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CONDITION SURVEY, MALMSTROM AIR FORCE BASE, MONTANA

by

R. D. Jackson

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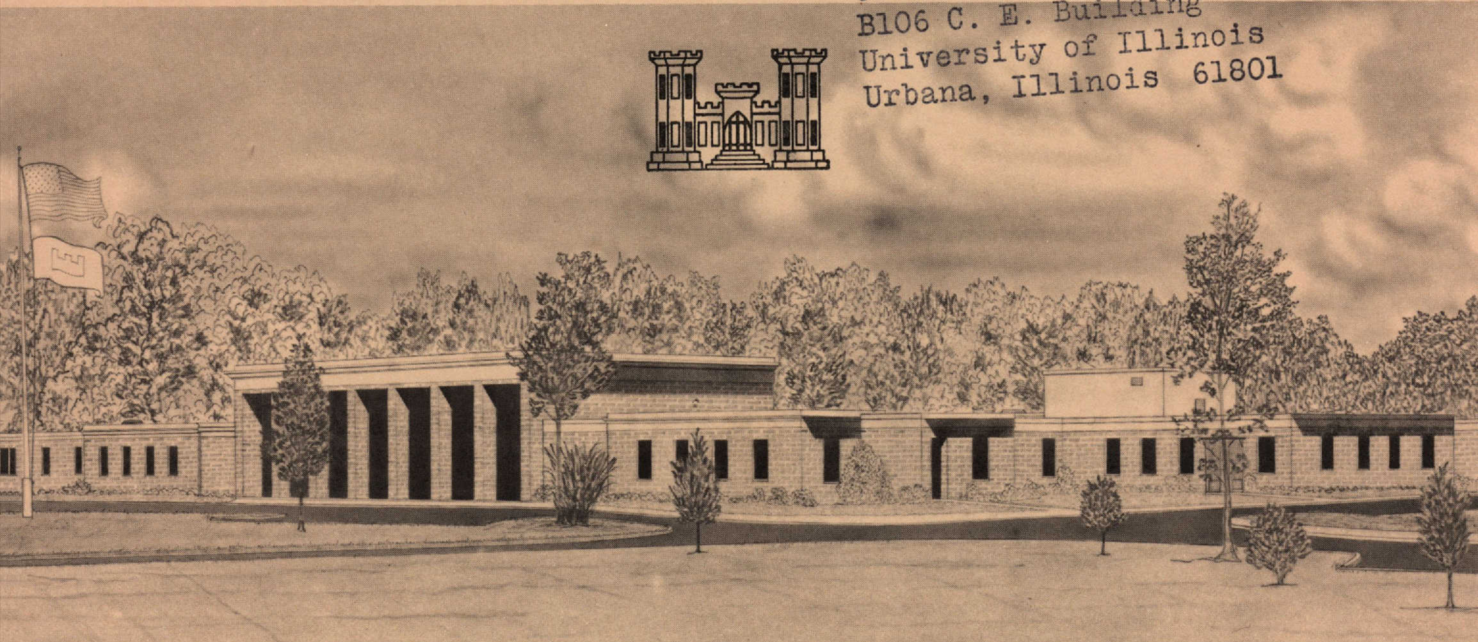

April 1973

Sponsored by **Office, Chief of Engineers, U. S. Army**

Conducted by **U. S. Army Engineer Waterways Experiment Station**
Soils and Pavements Laboratory
Vicksburg, Mississippi

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ARMY-MRC VICKSBURG. MISS.

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Foreword

The study reported herein was conducted under the general supervision of the Engineering Design Criteria Branch, Soils and Pavements Laboratory, of the U. S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Mississippi. Personnel involved in the condition survey were Mr. J. C. Hart of the U. S. Army Engineer Division, New England (NED), Waltham, Massachusetts, and Messrs. R. D. Jackson, K. A. O'Connor, and S. R. Rowland of the WES. The main portion of this report was prepared by Mr. Jackson under the general supervision of Messrs. J. P. Sale, R. G. Ahlvin, R. L. Hutchinson, and P. J Vedros of the Soils and Pavements Laboratory. That portion of the study pertaining to frost action was carried out by the U. S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, New Hampshire, with the assistance of the Foundations and Materials Branch, NED. The section of this report concerning frost action was prepared by Mr. Hart and by Mr. G. D. Gilman of CRREL.

COL Ernest D. Peixotto, CE, was Director of the WES during the conduct of the study and preparation of the report. Mr. F. R. Brown was Technical Director.

Contents

Conversion Factors, British to Metric Units of Measurement

British units of measurement used in this report can be converted to metric units as follows:

Multiply	By	To Obtain
inches	2.54	centimeters
feet	0.3048	meters
miles (U. S. statute)	1.609344	kilometers
square inches	6.4516	square centimeters
square yards	0.8361274	square meters
miles per hour	1.609344	kilometers per hour
pounds (mass)	0.45359237	kilograms
pounds (force) per square inch	0.6894757	newtons per square centimeter
Fahrenheit degrees	*	Celsius or Kelvin degrees

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* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: $C = (5/9)(F - 32)$. To obtain Kelvin (K) readings, use: $K = (5/9)(F - 32) + 273.15$.

CONDITION SURVEY, MALMSTROM AIR FORCE BASE, MONTANA

Authority

1. Authority for conducting condition surveys at selected airfields is contained in amendment to FY 1972 RDTE Funding Authorization (MFS-MC-5, 16 February 1972), subject: "Air Force Airfield Pavement Research Program," from the Office, Chief of Engineers, U. S. Army, Directorate of Military Construction, dated 18 February 1972.

Purpose and Scope

2. The purpose of this report is to present the results of a condition survey performed at Malmstrom Air Force Base (MAFB), Montana, during 24-27 April 1972. The following three major areas of interest were considered in this condition survey:

a. The structural condition of the primary airfield pavements.

b. The condition of pavement repairs and the types of maintenance materials that have been used at this airfield.

c. Any detrimental effects of frost to the pavement facilities.

3. This report is limited to a presentation of visual observations of the pavement conditions, discussion of these observations, and pertinent remarks with regard to the performance of the pavements. No physical tests of the pavements, foundations, or patching materials were performed during this survey.

Pertinent Background Data

General description of airfield

4. MAFB, formerly identified as Great Falls Army Air Base and Great Falls Air Force Base, is located in Cascade County, Montana,

approximately 4 miles* east of Great Falls, Montana. A vicinity map is shown in plates 1 and 2.

5. In April 1972, the airfield facilities consisted of a NE-SW (02-20) runway, a parallel taxiway, a large parking and maintenance apron, alert aprons, two warm-up aprons, connecting taxiways to the runway and aprons, and a calibration hardstand. The runway was 200 ft wide and 11,500 ft long; the parking apron was 425 to 875 ft wide and approximately 6,450 ft long. The taxiways were 75 ft wide, except for a portion of taxiway A, which was 175 ft wide. A layout of the airfield is shown in plate 1. A pavement plan indicating the type of pavement on each facility is shown in plate 2.

Previous reports

6. Previous reports concerning MAFB are listed below. Pertinent data were extracted from them for use in this condition survey.

7. Condition survey report: Ohio River Division Laboratories, CE, "Condition Survey Report, Malmstrom Air Force Base, Montana," March 1961, Cincinnati, Ohio.

8. Pavement evaluation reports:

a. U. S. Army Engineer District, Seattle, CE, "Report on Pavement Evaluation, Great Falls Army Air Base, Great Falls, Montana," July 1944, and Addendum No. 1, "Airfield Pavement Evaluation of NE-SW Runway, Warm-Up Apron, and Portions of N-S Runway, Taxiways P, Q, R, and S, Malmstrom Air Force Base, Great Falls, Montana," March 1955, Seattle, Washington.

b. U. S. Army Engineer District, Walla Walla, CE, "Pavement Evaluation Report, Apron, Runway Ends, Taxiway Extensions, and Alert Taxiway and Apron, Malmstrom Air Force Base, Great Falls, Montana," June 1958, Walla Walla, Washington.

