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MISCELLANEOUS PAPER NO. 4-989

CONDITION SURVEY, ROBERT GRAY ARMY AIRFIELD, FORT HOOD, TEXAS

by

P. J. Vedros

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April 1968



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Conducted by

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

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Foreword

Authority for performance of condition surveys at selected airfields is contained in Instructions and Outline for existing pavement condition surveys, FY 1968, and is in accordance with the Long-Range Program, "Investigations and Studies Program for Development of Engineering Criteria, FY 1968, Army Funds," dated March 1967.

The inspection of the facilities at Robert Gray Army Airfield was requested by the Office, Chief of Engineers, and was made by Mr. P. J. Vedros of the Flexible Pavement Branch, U. S. Army Engineer Waterways Experiment Station (WES). This report was prepared by Mr. Vedros under the general supervision of Messrs. W. J. Turnbull, A. A. Maxwell, R. G. Ahlvin, and A. H. Joseph of the Soils Division, WES.

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

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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>Multiplied</u>	<u>By</u>	<u>To Obtain</u>
inches	2.54	centimeters
feet	0.3048	meters
miles	1.609344	kilometers
square inches	6.4516	square centimeters
pounds	0.45359237	kilograms
pounds per square inch	0.070307	kilograms per square centimeter

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CONDITION SURVEY, ROBERT GRAY ARMY AIRFIELD

FORT HOOD, TEXAS

Purpose

1. The purpose of this report is to present the results of an inspection performed at Robert Gray Army Airfield (RGAAF) in June 1967. 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

2. RGAAF is located in the northwestern part of Bell County, Tex., 8 miles* southwest of Killeen, Tex., and 3 miles south of U. S. Highway 190.

3. The airfield is located in an area of rolling to hilly topography. Geologically, the airfield is located in outcrops of the Fredericksburg group of Cretaceous age. The topsoil consists chiefly of gray-to-brown calcareous sandy clays varying in thickness from a few inches to 5 ft. The underlying materials are generally weathered and disintegrated and consist of nodular pieces of limestone with clay binder and a mixture of shell, limestone, and clay.

4. In June 1967, the airfield consisted of a NW-SE runway approximately 200 ft wide and 10,000 ft long, two parking aprons, a cross taxiway, a taxiway parallel to the runway, two alert aprons with connecting taxiways to the runway, and a warm-up apron. Pavement plan is shown in plate 1.

Previous reports

5. Reports pertaining to the load-carrying capabilities of the pavements at RGAAF that have previously been published are as follows:

- a. U. S. Army Engineer District, Galveston, Texas, "Pavement Evaluation, Camp Hood Landing Strip, Killeen, Texas," dated July 1948.

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

- b. U. S. Army Engineer District, Fort Worth, Texas, "Pavement Evaluation Report," dated February 1956.
- c. U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi:
 - (1) "Airfield Pavement Evaluation Report, Gray Air Force Base, Killeen, Texas," Miscellaneous Paper No. 4-313, dated June 1958.
 - (2) "Army Airfield Pavement Evaluation, Robert Gray Army Airfield, Fort Hood, Texas," Miscellaneous Paper No. 4-697, dated January 1965.

History of airfield pavements

6. The construction of RGAAF (formerly Camp Hood Landing Strip and Gray Air Force Base) was accomplished in four phases, and there have been two phases in which reconstruction work was accomplished. Typical sections of all phases of construction are shown in plate 2.

- a. 1946-1947 construction. Facilities constructed during this period consisted of the 200-ft-wide by 8400-ft-long NW-SE runway, the north parking apron, the parallel taxiway, and the two alert aprons and their taxiways. Pavements were designed to support a gross aircraft load of 140,000 lb.
- b. 1951 construction. The south parking apron was constructed during this period. The pavement was designed to support a gross aircraft load of 140,000 lb.
- c. 1952-1953 construction. Construction at this time consisted of extensions of the runway (1600 ft to the south), the parallel taxiway, and the south parking apron extension. These pavements were designed to support a landing gear load of 85,000 lb on dual wheels spaced 37.5 in. center to center, each wheel having a contact area of 267 sq in. A blast area designed for a 5000-lb, single-wheel load was constructed at the south end of the taxiway extension.
- d. 1956 construction. A portland-cement concrete warm-up apron was constructed at the north end of the taxiway during this period. The pavement was designed to support a landing gear load of 100,000 lb on dual wheels spaced 37.5 in. center to center, each wheel having a contact area of 267 sq in. The blast area constructed adjacent to the warm-up apron was designed for a single-wheel load of 5000 lb.
- e. 1963 reconstruction. At this time, a 1500-ft section of the runway (sta 75+00 to 90+00) was reconstructed because of failures that had developed.
- f. 1965 reconstruction. During the summer of 1965, a 1900-ft section of the runway (sta 56+00 to 75+00) was reconstructed because of distress that was occurring in the pavements.

