V1394

VEHICLE AND DUMMY KINEMATICS IN A CONTROLLED ROLLOVER CRASH 1989 NISSAN PICK-UP TRUCK

PREPARED BY:
THE TRANSPORTATION RESEARCH CENTER OF OHIO
U.S. RT. 33, LOGAN COUNTY
EAST LIBERTY, OHIO 43319

TEST REPORT
NOVEMBER - DECEMBER, 1989

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

ERRATA (as of Nov 93)
Test Number 891122

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 4-4.
   Plots, Appendix B
   - Driver Neck Moment About X Axis
   - Driver Neck Moment About Y Axis
   - Driver Neck Moment About Z Axis

NOTICE

The Transportation Research Center of Ohio does not endorse or certify products of manufacturers. The manufacturer's name appears solely to identify the test article. The Transportation Research Center assumes no liability for the report or use thereof. It is responsible for the facts and the accuracy of the data presented herein. This report does not constitute a standard, specification, or regulation.

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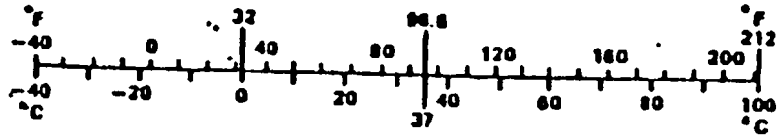
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	metric ton	t
	VOLUME			
tsp	teaspoons	5	milliliters	mL
Tbsp	tablespoons	15	milliliters	mL
in^3	cubic inches	16	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	degrees Fahrenheit	5/9 (after subtracting 32)	degrees Celsius	°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	metric ton (1000 kg)	1.1	short tons	
	VOLUME			
mL	milliliters	0.03	fluid ounces	fl oz
mL	milliliters	0.06	cubic inches	in^3
L	liters	2.1	pints	pt
L	liters	1.06	quarts	qt
L	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	degrees Celsius	9/5 (then add 32)	degrees Fahrenheit	°F



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SECTION 1.0

PURPOSE AND TEST PROCEDURE

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

This test was conducted by placing a 1989 Nissan Pick-up Truck on the NHTSA rollover cart at an angle 30° above the horizontal, crabbing the rollover cart 0°, towing the rollover cart to 30 mph, and releasing the test vehicle with its roll axis perpendicular to the direction of the rollover cart motion. The test vehicle contained an instrumented Part 572E dummy with a three-point unibelt restraint system. The vehicle was oriented to first contact its right side.

SECTION 2.0

SUMMARY OF ROLLOVER CRASH TEST

A 1989 Nissan pick-up truck containing one Part 572E instrumented test dummy was placed upon the rollover test device at 30 degrees above the horizontal and was released when the device had reached 30 mph. The device was attached to the tow cable of the drive system. After the vehicle had been released the device was brought to a stop with an auxiliary brake system. After release the vehicle impacted the ground on its right side. The vehicle made one full roll and came to rest on its tires. The rollover crash test was conducted by the Transportation Research Center of Ohio in East Liberty, Ohio on November 22, 1989.

The Part 572E 50th percentile adult male anthropomorphic test device (ATD) was placed in the driver's designated seating position according to the seating procedure in FMVSS 208 Notice 45. The ATD 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-five 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 J211.

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 procedure. 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 and post-test IPMD vehicle data sheet.

TEST NUMBER 891122

ROLL CART DATA SUMMARY

No.	LOCATION	POSITIVE DIRECTION MAX	POSITIVE DIRECTION SEC	NEGATIVE DIRECTION MAX	NEGATIVE DIRECTION SEC
1	CENTER OF GRAVITY ACCELERATION (g)				
	LONGITUDINAL	9.6	0.3	7.1	1.8
	LATERAL	6.1	1.8	21.5	0.3
	VERTICAL	11.7	1.7	37.5	1.1
	RESULTANT	38.2	1.1		
2	PLATFORM DISPLACEMENT (in)				
	LEFT SIDE	23.7	4.6	0.1	0.5
	RIGHT SIDE	24.6	1.0	0.1	0.3

VEHICLE/ROLL CART SEPARATION TIMES:

UPPER SWITCH: 0.7 SEC
LOWER SWITCH: 0.7 SEC

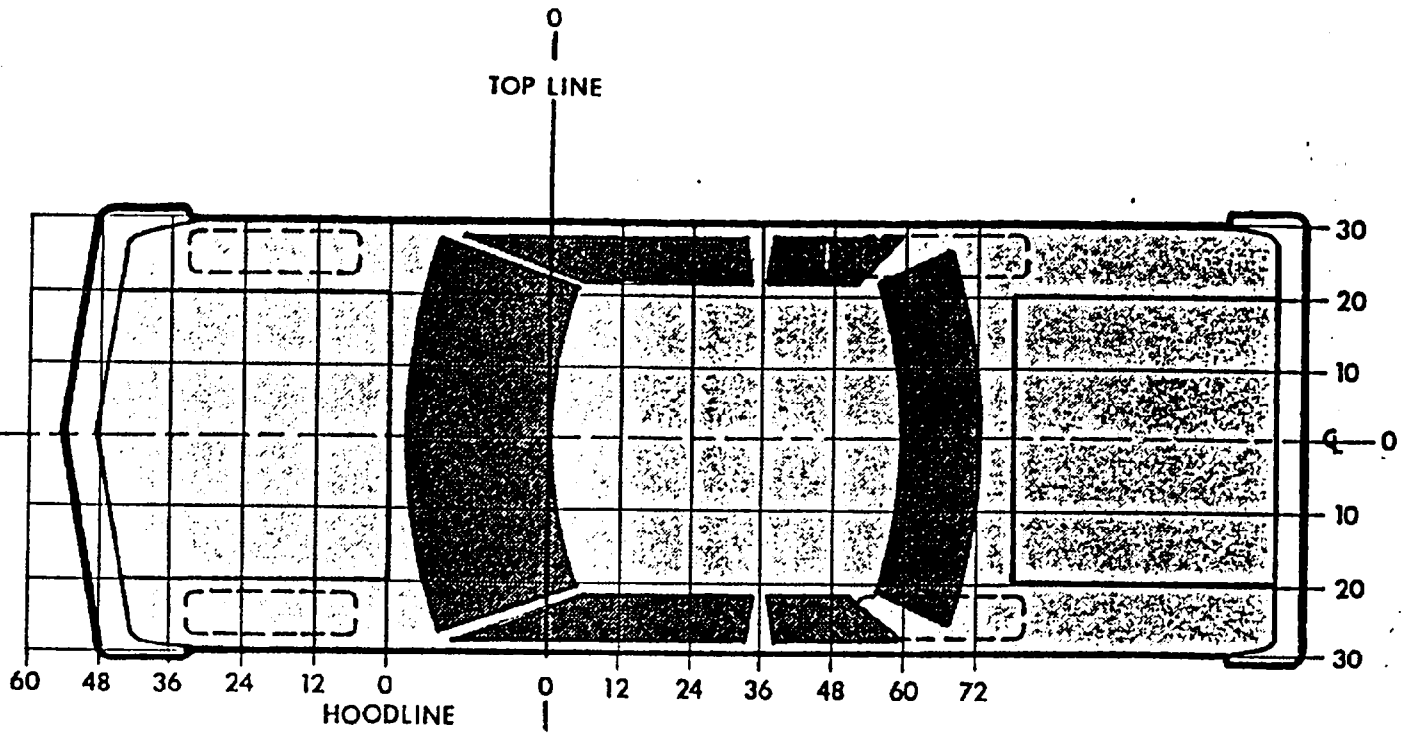
POSITIVE DIRECTION		NEGATIVE DIRECTION	
LONGITUDINAL:	FORWARD	LONGITUDINAL:	REARWARD
LATERAL:	LEFTWARD	LATERAL:	RIGHTWARD
VERTICAL:	UPWARD	VERTICAL:	DOWNWARD
FORCE:	OUTWARD	FORCE:	INWARD

See TEST ANOMALIES FOR INFORMATION RELATIVE TO ALL OF THE ABOVE DATA CHANNELS.

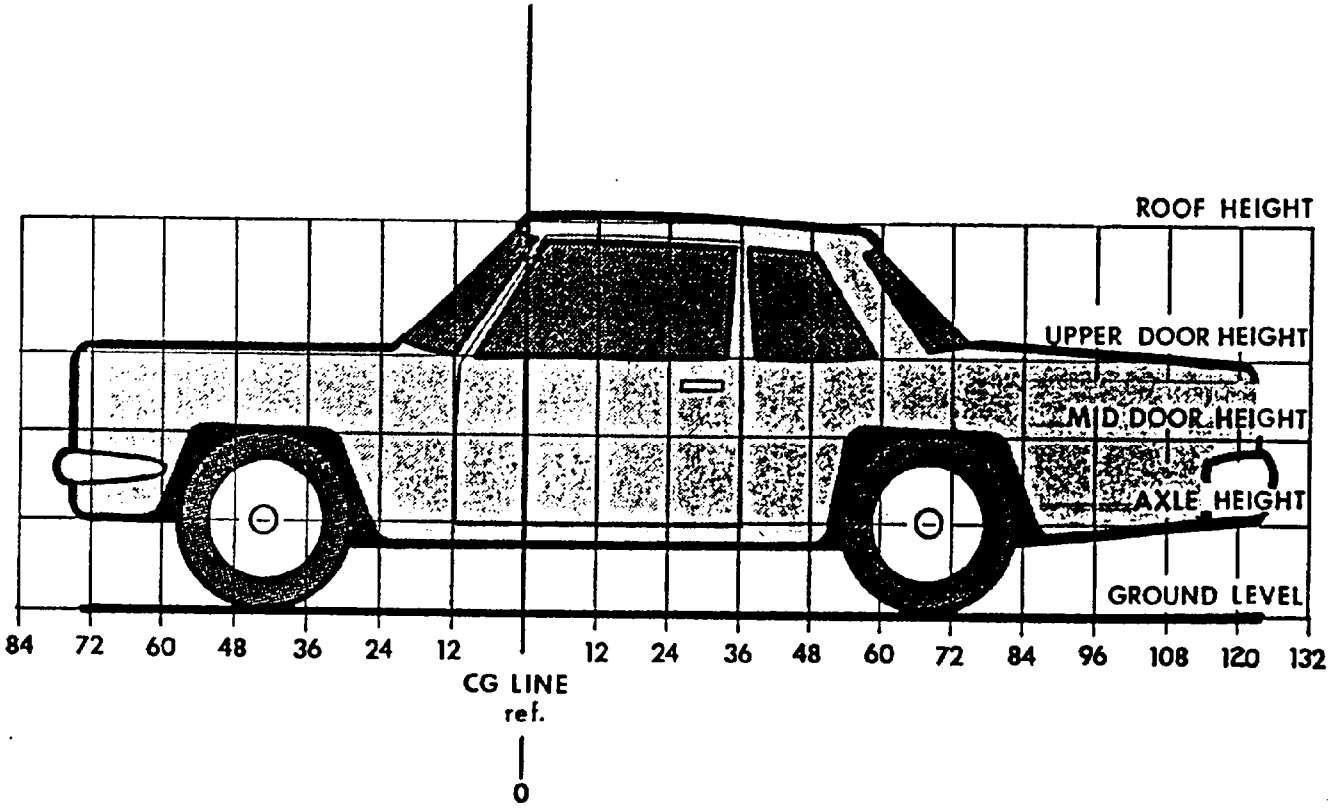
FINAL RESTING PLACES OF PARTS AND CARS

DESCRIPTION OF PART	X, FT*	Y, FT*
1989 Nissan Pick-up Truck	91.5	8.1
Rear window rubber frame	85.2	0.0

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



HOOD AND ROOF STATIC CRUSH LOCATIONS



LEFT AND RIGHT SIDE STATIC CRUSH LOCATIONS

VEHICLE INTERIOR MEASUREMENTS

DESCRIPTION	PRE	POST	DIFF
Floor board to top of left "A" post	39.8	27.5	12.3
Floor board to top of right "A" post	40.3	34.2	6.1
Door sill to top of left "B" post	41.6	33.4	8.2
Door sill to top of right "B" post	41.7	38.2	3.5
Door sill to top of left door opening	42.4	28.3	14.1
Door sill to top of right door opening	42.8	36.8	6.0
Floor tunnel to windshield header	35.6	25.6	10.0
Floor tunnel to center of roof	39.2	26.3	12.9
Rear of floor tunnel to roof	41.0	34.9	6.1
Maximum width at "B" post	64.5	56.0	8.5
Maximum width at "A" post	64.8	52.0	12.8
Maximum width at top of door opening	46.9	47.1	-0.2

ALL MEASUREMENTS ARE IN INCHES

VEHICLE HOOD EXTERIOR PROFILES
ZERO DISTANCE AT VEHICLE HOOD CENTERLINE*

LOCATION	30	20	10	0	10	20	30
PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)							
Trailing edge of cowl at centerline	X	41.9	42.4	42.1	42.4	41.8	X
Trailing edge of cowl + 12 inches***	X	40.1	41.1	40.8	40.6	40.4	X
Trailing edge of cowl + 24 inches	X	38.1	38.6	38.5	38.3	38.2	X
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
POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)							
Trailing edge of cowl at centerline	X	42.4	42.5	42.2	41.8	40.6	X
Trailing edge of cowl + 12 inches	X	40.6	41.2	40.9	40.5	38.6	X
Trailing edge of cowl + 24 inches	X	39.0	39.1	39.1	37.6	37.0	X
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
STATIC CRUSH (IN)							
Trailing edge of cowl at centerline	X	0.5	0.1	0.1	-0.6	-1.2	X
Trailing edge of cowl + 12 inches	X	0.5	0.1	0.1	-0.1	-1.8	X
Trailing edge of cowl + 24 inches	X	0.9	0.5	0.6	-0.7	-1.2	X
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.
***Longutudinal 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
PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)					
Longitudinal Center of Gravity - 12 inches	59.3	60.1	60.1	59.9	59.1
Longitudinal Center of Gravity	61.1	61.7	61.8	61.4	60.5
Longitudinal Center of Gravity + 12 inches***	61.2	61.8	61.9	61.6	60.9
Longitudinal Center of Gravity + 36 inches	X	X	X	X	X
Longitudinal Center of Gravity + 48 inches	X	X	X	X	X
Longitudinal Center of Gravity + 60 inches	X	X	X	X	X
POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)					
Longitudinal Center of Gravity -12 inches	43.1	44.8	47.9	51.2	51.2
Longitudinal Center of Gravity	43.9	46.6	48.5	50.5	53.2
Longitudinal Center of Gravity + 12 inches***	46.0	49.0	51.1	51.2	54.5
Longitudinal Center of Gravity + 36 inches	X	X	X	X	X
Longitudinal Center of Gravity + 48 inches	X	X	X	X	X
Longitudinal Center of Gravity + 60 inches	X	X	X	X	X
STATIC CRUSH (IN)					
Longitudinal Center of Gravity	-16.2	-15.3	-12.2	-8.7	-7.9
Longitudinal Center of Gravity + 12 inches	-17.2	-15.1	-13.3	-10.9	-7.3
Longitudinal Center of Gravity + 24 inches	-15.2	-12.8	-10.8	-10.4	-6.4
Longitudinal Center of Gravity + 36 inches	X	X	X	X	X
Longitudinal Center of Gravity + 48 inches	X	X	X	X	X
Longitudinal Center of Gravity + 60 inches	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 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	96
PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)																
Roof Height	59.2	X	X	X	X	X	23.9	22.9	22.8	X	X	X	X	X	X	X
Upper Door	29.9	X	18.6	17.8	17.8	17.1	17.2	16.8	16.9	16.9	17.1	16.9	17.6	17.1	17.4	X
Mid Door	28.2	17.8	X	X	15.9	15.9	15.9	15.9	15.6	15.9	15.8	X	X	16.1	16.2	X
Axle Height	13.9	X	X	X	X	18.7	18.8	18.8	18.6	18.8	18.8	X	X	X	X	X
POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)																
Roof Height	59.2	X	X	X	X	X	32.6	32.1	31.5	X	X	X	X	X	X	X
Upper Door	39.9	X	22.3	21.2	20.2	18.8	16.9	15.4	15.0	15.5	18.6	18.6	18.4	18.4	18.7	X
Mid Door	28.2	18.6	X	X	17.0	16.0	14.9	13.6	13.0	16.8	16.3	X	X	16.9	16.8	X
Axle Height	13.9	X	X	X	X	17.9	18.5	18.2	18.4	18.5	18.2	X	X	X	X	X
STATIC CRUSH (IN)																
Roof Height	59.2	X	X	X	X	X	8.7	9.2	8.7	X	X	X	X	X	X	X
Upper Door	39.9	X	3.7	3.4	2.4	1.7	-0.3	-1.4	-1.9	-1.4	1.5	1.7	0.8	1.3	1.3	X
Mid Door	28.2	0.8	X	X	1.1	0.1	-1.0	-2.3	-2.6	0.9	0.5	X	X	0.8	0.6	X
Axle Height	13.9	X	X	X	X	-0.8	-0.3	-0.6	-0.2	-0.3	-0.6	X	X	X	X	X

* Center of gravity is located 52.0 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 stucture 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	59.2	X	X	X	X	X	22.5	23.1	22.5	X	X	X	X	X	X	X
Upper Door	39.9	X	18.5	17.2	17.4	16.9	16.8	16.9	16.8	17.1	17.1	17.1	17.2	17.2	17.2	X
Mid Door	28.2	17.2	X	X	15.9	15.8	15.5	15.8	15.8	15.9	15.7	X	X	16.1	16.2	X
Axle Height	13.9	X	X	X	X	18.4	18.2	18.6	18.8	18.8	18.8	X	X	X	X	X
POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)																
Roof Height	59.2	X	X	X	X	X	19.0	18.9	20.0	X	X	X	X	X	X	X
Upper Door	39.9	X	16.6	15.9	15.3	13.8	12.0	10.8	9.5	15.4	15.4	15.8	15.9	16.3	15.9	X
Mid Door	28.2	16.6	X	X	15.0	13.6	12.2	11.1	10.8	15.2	14.6	X	X	15.5	15.5	X
Axle Height	13.9	X	X	X	X	18.2	18.0	18.1	17.9	19.3	20.0	X	X	X	X	X
STATIC CRUSH (IN)																
Roof Height	59.2	X	X	X	X	X	-3.5	-4.2	-2.5	X	X	X	X	X	X	X
Upper Door	39.9	X	-1.9	-1.3	-2.1	-3.1	-4.8	-6.1	-7.3	-1.7	-1.7	-1.3	-1.3	-0.9	-1.3	X
Mid Door	28.2	-0.6	X	X	-0.9	-2.2	-3.3	-4.7	-5.0	-0.7	-1.1	X	X	-0.6	-0.7	X
Axle Height	13.9	X	X	X	X	-0.2	-0.2	-0.5	-0.9	0.5	1.2	X	X	X	X	X

* Center of gravity is located 52.0 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 stucture is bowed outward.

IMPACTED VEHICLE MEASUREMENTS

VEHICLE MAKE/MODEL: Nissan Pick-up Truck TEST NUMBER: 891122

NO.	TYPE OF MEASUREMENT	DIMENSIONS IN INCHES PRE-TEST	POST-TEST	DIFF.
X1	TOTAL LENGTH OF VEHICLE AT CENTERLINE	174.8	174.9	-0.1
X2	REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK	156.4	156.0	0.4
X3	REAR SURFACE OF VEHICLE TO FIREWALL	137.4	136.4	1.0
X4	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR	127.9	128.0	-0.1
X5	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR	127.5	126.6	0.9
X6	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR	126.1	126.5	-0.4
X7	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR	125.9	125.8	0.1
X8	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR	82.2	82.8	-0.6
X9	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR	82.0	81.2	0.8
X10	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR	82.0	82.2	-0.2
X11	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR	81.8	81.4	0.4
X12	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE	126.2	125.9	0.3
X13	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE	126.2	126.0	0.2
X14	REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE	136.7	136.8	-0.1
X15	REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE	136.7	135.8	0.9
X16	REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER	107.5	107.6	-0.1
X17	CENTER OF STEERING COLUMN TO "A" POST	11.1	8.2	2.9
X18	CENTER OF STEERING COLUMN TO HEADLINER	17.3	2.0	15.3
X19	REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER	173.2	173.4	-0.2
X20	REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER	173.2	172.8	0.4
X21	LENGTH OF ENGINE BLOCK	18.2	18.2	0.0

TEST ANOMALIES

Vehicle Yaw Rate, VCGZV1, data was lost between 1.25 and 2.18 seconds. The data before 1.25 and after 2.18 seconds is included in the data summary.

The following data channels recorded anomalous noise spikes between 0.0 and 0.06 seconds. Only the data from 0.15 to 4.8 seconds is included on the data summary:

Rollcart Center of Gravity X-axis Accelerometer, VCGXG2

Rollcart Center of Gravity Y-axis Acceleroemter, VCGYG2

Rollcart Center of Gravity Z-axis Accelerometer, VCGZG2

Rollcart Center of Gravity Resultant Accelerometer calculation, VCGRG2, was affected by the above anomalies.

Rollcart Left Cylinder Displacement, RCPDL

Rollcart Right Cylinder Displacement, RCPDR

Vehicle/Rollcart Separation Time - Upper Switch, OTH1

Vehicle/Rollcart Separation Time - Lower Switch, OTH2

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: Nissan Motor Company, Ltd.

MAKE/MODEL: Nissan pickup VIN: 1N6ND11S0KC404690

BODY STYLE: Truck MODEL YEAR: 1989

NHTSA NO.: NA COLOR: Maroon

ENGINE DATA: TYPE: Inline CYLINDERS: 4 DISPLACEMENT: 2 liter

TRANSMISSION DATA: 5 SPEED, X MANUAL, ____AUTOMATIC, ____FWD, X RWD, ____4WI

DATE VEHICLE RECEIVED: 11/1/89 ODOMETER READING: 42

DEALER'S NAME AND ADDRESS: Nissan North
8645 North High Street
Columbus, Ohio

ACCESSORIES:

POWER STEERING	No	AUTOMATIC TRANSMISSION	No
POWER BRAKES	Yes	AUTOMATIC SPEED CONTROL	No
POWER SEATS	No	TILTING STEERING WHEEL	No
POWER WINDOWS	No	TELESCOPING STEERING WHEEL	No
TINTED GLASS	No	AIR CONDITIONING	No
RADIO	No	ANTI-SKID BRAKE	No
CLOCK	No	REAR WINDOW DEFROSTER	No
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? No
4. CONDITION OF THE FRONT/REAR BUMPER AND FRAME: Good

DATA FROM CERTIFICATION LABEL ON LEFT DOOR FACE OR "B" POST:

VEHICLE MANUFACTURED BY: Nissan Motor Company, Ltd.

DATE OF MANUFACTURE: 8/89

GVWR: 4400 LBS

GAWR: FRONT 2200 LBS., REAR 2544 LBS.

TEST VEHICLE INFORMATION CONT'D

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVEBOX, ETC.

VEHICLE LOAD (UP TO CAPACITY): FRONT 26 psi; REAR 26 psi

RECOMMENDED TIRE SIZE: P195/75R14 LOAD RANGE X B, C, D

TIRES ON VEHICLE (MFR., LINE, SIZE): Firestone WR-12 P195/75R14

IS SPARE TIRE A "SPACE SAVER": Yes

IS SPARE TIRE STANDARD EQUIPMENT: Yes

VEHICLE CAPACITY: TYPES OF SEATS: FRONT: Bench, Manual adjustable
REAR: None

*NUMBER OF OCCUPANTS____FRONT ____REAR ____TOTAL

**CARGO LOAD_____LBS. TOTAL_____LBS.

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (WITH MAXIMUM FLUIDS):

RIGHT FRONT	810 lbs.	RIGHT REAR	560 lbs.
LEFT FRONT	740 lbs.	LEFT REAR	600 lbs.

TOTAL FRONT WEIGHT 1550 lbs. (57.2% OF TOTAL VEHICLE WEIGHT)

TOTAL REAR WEIGHT 1160 lbs. (42.8% OF TOTAL VEHICLE WEIGHT)

TOTAL DELIVERED WEIGHT 2710 lbs.

CALCULATION FOR TARGET TEST WEIGHT:

RCLW = RATED CARGO AND LUGGAGE WEIGHT

UDW = UNLOADED DELIVERED WEIGHT (2710 LBS)

VCW = VEHICLE CAPACITY WEIGHT (LBS)

DSC = DESIGNATED SEATING CAPACITY ( )

RCLW = VCW - 150 (DCS) = 300 LBS*

TARGET TEST WEIGHT = UDW + RCLW + (1 DUMMY X 167 LBS/DUMMY)

= 2710 + 300 + 167 LBS

TARGET TEST WEIGHT = 3177 LBS

* FOR MULTI-PURPOSE VEHICLES, TRUCKS, AND BUSES A RATED CARGO AND LUGGAGE WEIGHT OF 300 POUNDS WAS USED.
**THE VEHICLE CONTAINED NO RECOMMENDED CARGO LOAD ON THE TIRE PRESSURE LABEL.

TEST VEHICLE INFORMATION CONT'D

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 307 LBS. CARGO

RIGHT FRONT	807 lbs.	RIGHT REAR	816 lbs.
LEFT FRONT	747 lbs.	LEFT REAR	814 lbs.

TOTAL FRONT WEIGHT 1554 lbs. (48.8% OF TOTAL VEHICLE WEIGHT)

TOTAL REAR WEIGHT 1630 lbs. (51.2% OF TOTAL VEHICLE WEIGHT)

TOTAL TEST WEIGHT 3184 lbs. (0.2% OVER TARGET WEIGHT)

WEIGHT OF BALLAST SECURED IN VEHICLE BED AREA: 150 LBS.

COMPONENTS REMOVED TO MEET TARGET WEIGHT: None

VEHICLE ATTITUDE (ALL DIMENSIONS IN INCHES):

DELIVERED ATTITUDE:	LF	28.8	;RF 28.5	;LR	30.8	;RR	30.2
PRE-TEST ATTITUDE:	LF	28.6	;RF 28.9	;LR	28.7	;RR	28.9
POST-TEST ATTITUDE:	LF	29.7	;RF 26.0	;LR	29.3	;RR	24.8

WHEELBASE: 104.5 INCHES

CG = 52.0 INCHES REARWARD OF FRONT WHEEL CENTERLINE

VEHICLE REBOUND AND CRUSH (ALL DIMENSIONS IN INCHES):

OVERALL LENGTH OF TEST VEHICLE:	PRE-TEST:	L	173.2	;C	174.8	;R	173.2
	POST-TEST:	L	172.8	;C	174.9	;R	173.4
	TOTAL CRUSH:	L	0.4	;C	-0.1	;R	-0.2

TEST CONDITIONS

TEST NUMBER: 891122

DATE OF TEST: 11/22/89 TIME OF TEST: 1405

WIND VELOCITY: NA HUMIDITY: NA

AMBIENT TEMPERATURE AT IMPACT AREA: 29°F

TEMPERATURE IN OCCUPANT COMPARTMENT: 60°F

DRIVER DUMMY TEMPERATURE: 65°F

SUBJECT VEHICLE DATA

	ACTUAL	INTENDED
VEHICLE TEST WEIGHT (lbs.)	3184	3177
VEHICLE ORIENTATION (deg.) YAW*	270	270
VEHICLE ORIENTATION (deg.) ROLL**	30	30
VEHICLE VELOCITY (mph)	30	30

DUMMIES

RIGHT FRONT PASSENGER

TYPE:	Part 572E
SERIAL NO.:	245
INSTRUMENTATION:	
HEAD ACCEL.:	3
NECK L.C.'C.:	6
CHEST ACCEL.:	3
PELVIS ACCEL.:	3
CHEST DISPLACEMENT POTENTIOMETER:	1
RESTRAINT SYSTEM:	3-point unibelt

REMARKS:

*AS MEASURED CLOCKWISE FROM THE DIRECTION OF TRAVEL.

**AS MEASURED FROM THE HORIZONTAL.

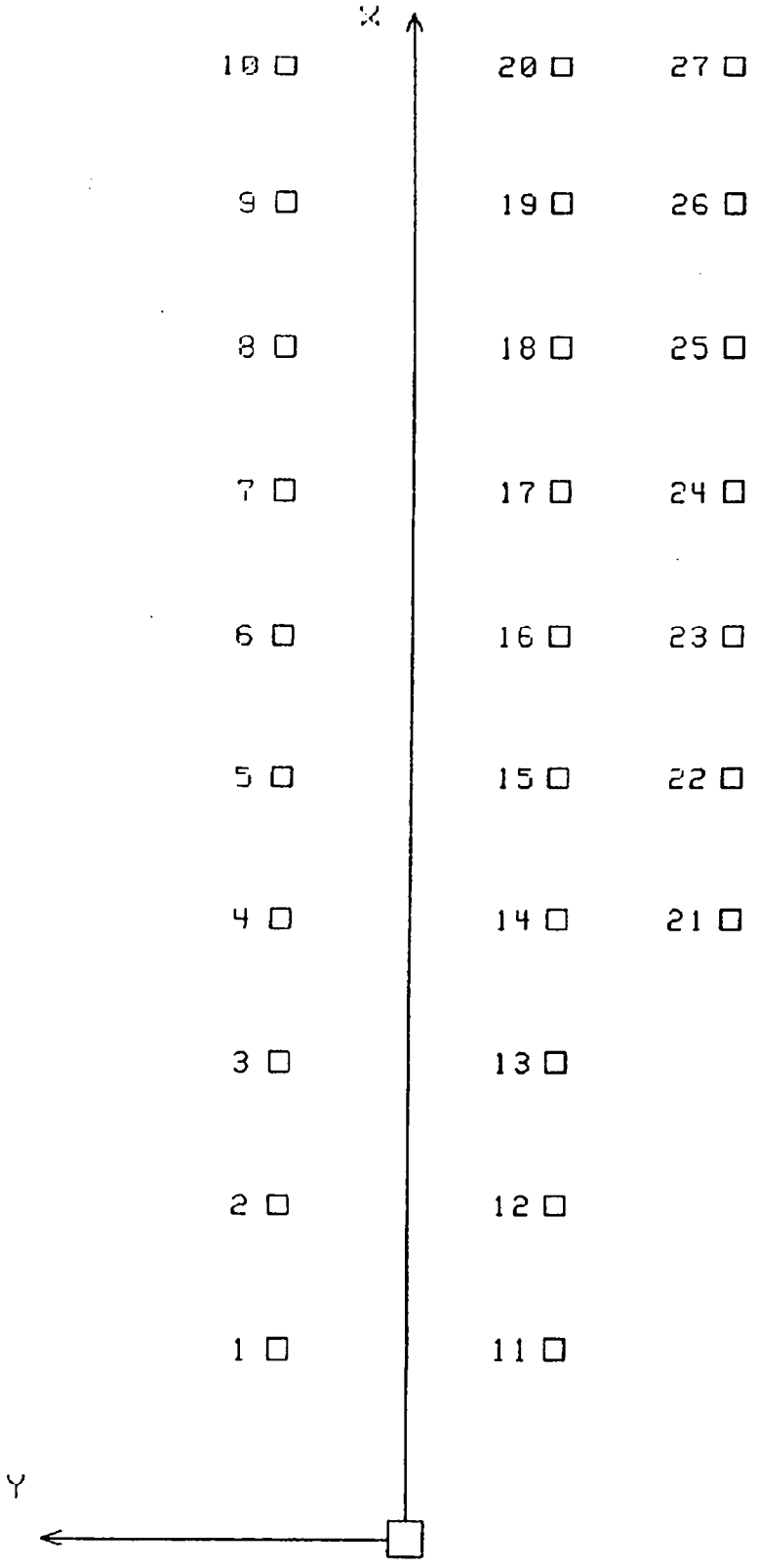
TEST NUMBER 891122

VEHICLE DATA SUMMARY

No.	LOCATION	POSITIVE DIRECTION MAX	POSITIVE DIRECTION SEC	NEGATIVE DIRECTION MAX	NEGATIVE DIRECTION SEC
1	CENTER OF GRAVITY ACCELERATION (g)				
	LONGITUDINAL	6.1	1.4	27.1	1.3
	LATERAL	8.9	1.3	15.4	1.4
	VERTICAL	14.5	1.4	20.8	1.4
	RESULTANT	28.7	1.3		
2	CENTER OF GRAVITY				
	ROLL (X-AXIS)	452.8	1.3	130.7	2.9
	PITCH (Y-AXIS)	207.1	1.3	225.2	1.3
	YAW (Z-AXIS)	100.7	2.2 Y	625.6	2.2
3	LEFT FRONT SUSPENSION DISPLACEMENT (in)				
	VERTICAL	0.3	0.6	5.4	2.9
4	RIGHT FRONT SUSPENSION DISPLACEMENT (in)				
	VERTICAL	1.3	1.4	6.5	2.2
5	LEFT REAR SUSPENSION DISPLACEMENT (in)				
	VERTICAL	1.0	2.2	7.3	2.0
6	RIGHT REAR SUSPENSION DISPLACEMENT (in)				
	VERTICAL	1.3	2.0	7.8	2.8
7	SHOULDER BELT DISPLACEMENT (in)				
	DRIVER	0.9	1.3	2.3	1.4

POSITIVE DIRECTION		NEGATIVE DIRECTION	
LONGITUDINAL:	FORWARD	LONGITUDINAL:	REARWARD
LATERAL:	LEFTWARD	LATERAL:	RIGHTWARD
VERTICAL:	UPWARD	VERTICAL:	DOWNWARD
ROLL:	TO RIGHT	ROLL:	TO LEFT
PITCH:	NOSE DOWNWARD	PITCH:	NOSE UPWARD
YAW:	COUNTER CLOCKWISE	YAW:	CLOCKWISE
FORCE:	OUTWARD	FORCE:	INWARD

Y See TEST ANOMALIES



STADIA POLE LAYOUT AND NUMBERING SYSTEM

STADIA POLE LOCATIONS

POLE NO.	X DISTANCE, FT. *	Y DISTANCE, FT. *
1	34.0	8.0
2	42.0	8.0
3	50.0	8.0
4	58.0	8.0
5	66.0	8.0
6	74.0	8.0
7	82.0	8.0
8	90.0	8.0
9	98.0	8.0
10	106.0	8.0
11	34.0	-8.0
12	42.0	-8.0
13	50.0	-0.0
14	58.0	-8.0
15	66.0	-8.0
16	74.0	-8.0
17	82.0	-8.0
18	90.0	-8.0
19	98.0	-8.0
20	106.0	-8.0
21	58.0	-18.0
22	66.0	-18.0
23	74.0	-18.0
24	82.0	-18.0
25	90.0	-18.0
26	98.0	-18.0
27	106.0	-18.0

*REFERENCE: +X: FORWARD FROM RELEASE BLOCK

+Y: LEFTWARD FROM CENTER RELEASE BLOCK

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Right panning	Kodak	16	24	Real Time
2	Left wide	Photosonic 1B	25	500	Vehicle Kinematics
3	Left wide (mid)	Photosonic 1B	13	500	Vehicle Kinematics
4	Left angle	Photosonic 1B	25	502	Vehicle Kinematics
5	Downstream	Photosonic 1B	50	505	Vehicle Kinematics
6	Onboard - floor	Photosonic 1B	8	525	Dummy Kinematics
7	Onboard - right door	Photosonic 1B	8	500	Dummy Kinematics
8	Documentary	Bealieu	11-108	24	Pre-test and Post-test Documentation

HIGH SPEED CAMERA INFORMATION

GROUND LEVEL

CAMERA NO.	X* (ft.)	Y* (ft.)	Z* (ft.)
2	107.6	420.8	5.0
3	107.6	195.0	5.1
4	240.8	81.9	3.8
5	221.2	0.4	2.5

*Reference:

+X = Forward from release block

+Y = Leftward from center release block

+Z = Upward from ground level

ONBOARD

CAMERA NO.	X**(inch)	Y**(inch)	Z**(inch)
6	-3.8	14.5	11.0
7	-10.5	10.0	22.0

**Reference:

+X = Forward from dash panel

+Y = Leftward from the right door sill

+Z = Upward from the vehicle floor level

SECTION 4.0

OCCUPANT INFORMATION

VISIBLE DUMMY CONTACT POINTS:

	DRIVER #245	PASSENGER #NA
Head	Roof, window sill and modified contact surface	NA
Chest	Roof	NA
Abdomen	NA	NA
Left knee	Left door padding and steering column	NA
Right knee	NA	NA

DOOR OPENING:

	LEFT	RIGHT
Front	Easy	Easy
Rear	NA	NA

SEAT MOVEMENT:

	SEAT BACK FAILURE	SEAT SHIFT
Front	None	None
Rear	NA	NA

GLAZING DAMAGE:

The entire windshield was cracked upon impact.