History of Airfield Pavements

Design and construction history

9. Details of the construction history of the airfield pavements (extracted from the reports referenced in paragraphs 7 and 8) are

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* A table of factors for converting British units of measurement to metric units is presented on page vii.

presented in table 1. Pavement thicknesses, descriptions, and other details are presented in table 2.

10. The pavements constructed during 1942-1943 were designed for a 60,000-lb, single-wheel load, except for the ASC apron, which was designed for a 75,000-lb, single-wheel load. Pavements constructed during 1951-1952 were designed for a 160,000-lb, twin-tandem assembly, with wheels spaced at 31 by 63 in. and with a contact area of 267 sq in. Most of the pavements constructed during 1955-1956 were designed for a 100,000-lb, twin-wheel assembly in a tricycle-type gear configuration, with wheel spacings of 37 in. and a contact area of 267 sq in. The alert area pavements constructed during 1955-1956 were designed for a 25,000-lb, single-wheel assembly, with a tire pressure of 200 psi. Pavements constructed during 1957-1959 were designed either for a 265,000-lb, twin-twin assembly having wheels spaced at 37-62-37 in. in a bicycle-type main gear configuration with a contact area of 267 sq in. per tire or for a 100,000-lb, twin-wheel assembly in a bicycle-type main gear configuration having wheels spaced 37.5 in. center-to-center with a contact area of 267 sq in. per tire. Design criteria used for construction during 1968 were for a 25,000-lb, single-wheel load with a tire inflation pressure of 200 psi.

Traffic history

11. A detailed traffic record was not available for this study; however, some traffic information was available from previous condition surveys and pavement evaluations. During World War II, traffic operations were primarily from P-39 fighters and B-25 medium bombers, with some traffic from B-17 bombers during the first 8 months of 1943. From 1944 to 1952, the majority of traffic consisted of C-47 and C-54 passenger and cargo aircraft operations. From 1953 to 1956, the aircraft that used the airfield were B-29 and B-50 medium bombers, C-54 and C-124 passenger and cargo aircraft, and jet fighters.

12. During the period January 1957 through June 1960, the airfield was subjected to 39,294 cycles* of aircraft traffic, of which

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* A cycle of traffic is one takeoff and one landing.

43 percent were aircraft with gross loads of less than 28,000 lb; 33 percent, with gross loads of 31,000 to 56,000 lb; 2 percent, with gross loads of 56,000 to 76,000 lb; less than 1 percent, with gross loads of 76,000 to 123,000 lb; and 22 percent, with gross loads over 123,000 lb. For the past 9 years, airfield traffic has averaged 1,300 cycles per month, of which 75 percent is composed of F-101 and F-106 fighter aircraft. The other 25 percent includes KC-135, L-188, C-9, C-141, C-130, C-118, and other miscellaneous aircraft. The average number of cycles per month for the heavier aircraft are as follows: KC-135, 15; L-188, 30; C-9, 12; C-141, 5; C-130, 2; and C-118, 2. No B-52 aircraft have been based at MAFB. The NE (20) end of the runway is used for approximately 90 percent of the takeoffs and landings.

Conditions of Pavement Surfaces

Pavement inspection procedure

13. The following procedure was used in conducting the inspection of the rigid pavements. Representative features were selected for detailed inspection. The features were then inspected slab* by slab, and the defects were recorded. The locations of the individual pavement features, the inspection starting points, and the directions in which the pavements were inspected (shown by arrows) are indicated in plate 1.

14. The results of the rigid pavement survey for those features that were inspected in detail are presented in table 3. This table shows a quantitative breakdown of the various types of defects and a condition rating for each pavement feature inspected in detail. The procedures used for determining the condition rating of a pavement are given in Appendix III of Department of the Army Technical Manual TM 5-827-3, "Rigid Airfield Pavement Evaluation," dated September 1965.

Runway

15. In general, the pavement on the runway was considered to be in good condition. The first 1000 ft of the SW (02) end of the runway (features R3A and R4B), which is 16-in. portland cement concrete (PCC),

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* A slab is the smallest unit, containing no joints, of a given pavement feature.

was in very good condition. The first 1000 ft of the NE (20) end (features R1A and R2B), which is also 16-in. PCC, was in excellent structural condition, and no major defects were noted. The joint sealing materials on both 1000-ft runway ends were in very poor condition and had completely deteriorated between several slabs at the southwest end. The asphaltic-concrete (AC) portion of the runway was in good condition, even though there were numerous longitudinal and transverse cracks that appeared to be reflection cracks (photos 1 and 2).

Primary taxiways

16. The primary taxiway system consists of taxiway T, the apron taxiway, and taxiway O. The southwest end of taxiway T (feature T1A) was in good condition. The AC portion of taxiway T was in poor condition (photo 3). The surface of this taxiway was uneven and contained numerous cracks and scales in the slurry seals placed in 1959 and 1965. The apron taxiway (features T3A and T7A) was in very good to excellent condition, even though there were a considerable number of minor defects. Taxiway O was in excellent condition.

Parking apron

17. The large maintenance and parking apron (features A1B and A2B) was in very good condition. Several discolored slabs were noted in the area that appeared to have been caused by water that originated from below the pavement surface. A french drain was installed along the apron taxiway in 1965. The installation of this drain has remedied the problem of water on the surface of the pavement. The joint seal on the apron was in fair condition.

Aerospace Defense Command (ADC) facilities

18. The ADC alert hangar aprons were in very good condition. The PCC portion in front of the alert hangar was placed in 1965. Taxiway B was considered to be in fair condition.

Frost Action

Objectives of inspection

19. One member of the team inspected the pavement facilities for

evidence of detrimental frost effects. The objectives of the inspection were to determine:

- a. Any adverse effects of frost heave to the pavements during the winter months.
- b. Any adverse effects of low-temperature contraction cracking to the flexible pavements.
- c. Any traffic-induced failures that might be related to thaw weakening of the subgrades or base courses.

Frost heave

20. The airfield pavements were inspected for surface irregularities indicative of differential frost heaving. The inspection, which was conducted on 25 and 26 April, did not coincide with the period of thawing of frozen base courses and subgrades when the effects of any nonuniform heave would be most apparent.

21. Engineers in the Base Civil Engineering Office were queried regarding the development of undesirable surface unevenness during the winter. Pilot testimony regarding runway unevenness was not sought, since the field has not been used by B-52's. The consensus of the survey team, however, was that the runway did not exhibit roughness detectable in an automobile at speeds of up to 50 mph. The flexible pavement runway interior was as smooth as the rigid pavement runway ends, despite the prevalence of low-temperature contraction cracking as described in paragraph 29. The 1961, 1962, and 1970 overlays of the runway interior were constructed to remedy a pavement roughness condition as well as instances of badly cracked pavement. This reported roughness seemed to be most noticeable to fighter plane pilots. Base Civil Engineer Office personnel reported that, during the spring thaw of either 1969 or 1970, a transverse crack appeared across the entire runway near the north end exhibiting a differential heave of 1 in. This pavement later settled, and the runway was heater-planed, leveled, and overlaid during the summer of 1970. If the heave and crack occurred during the winter of 1969, their development could be explained by the fact that this particular winter was the coldest recorded for the past 40 years and as a result there was substantial subgrade frost penetration.

