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REPORT NUMBER: 301-CAL-04-02

SAFETY COMPLIANCE TESTING FOR FMVSS 301 FUEL SYSTEM INTEGRITY

MAZDA MOTOR CORPORATION
2004 MAZDA 6
4-DOOR SEDAN

NHTSA NUMBER: C45400

GDAIS TEST NUMBER: 8655-F301-19

June 16, 2004

GENERAL DYNAMICS
ADVANCED INFORMATION ENGINEERING SERVICES
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FINAL REPORT

PREPARED FOR:

U. S. Department of Transportation
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
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16. Abstract

Compliance tests were conducted on the subject 2004 Mazda 6 4-Door Sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-301-03 for the determination of FMVSS 301 compliance. For the purpose of acquiring information for applied research, two instrumented Anthropomorphic Test Devices (ATDs) were placed in the front occupant seating positions and various instrumentation was added to the test vehicle. Test failures identified were as follows:

The test vehicle appeared to comply with all requirements of FMVSS 301 "Fuel System Integrity."

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SECTION 1

PURPOSE OF COMPLIANCE TEST

This 30 mph rear moving barrier impact test is part of the Federal Motor Vehicle Safety Standard (FMVSS) 301 Compliance Test Program conducted for the National Highway Traffic Safety Administration (NHTSA) by Advanced Information Engineering Services under Contract No. DTNH22-01-C-01025. The purpose of this test was to determine if the subject vehicle, a 2004 Mazda 6 4-Door Sedan, meets the performance requirements of FMVSS No. 301, "Fuel System Integrity." This compliance test was conducted using the requirements found in the OVSC Laboratory Test Procedure No. TP-301-03, dated February 28, 2003.

SECTION 2

COMPLIANCE TEST RESULTS SUMMARY

A 1590.5 kg 2004 Mazda 6 4-Door Sedan was impacted from the rear by an 1797 kg moving barrier at a velocity of 46.83 kph (29.1 mph). The test was performed by Advanced Information Engineering Services on June 16, 2004.

The test vehicle was equipped with a 68 liter fuel tank which was filled to 92.5 percent capacity with stoddard fluid prior to impact. No additional ballast was secured in the vehicle. For the purpose of acquiring information for applied research, one instrumented Part 572 E 50th percentile male Anthropomorphic Test Device (ATD) was placed in the P1 (driver) seating position and one instrumented Part 572 E 50th percentile male ATD was placed in the P3 (right rear) seating position. Various instruments were added to the test vehicle and the right front passenger seat was removed. Research data is presented in a separate report.

The crash event was recorded by ten high-speed cameras and one real-time camera. Camera locations and other pertinent camera information are found on pages 3-9 and 3-10 of this report. Pre- and post-test photographs of the vehicle can be found in Appendix A.

There was no fuel system fluid spillage following the impact or during any portion of the static rollover test. The average vehicle longitudinal crush was 356 millimeters. The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."

SECTION 3

COMPLIANCE TEST DATA

DATA SHEET 1

TEST VEHICLE SPECIFICATIONS

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2004 Mazda 6 4-Door Sedan

NHTSA No.: C45400 ; Color: Silver

Engine Data: 4 Cylinders; - CID; 2.3 Liters; - cc

Placement: - Longitudinal or In-Line; X Transverse or Lateral

Transmission Data: 4 Speeds; - Manual; X Automatic; X Overdrive

Final Drive: - Rear Wheel Drive; X Front Wheel Drive; - Four Wheel Drive

Major Options: X A/C; X Power Steering; X Power Brakes

X Power Windows; X Power Door Locks; X Tilt Wheel

Date Received: 10/22/2003 ; Odometer Reading 37 km

Selling Dealer: Jeff Wyler Mazda

& Address: Cincinnati, OH

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: Mazda Motor Corporation

Date of Manufacture: 09/03

VIN: JYVFP80C345N22817

GVWR: 1958 kg; GAWR-FRONT: 1070 kg; GAWR-REAR: 888 kg

DATA FROM VEHICLE'S TIRE LABEL:

Location of Placard on Vehicle: Driver side lower B-pillar

Recommended Tire Size: P205/60R16 or P215/50R17

* Recommended Cold Tire Pressure: FRONT: 220 kPa; REAR: 220 kPa

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: P205/60R16 91H Manufacturer: Michelin MXV4

Tire Pressure with Maximum Capacity Vehicle Load: FRONT: 400 kPa; REAR: 400 kPa

Type of Spare Tire: Temporary

VEHICLE CAPACITY DATA:

Type of Front Seats: - Bench; X Bucket; - Split Bench

Number of Occupants: 2 Front; 3 Rear; 5 Total

Vehicle Capacity Weight (VCW) = 385 kg

No. of Occupants x 68.04 kg = 340.2 kg

Rated Cargo/Luggage Weight (RCLW) = 44.8 kg

*Tire pressure used for test

DATA SHEET 2

PRE-TEST DATA

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (with maximum fluids)= UDW:

Right Front	=	419.0	kg	Right Rear =	275.0 kg
Left Front	=	423.0	kg.	Left Rear =	286.0 kg
TOTAL FRONT	=	842.0	kg	TOTAL REAR =	561.0 kg

TOTAL DELIVERED WEIGHT = 1403.0 kg

% of Total Front of Vehicle Weight = 60.0% of Total Rear Weight = 40.0%

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight	=	1403.0	kg
Rated Cargo/Luggage Weight (RCLW)	=	44.8	kg
Weight of 2 p.572 Dummies, 74.4 kg	=	148.8	kg
TARGET TEST WEIGHT	=	1596.6	kg

WEIGHT OF TEST VEHICLE WITH TWO DUMMIES AND 38.2 KG OF CARGO WEIGHT:

Right Front	=	458.0	kg	Right Rear =	323.0 kg
Left Front	=	454.0	kg	Left Rear =	355.0 kg
TOTAL FRONT	=	912.0	kg	TOTAL REAR =	678.0 kg

TOTAL TEST WEIGHT = 1590.0 kg

% of Total Front of Vehicle Weight = 57.4% of Total Rear Weight = 42.6%

* Weight of Ballast Secured in Vehicle Trunk Area = 0 kg

Type of Ballast: None

Method of Securing Ballast: No Applicable

Vehicle Components Removed for Weight Reduction: Right front door trim, headlights, front bumper cover, side mirrors, engine shroud, engine air intake.

