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TESTS ON SOILS SAMPLES FROM OVERSEAS AIR BASES

Army Engineer Waterways Experiment Station
Vicksburg, Mississippi

April 1949

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CORPS OF ENGINEERS
U. S. ARMY

TESTS ON SOILS SAMPLES FROM OVERSEAS AIR BASES

TECHNICAL MEMORANDUM NO. 3-274

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PREPARED BY

WATERWAYS EXPERIMENT STATION
VICKSBURG, MISSISSIPPI

FOR

OFFICE OF THE CHIEF OF ENGINEERS
AIRFIELDS BRANCH
ENGINEERING DIVISION
MILITARY CONSTRUCTION

APRIL 1966

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CONTENTS

	Page
Introduction	1
Soil Samples	2
Furnished Data on Theatre Soils Tests and Surveys, and other Pertinent Subjects	4
Waterways Experiment Station Soils Tests	4
Field classification	4
Airfield description	5
Location	5
Material	5
Description	6
Classification symbol	6
Grain sizes	6
Atterberg limits	6
Specific gravity	7
Modified AASHO compaction tests	7
CBR tests	7
Swell	8
Reports and Other Data Furnished in Connection with Soil Samples from Overseas Air Bases	9

TABLES 1-3

FIGURES 1-2

[redacted]

TESTS ON SOIL SAMPLES FROM OVERSEAS AIR BASES

Introduction

1. Collection and shipment of 50-lb soil samples, representative of soils at overseas airfields, was directed by letter from Headquarters, Army Air Forces, Washington, D. C., to all Theatre Commanders, subject: "Soil Samples," and dated 26 September 1945. The procedure to be followed in selecting and shipping the samples was outlined in a subsequent letter, same subject, dated 31 October 1945. In this letter layout maps showing sample location were requested, together with any available soil test data. A third letter, dated 31 October 1945, from Headquarters, Army Air Forces, to Theatre Commanders, subject: "Soil Samples," requested data on runways (descriptions of pavements, base courses, types of using planes, frequency of operation) and evaluation of performance of the airfield.

2. It was directed in these letters that the soil samples and all pertinent correspondence be sent to the Commanding General, 463rd AAF Base Unit, Geiger Field, Washington, where it was intended that the testing of the samples should be done by the soils laboratory operated by the Aviation Engineer Training School. However, due to the reduction of personnel and facilities at Geiger Field resulting from demobilization processes, arrangements were made by the Office of the Air Engineer, Army Air Forces, Washington, D. C., through the Office, Chief of Engineers, to have the samples and data transferred to the Waterways Experiment Station for necessary testing, analyzing, documenting and storing.

3. Direct authorization for the work by the Waterways Experiment

Station was contained in the 5th indorsement, dated 19 March 1946, from the Office, Chief of Engineers, to the President, Mississippi River Commission, to basic letter dated 4 February 1946, subject: "Analysis of Soil Samples," from the Office, Air Engineer, Army Air Forces, Washington, D. C., to the Chief of Engineers, U. S. Army.

4. The Instructions and Outlines for Testing Soil Samples from Overseas Air Bases, Office, Chief of Engineers, dated October 1946, defined the scope and objectives of the project as follows:

> "Scope: 3. This project consists of the performance of mechanical analyses, Atterberg limits, specific gravity, Proctor compaction, and California Bearing Ratio tests on each sample received from overseas air bases.
>
> "Objectives: 4. The purpose of this project is to accumulate information and data concerning soil conditions in overseas theatres."

Soil Samples

5. A total of 551 samples from 222 overseas air bases were received, identified, and tested by the Waterways Experiment Station. Correspondence indicated that samples were shipped from 20 additional air bases, but these samples were either lost en route, or had insufficient markings to be identified when received at the Waterways Experiment Station.

6. The airfields from which samples were received are listed geographically in five main groups as shown in table 1; this grouping and the order within each group have been retained in reporting the soils test data.

7. Table 2 shows the breakdown of the soil samples according to sample sizes by weight. It will be noted that the instructions to ship 50-lb samples must have been misconstrued in many instances, because one-half of the samples were less than 30 lb, and one-quarter less than 15 lb. Of the samples larger than 40 lb, those from Italy and the Philippines comprised 70%, the remaining 30% being scattered among the other reporting theatres.

8. It is therefore apparent that limitations were set by the sizes of the samples on the number of compaction and CBR tests which could be performed, and also on the methods of performing such tests without excessive reuse of the materials.

9. In many cases little or no data were furnished with the soil samples concerning their location and depth at the airfield, whether representative of paving aggregate, base course, subgrade or fill. A similar lack of information existed concerning the air fields: type and thickness of pavement and base course, preparation of subgrade; types of using planes; extent of use; performance of the airfield, et cetera.

10. It should be noted that in many cases it appeared that the soils were sampled by non-engineering types of army units, who were not familiar with details of the construction of the fields represented, nor had acquired the techniques and experience necessary to secure representative soil samples.

11. Particular mention is made of the very comprehensive and well-planned survey in connection with the soil sampling carried out by the Investigations Branch of the General Engineer District, APO 75, covering fields in the Philippines and several other Pacific islands. It is

unfortunate that similar surveys of the other overseas air bases reported were not made.

Furnished Data on Theatre Soils Tests and Surveys, and other Pertinent Subjects

12. Supplementary data consisting of soils tests, soil surveys, geological reports, etc., were furnished in various amounts by the following theatres only:

Group B - - - - - - - Italy
Group C - - - - - - - Africa
Group D - - - - - - - India and Burma
Group D - - - - - - - China
Group E - - - - - - - Philippines
Group F - - - - - - - Alaska

13. Such data, other than those pertaining to airfield description, have not been incorporated in this report, as they are beyond the scope of the project directive. These memoranda, letters, and reports are forwarded as inclosures, as listed on the sheets following the text of this report.

