

Report Number: 201-EXI-2004-003

**Safety Compliance Testing
for FMVSS 201
Rigid Pole Side Impact Test**

**Toyota Motor Company
2004 Toyota Sienna
NHTSA No. C45104**

**Prepared By:
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**Test Date: May 21, 2004
Report Date: September 28, 2004**

Final Report

**Prepared for:
U.S. Department of Transportation
National Highway Traffic Safety Administration
Office of Vehicle Safety Compliance (NVS-221)
400 Seventh Street, S.W., Room 6111
Washington, DC 20590**

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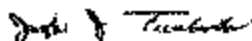
Report Prepared By:



James Heald, Project Engineer
Exponent Failure Analysis Associates

Date 9/28/2004

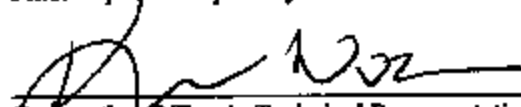
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16. Abstract A rigid pole side impact test was conducted on a 2004 Toyota Sienna minivan in accordance with FMVSS 201, "Occupant Protection in Interior Impact", S6.2(b)(3), and the Office of Vehicle Safety Compliance Test Procedure No. TP-201P-02, "Rigid Pole Side Impact Test." The test was conducted by the Exponent Test and Engineering Center in Phoenix, Arizona, on May 21, 2004. The impact velocity of the vehicle was 27.0 kph, and the ambient temperature at the driver side of the vehicle at the time of impact was 22.2 °C. The posttest maximum crush was 386 mm at level 2. The test vehicle's performance follows: HIC: Required: <1000 Measured: 445.5 Test Failures: None The doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.			
17. Key Words Compliance Testing Rigid Pole Side Impact Test FMVSS 201		18. Distribution Statement Copies of this report are available from: National Highway Traffic Safety Adm. Technical Information Services (TIS) 400 Seventh Street, S.W. Washington, DC 20590 Telephone No. (202) 366-4946	
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TABLE OF CONTENTS

Section 1 - Purpose and Test Procedure

Section 2 - Summary of Rigid Pole Side Impact Test

Section 3 - Side Impact Dummy (SID/HIII) and Vehicle Test Summary Data

Section 4 - Occupant and Vehicle Information

Appendix A - Photographs

Appendix B - Vehicle and SID/HIII Response Data

Appendix C - SID/HIII Configuration and Performance Verification Data

Appendix D - Test Equipment List and Calibration Information

Section 1 – Purpose and Test Procedure

This side impact test is part of the FMVSS 201 "Occupant protection in interior impact" compliance test program sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract No. DTNH22-01-D-11033. The purpose of this test was to evaluate the dynamic head protection system in a 2004 Toyota Sienna minivan. The rigid pole side impact test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure (TP-201P-02, dated October 21, 2001).

Section 2 – Summary of Rigid Pole Side Impact Test

A rigid pole side impact test was conducted on a 2004 Toyota Sienna minivan. The subject vehicle was towed into the rigid pole at a velocity of 27.0 kph. The test was conducted by the Exponent Test and Engineering Center in Phoenix, Arizona, on May 21, 2004. Pretest and posttest photographs of the test vehicle and the side impact dummy (SID/HIII) are included in Appendix A of this report.

One SID/HIII was placed in the left front outboard designated seating position according to instructions specified in TP-201P-02, dated October 21, 2001. The side impact event was documented by 13 cameras. Camera locations and other pertinent camera information are included in this report.

The SID/HIII was instrumented with the following accelerometers:

1. Head CG triaxial accelerometers
2. Upper neck 6-channel load cell (X, Y, and Z force and moment)
3. Left Upper Rib uniaxial accelerometer (Y-direction)
4. Left Lower Rib uniaxial accelerometer (Y-direction)
5. Lower Thoracic Spine uniaxial accelerometer (Y-direction)
6. Pelvic section uniaxial accelerometer (Y-direction)

Appendix B contains the vehicle and dummy response data traces. A summary of the side impact dummy (SID/HIII) configuration and performance verification test data is shown in Appendix C. Dummy and vehicle calibration data can be found in Appendix D of this report.

The following table summarizes the results of the test.

Injury Criteria	Front SID/HIII
HIC (1000)	445.5
TTI (g)*	56.8
Pelvic (g)*	41.8
Neck X Force (N)*	-336.3
Neck Y Force (N)*	-371.4
Neck Z force (N)*	538.7
Neck Moment X (N-m)*	-27.0
Neck Moment Y (N-m)*	15.2
Neck Moment Z (N-m)*	23.4

*For informational purposes only

Section 3 – Side Impact Dummy (SID/HIII) and Vehicle Test Summary Data

Data Sheet 1 – General Test Vehicle Parameter Data

Data Sheet 2 – Test Vehicle Summary of Results

Data Sheet 3 – Posttest Observations

DATA SHEET 1
GENERAL TEST VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Model Year/Make/Model: 2004 Toyota Sienna

Body Style/Color: Minivan / Sand VIN: 5TDZA23C54S

NHTSA No.: C45104 Build Date: 12/03

Engine Data: 6 cylinders CID 3.3 Liter cc

Placement: longitudinal X lateral

Transmission: 5 speeds manual X automatic X overdrive

Final Drive: rear wheel drive X front wheel drive four wheel drive

Odometer Reading: 34 km

Options: X A/C X pwr. steering X pwr. brakes X pwr. windows

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): 35 psi Front 36 psi Rear

Recommended Tire Size: P215/65R16, P225/60R17

Tires on Vehicle: P215/65R16 Mfr.: DUNLOP

VEHICLE CAPACITY DATA:

Number of Occupants: 2 front 3 center 3 rear 8 Total

Type of Front Seat(s): X buckets bench split bench

Type of Front Seat Back: fixed X adjustable with: lever X knob

Vehicle Maximum Capacity Loading = 594 kg (A)

Number of Occupants X 68.04 kg = 544 kg (B)

Vehicle Cargo Capacity (A-B) = 50 kg

DATA SHEET 1
GENERAL TEST VEHICLE PARAMETER DATA (CONTINUED)

TEST VEHICLE DELIVERED WEIGHT WITH MAXIMUM FLUIDS:

Right Front = 548 kg Right Rear = 400 kg
Left Front = 558 kg Left Rear = 415 kg
Total Front = 1106 kg Total Rear = 815 kg
Total Weight = 1921 kg (UVW)
Percent of Total Weight: Percent Front = 58 Percent Rear = 42

CALCULATION OF TEST VEHICLE TARGET WEIGHT:

A. Total Vehicle Delivered Weight/Max Fluids = 1921 kg (UVW)
B. Rated Cargo and Luggage Weight of Vehicle = 50 kg (RCLW (<136 kg))
C. Weight of Instrumented SID/HIII Dummy = 80 kg
Test Vehicle Target Weight (A+B+C) = 2051 kg (TVTW)

FULLY LOADED TEST VEHICLE (UDVW + SID/HIII + CARGO):

Right Front = 556 kg Right Rear = 439 kg
Left Front = 593 kg Left Rear = 463 kg
Total Front = 1149 kg Total Rear = 902 kg
Percent Front = 56 Percent Rear = 44
Total Weight = 2051 kg

DATA SHEET 1
GENERAL TEST VEHICLE PARAMETER DATA (CONTINUED)

AS-TESTED WEIGHT OF VEHICLE (SIDHIII DUMMY + CARGO + EQUIPMENT & INSTRUMENTATION):

Right Front =	<u>550</u> kg	Right Rear =	<u>441</u> kg
Left Front =	<u>590</u> kg	Left Rear =	<u>482</u> kg
Total Front =	<u>1140</u> kg	Total Rear =	<u>903</u> kg
Total Weight =	<u>2043</u> kg		
Percent Front =	<u>56</u>	Percent Rear =	<u>44</u>

TEST VEHICLE ATTITUDE:

	As Delivered	Fully Loaded	Ready for Test
Right Front	<u>782</u> mm	<u>757</u> mm	<u>762</u> mm
Left Front	<u>758</u> mm	<u>747</u> mm	<u>751</u> mm
Right Rear	<u>762</u> mm	<u>744</u> mm	<u>743</u> mm
Left Rear	<u>756</u> mm	<u>734</u> mm	<u>735</u> mm
Right Door Sill Angle	<u>-0.4</u> deg	<u>0.1</u> deg	<u>0.1</u> deg
Left Door Sill Angle	<u>-0.2</u> deg	<u>0.2</u> deg	<u>0.1</u> deg
Front Bumper Angle	<u>-0.1</u> deg	<u>-0.1</u> deg	<u>-0.1</u> deg
Rear Bumper Angle	<u>0.0</u> deg	<u>-0.1</u> deg	<u>-0.1</u> deg
Test Vehicle Wheelbase =	<u>3032</u> mm		
C.G. =	<u>1340</u> mm rearward of front wheel centerline		

DATA SHEET 1
GENERAL TEST VEHICLE PARAMETER DATA (CONTINUED)

TOTAL VEHICLE LENGTH:

Right Side = 4813 mm Left Side = 4820 mm Centerline = 5086 mm

FRONT SEAT CUSHION PLACEMENT:

Total length of Adjustment Travel = 241 mm

Total Number of Adjustment Positions or Detents = 17

Final Seat Position = 15 mm forward of mid position

FRONT SEAT BACK ADJUSTMENT POSITION:

Initial Seat Back Torso Angle = 5° degrees

Final Seat Back Torso Angle = 1° degrees

*Measurement taken with inclinometer positioned on headrest post

ADJUSTABLE STEERING COLUMN POSITION:

Telescopic = 20 mm aft of forward most position

Angle = 62 degrees from vertical

WINDOW POSITIONS:

Right Front = Down Right Rear = Removed for camera 13

Left Front = Down Left Rear = Down

AMOUNT OF STODDARD SOLVENT IN FUEL TANK:

Volume = 73.3 liters (92% to 94% of useable capacity)

LOCATION OF IMPACT POINT ON TEST VEHICLE SIDE TO BE IMPACTED:

Wheelbase = 3032 mm

Impact Reference Line is 1300 mm rearward of front axle centerline

RECORDED BY:

DATE: May 21, 2004

APPROVED BY:

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DATA SHEET 2
TEST VEHICLE SUMMARY OF RESULTS

Model Year/Make/Model: 2004 Toyota Sienna

Body Style: Minivan VIN: 5TDZA23C54S

NHTSA No. C45104 Build Date: 12/03

Test Date: May 21, 2004

Vehicle Overall Length = 5086 mm Vehicle Overall Width 1986 mm

VEHICLE TEST WEIGHT (PRETEST):

Left Front = 590 kg Left Rear = 462 kg

Right Front = 550 kg Right Rear = 441 kg

Total Front = 1140 kg Total Rear = 903 kg

Total Vehicle Test Weight = 2043 kg

Wheelbase = 3032 mm

Longitudinal C.G. from center of front axle = 1340 mm

Impact Angle with respect to Impactor = 90 degrees

IMPACT POINT:

Actual Impact Point = 13 mm rearward of nominal impact ref. line (Lateral)

DATA SHEET 2
TEST VEHICLE SUMMARY OF RESULTS (CONTINUED)

MAXIMUM EXTERIOR STATIC CRUSH:

Level 1 (302 mm above ground) = 285 mm

Level 2 (732* mm above ground) = 388 mm

Level 3 (887 mm above ground) = 382 mm

Level 4 (1021 mm above ground) = 384 mm

Level 5 (1640 mm above ground) = 181 mm

Maximum Post Test Intrusion = 388 mm

*Level 2 was higher than Level 3

OCCUPANTS:

Dummy ID: 053 SID/HIII No. 053

Restraint Used: 3-Point Active Restraint

INSTRUMENTATION:

Number of Data Channels = 37

Number of Cameras:

Onboard = 3

Offboard = 10

Total Cameras = 13

Remarks: None

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DATE: May 21, 2004

**DATA SHEET 3
POSTTEST OBSERVATIONS**

Test Vehicle: 2004 Toyota Sienna NHTSA No.: C45104

VISIBLE DUMMY CONTACT POINTS:

	SID/HII
Face	Side curtain airbag
Top of the Head	Side curtain airbag
Left Side of the Head	Side curtain airbag
Back of the Head	Side curtain airbag, edge of headliner
Left Hip	Seat, seat belt
Left Shoulder	Thoracic airbag, door panel, seat, seat belt

DOOR OPENING:

	Left Side	Right Side
Front	Tools needed	Easy
Rear	Tools needed	Easy

ARM REST LOCATION:

Front = Down

Rear = N/A

SEAT MOVEMENT:

Front = None

Rear = None

DATA SHEET 3
POSTTEST OBSERVATIONS (CONTINUED)

GLAZING DAMAGE:

Windshield: Broken

Window: Left front broken, all other windows not broken*

PILLAR PERFORMANCE:

No separation

SILL SEPARATION:

None

OTHER NOTABLE IMPACT EFFECTS:

Roof separated from left A-pillar at body seam

REMARKS:

*Right rear window removed pre-test for camera view 13

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APPROVED BY:

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DATE: May 21, 2004

Section 4 – Occupant and Vehicle Information

Data Sheet 4 – SID/HIII Instrumentation Data

Data Sheet 5 – Vehicle Pretest and Posttest Measurements

Data Sheet 6 – SID/HIII Longitudinal Clearance Dimensions

Data Sheet 7 – SID/HIII Lateral Clearance Dimensions

Data Sheet 8 – Vehicle Side Measurements

Data Sheet 9 – Vehicle Exterior Crush Profiles – All Levels

Data Sheet 10 – Vehicle Damage Profile Distances

Data Sheet 11 – High-Speed Camera Locations and Data

Data Sheet 12 – Dummy Damage Checklist – SID/HIII

Data Sheet 13 – Test Vehicle Accelerometer Locations Summary

Data Sheet 14 – Fuel System Integrity Summary

**DATA SHEET 4
SID/HIII INSTRUMENTATION DATA**

Test Vehicle: 2004 Toyota Sienna

NHTSA No.: C45104

SID/HIII ID# 053

Description	Units	Filter	Max Data	Max Data Time [s]	Min Data	Min Data Time [s]
<i>THEAD.FEU (Results calculated from -0.1 to 0.4 sec.)</i>						
Driver ATD Head (Ax)	g	CFC 1000	4.6	0.218	-12.8	0.076
Driver ATD Head (Vx)	kph	CFC 180	0.0	-0.100	-13.0	0.202
Driver ATD Head (Ay)	g	CFC 1000	60.7	0.063	-9.0	0.216
Driver ATD Head (Vy)	kph	CFC 180	19.9	0.064	-27.1	0.023
Driver ATD Head (Az)	g	CFC 1000	12.7	0.065	-1.7	0.047
Driver ATD Head (Vz)	kph	CFC 180	31.2	0.400	0.0	0.048
Driver ATD Head (Ar)	g	CFC 1000	70.1	0.063	0.0	-0.058
Driver HIC: 445.5 from 0.0548 to 0.0755 s.						
<i>TUNCK.FEU (Results calculated from -0.1 to 0.4 sec.)</i>						
Driver ATD Neck (Fx)	N	CFC 1000	80.2	0.248	-336.3	0.071
Driver ATD Neck (Fy)	N	CFC 1000	54.5	0.034	-371.4	0.055
Driver ATD Neck (Fz)	N	CFC 1000	538.7	0.085	-243.2	0.034
Driver ATD Neck (Mx)	N-m	CFC 500	4.4	0.308	-27.0	0.061
Driver ATD Neck (My)	N-m	CFC 500	15.2	0.104	-8.8	0.261
Driver ATD Neck (Mz)	N-m	CFC 500	23.4	0.069	-8.0	0.052
<i>TRBLSPL.FEU (Results calculated from -0.1 to 0.4 sec.)</i>						
Driver ATD Upper Rib (Ay)	g	CFC 1000	57.6	0.052	-13.6	0.088
Driver ATD Lower Rib (Ay)	g	CFC 1000	58.4	0.051	-15.3	0.168
Driver ATD Lower Spine (Ay)	g	CFC 1000	58.1	0.053	-9.9	0.084
Driver ATD Pelvis (Ay)	g	CFC 1000	44.1	0.047	-5.9	0.073
<i>TFIR100.FEU (Results calculated from -0.1 to 0.4 sec.)</i>						
Driver ATD Upper Rib (Ay)	g	FIR 100	55.6	0.051	-8.9	0.089
Driver ATD Upper Rib (Vy)	kph	FIR 100	8.8	0.086	-27.0	0.100
Driver ATD Lower Rib (Ay)	g	FIR 100	53.3	0.050	-12.0	0.089
Driver ATD Lower Rib (Vy)	kph	FIR 100	7.6	0.086	-27.0	-0.100
Driver ATD Lower Spine (Ay)	g	FIR 100	58.0	0.053	-6.4	0.098
Driver ATD Lower Spine (Vy)	kph	FIR 100	7.0	0.079	-27.0	-0.100
Driver ATD Pelvis (Ay)	g	FIR 100	41.8	0.048	-5.4	0.074
Driver ATD Pelvis (Vy)	kph	FIR 100	4.1	0.067	-27.0	-0.100
Driver TTI [g]: 56.8						

