TECHNICAL REPORT NO. 74-25

RIOT CONTROL BARRIER CONCEPT DEVELOPMENT AND FEASIBILITY TEST

TASK NO. 07-M-73

by

Joseph T. Gurganious
Mobility Branch

April 1974

Final Report

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Joseph T. Gurganious
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A riot control barrier is needed to assist law enforcement personnel in holding back crowds during civil disturbances and riots. The USALWL developed the concept of a riot control barrier intended to meet that need. Prototype riot control barriers were fabricated and feasibility-tested. The test results indicated that the corrugated steel panel riot control barrier is feasible and practical for the intended purpose, and that the concept is suitable for further development into troop use items.

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INTRODUCTION

Military Police personnel are sometimes called upon to render assistance to law enforcement agencies during civil disturbances and riots. In such riots and civil disturbances it may become necessary to hold back the crowds and to prevent entry into selected areas by using a control barrier.

The US Army Land Warfare Laboratory developed the concept for a riot control barrier, fabricated some prototype components and conducted feasibility testing of the barrier. The design characteristics of the Riot Control Barrier were based upon the requirements stated in a draft proposed ROC (ACN 20026 by CDC MP Agency, Fort Gordon, Georgia; letter dated 28 February 1973, file CDCMP-M; subject: Draft Proposed Required Operational Capability - DPROC - for a Quick-Erectable Barrier.)

This report states the design characteristics which guided development of the riot control barrier concept, describes the prototype units built to meet those characteristics, and briefly summarizes the test results.

DESIGN CHARACTERISTICS

In consonance with the requirements of the Draft Proposed ROC, the riot control barrier was devised and designed in a manner to assure that it would not have an "armed camp" appearance, would not present the connotation of "violent disorders", but would meet the following "essential characteristics":

1. Be suitable for use in all climatic and weather conditions encountered in CONUS.

2. Be compatible with chemical agents used in riot control operations.

3. Be designed to prevent easy scaling or tearing down by rioters. An undetermined individual must be denied access for 5 to 10 minutes; a determined individual should be denied access for 3 to 5 minutes.

4. Be reuseable.

5. Be capable of construction by two to three men without use of heavy lift equipment in 7 to 10 minutes. The length must be 50 to 75 feet.

6. Be capable of secure anchorage to streets or roadways without causing damage to the streets or roadways.

7. Be modular in construction and capable of construction to any desired length by connection end-to-end.

8. Be constructed of a material which is resistant to fire, cutting, and breaking by hostile rioters.

9. Require no special maintenance provisions other than normal care and cleaning or emergency repair such as patching.

10. Be capable of transport in a 2-1/2-ton truck in modules providing a total length of 200 to 300 feet.

DESCRIPTION OF THE PROTOTYPES

The Basic Configuration

The LWL Riot Control Barrier consists of modular units of barrier wall, each unit approximately 30" long. The cross section of the wall is an equilateral triangle of 8-foot long sides, with one side extending two feet above the apex. The base and two sides are made of corrugated panels. The panels are connected by hinge pins at the base of the two sides in such a way that the modules are collapsible for shipment and handling. During on-site assembly the two sides of each module are fastened together at the apex by a connector. Refer to Figures 1 through 3.

The modules are connected end to end with a one-corrugation overlap of the panels. The modules are held together by the overlapped corrugation, which provides the means for assembling a barrier wall of any desired length. By building the modules with one of the side panels two feet longer than the other, the barrier wall is made more difficult to scale. A comparison of the modules with and without the 2-foot side extension is shown in Figure 4.

The triangular configuration was envisioned as an approach toward stability of the wall without the need for extensive anchoring or tie-down provisions. The corrugated panel construction results in a barrier wall which is heavy and therefore difficult to overturn. If a crowd does succeed in turning it over, however, the net effect would be that the barrier is displaced by an 8-foot distance. The movement would not, under most conditions, significantly compromise the effectiveness of the barrier.

Comparative Prototypes

Corrugated Steel Panel Modular Units: The first concept investigated was a prototype which utilized standard corrugated steel roof deck panels of the type normally used in building construction. The panels are 36" wide, and weigh 2.13 lbs. per square foot. They provide barrier wall modules which are 30" net width and weigh 175 pounds. The prototypes shown in Figures 1 through 4 are of this type. The side panels are hinge connected at each end of the base panel by permanently installed 1/4" diameter steel rods. The side panels are connected at the apex with 1/4" diameter steel rods which are inserted during field assembly of the barrier wall (Figure 3).

An Alternate Concept of the Corrugated Steel Unit: An alternate, though similar version of the unit described above is shown in Figure 5. The only difference is that the alternate version utilizes sharp steel spikes along the top apex, intended to make the barrier less vulnerable to "climb-over". The spikes could, however, inflict permanent body injury to some of the more daring protesters. This alternative was therefore ruled out early in the program and was not tested.

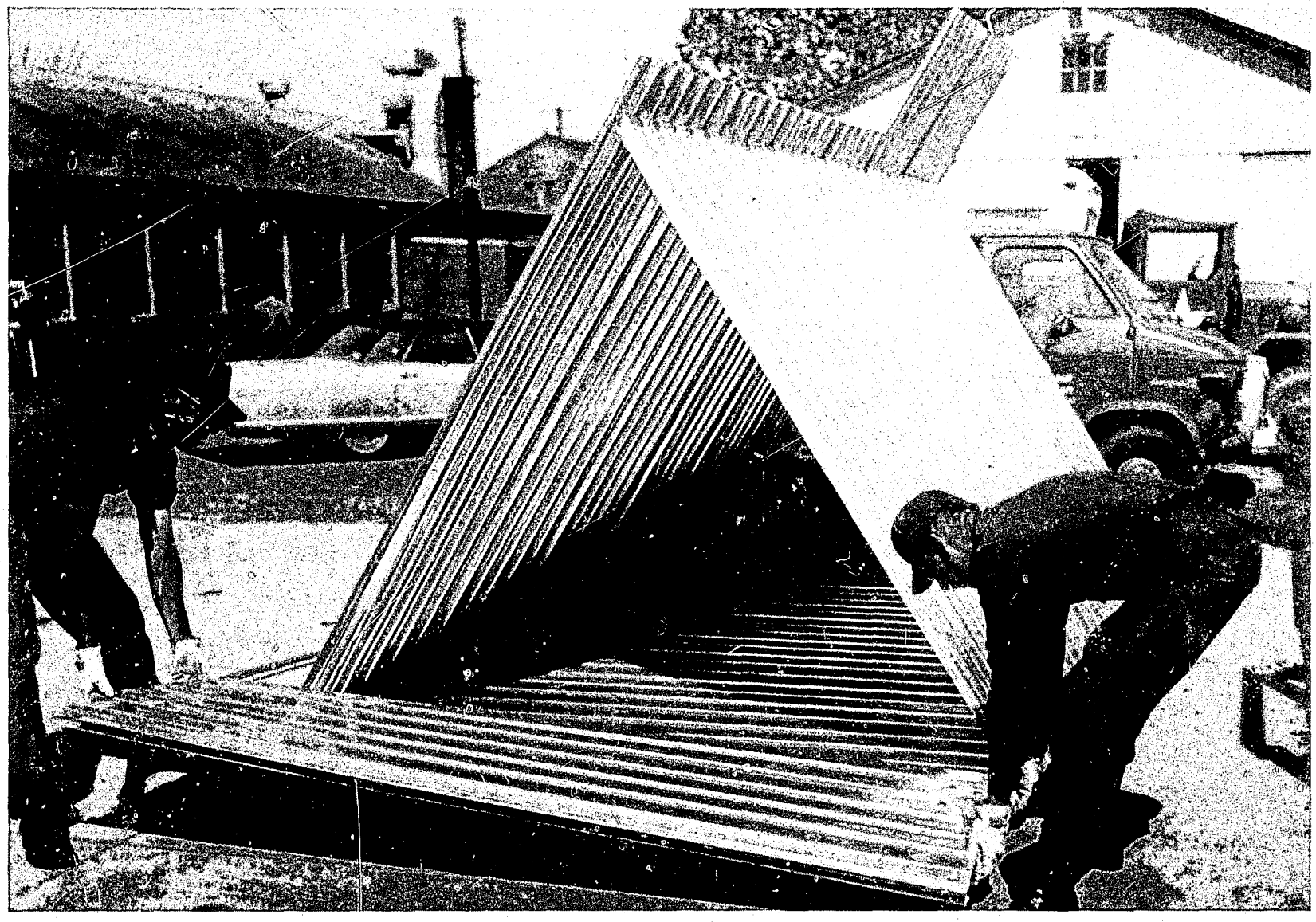

Figure 1. Test-Bed Modules of the Riot Control Barrier Showing a Collapsed Module Being Positioned for Erection.

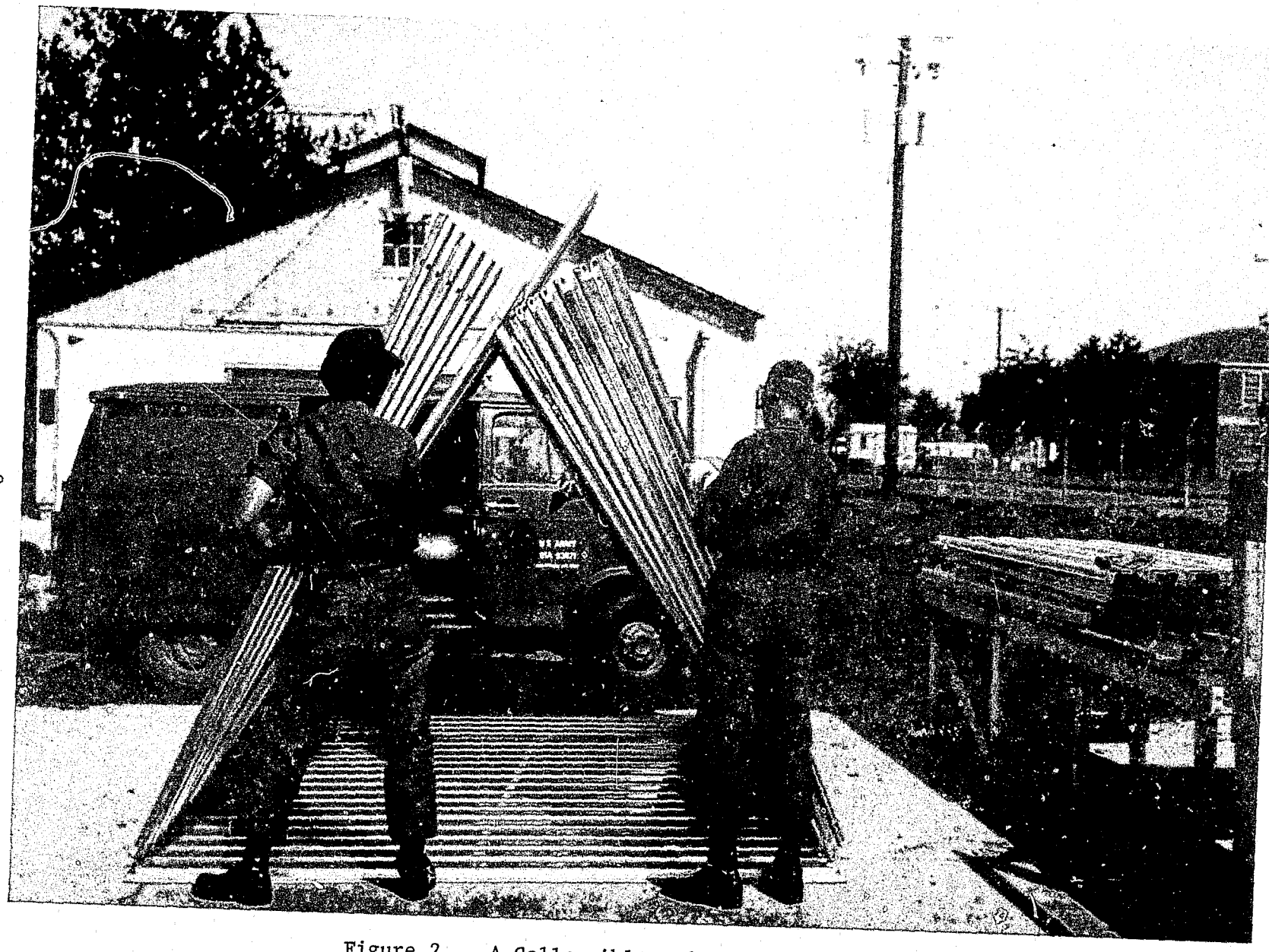

Figure 2. A Collapsible Module being Erected.