Waterways Experiment Station Soils Tests

14. Summaries of all test results are presented in table 3 together with pertinent airfield data and sample descriptions. The following paragraphs are explanations of terms of data shown in this table, and descriptions of testing methods used.

Field classification

15. The source of information for this column was the AAF Installations Directory, 15 March 1946, Headquarters AAF, Washington,

D. C. (Confidential). The following abbreviations are used:

F = fighter
FB = fighter bomber
MB = medium bomber
HB = heavy bomber
VHB = very heavy bomber
T = transport
HT = heavy transport
M = classified by AAF as minor airfield because either used only a short time by tactical units, or constructed or improved at over-all cost to the U. S. of less than $25,000.

Airfield description

16. This column includes data on type of surface, base course, subgrade, and pertinent information on operation, use, and general condition of the field. The following abbreviations are used in this column:

PSP = pierced steel plank
PAP = pierced aluminum plank
PBS = prefabricated bituminous surfacing.

Location

17. As previously mentioned, the information obtained identifying the location of samples was, in many instances, incomplete. However, this column indicates the location at the airfields from which the samples were taken insofar as data were available.

Material

18. This column includes data, where available, on the type of material sampled, such as base course, subgrade, etc. In some instances the depth of sample or thickness of layer are also shown in this column.

Description

19. The sample description includes the color and an appropriate name classification derived from the soil triangle of the Department of the Army Uniform Soil Classification System. The name of a soil is based on both gradation and plasticity characteristics. A copy of the soil triangle is shown on figure 1, together with notes explaining its use. Distinctive soil types such as tuff, volcanic ash, coral, etc., where so identified, are described as such.

Classification symbol

20. The soils were also classified using group symbols of the Department of the Army Uniform Soil Classification System. This system is based upon the one developed by A. Casagrande which was used extensively during World War II as the "Airfield Classification." Pertinent features of the presently used system are shown on figure 2.

Grain sizes

21. The division of grain sizes into major soil types is in accordance with the Department of the Army Uniform Soil Classification. Pertinent size ranges for each group are shown in the column headings; sieve sizes are U. S. Standard. The sand sizes have been broken down into "coarse" and "fine" fractions as an aid in evaluating the gradation of the various soils. Where an appreciable percentage of gravel sizes is present in a sample, the maximum size in inches is also shown.

Atterberg limits

22. Values reported are liquid limit (LL) and plasticity index

(PI). The limits tests were performed on that portion of the soil sample passing the No. 40 U. S. Standard sieve.

Specific gravity

23. The specific gravity tests were performed on that portion of a soil sample passing the No. 4 U. S. Standard sieve. The test was performed in a volumetric flask and air was evacuated by subjecting the soil and water to a vacuum.

Modified AASHO compaction tests

24. Because of the small quantity of material available for testing, all compaction tests were performed using the standard Proctor mold. The soil sample (< 1/4 in.) was compacted in five layers with 25 blows on each layer produced by free fall of 18 in. of a 10-lb hammer with a 2-in.-diameter striking face. The optimum water content (w in per cent of dry weight) and the maximum dry density (γ d) under the above conditions are shown in the table.

CBR tests

25. Because of the small quantity of each sample available (rarely more than 50 lb) the standard procedures for conducting the CBR tests* could not be followed entirely; however, the values reported are believed reasonable as discussed below. All specimens were soaked four days top

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* TB5-253-1, "Soil Testing Set No. 1 and Expedient Tests," War Department, June 1945, and T.M. 213-1, "The California Bearing Ratio Test as Applied to the Design of Flexible Pavements for Airports," Waterways Experiment Station, 1 July 1947.

and bottom. The penetration test was performed using a Baldwin-Southwark constant strain testing machine. A uniform surcharge load of 10 lb was applied to each specimen during the soaking and penetration testing.

26. The values reported in the CBR column of table 3 represent the CBR of coarse-grained soils compacted to 100% of modified AASHO maximum density and the CBR of fine-grained soils compacted to 95% of modified AASHO maximum density, and at the optimum moisture content for modified AASHO compaction. These densities are in accordance with design procedures for airfields currently used by the Corps of Engineers as shown in Chapter XII, Part 2 of the Engineering Manual. The CBR values are based on test data, but have in some cases been adjusted to compensate for variations in density and moisture content in the test from the standards listed above. Adjustment has also been made to compensate for variations from the standard procedure for conducting the CBR test. The adjustments are believed reasonable since they are based upon a considerable number of CBR tests on a variety of materials performed previously by the Waterways Experiment Station in which the effect of the above-mentioned variables was investigated.

Swell

27. Values of swell were obtained for the CBR samples after 4 days soaking. In table 3 swell is reported as "low" or "high." Swell values of 3 per cent or less were classed as "low," whereas values over 3 per cent were classed as "high."

REPORTS AND OTHER DATA FURNISHED IN CONNECTION WITH SOIL SAMPLES FROM OVERSEAS AIR BASES

Group B: Italy:

Incl. 1. Airfield Status Report 15 July 1945, Hq AAF Engr. Command, MTO

Group C: Africa: (French Airfield Survey Reports)

(a) Algeria

Incl 1. Blida
Incl 2. La Reghaia
Incl 3. Bougie
Incl 4. Djidjelli
Incl 5. Taher
Incl 6. Philippeville
Incl 7. Bone
Incl 8. Biskra
Incl 9. Navarin
Incl 10. St. Donat
Incl 11. Chateaudun du Rhumel
Incl 12. Timeslet
Incl 13. Telergma
Incl 14. Berteaux No. 1
Incl 15. Berteaux No. 2
Incl 16. Ain M'Lila
Incl 17. Le Kroub
Incl 18. Canrobert
Incl 19. Montesquieu
Incl 20. Tebessa

(b) Laghouat

Incl 21. Laghouat

Group D: India and Burma; China:

Part 1. Furnished by theatre:

Incl. 1 - Ltr, Hq AAF-IBT, dated 22 October 1945, subject: "Soil Samples."
Incl. 2 - Booklet, "USAAF Airfields, 'ia-Burma," Office of the Air Engineer CBI-/ (in dupl.).
Incl. 3 - "Airfield Status Map," IB-ASC, Office of the Air Engineer, 15 April 1945.
Incl. 4 - Geological Report, Midnapore District, 15 November 1944.