(Continued on next page)

REFERENCE:

Positive Direction:

Longitudinal (X) =

Forward

Lateral (Y) =

To Right

Vertical (Z) =

Down

Negative Direction:

Longitudinal (X) =

Rearward

Lateral (Y) =

To Left

Vertical (Z) =

Up

REMARKS:

None

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James H. Hall

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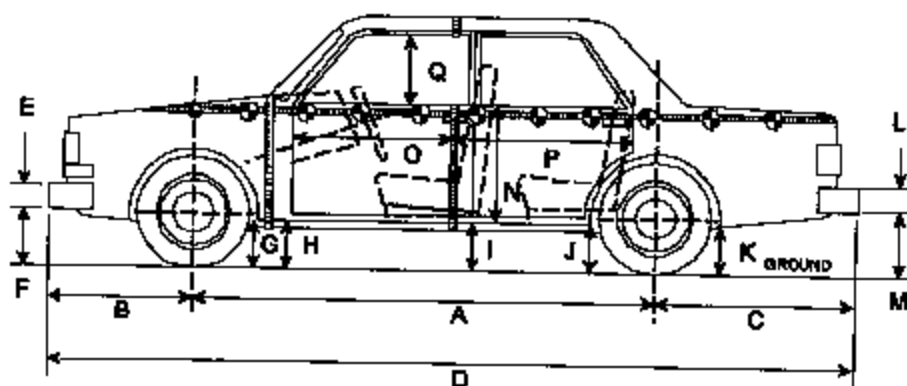
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John J. Treadwell

DATA SHEET 5
VEHICLE PRETEST AND POSTTEST MEASUREMENTS

Test Vehicle: 2004 Toyota Sienna NHTSA No.: C45104



LEFT SIDE VIEW

ALL MEASUREMENTS IN MILLIMETERS (mm) WITH TOLERANCE OF ± 3 mm

	PRETEST	POSTTEST	CHANGE
A	3032	2992	-40
B	959	970	11
C	1096	1093	-2
D	5088	5055	-31
E	132	132	0

(Continued on next page)

PRETEST				
	As-Delivered	As-Tested	POSTTEST	CHANGE
*F	429	425	462	37
*G	244	232	238	6
*H	584	572	576	3
*I	269	254	287	13
*J1/J2	234/269	217/249	232/267	15/18
*K	274	254	257	3
L	130		130	0
*M	437	414	416	2
O	870		865	-5
P	1380		1362	-18
Q	448		408	-42

D = Length at Centerline
 E & L = Bumper thickness
 J1 = To Pinch Weld
 J2 = To Sill

* THESE MEASUREMENTS ARE TO BE TAKEN IN THE "AS DELIVERED" AND IN THE "AS TESTED" CONFIGURATION (WHICH INCLUDES SID/HIII DUMMY, INSTRUMENTATION, CAMERAS, ETC.)

REMARKS:

None

RECORDED BY:

James Hall

DATE:

May 21, 2004

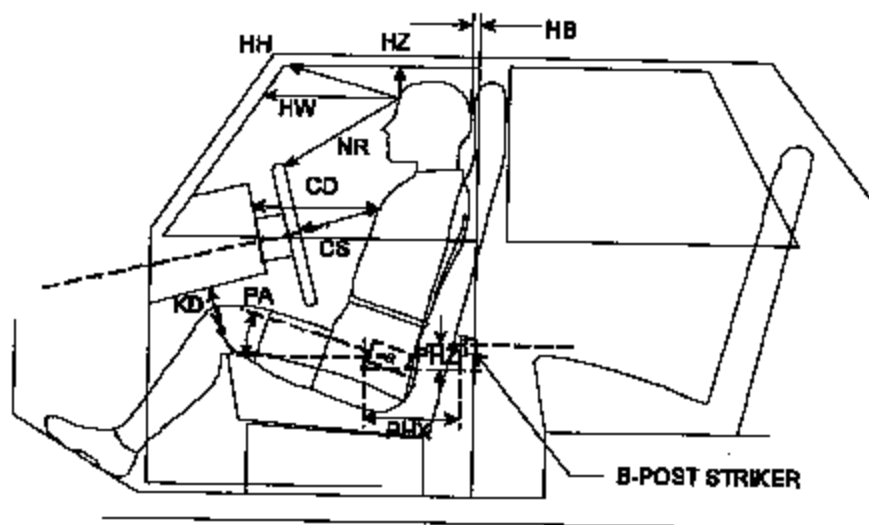
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DATA SHEET 6
SID/HIII LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2004 Toyota Sienna NHTSA No.: C46104

SID/HIII DUMMY LONGITUDINAL MEASUREMENTS



LEFT SIDE VIEW

SID/HIII ID#053	MEASUREMENT (mm)
HB	51
HH	368
HW	673
HZ	224
NR	439
CD	518
CS	310

(Continued on next page)

SID/HIII ID#	MEASUREMENT (mm)
KDL/(KDAp)	112/(21p) WRTH*
KDR	132
PAP	23p
PHX	213
PHY	122
PHZ	157

REMARKS:

PHX, PHY, PHZ taken from forward-most point on striker to outside edge of SID/HIII H-point tool
which extended 165 mm out from hip flesh.

*WRTH = With Respect to Horizontal

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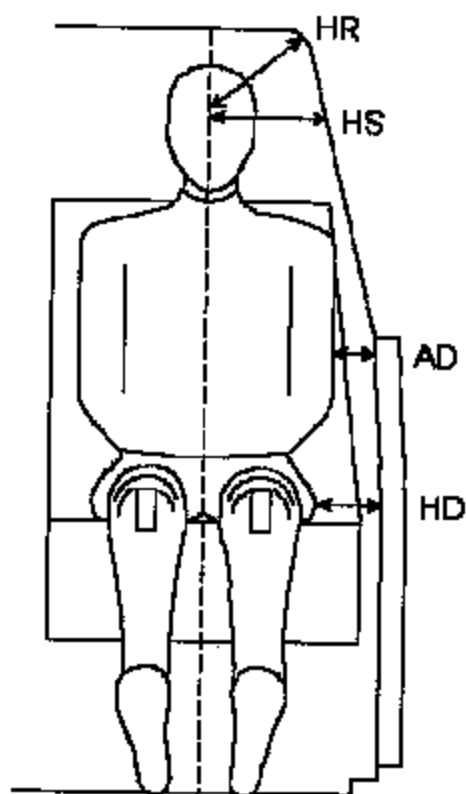
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DATA SHEET 7
SID/HIII DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2004 Toyota Sienna NHTSA No.: C45104

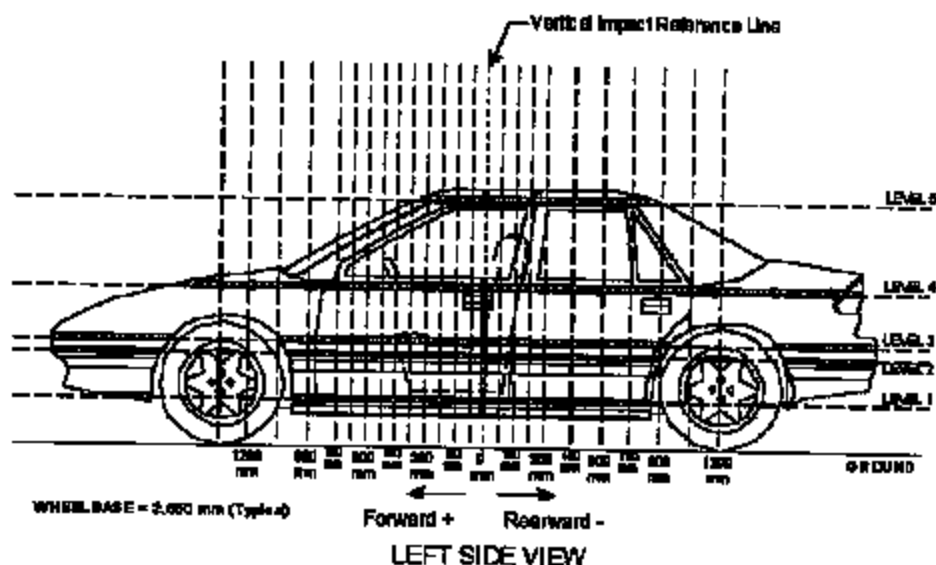


SID/HIII ID#053	MEASUREMENT(mm)
HR	252
HS	396
AD	51
HD	157

DATA SHEET 8 **VEHICLE SIDE MEASUREMENTS**

Test Vehicle: 2004 Toyota Sienna NHTSA No.: C45104

PRETEST AND POSTTEST EXTERIOR PROFILE MEASUREMENTS



VERTICAL MEASUREMENTS ALONG THE 0-mm LINE SHOWN ABOVE:

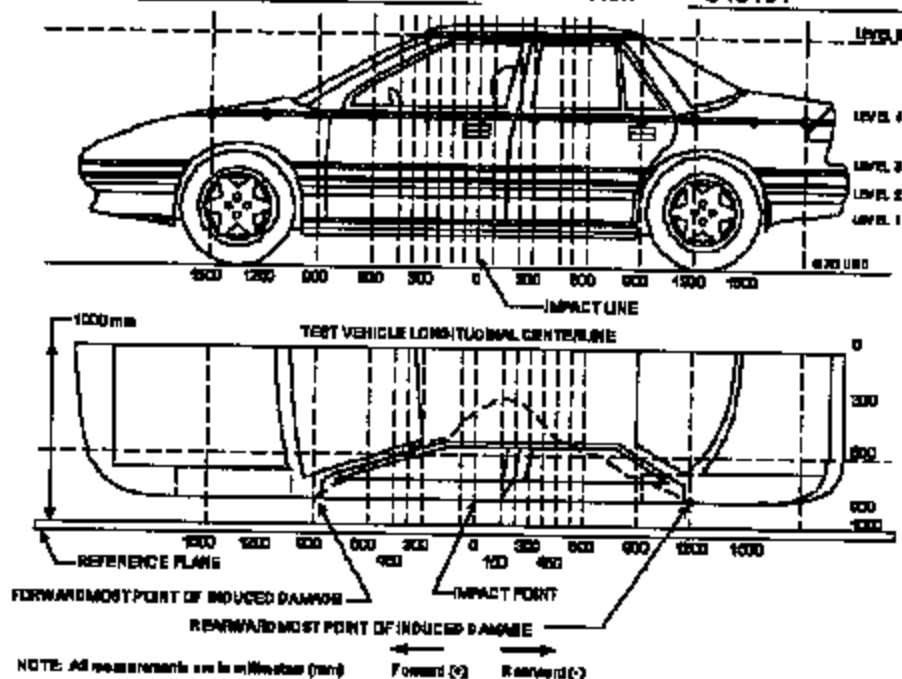
	Pretest		Posttest	
LEVEL 5 @ Window Top =	<u>1640</u>	mm	<u>1664</u>	mm
LEVEL 4 @ Window Sill =	<u>1021</u>	mm	<u>1032</u>	mm
LEVEL 3 @ Mid Door =	<u>697</u>	mm	<u>711</u>	mm
LEVEL 2 @ Occupant H-Point =	<u>732*</u>	mm	<u>743*</u>	mm
LEVEL 1 @ Sill Top Height	<u>302</u>	mm	<u>310</u>	mm

*Level 2 was higher than Level 3

DATA SHEET 9
VEHICLE EXTERIOR CRUSH PROFILES - ALL LEVELS

Test Vehicle: 2004 Toyota Sienna

NHTSA No.: C46104



DATA SHEET 9
VEHICLE EXTERIOR CRUSH PROFILES - ALL LEVELS (CONTINUED)

Test Vehicle: 2004 Toyota Sienna

NHTSA No.: C45104

LOCATION		HEIGHT	DISTANCE FROM IMPACT POINT						
			100	200	300	400	500	600	700
LEVEL 1 SIDE SILL	302	PRE					42	63	58
		POST					44	81	108
		CRUSH					2	18	50
LEVEL 2 H-POINT	732	PRE			5	8	7	6	4
		POST			0	7	12	40	70
		CRUSH			-5	-1	5	34	66
LEVEL 3 MID-DOOR	697	PRE			5	7	7	5	5
		POST			-2	7	10	39	68
		CRUSH			-7	0	3	34	63
LEVEL 4 WINDOW SILL	1021	PRE	106	88	78	71	68	63	59
		POST	95	86	76	70	71	80	105
		CRUSH	-11	-2	-2	-1	3	17	46
LEVEL 5 WINDOW TOP	1640	PRE							
		POST							
		CRUSH							

DATA SHEET 9
VEHICLE EXTERIOR CRUSH PROFILES - ALL LEVELS (CONTINUED)

Test Vehicle: 2004 Toyota Sienna NHTSA No.: C45104

LOCATION	HEIGHT		000	005	010	015	020	025	030
LEVEL 1 SIDE SILL	302	PRE	59	59	60	59	59	60	59
		POST	134	169	183	208	229	249	268
		CRUSH	75	100	123	148	170	189	209
LEVEL 2 H-POINT	732	PRE	4	2	1	1	0	-1	-2
		POST	99	131	159	191	222	259	301
		CRUSH	95	129	158	190	222	260	303
LEVEL 3 MID-DOOR	897	PRE	3	3	2	1	0	0	-2
		POST	98	127	157	188	217	258	298
		CRUSH	93	124	155	187	217	258	300
LEVEL 4 WINDOW SILL	1021	PRE	56	62	48	45	42	39	35
		POST	134	163	195	224	256	289	330
		CRUSH	78	111	147	179	214	250	295
LEVEL 5 WINDOW TOP	1640	PRE							
		POST							
		CRUSH							

DATA SHEET 8
VEHICLE EXTERIOR CRUSH PROFILES - ALL LEVELS (CONTINUED)

Test Vehicle: 2004 Toyota Sienna NHTSA No.: C45104

LOCATION		HEIGHT							
LEVEL 1 SIDE SILL	302	PRE	59	59	60	60	60	63	63
		POST	340	354	351	303	255	213	177
		CRUSH	281	295	291	243	195	150	114
LEVEL 2 H-POINT	732	PRE	-3	-3	-4	-4	1	-4	-3
		POST	357	383	362	321	224	183	153
		CRUSH	360	386	366	325	223	187	166
LEVEL 3 MID-DOOR	697	PRE	-2	-2	-3	-4	2	-3	-3
		POST	352	380	362	319	211	181	151
		CRUSH	354	382	365	323	209	184	154
LEVEL 4 WINDOW SILL	1021	PRE	33	31	41	27	27	40	20
		POST	385	395	383	333	288	231	187
		CRUSH	332	384	342	306	239	191	167
LEVEL 5 WINDOW TOP	1840	PRE	271	258	251	245	240	237	236
		POST	411	439	415	395	378	349	332
		CRUSH	140	181	184	150	136	112	96

