CORPS OF ENGINEERS
U.S. ARMY

J.E. ALLEN

FROST INVESTIGATIONS
1949-1950

SUMMARY TABULATION OF AIRFIELD PAVEMENTS
1943-1949

PREPARED BY
FROST EFFECTS LABORATORY
CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION, BOSTON, MASS.
FOR
OFFICE OF THE CHIEF OF ENGINEERS
AIRFIELDS BRANCH
ENGINEERING DIVISION
MILITARY CONSTRUCTION
JUNE 1950

TECHNICAL REPORT
NUMBER 32

57

NEW ENGLAND DIVISION
CORPS OF ENGINEERS, U. S. ARMY
BOSTON, MASS.

SUMMARY TABULATION OF AIRFIELD PAVEMENTS AT AIR FORCE INSTALLATIONS CONSTRUCTED ON FROST SUSCEPTIBLE SUBGRADES

FROST EFFECTS LABORATORY

JUNE 1950

TABLE OF CONTENTS

SUMMARY TABULATION OF AIRFIELD PAVEMENTS

LIST OF TABLES

LIST OF PLATES

SUMMARY TABULATION OF AIRFIELD PAVEMENTS

LIST OF PLATES (CONT'D)

SYNOPSIS

This report presents a summary tabulation of the pertinent data on pavements, base courses, and subgrades and on traffic histories from twenty-five Air Force bases where the pavement design is effected by frost conditions. The gross plane load evaluations of the pavements during both the normal period, where there is no weakening due to frost melting, and during the frost melting period have been determined using criteria presented in Chapters 2, 3 and 4, Part XII of the Engineering Manual.

Results of pavement condition surveys made at fifteen of the airfields are tabulated and correlated with the pavement evaluations and traffic histories.

All of the fields included in the tabulation have been subjected to a relatively large number of operations by planes of weights exceeding both the "normal" and "frost condition" evaluations which has generally resulted in pavement failures or distress at the portions of the fields receiving the most traffic usage.

Rigid pavements generally have given satisfactory performance where the slab thickness was at least 70 per cent of the "frost condition" design thickness required to support the heaviest type of planes using the field an average of five or more operations daily.

A limited amount of flexible pavement service behavior data is presently available from four of the airfields.

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SUMMARY TABULATION OF AIRFIELD PAVEMENTS

AT AIR FORCE INSTALLATIONS CONSTRUCTED ON

FROST SUSCEPTIBLE SUBGRADES

PART I. INTRODUCTION

1-01. Authorization. The Frost Investigations for 1949-1950, of which this investigation is a part, were authorized by the Chief of Engineers by teletype dated 22 November 1949, File: ENGMG.

This summary tabulation was authorized at the Consultant's Conference held at the Frost Effects Laboratory on 28 and 29 November 1949.

1-02. Purpose. The object of this report is to present in tabular form the traffic histories and pavement conditions at several of the major Air Force bases constructed on frost susceptible subgrades and to correlate the performance records of the pavements with the latest design criteria in the Engineering Manual for Airfield Pavement Design. The purpose of such a comparative study is to verify, or to provide information for the revision of, the existing design and evaluation criteria.

A similar tabulation which included all data available up to June 1948 was previously prepared and was included as Appendix B to Addendum No. 1, dated October 1949, to Report on Frost Investigation, dated April 1947.

1-03. Scope. This investigation has consisted of collatir_ _ata on details of pavement construction, traffic histories and plane load evaluation of pavements at twenty-five Air Force bases which frost susceptible conditions exist and comparing the data with pavement service behavior records available from fifteen of the airfields.

PART II. PREPARATION OF DATA

2-01. Sources of Data. The data used in the preparation of this summary tabulation were obtained principally from the following five sources:

a. Airfield Pavement Evaluation Reports prepared by the offices of the Corps of Engineers in the Divisions and Districts in which the airfields are located.

b. Airfield Pavement Failure Reports prepared by the Division and District Offices of the Corps of Engineers, which were based on pavement condition surveys made during 1944.

c. Monthly Runway Traffic Reports of Airplane Landings and Take-Offs furnished by the Headquarters of the United States Air Force.

d. Pavement Condition Survey Reports at ten of the airfields prepared by the Ohio River Division in 1947 as part of the Rigid Pavement Investigations.

e. Data obtained in conjunction with the Frost Investigations at several of the sites included in the tabulation.

2-02. Presentation of Data. The locations of the twenty-five airfields investigated are shown on the geographical location map on Plate 1. Plans of the fields showing the layout of the runways and taxiways are contained on Plates 3 to 27 inclusive.

The details of the pavement construction, the gross plane evaluation of the pavements, the summary of traffic history and the available pavement condition information for the twenty-five airfields are presented in Table 1. More detailed records of the annual traffic at the airfields together with traffic distribution data are given in Table 2.

The data tabulated in Table 1 permit a comparison between the weights of planes using the airfields, the frost condition evaluation of the pavements and the pavement performance. Using the average single wheel load of the maximum weight plane group using the airfield with a frequency of five or more landings and take-offs per day and the design criteria presented in Chapter 4, Part XII of the Engineering Manual, the slab thicknesses for rigid pavements and combined thickness of pavement and base for flexible pavements required by frost design criteria have been determined, as tabulated on Table 1. The percentage ratio of the actual thickness to the theoretical design thickness for frost conditions has been computed for each area where pavement condition survey data are available. The per cent design, computed in this manner, has been plotted on Plate 2 against the average wheel load of the weight group of planes using the airfields at least five cycles of landings and take-offs per day prior to the condition survey. The plotted points on Plate 2 indicate whether the pavement was satisfactory or failed. The plotted points are also numbered to cross reference with line numbers on Table 1, where the detailed data are presented.

The descriptions of the pavement conditions were obtained from Airfield Pavement Reports or Pavement Condition Survey Reports. For purposes of tabulation the data have been condensed and wording has been changed only where necessary for consistency. Where extensive cracking, rutting or ravelling was reported or a large number of the concrete slabs had corner cracks the pavement has been considered to have failed even though the pavement might be suitable for the operation of planes at the present rate for several years before extensive repairs would be necessary. Since the purpose of this study is to determine the adequacy of the design criteria, conditions of extensive cracking are considered structural failures which would become progressively worse in a short period of time if subjected to more intense traffic usage. It has not been considered within the scope of this investigation to determine whether it would be more economical to extend with extra maintenance the life of pavements which have shown signs of distress or whether it would have been cheaper to have provided additional pavement thicknesses in the original construction.

2-03. Evaluation Criteria. The evaluations of the flexible and rigid pavements for the normal strength period during which there is no weakening due to frost melting, and which are shown in Table 1, are based on Chapter 2 and Chapter 3, Part XII of the Engineering Manual dated May 1947 and July 1946 respectively. The normal period evaluations for rigid pavements have been determined using the subgrade modulus k when available. For cases where the modulus of the subgrade has not been determined, the modulus k of the base has been used to evaluate the pavements. Fields evaluated in the latter manner are Dow, Mitchel, Presque Isle, Stewart, Spokane and Wendover.

The pavement evaluations during the frost melting period have been determined using Chapter 4, Part XII of the Engineering Manual as revised in May 1950. The subgrade moduli used for rigid pavement evaluations during the frost melting period were obtained from Figure 7 of Chapter 4. Where the thickness of non-frost-susceptible base is less than 6 inches, the frost melting period evaluation is given as less than 30,000 pounds gross load.

Of the fifteen airfields for which pavement behavior data are presented, all have frost-susceptible subgrade soils, and seven have frost-susceptible base materials. The frost condition evaluations and design thicknesses shown on Table 1 are based on frost action in the frost-susceptible soils, whether base course or subgrade. It is not known whether ice segregation actually occurred in the soils considered frost-susceptible. The water table at six of the fifteen airfields is below the depth of influence.

2-04. Analysis of Results. Results of pavement condition surveys are available from fifteen of the twenty-five fields for which pertinent data are tabulated on Table 1. A comparison between the "frost condition" evaluation of the pavements, the actual traffic usage to which the pavements were subjected and the results of the pavement condition surveys reveals that the fields received relatively heavy usage by planes having weights in excess of the "frost condition" evaluations. As might be expected, a high percentage of failures resulted, particularly in those sections of the fields at which the records indicate concentration of traffic. The plots of per cent design against wheel load for both rigid and flexible pavements on Plate 2 also show the large number of failures which occurred. The failures that occurred, particularly of concrete pavements, are not necessarily attributable to frost action. At five of the fifteen fields for which pavement behavior data are available, frost action was reported as a contributing cause to the failures. The weight of pla using the fifteen airfields in excess of an average of five operations daily was greater than the normal period evaluation. Therefore the pavements were overloaded during the normal period, at which time some of the failures may have occurred, although with frost-susceptible conditions existing at the fields the degree of overloading was much greater during the frost melting period.

At Wright Field a 60,000 pound wheel load was used to determine the "frost condition" design thickness representing planes of the 120,000 - 135,000 pound weight-group which used the field an average of five operations daily. The "frost condition" design thicknesses at all of the other fifteen airfields at which pavement behavior data are available were determined using wheel loads of plane weight-groups using the fields for an average of ten or more operations daily, while at ten of the fifteen airfields the average actual daily operations of planes, of the weight-group represented by the design wheel loads, were in excess of 25 and ranged to a maximum of 677 operations at Lockbourne Air Base. In some cases the number of passages of this arbitrarily selected wheel load over any specific location on the pavements during the frost melting period is a relatively small percentage of the total usage and greater damage might have resulted from more frequent coverages by the planes of lighter weight groups. A time interval of a few days between wheel load repetitions over a specific pavement area would tend to allow the subgrade to regain strength between load application and appreciable loss in subgrade strength due to remolding under traffic deformations would be unlikely.

The only instances of failure of a rigid pavement when the pavement thickness was 70 per cent of "frost condition" design thickness or greater was at Chanute Air Force Base where local cracking occurred on three of the four runways. The traffic history at this field prior to failure is incomplete and the taxiways, apron and N-S Runway (which receives approximately 30 per cent of the traffic), were in satisfactory condition, although of similar construction to the three runways showing distress. These failures may be due to local conditions not revealed by the data tabulated in Table 1.

Where the rigid pavement thicknesses were less than 70 per cent of "frost condition" design, based on the average wheel load of the planes using the field for 5 or more daily operations, failures occurred in fifteen out of thirty-eight pavements. Of the sixteen pavements with slab thicknesses less than 50 per cent of the design thicknesses, ten failed and generally showed extensive cracking over large areas. The six pavements with slab thicknesses less than 50 per cent of design which did not fail either were at fields with a small number of operations or the unfailed pavements were located at portions of the field where traffic usage was light.

Failures were reported at three of the four airfields at which flexible pavement data were available. The data from these fields are plotted in Figure 2, Plate 2. The points numbered 1 through 4 represent data from Casper Air Force Base where five of the eleven taxiways became cracked and rutted followed by complete breakup of pavement and base course. The three runways also showed distress. The plan of the field on Plate 3 and traffic distribution data on Sheet 1 of Table 2 indicates that at least five of the six taxiways at which satisfactory pavements were reported were probably used infrequently.

The other two flexible paved areas on Figure 2, Plate 2, represented by plotted points 14 and 15, and which were in satisfactory condition, are at Dow Air Force Base, for which the combined pavement and base thickness is 67 per cent of "frost condition" design thickness. This field had only 14 average daily operations of planes weighing 50,000 to 75,000 pounds, on which the per cent of design thickness was based. This apparently did not result in sufficient coverages over any specific pavement area, as traffic tests on twenty-nine test lanes at this field during the frost melting periods of 1944 and 1945 showed progressive cracking and failure at all of the twelve locations at which the pavement and base thicknesses were less than 80 per cent of the "frost condition" design thicknesses for the traffic test wheel loads.

A comparison of the behavior of rigid pavements when placed directly on a frost susceptible subgrade and when placed on a base course is possible at two airfields. At Offutt Air Force Base the NW-SE Runway consists of a 9-inch thick slab on 2-1/2-inches of asphalt and 9-1/2-inches of bituminous stabilized gravel. The NE-SW Runway has an 11-inch concrete slab placed directly on the CL subgrade. The concrete flexural strength is the same for both runways while the NW-SE Runway receives 60 per cent of the traffic and the NE-SW Runway only 31 per cent. The NW-SE Runway with the thinner slab and most traffic is reported to be in excellent condition while the NE-SW Runway has a large number of transverse and diagonal cracks. A somewhat similar condition exists at Wright Field where the 7-inch thick apron slabs placed directly on an ML subgrade have cracked extensively while the 7-inch thick slabs of the NE-SW Runway having a 9-inch sand and gravel base are in good to excellent condition. However, the apron undoubtedly is subjected to more traffic coverages and more severe usage than the NE-SW Runway which receives 40 per cent of the traffic at the field.

PART III. CONCLUSIONS

3-01. Based on the service behavior at fifteen of the twenty-five fields tabulated the following conclusions are presented:

a. At all the installations included in this tabulation the pavements have been subjected to a relatively large number of operations of planes with weights exceeding both the "normal" and "frost condition" evaluations, thus tending to make isolation of the effect of frost action more difficult. However, the effect of overloading may be assumed to be much greater in the frost melting period than in the normal period.

b. Portland cement concrete pavements with slab thicknesses at least 70 per cent of those required under "frost condition" design to support wheel loads of planes using fields in excess of an average of five operations per day generally have given satisfactory performance. When the actual slab thicknesses have been less than 70 per cent of "frost condition" design, failures have increased and when less than 50 per cent of design thickness extensive cracking and pavement break-up have occurred at a large percentage of the pavements.

c. At two airfields, namely Offutt Air Force Base and Wright Field, rigid pavements gave satisfactory service when constructed on a base course while pavements of equal or greater thickness placed directly on the frost susceptible subgrades failed. The base course at Offutt, however, consisted of 2-1/2 inches of asphalt and 9-1/2 inches of bituminous stabilized gravel which undoubtedly has greater strength than a typical base course material. At Wright

Field the failed pavement without a base was on the apron while the satisfactory pavement constructed on a 9-inch sand and gravel base course was on a runway and presumably was subjected to less severe usage.

d. The service behavior of all pavements at three of the fields, Clinton County, Dow and Patterson airfields, has been satisfactory under the usage received while pavement elements at several of the other fields have also shown satisfactory performance.

e. It is concluded that pavements designed using the criteria presented in Chapter 4, Part XII of the Engineering Manual entitled Frost Conditions will give satisfactory service behavior with an adequate factor of safety to allow for increased operations of traffic when necessary.

AIRFIELD	LOCATION	PAVEMENT TYPE	PAVEMENT THICKNESS (INCHES)	PAVEMENT FLEXURAL STRENGTH OF CONCRETE AT 28 DAYS (LBS./SQ. IN.)	BASE TYPE	BASE THICKNESS (INCHES)	BASE % PASSING #200 SIEVE	BASE FROST SUSCEPTIBLE (% FINER THAN 0.02 mm)	C.B.R. OR SUBGRADE MODULUS K	$K_{f(1)}$	C.B.R.	SUBGRADE AIRFIELD CLASSIFICATION	SUBGRADE % PASSING #200 SIEVE	SUBGRADE FROST SUSCEPTIBLE (% FINER THAN 0.02mm)
Casper Air Force Base, Casper, Wyoming	N-S, E-W, NW-SE Runways	Asphaltic Concrete	6.0-6.6	-	Sand	6.6-7.8	10-17	Yes (4-9)	-	-	40	SF, ML, CL, SW, SP, SC	8-68	Yes (6-60)
					Subbase: SC, ML, SF, CL, SP, SW,	12.0-14.4	8-68	Yes (6-60)	-	-	4-5			
	Taxiways 1 & 5	Asphaltic Concrete	5.4	-	Sand	6.5	10-17	Yes (4-9)	-	-	40	ML, SC, SF	8-68	Yes (6-60)
					Subbase: SF, SC	8.4	8-68	Yes (6-60)	-	-	24			
	Taxiways, 2, 3, 4 and 7	Asphaltic Concrete	7.2	-	Sand	4.8	10-17	Yes (4-9	-	-	40	SF, SC, SP, ML, CL, SW	8-68	Yes (6-60)
					Subbase: ML, SC, SF, SP	9.6	8-68	Yes (6-60)	-	-	21			
	Taxiways, 9-12 inclusive	Asphaltic Concrete	6.0	-	Sand	8.4	10-17	Yes (4-9)	-	-	40	SF, CL, SW	8-68	Yes (6-60)
					Subbase: ML, SF, CL	9.6	8-60	Yes (6-60)	-	-	7			
	NE-SW Runway	Asphaltic Concrete	6.6	-	Sand	7.8	10-17	Yes (4-9)	-	-	40	SF, SC, ML, SF	8-68	Yes (6-60)
					Subbase: SF, ML, SF, SC	10.8	8-68	Yes (6-60)	-	-	10			
	Apron	P.C.C.	9-7-10.5	675	None	-	-	-	-	-	-	SW, CL, SC	8-68	Yes (6-60)
Chanute Air Force Base, Rantoul, Illinois	Original Apron	P.C.C.	8-6-8	700	None	-	-	-	-	-	-	CL-OL	62-87	Yes (51-65)
	NE-SW Runway	P.C.C.	8-6-8	700	None	-	-	-	-	-	-	CL-OL	62-87	Yes (51-65)
	NW-SE Runway	P.C.C.	8-6-8	700	None	-	-	-	-	-	-	CL-OL	62-87	Yes (51-65)
	Taxiways A-E	P.C.C.	8-6-8	700	None	-	-	-	-	-	-	CL-OL	62-87	Yes (51-65)
	N-S Runway	P.C.C.	8-6-8	815	Pit Run Sand and Gravel	6	4-15	Yes (3-10)	63	-	-	CL	62-87	Yes (51-65)
	E-W Runway	P.C.C.	8	815	Mech. Stab. Pit Run S. & G.	6	4-15	Yes (3-10)	63	-	-	OL	62-87	Yes (51-65)
Clinton County Air Force Base, Wilmington, Ohio	Runways	P.C.C.	7	730	Pit Run Gravel	6	13-18	Yes (10)	-	-	-	ML-CL	60-83	Yes (41-58)
	Aprons & Taxi A	P.C.C.	8½	680	Pit Run Gravel	6	13-18	Yes (10)	-	-	-	ML	60-83	Yes (41-58)
	Taxiway B	P.C.C.	8½	730	Pit Run Gravel	6	13-18	Yes (10)	-	-	-	ML	60-83	Yes (41-58)
Dow Air Force Base, Bangor, Maine	Runways	Bit.Conc.	3½	-	Bank Run S.&G.	18	2-7	Borderline	-	-	80	CL-GF	31-88	Yes (21-70)
	Main Service Apron	P.C.C.	8-6-8	607	Bank Run S.&G.	18	2-7	Borderline	315	65	-	CL-GF	31-88	Yes (21-70)
	Taxiways, B,C, D, E	Bit.Conc.	3½	-	Bank Run S.&G.	18	2-7	Borderline	-	-	80	CL-GF	31-88	Yes (21-70)
	Runway Turn-arounds.	P.C.C.	10-7-10	607	Bank Run S.&G.	17	2-7	Borderline	315	60	-	CL-GF	31-88	Yes (21-70)
Great Falls Air Force Base Great Falls, Montana	Taxiways	Asphaltic Concrete	6	-	Pit Run Gravel	10	9-20	Yes (12)	-	-	50	CL, SF, SC	71-92	Yes (45-75
	N-S Runway	Asphaltic Concrete	6	-	Pit Run Gravel	7	9-20	Yes (10)	-	-	50	CL, SF, SC	71-92	Yes (45-75
	NE-SW Runway	Asphaltic Concrete	6	-	Pit Run Gravel	9	9-20	Yes (12)	-	-	50	CL, SF, SC	71-92	Yes (45-75
	NW-SE Runway	Asphaltic Concrete	6	-	Pit Run Gravel	10	9-20	Yes (10)	-	-	50	CL, SF, SC	71-92	Yes (45-75
	E-W Runway	Asphaltic Concrete	6	-	Pit Run Gravel	11	9-20	Yes (12)	-	-	50	CL, SF, SC	71-92	Yes (45-75
	Large Parking Apron	P.C.C.	7	693	None	-	-	-	-	-	-	CL, SF, SC	71-92	Yes (45-75
Hill Air Force Base, Ogden, Utah	Original Anchorage	P.C.C.	6	385	Compacted Sand Subgrade	6	10-85	Yes (6-55)	-	-	-	SF, SF, SW	10-85	Yes (6-55)
	N-S, NE-SW, NW-SE Runys	P.C.C.	6	516	Compacted Sand Subgrade	6	10-85	Yes (6-55)	-	-	-	SF, SF, SW	10-85	Yes (6-55)
	E-W Runway	P.C.C.	6	516	Compacted Sand Subgrade	6	10-85	Yes (6-55)	-	-	-	SF, SF, SW	10-85	Yes (6-55)

(1) K_f = Subgrade Modulus during Frost

(2) Depth of Frost Penetration from Fr

(3) The figures tabulated denote the a
year of usage prior to pavement co
given cycles prior to the first of
"Pavement Condition" traffic data

A

FROST INVESTIGATION
1949 - 1950

SUMMARY TABULATION OF AIRFIELD PAVEMENTS

C.B.R. OR SUBGRADE MODULUS: K	$K_{f(1)}$	C.B.R.	SUBGRADE: AIRFIELD CLASSIFICATION	% PASSING #200 SIEVE	FROST SUSCEPTIBLE (% FINER THAN 0.02mm)	ATTERBERG LIMITS: L.L.	P.L.	C.B.R. OR SUBGRADE MODULUS: K	$K_{f(1)}$	C.B.R.	GROUND WATER DEPTH (FEET)	SUBSURFACE DRAINAGE	APPROX. FREEZING INDEX	FROST PENE-TRATION (INCHES)	EVALUATION LBS. GROSS PLANE WEIGHT: NORMAL PERIOD E.M. PART XII JULY 1946	FROST CONDITIONS E.M. PART XII	TRAFFIC: GROSS PLANE WT. (LBS.)	MAX. AVG. DAILY TRAFFIC (3)	
-	-	40	SF, ML, CL, SW, SP, SC	4-68	Yes (6-60)	23	15	-	-	3-5	90	None	532	33 (2)	10,000	< 10,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	- - 95 - - - -	
-	-	4-5																	
-	-	40	ML, SC, SF	4-68	Yes (6-60)			-	-	4					24,000	< 10,000			
-	-	24																	
-	-	40	SF, SC, SP, ML, CL, SW	4-68	Yes (6-60)			-	-	3					20,000	< 10,000			
-	-	21																	
-	-	40	SF, CL, SW	4-68	Yes (6-60)			-	-	3					20,000	< 10,000			
-	-	7																	
-	-	40	SF, SC, ML, SF	4-68	Yes (6-60)			-	-	7					50,000	< 10,000			
-	-	10																	
-	-	-	SW, CL, SC	4-68	Yes (6-60)			279	-	-					< 30,000	< 30,000			
-	-		CL-OL	62-87	Yes (51-65)	19-48	16-21	57	-	-	Below Influence Depth	Open jointed tile drains along side and parallel to runways and taxiways. With pervious backfill.	400	18 Av. 30 Max.	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	415 (< 15,000 to 50-75,000)	
-	-		CL-OL	62-87	Yes (51-65)			57	-	-					< 30,000	< 30,000			
-	-		CL-OL	62-87	Yes (51-65)			57	-	-					< 30,000	< 30,000			
-	-		CL-OL	62-87	Yes (51-65)			57	-	-					30,000	< 30,000			
-	-		CL	62-87	Yes (51-65)			-	-	-					30,000	< 30,000			
-	-		OL	62-87	Yes (51-65)			-	-	-					30,000	< 30,000			
-	-		ML-CL	60-83	Yes (41-58)	26-48	17-25	40	-	-	2-7 (approx)	Perforated pipe (6"-8") along both edges of runways and taxiways and at selected locations under apron.	100	20	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	- 12 7 11 Occ. 6/Mo. 1/Mo.	
-	-		ML	60-83	Yes (41-58)			30	-	-					30,000	< 30,000			
-	-		ML	60-83	Yes (41-58)			30	-	-					30,000	< 30,000			
-	80		CL-GF	31-88	Yes (21-70)	30	19	-	-	8	6 (approx)	Open joint drains back filled with pervious material adjacent to runway pavements.	1200	48 Av. 61 Max.	107,000	26,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	- 2 - 4 - - -	- 22 13 14 - 3/Mo. -
65	-		CL-GF	31-88	Yes (21-70)			-	-	-					< 30,000	< 30,000			
-	80		CL-GF	31-88	Yes (21-70)			-	-	8					72,000	26,000			
60	-		CL-GF	31-88	Yes (21-70)			-	-	-					< 30,000	< 30,000			
-	50		CL, SF, SC	71-92	Yes (45-75)	38-54	16-26	-	-	4	Below Influence Depth	None reported	750	60	15,000	< 10,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	- 56 - - - - -	
-	50		CL, SF, SC	71-92	Yes (45-75)			-	-	4					13,000	< 10,000			
-	50		CL, SF, SC	71-92	Yes (45-75)			-	-	4					16,000	< 10,000			
-	50		CL, SF, SC	71-92	Yes (45-75)			-	-	4					16,000	< 10,000			
-	50		CL, SF, SC	71-92	Yes (45-75)			-	-	4					30,000	< 30,000			
-	-		CL, SF, SC	71-92	Yes (45-75)			37	-	-					< 30,000	< 30,000			
-	-		SF, SF, SW	[illegible]	Yes [illegible]	20-25	7-18	185	-	-	Not Reported	None	500	15	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	119 136 18 15 Occ. 1 -	
-	-		SF, SF, SW	[illegible]	Yes [illegible]			285	-	-					< 30,000	< 30,000			
-	-		SF, SF, SW	[illegible]	Yes [illegible]			410	-	-					< 30,000	< 30,000			

NOTES

(1) K_f = Subgrade Modulus [illegible] during Frost Melting Period.