OTHER NOTABLE IMPACT EFFECTS:

The entire left and right front door and rear window glasses were shattered upon impact.

DUMMY KINEMATIC SUMMARY

Driver Dummy

Upon the vehicle's impact with the ground, the driver dummy's head struck the roof. As the vehicle rolled onto its roof, the dummy's head remained in contact with the roof, window sill and modified contact surface. The vehicle came to rest on its tires after one full rollover, with the driver dummy's head resting against the window sill. The dummy was restrained with a three-point unibelt.

DUMMY DATA SUMMARY

TEST NUMBER 891122

	DRIVER DUMMY SN: 192			
	POSITIVE DIRECTION		NEGATIVE DIRECTION	
	MAX	SEC	MAX	SEC
HEAD ACCELERATION (g)				
LONGITUDINAL	33.8	1.4	34.9	1.4
LATERAL	110.9	1.4	29.3	1.4
VERTICAL	147.8	1.4	100.6	1.4
RESULTANT	154.2	1.4		
HIC 36 MSEC	774.3 FROM 1.348 TO 1.360			
NECK FORCES (lbs)				
LONGITUDINAL	194.8	1.4	1174.2	1.4
LATERAL	1197.8	1.4	294.2	2.2
VERTICAL	491.8	2.2	2960.2	1.4
NECK MOMENT (in-lbs)				
ABOUT LONG.	234.9	1.4	36.8	1.4
ABOUT LATERAL	66.6	1.4	79.6	1.4
ABOUT VERTICAL	23.5	1.4	63.5	1.4
CHEST ACCELERATION (g)				
LONGITUDINAL	9.9	1.4	22.8	1.4
LATERAL	21.7	2.2	21.4	1.4
VERTICAL	9.6	1.4	77.9	1.4
RESULTANT	82.4	1.4		
3 MSEC	68.4 FROM 1.355 TO 1.358			
CHEST DISPLACEMENT (in)				
LONGITUDINAL	0.4	1.4	0.3	1.3
PELVIS ACCELERATION (g)				
LONGITUDINAL	15.7	1.4	12.9	1.4
LATERAL	9.4	1.4	14.2	1.4
VERTICAL	10.3	1.4	55.6	1.4
RESULTANT	57.6	1.4		

POSITIVE DIRECTION	
LONGITUDINAL:	FORWARD
LATERAL:	LEFTWARD
VERTICAL:	UPWARD
FORCE:	OUTWARD

NEGATIVE DIRECTION	
LONGITUDINAL:	REARWARD
LATERAL:	RIGHTWARD
VERTICAL:	DOWNWARD
FORCE:	INWARD

See APPENDIX D for neck load cell polarities.

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. After the vehicle had been positioned on the rollover device it was towed outside for launch.

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 #45 seating procedure. The H-point location of the seat was obtained by using the SAE J826 H-point machine as specified in the Notice #45. The driver dummy was restrained with a three-point unibelt.

DUMMY IN-VEHICLE POSITION RECORDING SHEET

MFR./MAKE/MODEL: Nissan Pick-up Truck

SEAT TYPE: X Bench
_____Bucket
_____Split bench

ADJUSTER TYPE: X Manual
_____Power
_____Non-adjustable

BUCKET SEAT BACK TYPE: X Non-adjustable
_____Adjustable reclining

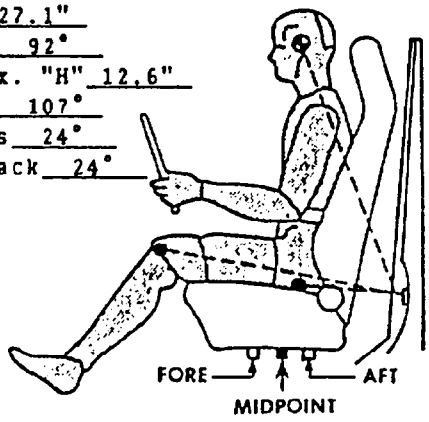
TECHNICIANS:
1. R. Branham
2. D. Ledley
3. _____
4. _____

POSITIONING DATE: 11/22/89

AMBIENT TEMP. 75°F TIME: 1120

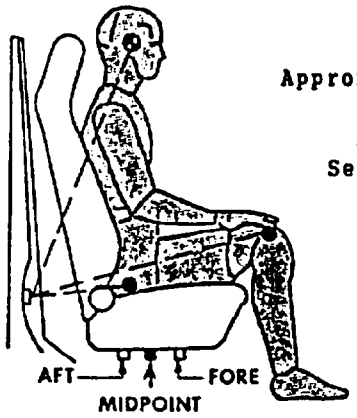
DRIVER DUMMY* # 245 TYPE: HIII

Head 22.9"
Target 22°
Knee 27.1"
Joint 92°
Approx. "H" 12.6"
Point 107°
Pelvis 24°
Seatback 24°

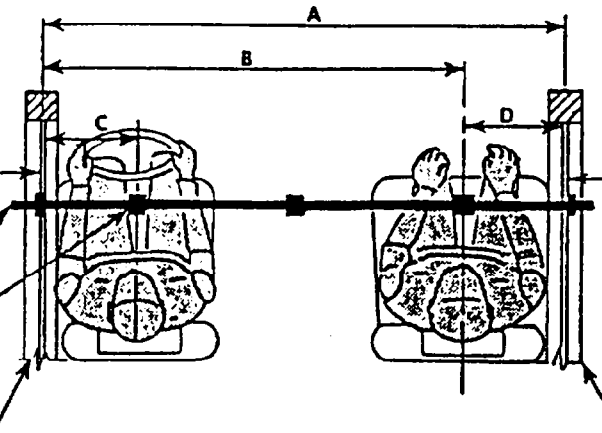


PASSENGER DUMMY* # NA TYPE: _____

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



A = 55.2"
B = NA
C = 12.4"
D = NA



DOOR GLASS HEIGHT = 9.1"

LATERAL BAR

ADJUSTABLE POINTER

DOOR GLASS HEIGHT = _____

LEFT FRONT DOOR

DRIVER DUMMY

PASSENGER DUMMY

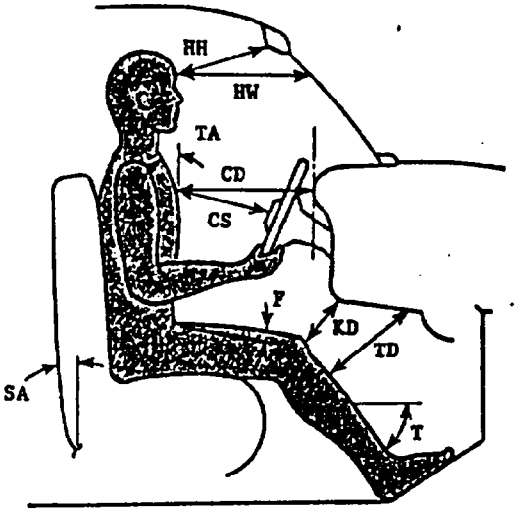
RIGHT FRONT DOOR

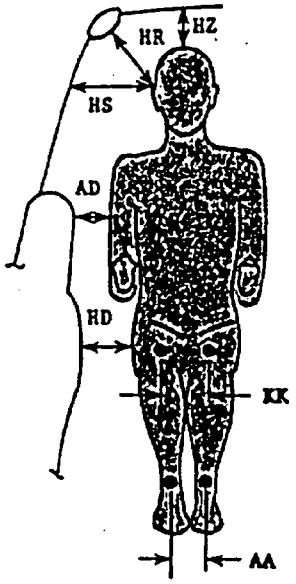
*Dummy measurements are referenced to top of striker bolt and all angles are referenced to vertical.

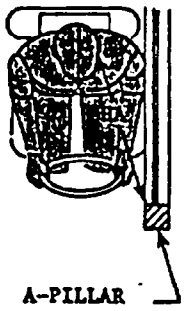
DUMMY IN-VEHICLE POSITION RECORDING SHEET

	DRIVER	PASSENGER
HH	13.9	NA
HW	20.0	NA
CD	21.2	NA
CS	10.8	NA
KDL	4.8	NA
KDR	4.9	NA
TA	26°	NA
SA	24°	NA
HA	15.4	NA
FL	17°	NA
FR	19°	NA
TDL	4.3	NA
TDR	4.0	NA
TL	40°	NA
TR	40°	NA
HZ	5.0	NA
HR	8.5	NA
HS	9.9	NA
AD	3.4	NA
HD	5.2	NA
KK	8.8	NA
AA	10.0	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.