Incl. 5 - Ltr, Hq SOS, USF, CBI, dated 24 February 1944, subject: "Design of VLR Fields."
Incl. 6 - Memo to District Engr, Engr Dist #10, 1 April 1944, subject: "Test Section using Moorum Base."
Incl. 7 - Ltr, Engr Dist #10, dated 4 May 1944, subject: "Subgrade Tests."
Incl. 8 - Memo to Chief Engineer, L of C Command, dated 4 January 1945, subject: "Tests - Elephant (Maugdaw) and Teknaf Airfield Sites."
Incl. 9 - Memo to Chief Engineer, 14th Army, dated 25 October 1944, subject: "Tests - Cox's Bazaar Airfield."
Incl. 10 - Memo to Chief Engineer, L of C Command, dated 12 December 1944, subject: "Tests on Soil Cement, Chiringa Airfield."
Incl. 11 - Ltr, Hq IB-ACS, dated 5 February 1945, subject: "Soil Reconnaissance Proposed Kyaukpyu Airfield."
Incl. 12 - Memo, Hq IB-ACS, 10 April 1945, subject: "Soil Reconnaissance - Airfield Sites on Akyab Island."
Incl. 13 - Memo, Hq IB-ACS, 10 April 1945, subject: "Hathazari Airfield."
Incl. 14 - Memo, Hq IB-ACS, 24 June 1945, subject: "Airfields in the Rangoon Area."
Incl. 15 - Memo, Hq IB-ACS, 15 August 1945, subject: "Soils Tests-Myingyan Airfield, Burma."
Incl. 16 - Memo, Hq IB-ACS, 31 May 1945, subject: "Soils Tests-Shwebo and Onbauk Airfields."
Incl. 17 - Ltr, Engr Dist #10, 6 March 1944, subject: "Tests on Concrete Aggregates."

Part 2. <u>Furnished by Office of Air Engineer, AAF, Washington, D.C.:</u>

Incl. A - "Final Report, B-29 Air Bases - India," Construction Service SOS USAF, CBI, November 1944 (Restricted).
Incl. B - "Construction of Airfields in North Burma," Air Engineer, ASF, IB 15 July 1945 (Restricted).
Incl. C - "Survey of Burma (Extract)," Command and General Staff School, Fort Leavenworth, Kansas (Restricted).

Part 3.

Incl. 1 - Soil Tests - Linan Airfield.
Incl. 2 - Soil Tests - Mengtze Airfield.
Incl. 3 - Soil Tests - Tatum #1 Airfield.
Incl. 4 - Soil Tests - Tatum (Chaopa) Airfield.

Part 4.

Incl. A - List of soil samples sent.
Incl. B - Map showing location of airfields.
Incl. C - Soils Survey - Chanyi Airfield.
Incl. D - Soils Tests - Hsinching Area.
Incl. E - Soils Survey - Luliang Airfield.
Incl. F - Supplementary Airfield Data.

Group E: Philippine and Other Pacific Islands:

Part 1. Airfield and Sample Data on Fields from Which Samples Were Forwarded:

Incl. 1 - Luzon Island (in dupl).
Incl. 2 - Mindoro Island.
Incl. 3 - Leyte, Samar, Cebu, Negros, and Mactan Islands (in dupl).
Incl. 4 - Mindanao, Palawan, Palau, Biak, and Los Negros Islands (in dupl).

Part 2. Various Reports on Airfields in the Philippine Islands:

Incl. P-2-a-(1): Soils Report on Nichols Field, NW-SE Runway and Taxiway, 8 April 1945.
Incl. P-2-b-(1): Specifications for Construction of Neilson Airdrome, 15 April 1945.
Incl. P-2-c-(1): Report on Evaluation of Clark Field, Florida Blanca and Porac Airdromes, 5 August 1945 (Inclosure missing).
Incl. P-2-c-(2): Photographic Report for March 1945. Clark Field Engr Area.
Incl. P-2-d-(1): Soil Profile, Proposed Taxiway, Florida Blanca Airdrome, June 1945.
Incl. P-2-d-(2): Operational Photos, Florida Blanca Airfield, 1 July 1945.
Incl. P-2-d-(3): Operational Photos, Florida Blanca Airfield, 1 September 1945.
Incl. P-2-d-(4): Specification for Double Asphalt Surface Treatment, Florida Blanca and Porac Airfields, 21 April 1945.
Incl. P-2-e-(1): Soils Investigation of C-47 Strip at San Fernando, La Union, 8 November 1945 (Inclosure missing).
Incl. P-2-e-(3): Photographic Report, Lingayen Area, February 1945.
Incl. P-2-e-(4): Photographic Report, Lingayen Area, March 1945.

Group F: Alaska:

Incl. 1 - Stabilization of Beach Gravel for Runway Construction at Point Spencer, Alaska, 31 August 1945 (Restricted).

