

# 1516

VEHICLE AND OCCUPANT ROLLOVER DYNAMICS  
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER  
INTO RIGID POLE AT 30 MPH

PREPARED BY:  
THE TRANSPORTATION RESEARCH CENTER OF OHIO  
10820 STATE ROUTE 347  
EAST LIBERTY, OHIO 43319

AUGUST - SEPTEMBER, 1990  
TEST REPORT

PREPARED FOR:  
SYSTEMS RESEARCH LABORATORIES, INC.  
2800 INDIAN RIPPLE ROAD  
DAYTON, OHIO 45440

1. The following channel on the Sign Convention Sheet at the end of Appendix D should read:

Neck Load Cells:      +Y Force:      Head Pushed Leftward

2. All neck load cell moments should be labeled lb-ft, instead of lb-in, including:

Dummy Data Summary Sheet, page 4-5.

Plots, Appendix B

Driver Neck Moment About X Axis

Driver Neck Moment About Y Axis

Driver Neck Moment About Z Axis

NOTICE

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# METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures  
 Symbol When You Know Multiply by To Find Symbol

LENGTH		
in	inches	2.5 centimeters
ft	feet	30 centimeters
yd	yards	0.9 meters
mi	miles	1.6 kilometers

AREA		
in <sup>2</sup>	square inches	6.5 square centimeters
ft <sup>2</sup>	square feet	0.09 square meters
yd <sup>2</sup>	square yards	0.8 square meters
mi <sup>2</sup>	square miles	2.6 square kilometers
acres	acres	0.4 hectares

MASS (weight)		
oz	ounces	28 grams
lb	pounds	0.45 kilograms
	short tons	0.9 metric ton
	(2000 lb)	

VOLUME		
tsp	teaspoons	5 milliliters
Tbsp	tablespoons	15 milliliters
in <sup>3</sup>	cubic inches	16 milliliters
fl oz	fluid ounces	30 milliliters
c	cups	0.24 liters
pt	pints	0.47 liters
qt	quarts	0.95 liters
gal	gallons	3.8 liters
ft <sup>3</sup>	cubic feet	0.03 cubic meters
yd <sup>3</sup>	cubic yards	0.76 cubic meters

TEMPERATURE (exact)		
°F	degrees Fahrenheit	5/9 (after subtracting 32)
		degrees Celsius

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

MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	metric ton	1.1	short tons	
	(1000 kg)			

VOLUME				
mL	milliliters	0.03	fluid ounces	fl oz
mL	milliliters	0.06	cubic inches	in <sup>3</sup>
L	liters	2.1	pints	pt
L	liters	1.06	quarts	qt
L	liters	0.26	gallons	gal
m <sup>3</sup>	cubic meters	35	cubic feet	ft <sup>3</sup>
m <sup>3</sup>	cubic meters	1.3	cubic yards	yd <sup>3</sup>

TEMPERATURE (exact)				
°C	degrees Celsius	9/5 (then add 32)	degrees Fahrenheit	°F

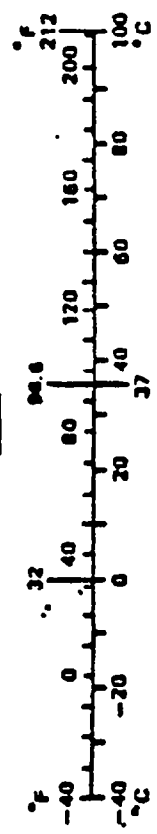


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## SECTION 1.0

### PURPOSE AND TEST SUMMARY

This rollover crash test has the main objective to investigate both vehicle and occupant dynamics during automobile rollover crashes.

This test, a driver's side curb rollover, was conducted with a 1988 Dodge Caravan, containing a driver dummy. The vehicle was oriented so that its roof and left side impacted a rigid pole. The vehicle was propelled laterally at a velocity of 30 mph. The test vehicle contained an instrumented Part 572E dummy restrained with a three-point unbelt.

## SECTION 2.0

### SUMMARY OF ROLLOVER CRASH TEST

A 1988 Dodge Caravan, containing one instrumented Part 572E test dummy, was propelled laterally so that the driver's side impacted into a rigid curb. The vehicle rolled so that its roof and left side impacted a rigid, vertical, instrumented pole at 30 mph. This driver's side curb rollover into pole crash test was conducted by the Transportation Research Center of Ohio in East Liberty, Ohio on August 20, 1990.

The Part 572E 50th percentile adult male anthropomorphic test device (dummy) was placed in the driver's designated seating position according to the seating procedure in FMVSS 208 Notice 60. The dummy was instrumented with head, chest, and pelvis triaxial accelerometers, a six-axis neck load cell, and a chest displacement potentiometer. The crash event was recorded by thirty-four channels of data on one 14-track tape drive. The analog data was digitally sampled at 8000 samples per second. The data was digitally filtered per SAE J2110CT88.

The crash event was filmed by six high-speed motion picture cameras operating at approximately 500 frames per second and one real-time panning motion picture camera.

Section 1.0 contains the purpose and test summary. Section 2.0 contains a summary of the rollover crash test. Section 3.0 contains the general test and vehicle parameter data. Section 4.0 contains the occupant information. Appendix A contains the pre-test and post-test still photographs. Appendix B contains the final data plots. Appendix C contains the pre-test dummy calibrations. Appendix D contains the pre-test and post-test IPMD vehicle data sheets.

POLE LOAD CELL LOCATIONS AND DATA SUMMARY

TEST NUMBER 900820

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
					MAX	MSEC	MAX	MSEC
1	POLE LEFT TOP FORCE (lbs) LONGITUDINAL	16.2	3.3	73.5	813.1	632.0	5092.3	427.5
2	POLE RIGHT TOP FORCE (lbs) LONGITUDINAL	16.2	-3.5	73.6	171.0	87.0	5510.3	510.5
3	POLE LEFT BOTTOM FORCE (lbs) LONGITUDINAL	16.2	3.2	5.0	1791.9	630.5	9908.1	423.5
4	POLE RIGHT BOTTOM FORCE (lbs) LONGITUDINAL	16.2	-3.3	5.0	2719.9	420.5	5080.4	535.0

\* ALL MEASUREMENTS OF POLE LOAD CELL LOCATIONS ARE IN INCHES.  
X, Y AND Z REFERENCE TO RELEASE BLOCK.

REFERENCE: X: + FORWARD FROM RELEASE BLOCK  
Y: + LEFTWARD FROM POLE CENTERLINE  
Z: + UPWARD FROM GROUND LEVEL  
FORCE: + TENSION

FINAL RESTING PLACE OF VEHICLE

<u>DESCRIPTION OF VEHICLE</u>	<u>X, DISTANCE *</u>	<u>Y, DISTANCE *</u>
1988 Dodge Caravan:		
Left rear corner	132.2	85.5
Right rear corner	76.8	114.5
Left front corner	60.5	-66.5
Right front corner	4.0	-42.5

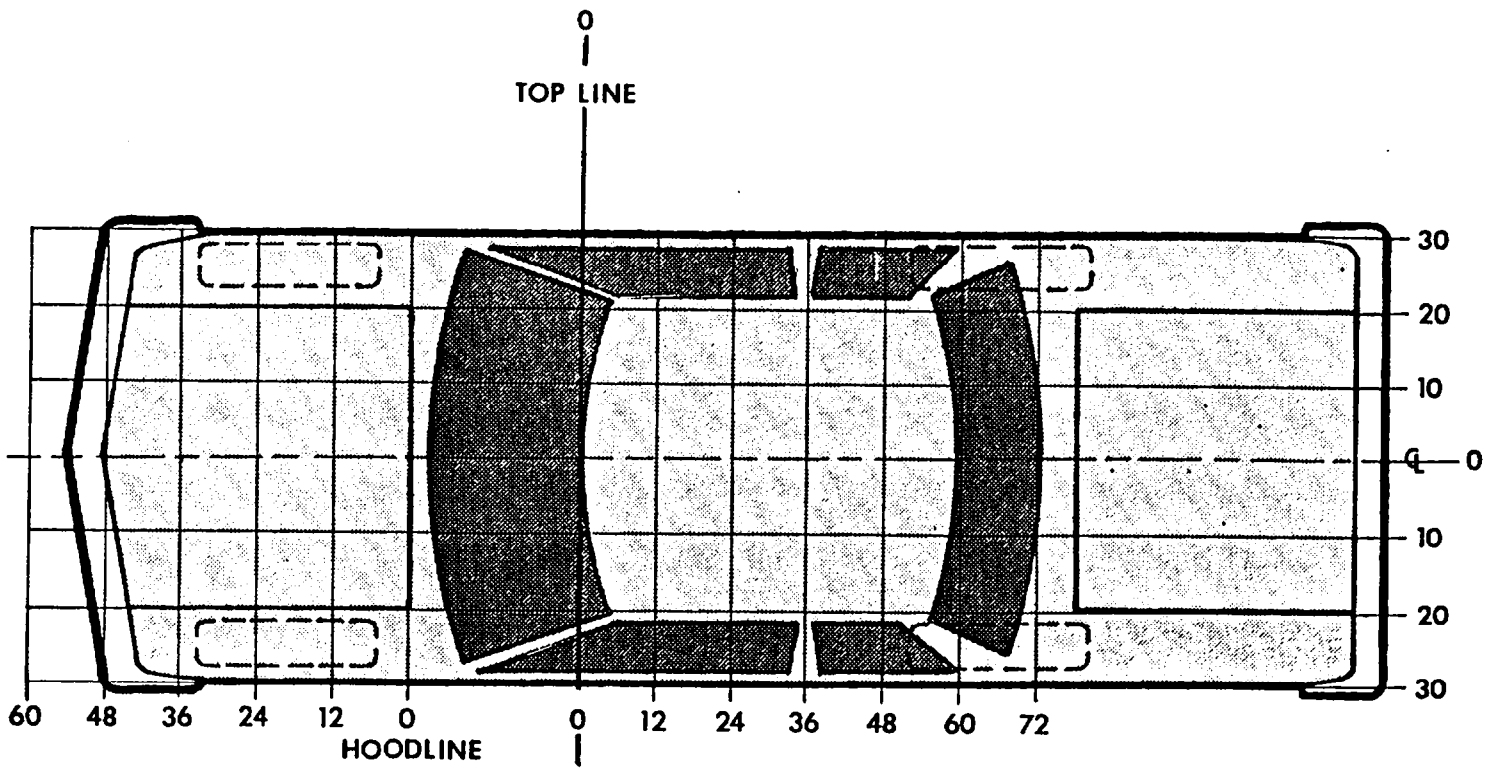
\*REFERENCE: +X: FORWARD FROM RELEASE BLOCK  
              +Y: LEFTWARD FROM CENTER RELEASE BLOCK

ALL MEASUREMENTS ARE IN INCHES.

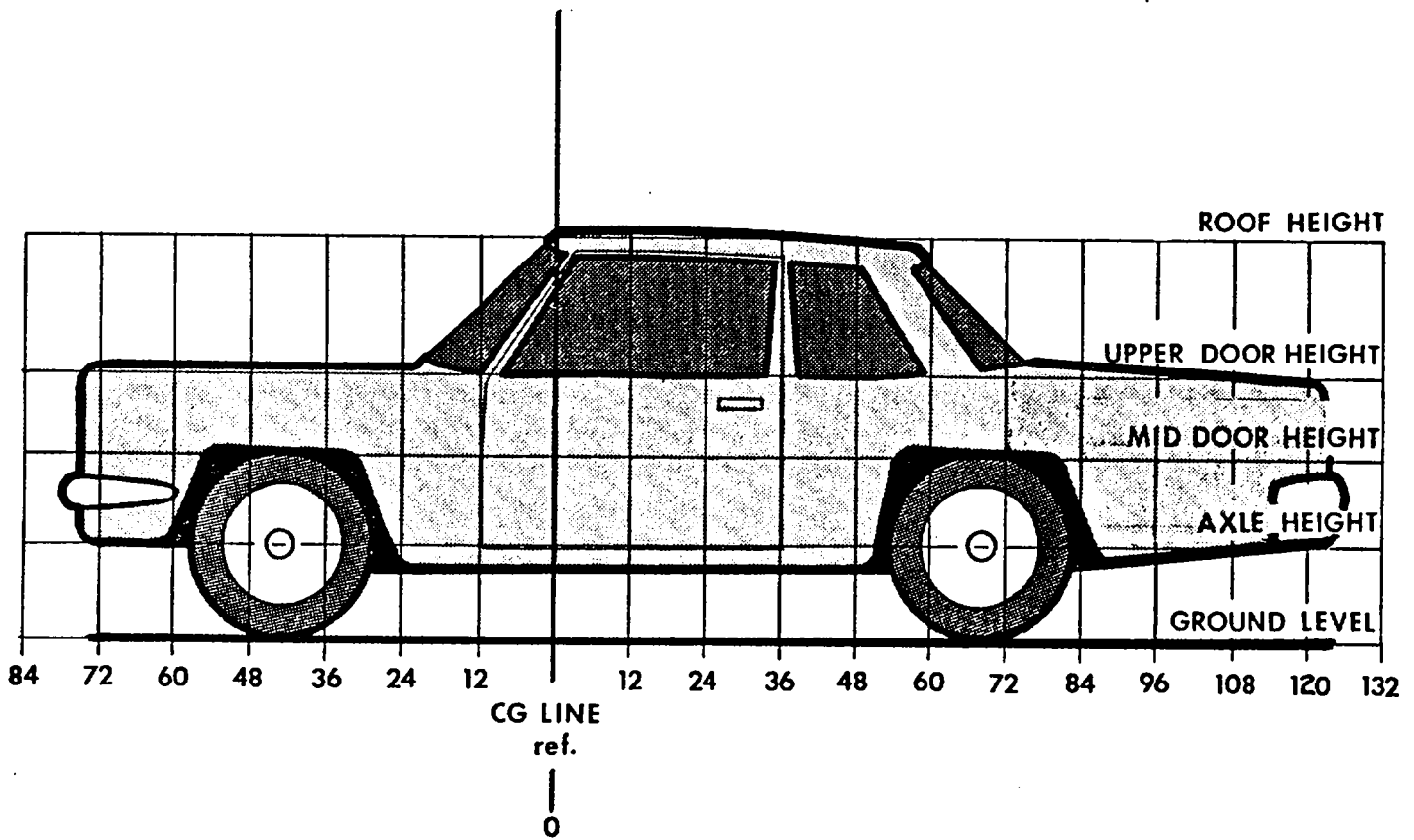
VEHICLE INTERIOR MEASUREMENTS

<u>DESCRIPTION</u>	<u>PRE</u>	<u>POST</u>	<u>DIFF</u>
Floor board to top of left "A" post	43.8	38.8	5.0
Floor board to top of right "A" post	43.5	44.1	-0.6
Door sill to top of left "B" post	47.1	45.2	1.9
Door sill to top of right "B" post	49.8	46.8	3.0
Door sill to top of left door opening	45.3	39.6	5.7
Door sill to top of right door opening	47.2	47.1	0.1
Floor tunnel to windshield header	45.4	50.9	-5.5
Floor tunnel to center of roof	49.2	46.6	2.6
Rear of floor tunnel to roof	48.4	47.5	0.9
Maximum width at "B" post	58.8	47.2	11.6
Maximum width at "A" post	56.8	54.7	2.1
Maximum width at top of door opening	51.0	40.7	10.3

ALL MEASUREMENTS ARE IN INCHES



HOOD AND ROOF STATIC CRUSH LOCATIONS



LEFT AND RIGHT SIDE STATIC CRUSH LOCATIONS

VEHICLE HOOD EXTERIOR PROFILES  
ZERO DISTANCE AT VEHICLE HOOD CENTERLINE\*

LOCATION	30	20	10	0	10	20	30
<u>PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)</u>							
Trailing edge of cowl at centerline	43.4	44.0	44.0	44.2	44.1	43.8	42.8
Trailing edge of cowl + 12 inches***	40.2	41.1	42.0	41.8	41.8	41.8	40.4
Trailing edge of cowl + 24 inches	37.2	38.1	38.6	38.9	39.1	38.8	37.8
Trailing edge of cowl + 36 inches	X	X	X	X	X	X	X
Trailing edge of cowl + 48 inches	X	X	X	X	X	X	X
<u>POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)</u>							
Trailing edge of cowl at centerline	42.5	42.8	43.0	43.4	43.2	42.8	41.6
Trailing edge of cowl + 12 inches	39.2	40.8	41.4	41.6	41.6	41.2	40.4
Trailing edge of cowl + 24 inches	36.1	38.4	39.1	39.5	39.5	39.9	39.0
Trailing edge of cowl + 36 inches	X	X	X	X	X	X	X
Trailing edge of cowl + 48 inches	X	X	X	X	X	X	X
<u>STATIC CRUSH (IN)</u>							
Trailing edge of cowl at centerline	-0.9	-1.2	-1.0	-0.8	-0.9	-1.0	-1.2
Trailing edge of cowl + 12 inches	-1.0	-0.3	-0.6	-0.2	-0.2	-0.6	0.0
Trailing edge of cowl + 24 inches	-1.1	0.3	0.5	0.6	0.4	1.1	1.2
Trailing edge of cowl + 36 inches	X	X	X	X	X	X	X
Trailing edge of cowl + 48 inches	X	X	X	X	X	X	X

- \* Column readings are left to right from left to right on vehicle.
- \*\* Reference plane is a horizontal plane at ground level.
- \*\*\* Longitudinal distance from trailing edge of cowl at centerline forward to measurement plane.
- + Static crush means vehicle structure is bowed upward.
- Static crush means vehicle structure is crushed.

VEHICLE ROOF EXTERIOR PROFILES  
ZERO DISTANCE AT VEHICLE ROOF CENTERLINE\*

LOCATION	20	10	0	10	20
<u>PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)</u>					
Longitudinal Center of Gravity	64.8	65.1	65.5	65.5	64.6
Longitudinal Center of Gravity + 12 inches***	65.1	65.3	65.2	65.4	65.4
Longitudinal Center of Gravity + 24 inches	65.2	65.4	65.4	65.6	65.2
Longitudinal Center of Gravity + 36 inches	65.2	65.8	65.2	65.3	65.4
Longitudinal Center of Gravity + 48 inches	65.2	64.9	65.4	65.2	65.2
Longitudinal Center of Gravity + 60 inches	65.1	65.2	65.0	65.4	64.9
<u>POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)</u>					
Longitudinal Center of Gravity	47.8	54.2	58.9	60.5	68.9
Longitudinal Center of Gravity + 12 inches	51.0	57.4	59.9	65.0	69.6
Longitudinal Center of Gravity + 24 inches	55.2	61.2	64.2	69.0	70.2
Longitudinal Center of Gravity + 36 inches	58.8	65.4	69.2	72.5	70.8
Longitudinal Center of Gravity + 48 inches	62.3	68.1	70.4	71.8	70.6
Longitudinal Center of Gravity + 60 inches	65.5	68.9	70.0	71.1	70.8
<u>STATIC CRUSH (IN)</u>					
Longitudinal Center of Gravity	-17.0	-10.9	-6.6	-5.0	4.3
Longitudinal Center of Gravity + 12 inches	-14.1	-7.9	-5.3	-0.4	4.2
Longitudinal Center of Gravity + 24 inches	-10.0	-4.2	-1.2	3.4	5.0
Longitudinal Center of Gravity + 36 inches	-6.4	-0.4	4.0	7.2	5.4
Longitudinal Center of Gravity + 48 inches	-2.9	3.2	5.0	6.6	5.4
Longitudinal Center of Gravity + 60 inches	0.4	3.7	5.0	5.7	5.9

\* Column readings are left to right from left to right on vehicle.

\*\* Reference plane is a horizontal plane at ground level.

\*\*\* Longitudinal distance from center of gravity rearward to measurement plane.

+ Static crush means vehicle structure is bowed upward.

- Static crush means vehicle structure is crushed.

VEHICLE LEFT SIDE EXTERIOR PROFILES AND STATIC CRUSH  
ZERO DISTANCE AT VEHICLE LONGITUDINAL CENTER OF GRAVITY\*

LOCATION	HEIGHT(IN)	72	60	48	36	24	12	0	12	24	36	48	60	72	84	9
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PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE\*\*)

Roof Height	63.0	X	X	X	X	X	22.2	22.1	22.2	22.1	22.2	22.2	22.2	22.0	22.5	X
Upper Door	41.2	X	17.0	15.9	15.2	14.6	14.1	14.0	14.2	14.2	14.2	14.6	14.4	14.5	15.1	
Mid Door	27.5	X	14.5	X	13.9	13.4	13.3	12.8	13.0	12.9	13.3	X	12.4	13.9		
Axle Height	12.2	X	X	X	X	16.2	15.8	15.8	15.9	15.8	16.1	X	X	X	X	

POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE\*\*)

Roof Height	63.0	X	X	X	X	X	39.9	47.5	45.8	40.8	36.6	32.4	28.8	25.8	X	
Upper Door	41.2	X	18.6	18.1	17.5	21.0	26.6	32.1	30.8	26.1	22.0	17.9	16.0	15.8	14.9	
Mid Door	27.5	X	15.8	X	15.9	17.5	21.0	25.1	23.0	19.5	16.2	14.2	X	12.5	13.8	
Axle Height	12.2	X	X	X	X	19.8	19.9	20.4	20.5	19.4	18.6	17.9	X	X	X	

STATIC CRUSH (IN)

Roof Height	63.0	X	X	X	X	X	17.7	25.4	23.6	18.7	14.4	10.2	6.8	3.3	X	
Upper Door	41.2	X	1.6	2.2	2.3	6.4	12.0	18.0	16.8	11.9	7.8	3.3	1.6	1.3	-0.2	
Mid Door	27.5	X	1.3	X	2.0	4.1	7.7	11.2	10.2	6.5	3.3	0.9	X	0.1	-0.1	
Axle Height	12.2	X	X	X	X	3.6	3.7	4.6	4.7	3.5	2.8	1.8	X	X	X	

\* Center of gravity is located 49.1 inches rearward of vehicle front wheels. Column readings are left to right from front to rear on vehicle.

\*\* Reference plane is parallel to and 48 inches from the vehicle longitudinal centerline.

+ Static crush means that vehicle structure is crushed.

- Static crush means that vehicle structure is bowed outward.

VEHICLE RIGHT SIDE EXTERIOR PROFILES AND STATIC CRUSH  
ZERO DISTANCE AT VEHICLE LONGITUDINAL CENTER OF GRAVITY\*

LOCATION	HEIGHT (IN)	72	60	48	36	24	12	0	12	24	36	48	60	72	84	96
----------	-------------	----	----	----	----	----	----	---	----	----	----	----	----	----	----	----

PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE\*\*)

Roof Height	63.0	X	X	X	X	X	22.8	22.3	22.4	22.7	22.2	21.9	21.9	22.5	X	X
Upper Door	41.2	X	17.3	16.2	15.5	15.2	14.9	14.6	14.6	14.6	14.5	14.5	14.4	14.8	15.0	X
Mid Door	27.5	X	14.6	X	13.9	13.9	13.4	13.2	13.1	13.1	13.1	13.1	X	12.5	13.6	X
Axle Height	12.2	X	X	X	X	16.5	16.1	15.9	15.9	15.8	15.8	15.6	X	X	X	X

POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE\*\*)

Roof Height	63.0	X	X	X	X	X	14.0	12.8	12.6	14.4	15.6	17.1	18.9	20.6	X	X
Upper Door	41.2	X	15.4	13.6	11.5	10.5	9.9	8.9	8.5	9.2	10.1	10.8	12.8	13.9	14.5	X
Mid Door	27.5	X	13.1	X	11.2	10.5	10.8	9.1	8.8	9.5	10.2	10.8	X	11.9	13.1	X
Axle Height	12.2	X	X	X	X	13.4	13.2	13.0	13.2	13.2	13.4	13.7	X	X	X	X

STATIC CRUSH (IN)

Roof Height	63.0	X	X	X	X	X	-8.8	-9.5	-9.8	-8.3	-6.6	-4.8	-3.0	-1.9	X	X
Upper Door	41.3	X	-1.9	-2.6	-4.0	-4.7	-5.0	-5.7	-6.1	-5.4	-4.4	-3.7	-1.6	-0.9	-0.5	X
Mid Door	27.5	X	-1.5	X	-2.7	-3.4	-2.6	-4.1	-4.3	-3.6	-2.9	-2.3	X	-0.6	-0.5	X
Axle Height	12.2	X	X	X	X	-3.1	-2.9	-2.9	-2.7	-2.6	-2.4	-1.9	X	X	X	X

\* Center of gravity is located 49.1 inches rearward of vehicle front wheels. Column readings are left to right from front to rear on vehicle.

\*\* Reference plane is parallel to and 48 inches from the vehicle longitudinal centerline.

+ Static crush means that vehicle structure is crushed.

- Static crush means that vehicle structure is bowed outward.

IMPACTED VEHICLE MEASUREMENTS

VEHICLE MAKE/MODEL: Dodge Caravan

TEST NUMBER: 900820

NO.	TYPE OF MEASUREMENT	ALL MEASUREMENTS ARE IN INCHES		
		PRE-TEST	POST-TEST	DIFF.
X1	TOTAL LENGTH OF VEHICLE AT CENTERLINE	175.7	174.8	0.9
X2	REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK	150.4	147.8	2.6
X3	REAR SURFACE OF VEHICLE TO FIREWALL	139.5	137.0	2.5
X4	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR	127.2	129.5	-2.3
X5	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR	127.2	120.9	6.3
X6	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR	124.2	124.8	-0.6
X7	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR	124.6	121.6	3.0
X8	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR	84.6	86.8	-2.2
X9	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR	84.6	85.1	-0.5
X10	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR	84.6	85.2	-0.6
X11	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR	84.8	82.2	2.6
X12	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE	125.2	125.7	-0.5
X13	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE	125.4	120.5	4.9
X14	REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE	139.9	140.8	-0.9
X15	REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE	137.1	130.6	6.5
X16	REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER	109.6	104.8	4.8
X17	CENTER OF STEERING COLUMN TO "A" POST	15.2	3.4	11.8
X18	CENTER OF STEERING COLUMN TO HEADLINER	18.2	18.8	-0.6
X19	REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER	172.9	174.2	-1.3
X20	REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER	173.2	168.2	5.0
X21	LENGTH OF ENGINE BLOCK	19.0	19.0	0.0

## TEST ANOMALIES

The following data channels recorded an anomalous noise spike at 87.5 milliseconds:

HEDXG1, driver's head X axis accelerometer  
HEDYG1, driver's head Y axis accelerometer  
HEDZG1, driver's head Z axis accelerometer  
NEKXF1, driver's neck shear force X axis  
NEKYF1, driver's neck shear force Y axis  
NEKZF1, driver's neck axial force Z axis  
CSTXG1, driver's chest X axis accelerometer  
CSTYG1, driver's chest Y axis accelerometer  
CSTZG1, driver's chest Z axis accelerometer  
CSTXD1, driver's chest X axis displacement  
PEVXG1, driver's pelvis X axis accelerometer  
PEVYG1, driver's pelvis Y axis accelerometer  
PEVZG1, driver's pelvis Z axis accelerometer

The driver's head, chest and pelvis resultant accelerations HEDRG1, CSTRG1, and PEVRG1, contained a spike at 87.5 milliseconds due to the above anomalies.

The driver's chest X axis displacement, CSTXD1, data was lost after 460 milliseconds due to sternum deflection causing the potentiometer arm to come out of its guide track.

The driver's shoulder belt displacement, SHBD1, data was lost after 350 milliseconds due to severe B-pillar crush damaging the potentiometer.

The vehicle yaw rate, VCGZV1, data was lost at 450 milliseconds due to the floorpan buckling severely and disconnecting the cable connector from the gyroscope.

The vehicle's left rear suspension displacement, SRLD1, data was lost after 150 milliseconds due to the vehicle's crush breaking the string mount off of the axle.

EVENT TIMES

TEST DATE: 08/20/90

EVENT DESCRIPTION	TIME, SEC.
CONTACT RELEASE BLOCK	-0.082
START COLLECTING DATA	-0.02
STOP COLLECTING DATA	3.60
ZERO TIME FOR DATA	0.0
STROBE LIGHTS FLASH	0.250*
CAMERA L E D GOES OFF	0.250**
PIN RELEASES (ROLLOVER CART)	NA
CYLINDERS START (ROLLOVER CART)	NA

\*Locate frame where event strobe lights flash. Put projector into reverse mode and go backwards 125 frames. This frame is T-zero for the data. The switch for the event strobes and camera LED was located on the pole. Time-zero is the time at which the vehicle's tires struck the curb as determined from the Y-axis acceleration data.

\*\*Locate frame where event LED stripe ends. Put projector into reverse mode and go backwards (4 + 125) frames. This frame is time-zero for the data. The event LED is exposed on the film 4 frames prior to the image.

SECTION 3.0

GENERAL TEST AND VEHICLE PARAMETER DATA

The following data sheets describe the General Test and Vehicle Parameter Data.

TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Chrysler, Canada LTD.

MAKE/MODEL: Dodge/Caravan

VIN: 2B4FK21K3JR746480

BODY STYLE: Van

MODEL YEAR: 1988

NHTSA NO.: NA

COLOR: Burgundy

ENGINE DATA: TYPE: transverse CYLINDERS: DISPLACEMENT: 2.5 liter

TRANSMISSION DATA: 3 SPEED,     MANUAL, X AUTOMATIC, X FWD,     RWD,     4WD

DATE VEHICLE RECEIVED: 8/10/90

ODOMETER READING: 20,908

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

POWER STEERING	Yes	AUTOMATIC TRANSMISSION	Yes
POWER BRAKES	Yes	AUTOMATIC SPEED CONTROL	No
POWER SEATS	No	TILTING STEERING WHEEL	No
POWER WINDOWS	No	TELESCOPING STEERING WHEEL	No
TINTED GLASS	Yes	AIR CONDITIONING	Yes
RADIO	Yes	ANTI-SKID BRAKE	Yes
CLOCK	Yes	REAR WINDOW DEFROSTER	Yes
OTHER	None		

REMARKS:

1. IS THE VEHICLE STOCK THROUGHOUT? Yes
2. DOES VEHICLE SHOW EVIDENCE OF PRIOR ACCIDENT HISTORY? No
3. DOES VEHICLE SHOW ANY SIGNIFICANT CORROSION? OK
4. CONDITION OF THE FRONT/REAR BUMPER AND FRAME: OK

CERTIFICATION DATA FROM VEHICLE'S LABEL:

VEHICLE MANUFACTURED BY: Chrysler, Canada LTD.

DATE OF MANUFACTURE: 5/88

VIN: 2B4FK21K3JR746480

GVWR: 4850 LBS

GAWR: FRONT: 2425 LBS., REAR: 2450 LBS.

TEST VEHICLE INFORMATION CONT'D

TIRES ON VEHICLE (MFR., LINE, SIZE): Goodyear/Invicta GL P195/75R14

TIRE PRESSURE WITH MAXIMUM CAPACITY VEHICLE LOAD: FRONT: 35 PSI  
REAR: 35 PSI

SPARE TIRE (MFR., LINE, SIZE): Temporary

TYPE OF SEATS: FRONT: Buckets  
REAR: Bench

TYPE OF FRONT SEAT BACKS: Non-adjustable

MAXIMUM WIDTH: 71.6 INCHES

WHEELBASE: 112.2 INCHES

LOCATION OF "RECOMMENDED TIRE PRESSURE" LABEL: ON THE LEFT B-PILLAR

TIRE & CAPACITY DATA FROM VEHICLE'S LABEL:

RECOMMENDED TIRE SIZE: P195/75R14

RECOMMENDED COLD TIRE PRESSURE: FRONT: 35 PSI; REAR: 35 PSI

SEATING CAPACITY: \_\_\_FRONT \_\_\_REAR \_\_\_TOTAL\*

CARGO LOAD: \_\_\_\_\_ LBS. VEHICLE CAPACITY WEIGHT: \_\_\_\_\_ LBS.

TEST VEHICLE ATTITUDE (ALL MEASUREMENTS ARE IN INCHES):

DELIVERED ATTITUDE:	LF	29.1	;RF	29.0	;LR	29.8	;RR	29.8
FULLY LOADED ATTITUDE:	LF	28.5	;RF	28.5	;LR	28.5	;RR	28.2
PRE-TEST ATTITUDE:	LF	28.5	;RF	29.0	;LR	28.0	;RR	28.4
POST-TEST ATTITUDE:	LF	27.9	;RF	29.2	;LR	29.2	;RR	32.5

\*VEHICLE DID NOT CONTAIN CAPACITY DATA.

TEST VEHICLE INFORMATION CONT'D

WEIGHT OF TEST VEHICLE AS RECEIVED (EMPTY):

RIGHT FRONT	950 LBS.	RIGHT REAR	640 LBS.
LEFT FRONT	978 LBS.	LEFT REAR	631 LBS.
TOTAL FRONT WEIGHT	1928 LBS.	(60.3% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1271 LBS.	(39.7% OF TOTAL VEHICLE WEIGHT)	
TOTAL DELIVERED WEIGHT 3199 LBS.			

CALCULATION OF TEST VEHICLE'S TARGET TEST WEIGHT:

RCLW = RATED CARGO AND LUGGAGE WEIGHT\*

UDW = UNLOADED DELIVERED WEIGHT (3199 LBS)

VCW = VEHICLE CAPACITY WEIGHT (NA LBS)

DSC = DESIGNATED SEATING CAPACITY (NA)

$RCLW^* = VCW - 150 (DSC) = 300$

TARGET TEST WEIGHT = UDW + RCLW\* + (NO. OF HYBRID III DUMMIES X 167 LBS/DUMMY)

TARGET TEST WEIGHT = 3199 + 300 + 167

TARGET TEST WEIGHT = 3666 LBS

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 301 LBS. OF CARGO WEIGHT:

RIGHT FRONT	973 LBS.	RIGHT REAR	807 LBS.
LEFT FRONT	1041 LBS.	LEFT REAR	846 LBS.
TOTAL FRONT WEIGHT	2014 LBS.	(54.9% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1653 LBS.	(45.1% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	3667 LBS.	(1 POUND OVER TARGET TEST WEIGHT)	

WEIGHT OF BALLAST SECURED IN VEHICLE CARGO AREA: 300 LBS.

COMPONENTS REMOVED TO MEET TARGET TEST WEIGHT: None

CG = 49.1 INCHES REARWARD OF FRONT WHEEL CENTERLINE

\*Cargo weight for multi-purpose passenger vehicles, trucks, and buses is the vehicle's rated cargo and luggage weight from the vehicle's label or 300 pounds, whichever is less.

TEST CONDITIONS

TEST NUMBER: 900820

TEST DATE: 8/20/90

TEST TEMPERATURES:

IMPACT AREA: 72°F;  
DRIVER DUMMY 72°F;

OCCUPANT COMPARTMENT 73°F  
PASSENGER DUMMY: NA°F

VEHICLE, POLE, AND CURB DATA

	ACTUAL	INTENDED
VEHICLE TEST WEIGHT (lbs.):	3667	3666
VEHICLE VELOCITY (mph)*:	30	30
IMPACT SIDE:	Driver	Driver
CURB HEIGHT:	8	8
CURB TO POLE DISTANCE:	75.5	75.5
POLE DIAMETER:	12	12
POLE OFFSET**:	-2	-2

VEHICLE MEASUREMENTS

MAXIMUM LENGTH:	175.7	WHEELBASE:	112.2
MAXIMUM WIDTH:	71.6	TOP WIDTH:	54.5
C.G. REARWARD OF FRONT WHEEL CENTERLINE:	49.1		
C.G. HEIGHT ABOVE GROUND LEVEL:	24.7		

VEHICLE TEST CONDITIONS

LEFT FRONT:	DOOR - LOCKED	WINDOW - UP
LEFT REAR:	DOOR - NA	WINDOW - NA
RIGHT FRONT:	DOOR - UNLOCKED	WINDOW - UP
RIGHT REAR:	DOOR - UNLOCKED	WINDOW - NA
EMERGENCY BRAKE:	ON	TRANSMISSION: IN PARK
HEADRESTS:	DRIVER - NON-ADJUSTABLE	PASSENGER - NON-ADJUSTABLE
TIRE PRESSURE:	FRONT - 35 PSI;	REAR - 35 PSI

DUMMY INFORMATION

TYPE:	Part 572E
POSITION:	Driver
SERIAL NO.:	907
INSTRUMENTATION:	
HEAD ACCELEROMETERS:	3
NECK LOAD CELLS:	6
CHEST ACCELEROMETERS:	3
CHEST DISPLACEMENT POTENTIOMETER:	1
PELVIS ACCELEROMETERS:	3
RIB DISPLACEMENT POTENTIOMETER:	--
RESTRAINT SYSTEM:	Three-point unbelt

REMARKS:

ALL DISTANCE MEASUREMENTS ARE IN INCHES.