DATA SHEET 9
VEHICLE EXTERIOR CRUSH PROFILES - ALL LEVELS (CONTINUED)

Test Vehicle: 2004 Toyota Sienna

NHTSA No.: C45104

LOCATION	HEIGHT								
LEVEL 1 SIDE SILL	302	PRE	85	84	85	80	48		
		POST	145	116	84	49	28		
		CRUSH	80	51	19	-11	-20		
LEVEL 2 H-POINT	732	PRE	-2	-1	0	2	3	2	-4
		POST	123	91	61	28	-2	2	5
		CRUSH	125	92	61	27	-5	0	9
LEVEL 3 MID-DOOR	687	PRE	-1	1	3	4	3	0	
		POST	120	88	58	27	-5	3	
		CRUSH	121	87	55	23	-8	3	
LEVEL 4 WINDOW SILL	1021	PRE	20	20	21	21	25	27	32
		POST	157	127	97	68	39	12	32
		CRUSH	137	107	78	47	14	-15	0
LEVEL 5 WINDOW TOP	1640	PRE	237	240	240	242	244	248	258
		POST	316	300	285	275	268	254	257
		CRUSH	79	60	45	33	24	6	-1

VEHICLE EXTERIOR CRUSH PROFILES - ALL LEVELS (CONTINUED)

Test Vehicle: 2004 Toyota Sienna NHTSA No.: C45104

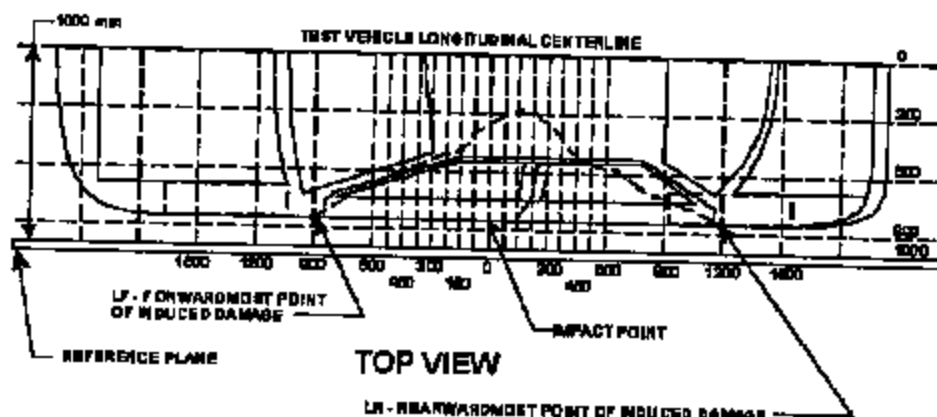
LOCATION	HEIGHT		
LEVEL 1 SIDE SILL	302	PRE	
		POST	
		CRUSH	
LEVEL 2 H-POINT	732	PRE	
		POST	
		CRUSH	
LEVEL 3 MID-DOOR	897	PRE	
		POST	
		CRUSH	
LEVEL 4 WINDOW SILL	1021	PRE	36
		POST	35
		CRUSH	-3
LEVEL 6 WINDOW TOP	1640	PRE	263
		POST	281
		CRUSH	-2

REMARKS:

None

**DATA SHEET 10
VEHICLE DAMAGE PROFILE DISTANCES**

Test Vehicle: 2004 Toyota Sienna NHTSA No.: C45104



MEASUREMENT CONVENTIONS:
Forward of the impact point (towards front of vehicle) is considered positive (+).
Rearward of the impact point (towards rear of vehicle) is considered negative (-).

NOTE: All measurements are in millimeters (mm) and should be accurate to ± 3 mm.

DPD MEASUREMENTS	POSTTEST (mm)	PRETEST (mm)	STATIC CRUSH (mm)
1 (LR = <u>-1426</u> mm)	3	0	3
2 <u>-875</u>	58	3	55
3 <u>-375</u>	181	-3	184
4 <u>75</u>	352	-2	354
5 <u>525</u>	127	3	124
6 (LF = <u>1050</u> mm)	-2	8	-7

REMARKS:

Data from measured locations on Level 3 that best approximated an even distribution along the vehicle length.

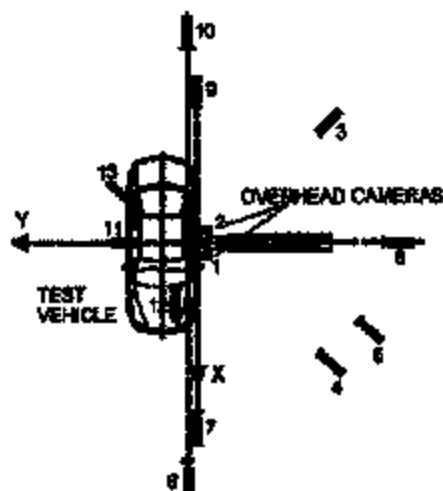
RECORDED BY: *[Signature]*

DATE: May 21, 2004

APPROVED BY: *[Signature]*

DATA SHEET 11
HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2004 Toyota Sienna NHTSA No.: C45104



REFERENCE (from Point of Impact): + X = Forward, + Y = To Right, + Z = Down from Ground, +θ = Clockwise from +X-axis

* All measurements accurate to ± 6 mm.

CAMERA NO.	VIEW	COORDINATES (mm)			ANGLE (deg)	LENS (mm)	FILM SPEED (fps)
		X*	Y*	Z*			
1	Overhead view of test vehicle	152	0	-8849	N/A	13	1000
2	Overhead close-up view of impact plane	0	0	-8849	N/A	25	1000
3	Left side 45° □ rearward pole view	-3982	-3982	-1372	225	13	1000
4	Left side 45° □ forward pole view	3982	-3982	-1372	315	13	1000
5	Real time (24 fps) film coverage of test	2886	-5182	-1402	289	N/A	24
6	Left side □ rear pole view	0	-7010	-1372	270	13	1000
7	Front ground level □ vehicle/pole impact	7886	0	-1219	0	25	1000
8	Front ground level □ vehicle roof targets and vehicle/pole impact	8169	457	-1372	0	25	1000
9	Rear ground level □ vehicle/pole impact	-7772	0	-1494	180	25	1000
10	Rear ground level	-7894	457	-1585	180	25	1000
11	Test vehicle onboard driver □ side view	N/A	N/A	N/A	N/A	7.5	1000
12	Test vehicle onboard driver □ front view	N/A	N/A	N/A	N/A	7.5	1000
13	Test vehicle o/b driver □ 3/4 rear view	N/A	N/A	N/A	N/A	7.5	1000

**DATA SHEET 12
DUMMY DAMAGE CHECKLIST - SID/HIII**

Dummy Serial No. 053 Date: 8/08/2004

DATE: 8/8/2004
SID/HIII NUMBER: 053

PART	ITEMS CHECKED	COMMENTS
SKIN	VISUAL INSPECTION	OK
HEAD	VISUAL, BALLAST, ACCELEROMETER MOUNT	OK
NECK	VISUAL, BROKEN OR CRACKS IN RUBBER, UPPER BRACKET FIRMLY ATTACHED TO LOWER BRACKET, LOOSE CONDYLE JOINT, NODDING BLOCKS- CRACKED OR OUT OF POSITION	Broke & Replaced Nodding Joint Assy During Pre-Test Calibration
SPINE BOX	VISUAL, BALLAST, WELDMENT, ACCELEROMETER MOUNT, RUBBER CRACKS	OK
RIB CAGE	VISUAL, MEASURE, STIFFENERS, BUMPERS IN PLACE	OK
STERNUM	VISUAL	OK
LUMBAR SPINE	VISUAL	OK
ABDOMEN	VISUAL	OK
PELVIS	VISUAL, PALPATE, ACCELEROMETER MOUNT	OK
UPPER LEGS	VISUAL	OK
KNEES	VISUAL, STOPS, INSERTS	OK
LOWER LEGS	VISUAL, RANGE OF MOTION	OK
ANKLES	VISUAL, RANGE OF MOTION	OK
FEET	VISUAL, RANGE OF MOTION	OK
JOINTS	1 TO 2 g RANGE	OK
HEAD/NECK	BRACKET ATTACHMENT CRACKED OR BROKEN	OK
OTHER		N/A

TEST DATES: 05/21/04

RECORDED BY: 

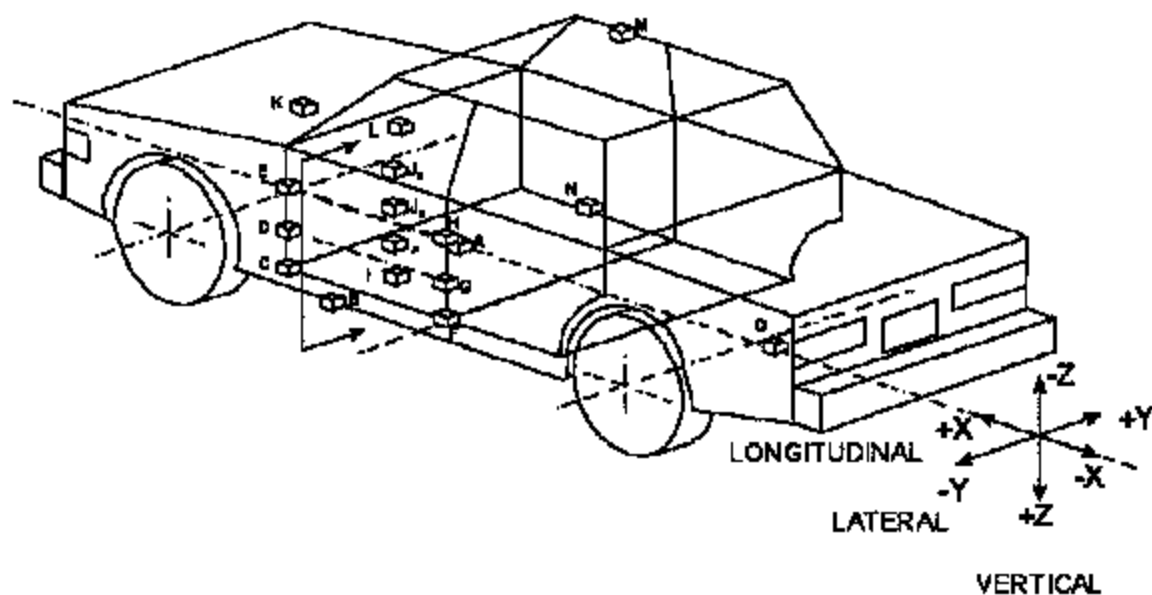
DATE: 08/09/04

APPROVED BY: 

DATE: 08/09/04

DATA SHEET 13
TEST VEHICLE ACCELEROMETER LOCATIONS SUMMARY

Test Vehicle: 2004 Toyota Sienna NHTSA No.: C45104



A	VEHICLE CG	I	DRIVER SEAT
B	LEFT FLOOR SILL	J1, J2, & J3	DRIVER DOOR (LOW, MID, UPPER)
C	A PILLAR SILL	K	ENGINE
D	A PILLAR LOW	L	FIREWALL
E	A PILLAR MID	M	RIGHT ROOF
F	B PILLAR SILL	N	RIGHT FLOOR SILL
G	B PILLAR LOW	O	REAR DECK
H	B PILLAR MID		

DATA SHEET 13
TEST VEHICLE ACCELEROMETER LOCATIONS SUMMARY (CONTINUED)

Test Vehicle: 2004 Toyota Sienna NHTSA No.: C45104

Accelerometers	LOCATION	Coord. mm		
		X	Y	Z
A	VEHICLE CG	1690	3	-474
B	LEFT FLOOR SILL	2048	-807	-323
C	A PILLAR SILL	2522	-924	-354
D	A PILLAR LOW	2553	-913	-814
E	A PILLAR MID	2569	-895	-842
F	B PILLAR SILL	1487	-900	-311
G	B PILLAR LOW	1504	-931	-592
H	B PILLAR MID	1486	-937	-869
I	DRIVER SEAT	1780	-668	-485
J1	DRIVER DOOR LOW	2212	-831	-279
J2	DRIVER DOOR MID	2211	-833	-813
J3	DRIVER DOOR UPPER	2214	-866	-1052
K	ENGINE	3395	2	-792
L	FIREWALL	2825	21	-832
M	RIGHT ROOF	1741	575	-1869
N	RIGHT FLOOR SILL	1731	898	-328
O	REAR DECK	-835	-30	-465

Note: Positive X-direction measurements forward of rear axle centerline, positive Y-direction measurements right of vehicle longitudinal centerline, positive Z-direction measurements down from ground

REMARKS:

None

**DATA SHEET 14
FUEL SYSTEM INTEGRITY SUMMARY**

Test Vehicle: 2004 Toyota Sienna NHTSA No.: C45104

Amount of spillage from time of impact to static rollover test commencement = 0

TIME AND LEAKAGE LOG		
Cumulative Time	Description	Standard Spillage [mL]
0m, 0s	Begin driver side down rotation to 0 degrees	0
1m, 10s	End roll to 0 degrees	0
6m, 10s	End of 5-minute interval at 0 degrees; begin rotation to 180 degrees	0
7m, 20s	End roll to 180 degrees	0
12m, 20s	End of 5-minute interval at -180 degrees; begin rotation to -270 degrees	0
13m, 27s	End roll to -270 degrees	0
18m, 27s	End of 5-minute interval at -270 degrees; begin rotation to -360 degrees	0
19m, 39s	End roll to -360 degrees	0
24m, 39s	End of 5-minute interval at -360 degrees	0

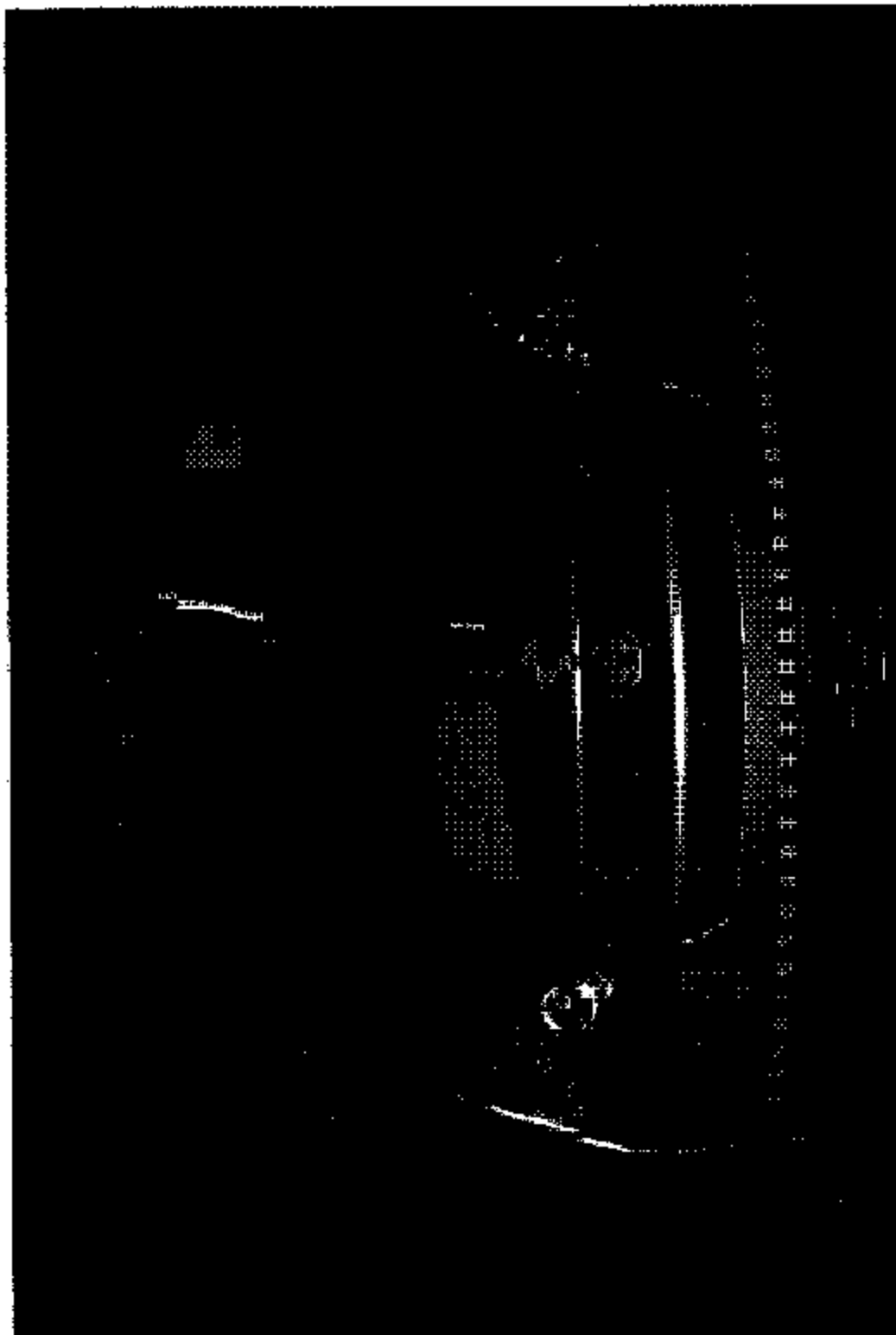
REMARKS:

None

Appendix A – Photographs



Pretest Frontal View of Test Vehicle
A-2



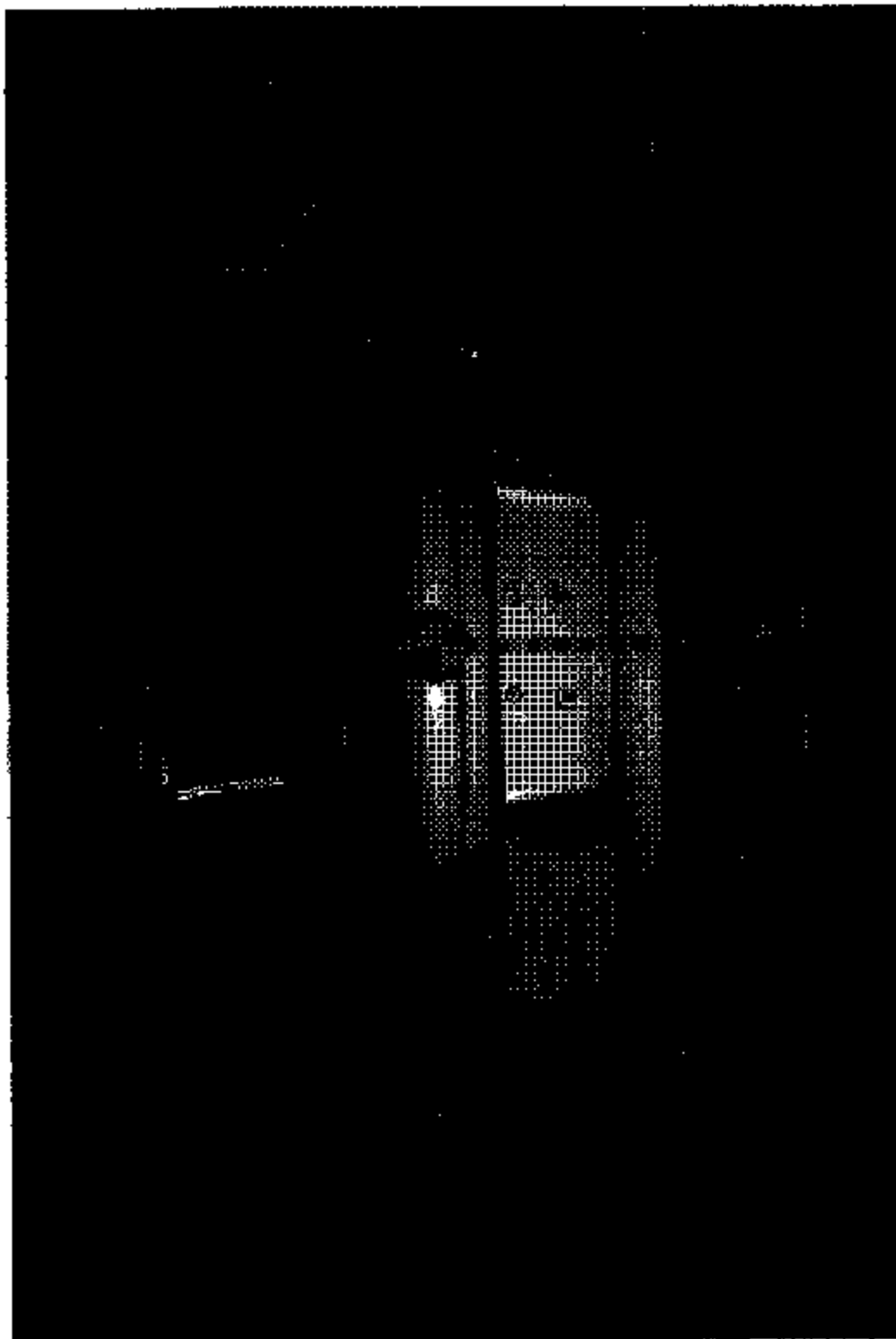
Posttest Frontal View of Test Vehicle

A-3



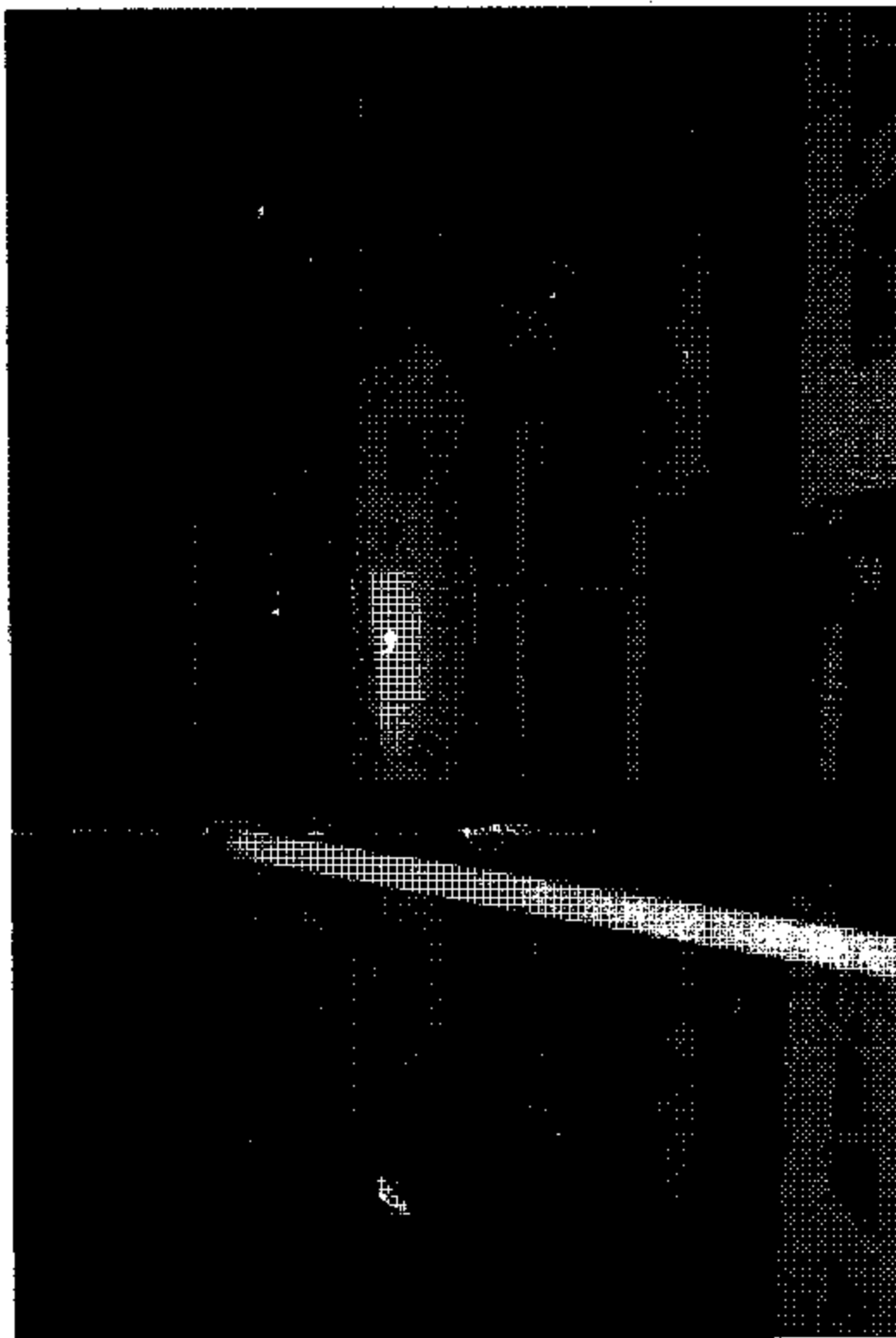
Pretest Rear View of Test Vehicle

A-4

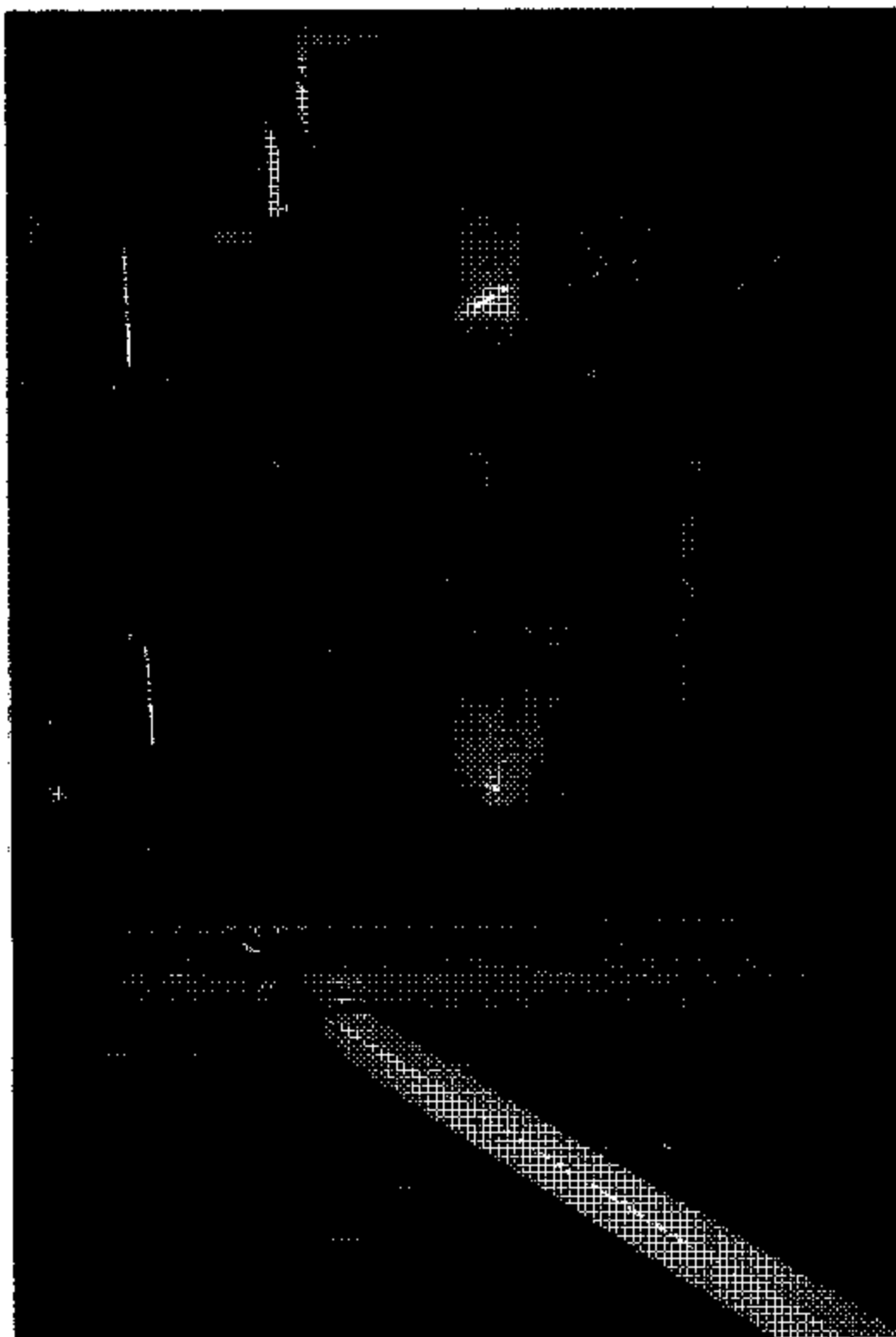


Posttest Rear View of Test Vehicle

A-5



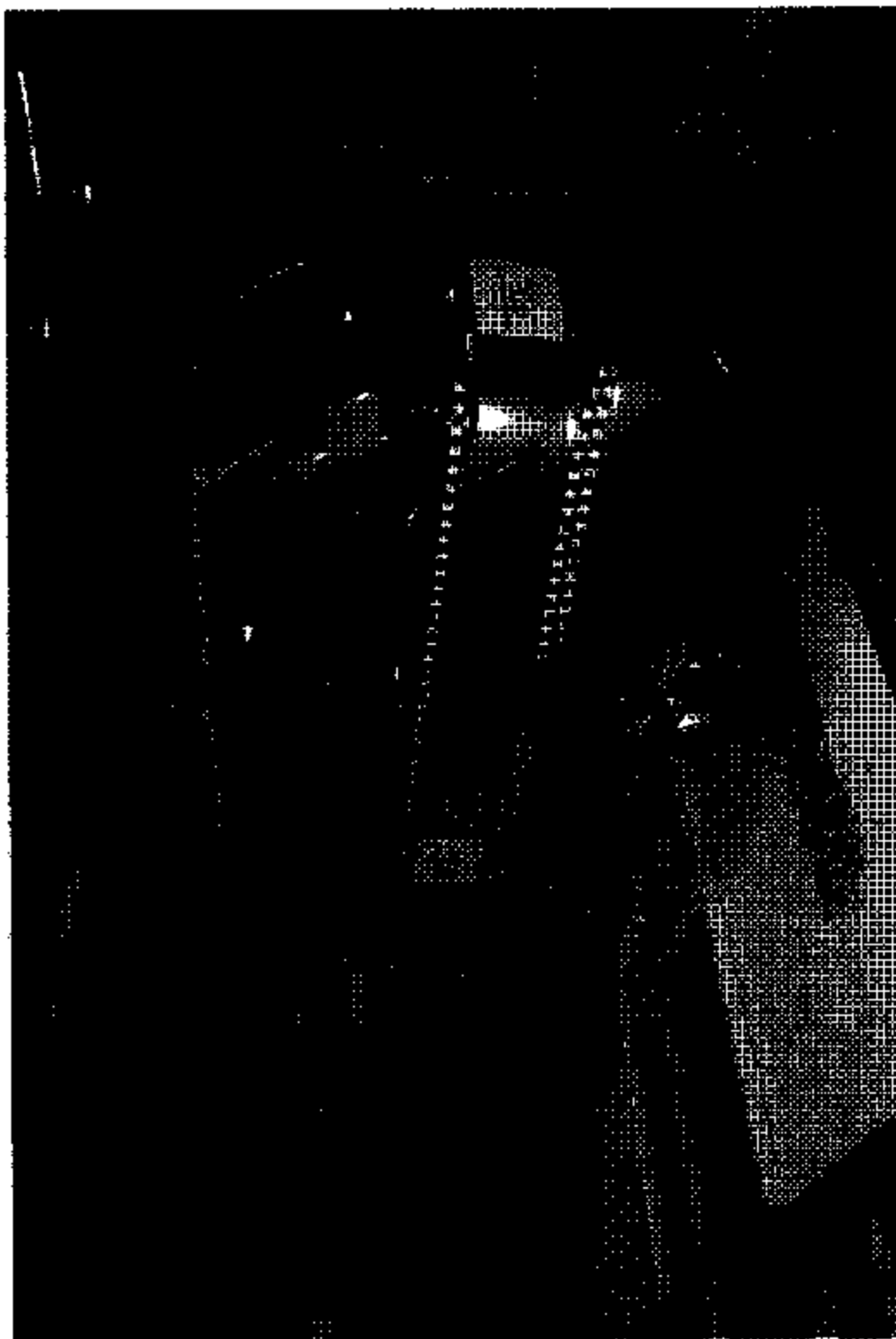
Pretest Impacted Side View of Test Vehicle
A-6