VEHICLE ATTITUDE (all dimension in millimeters):

AS DELIVERED:	RF	710	LF	718	RR	719	LR 704
AS TESTED:	RF	686	LF	697	RR	706	LR 679

Vehicle's Wheel Base: 2674 mm

Location of Vehicle's C.G.: 1140 millimeters rearward of front wheel center.

FUEL SYSTEM DATA:

Fuel System Capacity From Owner's Manual = 68.1 liters

Usable Capacity Figure Furnished by COTR = 68.0 liters

Test Volume Range (91 to 94% of Usable Capacity) = 61.88 to 63.92 liters

ACTUAL TEST VOLUME= 62.8 liters (with entire fuel system filled)

* Ballast weight includes the RCLW, the weight of drained vehicle fluids and the weight of any removed vehicle components less the weight of onboard instrumentation, cameras, and hardware.

DATA SHEET 2 (continued)

PRE-TEST DATA

FUEL SYSTEM DATA (continued):

Test Fluid Type: Stoddard Solution

Test Fluid Specific Gravity: 0.764

Test Fluid Kinematic Viscosity: 0.96 centistokes

Test Fluid Color: Orange ("red" is preferred)

Type of Vehicle Fuel Pump: Electric

Electric Fuel Pump Operation with Ignition Switch ON and Engine OFF -

When ignition is switched on without starting the engine, the fuel pump operates for several seconds then shuts off.

Details of Fuel System: Fuel filler is located on the left rear quarter panel aft of the rear axle; Fuel tank is located on the vehicle underbody beneath the rear seat and forward of the rear axle; Fuel lines are routed along the left side of the vehicle underbody.

Comments: None

DATA SHEET 3

MOVING BARRIER DATA

WEIGHT OF MOVING BARRIER:

Right Front	=	504.9 kg	Right Rear	=	393.7 kg.
Left Front	=	499.9 kg	Left Rear	=	398.3 kg
TOTAL FRONT	=	1004.8 kg	TOTAL REAR	=	792.0 kg

TOTAL BARRIER WEIGHT = 1796.8 kg

MOVING BARRIER DIMENSIONS:

Barrier Face Height: 1524 mm

Barrier Face Width: 1981 mm

Barrier Face Ground Clearance: 127 mm

Tread Width: 1511 mm

Wheel Base: 3048 mm

Location of C.G.: X: 1344 mm rearward of front wheel center.

Y: 0 mm from longitudinal-vertical plane of symmetry.

Z: 414 mm above ground.

MOVING BARRIER TIRES:

Manufacturer: Dunlop

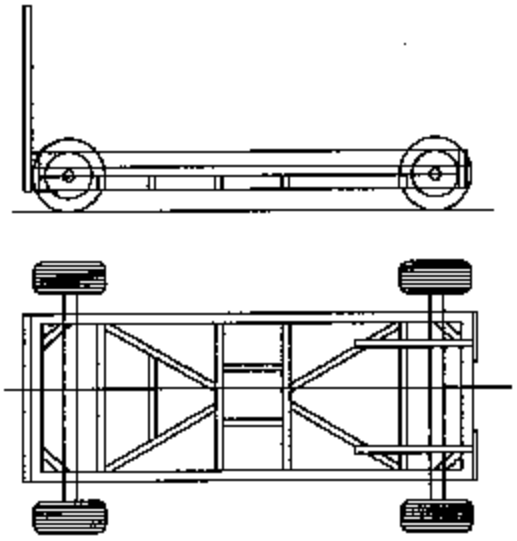
Model: AT Radial Rover

Size: P205/75R15

Recommended Max Pressure: 240 kPa:

MOVING BARRIER ABORT SYSTEM:

Type: Trailing cable



DATA SHEET 4

POST TEST DATA

TYPE OF TEST:

Type of Test: Rear Barrier Impact Angle: 0°

Test Date: June 16, 2004 Time:: 13:40 Temperature: 22.2 °C

Vehicle NHTSA No.: C45400 VIN: 1YVFP80C345N22817

Required Impact Velocity Range: 46.51 to 48.12 kph

BARRIER IMPACT VELOCITY: (Speed traps within 5 feet of impact plane.)

Trap No. 1 = 46.83 kph; Trap No. 2 = 46.83 kph

Average Impact Speed = 46.83 kph

VEHICLE STATIC CRUSH:

Vehicle Length:

Pre-Test	Left =	4555	; C/L =	4764	Right =	4555
Post-Test	Left =	4178	; C/L =	4376	Right =	4252
Crush	Left =	377	; C/L =	388	Right =	303

AVERAGE = 356 millimeters

DATA SHEET 4 (continued)

POST TEST DATA

TEST VEHICLE NHTSA NO.: C45400 TEST DATE: June 16, 2004

Vehicle Mfgr./Make/Model: 2004 Mazda 6 4-Door Sedan

Test vehicle fuel tank filled to 91% to 94% of manufacturer's "usable" capacity and with electric fuel pump operating (if it will operate without engine operation). Part 572 test dummies located at each front designated seating position.

