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Technical Note N-1110

AIRFIELD PAVEMENT CONDITION SURVEY, USNWL DAHLGREN, VIRGINIA

By

D. J. Lambiotte and L. J. Woloszynski

June 1970

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NAVAL CIVIL ENGINEERING LABORATORY
Port Hueneme, California 93041

AIRFIELD PAVEMENT CONDITION SURVEY, USNWL DAHLGREN, VIRGINIA

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53-125

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ABSTRACT

The results of a condition survey of the airfield pavements at the U. S. Naval Weapons Laboratory, Dahlgren, Virginia is presented. The survey established statistically-based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

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INTRODUCTION

In October, 1969, the Naval Facilities Engineering Command authorized a series of periodic pavement condition surveys to be conducted at Naval and Marine Corps air stations. The purpose of this condition survey task is to determine the suitability of the airfield pavement surfaces for aircraft operational requirements and to establish a uniform basis for maintenance and repair efforts. During the month of July, 1969, a pavement condition survey was conducted at the U. S. Naval Weapons Laboratory, Dahlgren, Virginia. The survey consisted of a sophisticated, statistically-based procedure of pavement defect identification and defect measurement which permitted the establishment of condition numbers (weighted defect densities) which are direct indicators of the surface condition of the asphaltic concrete (AC) and/or portland cement concrete (PCC) airfield pavement facilities. Though different survey techniques were used for the two pavement types, the resulting defect densities often were similar numerically. However, this was coincidental. The defect densities for the two types of pavement are incompatible and must be considered separately. Additional survey efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and delineation of requirements for future pavement evaluation efforts at the station.

BACKGROUND

The U. S. Naval Weapons Laboratory, Dahlgren, is located in Virginia, 40 miles south of Washington, D. C. at an elevation of 40 feet. An aerial photograph of the station is shown in Figure 1. The airfield has 3 runways, all 4,000 feet long. Runway numbers are 18-36 (abandoned), 15-33 and 9-27. Runway 15-33 is the most frequently used runway. Note that traffic is very light for the airfield as the mission of the Naval Weapons Laboratory only requires infrequent air operations.

CONSTRUCTION HISTORY

Portions of Runways 15-33 and 18-36 were constructed in 1936. Both of these runways were lengthened in 1941 when Runway 9-27 was constructed.

All of the runways were given a 2-inch AC overlay in 1954. Runway 15-33 received an additional 1-inch overlay in 1968. Runway 9-27 was given a slurry seal in 1968. A complete history of construction and recorded maintenance is provided in Appendix A.

CURRENT AIRCRAFT TRAFFIC

A tabulation of the number of aircraft operations for a 12-month period is shown in Table 1. Table 2 lists the aircraft normally based at the station and transient aircraft observed using the station during the period of evaluation.

CONDITION SURVEY PROCEDURES

The condition survey procedures used in this study are as follows:

Step 1. Preliminary Survey

In the preliminary survey the evaluators made a general and personal inspection of all airfield pavement areas, during which they noted the type and distribution of defects in each facility (runway, taxiway, etc.). In addition, a previously-prepared construction history was consulted and areas of different construction and different pavement type (AC or PCC) within a facility were noted. As a result of these efforts, each pavement facility was then divided into "discrete areas" of reasonably similar failure modes for performance of the subsequent sampling and tally or measurement of defects. Thus, if the type and/or number of defects found in one portion of a facility were distinctly different from those found in another portion of that facility, discrete areas were selected on this basis. If, however, the pavement facility contained few defects or if the defects found were similar in type and distribution throughout the facility, each facility was individually divided for survey according to the construction history. Under either criterion, a discrete area may vary, for example, from a 500 foot length of runway or taxiway to the entire length of the facility. Discrete areas selected at USNWL Dahlgren are shown in Figure 2. Note that all discrete areas are numbered with a system that relates the discrete area to the runway, taxiway, etc., of which it is a part. For example, the discrete area comprising Runway 9-27 is designated R9-1; discrete areas for Taxiway 2 are T2-1, T2-2, and T2-3, respectively, and so on.

A special survey of singular occurrences of serious defects was made during the preliminary survey. This is necessary because the statistical sampling techniques utilized in the subsequent survey are effective in spotting defects only when such defects are numerous and/or relatively well distributed. This abbreviated special survey provided information on those infrequent defects, if any, which may present a problem to safe aircraft operation.

Step 2. Statistical Sampling and Defect Survey

After selection of discrete areas, a number of small "sample areas" were chosen within each discrete area. The total number of sample areas was determined by statistical theory, as a function of the relative size of the discrete area. Actual locations of the sample areas were selected at random from the discrete area.

Sample areas in PCC pavements basically consisted of individual slabs, usually 12½ x 15 feet in size. For the convenience of the evaluators, either a single slab or a number of adjacent slabs can be considered as a sample area. Both types of sampling area are shown in schematic in Figure 3. Note from Figure 3 that individual sample slabs and/or sample strips were selected within the center 100 feet (laterally) of runways and within the center 50 feet (laterally) of taxiways by a random selection process. For parking Aprons, mats, etc., similar sample areas were selected at random over the entire pavement area.

For AC pavements, sample areas were fifty foot square areas, located as shown in Figure 4. For parking aprons, mats, etc. (not shown in Figure 4) sample areas were fifty feet square, as for other traffic areas, and randomly located over the entire pavement area.

All defects or defected slabs in each of the selected sample areas were noted on appropriate data sheets. For PCC pavement slabs or sample strips either single or multiple occurrences of a given defect type within the slab qualified the slab as a defected slab. For example, one or more spalls qualified a slab as a spalled slab. A crack in the same slab required that it be counted again, this time as a cracked slab. No measurement of length, area, etc., was recorded for PCC pavement defects. When a sample slab strip was chosen for test, the above mentioned tally method (slab by slab) was still utilized.

The defects found in AC sample areas were measured and tallied, rather than merely tallied as were those for PCC pavements. Depending on the type of defect, the total length in feet (for cracks, etc.) or total area in square feet (for pattern cracking, raveling, etc.) was recorded.

The above survey of defects found in sample areas (in each discrete area) are shown in column (c) of the Discrete Area Defect Summary sheets, pages 27 through 37 of this report. Separate summary sheets are provided for portland cement concrete (PCC) and asphaltic concrete (AC) pavements. Total defect counts for the entire discrete area were calculated by a linear extrapolation of the defect data in column (c), and are shown in column (d) of the Discrete Area Defect Summary sheets. To remove the influence of the size of the discrete area on the total defect count (i.e., the bigger the area, the larger the defect count), the total defect count was divided by either the number of slabs in the discrete area (for PCC pavements) or by the area (in 10 square foot increments) of the discrete area (for AC pavements). This gives a defect <u>density</u> (per slab or per 10 square feet) which is listed in column (e).

Step 3. Defect Severity Weighting System

A weighting system, providing a numerical weight for each type defect in proportion to the relative severity of that defect, was applied in the following manner to each of the defect counts in the discrete area:

given defect density x weight for that type defect = weighted defect density

This is accomplished in columns (f) and (g) of the Discrete Area Defect Summary sheets. Next, a total weighted defect density is obtained for each discrete area by summing column (g) of these sheets. Note that a letter suffix is added to each total weighted defect density for the purpose of further distinguishing between asphaltic concrete defect densities (suffix "A") and portland cement concrete defect densities (suffix "C").

The defect weighting guide developed by NCEL assigns greater weights to defects that (1) presently affect the safe operation of aircraft or the cost of aircraft operation; (2) will lead to increased airfield pavement maintenance costs; or (3) will result in significant deterioration of load-carrying capacity of the pavements. The resultant numerical weights were further modified to reflect variations in pavement environment from station to station. For example, higher (more severe) weights were assigned to defects which are affected by factors such as freezing weather, heavy rainfall, or blow sand for surveys of airfields located in areas where these undesirable environmental effects occur. Thus, it can be seen that the higher the numerical weighted defect density, the poorer the condition of the surveyed pavement. Defect severity weights used in calculating weighted defect densities at USNWL Dahlgren are given in Table 3.

Remarks concerning the general pavement condition and the defects identified are given in narrative form on each Discrete Area Summary sheet. In addition, photographs of typical pavement conditions noted during the survey can be seen in Figures 5 through 16.

Step 4. Facility Summary--Weighted Defect Densities

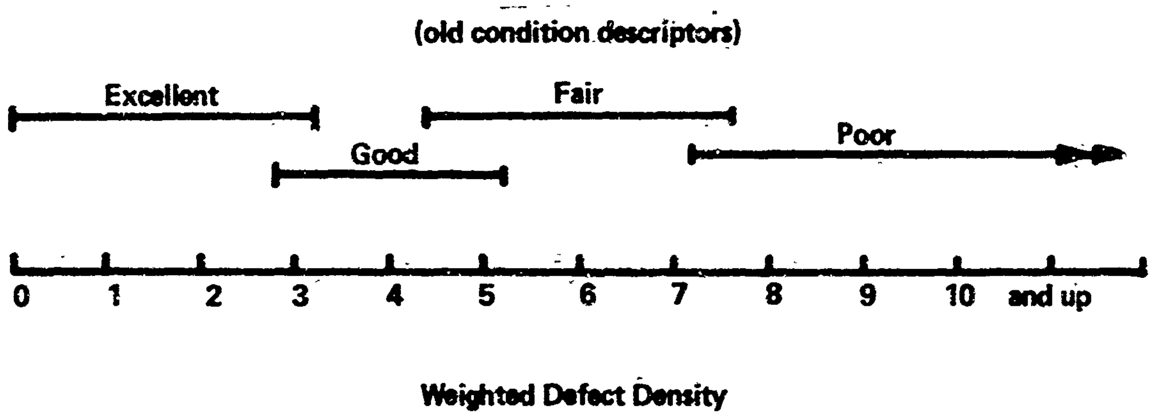
A final step in providing a numerical condition rating for each facility (runway, taxiway, etc.) is accomplished in the Facility Defect Summary sheets, pages 39 through 43 of this report. Again note that separate sheets have been provided for AC and PCC pavements. In these sheets the individual weighted defect densities for all discrete areas comprising the entire AC or PCC portion of a facility (runway, taxiway, etc.) are summarized in column (a). When an AC or PCC facility (or portion) has been divided into more than one discrete area for the condition survey, the proportional contribution of each discrete area to the entire AC or PCC facility area is determined in column (b). In column (c) these proportions are applied to the individual discrete area weighted defect densities listed in column (a) and added to obtain an overall average weighted defect density for the entire AC or PCC portion of the facility (marked "Total" in column (c)). When an entire AC or PCC facility (or portion) has been designated as a single discrete area (as often occurs), the proportionality factor in column (b) is obviously 1.00 and the discrete area weighted defect density from column (a) becomes the average weighted defect density for the entire facility (or portion) in column (c).

