

REPORT NUMBER TR-P25007-05-NC

FMVSS 301-FUEL SYSTEM INTEGRITY

TOYOTA MOTOR MANUFACTURING, CANADA, INC.
2005 TOYOTA MATRIX
5-DOOR SEDAN

NHTSA NUMBER: C55103

PREPARED BY:
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10/06/05

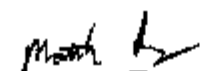
FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-01-C-31025.

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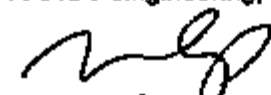
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11/3/05

Date of Acceptance

Technical Report Documentation Page

1. Report No. TR-P25007-05-NC		2. Government Accession No.		3. Recipients Catalog No.	
4. Title and Subtitle Final Report of FMVSS 301-Fuel System Integrity of a 2005 Toyota Matrix 5-Door Sedan NHTSA No. C55103				5. Report Date October 6, 2005	
				6. Performing Organization Code KAR	
7. Authors Mr. Matt Ivory, Project Engineer, Karco Mr. Frank Richardson, Program Manager, Karco				8. Performing Organization Report No. TR-P25007-05-NC	
9. Performing Organization Name and Address Karco Engineering, LLC 9270 Holly Rd. Adelanto, CA, 92301				10. Work Unit No.	
				11. Contract or Grant No. DTNH22-01-C-31025	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Enforcement Office of Vehicle Safety Compliance (NSA-31) 400 Seventh Street, SW, Room 6115 Washington, D.C. 20590				13. Type of Report and Period Covered Final Test Report	
				14. Sponsoring Agency Code NSA-31	
15. Supplementary Notes					
16. Abstract					
This 30 mph rear moving barrier impact test is a part of the Federal Motor Vehicle Safety Standard (FMVSS) 301 Compliance Test Program conducted for the National Highway Traffic Safety Administration (NHTSA) by KARCO Engineering, LLC Laboratories under Contract No. DTNH22-01-C-31025. The purpose of this test was to determine if the subject vehicle, a 2005 Toyota Matrix 5-Door Sedan, meets the performance requirements of FMVSS No. 301, "Fuel System Integrity." The test was conducted on August 30, 2005 in accordance with the Office of Vehicle Safety Compliance Laboratory Test Procedure TP-301-03, dated February 28, 2003. The impact velocity was 47.71 Km/h. The ambient temperature at the time of impact was 38.1 degrees Celsius. The vehicle's maximum post-test static crush was 266 mm right of the vehicle's centerline					
17. Key Words FMVSS 301 2005 Toyota Matrix 5-Door Sedan NHTSA No. C55103				18. Distribution of Statement Copies of this report available from: NHTSA Technical Reference Division National Highway Traffic Safety Admin. 400 Seventh St., SW, Room 5108 Washington, D.C. 20590	
19. Security Classification (this report) Unclassified		20. Security Classification (this page) Unclassified		21. No. of Pages 42	22. Price

TABLE OF CONTENTS

<u>Section</u>	<u>Description</u>	<u>Page</u>
1	Purpose of Test	1
2	Summary of Test	2

<u>Data Sheet</u>	<u>Description</u>	<u>Page</u>
1	General Test and Vehicle Parameter Data	3
2	Moving Barrier Data	6
3	Fuel System Integrity Post-Impact Data	7
4	Static Rollover Data	8
5	Camera Locations	10
6	Accident Investigation Division Data	11

<u>Appendix</u>	<u>Description</u>	<u>Appendix</u>
A	Photographs	A

SECTION 1
PURPOSE OF TEST

1. PURPOSE

The purpose of this test was to determine if the subject vehicle, a 2005 Toyota Matrix 5-Door Sedan, meets the performance requirements of FMVSS No. 301, "Fuel System Integrity." The test was conducted in accordance with the Office of Vehicle Safety Compliance Laboratory Test Procedure TP-301-03, dated February 28, 2003.

SECTION 2

SUMMARY OF TEST

2. SUMMARY

A 1450 kg 2005 Toyota Matrix 5-Door Sedan was impacted from the rear by a 1799 kg moving barrier at a velocity of 47.71 Km/h (29.65 mph). The test was performed by KARCO Engineering, LLC on August 30, 2005.

The vehicle was prepared and tested following the Office of Vehicle Safety Compliance Test Procedure for Federal Motor Vehicle Safety Standard (FMVSS) 301R (OVSC TP-301-03, dated February 28., 2003).

The crash event was recorded by ten (10) high speed and two (2) real time cameras. Camera locations and other pertinent camera information are found in the data sheets. Appendix A contains Pre- and Post-Test Photographs.

There was no fuel system fluid spillage following the impact event or during any portion of the static rollover test. The maximum longitudinal crush was 266 millimeters. The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Toyota Matrix 5-Door Sedan
 Test Program: FMVSS 301-Fuel System Integrity

NHTSA No.: C55103
 Test Date: 8/30/05

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	C55013
Make	Toyota
Model	Matrix
Body Style	5-Door Sedan
Vin No.	2T1KR32E25C358691
Color	White
Delivery Date	10/15/04
Odometer	134
Dealer	Valley Hi Toyota
Transmission	3 Speed Automatic
Final Drive	Front
Type/No. Cyl.	4
Engine Disp. (L)	1.8
Engine Placement	Transverse
Roof Rack	No
Sunroof/T-Top	No
Tinted Glass	No
Traction Control	No
Power Brakes	Yes
Front Disc	Yes
Rear Disc	Yes

Anti-Lock Brakes	No
All Wheel Drive	No
Power Steering	Yes
Driver Front Airbag	Yes
Driver Side Airbag	No
Driver Head Airbag	No
Driver Curtain Airbag	No
Pass. Airbag	Yes
Pass. Side Airbag	No
Pass. Head Airbag	No
Pass. Curtain Airbag	No
Pre-Tensioners	
Load Limiters	
Bucket Seats	Yes
Air. Cond.	Yes
AM/FM Cassette	Yes
Tilt Steering	Yes
Automatic Door Locks	Yes
Power Windows	Yes
Power Seats	No
Other	

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Manufacturing, Canada, Inc.
Date of Manufacture	Aug-04

GVWR (kg)	1744
GAWR Front (kg)	914
GAWR Rear (kg)	839

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench	None	
Number of Occupants	2	3	0	5
Capacity Weight (VCW) (kg)				390
Cargo Weight (RCLW) (kg)				50

DATA SHEET NO. 1...(CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Toyota Matrix 5-Door Sedan
 Test Program: FMVSS 301-Fuel System Integrity

NHTSA No.: C55103
 Test Date: 8/30/05

TEST VEHICLE WEIGHTS

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	365	266		405	329	
Right	kg	377	244		415	301	
Ratio	%	59.3%	40.7%		58.5%	43.5%	
Totals	kg	742	510	1252	819	631	1450

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1252
Weight of 2 P572 ATD's	kg	152
Rated Cargo/Luggage Wt. (RCLW)	kg	50
Calculated Vehicle Target Wt. (TVTW)	kg	1454

TEST VEHICLE ATTITUDE AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	702	703	723	722	1060
As Tested	mm	686	685	692	685	1132

Vehicle Wheel Base (mm) 2602

Weight of Ballast Secured in cargo area (kg) 0.0

Vehicle Components Removed None

* Ballast weight does not include cameras, instrumentation and brake abort system.

FUEL SYSTEM DATA

Fuel System Capacity From Owners Manual (L) 49.96

Usable Capacity Furnished by COTR (L) 49.96

Actual Test Volume with entire fuel System Filled (L) 48.44

1/3 of Usable Capacity (L) N/A

Test Fluid Type: Stoddard Solvent

Kinematic Viscosity: as per ASTM Standard D484-71 Purple

Is Vehicle Fuel Pump Electric or Mechanical? Electric

If electric, does pump operate with ignition switch "On" & engine "OFF" Yes

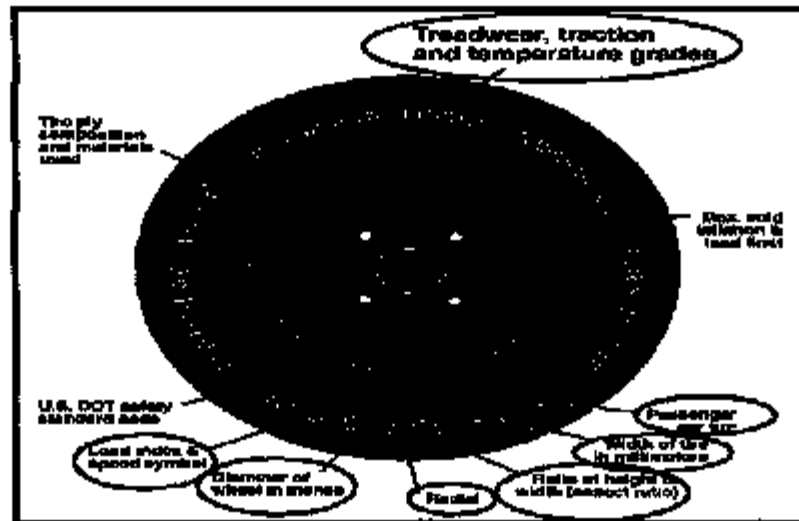
Fuel System Particulars: The fuel filler door is located on the left rear fender.
The standard fuel tank occupies the area under the rear seat.

