MISCELLANEOUS PAPER NO. 4-759

EVALUATION OF U. S. STEEL TYPE 4.5 AIR-DEK LANDING MAT

by

H. L. Green
G. L. Carr

November 1965

Sponsored by

U. S. Army Materiel Command

Conducted by

U. S. Army Engineer Waterways Experiment Station
CORPS OF ENGINEERS
Vicksburg, Mississippi

R

47

MISCELLANEOUS PAPER NO. 4-759

EVALUATION OF U. S. STEEL TYPE 4.5 AIR-DEK LANDING MAT

by

H. L. Green
G. L. Carr

November 1965

Sponsored by

U. S. Army Materiel Command
Project No. 1-V-0-21701-A-046
Task 05

Conducted by

U. S. Army Engineer Waterways Experiment Station
CORPS OF ENGINEERS
Vicksburg, Mississippi

ARMY-MRC VICKSBURG, MISS.

THE CONTENTS OF THIS REPORT ARE NOT TO BE USED FOR ADVERTISING, PUBLICATION, OR PROMOTIONAL PURPOSES. CITATION OF TRADE NAMES DOES NOT CONSTITUTE AN OFFICIAL INDORSEMENT OR APPROVAL OF THE USE OF SUCH COMMERCIAL HARDWARE OR SOFTWARE.

FOREWORD

The general authorization for this investigation is contained in Research and Development Project Card for Mobility Engineering Support, Project No. 1-V-0-21701-A-046, Task No. 05, approved June 1960. The specific authorization for conducting the test reported herein is given in letters dated 1 September and 28 September 1964, from Headquarters, U. S. Army Materiel Command (AMC) to Director, U. S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Miss.

The engineering traffic tests pertinent to this investigation were performed at WES during September 1965. Engineers of the WES Soils Division who were actively engaged in the planning, testing, analysis, and report phases of this investigation were Messrs. W. J. Turnbull, W. G. Shockley, A. A. Maxwell, W. L. McInnis, Robert Turner, Hugh L. Green, Dewey W. White, Jr., and Gordon L. Carr. This report was prepared by Messrs. Green and Carr.

Director of the WES during the conduct of this investigation and preparation of this report was Col. John R. Oswalt, Jr., CE. Technical Director was Mr. J. B. Tiffany.

CONTENTS

SUMMARY

This report describes an investigation conducted to evaluate a steel landing mat, designated U. S. Steel Type 4.5 Air-Dek. The mat which was designed and fabricated by the U. S. Steel Corp., Pittsburgh, Pa., is a sandwich structure composed of an egg-crate type configuration core bonded by adhesives on top and bottom to steel facings. The sides of the panels are joined by integral tongue-and-groove connections and secured by stainless steel pins. This investigation consisted of engineering traffic tests to obtain information for use in comparing the performance of the Air-Dek with project requirements.

The traffic tests were conducted on a prepared subgrade with a rolling wheel load simulating actual aircraft operations. These tests were conducted with a single-wheel load of 25,000 lb with tire inflation pressure of 250 psi on a mat-surfaced subgrade with a rated CBR of 4.4. Results of this investigation revealed that the Air-Dek mat sustained 330 coverages of traffic under the above-stated conditions, and the mat in test item 1 met the project requirements (200 coverages on a 4-CBR subgrade).

Results from test item 2 indicated the probability of satisfactory Air-Dek mat being produced by several variations in fabrication; however, more extensive testing would be required to obtain valid conclusions.

EVALUATION OF U. S. STEEL TYPE 4.5 AIR-DEK LANDING MAT

PART I: INTRODUCTION

Background

1. The investigation and evaluation of the landing mat described herein comprise a phase of the U. S. Army Corps of Engineers continuous program for the development of satisfactory landing mats for use as expedient surfacing materials for forward-area airfields. The engineering tests conducted on the U. S. Steel Air-Dek mat are part of a recent program designed to develop a tri-service landing mat compatible with the present-day aircraft concepts of the Army, Navy, and Air Force. With given criteria, the U. S. Steel Corp., Pittsburgh, Pa., designed and fabricated the Air-Dek in various weights and strengths. The Type 4.5 Air-Dek is evaluated in this report.

Objectives

2. The general objectives of this investigation were to evaluate both the design and the performance of the mat as fabricated to determine its suitability as expedient surfacing material for forward operating bases. The specific objectives of this investigation were to determine:

a. The service life (200 coverages minimum required) of the Air-Dek mat when placed on a subgrade having a CBR of 4 and trafficked with a 25,000-lb single-wheel load with tire inflation pressure of 250 psi.

b. The rate at which the Air-Dek mat can be placed.

Scope

3. This report describes and gives results of accelerated traffic tests conducted to evaluate U. S. Steel Type 4.5 Air-Dek. The desired data were obtained by engineer tests as follows:

a. Engineering traffic tests were conducted on a specially constructed test area to study subgrade behavior and to observe the performance of the Air-Dek under a rolling wheel load.

b. In laying the mat during the assembly of the test section, the speed of placement was recorded and the placing rate computed.

Definitions of Pertinent Terms

4. For clarity, certain terms used in this report are defined below:

Coverage. One application of the test wheel of the load cart over each point in the traffic lane.

Subgrade. The portion of the test section constructed with soil processed under controlled conditions to provide the desired bearing capacity and upon which the landing mat is placed.

CBR. The California Bearing Ratio (CBR) of the soil as measured in the field (see Corps of Engineers Test Procedure in EM 1110-45-302).

Run. A strip of landing mat equal to one panel width and extending transversely (perpendicular to direction of traffic) across the entire test section.

Deflection. Temporary bending of landing mat panels under the static load from the test wheel of the load cart.

PART II: DESCRIPTION OF MAT TESTED

5. The U. S. Steel Type 4.5 Air-Dek panel is a sandwich-type structure (photograph 1) fabricated from high-strength "Cor-Ten" steel. The core is composed of an "egg-crate" type configuration with structural members bonded together by an adhesive. The core is bonded on top and bottom to 0.025-in.-thick steel facings, with the top facing having a dimpled design for improved strength. Individual panels are approximately 4 ft square and 1.6 in. thick, and weigh 74.9 lb. Panel connections are made by use of tongue-and-groove connectors which are integral parts of the panels. The connections are secured by a total of 12 stainless steel pins per panel. The actual weight per square foot of placing area is 4.65 lb (as compared with 4.5 lb proposed in design). The top facing of the panels is coated with an antiskid compound developed by the W. P. Fuller Paint Co. Minor fabrication changes were made by variations in the adhesives in some of the panels and are described in paragraph 7. A layout of the test section is shown in plate 1.

Test Item 1

6. The traffic lane was 40 ft long and 10 ft wide and contained panels which were all fabricated using an adhesive manufactured by the Minnesota Mining and Manufacturing Co. A general view of this section is shown in photograph 4.

Test Item 2

7. The traffic lane was 24 ft long and 10 ft wide. The landing mat in this lane had three variations in fabrication. All of the mat was fabricated using an adhesive developed by the Pittsburgh Chemical Co., Pittsburgh, Pa. Three runs of mat or 12 linear feet of the traffic lane contained panels with no adhesive primer, and two runs or 8 linear feet contained panels with adhesive primer (see items 2a and 2b, respectively, in plate 1). The remaining run of mat or 4 linear feet contained panels with no adhesive primer and low-elongation steel in the bottom facing (see item 2c, plate 1). The weights per square foot of placing area for the mats without primer, with primer, and with low-elongation steel were 4.71, 4.76, and 4.97 lb, respectively.

PART III: CONTROLLED TRAFFIC TESTS

Location and Description of Test Area

8. The test area was located in a hangar-type structure to provide protection from the elements and to maintain conditions necessary for accurately controlled comparative traffic tests. The test lane, 124 ft long and 24 ft wide, was divided into two items, with a 30-ft-long approach section at each end of the lane (see plate 1). Item 1 was 40 ft long and contained regular Type 4.5 Air-Dek mat (4.65 lb per sq ft) which was of primary concern in this test. Item 2 was 24 ft long and contained special Air-Dek mat of secondary interest in which fabrication variables were employed. Panels in the traffic lane were numbered from 1 through 56 for the purpose of identifying individual panels subjected to test. After the mat was placed, the section was subjected to 8 coverages with a Bros roller loaded to 50,000 lb with 90-psi tire pressure to seat the mat.

Construction of Subgrade

9. The plan of investigation specified a uniform subgrade with an in-place CBR of 4 for a depth of 24 in. The test area was excavated to a depth of 24 in. below the final grade and was then backfilled with five 5-in.-thick (after compaction) lifts of a fat clay (CH) having an average liquid limit of 58 and an average plasticity index of 33 (see plate 2). Each lift was compacted with 8 coverages of a rubber-tired (Bros) roller with a 30,000-lb total load and 60-psi tire inflation pressure. The top 1 in. of compacted material of the fifth lift was carefully removed to provide a relatively smooth surface with no transverse grade. CBR, moisture content, and density tests were made during construction to ensure that the desired strength was obtained. Soil data are shown in table 1.

Mat Placement

10. The mats were placed on the test lane by an experienced mat placing crew of four men under the direction of a foreman. The mats were stacked alongside the test lane in opened bundles to minimize the distance panels had to be hand-carried by the placing crew. Panels were carried by hand and placed in their proper positions (see photograph 2). When the tongue and groove of a panel were properly positioned, the pin holes were aligned and the pins inserted by hand to maintain alignment during mat placement and to prevent separation under traffic. The panels were placed in a pattern of staggered joints in the direction parallel to traffic with continuous joints perpendicular to traffic (see plate 1).

11. The 5-man crew placed 720 sq ft of mat in 30 min for an average placing rate of 288 sq ft per man-hour.

Skid-Resistance and Tire-Wear Tests

12. Tire-wear and skid-resistance tests were not run on this mat because of the limited quantity of mat available and because this type data was previously obtained on Air-Dek mat of similar design having a similar type antiskid coating. The previous tests were conducted on both dry and wet surfaces with the following results:

Condition of Mat Surface	Length of Pull, ft	Total Wt on Two Locked Wheels, lb	Force Required to Maintain Motion, lb	Deg of Tire Wear	Coefficient of Friction
Dry	13	20,000	12,000	Moderate	0.60
Wet	13	20,000	8,800	Slight	0.44

Traffic Tests

Test vehicle and method of testing

13. The mats were subjected to accelerated traffic in a lane 10 ft wide in the center of the test lane as shown in plate 1. The traffic was applied with a specially designed runway load cart (photograph 3) utilizing a 25,000-lb single-wheel load with a tire inflation pressure of 250 psi. A 30.00-11.5, 24-ply tire with a contact area of 111.1 sq in. and an average contact pressure of 225 psi was used. Traffic was applied to simulate the traffic distribution pattern that would be encountered in actual aircraft takeoffs and landings. This pattern approaches a normal distribution curve.* The test lane was trafficked by starting at one side of the test lane, driving the load cart forward and then backward in the same path for the length of the traffic lane, and shifting the path of the cart laterally 10 in. (the width of a tire print) on each successive forward trip, thus producing 2 coverages of the entire traffic lane when the load cart maneuvered from one side of the traffic lane to the other. The interior 100 in. of the traffic lane was then trafficked for 6 additional coverages. The longitudinal center 60 in. of the traffic test lane received 2 additional coverages for a total of 10 coverages. The net result was that the longitudinal center 60-in.-wide strip of the traffic lane received 100 percent of the traffic, while the two 20-in.-wide interior strips received 80 percent and the two 10-in.-wide edge strips received only 20 percent (see plate 3). This pattern of traffic application was repeated until failure occurred.

---

* See U. S. Army Engineer Waterways Experiment Station, CE, Miscellaneous Paper 4-369, Study of Lateral Distribution of Aircraft Traffic on Runways (January 1960) and U. S. Army Engineer Waterways Experiment Station, CE, Technical Memorandum 3-426, Study of Channelized Traffic (February 1956).

Types of data obtained

14. Subgrade density, water content, and in-place CBR measurements were taken prior to traffic testing, at intervals throughout the test period, and at the conclusion of traffic as shown in table 1. The soil test locations are shown in plate 1. These tests were made at the surface of the subgrade and at depths of 6, 12, and 18 in. below the surface, with a minimum of three values being obtained at each depth. Static deflections of the mats at various locations were measured under the load wheel, and results are shown in plate 4. Level readings of cross sections and profiles were taken prior to, at intervals during, and at the conclusion of traffic to measure permanent deformation of the section and to reveal the development of roughness (see plates 5 and 6). Visual observations of the mat and subgrade behavior and other relevant factors were recorded throughout the period of traffic and were supplemented by photographs.

Behavior of Items Under Traffic

Item 1

15. The traffic lane in item 1 was surfaced with regular Type 4.5 Air-Dek in which a commercial adhesive produced by Minnesota Mining and Manufacturing Co. was used in fabrication. Prior to application of traffic, the rated subgrade CBR was 4.4 (table 1) and the surface of the mat was generally smooth (photograph 4).

16. After 80 coverages, it was observed that small cracks had developed in the surface of panels 13, 20, 27, and 34 (photograph 5). A summary of mat breaks is shown in table 2.

17. After 100 coverages, the surface of the mat remained smooth and the performance was satisfactory (photograph 6). At this time the corners of panels 23 and 24 were protruding up approximately 1/8 in. and the length of the cracks at the pin holes had increased slightly.

18. At 140 coverages, a crack was observed in panel 5 at a pin hole, an additional crack had developed in the facing of panel 34, and the original crack in panel 34 had increased to a length of 1-1/2 in. At this point in the test, soil was being extruded up through the joints in several locations; however, the mat continued to perform satisfactorily.

19. At the completion of 190 coverages, the crack in panel 34 had increased to 5 in. (see photograph 7) and cracks had developed in panels 4, 16, 17, 19, 28, 33, and 35, making a total of 19 cracks in 13 panels (see table 2). A general view of the test section after 200 coverages is shown in photograph 8, and a close-up of panel 17 is shown in photograph 9.

20. As traffic continued the cracks in the panels progressed, and at 300 coverages a crack had progressed across the full width of panel 17 (see photograph 10) and the core along the edge of panel 16 had failed in

compression (see photograph 11). Panels 16 and 17 were removed at this time. A general view of the section is shown in photograph 12.

