DOT#359

AETL

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A NATIONAL TECHNICAL SERVICES COMPANY

REPORT NO. 301-AETL-81-040-971-3882-40

NEW VEHICLE ASSESSMENT AND STANDARDS ENFORCEMENT INDICANT TESTING

FMVSS 301-75

ISUZU MOTORS LIMITED
1981 ISUZU I-MARK DELUXE - 2 DOOR COUPE
NHTSA 810503

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

JUNE 1981

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
- ENFORCEMENT -
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Date 26 June 1981

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Date

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15. Supplementary Notes

16. Abstract

New Vehicle Assessment and Standards Enforcement Indicant Test to the requirement of FMVSS 301-75 on a 1981 Isuzu I-Mark Deluxe - 2 Door Coupe, NHTSA 810503, VIN-JABAT77B1B0802624 was conducted at Approved Engineering Test Laboratories test facility in Fullerton, California.

The moving barrier impact speed was 35.52 mph in the rear (0°) mode. Test date was June 3, 1981, and the ambient temperature was 88°F.

The subject test vehicle does not appear to comply with all the requirements of FMVSS 301-75.

17. Key Words	18. Distribution Statement
New Vehicle Assessment FMVSS 301-75 - Fuel System Integrity	

19. Security Class. (of this report)	20. Security Class. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	113	

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1.0 INTRODUCTION

This report contains information regarding a joint program for the Office of Vehicle Safety Compliance (OVSC), Office of Automotive Ratings (OAR), and Research and Development (R&D) for a vehicle assessment and standards enforcement indicant test of fuel system integrity relative to Federal Motor Vehicle Safety Standard (FMVSS) No. 301-75. 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 (TP212-02).

The specific purpose of this test was to obtain research and vehicle rating data in conjunction with fuel system integrity indicant data, when a vehicle is impacted in excess of the velocity (30 mph) requirements of FMVSS 301-75.

Section 2 contains general test and vehicle information, occupant/vehicle acceleration summary data, while Section 3 contains all compliance related data. Section 4 contains test dummy and vehicle measurements, along with camera positions. Section 5 discusses AETL's test facilities and data acquisition and reduction system.

SECTION 1

Appendix A contains additional photographs not related to vehicle compliance. Appendix B contains the computer generated plots, while Appendix C contains the dummy certification reports if applicable.

1.1 ADMINISTRATIVE DATA

A. References

1. Federal Motor Vehicle Safety Standard No. 301-75 "Fuel System Integrity" as published in the Federal Register, Volume 40, No. 48352, dated October 15, 1975.

2. National Highway Traffic Safety Administration - Office of Vehicle Safety Compliance Laboratory Procedures for Vehicle Assessment and Standards Enforcement Indicant Testing for "Windshield Mounting", FMVSS 212 - "Windshield Zone Intrusion", FMVSS 219 - "Fuel System Integrity", FMVSS 301-75, TP212-02, dated April 4, 1980.

SECTION 1

B. Description of Test Vehicle

1. 1981 Isuzu I-Mark Deluxe - 2 Door Coupe
2. Vehicle Identification No.: JABAT77B1B0802624
3. NHTSA No.: 810503
4. Manufactured Date: December 1980
5. GVWR: 3,080 pounds

C. Dates

1. Vehicle Received: May 29, 1981
2. Start of Test: June 1, 1981
3. Completion of Test: June 3, 1981

SECTION 2

SECTION 2

2.0 GENERAL TEST INFORMATION AND SUMMARY DATA

The 1981 Isuzu I-Mark Deluxe - 2 Door Coupe was subjected to a rear moving 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 the passenger dummy head painted with blue chalk to provide post-impact visual inspection of possible dummy head contact with interior components during the impact event.

TABLE I

SUMMARY OF TEST CONDITIONS

TEST VEHICLE INFORMATION:

Manufacturer: Isuzu Motors Limited

Make/Model: Isuzu I-Mark Deluxe

Body Style: 2 Door Coupe Model Year: 1981

VIN: JABAT77B1B0802624 Build Date: December 1980

NHTSA No.: 810503 Color: Silver

Engine Data: Four (4) Cylinders; 111.0 Cu. In. Displ.

Transmission Data: Five (5) Speed (X) Manual ( ) Automatic

Major Options: AM-FM Radio

VEHICLE ATTITUDE:

Delivered Attitude: LF 24.8 in.; RF 24.5 in.; LR 23.7 in.; RR 24.3 in.

Test Attitude: LF 23.6 in.; RF 23.8 in.; LR 22.5 in.; RR 22.2 in.

VEHICLE TIRE DATA:

Recommended Cold Tire Pressure: Front = 24 psi

(Up to Vehicle Load Capacity) Rear = 28 psi

Recommended Tire Size: 155SR13 Load Range: "B"

Tires on Vehicle: 155SR13-w/s/w-Goodrich

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

NOTE: Metric Mini T115/70D14 - Goodrich @ 60PSI

TABLE Ia

SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS:

Date of Test: June 3, 1981 Time of Test: 1522

Ambient Temperature: 88 °F at Impact Area

VEHICLE CAPACITY:

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

Designated Seating Capacity: Front 2
Center 0
Rear 2
Total 4

Cargo: 125 lbs.

Total 725 lbs. (Vehicle Capacity Weight)

GVWR: 3,080 lbs. (Taken From Certification Label)

GAWR: Front 1,485 lbs.; Rear 1,620 lbs.

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

Left Front 577 lbs. Left Rear 510 lbs.
Right Front 629 lbs. Right Rear 471 lbs.
Total Front Weight 1,206 lbs. (55.1% of Total Vehicle Weight)
Total Rear Weight 981 lbs. (44.9% of Total Vehicle Weight)
Total Delivered Weight 2,187 lbs.

CALCULATED VEHICLE TEST WEIGHT: 2,640 lbs.
(With Required Dummies and 125 lbs. Cargo)

ACTUAL VEHICLE TEST WEIGHT:

Left Front 662 lbs. Left Rear 656 lbs.
Right Front 696 lbs. Right Rear 612 lbs.
Total Front Weight 1,358 lbs. (51.7% of Total Vehicle Weight)
Total Rear Weight 1,268 lbs. (48.3% of Total Vehicle Weight)
Total Test Weight 2,626 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: 13.70 gals. (NFC)

Test Volume: 12.74 gals. (92-94% of NFC)

Fuel System Capacity: 13.70 gals.
(Data from Owner's Manual)

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

Does Electric Fuel Pump Operate with Ignition Switch "On"

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

Details of Fuel System: Fuel filler located on right rear "C" post above wheel opening recessed behind a hinged door. Fuel tank located vertically between rear wheel housings inside trunk compartment adjacent to the rear seat back wall.

VEHICLE TEST CONDITIONS:

Temperature in Occupant Compartment: N/A °F

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

VEHICLE CRUSH AND REBOUND:

Overall Length of Test Vehicle: Pre-Test - Left 168.5 in.; Right 168.5 in.

Post-Test - Left 142.2 in.; Right 143.9 in.

Crush: Left 26.3 in.; Right 24.6 in.

Rebound (From Rigid Barrier Only): N/A in.

TABLE III

POST IMPACT SUMMARY

cle 1981 Isuzu I-Mark

A No. 810503 Test Date June 3, 1981

E OF TEST: [ ] 0° Frontal Impact

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

[XX] Rear Impact

QUIRED IMPACT VELOCITY RANGE: 34.5 to 35.5 mph

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

Trap 1 = 35.52 mph

Trap 2 = N/D mph

Average 35.52 mph

ctual distance from vehicle rear bumper to barrier face when entering timing trap 56.0 in.

ctual distance from vehicle rear bumper to barrier face when exiting timing trap 32.0 in.

VEHICLE STATIC CRUSH: Driver's Side = 26.3 inches

Passenger's Side = 24.6 inches

Average = 25.45 inches

Crush Details: Rear window shattered, left rear tire flat, trunk floor pan collapsed to ground level, the driver and passenger dummy head impacted rear seat back cushion.

VEHICLE REBOUND: (From rigid barrier only)

Driver's Side = N/A inches

Passenger's Side = N/A inches

Average = N/A inches

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SECTION 3

3.0 TEST DATA

The 1981 Isuzu I-Mark Deluxe - 2 Door Coupe was subjected to a rear moving barrier impact and a static rollover maneuver as required by Federal Motor Vehicle Safety Standard No. 301-75.

Color motion picture coverage of the 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 VI

POST IMPACT SUMMARY

FUEL SYSTEM INTEGRITY - FMVSS 301-75

Vehicle 1981 Isuzu I-Mark

NHTSA No. 810503 Test Date June 3, 1981

	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.	22 minutes	30 minutes

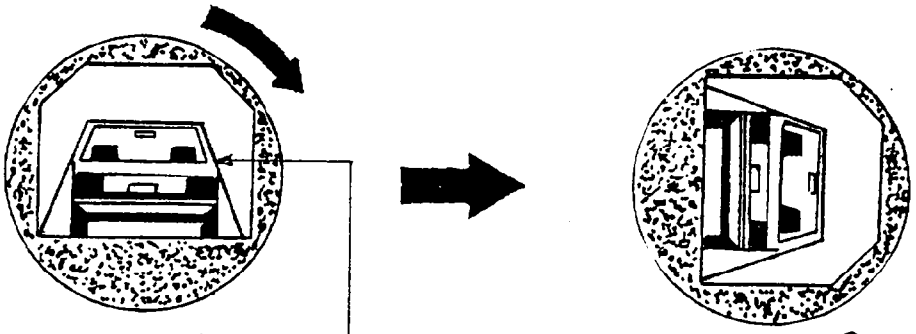
Fuel Spillage Location: Not applicable.

TABLE VII

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1981 Isuzu I-Mark NHTSA No. 810503



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 minutes, 14 seconds	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	3.34 oz.	5 ounces
Fuel spillage during 6th minute period from onset of rotation	2.86 oz.	1 ounce
Fuel spillage during 7th minute period from onset of rotation	4.91 oz.	1 ounce

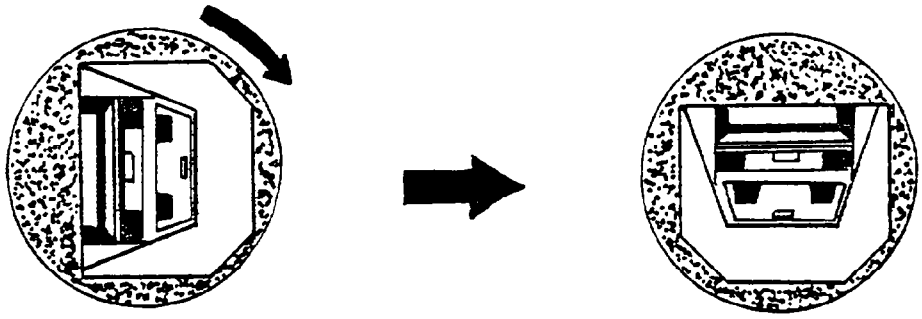
Fuel Spillage Location: Emission canister in engine compartment.