TABLE 1

GEOGRAPHICAL BREAKDOWN OF FIELDS AT WHICH SOIL SAMPLES WERE TAKEN

Group	Subgroup: Country or Island		No. Fields	Total Fields in Group
A. Germany, Austria and France	(1) Germany		19	
	(2) Austria		1	
	(3) France		1	21
B. Italy				43 (2)
C. Africa	(1) Rio de Oro		1	
	(2) French Morocco		3	
	(3) Algeria:			
	(a) Oran area	6 (1)		
	(b) Algiers area	2 (1)		
	(c) Constantine area	20		
	(d) Chardaia area	1		
	(e) Touggourt area	1	30 (2)	
	(4) Tunisia		28 (2)	
	(5) Libya		1	
	(6) French West Africa		1	
	(7) Gold Coast		2	
	(8) French Equatorial Africa		1	
	(9) Belgian Congo		2	
	(10) Nigeria		3	
	(11) Anglo-Egyptian Sudan		3	
	(12) Eritrea		2	
	(13) Egypt		(1)	77 (4)
D. Near East, India, Burma, and China	(1) Near East:			
	(a) Turkey	2		
	(b) Syria (Lebanon)	1		
	(c) Palestine	1		
	(d) Iraq	1		
	(e) Iran	1		
	(f) Saudi Arabia	4	10	
	(2) India:			
	(a) United Provinces	1		
	(b) Bombay	1		
	(c) Bengal	9 (1)		
	(d) Assam	1 (1)		
	(e) Mysore	(1)	12 (3)	
	(3) Burma:		4	
	(4) China:			
	(a) Shensi Province	3		

( ) = Samples from fields either lost enroute or unidentified.

TABLE 1 (Cont.)

GEOGRAPHICAL BREAKDOWN OF FIELDS AT WHICH SOIL SAMPLES WERE TAKEN

Group	Subgroup: Country or Island		No. Fields	Total Fields in Group
	(b) Szechwan Province	4 (1)		
	(c) Hunan Province	2		
	(d) Kweichow Province	3		
	(e) Yunnan Province	2		
	(f) Kwangsi Province	2	16 (1)	42 (4)
Pacific Islands:				
E. Philippine, Palau and Admiralty Islands; and New Guinea Area	(1) Philippine Islands:			
	(a) Luzon	9		
	(b) Mindoro	4		
	(c) Palawan	1		
	(d) Negros	1		
	(e) Cebu	2		
	(f) Leyte	4		
	(g) Samar	1		
	(h) Mindanao	2	24	
	(2) Palau Group - Peleliu		1	
	(3) Admiralty Islands - Los Negros		1	
	(4) New Guinea Area - Biak		1	27
F. Hawaiian Islands, Alaska, and Aleutian Islands	(1) Hawaiian Islands (Oahu)		3	
	(2) Alaska		6 (9)	
	(3) Aleutian Islands:			
	(a) Umnak	1		
	(b) Atka	1		
	(c) Adak	1		
	(d) Shemya	(1)	3 (1)	12 (10)
	TOTALS			222 (20)

( ) = Samples from fields either lost enroute or unidentified.

TABLE 2

BREAKDOWN OF SAMPLES ACCORDING TO SAMPLE SIZE

Geographical Group		10-15 Lb	20-30 Lb	40-50 Lb	Over 50 Lb	Total Number
Group A:	Germany	5	31	12	2	50
	Austria	1	-	-	-	1
	France	-	3	6	-	9
Group B:	Italy	-	-	124	-	124
Group C:	Africa: Algeria	73	15	-	-	88
	Tunisia	21	8	19	1	49
	Others	27	5	10	5	47
Group D:	Near East	-	6	6	5	17
	India	-	20	6	-	26
	Burma	-	12	-	-	12
	China	5	9	2	-	16
Group E:	Philippine Islands	-	-	49	18	67
	Other Pacific Islands	-	-	2	1	3
Group F:	Hawaiian Islands (Oahu)	-	10	-	-	10
	Alaska and Aleutian Islands	-	27	5	-	32
	TOTALS	132	146	241	32	551