\*AS MEASURED OVER FINAL ONE FOOT OF TRAVEL.

\*\*AS MEASURED FROM VEHICLE'S C.G. (POSITIVE DENOTES VEHICLE IMPACTS THE POLE IN FRONT OF THE VEHICLE'S C.G.)

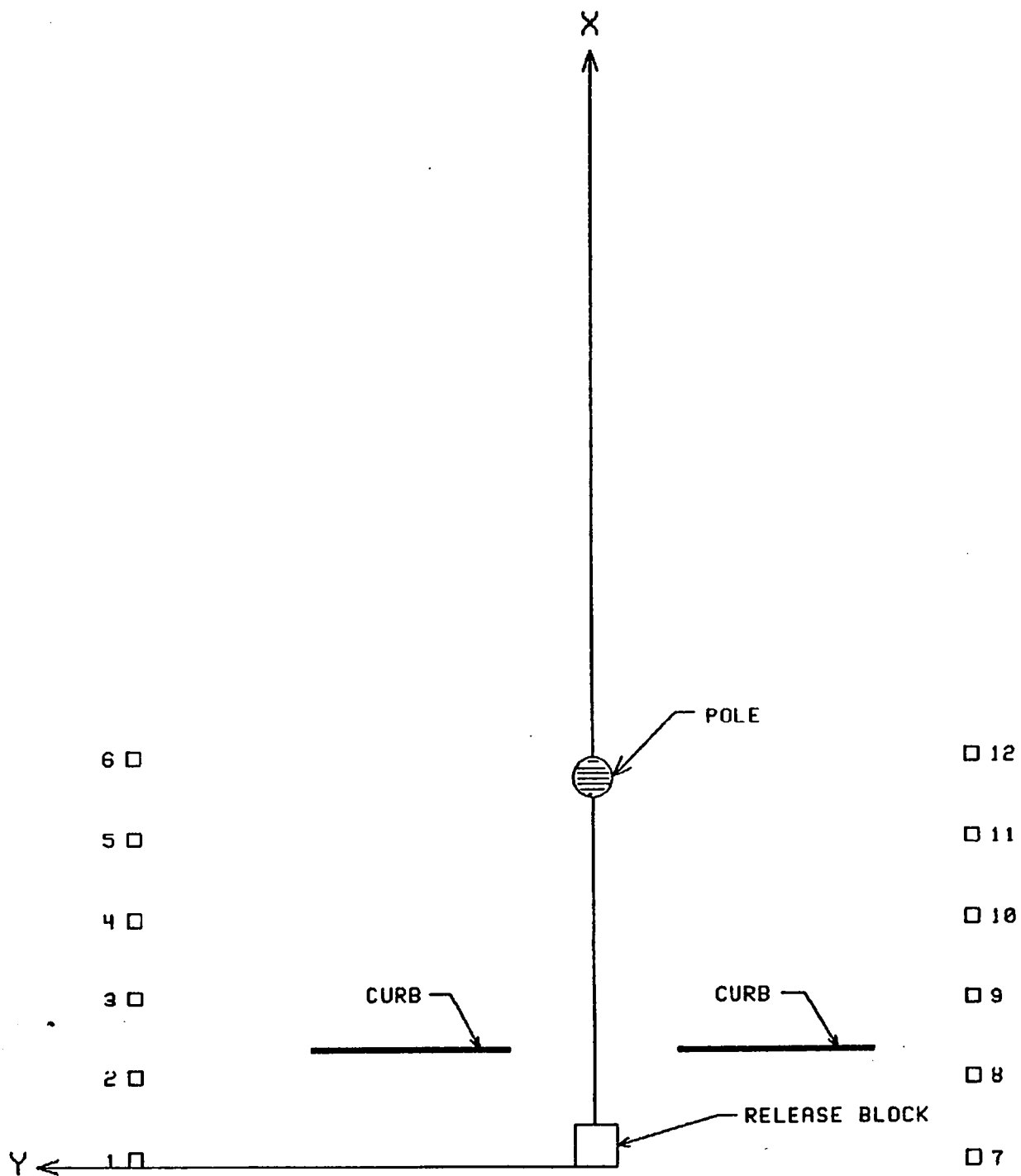
VEHICLE INSTRUMENTATION LOCATIONS AND DATA SUMMARY

TEST NUMBER 900820

No. LOCATION	X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
				MAX	MSEC	MAX	MSEC
1 CENTER OF GRAVITY ACCELERATION (g)	96.0	0.0	20.0				
LONGITUDINAL				26.7	144.5	23.3	150.0
LATERAL				38.5	142.5	54.2	132.5
VERTICAL				30.0	103.5	22.9	428.0
RESULTANT				54.4	132.5		
2 CENTER OF GRAVITY ANGULAR VELOCITY (deg/sec)	96.0	0.0	20.0				
ROLL (X-AXIS)				667.6	99.5	690.4	129.5
PITCH (Y-AXIS)				489.8	136.5	410.9	146.0
YAW (Z-AXIS)				711.5	532.0	630.1	468.0
3 LEFT FRONT SUSPENSION DISPLACEMENT (in)	148.2	24.6	33.5				
VERTICAL				0.0	71.0	4.6	146.0
4 RIGHT FRONT SUSPENSION DISPLACEMENT (in)	149.8	-23.9	32.5				
VERTICAL				1.5	138.0	2.2	1104.5
5 LEFT REAR SUSPENSION DISPLACEMENT (in)	31.0	24.7	30.0				
VERTICAL				2.7	108.0	8.6	237.0
6 RIGHT REAR SUSPENSION DISPLACEMENT (in)	29.2	-24.8	29.9				
VERTICAL				5.9	168.5	4.7	1209.0
7 SHOULDER BELT DISPLACEMENT (in) DRIVER	86.0	26.0	18.0				
				0.7	171.0	1.7	321.5

\* ALL MEASUREMENTS OF INSTRUMENTATION LOCATIONS ARE IN INCHES.

REFERENCE: X: + FORWARD FROM VEHICLE'S REAR BUMPER  
 Y: + LEFTWARD FROM VEHICLE'S CENTERLINE  
 Z: + UPWARD FROM GROUND LEVEL  
 ROLL: + TO RIGHT  
 PITCH: + FRONT DOWNWARD  
 YAW: + COUNTERCLOCKWISE  
 DISPLACEMENT: + OUTWARD



STADIA POLE LAYOUT AND NUMBERING SYSTEM

STADIA POLE LOCATIONS

<u>POLE NO.</u>	<u>X DISTANCE, *</u>	<u>Y DISTANCE, *</u>
1	2.0	12.4
2	4.0	12.4
3	6.0	12.4
4	8.0	12.4
5	10.0	12.4
6	12.0	12.4
7	2.0	-9.5
8	4.0	-9.5
9	6.0	-9.5
10	8.0	-9.5
11	10.0	-9.5
12	12.0	-9.5

RIGID, INSTRUMENTED POLE LOCATION

CENTER OF POLE	9.2	0.0
----------------	-----	-----

STEEL CURB LOCATIONS

CENTER OF LEFT		
CURB SECTION	3.0	4.7
CENTER OF RIGHT		
CURB SECTION	3.0	-4.7

\*REFERENCE: +X: FORWARD FROM RELEASE BLOCK  
              +Y: LEFTWARD FROM CENTER RELEASE BLOCK  
ALL MEASUREMENTS ARE IN FEET.

NOTES: INSTRUMENTED POLE OUTSIDE DIAMETER: 12"  
       STEEL CURB: 5' LONG, 8" HIGH, 8.5" WIDE AT BASE

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Panning	Kodak	25	24	Real-time documentation
2	Left	Photosonic 1B	25	495	Vehicle dynamics
3	Right	Photosonic 1B	8.5	500	Vehicle dynamics
4	Downstream	Photosonic 1B	25	495	Vehicle dynamics
5	Overhead	Photosonic 1B	17	500	Vehicle dynamics
6	Onboard - front	Photosonic 1B	8	500	Dummy kinematics
7	Onboard - rear	Photosonic 1B	8	500	Dummy kinematics
8	Documentary	Beaulieu	16-105	24	Pre & post-test documentation

HIGH SPEED CAMERA LOCATION

OFFBOARD

CAMERA NO.	X*	Y*	Z*
2	7.4	42.8	4.9
3	7.1	-24.7	3.7
4	50.2	0.0	3.6

\*Reference:

+X: Forward from release block  
+Y: Leftward from the centerline of the release block  
+Z: Upward from the ground level

ONBOARD

CAMERA NO.	X**	Y**	Z**
6	2.0	-0.9	1.0
7	-4.7	0.3	2.3

\*\*Reference:

+X: Forward from the C.G. of vehicle  
+Y: Leftward from centerline of vehicle  
+Z: Upward from floor of vehicle

ALL MEASUREMENTS ARE IN FEET.

SECTION 4.0

OCCUPANT INFORMATION

POST-IMPACT DUMMY/VEHICLE DATA

VISIBLE DUMMY CONTACT POINTS:

	DRIVER #907	PASSENGER #NA
HEAD	<u>Left B-pillar and roof</u>	<u>NA</u>
CHEST	<u>Left front door and passenger seat</u>	<u>NA</u>
ABDOMEN	<u>None</u>	<u>NA</u>
LEFT KNEE	<u>Door</u>	<u>NA</u>
RIGHT KNEE	<u>None</u>	<u>NA</u>

DOOR OPENING:

	LEFT	RIGHT
FRONT	<u>Difficult</u>	<u>Easy</u>
REAR	<u>NA</u>	<u>Easy</u>

SEAT MOVEMENT:

	SEAT BACK FAILURE	SEAT SHIFT
FRONT	<u>None</u>	<u>None</u>
REAR	<u>NA</u>	<u>NA</u>

GLAZING DAMAGE:

Upon impact the entire glass on the vehicle's left side was shattered and the windshield's top edge was not retained by the windshield frame.

OTHER NOTABLE IMPACT EFFECTS:

The left front tire received a large cut. The left rear axle was broken at impact separating the rear wheel from the axle. The rear hatch door was easy to open following the impact.

## DUMMY KINEMATIC SUMMARY

### Driver Dummy

Upon the vehicle's impact with the pole, the driver dummy's head struck the left B-pillar and roof. The dummy's upper torso contacted the left front door. The dummy's lower torso remained in contact with the left door. The dummy's head and upper torso contacted on the right front passenger's seat back. The dummy came to rest leaning to the right, against the right front passenger's seat back, restrained with a three-point unbelt.

### DUMMY TEMPERATURE CONTROL AND POSITIONING

The vehicle and dummy were left inside the temperature controlled building eight hours prior to the time the dummy was loaded into the vehicle. The temperature was controlled to the last minute before launching of the vehicle.

One Part 572E dummy was instrumented for this test. The dummy instrumentation consisted of triaxial accelerometers in the head, chest, and pelvis, a displacement potentiometer in the chest, and six (6) load cells in the neck. Prior to seating the dummy, the driver's seat was positioned in the mid-adjustment notch of the seat track. The seat back angle was non-adjustable. The dummy was positioned in the seat using NHTSA's Notice #60 seating procedure. The H-point location of the seat was obtained by using the SAE J211OCT88 H-point machine as specified in the Notice #60. The driver dummy was restrained with a three-point unbelt.

DUMMY DATA SUMMARY

TEST NUMBER 900820

DRIVER DUMMY

SN: 907

POSITIVE		NEGATIVE	
DIRECTION		DIRECTION	
MAX	MSEC	MAX	MSEC

HEAD ACCELERATION (g)

LONGITUDINAL	230.7	87.5Y	24.4	293.0Y
LATERAL	157.4	87.5Y	190.9	293.0Y
VERTICAL	96.3	87.5Y	163.4	293.0Y
RESULTANT	295.4	87.5Y		
HIC 36 MSEC	1328.3 FROM 292.0 TO 294.5 Y			

NECK FORCES (lbs)

LONGITUDINAL	2098.8	87.5Y	337.2	437.0Y
LATERAL	2889.1	87.5Y	321.6	88.0Y
VERTICAL	2128.5	87.5Y	1805.3	296.5Y

NECK MOMENT (in-lbs)

ABOUT LONG.	66.1	168.5	77.4	299.0
ABOUT LATERAL	20.1	297.5	14.4	180.5
ABOUT VERTICAL	11.5	185.5	8.8	358.5

CHEST ACCELERATION (g)

LONGITUDINAL	22.8	420.5Y	72.0	87.5Y
LATERAL	71.9	87.5Y	99.6	318.0Y
VERTICAL	17.6	301.0Y	57.5	87.5Y
RESULTANT	116.9	87.5Y		
3 MSEC	67.2 FROM 317.5 TO 322.4Y			

CHEST DISPLACEMENT (in)

LONGITUDINAL	0.8	443.0Y	3.4	494.5Y
--------------	-----	--------	-----	--------

PELVIS ACCELERATION (g)

LONGITUDINAL	5.4	142.0Y	140.2	87.5Y
LATERAL	104.4	87.5Y	29.9	340.0Y
VERTICAL	324.1	87.5Y	46.5	88.0Y
RESULTANT	368.2	87.5Y		

POSITIVE DIRECTION

LONGITUDINAL: FORWARD  
 LATERAL: LEFTWARD  
 VERTICAL: UPWARD

NEGATIVE DIRECTION

LONGITUDINAL: REARWARD  
 LATERAL: RIGHTWARD  
 VERTICAL: DOWNWARD

See APPENDIX D for neck load cell polarities.

Y See TEST ANOMALIES

DUMMY IN-VEHICLE POSITION RECORDING SHEET

MFR./MAKE/MODEL: Chrysler, Canada LTD./Dodqe/Caravan

SEAT TYPE:      Bench

ADJUSTER TYPE:   X   Manual

  X   Bucket

     Power

     Split bench

     Non-adjustable

STEERING COLUMN:   X   Non-adjustable

TECHNICIANS:

BUCKET SEAT BACK TYPE:   X   Non-adjustable

1. B. Miller

     Adjustable reclining

2.                     

POSITIONING DATE:   8/20/90  

3.                     

AMBIENT TEMP.   72°   F TIME:   1100  

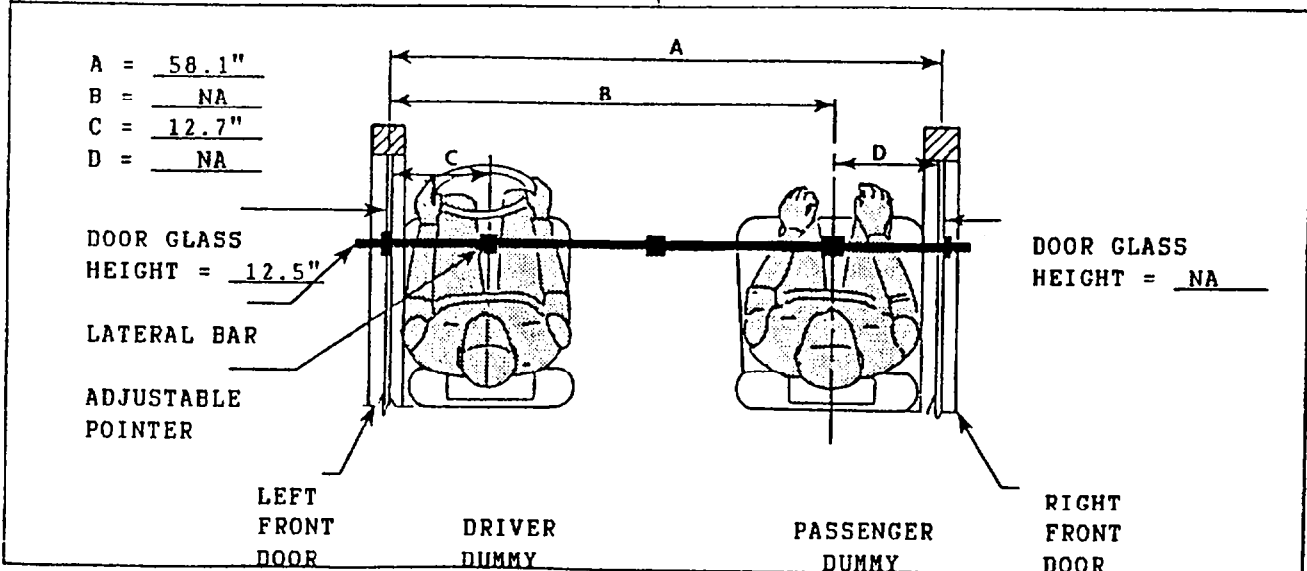
4.                     

DRIVER DUMMY\* # 907 TYPE: HIII

Head 15°  
 Target 24.6"  
 Knee 88°  
 Joint 24.4"  
 Approx. "H" 109°  
 Point 99.0"  
 Pelvis 22°  
 Seatback 30°

PASSENGER DUMMY\* # NA TYPE:     

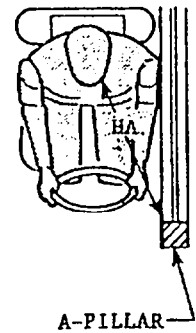
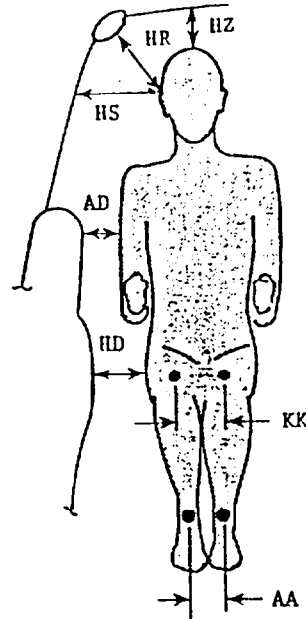
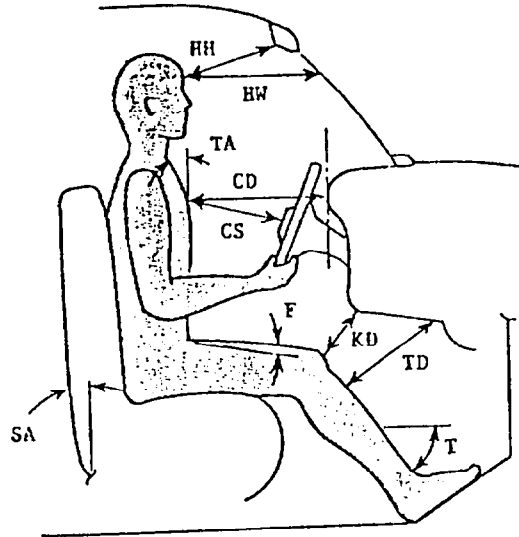
Head       
 Target       
 Knee       
 Joint       
 Approx. "H"       
 Point       
 Pelvis       
 Seatback     



\*Dummy measurements are referenced to top of striker bolt and all angles are referenced to vertical 4-6

DUMMY IN-VEHICLE POSITION RECORDING SHEET

	DRIVER	PASSENGER
HH	17.8	NA
HW	23.6	NA
CD	21.3	NA
CS	13.1	NA
KDL	4.2	NA
KDR	4.7	NA
TA	25°	NA
SA	30°	NA
HA	15.8	NA
FL	17°	NA
FR	19°	NA
TDL	5.3	NA
TDR	5.0	NA
TL	30°	NA
TR	29°	NA
HZ	4.8	NA
HR	7.8	NA
HS	9.0	NA
AD	3.9	NA
HD	5.4	NA
KK	11.0	NA
AA	15.5	NA



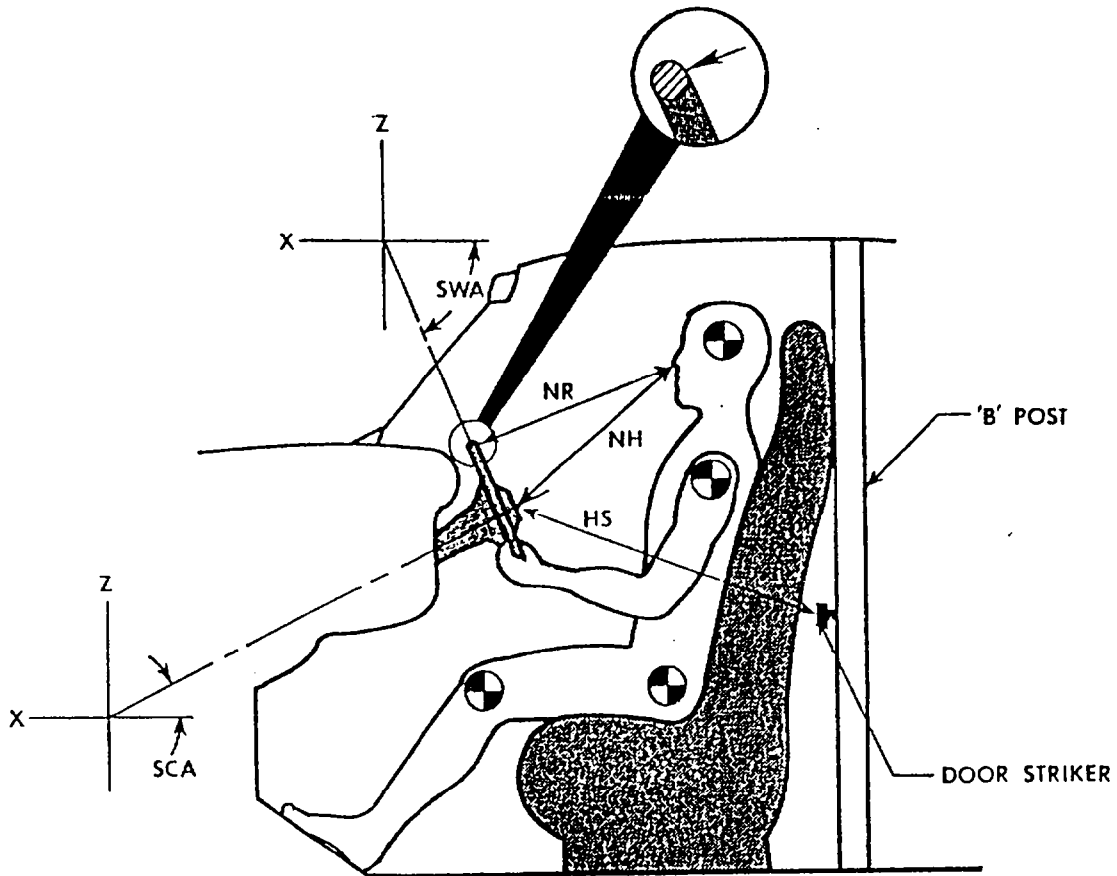
Knee outer clevis to outer clevis:  
 Driver = 10.6" Passenger = NA

HH = Head to Windshield Header  
 HW = Head to Windshield  
 CD = Chest to Dash  
 CS = Chest to Steering Wheel  
 KD = Knee to Dash  
 TA = Torso Angle  
 SA = Seat Back Angle  
 HA = Head to A-Pillar  
 FL = Femur Left  
 FR = Femur Right  
 TDL = Tibia Dash Left

TDR = Tibia Dash Right  
 TL = Tibia Left  
 TR = Tibia Right  
 HZ = Head to Roof  
 HR = Head to Side Roof  
 HS = Head to Side Window  
 AD = Arm to Door  
 HD = Hip to Door  
 KK = Knee to Knee  
 AA = Ankle to Ankle

Torso and seat back angles are relative to vertical.  
 Femur and tibia angles are relative to horizontal.  
 ALL DISTANCE MEASUREMENTS ARE IN INCHES.

DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSEMBLY DATA

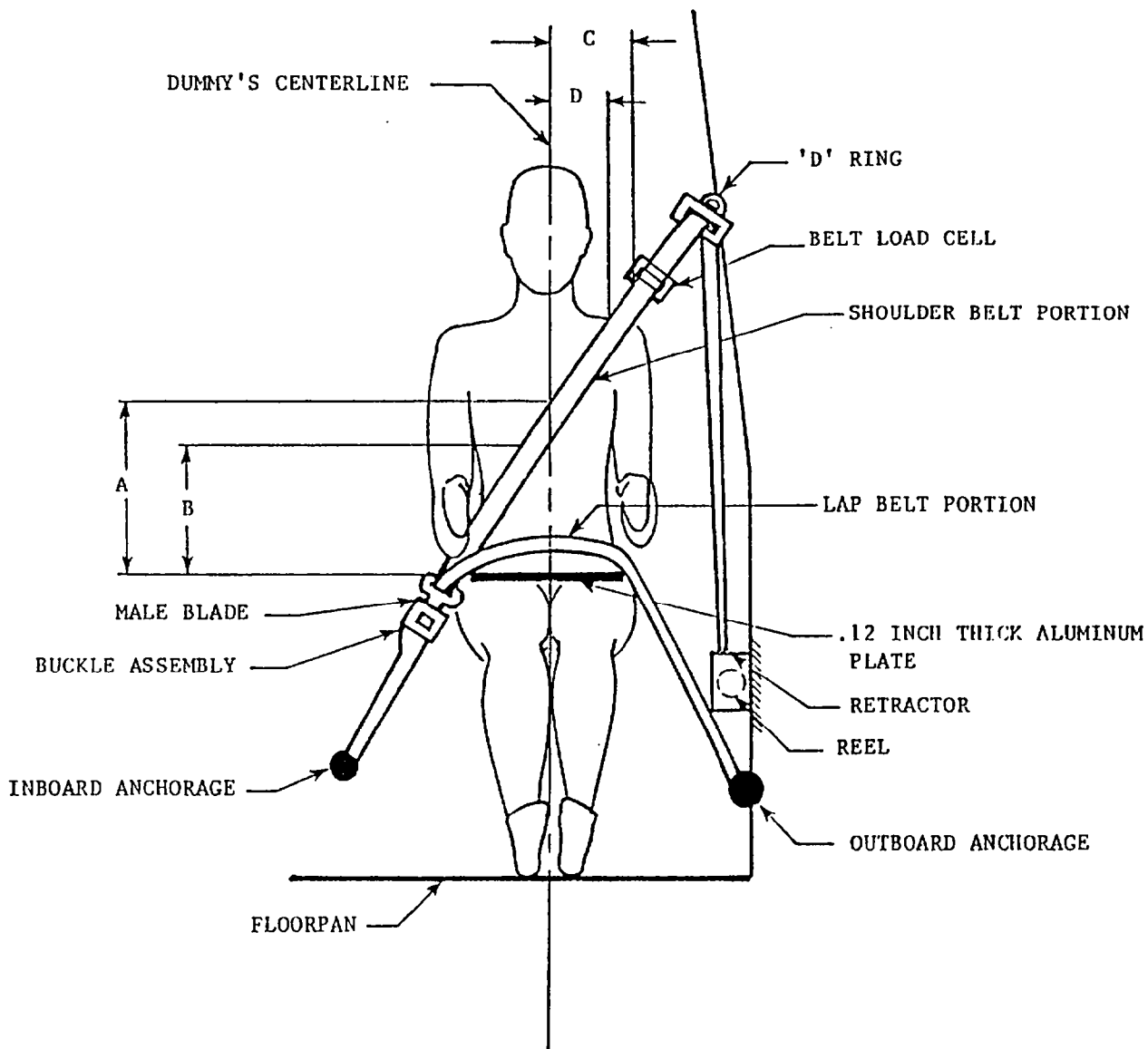


POSITION OF STEERING COLUMN TILTING AND TELESCOPING ADJUSTMENTS, IF ANY:  
Non-adjustable

		<u>MEASUREMENTS</u>
NR	- DISTANCE FROM TIP OF DUMMY'S NOSE TO TOP REAR SURFACE OF STEERING WHEEL RIM.	16.8
NH	- DISTANCE FROM TIP OF DUMMY'S NOSE TO CENTER OF STEERING COLUMN HUB.	17.2
HS	- DISTANCE FROM CENTER OF STEERING COLUMN HUB TO THE FORWARD SURFACE OF THE DOOR LOCK STRIKER PIN.	25.3
SCA	- ANGLE OF STEERING COLUMN RELATIVE TO THE HORIZONTAL X AXIS	35°
SWA	- ANGLE OF STEERING WHEEL RELATIVE TO THE HORIZONTAL X AXIS	55°

ALL DISTANCE MEASUREMENTS ARE IN INCHES.

SEAT BELT POSITIONING DATA



	DRIVER DUMMY	PASSENGER DUMMY
A - TOP SURFACE OF ALUMINUM PLATE TO BELT UPPER EDGE	11.9	NA
B - TOP SURFACE OF ALUMINUM PLATE TO BELT LOWER EDGE	8.6	NA
C - DUMMY CENTERLINE TO OUTER EDGE OF BELT AT CHEST FLESH TOP	5.8	NA
D - DUMMY CENTERLINE TO INNER EDGE OF BELT AT CHEST FLESH TOP	3.6	NA

ALL DISTANCE MEASUREMENTS ARE IN INCHES.

