



DOT 316

APPROVED ENGINEERING TEST LABORATORIES / 1536 EAST VALENCIA / FULLERTON, CALIFORNIA 92631 / TEL. (714) 879-6110
A NATIONAL TECHNICAL SERVICES COMPANY

OCCUPANT RESPONSE
AND
VEHICLE ACCELERATION
IN A
30 MPH FRONTAL IMPACT TEST

GENERAL MOTORS CORPORATION
1978 BUICK CENTURY CUSTOM - 2 DOOR COUPE
NHTSA 780106

APPROVED ENGINEERING TEST LABORATORIES
1536 EAST VALENCIA DRIVE
FULLERTON, CALIFORNIA 92631



APRIL 1979

CONTRACT NUMBER DOT-HS-6-01477

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF RESEARCH AND DEVELOPMENT
2100 SECOND STREET S. W.
WASHINGTON, D. C. 20590



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16. Abstract A 1978 Buick Century Custom - 2 Door Coupe, NHTSA 780106, VIN-4H87U 8Z116755, was impact tested for compliance with FMVSS 219 (Windshield Zone Intrusion), FMVSS 301-75 (Fuel System Integrity) and documented in Reports No. 219-AETL-78-027 and 301-AETL-78-065. As a parallel, non-conflicting effort, the anthropomorphic dummies and the vehicle were instrumented with accelerometers to measure occupant response and vehicle acceleration. The results of this effort are documented herein. The average vehicle impact speed was 29.835 mph in the frontal (0°) mode.			
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SECTION 1



APPROVED ENGINEERING TEST LABORATORIES

SECTION 1

1.0 INTRODUCTION

The test was performed by Approved Engineering Test Laboratories under Contract Number DOT-HS-6-01477 in accordance with the Office of Vehicle Safety Compliance Laboratory Procedures.

The purpose of the effort documented herein was to acquire occupant response and vehicle acceleration data in a 1978 Buick Century Custom - 2 Door Coupe, NHTSA 780106 during a 30-mph frontal fixed barrier impact test. This effort was conducted in conjunction with Federal Motor Vehicle Safety Standards (FMVSS) 219 - "Windshield Zone Intrusion" and 301-75 - "Fuel System Integrity" compliance test. These compliance tests were previously documented in NHTSA/OVSC Report No. 219-AETL-78-027 and 301-AETL-78-065. Only the occupant response and vehicle acceleration aspects of the test are covered in this report.

The scope of the vehicle test was expanded to accommodate the acquisition of occupant response and vehicle acceleration data. This was accomplished without creating any conflict with the Laboratory Procedures (TP219-01) issued by the Office of Vehicle Safety Compliance (OVSC). Specific procedures used to obtain the additional data are detailed in Section 4.



APPROVED ENGINEERING TEST LABORATORIES

SECTION 2



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SECTION 2

2.0 TEST SUMMARY

The 1978 Buick Century Custom - 2 Door Coupe was subjected to a frontal fixed barrier impact as required by Federal Motor Vehicle Safety Standards 219 and 301-75.

Color motion picture coverage of the vehicle impact are considered part of the accumulated pertinent data. Where applicable, still photographs are presented in this report, while the motion picture coverage is submitted separately.

TABLE I

SUMMARY OF TEST CONDITIONS

TEST VEHICLE IDENTIFICATION:

Manufacturer: General Motors Corporation
Make/Model: Buick Century Custom
Body Style: 2 Door Coupe Model Year: 1978
VIN: 4H87U8Z116755 Build Date: December 1977
NHTSA No.: 780106 Color: Blue
Engine Data: Eight (8) Cylinders; 305 Cu. In. Displ.
Transmission Data: Three (3) Speed () Manual (X) Automatic
Major Options: Power Brakes, Power Steering, Air Condition, AM Radio,
Tilt Steering Wheel

VEHICLE ATTITUDE:

Delivered Attitude: LF 30.0 in.; RF 30.0 in.; LR 30.3 in.; RR 30.0 i
Test Attitude: LF 28.8 in.; RF 29.0 in.; LR 28.6 in.; RR 28.4 i

VEHICLE TIRE DATA:

Recommended Cold Tire Pressure: Front = 28 psi
(Up to Vehicle Load Capacity) Rear = 32 psi
Recommended Tire Size: P195/75R14 Load Range: Unknown
Tires on Vehicle: P195/75R14 - w/s/w - Firestone
Spare Tire: X Yes; No; Space Saver: X Yes; No

TABLE Ia

SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS:

Date of Test: 3 April 1979 Time of Test: 1238

Ambient Temperature: 77 °F at Impact Area

VEHICLE CAPACITY:

Type of Seats: Bench; Bucket; X Split Bench

Designated Seating Capacity: Front 3
 Center 0
 Rear 3
 Total 6

Cargo: 160 lbs.

Total: 1,060 lbs. (Vehicle Capacity Weight)

GVWR: 4,546 lbs. (Taken From Certification Label)

GAWR: Front 2,244 lbs.; Rear 2,302 lbs.

VEHICLE DELIVERED WEIGHT: (Fluids to Capacity)

Left Front 984 lbs. Left Rear 689 lbs.
Right Front 941 lbs. Right Rear 745 lbs.
Total Front Weight 1,925 lbs. (57.3 % of Total Vehicle Weight)
Total Rear Weight 1,434 lbs. (42.7 % of Total Vehicle Weight)
Total Delivered Weight 3,359 lbs.

CALCULATED VEHICLE TEST WEIGHT: 3,847 lbs.

(With Required Dummies and 160 lbs. Cargo)

ACTUAL VEHICLE TEST WEIGHT:

Left Front 1,037 lbs. Left Rear 880 lbs.
Right Front 993 lbs. Right Rear 930 lbs.
Total Front Weight 2,030 lbs. (52.9 % of Total Vehicle Weight)
Total Rear Weight 1,810 lbs. (47.1 % of Total Vehicle Weight)
Total Test Weight 3,840 lbs.



SUMMARY OF TEST CONDITIONS (Cont'd)

PRE-TEST DUMMY POSITIONS:

<u>MEASUREMENT</u>	<u>DRIVER</u> <u>S/N S03</u>	<u>PASSENGER</u> <u>S/N S05</u>
Dummy Centerline to Vehicle Center line	<u>13.4</u> in.	<u>13.1</u> in.
Nose to Upper Rim of Steering Wheel	<u>15.8</u> in.	
Nose to Windshield (Horizontal Distance)		<u>21.0</u> in.
Left Knee to Closest Point on Lower Panel	<u>3.8</u> in.	<u>7.6</u> in.
Right Knee to Closest Point on Lower Panel	<u>4.3</u> in.	<u>7.0</u> in.
Ankle Distance	<u>7.8</u> in.	<u>7.8</u> in.
Knee Distance	<u>7.8</u> in.	<u>7.0</u> in.



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SECTION 2

2.1 SUMMARY OF TEST RESULTS

The following data sheets summarize:

1. The occupant response data (Part 572 Dummy Data Sheet)
2. The vehicle acceleration data (Vehicle Structural Data Sheet)
3. The Pre and Post-Test vehicle dimensions data (Vehicle Structural Data Sheets)

More comprehensive data is presented in Appendix A in the form of computer-generated plots.

2.2 INSTRUMENTATION MALFUNCTION

The longitudinal vehicle accelerometer (Tape 1, channel 10) experienced data response drop out at 64 milliseconds after impact due to accelerometer cable failure.

PART 572 DUMMY DATA

Vehicle 1978 Buick Century Custom NHTSA No. 780106

Driver S/N <u>S03</u> Passenger S/N <u>S05</u>	DRIVER				PASSENGER			
	Positive* Direction		Negative* Direction		Positive* Direction		Negative* Direction	
	Peak G	Time (msec)	Peak G	Time (msec)	Peak G	Time (msec)	Peak G	Time (msec)
Head Acceleration								
Longitudinal	3.6	161.8	82.7	87.8	4.5	54.8	37.8	117.4
Lateral	4.1	100.4	15.9	113.4	4.5	195.0	12.7	124.2
Vertical	6.8	154.4	44.6	100.2	1.0	1.4	58.9	99.8
Resultant	89.4	87.8			68.0	99.8		
HIC	635.3 (86-118 msec)				892.0 (75-143 msec)			
Chest Acceleration								
Longitudinal	4.3	196.4	45.4	86.8	4.3	154.0	61.1	89.6
Lateral	9.1	90.6	6.0	103.2	17.8	92.8	20.4	94.8
Vertical	11.5	135.6	11.2	62.8	12.9	94.0	10.7	72.2
Resultant	45.4	86.8			61.6	89.6		
Severity Index	266				358			
Femur Loads	(lb)	Time (msec)	(lb)	Time (msec)	(lb)	Time (msec)	(lb)	Time (msec)
Left	136	53.8	588	72.0	277	85.2	204	44.2
Right	178	62.8	544	75.2	192	62.8	470	82.4
Belt Load								
Torso	1407	86.4			1406	90.0		

Average Vehicle Impact Speed 29.835 mph

*Positive Direction - Longitudinal: Forward

Lateral: Leftward

Vertical: Upward

Femur: Tension

*Negative Direction - Longitudinal: Rearward

Lateral: Rightward

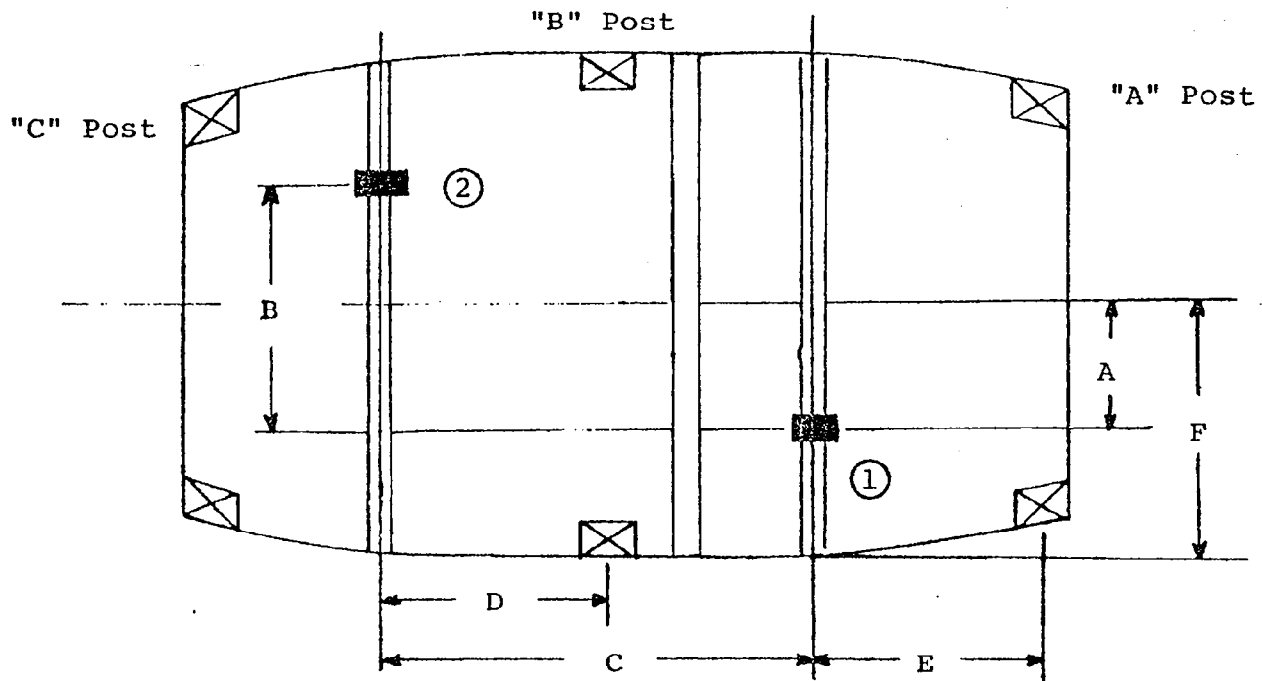
Vertical: Downward

Femur: Compression

VEHICLE STRUCTURAL DATA

Vehicle 1978 Buick Century Custom NHTSA No. 780106

Average Vehicle Impact Speed 29.835 mph; Test Weight 3,840 lbs



DIMENSIONS

LOCATION	MEASUREMENT (in.)	LOCATION	MEASUREMENT (in.)
A	14.5	D	9.0
B	16.6	E	13.0
C	31.1	F	70.3

Steering Column Movement Rearward 1.0", Leftward 0.8", Downward 1.5"
 Vehicle Rebound Distance 14.3 in.
 Overall Vehicle Crush 21.3 in

Acceleration Peaks

LOCATION	Positive* Direction		Negative* Direction	
	Peak G	Time (msec)	Peak G	Time (msec)
No. 1 Longitudinal	1.6	5.8	27.7	31.8
No. 2 Longitudinal	2.8	174.0	34.9	54.4
No. 2 Lateral	N/A	N/A	N/A	N/A
No. 2 Vertical	19.8	56.6	16.1	62.8

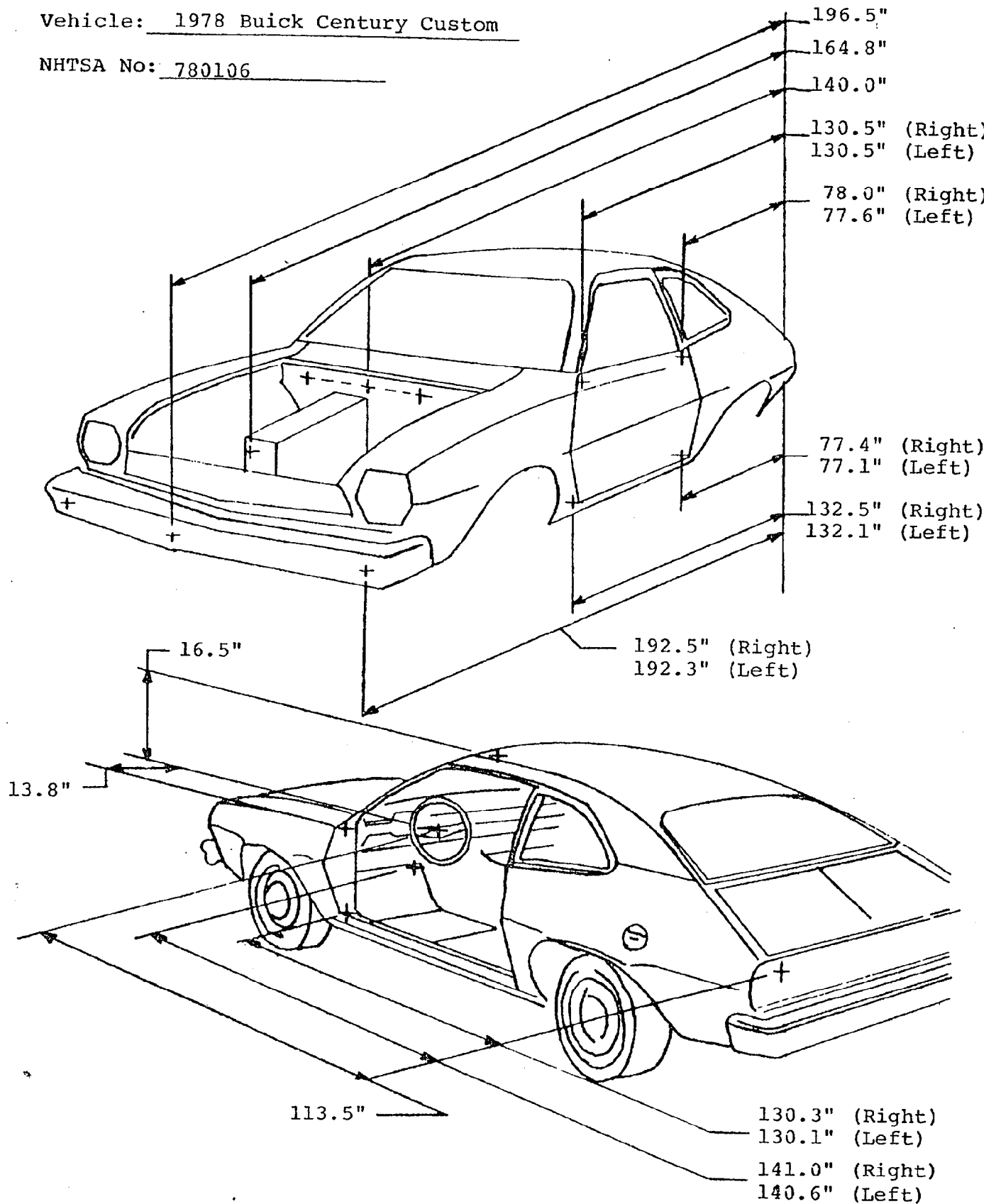
Positive Direction - Longitudnal: Forward
 Lateral: Leftward
 Vertical: Upward

Negative Direction - Longitudnal: Rearward
 Lateral: Rightward
 Vertical: Downward