GENERAL COMMENTS ON CONDITION SURVEY PROGRAM

The weighted defect densities, listed in column (a) of the Facility Defect Summary for individual discrete pavement areas and in column (c) as averaged weighted defect densities for entire AC or PCC runways, taxiways, etc. (or portions thereof) represent, numerically, the surface condition of the airfield pavements at the station. As previously stated, the larger defect density numbers indicate basically a greater number and/or severity of defects per unit area of pavement, i.e., a poorer pavement. Thus, they represent the final product of the pavement condition survey. It should be noted specifically, however, that AC and PCC pavement defect densities, although often numerically similar, are obtained by two different condition survey techniques and, as such, are <u>not numerically compatible</u> and <u>must not be combined</u>. (It is largely because of this fact that the letter suffixes "A" and "C" have been affixed to defect densities for AC and PCC pavements respectively.) As an example consider the common case of an AC runway with PCC ends. The condition survey system presented herein provides individual discrete area weighted defect densities for discrete areas selected on <u>both</u> AC and PCC pavements, but provides a <u>separate</u> average weighted defect density for the entire AC portion and a <u>separate</u> average weighted defect density for the combined PCC end pavements. It is <u>not</u> possible to combine these defect densities to obtain an averaged AC/PCC defect density for the entire runway. Thus the defect densities for AC and PCC are reported separately, given different letter suffixes, and should include the letter suffix when reference is made to them.

Individual numerical defect densities, however accurately they indicate pavement condition, may mean little to the reader of an individual airfield condition survey report, for he has no basis upon which to judge the relative severity of pavement condition associated with the numbers obtained for his pavements. The primary value of a numerical condition survey program will be the accumulation of uniformly-obtained, comparative condition data for <u>many</u> airfields which can best be correlated, studied, and used in the decision-making processes at headquarters levels.

For the benefit of the individual reader, however, an effort was made during the first year of pavement condition surveys (FY-70) to relate the numerical condition (defect densities) to the basic subjective condition descriptors (excellent, good, fair, poor, etc.) used in all previous Navy pavement evaluation procedures. Although the subjective, condition-descriptor approach is poorly regarded as a means of comparing pavement condition from one airfield to another, the following diagram may serve temporarily as a rudimentary bridge between the old subjective system and the new (numerical) condition approach:



The numerical defect densities presented in this report were developed to aid in determining the suitability of the airfield pavement surfaces for aircraft operational requirements and to establish an unbiased, uniform basis for initiating maintenance and repair efforts. As such, defect densities are simply visually-determined indicators of the condition of the pavement and do not represent true "condition ratings" in that they do not include factors relating to pavement strengths, traffic usage, etc. It is possible that additional measurements or modifications may be considered necessary or desirable in future condition survey programs.

RESULTS OF CONDITION SURVEY

Weighted defect densities for discrete areas selected on AC pavements at USNWL Dahlgren ranged from 0.28 A for the best AC discrete area (Runway 15-33) to a worst defect density of 30.01 A for a portion of Taxiway 1. Average weighted defect densities for entire AC portions of runways at USNWL Dahlgren ranged from 0.28 A for Runway 15-33 to 24.89 A for Runway 9-27.

Weighted defect densities for discrete areas selected on PCC pavements ranged from 8.24 C for the best PCC discrete area (Parking Apron 1) to a worst defect density of 21.82 C (for the PCC portion of Taxiway 2).

RESULTS OF ASSOCIATED FIELD TESTS

In order to determine the skid resistance characteristics of the runway pavements at USNWL Dahlgren, vehicle braking tests were performed using a calibrated decelerometer, at 30 miles per hour and on a wet pavement. Results of decelerometer skid tests are as follows:

Runway	Average Deceleration (feet per second per second)	Friction Coefficient
Runway 15-33		
Sta 10+00	23	0.71
Sta 30+00	24	0.75
Runway 9-27		
Sta 10+00	20	0.62
Sta 30+00	25	0.78

Although the Navy, at present, has no official standard or specification for pavement skid resistance, a study of the literature, coupled with the results of limited skid resistance testing performed by NCEL in recent years, indicates that friction coefficients above 0.5 may be considered generally acceptable for airfield pavements. Thus, the pavements at USNWL Dahlgren exhibited a degree of skid resistance well above the acceptable minimum.

RECOMMENDATIONS FOR FURTHER EVALUATION EFFORTS

A pavement evaluation was performed by the Fifth Naval District at Norfolk in 1961 (see Reference 1). The evaluation did not include subsurface plate testing and auger holes were only dug to a depth of 16 inches maximum.

The following testing program is recommended for USNWL Dahlgren to meet present NAVFAC Design Manual DM-21 evaluation requirements.

(1) Auger borings on all pavement areas to a depth of 6 feet to obtain soil profiles.

(2) Test pits and subsurface plate bearing tests in all asphaltic concrete areas.

(3) Concrete cores in portland cement concrete pavement areas.

(4) Laboratory tests on asphaltic concrete samples and subsurface pavement materials obtained from auger borings and test pits.

(5) Tensile splitting tests on concrete cores.

Table 1. Aircraft Operations Data
USNWL Dahlgren, Virginia

Date	Number of Operations
3 Sep - 31 Dec 1968	105
1 Jan - 14 Sep 1969	239

Nineteen of the above operations were by a P-2 aircraft, which was the heaviest aircraft in use.

Table 2. Aircraft Using
USNWL Dahlgren, Virginia

Type of aircraft using facilities:	S-2, P-2, P-3, C-131, C-54, C-47, C-45, also many types of helicopters, no jet aircraft

NOTE: Except for one P-2 aircraft, no aircraft are permanently stationed at NWL Dahlgren. Aircraft are sent to Dahlgren as required for evaluation of classified aircraft systems.

Table 3 . Defect Severity Weights

Airfield: USNWL Dahlgren, Virginia

Asphaltic Concrete		Portland Cement Concrete	
Defect	Weight	Defect	Weight
Depression	9.0	Depression	9.0
Rutting	9.0	Shattered Slab	9.0
Broken-up Area	9.0	Faulting	8.5
Faulting	8.5	Spalling	7.5
Raveling	7.0	Scaling	7.0
Erosion-Jet Blast	7.5	"D-Line" Cracking	6.5
Longitudinal, Transverse, or Longitudinal Construction Joint Crack	3.0	Pumping	4.0
Pattern Cracking	3.0	Poor Joint Seal	3.0
Patching	3.5	Corner Break	3.0
Reflection Crack	1.5	Intersecting Crack	3.0
Oil Spillage	1.5	Longitudinal or Transverse Crack	1.5

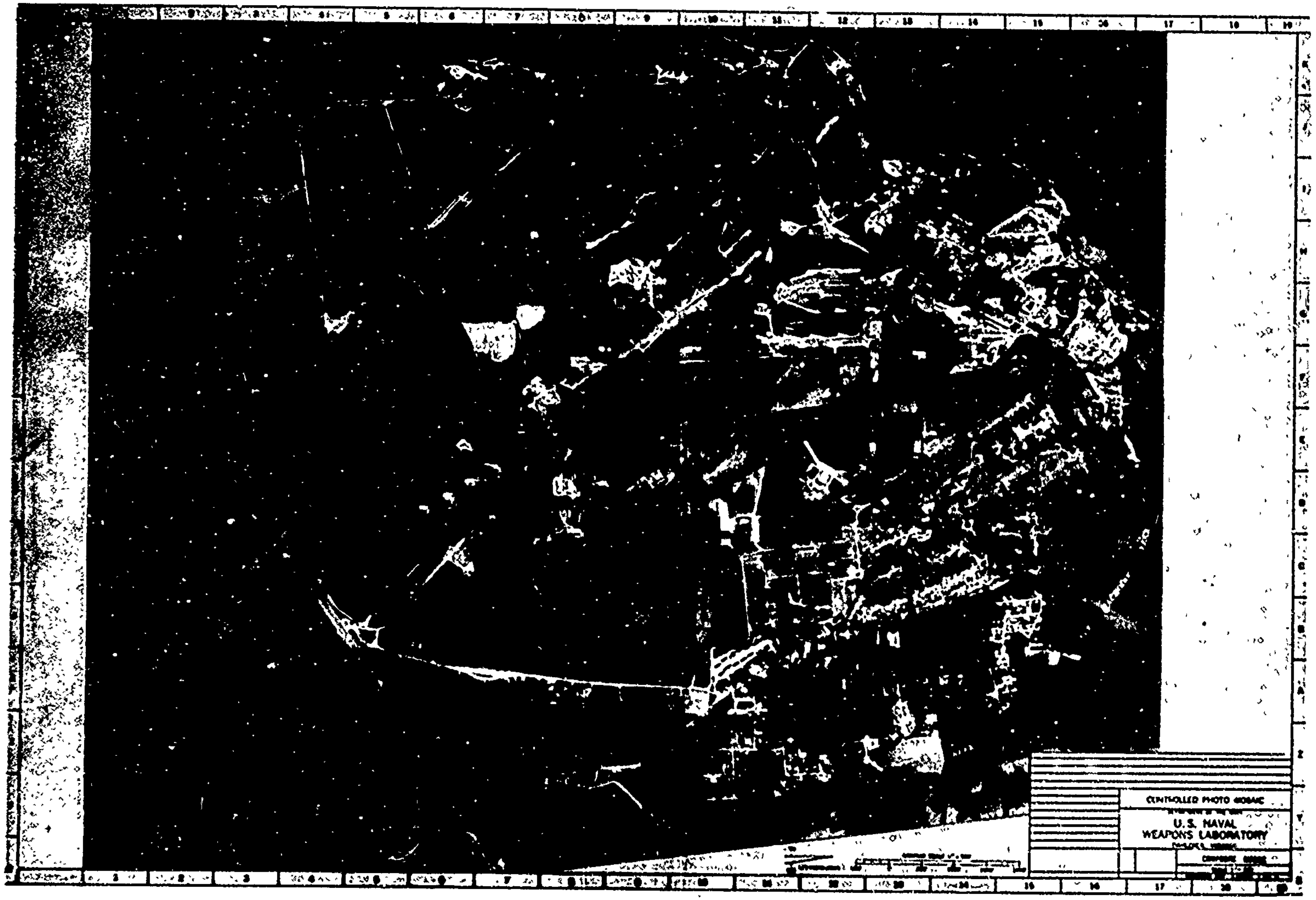
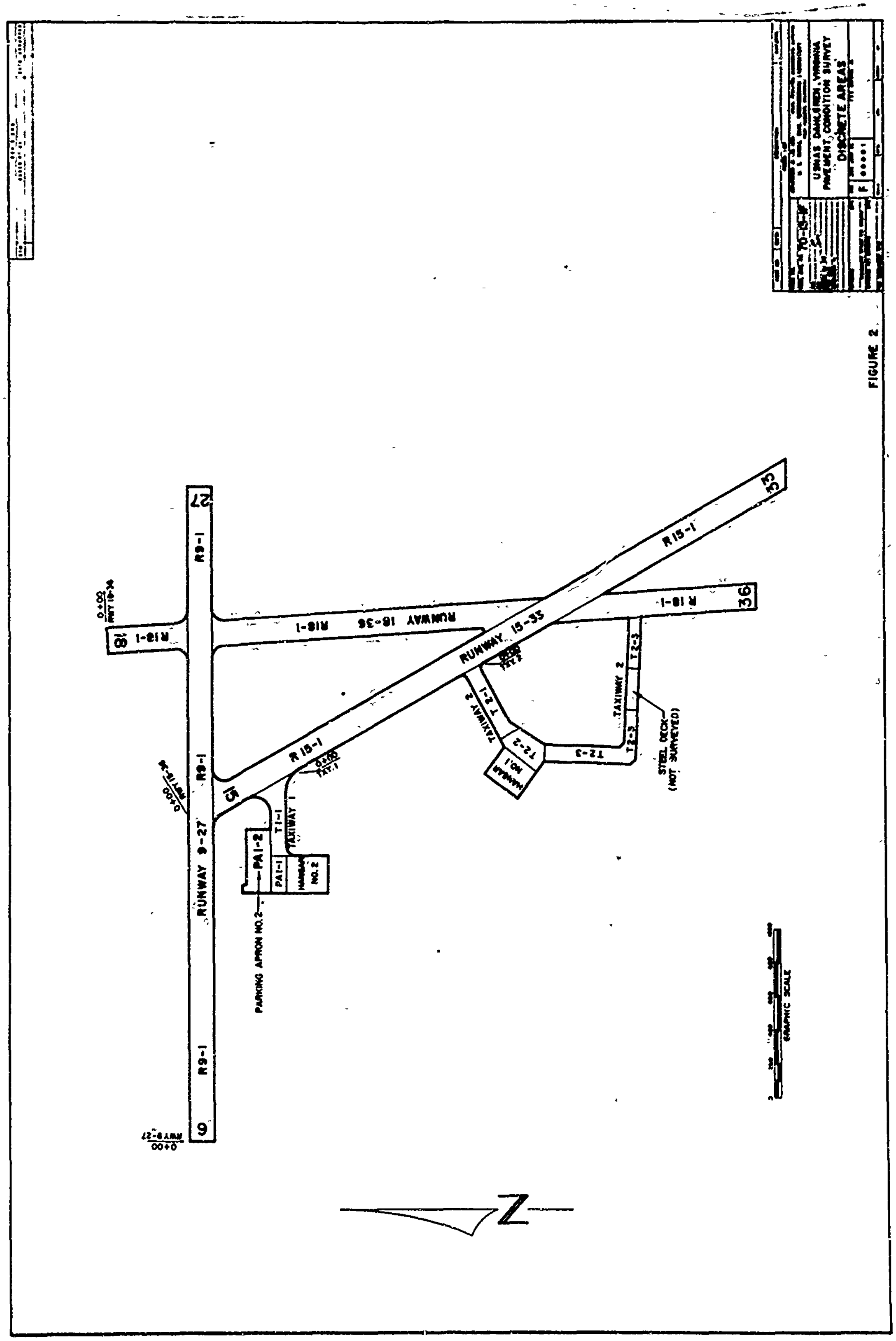


