NTS

DOT-HS-9-02273

National Technical Systems

Scientific Services Group

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REPORT NO. 971-3882-49-M

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

FORD MOTOR COMPANY
1983 FORD R100 RANGER STYLESIDE - PICKUP
NHTSA 830603

NATIONAL TECHNICAL SYSTEMS
1536 EAST VALENCIA DRIVE
FULLERTON, CALIFORNIA 92631-4797

JULY 1982

CONTRACT NUMBER DOT-HS-9-02273

FINAL REPORT

PREPARED FOR

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

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Prepared by D. H. Hamed

Approved by [signature]

Date 30 June 1982

Report Accepted by:

_____
Contract Technical Manager
Office of Passenger Vehicle Research

_____
Date

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16. Abstract

The Office of Passenger Vehicle Research (OPVR) Occupant Packaging Branch (OPB) has been interested for several years in obtaining certain information on various impact modes and vehicle types through staged collisions. The specific data needed has been imcomplete or unavailable for the majority of staged collision. The vehicle collision reported herein was performed under Contract No. DOT-HS-9-02273 entitled "Vehicle Safety Compliance Testing of Windshield Mounting, Windshield Zone Intrusion and Fuel System Integrity in a Frontal Collision", which established data on a truck type vehicle for which very little such data is presently available.

The information collected includes occupant injury measurement (Ref. FMVSS 208) as well as seat belt loads, and vehicle acceleration.

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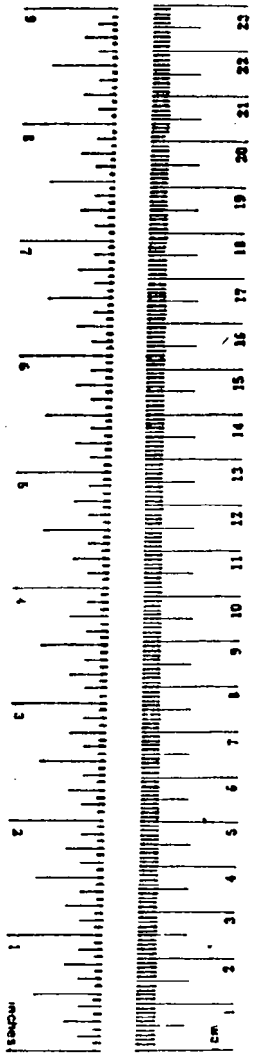
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

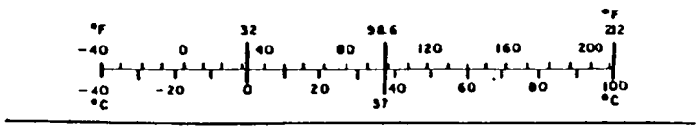
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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ILLUSTRATIONS

SECTION 1

1.0 INTRODUCTION

The vehicle impact test was performed by National Technical Systems under Contract Number DOT-HS-9-02273 in accordance with the Office of Vehicle Safety Compliance Laboratory Procedures (TP219-02).

The purpose of the effort documented herein was to acquire occupant response and vehicle acceleration in a 1983 Ford R100 Ranger Styleside - Pickup, NHTSA 830603 during a 30 mph frontal fixed barrier impact test. This effort was conducted in conjunction with Federal Motor Vehicle Safety Standard (FMVSS) 212 - "Windshield Mounting", 219 - "Windshield Zone Intrusion", and 301-75 "Fuel System Integrity" compliance test. These compliance test results were previously documented in NHTSA/OVSC Report No. 212-NTS-82-026; 219-NTS-82-025; 301-NTS-82-049. Only the occupant response and vehicle acceleration aspects of the test are covered in this report.

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).

SECTION 1

Section 2 contains general test and vehicle information, while Section 3 contains occupant/vehicle acceleration summary data, along with test dummy and vehicle measurements. Section 3 also contains pre and post test photographs. Section 4 discusses NTS's test facilities and data acquisition and reduction system. Appendix A contains the computer-generated plots.

SECTION 2

2.0 GENERAL TEST INFORMATION

The 1983 Ford R100 Ranger Styleside - Pickup was subjected to a frontal fixed barrier impact as requried by Federal Motor Vehicle Safety Standards 212/219/301-75.

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

Two (2) Part 572 test dummies were positioned in each 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 yellow chalk to provide post-impact visual inspection of possible dummy head and knee contact with the interior components during the impact event.

TABLE I

SUMMARY OF TEST CONDITIONS

TEST VEHICLE INFORMATION:

Manufacturer: Ford Motor Company

Make/Model: Ford R100 Ranger Styleside

Body Style: Pickup Model Year: 1983

VIN: 1FTBR10A1DUA11214 Build Date: February 1982

NHTSA No.: 830603 Color: White

Engine Data: Four (4) Cylinders; 2.3 Liter

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

Major Options: None

VEHICLE ATTITUDE:

Delivered Attitude: LF 27.9 in.; RF 28.1 in.; LR 29.2 in.; RR 29.4 in.

Test Attitude: LF 27.3 in.; RF 27.5 in.; LR 27.0 in.; RR 27.5 in.

VEHICLE TIRE DATA:

Recommended Cold Tire Pressure: Front = 35 psi

(Up to Vehicle Load Capacity) Rear = 35 psi

Recommended Tire Size: P185/75R14 Load Range: 1290 @ 35 psi

Tires on Vehicle: P185/75R14 - Firestone

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

NOTE: Limited Service Spare
P185/80D14 @ 60 psi

TABLE Ia

SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS:

Date of Test: May 27, 1982 Time of Test: 1349

Ambient Temperature: 64 °F at Impact Area

VEHICLE CAPACITY:

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

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

Cargo: unknown lbs.

Total unknown lbs. (Vehicle Capacity Weight)

GVWR: 3,740 lbs. (Taken From Certification Label)

GAWR: Front 1,851 lbs.; Rear 2,012 lbs.

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

Left Front 797 lbs. Left Rear 483 lbs.
Right Front 720 lbs. Right Rear 535 lbs.
Total Front Weight 1,517 lbs. (59.8 % of Total Vehicle Weight)
Total Rear Weight 1,018 lbs. (40.2 % of Total Vehicle Weight)
Total Delivered Weight 2,535 lbs.

CALCULATED VEHICLE TEST WEIGHT: 3,163 lbs.
(With Required Dummies and 300 lbs. Cargo)

ACTUAL VEHICLE TEST WEIGHT:

Left Front 891 lbs. Left Rear 721 lbs.
Right Front 774 lbs. Right Rear 763 lbs.
Total Front Weight 1,665 lbs. (52.9 % of Total Vehicle Weight)
Total Rear Weight 1,484 lbs. (47.1 % of Total Vehicle Weight)
Total Test Weight 3,149 lbs.

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 A in the form of computer-generated plots.

TABLE 3-1

PART 572 DUMMY IN-VEHICLE POSITION

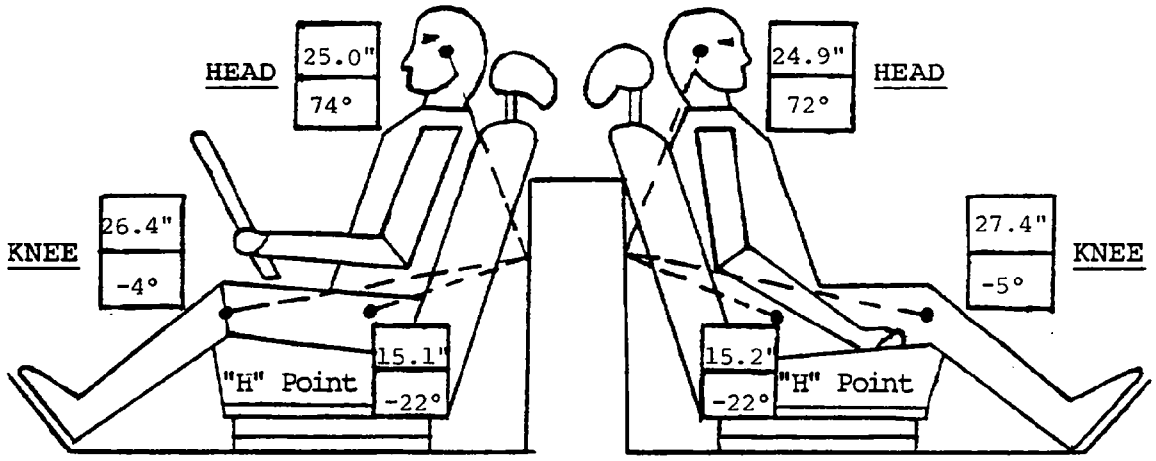
VEHICLE 1983 Ford Ranger NHTSA NO. 830603

POSITIONING DATE: May 27, 1982 AMBIENT TEMP: 65 °F TIME 1310

SEAT TYPE: X Bench
_____Bucket
_____Split Bench

ADJUSTER TYPE: X Manual
_____Power

BUCKET SEAT BACK TYPE: _____Fixed
_____Adjustable Reclining
X Not Applicable



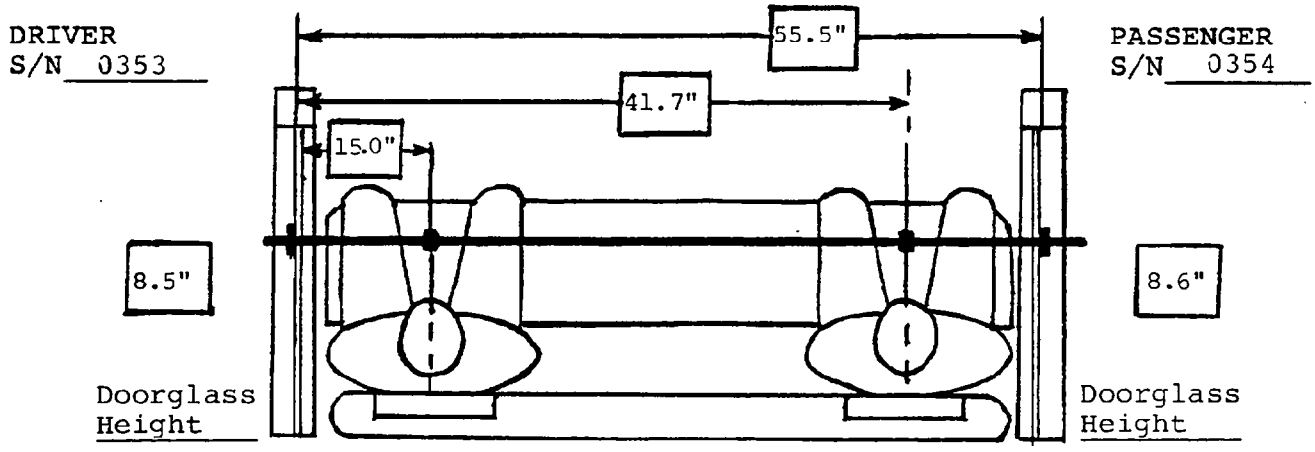


TABLE 3-2

PART 572 DUMMY PRE-TEST CLEARANCE DISTANCES

DRIVER

HH = 17.5 in.

HW = 20.7 in.

HR = 9.1 in.

HS = 11.5 in.

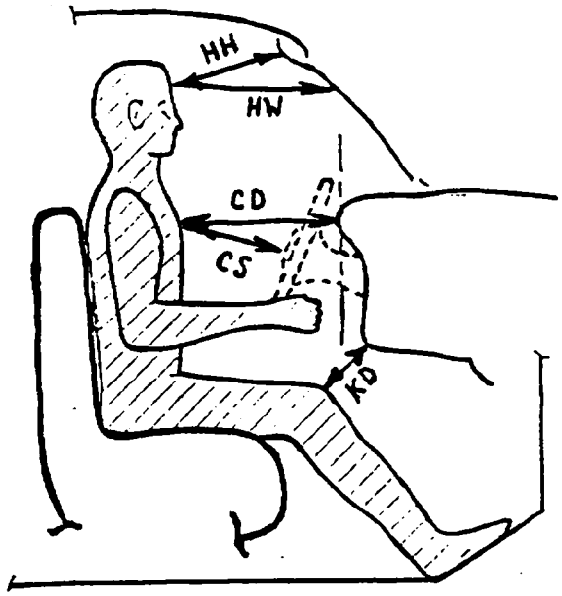
CD = 23.0 in.

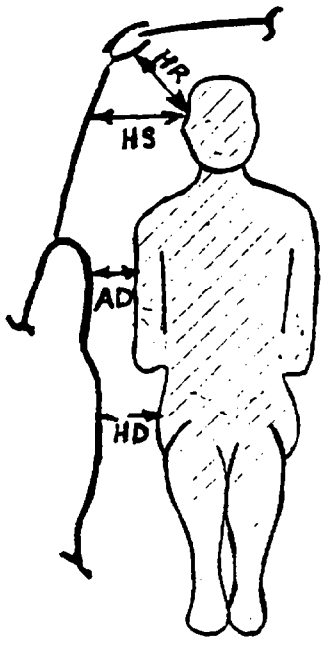
CS = 13.4 in.

AD = 5.0 in.

HD = 7.5 in.

KD = 7.6 in.





PASSENGER

HH = 17.8 in.

HW = 22.8 in.

HR = 9.3 in.

HS = 10.6 in.

CD = 24.0 in.

AD = 5.0 in.

HD = 8.6 in.

KD = 6.5 in.

TABLE 3-3

MANUFACTURERS SEAT BELT INSTRUCTIONS

BEFORE DRIVING YOUR VEHICLE

OCCUPANT RESTRAINTS

Continuous Loop Lap Shoulder Belt System

Ford Motor Company recommends that you always "buckle up". In some areas, seat belt use is required by law. Your vehicle features a Continuous Loop Lap Shoulder Belt system for the driver and right front seating positions. The driver's position also contains a seat belt warning system. If the driver does not buckle up before turning the ignition on, the buzzer will sound for four to eight seconds. The seat belt warning light will remain on for the same time period with or without the belts buckled.

Front Lap-Shoulder Belts

After entering your vehicle, adjust the front seat to obtain the best position for your driving comfort and visibility. Then use the following procedure for fastening belts.

- Pull the lap-shoulder belt from the retractor so the shoulder portion of the belt crosses your shoulder and chest and insert the belt slip tongue into the proper buckle until you hear a snap and feel it latch.
- The shoulder restraint portion of the belt adjusts automatically to a snug position. The inertia reel allows freedom of movement, locking tight only on hard braking or impacts of approximately 5 mph (8 km/h) or more. The reel cannot be made to lock by jerking on the webbing.
- The lap portion of the belt adjusts automatically to a snug position.

WARNING — Never allow more slack than is required to insert a fist between the shoulder belt and the chest. Never wear the shoulder belt under the arm. Never swing it around your neck over the inside shoulder. Never use a single belt for more than one person. Be sure the lap portion of the belt is fitted around the hips, not the waist. Failure to follow these precautions could increase the chance and/or severity of injury in an accident. Use shoulder belt on outside shoulder only.

ON THE DELUXE SEAT BELTS:

To relieve belt pressure on your shoulder after the belt is fastened, a shoulder harness comfort regulator is provided in the retractor. This regulator allows you to adjust your shoulder belt length for optimum comfort. This comfort regulator works like a window shade.

- Close the door.
- Pull several inches of shoulder belt away from your body and release.
- Pull down a small amount of shoulder belt and release.
- If the desired setting is not achieved, repeat the above procedure.
- The comfort regulator is designed to automatically release when the respective front door is opened. As the seat belt is unbuckled, it should be hand-guided back to the retractors to prevent the belt tongue from striking occupants or objects nearby during retraction.

Center Lap Belts
(Front Bench Seat)

The center lap belts don't have retractors. To lengthen the belt, tip the tongue at a right angle to the belt, and pull the tongue until the ends can be joined over the lap.

To fasten the belt, insert the tongue into the open end of the buckle until you hear a snap and feel the latch engage. Shorten the belt, if necessary, by pulling on the loose end of the webbing.

Unfastening Seat Belts

Push the release button in the buckle and allow the belts to retract to the fully-stowed position.

TABLE 3-4

PART 572 DUMMY DATA

Vehicle 1983 Ford Ranger NHTSA No. 830603

Driver S/N 0353 Passenger S/N 0354	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	60.6	144.8	152.9	82.6	6.8	191.0	32.3	86.8
Lateral	21.0	82.6	20.6	156.8	5.2	182.8	20.7	102.4
Vertical	8.7	144.8	51.9	87.0	2.1	195.8	51.5	71.4
Resultant	156.3	82.6			56.8	70.4		
HIC	908.8 (58 - 90 msec)				585.9 (55 - 110 msec)			
CHEST ACCELERATION								
Longitudinal	7.1	185.2	46.4	60.0	3.6	127.0	41.3	62.6
Lateral	4.8	166.8	13.4	61.6	11.0	64.4	19.1	84.0
Vertical	12.6	106.0	15.9	55.6	11.3	85.2	15.6	65.8
Resultant	49.5	59.8			43.6	65.4		
CSI	356 (48.6 g's - 3 msec clip)				243 (42.8 g's - 3 msec clip)			
	(lb)	Time (msec)	(lb)	Time (msec)	(lb)	Time (msec)	(lb)	Time (msec)
FEMUR LOAD								
Left	152	47.0	479	49.0	84	47.4	186	26.4
Right	150	74.0	958	57.6	78	105.6	561	47.4
BELT LOAD								
Torso	2006	64.8			2057	70.0		
Lap	1724	60.0			715	54.2		

Average Vehicle Impact Speed 29.69 mph

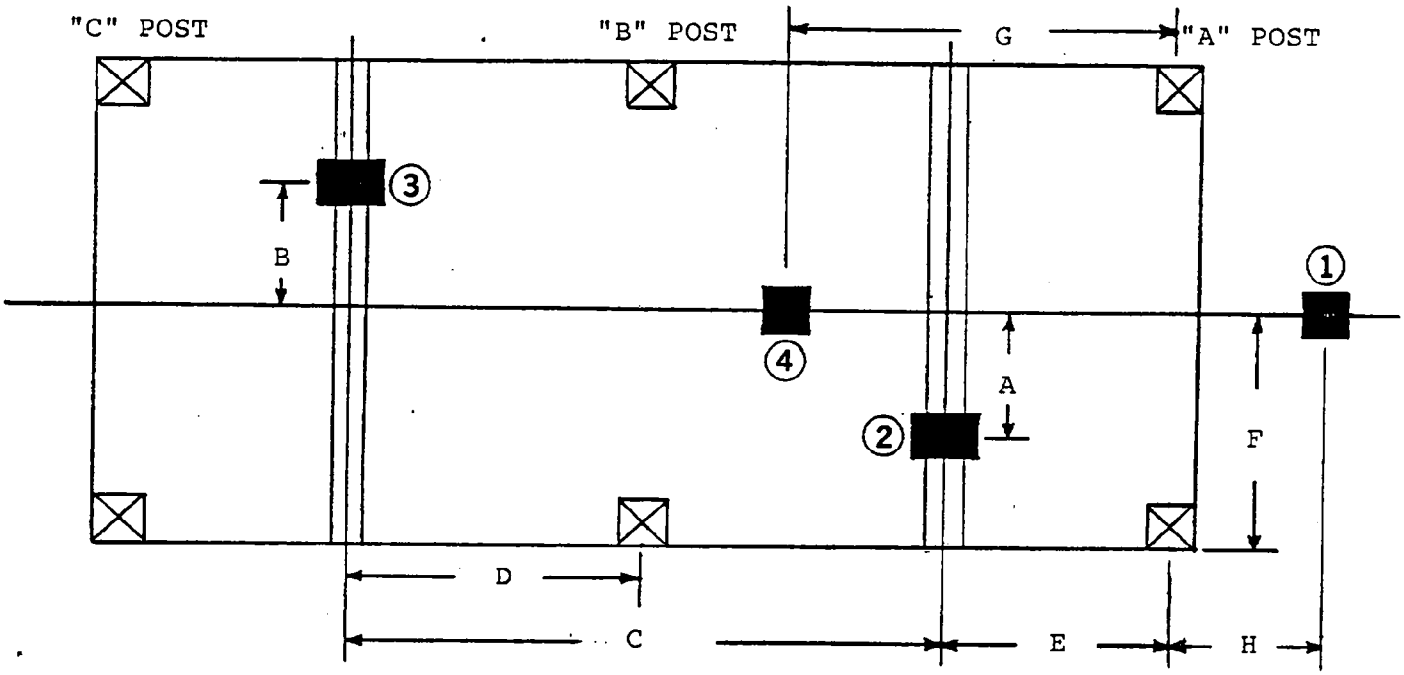
*Positive Direction - Longitudinal: Forward
Lateral: Leftward
Vertical: Upward
Femur: Tension

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

TABLE 3-5

VEHICLE STRUCTURAL DATA

VEHICLE 1983 Ford Ranger NHTSA NO. 830603



DIMENSIONS			
LOCATION	MEASUREMENT (IN.)	LOCATION	MEASUREMENT (IN.)
A	18.9	E	12.5
B	22.5	F	25.5
C	46.5	G	25.1
D	20.3	H	32.3

ACCELERATION PEAKS				
ACCELEROMETER LOCATION	POSITIVE* DIRECTION		NEGATIVE* DIRECTION	
	PEAK "G"	TIME (MSEC)	PEAK "G"	TIME (MSEC)
NO. 1 LONGITUDINAL	17.5	59.0	121.2	38.4
NO. 1 LATERAL	7.5	73.8	7.0	57.8
NO. 1 VERTICAL	23.0	34.4	13.8	21.8
NO. 2 LONGITUDINAL	8.3	81.8	42.8	48.0
NO. 2 LATERAL	8.1	34.0	8.7	71.0
NO. 3 LONGITUDINAL	1.5	174.6	38.9	32.6
NO. 3 LATERAL	13.0	59.6	15.5	29.6
NO. 4 LONGITUDINAL	6.9	80.4	48.5	57.0

