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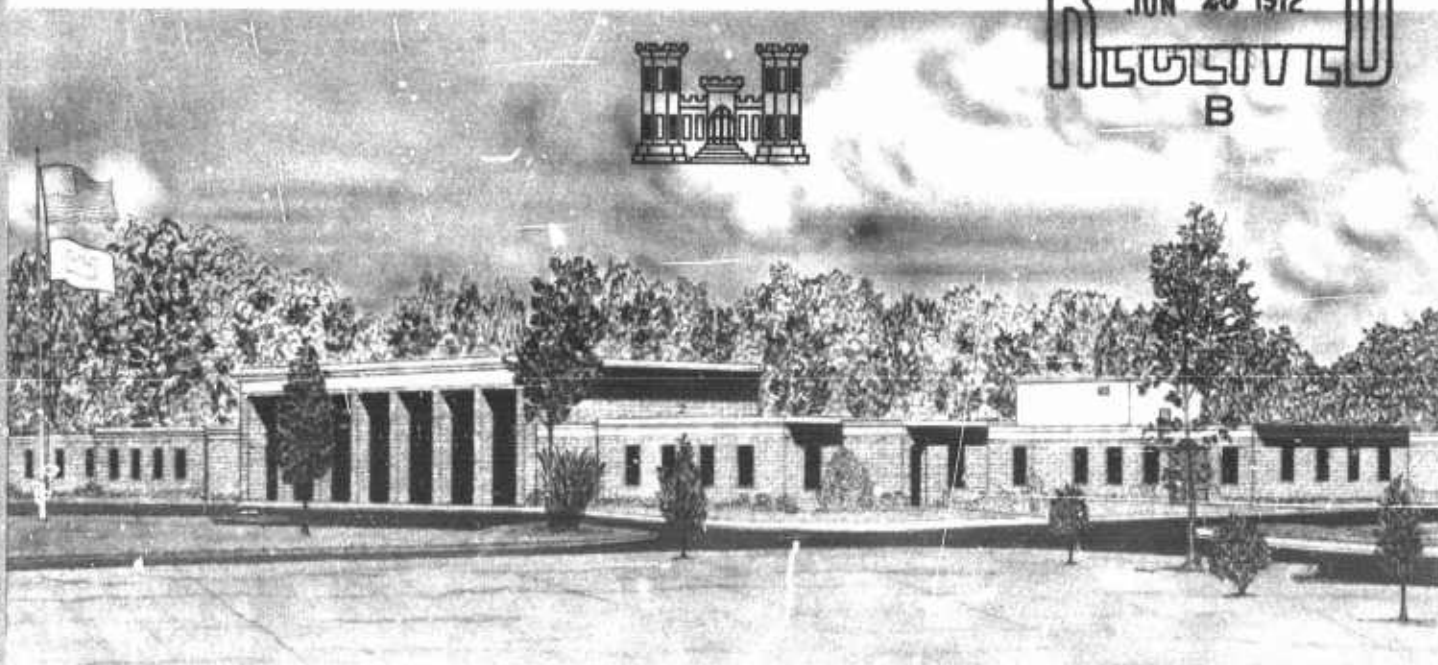
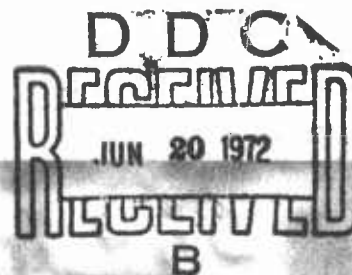


MISCELLANEOUS PAPER S-72-19

CONDITION SURVEY, CAMPBELL ARMY AIRFIELD, FORT CAMPBELL, KENTUCKY

by

P. J. Vedros, S. J. Alford



June '972

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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Foreword

Authority for performance of condition surveys at selected airfields is contained in Long Range Program, O&M, A FY 1971, Project Q6-1: "Engineering Criteria for Design and Construction - WES," dated May 1970.

The facilities at Campbell Army Airfield were inspected in April 1971 by Messrs. P. J. Vedros and S. J. Alford of the Engineering Design Criteria Branch, U. S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Miss. This report was prepared by Messrs. Vedros and Alford under the general supervision of Messrs. J. P. Sale, R. G. Ahlvin, and R. L. Hutchinson of the Soils and Pavements Laboratory, WES.