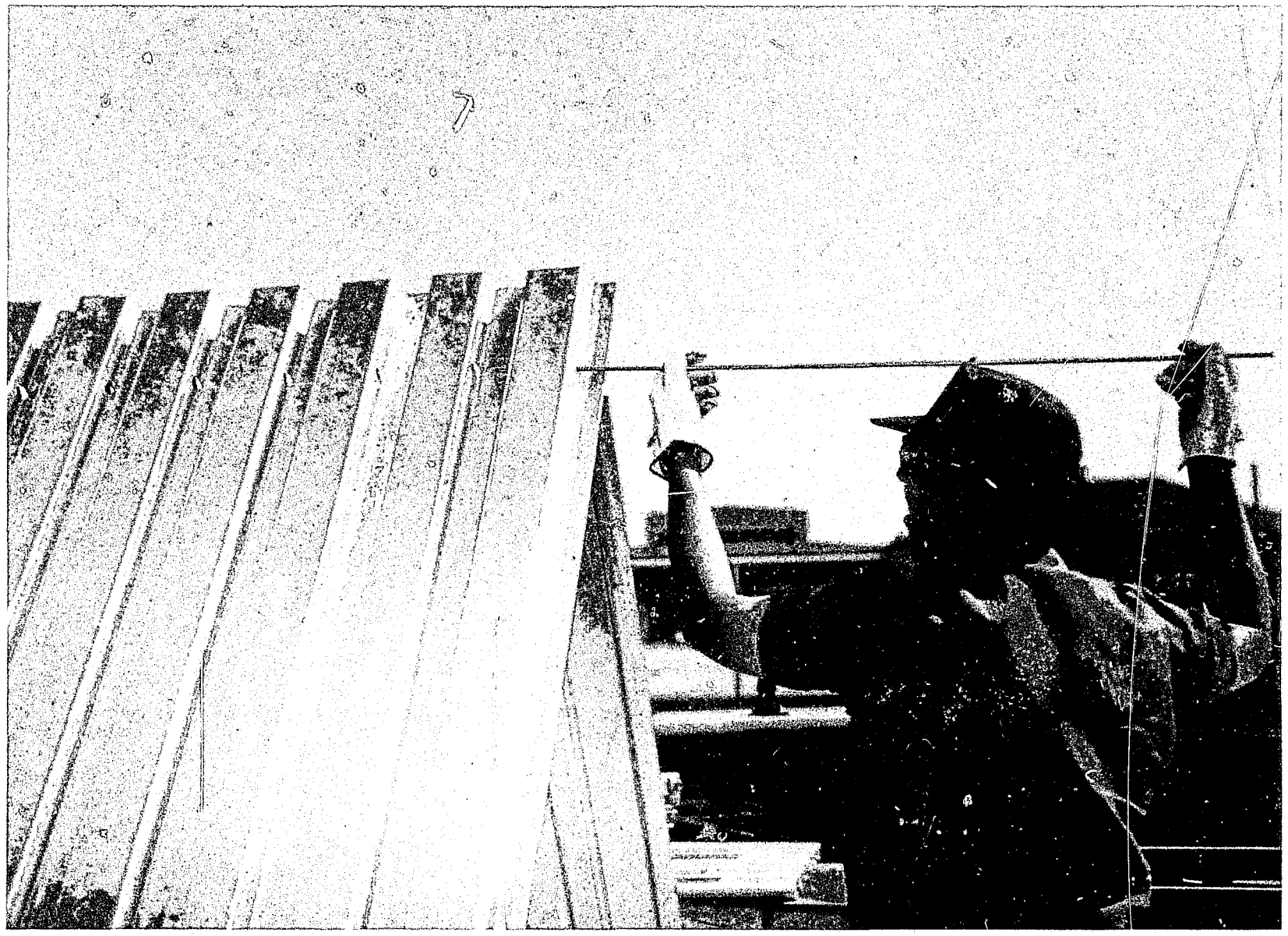

Figure 3. Pin Connection of the Apex of the Two Sides

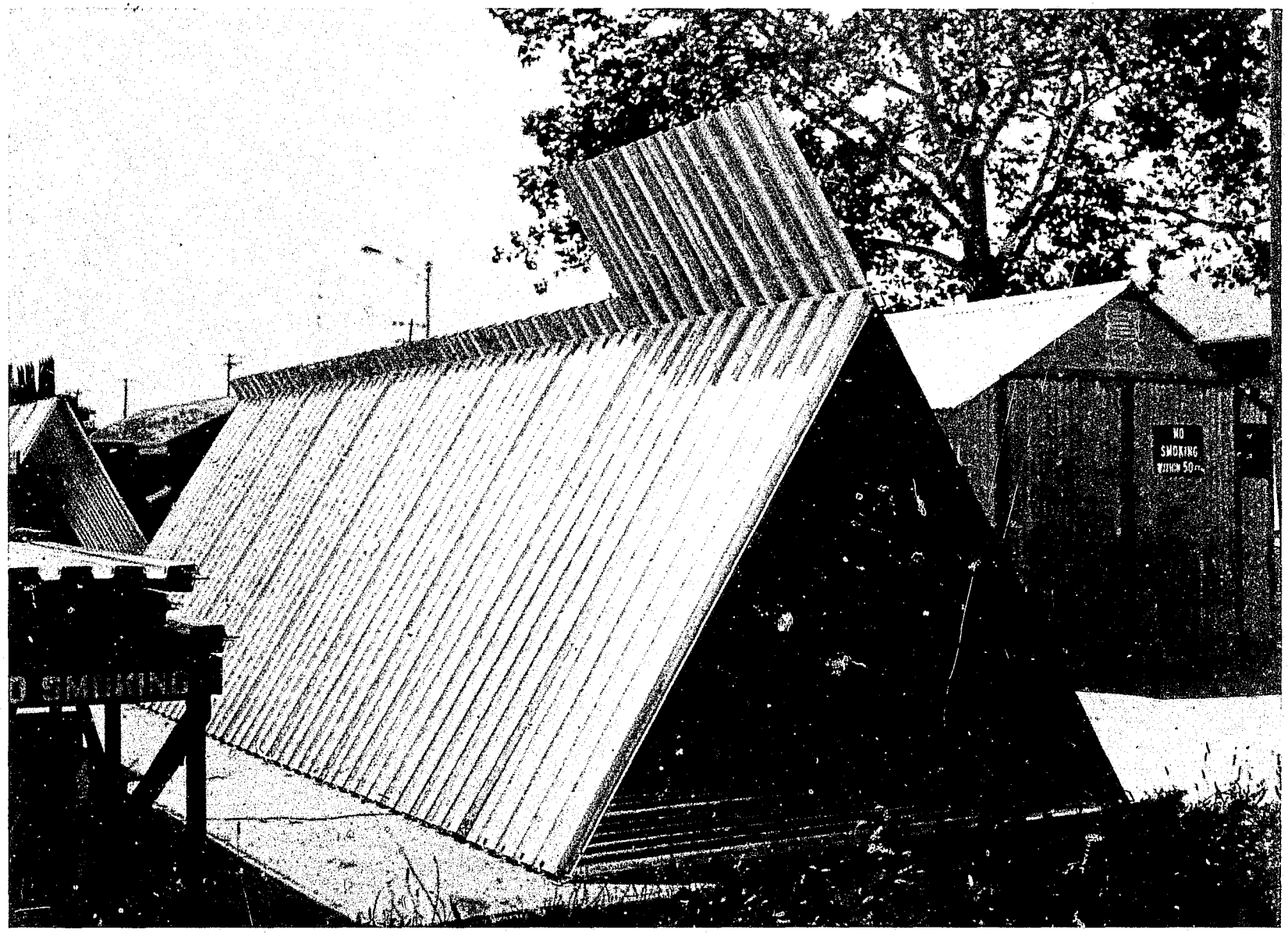

Figure 4. Comparison of Modules With and Without the 2-foot Extension to One Side.

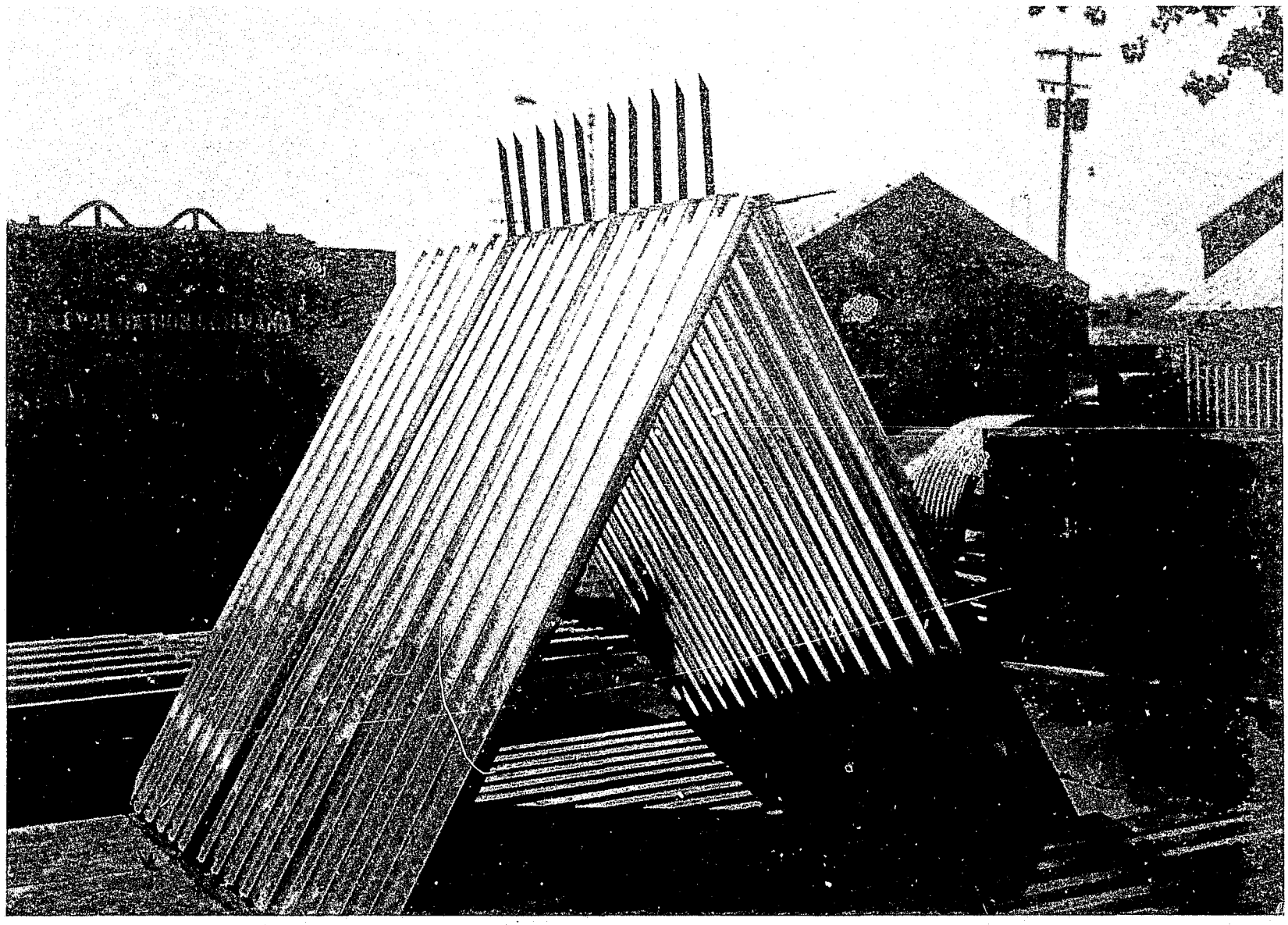

Figure 5. Alternate Riot Barrier Concept with Steel Spiked Apex.

Corrugated Aluminum Panel Modular Units: Another concept was a prototype which utilized standard corrugated aluminum panels normally used as a roofing and siding. The panels are 44" wide by 0.05" thick, and weigh 0.87 lbs. per square foot. They provide barrier wall modules which are 40" net length, each module weighing approximately 85 pounds. The prototype shown in Figures 6 and 7 are of this type. The panels are connected to each other by use of steel wire rope cable assemblies. The cables are interlaced between the abutting panels during field assembly of the barrier wall. Each cable assembly is approximately 42" long.

Figure 6. Assembly of Corrugated Aluminum Panels Using Wire Cables for Fastening.

