RS # 210

REPORT NO. 6525-V-43

NEW CAR ASSESSMENT AND STANDARDS ENFORCEMENT INDICANT TESTING

FMVSS NOS. 212, 219 AND 301-75

1981 MERCURY LYNX 2-DOOR HATCHBACK

Rear Impact, 35 mph

NHTSA 308-43-506

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November 1980

FINAL REPORT

Prepared For

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
Enforcement
Office of Vehicle Safety Compliance
Nassif Building - 400 Seventh Street, S. W.
Washington, D. C. 20590

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FINAL REPORT ACCEPTED BY:

_____

Contract Technical Manager

_____

Date of Report Acceptance

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15 Supplementary Notes

Reviewed _____ Project Engineer

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16 Abstract

A rear moving barrier impact test of a 1981 Mercury Lynx 2-door hatchback was performed at Calspan Corporation, Advanced Technology Center, Transportation Research Department facility for the New Car Assessment and Standards Enforcement Indicant Testing of FMVSS 212 - Windshield Mounting; FMVSS 219 - Windshield Zone Intrusion; FMVSS 301-75 - Fuel System Integrity for the Office of Vehicle Safety Compliance, the Office of Automotive Rating and for Research and Development.

There are no requirements for compliance with FMVSS 212 and FMVSS 219 for rear barrier impact tests.

Dummies used in rear impact tests need not be instrumented nor calibrated.

- Impact speed was 34.7 mph
- Ambient temperature on the test date was 48°F
- Maximum static crush was 19.7 inches
- The vehicle complied with FMVSS 301-75 - Fuel System Integrity

17 Key Words	18 Distribution Statement
Impact Barrier Test Car Assessment	Copies of this report are available from: Technical Reference Division National Highway Traffic Safety Administration Room 5108 - Nassif Building 400 Seventh St., SW, Washington, DC 20590

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SECTION 1

PURPOSE AND TEST PROCEDURE

PURPOSE· The purpose of this was to determine whether the subject vehicle (a 1981 Mercury Lynx 2-door hatchback) meets the requirements of FMVSS No. 301-75 (Fuel System Integrity) at a higher test speed and also to obtain structural information for Research and Development and the Office of Automotive Ratings of the National Highway Traffic Safety Administration (NHTSA). This test is part of the New Car Assessment Program, B.O.A., Task 2, sponsored by the NHTSA under Contract DOT-HS-8-01938.

TEST PROCEDURE· The Calspan Corporation, Advanced Technology Center, Transportation Research Department Test Procedure for the New Car Assessment Crash Tests submitted to, and approved by, the Contract Technical Manager (CTM) contains the specific procedure used to perform this test.

With the exception of a higher test speed, this procedure is not in conflict with any portion of FMVSS Procedures issued by the Office of Standard Enforcement and the amendments in effect as noted by the applicable contract.

SECTION 2

SUMMARY OF CRASH TEST NUMBER 43

A 1981 Mercury Lynx 2-door hatchback was impacted from the rear by a moving barrier at 34.7 mph. This vehicle was equipped with a 1.6 liter four cylinder engine and a four speed transmission. The ten gallon fuel tank was filled to ninety-three percent capacity with red Stoddard fluid.

The moving barrier weight was 3990 pounds and the vehicle test weight was 2450 lbs.

Two uninstrumented 50th percentile Part 572 anthropometric test devices (ATDs) were placed in the driver's and right front passenger's seating positions and restrained with the production three-point belt system. These ATDs were positioned according to the dummy placement procedure specified in Laboratory Procedure TP-212-02. The back of the ATDs heads were chalked to indicate any head contact with the interior.

The crash event was recorded by one real-time and six high-speed cameras. Pertinent camera information can be found in Section 4 of this report. All film has been delivered under separate cover to the National Highway Traffic Safety Administration.

GENERAL COMMENTS

The 1981 Mercury Lynx, rear impacted at 34.7 mph, complied with all requirements of FMVSS 301-75 - Fuel System Integrity. There was no fuel leakage during any phase of the procedure. Because this was a rear impact test, FMVSS 212 - Windshield Mounting and FMVSS 219 - Windshield Zone Intrusion did not apply.

The outputs from the seven channels of the vehicle mounted accelerometers on the Mercury Lynx were not recorded during the test. The instrumentation cables had been connected to the FM analog magnetic tape recorders and checked for continuity by means consistant with Calspan Standard Operating Procedure (SOP) for the crash facility prior to the start of the test. Unfortunately the magnetic tape had not been properly threaded onto the machine and therefore the tape did not move over the recording head. The loss of these data is attributed to operator error. The SOP for the crash test facility has subsequently been reviewed and improved to preclude a recurrence of this type of error.

OTHER POST-TEST OBSERVATIONS

- Both front seat backs failed at impact and the passenger's seat right rail separated from the track.

- Both driver's and right front passenger's heads contacted the rear seat backs as indicated by the chalk marks, see Figure A-11.

- Both left and right rear side windows separated from the vehicle at the time of impact.

- Windshield has stress cracks on left side of vehicle.

- Rear tires remained inflated.

- The driver's door was operable but the right front passenger's door could not be opened after the test.

Table 1

CRASH TEST SUMMARY

TEST NO. 308-43-506 PROJECT: 1981 Mercury Lynx NEW CAR ASSESSMENT PROGRAM

DATE: 10-22-80 TIME: 1430 TEMP: 48°F

VEHICLE	1981 Mercury Lynx
TEST WEIGHT (lbs)	2450
IMPACT ANGLE (deg)*	0
IMPACT VELOCITY (mph)**	34.7
MAX. CRUSH (in)(Static)	19.7
MAX. INTRUSION (in)	--

DUMMIES

TYPE	HYBRID, PART 572	HYBRID II, PART 572
LOCATION	LF(1)	RF(2)
RESTRAINT	3-Point Production Belt System	3-Point Production Belt System

NUMBER OF DATA CHANNELS 7

NUMBER OF HIGH SPEED CAMERAS 6 + 1 Real Time

*With respect to tow track Centerline

**Speed trap measurement (± .05% accuracy)

Table 2

VEHICLE TEST WEIGHTS AS TESTED

Left Front	730	lbs	Left Rear	470	lbs
Right Front	770	lbs	Right Rear	480	lbs
TOTAL FRONT	1500	lbs	TOTAL REAR	950	lbs

Total Weight = 1500 + 950 = 2450 lbs

Wheel Base = 94.5 inches

$$Cg_{F.W.} = \frac{950 \text{ lbs} \quad 94.5 \text{ inches}}{2450 \text{ lbs}} = 36.64 \text{ inches}$$

CALCULATION FOR TEST WEIGHT

RCLW = Rated Cargo and Luggage Weight
UDW = Unloaded Delivered Weight (2060 lbs)
VCW = Vehicle Capacity Weight (650 lbs)
DSC = Designated Seating Capacity (4)

RCLW = VCW - 150 (DSC)
RCLW = 650 - 150 (4) = 50 lbs

TEST WEIGHT = UDW + RCLW + (No. Dummies x 164 lbs)
TEST WEIGHT = 2060 lbs + 50 lbs + 2 (164 lbs)
TEST WEIGHT = 2438 lbs CALCULATED