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

	<u>Page</u>
Foreword	iii
Conversion Factors, British to Metric Units of Measurement	vii
Purpose	1
Pertinent Background Data	1
History of Airfield Pavements	2
Construction history	2
Traffic history	4
Maintenance	4
Condition of pavement surfaces	4
Evaluation	5
Tables 1-3	
Photographs 1-10	
Plates 1-3	

Conversion Factors, British to Metric Units of Measurement

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

<u>Multiply</u>	<u>By</u>	<u>To Obtain</u>
inches	2.54	centimeters
feet	0.3048	meters
miles (U. S. statute)	1.609344	kilometers
pounds	0.45359237	kilograms
pounds per square inch	0.6894757	newtons per square centimeter

CONDITION SURVEY, CAMPBELL ARMY AIRFIELD
FORT CAMPBELL, KENTUCKY

Purpose

1. The purpose of this report is to present the results of an investigation performed at Campbell Army Airfield (CAAF) in April 1971. The inspection was limited to visual observations, and no tests were conducted on the existing runways and taxiways. A layout of the airfield is shown in plate 1.

Pertinent Background Data

General description of airfield

2. CAAF is located on the reservation of Fort Campbell, Kentucky. It is approximately 10 miles* north of Clarksville, Tennessee, and 15 miles south of Hopkinsville, Kentucky, along U. S. Highway 41. The original ground surface at CAAF was gently rolling with grades up to 15 percent, the average being about 3 percent. The maximum difference in ground elevations was approximately 35 ft. The soils found in the area were derived from limestone, sandstone, and shales and are generally classified as CL (lean to sandy clays). The soils tend to become quite cherty with depth. A cavernous limestone lies 50 to 90 ft below the ground surface with the caverns considered to be interconnected. Much of the rainwater at the airfield drains naturally into sink holes and percolates through the soil to the caverns below.

3. In April 1971, the airfield facilities consisted of a primary runway (northeast-southwest) 12,100 ft long and 200 ft wide, two crosswind

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

runways (north-south and northwest-southeast) each 4500 ft long and 150 ft wide, connecting taxiways, three parking aprons, and six hardstands (see plate 1).

Previous reports

4. Previous reports relative to CAAF are as follows:

- a. Condition survey. No previous condition surveys have been made at CAAF.
- b. Evaluation. Two evaluation reports have been prepared for the pavements at CAAF: (1) "Report on Airfield Pavement Evaluation, Campbell Army Airfield," dated November 1944, prepared by the Soils Division, Cincinnati Testing Laboratory, Ohio River Division, Cincinnati, Ohio; and (2) "Airfield Pavement Evaluation, Campbell Air Force Base, Kentucky," Technical Memorandum No. 3-344, Report No. 1, dated January 1953, prepared by the U. S. Army Engineer Waterways Experiment Station (WES), CE, Vicksburg, Miss.
- c. Other reports. The WES tested five locations on the north-south runway in 1946 in connection with a research study of pavement design, and results of these tests were included in the second interim report on "Flexible Pavement Behavior Studies," published by the WES in May 1947.

Pertinent data have been extracted from these reports and used herein.

History of Airfield Pavements

Construction history

5. 1942-43 construction. The original construction was started in July 1942 and all work completed in January 1943. The northwest-southeast and north-south runways and taxiways D, F, and J were constructed at this time. This work was under the supervision of the Nashville District, Corps of Engineers. Pavements were designed for a 15,000-lb single-wheel load and 44-psi tire pressure.

6. 1946-47 construction. In July 1946, construction was begun on the northeast-southwest runway, Alpha parking apron, and taxiways 3, 5, and 7 (see plate 1). This work was under the supervision of the Louisville District, Corps of Engineers. Construction was halted for the winter months

with the subgrade incomplete and was resumed in July 1947 with completion by the latter part of September 1947.