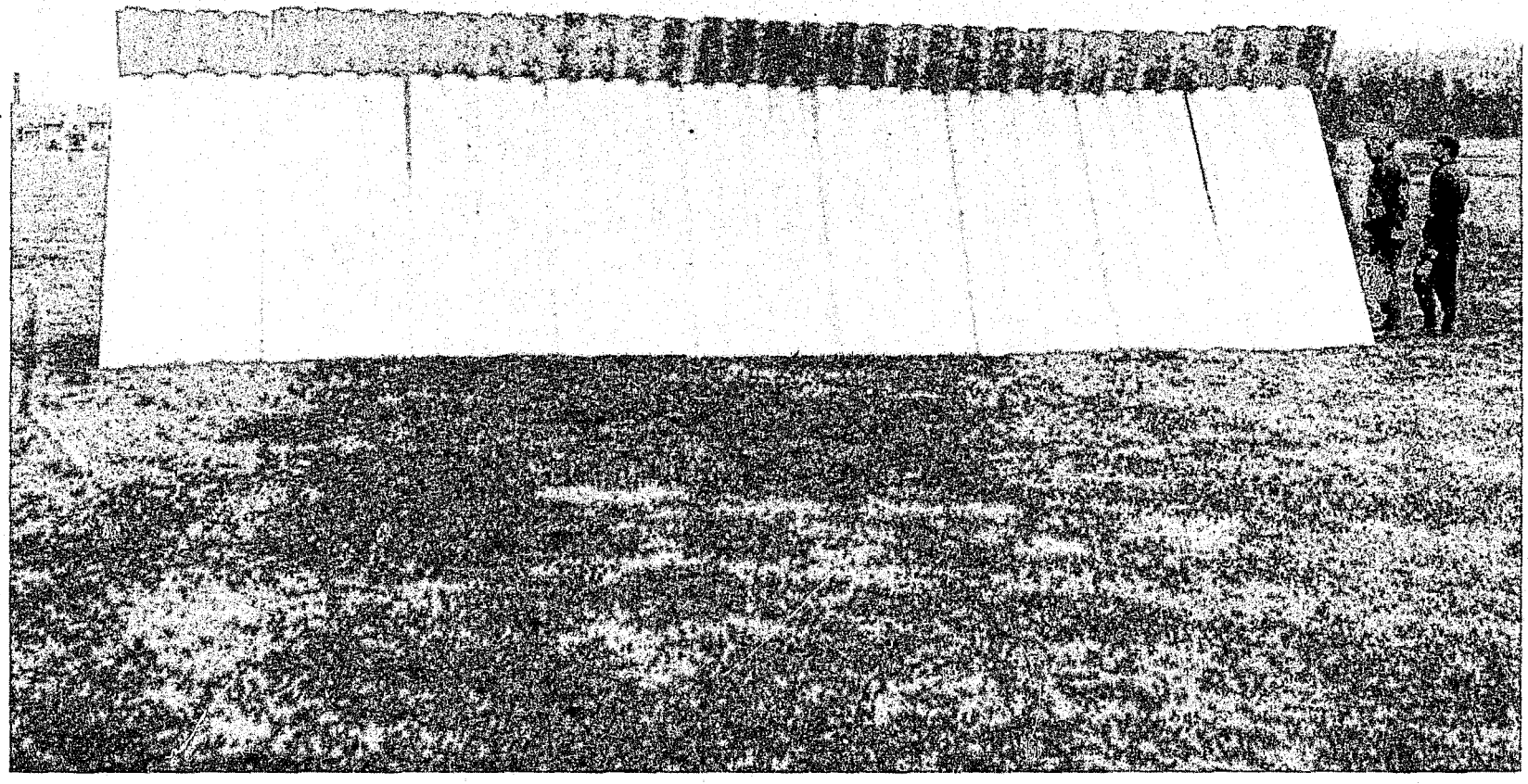

Figure 7. Prototype of the Corrugated Aluminum Panel Riot Control Barrier.

FEASIBILITY TEST

Test Procedures

The two prototype Riot Control Barrier prototypes (one of steel and one of aluminum) were assembled and tested in a simulated operational manner. The troops attempted to kick or stamp down the barrier wall, as shown in Figures 8 and 9. Then they attempted to scale the wall; first from the overhang side as shown in Figures 10 and 11, and then from the smooth side (the side opposite the overhang) as shown in Figure 12. Attempts were made to turn over the wall as shown in Figure 13. The purposes of these tests were as follows:

1. To compare the two methods of assembly - the 1/4" diameter rods and the wire rope cables.

2. To compare the two types of corrugated panels, and to determine if either or both are strong enough to take the abuse expected from rioters.

3. To determine if the weight and handling characteristics of the aluminum panels offer any significant advantages over steel panels.

4. To determine how long an average individual with no prior experience with the barrier would require to climb over or breach the barrier, both as an individual and with assistance.

5. To determine if the barrier could be easily overturned when not secured or anchored to the ground, and if it remains intact after overturn.

Test Results

Vulnerability to Scaling: When approaching from the overhang side, the troops were able to run up to the barrier, jump up and grab the overhang, and climb over it, as shown in Figures 10 and 11. When approaching from the smooth side (opposite the overhang), the troops were not able to reach the top of the wall, and therefore could not climb over. When assisted, however, as shown in Figure 12, the simulated protester could easily climb over the barrier.

Vulnerability to Turn-Over: The aluminum barrier was of light unit-weight, and easily overturned. Refer to Figure 13. The steel barrier, being approximately three times as heavy, was more difficult to turn over. The corrugated steel barrier is considered practical for use without the need for tie-down devices.

Vulnerability to Damage: The aluminum barrier was easily stamped in by action of the type shown in Figures 8 and 9. The steel panel barrier could not be stamped in.

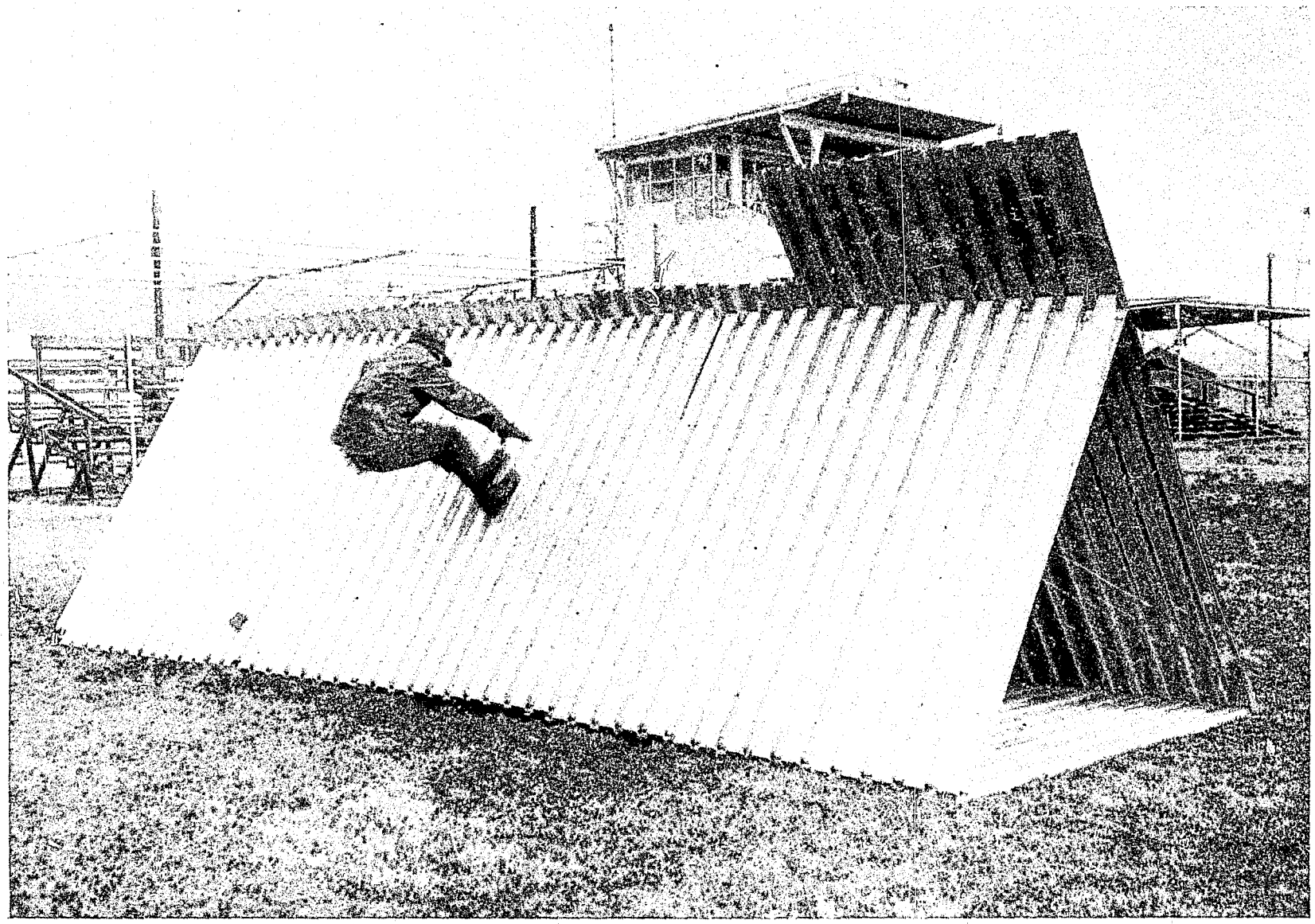

Figure 8. Feasibility Test of the Corrugated Steel Riot Control Barrier In Which an Attempt is Made to Compromise the Wall by "Stamping It In".

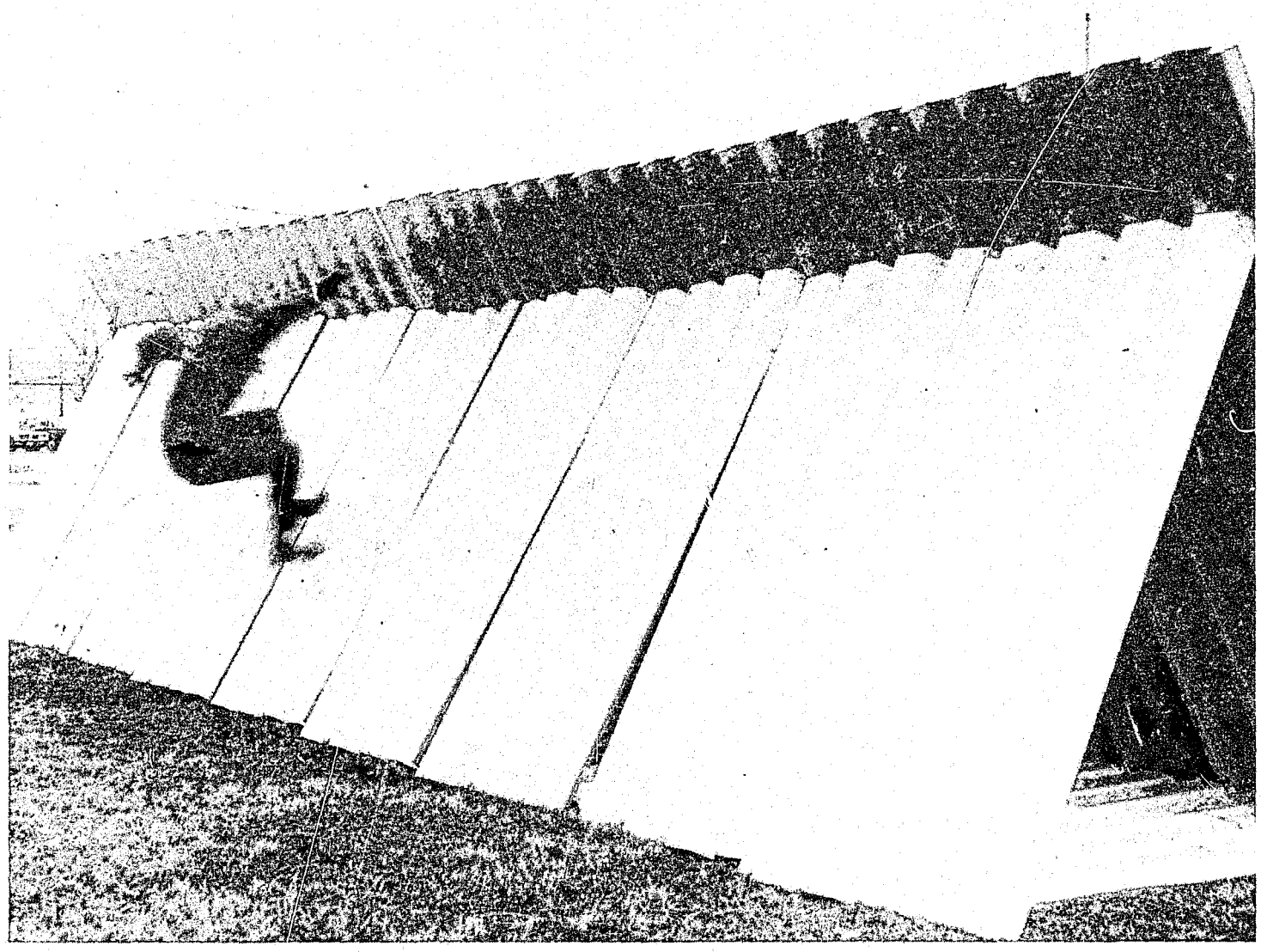

Figure 9. Feasibility Test of the Corrugated Aluminum Barrier Undergoing the "Stamping" test.