(2) Depth of Frost [illegible] from Freezing Index Curve, Chapter 4, Part XII of Engineering Manual.

(3) The figures tabulated [illegible] the average daily cycles of landing and take-offs for the maximum year of usage [illegible] condition survey. Where two columns are tabulated, left column gives cycles [illegible] the two condition surveys. Where "No Data" is shown under "Pavement Con[illegible]" [illegible] is for period prior to January 1950.

(4) Numbers under "Line" heading denote plotted points on Plate 2.

(5) "Percent of Design" is the ratio of the actual pavement thickness to desig[n] Design thickness is for average wheel load of heaviest weight class of pl[ane] with average frequency of 5 or more cycles of landings and take-offs per [illegible] survey.

Where base or subbase materials under flexible paved areas are frost susc[eptible] as controlling the design. Borderline materials were considered non-frost[-susceptible]

B

ENTS

EVALUATION LBS. GROSS PLANE WEIGHT: NORMAL PERIOD E.M. PART XII JULY 1946	FROST CONDITIONS E.M. PART XII	TRAFFIC: GROSS PLANE WT. (LBS.)	MAX. AVG. DAILY TRAFFIC (3)	PAVEMENT CONDITION: LOCATION	LINE (4)	DESIGN THICKNESS	% OF DESIGN (5)	DESCRIPTION	DATE OF SURVEY	REPORTED CAUSE OF FAILURE
10,000 24,000 20,000 20,000 50,000 < 30,000	< 10,000 < 10,000 < 10,000 < 10,000 < 10,000 < 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	- - 95 - - - -	Taxiways 1 and 5 Taxiways 2, 3, 4, 7 Taxiways 9-13 inc. Runways and Runway shoulders Apron	1 2 3 4 5	18 18 18 18 11	30 40 33 33 64	Cracking and rutting on scattered areas of taxiways 1, 2, 9, 12 and 13 followed by complete breakup of pavement and base course. Taxiways 3, 4, 5, 7, 10 and 11 satisfactory. Small depressed cracked and checked areas. Cracking and slab displacement.	Mar. 1944	Local rock subgrade, ponding, poor base, slight frost action in subgrade. Differential settlement under traffic. Overstressing along taxiing lanes.
< 30,000 < 30,000 < 30,000 30,000 30,000 30,000	< 30,000 < 30,000 < 30,000 < 30,000 < 30,000 < 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	445 (< 15,000 to 50-75,000)	E-W Runway NE-SW and NW-SE Runways Apron and Taxiways N-S Runway Design thicknesses determined using a 20,000 lb. wheel load	6 7 8 9	7 8 11 7	114 } 75 } 55 86	Sheared tongue and groove joints, corner cracks, spalling and fracturing of concrete for a width of several inches at joints. Satisfactory conditions. Satisfactory conditions.	June 1944	Overloading subgrade, weakening of subgrade during thaw.
< 30,000 30,000 30,000	< 30,000 < 30,000 < 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	- 12 7 11 Occ. 6/Mo. 1/Mo.	Runways Aprons and taxiway A Taxiway B	10 11 12	10 13 13	70 } 65 } 65 }	Good to very good condition except for some cracking and joint spalling on Taxiway A.	April 1947	
107,000 < 30,000 72,000 < 30,000	26,000 < 30,000 26,000 < 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	- - 2 22 - 13 4 14 - - - 3/Mo. - -	Main service apron Runways Taxiways Apron widening, turnaround and warm-up apron (Not controlling pavements).	13 14 15	13 33 33 13	46 } 67 } 67 } 54	Satisfactory condition. Random and corner cracks. 9% of slabs cracked in Spring of 1943. 30% cracked by Fall of 1946.	Spring 1943 Fall 1946	Settlement of subgrade. Low strength of concrete and frost action.
15,000 13,000 16,000 18,000 30,000 < 30,000	< 10,000 < 10,000 < 10,000 < 10,000 < 30,000 < 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	- 56 - - - - -	Runways Taxiways Apron	16 17 18	13 13 9	46 46 78	Longitudinal cracking at joints between runway or taxiway pavement and shoulder pavement allowing water to enter base. Depressions occurred under traffic. Satisfactory condition.	Not Reported (1944)	Inadequate drainage. Frost action.
< 30,000 < 30,000 < 30,000	< 30,000 < 30,000 < 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	119 136 18 15 Occ. 1 -	No Data						

heading denote plotted points on Plate 2.

the ratio of the actual pavement thickness to design thickness x 100.
for average wheel load of heaviest weight class of planes using field
by of 5 or more cycles of landings and take-offs per day prior to condition

materials under flexible paved areas are frost susceptible they were considered
sign. Borderline materials were considered non-frost susceptible.

SUMMARY TABULATION OF AIRFIELD PAVEMENTS

Sheet 1 of 4 TABLE 1

SUMM

AIRFIELD	LOCATION	PAVEMENT TYPE	PAVEMENT THICKNESS (INCHES)	PAVEMENT FLEXURAL STRENGTH OF CONCRETE AT 28 DAYS (LBS./SQ IN.)	BASE TYPE	BASE THICKNESS (INCHES)	BASE % PASSING #200 SIEVE	BASE FROST SUSCEPTIBLE (% FINER THAN 0.02 mm)	C.B.R. OR SUBGRADE MODULUS K	C.B.R. OR SUBGRADE MODULUS K_f (1)	C.B.R. OR SUBGRADE MODULUS C.B.R.	SUBGRADE AIRFIELD CLASSIFICATION	SUBGRADE % PASSING #200 SIEVE	SUBGRADE FROST SUSCEPTIBLE (% FINER THAN 0.02 mm)	ATTERBERG LIMITS L.L.	ATTERBERG LIMITS P.L.
Kearney Air Force Base, Kearney, Nebraska	Apron	P.C.C.	12-4½-8½-11	[illegible]	Sand Cushion	8	26-89	Yes (12-55)	-	-	-	CL, ML, CH	82-[illegible]	Yes (45-69)	30-52	16-24
	Taxiways	P.C.C.	12-4½-8½-11	[illegible]	Sand Cushion	8	26-89	Yes (12-55)	-	-	-	CL, ML	82-94	Yes (45-69)		
	N-S Runway	P.C.C.	12-4½-8½-11	590	Sand Cushion	8	26-89	Yes (12-55)	-	-	-	CL, CH, ML, SF	82-94	Yes (45-69)		
	NE-SW Runway	P.C.C.	7	450	Sand Cushion A.C. Pavement	3 2	26-89	Yes (12-55)	-	-	-	CL, ML	82-94	Yes (45-69)		
	NW-SE Runway	P.C.C.	12-4½-8½-11	600	Sand Cushion	8	26-89	Yes (12-55)	-	-	-	CL, ML	82-94	Yes (45-69)		
Lockbourne Air Force Base, Columbus, Ohio	Main Apron Ext. Taxiways F, G, H, J East and West Wing	P.C.C.	8	590	Stabilized Gravel	6	24-44	Yes (10-16)	-	-	-	CL, ML	44-67	Yes (28-42)	24-52	13-25
	N-S and NE-SW Runways, Taxiways C,D,E, Main Apron	P.C.C.	8	590	Stabilized Gravel	6	23-44	Yes (10-16)	-	-	-	CL, ML	44-67	Yes (28-42)		
	NW-SE Runway Taxiway A	P.C.C.	10-7-10	590	Stabilized Gravel	3-6-3	23-44	Yes (10-16)	-	-	-	CL	44-67	Yes (28-42)		
	E-W Runway Taxiway B	P.C.C.	10½-7-10½	610	Stabilized Gravel	3-7-3	23-44	Yes (10-16)	-	-	-	CL	44-67	Yes (28-42)		
Lowry Air Force Base, Denver, Colorado	Apron No. 1 Taxiways	P.C.C.	8-6-8	520-565	None	-	-	-	-	-	-	SF-CL, SF, CH	32-69	Yes (14-48)	16-50	15-28
	Runways	P.C.C.	8-6-8	565	None	-	-	-	-	-	-	CL, SF	32-69	Yes (14-48)		
	Apron No. 2	P.C.C.	18-12-18	520	None	-	-	-	-	-	-	CL, SF	32-69	Yes (14-48)		
Marshall Air Force Base, Fort Riley, Kansas	Taxiways and Aprons	P.C.C.	6	500	None	-	-	-	-	-	-	ML, CH, CL	84-96	Yes (28-54)	21-67	15-28
	Runways	P.C.C.	6	500	None	-	-	-	-	-	-	ML, CH, CL	84-96	Yes (28-54)		
Mitchel Air Force Base, Hempstead, Long Island, New York	Hangar Apron	P.C.C.	6	430	Sand and Gravel	12	7-46	Yes (4-32)	140	-	-	GP	20-87	Yes (12-56)	25	23
	NW-SE Runway	P.C.C.	8-6-8	506	Mech. Stab. Sand and Gravel	12	7-46	Yes (4-32)	250	-	-	SW	20-87	Yes (12-56)		
	E-W Taxiway	P.C.C.	6	525	Compacted Subg. Silt, Sand, Gravel	12	7-46	Yes (4-32)	160	-	-	GC	20-97	Yes (12-56)		
	E-W Runway	P.C.C.	6	480	Mech. Stab. Sand and Gravel	12	7-46	Yes (4-32)	210	-	-	SW	20-87	Yes (12-56)		
	NE-SW Runway	P.C.C.	6	515	Compacted Subg. Silt, Sand, Gravel	12	7-46	Yes (4-32)	240	-	-	GP	20-87	Yes (12-56)		
	N-S Runway	P.C.C.	6	534	Compacted Subg. Selected Borrow	12	7-46	Yes (4-32)	400	-	-	GP	20-87	Yes (12-56)		
Offutt Air Force Base, Fort Crook, Nebraska	N-S Runway	Asphaltic Concrete	2½	-	Gravel (Bit. Stab.)	9½	-	-	-	-	80	CL	85-94	Yes (44-65)	36-48	18-25
	Hangar Apron	P.C.C.	6	685	None	-	-	-	-	-	-	CL	85-94	Yes (44-65)		
	NE-SW Runway	P.C.C.	11	685	None	-	-	-	-	-	-	CL	85-94	Yes (44-65)		
	NW-SE Runway	P.C.C.	9	685	Asphalt Bit.Stab.Gravel	2½ 7½	-	-	403	45	-	CL, ML	85-94	Yes (44-65)		
Olmsted Air Force Base, Middletown, Pennsylvania	Taxiway between runway 29 and runway 32	Bit.Conc.	1	-	No. 4 Trap Rock	8	-	No	-	-	80	CL	46-65	Yes (10-25)	20-22	16-19
	Runway 14-32 Runway 11-29	P.C.C.	6	746	None	-	-	-	-	-	-	CL	46-72	Yes (16-47)		
Patterson Field Fairfield, Ohio	Apron	P.C.C.	6	740	Pit Run Gravel	18	2-12	Assumed No	400	65	-	GP	22-90	Yes (14-75)	22-71	17-32
	Taxiway No. 1	P.C.C.	8	735	Pit Run Gravel	6	2-12	Assumed No	-	-	-	CL	22-90	Yes (14-75)		
	Runway A	P.C.C.	7	740	Stab. Gravel	8	10	Yes (4-10)	-	-	-	ML	22-90	Yes (14-75)		
	Runways B & C	P.C.C.	9	695	Pit Run Gravel	6	2-12	Assumed No	-	-	-	ML, CL	22-90	Yes (14-75)		

(1) K_f = Subgrade Modulus during Frost Melting Period.

(2) Depth of Frost Penetration from Freezing Index Curve

(3) The figures tabulated denote the average daily cycle year of usage prior to pavement condition survey. W gives cycles prior to the first of the two condition "Pavement Condition" traffic data is for period prio

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FROST INVESTIGATION
1949 - 1950
SUMMARY TABULATION OF AIRFIELD PAVEMENTS

C.B.R. OR [SUBGR]ADE MODULUS: K_f (1)	C.B.R. OR [SUBGR]ADE MODULUS: C.B.R.	SUBGRADE: AIRFIELD CLASSIFICATION	SUBGRADE: % PASSING #200 SIEVE	SUBGRADE: FROST SUSCEPTIBLE (% FINER THAN 0.02 mm)	SUBGRADE: ATTERBERG LIMITS L.L.	SUBGRADE: ATTERBERG LIMITS P.L.	SUBGRADE: C.B.R. OR SUBGRADE MODULUS K	SUBGRADE: C.B.R. OR SUBGRADE MODULUS K_f (1)	SUBGRADE: C.B.R. OR SUBGRADE MODULUS C.B.R.	GROUND WATER DEPTH (FEET)	SUBSURFACE DRAINAGE	APPROX FREEZING INDEX	FROST PENETRATION (INCHES)	EVALUATION LBS. GROSS PLANE WEIGHT: NORMAL PERIOD E.M. PART XII JULY 1946	EVALUATION LBS. GROSS PLANE WEIGHT: FROST CONDITIONS E.M. PART XII	TRAFFIC: GROSS PLANE WT. (LBS.)	TRAFFIC: MAX. DA[ILY] TRA[FFIC]
-	-	CL, ML, CH	82-94	Yes (45-69)	30-52	16-24	143	-	-	[illegible]	None reported	[illegible]	42 (2)	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	- - - - - -
-	-	CL, ML	82-94	Yes (45-69)			143	-	-					< 30,000	< 30,000		
-	-	CL, CH, ML, SF	82-94	Yes (45-69)			143	-	-					30,000	< 30,000		
-	-	CL, ML	82-94	Yes (45-69)			143	-	-					35,000	< 30,000		
-	-	CL, ML	82-94	Yes (45-69)			143	-	-					3[illegible],000	< 30,000		
-	-	CL, ML	44-67	Yes (28-42)	24-52	13-25	50	-	-	3-5	Perforated pipe in trenches backfilled with graded filter material on either side of runways.	100	25	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	- 42 13 67 Dec 9/h -
-	-	CL, ML	44-67	Yes (28-42)			50	-	-					< 30,000 NE-SW Runway 36,000	< 30,000 < 30,000		
-	-	CL	44-67	Yes (28-42)			50	-	-					< 30,000	< 30,000		
-	-	CL	44-67	Yes (28-42)			50	-	-					30,000	< 30,000		
-	-	SF-CL, SF, CH	32-69	Yes (14-48)	18-50	15-28	52	-	-	5	Open joint pipe and gravel backfil trenches along shoulders of some pavements.	200	21 (2)	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 20-135,000 >135,000	76 150 173 5c Dec 80 -
-	-	CL, SF	32-69	Yes (14-48)			52	-						< 30,000	< 30,000		
-	-	CL, SF	32-69	Yes (14-48)			52	-	-					36,000	< 30,000		
-	-	ML, CH, CL	84-96	Yes (28-54)	21-67	15-28	112	-	-	0-18	None	200	21 (2)	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 20-135,000 >135,000	51 1c 2 8/h Dec Dec -
-	-	ML, CH, CL	84-96	Yes (28-54)			112	-	-					< 30,000	< 30,000		
-	-	GP	20-87	Yes (12-56)	25	23	-	-	-	21	Open joint drain pipes along edges of paved areas.	150	18 (2)	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 20-135,000 >135,000	16 10 4 19 6/Mo 19/Mo -
-	-	SW	20-87	Yes (12-56)			-	-	-					< 30,000	< 30,000		
-	-	GC	20-87	Yes (12-56)			-	-	-					< 30,00	< 30,000		
-	-	SW	20-87	Yes (12-56)			-	-	-					< 30,000	< 30,000		
-	-	GP	20-87	Yes (12-56)			-	-	-					< 30,000	< 30,000		
-	-	GP	20-87	Yes (12-56)			-	-	-					< 30,000	< 30,000		
-	80	CL	85-94	Yes (44-65)	36-48	18-25	-	-	8	Not Reported	None	740	39 (2)	19,000	< 10,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 20-135,000 >135,000	7 6 1 1
-	-	CL	85-94	Yes (44-65)			83	-	-					< 30,000	< 30,000		
-	-	CL	85-94	Yes (44-65)			83	-	-					50,000	< 30,000		
45	-	CL, ML	85-94	Yes (44-65)			-	-	-					34,000	< 30,000		
-	80	CL	46-65	Yes (10-25)	20-22	16-19	-	-	3	Not Reported	Perforated concrete pipe ±5 ft. from edge pavements in trenches, backfilled with crushed stone under 6" of consolidated earth.	150	-	< 10,000	< 10,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	6 10 10 3/h 6/h -
-	-	CL	46-72	Yes (16-47)			100	-	-					< 30,000	< 30,000		
65	-	GP	22-90	Yes (14-75)	22-71	17-32	-	-	-	4-7	None	150	23	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	- 98 17 21 5/h - -
-	-	CL	22-90	Yes (14-75)			40	25	-					< 30,000	< 30,000		
-	-	ML	22-90	Yes (14-75)			80	-	-					40,000	30,000		
-	-	ML, CL	22-90	Yes (14-75)			80	25	-					58,000	50,000		

NOTES

(1) K_f = Subgrade Modulus during Frost Melting Period.

(2) Depth of Frost Penetration from Freezing Index Curve, Chapter 4, Part XII of Engineering Manual.

(3) The figures tabulated denote the average daily cycles of landing and take-offs for the maximum year of usage prior to pavement condition survey. Where two columns are tabulated, left column gives cycles prior to the first of the two condition surveys. Where "No Data" is shown under "Pavement Condition" traffic data is for period prior to January 1950.

(4) Numbers under "Line" heading denote plotted points on Plate 2.

(5) "Percent of Design" is the ratio of the actual pavement thickness to d[esign] Design thickness is for average wheel load of heaviest weight class o[f] with average frequency of 5 or more cycles of landings and take-offs survey.

Where base or subbase materials under flexible paved areas are frost [susceptible] as controlling the design. Borderline materials were considered non-

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…VEMENTS

…T E- ON ES)	EVALUATION LBS. GROSS PLANE WEIGHT: NORMAL PERIOD E.M. PART XII JULY 1946	FROST CONDITIONS E.M. PART XII	TRAFFIC: GROSS PLANE WT. (LBS.)	MAX. AVG. DAILY TRAFFIC (3)	PAVEMENT CONDITION: LOCATION	LINE (4)	DESIGN THICKNESS	% OF DESIGN (5)	DESCRIPTION	DATE OF SURVEY	REPORTED CAUSE OF FAILURE
)	< 30,000 < 30,000 30,000 38,000 3[illegible],000	< 30,000 < 30,000 < 30,000 < 30,000 < 30,000	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	- 33 - 4 - 1 45 5 - - - - - -	Apron Taxiways 1A, 1B, 2 and 3 NE-SW Runway NW-SE Runway N-S Runway Taxiways	19 20 21 22 23 20	18 18 14 13 14 18	47 47 50 65 61 47	Complete failure taxiway 1A and S.E. corner of apron. Excessive cracking particularly at joints on Taxiways 1B, 2 and 3. Numerous cracks and joint failures. Excessive cracking and joint failures	Mar. 1943 May 1947	Poor subgrade and insufficient pavement thickness. Frequent load repetitions over confined areas. Overloading and poor subgrade conditions. Overloading and poor subgrade conditions.
	< 30,000 < 30,000 NE-SW Runway 36,000 < 30,000 30,000	< 30,000 < 30,000 <30,000 < 30,000 < 30,000	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	- 42 13 677 Occ. 9/Mo. -	Main Apron Apron Ext., Apron Wings and Taxiways N-S and NE-SW Runway NW-SE Runway E-W Runway	24 25 26 27 28	15 15 12 12 11	53 53 67 58 54	75% of slabs with cracks, corner breaks or spalls. Good to excellent condition	Mar. 1947	Pavement 11 years old. Age and large slab size believed responsible for failure.
)	< 30,000 < 30,000 36,000	< 30,000 < 30,000 < 30,000	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 20-135,000 >135,000	76 150 173 56 Occ. 80 -	Apron No. 1 and Taxiways Apron No. 2 Runways	29 30 31	23 23 16	26 52 38	Fair to poor condition, considerable cracking, especially shrinkage cracks. Good condition. Fair condition	May 1947	Shrinkage cracks due to construction during cold weather period. Pavements consistently overloaded.
)	< 30,000 < 30,000	< 30,000 < 30,000	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 20-135,000 >135,000	51 10 2 8/Mo. Occ. Occ. -	No Data.						
)	< 30,000 < 30,000 < 30,000 < 30,000 < 30,000 < 30,000	< 30,000 < 30,000 < 30,000 < 30,000 < 30,000 < 30,000	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 20-135,000 >135,000	167 104 47 192 6/Mo. 1[illegible]/Mo. -	No Data						
)	19,000 < 30,000 50,000 34,000	<10,000 < 30,000 < 30,000 < 30,000	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 20-135,000 >135,000	71 64 18 1 - 17 -	NW-SE Runway NE-SW Runway Hanger Apron	32 33 34	15 15 19	60 73 32	Good to excellent condition. Fair condition. Large number of transverse and diagonal cracks. Extensive cracking. Numerous shattered slabs, and spalls.	May 1947	 Not Reported.
	< 10,000 < 30,000	< 10,000 < 30,000	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	6[illegible] 10[illegible] [illegible]0 7 3/Mo. 6/Mo. -	No Data						
	< 30,000 < 30,000 40,000 58,000	< 30,000 < 30,000 30,000 30,000	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	- 98 17 21 [illegible]/Mo. 2 -	Apron Taxiways Runway A Runways B and C	35 36 37 38	11 12 9 10	55 67 78 90	Good to very good condition.	April 1947	

…me" heading denote plotted points on Plate 2.

…n" is the ratio of the actual pavement thickness to design thickness x 100.
… is for average wheel load of heaviest weight class of planes using field
…quency of 5 or more cycles of landings and take-offs per day prior to condition

…bbase materials under flexible paved areas are frost susceptible they were considered
…he design. Borderline materials were considered non-frost susceptible.

SUMMARY TABULATION OF AIRFIELD PAVEMENTS

Sheet 2 of 4 TABLE I

AIRFIELD	LOCATION	PAVEMENT			BASE							SUBGRADE				
		TYPE	THICKNESS (INCHES)	FLEXURAL STRENGTH OF CONCRETE AT 28 DAYS (LBS./SQ. IN.)	TYPE	THICKNESS (INCHES)	% PASSING #200 SIEVE	FROST SUSCEPTIBLE (% FINER THAN 0.02 mm)	C.B.R. OR SUBGRADE MODULUS: K	K_f (1)	C.B.R.	AIRFIELD CLASSIFICATION	% PASSING #200 SIEVE	FROST SUSCEPTIBLE (% FINER THAN 0.02mm)	ATTERBE[RG] LIMITS: L.L.	P
Presque Isle Air Force Base, Presque Isle, Maine	Hangar Service Aprons and Taxiways A to F.	P.C.C.	3-6-8	553	Sand & Gravel	6-24 (12 Avg.)	3-10	Borderline (0-8)	300	24	-	GF	18-50	Yes (12-43)	30	:
	Runways	Bit. Conc.	3½-4½	-	Sand & Gravel	4-44 (12 Avg.)	3-10	Borderline (0-8)	-	-	80	GF	18-50	Yes (12-43)		
Rome Airfield, Griffiss Air Force Base Rome, New York	Runways	P.C.C.	7	665	None	-	-	-	-	-	-	GW (small area GP, GF)	2-14	Yes (1-8)	22-42	19-
Scott Air Force Base, Belleville, Illinois	Apron and apron extension, taxiways A,B,C and E-W, NE-SW, NW-SE Runways.	P.C.C.	8-6-8	590	None	-	-	-	-	-	-	OL, CL	96-98	Yes (52-74)	25-43	18-
	N-S Runway	P.C.C.	8-6-8	590	None	-	-	-	-	-	-	OL	96-98	Yes (52-74)		
	Taxiways D, E, and F	P.C.C.	9-6-9	700	None	-	-	-	-	-	-	OL	96-98	Yes(52-74)		
Selfridge Air Force Base, Mt. Clemens, Michigan	Original E-W Runway (used as apron) original N-S Runway (used as taxiway)	P.C.C.	8-6-8	649	None	-	-	-	-	-	-	ML	35-93	Yes (18-73)	24-52	20-
	NE-SW and E-W Runways.	P.C.C.	12-9-12	742	Gravel Sand	6 15	6-12 5	Yes (3-5) No (1)	176	-	-	ML, CH	35-93	Yes (18-75)		
	N-S Runway	P.C.C.	12-9-12	725	Gravel Sand	6 18	6-12 5	Yes (3-5) No (1)	190	-	-	ML	35-93	Yes (18-73)		
	Apron	P.C.C.	12-10-12	750	Gravel	12	6-12	Yes (3-5)	130	-	-	ML	35-93	Yes (18-73)		
Sherman Air Force Base, Fort Leavenworth, Kansas	N-S & NW-SE Runway ends.	P.C.C.	9-6-9	-	Cinders	6	-	-	-	-	-	-	-	-		
	Runways	Cinders	6	-	-	-	-	-	-	-	-	-	-	-		
	Taxiways	P.C.C.	9-6-9	-	Cinders	6	-	-	-	-	-	-	-	-		
Smoky Hill Air Force Base, Salina, Kansas	NE-SW & E-W Runways	P.C.C.	8	490	None	-	-	-	-	-	-	CL, CH	66-99	Yes (30-76)	35-65	17-
	NW-SE Runway	P.C.C.	8	540	None	-	-	-	-	-	-	CL, CH	66-99	Yes (30-76)		
	Taxiways 1-2, 4-12, original apron.	P.C.C.	8	610	None	-	-	-	-	-	-	CL, CH	66-99	Yes (30-76)		
	N-S Runway	P.C.C.	8	610	None	-	-	-	-	-	-	CL, CH	66-99	Yes (30-76)		
Spokane Air Force Base, Spokane, Washington	NE-SW Runway Left and right wing. Center Taxiways	P.C.C.	8-6-8	675	Pit Run Gravel	12	4-10	Assumed No	217	45	-	GF, GM, SG, SF, ML	2-73	Yes (2-44)	16-33	16-
	E-W, N-S Runway	P.C.C.	8-6-8	675	Pit Run Gravel	12	4-10	Assumed No	217	45	-	GF, GW, SG, SF, ML	2-73	Yes (2-44)		
	Apron	P.C.C.	8-6-8	919	Pit Run Gravel	12	4-10	Assumed No	217	45	-	GF, GW, SF, SP, ML	2-73	Yes (2-44)		

(1) K_f = Subgrade Modulus during Frost Melting Period.