****

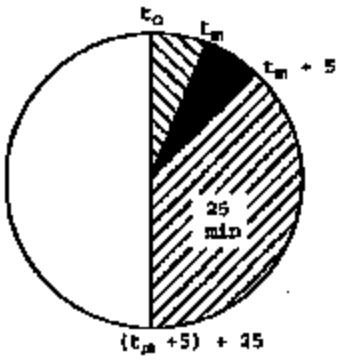
TEST VEHICLE IMPACT TYPE:

- Frontal (42.28 kph target velocity)
- Oblique (42.28 kph target velocity) with - °barrier face first contacting - (driver/passenger) side

X Rear Moving Barrier (42.28 kph target velocity)

- Lateral Moving Barrier (32.19 kph target velocity)

FUEL SPILLAGE MEASUREMENT:



		ACTUAL	MAX ALLOWED
1.	From impact until vehicle motion ceases	0	28 g
2.	For five minute period after vehicle motion ceases	0	28 g.
3.	For next 25 minutes	0	28 g/min.

SOLVENT SPILLAGE DETAILS:

None

DATA SHEET 5

STATIC ROLLOVER TEST DATA

Table 7 FMVSS NO. 301 - STATIC ROLLOVER DATA SHEET

Vehicle: 2004 Mazda 6 4-Door Sedan NHTSA No.: C45400

I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Stage	Rotation Time (spec. 1 -3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0° - 90°	1	minutes	11	seconds	5	minutes	6	minutes	11	seconds	7	minutes
90° - 180°	1	minutes	5	seconds	5	minutes	6	minutes	5	seconds	7	minutes
180°-270°	1	minutes	4	seconds	5	minutes	6	minutes	4	seconds	7	minutes
270°-360°	1	minutes	5	seconds	5	minutes	6	minutes	5	seconds	7	minutes

II. FMVSS 301 REQUIREMENTS: (Maximum allowable solvent spillage):

First 5 minutes from onset of rotation	6th min.	7th min.	8th min. (if required)
142 g	28 g	28 g	28 g

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

Rollover Stage	First 5 minutes from onset of rotation (g)	6th min. (g)	7th min. (g)	8th min. (if required) (g)
0° - 90°	0	0	0	-
90° - 180°	0	0	0	-
180°-270°	0	0	0	-
270°-360°	0	0	0	-

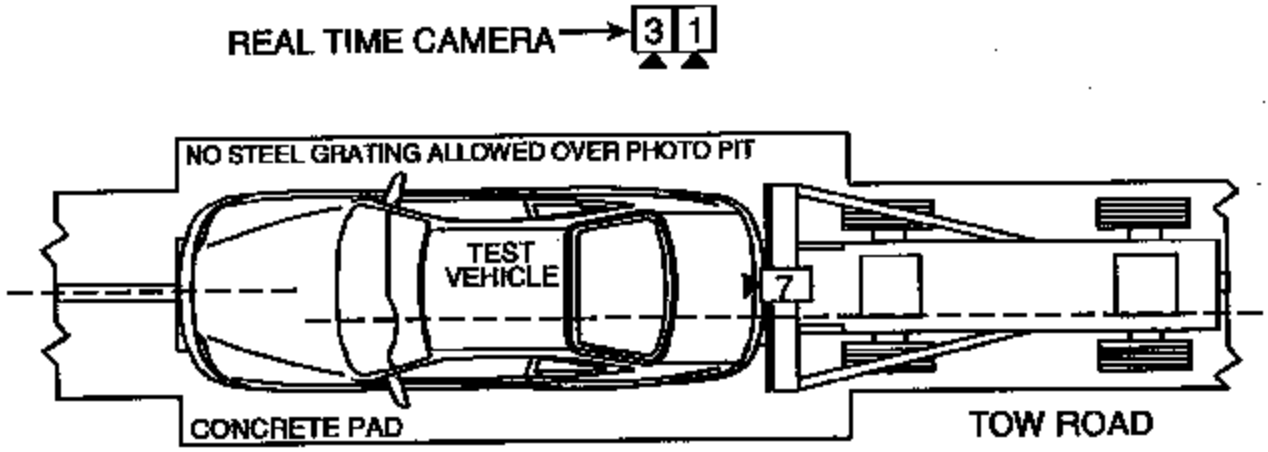
Note: Record spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATION(S):

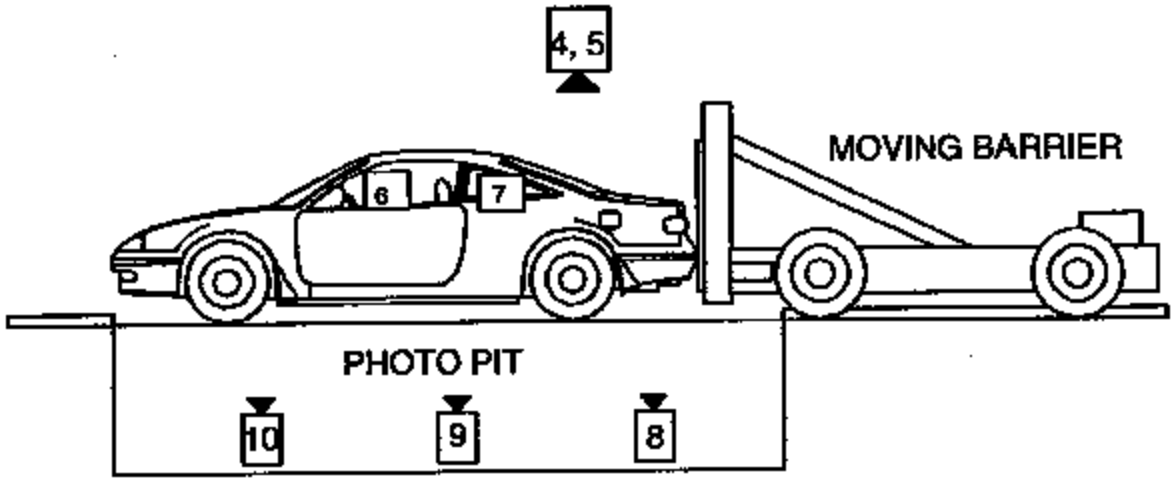
Rollover Stage	Spillage Location
0° - 90°	None
90° - 180°	None
180°-270°	None
270°-360°	None

DATA SHEET 6

HIGH SPEED CAMERA LOCATIONS



TOP VIEW



LEFT SIDE VIEW

DATA SHEET 6 (continued)