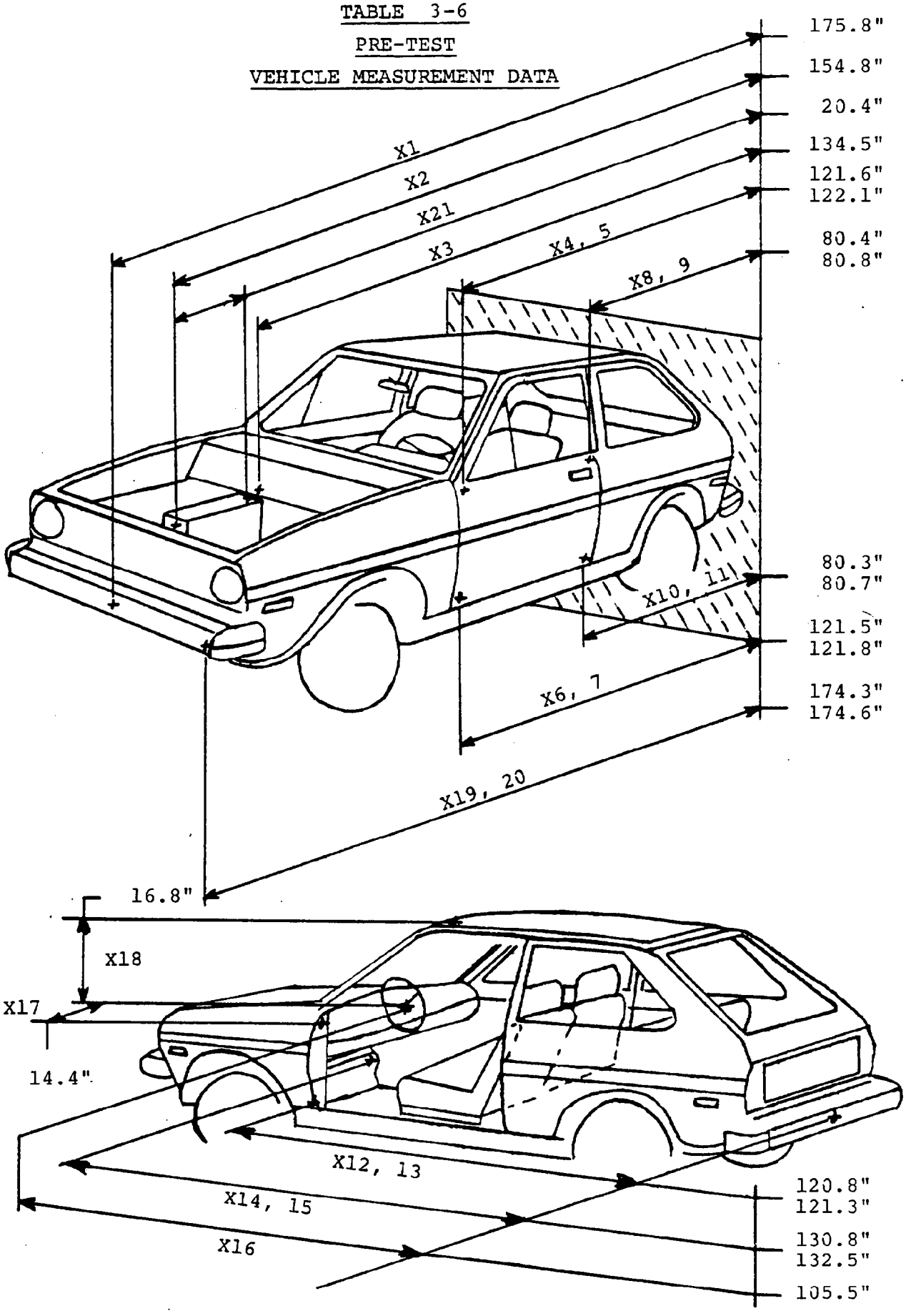
*POSITIVE DIRECTION - LONGITUDINAL: FORWARD, LATERAL: RIGHTWARD, VERTICAL: UPWARD

*NEGATIVE DIRECTION - LONGITUDINAL: REARWARD, LATERAL: LEFTWARD, VERTICAL: DOWNWARD

TABLE 3-6

PRE-TEST

VEHICLE MEASUREMENT DATA



X1	175.8"
X2	154.8"
X21	20.4"
X3	134.5"
X4, 5	121.6" / 122.1"
X8, 9	80.4" / 80.8"
X10, 11	80.3" / 80.7"
X6, 7	121.5" / 121.8"
X19, 20	174.3" / 174.6"
X18	16.8"
X17	14.4"
X12, 13	120.8" / 121.3"
X14, 15	130.8" / 132.5"
X16	105.5"

TABLE 3-7

POST-TEST

VEHICLE MEASUREMENT DATA

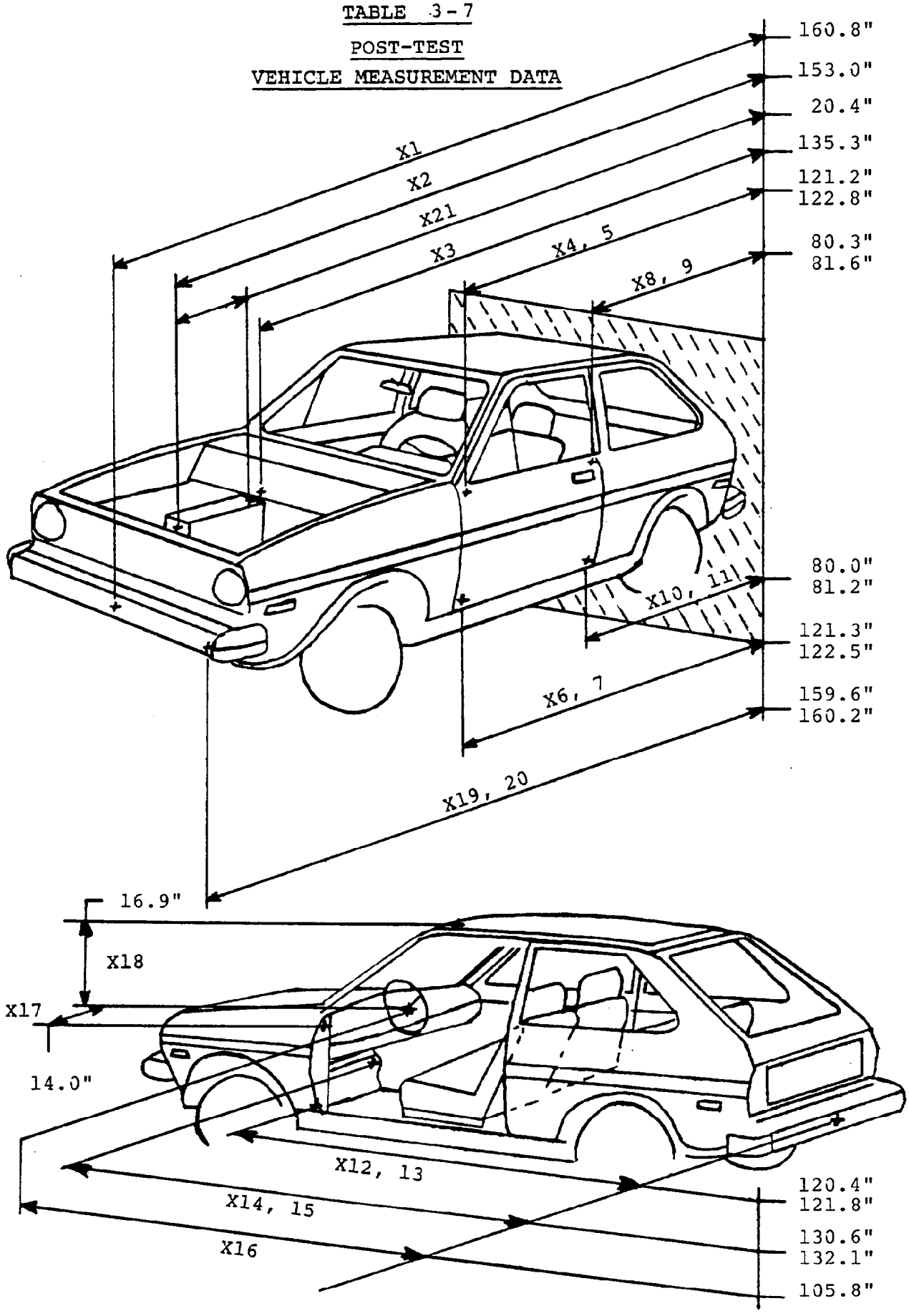


TABLE 3-8

SUMMARY

PRE-TEST AND POST-TEST VEHICLE DIMENSIONS

Measurement Point	Pre-Test	Post-Test	Difference
X1	175.8"	160.8"	15.0"
X2	154.8"	153.0"	1.8"
X3	134.5"	135.3"	+0.8"
X4	121.6"	121.2"	0.4"
X5	122.1"	122.8"	+0.7"
X6	121.5"	121.3"	0.2"
X7	121.8"	122.5"	+0.7"
X8	80.4"	80.3"	0.1"
X9	80.8"	81.6"	+0.8"
X10	80.3"	80.0"	0.3"
X11	80.7"	81.2"	+0.5"
X12	120.8"	120.4"	0.4"
X13	121.3"	121.8"	+0.5"
X14	130.8"	130.6"	0.2"
X15	132.5"	132.1"	0.4"
X16	105.5"	105.8"	+0.3"
X17	14.4"	14.0"	0.4"
X18	16.8"	16.9"	+0.1"
X19	174.3"	159.6"	14.7"
X20	174.6"	160.2"	14.4"
X21	20.4"	20.4"	0.0"

TABLE 3-9

FMVSS 212/219/301-75

CAMERA POSITIONS

VEHICLE 1983 Ford Ranger

NHTSA NO. 830603 TEST DATE May 27, 1982

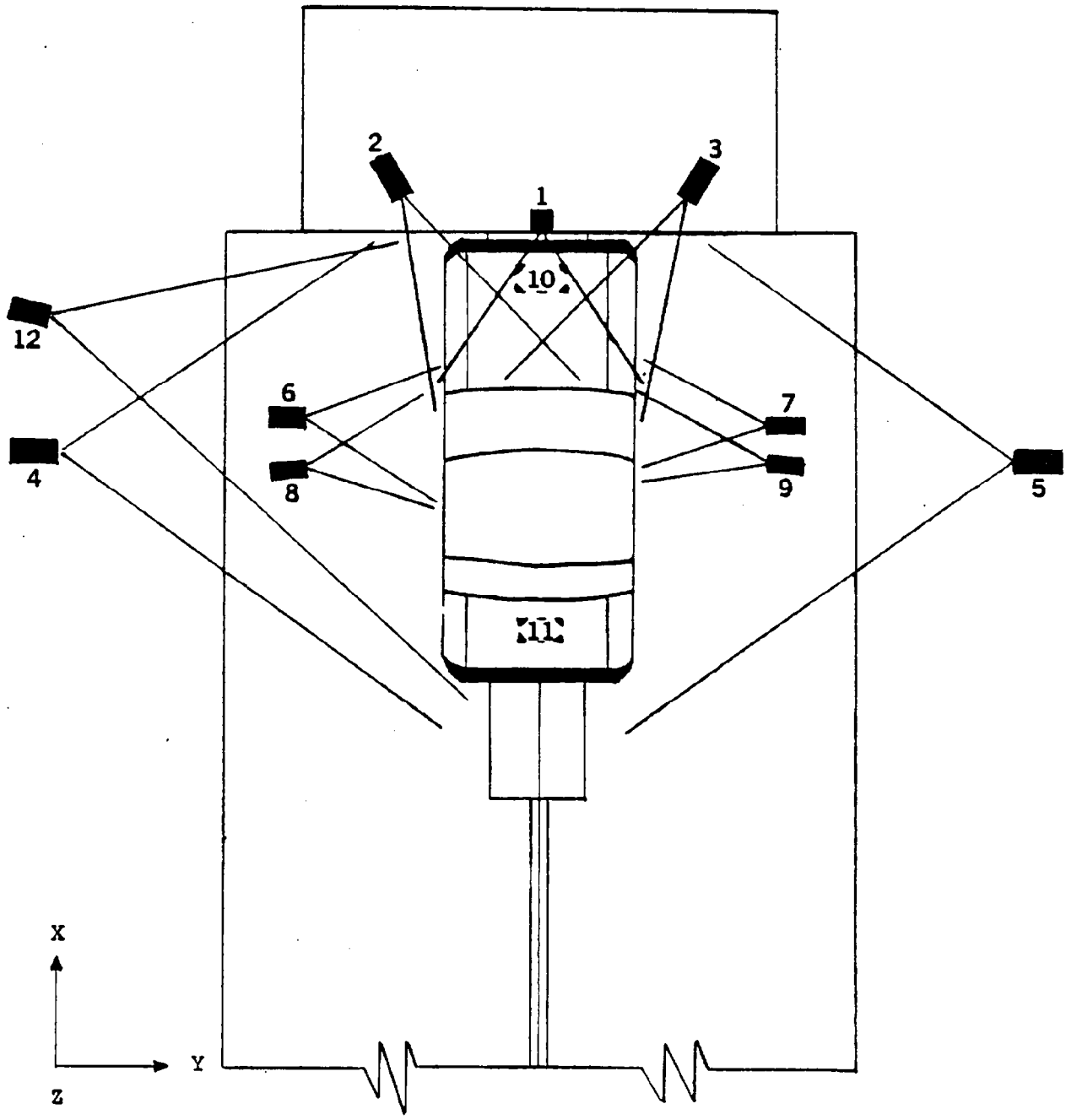


TABLE 3-10
FMVSS 212/219/301-75
CAMERA POSITIONS

VEHICLE 1983 Ford Ranger

NHTSA NO. 830603 TEST DATE May 27, 1982

1.	Photo-Sonics 13mm 500FPS	X 12.0" Y - 0 - Z 235.0"	2.	Photo-Sonics 13mm 500FPS	X -9.0" Y 28.0" Z 103.0"
3.	Photo-Sonics 13mm 500FPS	X -8.0" Y 35.0" Z 101.0"	4.	Photo-Sonics 13mm 500FPS	X 36.0" Y 276.0" Z 48.0"
5.	Photo-Sonics 13mm 500FPS	X 42.0" Y 189.0" Z 55.0"	6.	Locam 12.5mm 500FPS Dummy Head	X 80.0" Y 94.0" Z 58.0" 78.0"
7.	Locam 13mm 500FPS Dummy Head	X 81.0" Y 94.0" Z 59.0" 77.0"	8.	Locam 15mm 500FPS Dummy Head	X 87.0" Y 94.0" Z 58.0" 77.0"
9.	Locam 12.5mm 500FPS Dummy Head	X 88.0" Y 93.0" Z 59.0" 76.0"	10.	Photo-Sonics 13mm 500FPS	X -16.0" Y 1.0" Z -36.0"
11.	Photo-Sonics 13mm 500FPS	X 163.0" Y 9.0" Z -32.0"	12.	Canon Scoopic 12.5 - 75mm 24FPS - Documentary -	

SECTION 3

3.1 TEST RESULTS AND PHOTOGRAPHS

The test vehicle performance was determined by a frontal fixed barrier impact at an average speed of 29.69 mph. The vehicle rebound distance from the barrier face was 6.75 inch and the average static crush was 14.55 inch.

Post-impact inspection of the test vehicle revealed almost all crush occurred forward of the cab doors. The left and right frame rail buckled under the cab door and the cargo box impacted the cab wall. The driver dummy head made contact with the steering wheel assembly and both knees impacted the dash assembly. The passenger dummy head made contact with the rear cab window and both knees impacted the dash assembly.

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 0.0 inch and the passenger shoulder belt was 1.0 inch.

SECTION 3

The steering column assembly was marked and measured prior to the impact event to provide a static measurement of the steering column movement after the impact. Post-impact measurement determined approximately 0.5 inch steering column collapse while moving leftward 0.4 inch; downward 0.1 inch; forward 0.3 inch.

Figure 3-1

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

Pre-Test, Full Front View

Figure 3-2

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

Pre-Test, Left Side View


830603
NHTSA 830603
FMVSS 212 219 301

Figure 3-3

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

Pre-Test, Right Side View


NHTSA 830603
FMVSS 212 219 301
Ranger

Figure 3-4

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

Post-Impact, Full Front View

Figure 3-5

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

Post-Impact, Left Side View


830603

Figure 3-6

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

Post-Impact, Right Side View


830603

Figure 3-7

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

Pre-Test, Driver Dummy View

Figure 3-8

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

Pre-Test, Driver Dummy View

Figure 3-9

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

Pre-Test, Passenger Dummy View

Figure 3-10

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

Pre-Test, Passenger Dummy View

Figure 3-11

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

Post-Impact, Driver Dummy View

Figure 3-12

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

Post-Impact, Driver Dummy Contact Area

Figure 3-13

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

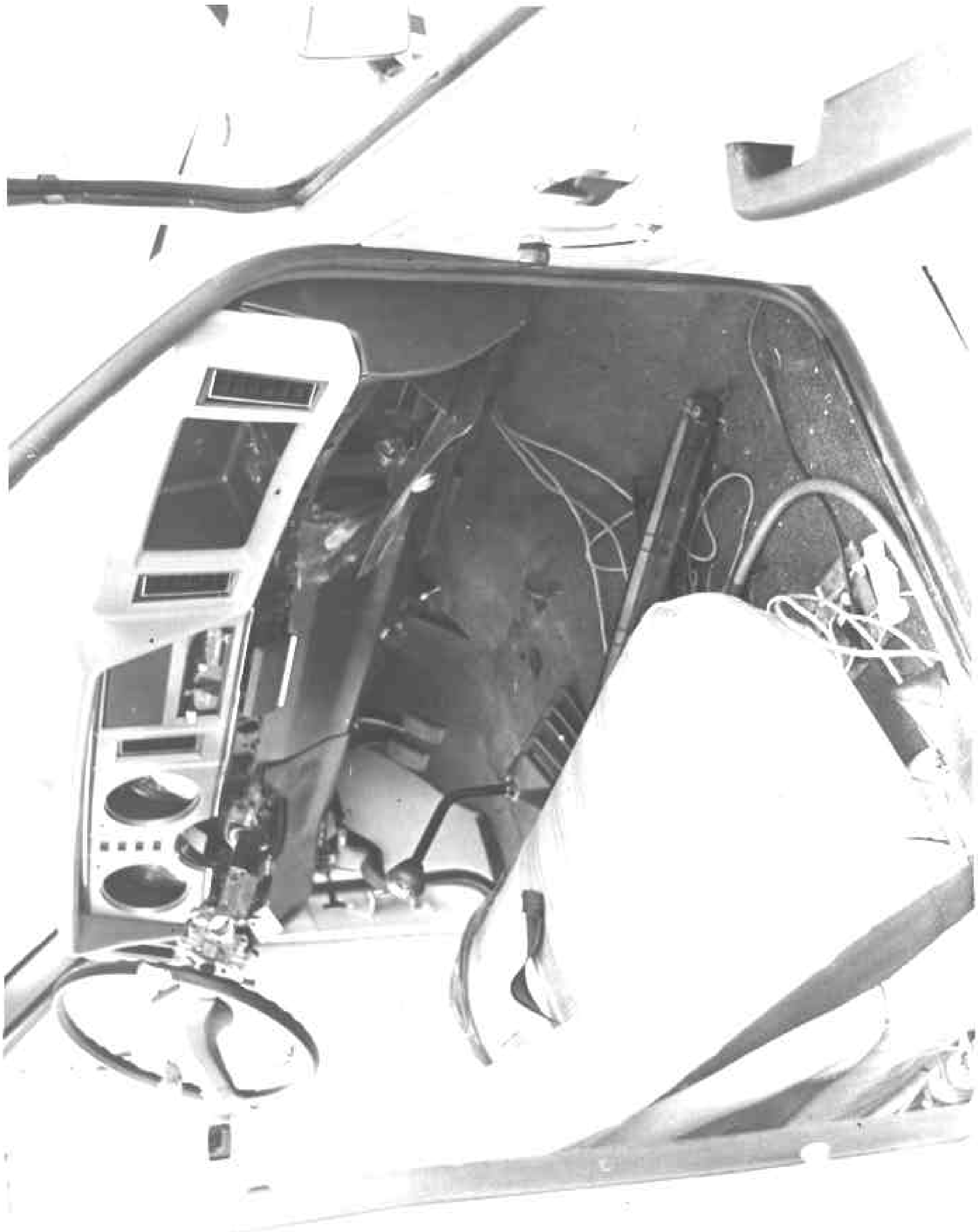
Post-Impact, Passenger Dummy View

Figure 3-14

1983 Ford R100 Ranger Styleside - Pickup

NHTSA 830603

Post-Impact, Passenger Dummy Contact Area



SECTION 4

4.0 TEST FACILITIES AND EQUIPMENT

National Technical Systems (NTS) 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 aliding 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

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 above 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 camera each have a side view of the test vehicle at impact. The sixth, seventh, eighth, and ninth camera are located adjacent to the test vehicle front passenger compartment and positioned to photograph motion of each test dummy at impact. The tenth and eleventh camera 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 three (3) 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. Four (4) of the high speed cameras are located at stationary positions near the point of impact. Two (2) 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 third and fourth camera each have a side view of the test vehicle at impact.

The fifth 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 4-1. A complete list of instrumentation is provided in Table 4-1. An itemized procedure for acquiring data is provided on Table 4-2.

Prior to the vehicle impact test the onboard instrumentation package 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 48 db/octave above 1250 Hz for class 60, class 180 and class 600 data. A predigitizing filter of 24 db/octave above 1650 Hz is used for class 1000 data.

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. Table 4-3 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. (Nine vehicle sets are stored on each magnetic disc. All magnetic discs and FM recorder tapes are retained on file at NTS).