21. Traffic was concluded at completion of 330 coverages as panels 31 and 34 failed (see photograph 13) because breaks had increased to the point of producing tire hazards. A general view of the section at failure is shown in photograph 14.

22. Static deflection measurements were made with the load wheel at the center of a panel, at the center of a joint between two panels, and at the corner of two panels adjacent to the center edge of a third panel (plate 4). The maximum deflection prior to traffic was 0.6 in. and occurred at the center of a joint between two panels. The maximum increase in deflection from beginning of traffic until end of test was 0.1 in. The maximum change in cross section and profile measurements from the beginning of traffic to completion of 330 coverages was 0.4 in. and 0.7 in., respectively (plates 5 and 6).

Item 2

23. The traffic lane in item 2 was surfaced with Air-Dek fabricated with minor design changes as described in paragraph 7, resulting in three test variables.

24. Photograph 15 shows the completed test section in item 2 just prior to traffic. Traffic was applied as described in paragraph 13 to the center 10 ft of the test section. Deflections of the mat under the load wheel were recorded at three locations on the panels at 0, 20, 40, 100, 200, and 330 coverages. The deflection curves are shown in plate 4. Cross sections and center-line profiles were also made at the completion of various coverage levels and are shown in plates 5 and 6.

25. The mat performed satisfactorily during the first 80 coverages on item 2. During this period of traffic the corner joints of panels 41, 44, and 45 began to rise slightly (approximately 1/16 in., see photograph 16). However, the overall surface of the section was relatively smooth. At 100 coverages, cracks were observed at the pin holes in panels 40, 47, and 48. During this phase of traffic a slight increase in roughness was observed as the load cart passed over end joints. The raised corners had increased to a maximum of 1/8 in. A general view of item 2 at this time is shown in photograph 17.

26. At 140 coverages, two additional panels (panels 41 and 44) contained cracks at pin holes on the top facing. The cracks started at the holes and progressed toward the edge of the panel; then as additional traffic was applied the crack began on the opposite side of the hole and progressed toward the center of the panel. All cracks were in the concentrated traffic area and parallel to the direction of traffic.

27. The adhesive bond between the top facing and the core in panel 48 began to fail at 190 coverages. There were numerous cracks at pin holes in panels 42, 51, and 55 and the raised corners on panels 41, 44, and 45 had increased to 3/16 in. At 200 coverages, the adhesive

failure in panel 48 was extended to an area of a circle 10 in. in diameter. The overall section remained relatively smooth at this time as shown in photograph 18. Panel 48 was removed and repaired at 206 coverages due to core-to-facing bond failure.

28. After 300 coverages of traffic on item 2, all mats with the Pittsburgh Chemical adhesive without primer were still serviceable; however, five panels were approaching failure (see photograph 19). The core along the edges of panels 37, 38, and 41 had crushed for a width of approximately 2 in. The mats containing the Pittsburgh Chemical adhesive with primer had one panel failed (panel 48) and one (panel 47) with two 6-in. cracks at completion of 300 coverages. The panels with low elongation and no primer in item 2 performed satisfactorily up to 300 coverages; however, panels 55 and 56 both had facing damage on the edges located adjacent to the approach area. Panels in this section were slightly heavier than the other two types of panels in this item.

29. An additional 30 coverages were placed on the test section giving a total of 330 coverages on item 2 before the section was considered failed. The following panels were considered failed at the end of trafficking: panels 37, 38, 40, 41, 44, and 48. Photograph 20 shows a general view of the section at failure. A close-up of typical panel failure is shown in photograph 21. This photograph shows facing shear across the entire length of one panel and crushed core is evident on adjacent panels.

30. A CBR pit in the traffic lane under panel 43 prior to traffic showed the CBR at that location to be 4.3. A pit was taken under panel 48 after failure at 206 coverages and indicated a CBR value of 4.8. However, a CBR pit taken under a failed panel (panel 41) at 330 coverages showed a value of 4.1.

31. Maximum deflections recorded were only 0.9 in. and occurred at zero coverages. The change in maximum deflections from before traffic to after 330 coverages was approximately 0.2 in. The changes in the cross section and center-line profile from beginning of traffic to end of test were approximately 0.4 and 0.6 in., respectively (see plates 5 and 6).

Mat Removal

32. After completion of tests, the panels were disassembled, removed from the test lane, and inspected. There were no failures of any type on the bottom skins of the panels. Panels that were not in the traffic lane were removed with very little difficulty; however, the panels in the traffic lane were deformed, and with soil in the connecting edges were very difficult to remove. Some of the connector pins could not be removed and were driven through the bottom plate. In forcing the panels apart, approximately 25 percent of the panels were damaged along the edge connectors and on the top sheet where the sheet turns down along the connector edges.

PART IV: ANALYSIS OF RESULTS

Item 1

33. The mat sustained 330 coverages of traffic before failure, utilizing 10 percent mat replacement during the traffic tests, on a rated subgrade CBR of 4.4. The service life, load-carrying capacity, and other criteria are given in the test objectives (paragraph 2a). Using the data obtained from the tests of the Air-Dek mat in the CBR equation*, it is determined that the Air-Dek mat would sustain 245 coverages of the test load and tire pressure on a subgrade having a CBR of 4 (see plate 7) which exceeds the coverage requirement by 22.5 percent. However, the actual weight of 4.65 lb per sq ft exceeds the desired weight of 4.0 lb per sq ft by 18 percent. There was no adhesive failure observed prior to a structural failure during the traffic testing of item 1.

34. From the performance of the mat under traffic, it is concluded that the adhesive, when properly applied and cured, will produce adequate properties for the mat design criteria. The tongue-and-groove connectors and connector pins performed satisfactorily in traffic tests. The placing rate of 288 sq ft per man-hour is below the required rate of 400 sq ft per man-hour.

Item 2

35. The performance of item 2 was very similar to that of item 1. There was one adhesive failure (panel 48) in the mats bonded using a primer. Indications were that the panels would perform satisfactorily as fabricated. However, with the limited number of panels tested in each case, no firm conclusions can be drawn from the results of test item 2. It should be pointed out that the low-elongation steel panels (panels 54, 55, and 56) were the heaviest panels tested and were probably tested on the highest CBR since they were placed at the end of the prepared subgrade (plate 1).

36. Arresting-hook landing tests on the Air-Dek mat are to be conducted in the near future. These tests are normally performed on new mat. However, because of the tendency for the corners of the Air-Dek panels to protrude up after traffic (paragraph 25), the test should also be performed on panels which have been subjected to traffic.

37. A majority of the defects which occurred in the panels during the traffic tests initially developed as cracks at the pin holes in the

---

* See U. S. Army Engineer Waterways Experiment Station, CE, Instruction Report 4, Developing a Set of CBR Design Curves (November 1959).

top facings. Since the holes are evidently areas of stress concentration, reinforcement of the facing at the pin holes or relocation of the pin holes would probably correct this defect.

PART V: CONCLUSIONS

38. From this investigation of the U. S. Steel Air-Dek landing mat, the following conclusions are drawn:

a. The Air-Dek landing mat when placed on a minimum CBR of 4 will support in excess of 200 coverages of a 25,000-lb single-wheel load with tire pressure of 250 psi (plate 7).

b. The bond between the facings and core material provided sufficient shear strength between facing and core to carry the rolling wheel load.

c. The tongue-and-groove connectors allowed placement of the panels at the rate of 288 sq ft per man-hour.

It is probable that satisfactory Air-Dek mat can be produced by several variations in fabrication; however, conclusive proof of this would require more extensive testing.

Table 1

Summary of CBR and Density Data

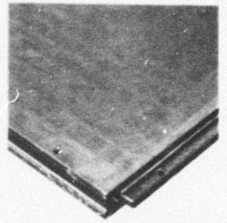
Station No.	Depth in.	WC, % Dry Wt	Dry Density lb/cu ft	CBR	Remarks
		0 Coverages			
		Panels 7, 10, and 11			
2+34	Surface	25.1	96.0	3.7	
	6	24.6	97.7	5.6	
	12	27.6	92.3	3.2	
	18*	25.8	94.9	4.9	
	Average	25.8	95.3	4.2	
		Panel 15			
2+42	Surface	26.7	93.1	2.7	
	6	24.8	97.2	5.4	
	12	25.6	96.7	5.1	
	18*	27.0	93.1	4.0	
	Average	25.7	95.7	4.4	
		Panel 35			
2+65	Surface	25.8	94.8	4.8	
	6	25.2	96.9	5.2	
	12	26.8	93.9	4.0	
	18*	25.5	95.9	4.7	
	Average	25.9	95.2	4.7	
		Panel 43			
2+75	Surface	25.7	94.9	3.4	
	6	25.3	96.3	4.9	
	12	25.0	96.7	4.5	
	18*	27.1	92.7	4.4	
	Average	25.3	96.0	4.3	
		206 Coverages			
		Panel 48			
2+80	Surface	26.1	97.1	5.4	CBR pit taken under failed panel.
	6	25.0	96.6	4.8	
	12	25.3	95.0	4.1	
	Average	25.5	96.2	4.8	
		300 Coverages			
		Panels 16 and 17			
2+44	Surface	26.5	95.3	3.6	CBR pit taken under failed section at 300 coverages.
	6	25.8	97.4	4.0	
	12	25.9	95.5	4.3	
	Average	26.1	96.1	4.0	
		Panel 27			
2+55	Surface	27.1	95.1	4.3	CBR pit taken under unfailed panel.
	6	25.5	96.3	5.0	
	12	25.5	96.4	4.5	
	Average	26.0	95.9	4.6	
		330 Coverages			
		Panel 41			
2+71	Surface	27.2	96.0	4.4	CBR pit taken under failed panel at 330 coverages.
	6	26.5	94.7	4.1	
	12	27.1	94.5	3.8	
	Average	26.9	95.1	4.1	

* Readings at 18-in. depth not used in computing average.

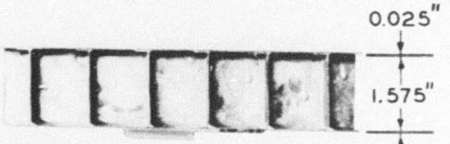
Table 2

Occurrence of Traffic Damage to Panels

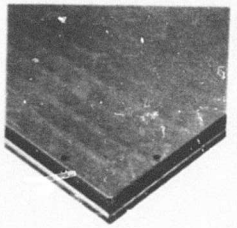
Panel Number	Type Damage	Coverages
	Item 1	
13, 20, 27, 34	Cracks at pin holes	80
6	Cracks at pin holes	100
23, 24	Raised corners	100
34	Crack in facing	140
5	Cracks at pin holes	140
17	Cracks in facing	190
9, 16, 19, 28, 33, 35	Cracks at pin holes	190
16	Core crushed along edge	300
30, 31	Facing bent along edge	314
	Item 2	
41, 44, 45	Raised corners	20
40, 47, 48	Cracks at pin holes	100
41, 44	Cracks at pin holes	140
48	Core-to-facing bond failure	190
42, 51, 55	Cracks at pin holes	190
37, 38, 41	Crushed core along edge, 2 in. wide	300
55, 56	Facing damage along edge	330



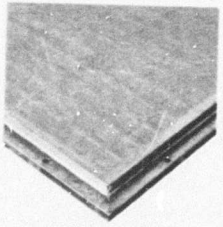
GROOVE & TONGUE
CONNECTORS



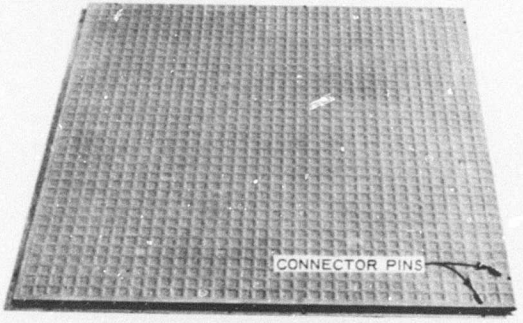
PROFILE



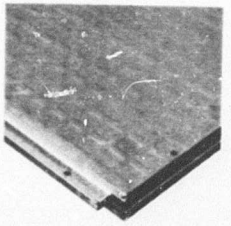
GROOVE
CONNECTORS



TONGUE
CONNECTORS



PLAN OF PANEL
NOMINAL DIMENSIONS
4'-0 3/4" X 4'-0 3/4"



