SIDE IMPACT PROTECTION IN PRODUCTION VEHICLES

MDB-TO-CAR 90° SIDE IMPACT TEST OF A MOVING DEFORMABLE BARRIER TO A 1989 FORD F-150 AT 30 MPH

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

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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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PREPARED BY: S. Pruitt/D. Gokhale/T. Kippen

APPROVED BY: _____
Dr. Anil V. Khadilkar

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_____
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Dr. Anil V. Khadilkar/S.D. Pruitt/D. Gokhale /T. Kippen

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MOBILITY SYSTEMS AND EQUIPMENT COMPANY
9920 La Cienega Boulevard, Suite 708
Inglewood, California 90301

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16. Abstract

This test report documents a crash test to evaluate side impact protection. Testing was conducted on a 1989 Ford F-150, Pickup at the Mobility Systems and Equipment Company Test Facility, Mira Loma, California. The test vehicle was impacted on the right side by a moving deformable barrier at 30.4 mph. The test was a 90° intersection collision with the striking vehicle traveling at 30 mph. Occupant response of one side impact dummy was measured. The dummy was located in passenger's designated seating position. The test date was 17 August 1989.

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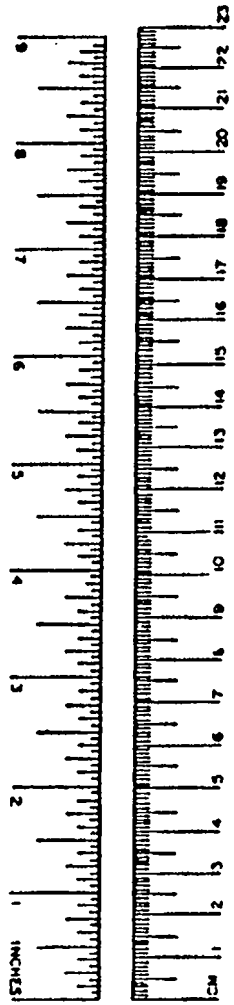
METRIC CONVERSION FACTORS

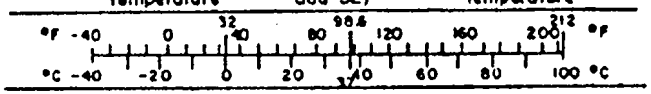
APPROXIMATE CONVERSIONS FROM METRIC MEASURES

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	0.6	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
ft^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



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	0.03	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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SECTION 1

PURPOSE AND INTRODUCTION

This testing program is 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) (with no crab angle) into the struck test vehicle which is placed in a stationary position. The velocity of the MDB is to be 30.0 $\pm$0.5 mph.

The subject vehicle for this test was a 1989 Ford F-150 Pickup. The test was performed on 17 August 1989 at an actual impact speed of 30.4 mph. The centerline of the MDB contacted the test vehicle 1.0 inches rearward of the vehicle longitudinal c.g.

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 1989 Ford F-150 Pickup, Test No. 1, was tested on 17 August 1989. General test vehicle information and pretest conditions are given in Tables 2-1 and 2-2. Note that the test vehicle was previously subjected to a FMVSS 214 test on the driver's side door. 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 right side vehicle profile. The impact point was marked on the vehicle at the vehicle longitudinal c.g.

One side impact anthropomorphic dummy (SID) was placed in the vehicle's passenger seat and positioned using the side impact dummy seating procedure (Appendix D). SID position measurements are shown in Table 2-5. The SID were 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 two SID's head, right shoulder, right hip and his knees to help determine dummy contact points during the test.

The MDB was not crabbed and was 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 26 channels of information was recorded on two (2) FM data tapes.

TABLE 2-1 TEST VEHICLE DATA

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1989/FORD/F-150 CUSTOM/PICKUP

VEHICLE NHTSA NO.: N/A VIN: 1FTDF15Y8KPA06322

VEHICLE BODY COLOR: BLACK ; MONTH & YEAR OF MANUFACTURE: 09/88

ENGINE: Cyl.; ___ C.I.D. 4.9 Liters; Placement; ___
Longitudinal; X Lateral X Gas; ___ Diesel; ___ Turbocharged

TRANSMISSION: 5 Speed; X Manual; ___ Automatic; X Overdrive

FINAL DRIVE: ___ Front Wheel Drive; X Rear Wheel Drive; ___
Four Wheel Drive ___

DATE VEHICLE AVAILABLE FOR SIDE IMPACT TESTING: 08/89

ODOMETER READING: 72 miles; OPTIONS: ___ A/C; X P/S; ___ P/Wdo; ___
___ Tilt Whl.; ___ Cruise Control

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): 35 psi Front; 41 psi Rear

Recommended Tire Size: P235/75R 15XL

Tires On Vehicle: P235/75R 15XL ; Manufacturer: AMERIWAY

Number Of Occupants: 3 Front; ___ Rear; ___ 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 = 1591* lb (A)

No. Of Occupants x 150 lb - - - = 450 lb (B)

Cargo Capacity (A - B)- - - - - = 1141 lb
*GVWR - Delivered Weight

TEST VEHICLE DELIVERED WEIGHT WITH MAXIMUM FLUIDS:

Right Front = 1040 lb
Left Front = 1124 lb
Right Rear = 747 lb
Left Rear = 748 lb
TOTAL WEIGHT = 3659 lb

TOTAL FRONT = 2164 lb (59.1% of TOTAL)

TOTAL REAR = 1495 lb (40.9% of TOTAL)

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

CALCULATION OF TEST VEHICLE TARGET WEIGHT:

Total Test Vehicle Delivered Weight With Maximum Fluids = 3659 lb

Maximum Cargo Carrying Capacity Of Test Vehicles* - - - = 300 lb

Weight Of One P.572 Dummies (1 x 174 lb)- - - - - - - - = 174 lb

TEST VEHICLE TARGET WEIGHT- - - - - - - = 4133 lb

* 300 lb for light trucks and MPVs

ACTUAL WEIGHT OF TEST VEHICLE WITH 1 DUMMY AND CARGO:

Right Front = 1092 lb

Left Front = 1293 lb

TOTAL FRONT = 2385 lb (57.8% of TOTAL)

Right Rear = 837 lb

Left Rear = 903 lb

TOTAL REAR = 1740 lb (42.2% of TOTAL)

TOTAL WEIGHT = 4125 lb (which includes 0 lb of cargo ballast weight

TEST VEHICLE ATTITUDE:

As Delivered -----Right Front = 33.1 in

Left Front = 33.5 in

Right Rear = 36.2 in

Left Rear = 36.2 in

Test Vehicle Wheelbase: 117.5 in; C.G.= 49.6 in rearward of front wheel centerline

Ready For Test -- Right Front = 32.2 in

Left Front = 32.6 in

Right Rear = 35.1 in

Left Rear = 35.4 in

TOTAL VEHICLE LENGTH:

Right Side = 194.5 in

Left Side = 194.5 in

Centerline = 199.9 in

TABLE 2-2 PRETEST CONDITIONS

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1989/FORD/F-150 CUSTOM/PICKUP

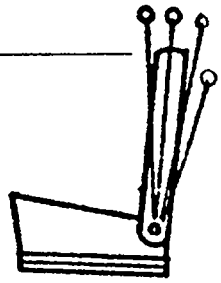
VEH. NHTSA NO. N/A ; TEST DATE: 08/17/89

FRONT SEAT CUSHION PLACEMENT: Midpoint of forward/aft travel (7th notch rearward)

TOTAL NUMBER OF ADJUSTMENT POSITIONS OR DETENTS: 12 notches

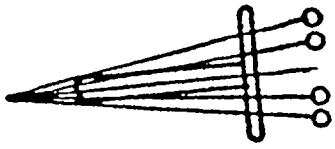
FRONT SEAT BACK ADJUSTMENT POSITION: Not Adjustable

(latch position, knob rotations, etc.)



TORSO ANGLE 24°

ADJUSTABLE STEERING COLUMN POSITION:



Midpoint of swing

X Not Applicable

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

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 17.5 Gal
Rear Optional Tank 17.0 Gal
(92 to 94% of USABLE CAPACITY)

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

Wheelbase = 117.5 in
Impact point is 56.1 inches rearward of front axle centerline (which at vehicle longitudinal c.g.).

TABLE 2-3 CRASH TEST SUMMARY FOR TEST VEHICLE

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1989/FORD/F-150/CUSTOM/PICKUP

VEH. NHTSA NO. N/A ; VIN: 1FTDF15Y8KPA06322

TEST DATE: 08/17/89 BUILD DATE: 09/88

OVERALL LENGTH = 199.9 inches; OVERALL WIDTH = 75.5 inches

TEST WEIGHT: Left Front = 1293 lb; Left Rear = 903 lb

Right Front = 1092 lb; Right Rear = 837 lb

SUBTOTALS - - - Front = 2385 lb Rear = 1740 lb

TOTAL VEHICLE WEIGHT - - - - - - - - - - - - - - 4125 lb

WHEELBASE = 117.5 inches

LONGITUDINAL C.G. FROM CENTER OF FRONT AXLE = 49.6 inches

IMPACT ANGLE WITH RESPECT TO IMPACTOR = 90 degrees

MAXIMUM EXTERIOR STATIC CRUSH:

1. LEVEL 1 (20.0" above ground) = 23.0 inches
2. LEVEL 2 (36.1" above ground) = 14.1 inches
3. LEVEL 3 (30.0" above ground) = 16.7 inches
4. LEVEL 4 (43.0" above ground) = 8.2 inches
5. LEVEL 5 (67.7" above ground) = 4.7 inches

MAXIMUM POSTTEST INTRUSION = 23.0 inches

OCCUPANTS:	PASSENGER	RIGHT REAR
TYPE OF DUMMY - - - -	SID	N/A
RESTRAINT USED- - - -	None	N/A

INSTRUMENTATION:

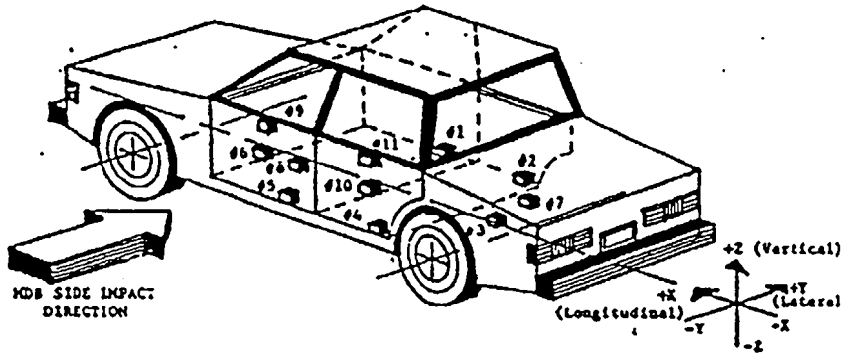
NUMBER OF DATA CHANNELS = 26

NUMBER OF CAMERAS: ONBOARD = 4 High-speed

OFFBOARD = 4 High-speed, 1 Real-time

TABLE 2-4 TEST VEHICLE ACCELOMETER LOCATIONS AND DATA SUMMARY

TEST VEHICLE: 1989 FORD F-150 CUSTOM PICKUP NHTSA NO.: N/A TEST DATE: 08/17/89

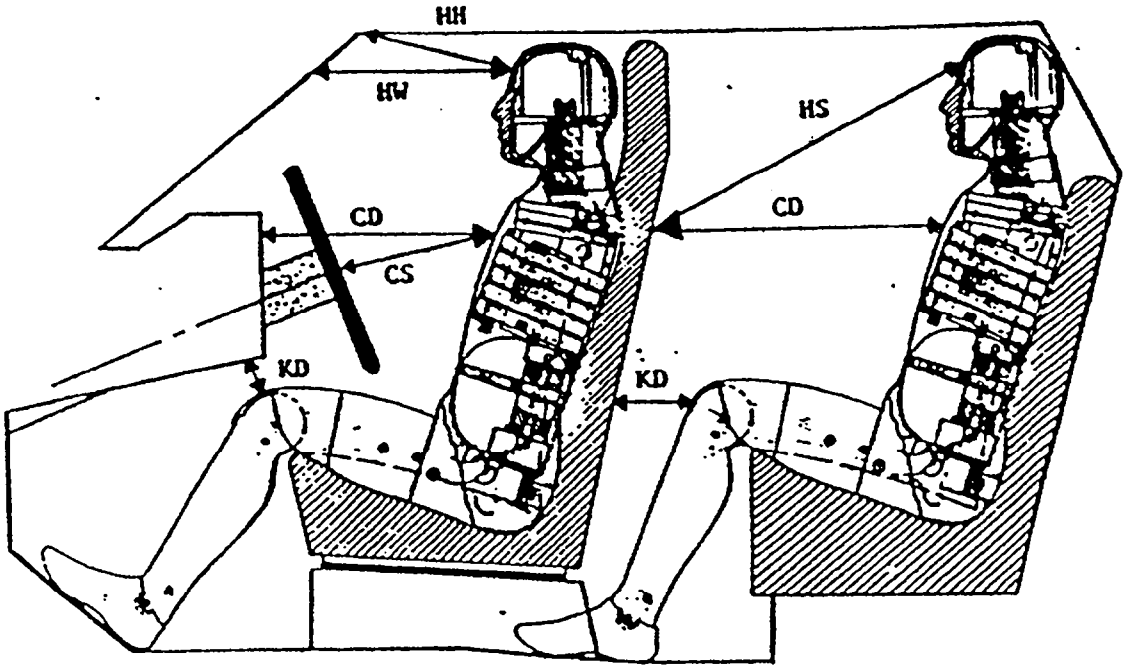


NOTE: IMPACT WAS ON PASSENGER SIDE.

ACCEL. NO.	LOCATION	COORDINATES (") X*	Y*	Z*	LONG. (X) POS. / NEG. MAX (g)	TIME (msec)	LAT. (Y) POS./ NEG. MAX (g)	TIME (msec)	VERT. (Z) POS. / NEG. MAX (g)	TIME (msec)	RESULTANT MAX./MIN. MAX (g)	TIME (msec)
1	Right Side Sill At Front Seat	128.0	25.5	22.0	-9.7	15.3	-28.9	17.4	-21.6	23.4	31.6	17.2
2	Right Side Sill At Rear Seat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Right Floorpan Above Axle	51.5	0.0	33.0	-5.9	22.6	-28.8	31.6	-31.5	14.9	34.5	14.8
4	Right Side Sill At Rear Seat	NA	NA	NA			NA	NA				
5	Right Side Sill At Front Seat	128.0	-31.5	21.8			-106.2	20.5				
6	Right Front Door on Centerline	123.0	-32.0	40.0			-165.0	11.3				
7	Right Rear Occ. Compartment	NA	NA	NA	NA	NA						
8	Midrear of Right Front Door	100.0	32.0	40.0			-149.3	8.6				
9	Right Front Door Upper Centerline	121.0	32.0	45.0			-112.1	16.8				
10	Midrear of Right Rear Door	NA	NA	NA			NA	NA				
11	Right Rear Door Upper Centerline	NA	NA	NA			NA	NA				

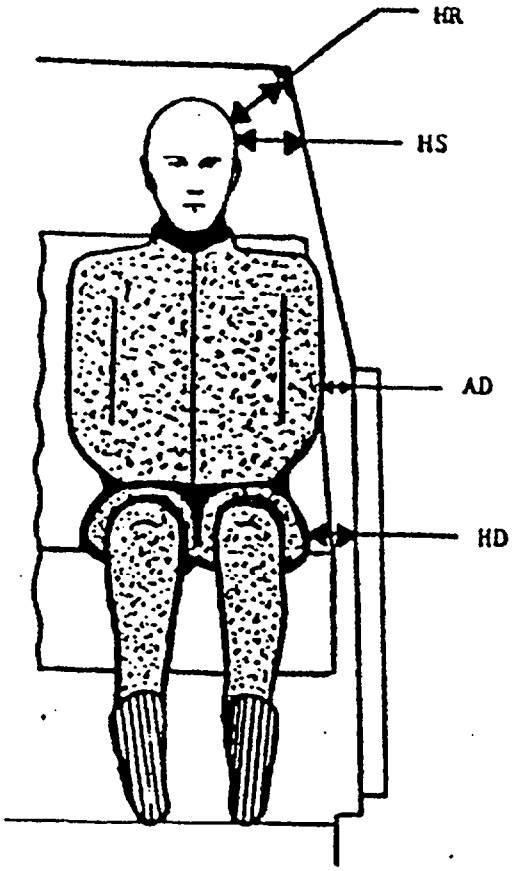
* Reference: X - Rear Bumper (+ Forward)
Y - Vehicle Centerline (+ To Right)
Z - Ground Level (+ Up)

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



	FRONT PASSENGER ID # 319	REAR PASSENGER ID # N/A
HH	19.0 in	NA in
HW	24.8 in	NA in
HS	NA in	NA in
CD	23.8 in	NA in
CS	NA in	NA in
KDL	9.8 in	NA in
KDR	9.3 in	NA in

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



	FRONT PASSENGER ID # 319	REAR PASSENGER ID # N/A
HR	6.7 in	NA in
HS	9.3 in	NA in
AD	6.2 in	NA in
HD	6.2 in	NA in

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

TEST DATE: 08/17/89	FRONT DUMMY -- ID # 137				REAR DUMMY -- ID # NA			
	POS.	DIRECT	NEG.	DIRECT	POS.	DIRECT	NEG.	DIRECT
	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
HEAD ACCELERATIONS:								
Longitudinal --- X	8.4	196.0	-18.2	64.8				
Lateral -------- Y	14.2	49.4	-70.8	63.3				
Vertical ------- Z	31.9	69.0	-46.0	91.5				
RESULTANT ------ R	73.6	63.3	0.0	0.0	N/A	N/A	N/A	N/A
HIC ----------*	202.1							
RIB ACCELERATIONS:								
1.Upper Rib Lateral Y*	4.4	84.4	-40.9	60.0				
2.Upper Rib Lateral Y*	3.5	84.4	-41.2	60.0	N/A	N/A	N/A	N/A
1.Lower Rib Lateral Y*	13.0	78.1	-45.6	48.8				
2.Lower Rib Lateral Y*	12.9	78.1	-43.9	48.8	N/A	N/A	N/A	N/A
SPINE ACCELERATIONS:								
1.Upper Rib Lateral Y*	7.6	106.3	-54.3	66.3				
2.Upper Rib Lateral Y*	8.1	106.3	-51.7	66.3	N/A	N/A	N/A	N/A
1.Lower Rib Lateral Y*	13.8	75.6	-40.8	50.0				
2.Lower Rib Lateral Y*	14.4	75.6	-39.6	50.0	N/A	N/A	N/A	N/A
PELVIS ACCELERATIONS:								
Lateral Y*	3.9	245.6	-69.9	38.1	N/A	N/A	N/A	N/A
RIB DEFLECTION:								
Lateral	0.17	166.6	-0.52	82.8	N/A	N/A	N/A	N/A

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

REFERENCE: Positive Direction -- Longitudinal (X) = forward
Lateral (Y) = to right
Vertical (Z) = up

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

TABLE 2-7 CRASH TEST SUMMARY FOR SIDE IMPACTOR

TYPE OF TEST: 90 SIDE IMPACT TEST DATE 08/17/89

NHTSA NO. FOR TARGET VEHICLE: N/A

POSITION OF IMPACTOR (MDB) ON MONORAIL: CENTERLINE PARALLEL TO MONORAIL

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 = 50 in.
MDB Weight --Left Front = 1123 lb; Left Rear = 884 lb
Right Front = 1077 lb; Right Rear = 896 lb
SUBTOTAL: Front = 2200 lb; Rear = 1780 lb
TOTAL MDB WEIGHT = 3980 lb

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

IMPACT SPEED = 30.4 MPH

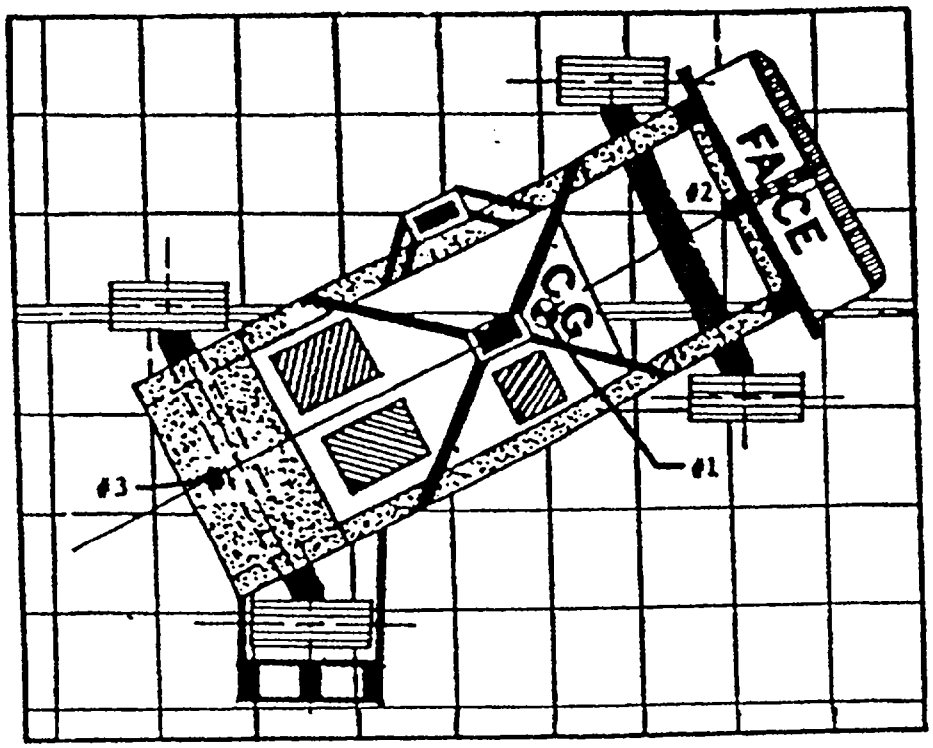
MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE:

1. ROW A at bumper level = 2.5 in.
2. ROW B at mid-stack level = 2.5 in.
3. ROW C at top of stack level = 8.0 in.

INSTRUMENTATION:

Number of MDB Data Channels = 5 accelerometer channels

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



NOTE: MDB WAS NOT CRABBED.

ACCEL. NO.	LOCATION	Coordinates X*	Y*	Z*	POS. MAX (g)	DIRECT. TIME (msec)	NEG. MAX (g)	DIRECT. TIME (msec)
1	MDB Center of Gravity							
	Longitudinal X				0.3	189.9	-12.8	35.8
	Lateral Y				2.0	51.9	-2.0	90.4
	Vertical Z	56.4	0.0	12.0	4.2	19.6	-3.3	60.1
	Resultant R				13.0	35.5	0.0	0.0
2	Front Frame Member Longitudinal X	121.4	0.0	9.8	25.3	64.5	-29.8	68.2
3	Rear Frame Member Longitudinal X	2.5	0.0	14.0	1.4	283.4	-13.8	38.2

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

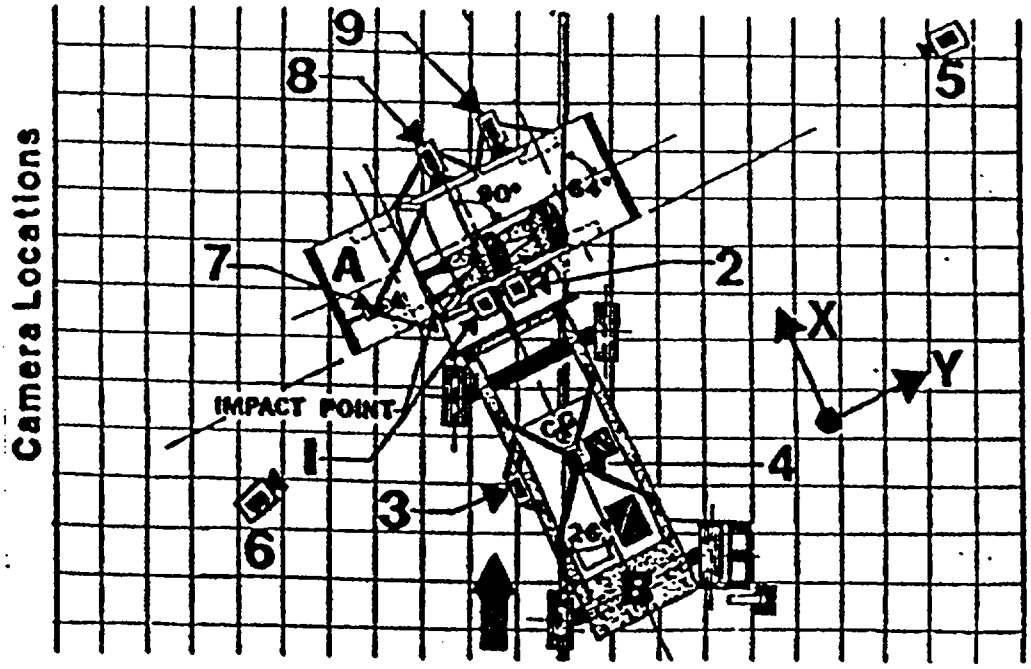
TABLE 2-9 HIGH-SPEED CAMERA LOCATIONS AND DATA

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	COORDINATES (in) X*	Y*	Z*
1	Overhead view of test vehicle dynamics	Fastex	16	600	0	0	248
2	Overhead Closeup view of impact plane	Fastex	28	500	0	0	248
3	MDB Onboard Closeup view of impact point	Himac	28	600	-85	-72	48.5
4	MDB Onboard view of driver dummy kinematics	Himac	16	600	-112	-32	30.2
5	Overhead view of test Level--Overall View	Himac	16	600	27	342	54
6	Left Side Ground Level--Overall View	Fastex	16	No Data	0	-294	37.5
7	Test Vehicle Onboard-driver dummy front view kinematics	Fastex	16	600	21	46	64
8	Test Vehicle Onboard-pass. dummy side view kinematics	Fastex	16	600	84	-34	54.5
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 test, and post-test event included in final print

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

SAMPLE



ANGLES INDICATED ARE HYPOTHETICAL

NOTE: MDB WAS NOT CRABBED.

SECTION 3

TEST RESULTS

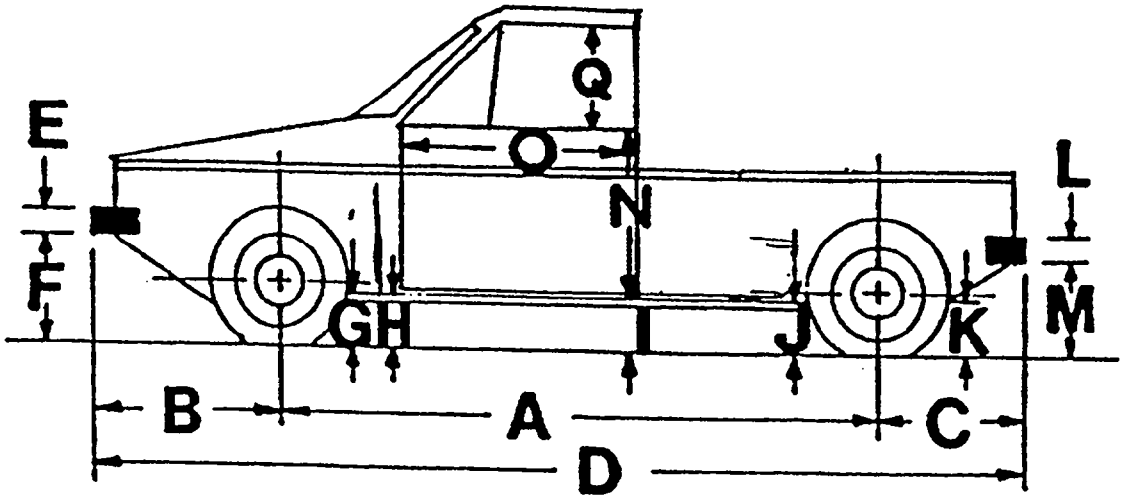
The 1989 Ford F-150 Pickup was impacted at 30.4 mph by MDB on 17 August 1989. The MDB's centerline contacted the test vehicle 1.0 inches rearward of the vehicle c.g. The test vehicle slid sideways approximately 18 feet from the point of impact. The vehicle passenger side door and bed were crushed inwards a maximum of 23.0 inches. Pretest and posttest vehicle dimensions are shown in Tables 3-1 to 3-5.

The SID impacted the passenger door with the right knee, hip and shoulder. The neck and body were rotated far enough by the impact force to allow the SID head to go through the passenger side window. The SID head did contact the top and then the bottom window sills of the passenger door. The SID then rotated to its right while being thrown across the cab interior. The SID ended up in the driver position laying on his right side. SID contact is documented in Table 3-6.

The SID instrumentation showed Head Injury Criterion (HIC) of 202.1, Pelvic Acceleration Value of -69.9 g's and Thoracic Trauma Index (TTI) of 47.6. The detailed results are included in this Section and Appendix B.

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 to the front face with a maximum crush of 8.0 inches on the upper right-hand corner. The crush details for the MDB are given in Table 3-7.

TABLE 3-1 PRE AND POSTTEST MEASUREMENTS



NOTE: IMPACT WAS ON PASSENGER SIDE.

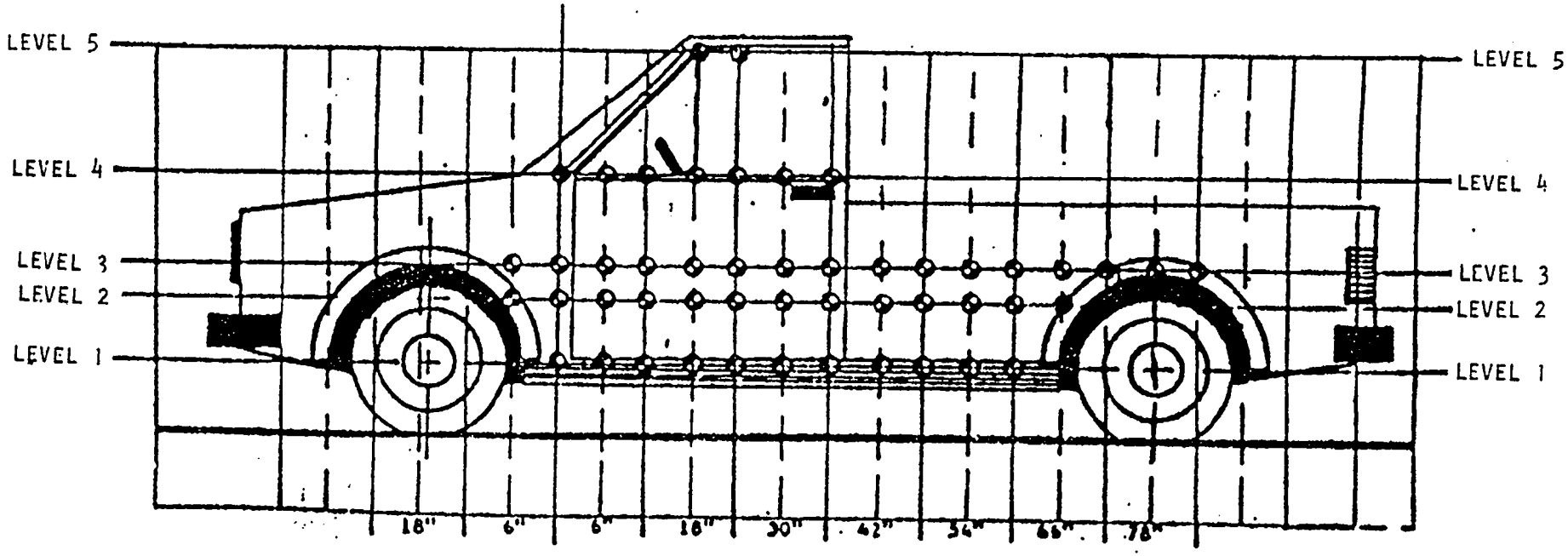
NOTE: All dimensions are in inches

	PRETEST	POSTTEST	CHANGE
A	111.8	111.5	0.3
B	31.8	31.8	0.0
C	111.8	111.5	0.3
D	31.8	31.8	0.0
E	31.8	31.8	0.0
F	111.8	111.5	0.3
G	31.8	31.8	0.0
H	31.8	31.8	0.0
I	111.8	111.5	0.3
J	31.8	31.8	0.0
K	31.8	31.8	0.0
L	111.8	111.5	0.3
M	31.8	31.8	0.0
N	31.8	31.8	0.0
O	111.8	111.5	0.3
P	31.8	31.8	0.0
Q	31.8	31.8	0.0

TABLE 3-2 VEHICLE SIDE MEASUREMENT

TEST VEHICLE NHTSA NO.: N/A

LEVEL 5 @	Window Top - - - - - - - -	67.7	in
LEVEL 4 @	Window Sill - - - - - - - -	48.0	in
LEVEL 3 @	Mid Door- - - - - - - - - -	30.0	in
LEVEL 2 @	Occupant H-Point- - - - -	36.1	in
LEVEL 1 @	Axle Centerline Height- - (or Sill Top Height)	20.0	in



NOTE: IMPACT WAS ON PASSENGER SIDE.

TABLE 3-3 TEST VEHICLE EXTERIOR PROFILES FROM REFERENCE PLANE* AND STATIC CRUSH DATA

TEST DATE		IMPACT POINT ← FORWARD REARWARD →													
LOCATION:	HEIGHT (in)**	PROFILES/ CRUSH	6"	0" ***	6"	12"	18"	24"	30"	36"	42"	48"	54"	60"	66"	
1.Window Top	67.7	Posttest- - -	NA	NA	NA	NA	NA	29.7	29.9	29.5	29.2	29.3	NA	NA	NA	
		Pretest - - -	NA	NA	NA	NA	NA	25.1	25.2	25.1	24.5	25.1	NA	NA	NA	
		Static Crush-						4.6	4.7	4.4	4.7	4.2				
2.Window Sill	48.0	Posttest- - -	NA	NA	23.5	24.0	26.0	NA	NA	NA	27.0	NA	NA	26.2	23.0	2
		Pretest - - -	NA	NA	20.1	19.9	19.7	19.5	19.3	19.1	18.8	19.0	19.3	19.2	19.0	1
		Static Crush-			3.4	4.1	6.3				8.2			7.0	4.0	
3.Mid-Door	30.0	Posttest- - -	22.3	23.7	27.9	33.5	33.6	32.8	32.1	31.6	30.5	31.8	29.2	34.2	33.3	3
		Pretest - - -	17.6	17.8	17.7	18.5	17.9	17.7	17.6	17.5	17.5	17.5	17.7	17.5	17.5	1
		Static Crush-	4.7	5.9	10.2	15.0	15.7	15.1	14.5	14.1	13.0	14.3	11.5	16.7	15.8	1
4.H-Point	36.1	Posttest- - -	21.2	22.2	24.0	31.2	31.5	31.5	31.0	29.0	27.0	30.6	31.3	30.5	27.0	2
		Pretest - - -	17.2	17.2	17.7	17.9	17.5	17.4	17.3	17.3	17.3	17.3	17.5	17.3	17.3	1
		Static Crush-	4.0	5.0	6.3	13.3	14.0	14.1	13.7	11.7	9.7	13.3	13.8	13.2	9.7	1
5.Axle Centerline	20.0	Posttest- - -	NA	28.3	35.1	36.4	36.5	36.4	36.3	36.0	36.0	38.0	42.2	42.0	41.2	3
		Pretest - - -	NA	19.9	20.0	19.5	19.5	19.5	19.4	19.3	19.3	19.3	19.2	19.0	18.9	1
		Static Crush-		8.4	15.1	16.9	17.0	16.9	16.9	16.7	16.7	18.7	23.0	23.0	22.3	1

*Reference Plane is parallel to and 48 inches from test vehicle longitudinal centerline

**Measured from ground

***Impact Point

TABLE 3-4A PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 1 - AXLE CENTERLINE

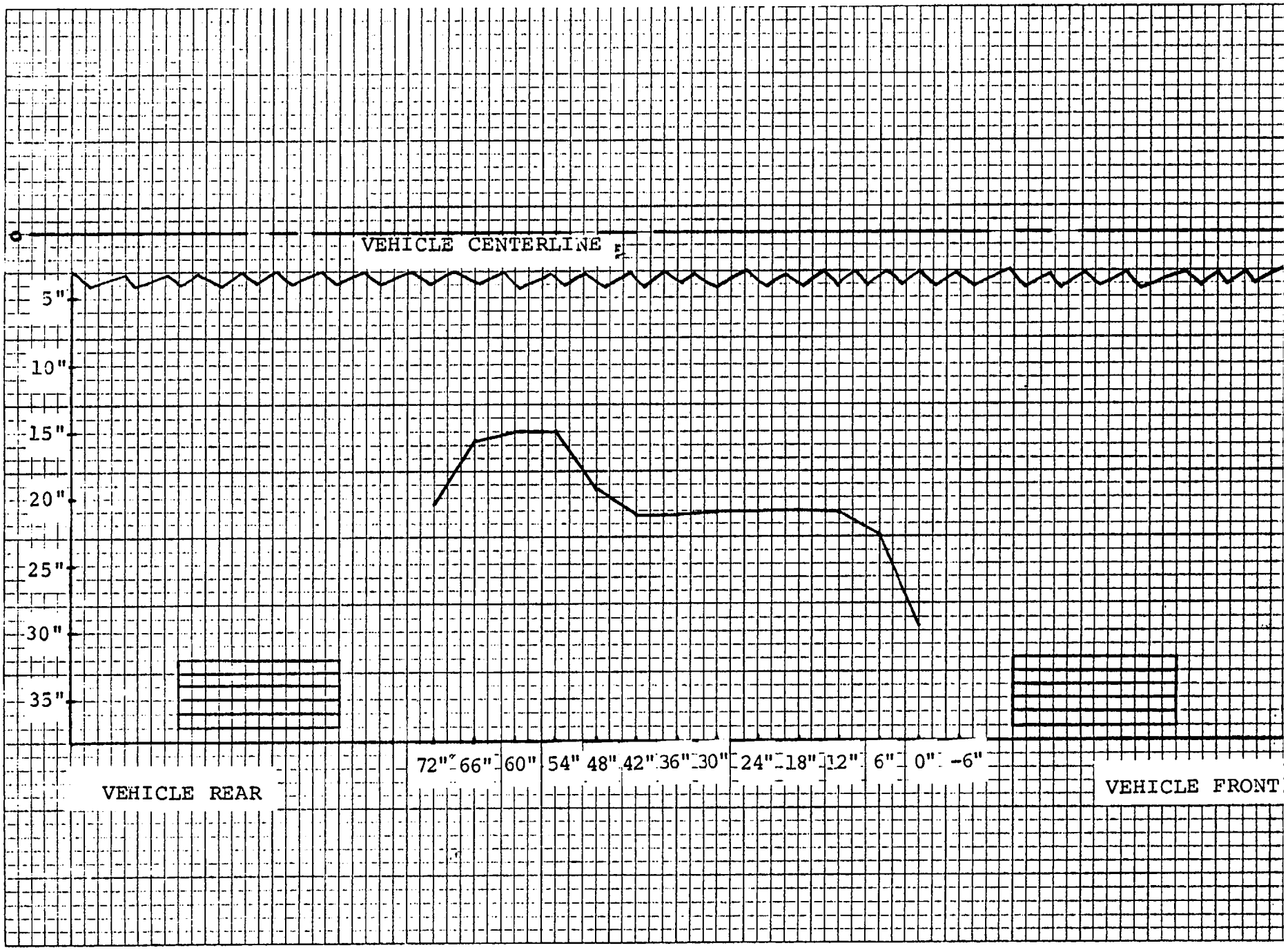


TABLE 3-4B PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 2 - H-POINT

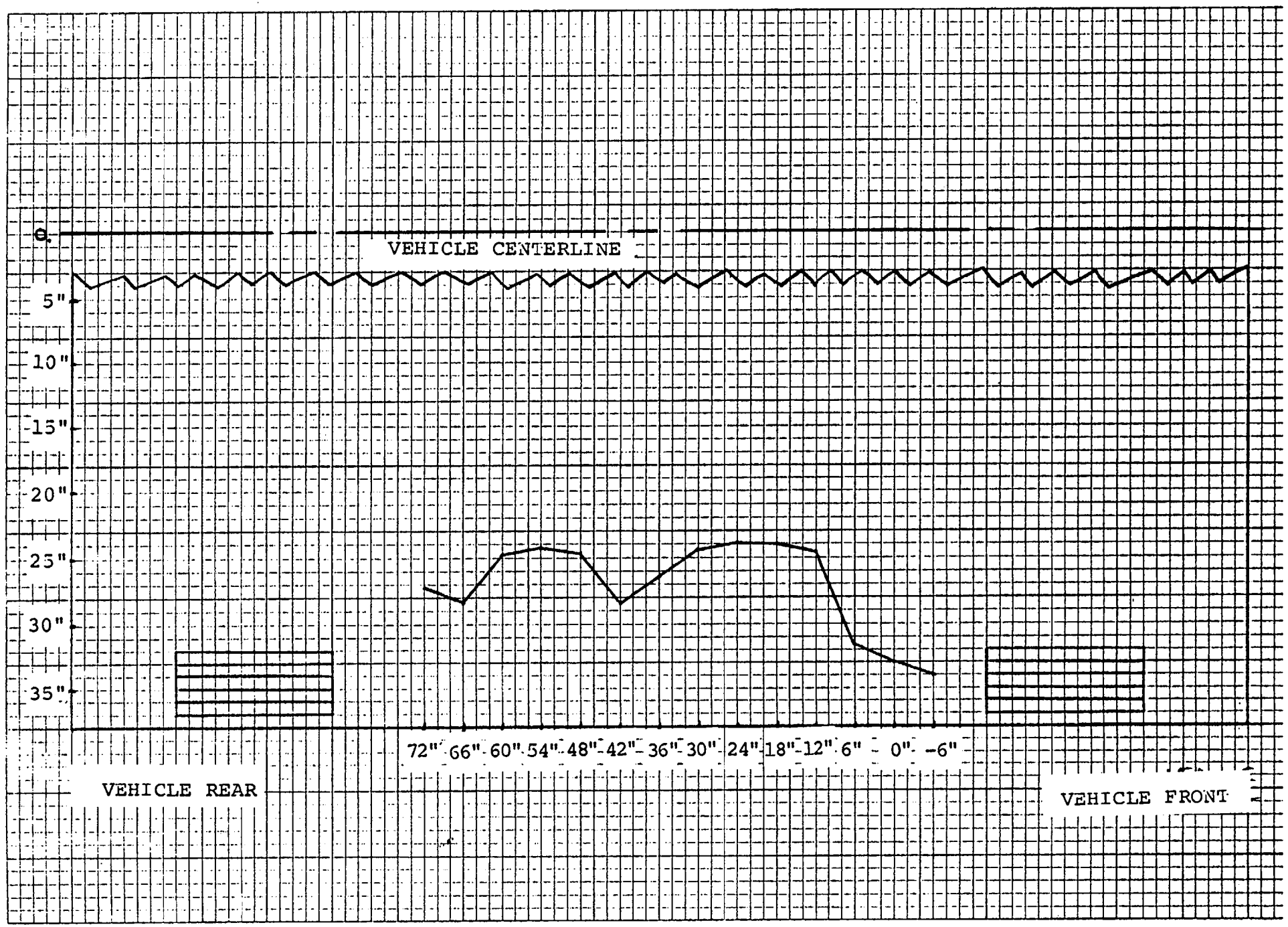


TABLE 3-4C PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 3 - MID DOOR

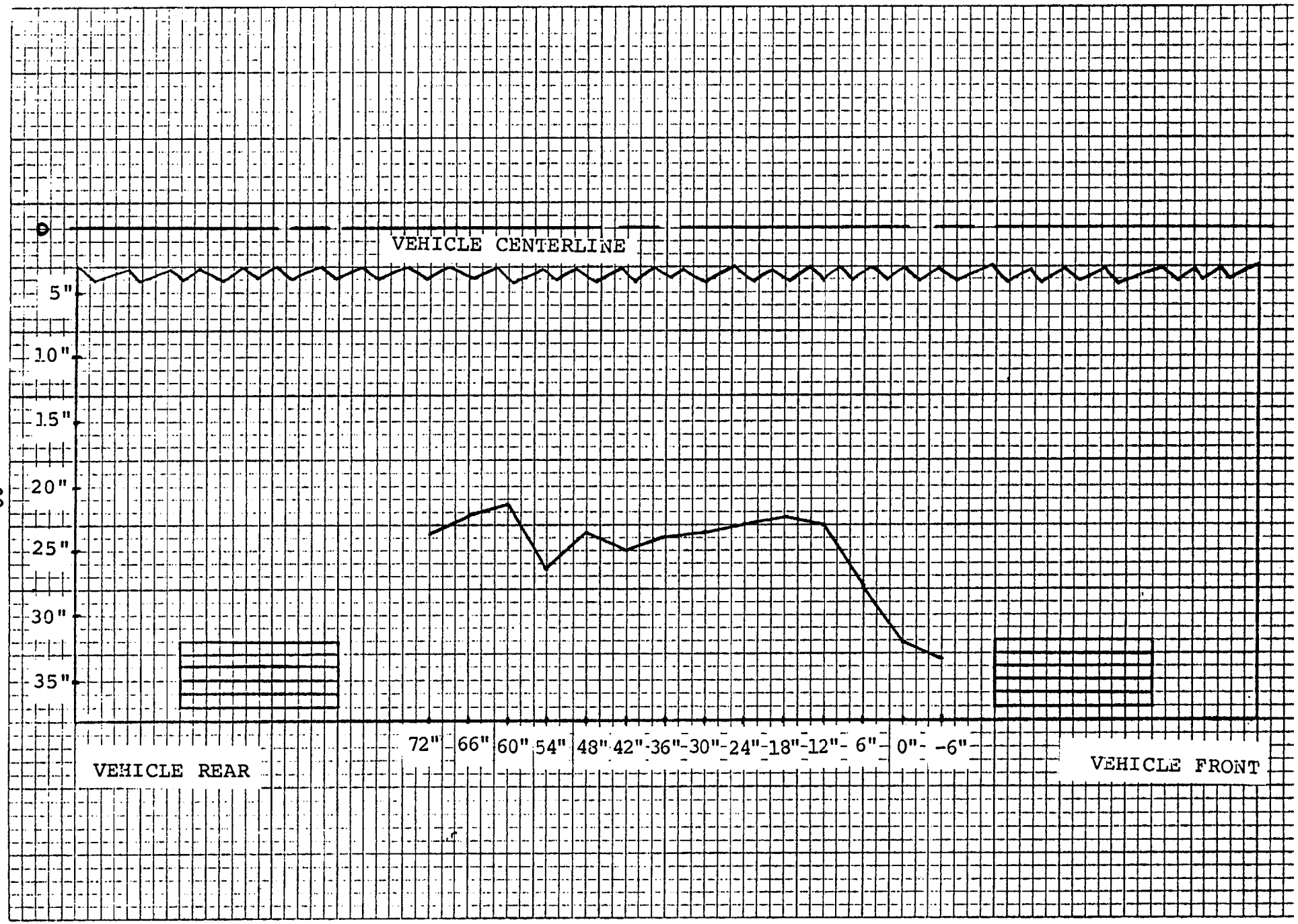


TABLE 3-4D PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 4 - WINDOW SILL