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 (5000 Hz sampling for a 200 ms window). After the data is moved to permanent storage it is recalled by test personnel and plotted with the appro-

priate label and vehicle designation. As the data is recalled, the DFA is programmed to automatically filter the data with the appropriate SAE filter.

Figure 4-2 illustrates the SAE class 60, 180, 600 and 1000 filters applied to the data. These filters are in accordance with SAE J211a, Instrumentation for Impact Tests. These recommended filters are quadratic double pole with 65% damping and a 12 db/octave rolloff. They are applied to the data using a Fast Fourier Transform (FFT) of the data, frequency domain multiplication, and an inverse Fast Fourier Transform (FFT) of the product.

It should be noted that in Figure 4-2 the predigitizing analog filter attenuates data above the 1250 Hz or 1650 Hz cutoff frequency. This has no effect on the class 60 or class 180 data. The class 600 data is within SAE J211a recommendation to 1900 Hz and -20 db. Above 1900 Hz the class 600 data is attenuated at 48 db/octave instead of 24 db/octave. This has very negligible effect on the class 600 data. The modification of class 1000 data, by predigitizing filter, is attenuation of 24 db/octave above

1650 Hz. Therefore, the class 1000 data falls within the filter envelope as defined by SAE J211b until 2500 Hz and -15 db.

Class 60 filters are applied to the vehicle acceleration and belt restraint forces, while the class 180 filter is applied to the chest acceleration forces. The class 600 filter is applied to the femur forces and class 1000 filter is applied to the head acceleration forces.

4.7.1 IMPACT DATA

All impact data is presented in computer plots of data digitized at 200 microseconds. Special SAE filters are applied to the 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 as class 1000 data, 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 and the highest acceleration value of at least three millisecond duration (3 ms clip) are performed. Data output is in the form of computer plots with the 3 ms clip calculations.

4.7.1.4 FEMUR LOAD DATA

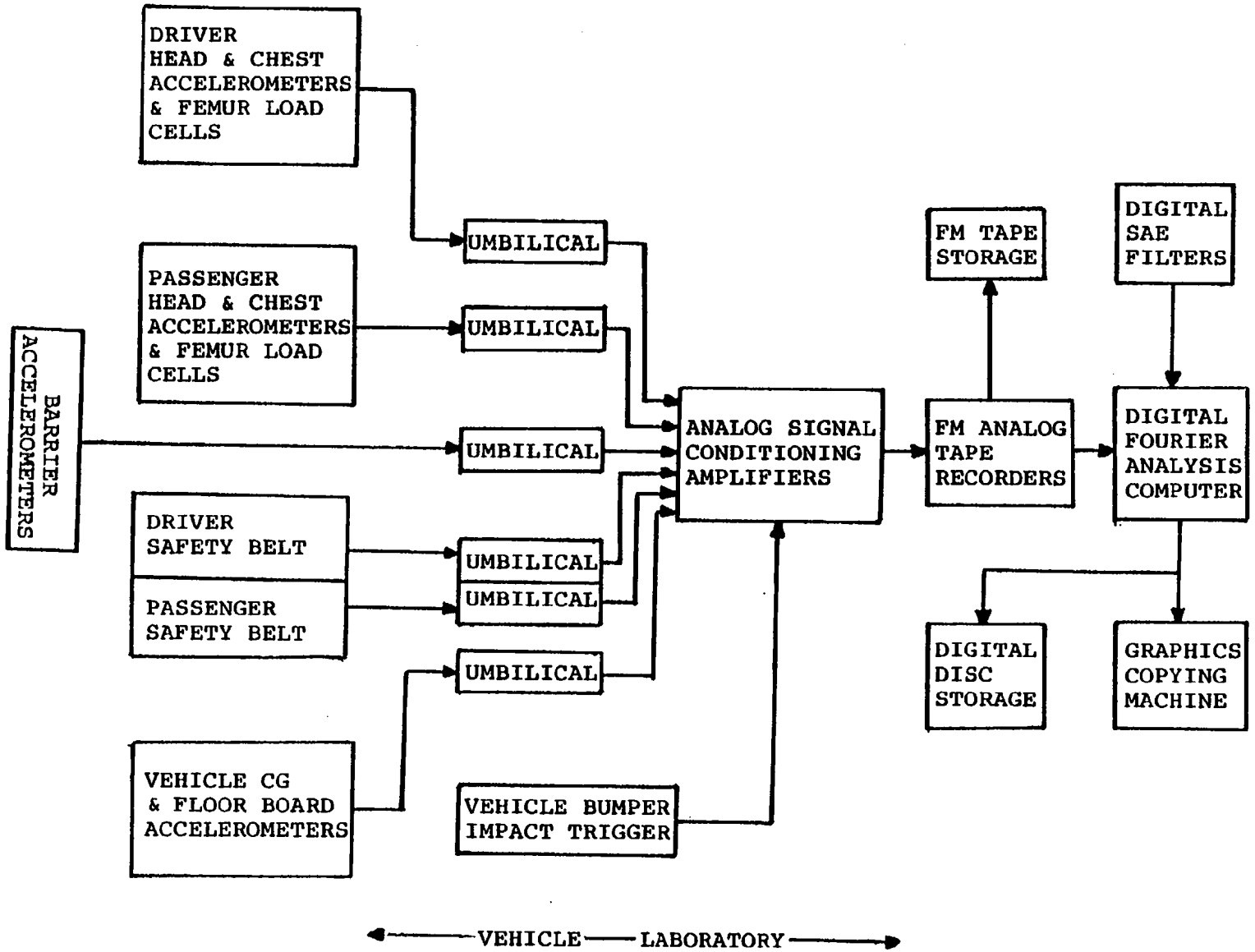
The dummy femur loads are processed as class 600 data, and presented as computer plots.

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. Additionally, the longitudinal vehicle acceleration is integrated to provide approximate vehicle velocity change and vehicle crush during the impact event.



VEHICLE AND OCCUPANT CRASH IMPACT DATA ACQUISITION SYSTEM

FIGURE 4-1

TABLE 4-1 INSTRUMENTATION FOR CRASH TEST

Instrument	Manufacturer	Model No.	Full Scale	Accuracy	Frequency Max.
Accelerometers, Head, Chest, Vehicle	Endevco	2262C-200	200g	±1%	3600 Hz
Load Cells, Femurs	GSE	2430	3000 lb	±1%	>3600 Hz
Load Cells, Safety Belts	GSE	2500	3000 lb	±1%	>3600 Hz
Contact Switch, Impact	NTS	-	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	5444OA	-	0.5%	1250 Hz, 48 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	-	-
Low Pass Filter	Rockland	452	-	±1%	1650 Hz, 24 db/oct

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 or 1650 Hz b) Data digitized at 200 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
13	Vehicle Dynamics Evaluated (MPH & Crush)

TABLE 4-3

DATA DESIGNATIONS FOR VEHICLE CRASH IMPACT DATA ACQUISITION

Data Set	Tape No.	Channel No.	Description
1	1	1	Driver Longitudinal Head Acceleration 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 Shoulder Belt Force
3	1	10	Driver Lap Belt Force
4	1	11	Left Rear Floor Pan Longitudinal Acceleration Ax
10	1	12	Vehicle Longitudinal CG Acceleration Ax
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 Left Femur Force
7	2	9	Passenger Shoulder Belt Force
7	2	10	Passenger Lap Belt Force
4	2	11	Right Front Floor Pan Longitudinal Acceleration Ax
4	2	12	Right Front Floor Pan Lateral Acceleration Ay
9	3	1	Engine Longitudinal Acceleration Ax
9	3	2	Engine Lateral Acceleration Ay
9	3	3	Engine Vertical Acceleration Az
4	3	5	Left Rear Floor Pan Lateral Acceleration Ay

DOT CRASH PROGRAM

NATIONAL TECHNICAL SYSTEMS

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

SAE FILTER ROLL OFF IS 12 DB/OCTAVE, ANALOG FILTER ROLL OFF IS 48 DB/O

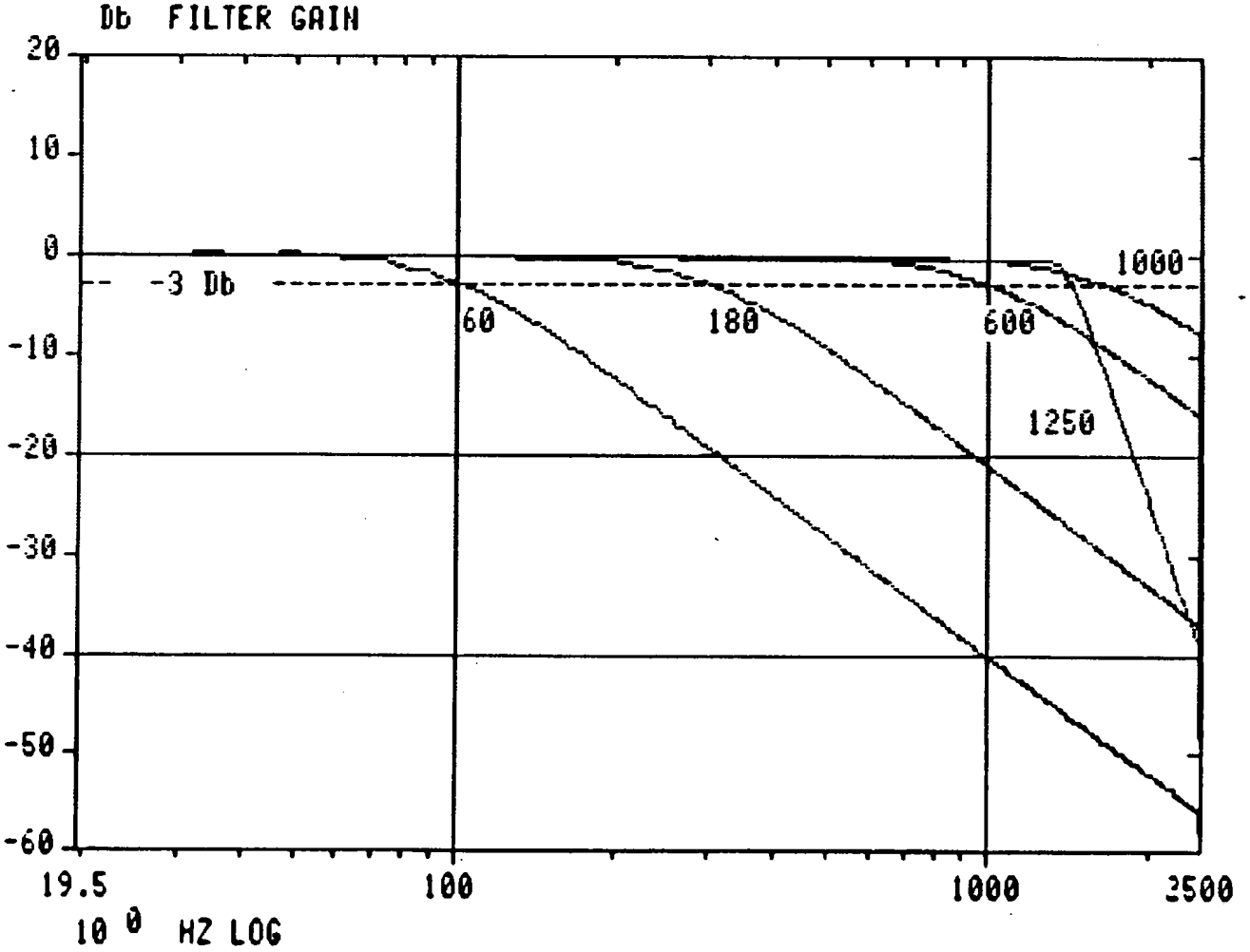


FIGURE 4-2

APPENDIX A

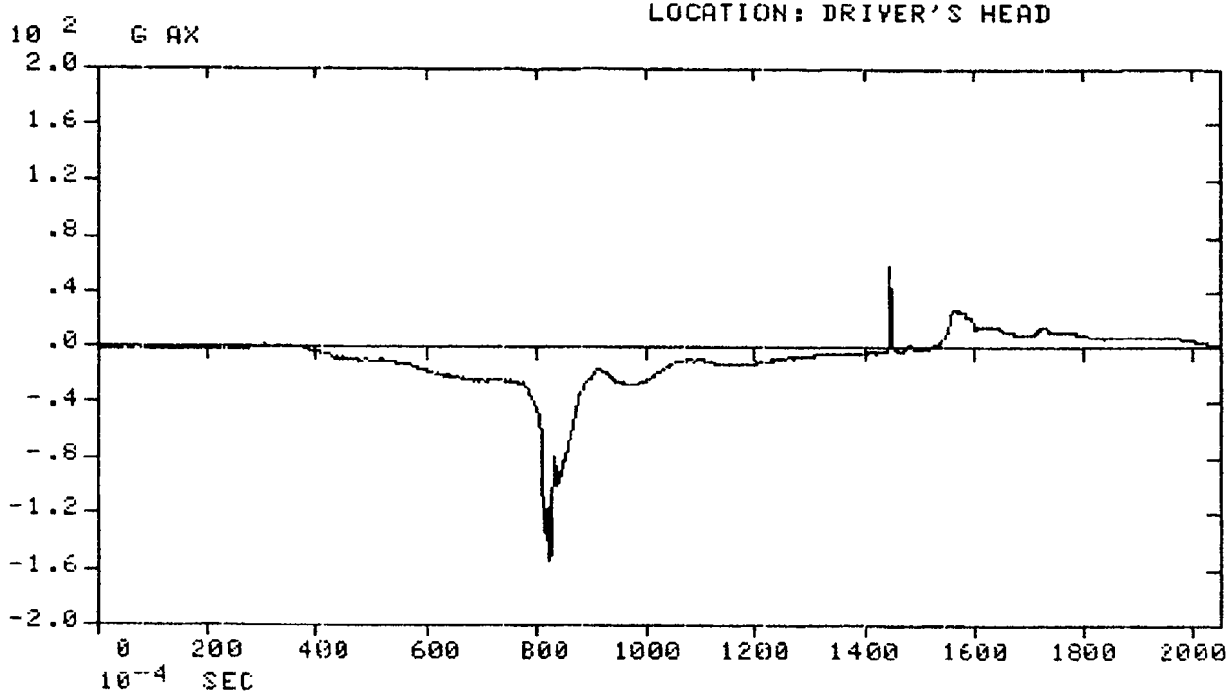
The following computer plots provide complete and comprehensive occupant response and vehicle acceleration during the frontal fixed barrier impact test of a 1983 Ford R100 Ranger Styleside - Pickup, NHTSA 830603.

DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 1000
ACCELEROMETER: TAPE 1, CH 1
DIRECTION: FORWARD
LOCATION: DRIVER'S HEAD

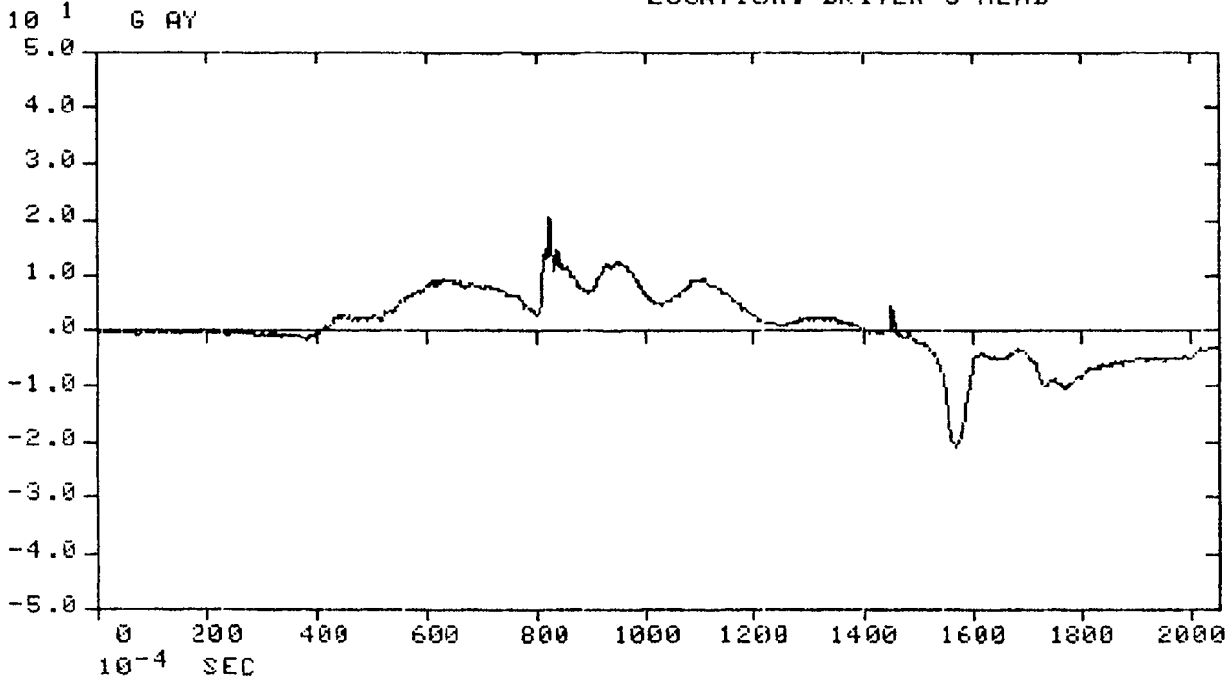


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER : CLASS 1000
ACCELEROMETER: TAPE 1, CH 2
DIRECTION: LEFT
LOCATION: DRIVER'S HEAD

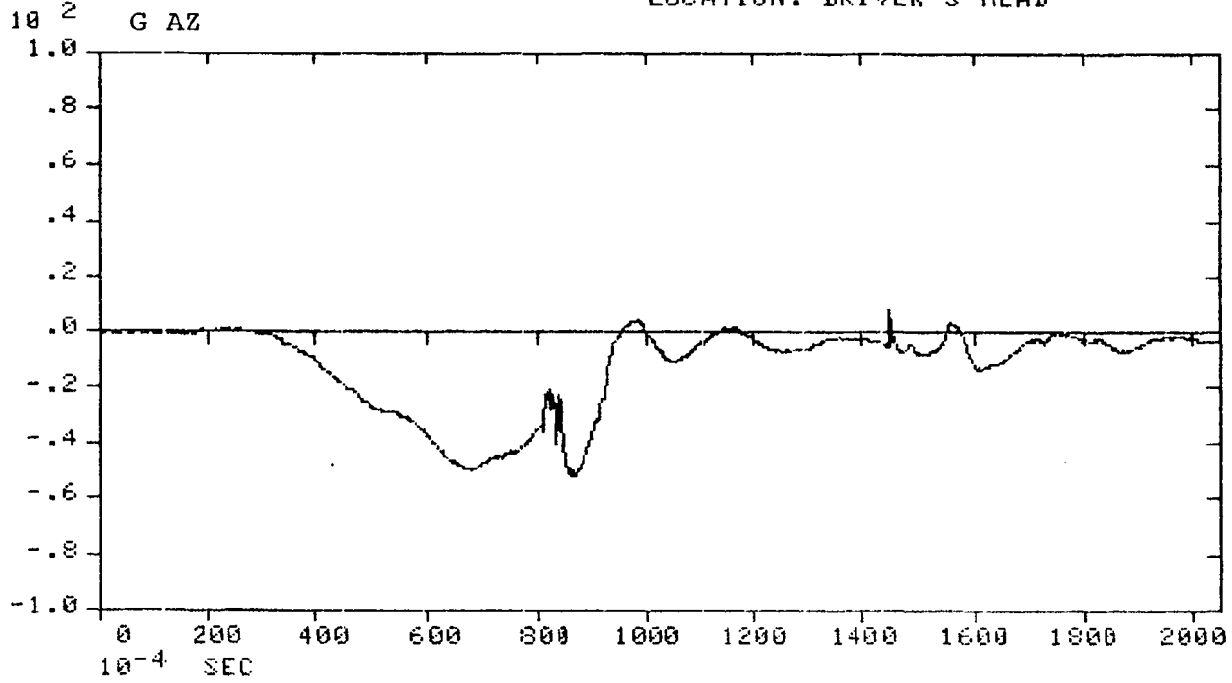


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 1000
ACCELEROMETER: TAPE 1, CH 3
DIRECTION: UPWARD
LOCATION: DRIVER'S HEAD

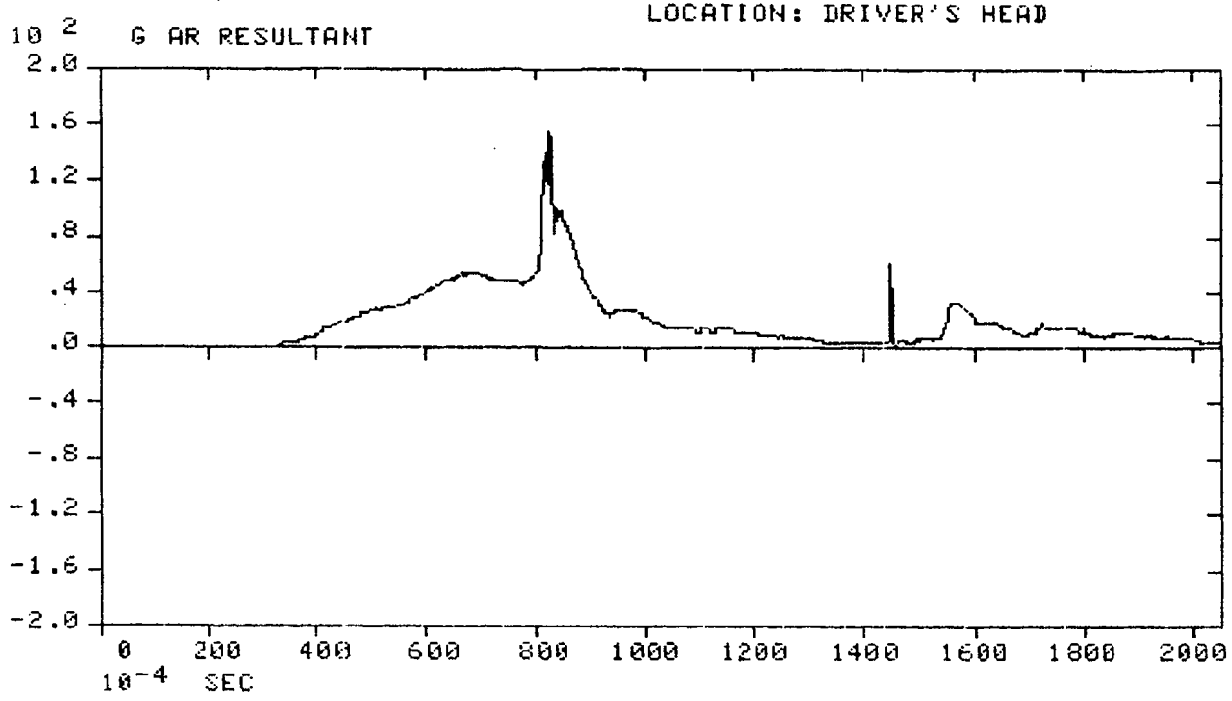


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 1000
ACCELEROMETER: TAPE 1, CH 1-3
DIRECTION: RESULTANT OF XYZ
LOCATION: DRIVER'S HEAD