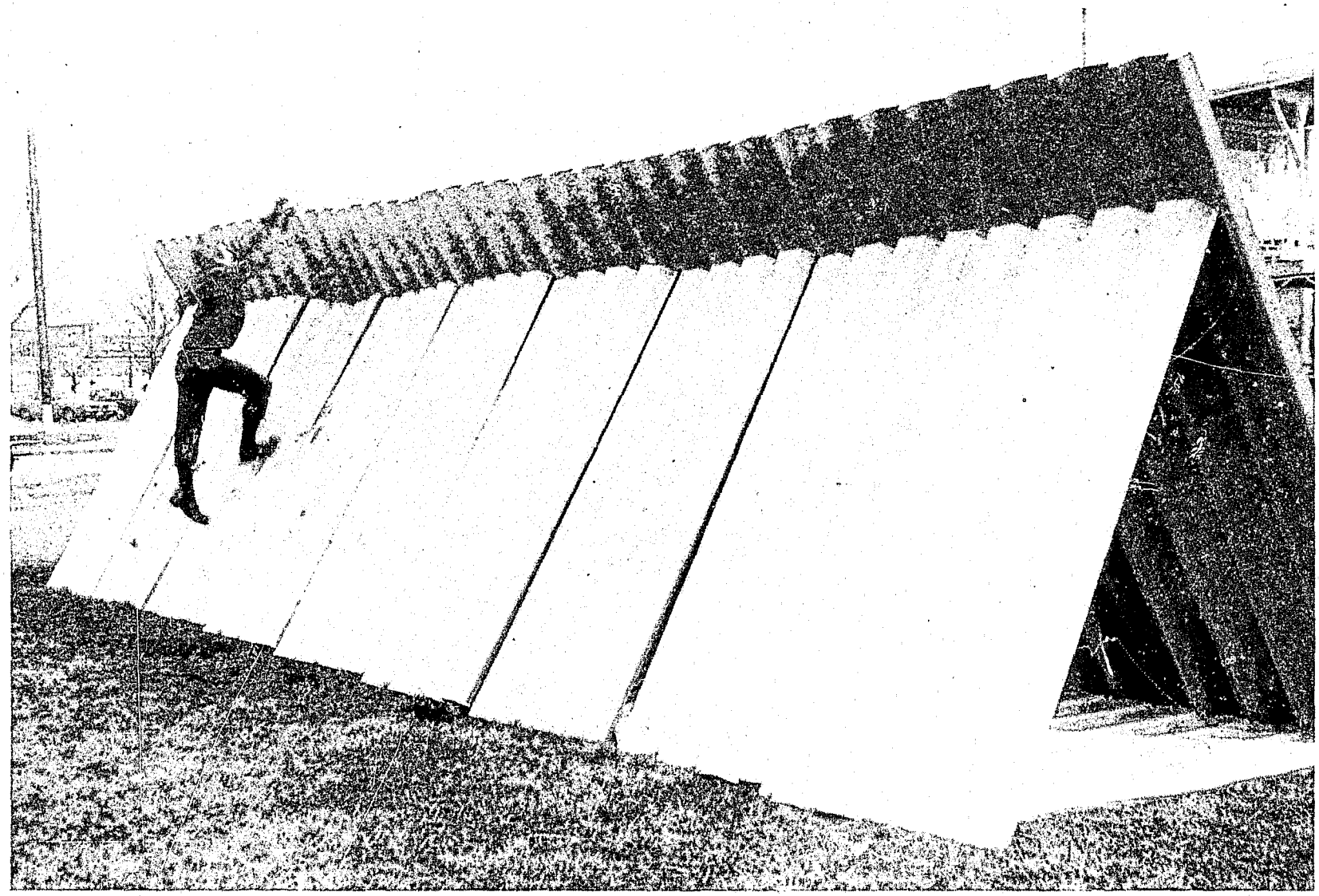

Figure 10. Feasibility Test of the Corrugated Aluminum Barrier Being Scaled from the Overhang Side--Showing the Initial Phase of the Scaling Operation.

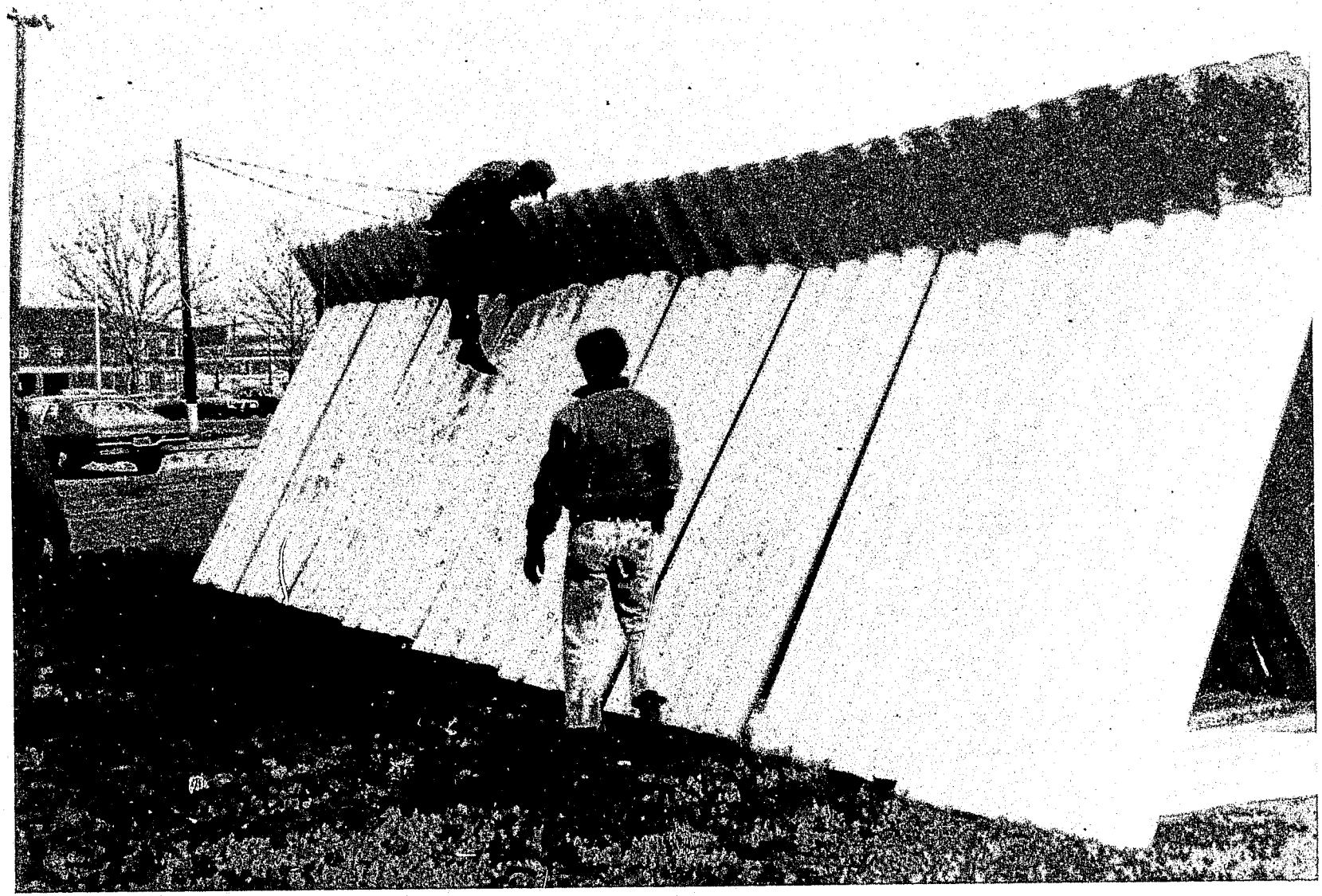

Figure 11. Feasibility Test of the Corrugated Aluminum Barrier Being Scaled From the Overhand Side, Showing the Intermediate Phase.

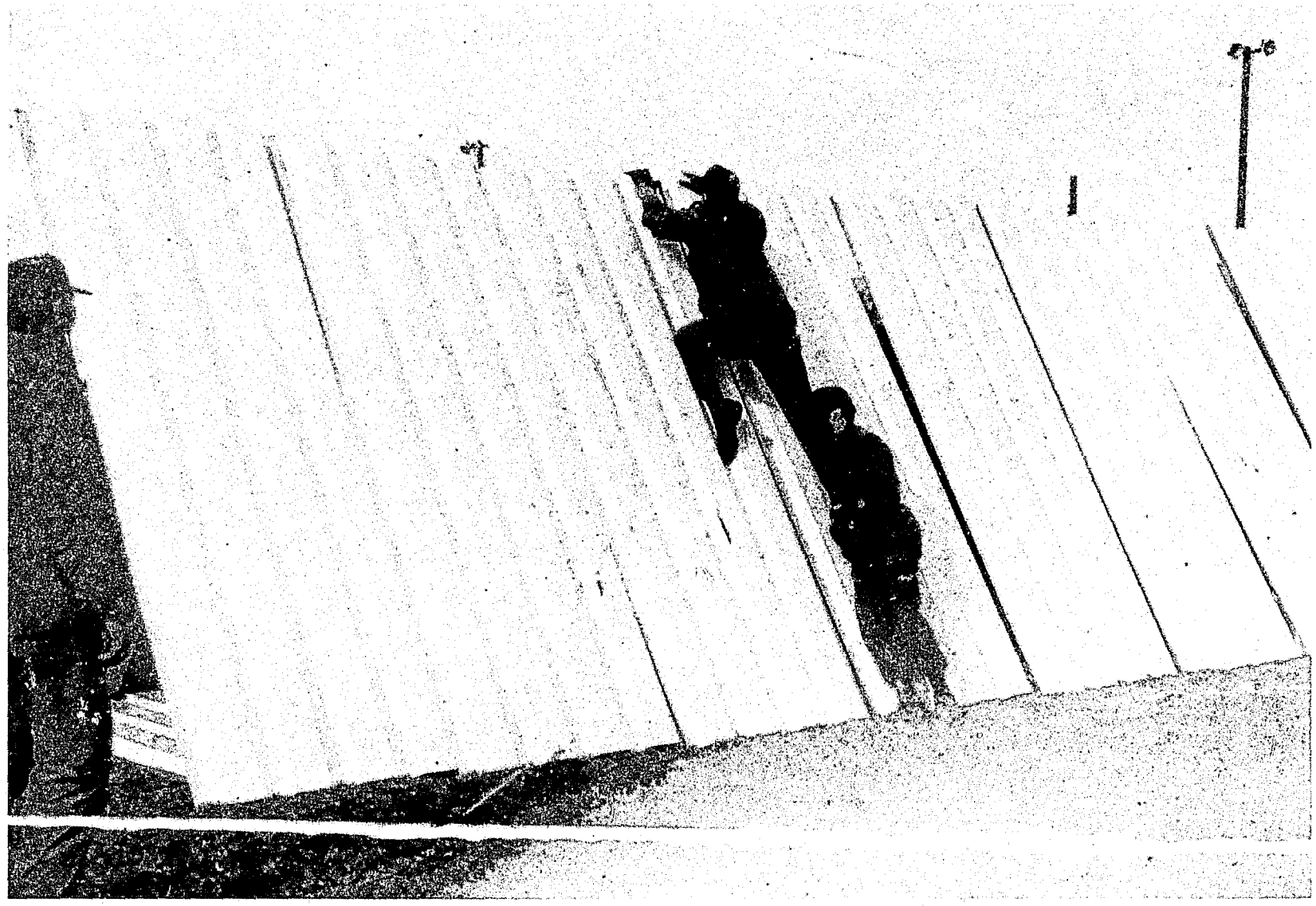

Figure 12. Feasibility Test of the Corrugated Aluminum Barrier Being Scaled from the Smooth Side (Side Opposite the Overhang).