APPENDIX A

PHOTOGRAPHS



Figure A-1. PRE-TEST FRONT VIEW

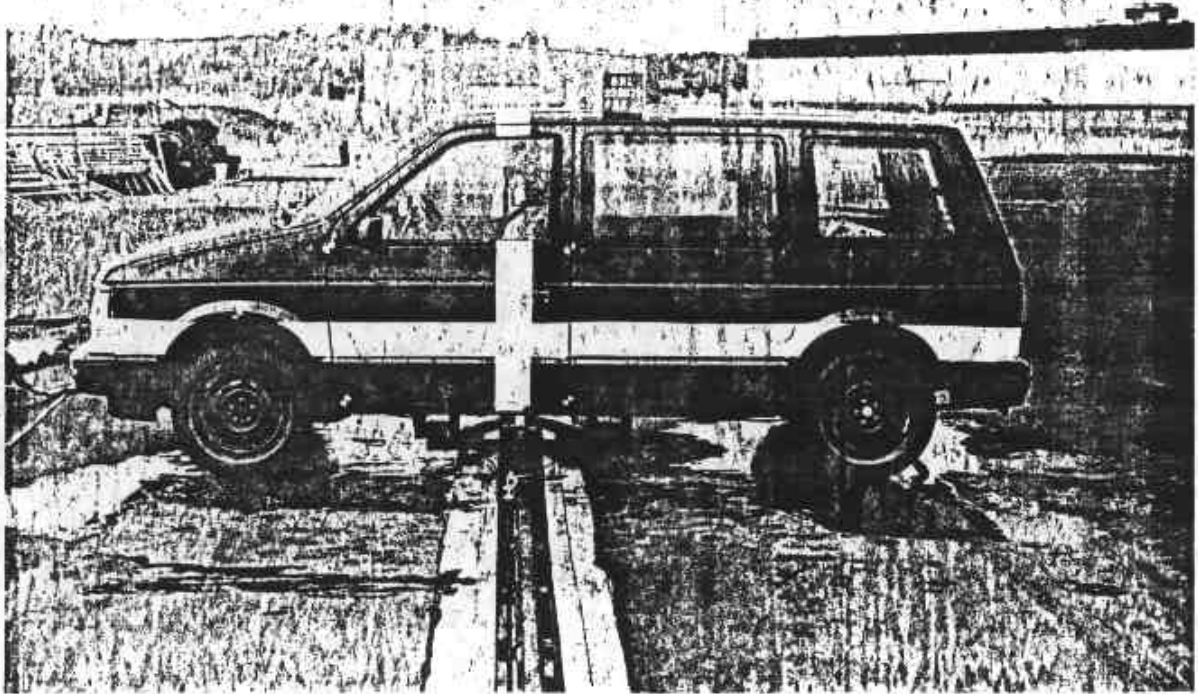


Figure A-2. PRE-TEST LEFT SIDE VIEW



Figure A-3. PRE-TEST REAR VIEW

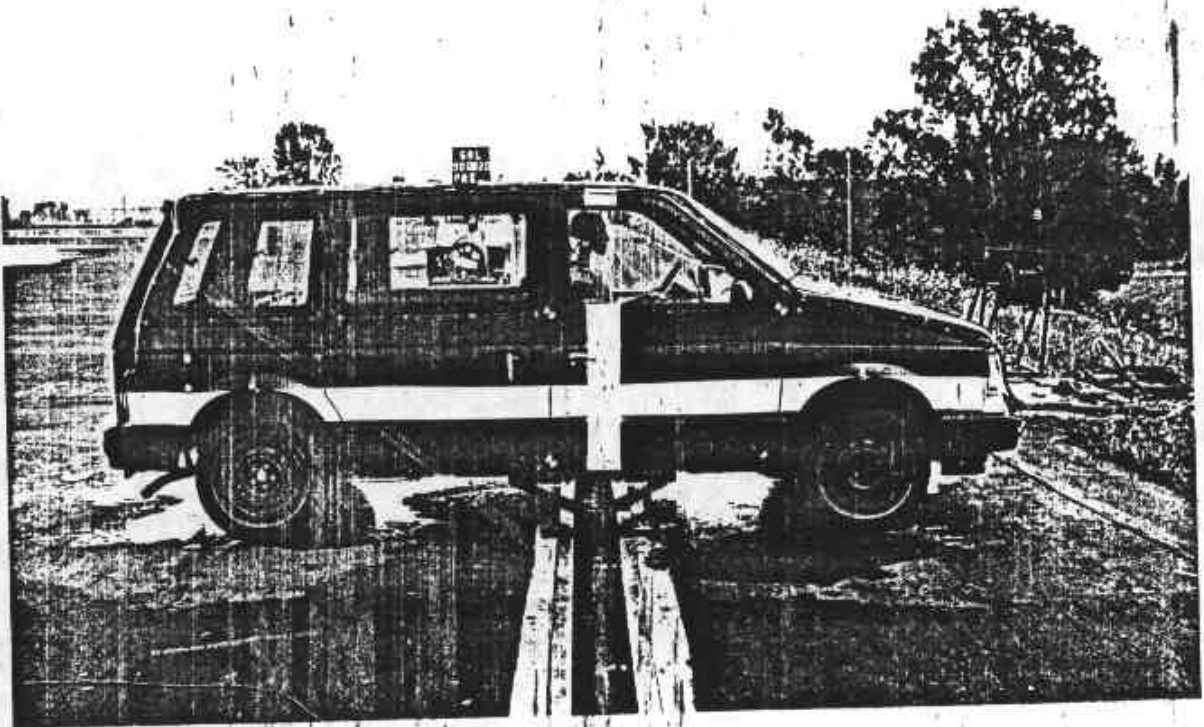


Figure A-4. PRE-TEST RIGHT SIDE VIEW

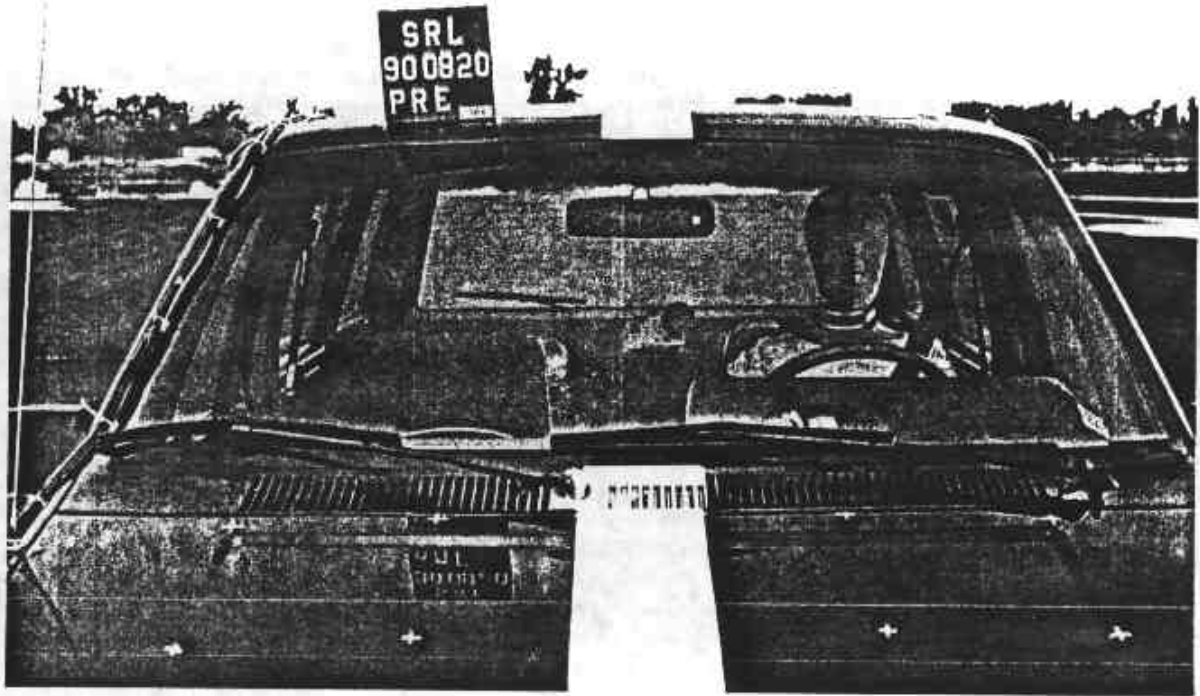


Figure A-5. PRE-TEST WINDSHIELD VIEW

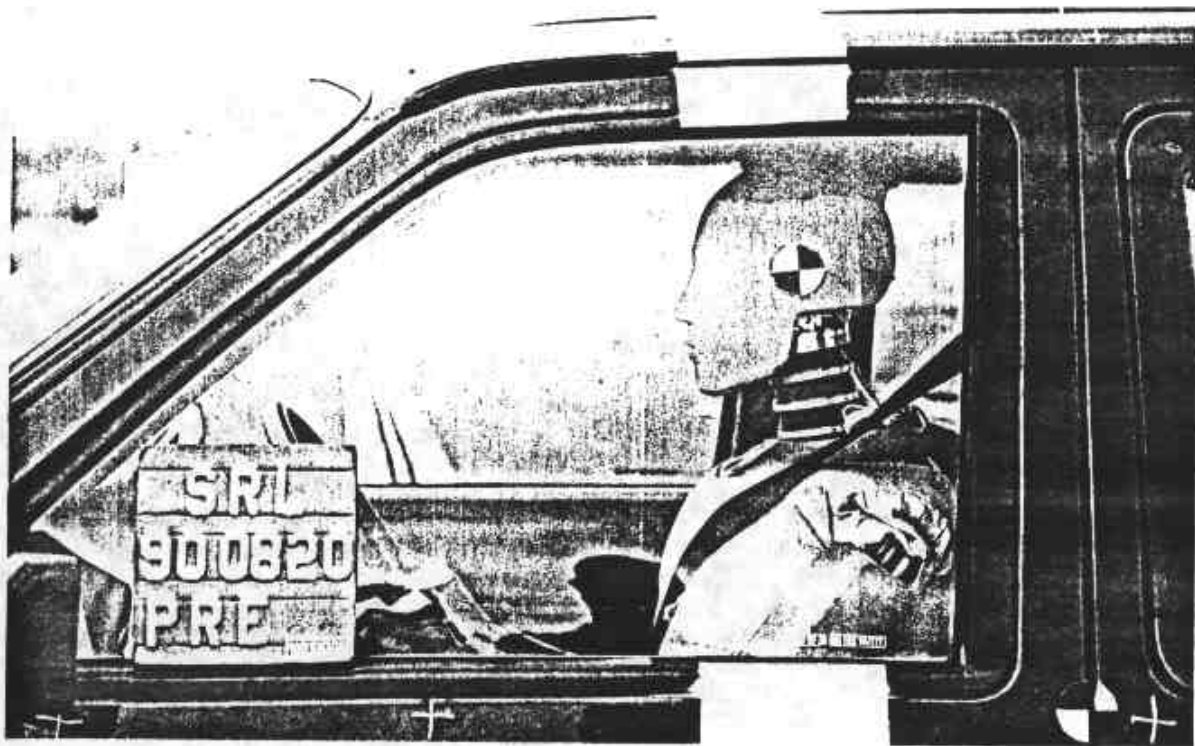


Figure A-6. PRE-TEST DRIVER DUMMY - VIEW 1

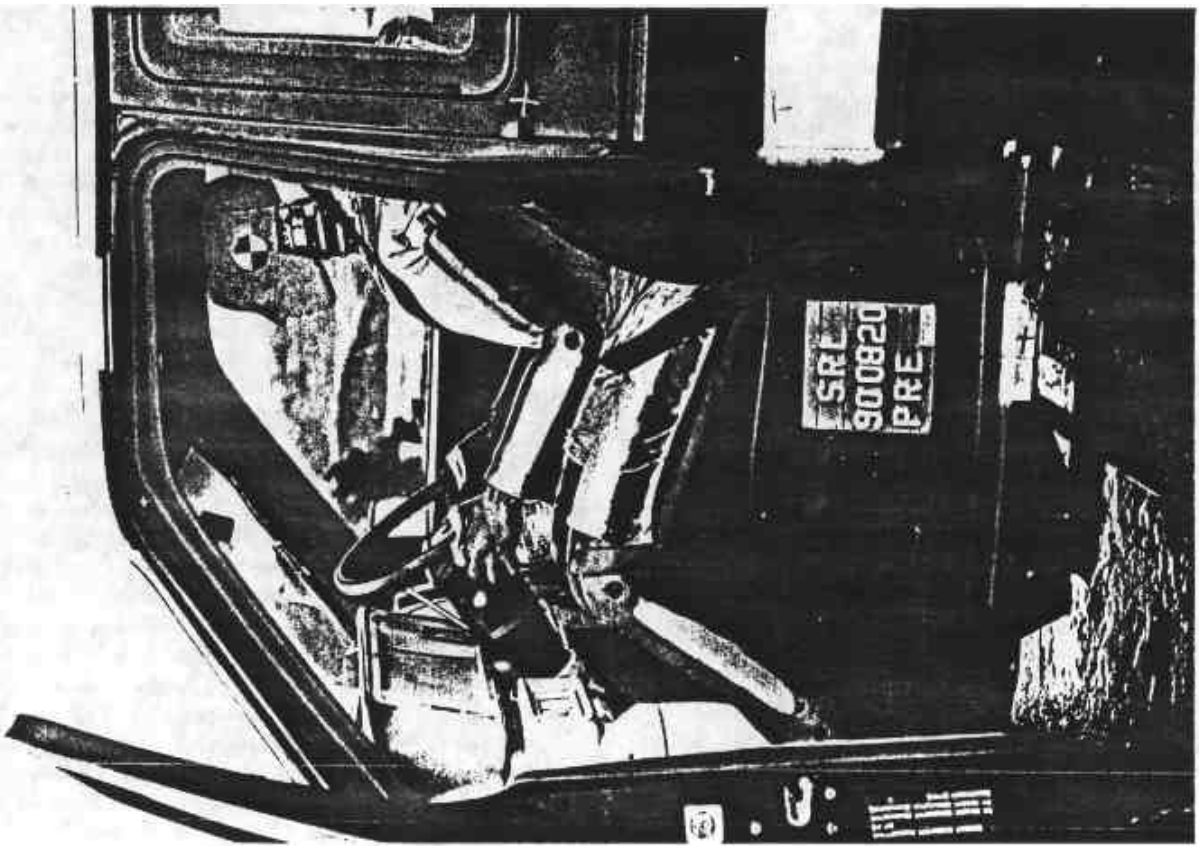


Figure A-7. PRE-TEST DRIVER DUMMY - VIEW 2

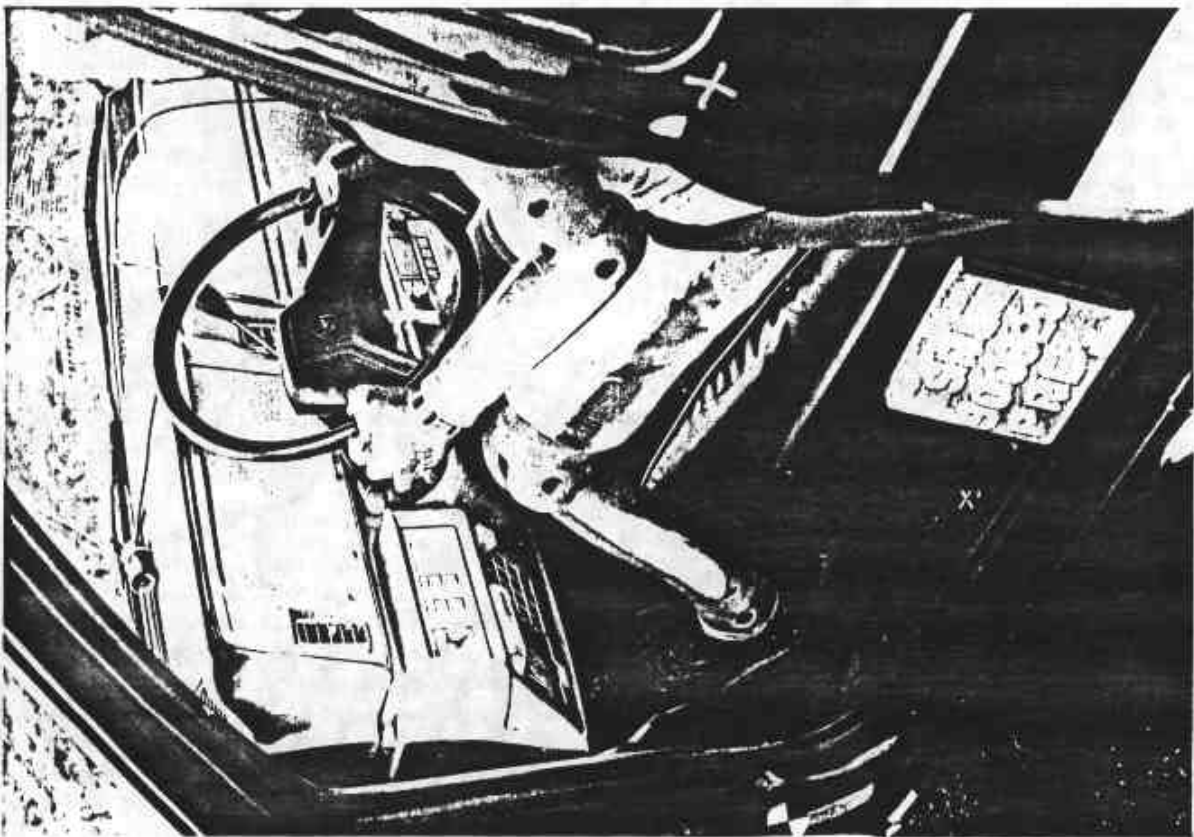


Figure A-8. PRE-TEST DRIVER DUMMY - VIEW 3

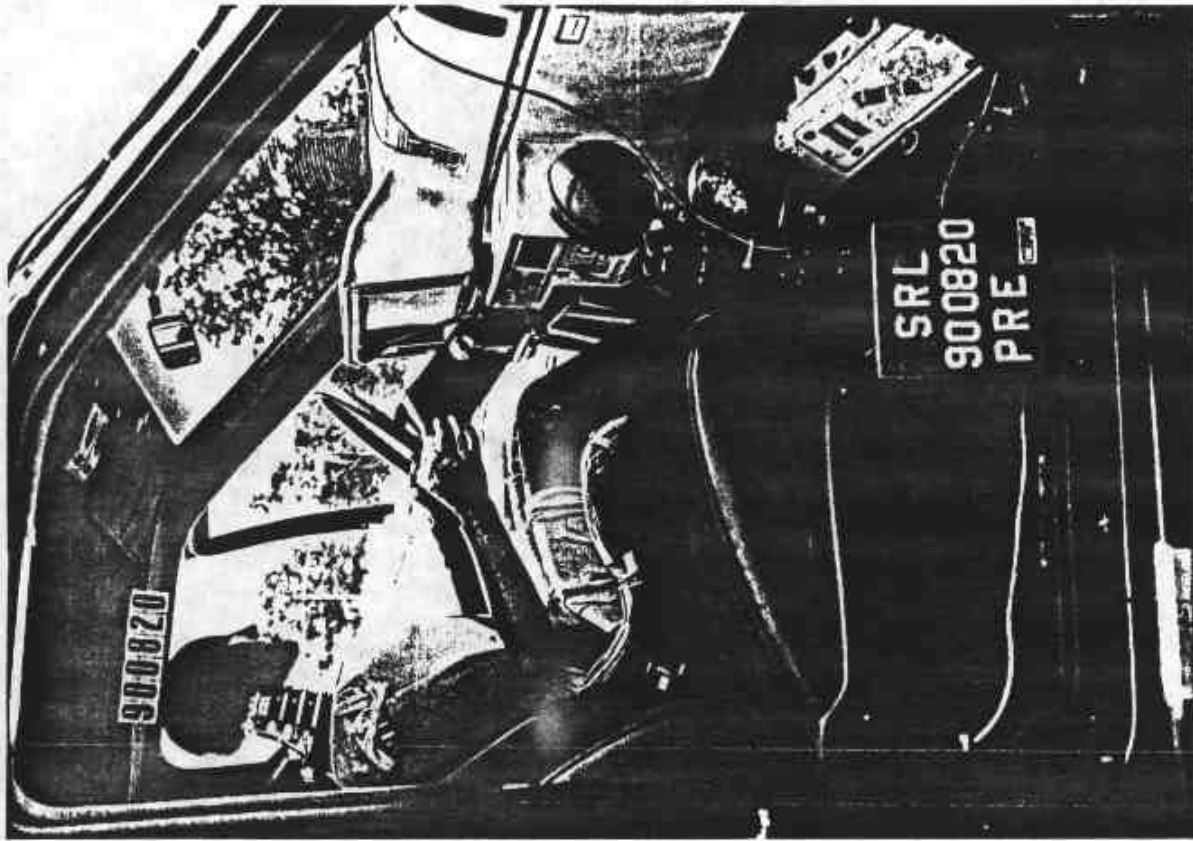


Figure A-9. PRE-TEST DRIVER DUMMY AND VEHICLE VIEW

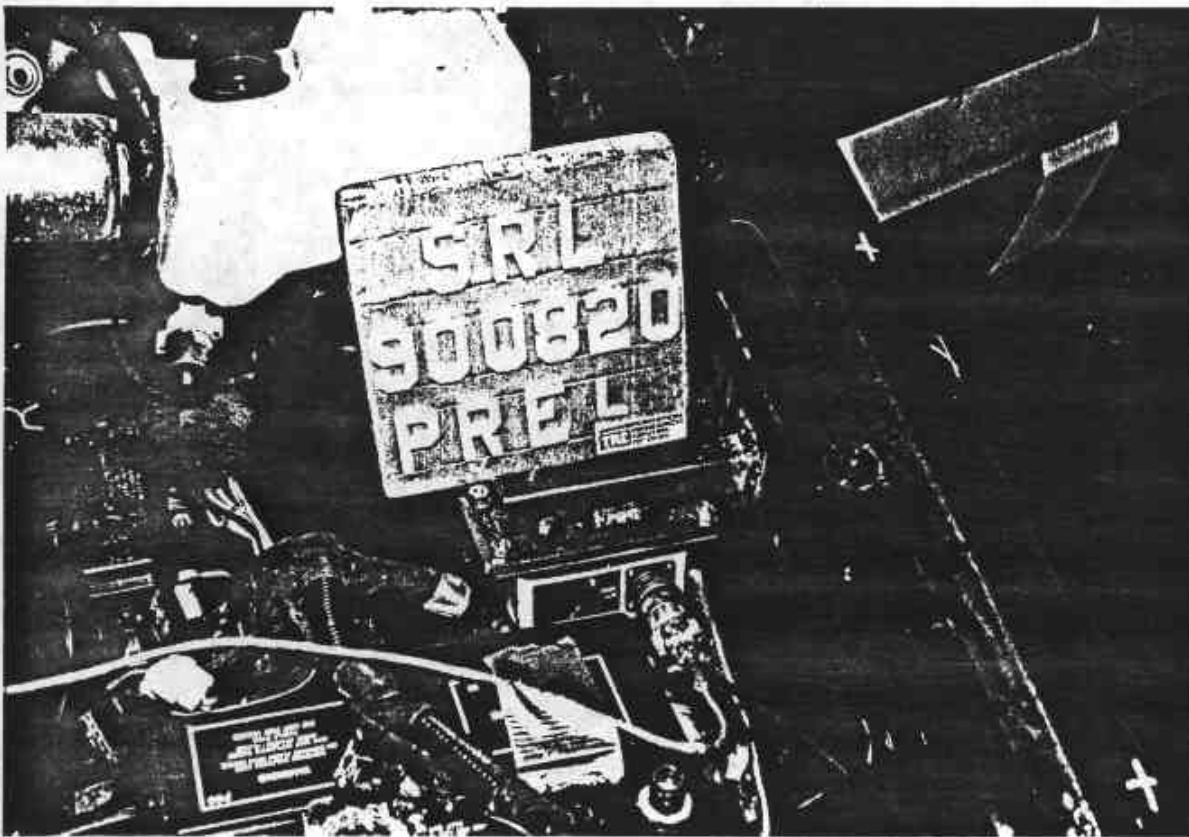


Figure A-10. PRE-TEST LEFT FRONT SUSPENSION STRING POTENTIOMETER VIEW

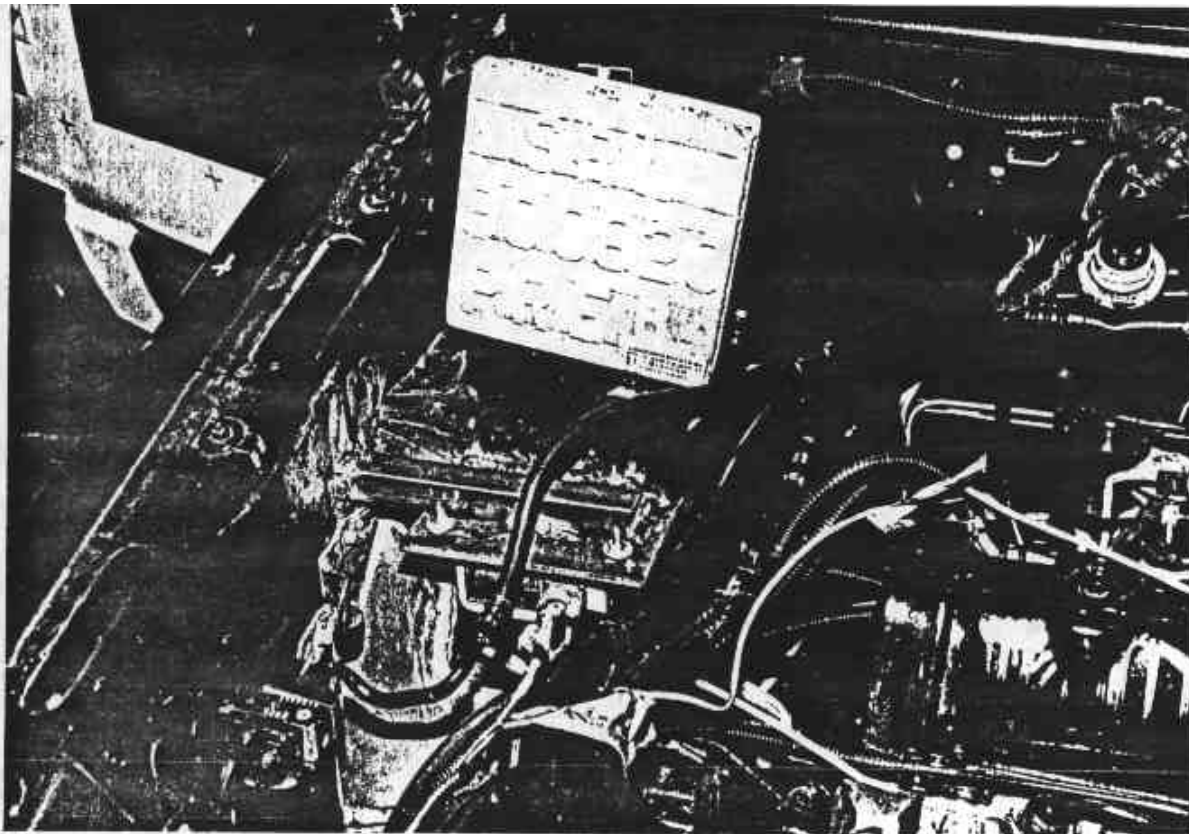


Figure A-11. PRE-TEST RIGHT FRONT SUSPENSION STRING POTENTIOMETER VIEW



Figure A-12. PRE-TEST LEFT REAR SUSPENSION STRING POTENTIOMETER VIEW

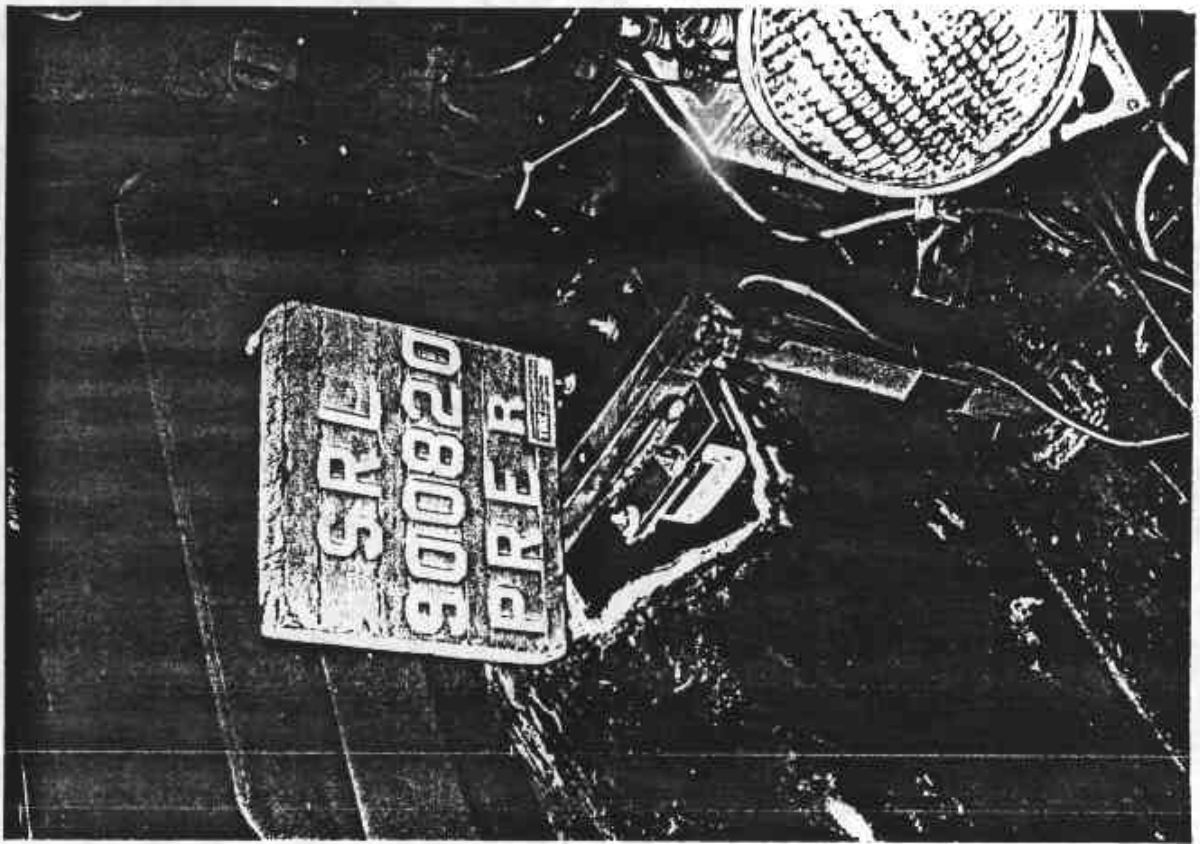


Figure A-13. PRE-TEST RIGHT REAR SUSPENSION STRING POTENTIOMETER VIEW

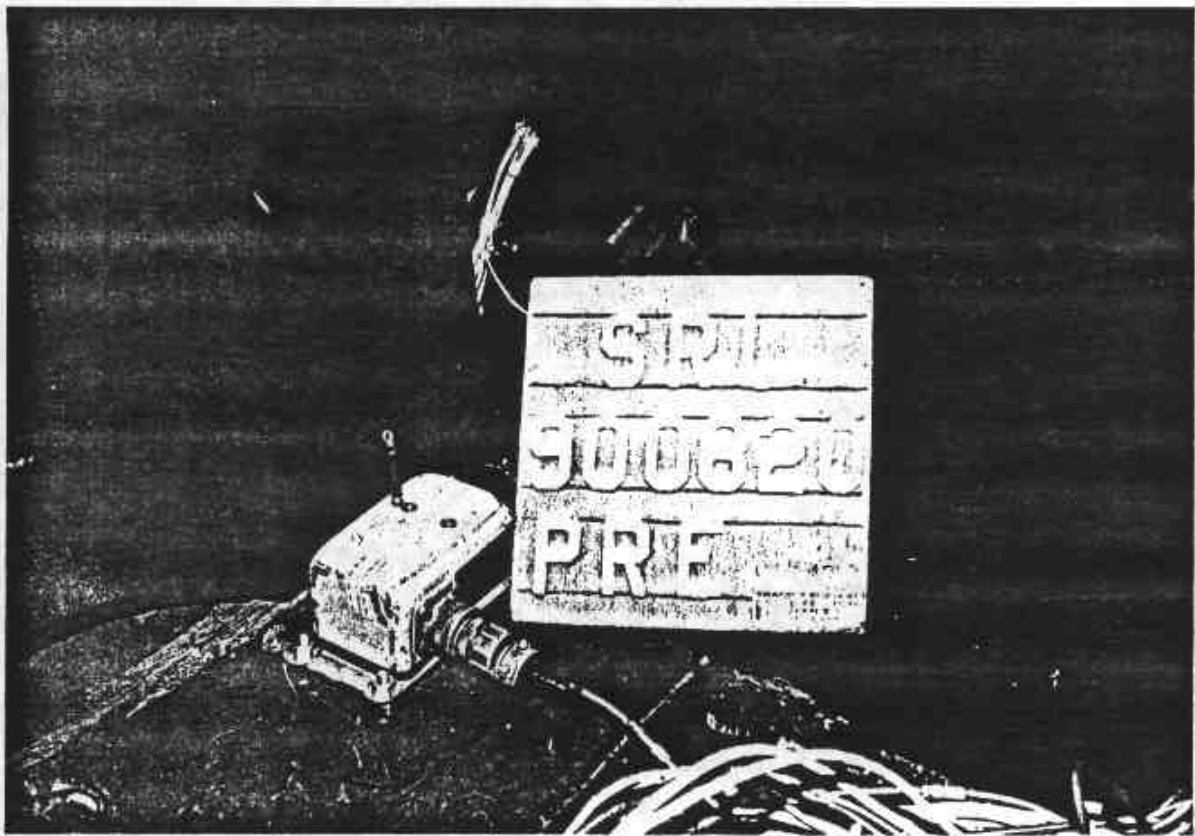


Figure A-14. PRE-TEST DRIVER'S SEAT BELT STRING POTENTIOMETER VIEW

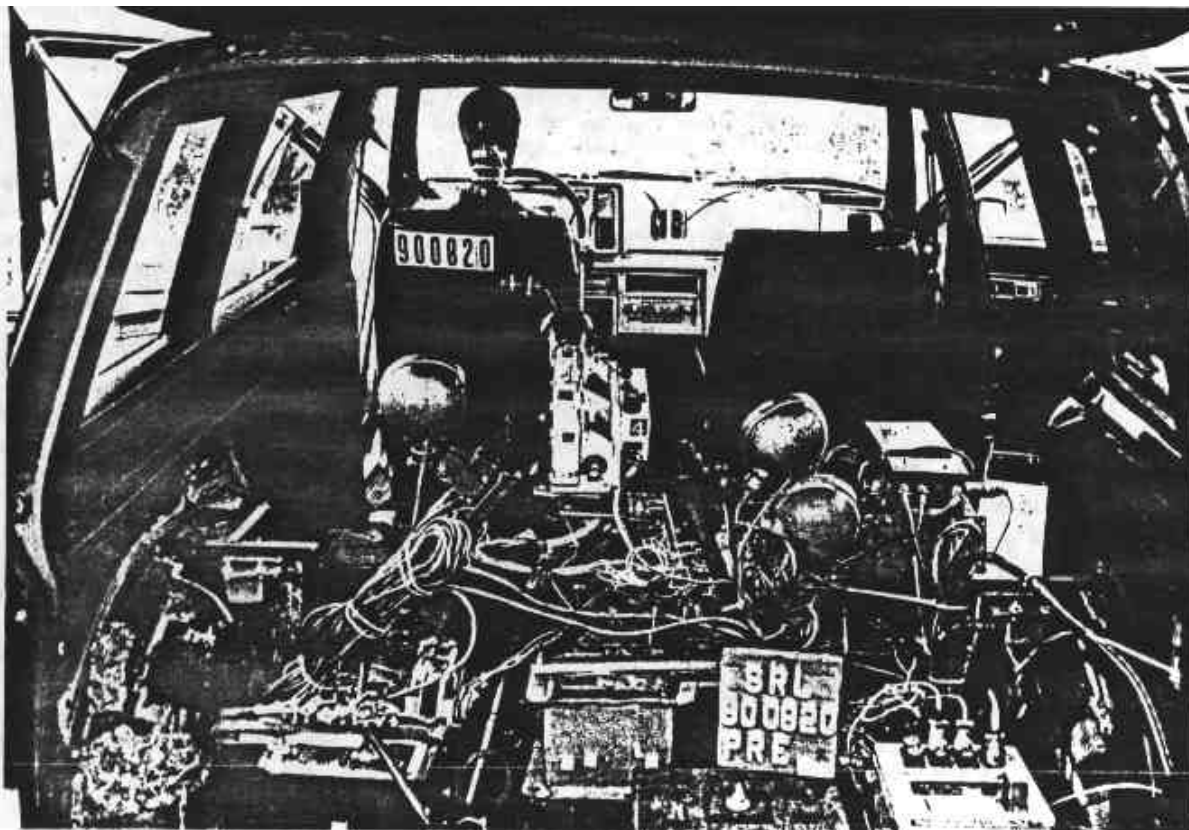


Figure A-15. PRE-TEST VEHICLE INSTRUMENTATION AND CAMERA LOCATION

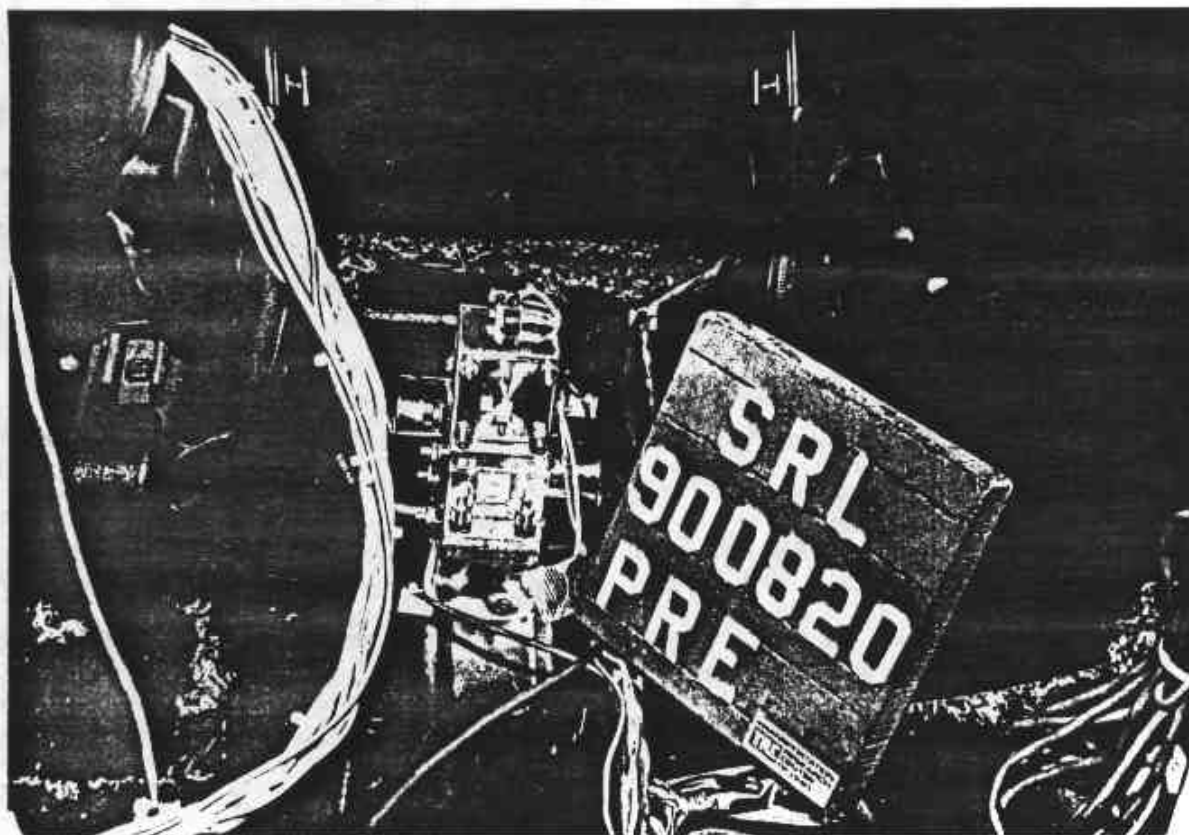


Figure A-16. PRE-TEST GYROSCOPE PLACEMENT VIEW



Figure A-17. POST-TEST FRONT VIEW



Figure A-18. POST-TEST RIGHT SIDE VIEW

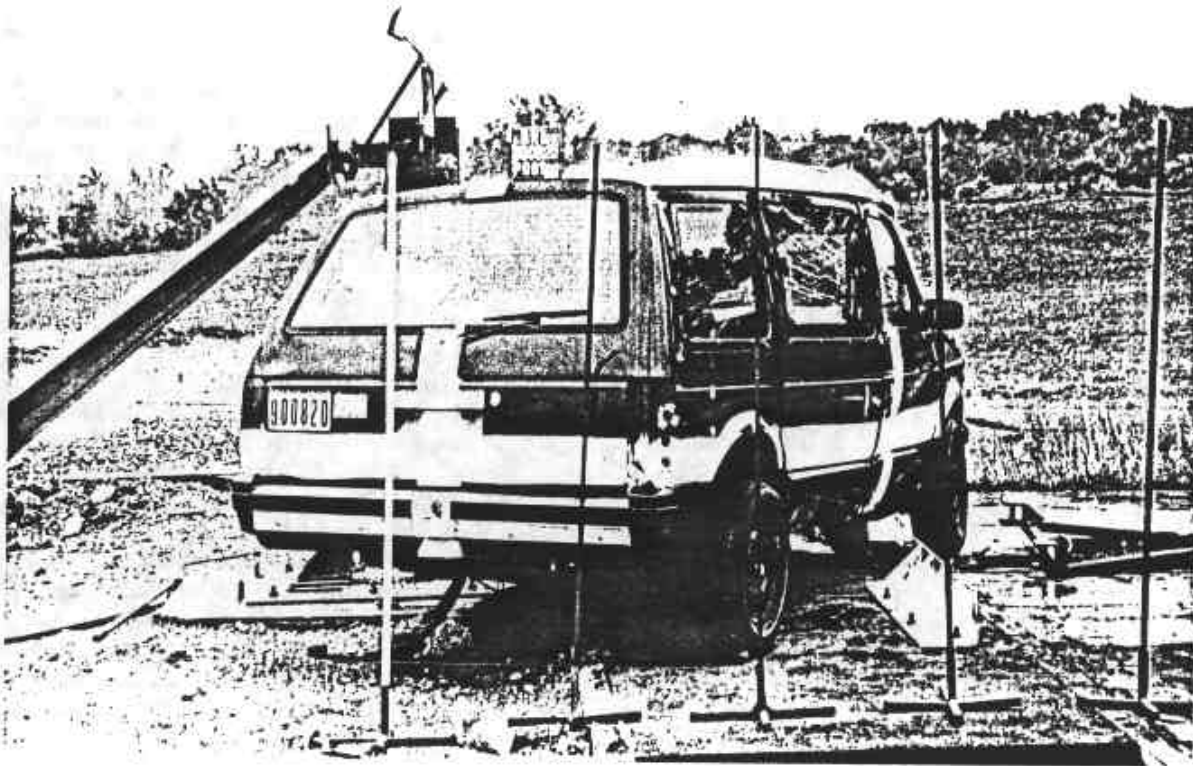


Figure A-19. POST-TEST REAR VIEW

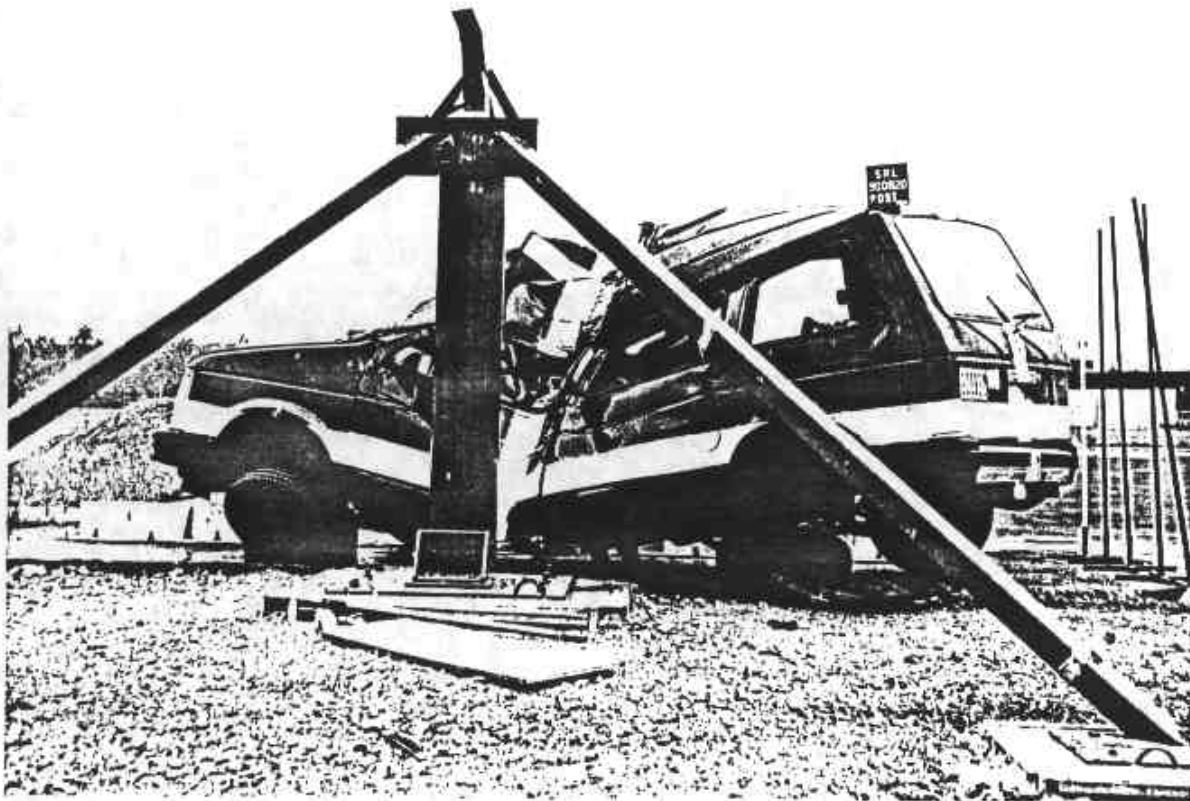


Figure A-20. POST-TEST LEFT SIDE VIEW

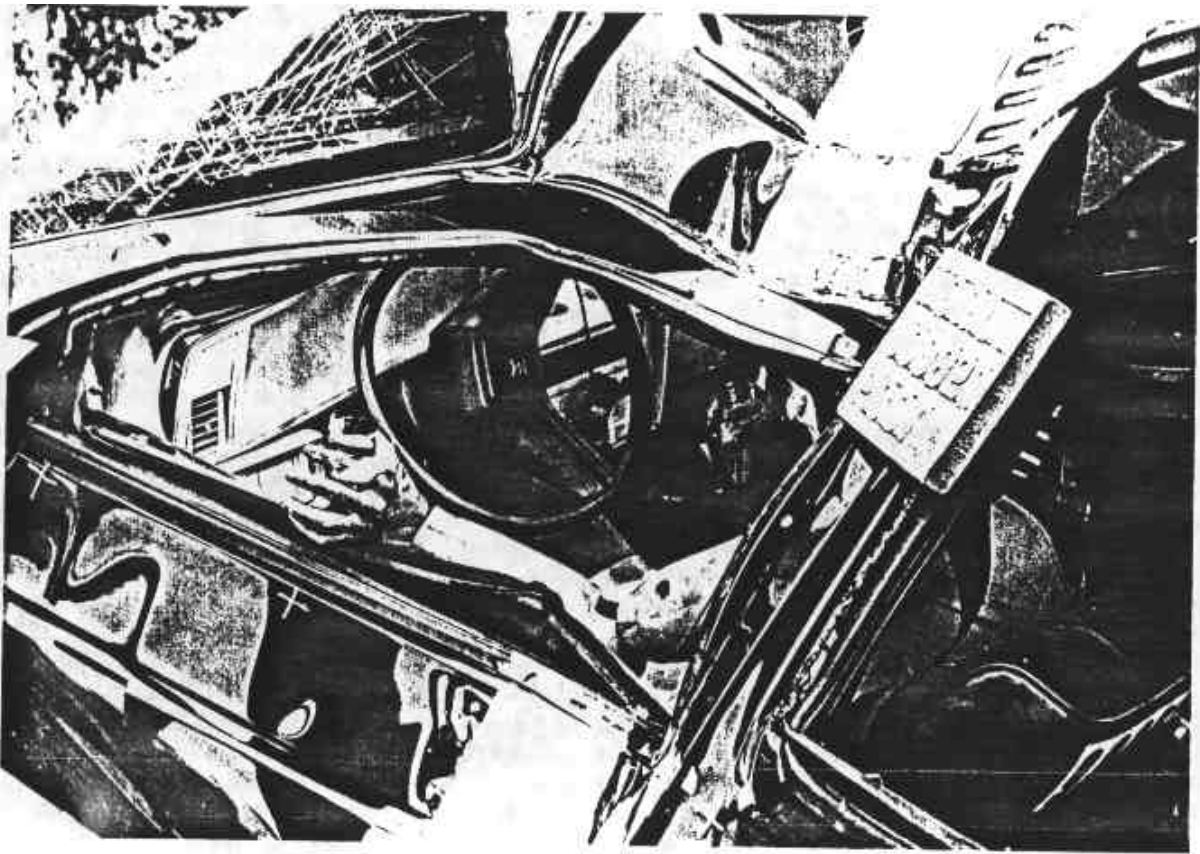


Figure A-21. POST-TEST DUMMY AND VEHICLE - VIEW 1

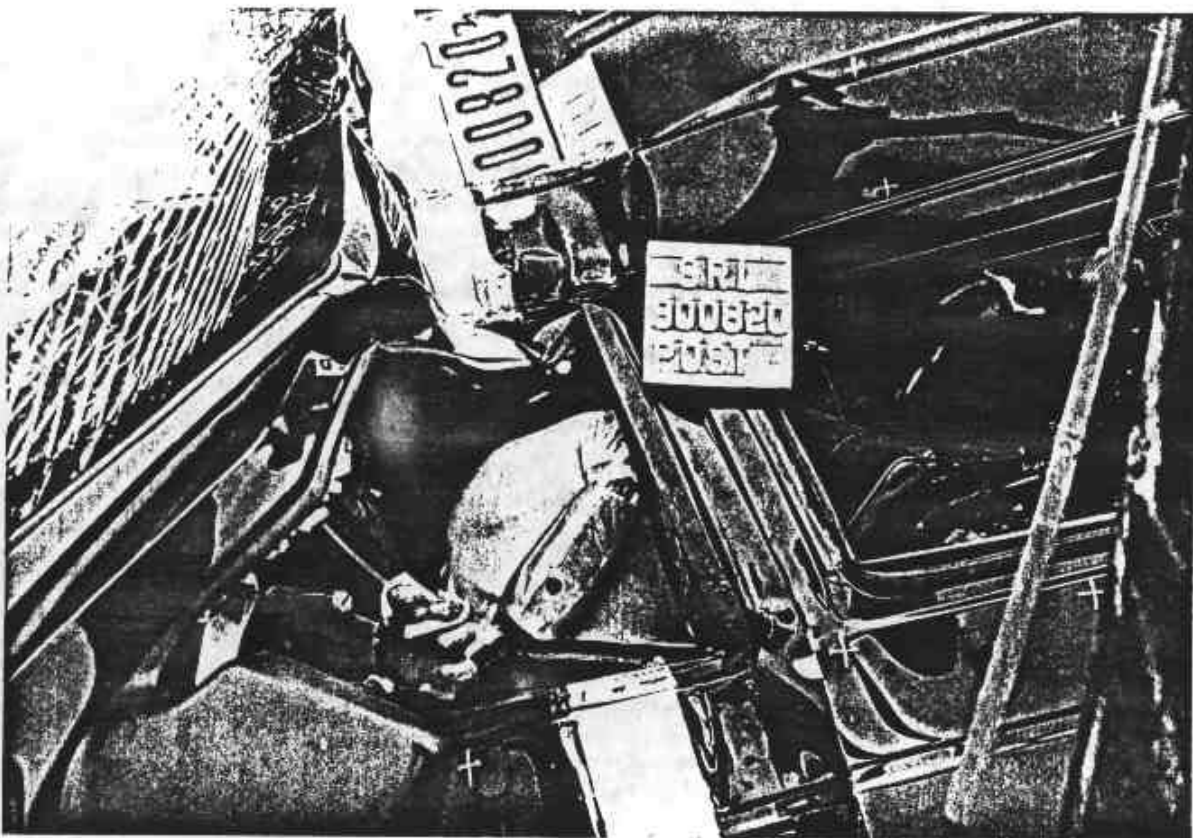


Figure A-22. POST-TEST DUMMY AND VEHICLE - VIEW 2