(2) Depth of Frost Penetration from Freezing Index Cur

(3) The figures tabulated denote the average daily cyc year of usage prior to pavement condition survey. gives cycles prior to the first of the two conditi "Pavement Condition" traffic data is for period pr

FROST INVESTIGATION
1949 - 1950
SUMMARY TABULATION OF AIRFIELD PAVEMENTS

SUBGRADE: % PASSING 200 SIEVE	SUBGRADE: FROST SUSCEPTIBLE (% FINER THAN 0.02mm)	ATTERBERG LIMITS: L.L.	ATTERBERG LIMITS: P.L.	C.B.R. OR SUBGRADE MODULUS: K	C.B.R. OR SUBGRADE MODULUS: $K_{f(1)}$	C.B.R. OR SUBGRADE MODULUS: C.B.R.	GROUND WATER DEPTH (FEET)	SUBSURFACE DRAINAGE	APPROX. FREEZING INDEX	FROST PENE-TRATION (INCHES)	EVALUATION LBS. GROSS PLANE WEIGHT: NORMAL PERIOD E.M. PART XII JULY 1946	EVALUATION LBS. GROSS PLANE WEIGHT: FROST CONDITIONS E.M. PART XII	TRAFFIC: GROSS PLANE WT. (LBS.)	TRAFFIC: MAX. AVG. DAILY TRAFFIC (3)	
18-50	Yes (12-43)	30	20	-	-	-	2-6	Perforated metal pipe in trenches backfilled with coarse graded rock and P.C. open joint pipe with run of bank gravel backfill laid edges of runways.	2061	71	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	- - 5 25 - - -	Portle
18-50	Yes (12-43)			-	-	10					63,000	13,000			Aprons
2-14	Yes (1-8)	22-42	19-26	220	-	-	Not Reported	Not Reported.	750	39 (2)	30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	78 48 50 3 7/Mo. 20/Mo. -	No Dat
96-98	Yes (52-74)	25-43	18-26	66	-	-	Below Influence depth	Open joint tile drains along edges of runway pavement	150	12	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	157 (150 for < 15,000 through 50-75,000) 208 21 12 2/Mo. 16/Mo.	Apron E-W Ru
96-98	Yes (52-74)			66	-	-					< 30,000	< 30,000			N-S, N
96-98	Yes (52-74)			66	-	-					< 30,000	< 30,000			Apron
															Apron E-W Ru
35-93	Yes (18-73)	24-52	20-27	85	-	-	0.5-6.0	Perforated tile pipe backfilled with bank run gravel along edges of all pavements. Open joint tile pipe backfilled with gravel on 30' centers under apron and interior of field.	520	30	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	200 110 44 75 - 13/Mo. Occ.	Origin
35-93	Yes (18-73)			48	-	-					34,000	< 30,000			NE-SW Apron
35-93	Yes (18-73)			48	-	-					55,000	< 30,000			N-3 an
35-93	Yes (18-73)			48	-	-					36,000	< 30,000			
-	-			-	-	-	Shallow	Not Reported.	250	24 (2)	-	-	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	13 4 3 5/Mo. - - -	No Dat
-	-			-	-	-					-	-			
-	-			-	-	-					-	-			
66-99	Yes (30-76)	35-65	17-29	84	-	-	Not Reported	Not Reported.	150	18 (2)	30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	20 25 8 25 1/Mo. 41 Occ.	No Dat
66-99	Yes (30-76)			84	-	-					30,000	< 30,000			
66-99	Yes (30-76)			84	-	-					< 35,000	< 30,000			
66-99	Yes (30-76)			84	-	-					40,000	< 30,000			
2-73	Yes (2-44)	16-33	15-37	-	-	-	Not Reported	Not Reported.	250	24	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 > 135,000	27 40 10 9 10/Mo. 15 Occ.	No Dat
2-73	Yes (2-44)			-	-	-					30,000	< 30,000			
2-73	Yes (2-44)			-	-	-					30,000	< 30,000			

NOTES

Modulus during Frost Melting Period.

[illegible] Penetration from Freezing Index Curve, Chapter 4, Part XII of Engineering Manual.

[illegible] denote the average daily cycles of landing and take-offs for the maximum [illegible] prior to pavement condition survey. Where two columns are tabulated, left column [illegible] prior to the first of the two condition surveys. Where "No Data" is shown under [illegible]ition" traffic data is for period prior to January 1950.

(4) Numbers under "Line" heading denote plotted points on Plate 2.

(5) "Percent of Design" is the ratio of the actual pavement thickness to design thickness Design thickness is for average wheel load of heaviest weight class of planes using with average frequency of 5 or more cycles o landings and take-offs per day prior t survey.

Where base or subbase materials under flexible paved areas are frost susceptible the as controlling the design. Borderline materials were considered non-frost susceptib

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EVALUATION ...OSS PLANE WEIGHT ...AL ...OD ...T XII ...1946	FROST CONDITIONS E.M. PART XII	TRAFFIC GROSS PLANE WT. (LBS.)	MAX. AVG. DAILY TRAFFIC (3)	PAVEMENT CONDITION LOCATION	LINE (4)	DESIGN THICKNESS	% OF DESIGN (5)	DESCRIPTION	DATE OF SURVEY	REPORTED CAUSE OF FAILURE
00 00	< 30,000 13,000	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	- - 5 25 - - -	Portion of N-S Runway Aprons and Taxiways	39 39a	33 15	48 40	Developed weaving during Spring thaw of 1943 causing some cracking and rutting. Good condition	Spring 1943	Severe frost action in subgrade.
00	< 30,000	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	78 48 50 3 7/Mo. 20/Mo. -	No Data.						
00 00 00	< 30,000 < 30,000 < 30,000	<15,000 ┐ 15-35,000 ├ 150 35-50,000 │ 50-75,000 ┘ 75-120,000 120-135,000 >135,000	157 208 21 12 2/Mo. 16/Mo.	Apron E-W Runway N-S, NE-SW, NW-SE Runways Apron extension in Taxiways Apron E-W Runway	40 41 42 43 40 41	15 11 11 13 15 11	40 ┐ 55 ┘ 55 ┐ 46 ┘ 40 ┐ 55 ┘	Cracking at tongue and groove joints and corners on apron. Long cracks on E-W Runway parallel to longitudinal joints. Generally good condition. 50% of slabs cracked or shattered.	Fall 1945 May 1947	Lack of subsurface drainage. Overloading during Spring and Fall of 1945. Overloading particularly during thaw.
00 00 00 00	< 30,000 < 30,000 < 30,000 < 30,000	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	100 110 44 75 - 13/Mo. Occ.	Original E-W and N-S Runways NE-SW Runway Apron N-S and E-W Runways	44 45 46 45	14 9 12 9	43 100 ┐ 83 ┘ 100	Extensive cracking and spalling. Transverse cracks open and ravelling. Fair condition with scaling and shrinkage cracks on 50% of slabs. Good condition.	May 1947	Condition consistent with age (13 years) and use. Constructed during winter. CaCl used in curing process. Not considered failure.
- - -	- - -	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	13 4 3 5/Mo. - - -	No Data						
000 000 000 000	< 30,000 < 30,000 < 30,000 < 30,000	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	20 25 8 25 1/Mo. 41 Occ.	No Data						
000 000 000	< 30,000 < 30,000 < 30,000	<15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	27 40 10 9 10/Mo. 15 Occ.	No Data						

...denote plotted points on Plate 2.

...atio of the actual pavement thickness to design thickness x 100.
...rage wheel load of heaviest weight class of planes using field
... or more cycles of landings and take-offs per day prior to condition

...ials under flexible paved areas are frost susceptible they were considered
... Borderline materials were considered non-frost susceptible.

SUMMARY TABULATION OF AIRFIELD PAVEMENTS

C

AIRFIELD	LOCATION	PAVEMENT			BASE				C.B.R. OR SUBGRADE MODULUS				
		TYPE	THICKNESS (INCHES)	FLEXURAL STRENGTH OF CONCRETE AT 28 DAYS (LBS./SQ. IN.)	TYPE	THICKNESS (INCHES)	% PASSING #200 SIEVE	FROST SUSCEPTIBLE (% FINER THAN 0.02 mm)	K	K_f (1)	C.B.R.	AIRFIELD CLASSIFICATION	% PASSING #200 SIEVE
Stewart Air Force Base, Newburgh, New York	Taxiways H-I, and I-W	P.C.C.	6	565	Gravel	12	4-14	Yes (3-8)	350	-	-	GP	6-82
	Landing Mat	P.C.C.	4	663	Gravel	12	4-14	Yes (3-8)	313	-	-	GP	6-82
	NE-SW Runway	P.C.C.	6	606	Gravel	12	4-14	Yes (3-8)	250	-	-	GP	6-82
	E-W Runway	P.C.C.	6	608	Gravel	12	4-14	Yes (3-8)	[illegible]	-	-	GP	6-82
	NW-SE Runway	P.C.C.	6	606	Gravel	12	4-14	Yes (3-8)	[illegible]	-	-	GP	6-82
	A-1 Runway	P.C.C.	6	606	Gravel	12	4-14	Yes (3-8)	[illegible]	-	-	GP	6-82
Weaver Air Base, (Rapid City Air Force Base,) Rapid City, South Dakota	Taxiways A-E, Apron	P.C.C.	7	580	None	-	-	-	-	-	-	CH, CL, GP, OL	53-85
	E-W Runway	P.C.C.	7	565	Asphalt Conc. Gravel	3½ 8	- 9-26	- Yes (10)	282	-	-	CH, CL, GP	53-85
	NW-SE Runway	P.C.C.	7	580	Asphalt Conc. Gravel	3½ 8	- 9-26	- Yes (10)	282	-	-	CH, CL	53-85
	N-S Runway	P.C.C.	7	635	Asphalt Conc. Gravel	3½ 8	- 9-26	- Yes (10)	282	-	-	CH, GP, UP, SP	53-85
Wendover Air Force Base, Wendover, Utah	Anchorage Extension "C"	P.C.C.	6	674	Gravel	25	11	Yes (8)	396	-	-	CL, ML, SP, OL	87-99
	Old North Taxiway	P.C.C.	6	683	Gravel	18	11	Yes (8)	406	-	-	ML, MH	87-99
	Anchorage "A" (Original)	P.C.C.	6	683	Gravel	24	11	Yes (8)	406	-	-	CL, ML, SP, OL	87-99
	NW-SE Runway	P.C.C.	6	630	Gravel	17	11	Yes (8)	406	-	-	CL, MH	87-99
	E-W Runway	P.C.C.	6	630	Gravel	24	11	Yes (8)	440	-	-	CL, MH	87-99
	NE-SW Runway	P.C.C.	6	726	Gravel	12-23	11	Yes (8)	500	-	-	CL, MH	87-99
Wright Field Dayton, Ohio	NE-SW Runway	P.C.C.	7	750	Sand & Gravel	9	6	No	-	-	-	ML	1-90
	Taxiways & Apron	P.C.C.	10	650	Bank Run Gravel	6	6	No	-	-	-	ML	1-90
	NW-SE Runway	P.C.C.	8	650	Bank Run Gravel	6	6	No	-	-	-	ML	1-90
	E-W Runway	P.C.C.	9	650	Bank Run Gravel	6	6	No	-	-	-	ML	1-90
	Original Apron	P.C.C.	7	790	None	-	-	-	-	-	-	ML	1-90
	Apron	P.C.C.	6	750	Bank Run Gravel	18	6	No	-	-	-	ML	1-90

(1) K_f = Subgrade Modulus dur

(2) Depth of Frost Penetratio

(3) The figures tabulated den
year of usage prior to pa
given cycles prior to the
"Pavement Condition" traf

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FROST INVESTIGATION
1949 - 1950

SUMMARY TABULATION OF AIRFIELD PAVEMENTS

LUS C.B.R.	SUBGRADE AIRFIELD CLASSIFICATION	% PASSING #200 SIEVE	FROST SUSCEPTIBLE (% FINER THAN 0.02mm)	ATTERBERG LIMITS L.L.	ATTERBERG LIMITS P.L.	C.B.R. OR SUBGRADE MODULUS K	K_f (1)	C.B.R.	GROUND WATER DEPTH (FEET)	SUBSURFACE DRAINAGE	APPROX. FREEZING INDEX	FROST PENE-TRATION (INCHES)	EVALUATION LBS. GROSS PLANE WEIGHT: NORMAL PERIOD E.M. PART XII JULY 1946	FROST CONDITIONS E.M. PART XII	TRAFFIC: GROSS PLANE WT. (LBS.)	MAX. AVG. DAILY TRAFFIC (3)	
-	GF	6-82	Yes (4-54)	13-22	16-27	-	-	-	0-7	Open joint pipe in pervious granular back-fill at low points.	500	50	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	152 246 17 17/Mo. Occ. Occ. -	No Data
-	GF	6-82	Yes (4-54)			-	-	-					< 30,000	< 30,000			
-	GF	6-82	Yes (4-54)			-	-	-					< 30,000	< 30,000			
-	GF	6-82	Yes (4-54)			-	-	-					< 30,000	< 30,000			
-	GF	6-82	Yes (4-54)			-	-	-					< 30,000	< 30,000			
-	GF	6-82	Yes (4-54)			-	-	-					< 30,000	< 30,000			
-	CH, CL, GF, OL	53-85	Yes (54)	26-68	14-30	58	-	-	600	None	1,300	40 (2)	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	- 19 - 27 - 7 79 101 - - - 3 - -	E-W Ru Apron Other All ta Apron
-	CH, CL, GF	53-85	Yes (54)			-	-	-					< 30,000	< 30,000			
-	CH, CL	53-85	Yes (54)			-	-	-					30,000	< 30,000			
-	CH, GF, UP, SP	53-85	Yes (54)			-	-	-					30,000	< 30,000			
-	CL, ML, SP, OL	87-99	Yes (68-96)	23-49	15-40	-	-	-	2-7	None Reported	550	-	< 30,000	< 30,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	6 12 4 90 Occ. 4 -	No Data
-	ML, MH	87-99	Yes (68-96)			-	-	-					< 30,000	< 30,000			
-	CL, ML, SP, OL	87-99	Yes (68-96)			-	-	-					< 30,000	< 30,000			
-	CL, MH	87-99	Yes (68-96)			-	-	-					< 30,000	< 30,000			
-	CL, MH	87-99	Yes (68-96)			-	-	-					< 30,000	< 30,000			
-	CL, MH	87-99	Yes (68-96)			-	-	-					30,000	< 30,000			
-	ML	1-90	Yes (0-54)	20-39	15-26	40	35	-	15-20	NW-SE and NE-SW Runways have side drains of pervious material in trenches over 8" pipe. Interceptor drains for Aprons and Taxiways.	150	24	36,000	35,000	< 15,000 15-35,000 35-50,000 50-75,000 75-120,000 120-135,000 >135,000	- 248 16 12 18/Mo. 5 -	NE-SW Apron NW-SE E-W R 6" Apr Origi
-	ML	1-90	Yes (0-54)			40	25	-					35,000	35,000			
-	ML	1-90	Yes (0-54)			40	25	-					40,000	38,000			
-	ML	1-90	Yes (0-54)			40	25	-					48,000	40,000			
-	ML	1-90	Yes (0-54)			40	25	-					< 30,000	< 30,000			
-	ML	1-90	Yes (0-54)			40	25	-					< 30,000	< 30,000			

NOTES

(1) K_f = Subgrade Modulus during Frost Melting Period.

(2) Depth of Frost Penetration from Freezing Index Curve, Chapter 4, Part XII of Engineering Manual.

(3) The figures tabulated denote the average daily cycles of landing and take-offs for the maximum year of usage prior to pavement condition survey. Where two columns are tabulated, left column gives cycles prior to the first of the two condition surveys. Where "No Data" is shown under "Pavement Condition" traffic data is for period prior to January 1950.

(4) Numbers under "Line" heading denote plotted points on Plate 2.

(5) "Percent of Design" is the ratio of the actual pavement thickness to design thickne Design thickness is for average wheel load of heaviest weight class of planes usin with average frequency of 5 or more cycles of landings and take-offs per day prior survey.

Where base or subbase materials under flexible paved areas are frost susceptible t as controlling the design. Borderline materials were considered non-frost suscept

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EVALUATION LBS. GROSS PLANE WEIGHT: NORMAL PERIOD E.M. PART XII JULY 1946	EVALUATION LBS. GROSS PLANE WEIGHT: FROST CONDITIONS E.M. PART XII	TRAFFIC: GROSS PLANE WT. (LBS.)	TRAFFIC: MAX. AVG. DAILY TRAFFIC (3)	PAVEMENT CONDITION: LOCATION	LINE (4)	DESIGN THICKNESS	% OF DESIGN (5)	DESCRIPTION	DATE OF SURVEY	REPORTED CAUSE OF FAILURE
< 30,000	< 30,000	<15,000	152	No Data						
< 30,000	< 30,000	15-35,000	246							
< 30,000	< 30,000	35-50,000	17							
< 30,000	< 30,000	50-75,000	17 Mo.							
< 30,000	< 30,000	75-120,000	Occ.							
< 30,000	< 30,000	120-135,000	Occ.							
		>135,000	-							
< 30,000	< 30,000	<15,000	- 19	E-W Runway and shoulders	47	11	64	Matting under traffic in joint areas	Mar. 1943	Moisture penetration into base and subgrade through longitudinal joints.
< 30,000	< 30,000	15-35,000	- 27	Apron	48	16	44	Extensive cracking and crazing		
30,000	< 30,000	35-50,000	- 7	Other Runways	49	11	64	Good condition with considerable scaling.	May 1947	
30,000	< 30,000	50-75,000	79 101	All taxiways except B	50	16	44	Good to fair condition with considerable scaling.		
		75-120,000	- -	Apron and taxiway B	48	16	44	Extensive cracking, shattered slabs and joints spalls.		Continued overloading since 1943.
		120-135,000	- 3							
		>135,000	- -							
< 30,000	< 30,000	<15,000	6	No Data						
< 30,000	< 30,000	15-35,000	12							
< 30,000	< 30,000	35-50,000	4							
< 30,000	< 30,000	50-75,000	90							
< 30,000	< 30,000	75-120,000	Occ.							
30,000	< 30,000	120-135,000	4							
		>135,000	-							
36,000	35,000	<15,000	-	NE-SW Runway	51	14	50	Good to excellent condition	Mar. 1947	
35,000	33,000	15-35,000	248	Apron (10")	52	20	50			
40,000	38,000	35-50,000	16	NW-SE Runway	53	15	55			
48,000	46,000	50-75,000	12	E-W Runway	54	15	60			
< 30,000	< 30,000	75-120,000	18/Mo.	6" Apron and connecting taxiway	55	17	41	Poor condition, extensive cracking, numerous shattered slabs.		Failures believed due to large slabs.
< 30,000	< 30,000	120-135,000	5	Original Apron	56	17	35			
		>135,000	-							

heading denote plotted points on Plate 2.

is the ratio of the actual pavement thickness to design thickness x 100.
for average wheel load of heaviest weight class of planes using field
ncy of 5 or more cycles of landings and take-offs per day prior to condition

se materials under flexible paved areas are frost susceptible they were considered
design. Borderline materials were considered non-frost susceptible.

SUMMARY TABULATION OF AIRFIELD PAVEMENTS

Sheet 4 of 4 TABLE I

TRAFFIC HISTORY

1943-1949

AIRFIELD	GROSS PLANE WEIGHT (LBS.)	CYCLES OF LANDINGS AND TAKE OFFS														TRAFFIC DISTRIBUTION	
		1943		1944		1945		1946		1947		1948		1949			
		TOTAL	APPROX. DAILY	TOTAL	APPROX. DAILY	TOTAL	APPROX. DAILY	TOTAL	APPROX. DAILY	TOTAL	APPROX. DAILY	TOTAL	APPROX. DAILY	TOTAL	APPROX. DAILY	RUNWAY	% OF TRAFFIC
Cooper Air Force Base, Cooper, Wyoming	<15,000	-	-	-	-	-	-	No Data		808	2	700	2	6,205	17	NE-SW	62
	15-35,000	-	-	-	-	90	45/Mo.			287	1	200	17/Mo.	1,460	4	E-W	29
	35-50,000	-	95	-	95	19	10/Mo.			102	9/Mo.	131	11/Mo.	204	17/Mo.	NW-SE	5
	50-75,000	-	-	-	-	6,716	112			13	1/Mo.	14	1/Mo.	-	-	N-S	4
	75-120,000	-	-	-	-					-	-	1	Occ.	-	-		
	120-135,000	-	-	-	-	Inactive				2	Occ.	11	1/Mo.	-	-		
	>135,000	-	-	-	-	Mar.-Dec.				-	-	-	-	-	-		
Chanute Air Force Base, Rantoul, Illinois	<15,000					-	-	-	-	17,049	47	19,121	52	25,785	65	NE-SW	30
	15-35,000	(-	445	-	445)	5,096	16	21,170	58	5,473	15	10,957	30	8,090	22	N-S	30
	35-50,000		(<15,000	- 75,000)		2,154	6	44,895	125	28,236	78	25,461	70	28,470	78	E-W	27
	50-75,000					6,139	17	3,885	9	901	2	300	1	365	1	NW-SE	13
	75-120,000	-	-	-	-	-	-	30	3/Mo.	-	-	-	-	-	-		
	120-135,000	-	-	-	-	106	9/Mo.	84	7/Mo.	122	10/Mo.	97	8/Mo.	84	7/Mo.		
	>135,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Clinton County Air Force Base, Great Falls, Montana	<15,000	-	-	-	-	-	-	-	-	2,580	7	5,912	16	7,300	20	NE-SW	72
	15-35,000	-	-	-	-	2,253	6	4,444	12	5,463	15	4,399	12	1,460	4	NW-SE	28
	35-50,000	-	6	-	6	1,296	3	2,385	7	2,092	6	3,205	9	8,190	6		
	50-75,000	-	1	-	1	4,067	11	1,884	5	1,849	5	5,392	15	2,555	7		
	75-120,000	-	-	-	-	-	-	4	Occ.	4	Occ.	-	-	-	-		
	120-135,000	-	-	-	-	49	4/Mo.	188	6/Mo.	57	5/Mo.	125	10/Mo.	-	-		
	>135,000	-	-	-	-	-	-	14	1/Mo.	-	-	-	-	-	-		
Dow Air Force Base, Bangor, Maine	<15,000	-	-	No Data		-	-	No Data		22,523	62	25,470	70	29,200	80	NE-SW	51
	15-35,000	-	2			8,090	22			3,982	11	3,325	9	2,555	7	NW-SE	48
	35-50,000	-	-			4,745	13			581	2	1,595	4	1,460	4	E-W	1
	50-75,000	-	4			5,110	14			17	1/Mo.	158	13/Mo.	131	11/Mo.		
	75-120,000	-	-			-	-			2	Occ.	-	-	12	1/Mo.		
	120-135,000	-	-			56	3/Mo.			-	-	18	2/Mo.	12	1/Mo.		
	>135,000	-	-			-	-			-	-	-	-	-	-		
Great Falls Air Force Base, Great Falls, Montana	<15,000	No Data		-	-	-	-	-	-	4,707	13	1,506	4	1,016	3	NE-SW	73
	15-35,000			-	56	10,888	30	24,987	68	5,344	15	4,875	13	5,840	16	E-W	15
	35-50,000			-	-	1,340	4	1,006	3	987	3	2,304	6	1,095	3	N-S	8
	50-75,000			-	-	1,091	3	3,045	9	3,299	9	18,224	50	78,110	214	[illegible]	4
	75-120,000			-	-	-	-	24	2/Mo.	1	Occ.	-	-	5	Occ.		
	120-135,000			-	-	27	2/Mo.	182	16/Mo.	210	17/Mo.	191	16/Mo.	168	14/Mo.		
	>135,000			-	-	-	-	-	-	-	-	-	-	-	-		
Hill Air Force Base, Ogden, Utah	<15,000	-	-	No Data		-	-	-	-	43,313	119	24,192	66	11,315	31	NW-SE	43
	15-35,000	-	11			15,712	43	40,746	136	4,982	14	7,886	22	9,185	25	E-W	20
	35-50,000	-	18			3,486	10	2,182	6	3,379	9	4,261	12	4,745	13	NE-SW	20
	50-75,000	-	1			5,612	15	1,379	4	1,865	5	1,980	5	1,095	3	N-S	17
	75-120,000	-	-			1	Occ.	4	Occ.	-	-	-	-	-	-		
	120-135,000	-	-			354	1	262	1	448	1	766	2/Mo.	612	51/Mo.		
	>135,000	-	-			-	-	-	-	-	-	-	-	-	-		
Kearney Air Force Base, Kearney, Nebraska	<15,000	-	-	No Data		-	-	-	-	18,969	33	14,419	40	897	9	N-S	71
	15-35,000	-	-			2,861	6	1,460	4	1,843	4	9,294	25	2,634	29	NW-SE	17
	35-50,000	-	-			470	1	204	17/Mo.	470	1	705	2	375	4	NE-SW	12
	50-75,000	-	45			1,670	5	30	3/Mo.	13	1/Mo.	249	1	63	21/Mo.		
	75-120,000	-	-			-	-	-	-	-	-	-	-	-	-		
	120-135,000	-	-			4,257	12	4	Occ.	-	-	41	3/Mo.	32	10/Mo.		
	>135,000	-	-			-	-	-	-	-	-	1	Occ.	Inactive Mar.-Dec.			
Lockbourne Air Force Base, Columbus, Ohio	<15,000	-	-	No Data		-	-	-	-	16,346	48	26,280	72	35,770	98	N-S	46
	15-35,000	-	-			1,465	4	15,867	42	9,891	27	9,855	27	4,745	13	NE-SW	31
	35-50,000	-	185			1,899	5	4,690	13	6,346	18	6,570	18	1,825	5	E-W	13
	50-75,000	-	1			247,131	677	465	1	13	1/Mo.	96	8/Mo.	108	9/Mo.	NW-SE	10
	75-120,000	-	-			6	Occ.	6	Occ.	-	-	-	-	12	1/Mo.		
	120-135,000	-	-			70	6/Mo.	107	9/Mo.	2	Occ.	38	3/Mo.	24	2/Mo.		
	>135,000	-	-			-	-	-	-	-	-	-	-	-	-		
Lowry Air Force Base, Denver, Colorado	<15,000	-	-	-	-	-	-	-	-	27,448	76	27,187	74	29,200	80	N-S	48
	15-35,000	-	150	-	-	3,246	9	50,330	138	21,338	58	23,000	63	24,090	66	E-W	28
	35-50,000	-	-	-	173	13,077	36	19,655	54	5,165	14	5,077	14	8,030	22	NE-SW	24
	50-75,000	-	-	-	-	20,587	56	4,140	11	957	3	885	74/Mo.	1,095	3		
	75-120,000	-	-	-	-	8	Occ.	5	Occ.	-	-	-	-	3	Occ.		
	120-135,000	-	-	-	2	80,100	80	387	1	158	13/Mo.	193	16/Mo.	1,095	3		
	>135,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Marshall Air Force Base, Fort Riley, Kansas	<15,000	-	-	-	-	-	-	No Data		15,511	42	18,617	51	6,205	17	E-W	57
	15-35,000	-	10	-	10	-	10			1,467	4	1,967	5	1,460	4	NE-SW	43
	35-50,000	-	-	-	-	-	-			787	2	545	45/Mo.	730	2		
	50-75,000	-	8/Mo.	-	8/Mo.	-	8/Mo.			90	8/Mo.	23	2/Mo.	6	Occ.		
	75-120,000	-	-	-	-	-	-			4	Occ.	-	-	-	-		
	120-135,000	-	-	-	-	-	-			-	-	-	-	2	Occ.		
	>135,000	-	-	-	-	-	-			-	-	-	-	-	-		
Mitchel Air Force Base, Hempstead, Long Island, New York	<15,000	-	-	No Data		-	-	-	-	61,098	167	49,068	134	35,770	98	NE-SW	48
	15-35,000	-	-			13,509	37	37,889	104	13,677	37	19,988	55	18,250	50	NW-SE	45
	35-50,000	-	-			7,674	21	7,281	20	7,598	21	14,284	39	17,155	47	E-W	6
	50-75,000	-	192			8,644	24	2,190	6	1,097	3	979	3	730	2	N-S	1
	75-120,000	-	-			62	5/Mo.	1	Occ.	2	Occ.	2	Occ.	72	6/Mo.		
	120-135,000	-	-			55	5/Mo.	127	10/Mo.	157	13/Mo.	227	19/Mo.	108	9/Mo.		
	>135,000	-	-			-	-	-	-	-	-	-	-	-	-		
Offutt Air Force Base, Fort Crook, Nebraska	<15,000	-	-	-	-	-	-	-	-	25,098	71	18,615	51	15,695	43	NW-SE	60
	15-35,000	-	55	-	-	-	-	25,398	64	2,999	8	3,518	10	6,570	18	NE-SW	31
	35-50,000	-	-	-	18	-	18	1,601	4	1,995	5	4,006	11	7,665	21	N-S	9
	50-75,000	-	-	-	-	-	-	855	1	200	17/Mo.	654	2	3,285	9		
	75-120,000	-	-	-	-	-	-	-	-	-	-	-	-	6	Occ.		
	120-135,000	-	-	-	17	-	17	32	3/Mo.	20	2/Mo.	204	17/Mo.	1,095	3		
	>135,000	-	-	-	-	-	-	-	-	-	-	-	-	8	1/Mo.		
Olmsted Air Force Base, Middletown, Pennsylvania	<15,000	-	-	-	-	-	-	-	-	22,400	61	18,586	51	14,235	39	E-W	62
	15-35,000	-	-	-	-	9,183	25	38,906	109	7,480	20	8,123	22	8,760	24	NW-SE	38
	35-50,000	-	30	-	30	1,321	4	2,806	8	3,088	9	3,358	9	3,650	10		
	50-75,000	-	-	-	-	2,106	6	1,940	5	2,395	7	2,997	7	1,825	5		
	75-120,000	-	-	-	-	2	Occ.	-	-	-	-	10	1/Mo.	36	3/Mo.		
	120-135,000	-	-	-	-	2	Occ.	71	6/Mo.	122	10/Mo.	46	4/Mo.	-	-		
	>135,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