TABLE VIII

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1981 Isuzu I-Mark NHTSA No. 810503



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 minutes, 13 seconds	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	35.47 oz.	5 ounces
Fuel spillage during 6th minute period from onset of rotation	0.62 oz.	1 ounce
Fuel spillage during 7th minute period from onset of rotation	0.21 oz.	1 ounce

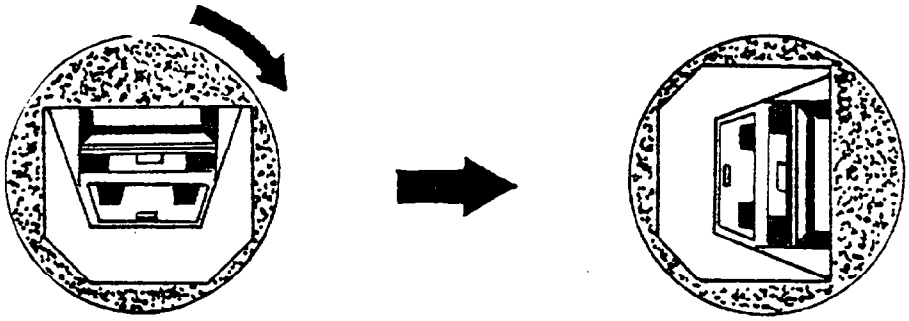
Fuel Spillage Location: Carburetor air cleaner assembly.

TABLE IX

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1981 Isuzu I-Mark NHTSA No. 810503



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 minutes, 18 seconds	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	1.83 oz.	5 ounces
Fuel spillage during 6th minute period from onset of rotation	0.14 oz.	1 ounce
Fuel spillage during 7th minute period from onset of rotation	0.26 oz.	1 ounce

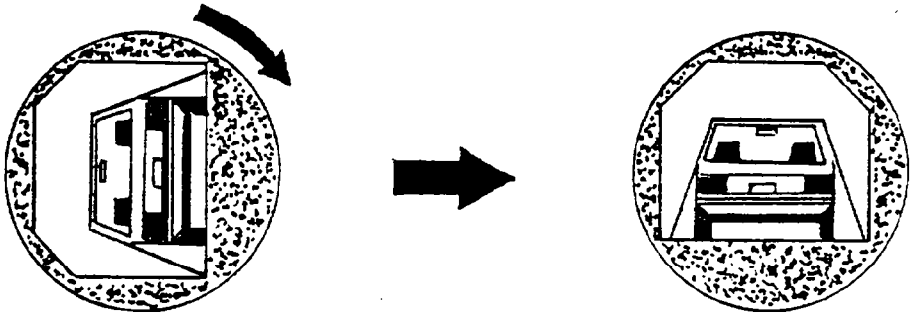
Fuel Spillage Location: Carburetor air cleaner assembly.

TABLE X

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1981 Isuzu I-Mark NHTSA No. 810503



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 minutes, 12 seconds	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	10.10 oz.	5 ounces
Fuel spillage during 6th minute period from onset of rotation	immeasurable	1 ounce
Fuel spillage during 7th minute period from onset of rotation	immeasurable	1 ounce

Fuel Spillage Location: Engine compartment area.

SECTION 3

3.1 TEST RESULTS AND PHOTOGRAPHS

Post-impact inspection of the test vehicle revealed almost all crush occurred rearward of the front doors. The trunk floor pan collapsed to ground level and jammed both rear wheels. The left rear tire was flat and the rear window shattered. Both front seat backs bent backward and the passenger seat assembly twisted inward. The driver dummy head made contact with the rear seat back cushion, while the passenger dummy head made contact with the roof headliner and the rear seat back cushion.

No fuel spillage was noted following the moving barrier impact, nor during the time period before the start of the rollover test. However, fuel spillage was noted emitting from the emission canister, located in the engine compartment, after the vehicle had obtained the first 90° test increment (right side down). The fuel spillage continued during the 90° test increment time period, however, the fuel spillage from the emission canister ceased, after the onset of rotation to the 180°

SECTION 3

test increment, and fuel spillage appeared emitting from the carburetor air cleaner assembly. The fuel spillage continued as recorded during the remaining rollover test increment time periods.

The 1981 Isuzu I-Mark Deluxe - 2 Door Coupe test vehicle does not appear to comply with all the requirements of FMVSS 301-75.

Figure 3-1

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Pre-Test, Left Side View


FMVSS 301
NHTSA 810503
AETL
40

Figure 3-2

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Pre-Test, Full Rear View


NHTSA 810503
FMVSS 301
ISUZU I-MARK

Figure 3-3

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Pre-Test, Right Side View


NHTSA 810503
FMVSS 301
AETL
40

Figure 3-4

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Left Side View


FMVSS 301
AETL
40

Figure 3-5

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Full Rear View


301
ISUZU

Figure 3-6

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Right Side View


FMVSS 301
AETL
40

Figure 3-7

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Rollover Test, 90° Increment

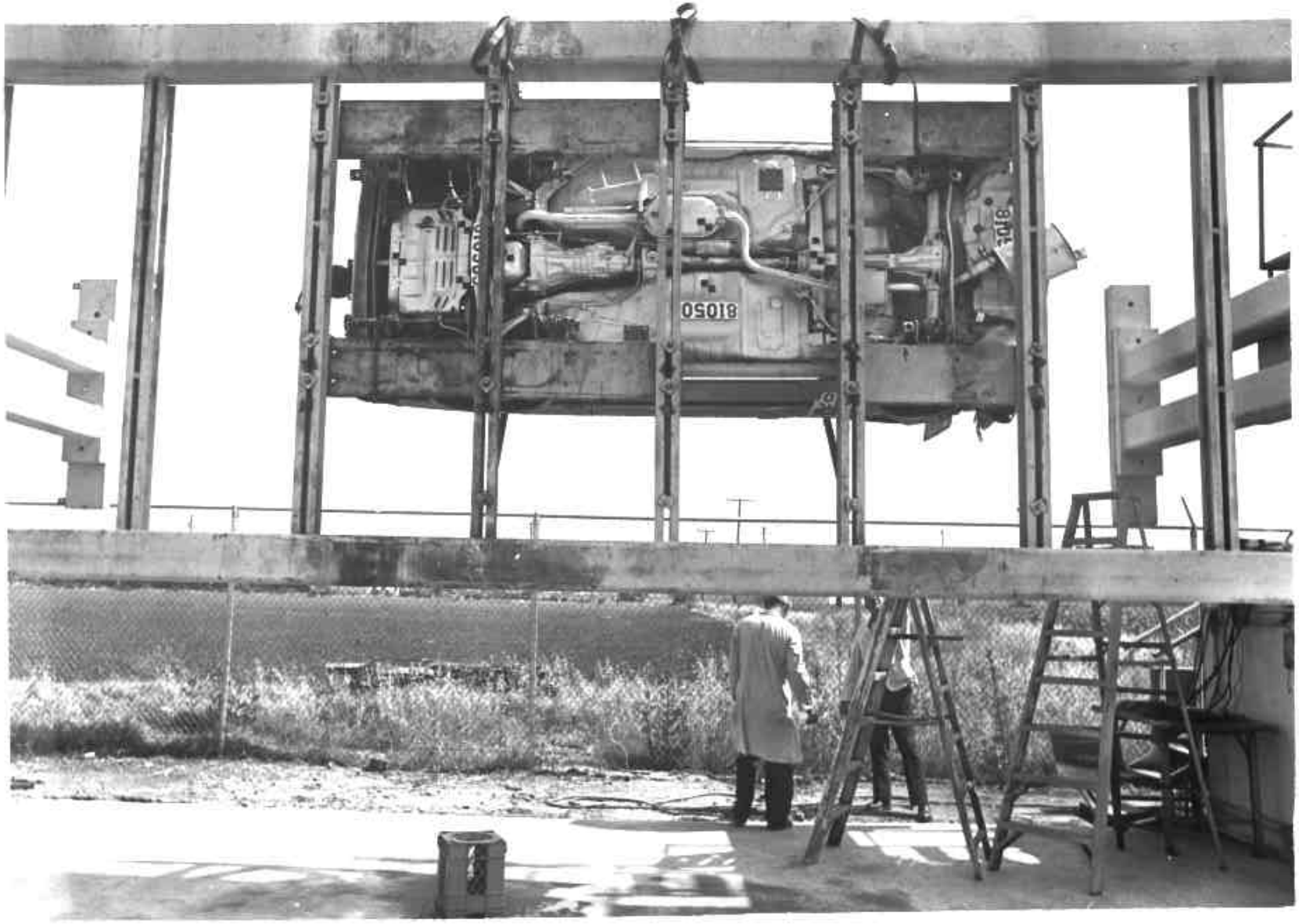


Figure 3-8

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Fuel Spillage, 90° Increment

Figure 3-9

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Fuel Spillage, 180° Increment

Figure 3-10

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Rollover Test, 270° Increment


301

Figure 3-11

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Fuel Spillage, 270° Increment

Figure 3-12

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Test, Fuel Spillage Collection

SECTION 4

SECTION 4

4.0 OCCUPANT RESPONSE AND VEHICLE ACCELERATION SUMMARY DATA

The following data sheets summarize:

A. The dummy position data (Part 572 Dummy Pre-Test Dummy Clearance Distances Sheet)

B. The vehicle acceleration data (Vehicle Structural Data Sheet)

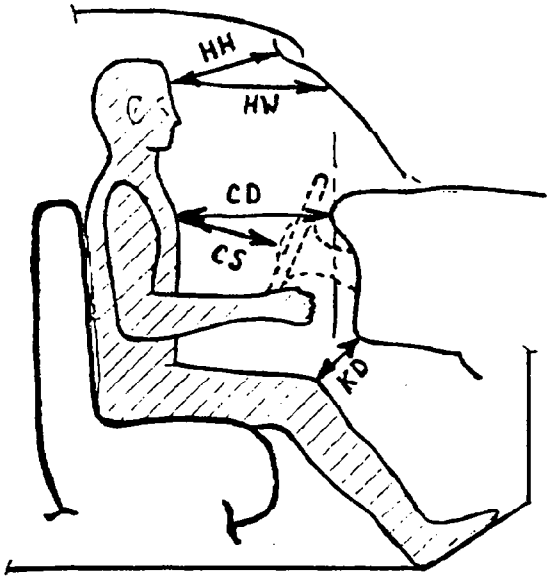
C. The pre and post-test vehicle dimensions data (Vehicle Measurement Data Sheet)

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

TABLE 4-1

PART 572 DUMMY PRE-TEST CLEARANCE DISTANCES

DRIVER		PASSENGER	
HH =	15.3 in.	HH =	14.0 in.
HW =	18.6 in.	HW =	18.6 in.
HR =	7.0 in.	HR =	7.1 in.
HS =	8.5 in.	HS =	7.8 in.
CD =	21.3 in.	CD =	19.8 in.
CS =	12.2 in.	AD =	3.5 in.
AD =	2.8 in.	HD =	5.8 in.
HD =	5.1 in.	KD =	5.5 in.
KD =	4.5 in.		