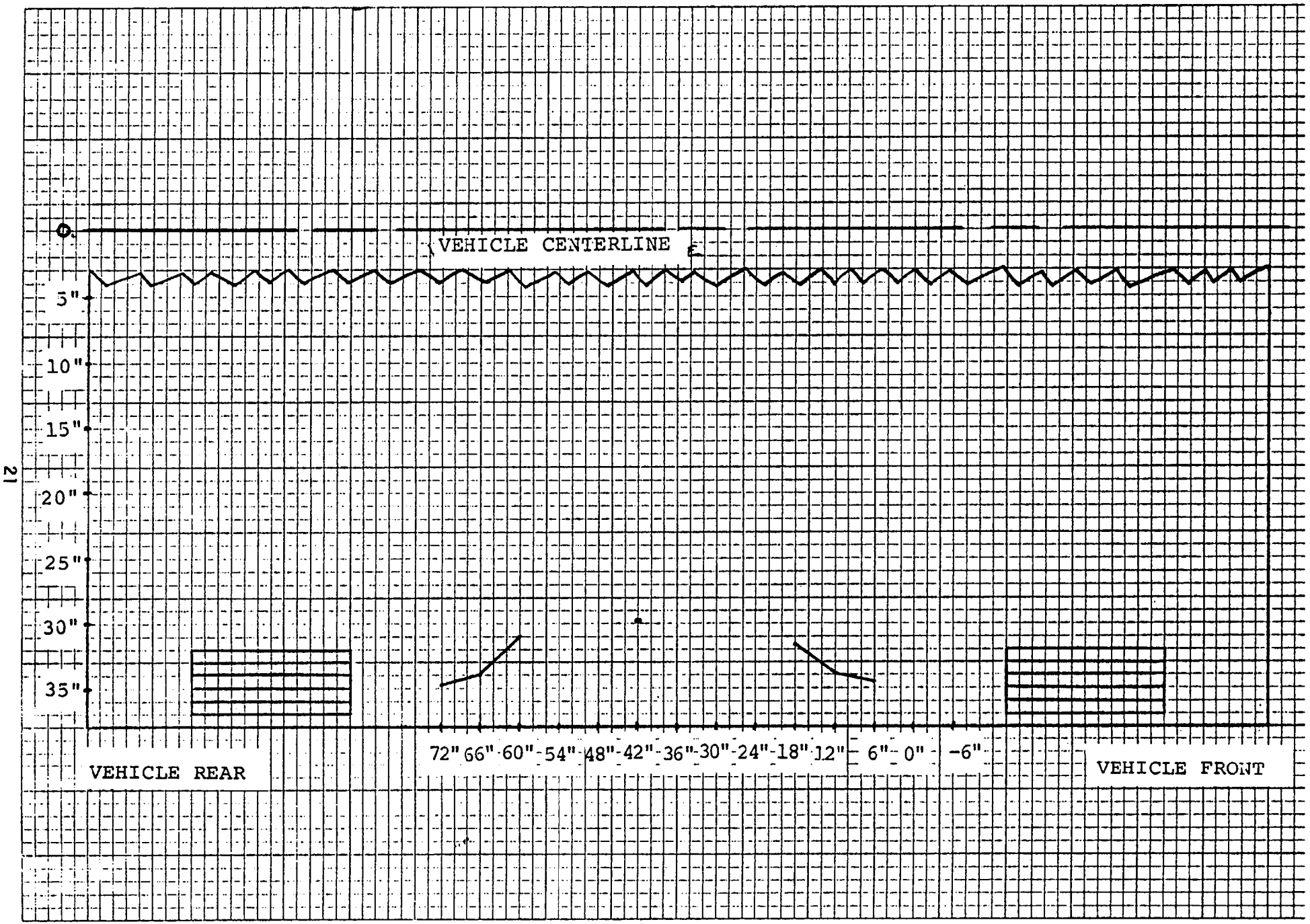
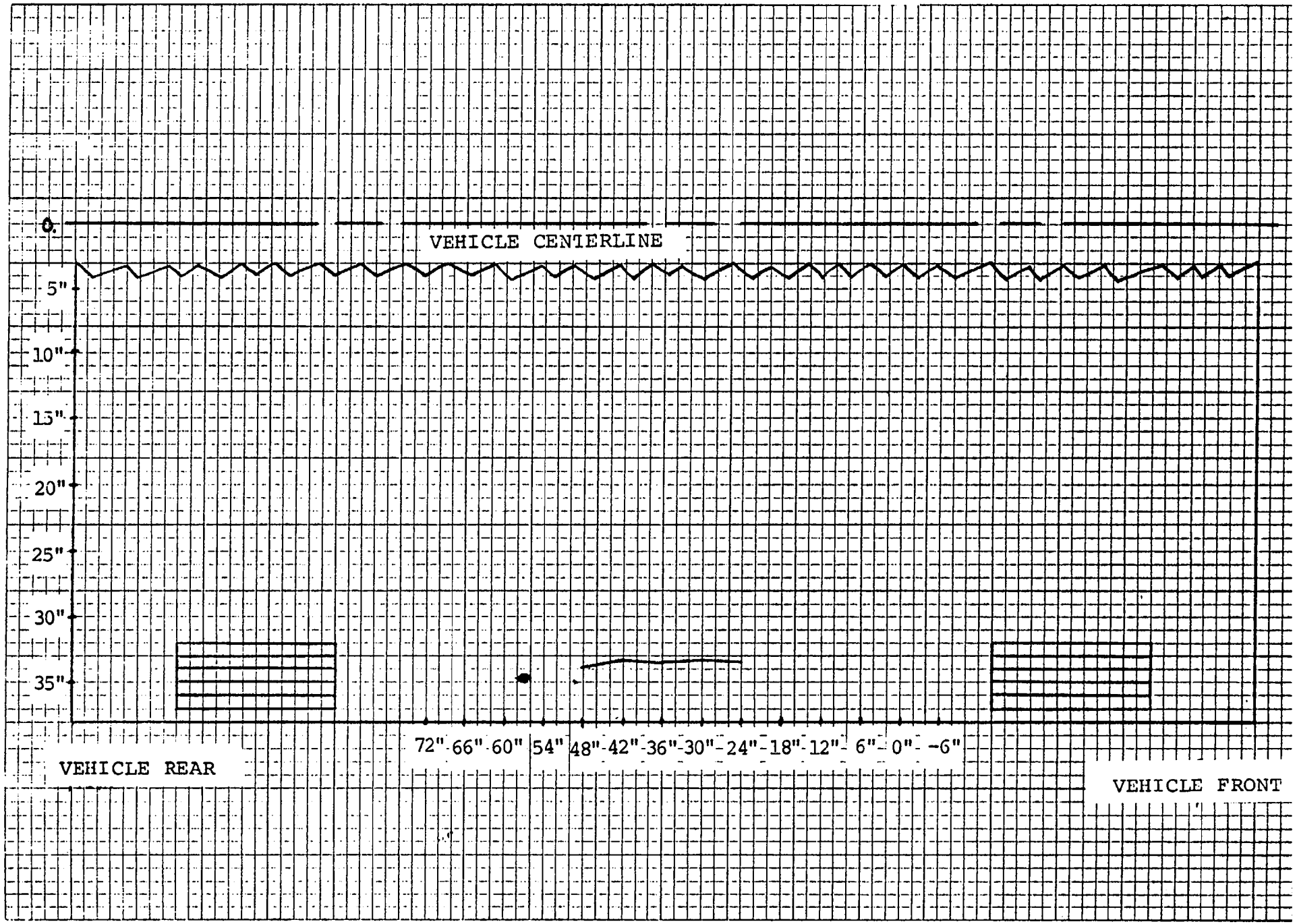


TABLE 3-4E PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 5 - WINDOW TOP



NO.	MEASUREMENT DESCRIPTION	Pre-Test (in.)	Post-Test (in.)	Diff. (in.)
X1	Total Length of Test Vehicle at Centerline	199.9	197.2	2.7
X2	Rear Surface of Vehicle to Front of Engine	181.0	179.0	2.0
X3	Rear Surface of Vehicle to Firewall	147.5	143.7	3.8
X4	Rear Surface to Upr. Leading Edge of Right Door	139.9	135.0	4.9
X5	Rear Surface to Upr. Leading Edge of Left Door	138.9	143.5	-4.6
X6	Rear Surface to Lwr. Leading Edge of Right Door	134.2	137.0	-2.8
X7	Rear Surface to Lwr. Leading Edge of Left Door	136.0	139.5	-3.5
X8	Rear Surface to Upr. Trailing Edge of Right Door	97.9	95.7	2.2
X9	Rear Surface to Upr. Trailing Edge of Left Door	103.0	103.5	-0.5
X10	Rear Surface to Lwr. Trailing Edge of Right Door	97.3	95.2	2.1
X11	Rear Surface to Lwr. Trailing Edge of Left Door	100.8	100.5	0.3
X12	Rear Surface to Bottom 'A' Post on Right Side	137.8	137.5	0.3
X13	Rear Surface to Bottom 'A' Post on Left Side	136.0	134.0	2.0
X14	Rear Surface to Firewall on Right Side	151.3	145.5	5.8
X15	Rear Surface to Firewall on Left Side	151.9	155.0	-3.1
X16	Rear Surface to Steering Column	121.1	124.8	-3.7
X17	Center of Steering Column to 'A' Post	15.7	16.2	-0.5
X18	Center Steering Column to Headlining	18.5	17.5	1.0
X19	Rear Surface to Right Side of Front Bumper	194.5	194.5	0.0
X20	Rear Surface to Left Side of Front Bumper	194.5	195.2	-0.7
X21	Length of Engine Block	31.0	31.0	0.0

TABLE 3-6 POSTTEST OBSERVATIONS

TEST VEHICLE: 1989 FORD F-150 PICKUP; NHTSA NO.: N/A

VISIBLE DUMMY CONTACT POINT:	FRONT SID	REAR SID
HEAD	Right door window sill	N/A
CHEST	Right Door	N/A
ABDOMEN	Right Door	N/A
LEFT KNEE	None	N/A
RIGHT KNEE	Right Door	N/A

DOOR OPENING:	LEFT SIDE	RIGHT SIDE
FRONT	Opened without tools	Need tools to open
REAR	N/A	N/A

SEAT MOVEMENT:

None

GLAZING DAMAGE:

No separation. Some cracking of windshield in right lower corner.

OTHER NOTABLE IMPACT EFFECTS:

Vehicle slid sideways approximately 18 feet. No fuel tank damage or leakage. Bed pulled away from cab on left side approximately 6 inches.

TABLE 3-7 EXTERIOR STATIC CRUSH FOR SIDE IMPACTOR

		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	37.0 ~~35.5~~	8.0	4.0	1.4	0.9	0.9	0.8	1.0	1.0	1.7	2.6	3.8	3.6	3.2	1.7	2.1	2.7	3.4
Mid-Stack Level	27.0 ~~25.5~~	2.5	0.7	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.6	0.5	0.7	2.2	0.4	0.1	0.2
Bumper Level	22.0 ~~20.5~~	2.5	1.2	0.5	0.3	0.2	0.2	0.15	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	1.5	2.2