See sheet 2 of 2 for notes

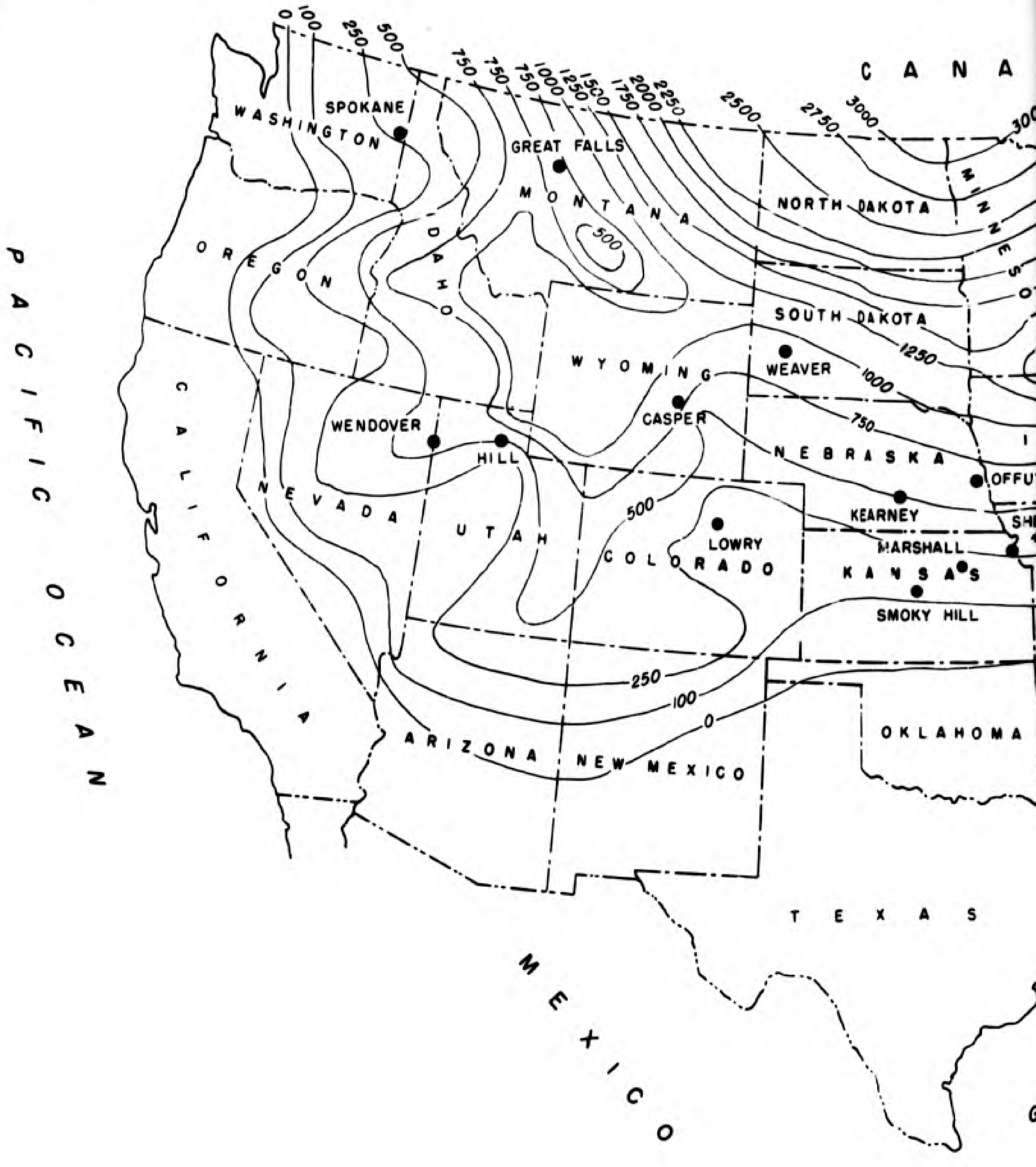
TRAFFIC HISTORY

1943-1949

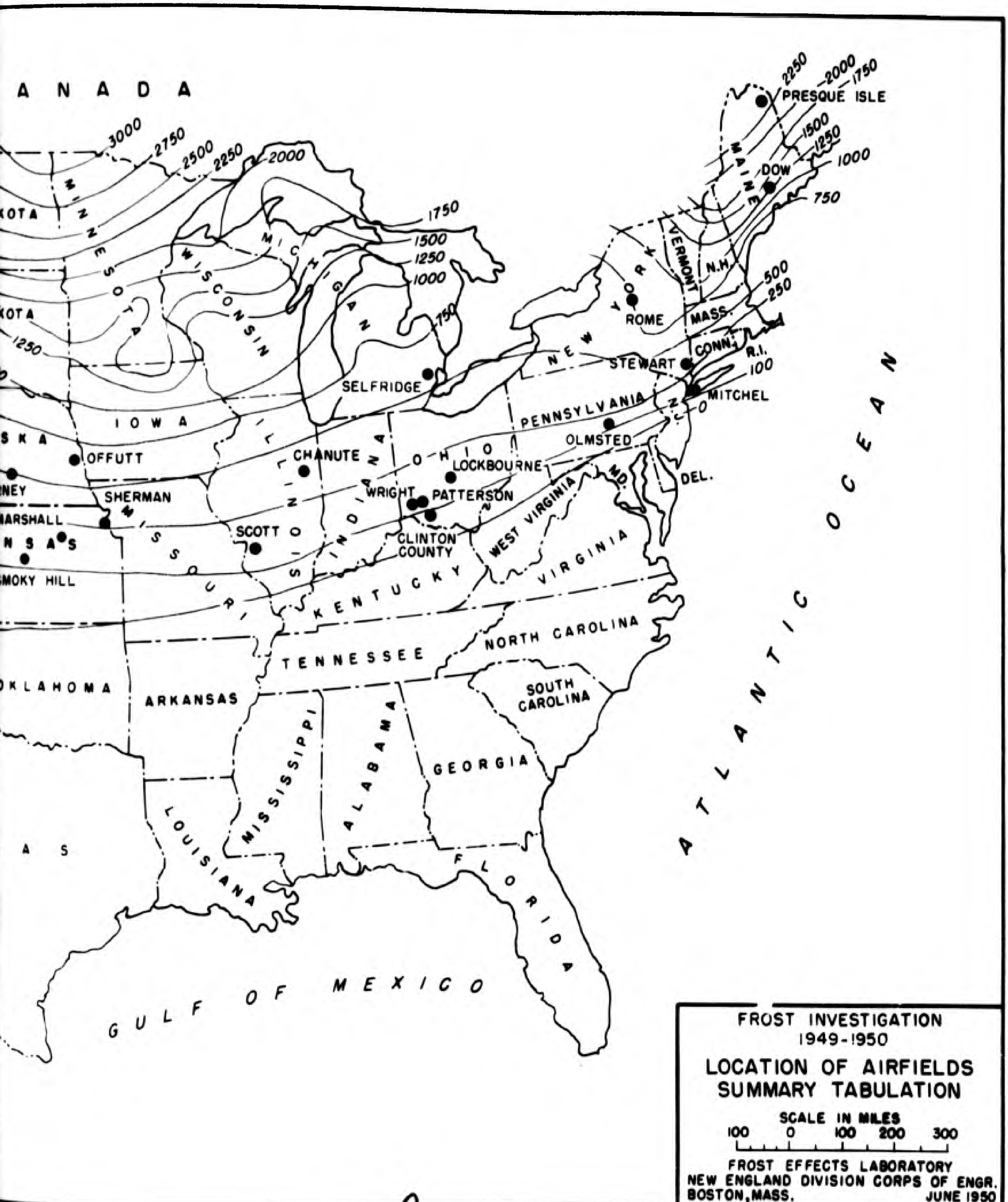
AIRFIELD	GROSS PLANE WEIGHT (LBS.)	CYCLES OF LANDINGS AND TAKE OFFS: 1943 TOTAL	1943 APPROX. DAILY	1944 TOTAL	1944 APPROX. DAILY	1945 TOTAL	1945 APPROX. DAILY	1946 TOTAL	1946 APPROX. DAILY	1947 TOTAL	1947 APPROX. DAILY	1948 TOTAL	1948 APPROX. DAILY	1949 TOTAL	1949 APPROX. DAILY	TRAFFIC DISTRIBUTION: RUNWAY	% OF TRAFFIC
Patterson Field, Fairfield, Ohio	< 15,000	-	-	No Data		-	-	-	-	14,895	41	21,398	99	24,090	66	NE-SW (A)	56
	15-35,000	-	87			21,420	59	35,603	98	14,209	39	19,323	53	20,803	57	NE-SW (B)	23
	35-50,000	-	15			5,898	16	6,178	17	6,600	18	9,415	26	11,680	32	NW-SE	21
	50-75,000	-	12			7,534	21	4,681	13	3,185	9	5,000	8	1,885	5		
	75-120,000	-	-			56	5/Mo.	20	2/Mo.	-	-	16	1/Mo.	221	19/Mo.		
	120-135,000	-	-			247	1	878	2	753	2	1,080	3	1,095	3		
	> 135,000	-	-			-	-	-	-	-	-	45	4/Mo.	72	6/Mo.		
Presque Isle Air Force Base, Presque Isle, Maine	< 15,000	-	-	-	-	No Data		-	-	496	1	51	18/Mo.	No Data		N-S	46
	15-35,000	-	-	-	8			2,920	8	2,309	6	327	4			E-W	31
	35-50,000	-	5	-	8			120	10/Mo.	87	7/Mo.	11	4/Mo.			NW-SE	23
	50-75,000	-	85	-	8			240	20/Mo.	53	4/Mo.	26	8/Mo.				
	75-120,000	-	-	-	-			-	-	2	Occ.	-	-				
	120-135,000	-	-	-	-			-	-	-	-	Inactive					
	> 135,000	-	-	-	-			-	-	-	-	Mar.-Dec.					
Rome Airfield, (Griffiss Air Force Base), Rome, New York	< 15,000	-	-	No Data		-	-	-	-	28,344	78	21,955	60	12,775	35	E-W	57
	15-35,000	-	-			3,613	10	17,465	48	2,505	7	4,174	11	3,285	9	NW-SE	36
	35-50,000	-	50			1,880	4	575	2	1,044	3	1,616	5	2,190	6	NE-SW	7
	50-75,000	-	-			1,307	4	662	2	815	2	944	3	730	2		
	75-120,000	-	-			3	Occ.	-	-	-	-	81	7/Mo.	4	Occ.		
	120-135,000	-	-			12	1/Mo.	55	4/Mo.	88	7/Mo.	236	20/Mo.	-	-		
	> 135,000	-	-			-	-	-	-	-	-	-	-	-	-		
Scott Air Force Base, Belleville, Illinois	< 15,000					-	-	-	-	57,329	157	46,686	128	37,960	104	N-S	53
	15-35,000	-	150	-	150	14,822	41	74,871	208	28,000	77	30,513	84	22,995	63	NE-SW	23
	35-50,000					2,839	8	7,488	21	6,253	17	7,409	20	10,220	28	NW-SE	19
	50-75,000	< 15,000 - 75,000				4,321	12	530	2	650	2	531	44/Mo.	600	50/Mo.	E-W	5
	75-120,000	-	-	-	-	-	-	21	2/Mo.	-	-	-	-	1	Occ.		
	120-135,000	-	-	-	-	191	16/Mo.	56	4/Mo.	88	7/Mo.	82	7/Mo.	72	6/Mo.		
	> 135,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Selfridge Air Force Base, Mt. Clemens, Michigan	< 15,000	-	-	No Data		-	-	-	-	36,498	100	37,804	104	53,290	146	N-S	51
	15-35,000	-	-			1,269	3	40,186	110	14,275	39	4,880	13	4,748	13	E-W	41
	35-50,000	-	-			15,984	44	1,578	4	1,376	4	1,771	5	6,570	18	NE-SW	8
	50-75,000	-	75			991	3	518	1	343	1	659	2	480	40/Mo.		
	75-120,000	-	-			2	Occ.	-	-	-	-	-	-	-	-		
	120-135,000	-	-			13	1/Mo.	55	5/Mo.	199	13/Mo.	132	11/Mo.	730	2		
	> 135,000	-	-			-	-	-	-	-	-	2	Occ.	-	-		
Sherman Air Force Base, Fort Leavenworth, Kansas	< 15,000	No Data		No Data		No Data		No Data		4,812	13	4,564	12	4,015	11	N-S	77
	15-35,000									770	2	960	3	1,460	4	NW-SE	23
	35-50,000									878	2	1,088	3	960	80/Mo.		
	50-75,000									55	5/Mo.	35	3/Mo.	36	3/Mo.		
	75-120,000									-	-	-	-	-	-		
	120-135,000									-	-	-	-	-	-		
	> 135,000									-	-	-	-	-	-		
Smoky Hill Air Force Base, Salina, Kansas	< 15,000	-	-	No Data		-	-	No Data		4,308	12	7,452	20	2,920	8	N-S	77
	15-35,000	-	-			8,994	25			2,399	6	4,780	13	4,015	11	NW-SE	17
	35-50,000	-	-			804	2			1,409	4	2,148	6	2,920	8	NE-SW	5
	50-75,000	-	25			3,941	11			374	1	448	1	365	1	E-W	1
	75-120,000	-	-			-	-			11	1/Mo.	-	-	-	-		
	120-135,000	-	-			14,994	41			7,465	20	5,863	16	6,205	17		
	> 135,000	-	-			-	-			-	-	1	Occ.	2	Occ.		
Spokane Air Force Base, Spokane, Washington	< 15,000	-	-	-	-	-	-	-	-	9,869	27	5,884	16	730	2	NE-SW	79
	15-35,000	-	10	-	10	5,205	14	14,400	40	3,433	9	3,565	10	2,555	7	N-S	12
	35-50,000	-	10	-	10	350	1	1,992	5	1,847	5	1,610	4	1,460	4	E-W	9
	50-75,000	-	-	-	-	3,150	9	841	2	698	2	368	1	221	19/Mo.		
	75-120,000	-	-	-	-	-	-	115	10/Mo.	-	-	-	-	-	-		
	120-135,000	-	-	-	-	12	1/Mo.	330	1	2,188	6	5,559	15	4,380	12		
	> 135,000	-	-	-	-	-	-	-	-	-	-	-	-	2	Occ.		
Stewart Air Force Base, Newburgh, New York	< 15,000		(10 - [illegible]/Day)			-	-	-	-	55,574	152	37,780	104	20,440	56		
	15-35,000	-	-	-	-	916	2	89,803	246	1,502	4	2,257	6	3,285	9	E-W	44
	35-50,000	-	-	-	-	1,103	3	2,213	6	2,836	8	6,329	17	6,205	17	NE-SW	22
	50-75,000	-	-	-	-	227	19/Mo.	115	10/Mo.	215	17/Mo.	114	10/Mo.	72	6/Mo.	NW-SE	22
	75-120,000	-	-	-	-	-	-	-	-	5	Occ.	-	-	2	Occ.	N-S	12
	120-135,000	-	-	-	-	5	Occ.	5	Occ.	1	Occ.	3	Occ.	2	Occ.		
	> 135,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Weaver Air Base, (Rapid City Air Force Base), Rapid City, South Dakota	< 15,000	-	-	-	-	-	-	-	-	6,763	19	6,367	17	2,190	6	N-S	57
	15-35,000	-	-	-	-	2,248	6	9,772	27	4,462	12	6,675	18	5,840	16	NW-SE	39
	35-50,000	-	-	-	-	1,232	3	2,657	7	1,191	3	1,861	5	1,825	5	E-W	4
	50-75,000	-	79	-	250	36,847	101	100	8/Mo.	212	17/Mo.	149	12/Mo.	221	19/Mo.		
	75-120,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	120-135,000	-	-	-	-	21	2/Mo.	47	4/Mo.	1,194	3	2,581	7	1,825	5		
	> 135,000	-	-	-	-	-	-	-	-	-	-	-	-	156	13/Mo.		
Wendover Air Force Base, Wendover, Utah	< 15,000	-	-	No Data		-	-	-	-	1,182	3	2,190	6	730	2	NW-SE	60
	15-35,000	-	-			1,638	4	4,245	12	1,330	4	1,095	3	376	1	NE-SW	21
	35-50,000	-	-			1,278	4	528	1	615	2	349	1	156	13/Mo.	E-W	19
	50-75,000	-	90			1,949	6	1,486	4	300	1	36	3/Mo.	36	3/Mo.		
	75-120,000	-	-			-	-	-	-	-	-	-	-	2	Occ.		
	120-135,000	-	-			1,209	3	136	11/Mo.	1,614	4	752	2	156	13/Mo.		
	> 135,000	-	-			-	-	-	-	-	-	-	-	-	-		
Wright Field, Dayton, Ohio	< 15,000	-	-	No Data		-	-	-	-	38,068	104	45,423	124	42,70[illegible]	117	NE-SW	40
	15-35,000	-	33			6,087	17	90,400	248	3,828	10	5,190	14	6,205	17	NW-SE	36
	35-50,000	-	12			5,505	15	5,911	16	7,325	20	9,540	26	9,125	25	E-W	24
	50-75,000	-	-			4,353	12	3,137	9	2,402	7	1,709	5	1,460	4		
	75-120,000	-	-			57	5/Mo.	214	18/Mo.	258	1	368	1	72	6/Mo.		
	120-135,000	-	-			1,477	4	1,800	5	1,351	4	1,403	4	1,095	3		
	> 135,000	-	-			-	-	-	-	1	Occ.	3	Occ.	24	2/Mo.		

TRAFFIC HISTORY

Notes - Traffic histories for 1943 and 1944 obtained from Pavement Evaluation Reports.
Traffic histories for 1945-1949 inc. summarized from data made available by Air Force Headquarters.
Traffic shown as 15-35,000 lb. gross load for years 1945 and 1946 also includes planes with gross weight below 15,000 lbs.
Traffic distribution based on data from 1945-1949 inclusive.

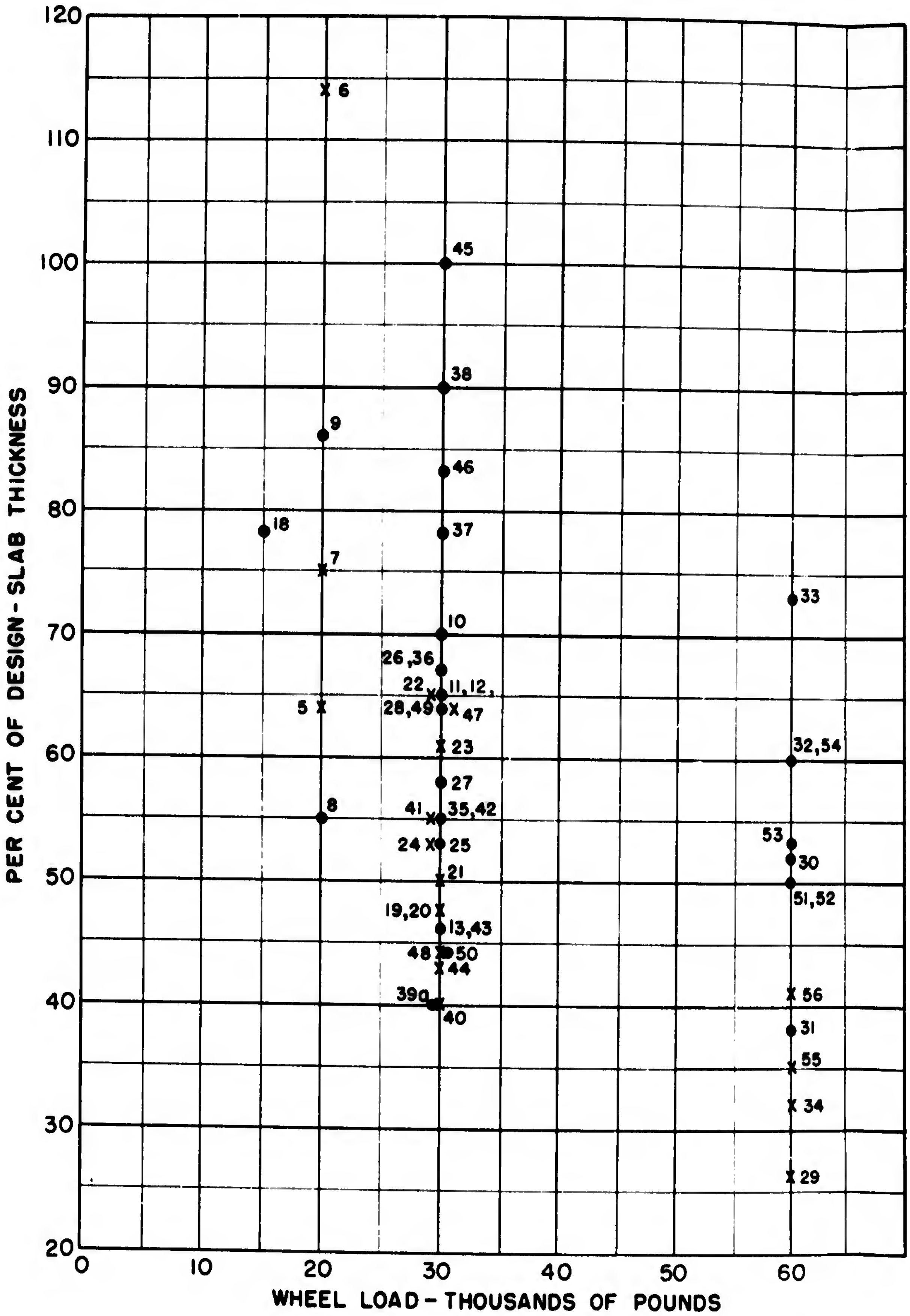


Contours indicate Normal Freezing Index.