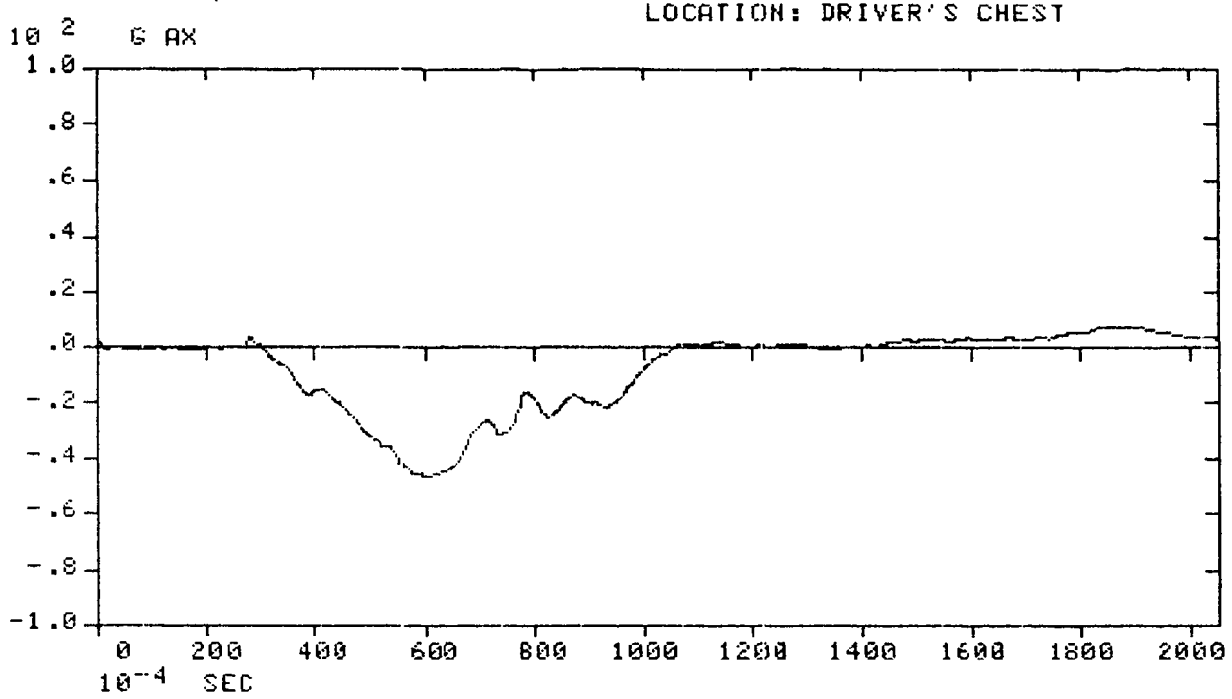


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 5
DIRECTION: FORWARD
LOCATION: DRIVER'S CHEST

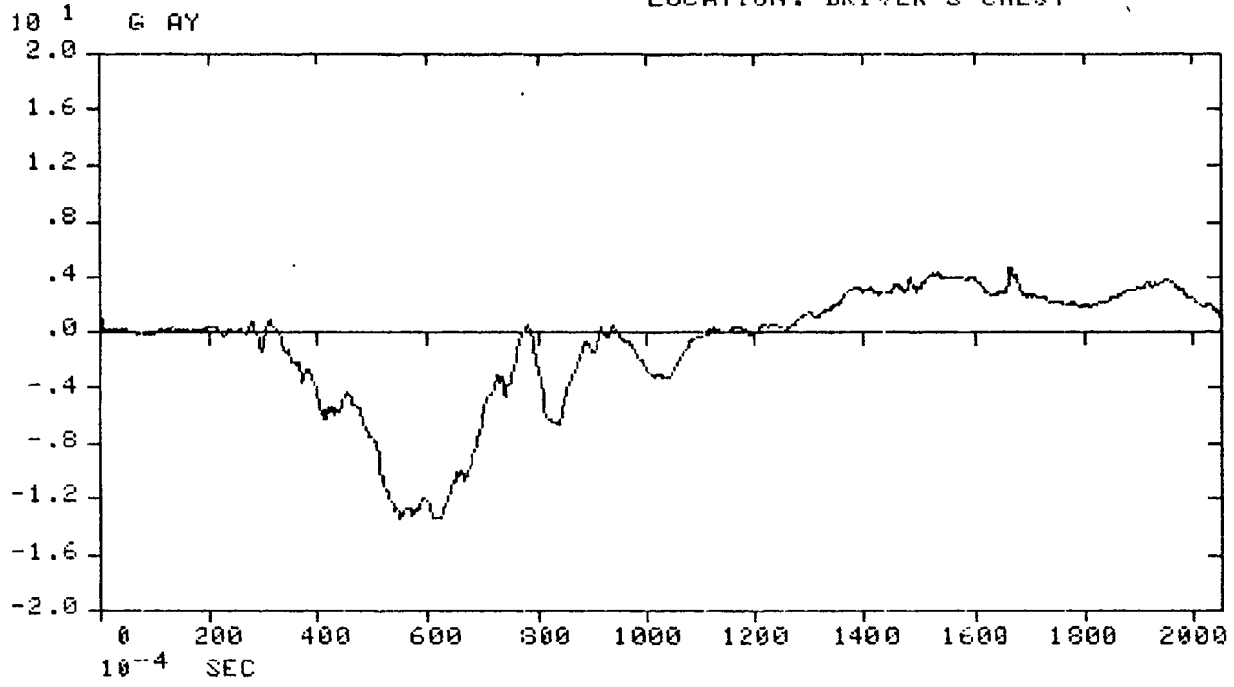


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 6
DIRECTION: LEFT
LOCATION: DRIVER'S CHEST

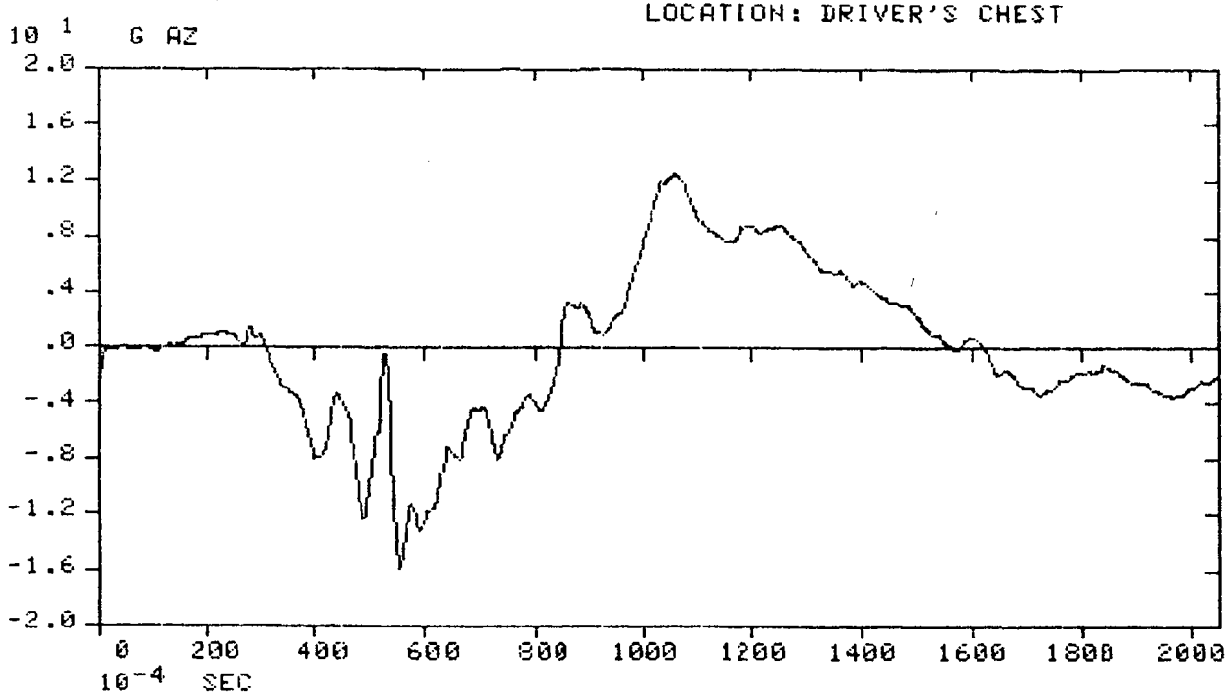


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 7
DIRECTION: UPWARD
LOCATION: DRIVER'S CHEST

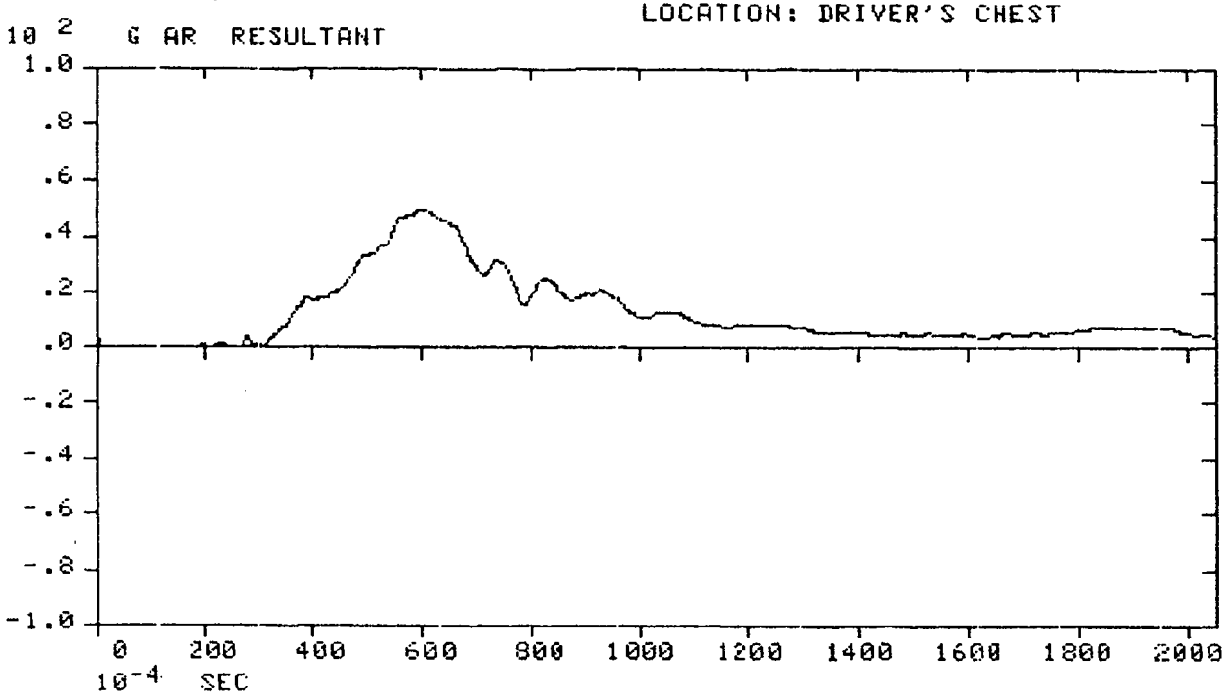


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 5-7
DIRECTION: RESULTANT OF XYZ
LOCATION: DRIVER'S CHEST

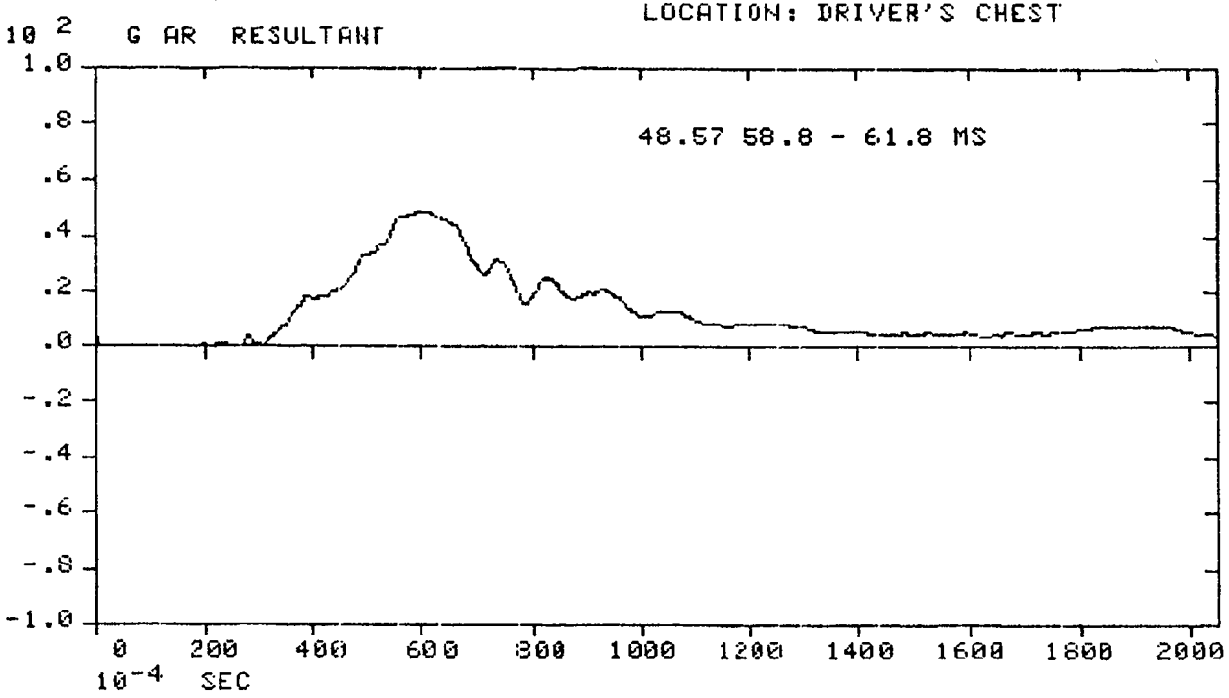


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 5-7
DIRECTION: RESULTANT OF XYZ
LOCATION: DRIVER'S CHEST

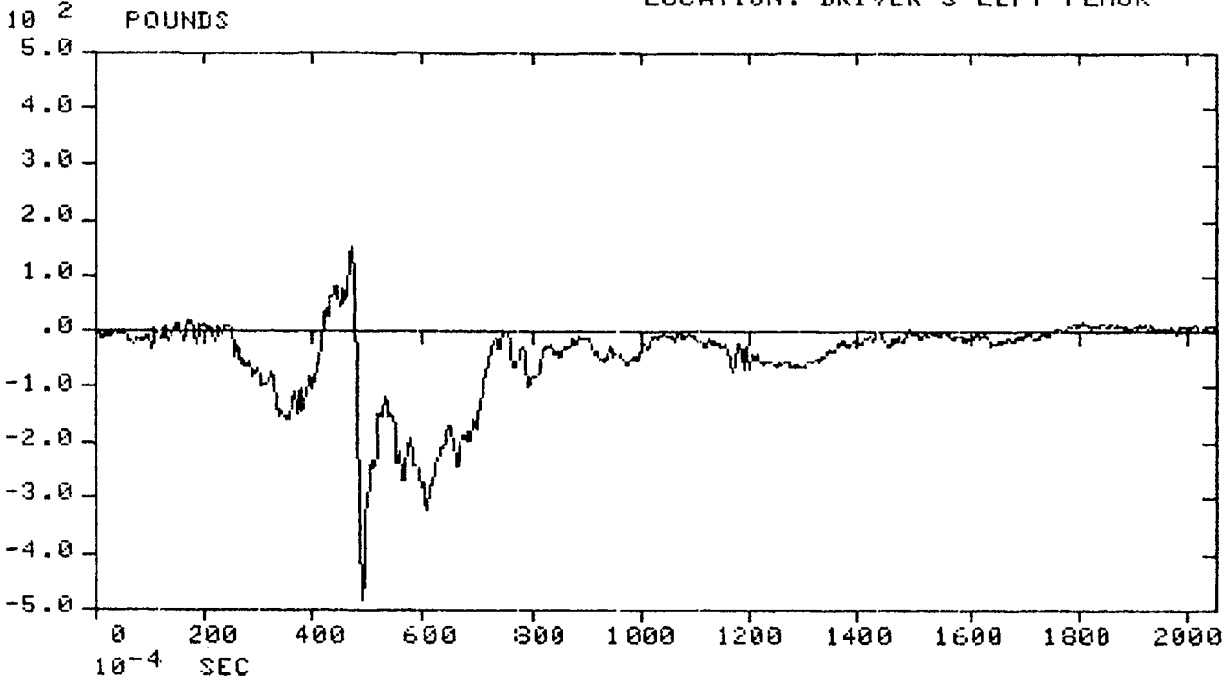


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 600
LOAD CELL: TAPE 1, CH 8
DIRECTION: TENSION
LOCATION: DRIVER'S LEFT FEMUR

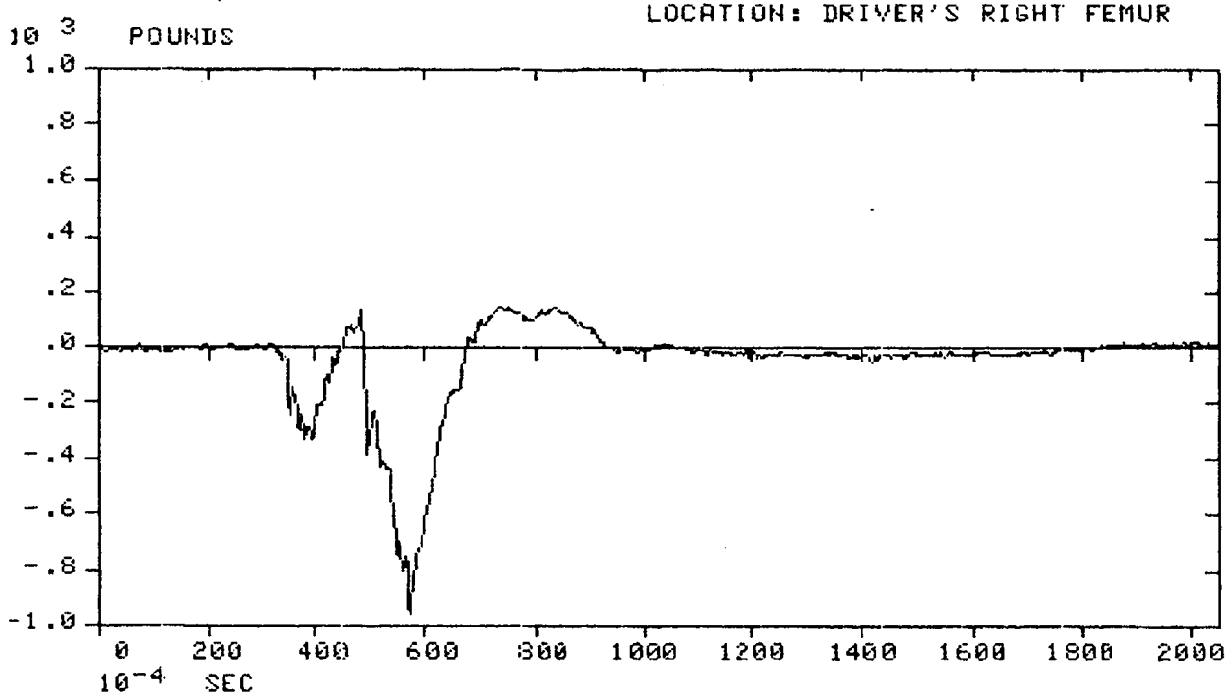


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 600
LOAD CELL: TAPE 1, CH 4
DIRECTION: TENSION
LOCATION: DRIVER'S RIGHT FEMUR