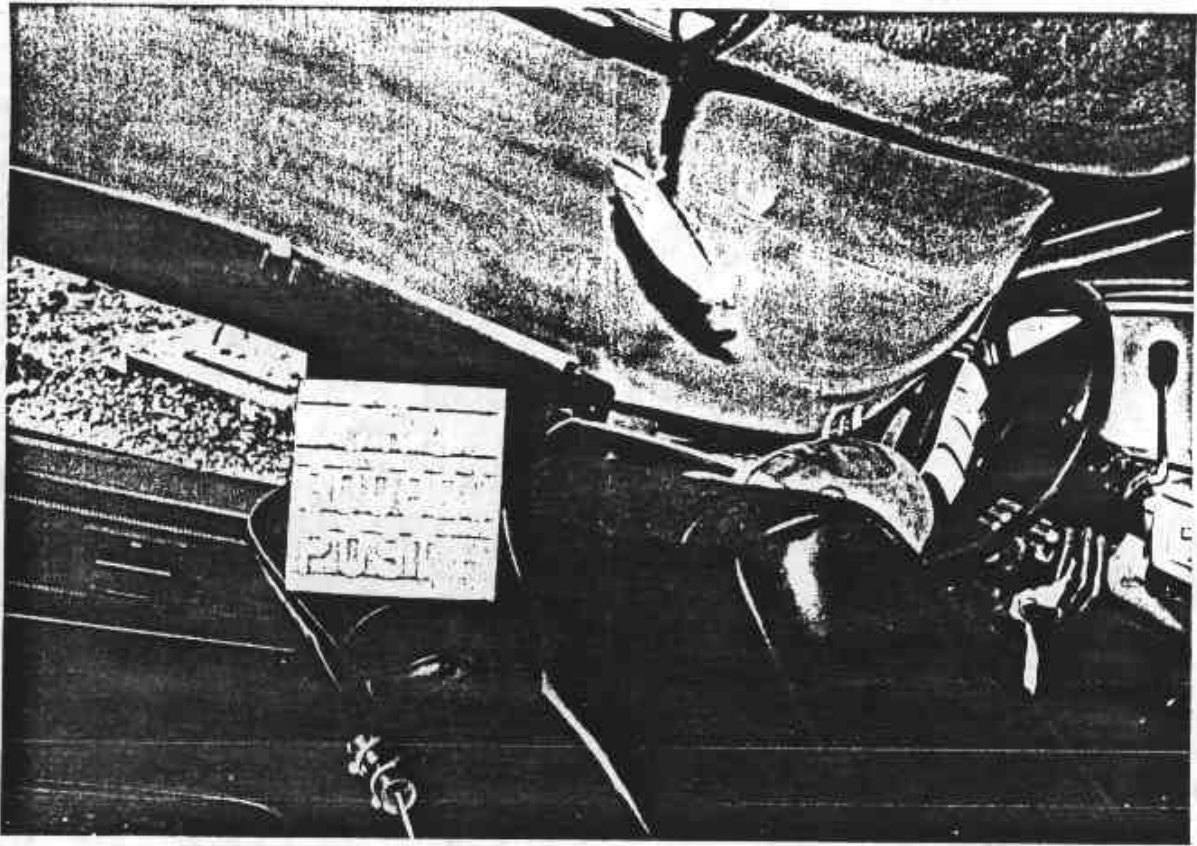


Figure A-23. POST-TEST DUMMY AND VEHICLE - VIEW 3

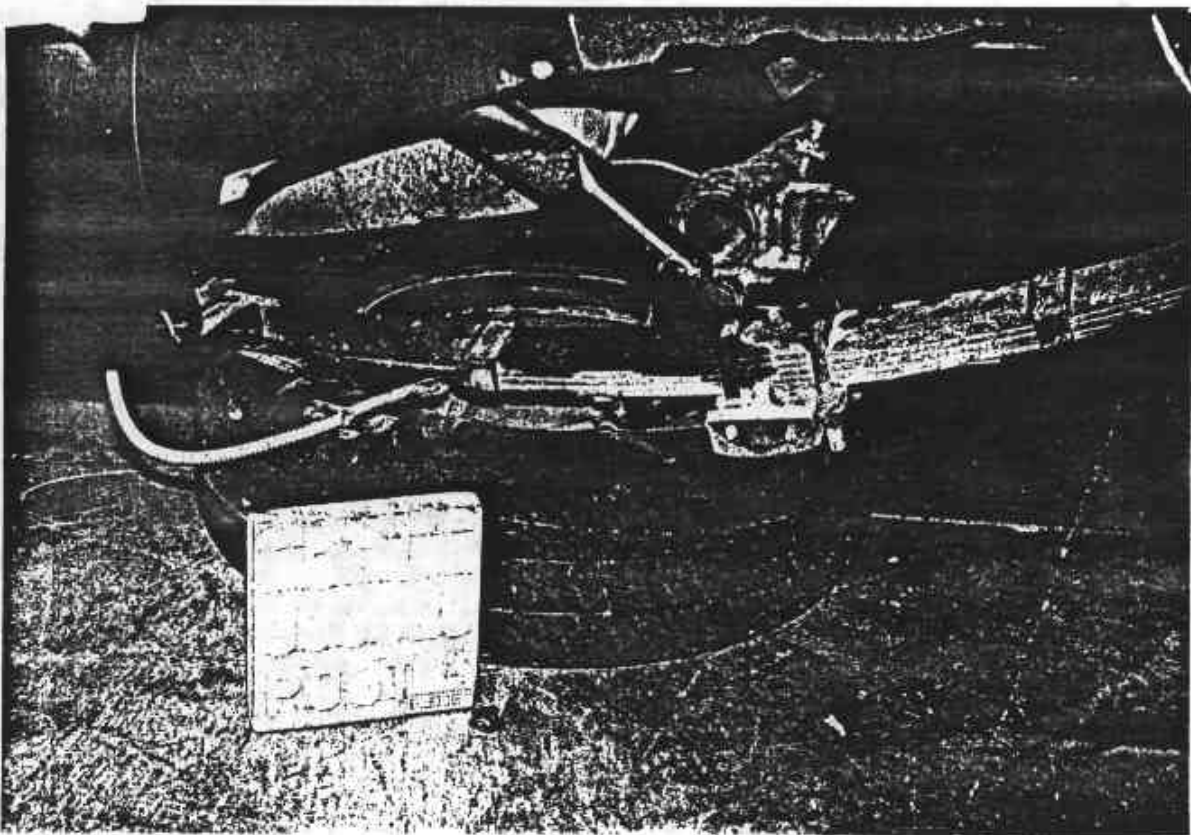


Figure A-24. POST-TEST VEHICLE DAMAGE VIEW

APPENDIX B

DATA PLOTS

UNCONTROLLED ROLL-OVER CRASH

90232

HEDXG1

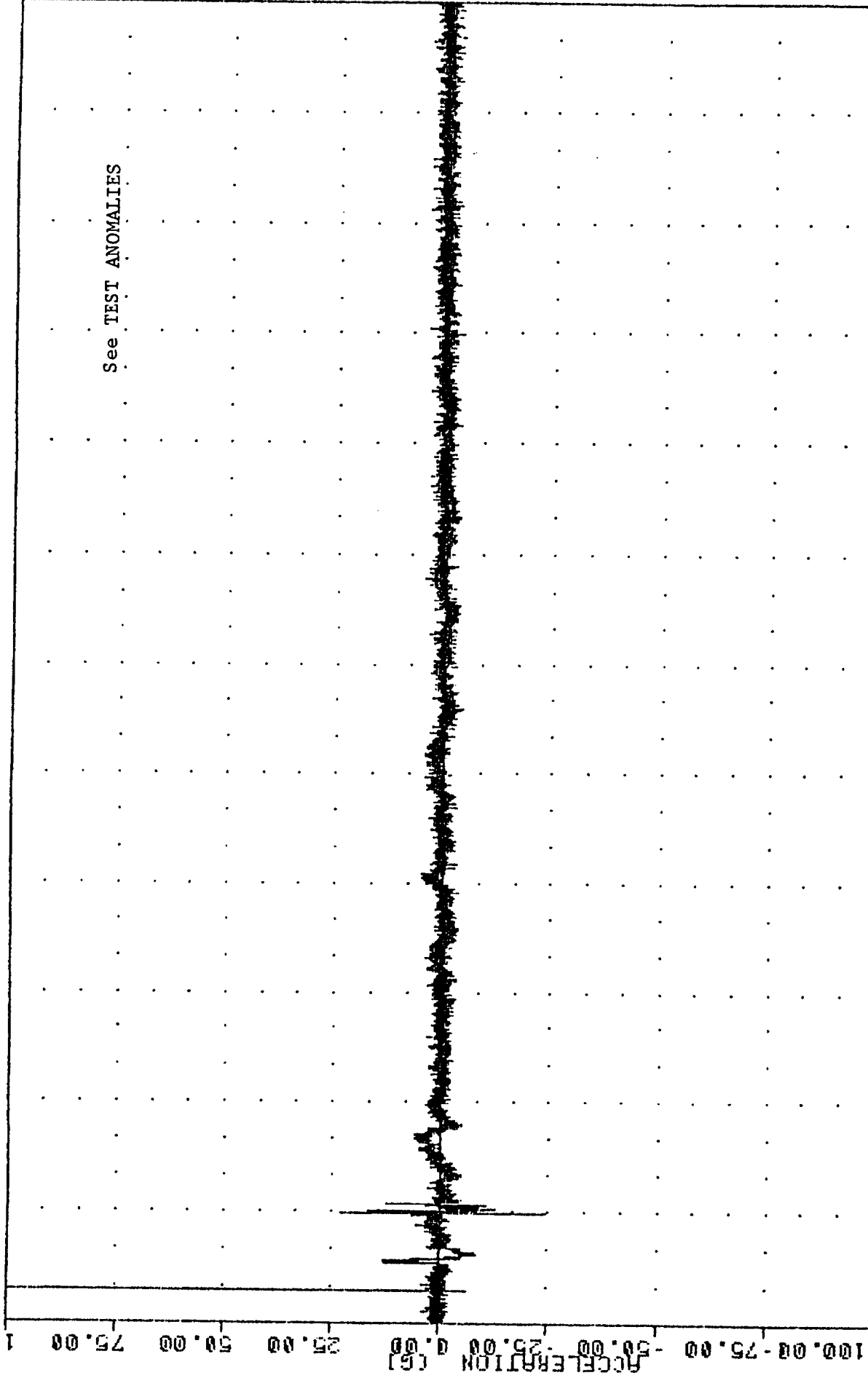
FILTER = ALPF 1650/ 5214/ -40

MIN. MAX VALUES = -24.43%

293.00

230.67

87.50

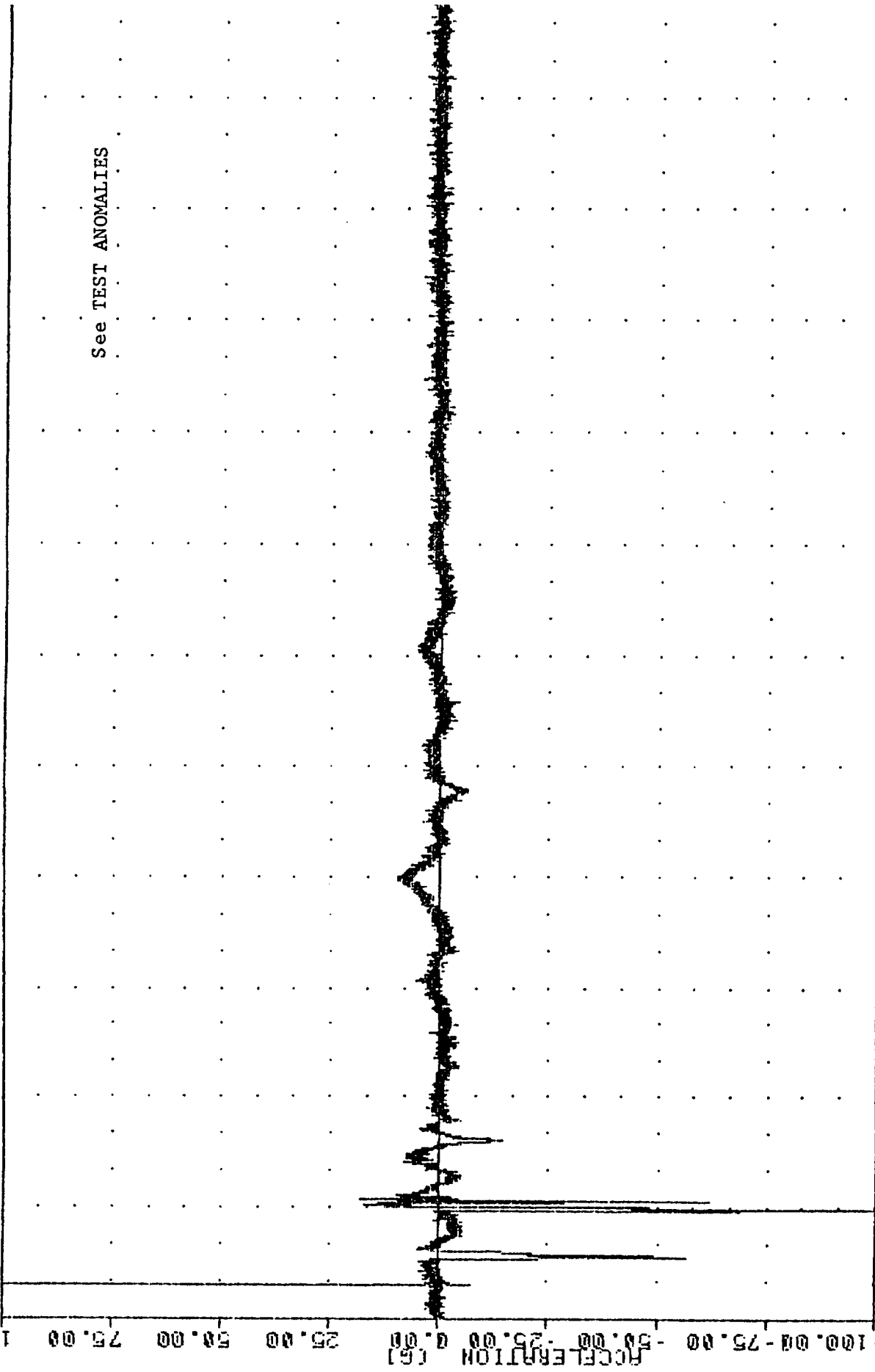


0.00 30.00 50.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00 350.00  
TIME (MSEC)

1988 DODGE CARRAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
DRIVER HEAD X AXIS ACCELERATION

90232  
HEDY61

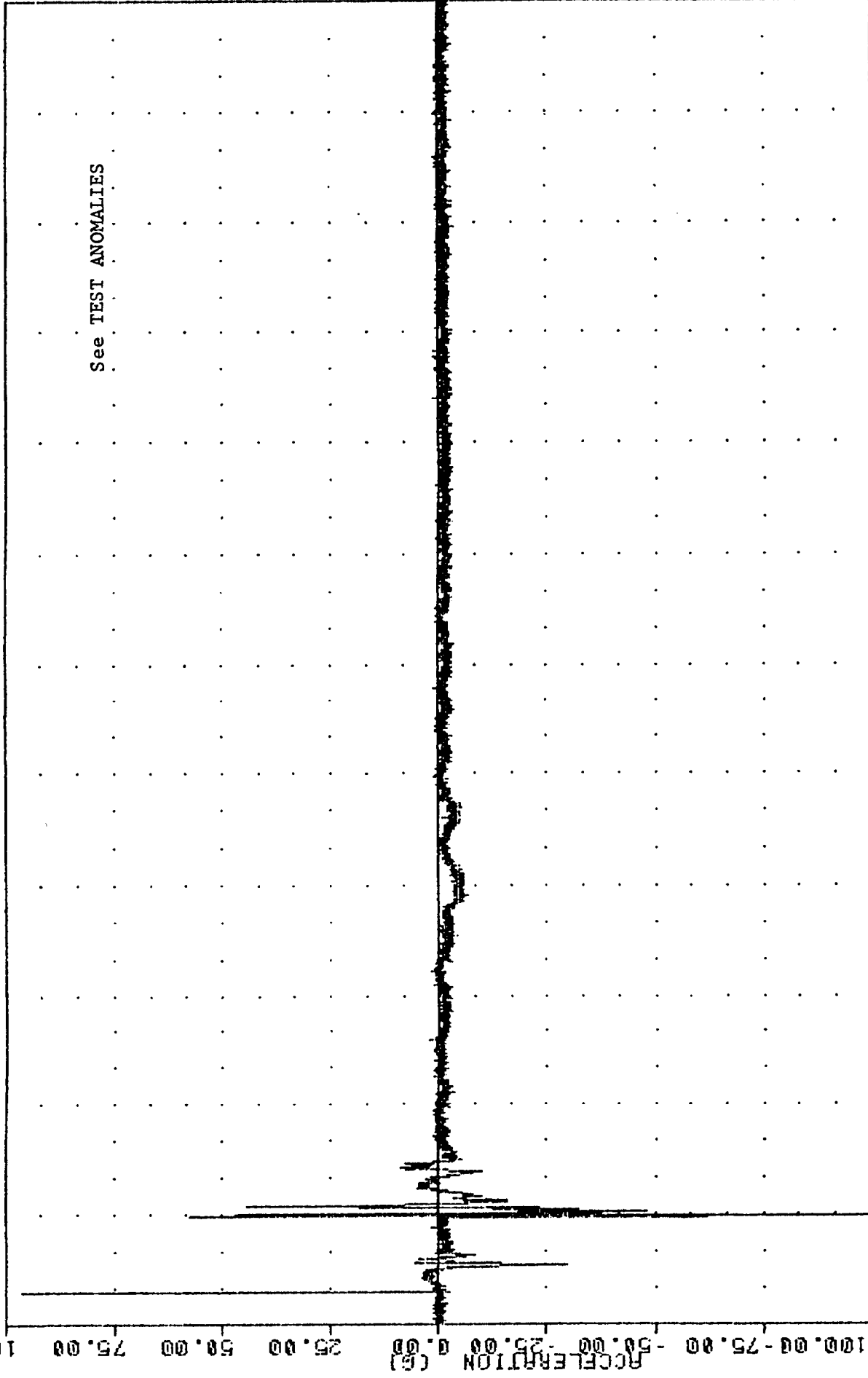
FILTER = ALFF 1650/ 5214/ -40  
MIN. MAX VALUES = -190.86e 293.00, 157.42 e 67.50



0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC) (x10<sup>1</sup>)  
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MP.  
DRIVER HEAD Y AXIS ACCELERATION

90232  
HEDZG1

FILTER = ALFF 1650/ 5214/ -40  
MIN, MAX VALUES = -163.39 293.00, 96.33 @ 67.50



0.00 50.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00 3  
TIME (MSEC) CX16j

1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
DRIVER HEAD Z AXIS ACCELERATION

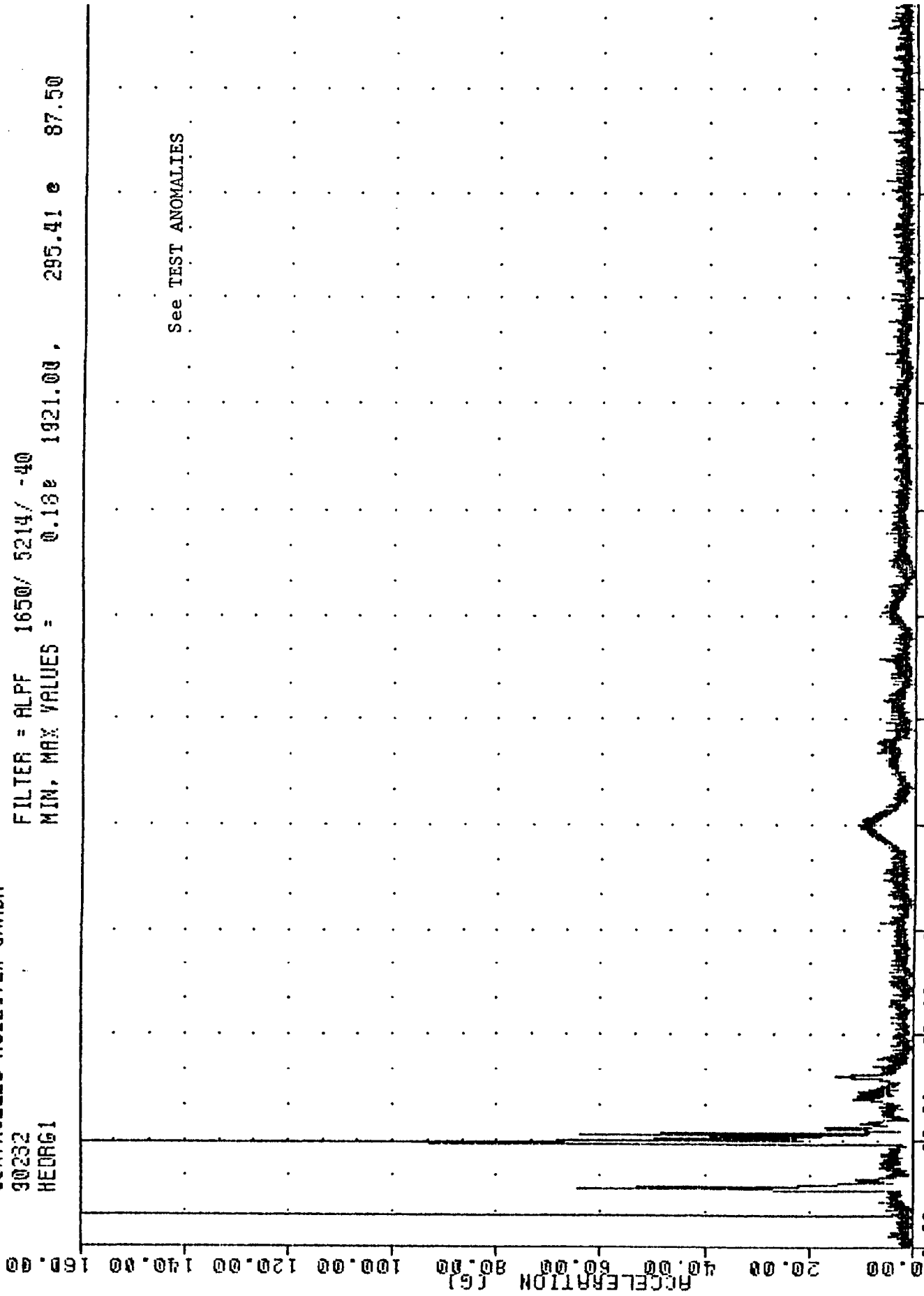
CONTROLLED ROLLOVER CRASH

90232

HEADG1

FILTER = ALPF 1650/ 5214/ -40

MIN, MAX VALUES = 0.13e 1921.00, 295.41 e 87.50



0.00 20.00 40.00 60.00 80.00 100.00 120.00 140.00 160.00  
ACCELERATION (G)

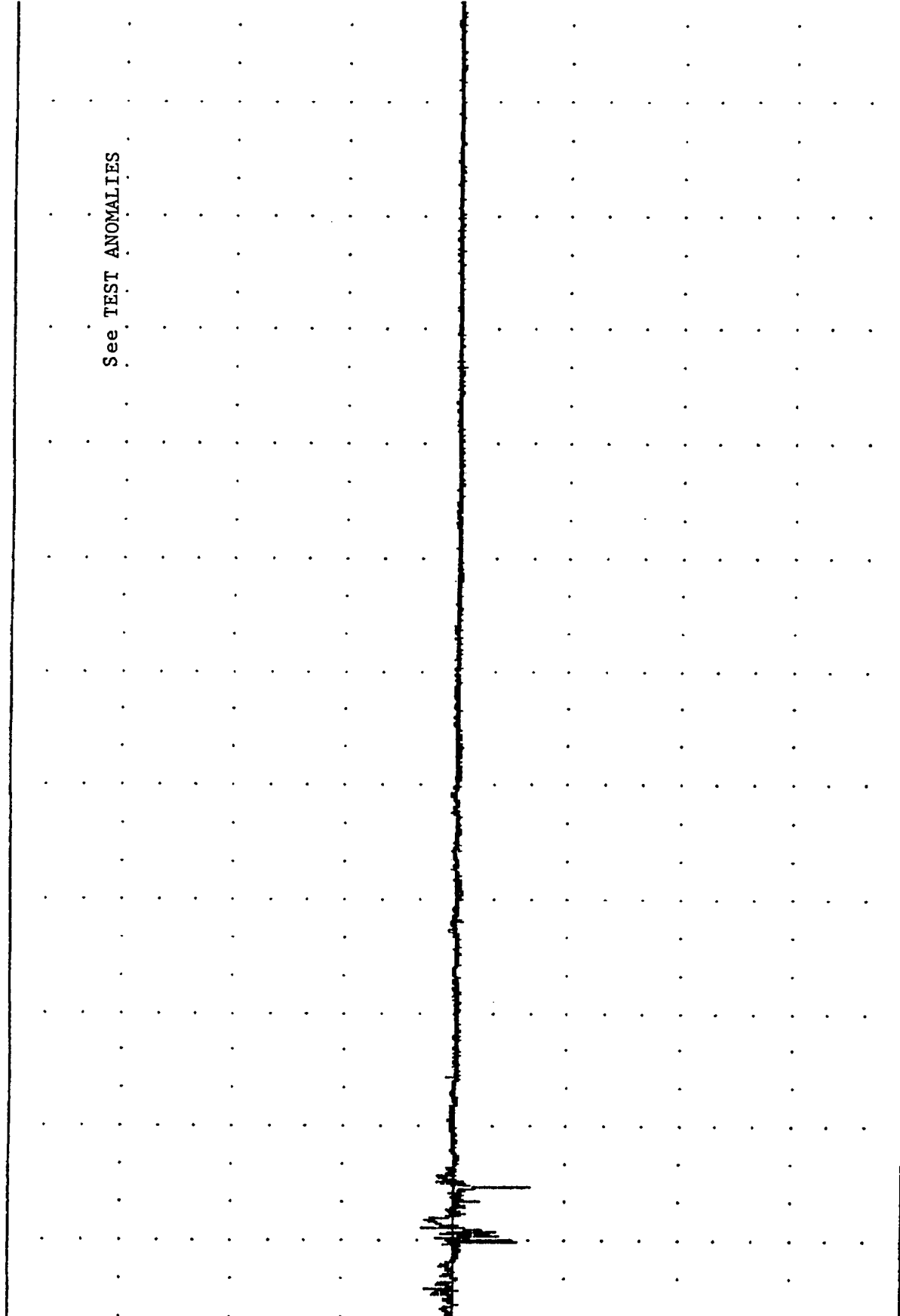
0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC)

1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MP  
DRIVER HEAD RESULTANT ACCELERATION

30232  
 MEKXF1  
 CONTROLLED ROLLOVER CRASH

FILTER = ALPF 1650/ 5214/ -40  
 MIN. MAX VALUES = -337.21 e 437.00 , 2098.79 e 87.50

0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
 TIME (MSEC)