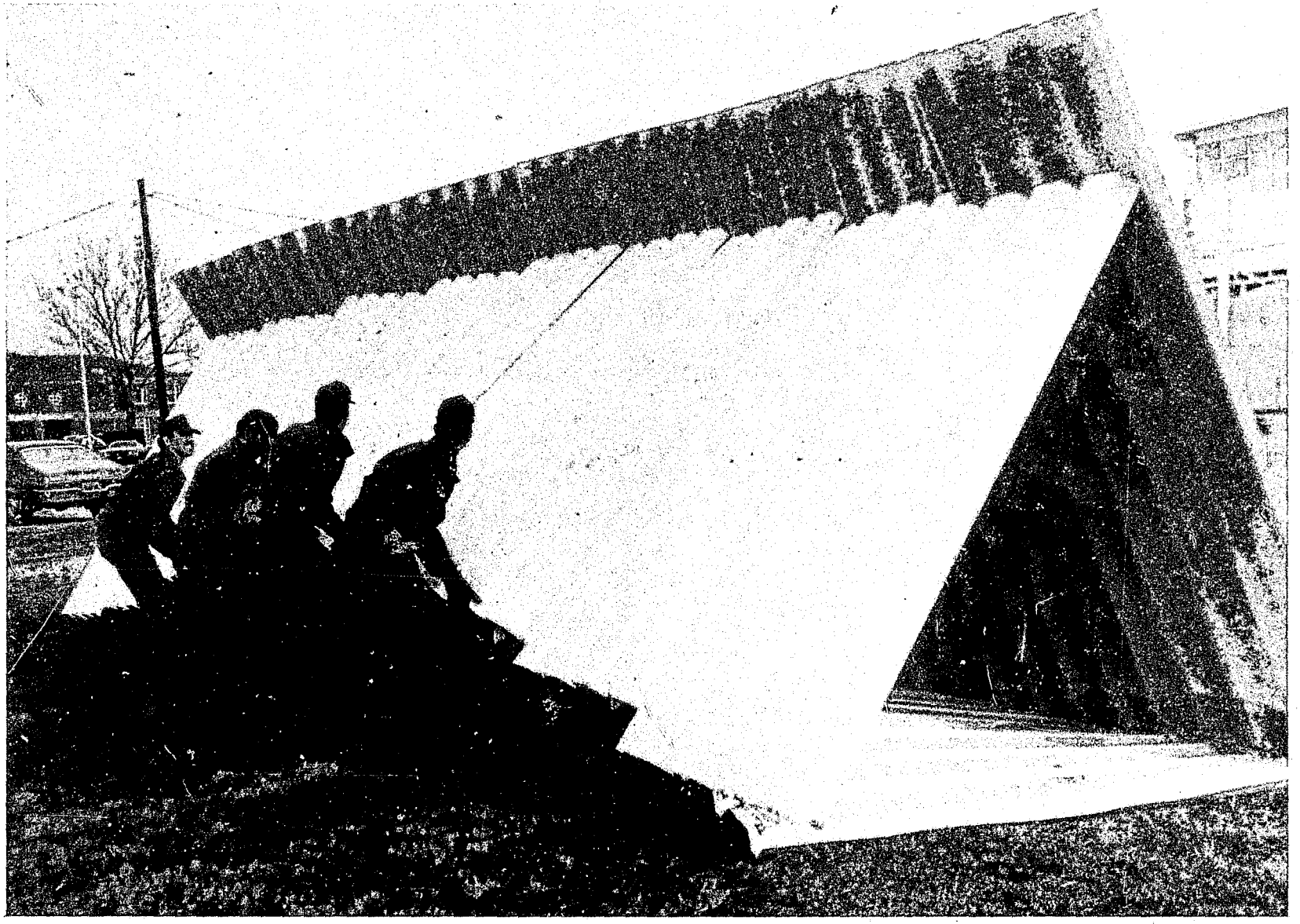

Figure 13. Feasibility Test of the Corrugated Aluminum Panel Riot Barrier Showing the Initial Phase in Turning over the Barrier.

Steel Rod Versus Wire Rope Cable for Use as Panel Connectors: The 1/4" diameter rods were found to be superior to the wire rope cables for use in the assembly of the riot control barrier. Refer to Figures 3 and 6. The rods require less time, and they provide a more tightly connected barrier wall.

Aluminum Versus Steel: The aluminum barrier was found to be unsatisfactory because it was too easily stamped in by action of the type illustrated in Figures 8 and 9, and was too easily overturned.

Modification and Retest

Modification: Though the corrugated steel barrier concept was found to be practical for the intended purpose, it was not sufficiently resistant to scaling. To correct this deficiency, two strands of barbed wire were applied along the top of each module. Refer to LWL Dwgs. 050095004 and 005 which are included in the Appendix.

Re-Test: The modified modules were assembled and evaluated for vulnerability to scaling. The test personnel were unwilling to attempt climbing over the barrier which demonstrated to some extent the deterrent value of the barbed wire. In the absence of a valid test, it could only be postulated that few protesters would be likely to risk tearing their clothes and skin by climbing over the barrier; further, that injuries to those persons who did encounter the barbed wire would be superficial with no lasting effect. It also appeared likely that the barrier could eventually be overcome if several layers of a heavy blanket or clothing were placed on the wire to act as a mat.

Final Prototype Design

Complete fabrication drawings of the riot control barrier prototype as finally modified are included in this report as the Appendix (LWL Drawings No. 050095001, 002, 003, 004 and 005, respectively).

CONCLUSION

The corrugated steel panel Riot Control Barrier concept is practical. The concept is suitable for further development and subsequent evaluation by troops.

APPENDIX

LWL Drawings No. 050095001,
002, 003, 004, and 005, respectively.

(Fabrication Drawings of Corrugated Steel Panel
Riot Control Barrier Prototype)

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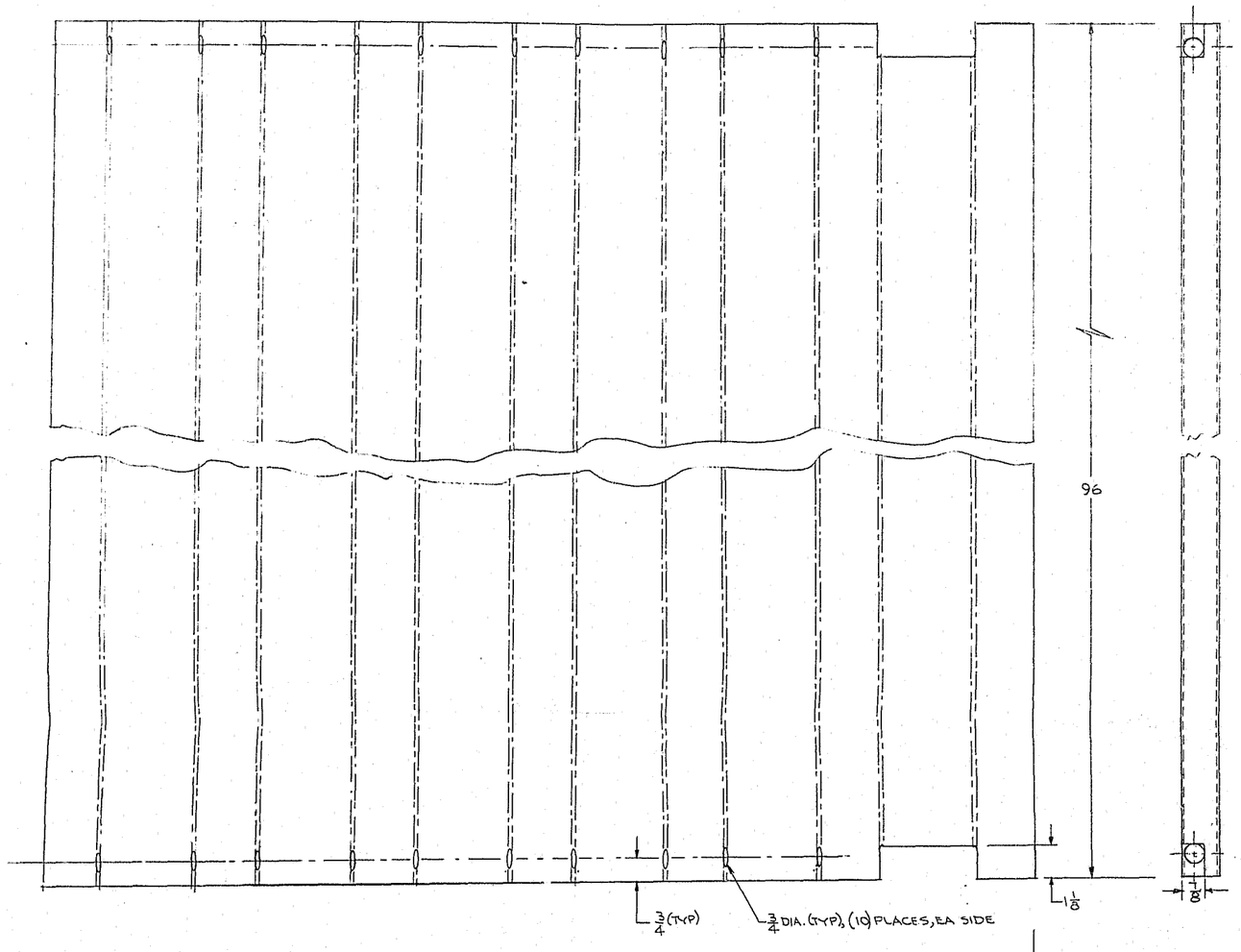

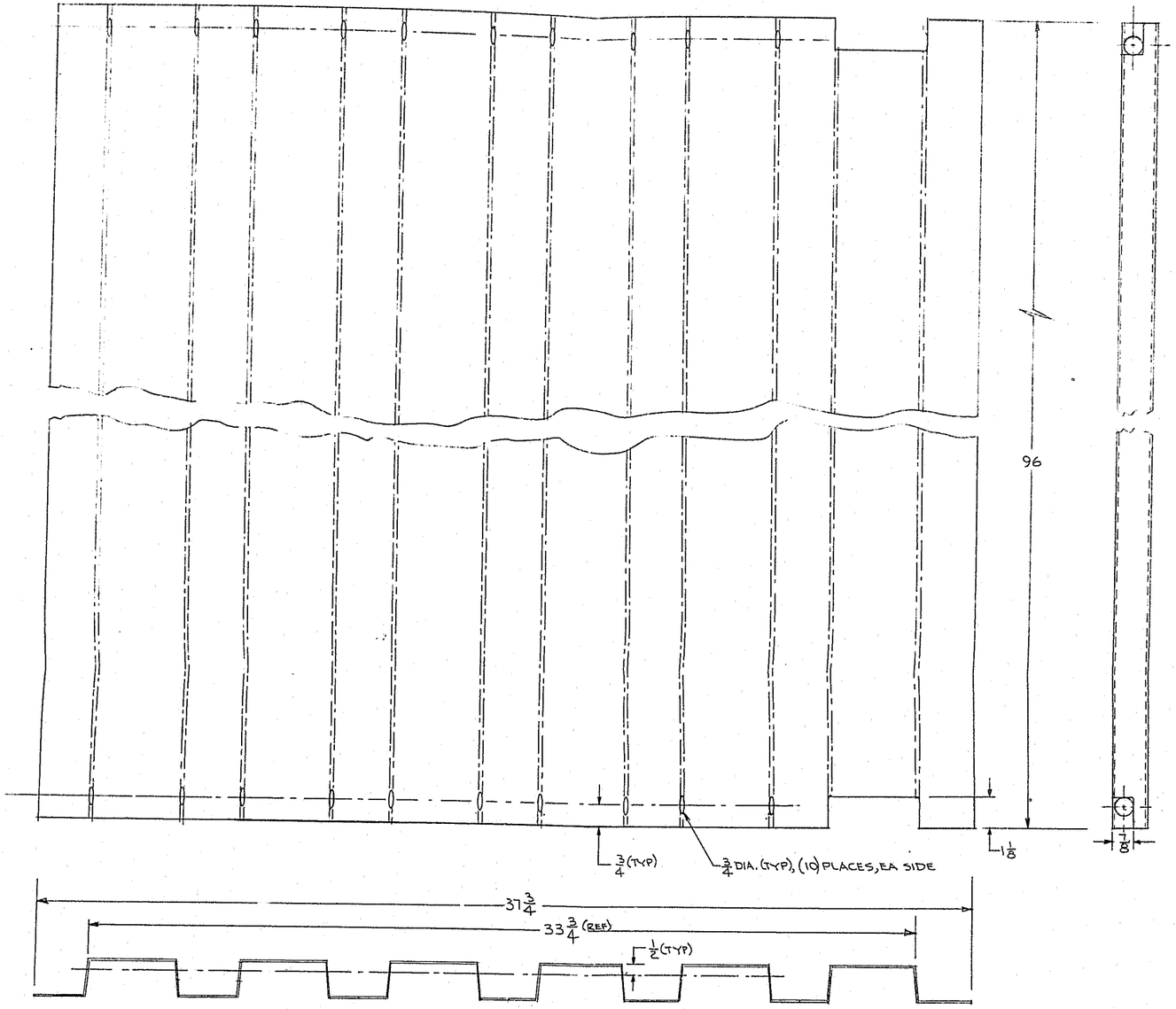

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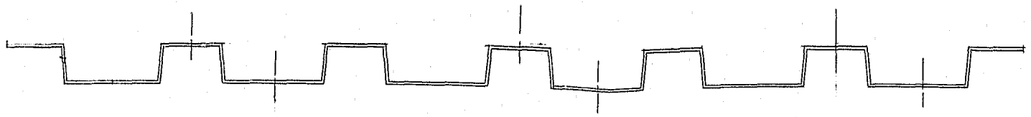