Table 3

SUMMARY OF TEST CONDITIONS

TEST VEHICLE INFORMATION

Vehicle Manufacturer: Ford Motor Company

Make/Model: Mercury Lynx

Body Style: 2-door Hatchback — Model Year: 1981

VIN: 1MEBP6328BT600611 — Build Date: 8-80

NHTSA No.: 308-43-506 — Color: White

Engine Data: 4 cylinders 1.6 liter XXX/cc displacement

Transmission Data: 4 speed (X) Manual ( ) Automatic

Date Vehicle Received by Laboratory: 10-15-80

Dealer's Name & Address: Towne Lincoln Mercury, Buffalo, New York

DATA FROM CERTIFICATION LABEL ON LEFT DOOR REAR FACE OR 'B' POST

Vehicle Manufactured by: Ford Motor Company

Date of Manufacture: 8-80 — VIN: 1MEBP6328BT600611

GVRW: 3040 lbs GAWR: Front 1686 lbs Rear 1364 lbs

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

Vehicle Load (up to capacity) - Front 35 psi
Rear 35 psi

Recommended Tire Size: P155/80R13

Vehicle Capacity: Types of Seats ___ Bench X Bucket ___ Split Bench

Number of Occupants (Designated Seating Capacity): 2 Front
2 Rear
4 TOTAL

Cargo Load = 50 lbs

TOTAL = 650 lbs

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

Right Front = 670 lbs — Right Rear = 380 lbs

Left Front = 610 lbs — Left Rear = 400 lbs

TOTAL FRONT WEIGHT = 1280 lbs (62.1 % of Total Vehicle Weight)

TOTAL REAR WEIGHT = 780 lbs (37.9 % of Total Vehicle Weight)

TOTAL DELV. WEIGHT = 2060 lbs

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 62 lbs CARGO

Right Front = 770 lbs — Right Rear = 480 lbs

Left Front = 730 lbs — Left Rear = 470 lbs

TOTAL FRONT WEIGHT = 1500 lbs (61.2 % of Total Vehicle Weight)

TOTAL REAR WEIGHT = 950 lbs (38.8 % of Total Vehicle Weight)

TOTAL TEST WEIGHT = 2450 lbs

Weight of ballast secured in vehicle trunk area = 0 lbs

Table 3
SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS

Date of Test 10-22-80 Time of Test 1430 am/pm

Ambient Temperature 48 °F at impact area

Temperature in Occupant Compartment 70 °F

VEHICLE ATTITUDE (all dimensions in inches)

	RF	LF	RR	LR
Delivered Attitude:	25	25	25	25
Test Attitude:	24	24.5	24.5	24.7

VEHICLE TIRE DATA

Recommended Cold Tire Pressure: Front = 35 psi Rear = 35 psi

Recommended Tire Size P155/80R13

Tires on Vehicle Michelin P155/80R13

Is Spare Tire a "Space Saver" X yes ____ no

Is Spare Tire Standard Equipment X yes ____ no

TEST FLUID DATA

Test Fluid Type: Red Stoddard Solvent #2 Spec. Grav.: 0.764

Kinematic Viscosity 0.96 Centistokes

EPA Capacity 10 gal (SPV)

Test Volume 9.3 gal (93% of EPA Capacity)

Fuel System Capacity (data from Owner's Manual) 10 gal

Details of fuel system Engine operated fuel pump. Fuel tank is located forward of the rear axle and held in place by two tank straps. The fill tube is on the right side of the vehicle and sealed by a twist-type cap and concealed by a hinged access door.

Electric Fuel Pump ___ Yes X No Fuel Injection ___ Yes X No

Does electric fuel pump operate with ignition switch "on" and the engine not operating - Yes - No

VEHICLE REBOUND AND CRUSH

Overall Length of Test Vehicle: Pre-Test = R 161.2 /L 161.2 inches

Post-Test = R 142.7 /L 141.5 inches

Crush = R 18.5 /L 19.7

SECTION 3

SUMMARY OF RESULTS OF FMVSS 301-75

- Post-Impact Data
- Fuel System Integrity Post-Impact

Table 4

POST-IMPACT DATA - STANDARDS 219 AND 301

DATA SHEET

TYPE OF TEST _____ Frontal (90°) Impact
_____ Oblique (____°) Impact on _____ Left (Driver's) Side
_____ Right Side
_____ Lateral or Side Impact on _____ Left (Driver's) Side
_____ Right Side
X Rear Impact

DATE OF TEST 10-22-80 TIME 1430 TEMP 48 °F

VEHICLE NHTSA NO. 308-43-506 VIN 1MEBP6328BT600611

REQUIRED VEHICLE VELOCITY RANGE 34.5 to 35.5 mph

IMPACT VELOCITY (traps within 5 feet of impact event) 34.73

Trap No. 1 = 34.73 mph Trap No. 2 = 34.74 mph

Distance from the vehicle's front bumper to the barrier face entering the vehicle velocity measurement device = 58 inches

exiting the vehicle velocity measurement device = 18 inches

VEHICLE STATIC CRUSH (for frontal and rear impacts only)

Driver's Side = 19.7 in Passenger's Side = 18.5 in

Average = 19.1 in

Crush Details:

Total crush of vehicle at centerline was 18.4 inches.

VEHICLE STATIC CRUSH (for side impacts only)

Amount of Crush = -- inches on -- side

Crush Details:

VEHICLE REBOUND (from rigid barrier only)

Driver's Side = -- in Passenger's Side = -- in

Average = _____ in

Table 5

"FUEL SYSTEM INTEGRITY" POST-IMPACT TEST DATA

FMVSS No. 301-75

TEST VEHICLE NHTSA NO. 308-43-506 Test Date 10-22-80

Vehicle Manufacture/Make/Model 1981 Mercury Lynx

Test vehicle fuel tank filled to 90-91% of capacity with Stoddard Solvent and with electric fuel pump operating (if it will operate without engine operation). Part 572 test dummies located at each front designated seating position.

TEST VEHICLE IMPACT TYPE

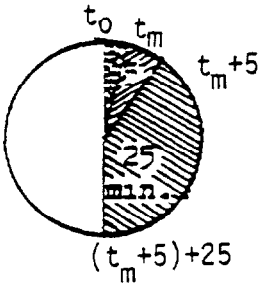
X Frontal (35 mph)

_____ Oblique (30 mph) with _____° barrier face first contacting _____ driver _____ passenger side

_____ Rear Moving Barrier (35 mph)

_____ Lateral Moving Barrier (20 mph)

FUEL SPILLAGE MEASUREMENT



	Actual	Max. Allow.
From impact until vehicle motion ceases	0	1 oz
For 5 min. period after vehicle motion ceases	0	5 oz
For next 25 min.	0	1 oz/1 min

TEST VEHICLE STATIC ROLLOVER

Test information will be added to the following static rollover data sheets

(1) Figure 8A - Rollover data for 0° to 90° test phase

(2) Figure 8B - Rollover data for 90° to 180° test phase

(3) Figure 8C - Rollover data for 180° to 270° test phase

(4) Figure 8D - Rollover data for 270° to 360° test phase

SOLVENT SPILLAGE DETAILS

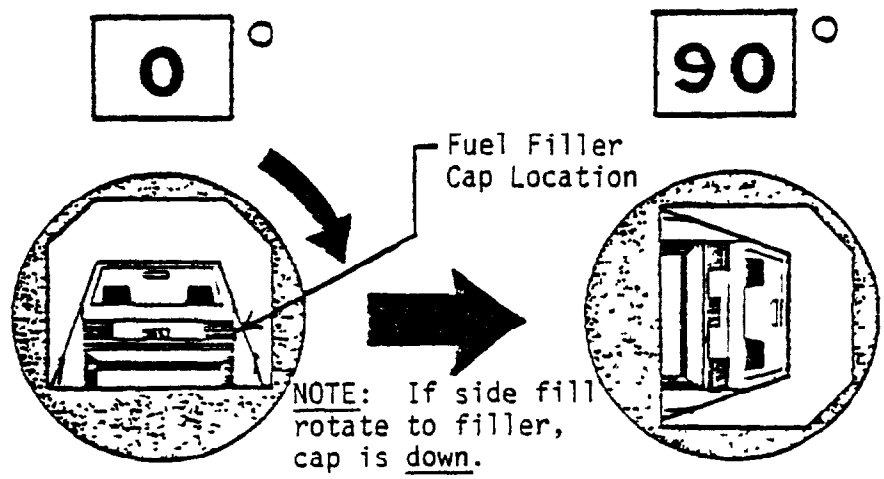
No fuel leakage.