PRE-TEST
VEHICLE STRUCTURAL DATA

Vehicle: 1978 Buick Century Custom

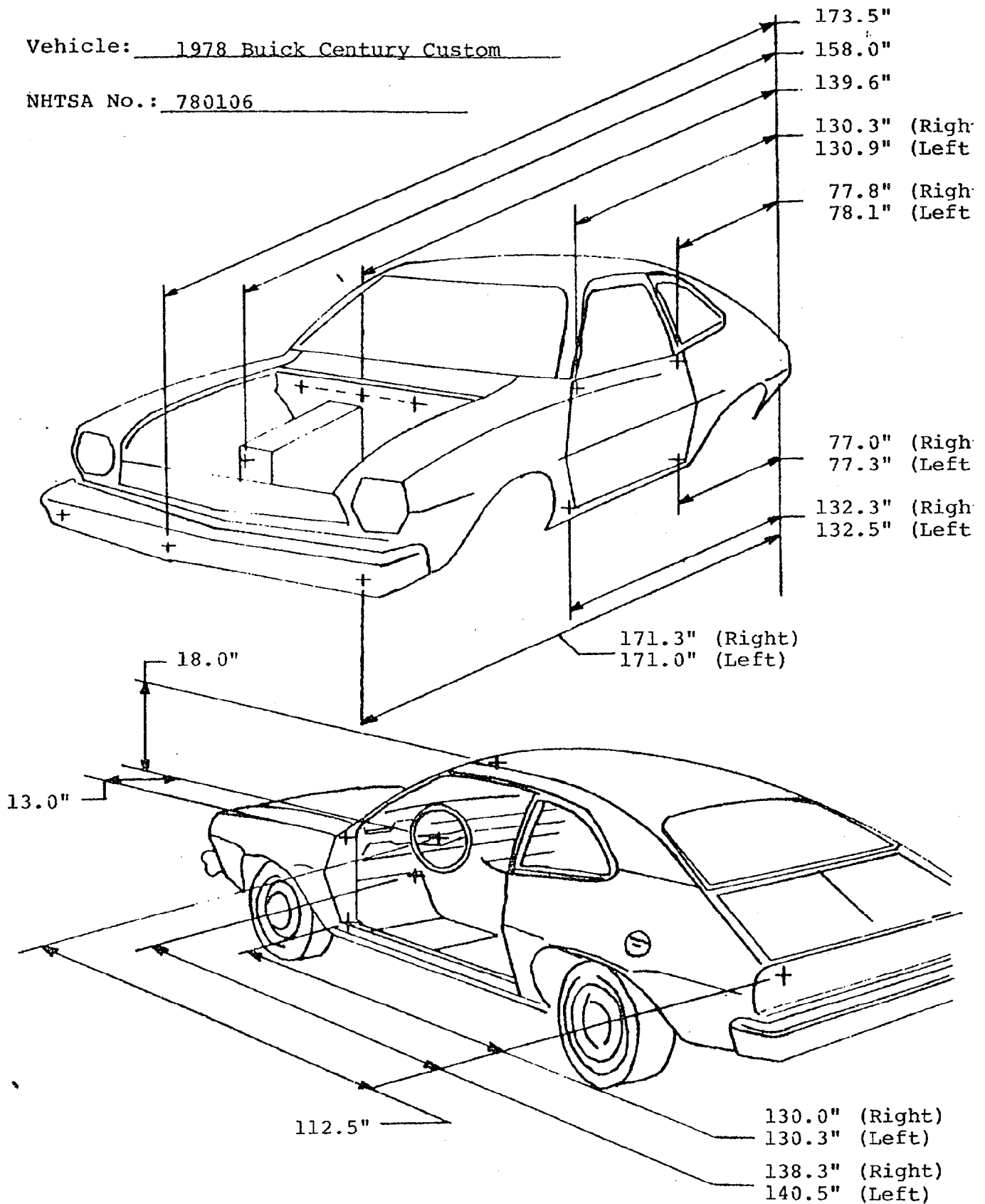
NHTSA No: 780106



POST-TEST
VEHICLE STRUCTURAL DATA

Vehicle: 1978 Buick Century Custom

NHTSA No.: 780106





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SECTION 3



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SECTION 3

3.0 TEST RESULTS AND PHOTOGRAPHS

The test vehicle performance was determined by a frontal fixed barrier impact at an average speed of 29.835 mph. The vehicle rebound distance from the barrier face was 14.3 inches and the average vehicle static crush was 21.3 inches.

Post-impact inspection of the vehicle revealed almost all crush occurred forward of the front doors. The hood buckled up in the middle and both front fenders bowed out and pushed back into the doors. The left and right frame rails buckled in the vicinity of the "A" posts and the roof buckled over both "B" posts. The windshield had numerous cracks and partial retention loss along the lower edge in addition, the glazing caved inward to a degree on the left (driver) side from an unknown cause. The driver dummy impacted the steering wheel assembly and the steering wheel rim was severely bent. The passenger dummy impacted the dash assembly with his legs.

Figure 3-1 through 3-4 are pre-test and post-test views of the occupant compartment, restraint system, and dummies.



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Figure 3-1

1978 Buick Century Custom - 2 Door Coupe

NHTSA 780106

Pre-Test, Driver Dummy View





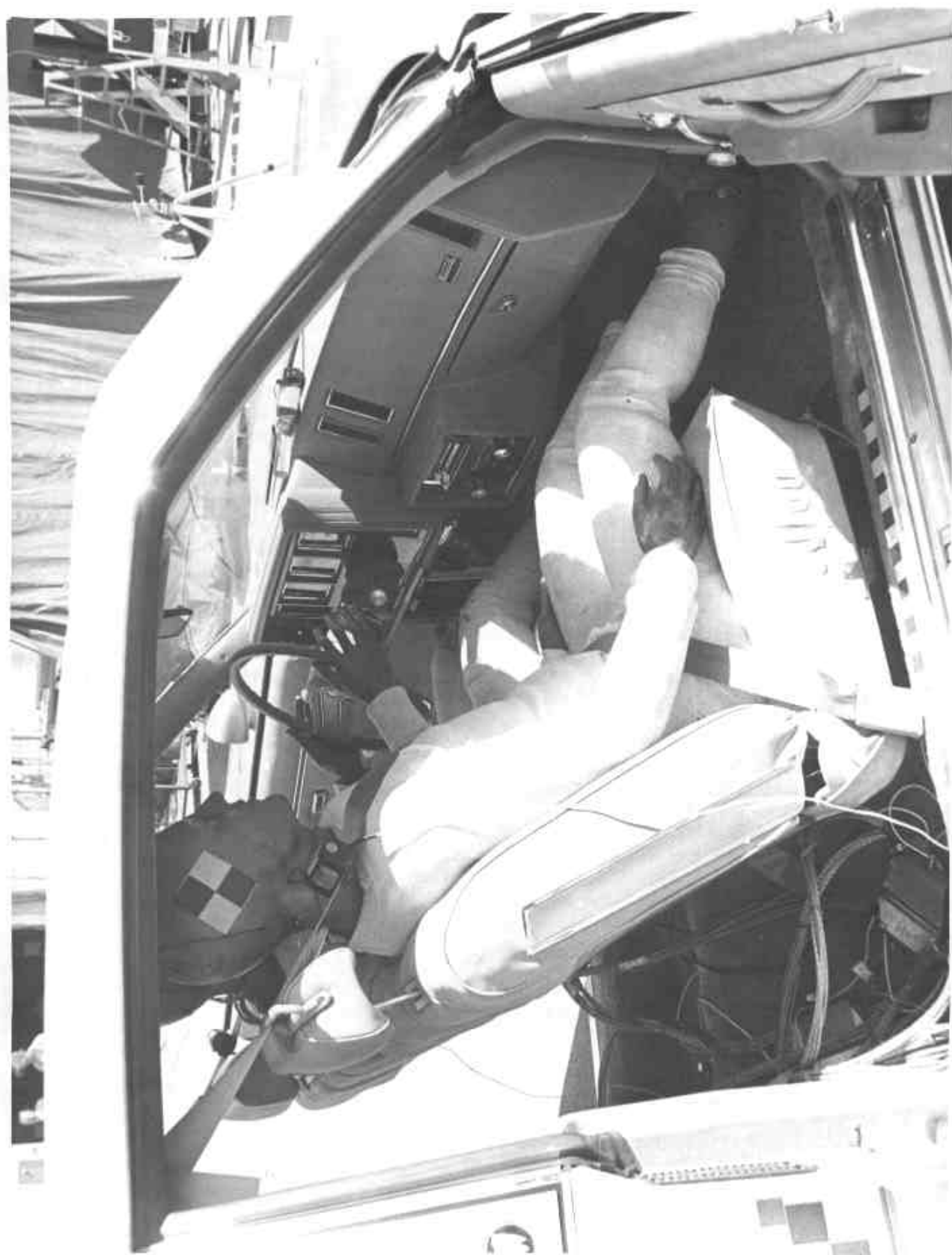
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Figure 3-2

1978 Buick Century Custom - 2 Door Coupe

NHTSA 780106

Pre-Test, Passenger Dummy View





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Figure 3-3

1978 Buick Century Custom - 2 Door Coupe

NHTSA 780106

Post-Impact, Driver Dummy View





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Figure 3-4

1978 Buick Century Custom - 2 Door Coupe

NHTSA 780106

Post-Impact, Passenger Dummy View





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SECTION 4



SECTION 4

4.0 TEST PROCEDURES

4.1 FIXED BARRIER IMPACT TEST

The procedures for conducting the fixed barrier impact test are presented in detail in the FMVSS 219 "Windshield Zone Intrusion" and FMVSS 301-75 "Fuel System Integrity" reports previously submitted to DOT-NHTSA Office of Vehicle Safety Compliance

4.2 TEST DUMMY POSITIONING

The driver and right front passenger dummies were placed in the center of the seat cushion and pushed into the seat back. The shoulders were pushed back against the seat back and the head centered on the head restraint. The thighs were pushed down on the seat cushion and the heels placed on the floor. The thumbs and index fingers of the driver dummy were positioned around the steering wheel rim at the 3 and 9 o'clock positions. The upper portion of the passenger dummy arms were pushed against the seat back and the hands placed to the side of the thighs.



SECTION 4

4.3 DATA ACQUISITION AND REDUCTION

The data acquisition and analysis system used for acquiring occupant response and vehicle acceleration are shown schematically in Figure 4-1. A complete list of instrumentation is provided in Table 4-1. An itemized procedure for acquiring data is provided on Table 4-2.

Prior to the vehicle impact test the onboard instrumentation package was installed and a calibration and null reference check was performed to checkout all data analog devices including the FM magnetic tape recorders. The moment of impact trigger switch attached to the vehicle was also checked out. Immediately following vehicle impact a post-impact calibration and null reference check was performed.

The analog data was then played back into a Hewlett Packard Digital Fourier Analyzer (DFA) system using a HP 2100S mini computer with 35K word core storage. This system used four program controlled analog filters which provided predigitizing filter capability of 60 db/octave above 1250 Hz.

The DFA is a hard disc based system with standard HP design software for performing data acquisition and analysis functions. The HP software was programmed using direct keyboard program functions to automate the data reduction process. The data was entered into temporary storage, four channels (one set) at a time with six total sets. Table 4-3 defines each data channel and data set. The data sets were divided into driver and passenger tape recorder groups to facilitate simultaneous data acquisition for the head, chest



SECTION 4

4.3 DATA ACQUISITION AND REDUCTION (COND'T)

and vehicle accelerometers to assure appropriate calibration of injury criteria and vehicle dynamics. At the time of entry, test personnel entered the appropriate calibration for each data channel and the computer then scaled the data appropriately. When all data had been acquired it was moved as a vehicle set to permanent storage on a removable magnetic disc. (Nine vehicle sets are stored on each magnetic disc. All magnetic discs and FM recorder tapes are retained on file at AETL).

The only modification to the data at the time of permanent storage was the filtering and digitizing process of the FM recorder tape (2500 Hz) and the DFA (1250 Hz, 200 ms). Immediately after the data was moved to permanent storage it was recalled by the test personnel and plotted with the appropriate label and vehicle designation. As the data was recalled the DFA was programmed to automatically filter the data with the appropriate SAE filter. Figure 4-2 illustrates the SAE class 60, 180, 600, and 1000 filters applied to the data. These filters are in accordance with SAE J211a, Instrumentation for Impact Tests. The class 60 filter was applied to the vehicle acceleration and belt restraint forces. The class 180 filter was applied to the chest acceleration forces. The class 600 filter was applied to the femur forces and the class 1000 filter was applied to the head acceleration forces.



SECTION 4

4.3 DATA ACQUISITION AND REDUCTION (CONT'D)

The SAE recommended filters are quadratic double pole filters with 65% damping and 12 db/octave rolloff. They are applied to the data using a Fast Fourier Transform (FFT) of the data, frequency domain multiplication, and inverse FFT operation on the product.

It should be noted in Figure 4-2 that the predigitizing analog filter attenuates all signals above the 1250 Hz cutoff frequency. This has no effect on the class 60 or class 180 data. The class 600 data is within SAE J211a recommendation to 1900 Hz and -20 db. Above 1900 Hz the class 600 data was attenuated at 60 db/octave instead of 24 db/octave. This had very negligible effect on the class 600 data. The modification of class 1000 data by the predigitizing filter is attenuation of 60 db/octave above 1250 Hz instead of 24 db/octave above 1650 Hz. Examination of typical class 1000 data shows the high frequency components between 1250 Hz and 1650 Hz are uniformly less than 3 percent of the largest components at lower frequencys. The effect of the predigitizing filter has a very slight smoothing of the plotted data.

4.4 IMPACT DATA

All impact data is presented in computer plots of data digitized at 200 microseconds. Special SAE filters were applied to each data set. Each data plot includes labeling, defining the test vehicle, filter class, and the complete identification of the data plotted.



SECTION 4

4.4.1 DUMMY HEAD DATA

The dummy head accelerations were processed as class 1000 data, and the Head Injury Criteria (HIC) calculation was performed. The HIC calculations were maximized for start time (T1) and end time (T2), using a manual iteration routine, usually requiring about ten iterations and between 5,000 and 10,000 combinations of start and end times. Data output is in the form of computer plots with the final HIC calculations. Listing of data value and HIC calculations are available, but not provided in the final report.

4.4.2 DUMMY CHEST DATA

The dummy chest accelerations were processed as class 180 data, and direct Chest Severity Index (CSI) calculations were performed. Data output is in the form of computer plots with the CSI calculations.

4.4.3 FEMUR LOAD DATA

The dummy femur loads were processed as class 600 data, and presented as computer plots.

4.4.4 RESTRAINT LOAD DATA

The dummy restraint loads were processed as class 60 data, and presented as computer plots.



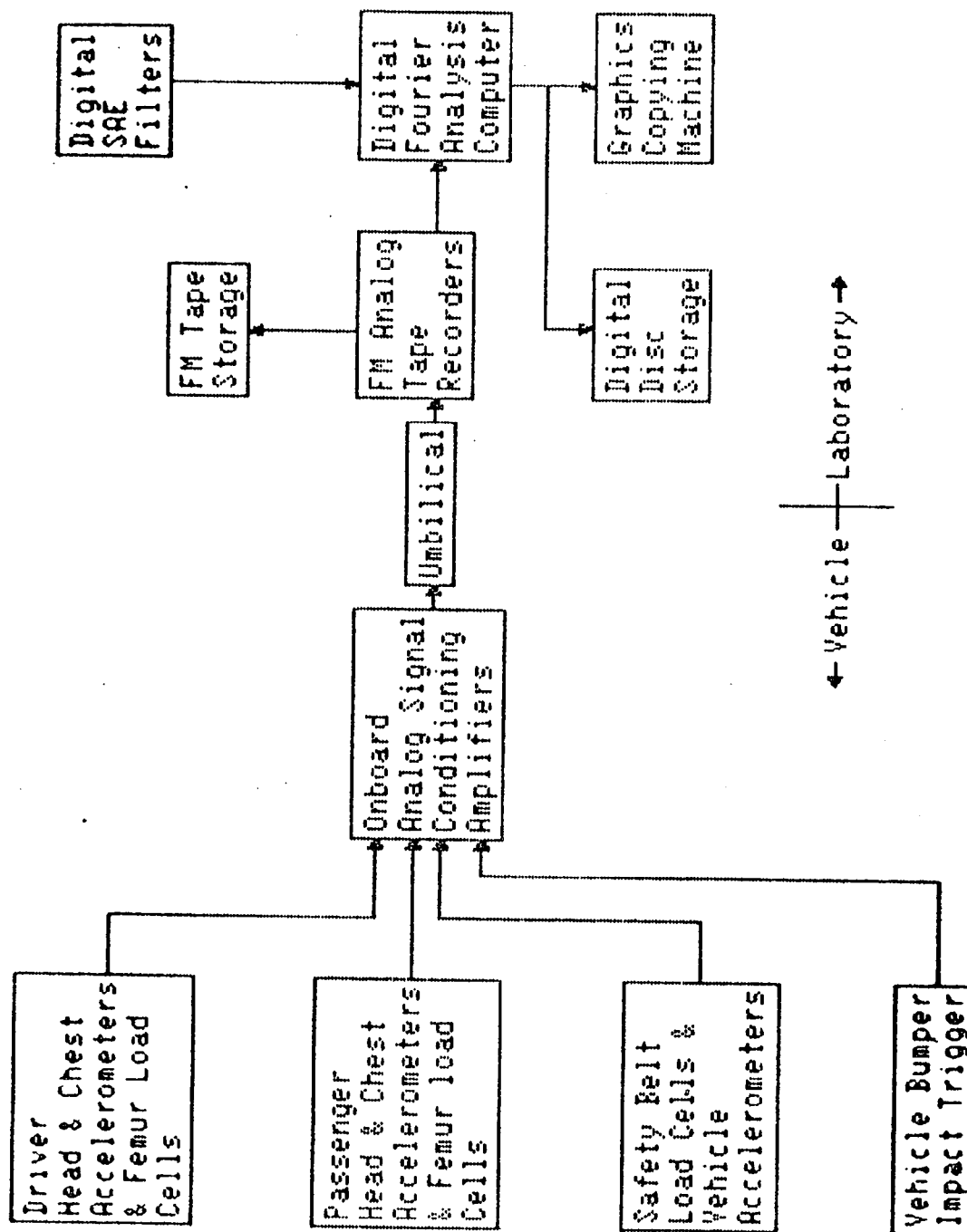
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SECTION 4

4.4.5 VEHICLE ACCELERATION DATA

The vehicle accelerations were processed as class 60 data, and presented as computer plots. Additionally, the longitudinal vehicle acceleration was integrated to provide approximate vehicle velocity change and vehicle crush during the impact event.