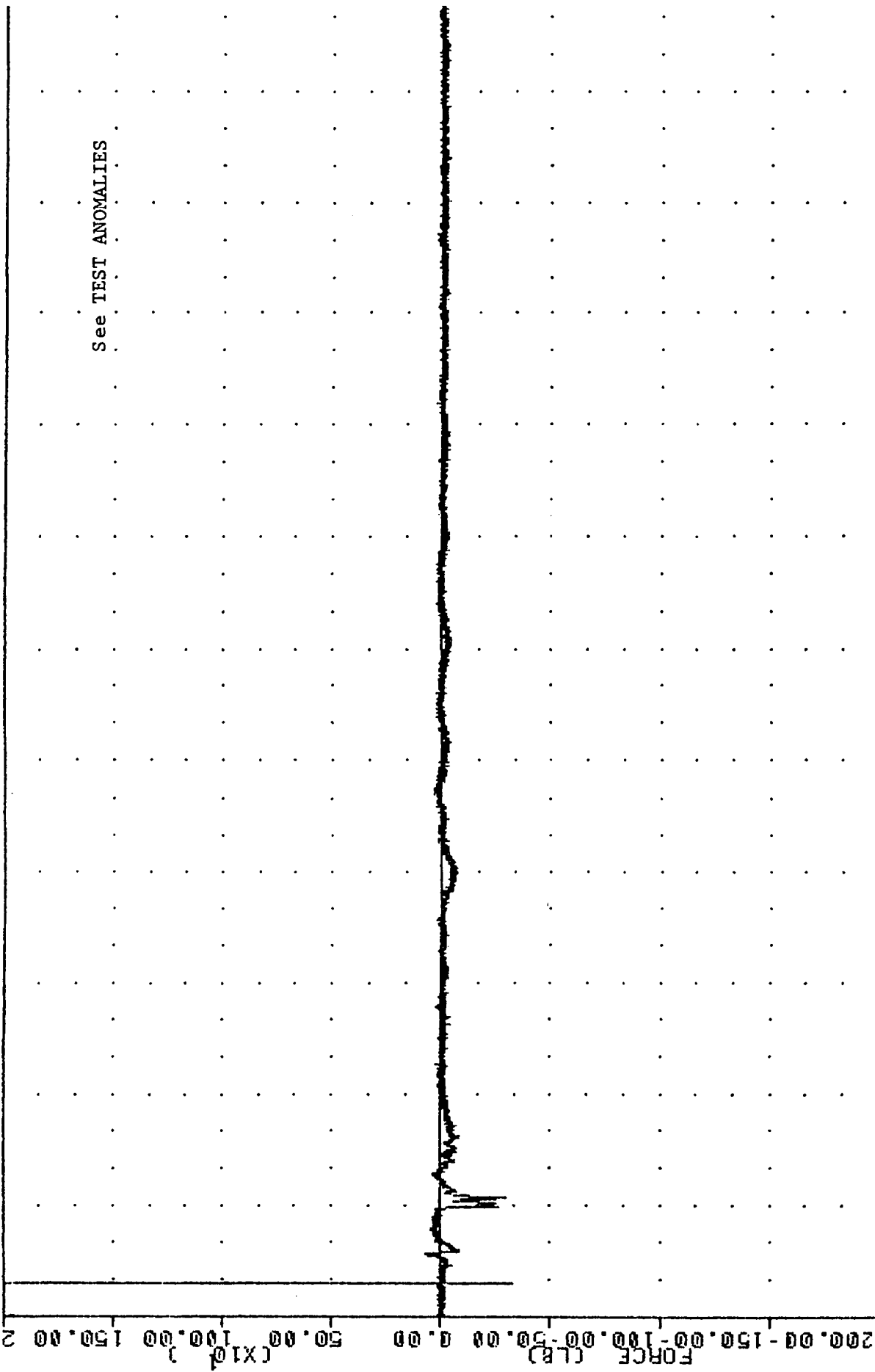


1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
 DRIVER NECK SHEAR FORCE Y AXYS

90232  
NEKYF1

FILTER = ALPT 1650/ 5214/ -40  
MIN, MAX VALUES = -321.63e 68.00,

2889.14 e 87.50

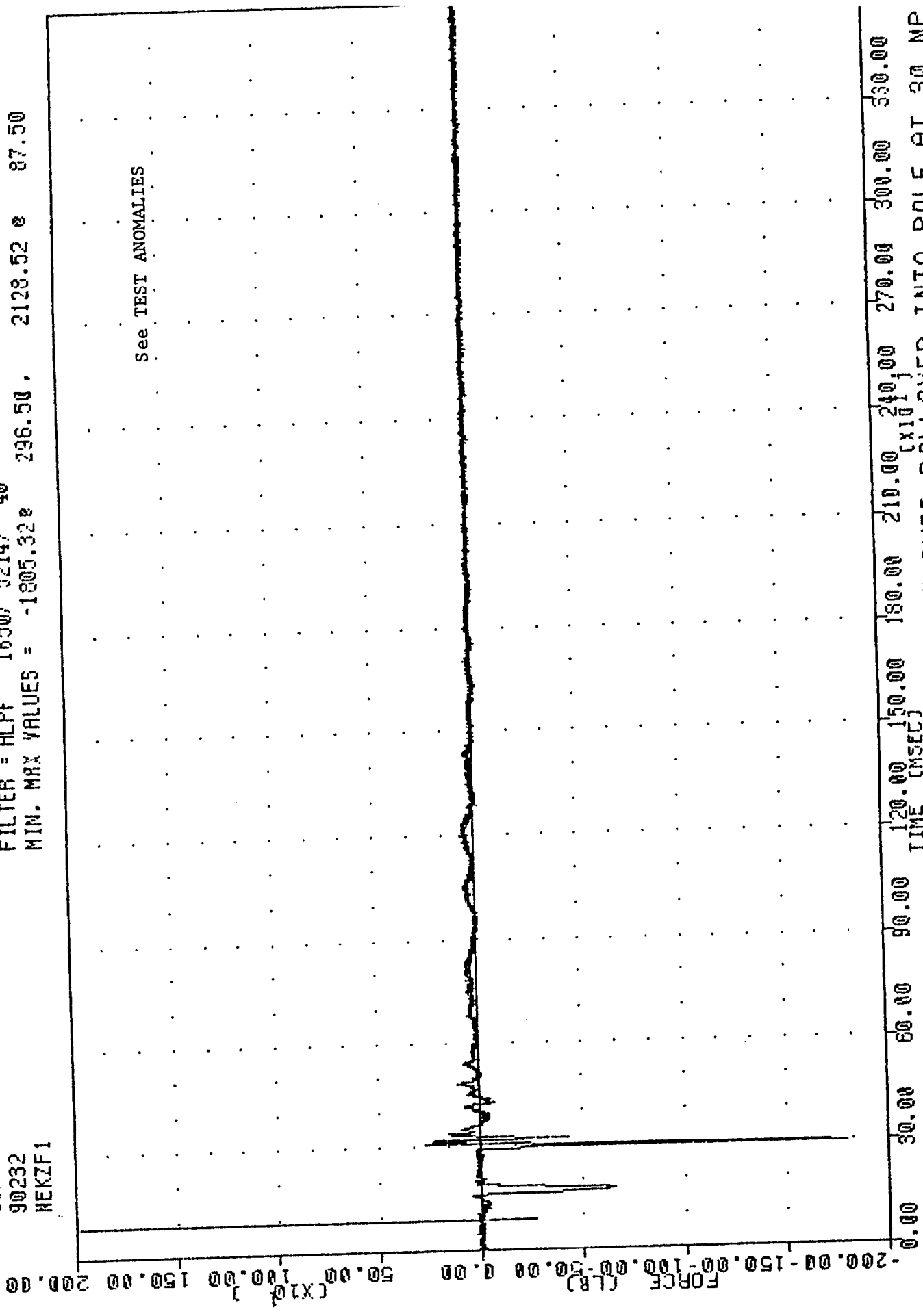


0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC) [x10<sup>3</sup>]  
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MF  
DRIVER NECK SHEAR FORCE Y AXIS

CONTROLLED ROLLOVER CRASH  
90232  
HEKZF1

FILTER = ALFF 1650/ 5214/ -40  
MIN. MAX VALUES = -1805.32e 296.50, 2128.52 e 87.50

See TEST ANOMALIES

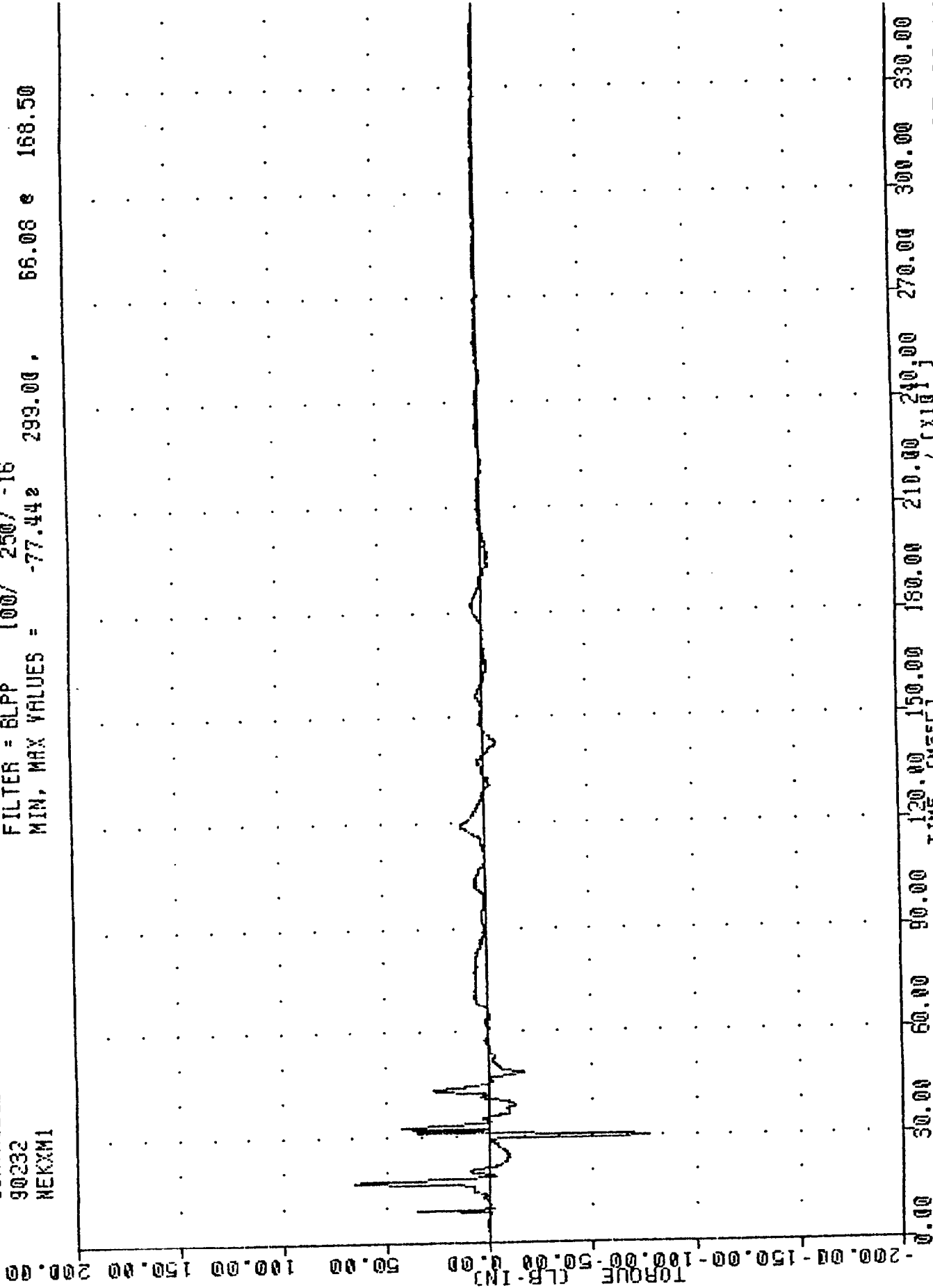


0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MP  
DRIVER NECK AXIAL FORCE Z AXIS

CONTROLLED ROLL-OVER CARTR

90232  
NEKXMI

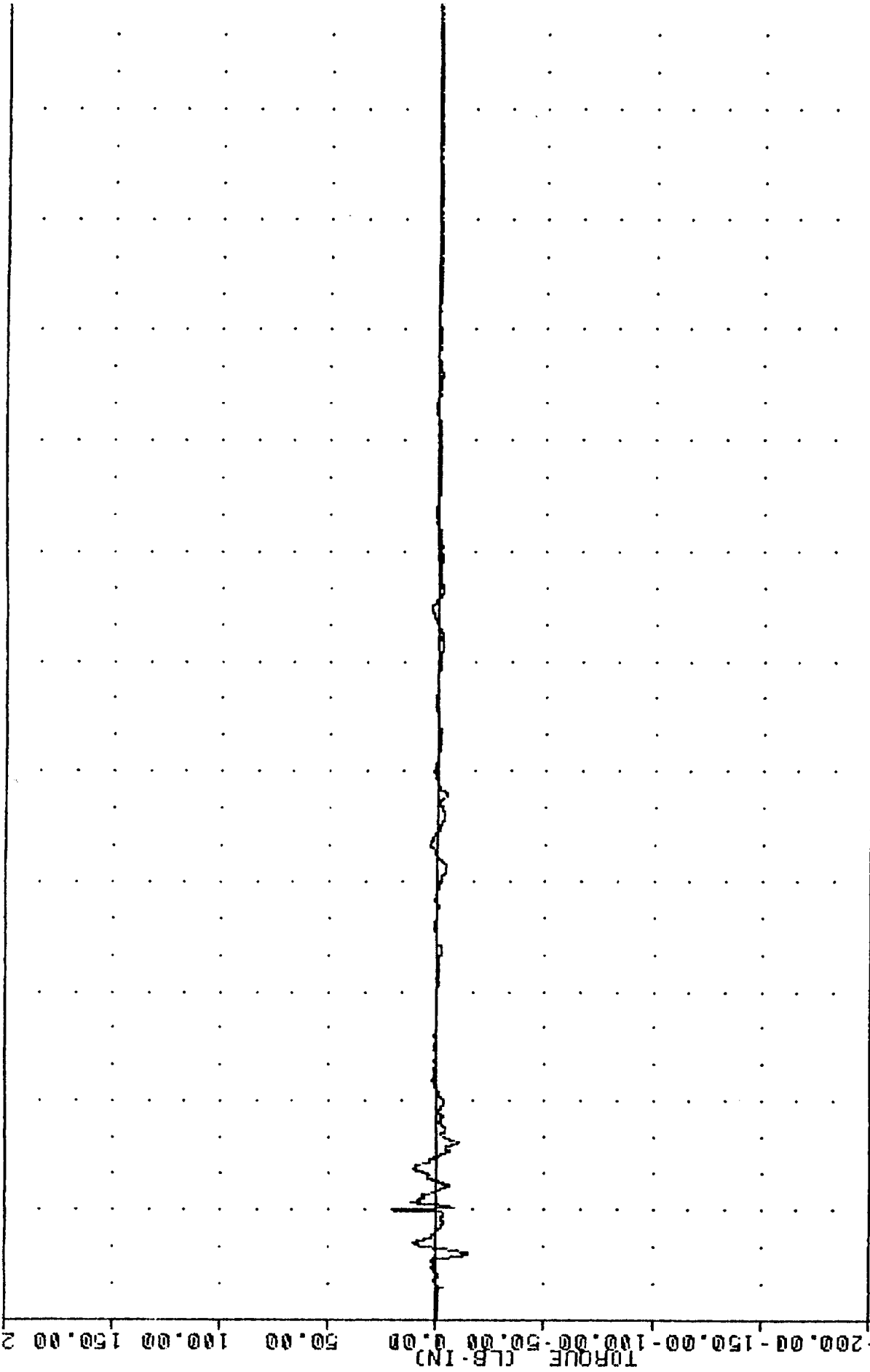
FILTER = BLPP 100/ 250/ -16  
MIN, MAX VALUES = -77.442 299.00, 66.08 e 168.50



120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (CMSEC), Cx10<sup>10</sup>  
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLL-OVER INTO POLE AT 30 MI  
DRIVER NECK MOMENT ABOUT X AXIS

90232  
NEKYM1

FILTER = BLPP 100/ 250/ -16  
MIN. MAX VALUES = -14.37e 180.50, 20.14 e 297.50

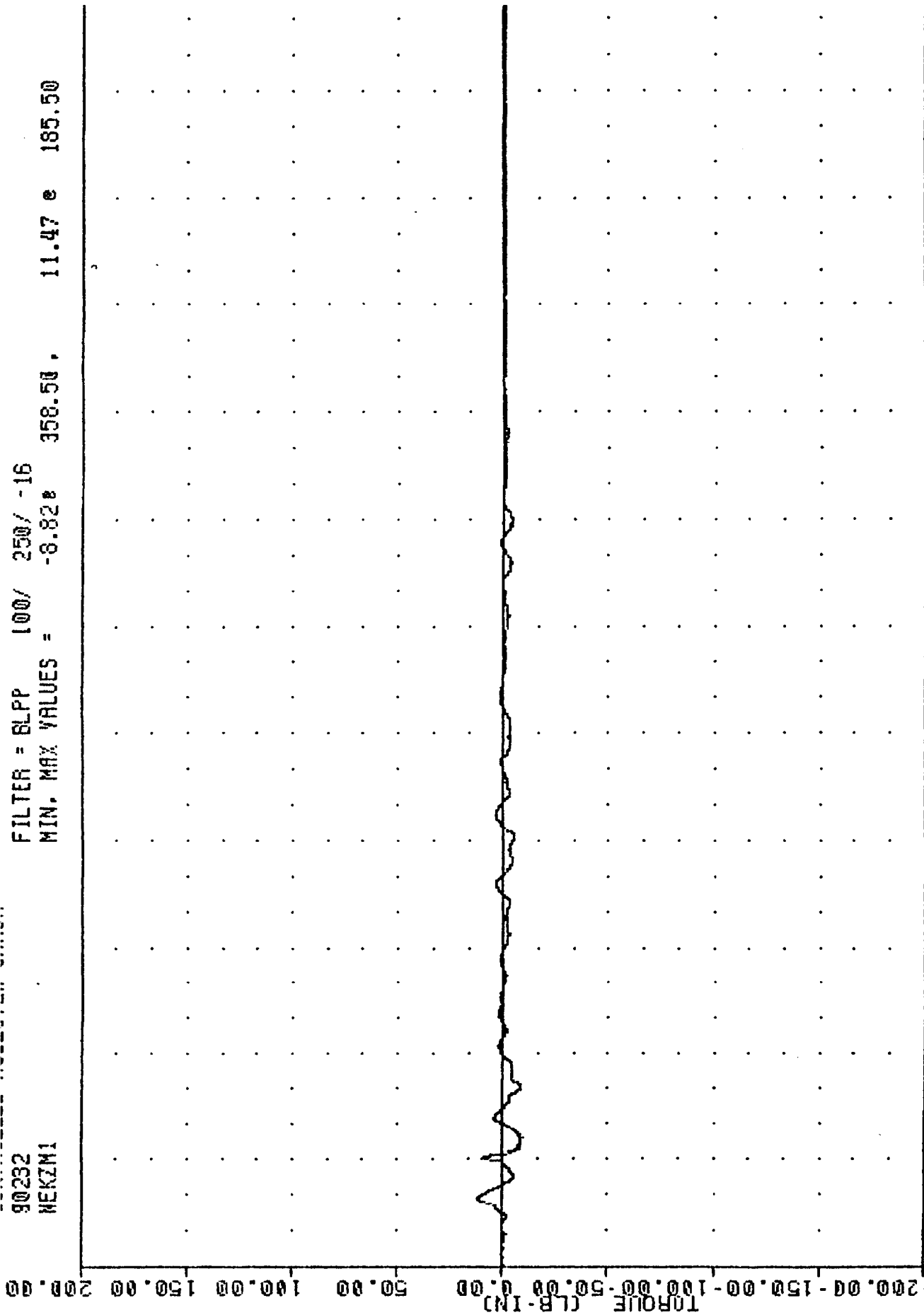


1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
DRIVER NECK MOMENT ABOUT Y AXIS

90232  
MEKZM1

FILTER = BLPP 100/ 250/ -16  
MIN. MAX VALUES = -8.82e 358.50 .

11.47 e 185.50



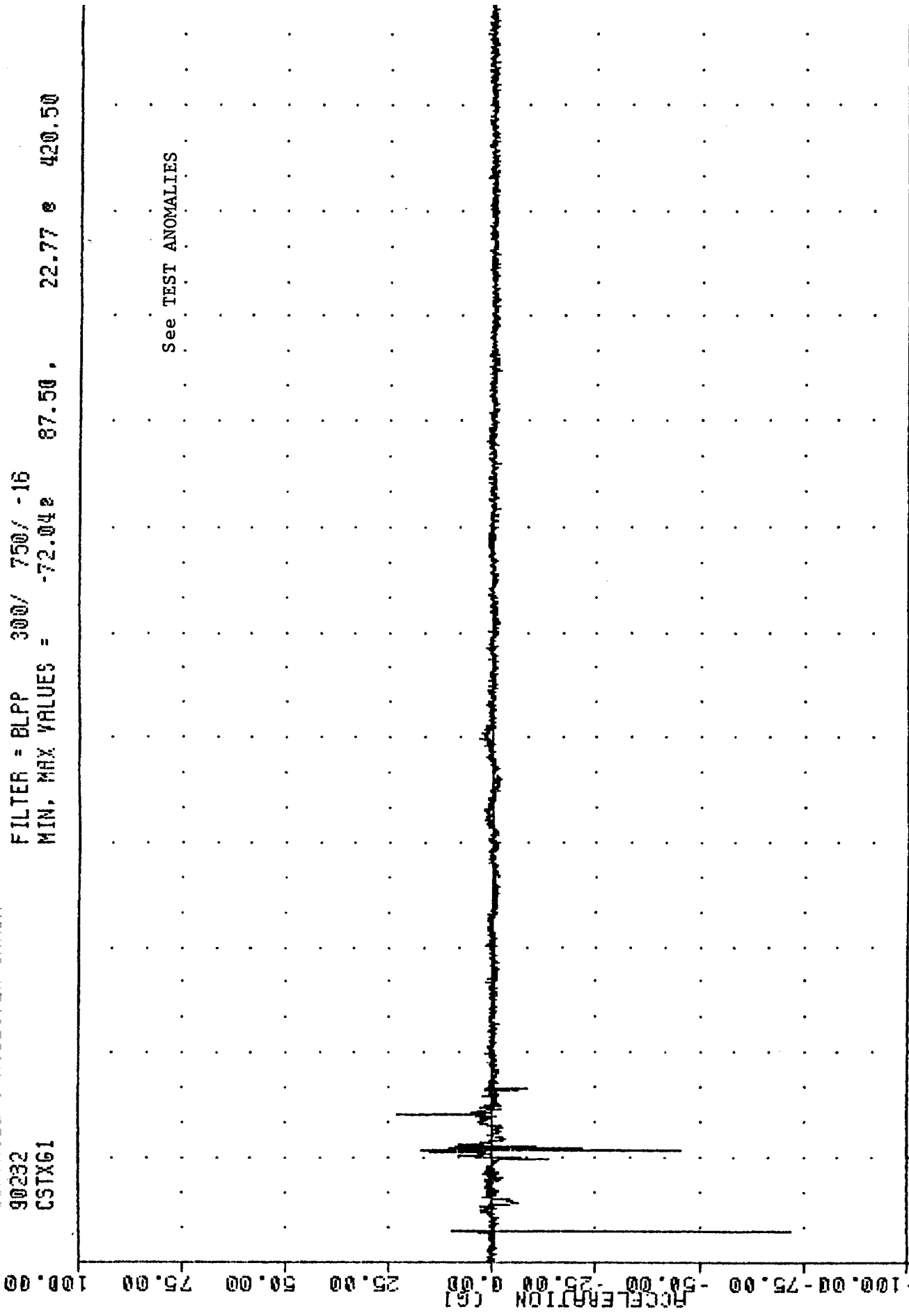
0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC) (x10<sup>10</sup>)

1988 DODGE CARRAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MP  
DRIVER NECK MOMENT ABOUT Z AXIS

90232  
CSTX61

FILTER = BLPP 300/ 750/ -16  
MIN, MAX VALUES = -72.04e 87.50 . 22.77 e 420.50

See TEST ANOMALIES



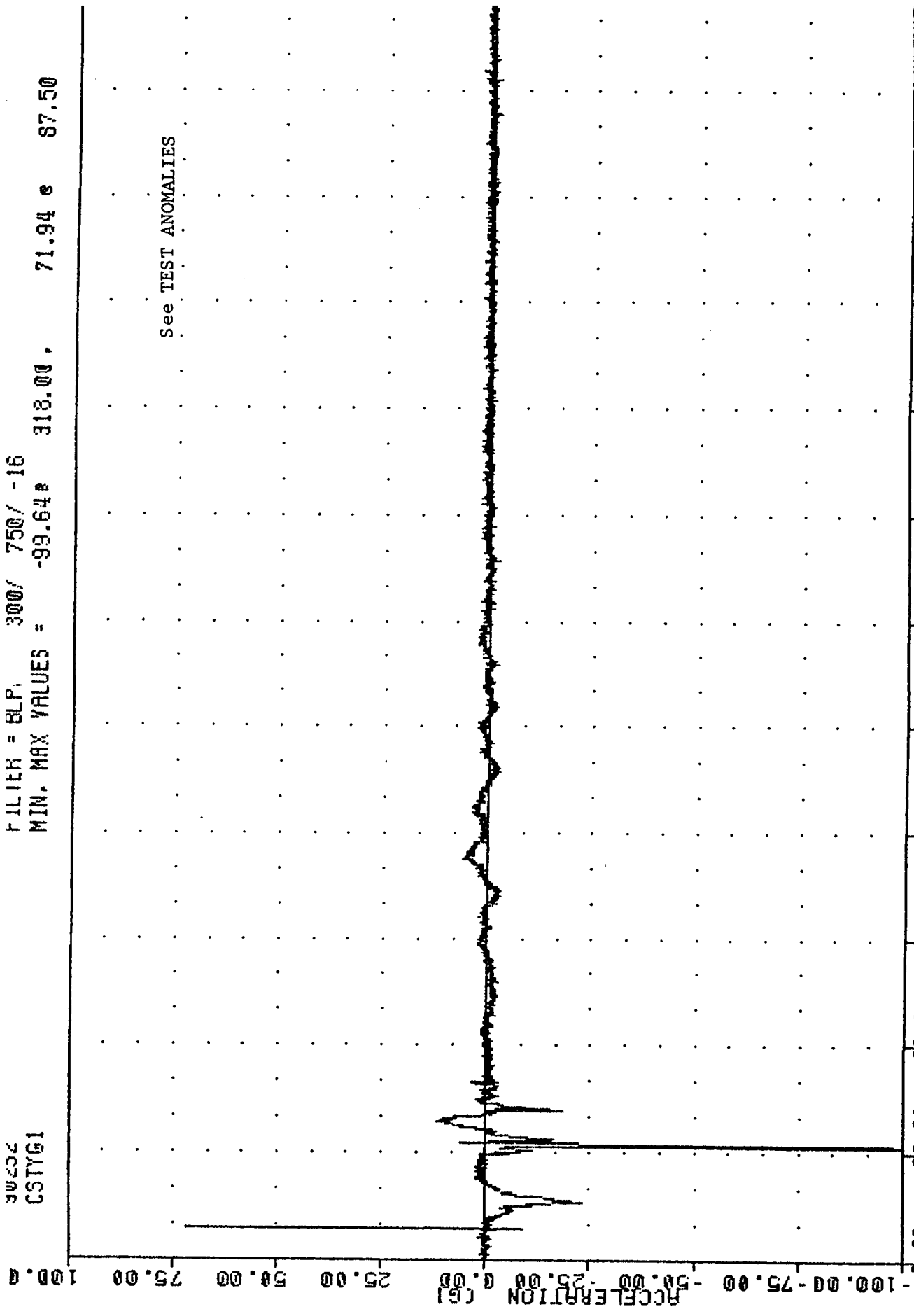
0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC) (x10<sup>3</sup>)  
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
DRIVER CHEST X AXIS ACCELERATION

30232  
CSTY61

FILIER = BLP, 300/ 750/ -16  
MIN. MAX VALUES = -99.64# 318.00.

71.94 e 87.50

See TEST ANOMALIES



0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC)

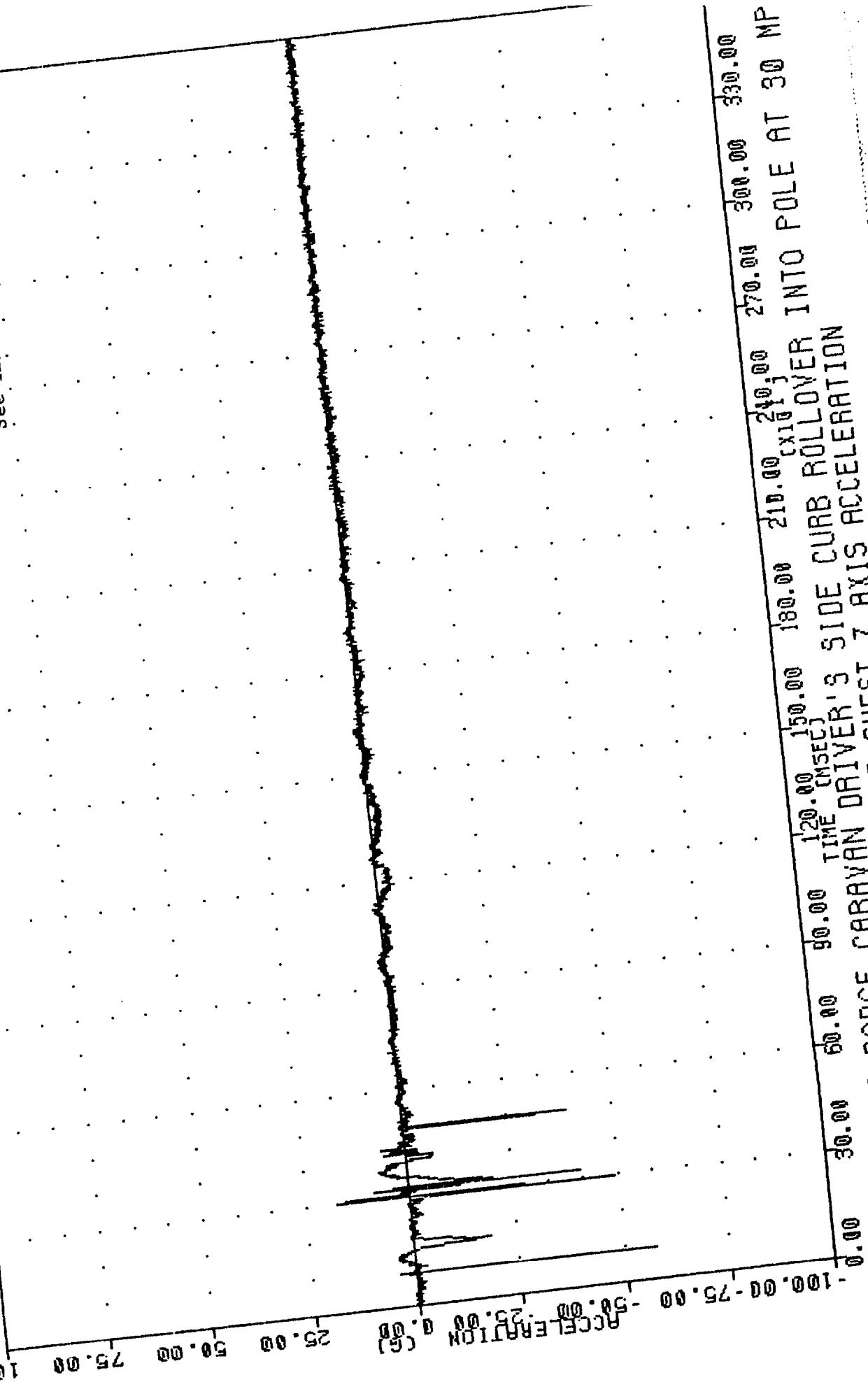
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MP  
DRIVER CHEST Y AXIS ACCELERATION

UNIT NUMBER 300020  
CONTROLLED ROLLOVER CRASH  
90232  
C3T161

FILTER = 6LPP 300/ .50/ -10 87.50  
MIN. MAX VALUES = -57.488

17.00

See TEST ANOMALIES



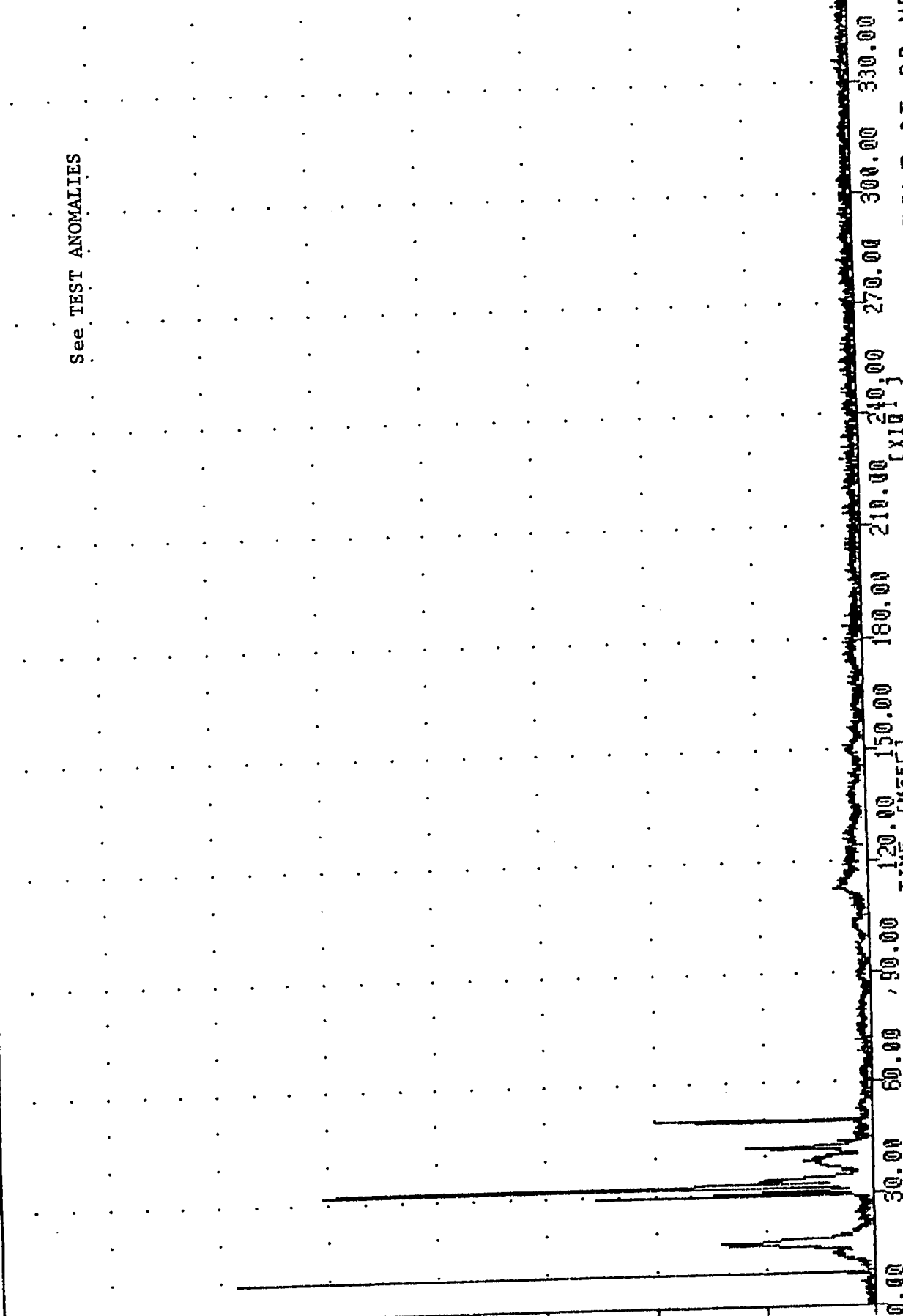
120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC) (x10<sup>3</sup>)  
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MP  
DRIVER CHEST Z AXIS ACCELERATION