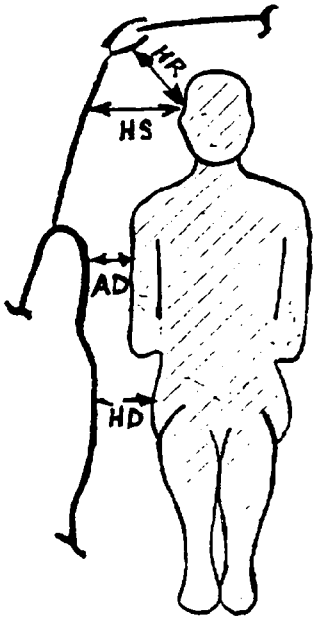


TABLE 4-2

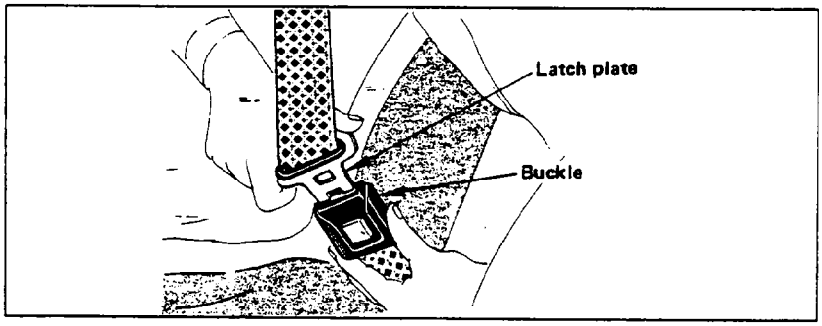
MANUFACTURERS SEAT BELT INSTRUCTIONS

SEAT BELTS

To help lessen the chance of injury and/or the severity of injury in accidents or sudden stops, we urge that people riding in the car be properly restrained at all times, using the seat belts provided. This includes women who are pregnant and children of all ages. See the following pages for use of restraints by children and pregnant women.

FRONT SEAT LAP/SHOULDER BELT

- Adjust the front seat as needed and sit up straight and well back in the seat.
- Take hold of the seat belt latch plate and pull the lap/shoulder belt webbing across the body. At the same time, slide the latch plate along the belt until it reaches the buckle. Push the latch plate into the buckle until it clicks.
- In the rear seat, hold the belt retractor, NOT the latch plate, and pull out the webbing until it reaches the buckle. Push the latch plate into the buckle until it clicks.

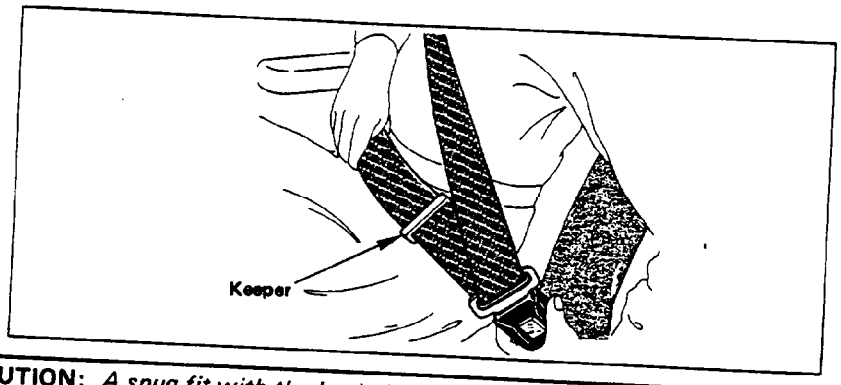


- Position the "lap" portion of the belt across the lap as LOW ON THE HIPS as possible. Then, adjust to a SNUG FIT by holding the "shoulder" portion of the front seat belt and pulling it UPWARD through the latch plate, until the lap portion is snug across the lap. This reduces the risk of sliding under the belt during an accident. If the keeper blocks the latch plate, slide the keeper toward your door. Adjust the rear seat lap belt to a SNUG FIT by letting the retractor fully take up the slack. The rear seat retractor is designed to lock when the angle between the retractor and the latch plate is straightened by pressure against the torso.

TABLE 4-2

MANUFACTURERS SEAT BELT INSTRUCTIONS

(Continued)



CAUTION: *A snug fit with the lap belt positioned low on the hips is necessary to lessen the chance of injury and/or the degree of injury in an accident. This spreads the force of the lap belt over the strong hip bone instead of across the soft abdomen. To help lessen the chance of injury and/or the degree of injury in the event of an accident: never use the same belt for more than one person at a time; do not wear twisted belts; and do not damage belts or belt buckles by pinching them in the seat or door.*

- The shoulder portion of the front seat belt restraint has a "vehicle sensitive retractor" which is designed to lock ONLY during a sudden stop or impact. At other times, it is designed to move freely with the person.

CAUTION: *Too much slack could increase the amount of injury because the belt would not be able to properly restrain you in an accident. DO NOT wear shoulder belt under the arm or out of position. Such use could increase the chance of injury and/or the degree of injury in an accident.*

- To unfasten the belts, push in the button in the center of the buckle.

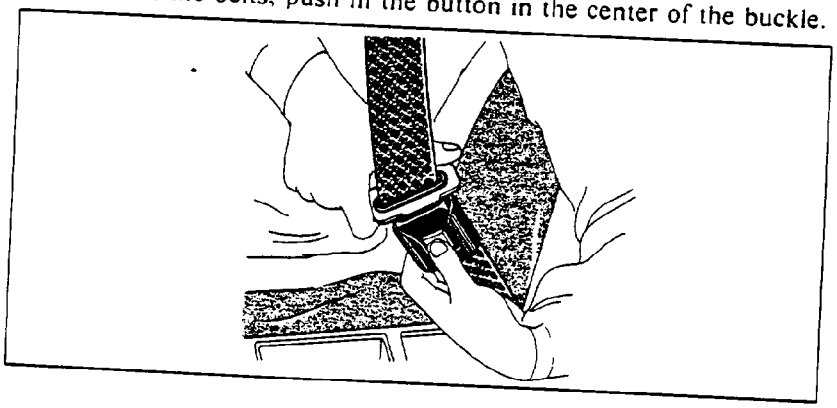


TABLE 4-2

MANFACTURERS SEAT BELT INSTRUCTIONS

(Continued)

- When no longer in use, seat belts can be stowed by letting them rewind into their retractors. If needed, move the keeper along the front seat belt webbing to let the belt retract fully. This will also put the latch plate within easy reach on the door pillar.

RESTRAINT OF PREGNANT WOMEN

We urge that pregnant women use a lap/shoulder belt whenever one is present. This will help lessen the chance of a pregnant woman and her unborn child being injured and/or will reduce the degree of their injury in an accident. The lap belt should be used alone if a shoulder belt is not present. In either case, the lap belt should be worn as low and snug over the hips as possible as advised for regular seat belt use (see the preceding instructions).

SEAT BELT LIGHT/BUZZER REMINDER

When the key is turned to the "ON" or "START" Position, a reminder light is designed to come on for four to eight seconds. It is to remind riders to fasten their seat belts.

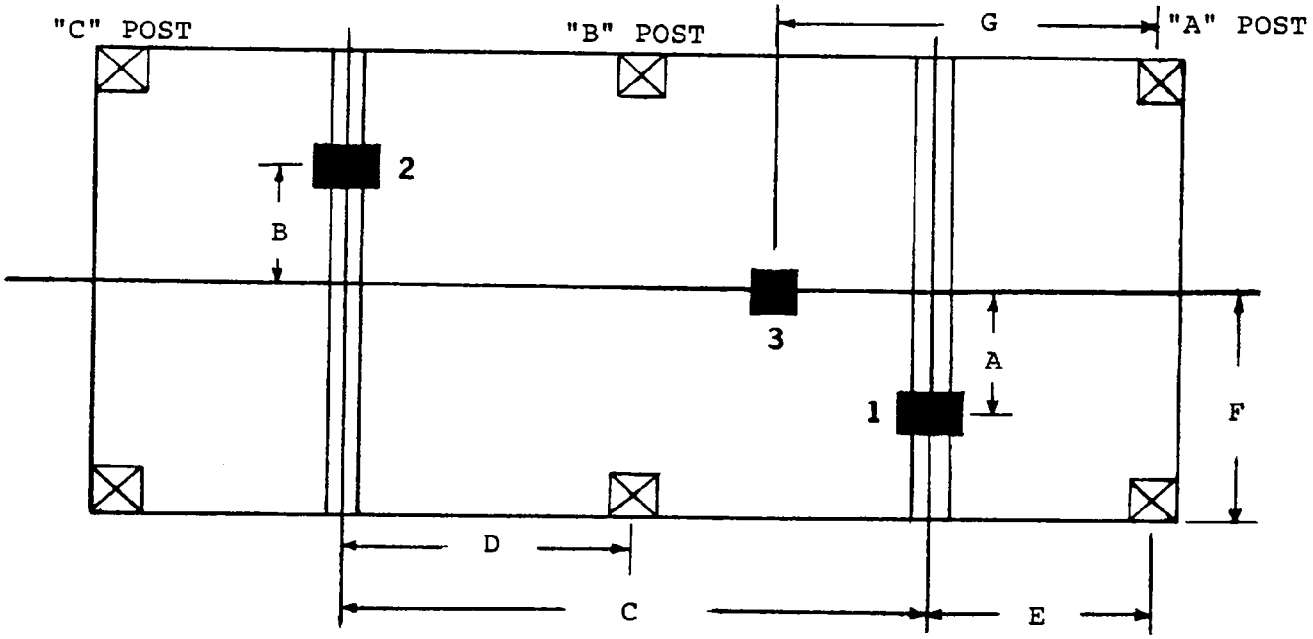
If the driver's seat belt has not been buckled before turning the key to "ON" or "START", a buzzer is designed to sound for four to eight seconds (or until buckled) as a reminder.

If the seat belt or reminder system does not work as described, see your Isuzu dealer or service facility for service.

