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AUG 11 1953

Ref. Sym: 1612 (81)

Project No. TM-148

Case No. 549.02

[Redacted]

MR. S. A. MOORE - 1322

Attn: J. C. Peak

Re: Road Test of XW-7 Corporal Warhead

1 st Review Date: <u>7/27/98</u>		Classification (Circle Number):	
Authority: <input type="checkbox"/> ADG <input checked="" type="checkbox"/> SAC <u>W Lape</u>		1. Classification Retained <u>U</u>	
Name: _____		2. Classification Changed to _____	
2 nd Review Date: <u>7/28/98</u>		3. Contains No DOE Classified Information _____	
Authority: _____		4. Coordinate With: _____	
Name: <u>R.B. Crann</u>		5. Contains UCAI? <u>No</u>	
_____		6. Comments: <u>off for Opened</u>	

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Summary of Results

The XW-7 Corporal warhead withstood, without electrical or mechanical damage, 300 miles of trailer transportation over roads varying from unimproved dirt to smooth pavement. The maximum vertical acceleration during the test was 14.1 g peak-to-peak at 350 cps; the maximum longitudinal acceleration was 4.7 g peak-to-peak at 360 cps; and the maximum lateral acceleration was 7.3 g peak-to-peak at 390 cps; all were recorded on the C-section harness. The peak-to-peak acceleration noted in this report are twice the value of acceleration used in specifications for shake table tests; ie, a peak-to-peak of 10 g is equivalent to a $\frac{1}{2}$ g or a generally understood 5 g shake table acceleration.

The warhead trailer gave repeated trouble throughout the test for the following reasons:

1. seizing of the right rear wheel brake
2. shearing of the bolts holding the brake shoe assembly to the axle flange
3. failure of the brake cable in tension
4. bending and failure of the tongue eye
5. twisting of the tongue
6. tearing of the shock mount boots

At the completion of the test the bracket holding the tongue and attaching the tongue to the front axle was cracked on one side because of the twisting of the tongue.

MAR 2 1959
BY ORG. 4722

CDL No. _____
ACCOUNTABILITY _____
FILE No. _____
INVENTORIED 3-
APR 1 1957
BY ORG. 2743

Object of Test

The objects of this test were to investigate the resistance of the XW-7 Corporal warhead to vibrations occurring in 300 miles of road transportation and to take representative vibration readings at various points on the warhead and trailer for each road type encountered.

GENERAL M & R
CONTROL NO. Q 31359

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SEP 14 1965
3428-3

INVENTORIED
AUG 6 1964
3427-1

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW DOWNGRADING OR DECLASSIFICATION STAMP	
CLASSIFICATION CHANGED TO: <u>U</u>	AUTHORITY: <u>R.B. Crann</u>
PERSON CHANGING MARKING & DATE: <u>Emelda Selph 7/30/98</u>	RECORD ID: <u>985N3179</u>
PERSON VERIFYING MARKING & DATE: <u>WC Lape 11/30/98</u>	DATED: <u>7/28/98</u>

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Reason for Test

The test was requested in a Work Order Authorization from S. A. Moore, 1322, to P. H. Adams, 1612, dated April 22, 1953. Mr. J. C. Peak was the consultant.

Summary of Past Tests

The following summary is taken from Interim Report on XW-7/Cp Vibration, from J. W. Pearce, 1611, to S. A. Moore, 1322, dated June 12, 1953, Ref. Sym: 1611 (190), Project No. ET-1078.

This test was conducted on a complete Corporal warhead by suspending the C-section harness, containing the warhead, from four cables connected to an overhead A-frame. The vibration was applied from the Sonntag shake table to the warhead through a jig simulating the actual mounting of the warhead.

The vibration input during this test was either 0.030 inch double amplitude between 10 and 60 cps, or a maximum double amplitude that would not exceed 5 g input at 60 cps. During vibration along the longitudinal axis a resonance existed in the setup above 55 cps, so the input was kept below this frequency. After the 45-minute test along this axis, the SAT indicated the unit nonoperable because of the loosening of the red firing plug and one connector. After these were tightened, the FAT and SAT indicated normal operability.

At 55 cps during vibration along the transverse axis, the cover of the IFI shook off and the inside of the guide tube of the IFI was galled by the movement of the ITD, although the IFI was still operable. The lower right and left bolts holding the dashboard and the rear bearing on one of the IFI lead screws broke. The rivets holding the dashboard to the dashboard bracket were sheared. At the end of this test, the SAT indicated normal operation, but the FAT indicated failure because one contact of the acceleration switch was closed instead of open.