Figure 1. Aerial photograph of USNWL Dahlgren, Virginia.



USNAS DAHLGREN, VIRGINIA
PAVEMENT CONDITION SURVEY
DISCRETE AREAS
RUNWAY 9-27
RUNWAY 18-36
RUNWAY 15-33
R9-1
R18-1
R15-1
9
27
18
36
15
33
TAXIWAY 1
TAXIWAY 2
T1-1
T2-1
T2-2
T2-3
PA1-1
PA1-2
PARKING APRON NO.2
HANGAR NO.2
HANGAR NO.1
STEEL DECK (NOT SURVEYED)
GRAPHIC SCALE

FIGURE 2

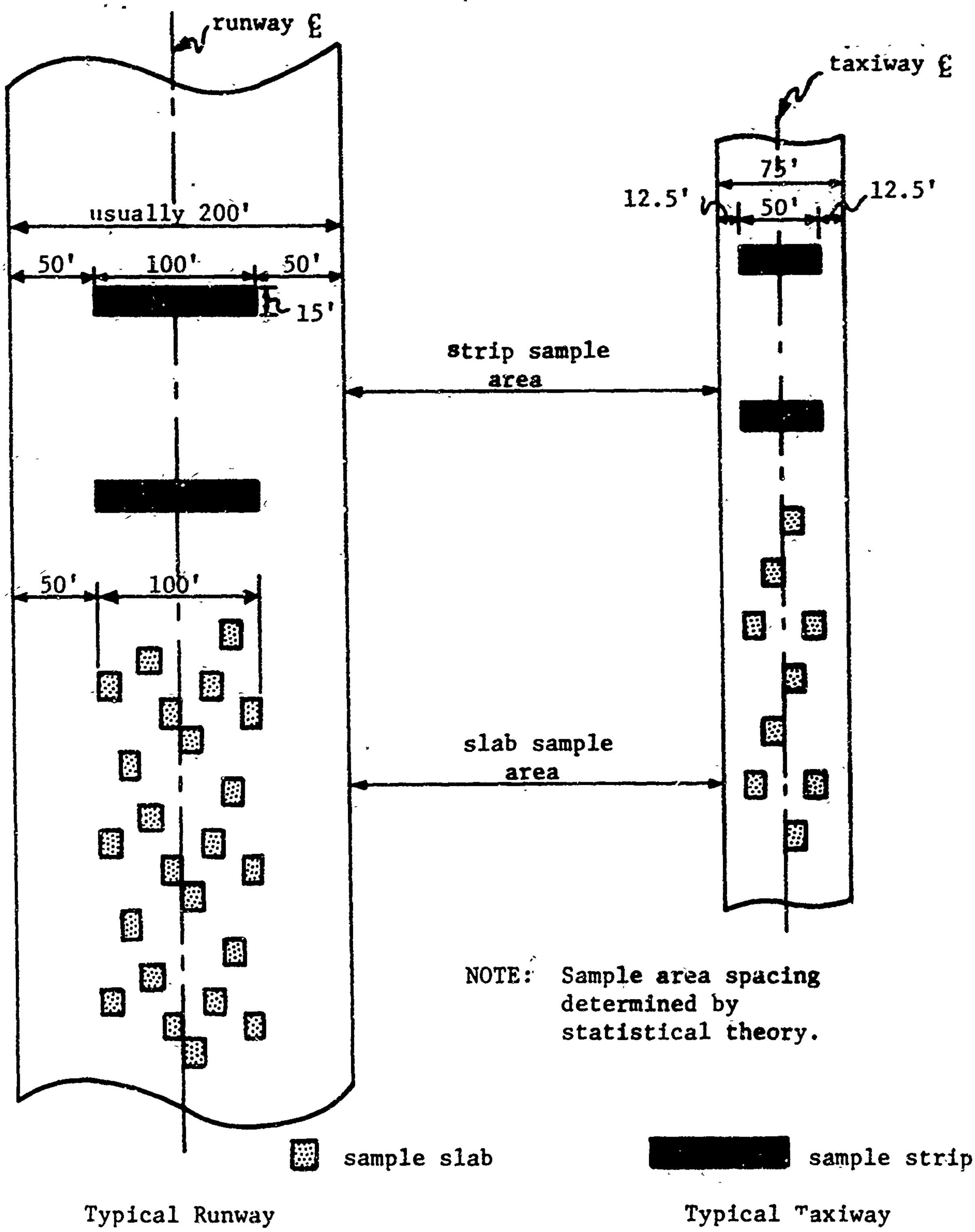


Figure 3. Portland cement concrete sample areas.

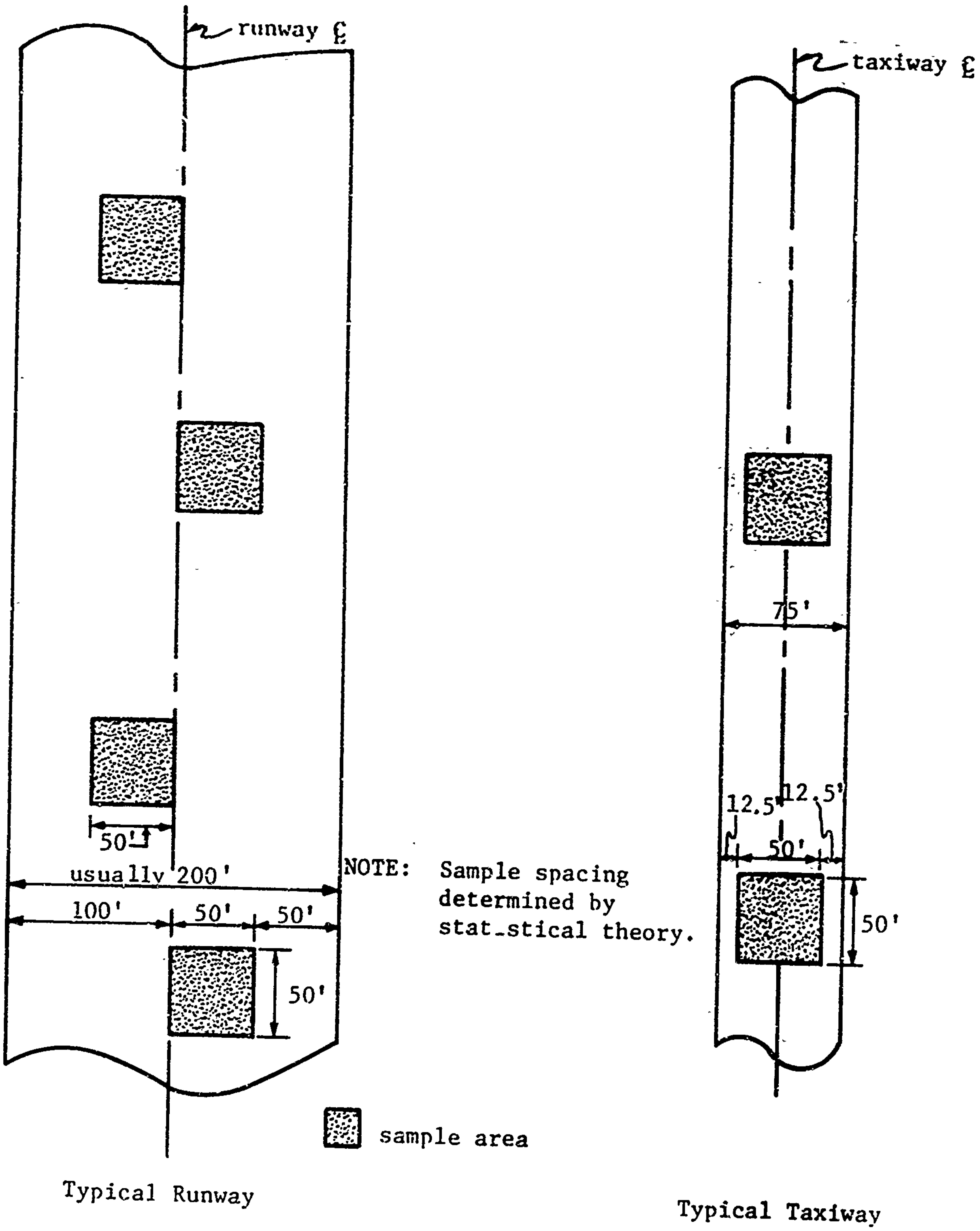


Figure 4. Asphaltic concrete sample areas.