Posttest Impacted Side View of Test Vehicle



Pretest Left $\frac{3}{4}$ Front View of Vehicle and Pole



Pretest Left $\frac{3}{4}$ Rear View of Vehicle and Pole

A-9

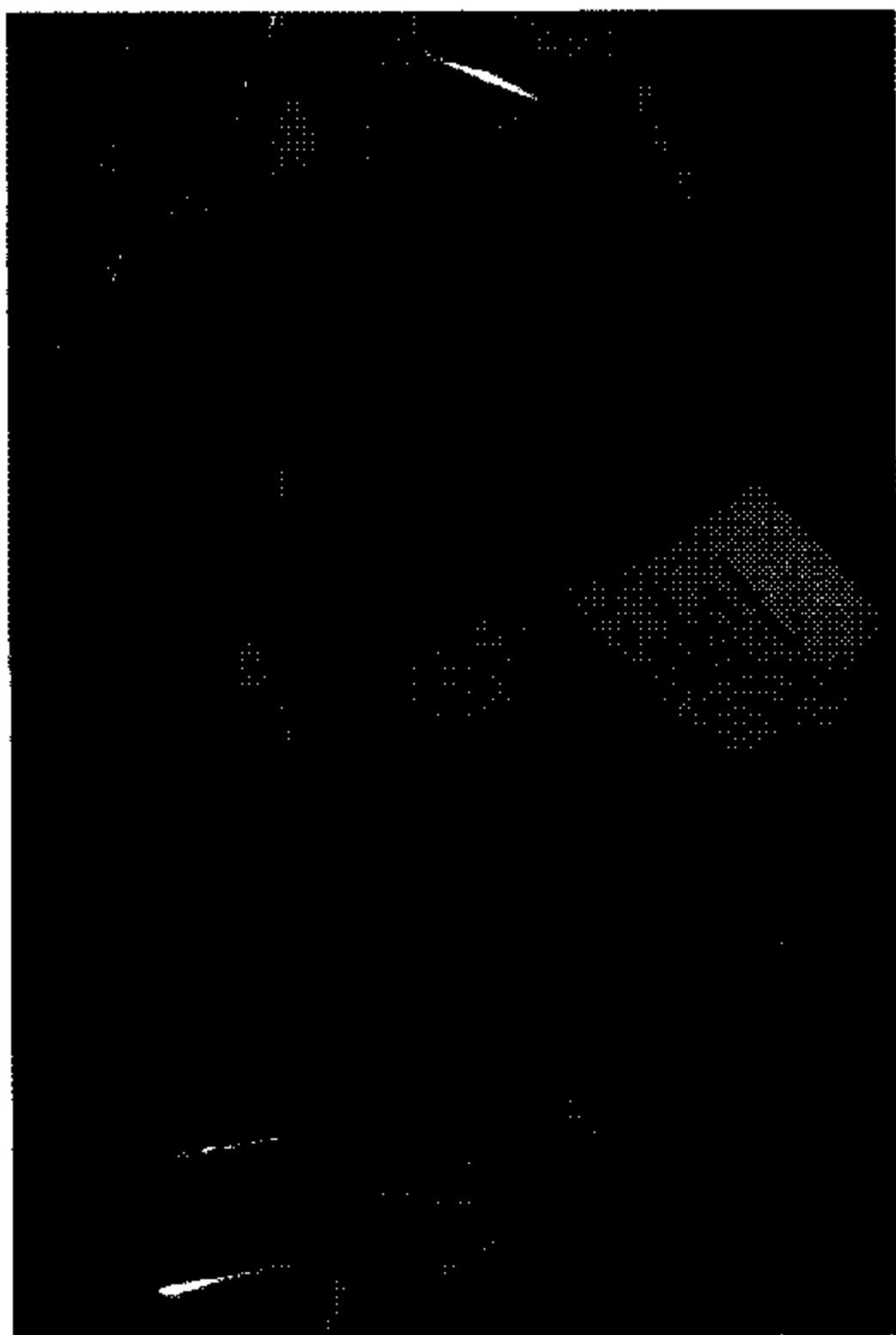


Posttest Overhead View of Impact Location
on Test Vehicle

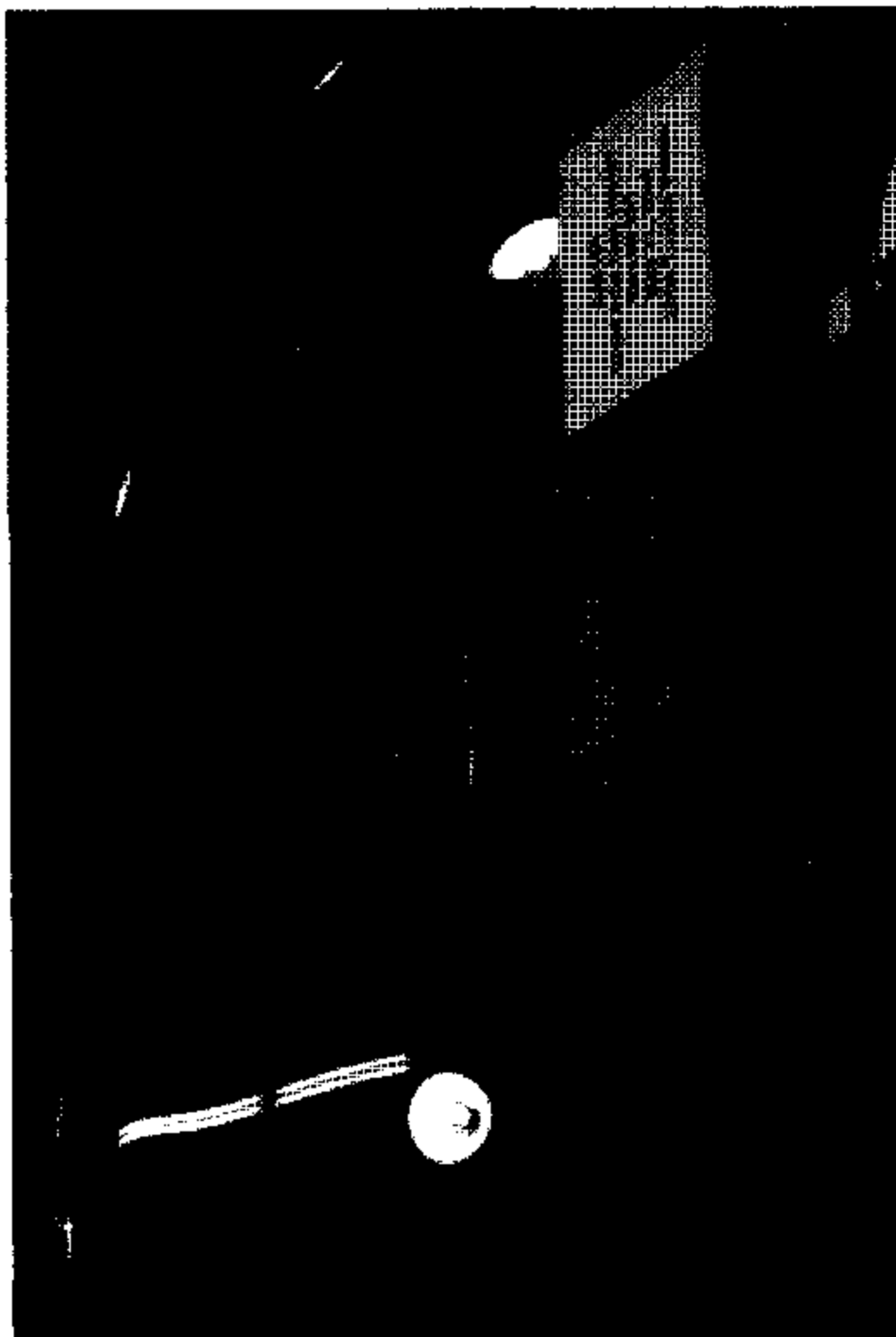


Pretest Dummy Through Opposite Window

A-11



Posttest Dummy Through Opposite Window
A-12



Pretest Dummy Front View Through Windshield
A-13

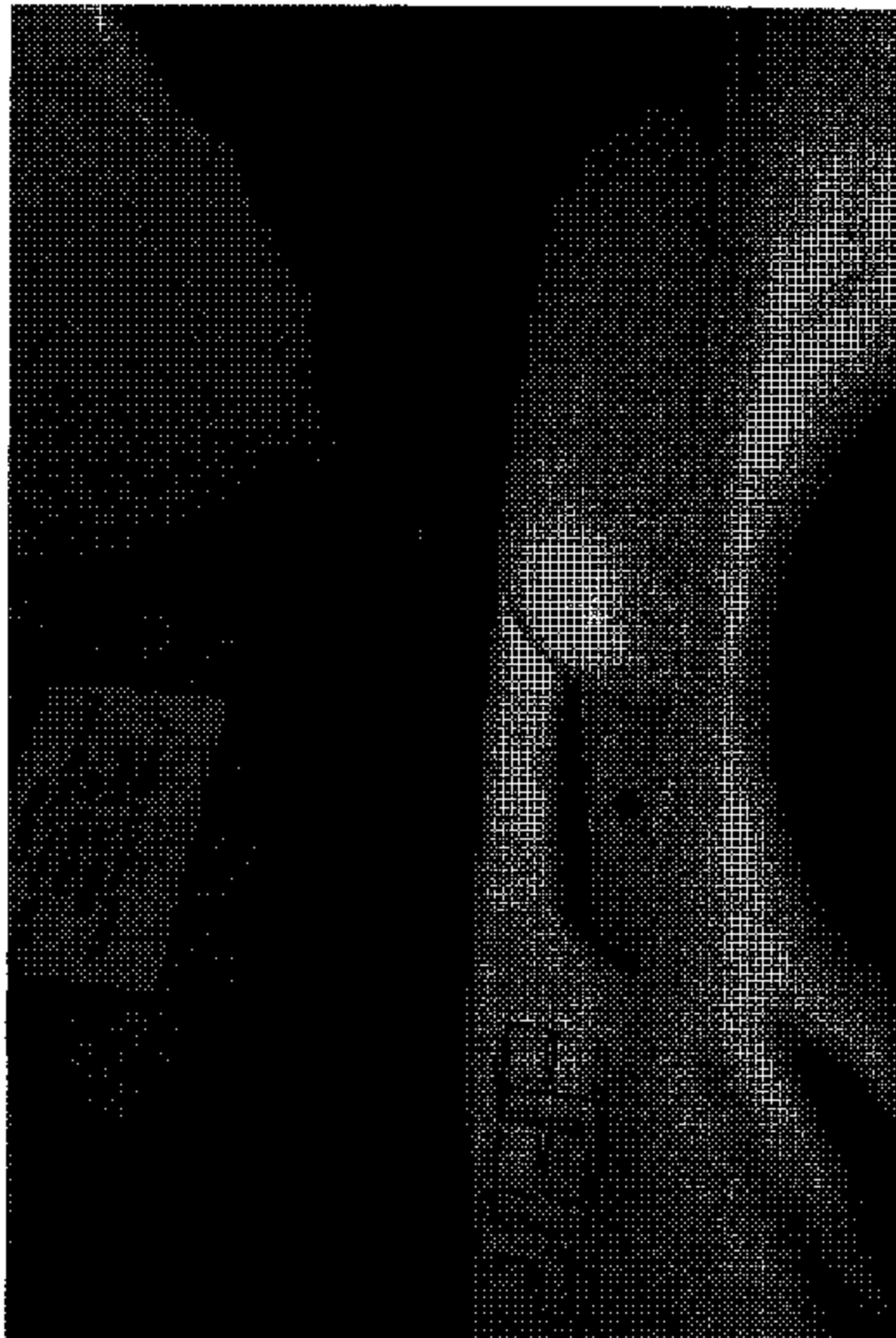


Posttest Dummy Front View Through Windshield



Pretest Dummy Door Open