TABLE 4-3

VEHICLE STRUCTURAL DATA

VEHICLE 1981 Isuzu I-Mark NHTSA NO. 810503



DIMENSIONS			
LOCATION	MEASUREMENT (IN.)	LOCATION	MEASUREMENT (IN.)
A	17.5	E	7.0
B	17.5	F	30.9
C	29.0	G	21.5
D	-7.0		

ACCELERATION PEAKS				
ACCELEROMETER LOCATION	POSITIVE* DIRECTION		NEGATIVE* DIRECTION	
	PEAK "G"	TIME (MSEC)	PEAK "G"	TIME (MSEC)
NO. 1 LONGITUDINAL	31.0	84.0	4.6	152.0
NO. 2 LONGITUDINAL	27.4	85.0	5.2	130.0
NO. 3 LONGITUDINAL	24.8	90.0	4.8	139.0

*POSITIVE - LONGITUDINAL: FORWARD DIRECTION

*NEGATIVE - LONGITUDINAL: REARWARD DIRECTION

TABLE 4-4

PRE-TEST

VEHICLE MEASUREMENT DATA

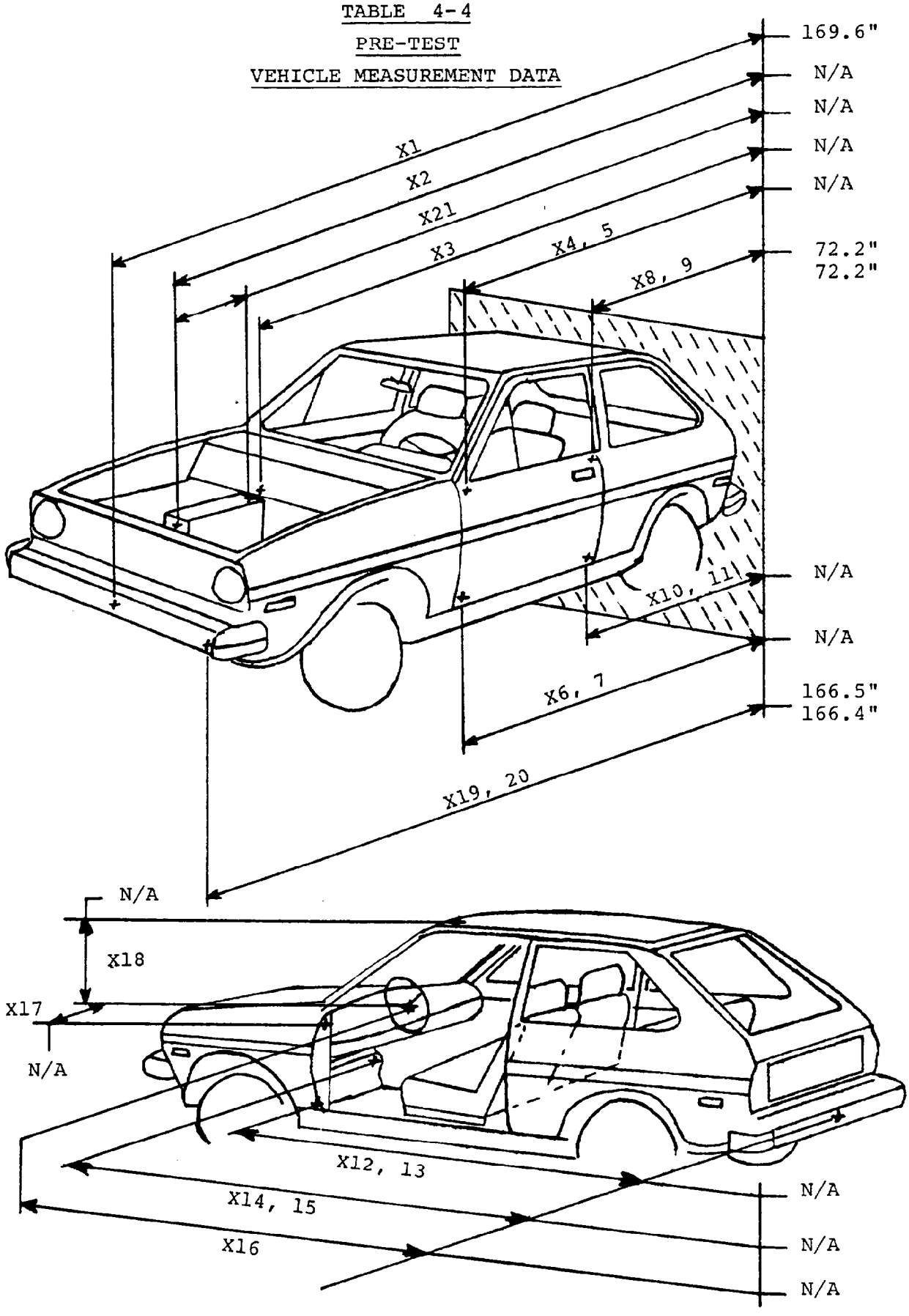


TABLE 4-5

POST-TEST

VEHICLE MEASUREMENT DATA

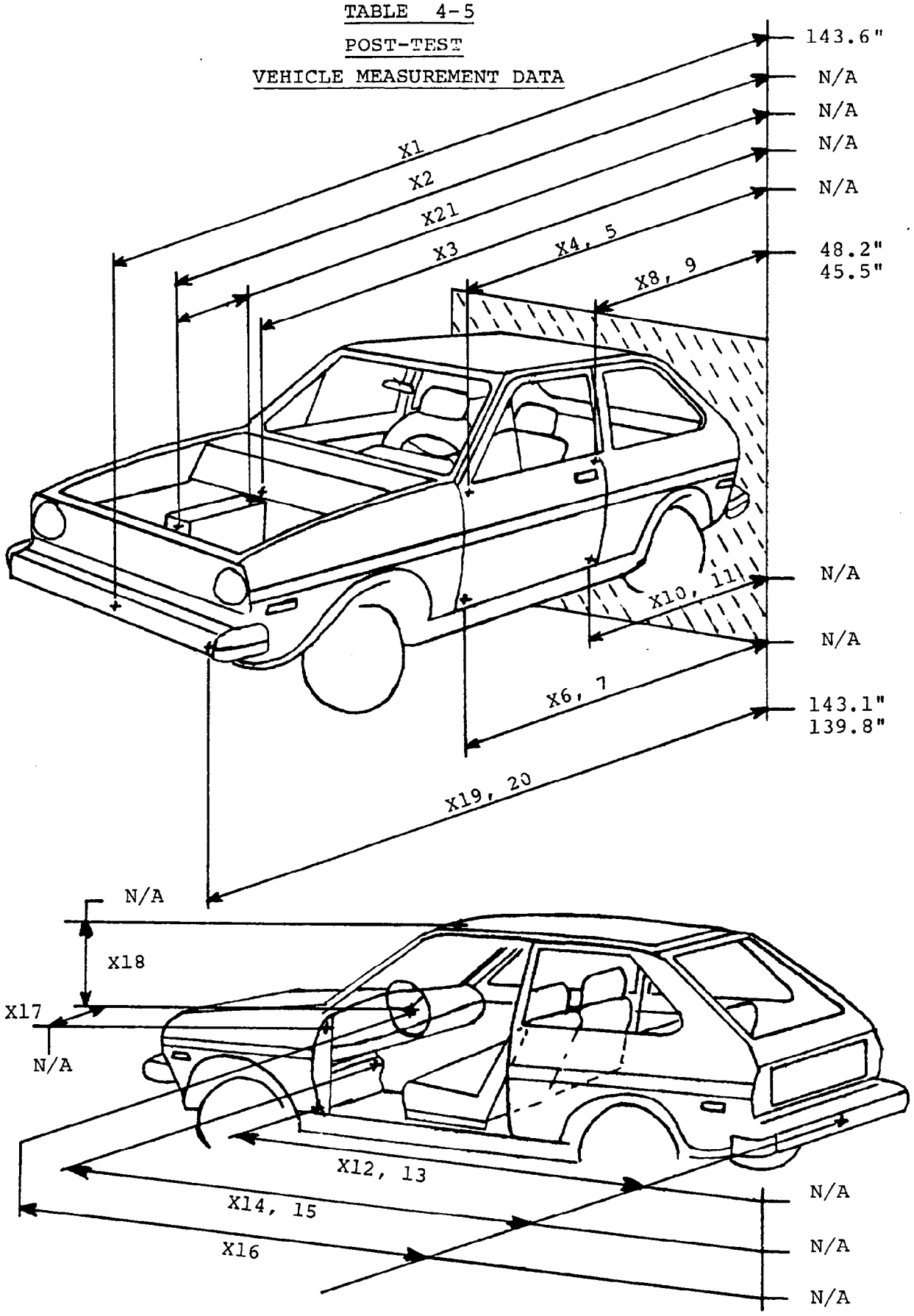


TABLE 4-6

SUMMARY

PRE-TEST AND POST-TEST VEHICLE DIMENSIONS

Measurement Point	Pre-Test	Post-Test	Difference
X1	169.6"	143.6"	26.0"
X8	72.2"	48.2"	24.0"
X9	72.2"	45.5"	26.7"
X19	166.5"	143.1"	23.4"
X20	166.4"	139.8"	26.6"

TABLE 4-7
FMVSS 301-75
CAMERA POSITIONS

VEHICLE 1981 Isuzu I-Mark

NHTSA NO. 810503 TEST DATE June 3, 1981

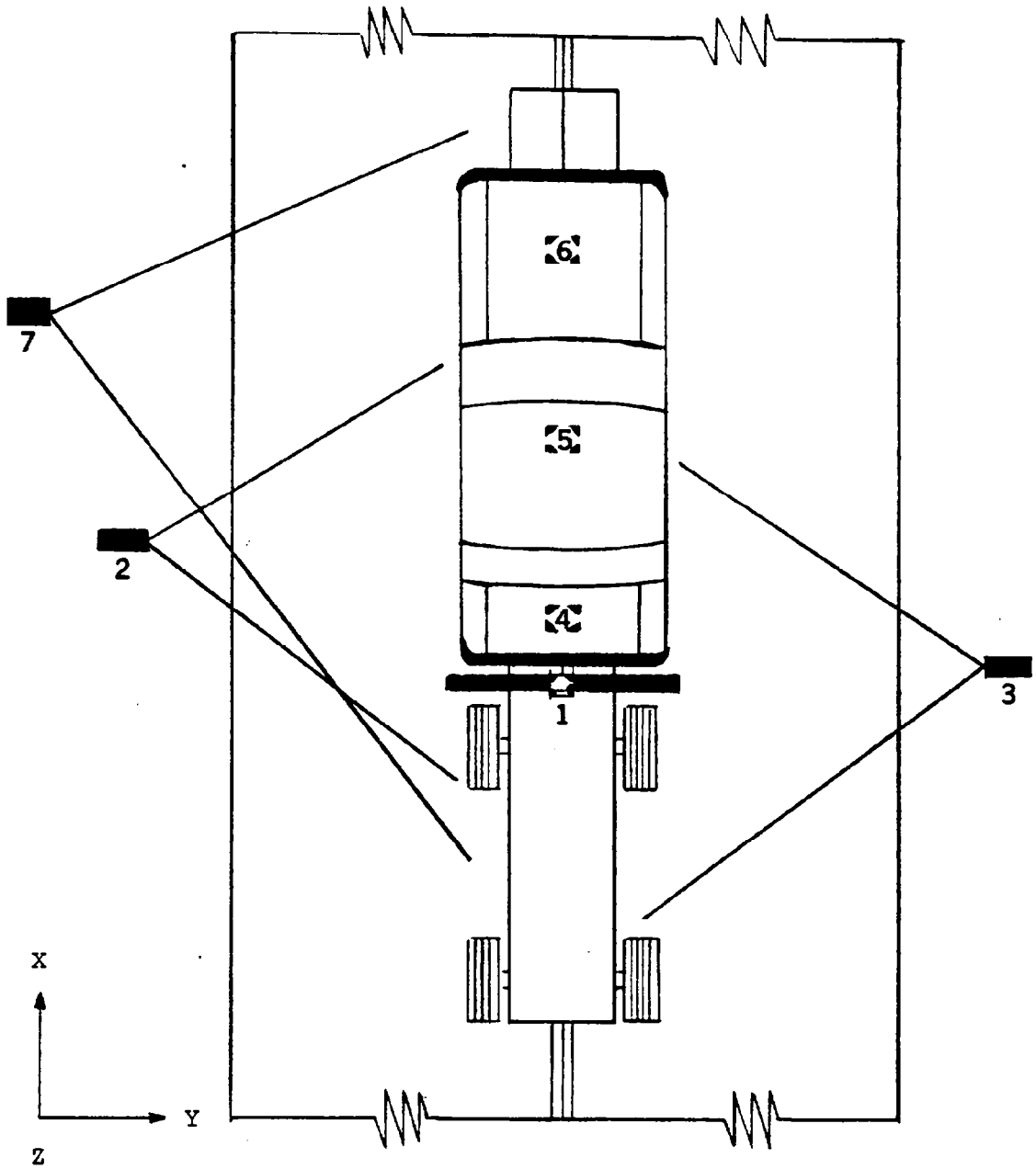


TABLE 4-8

FMVSS 301-75

CAMERA POSITIONS

VEHICLE 1981 Isuzu I-Mark

NHTSA NO. 810503 TEST DATE June 3, 1981

1.	Photo-Sonics 13mm 500FPS	X 7.5" Y - 0 - Z 99.0"	2.	Locam 13mm 500FPS	X 18.5" Y 220.0" Z 43.0"
3.	Locam 13mm 500FPS	X 16.0" Y 187.0" Z 41.0"	4.	Photo-Sonics 13mm 500FPS	X -29.0" Y 3.0" Z -42.0"
5.	Photo-Sonics 13mm 500 FPS	X 28.0" Y 0.3" Z -46.0"	6.	Photo-Sonics 13mm 500FPS	X 68.0" Y 0.7" Z -48.0"

7. Canon Scoopic
   12.5 - 75mm 24FPS
   - Documentary -

SECTION 5

SECTION 5

5.0 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.