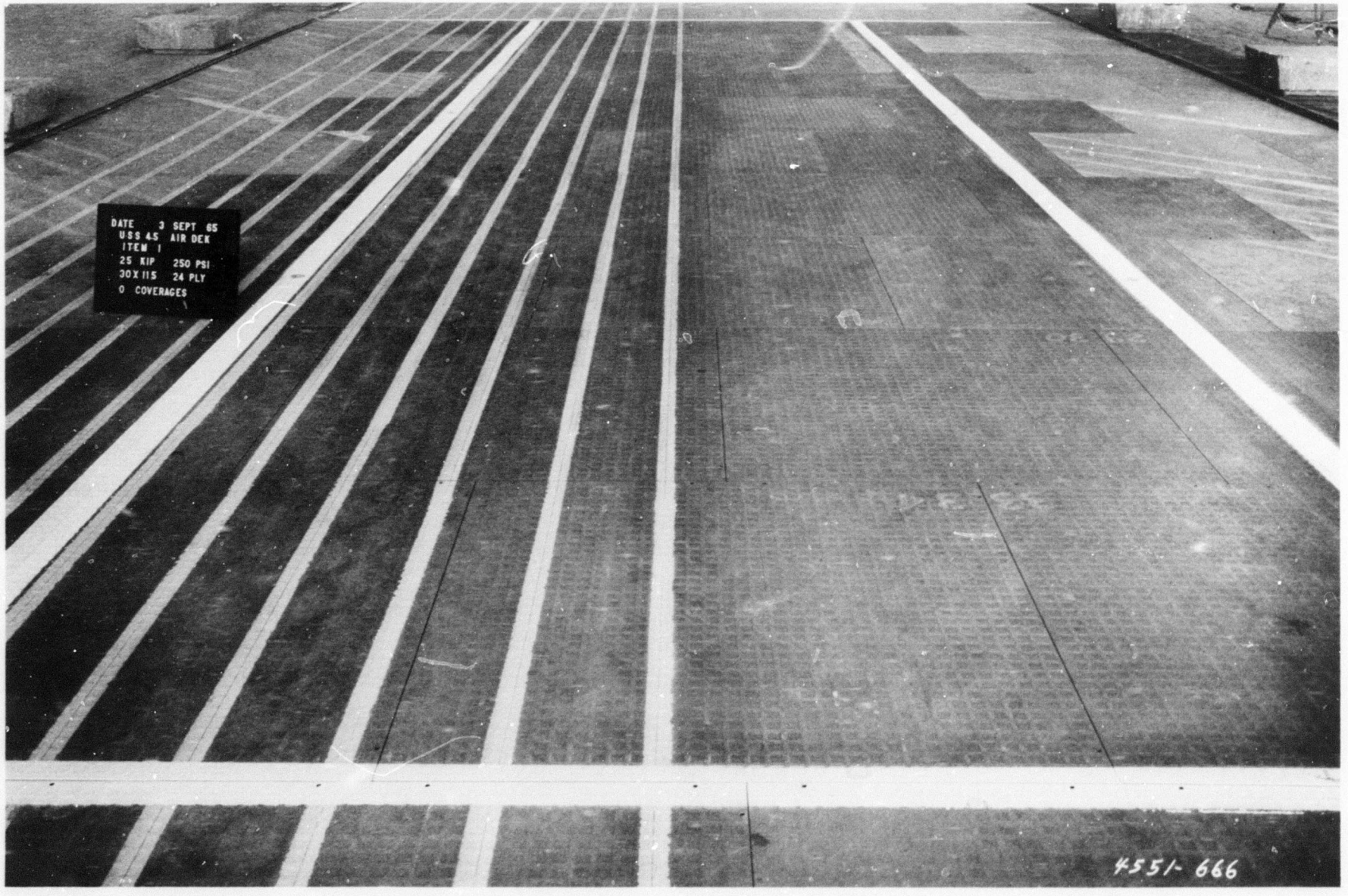
TONGUE & GROOVE
CONNECTORS

U.S. STEEL 4.65 LB / SQ FT LANDING MAT

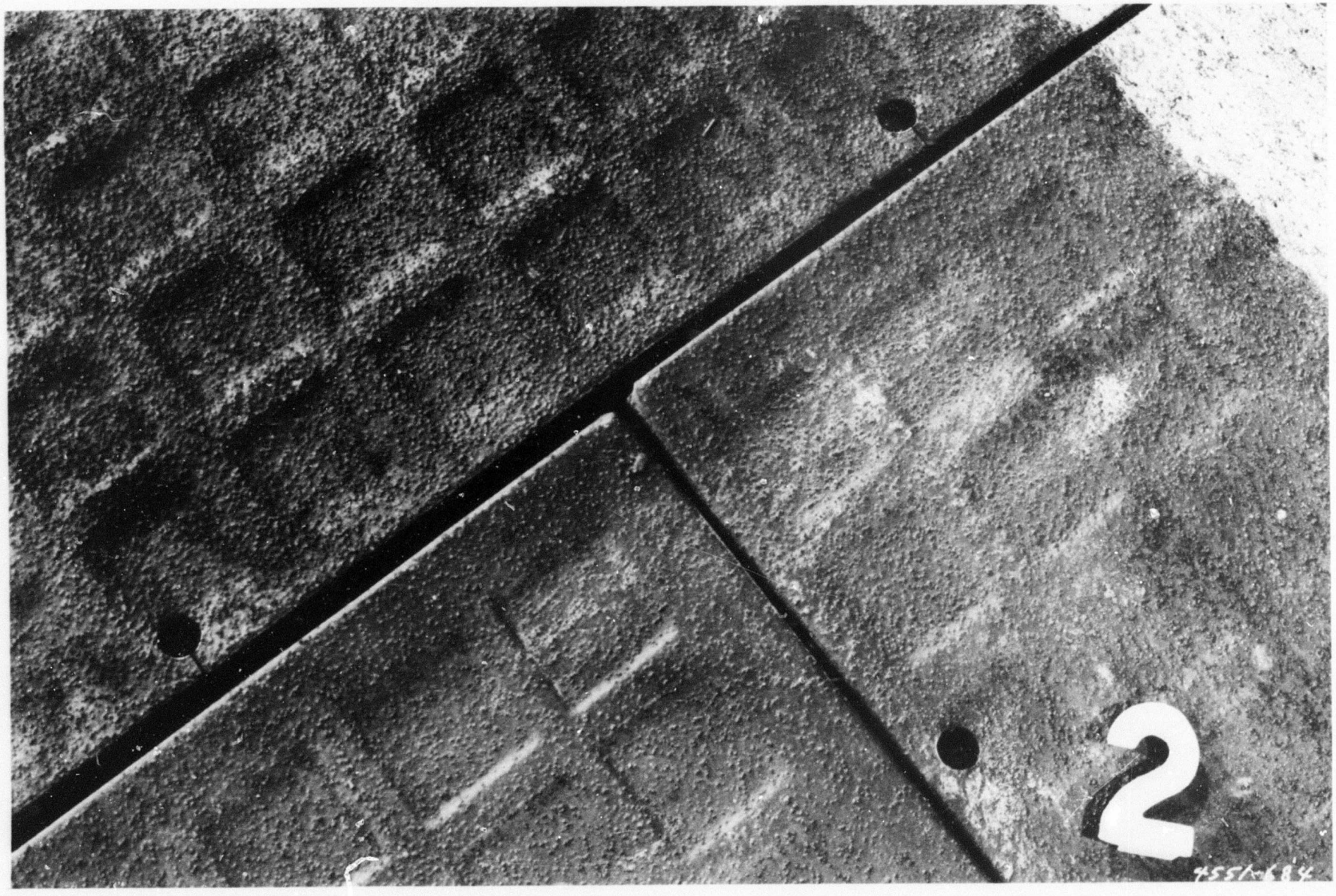
Photograph 1. Composite view of U. S. Steel Air-Dek landing mat

Photograph 2. Individual panels being assembled to form test section

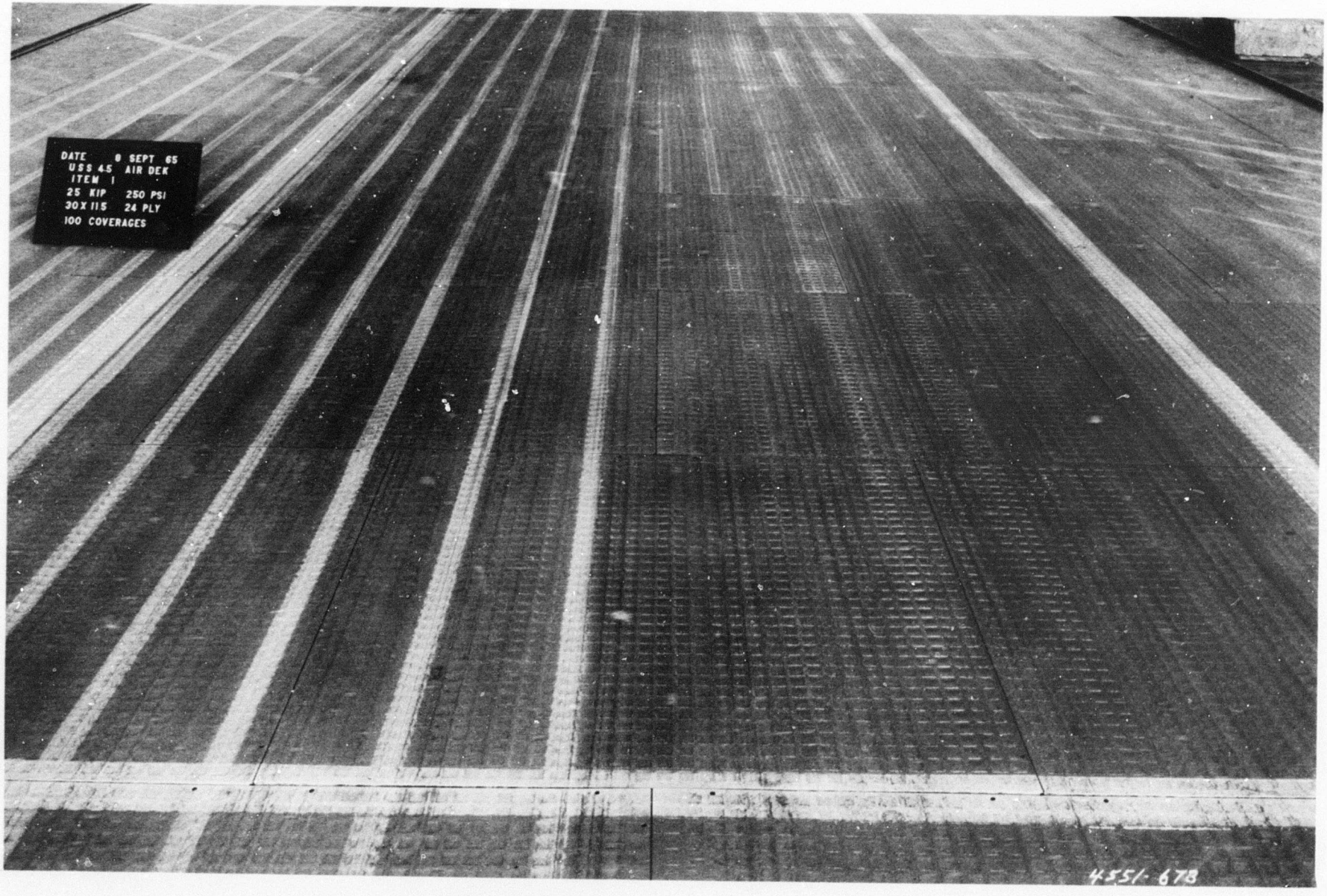
Photograph 3. Load cart used in traffic tests; 25,000-lb single-wheel load, 250-psi tire pressure, and 111.1- sq-in. tire contact area



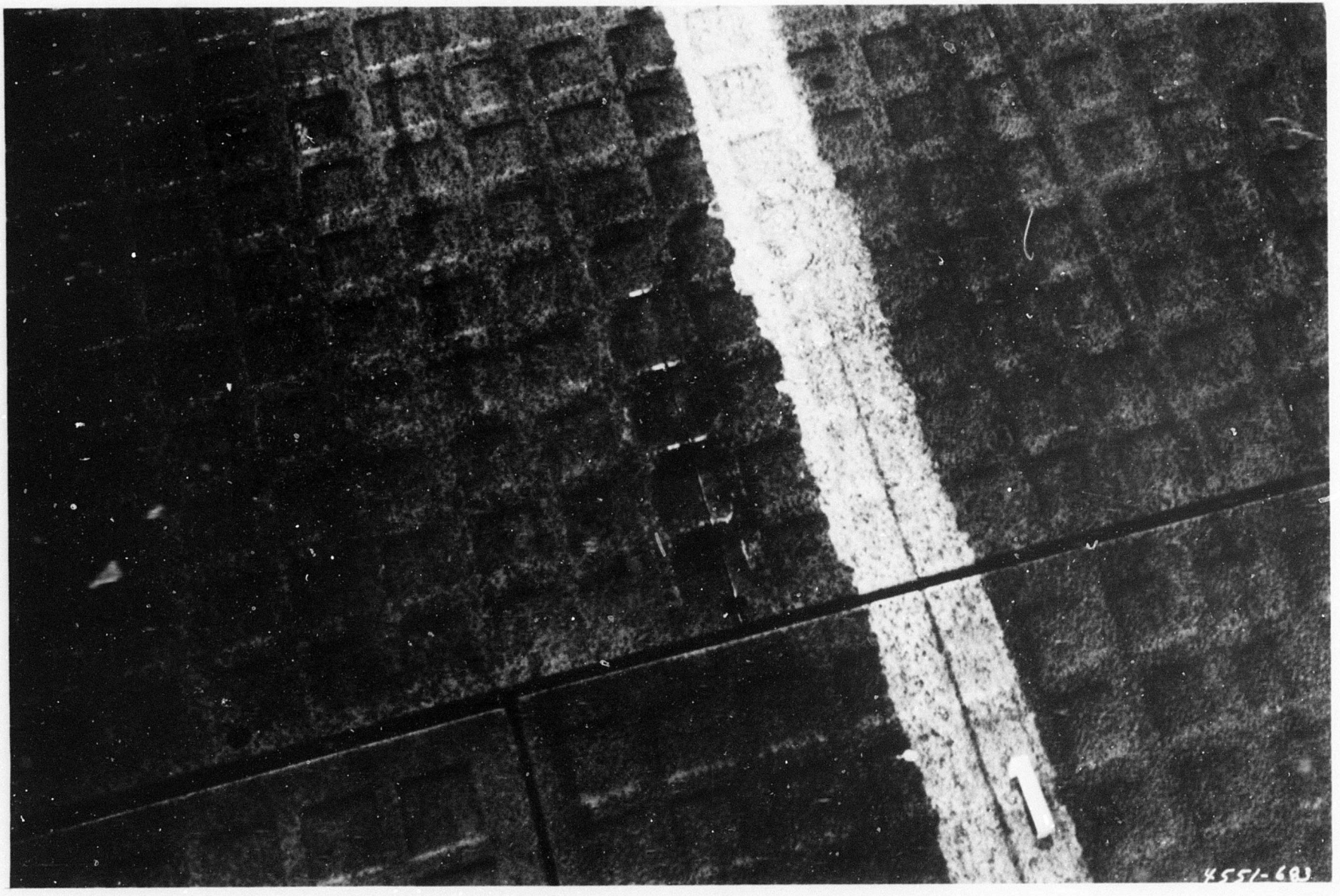
Photograph 4. Overall view of test section showing item 1 prior to traffic