DATA SHEET NO. 1...(CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Toyota Matrix 5-Door Sedan
 Test Program: FMVSS 301-Fuel System Integrity

NHTSA No.: C55103
 Test Date: 8/30/05

Collect year, make, model, VIN, items circled in red, and tire manufacturer and tire name.



TIRE INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kpa)	300	300
Cold Pressure (kpa)	220	220
Recommended Tire Size	P205/55R16	P205/55R16
Tire Size on Vehicle	P205/55R16	P205/55R16
Tire Manufacturer	Continental	Continental
Treadwear	360	360
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	1 Polyester, 2 Steel	1 Polyester, 2 Steel
Load Index/Speed Symbol	29H	29H
Tire Material	Polyester, Steel	Polyester, Steel
DOT Safety Code Right	ACT2 3LB 2704	ACT2 3LB 2704
DOT Safety Code Left	ACT2 3LB 2704	ACT2 3LB 2704

**DATA SHEET NO. 2
MOVING BARRIER DATA**

Test Vehicle: 2005 Toyota Matrix 5-Door Sedan
Test Program: FMVSS 301-Fuel System Integrity

NHTSA No.: C55103
Test Date: 8/30/05

BARRIER SPECIFICATIONS

Measurement Description	mm
Barrier Face Height	1525
Barrier Face Width	1980
Barrier Face Ground Clearance	115
Tread Width	200
Wheelbase	3045
Tread Width	1530

LOCATION OF BARRIER CG

Measurement Description	mm
X-distance rearward of front wheel center	1372
Y-distance from longitudinal-vertical plane of symmetry	1523

BARRIER WEIGHTS

	Units	Front Axle	Rear Axle	Total
Left	kg	494	405	
Right	kg	494	406	
Ratio	%	54.9%	45.1%	
Totals	kg	988	811	1799

BARRIER TIRES

Manufacturer	Maxdum II
Model	Remington
Size	205-75-R15
Pressure (kPa)	241

BARRIER IMPACT VELOCITY

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	46.51 to 48.12	47.71
Trap No. 2 Velocity (Redundant)	km/h	46.51 to 48.12	47.67

DATA SHEET NO. 3
FUEL SYSTEM INTEGRITY POST-IMPACT DATA

Test Vehicle: 2005 Toyota Matrix 5-Door Sedan

NHTSA No.: C55103

Test Program: FMVSS 301-Fuel System Integrity

Test Date: 8/30/05

Test Time: 1:55 PM

Temperature: 36.1 Deg. C.

STODDARD SOLVENT SPILLAGE MEASUREMENTS

A. From impact until vehicle motion ceases: 0.0 oz.
(Maximum Allowable = 1 ounce)

B. For the 5 minute period after motion ceases: 0.0 oz.
(Maximum Allowable = 5 ounces)

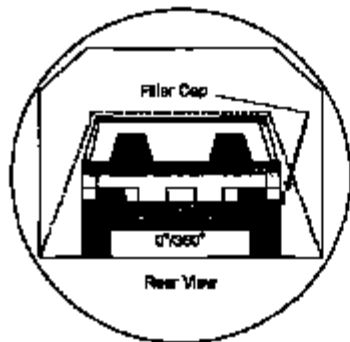
C. For the following 25 minutes: 0.0 oz.
(Maximum Allowable = 1 oz./minute)

D. Spillage Location Details: No leakage occurred

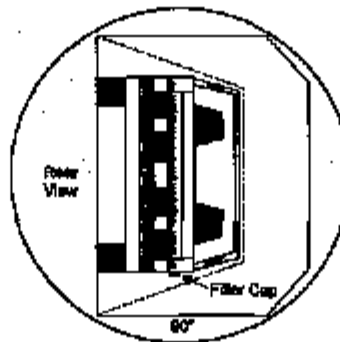
DATA SHEET NO. 4
STATIC ROLLOVER DATA

Test Vehicle: 2005 Toyota Matrix 5-Door Sedan
Test Program: FMVSS 301-Fuel System Integrity

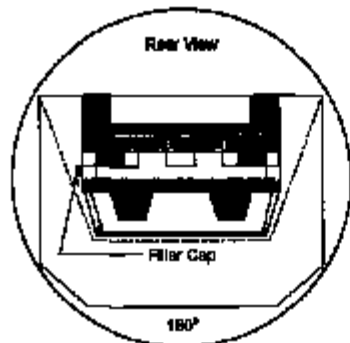
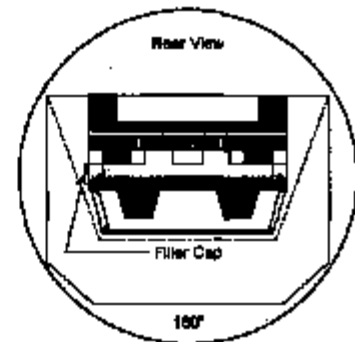
NHTSA No.: C55103
Test Date: 8/30/05



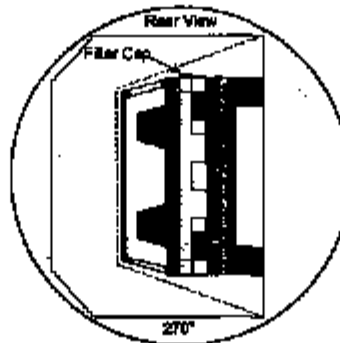
0° to 90°



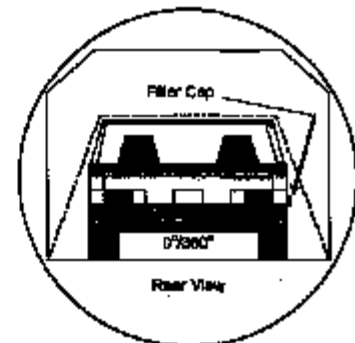
90° to 180°



180° to 270°



270° to 360°



1. The specified fixture rollover rate for each 90° of rotation is 60 to 120 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. No solvent leakage occurred during rollover.

DATA SHEET NO. 4...(CONTINUED)
STATIC ROLLOVER DATA

Test Vehicle: 2005 Toyota Matrix 5-Door Sedan
 Test Program: FMVSS 301-Fuel System Integrity

NHTSA No.: C55103
 Test Date: 8/30/05

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	85	300	385
90° to 180°	82	300	382
180° to 270°	76	300	376
270° to 360°	82	300	382

FMVSS 301 SPILLAGE TABLE REQUIREMENT (oz.)

First 5 Minutes	5.0
Sixth Minute	1.0
Seventh Minute	1.0
Eighth Minute	1.0

ACTUAL TEST VEHICLE SOLVENT SPILLAGE TABLE (oz.)

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

DATA SHEET NO. 6
CAMERA LOCATIONS

Test Vehicle: 2005 Toyota Matrix 5-Door Sedan
Test Program: FMVSS 301-Fuel System Integrity

NHTSA No.: C55103
Test Date: 8/30/05

VEHICLE CAMERA MEASUREMENT TABLE

No.	Camera View	Location (mm)			Angle (deg.)	Lens (mm)	Speed (fps)
		X	Y	Z			
1	Real Time, Documentary	2055	1485	-1842	-7.0	Zoom	30
2	Left Side	560	-12155	-1700	0.0	35mm	1000
3	Right Side	2267	-11875	-1700	0.0	35mm	1000
4	Overhead	1230	2869	-5488	-90.0	20mm	1000
5	Moving Barrier	0	0	-2332	64.0	7mm	900
6	Rear Underside	648	0	1830	90.0	13mm	1000
7	Mid Underside	1878	0	1870	90.0	12mm	1000
8	Front Underside	3055	0	1865	90.0	12mm	1000
9	Underside Close-Up	835	385	1870	84.0	25mm	1000
10	Driver Side On-Board	-1653	82	-1156	-2.0	14mm	1000
11	Passenger On-Board	-1656	-79	-1152	-2.0	8mm	1000
12	Real Time Left Side	630	12320	-1665	-3.0	Zoom	30

X = Monorail Centerline Y = Impact Location Z = Ground DNR = Did Not Run NTM = No Timing Marks