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← Vehicle — Laboratory →

VEHICLE AND OCCUPANT CRASH IMPACT DATA ACQUISITION SYSTEM

FIGURE 4-1

TABLE 4.1 INSTRUMENTATION FOR CRASH TEST

Instrument	Manufacturer	Model No.	Full Scale	Accuracy	Frequency Max.
Accelerometers, Head, Chest, Vehicle	Endevco	2262C-200	200g	±1%	3600 Hz
Load Cells, Femurs	GSE	2430	3000 lb	±1%	>3600 Hz
Load Cells, Safety Belts	GSE	2500	3000 lb	±1%	>3600 Hz
Contact Switch, Impact	AETL	-	2 V	-	<200 us rise time
FM Tape Recorder	Bell & Howell	4020	±2.8 V	47 db SNR	2500 Hz WB
Programmable Filter, All Data	Hewlett Packard	54440A	-	0.5%	1250 Hz, 60 db/oct
Analog-Digital Converter, All Data	Hewlett Packard	5466B	-	0.5%	200 us sampling
Analysis Computer, All Analysis	Hewlett Packard	2100S	32 K Words	16 Bit Word	-
Disc Drive	Hewlett Packard	7900A	5 Meg Words	-	-



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TABLE 4-2

DATA ACQUISITION AND REDUCTION PROCESS

<u>STEP</u>	<u>DESCRIPTION</u>
1	DA System Installation
2	DA System Pre-Impact Calibration
3	Impact Trigger Checkout
4	Vehicle Impact Performed
5	DA System Post-Impact Calibration
6	Data Reproduced From FM Tape Into Computer a) Data analog filtered at 1250 Hz b) Data digitized at 200 ms sample rate c) Data sychronized by impact trigger signal
7	Digitized Data Examined
8	Data Transferred Permanent Disc Storage
9	Appropriate SAE Filters Are Applied
10	Each Data Signal Plotted With Lables
11	Chest Severity Index Values Determined
12	Head Injury Criteria Values Determined
13	Vehicle Dynamics Evaluated (MPH & Crush)

TABLE 4-3

DATA DESIGNATIONS FOR VEHICLE CRASH IMPACT DATA ACQUISITION

DATA SET	TAPE NO.	CHANNEL NO.	DESCRIPTION
1	1	1	Driver Longitudinal Head Acceleration A_x
1	1	2	Driver Lateral Head Acceleration A_y
1	1	3	Driver Vertical Head Acceleration A_z
1	1	4	Driver Right Femur Force
2	1	5	Driver Longitudinal Chest Acceleration A_x
2	1	6	Driver Lateral Chest Acceleration A_y
2	1	7	Driver Vertical Chest Acceleration A_z
2	1	8	Driver Left Femur Force
3	1	9	Driver Restraint Belt Force
3	1	10	Longitudinal Vehicle Acceleration (Front) A_x
3	1	11	Longitudinal Vehicle Acceleration (Rear) A_x
3	1	12	Vertical Vehicle Acceleration (Rear) A_z
4	2	1	Passenger Longitudinal Head Acceleration A_x
4	2	2	Passenger Lateral Head Acceleration A_y
4	2	3	Passenger Vertical Head Acceleration A_z
4	2	4	Passenger Right Femur Force
5	2	5	Passenger Longitudinal Chest Acceleration A_x
5	2	6	Passenger Lateral Chest Acceleration A_y
5	2	7	Passenger Vertical Chest Acceleration A_z
5	2	8	Passenger Left Femur Force
6	2	9	Passenger Restraint Belt Force
6	2	10-12	Same as Tape 1, Ch's 10-12

COMPARISON PLOT OF SAE CLASS 60, 180, 600, 1000 FILTERS AND
THE DATA ANALYSIS 1250 HZ PREDIGITIZING ANALOG FILTER.

SAE FILTERS ROLL OFF IS 12DB/OCT, ANALOG FILTER ROLL OFF IS 60DB/OCT

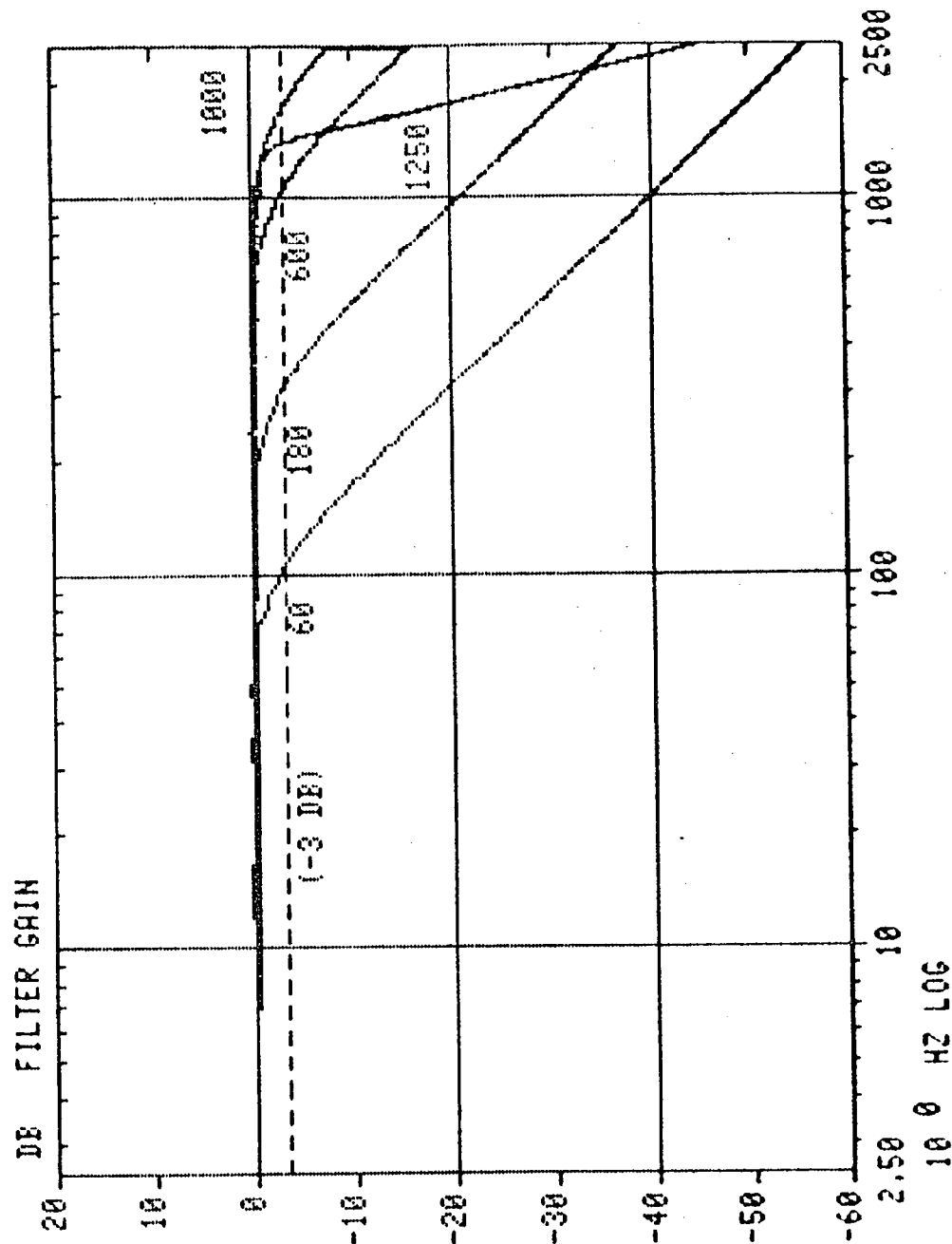


FIGURE 4-2



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APPENDIX A



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APPENDIX A

The following computer plots provide complete and comprehensive occupant response and vehicle acceleration during the impact event.

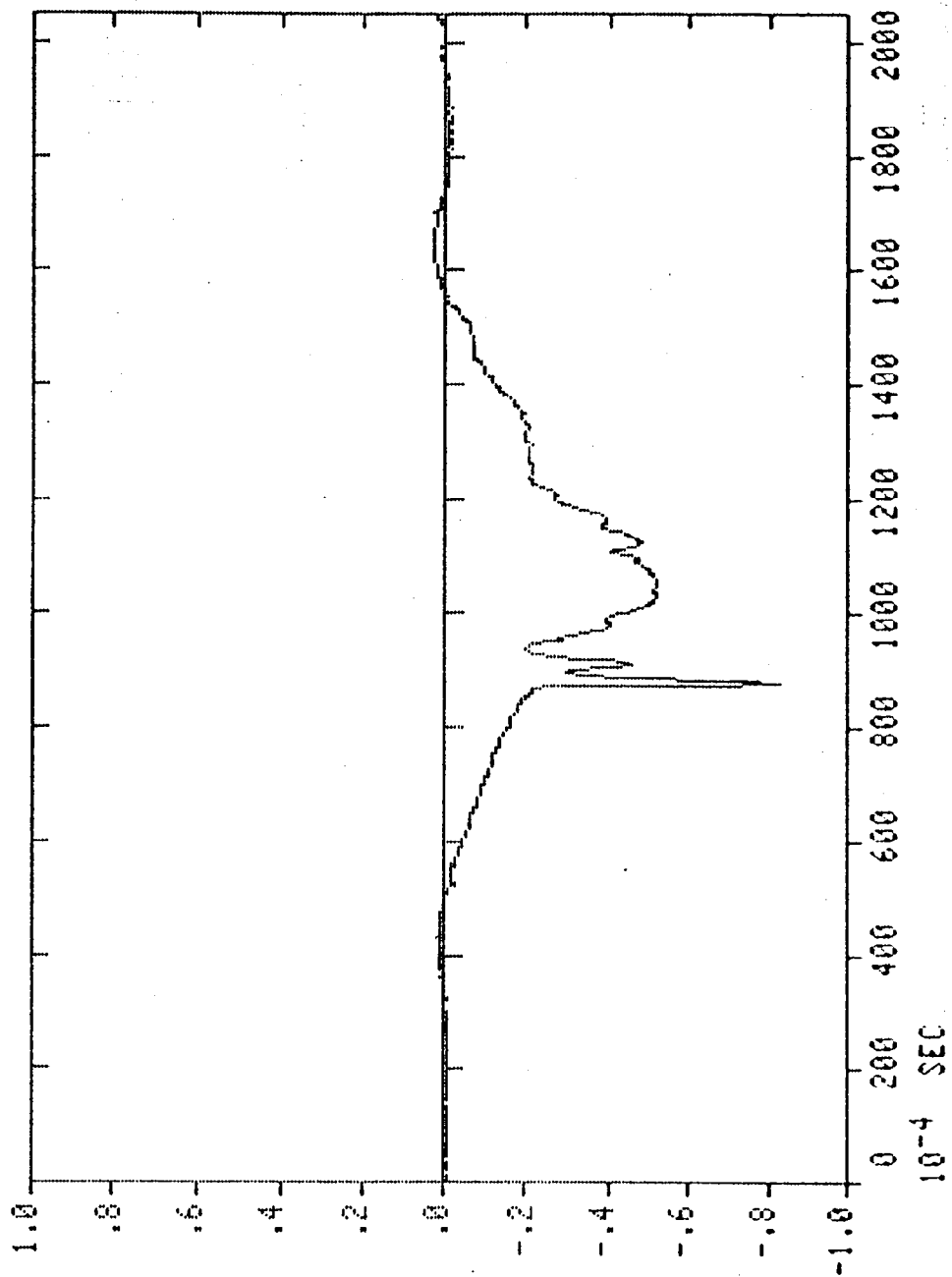
DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO. : 21
DATE: APRIL 3, 1979

MJO NO. : 671-1489-65
FILTER: CLASS 1000
ACCELEROMETER: TAPE 1, CH 1
DIRECTION: FORWARD
LOCATION: DRIVER'S HEAD

10 2 G AX

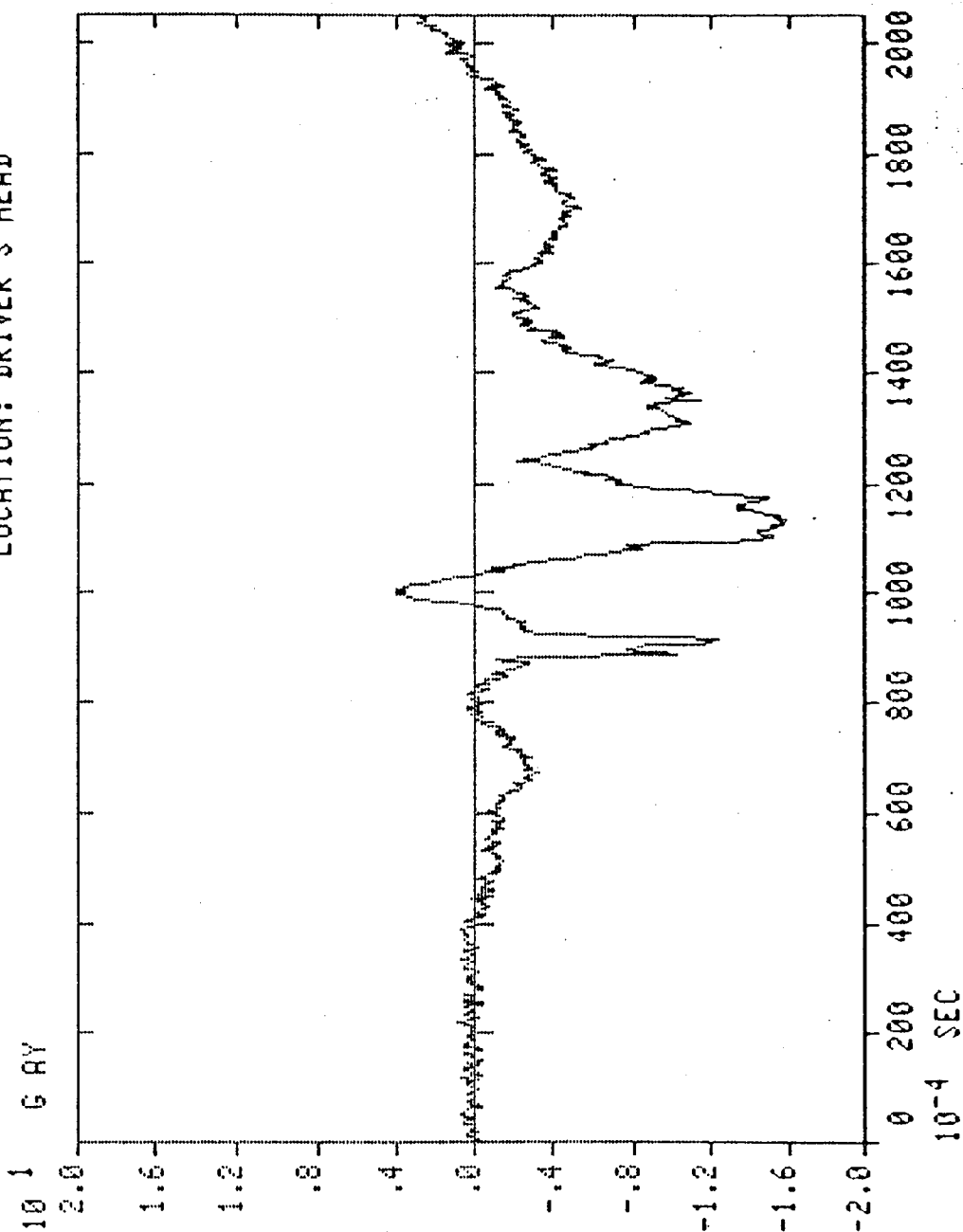


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 1000
ACCELEROMETER: TAPE 1, CH 2
DIRECTION: LEFT
LOCATION: DRIVER'S HEAD

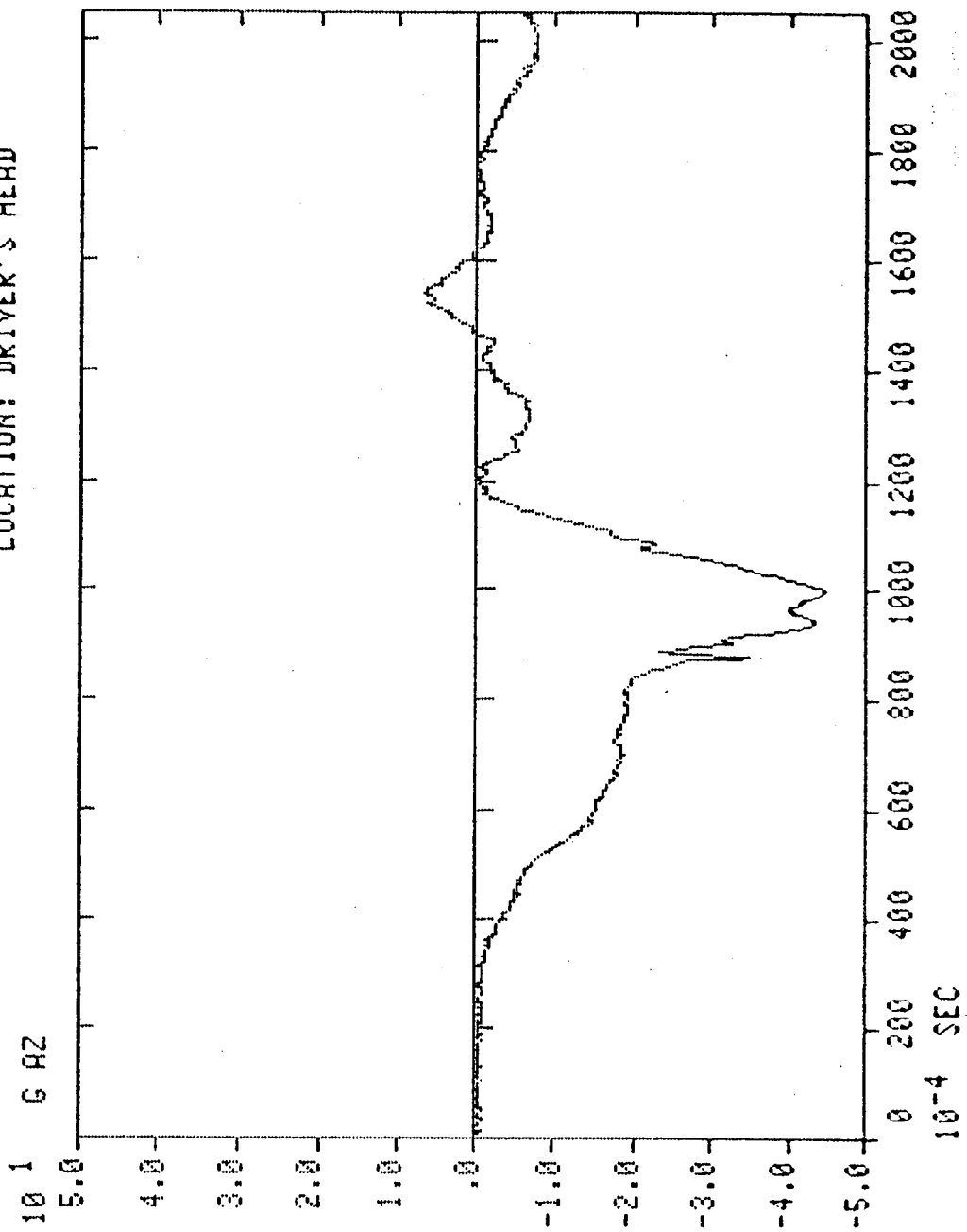


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 1000
ACCELEROMETER: TAPE 1, CH 3
DIRECTION: UPWARD
LOCATION: DRIVER'S HEAD