TABLE 3: SUMMARY OF AIRFIELD TEST DATA

Group A: Germany, Austria, France

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes								Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	Max. γ	CBR	Swell
(1) GERMANY:																			
Northolz (Fassberg)	53 46 N 03 39 E	FB	Surface: 6" concrete runway (German) Base: None Subgrade: 6" to 8" black loam over fine sand General: Field begun in 1942. Condition good. Used by fighters	-	Topsoil	Black silty sand	SM	-	0	22	55	23	N P		-	-	-	-	-
				-	Topsoil	Black silty sand	SM	-	0	25	62	13	N P		-	-	-	-	-
				-	Subsoil	Tan fine sand	SP	-	0	30	70	0	N P		-	-	-	-	-
Northwestern (Kassel)	51 23 N 09 32 E	FB	Surface: PSP runway and taxiway General: Good condition	-	Base course (?)	Brown clay	ML	-	0	0	14	52	30	7	-	-	-	-	-
				-	Subgrade	Brown clay	CL	-	0	0	3	97	30	9	-	-	-	-	-
Waldau (Kassel)	51 16 N 09 30 E	FB	Surface: 6" concrete runway with PSP extension Base: None under concrete, 6" pit run gravel under PSP Subgrade: Clay General: Moderate traffic. PSP in fair cond.	Beneath concrete	Subgrade	Brown & gray clay	CL	-	0	1	7	92	39	13	-	14	117		low
				Beneath PSP	Base course	Brown sandy gravel	GW	1-1/2	72	13	12	3	N P		-	-	-	-	-
Fritzlar	51 07 N 09 17 E	FB	Surface: PSP Base: 10 in. gravel General: Considerable fighter and transport traffic. Condition excellent	-	Subgrade	Silty sand	SM	-	0	39	42	20	N P		-	-	-	-	-
				-	Base course	Brown clayey gravel	GC	2	72	4	2	22	32	10	-	13	115	40	low
Eschborn (Frankfurt)	50 08 N 08 33 E	F	Surface: PSP runway and taxiway Base: 6" to 10" rubble on runway Subgrade: 20" of sandy clay General: Condition fair. Heavy transport traffic	Runway	Base course	Bricks, rocks & sandstone	GP	3	1	0	0	0	N P		-	-	-	-	
				Taxiway	Base course	Black cinders	GW	1-1/2	61	25	11	3	N P		1.64	-	-	-	-
				-	Subgrade	Brown clay	CH	-	2	2	13	83	51	26	-	-	-	-	-
Langendieback (Hanau)	50 10 N 08 58 E	T	No information	Runway shoulder	-	Gray & tan clay	CH	-	0	0	7	93	65	30	-	-	-	-	-
				Runway shoulder	-	Gray sandy clay	CL	-	0	14	24	62	29	9	-	-	-	-	-
				Runway shoulder	-	Brown clay	MH	-	0	4	4	92	64	22	-	-	-	-	-
				Concrete apron shoulder	-	Brown sandy clay	MH	-	0	13	19	68	53	20	-	-	-	-	-
				Taxiway shoulder	-	Brown sandy clay	MH	-	0	12	17	71	51	22	-	-	-	-	-
Rhein-Main (Frankfurt)	50 02 N 08 35 E	HB	Surface: 8" concrete over 6" concrete runway (German) (see Note) Base: None	Near west end runway	Subgrade	Tan coarse to fine sand	SW	-	2	45	49	4	N P		2.59	-	-	-	-
				Emergency landing strip	-	Black cinders	-	-	-	-	-	-	-		-	-	-	-	-
				Near east end runway	Subgrade	Tan silty sand	SM	-	2	53	30	15	N P		2.61	-	-	-	-
				-	-	Gravelly sand	SP	3/4	19	46	30	5	N P		-	-	-	-	-
Weistaden	50 03 N 08 20 E	MB	Surface: 8" concrete runway. Concrete, PSP and Tarmac taxiway Base: None under runway Subgrade: Clay General: Heavy traffic. Excellent condition	Shoulder, concrete taxiway	-	Brown clay	CL	-	0	2	10	88	36	15	2.63	-	-	-	-
				Agg. stockpile	-	Gray rock	-	-	-	-	-	-	N P		-	-	-	-	-
				Shoulder PSP taxiway	-	Brown medium gravel	GP	1	87	6	7	0	N P		2.60	-	-	-	-
Tiebelstadt	49 39 N 09 59 E	HB	Surface: Concrete runway and taxiway	1000' west of west end runway	-	Brown clay	CL	-	0	0	0	100	49	30	2.68	-	-	-	-
				Near east end runway	-	Brown clay	CL	-	0	0	4	96	35	15	2.66	-	-	-	-
				Near south taxiway	-	Brown clay	CL	-	0	0	8	92	42	29	2.67	16	113	-	-
				Near north taxiway	-	Brown clay	CL	-	0	7	4	89	43	29	2.71	15	112	-	-
Bayreuth	49 59 N 11 55 E	T	No information on samples received																
Furth (Nuremberg)	49 30 N 10 51 E	F	Surface: PAP Base: 6-inch sand General: Considerable light traffic. Runway in good cond. Taxiway deteriorating under wet weather operations	-	Subgrade	Brown coarse to fine sand	SW	-	2	63	25	5	N P		-	11	117	53	low
				Runway	Base course	Brown gravelly sand	SW	3/8	24	69	6	0	N P		-	-	-	-	-
				Taxiway	Base course	Gray & brown coarse sand	SP	-	2	80	18	0	N P		-	-	-	-	-

Note: Soil investigations available to Waterways Experiment Station show this underlying pavement to be soil cement. It extends about 1000 feet from the west end of the runway. The subgrade is a course to [illegible] sand with a LL of about 35 percent and a subgrade modulus, "K", of about 300.

Best Available Copy

TABLE 1: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group A: Germany, Austria, France