APPENDIX A

PHOTOGRAPHS

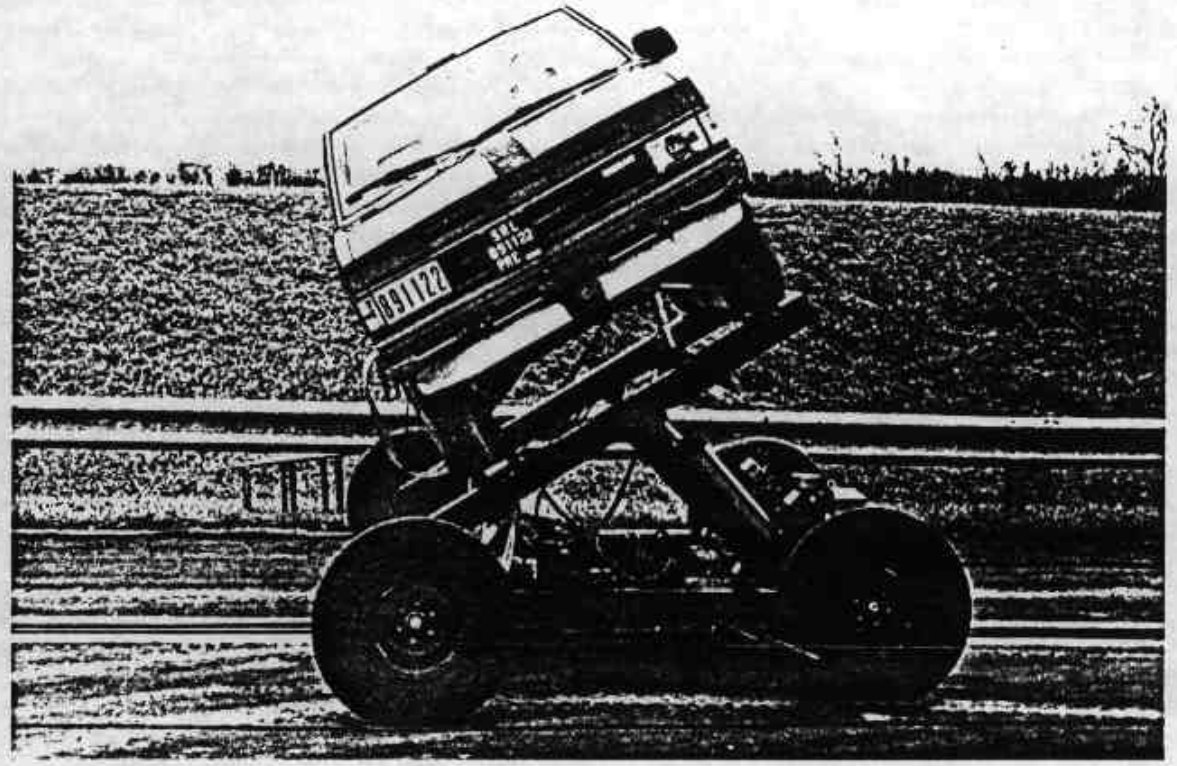


Figure A-1. PRE-TEST OVERALL FRONT VIEW

Figure A-2. PRE-TEST OVERALL LEFT VIEW

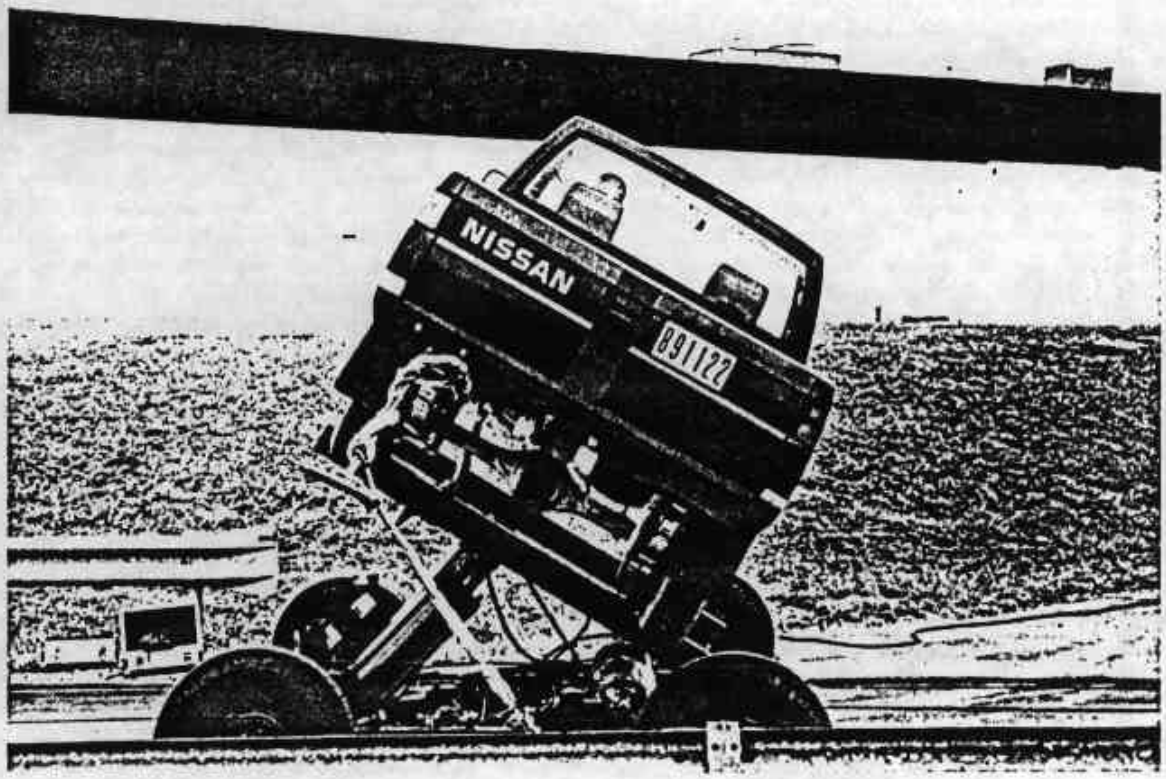


Figure A-3. PRE-TEST OVERALL REAR VIEW

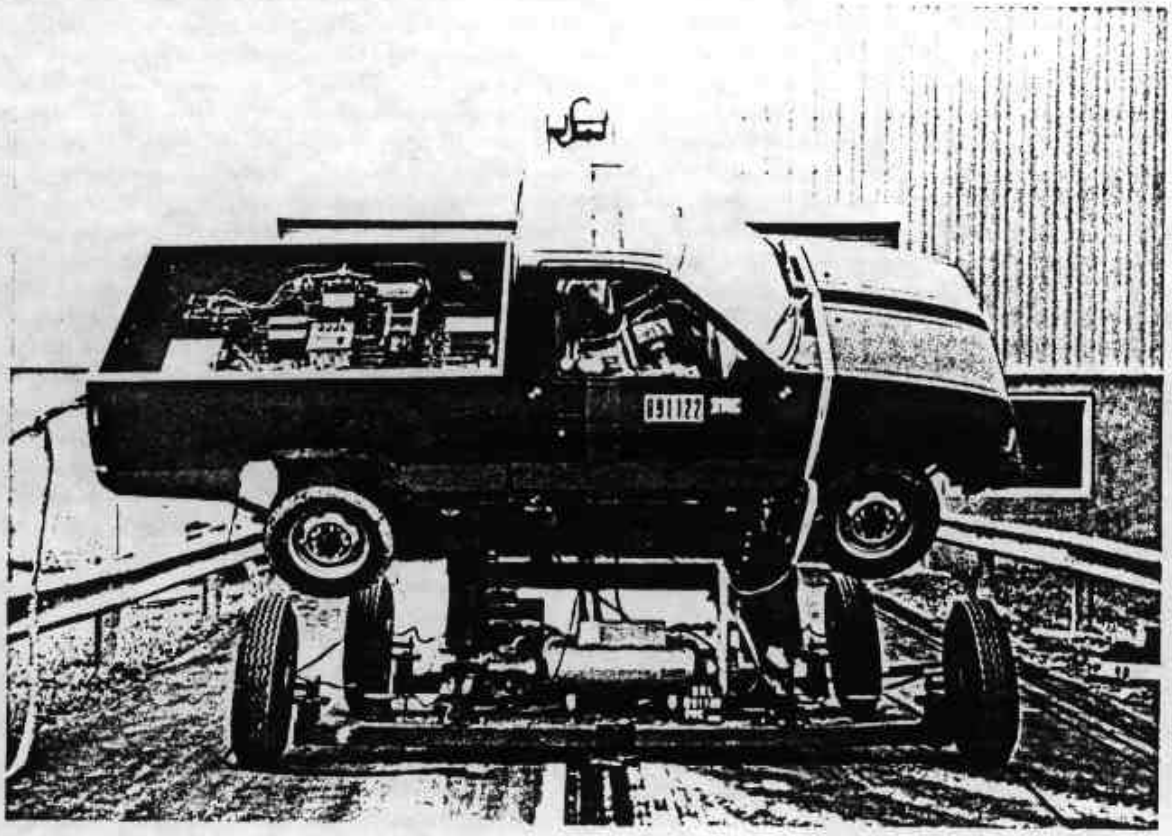


Figure A-4. PRE-TEST OVERALL RIGHT VIEW

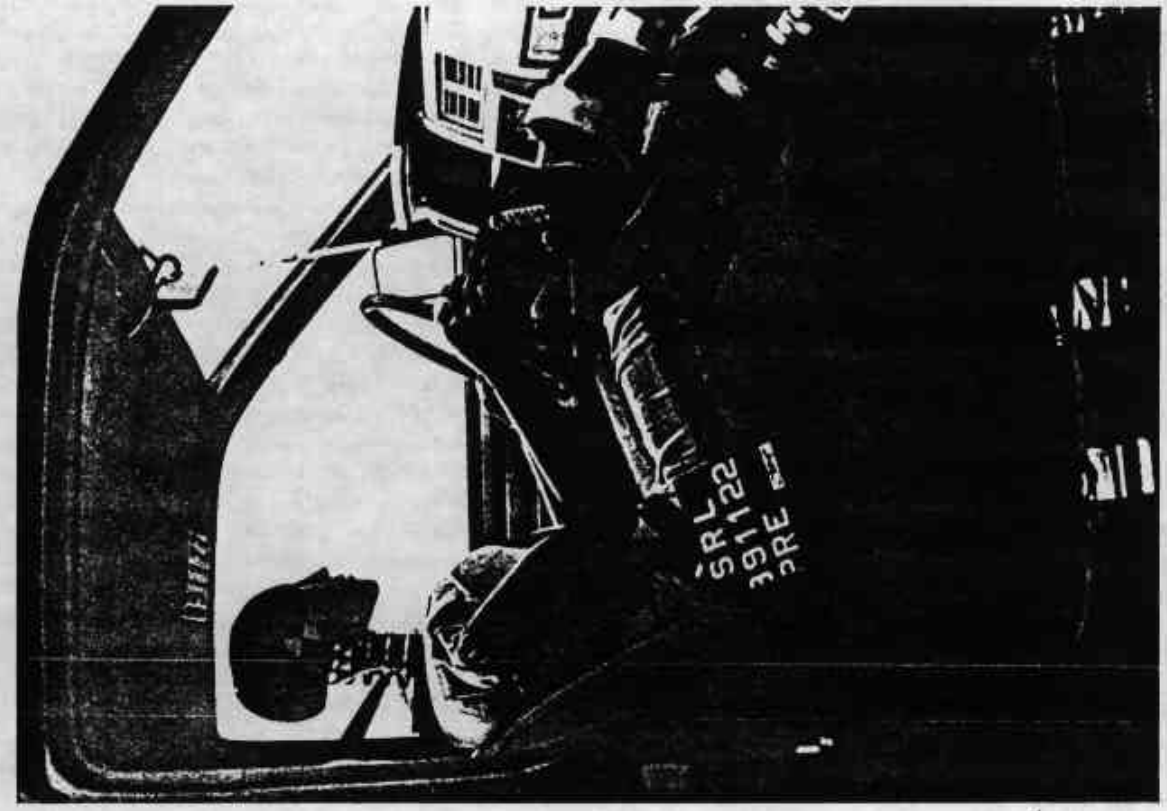


Figure A-5. PRE-TEST DRIVER DUMMY VIEW

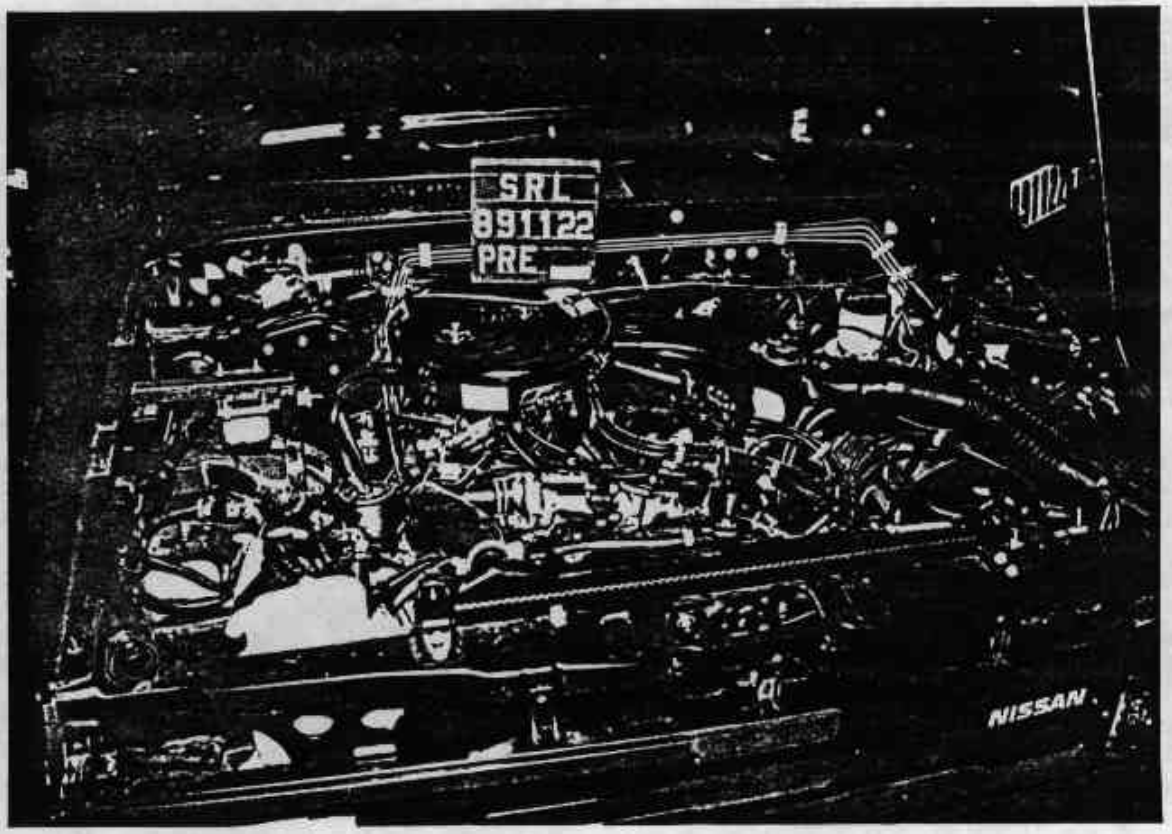


Figure A-6. PRE-TEST ENGINE COMPARTMENT VIEW

Figure A-7. PRE-TEST LEFT FRONT SUSPENSION STRING POTENTIOMETER VIEW

Figure A-8. PRE-TEST RIGHT FRONT SUSPENSION STRING POTENTIOMETER - VIEW 1

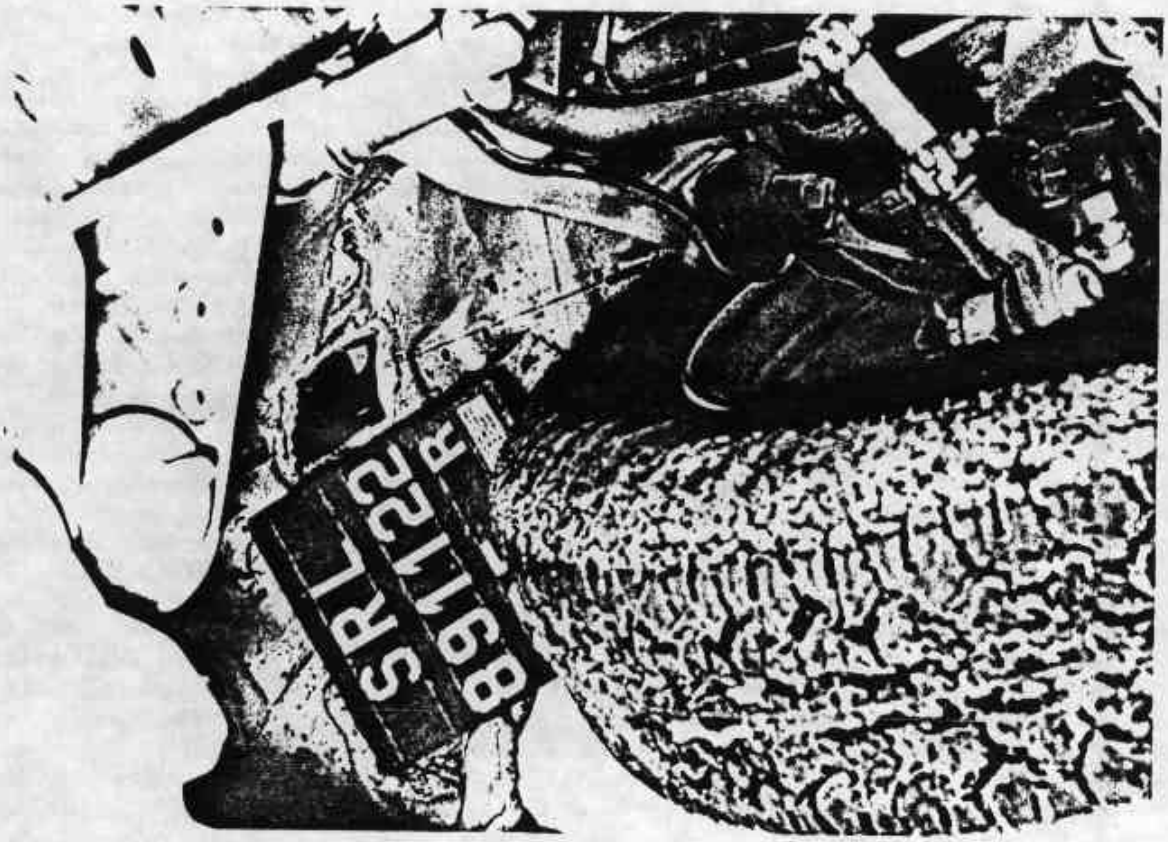


Figure A-9. PRE-TEST RIGHT FRONT SUSPENSION STRING POTENTIOMETER - VIEW 2

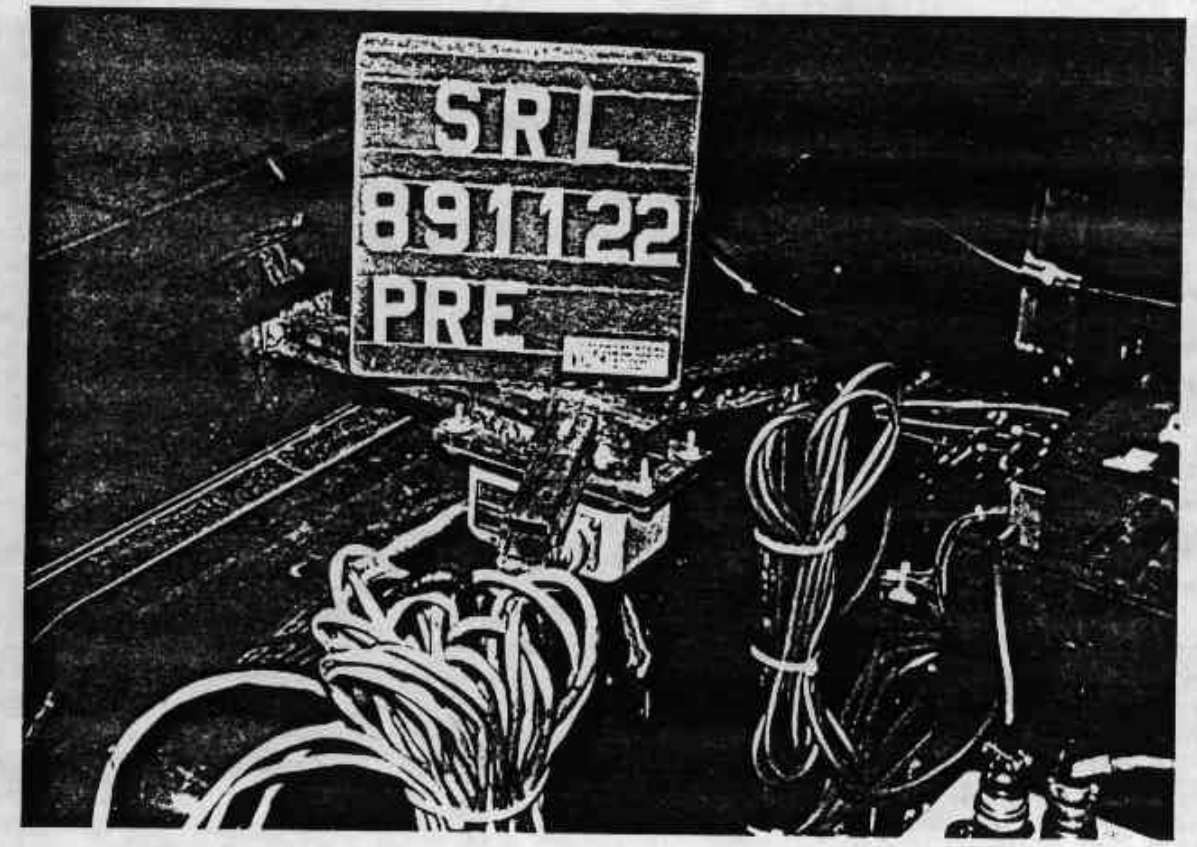


Figure A-10. PRE-TEST LEFT REAR SUSPENSION STRING POTENTIOMETER - VIEW 1

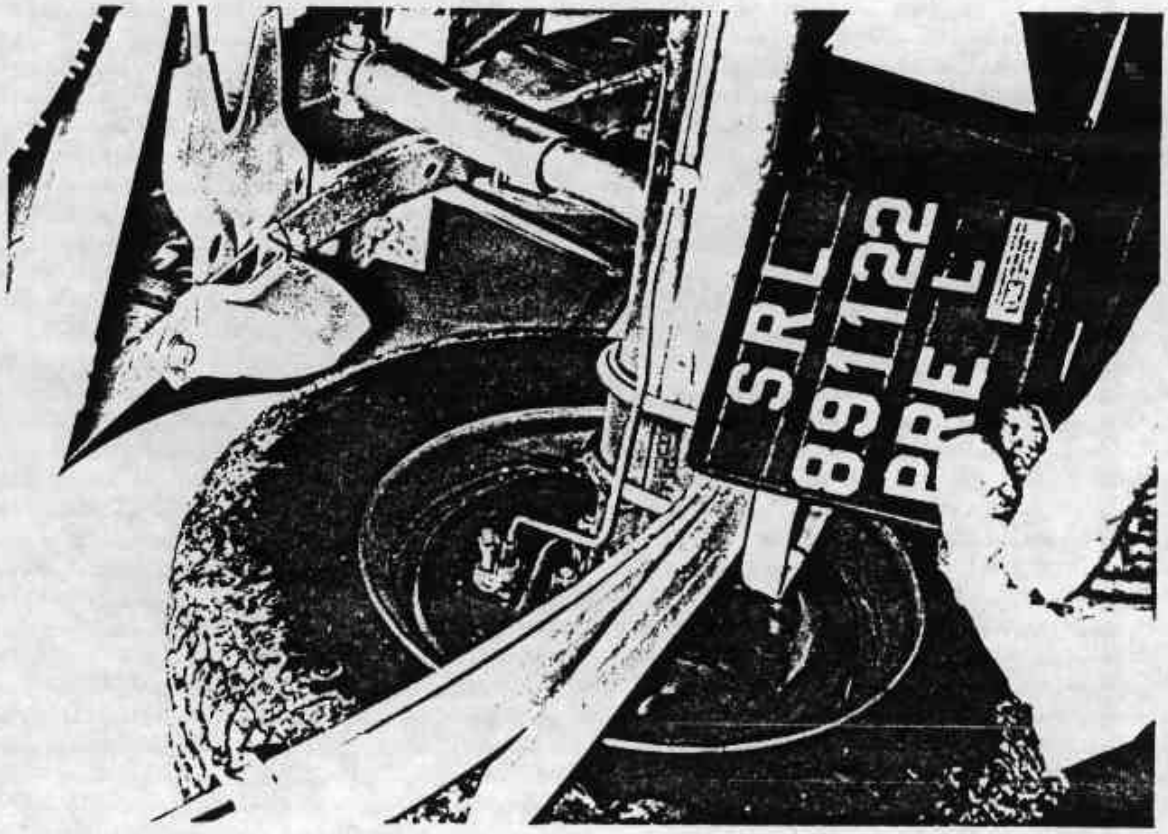


Figure A-11. PRE-TEST LEFT REAR SUSPENSION STRING POTENTIOMETER - VIEW 2

Figure A-12. PRE-TEST RIGHT REAR SUSPENSION STRING POTENTIOMETER - VIEW 1

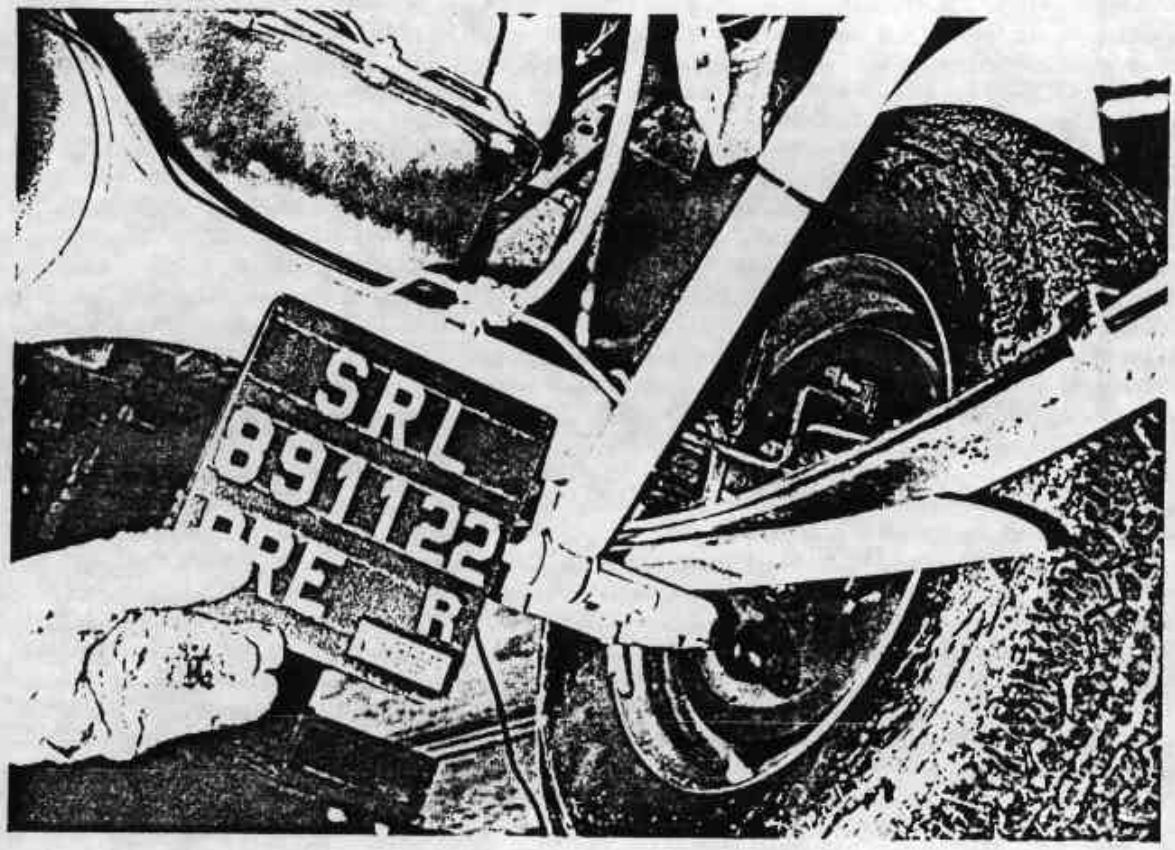


Figure A-13. PRE-TEST RIGHT REAR SUSPENSION STRING POTENTIOMETER - VIEW 2

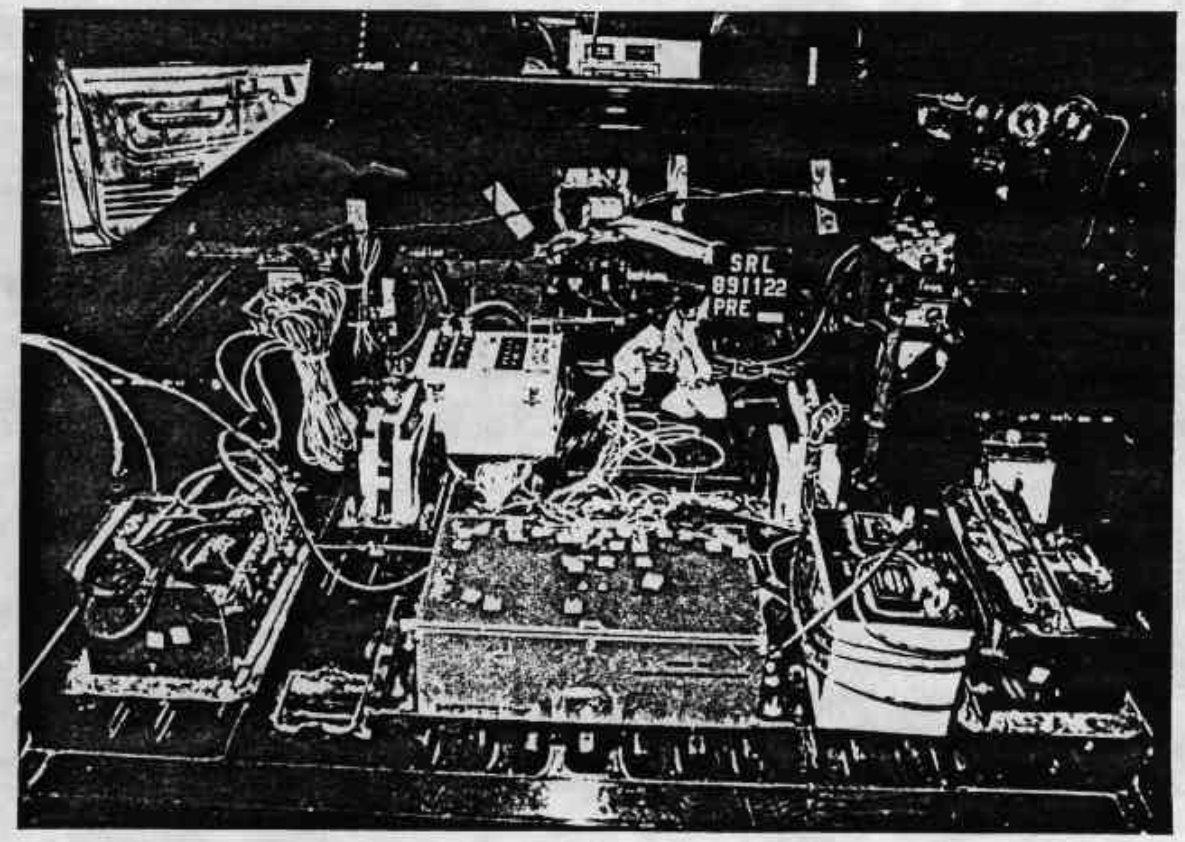


Figure A-14. PRE-TEST VEHICLE INSTRUMENTATION AND BALLAST LOCATION

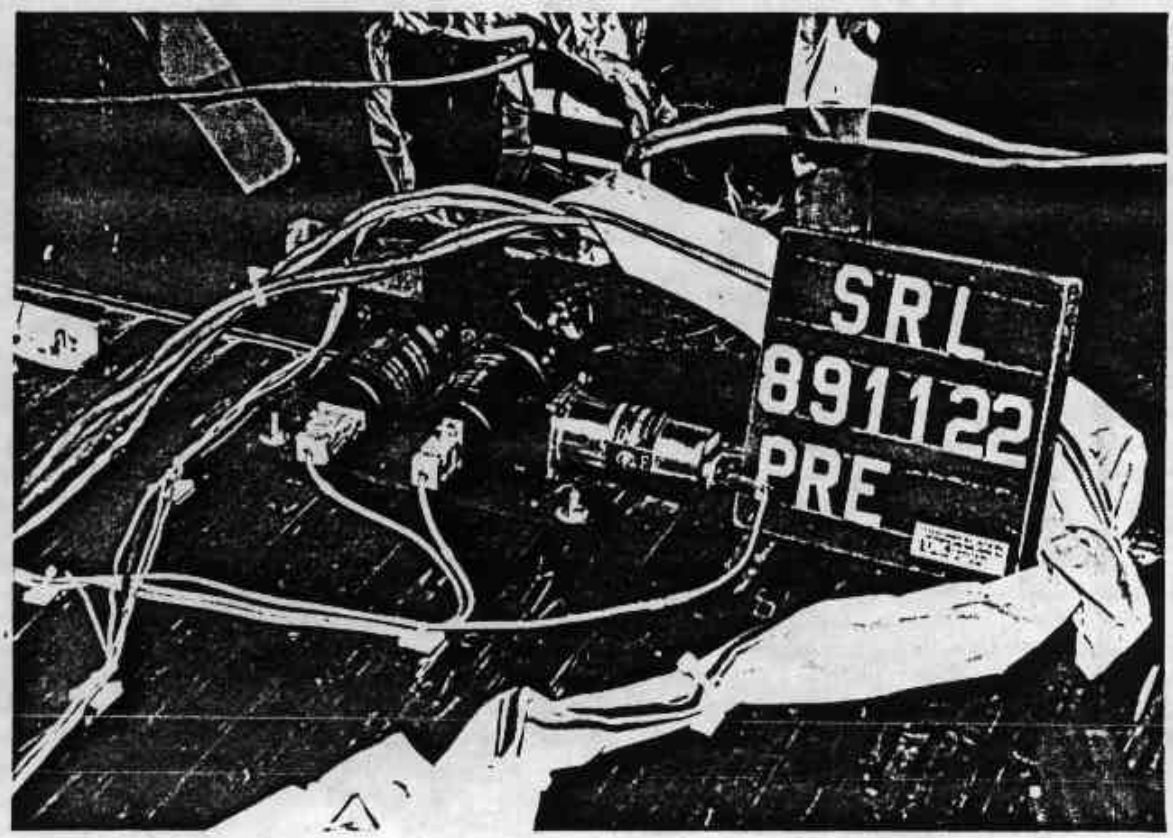


Figure A-15. PRE-TEST GYRO PLACEMENT VIEW

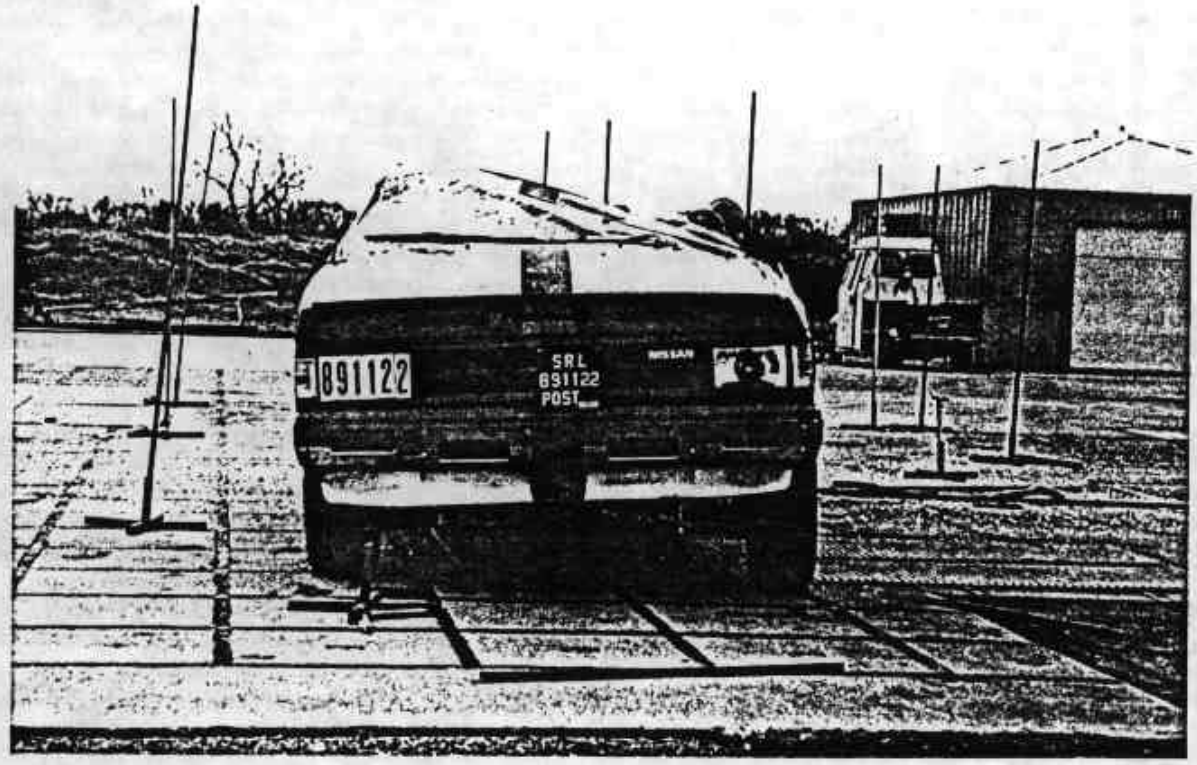


Figure A-16. POST-TEST OVERALL FRONT VIEW

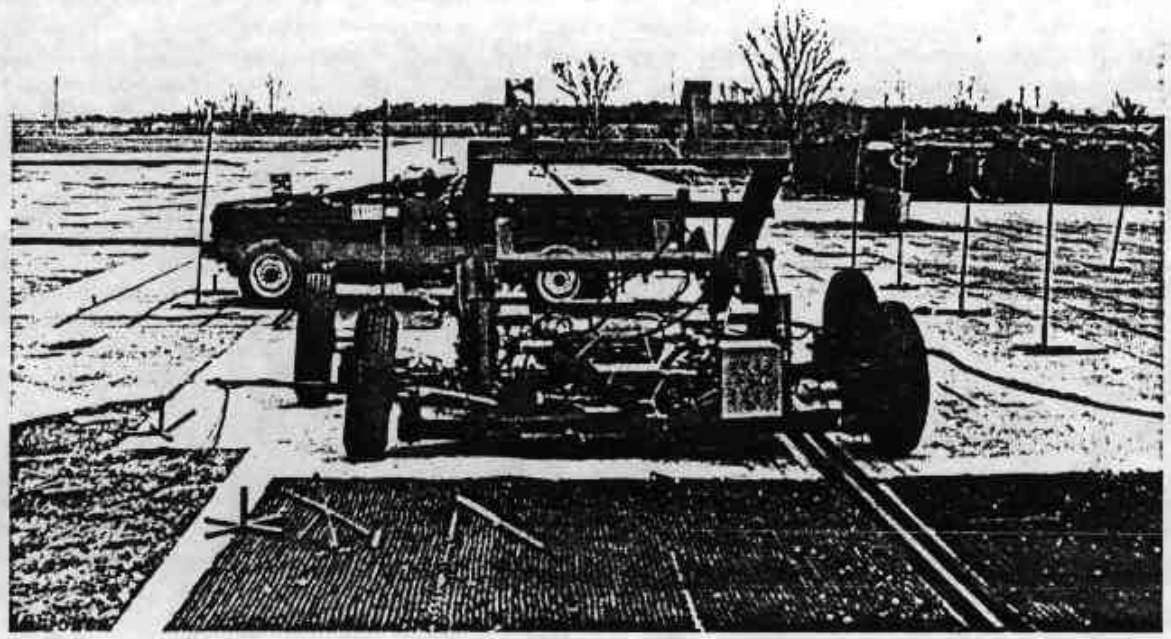


Figure A-17. POST-TEST OVERALL LEFT VIEW

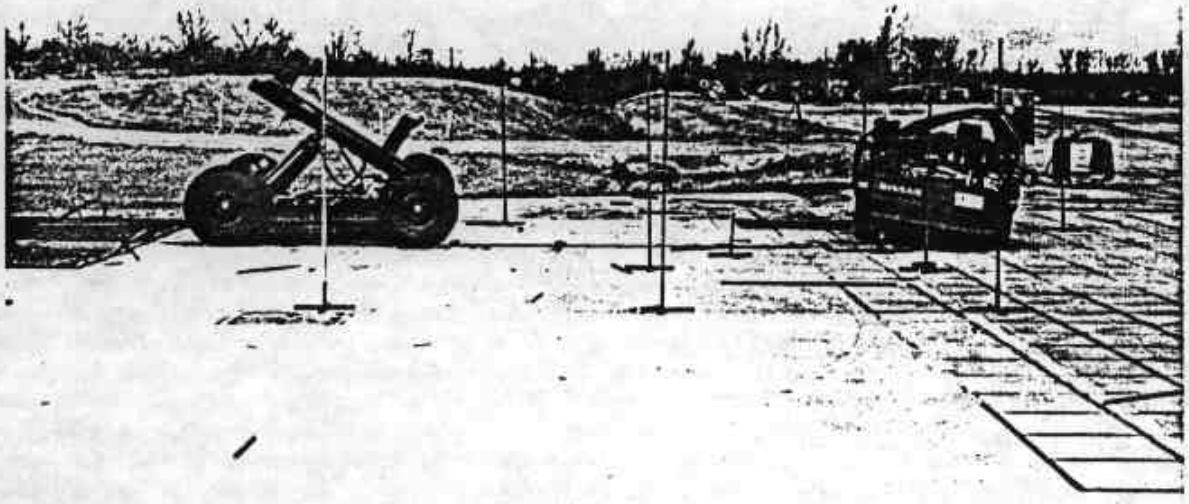


Figure A-18. POST-TEST OVERALL REAR - VIEW 1

Figure A-19. POST-TEST OVERALL REAR - VIEW 2

Figure A-20. POST-TEST OVERALL RIGHT VIEW

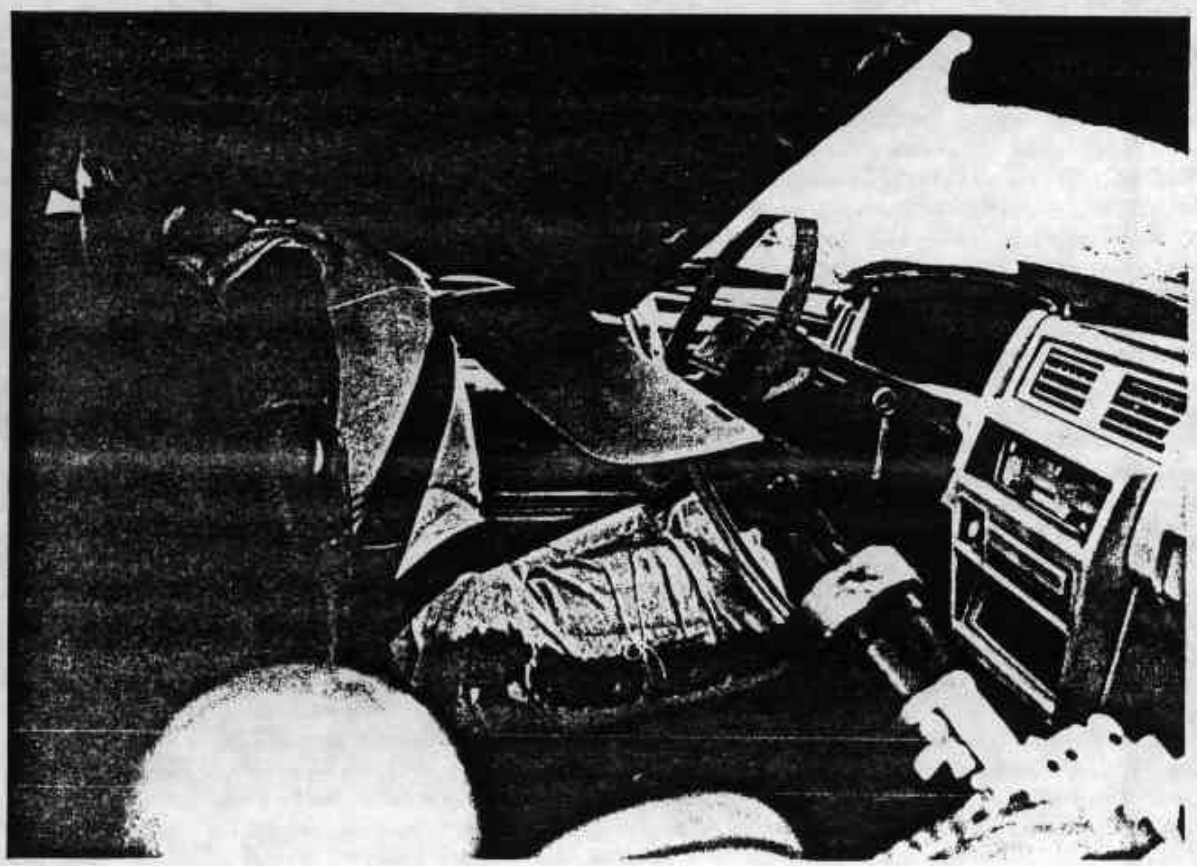


Figure A-21. POST-TEST DUMMY AND VEHICLE - VIEW 1

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

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

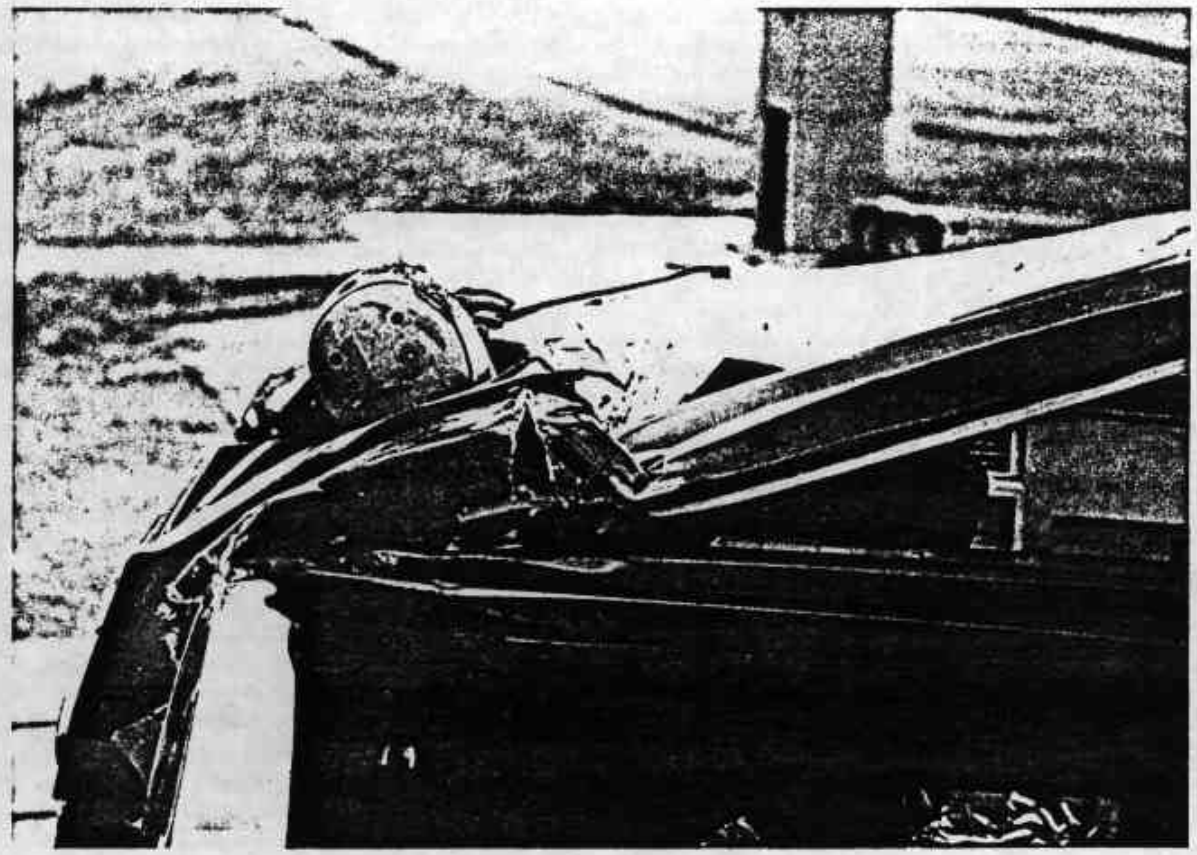


Figure A-24. POST-TEST DUMMY AND VEHICLE - VIEW 4

Figure A-25. POST-TEST DUMMY AND VEHICLE - VIEW 5

Figure A-26. POST-TEST DUMMY AND VEHICLE - VIEW 6

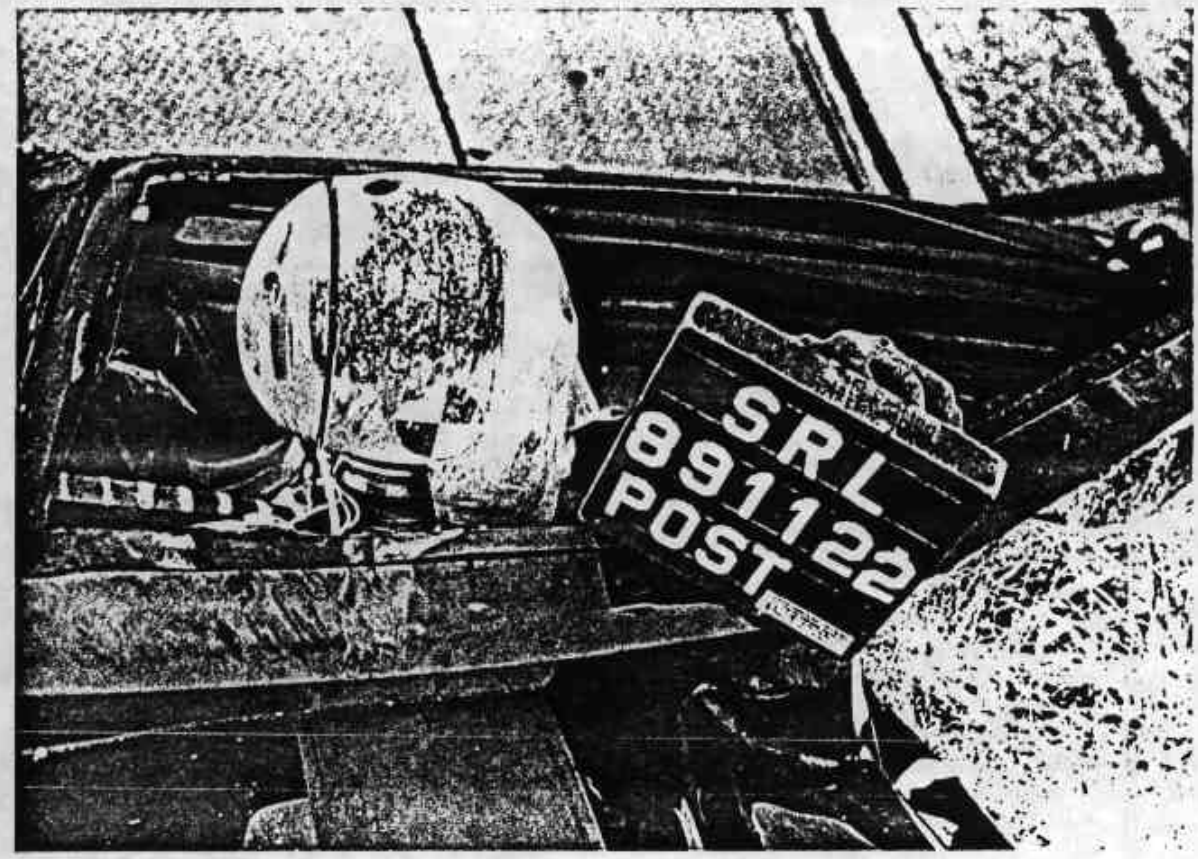
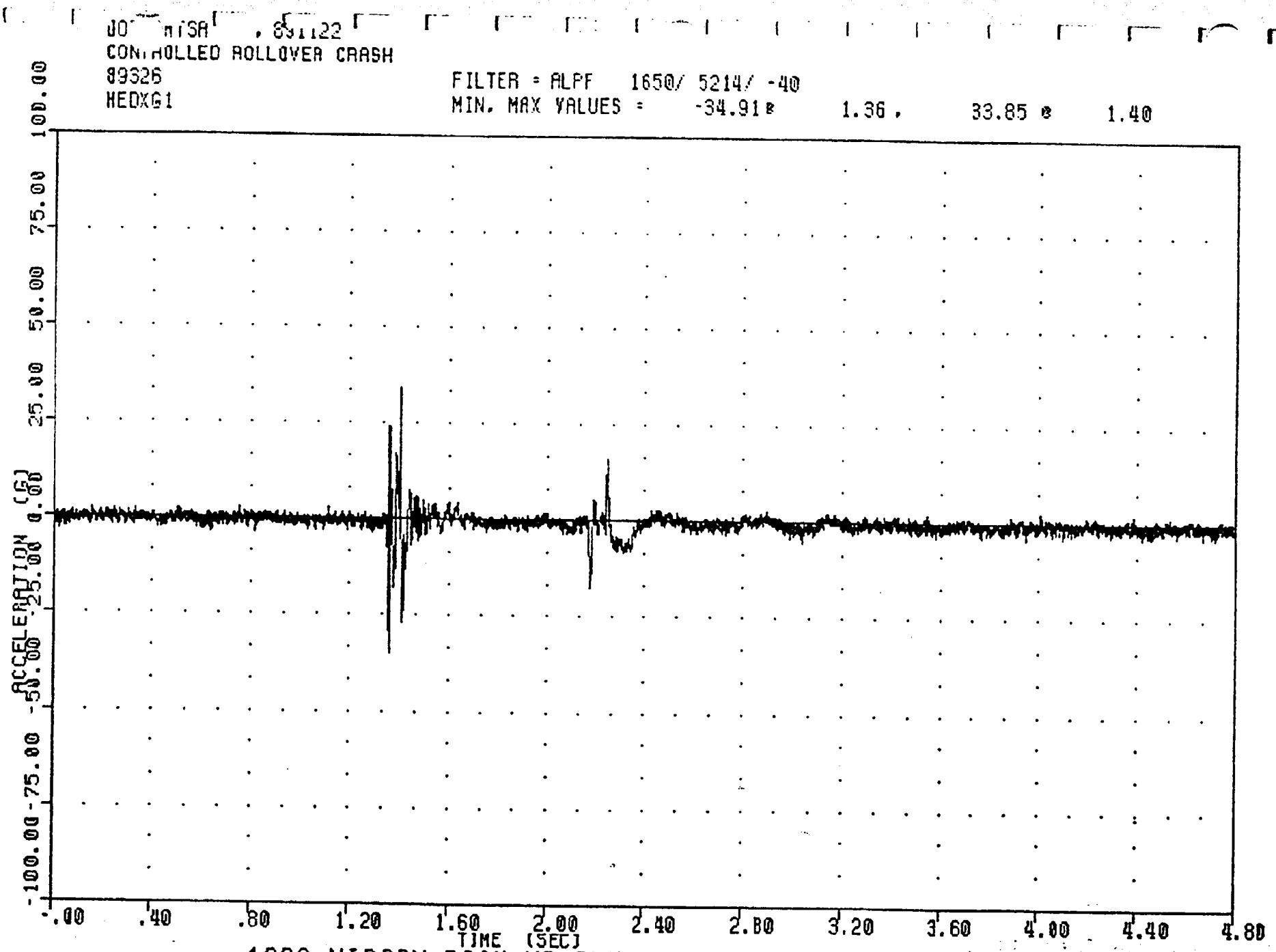


