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REPORT NO. 301-AETL-80-021-971-3882-21

FMVSS 301-75
VEHICLE SAFETY COMPLIANCE
AND
RESEARCH AND DEVELOPMENT TESTING
OF
"FUEL SYSTEM INTEGRITY"

VOLKSWAGENWERK AG
1980 VOLKSWAGEN VANAGON - 3 DOOR STATION WAGON
NHTSA 801301

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

NOVEMBER 1980

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
- ENFORCEMENT -
OFFICE OF VEHICLE SAFETY COMPLIANCE
400 SEVENTH STREET S. W.
WASHINGTON, D. C. 20590

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Date 12 November 1980

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Final Report of FMVSS 301-75 Vehicle Safety Compliance and Research and Development Testing on a 1980 Volkswagen Vanagon - 3 Door Station Wagon - NHTSA 801301	November 12, 1980
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15. Supplementary Notes

16. Abstract

FMVSS 301-75 Vehicle Safety Compliance Test of a 1980 Volkswagen Vanagon - 3 Door Station Wagon, NHTSA 801301, VIN-25A0027785 was conducted at Approved Engineering Test Laboratories test facility in Fullerton, California, to determine compliance with the requirements of FMVSS 301-75.

As a parallel non-conflicting effort, the test 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 29.56 mph in the frontal (0°) mode. Test date was October 23, 1980, and the ambient temperature was 73°F.

The subject test vehicle appears to comply with all the requirements of FMVSS 301-75.

17. Key Words	18. Distribution Statement
FMVSS 301-75 - Fuel System Integrity Research and Development	

19. Security Class. (of this report)	20. Security Class. (of this page)	21. No. of Pages	22. Price
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SECTION 1

1.0 INTRODUCTION

This report contains information regarding a joint program for the Office of Vehicle Safety Compliance (OVSC), and Research and Development (R&D) for the conduct of a vehicle Fuel System Integrity Test relative to Federal Motor Vehicle Safety Standard No. 301-75, in addition, occupant response and vehicle acceleration. This test was performed under Contract Number DOT-HS-9-02273 by Approved Engineering Test Laboratories, 1536 East Valencia Drive, Fullerton, California, in accordance with the Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures.

The specific purpose of this test was to check the performance of a 1980 Volkswagen Vanagon - 3 Door Station Wagon, NHTSA 801301 to the requirements of FMVSS 301-75 and to acquire occupant response and vehicle acceleration data during the 30 mph frontal fixed barrier impact.

SECTION 1

The scope of the vehicle compliance 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 (TP219-02) issued by the Office of Vehicle Safety Compliance (OVSC). Specific procedures used to obtain the additional data are detailed in the (OVSC) Laboratory Procedures TP212-02.

Section 2 of this report contains all compliance test related data, while Section 3 contains occupant response and vehicle acceleration summary data, along with test dummy and vehicle measurements. Section 4 discusses AETL's test facilities and data acquisition and reduction system. Appendix A contains additional photographs not related to vehicle compliance. Appendix B contains the computer-generated plots, while Appendix C contains the test dummy calibration reports.

SECTION 1

1.1 ADMINISTRATIVE DATA

A. References

1. Federal Motor Vehicle Safety Standard 301-75 - "Fuel System Integrity," as published in the Federal Register, Volume 38, No. 22397, dated 20 August 1973.

2. National Highway Traffic Safety Administration, Office of Vehicle Safety Compliance Laboratory Procedures "Windshield Mounting" FMVSS 212 - "Windshield Zone Intrusion" FMVSS 219 - "Fuel System Integrity" FMVSS 301-75, TP219-02, dated 9 January 1979.

SECTION 1

B. Description of Test Vehicle

1. 1980 Volkswagen Vanagon - 3 Door Station Wagon
2. Vehicle Identification No.: 25A0027785
3. NHTSA no.: 801301
4. Manufactured Date: October 1979
5. GVWR: 5,093 pounds

C. Dates

1. Vehicle Received: May 10, 1980
2. Start of Test: October 7, 1980
3. Completion of Test: October 23, 1980

SECTION 2

SECTION 2

2.0 TEST DATA

The 1980 Volkswagen Vanagon - 3 Door Station Wagon was subjected to a frontal fixed barrier impact and a static rollover maneuver as required by Federal Motor Vehicle Safety Standard No. 301-75.

Two (2) Part 572 test dummies were positioned in each front designated outboard seating position and were restrained by the belt system in the test vehicle. Just prior to the impact event, the driver dummy head was painted with red chalk and his knees were painted with yellow chalk. The passenger dummy head was painted with blue chalk and his knees were painted with white chalk to provide post-impact visual inspection of possible dummy head and knee contact with interior components during the impact event.

The test vehicle "rated cargo and luggage weight" (RCLW) was not used as calculated, in lieu, a 300 pound cargo ballast was utilized in determining the ultimate calculated vehicle test weight.

SECTION 2

Impact velocity for the test vehicle was regulated by the fixed tow propulsion and certified by the redundant timing traps described in Section 4.

Color motion picture coverage of the vehicle impact along with the static rollover test 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 INFORMATION:

Manufacturer: Volkswagenwerk AG

Make/Model: Volkswagen Vanagon

Body Style: 3 Door Station Wagon Model Year: 1980

VIN: 25A0027785 Build Date: October 1979

NHTSA No.: 801301 Color: Orange/Creme

Engine Data: Four (4) Cylinders; 120.0 Cu. In. Displ.

Transmission Data: Four (4) Speed (XX) Manual ( ) Automatic

Major Options: Deluxe Package, Tinted Glass

VEHICLE ATTITUDE:

Delivered Attitude: LF 29.2 in.; RF 29.3 in.; LR 29.5 in.; RR 29.5 in

Test Attitude: LF 27.6 in.; RF 27.5 in.; LR 29.5 in.; RR 29.2 in

VEHICLE TIRE DATA:

Recommended Cold Tire Pressure: Front = 33 psi

(Up to Vehicle Load Capacity) Rear = 40 psi

Recommended Tire Size: 185R14 Load Range: unknown

Tires on Vehicle: 185SR14 - Continental

Spare Tire: X Yes; No; Space Saver: Yes; X No

TABLE Ia

SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS:

Date of Test: October 23, 1980 Time of Test: 1208

Ambient Temperature: 73 °F at Impact Area

VEHICLE CAPACITY:

Type of Seats: ____ Bench; X Bucket; ____ Split Bench

Designated Seating Capacity: Front 2
Center 2
Rear 3
Total 7

Cargo: unknown lbs.

Total unknown lbs. (Vehicle Capacity Weight)

GVWR: 5,093 lbs. (Taken From Certification Label)

GAWR: Front 2,425 lbs.; Rear 2,866 lbs.

VEHICLE DELIVERED WEIGHT: (Fuel - 93% of NFC)

Left Front 851 lbs. Left Rear 751 lbs.
Right Front 817 lbs. Right Rear 804 lbs.
Total Front Weight 1,668 lbs. (51.8 % of Total Vehicle Weight)
Total Rear Weight 1,555 lbs. (48.2 % of Total Vehicle Weight)
Total Delivered Weight 3,223 lbs.

CALCULATED VEHICLE TEST WEIGHT: 3,851 lbs.
(With Required Dummies and 300 lbs. Cargo)

ACTUAL VEHICLE TEST WEIGHT:

Left Front 1,027 lbs. Left Rear 845 lbs.
Right Front 1,170 lbs. Right Rear 811 lbs.
Total Front Weight 2,197 lbs. (57.0 % of Total Vehicle Weight)
Total Rear Weight 1,656 lbs. (43.0 % of Total Vehicle Weight)
Total Test Weight 3,853 lbs.

TABLE Ib

SUMMARY OF TEST CONDITIONS (Cont'd)

TEST FLUID DATA:

Test Fluid Type: Red Stoddard Solvent ; Specific Gravity: 0.764

Kinematic Viscosity: 1.31

Nominal Fuel Capacity: 16.00 gals. (NFC)

Test Volume: 14.88 gals. (92-94% of NFC)

Fuel System Capacity: 16.00 gals.
(Data from Owner's Manual)

Electric Fuel Pump: X Yes; ____ No; Fuel Injection: X Yes; ____ No

Does Electric Fuel Pump Operate with Ignition Switch "On"

And the Engine Not Operating: ____ Yes; X No; ____ N/A

Details of Fuel System: Fuel filler located on right front door sill aft of wheel opening adjacent to the "B" post, fuel tank located horizontally between frame side rails under front passenger compartment floor pan aft of spare tire storage rack.

VEHICLE TEST CONDITIONS:

Temperature in Occupant Compartment: 70 °F

Temperature of Windshield Glazing/Moulding: N/A °F

VEHICLE CRUSH AND REBOUND:

Overall Length of Test Vehicle: Pre-Test - Left 177.5 in.; Right 177.3 in.

Post-Test - Left 165.3 in.; Right 165.2 in.

Crush: Left 12.2 in.; Right 12.1 in.

Rebound (From Rigid Barrier Only): 12.3 in.

TABLE III

POST IMPACT SUMMARY

Vehicle 1980 Volkswagen Vanagon

NHTSA No. 801301 Test Date October 23, 1980

TYPE OF TEST: [XX] 0° Frontal Impact

[ ] 30° Oblique Impact (Driver/Passenger) Side

[ ] Rear Impact

REQUIRED IMPACT VELOCITY RANGE: 28.9 to 29.9 mph

IMPACT VELOCITY: (Traps within 5 feet of impact event)

Trap 1 = N/R mph

Trap 2 = 29.56 mph

Average 29.56 mph

Actual distance from vehicle front bumper to barrier face when entering timing trap 57.0 in.

Actual distance from vehicle front bumper to barrier face when exiting timing trap 33.0 in.

VEHICLE STATIC CRUSH: Driver's Side = 12.2 inches

Passenger's Side = 12.1 inches

Average = 12.15 inches

Crush Details: Windshield ejected, roof buckled over both "B" post, front compartment floor pan buckled, driver dummy impacted steering wheel and dash assembly, passenger dummy impacted dash assembly.

VEHICLE REBOUND: (From rigid barrier only)

Driver's Side = 13.3 inches

Passenger's Side = 11.3 inches

Average = 12.3 inches

TABLE VI

POST IMPACT SUMMARY

FUEL SYSTEM INTEGRITY - FMVSS 301-75

Vehicle 1980 Volkswagen Vanagon

NHTSA No. 801301 Test Date October 23, 1980

	Actual	Max. Allow.
Fuel spillage from impact until vehicle motion ceases.	- 0 -	1 ounce
Fuel spillage for 5 minute period following cessation of vehicle motion after impact.	- 0 -	5 ounces
Fuel spillage for next 25 minute period.	- 0 -	1 ounce/ 1 minute
Time duration from impact until start of rollover test periods.	29 min. 50 sec.	30 minutes

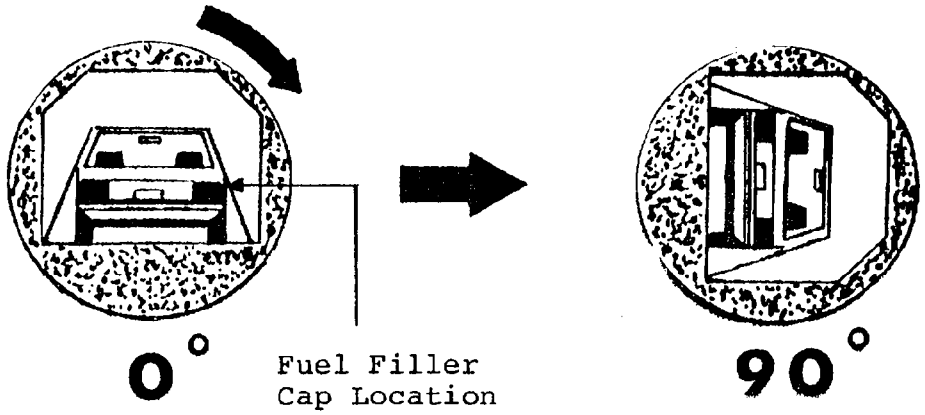
Fuel Spillage Location: Not Applicable

TABLE VII

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1980 Volkswagen Vanagon NHTSA No. 801301



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 13 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

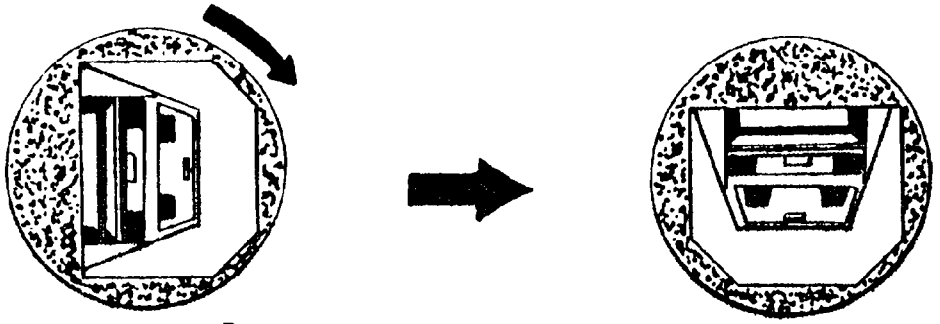
Fuel Spillage Location: Not Applicable

TABLE VIII

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1980 Volkswagen Vanagon NHTSA No. 801301



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 13 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

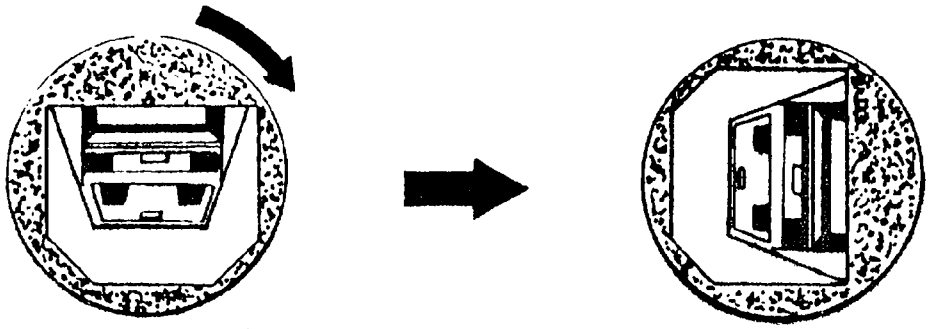
Fuel Spillage Location: Not Applicable

TABLE IX

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1980 Volkswagen Vanagon NHTSA No. 801301



180° 270°

	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 37 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

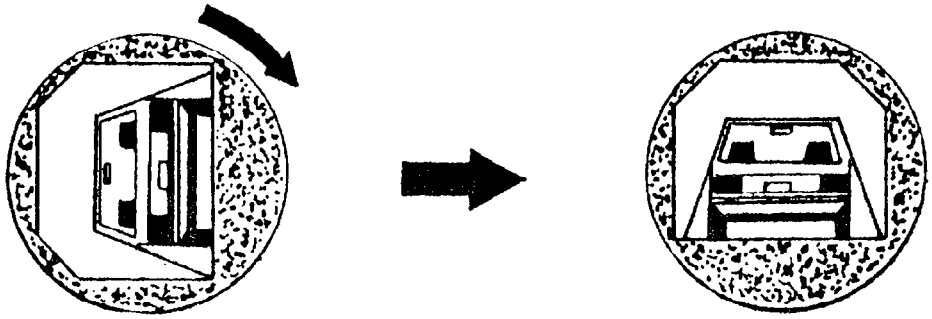
Fuel Spillage Location: Not Applicable

TABLE X

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1980 Volkswagen Vanagon NHTSA No. 801301



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 17 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

Fuel Spillage Location: Not Applicable

SECTION 2

2.1 TEST RESULTS AND PHOTOGRAPHS

The 1980 Volkswagen Vanagon - 3 Door Station Wagon was subjected to a frontal fixed barrier impact followed by a static rollover test in accordance with the procedures referenced in Section 1 of this report under Administrative Data. The results presented here relate specifically to vehicle performance under Federal Motor Vehicle Safety Standard 301-75 "Fuel System Integrity".

The test was conducted essentially in accordance with NHTSA Office of Vehicle Safety Compliance Laboratory Procedures. The critical parameters were impact velocity; and fuel spillage criteria defined in FMVSS 301-75, paragraph S5.5 and S5.6.

Post-impact inspection of the test vehicle revealed almost all crush occurred forward of the front doors. The windshield ejected from the body opening and the roof buckled over the left and right "B" post. The front passenger compartment floor pan buckled on both sides and the spare tire (stored under the front floor pan) remained inflated. The driver dummy made contact with the steering wheel and dash assembly. The passenger dummy also made contact with the dash assembly.

SECTION 2

No fuel spillage was recorded following the test vehicle impact, nor during the time period before the start of the rollover test. No fuel spillage was recorded during the rollover test increment time periods.

The 1980 Volkswagen Vanagon - 3 Door Station Wagon test vehicle appears to comply with all the requirements of FMVSS 301-75.

Figure 2-1

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Pre-Test, Full Front View


NHTSA 801301
FMVSS 301
AETL
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Figure 2-2

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Pre-Test, Left Side View


NHTSA 80130
FMVSS 301
AETL
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Figure 2-3

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Pre-Test, Right Side View


NHTSA 80130
FMVSS 301
AETL
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Figure 2-4

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Left Side View


AETL
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Figure 2-5

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Right Side View


NHTSA 80130
FMVSS 301
AETL
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Figure 2-6

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Rollover Test, 90° Increment

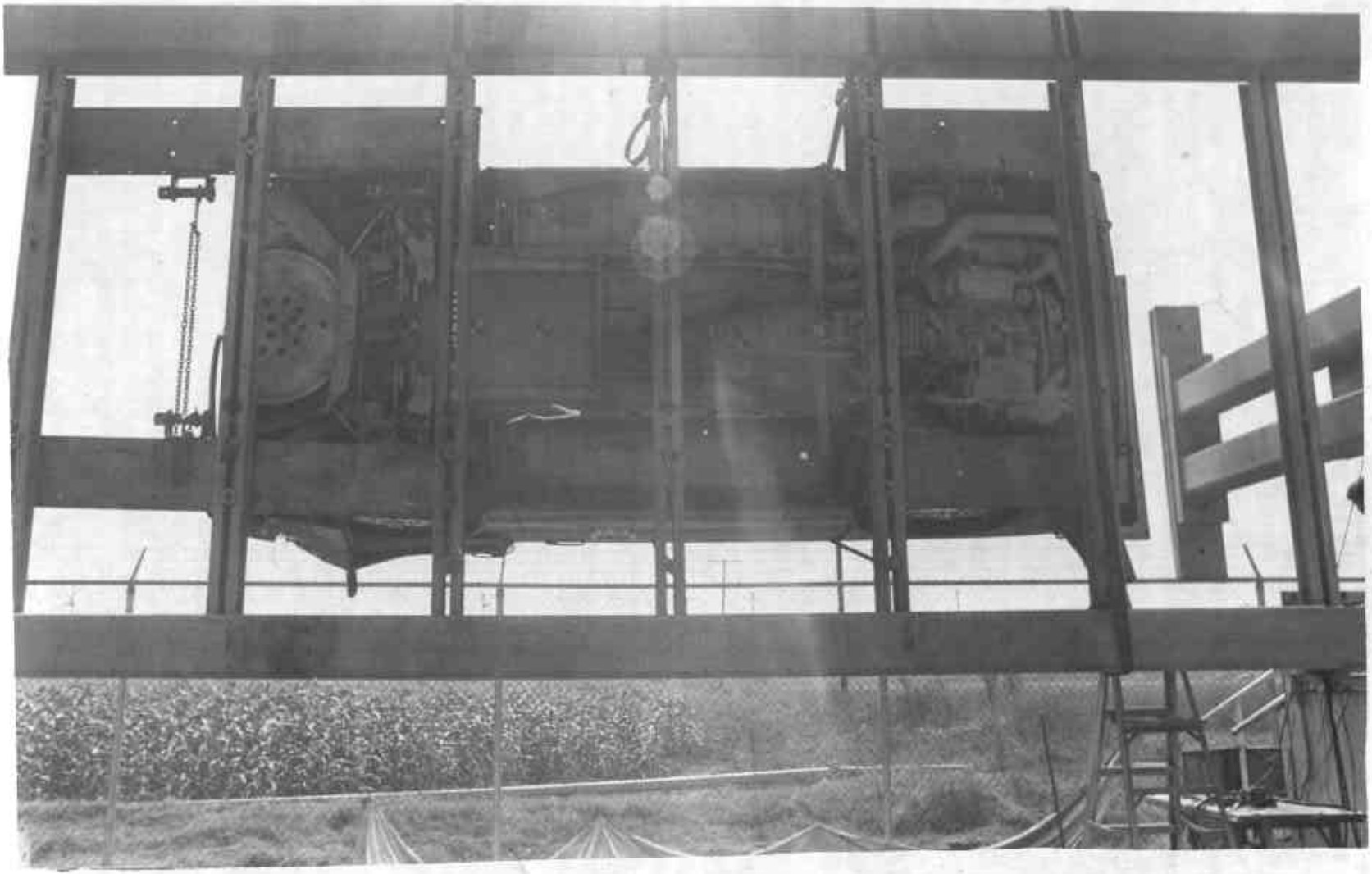
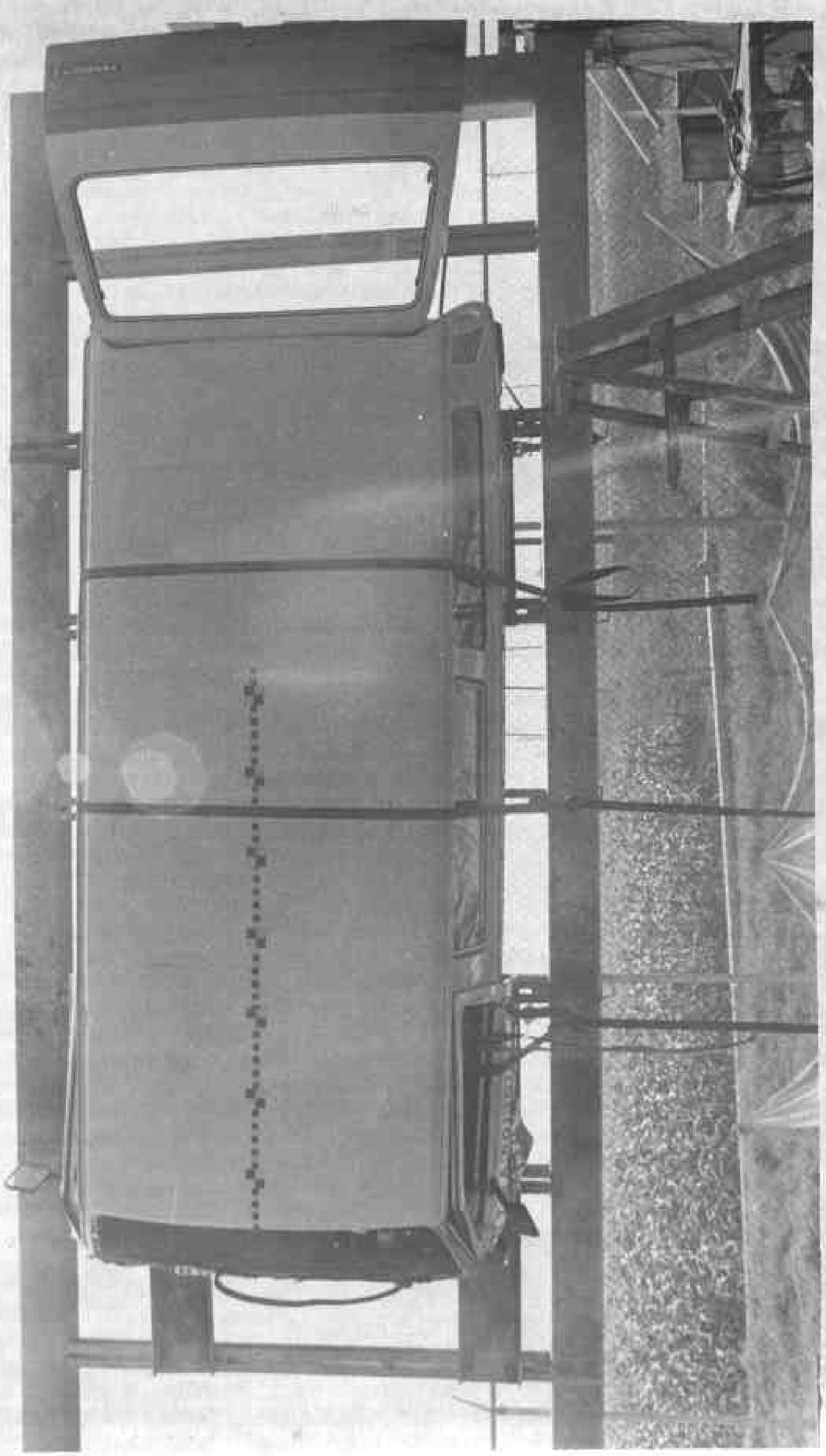


Figure 2-7

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Rollover Test, 270° Increment



SECTION 3

SECTION 3

3.0 OCCUPANT RESPONSE AND VEHICLE ACCELERATION SUMMARY DATA

The following data sheets summarize:

A. The Dummy Position Data (Part 572 Dummy In-Vehicle Position/Part 572 Dummy Pre-Test Clearence Distances Sheets)

B. The Occupant Response Data (Part 572 Dummy Data Sheet)

C. The Vehicle Acceleration Data (Vehicle Structural Data Sheet)

D. The Pre and Post-Test Vehicle Dimensions Data (Vehicle Measurement Data Sheet)

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

The driver dummy experienced a HIC value of 1313 which is in excess of the limit specified in FMVSS 208 injury criteria. The passenger dummy experienced a HIC value of 831. All other values from both test dummies satisfy the FMVSS 208 requirements.

SECTION 3

In addition to the occupant and vehicle data, each shoulder belt was marked at the D-ring after dummy positioning to provide a static measurement of belt position after the impact event. Post-impact measurement of the driver shoulder belt was 2.0 inch and the passenger shoulder belt was 1.8 inch.

TABLE 3-1

PART 572 DUMMY IN-VEHICLE POSITION

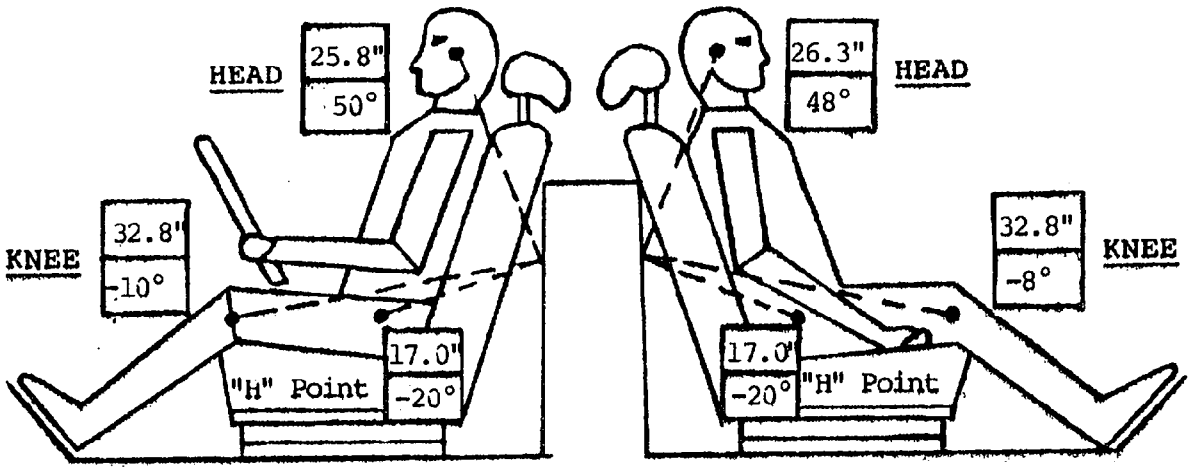
VEHICLE 1980 Volkswagen Vanagon NHTSA NO. 801301

POSITIONING DATE: Oct. 23, 1980 AMBIENT TEMP: 69 °F TIME 1100

SEAT TYPE: ____ Bench
__X__ Bucket
____ Split Bench

ADJUSTER TYPE: __X__ Manual
____ Power

BUCKET SEAT BACK TYPE: ____ Fixed
__X__ Adjustable Reclining



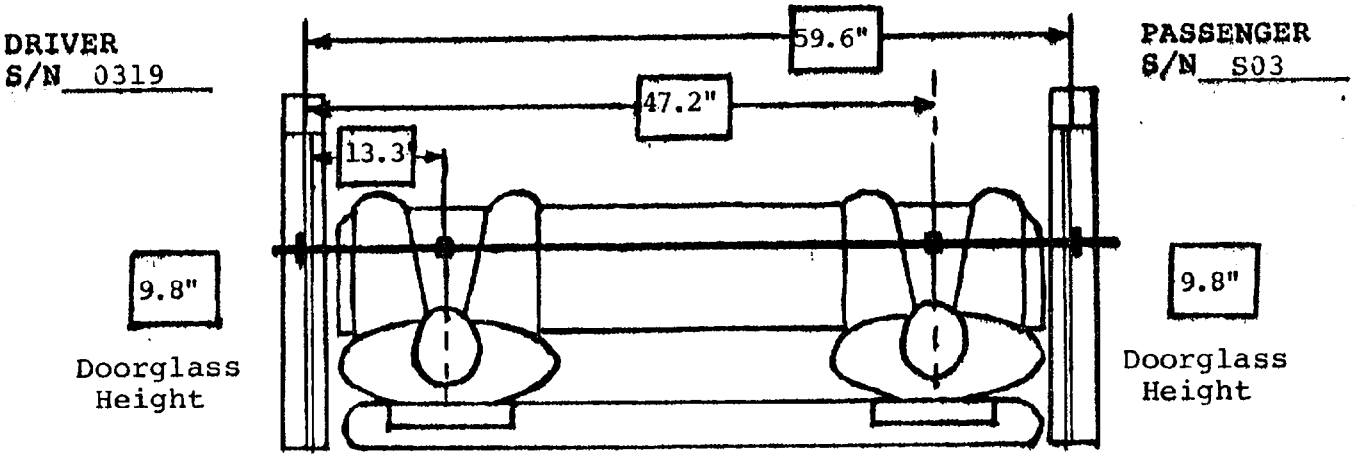
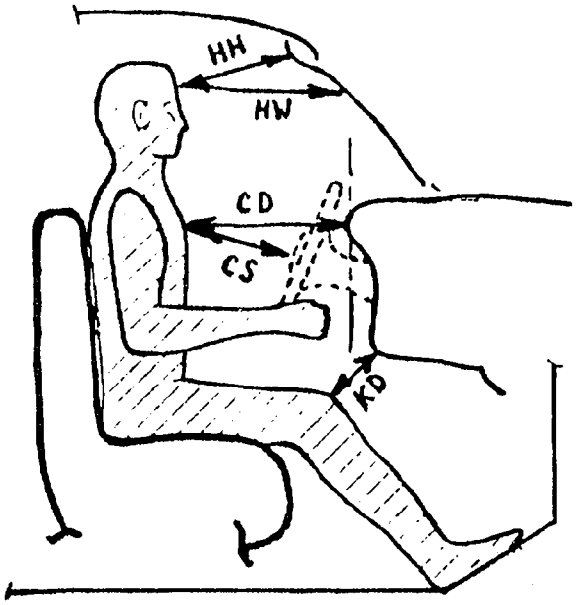


TABLE 3-2

PART 572 DUMMY PRE-TEST CLEARANCE DISTANCES

DRIVER		PASSENGER	
HH =	18.2 in.	HH =	19.3 in.
HW =	21.6 in.	HW =	23.0 in.
HR =	9.0 in.	HR =	8.5 in.
HS =	9.4 in.	HS =	9.0 in.
CD =	21.3 in.	CD =	20.8 in.
CS =	13.0 in.	AD =	4.4 in.
AD =	4.0 in.	HD =	7.2 in.
HD =	7.4 in.	KD =	5.7 in.
KD =	5.5 in.		



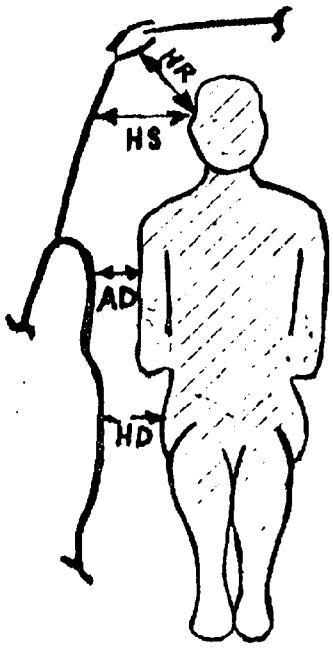


TABLE 3-3

MANUFACTURERS SEAT BELT INSTRUCTIONS

Safety belts

For you and your passenger's protection, use safety belts at all times while the car is in motion.

The safety belts should not be used to hold a child's seat; the diagonal belt will not provide the needed protection.

A shoulder belt should not be worn by a person less than 4'7" or 1.40 m in height because it would not be in its most protective position, and therefore may increase the possibility of injury in a collision.

Lap/shoulder belts

- To **fasten**, grasp belt tongue and pull belt in continuous slow motion across your chest and lap.
- Insert belt tongue into buckle on inboard side of seat. Push down until it is securely locked with an audible click.
  Pull shoulder section to make sure belt fits snugly across the hips.
- To **unfasten** belt, push in release marked PRESS on buckle. Belt will spring out of buckle.
- To **store** lap/shoulder belt, allow belt to wind up on retractor as you guide belt tongue to its stowed position on doorpost.

Inertia reel retractor

The one-piece lap/shoulder belt with inertia reel locking mechanism will adjust automatically to your size and movements as long as the pull on the belt is slow.

Rapid deceleration during hard braking or a collision locks the belt. The belt will also lock when you drive up or down a steep hill or in a sharp curve.

To release a locked belt, lean back to take the body pressure off the belt.

Notes:

- **Belts should fit snugly across lap and chest. Make sure any slack is wound on the retractor.**
- **Do not strap in more than one person with each belt.**
- **Belts should not be worn twisted.**

  For maximum effectiveness the lap belt portion should be worn low across the pelvic crests.
- Make sure the belt of the **unoccupied passenger seat** is fully wound up on its retractor so that the belt tongue is in its stowed position on the doorpost. This reduces the possibility of its becoming a striking object in case of a sudden stop.