VEHICLE NHTSA ID NO. 308-43-506

Table 5A

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEET

TEST PHASE



DETERMINATION OF SOLVENT COLLECTION TIME PERIOD

Rollover Fixture 90° Rotation Time (Spec. Range = 1 to 3 min.)	=	2	minutes	54 seconds
FMVSS 301-75 Position Hold Time	=	5	minutes	00 seconds
TOTAL	=	7	minutes	54 seconds
Next Whole Minute Interval	=	8	minutes	

FMVSS 301-75 REQUIREMENTS

Time Period

First 5 min. from onset of rotation	6th min.	7th min.	8th min. if reqd.

Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce

ACTUAL TEST VEHICLE SOLVENT SPILLAGE

0	0	0	0

NOTE: Record spillage for whole minute intervals only as determined above.

SOLVENT SPILLAGE LOCATION(S)

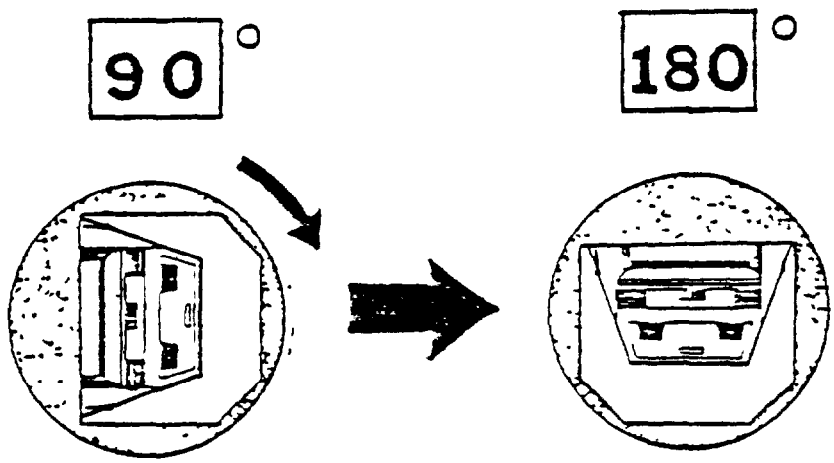
None

VEHICLE NHTSA ID NO. 308-43-506

Table 5B

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEET

TEST PHASE



DETERMINATION OF SOLVENT COLLECTION TIME PERIOD

Rollover Fixture 90° Rotation Time (Spec. Range = 1 to 3 min.)	=	2 minutes	55	seconds
FMVSS 301-75 Position Hold Time	=	5 minutes	00	seconds
TOTAL	=	7 minutes	55	seconds
Next Whole Minute Interval	=	8 minutes		

FMVSS 301-75 REQUIREMENTS

Time Period

First 5 min. from onset of rotation	6th min.	7th min.	8th min. if reqd.

Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce

ACTUAL TEST VEHICLE SOLVENT SPILLAGE

0	0	0	0

NOTE: Record spillage for whole minute intervals only as determined above.

SOLVENT SPILLAGE LOCATION(S)

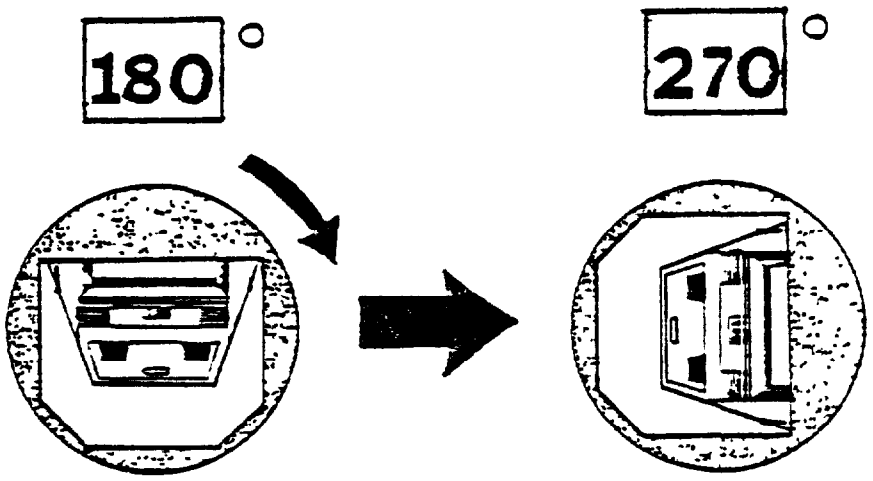
None

VEHICLE NHTSA ID NO. 308-43-506

Table 5C

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEET

TEST PHASE



DETERMINATION OF SOLVENT COLLECTION TIME PERIOD

Rollover Fixture 90° Rotation Time (Spec. Range = 1 to 3 min.)	=	2 minutes	57	seconds
FMVSS 301-75 Position Hold Time	=	5 minutes	00	seconds
TOTAL	=	7 minutes	57	seconds
Next Whole Minute Interval	=	8 minutes		

FMVSS 301-75 REQUIREMENTS

Time Period

First 5 min. from onset of rotation	6th min.	7th min.	8th min. if reqd.

Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce

ACTUAL TEST VEHICLE SOLVENT SPILLAGE

0	0	0	0

NOTE: Record spillage for whole minute intervals only as determined above.

SOLVENT SPILLAGE LOCATION(S)

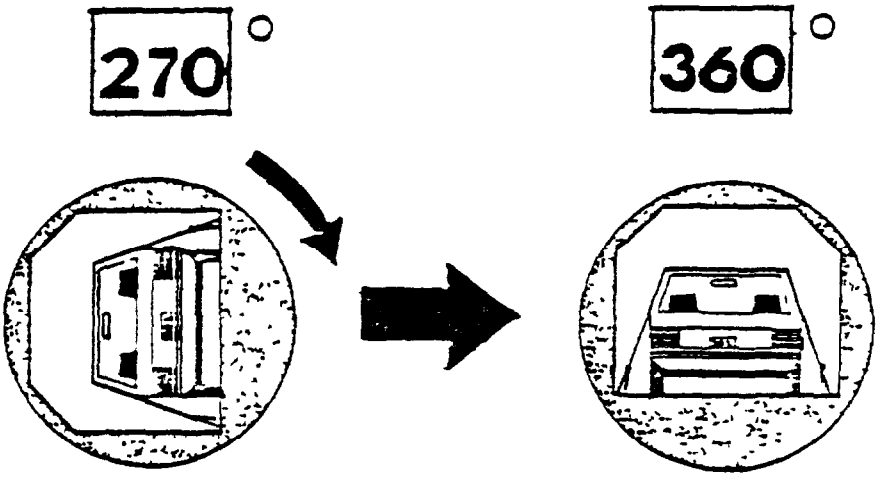
None

VEHICLE NHTSA ID NO. 308-43-506

Table 5D

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEET

TEST PHASE



DETERMINATION OF SOLVENT COLLECTION TIME PERIOD

Rollover Fixture 90° Rotation Time (Spec. Range = 1 to 3 min.)	=	2	minutes	56 seconds
FMVSS 301-75 Position Hold Time	=	5	minutes	00 seconds
TOTAL	=	7	minutes	56 seconds
Next Whole Minute Interval	=	8	minutes	

FMVSS 301-75 REQUIREMENTS

Time Period

First 5 min. from onset of rotation	6th min.	7th min.	8th min. if reqd.

Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce

ACTUAL TEST VEHICLE SOLVENT SPILLAGE

0	0	0	0

NOTE: Record spillage for whole minute intervals only as determined above.

SOLVENT SPILLAGE LOCATION(S)

None

SECTION 4

OCCUPANT AND VEHICLE INFORMATION

- Pre- and Post-Test Vehicle Measurements
- Vehicle Accelerometer Locations
- Camera Locations and Focal Lengths
- Dummy Clearance Dimensions

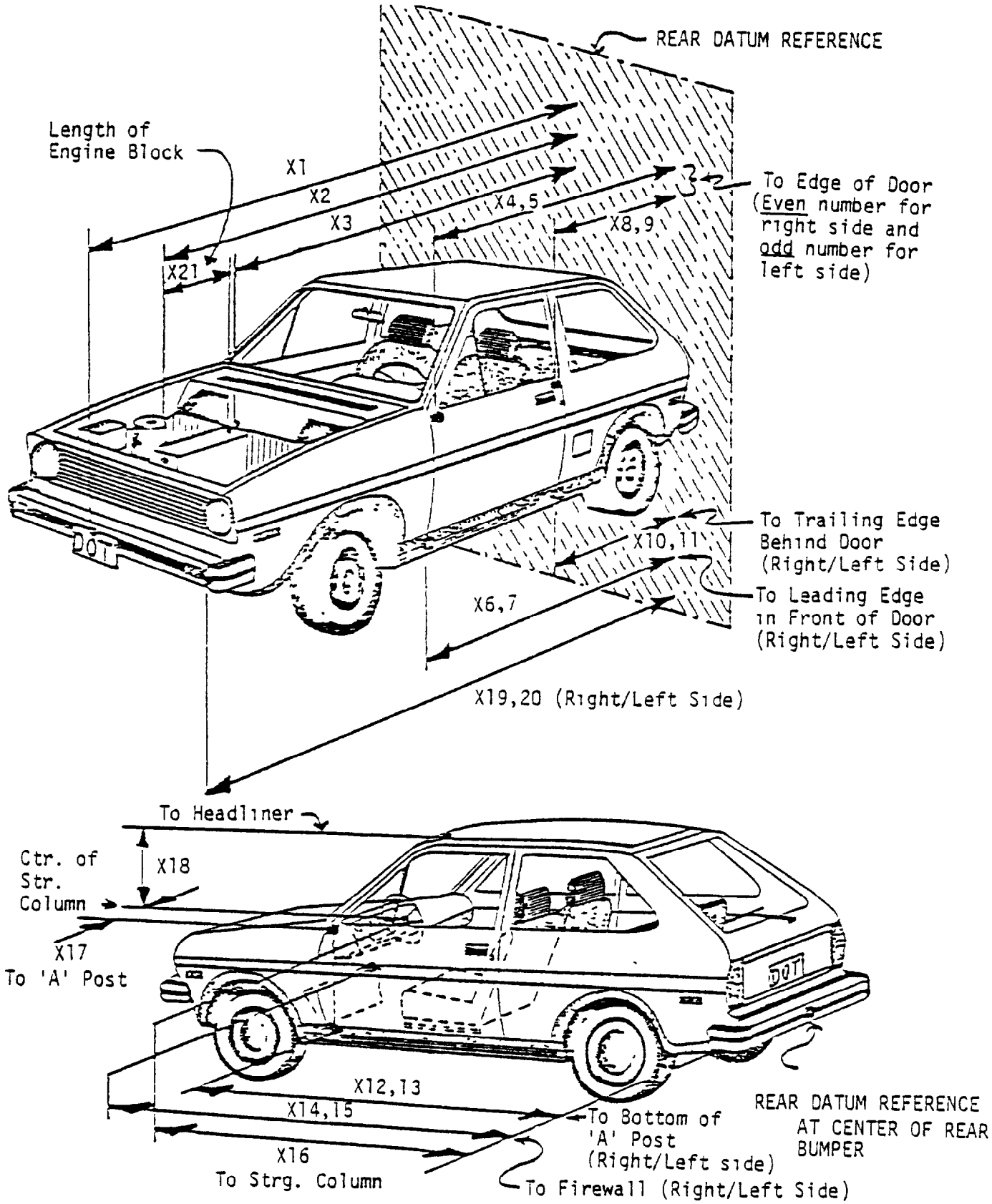
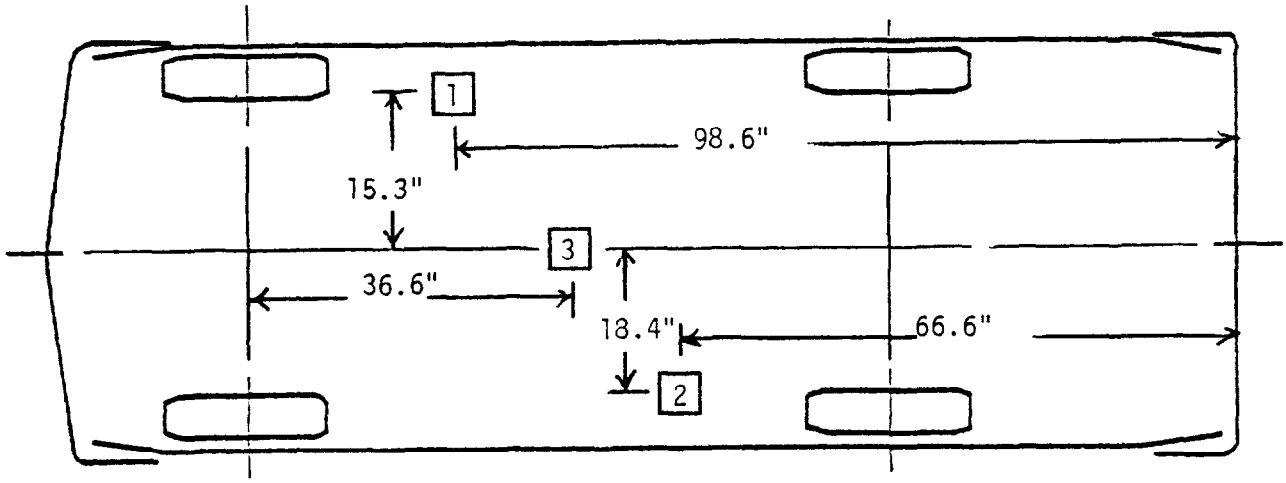