DATA SHEET NO. 6
ACCIDENT INVESTIGATION DIVISION DATA

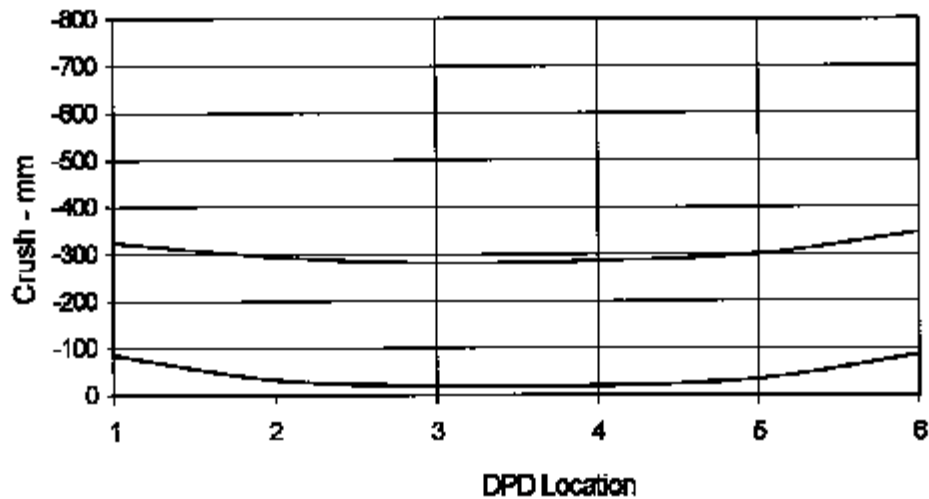
Test Vehicle: 2005 Toyota Matrix 5-Door Sedan
 Test Program: FMVSS 301-Fuel System Integrity

NHTSA No.: C55103
 Test Date: 8/30/05

CRUSH PROFILE

Damage Region Length (mm): 1300 Midpoint of Damage: Centerline
 Impact Mode: Rear Impact (0 Deg.)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	-85	-324	239
C2	Crush zone 2 on left side	mm	-32	-294	262
C3	Crush zone 3 on left side	mm	-20	-280	260
C4	Crush zone 4 on right side	mm	-20	-285	265
C5	Crush zone 5 on right side	mm	-34	-300	266
C6	Crush zone 6 at right side	mm	-85	-345	260



APPENDIX A
PHOTOGRAPHS

LIST OF PHOTOGRAPHS

Figure		Page
A-1	Left Front ¾ View, As Received	A-1
A-2	Right Rear ¾ View, As Received	A-2
A-3	Vehicle Certification Label	A-3
A-4	Vehicle Tire Label	A-4
A-5	Pre-Test Front View	A-5
A-6	Post-Test Front View	A-6
A-7	Pre-Test Left Side View	A-7
A-8	Post-Test Left Side View	A-8
A-9	Pre-Test Right Side View	A-9
A-10	Post-Test Right Side View	A-10
A-11	Pre-Test Left Front 3/4 View	A-11
A-12	Post-Test Left Front 3/4 View (Vehicle Moved)	A-12
A-13	Pre-Test Right Rear 3/4 View	A-13
A-14	Post-Test Right Rear 3/4 View	A-14
A-15	Pre-Test Front Underbody View	A-15
A-16	Post-Test Front Underbody View	A-16
A-17	Pre-Test Mid Underbody View	A-17
A-18	Post-Test Mid Underbody View	A-18
A-19	Pre-Test Rear Underbody View	A-19
A-20	Post-Test Rear Underbody View	A-20
A-21	Vehicle on Rollover Device 0°	A-21
A-22	Vehicle on Rollover Device 90°	A-22
A-23	Vehicle on Rollover Device 180°	A-23
A-24	Vehicle on Rollover Device 270°	A-24
A-25	Vehicle During Impact	A-25