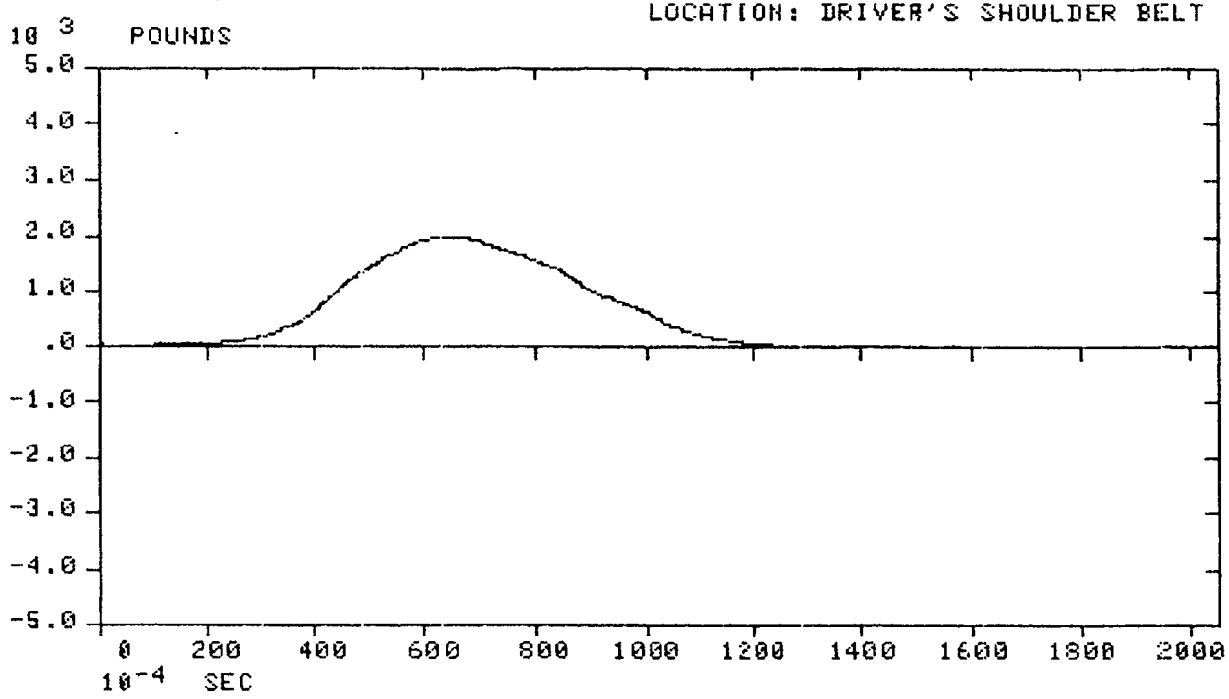


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
LOAD CELL: TAPE 1, CH 9
DIRECTION: TENSION
LOCATION: DRIVER'S SHOULDER BELT

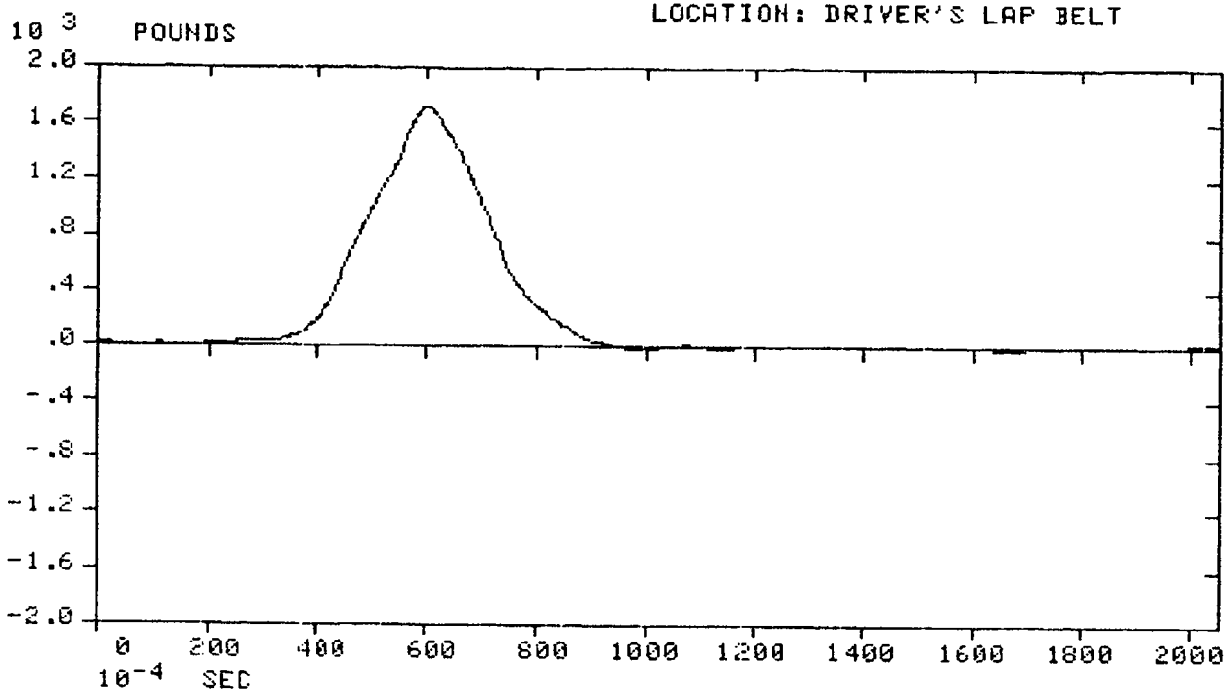


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
LOAD CELL: TAPE 1, CH 10
DIRECTION: TENSION
LOCATION: DRIVER'S LAP BELT

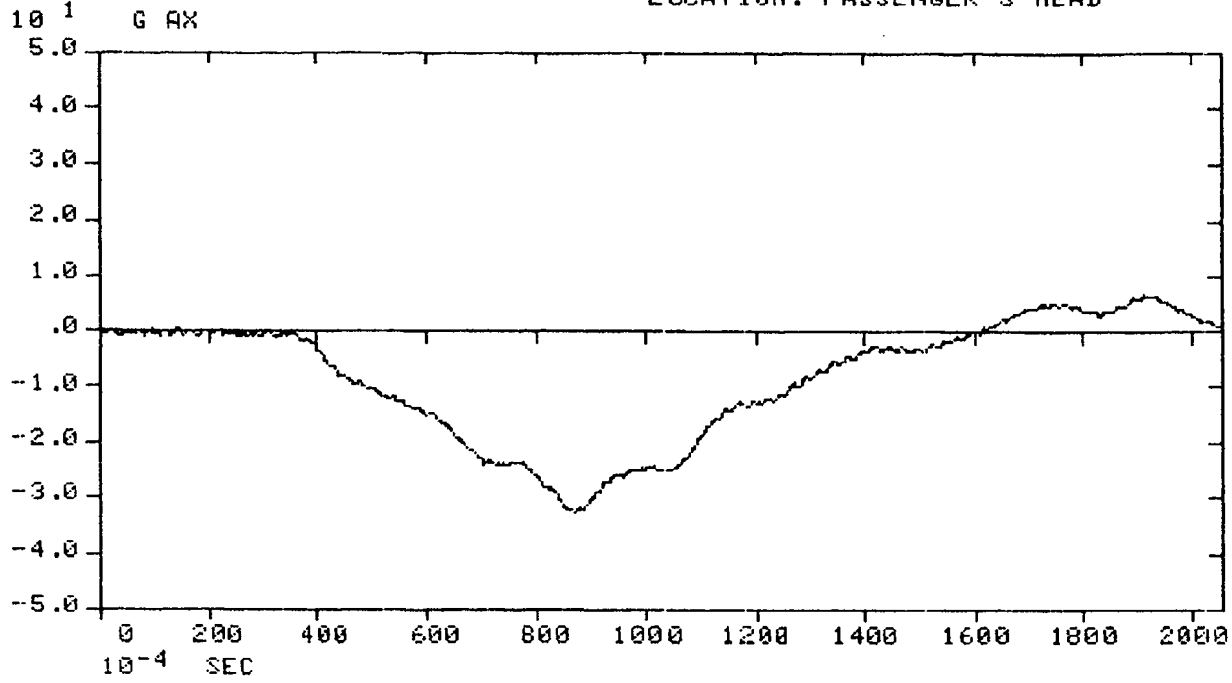


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 1
DIRECTION: FORWARD
LOCATION: PASSENGER'S HEAD

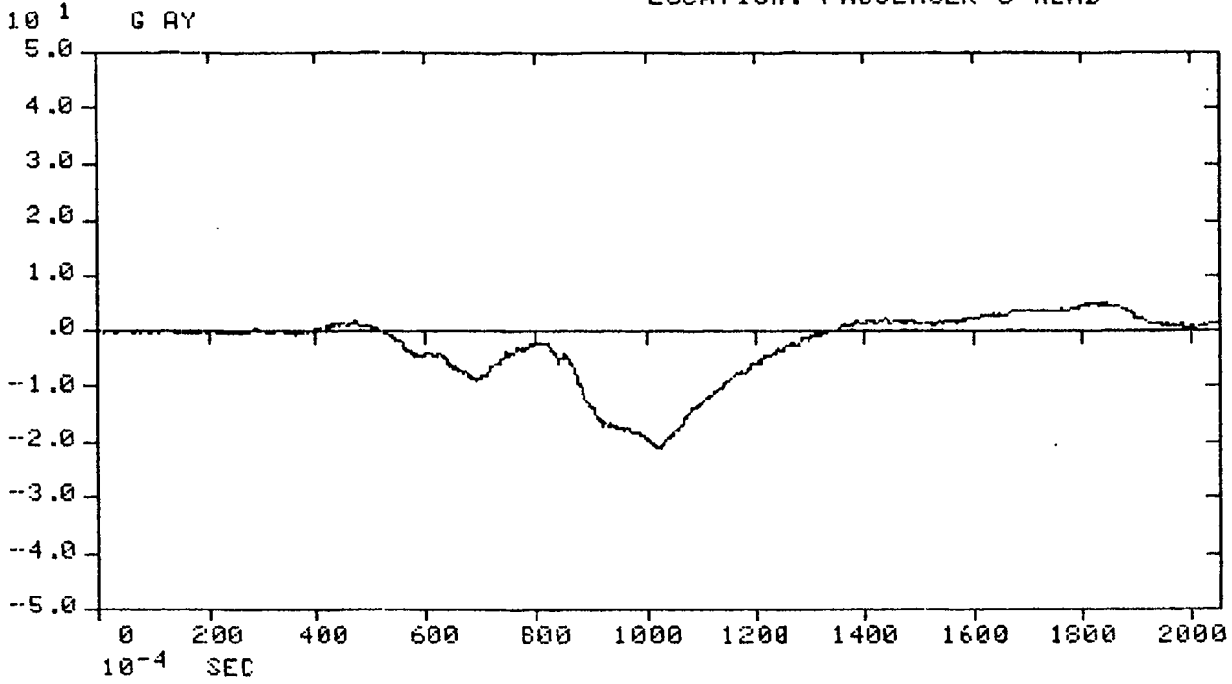


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 2
DIRECTION: LEFT
LOCATION: PASSENGER'S HEAD

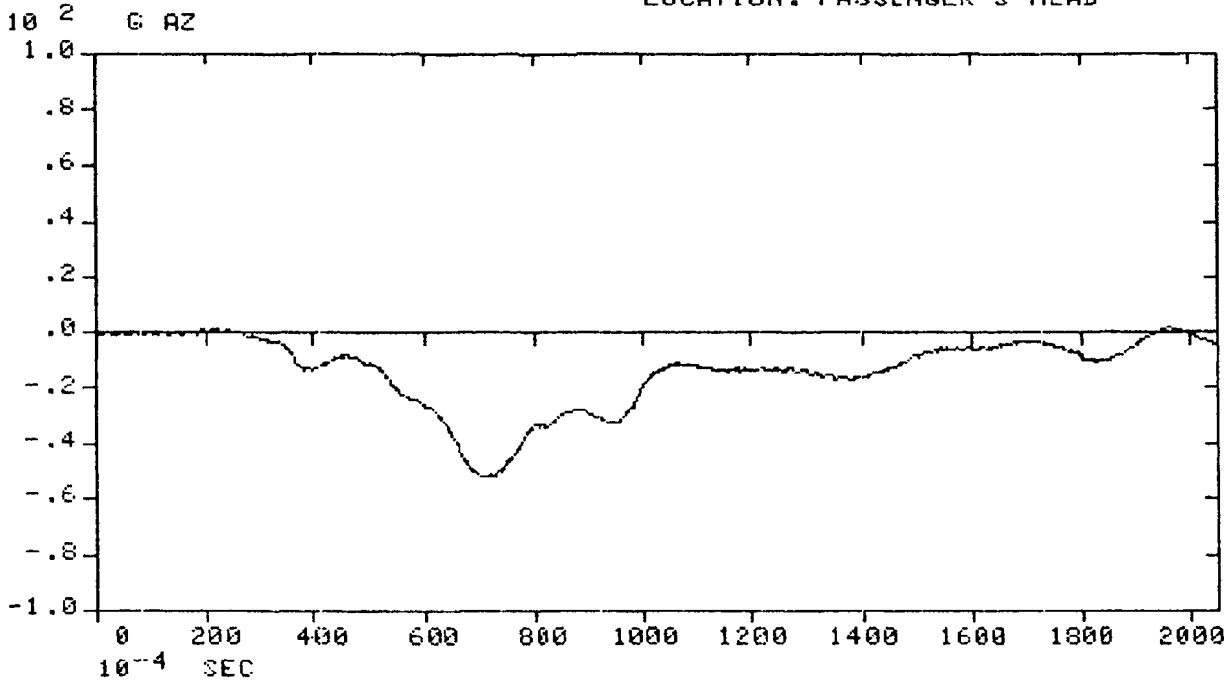


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 3
DIRECTION: UPWARD
LOCATION: PASSENGER'S HEAD

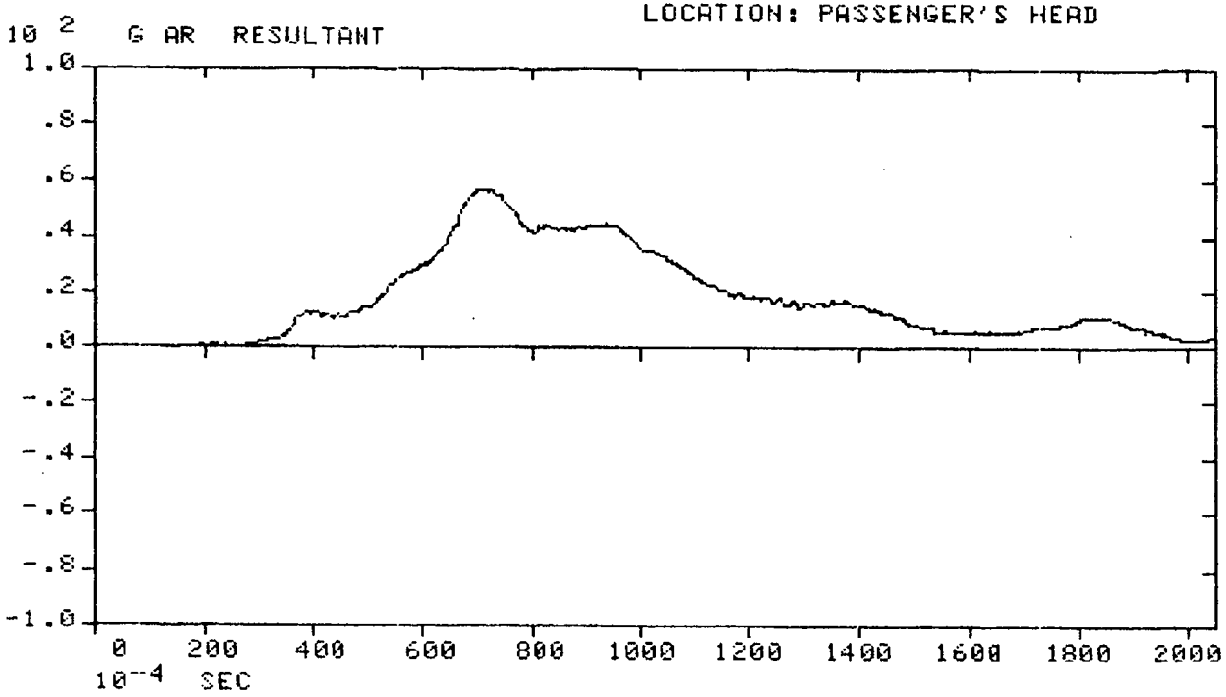


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 1-3
DIRECTION: RESULTANT OF XYZ
LOCATION: PASSENGER'S HEAD

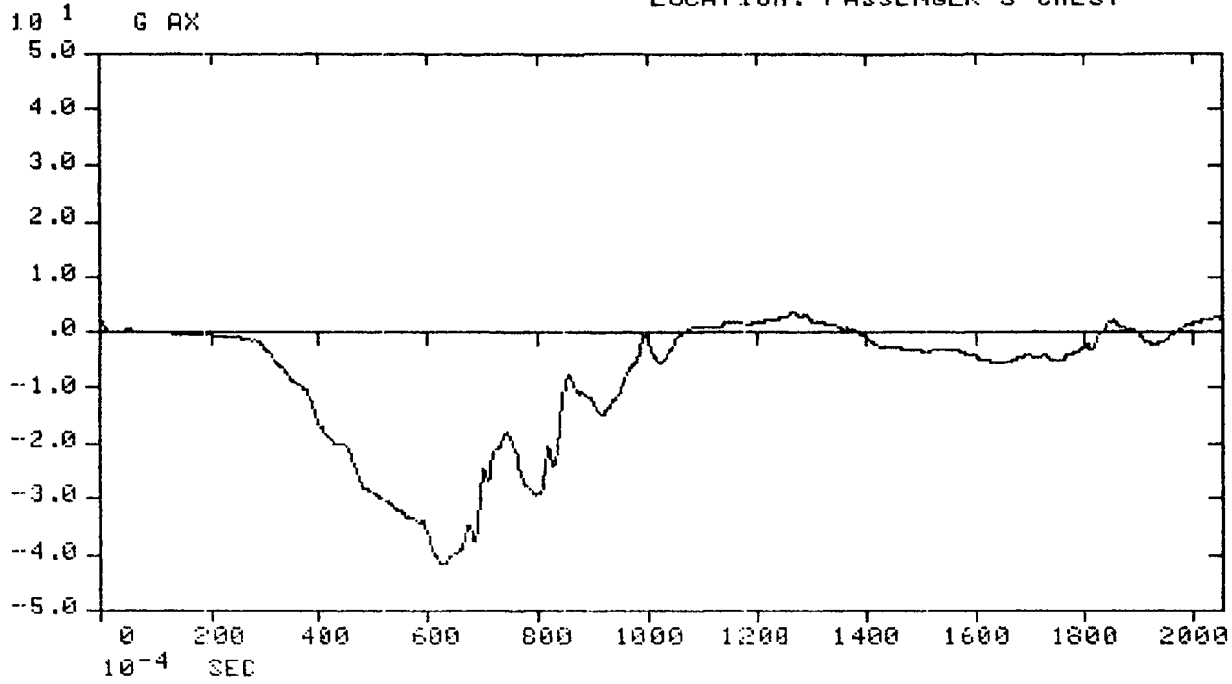


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 180
ACCELEROMETER: TAPE 2, CH 5
DIRECTION: FORWARD
LOCATION: PASSENGER'S CHEST

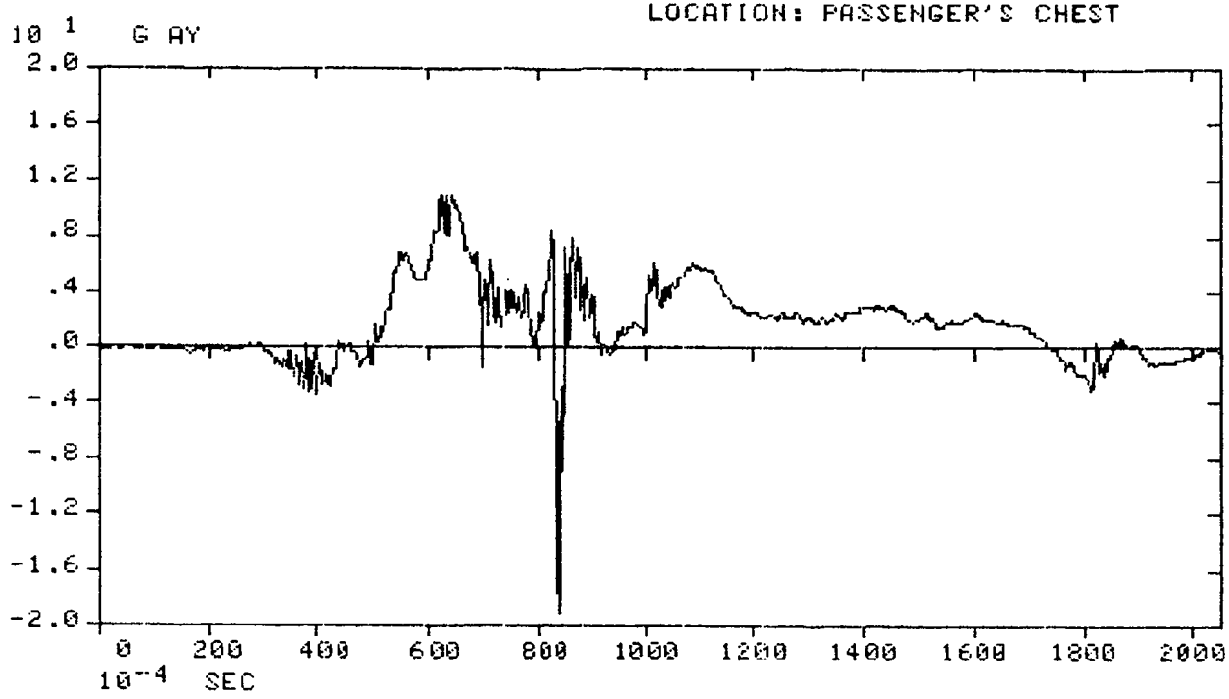


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 180
ACCELEROMETER: TAPE: 2, CH 6
DIRECTION: LEFT
LOCATION: PASSENGER'S CHEST