A-15

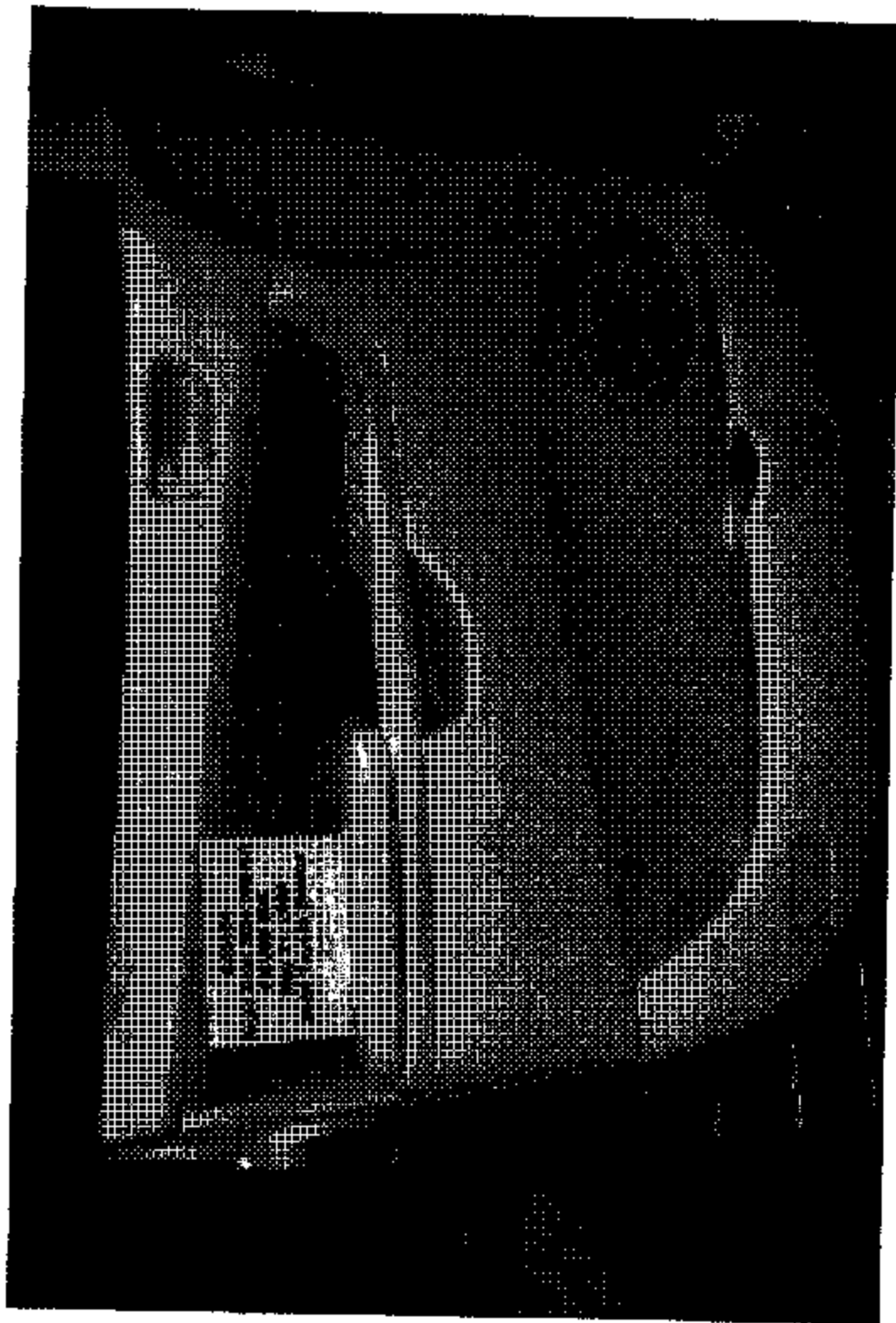


Pretest Dummy Shoulder and Door Top View

A-16

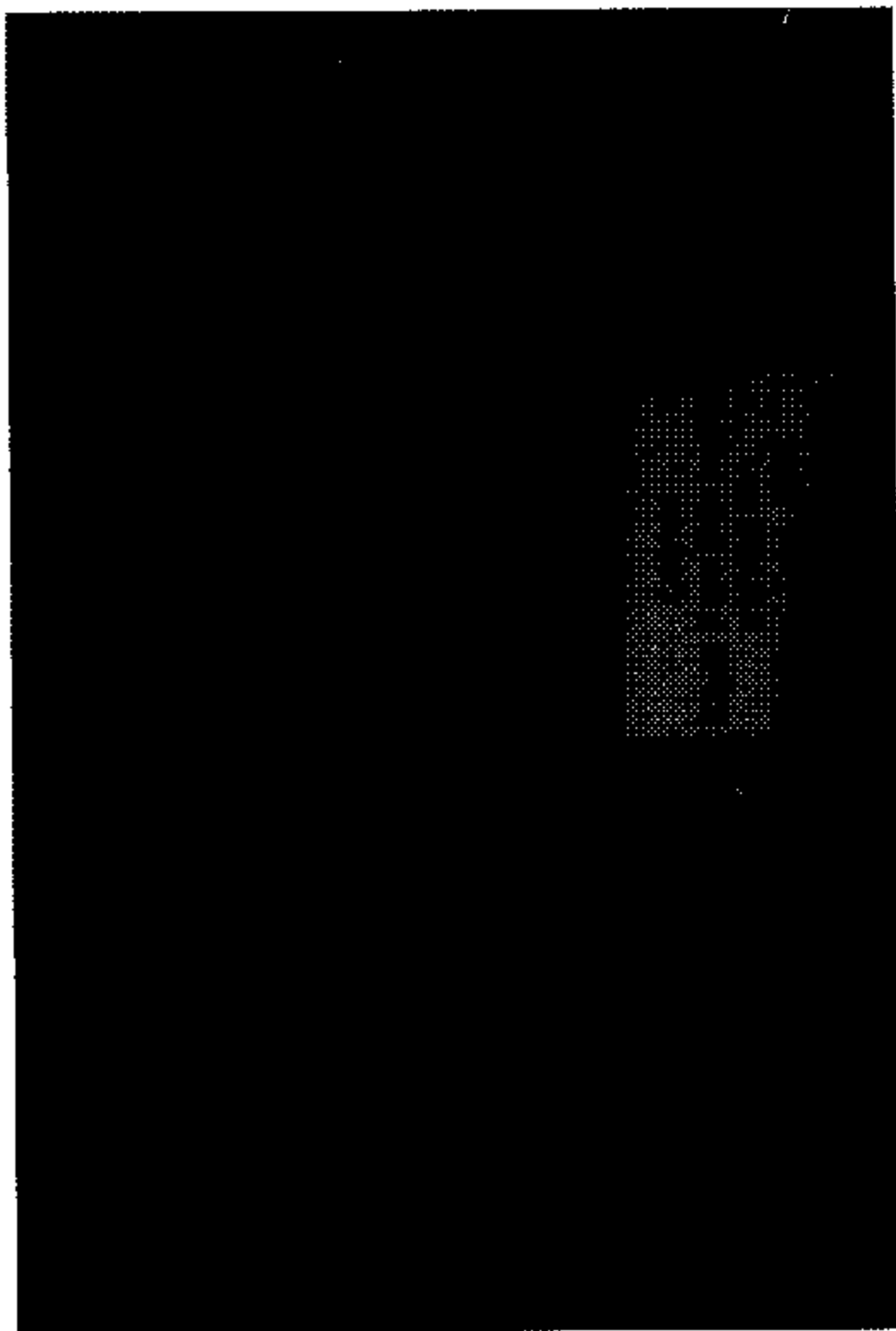


Posttest Dummy Shoulder and Door Top View
A-17



Pretest Interior of Front Door

A-18



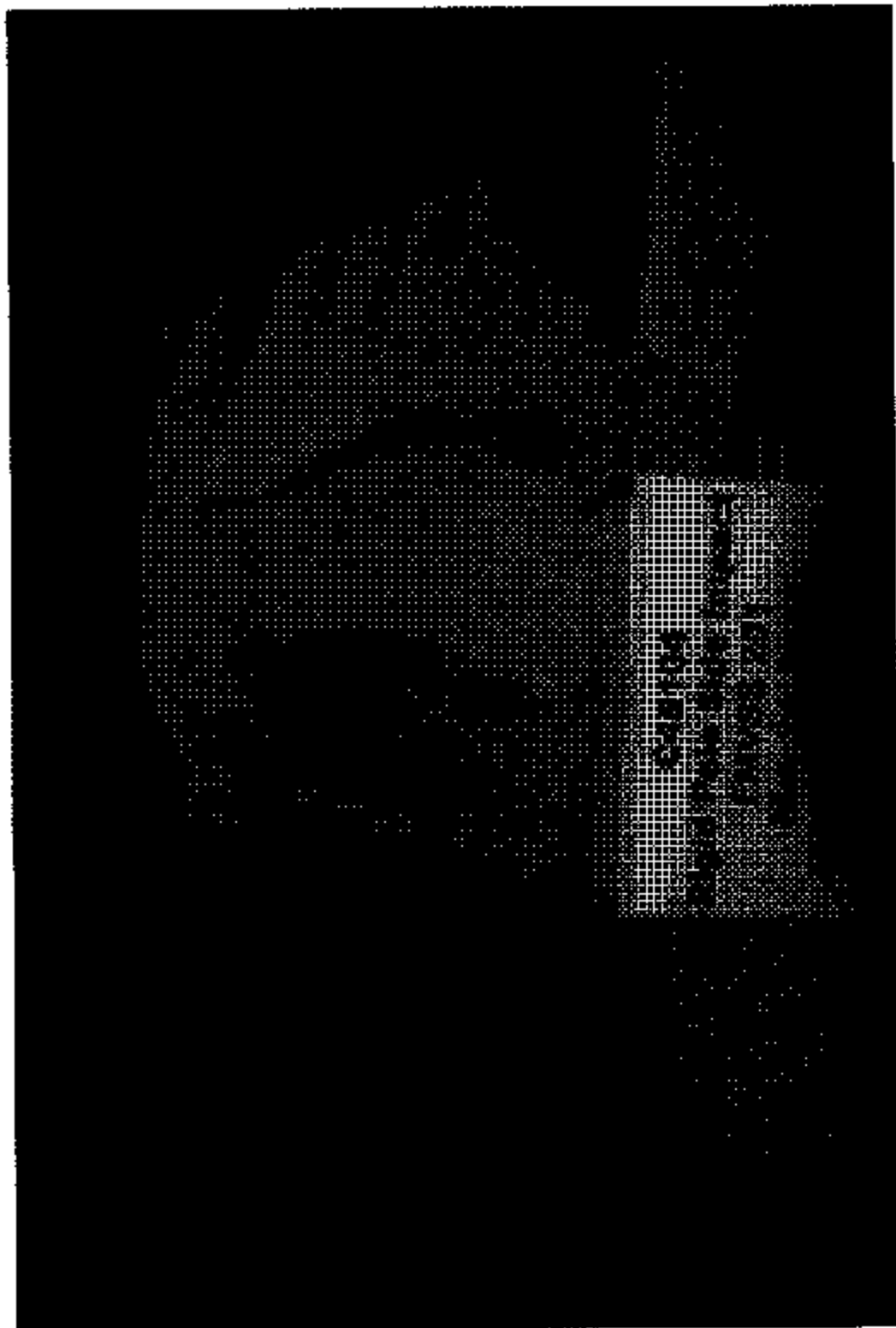
Posttest Interior of SID/HIII Impact Location –
Front View



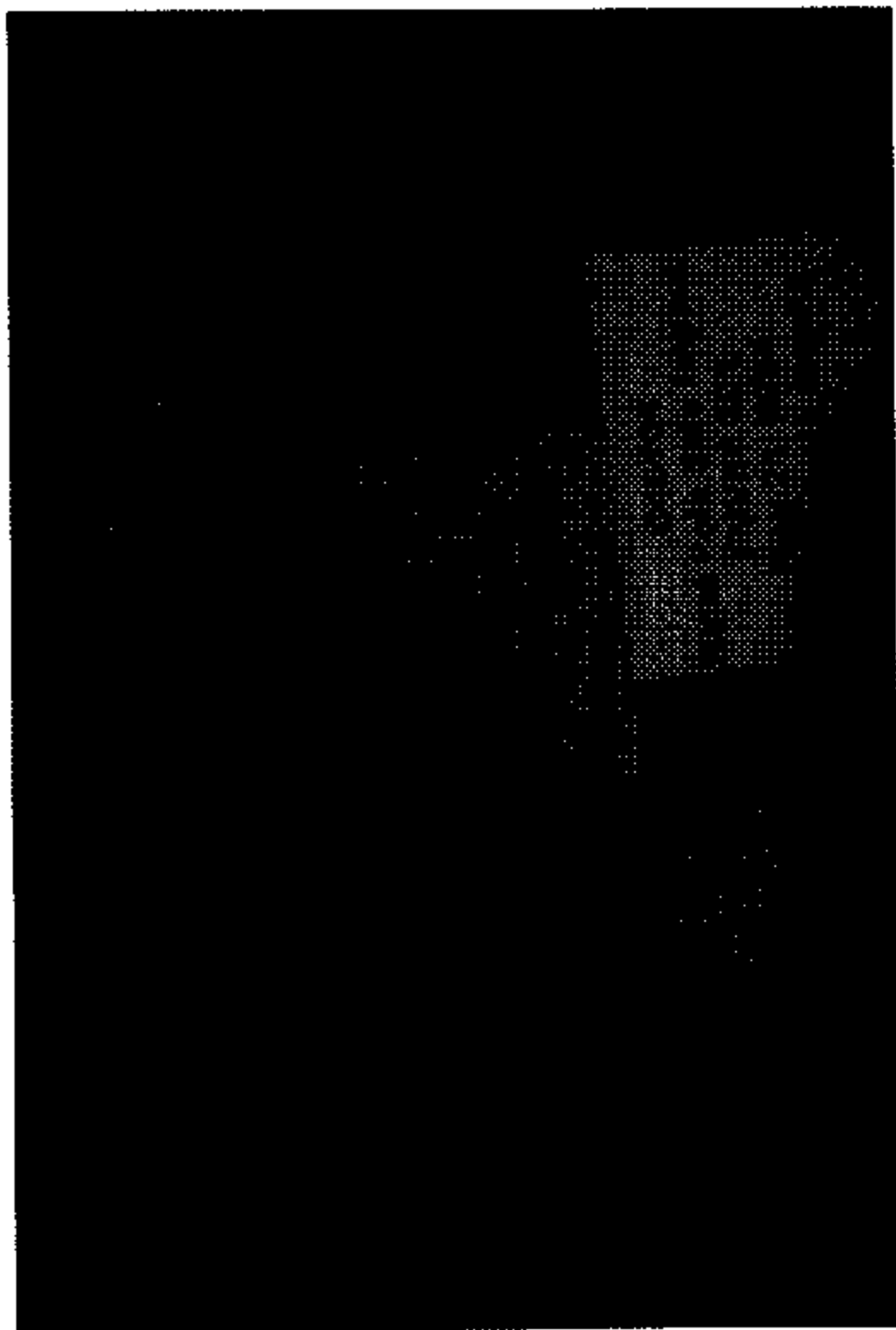
Posttest Interior of SID/HIII Impact Location –
Side View
A-20



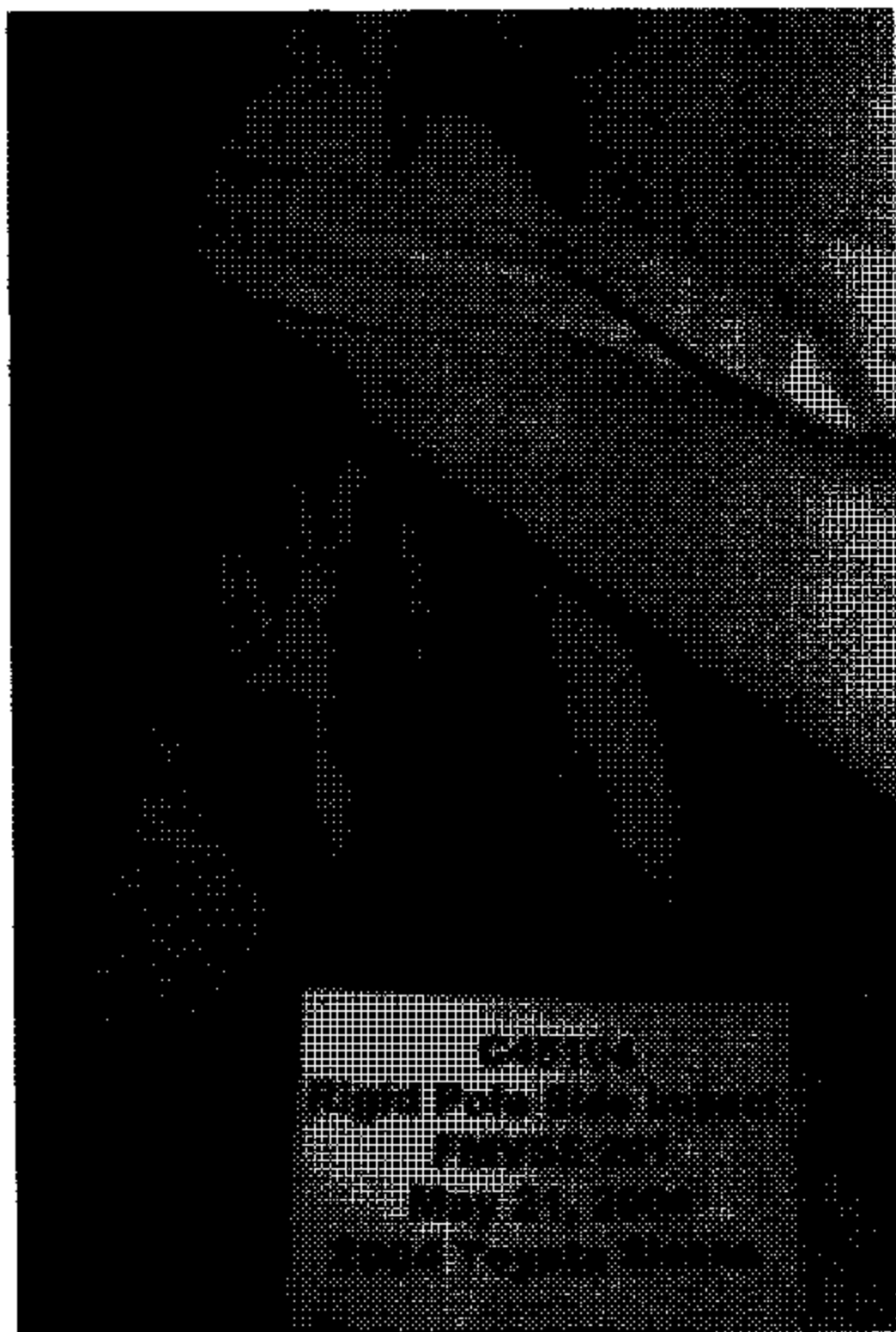
Posttest Interior of SID/HII Impact Location --
Shoulder Contact Point