CANADA
PRESQUE ISLE
DOW
MAINE
VERMONT
N.H.
MASS.
CONN.
R.I.
NEW YORK
ROME
STEWART
MITCHEL
PENNSYLVANIA
OLMSTED
N.J.
DEL.
MD.
MINNESOTA
WISCONSIN
MICHIGAN
SELFRIDGE
IOWA
OFFUTT
ILLINOIS
CHANUTE
SCOTT
INDIANA
OHIO
LOCKBOURNE
WRIGHT
PATTERSON
CLINTON COUNTY
WEST VIRGINIA
VIRGINIA
KENTUCKY
MISSOURI
SHERMAN
MARSHALL
SMOKY HILL
TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
OKLAHOMA
ARKANSAS
MISSISSIPPI
ALABAMA
GEORGIA
LOUISIANA
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
3000
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
100
0
FROST INVESTIGATION
1949-1950
LOCATION OF AIRFIELDS
SUMMARY TABULATION
SCALE IN MILES
100 0 100 200 300
FROST EFFECTS LABORATORY
NEW ENGLAND DIVISION CORPS OF ENGR.
BOSTON, MASS.
JUNE 1950

B

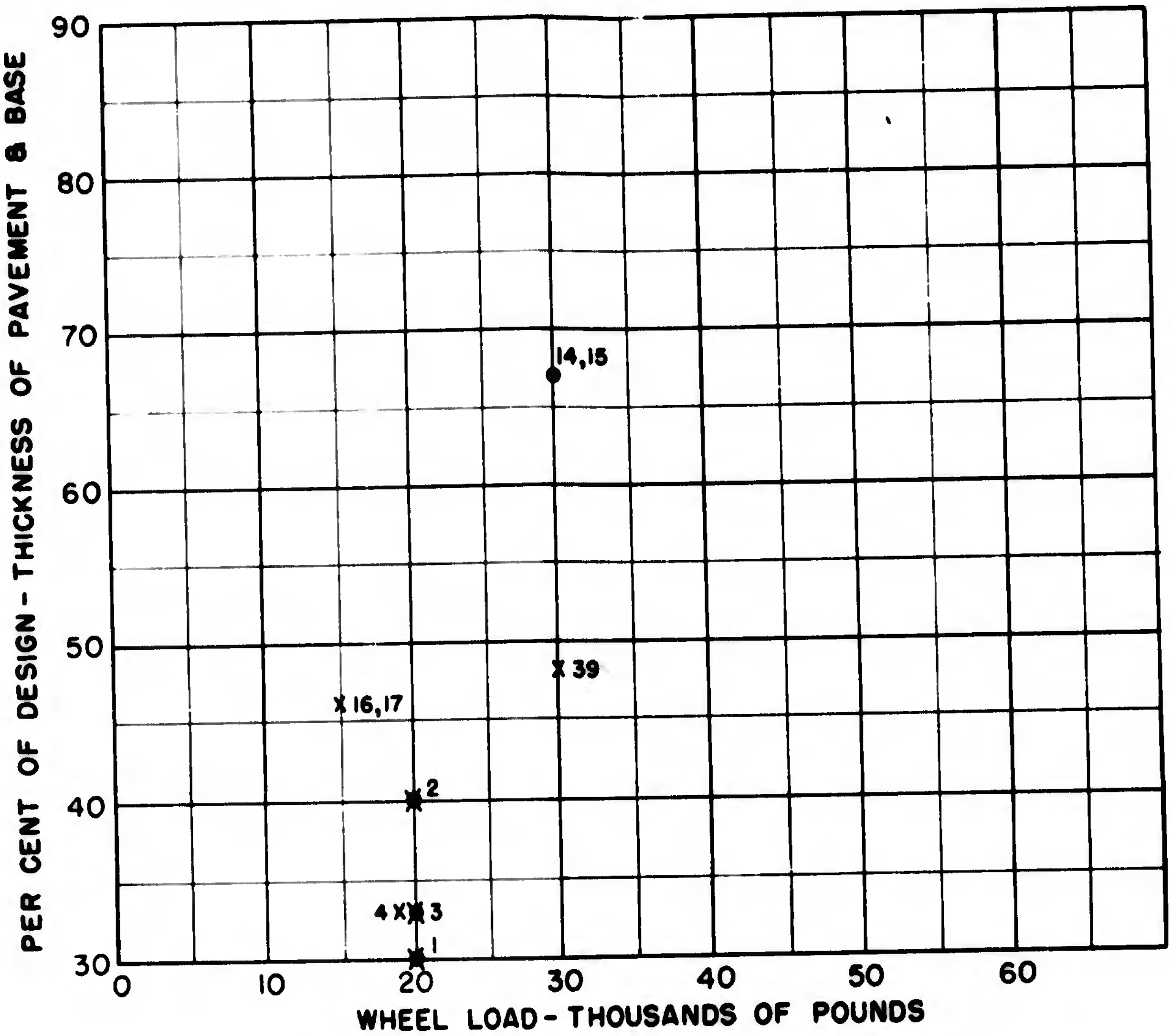
PLATE I



RIGID PAVEMENT

FIG.1

A



FLEXIBLE PAVEMENT

FIG.2

NOTE:

Numbers adjacent to plotted points on Figure 1 and Figure 2 refer to line numbers on Summary Tabulation Table 1, Sheets 1 to 4.

Wheel loads plotted are of heaviest class of planes using field with frequency of 5 or more cycles of landings and take offs per day for the year with maximum traffic prior to failure study or condition survey.

Wheel load considered to be one half of gross plane load.

The wheel loads plotted represent planes in the following gross weight ranges:

15,000 lb. wheel load - 15,000 to 35,000 gross plane wt.
20,000 " " " -35,000 to 50,000 " " "
30,000 " " " -50,000 to 75,000 " " ".
60,000 " " " -120,000 to 135,000 " " ".

LEGEND

X Failed

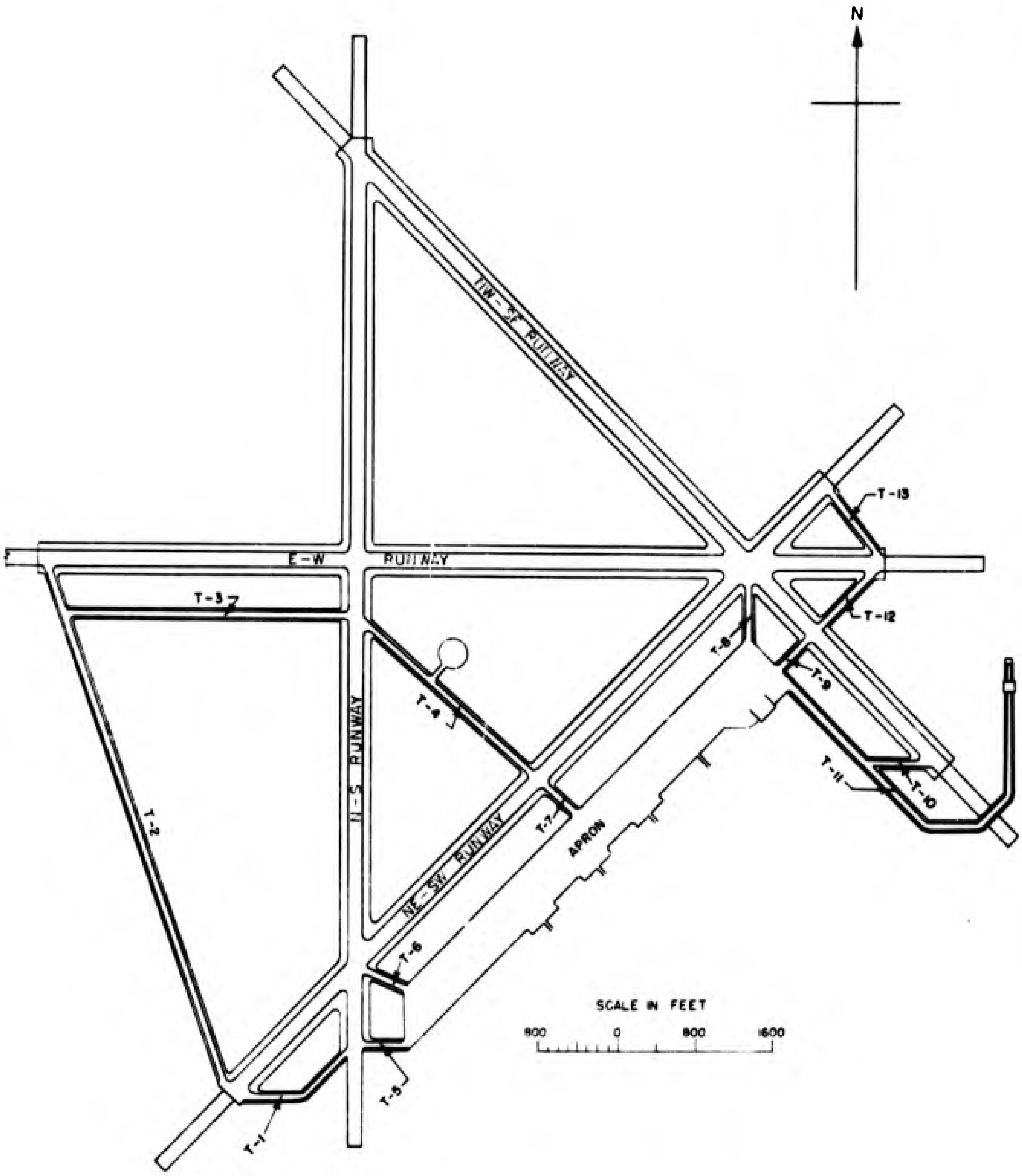
● Satisfactory

FROST INVESTIGATION
1949-1950

PAVEMENT BEHAVIOR
VS
PER CENT OF DESIGN
THICKNESS

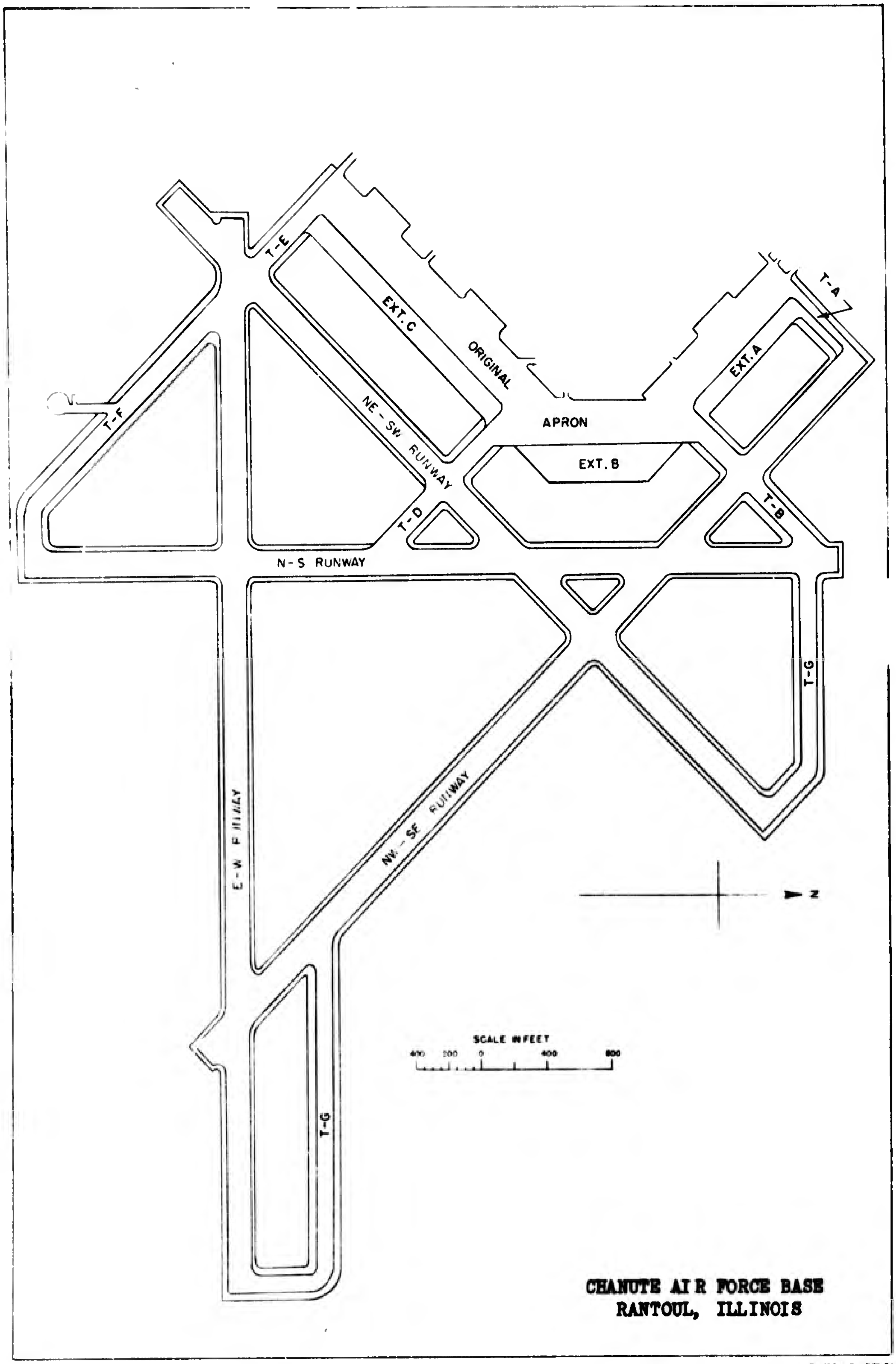
FROST EFFECTS LABORATORY
NEW ENGLAND DIVISION CORPS OF ENGR.
BOSTON, MASS. JUNE 1950

B



CASPER AIR FORCE BASE
CASPER, WYOMING

PLATE 3



CHANUTE AIR FORCE BASE
RANTOUL, ILLINOIS

PLATE 4

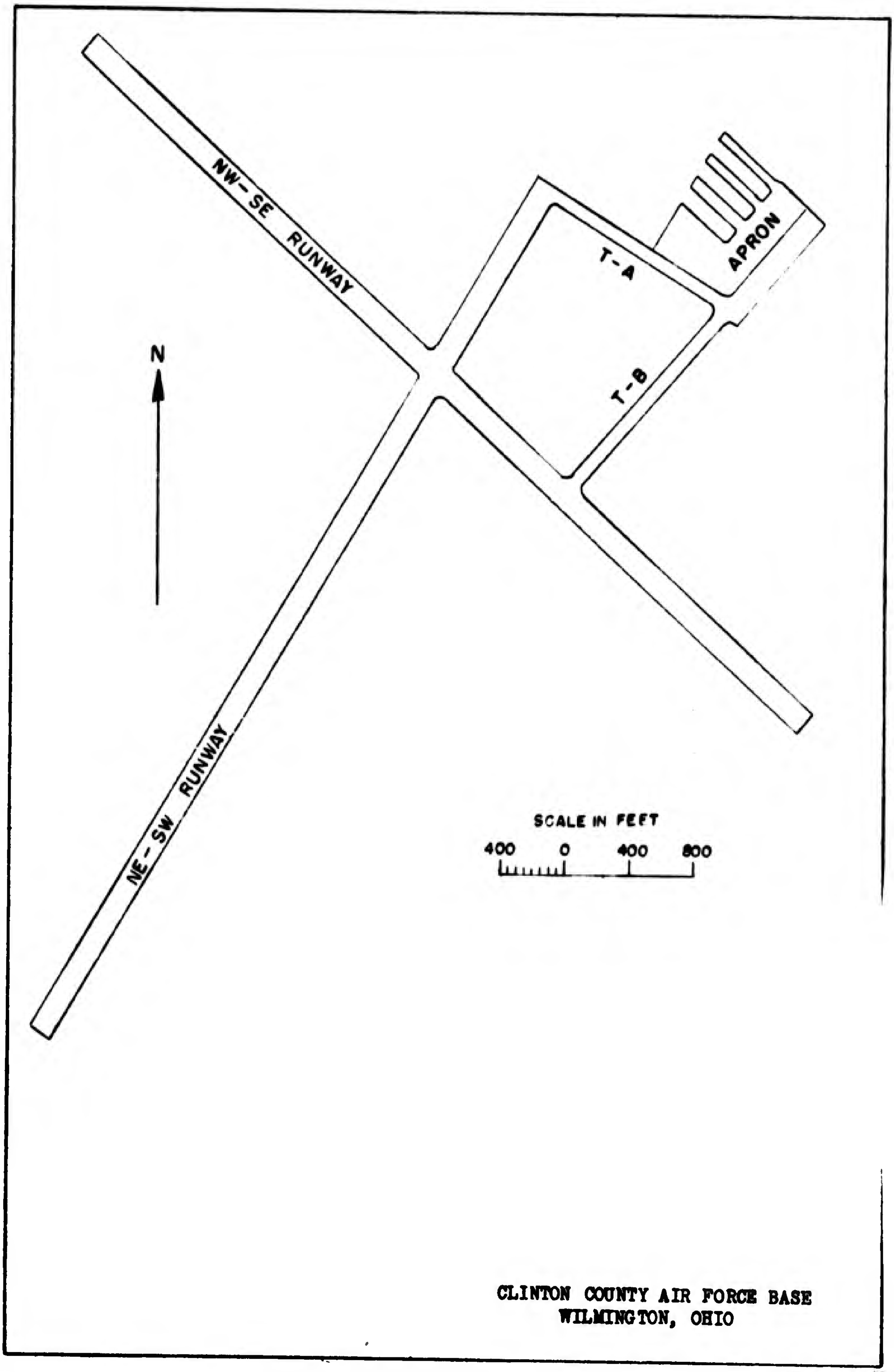
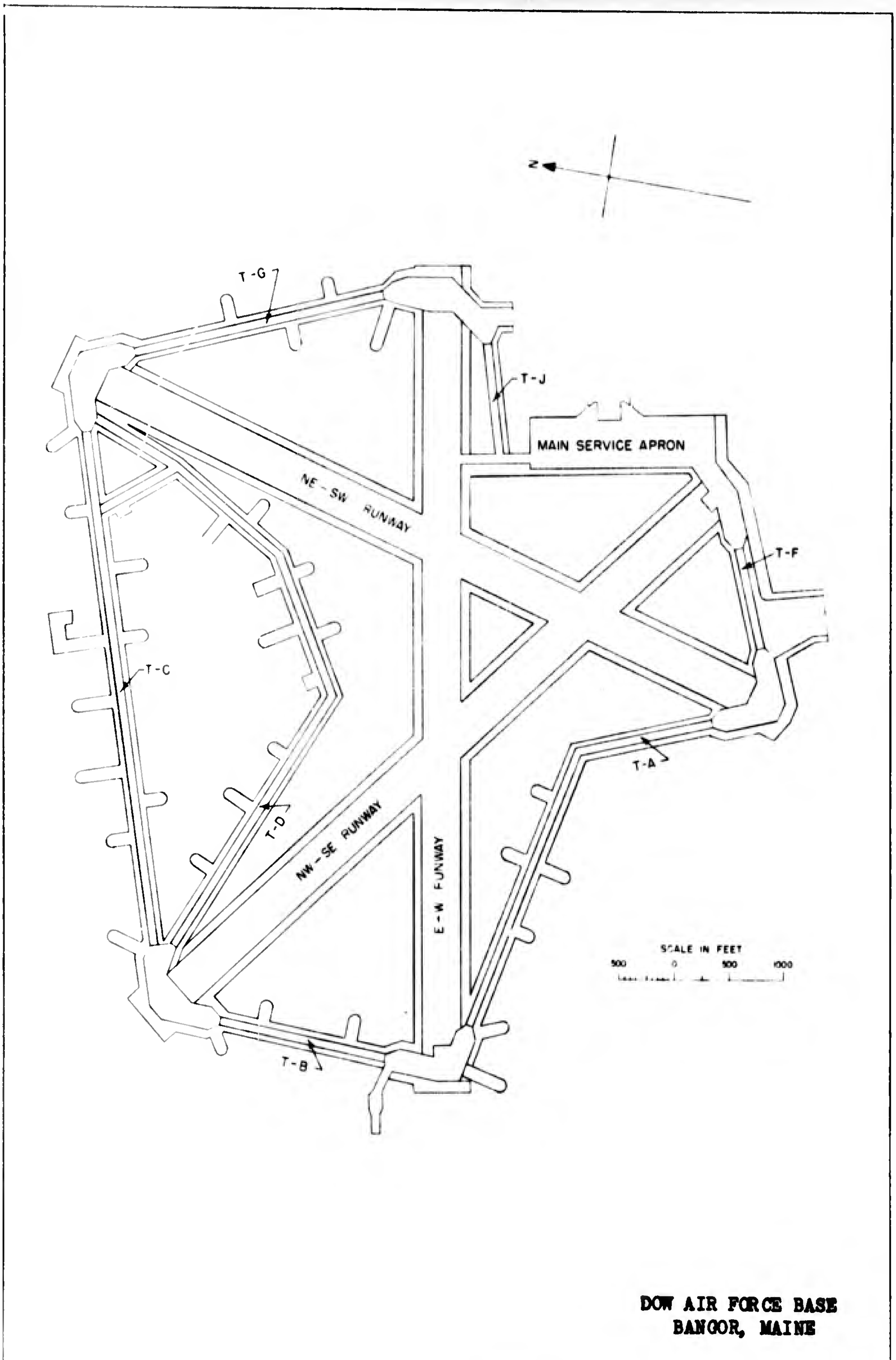
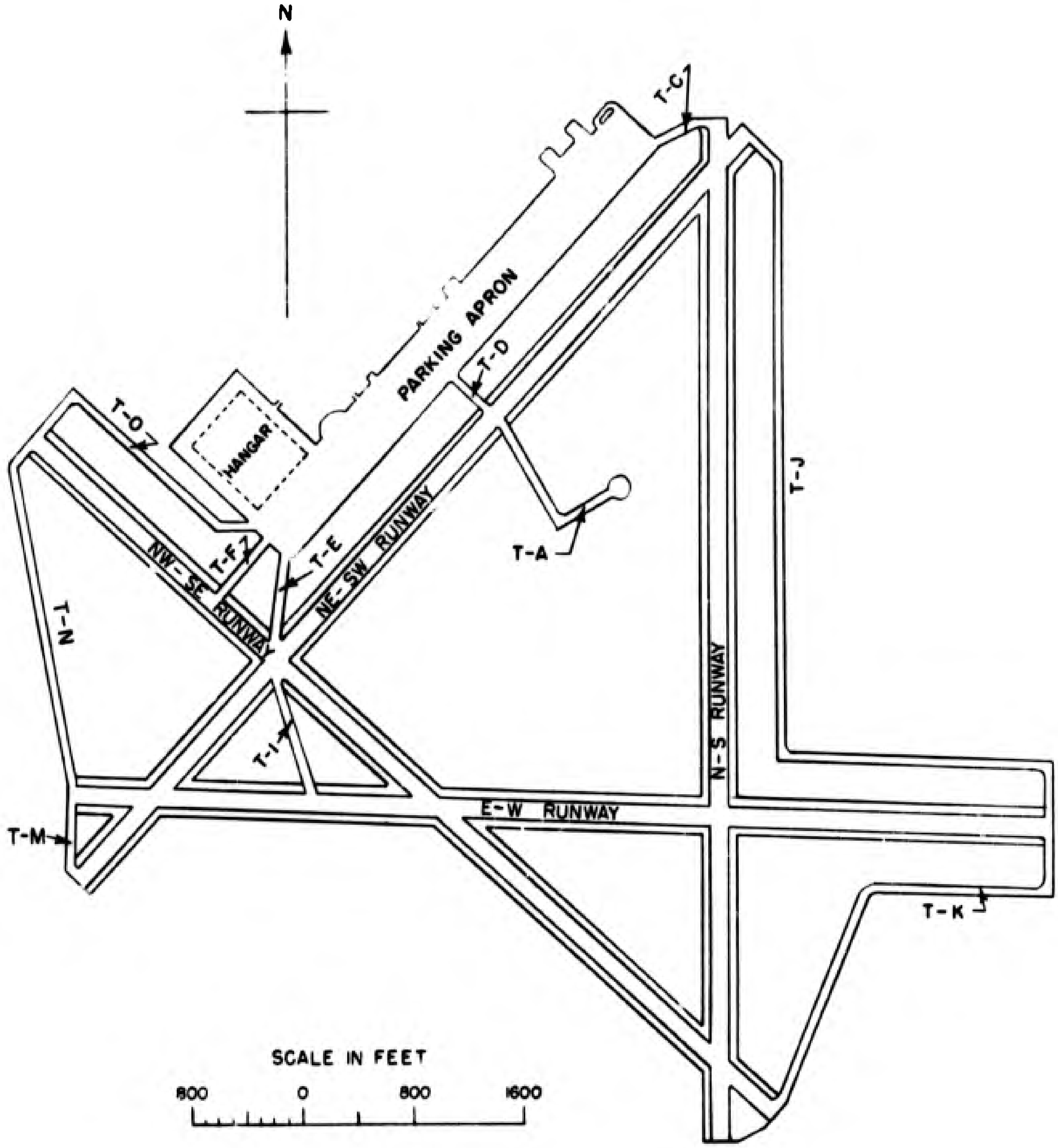