22. Except for some minor surface unevenness along taxiways T

and S, the taxiways and aprons were smooth at the time of the inspection and were rated in good to excellent condition. The Base Civil Engineering Office reported no undesirable surface unevenness in the winter or spring. The surfaces of the flexible pavement shoulders were 1/2 to 1-1/2 in. lower than the adjacent PCC pavements in two limited areas along the parking apron. It was not determined whether these vertical displacements at the junctions of the rigid and flexible pavements were consequences of slightly greater frost heave of the rigid pavement or of settlement of the flexible pavement. In 1968, a 100-ft section of the flexible pavement of taxiway T was replaced because of cracking and settlement. In the same year a 200-ft section of flexible pavement at the east end of taxiway R was also replaced because of aging, deterioration, and settlement.

23. The runway overruns were smooth and showed no evidence of frost heaving. (The combined thickness of the overrun pavement is 65 in., while that of the adjacent rigid pavement is only 36 in.) The taxiway and apron shoulders showed considerable unevenness in many areas, with some longitudinal and transverse cracks, particularly in taxiways T, S, R, and Q and in the southwest warm-up apron (see photos 4 and 5). The roughness was probably the result of frost heaving, while much of the cracking was probably the result of vehicular traffic.

24. The most noticeable frost heaves were those affecting the concrete bases for taxiway lights and manholes inserted in the shoulder pavements. Several light bases along taxiway T were heaved for about 1 in. above the adjacent pavement, while 2 manhole covers in taxiways R and A were about 3 in. higher than the adjacent pavement. These differences in pavement elevations constituted a problem for snow removal equipment.

Freezing indices

25. A design freezing index of 1958 degree-days (based on temperature data from the Great Falls International Airport Weather Station) was cited in a previous condition survey report (see paragraph 7). This value reflected the average of the three coldest winters in the 30 years preceding the design of the pavements. Utilizing data from the same

station, up to and including the 1971-72 season, a recomputed index of 1820 degree-days can be obtained based on the three coldest winters of the past 30. Seasonal indices since 1957-58 are tabulated below:

Freezing Season	Freezing Index degree-days	Freezing Season	Freezing Index degree-days
1958-59	764	1966-67	543
1959-60	611	1967-68	617
1960-61	56	1968-69	2183
1961-62	1336	1969-70	694
1962-63	595	1970-71	908
1963-64	524	1971-72	1305
1964-65	1383		
1965-66	788	Mean 1938-71	671

26. The MAFB area is noted for winter occurrences of southwest "chinook" winds, which can produce sharp temperature rises of 40 F or more in 24 hours. Frequent occurrences of these winds can result in seasonal freezing indices which are unusually low for a continental location at this latitude. The indices tabulated above were determined solely on the basis of average monthly temperatures. Indices thus determined are generally somewhat lower than those determined with consideration given to average daily temperatures for the transition months at both ends of the freezing season. The tabulated indices, however, do indicate the relative severity of winters during the period of heavy-load aircraft operation. In this respect, the 1968-69 winter was over 600 degree-days colder than any other winter in the past 40 years. Three other very cold winters (1961-62, 1964-65, and 1971-72) occurred during this period.

27. In view of the fact that experienced freezing indices have been of design magnitude or higher during four seasons since the pavements have been constructed, the general absence of evidence of differential frost heaving of the heavy-load pavements is significant. The combined thickness of pavement and base required for prevention of subgrade freezing during the design year ranges from approximately 90 to

95 in. and for limited subgrade frost penetration ranges from about 65 to 70 in. Substantial subgrade freezing, therefore, is possible beneath all the heavy-load pavements, since the combined thickness for the rigid pavement is only 36 in., while that for flexible pavements ranges from 44 to 46 in. The resulting frost heaving has been remarkably uniform, and the condition of the pavements indicates that it has been a minor factor in pavement cracking. The performance of the shoulders is not considered unsatisfactory, although some of these pavements show considerable unevenness.

Groundwater

28. The water table at MAFB is approximately 200 ft below present ground elevation, but there is definite evidence of a perched water table under portions of the pavement system. The sandstone bedrock is not very deep, and the soil types in the subgrade consist of predominantly lean to sandy clays (CL),* with some scattered areas of fat clay (CH).* Evidence of a perched water table was found at the following pavement features during this inspection:

- a. Taxiway T, where some of the subdrains were emptying into the manholes, while other subdrains were dry. KC-97 aircraft traffic was reported to have pumped water through the cracks in the pavement along portions of this taxiway.
- b. Taxiway S, where a subdrain on the southwest side contained a slight flow, while a subdrain on the northeast side was dry.
- c. Taxiway Q, where water was observed flowing into a manhole from the subdrains.
- d. The parking apron between taxiway Q and sta 77+23, where the reported flow of water from the pavement joints was eliminated by the installation of a subdrain along the northeast edge of the rigid pavement in 1965.

Low-temperature contraction cracking

29. Record temperatures for MAFB are -43 F (December 1968) and

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* CL and CH are designations for soil classifications under the U. S. Department of Defense, "Unified Soil Classification System for Roads, Airfields, Embankments, and Foundations," Military Standard MIL-STD-619B, June 1968, U. S. Government Printing Office, Washington, D. C.

106 F (August 1969). Most of the flexible pavements have experienced low-temperature contraction cracking. These cracks are not induced by traffic or frost heaving but result from a stiffness characteristic of AC at low temperatures and its inability to withstand or adjust to thermal contraction stresses. Where this type of action is present, most of the cracks are transverse. However, there are also some longitudinal cracks, generally coinciding with the longitudinal paving joints. As of yet, only a minor amount of raveling has occurred at these cracks. The contraction cracking does not appear to have adversely affected either the load-carrying capacity or the smoothness of these pavements. The runway overrun pavements appear to be the least affected by this type of cracking, although some raveling of the surface treatment has occurred. Apparently, the thin, double bituminous surface treatment is more tolerant of thermal contraction stresses than the thicker AC. This fact may reflect a greater tolerance of such stresses by these low-stability surface cources, but more probably results from the lower temperature-susceptibility of the bitumen used.

Thaw weakening

30. The extent of thaw weakening of the subgrade and base courses could not be readily determined by inspection of the pavements. Pavement failures usually are repaired or otherwise corrected (as with overlays) as they occur and usually are not easily examined during a condition survey. However, even where examination is possible, it is often impossible to establish by visual observations whether a failure is the result of thaw weakening or of deficiencies in the thickness of the pavement components with respect to the "normal" period loading. The depletion of the fatigue resistance of a pavement system in a frost area is progressive under repeated loadings and is related to thaw weakening in that the rate of depletion is greater during the frost-melting period. This rate of pavement weakening holds true whether the evidence of fatigue becomes apparent during the melting period or at some other time. The degree of thaw weakening and its effects, if any, on the condition of the pavements at MAFB consequently could not be appraised solely by this inspection. Some limited perception of the severity of thaw

weakening effects can be gained, however, by comparing the performance of certain pavement features with what might be expected in the light of current frost design criteria.

31. The heavy-load flexible pavement features include the runway interior, with a combined thickness of 44 in., and portions of the taxiway system, with a combined thickness of 46 in. These combined thicknesses are substantially less than those required by the current design criteria for limited subgrade frost penetration and the reduced subgrade strength requirements for medium-load pavements. Furthermore, the taxiway pavement thicknesses are 2 in. less than those required by current criteria for a nonfrost design. Despite these deficiencies, these features appear to be in good to excellent condition, except for portions of taxiways S and T, where significant deformation and longitudinal cracking have occurred. The damage to these features is considered to have been load induced, and thaw weakening of the base course and subgrade may have been partially responsible.

32. The heavy-load rigid pavement features are generally 3 to 4 in. deficient in pavement thickness according to current nonfrost design criteria. In addition, the combined pavement and base thicknesses are substantially less than those required by current frost-condition design criteria for reduced subgrade strength design. Despite these deficiencies, these facilities appear to be in good to excellent condition. There has been no B-52 traffic reported at this base, and neither the pavements nor the design criteria can be considered to have been fully tested.