AIRFIELD				AVOIDE				SOIL TESTS											
								Grain size											
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel Sizes 3 in. to No. 4 Sieve	% Coarse Sand Sizes No. 4 to No. 10 Sieve	% Fine Sand Sizes No. 10 to No. 200 Sieve	% Fines Sizes No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Mod. AASHO Compaction Opt. W %	Mod. AASHO Compaction Max. γ d	CBR	Swell
Straubing	48 54 N 12 33 E	FB	Surface: PCP on thin sand and gravel layer Base: 9 in. to 12 in. rock General: Medium traffic. Good condition.	-	Thin textile layer	Brown sandy gravel	GP	1	14	17	-	2	N P		-	-	-	-	-
					Subgrade	Brown clay	CL	-	-	-	5	34	31	10	-	-	-	-	-
Augsburg	48 23 N 10 54 E	T	Surface: PCP Base: 10" to 12" gravel replacing stripped topsoil Subgrade: Gravel 15 to 20 feet thick General: Good condition.	Borrow pit sample	Base course	Tan sandy gravel	GW	1	72	5	17	6	N P		2.70	-	-	-	-
Lechfeld	48 11 N 10 51 E	FB	Surface: 10 in. concrete Base: 12 in. base course General: Condition fair. Numerous cracks in concrete	-	Subgrade	Medium gravel	GW	1-1/2	74	4	-	3	N P		-	-	-	-	-
				Borrow pit sample	Base course	Medium to fine gravel	GW	1	55	9	12	3	N P		-	-	-	-	-
Furstenfeldbruck (Munich)	48 12 N 11 17 E	FB	Surface: 8 in. concrete runway Base: 8 in. to 10 in. gravel base Subgrade: Gravel General: Good condition.	Runway	Subgrade	Gray sandy gravel	GW	1	77	10	13	0	N P		-	-	-	-	-
				Runway	Subgrade	Gray sandy gravel	GW	1-1/2	76	13	13	0	N P		-	-	-	-	-
				Taxiway	Subgrade	Gray sandy gravel	GW	1	68	12	20	0	N P		-	-	-	-	-
Oberpfaffenhofen (Munich)	48 05 N 11 17 E	FB	Surface: (Conc. runway (German). Conc. runway extension and taxiway on subsoil (see Note) Base: None Subgrade: Topsoil 1' thick for a depth of one foot. Subsoil sand and gravel	-	Topsoil	Brown sandy clay	OH	-	5	7	19	69	61	16	-	22	93	5	Low
				-	Subsoil	Gravel and sand	-	-	Sample missing										
Schleissheim (Munich)	48 14 N 11 33 E	MB	Surface: 8" conc. runway (German). Runway extension & taxiway directly on subgrade, except PCP taxiway on 12" gravel base Base: 12" gravel under PCP Subgrade: Gravel throughout at 12" to 20" depth General: Moderate traffic. Condition good	West runway, extension	Subgrade	Brown sandy gravel	GW	1	82	11	7	0	N P		-	-	-	-	-
				German runway	Subgrade	Tan medium gravel	GP	1-1/2	92	5	3	0	N P		-	-	-	-	-
				PCP taxiway	Base course	Tan sandy gravel	GW	1	77	6	12	0	N P		-	-	-	-	-
				East runway extension	Subgrade	Gravel	GP	2	92	1	3	0	N P		-	-	-	-	-
Fraing	48 17 N 11 50 E	T	No information	-	Subgrade	Brown sandy clay	CL	-	2	0	25	75	31	14	-	10	119	16	Low
				Borrow pit	Base course	Coarse to fine gravel	GP	2	25	8	7	0	N P		-	-	-	-	-
Reim (Munich)	48 07 N 11 42 E	T	Surface: PCP Base: 14-inch General: Considerable transport traffic. Good condition.	-	Subgrade(1)	Silty gravel	GM	1-1/2	3	7	4	11	N P		-	-	-	-	-
				-	Base course	Coarse to medium gravel	GW	2	81	9	0	0	N P		-	-	-	-	-
(2) AUSTRIA: Tulln (Vienna)	48 18 N 16 05 E	T	No information	-	Subgrade	Gray sandy clay	CL	-	0	2	43	5	27	7	-	-	-	-	-
(3) FRANCE: Istres Le Tube (Marseilles)	43 31 N 04 59 E	MB	General: Main taxiway under construction (PCP to be used) Dry weather runway - natural ground compacted & oiled. Good condition All weather runways - 1" asphalt on 4" Telford base. PCP is 6" conc. Excellent condition North taxiway - natural ground compacted and oiled. Fair condition South taxiway - PCP on 12" pit-run gravel. Good condition South apron - PCP on 12" pit-run gravel. Excellent condition North apron - 2" x 1" x 2' conc. slats on 2" conc. over 12" crushed rock. Excellent condition West apron - natural ground compacted and oiled. Fair condition	Main taxiway	Subgrade	Brown sandy silt	ML	-	2	6	30	64	25	6	-	-	-	-	-
				Dry weather runway	-	Brown sandy silt	ML	-	0	-	35	56	24	2	-	-	-	-	-
				All weather runways	Subgrade	Brown sandy silt	ML	-	0	6	35	56	25	6	-	-	-	-	-
				North taxiway	-	Red sandy clay	CL	-	0	6	32	62	25	7	-	-	-	-	-
				South taxiway	Subgrade	Brown clayey gravel	GC	1	75	5	3	17	26	7	-	-	-	-	-
				South taxiway sample from borrow pit	Base course	Gray coarse to medium gravel	GP	2	83	4	10	3	N P		-	-	-	-	-
				South apron	Subgrade	Red sandy silt	ML	-	2	12	24	58	21	[illegible]	-	-	-	-	-
				North apron	Base course	Brown sandy gravel	GW	1-1/2	84	5	6	0	N P		-	-	-	-	-
				West apron	-	Brown sandy silt	ML	-	0	4	33	63	24	[illegible]	-	-	-	-	-

Note: This is one of the best fields in Germany. The topsoil sample is not the subgrade material under the runway.