During vibration along the vertical axis the pin in the latching mechanism in the heelplate of the IFI sheared off. After 25 minutes of vibration, 3 of the 12 cartridge hold-down bolts broke, and the test was terminated. After the vibration along this axis the SAT and FAT indicated normal operation due to the reopening of the acceleration switch contacts.

Setup for Test

The Corporal warhead consisted of the following components:

Two MC-1's	Serial Nos. 6199-A2 and 7104-D2
Two MC-84A's	Serial Nos. 6199-A2 and 7181-D2
Two SA-15's	Serial Nos. 170 and 548
MC-10	Serial No. None
MC-43	Serial No. None
MC-44	Serial No. 119
MC-102	Serial No. 352
MC-122	Serial No. 3311

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Setup for Test (Cont.)

MC-158	Serial No.	0030
Two MC-193's	Serial Nos.	A-1298 and 1036-J2
Two MC-291's	Serial Nos.	633 and 550
MC-231	Serial No.	00290-C3
Ballistic skin	Serial No.	None
Corporal warhead trailer, no model nor serial number		

The equipment used to test the warhead and trailer was as follows:

1. FWD 2-1/2 ton truck
2. Consolidated recording oscillograph, Type 5-114-P3, Serial No. 508AM13
3. Eight Consolidated amplifiers, Type 1-11313
4. Gothard rotary converter, Serial No. 18243
5. Twenty-five Edison cells, no serial numbers
6. System assembly tester, prototype, no serial number
7. Final assembly tester, XT-93, no serial number
8. Baro-switch tester, T-1, AH-1216-F2

The accelerometers used during this test and their locations are given in Table I.

Procedure

The Consolidated oscillograph and its associated equipment was surrounded by rosin-bonded hair for shock protection and installed in plywood boxes mounted on the bed of the FWD truck. Twenty-five Edison cells and a Gothard rotary converter, also mounted on the bed of the FWD truck, were used to furnish the instrument power.

The trailer was pulled over a 15.9-mile circuit of various types of road and terrain, as shown in Fig. 1, for a total distance of 300 miles. Sufficient instrument recordings were made to give representative vibration data on each road type. At intervals of 50 miles the unit was subjected to the following operational checks: FAT, SAT, operation of the MC-44, and monitoring of the MC-231 and MC-122.

Results

No electrical nor mechanical damage was sustained by the Corporal warhead as a result of this 300-mile road test. Representative peak-to-peak accelerations and their frequencies are given in Table II for the various road types encountered in the 16-mile circuit which made up the road test route. The column headings used in Table II refer to the road sections between the lettered points given on the map in Fig. 1. The accelerations reported are the maximums which occurred on each type of road and only lasted for a few cycles of the frequency given.

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Although the warhead trailer (Fig. 2) was not originally considered a part of the equipment being tested, it gave such repeated trouble that the resultant damage will be reported. On the first trip the eye of the trailer tongue was bent, and the right rear wheel brake seized, shearing three of the five bolts which hold the brake shoe assembly to the axle flange. The brakes were repaired and loosened, and the test continued. During the second mile of the second circuit the brake cable failed in tension. The cable was repaired and the test continued without incident until the sixth circuit (approximately 90 miles) when the 5 bolts on the right rear brake assembly were sheared, wrapping the brake cable around the axle and causing it to again fail in tension (Figs. 3 and 4). Figure 3 also shows one of the damaged shock absorber boots.

During the sixth circuit the eye of the tongue was fractured as shown in Fig. 5. The tongue eye was replaced with a larger eye which performed satisfactorily for the remainder of the test. The brakes were not repaired after the failure on the sixth circuit, and the test was completed with them in a nonoperable condition.

Figures 6 and 7 show the twisted tongue and the fracture of the bracket which attaches the tie rods and the tongue to the front axle after the completion of the 300-mile test.

Further frequency and magnitude analysis will be made of the vibration records as soon as a suitable input method is devised for analyzing long recordings in the Reeves analog computer.

Conclusions

The XW-7 Corporal warhead will satisfactorily withstand the vibration encountered during 300 miles of trailer transportation.

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The Corporal warhead trailer should be strengthened and modified to remedy the weak points discovered during this test.