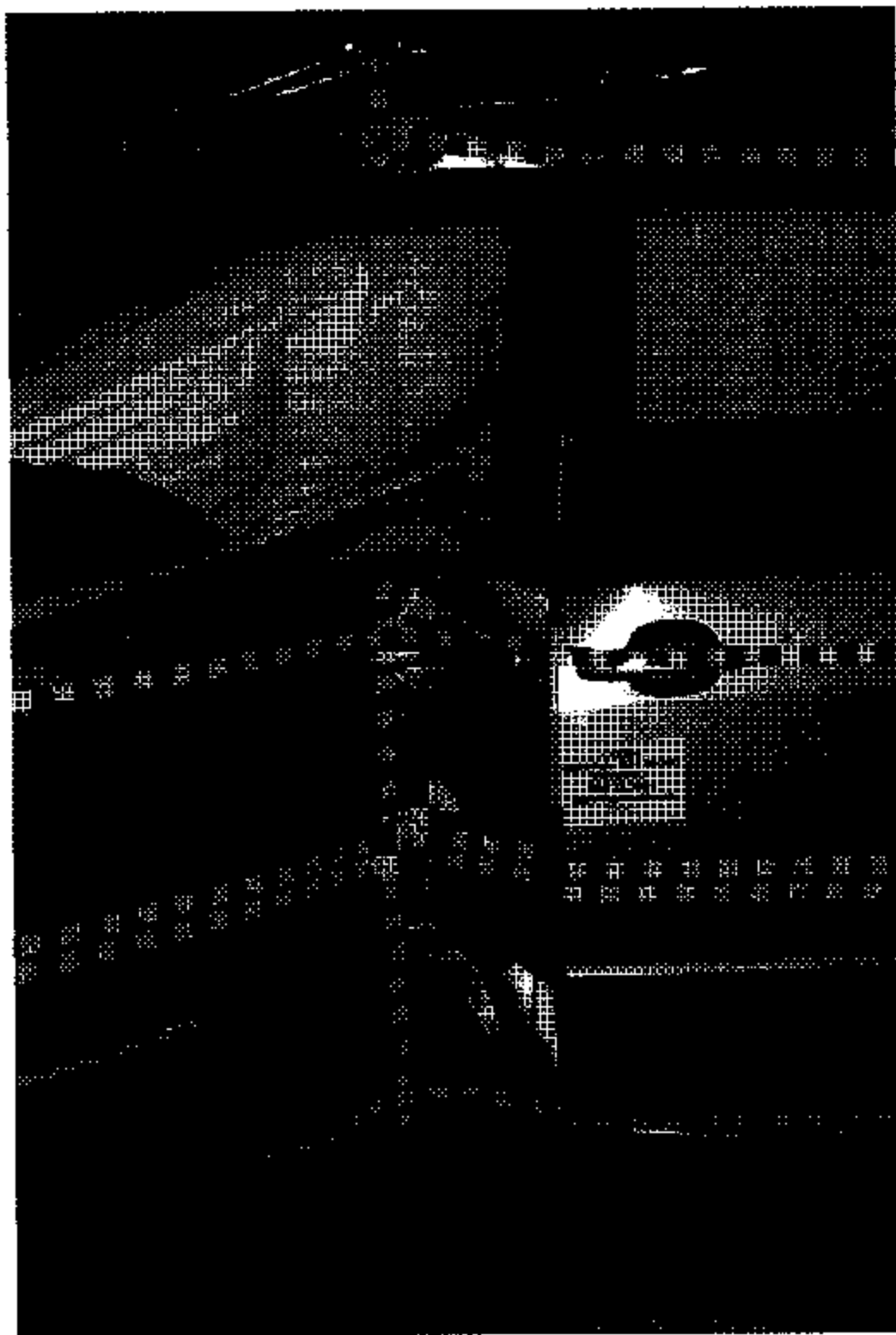
Posttest Interior of SID/HIII Impact Location --
Head Contact Point



Posttest Interior of SID/HIII Impact Location --
Head Contact Point



Posttest Interior of SID/HIII Impact Location –
Shoulder Contact Point

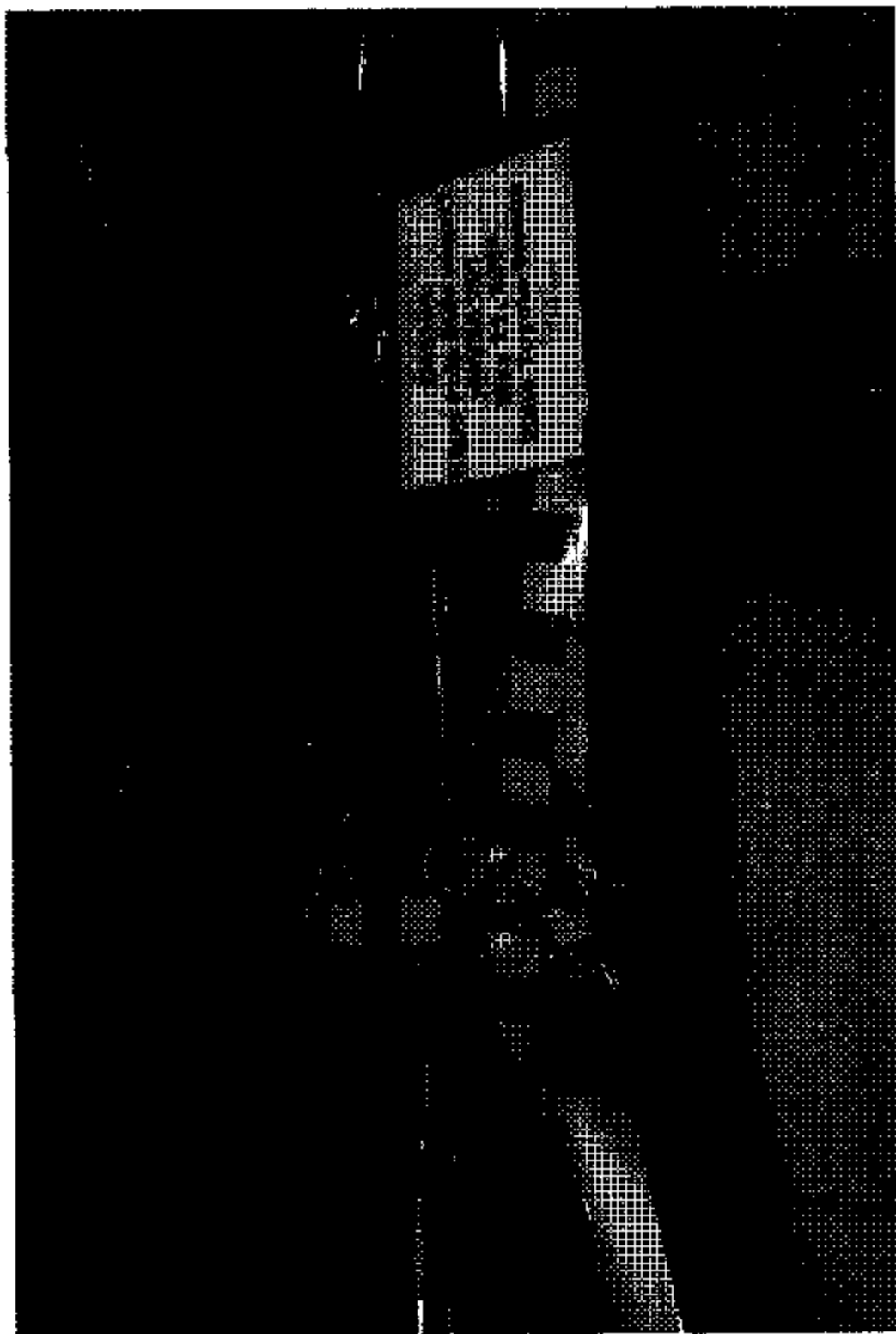


Post Impact Zone
A-25

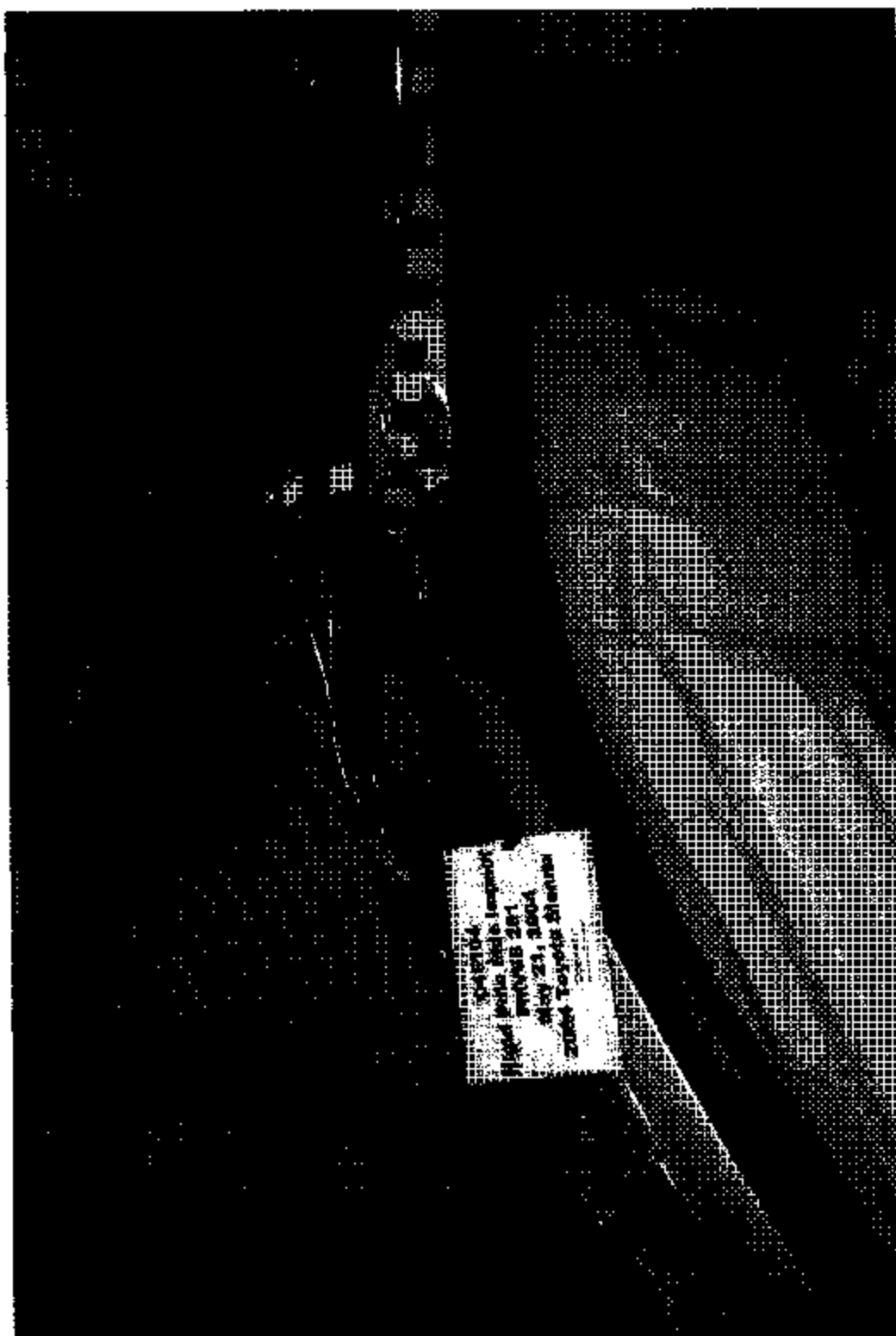


Post Impact Zone - Close-up View

A-26



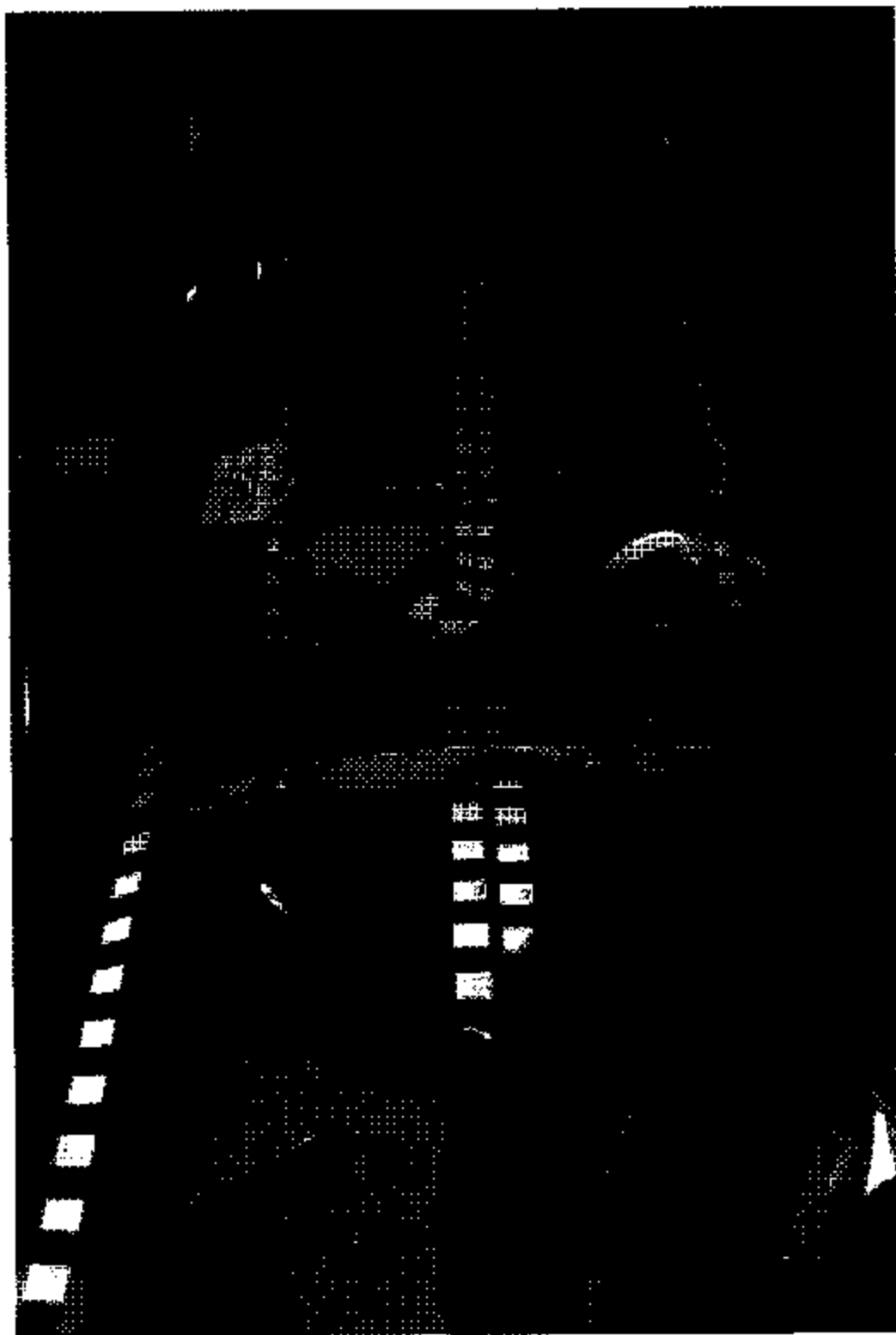
Post Impact Zone – Close-up View of Roof
A-27



