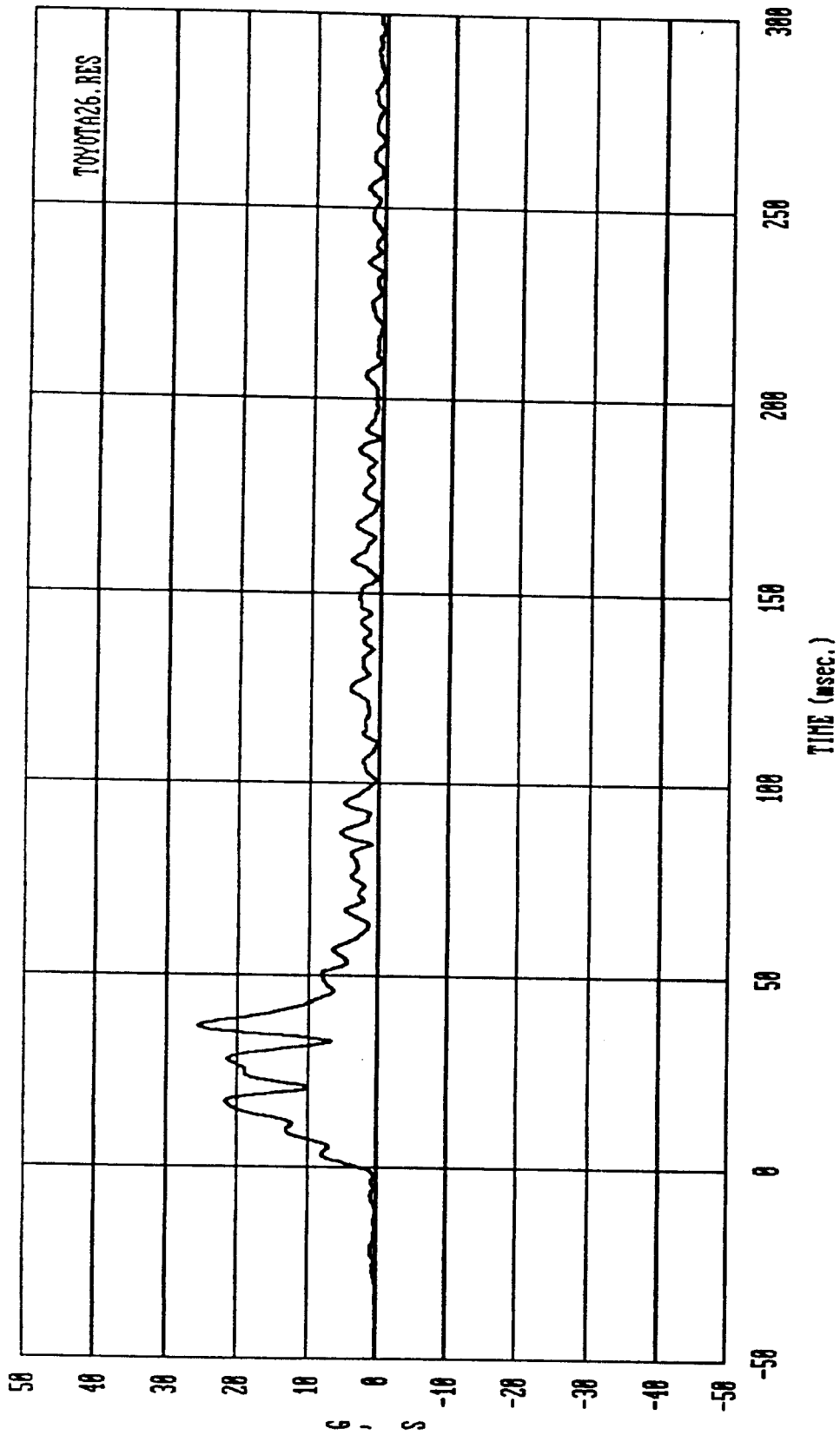
Curve: Movable Deformable Barrier C/G delta V - Y axis Filter: SAE CLASS 180 Max = 21.089 Min = 15.286