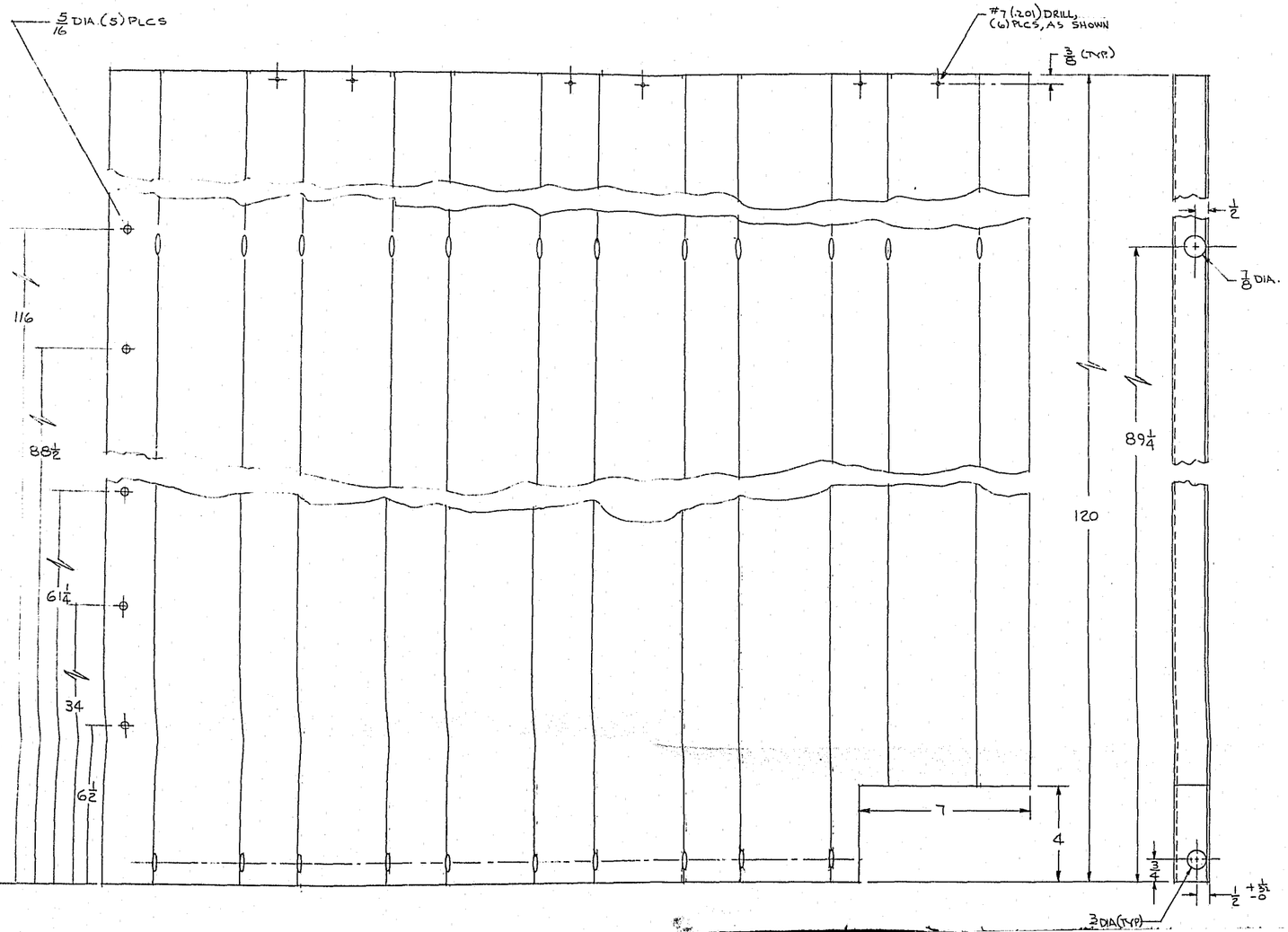

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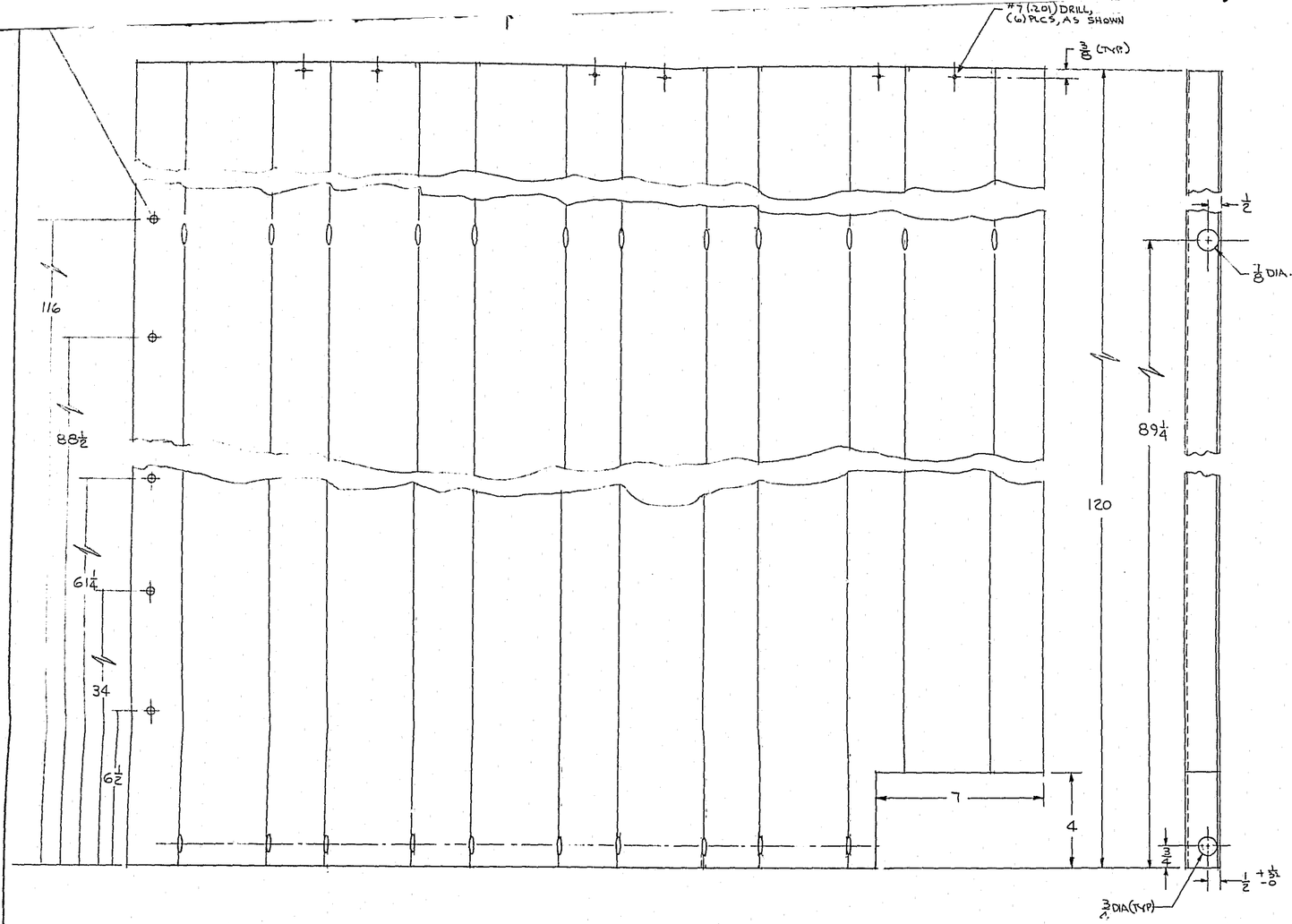

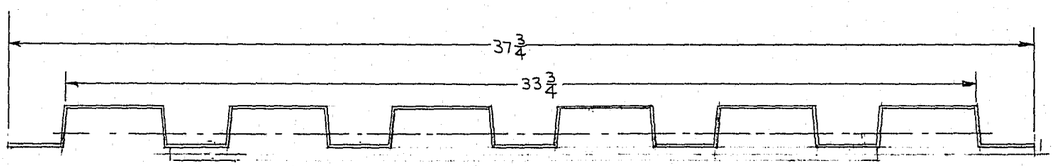

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SIDE PANEL (LONG)

U.S. ARMY LAND WARFARE LABORATORY
ABERDEEN PROVING GROUND, MARYLAND 21005
RIOT CONTROL BARRIER

SIZE	CODE IDENT. NO.	DRAWING NO.	REV.
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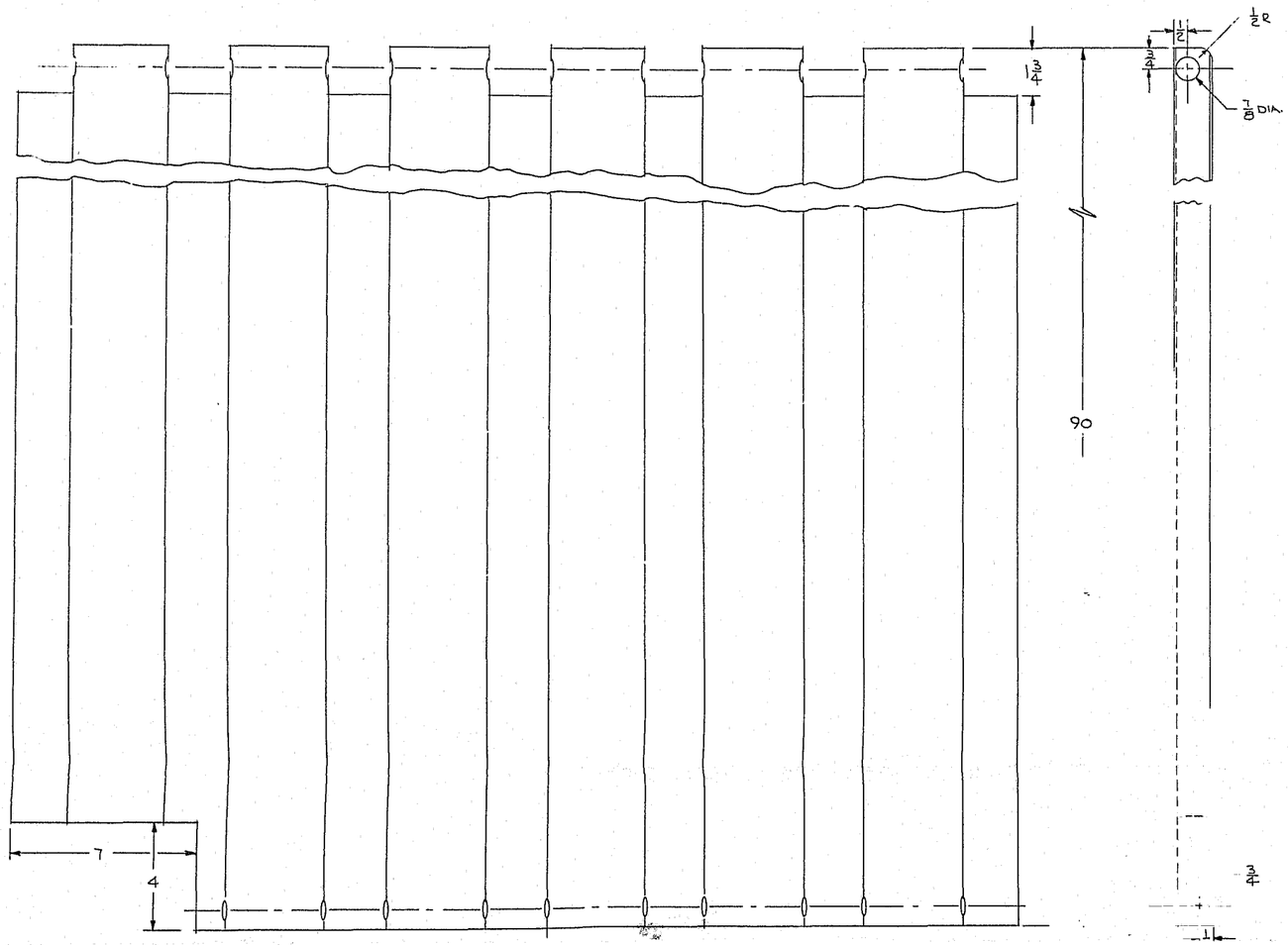