A-1

TR-P25007-05-NC



Figure A-1: Left Front $\frac{3}{4}$ View, As Received

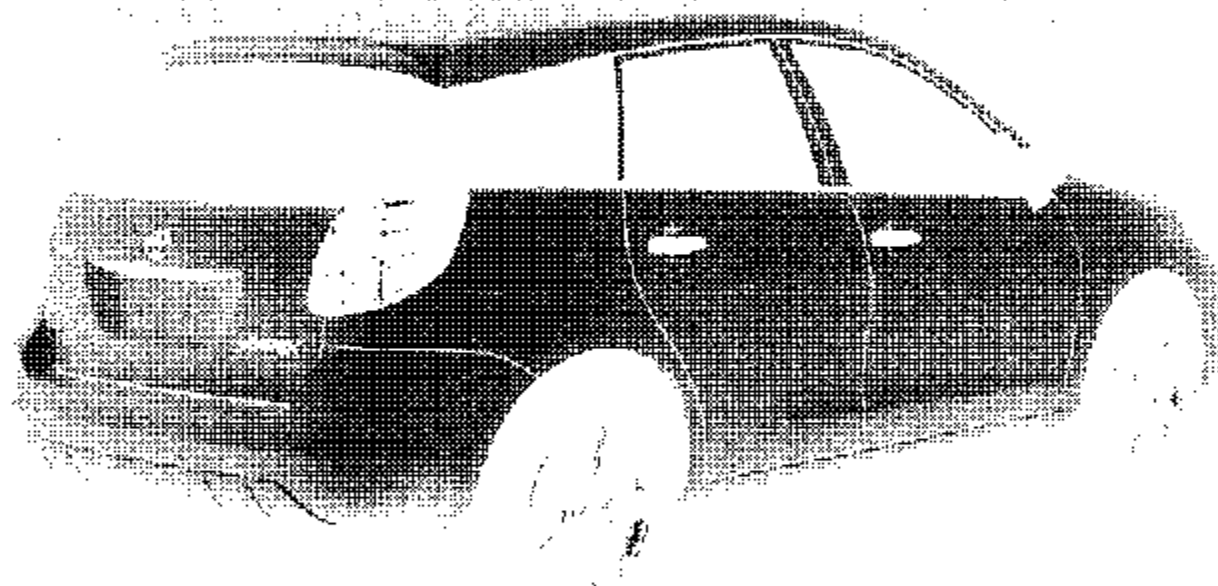


Figure A-2: Right Rear 3/4 View, as Received

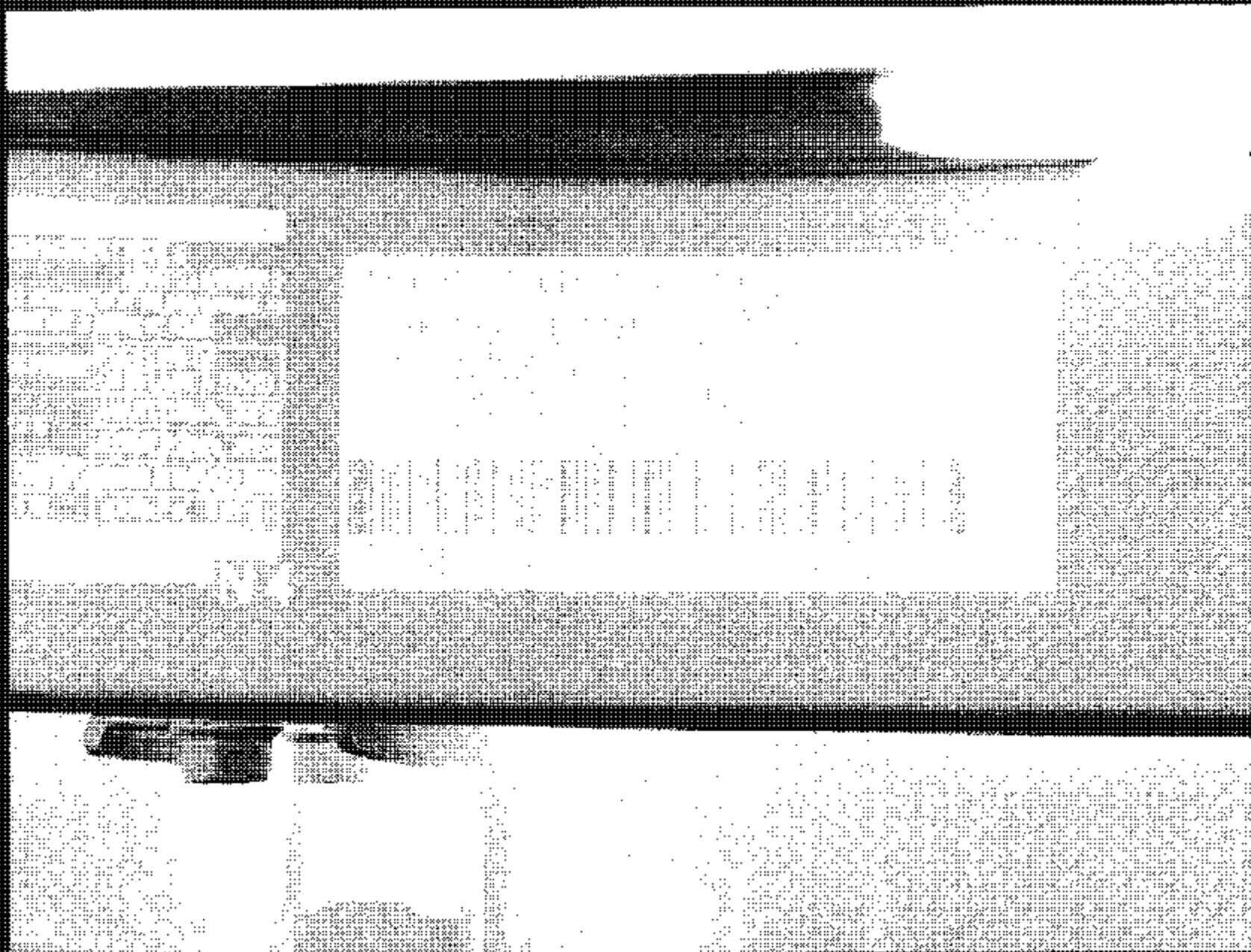


Figure A-3. Vehicle Certification Label

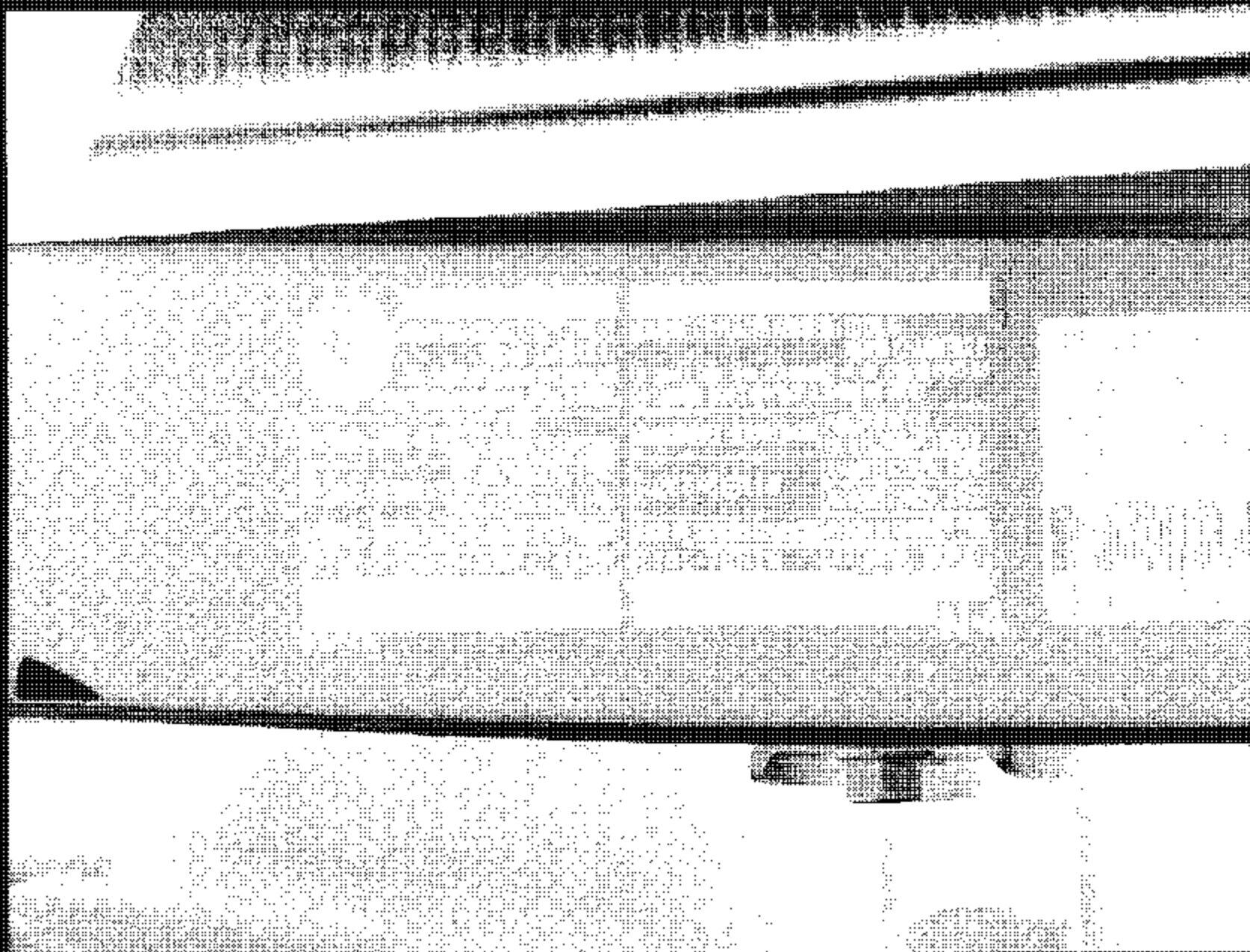


Figure A-4. Vehicle Tire Label



Figure A-5: Pre-Test Front View



Figure A-6: Post-Test Front View

A-7

TR-P25007-05-NC