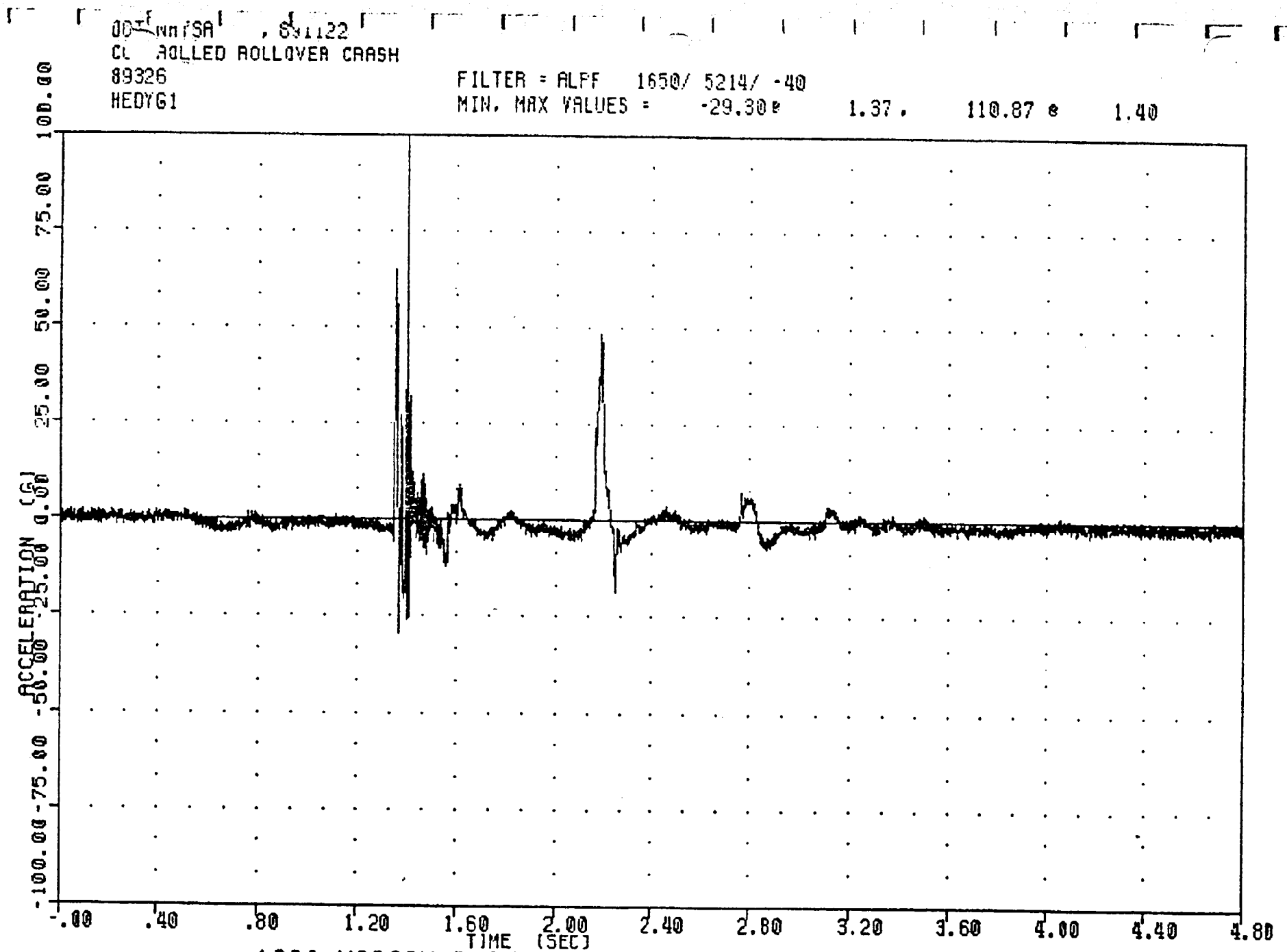
Figure A-27. POST-TEST DUMMY AND VEHICLE - VIEW 7

APPENDIX B

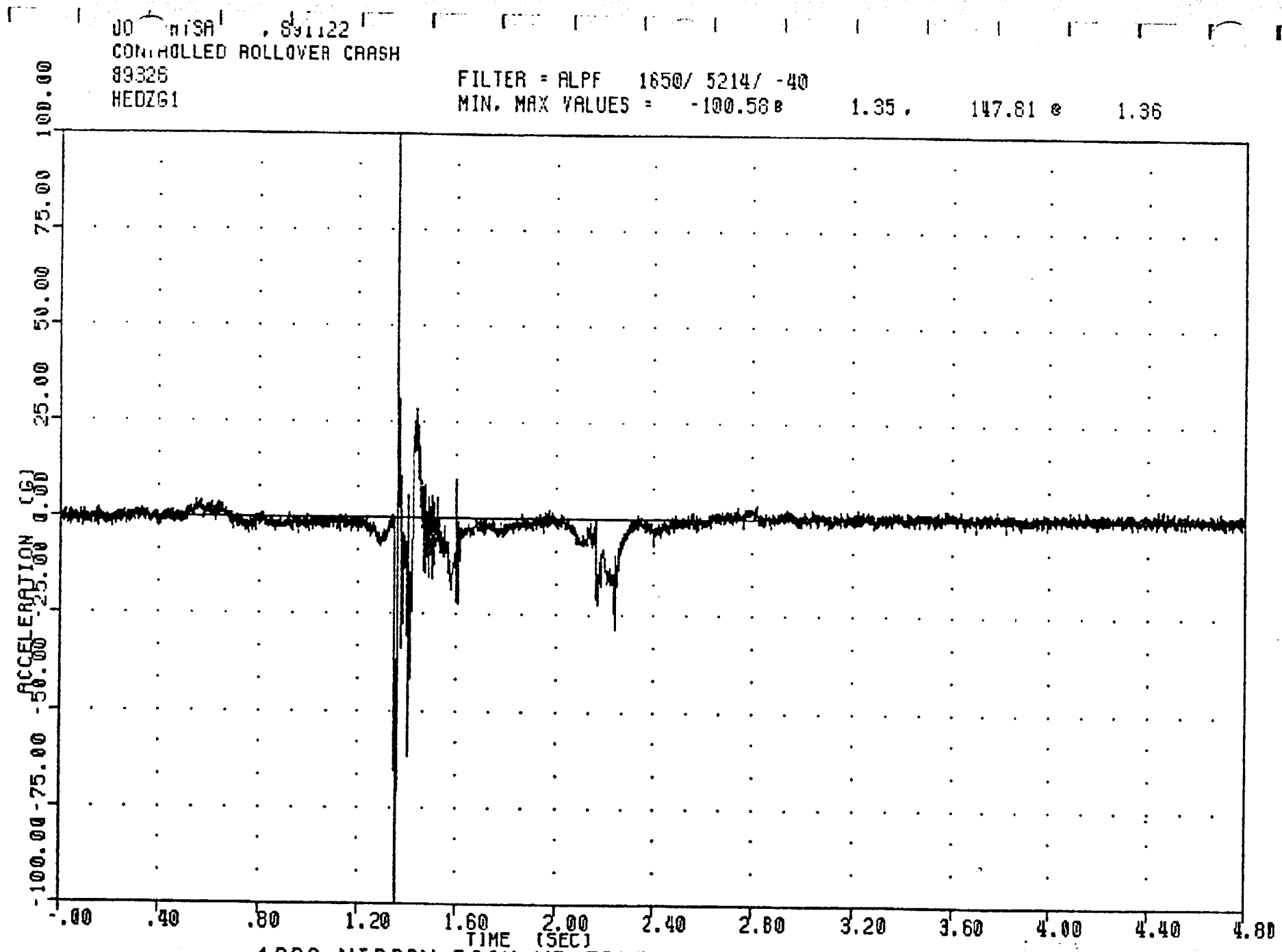
DATA PLOT PRESENTATION



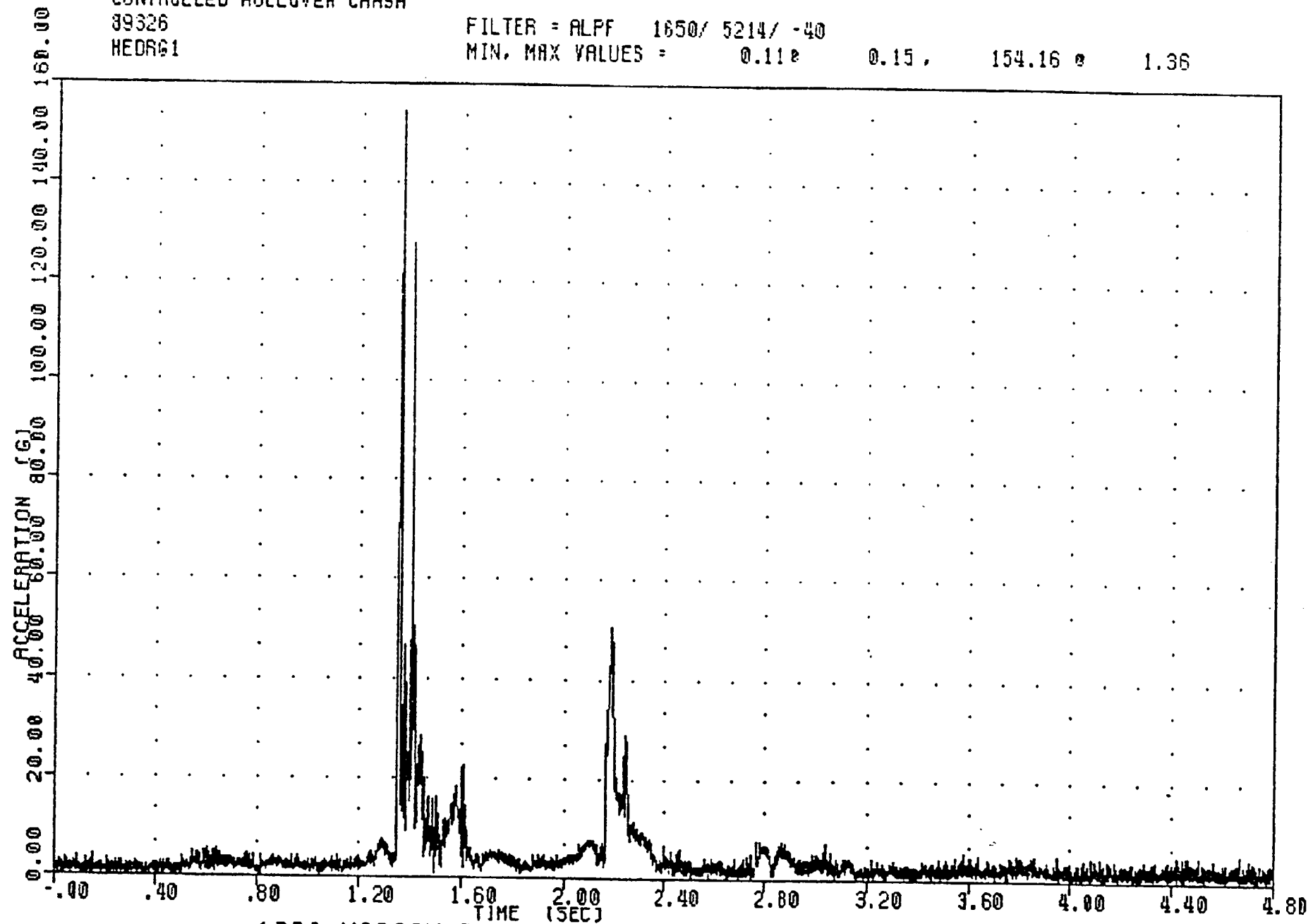
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER HEAD X AXIS ACCELERATION



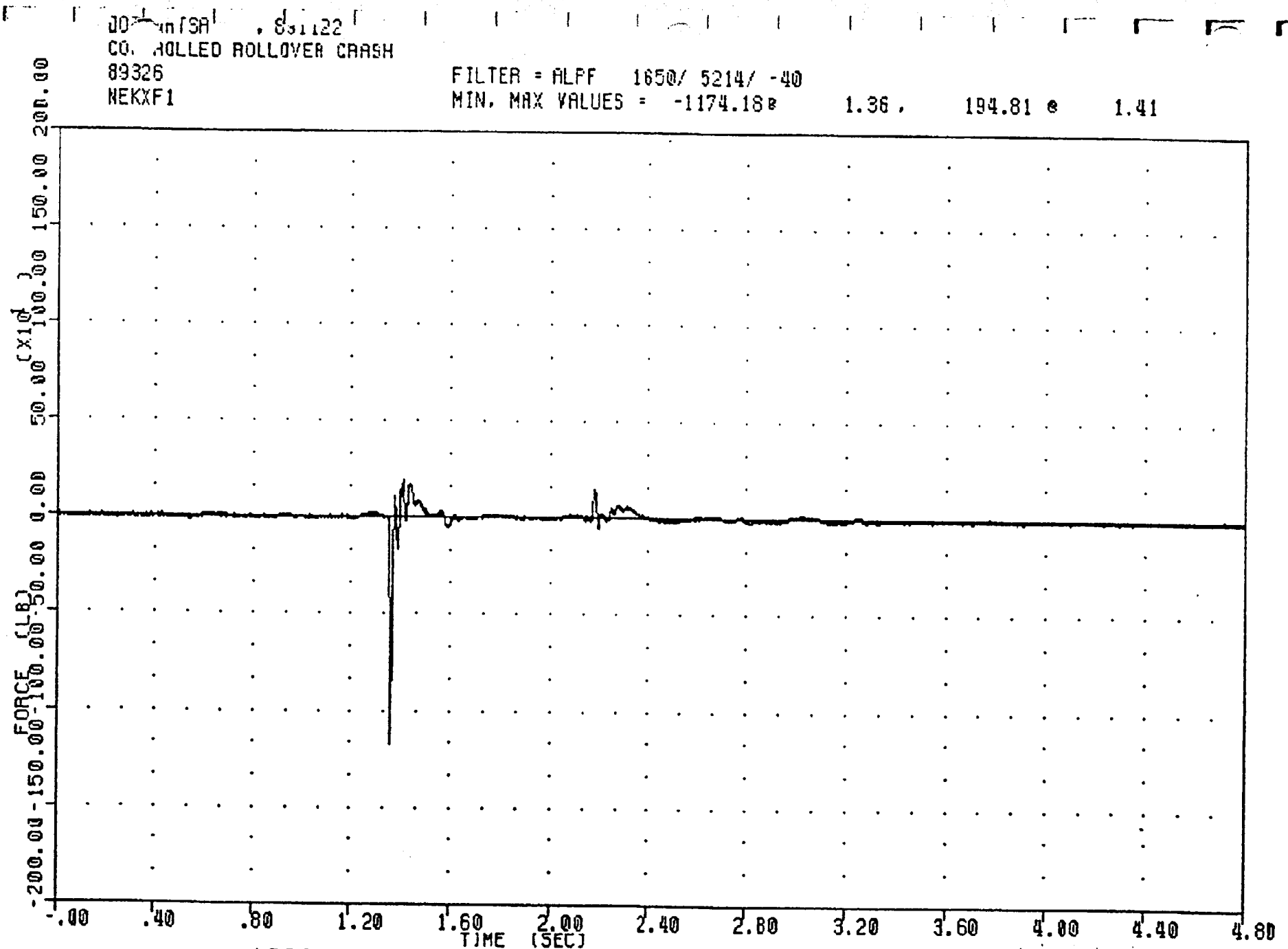
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER HEAD Y AXIS ACCELERATION



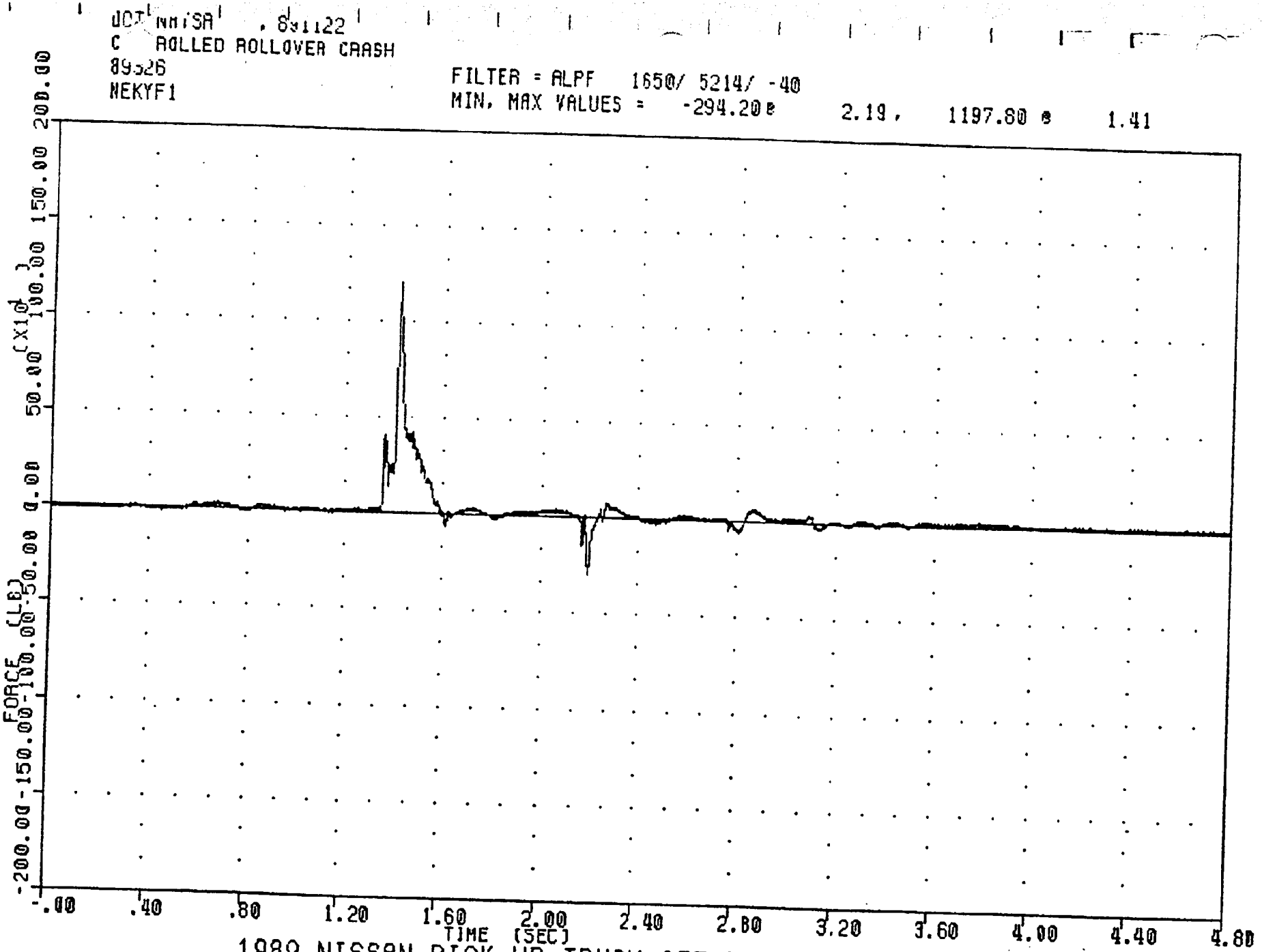
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER HEAD Z AXIS ACCELERATION



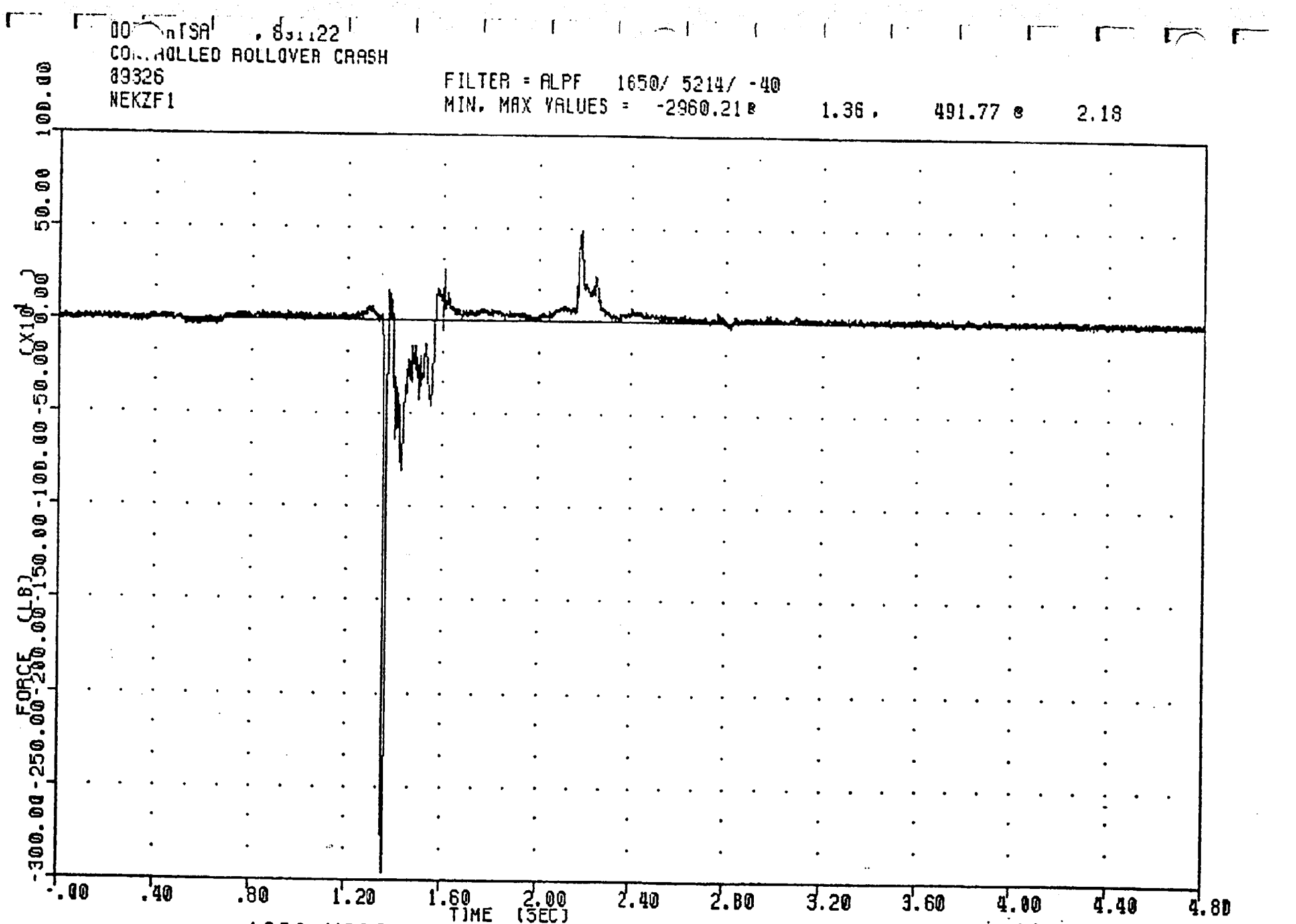
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER HEAD RESULTANT ACCELERATION



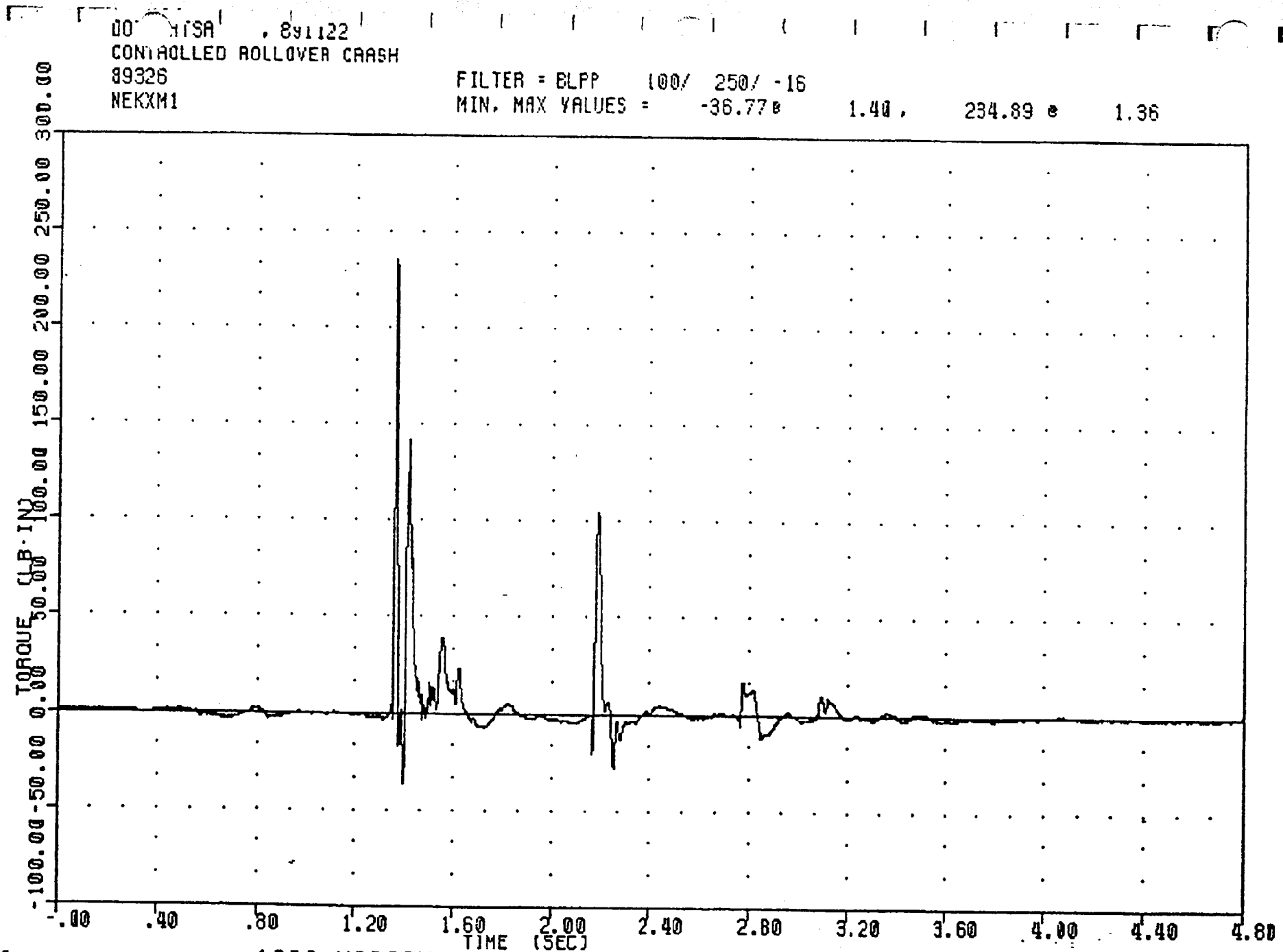
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER NECK SHEAR FORCE X AXIS



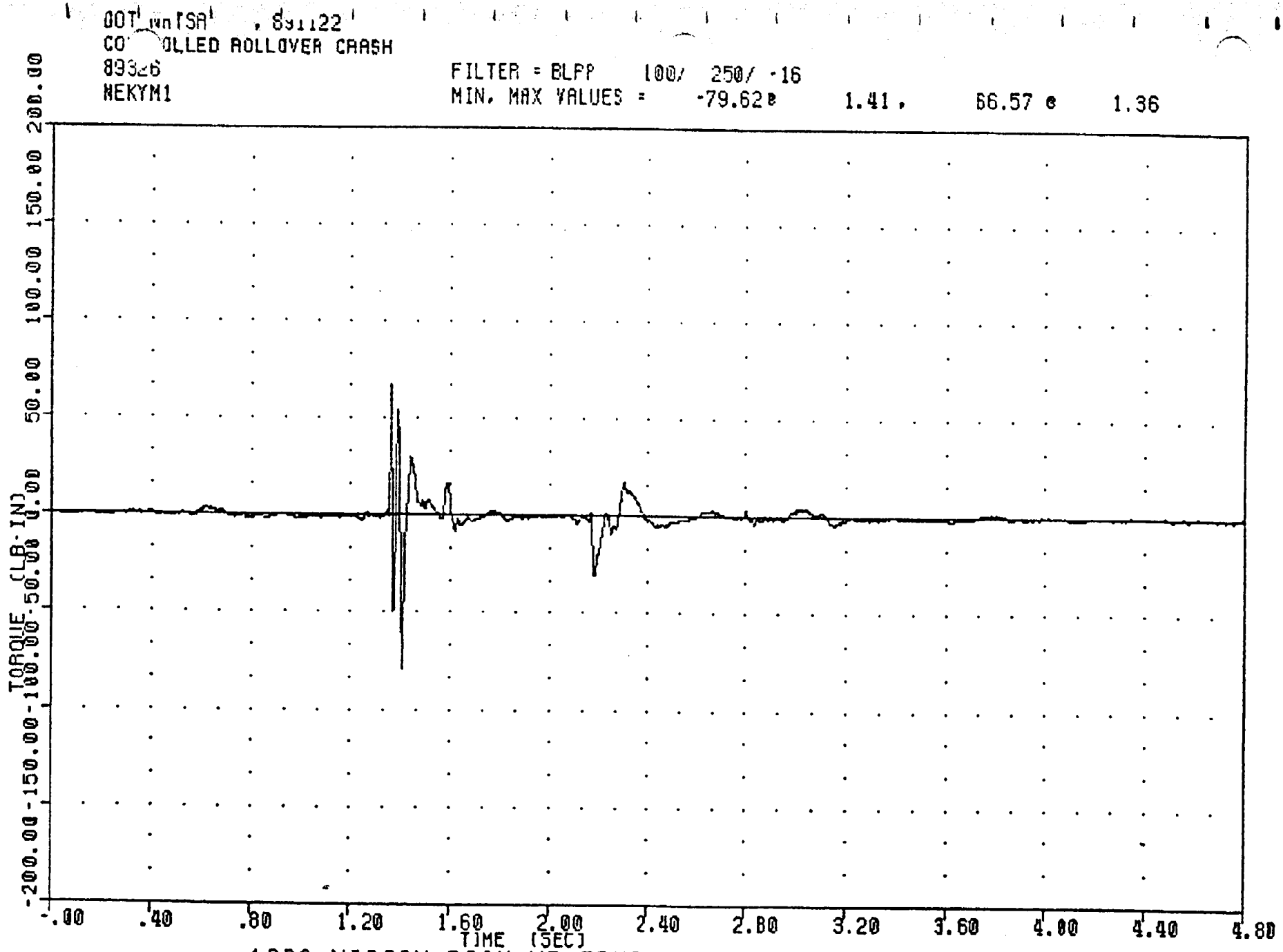
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER NECK SHEAR FORCE Y AXIS