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TABLE 3-4

PART 572 DUMMY DATA

Vehicle 1980 Volkswagen Vanagon NHTSA No. 801301

Driver S/N 0319 Passenger S/N S03	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	5.8	174.6	193.3	70.4	6.7	184.0	43.2	92.4
Lateral	12.6	82.8	6.4	68.2	9.3	97.2	2.9	50.8
Vertical	6.8	91.2	51.1	73.8	1.2	18.0	52.5	65.8
Resultant	197.0	70.4			56.5	65.6		
HIC	1313 (68-74 msec)				831 (32-108 msec)			
CHEST ACCELERATION								
Longitudinal	4.5	170.4	51.3	38.4	4.2	117.4	42.4	49.8
Lateral	3.5	73.4	9.8	64.8	3.0	30.2	6.0	55.4
Vertical	24.4	61.4	33.7	31.0	15.3	53.2	13.9	33.2
Resultant	53.6	38.4			43.2	49.8		
CSI	462 (49.5g - 3 msec clip)				292 (41.1g - 3 msec clip)			
	(lb)	Time (msec)	(lb)	Time (msec)	(lb)	Time (msec)	(lb)	Time (msec)
FEMUR LOAD								
Left	145	26.3	1796	33.2	195	49.4	599	32.2
Right	769	73.6	98	34.2	185	30.4	263	36.8
BELT LOAD								
Torso	1418	43.6			1470	51.2		
Lap	2012	40.6			1513	41.6		

Average Vehicle Impact Speed 29.56 mph

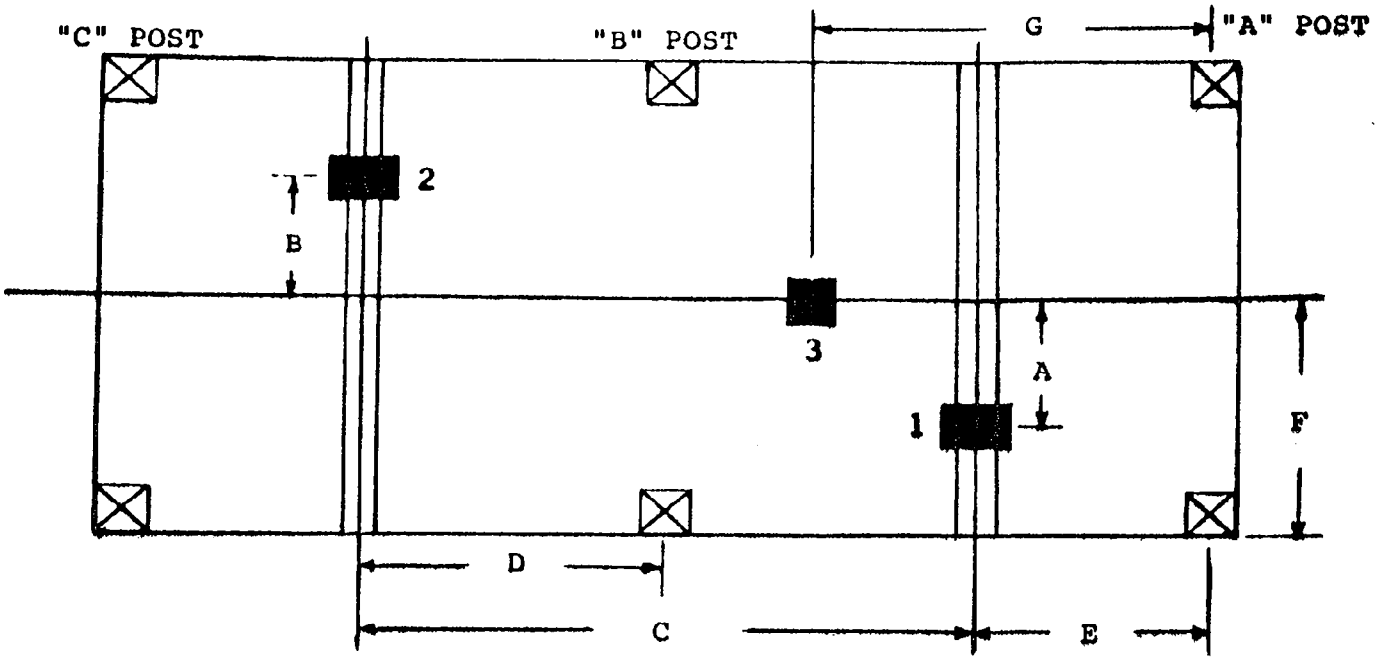
*Positive Direction - Longitudinal: Forward
Lateral: Leftward
Vertical: Upward
Femur: Tension

*Negative Direction - Longitudinal: Rearward
Lateral: Rightward
Vertical: Downward
Femur: Compression

TABLE 3-5

VEHICLE STRUCTURAL DATA

VEHICLE 1980 Volkswagen Vanagon NHTSA NO. 801301



DIMENSIONS			
LOCATION	MEASUREMENT (IN.)	LOCATION	MEASUREMENT (IN.)
A	23.3	E	10.5
B	23.5	F	36.3
C	47.3	G	74.7
D	8.5		

ACCELERATION PEAKS				
	POSITIVE* DIRECTION		NEGATIVE* DIRECTION	
ACCELEROMETER LOCATION	PEAK "G"	TIME (MSEC)	PEAK "G"	TIME (MSEC)
NO. 1 LONGITUDINAL	15.7	41.6	89.8	26.2
NO. 2 LONGITUDINAL	1.0	135.6	42.2	19.0
NO. 3 LONGITUDINAL	2.7	98.4	69.5	18.4

*POSITIVE - LONGITUDINAL: FORWARD DIRECTION

*NEGATIVE - LONGITUDINAL: REARWARD DIRECTION

TABLE 3-6

PRE-TEST

VEHICLE MEASUREMENT DATA

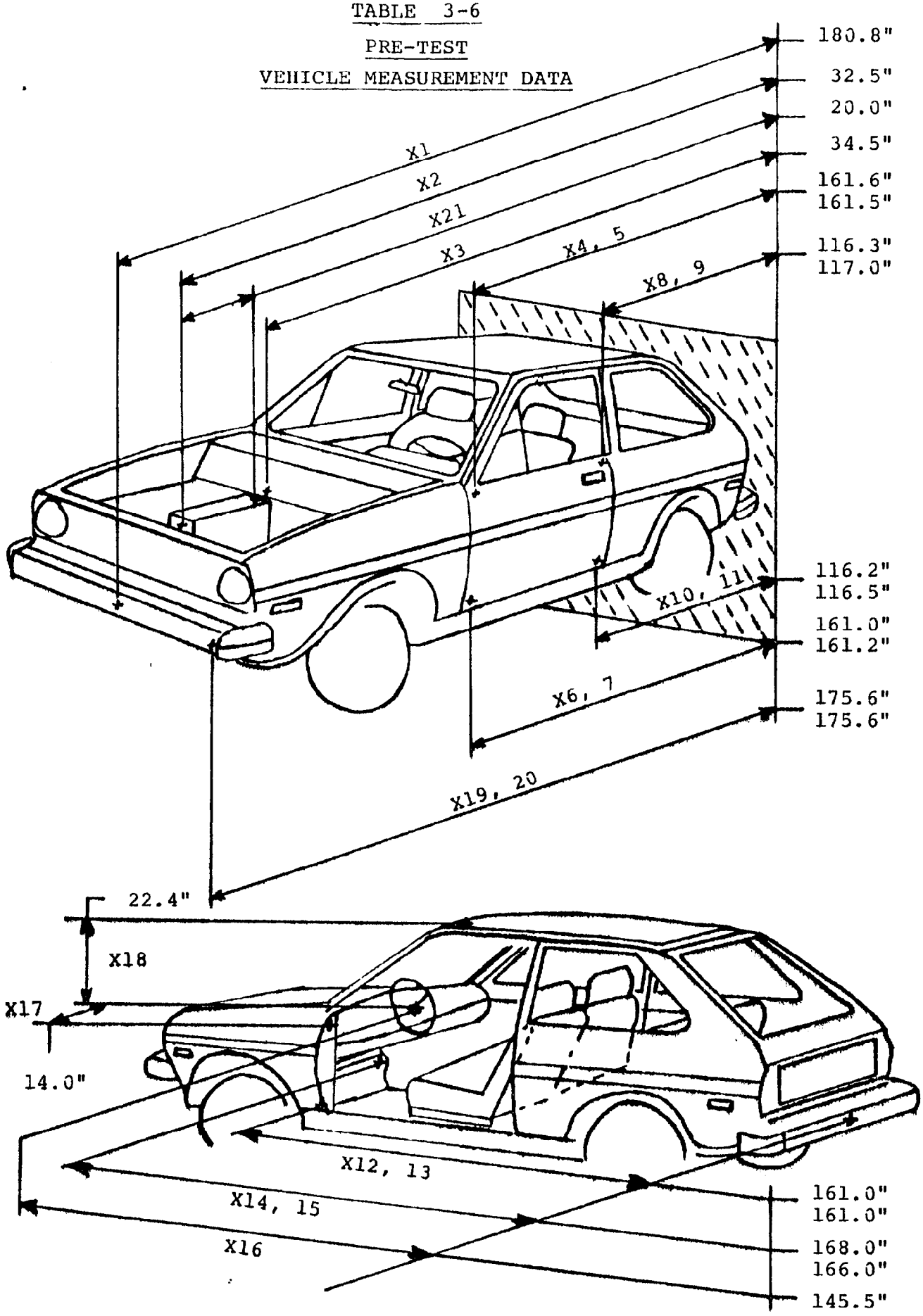


TABLE 3-7

POST-TEST

VEHICLE MEASUREMENT DATA

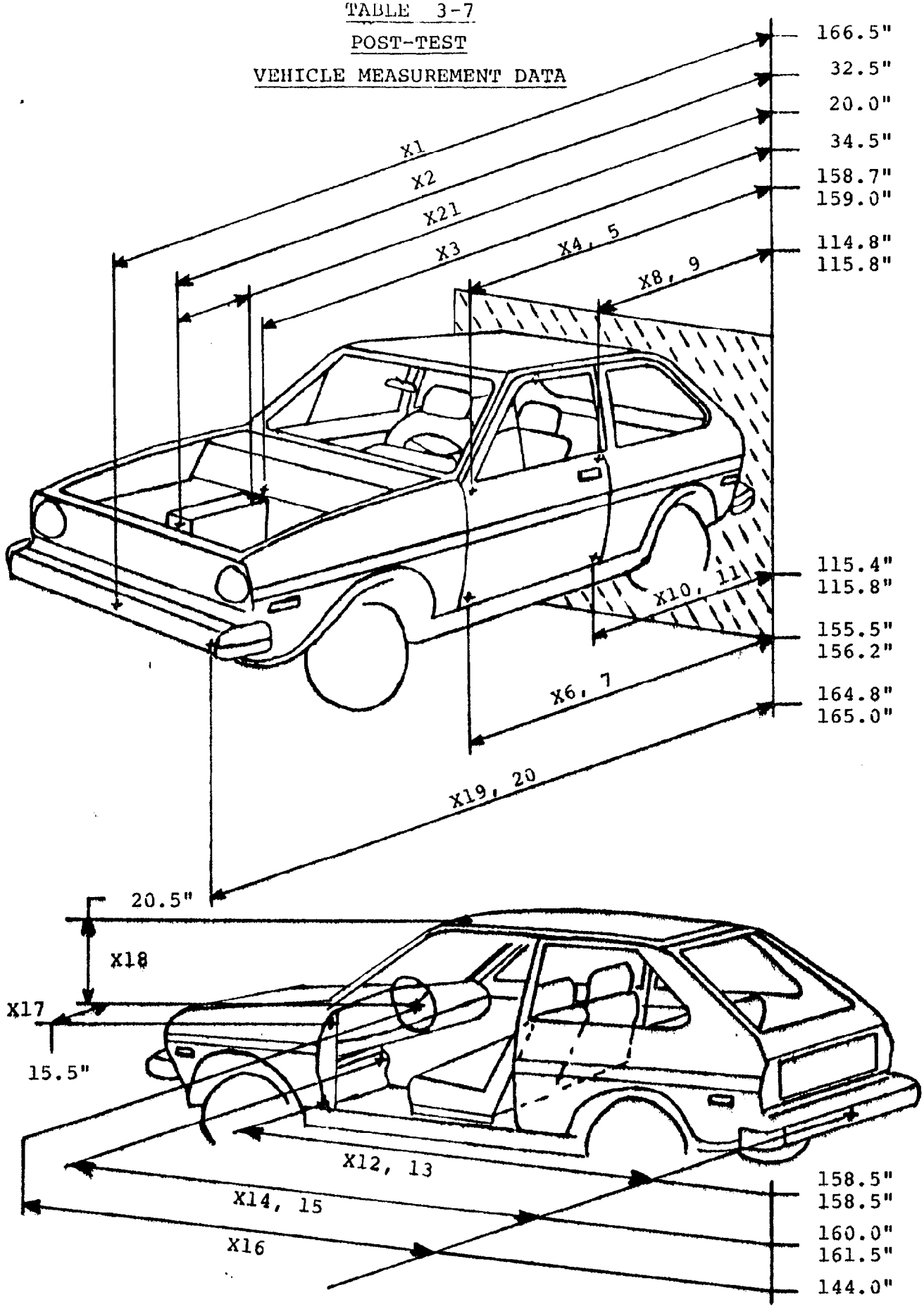


TABLE 3-8

SUMMARY

PRE-TEST AND POST-TEST VEHICLE DIMENSIONS

Measurement Point	Pre-Test	Post-Test	Difference
X1	180.0"	166.5"	14.3"
X2	32.5"	32.5"	0.0"
X3	34.5"	34.5"	0.0"
X4	161.6"	158.7"	2.9"
X5	161.5"	159.0"	2.5"
X6	161.0"	155.5"	5.5"
X7	161.2"	156.2"	5.0"
X8	116.3"	114.8"	1.5"
X9	117.0"	115.8"	1.2"
X10	116.2"	115.4"	0.8"
X11	116.5"	115.8"	0.7"
X12	161.0"	158.5"	2.5"
X13	161.0"	158.5"	2.5"
X14	168.0"	160.0"	8.0"
X15	166.0"	161.5"	4.5"
X16	145.5"	144.0"	1.5"
X17	14.0"	15.5"	+1.5"
X18	22.4"	20.5"	1.9"
X19	175.6"	164.8"	10.8"
X20	175.6"	165.0"	10.6"
X21	20.0"	20.0"	0.0"

TABLE 3-9

FMVSS 212/219/301-75

CAMERA POSITIONS

VEHICLE 1980 Volkswagen Vanagon

NHTSA NO. 801301 TEST DATE October 23, 1980

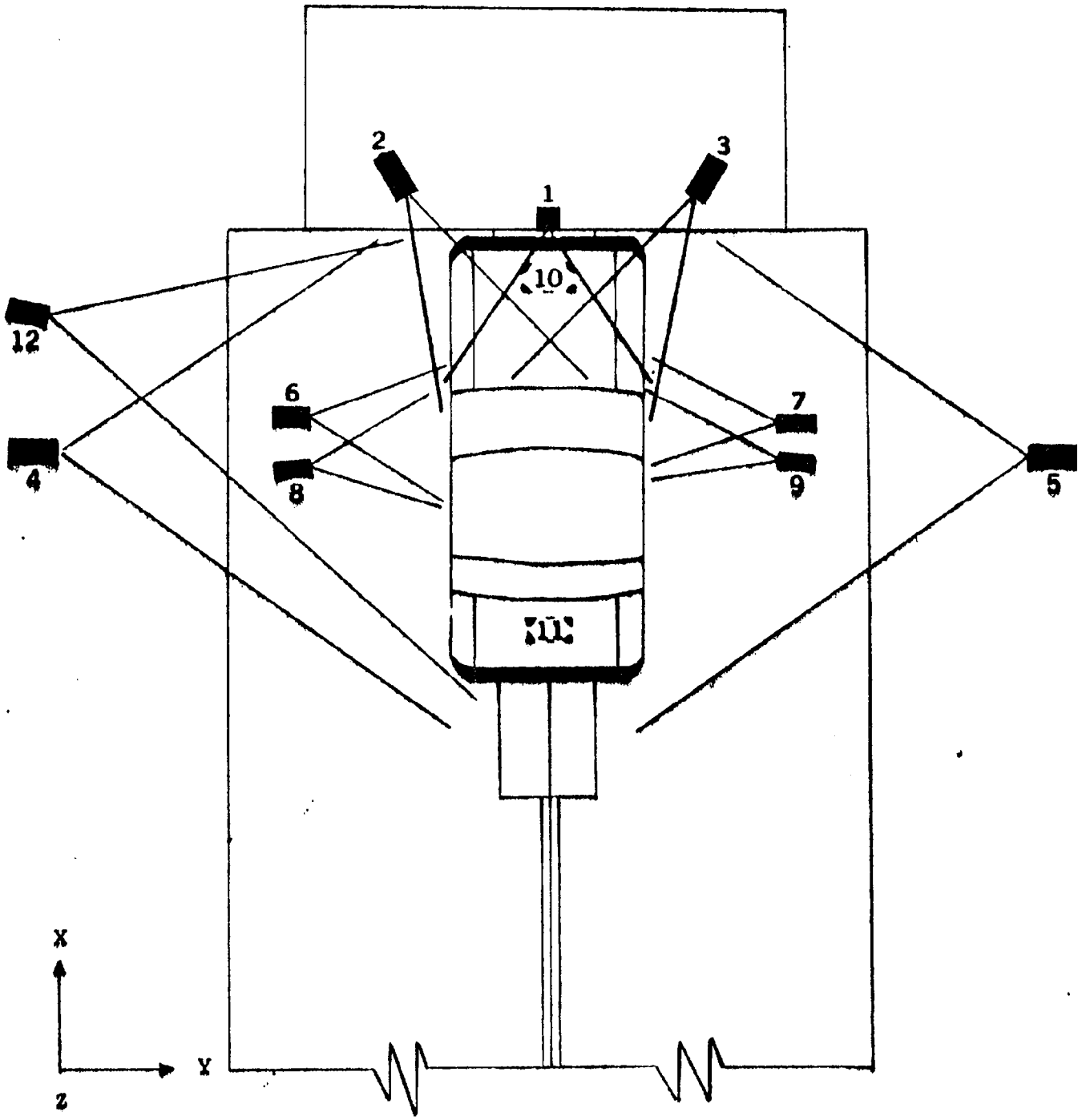


TABLE 3-10

FMVSS 301-75

CAMERA POSITIONS

VEHICLE 1980 Volkswagen Vanagon

NHTSA NO. 801301 TEST DATE October 23, 1980

1.	Photo-Sonics 13mm 500FPS	X 11.0" Y - 0 - Z 238.0"	2.	Photo-Sonics 13mm 500FPS	X N/A Y N/A Z N/A
3.	Photo-Sonics 13mm 500FPS	X N/A Y N/A Z N/A	4.	Photo-Sonics 13mm 500FPS	X 49.0" Y 313.0" Z 51.0"
5.	Photo-Sonics 13mm 500FPS	X 43.0" Y 189.0" Z 59.0"	6.	Locam 12.5mm 500FPS Dummy Head	X 54.0" Y 103.5" Z 66.0" 84.0"
7.	Locam 13mm 500FPS Dummy Head	X 58.0" Y 97.0" Z 66.0" 74.5"	8.	Locam 15mm 500FPS Dummy Head	X 61.0" Y 106.0" Z 66.5" 82.0"
9.	Locam 12.5mm 500FPS Dummy Head	X 65.0" Y 96.5" Z 66.0" 73.0"	10.	Photo-Sonics 13mm 500FPS	X 96.0" Y 2.5" Z -38.0"
11.	Photo-Sonics 13mm 500FPS	X 161.0" Y 4.0" Z -45.0"	12.	Canon Scoopic 12.5 - 75mm 24FPS - Documentary -	

SECTION 4

SECTION 4

4.0 TEST FACILITIES AND EQUIPMENT

Approved Engineering Test Laboratories (AETL) collision barriers, vehicle static rollover machine, and data processing/computer analysis test facilities are located at the Fullerton, California Division.

This section discusses these specialized facilities, along with associated equipment and instrumentation required for the performance of this test.

4.1 FRONTAL COLLISION BARRIER FACILITY

4.1.1 The frontal (fixed) collision barrier conforms to the requirements as set by the NHTSA Office of Vehicle Safety Compliance (OVSC) and as defined in the Laboratory Procedures for FMVSS 212/219/301-75, TP219-02, dated January 9, 1979, with the following special characteristics.

4.1.2 The fixed collision barrier is a steel clad, steel reinforced concrete block with a 6'4" X 12' face. The face is 1" steel plate faced with 3/4 inch plywood. The total mass of the structure is approximately 200,000 pounds, with a substantial portion below ground to provide resistance against sliding or tipping of the barrier during impact.

4.1.3 The facility consists of a 500 foot concrete paved runway, with a steel monorail embedded in the approach surface. Two camera pits are provided to allow photographing the test vehicle at impact. One pit is located immediately in front of the fixed collision barrier and is 36 inches wide (expandable to 48 inches), 7 feet deep, and 23 feet long (3 feet of the pit length extends under the barrier face). The second (mid) pit with removable monorail section is located approximately 160 feet from the fixed collision barrier and is 43 inches wide, 7 feet deep, and 23 feet long.

4.1.4 Tow propulsion is provided by a fixed prime mover and continuous cable drive system located near the mid camera pit position. The power plant for the tow cable system is a 200 h.p. synchronous electric motor, coupled to an electronically controlled Eddy Current Clutch and a 4:1 gear reduction transfer assembly.

The endless 1/2 inch diameter steel tow cable is wrapped around the drive pulley and is tensioned by a pneumatic loaded idler wheel. The tow cable passes through the fixed collision barrier and around fixed idler pulleys to complete the loop. The test vehicle or moving collision barrier is towed by a dolly assembly attached to the vehicle

or moving collision barrier by a shear pin release mechanism. For a fixed collision barrier test, the test vehicle is towed within 20 feet of the fixed barrier, at which point the towing dolly assembly is disconnected from the test vehicle and the test vehicle proceeds under its own momentum for the final 20 feet to impact. For a moving collision barrier test, the moving collision barrier is towed within 5 feet of the test vehicle, at which point the towing dolly is disconnected from the moving collision barrier and the moving collision barrier proceeds under its own momentum for the final 5 feet to impact. Heavy steel stops actuate the tow cable release mechanism and prevent the towing dolly from continuing past the point of impact. The towing dolly is designed to fit inside the monorail such that it is constrained in the vertical and lateral directions, and capable of sliding freely along the monorail.

4.2 OBLIQUE ANGLE COLLISION BARRIER

4.2.1 The oblique angle collision barrier conforms to the requirements as set by NHTSA Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures TP219-02, with the following special characteristics.

4.2.2 The oblique angle collision barrier is constructed of a flat 1 1/2 inch steel plate faced with 3/4 inch plywood. The barrier face is 6' X 12' and is adjustable for left or right angle impacts by means of seven tubular gussets that attach to the standard fixed frontal collision barrier to form a rigid buttress structure.

4.3 MOVING COLLISION BARRIER

4.3.1 The moving collision barrier conforms to the requirements as set by Federal Motor Vehicle Safety Standard No. 208, Paragraph S8.2 with the following special characteristics.

4.3.2 The chassis is constructed of 12 inch steel channel with tubular frame gussets. The flat impacting face plate is 1/2 inch steel plate faced with 3/4 inch plywood. The face plate is reinforced with 6 inch steel channel horizontally welded to the chassis to form a rigid symetrical structure. A camera boom extends above the barrier face plane to provide a view of barrier to vehicle impact. The barrier assembly weighs 3,977 pounds and has a four wheel electric brake system.

SECTION 4

4.4 VEHICLE STATIC ROLLOVER MACHINE

4.4.1 The vehicle static rollover machine conforms to the requirements as set by the NHTSA Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures TP219-02 with the following special characteristics.

4.4.2 The vehicle static rollover machine is constructed of 10 inch square tube with adjustable wheelbase and tread width platforms to accommodate the various test vehicles. The total usable platform area is 8 feet wide and 25 feet long with special design feature to accomodate vehicles with a gross vehicle weight rating (GVWR) of 10,000 pounds or less with various body configuration heights to 12 feet. The test vehicle can be rotated left or right and can turn each 90° rotational increment in approximately two (2) minutes.

4.5 IMPACT VELOCITY MEASUREMENT

The test vehicle impact velocity is measured by two (2) separate certification timing trap systems located within five (5) feet of the vehicle to fixed collision barrier face and to one side on the approach apron. Each timing

trap system contains two (2) optical beams, mounted twenty four (24) inches apart, in a mechanical housing assembly providing a start-stop signal to a digital display counter. As the test vehicle traverses the impact apron, a blade attached to the test vehicle rear fender interrupts each optical beam providing the precise measurement of time interval for the test vehicle to advance the known distance between the optical beams. Each interval of time measurement is stored in the digital display counter and photographically recorded.

The moving collision barrier impact velocity is measured by two (2) separate certification timing trap systems located within five (5) feet of the moving collision barrier to vehicle impact location and to one side on the approach apron. Each timing trap system contains two (2) optical beams, mounted twenty-four (24) inches apart, in a mechanical housing assembly providing a start-stop signal to a digital display counter. As the moving barrier traverses the impact apron, a blade attached to the moving barrier side interrupts each optical beam providing the precise measurement of time interval for the moving barrier to advance the known distance between the optical beams. Each interval of time measurement is stored in the digital display counter and photographically recorded.

SECTION 4

4.6 PHOTOGRAPH COVERAGE

4.6.1 Because FMVSS 212/219/301-75 may be a combined test, it is necessary that all photographic coverage of the test vehicle be done at one time with specific photographs to document the areas for Vehicle Safety Compliance consideration; windshield area and the fuel system. Each report will utilize only those photographs pertaining to the Vehicle Safety Compliance Test being reported.

4.6.2 FIXED BARRIER IMPACT TEST

Motion picture coverage of the event employs seven (7) 16mm 1B Photo-Sonics cameras and four (4) 16mm 51 Redlake Locam cameras using color film at 500 frames per second (fps). Also a 16mm Canon Scoopic 24 frames per second (fps) camera with color film is used to record vehicle pre-test condition, vehicle in-run, impact, and post-impact vehicle conditions including the rollover increments for documentary purposes. The eleven (11) high speed cameras are located at stationary positions near the point of impact. One is an overhead camera mounted on a tower above the fixed barrier face on centerline of the test vehicle at impact. Its field of view includes the barrier face and the front of the vehicle to a point about one foot aft of the windshield. A second and third camera are mounted on top of the fixed barrier with

their field of view concentrating on the windshield area (FMVSS 212/219). The fourth and fifth cameras each have a side view of the test vehicle at impact. The sixth, seventh, eight, and ninth cameras are located adjacent to the test vehicle front passengers compartment and positioned to photograph motion of each test dummy at impact. The tenth and eleventh cameras are located in the pit and positioned to photograph the underside of the engine compartment and fuel tank area.

4.6.3 MOVING BARRIER IMPACT TEST

Motion picture coverage of the event employs four (4) 16mm 1B Photo Sonics cameras and two (2) 16mm 51 Redlake Locam cameras using color film at 500 frames per second (fps). Also a 16mm Canon Scoopic 24 frames per second (fps) camera with color film is used to record vehicle pre-test condition, barrier in-run, impact, and post-impact vehicle conditions including the rollover increments for documentary purposes. Five (5) of the high speed cameras are located at stationary positions near the point of impact. Three (3) cameras are located in the pit and positioned to photograph the underside of the engine compartment, with overlapping field of views, aft to the fuel tank area. The fourth and fifth cameras each have a side view of the test vehicle at impact.

The sixth camera is attached to the moving collision barrier to photograph the contact between the barrier and the test vehicle.

4.6.4 TIME PULSE GENERATOR

Time data from two (2) sources are contained in the high speed film coverage. The first is a time reference of 100 pulse per second (pps) light emitting diode event mark along the film adge. This pulse is generated by the time pulse generator and fed to all high speed cameras. Thus, it is possible to relate film data to a real time base. The second time record is an indication of time zero (moment of impact). This is accomplished by a trip switch and event mark system. The trip switch is positioned at the impact point so that it triggers the light emitting diode event mark along the film edge at the moment of bumper-barrier contact. Thus, the particular film frame corresponding to the point of impact is clearly indicated on all the high speed film.

SECTION 4

4.7 DATA ACQUISITION AND REDUCTION

The data acquisition and analysis system used for acquiring occupant response and vehicle acceleration are shown schematically in Figure 5-1. A complete list of instrumentation is provided in Table 5-1. An itemized procedure for acquiring data is provided on Table 5-2.

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

The analog data is then played back into a Hewlett Packard Digital Fourier Analyzer (DFA) system using a HP 2100S mini computer with 32K word core storage. This system uses four program controlled analog filters which provides predigitizing filter capability of 60 db/octave above 1250 Hz.

SECTION 4

The DFA is a hard disc based system with standard HP design software for performing data acquisition and analysis functions. The HP software is programmed using direct keyboard functions to automate the data reduction process. The data is entered into temporary storage, four channels (one set) at a time with eight total sets. Table 5-3 defines each data channel and data set. The data sets are divided into driver and passenger tape recorder groups to facilitate simultaneous data acquisition for the head, chest and vehicle accelerometers to assure appropriate calibration of injury criteria and vehicle dynamics. At the time of entry, test personnel enter the appropriate calibration for each data channel and the computer then scales the data appropriately. When all data has been acquired it is moved as a vehicle set to permanent storage on a removable magnetic disc. (Eight vehicle sets are stored on each magnetic disc. All magnetic discs and FM recorder tapes are retained on file at AETL).

The only modifications to the data at the time of permanent storage is the filtering and digitizing process of the FM tape recorder (2500 Hz) and the DFA (2000 Hz sampling for a 500 ms window). After the data is moved to permanent storage it is recalled by test personnel and plotted with the appro-

priate labels and vehicle designation. As the data is recalled, the DFA is programmed to automatically apply the appropriate SAE filter where applicable.

A 1250 Hz predigitizing analog filter with a rolloff of 60 db/octave, shown in figure 5-2, was applied to all data. Also shown in figure 5-2 are SAE class 60 and class 180 filters. These filters are in accordance with SAE J211A, Instrumentation for Impact Tests. These SAE recommended filters are quadratic double pole with 65% damping and a 12 db/octave rolloff. They are applied using a fast fourier transform of the data, frequency domain multiplication, and an inverse fast fourier transform of the product. The class 60 filters is applied to vehicle acceleration and belt restraint forces. The class 180 filter is applied to chest acceleration. SAE filters were not applied to head accelerations and femur forces.

4.7.1 IMPACT DATA

All impact data is presented in computer plots of data digitized at 500 microseconds. Special SAE filters are applied to appropriate data sets. Each data plot includes labeling, defining the test vehicle, filter class, and the complete identification of the data plotted.

4.7.1.2 DUMMY HEAD DATA

The dummy head accelerations are processed and the Head Injury Criteria (HIC) calculation is performed. The HIC calculations are maximized for start time (T1) and end time (T2), using a manual iteration routine, usually requiring about ten interations 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.

4.7.1.3 DUMMY CHEST DATA

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

4.7.1.4 FEMUR LOAD DATA

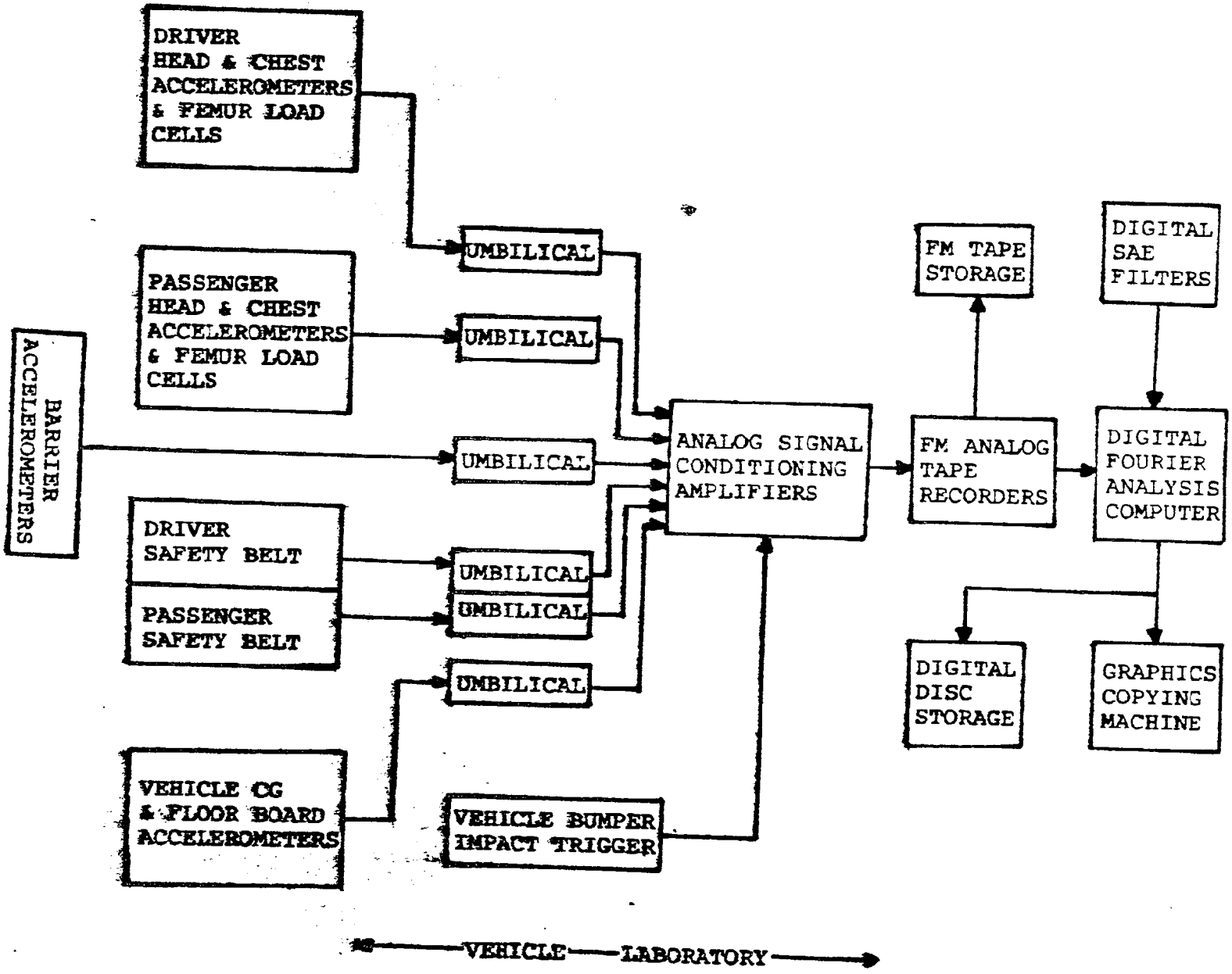
The dummy femur loads are processed and presented as computer plots.

4.7.1.5 RESTRAINT LOAD DATA

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

4.7.1.6 VEHICLE ACCELERATION DATA

The vehicle accelerations are processed as class 60 data, and presented as computer plots.