* Heights measured above ground level.
** Impact Side

APPENDIX A

PHOTOGRAPHIC COVERAGE

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

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

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

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

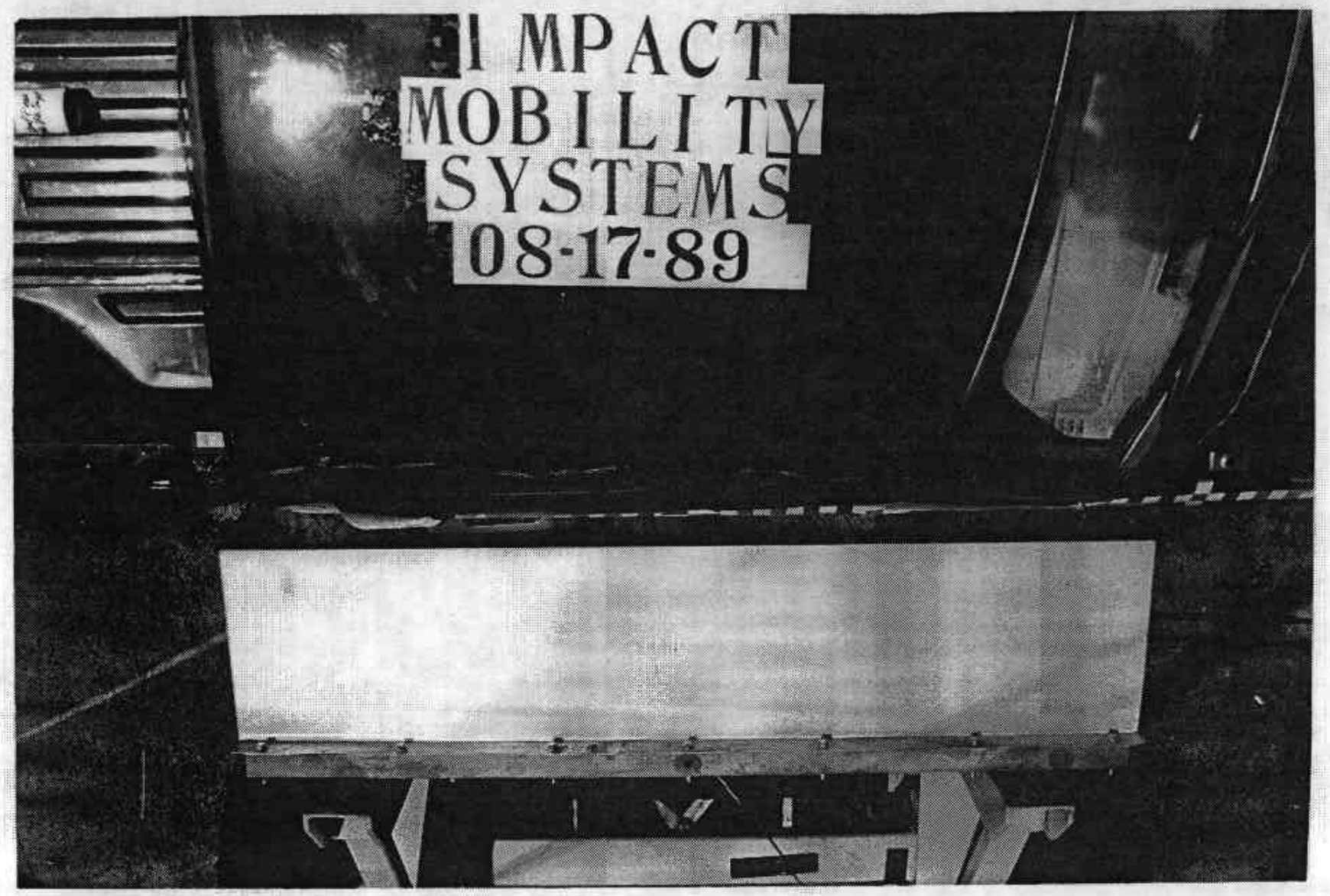


FIGURE A-5 TEST VEHICLE AND MDB, OVERHEAD VIEW – PRETEST

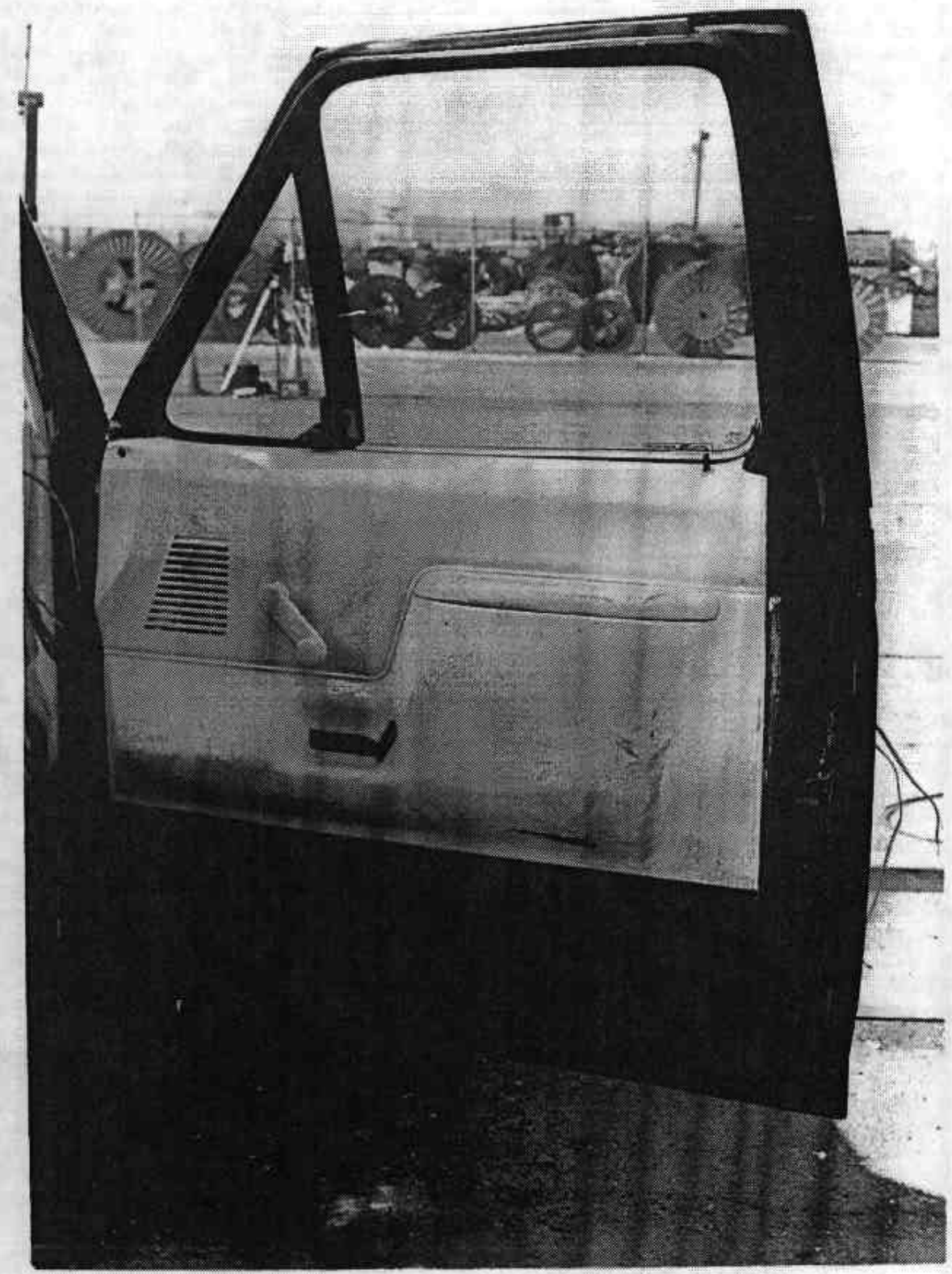


FIGURE A-6 TEST VEHICLE, PASSENGER SIDE DOOR, PRETEST

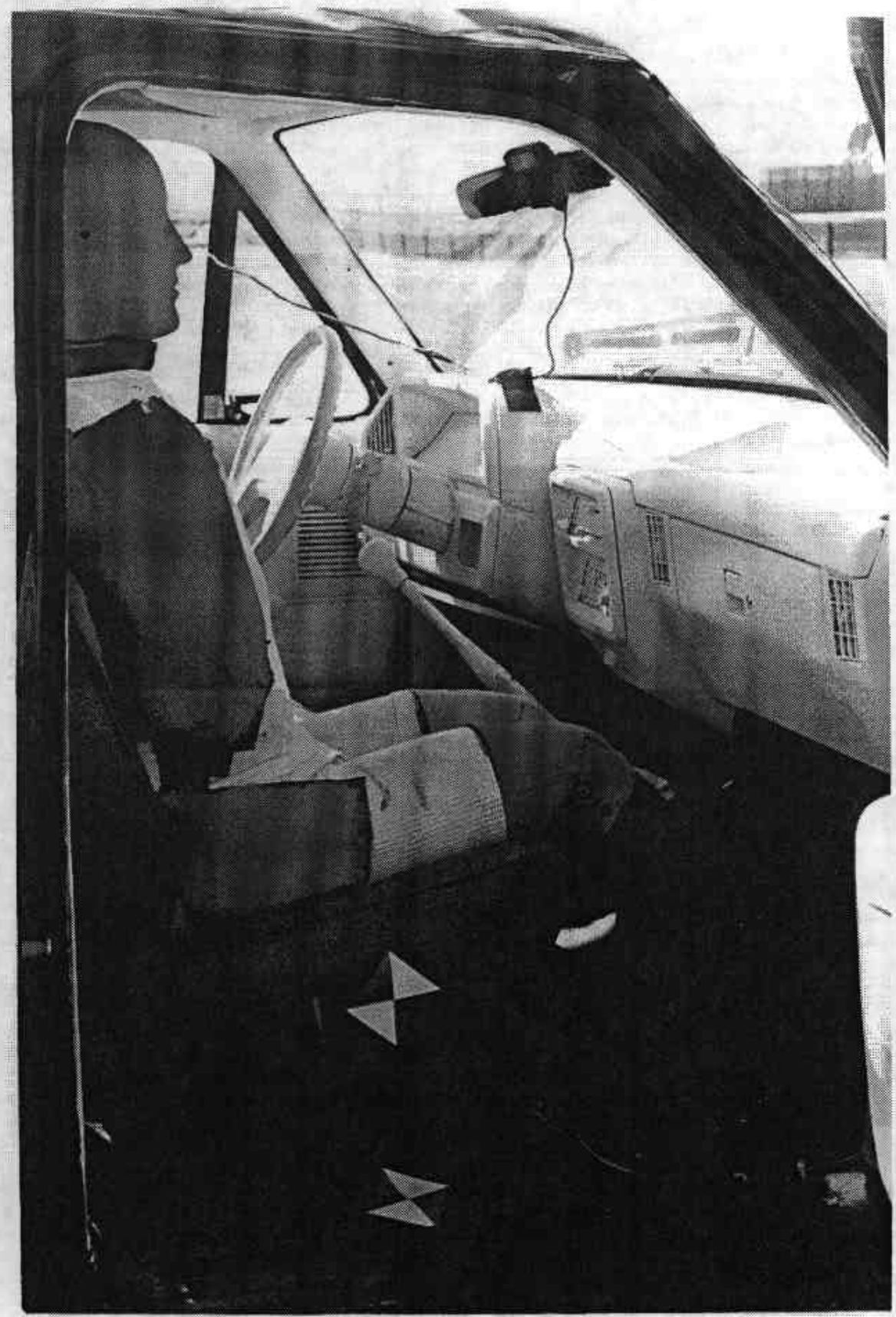


FIGURE A-7 SID IN PASSENGER POSITION, PRETEST

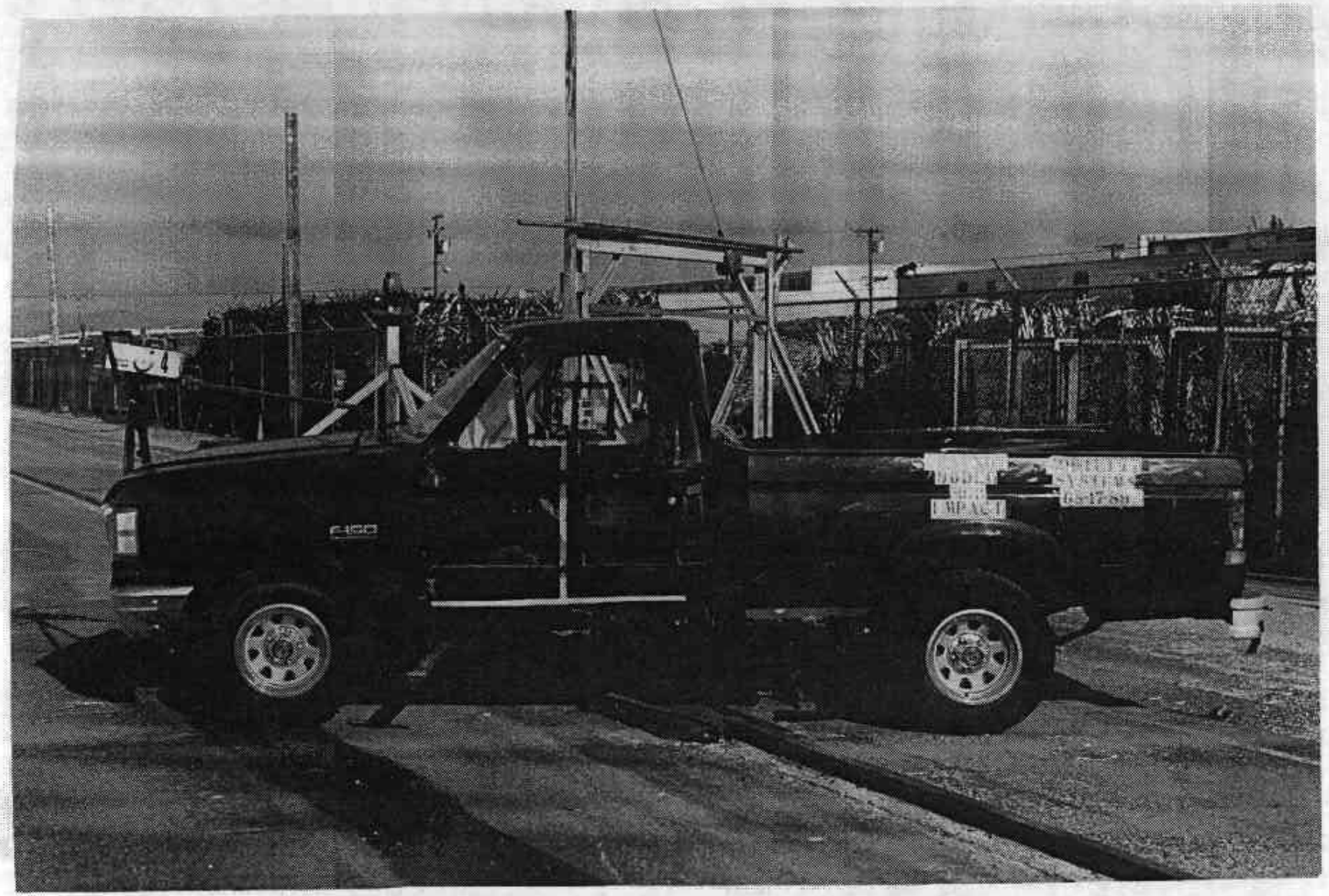


FIGURE A-8 TEST VEHICLE, LEFT SIDE VIEW - POSTTEST

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

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

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

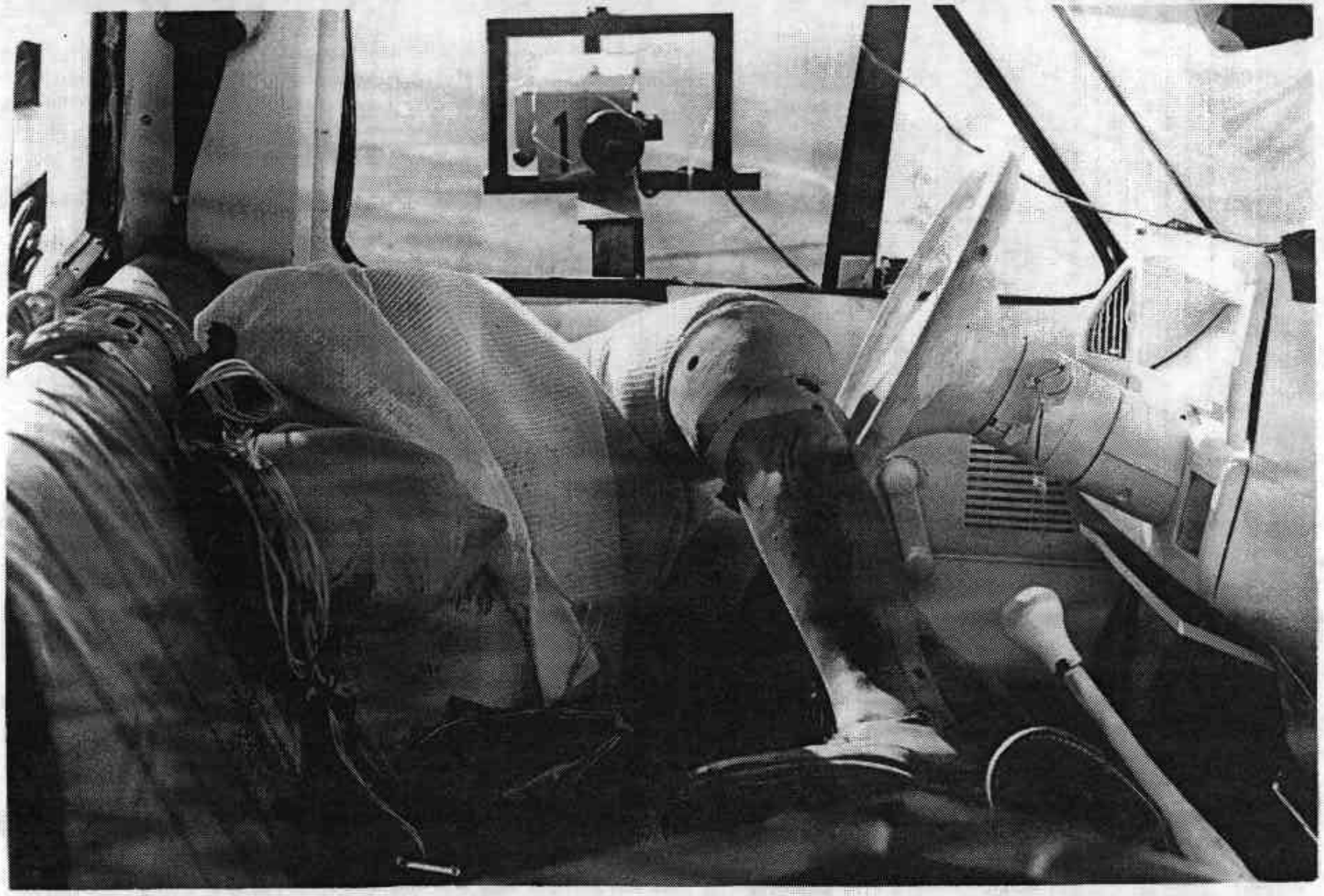


FIGURE A–12 SID FINAL POSITION – POSTTEST

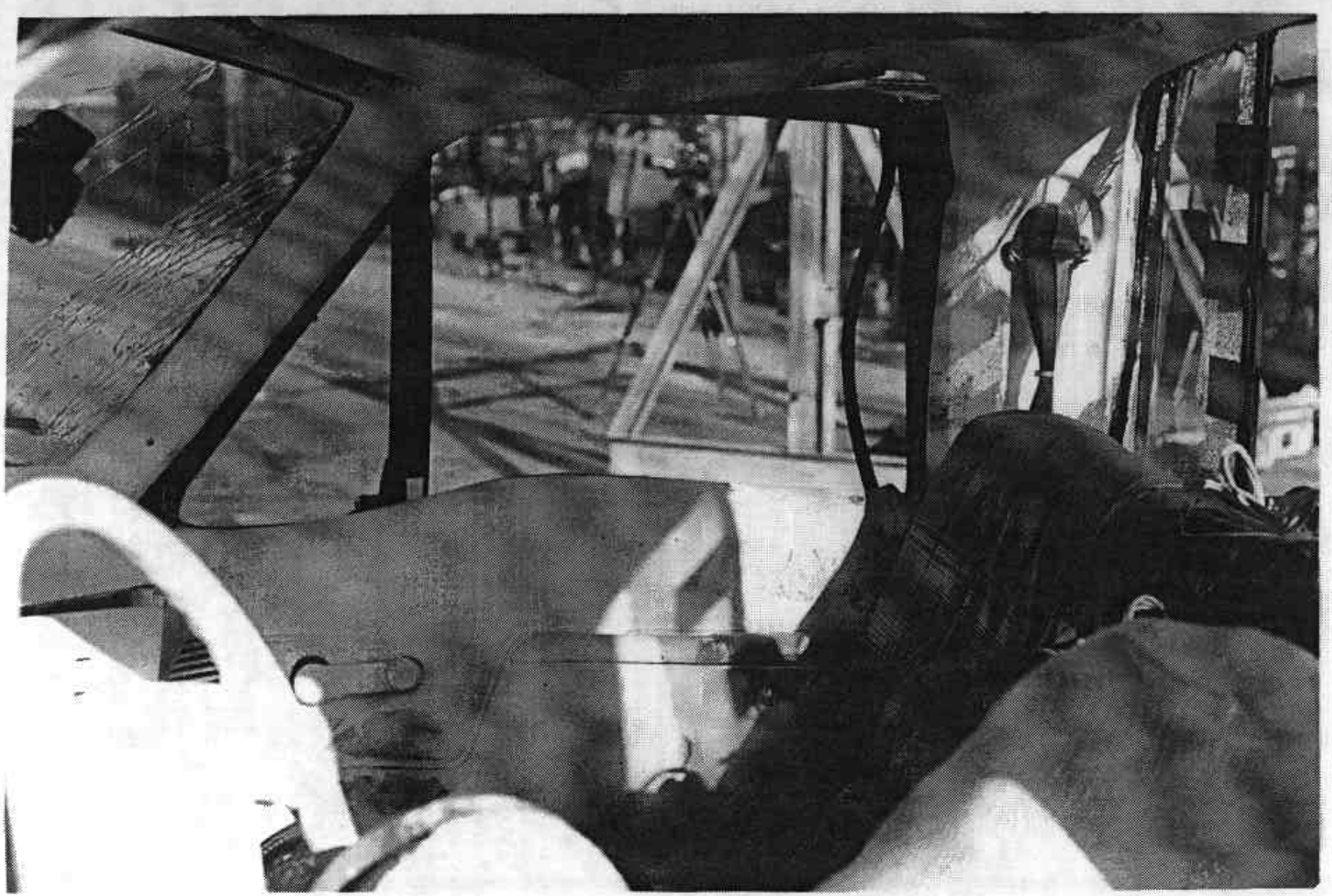


FIGURE A-13 OCCUPANT COMPARTMENT INTERIOR - POSTTEST

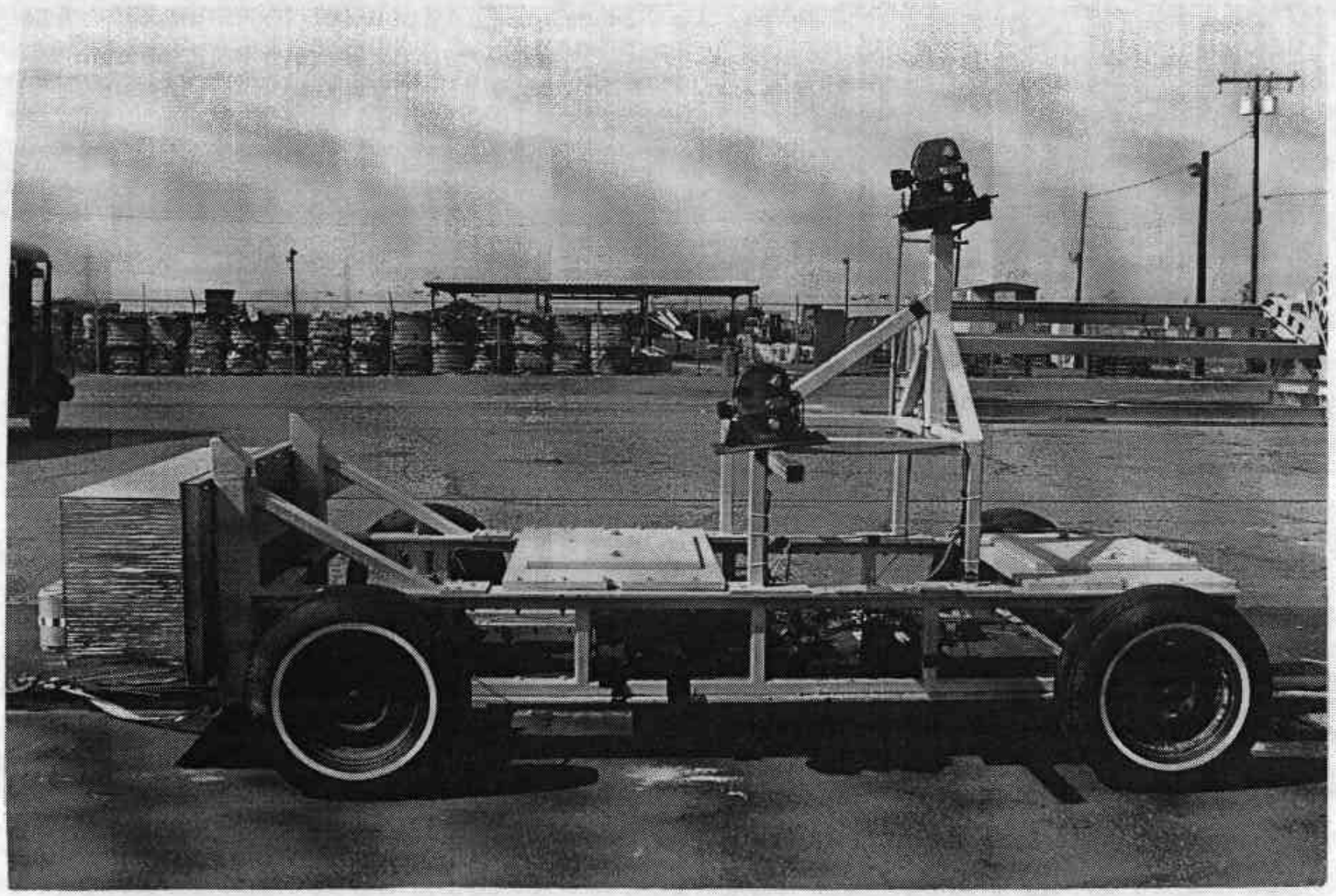


FIGURE A-14 MDB, VIEW NO. 1 - PRETEST

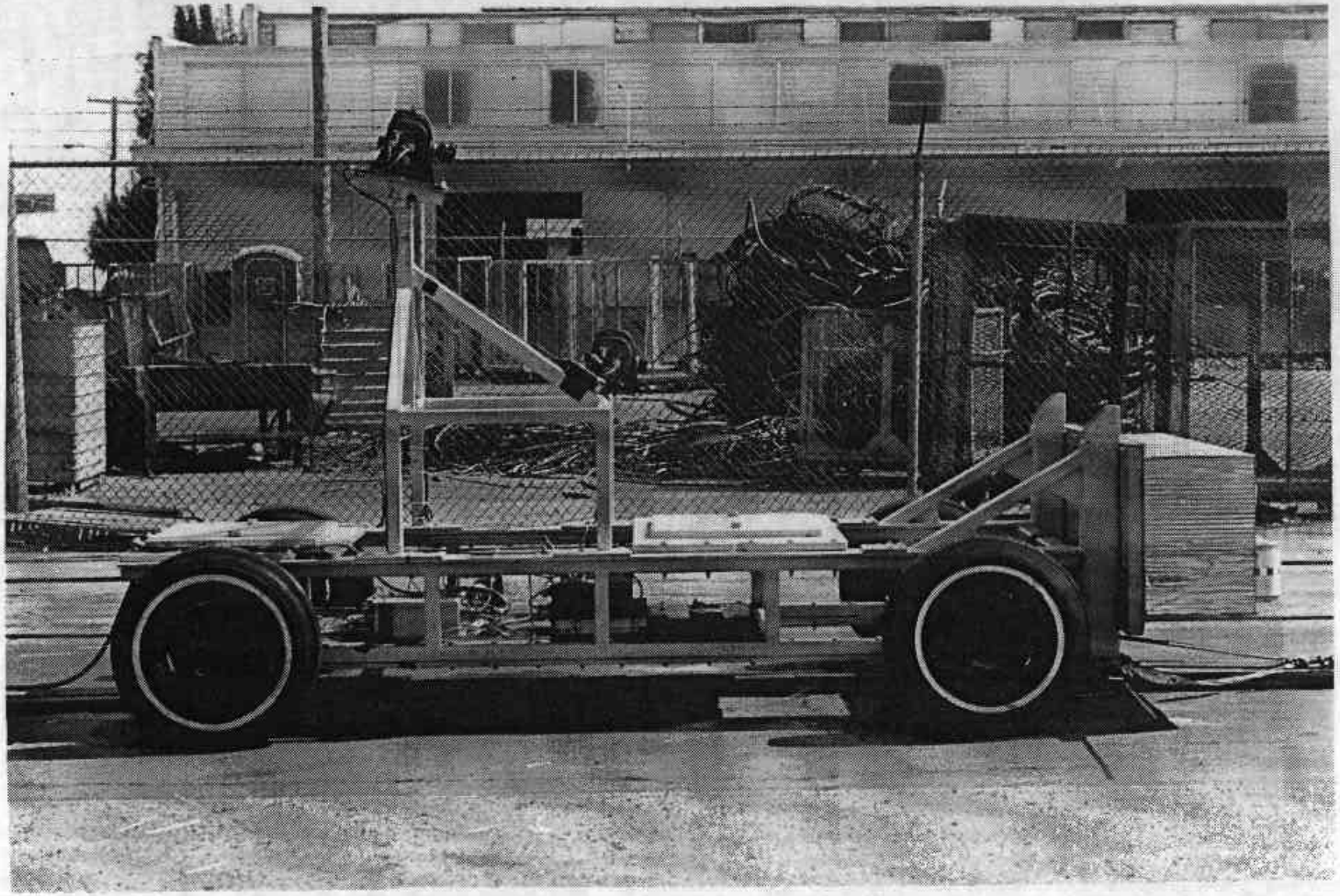


FIGURE A-15 MDB, VIEW NO. 2 - PRETEST

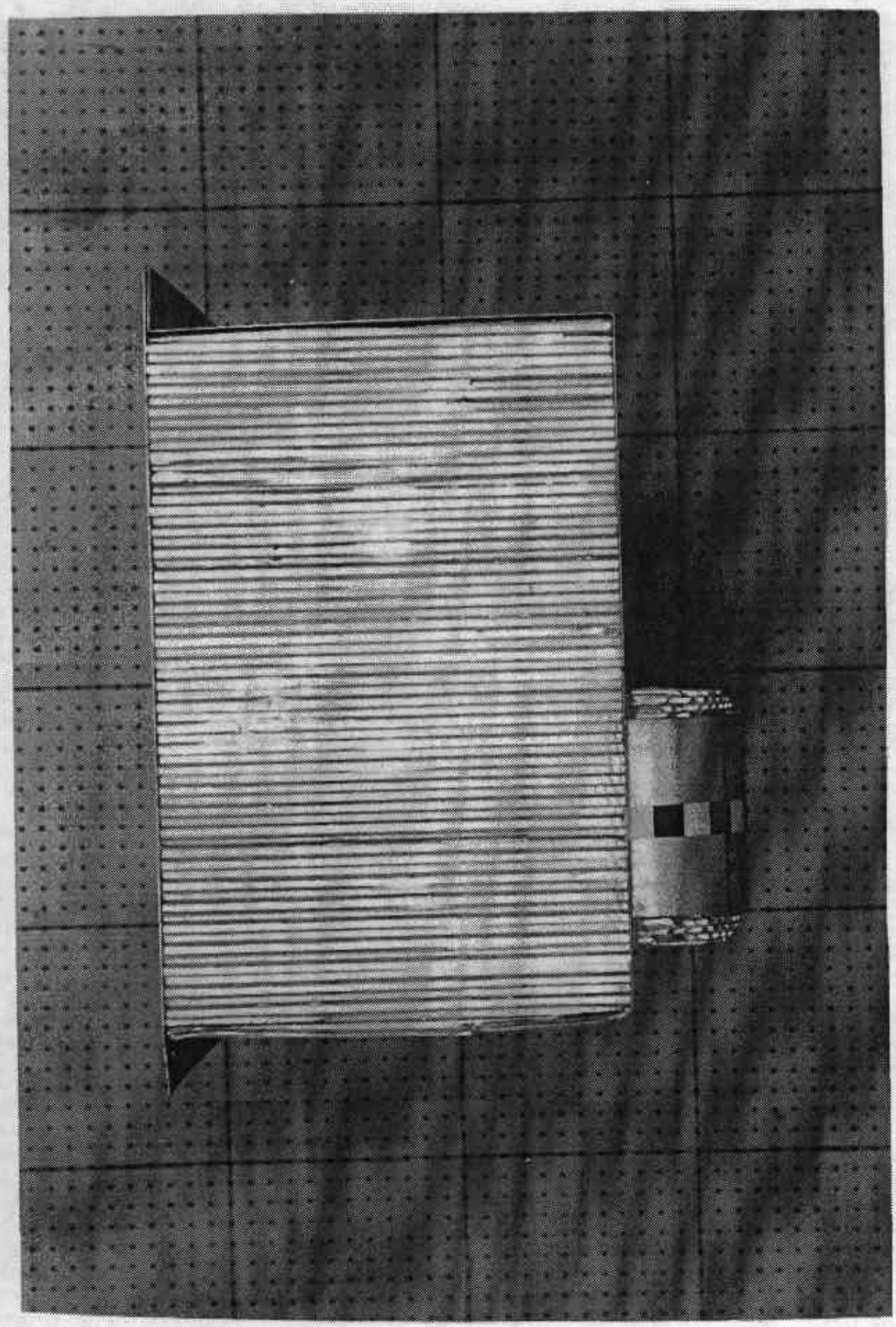


FIGURE A-16 MDB FACE, VIEW NO. 1 - PRETEST

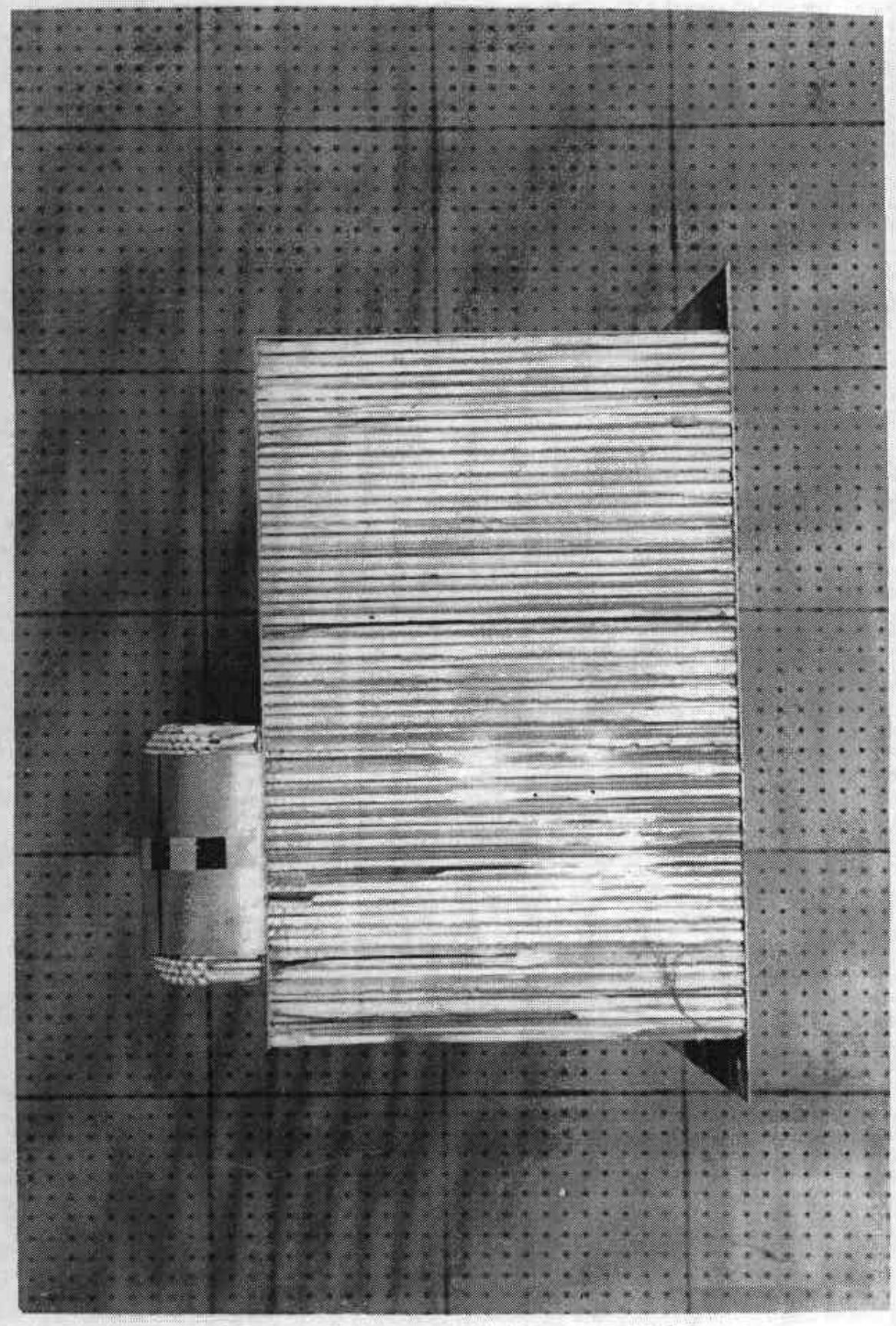


FIGURE A-17 MDB FACE, VIEW NO. 2 - PRETEST

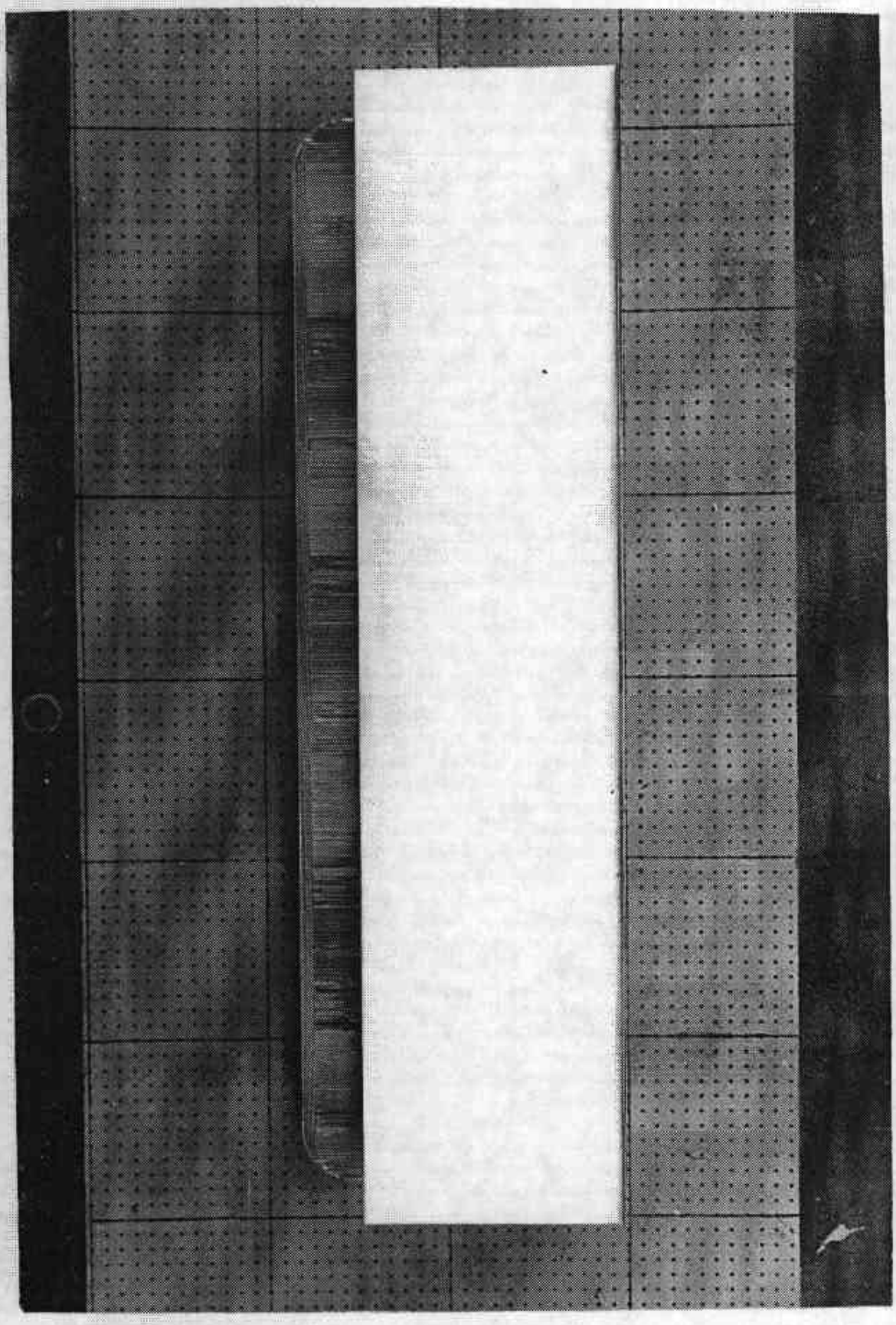


FIGURE A-18 MDB FACE, VIEW NO. 3 - PRETEST

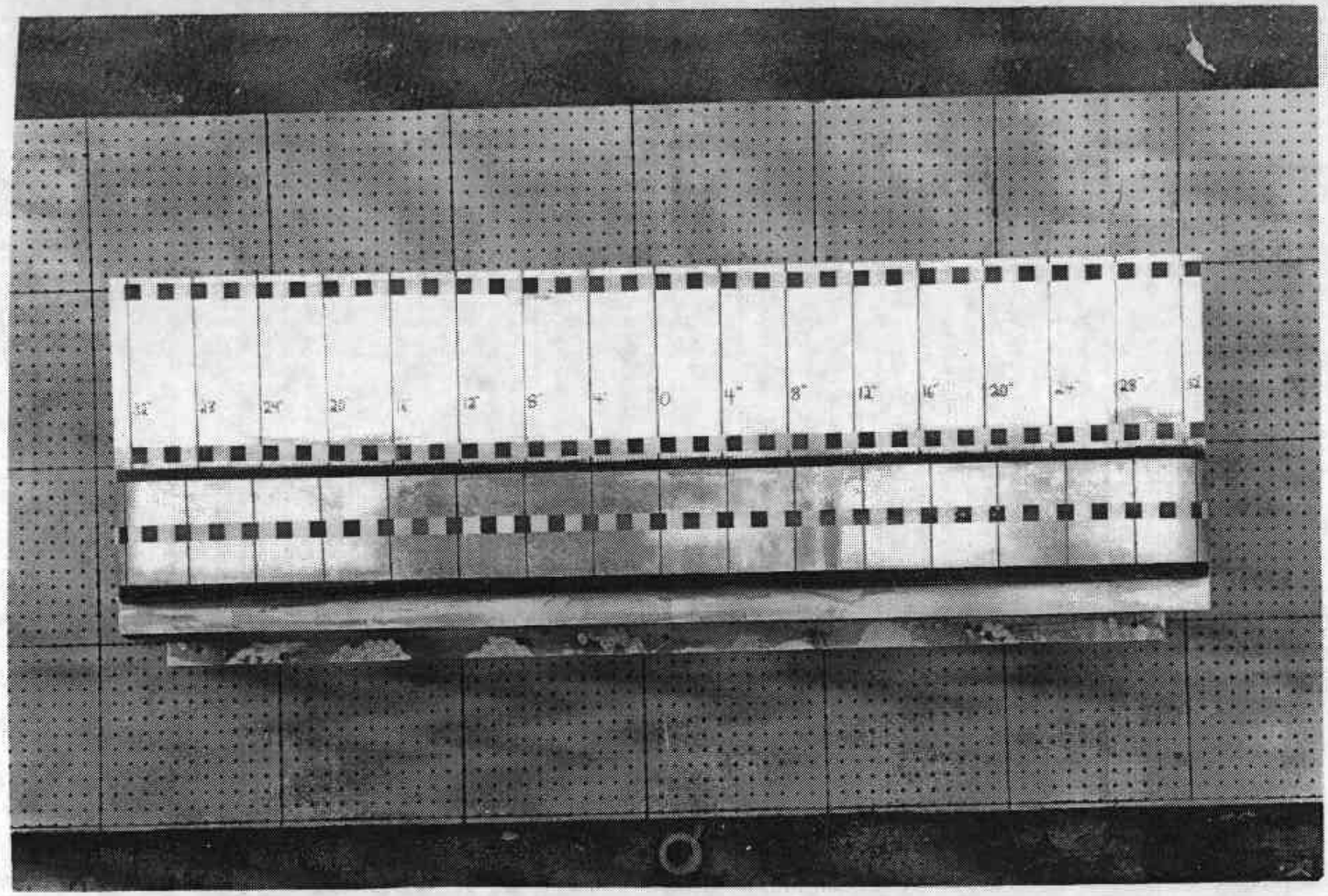


FIGURE A-19 MDB FACE, VIEW NO. 4 - PRETEST

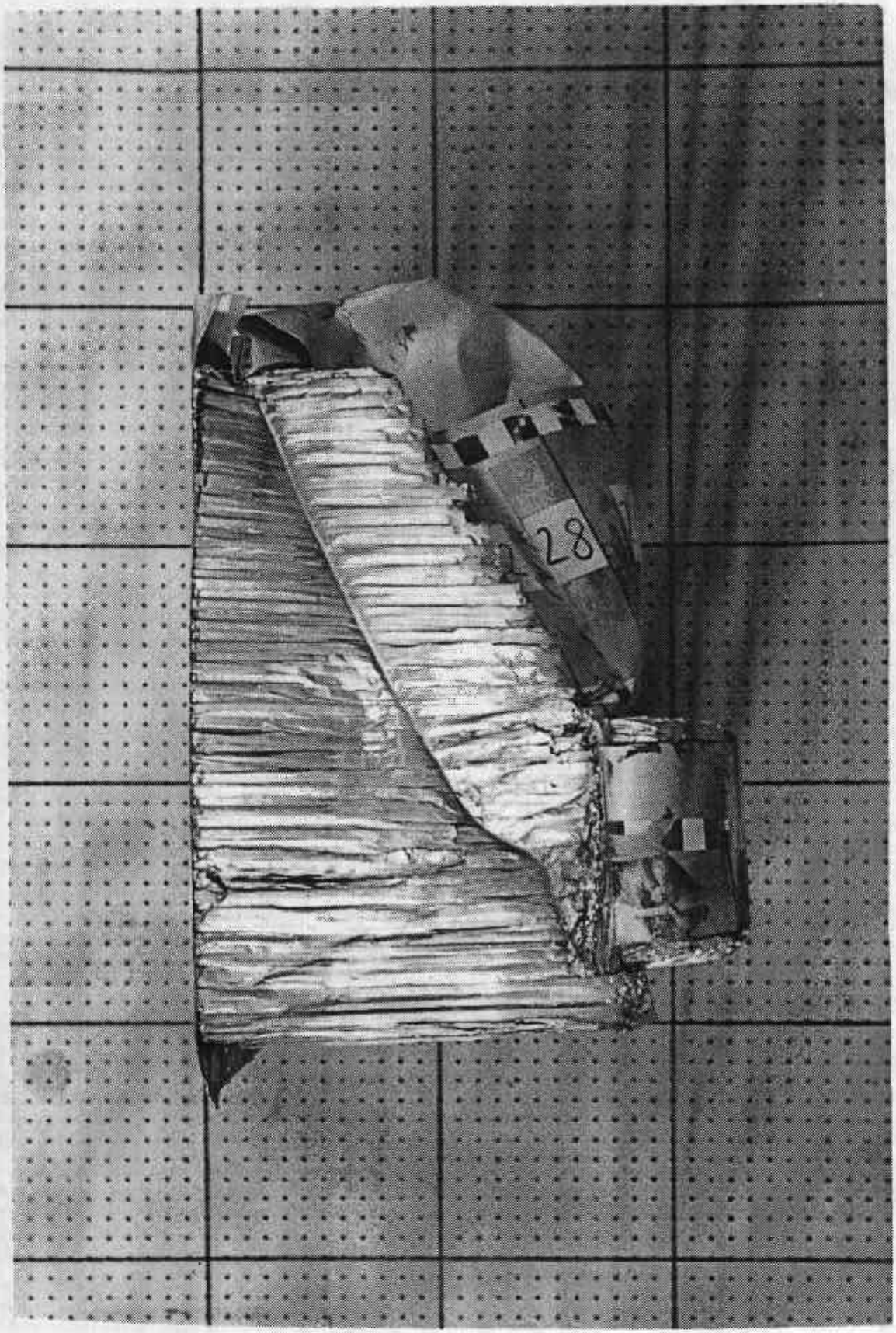


FIGURE A-20 MDB FACE, VIEW NO. 1 - POSTTEST

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

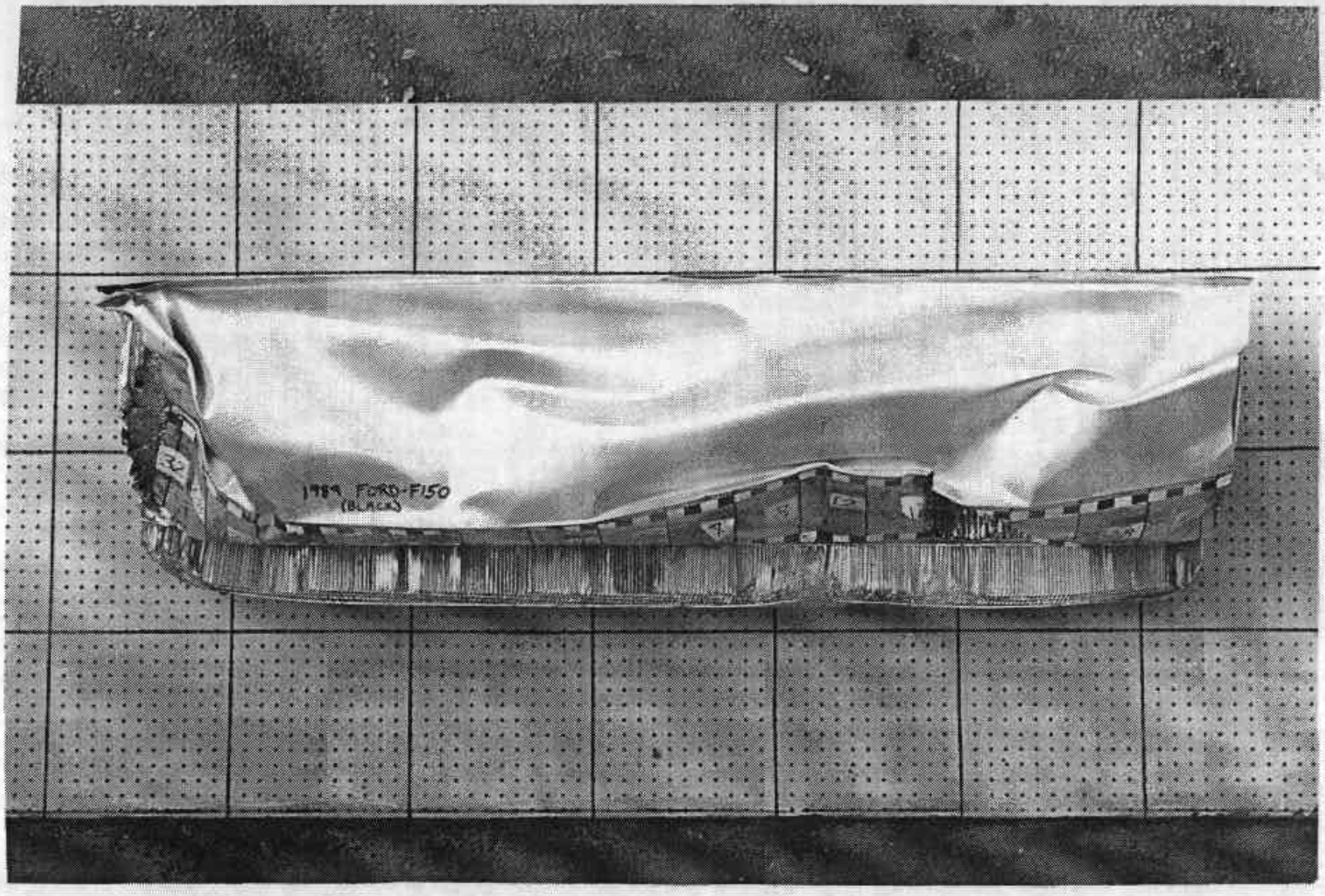


FIGURE A-22 MDB FACE, VIEW NO. 3 - POSTTEST

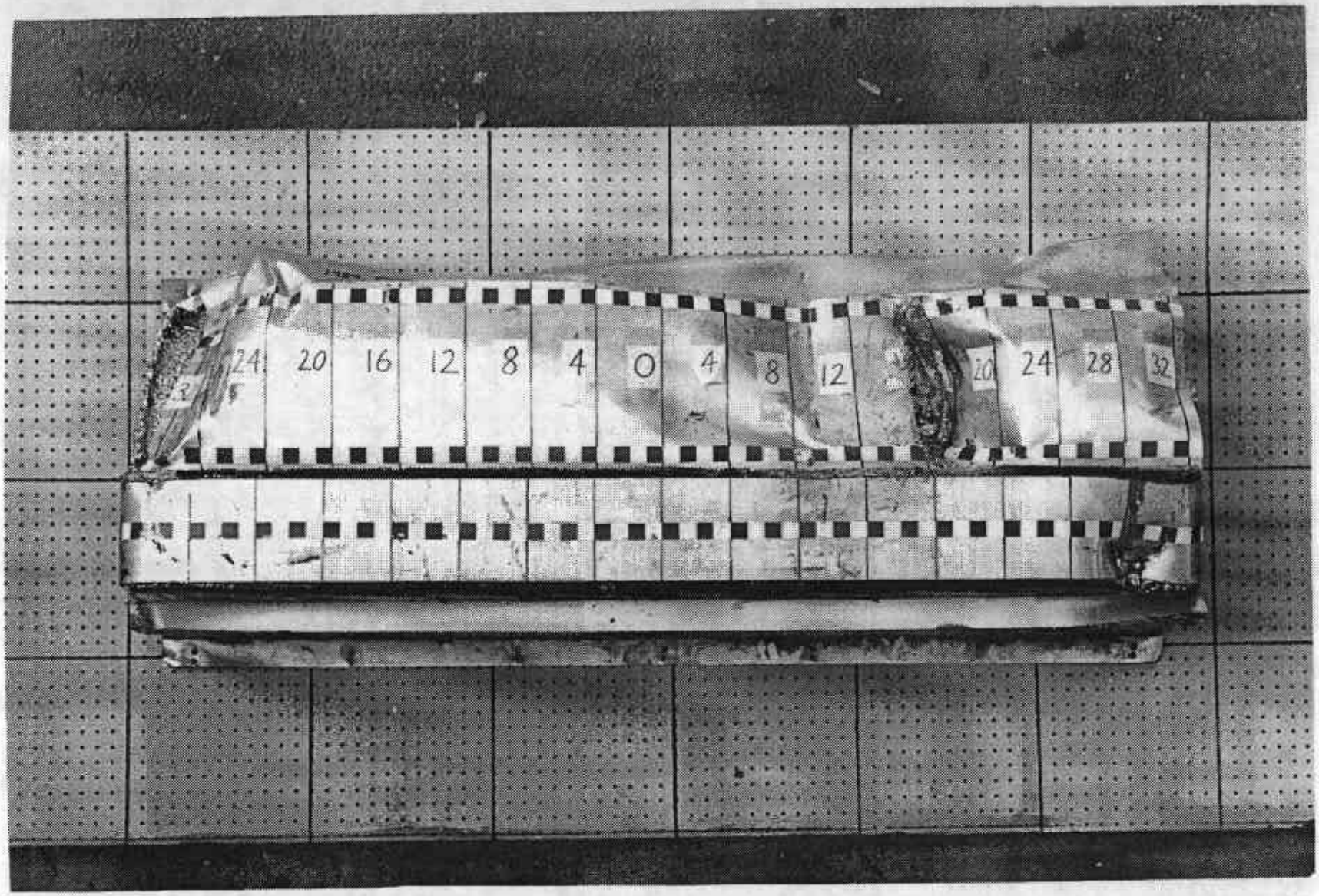
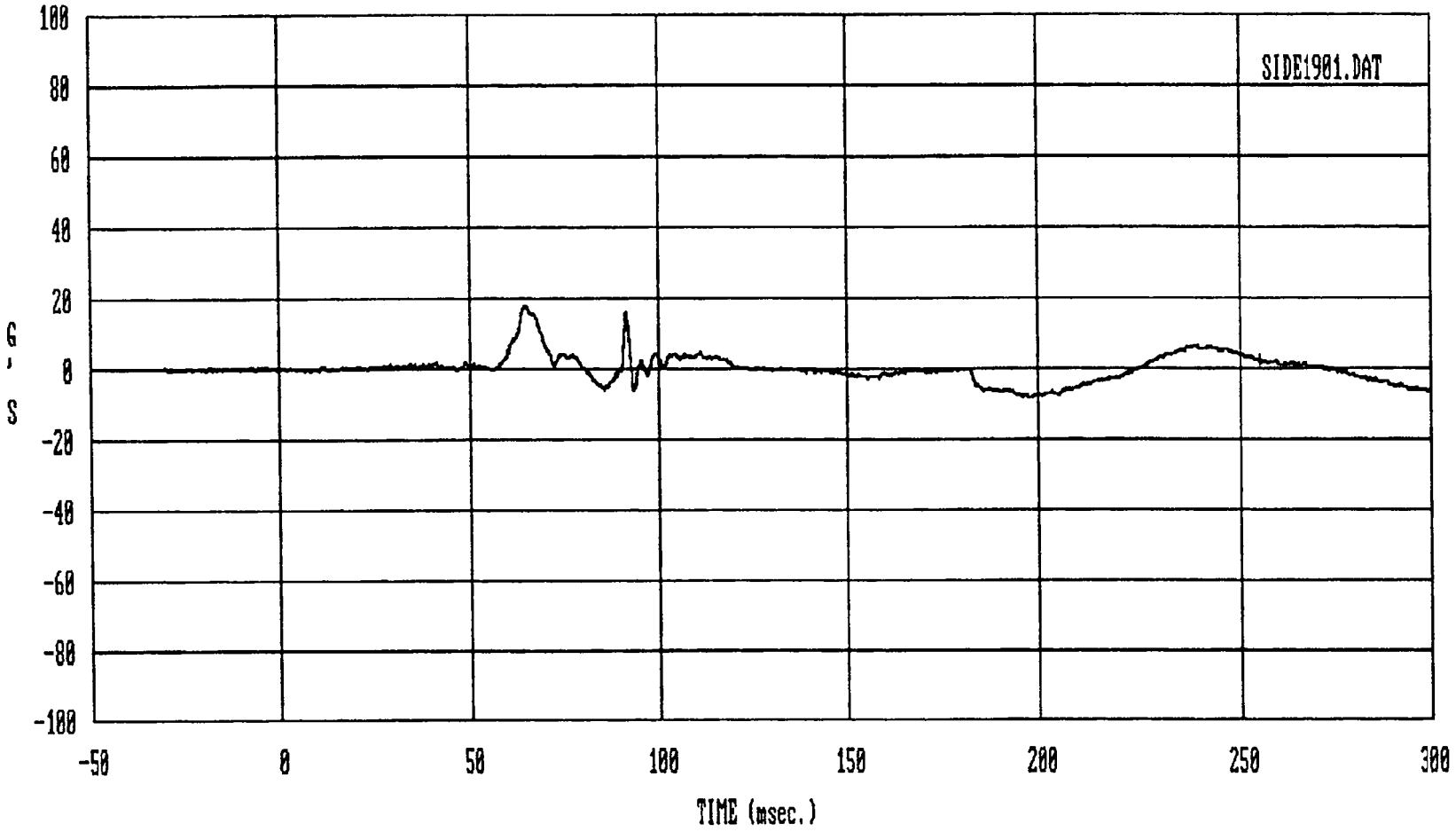


FIGURE A-23 MDB FACE, VIEW NO. 4 - POSTTEST

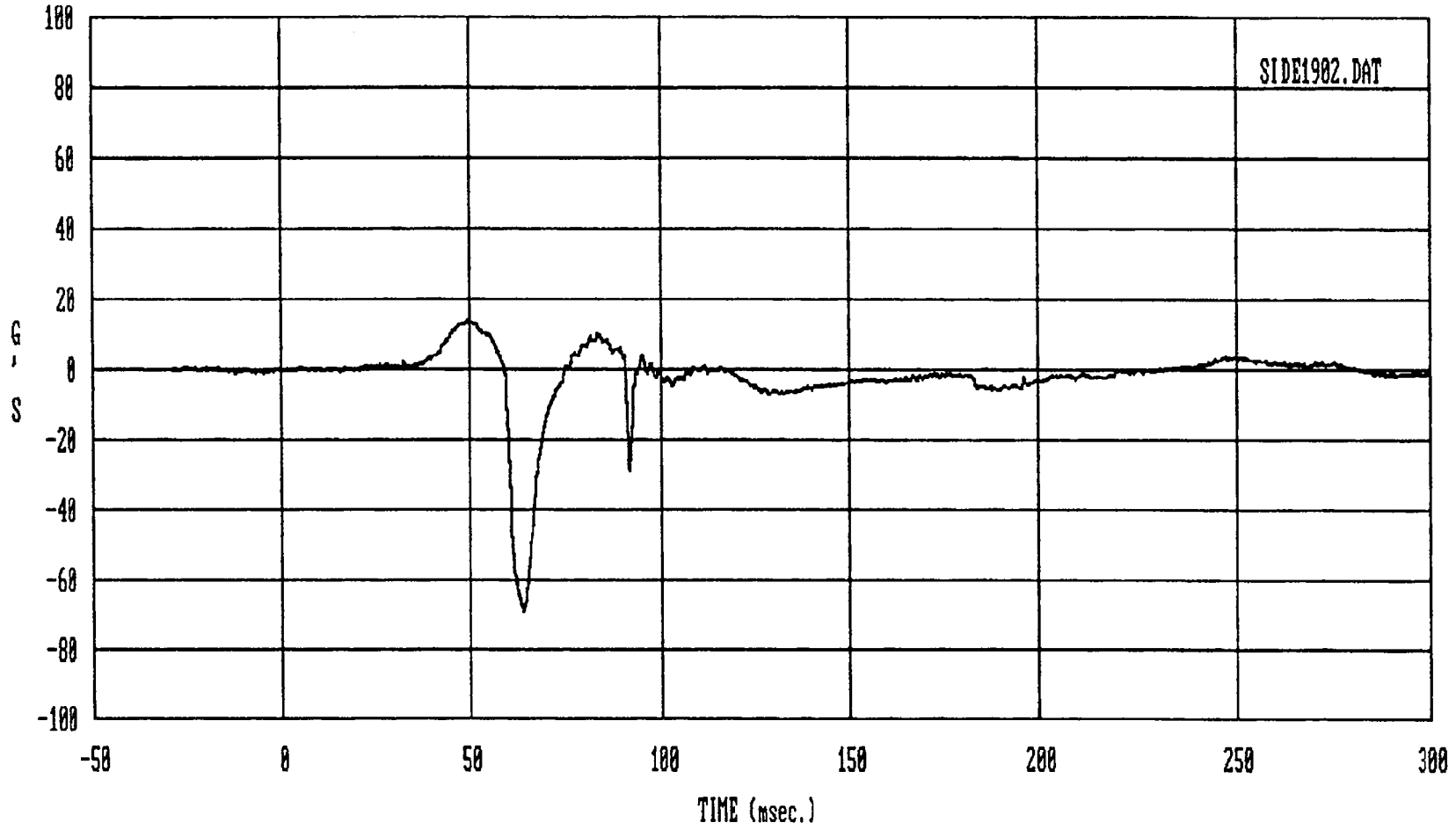
APPENDIX B

DATA PLOTS



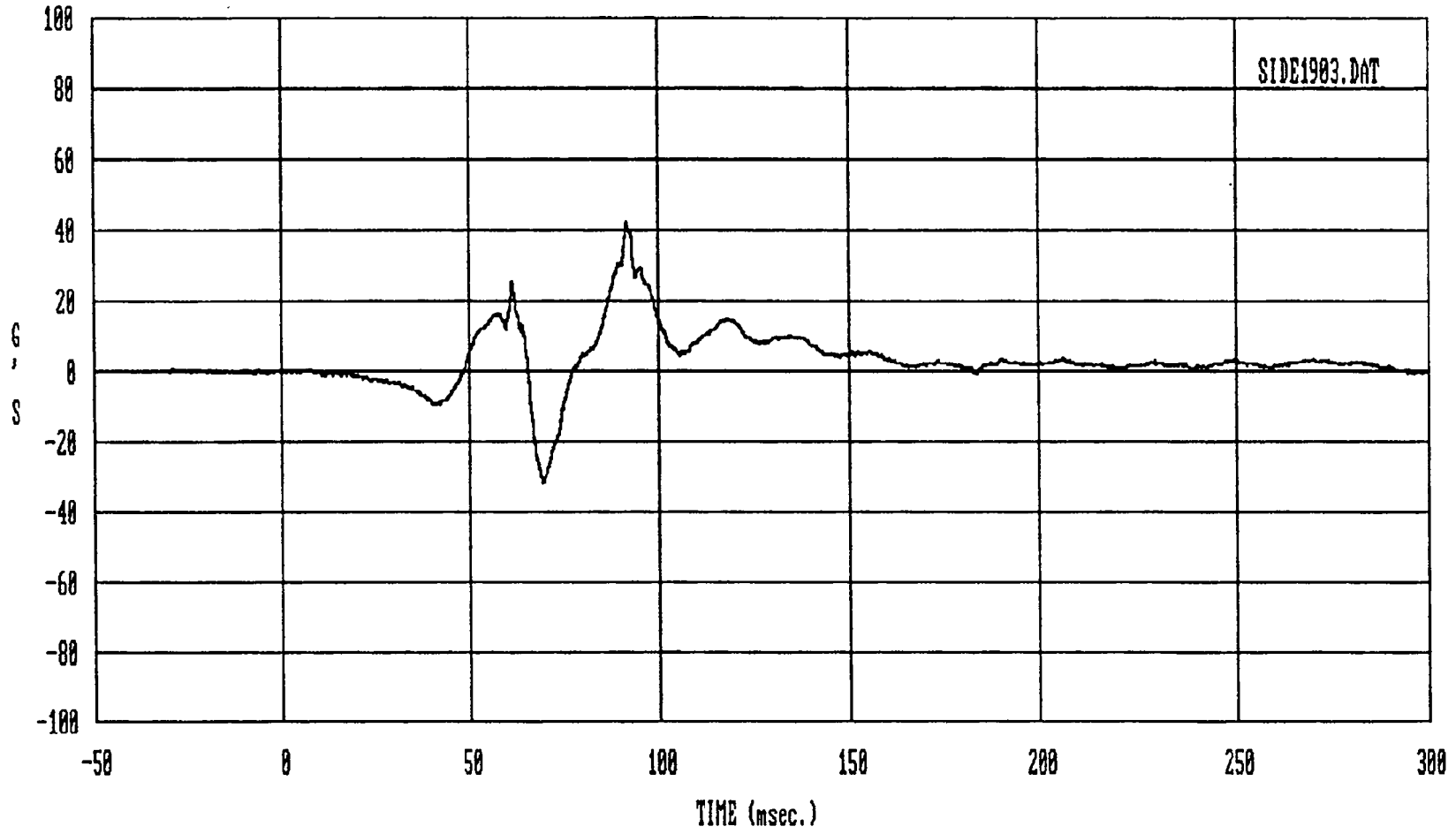
Curve: Pasngr Head acceleration -- X axis Filter: SAE CLASS 1000 Max = 18.224 Min = -8.3598