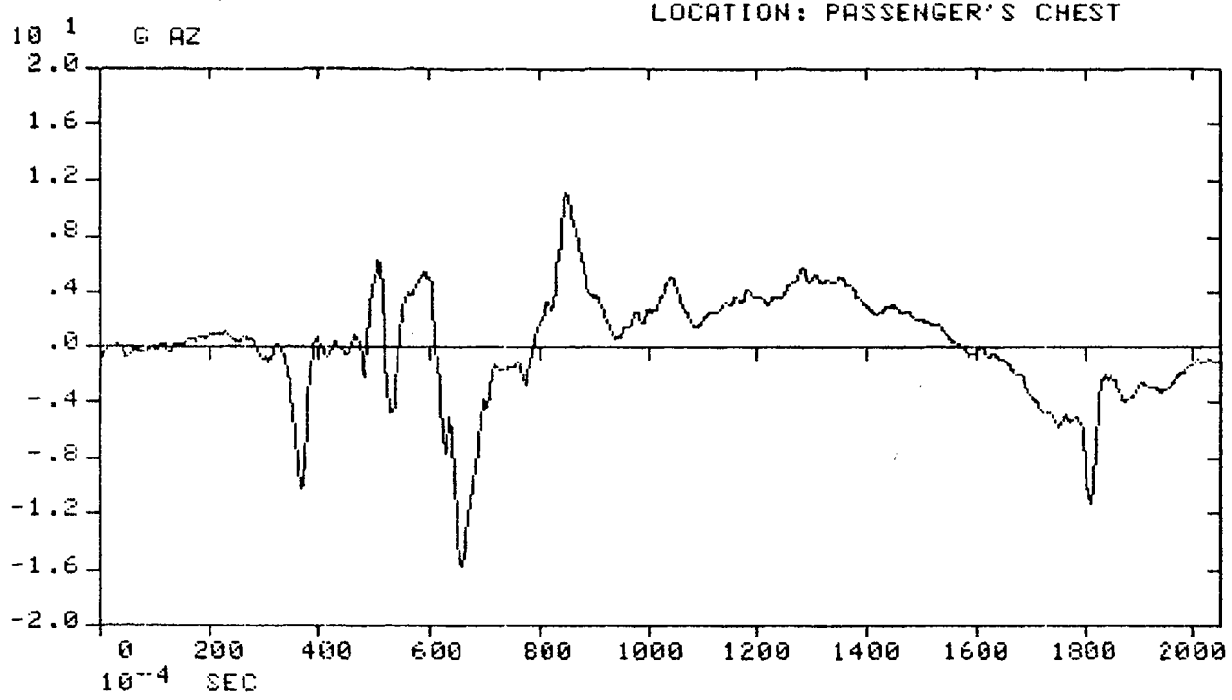


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 180
ACCELEROMETER: TAPE 2, CH 7
DIRECTION: UPWARD
LOCATION: PASSENGER'S CHEST

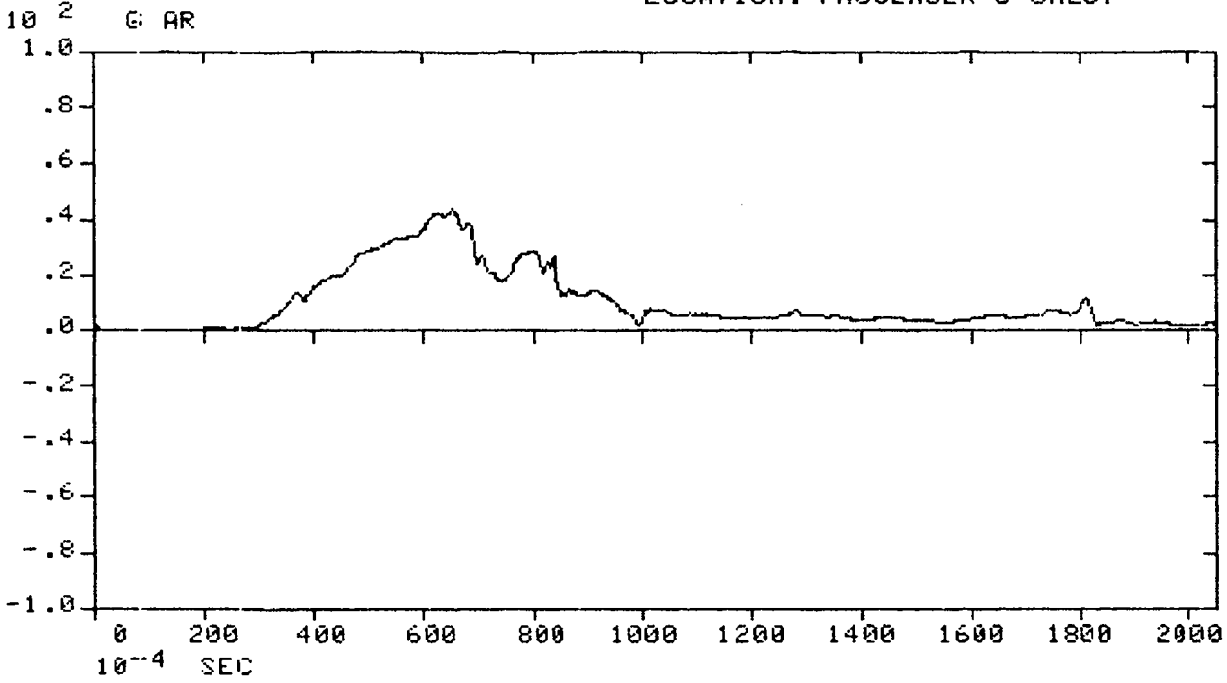


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 5-7
DIRECTION: RESULTANT OF XYZ
LOCATION: PASSENGER'S CHEST

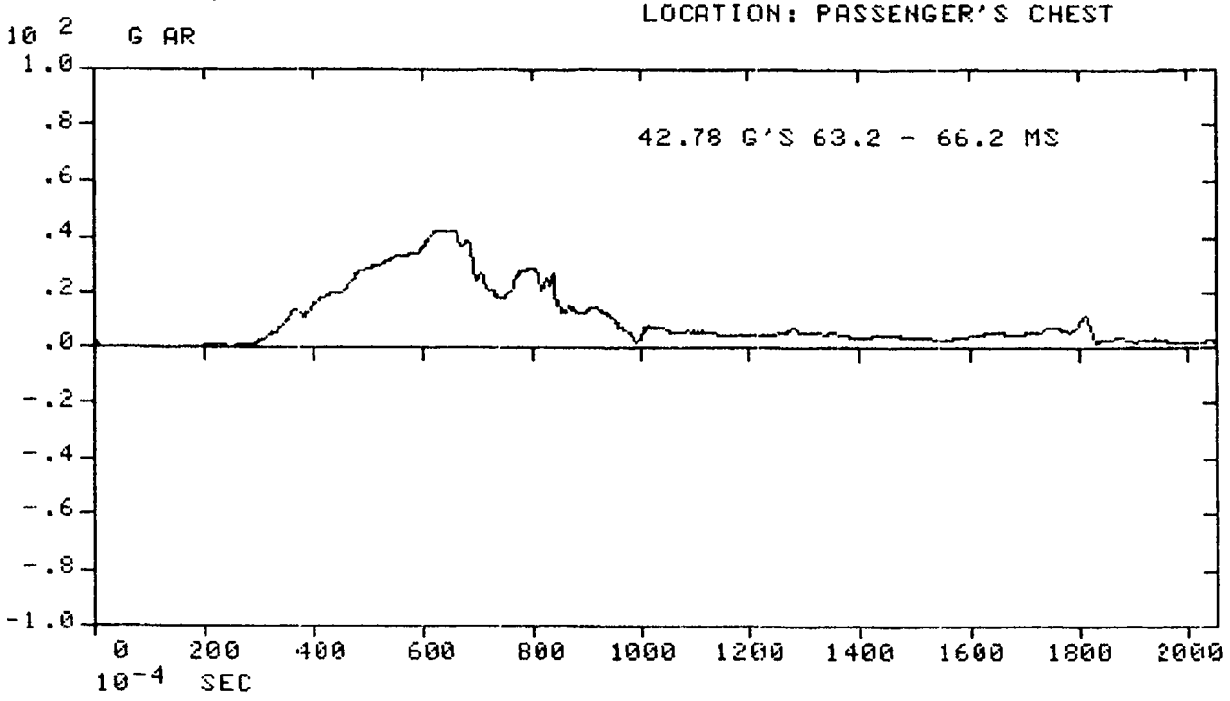


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 5-7
DIRECTION: RESULTANT OF XYZ
LOCATION: PASSENGER'S CHEST

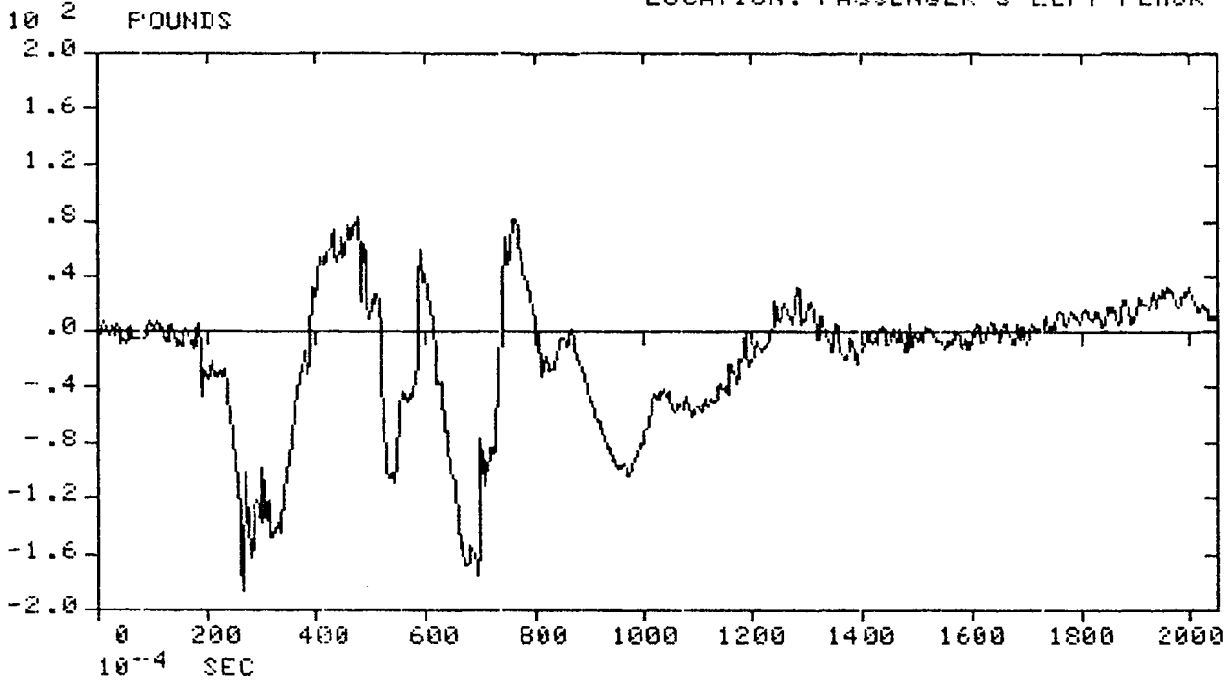


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 600
LOAD CELL: TAPE 2, CH 8
DIRECTION: TENSION
LOCATION: PASSENGER'S LEFT FEMUR

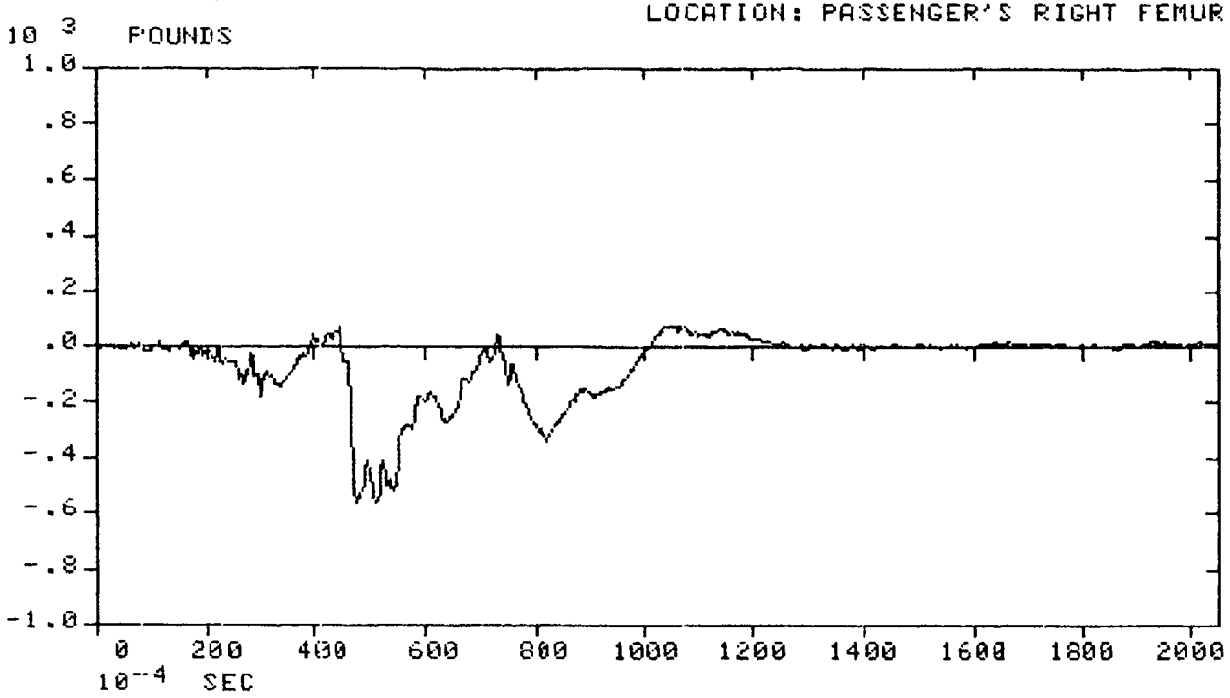


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 600
LOAD CELL: TAPE 2, CH 4
DIRECTION: TENSION
LOCATION: PASSENGER'S RIGHT FEMUR

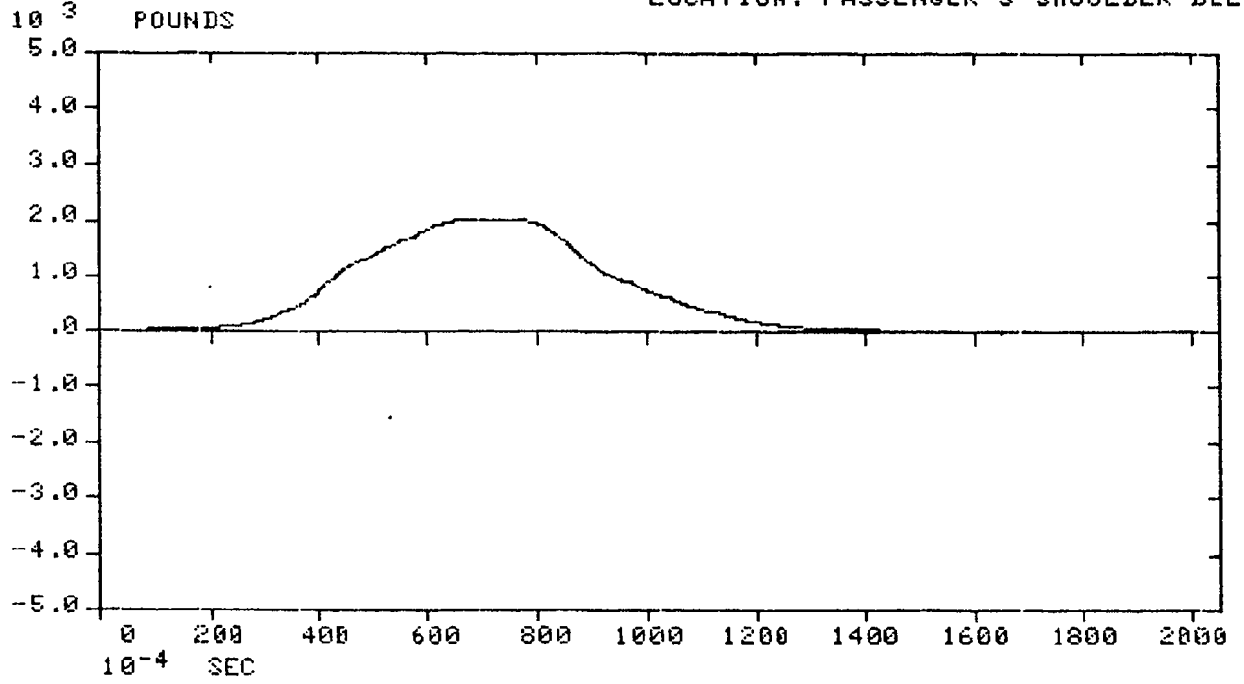


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
LOAD CELL: TAPE 2, CH 9
DIRECTION: TENSION
LOCATION: PASSENGER'S SHOULDER BELT

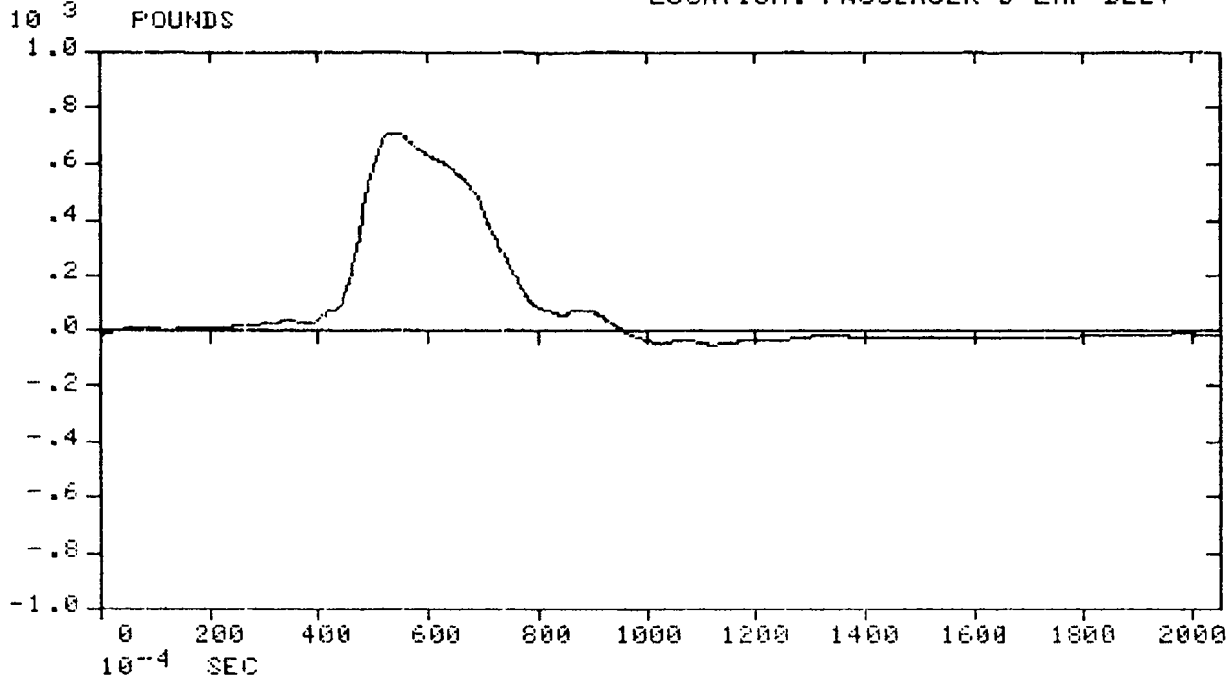


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
LOAD CELL : TAPE 2, CH 10
DIRECTION: TENSION
LOCATION: PASSENGER'S LAP BELT