5.1 FRONTAL COLLISION BARRIER FACILITY

5.1.1 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.

5.1.2 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.

SECTION 5

5.1.3 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.

5.1.4 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.

5.2 OBLIQUE ANGLE COLLISION BARRIER

5.2.1 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.

5.2.2 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.

5.3 MOVING COLLISION BARRIER

5.3.1 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.

5.3.2 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 5

5.4 VEHICLE STATIC ROLLOVER MACHINE

5.4.1 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.

5.4.2 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.

5.5 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 5

5.6 PHOTOGRAPH COVERAGE

5.6.1 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.

5.6.2 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.

5.6.3 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.

SECTION 5

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

5.6.4 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 5

5.7 DATA ACQUISITION AND REDUCTION

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

Prior to the vehicle impact test, onboard instrumentation is installed and a calibration and null reference check is performed to check out all analog devices, including the FM magnetic tape recorders. 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 250 Hz.

SECTION 5

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 5-3 defines each data channel and data set. At the time of entry, test personnel designate the calibration for each data channel; 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 tapes are retained on file at AETL).

The only modifications to the data at the time of permanent storage are: the application of a 250 Hz pre-digitizing analog filter (48 db/octave rolloff), the filtering and digitizing process of the FM tape recorder (2500 Hz) and the DFA (1000 Hz sampling for a 1 second window), and the application of the appropriate calibration scale factors.

SECTION 5

As the data is recalled for integration or plotting, the appropriate SAE filter is applied. These filters are in accordance with SAE J211a, Instrumentation for Impact Tests. Acceleration data is plotted after the application of an SAE class 60 filter. Velocity and displacement data is plotted after the application of an SAE calss 180 filter. The filters are shown in Figure 5-2.

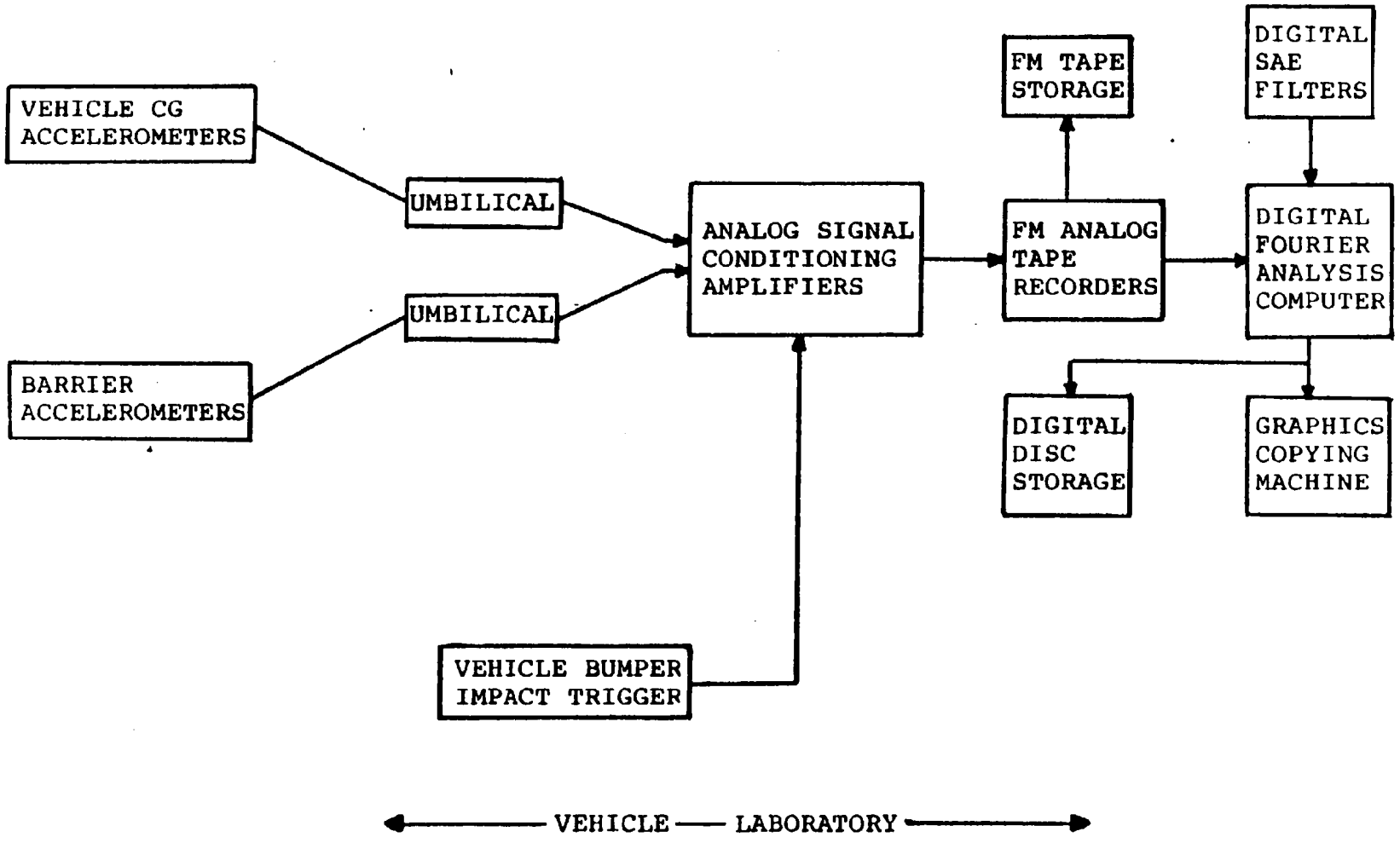
Before plotting, the test engineer determines vehicle onset and vehicle separation times. This is done by looking for characteristics contained in both the vehicle and barrier acceleration signals which indicate when these events occurred. Impact onset is verified with the trigger signal. When a velocity, or displacement trace is to be plotted, integration of the appropriate acceleration signal is performed digitally in the DFA.

All impact data is presented in the form of computer plots with a 1 second time window. Impact onset and vehicle separation times are shown, as well as appropriate labels defining the test vehicle, filter class and data plotted. The descriptions on the plots are self explanatory.

SECTION 5

In addition to the data plots, a table listing the barrier closing speed, impact and vehicle separation times and delta velocities is given. Delta velocity is taken as the difference between the velocity at the moment of impact and the velocity at the moment of separation for the barrier or vehicle.

The above data reduction process from digitizing data through plotting data is controlled with standard Hewlett Packard Fourier software in conjunction with AETL designed software written specifically for crash data reduction.



VEHICLE AND MOVING BARRIER IMPACT DATA ACQUISITION SYSTEM

FIGURE 5-1

TABLE 5-1

INSTRUMENTATION FOR CRASH TEST

Instrument	Manufacturer	Model No.	Full Scale	Accuracy	Freq. Max.
Accelerometers, Vehicle, Barrier	Endevco	2262C-200	200g	±1%	3600 Hz.
Contact Switch, Impact	AETL	-	2 V	-	<200 us rise time
FM Tape Recorder	Bell & Howell	4020	±2.8V	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 5-2

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 250 Hz b) Data digitized at 100 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 Labels

TABLE 5-3

DATA DESIGNATIONS FOR VEHICLE CRASH IMPACT DATA ACQUISITION

DATA SET	TAPE NO.	CHANNEL NO.	DESCRIPTION
1	1	1	Vehicle Longitudinal CG Acceleration Ax
1	1	2	Right Front Floor Pan Longitudinal Acceleration Ax
1	1	3	Left Rear Floor Pan Longitudinal Acceleration Ax
1	1	4	Barrier Longitudinal CG Acceleration Ax