- g. Proposed future construction. It was proposed in the summer of 1967 to reconstruct another 1900-ft section of the runway (sta 37+00 to 56+00). The pavement section would be the same as that of the area that was replaced in 1965 (sta 56+00 to 75+00).

Traffic history

7. An accurate traffic history for RGAAF is not available. The report referenced in paragraph 5c(2) included the limited traffic data available to the period ending 22 April 1964. The mission of the airfield is still to provide (a) support to the Defense Atomic Support Agency (DASA) located at Fort Hood, and (b) landing facilities for large aircraft, which cannot operate from the small Army airstrip located at Fort Hood. A listing of the heavier aircraft that have operated on the pavement since 1964 was obtained from the operations office at the field. Type aircraft and number of cycles applied on the pavements are shown in the following tabulation.

Date	Type Aircraft and Number of Cycles of Operation					
	C-124	C-130	C-133	C-135	C-140	727
1965	115	88	0	0	8	0
1966	65	17	0	1	9	1
1 Jan - 13 July 1967	18	10	1	2	1	1

Note: Other lighter aircraft operated on the pavements, but no traffic records are available for these aircraft.

Condition of Pavement Surface

8. In June 1967, the condition of the pavement surface ranged from excellent to poor. The section of the runway reconstructed in 1965 (sta 56+00 to 75+00) was in excellent condition (photograph 1). The section of the runway that was reconstructed in 1963 (sta 75+00 to 90+00) was in good condition, but there was evidence of random cracking and opening of the longitudinal paving joints (photograph 2). About 90 percent of the takeoffs originate from this section of the runway. The remaining flexible pavements contained numerous cracks, with the cracking most pronounced on the taxiway leading to the northwest end of the runway and on the northwest end of the

runway (photograph 3). The cracking appeared to have increased since the inspection made by the U. S. Army Engineer Waterways Experiment Station (WES) in 1964, and there was evidence of slight deformation associated with the cracking.

9. As described in the report of the 1964 inspection (reference paragraph 5c(2)), a seepage problem exists at this field. During certain periods, free water seeps through cracks in the pavement and puddles on the surface. Cracks have developed in the runway pavement in the area between sta 75+00 and 90+00 since the evaluation made by the WES in 1964. Seepage puddles have been observed in this area (photograph 4). There was no water standing on the pavement at the time of the current inspection, probably due to drouth conditions, but stains surrounding the cracks indicated that it had done so in the past.

10. In an attempt to eliminate seepage in this area, the Post Engineer has installed a series of subsurface drains (photograph 5). Locations of the drains are shown in plate 3. It was reported that these drains are functioning and helping to keep the pavement relatively dry. The subsurface drains were installed at the time that the area from sta 56+00 to 75+00 was reconstructed. Layout of the drainage system is shown in plate 3.

Evaluation

11. The pavement evaluation from the report referenced in paragraph 5c(2) was updated for this report (table 1) to take into account other types of aircraft gear configurations that are included in present evaluation reports. An aircraft identification index is presented in table 2, which lists the various types of aircraft according to landing gear configurations. The loads shown in table 1 were determined using the pavement sections and CBR values selected in the 1964 report, except that the CBR values assigned from sta 75+00 to 90+00 were reduced from those obtained in the 1964 tests. These values were reduced because it is believed that the increase in moisture has affected the strength of the underlying materials.

Summary

12. Conclusions based on the foregoing discussion and on observations made during the survey are as follows:

- a. The pavements are performing satisfactorily under the present aircraft loads but show signs of further deterioration since the investigation by WES in 1964. As noted in the traffic history, the pavements have been subjected to a few operations by overload aircraft such as the C-133 and C-135. The low rainfall in 1967 has benefited the pavements in that the base course material probably has dried out and increased in strength.
- b. Maintenance in the form of crack sealing should be performed in the area from sta 75+00 to 90+00 to prevent infiltration of water into the base course. The base course contains an excessive amount of fines (approximately 15 percent passing -200 mesh) and will decrease rapidly in strength with an increase in moisture.
- c. The efficiency of the subsurface drainage system should be checked periodically by WES to determine if the system is removing excess moisture from the base course material. Permeability studies by WES on similar base course material obtained from the south parking apron indicated that the material is not free-draining, and drains would be ineffective in reducing the saturated condition of the base course.