R. E. McKay
R. E. McKay - 1612-1

Approved by:

Paul H. Adams
P. H. ADAMS - 1612

REM:1612-1:rv

DISTRIBUTION:

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 2/8A - A. W. Fite, 1324
 3/8A - J. F. Cody, 1320
 4/8A - F. J. Given, 5300
 5/8A - A. F. Cone, 1510
 6/8A - T. B. Morse, 1610
 7/8A - G. M. Byrne, 1925-3
 8/8A - J. M. Ralls, 1521-4, Attn: 1500 Drawing File

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TABLE I
Road Test of KW-7 Corporal Warhead

Location, Range, Serial and Model Numbers of Accelerometers

Serial No.	Location	Model No.	Range (g)	Natural Frequency (cps)
516	Vertical on Baro Shelf at Sta. No. 27.5	A5A-50-240	±50	660
658	Vertical on IFI at Sta. No. 31.5	A5A-50-300	±50	500
636	Longitudinal on C-section harness at Sta. No. 70.5	A5A-50-300	±50	500
643	Vertical " " " " " "	A5A-50-300	±50	500
637	Lateral " " " " " "	A5A-50-300	±50	500
518	Longitudinal on main channel of trailer	A5A-50-240	±50	680
276	Vertical " " " " " "	A5A-50-240	±50	640

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TABLE II

Road Test of XM-7 Corporal War
Peak to-Peak Accelerations and Freq

Location of Accelerometer	Point 1 to A (Washboard road at 20 to 30 mph)					
	Accel. (g)	Freq. (cps)	Accel. (g)	Freq. (cps)	Accel. (g)	Freq. (cps)
Vertical Baro Shelf	6.3	350	3.4	300	1.0	380
Vertical IPI	6.2	70	12.2	300	2.7	80
Vertical Harness	14.1	350	7.8	290	2.0	280
Vertical Trailer	5.2	10	7.1	11	3.1	10
Longitudinal Trailer					0.5	30
Lateral Harness	6.1	260	7.3	390	1.7	250
Longitudinal Harness	4.7	360	3.8	340	0.7	440

	D to G (Stop from 30 mph)				G to H	
	Accel. (g)	Freq. (cps)	Accel. (g)	Freq. (cps)	Accel. (g)	Freq. (cps)
Vertical Baro Shelf	3.4	350	3.3	80	1.5	290
Vertical IPI	4.5	60	8.2	210	3.2	70
Vertical Harness	6.9	270	8.4	310	3.2	80
Vertical Trailer	6.1	10	7.8	10	4.6	10
Longitudinal Trailer			1.1	35	0.5	40
Lateral Harness	6.5	360	2.2	300	2.9	80
Longitudinal Harness	2.8	360	2.8	200	1.4	110

*Note: The peak-to-peak accelerations are double the magnitude of accelerations used in sheet.
The column headings (point 1 to A etc.) refer to points on the map in Fig. 1.
Column D to I is for a cattle guard on paved road at 35 to 45 mph.

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Temporal WarheadTests and Frequencies*

0 to 30 mph)

		A to B		
Freq. (cps)	Accel. (g)	Freq. (cps)	Accel. (g)	Freq. (cps)
380	1.1	250	5.3	350
80	1.6	60	5.7	70
280	1.8	100	6.3	210
10	5.6	11	5.7	10
30	0.8	50		
250	2.3	80	6.5	250
440	0.9	90	2.9	380

I to H

H to O

O to I

I to J

Freq. (cps)	Accel. (g)	Freq. (cps)	Accel. (g)	Freq. (cps)	Accel. (g)	Freq. (cps)
290	4.0	380	1.4	260	3.0	340
70	7.5	200	3.4	290	2.9	50
80	13.9	250	6.5	330	8.4	260
10	6.3	10	4.8	10	7.1	10
40			0.7	30		
80	12.7	220	1.8	330	6.8	230
110	4.4	400	1.4	390	4.3	110

used in shake table tests.