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



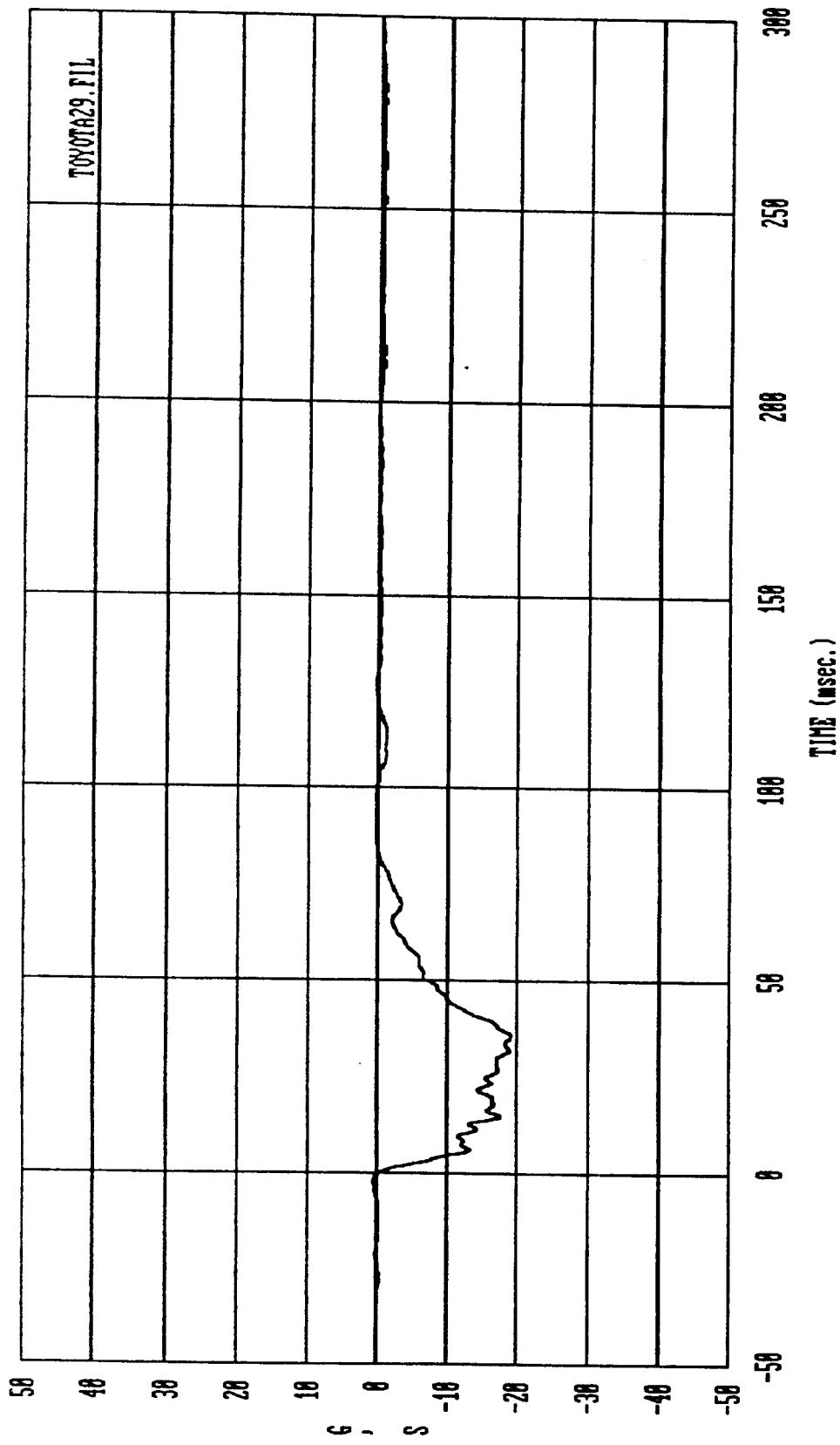
Curve: Movable Deformable Barrier C/G accel. - Z axis Filter: SAE CLASS 60 Max = 3.4098 Min = -4.6922