Table 2
Aircraft Identification Index

Single Wheel		Multiple Wheel						
Tricycle		Tricycle		Tricycle		Bicycle		
100-psi Tire Pres- sure	100-sq-in. Contact Area Each Tire	TW 28-in.-c-c 226-sq-in. Contact Area Each Tire	Single Tandem 60-in.-c-c 400-sq-in. Contact Area Each Tire	TW 37-in.-c-c 267-sq-in. Contact Area Each Tire	TW 44-in.-c-c 630-sq-in. Contact Area Each Tire	Twin Tandem 33x48-in. 208-sq-in. Contact Area Each Tire	C-54 Gear Configu- ration	Twin-Twin 37x62x37-in. 267-sq-in. Contact Area Each Tire
B-66	F-64	C-119	C-130	B-50	C-124	C-133	C-5A	B-52
C-45	F-66	C-54		KC-97		C-135		
C-47	F-89	C-118		C-97		KC-135		
C-46	F-94	C-131		C-121		C-141		
C-123	F-100	T-29				VC-137		
	F-101							
	B-57							
	F-102							
	F-104							
	F-105							
	F-106							
	F-111							
	F-4C							
	T-38							



Photograph 1. Runway from sta 56+00 to 75+00, 1965 reconstruction area, is in excellent condition; June 1967

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a. Random surface cracking



b. Opening of longitudinal joints

Photograph 2. Runway from sta 75+00 to 90+00; June 1967



a. Taxiway leading to northwest end of runway



b. Northwest end of runway

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c. Sta 56+00, new construction in foreground

Photograph 3. Areas of pronounced surface cracking



Photograph 4. Evidence of water seepage in the vicinity of sta 85+00

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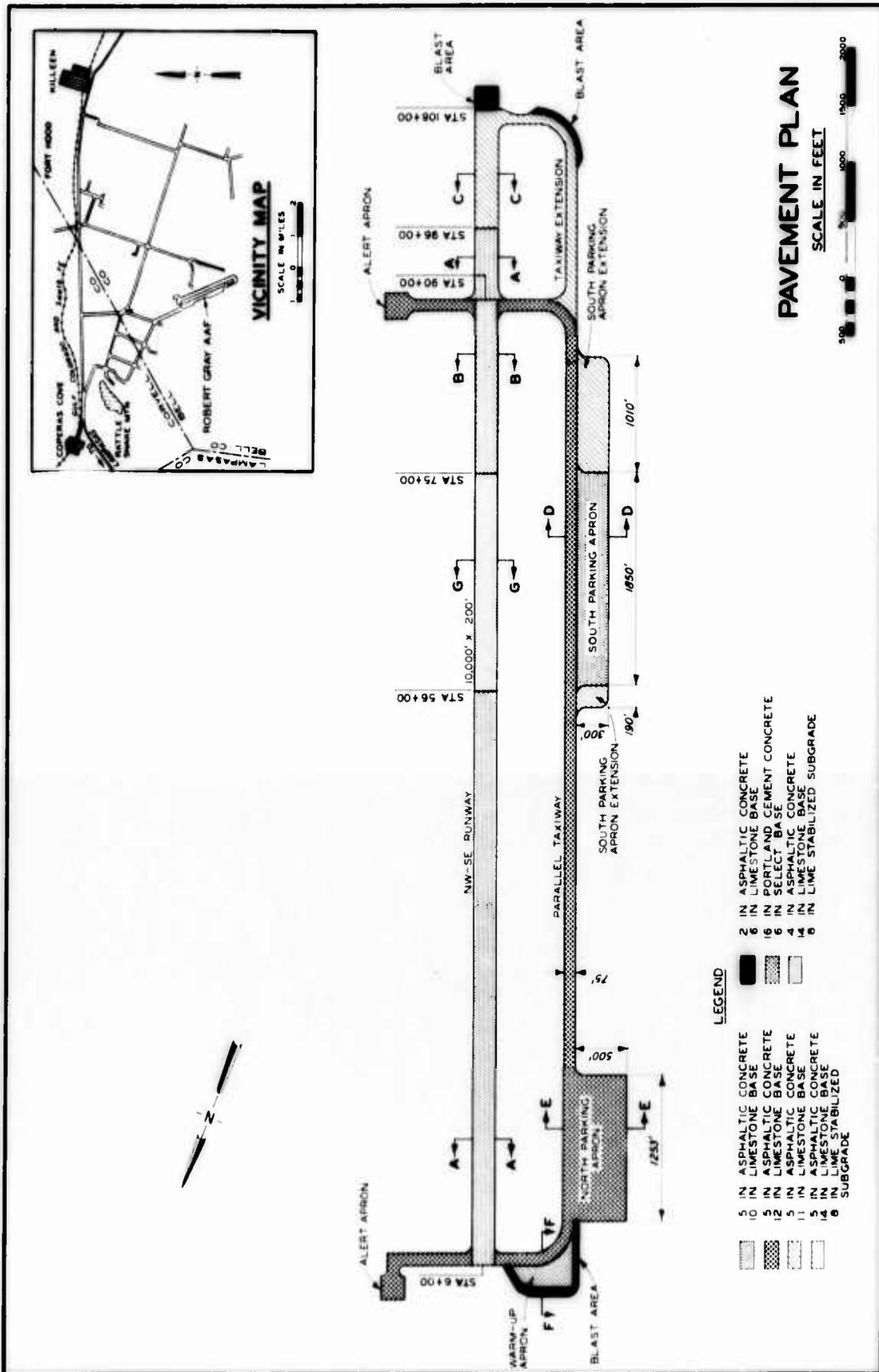