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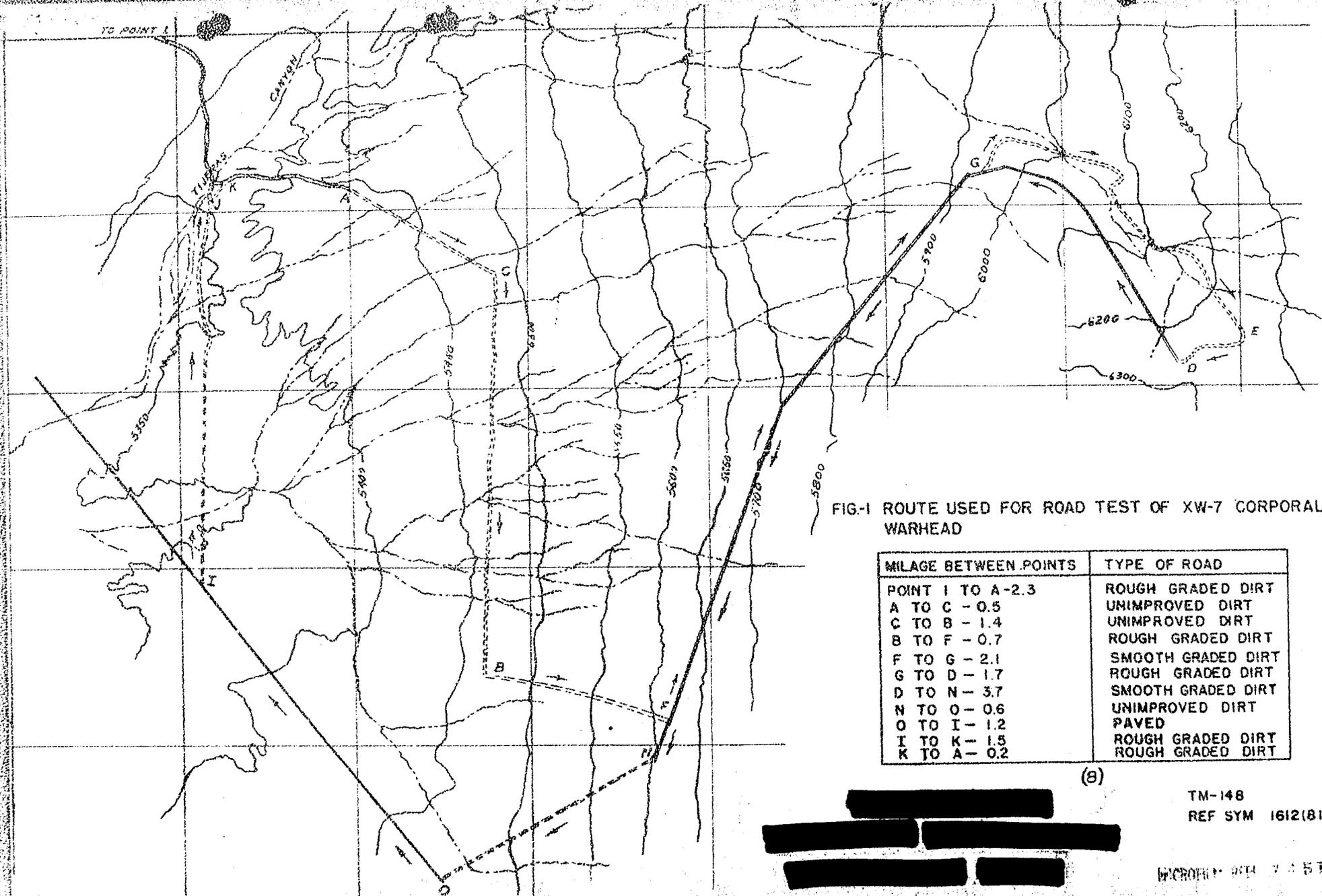


FIG-1 ROUTE USED FOR ROAD TEST OF XW-7 CORPORAL WARHEAD

MILAGE BETWEEN POINTS	TYPE OF ROAD
POINT I TO A - 2.3	ROUGH GRADED DIRT
A TO C - 0.5	UNIMPROVED DIRT
C TO B - 1.4	UNIMPROVED DIRT
B TO F - 0.7	ROUGH GRADED DIRT
F TO G - 2.1	SMOOTH GRADED DIRT
G TO D - 1.7	ROUGH GRADED DIRT
D TO N - 3.7	SMOOTH GRADED DIRT
N TO O - 0.6	UNIMPROVED DIRT
O TO I - 1.2	PAVED
I TO K - 1.5	ROUGH GRADED DIRT
K TO A - 0.2	ROUGH GRADED DIRT