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



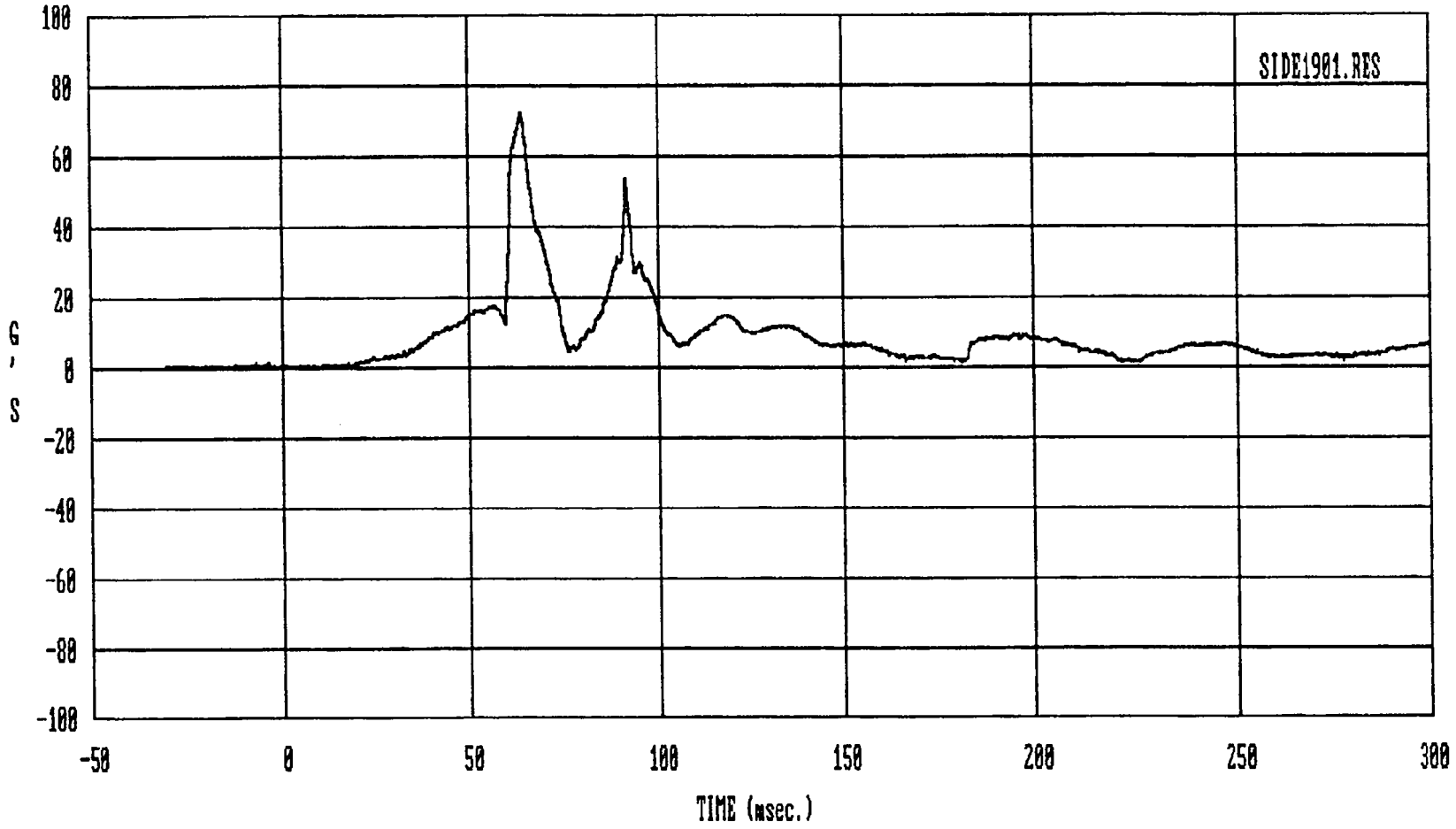
Curve: Pasngr Head acceleration -- Y axis Filter: SAE CLASS 1000 Max = 14.224 Min = -70.776

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



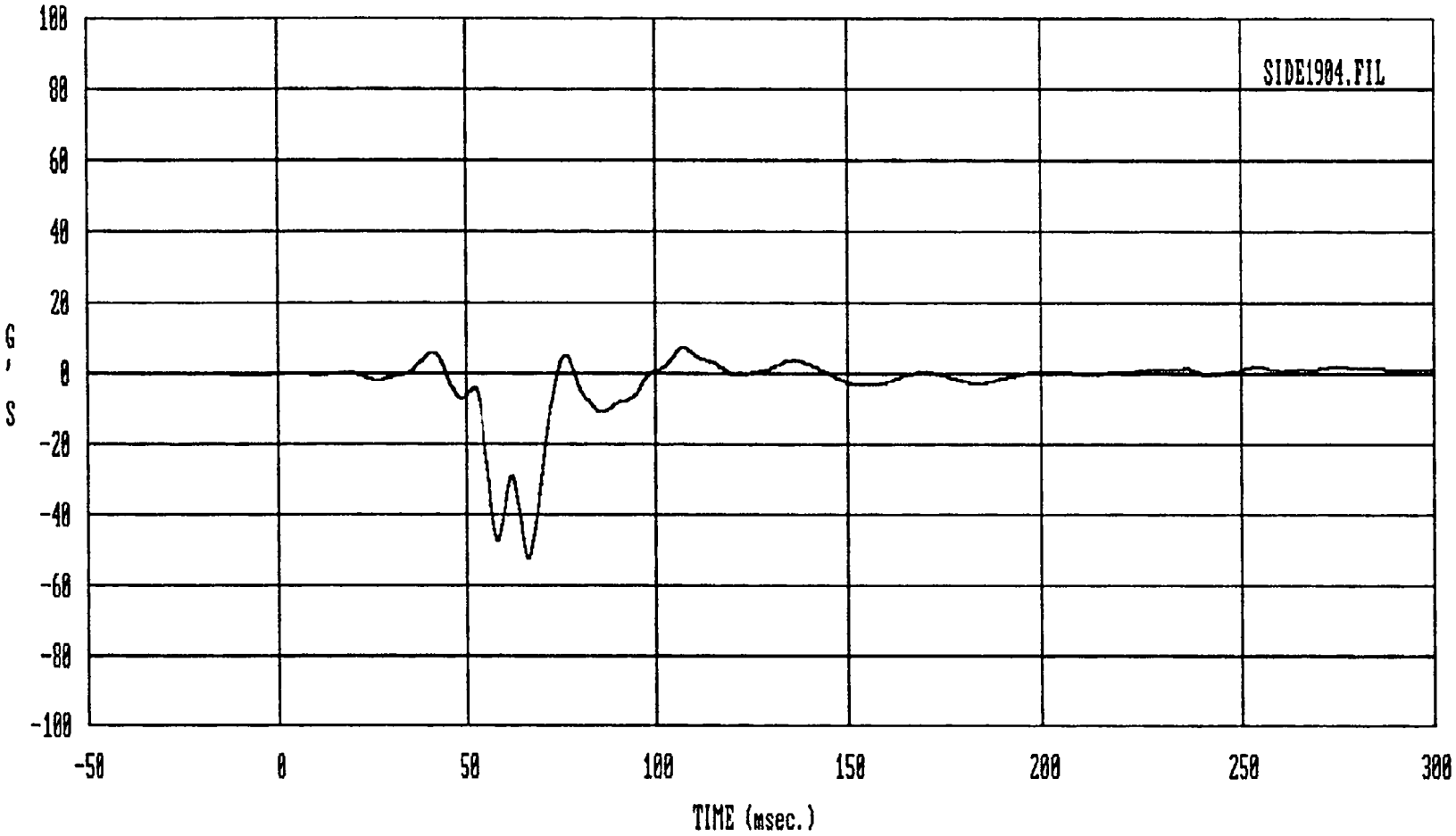
Curve: Pasngr Head acceleration -- Z axis Filter: SAE CLASS 1000 Max = 45.960 Min = -31.898

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



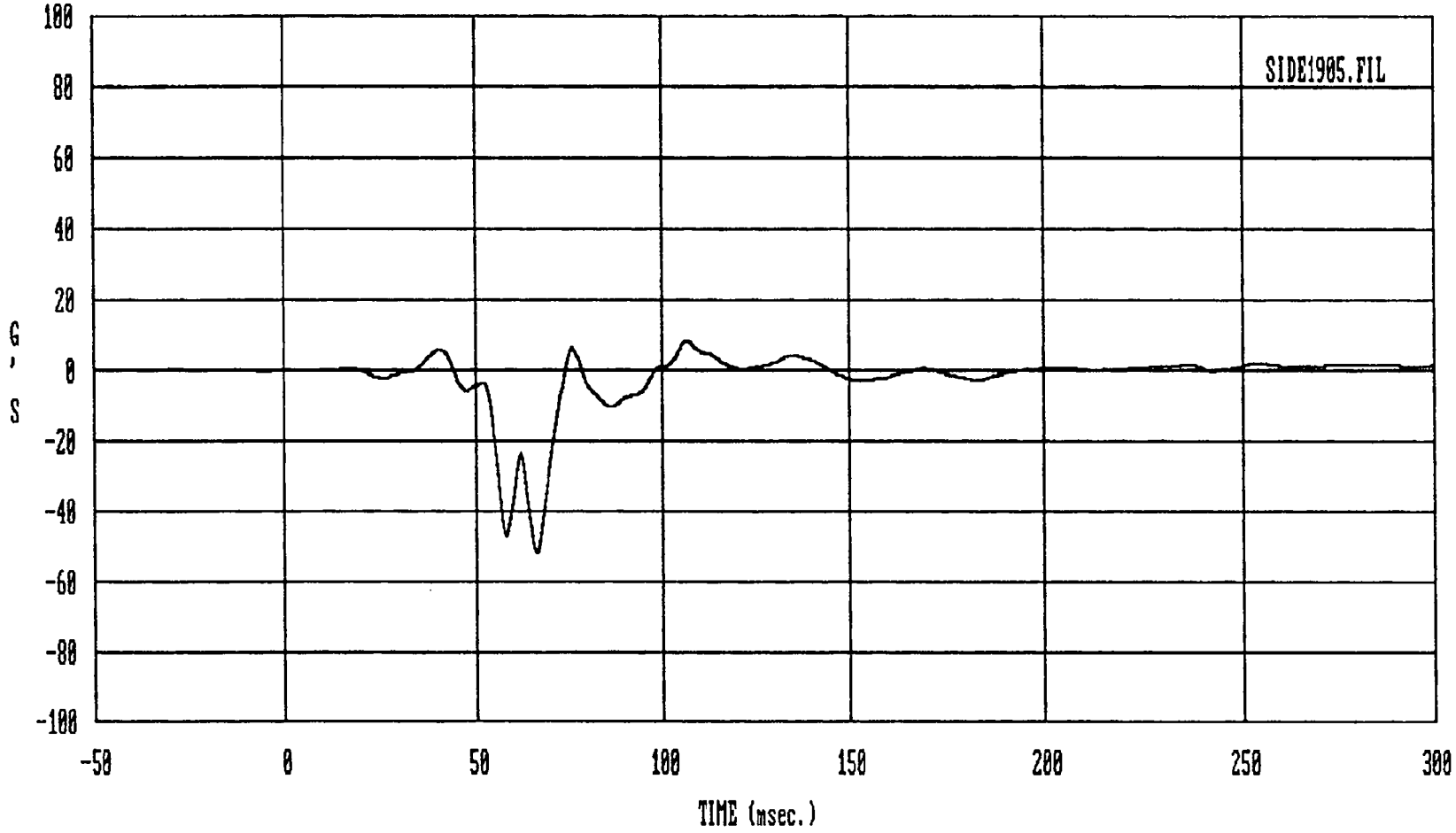
Curve: Pasngr Head resultant acceleration Filter: SAE CLASS 1000 Max = 73.588 Min = .00000

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



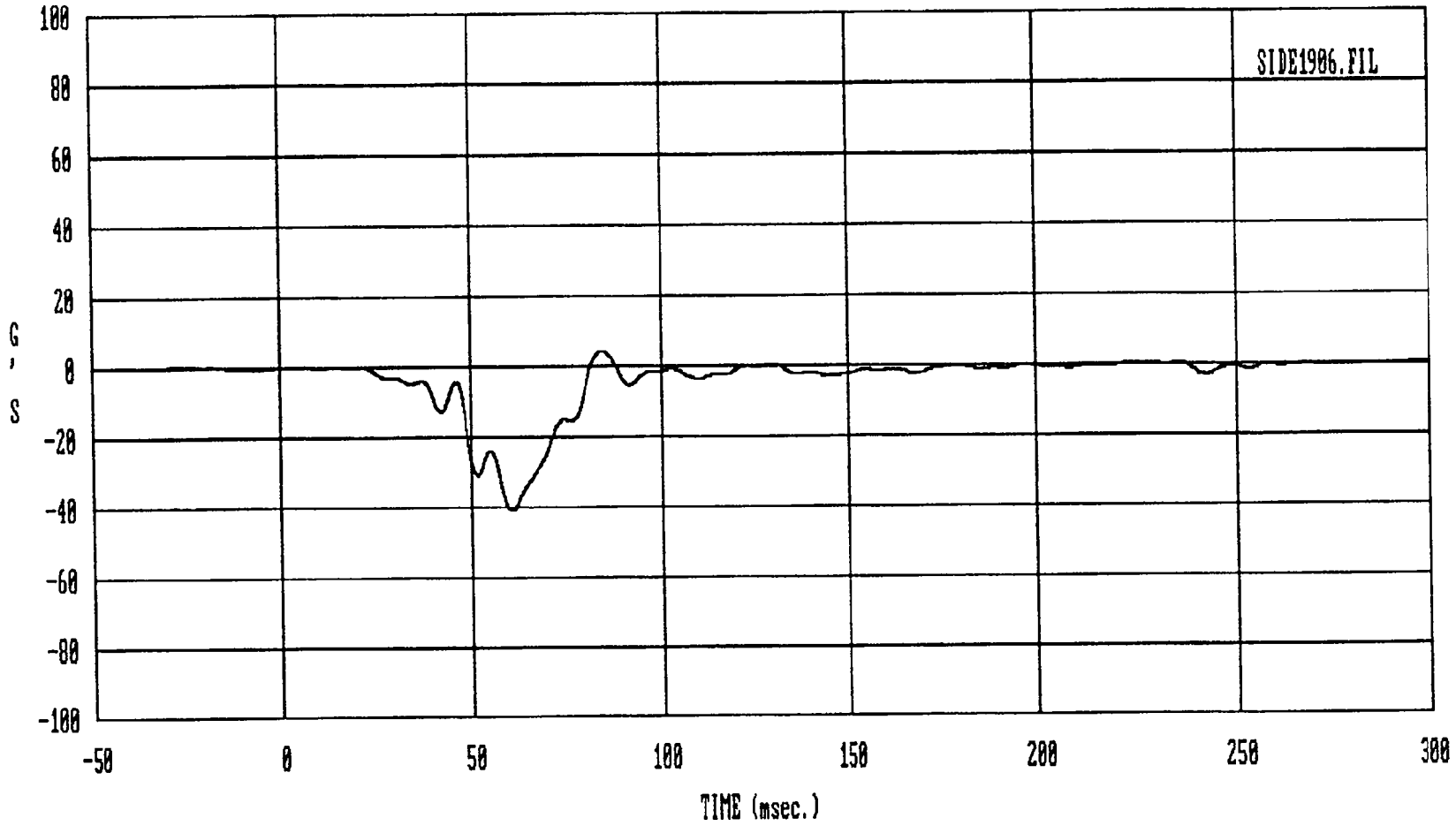
Curve: Pasngr Upper Spine 1 acceleration — Primary Filter: FIR 100 Max = 7.4028 Min = -52.534

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



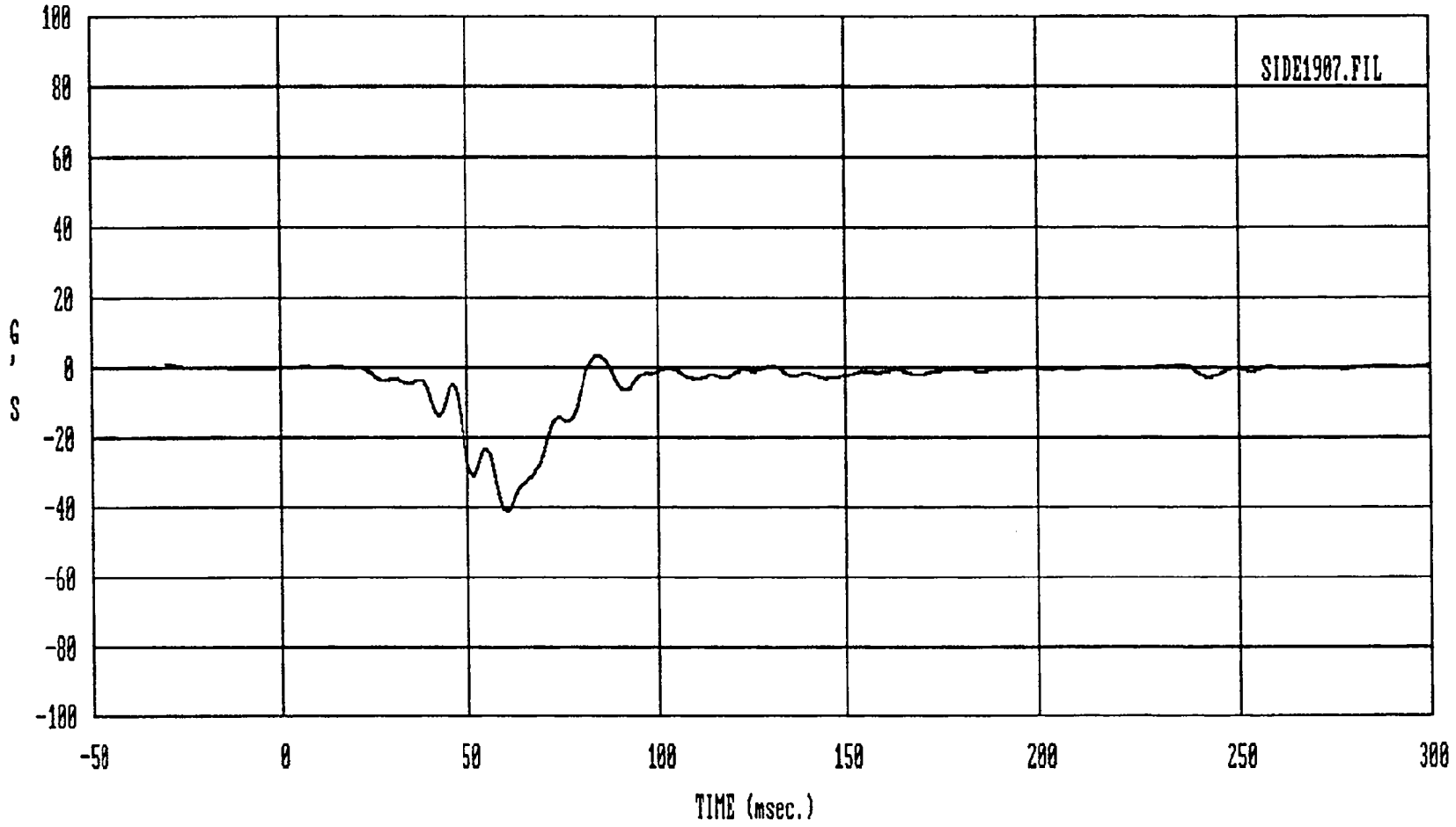
Curve: Pasngr Upper Spine 2 acceleration — Redundant Filter: FIR 100 Max = 8.1392 Min = -51.717

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



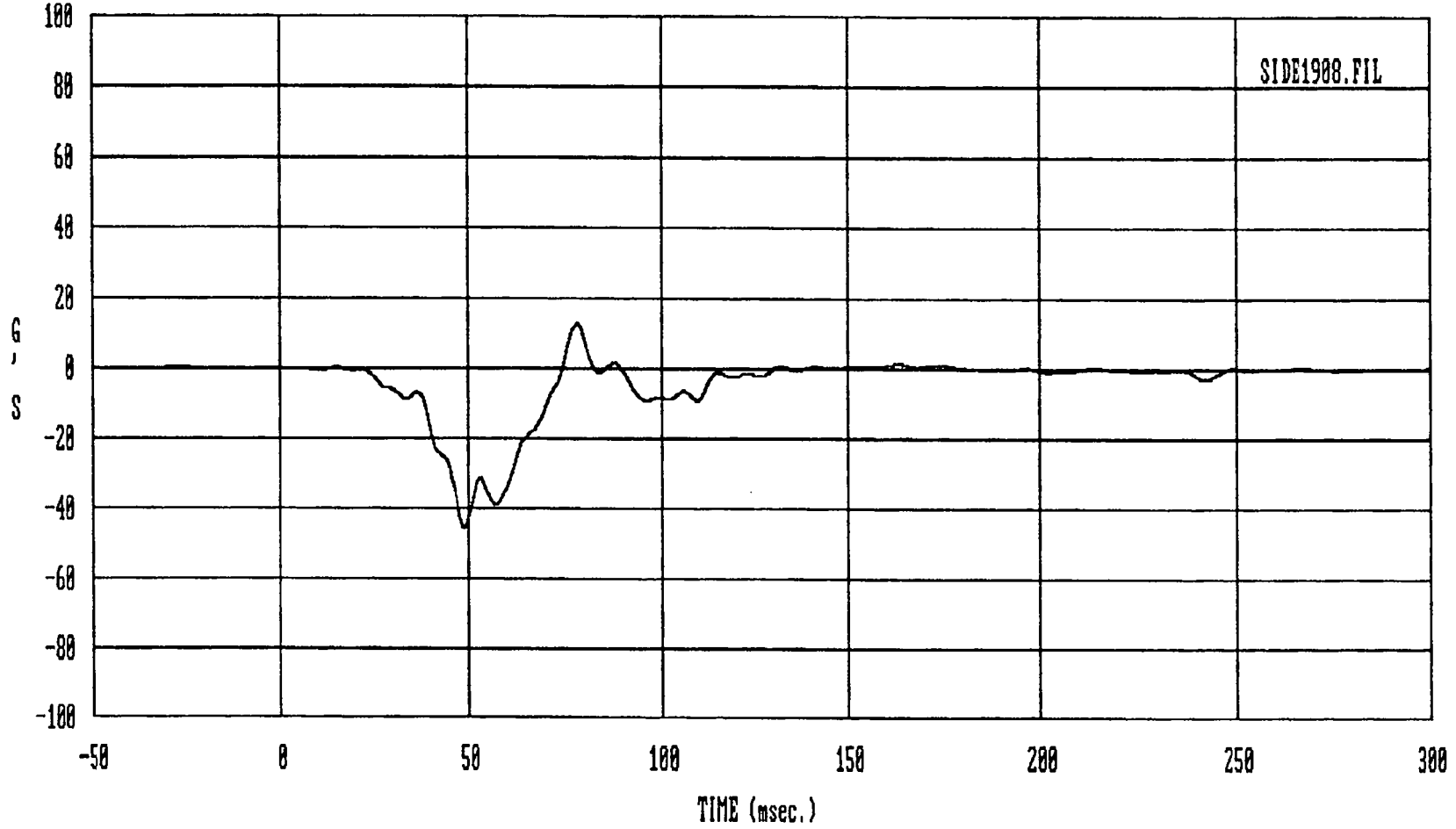
Curve: Pasngr Upper Rib 1 acceleration — Primary Filter: FIR 100 Max = 4.3765 Min = -40.884

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



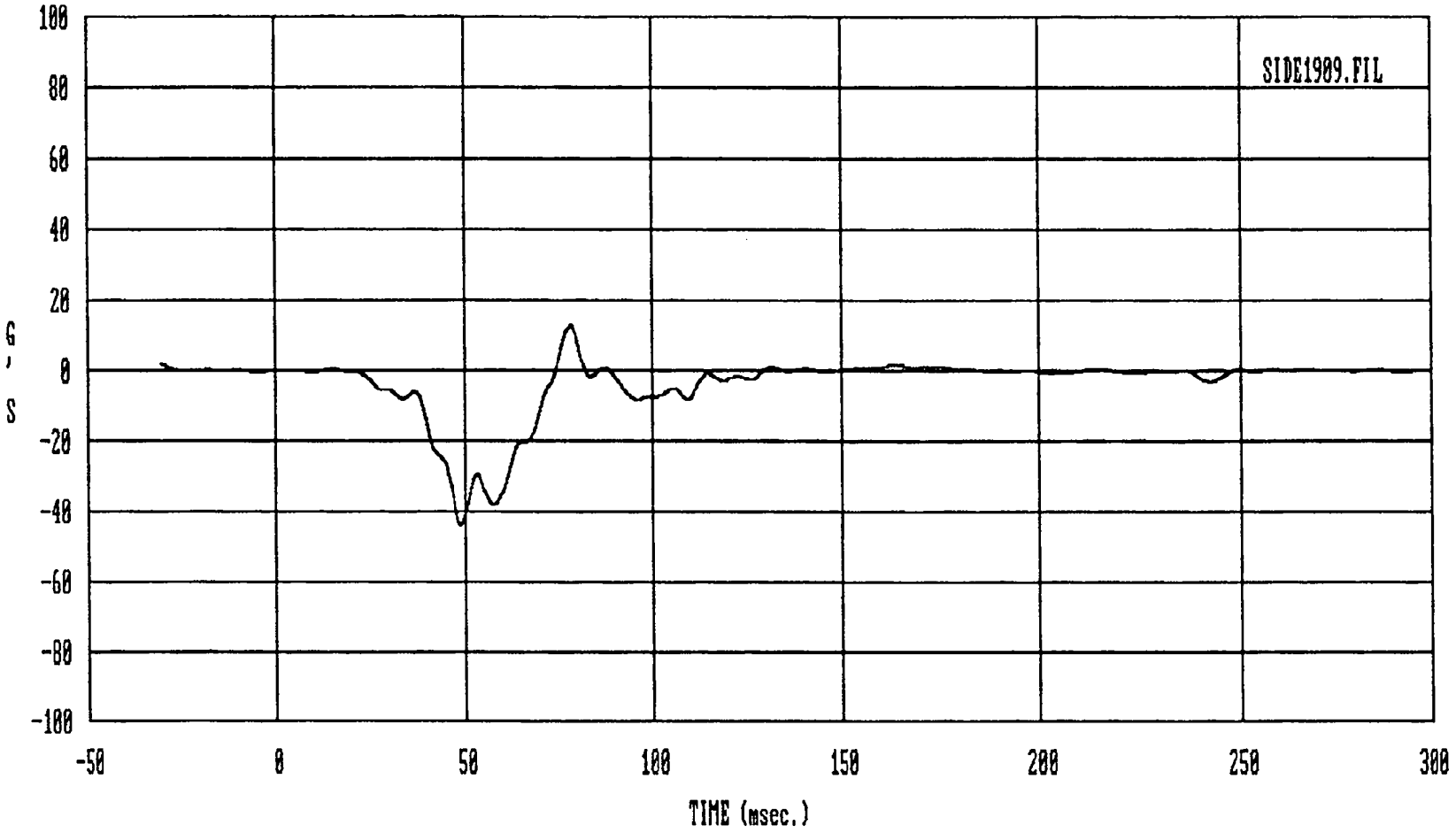
Curve: Pasngr Upper Rib 2 acceleration — Redundant Filter: FIR 100 Max = 3.4917 Min = -41.168

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



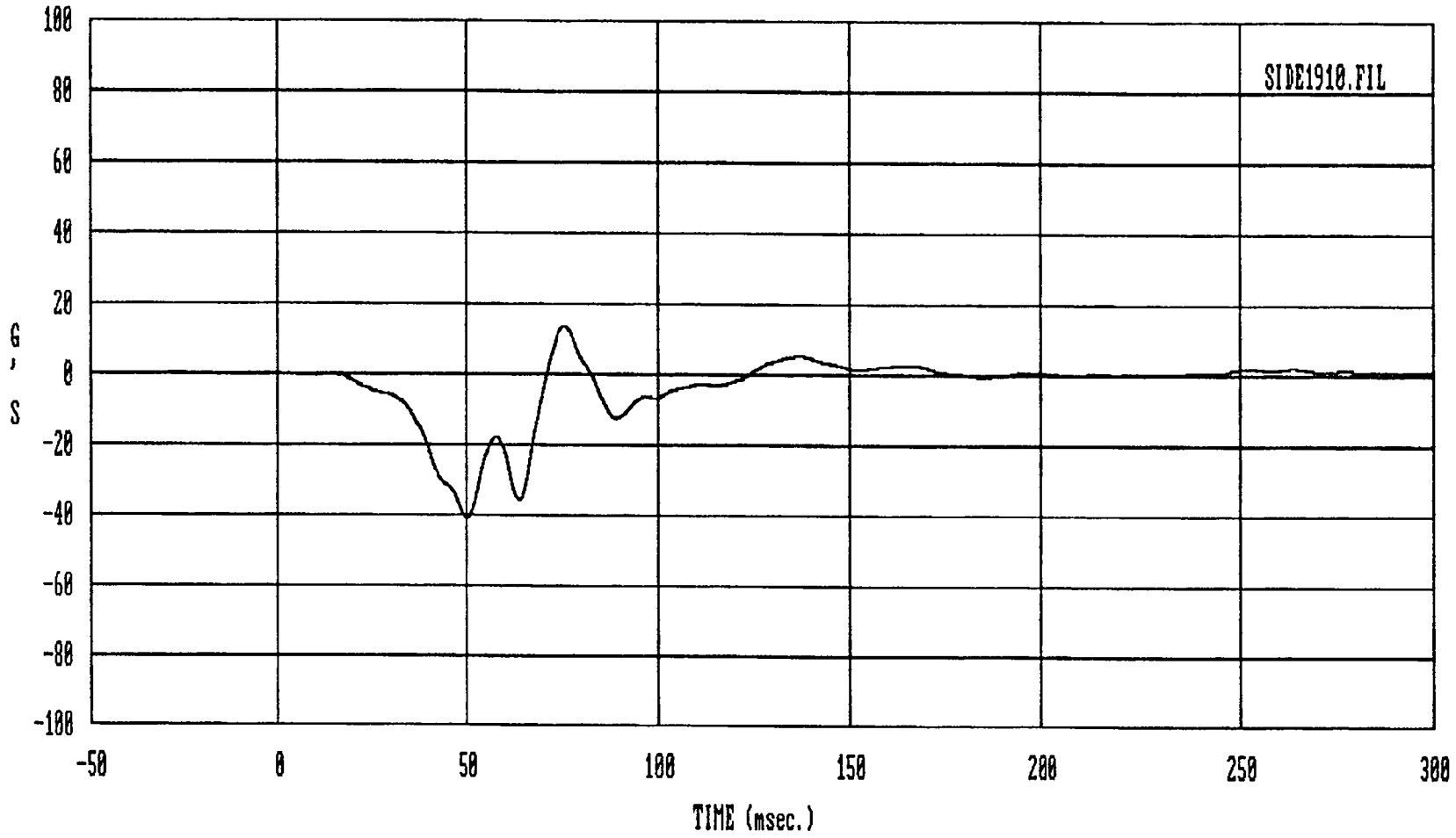
Curve: Pasngr Lower Rib 1 acceleration — Primary Filter: FIR 100 Max = 13.028 Min = -45.565

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



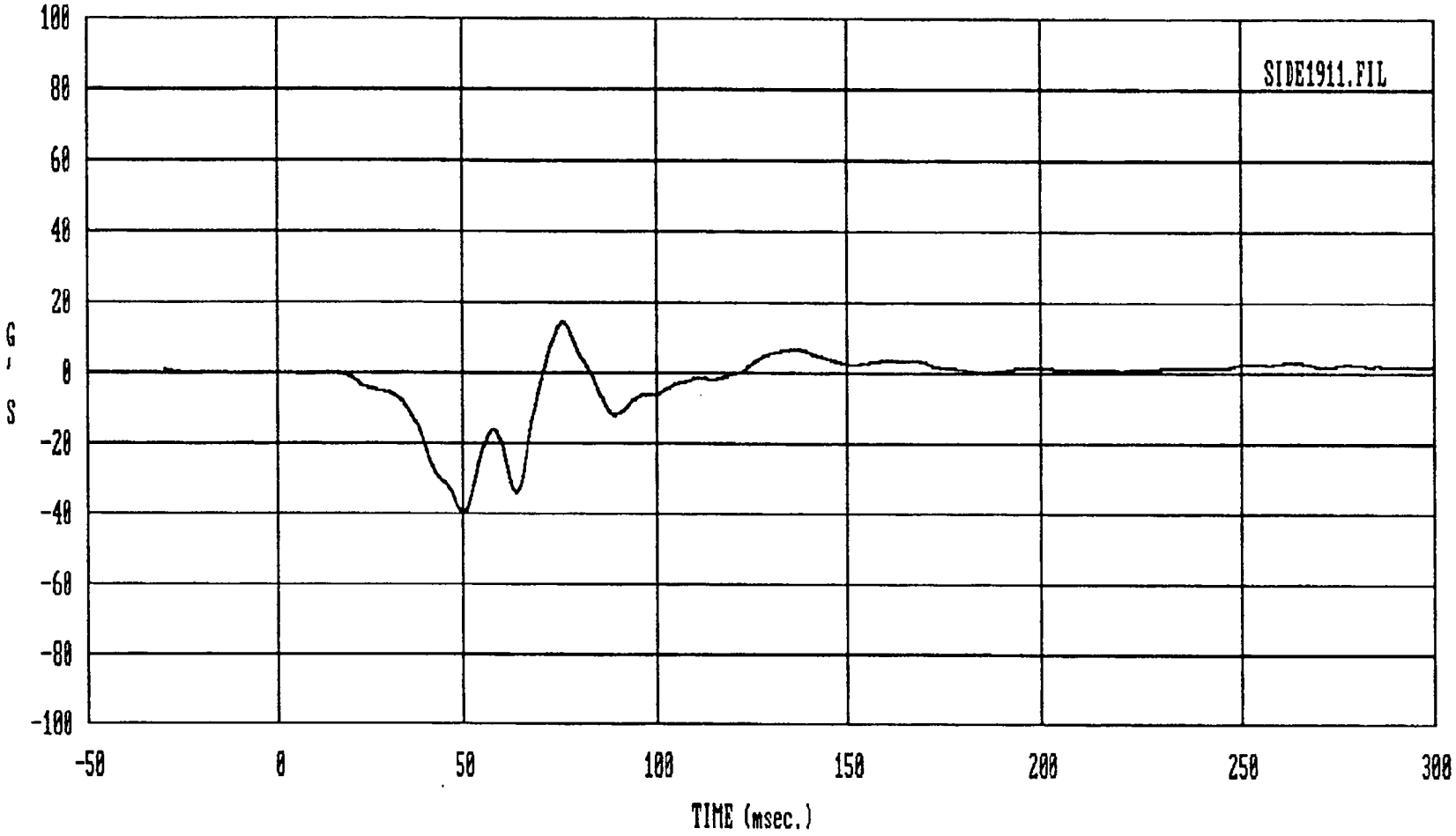
Curve: Pasngr Lower Rib 2 acceleration — Redundant Filter: FIR 100 Max = 12.854 Min = -43.918

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



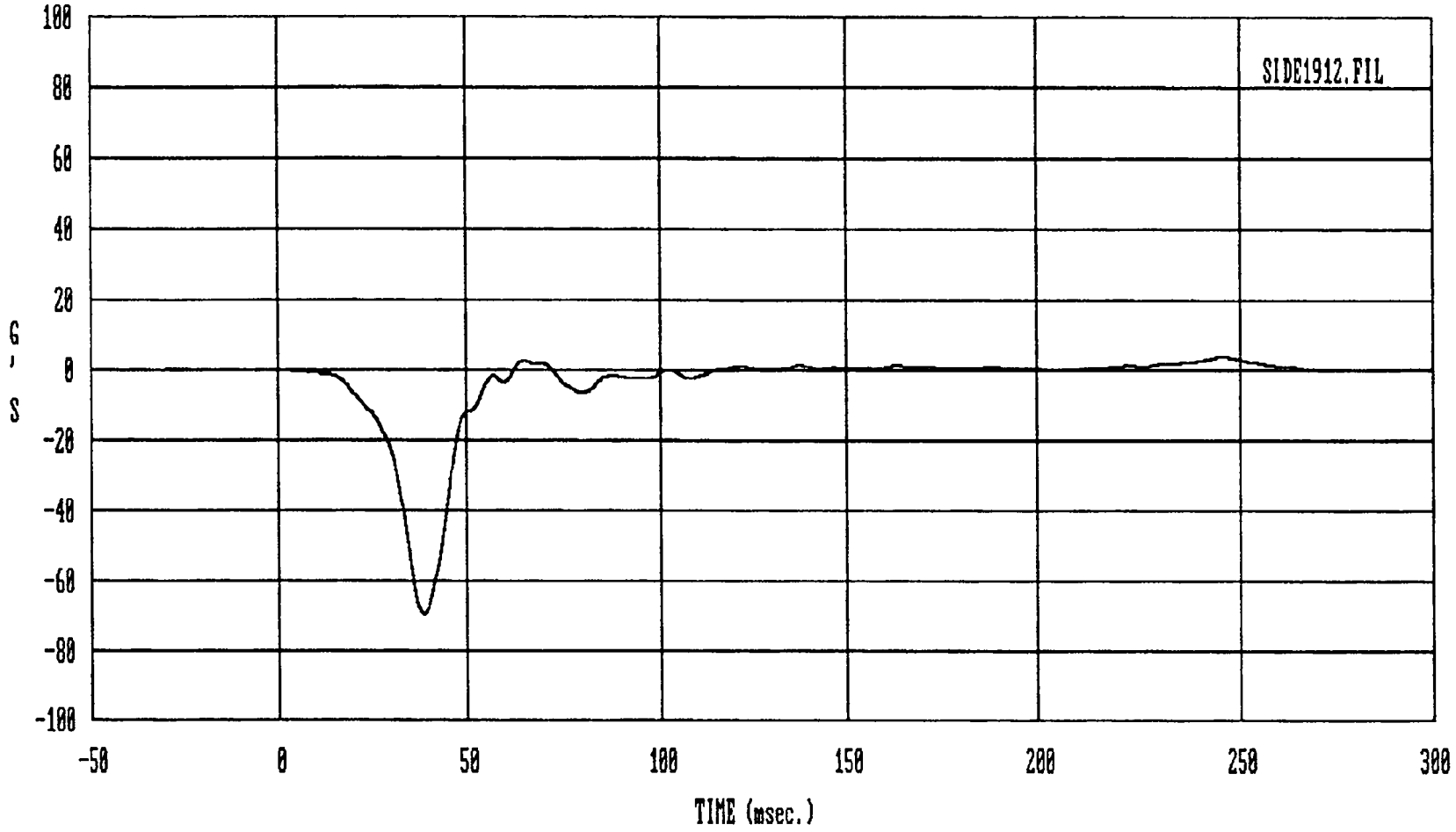
Curve: Pasngr Lower Spine 1 acceleration — Primary Filter: FIR 100 Max = 13.766 Min = -48.760

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



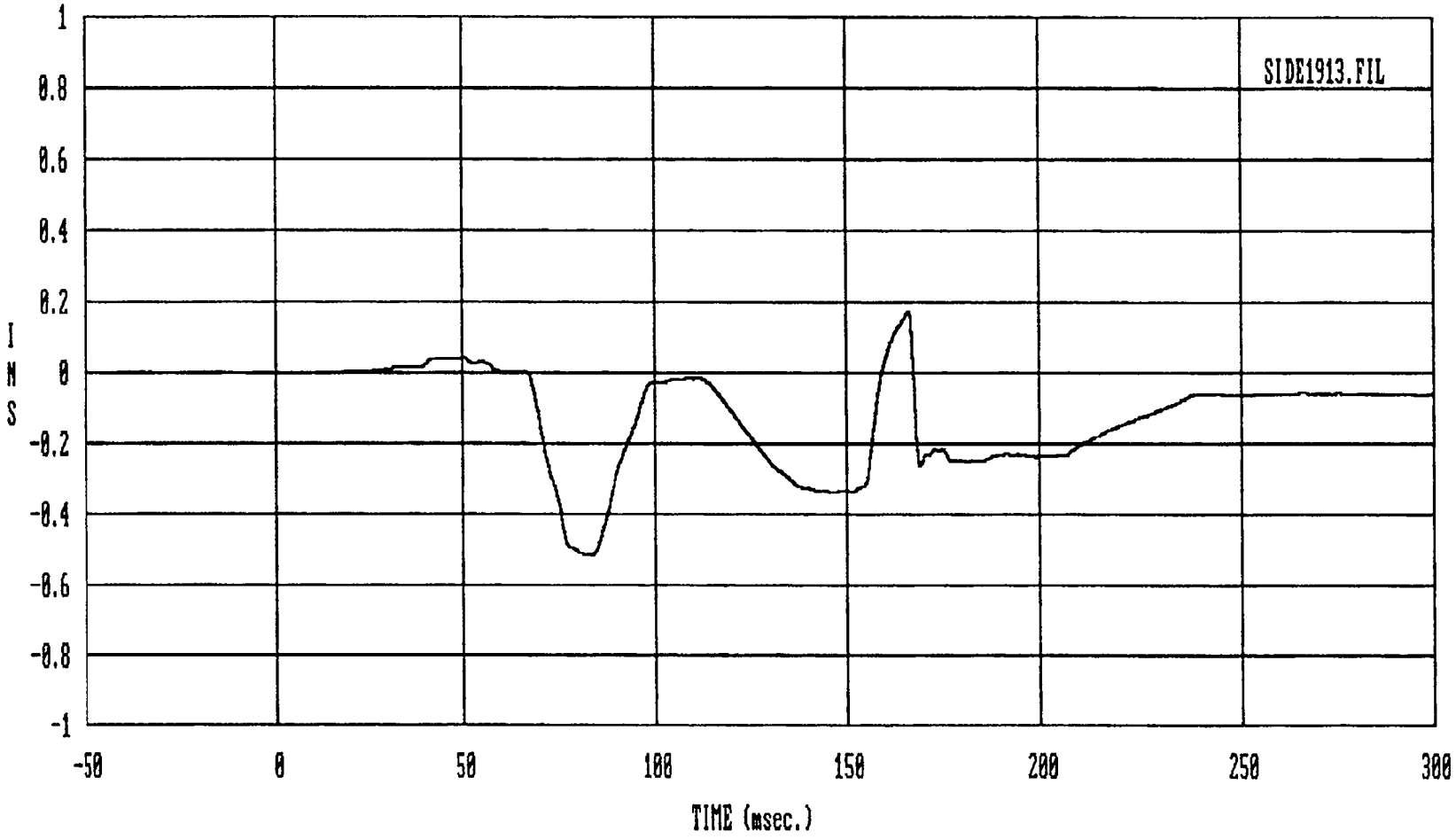
Curve: Pasngr Lower Spine 2 acceleration — Redundant Filter: FIR 100 Max = 14.386 Min = -39.642