7. 1953 construction. In 1953, the northeast-southwest runway was extended 900 ft on the south end and 1000 ft on the north end, and taxiway 2 and Charlie parking apron were constructed. This construction was under the supervision of the Louisville District, Corps of Engineers.

8. 1956 construction. The northeast-southwest runway was extended 1900 ft on the north end and taxiway 1 was constructed during this period. This work was under the supervision of the Nashville District, Corps of Engineers.

9. 1958 construction. In 1958, six hardstands adjacent to taxiway 1 on the north end of the field were constructed of 17-in. portland cement concrete (PCC). This work was under the supervision of the Nashville District, Corps of Engineers.

10. 1960 construction. In 1960, the Alpha parking apron was overlaid with a 2-in. hot-mix asphaltic concrete (AC). Prior to the overlay, a surface treatment with 1-1/2-in. maximum-size aggregate was placed in an effort to prevent reflection cracking on the overlay. An emulsified tar slurry seal coat was placed over the 2-in. overlay. This work was under the supervision of the Nashville District, Corps of Engineers.

11. 1963 construction. In 1963, the southwest parking apron was constructed of 8-in. PCC. The apron was designed for a 25,000-lb single-wheel load. Construction was under the supervision of the Nashville District, Corps of Engineers.

12. 1967 construction. In 1967, the asphalt portions of the northeast-southwest runway and taxiways 3 and 5 were overlaid with 2 in. of AC. A surface treatment similar to the one placed on the Alpha apron in 1960 was placed prior to the overlay. Construction was under the supervision of the Mobile District, Corps of Engineers.

13. A complete construction history is shown in table 1. A layout of the airfield pavements is shown in plate 1. Typical pavement sections are shown in plates 2 and 3.

Traffic history

14. Detailed traffic records were not available. The airfield pavements were originally designed for and used by all types of Air Force aircraft; even though the airfield has been transferred to the Army, the field is still used by all types of Air Force aircraft. It was reported that the facilities receive normal use by light Army aircraft and considerable traffic from transient aircraft, such as heavy cargo and fighter planes. For the past two years, C-130 aircraft from another airbase have been using the airfield for training exercises. This has consisted of five-days-a-week operations of practicing assault and touch-and-go landings. The assault landings have been made on runway 18-36, and at the time of this survey, failures were occurring in the pavement surface from this type operation.

Maintenance

15. Maintenance over the years has consisted of crack sealing and applications of slurry or other types of seal coats. No maintenance has been performed on the pavements since the last overlay placed in 1967, except the failed area that was being patched on runway 18-36 at the time of this survey. There is a need for crack sealing and repair of the spalled areas.

Condition of pavement surface

16. A visual inspection of the pavements in April 1971 indicated that the pavement condition ranged from poor to excellent. The primary pavements necessary for normal operations of the field are generally in very good condition. The northeast-southwest or primary runway contained some surface defects, such as spalling of the PCC on the northeast end of the runway and minor shrinkage cracking on the asphaltic concrete surface. The spalling (photograph 1) is occurring along the joints in the takeoff area at the runway end and was reported to have been caused by the blast of the F-4C aircraft. This has probably been caused by vibrations created by the aircraft and the blast on takeoff blowing the broken pieces from

the surface. These areas will be patched with an epoxy grout in the near future. A general view of the asphaltic concrete portion of the runway is shown in photograph 2. The surface condition along the parallel taxiway indicated more cracking and longitudinal joint opening (photographs 3 and 4) than observed on the runway. The runway and taxiways 2 and 5 were overlaid in 1967, and the pavement surface is in better condition than the other facilities that had not been overlaid, as can be seen by comparison of photograph 2 with photographs 3 and 4. The pavement surface on runways 18-36 (north-south) and 14-32 (northwest-southeast) and taxiways D, F, and J was generally in fair to poor condition. The pavements were constructed in 1942-43 and appear to be very dead and dried out. Failures had occurred in a marked-off landing area on runway 18-36, which was being used by C-130 aircraft. Photographs 5-7 indicate the condition of these pavements and types of failures. Future plans consist of building helicopter hangars adjacent to the east side of runway 14-32 and north side of taxiway F, and these facilities will be overlaid or strengthened at that time. The PCC hardstands were in excellent condition. The PCC apron (designated southwest parking apron, plate 1) was in good condition with less than 3 percent of the slabs containing structural defects (photograph 8). There were one or two areas near drainage catch basins where the slabs were tilted. The Alpha and Charlie parking aprons were in fair condition. The pavements had numerous shrinkage cracks and openings at the joints, as shown in photographs 9 and 10.