VEHICLE AND OCCUPANT CRASH IMPACT DATA ACQUISITION SYSTEM

FIGURE 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	-	-

TABLE 4-2

DATA ACQUISITION AND REDUCTION PROCESS

STEP	DESCRIPTION
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 500 ms sample rate c) Data sychronized by impact trigger signal
7	Digitized Data Examined
8	Data Transfered 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

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 Ax
1	1	2	Driver Lateral Head Acceleration Ay
1	1	3	Driver Vertical Head Acceleration Az
1	1	4	Driver Right Femur Force
2	1	5	Driver Longitudinal Chest Acceleration Ax
2	1	6	Driver Lateral Chest Acceleration Ay
2	1	7	Driver Vertical Chest Acceleration Az
2	1	8	Driver Left Femur Force
3	1	9	Driver Restraint Belt Force
3	1	10	Vehicle Vertical CG Acceleration Az
3	1	11	Vehicle Lateral CG Acceleration Ay
3	1	12	Vehicle Longitudinal CG Acceleration Ax
4	1	13	Left Rear Floor Pan Longitudinal Acceleration Ax
4	1	14	Left Rear Floor Pan Vertical Acceleration Az
5	2	1	Passenger Longitudinal Head Acceleration Ax
5	2	2	Passenger Lateral Head Acceleration Ay
5	2	3	Passenger Vertical Head Acceleration Az
5	2	4	Passenger Right Femur Force
6	2	5	Passenger Longitudinal Chest Acceleration Ax
6	2	6	Passenger Lateral Chest Acceleration Ay
6	2	7	Passenger Vertical Chest Acceleration Az
6	2	8	Passenger Femur Force
7	2	9	Passenger Restraint Belt Force
7	2	10	Barrier Lateral Acceleration Ay
7	2	11	Barrier Longitudinal Acceleration Ax
7	2	12	Barrier Vertical Acceleration Az
8	2	13	Right Front Floor Pan Longitudinal Acceleration Ax
8	2	14	Right Front Floor Pan Vertical Acceleration Az

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

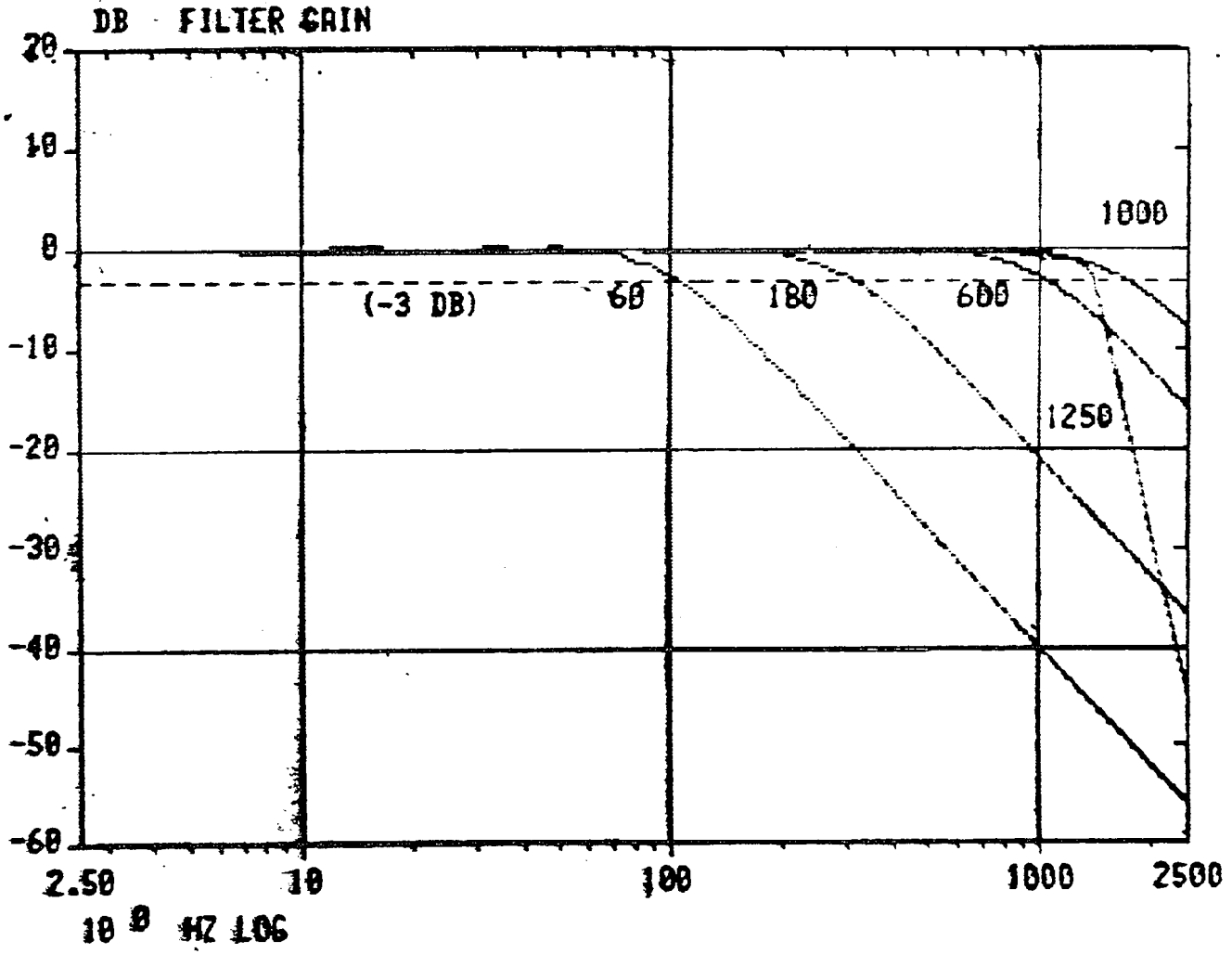


FIGURE 4-2

APPENDIX A

APPENDIX A

The following photographs are pre and post test dummy positions and interior compartment locations of dummy contact during the impact event.

Figure A-1

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Pre-Test, Driver Dummy View

DOT 0249

AETL

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A NATIONAL TECHNICAL SERVICES COMPANY

REPORT NO. 301-AETL-80-021-971-3882-21

FMVSS 301-75
VEHICLE SAFETY COMPLIANCE
AND
RESEARCH AND DEVELOPMENT TESTING
OF
"FUEL SYSTEM INTEGRITY"

VOLKSWAGENWERK AG
1980 VOLKSWAGEN VANAGON - 3 DOOR STATION WAGON
NHTSA 801301

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

NOVEMBER 1980

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
- ENFORCEMENT -
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Prepared by D. N. Hand

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Date 12 November 1980

Report Accepted by:

Robert Krauss
Contract Technical Manager
Office of Vehicle Safety Compliance

11/24/80
Date

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	6. Performing Organization Code

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U. S. Department of Transportation National Highway Traffic Safety Admin. Enforcement Office of Vehicle Safety Compliance 400 Seventh Street S. W. Washington, D. C. 20590	Final Report October 7 - October 23, 1980
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15. Supplementary Notes

16. Abstract

FMVSS 301-75 Vehicle Safety Compliance Test of a 1980 Volkswagen Vanagon - 3 Door Station Wagon, NHTSA 801301, VIN-25A0027785 was conducted at Approved Engineering Test Laboratories test facility in Fullerton, California, to determine compliance with the requirements of FMVSS 301-75.

As a parallel non-conflicting effort, the test 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 29.56 mph in the frontal (0°) mode. Test date was October 23, 1980, and the ambient temperature was 73°F.

The subject test vehicle appears to comply with all the requirements of FMVSS 301-75.

17. Key Words	18. Distribution Statement
FMVSS 301-75 - Fuel System Integrity Research and Development	

19. Security Class. (of this report)	20. Security Class. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	136	

TABLE OF CONTENTS

TABLES

ILLUSTRATIONS

SECTION 1

SECTION 1

1.0 INTRODUCTION

This report contains information regarding a joint program for the Office of Vehicle Safety Compliance (OVSC), and Research and Development (R&D) for the conduct of a vehicle Fuel System Integrity Test relative to Federal Motor Vehicle Safety Standard No. 301-75, in addition, occupant response and vehicle acceleration. This test was performed under Contract Number DOT-HS-9-02273 by Approved Engineering Test Laboratories, 1536 East Valencia Drive, Fullerton, California, in accordance with the Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures.

The specific purpose of this test was to check the performance of a 1980 Volkswagen Vanagon - 3 Door Station Wagon, NHTSA 801301 to the requirements of FMVSS 301-75 and to acquire occupant response and vehicle acceleration data during the 30 mph frontal fixed barrier impact.

SECTION 1

The scope of the vehicle compliance 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 (TP219-02) issued by the Office of Vehicle Safety Compliance (OVSC). Specific procedures used to obtain the additional data are detailed in the (OVSC) Laboratory Procedures TP212-02.

Section 2 of this report contains all compliance test related data, while Section 3 contains occupant response and vehicle acceleration summary data, along with test dummy and vehicle measurements. Section 4 discusses AETL's test facilities and data acquisition and reduction system. Appendix A contains additional photographs not related to vehicle compliance. Appendix B contains the computer-generated plots, while Appendix C contains the test dummy calibration reports.

SECTION 1

1.1 ADMINISTRATIVE DATA

A. References

1. Federal Motor Vehicle Safety Standard 301-75 - "Fuel System Integrity," as published in the Federal Register, Volume 38, No. 22397, dated 20 August 1973.

2. National Highway Traffic Safety Administration, Office of Vehicle Safety Compliance Laboratory Procedures "Windshield Mounting" FMVSS 212 - "Windshield Zone Intrusion" FMVSS 219 - "Fuel System Integrity" FMVSS 301-75, TP219-02, dated 9 January 1979.

SECTION 1

B. Description of Test Vehicle

1. 1980 Volkswagen Vanagon - 3 Door Station Wagon
2. Vehicle Identification No.: 25A0027785
3. NHTSA no.: 801301
4. Manufactured Date: October 1979
5. GVWR: 5,093 pounds

C. Dates

1. Vehicle Received: May 10, 1980
2. Start of Test: October 7, 1980
3. Completion of Test: October 23, 1980

SECTION 2

SECTION 2

2.0 TEST DATA

The 1980 Volkswagen Vanagon - 3 Door Station Wagon was subjected to a frontal fixed barrier impact and a static rollover maneuver as required by Federal Motor Vehicle Safety Standard No. 301-75.

Two (2) Part 572 test dummies were positioned in each front designated outboard seating position and were restrained by the belt system in the test vehicle. Just prior to the impact event, the driver dummy head was painted with red chalk and his knees were painted with yellow chalk. The passenger dummy head was painted with blue chalk and his knees were painted with white chalk to provide post-impact visual inspection of possible dummy head and knee contact with interior components during the impact event.

The test vehicle "rated cargo and luggage weight" (RCLW) was not used as calculated, in lieu, a 300 pound cargo ballast was utilized in determining the ultimate calculated vehicle test weight.

SECTION 2

Impact velocity for the test vehicle was regulated by the fixed tow propulsion and certified by the redundant timing traps described in Section 4.

Color motion picture coverage of the vehicle impact along with the static rollover test 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 INFORMATION:

Manufacturer: Volkswagenwerk AG

Make/Model: Volkswagen Vanagon

Body Style: 3 Door Station Wagon Model Year: 1980

VIN: 25A0027785 Build Date: October 1979

NHTSA No.: 801301 Color: Orange/Creme

Engine Data: Four (4) Cylinders; 120.0 Cu. In. Displ.

Transmission Data: Four (4) Speed (XX) Manual ( ) Automatic

Major Options: Deluxe Package, Tinted Glass

VEHICLE ATTITUDE:

Delivered Attitude: LF 29.2 in.; RF 29.3 in.; LR 29.5 in.; RR 29.5 in

Test Attitude: LF 27.6 in.; RF 27.5 in.; LR 29.5 in.; RR 29.2 in

VEHICLE TIRE DATA:

Recommended Cold Tire Pressure: Front = 33 psi

(Up to Vehicle Load Capacity) Rear = 40 psi

Recommended Tire Size: 185R14 Load Range: unknown

Tires on Vehicle: 185SR14 - Continental

Spare Tire: X Yes; No; Space Saver: Yes; X No

TABLE Ia

SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS:

Date of Test: October 23, 1980 Time of Test: 1208

Ambient Temperature: 73 °F at Impact Area

VEHICLE CAPACITY:

Type of Seats: ____ Bench; X Bucket; ____ Split Bench

Designated Seating Capacity: Front 2
Center 2
Rear 3
Total 7

Cargo: unknown lbs.

Total unknown lbs. (Vehicle Capacity Weight)

GVWR: 5,093 lbs. (Taken From Certification Label)

GAWR: Front 2,425 lbs.; Rear 2,866 lbs.

VEHICLE DELIVERED WEIGHT: (Fuel - 93% of NFC)

Left Front 851 lbs. Left Rear 751 lbs.
Right Front 817 lbs. Right Rear 804 lbs.
Total Front Weight 1,668 lbs. (51.8 % of Total Vehicle Weight)
Total Rear Weight 1,555 lbs. (48.2 % of Total Vehicle Weight)
Total Delivered Weight 3,223 lbs.

CALCULATED VEHICLE TEST WEIGHT: 3,851 lbs.
(With Required Dummies and 300 lbs. Cargo)

ACTUAL VEHICLE TEST WEIGHT:

Left Front 1,027 lbs. Left Rear 845 lbs.
Right Front 1,170 lbs. Right Rear 811 lbs.
Total Front Weight 2,197 lbs. (57.0 % of Total Vehicle Weight)
Total Rear Weight 1,656 lbs. (43.0 % of Total Vehicle Weight)
Total Test Weight 3,853 lbs.

TABLE Ib

SUMMARY OF TEST CONDITIONS (Cont'd)

TEST FLUID DATA:

Test Fluid Type: Red Stoddard Solvent ; Specific Gravity: 0.764

Kinematic Viscosity: 1.31

Nominal Fuel Capacity: 16.00 gals. (NFC)

Test Volume: 14.88 gals. (92-94% of NFC)

Fuel System Capacity: 16.00 gals.
(Data from Owner's Manual)

Electric Fuel Pump: X Yes; ____ No; Fuel Injection: X Yes; ____ No

Does Electric Fuel Pump Operate with Ignition Switch "On"

And the Engine Not Operating: ____ Yes; X No; ____ N/A

Details of Fuel System: Fuel filler located on right front door sill aft of wheel opening adjacent to the "B" post, fuel tank located horizontally between frame side rails under front passenger compartment floor pan aft of spare tire storage rack.

VEHICLE TEST CONDITIONS:

Temperature in Occupant Compartment: 70 °F

Temperature of Windshield Glazing/Moulding: N/A °F

VEHICLE CRUSH AND REBOUND:

Overall Length of Test Vehicle: Pre-Test - Left 177.5 in.; Right 177.3 in.

Post-Test - Left 165.3 in.; Right 165.2 in.

Crush: Left 12.2 in.; Right 12.1 in.

Rebound (From Rigid Barrier Only): 12.3 in.

TABLE III

POST IMPACT SUMMARY

Vehicle 1980 Volkswagen Vanagon

NHTSA No. 801301 Test Date October 23, 1980

TYPE OF TEST: [XX] 0° Frontal Impact

[ ] 30° Oblique Impact (Driver/Passenger) Side

[ ] Rear Impact

REQUIRED IMPACT VELOCITY RANGE: 28.9 to 29.9 mph

IMPACT VELOCITY: (Traps within 5 feet of impact event)

Trap 1 = N/R mph

Trap 2 = 29.56 mph

Average 29.56 mph

Actual distance from vehicle front bumper to barrier face when entering timing trap 57.0 in.

Actual distance from vehicle front bumper to barrier face when exiting timing trap 33.0 in.

VEHICLE STATIC CRUSH: Driver's Side = 12.2 inches

Passenger's Side = 12.1 inches

Average = 12.15 inches

Crush Details: Windshield ejected, roof buckled over both "B" post, front compartment floor pan buckled, driver dummy impacted steering wheel and dash assembly, passenger dummy impacted dash assembly.

VEHICLE REBOUND: (From rigid barrier only)

Driver's Side = 13.3 inches

Passenger's Side = 11.3 inches

Average = 12.3 inches

TABLE VI

POST IMPACT SUMMARY

FUEL SYSTEM INTEGRITY - FMVSS 301-75

Vehicle 1980 Volkswagen Vanagon

NHTSA No. 801301 Test Date October 23, 1980

	Actual	Max. Allow.
Fuel spillage from impact until vehicle motion ceases.	- 0 -	1 ounce
Fuel spillage for 5 minute period following cessation of vehicle motion after impact.	- 0 -	5 ounces
Fuel spillage for next 25 minute period.	- 0 -	1 ounce/ 1 minute
Time duration from impact until start of rollover test periods.	29 min. 50 sec.	30 minutes

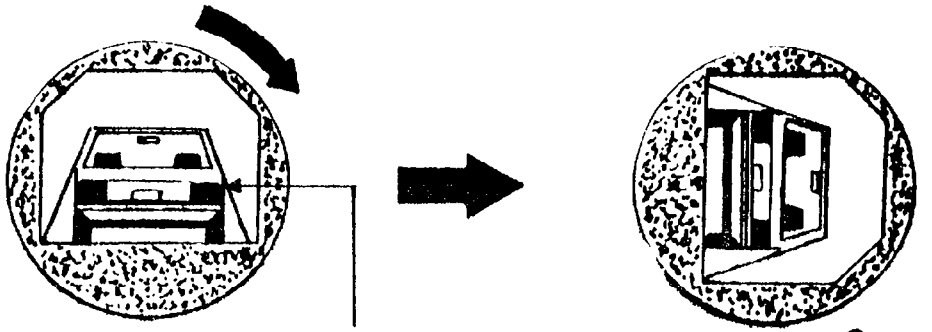
Fuel Spillage Location: Not Applicable

TABLE VII

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1980 Volkswagen Vanagon NHTSA No. 801301



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 13 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

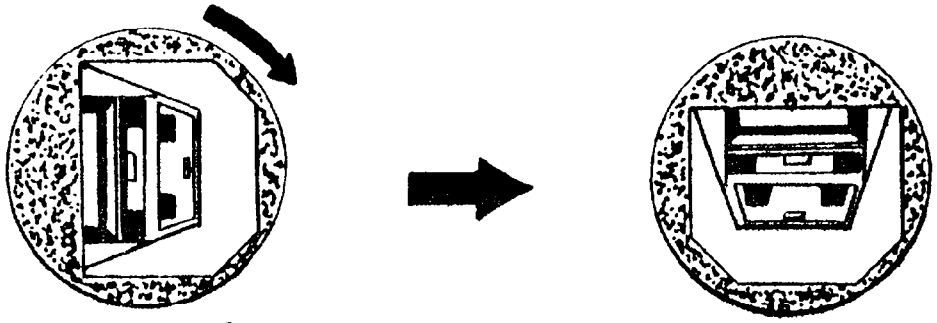
Fuel Spillage Location: Not Applicable

TABLE VIII

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1980 Volkswagen Vanagon NHTSA No. 801301



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 13 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

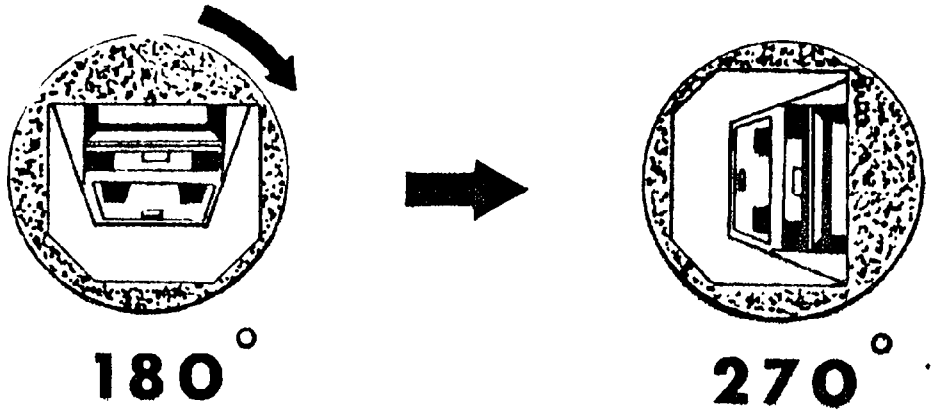
Fuel Spillage Location: Not Applicable

TABLE IX

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1980 Volkswagen Vanagon NHTSA No. 801301



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 37 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

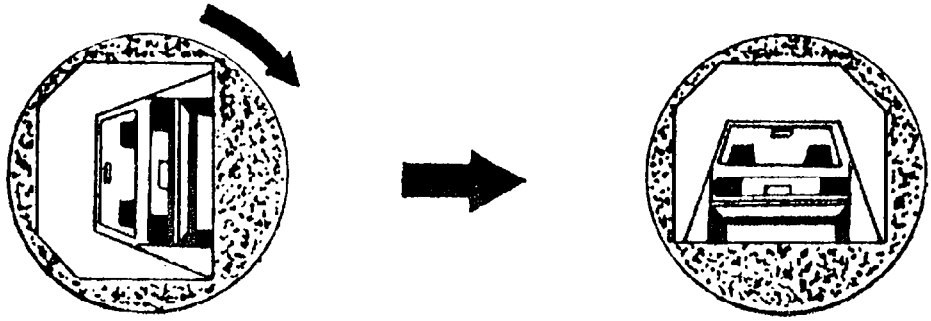
Fuel Spillage Location: Not Applicable

TABLE X

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1980 Volkswagen Vanagon NHTSA No. 801301



270° 360°

	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 17 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

Fuel Spillage Location: Not Applicable

SECTION 2

2.1 TEST RESULTS AND PHOTOGRAPHS

The 1980 Volkswagen Vanagon - 3 Door Station Wagon was subjected to a frontal fixed barrier impact followed by a static rollover test in accordance with the procedures referenced in Section 1 of this report under Administrative Data. The results presented here relate specifically to vehicle performance under Federal Motor Vehicle Safety Standard 301-75 "Fuel System Integrity".

The test was conducted essentially in accordance with NHTSA Office of Vehicle Safety Compliance Laboratory Procedures. The critical parameters were impact velocity; and fuel spillage criteria defined in FMVSS 301-75, paragraph S5.5 and S5.6.

Post-impact inspection of the test vehicle revealed almost all crush occurred forward of the front doors. The windshield ejected from the body opening and the roof buckled over the left and right "B" post. The front passenger compartment floor pan buckled on both sides and the spare tire (stored under the front floor pan) remained inflated. The driver dummy made contact with the steering wheel and dash assembly. The passenger dummy also made contact with the dash assembly.

SECTION 2

No fuel spillage was recorded following the test vehicle impact, nor during the time period before the start of the rollover test. No fuel spillage was recorded during the rollover test increment time periods.

The 1980 Volkswagen Vanagon - 3 Door Station Wagon test vehicle appears to comply with all the requirements of FMVSS 301-75.

Figure 2-1

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Pre-Test, Full Front View


NHTSA 801301
FMVSS 301
AETL
21

Figure 2-2

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Pre-Test, Left Side View


NHTSA 801301
FMVSS 301
AETL
21

Figure 2-3

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Pre-Test, Right Side View


NHTSA
FMVSS 301
AETL
21

Figure 2-4

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Left Side View


AETL
21

Figure 2-5

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Right Side View


NHTSA 80130
FMVSS 301
AETL
21

Figure 2-6

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

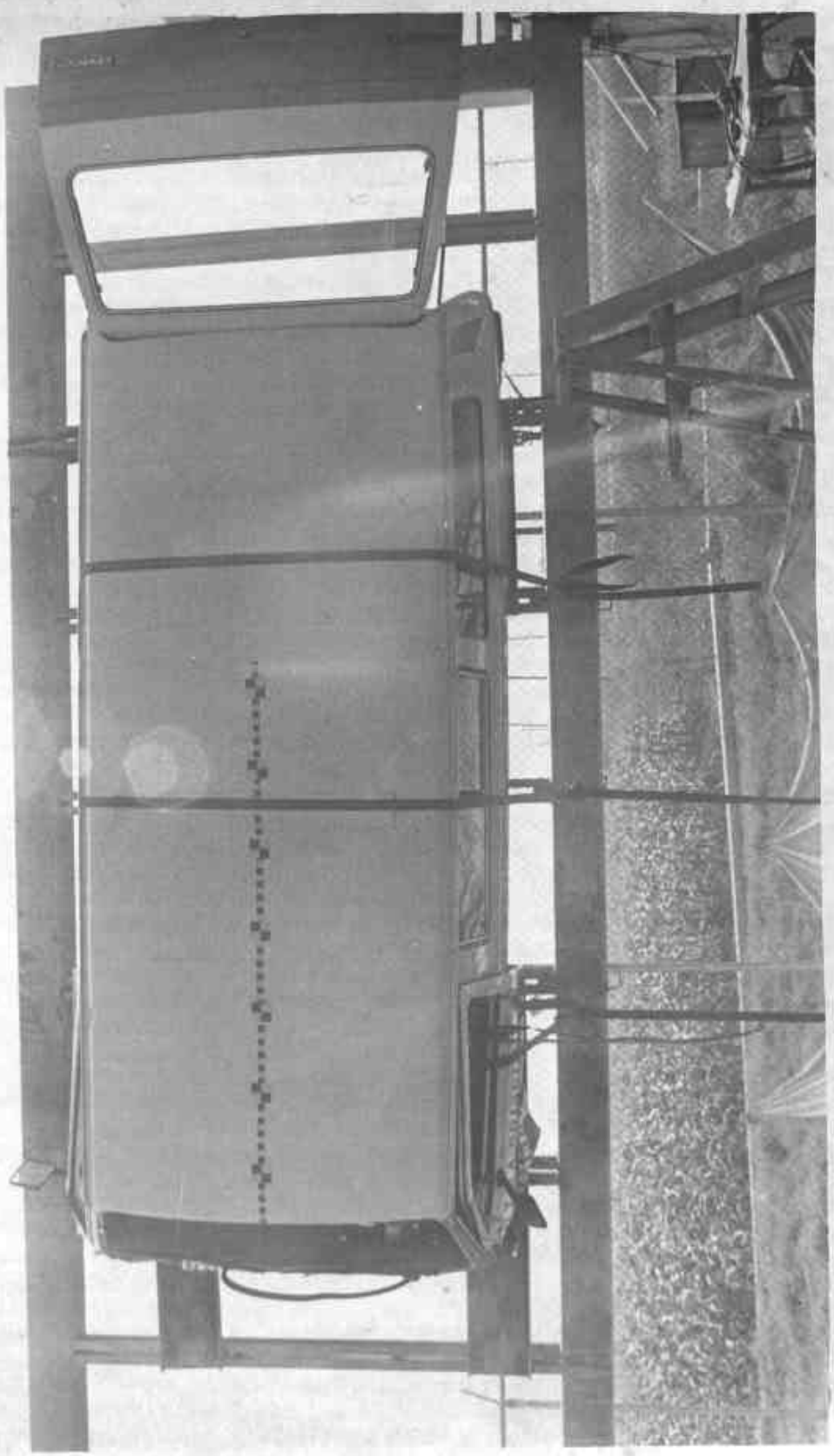
Post-Impact, Rollover Test, 90° Increment

Figure 2-7

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Rollover Test, 270° Increment



SECTION 3

SECTION 3

3.0 OCCUPANT RESPONSE AND VEHICLE ACCELERATION SUMMARY DATA

The following data sheets summarize:

A. The Dummy Position Data (Part 572 Dummy In-Vehicle Position/Part 572 Dummy Pre-Test Clearence Distances Sheets)

B. The Occupant Response Data (Part 572 Dummy Data Sheet)

C. The Vehicle Acceleration Data (Vehicle Structural Data Sheet)

D. The Pre and Post-Test Vehicle Dimensions Data (Vehicle Measurement Data Sheet)

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

The driver dummy experienced a HIC value of 1313 which is in excess of the limit specified in FMVSS 208 injury criteria. The passenger dummy experienced a HIC value of 831. All other values from both test dummies satisfy the FMVSS 208 requirements.

SECTION 3

In addition to the occupant and vehicle data, each shoulder belt was marked at the D-ring after dummy positioning to provide a static measurement of belt position after the impact event. Post-impact measurement of the driver shoulder belt was 2.0 inch and the passenger shoulder belt was 1.8 inch.

TABLE 3-1

PART 572 DUMMY IN-VEHICLE POSITION

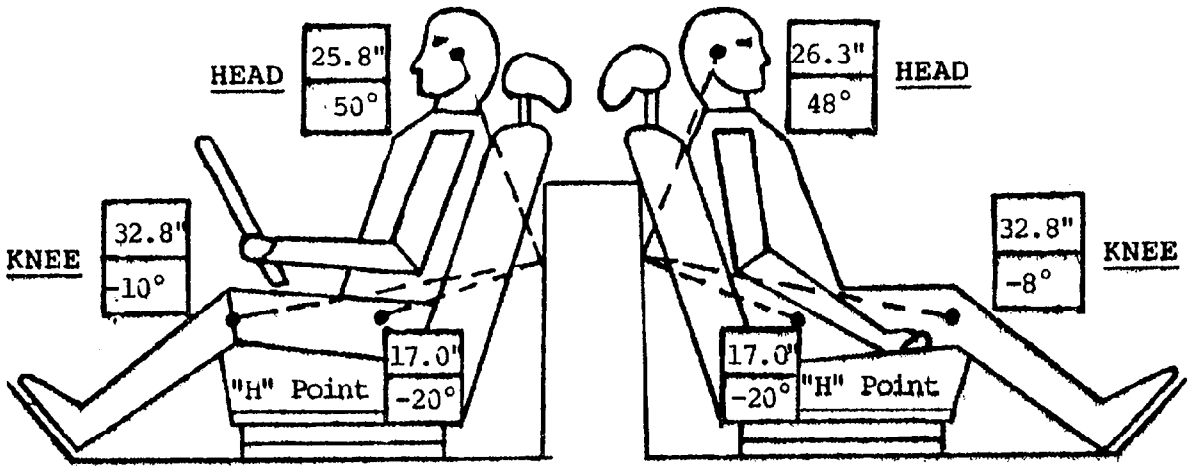
VEHICLE 1980 Volkswagen Vanagon NHTSA NO. 801301

POSITIONING DATE: Oct. 23, 1980 AMBIENT TEMP: 69 °F TIME 1100

SEAT TYPE: ____ Bench
__X__ Bucket
____ Split Bench

ADJUSTER TYPE: __X__ Manual
____ Power

BUCKET SEAT BACK TYPE: ____ Fixed
__X__ Adjustable Reclining



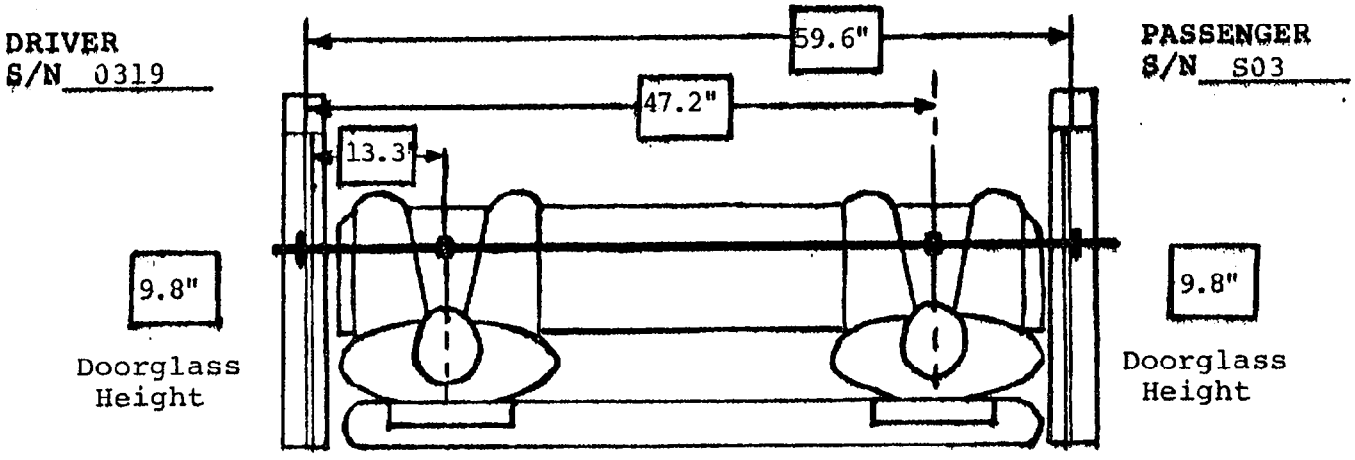
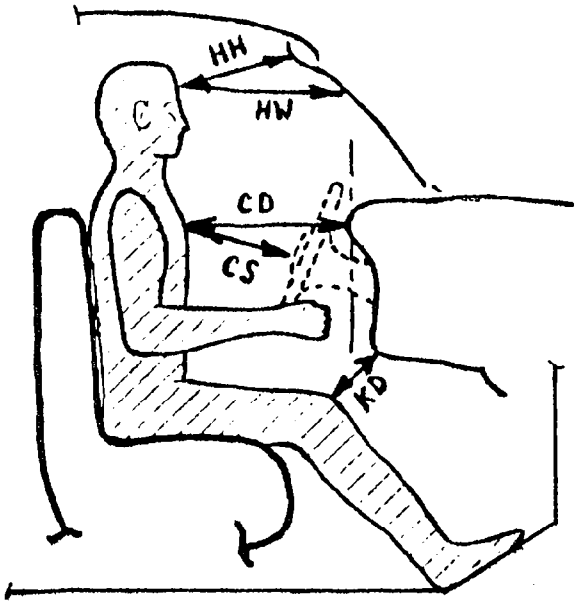


TABLE 3-2

PART 572 DUMMY PRE-TEST CLEARANCE DISTANCES

DRIVER		PASSENGER	
HH =	18.2 in.	HH =	19.3 in.
HW =	21.6 in.	HW =	23.0 in.
HR =	9.0 in.	HR =	8.5 in.
HS =	9.4 in.	HS =	9.0 in.
CD =	21.3 in.	CD =	20.8 in.
CS =	13.0 in.	AD =	4.4 in.
AD =	4.0 in.	HD =	7.2 in.
HD =	7.4 in.	KD =	5.7 in.
KD =	5.5 in.		



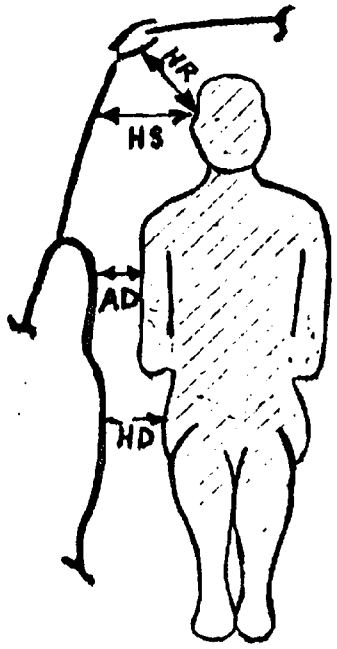


TABLE 3-3

MANUFACTURERS SEAT BELT INSTRUCTIONS

Safety belts

For you and your passenger's protection, use safety belts at all times while the car is in motion.

The safety belts should not be used to hold a child's seat; the diagonal belt will not provide the needed protection.

A shoulder belt should not be worn by a person less than 4'7" or 1.40 m in height because it would not be in its most protective position, and therefore may increase the possibility of injury in a collision.

Lap/shoulder belts

- To **fasten**, grasp belt tongue and pull belt in continuous slow motion across your chest and lap.
- Insert belt tongue into buckle on inboard side of seat. Push down until it is securely locked with an audible click.
  Pull shoulder section to make sure belt fits snugly across the hips.
- To **unfasten** belt, push in release marked PRESS on buckle. Belt will spring out of buckle.
- To **store** lap/shoulder belt, allow belt to wind up on retractor as you guide belt tongue to its stowed position on doorpost.

Inertia reel retractor

The one-piece lap/shoulder belt with inertia reel locking mechanism will adjust automatically to your size and movements as long as the pull on the belt is slow.

Rapid deceleration during hard braking or a collision locks the belt. The belt will also lock when you drive up or down a steep hill or in a sharp curve.

To release a locked belt, lean back to take the body pressure off the belt.

Notes:

- **Belts should fit snugly across lap and chest. Make sure any slack is wound on the retractor.**
- **Do not strap in more than one person with each belt.**
- **Belts should not be worn twisted.**

  For maximum effectiveness the lap belt portion should be worn low across the pelvic crests.
- Make sure the belt of the **unoccupied passenger seat** is fully wound up on its retractor so that the belt tongue is in its stowed position on the doorpost. This reduces the possibility of its becoming a striking object in case of a sudden stop.