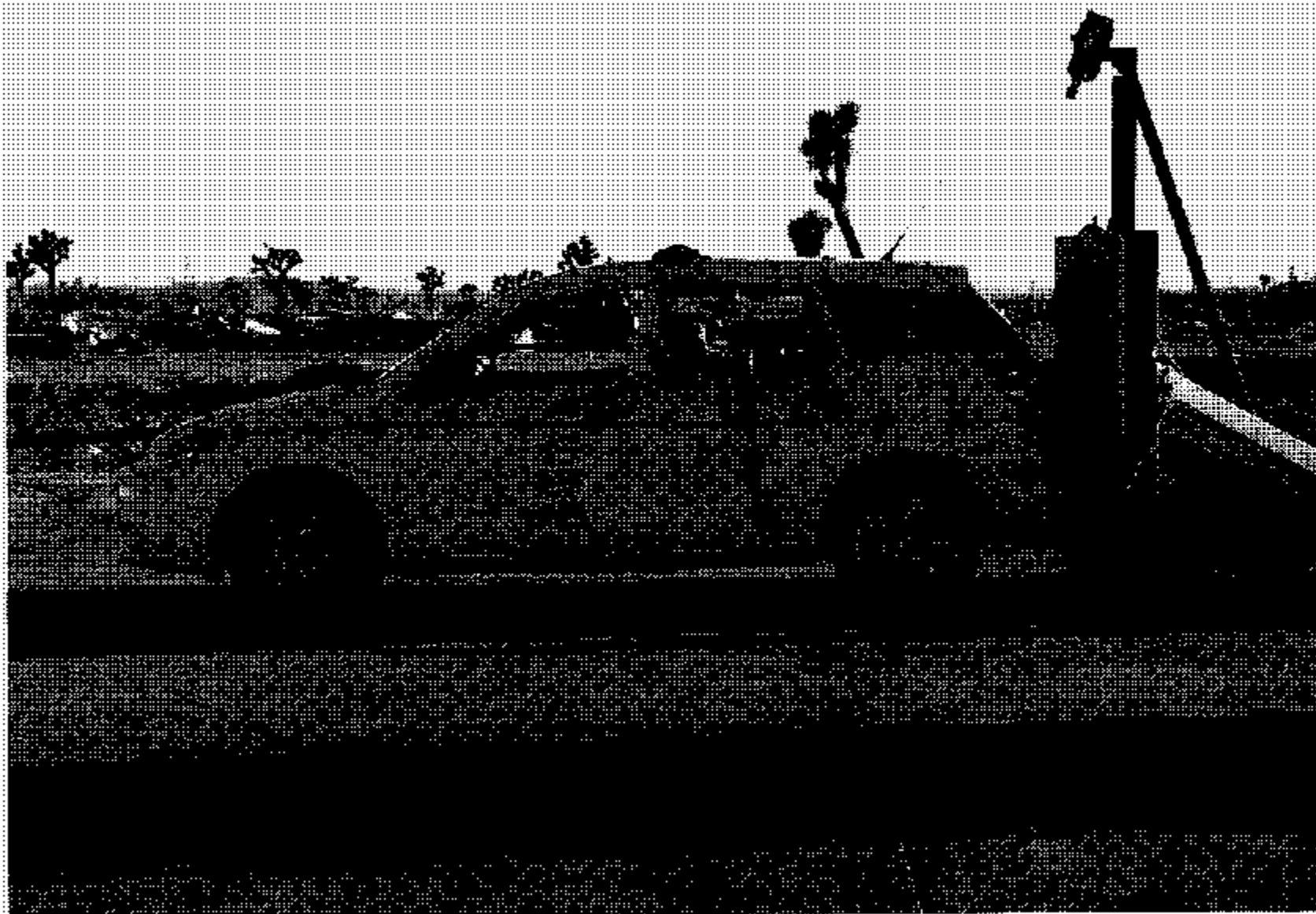


Figure A-7: Pre-Test Left Side View

TR-P25007-05-NC



A-9

TRP25007-05-NC

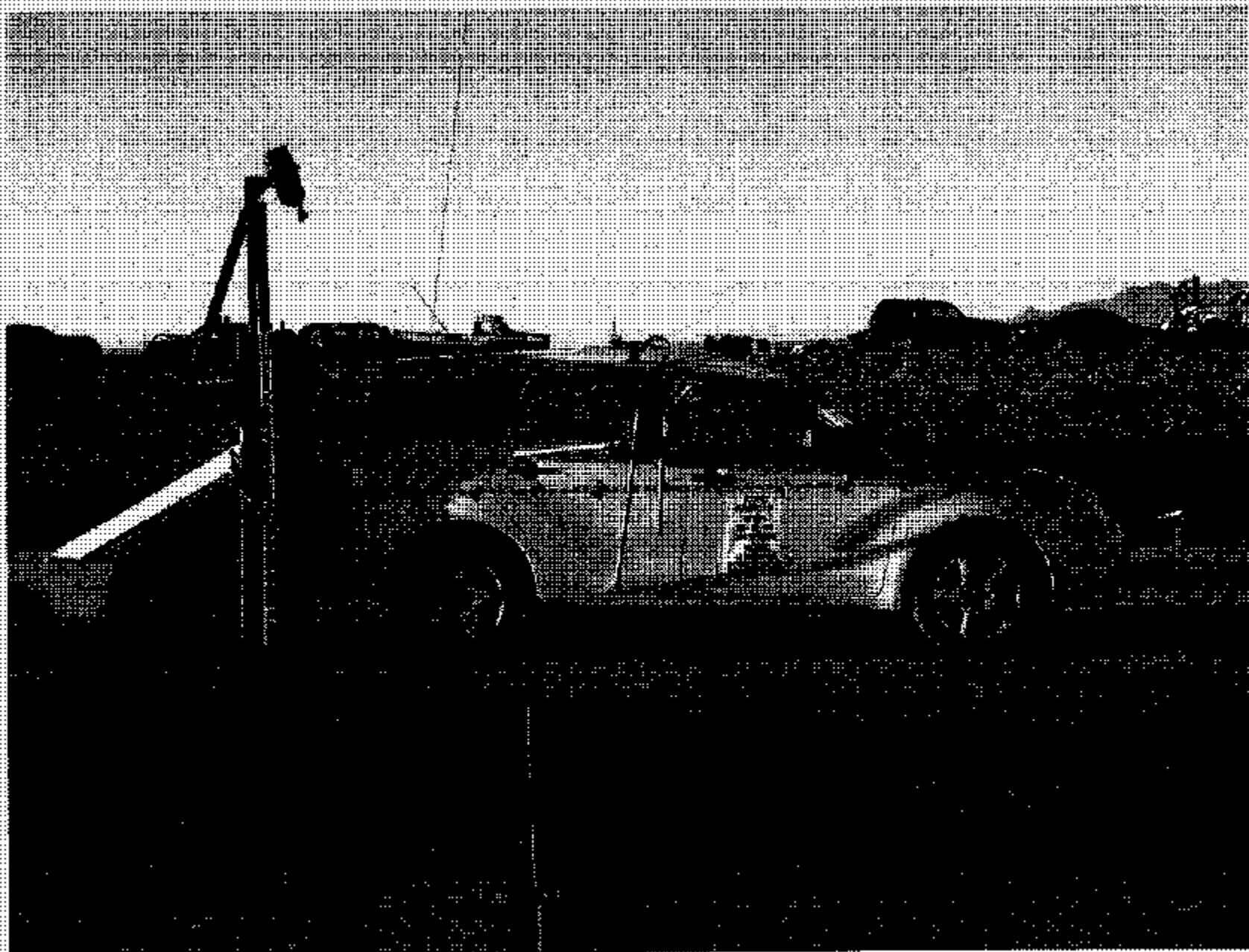


Figure A-9: Pre-Test Right Side View



Figure A-10: Post-Test Right Side View

A-10

TR-F25007-05-NC

A-11

TR-P25007-06-NC

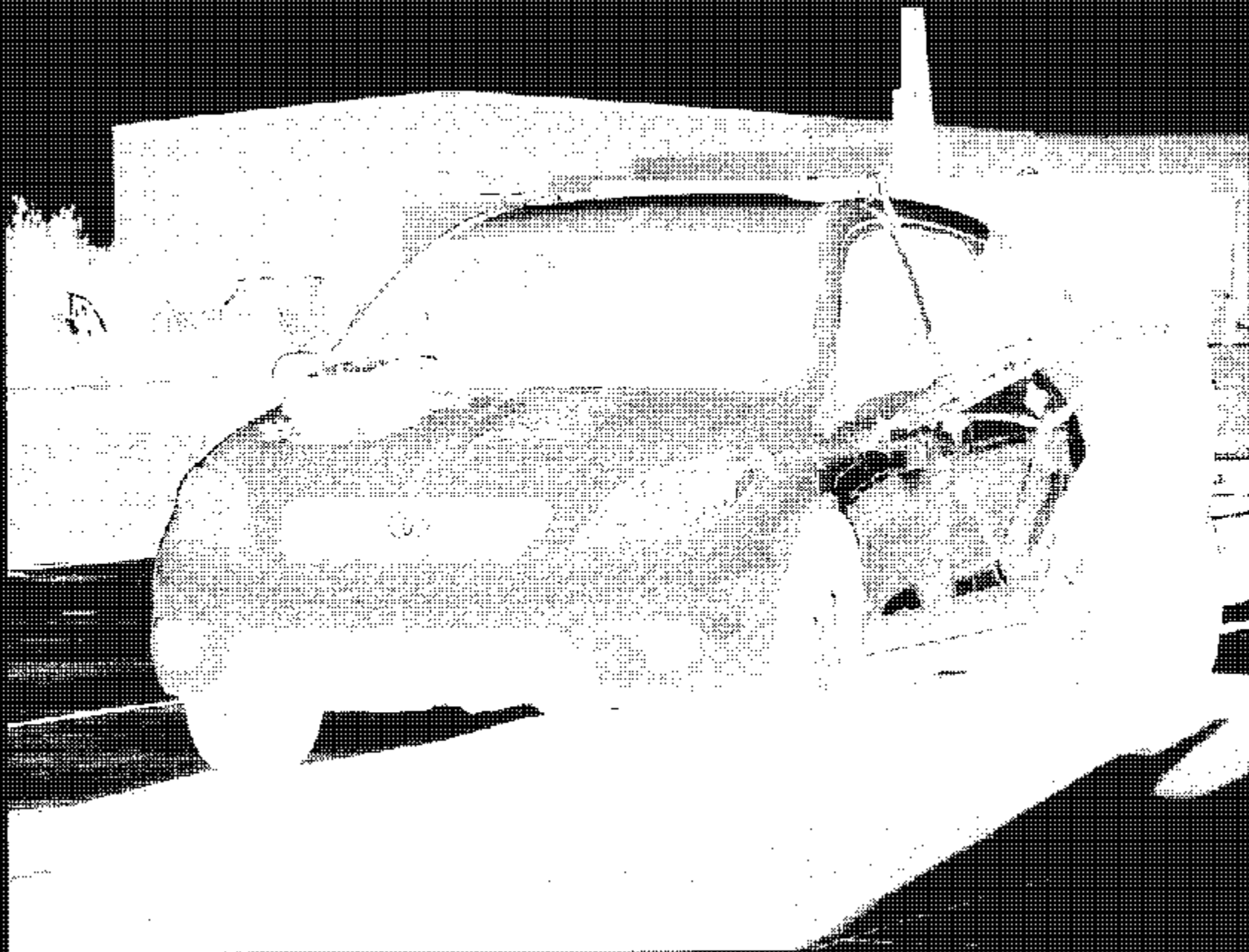


Figure A-11: Pre-Test Left Front 3/4 View



Figure A-12: Post-Test Left Front $\frac{3}{4}$ View (Vehicle Moved)