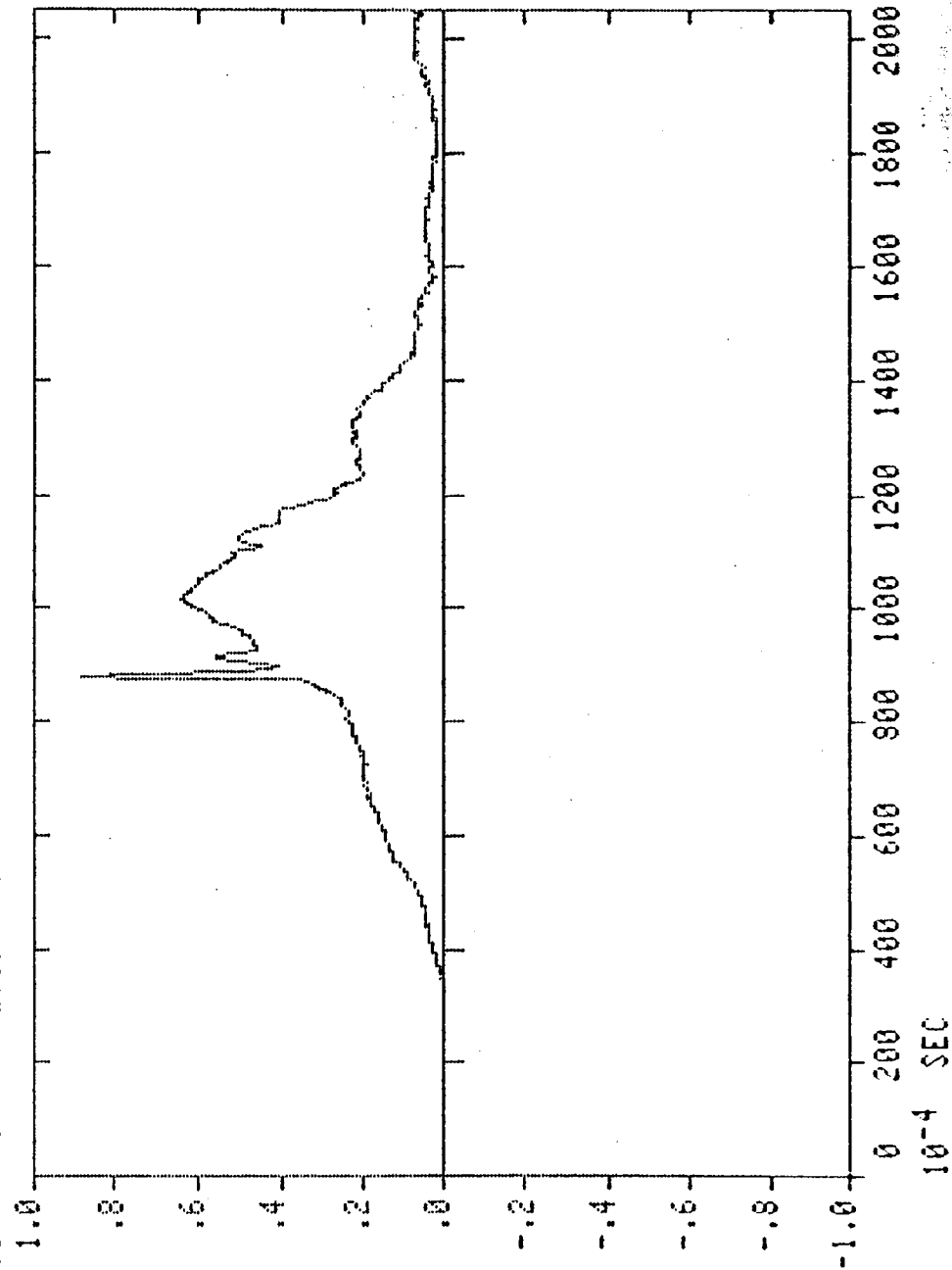
DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 1000
ACCELEROMETER: TAPE 1, CH 1-3
DIRECTION: RESULTANT OF XYZ
LOCATION: DRIVER'S HEAD

10 2 G AR RESULTANT

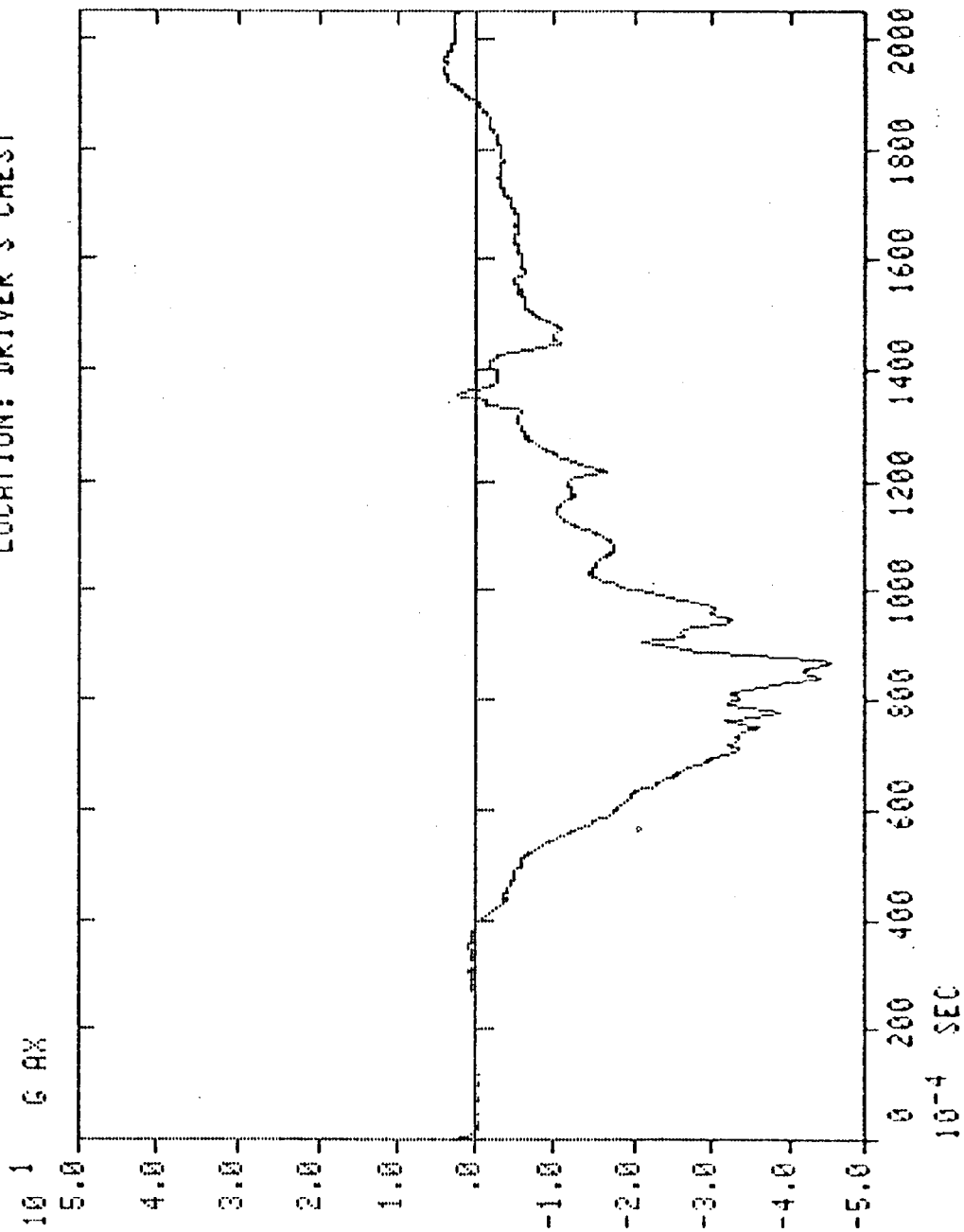


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
 VEHICLE ID: NHTSA 780106
 TEST FILE NO.: 21
 DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
 FILTER: CLASS 180
 ACCELEROMETER: TAPE 1, CH 5
 DIRECTION: FORWARD
 LOCATION: DRIVER'S CHEST

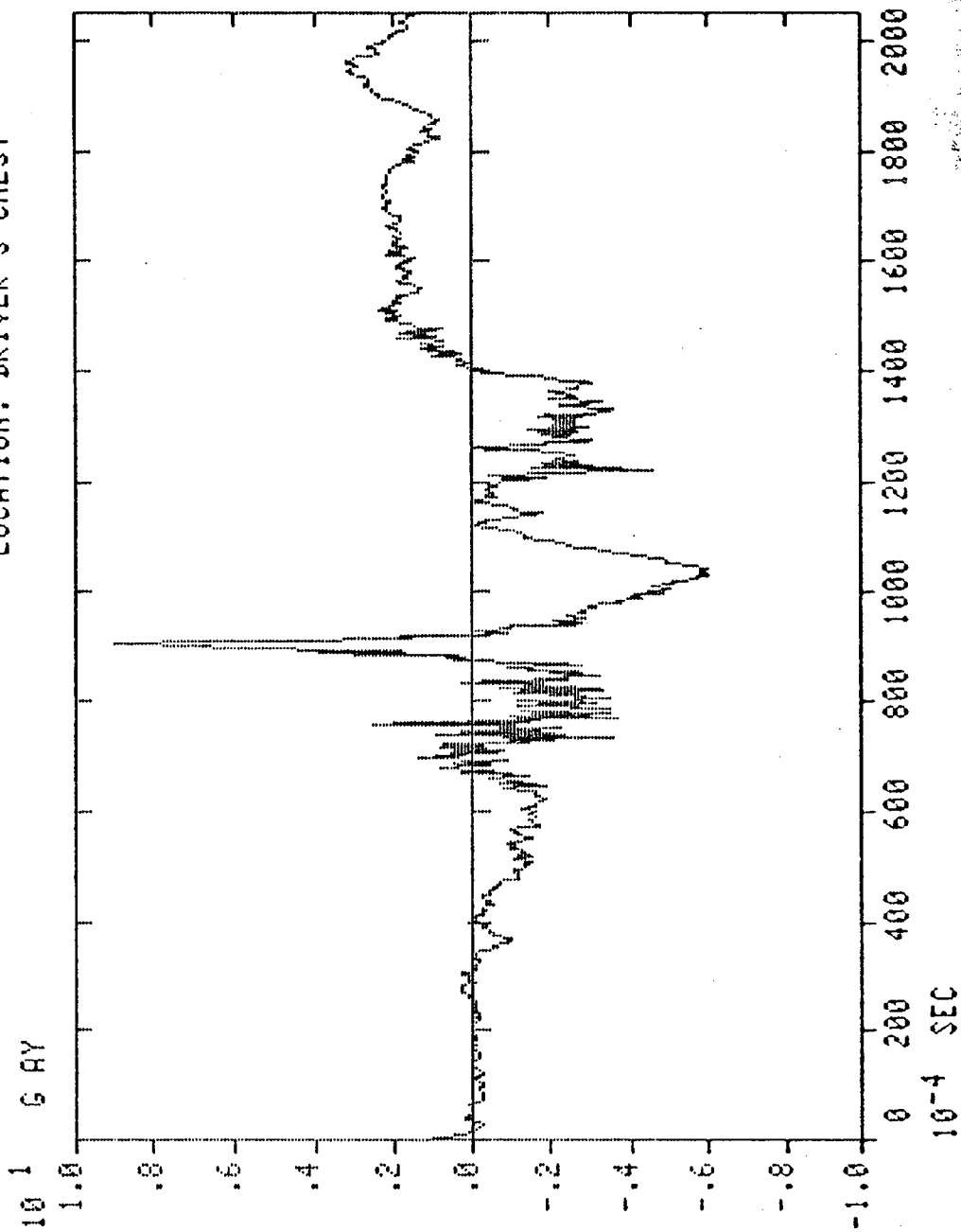


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 6
DIRECTION: LEFT
LOCATION: DRIVER'S CHEST