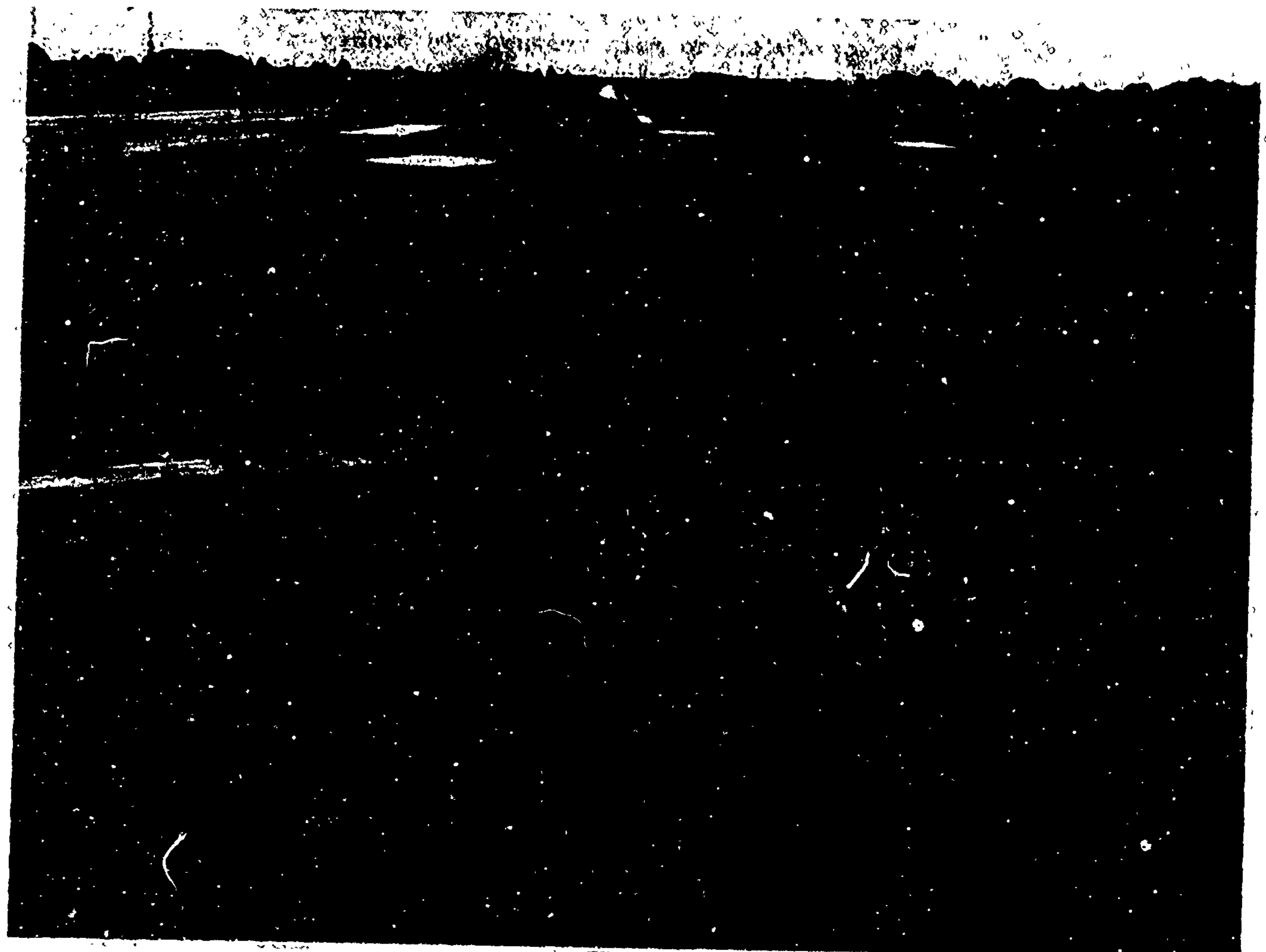


Figure 5. General view of Runway 15-33.

Figure 6. General view of Runway 15-33.

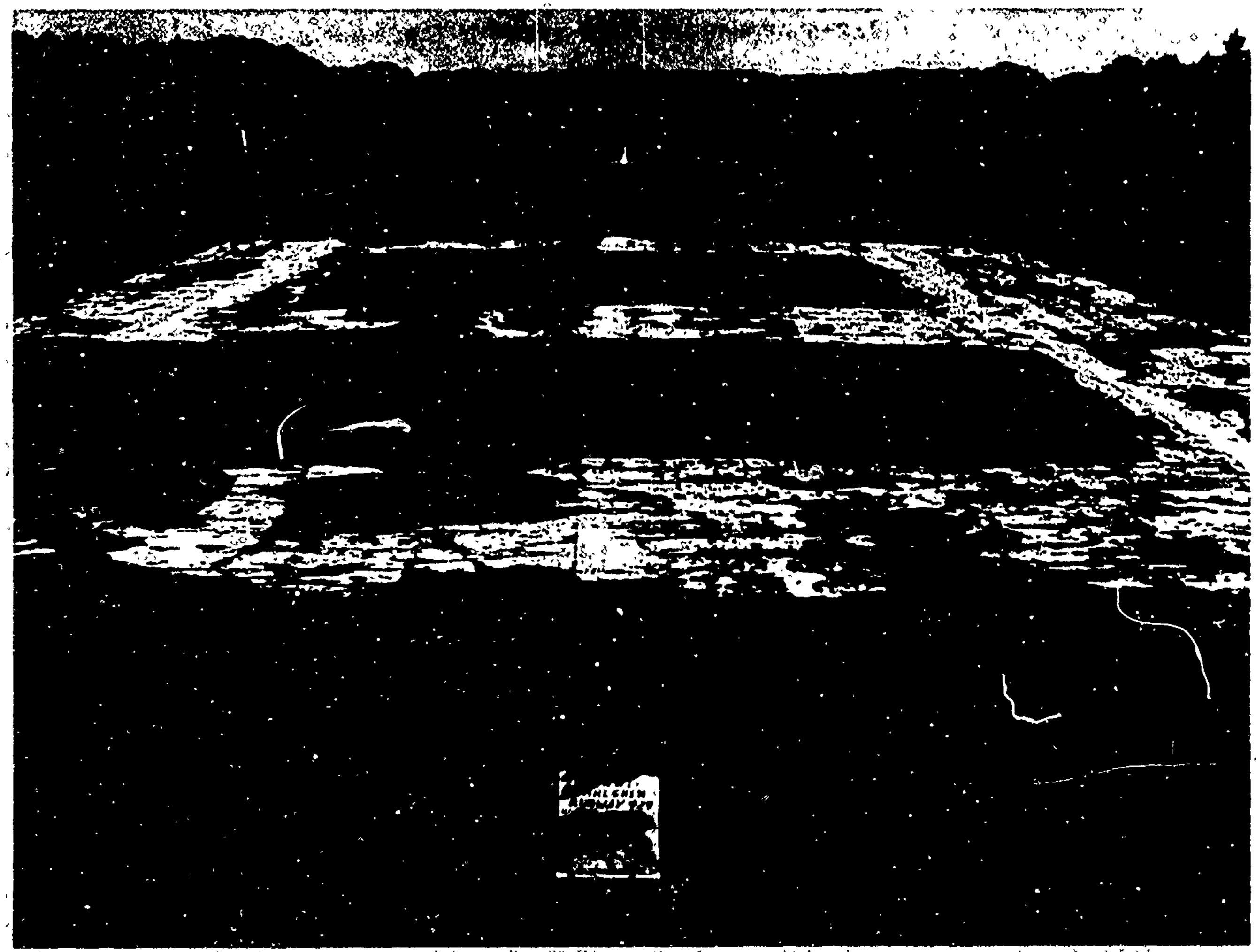


Figure 7. General view of Runway 9-27.