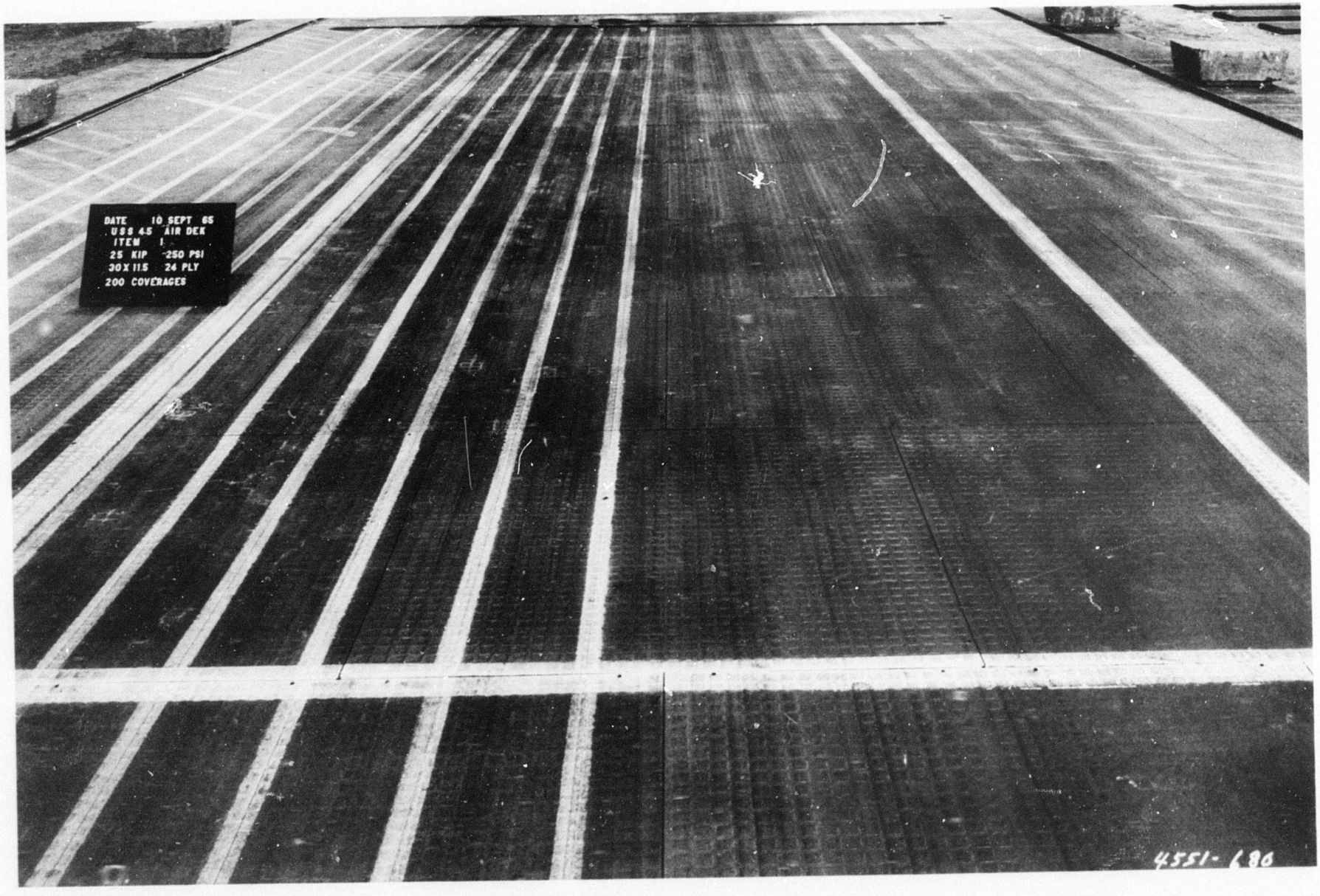
Photograph 5. Shear developing at pin holes in panel 27 in item 1 after 80 coverages



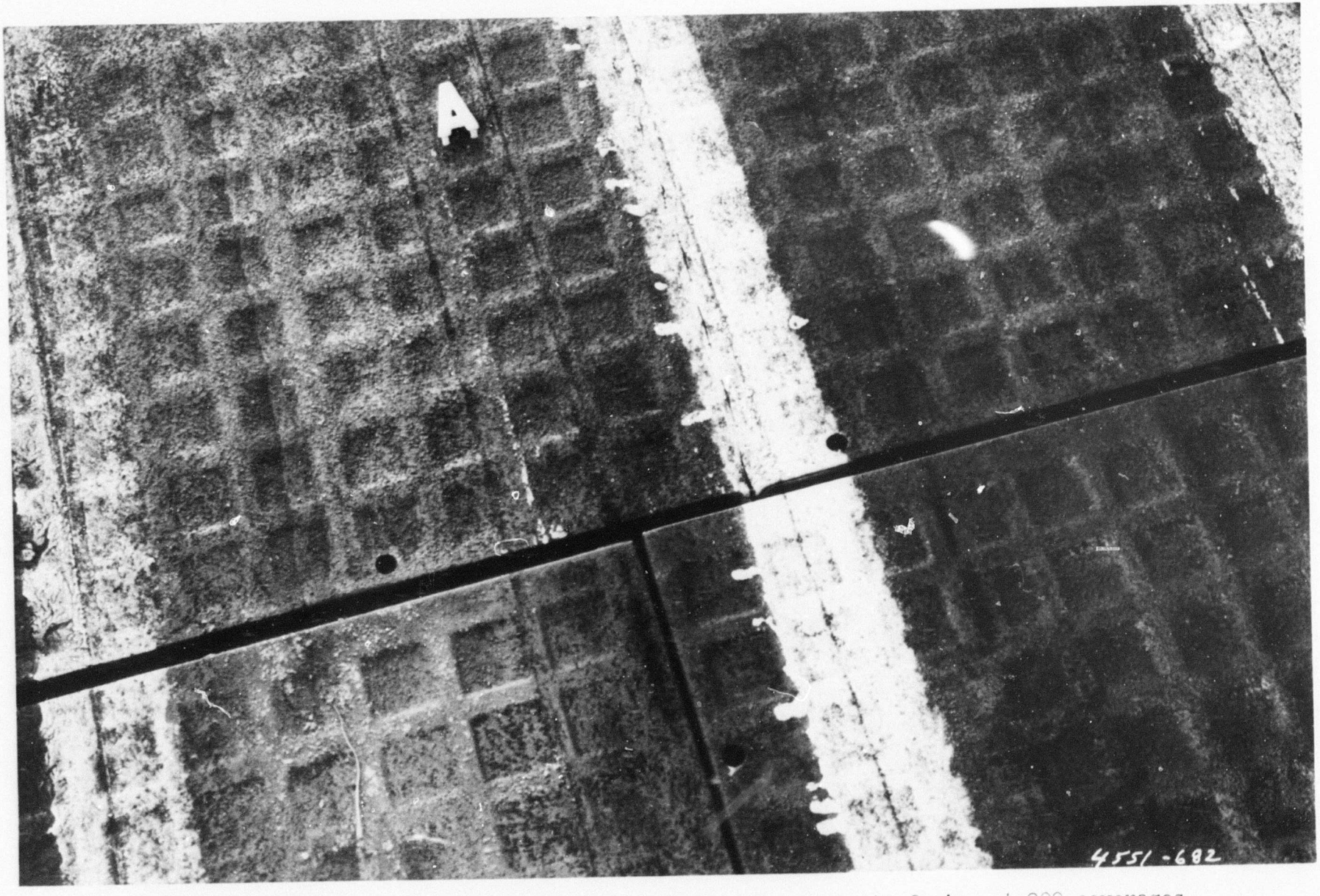
Photograph 6. Item 1 after 100 coverages



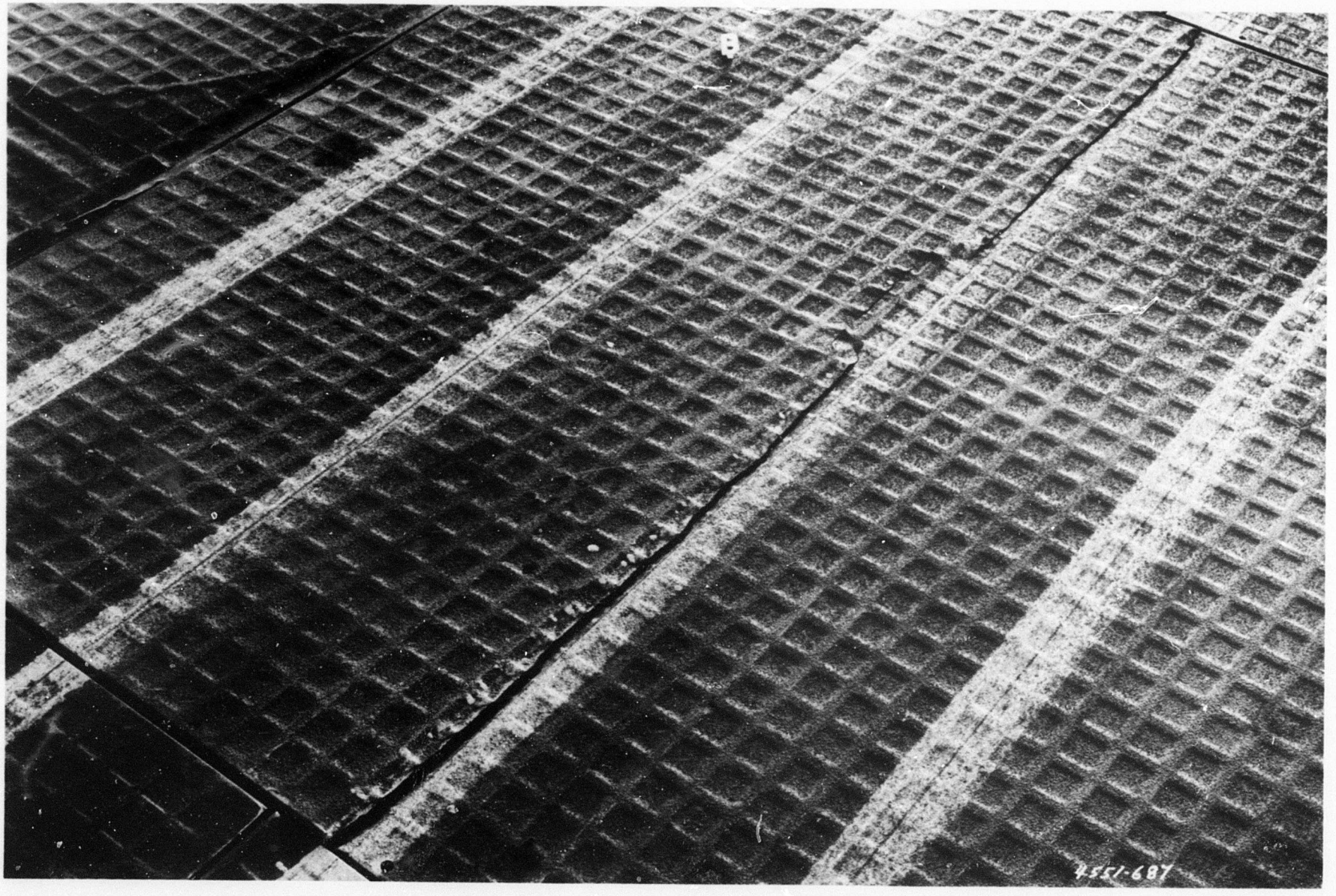
Photograph 7. Shear in facing beginning at rivet hole in panel 34 in item 1 at 190 coverages



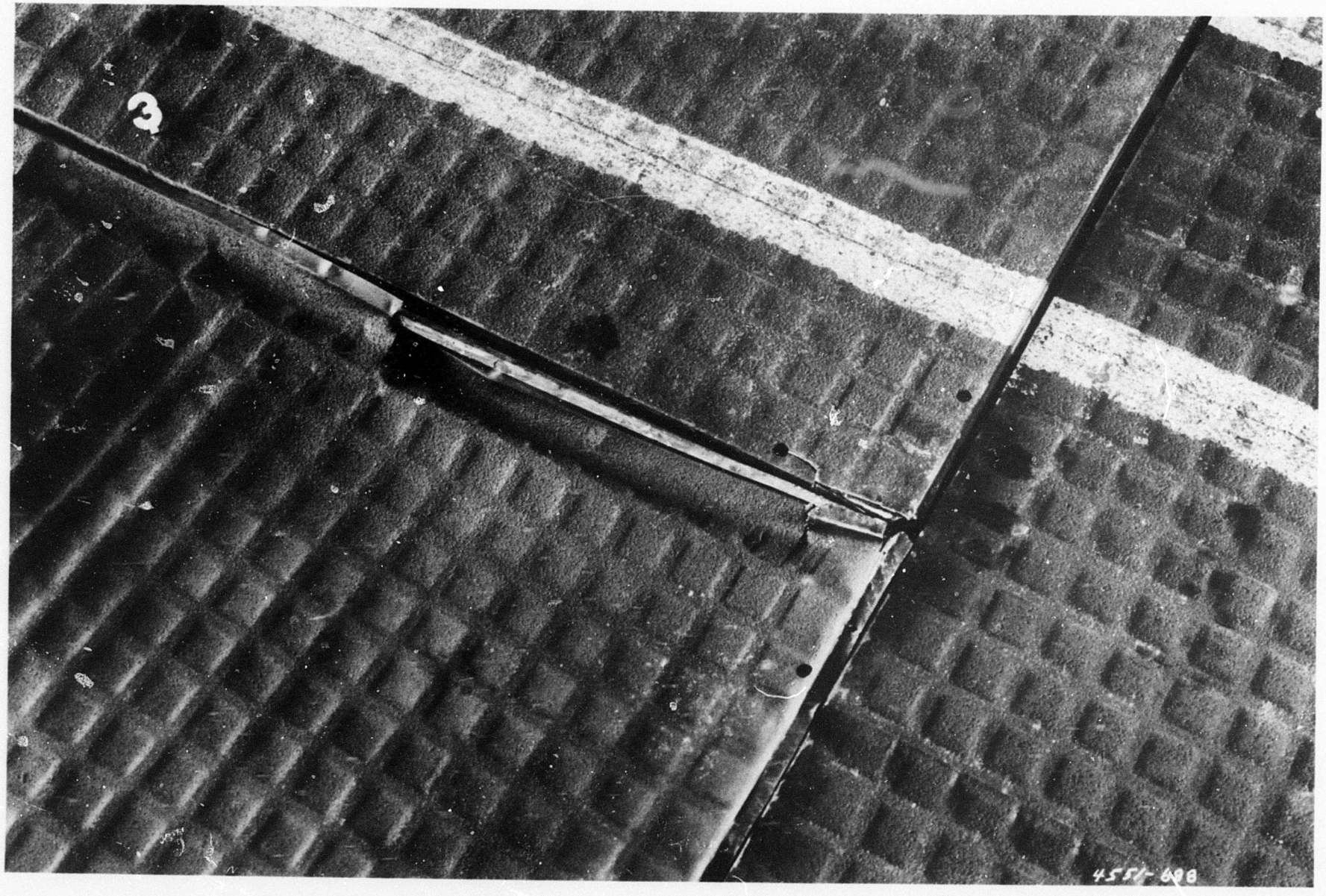
Photograph 8. Item 1 after 200 coverages