TABLE 3-4

PART 572 DUMMY DATA

Vehicle 1980 Volkswagen Vanagon NHTSA No. 801301

Driver S/N 0319 Passenger S/N S03	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	5.8	174.6	193.3	70.4	6.7	184.0	43.2	92.4
Lateral	12.6	82.8	6.4	68.2	9.3	97.2	2.9	50.8
Vertical	6.8	91.2	51.1	73.8	1.2	18.0	52.5	65.8
Resultant	197.0	70.4			56.5	65.6		
HIC	1313 (68-74 msec)				831 (32-108 msec)			
CHEST ACCELERATION								
Longitudinal	4.5	170.4	51.3	38.4	4.2	117.4	42.4	49.8
Lateral	3.5	73.4	9.8	64.8	3.0	30.2	6.0	55.4
Vertical	24.4	61.4	33.7	31.0	15.3	53.2	13.9	33.2
Resultant	53.6	38.4			43.2	49.8		
CSI	462 (49.5g - 3 msec clip)				292 (41.1g - 3 msec clip)			
	(lb)	Time (msec)	(lb)	Time (msec)	(lb)	Time (msec)	(lb)	Time (msec)
FEMUR LOAD								
Left	145	26.3	1796	33.2	195	49.4	599	32.2
Right	769	73.6	98	34.2	185	30.4	263	36.8
BELT LOAD								
Torso	1418	43.6			1470	51.2		
Lap	2012	40.6			1513	41.6		

Average Vehicle Impact Speed 29.56 **mph**

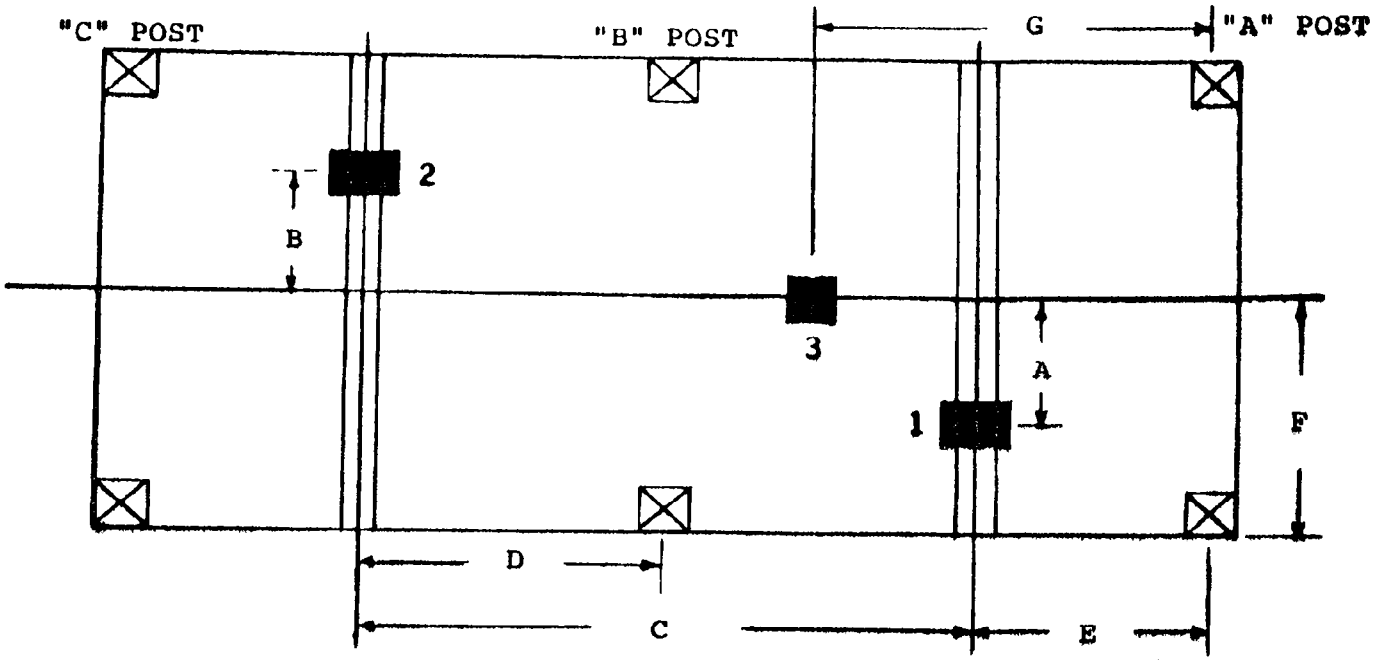
*Positive Direction - Longitudinal: Forward
Lateral: Leftward
Vertical: Upward
Femur: Tension

*Negative Direction - Longitudinal: Rearward
Lateral: Rightward
Vertical: Downward
Femur: Compression

TABLE 3-5

VEHICLE STRUCTURAL DATA

VEHICLE 1980 Volkswagen Vanagon NHTSA NO. 801301



DIMENSIONS			
LOCATION	MEASUREMENT (IN.)	LOCATION	MEASUREMENT (IN.)
A	23.3	E	10.5
B	23.5	F	36.3
C	47.3	G	74.7
D	8.5		

ACCELERATION PEAKS				
	POSITIVE* DIRECTION		NEGATIVE* DIRECTION	
ACCELEROMETER LOCATION	PEAK "G"	TIME (MSEC)	PEAK "G"	TIME (MSEC)
NO. 1 LONGITUDINAL	15.7	41.6	89.8	26.2
NO. 2 LONGITUDINAL	1.0	135.6	42.2	19.0
NO. 3 LONGITUDINAL	2.7	98.4	69.5	18.4

*POSITIVE - LONGITUDINAL: FORWARD DIRECTION

*NEGATIVE - LONGITUDINAL: REARWARD DIRECTION

TABLE 3-6

PRE-TEST

VEHICLE MEASUREMENT DATA

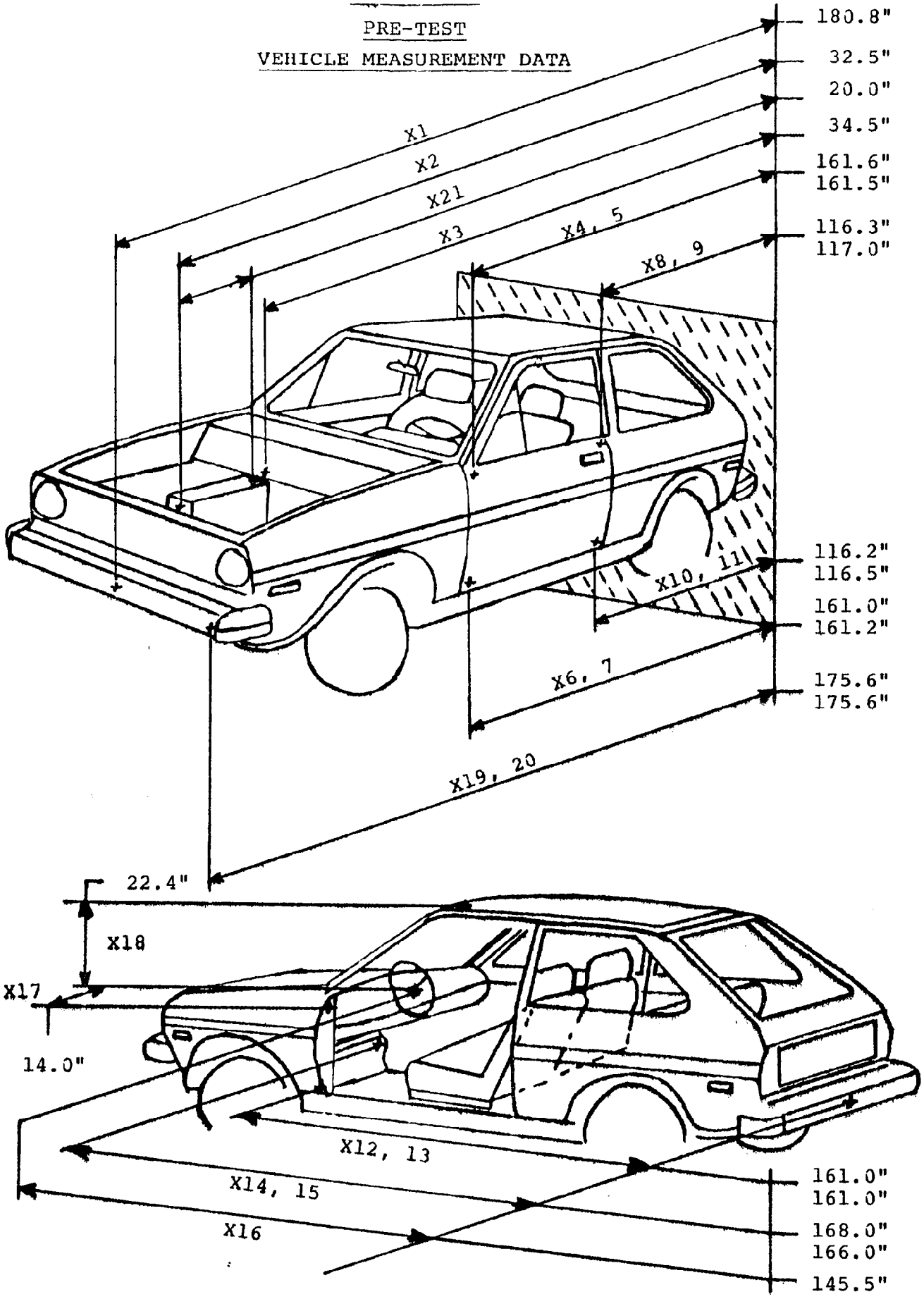


TABLE 3-7

POST-TEST

VEHICLE MEASUREMENT DATA

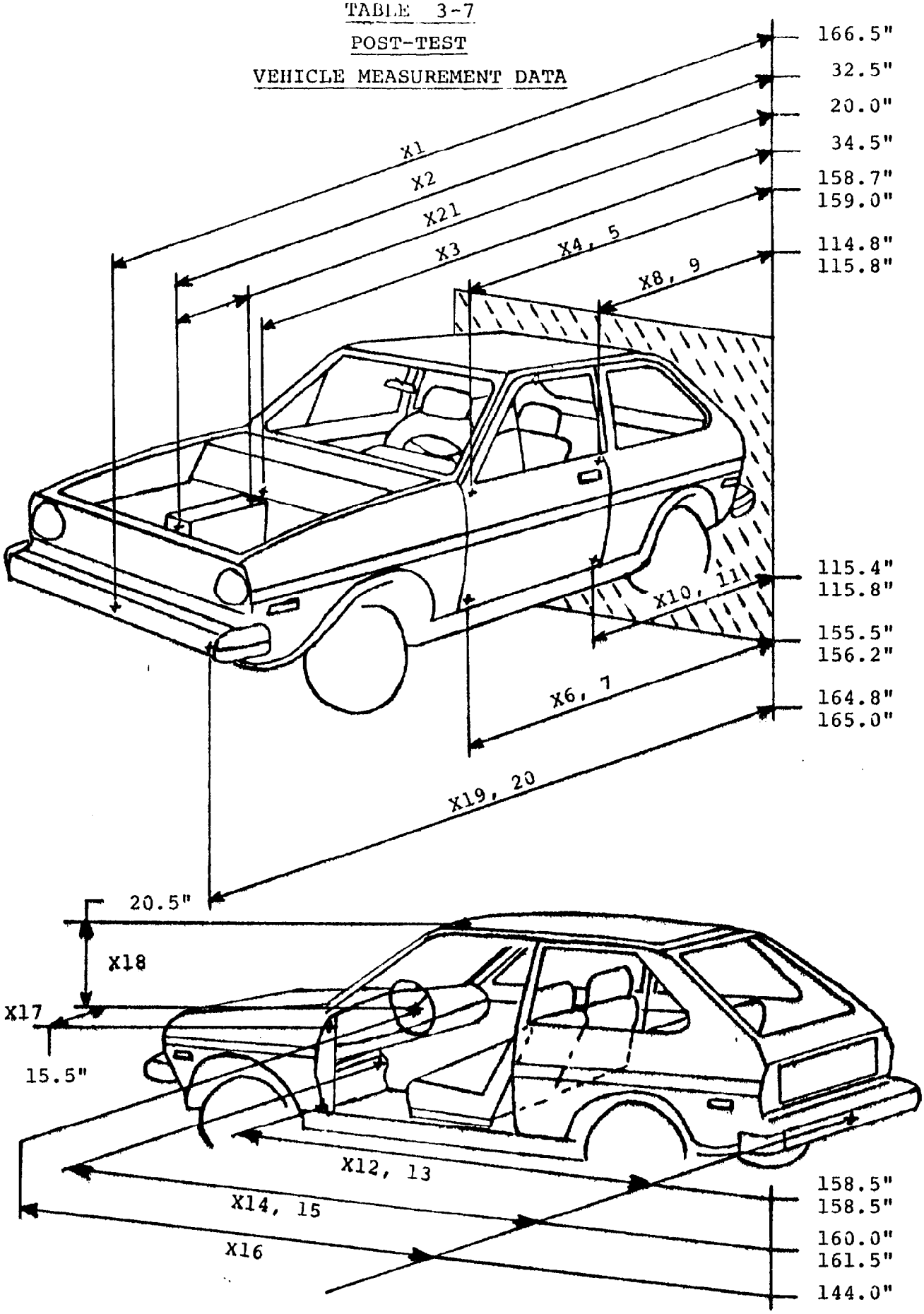


TABLE 3-8

SUMMARY

PRE-TEST AND POST-TEST VEHICLE DIMENSIONS

Measurement Point	Pre-Test	Post-Test	Difference
X1	180.0"	166.5"	14.3"
X2	32.5"	32.5"	0.0"
X3	34.5"	34.5"	0.0"
X4	161.6"	158.7"	2.9"
X5	161.5"	159.0"	2.5"
X6	161.0"	155.5"	5.5"
X7	161.2"	156.2"	5.0"
X8	116.3"	114.8"	1.5"
X9	117.0"	115.8"	1.2"
X10	116.2"	115.4"	0.8"
X11	116.5"	115.8"	0.7"
X12	161.0"	158.5"	2.5"
X13	161.0"	158.5"	2.5"
X14	168.0"	160.0"	8.0"
X15	166.0"	161.5"	4.5"
X16	145.5"	144.0"	1.5"
X17	14.0"	15.5"	+1.5"
X18	22.4"	20.5"	1.9"
X19	175.6"	164.8"	10.8"
X20	175.6"	165.0"	10.6"
X21	20.0"	20.0"	0.0"

TABLE 3-9

FMVSS 212/219/301-75

CAMERA POSITIONS

VEHICLE 1980 Volkswagen Vanagon

NHTSA NO. 801301 TEST DATE October 23, 1980

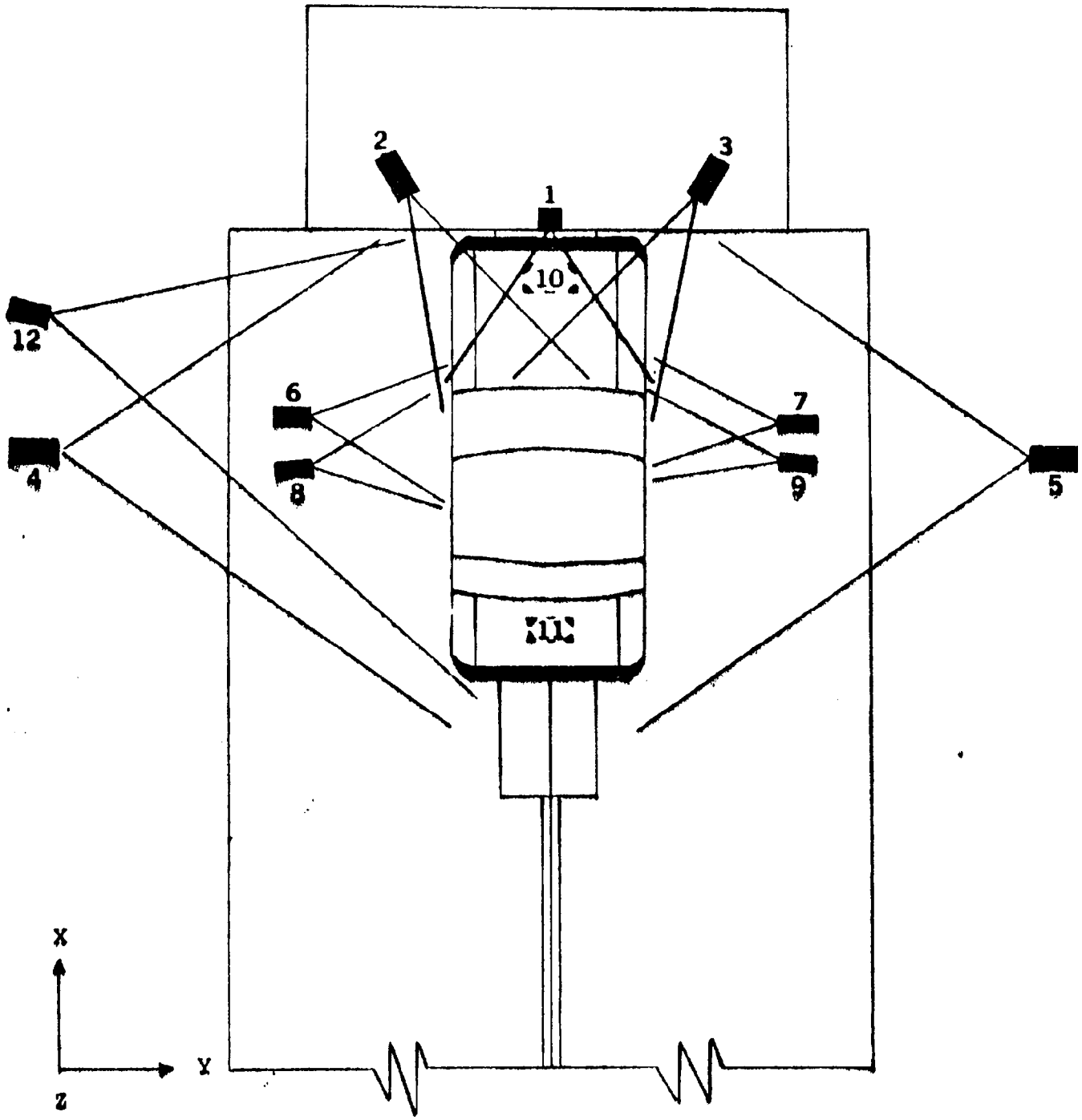


TABLE 3-10

FMVSS 301-75

CAMERA POSITIONS

VEHICLE 1980 Volkswagen Vanagon

NHTSA NO. 801301 TEST DATE October 23, 1980

1.	Photo-Sonics 13mm 500FPS	X 11.0" Y - 0 - Z 238.0"	2.	Photo-Sonics 13mm 500FPS	X N/A Y N/A Z N/A
3.	Photo-Sonics 13mm 500FPS	X N/A Y N/A Z N/A	4.	Photo-Sonics 13mm 500FPS	X 49.0" Y 313.0" Z 51.0"
5.	Photo-Sonics 13mm 500FPS	X 43.0" Y 189.0" Z 59.0"	6.	Locam 12.5mm 500FPS Dummy Head	X 54.0" Y 103.5" Z 66.0" 84.0"
7.	Locam 13mm 500FPS Dummy Head	X 58.0" Y 97.0" Z 66.0" 74.5"	8.	Locam 15mm 500FPS Dummy Head	X 61.0" Y 106.0" Z 66.5" 82.0"
9.	Locam 12.5mm 500FPS Dummy Head	X 65.0" Y 96.5" Z 66.0" 73.0"	10.	Photo-Sonics 13mm 500FPS	X 96.0" Y 2.5" Z -38.0"
11.	Photo-Sonics 13mm 500FPS	X 161.0" Y 4.0" Z -45.0"	12.	Canon Scoopic 12.5 - 75mm 24FPS - Documentary -	

SECTION 4

SECTION 4

4.0 TEST FACILITIES AND EQUIPMENT

Approved Engineering Test Laboratories (AETL) collision barriers, vehicle static rollover machine, and data processing/computer analysis test facilities are located at the Fullerton, California Division.

This section discusses these specialized facilities, along with associated equipment and instrumentation required for the performance of this test.

4.1 FRONTAL COLLISION BARRIER FACILITY

4.1.1 The frontal (fixed) collision barrier conforms to the requirements as set by the NHTSA Office of Vehicle Safety Compliance (OVSC) and as defined in the Laboratory Procedures for FMVSS 212/219/301-75, TP219-02, dated January 9, 1979, with the following special characteristics.

4.1.2 The fixed collision barrier is a steel clad, steel reinforced concrete block with a 6'4" X 12' face. The face is 1" steel plate faced with 3/4 inch plywood. The total mass of the structure is approximately 200,000 pounds, with a substantial portion below ground to provide resistance against sliding or tipping of the barrier during impact.

4.1.3 The facility consists of a 500 foot concrete paved runway, with a steel monorail embedded in the approach surface. Two camera pits are provided to allow photographing the test vehicle at impact. One pit is located immediately in front of the fixed collision barrier and is 36 inches wide (expandable to 48 inches), 7 feet deep, and 23 feet long (3 feet of the pit length extends under the barrier face). The second (mid) pit with removable monorail section is located approximately 160 feet from the fixed collision barrier and is 43 inches wide, 7 feet deep, and 23 feet long.

4.1.4 Tow propulsion is provided by a fixed prime mover and continuous cable drive system located near the mid camera pit position. The power plant for the tow cable system is a 200 h.p. synchrouous electric motor, coupled to an electronically controlled Eddy Current Clutch and a 4:1 gear reduction transfer assembly.

The endless 1/2 inch diameter steel tow cable is wrapped around the drive pulley and is tensioned by a pneumatic loaded idler wheel. The tow cable passes through the fixed collision barrier and around fixed idler pulleys to complete the loop. The test vehicle or moving collision barrier is towed by a dolly assembly attached to the vehicle

or moving collision barrier by a shear pin release mechanism. For a fixed collision barrier test, the test vehicle is towed within 20 feet of the fixed barrier, at which point the towing dolly assembly is disconnected from the test vehicle and the test vehicle proceeds under its own momentum for the final 20 feet to impact. For a moving collision barrier test, the moving collision barrier is towed within 5 feet of the test vehicle, at which point the towing dolly is disconnected from the moving collision barrier and the moving collision barrier proceeds under its own momentum for the final 5 feet to impact. Heavy steel stops actuate the tow cable release mechanism and prevent the towing dolly from continuing past the point of impact. The towing dolly is designed to fit inside the monorail such that it is constrained in the vertical and lateral directions, and capable of sliding freely along the monorail.

4.2 OBLIQUE ANGLE COLLISION BARRIER

4.2.1 The oblique angle collision barrier conforms to the requirements as set by NHTSA Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures TP219-02, with the following special characteristics.

4.2.2 The oblique angle collision barrier is constructed of a flat 1 1/2 inch steel plate faced with 3/4 inch plywood. The barrier face is 6' X 12' and is adjustable for left or right angle impacts by means of seven tubular gussets that attach to the standard fixed frontal collision barrier to form a rigid buttress structure.

4.3 MOVING COLLISION BARRIER

4.3.1 The moving collision barrier conforms to the requirements as set by Federal Motor Vehicle Safety Standard No. 208, Paragraph S8.2 with the following special characteristics.

4.3.2 The chassis is constructed of 12 inch steel channel with tubular frame gussets. The flat impacting face plate is 1/2 inch steel plate faced with 3/4 inch plywood. The face plate is reinforced with 6 inch steel channel horizontally welded to the chassis to form a rigid symetrical structure. A camera boom extends above the barrier face plane to provide a view of barrier to vehicle impact. The barrier assembly weighs 3,977 pounds and has a four wheel electric brake system.

SECTION 4

4.4 VEHICLE STATIC ROLLOVER MACHINE

4.4.1 The vehicle static rollover machine conforms to the requirements as set by the NHTSA Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures TP219-02 with the following special characteristics.

4.4.2 The vehicle static rollover machine is constructed of 10 inch square tube with adjustable wheelbase and tread width platforms to accommodate the various test vehicles. The total usable platform area is 8 feet wide and 25 feet long with special design feature to accomodate vehicles with a gross vehicle weight rating (GVWR) of 10,000 pounds or less with various body configuration heights to 12 feet. The test vehicle can be rotated left or right and can turn each 90° rotational increment in approximately two (2) minutes.

4.5 IMPACT VELOCITY MEASUREMENT

The test vehicle impact velocity is measured by two (2) separate certification timing trap systems located within five (5) feet of the vehicle to fixed collision barrier face and to one side on the approach apron. Each timing

trap system contains two (2) optical beams, mounted twenty four (24) inches apart, in a mechanical housing assembly providing a start-stop signal to a digital display counter. As the test vehicle traverses the impact apron, a blade attached to the test vehicle rear fender interrupts each optical beam providing the precise measurement of time interval for the test vehicle to advance the known distance between the optical beams. Each interval of time measurement is stored in the digital display counter and photographically recorded.

The moving collision barrier impact velocity is measured by two (2) separate certification timing trap systems located within five (5) feet of the moving collision barrier to vehicle impact location and to one side on the approach apron. Each timing trap system contains two (2) optical beams, mounted twenty-four (24) inches apart, in a mechanical housing assembly providing a start-stop signal to a digital display counter. As the moving barrier traverses the impact apron, a blade attached to the moving barrier side interrupts each optical beam providing the precise measurement of time interval for the moving barrier to advance the known distance between the optical beams. Each interval of time measurement is stored in the digital display counter and photographically recorded.

SECTION 4

4.6 PHOTOGRAPH COVERAGE

4.6.1 Because FMVSS 212/219/301-75 may be a combined test, it is necessary that all photographic coverage of the test vehicle be done at one time with specific photographs to document the areas for Vehicle Safety Compliance consideration; windshield area and the fuel system. Each report will utilize only those photographs pertaining to the Vehicle Safety Compliance Test being reported.

4.6.2 FIXED BARRIER IMPACT TEST

Motion picture coverage of the event employs seven (7) 16mm 1B Photo-Sonics cameras and four (4) 16mm 51 Redlake Locam cameras using color film at 500 frames per second (fps). Also a 16mm Canon Scoopic 24 frames per second (fps) camera with color film is used to record vehicle pre-test condition, vehicle in-run, impact, and post-impact vehicle conditions including the rollover increments for documentary purposes. The eleven (11) high speed cameras are located at stationary positions near the point of impact. One is an overhead camera mounted on a tower above the fixed barrier face on centerline of the test vehicle at impact. Its field of view includes the barrier face and the front of the vehicle to a point about one foot aft of the windshield. A second and third camera are mounted on top of the fixed barrier with

their field of view concentrating on the windshield area (FMVSS 212/219). The fourth and fifth cameras each have a side view of the test vehicle at impact. The sixth, seventh, eight, and ninth cameras are located adjacent to the test vehicle front passengers compartment and positioned to photograph motion of each test dummy at impact. The tenth and eleventh cameras are located in the pit and positioned to photograph the underside of the engine compartment and fuel tank area.

4.6.3 MOVING BARRIER IMPACT TEST

Motion picture coverage of the event employs four (4) 16mm 1B Photo Sonics cameras and two (2) 16mm 51 Redlake Locam cameras using color film at 500 frames per second (fps). Also a 16mm Canon Scoopic 24 frames per second (fps) camera with color film is used to record vehicle pre-test condition, barrier in-run, impact, and post-impact vehicle conditions including the rollover increments for documentary purposes. Five (5) of the high speed cameras are located at stationary positions near the point of impact. Three (3) cameras are located in the pit and positioned to photograph the underside of the engine compartment, with overlapping field of views, aft to the fuel tank area. The fourth and fifth cameras each have a side view of the test vehicle at impact.

The sixth camera is attached to the moving collision barrier to photograph the contact between the barrier and the test vehicle.

4.6.4 TIME PULSE GENERATOR

Time data from two (2) sources are contained in the high speed film coverage. The first is a time reference of 100 pulse per second (pps) light emitting diode event mark along the film adge. This pulse is generated by the time pulse generator and fed to all high speed cameras. Thus, it is possible to relate film data to a real time base. The second time record is an indication of time zero (moment of impact). This is accomplished by a trip switch and event mark system. The trip switch is positioned at the impact point so that it triggers the light emitting diode event mark along the film edge at the moment of bumper-barrier contact. Thus, the particular film frame corresponding to the point of impact is clearly indicated on all the high speed film.

SECTION 4

4.7 DATA ACQUISITION AND REDUCTION

The data acquisition and analysis system used for acquiring occupant response and vehicle acceleration are shown schematically in Figure 5-1. A complete list of instrumentation is provided in Table 5-1. An itemized procedure for acquiring data is provided on Table 5-2.

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

The analog data is then played back into a Hewlett Packard Digital Fourier Analyzer (DFA) system using a HP 2100S mini computer with 32K word core storage. This system uses four program controlled analog filters which provides predigitizing filter capability of 60 db/octave above 1250 Hz.

SECTION 4

The DFA is a hard disc based system with standard HP design software for performing data acquisition and analysis functions. The HP software is programmed using direct keyboard functions to automate the data reduction process. The data is entered into temporary storage, four channels (one set) at a time with eight total sets. Table 5-3 defines each data channel and data set. The data sets are divided into driver and passenger tape recorder groups to facilitate simultaneous data acquisition for the head, chest and vehicle accelerometers to assure appropriate calibration of injury criteria and vehicle dynamics. At the time of entry, test personnel enter the appropriate calibration for each data channel and the computer then scales the data appropriately. When all data has been acquired it is moved as a vehicle set to permanent storage on a removable magnetic disc. (Eight vehicle sets are stored on each magnetic disc. All magnetic discs and FM recorder tapes are retained on file at AETL).

The only modifications to the data at the time of permanent storage is the filtering and digitizing process of the FM tape recorder (2500 Hz) and the DFA (2000 Hz sampling for a 500 ms window). After the data is moved to permanent storage it is recalled by test personnel and plotted with the appro-

priate labels and vehicle designation. As the data is recalled, the DFA is programmed to automatically apply the appropriate SAE filter where applicable.

A 1250 Hz predigitizing analog filter with a rolloff of 60 db/octave, shown in figure 5-2, was applied to all data. Also shown in figure 5-2 are SAE class 60 and class 180 filters. These filters are in accordance with SAE J211A, Instrumentation for Impact Tests. These SAE recommended filters are quadratic double pole with 65% damping and a 12 db/octave rolloff. They are applied using a fast fourier transform of the data, frequency domain multiplication, and an inverse fast fourier transform of the product. The class 60 filters is applied to vehicle acceleration and belt restraint forces. The class 180 filter is applied to chest acceleration. SAE filters were not applied to head accelerations and femur forces.

4.7.1 IMPACT DATA

All impact data is presented in computer plots of data digitized at 500 microseconds. Special SAE filters are applied to appropriate data sets. Each data plot includes labeling, defining the test vehicle, filter class, and the complete identification of the data plotted.

4.7.1.2 DUMMY HEAD DATA

The dummy head accelerations are processed and the Head Injury Criteria (HIC) calculation is performed. The HIC calculations are maximized for start time (T1) and end time (T2), using a manual iteration routine, usually requiring about ten interations 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.

4.7.1.3 DUMMY CHEST DATA

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

4.7.1.4 FEMUR LOAD DATA

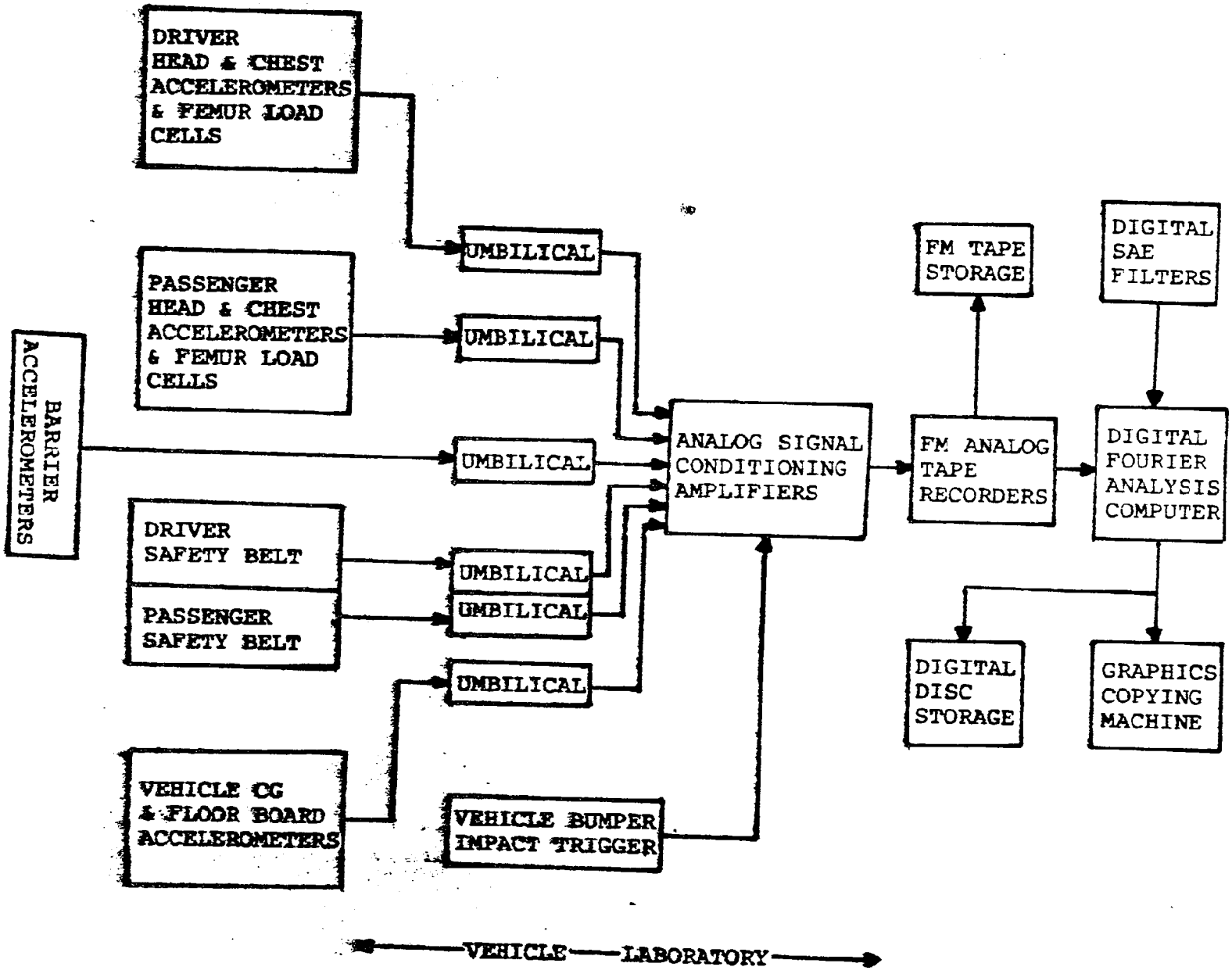
The dummy femur loads are processed and presented as computer plots.

4.7.1.5 RESTRAINT LOAD DATA

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

4.7.1.6 VEHICLE ACCELERATION DATA

The vehicle accelerations are processed as class 60 data, and presented as computer plots.