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



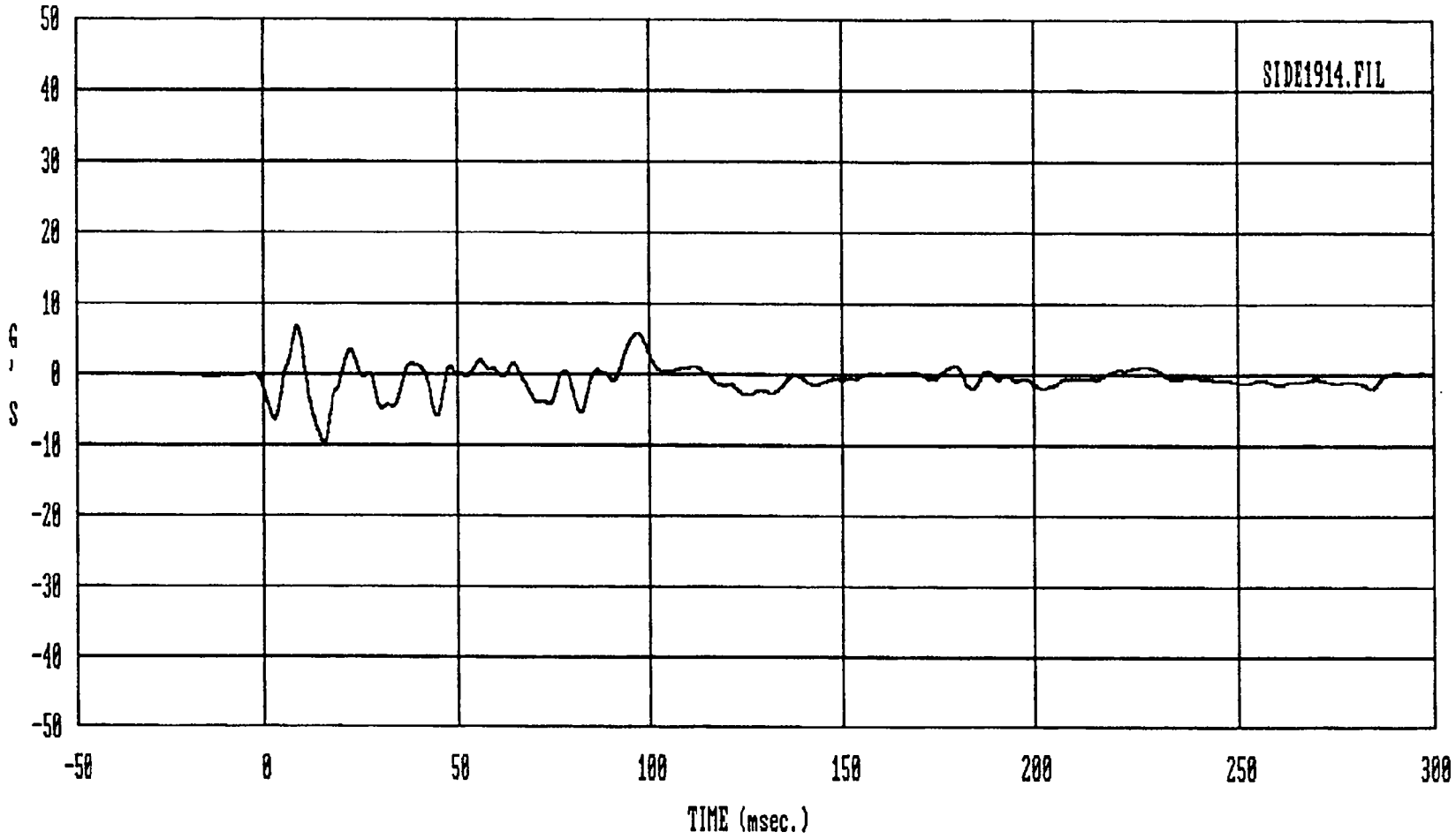
Curve: Pasngr Pelvis acceleration Filter: FIR 100 Max = 3.9400 Min = -69.890

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



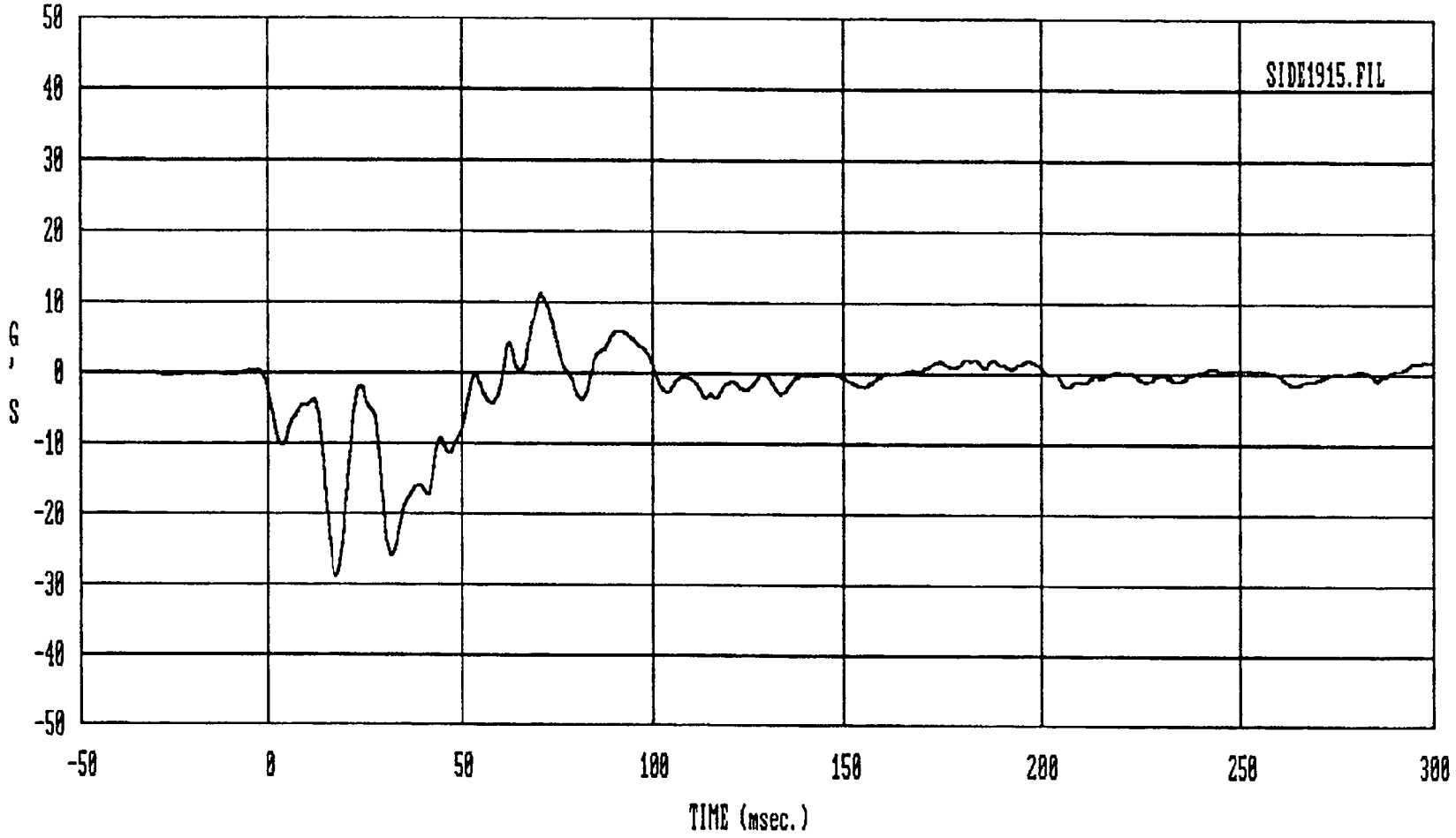
Curve: Pasngr Rib deflection Filter: SAE CLASS 180 Max = .17489 Min = -.51571

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



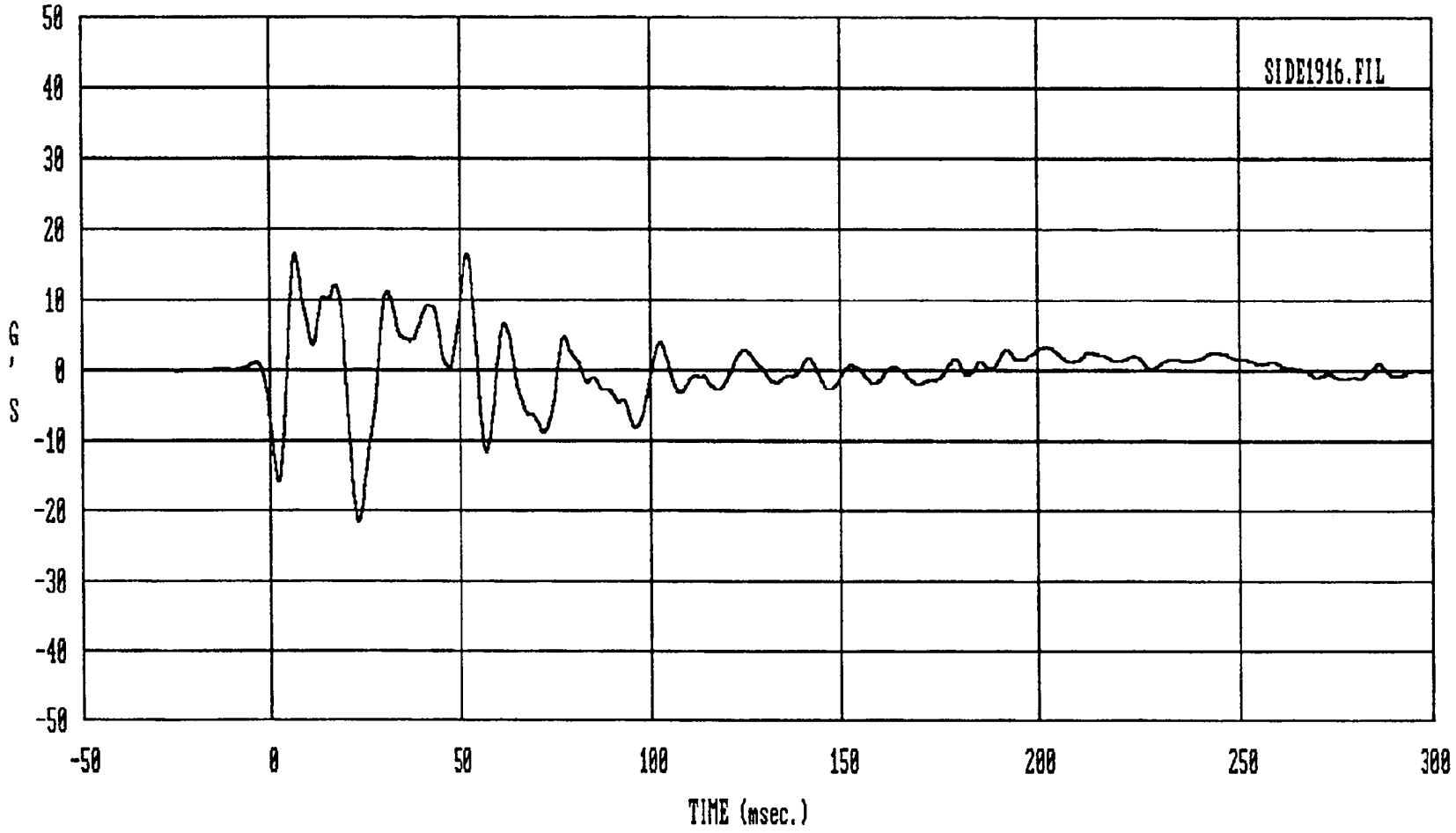
Curve: Front Seat Left sill acceleration — X axis Filter: SAE CLASS 60 Max = 6.9443 Min = -9.7333

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



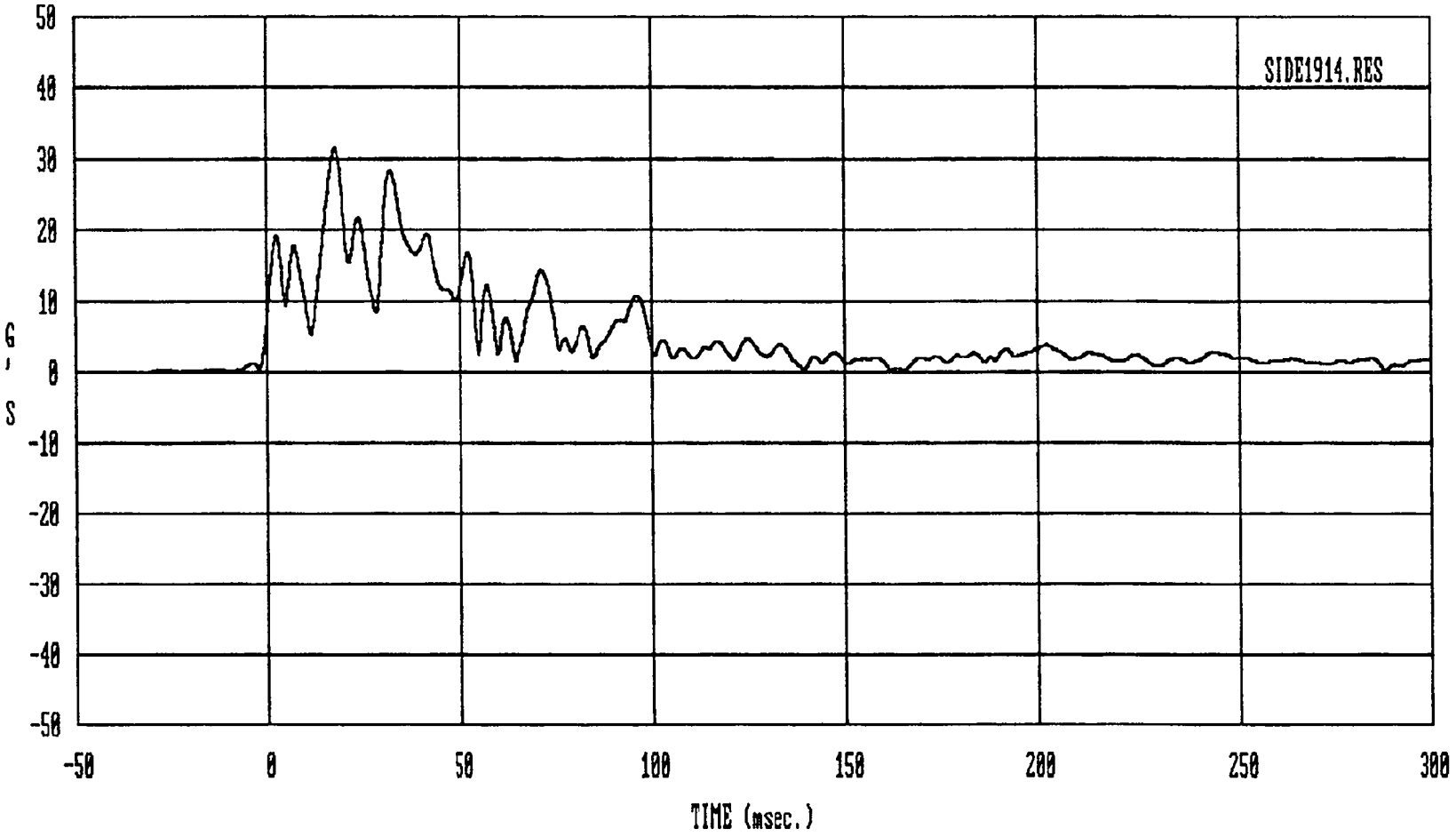
Curve: Front Seat Left sill acceleration — Y axis Filter: SAE CLASS 60 Max = 11.151 Min = -28.888

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



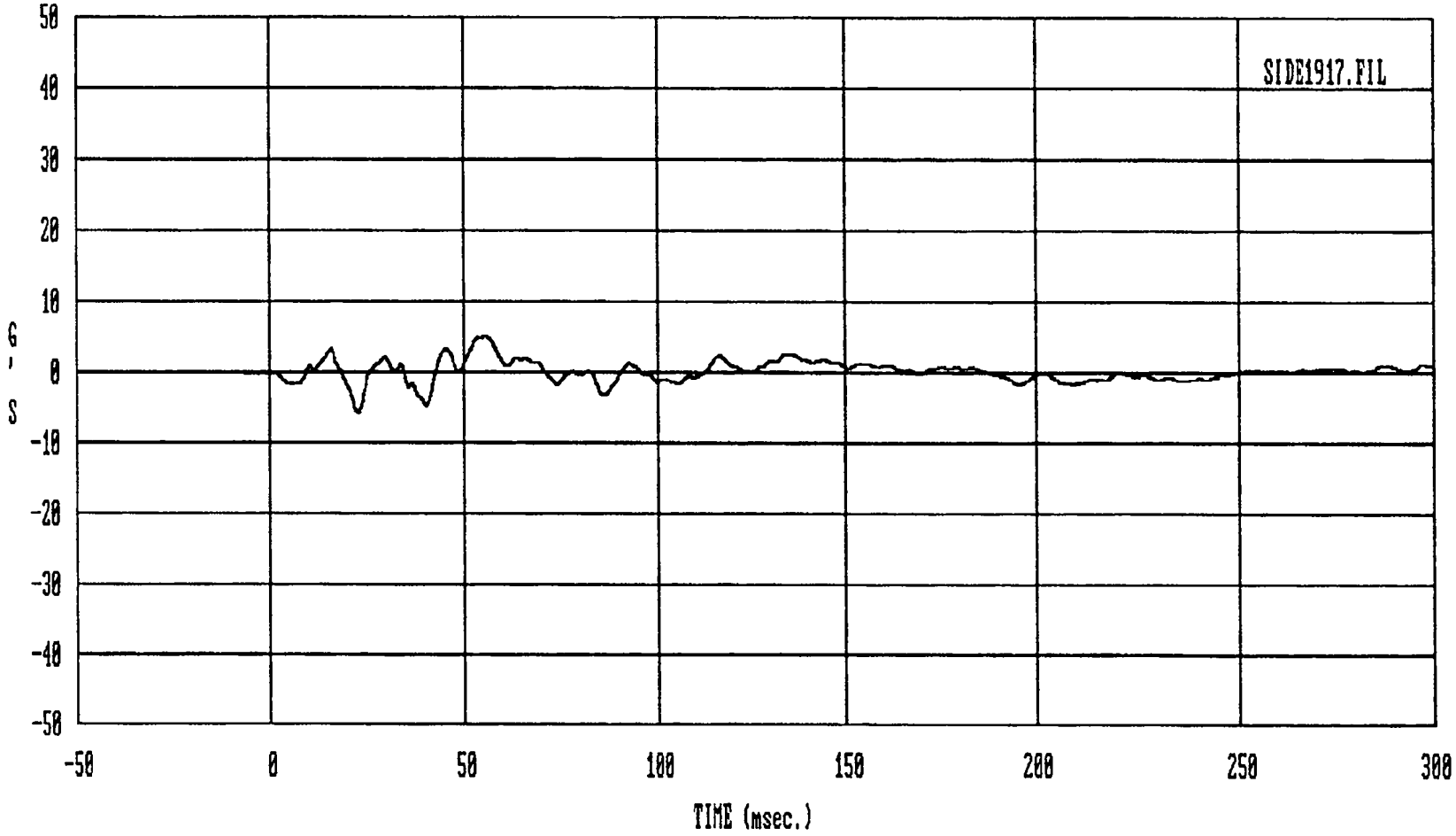
Curve: Front Seat Left sill acceleration — Z axis Filter: SAE CLASS 60 Max = 16.711 Min = -21.617

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



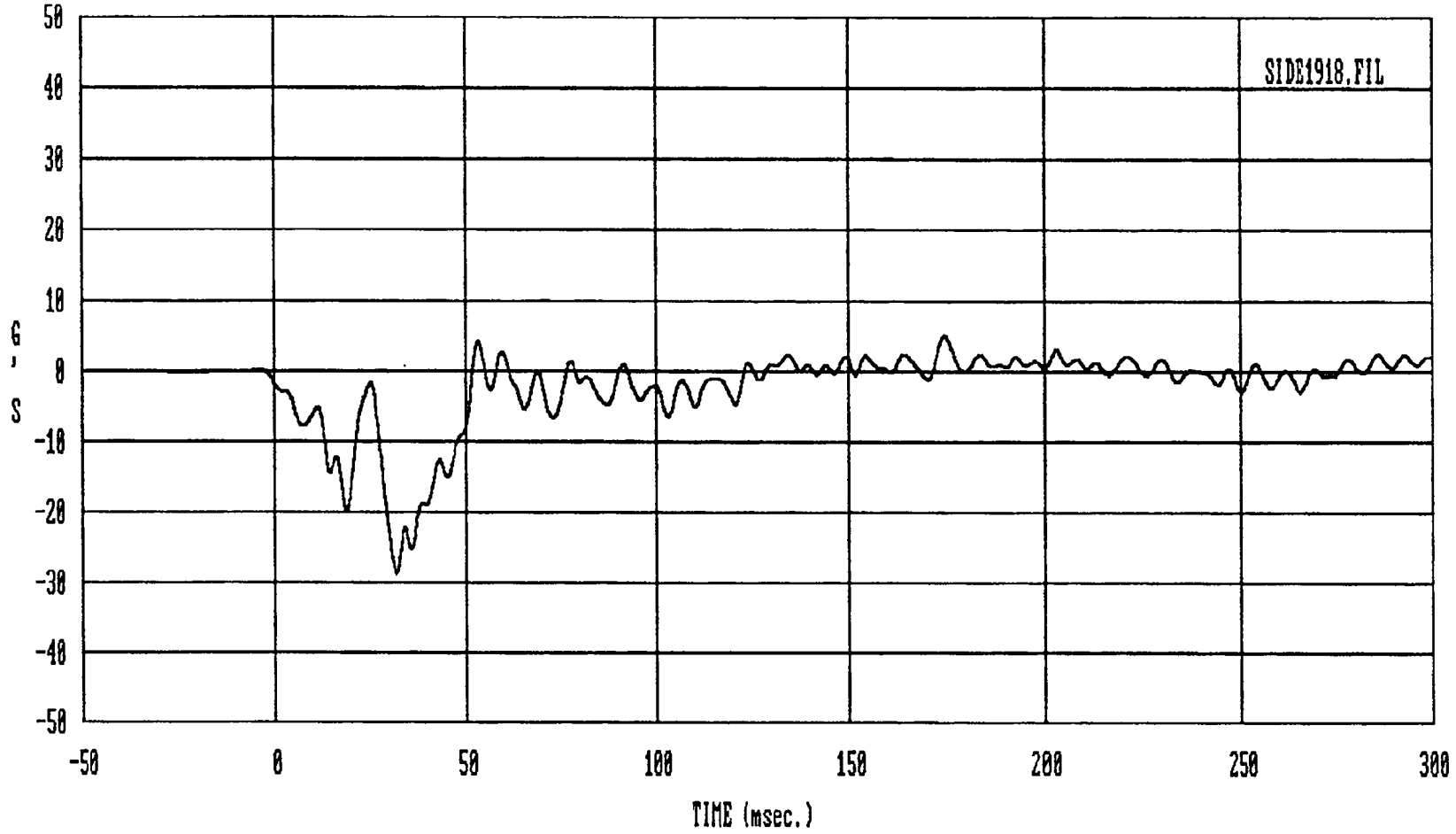
Curve: Front Seat Left sill resultant acceleration Filter: SAE CLASS 60 Max = 31.596 Min = .20370

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



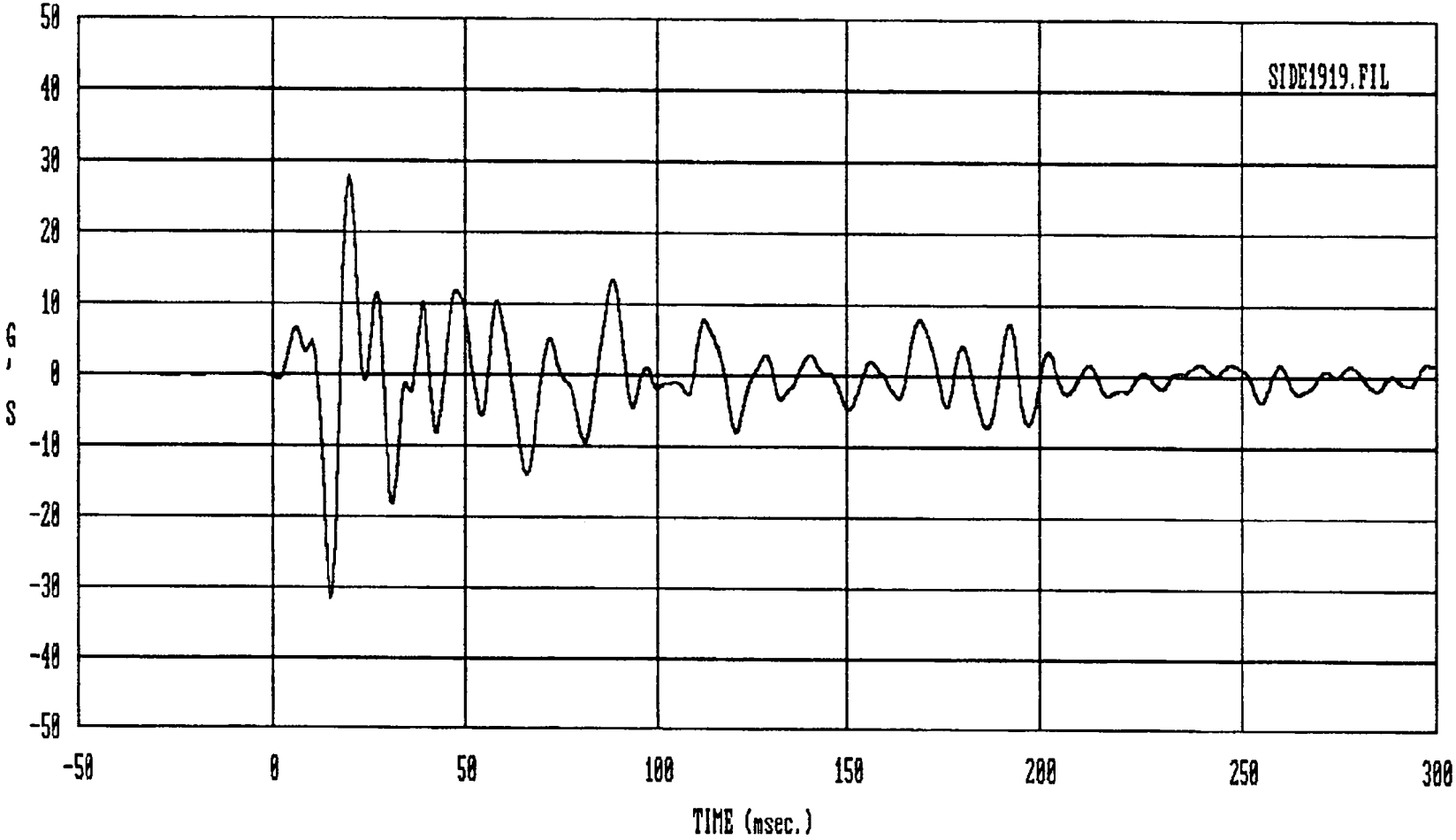
Curve: Rear Floor above axle acceleration — X axis Filter: SAE CLASS 60 Max = 5.1488 Min = -5.8886

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



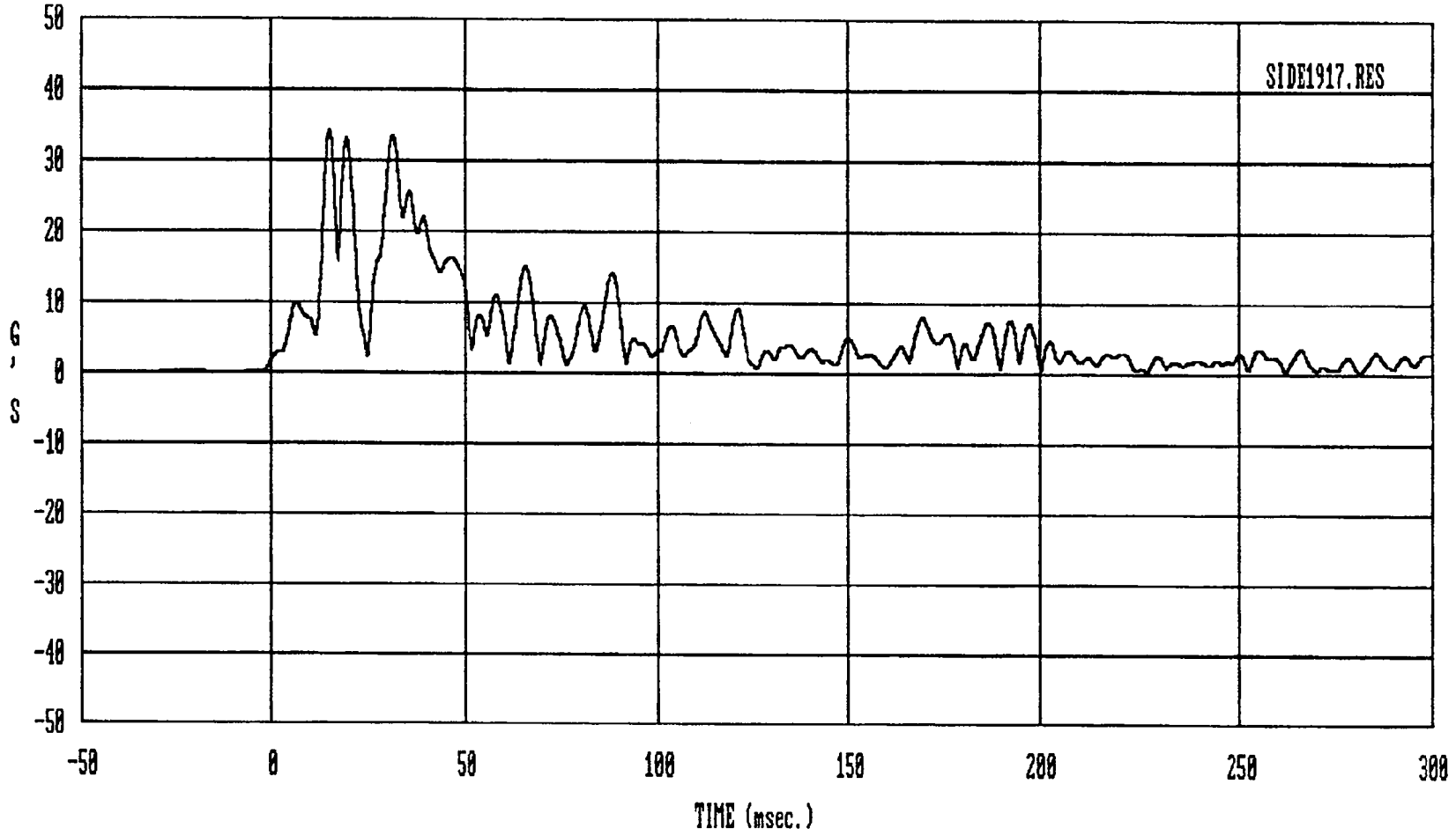
Curve: Rear Floor above axle acceleration — Y axis Filter: SAE CLASS 60 Max = 5.0468 Min = -28.797

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



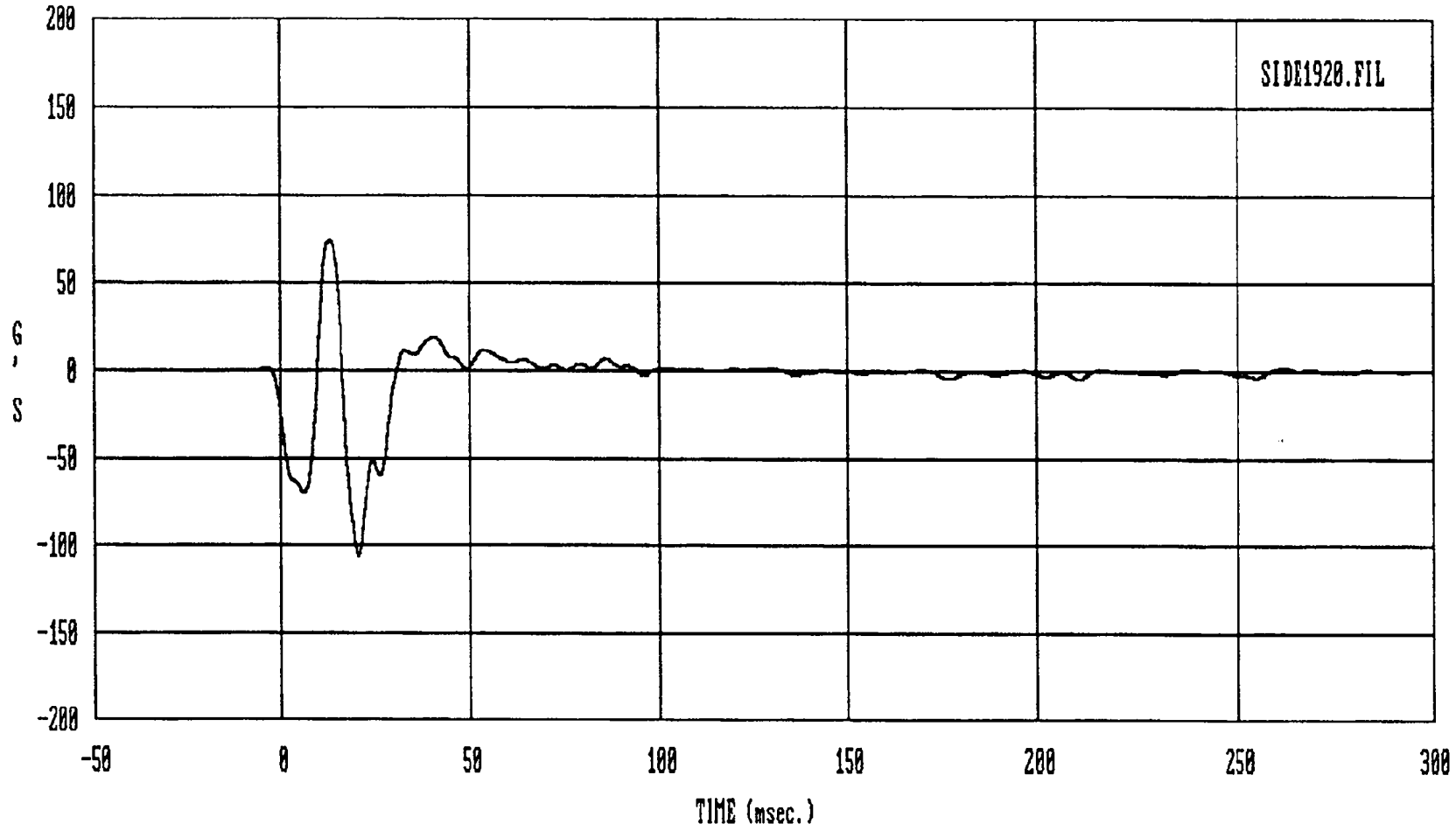
Curve: Rear Floor above axle acceleration — Z axis Filter: SAE CLASS 60 Max = 28.121 Min = -31.509

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



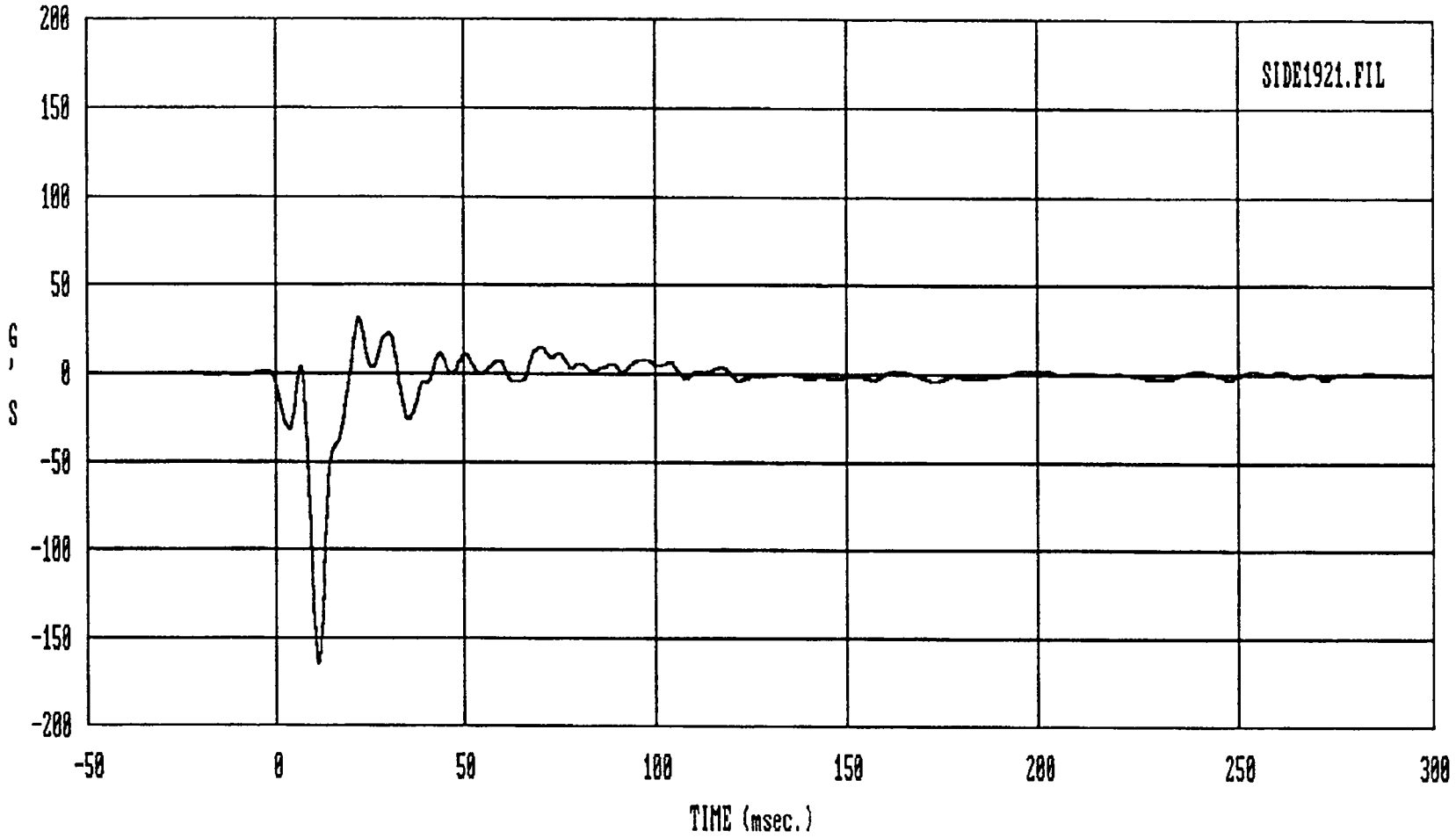
Curve: Rear Floor above axle resultant acceleration Filter: SAE CLASS 60 Max = 34.459 Min = .79076E-01

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



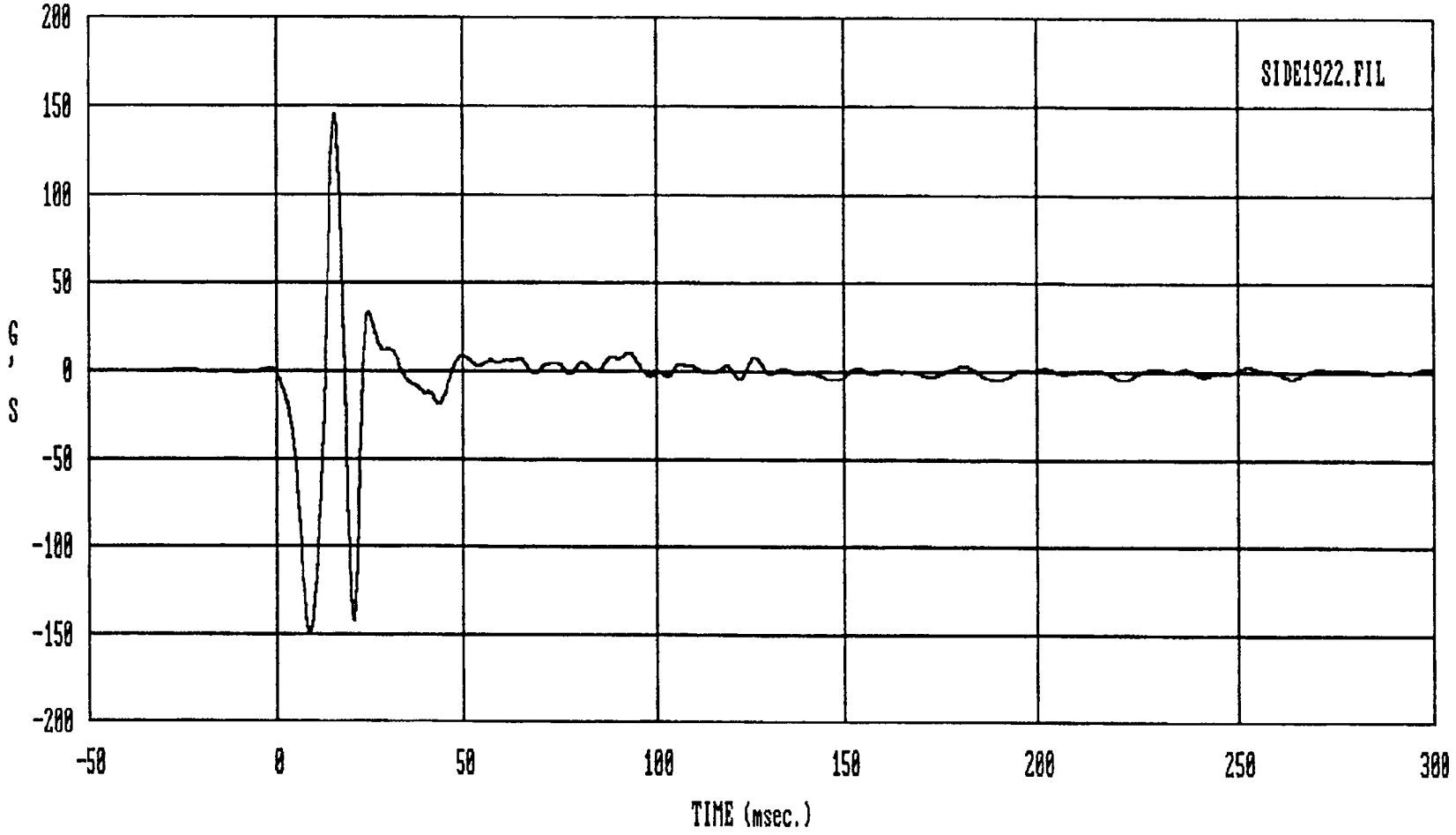
Curve: Front Seat Right Sill acceleration -- Y axis Filter: SAE CLASS 60 Max = 74.377 Min = -106.22