Maintenance

33. Maintenance of the runway pavements at MAFB has included applying overlays, sealing cracks, applying a rejuvenator, and heater-planing. The maintenance of the remaining AC pavements has consisted of the placement of slurry seals and the replacement of small sections of taxiways R and T with AC of the same structure as the original pavement. A 300- by 100-ft section of the alert hangar apron was replaced

with 12 in. of PCC in 1968. Maintenance of the PCC pavements has been limited to the sealing of joints and cracks and the repair of spalls. Maintenance expenditures at MAFB have been as follows:

FY 1967	$17,312	FY 1970	$ 27,863
FY 1968	6,745	FY 1971	628,459
FY 1969	54,491	FY 1972 (3 quarters)	6,564

Evaluation

34. A summary of the pavement evaluation is given in table 4. Previously published pavement evaluations were updated to eliminate aircraft that are no longer in the Air Force inventory and to include aircraft that have been added to the inventory since the last pavement evaluation. The evaluation is based on the pavement thickness, flexural strength (PCC), base and subbase thickness and strength, strength of subgrade (CBR or k value), and the structural condition of the pavement.

Conclusions

35. The following statements summarize the findings of this inspection:

a. The 16-in. PCC pavements on the runway were in very good to excellent structural condition.

b. The AC pavement on the runway was in good condition.

c. The 16- and 19-in. PCC apron pavements were in very good to excellent condition.

d. The alert area pavements (10- and 12-in. PCC) were carrying the loads imposed on them, even though taxiway B was approaching failure, based on the percentage of slabs containing no major defects.

e. The PCC pavements on the taxiways were in good to excellent condition.

f. The joint seal materials in the PCC pavements were in poor to fair condition.

g. Damage to the pavements as a result of freeze-thaw cycles has been minor.

Table 1

Airfield Construction History

Designation	Dimensions		Pavement		Construction		Remarks
	Length ft	Width ft	Thickness, in.	Type	Year(s)	Agency	
NE-SW runway	8850	150	6 AC/10 base	AC	1942	CE	Pavements reconstructed either completely or partially at later date
E-W runway	8850	150	6 AC/27-1/2 base	AC	1942	CE	Abandoned as of 1960
NW-SE runway	8850	150	6 AC/27-1/2 base	AC	1942	CE	Abandoned as of 1960
N-S runway	8850	150	6 AC/27-1/2 base	AC	1942	CE	Abandoned as of 1960
Taxiway A	980	75	6 AC/10 base	AC	1942	CE	Pavements reconstructed either completely or partially at later date
Taxiway B	500	75	6 AC/10 base	AC	1942	CE	↓
Taxiway C	430	75	6 AC/10 base	AC	1942	CE	↓
Taxiway D	350	75	6 AC/10 base	AC	1942	CE	↓
Taxiway E	712	75	6 AC/10 base	AC	1942	CE	Abandoned as of 1960
Taxiway F	612	75	6 AC/10 base	AC	1942	CE	↓
Taxiway H	280	75	6 AC/10 base	AC	1942	CE	↓
Taxiway I	875	75	6 AC/10 base	AC	1942	CE	↓
Taxiway J	8435	75	6 AC/10 base	AC	1942	CE	↓
Taxiway K	4071	75	6 AC/10 base	AC	1942	CE	↓
Taxiway M	500	75	6 AC/10 base	AC	1942	CE	↓
Taxiway N	2930	75	6 AC/10 base	AC	1942	CE	↓
Taxiway O	2588	75	6 AC/10 base	AC	1942	CE	↓
Parking apron	4900±	425	7	PCC	1942	CE	Pavements reconstructed either completely or partially at later date
ASC apron (54,850 sq yd)	--	--	8	PCC	1943	CE	Pavements reconstructed either completely or partially at later date
NE-SW runway	9500	200	4	AC	1951-52	CE	Reconstruction
Taxiway S	4250	75	4	AC	1951-52	CE	
Warm-up apron	Varies	Varies	4	AC	1951-52	CE	
Taxiway T (original E-W runway)	1195	75	4	AC	1951-52	CE	Transition
N-S runway (now taxiway N)	1100	75	4	AC	1951-52	CE	Transition
Taxiway A (original N-S runway 04 end)	575±	Varies	4	AC	1951-52	CE	
Taxiway J	1200	50	3	AC	1951-52	CE	Transition
Taxiway P (original taxiway J)	Varies	Varies	4	AC	1951-52	CE	
Taxiway Q (original taxiways A and D)	730	75	4	AC	1951-52	CE	Transition
Taxiway R (original taxiway E)	515	75	4	AC	1951-52	CE	Transition
Parking apron (sta 31+05 to 46+55)	1550	950	16	PCC	1955-56	CE	
Parking apron (sta 46+55 to 58+98)	1243	425	16	PCC	1955-56	CE	Reconstruction
Parking apron (sta 58+98 to 95+54)(apron taxiway)	3656	75	16	PCC	1955-56	CE	Reconstruction
NE-SW runway extensions	1000 each	200	16	PCC	1955-56	CE	
SW warm-up apron taxiway	Varies	Varies	16	PCC	1955-56	CE	
Taxiway S extension	550±	75	4	AC	1955-56	CE	
NE warm-up apron and taxiway	Varies	Varies	16	PCC	1955-56	CE	
Taxiway U	1300±	75	4	AC	1955-56	CE	
Alert hangar apron and taxiway	Varies	Varies	3	AC	1955-56	CE	
Apron (sta 58+98 to 77+23)	1725	325	19	PCC	1957	CE	Reconstruction
Alert hangar apron and connecting taxiway	300± 450±	100 75	10 10	PCC PCC	1957 1957	CE CE	
Apron (sta 85+33 to 95+54.3)	1021.3	325	16	PCC	1958	AF	Reconstruction
Taxiway D and nose dock aprons 1 and 2	750 Approximately	75	16	PCC	1958	AF	
Taxiway P	350	75	16	PCC	1959	AF	Reconstruction
Alert hangar apron	300	100	12	PCC	1968	AF	Reconstruction

Note: CE denotes Corps of Engineers; AF denotes Air Force.

Table 2

SUMMARY OF PHYSICAL PROPERTY DATA

FACILITY			OVERLAY PAVEMENT			PAVEMENT			BASE			SUBGRADE		GENERAL CONDITION OF AREA CONSIDERED
FACILITY NUMBER AND IDENTIFICATION	LENGTH FT	WIDTH FT	THICK. IN.	DESCRIPTION	FLEX. STR PSI	THICK. IN.	DESCRIPTION	FLEX. STR PSI	THICK. IN.	CLASSIFICATION	CBR OR K	CLASSIFICATION	CBR OR K	
NE-SW Runway Extension 1st 500 ft (20 End) R1A	500	200				16	Portland cement concrete	960	20	Crushed sandstone	200 K_f120	Clay (CL)		Excellent
NE-SW Runway Extension 2nd 500 ft (20 End) R2B	500	200				16	Portland cement concrete	960	20	Crushed sandstone	200 K_f120	Clay (CL)		Excellent
NE-SW Runway Interior Center 100 ft R5C	9500	100	4 2	Asphaltic concrete		4	Asphaltic concrete		36	Crushed sandstone	80	Clay (CL)	5	Good
NE-SW Runway Interior Outside Edges (50 ft Each Side) R6D	9500	100	2	Asphaltic concrete		4	Asphaltic concrete		36	Crushed sandstone	80	Clay (CL)	5	Good
NE-SW Runway Extension 1st 500 ft (02 End) R3A	500	200				16	Portland cement concrete	840	20	Crushed sandstone	225 K_f120	Clay (CL)		Very good
NE-SW Runway Extension 2nd 500 ft (02 End) R4B	500	200				16	Portland cement concrete	840	20	Crushed sandstone	225 K_f120	Clay (CL)		Very good
Taxiway T T1A	603±	75				16	Portland cement concrete	840	20	Crushed sandstone	225 K_f120	Clay (CL)		Good
Taxiway T T8A	3468	75				4	Asphaltic concrete		42	Crushed sandstone	80	Clay (CL)	5	Good
Taxiway O T2A	586±	75				16	Portland cement concrete	850	20	Crushed sandstone	250 K_f120	Clay (CL)		Excellent
Taxiway O T4A	325±	Variable				16	Portland cement concrete	775	20	Crushed sandstone	175 K_f120	Clay (CL)		Excellent
Taxiway O T9A	1247	75				3	Asphaltic concrete		42	Crushed sandstone	80	Clay (CL)	4	Good
Apron Taxiway Sta 46+55 to 95+54 T3A	4899	75				16	Portland cement concrete	850	20	Crushed sandstone	175 K_f120	Clay (CL)		Excellent
Alert Taxiway B T5B	450±	75				10	Portland cement concrete	800	10	Crushed sandstone	150 K_f60	Clay (CL)		Fair
Taxiway D and Nose Dock Aprons 1 and 2 T6B	550 150	75				16	Portland cement concrete	775	20	Crushed sandstone	175 K_f120	Clay (CL)		Good
Apron Taxiway Sta 31+05 to 46+55 T7A	1550	75				16	Portland cement concrete	850	20	Crushed sandstone	175 K_f120	Clay (CL)		Very good
Apron Sta 31+05 to 58+98 A1B	2793	Variable				16	Portland cement concrete	850	20	Crushed sandstone	175 K_f120	Clay (CL)		Very good
Apron Sta 58+98 to 77+23 A2B	1825	425				19	Portland cement concrete	830	17	Crushed sandstone	160 K_f105	Clay (CL)		Very good