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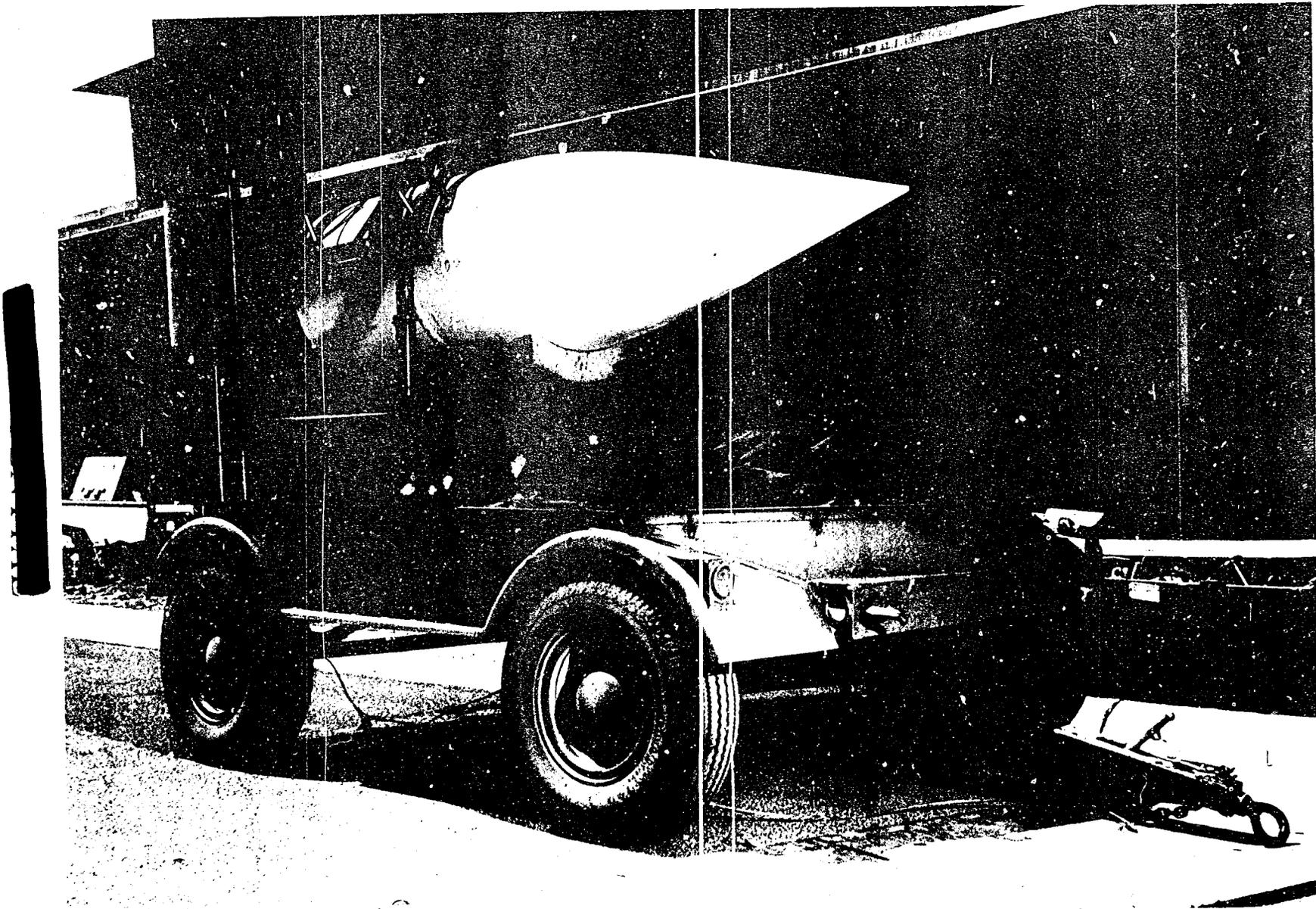


FIG-2 CORPORAL TRAILER WITH WARHEAD INSTALLED, XW-7/CP ROAD TEST

D#40211

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5001X

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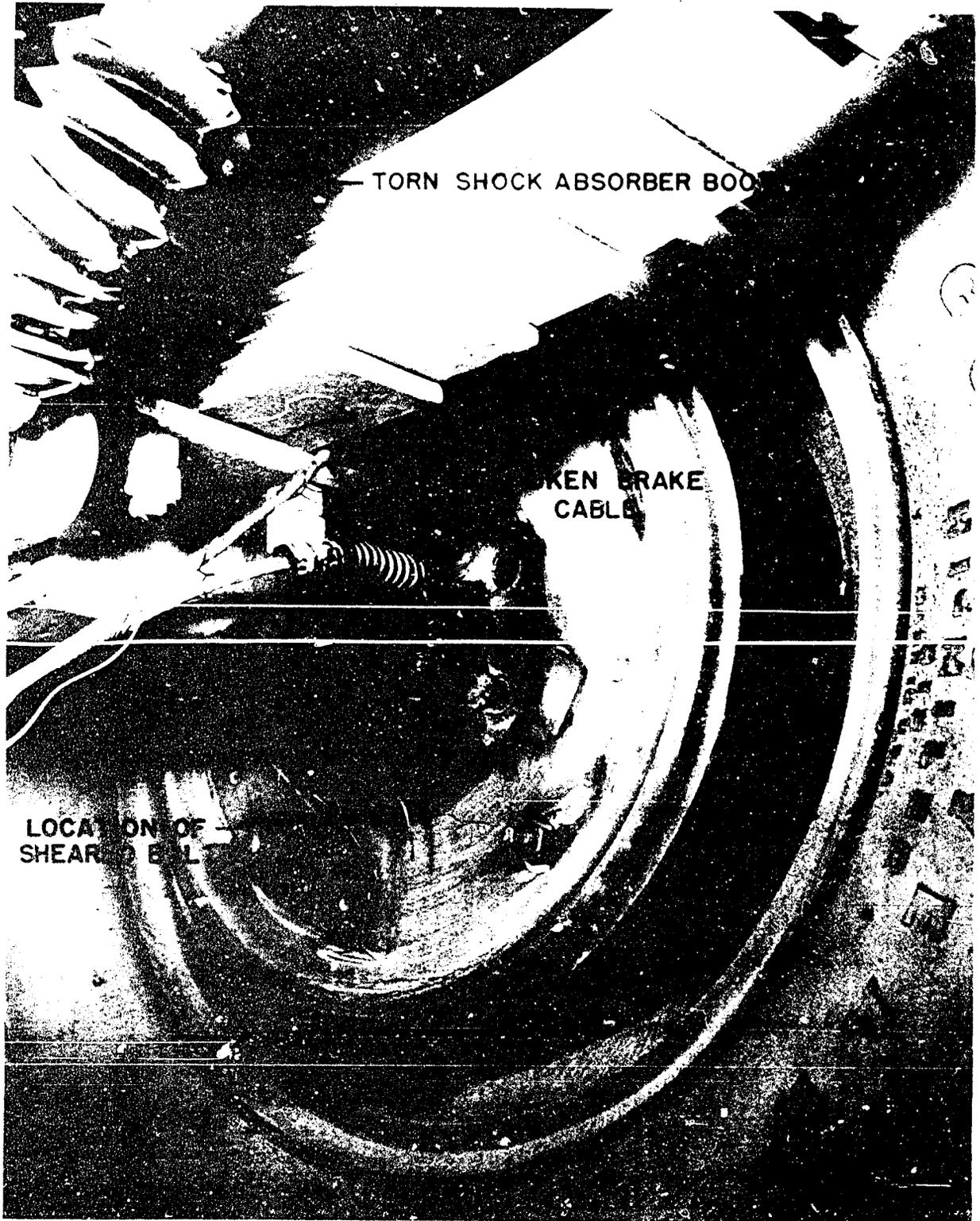