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



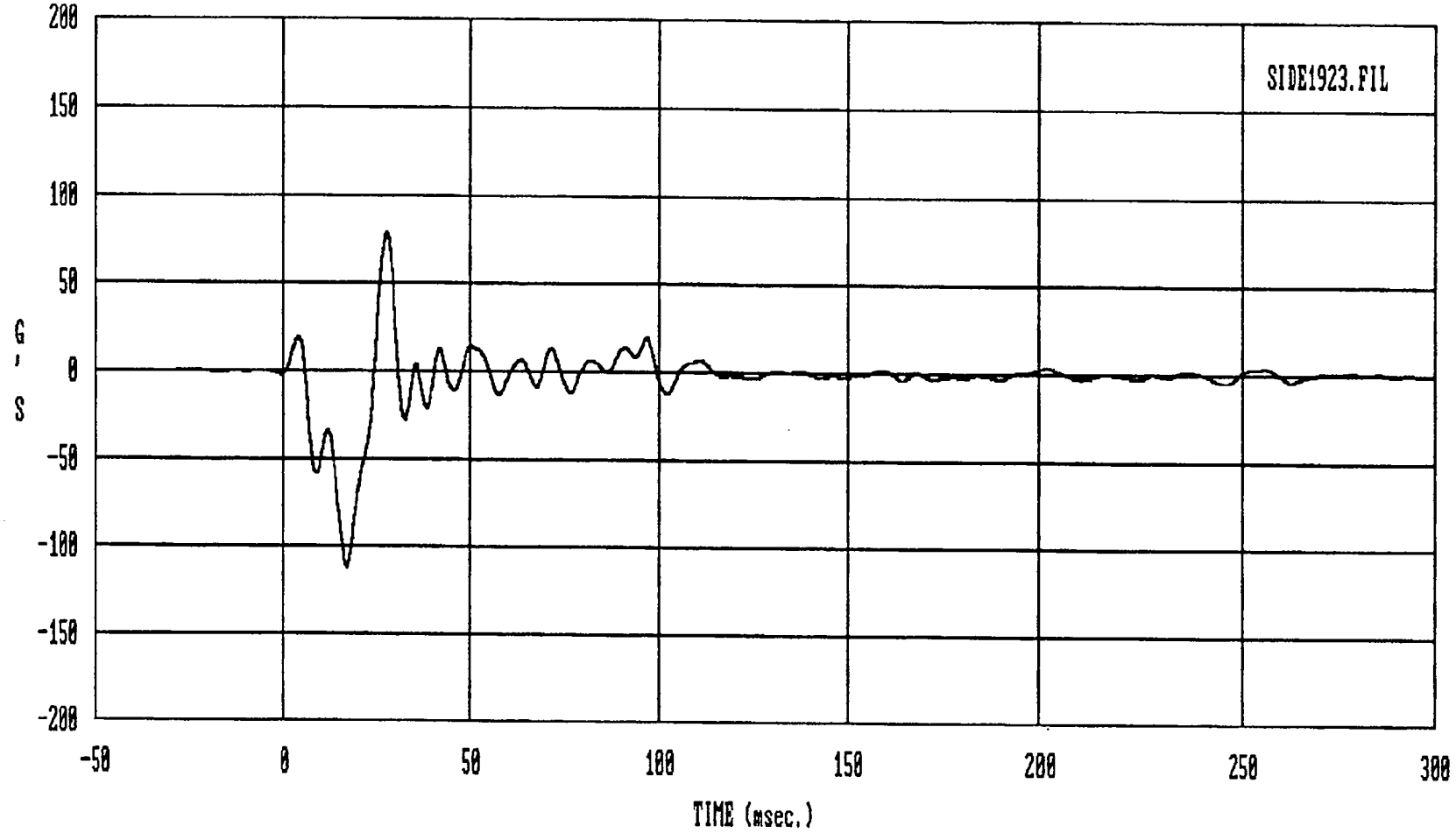
Curve: Right Front Door at centerline — Y axis Filter: SAE CLASS 60 Max = 31.527 Min = -164.99

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



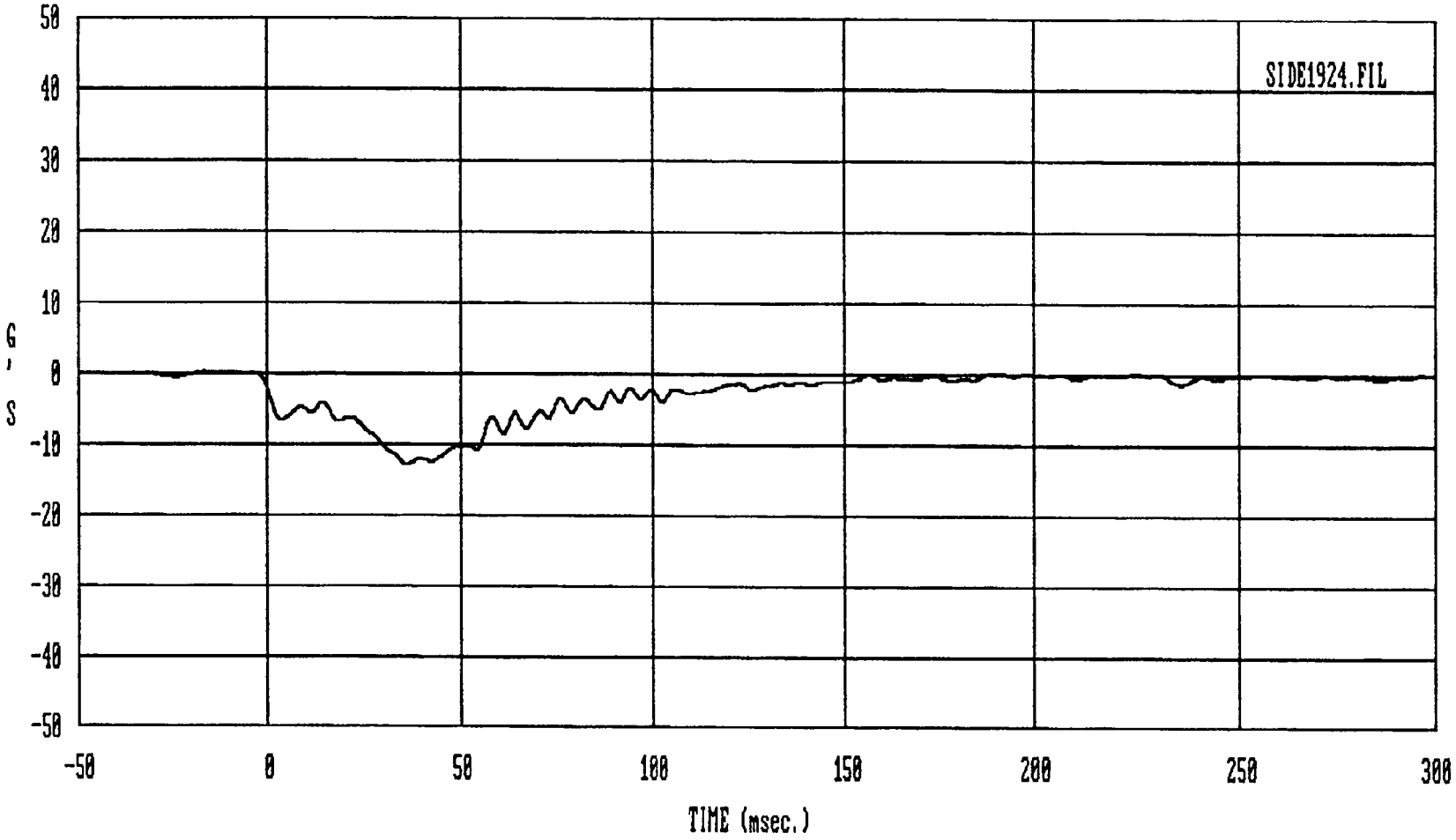
Curve: Right Front Door at mid-rear -- Y axis Filter: SAE CLASS 60 Max = 146.30 Min = -149.27

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



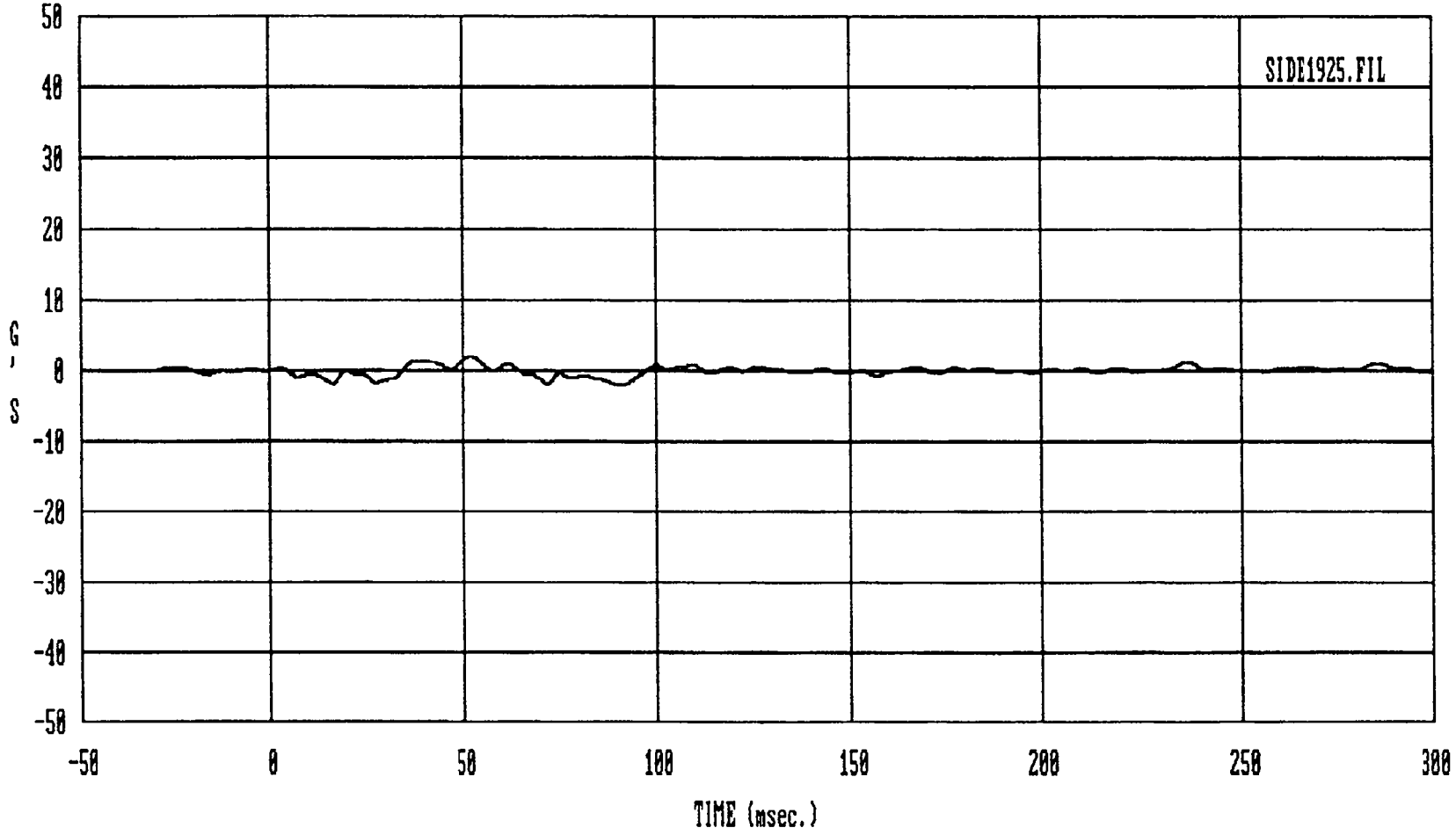
Curve: Right Front Door at upper centerline — Y axis Filter: SAE CLASS 60 Max = 78.890 Min = -112.88

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



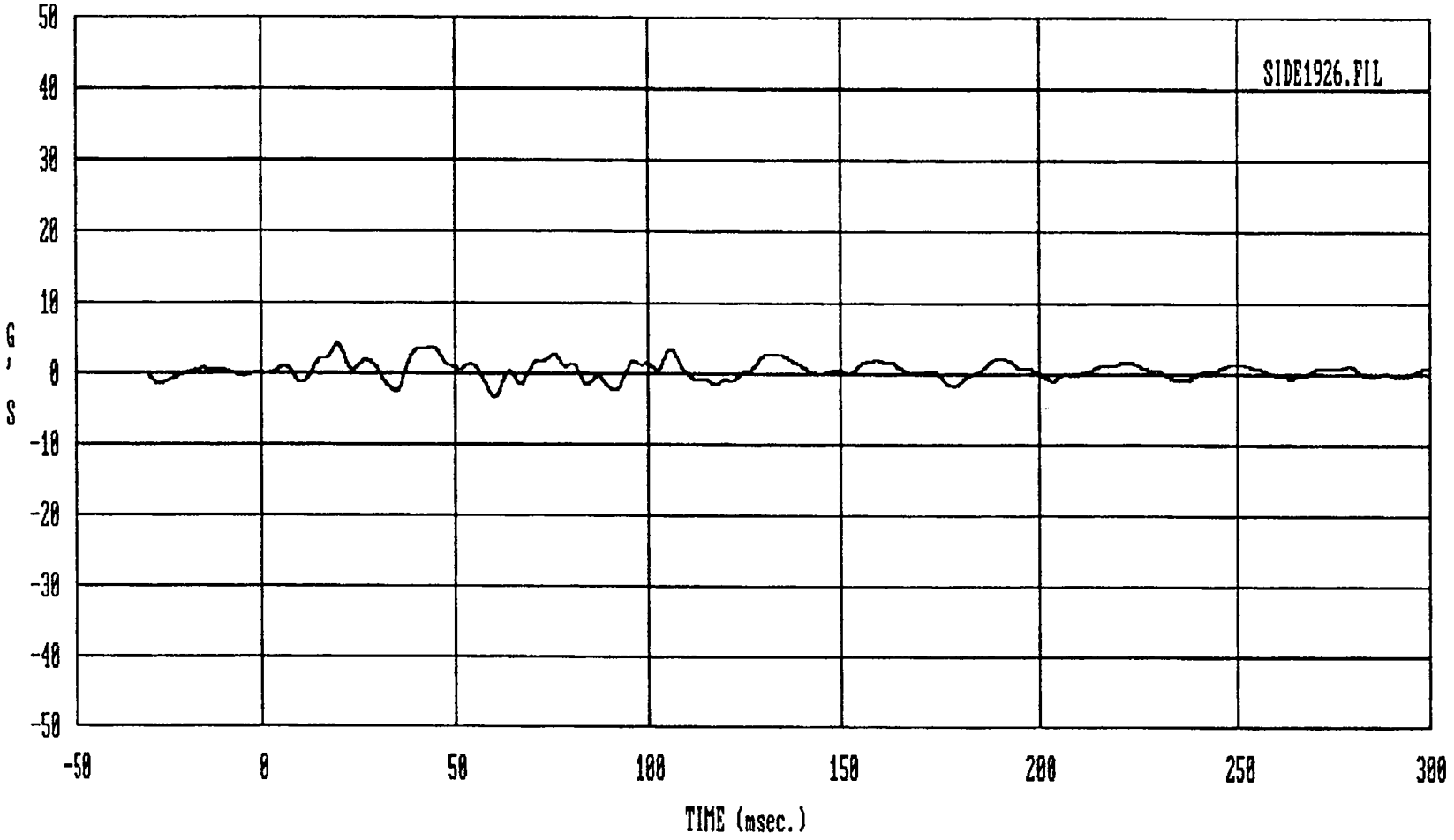
Curve: Movable Deformable Barrier C/G accel. — X axis Filter: SAE CLASS 60 Max = .27987 Min = -12.772

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



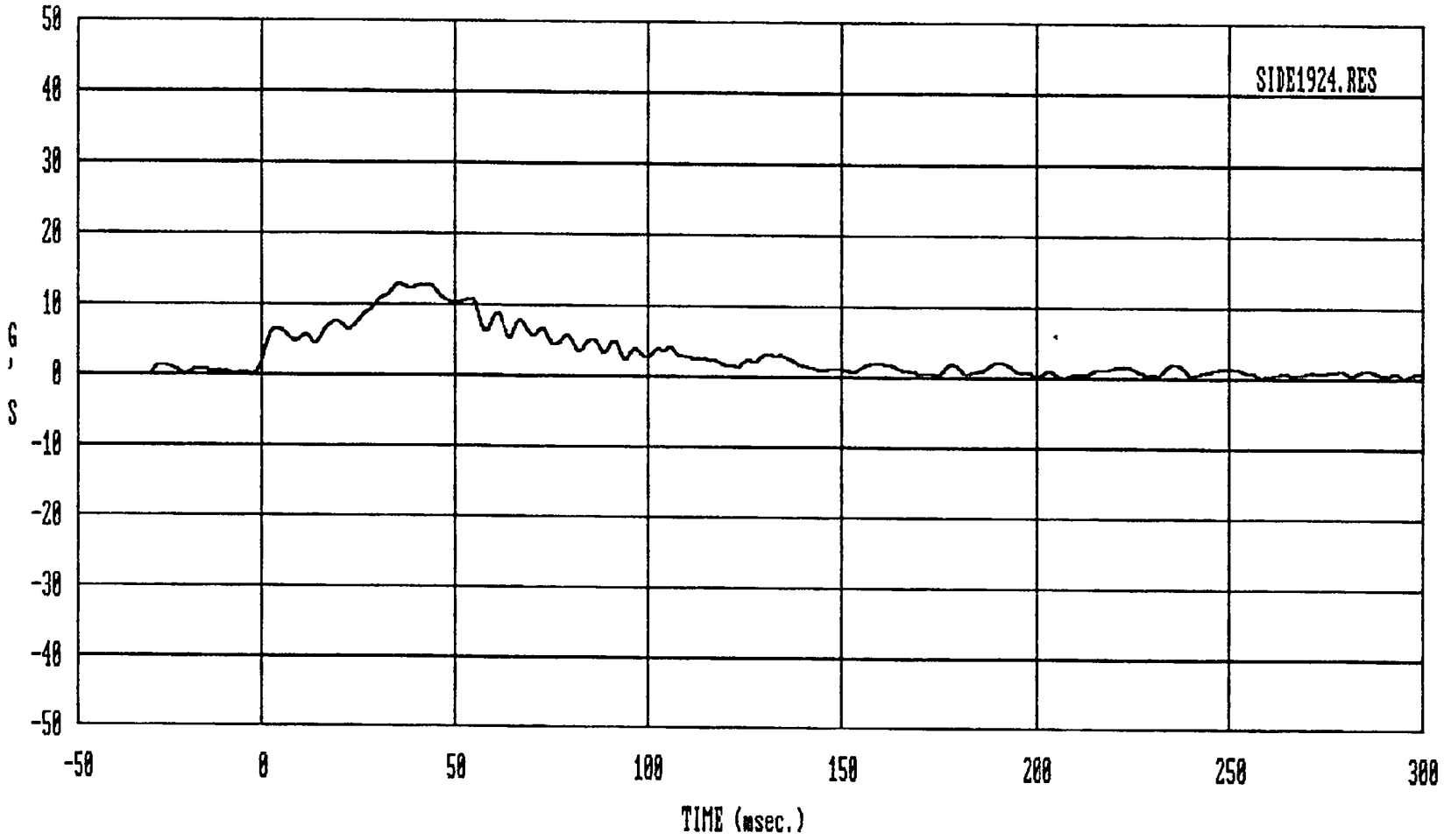
Curve: Movable Deformable Barrier C/G accel. — Y axis Filter: SAE CLASS 60 Max = 1.9944 Min = -2.0417

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1939 Ford F-150



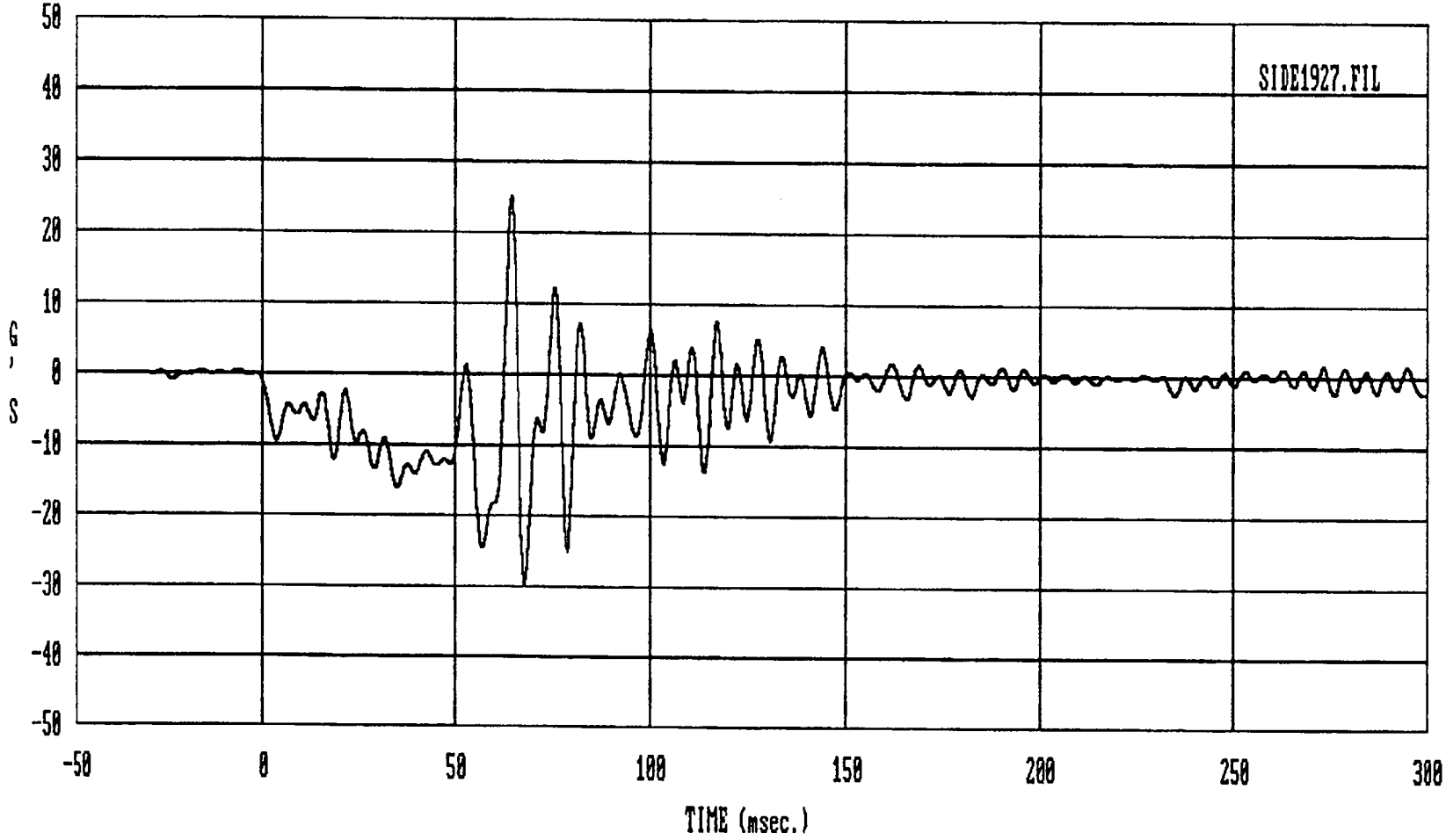
Curve: Movable Deformable Barrier C/G accel. — Z axis Filter: SAE CLASS 60 Max = 4.2410 Min = -3.2951

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



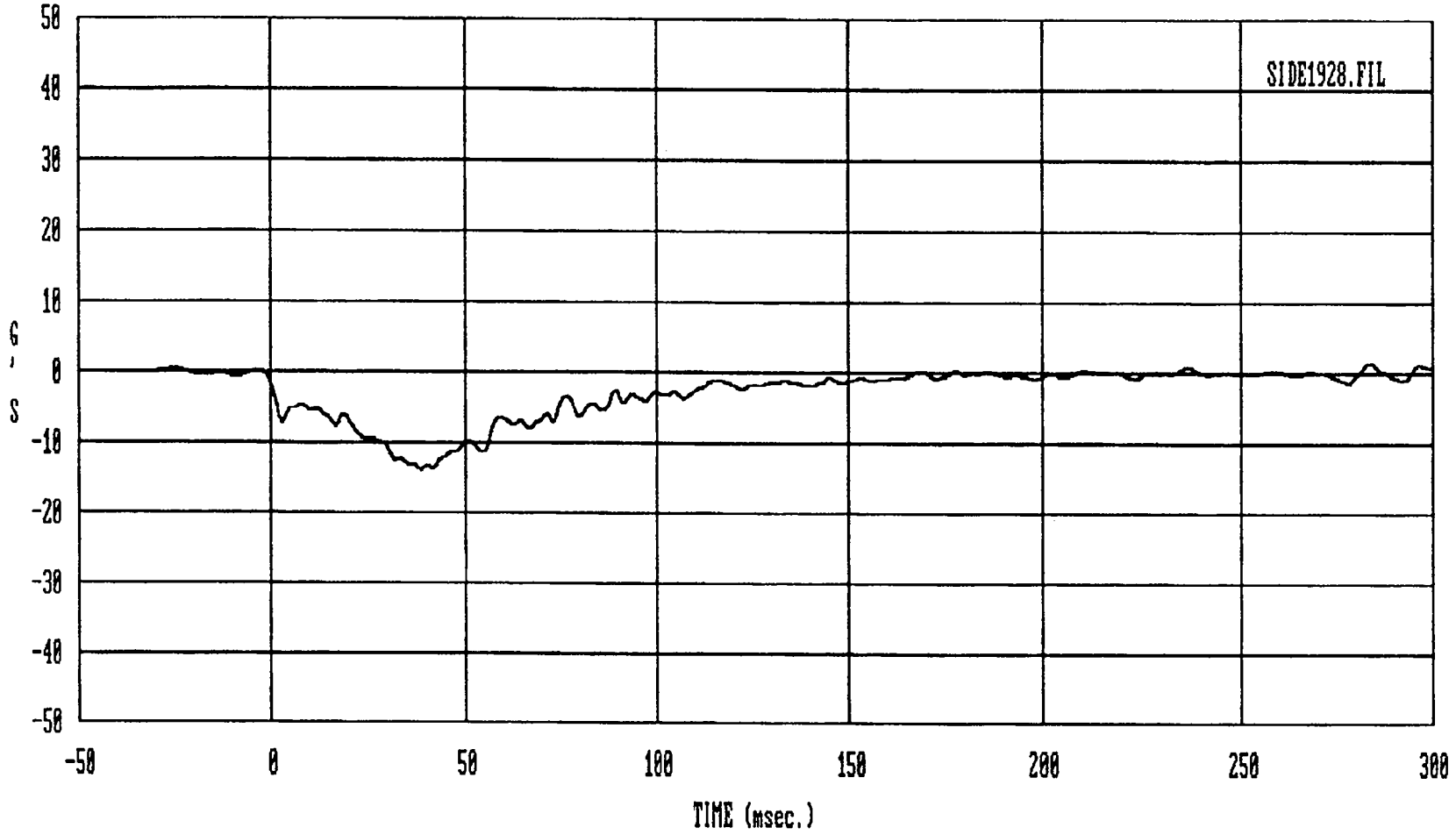
Curve: Movable Deformable Barrier C/G resultant accel. Filter: SAE CLASS 60 Max = 12.956 Min = .30369E-01

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



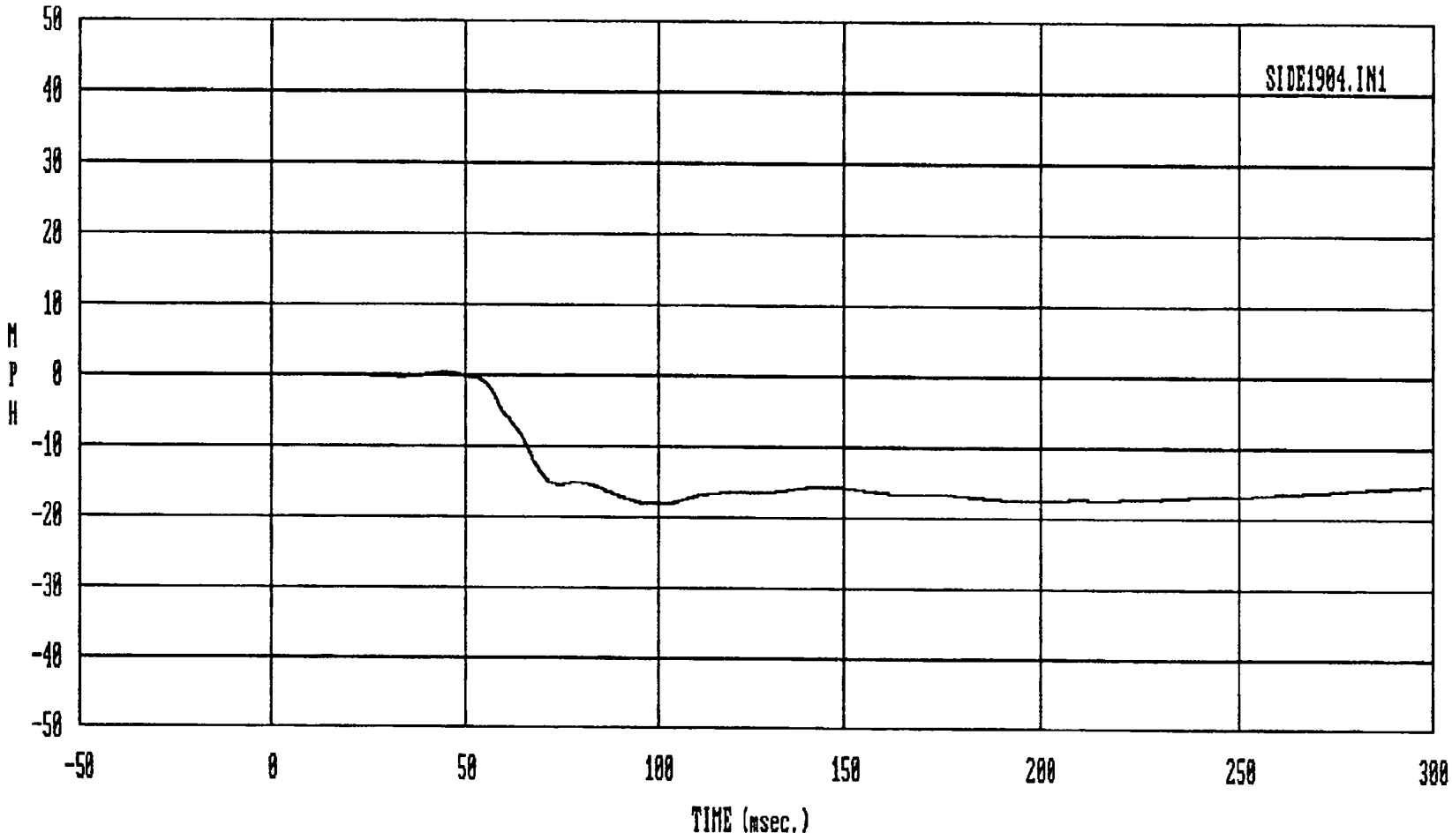
Curve: Movable Deformable Barrier Front frame - X axis Filter: SAE CLASS 60 Max = 25.340 Min = -29.842

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



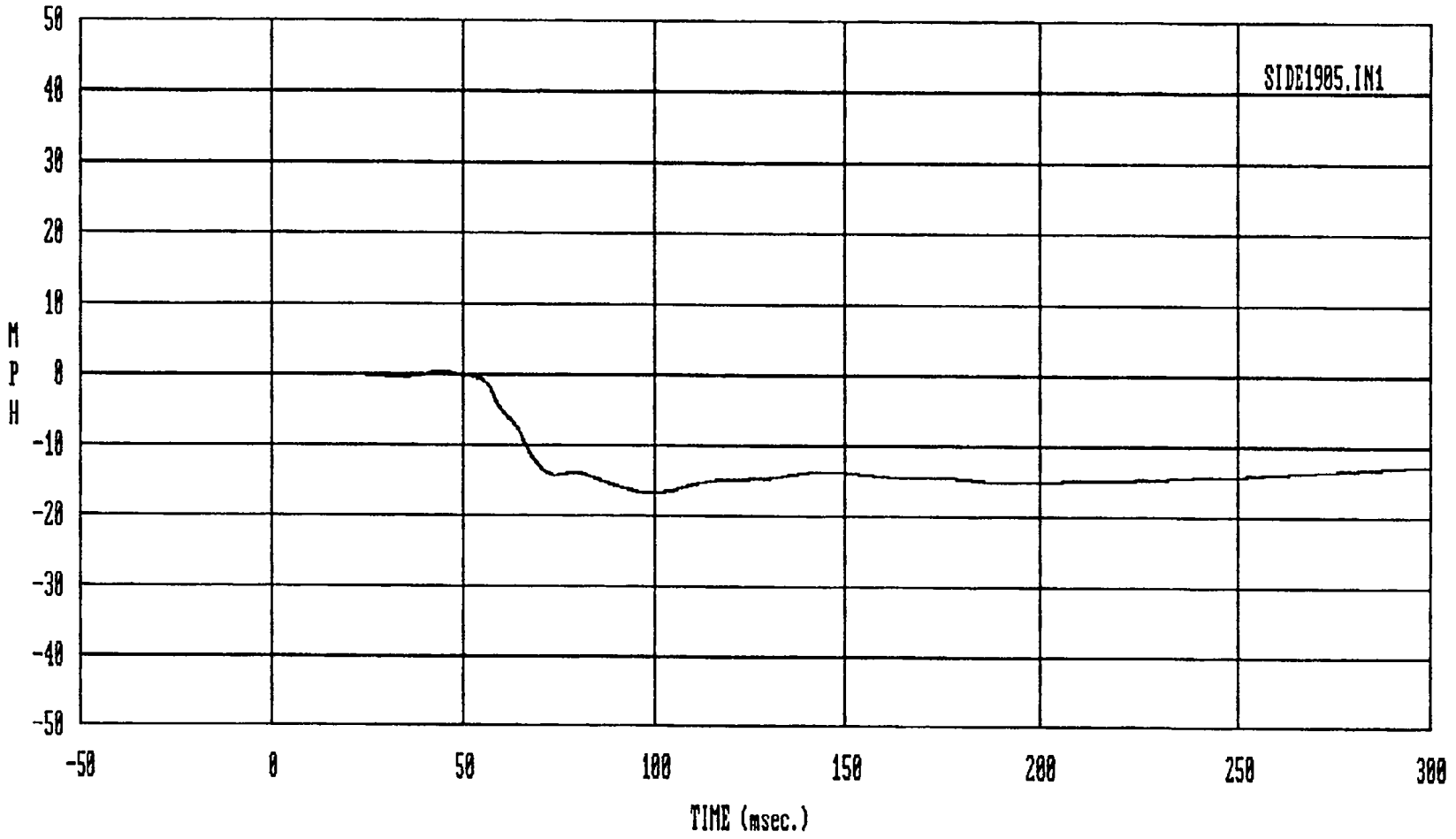
Curve: Movable Deformable Barrier Rear frame — X axis Filter: SAE CLASS 60 Max = 1.4397 Min = -13.847

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



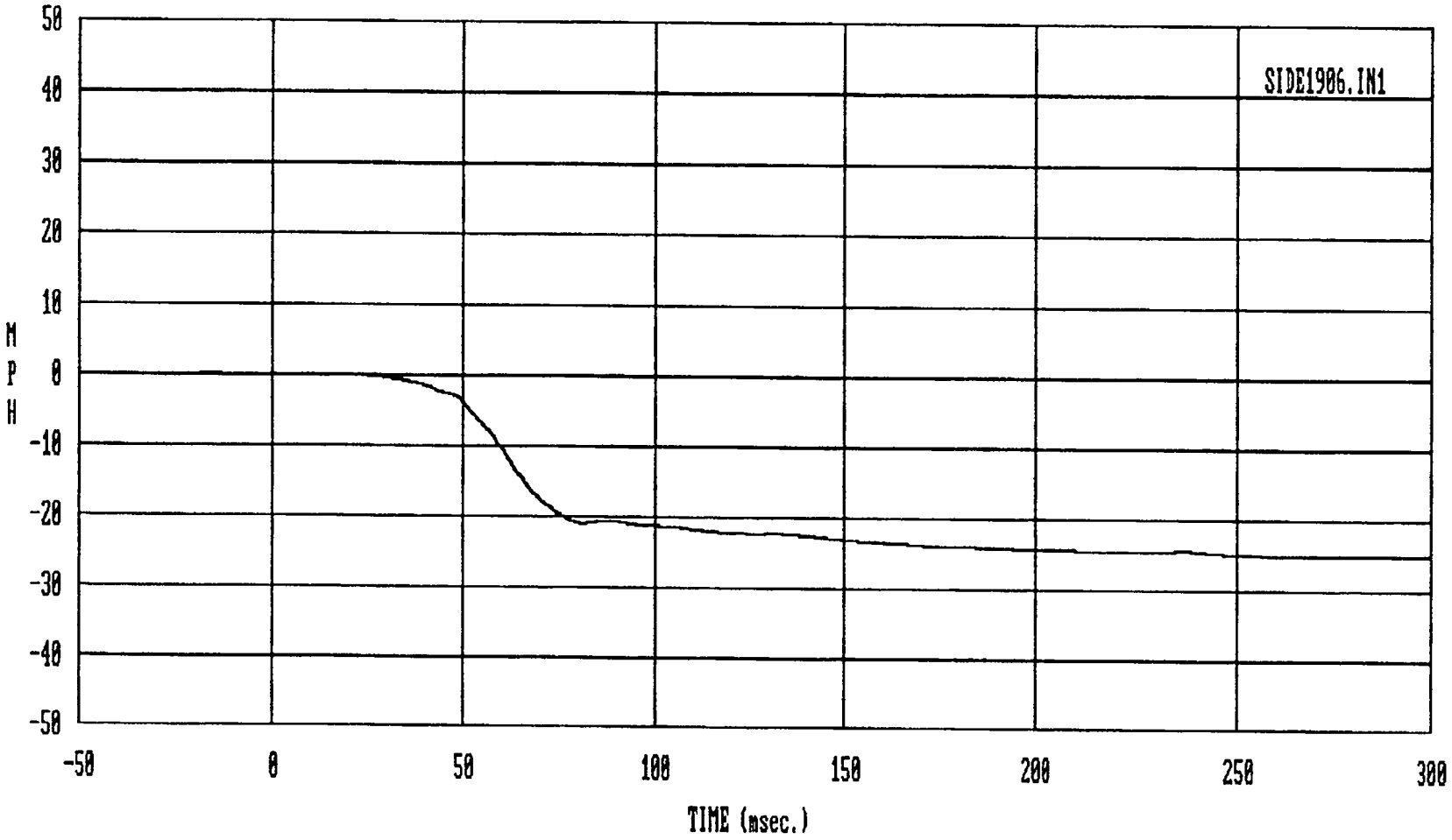
Curve: Pasngr Upper Spine 1 delta V — Primary Filter: FIR 100 Max = .51501 Min = -18.116

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



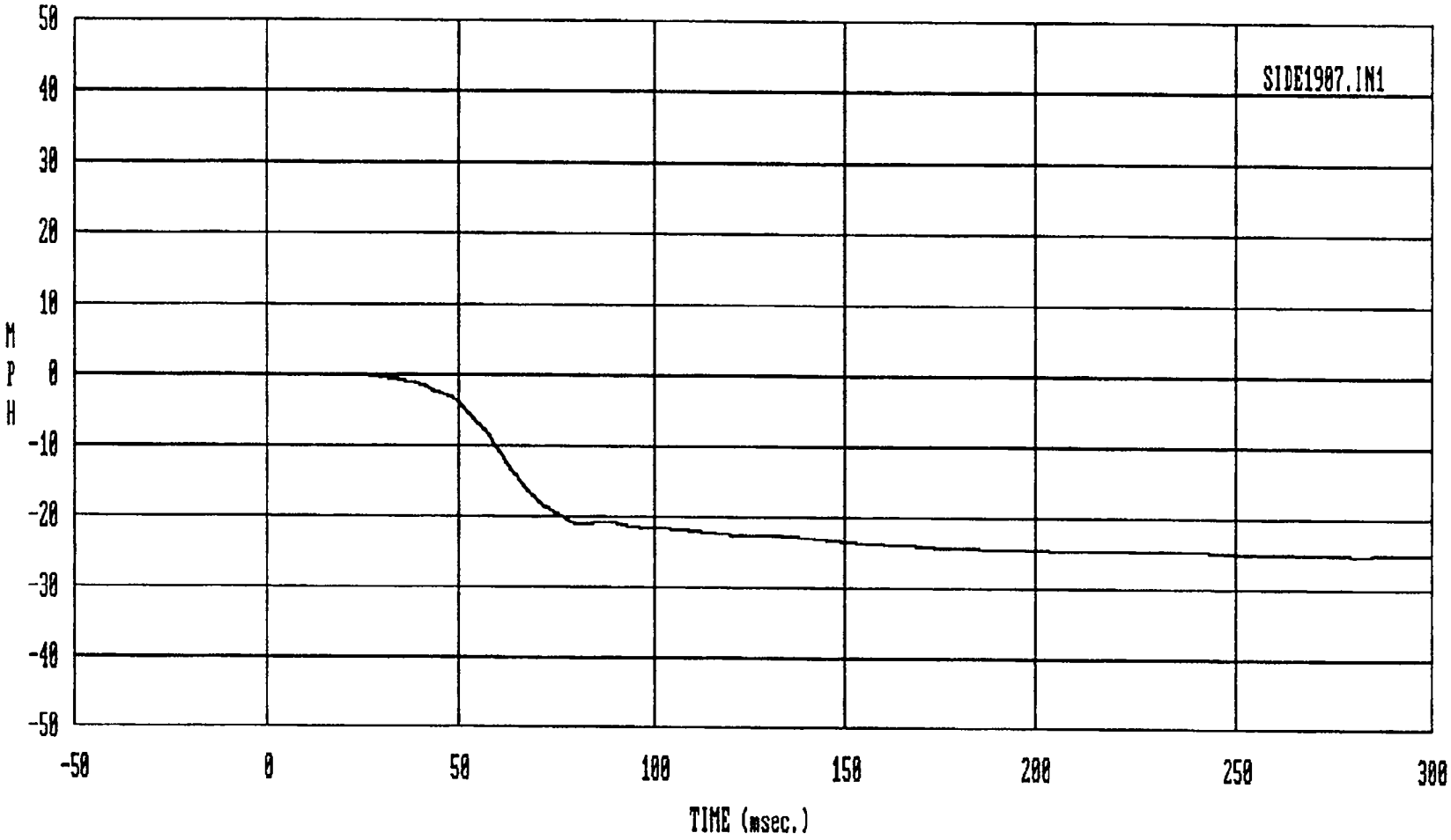
Curve: Pasngr Upper Spine 2 delta V — Redundant Filter: FIR 100 Max = .46868 Min = -16.722