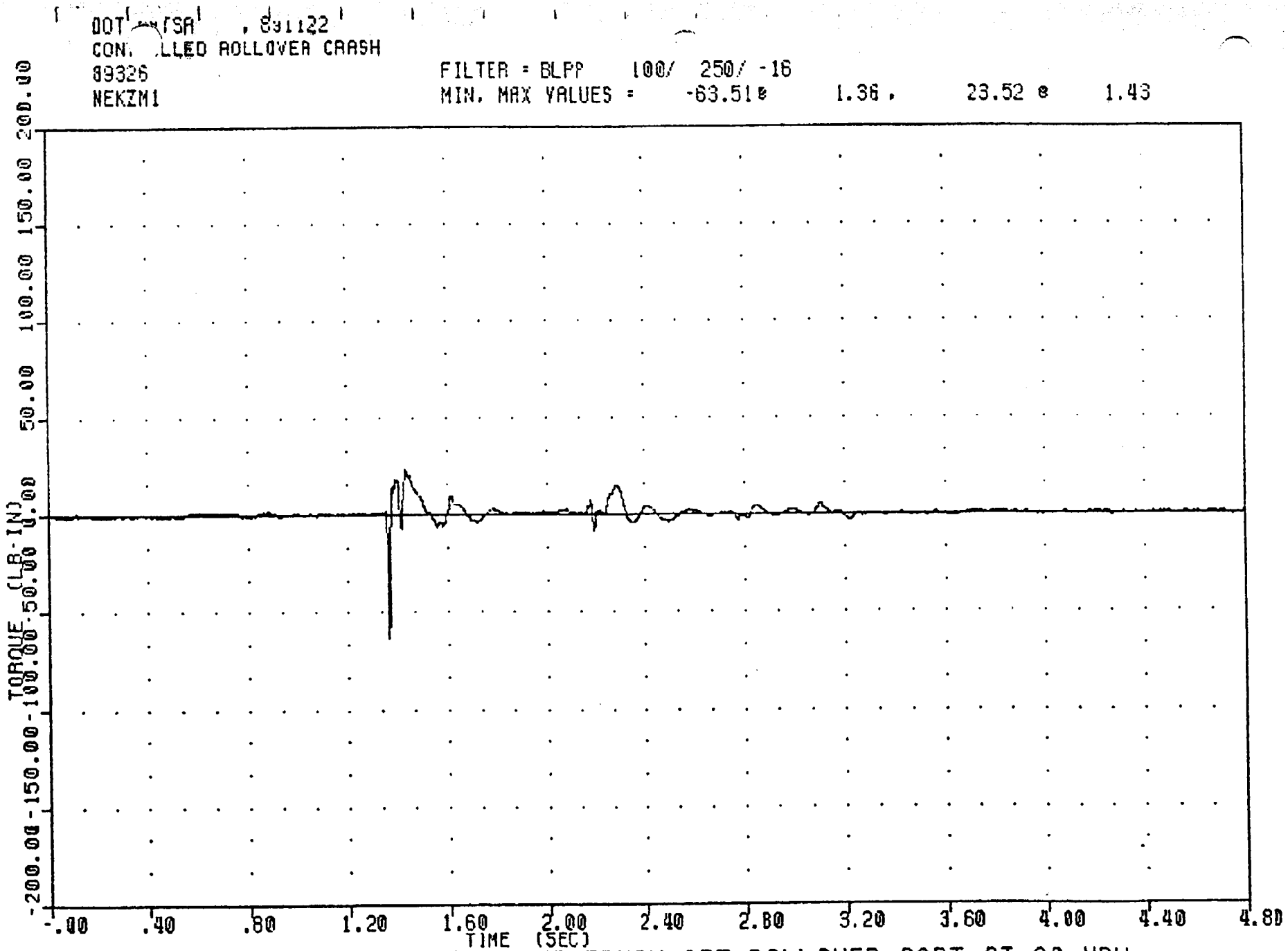
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER NECK AXIAL FORCE Z AXIS



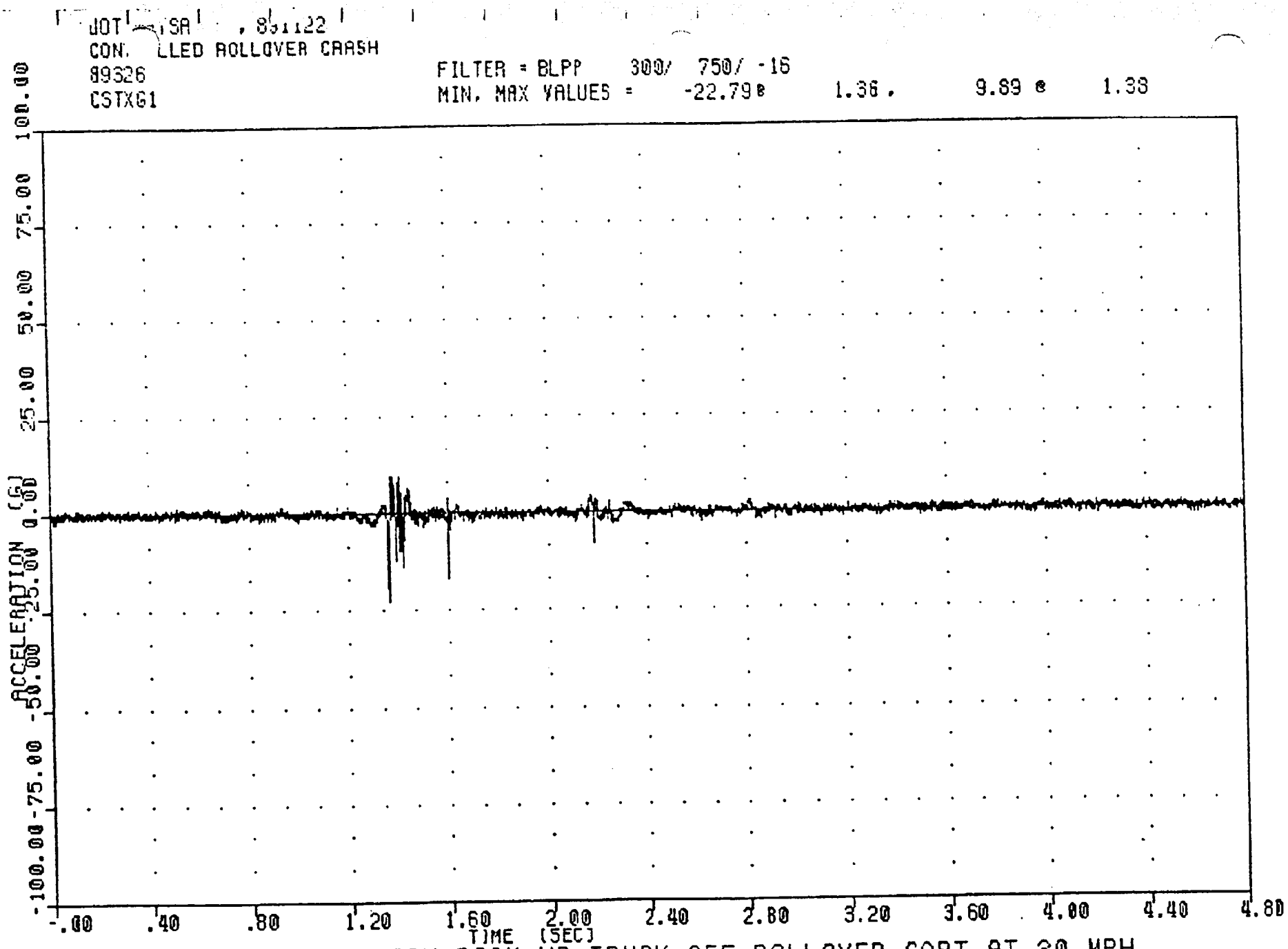
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER NECK MOMENT ABOUT X AXIS



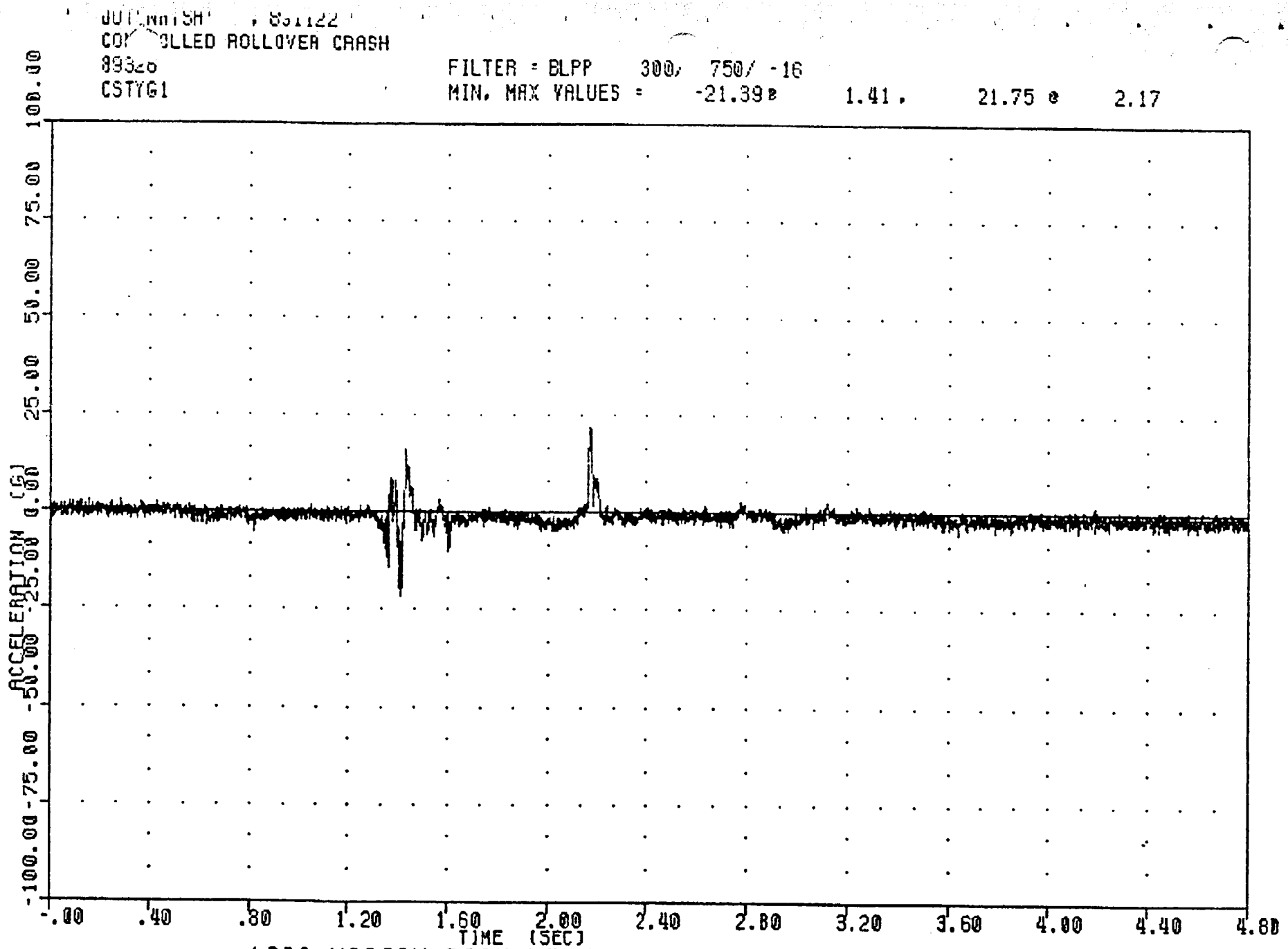
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER NECK MOMENT ABOUT Y AXIS



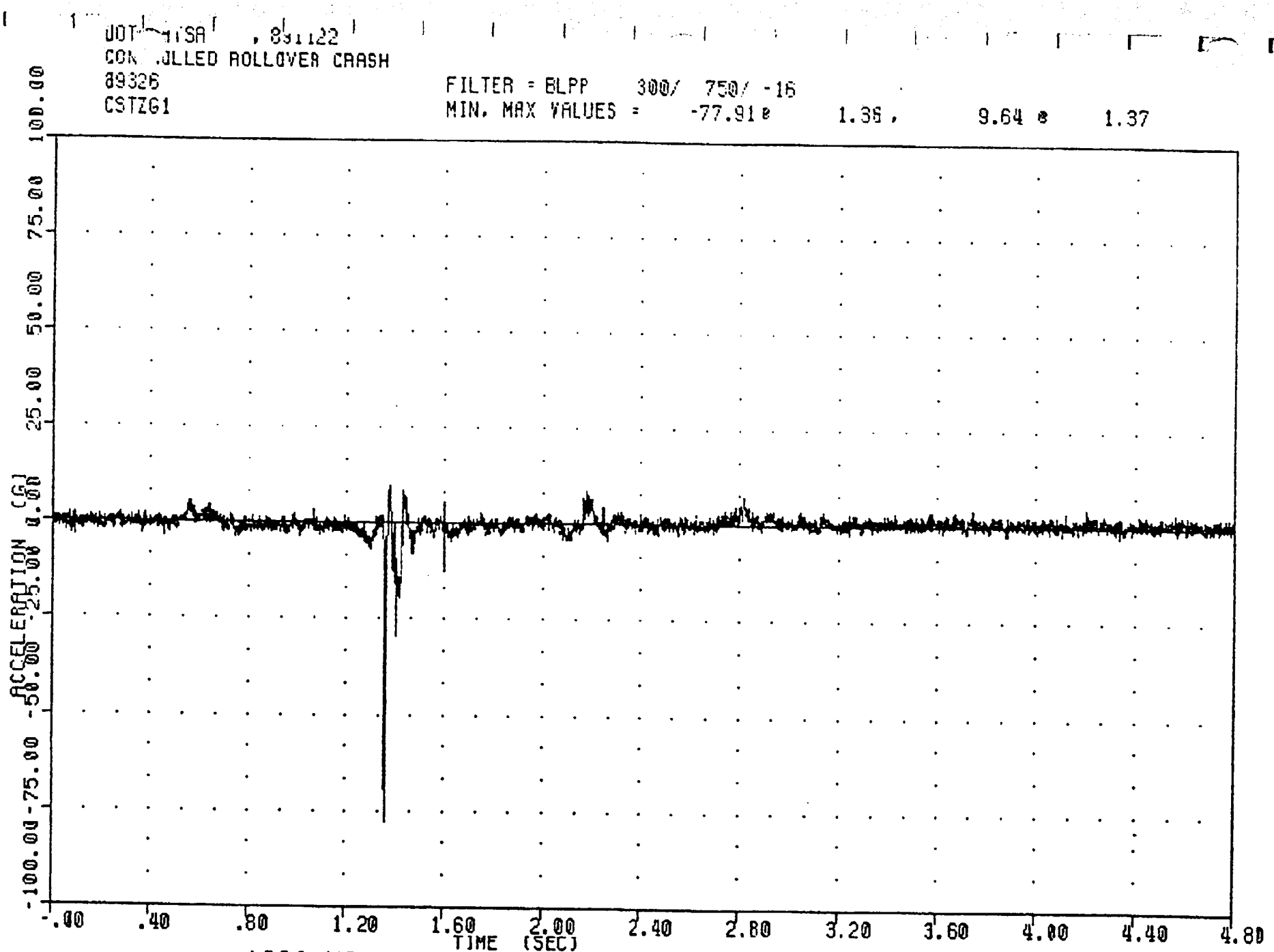
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER NECK MOMENT ABOUT Z AXIS



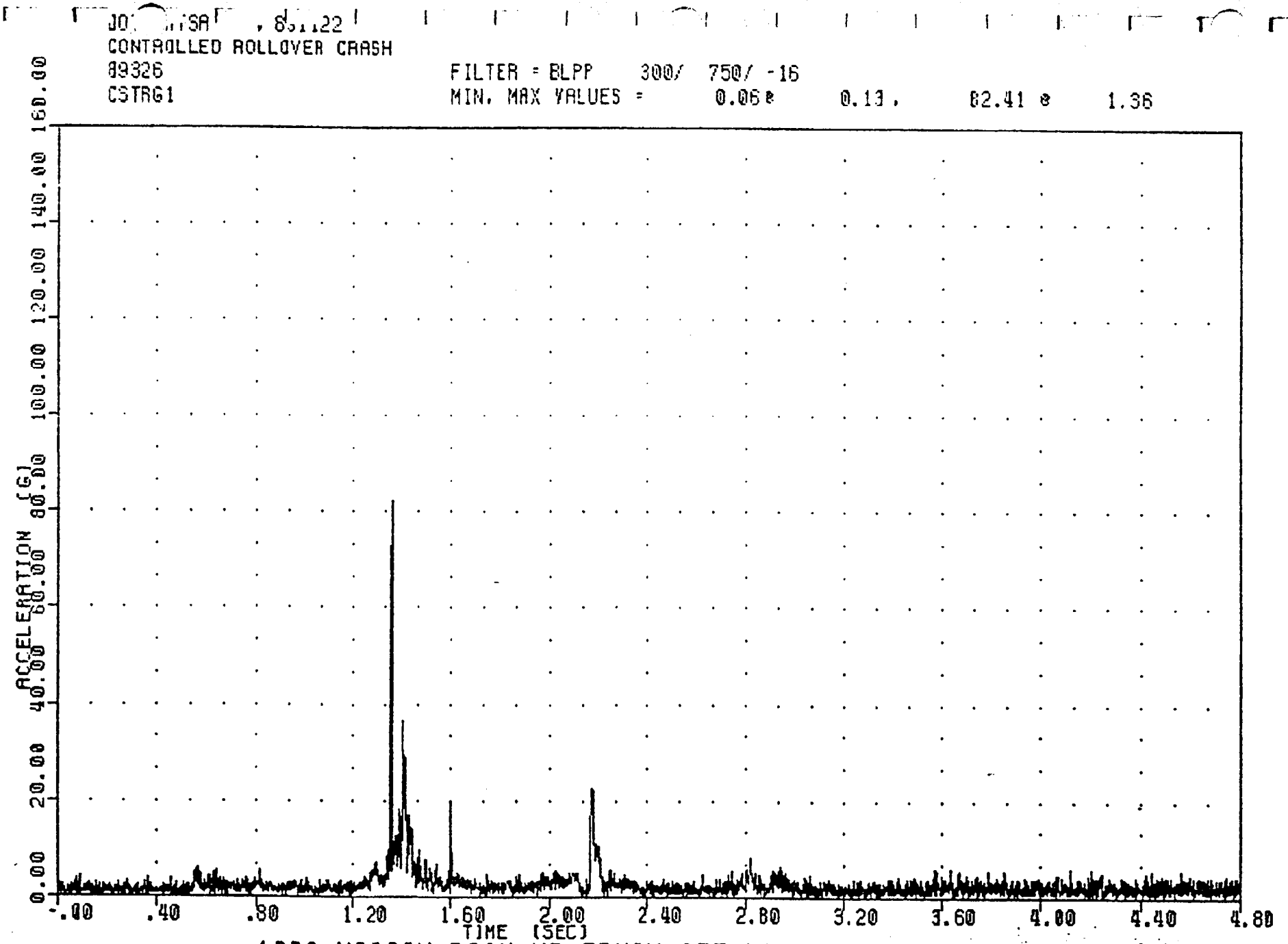
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER CHEST X AXIS ACCELERATION



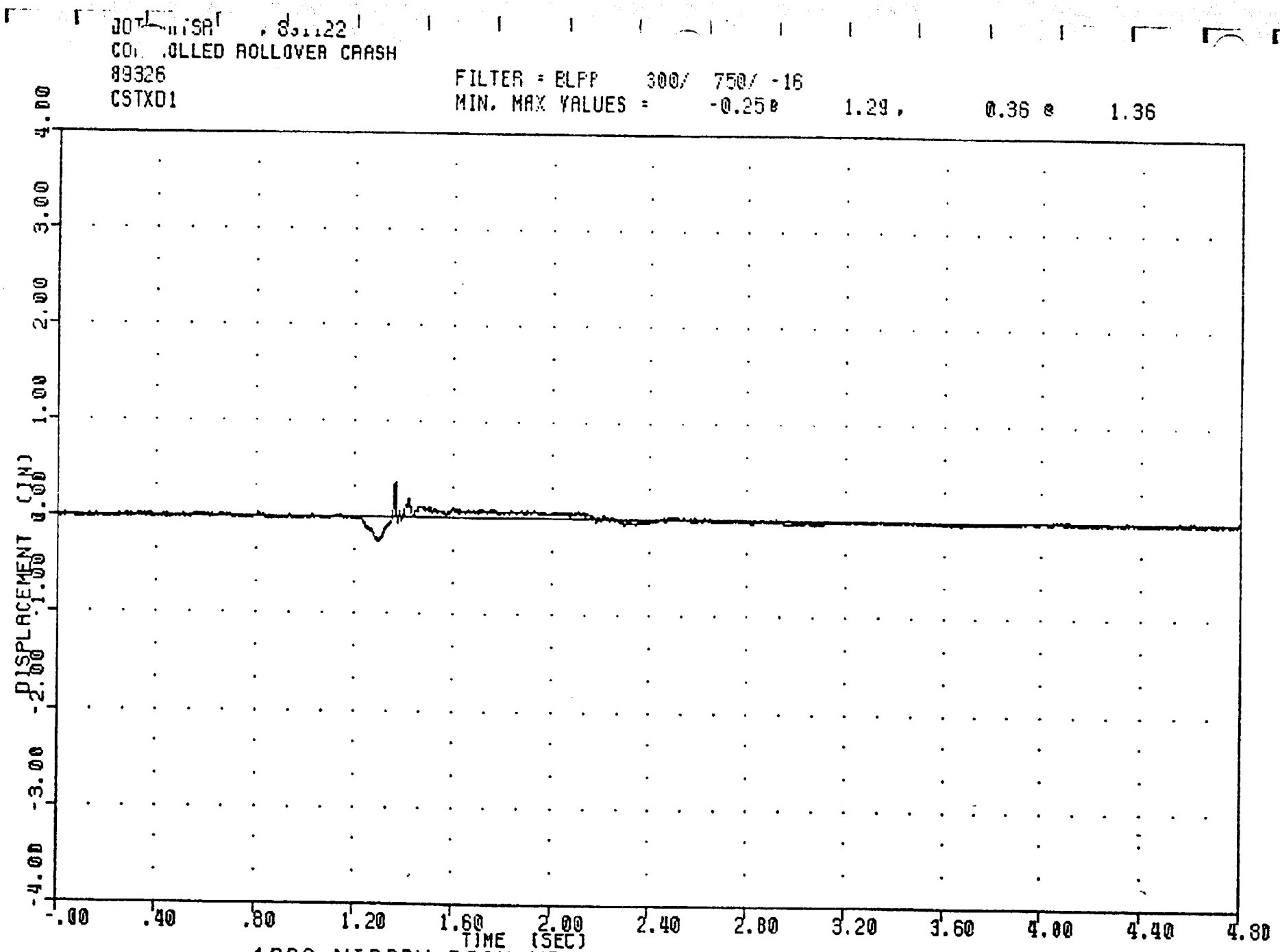
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER CHEST Y AXIS ACCELERATION



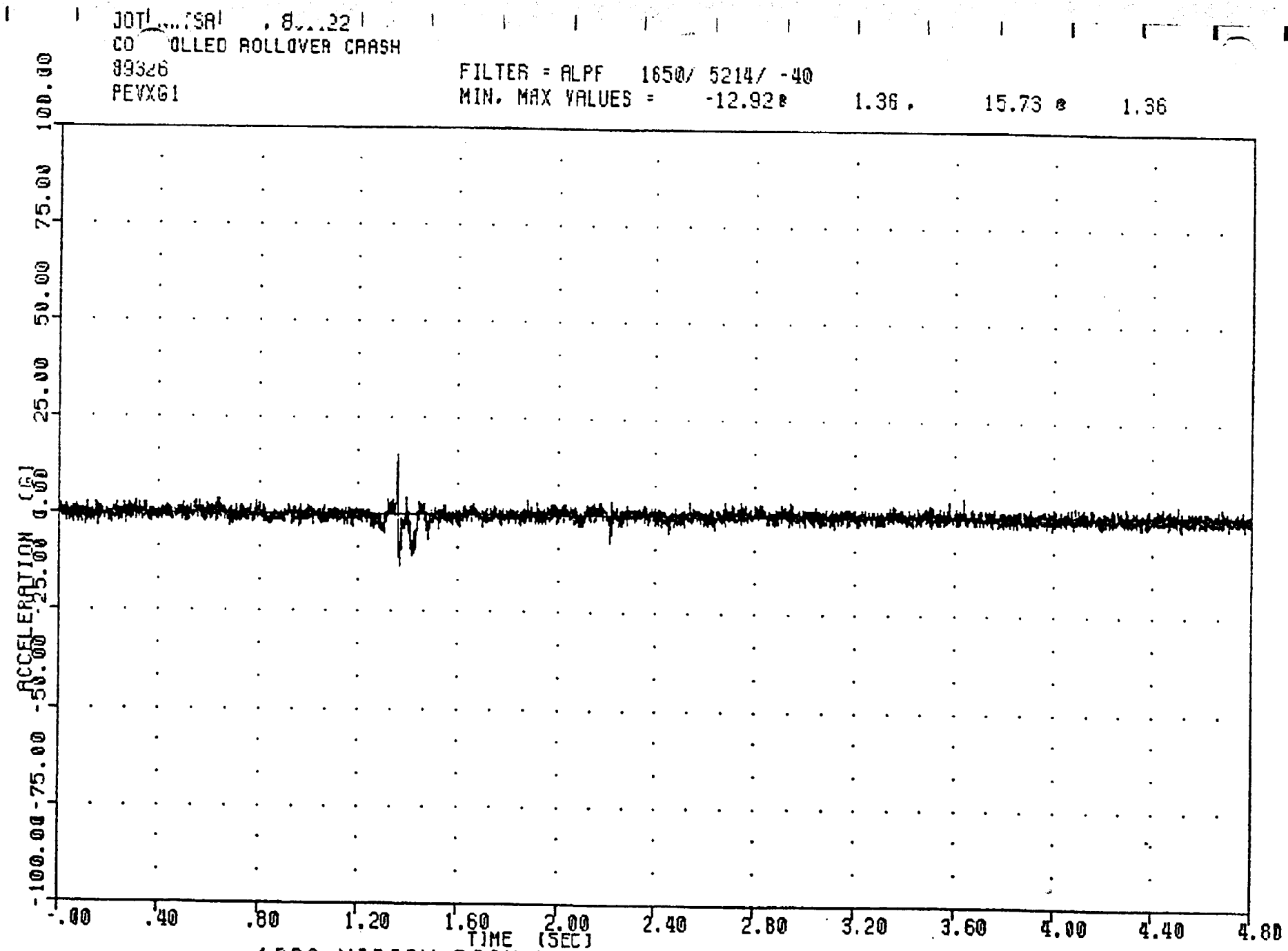
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER CHEST Z AXIS ACCELERATION



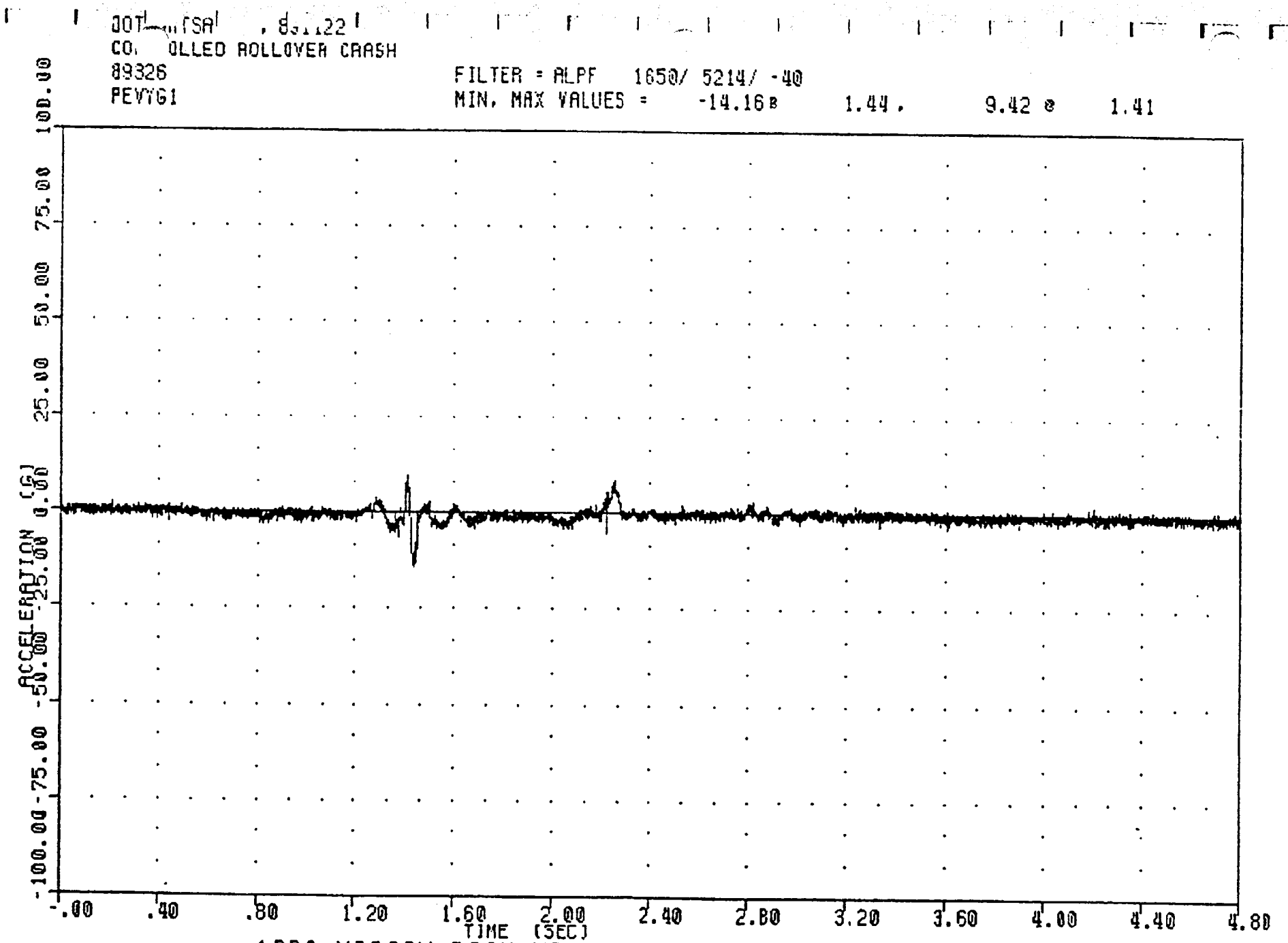
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER CHEST RESULTANT ACCELERATION



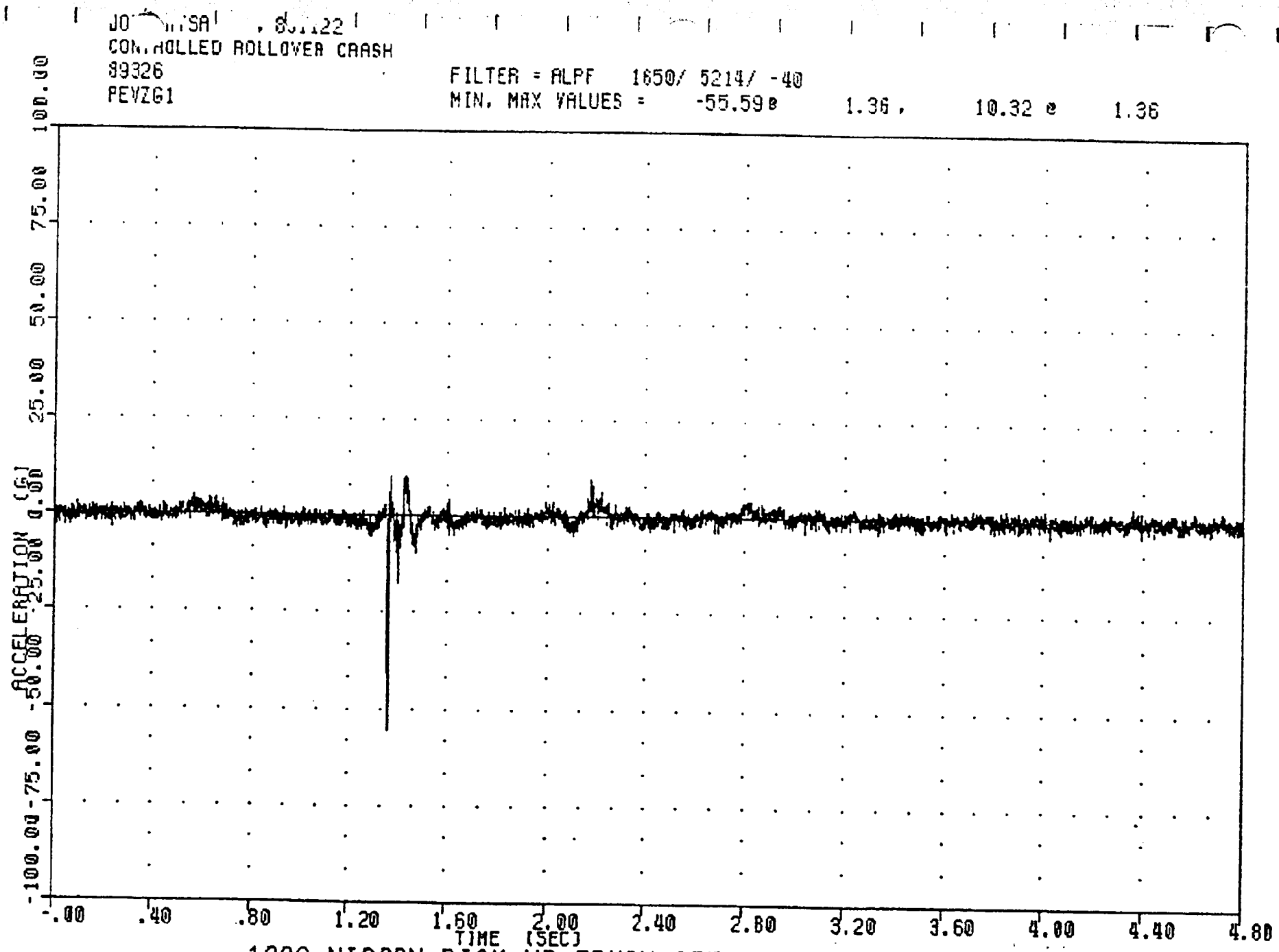
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER CHEST X AXIS DISPLACEMENT