WES FORM 1000
MAR 1958

Table 2 (Continued)

SUMMARY OF PHYSICAL PROPERTY DATA

FACILITY			OVERLAY PAVEMENT			PAVEMENT			BASE			SUBGRADE		GENERAL CONDITION OF AREA CONSIDERED
FACILITY NUMBER AND IDENTIFICATION	LENGTH FT	WIDTH FT	THICK. IN.	DESCRIPTION	FLEX. STR PSI	THICK. IN.	DESCRIPTION	FLEX. STR PSI	THICK. IN.	CLASSIFICATION	CBR OR K	CLASSIFICATION	CBR OR K	
Apron Sta 77+23 to 85+73 A3B	850	425	2	Asphaltic concrete $h_E = 8.43$		7	Portland cement concrete	775				Clay (CL)	75 K_f25	Failed
Apron Sta 85+73 to 95+54.3 A4B	981.3	425				16	Portland cement concrete	775	20	Crushed sandstone	175 K_f120	Clay (CL)		Excellent
Alert Hangar Apron A5B	300	100				10	Portland cement concrete	800	10	Crushed sandstone	150 K_f60	Clay (CL)		Very good
Alert Hangar Apron A8B	300	100				12	Portland cement concrete	750	23	Crushed sandstone	150 K_f120	Clay (CL)		Very good
NE Warm-up Apron A6B	Variable	Variable				16	Portland cement concrete	850	20	Crushed sandstone	250 K_f120	Clay (CL)		Very good
SW Warm-up Apron A7B	Variable	Variable				16	Portland cement concrete	840	20	Crushed sandstone	225 K_f120	Clay (CL)		Good
Taxiway A T10B	650±	175				4	Asphaltic concrete		42	Crushed sandstone	80	Clay (CL)	5	Good
Taxiway A T11B	575±	Variable				3	Asphaltic concrete		29	Crushed sandstone	80	Clay (CL)	5	Good
Taxiway J T12C	1200	50				3	Asphaltic concrete		27	Crushed sandstone	80	Clay (CL)	4	Good
Taxiway N T13C	1100	75				4	Asphaltic concrete		42	Crushed sandstone	80	Clay (CL)	5	Good
Taxiway Q T14C	700	75				4	Asphaltic concrete		42	Crushed sandstone	80	Clay (CL)	7	Good
Taxiway R T15C	650	75				4	Asphaltic concrete		42	Crushed sandstone	80	Clay (CL)	3	Good
Taxiway S T16C	850±	Variable				4	Asphaltic concrete		42	Crushed sandstone	80	Clay (CL)	5	Good
NE-SW Blast Pad (Each End) R1X	150	200				2	Asphaltic concrete		64	Crushed sandstone		Clay (CL)		
NE-SW Overrun (Each End) R2X	850	200					Double bituminous		65	Crushed sandstone		Clay (CL)		

Table 3

DATE: April 1972

SUMMARY OF DATA - RIGID PAVEMENT CONDITION SURVEY

AIRFIELD: Malmstrom AFB, Montana

FEATURE		SLAB SIZE FT	APPROX NO. OF SLABS	PAVE. THICK. IN.	NO. OF SLABS CONTAINING INDICATED DEFECTS																	% OF SLABS NO DEFECTS	% OF SLABS NO MAJOR DEFECTS	CONDITION
NO.	DESIGNATION				I	—	\	Δ	✱	K	〰	S	J	Ɉ	J	⌖	M	P	O	C	D			
R1A	NE-SW Runway Extension 1st 500 ft (20 End)	25x25	160	16									2	2	6		1		20			80.6	100	Excel-lent
R2B	NE-SW Runway Extension 2nd 500 ft (20 End)	25x25	160	16									1	1	5				19			83.8	100	Excel-lent
R3A	NE-SW Runway Extension 1st 500 ft (02 End)	25x25	160	16	1	2	1	3					6	1	3		1		6			85.0	95.6	Very good
R4B	NE-SW Runway Extension 2nd 500 ft (02 End)	12.5x25 25x25	160	16	1	2		2					5	1	2				6			88.1	96.9	Very good
T1A	Taxiway T	20x25	112	16	9	2	3	1			1		1		2				4			79.5	86.6	Good
T2A	Taxiway O	12.5x25 20x25	114	16	1								3	1	3				1	2		90.4	99.1	Excel-lent
T4A T3A	Taxiway O and Apron Taxiway Sta 46+55 to 95+54.3	25x25	609	16	5	5		2			6		26	29	64				55	3		76.2	98.4	Excel-lent
T5B	Alert Taxiway B	25x25	42	10	1	3	5		1		5		1		1				5	1		45.3	76.3	Fair
T6B	Taxiway D and Nose Dock Aprons*	25x25	117	16																				Good
T7A	Apron Taxiway Sta 31+05 to 46+55	25x25	207	16	7	3	1				5	1	13	3	13				8	6		71.1	94.7	Very good

REMARKS: * Not surveyed in detail.

LEGEND:

I	LONGITUDINAL CRACK	〰	SHRINKAGE CRACK	M	MAP CRACKING
—	TRANSVERSE CRACK	S	SCALING	P	PUMPING JOINT
\	DIAGONAL CRACK	J	SPALL ON TRANSVERSE JOINT	O	POP-OUT
Δ	CORNER BREAK	Ɉ	SPALL ON LONGITUDINAL JOINT	C	UNCONTROLLED CONTRACTION CRACK
✱	SHATTERED SLAB	J	CORNER SPALL	D	"D" CRACKING
K	KEYED JOINT FAILURE	⌖	SETTLEMENT		

WES FORM NO. 2004
JUN 1972

Table 3 (Continued)