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



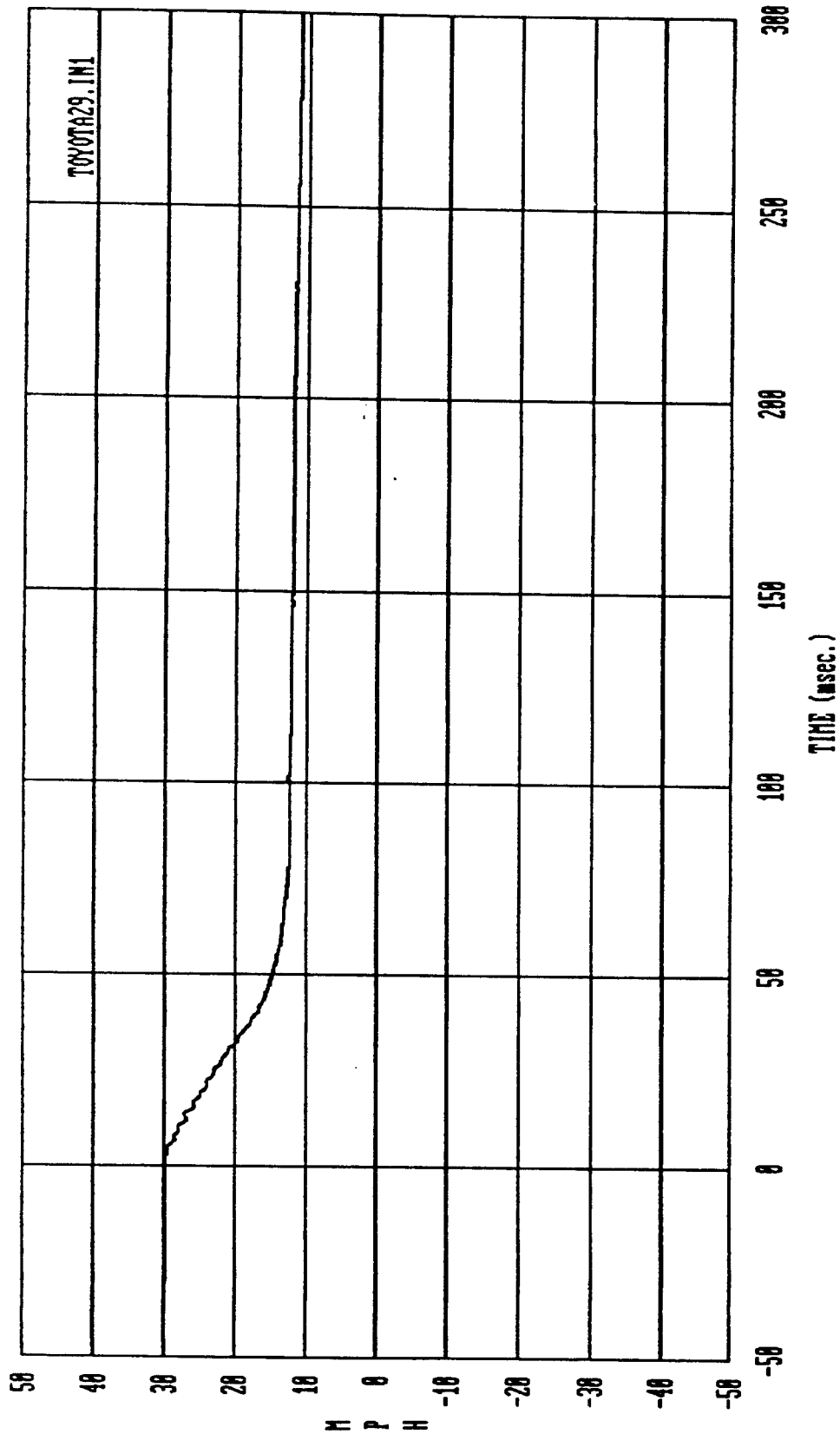
Curve: Movable Deformable Barrier C/G resultant accel. Filter: SAE CLASS 60 Max = 25.732 Min = .12577