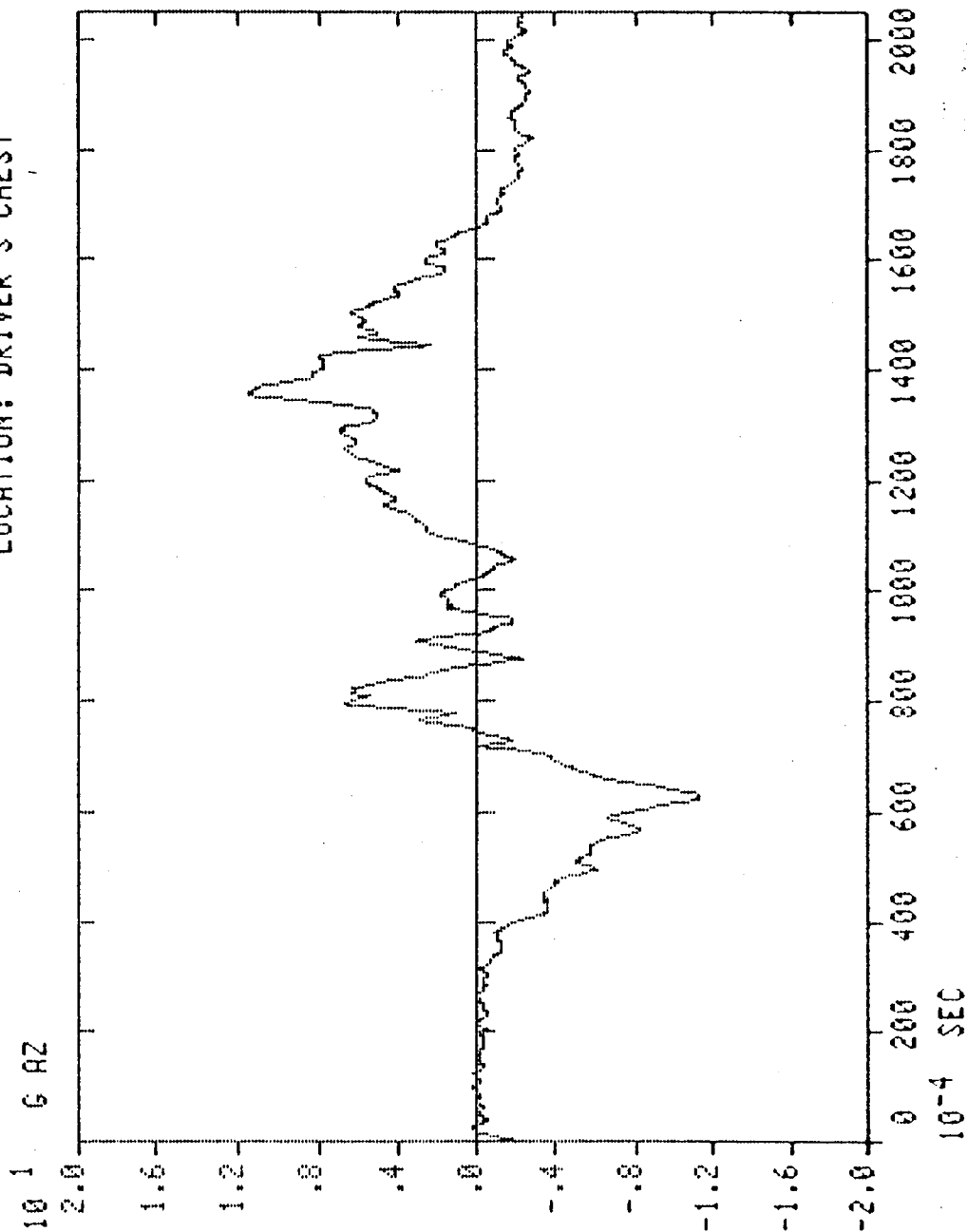


NOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 7
DIRECTION: UPWARD
LOCATION: DRIVER'S CHEST

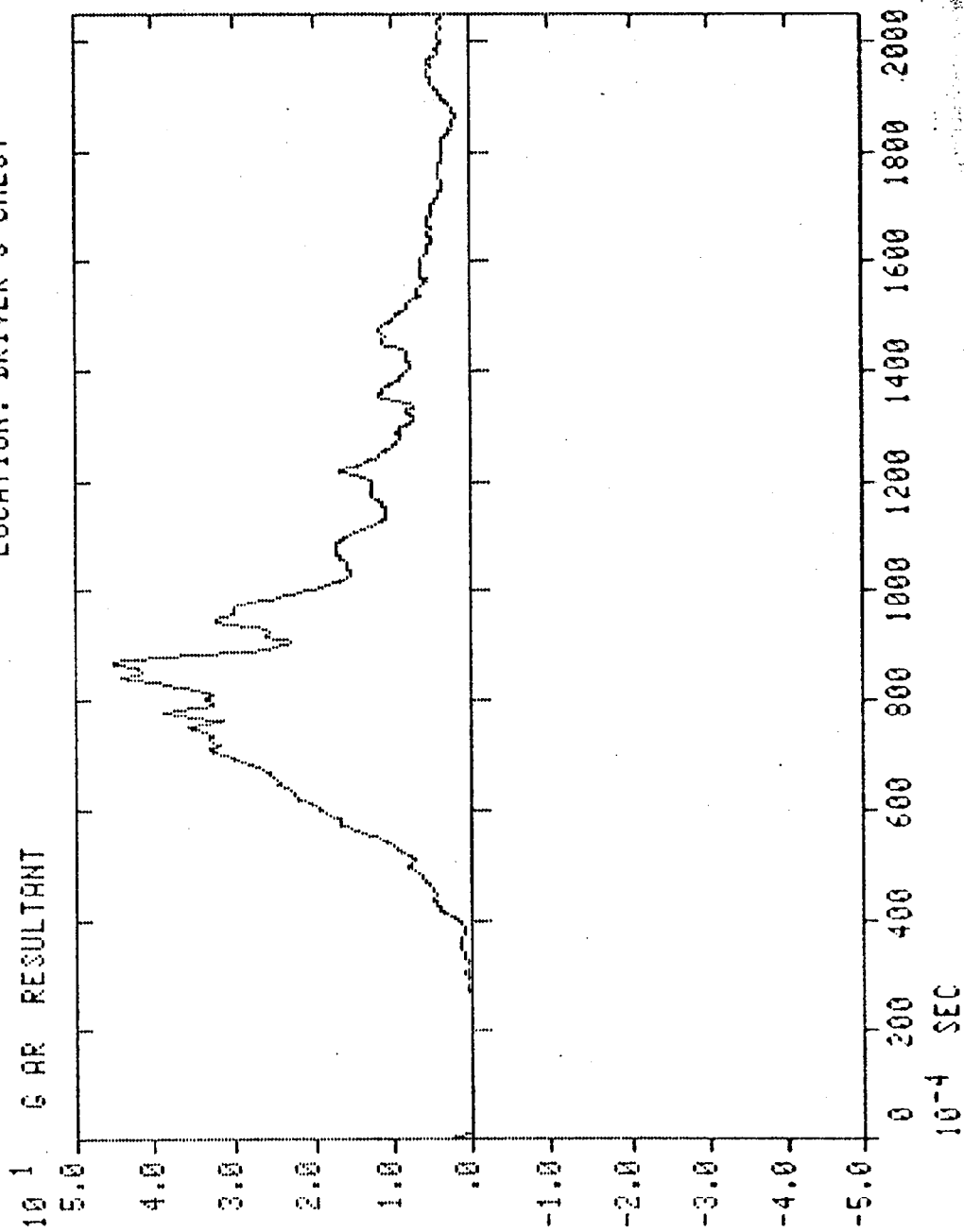


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO. : 21
DATE: APRIL 3, 1979

NJO NO. : 671-1489-65
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 5-7
DIRECTION: RESULTANT OF XYZ
LOCATION: DRIVER'S CHEST

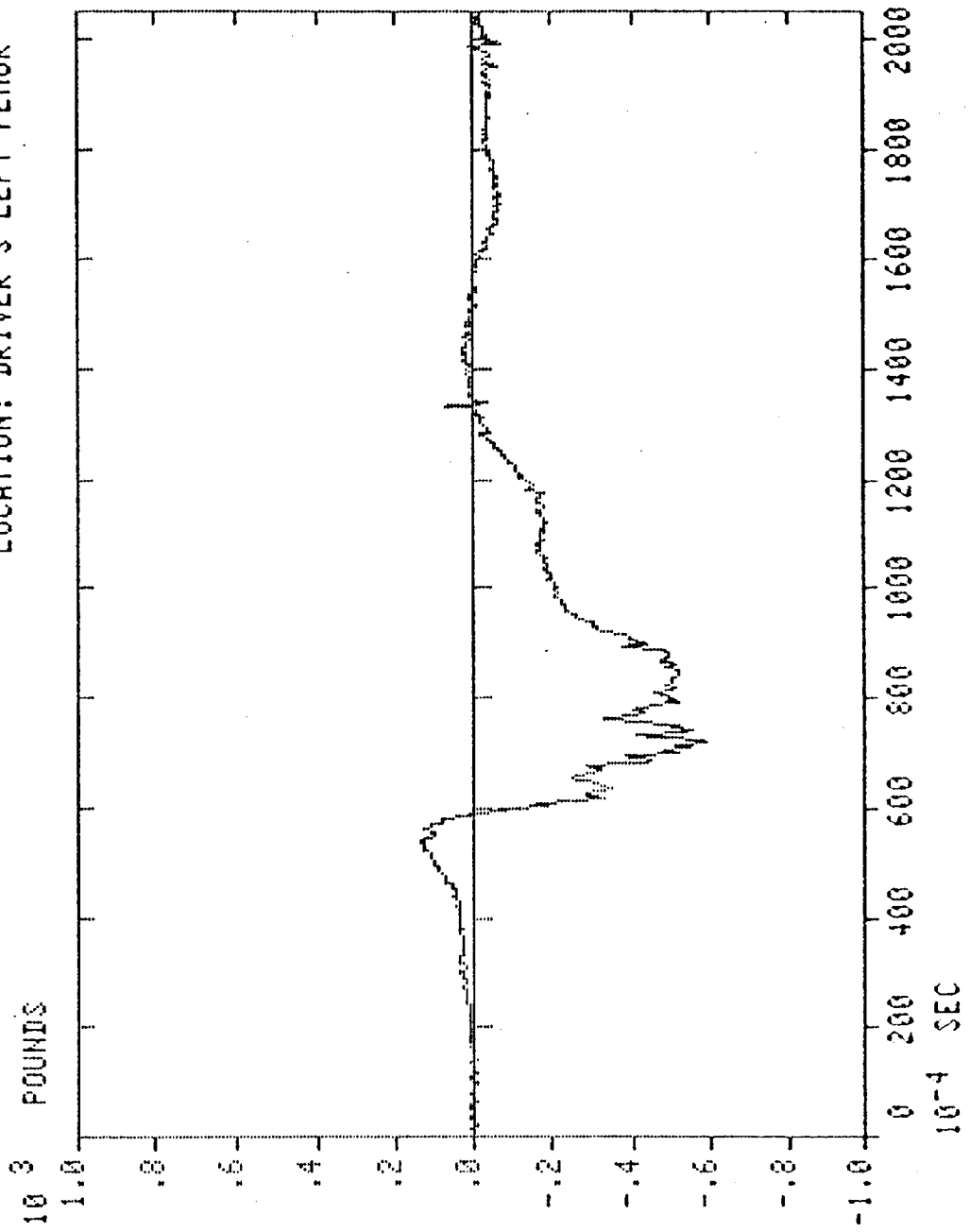


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO. : 21
DATE: APRIL 3, 1979

MJO NO. : 671-1489-65
FILTER: CLASS 600
LOAD CELL: TAPE 1, CH 8
DIRECTION: TENSION
LOCATION: DRIVER'S LEFT FEMUR

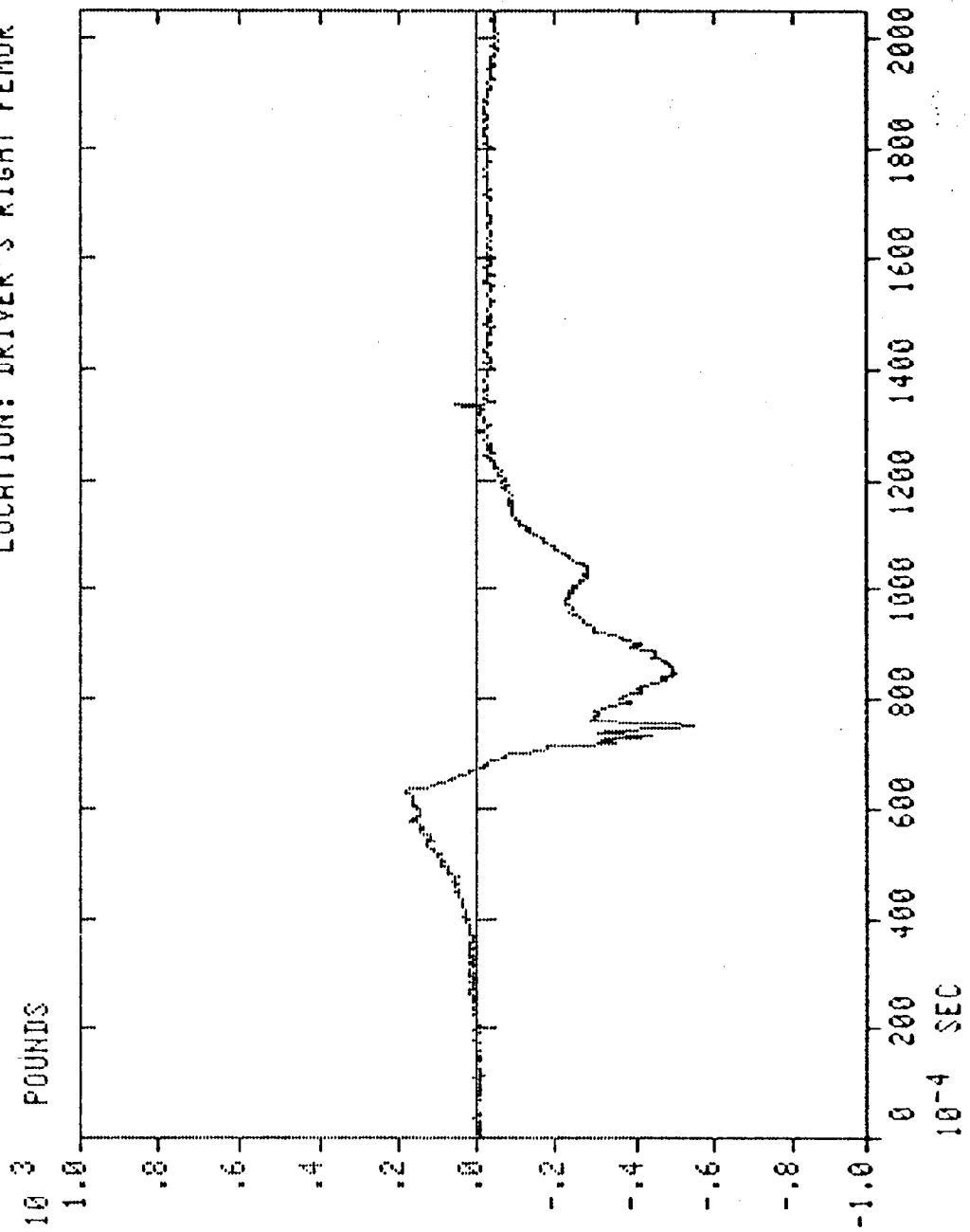


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 600
LOAD CELL: TAPE 1, CH 4
DIRECTION: TENSION
LOCATION: DRIVER'S RIGHT FEMUR

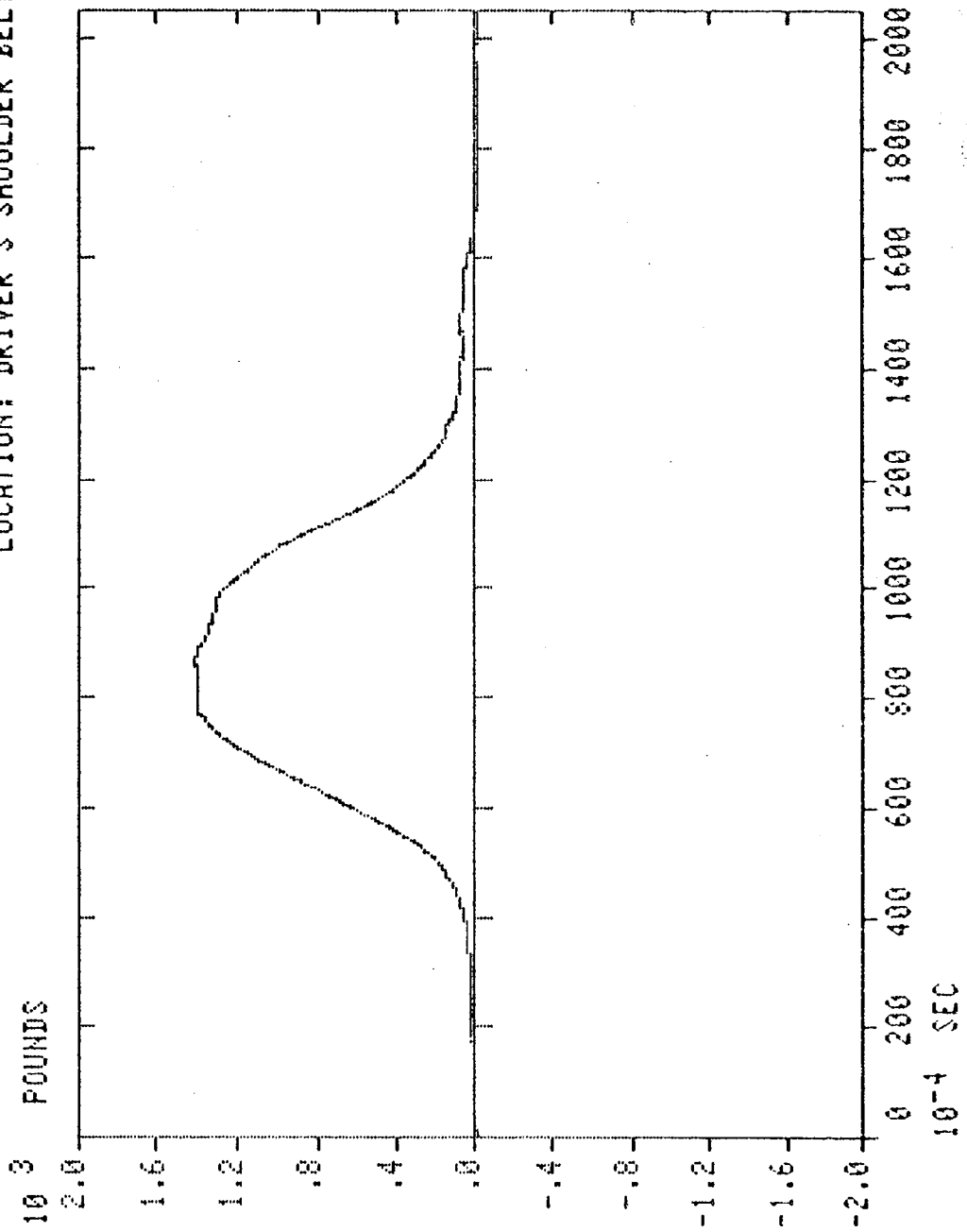


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 60
LOAD CELL: TAPE 1, CH 9
DIRECTION: TENSION
LOCATION: DRIVER'S SHOULDER BELT