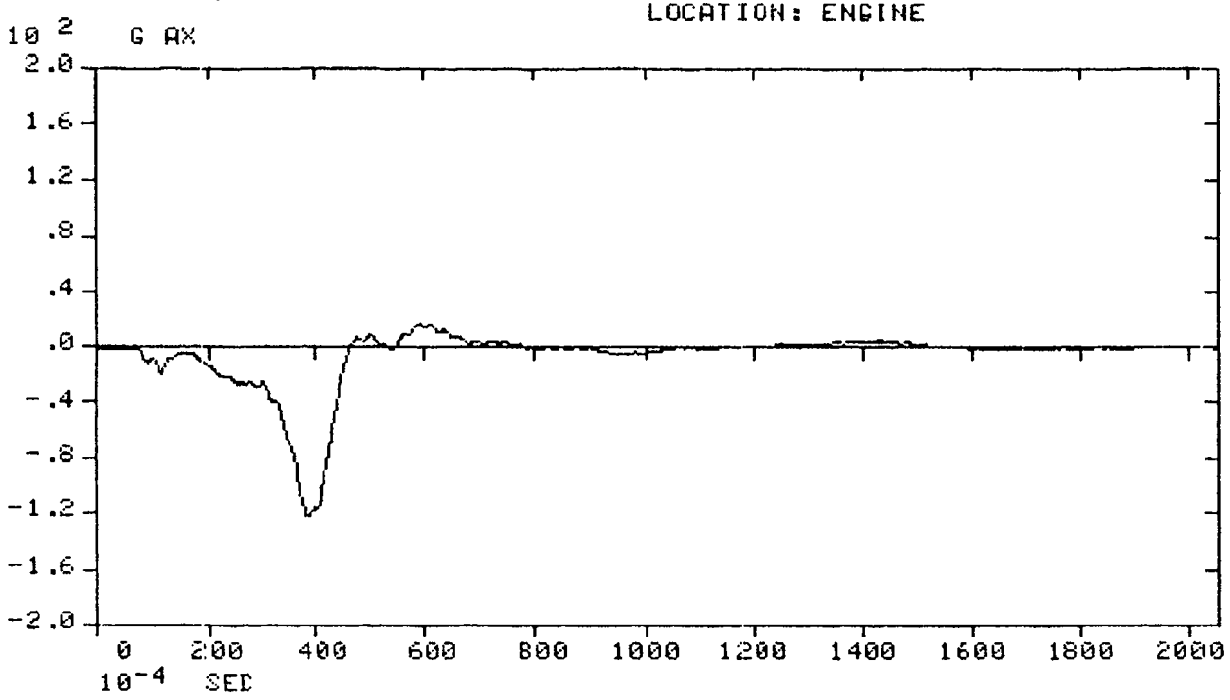


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
ACCELEROMETER: TAPE 3, CH 1
DIRECTION: FORWARD
LOCATION: ENGINE

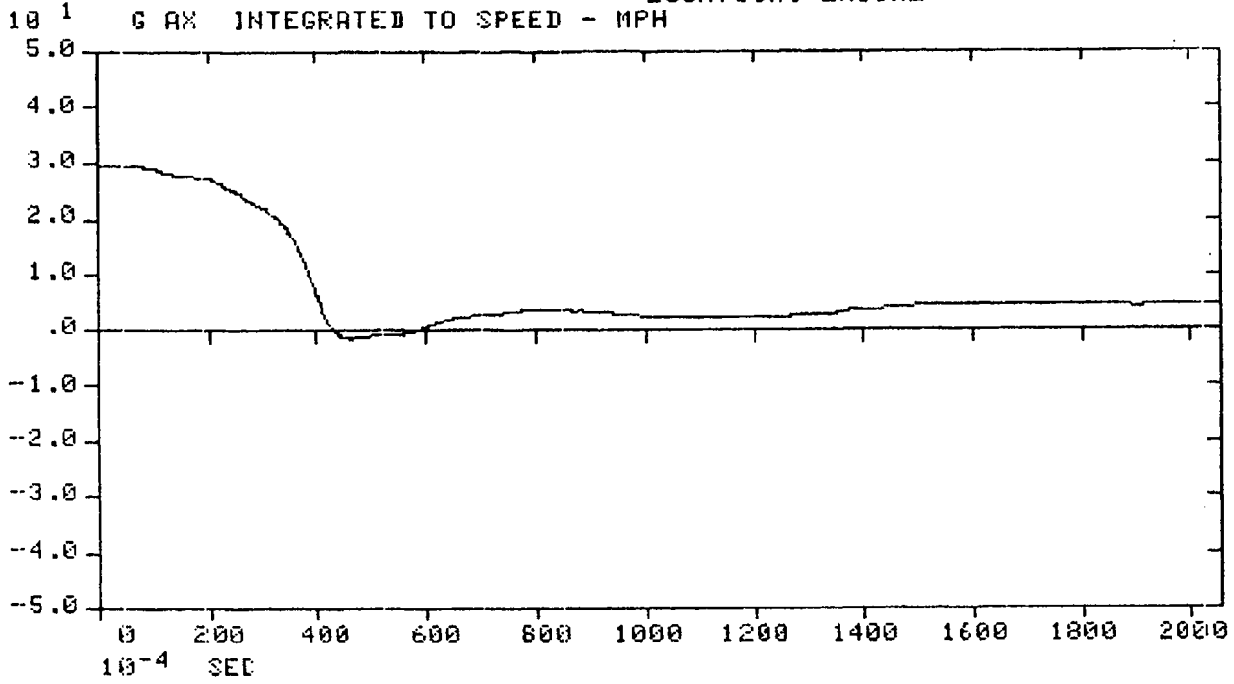


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
ACCELEROMETER: TAPE 3, CH 1
DIRECTION: FORWARD
LOCATION: ENGINE

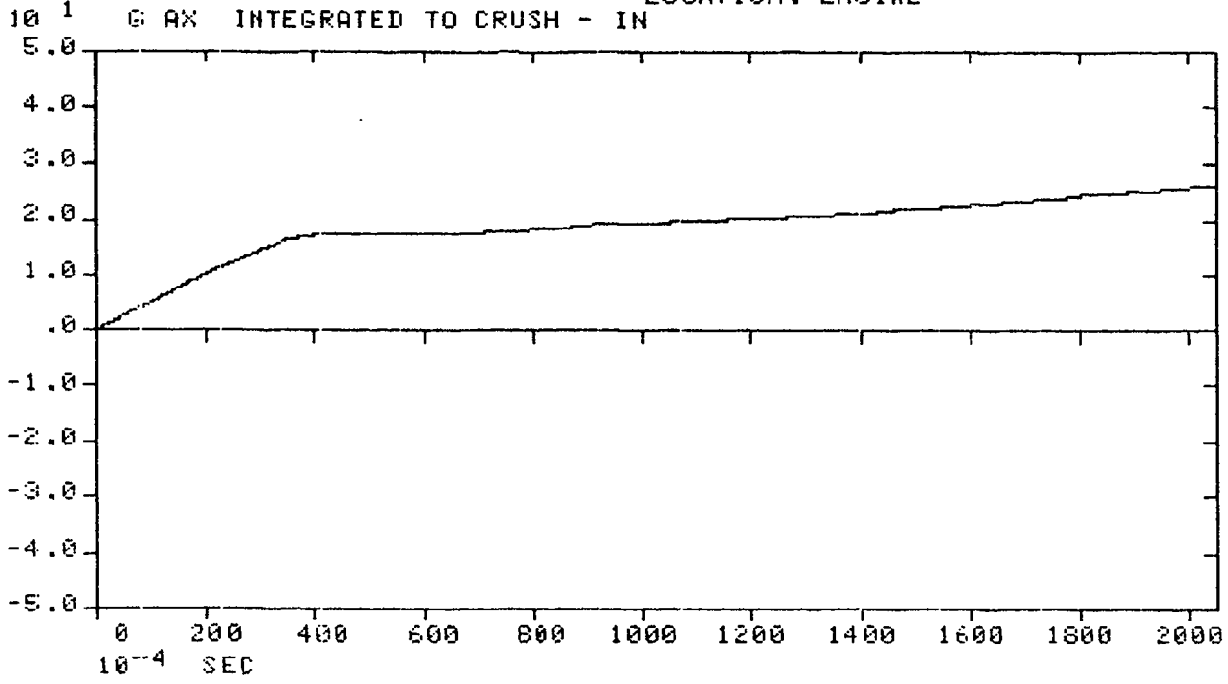


DOT CRASH PROGRAM

NATIONAL TECHNICAL SYSTEMS

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

MJO NO. : 971-3882-49
FILTER: CLASS 60
ACCELEROMETER: TAPE 3, CH 1
DIRECTION: FORWARD
LOCATION: ENGINE

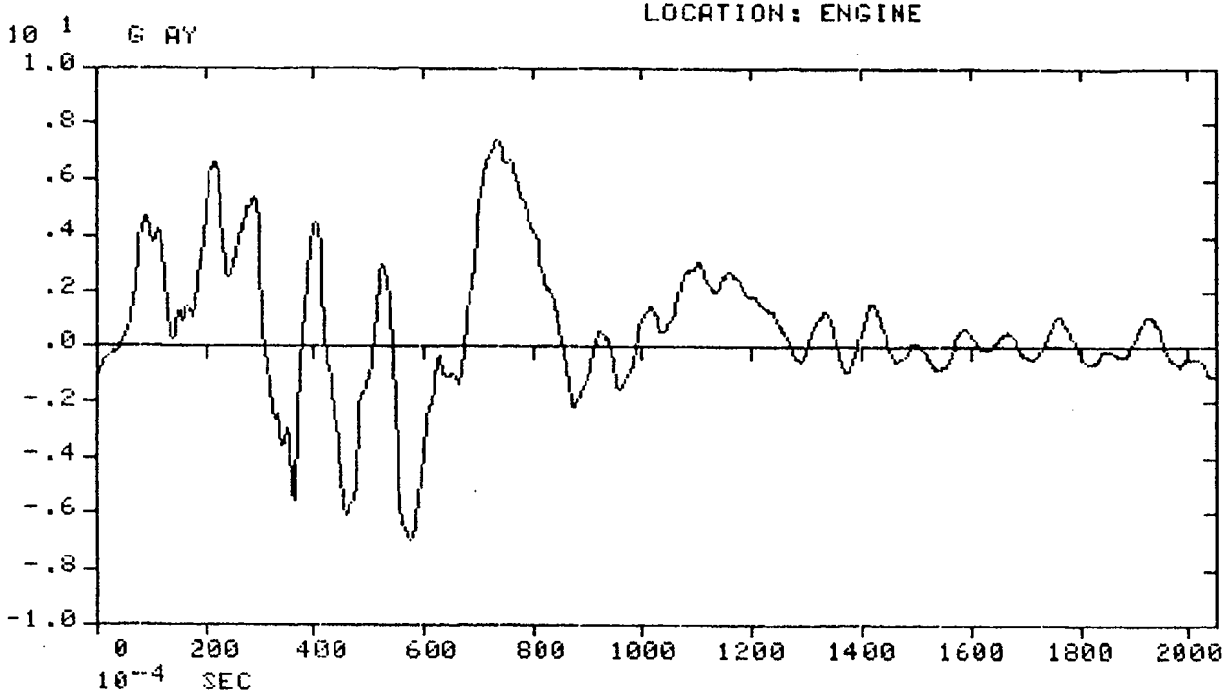


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
ACCELEROMETER: TAPE 3, CH 2
DIRECTION: RIGHT
LOCATION: ENGINE

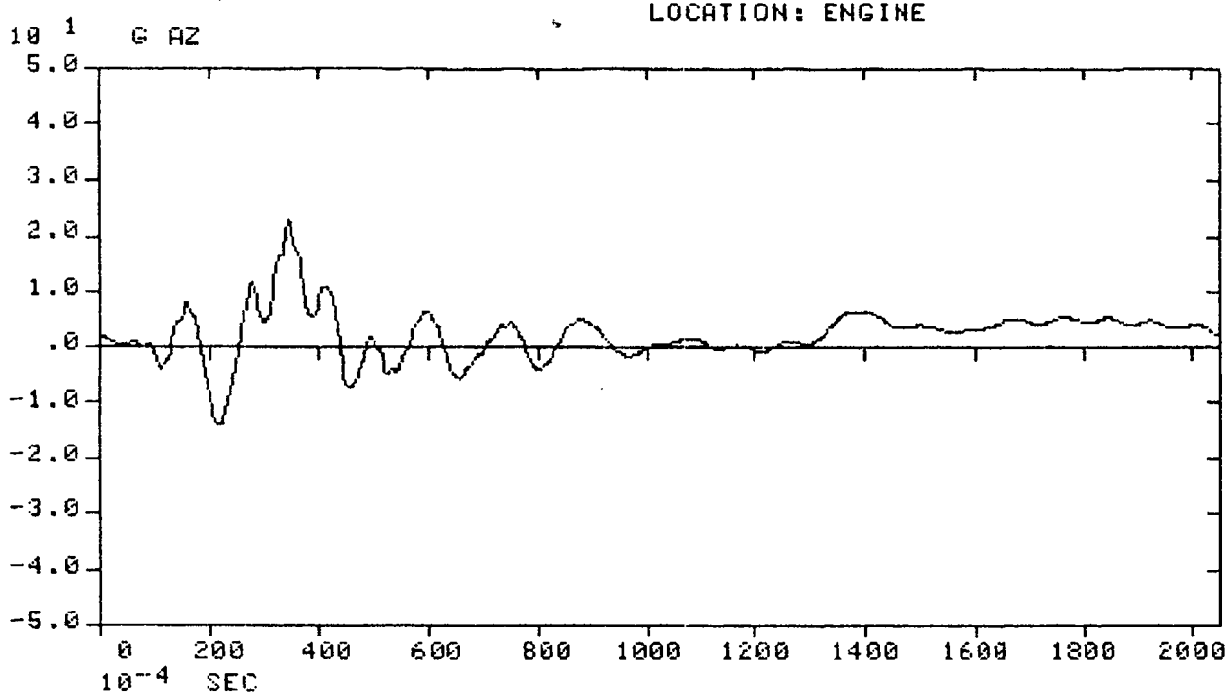


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
ACCELEROMETER: TAPE 3, CH 3
DIRECTION: UPWARD
LOCATION: ENGINE

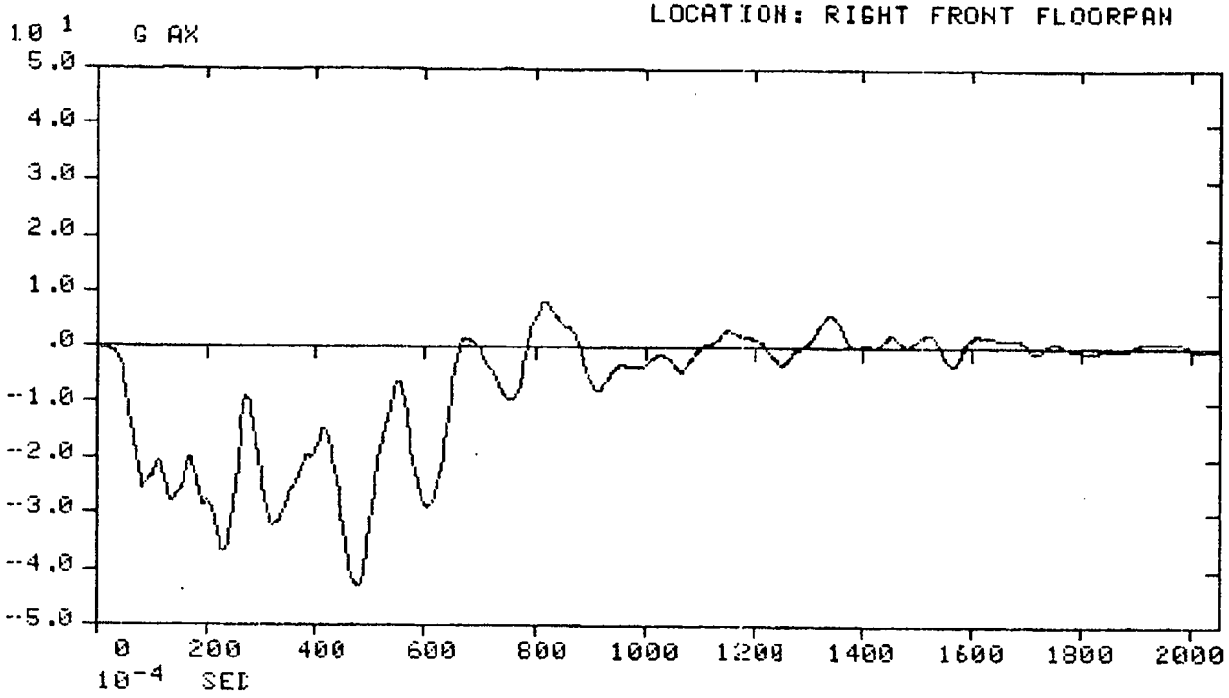


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
ACCELEROMETER: TAPE 2, CH 11
DIRECTION: FORWARD
LOCATION: RIGHT FRONT FLOORPAN

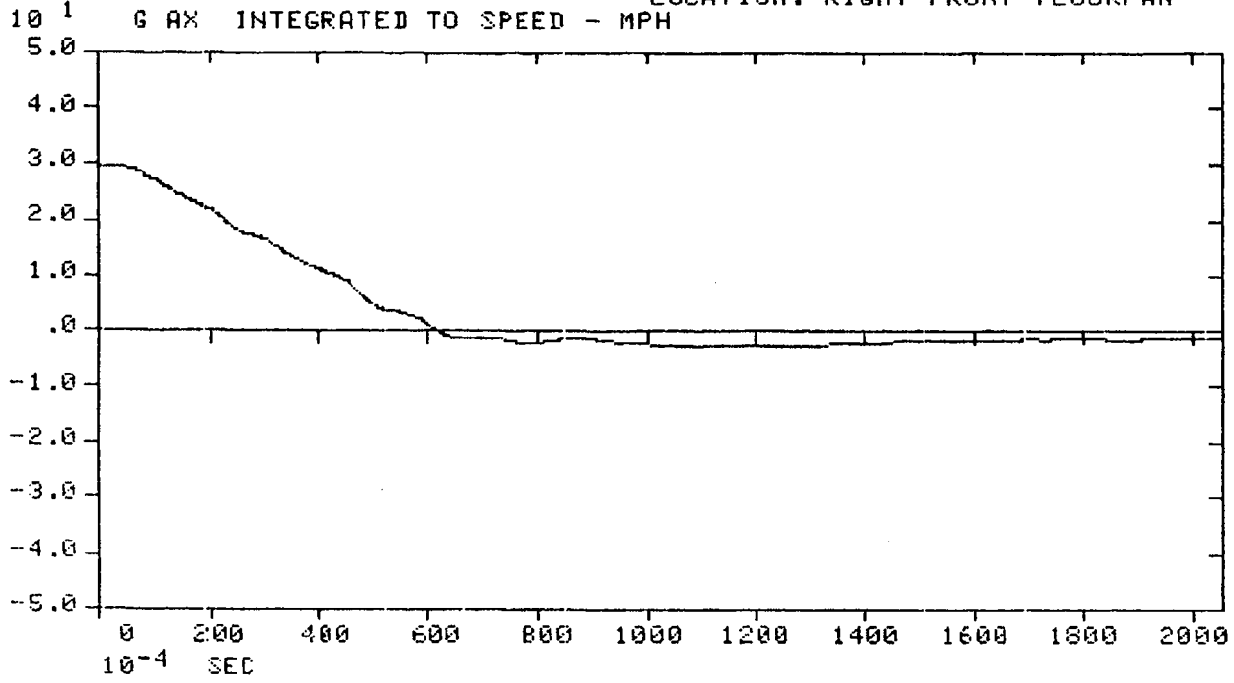


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
ACCELEROMETER: TAPE 2, CH 11
DIRECTION: FORWARD
LOCATION: RIGHT FRONT FLOORPAN

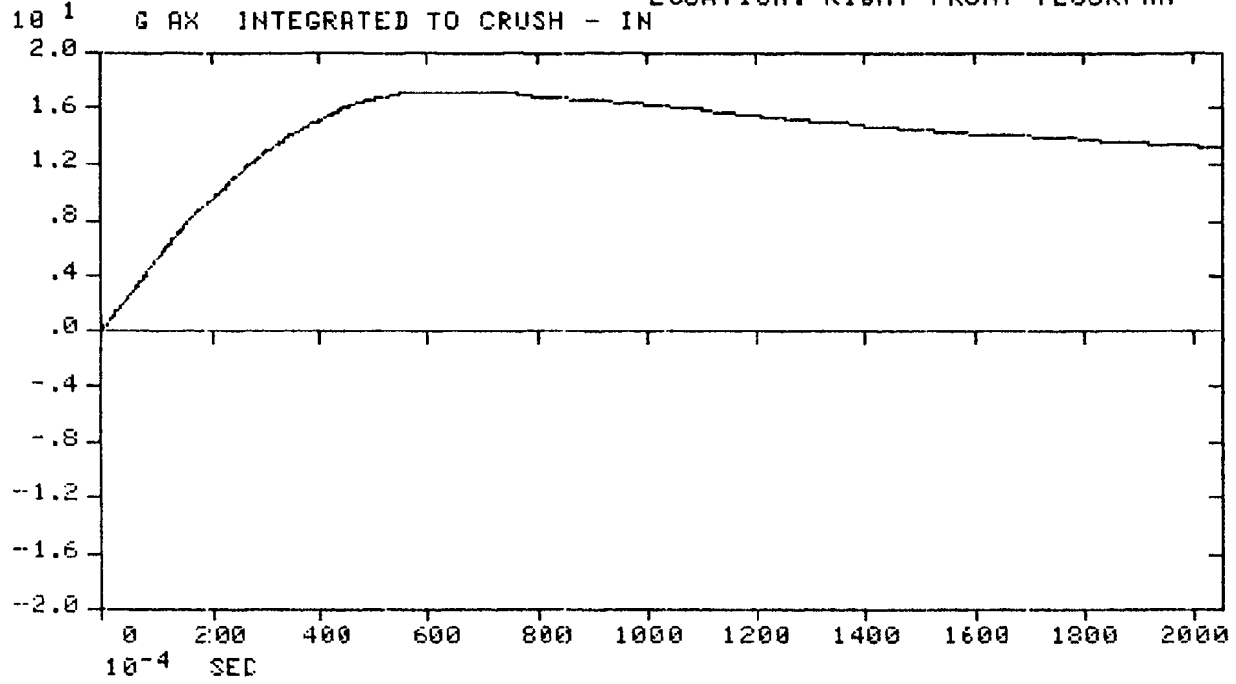


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
ACCELEROMETER: TAPE 2, CH 11
DIRECTION: FORWARD
LOCATION: RIGHT FRONT FLOORPAN