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



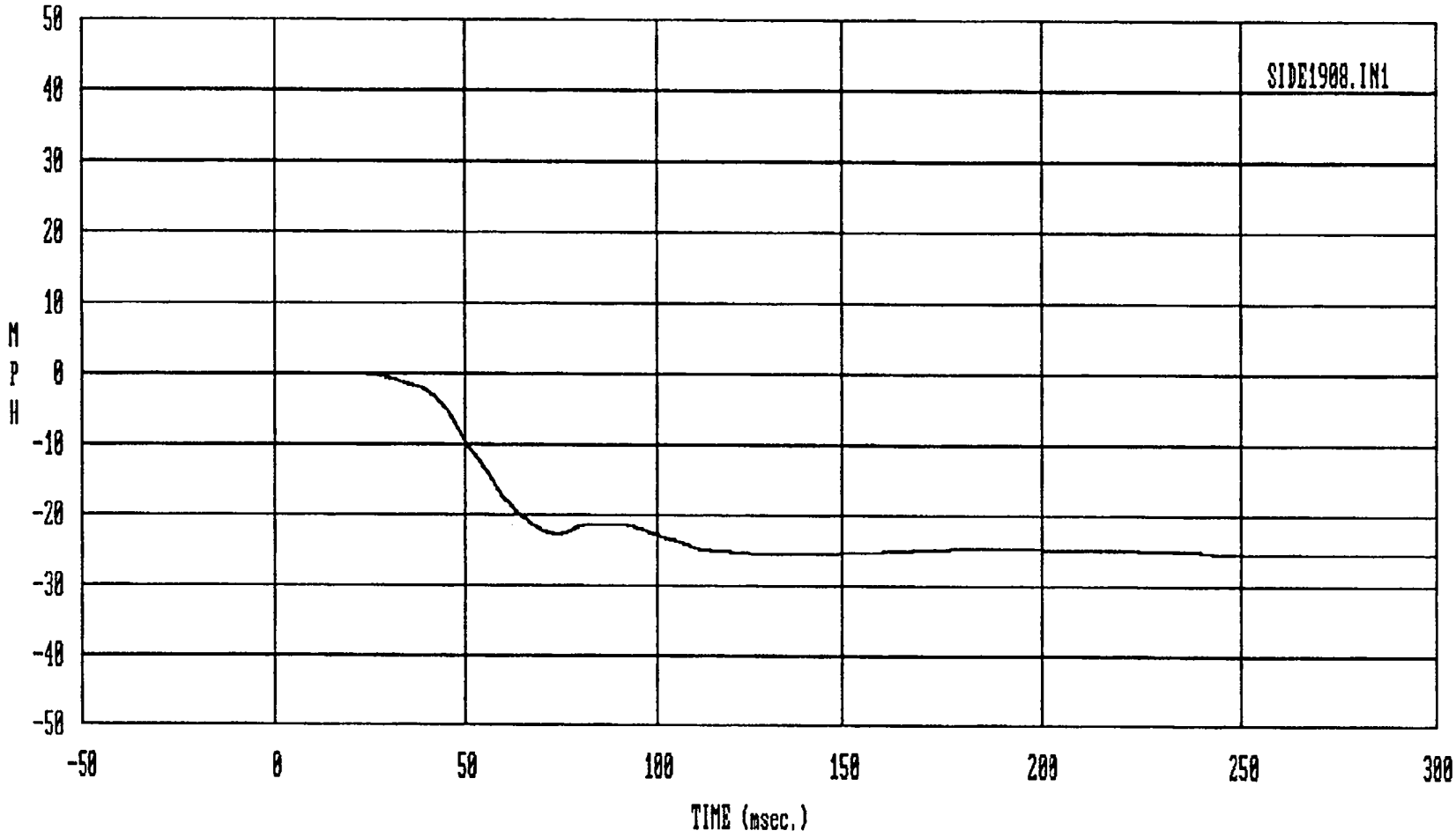
Curve: Pasngr Upper Rib 1 delta V — Primary Filter: FIR 100 Max = .14323E-01 Min = -25.205

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



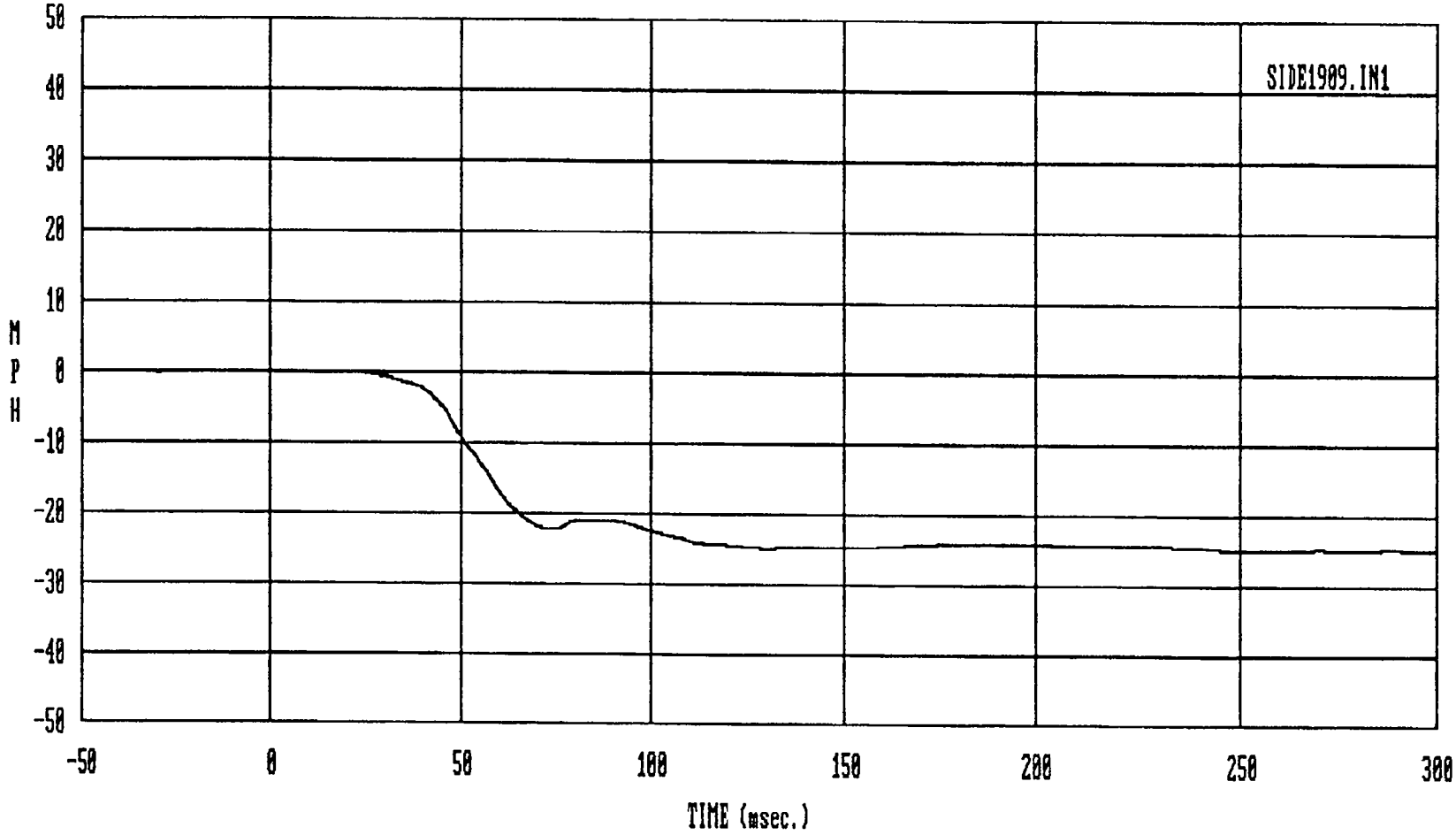
Curve: Pasngr Upper Rib 2 delta V -- Redundant Filter: FIR 100 Max = .66039E-01 Min = -25.240

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



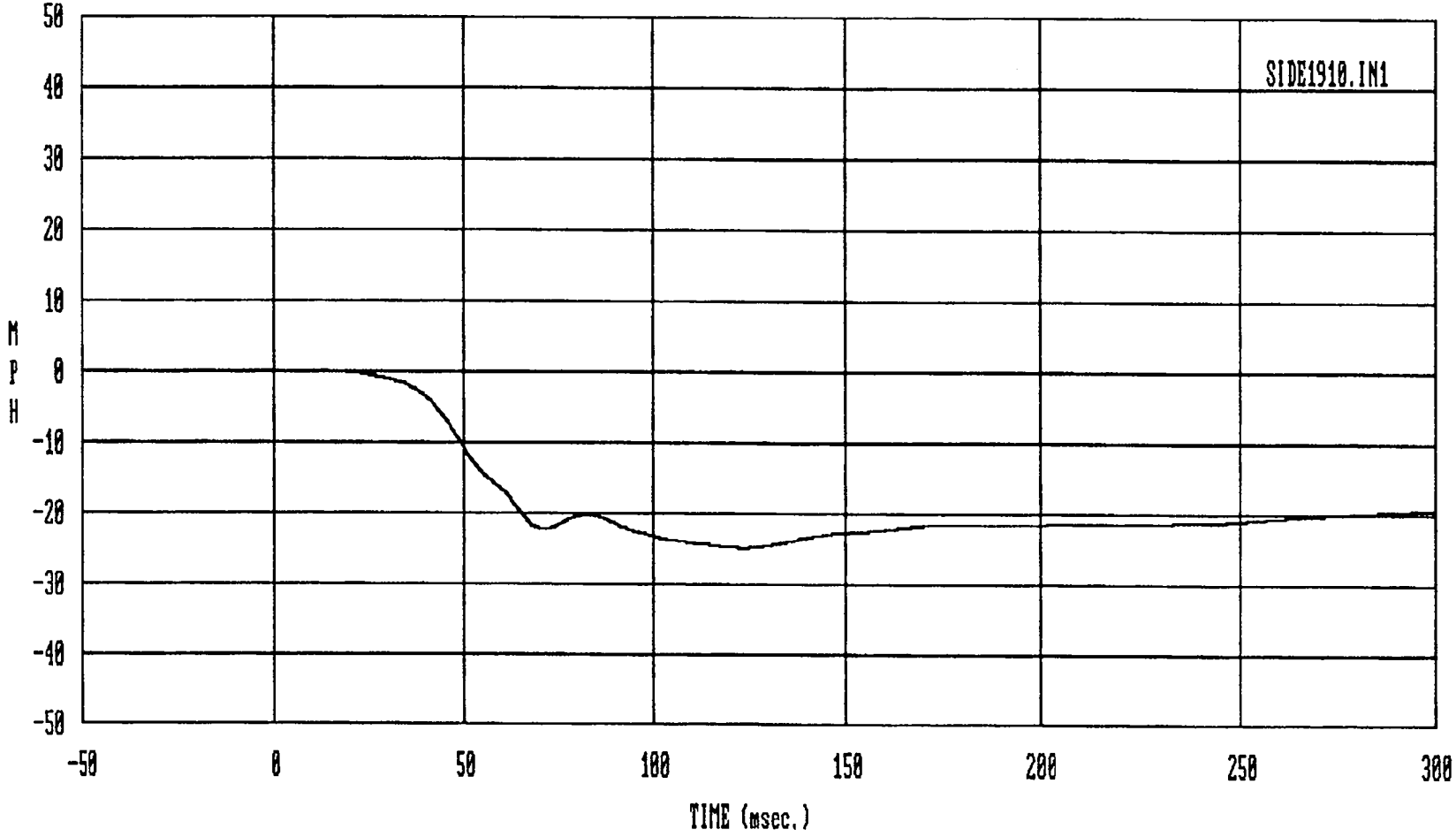
Curve: Pasngr Lower Rib 1 delta V — Primary Filter: FIR 100 Max = .29504E-02 Min = -25.600

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



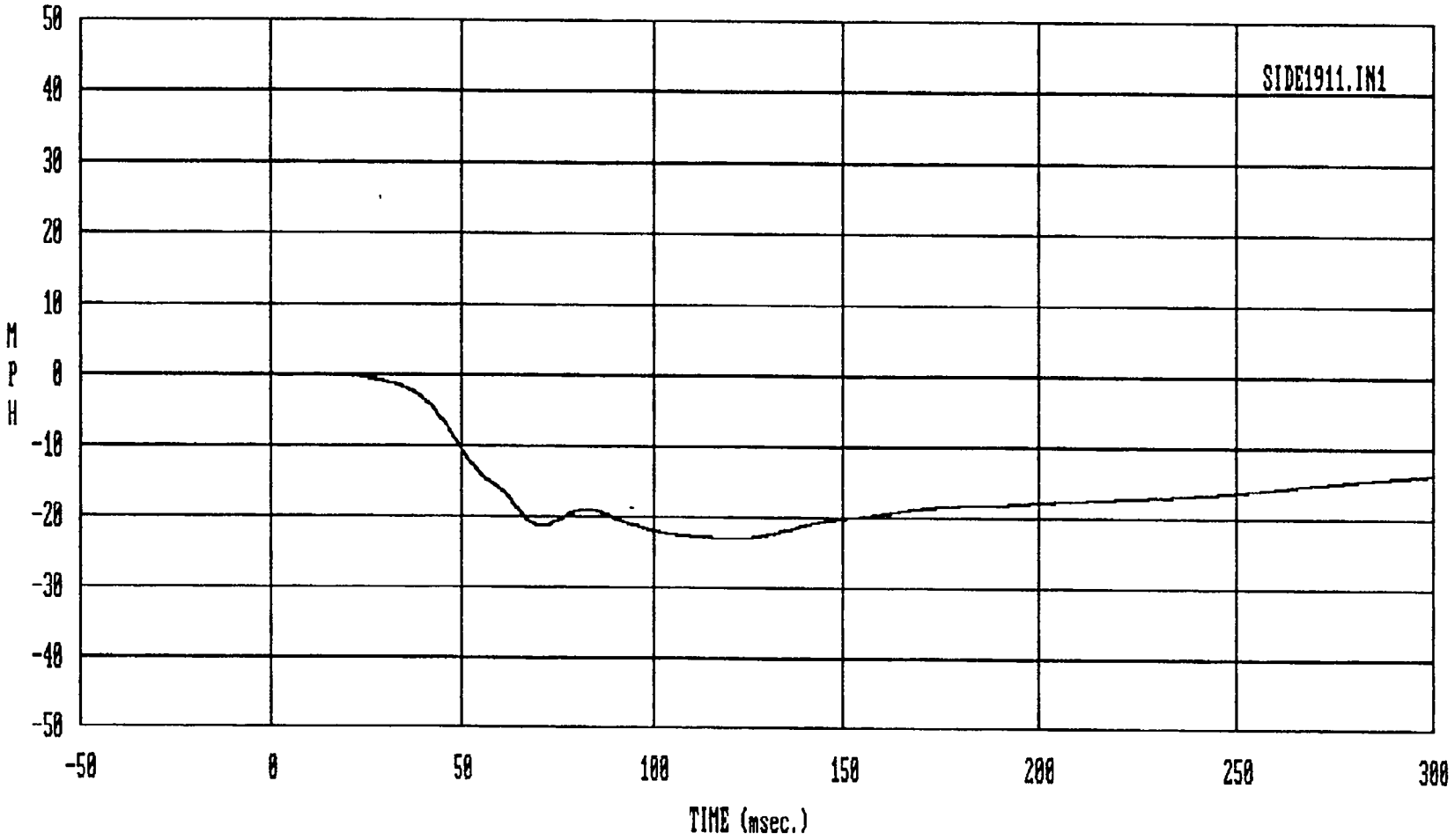
Curve: Pasngr Lower Rib 2 delta V — Redundant Filter: FIR 100 Max = .11643E-01 Min = -24.896

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



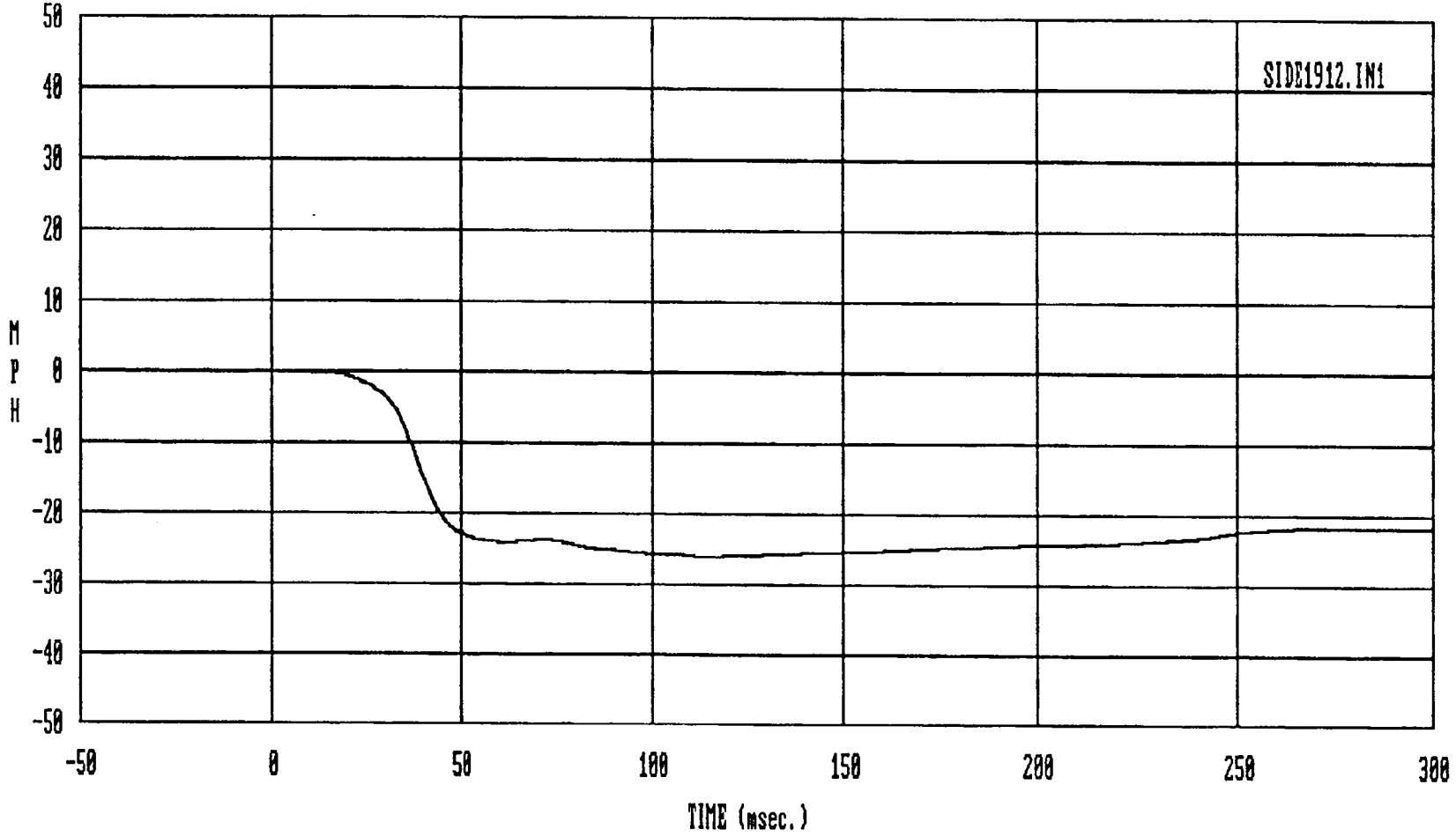
Curve: Pasngr Lower Spine 1 delta V — Primary Filter: FIR 100 Max = .57409E-02 Min = -24.841

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



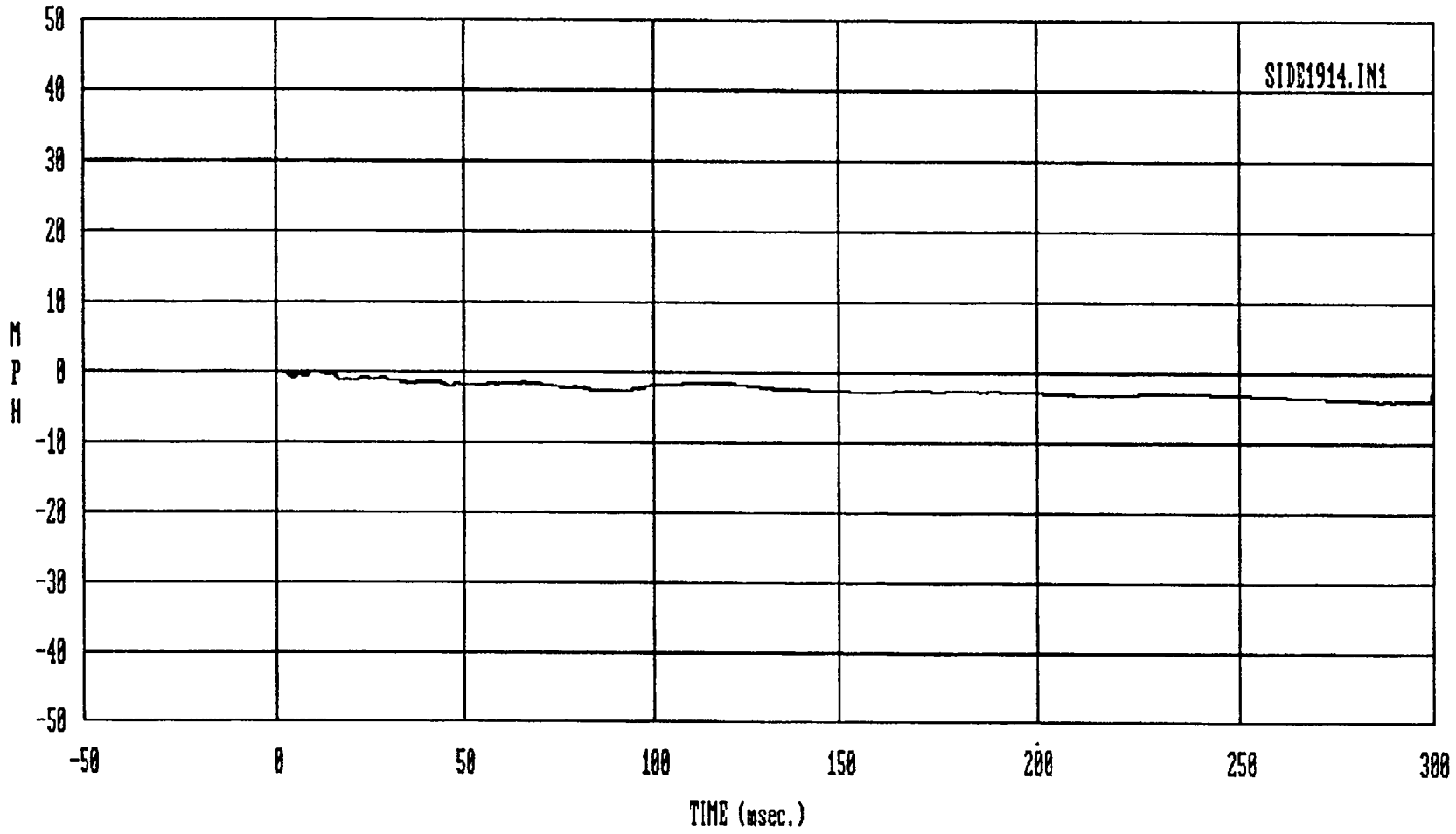
Curve: Pasngr Lower Spine 2 delta V -- Redundant Filter: FIR 100 Max = -.30603E-03 Min = -23.001

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



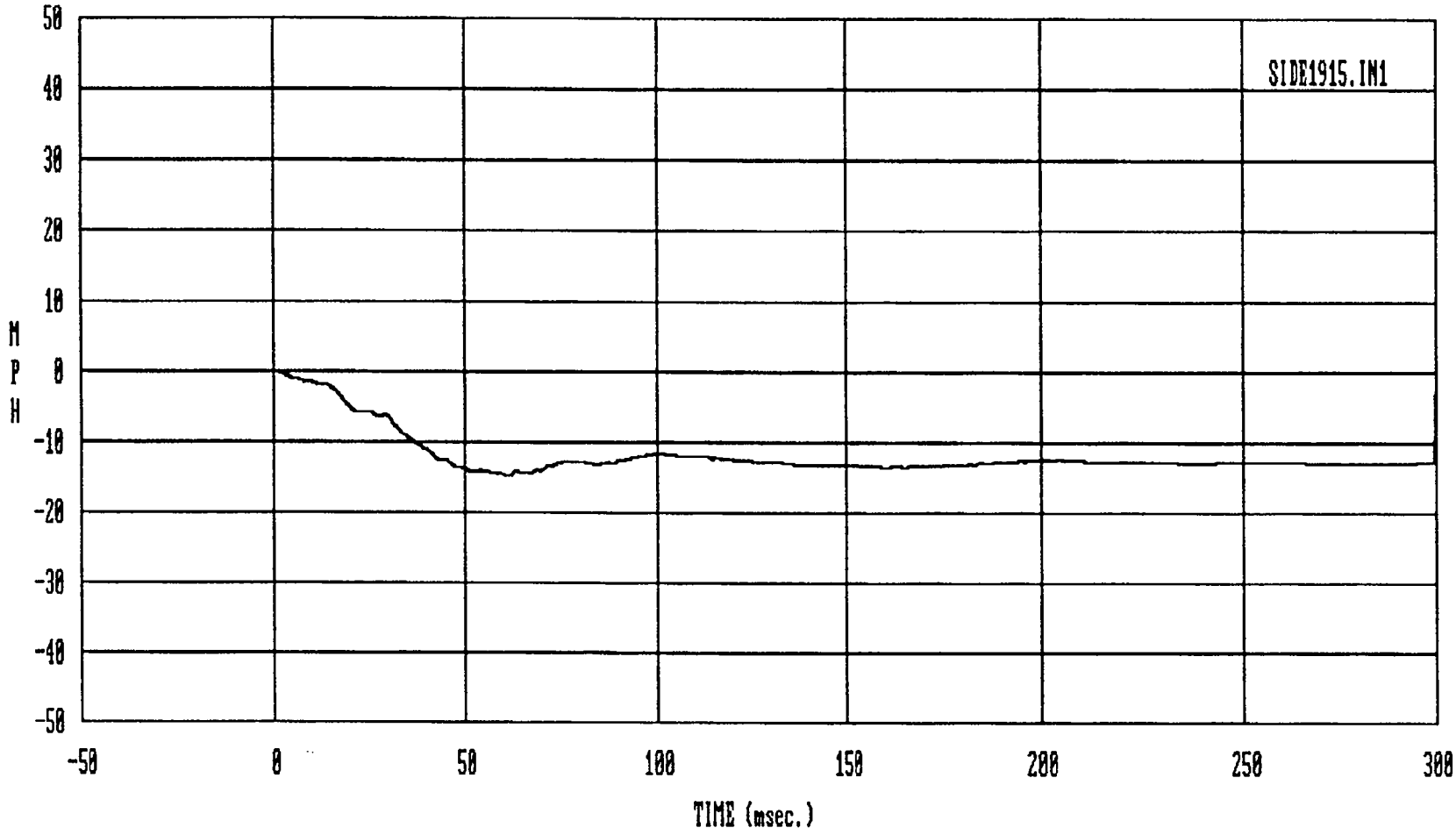
Curve: Pasngr Pelvis delta V Filter: FIR 180 Max = .17419E-02 Min = -26.045

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



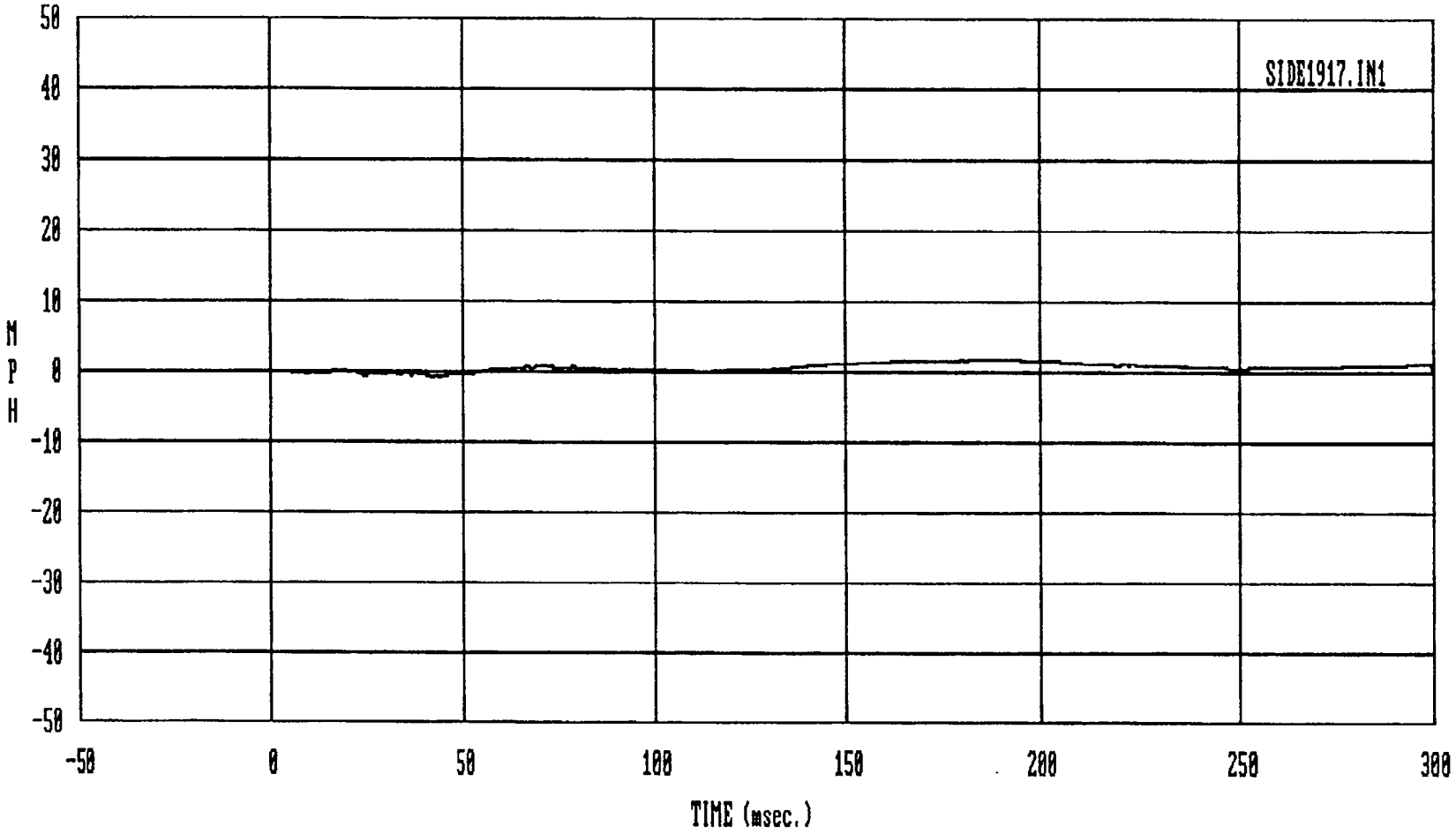
Curve: Front Seat Left sill delta V — X axis Filter: SAE CLASS 180 Max = .81252E-01 Min = -4.0262

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



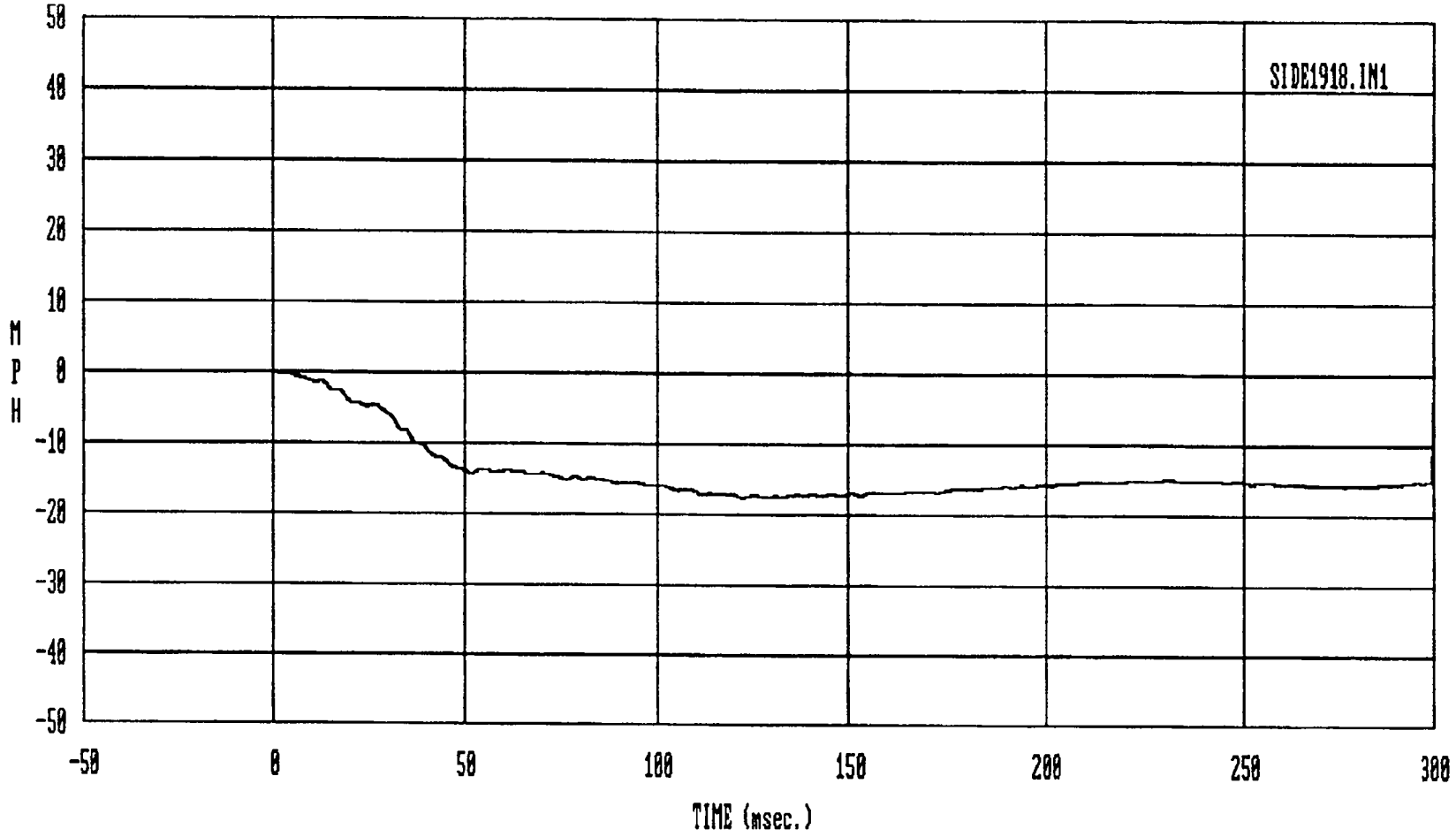
Curve: Front Seat Left sill delta V — Y axis Filter: SAE CLASS 180 Max = -.15900E-02 Min = -14.804

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



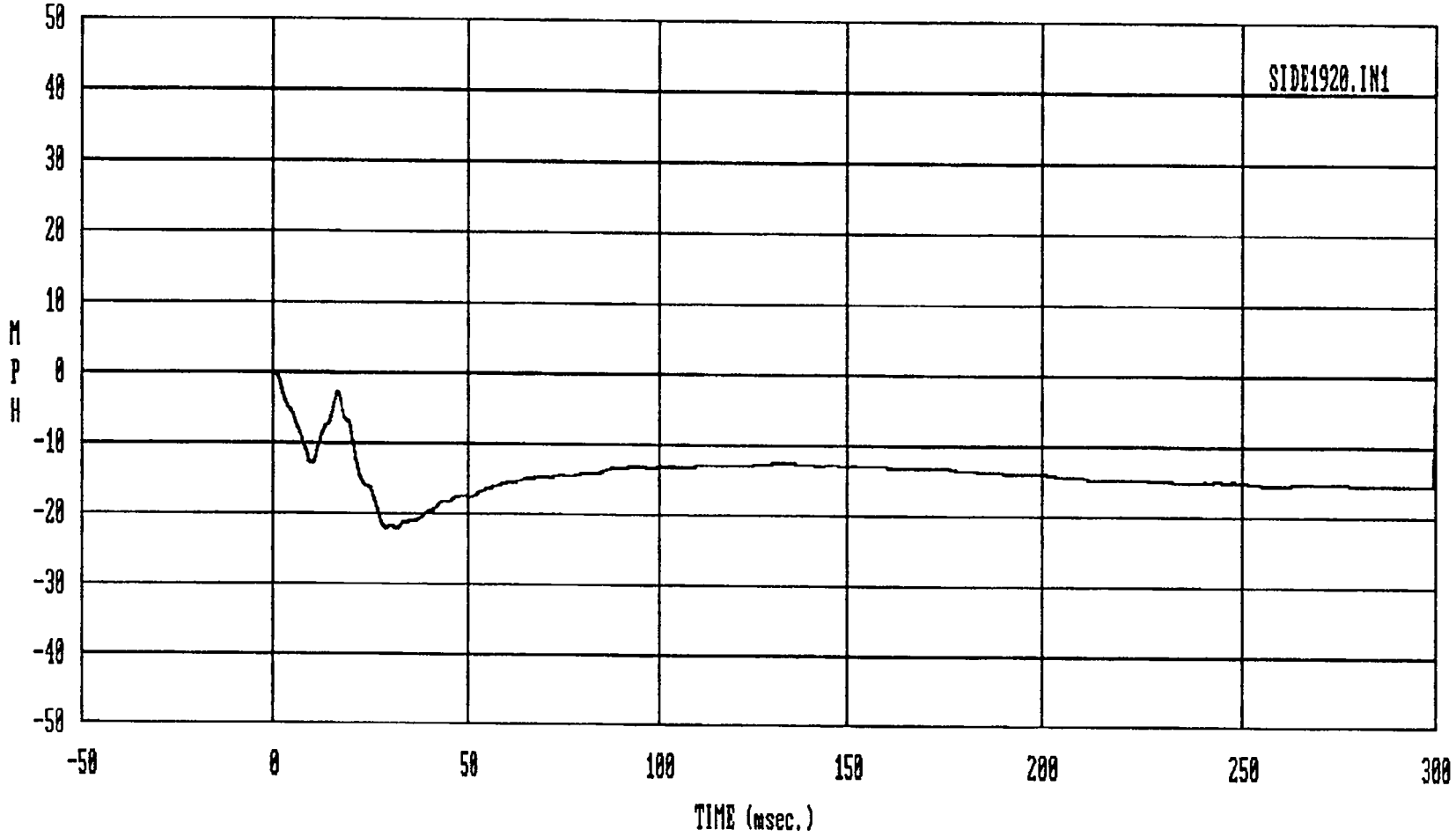
Curve: Rear Floor above axle delta V — X axis Filter: SAE CLASS 180 Max = 1.7743 Min = -.74415

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



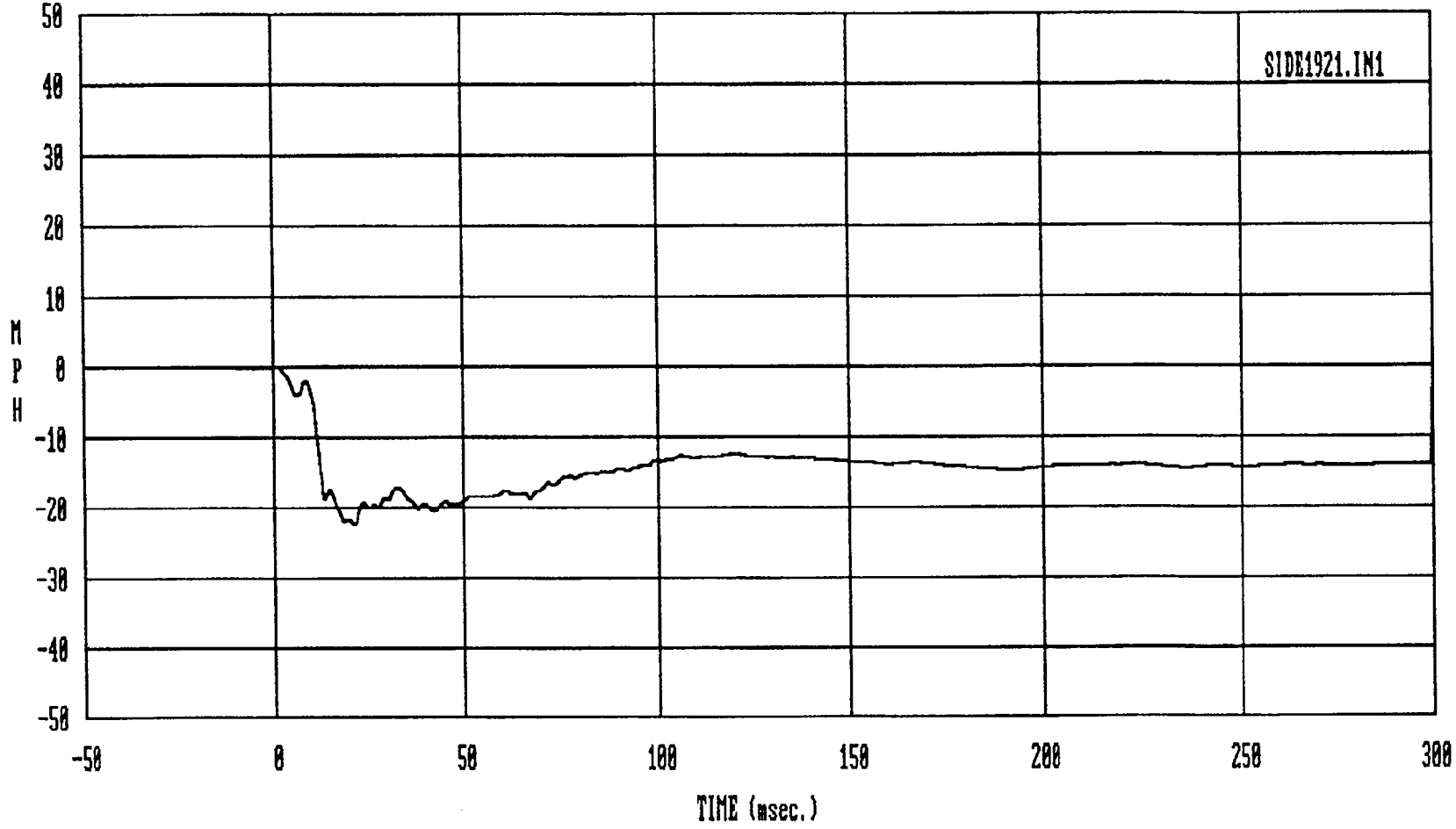
Curve: Rear Floor above axle delta V — Y axis Filter: SAE CLASS 180 Max = -.32744E-02 Min = -17.591