Figure 1 PRE-TEST AND POST-TEST MEASUREMENT POINTS

Table 6

NO	VEHICLE MEASUREMENTS TYPE OF MEASUREMENT	ALL DIMENSIONS IN INCHES PRE-TEST	POST TEST	Diff.
X1	Total Length of Vehicle at Centerline	164.5	146.1	18.4
X2	Rear Surface of Vehicle to Front of Engine	N/A	N/A	--
X3	Rear Surface of Vehicle to Firewall	N/A	N/A	--
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	N/A	N/A	--
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	N/A	N/A	--
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	N/A	N/A	--
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	N/A	N/A	--
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	64.1	46.2	17.9
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	64.1	44.6	19.5
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	N/A	N/A	--
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	N/A	N/A	--
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	N/A	N/A	--
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	N/A	N/A	--
X14	Rear Surface of Vehicle to Firewall - Right Side	N/A	N/A	--
X15	Rear Surface of Vehicle to Firewall - Left Side	N/A	N/A	--
X16	Rear Surface of Vehicle to Steering Column	N/A	N/A	--
X17	Center of Steering Column to "A" Post	N/A	N/A	--
X18	Center of Steering Column to Headliner	N/A	N/A	--
X19	Rear Surface of Vehicle to Right Side of Front Bumper	161.2	142.7	18.5
X20	Rear Surface of Vehicle to Left Side of Front Bumper	161.2	141.5	19.7
X21	Length of Engine Block			



ACCELEROMETER NUMBER	ACCELEROMETER LOCATION	DIRECTION		
		X	Y	Z
1	Accel. Pack #1 Front Crossmember	X		X
2	Accel. Pack #2 Rear Crossmember	X		X
3	Accel. Pack #3 Center of Gravity	X	X	X

FIGURE 2 VEHICLE ACCELEROMETER LOCATIONS

Note: Camera information shown on Tables 7 and 8.

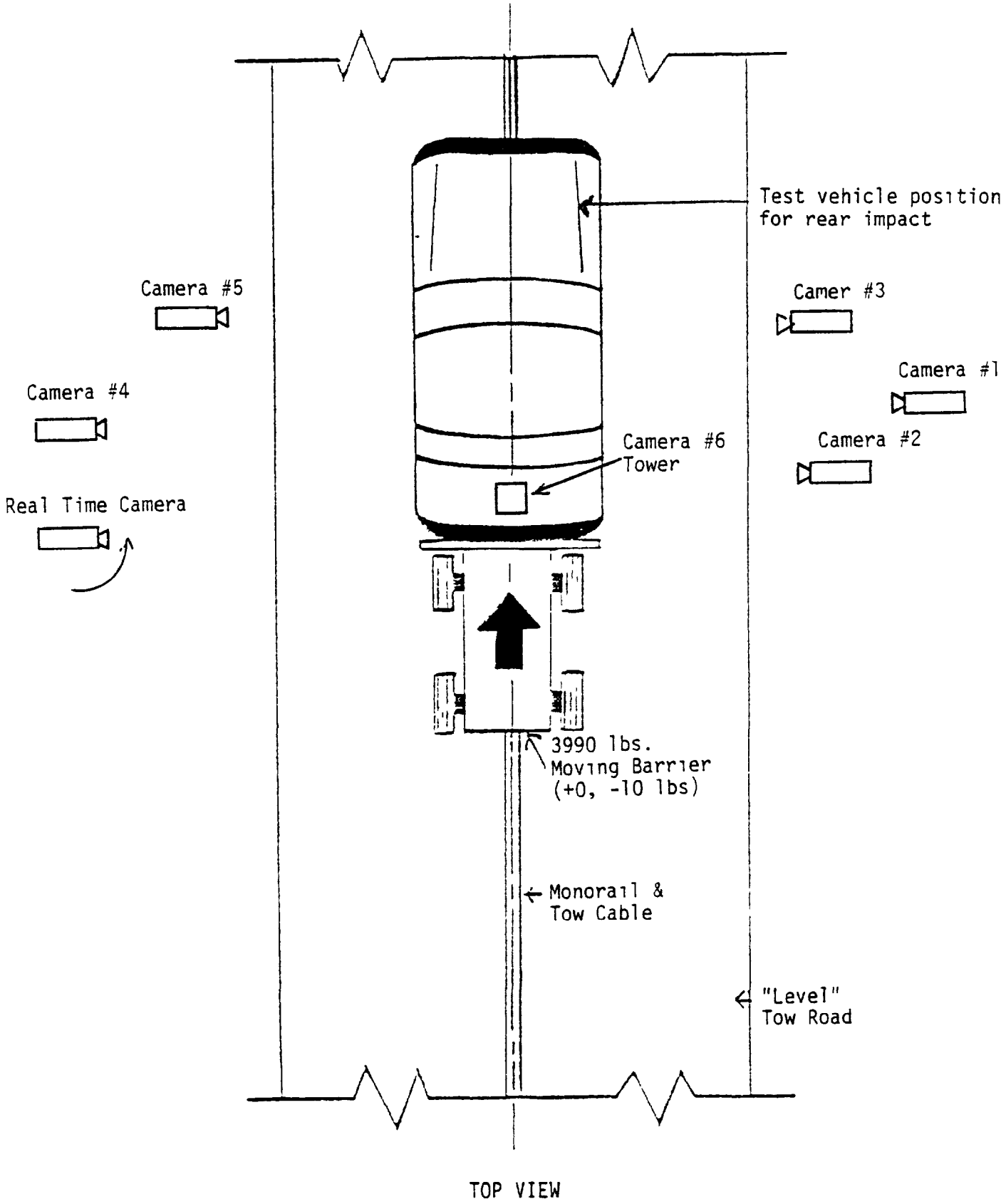


FIGURE 3 CAMERA POSITIONS FOR REAR IMPACTS

Table 7

HIGH SPEED CAMERA LOCATIONS

Test No.: 308-43-506 Vehicle No. 1981 Dodge Aries

CAMERA NUMBER	VIEW	CAMERA POSITIONS (IN)* X	Y	Z	CAMERA ANGLE (DEG)**	FILM PLANE TO HEAD TARGET (IN) X
1	Impact Event	413	144	51	- 4	389
2	Impact (Close-up)	312	100	41	- 3	288
3	Right Front Passenger	150	72	41	- 3.5	126
4	Impact Event	295	68	49.5	- 1	271
5	Driver	243	96	45.5	- 2	219
6	Tower Overhead	0	75	388	-80	---
7						
8						
9						

*X = film plane to monorail centerline
Y = film plane to impact location
Z = film plane to ground

**Referenced to Horizontal Plane

Table 8

HIGH SPEED CAMERA INFORMATION

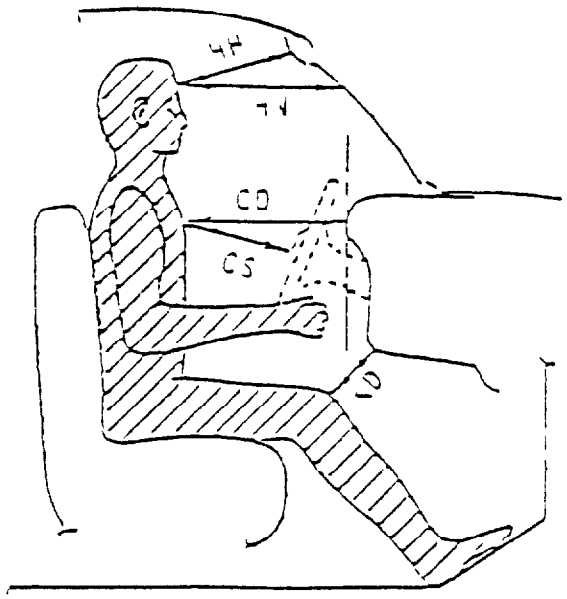
(Test 308-43-506)

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)
1	Impact Event	Photosonic	13 mm	900
2	Impact Close-up	Photosonic	35 mm	900
3	Right Front Passenger	Photosonic	35 mm	900
4	Impact Event	Photosonic	13 mm	900
5	Driver	Photosonic	35 mm	900
6	Tower Overhead	Photosonic	13 mm	900

NOTE CAMERAS ARE NUMBERED ACCORDING TO SPLICING SEQUENCE OF FILM.