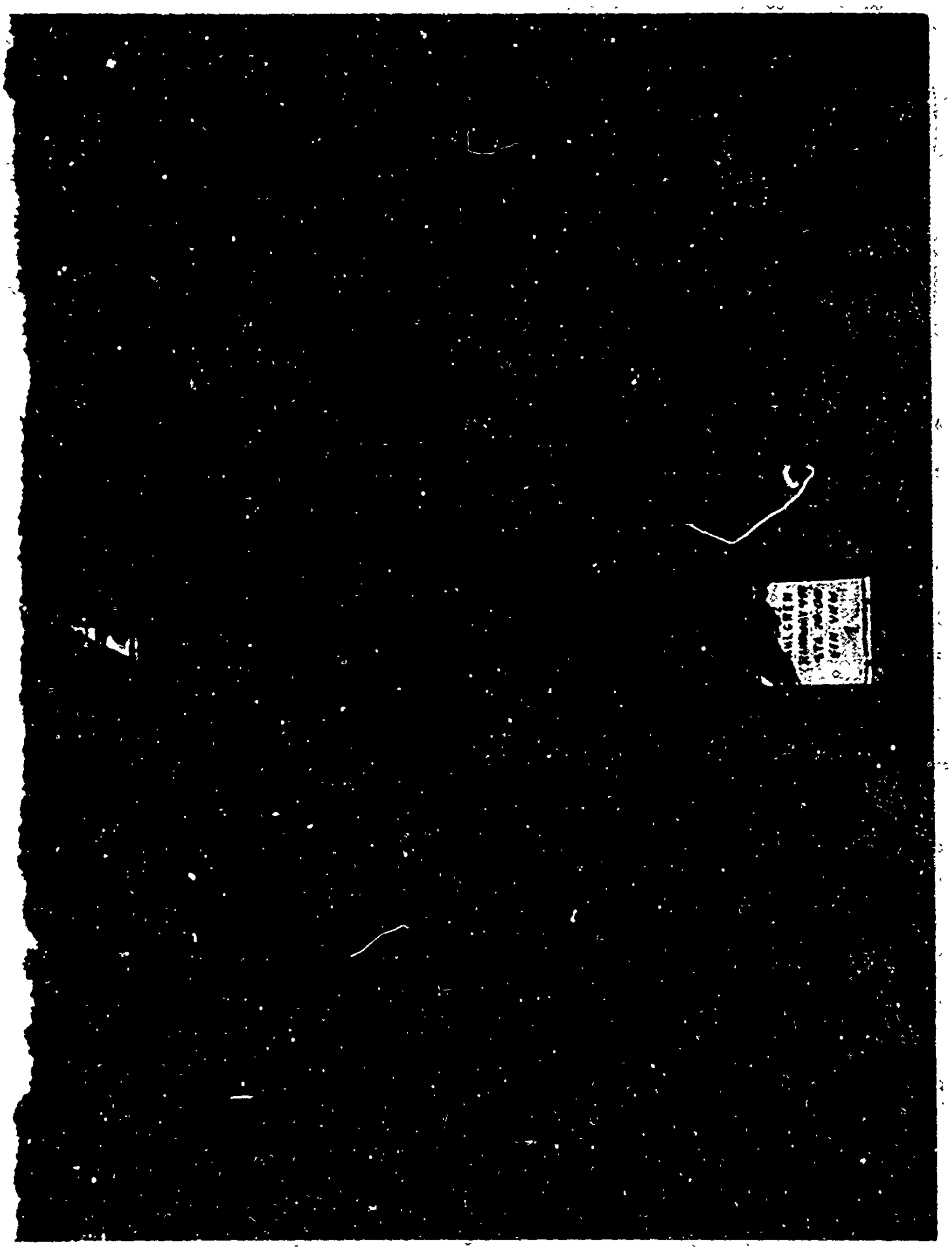


Figure 8. General view of Runway 9-27.

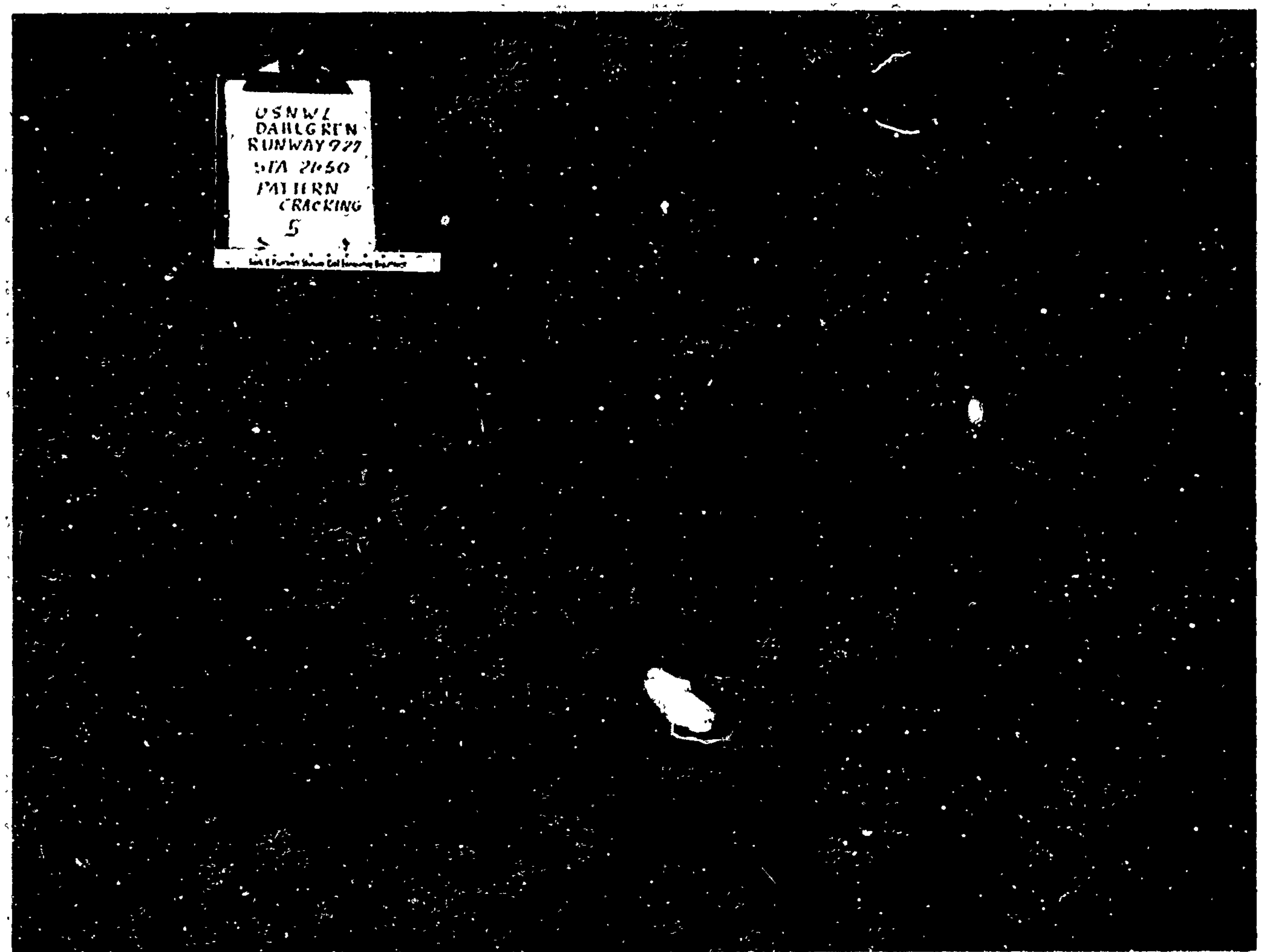


Figure 9. Typical pattern cracking on Runway 9-27.

Figure 10. General view of Runway 18-36.

Figure 11. Typical cracking and pattern cracking in Runway 18-36.

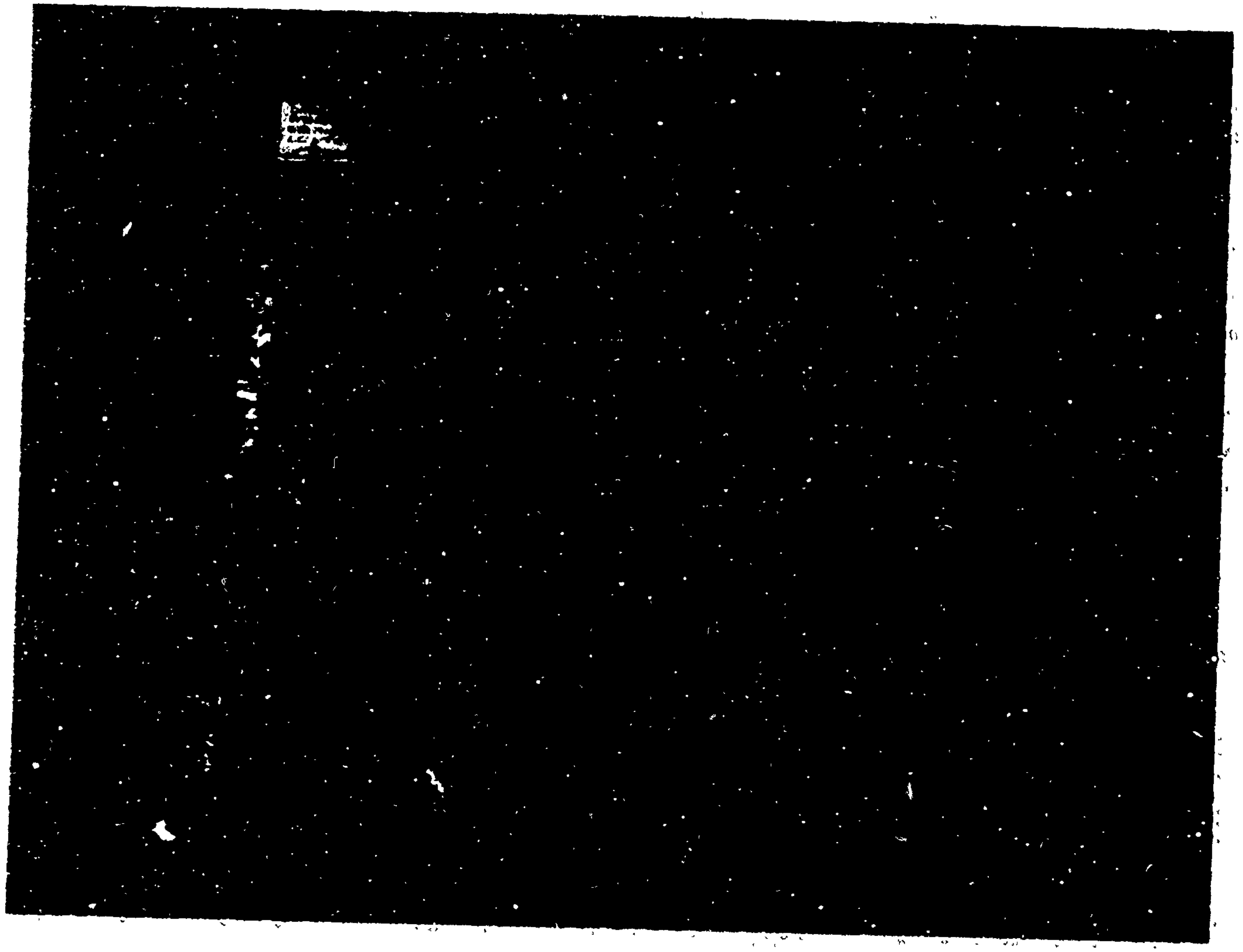


Figure 12. Longitudinal and transverse cracks on Runway 18-36.