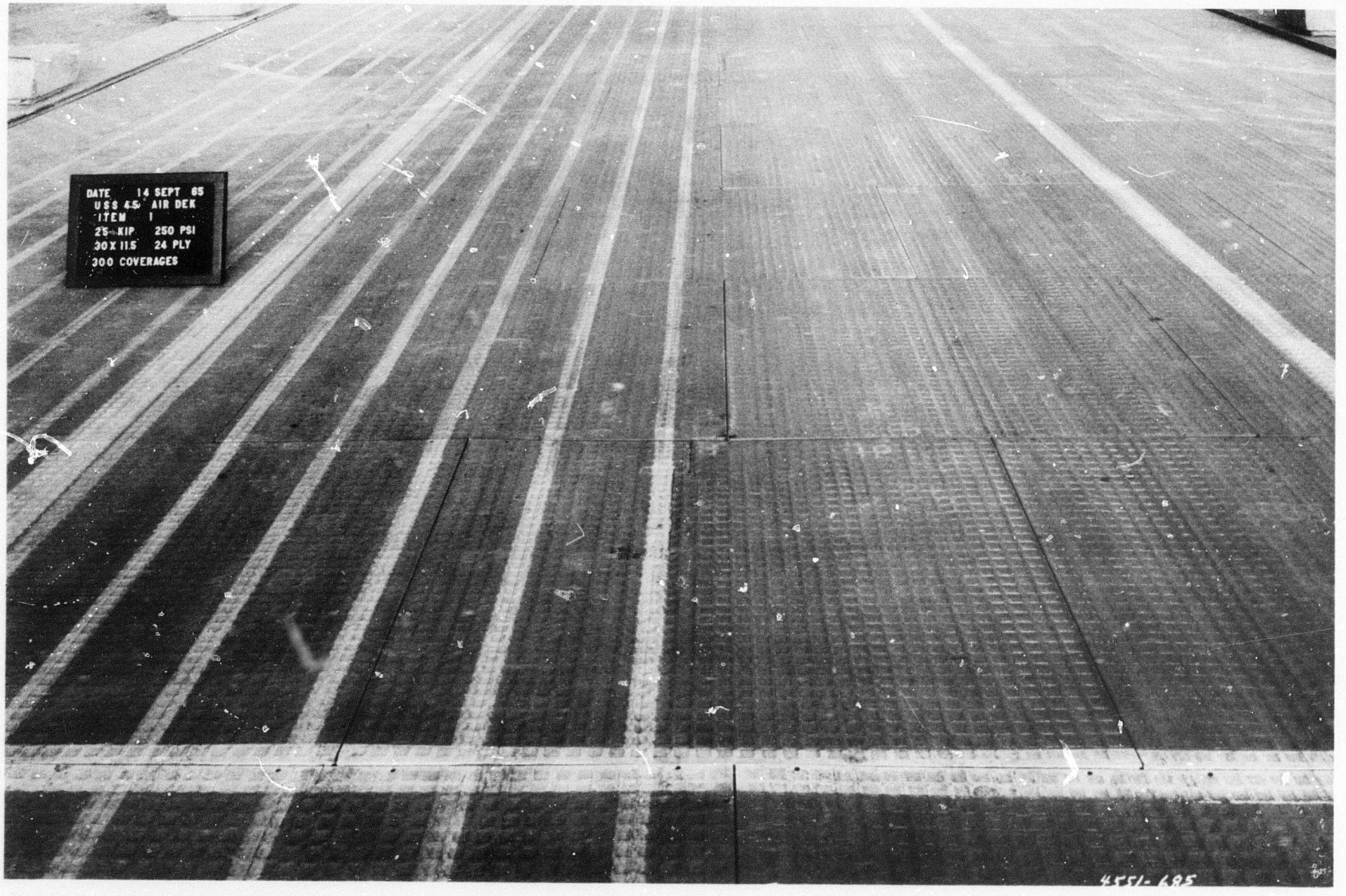
Photograph 9. Close-up of panel 17 in item 1 showing shear in facing at 200 coverages



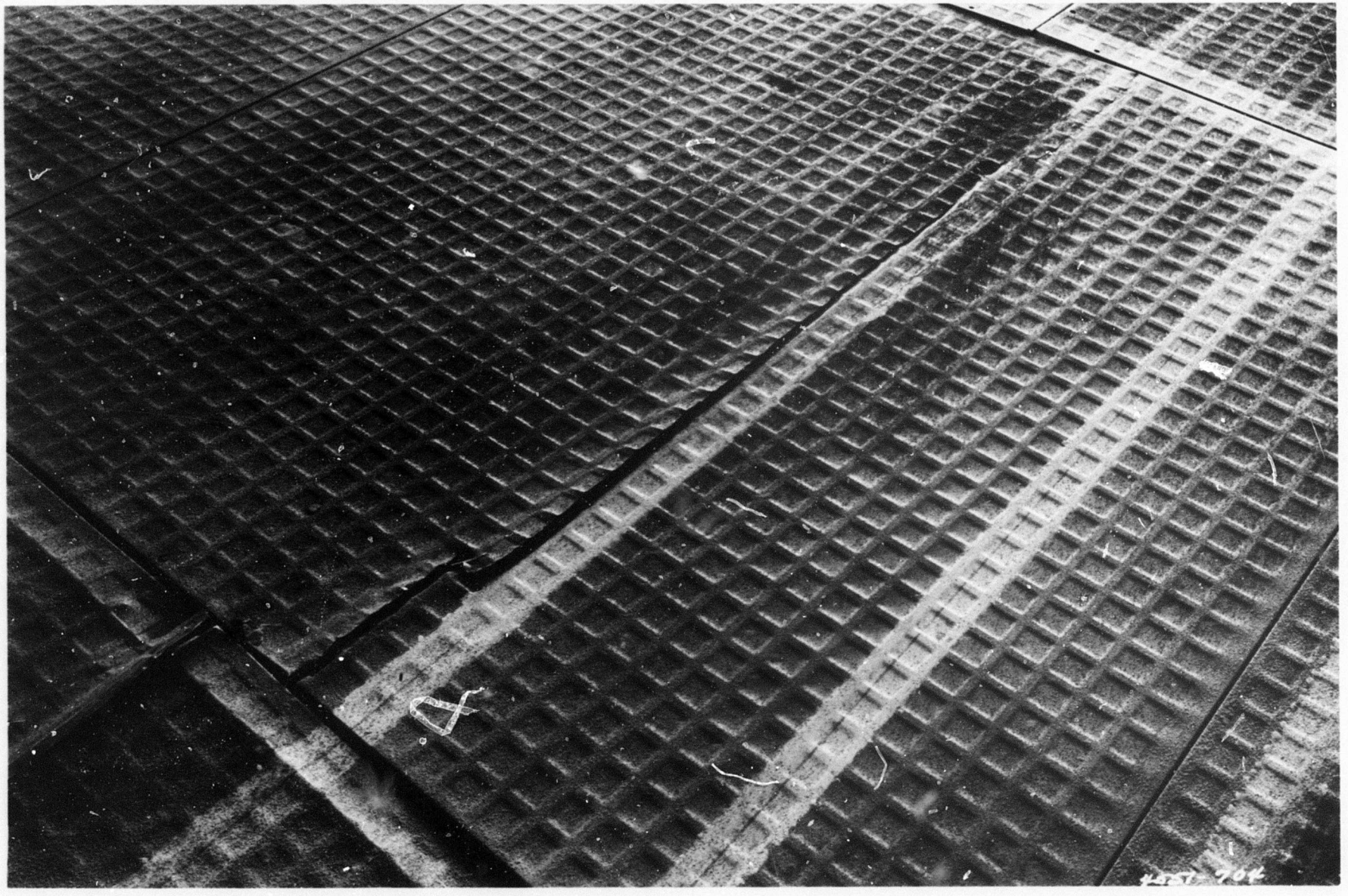
Photograph 10. Panel 17 in item 1 showing failure after 300 coverages



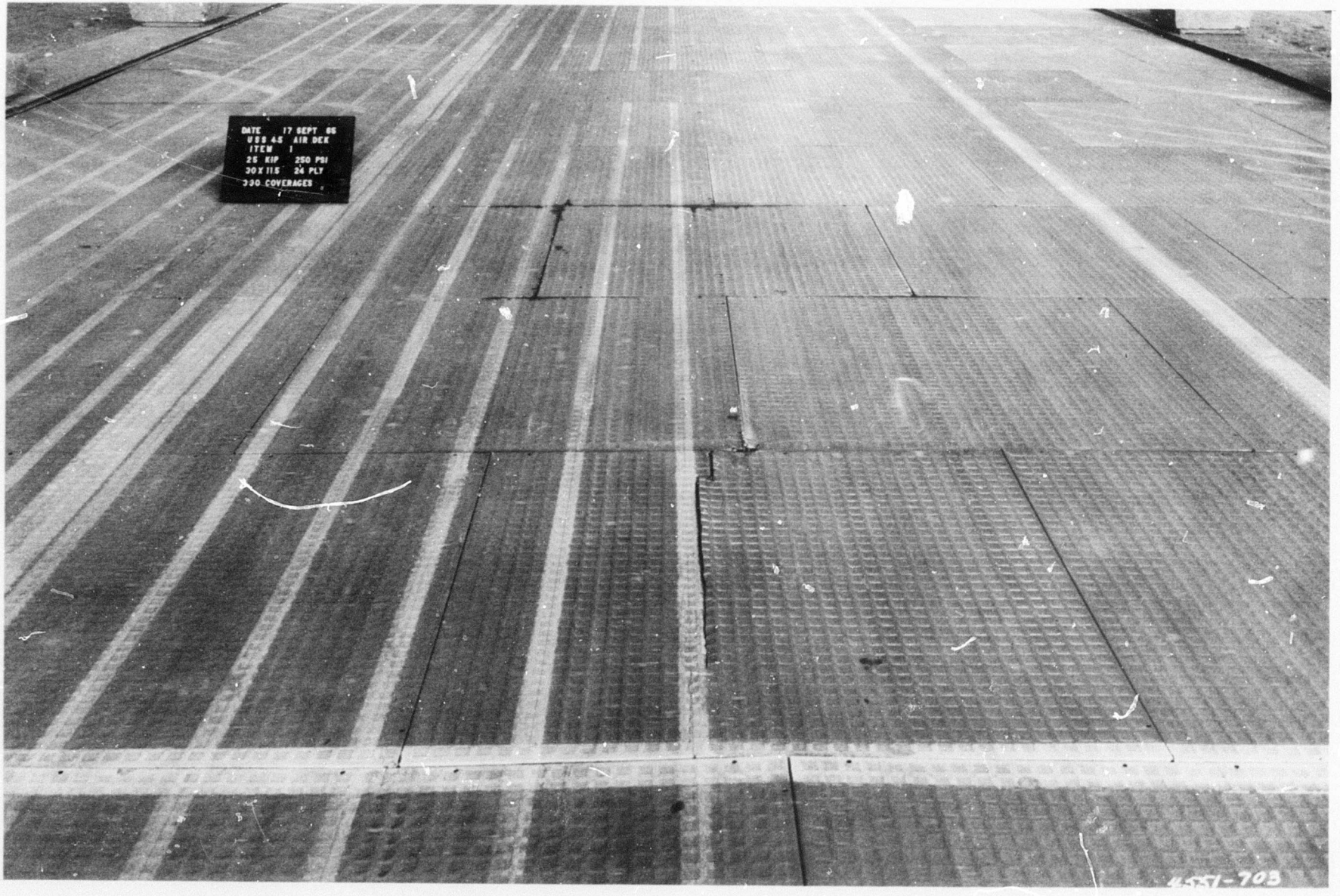
Photograph 11. Close-up of failure of panel 16 in item 1 after 300 coverages