FIG-3 REAR WHEEL OF WARHEAD TRAILER, XW-7/CP ROAD TEST

D# 41691

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REF SYM 1612(81)

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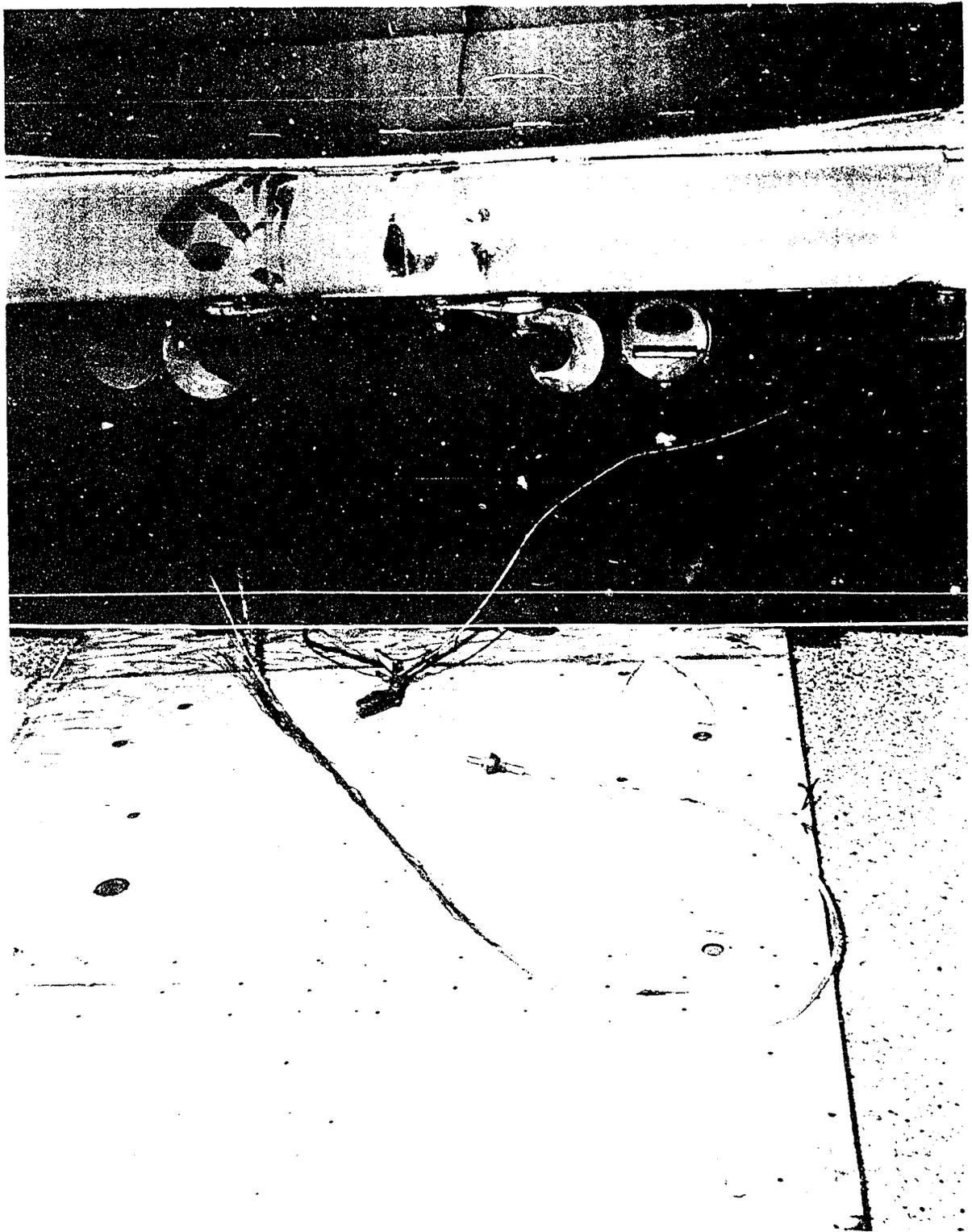