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



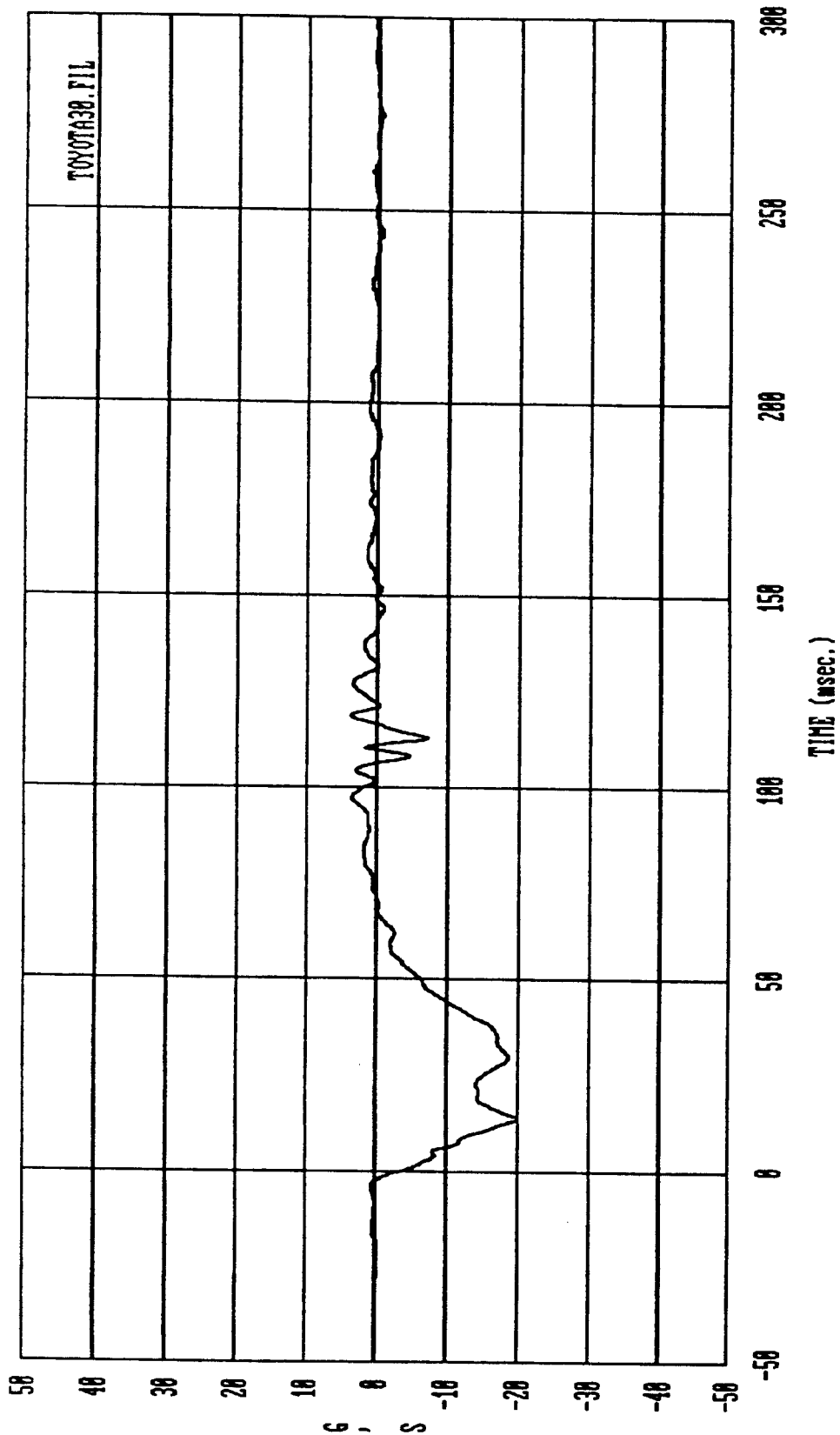
Curve: Movable Deformable Barrier Front frame - X axis Filter: SAE CLASS 60 Max = .23218 Min = -19.168