NW-SE RUNWAY
T-A
APRON
N
T-B
NE-SW RUNWAY
SCALE IN FEET
400 0 400 800
CLINTON COUNTY AIR FORCE BASE
WILMINGTON, OHIO

PLATE 5



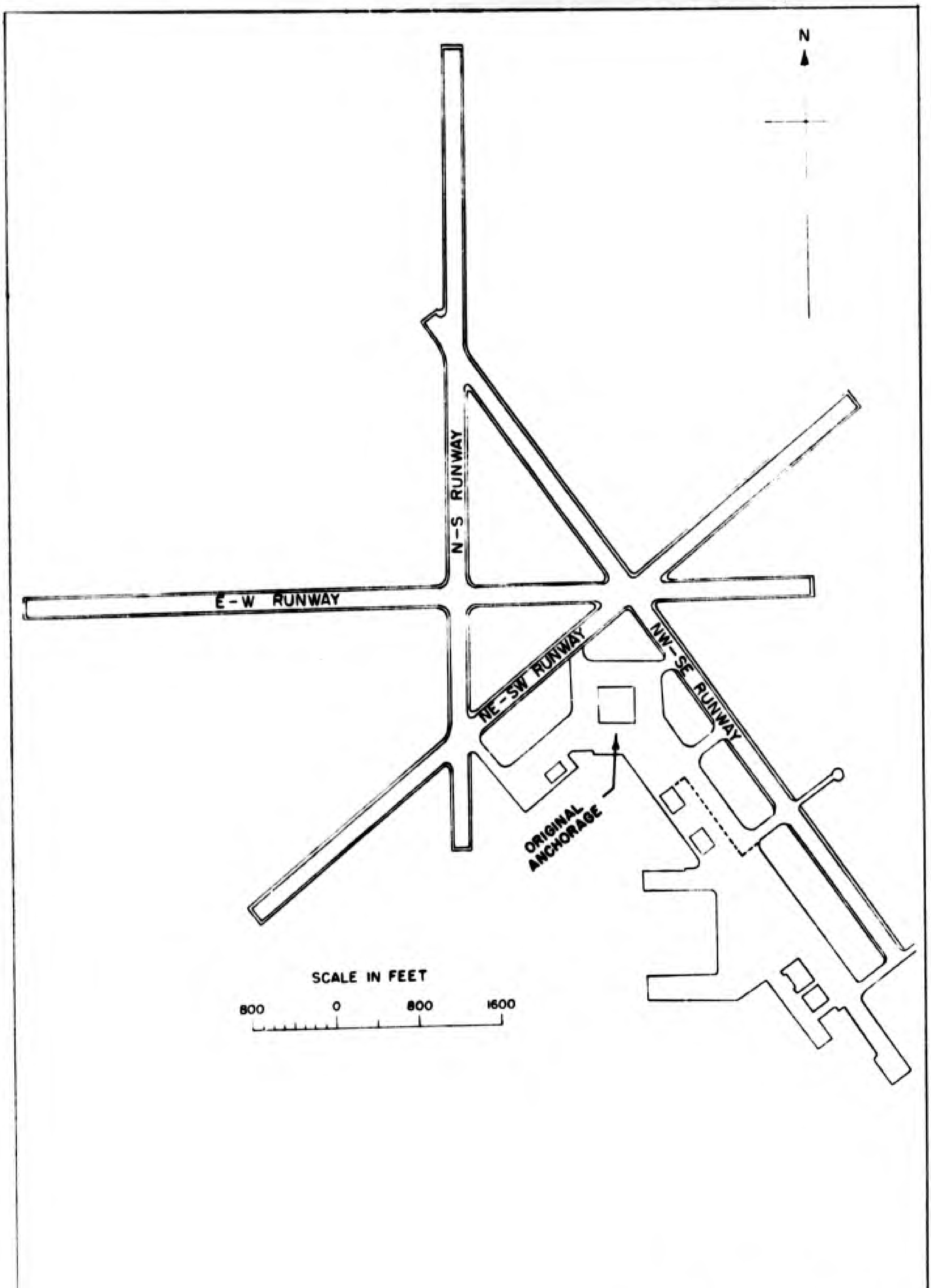
DOW AIR FORCE BASE
BANGOR, MAINE

PLATE 6



GREAT FALLS AIR FORCE BASE
GREAT FALLS, MONTANA

PLATE 7



HILL AIR FORCE BASE
OGDEN, UTAH

PLATE 8

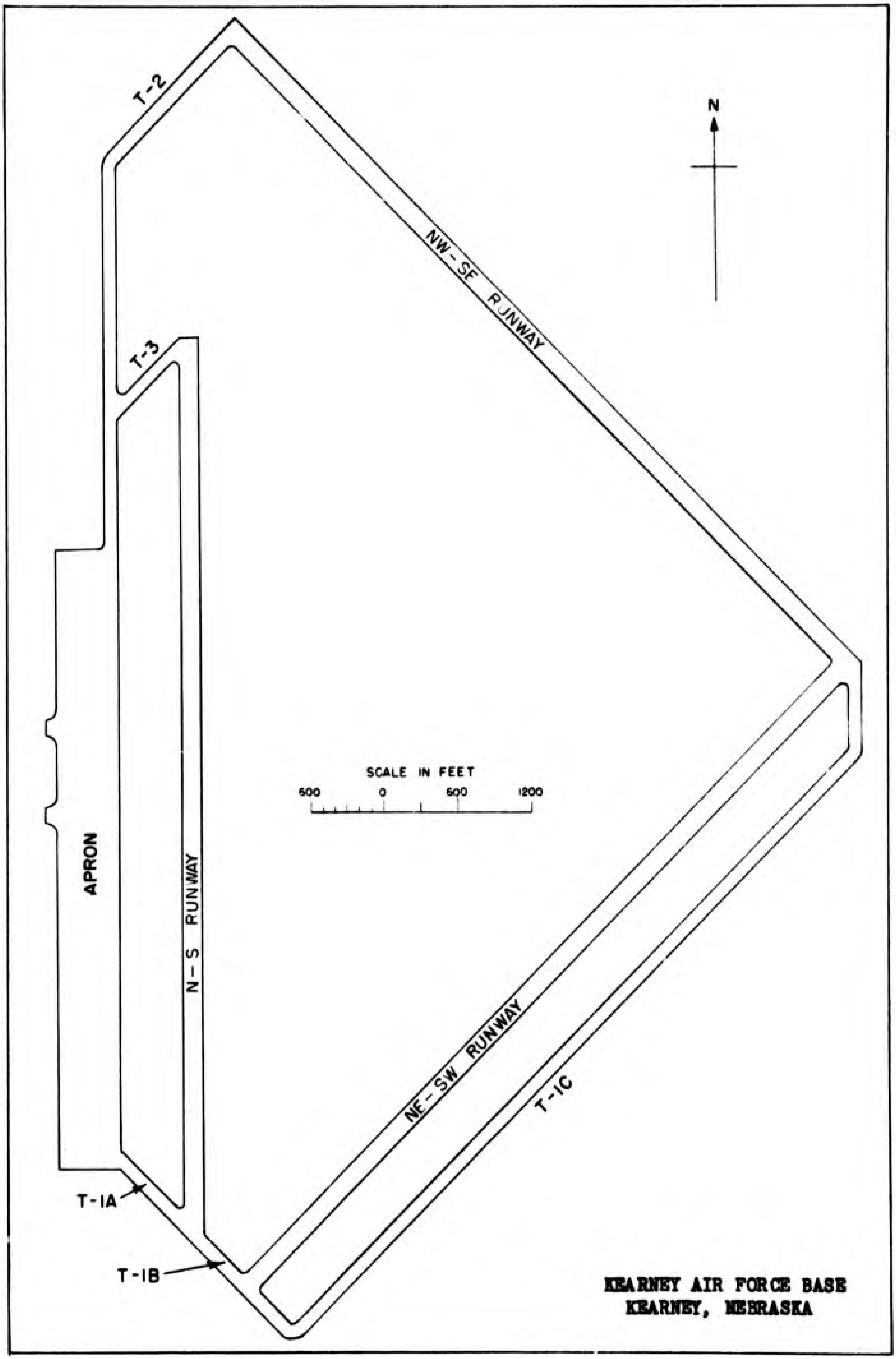
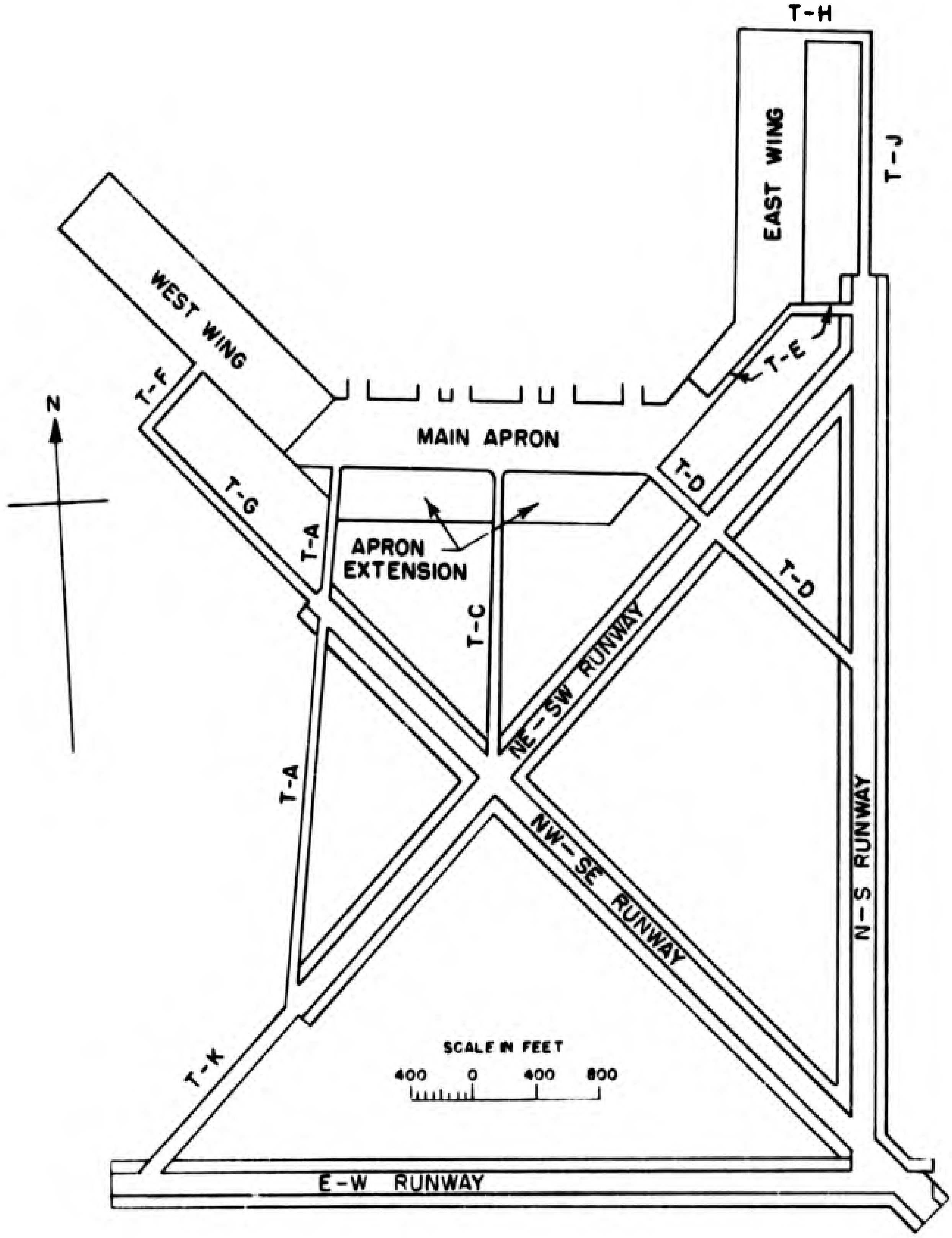

N
T-2
NW-SE RUNWAY
T-3
SCALE IN FEET
600
0
600
1200
APRON
N-S RUNWAY
NE-SW RUNWAY
T-1C
T-1A
T-1B
KEARNEY AIR FORCE BASE
KEARNEY, NEBRASKA

PLATE 9



LOCKBOURNE AIR FORCE BASE
COLUMBUS, OHIO

PLATE 10

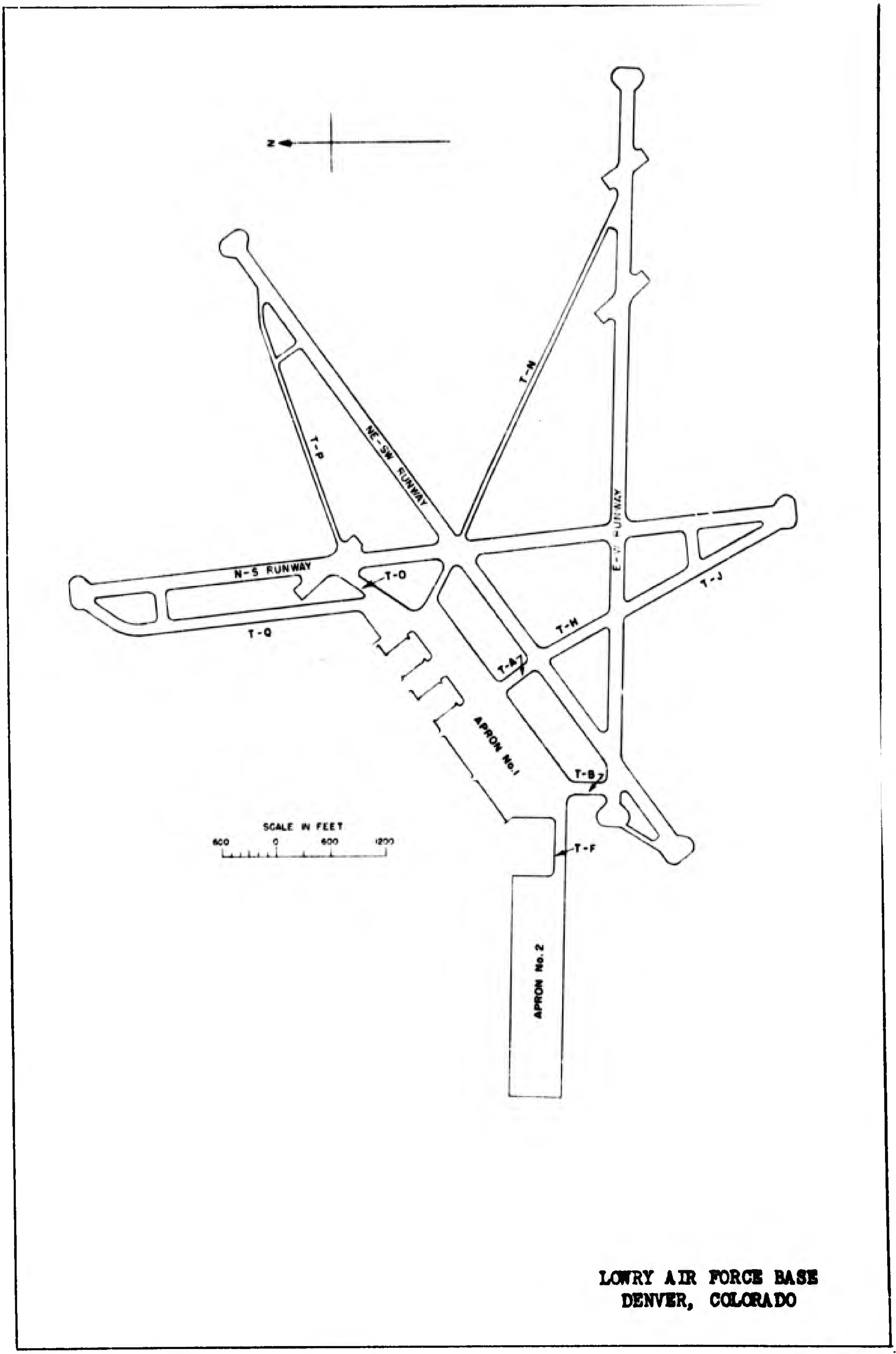
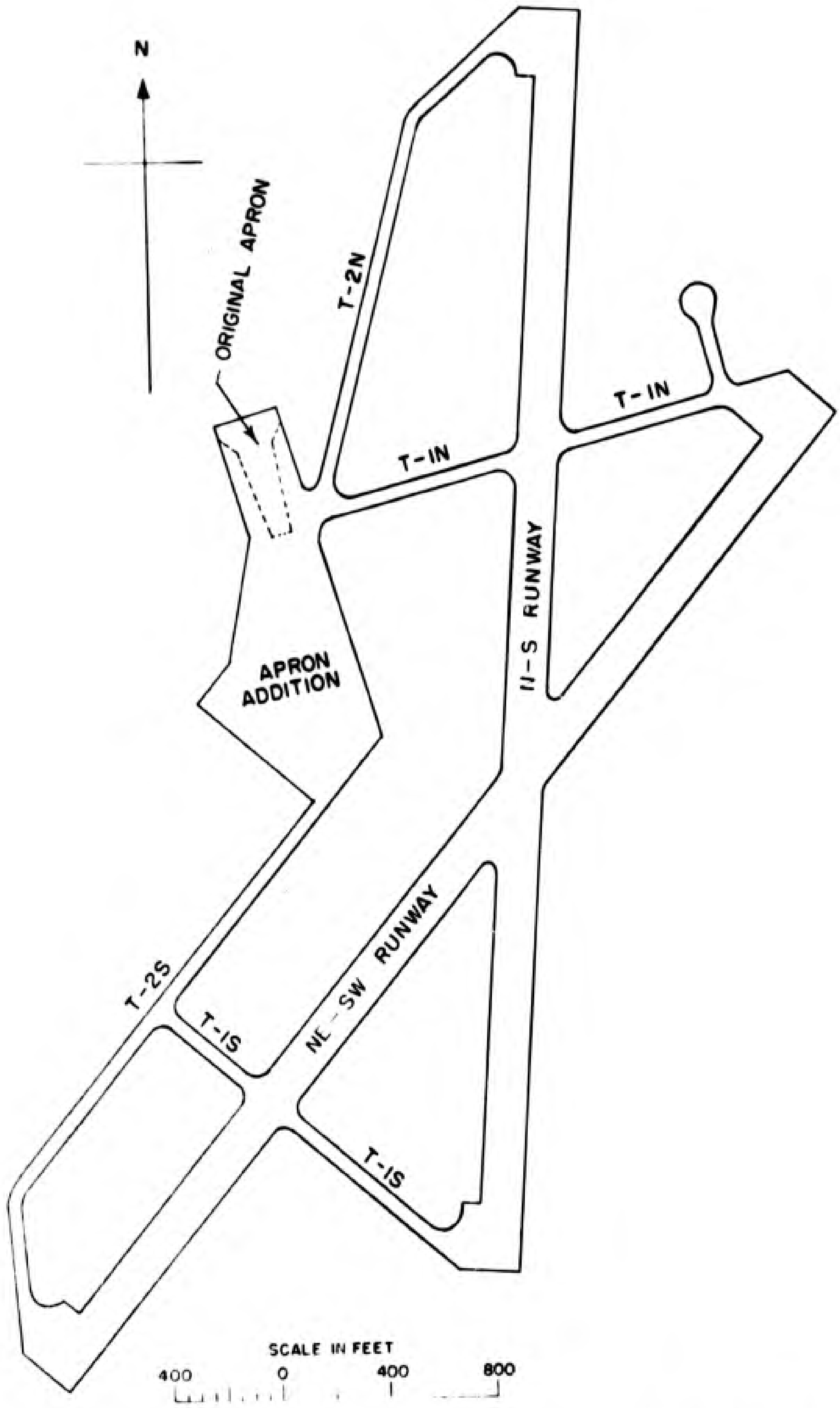
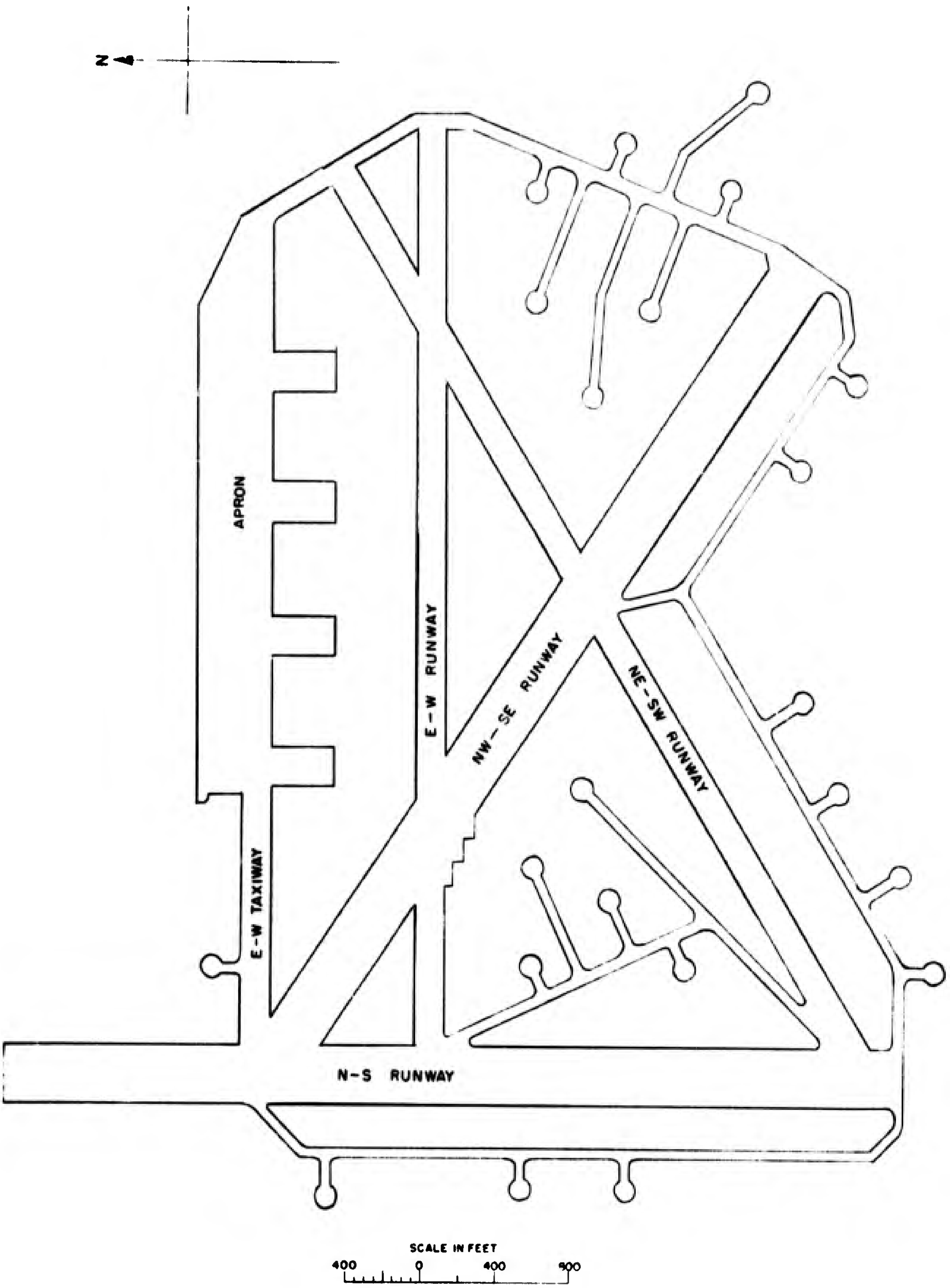

N
NE-SW RUNWAY
T-N
T-P
E-W RUNWAY
N-S RUNWAY
T-O
T-J
T-H
T-Q
T-A
APRON No. 1
T-B
T-F
SCALE IN FEET
600 0 600 1200
APRON No. 2
LOWRY AIR FORCE BASE
DENVER, COLORADO