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group B: Italy

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes								Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size > In.	% Gravel No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines < No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. %	Max. γd	CBR	Swell
Bologna	44 32 N 11 18 E	F	Surface: Turf	-	Subgrade	Brown sandy clay	CL	-	0	1	39	60	35	15	-	-	-	-	-
				-	Base course	Brown medium gravel	GP	1-1/2	100	0	0	0	N	P		-	-	-	-
Bevagnanta	44 41 N 11 44 E	M	Surface: Turf Base: None	-	-	Brown sandy gravel	GW	3/4	62	20	16	2	N	P	-	-	-	-	-
Forli	44 12 N 12 04 E	MB	Surface: Tarmac with PSP extension	-	Base course	Brown sandy gravel	GP	1-1/2	77	15	6	2	N	P	-	-	-	-	-
				-	Subgrade	Brown sandy clay	CL	-	0	2	33	65	34	15	-	-	-	-	-
Cesenatico	44 13 N 12 23 E	M	Surface: PSP Base: None	-	-	Silty fine sand	SM	-	0	2	84	14	N	P	-	-	-	-	-
Rimini	44 01 N 12 37 E	MB	Surface: PSP Base: Gravel	-	Subgrade	Gray sandy clay	CL	-	0	3	22	75	42	22	-	-	-	-	-
				-	Base course	Coarse to medium gravel	GP	2	91	2	7	0	N	P	-	-	-	-	-
Cattolica	43 58 N 12 41 E	MB	Surface: PSP	-	Subgrade	Brown sandy clay	CL	-	0	1	21	78	50	19	-	12	120	12	Low
				-	Base course	Brown sandy gravel	GW	1	83	6	10	1	N	P	-	-	-	-	-
Pesaro	43 50 N 13 01 E	MB	Surface: PSP Base: Gravel	-	Subgrade	Gray medium gravel	GW	1-1/2	87	3	6	4	N	P	-	-	-	-	-
				-	Base course	Gray coarse to fine gravel	GW	1-1/2	85	7	6	2	N	P	-	-	-	-	-
Ptagielino	43 43 N 13 05 E	T	Surface: PSP Base: Gravel	-	Subgrade	Brown clay	CH	-	0	0	6	94	52	34	-	-	-	-	-
				-	Base course	Medium gravel	GP	1-1/2	92	4	4	0	N	P	-	-	-	-	-
Mondolfo	43 45 N 13 09 E	MB	Surface: PSP Base: Gravel	-	Subgrade	Medium gravel	GP	1-1/2	100	0	0	0	N	P	-	-	-	-	-
				-	Base course	Medium gravel	GP	1	100	0	0	0	N	P	-	-	-	-	-
Falconara	43 37 N 13 22 E	MB	Surface: PSP Base: Gravel	-	Subgrade	Medium gravel	GP	1	100	0	0	0	N	P	-	-	-	-	-
				-	Base course	Medium gravel	GP	1	100	0	0	0	N	P	-	-	-	-	-
Iesi	43 32 N 13 16 E	M	Surface: Tarmac with PSP extension Base: Gravel	-	Subgrade	Clay	CL	-	1	3	2	94	49	26	-	-	-	-	-
				-	Base course	Medium gravel	GP	1	98	2	0	0	N	P	-	-	-	-	-
Trigno	42 04 N 14 46 E	M	Landing strip	Northwest taxiway	2 ft depth	Tan fine sand	SP	-	0	12	88	0	N	P	-	-	-	-	-
				Landing strip	2 ft depth	Tan fine sand	SP	-	0	8	86	6	N	P	-	-	-	-	-
				Southwest taxiway	2 ft depth	Tan fine sand	SP	-	0	16	84	0	N	P	-	-	-	-	-
Cutella	42 03 N 14 49 E	M	Landing strip	SW taxiway	2 ft depth	Tan fine sand	SP	-	0	4	90	6	N	P	-	-	-	-	-
				-	2 ft depth	Tan fine sand	SP	-	0	1	99	0	N	P	-	-	-	-	-
				-	2 ft depth	Tan gravelly sand	SP	1-1/2	17	11	72	0	N	P	-	-	-	-	-
Biferno	41 58 N 15 03 E	M	Surface: PSP runway and taxiway	Runway	2 ft depth	Tan fine sand	SP	-	0	13	78	9	N	P	-	-	-	-	-
				Northwest taxiway	2 ft depth	Brown coarse to fine sand	SW	1/10	10	19	64	7	N	P	-	-	-	-	-
				Southwest taxiway	2 ft depth	Tan fine sand	SP	-	0	15	85	0	N	P	-	-	-	-	-
Manfredi	41 54 N 15 01 E	F	No information	North taxiway	2 ft depth	Brown sandy clay	CL	-	0	5	15	80	49	22	-	-	-	-	-
				Runway	2 ft depth	Brown clay	CL	-	0	2	15	83	41	19	-	-	-	-	-
				South taxiway	2 ft depth	Brown clay	CL(?)	-	0	2	12	86	-	-	-	-	-	-	-
Cerno	41 56 N 15 04 E	F	Surface: PSP and brick runway. PSP on gravel taxiway	Northeast taxiway	2 ft depth	Brown clay	CL	-	0	3	15	82	50	25	-	-	-	-	-
				Northwest taxiway	2 ft depth	Brown clay	CH	-	0	3	9	88	67	41	-	-	-	-	-
				Runway	2 ft depth	Brown clay	CL	-	0	3	15	82	45	25	-	-	-	-	-
Madna	41 55 N 15 05 E	F	No information	Runway	2 ft depth	Brown clay	CL	-	0	4	13	83	44	23	-	-	-	-	-
				Southwest taxiway	2 ft depth	Brown clay	CH	-	0	2	9	89	57	32	-	-	-	-	-
				South taxiway	2 ft depth	Brown clay	CL(?)	-	3	4	11	82	-	-	-	-	-	-	-
Lesina	41 52 N 15 19 E	F	Surface: PSP runway and taxiway	Southwest taxiway	-	Brown clay	CL	-	0	3	15	82	45	27	-	-	-	-	-
				-	-	Brown clay	CH	-	0	2	13	85	55	33	-	-	-	-	-
				-	-	Brown clay	CL	-	0	1	16	83	42	20	-	-	-	-	-