(24 fps) REAL TIME MOVIE FILM COVERAGE OF PRE-CRASH, POST CRASH AND CRASH EVENT SPLICED AT START OF FILM.

	DRIVER	PASS
⊣H	15.2	15.5
⊓W	21.5	21.2
CD	21.5	21.0
CS	13.5	---
<DL	3.5	3.25
<DR	3.5	3.25



⊣R	5.5	5.25
HS	7.5	7.25
AD	3.0	3.5
HD	6.5	6.0

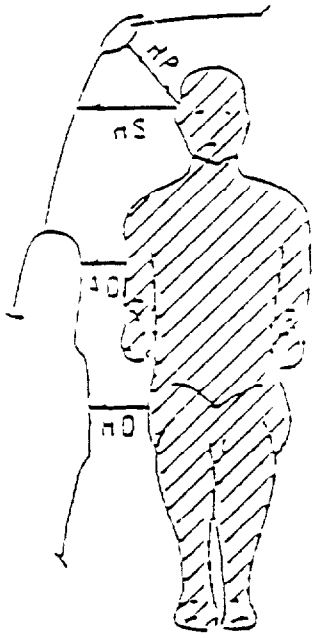


FIGURE 4 DUMMY CLEARANCE DIMENSIONS

APPENDIX A

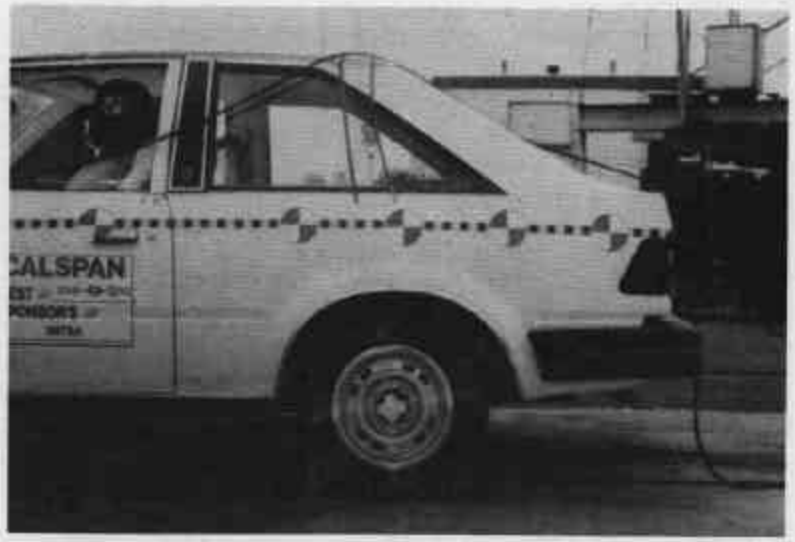
STILL PHOTOGRAPHS

1981 FORD LYNX

FIGURE A-1 PRE- AND POST-TEST VIEWS OF FRONT AND REAR EXTERIOR

FIGURE A-2 PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT REAR THREE-QUARTERS

FIGURE A-3 PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT FRONT THREE-QUARTERS