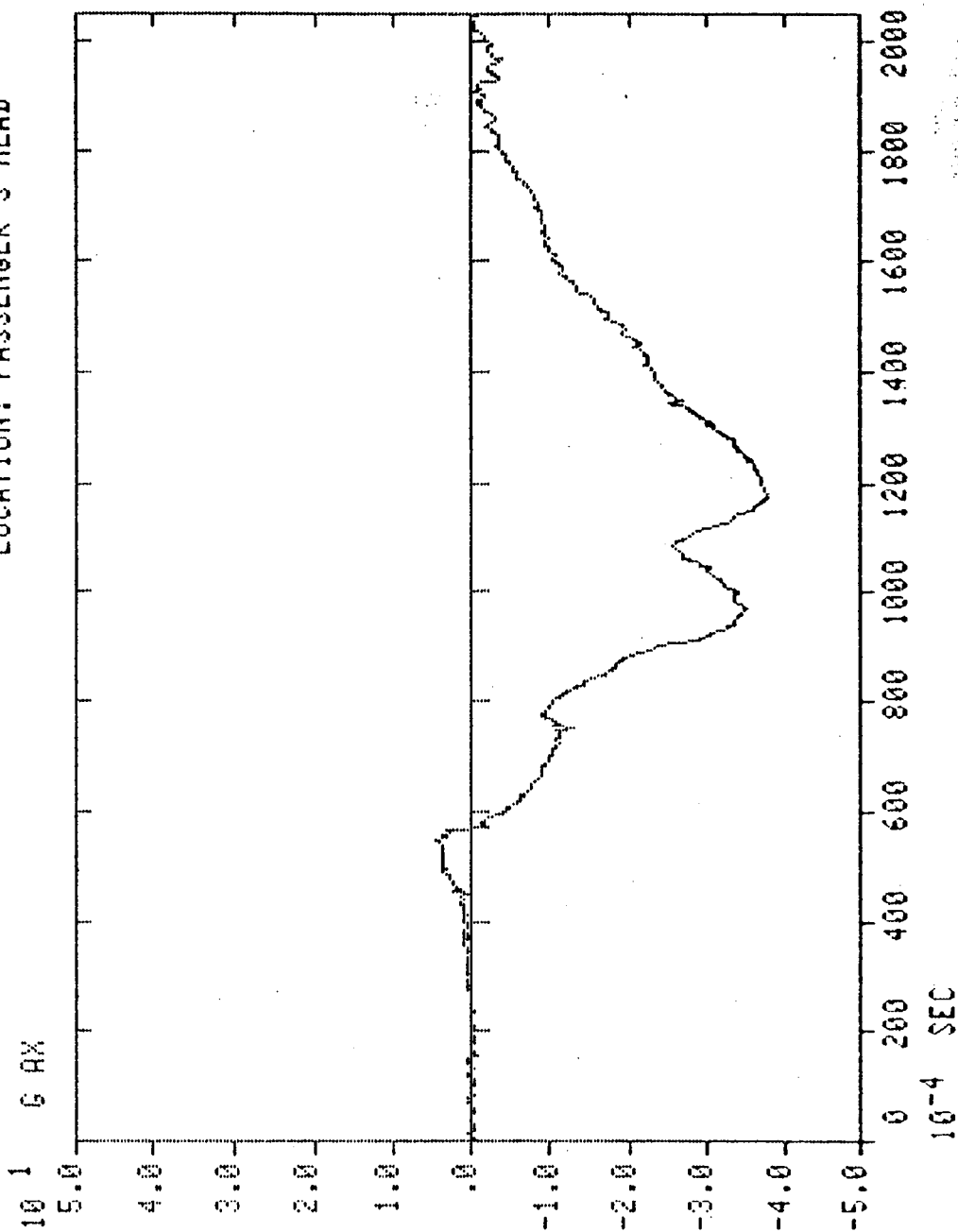


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 1
DIRECTION: FORWARD
LOCATION: PASSENGER'S HEAD

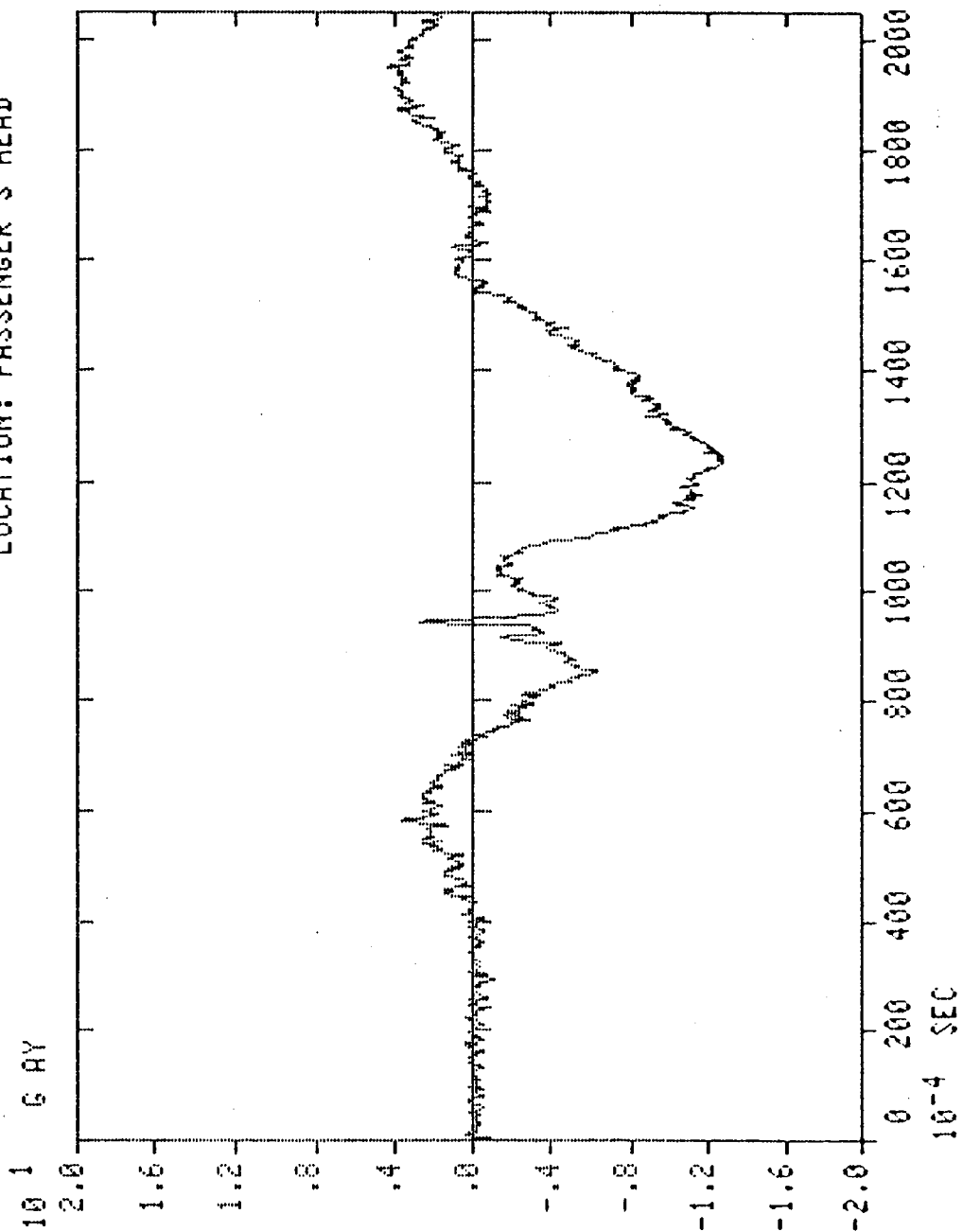


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 2
DIRECTION: LEFT
LOCATION: PASSENGER'S HEAD

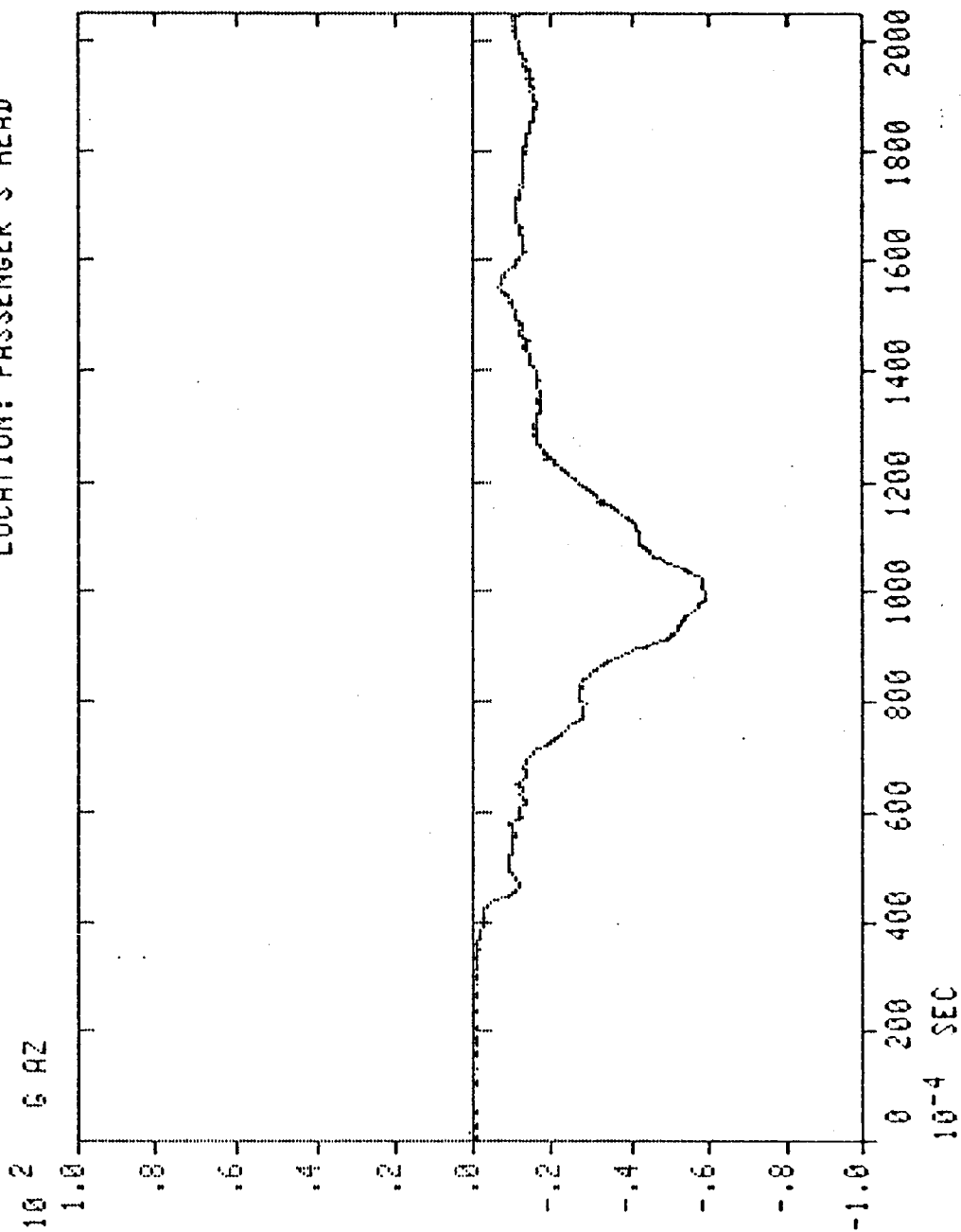


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
 VEHICLE ID: NHTSA 780106
 TEST FILE NO.: 21
 DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
 FILTER: CLASS 1000
 ACCELEROMETER: TAPE 2, CH 3
 DIRECTION: UPWARD
 LOCATION: PASSENGER'S HEAD



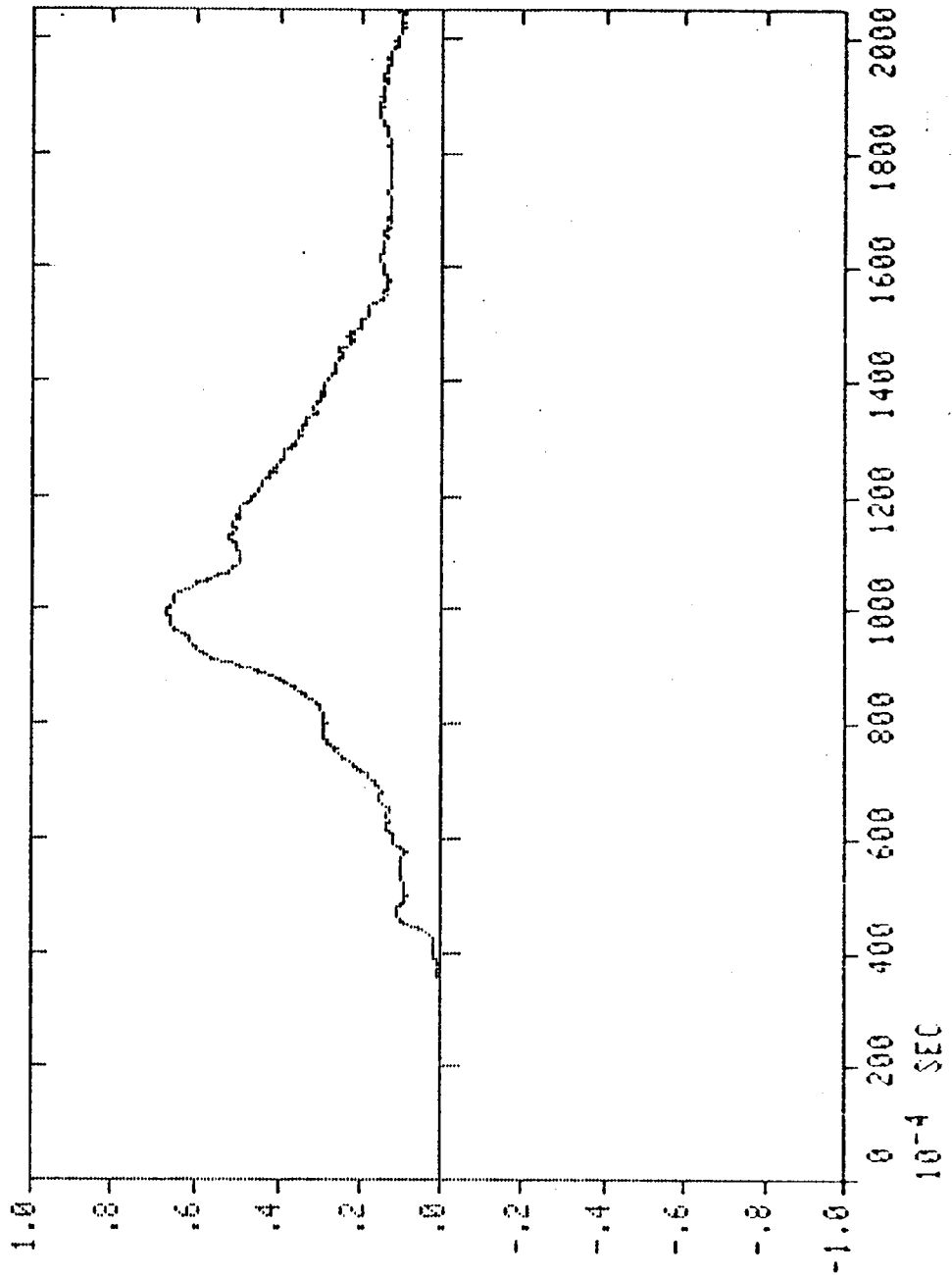
DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 1-3
DIRECTION: RESULTANT OF XYZ
LOCATION: PASSENGER'S HEAD