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



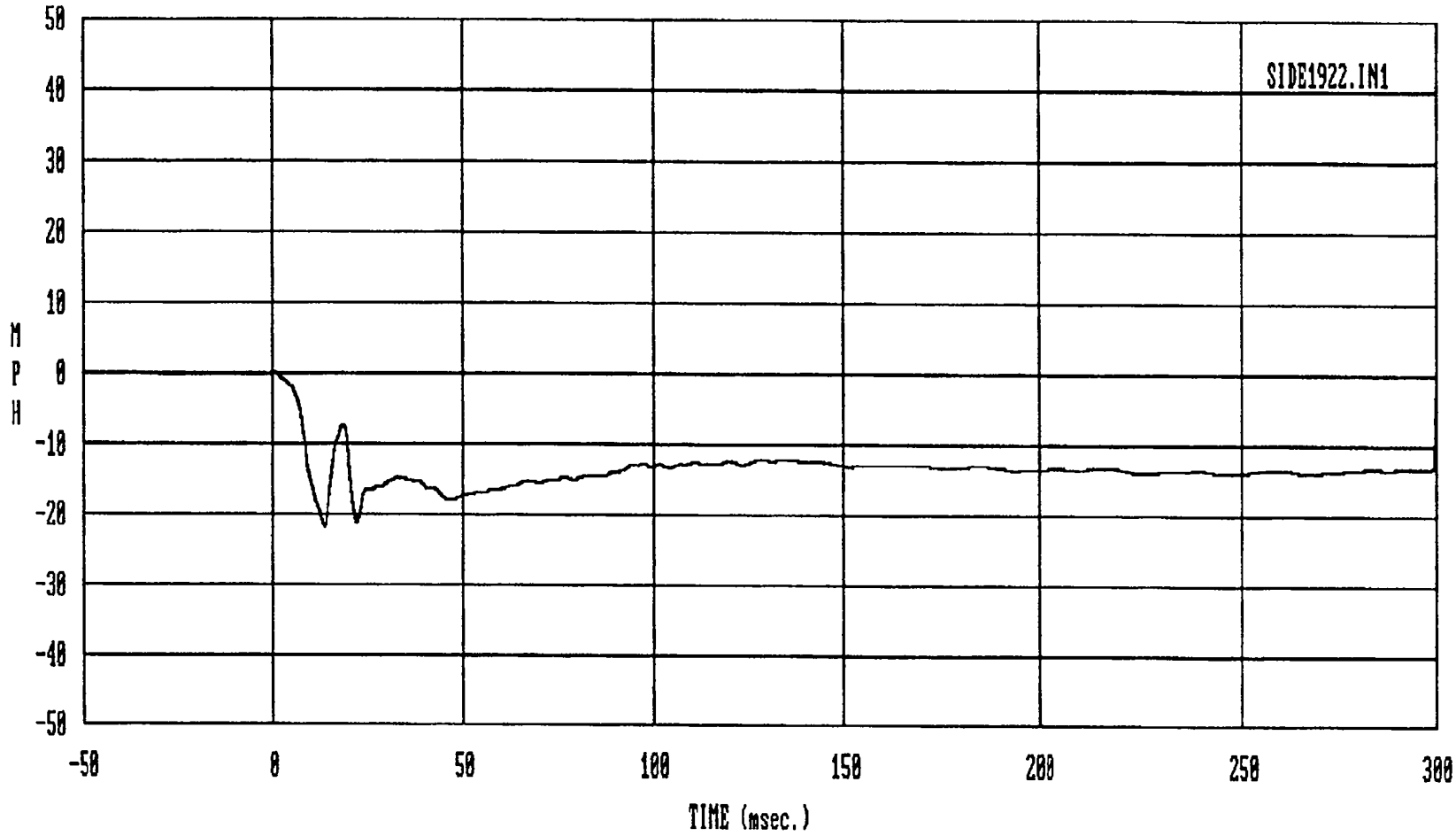
Curve: Front Seat Right Sill delta V — Y axis Filter: SAE CLASS 180 Max = -.86008E-02 Min = -22.240

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



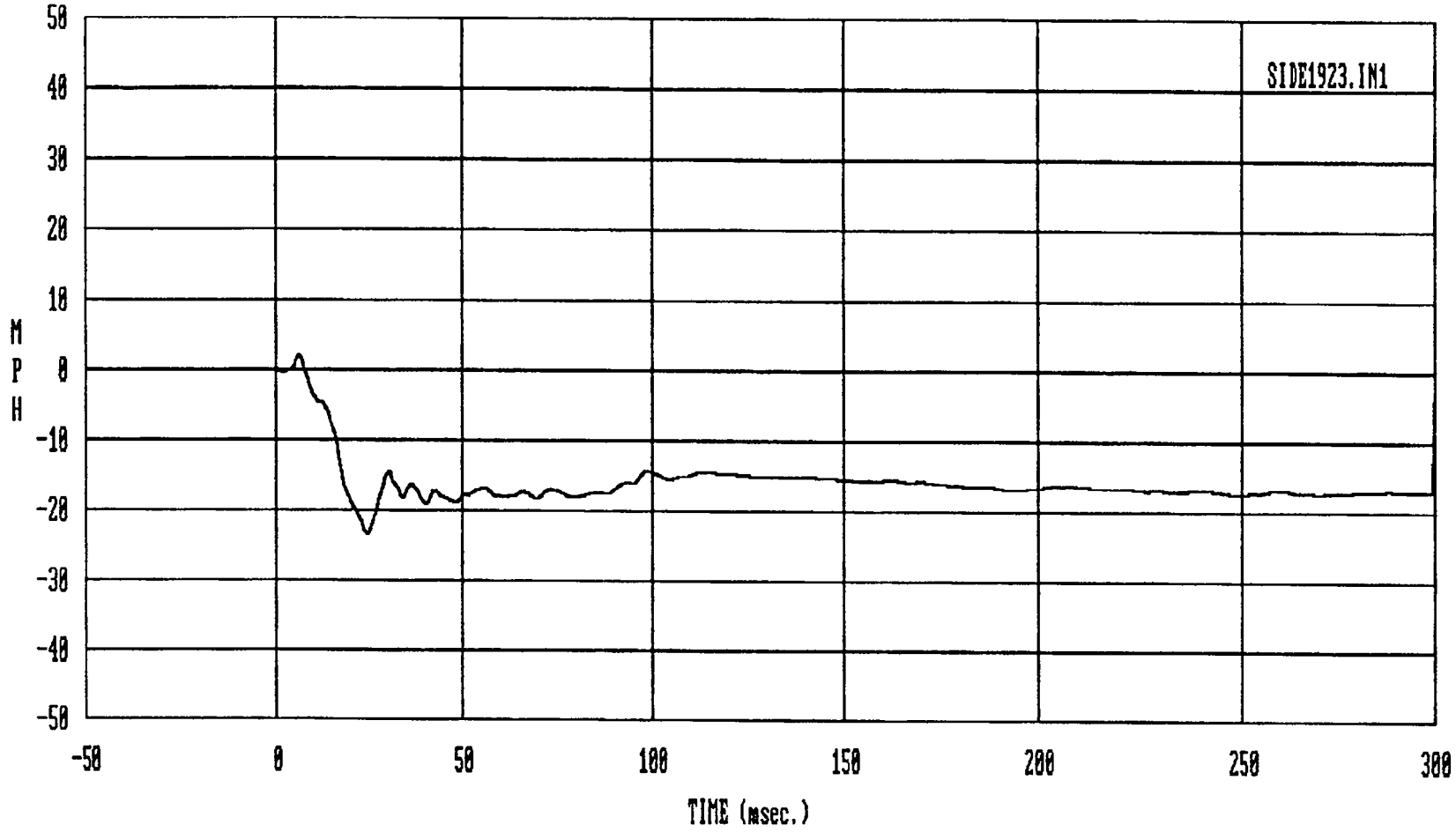
Curve: Right Front Door at centerline delta V Filter: SAE CLASS 180 Max = .88681E-01 Min = -22.487

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



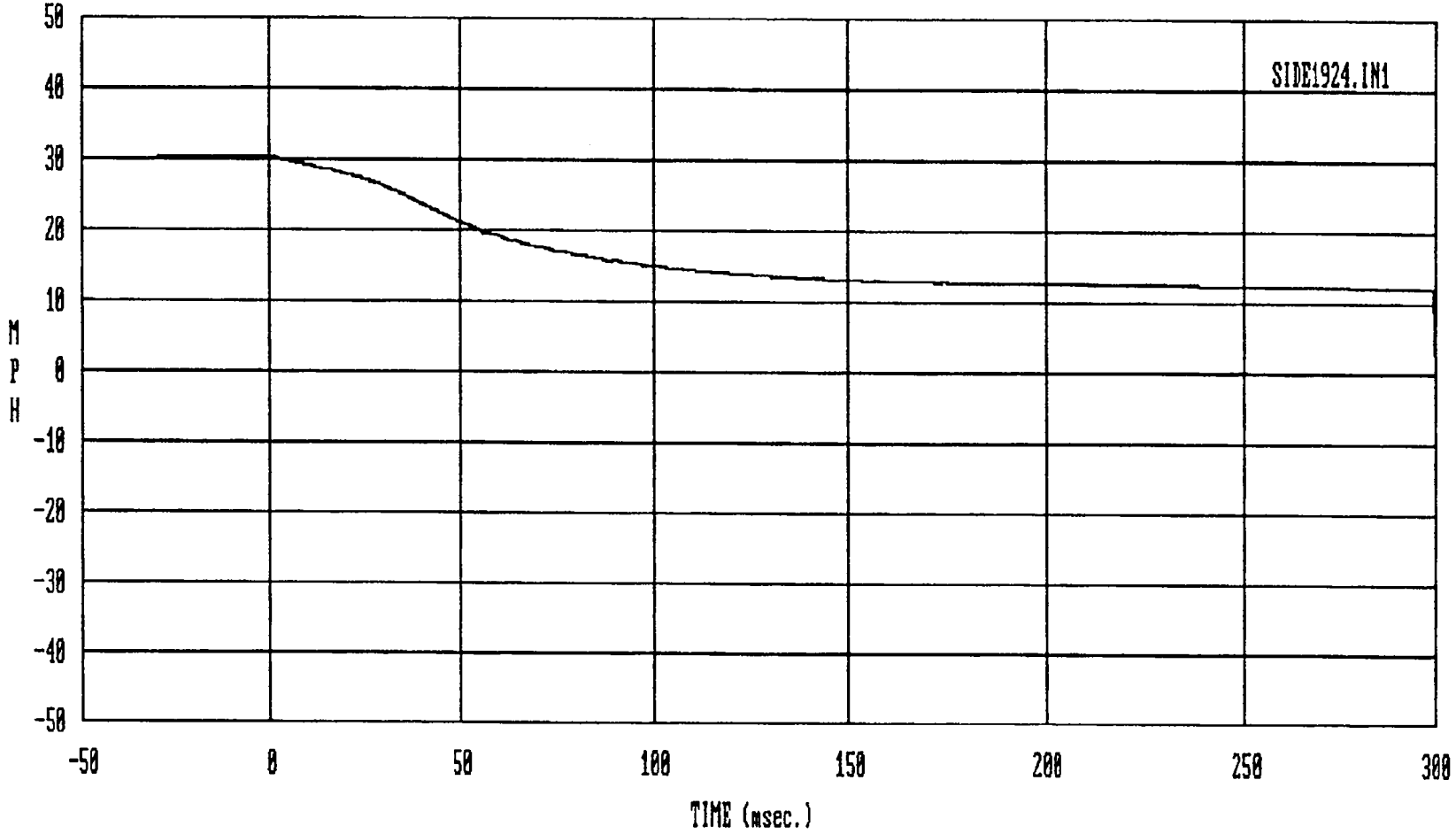
Curve: Right Front Door at mid-rear delta V Filter: SAE CLASS 180 Max = .12410 Min = -21.771

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



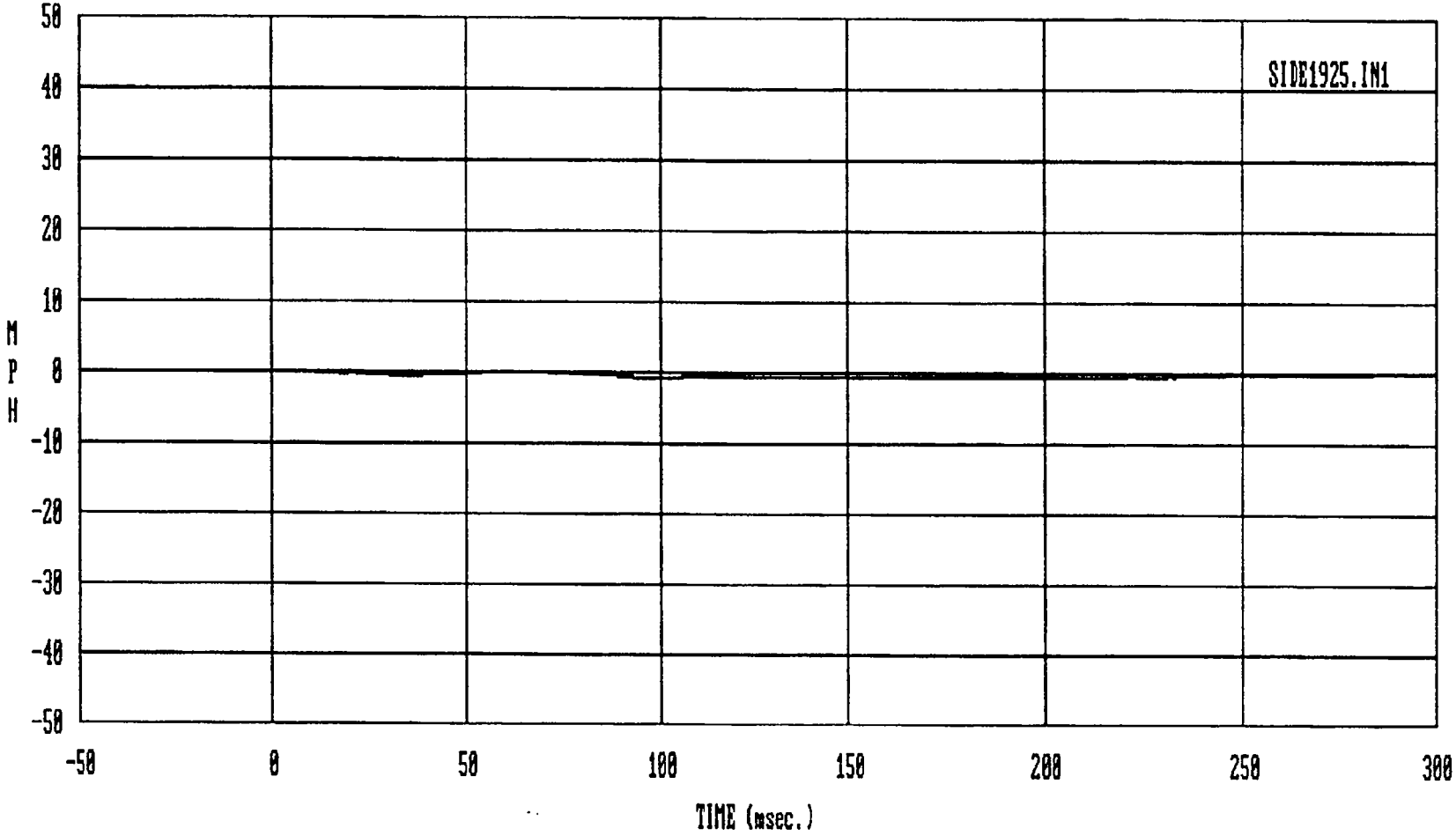
Curve: Right Front Door at upper centerline delta V Filter: SAE CLASS 180 Max = 2.2249 Min = -23.289

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



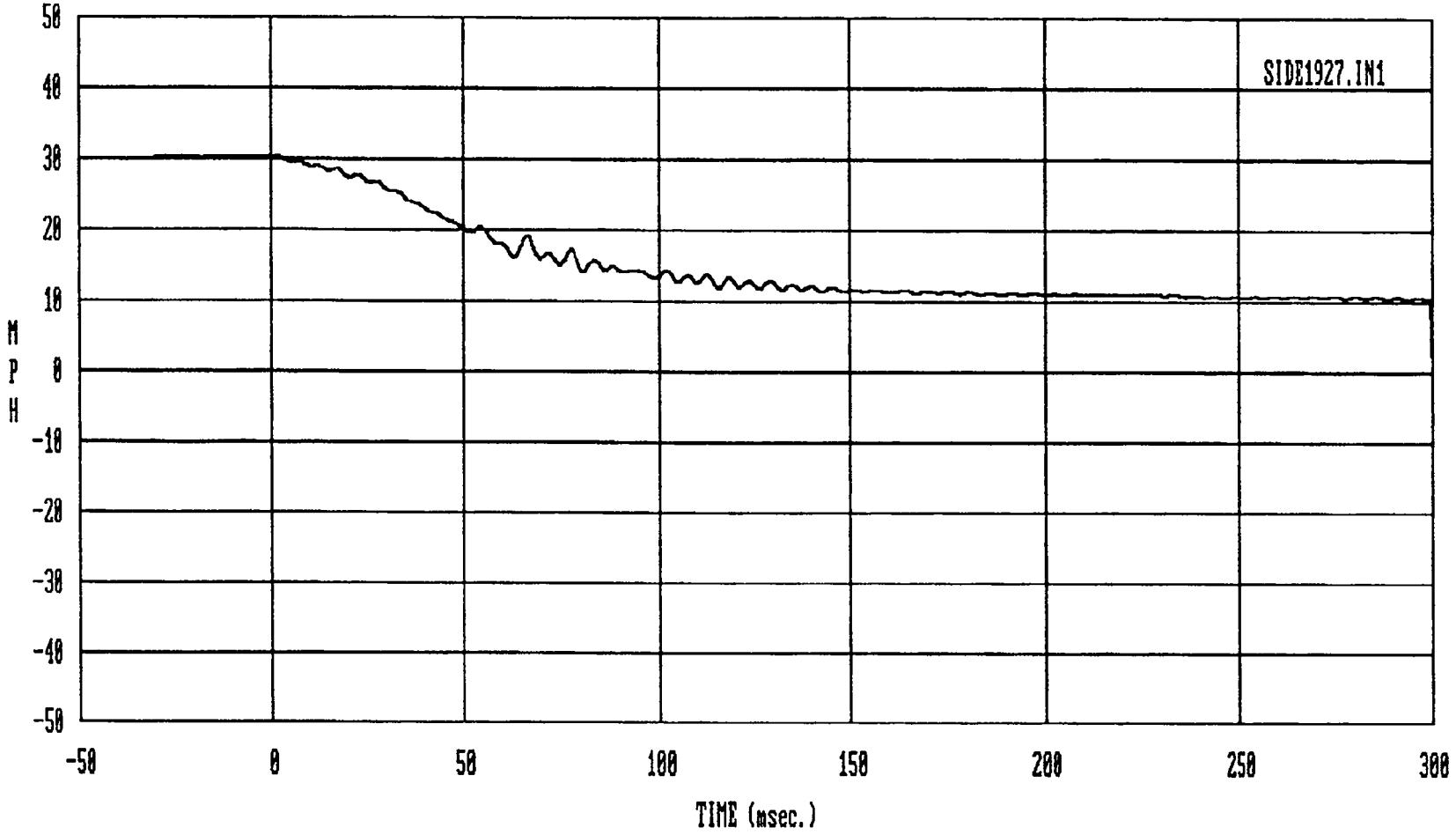
Curve: Movable Deformable Barrier C/G delta V - X axis Filter: SAE CLASS 180 Max = 30.399 Min = 12.154

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



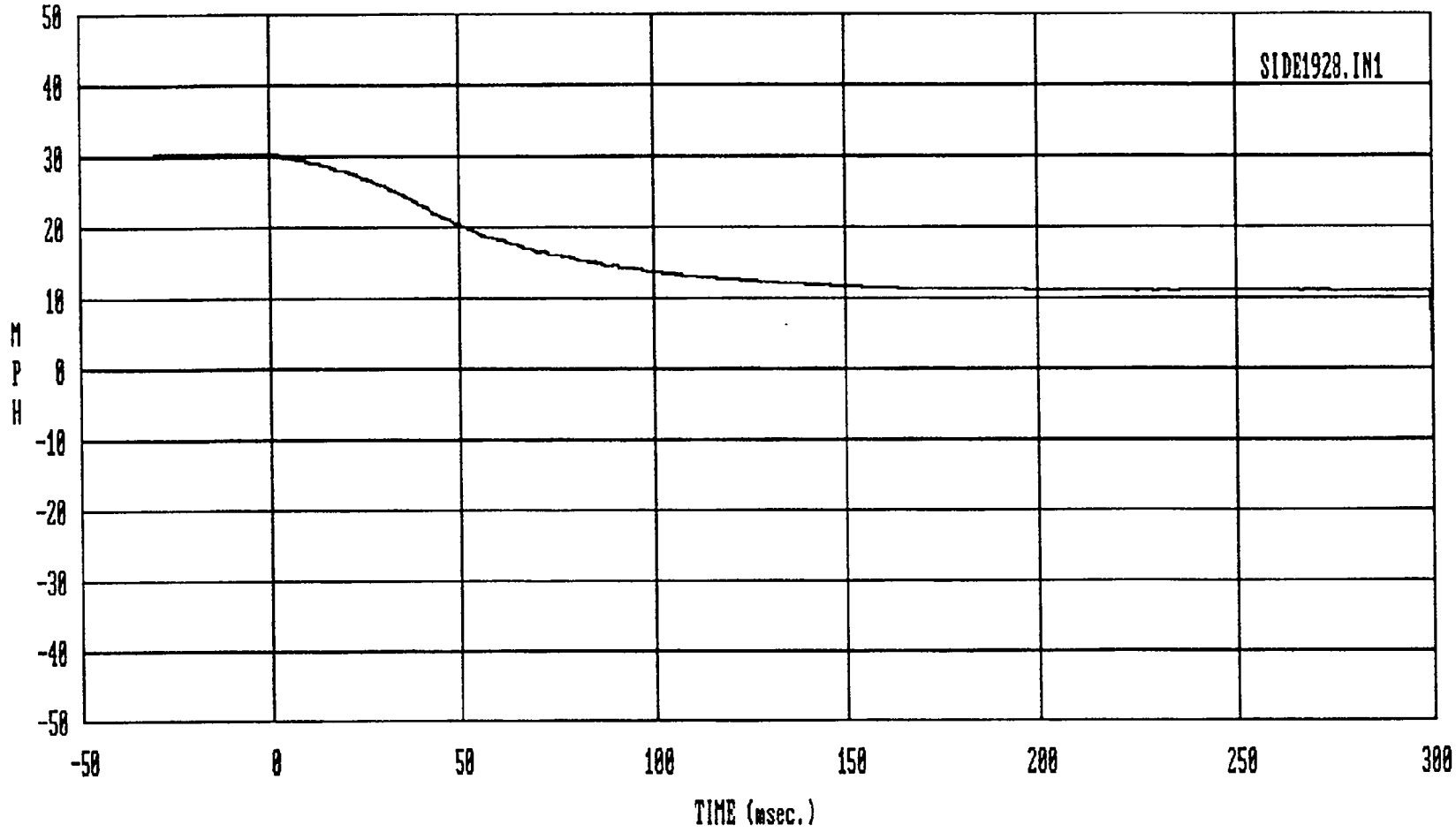
Curve: Movable Deformable Barrier C/G delta V - Y axis Filter: SAE CLASS 180 Max = .91212E-01 Min = -.76343

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



Curve: Movable Deformable Barrier Front frame delta V Filter: SAE CLASS 180 Max = 30.402 Min = 10.414

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150



Curve: Movable Deformable Barrier Rear frame delta V Filter: SAE CLASS 180 Max = 30.413 Min = 10.919

MSE Date: 08/17/89 Program: 1989 Side Impact (passenger side) Vehicle: 1989 Ford F-150

APPENDIX C

SID CERTIFICATION DATA
(DATA PRESENTED HERE ARE FOR POSTTEST CALIBRATION)

SID IMPACT CALIBRATION SUMMARY SHEET

S.I.D. I.D. NO. : 319

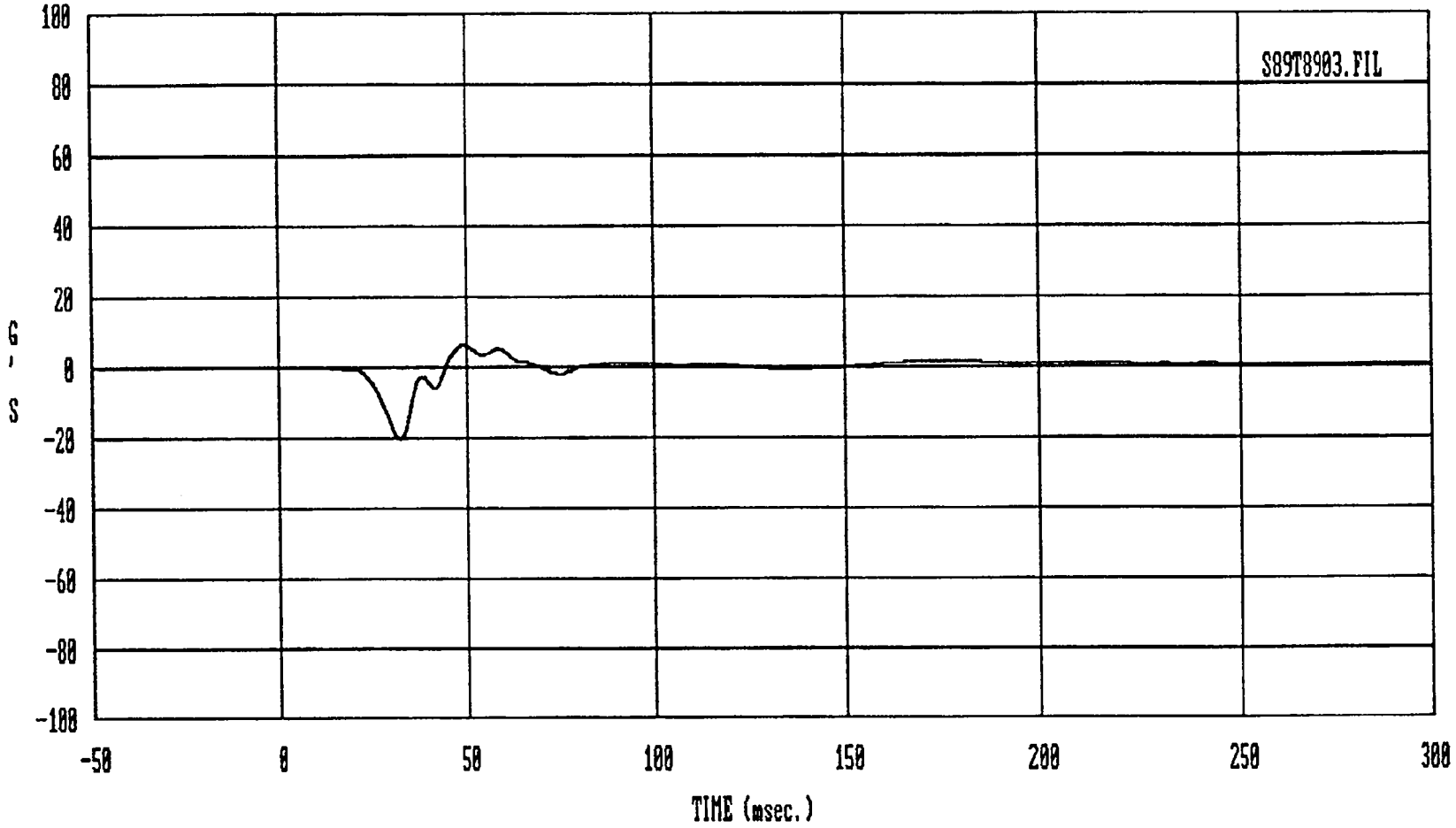
LABORATORY TECHNICIAN: APURVA MAPARA

Sheet No. 1 of 2		Pretest Calibration	Posttest Calibration
Date of SID Calibration - - - - - - - - - - -		11/10/89	
Calibration Sequential Number for Dummy - -			
Temperature min Lab. (Spec.=66 to 78° F)- -			
Relative Humidity in Lab. (Spec.=10 to 70%)			
TEST PARAMETER	SPECIFICATION		
1. NECK BENDING TEST:			
a. Pendulum Speed- - - -	21.5 to 25.5 fps		
b. Pendulum Avg. Decel - (over t3-t2)- - - - -	20 to 24G	N/A	
c. Peak resultant Head Acceleration- - - - -	26G maximum		
d. Pendulum Decel. (t2-t1)	<3 ms		
e. Pendulum Decel. (t2-t2)	25 to 30 ms		
f. Pendulum Decel. (t2-t3)	<0 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		
0 Displ.	.5 to .5 in		
30° Time	25.6 to 34.4 ms		
30 Displ.	2.1 to 3.1 in.		
60° Time	40.3 to 51.7 ms	N/A	
60 Displ.	4.3 to 5.3 in		
Maximum ° Time	53.2 to 66.8 ms		
( ) 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		
0 Displ.	4.3 to 5.3 in		
30° Time	85.4 to 104.6ms	N/A	
30 Displ.	2.1 to 3.1 in.		
60° Time	101.0 to 123.0ms		
60 Displ.	-.5 to 0.5 in		

S.I.D. I.D. NO. : 319

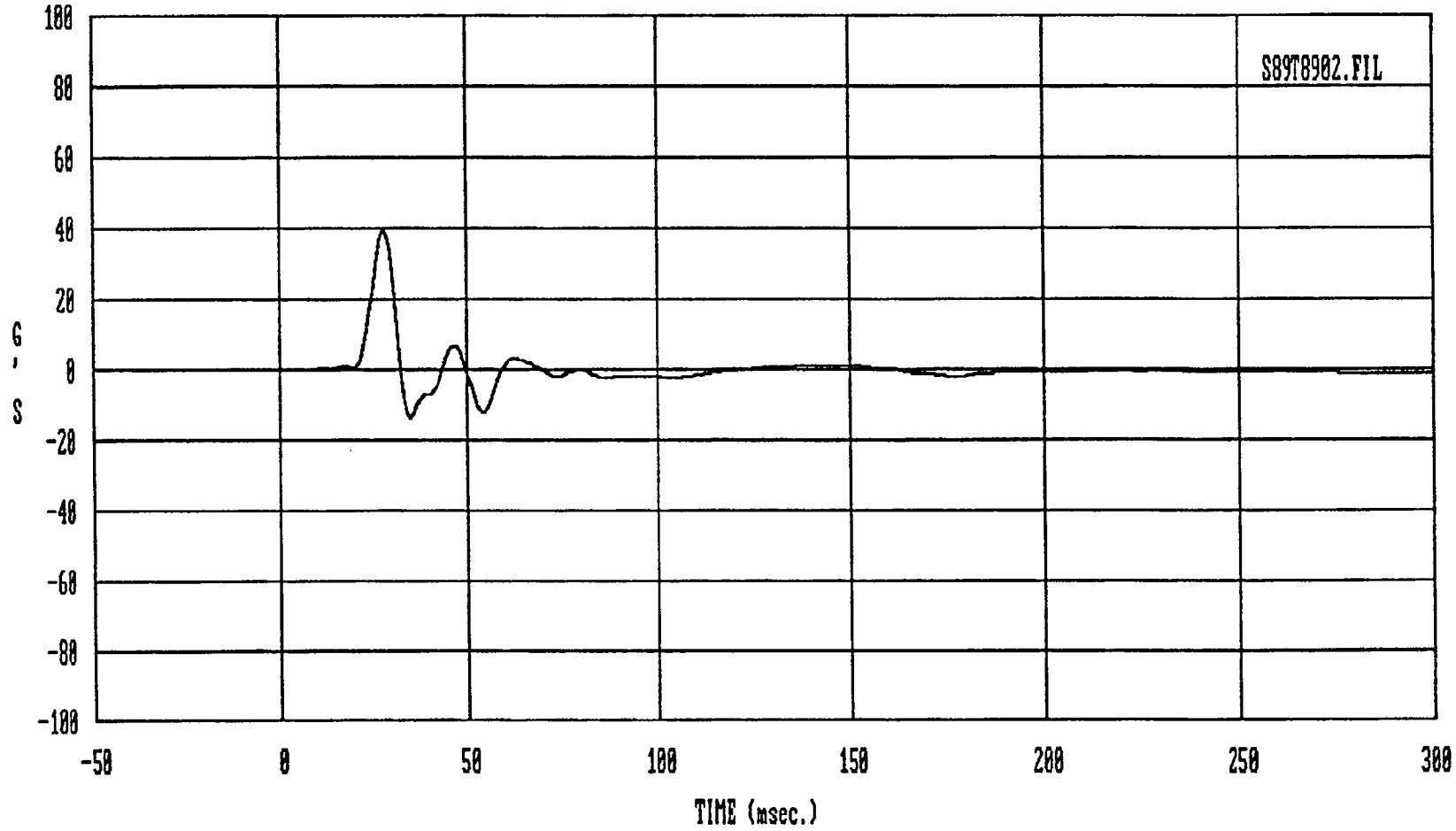
LABORATORY TECHNICIAN: APURVA MAPARA

Sheet No. 2 of 2 TEST PARAMETER	SPECIFICATION	Pretest Calibration	Posttest Calibration
3.ABDOMINAL COMPRESSION TEST (Preload = 10 pounds)		↑	
a. Force @ .5" - - - - -	23 - 36 lbs	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	
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 37 - 46g's Sec	42.314	
b. Lower Rib accel. - - -	Primary 37 - 46g's Sec	39.654	
c. Lower Spine accel- - -	Primary 15 -22 g's Sec	20.364	
6. PELVIC IMPACT TEST:			
Pelvic accel.- - - - -	40 - 60g's	44.218	



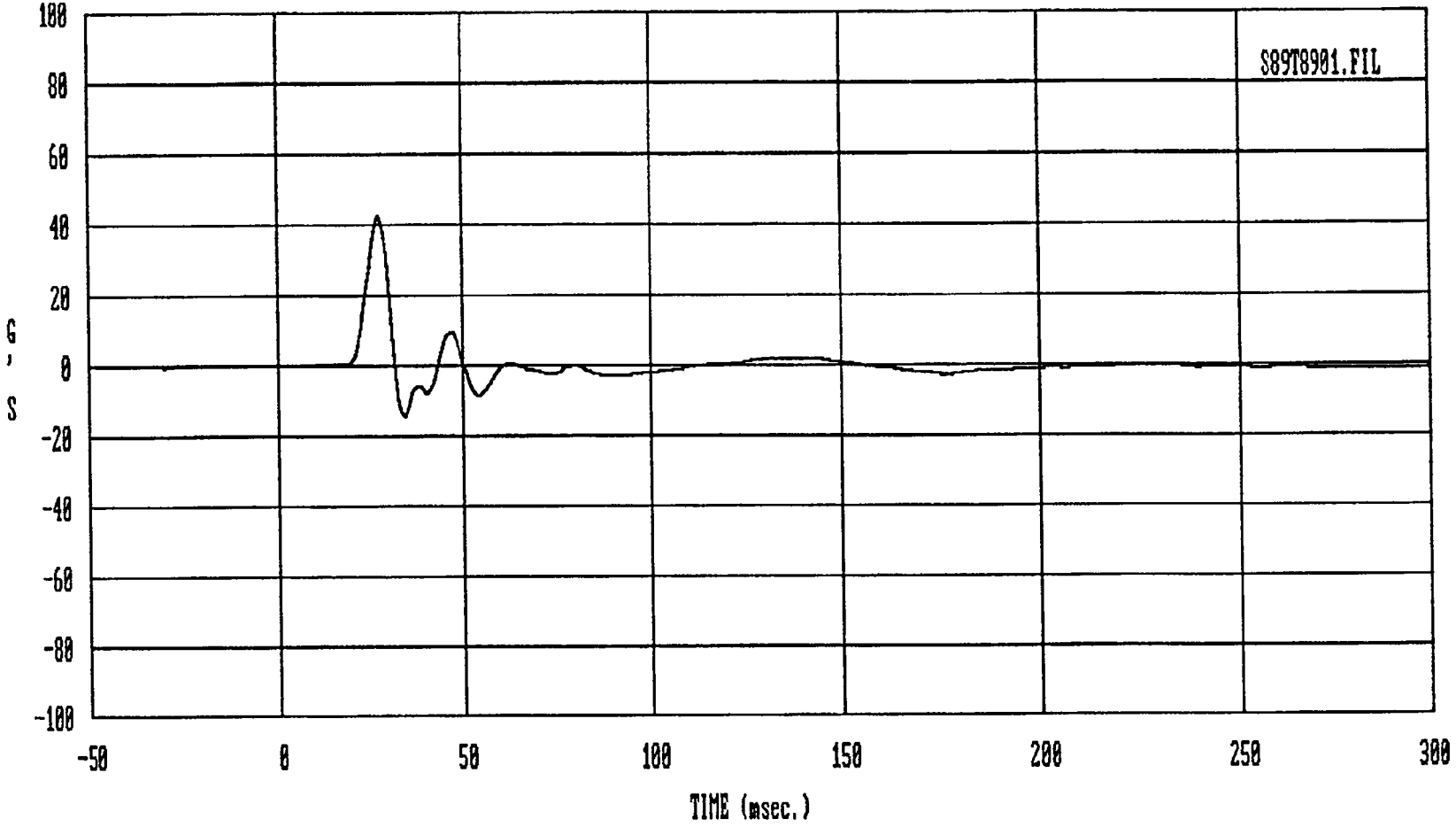
Curve: Lower Spine Acceleration Filter: FIR 100 Max = 6.3057 Min = -28.364

MSE Date: 11/10/89 S.I.D. NO. 319 TEST: THORAX IMPACT



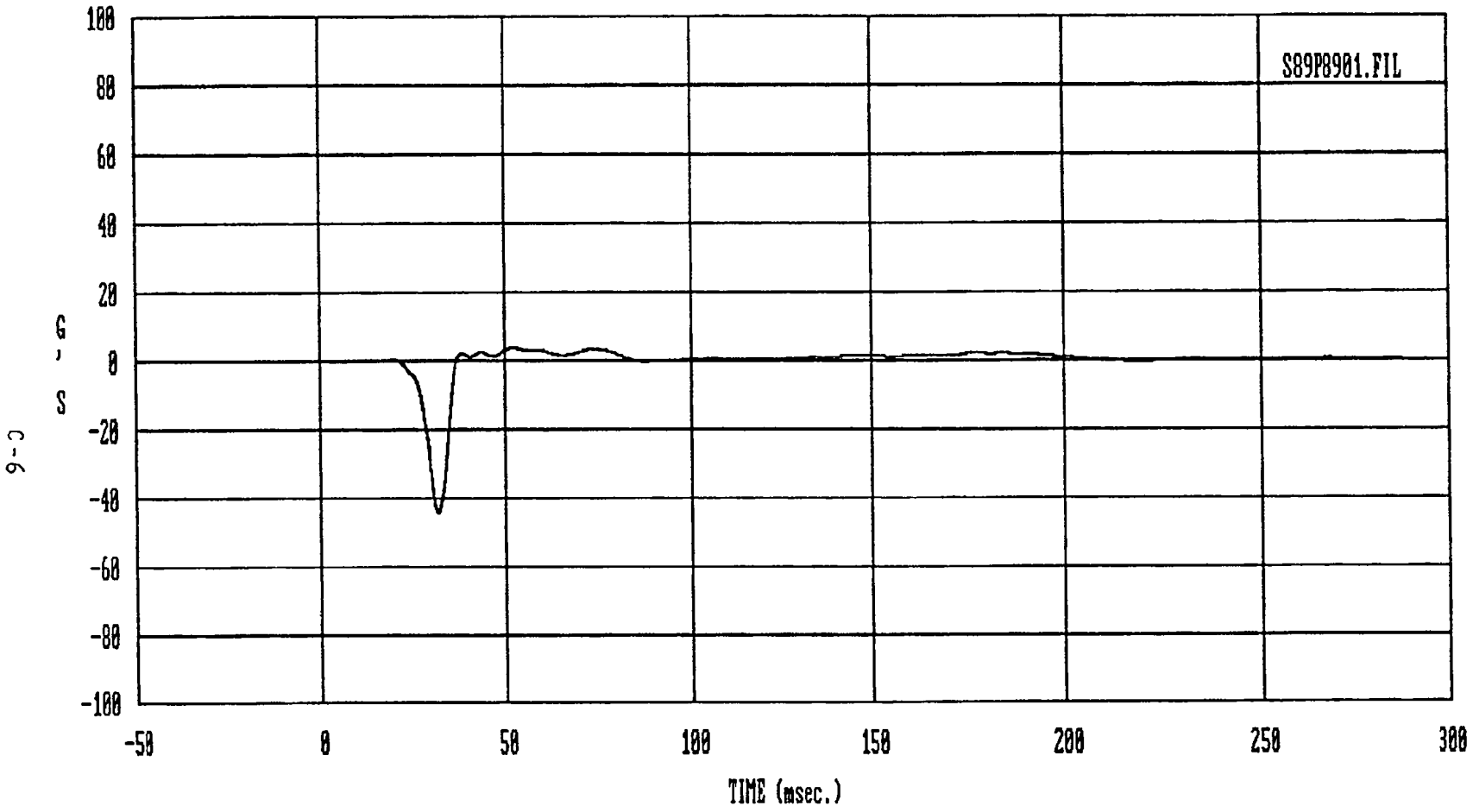
Curve: Lower Rib Acceleration Filter: FIR 100 Max = 39.654 Min = -13.798

MSE Date: 11/10/89 S.I.D. NO. 319 TEST: THORAX IMPACT



Curve: Upper Rib Acceleration Filter: FIR 100 Max = 42.314 Min = -14.563

MSE Date: 11/10/89 S.I.D. NO. 319 TEST: THORAX IMPACT



Curve: Pelvic Acceleration Filter: FIR 100 Max = 3.9566 Min = -44.218

MSE Date: 11/10/89 S.I.D. NO. 319 TEST: PELVIC IMPACT

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).