FIG-4 BROKEN BRAKE CABLE, XW-7/CP ROAD TEST

D# 40215

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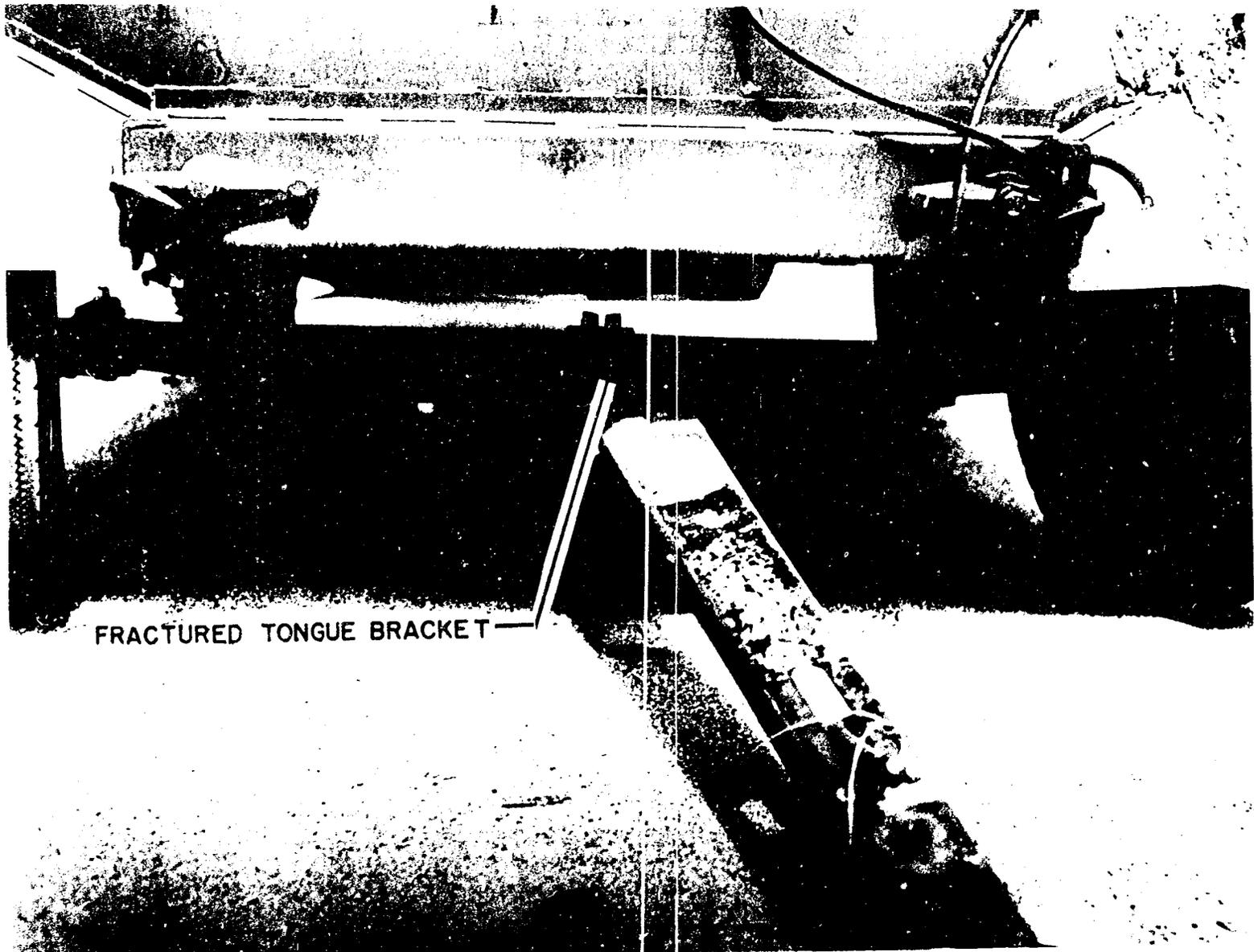
FIG-5 DAMAGED TRAILER TONGUE, XW-7/CP' ROAD TEST