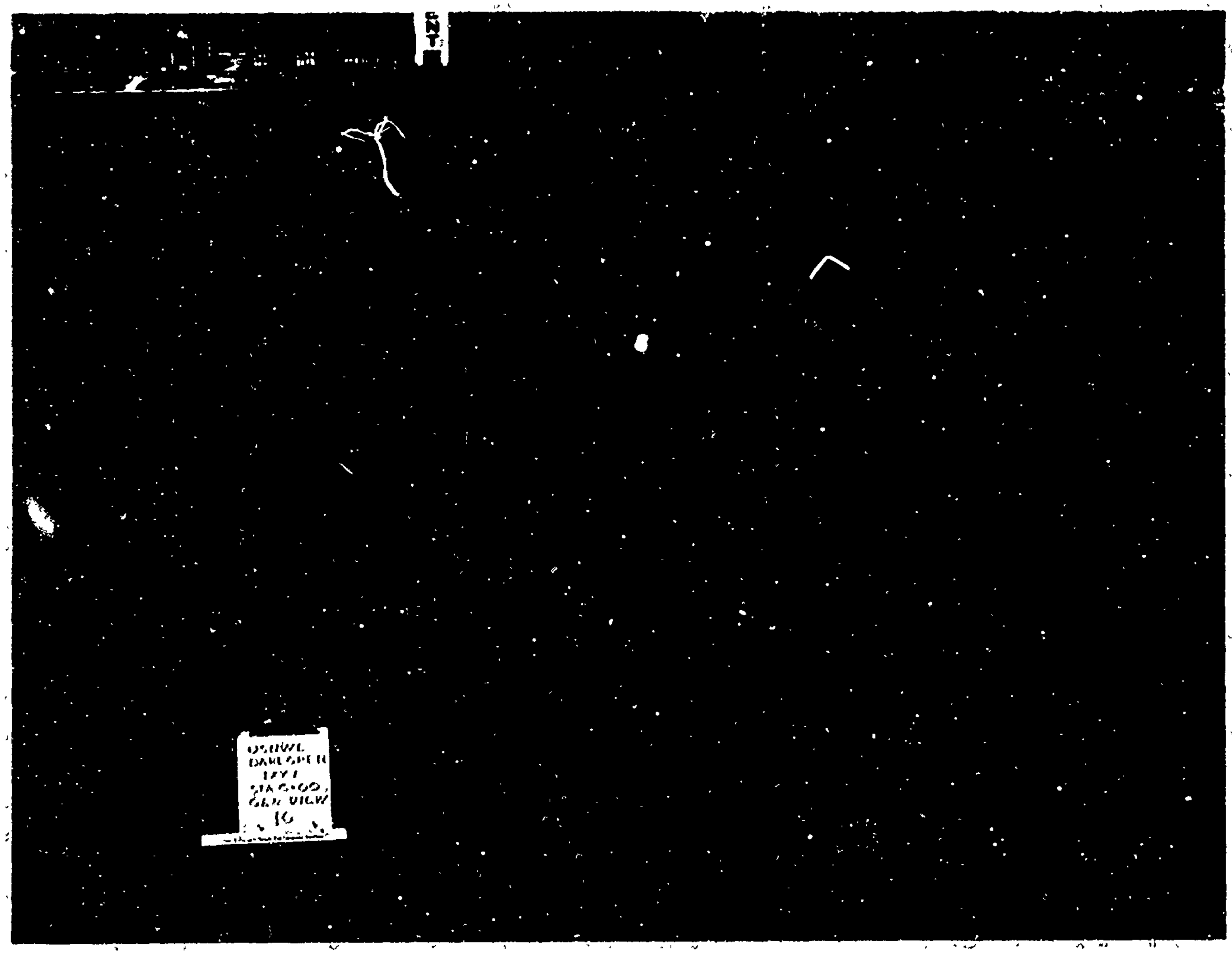


Figure 13. General view of Taxiway 1.

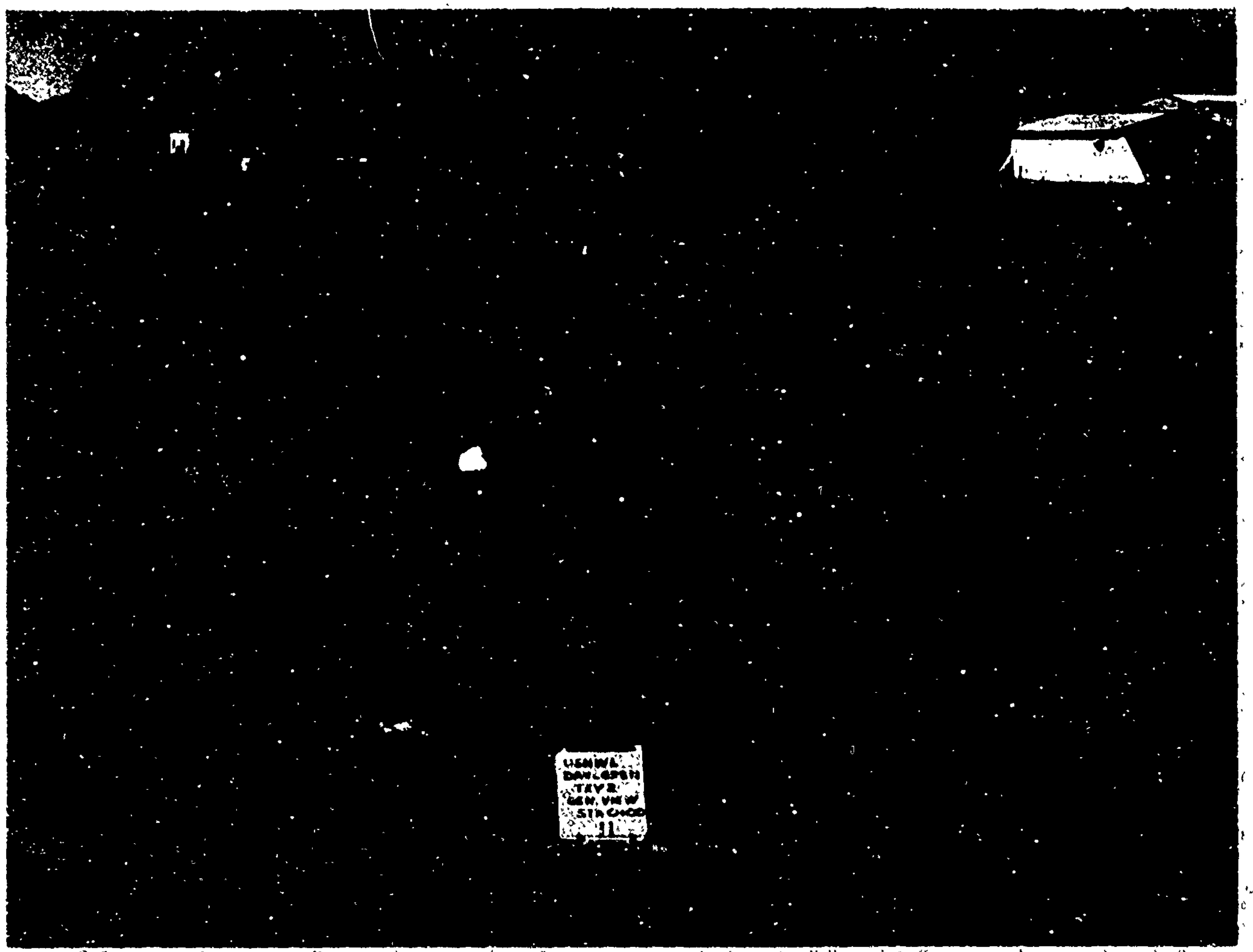


Figure 14. General view of Taxiway 2.

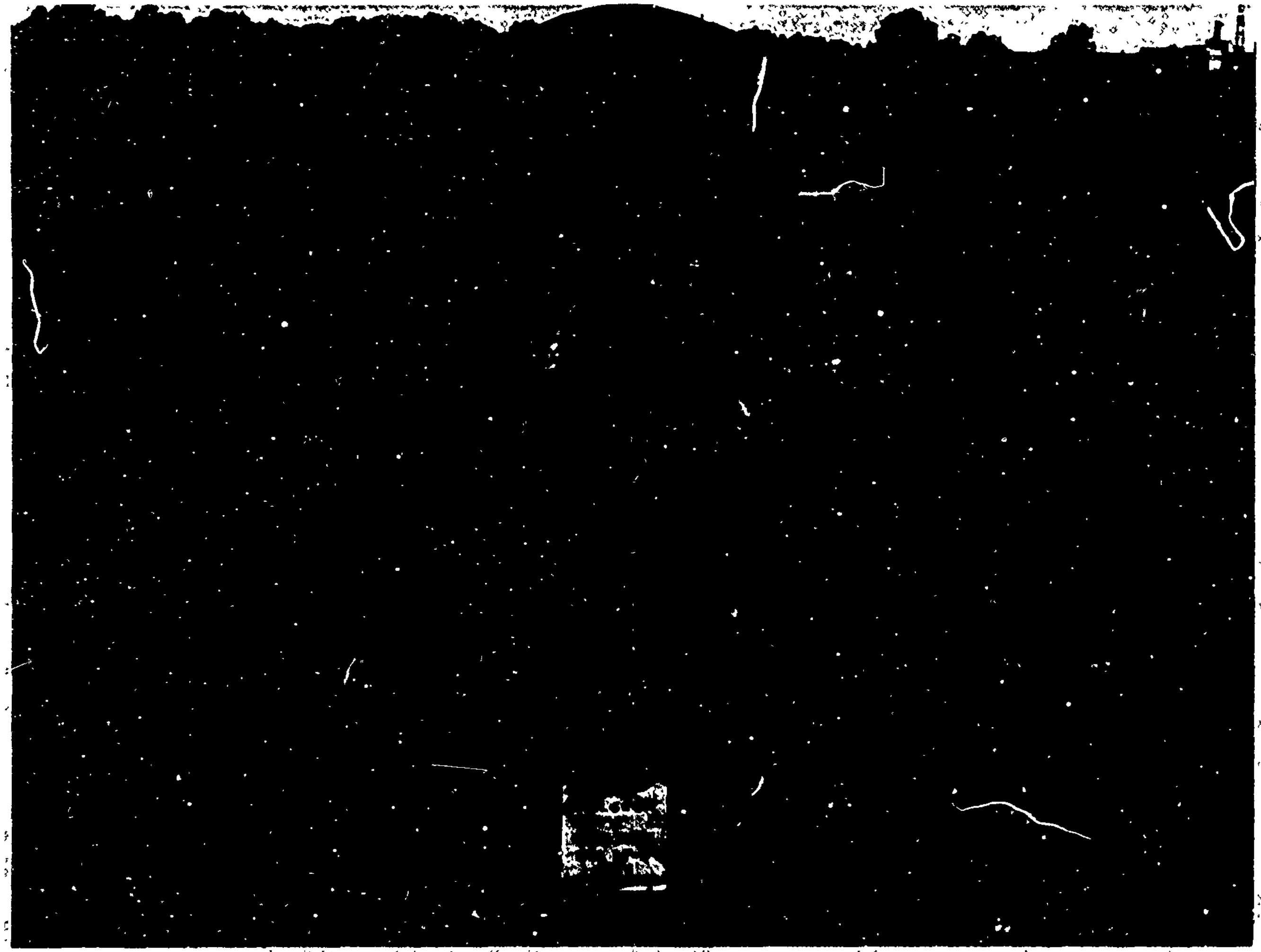


Figure 15. General view of Taxiway 2.