A-13

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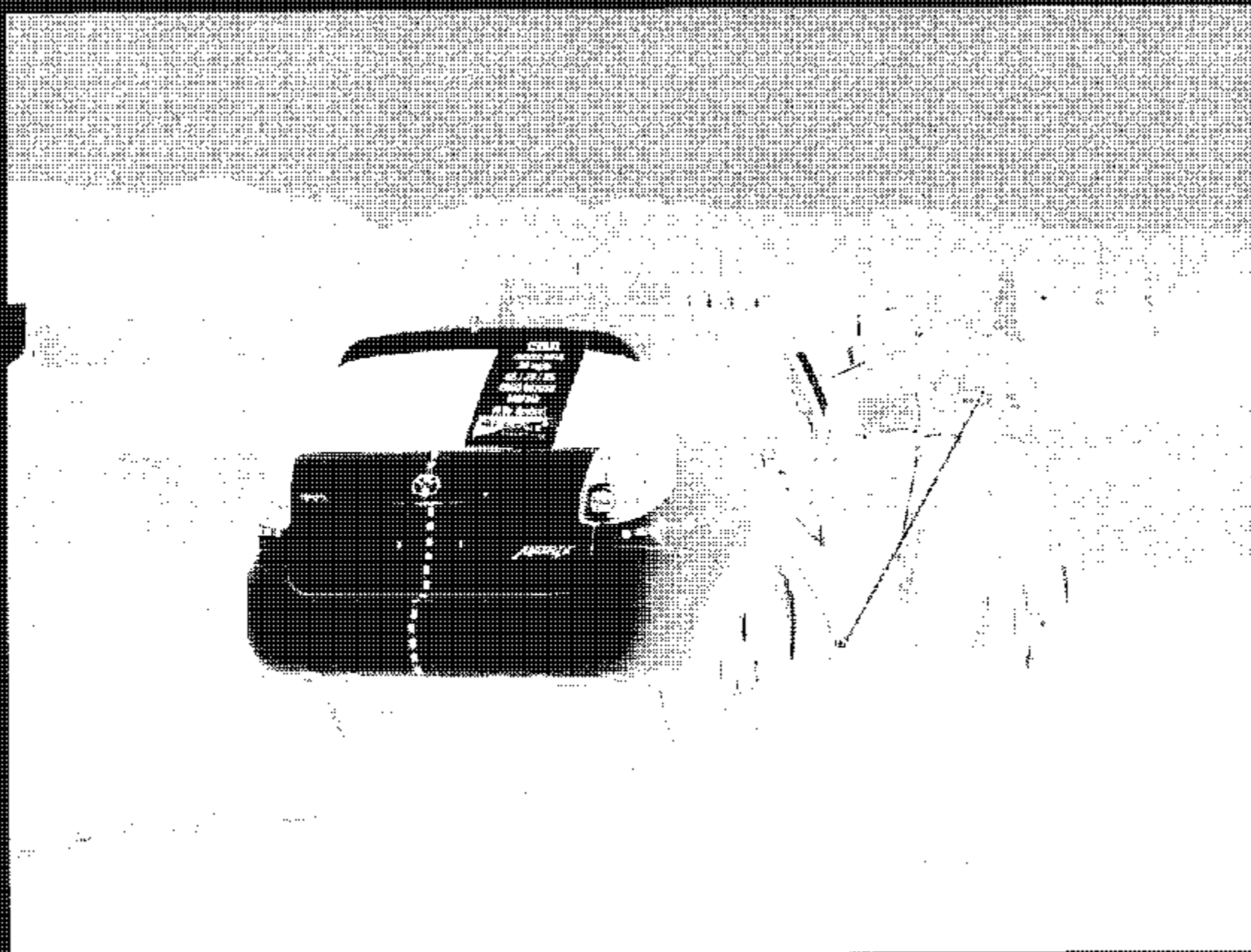