VEHICLE AND OCCUPANT CRASH IMPACT DATA ACQUISITION SYSTEM

FIGURE 4.3

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	-	-

TABLE 4-2

DATA ACQUISITION AND REDUCTION PROCESS

STEP	DESCRIPTION
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 500 ms sample rate c) Data sychronized by impact trigger signal
7	Digitized Data Examined
8	Data Transfered 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

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 Ax
1	1	2	Driver Lateral Head Acceleration Ay
1	1	3	Driver Vertical Head Acceleration Az
1	1	4	Driver Right Femur Force
2	1	5	Driver Longitudinal Chest Acceleration Ax
2	1	6	Driver Lateral Chest Acceleration Ay
2	1	7	Driver Vertical Chest Acceleration Az
2	1	8	Driver Left Femur Force
3	1	9	Driver Restraint Belt Force
3	1	10	Vehicle Vertical CG Acceleration Az
3	1	11	Vehicle Lateral CG Acceleration Ay
3	1	12	Vehicle Longitudinal CG Acceleration Ax
4	1	13	Left Rear Floor Pan Longitudinal Acceleration Ax
4	1	14	Left Rear Floor Pan Vertical Acceleration Az
5	2	1	Passenger Longitudinal Head Acceleration Ax
5	2	2	Passenger Lateral Head Acceleration Ay
5	2	3	Passenger Vertical Head Acceleration Az
5	2	4	Passenger Right Femur Force
6	2	5	Passenger Longitudinal Chest Acceleration Ax
6	2	6	Passenger Lateral Chest Acceleration Ay
6	2	7	Passenger Vertical Chest Acceleration Az
6	2	8	Passenger Femur Force
7	2	9	Passenger Restraint Belt Force
7	2	10	Barrier Lateral Acceleration Ay
7	2	11	Barrier Longitudinal Acceleration Ax
7	2	12	Barrier Vertical Acceleration Az
8	2	13	Right Front Floor Pan Longitudinal Acceleration Ax
8	2	14	Right Front Floor Pan Vertical Acceleration Az

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

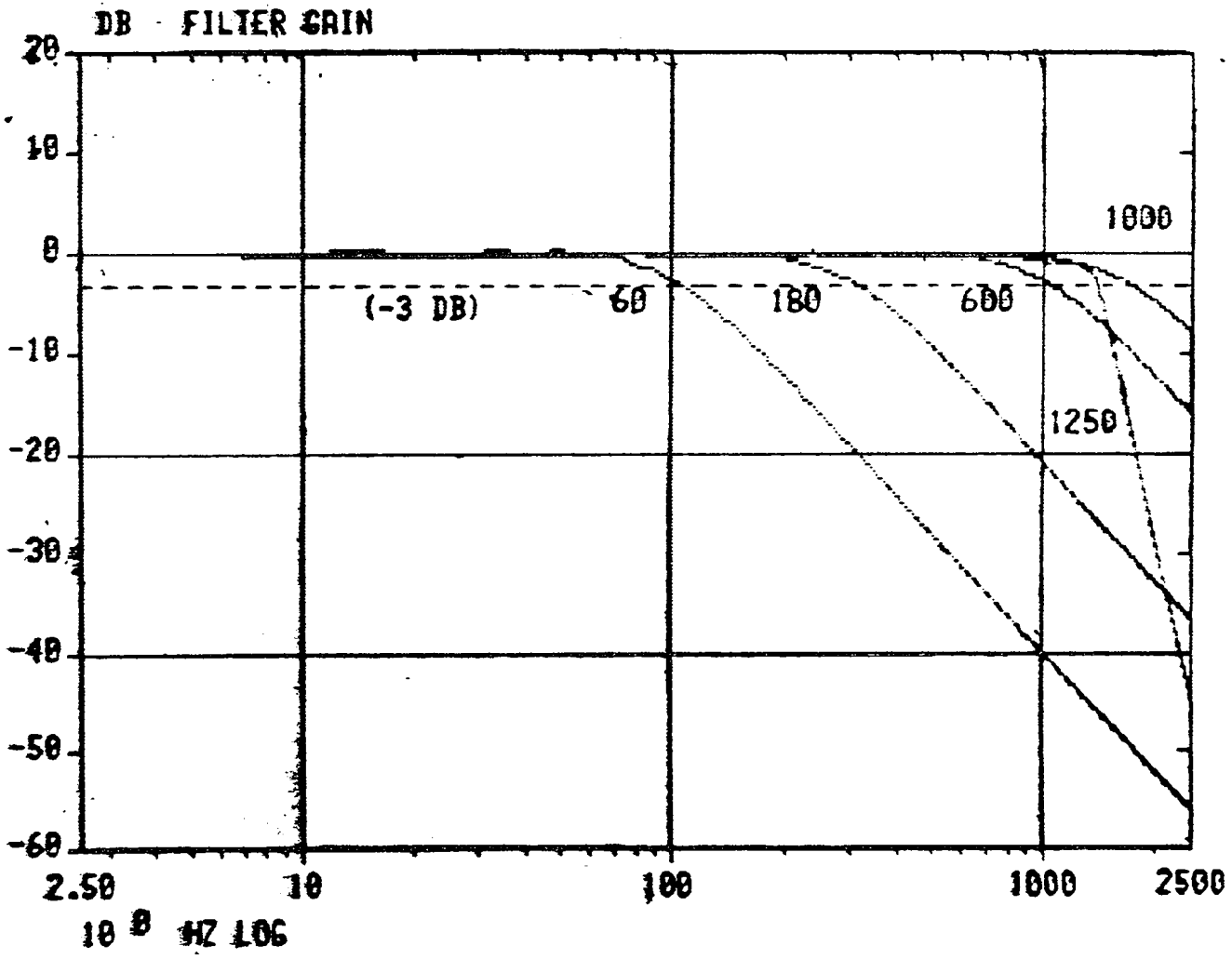


FIGURE 4-2

APPENDIX A

APPENDIX A

The following photographs are pre and post test dummy positions and interior compartment locations of dummy contact during the impact event.

Figure A-1

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Pre-Test, Driver Dummy View


801301

Figure A-2

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Pre-Test, Passenger Dummy View

Figure A-3

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Driver Dummy View


801301

Figure A-4

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Driver Dummy Contact Area

Figure A-5

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Driver Dummy Contact Area

Figure A-6

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Driver Dummy Contact Area

Figure A-7

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Passenger Dummy View

Figure A-8

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Passenger Dummy Contact Area

Figure A-9

1980 Volkswagen Vanagon - 3 Door Station Wagon

NHTSA 801301

Post-Impact, Passenger Dummy Contact Area

APPENDIX B

APPENDIX B

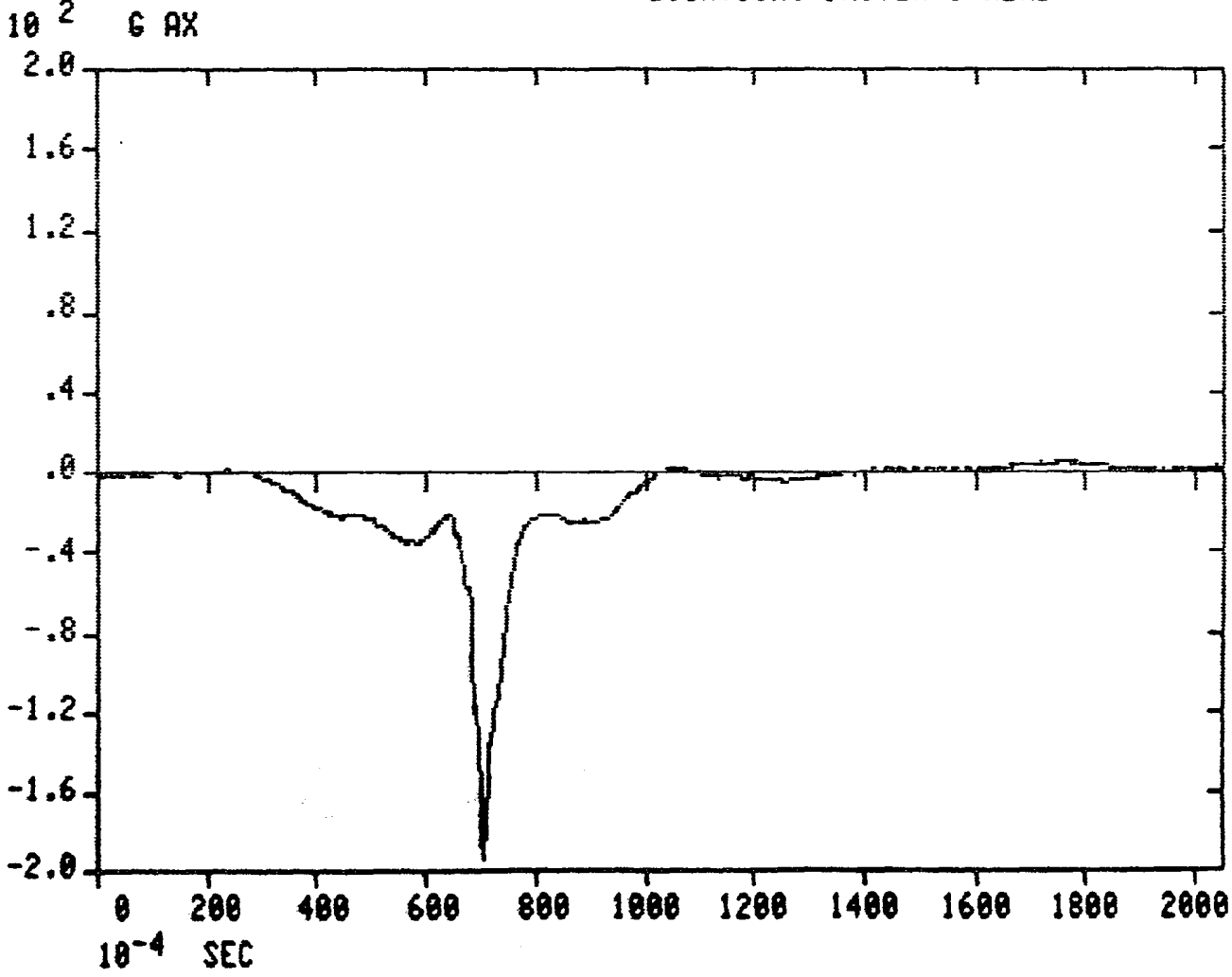
The following computer plots provide complete and comprehensive occupant response and vehicle acceleration during the frontal fixed barrier impact test of a 1980 Volkswagen Vanagon - 3 Door Station Wagon, NHTSA 801301.

DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 1000
ACCELEROMETER: TAPE 1, CH 1
DIRECTION: FORWARD
LOCATION: DRIVER'S HEAD

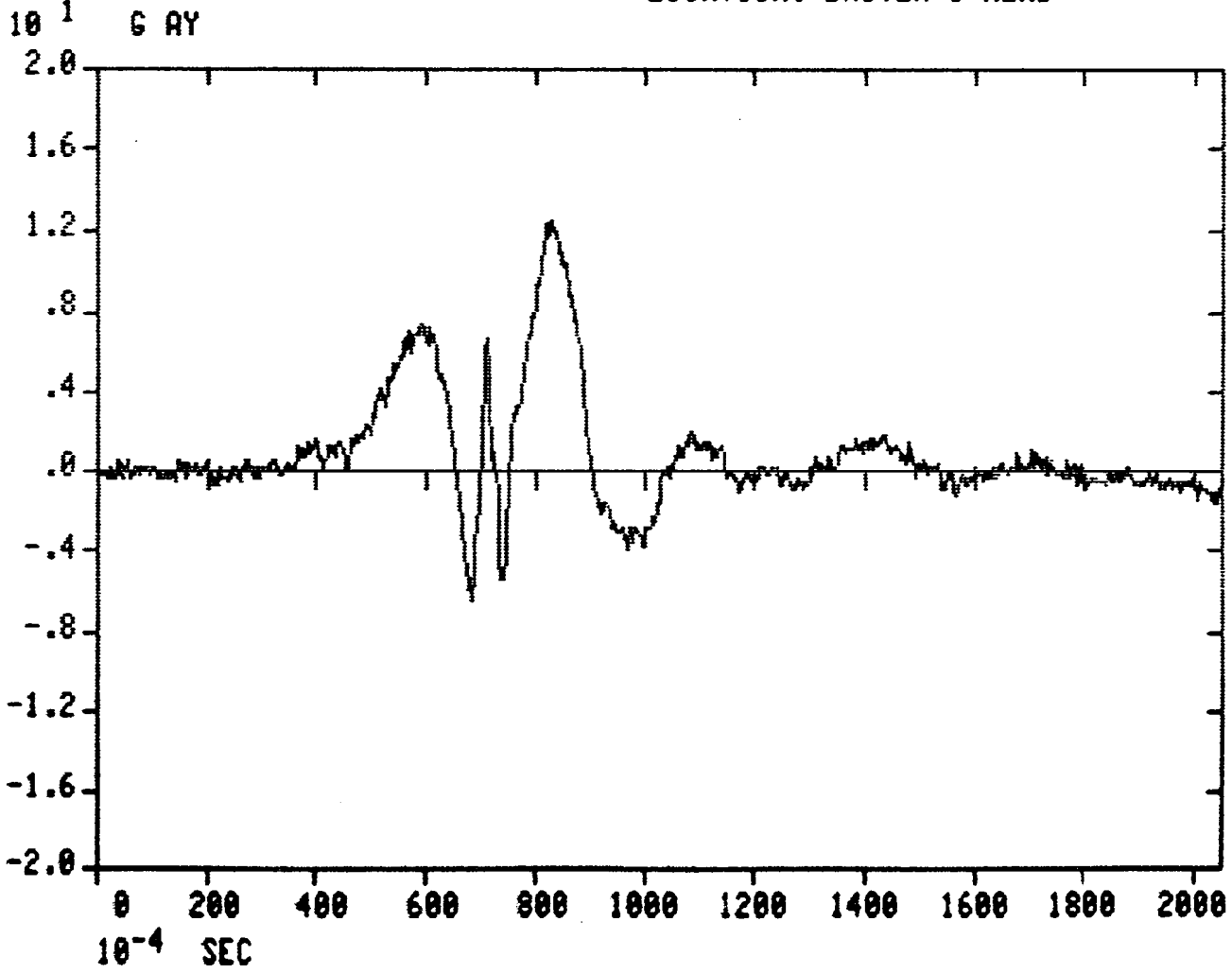


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER : CLASS 1000
ACCELEROMETER: TAPR 1, CH 2
DIRECTION: LEFT
LOCATION: DRIVER'S HEAD

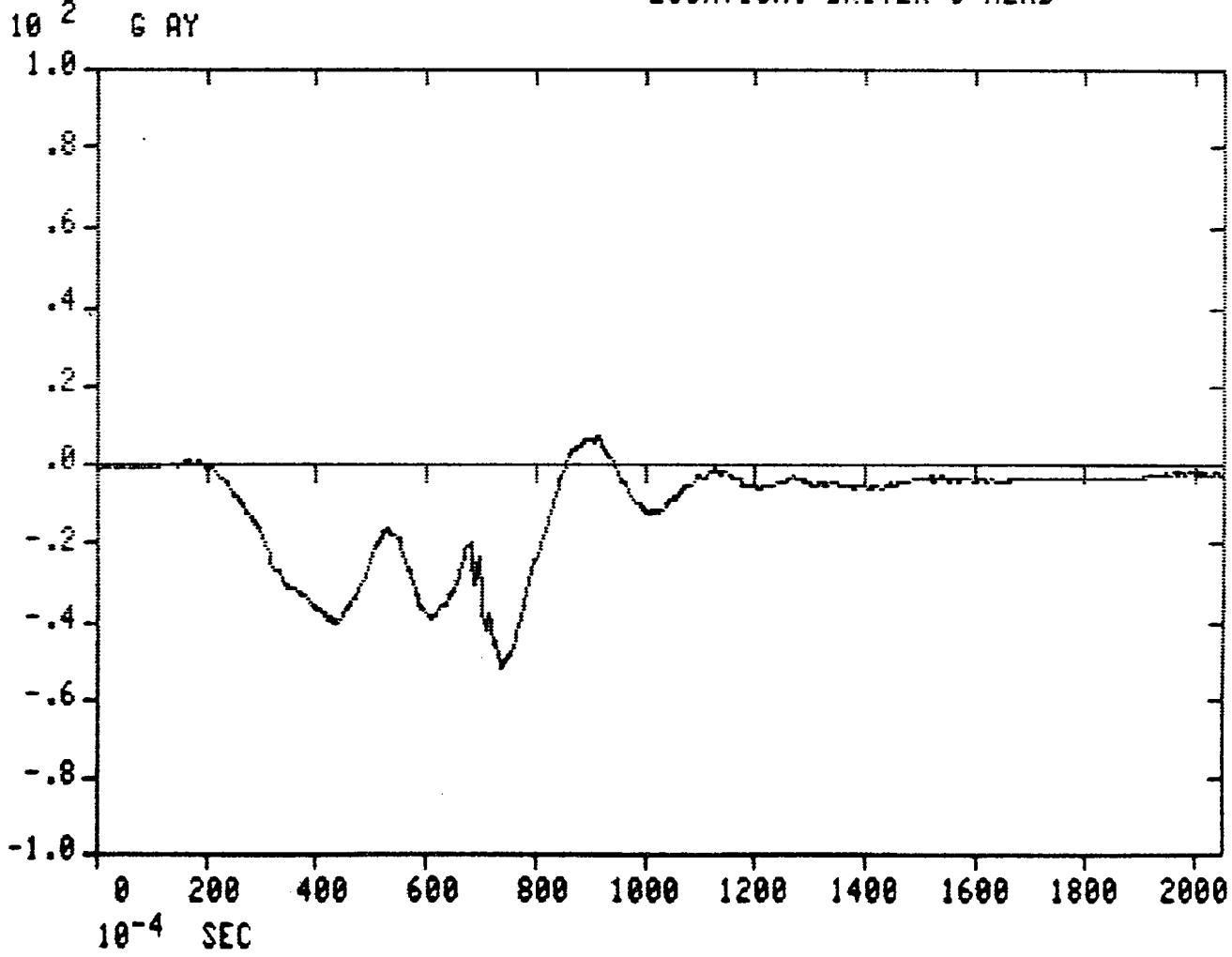


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 1000
ACCELEROMETER: TAPE 1, CH3
DIRECTION: UPWARD
LOCATION: DRIVER'S HEAD

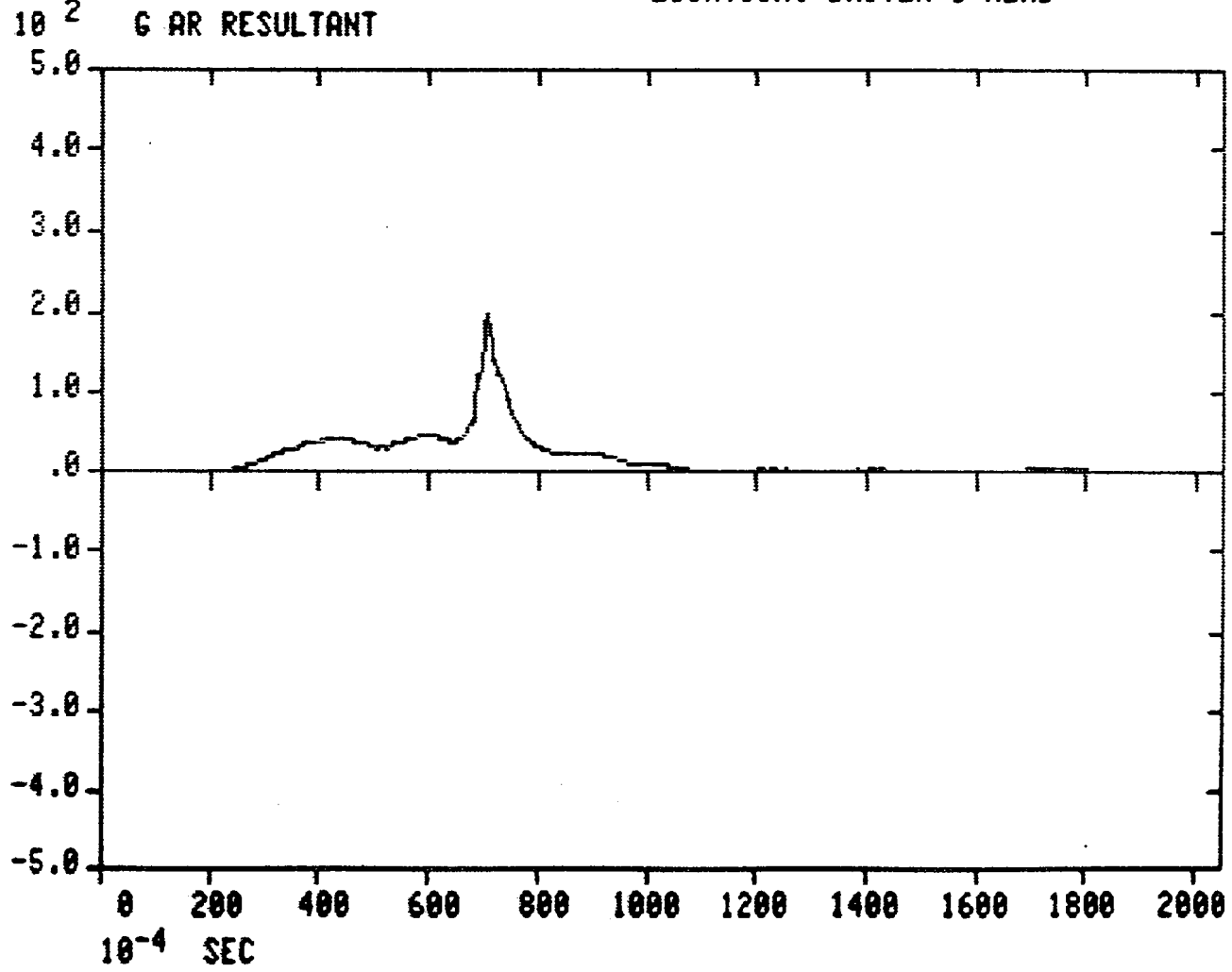


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

MJO NO. : 971-3882-21
FILTER: CLASS 1000
ACCELEROMETER: TAPE 1, CH 1-3
DIRECTION: RESULTANT OF XYZ
LOCATION: DRIVER'S HEAD

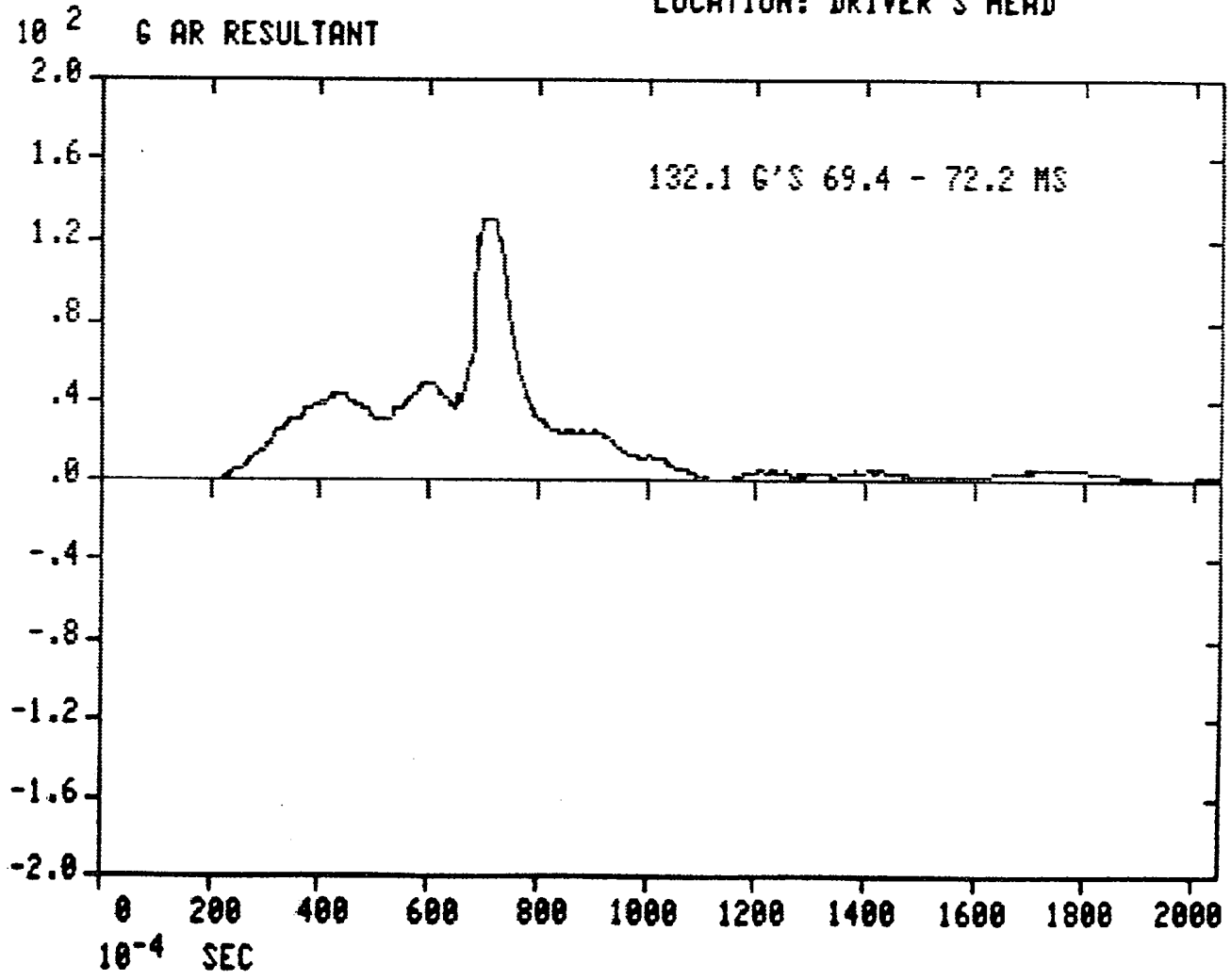


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 1000
ACCELEROMETER: TAPE 1, CH 1-3
DIRECTION: RESULTANT OF XYZ
LOCATION: DRIVER'S HEAD

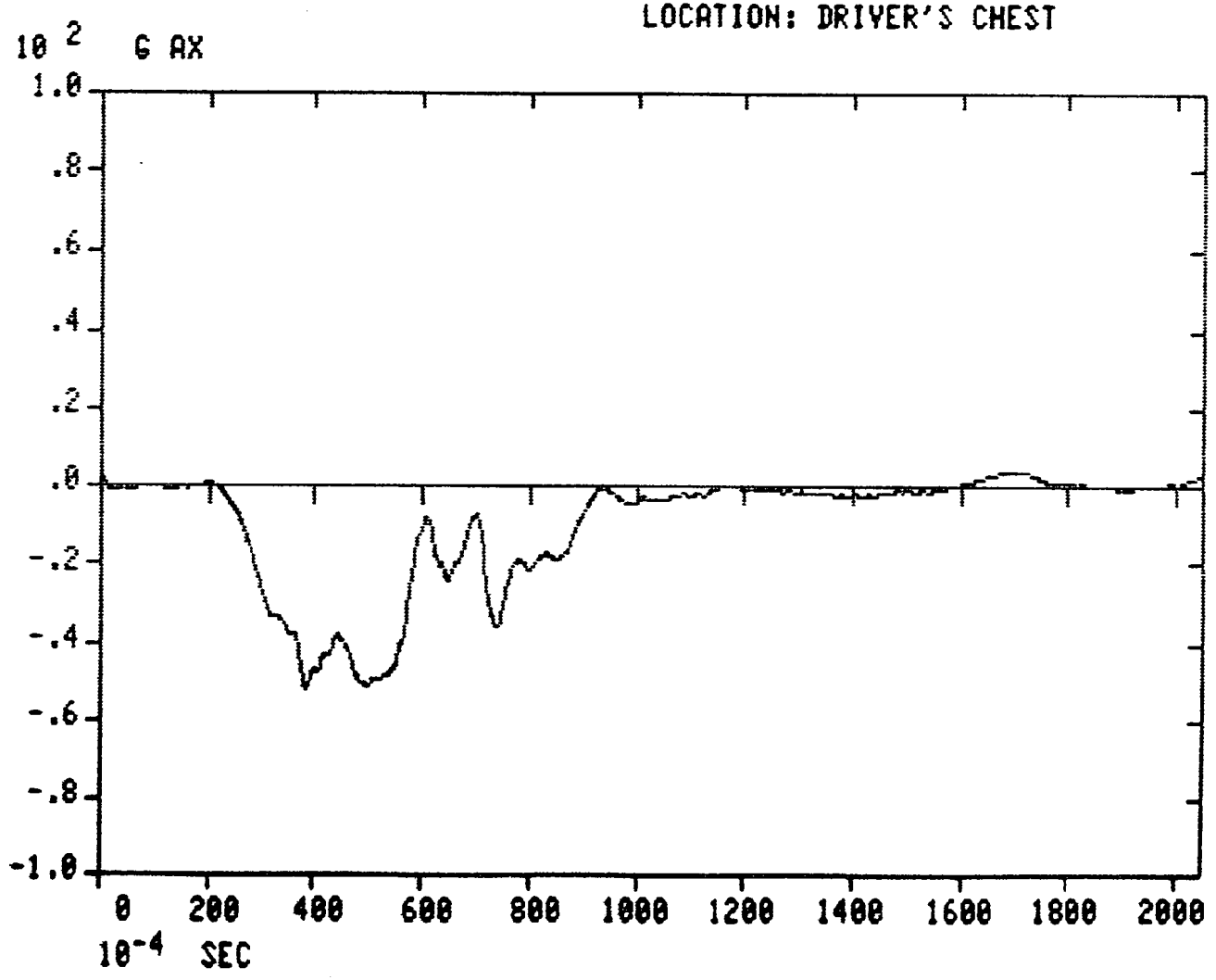


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 5
DIRECTION: FORWARD
LOCATION: DRIVER'S CHEST

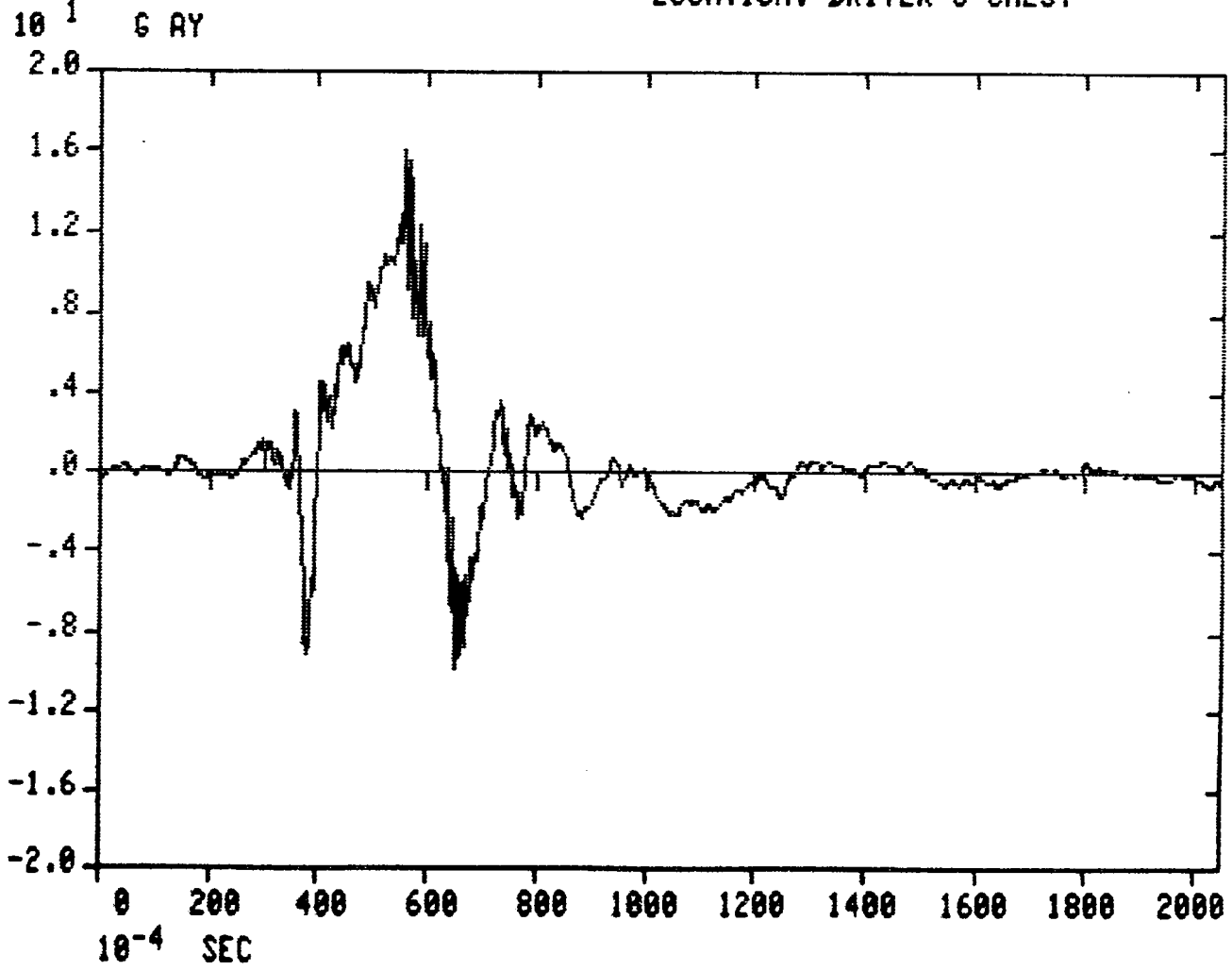


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 6
DIRECTION: LEFT
LOCATION: DRIVER'S CHEST

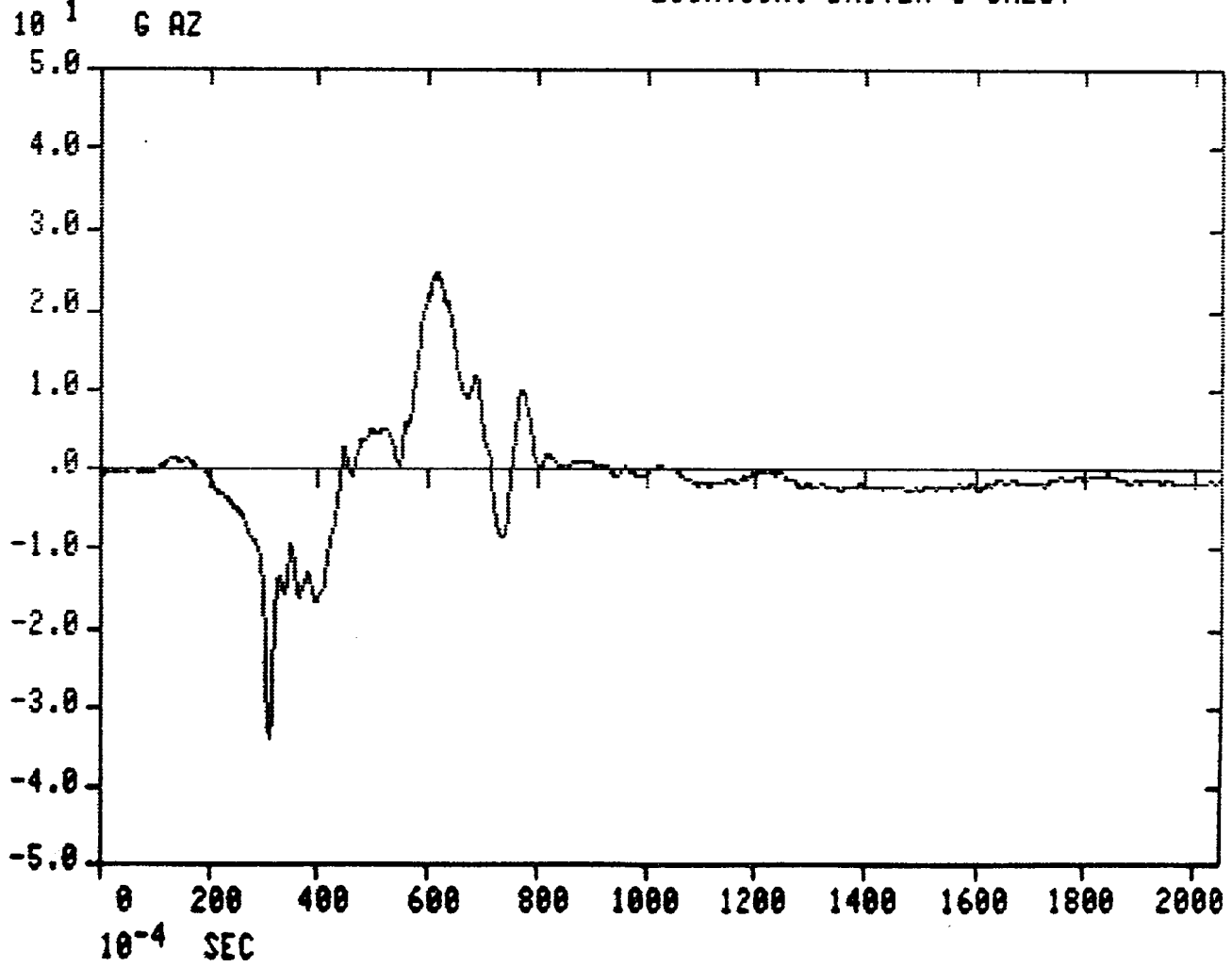


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 7
DIRECTION: UPWARD
LOCATION: DRIVER'S CHEST