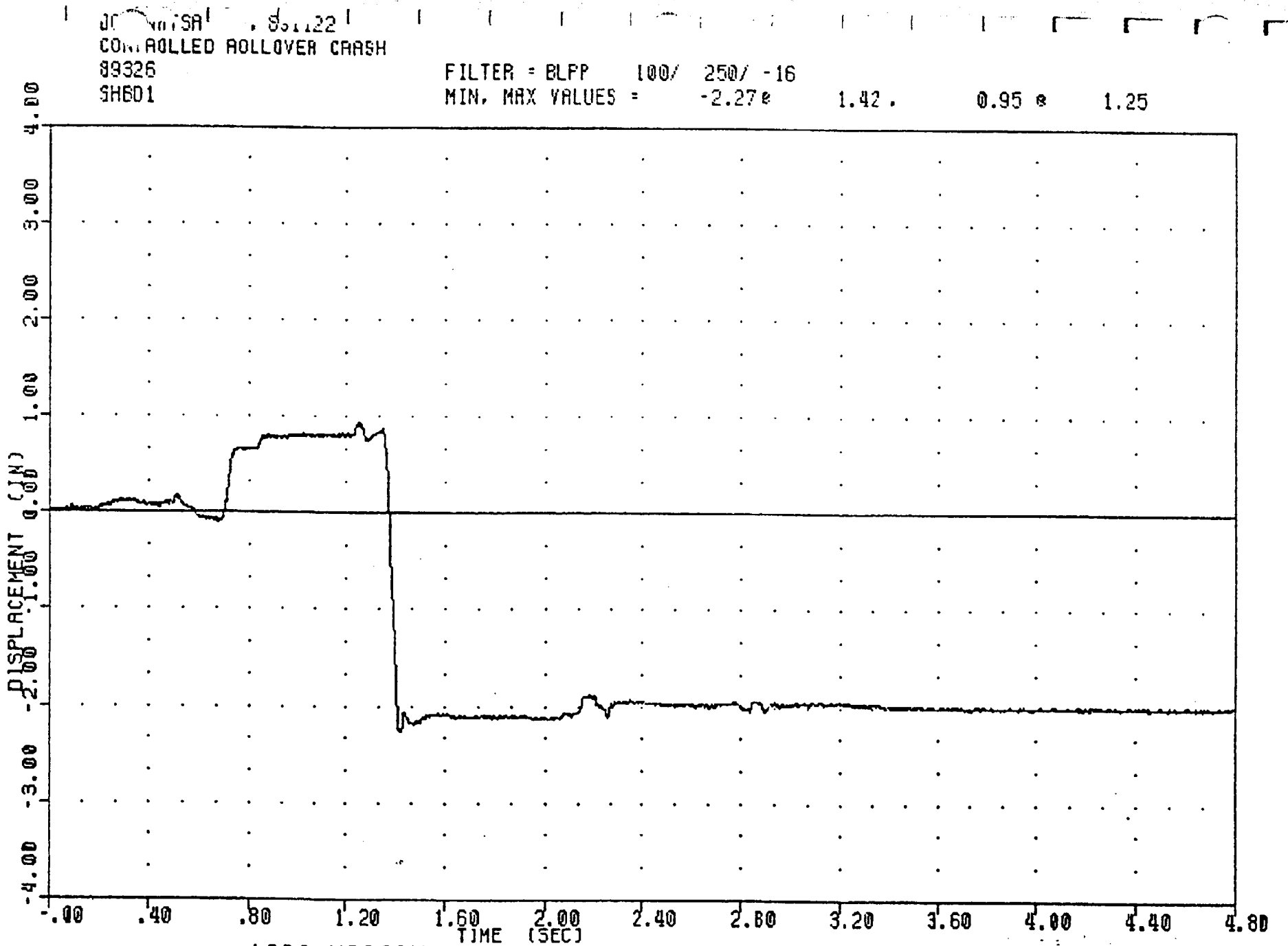
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER PELVIS X AXIS ACCELERATION



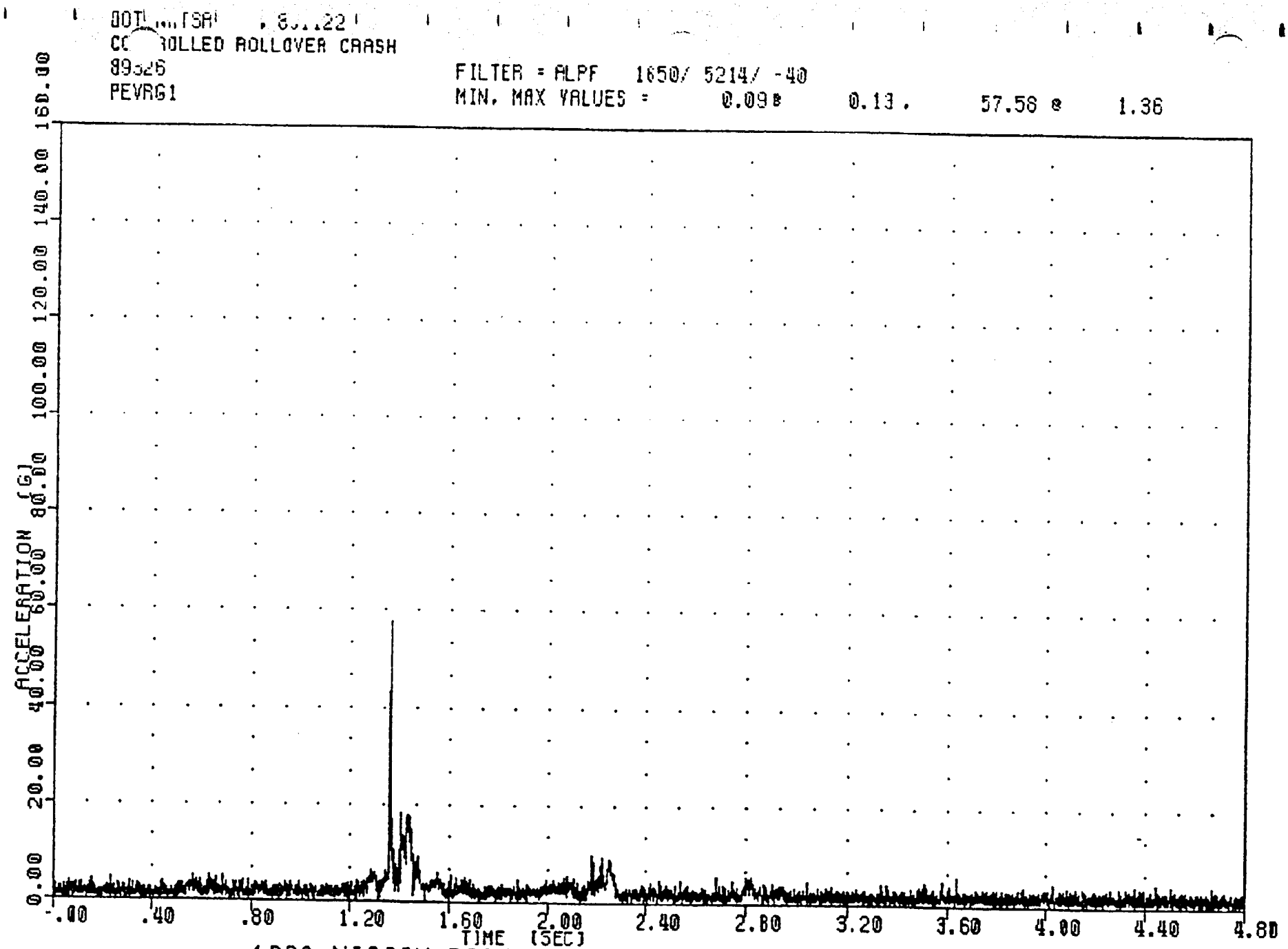
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER PELVIS Y AXIS ACCELERATION



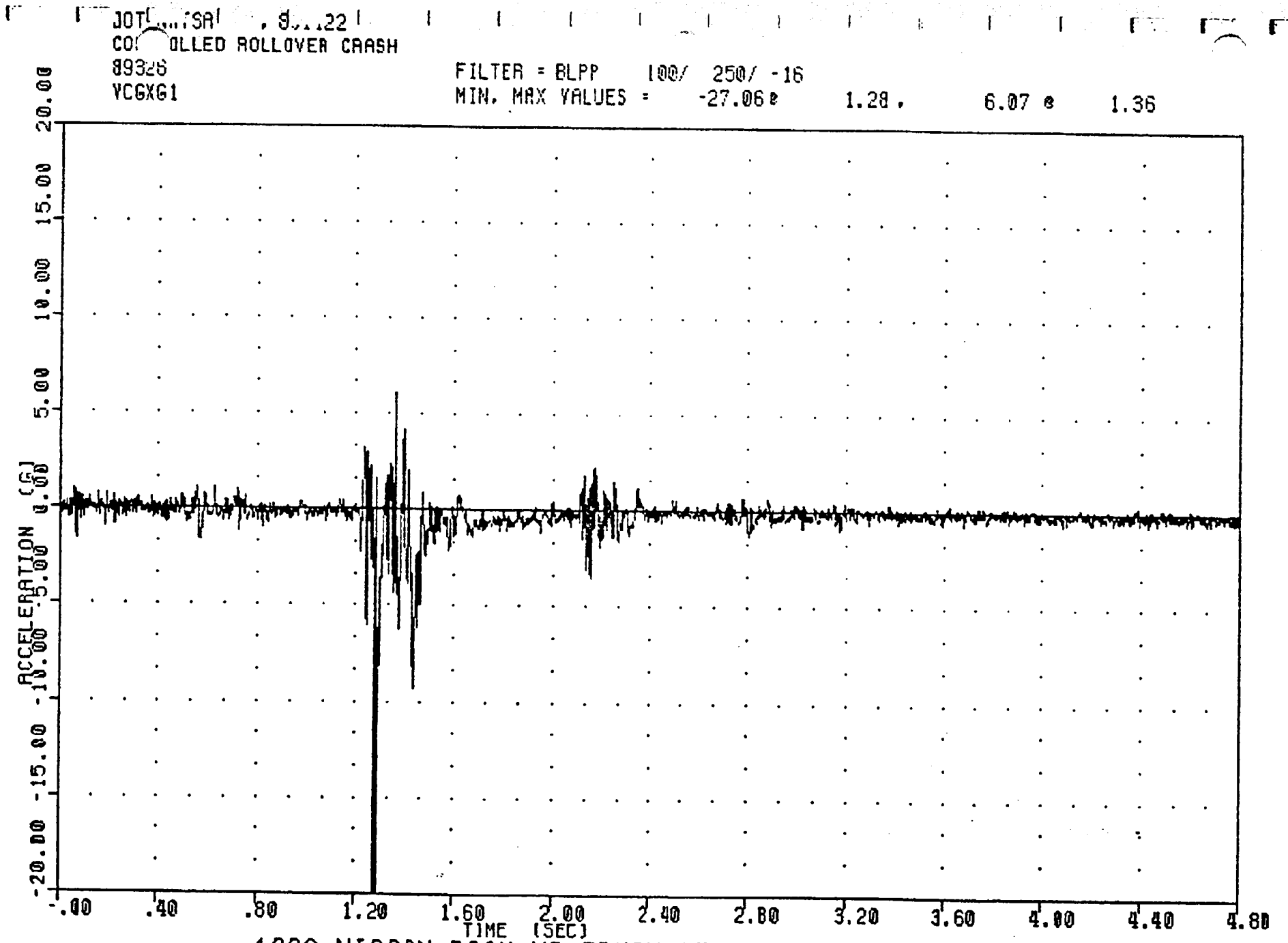
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER PELVIS Z AXIS ACCELERATION



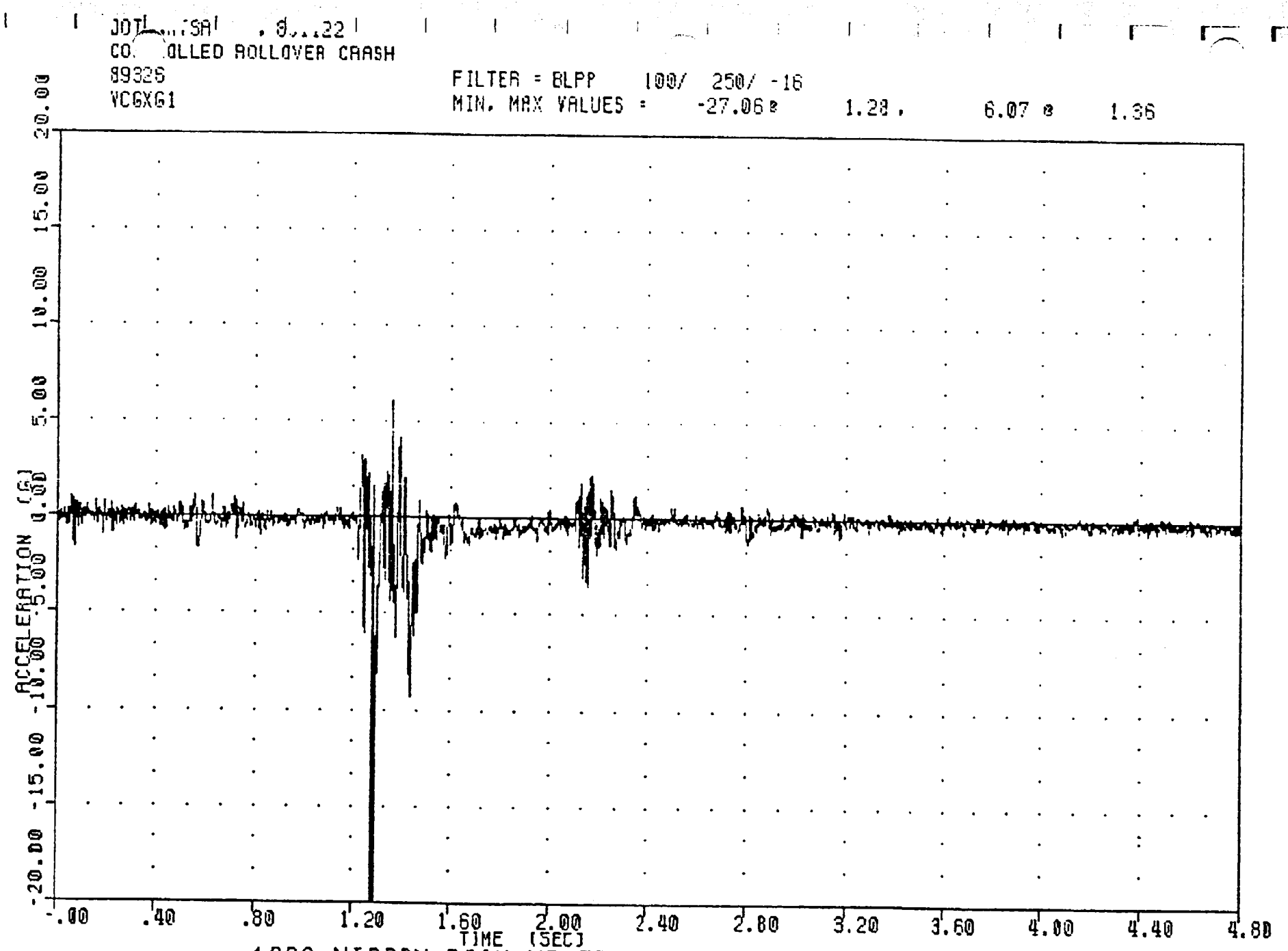
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER SHOULDER BELT DISPLACEMENT



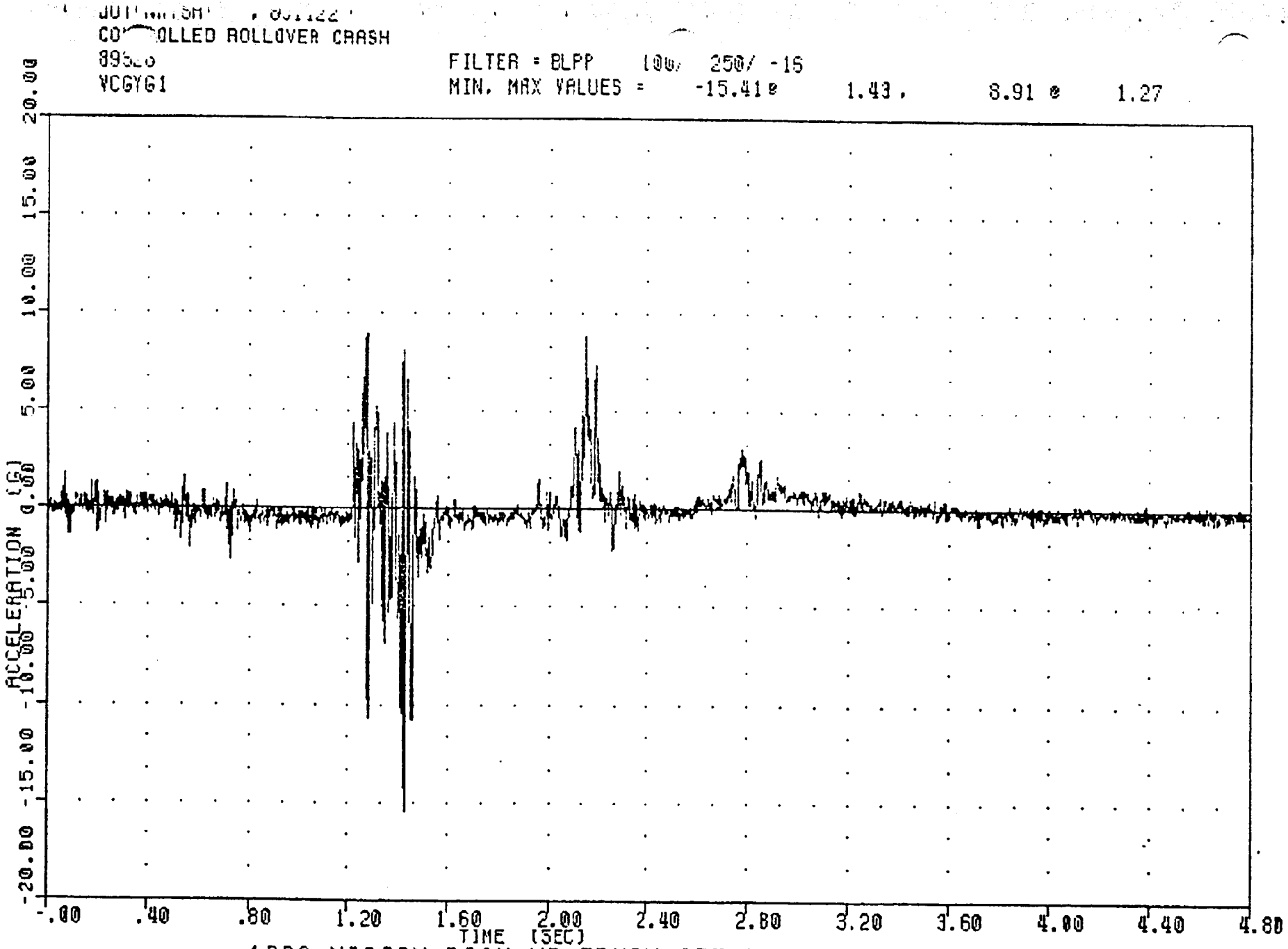
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
DRIVER PELVIS RESULTANT ACCELERATION



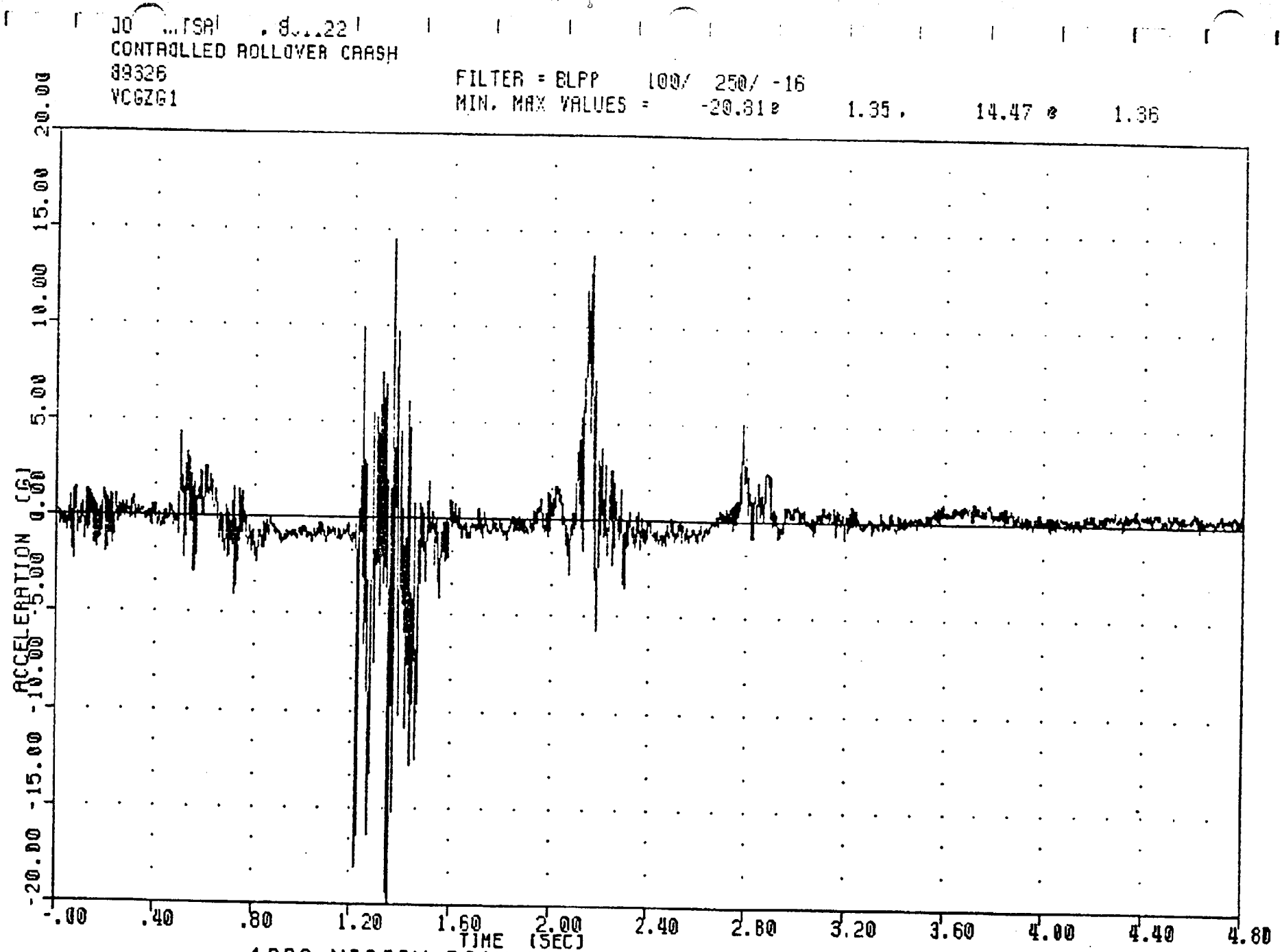
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
VEHICLE CENTER OF GRAVITY X AXIS ACCELERATION



1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
VEHICLE CENTER OF GRAVITY X AXIS ACCELERATION

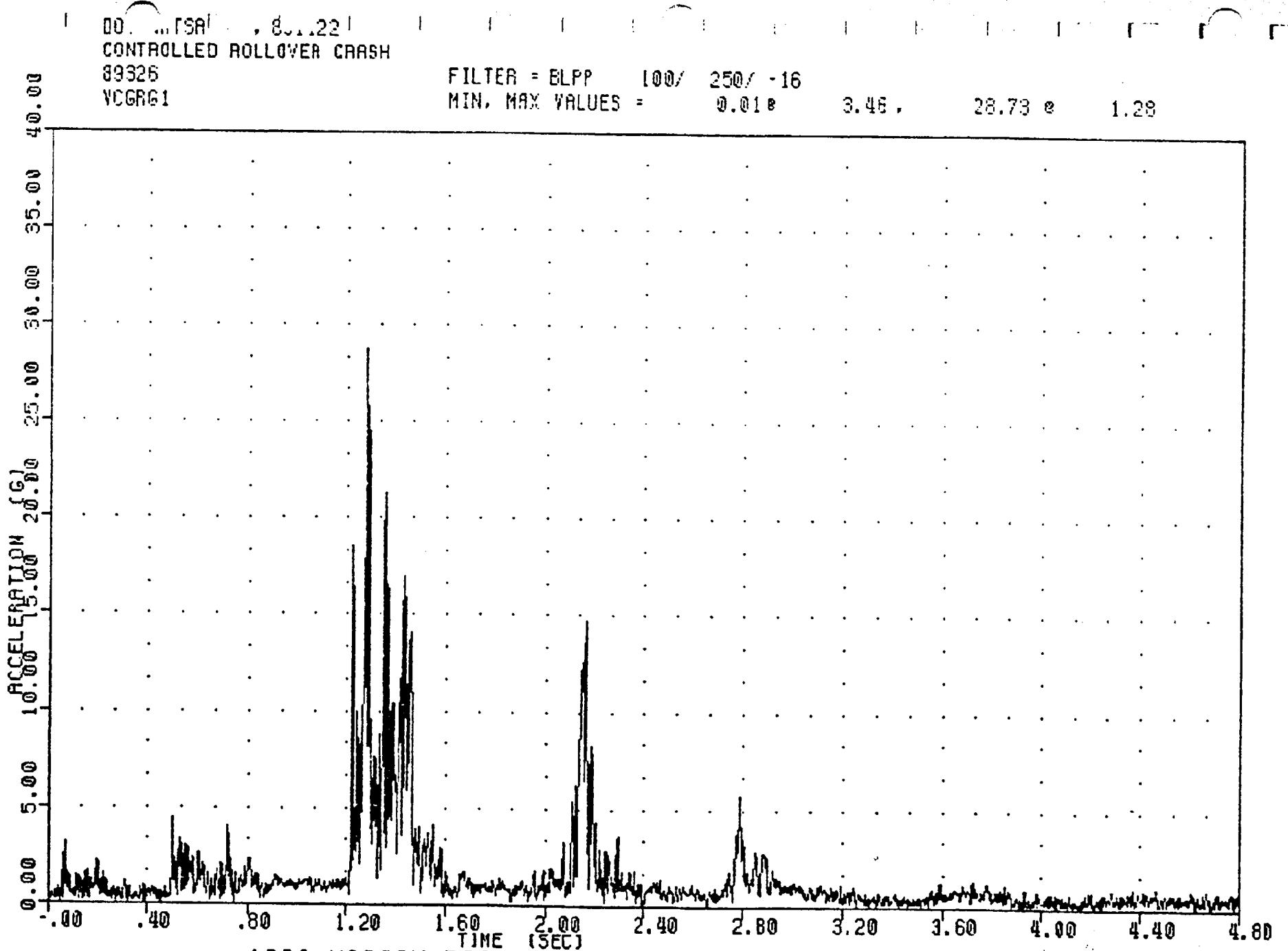


1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
VEHICLE CENTER OF GRAVITY Y AXIS ACCELERATION



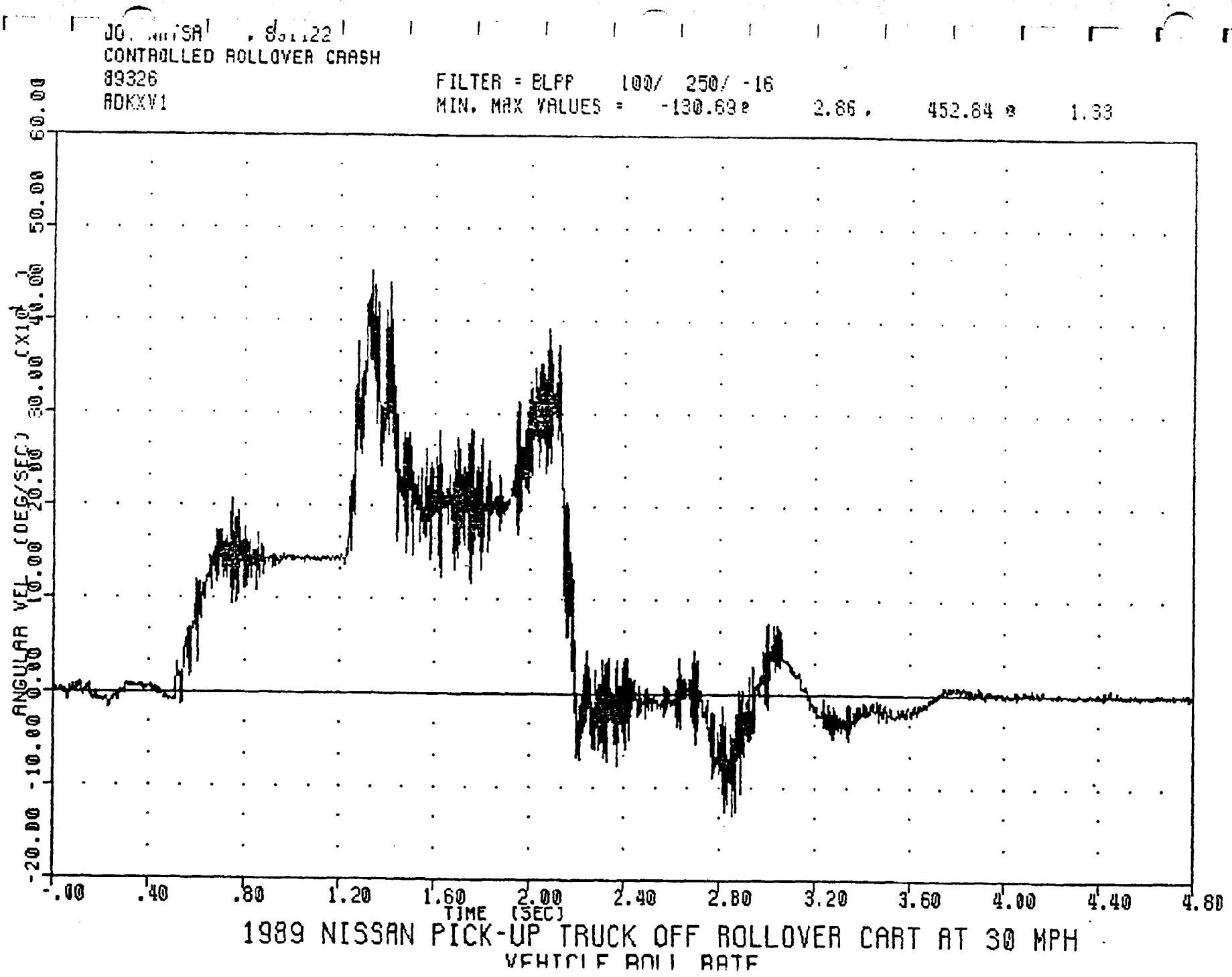
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH

VEHICLE CENTER OF GRAVITY Z AXIS ACCELERATION



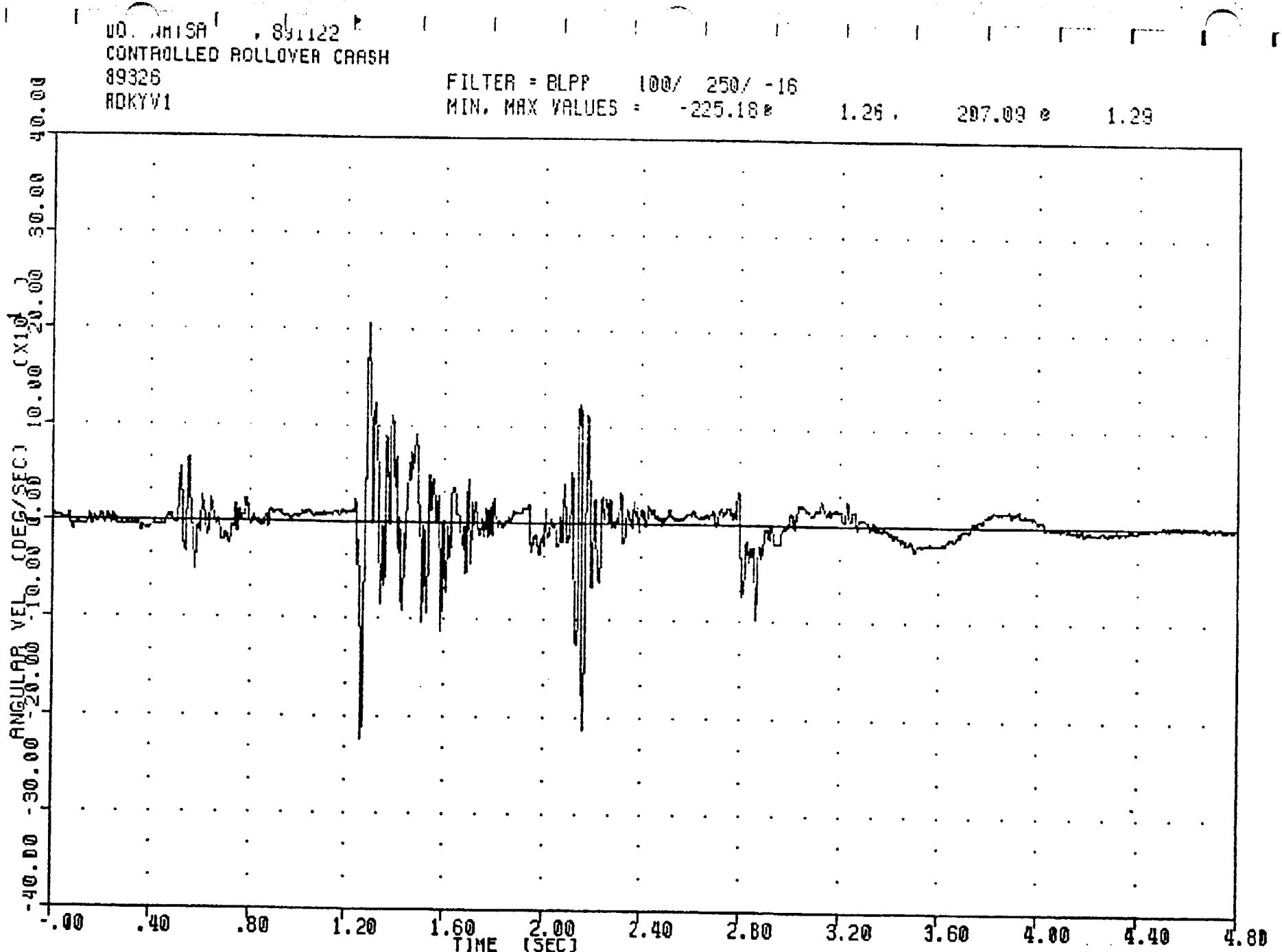
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH

VEHICLE CENTER OF GRAVITY RESULTANT ACCELERATION



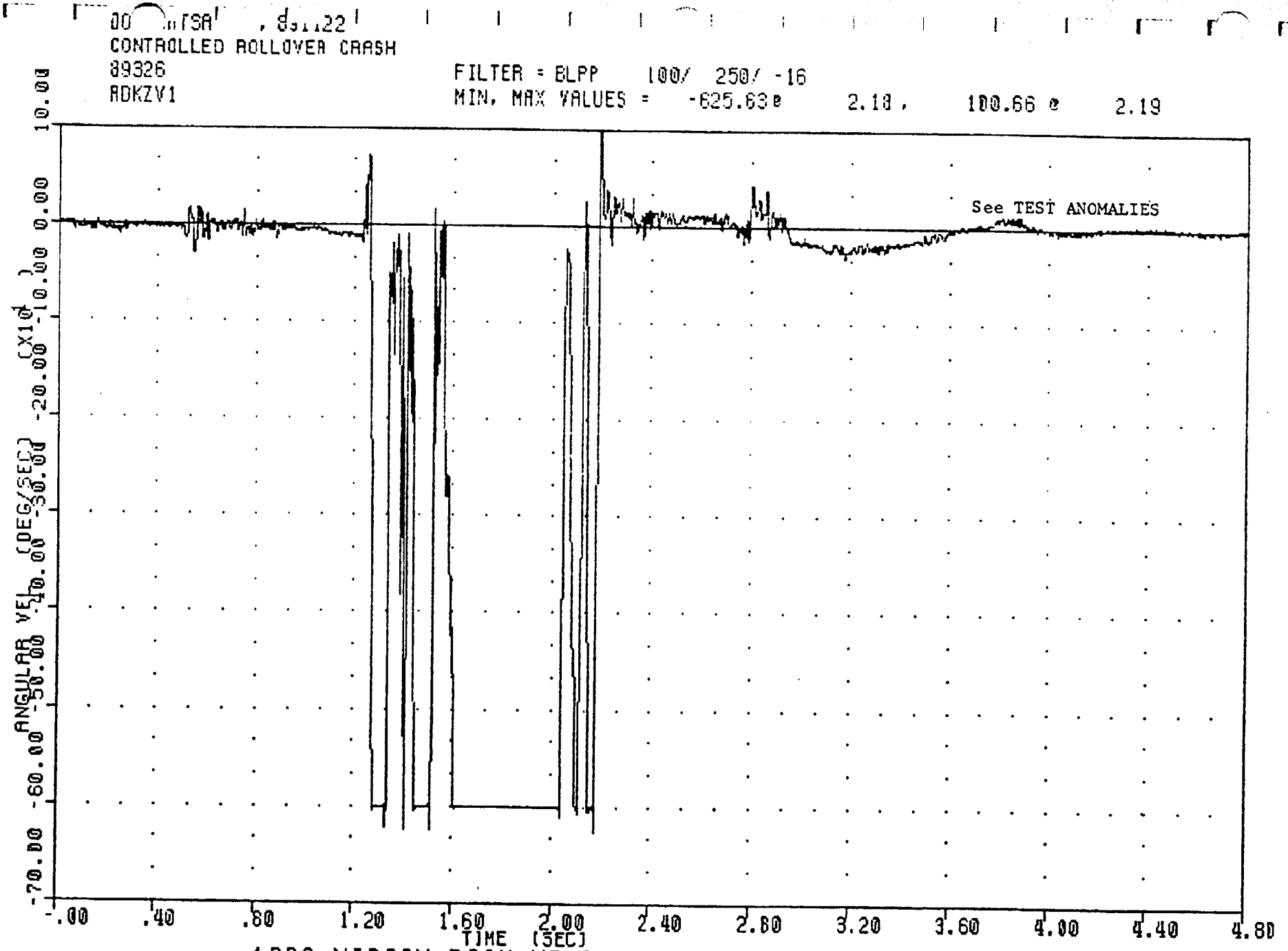
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH

VEHICLE ROLL RATE

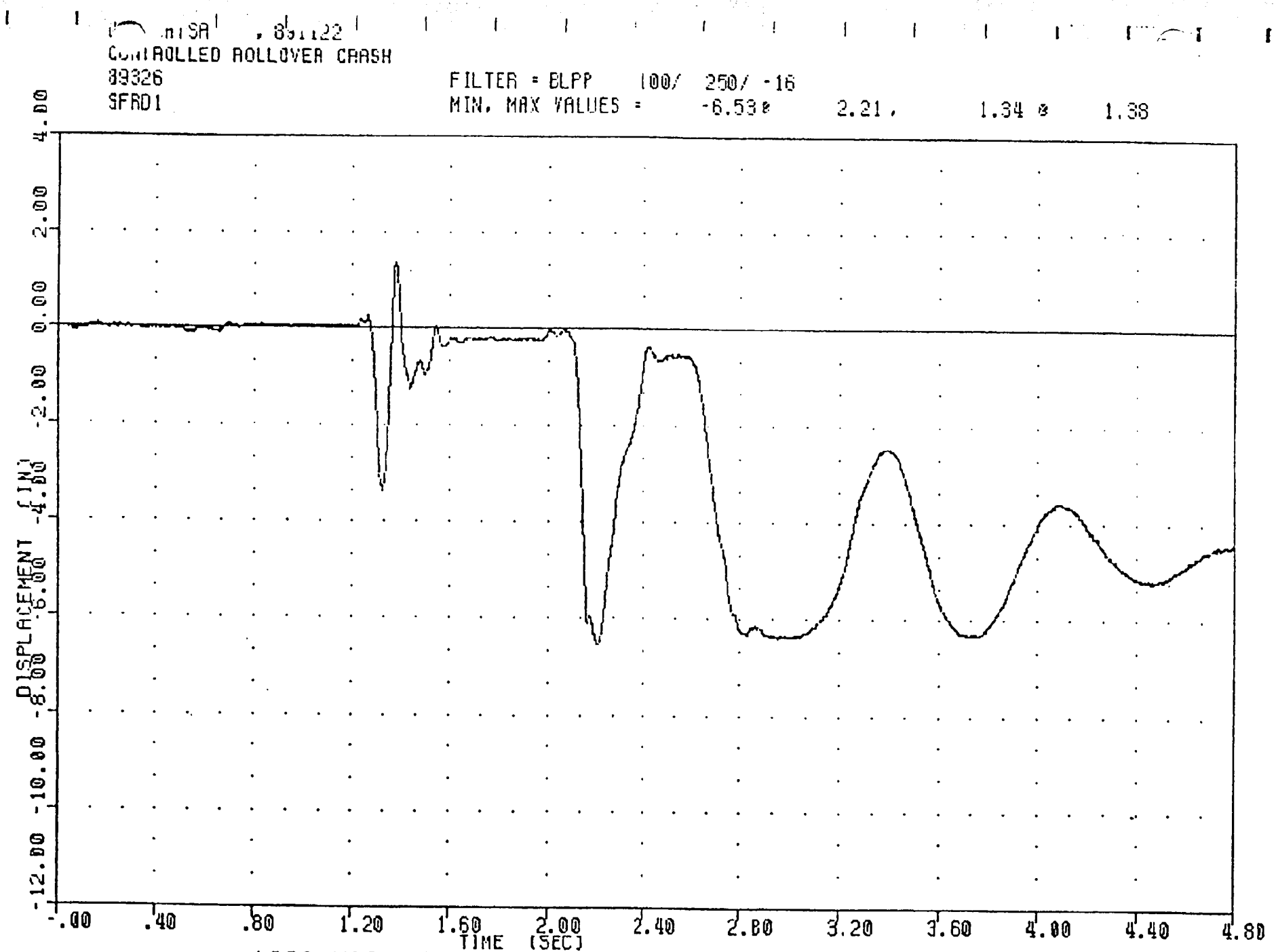


1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH

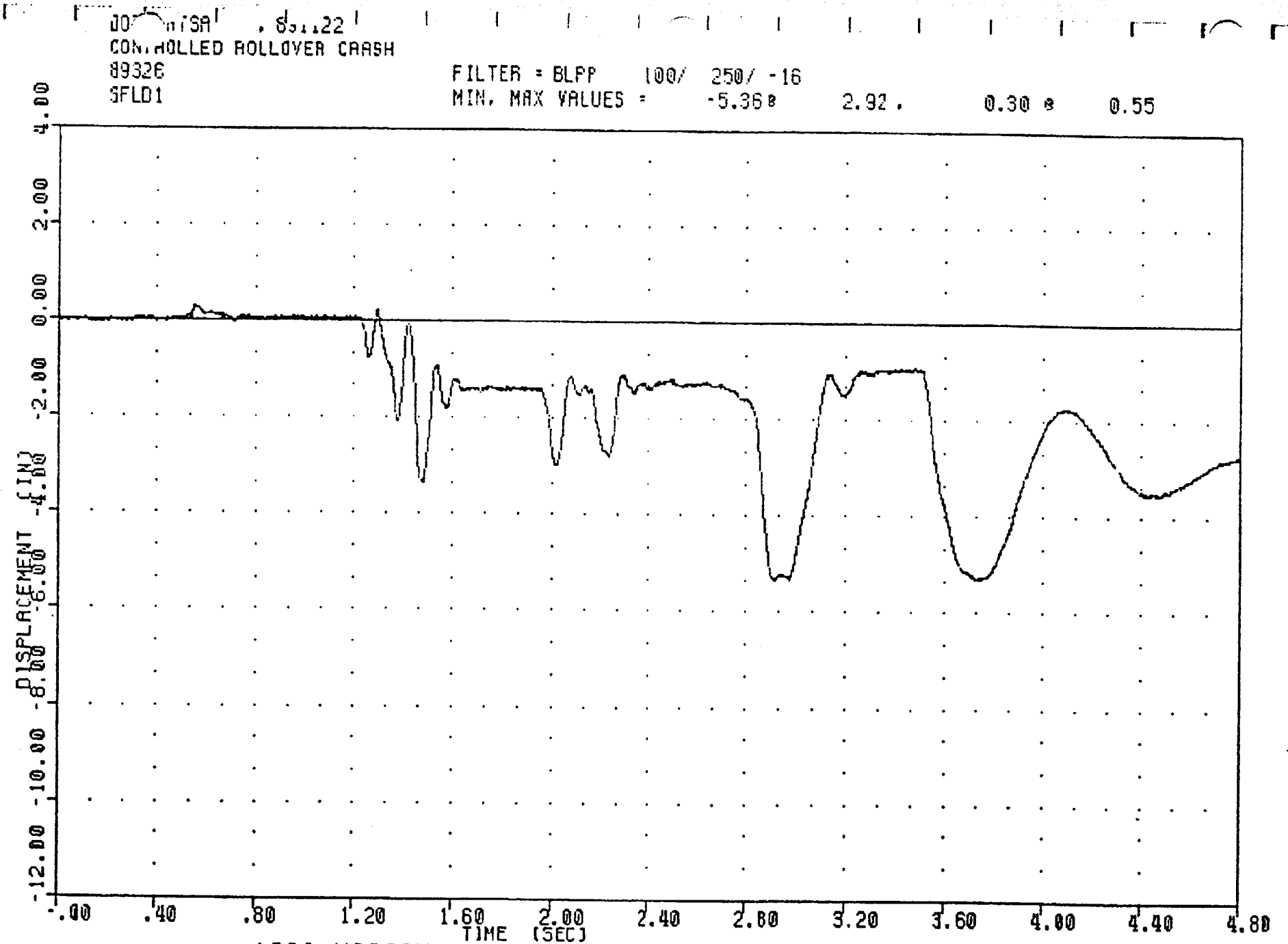
VEHICLE PITCH RATE



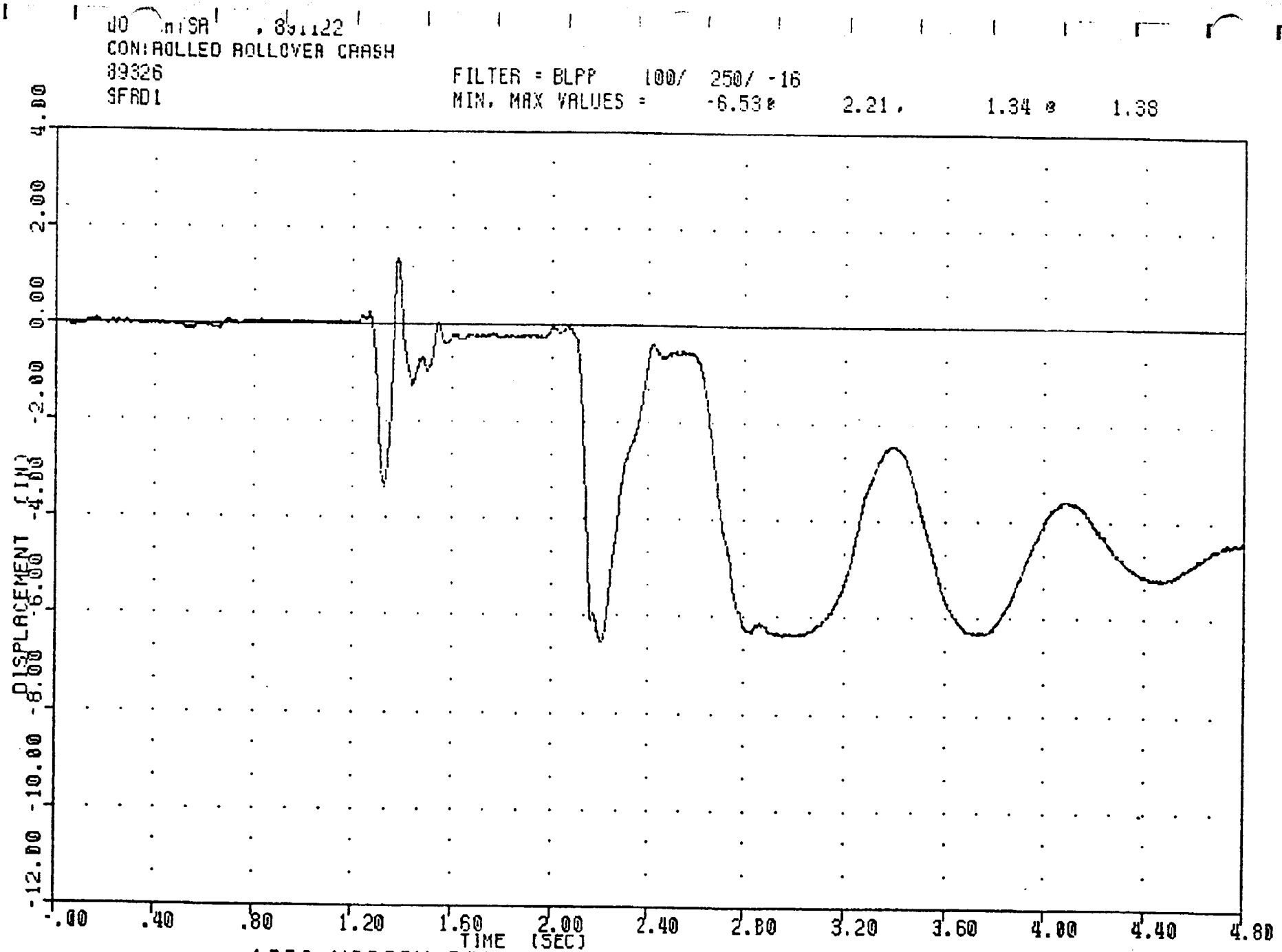
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
VEHICLE YAW RATE



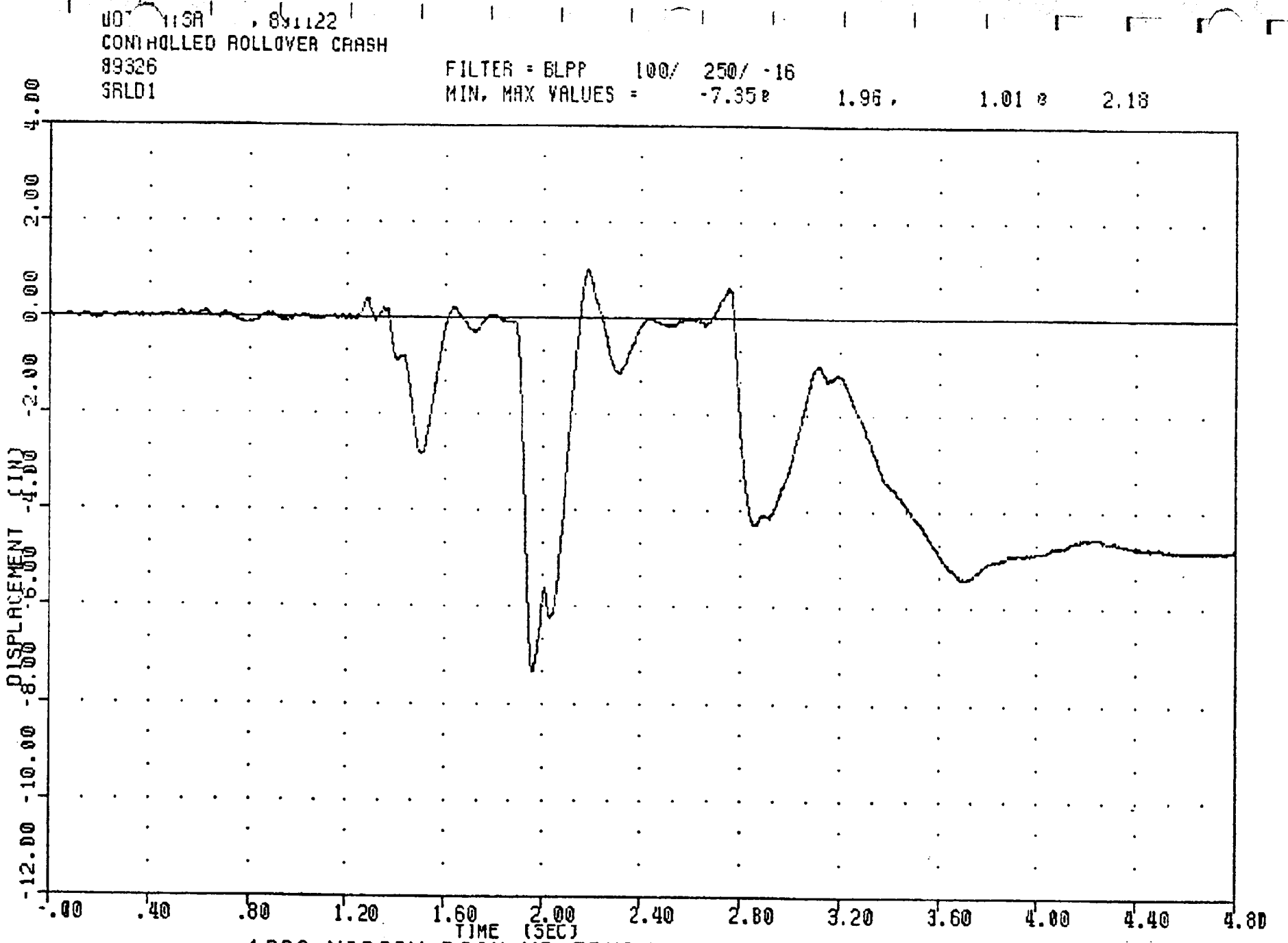
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
VEHICLE RIGHT FRONT SUSPENSION DISPLACEMENT



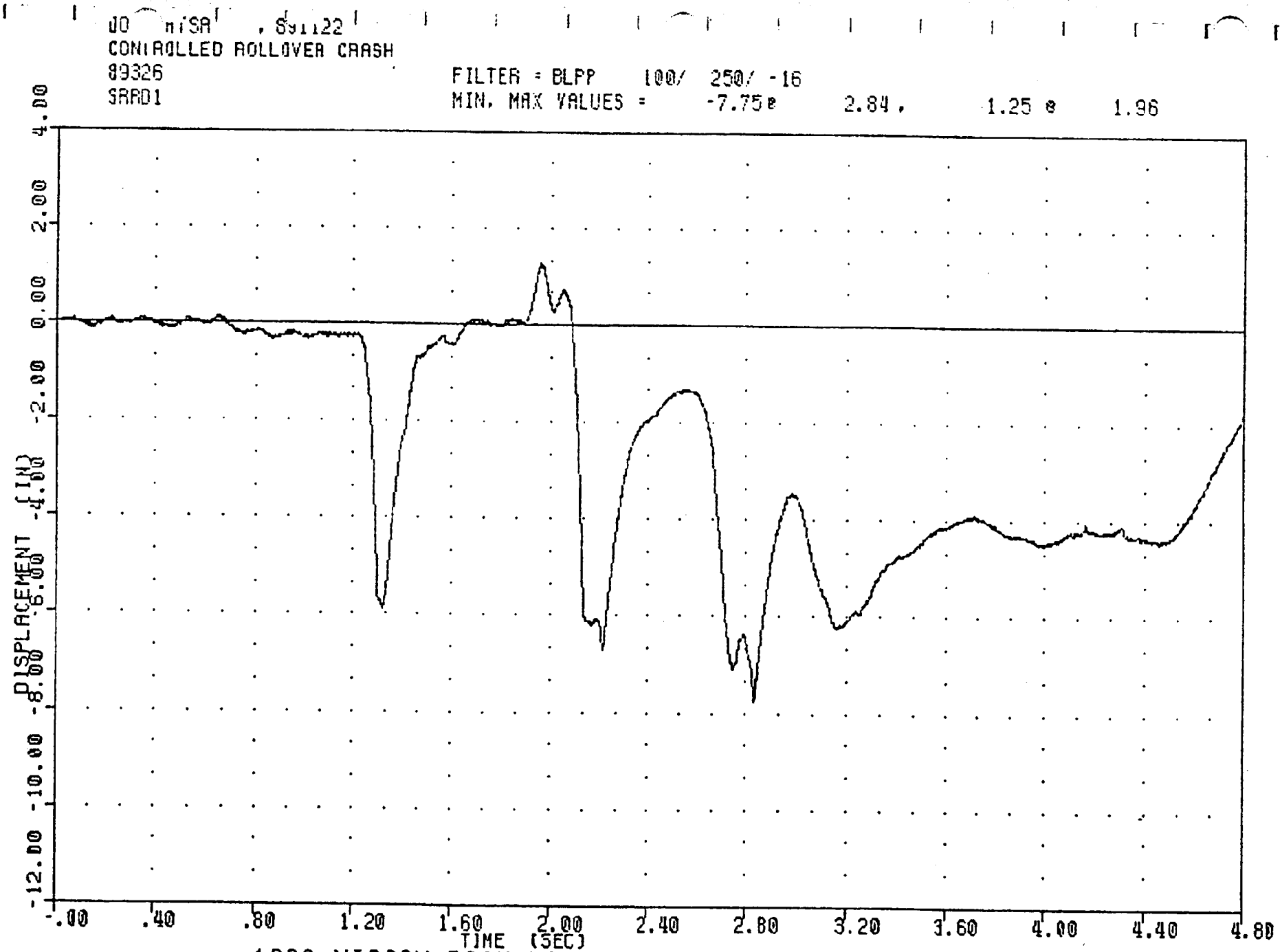
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
VEHICLE LEFT FRONT SUSPENSION DISPLACEMENT



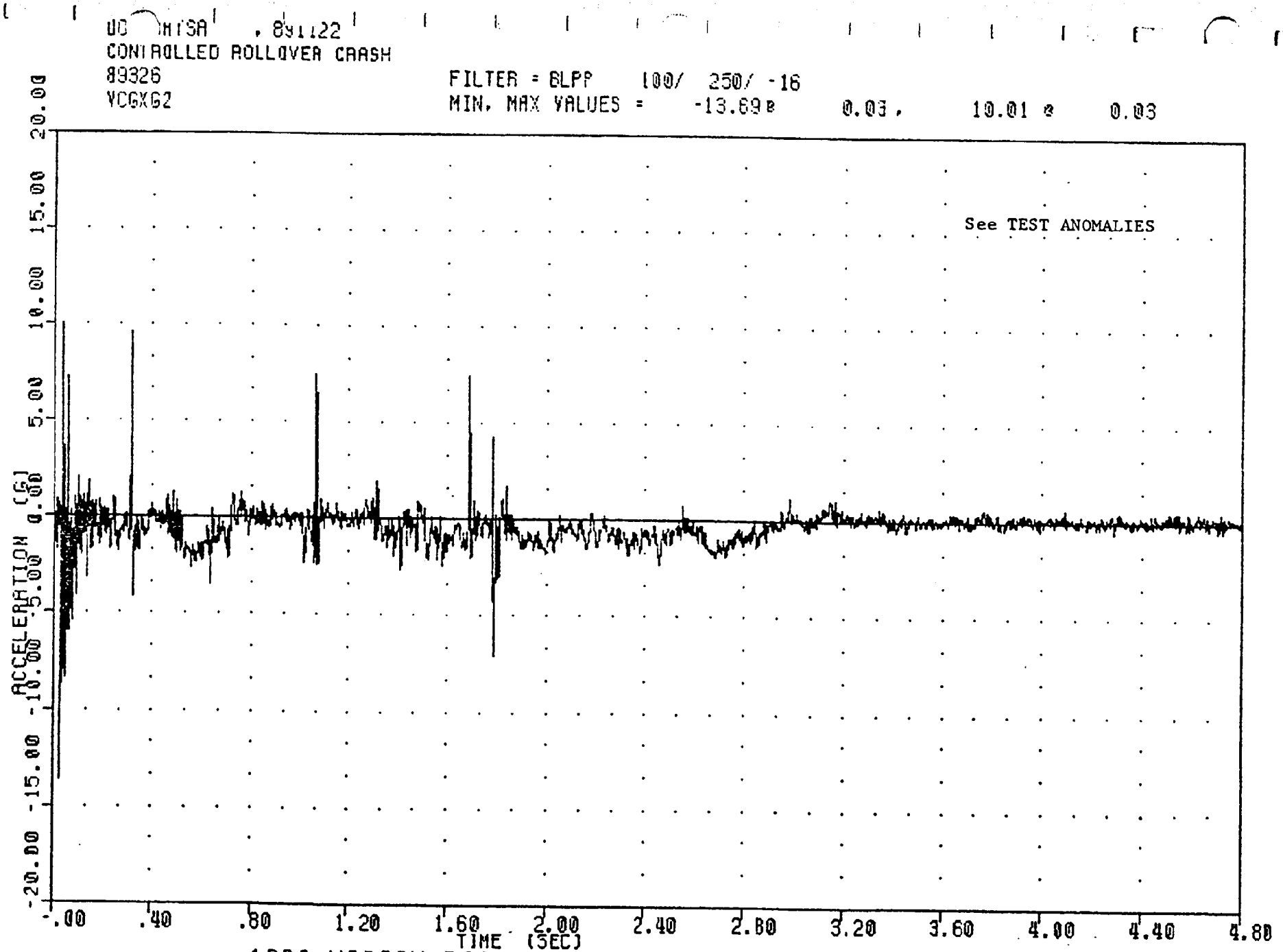
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
VEHICLE RIGHT FRONT SUSPENSION DISPLACEMENT



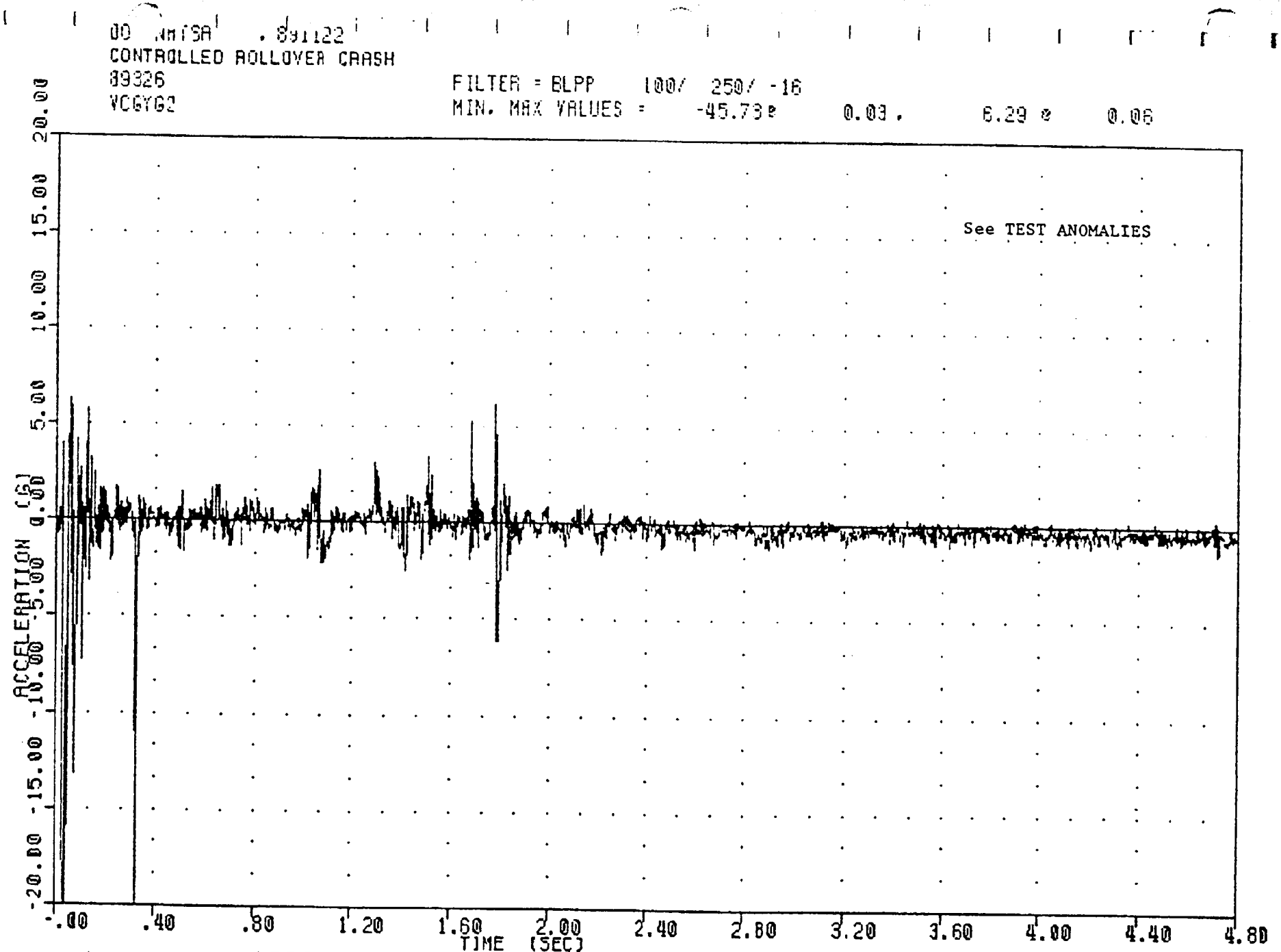
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
VEHICLE LEFT REAR SUSPENSION DISPLACEMENT