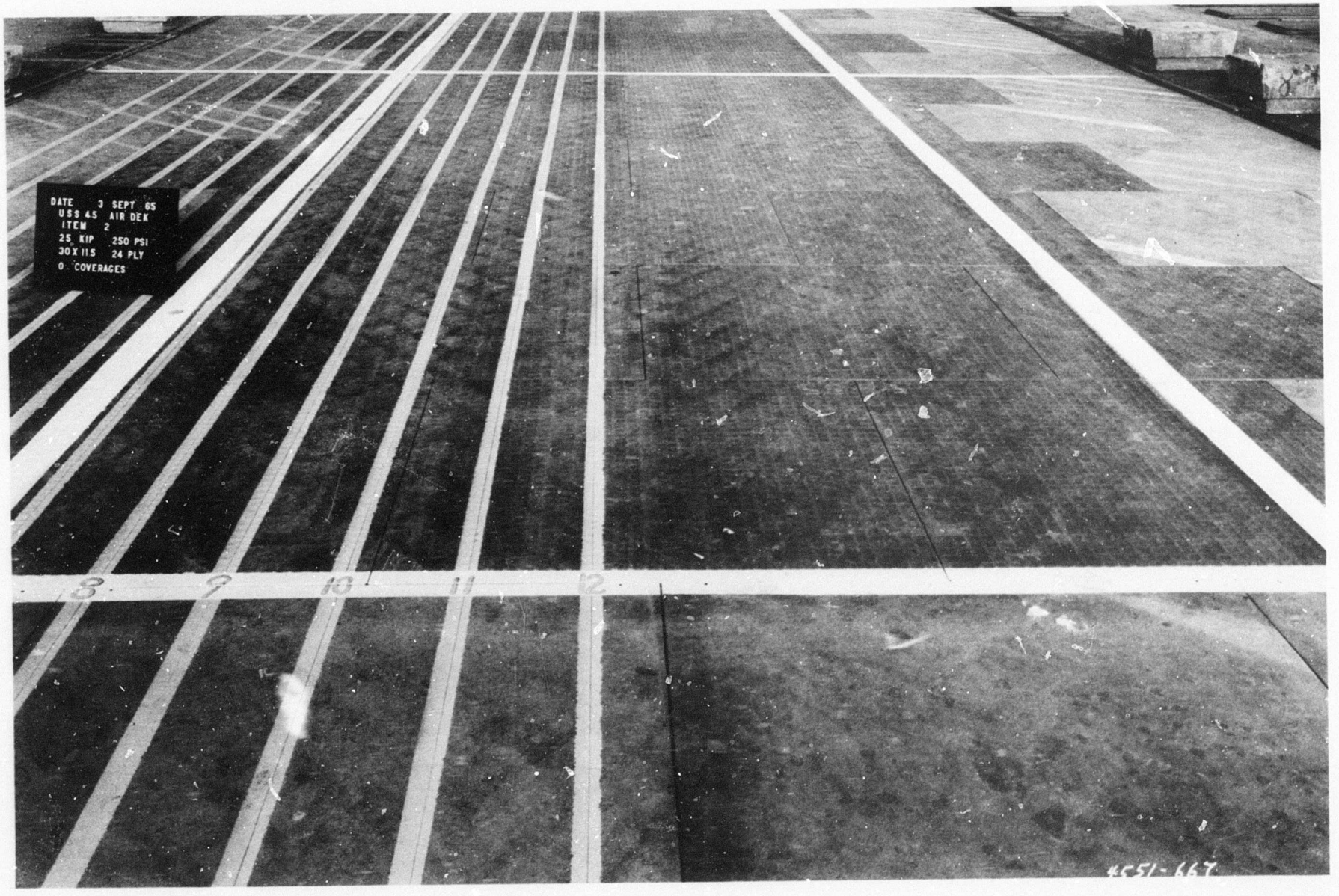
Photograph 12. Overall view of item 1 after 300 coverages. Note crack in top facing of panel in foreground



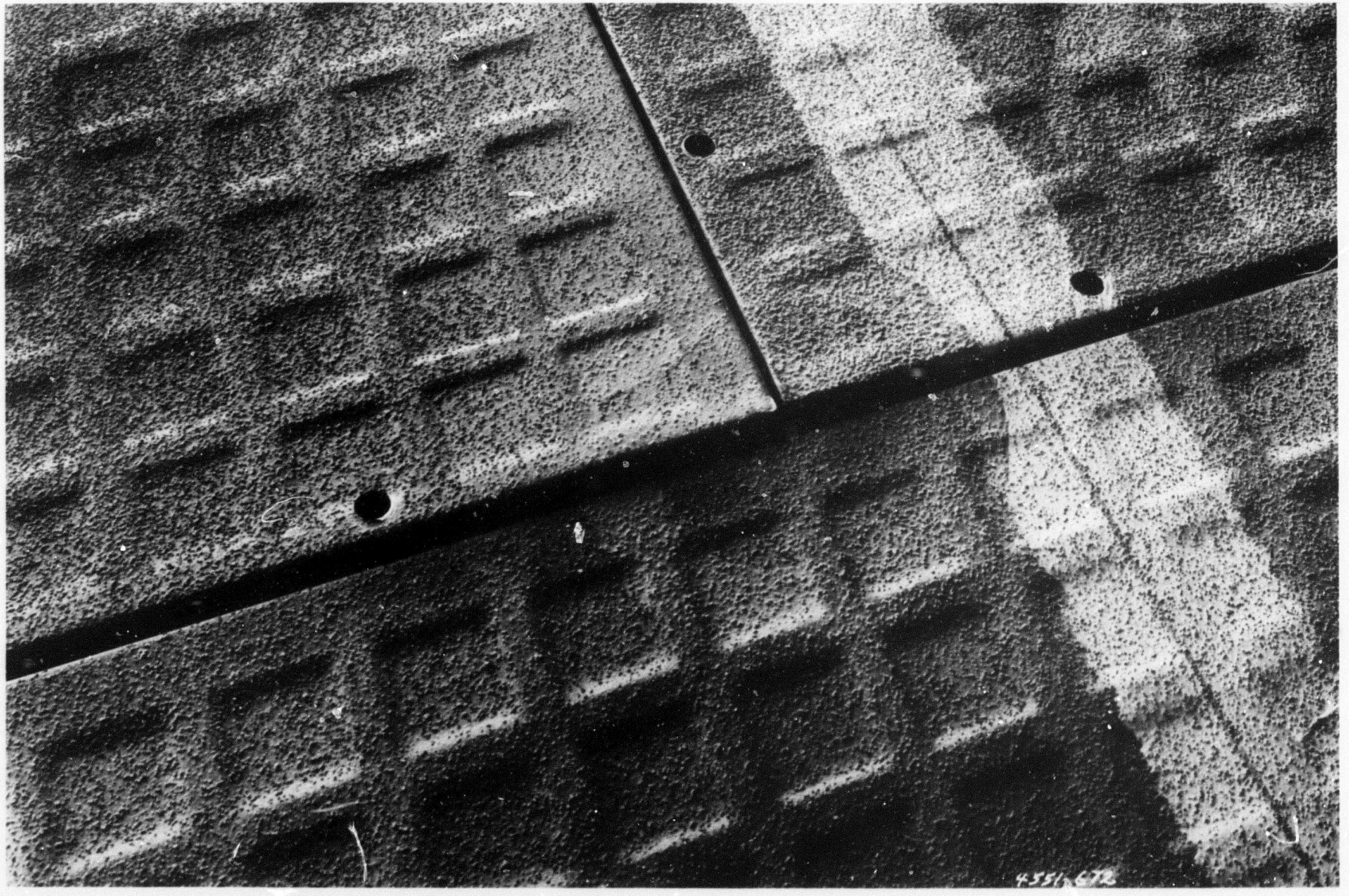
Photograph 13. Close-up of panel failures in item 1 after 330 coverages



Photograph 14. General view of item 1 after 330 coverages showing failed section. Note subgrade pumping near center of section

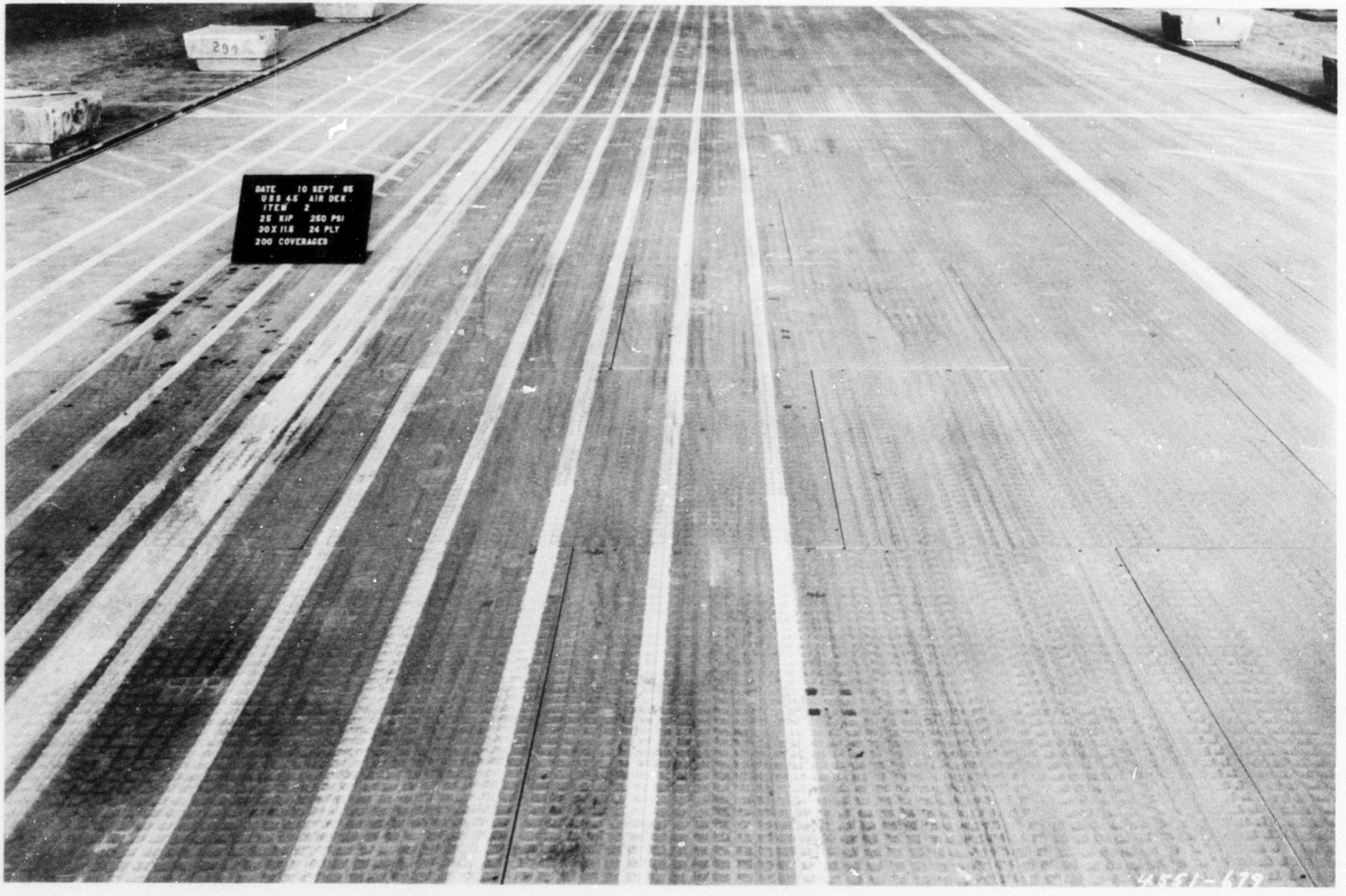


Photograph 15. Overall view of test section showing item 2 prior to traffic



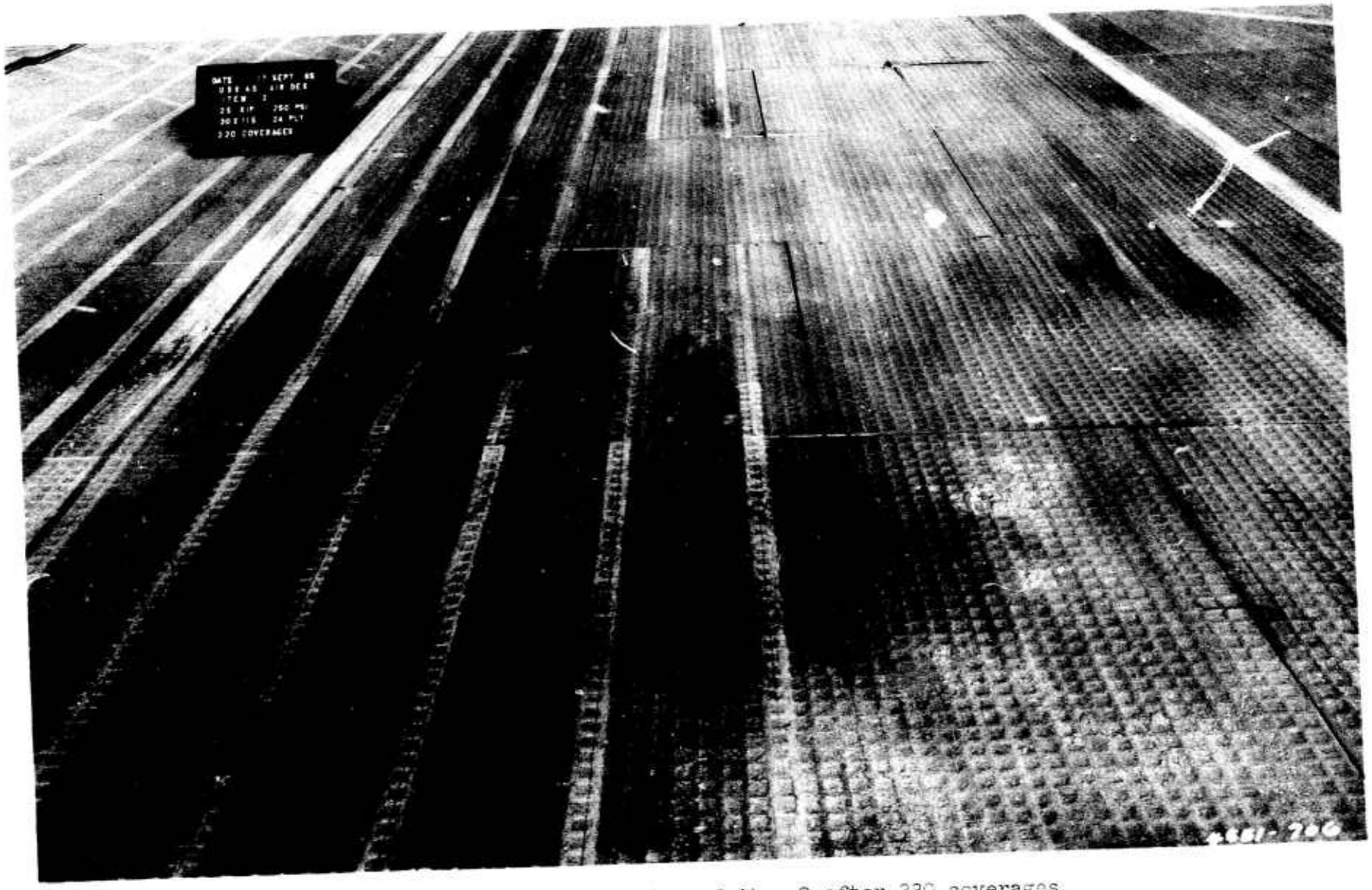
Photograph 16. Close-up of joint in item 2 showing raised corner at 40 coverages