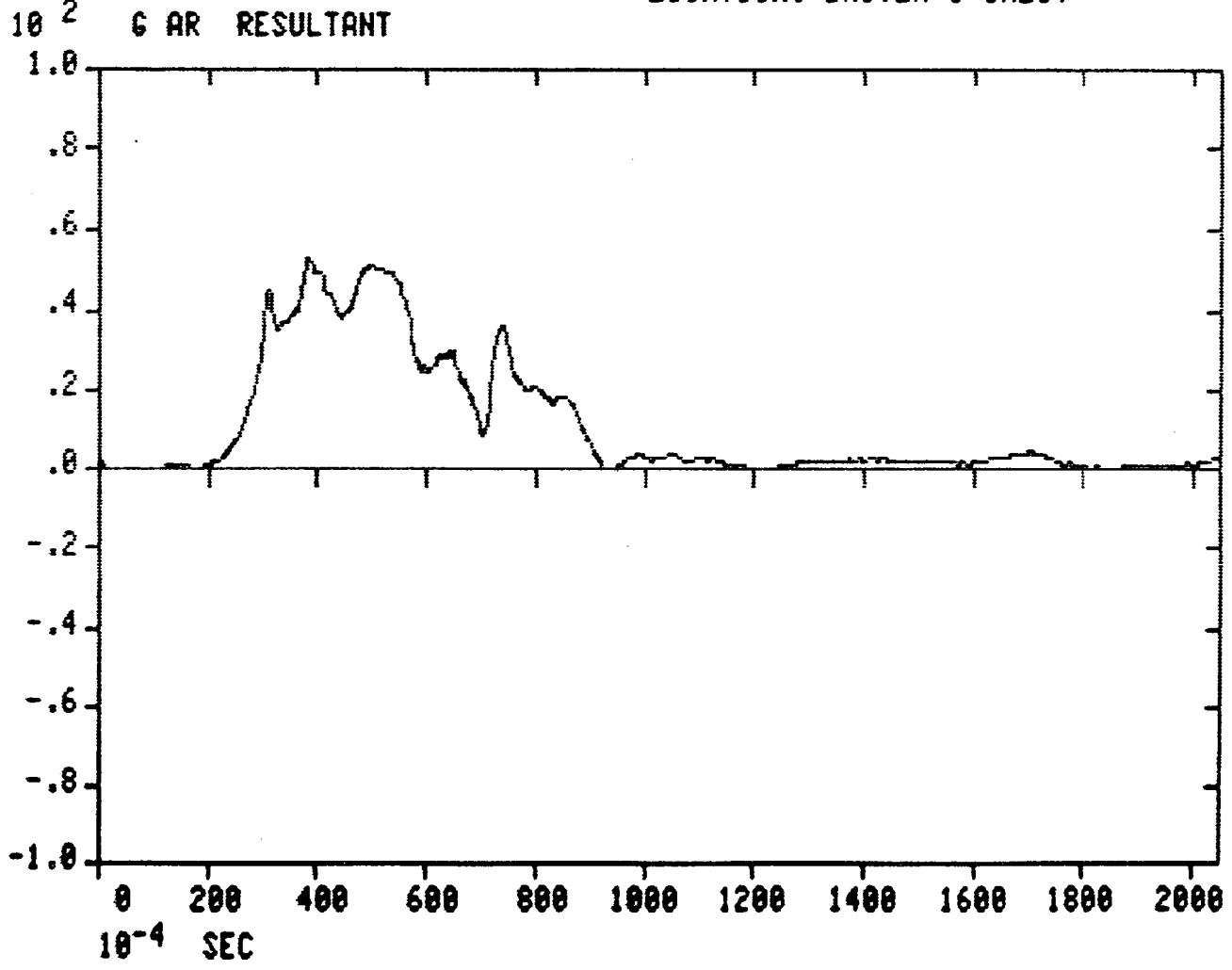


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 5-7
DIRECTION: RESULTANT OF XYZ
LOCATION: DRIVER'S CHEST

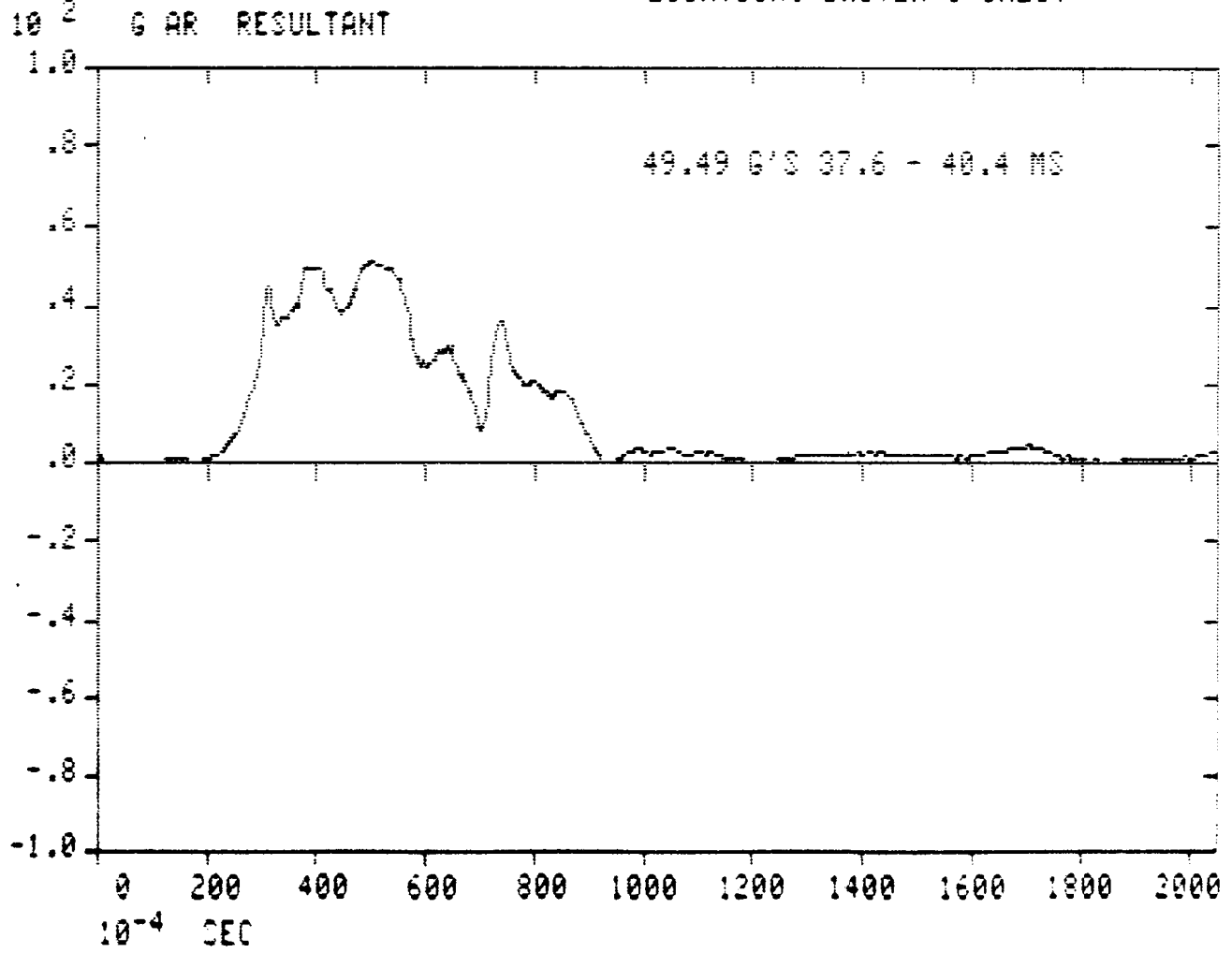


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

[illegible] ENGINEERING TEST LABS

MGS NO. : [illegible]
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH E-[illegible]
DIRECTION: RESULTANT OF [illegible]
LOCATION: DRIVER'S CHEST

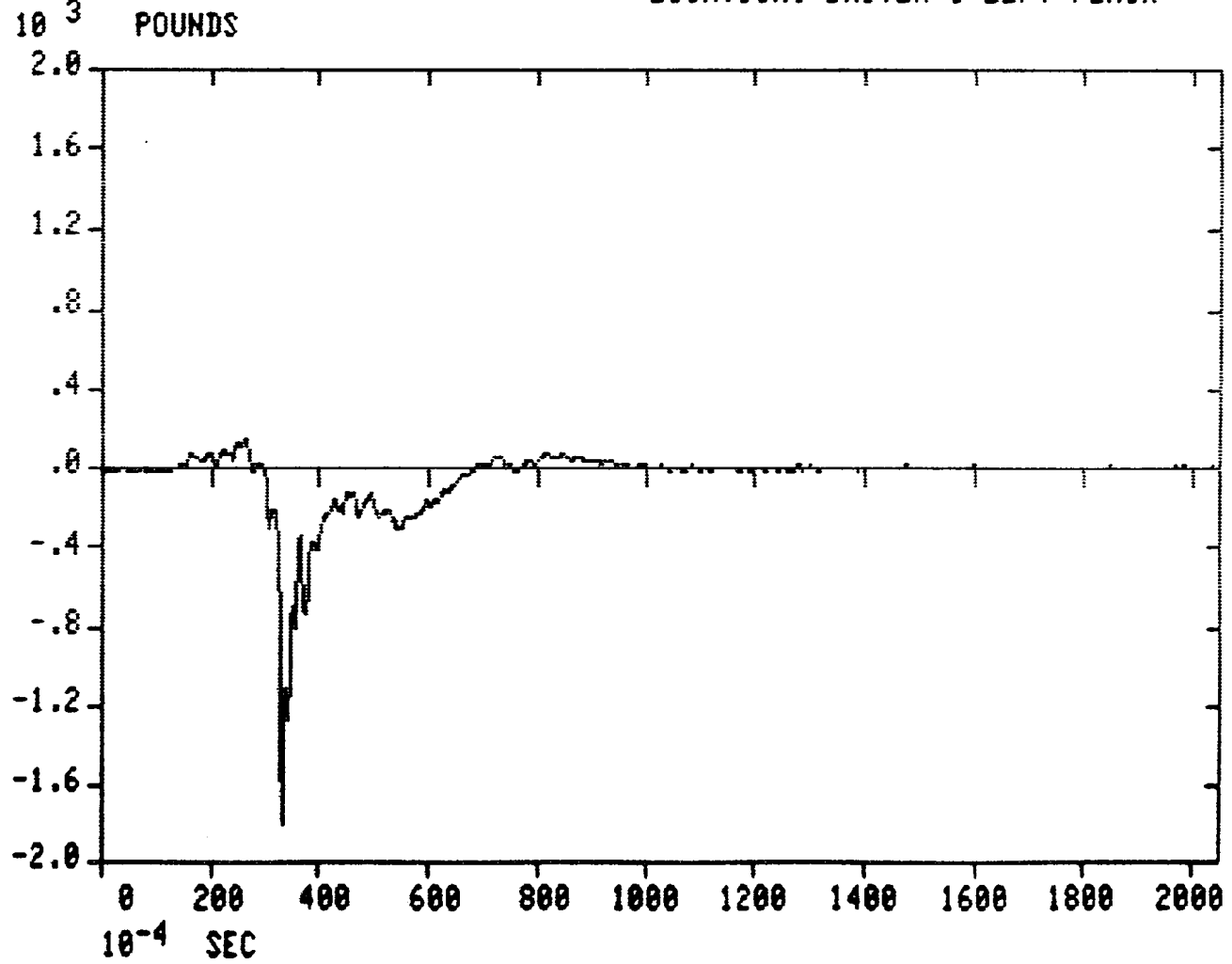


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 600
LOAD CELL: TAPE 1, CH 8
DIRECTION: TENSION
LOCATION: DRIVER'S LEFT FEMUR

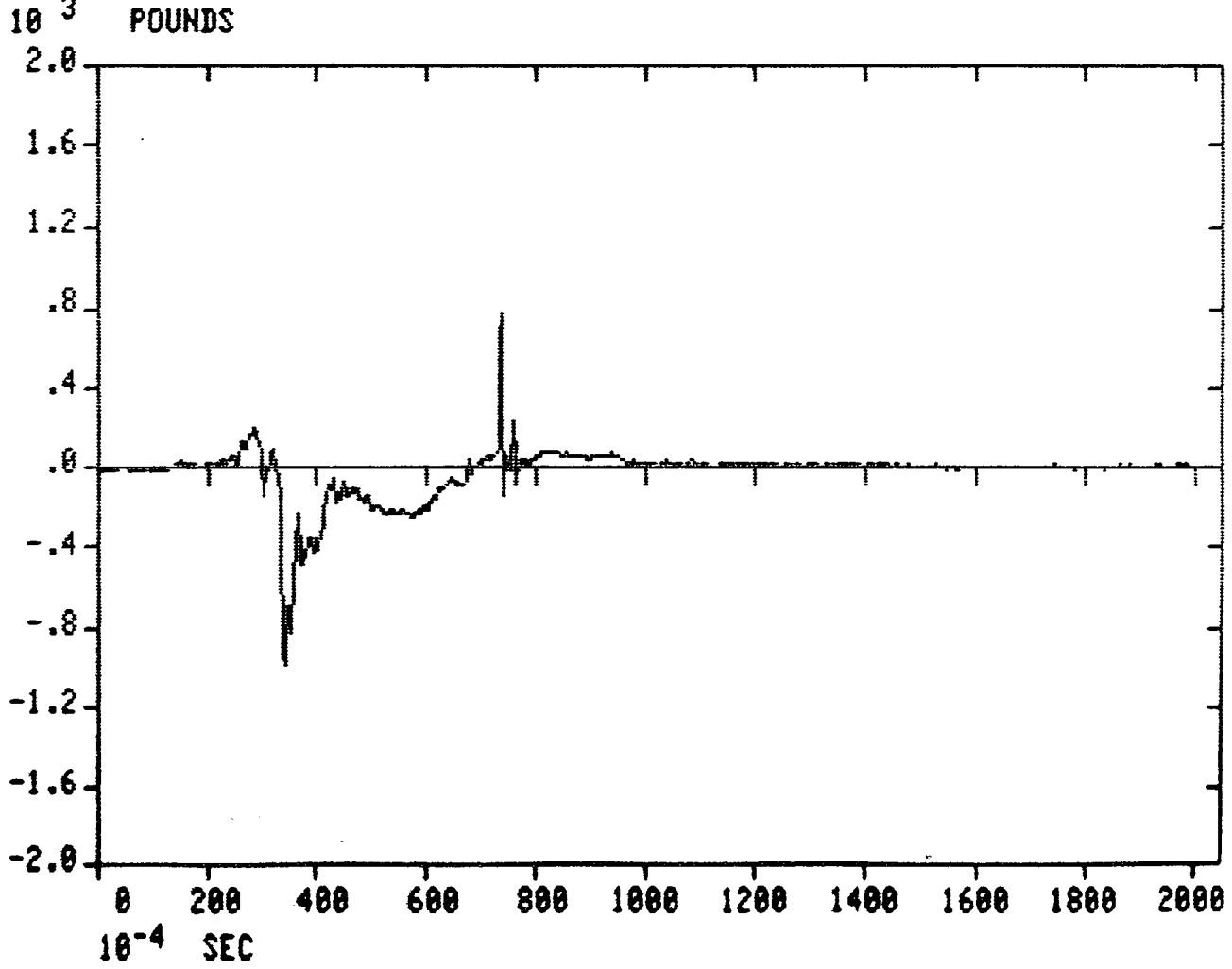


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 600
LOAD CELL: TAPE 1, CH 4
DIRECTION: TENSION
LOCATION: DRIVER'S RIGHT FEMUR

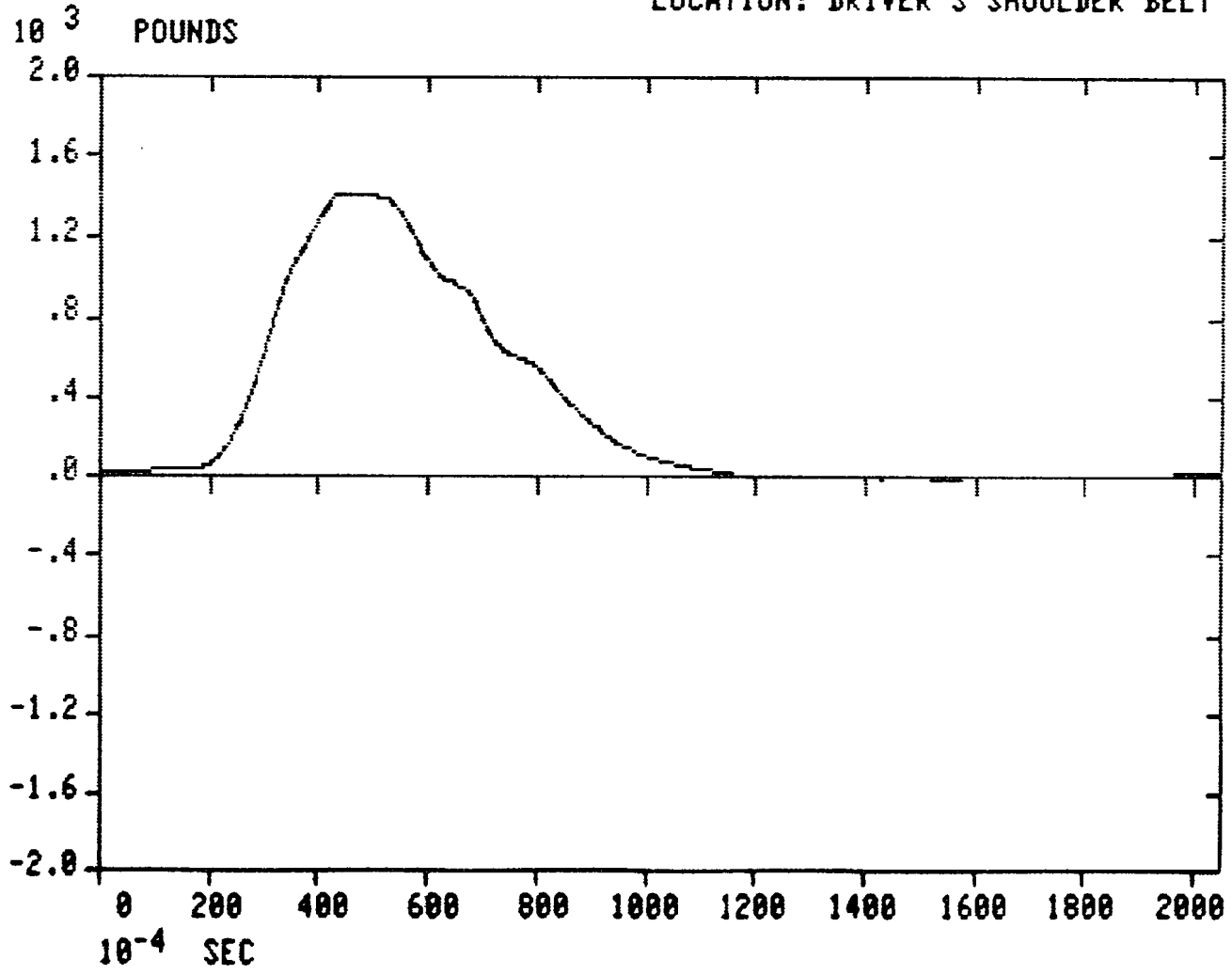


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 60
LOAD CELL: TAPE 1, CH 9
DIRECTION: TENSION
LOCATION: DRIVER'S SHOULDER BELT

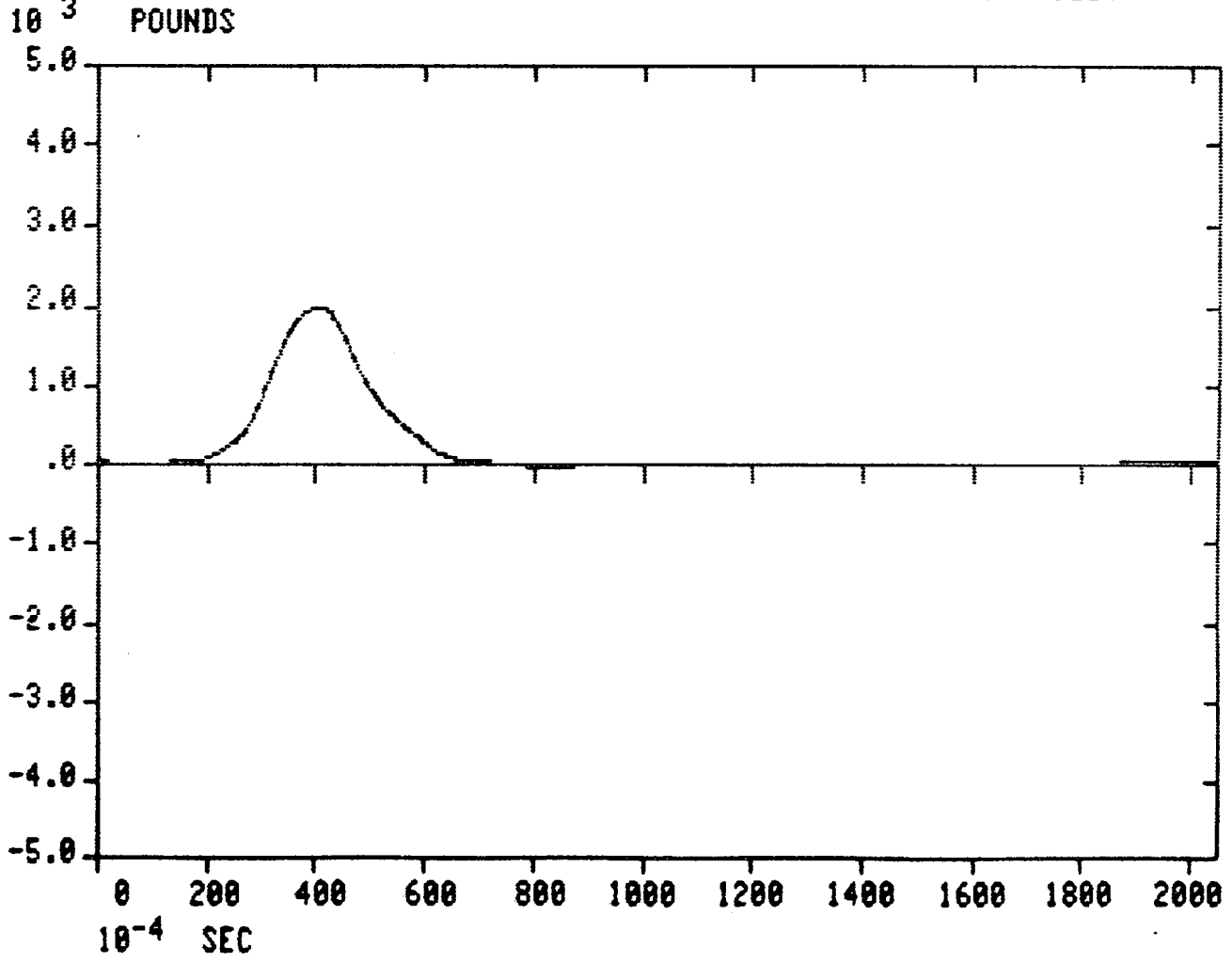


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

MJO NO. : 971-3882-21
FILTER: CLASS 60
LOAD CELL: TAPE 1, CH 10
DIRECTION: TENSION
LOCATION: DRIVER'S LAP BELT

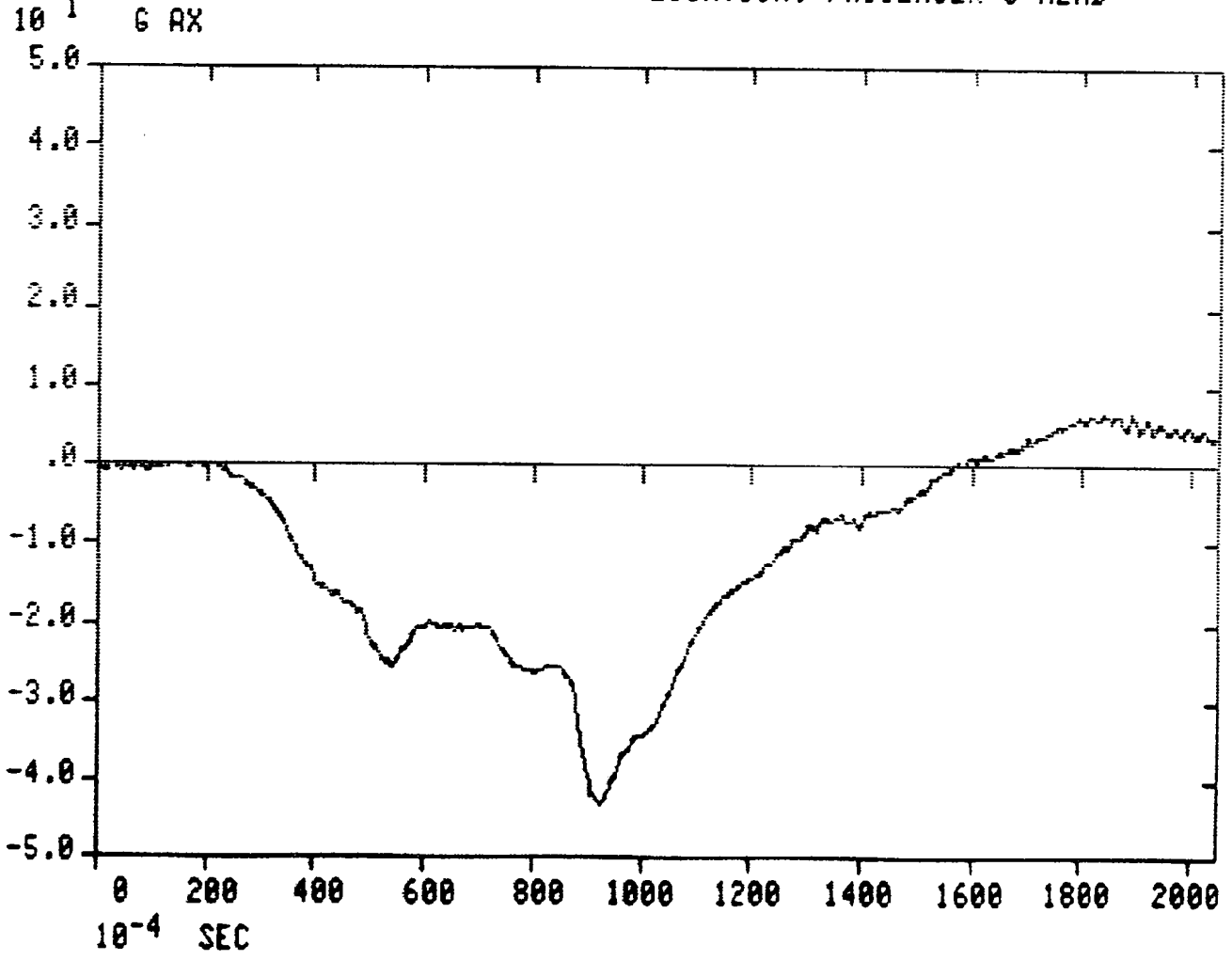


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 1
DIRECTION: FORWARD
LOCATION: PASSENGER'S HEAD

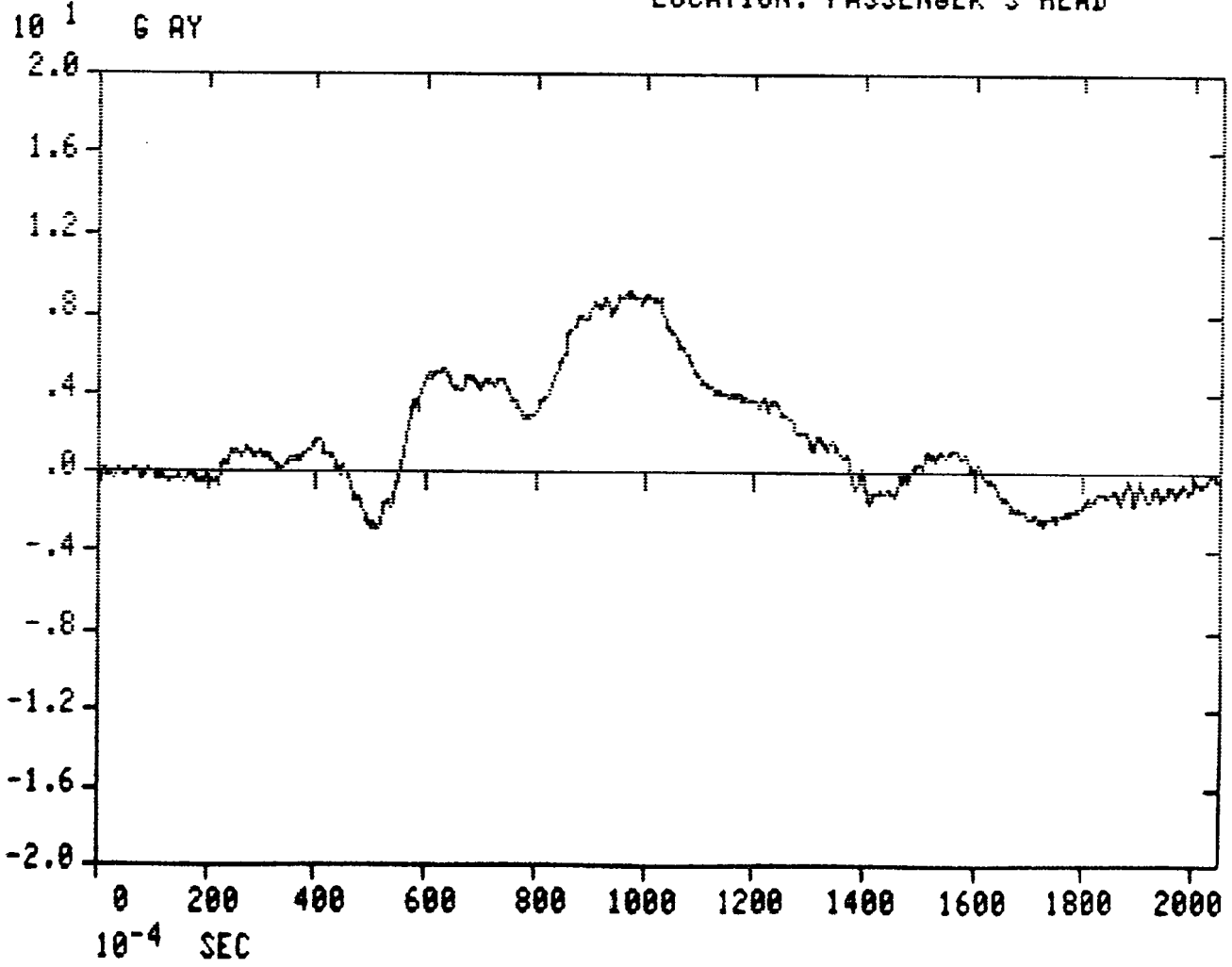


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 2
DIRECTION: LEFT
LOCATION: PASSENGER'S HEAD