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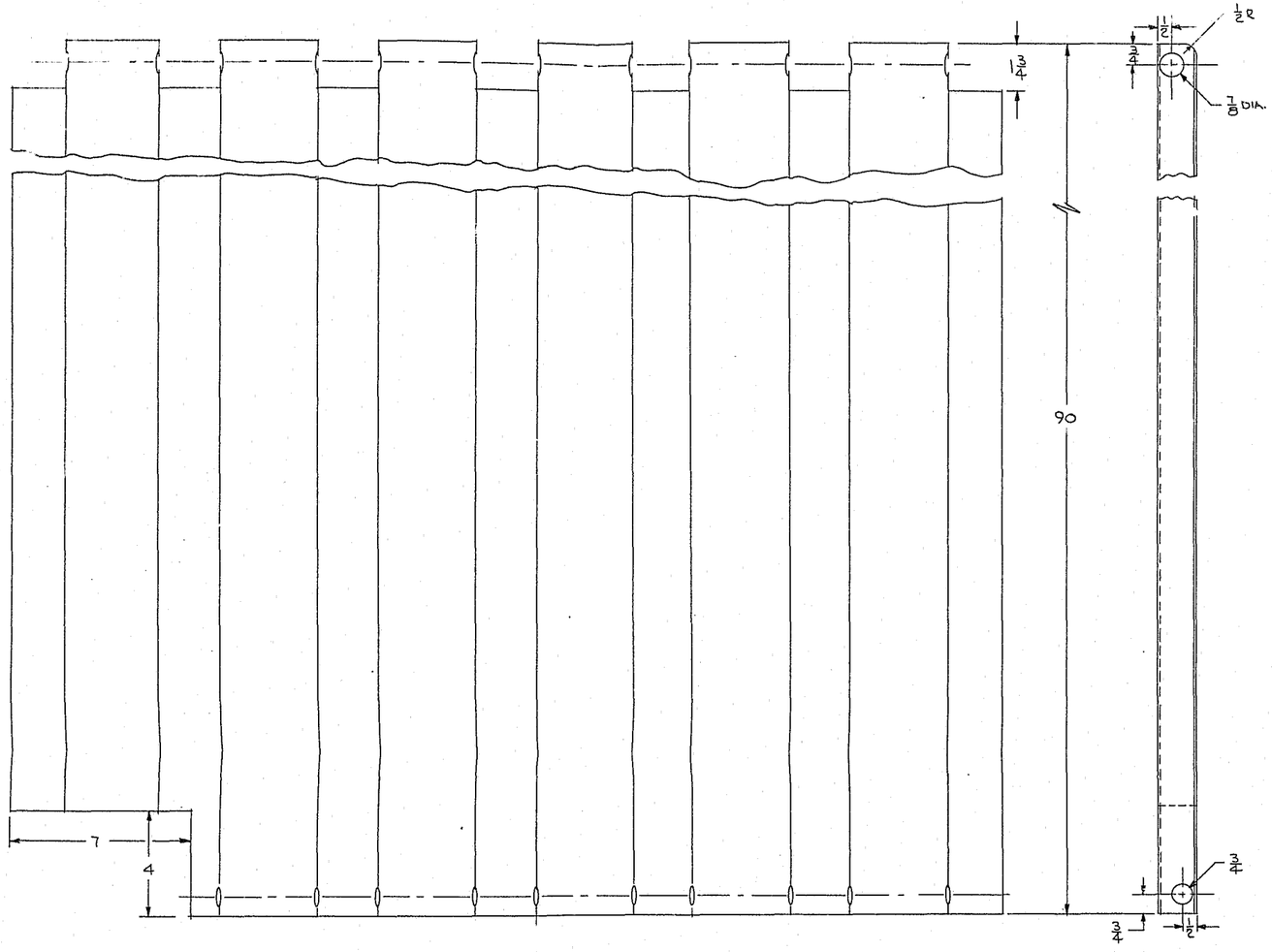

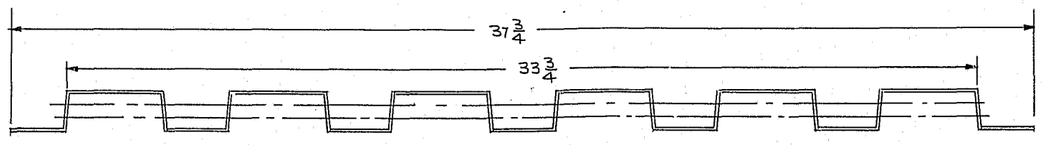

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ABERDEEN PROVING GROUND, MARYLAND 21005

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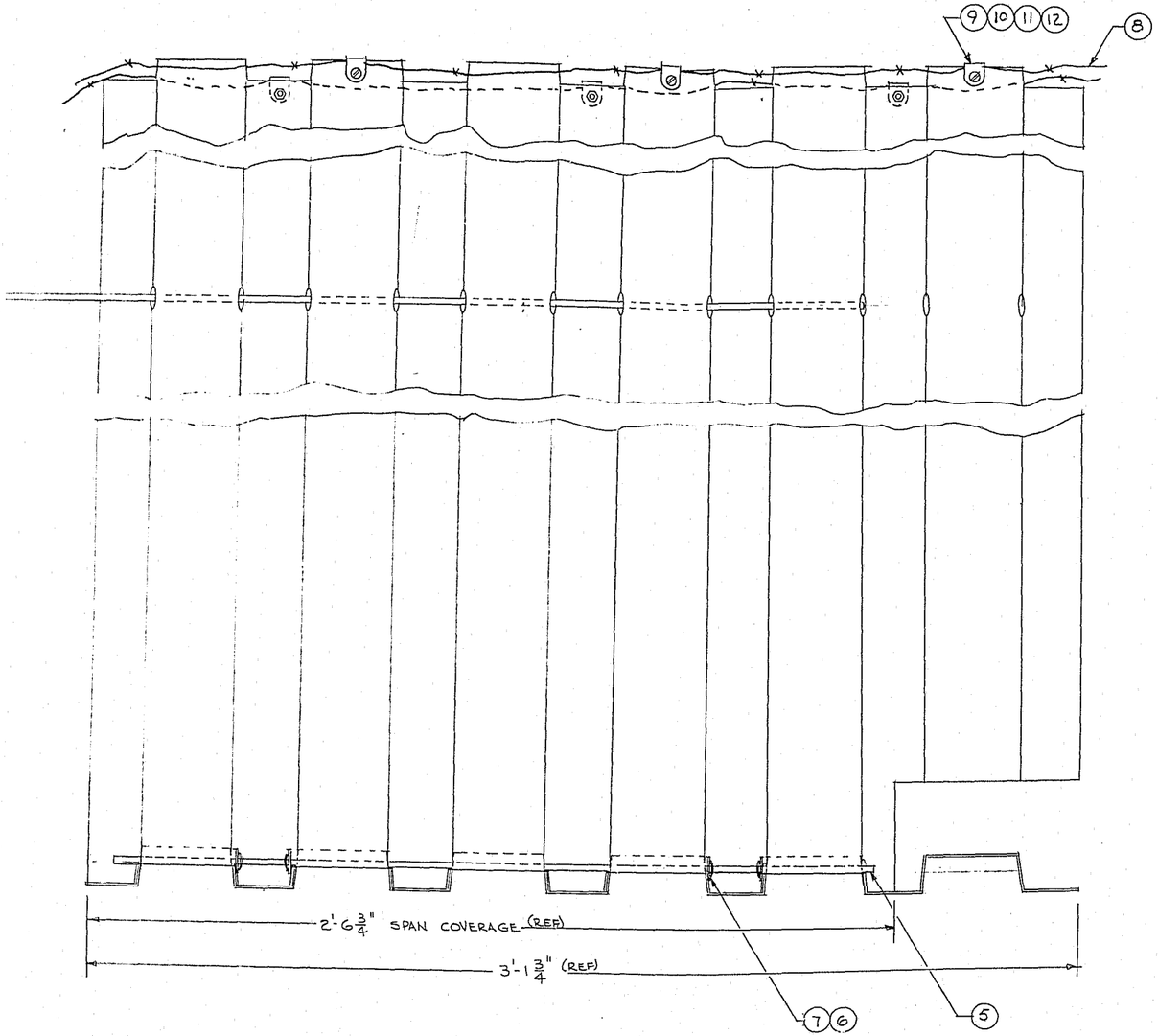

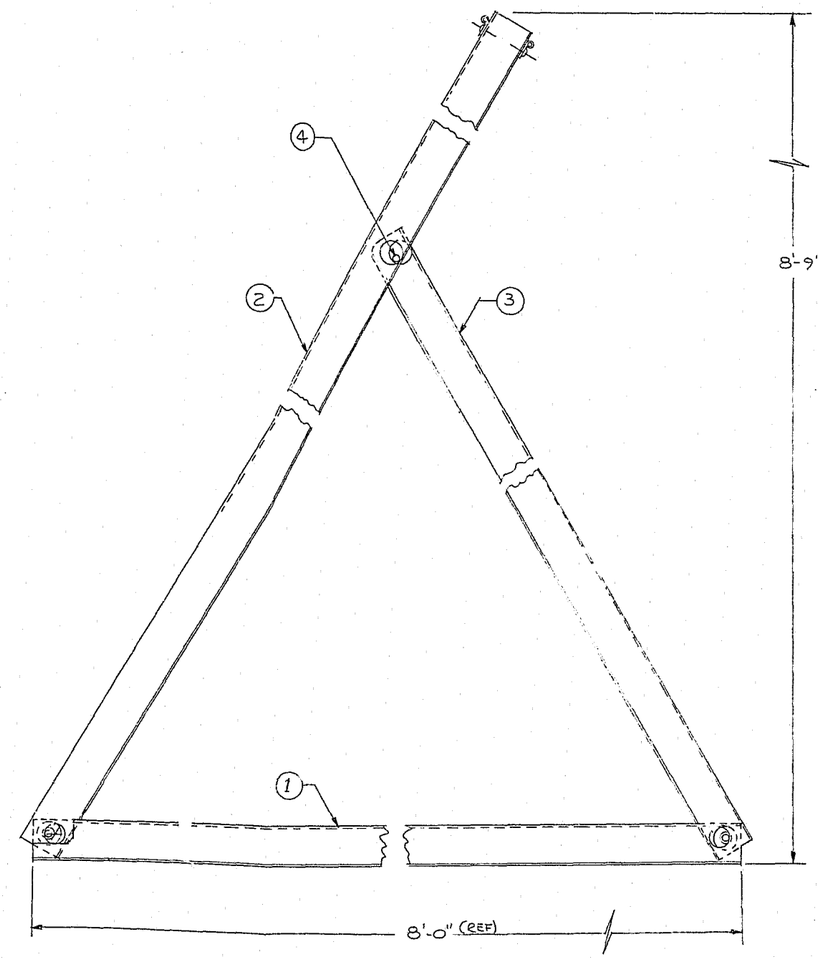

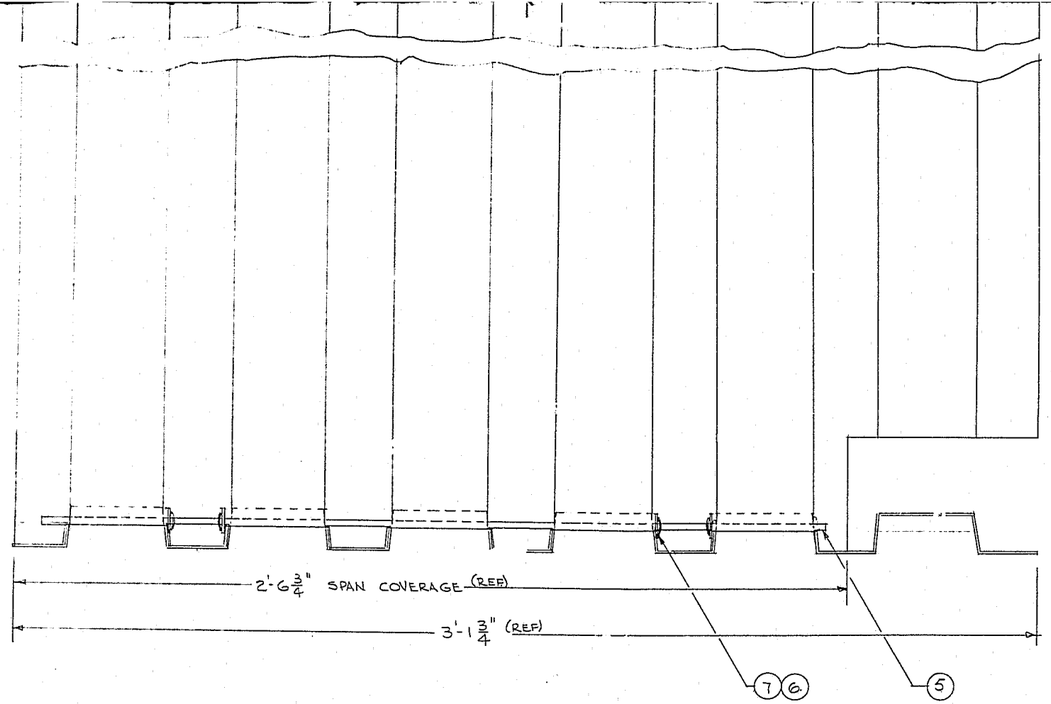

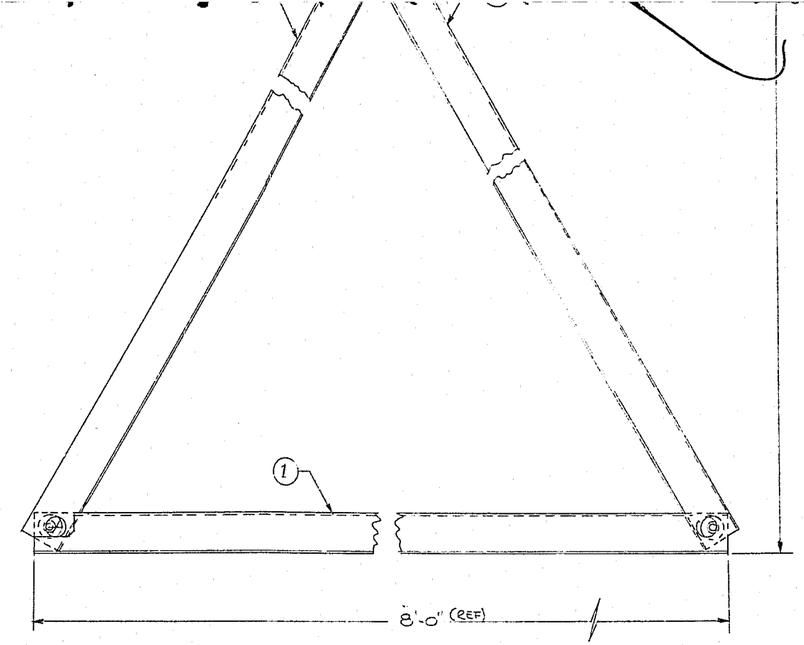

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2	NO. 1954	CLIP	3/4 SIZE, NORTH & JUDD OR EQUAL	STEEL	COMM.	9
		BARBED WIRE, 2 PT BARB	14GA, SINGLE STRAND, 4 FT LONG	GALV. STEEL	COMM.	8
8		WASHER, PLAIN, FLAT	3/8 DIA. SIZE x 3/32 THICK	STEEL	C.R.	7
2	C-390-017-1	STUD RECEIVER	1/4 DIA. SIZE, TINNERMAN (EATON CORP)	STEEL	SPRING	6
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1	050095006-2	LOCKING ROD (TOP)				4
1	050095003-1	SIDE PANEL (SHORT)				3
1	050095002-1	SIDE PANEL (LONG)				2
1	050095001	FLOOR PANEL				1