Evaluation

17. The last evaluation of the load-carrying capacity of the airfield pavements at CAAF was made in 1953, as indicated in paragraph 4b. There is a need to perform the necessary field tests to evaluate the pavements for current aircraft requirements. The airfield operations personnel are using the old 1953 evaluation to restrict aircraft usage on certain pavements. The Mobile District performed tests in two pits on the northwest-southeast

runway for proposed construction in this area; the results of these tests, data from the 1953 evaluation report, and the performance of the pavements under the present traffic are considered in the evaluation presented herein. This upgraded evaluation does not eliminate the need for field tests.

18. The load-carrying capacity of the pavements at CAAF is shown in table 2. As noted, the basic field evaluation for the primary pavements is controlled by the carrying capacity of taxiway 7 and Charlie apron. Occasional use of the pavement facilities by aircraft having gross weights greater than those used for the basic evaluation may be necessary. Table 3 shows the allowable loading of such aircraft operating at frequencies of one cycle per day, one cycle per week, and one cycle per month.

Table 1

Construction History

Facility	Dimensions		Surface		Construction	
	Length ft	Width ft	Thickness in.	Type	Year	Agency
NW-SE runway	4,500	150	3	Asphaltic concrete	1942	USCE (Nashville Dist)
N-S runway	4,500	150	3	Asphaltic concrete	1942	"
Taxiway D	4,500	150	3	Asphaltic concrete	1942	"
Taxiways F and J	2,600	50	3	Asphaltic concrete	1942	"
NE-SW runway Original	8,000	200	3	Asphaltic concrete	1947	USCE (Louisville Dist)
South extension	900	200	3	Asphaltic concrete	1953	"
North extension	1,000	200	3	Asphaltic concrete	1953	"
	900	200	3	Asphaltic concrete	1956	USCE (Nashville Dist)
	1,000	200	16	Portland cement concrete	1956	"
Blast pads	300	200	2	Asphaltic concrete	1956	"
Overlay	10,800	200	2	Asphaltic concrete	1967	USCE (Mobile Dist)
Alpha parking apron Original	1,500	415	3	Asphaltic concrete	1947	USCE (Louisville Dist)
Overlay	1,500	415	2	Asphaltic concrete	1960	USCE (Nashville Dist)
Taxiway 7	4,700	75	3	Asphaltic concrete	1947	USCE (Louisville Dist)

Table 1 (Concluded)

Facility	Dimensions		Thickness in.	Surface		Construction	
	Length ft	Width ft		Type	Year	Agency	
Taxiways 3 and 5 Original	varies	75	3	Asphaltic concrete	1947	USCE (Louisville Dist.)	
	varies	75	2	Asphaltic concrete	1967	USCE (Mobile Dist.)	
Taxiway 2	1,700	285	3	Asphaltic concrete	1953	USCE (Louisville Dist.)	
Charlie parking apron	1,700	415	3	Asphaltic concrete	1953	"	
	2,600	75	4	Asphaltic concrete	1956	USCE (Nashville Dist.)	
Warm-up aprons	350±	175	16	Portland cement concrete	1956	"	
Hardstands 1-6	400	200	17	Portland cement concrete	1958	"	
SW parking apron	1,450	425	8	Portland cement concrete	1963	"	