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



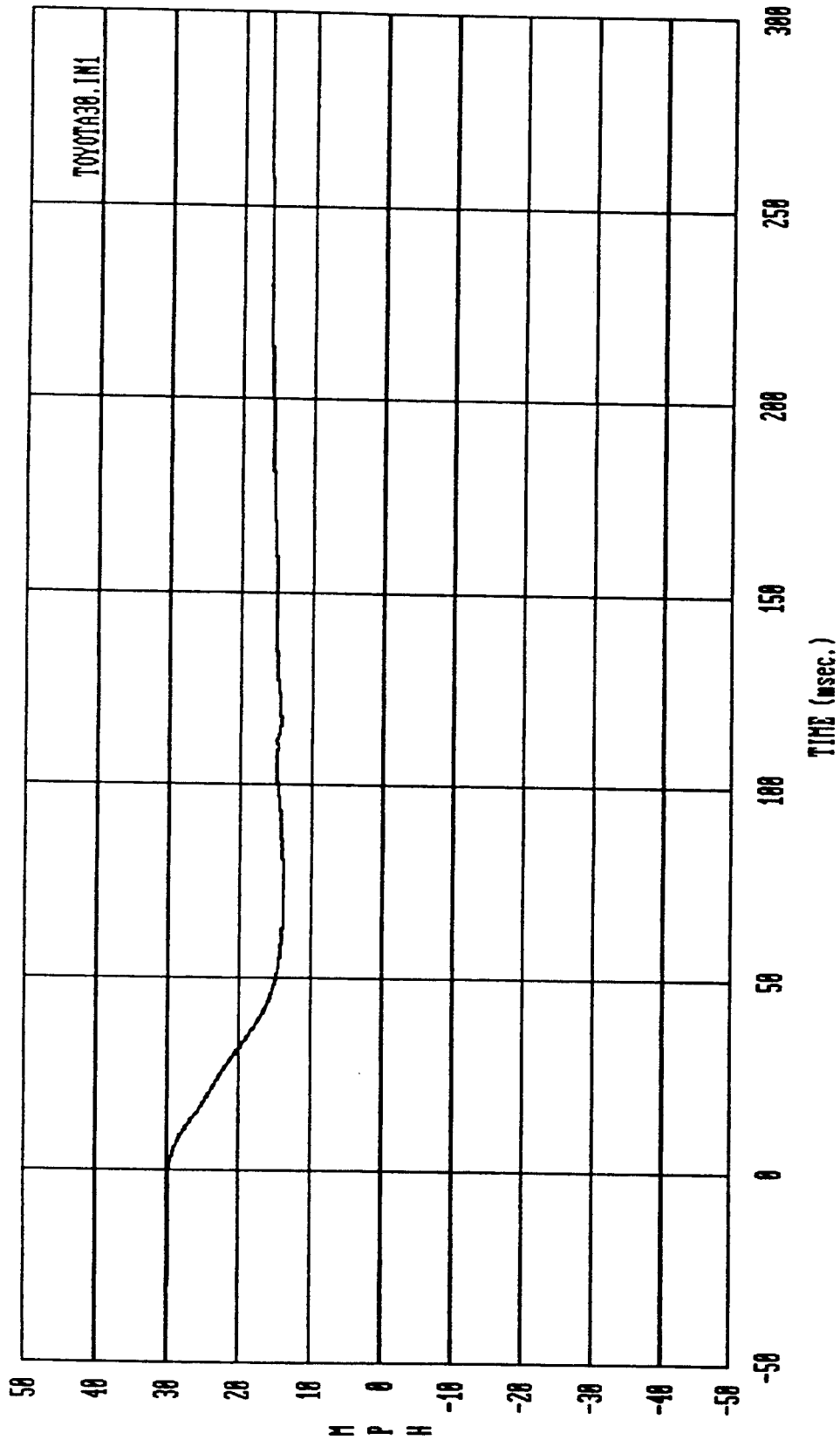
Curve: Movable Deformable Barrier Front frame delta V Filter: SAE CLASS 100 Max = 29.910 Min = 11.192