10 2 G AR RESULTANT

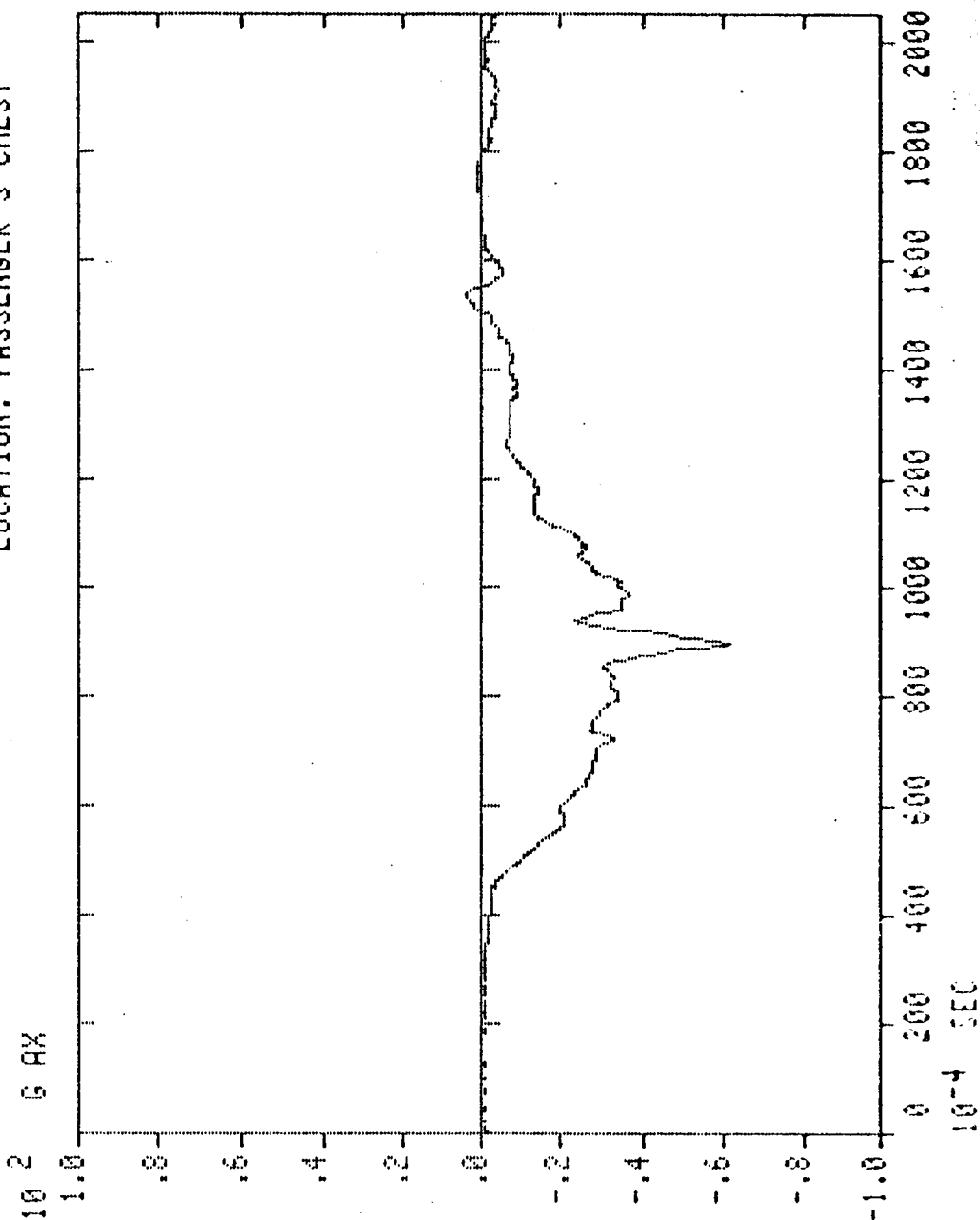


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO. : 21
DATE: APRIL 3, 1979

MJO NO. : 671-1489-65
FILTER: CLASS 180
ACCELEROMETER: TAPE 2, CH 5
DIRECTION: FORWARD
LOCATION: PASSENGER'S CHEST

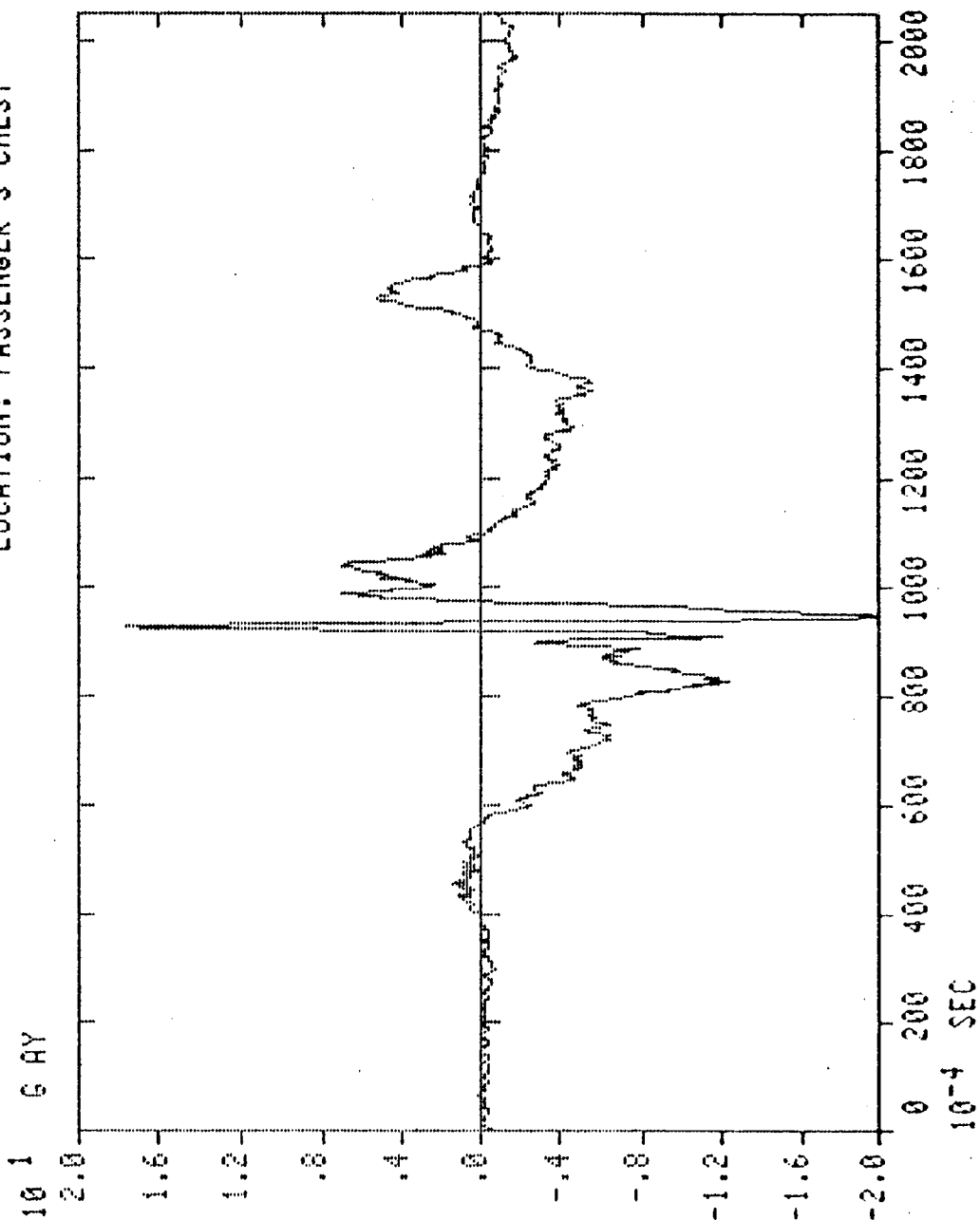


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO. : 21
DATE: APRIL 3, 1979

MJO NO. : 671-1489-65
FILTER: CLASS 180
ACCELEROMETER: TAPE: 2, CH 6
DIRECTION: LEFT
LOCATION: PASSENGER'S CHEST

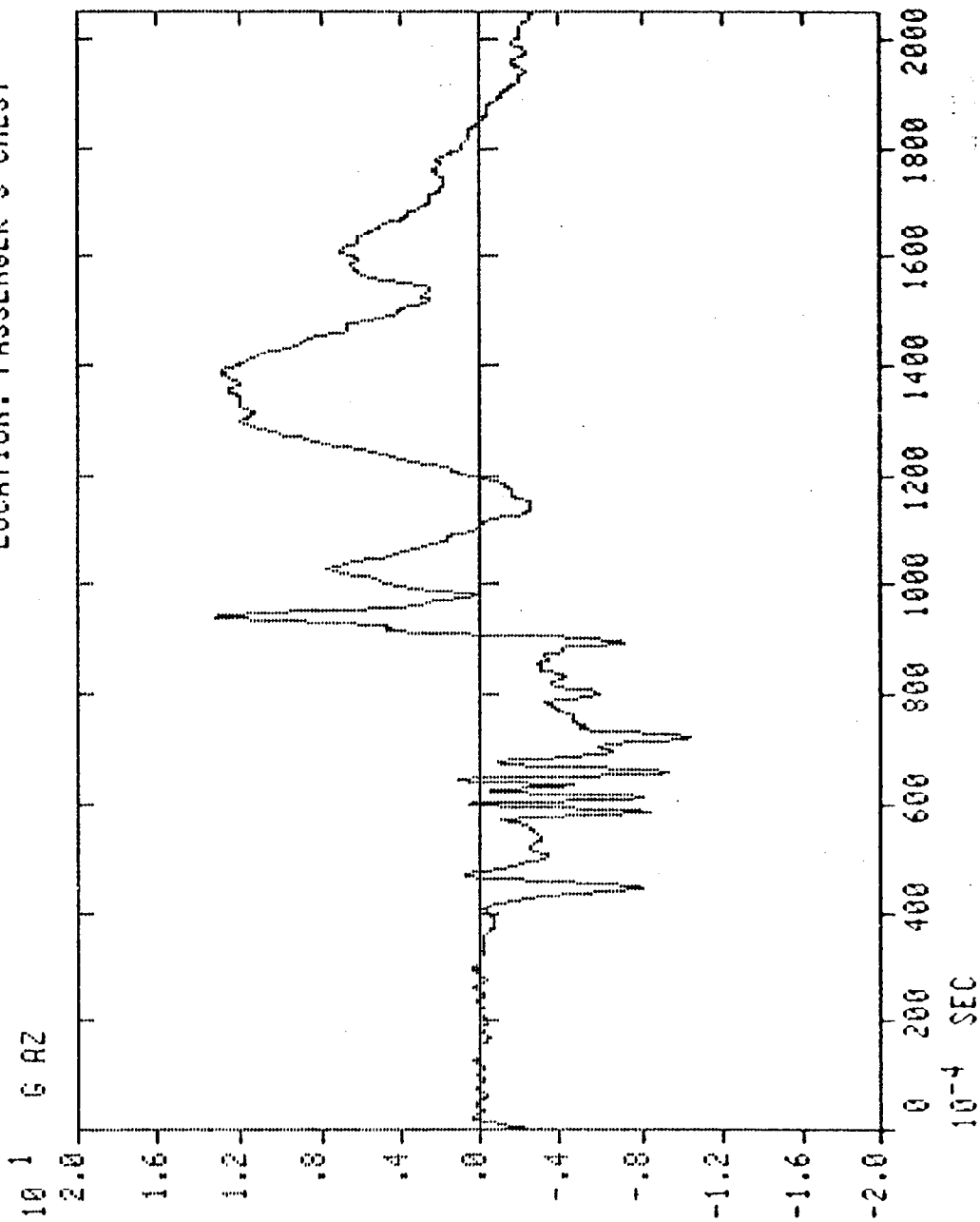


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 180
ACCELEROMETER: TAPE 2, CH 7
DIRECTION: UPWARD
LOCATION: PASSENGER'S CHEST

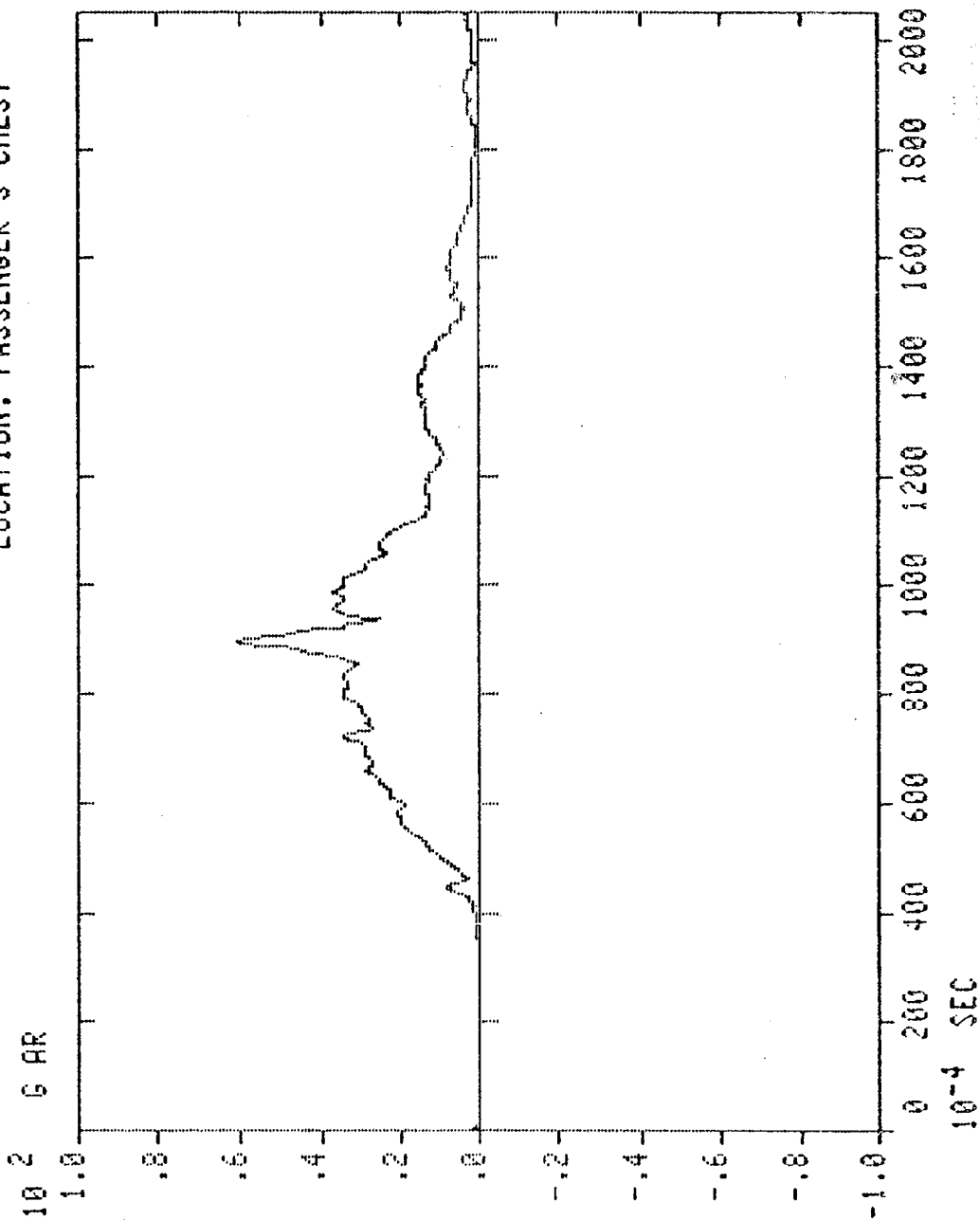


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO. : 21
DATE: APRIL 3, 1979

MJO NO. : 671-1489-65
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 5-7
DIRECTION: RESULTANT OF XYZ
LOCATION: PASSENGER'S CHEST

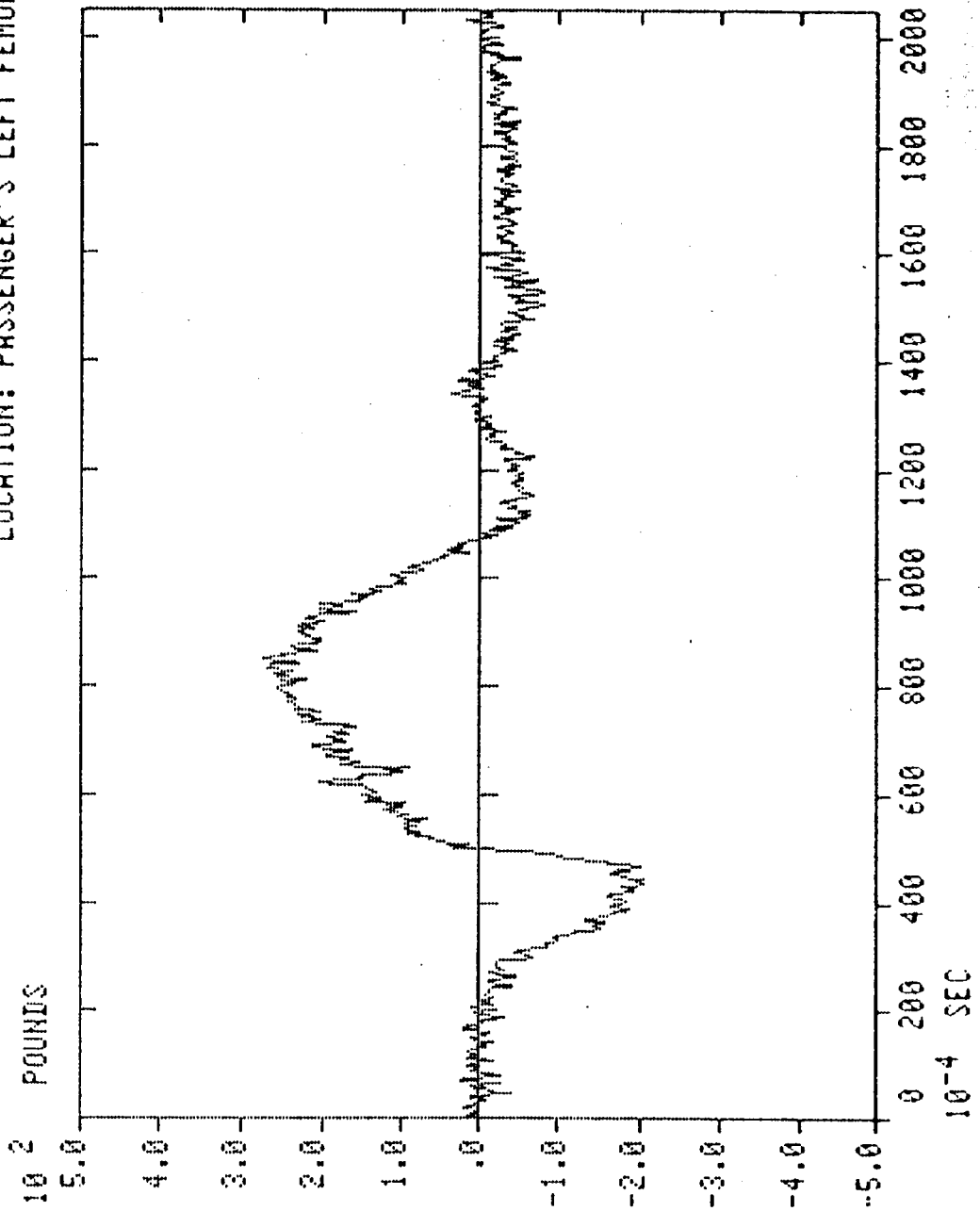


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO. : 21
DATE: APRIL 3, 1979

MJO NO. : 671-1489-65
FILTER: CLASS 600
LOAD CELL: TAPE 2, CH 8
DIRECTION: TENSION
LOCATION: PASSENGER'S LEFT FEMUR

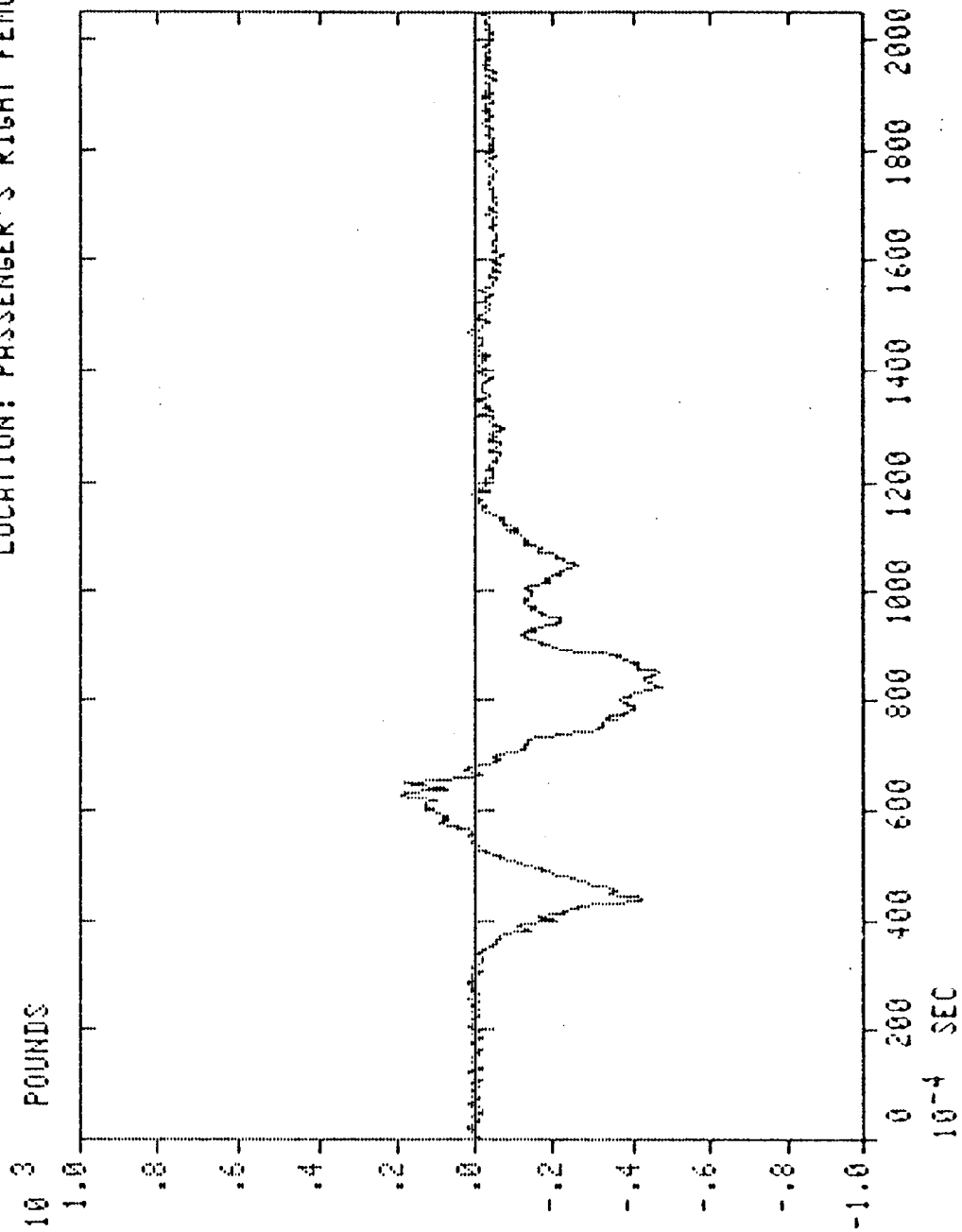


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 600
LOAD CELL: TAPE 2, CH 4
DIRECTION: TENSION
LOCATION: PASSENGER'S RIGHT FEMUR