Table 2

Summary of Basic Evaluation

Facility	Allowable Gross Aircraft Loadings in Pounds						Remarks
	Normal Period Operation		Frost-Melting Period Operation				
	Single-Wheel	Twin-Wheel	Single-Wheel		Twin-Wheel		
			Gear	Gear	Gear	Gear	
<u>Primary Pavements</u>							
NE-SW runway First 500-ft ends Interior portion	70,000+	50,000+	NA		NA		
	70,000+	50,000+					
	70,000+	50,000+	NA		NA		
	70,000+	50,000+	NA		NA		Basic field evaluation
	70,000+	50,000+	NA		NA		Basic field evaluation
Charlie parking apron	70,000+	50,000+	NA		NA		
Alpha parking apron	70,000+	50,000+	NA		NA		
<u>Secondary Pavements</u>							
Taxiways 2, 3, & 5 SW parking apron	70,000+	50,000+	NA		NA		
	45,000	50,000+	NA		NA		
NW-SE & N-S runways, taxiways D, F, & J	20,000	30,000	NA		NA		
	70,000+	50,000+	NA		NA		
Hardstands							

Table 3

Summary of Pavement Evaluation for Overload Aircraft

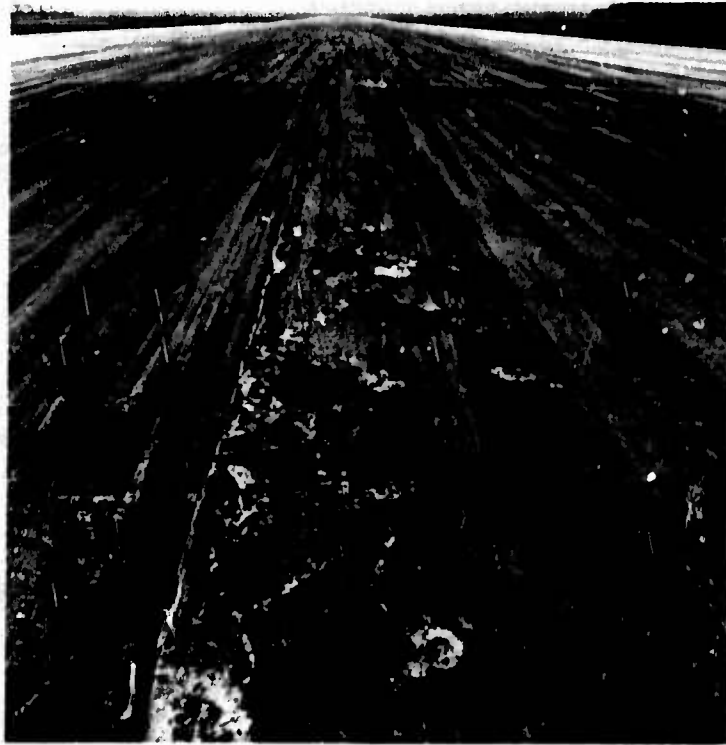
(Basic Field Evaluation: 70,000+ lb gross wt for single wheel and
50,000+ lb gross wt for twin wheel)

Type Aircraft	Overload Aircraft		Allowable Gross Aircraft Load, lb		
	Empty	Weight, lb Gross	One Cycle Per Day	One Cycle Per Week	One Cycle Per Month
C-123	30,000	60,000			
C-131	30,700	60,000			
C-119	41,000	77,000			
C-54	39,000	82,500			
C-130	69,837	155,000			
C-124	100,700	216,000	210,000		
C-141	134,000	316,600	245,000	245,000	
C-5A	318,200	770,000	690,000		

Aircraft can operate at maximum gross load.

Aircraft can operate at indicated gross load.

Note: Evaluation presented above is for the primary pavements. Allowable loads for secondary pavements are the same for taxiways 2, 3, and 5 as shown above; however, they are considerably lower for the SW parking apron, NW-SE and N-S runways, and taxiways D, F, and J. Hardstands were evaluated for maximum gross load for all aircraft.