D# 1692

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FRACTURED TONGUE BRACKET

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FIG-6 TWISTED TRAILER TONGUE, XW-7/CP ROAD TEST

D# 41693

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REF SYM 1612(81)

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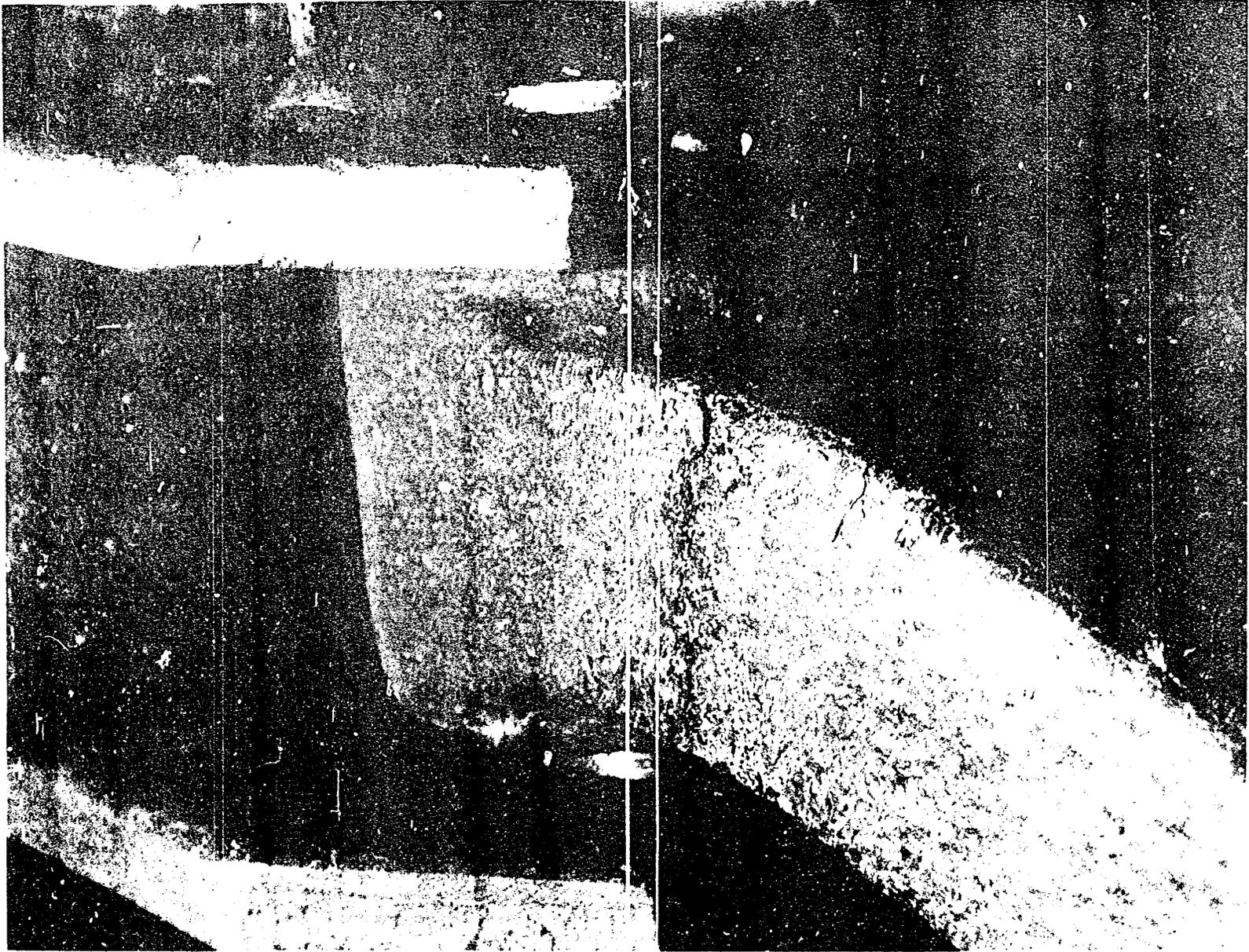


FIG-7 FRACTURED TONGUE BRACKET, XW-7/CP ROAD TEST

D# 40683

TM-148
REF SYM 1612(81)

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