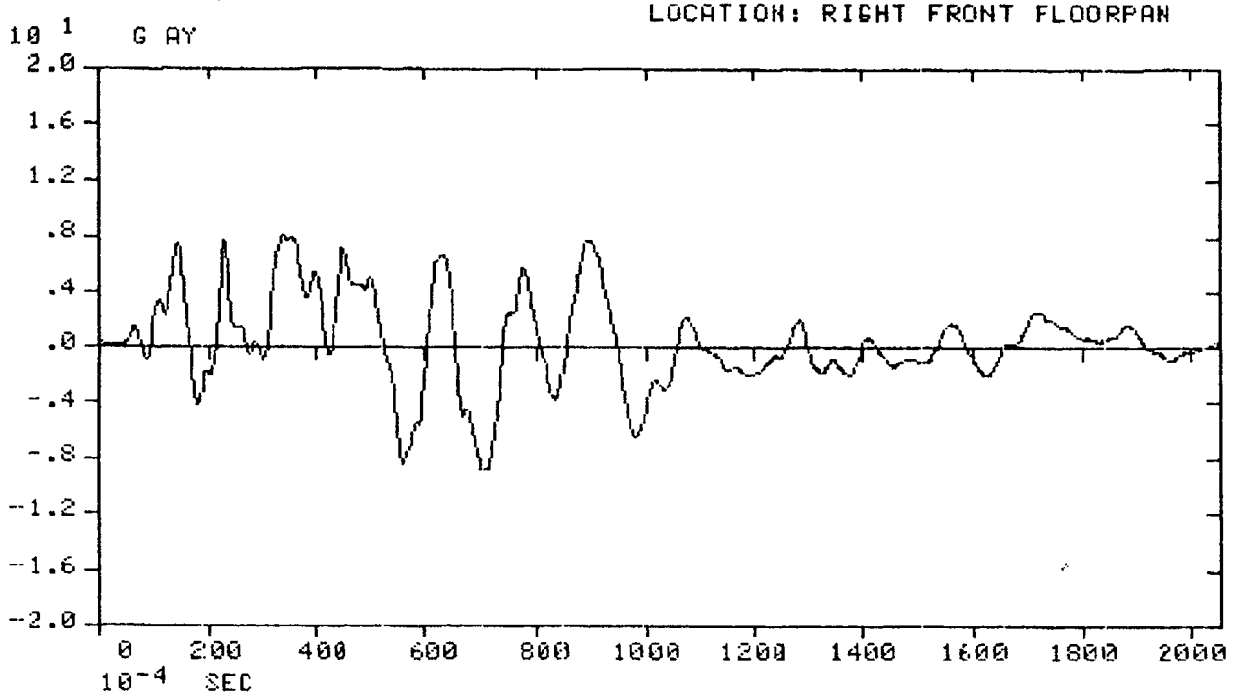


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
ACCELEROMETER: TAPE 2, CH 12
DIRECTION: LEFT
LOCATION: RIGHT FRONT FLOORPAN

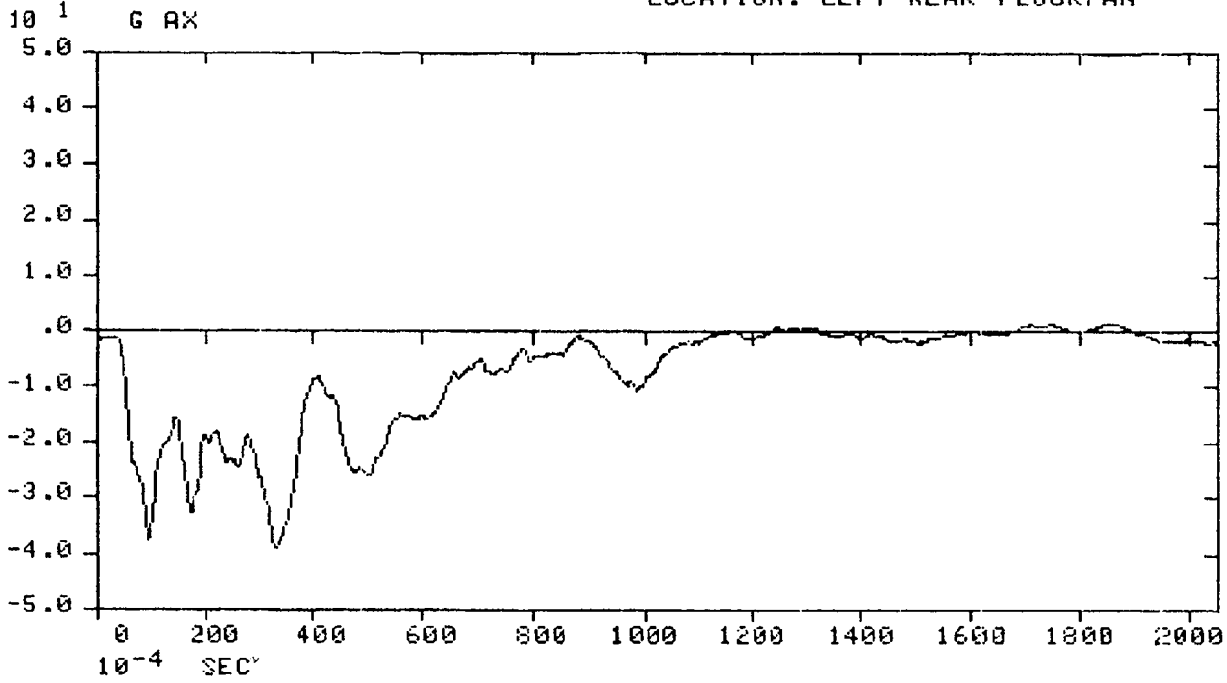


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
ACCELEROMETER: TAPE 1, CH 11
DIRECTION: FORWARD
LOCATION: LEFT REAR FLOORPAN

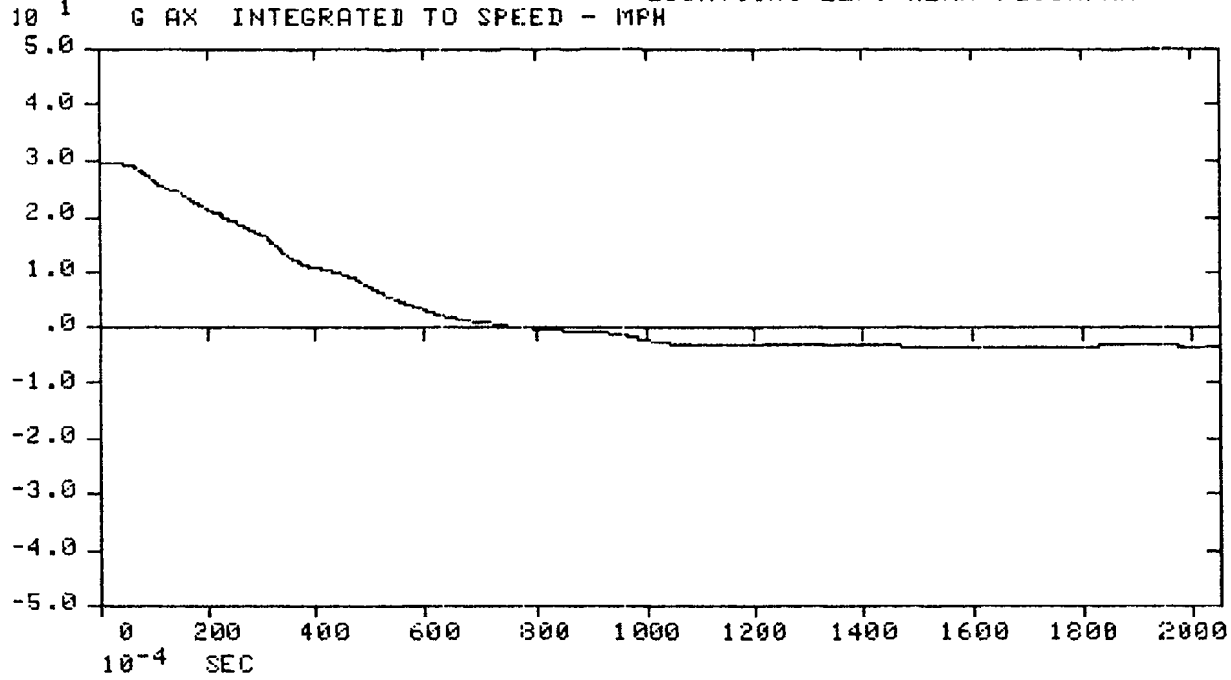


DOT CRASH PRDGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
ACCELEROMETER: TAPE 1, CH 11
DIRECTION: FORWARD
LOCATION: LEFT REAR FLOORPAN

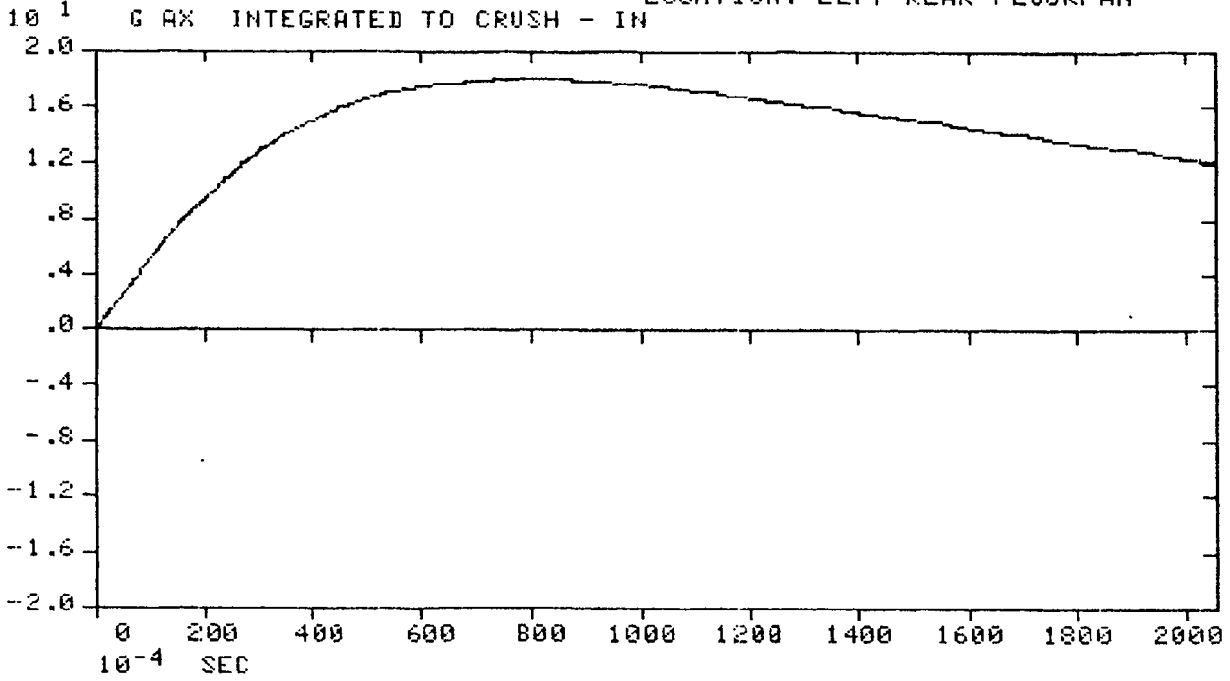


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
ACCELEROMETER: TAPE 1, CH 11
DIRECTION: FORWARD
LOCATION: LEFT REAR FLOORPAN

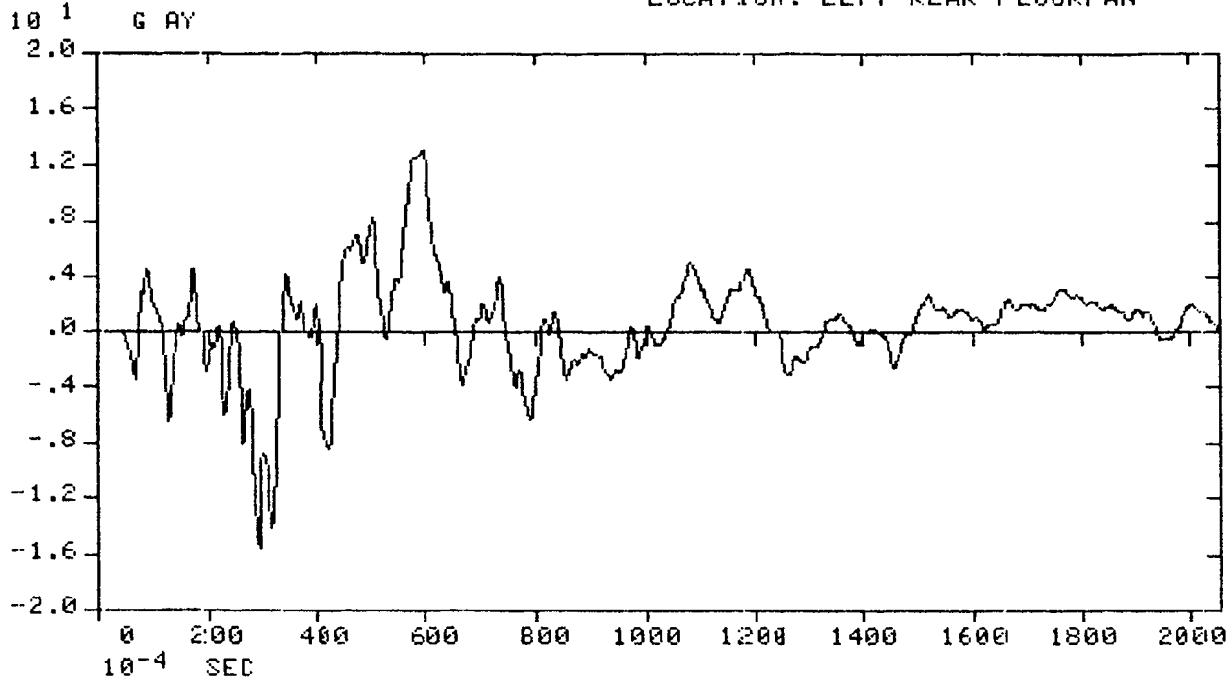


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 60
ACCELEROMETER: TAPE 3, CH 5
DIRECTION: LEFT
LOCATION: LEFT REAR FLOORPAN

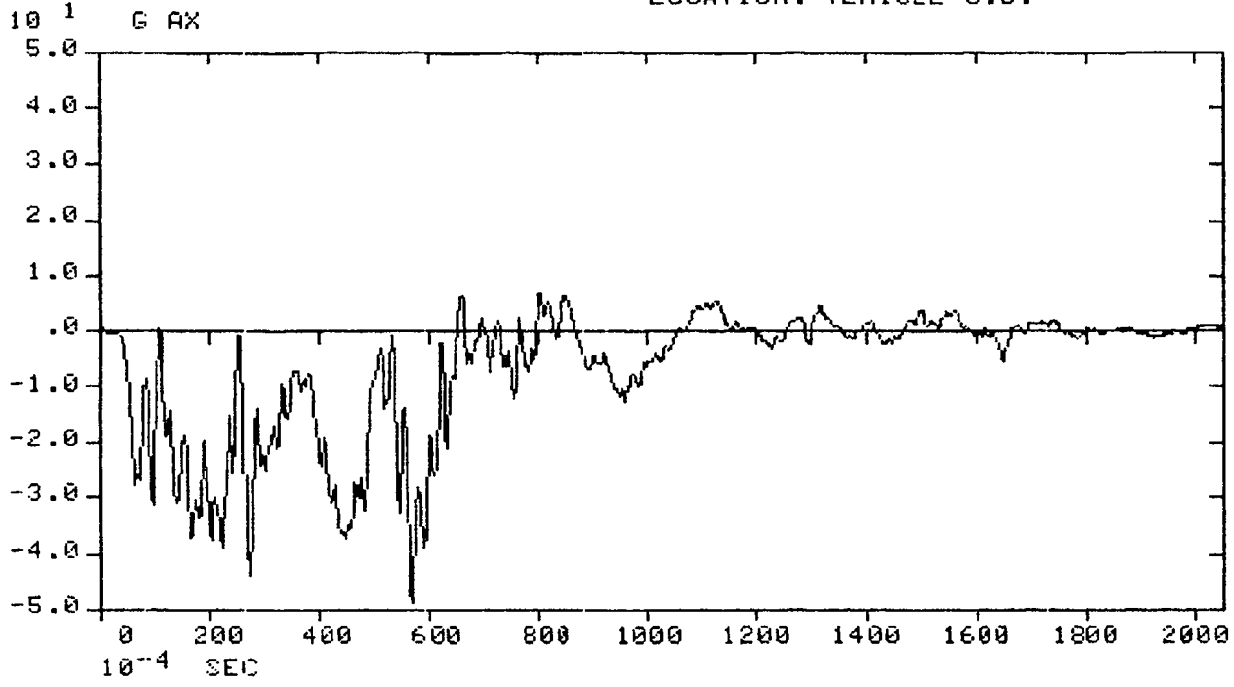


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH12
DIRECTION: FORWARD
LOCATION: VEHICLE C.G.

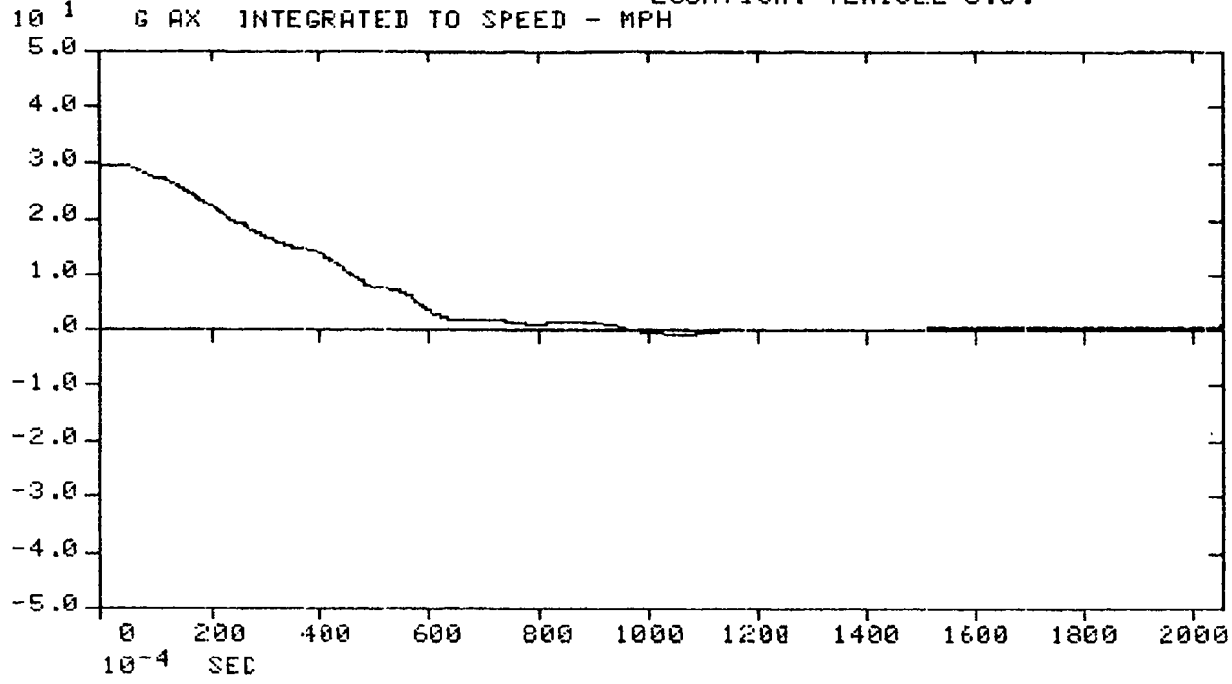


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 12
DIRECTION: FORWARD
LOCATION: VEHICLE C.G.

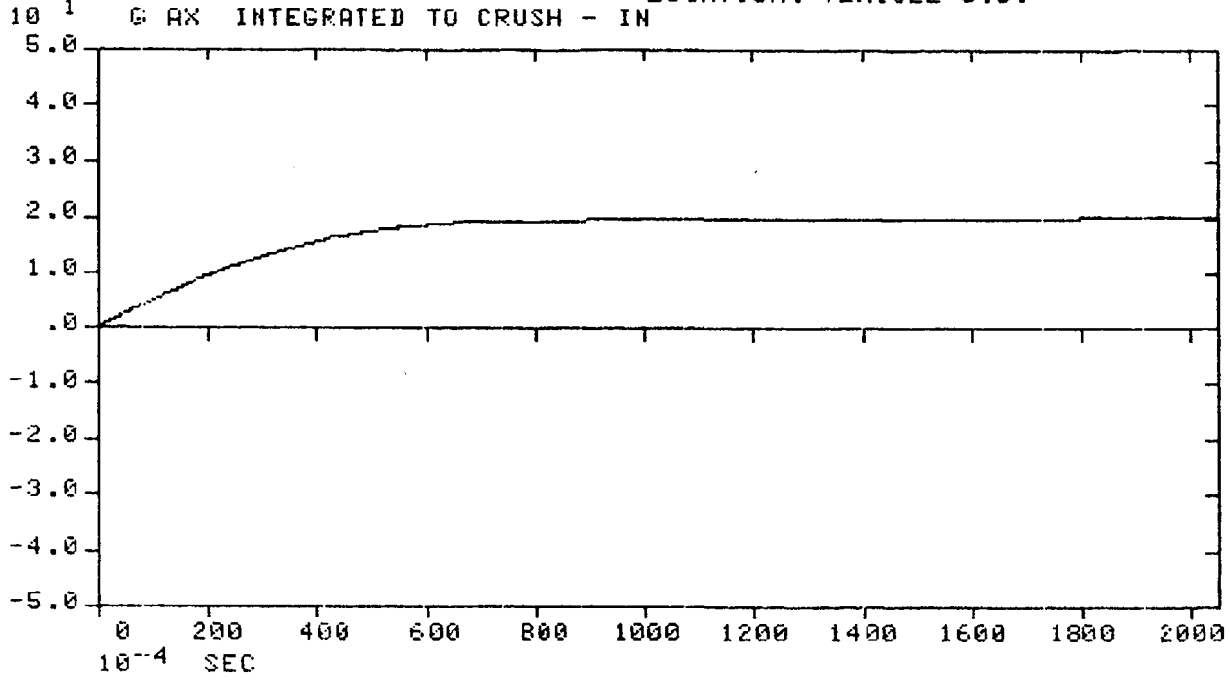


DOT CRASH PROGRAM

VEHICLE: FORD RANGER P/U
VEHICLE ID: NHTSA 830603
TEST FILE NO. : 207-17 29.69 MPH
DATE: MAY 27, 1982 FRONTAL

NATIONAL TECHNICAL SYSTEMS

MJO NO. : 971-3882-49
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 12
DIRECTION: FORWARD
LOCATION: VEHICLE C.G.



SERVICE FOR: U. S. Department of Transportation
National Highway Traffic Safety Administration
Office of Passenger Vehicle Research
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.

NATIONAL TECHNICAL SYSTEMS

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