Figure 16. General view of Parking Apron 1.

ASPHALTIC AND PORTLAND CEMENT CONCRETE

DISCRETE AREA DEFECT SUMMARY SHEETS

ASPHALTIC CONCRETE DISCRETE AREA DEFECT SUMMARY

Airfield USNWL Dahlgren Facility Runway 15-33

Discrete Area R15-1 Area of Discrete Area (a) 419,000 ft²

No. of Sample Areas (b) 15 Ratio: (a/2500b) 11.2

Defect Type	Length or Area of Sampled Defects	Total Length or Area of All Defects: (c) x Ratio	Defect Density (per 10 sq. ft.) 10 d/a	Defect Severity Weight	Weighted Defect Density: (e) x (f)
	(c)	(d)	(e)	(f)	(g)
T.C., L.C. or LC. *	252 ft	2,822 ft	0.067	3.0	0.201
Reflection Crack					
Faulting					
Patching					
Settlement or Depression					
Pattern Cracking	90 ft²	1,008 ft²	0.025	3.0	0.075
Rutting					
Raveling					
Erosion—Jet Blast					
Oil Spillage					
Broken-up Area					
				Total	0.28 A**

Remarks on Pavement Condition

Transverse, longitudinal and longitudinal construction joint cracks were unsealed and generally 1/32" wide. Pattern cracking formed polygons with 6" to 15" sides with 1/8" wide cracks. This area had a 1" asphaltic concrete overlay in 1968. (See Figures 5 and 6.)

* Transverse crack, longitudinal crack or longitudinal construction joint crack

** Letter suffix "A" indicates asphaltic concrete pavement

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ASPHALTIC CONCRETE DISCRETE AREA DEFECT SUMMARY

Airfield USNWL Dahlgren Facility Runway 9-27

Discrete Area R9-1 Area of Discrete Area (a) 380,000 ft²

No. of Sample Areas (b) 16 Ratio: (a/2500b) 9.5

Defect Type	Length or Area of Sampled Defects	Total Length or Area of All Defects: (c) x Ratio	Defect Density (per 10 sq. ft.) 10 d/a	Defect Severity Weight	Weighted Defect Density: (e) x (f)
	(c)	(d)	(e)	(f)	(g)
T.C., L.C. or L.C. *	1,740 ft	16,530 ft	0.435	3.0	1.305
Reflection Crack					
Faulting					
Patching					
Settlement or Depression					
Pattern Cracking	31,450 ft^2	298,775 ft^2	7.862	3.0	23.586
Rutting					
Raveling					
Erosion—Jet Blast					
Oil Spillage					
Broken-up Area					
				Total	24.89 A**

Remarks on Pavement Condition

Pattern cracking formed polygons up to approximately 5' by 5'. Cracks were unsealed, and were between 1/4" to 1/2" wide. Some vegetation appeared through cracks at the 27 end of the runway. (See Figures 7, 8 and 9.)

* Transverse crack, longitudinal crack or longitudinal construction joint crack

** Letter suffix "A" indicates asphaltic concrete pavement

ASPHALTIC CONCRETE DISCRETE AREA DEFECT SUMMARY

Airfield USNWL Dahlgren Facility Runway 18-36 (abandoned)

Discrete Area R18-1 Area of Discrete Area (a) 350,000 ft²

No. of Sample Areas (b) 15 Ratio: (a/2500b) 9.3

Defect Type	Length or Area of Sampled Defects	Total Length or Area of All Defects: (c) x Ratio	Defect Density (per 10 sq. ft.) 10 d/a	Defect Severity Weight	Weighted Defect Density: (e) x (f)
	(c)	(d)	(e)	(f)	(g)
T.C., L.C. or LCJ *	3,035 ft	28,225 ft	0.806	3.0	2.418
Reflection Crack					
Faulting					
Patching					
Settlement or Depression					
Pattern Cracking	23,420 ft²	217,806 ft²	6.223	3.0	18.669
Rutting					
Raveling					
Erosion—Jet Blast					
Oil Spillage					
Broken-up Area					
				Total	21.09 A**

Remarks on Pavement Condition

Cracks were unsealed, and up to 1-1/4" wide. Pattern cracking formed polygons with sides ranging from 12" by 25" to 5' by 5'. Vegetation was growing up to 12" high through many cracks. The asphaltic surface was dead-appearing. This runway was designated closed. (See Figures 10, 11 and 12.)

* Transverse crack, longitudinal crack or longitudinal construction joint crack

** Letter suffix "A" indicates asphaltic concrete pavement

ASPHALTIC CONCRETE DISCRETE AREA DEFECT SUMMARY

Airfield USNWL Dahlgren Facility Taxiway 1

Discrete Area T1-1 Area of Discrete Area (a) 24,450 ft²

No. of Sample Areas (b) 1 Ratio: (a/2500b) 1

Defect Type	Length or Area of Sampled Defects	Total Length or Area of All Defects: (c) x Ratio	Defect Density (per 10 sq. ft.) 10 d/a	Defect Severity Weight	Weighted Defect Density: (e) x (f)
	(c)	(d)	(e)	(f)	(g)
T.C., L.C. or LCJ *					
Reflection Crack					
Faulting					
Patching					
Settlement or Depression					
Pattern Cracking	24,450 ft^2	24,450 ft^2	10.000	3.0	30.000
Rutting					
Raveling	2 ft^2	2 ft^2	0.001	7.0	0.007
Erosion—Jet Blast					
Oil Spillage					
Broken-up Area					
				Total	30.01 A**

Remarks on Pavement Condition

Pattern cracking formed polygons with sides from 6" to 12". Pavement surface was rough and had a dead appearance. (See Figure 13.)

* Transverse crack, longitudinal crack or longitudinal construction joint crack

** Letter suffix "A" indicates asphaltic concrete pavement

ASPHALTIC CONCRETE DISCRETE AREA DEFECT SUMMARY

Airfield USNWL Dahlgren Facility Taxiway 2

Discrete Area T2-1 Area of Discrete Area (a) 24,250 ft^2

No. of Sample Areas (b) 3 Ratio: (a/2500b) 3.2

Defect Type	Length or Area of Sampled Defects	Total Length or Area of All Defects: (c) x Ratio	Defect Density (per 10 sq. ft.) 10 d/a	Defect Severity Weight	Weighted Defect Density: (e) x (f)
	(c)	(d)	(e)	(f)	(g)
T.C., L.C. or LCJ *	335 ft	1,072 ft	0.442	3.0	1.326
Reflection Crack					
Faulting					
Patching					
Settlement or Depression	190 ft^2	608 ft^2	0.251	9.0	2.259
Pattern Cracking	780 ft^2	2,496 ft^2	1.029	3.0	3.088
Rutting					
Raveling					
Erosion—Jet Blast					
Oil Spillage					
Broken-up Area					
				Total	6.67 A**

Remarks on Pavement Condition

Cracks were unsealed up to 3/4" wide with vegetation growing through the cracks. Pavement surface was rough and had a dead appearance. Pattern cracking formed polygons with 2' to 3' sides. Depressions were up to 2-1/2" deep with pattern cracking within the depressions. (See Figure 14.)

* Transverse crack, longitudinal crack or longitudinal construction joint crack

** Letter suffix "A" indicates asphaltic concrete pavement

ASPHALTIC CONCRETE DISCRETE AREA DEFECT SUMMARY

Airfield USNWL Dahlgren Facility Taxiway 2

Discrete Area T2-3 Area of Discrete Area (a) 60,600 ft²

No. of Sample Areas (b) 6 Ratio: (a/2500b) 4.0

Defect Type	Length or Area of Sampled Defects	Total Length or Area of All Defects: (c) x Ratio	Defect Density (per 10 sq. ft.) 10 d/a	Defect Severity Weight	Weighted Defect Density: (e) x (f)
	(c)	(d)	(e)	(f)	(g)
T.C., L.C. or LCJ *	95 ft	380 ft	0.063	3.0	0.189
Reflection Crack					
Faulting					
Patching					
Settlement or Depression					
Pattern Cracking	175 ft²	700 ft²	0.115	3.0	0.345
Rutting					
Raveling					
Erosion—Jet Blast					
Oil Spillage					
Broken-up Area					
				Total	0.53 A**

Remarks on Pavement Condition

Pavement surface had a smooth appearance. Pattern cracking formed polygons with 6" sides. (See Figure 15.)

* Transverse crack, longitudinal crack or longitudinal construction joint crack

** Letter suffix "A" indicates asphaltic concrete pavement

PORTLAND CEMENT CONCRETE DISCRETE AREA DEFECT SUMMARY

Airfield USNWL Dahlgren Facility Taxiway 2

Discrete Area T2-2 Total Slabs in Discrete Area (a) 26

No. of Slabs Sampled (b) 26 Ratio a/b = 1

Defect Type	No. of Sample Slabs w/Defect	Total Slabs w/Defect: c x a/b	Defect Density (per slab) d/a	Defect Severity Weight	Weighted Defect Density e x f
	(c)	(d)	(e)	(f)	(g)
Faulting					
Corner Break	7	7	0.2692	3.0	0.808
L.C. or T.C.*	5	5	0.1923	1.5	0.288
I.C.**	5	5	0.1923	3.0	0.577
Depression					
Spalling	24	24	0.9230	7.5	6.922
Scaling	18	18	0.6923	7.0	4.846
Disintegrated Slab	4	4	0.1538	9.0	1.384
Joint Seal	26	26	1.0000	3.0	3.000
"D"-Line Cracking	16	16	0.6153	6.5	3.999
				Total	21.82 C***

Remarks on Pavement Condition

The concrete surface had a rough and weathered appearance. Scaled areas were up to 6" wide along slab edges. Joint seal was completely missing with grass growing through joints. Cracks were unsealed and up to 1/2" wide. Scaling generally started at "D"-line cracked areas.