HIGH SPEED CAMERA LOCATIONS

NHTSA No.: C45400 Vehicle: 2004 Mazda 6 4-Door Sedan

CAMERA NO.	VIEW	CAMERA POSITIONS (mm)*			ANGLE** (degrees)	LENS (mm)	SPEED (fps)
		X	Y	Z			
1	Real-Time Camera	-	-	-	-	-	24
2	Left Side View	2162	16972	1065	0.0	35	1005
3	Right Side View	1165	16560	1094	-2.0	35	1005
4	Overhead Overall View	-508	0	9804	-90	13	1000
5	Overhead Close View	-508	0	9804	-105	13	1000
6†	Onboard Driver View	2561	960	1031	-6.0	8	1000
7†	Onboard Passenger View	1730	988	1088	-6.5	8	1000
8	Vehicle Rear Underbody View	0	700	-1956	90	13	1025
9	Vehicle Mid-Section Underbody View	0	2115	-1956	90	13	1000
10	Vehicle Front Underbody View	0	3650	-1956	90	13	1005

* X = film plant to monorail centerline (+ to left of rail)
Y = film plane to impact location (+ ahead of impact location)
Z = film plane to ground (+ above ground)
** = referenced to horizontal plane

† Research cameras.

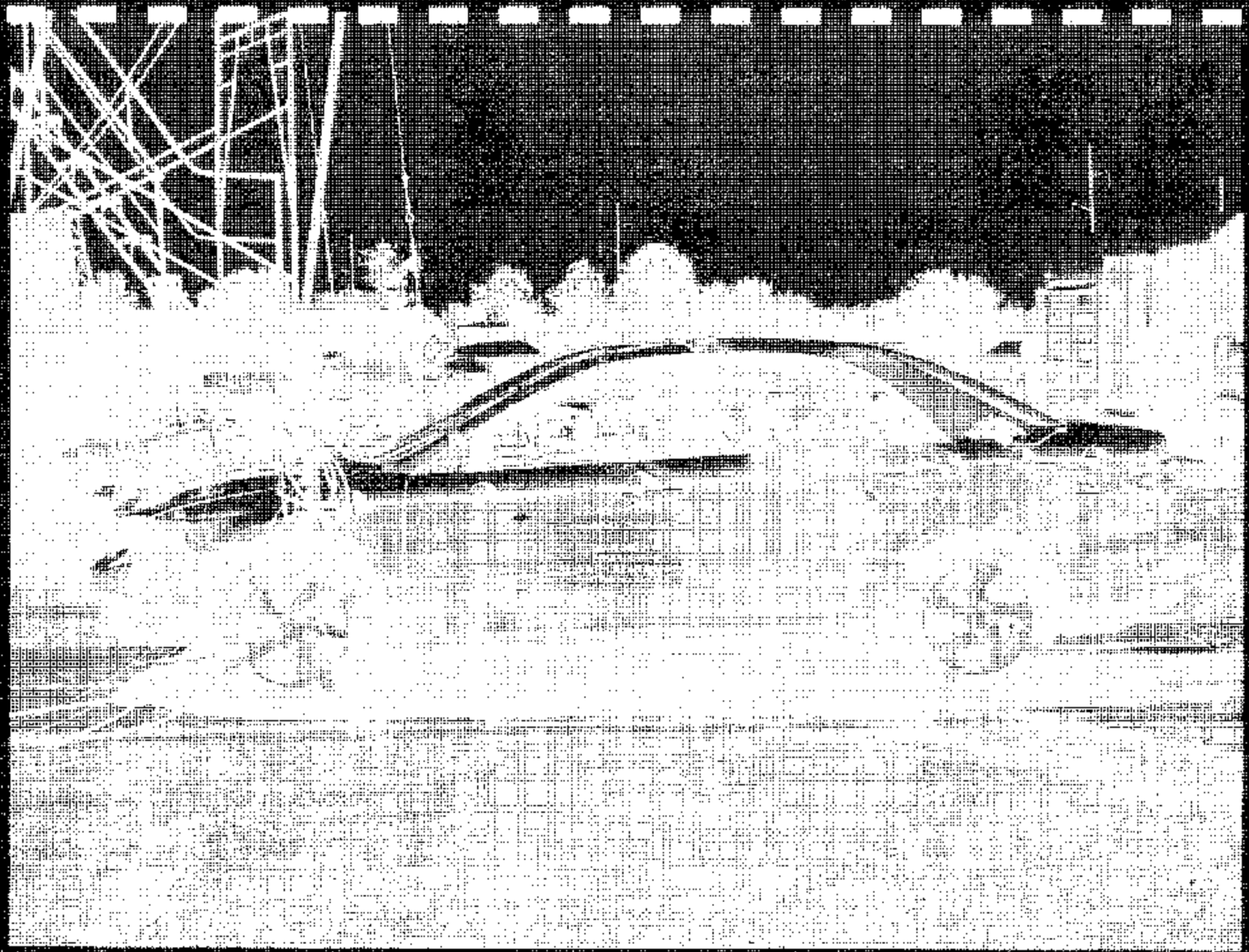
Appendix A

PHOTOGRAPHS

LIST OF PHOTOGRAPHS

Figure A-1 PRE-TEST FRONT VIEW

Figure A-2 POST-TEST FRONT VIEW



A-5

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Figure A-3 PRE-TEST LEFT SIDE VIEW