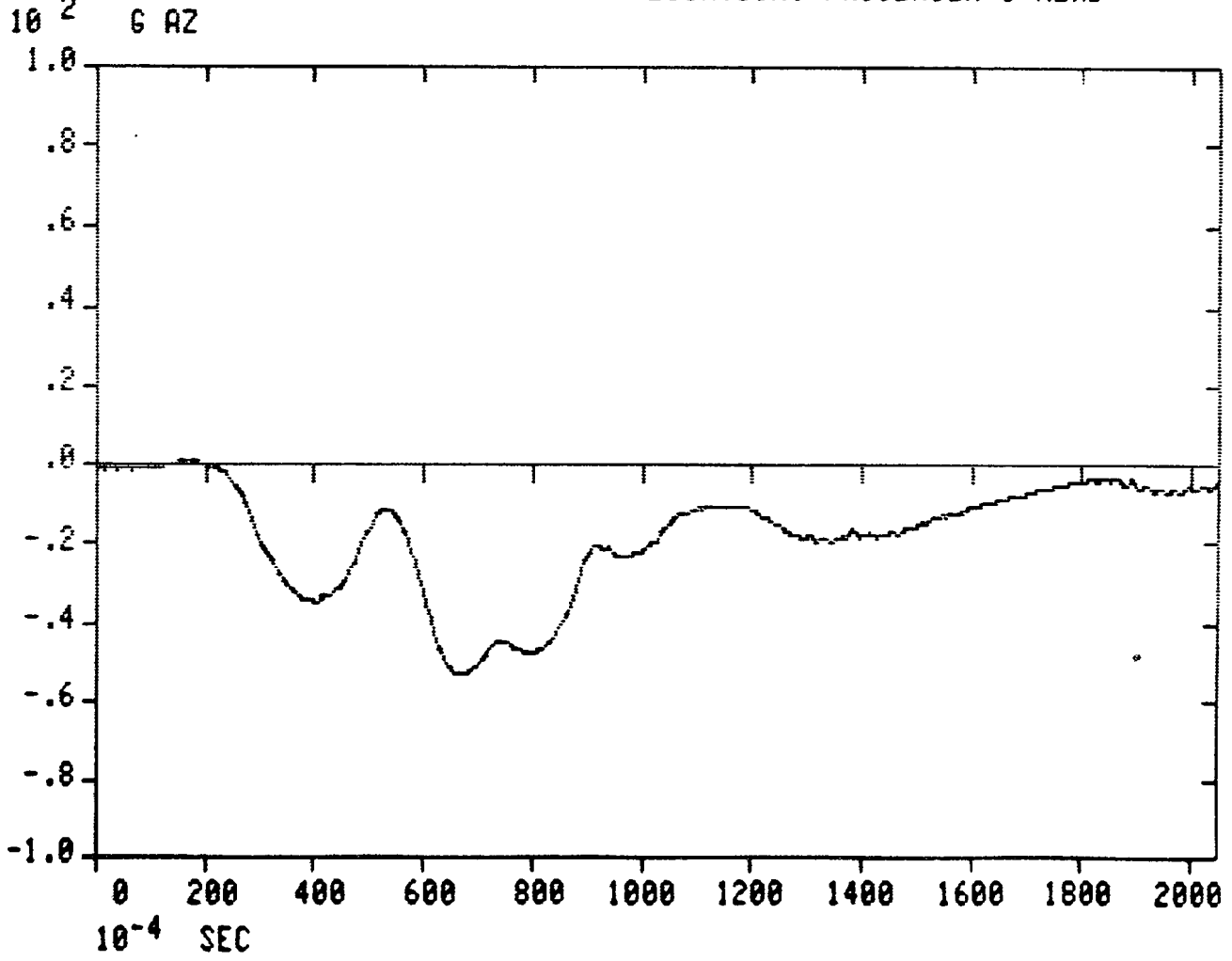


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 3
DIRECTION: UPWARD
LOCATION: PASSENGER'S HEAD

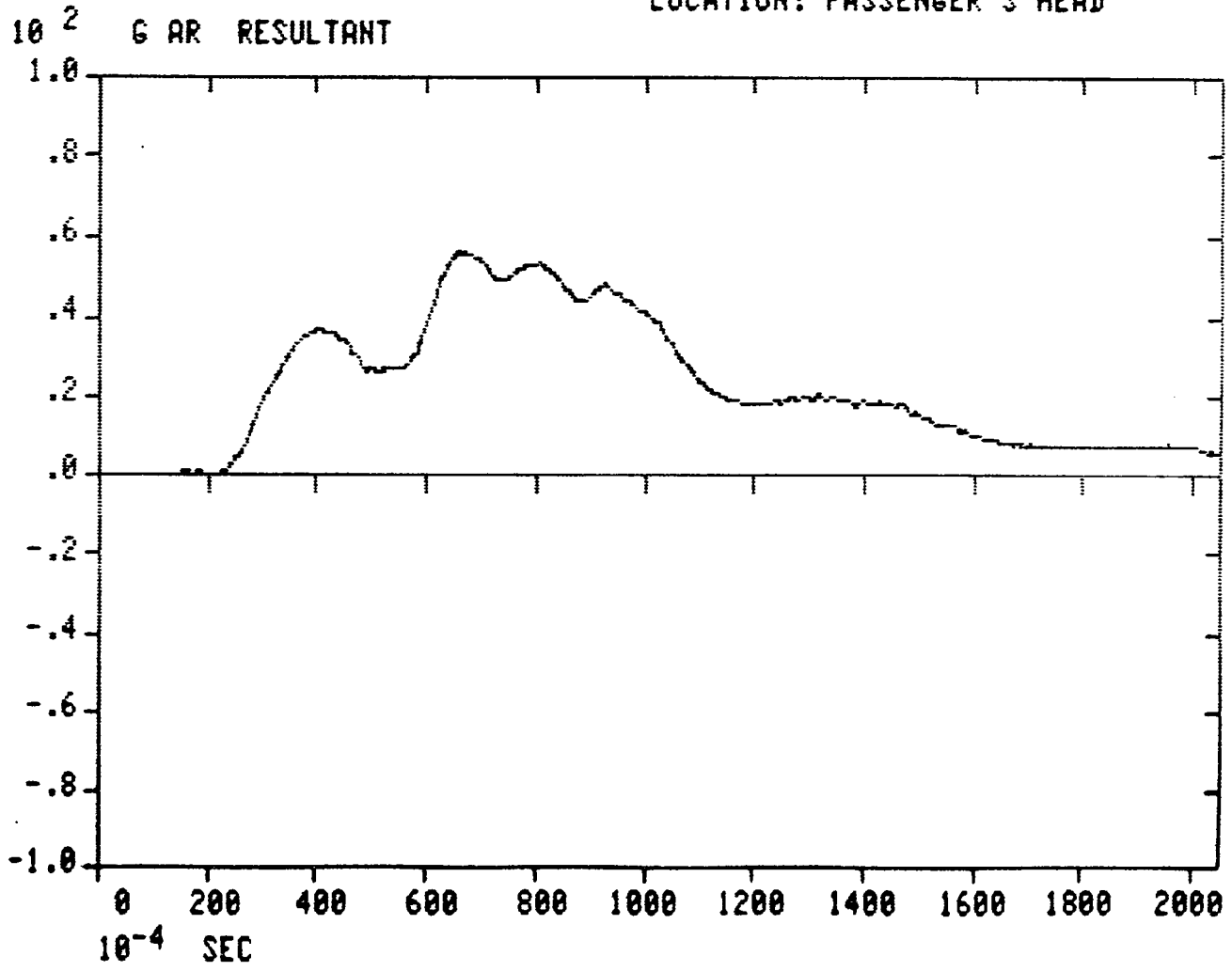


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 1-3
DIRECTION: RESULTANT OF XYZ
LOCATION: PASSENGER'S HEAD

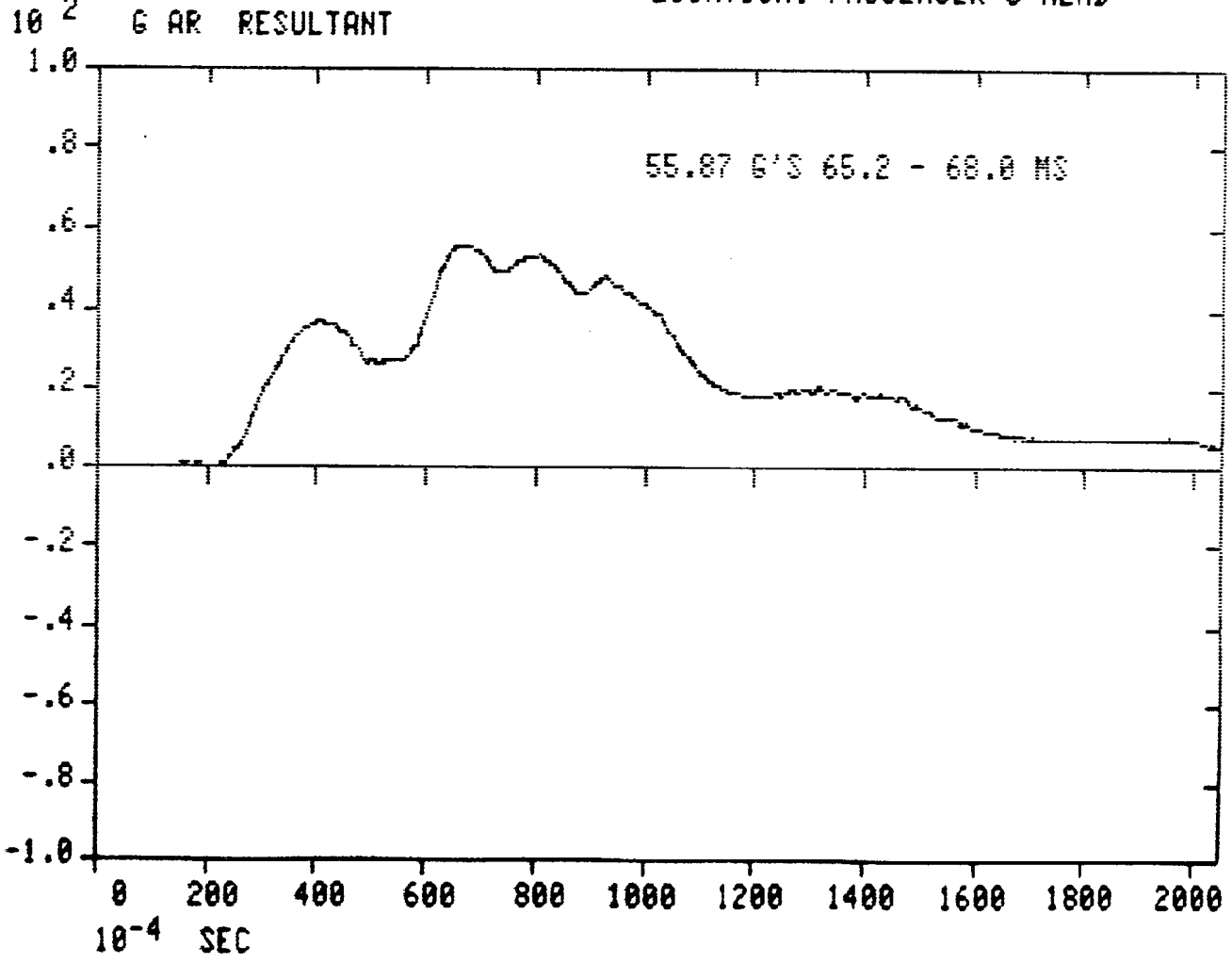


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 1-3
DIRECTION: RESULTANT OF XYZ
LOCATION: PASSENGER'S HEAD

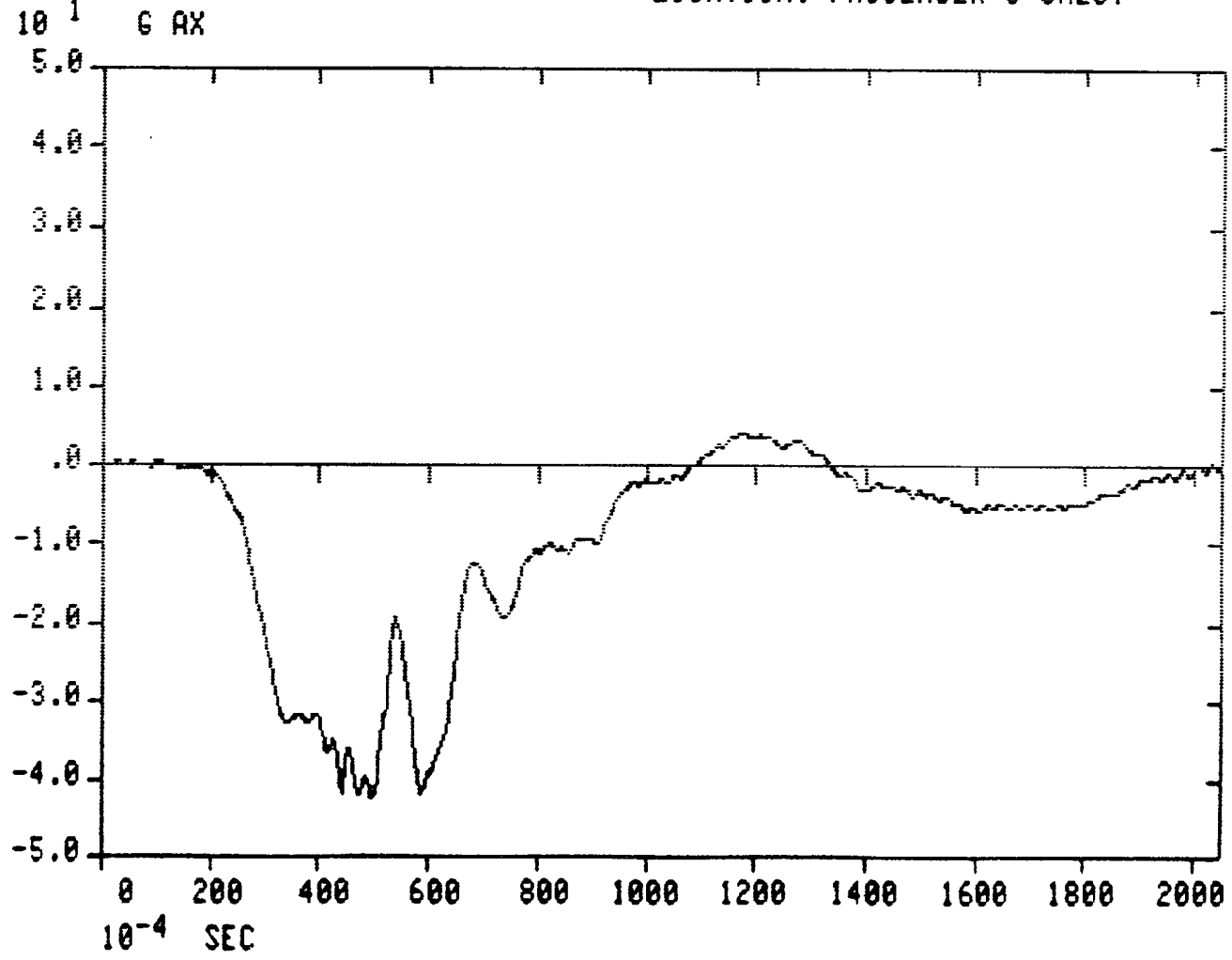


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 180
ACCELEROMETER: TAPE 2, CH 5
DIRECTION: FORWARD
LOCATION: PASSENGER'S CHEST

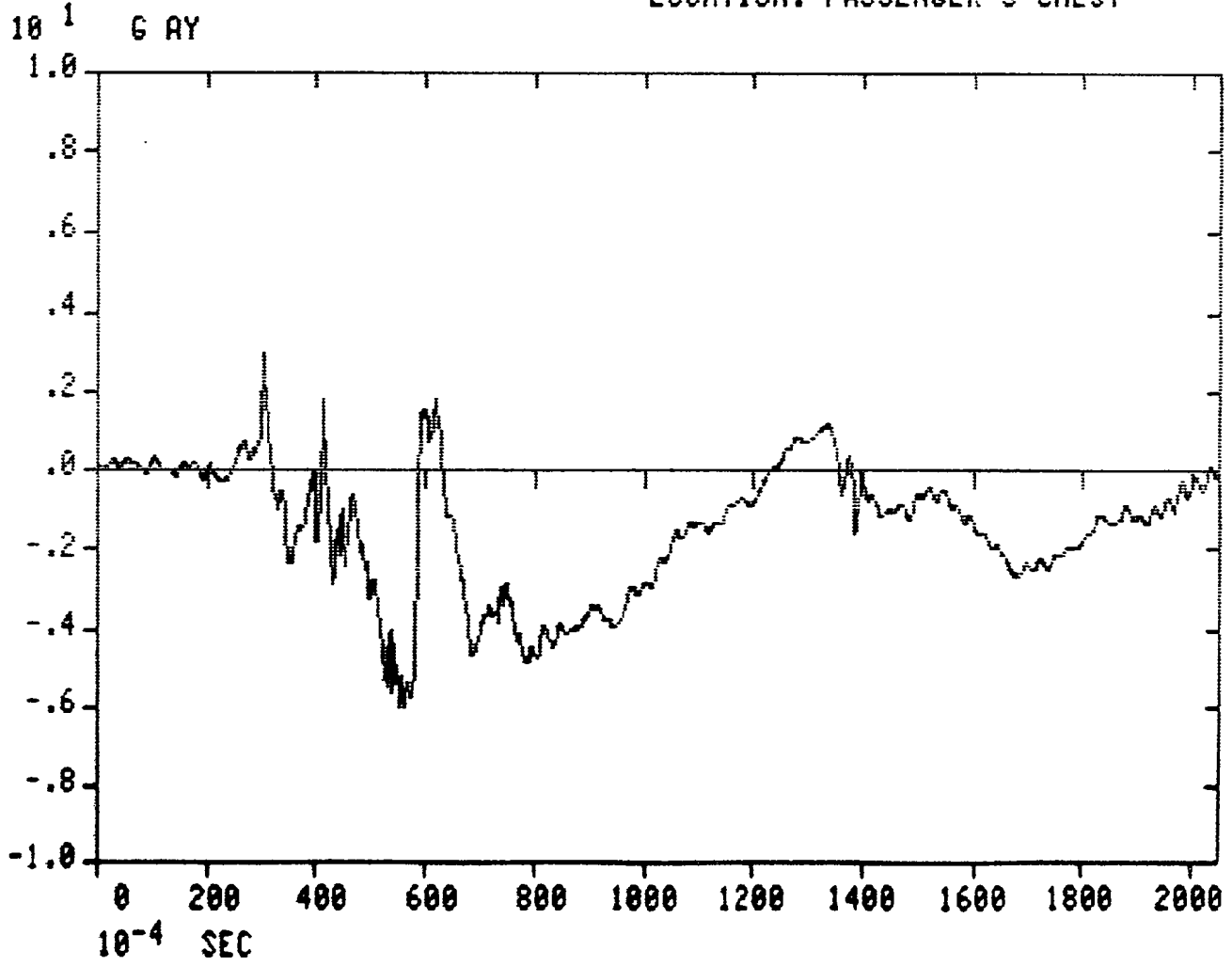


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 180
ACCELEROMETER: TAPE: 2, CH 6
DIRECTION: LEFT
LOCATION: PASSENGER'S CHEST

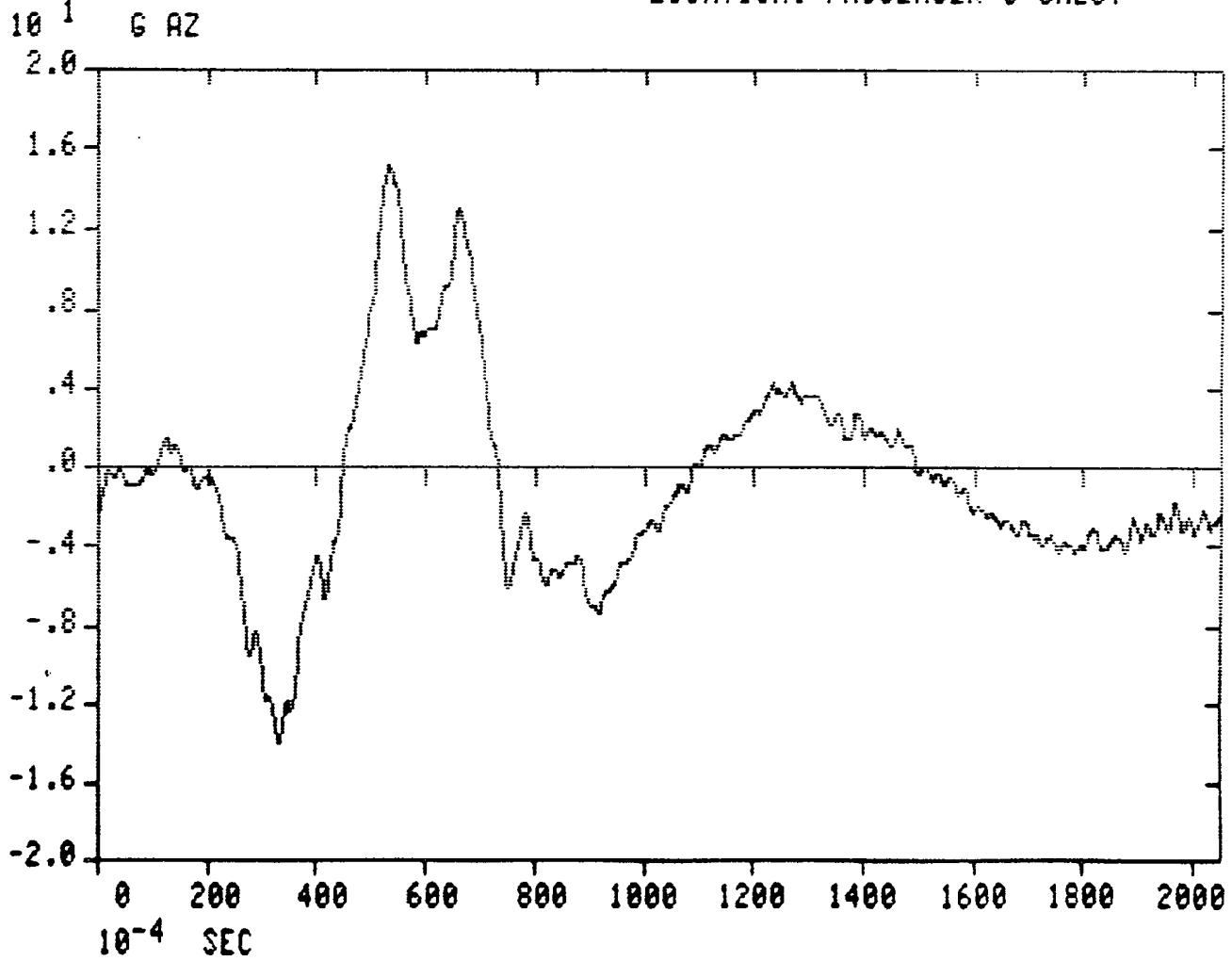


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 180
ACCELEROMETER: TAPE 2, CH 7
DIRECTION: UPWARD
LOCATION: PASSENGER'S CHEST

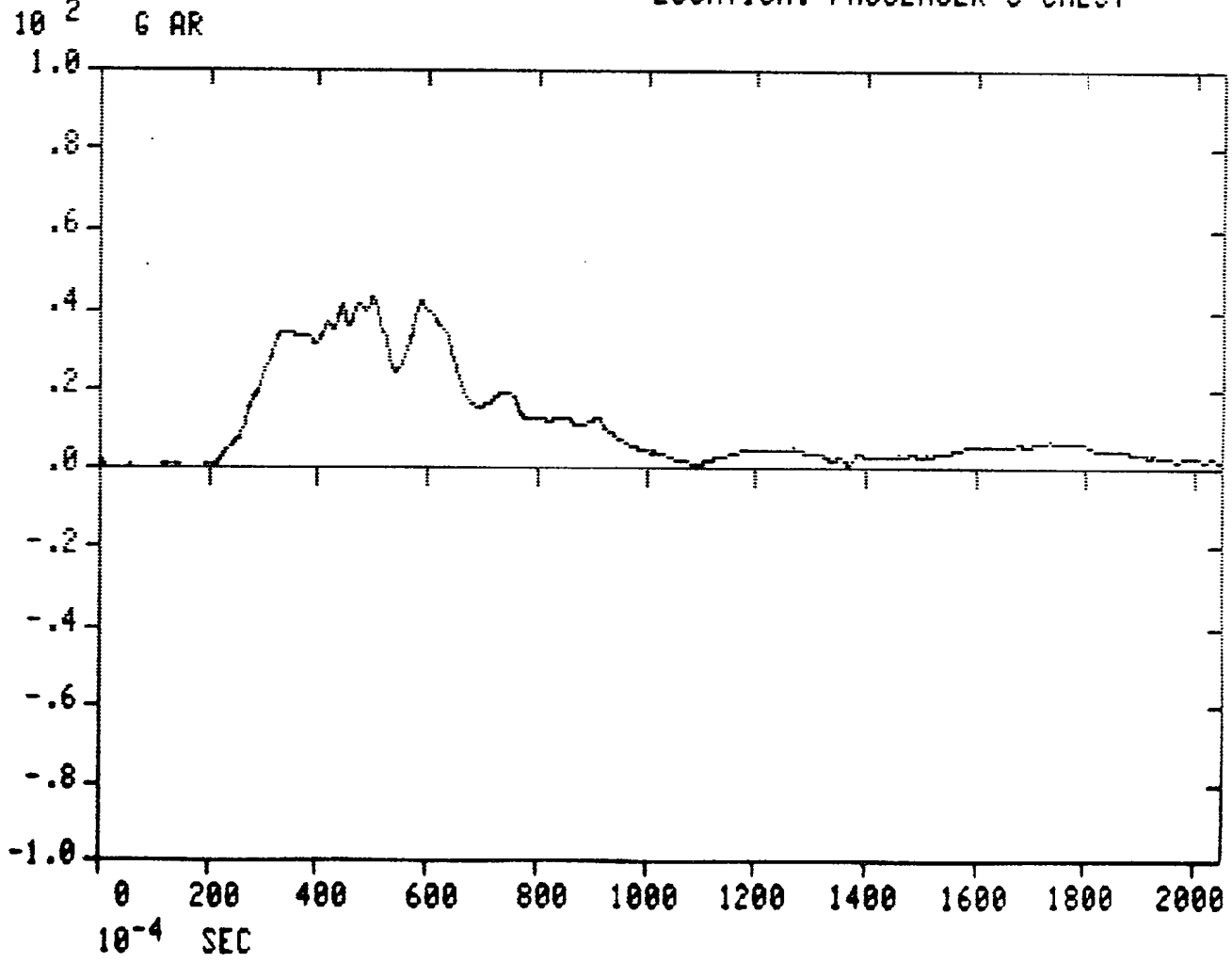


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 5-7
DIRECTION: RESULTANT OF XYZ
LOCATION: PASSENGER'S CHEST

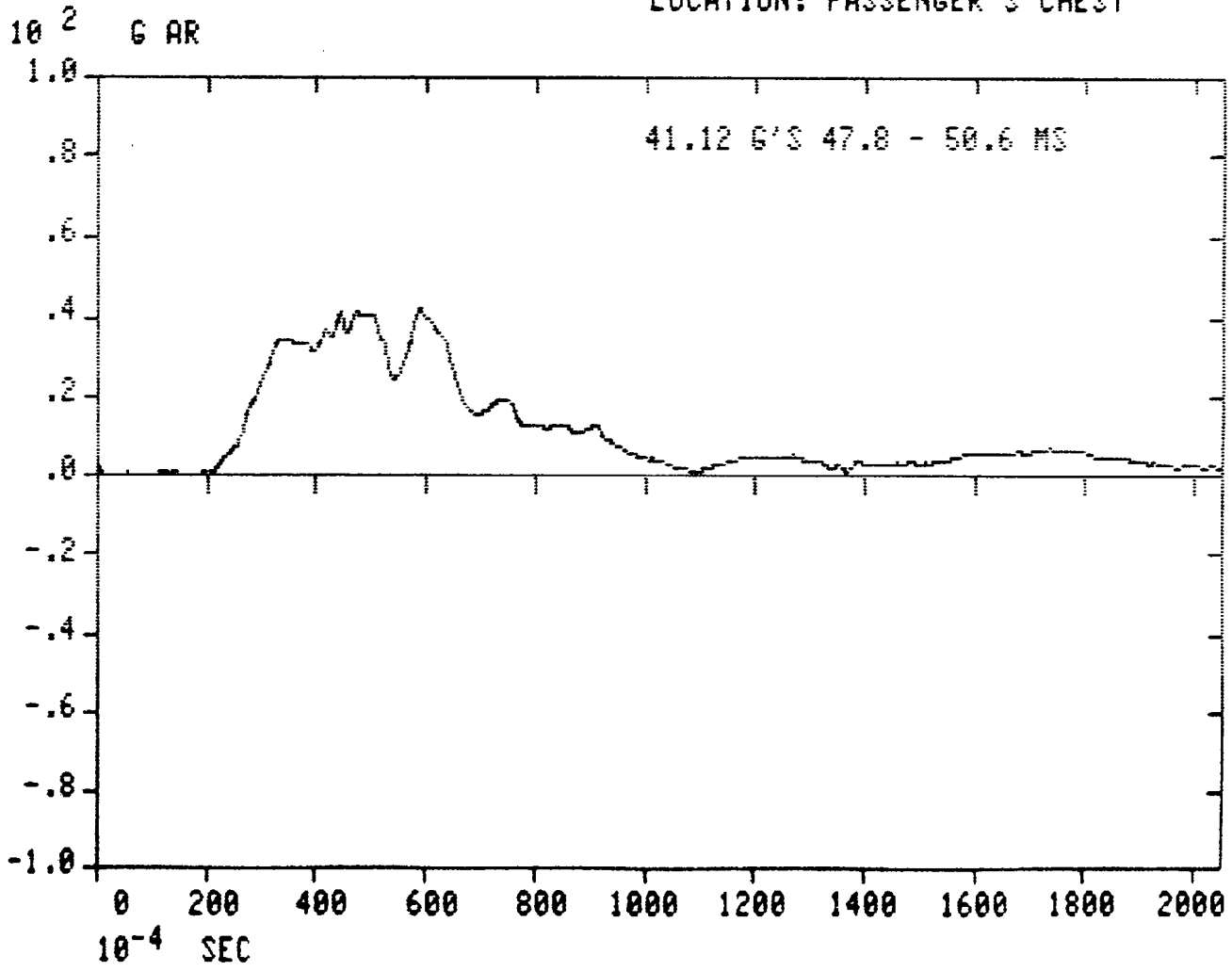


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 5-7
DIRECTION: RESULTANT OF XYZ
LOCATION: PASSENGER'S CHEST

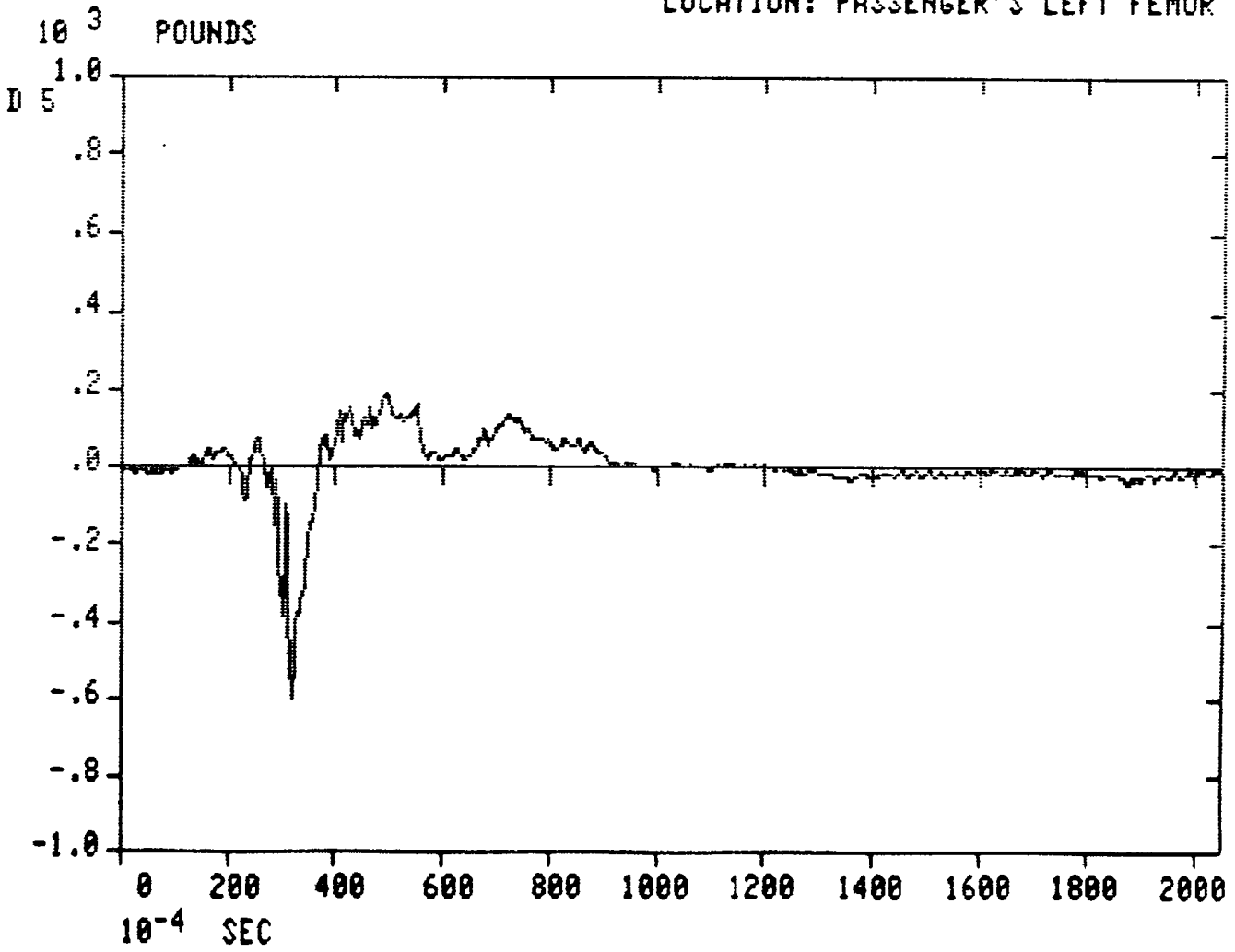


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

MJO NO. : 971-3882-21
FILTER: CLASS 600
LOAD CELL: TAPE 2, CH 8
DIRECTION: TENSION
LOCATION: PASSENGER'S LEFT FEMUR

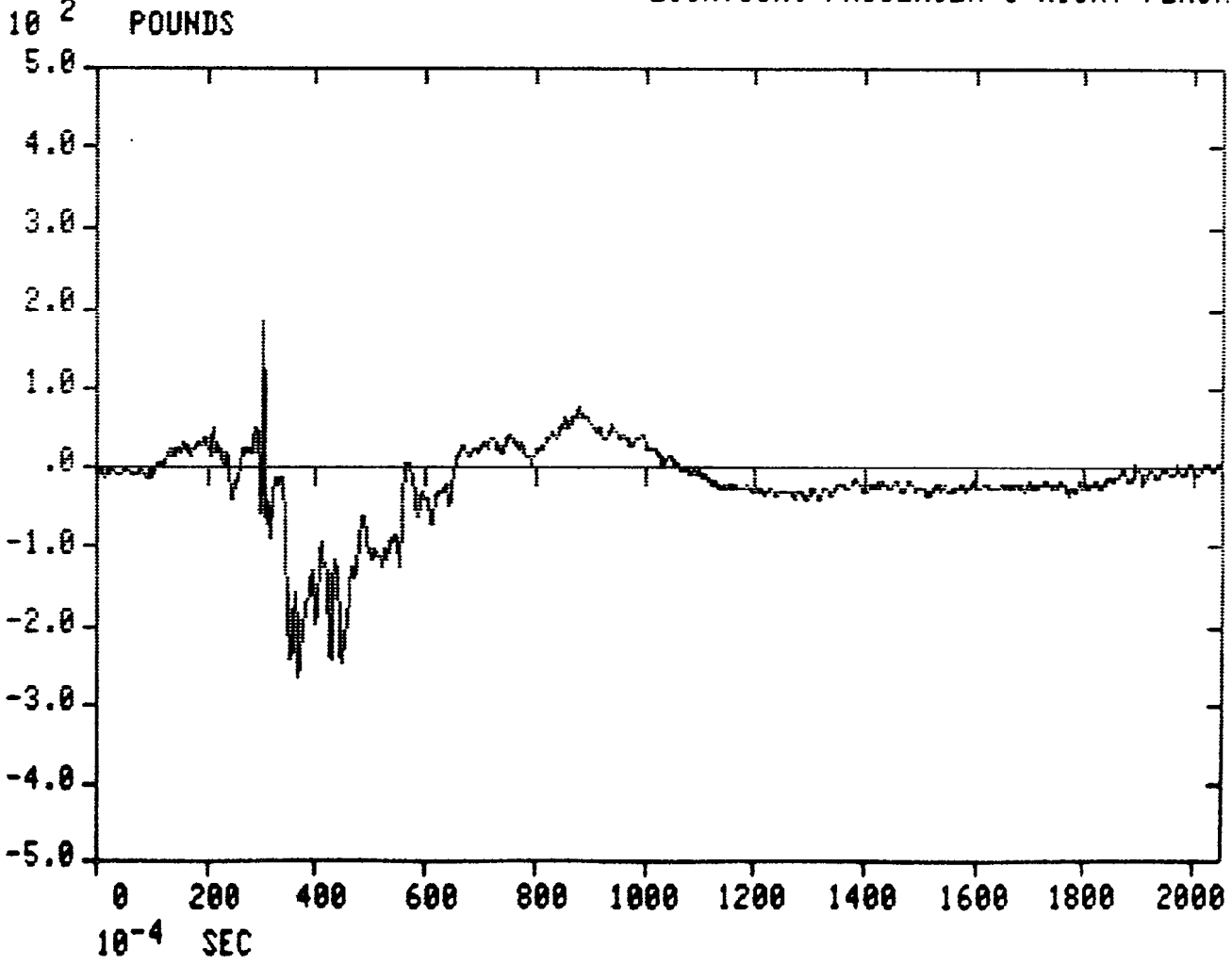


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

MJO NO. : 971-3882-21
FILTER: CLASS 600
LOAD CELL: TAPE 2, CH 4
DIRECTION: TENSION
LOCATION: PASSENGER'S RIGHT FEMUR

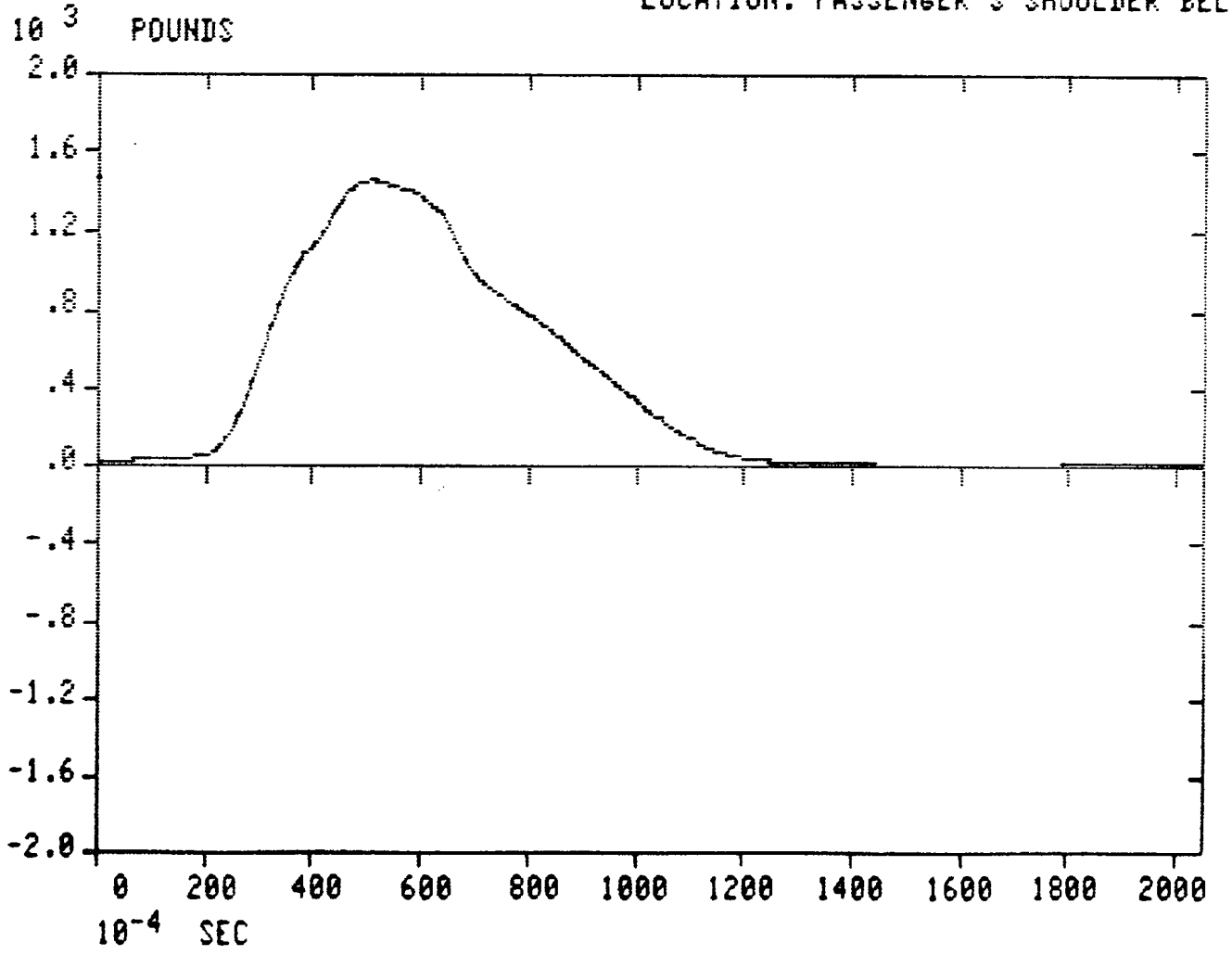


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 60
LOAD CELL: TAPE 2, CH 9
DIRECTION: TENSION
LOCATION: PASSENGER'S SHOULDER BELT