DATE: April 1972

SUMMARY OF DATA – RIGID PAVEMENT CONDITION SURVEY

AIRFIELD: Malmstrom AFB, Montana

FEATURE		SLAB SIZE FT	APPROX NO. OF SLABS	PAVE. THICK. IN.	NO. OF SLABS CONTAINING INDICATED DEFECTS																	% OF SLABS NO DEFECTS	% OF SLABS NO MAJOR DEFECTS	CONDITION
NO.	DESIGNATION				I	—	\	Δ	✳	K	〰	S	J	ɟ	J	⊕	M	P	O	C	D			
A1B	Apron Sta 31+05 to 58+98	25x25	3386	16	110	52	21	8			85	12	213	48	206				127	94		71.2	94.4	Very good
A2B	Apron Sta 58+98 to 77+23	25x25	1168	19	3	18		1			15	94	82	17	54		2		97	22		73.5	96.2	Very good
A4B	Apron Sta 85+73 to 95+54.3	25x25	555	16			1				24	2	4	16	21		3		44	1		80.4	99.3	Excel-lent
A5B A8B	Alert Hangar Apron	20x25	95	10 12	4	4	1				3											87.5	90.5	Very good
A6B	NE Warm-up Apron	12.5x25 25x25	197	16	1	1	1	1					4	3	4				3	4		88.8	98.0	Very good
A7B	SW Warm-up Apron	12.5x25 25x25	202	16	17	5	5	2			1		1	1	5				8			77.7	85.6	Good

REMARKS:

LEGEND:

I LONGITUDINAL CRACK
— TRANSVERSE CRACK
\ DIAGONAL CRACK
Δ CORNER BREAK
✳ SHATTERED SLAB
K KEYED JOINT FAILURE

〰 SHRINKAGE CRACK
S SCALING
J SPALL ON TRANSVERSE JOINT
ɟ SPALL ON LONGITUDINAL JOINT
J CORNER SPALL
⊕ SETTLEMENT

M MAP CRACKING
P PUMPING JOINT
O POP-OUT
C UNCONTROLLED CONTRACTION CRACK
D "D" CRACKING

WES FORM NO. 2004
JUN 1972

Table 4

SUMMARY OF PAVEMENT EVALUATION

NAME OF AIRFIELD: Malmstrom AFB

DATE OF EVALUATION

MONTH: April YR: 1972

FEATURE		PAVEMENT OPERATIONAL USE	LOAD-CARRYING CAPACITY IN LB OF GROSS PLANE LOAD FOR INDICATED LANDING GEAR TYPES AND CONFIGURATIONS										REMARKS
			TRICYCLE ARRANGEMENT									BICYCLE	
NO.	DESIGNATION		SINGLE 100-PSI TIRE PRESSURE	SINGLE 100-SQ-IN. CONTACT AREA	SINGLE 241-SQ-IN. CONTACT AREA	TW 28-IN. C-C 226-SQ-IN. CONTACT AREA EACH TIRE	SINGLE TANDEM 60-IN. SPACING 400-SQ-IN. CONTACT AREA	TW 37-IN. C-C 267-SQ-IN. CONTACT AREA EACH TIRE	TW 44-IN. C-C 630-SQ-IN. CONTACT AREA EACH TIRE	TWIN TANDEM 33 IN. × 48 IN. 208-SQ-IN. CONTACT AREA EACH TIRE	C-5A GEAR CONFIGURATION	TWIN TWIN SPCG 37-62-37 267-SQ-IN. CONTACT AREA EACH TIRE	
			1	2	3	4	5	6	7	8	9	10	
R1A	NE-SW Runway Extension 1st 500 ft (20 End)	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	290,000	230,000+	380,000+	800,000+	440,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	290,000	230,000+	380,000+	800,000	410,000	
R2B	NE-SW Runway Extension 2nd 500 ft (20 End)	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	330,000+	230,000+	380,000+	800,000+	470,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	290,000	230,000+	380,000+	800,000+	410,000	
R5C	NE-SW Runway Interior Center 100 ft	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	330,000+	230,000+	360,000	800,000+	340,000	
		Frost capacity	155,000+	85,000+	155,000+	195,000	200,000+	195,000	195,000	240,000	780,000	(a)	
R3A	NE-SW Runway Extension 1st 500 ft (02 End)	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	265,000	230,000+	380,000+	800,000+	400,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	265,000	230,000+	380,000+	800,000+	360,000	
R4B	NE-SW Runway Extension 2nd 500 ft (02 End)	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	320,000	230,000+	380,000+	800,000+	430,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	265,000	230,000+	380,000+	800,000+	360,000	
T1A	Taxiway T	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	265,000	230,000+	380,000+	800,000+	400,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	265,000	230,000+	380,000+	800,000+	360,000	
T8A	Taxiway T	Capacity	155,000+	60,000	115,000	140,000	180,000	180,000	230,000+	215,000	600,000	(a)	
		Frost capacity	155,000+	60,000	115,000	140,000	180,000	180,000	145,000	145,000	600,000	(a)	
T2A	Taxiway O	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	275,000	230,000+	380,000+	800,000+	425,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	265,000	230,000+	380,000+	800,000+	360,000	
T4A	Taxiway O	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	225,000	230,000+	380,000+	800,000+	340,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	225,000	230,000+	380,000+	800,000+	340,000	

Note: + sign denotes allowable gross loading greater than maximum gross weight of any existing aircraft having indicated gear configuration.
(a) denotes allowable gross loading less than minimum gross weight of any existing aircraft having indicated gear configuration.

(1 of 3 sheets)

Table 4 (Continued)

SUMMARY OF PAVEMENT EVALUATION

NAME OF AIRFIELD: Malmstrom AFB

DATE OF EVALUATION
MONTH: April YR: 1972

FEATURE		PAVEMENT OPERATIONAL USE	LOAD-CARRYING CAPACITY IN LB OF GROSS PLANE LOAD FOR INDICATED LANDING GEAR TYPES AND CONFIGURATIONS										REMARKS
			TRICYCLE ARRANGEMENT									BICYCLE	
NO.	DESIGNATION		SINGLE 100-PSI TIRE PRESSURE 1	SINGLE 100-SQ-IN. CONTACT AREA 2	SINGLE 241-SQ-IN. CONTACT AREA 3	TW 28-IN. C-C 226-SQ-IN. CONTACT AREA EACH TIRE 4	SINGLE TANDEM 60-IN. SPACING 400-SQ-IN. CONTACT AREA 5	TW 37-IN. C-C 267-SQ-IN. CONTACT AREA EACH TIRE 6	TW 44-IN. C-C 630-SQ-IN. CONTACT AREA EACH TIRE 7	TWIN TANDEM 33 IN. × 48 IN. 208-SQ-IN. CONTACT AREA EACH TIRE 8	C-5A GEAR CONFIGURATION 9	TWIN TWIN SPCG 37-62-37 267-SQ-IN. CONTACT AREA EACH TIRE 10	
T9A	Taxiway O	Capacity	155,000+	45,000	90,000	105,000	145,000	135,000	150,000	160,000	460,000	(a)	
		Frost capacity	145,000	45,000	90,000	105,000	145,000	135,000	145,000	160,000	460,000	(a)	
T3A	Apron Taxiway Sta 46+55 to 95+54	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	250,000	230,000+	380,000+	800,000+	370,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	245,000	230,000+	380,000+	800,000+	360,000	
T5B	Alert Taxiway B	Capacity	80,000	65,000	115,000	120,000	185,000	135,000	180,000	260,000	740,000	(a)	
		Frost capacity	75,000	60,000	100,000	105,000	160,000	120,000	155,000	220,000	630,000	(a)	
T6B	Taxiway D and Nose Dock Aprons 1 and 2	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	270,000	230,000+	380,000+	800,000+	360,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	225,000	230,000+	380,000+	800,000+	340,000	
T7A	Apron Taxiway Sta 31+05 to 46+55	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	250,000	230,000+	380,000+	800,000+	370,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	245,000	230,000+	380,000+	800,000+	360,000	
A1B	Apron Sta 31+05 to 58+98	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	330,000+	230,000+	380,000+	800,000+	530,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	245,000	230,000+	380,000+	800,000+	360,000	
A2B	Apron Sta 58+98 to 77+23	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	330,000+	230,000+	380,000+	800,000+	600,000+	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	330,000+	230,000+	380,000+	800,000+	450,000	
A3B	Apron Sta 77+23 to 85+73	Capacity	65,000	50,000	90,000	100,000	140,000	105,000	135,000	195,000	600,000	(a)	
		Frost capacity	55,000	45,000	70,000	75,000	115,000	85,000	105,000	140,000	450,000	(a)	
A4B	Apron Sta 85+73 to 95+54.3	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	330,000+	230,000+	380,000+	800,000+	480,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	225,000	230,000+	380,000+	800,000+	340,000	
A5B	Alert Hangar Apron	Capacity	80,000	65,000	115,000	120,000	185,000	135,000	180,000	260,000	740,000	(a)	
		Frost capacity	75,000	60,000	100,000	105,000	160,000	120,000	150,000	210,000	630,000	(a)	
A8B	Alert Hangar Apron	Capacity	100,000	80,000	140,000	150,000	200,000+	170,000	220,000	310,000	800,000+	235,000	
		Frost capacity	100,000	80,000	135,000	145,000	200,000+	165,000+	210,000	300,000	800,000+	(a)	