Figure A-13: Pre-Test Right Rear $\frac{3}{4}$ View

A-14

TR-P25007-06-NC

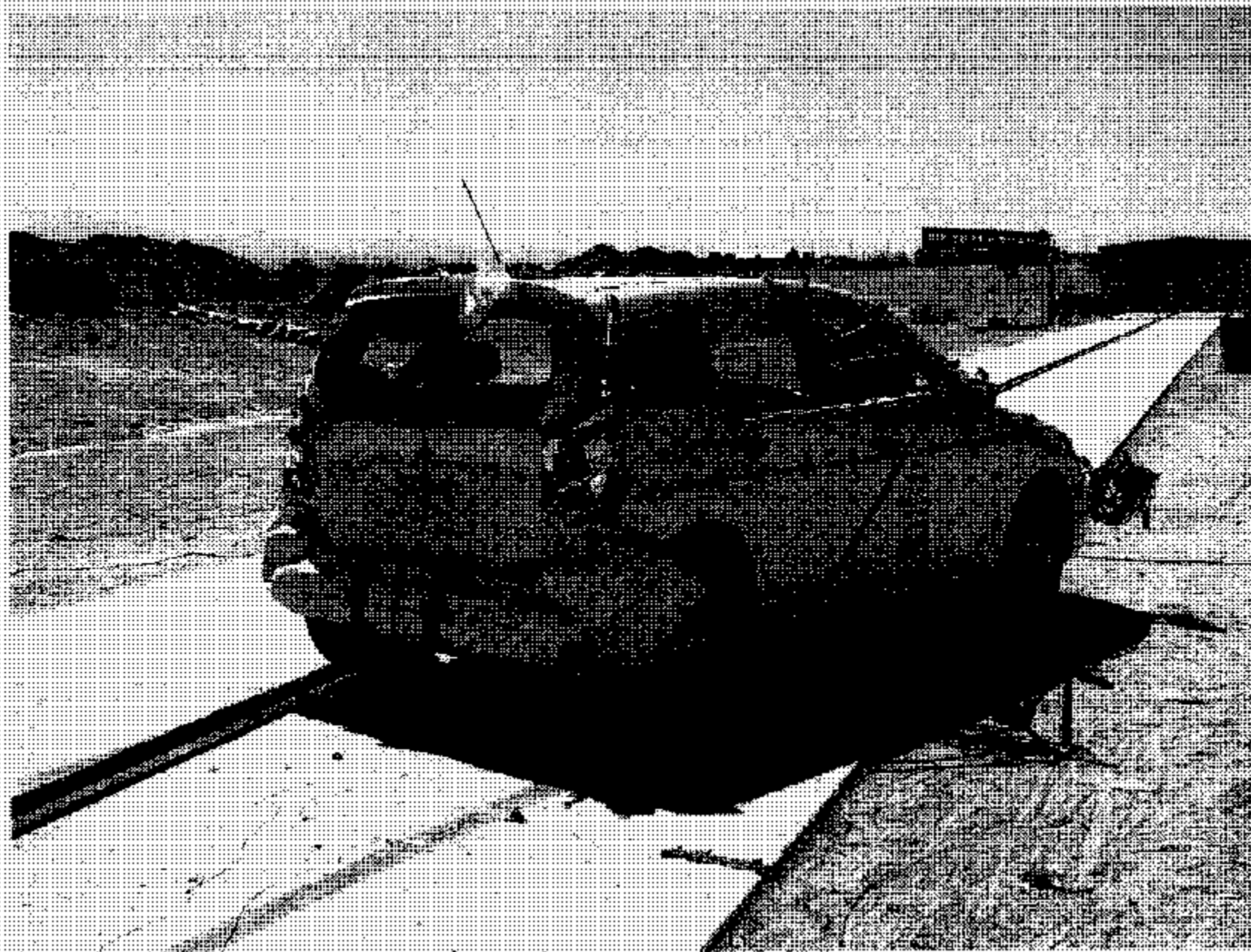


Figure A-14: Post-Test Right Rear 3/4 View

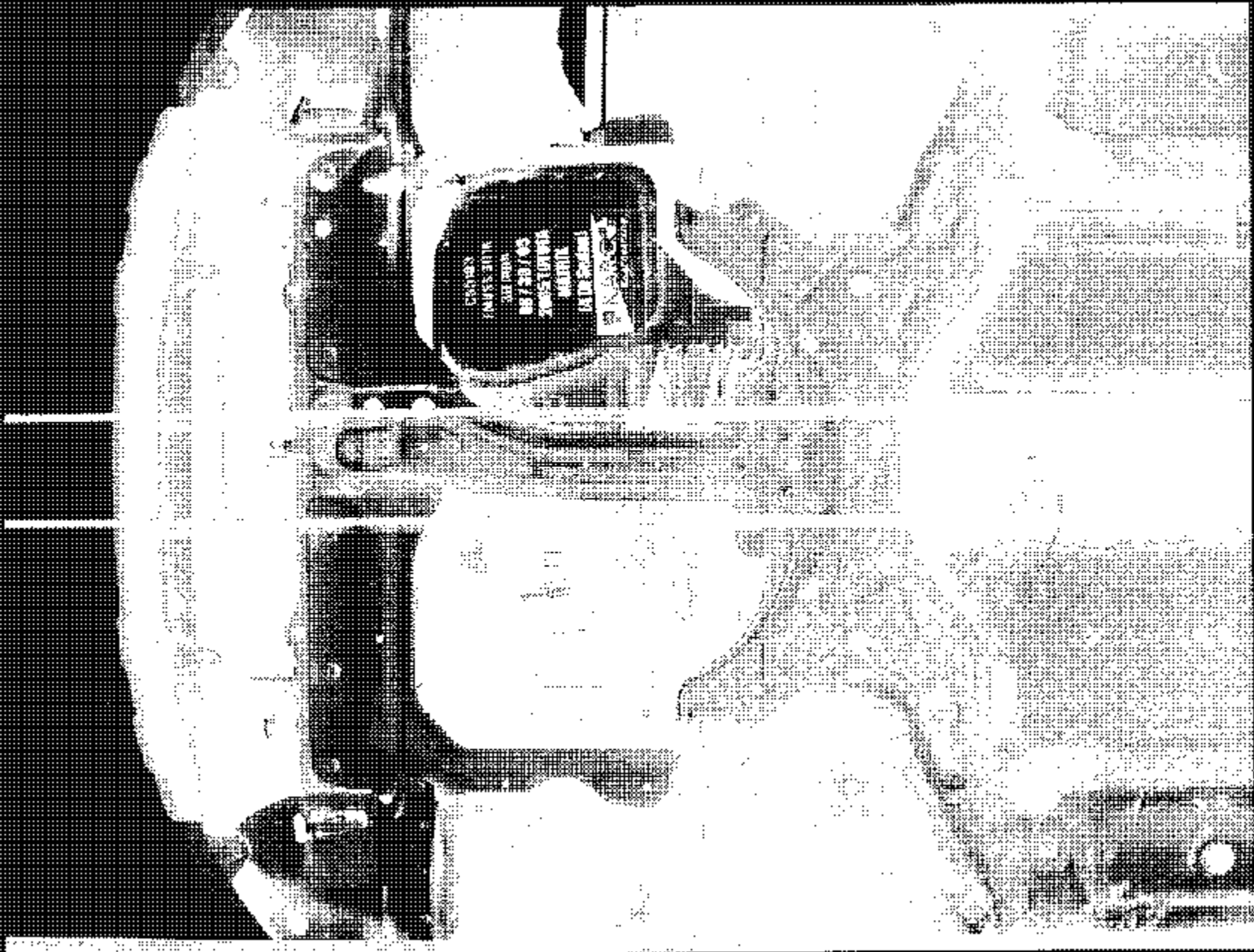


Figure A-15: Pre-Test Front Underbody

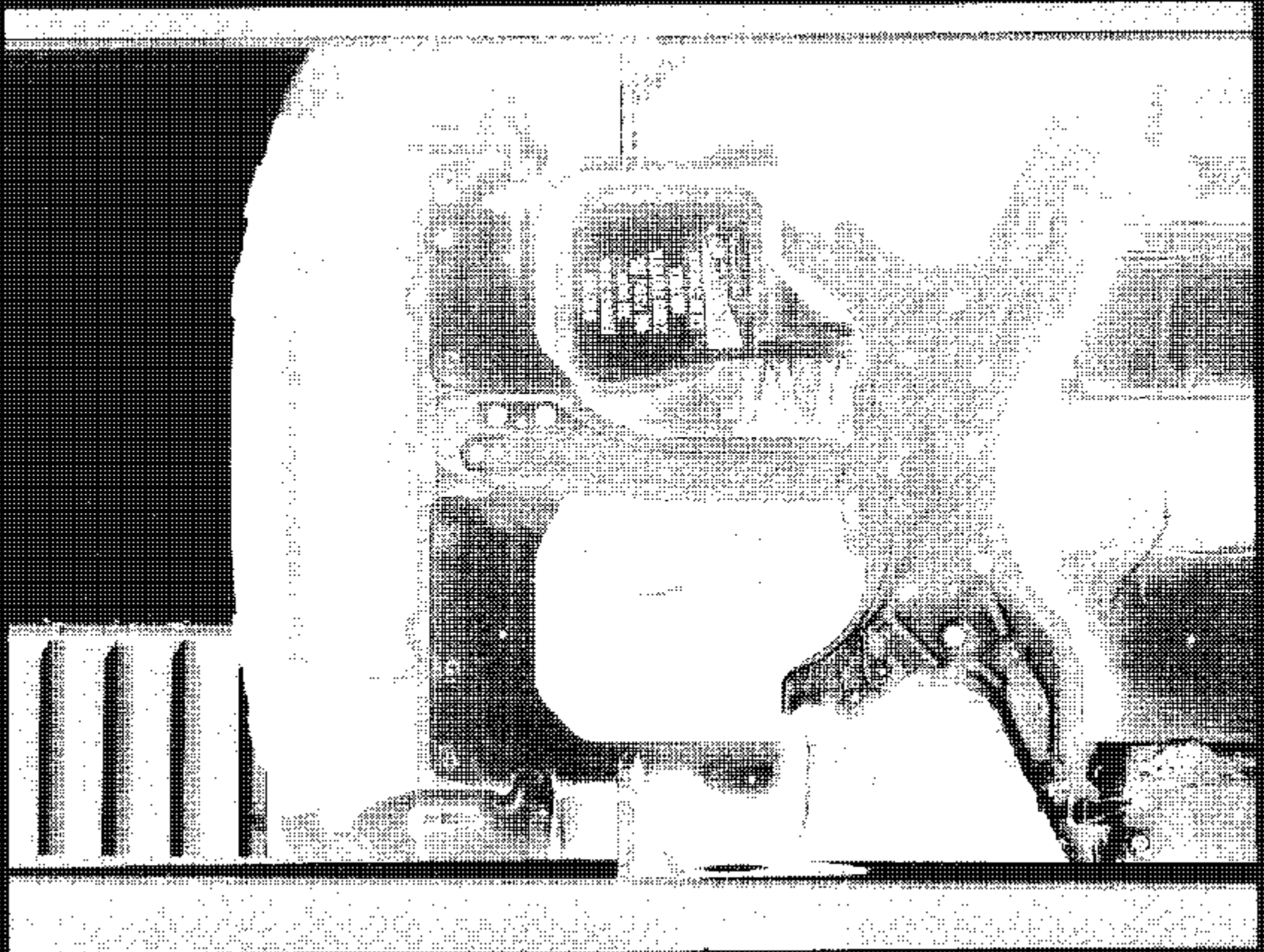


Figure A-16. Post-Test Front Underbody

A-17

TRP25007-05-NC

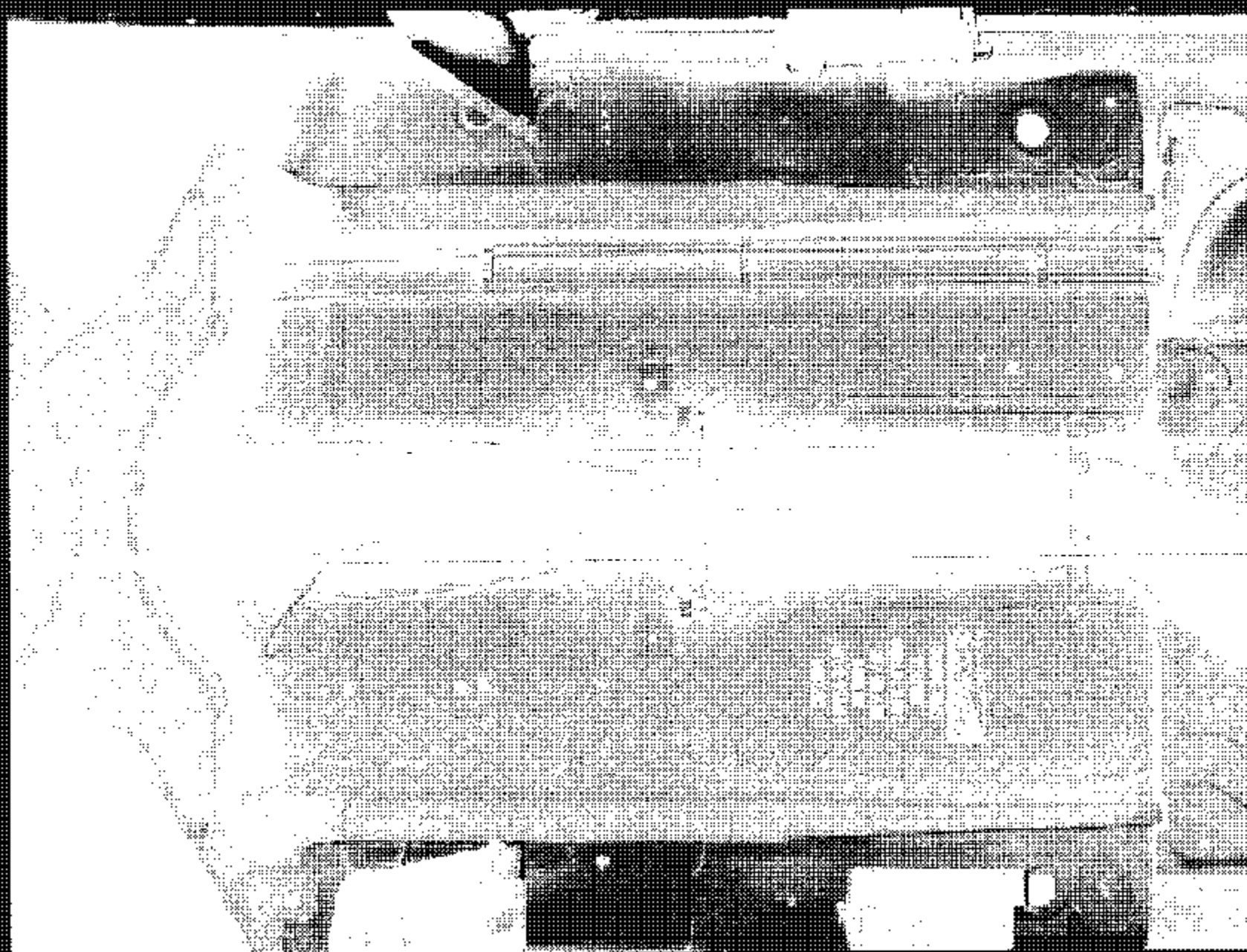


Figure A-17. Pre-Test Mid Underbody

A-18