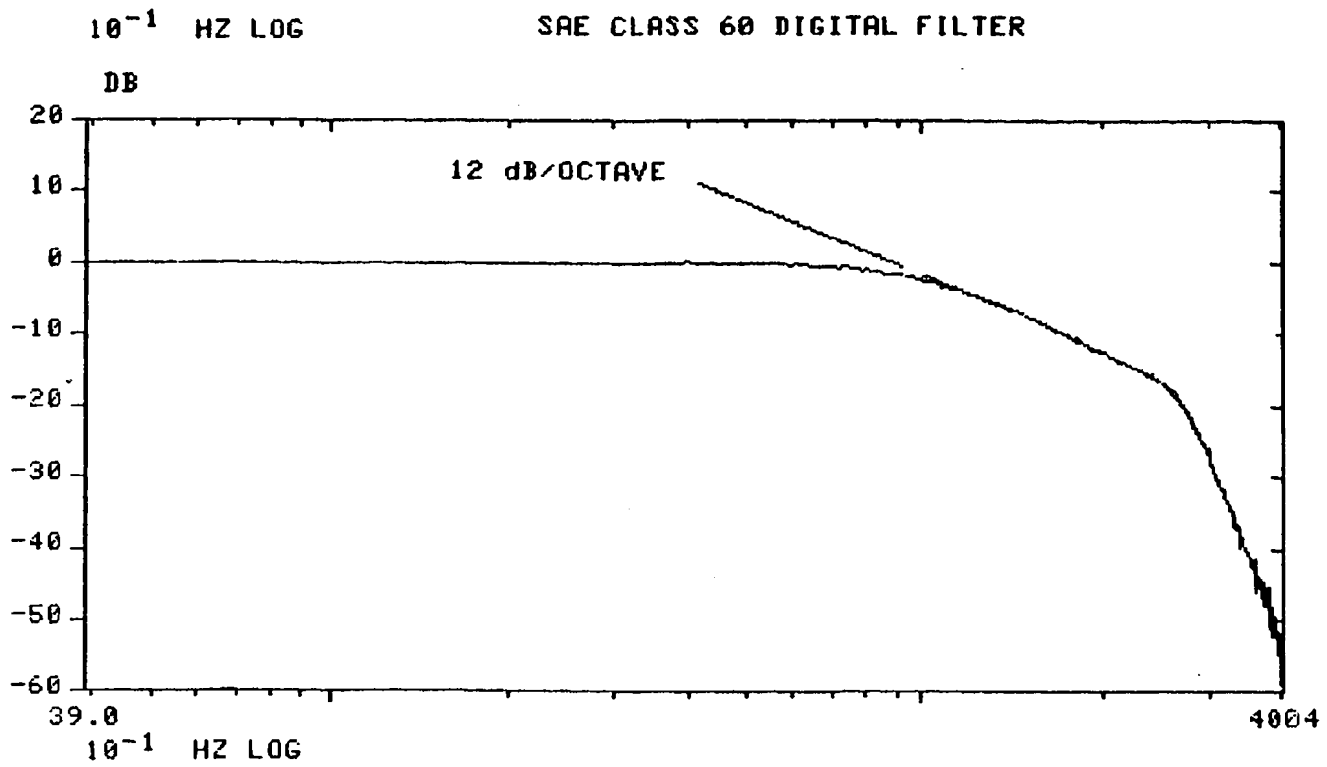

10^{-1} HZ LOG
SAE CLASS 60 DIGITAL FILTER
DB
20
10
0
-10
-20
-30
-40
-50
-60
12 dB/OCTAVE
39.0
4004
10^{-1} HZ LOG

FIGURE 5-2

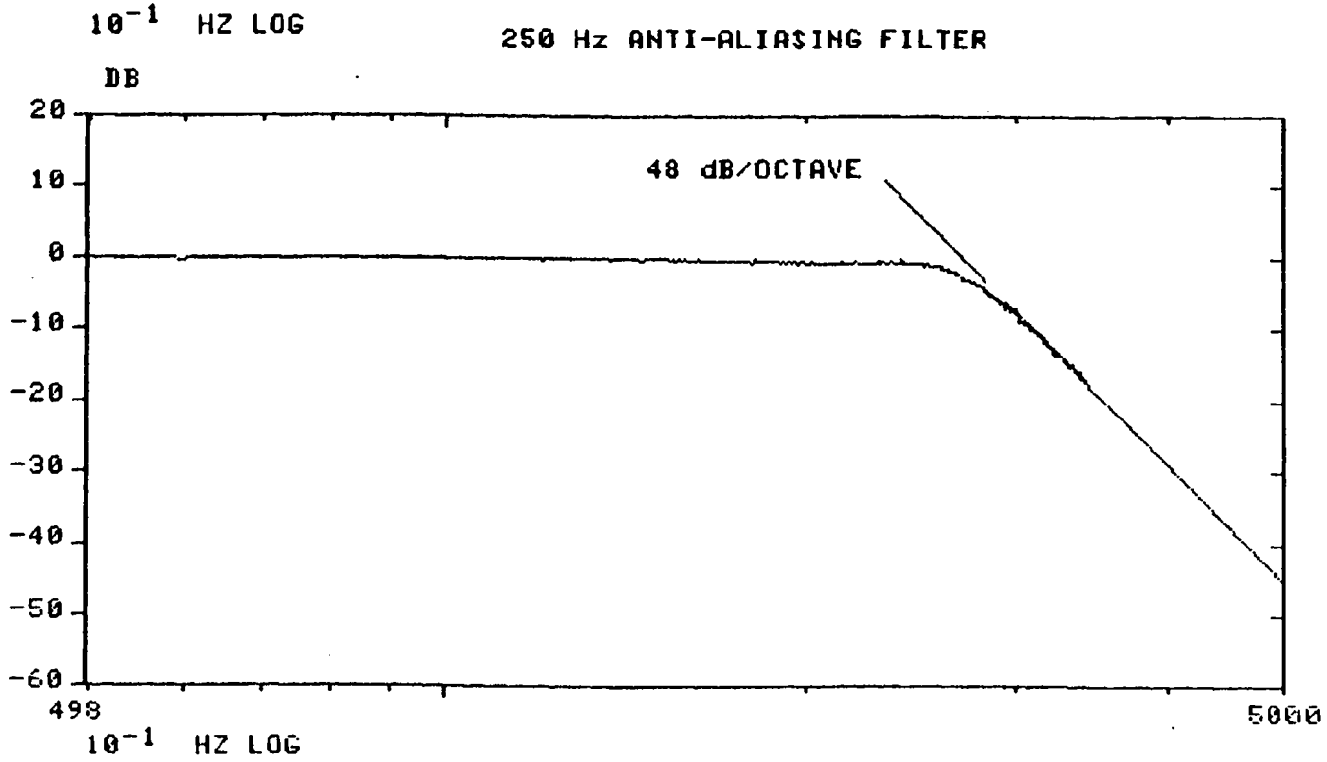


FIGURE 5-2 (Continued)

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

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Pre-Test, Driver Dummy View


810503

Figure A-2

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Pre-Test, Passenger Dummy View


810503

Figure A-3

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Driver Dummy View

Figure A-4

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Driver Dummy View

Figure A-5

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Driver Dummy Contact Area

Figure A-6

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Passenger Dummy View


810502
301
AETJ
40

Figure A-7

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Passenger Dummy View

Figure A-8

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Passenger Dummy Contact Area

Figure A-9

1981 Isuzu I-Mark Deluxe - 2 Door Coupe

NHTSA 810503

Post-Impact, Test Dummy Contact Area

APPENDIX B

APPENDIX B

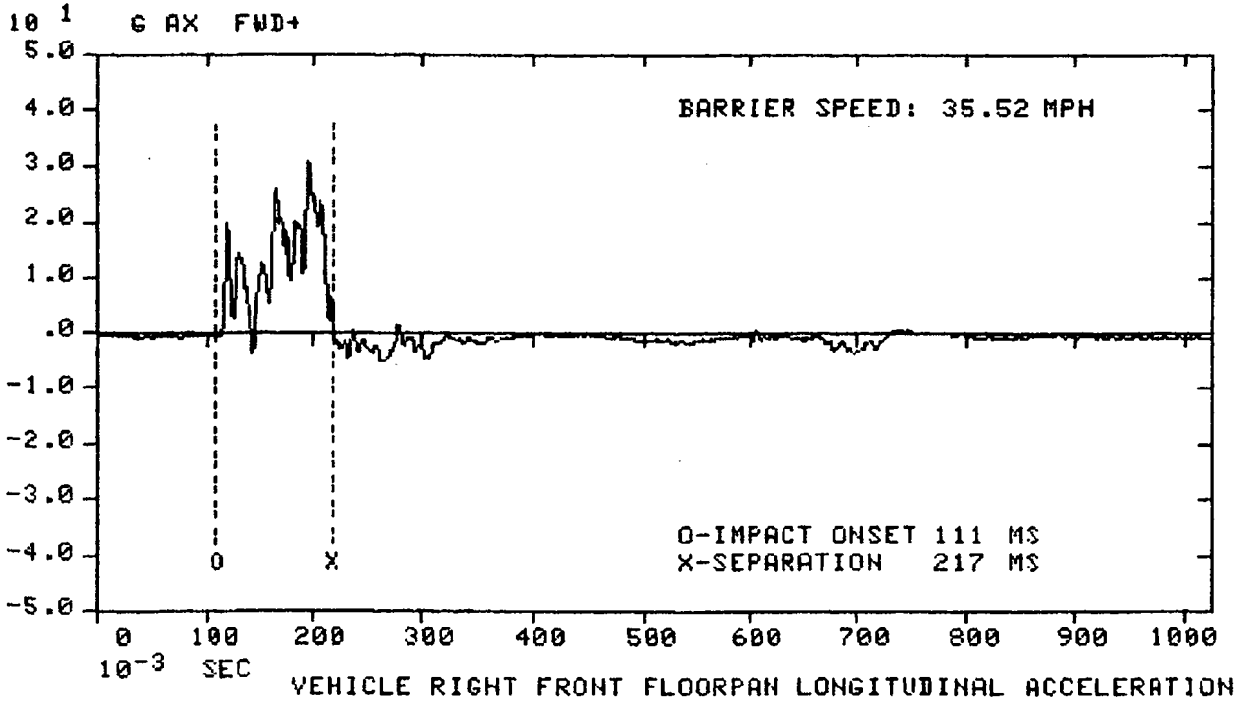
The following computer plots provide complete and comprehensive vehicle acceleration during the rear moving barrier impact test of a 1981 Isuzu I-Mark Deluxe - 2 Door Coupe - NHTSA 810503.

DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: ISUZU I-MARK COUPE
VEHICLE ID: NHTSA 810503
TEST FILE NO: 57-15 REAR IMPACT
DATE: JUNE 3, 1981

MJO NO: 971-3882-40
FILTER: CLASS 60



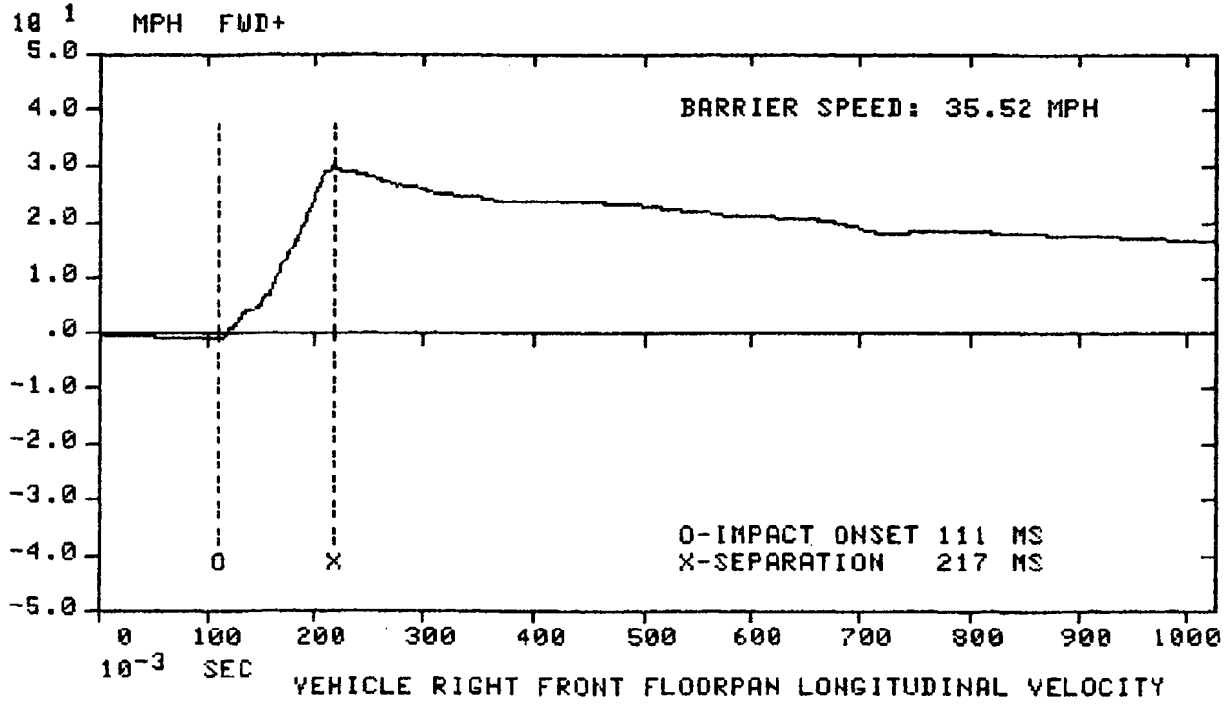
VEHICLE RIGHT FRONT FLOORPAN LONGITUDINAL ACCELERATION

DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: ISUZU I-MARK COUPE
VEHICLE ID: NHTSA 810503
TEST FILE NO: 57-15 REAR IMPACT
DATE: JUNE 3, 1981