Table 4 (Continued)

SUMMARY OF PAVEMENT EVALUATION

NAME OF AIRFIELD: Malmstrom AFB

DATE OF EVALUATION
MONTH: April YR: 1972

FEATURE			LOAD-CARRYING CAPACITY IN LB OF GROSS PLANE LOAD FOR INDICATED LANDING GEAR TYPES AND CONFIGURATIONS										REMARKS
			TRICYCLE ARRANGEMENT									BICYCLE	
NO.	DESIGNATION	PAVEMENT OPERATIONAL USE	SINGLE 100-PSI TIRE PRESSURE 1	SINGLE 100-SQ-IN. CONTACT AREA 2	SINGLE 241-SQ-IN. CONTACT AREA 3	TW 28-IN. C-C 226-SQ-IN. CONTACT AREA EACH TIRE 4	SINGLE TANDEM 60-IN. SPACING 400-SQ-IN. CONTACT AREA 5	TW 37-IN. C-C 267-SQ-IN. CONTACT AREA EACH TIRE 6	TW 44-IN. C-C 630-SQ-IN. CONTACT AREA EACH TIRE 7	TWIN TANDEM 33 IN. × 48 IN. 208-SQ-IN. CONTACT AREA EACH TIRE 8	C-5A GEAR CONFIGURATION 9	TWIN TWIN SPCG 37-62-37 267-SQ-IN. CONTACT AREA EACH TIRE 10	
A6B	NE Warm-Up Apron	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	330,000+	230,000+	380,000+	800,000+	455,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	245,000	230,000+	380,000+	800,000+	360,000	
A7B	SW Warm-Up Apron	Capacity	155,000+	85,000+	155,000+	220,000+	200,000+	320,000	230,000+	380,000+	800,000+	430,000	
		Frost capacity	155,000+	85,000+	155,000+	220,000+	200,000+	265,000	230,000+	380,000+	800,000+	360,000	
T10B	Taxiway A	Capacity	155,000+	60,000	115,000	140,000	200,000+	220,000	230,000+	265,000	780,000	255,000	
		Frost capacity	145,000	60,000	115,000	140,000	190,000	145,000	145,000	180,000	590,000	(a)	
T11B	Taxiway A	Capacity	110,000	45,000	90,000	105,000	155,000	150,000	145,000	165,000	470,000	(a)	
		Frost capacity	75,000	45,000	75,000	80,000	110,000	80,000	(a)	(a)	(a)	(a)	
T12C	Taxiway J	Capacity	75,000	45,000	70,000	85,000	115,000	95,000	110,000	(a)	355,000	(a)	
		Frost capacity	75,000	45,000	70,000	85,000	115,000	95,000	110,000	(a)	(a)	(a)	
T13C	Taxiway N	Capacity	155,000+	60,000	115,000	140,000	180,000	195,000	200,000	(a)	470,000	230,000	
		Frost capacity	155,000+	60,000	115,000	140,000	180,000	190,000	190,000	(a)	470,000	(a)	
T14C	Taxiway Q	Capacity	155,000+	60,000	115,000	140,000	200,000+	220,000	230,000+	320,000	800,000+	360,000	
		Frost capacity	155,000+	60,000	115,000	140,000	200,000+	190,000	190,000	240,000	780,000	(a)	
T15C	Taxiway R	Capacity	125,000	60,000	115,000	130,000	160,000	140,000	140,000	160,000	460,000	(a)	
		Frost capacity	125,000	60,000	115,000	130,000	160,000	140,000	140,000	160,000	460,000	(a)	
T16C	Taxiway S	Capacity	155,000+	60,000	115,000	135,000	200,000+	220,000	230,000+	265,000	800,000+	260,000	
		Frost capacity	155,000+	60,000	115,000	135,000	200,000+	190,000	190,000	140,000	780,000	(a)	

WES FORM NO. 999
JUNE 1972

EDITION OF AUG 1960 IS OBSOLETE.

(3 of 3 sheets)