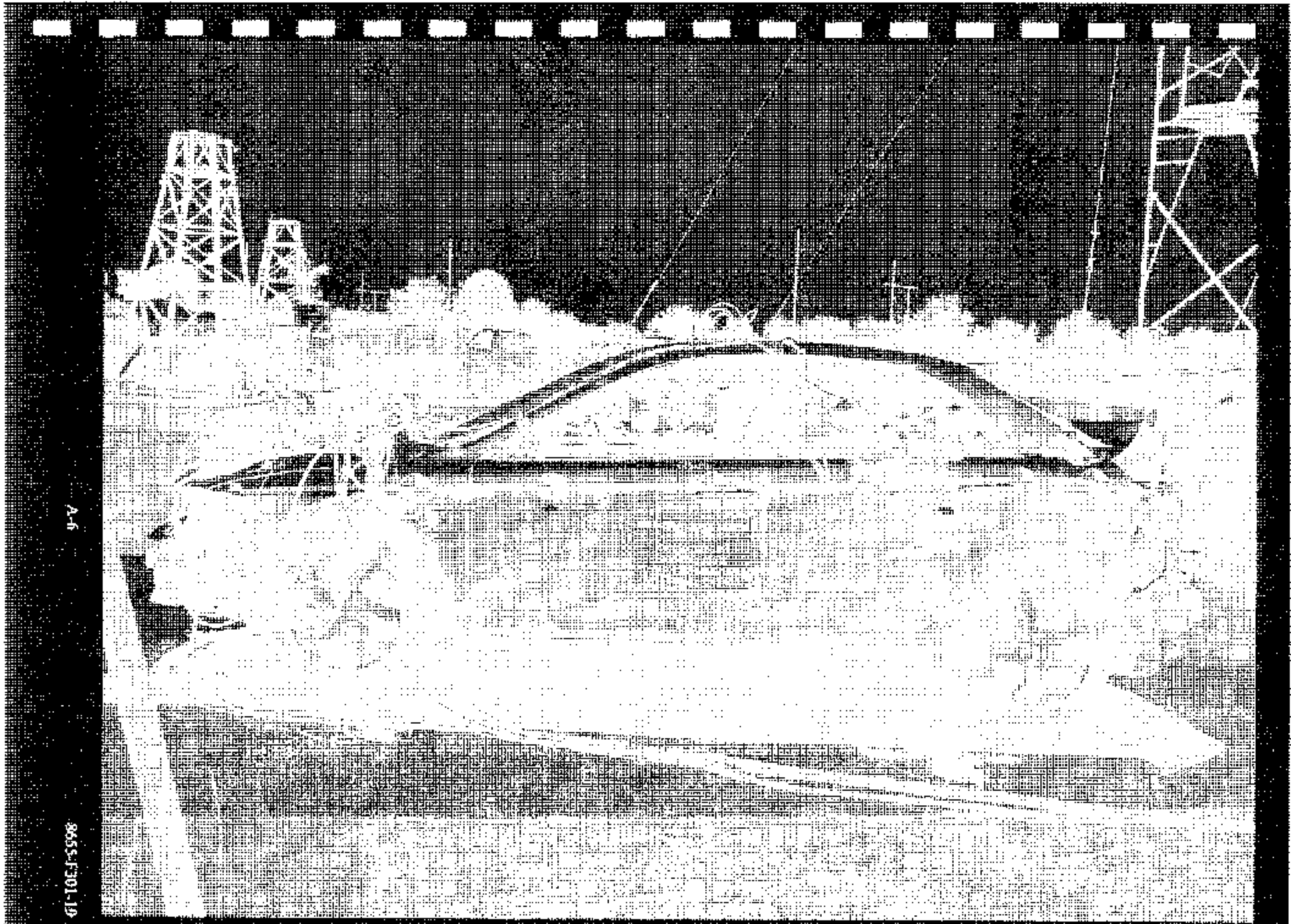

Figure A-4 POST-TEST LEFT SIDE VIEW

Figure A-3 PRE-TEST RIGHT SIDE VIEW

Figure A-6 POST-TEST RIGHT SIDE VIEW

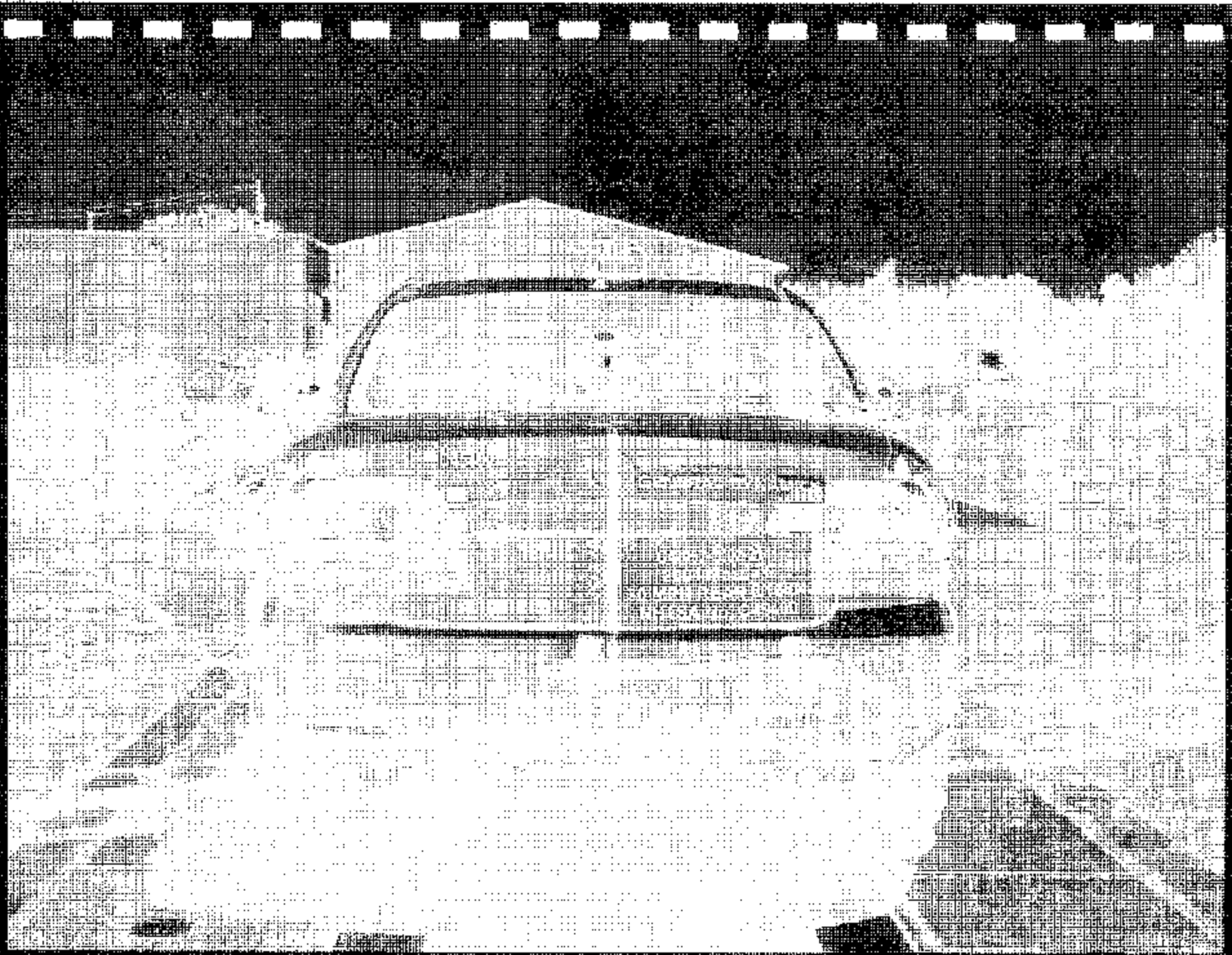

Figure A-7 PRE-TEST REAR VIEW

Figure A-3 POST-TEST REAR VIEW