PLATE II



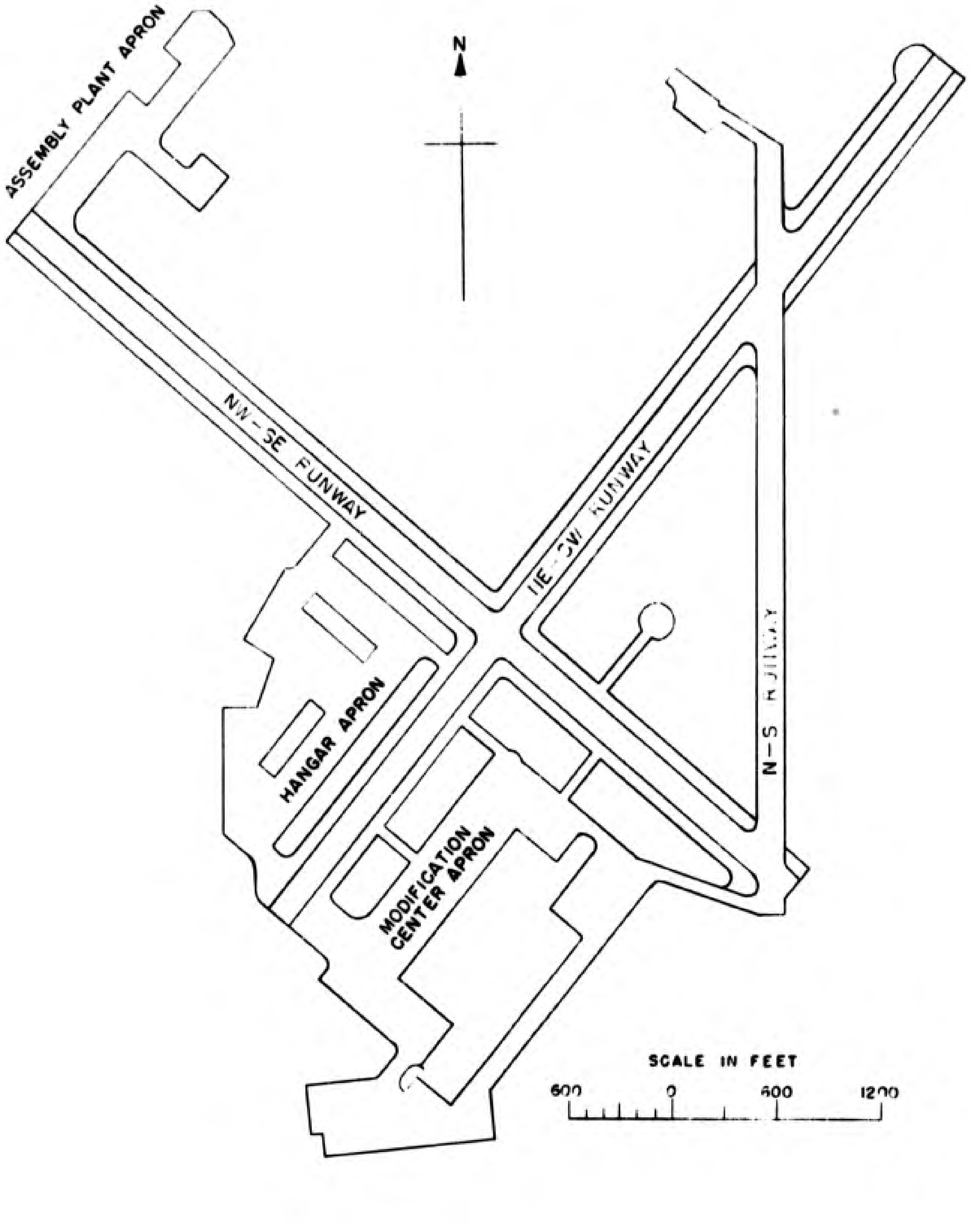
MARSHALL AIR FORCE BASE
FORT RILEY, KANSAS

PLATE 12



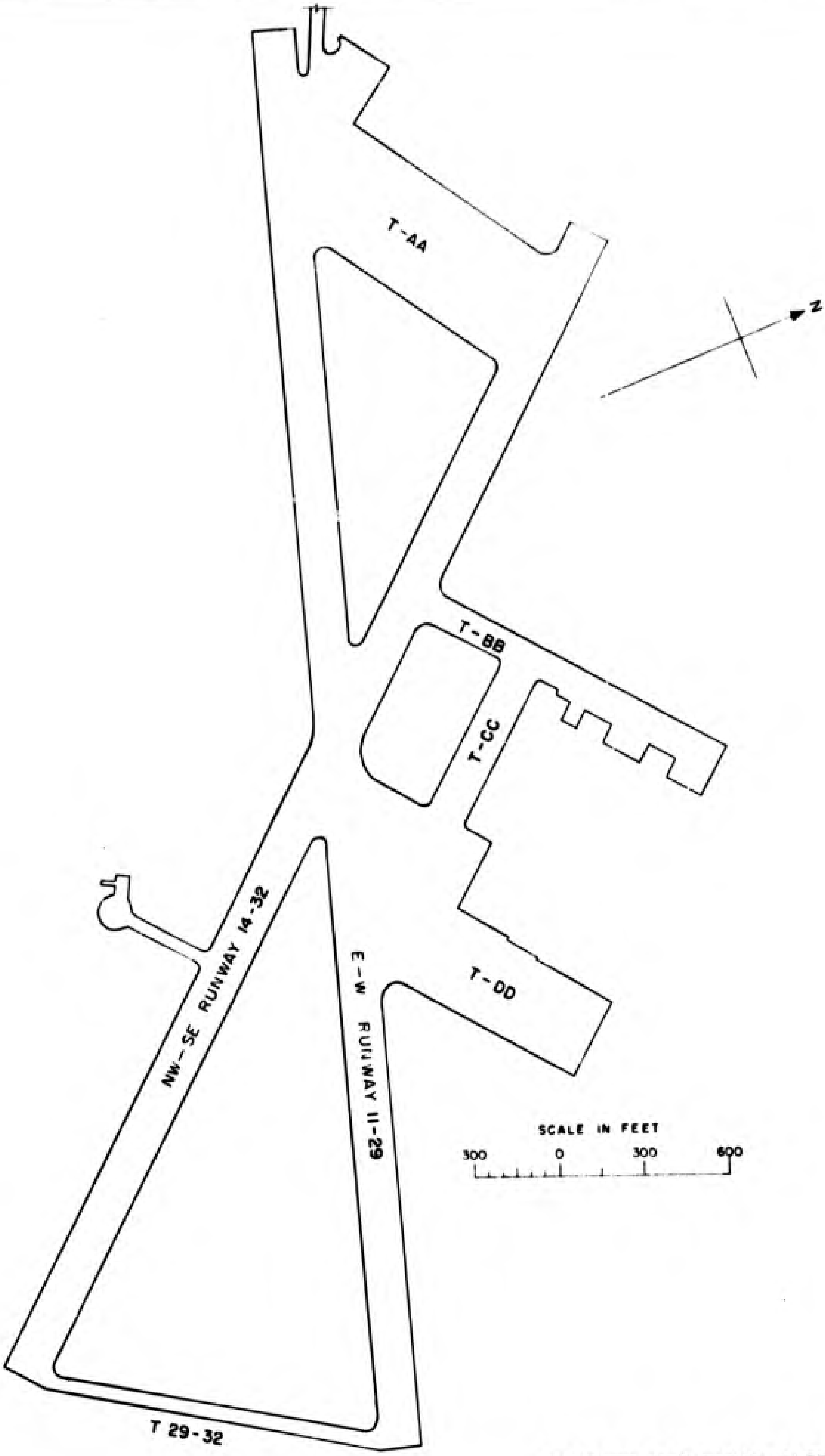
MITCHEL AIR FORCE BASE
HEMPSTEAD, LONG ISLAND, NEW YORK

PLATE 13



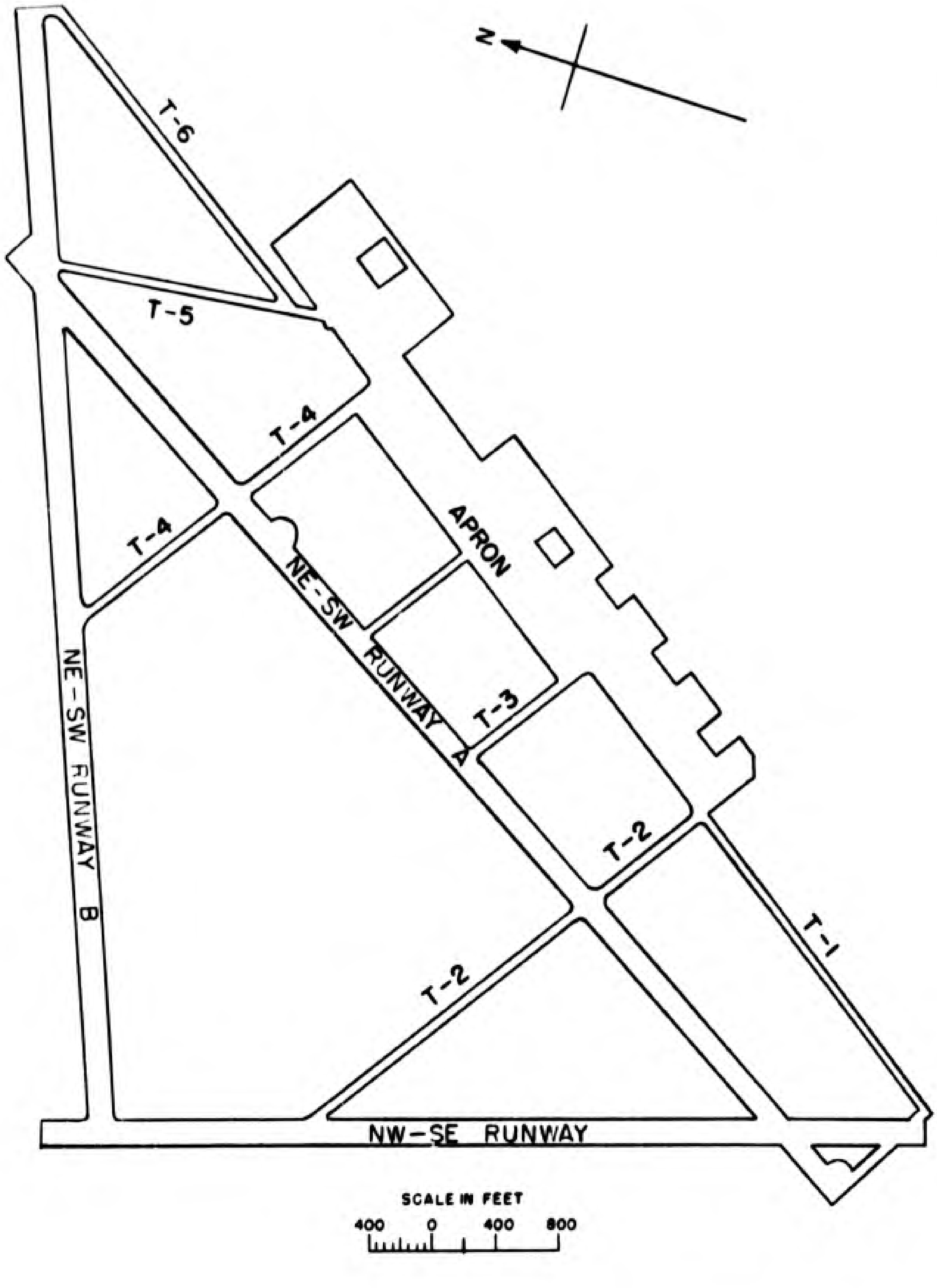
OFFUTT AIR FORCE BASE
FORT CROOK, NEBRASKA

PLATE 14



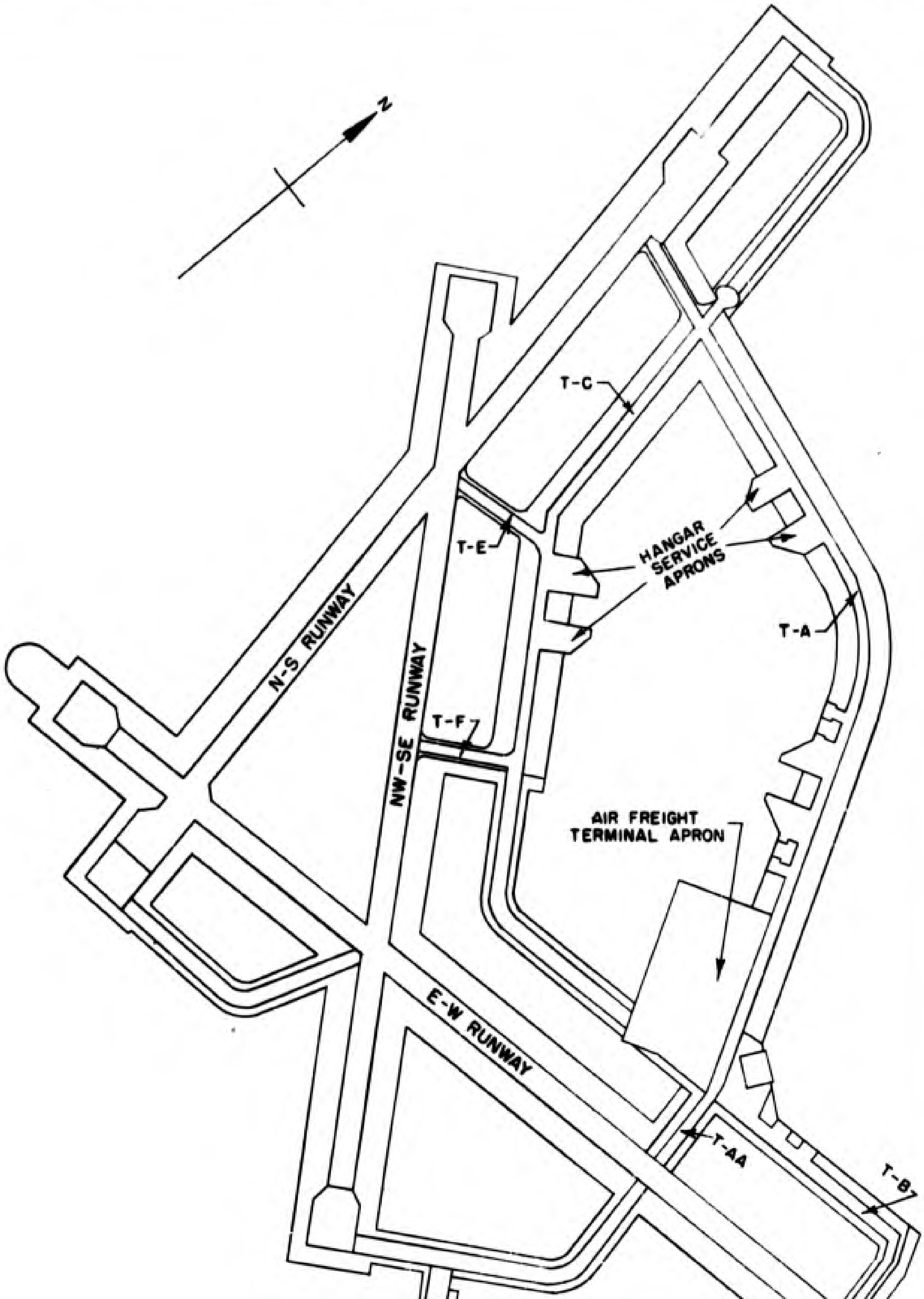
OLMSTED AIR FORCE BASE
MIDDLETOWN, PENNSYLVANIA

PLATE 15



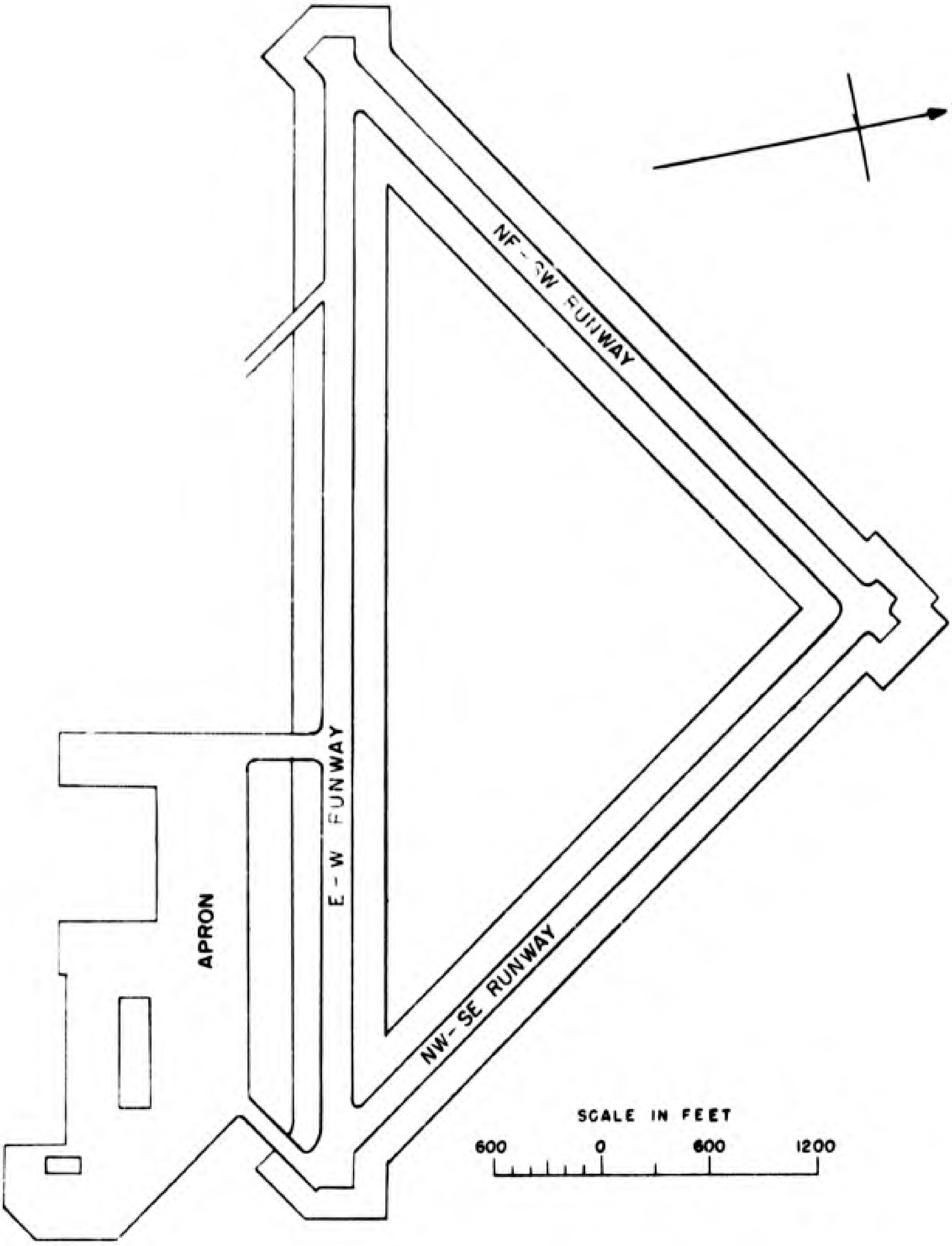
PATTERSON FIELD
FAIRFIELD, OHIO

PLATE 16



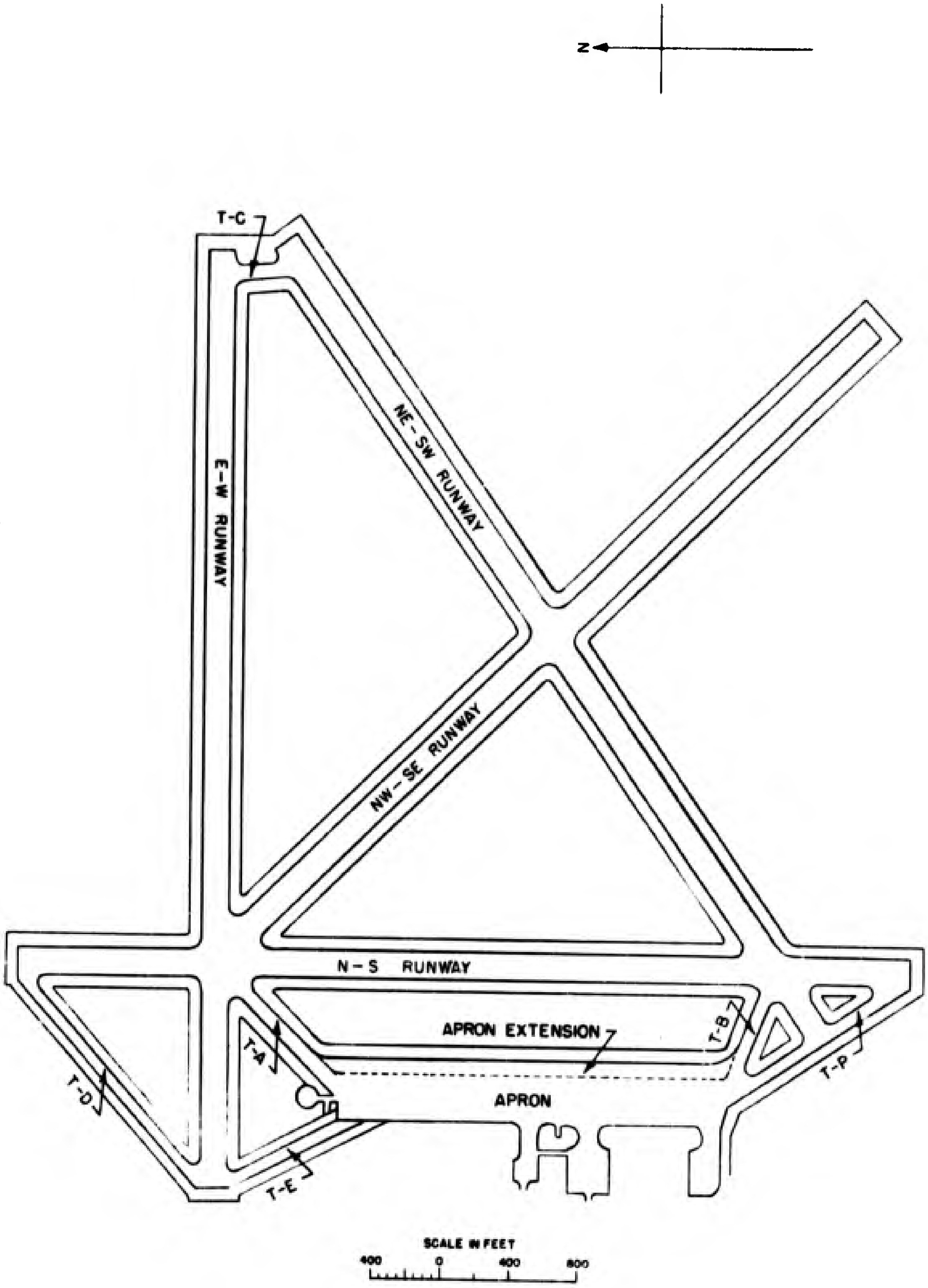
PRESQUE ISLE AIR FORCE BASE
PRESQUE ISLE, MAINE

PLATE 17



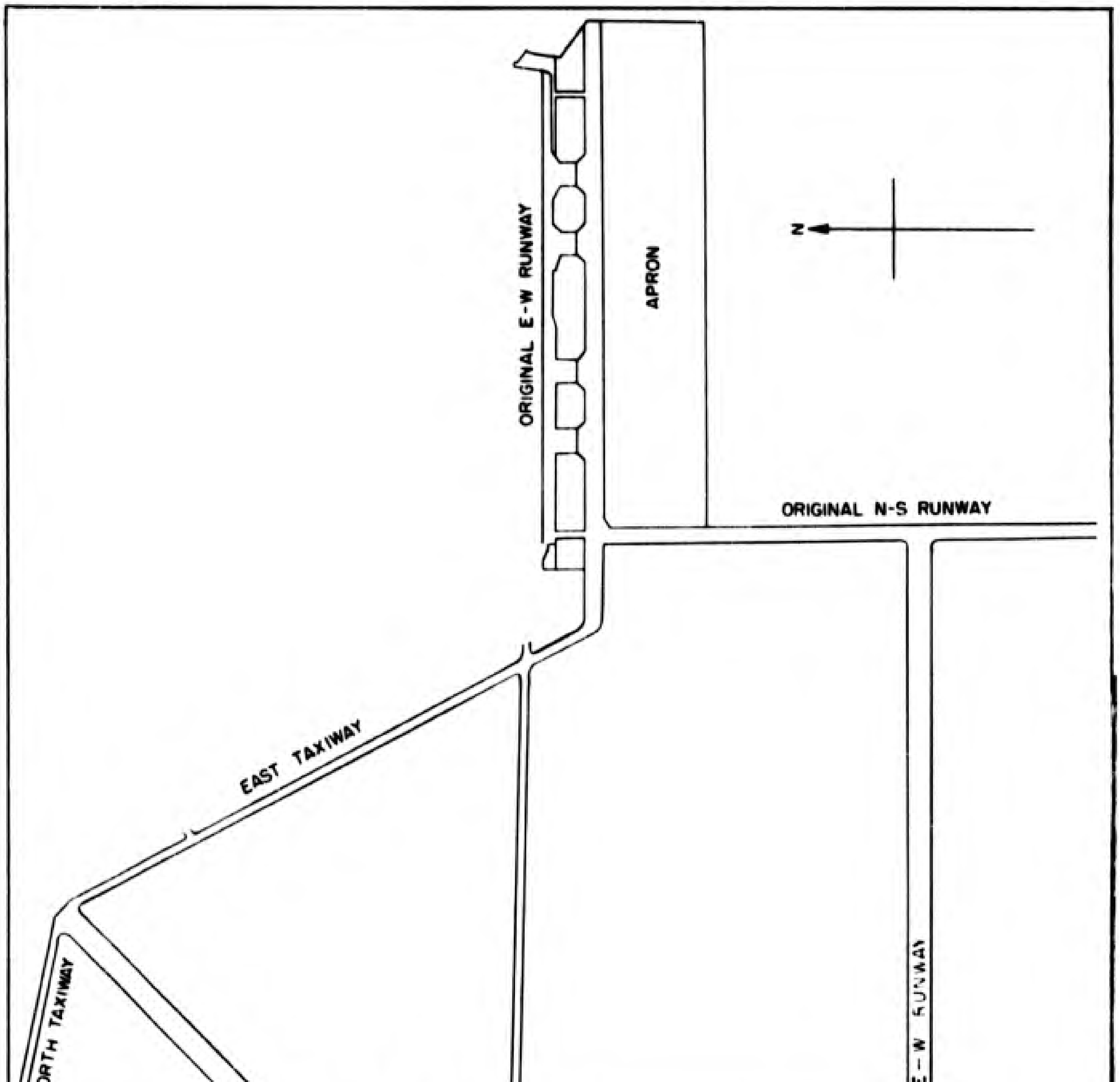
ROME AIRFIELD
(GRIFFISS AIR FORCE BASE)
ROME, NEW YORK

PLATE 18



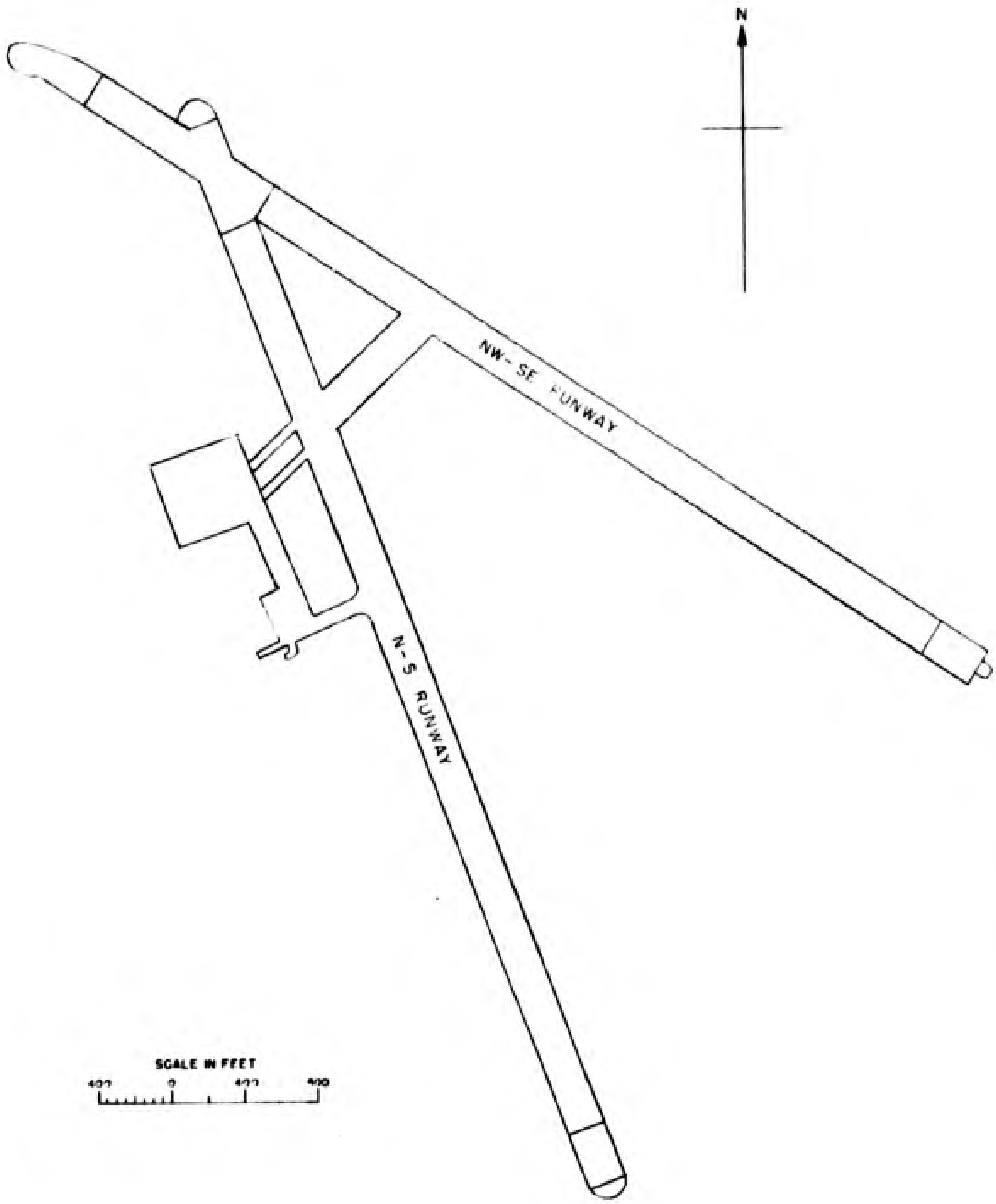