HSE Date: 84/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



Curve: Movable Deformable Barrier Rear frame -- X axis Filter: SAE CLASS 60 Max = 3.7888 Min = -20.000

HSE Date: 04/05/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup



Curve: Movable Deformable Barrier Rear frame delta V Filter: SAE CLASS 180 Max = 29.832 Min = 13.985

HSE Date: 04/85/91 Program: 1991 Side Impact Vehicle: 1991 Toyota pickup

APPENDIX C
SID CERTIFICATION DATA

SID IMPACT CALIBRATION SUMMARY SHEET

S.I.D. I.D. NO. : 137

LABORATORY TECHNICIAN: APURVA MAPARA

Sheet No. 1 of 3

	Pretest Calibration	Posttest Calibration
Date of SID Calibration - - - - -	03/22/91	
Calibration Sequential Number for Dummy		
Temperature in Lab. (Spec. = 66° to 78° F) - - - -	70°	N/A
Relative Humidity in Lab. (Spec. = 10 to 70%)	25 %	

TEST PARAMETER	SPECIFICATION		
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1. NECK BENDING TEST:			
a. Pendulum Speed - - -	21.5 to 25.5 fps		
b. Pendulum Avg. Decel (over t3 - t2) - - - -	20 to 24G		
c. Peak Resultant Head Acceleration- - - -	26G maximum		
d. Pendulum Decel. (t2-t1)	3 ms	N/A	N/A
e. Pendulum Decel. (t2-t2)	25 to 30 ms		
f. Pendulum Decel. (t2-t3)	10 ms		
g. Pendulum Direction Reversal Time - - - -	123 ms		
h. Max. Head Rotation- -	63 to 73'		
i. Chordal Displacement: Head Rotation Angle -			
0'	Time	-2 to 2 ms	
	Displ.	.5 to .5 in	
30'	Time	25.6 to 34.4 ms	
	Displ.	2.1 to 3.1 in.	N/A
	Time	40.3 to 51.7 ms	
	Displ.	4.3 to 5.3 in	N/A
60'	Time	53.2 to 66.8 ms	
Maximum (')	Displ.	5.0 to 6.0	

2. NECK BENDING TEST continued:			
i. Chordal Displacement: Head Rotation angle-			
0'	Time	67.0 to 83.0 ms	
	Displ.	4.3 to 5.3 in.	
30'	Time	85.4 to 104.6 ms	
	Displ.	2.1 to 3.1 in.	N/A
	Time	101.0 to 123.0 ms	
60'	Displ.	-.5 to 0.5 in.	N/A

SID IMPACT CALIBRATION SUMMARY SHEET (Continued)

S.I.D. I.D. NO. : 137

LABORATORY TECHNICIAN: APURVA MAPARA

Sheet No. 2 of 3

TEST	PARAMETER	SPECIFICATION	Pretest Calibration	Posttest Calibration
3. ABSOMINAL COMPRESSION TEST (Preload = 10 pounds)				
a.	Force @ .5" - - - -	23 - 36 lbs.	N/A	N/A
b.	Force @ .75"- - - -	36 - 50 lbs.		
c.	Force @ 1.0"- - - - -	50 - 63 lbs		
d.	Force @ 1.3"- - - - -	73 - 88 lbs.		
4. LUMBAR FLEXION TEST:				
a.	Force @ 20' - - - -	22 to 34 lbs	N/A	N/A
b.	Force @ 30' - - - -	34 to 46 lbs		
c.	Force @ 40' - - - - -	46 to 58 lbs		
d.	Return Angle - - - -	12 maximum		
5. THORAX IMPACT TEST:				
a.	Upper Rib accel.- - -	Primary	43.39	N/A
		37 - 46g's Sec	-	
b.	Lower Rib accel.- - -	Primary	40.71	
		37 - 46g's Sec	-	
c.	Lower Spine accel - -	Primary	21.89	
		15 -22 g's Sec	-	
6. PELVIC IMPACT TEST:				
	Pelvic accel. - - - -	40 - 60g's	55.59	