Photograph 17. Item 2 after 100 coverages

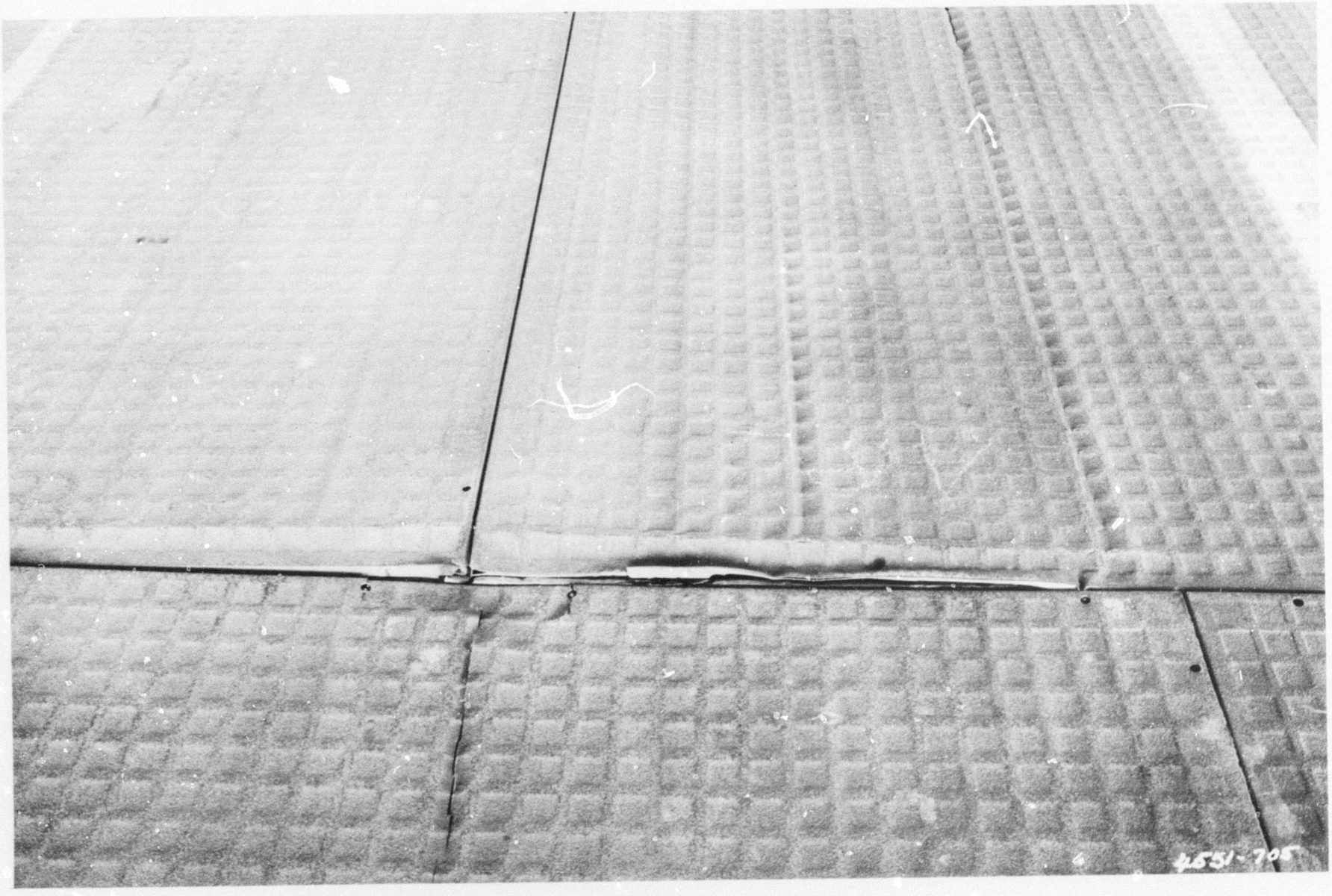


Photograph 18. Item 2 after 200 coverages

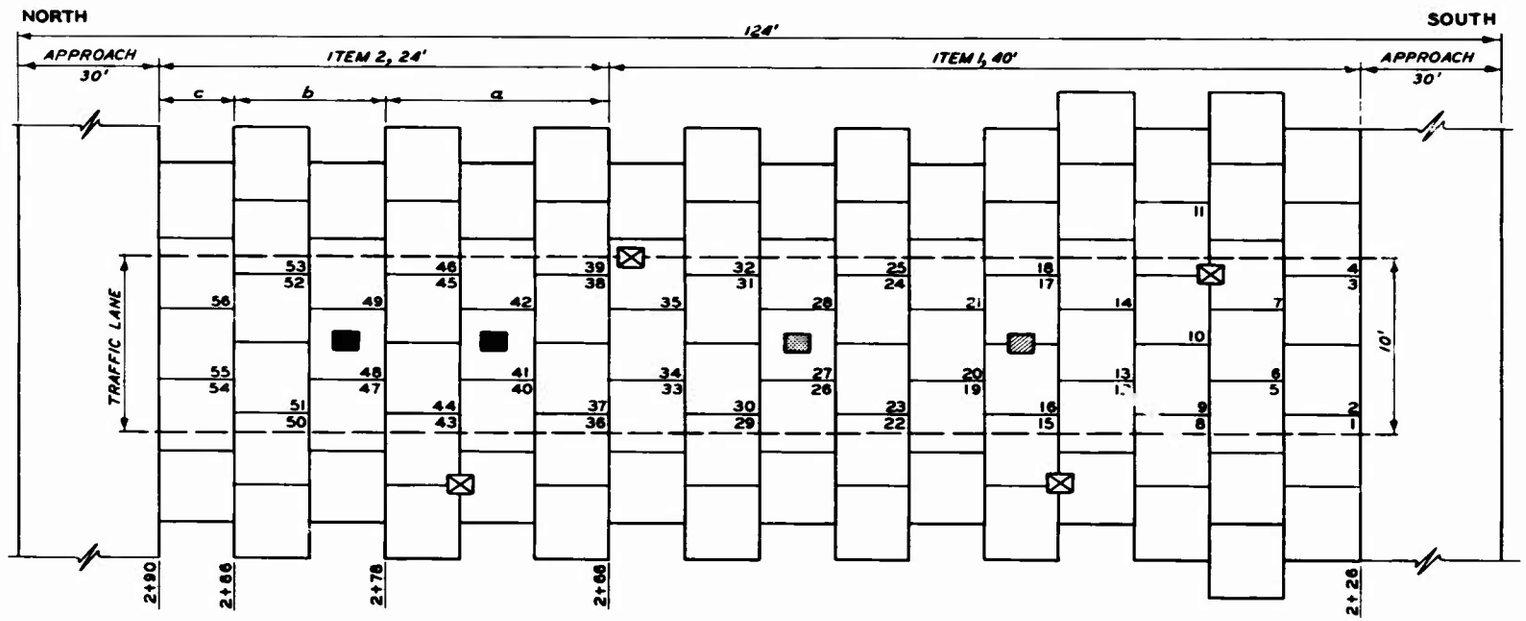
Photograph 19. Overall view of item 2 after 300 coverages



Photograph 20. General view of item 2 after 330 coverages



Photograph 21. Close-up of panel failures in item 2 after 330 coverages



LEGEND

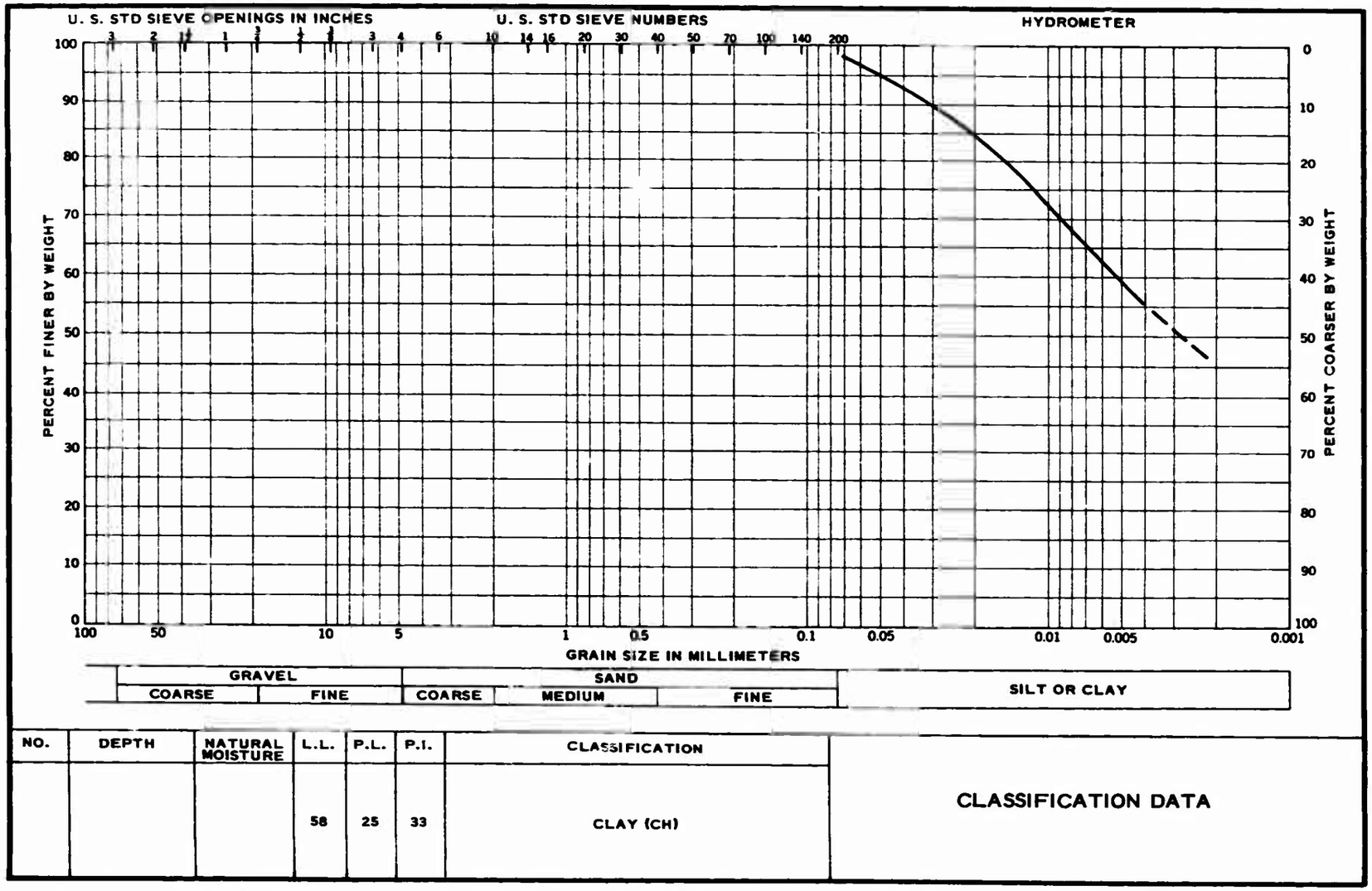
- 0 COVERAGE
- 206 COVERAGES (FAILURE)
- 300 COVERAGES (FAILURE)
- 300 COVERAGES (NO FAILURE)
- 330 COVERAGES (FAILURE)

NOTE: SYMBOLS INDICATE CBR TEST PIT LOCATIONS.

LAYOUT OF TEST LANE FOR EVALUATION OF 4.5 TYPE AIR-DEK MAT

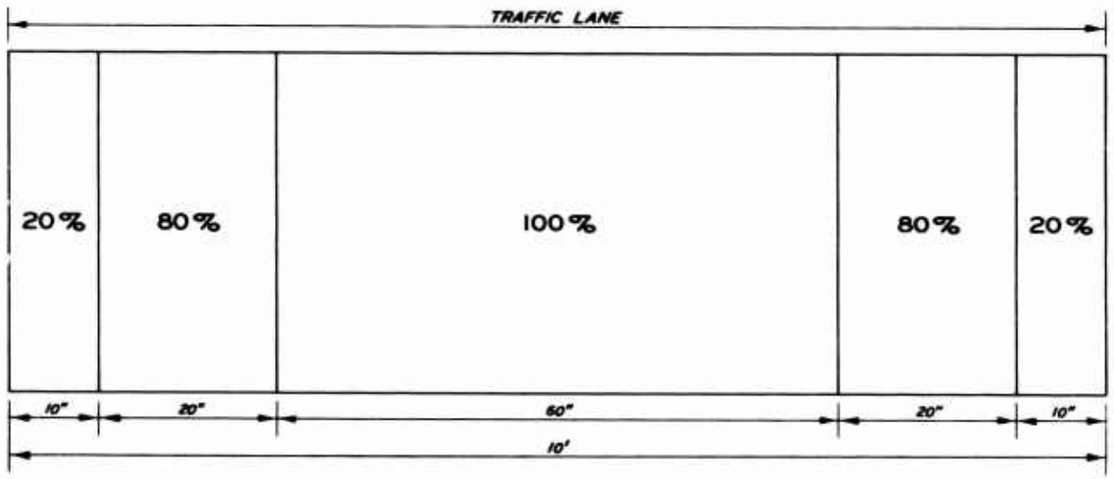
PLATE 1

PLATE 2



NO.	DEPTH	NATURAL MOISTURE	L.L.	P.L.	P.I.	CLASSIFICATION
			58	25	33	CLAY (CH)