CONTROLLED RULLOVER LADDER  
90232  
CSTR61

FILTER = BLPP 300/ 750/ -16  
MIN. MAX VALUES = 0.09e 2929.00, 116.91 e 87.50

See TEST ANOMALIES

ACCELERATION (G)



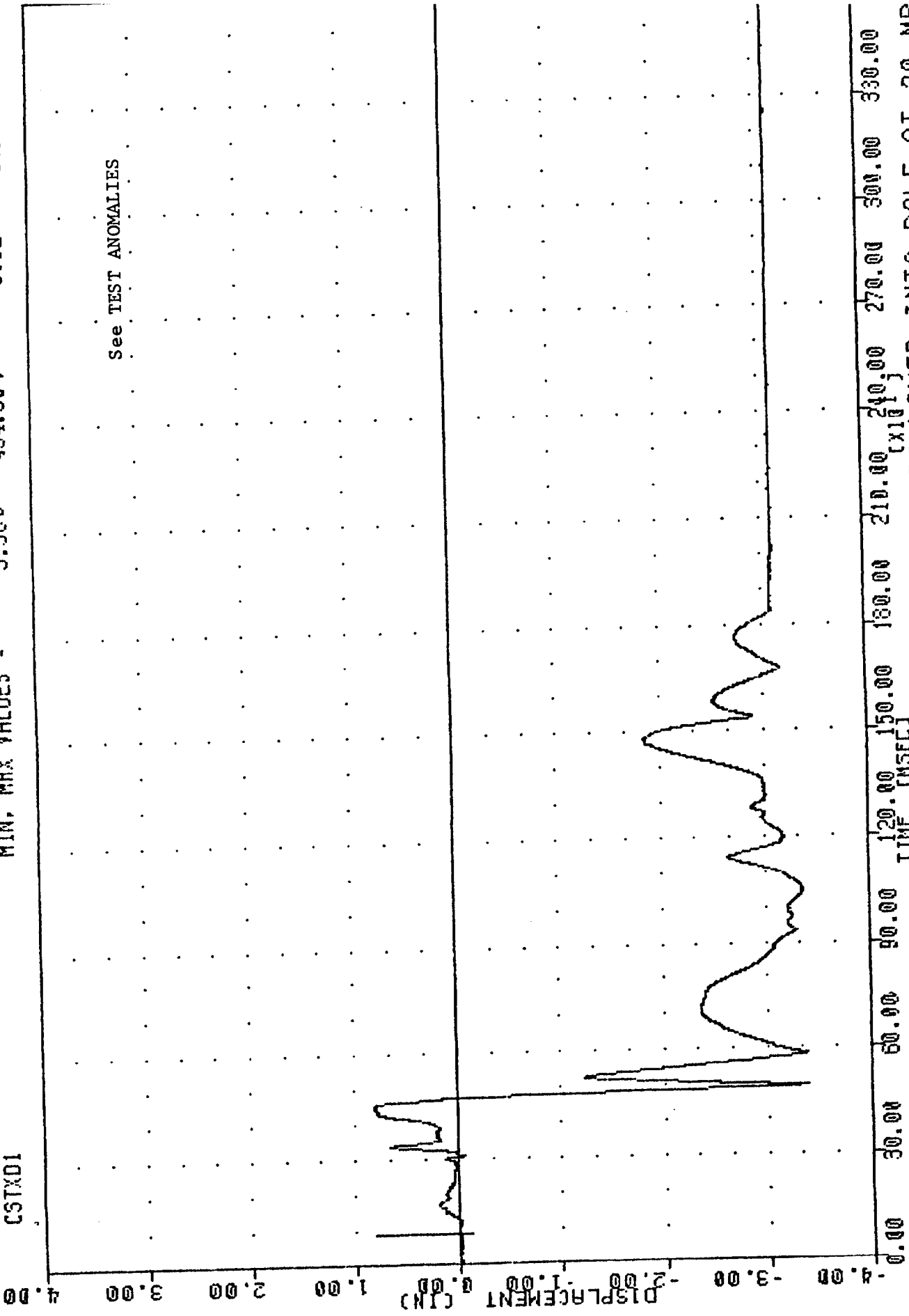
0.00 20.00 40.00 60.00 80.00 100.00 120.00 140.00 160.00  
0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC)

1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MF  
DRIVER CHEST RESULTANT ACCELERATION

UNFILTERED ROLLOVER GROUND  
90232  
CSTXD1

FILTER = BLPP 300/ 750/ -16  
MIN. MAX VALUES = -3.38e 494.50 , 0.82 e 443.00

See TEST ANOMALIES

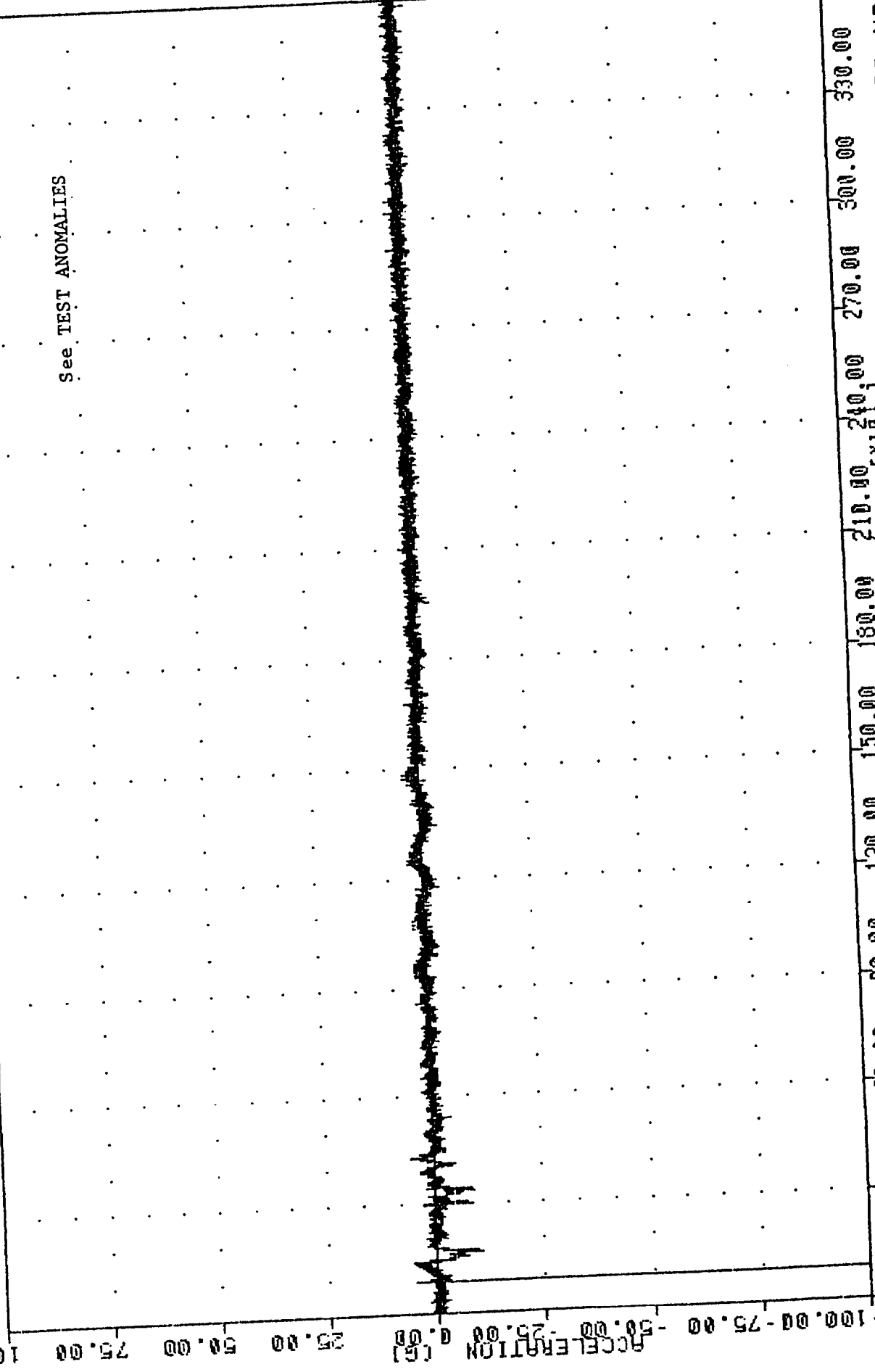


1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MP  
DRIVER CHEST X AXIS DISPLACEMENT

CONTROLLED ROLLOVER CRASH  
90232  
PEVXG1

FILTER = ALPF 1650/ 5214/ -40  
MIN. MAX VALUES = -140.192 87.50 5.37 e 142.00

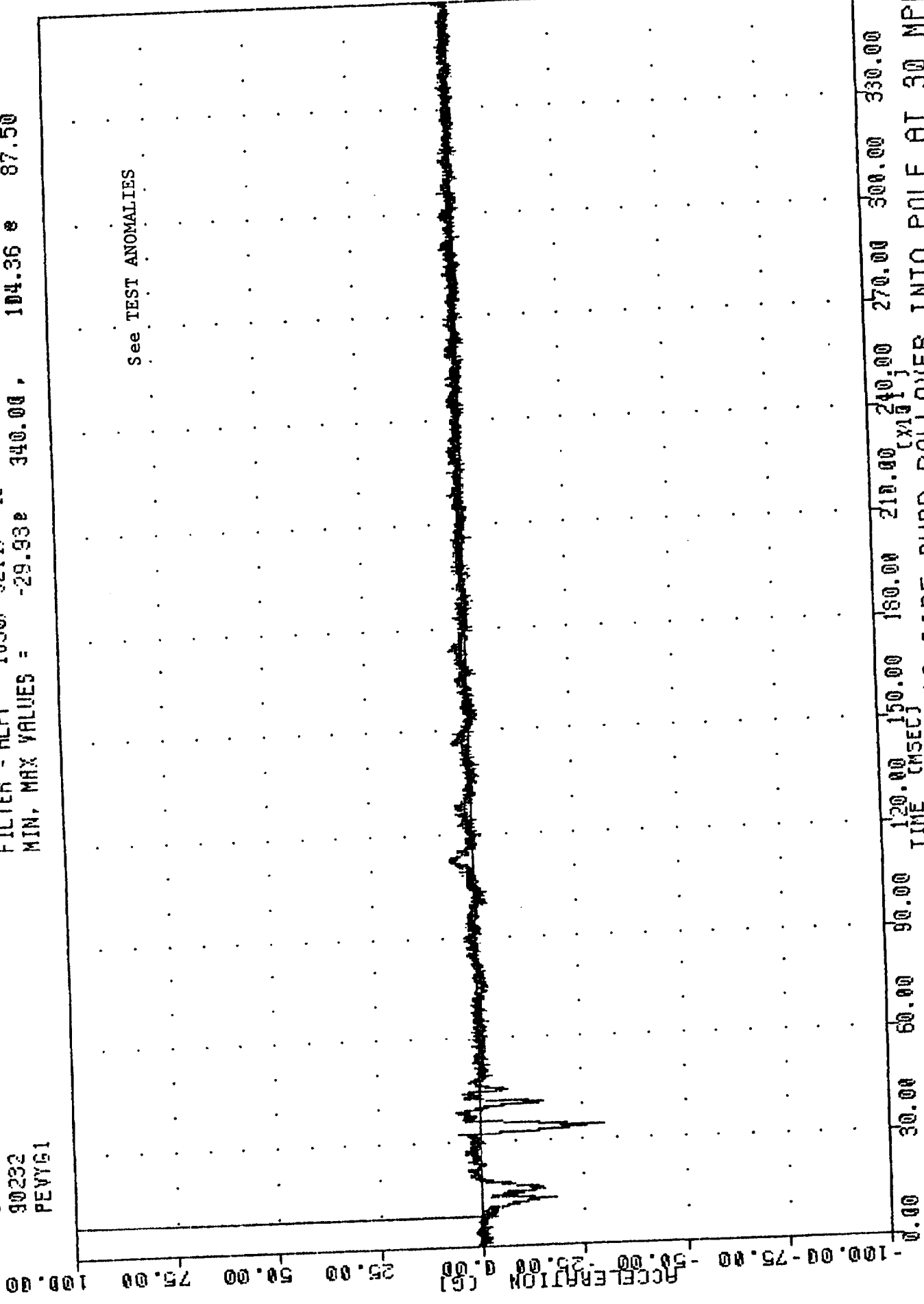
See TEST ANOMALIES



120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC)  $\times 10^{-3}$   
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MP  
DRIVER PELVIS X AXIS ACCELERATION

CONTROLLED ROLLOVER CRASH  
90232  
PEVYG1

FILTER = ALPF 1650/ 5214/ -40  
MIN, MAX VALUES = -29.93 e 340.00 , 104.36 e 87.50



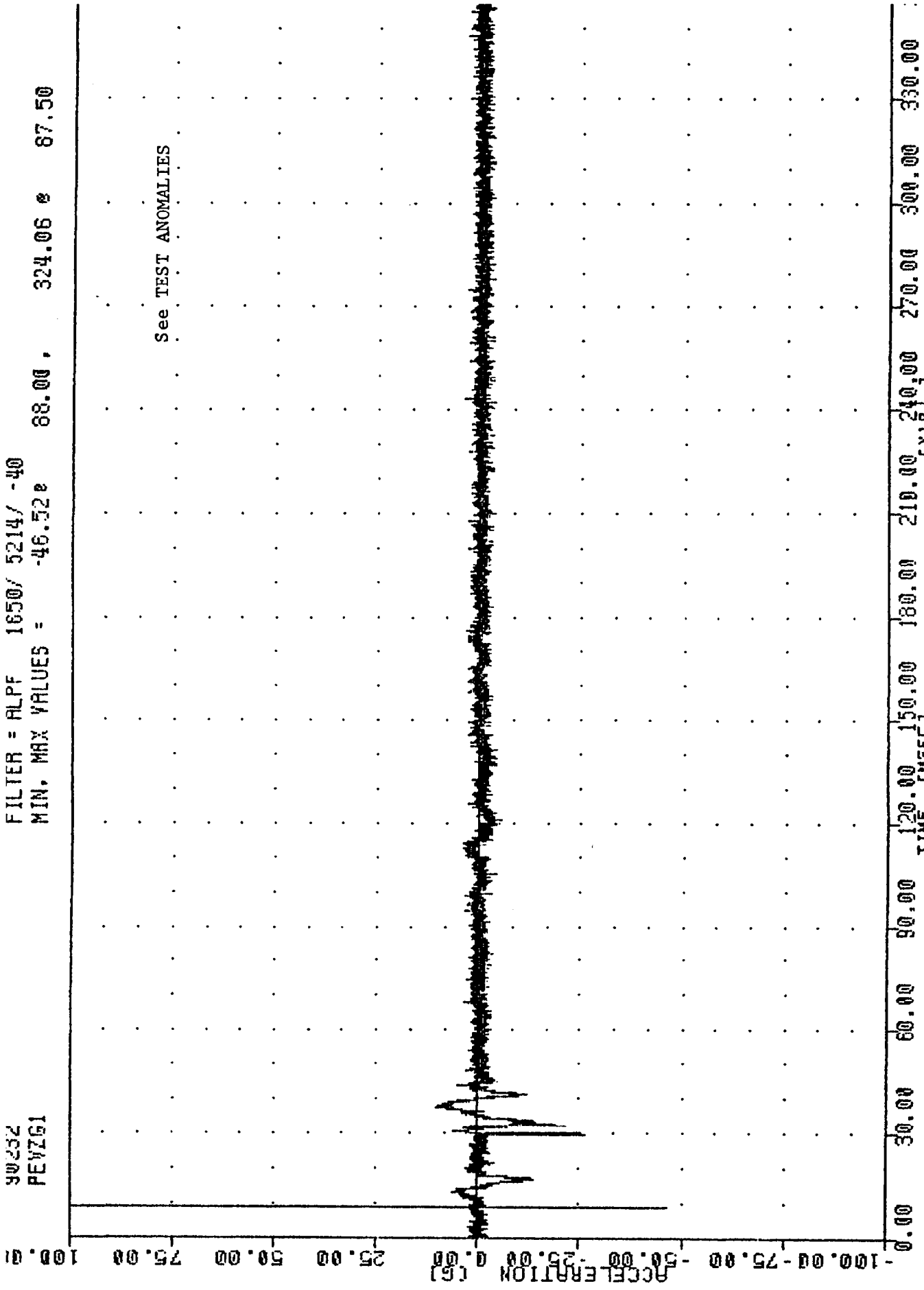
0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC)  
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPI  
DRIVER PELVIS Y AXIS ACCELERATION

30232  
PEVZG1

FILTER = ALPF 1650/ 5214/ -40  
MIN. MAX VALUES = -46.52e 88.00 .

324.06 e 87.50

See TEST ANOMALIES



1968 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
DRIVER PELVIS Z AXIS ACCELERATION

UNCONTROLLED INVERSION  
90232  
PEYR61

FILTER = ALPF .050/ 5214/ -40  
MIN. MAX VALUES = 0.092 3.50 368.19 87.50

See TEST ANOMALIES

ACCELERATION (G) 160.00 140.00 120.00 100.00 80.00 60.00 40.00 20.00 0.00

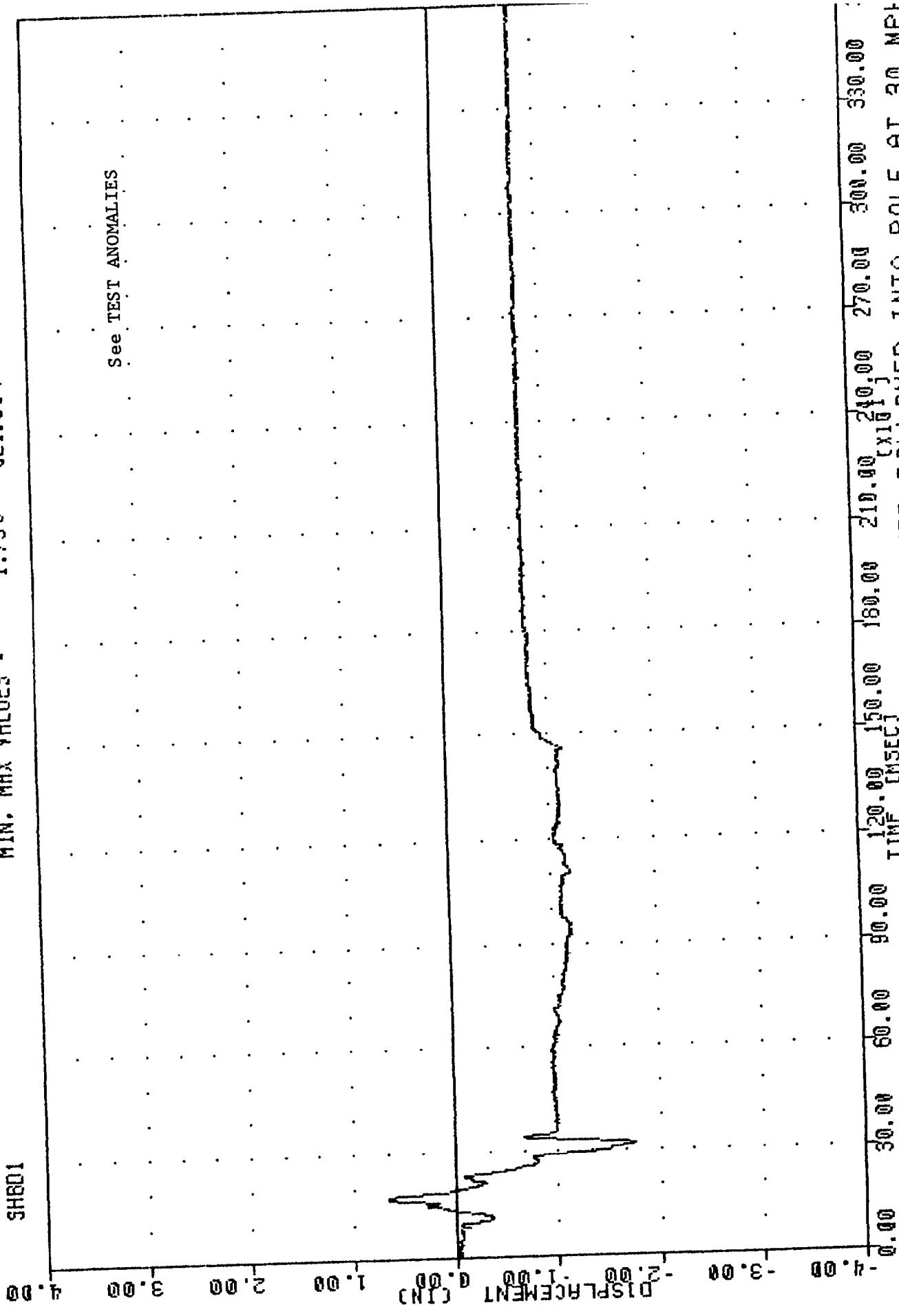
0.00 30.00 50.00 60.00 80.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC) (x10<sup>3</sup>)

1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MF  
DRIVER PELVIS RESULTANT ACCELERATION

UNIMULLEN POLYMER SYSTEMS  
90232  
SH801

FILTER = BLPP .00/ 250/ -16  
MIN, MAX VALUES = -1.75e 321.50, 0.67 e 171.00

See TEST ANOMALIES



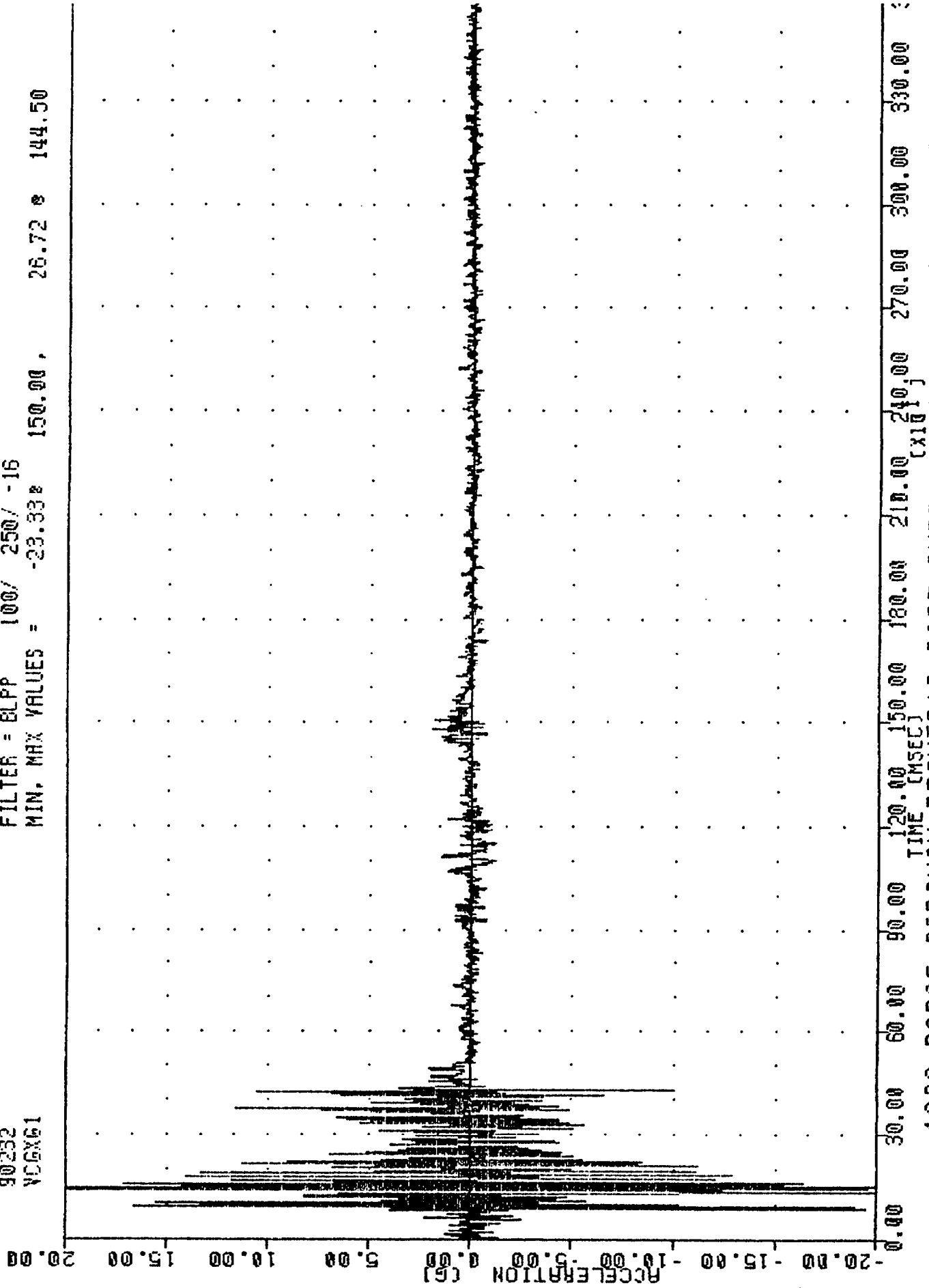
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
DRIVER SHOULDER BELT DISPLACEMENT

CONTROLLED ROLLOVER CRASH

90232  
YDCXG1

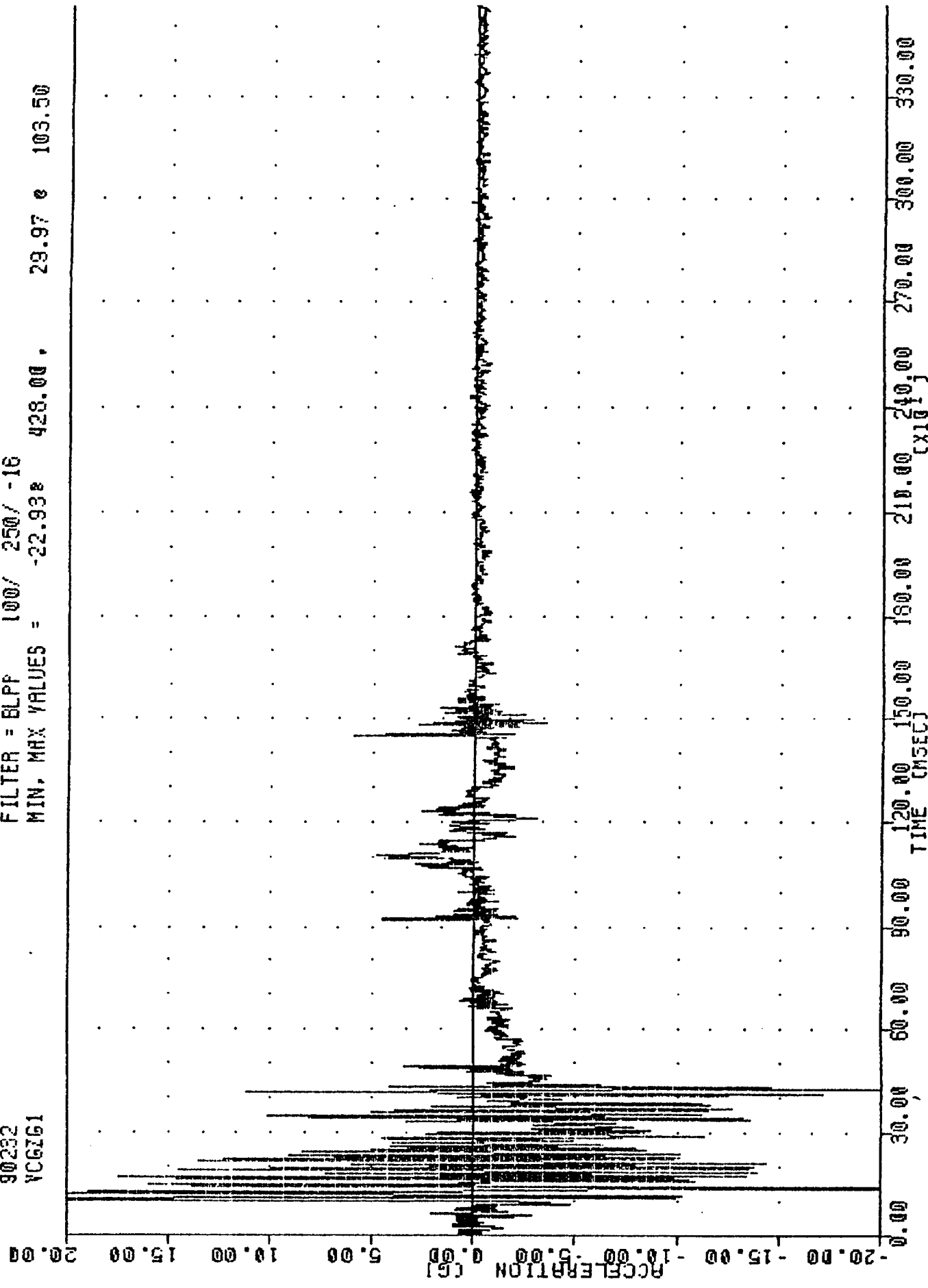
FILTER = BLPP 100/ 250/ -16  
MIN. MAX VALUES = -23.33 150.00 ,

26.72 144.50



1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
VEHICLE CENTER OF GRAVITY X AXIS ACCELERATION

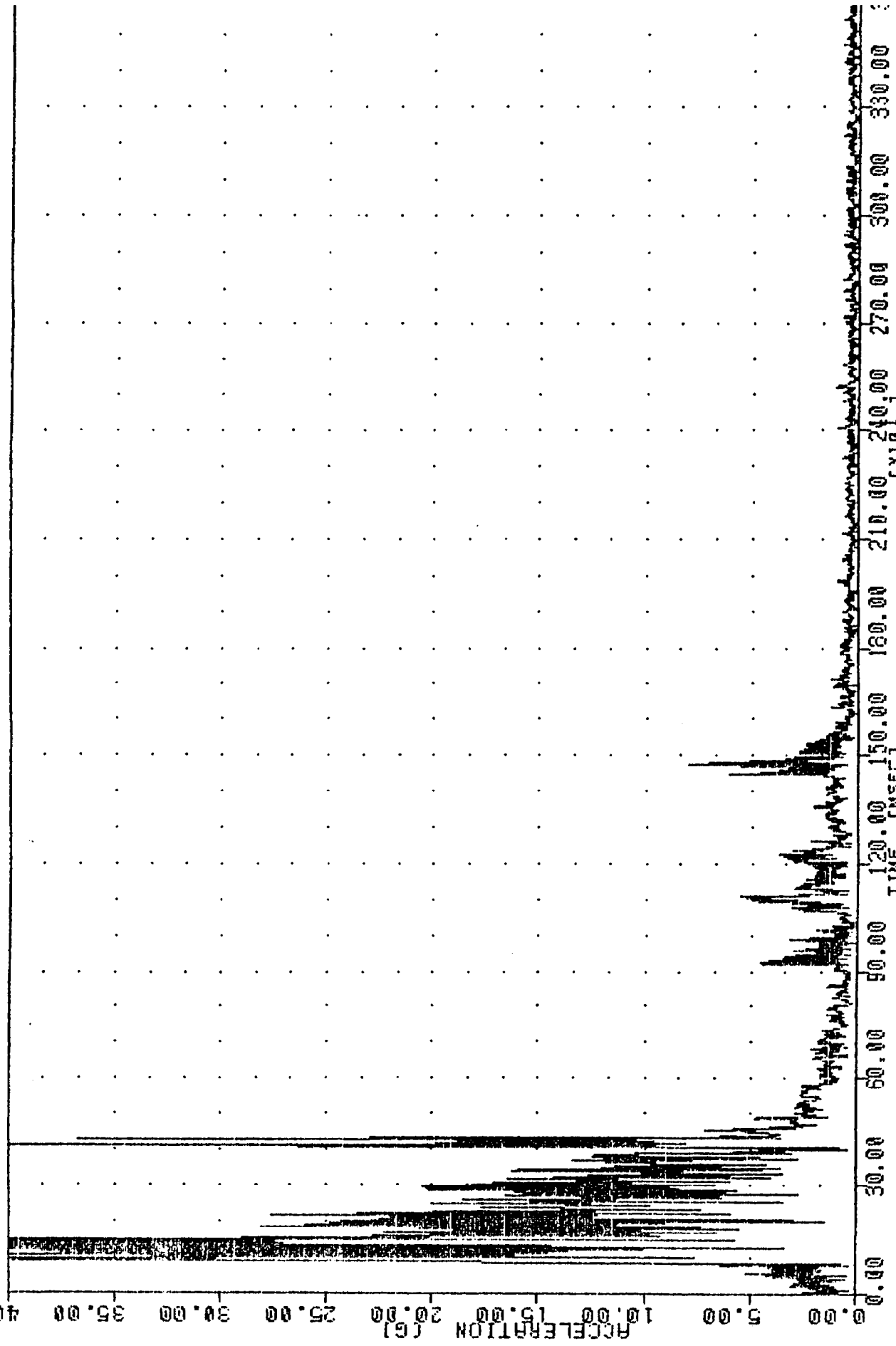
90232  
VC6161  
FILTER = BLPP 100/ 250/ -16  
MIN, MAX VALUES = -22.93e 428.00, 29.97 e 103.50



1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPI  
VEHICLE CENTER OF GRAVITY Z AXIS ACCELERATION

3W232  
YCGR61

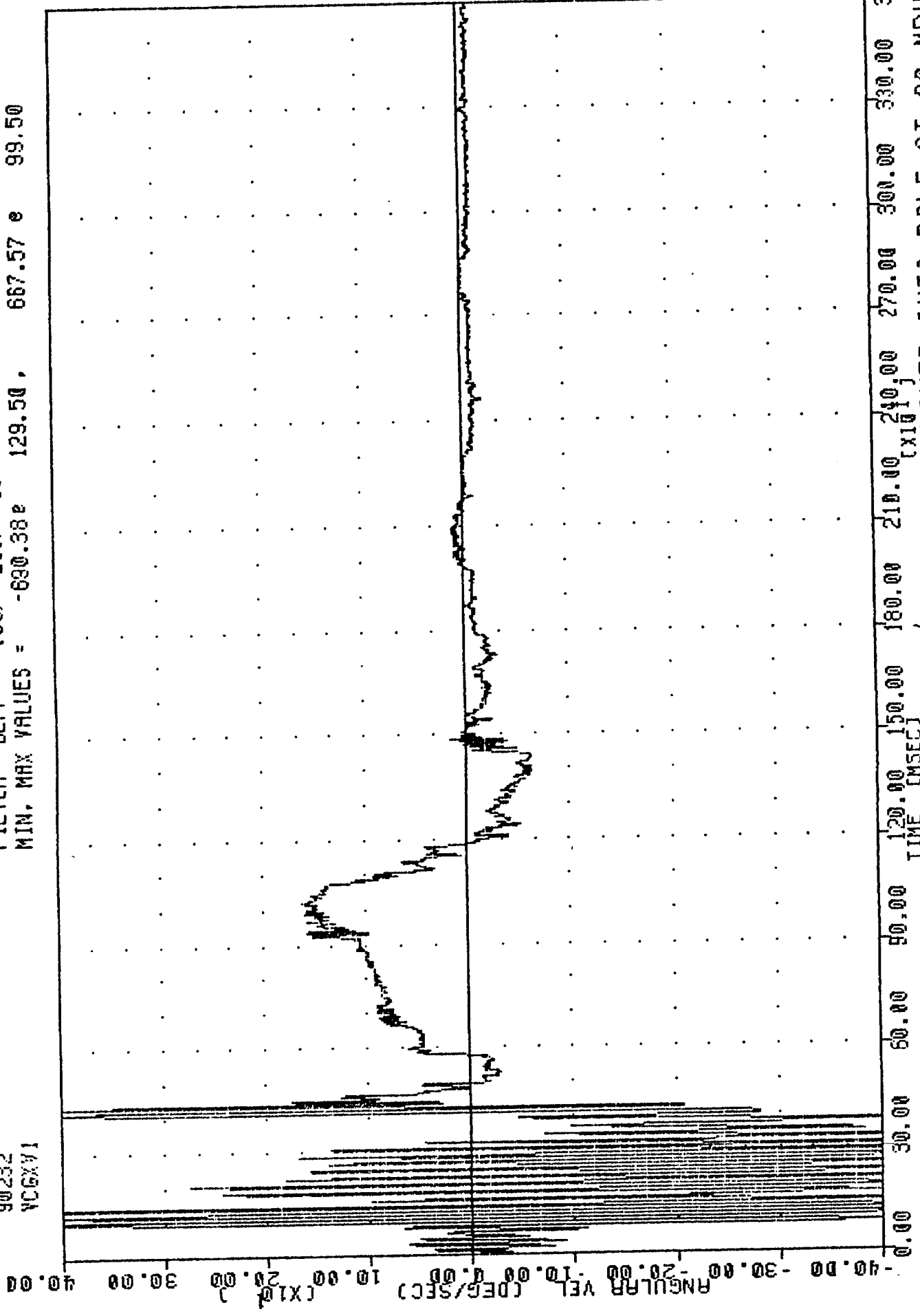
FILTER = BLPP 100/ 250/ -16  
MIN, MAX VALUES = 0.02e 3466.50 , 54.43 e 132.50