Figure A-9 PRE-TEST LEFT FRONT THREE-QUARTER VIEW

Figure A-10 POST-TEST LEFT FRONT THREE-QUARTER VIEW

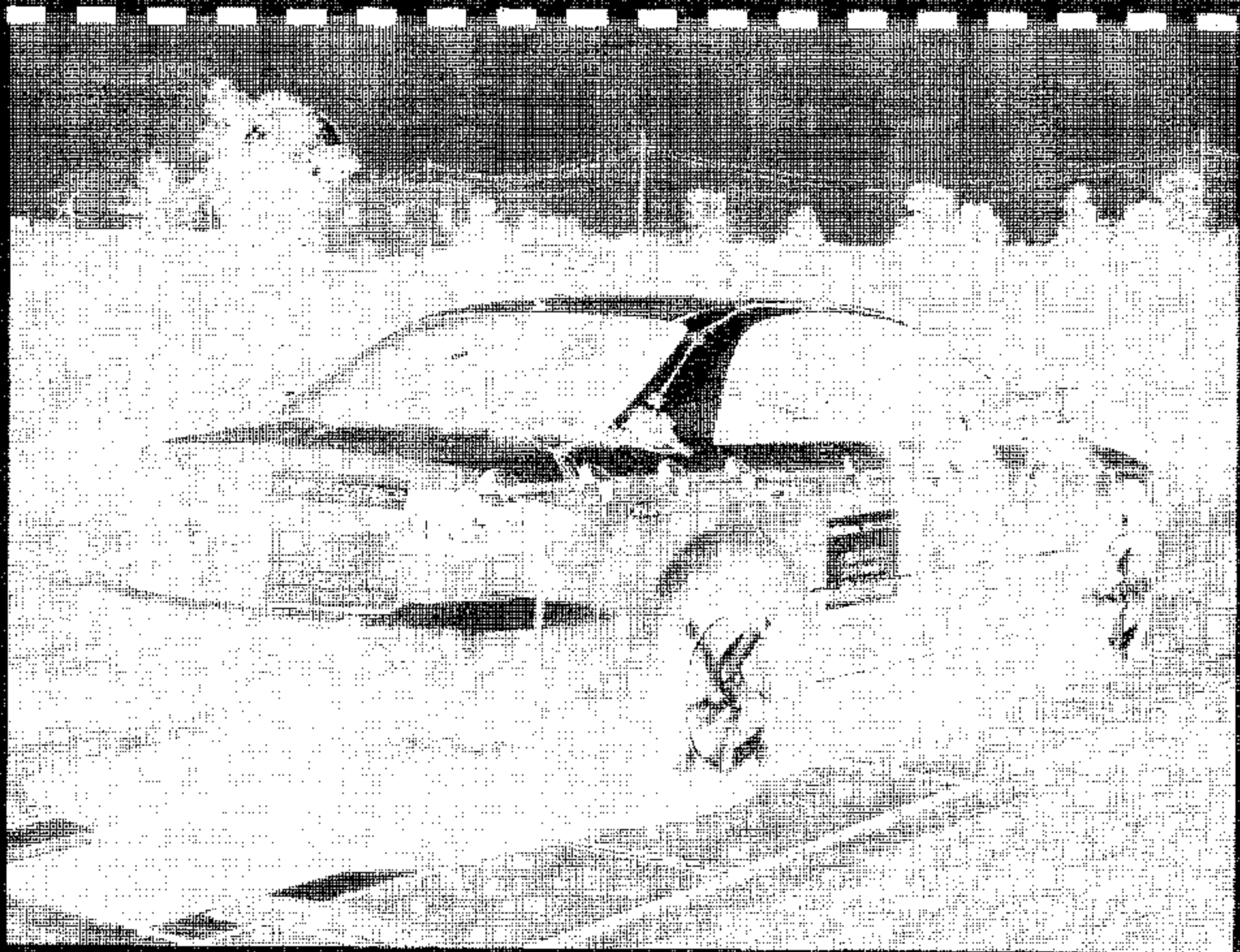

Figure A-11 PRE-TEST RIGHT REAR THREE-QUARTER VIEW

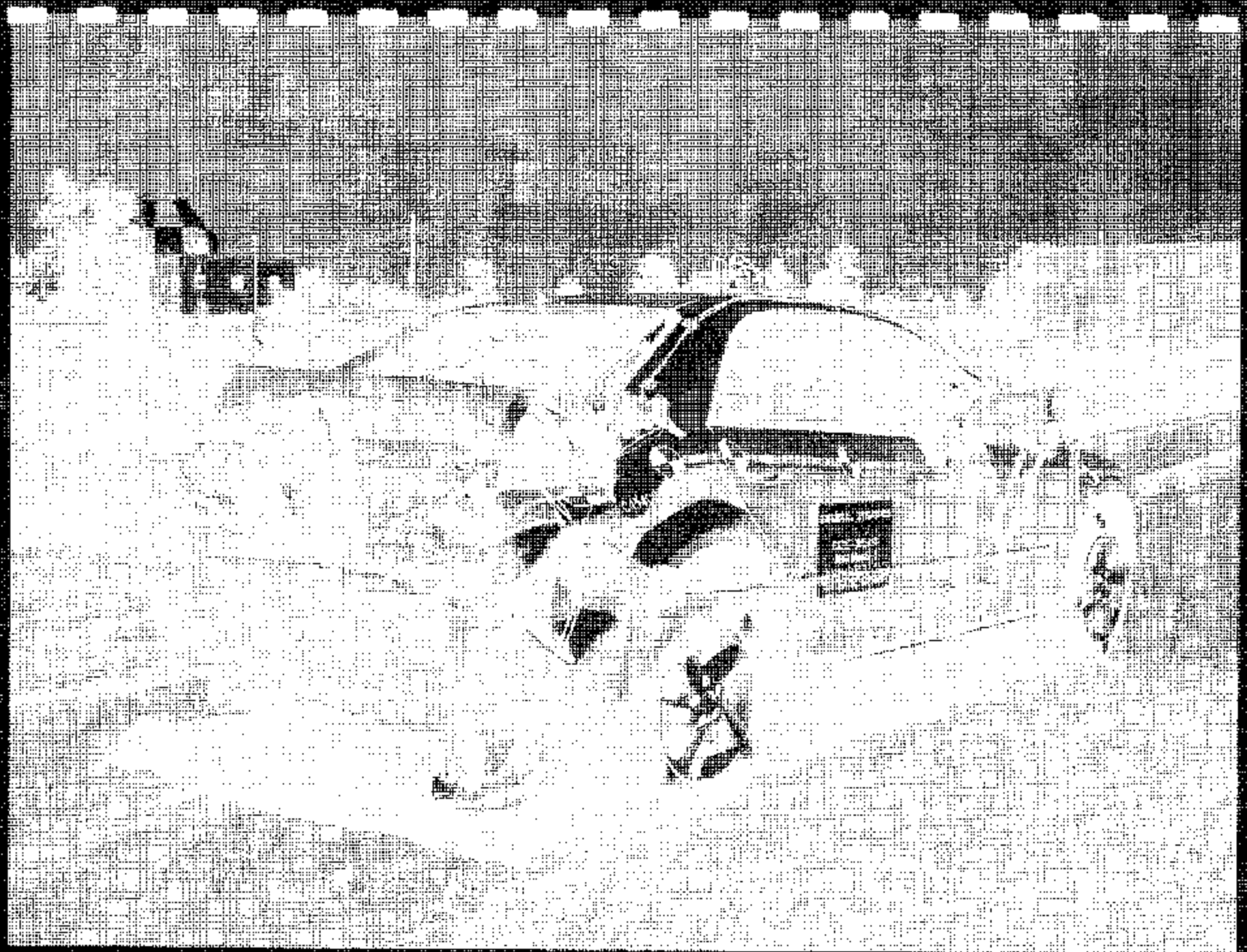