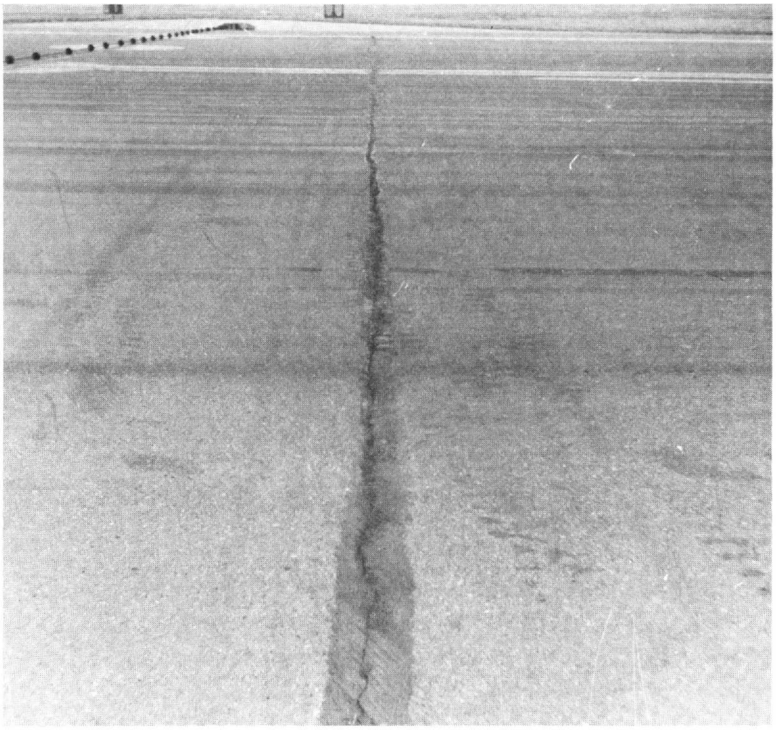


Photo 1. Transverse crack in runway near NE end

Photo 2. Longitudinal and transverse cracks near NE end of runway

Photo 3. View of AC portion of taxiway T

Photo 4. Taxiway R shoulder pavement. Note heaving adjacent to manhole on left

Photo 5. Taxiway T shoulder pavement

LEGEND

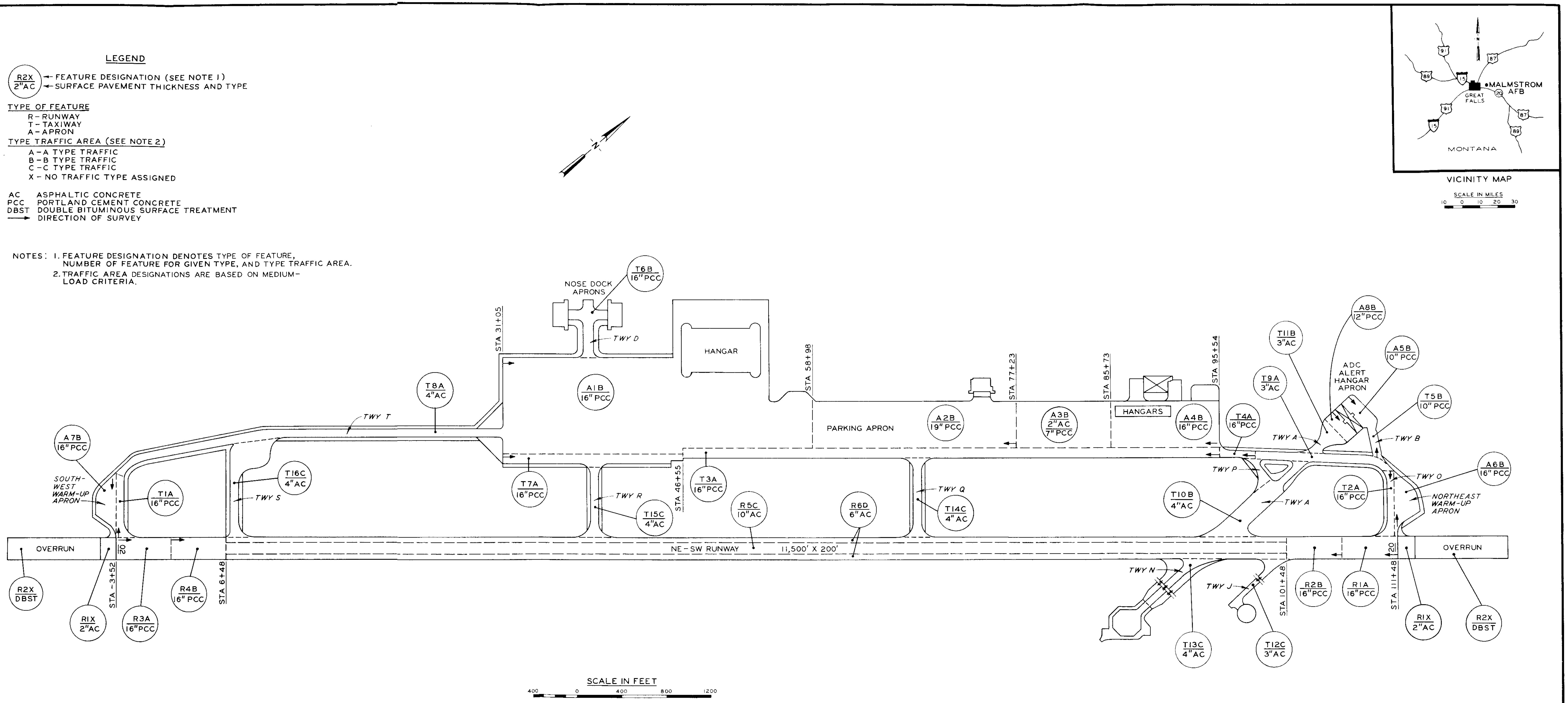
R2X / 2"AC ← FEATURE DESIGNATION (SEE NOTE 1) ← SURFACE PAVEMENT THICKNESS AND TYPE

TYPE OF FEATURE
R - RUNWAY
T - TAXIWAY
A - APRON

TYPE TRAFFIC AREA (SEE NOTE 2)
A - A TYPE TRAFFIC
B - B TYPE TRAFFIC
C - C TYPE TRAFFIC
X - NO TRAFFIC TYPE ASSIGNED

AC ASPHALTIC CONCRETE
PCC PORTLAND CEMENT CONCRETE
DBST DOUBLE BITUMINOUS SURFACE TREATMENT
⟶ DIRECTION OF SURVEY

NOTES: 1. FEATURE DESIGNATION DENOTES TYPE OF FEATURE, NUMBER OF FEATURE FOR GIVEN TYPE, AND TYPE TRAFFIC AREA.
2. TRAFFIC AREA DESIGNATIONS ARE BASED ON MEDIUM-LOAD CRITERIA.



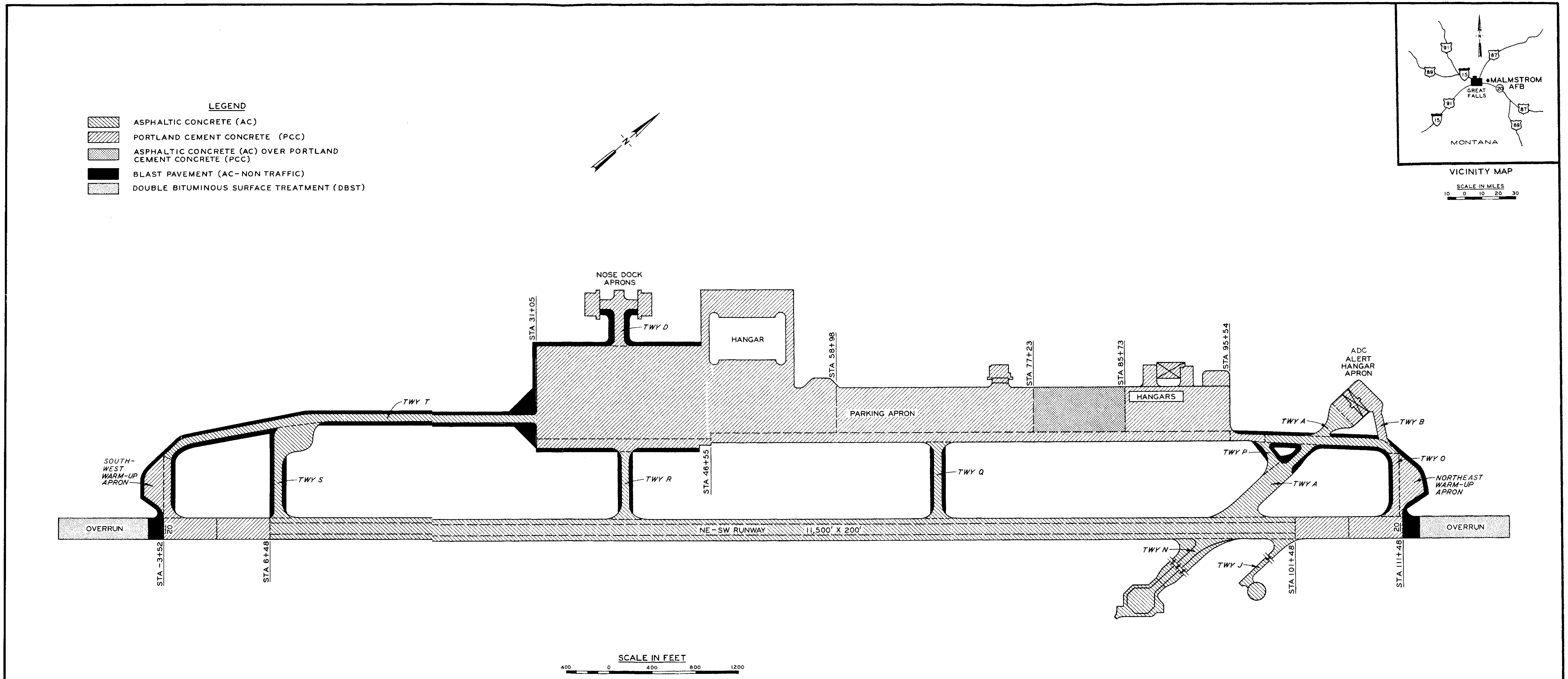
VICINITY MAP

SCALE IN MILES
10 0 10 20 30

MALMSTROM AFB

AIRFIELD LAYOUT

PLATE 1



MALMSTROM AFB

PAVEMENT PLAN

PLATE 2

Metz Reference Room
University of Illinois
B106 NCEL
208 N. Romine Street
Urbana, Illinois 61801