APPENDIX D
SID POSITIONING PROCEDURE

SIDE IMPACT DUMMY SEATING PROCEDURE

1. Seat Positioning

- A. Place seat at the longitudinal midpoint of fore to aft adjustment (forward most locking position to rear most locking position). If no locking position is available at mid-travel, use the position immediately rearward of mid-travel.
- B. If the seat back angle is adjustable, place it in the manufacturer's stated nominal design location. If not specified, set it at the first detent rearward of 25'.
- C. Adjustable head restraints are set such that the top surface of the restraint is level with the c.g. of the dummy's head.
- D. If the seat is equipped with adjustable side or lumbar supports, they are set in their "released" or full back positions.
- E. All other seat adjustments are positioned to their mid-travel locations. If locking positions are not available at these mid-points, use the position immediately rearward, down, left, or clockwise of mid-travel. Clockwise is defined looking rear to front or left to right relative to the vehicle. This also applies to adjustable steering columns.

2. H-point Determination

- A. The SAE three-dimensional H-point machine (SAE J826 APR80 - 50th percentile male configuration) is used to locate the H-point for each surrogate (see Appendix A).
- B. The H-point machine is positioned on the seat as follows:
 - 1. Bucket or Contoured Seats - The H-point machine is centered on the bucket or contour such that its midsagittal plane is vertical and longitudinal.
 - 2. Bench Seats
 - a. Driver position - The H-point machine is positioned such that its midsagittal plane is vertical, longitudinal, and contains the steering wheel center point.
 - b. Outboard passenger positions - The H-point machine is positioned such that its midsagittal plane is vertical, longitudinal, and the same distance from the longitudinal vehicle centerline as that for the driver position.

- c. Center passenger positions - The H-point machine is positioned such that its midsagittal plane is vertical and contains the longitudinal vehicle centerline.
- C. Locate the H-point position using the steps outlined in sections 4 through 6 of SAE Standard J826 APR80, unless otherwise specified in section 1 or 2 of this document. Record the coordinates of this point, relative to the vehicle, for use in section 4 of this document.

3. Test Dummies

- A. All NHTSA side impact crash test use the NHTSA Side Impact Dummy (SID) as the surrogate(s), unless otherwise specified by the COTR.
- B. All dummy joints are inspected for mobility prior to each test usage and reset to hold between 1 and 2 g's. This amount just barely restrains the weight of the individual limb when it is extended horizontally.
- C. Each test dummy is clothed in form-fitting cotton stretch underwear with short sleeves and mid-calf length pants. Each foot of each dummy is equipped with a size 11EE shoe which meets the configuration, size, sole, and heel thickness specifications of MIL-S-13192 and weighs 1.25 ± 0.2 pounds. All the above items are supplied by the contractor.

4. Initial Dummy Placement

The SID dummy(s) is placed in the vehicle seat with its pelvis positioned such that a lateral line passing through the dummy H-point is perpendicular to the longitudinal centerplane of the vehicle.

- A. Bucket or Contoured Seats. The dummy is centered on the bucket or contoured seat such that its midsagittal plane is vertical and longitudinal. The legs are positioned as follows, keeping the femur and tibia centerlines in a plane that is as near to vertical as possible.
 - 1. Driver position placement - The right foot of the dummy is placed on the underpressed accelerator pedal, with the heel resting on the floorpan as far forward as possible. The left knee is positioned such that the distance from the outer surface of the knee pivot bolt to the dummy's midsagittal plane is 6 inches.