SCOTT AIR FORCE BASE
BELLEVILLE, NEW YORK

PLATE 19



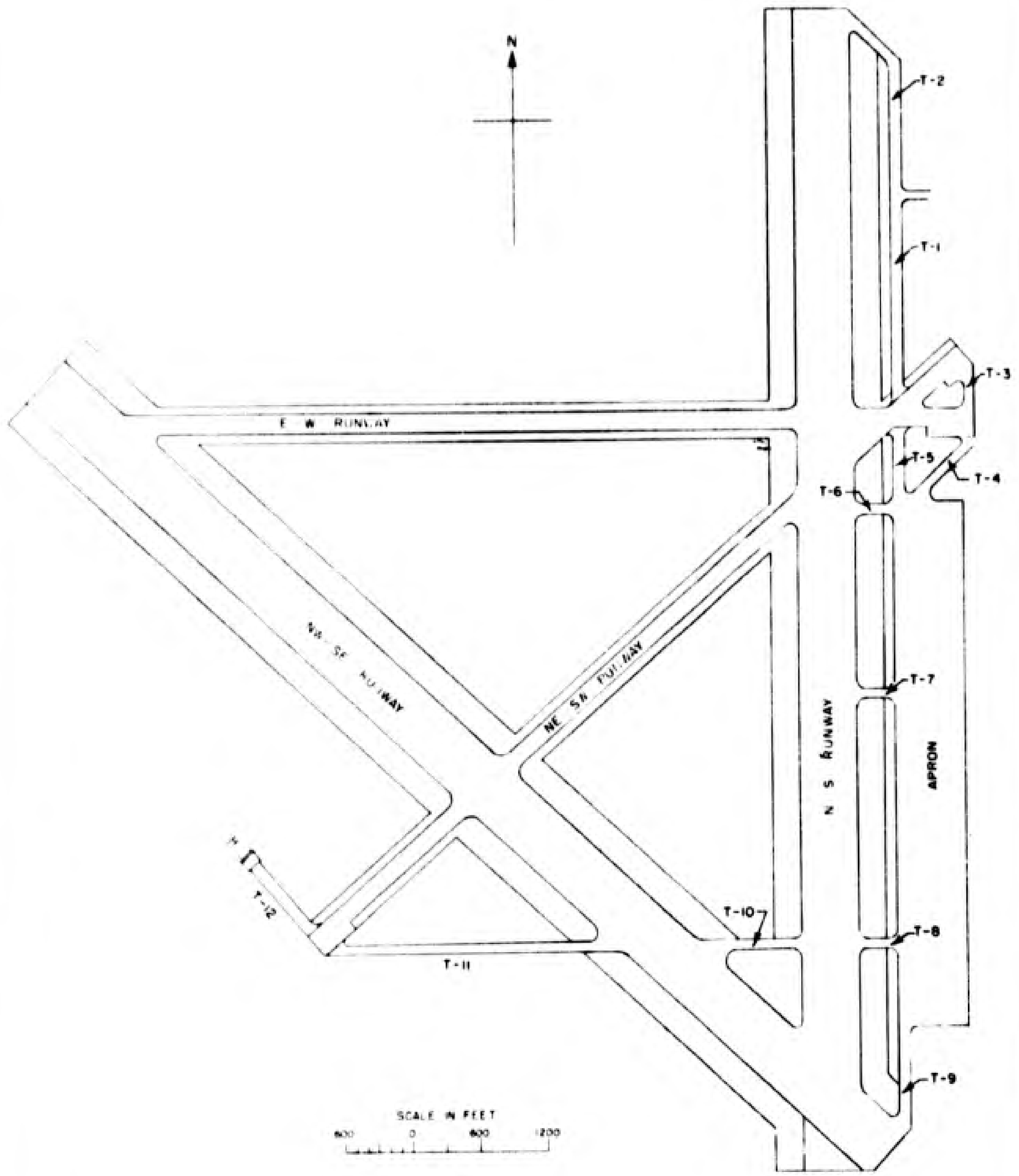
SELFRIDGE AIR FORCE BASE
MT. CLEMENS, MICHIGAN

PLATE 20



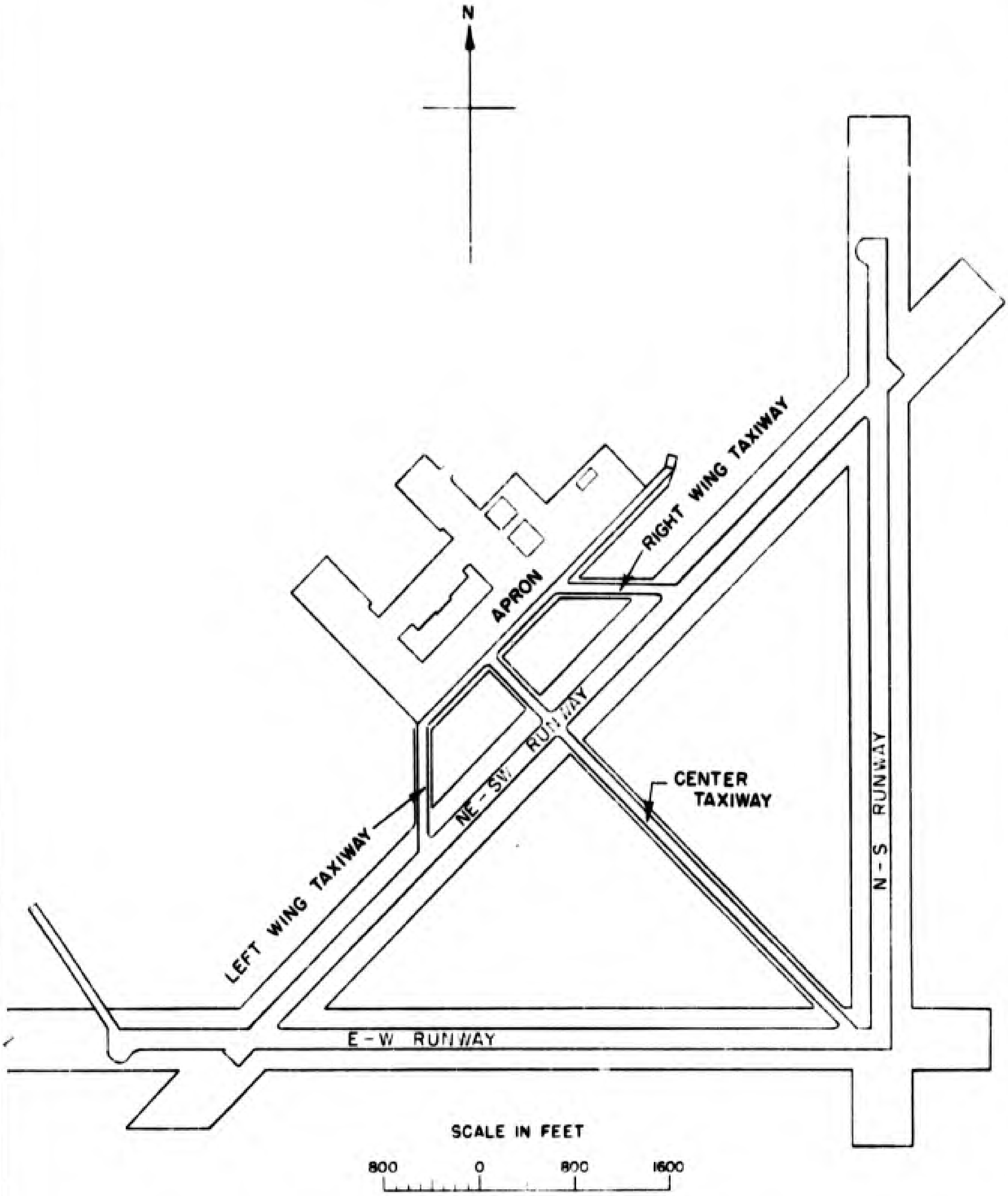
SHERMAN AIR FORCE BASE
FORT LEAVENWORTH, KANSAS

PLATE 21



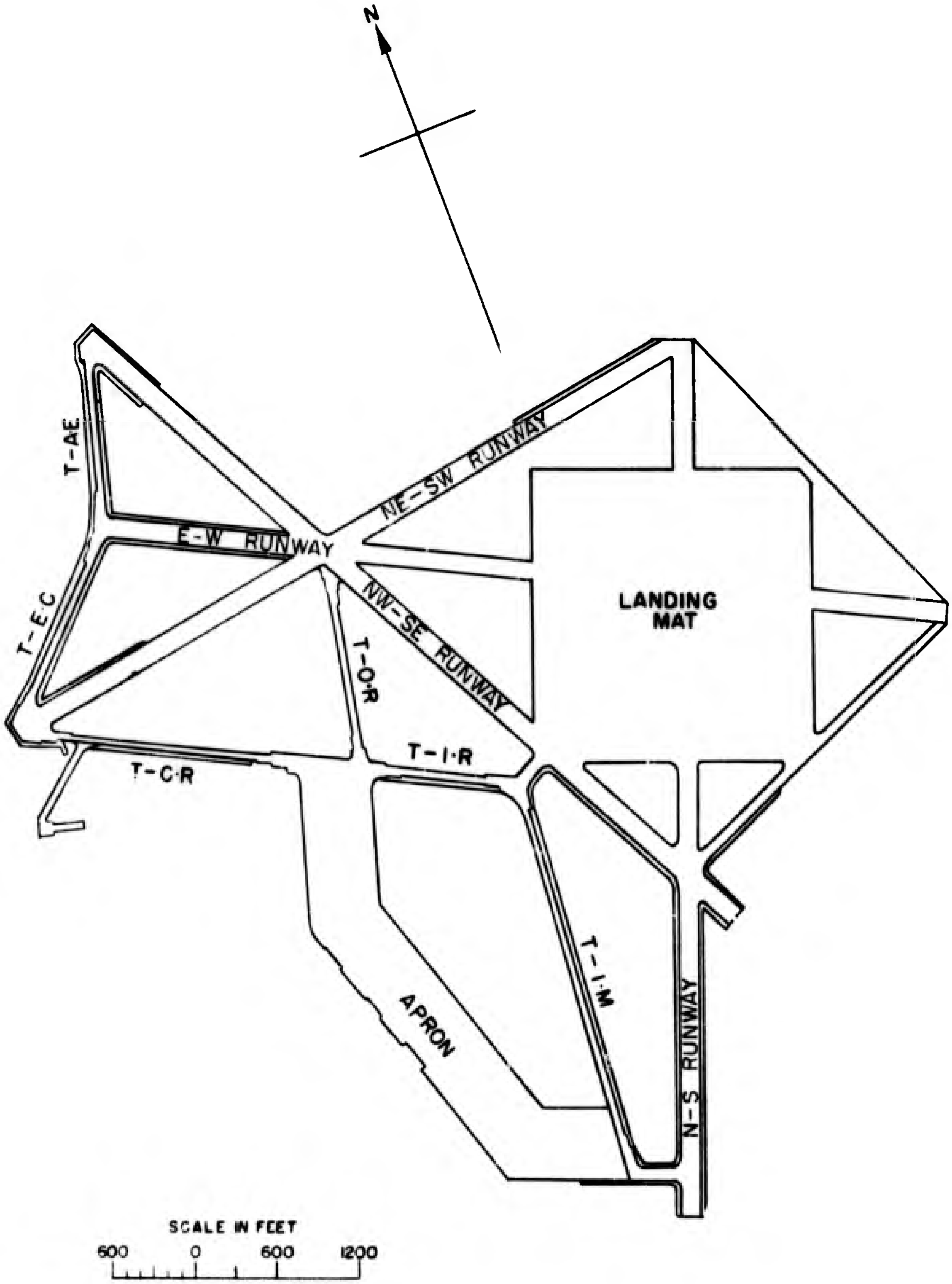
SMOKY HILL AIR FORCE BASE
SALINA, KANSAS

PLATE 22



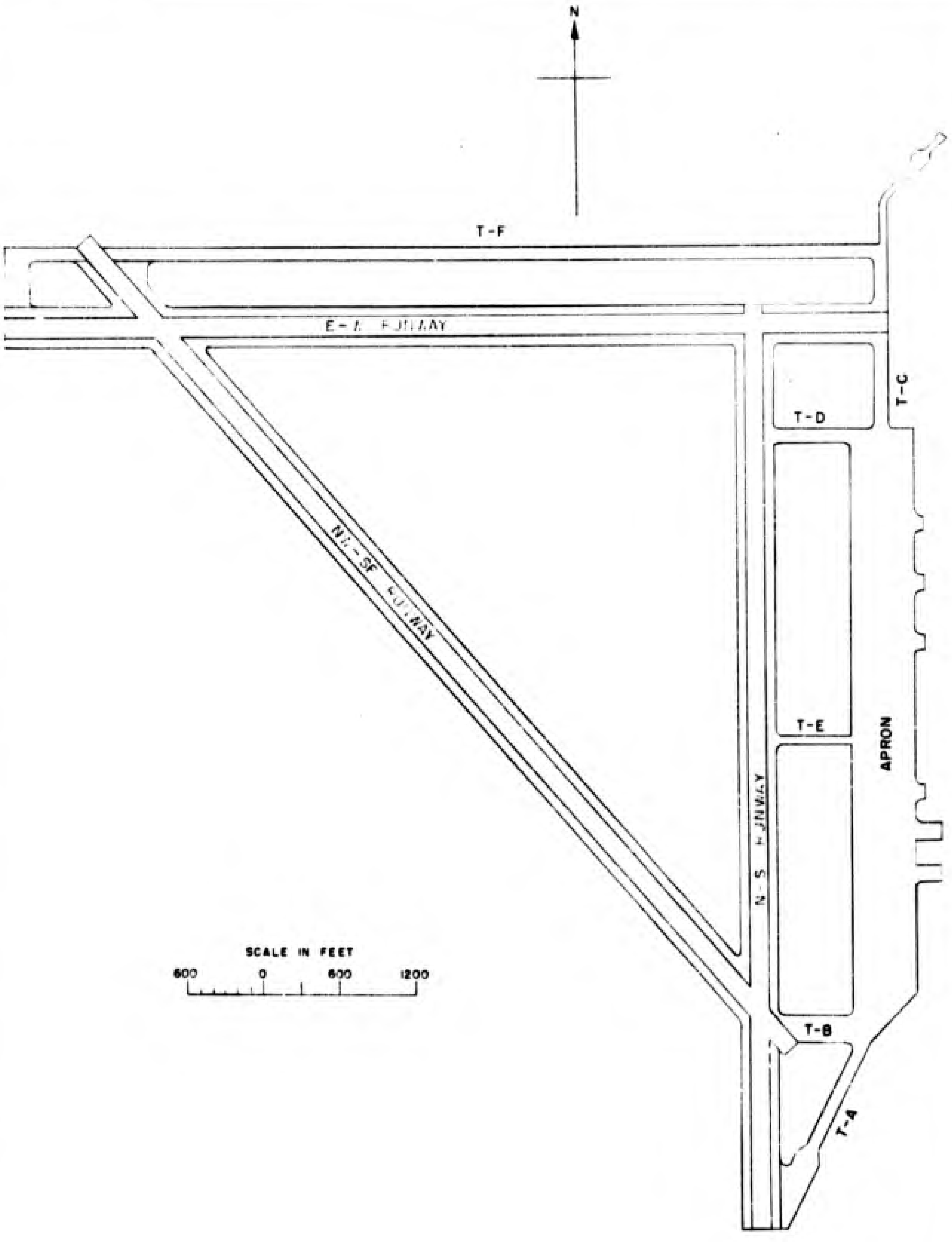
SPOKANE AIR FORCE BASE
SPOKANE, WASHINGTON

PLATE 23



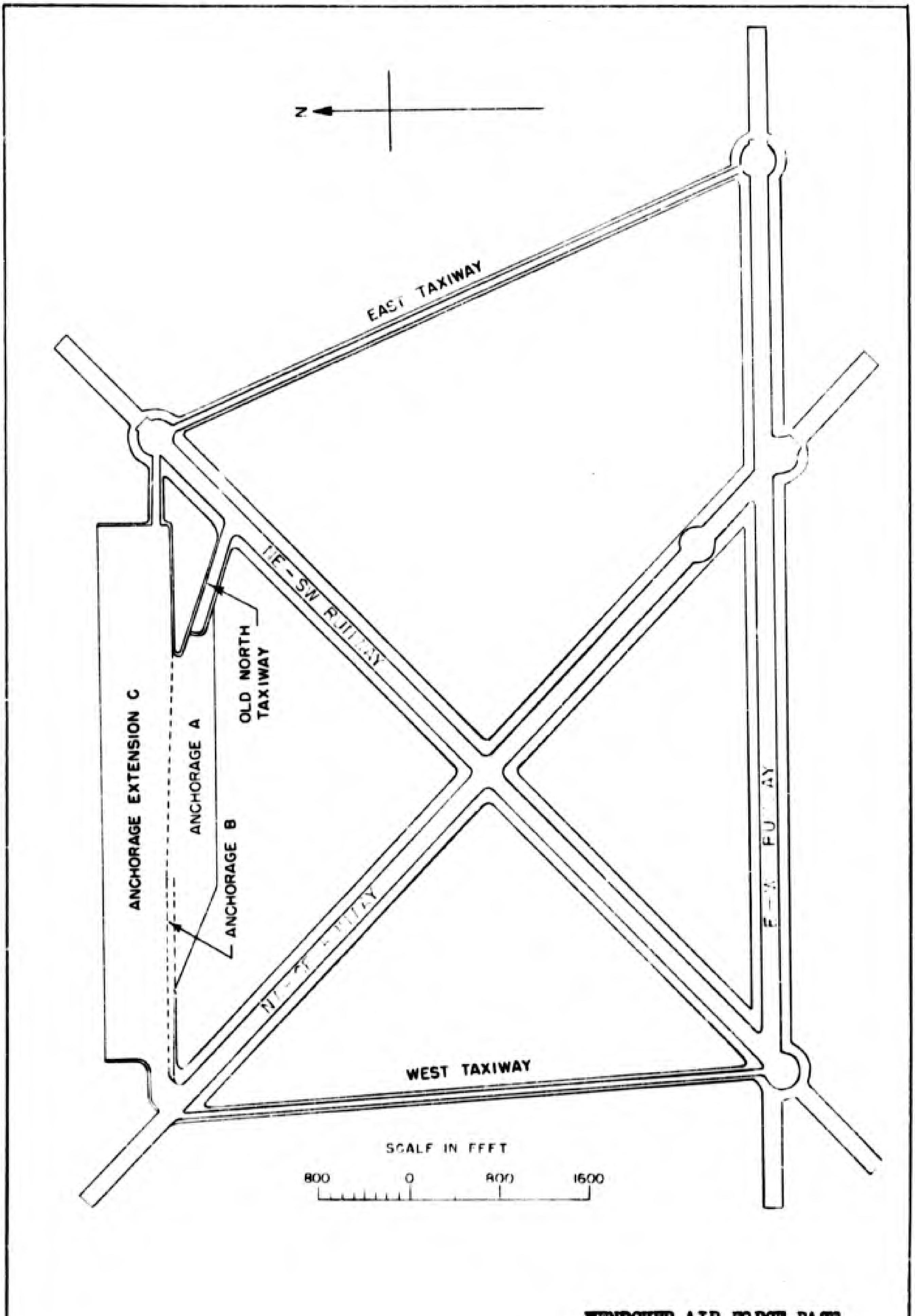
STEWART AIR FORCE BASE
NEWBURGH, NEW YORK

PLATE 24



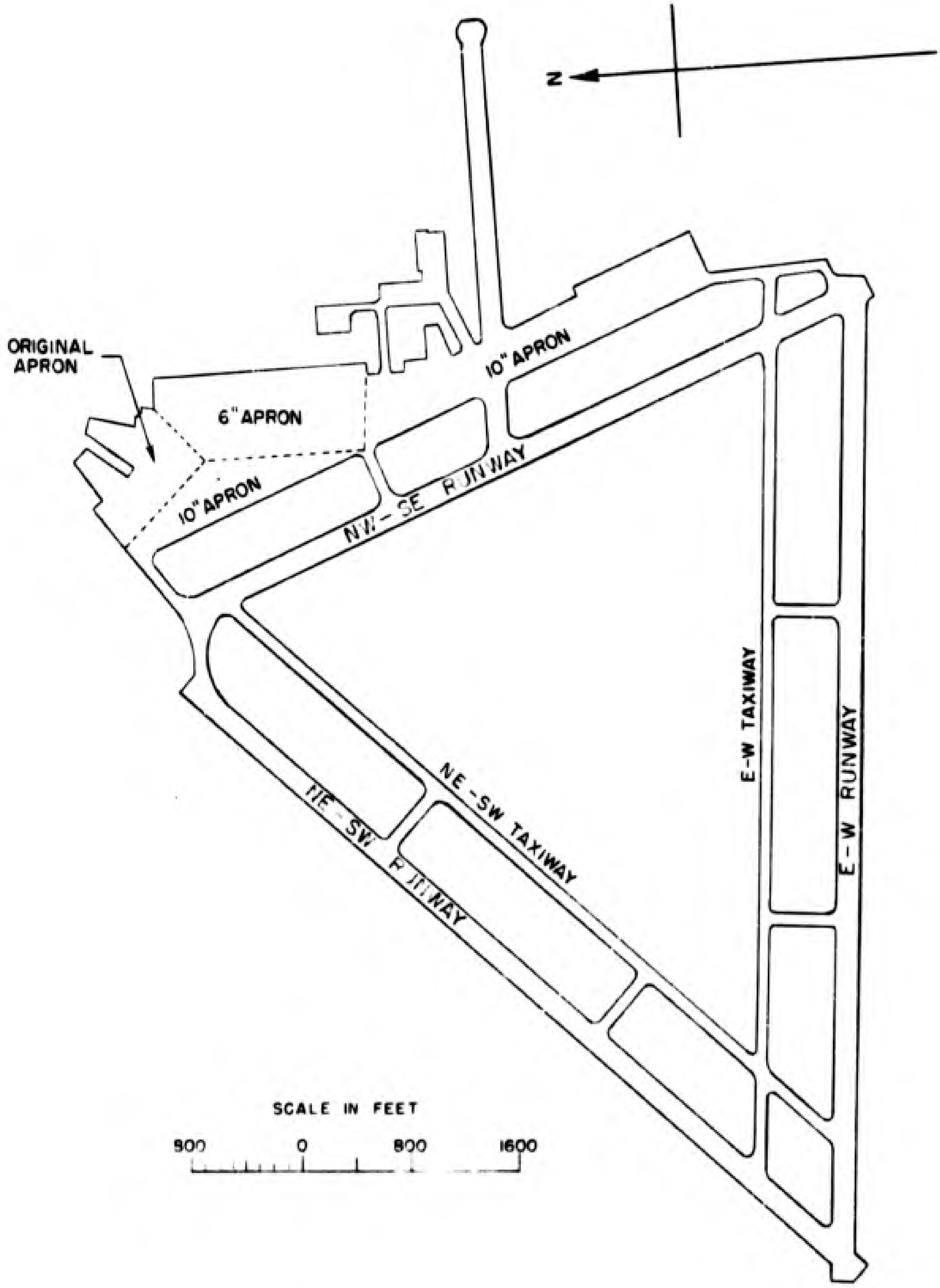
WEAVER AIR BASE
(RAPID CITY AIR FORCE BASE)
RAPID CITY, SOUTH DAKOTA

PLATE 25



WENDOVER AIR FORCE BASE
WENDOVER, UTAH

PLATE 26



WRIGHT FIELD
DAYTON, OHIO

PLATE 27