1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
VEHICLE CENTER OF GRAVITY RESULTANT ACCELERATION

FILTER = BLPP 1.00/ 250/ -16  
MIN, MAX VALUES = -630.38 e 129.50 , 667.57 e 99.50

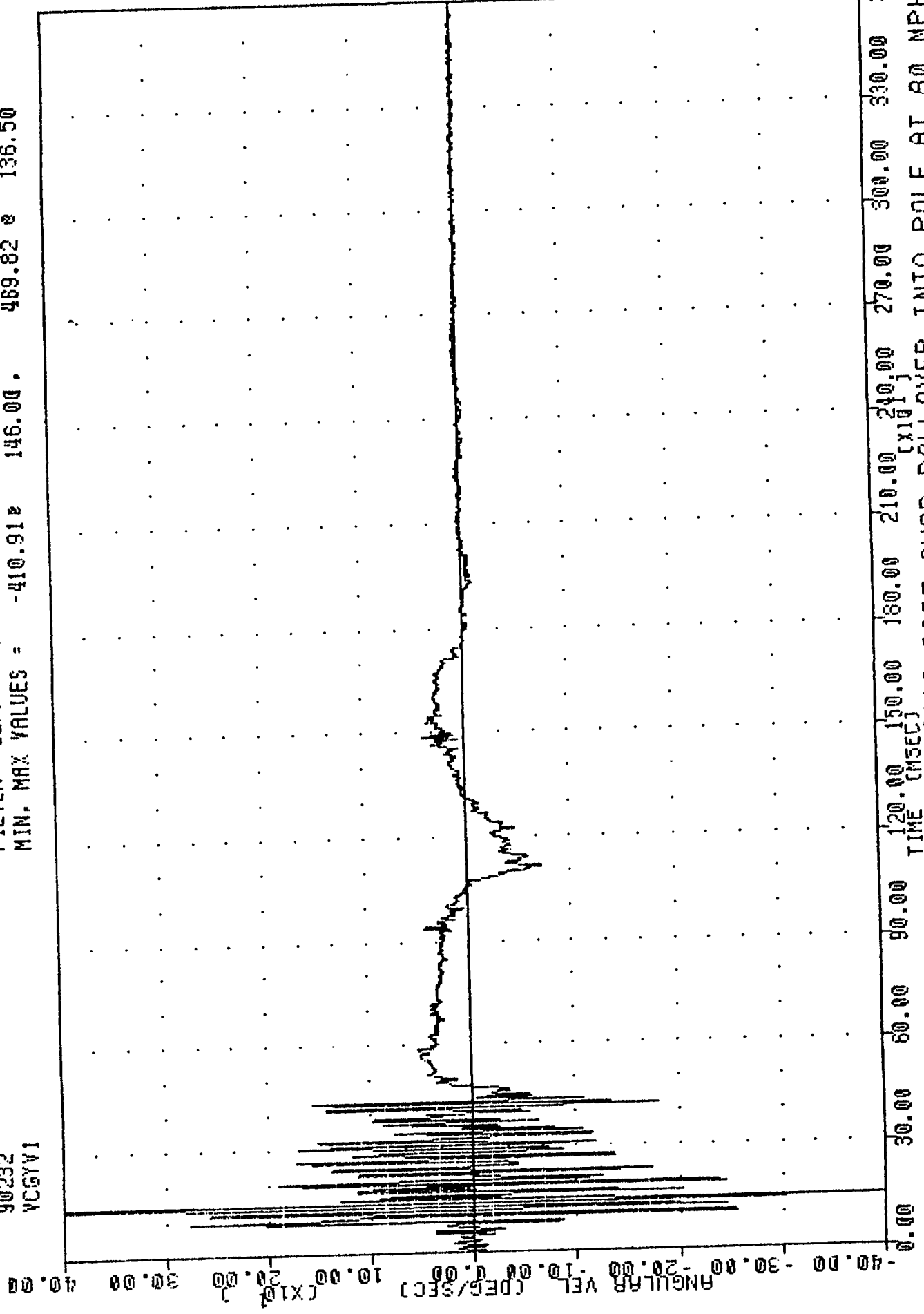
90232  
VCGXV1



1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
VEHICLE ROLL RATE

FILTER = BLPP 100/ 250/ -15  
MIN. MAX VALUES = -410.91 146.00 489.82 136.50

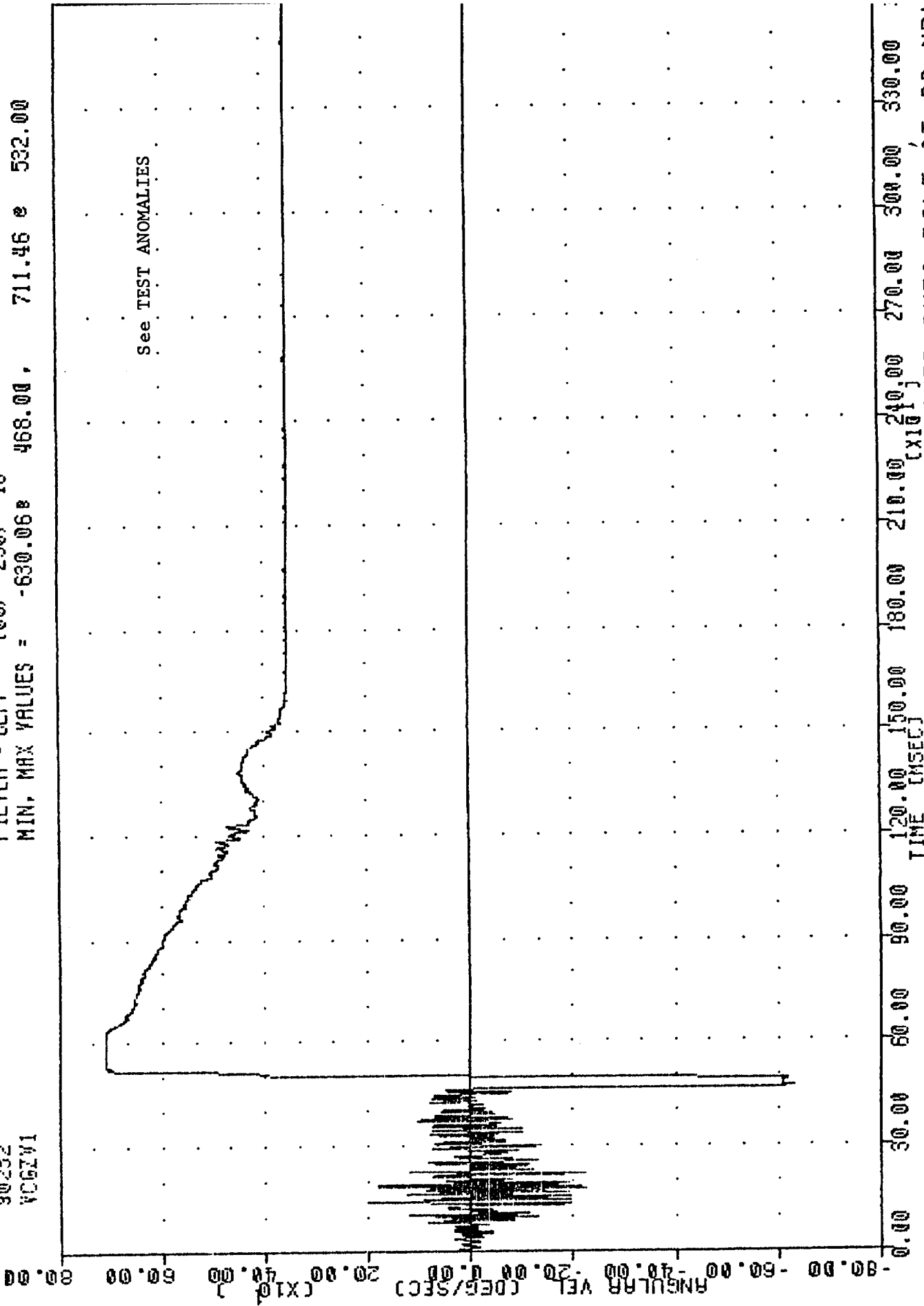
90232  
VCGYVI



0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC) (x10<sup>4</sup>)  
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 80 MPH  
VEHICLE PITCH RATE

UNINHIBITED ROLL-OVER DATA  
90232  
VCG1V1

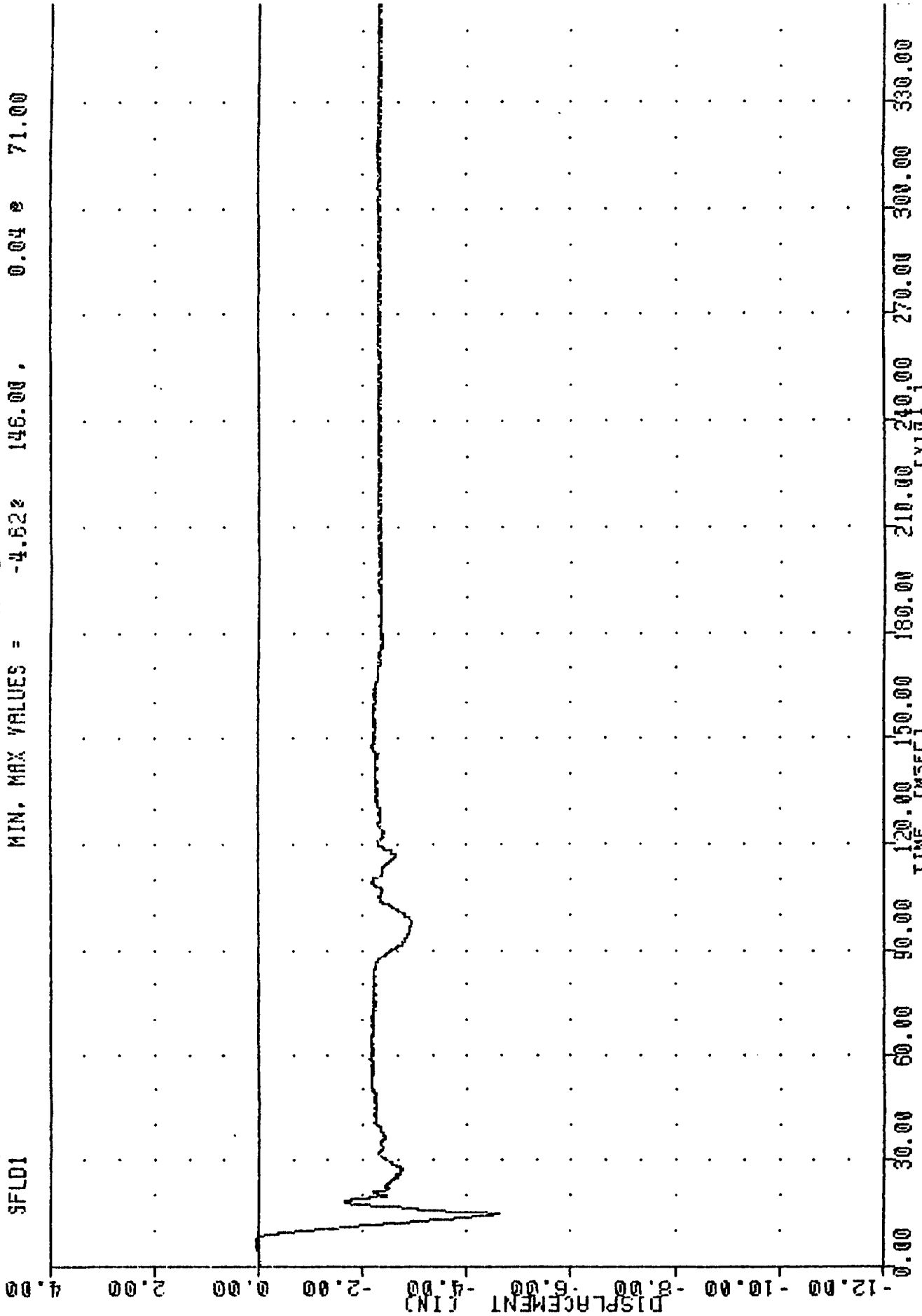
FILTER = BLPF 100/ 250/ -16  
MIN. MAX VALUES = -630.068 468.00 , 711.46 e 532.00



0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC)  $\times 10^3$   
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
VEHICLE YAW RATE

90232  
SFL01

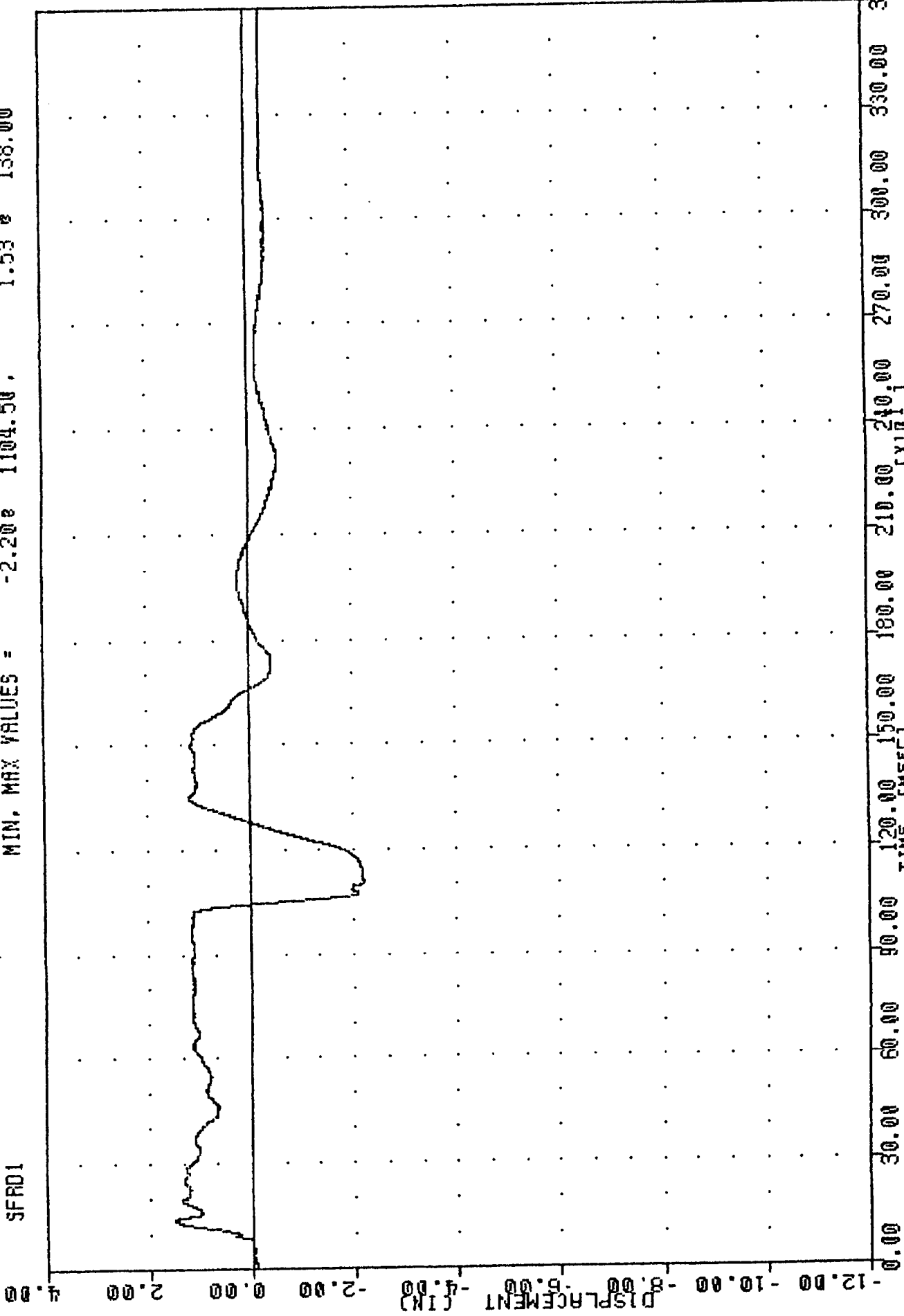
FILTER = BLPP 100/ 250/ -16  
MIN, MAX VALUES = -4.522 146.00, 0.04 71.00



1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
VEHICLE LEFT FRONT SUSPENSION DISPLACEMENT

UNFILTERED ROLLOVER MOMENT  
90232  
SFR01

FILTER = BLPP 100/ 250/ -16  
MIN, MAX VALUES = -2.20e 1104.50, 1.53 e 136.00

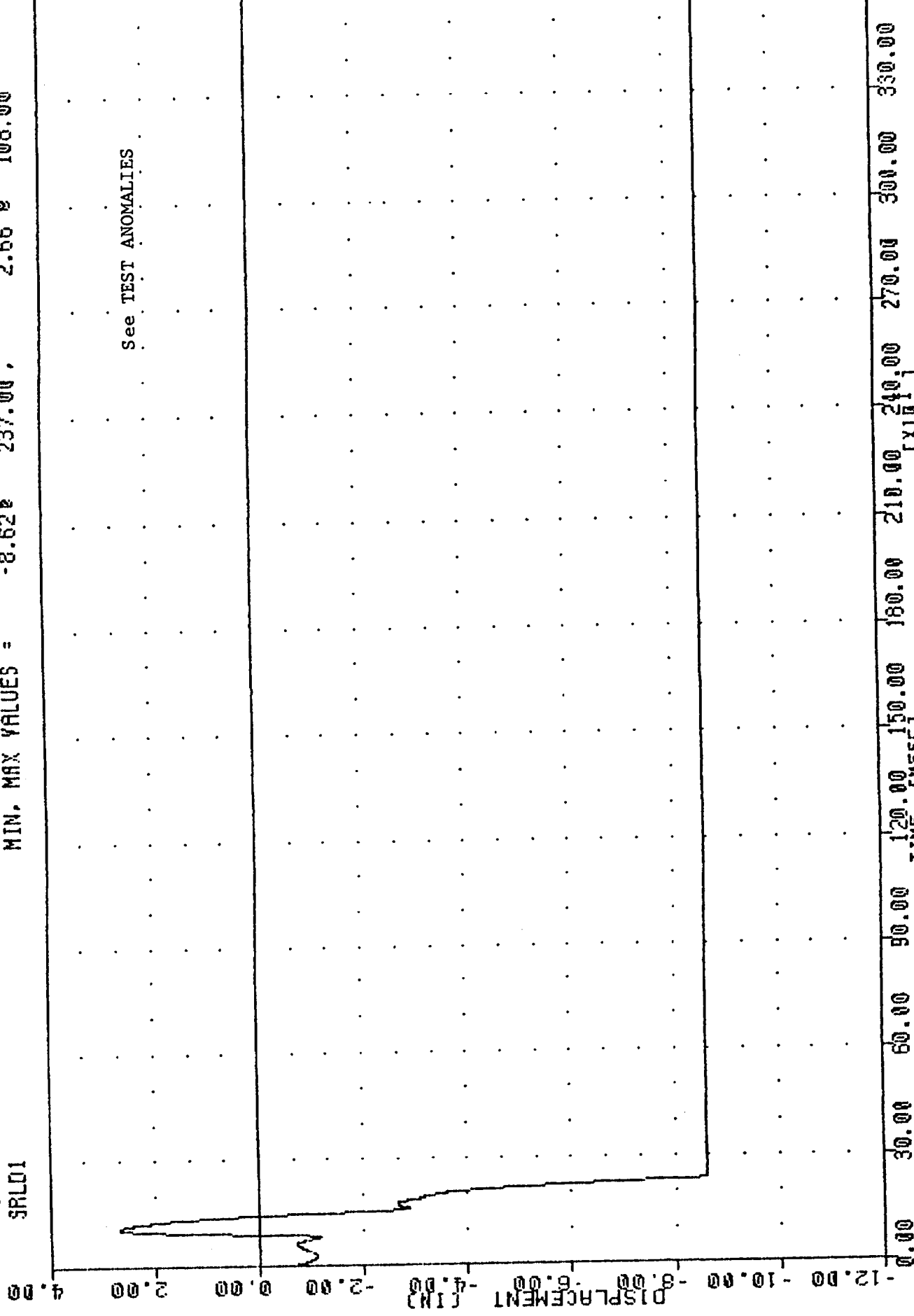


1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
VEHICLE RIGHT FRONT SUSPENSION DISPLACEMENT

CURT MULLER MULLYER WOODEN  
90232  
SRL01

FILTER = BLPP 100/ 250/ -16  
MIN. MAX VALUES = -8.62e 237.00, 2.66 e 108.00

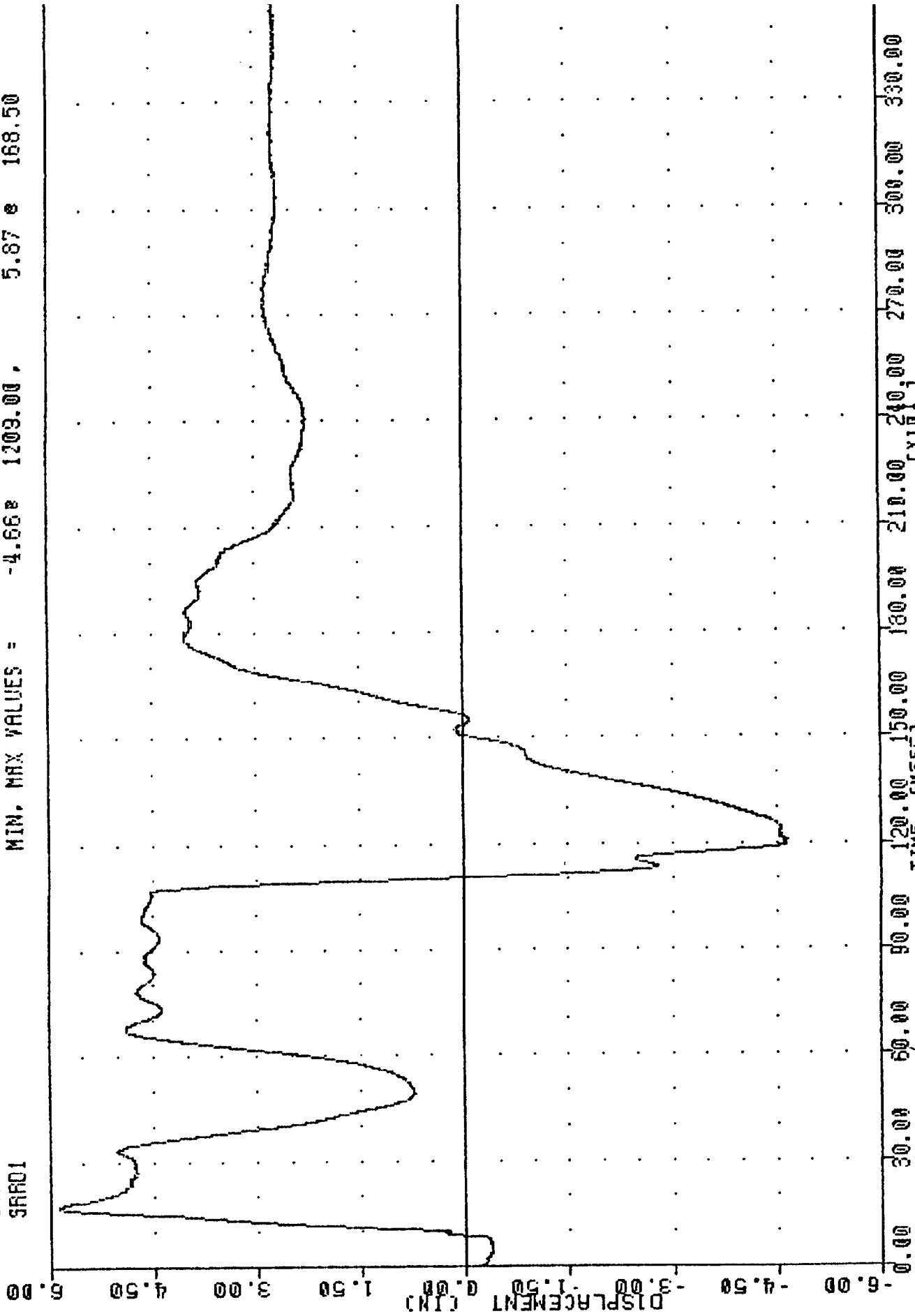
See TEST ANOMALIES



1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MP  
VEHICLE LEFT REAR SUSPENSION DISPLACEMENT

90232  
SRA01

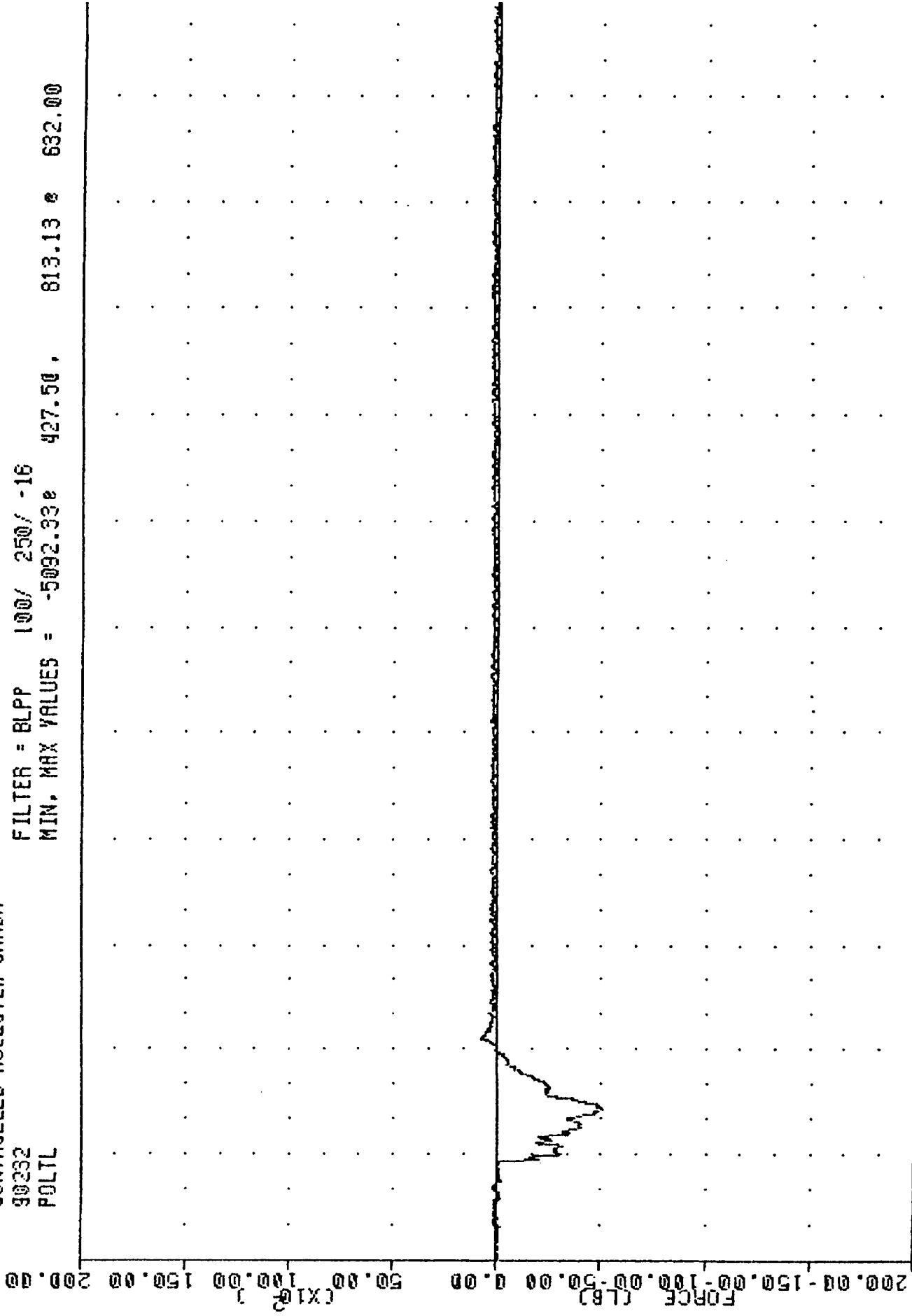
FILTER = BLPP 100/ 250/ -16  
MIN. MAX VALUES = -4.66e 1203.00, 5.87 e 168.50



0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC) [x10<sup>3</sup>]  
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPI  
VEHICLE RIGHT REAR SUSPENSION DISPLACEMENT

90232  
 POLTL

FILTER = BLPP 100/ 250/ -16  
 MIN. MAX VALUES = -5092.33e 427.50 , 813.13 e 632.00

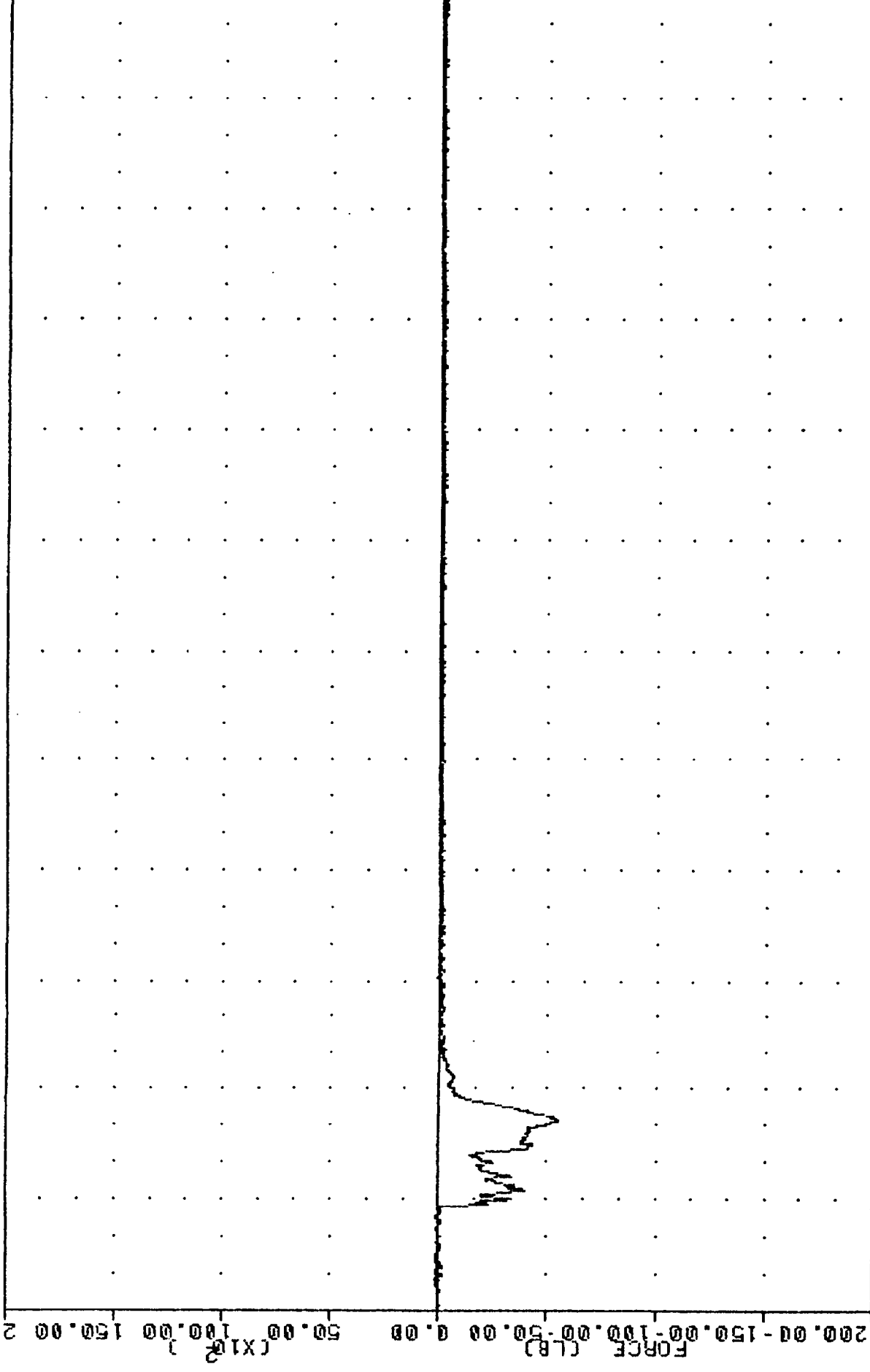


TIME (MSEC)	FORCE (LB) (X10 <sup>3</sup> )
0.00	0.00
30.00	0.00
40.00	100.00
50.00	-50.00
60.00	0.00
90.00	0.00
120.00	0.00
150.00	0.00
180.00	0.00
210.00	0.00
240.00	0.00
270.00	0.00
300.00	0.00
330.00	0.00

1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
 POLE TOP LEFT LOAD CELL FORCE

90232  
POLTR

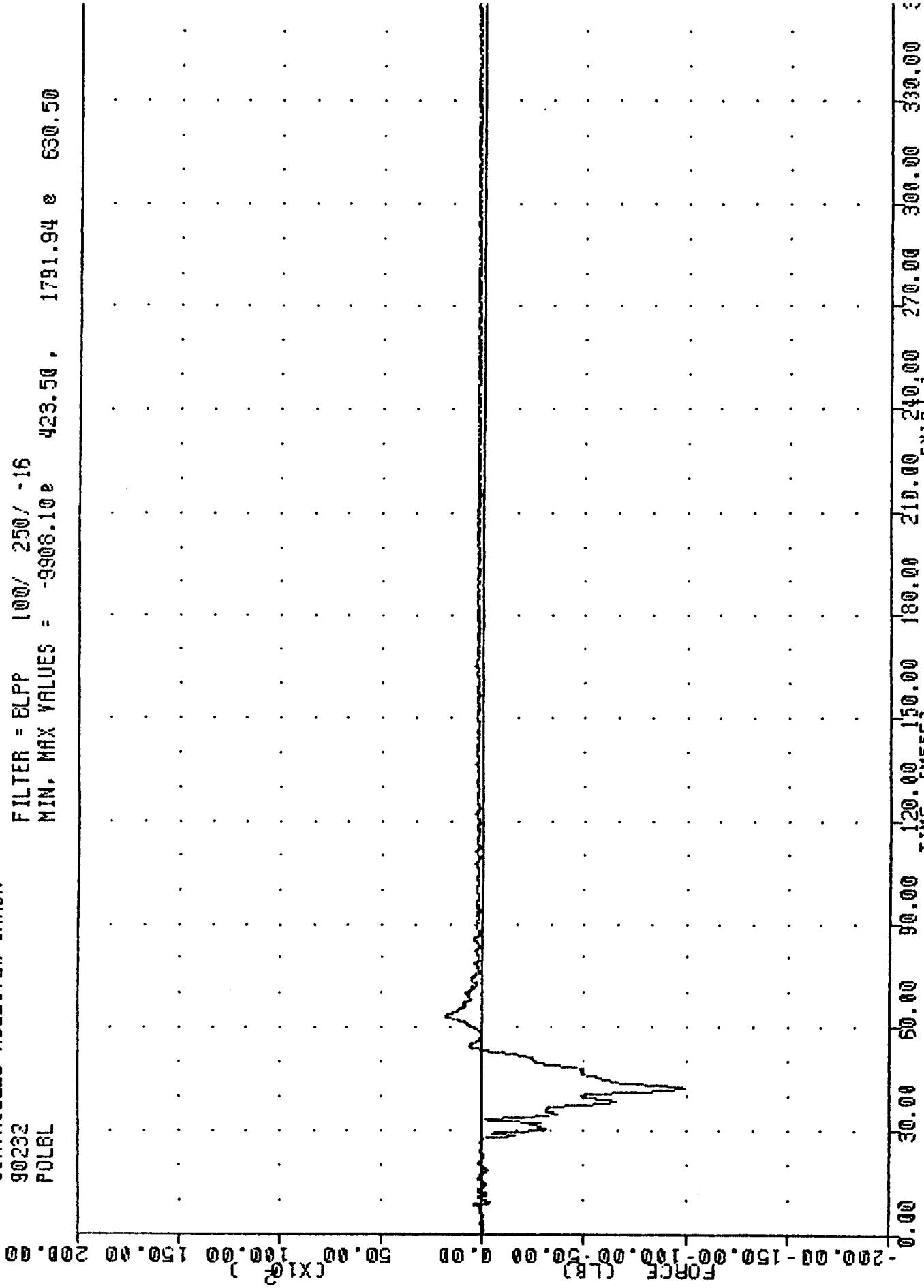
FILTER = BLPP 100/ 250/ -16  
MIN. MAX VALUES = -5510.27e 510.50 . 171.01 e 87.00