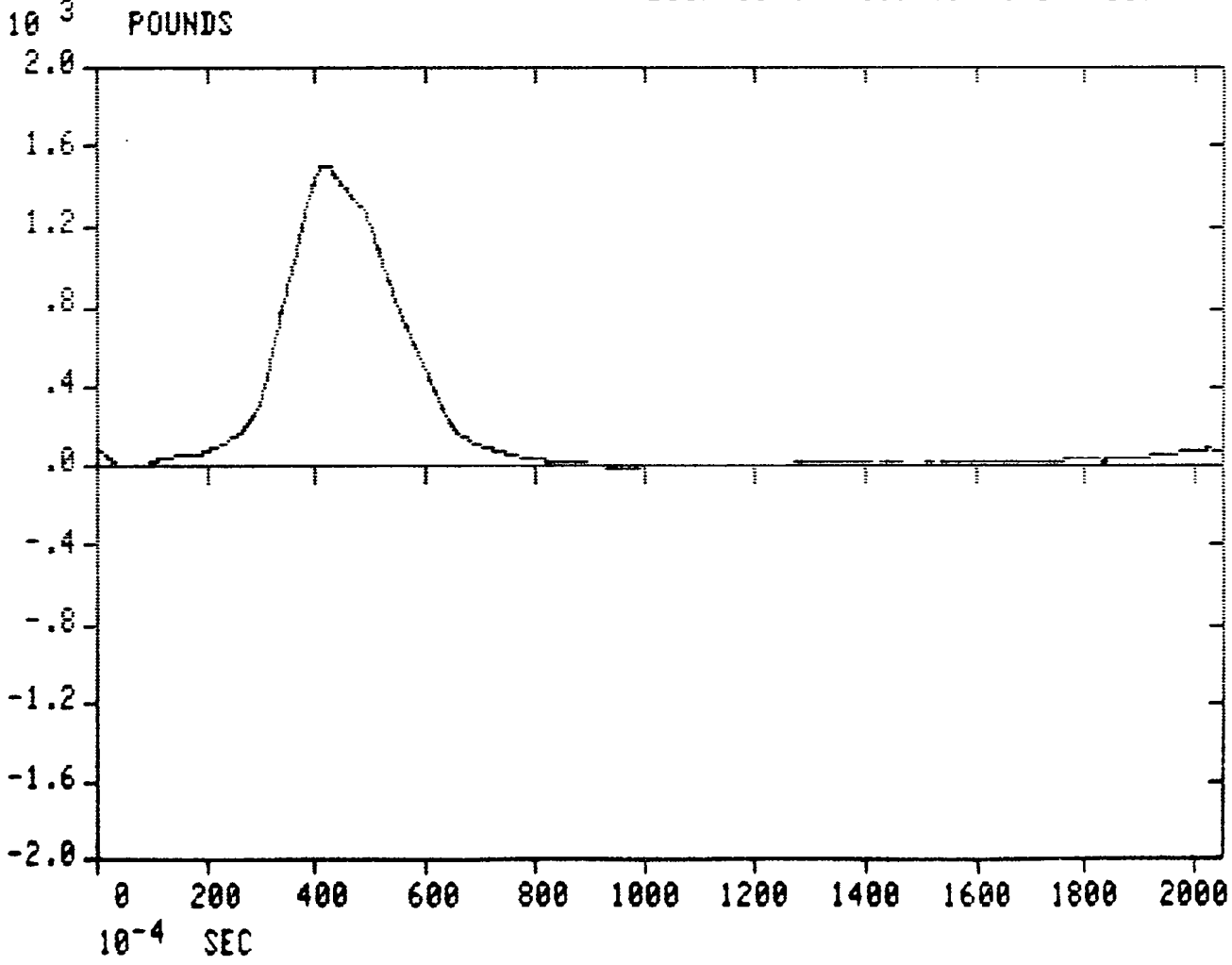


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

MJO NO. : 971-3882-21
FILTER: CLASS 60
LOAD CELL : TAPE 2, CH 10
DIRECTION: TENSION
LOCATION: PASSENGER'S LAP BELT

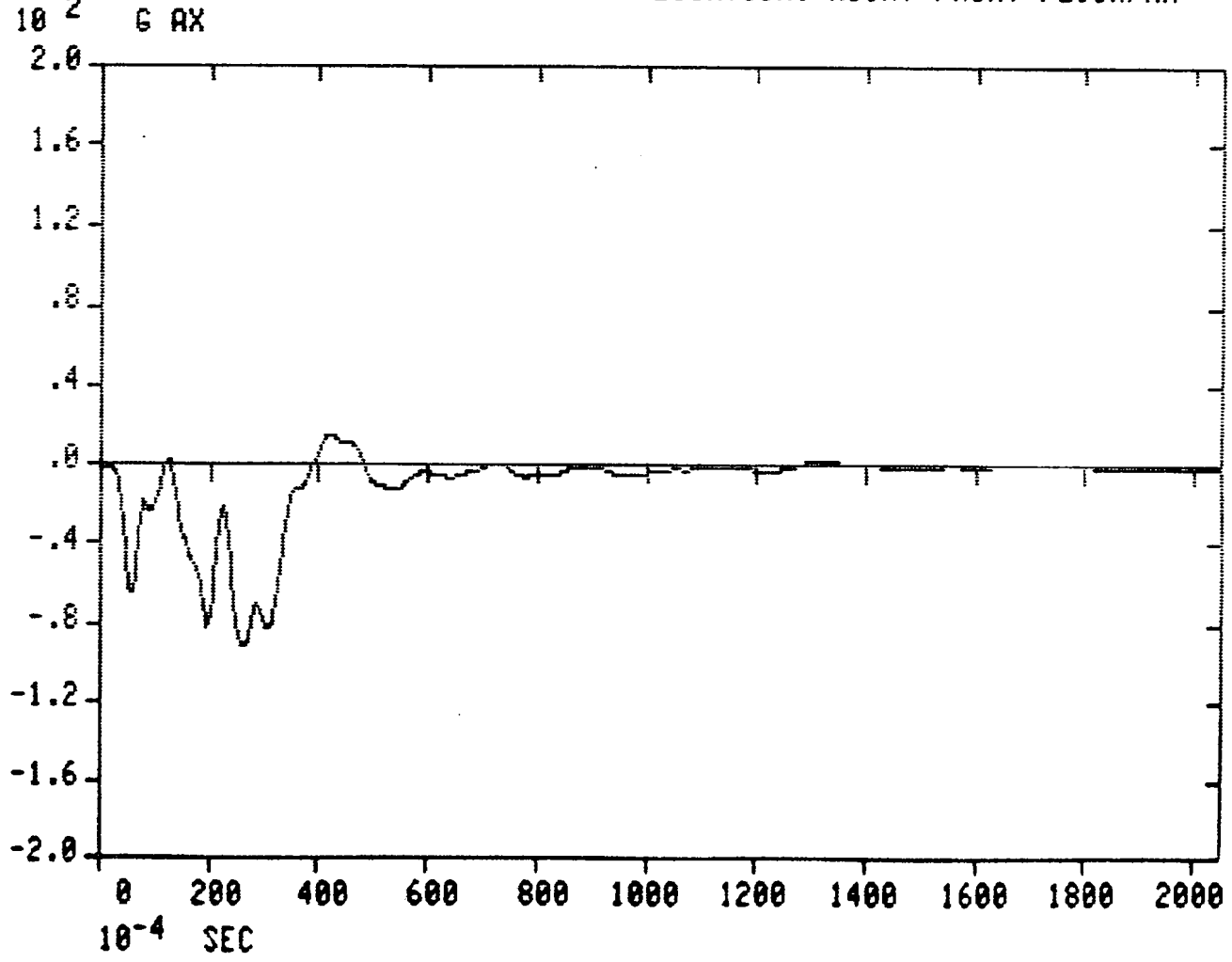


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

MJO NO. : 971-3882-21
FILTER: CLASS 60
ACCELEROMETER: TAPE 1, CH 12
DIRECTION: FORWARD
LOCATION: RIGHT FRONT FLOORPAN

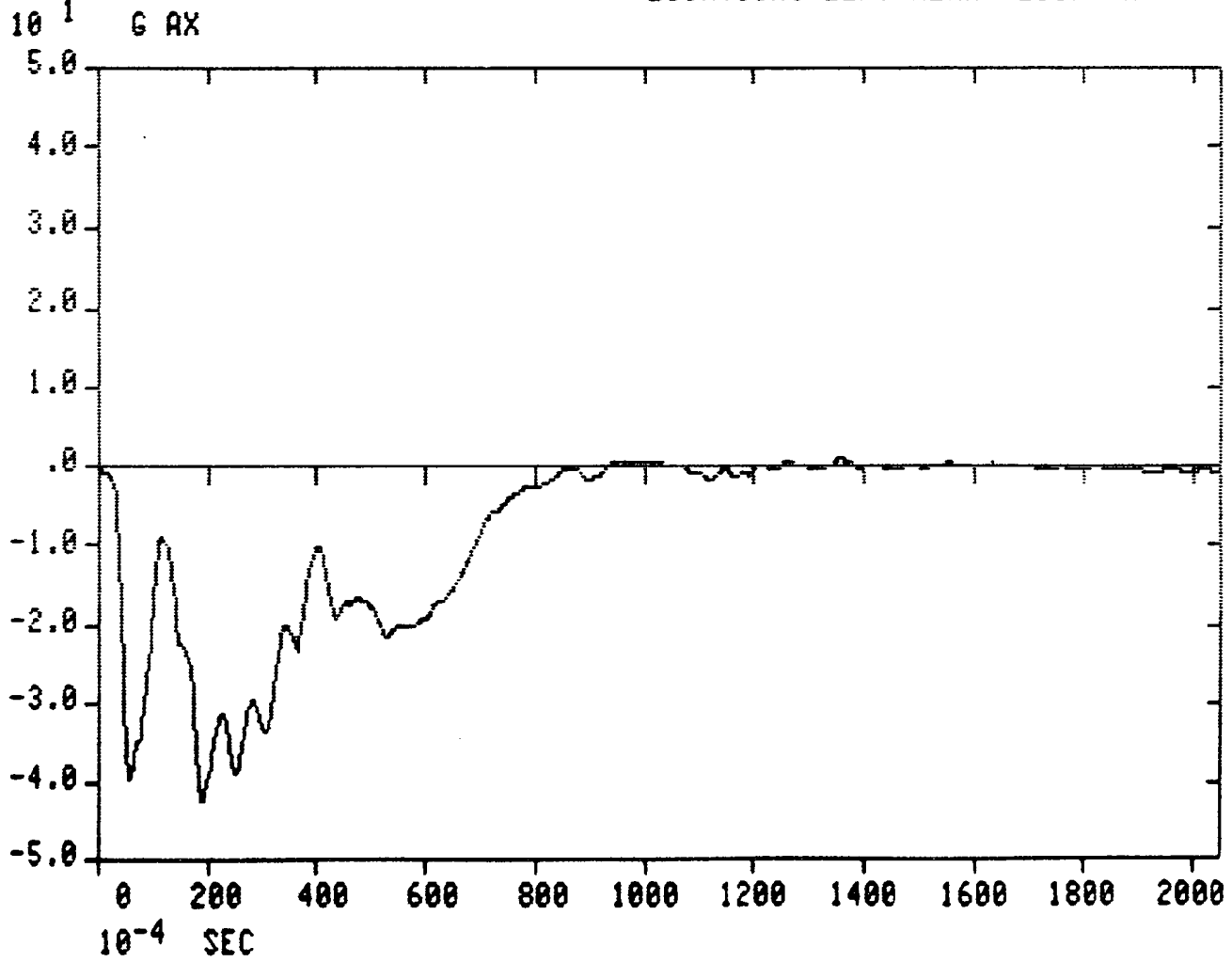


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 60
ACCELEROMETER: TAPE 1, CH 10
DIRECTION: FORWARD
LOCATION: LEFT REAR FLOORPAN

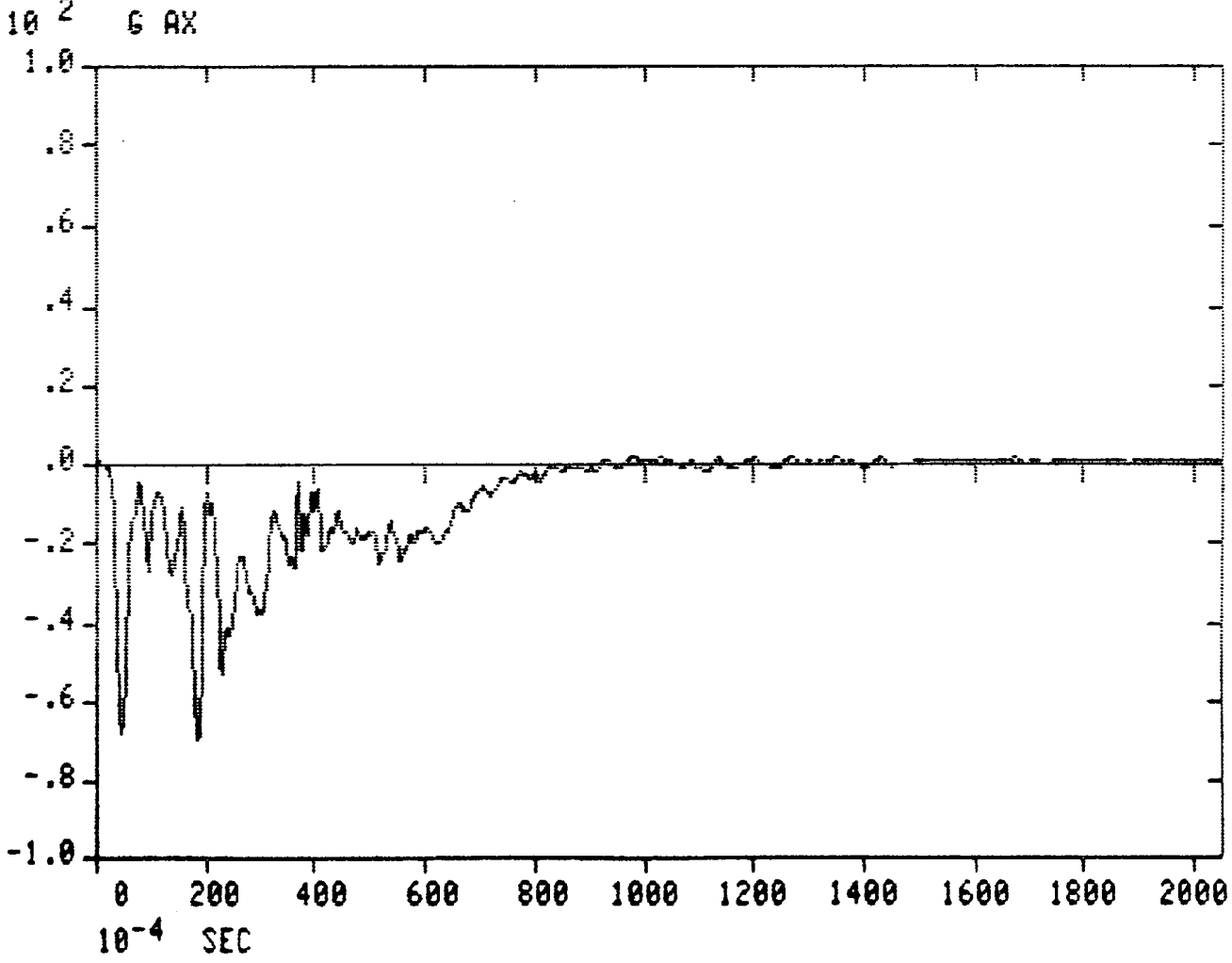


DOT CRASH PROGRAM

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-21
FILTER: CLASS 180
ACCELEROMETER: TAPE 3, CH 5
DIRECTION: FORWARD
LOCATION: VEHICLE C.G.

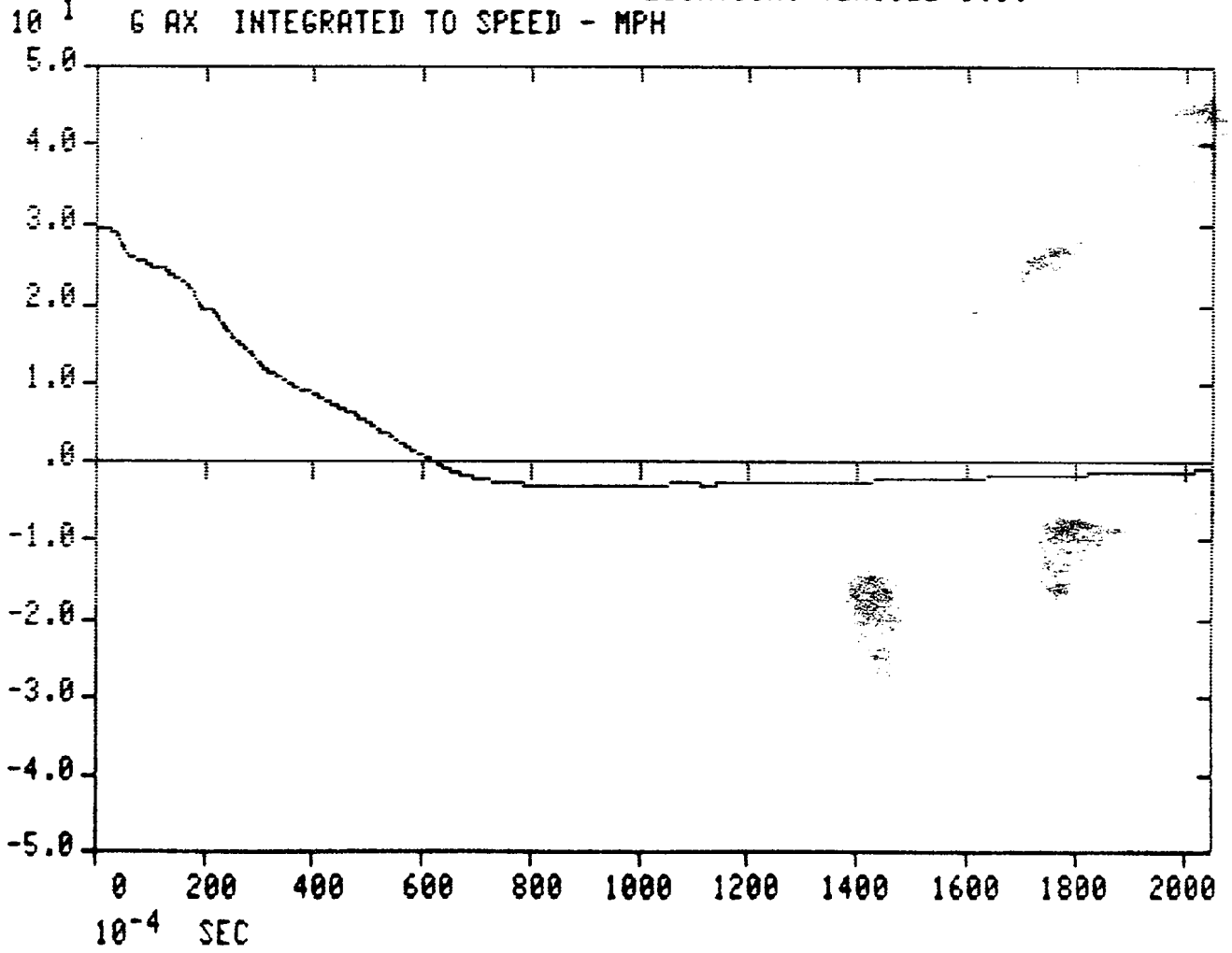


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

MJO NO. : 971-3882-2
FILTER: CLASS 180
ACCELEROMETER: TAPE 3, CH 5
DIRECTION: FORWARD
LOCATION: VEHICLE C.G.

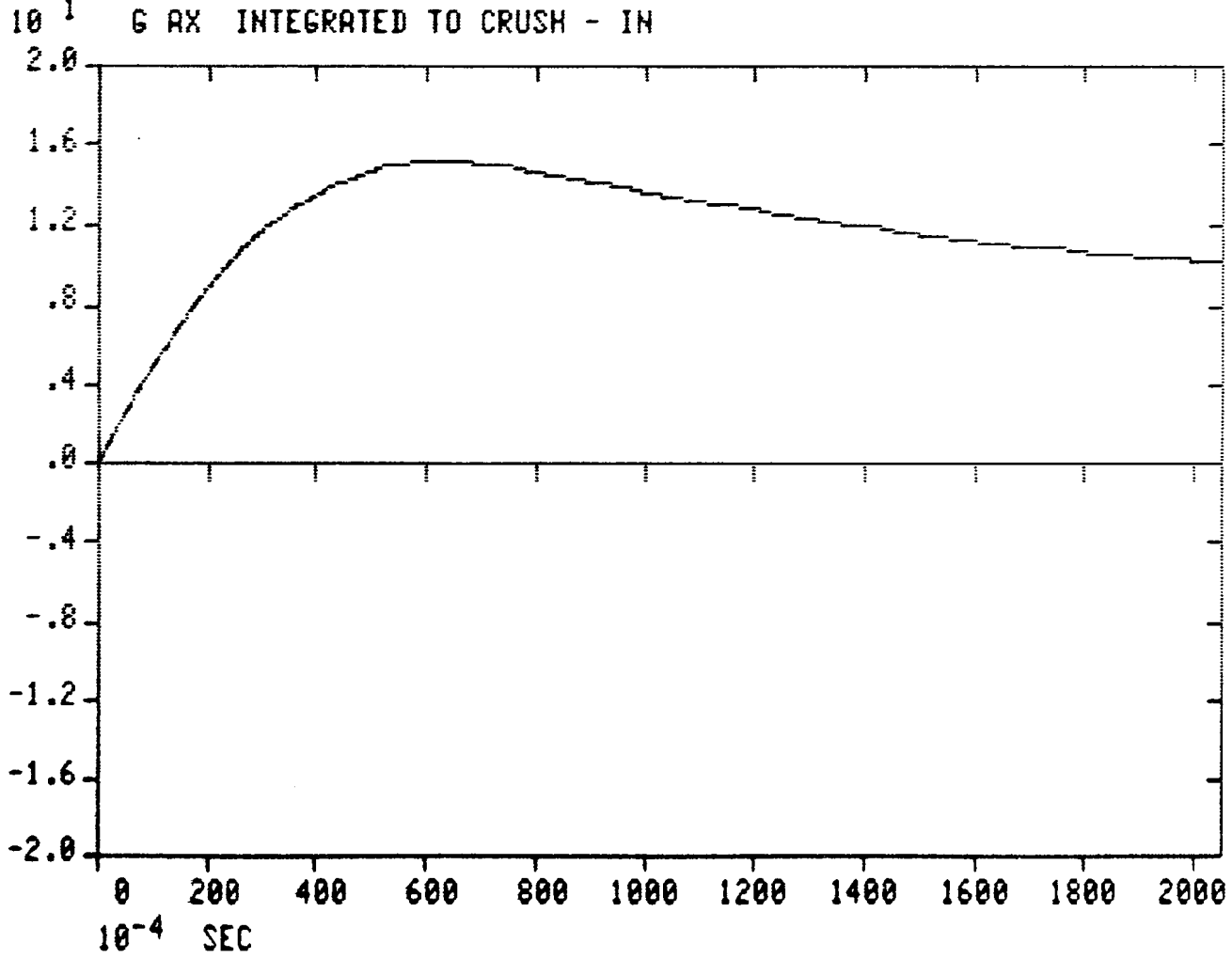


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: VW VANAGON
VEHICLE ID: NHTSA 801301
TEST FILE NO. : 141 29.56 MPH
DATE: OCT. 23, 1980 FRONTAL

MJO NO. : 971-3882-21
FILTER: CLASS 180
ACCELEROMETER: TAPE 3, CH 5
DIRECTION: FORWARD
LOCATION: VEHICLE C.G.



APPENDIX C

APPENDIX C

The following report sheets are the Part 572 test dummy calibration test data for the dummies used in the 1980 Volkswagen Vanagon - 3 Door Station Wagon, NHTSA 801301 frontal fixed barrier impact test.

PART 572 DUMMY CALIBRATION TEST DATA

Dummy S/N 0319

Calibration Laboratory Humanoid Systems

			Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration			10/10/80	10/31/80
Calibration Sequential Number for Dummy			2	3
Temperature in Lab. (Spec. = 66 to 78°F)			71°F	71°F
Relative Humidity in Lab. (Spec. = 10 to 70%)			67%	67%
TEST PARAMETER			SPECIFICATION	
1. HEAD DROP TEST:				
a. Peak Resultant Accel.			210 to 260G	239.8 g	234.3 g
b. Peak Lateral Accel.			≤ 10G	8.5 g	7.2 g
c. Time above 100G			0.9 to 1.5 ms	1.33 ms	1.42 ms
2. NECK BENDING TEST:				
a. Pendulum Speed			21.5 to 25.5 fps	22.0 fps	22.0 fps
b. Pendulum Avg. Decel. (over $t_3 - t_2$)			20 to 24G	21.9 g	22.3 g
c. Peak Resultant Head Acceleration			26G maximum	23.8 g	23.5 g
d. Pendulum Decel. (t_2-t_1)			≤ 3 ms	2.0 ms	1.9 ms
e. Pendulum Decel. (t_3-t_2)			25 to 30 ms	26.9 ms	27.4 ms
f. Pendulum Decel. (t_4-t_3)			≤ 10 ms	5.0 ms	4.0 ms
g. Pendulum Direction Reversal Time			≥ 123 ms	125.3 ms	128.1 ms
h. Max. Head Rotation			63 to 73°	66.8°	69.5°
i. Chordal Displacement: Head Rotation Angle					
	0°	Time	-2 to 2 ms	0 ms	0 ms
		Displ.	-.5 to .5 in.	0 in.	0 in.
	30°	Time	25.6 to 34.4 ms	29.8 ms	30.6 ms
		Displ.	2.1 to 3.1 in.	2.65 in.	2.83 in.

PART 572 DUMMY CALIBRATION TEST DATA
(Continued)

Dummy S/N 0319

Calibration Laboratory Humanoid Systems

TEST PARAMETER		SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. NECK BENDING TEST Continued:				
i. Chordal Displacement: Head Rotation Angle				
60°	Time	40.3 to 51.7 ms	47.9 ms	48.2 ms
	Displ.	4.3 to 5.3 in.	4.63 in.	4.75 in.
Maximum (°)	Time	53.2 to 66.8 ms	64.8 ms	61.6 ms
	Displ.	5.0 to 6.0 in.	5.22 in.	5.37 in.
60°	Time	67.0 to 83.0 ms	76.9 ms	75.1 ms
	Displ.	4.3 to 5.3 in.	4.78 in.	4.51 in.
30°	Time	85.4 to 104.6 ms	103.0 ms	100.6 ms
	Displ.	2.1 to 3.1 in.	2.35 in.	2.36 in.
0°	Time	101.0 to 123.0 ms	119.7 ms	117.1 ms
	Displ.	-.5 to 0.5 in.	0.04 in.	-0.18 in.
3. ABDOMINAL COMPRESSION TEST: (Preload = 10 pounds)				
a. Force @ .5"		23 to 37 lbs.	36.0 lbs.	30.0 lbs.
b. Force @ .75"		39 to 53 lbs.	43.0 lbs.	44.0 lbs.
c. Force @ 1.0"		50 to 63 lbs.	56.0 lbs.	58.0 lbs.
d. Force @ 1.3"		73 to 88 lbs.	80.0 lbs.	82.0 lbs.
4. LUMBAR FLEXION TEST:				
a. Force @ 20°		22 to 34 lbs.	22.3 lbs.	29.0 lbs.
b. Force @ 30°		34 to 46 lbs.	44.5 lbs.	44.5 lbs.
c. Force @ 40°		46 to 58 lbs.	51.0 lbs.	51.0 lbs.
d. Return Angle		12° maximum	8.0°	8.0°

PART 572 DUMMY CALIBRATION TEST DATA
(Continued)

Dummy S/N 0319

Calibration Laboratory Humanoid Systems

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
5. CHEST IMPACT TESTS:			
a. High Speed			
(1) Probe Speed	21.78-22.22 fps	22.0 fps	22.0 fps
(2) Peak Deflection	1.7" maximum	0.77 in.	1.48 in.
(3) Peak Resistive Force	2250 lbs. max.	2154.0 lbs.	2124.3 lbs.
(4) Internal Hysteresis	50 to 70%	57.0%	60.8%
b. Low Speed			
(1) Probe Speed	13.86-14.14 fps	14.0 fps	14.0 fps
(2) Peak Deflection	1.1" maximum	0.99 in.	0.98 in.
(3) Peak Resistive Force	1450 lbs. max.	1236.4 lbs.	1329.6 lbs.
(4) Internal Hysteresis	50 to 70%	56.6%	55.5%
6. KNEE IMPACT TESTS:			
a. Right Side			
(1) Probe Side	6.76 to 7.04 fps	6.90 fps	6.90 fps
(2) Maximum Force	1850 to 2500 lbs.	2289.0 lbs.	2306.1 lbs.
(3) Time Above 1000#	1.7 ms minimum	1.86 ms	1.79 ms
b. Left Side			
(1) Probe Speed	6.76 to 7.04 fps	6.90 fps	6.90 fps
(2) Maximum Force	1850 to 2500 lbs.	2250.0 lbs.	2249.5 lbs.
(3) Time Above 1000#	1.7 ms minimum	1.94 ms	1.79 ms

PART 572 DUMMY CALIBRATION TEST DATA

Dummy S/N S03

Calibration Laboratory Humanoid Systems

		Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration		10/10/80	
Calibration Sequential Number for Dummy		2	
Temperature in Lab. (Spec. = 66 to 78°F)		71°F	
Relative Humidity in Lab. (Spec. = 10 to 70%)		67%	
TEST PARAMETER	**SPECIFICATION**		
1. HEAD DROP TEST:			
a. Peak Resultant Accel.	210 to 260G	245.2 g	
b. Peak Lateral Accel.	$\leq$ 10G	7.23 g	
c. Time above 100G	0.9 to 1.5 ms	1.26 ms	
2. NECK BENDING TEST:			
a. Pendulum Speed	21.5 to 25.5 fps	22.0 fps	
b. Pendulum Avg. Decel. (over $t_3 - t_2$)	20 to 24G	22.30 g	
c. Peak Resultant Head Acceleration	26G maximum	22.79 g	
d. Pendulum Decel. (t_2-t_1)	$\leq$ 3 ms	1.65 ms	
e. Pendulum Decel. (t_3-t_2)	25 to 30 ms	27.31 ms	
f. Pendulum Decel. (t_4-t_3)	$\leq$ 10 ms	4.38 ms	
g. Pendulum Direction Reversal Time	$\geq$ 123 ms	112.3 ms	
h. Max. Head Rotation	63 to 73°	65.22°	
i. Chordal Displacement: Head Rotation Angle			
0° Time	-2 to 2 ms	0 ms	
0° Displ.	-.5 to .5 in.	0 in.	
30° Time	25.6 to 34.4 ms	29.13 ms	
30° Displ.	2.1 to 3.1 in.	2.67 in.	

PART 572 DUMMY CALIBRATION TEST DATA
(Continued)

Dummy S/N S03

Calibration Laboratory Humanoid Systems

TEST PARAMETER			SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. NECK BENDING TEST Continued:					
i. Chordal Displacement: Head Rotation Angle					
	60°	Time	40.3 to 51.7 ms	48.58 ms	
		Displ.	4.3 to 5.3 in.	4.67 in.	
	Maximum (°)	Time	53.2 to 66.8 ms	57.05 ms	
		Displ.	5.0 to 6.0 in.	5.24 in.	
	60°	Time	67.0 to 83.0 ms	70.88 ms	
		Displ.	4.3 to 5.3 in.	4.84 in.	
	30°	Time	85.4 to 104.6 ms	98.99 ms	
		Displ.	2.1 to 3.1 in.	2.89 in.	
	0°	Time	101.0 to 123.0 ms	116.38 ms	
		Displ.	-.5 to 0.5 in.	0.02 in.	
3. ABDOMINAL COMPRESSION TEST: (Preload = 10 pounds)					
a. Force @ .5"			23 to 37 lbs.	26.0 lbs.	
b. Force @ .75"			39 to 53 lbs.	41.0 lbs.	
c. Force @ 1.0"			50 to 63 lbs.	58.0 lbs.	
d. Force @ 1.3"			73 to 88 lbs.	86.0 lbs.	
4.. LUMBAR FLEXION TEST:					
a. Force @ 20°			22 to 34 lbs.	25.0 lbs.	
b. Force @ 30°			34 to 46 lbs.	33.0 lbs.	
c. Force @ 40°			46 to 58 lbs.	47.0 lbs.	
d. Return Angle			12° maximum	10.0°	

PART 572 DUMMY CALIBRATION TEST DATA
(Continued)

Dummy S/N S03

Calibration Laboratory Humanoid Systems

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
5. CHEST IMPACT TESTS:			
a. High Speed			
(1) Probe Speed	21.78-22.22 fps	22.0 fps	
(2) Peak Deflection	1.7" maximum	1.59 in.	
(3) Peak Resistive Force	2250 lbs. max.	2183.8 lbs.	
(4) Internal Hysteresis	50 to 70%	60.9%	
b. Low Speed			
(1) Probe Speed	13.86-14.14 fps	14.0 fps	
(2) Peak Deflection	1.1" maximum	0.97 in.	
(3) Peak Resistive Force	1450 lbs. max.	1340.8 lbs.	
(4) Internal Hysteresis	50 to 70%	50.0%	
6. KNEE IMPACT TESTS:			
a. Right Side			
(1) Probe Side	6.76 to 7.04 fps	6.90 fps	
(2) Maximum Force	1850 to 2500 lbs.	1947.8 lbs.	
(3) Time Above 1000#	1.7 ms minimum	2.00 ms	
b. Left Side			
(1) Probe Speed	6.76 to 7.04 fps	6.90 fps	
(2) Maximum Force	1850 to 2500 lbs.	2312.4 lbs.	
(3) Time Above 1000#	1.7 ms minimum	1.75 ms	

APPROVED ENGINEERING TEST LABORATORIES

SERVICE FOR: U. S. Department of Transportation
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
400 Seventh Street S. W.
Washington, D. C. 20590

CONTRACT NUMBER: DOT-HS-9-02273

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

Kevin Hogg, Dynamics Engineer

G. J. Valenzuela, Mechanical Department Supervisor

R. J. McKelligott, P.E., Quality Assurance Manager

rmh