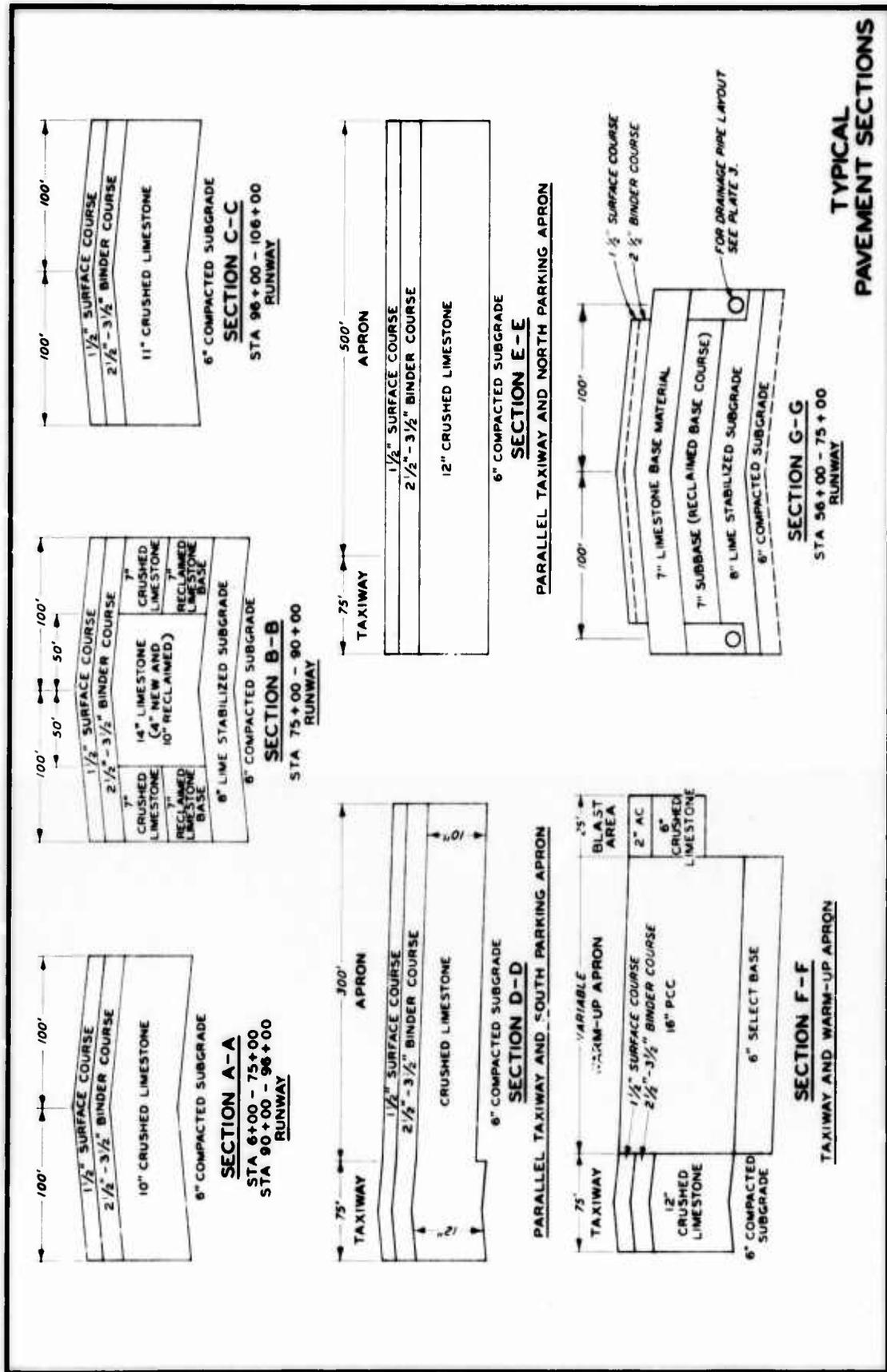
a. Installation on east side of runway from sta 84+00 to 88+40



b. Installation on west side of runway from sta 88+40 to 90+00

Photograph 5. Subdrains installed to eliminate seepage





TYPICAL PAVEMENT SECTIONS