* Longitudinal crack or transverse crack
** Intersecting crack
*** Letter suffix "C" indicates portland cement concrete pavement

ORTLAND CEMENT CONCRETE DISCRETE AREA DEFECT SUMMARY

Airfield USNWL Dahlgren Facility Parking Apron 1

Discrete Area PA1-1 Total Slabs in Discrete Area (a) 32

No. of Slabs Sampled (b) 32 Ratio a/b = 1

Defect Type	No. of Sample Slabs w/Defect	Total Slabs w/Defect: c x a/b	Defect Density (per slab) d/a	Defect Severity Weight	Weighted Defect Density e x f
	(c)	(d)	(e)	(f)	(g)
Faulting					
Corner Break	2	2	0.0625	3.0	0.188
L.C. or T.C.*	27	27	0.8437	1.5	1.266
I.C.**	11	11	0.3437	3.0	1.031
Depression					
Spalling	12	12	0.3750	7.5	2.812
Scaling					
Disintegrated Slab					
Joint Seal	32	32	1.0000	3.0	3.000
"D"-Line Cracking	2	2	0.0625	6.5	0.406
				Total	8.70 C***

Remarks on Pavement Condition

Concrete surface had a rough and weathered appearance. Joint seal was completely gone with vegetation growing through joints. Cracks were unsealed and up to 1/8" wide. Spalls averaged 2" wide by 8" long.

* Longitudinal crack or transverse crack
** Intersecting crack
*** Letter suffix "C" indicates portland cement concrete pavement

PORTLAND CEMENT CONCRETE DISCRETE AREA DEFECT SUMMARY

Airfield USNWL Dahlgren Facility Parking Apron 1

Discrete Area PA1-2 Total Slabs in Discrete Area (a) 405

No. of Slabs Sampled (b) 102 Ratio a/b = 4.0

Defect Type	No. of Sample Slabs w/Defect	Total Slabs w/Defects c x a/b	Defect Density (per slab) d/a	Defect Severity Weight	Weighted Defect Density e x f
	(c)	(d)	(e)	(f)	(g)
Faulting	1	4	0.0098	8.5	0.083
Corner Break	3	12	0.0296	3.0	0.089
L.C. or T.C.*	4	16	0.0395	1.5	0.059
I.C.**	1	4	0.0098	3.0	0.029
Depression					
Spalling	38	152	0.3753	7.5	2.815
Scaling	22	88	0.2172	7.0	1.520
Disintegrated Slab					
Joint Seal	101	404	1.0000	3.0	3.000
"D"-Line Cracking	10	40	0.0987	6.5	0.642
				Total	8.24 C***

Remarks on Pavement Condition

Cracks were unsealed and up to 1/4" wide. Spalls were generally 2" by 6". Joint seal was completely gone with grass growing between slabs. Scaling was generally found at the edges of slabs where "D"-line cracking was present. (See Figure 16.)

* Longitudinal crack or transverse crack
** Intersecting crack
*** Letter suffix "C" indicates portland cement concrete pavement

ASPHALTIC AND PORTLAND CEMENT CONCRETE

FACILITY DEFECT SUMMARY SHEETS

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ASPHALTIC CONCRETE FACILITY DEFECT SUMMARY

Airfield USNWL Dahlgren, Virginia

Date Surveyed September 1969

Facility (or portion)	Weighted Defect Density Total	Ratio: Discrete Area / Total Facility Area*	Average Weighted Defect Density (a) x (b)
	(a) **	(b)	(c)**
Runway 15-33			
R15-1	0.28 A	1.00	0.28 A
Runway 9-27			
R9-1	24.89 A	1.00	24.89 A
Runway 18-36 (Abandoned)			
R18-1	21.09 A	1.00	21.09 A
Taxiway 1			
T1-1	30.01 A	1.00	30.01 A
Taxiway 2			
T2-1	6.67 A	0.29	1.93
T2-3	0.53 A	0.71	0.23
			2.16 A (Total)

* If facility entirely constructed of AC, indicates total facility area. If facility only partly constructed of AC, indicates total area of AC portion of facility.

** Letter suffix "A" on weighted defect densities indicates asphaltic concrete pavements.

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PORTLAND CEMENT CONCRETE FACILITY DEFECT SUMMARY

Airfield USNWL Dahlgren

Date Surveyed September 1969

Facility (or portion)	Weighted Defect Density Total	Ratio: Discrete Area / Total Facility Area*	Average Weighted Defect Density (a) x (b)
	(a) **	(b)	(c)**
Taxiway 2			
T2-2	21.82 C	1.00	21.82 C
Parking Apron 1			
PA1-1	8.70 C	0.07	0.61
PA1-2	8.24 C	0.93	7.66
			8.27 C (Total)

* If facility entirely constructed of PCC, indicates total facility area. If facility only partly constructed of PCC, indicates total area of PCC portion of facility.

** Letter suffix "C" on weighted defect densities indicates Portland cement concrete pavements.

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Appendix A

CONSTRUCTION HISTORY

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Appendix A

CONSTRUCTION HISTORY FOR USNWL DAHLGREN, VIRGINIA

Item No.	Section From Surface to Subgrade	Date Constructed	Date Strengthened or Sealed
1	Runway 9-27		
	Slurry seal		1968
	2" AC overlay		1954
	3" Bituminous macadam	1941	
	8" Compacted bank gravel	1941	
	6" #2 Slag gravel mixture	1941	
2	Runway 15-33, Station 0+00 to 21+50		
	1" AC overlay		1968
	Seal coat		1956
	2" AC overlay		1954
	3" Bituminous macadam	1941	
	8" Compacted bank gravel	1941	
	6" #2 Slag gravel sand mixture	1941	
	NOTE: Boring logs prepared on Runway 15-33 in 1961 show that AC ranged from 4" to 7" and crushed stone ranged from 4" to 6".		
3	Runway 15-33, Station 21+50 to 42+60		
	Same as above except for date of original construction	1936	
4	Runway 18-36, Station 0+00 to 16+00		
	2" AC overlay		1954
	3" Bituminous macadam	1941	
	8" Compacted bank gravel	1941	
	6" #2 Slag material	1941	

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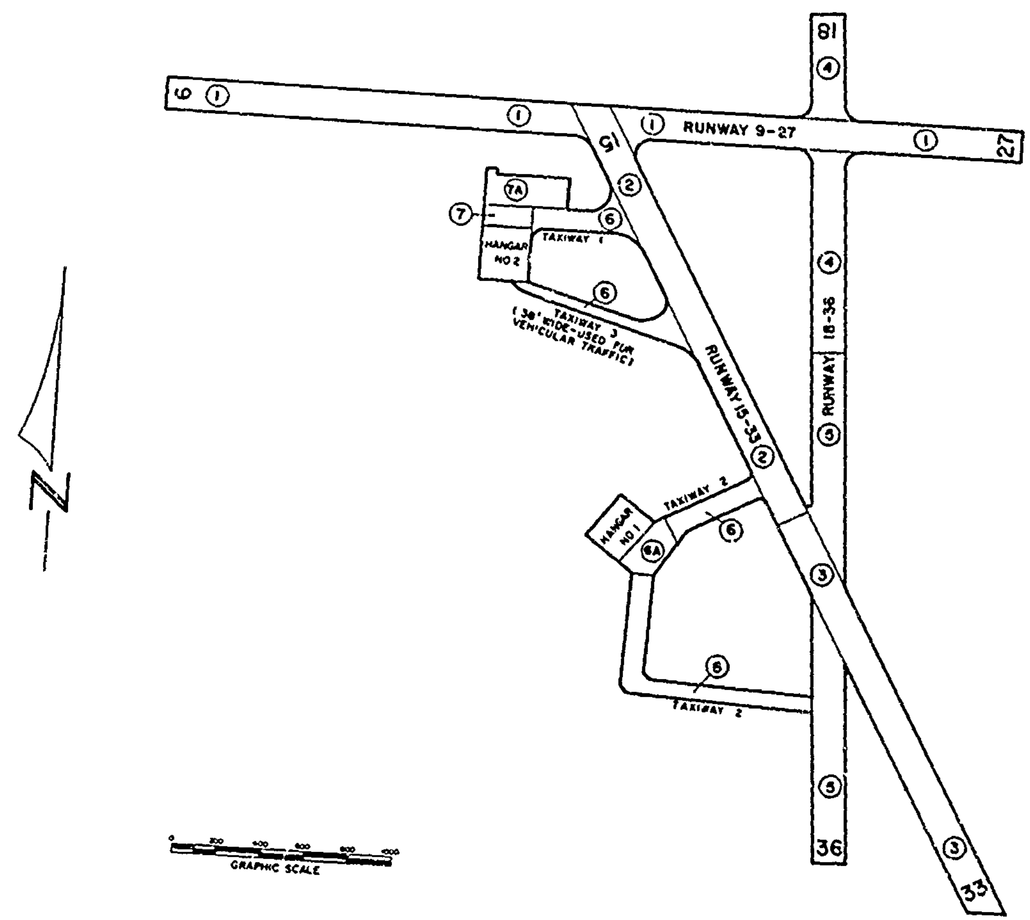
Item No.	Section From Surface to Subgrade	Date Constructed	Date Strengthened or Sealed
5	Runway 18-36, Station 16+00 to 40+00		
	Same as Item 4 except for date of original construction	1936	
6	Taxiways 1 and 3; Taxiway 2, Station 0+00 to 4+60 and Station 7+00 to 20+00		
	2" AC overlay		1954
	Widened 20'		1941
	3" Bituminous macadam	1936	
	8" Compacted bank gravel	1936	
	6" #2 Slag sand gravel mixture	1936	
6A	Taxiway 2, Station 4+60 to 7+00		
	6" Portland cement concrete	1941	
7	Parking on 1		
	6" Portland cement concrete	1941	
7A	Parking Apron 1		
	6" Portland cement concrete	1945	



USNAS DAHLGREN, VIRGINIA
PAVEMENT CONDITION SURVEY
CONSTRUCTION HISTORY

APPENDIX A. FIGURE A-1

REFERENCES

1. Soil Mechanics and Paving Branch, District Public Works Office, Fifth Naval District, Norfolk, Virginia. Airfield Pavement Evaluation, Naval Weapon Laboratory, Dahlgren, Virginia, by W. J. Dunning and T. B. West, 1961.

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13. ABSTRACT

The results of a condition survey of the airfield pavements at the U. S. Naval Weapons Laboratory, Dahlgren, Virginia is presented. The survey established statistically-based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

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14 KEY WORDS	LINK A		LINK B		LINK C	
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Condition Survey						
Runways						
Taxiways						
Condition Numbers						

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