MJO NO: 971-3882-40
FILTER: CLASS 180

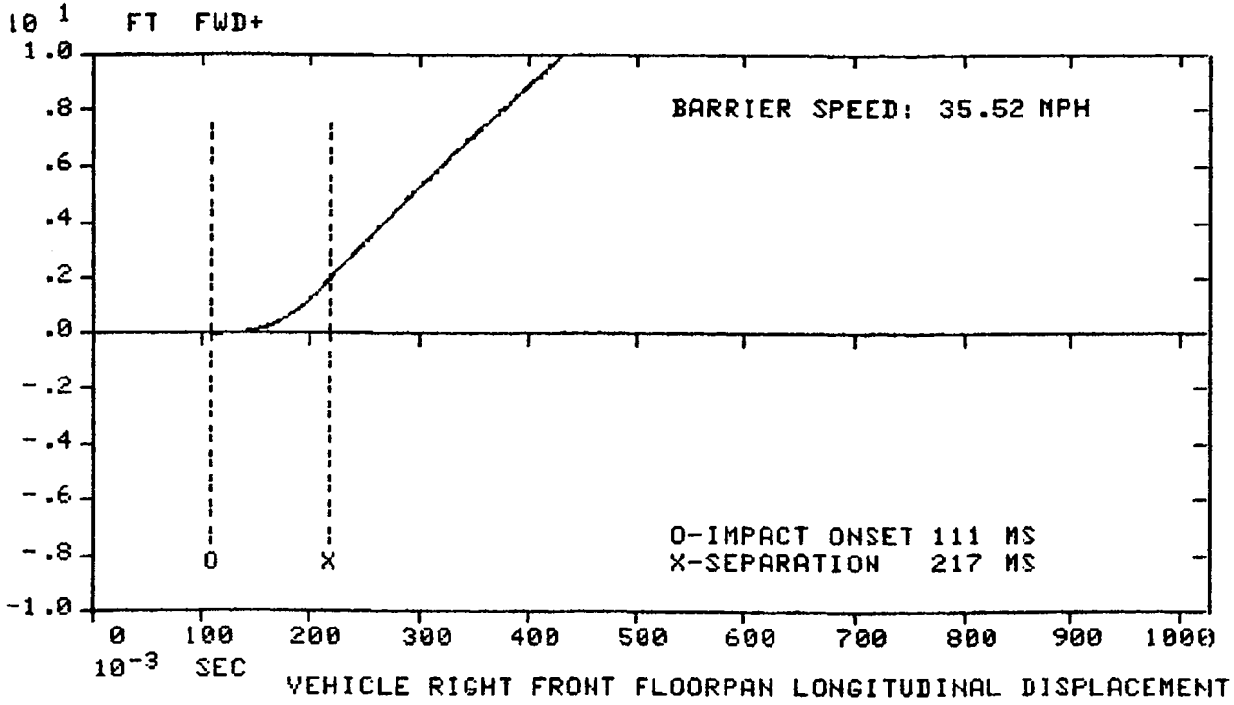


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: ISUZU I-MARK COUPE
VEHICLE ID: NHTSA 810503
TEST FILE NO: 57-15 REAR IMPACT
DATE: JUNE 3, 1981

MJO NO: 971-3882-40
FILTER: CLASS 180

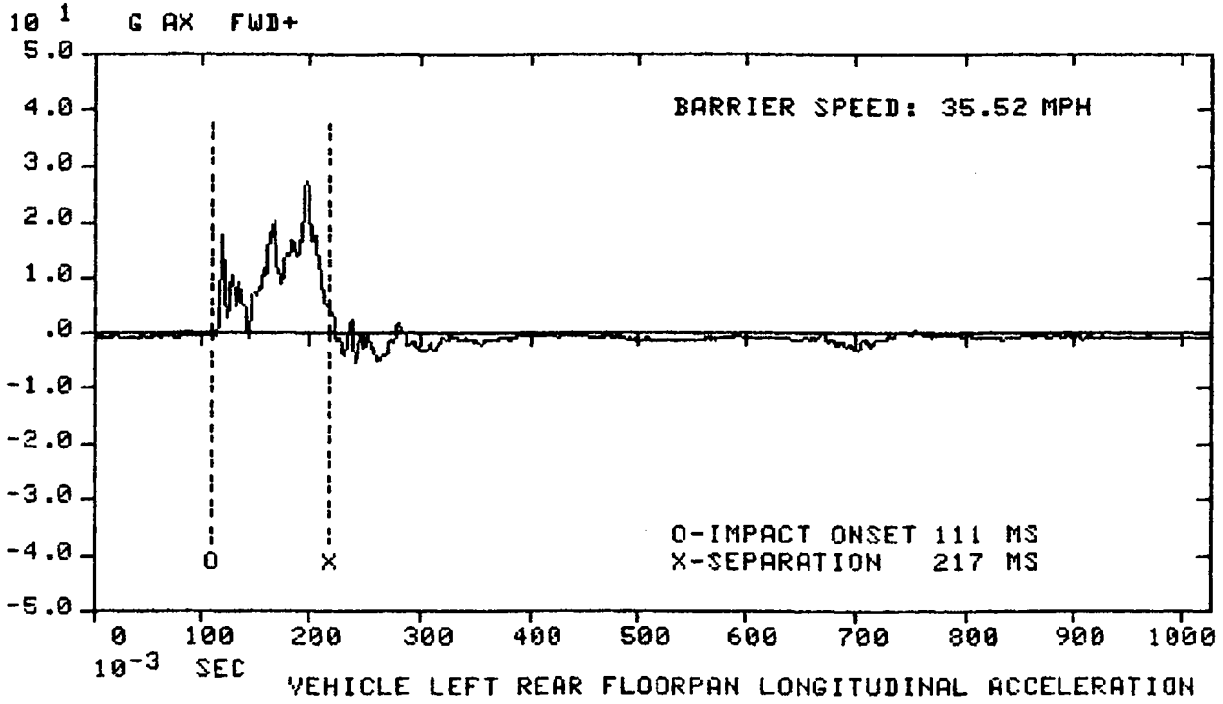


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: ISUZU I-MARK COUPE
VEHICLE ID: NHTSA 810503
TEST FILE NO: 57-15 REAR IMPACT
DATE: JUNE 3, 1981

MJO NO: 971-3882-40
FILTER: CLASS 60



VEHICLE LEFT REAR FLOORPAN LONGITUDINAL ACCELERATION

DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: ISUZU I-MARK COUPE
VEHICLE ID: NHTSA 810503
TEST FILE NO: 57-15 REAR IMPACT
DATE: JUNE 3, 1981

MJO NO: 971-3882-40
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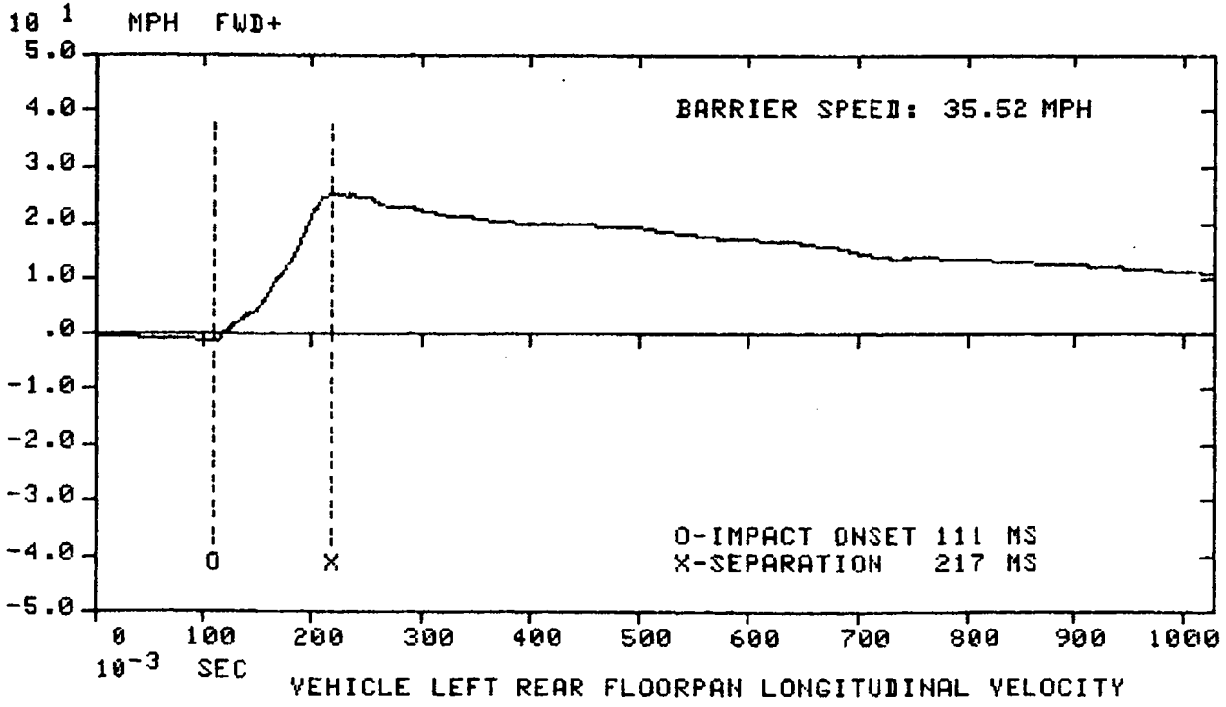

DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

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VEHICLE ID: NHTSA 810503
TEST FILE NO: 57-15 REAR IMPACT
DATE: JUNE 3, 1981