Photograph 1. Spalling of portland cement concrete on northeast end of NE-SW runway



Photograph 2. General view of asphaltic concrete along NE-SW runway



Photograph 3. Longitudinal joint opening and shrinkage cracking in parallel taxiway



Photograph 4. General condition of surface of pavement that was not overlaid in 1967



Photograph 5. General condition
of surface of runway 18-36



Photograph 6. Area on runway 18-36 that was
patched after failure from C-130 operations



Photograph 7. Typical failure
resulting from C-130 operations



Photograph 8. Cracking in slabs near juncture
of asphalt and rigid pavement on southwest
parking apron



Photograph 9. Condition of pavement
surface on Alpha parking apron



Photograph 10. Condition of pavement
surface on Charlie parking apron

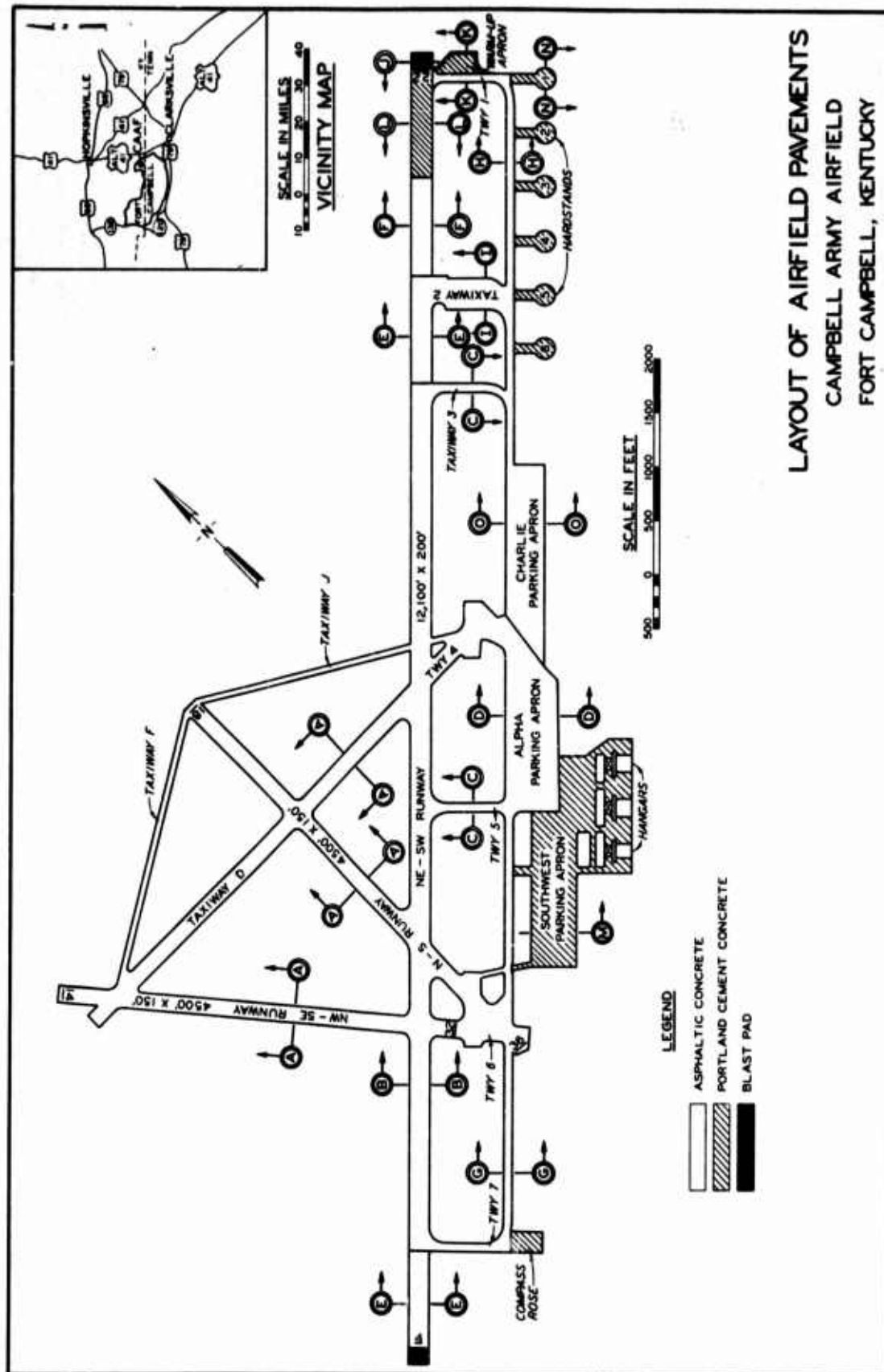
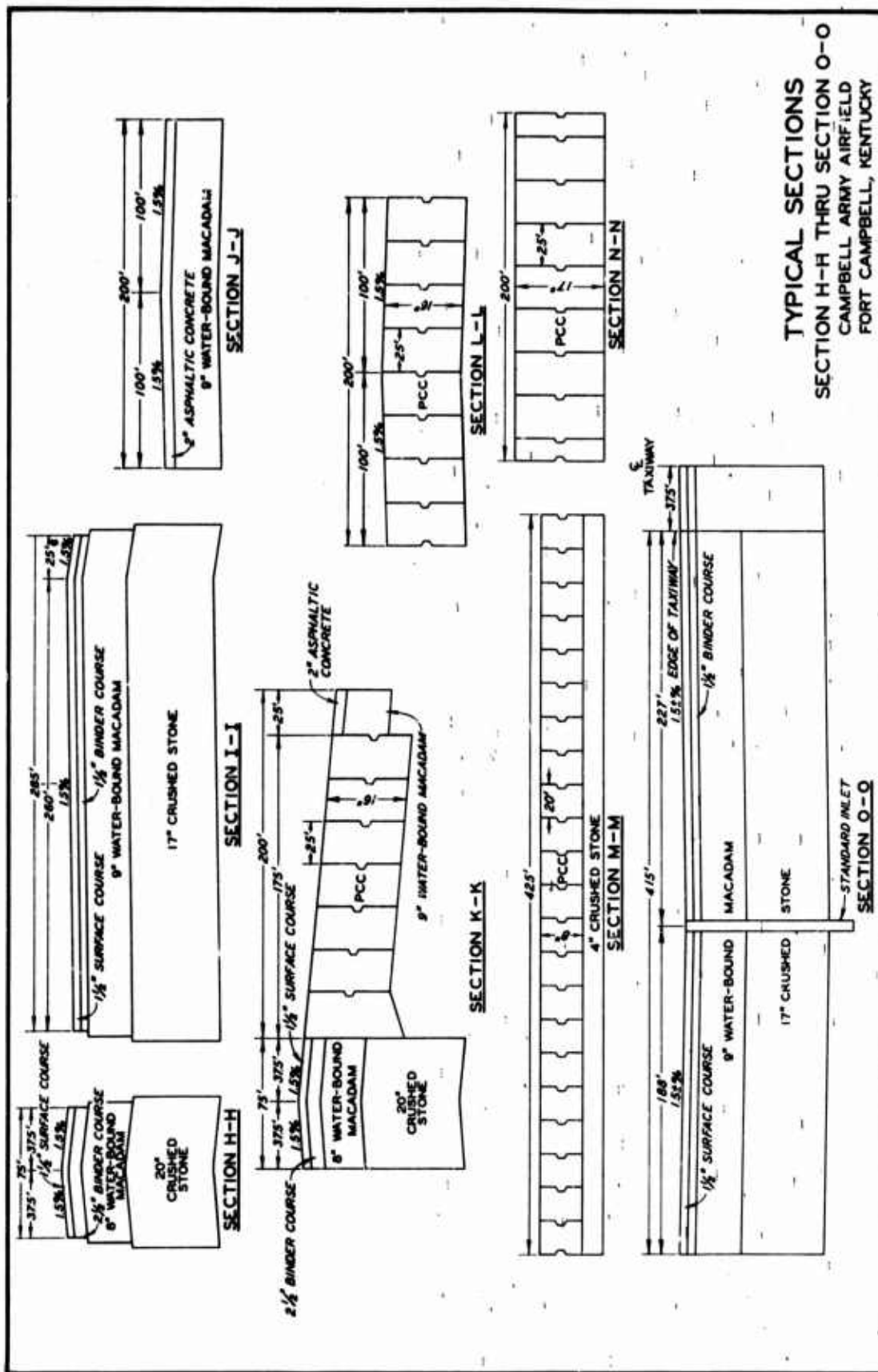


PLATE 1



TYPICAL SECTIONS
SECTION H-H THRU SECTION O-O
CAMPBELL ARMY AIRFIELD
FORT CAMPBELL, KENTUCKY