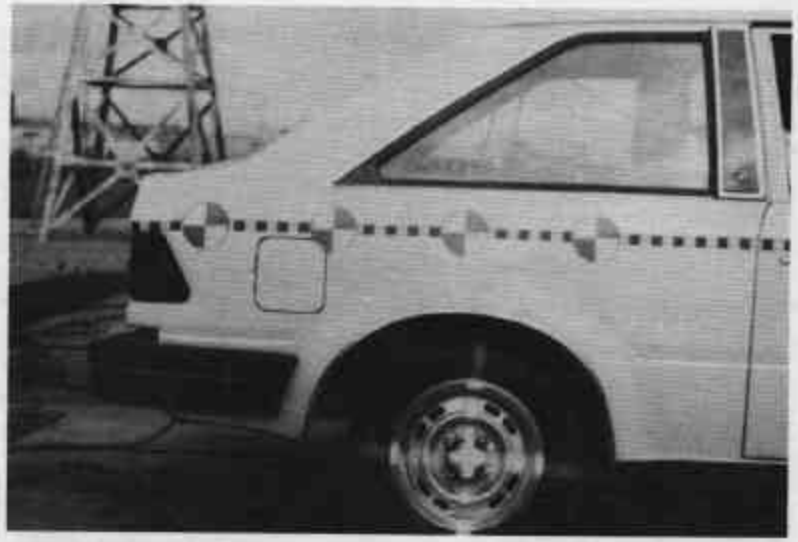


FIGURE A-4 PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT REAR QUARTERS

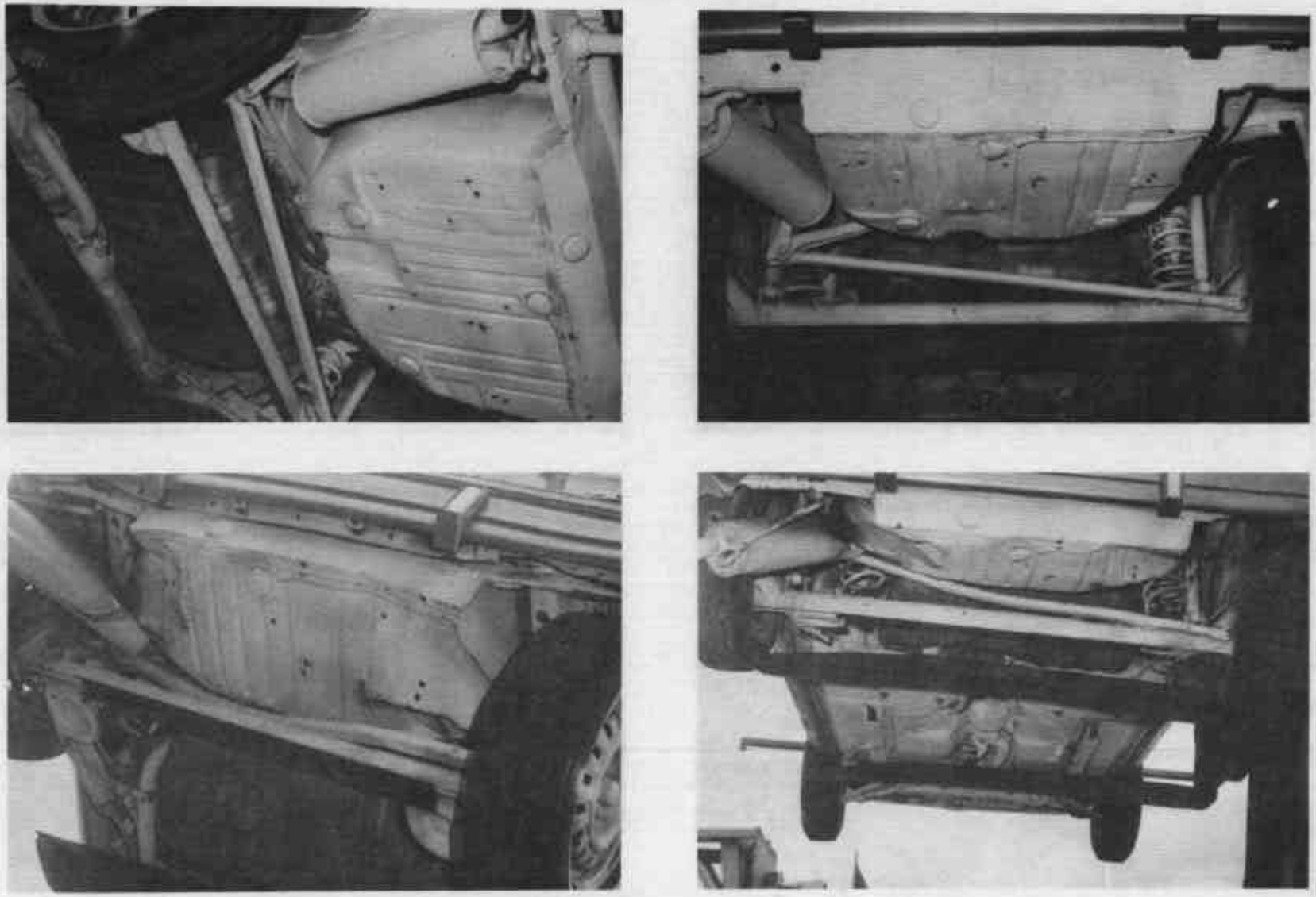


FIGURE A-5 PRE- AND POST-TEST VIEWS OF REAR UNDERBODY

FIGURE A-6 PRE- AND POST-TEST VIEWS OF RIGHT SIDE

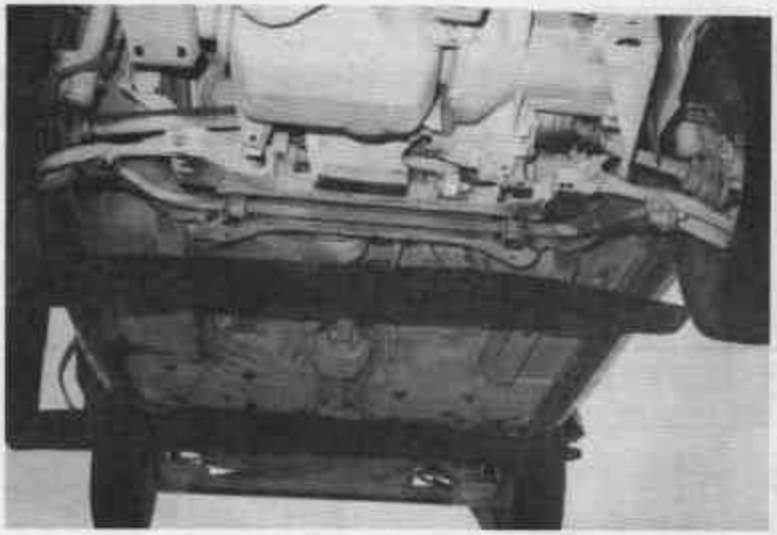


FIGURE A-7 PRE- AND POST-TEST VIEWS OF FRONT UNDERBODY

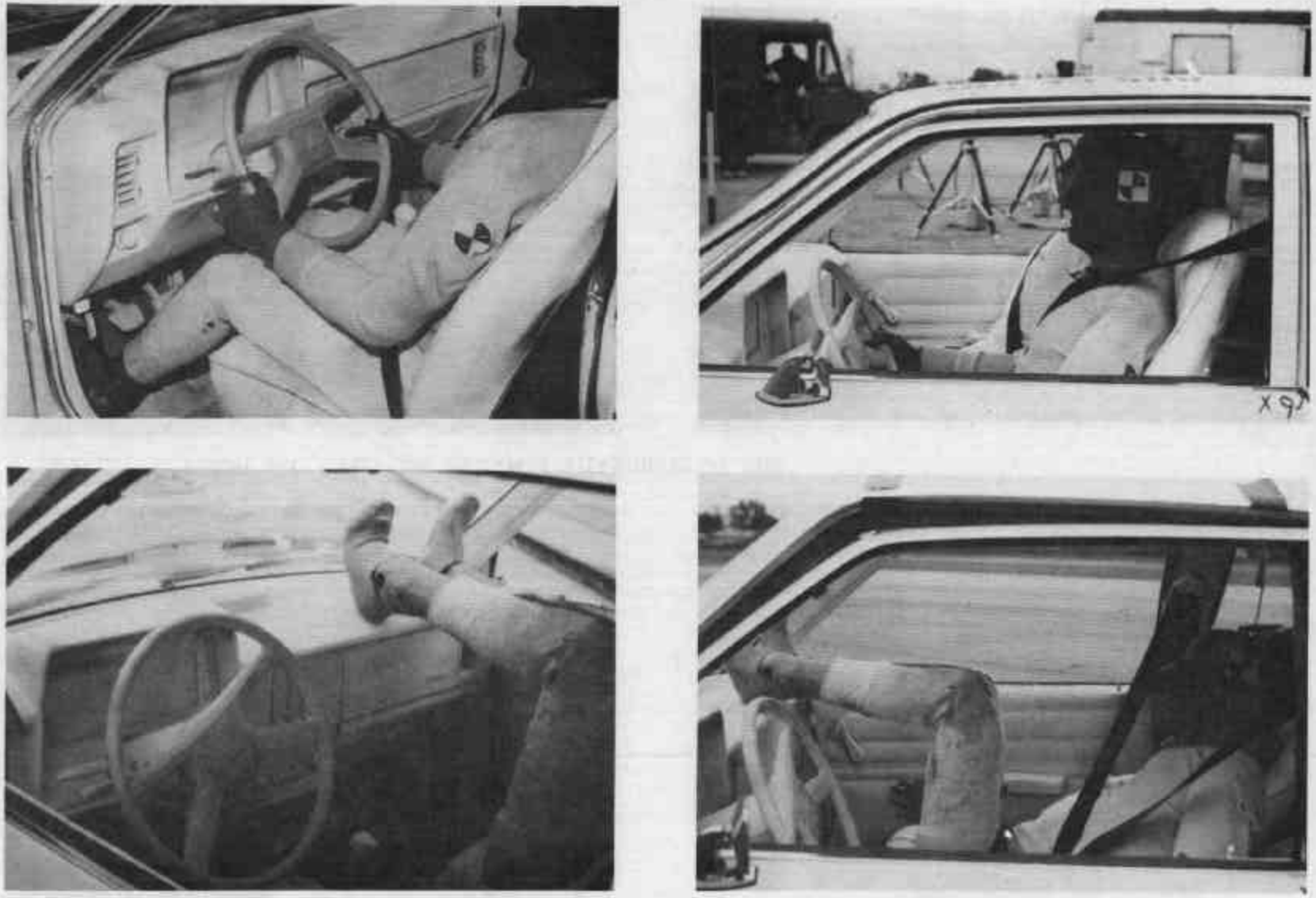
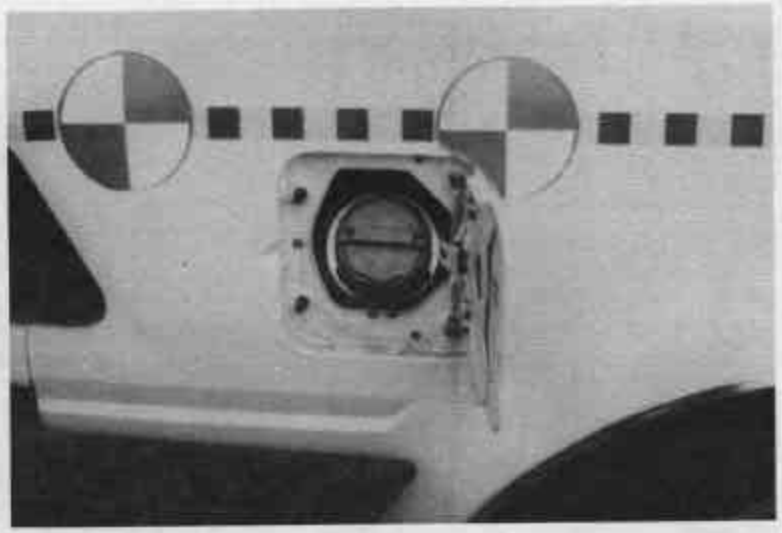