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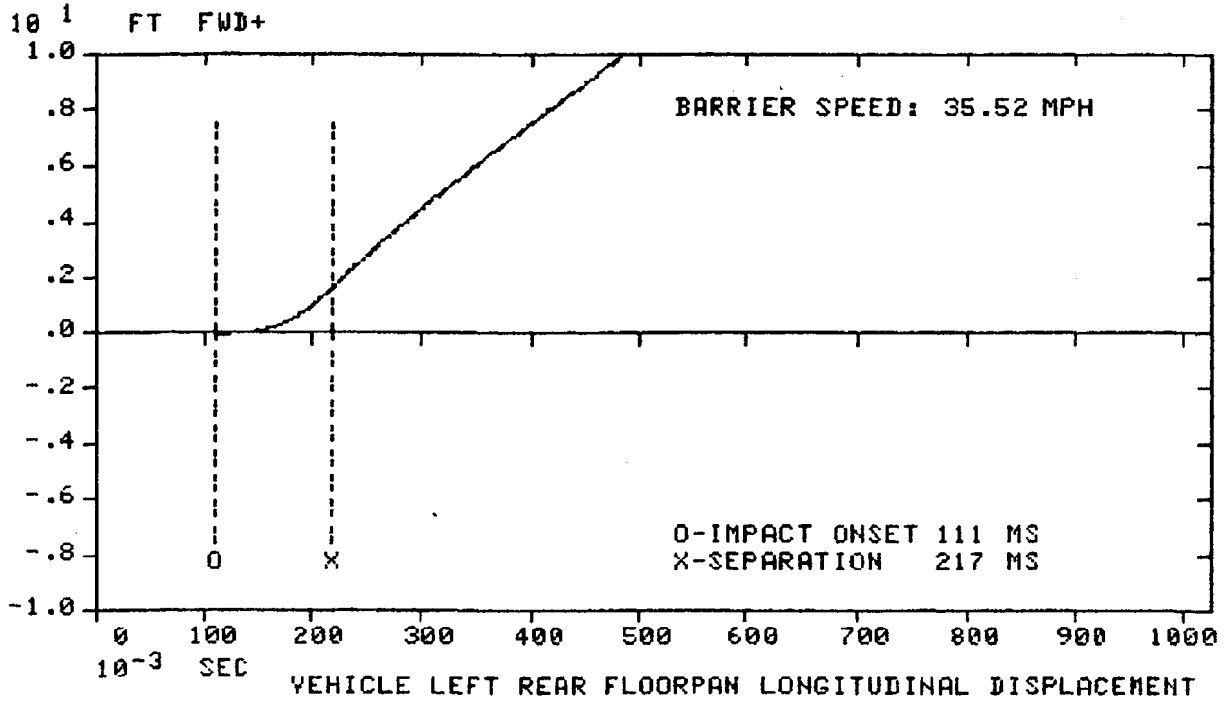

DOT CRASH PROGRAM

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VEHICLE ID: NHTSA 810503
TEST FILE NO: 57-15 REAR IMPACT
DATE: JUNE 3, 1981

APPROVED ENGINEERING TEST LABS

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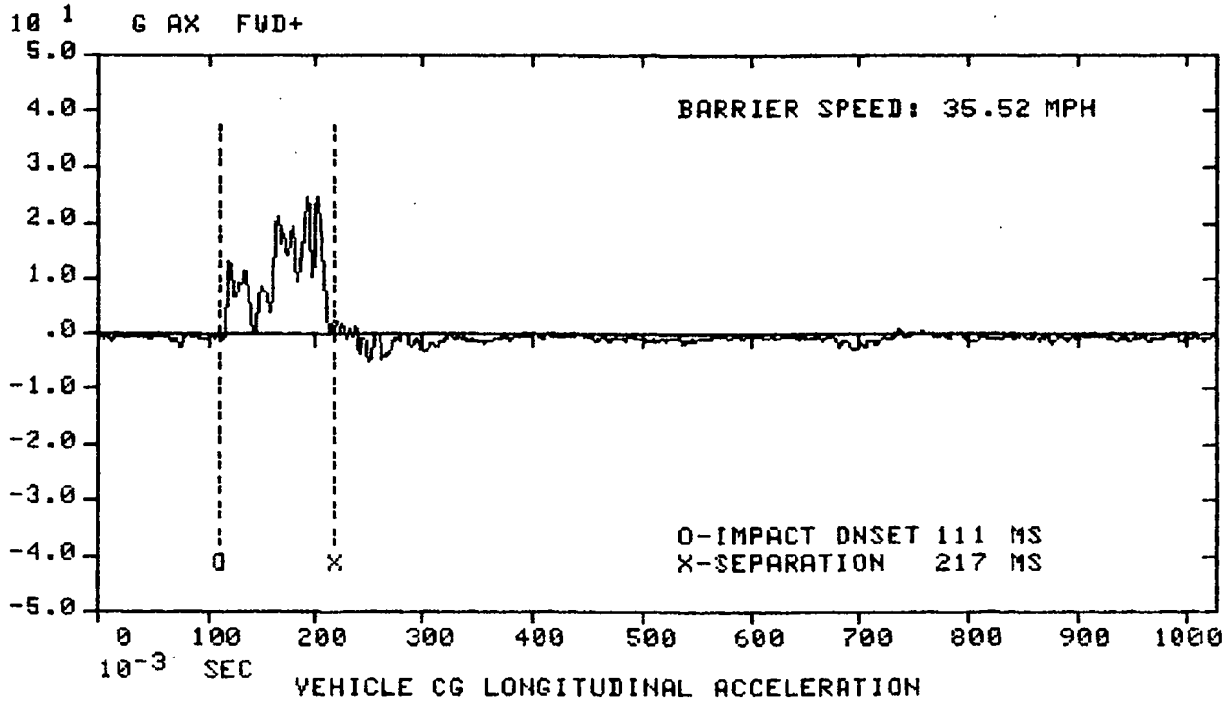


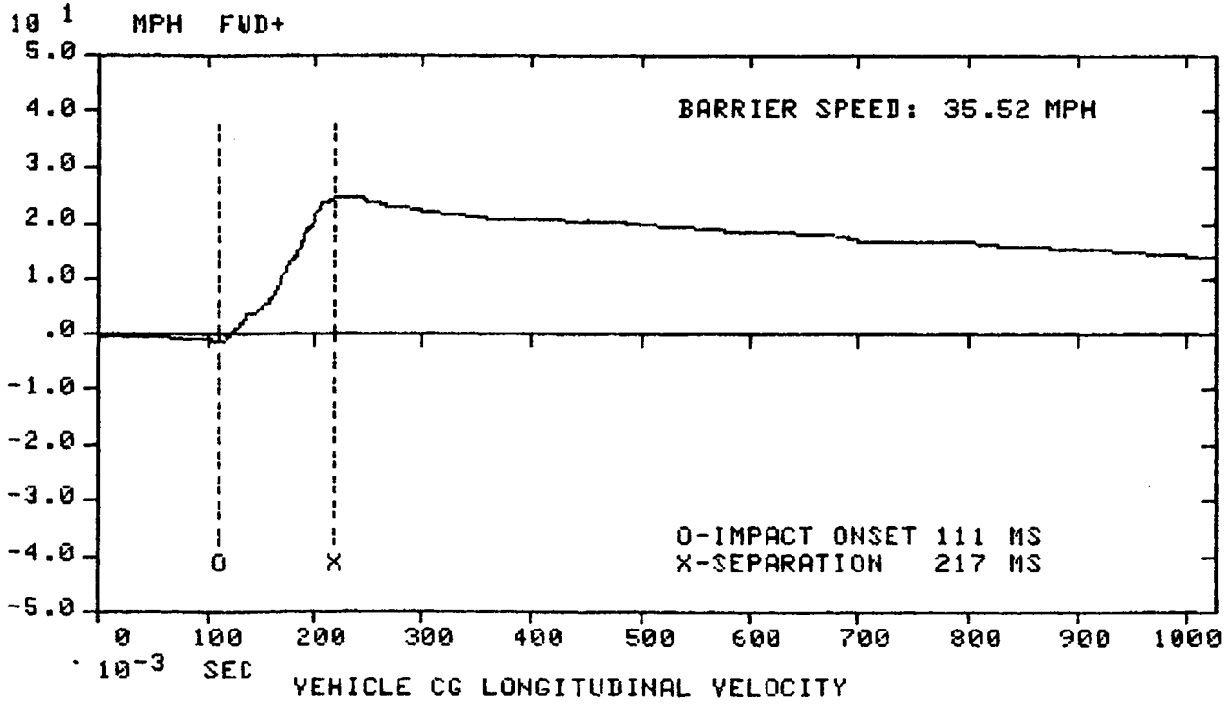
VEHICLE CG LONGITUDINAL ACCELERATION

DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: ISUZU I-MARK COUPE
VEHICLE ID: NHTSA 810503
TEST FILE NO: 57-15 REAR IMPACT
DATE: JUNE 3, 1981

MJO NO: 971-3882-40
FILTER: CLASS 180

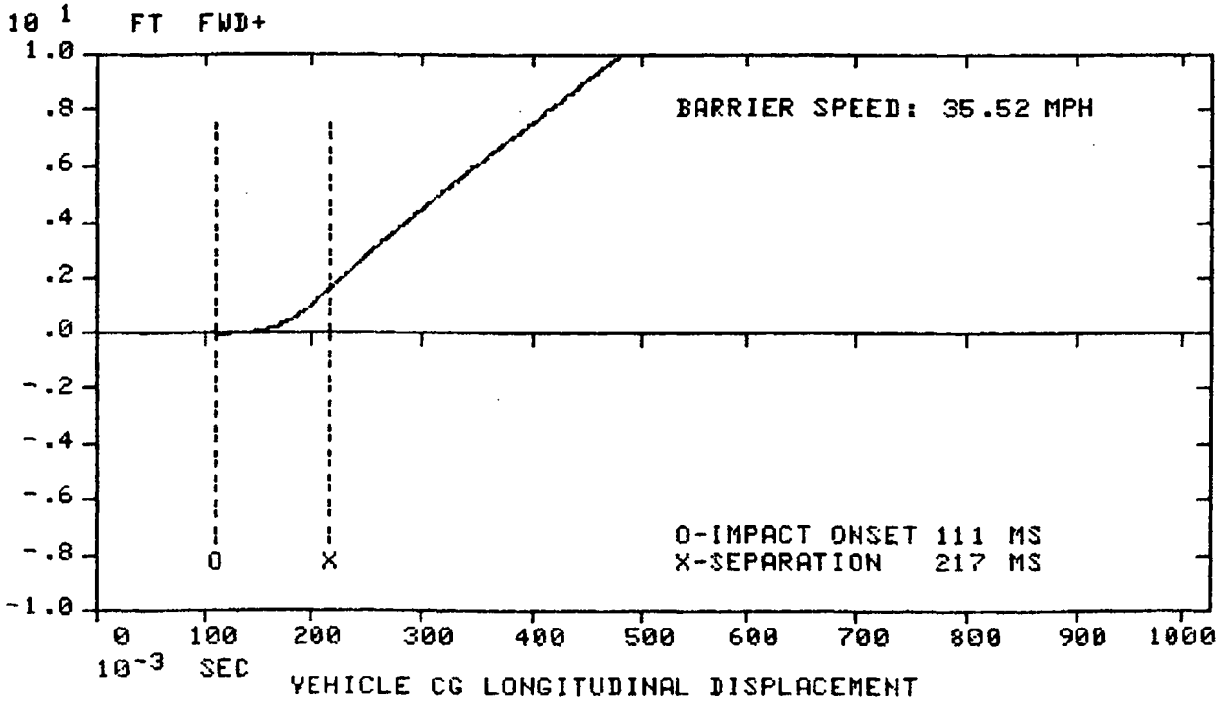


DOT CRASH PROGRAM

APPROVED ENGINEERING TEST LABS

VEHICLE: ISUZU I-MARK COUPE
VEHICLE ID: NHTSA 810503
TEST FILE NO: 57-15 REAR IMPACT
DATE: JUNE 3, 1981

MJO NO: 971-3882-40
FILTER: CLASS 180



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.

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P. C. MacDonald, Dynamics Engineer

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

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