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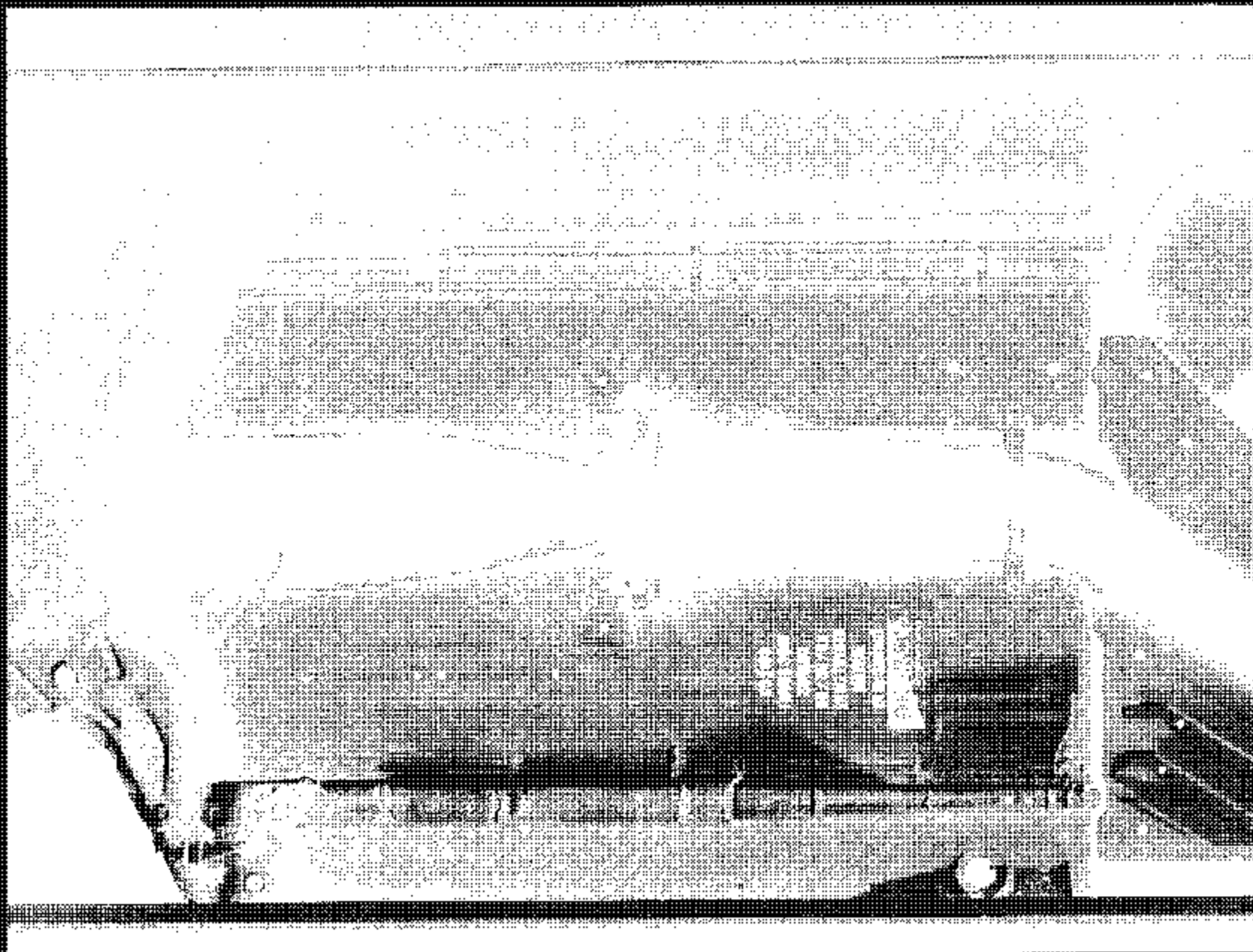


Figure A-18: Post-Test Mid Underbody



Figure A-20. Post-Test Rear Underbody



Figure A-21. Vehicle on Rollover Device at 0°



Figure A-22: Vehicle on Rollover Device at 90°



Figure A-23. Vehicle on Rollover Device at 180°

A-24

TR-P26007-05-NC

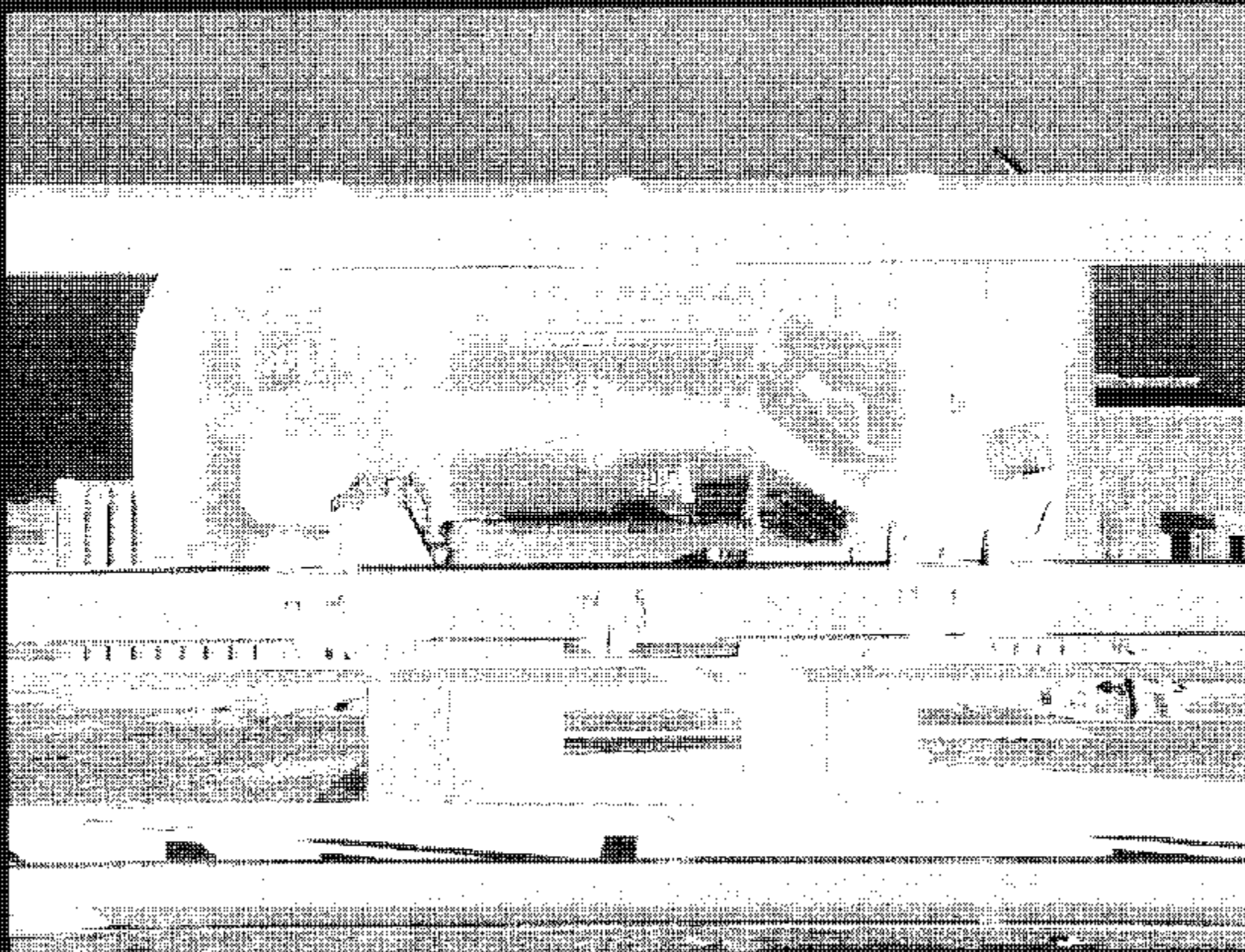


Figure A-24: Vehicle on Rollover Device at 270°

A-25

TR-P-25007-05-NC



Figure A-25: Vehicle During Impact