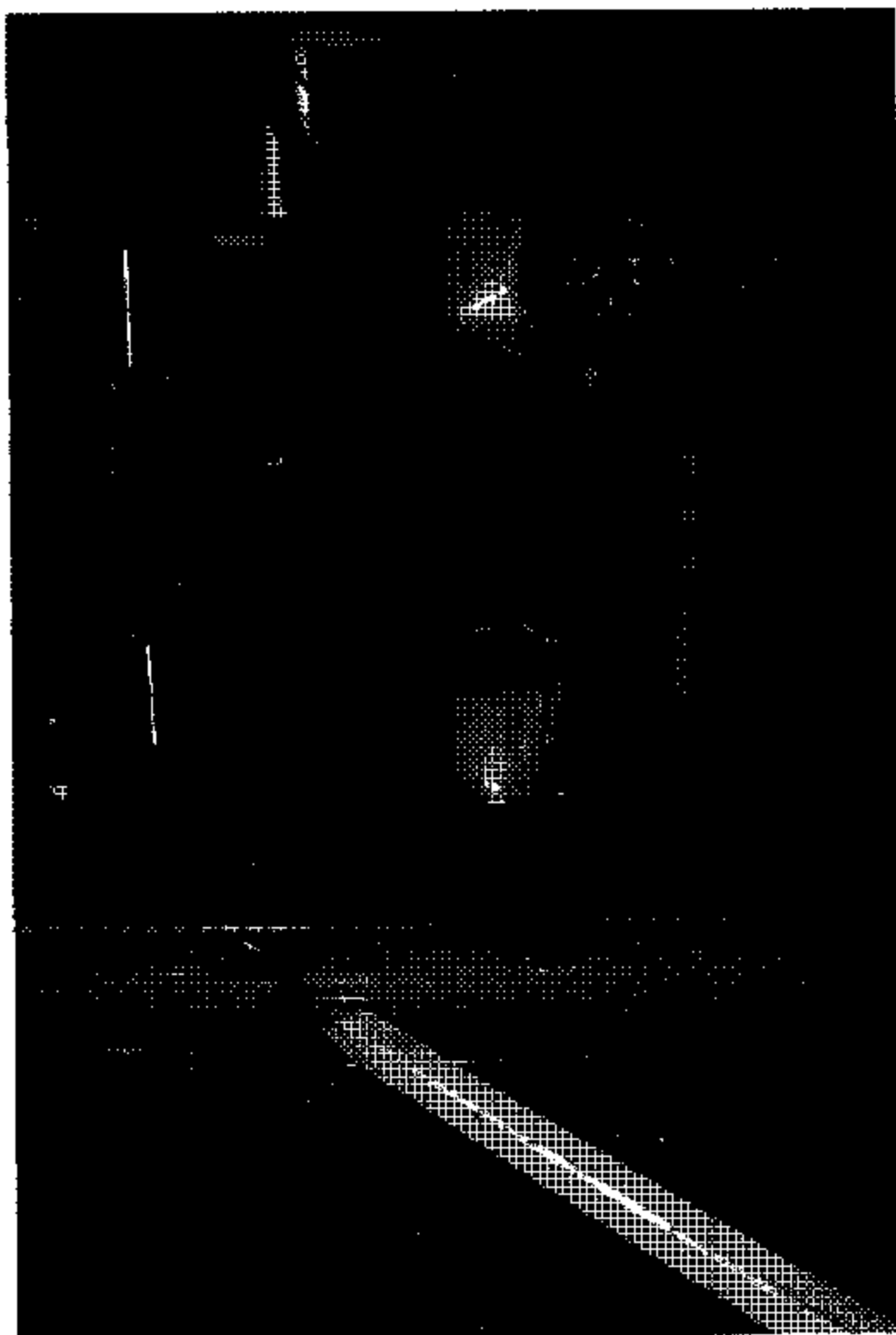
Post Impact Zone – Close-up View of Roof
A-28



Post Impact Zone – Close-up View of Sill
A-29



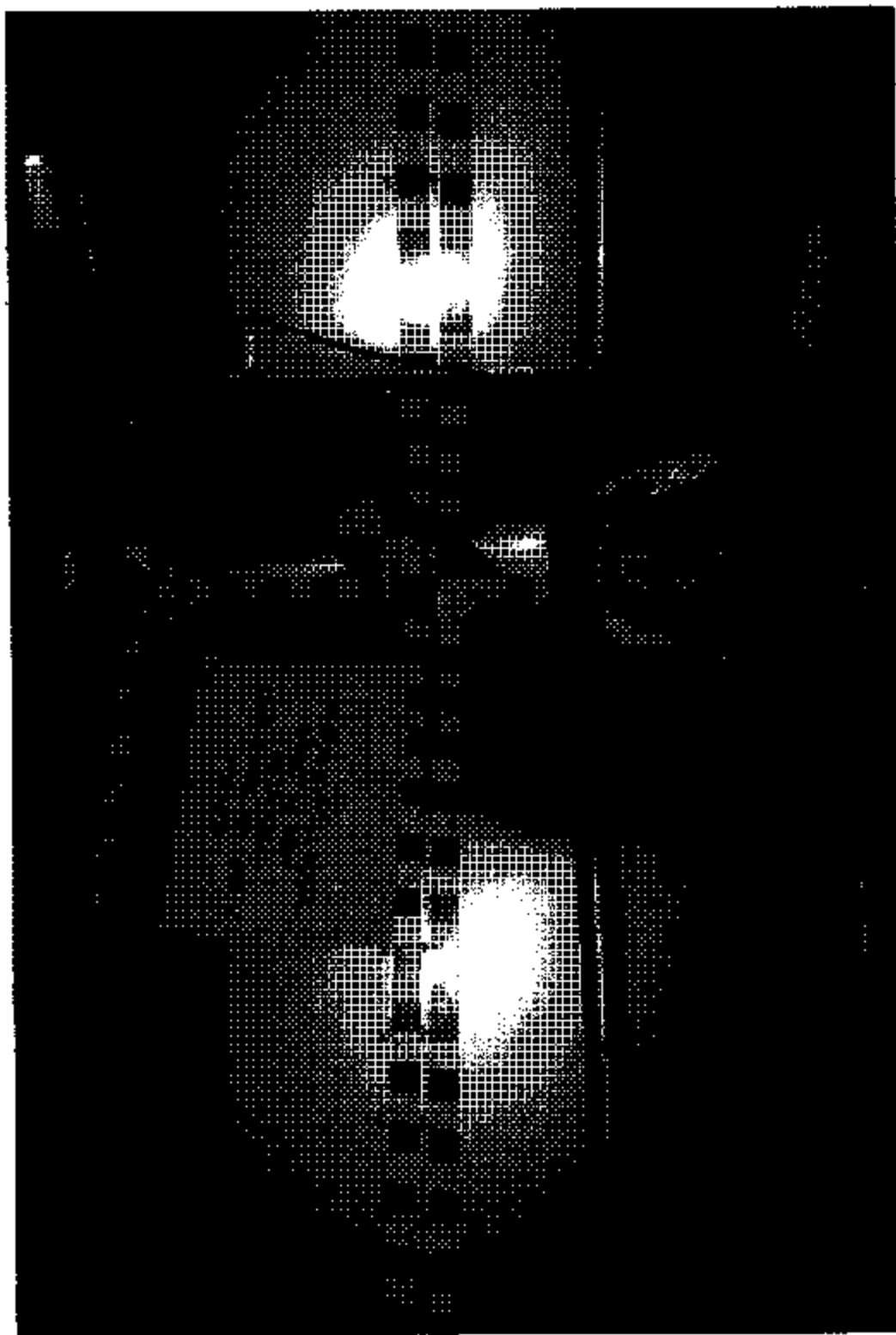
Post Impact Zone - $\frac{3}{4}$ Front View
A-30



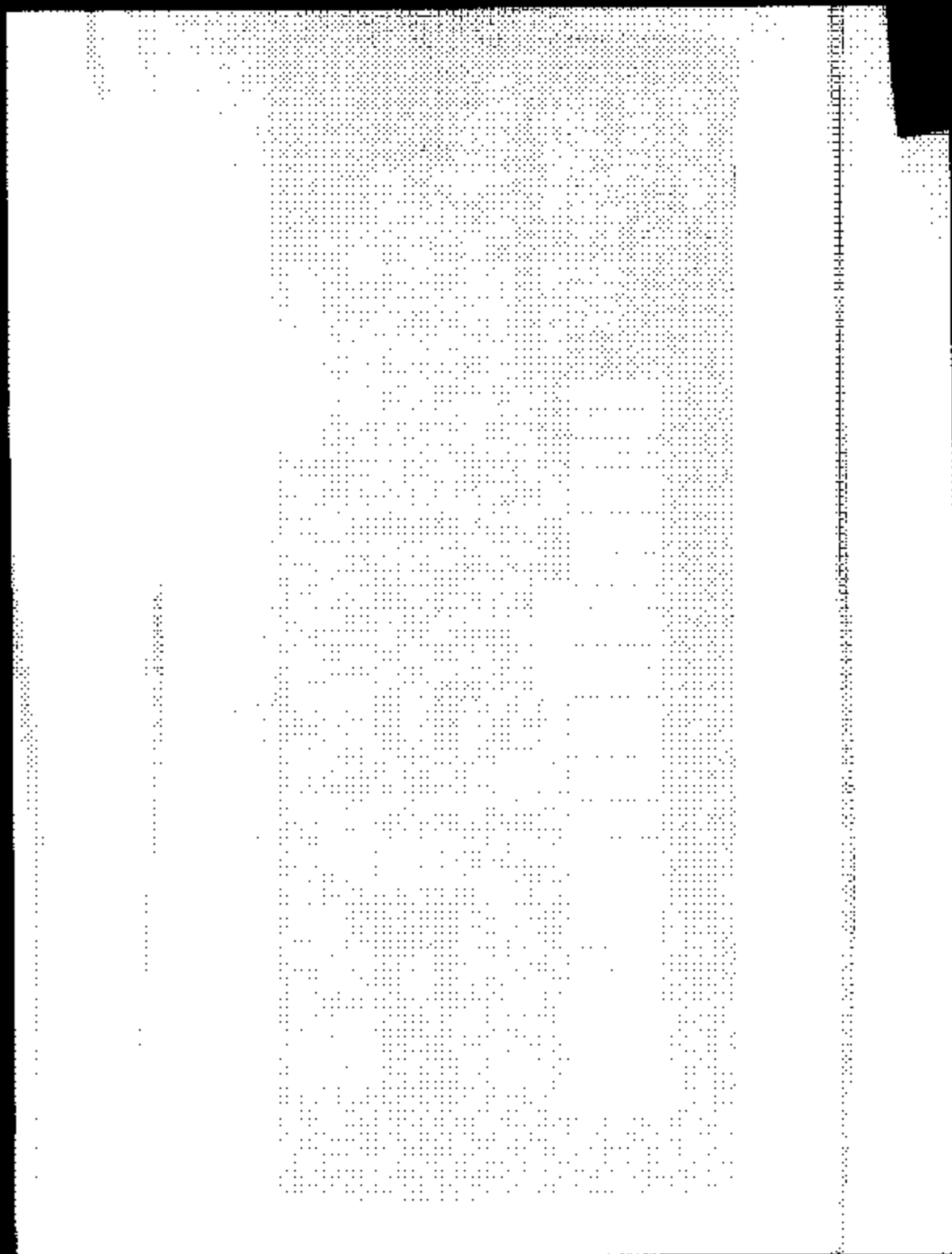
Post Impact Zone - $\frac{3}{4}$ Rear View with Pole
A-31



Post Impact Zone - $\frac{3}{4}$ Rear View
A-32

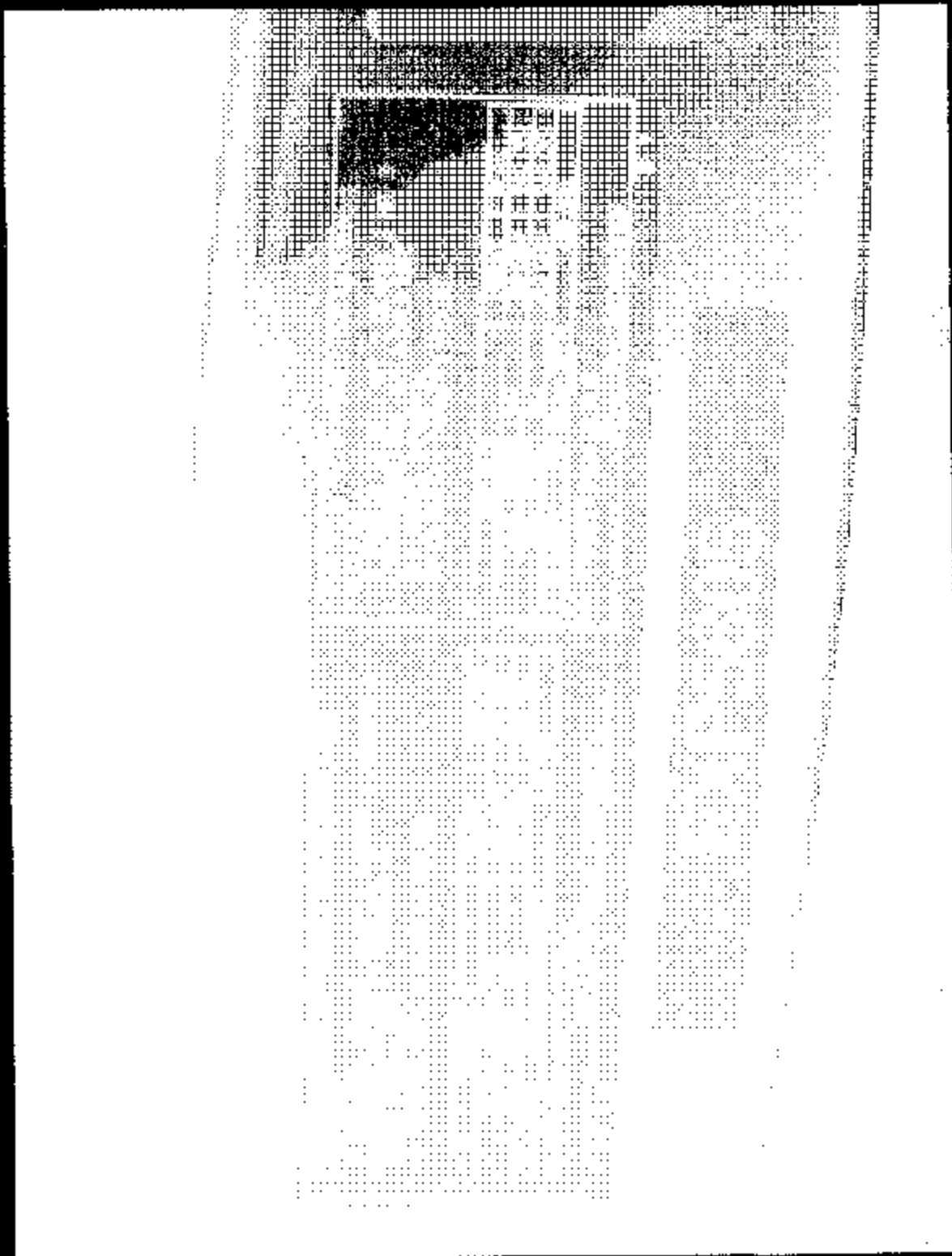


Impact Point Target and Cement Tack



Test Vehicle Certification Label

A-34



Test Vehicle Tire Placard Label
A-35