Figure A-12 POST-TEST RIGHT REAR THREE-QUARTER VIEW

Figure A-13. REF-TEST FRONT UNDERBODY VIEW

Figure A-14 POST-TEST FRONT UNDERBODY VIEW

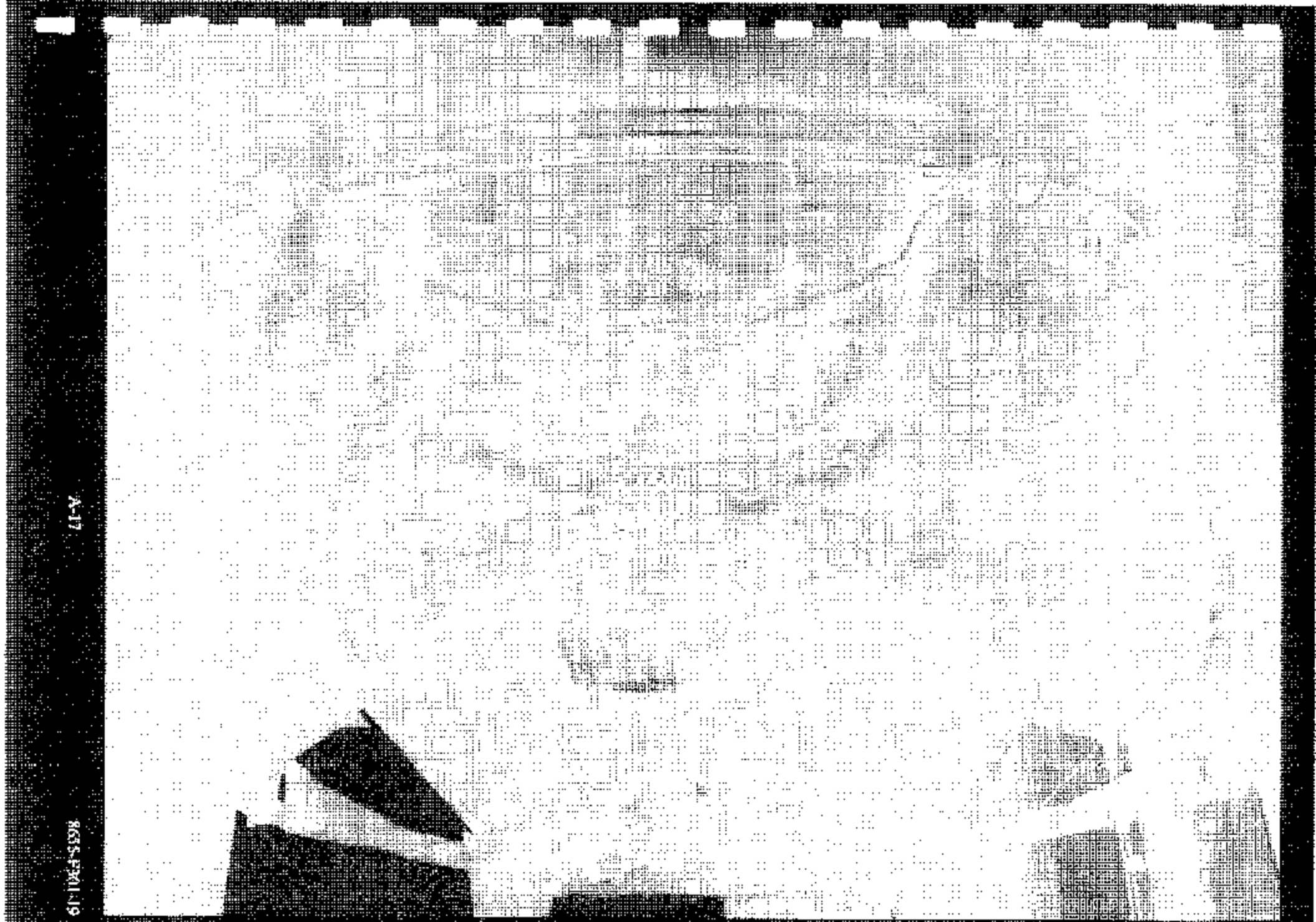

Figure A-15 PRE-TEST REAR UNDERBODY VIEW