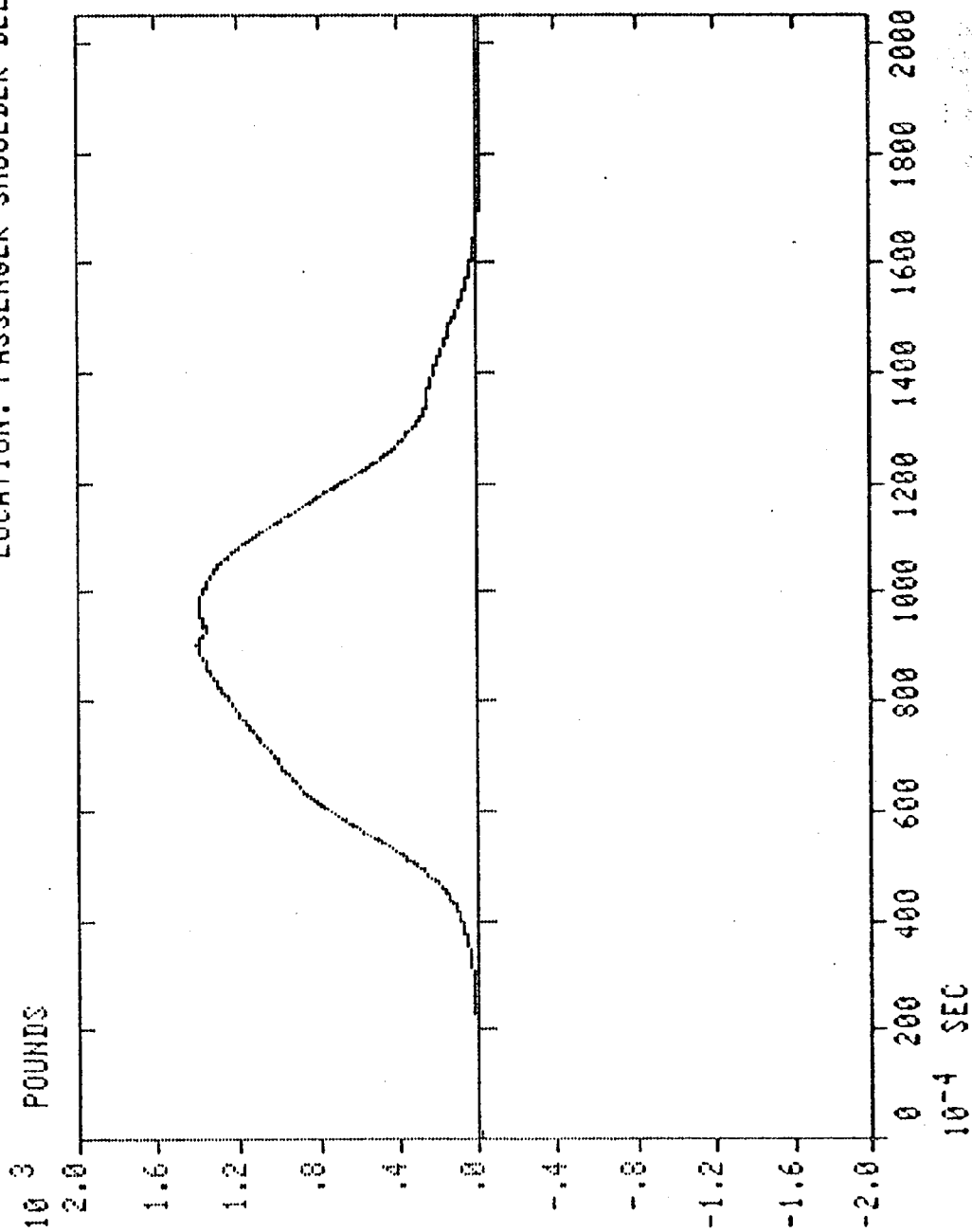


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 60
LOAD CELL: TAPE 2, CH 9
DIRECTION: TENSION
LOCATION: PASSENGER SHOULDER BELT

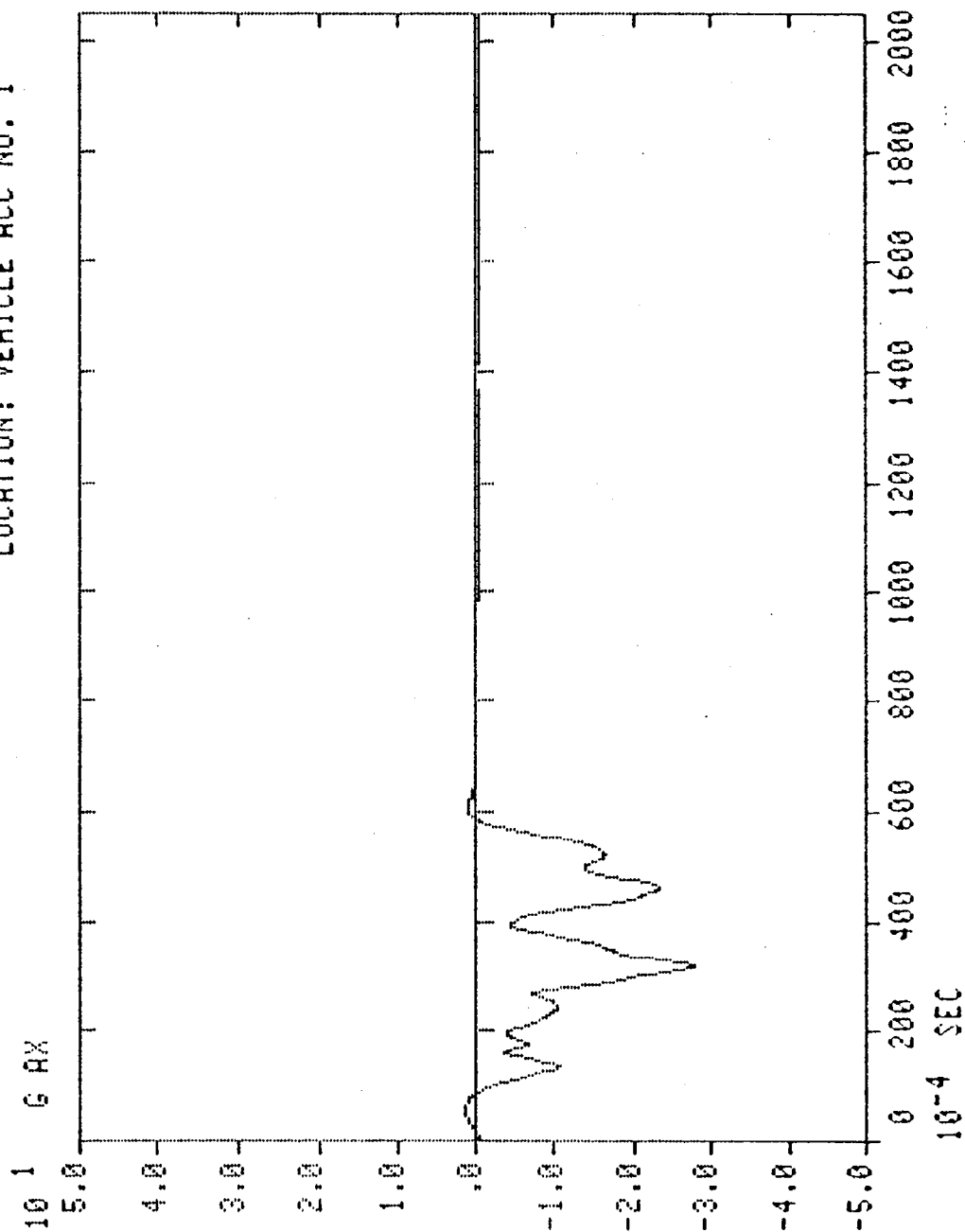


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
 VEHICLE ID: NHTSA 780106
 TEST FILE NO.: 21
 DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
 FILTER: CLASS 60
 ACCELEROMETER: TAPE 1, CH 10
 DIRECTION: FORWARD
 LOCATION: VEHICLE ACC NO. 1

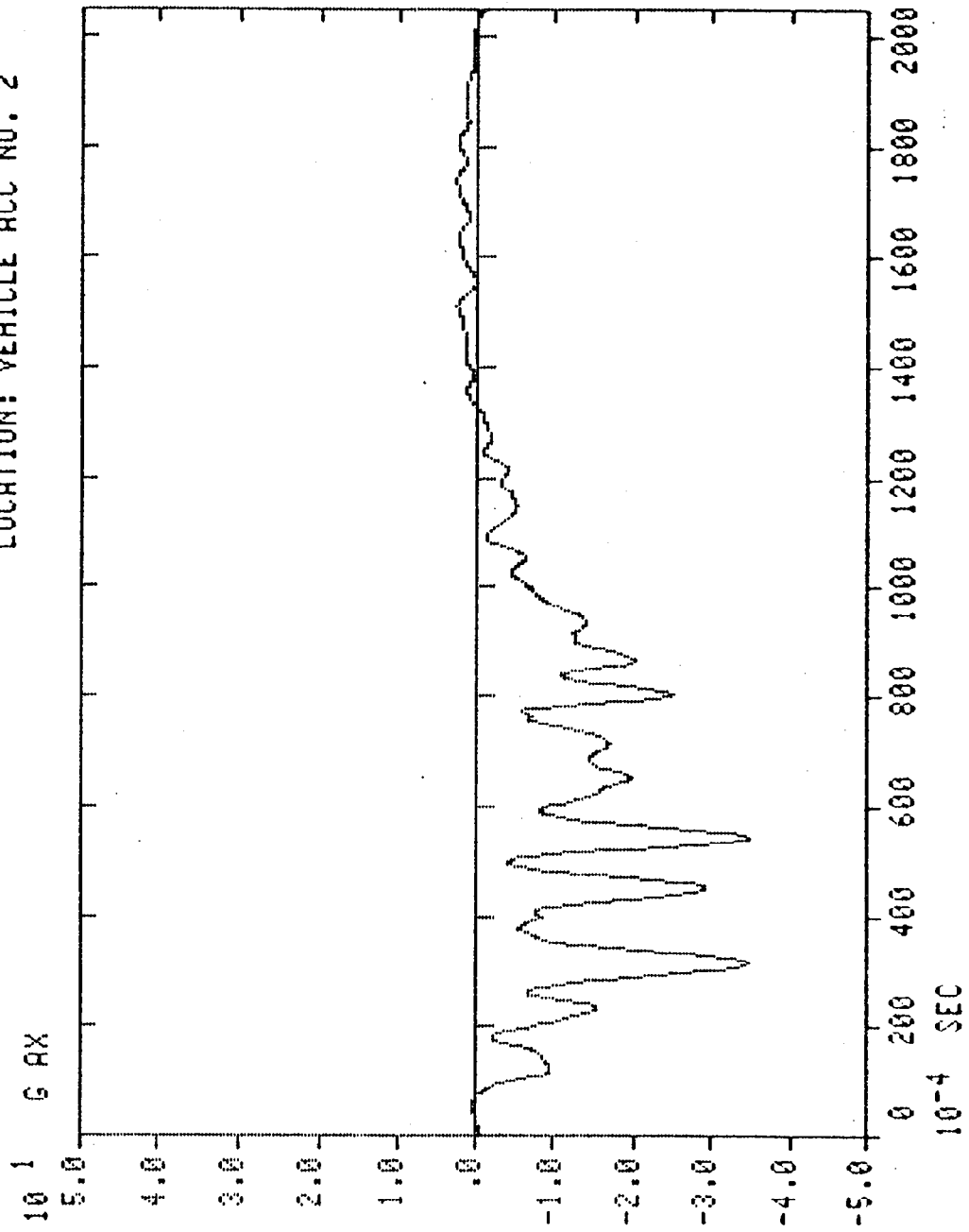


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 60
ACCELEROMETER: TAPE 1, CH 11
DIRECTION: FORWARD
LOCATION: VEHICLE ACC NO. 2

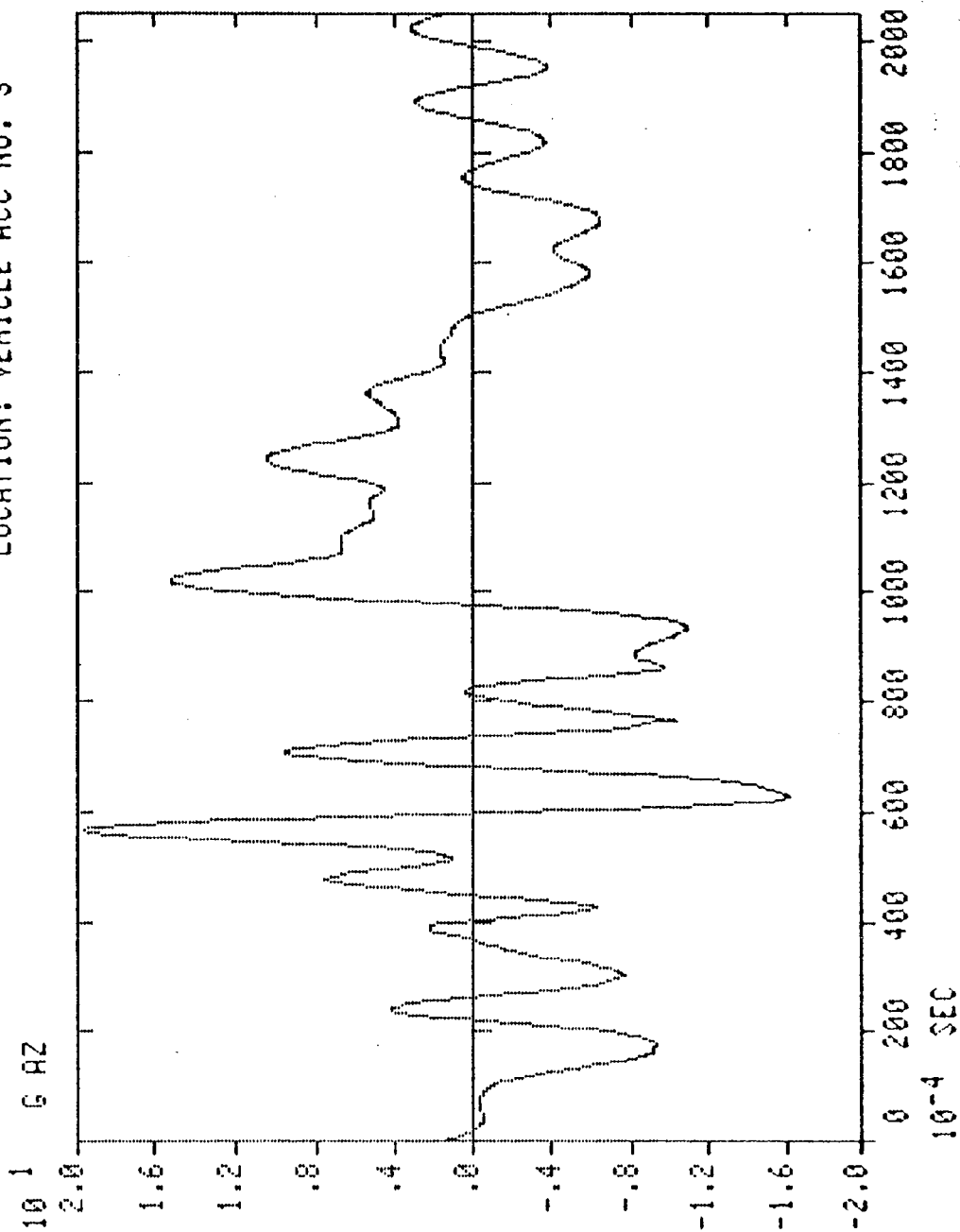


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: BUICK CENTURY
VEHICLE ID: NHTSA 780106
TEST FILE NO.: 21
DATE: APRIL 3, 1979

MJO NO.: 671-1489-65
FILTER: CLASS 60
ACCELEROMETER: TAPE 1, CH 12
DIRECTION: UPWARD
LOCATION: VEHICLE ACC NO. 3





APPROVED ENGINEERING TEST LABORATORIES

SERVICE FOR:

U. S. Department of Transportation
National Highway Traffic Safety Administration
Office of Research and Development
2100 Second Street S. W.
Washington, D. C. 20590

PURCHASE ORDER NUMBER: DOT-HS-6-01477

I hereby certify that the preceding report is true and correct to the best of my knowledge.

APPROVED ENGINEERING TEST LABORATORIES

R. D. Short, Division Manager

D. H. Hand, Project Engineer

R. E. Allen, Dynamics
R & D Department Manager

G. J. Valenzuela, Mechanical
Department Supervisor

R. J. McKelligott,
Quality Assurance Manager

rmh