0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
TIME (MSEC)  
1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPI  
POLE TOP RIGHT LOAD CELL FORCE

CONTROLLED ROLLOVER CRASH  
 90232  
 POLBL

FILTER = BLPP 100/ 250/ -16  
 MIN, MAX VALUES = -9906.10e 423.50, 1791.94 e 630.50

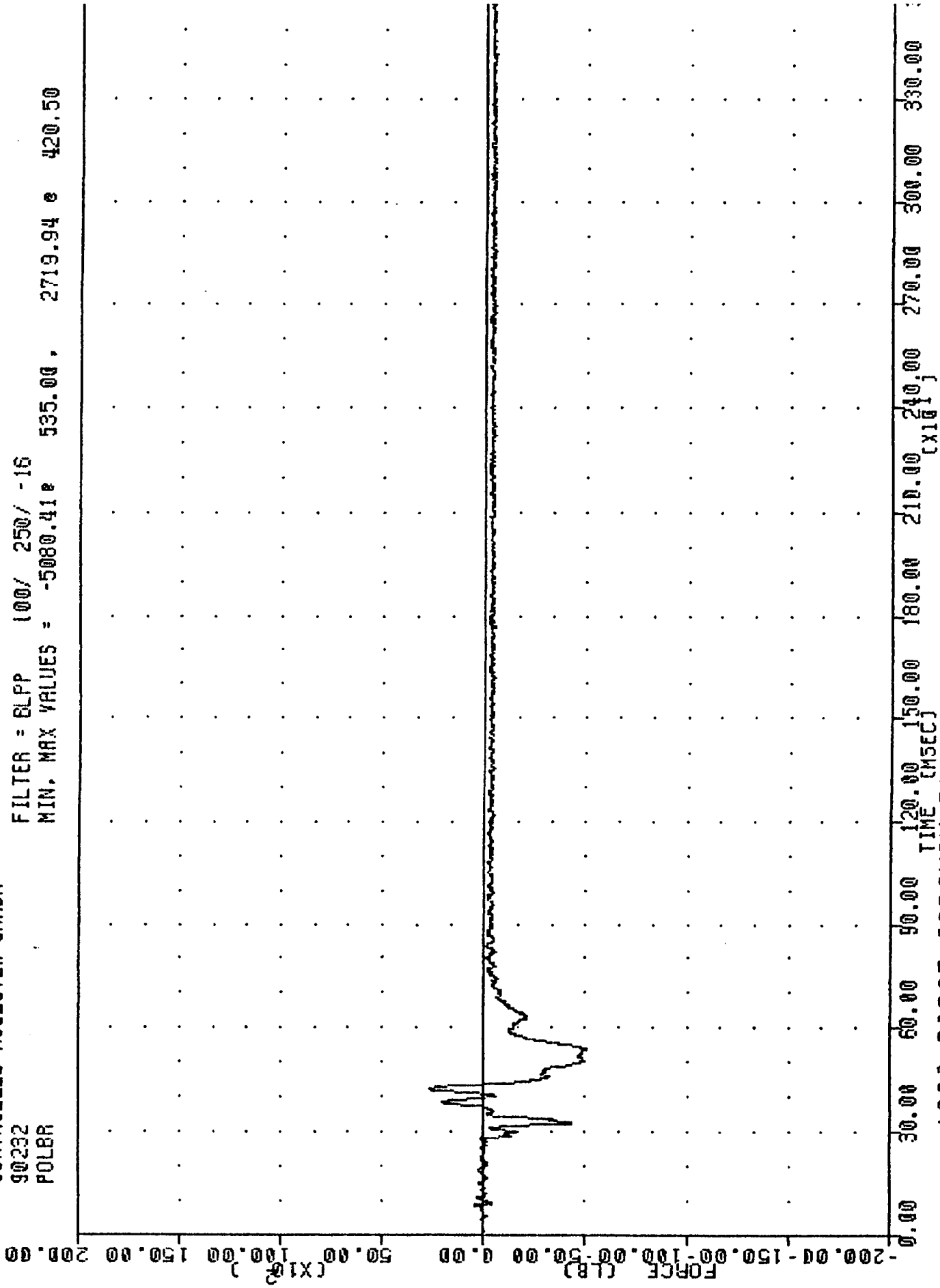


1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
 POLE BOTTOM LEFT INAN CELL FORCE

UNIVERSITY MICROFILMS

90232  
POLBR

FILTER = BLPP 100/ 250/ -16  
MIN. MAX VALUES = -5080.41# 535.00, 2719.94 e 420.50



120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00  
 TIME (MSEC) (x10<sup>1</sup>)  
 1988 DODGE CARAVAN DRIVER'S SIDE CURB ROLLOVER INTO POLE AT 30 MPH  
 POLE BOTTOM RIGHT LOAD CELL FORCE

APPENDIX C

DRIVER DUMMY'S CALIBRATION DATA

HYBRID III EXTERNAL DIMENSIONS  
907 HUMANOID

31-JUL-90

SRL	907C1ED1	572E SN907 EXT. DIMENSION CAL01
TEST PARAMETER	(DIMEN.)	SPECIFICATION   TEST RESULTS
TEMPERATURE		72.0 DEG. F
RELATIVE HUMIDITY		64.0 %
LOCATION FOR CHEST CIRCUMFERENCE (AA)		16.9-17.1 IN   17.0 IN
LOCATION FOR WAIST CIRCUMFERENCE (BB)		8.9- 9.1 IN   9.0 IN
CHEST CIRCUMFERENCE (Y)		38.2-39.4 IN   38.7 IN
WAIST CIRCUMFERENCE (Z)		32.9-34.1 IN   33.6 IN
CHEST DEPTH (O)		8.4- 9.0 IN   8.7 IN
H-POINT HEIGHT (C)		3.3- 3.5 IN   3.5 IN
H-POINT FROM SEATBACK (D)		5.3- 5.5 IN   5.5 IN
SKULL CAP TO BACKLINE (H)		1.6- 1.8 IN   1.7 IN
TOTAL SITTING HEIGHT (A)		34.6-35.0 IN   34.8 IN
THIGH CLEARANCE (F)		5.5- 6.1 IN   6.0 IN
BUTTOCK KNEE LENGTH (K)		22.8-23.8 IN   23.6 IN
BUTTOCK POPLITEAL LENGTH (N)		17.8-18.8 IN   18.5 IN
POPLITEAL HEIGHT (L)		16.9-17.9 IN   17.5 IN
KNEE PIVOT HEIGHT (M)		19.1-19.7 IN   19.4 IN
FOOT LENGTH (P)		9.9-10.5 IN   10.1 IN
FOOT BREADTH (W)		3.6- 4.2 IN   3.8 IN
SHOULDER PIVOT FROM BACKLINE (E)		3.3- 3.7 IN   3.7 IN
SHOULDER BREADTH (V)		16.6-17.2 IN   16.7 IN
SHOULDER PIVOT HEIGHT (B)		19.9-20.5 IN   20.3 IN
ELBOW REST HEIGHT (J)		7.5- 8.3 IN   8.1 IN
SHOULDER-ELBOW LENGTH (I)		13.0-13.6 IN   13.4 IN
BACK OF ELBOW TO WRIST PIVOT (G)		11.4-12.0 IN   11.5 IN

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Chas. Meddlet

TRANSPORTATION RESEARCH CENTER OF OHIO

HEAD DROP TEST

HYBRID III

01-AUG-90

SRL

907C1HD1

572E SN907 HEAD DROP CAL 01

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEG. F	71.00 DEG. F
RELATIVE HUMIDITY	10% - 70%	61.00 %
PEAK RESULTANT ACCELERATION	225 - 275 G	237.57 G
PEAK LATERAL ACCELERATION	15 G MAX	-4.27 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN Chas. Middleton

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK FLEXION TEST

HYBRID III

02-Aug-90

6 AXIS NECK TRANSDUCER  
SRL 907C1NF1

572E SN907 NECK FLEXION CAL01

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	71.00 DEG. F
RELATIVE HUMIDITY	10% - 70%	66.00 %
IMPACT VELOCITY	22.6-23.4 FT/SEC	23.08 FT/SEC
PENDULUM DECELERATION	10 MS   22.50 - 27.50 G	23.67 G
	20 MS   17.60 - 22.60 G	18.70 G
	30 MS   12.50 - 18.50 G	17.23 G
MAX PENDULUM G ABOVE 30 MS	29 G MAX	17.12 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G	34 - 42 MS	37.13 MS
D PLANE ROTATION	MAX   64 - 78 DEG.	75.92 DEG.
	TIME   57 - 64 MS	59.88 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX   65 - 80 FT.LBS	70.14 FT.LBS
	TIME   47 - 58 MS	51.38 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO	113 - 128 MS	117.25 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO	97 - 107 MS	102.13 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN Chas. Middle

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK EXTENSION TEST

HYBRID III

02-Aug-90

6 AXIS NECK TRANSDUCER  
SRL 907C1NE1

572E SN907 NECK EXT. CAL01

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	71.00 DEG. F
RELATIVE HUMIDITY	10% - 70%	66.00 %
IMPACT VELOCITY	19.50-20.30 FT/SEC	19.67 FT/SEC
PENDULUM DECELERATION	10 MS   17.20 - 21.20 G	18.66 G
	20 MS   14.00 - 19.00 G	14.96 G
	30 MS   11.00 - 16.00 G	11.97 G
MAX PENDULUM G ABOVE 30 MS	22 G MAX	12.58 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G	38 - 46 MS	40.88 MS
D PLANE ROTATION	MAX   81 - 106 DEG.	102.09 DEG.
	TIME   72 - 82 MS	79.25 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MIN   -59.0/-39.0 FT.LBS	-44.92 FT.LBS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO	TIME   65 - 79 MS	76.63 MS
	147 - 174 MS	166.00 MS
NEGATIVE MOMENT-TIME CURVE DECAY TIME TO ZERO	120 - 148 MS	146.63 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN *Chas. Maddlet*

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

HYBRID III

02-Aug-90

SRL

907C1TH1

572E SN907 H.S.THORAX CAL01

HIGH SPEED TEST		
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	71.80 DEG. F
RELATIVE HUMIDITY	10% - 70%	63.00 %
PENDULUM VELOCITY	21.6-22.4 FT/SEC	22.07 FT/SEC
MAXIMUM DEFLECTION	2.50 - 2.86 IN	2.50 IN
MAXIMUM RESISTIVE FORCE	1160 - 1325 LBS	1265.5 LBS
INTERNAL HYSTERESIS	69% - 85%	74.2%

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN Chas Middleton

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

01-Aug-90

RIGHT  
SRL

KNEE  
907C1RK1

572E SN907 R.KNEE 11LB CAL01

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEG. F	71.00 DEG. F
RELATIVE HUMIDITY	10% - 70%	61.00 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	6.90 FT/SEC
PEAK KNEE IMPACT FORCE	1060 - 1300 LBS	1167.93 LBS
PROBE WEIGHT	11.0 LBS	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN Chas. Middle

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

01-Aug-90

LEFT  
ARL

KNEE  
907C1LK1

572E SN907 L.KNEE 11LB CAL01

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEG. F	71.00 DEG. F
RELATIVE HUMIDITY	10% - 70%	59.00 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	7.00 FT/SEC
PEAK KNEE IMPACT FORCE	1060 - 1300 LBS	1210.66 LBS
PROBE WEIGHT	11.0 LBS	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN Chris Middleton

APPENDIX D

MISCELLANEOUS INFORMATION

DUMMY INSTRUMENTATION PLACEMENT  
 DUMMY MANUFACTURER & S/N: HUMANOID #907  
 SEATING POSITION: DRIVER

LOCATION	AXIS	MFR	MODEL	S/N	ORIENTATION (+ SENSING)
HEAD ACCELERATION	X	ENDEVCO	7264	BG96J	FRONT
HEAD ACCELERATION	Y	ENDEVCO	7264	AA05	LEFT
HEAD ACCELERATION	Z	ENDEVCO	7264	BG94J	UP
NECK FORCE	X	DENTON	1716	085-FX	**
NECK FORCE	Y	DENTON	1716	085-FY	**
NECK FORCE	Z	DENTON	1716	085-FZ	**
NECK MOMENT	X	DENTON	1716	085-MX	**
NECK MOMENT	Y	DENTON	1716	085-MY	**
NECK MOMENT	Z	DENTON	1716	085-MZ	**
CHEST ACCELERATION	X	ENDEVCO	7264	AA19	REAR
CHEST ACCELERATION	Y	ENDEVCO	7264	AN03	LEFT
CHEST ACCELERATION	Z	ENDEVCO	7264	BF28J	DOWN
CHEST DISPLACEMENT		VERNITECH	81422-A	87313-91	OUTWARD ~
PELVIS ACCELERATION	X	ENDEVCO	7264	BD88J	REAR
PELVIS ACCELERATION	Y	ENDEVCO	7264	AC44	LEFT
PELVIS ACCELERATON	Z	ENDEVCO	7264	BD75J	UP

\*\*See SIGN CONVENTION sheet for positive sensing orientation of neck load channels.

VEHICLE INSTRUMENTATION PLACEMENT

LOCATION	AXIS	MFR	MODEL	S/N	ORIENTATION (+ SENSING)
CENTER OF GRAVITY ACCEL	X	ENDEVCO	7264	DB14H	REAR
CENTER OF GRAVITY ACCEL	Y	ENDEVCO	7264	BP26J	LEFT
CENTER OF GRAVITY ACCEL	Z	ENDEVCO	7264	CY23H	UP
CENTER OF GRAVITY ROLL	X	HUMPHREY	RG28-0128-1	H-14	LEFT
CENTER OF GRAVITY PITCH	Y	HUMPHREY	RG28-0128-1	H-16	UP
CENTER OF GRAVITY YAW	Z	HUMPHREY	RG28-0128-1	H-21	RIGHT
DRIVER'S SHOULDER BELT DISPLACEMENT		CELESCO	PT-101-50A	A02465	OUTWARD
LEFT FRONT SUSPENSION DISPLACEMENT		CELESCO	PT-101-40A	A12898	OUTWARD
RIGHT FRONT SUSPENSION DISPLACEMENT		CELESCO	PT-101-40A	A12899	OUTWARD
LEFT REAR SUSPENSION DISPLACEMENT		CELESCO	PT-101-50A	0275534	OUTWARD
RIGHT REAR SUSPENSION DISPLACEMENT		CELESCO	PT-101-40A	0586135	OUTWARD

IPMD VEHICLE DATA SHEET

Filled Out By: Bob Leib Date: 8/2/90

Checked By: \_\_\_\_\_ Date: \_\_\_\_\_

VEHICLE DATA

Vehicle Make and Model (written out): Dodge Caravan

NHTSA ID Code (7 characters): \_\_\_\_\_ / Model Year (2 digits): 88

Vehicle Make (2 characters): 07

11 = American	02 = Ford	64 = Nissan
12 = Audi	40 = GMC	48 = Odyssey
53 = Batronics	23 = Honda	06 = Oldsmobile
27 = BMW	34 = Hyundai	14 = Peugeot
04 = Buick	41 = IH	05 = Plymouth
10 = Cadillac	42 = Isuzu	03 = Pontiac
35 = Champion	44 = Jeep	17 = Renault
36 = Checker	54 = Jet	30 = Saab
01 = Chevrolet	22 = Lectra	26 = Subaru
37 = Chinook	59 = Lectric	33 = Suzuki
21 = Chrysler	13 = Lincoln	16 = Toyota
29 = Comuta	18 = Mazda	31 = Triumph
15 = Datsun	28 = Mercedes	56 = UM
38 = Delorean	09 = Mercury	08 = Volkswagen
07 = Dodge	25 = MG	20 = Volvo
58 = Eva	62 = Mitsubishi	60 = Winnebago
19 = Fiat	32 = NHTSA	24 = Yugo
99 = Other: _____		

Vehicle Model (2 characters = see appendix B): \_\_\_\_\_

Body Style (2 characters): VN

2C = 2 Door Coupe	SW = Stationwagon
2S = 2 Door Sedan	PU = Pickup Truck
3H = 3 Door Hatchback	TR = Truck
4S = 4 Door Sedan	VN = Van
5H = 5 Door Hatchback	BU = Bus
OH = Other: _____	MP = Multipurpose
	UT = Utility

VIN Number (20 characters): 2B4FK21K3JR746480

Odometer Reading: <u>20911.0</u>	Thousands of Miles: <u>20.911</u>
Overall Length: <u>173.0</u>	(in) x 25.4 =: <u>4394</u> (mm)
Wheelbase: <u>112.0</u>	(in) x 25.4 =: <u>2845</u> (mm)
Front Track: <u>59.875</u>	(in) x 25.4 =: <u>1521</u> (mm)
Rear Track: <u>61.125</u>	(in) x 25.4 =: <u>1553</u> (mm)
Roof Height: <u>65.250</u>	(in) x 25.4 =: <u>1657</u> (mm)

IPMD VEHICLE DATA SHEET

G.V.W.R.: 4850 (lbs) x 4.45 =: 21582 (N)  
FRONT G.A.W.R.: 2425 (lbs) x 4.45 =: 10791 (N)  
REAR G.A.W.R.: 2450 (lbs) x 4.45 =: 10902 (N)

The following tire loadings are measured with vehicle at Curb Weight.

Weight on RF Tire: 1008 (lbs) x 4.45 =: 4486 (N)  
Weight on LF Tire: 1022 (lbs) x 4.45 =: 4548 (N)  
Weight on LR Tire: 797 (lbs) x 4.45 =: 3547 (N)  
Weight on RR Tire: 787 (lbs) x 4.45 =: 3502 (N)  
Vehicle Test Weight: 3614 (lbs) x 4.45 =: 16082 (N)

Lateral and Longitudinal Center of Gravity Location.

From Front Axle: 49.09 (in) x 25.4 =: 1247 (mm)  
From Center Line: 0.20 (in) x 25.4 =: 5.1 (mm)  
Engine Displacement: 152.6 (cu in) x 0.0164 =: 2.5 (L)

Engine Type (2 characters): L4

L3            F4            L4  
V4            F6            L6  
V6            V8            RT = Rotary  
L5            OT = Other: \_\_\_\_\_

Engine Location (1 character): F

F = Front            M = Mid            R = Rear

Engine Orientation (1 character): T

L = Longitudinal            T = Transverse

Transmission Type: (1 character): A

M = Manual            A = Automatic

Drive Axle (1 character): F

F = Front            R = Rear            4 = Four Wheel Drive

Vehicle Comments (30 characters): Pre-test IPMD

IPMD VEHICLE DATA SHEET

FRONT SUSPENSION

Suspension Number (4 digits): \_\_\_\_\_

Front/Rear Flag (1 character):     F    

Axle Type (1 character):     I      
I = Independent      S = Solid

Suspension Type (1 character):     S    

A = Unequal A Arm

L = Leaf

M = Multiple Link

Q = Torque Arm

S = Strut

O = Other: \_\_\_\_\_

T = Semi-Trailing Arm

W = Twist

4 = 4 Link

3 = 3 Link

I = Twin I Beam

Spring Type (2 characters):     CO    

CO = Coil

LL = Longitudinal Leaf

OT = Other: \_\_\_\_\_

TB = Torsion Bar

TL = Transverse Leaf

Brake Type (2 characters):     DI    

DI = Disk

DS = Duo-Servo Shoe

OT = Other: \_\_\_\_\_

LT = Leading-Trailer Shoe

Suspension Modified (1 character):     N    

N = No

Y = Yes

Suspension Modification

R = Raised

S = Stiffened

O = Other

L = Lowered

W = Widened

1 = \_\_\_\_\_

2 = \_\_\_\_\_

IPMD VEHICLE DATA SHEET

FRONT SUSPENSION

Tire Manufacturer (10 characters): Goodyear

Tire Size Code (10 characters): P195/75R14

Tire Construction (2 characters): SB

BB = Bias Belted

GP = Glass Belted Radial

BP = Bias Ply

SB = Steel Belted Radial

OT = Other: \_\_\_\_\_

Tire Rim width: 5.0 (in) X 25.4 =: 127 (mm)

Axle Height: 11.75 (in) X 25.4 =: 298 (mm)

Tire Pressure: 35.0 (psi) X 6.897 =: 241.4 (kpa)

IPMD VEHICLE DATA SHEET

REAR SUSPENSION

Suspension Number (4 digits): \_\_\_\_\_

Front/Rear Flag (1 character):     R    

Axle Type (1 character):     S      
I = Independent      S = Solid

Suspension Type (1 character):     L    

A = Unequal A Arm	T = Semi-Trailing Arm
L = Leaf	W = Twist
M = Multiple Link	4 = 4 Link
Q = Torque Arm	3 = 3 Link
S = Strut	I = Twin I Beam
O = Other: _____	

Spring Type (2 characters):     LL    

CO = Coil	TB = Torsion Bar
LL = Longitudinal Leaf	TL = Transverse Leaf
OT = Other: _____	

Brake Type (2 characters):     LT    

DI = Disk	LT = Leading-Trailer Shoe
DS = Duo-Servo Shoe	
OT = Other: _____	

Suspension Modified (1 character):     N    

N = No      Y = Yes

Suspension Modification

R = Raised	L = Lowered
S = Stiffened	W = Widened
O = Other	

1 = \_\_\_\_\_  
2 = \_\_\_\_\_

IPMD VEHICLE DATA SHEET

REAR SUSPENSION

Tire Manufacturer (10 characters):

Goodyear

Tire Size Code (10 characters):

P195/75R14

Tire Construction (2 characters):

BB = Bias Belted  
BP = Bias Ply  
OT = Other: \_\_\_\_\_

GP = Glass Belted Radial  
SB = Steel Belted Radial

Tire Rim Width: 5.0

(in) X 25.4 =: 127 (mm)

Axle Height: 11.75

(in) X 25.4 =: 298 (mm)

Tire Pressure: 35.0

(psi) X 6.897 =: 241.4 (kpa)

IPMD MEASURED DATA

VEHICLE # AND RUN # VAN DATE: 08-07-90 TIME: 07:47:34

Pitch Inertia:

Run #	Period (Sec)	Platform Motion	Relative Motion	Individual
		Amplitude (Deg.)	Amplitude (In.)	Pitch Calc. (Ft. Lb. Sec <sup>2</sup> )
1	4.455	10.73	0.163	2518.0
2	4.450	10.63	0.161	2511.5
3	4.445	10.71	0.161	2505.1
Average Pitch Inertia:				2511.6

Roll Inertia:

Distance between ramps (in.): 51.20

Run #	Period (Sec)	Platform Motion	Relative Motion	Individual
		Amplitude (Deg.)	Amplitude (In.)	Roll Calc. (Ft. Lb. Sec <sup>2</sup> )
1	2.655	7.46	0.165	552.6
2	2.655	7.63	0.170	552.0
3	2.655	7.66	0.172	551.5
Average Roll Inertia:				552.0

Yaw Inertia:

String Pot Offset from platform center (in.): 73.00

Run #	Period (Sec)	Platform Motion	Relative Motion	Individual
		Amplitude (Deg.)	Amplitude (In.)	Yaw Calc. (Ft. Lb. Sec <sup>2</sup> )
1	2.680	11.07	0.13	2559.8
2	2.685	9.87	0.10	2574.8
3	2.685	10.35	0.11	2572.7
Average Yaw Inertia:				2569.1

IPMD MEASURED DATA

Vehicle # and Run #: VAN Date: 08-07-90 Time: 07:47:28

Vehicle Weight: 3614 Roof Height: 65.25 Load Config: CURB+DR

No System CG Pivot Data Computed

C.G. Height:

Applied Weight (lbs.)	Schaevitz Output (Deg.)	Resultant	
		Longitudinal Movement (In.)	Individual C.G. Values (In.)
0	0.16	0.000	0.00
100	-3.46	0.059	24.77
200	-7.15	0.162	24.69
0	0.11	0.019	0.00
-100	3.74	-0.062	24.47
-200	7.40	-0.135	24.72
0	0.16	-0.035	0.00
Average calculated C.G. Height:			24.66

IPMD VEHICLE DATA SHEET

Filled Out By: B. Dotson Date: 8/31/90

Checked By: \_\_\_\_\_ Date: \_\_\_\_\_

VEHICLE DATA

Vehicle Make and Model (written out): Dodge Caravan

NHTSA ID Code (7 characters): \_\_\_\_\_ / Model Year (2 digits): 88

Vehicle Make (2 characters): 07

- |                   |                 |                 |
|-------------------|-----------------|-----------------|
| 11 - American     | 02 - Ford       | 64 = Nissan     |
| 12 = Audi         | 40 = GMC        | 48 = Odyssey    |
| 53 = Battronics   | 23 = Honda      | 06 = Oldsmobile |
| 27 = BMW          | 34 = Hyundai    | 14 = Peugeot    |
| 04 = Buick        | 41 = IH         | 05 = Plymouth   |
| 10 = Cadillac     | 42 = Isuzu      | 03 = Pontiac    |
| 35 = Champion     | 44 = Jeep       | 17 = Renault    |
| 36 = Checker      | 54 = Jet        | 30 = Saab       |
| 01 = Chevrolet    | 22 = Lectra     | 26 = Subaru     |
| 37 = Chinook      | 59 = Lectric    | 33 = Suzuki     |
| 21 = Chrysler     | 13 = Lincoln    | 16 = Toyota     |
| 29 = Comuta       | 18 = Mazda      | 31 = Triumph    |
| 15 = Datsun       | 28 = Mercedes   | 56 = UM         |
| 38 = Delorean     | 09 = Mercury    | 08 = Volkswagen |
| 07 = Dodge        | 25 = MG         | 20 = Volvo      |
| 58 = Eva          | 62 = Mitsubishi | 60 = Winnebago  |
| 19 = Fiat         | 32 = NHTSA      | 24 = Yugo       |
| 99 = Other: _____ |                 |                 |

Vehicle Model (2 characters = see appendix B): \_\_\_\_\_

Body Style (2 characters): VN

- |                       |                   |
|-----------------------|-------------------|
| 2C = 2 Door Coupe     | SW = Stationwagon |
| 2S = 2 Door Sedan     | PU = Pickup Truck |
| 3H = 3 Door Hatchback | TR = Truck        |
| 4S = 4 Door Sedan     | VN = Van          |
| 5H = 5 Door Hatchback | BU = Bus          |
| OH = Other: _____     | MP = Multipurpose |
|                       | UT = Utility      |

VIN Number (20 characters): 2B4FK21K3JR746480

Odometer Reading: <u>20,913.0</u>	Thousands of Miles: <u>20,913.0</u>
Overall Length: <u>173.0</u>	(in) x 25.4 =: <u>4394</u> (mm)
Wheelbase: <u>112.0</u>	(in) x 25.4 =: <u>2845</u> (mm)
Front Track: <u>56.0</u>	(in) x 25.4 =: <u>1422</u> (mm)
Rear Track: <u>NA</u>	(in) x 25.4 =: <u>NA</u> (mm)
Roof Height: <u>70.75</u>	(in) x 25.4 =: <u>1797</u> (mm)

IPMD VEHICLE DATA SHEET

G.V.W.R.: 4850 (lbs) x 4.45 =: 21582 (N)  
FRONT G.A.W.R.: 2425 (lbs) x 4.45 =: 10791 (N)  
REAR G.A.W.R.: 2450 (lbs) x 4.45 =: 10902 (N)

The following tire loadings are measured with vehicle at Curb Weight.

Weight on RF Tire: 925 (lbs) x 4.45 =: 4116 (N)  
Weight on LF Tire: 931 (lbs) x 4.45 =: 4143 (N)  
Weight on LR Tire: 1291 (lbs) x 4.45 =: 5745 (N)  
Weight on RR Tire: 449 (lbs) x 4.45 =: 1998 (N)  
Vehicle Test Weight: 3596 (lbs) x 4.45 =: 16002 (N)

Lateral and Longitudinal Center of Gravity Location.

From Front Axle: 49 (in) x 25.4 =: 1245 (mm)  
From Center Line: -6.6 (in) x 25.4 =: -168 (mm)  
Engine Displacement: 152.5 (cu in) x 0.0164 =: 2.5 (L)

Engine Type (2 characters): L4

L3            F4            L4  
V4            F6            L6  
V6            V8            RT = Rotary  
L5            OT = Other: \_\_\_\_\_

Engine Location (1 character): F

F = Front            M = Mid            R = Rear

Engine Orientation (1 character): T

L = Longitudinal            T = Transverse

Transmission Type: (1 character): A

M = Manual            A = Automatic

Drive Axle (1 character): F

F = Front            R = Rear            4 = Four Wheel Drive

Vehicle Comments (30 characters): Post-crash IPMD 2 X 8 EXE

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IPMD VEHICLE DATA SHEET

FRONT SUSPENSION

Suspension Number (4 digits): \_\_\_\_\_

Front/Rear Flag (1 character): \_\_\_\_\_ F \_\_\_\_\_

Axle Type (1 character): \_\_\_\_\_ I \_\_\_\_\_

I = Independent      S = Solid

Suspension Type (1 character): \_\_\_\_\_ S \_\_\_\_\_

A = Unequal A Arm

L = Leaf

M = Multiple Link

Q = Torque Arm

S = Strut

O = Other: \_\_\_\_\_

T = Semi-Trailing Arm

W = Twist

4 = 4 Link

3 = 3 Link

I = Twin I Beam

Spring Type (2 characters): \_\_\_\_\_ CO \_\_\_\_\_

CO = Coil

LL = Longitudinal Leaf

OT = Other: \_\_\_\_\_

TB = Torsion Bar

TL = Transverse Leaf

Brake Type (2 characters): \_\_\_\_\_ DI \_\_\_\_\_

DI = Disk

DS = Duo-Servo Shoe

OT = Other: \_\_\_\_\_

LT = Leading-Trailer Shoe

Suspension Modified (1 character): \_\_\_\_\_ N \_\_\_\_\_

N = No

Y = Yes

Suspension Modification

R = Raised

L = Lowered

S = Stiffened

W = Widened

O = Other

1 = \_\_\_\_\_

2 = \_\_\_\_\_

IPMD VEHICLE DATA SHEET

FRONT SUSPENSION

Tire Manufacturer (10 characters): Goodyear

Tire Size Code (10 characters): P195/75R14

Tire Construction (2 characters): SB

BB = Bias Belted

GP = Glass Belted Radial

BP = Bias Ply

SB = Steel Belted Radial

OT = Other: \_\_\_\_\_

Tire Rim width: 5.0 (in) X 25.4 =: 127 (mm)

Axle Height: 10 (in) X 25.4 =: 254 (mm)

Tire Pressure: NA (psi) X 6.897 =: NA (kpa)

IPMD VEHICLE DATA SHEET

REAR SUSPENSION

Suspension Number (4 digits): \_\_\_\_\_

Front/Rear Flag (1 character):     R    

Axle Type (1 character):     S    

I = Independent      S = Solid

Suspension Type (1 character):     L    

A = Unequal A Arm	T = Semi-Trailing Arm
L = Leaf	W = Twist
M = Multiple Link	4 = 4 Link
Q = Torque Arm	3 = 3 Link
S = Strut	I = Twin I Beam
O = Other: _____	

Spring Type (2 characters):     LL    

CO = Coil	TB = Torsion Bar
LL = Longitudinal Leaf	TL = Transverse Leaf
OT = Other: _____	

Brake Type (2 characters):     LT    

DI = Disk	LT = Leading-Trailer Shoe
DS = Duo-Servo Shoe	
OT = Other: _____	

Suspension Modified (1 character):     N    

N = No      Y = Yes

**Suspension Modification**

R = Raised	L = Lowered
S = Stiffened	W = Widened
O = Other	

1 = \_\_\_\_\_  
2 = \_\_\_\_\_

IPMD VEHICLE DATA SHEET

REAR SUSPENSION

Tire Manufacturer (10 characters): Goodyear

Tire Size Code (10 characters): P195/75R14

Tire Construction (2 characters): SB

BB = Bias Belted

GP = Glass Belted Radial

BP = Bias Ply

SB = Steel Belted Radial

OT = Other: \_\_\_\_\_

Tire Rim Width: 5.0

(in) X 25.4 =: 127 (mm)

Axle Height: 10.0

(in) X 25.4 =: 254 (mm)

Tire Pressure: NA

(psi) X 6.897 =: NA (kpa)

IPMD MEASURED DATA

VEHICLE # AND RUN # VAN DATE: 08-31-90 TIME: 14:28:38

Pitch Inertia:

		Platform Motion	Relative Motion	Individual ~ Pitch Calc.
<u>Run #</u>	<u>Period (Sec)</u>	<u>Amplitude (Deg.)</u>	<u>Amplitude (In.)</u>	<u>(Ft. Lb. Sec<sup>2</sup>)</u>
1	4.160	11.01	0.076	2263.5
2	4.160	10.89	0.073	2265.3
3	4.160	10.98	0.072	2265.9
Average Pitch Inertia:				2264.9

Roll Inertia:

Distance between ramps (in.): 51.20

		Platform Motion	Relative Motion	Individual Roll Calc.
<u>Run #</u>	<u>Period (Sec)</u>	<u>Amplitude (Deg.)</u>	<u>Amplitude (In.)</u>	<u>(Ft. Lb. Sec<sup>2</sup>)</u>
1	2.530	7.81	0.060	505.8
2	2.535	8.28	0.061	510.9
3	2.530	7.90	0.056	507.1
Average Roll Inertia:				508.0

Yaw Inertia:

		Platform Motion	Relative Motion	Individual Yaw Calc.
<u>Run #</u>	<u>Period (Sec)</u>	<u>Amplitude (Deg.)</u>	<u>Amplitude (In.)</u>	<u>(Ft. Lb. Sec<sup>2</sup>)</u>
1	2.595	10.51	0.05	2353.3
2	2.595	9.97	0.05	2352.7
3	2.595	10.52	0.05	2353.5
Average Yaw Inertia:				2353.2

IPMD MEASURED DATA

Vehicle # and Run #: VAN Date: 08-31-90 Time: 14:28:38

No System CG Pivot Data Computed

C.G. Height:

Applied	Schaevitz	Resultant Longitudinal	Individual
Weight (lbs.)	Output (Deg.)	Movement (In.)	C.G. Values (In.)
0	-1.29	0.000	0.00
100	-4.66	0.032	22.48
200	-8.09	0.087	22.55
0	-1.37	0.040	0.00
-100	2.02	0.016	22.33
-200	5.47	-0.030	22.88
0	-1.31	-0.011	0.00
Average calculated C.G. Height:			22.56

## SIGN CONVENTION

### ACCELEROMETERS:

+X: FORWARD  
+Y: LEFTWARD  
+Z: UPWARD

### POTENTIOMETERS:

+CHEST DISPLACEMENT: OUTWARD  
+SEAT BELT DISPLACEMENT: OUTWARD  
+SEAT BELT EXTENSION: ENLONGATION  
+VEHICLE DISPLACEMENT: OUTWARD

### LOAD CELLS:

+FEMUR FORCE: TENSION  
+SEAT BELT FORCE: TENSION  
+BARRIER FORCE: TENSION

### NECK LOAD CELLS:

+X FORCE: HEAD FORWARD  
+Y FORCE: HEAD RIGHTWARD  
+Z FORCE: HEAD UPWARD (TENSION ON NECK)  
+X MOMENT: RIGHT EAR TO RIGHT SHOULDER  
+Y MOMENT: HEAD ROTATING FORWARD  
+Z MOMENT: HEAD ROTATING LEFTWARD

### GYROSCOPES:

+X ROLL: TO RIGHT  
+Y PITCH: FRONT DOWN  
+Z YAW: COUNTERCLOCKWISE