Figure A-16 POST-TEST REAR UNDERBODY VIEW

Figure A-17 CERTIFICATION PLACARD

Figure A-15 TIRE PLACARD

FIGURE 4-19 ROLLOVER 90°

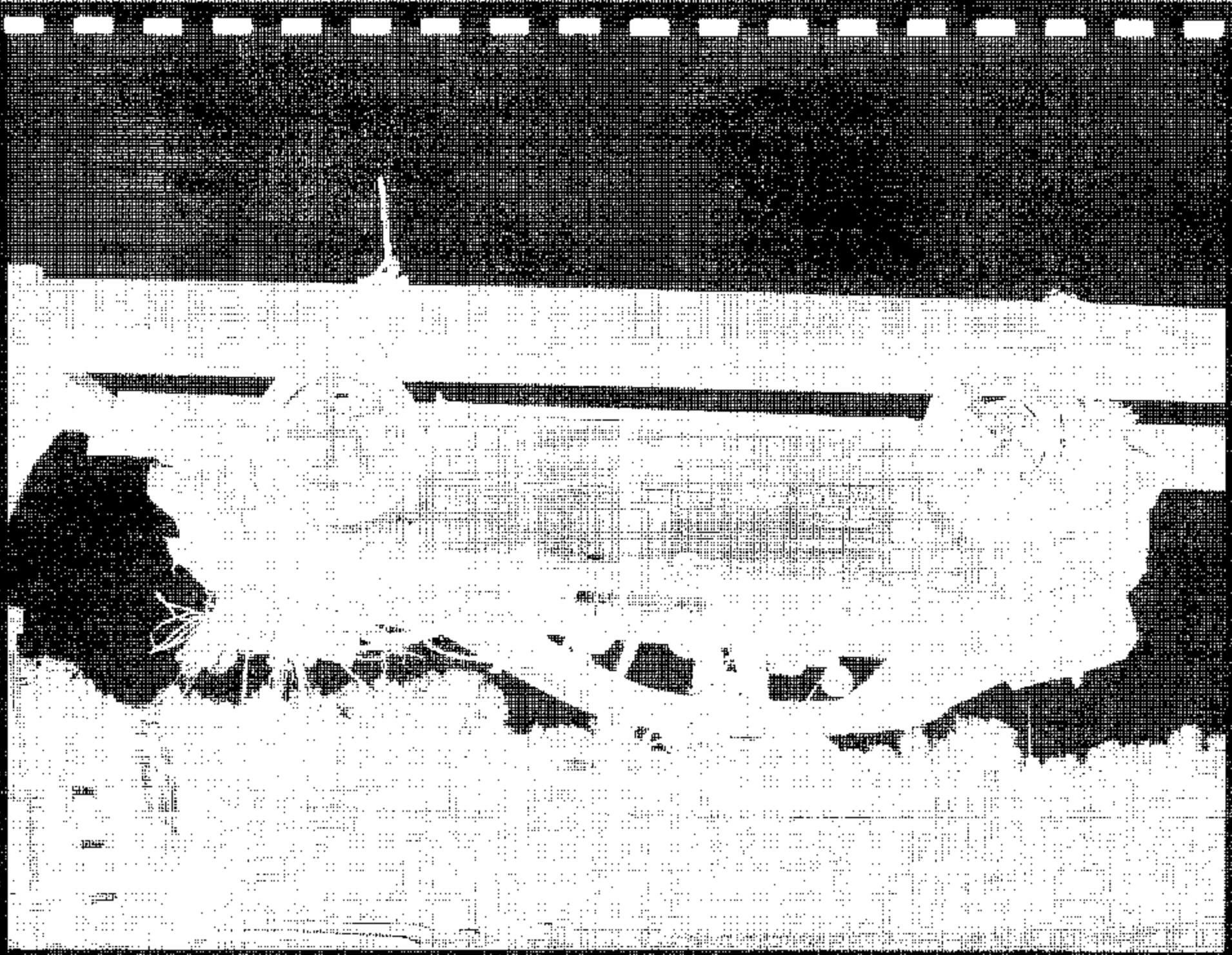

Figure A-20 ROLLOVER 180°

Figure A-21 ROLLOVER 270°

Figure A-23 ROLLOVER 360