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RIOT CONTROL BARRIER
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ABERDEEN PROVING GROUND, MARYLAND 21005
(1) BAY ASSY, LEFT HAND

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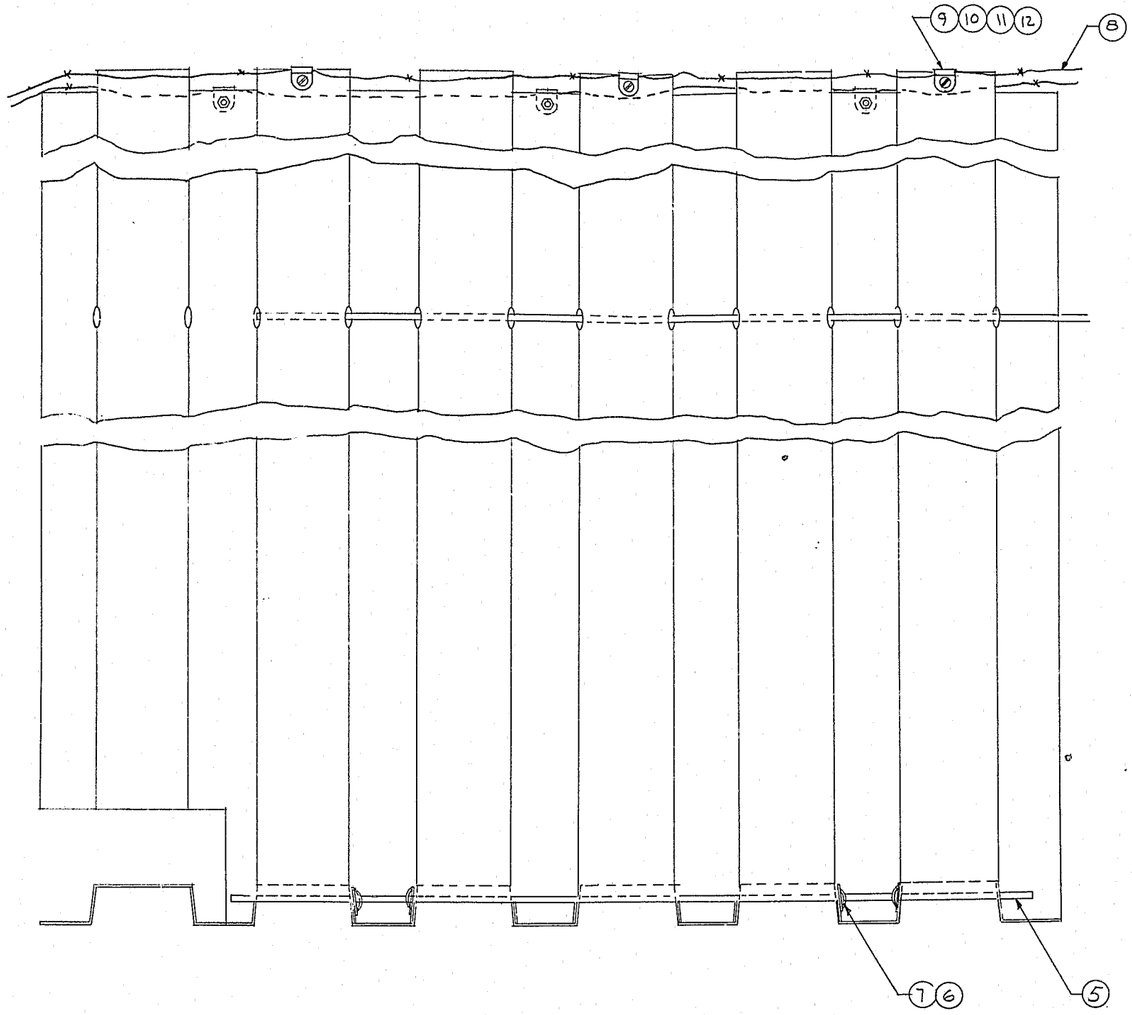
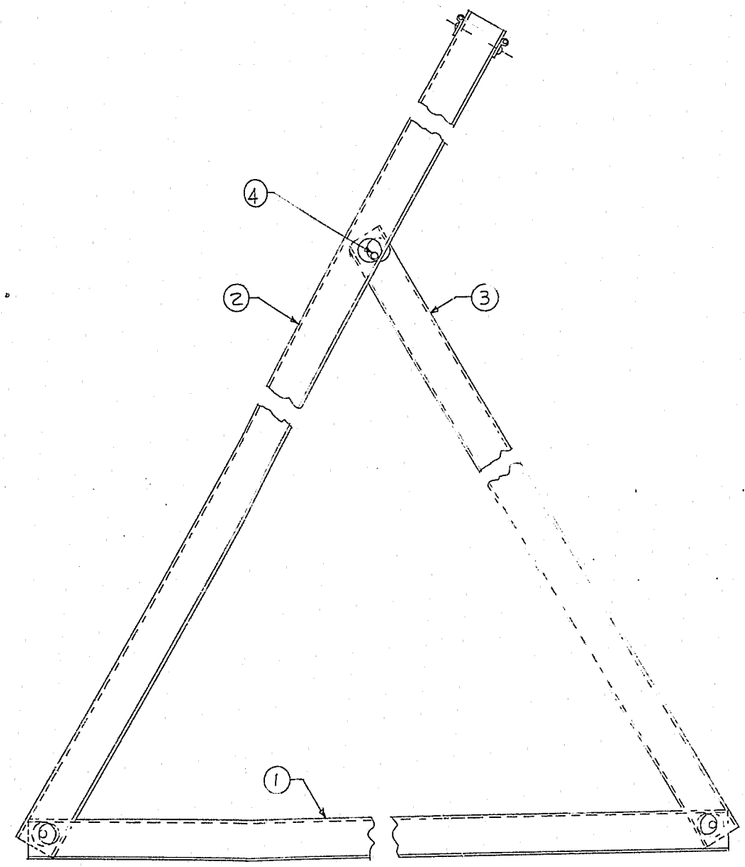
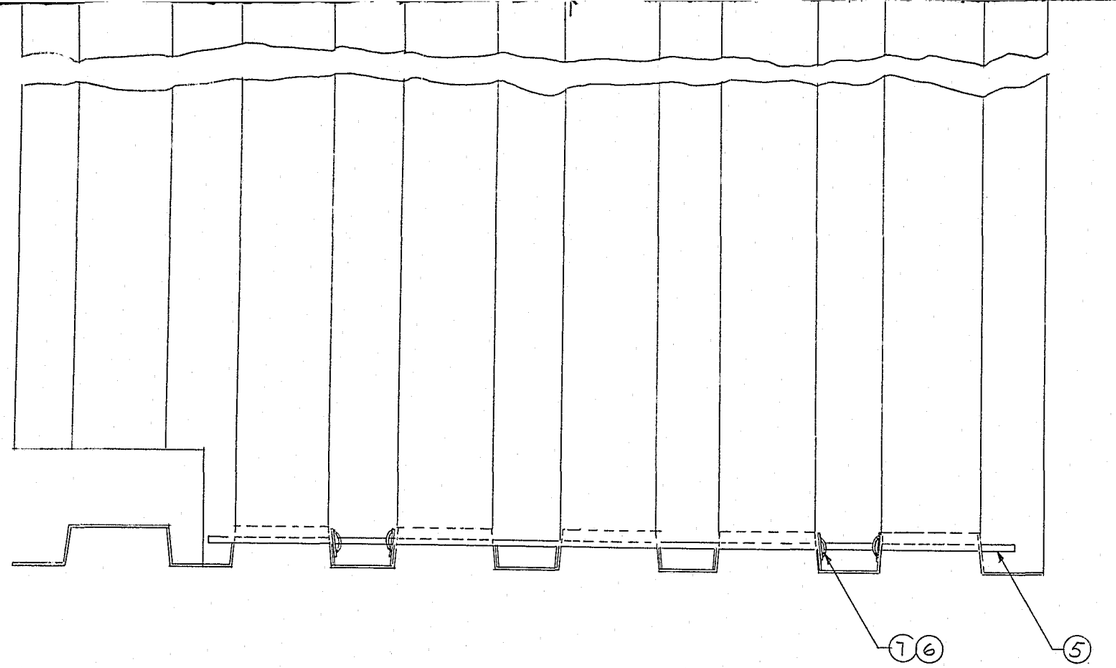
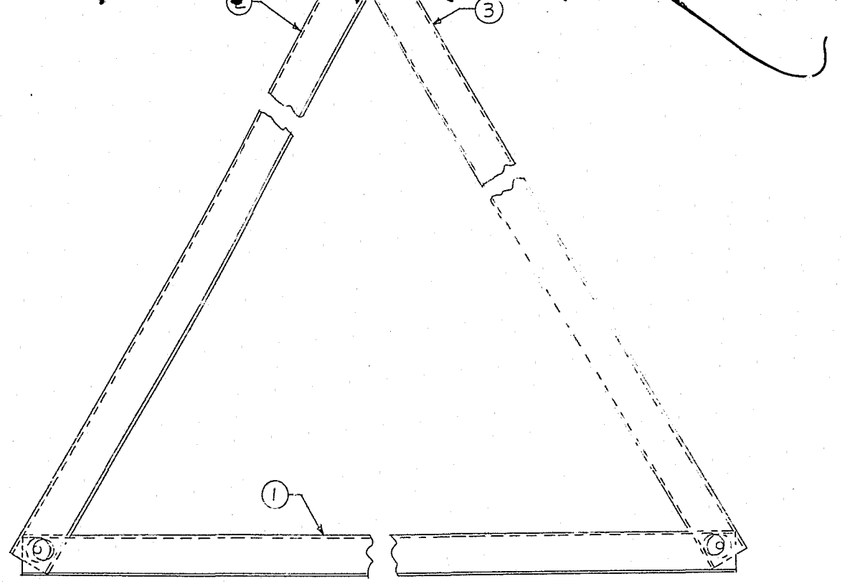
REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED









QTY	PART NO.	PART NAME	STOCK SIZE	MATERIAL	SPEC	ITEM
6		LOCK WASHER	NO. 10 SIZE	SS	COMM.	12
6		HEX NUT	NO. 10-24 UNC-2	SS	COMM.	11
6		SCREW, RD HD	NO. 10-24 UNC-2 x 3/8	SS	COMM.	10
2	NO. 19 54	CLIP	3/4 SIZE, NORTH & JUDD OR EQUAL	STEEL	COMM.	9
		BARBED WIRE, 2 PT BARB	14 GA., SINGLE STRAND, 4 FT LONG	GALV. STEEL	COMM.	8
8		WASHER, PLAIN, FLAT	3/8 DIA. SIZE x 7/32 THICK	STEEL	C.R.	7
2	C-390-017-1	STUD RECEIVER	1/4 DIA. SIZE, TINNERMAN (EATON CORP)	STEEL	SPRING	6
2	050095006-1	LOCKING ROD (BASE)				5
1	050095006-2	LOCKING ROD (TOP)				4
1	050095003-2	SIDE PANEL (SHORT)				3
1	050095002-2	SIDE PANEL (LONG)				2
1	050095001	FLOOR PANEL				1

QTY	NEXT ASSY	USED ON
APPLICATION		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS ± DECIMALS ± ANGLES ±
MATERIAL:
FINISH:
HEAT TREATMENT:

ORIGINAL DATE OF DRAWING: 26 MAR 73
DRAFTSMAN: LJM 8-30-73
CHECKER:
PROJECT ENG.:
PROJECT NO.: 07-M-73
APPROVED: DATE:

[redacted]

BAY ASSY, RIGHT HAND
U.S. ARMY LAND WARFARE LABORATORY
ABERDEEN PROVING GROUND, MARYLAND 21005

SIZE: E | CODE IDENT. NO.: 050095005 | REV.:
SCALE: 1/2 | SHEET OF

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