FIGURE A-8 PRE- AND POST-TEST VIEWS OF DRIVER'S POSITIONS

FIGURE A-9 PRE- AND POST-TEST VIEWS OF RIGHT FRONT PASSENGER'S POSITIONS

FIGURE A-10 POST-TEST VIEWS OF DRIVER'S POSITIONS

FIGURE A-11 POST-TEST VIEWS OF RIGHT FRONT PASSENGER'S POSITIONS



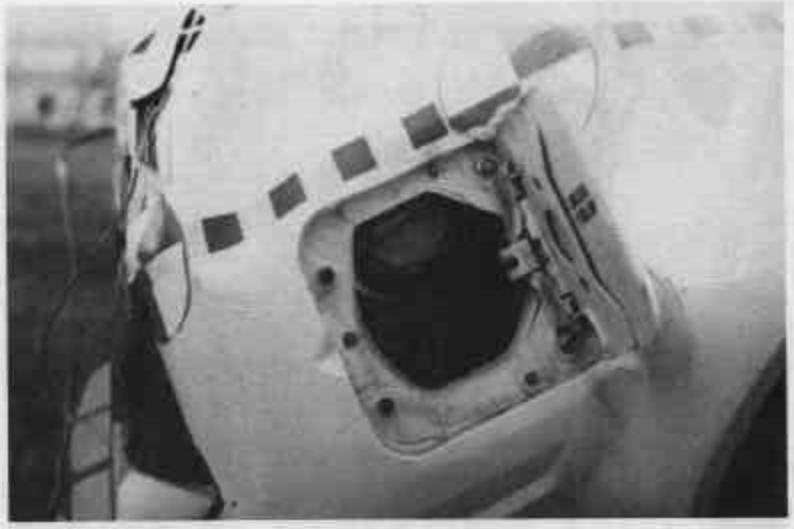


FIGURE A-12 PRE- AND POST-TEST VIEWS OF FILLER TUBE AND CAP

FIGURE A-13 FUEL TANK AND FILLER TUBE

FIGURE A-14 VELOCITY TRAP COUNTER

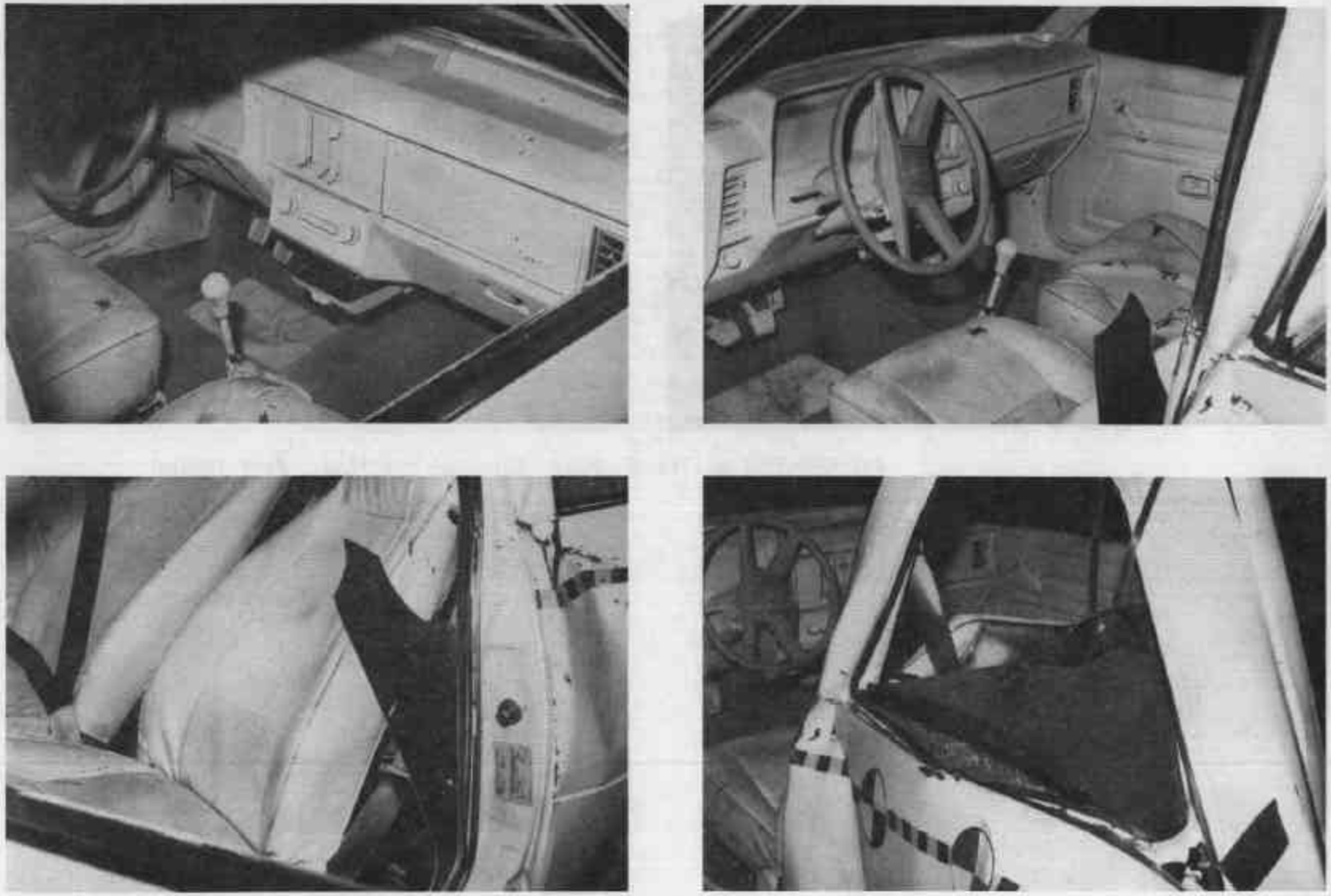


FIGURE A-15 POST-TEST VIEWS OF INTERIOR