1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
VEHICLE RIGHT REAR SUSPENSION DISPLACEMENT

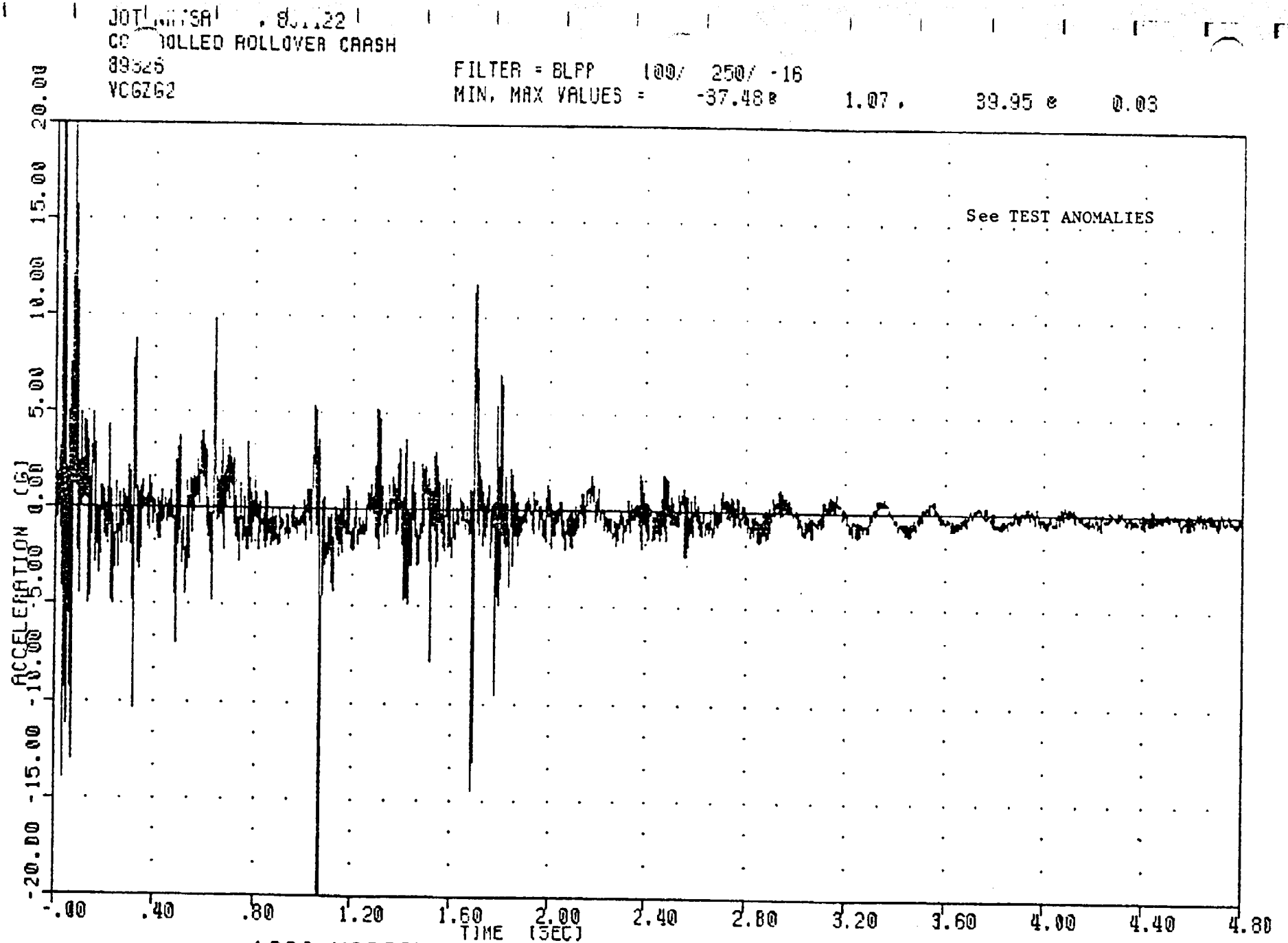


1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
ROLL CART CENTER OF GRAVITY X AXIS ACCELERATION

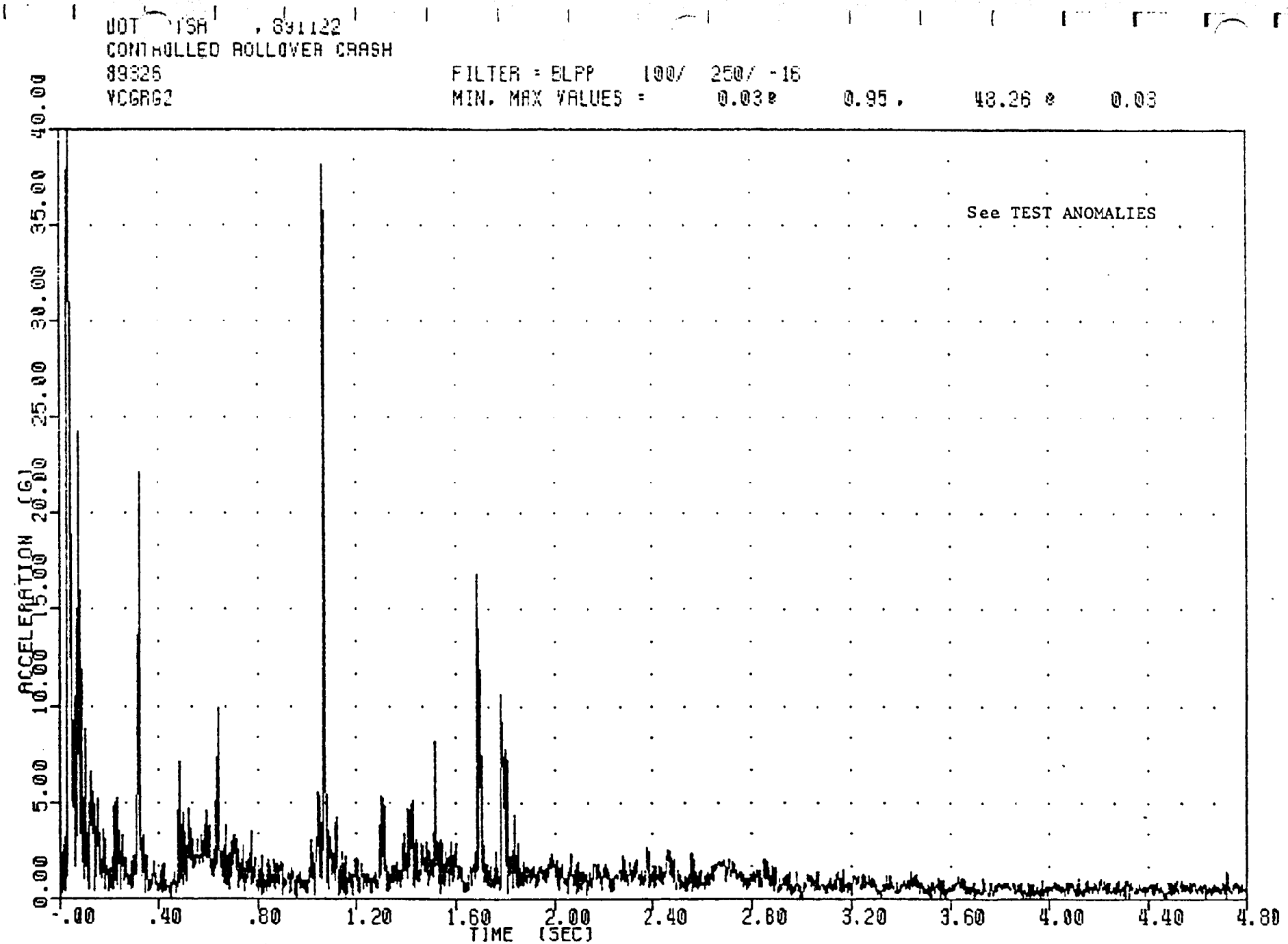


1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH

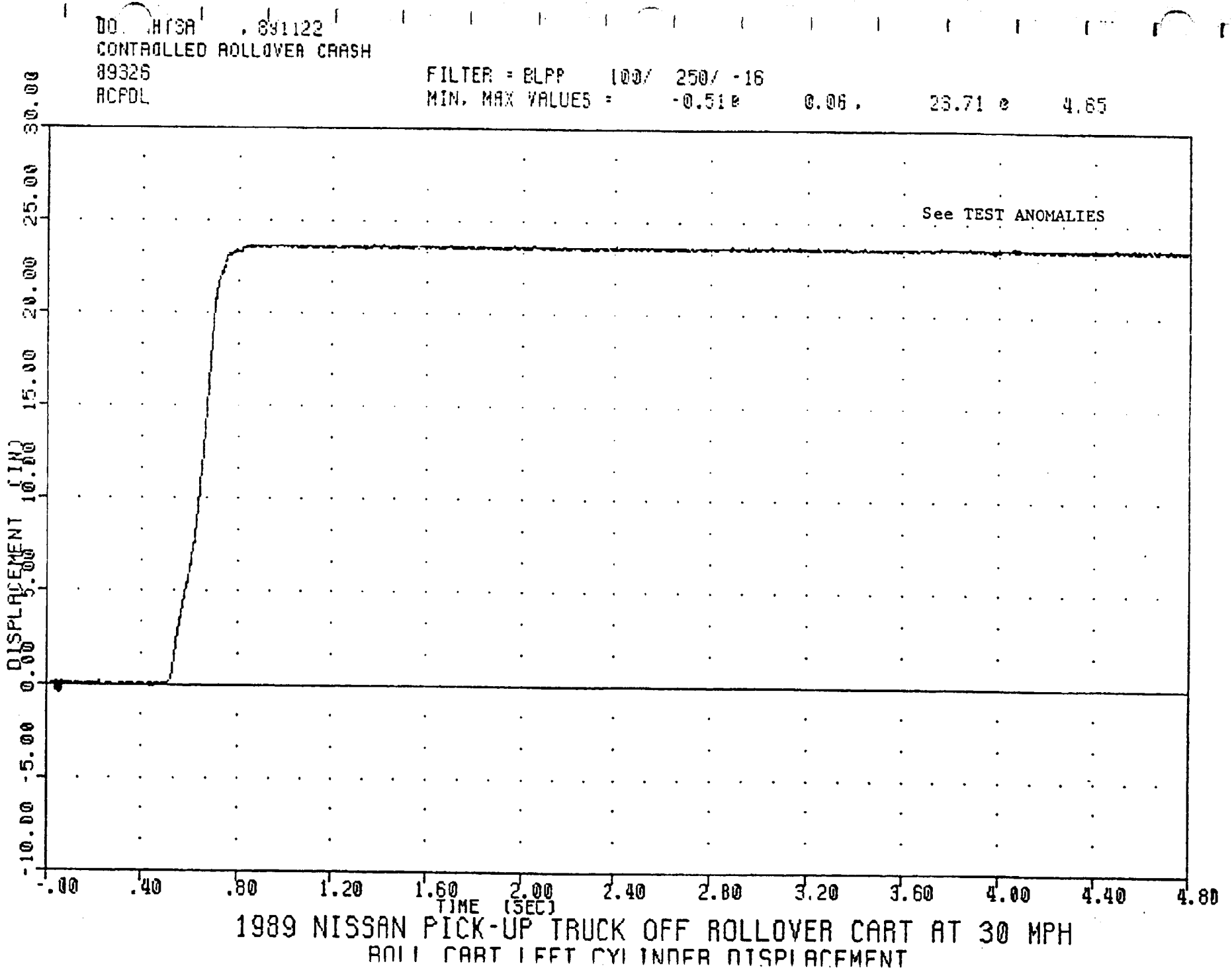
ROLL CART CENTER OF GRAVITY Y AXIS ACCELERATION



1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
ROLL CART CENTER OF GRAVITY Z AXIS ACCELERATION

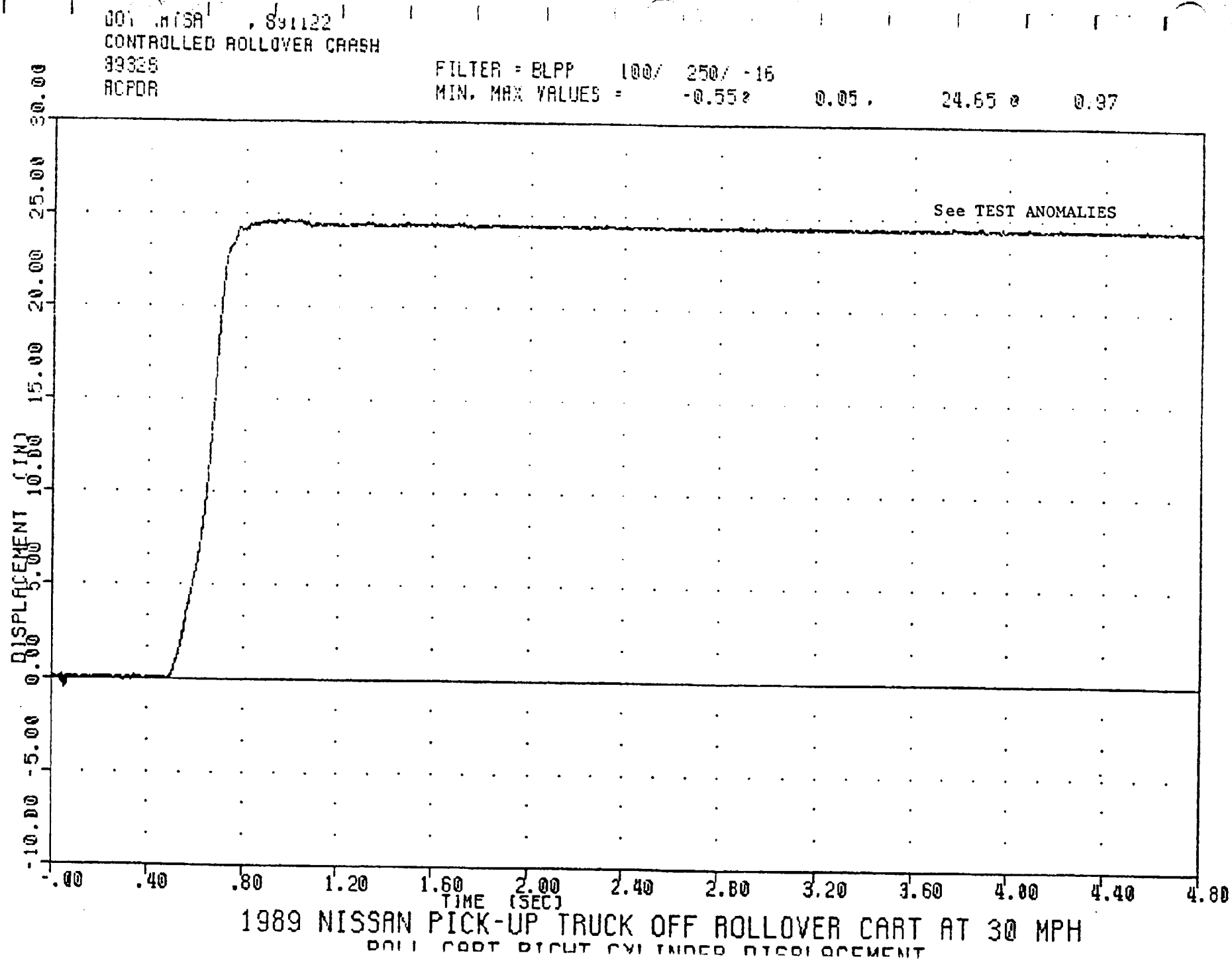


1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
ROLL CART CENTER OF GRAVITY RESULTANT ACCELERATION



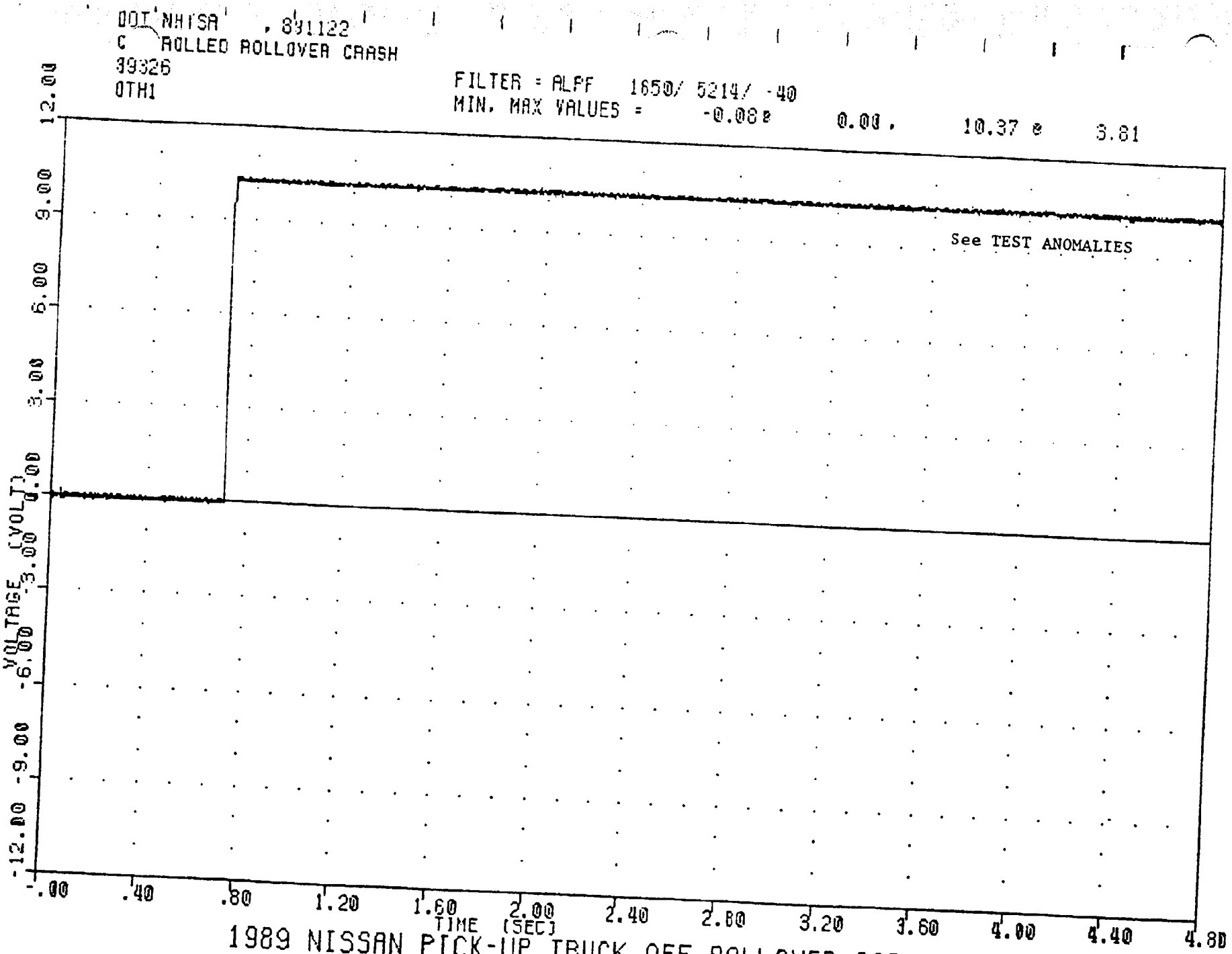
1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH

ROLL CART LEFT CYLINDER DISPLACEMENT

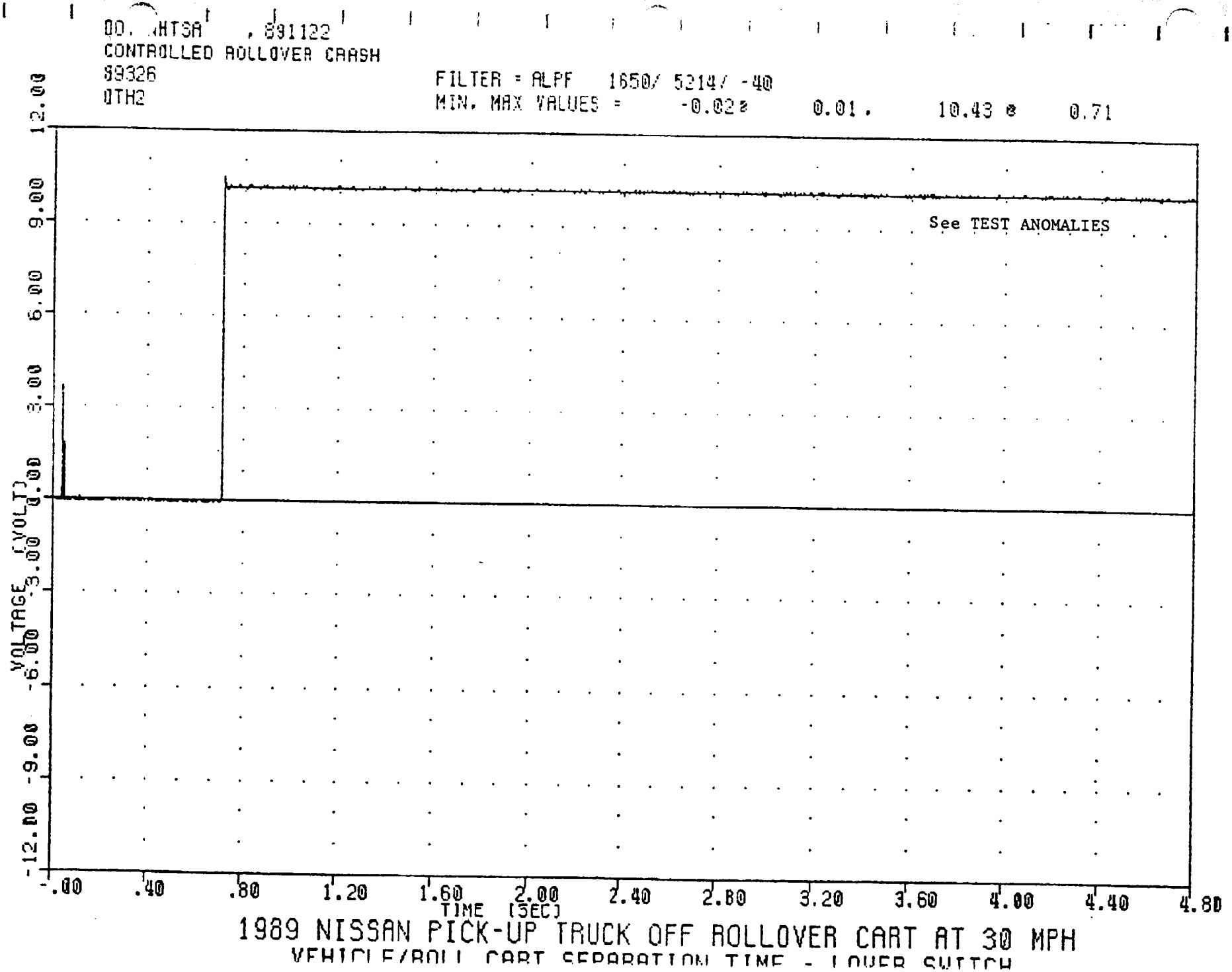


1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH

ROLL CART RIGHT CYLINDER DISPLACEMENT



1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH
VEHICLE/ROLL CART SEPARATION TIME - UPPER SWITCH



1989 NISSAN PICK-UP TRUCK OFF ROLLOVER CART AT 30 MPH

VEHICLE/ROLL CART SEPARATION TIME - LOWER SWITCH

APPENDIX C

MISCELLANEOUS TEST INFORMATION

PRE-TEST INERTIA PARAMETERS DATA

IPMD VEHICLE DATA SHEET

Filled Out By: B. Dotson Date: 11/20/89

Checked By: J. Chrstos Date: 12/18/89

VEHICLE DATA

Vehicle Make and Model (written out): 1989 Nissan pickup

NHTSA ID Code (7 characters): V89233 / Model Year (2 digits): 89

Vehicle Make (2 characters): 64

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): 99

Body Style (2 characters): PU

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): 1N6ND11S0KC404690

Odometer Reading: 46.0 Thousands of Miles: 0.046

Overall Length: 174.0 (in) x 25.4 =: 4420 (mm)

Wheelbase: 104.5 (in) x 25.4 =: 2654 (mm)

Front Track: 54.9 (in) x 25.4 =: 1394 (mm)

Rear Track: 54.7 (in) x 25.4 =: 1389 (mm)

Roof Height: 61.4 (in) x 25.4 =: 1560 (mm)

IPMD VEHICLE DATA SHEET

G.V.W.R.: 4400 (lbs) x 4.45 =: 19580 (N)

FRONT G.A.W.R.: 2200 (lbs) x 4.45 =: 9790 (N)

REAR G.A.W.R.: 2544 (lbs) x 4.45 =: 11321 (N)

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

Weight on RF Tire: 811 (lbs) x 4.45 =: 3609 (N)

Weight on LF Tire: 787 (lbs) x 4.45 =: 3502 (N)

Weight on LR Tire: 812 (lbs) x 4.45 =: 3613 (N)

Weight on RR Tire: 763 (lbs) x 4.45 =: 3395 (N)

Vehicle Test Weight: 3173 (lbs) x 4.45 =: 14120 (N)

Lateral and Longitudinal Center of Gravity Location.

From Front Axle: 51.87 (in) x 25.4 =: 1317.5 (mm)

From Center Line: -0.22 (in) x 25.4 =: -5.6 (mm)

Engine Displacement: 145.8 (cu in) x 0.0164 =: 2.4 (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): L

L = Longitudinal T = Transverse

Transmission Type: M

M = Manual A = Automatic

Drive Axle (1 character): R

F = Front R = Rear 4 = Four Wheel Drive

Vehicle Comments (30 characters): Pre rollover test.

IPMD VEHICLE DATA SHEET

FRONT SUSPENSION

Suspension Number (4 digits): F233

Front/Rear Flag (1 character): F

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

Suspension Type (1 character): A

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): TB

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): Firestone

Tire Size Code (10 characters): 185/75R14

Tire Construction (2 characters): SB

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 =: 127.0 (mm)

Axle Height: 11.9 (in) X 25.4 =: 302.3 (mm)

Tire Pressure: 26.0 (psi) X 6.897 =: 241.4 (kpa)

IPMD VEHICLE DATA SHEET

REAR SUSPENSION

Suspension Number (4 digits): R233

Front/Rear Flag (1 character): R

Axle Type (1 character): S

I = Independent S = Solid

Suspension Type (1 character): L

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

1pring Type (2 characters): LL

CO = Coil
LL = Longitudinal Leaf
OT = Other: _____

TB = Torsion Bar
TL = Transverse Leaf

Brake Type (2 characters): LT

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

REAR SUSPENSION

Tire Manufacturer (10 characters): Firestone

Tire Size Code (10 characters): 185/75R14

Tire Construction (2 characters): SB

BB = Bias Belted
BP = Bias Ply
OT = Other: _____

GP = Glass Belted Radial
SP = Steel Belted Radial

Tire Rim Width: 5.0 (in) X 25.4 =: 127.0 (mm)

Axle Height: 12.0 (in) X 25.4 =: 304.8 (mm)

Tire Pressure: 34.0 (psi) X 6.897 =: 234.5 (kpa)

IPMD MEASURED DATA

IPMD Calibration Check (no vehicle):

Applied Weight (lbs)	Schaevitz Output (Volts)
0	0.114
+100	1.053
+200	1.964
0	0.113
-100	0.827
-200	-1.745
0	0.115

C.G. HEIGHT:

Applied Weight (lbs)	Schaevitz Output (Volts)	Resultant Longitudinal Movement (mv)
0	0.056	3.009
+100	0.703	3.131
+200	1.335	3.220
0	0.076	3.061
-100	-0.568	2.925
-200	-1.218	2.770
0	0.053	3.002

Calculated C.G. Height (in): 23.833

Pitch Inertia:

Run	Period (sec)	*Amplitude (mv)	Relative Motion Amplitude (mv)
1	4.02	271	220
2	4.02	273	218
3	4.02	265	223

Pitch Inertia (ft. lb. sec2): 1887.132

IPMD MEASURED DATA

Roll Inertia:

Distance between ramps (in): 45.9

Run	Period (sec)	*Amplitude (mv)	Amplitude (mv)
1	2.42	232	232
2	2.42	238	230
3	2.42	231	233

Roll Inertia (ft. lb. sec2): 363.35

Yaw Inertia:

Distance betwee ramps (in): 45.9

String Pot Offset from platform center (in): 73.0

Run	Period (sec)	*Amplitude (mv)	Relative Motion
1	2.35	139	250
2	2.36	145	283
3	2.35	140	251

Yaw Inertia (ft. lb. sec2): 1880.535

POST-TEST INERTIA PARAMETERS DATA

IPMD VEHICLE DATA SHEET

Filled Out By: B. Dotson Date: 12/11/89

Checked By: J. Chrstos Date: 12/18/89

VEHICLE DATA

Vehicle Make and Model (written out): 1989 Nissan pickup

NHTSA ID Code (7 characters): V89233 / Model Year (2 digits): 89

Vehicle Make (2 characters): 64

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): 99

Body Style (2 characters): PU

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): 1N6ND11S0KC404690

Odometer Reading: 51.0 Thousands of Miles: 0.051

Overall Length: 174.0 (in) x 25.4 =: 4420 (mm)

Wheelbase: 104.5 (in) x 25.4 =: 2654 (mm)

Front Track: 55.1 (in) x 25.4 =: 1400 (mm)

Rear Track: 54.7 (in) x 25.4 =: 1389 (mm)

Roof Height: 54.5 (in) x 25.4 =: 1384 (mm)

IPMD VEHICLE DATA SHEET

G.V.W.R.: 4400 (lbs) x 4.45 =: 19580 (N)

FRONT G.A.W.R.: 2200 (lbs) x 4.45 =: 9790 (N)

REAR G.A.W.R.: 2544 (lbs) x 4.45 =: 11321 (N)

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

Weight on RF Tire: 912 (lbs) x 4.45 =: 4058 (N)

Weight on LF Tire: 683 (lbs) x 4.45 =: 3039 (N)

Weight on LR Tire: 836 (lbs) x 4.45 =: 3720 (N)

Weight on RR Tire: 679 (lbs) x 4.45 =: 3022 (N)

Vehicle Test Weight: 3110 (lbs) x 4.45 =: 13840 (N)

Lateral and Longitudinal Center of Gravity Location.

From Front Axle: 50.9 (in) x 25.4 =: 1293.1 (mm)

From Center Line: 0.63 (in) x 25.4 =: 16.0 (mm)

Engine Displacement: 145.8 (cu in) x 0.0164 =: 2.4 (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): L

L = Longitudinal T = Transverse

Transmission Type: M

M = Manual A = Automatic

Drive Axle (1 character): R

F = Front R = Rear 4 = Four Wheel Drive

Vehicle Comments (30 characters): Post rollover test. Rear tire flat.

IPMD VEHICLE DATA SHEET

FRONT SUSPENSION

Suspension Number (4 digits): F233

Front/Rear Flag (1 character): F

Axle Type (1 character): I

I = Independent S = Solid

Suspension Type (1 character): A

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): TB

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): Firestone

Tire Size Code (10 characters): 185/75R14

Tire Construction (2 characters): SB

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 =: 127.0 (mm)

Axle Height: 11.9 (in) X 25.4 =: 302.3 (mm)

Tire Pressure: 26.0 (psi) X 6.897 =: 179.3 (kpa)

IPMD VEHICLE DATA SHEET

REAR SUSPENSION

Suspension Number (4 digits): R233

Front/Rear Flag (1 character): R

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

Suspension Type (1 character): L

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): LL

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

Brake Type (2 characters): LT

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

REAR SUSPENSION

Tire Manufacturer (10 characters): Firestone

Tire Size Code (10 characters): 185/75R14

Tire Construction (2 characters): SB

BB = Bias Belted
BP = Bias Ply
OT = Other:_____

GP = Glass Belted Radial
SP = Steel Belted Radial

Tire Rim Width: 5.0 (in) X 25.4 =: 127.0 (mm)

Axle Height: 10.0 (in) X 25.4 =: 254.0 (mm)

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

IPMD MEASURED DATA

IPMD Calibration Check (no vehicle):

Applied Weight (lbs)	Schaevitz Output (Volts)
0	-0.102
+100	-1.040
+200	-1.931
0	-0.105
-100	0.844
-200	1.771
0	-0.104

C.G. HEIGHT:

Applied Weight (lbs)	Schaevitz Output (Volts)	Resultant Longitudinal Movement (mv)
0	-0.036	2.295
+100	-0.619	2.364
+200	-1.195	2.485
0	-0.434	2.337
-100	0.546	2.244
-200	1.142	2.120
0	0.031	2.279

Calculated C.G. Height (in): 21.588

Pitch Inertia:

Run	Period (sec)	*Amplitude (mv)	Relative Motion Amplitude (mv)
1	3.80	286	215
2	3.80	289	188
3	3.81	300	201

Pitch Inertia (ft. lb. sec2): 1790.151

IPMD MEASURED DATA

Roll Inertia:

Distance between ramps (in): 45.5

Run	Period (sec)	*Amplitude (mv)	Amplitude (mv)
1	2.31	231	269
2	2.31	241	289
3	2.32	231	248

Roll Inertia (ft. lb. sec2): 325.632

Yaw Inertia:

Distance betwee ramps (in): 45.5

String Pot Offset from platform center (in): 73.5

Run	Period (sec)	*Amplitude (mv)	Amplitude (mv)
1	2.35	149	262
2	2.31	148	269
3	2.34	152	275

Yaw Inertia (ft. lb. sec2): 1844.253

SIGN CONVENTION

Compression on barrier face load cells is positive.

Compression on femur load cells is positive.

Tension on seat belt load cells is positive.

Outward chest displacement is positive.

All accelerometers:

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

Neck load cell:

- +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