2. Passenger positions placement - The knees of the dummy are initially set 11 1/2" apart, measured between the outer surfaces of the knee pivot bolt heads. If a center tunnel prevents this, place the feet on either side of the tunnel.

B. Bench Seats.

1. Driver position placement - The dummy is placed in the seat as outlined in section 4.A.2 except that its midsagittal plane is vertical, longitudinal, and contains the steering wheel center point.
2. Outboard passenger positions - The dummy is placed in the seat as outlined in section 4.A.2 except that its midsagittal plane is vertical, longitudinal, and the same distance from the vehicle centerline as that for the driver position.
3. Center passenger positions - The dummy is positioned in the seat as outlined in section 4.A.2 except that its midsagittal plane is vertical and contains the vehicle centerline.

5. Initial Dummy Positioning

A. H-point Positioning.

1. With the dummy laterally positioned as in section 4, insert the pelvis angle indicator bar in the hole provided above, and to the rear of the dummy H-point. Position the longitudinal pelvis angle between 23' and 25' to the horizontal. This may be accomplished by raising the legs or flexing the upper torso forward and allowing the pelvis to rotate. The lateral pelvis angle is to be horizontal.
2. Apply sufficient force on the lower torso in a horizontal and vertical direction to place the dummy H-point at the coordinates obtained in section 2.
3. If the H-point cannot be placed at the desired coordinates, adjust the pelvis angle within the 2' band and reposition to the coordinates. After repositioning the H-point, any deviation from the desired coordinates is recorded and used to indicate actual H-point locations. This deviation is not to exceed 1/2".

- B. Upper Torso Positioning. The dummy's upper torso should rest against the seat back. If not, adjust the upper torso, maintaining the H-point location and pelvis angle, so that the dummy's back rests against the seat back. If this

cannot be done, modify the H-point location and/or pelvis angle within the allowable bands until the back rests against the seat.

6. Final Dummy Positioning

- A. Driver Position. Without inducing pelvis or torso movement, the dummy's right foot is placed on the underpressed accelerator pedal with the heel resting as far forward as possible on the floorpan. The left foot is set perpendicular to the lower leg with the heel resting on the floorpan in the same lateral line as the right heel. If possible within these constraints, the dummy's thighs should be in contact with the seatpan.
- B. Front Passenger Positions. Without inducing pelvis or torso movement, place the dummy's feet on the vehicle's toeboard with the heel resting on the floorpan as close as possible to the intersection of the toeboard and floorpan. If the feet cannot be placed on the toeboard, they are set perpendicular to the lower legs and placed as far forward as possible such that the heels rest on the floorpan.
- C. Rear Passenger Positions. Without inducing pelvis or torso movement, the feet are placed flat on the floorpan and beneath the front seat as far forward as possible without front seat interference. If necessary, change the distance between the knees as required to place the feet beneath the seat. Record the new distance.
- D. Vehicles with wheelhouse projections in the passenger compartment. The foot(feet) in question is placed in the well of the floorpan/toeboard and not on the wheelhouse projection. This is done by twisting the foot at the ankle, maintaining the upper and lower leg positions outlined in section 4. If this does not resolve the situation, move the leg of the foot in question just enough to achieve the correct position, keeping the femur and tibia centerlines in a plane that is as near to vertical as possible. Record the new distance between the knees.
- F. Prior to conducting the test, the dummy position is visually checked. The dummy is to be properly positioned laterally with its midsagittal plane vertical and longitudinal, and the upper torso resting against the seat back. The H-point and pelvis angle are to be within the specified ranges and the foot, knee, and leg placements are to be as outlined. The COTR is to be satisfied with the final dummy position and any deviations from this procedure are to be approved by the COTR.

- G. The final dummy position is recorded. These measurements are to include, but not be limited to, pelvis and head angles as well as actual H-point and head c.g. locations relative to the vehicle. The straight line distance from the H-point to the center of the outer ankle bolt is also recorded for one of the legs (eg. left H-point to left ankle bolt).