CLASSIFICATION DATA



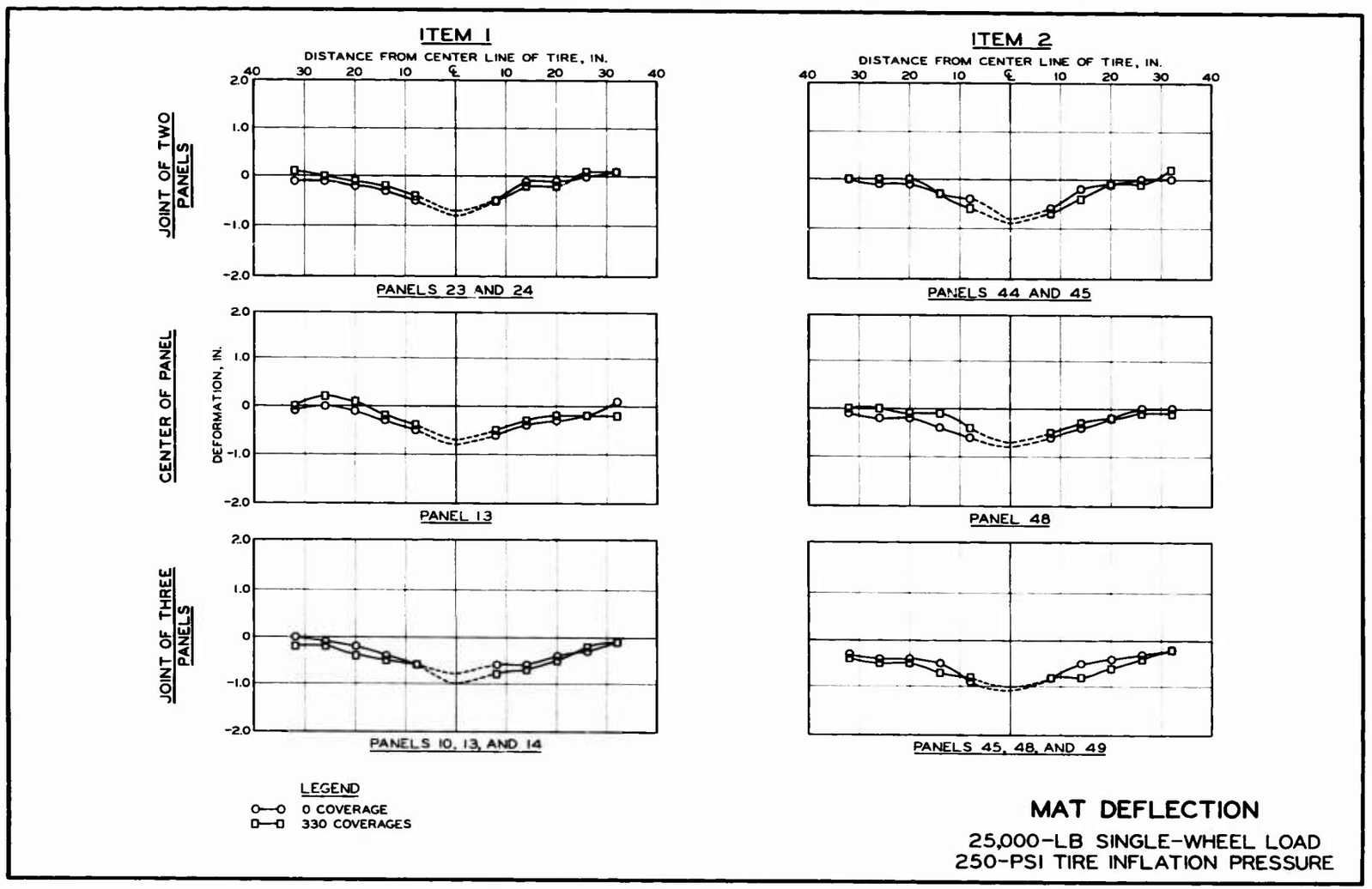
LOAD CONDITIONS

SINGLE WHEEL LOAD 25,000 LB
TIRE INFLATION PRESSURE 250 PSI
CONTACT AREA 111.1 SQ IN.

TRAFFIC DISTRIBUTION PATTERN FOR LANDING MAT TESTS

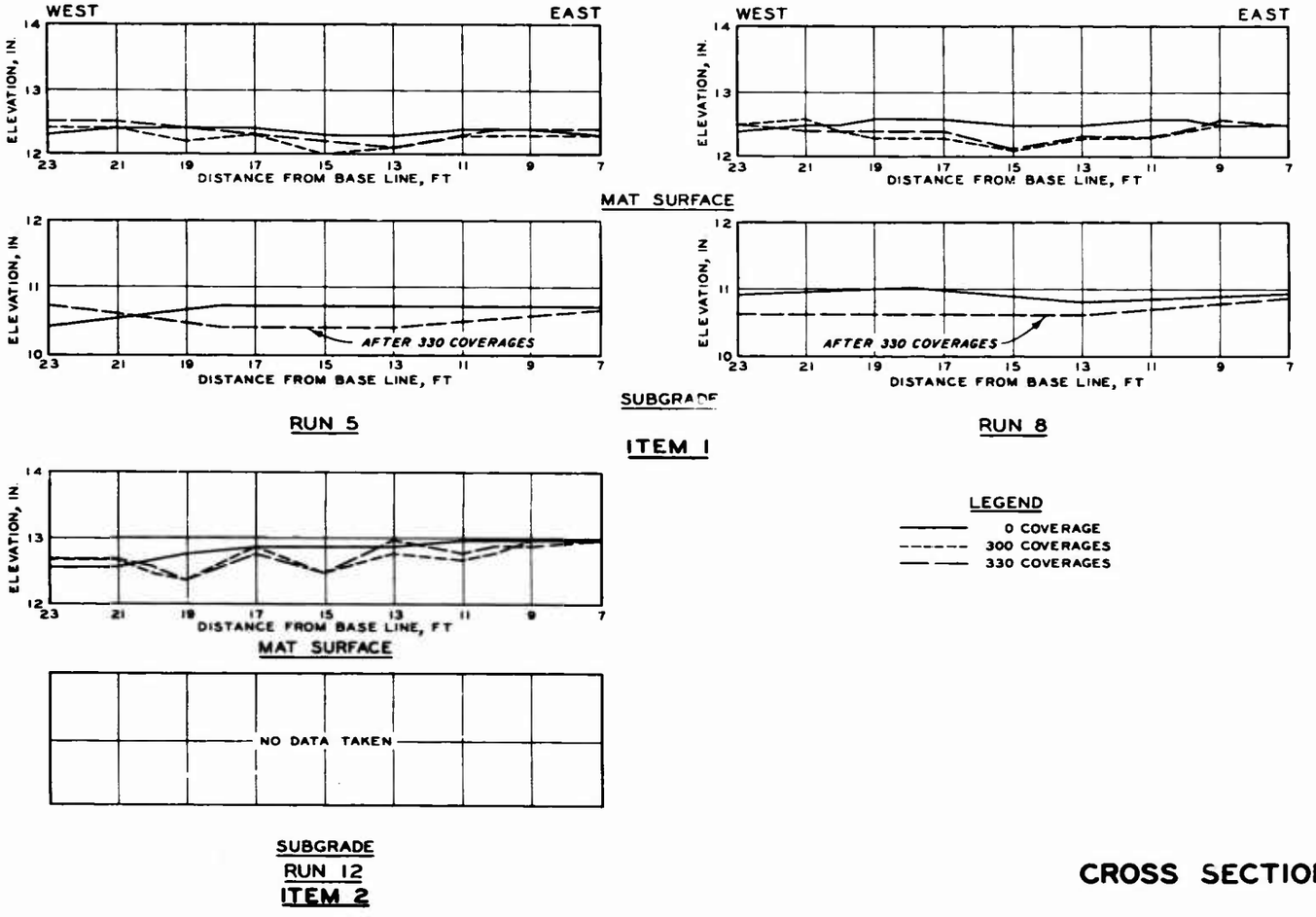
PLATE 3

PLATE 4



MAT DEFLECTION

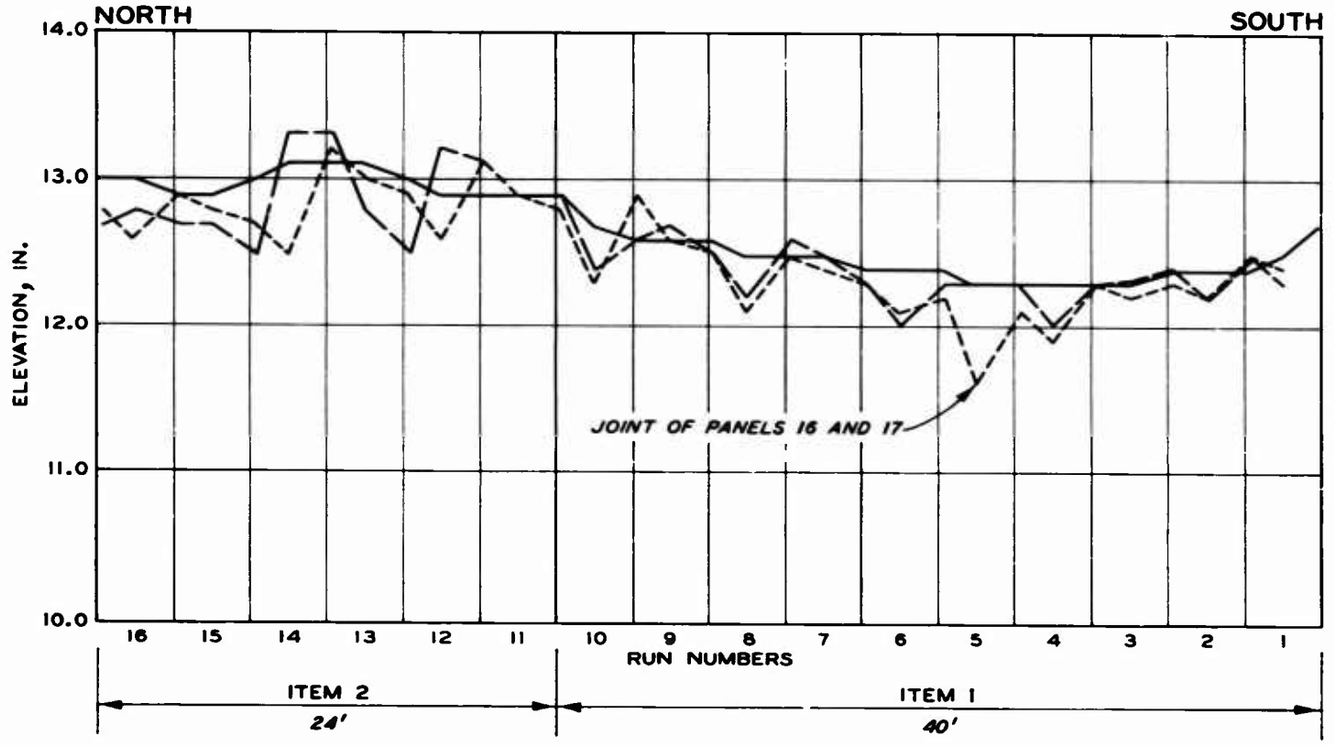
25,000-LB SINGLE-WHEEL LOAD
250-PSI TIRE INFLATION PRESSURE



CROSS SECTIONS

PLATE 5

PLATE 6

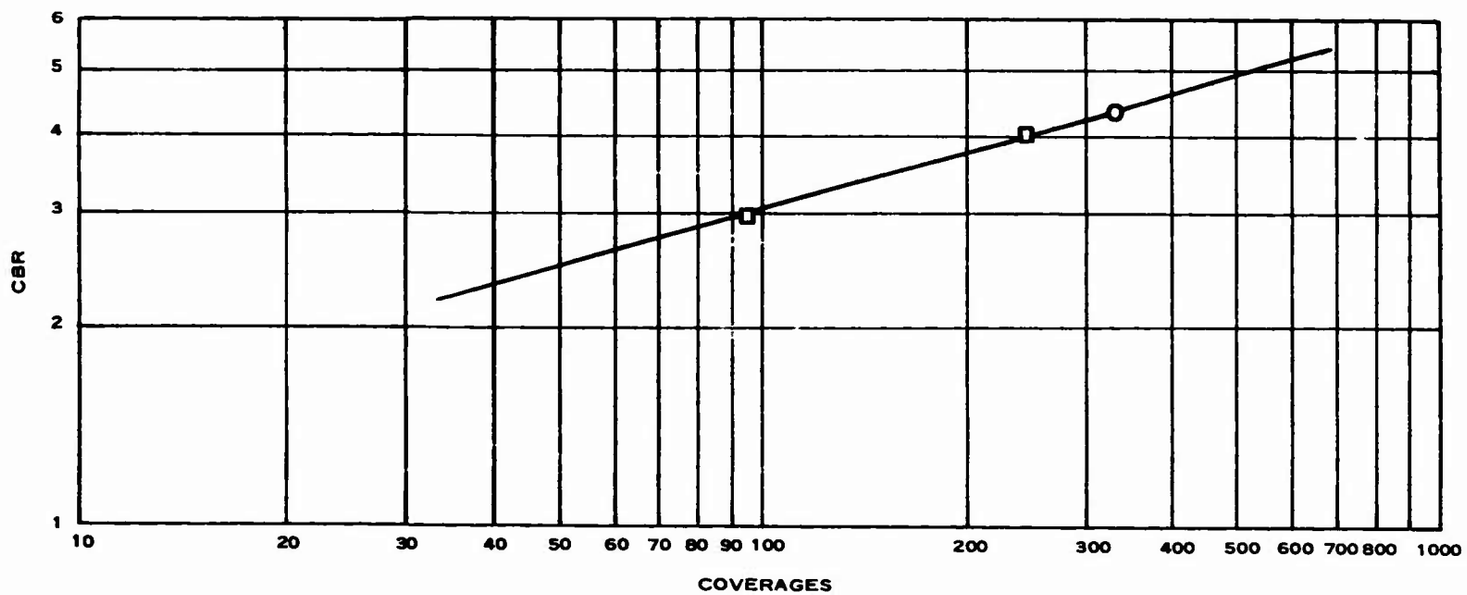


LEGEND

——— 0 COVERAGE
– – – – 300 COVERAGES
—— —— 330 COVERAGES

PERMANENT DEFORMATION PROFILE OF MAT SURFACE

CENTER LINE OF TRAFFIC LANE



LEGEND

O SECTION FAILURE POINT

□ COMPUTED FAILURE POINT

NOTE: BASED ON CBR EQUATION FROM WES INSTRUCTION REPORT 4, DATED NOV 1959.

STRENGTH EVALUATION OF
U. S. STEEL 4.5 TYPE AIR-DEK LANDING MAT

25,000-LB, SINGLE-WHEEL LOAD
250-PSI TIRE PRESSURE

PLATE 7