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group B: Italy

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes							Mod. AASHO Compaction				
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	Max. γ_d	CBR	Swell
San Severo	41 43 N 15 26 E	MB	Surface: Runway - gravel, oiled Taxiway - gravel Landing strip - gravel	Runway East taxiway West taxiway	- - -	Brown sandy clay Brown clay Brown sandy clay	CL CH CL	- - -	0 0 0	1 1 1	21 14 21	78 85 78	- [illegible] [illegible]	- 40 17	- - -	- - -	- - -	- - -	- - -
Sterparone	41 46 N 15 13 E	MB	Surface: Landing strip - oiled Taxiway - gravel, oiled	North taxiway Southwest taxiway "	3 ft depth 3-1/2 ft depth "	Brown clay Brown clay Crushed rock	CL CL GW	- - 1-1/2	3 0 52	2 1 23	5 11 19	90 88 6	[illegible] [illegible] N.P.	[illegible] [illegible]	- - -	- - -	- - -	- - -	- - -
Salsola	41 33 N 15 27 E	MB	No information	Taxiway Runway Taxiway	2 ft depth 2 ft depth 2 ft depth	Brown clay Tan clay Brown clay	CH CL CL	- - -	0 0 0	1 6 0	11 9 14	53 85 86	[illegible] [illegible] [illegible]	34 [illegible] [illegible]	- - -	- - -	- - -	- - -	- - -
Triolo	41 37 N 15 27 E	MB	Surface: Oiled landing strip	East taxiway Landing strip Southeast taxiway	2 ft depth 2 ft depth 2 ft depth	Brown clay Brown clay Brown clay	CH CH CH	- - -	0 0 0	0 - 2	9 10 18	91 83 80	58 52 51	32 26 [illegible]	- - -	- - -	- - -	- - -	- - -
Celsus	41 33 N 15 34 E	MB	Surface: PSP runway	West taxiway West runway East taxiway	2 ft depth 2 ft depth 2 ft depth	Brown clay Brown clay Brown clay	CH CH CH	- - -	0 0 1	1 9 8	8 9 8	91 91 91	53 52 52	[illegible] 24 28	- - -	[illegible] [illegible] 24	96 96 98	12 12 10	Low Low Low
Lucera	41 30 N 15 25 E	MB	Surface: Runway - PSP Taxiway - gravel, oiled	Northwest taxiway Northeast taxiway Runway	2 ft depth 2 ft depth 2 ft depth	Brown sandy clay Brown sandy clay Brown sandy clay	CL CL CL	- - -	0 0 0	4 9 3	11 29 21	78 62 76	33 32 44	11 11 [illegible]	- - -	- - -	- - -	- - -	- - -
Vincenza	41 25 N 15 27 E	F	Surface: Runway - sod, oiled Taxiway - sod	Runway Southeast taxiway Northwest taxiway	2 ft depth 2 ft depth 2 ft depth	Brown sandy clay Brown clay Brown sandy clay	CL CL ML	- - -	0 0 0	4 1 1	23 17 21	73 82 78	31 40 34	9 15 9	- - -	- 20 -	- 100 -	- 15 -	- Low -
Foggia Main	41 26 N 15 32 E	MB	Surface: Northsouth runway - asphalt Eastwest runway - gravel, oiled Taxiway - asphalt and gravel	Northsouth runway Eastwest runway Southeast taxiway East taxiway	2 ft depth 2 ft depth 2 ft depth 2 ft depth	Brown sandy clay Brown sandy clay Brown sandy clay White crushed chalk	ML CL ML ML	- - - -	1 1 0 0	5 3 3 4	29 20 25 18	65 76 72 78	31 [illegible] 34 29	7 [illegible] 8 4	- - - -	- - - -	- - - -	- - - -	- - - -
Amendola	41 33 N 15 42 E	MB	Surface: Tufa runway and taxiway. Oiled landing strip	Runway Northwest taxiway South runway West taxiway	2 ft depth 2 ft depth 2 ft depth 2 ft depth	Dark brown clay Dark brown clay Dark brown clay Dark brown sandy clay	MH CH CL CL	- - - -	0 0 0 0	0 4 2 2	13 15 17 22	87 81 81 76	50 51 42 42	21 26 19 18	- - - -	- - - -	- - - -	- - - -	- - - -
Torterella	41 29 N 15 39 E	MB	Surface: 2 runways - oiled tufa Taxiway - gravel	East runway South taxiway Southwest taxiway West runway	2 ft depth 2 ft depth 2 ft depth 2 ft depth	Brown clay Brown sandy clay Brown clay (?) Brown sandy clay	CL CL ML CH	- - - -	0 0 - 0	0 3 - 23	11 21 - 25	89 76 - 52	38 37 36 54	13 14 11 28	- - - -	- - - -	- - - -	- - - -	- - - -
Castelluccio	41 19 N 15 33 E	MB	No information	Taxiway Runway Taxiway	2 ft depth 2 ft depth 2 ft depth	Brown sandy clay Brown sandy clay Brown sandy clay	ML ML ML	- - -	0 5 0	2 6 4	20 26 25	78 65 71	34 33 31	10 6 7	- - -	- - -	- - -	- - -	- - -
Sterrara	41 17 N 15 44 E	MB	Surface: Runway - gravel, ends oiled. Rock at 2 ft depth Taxiway - gravel	Runway shoulder Taxiway Taxiway	2 ft depth 2 ft depth 2 ft depth	Brown sandy clay Brown sandy clay Brown sandy clay	CL ML ML	- - -	0 0 0	3 3 4	33 39 37	64 58 64	33 30 39	9 2 6	- - -	- - -	- - -	- - -	- - -
Gielia	41 18 N 15 50 E	MB	Surface: Runway - gravel, oiled Taxiway - gravel	Runway Southeast taxiway	- -	Light gray sandy silt Silty sandy gravel	ML GM	- 1	0 58	3 14	42 17	55 13	22 N P	4 -	- -	15 15	108 112	25 50	Low Low
San Giovanni	41 14 N 15 48 E	MB	Surface: 2 runways - gravel, ends PSP Taxiway - gravel	- East runway West runway Southwest taxiway	2 ft depth 2 ft depth 2 ft depth 2 ft depth	Brown clay Brown clay Brown clay Brown clay	CH CL CL CH	- - - -	0 1 0 0	2 4 3 [illegible]	17 14 14 17	81 81 83 80	51 46 44 47	25 20 21 [illegible]	- - - -	- - - -	- - - -	- - - -	- - - -

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group B: Italy

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes								Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	Max. γd	CBR	Swell
Torretta	41 11 N 15 46 E	MB	Surface: 2 runways - gravel, with PSP Taxiway - gravel	West runway	2 ft depth	Brown sandy clay	CL	-	2	4	18	76	41	19	-	-	-	-	-
				East runway	2 ft depth	Brown clay	MH	-	0	2	14	84	61	23	-	-	-	-	-
				West taxiway	2 ft depth	Brown sandy clay	CL	-	1		27	69	34	16	-	-	-	-	-
				Southwest taxiway	2 ft depth	Brown sandy clay	CH	-	0	4	30	66	56	31	-	-	-	-	-
Pantanella	41 06 N 15 55 E	MB	Surface: Runway - PSP Taxiway - gravel	Shoulder south runway	2 ft depth	Brown sandy clay	CL	-	0	0	25	75	43	14	-	19	106	4	Low
				Shoulder north runway	2 ft depth	Brown clay	MH	-	0	1	14	85	63	23	-	25	92	7	Low
				North taxiway	2 ft depth	Brown sandy clay	CL	-	0	2	28	70	34	16	-	13	107	8	Low
				South taxiway	2 ft depth	Brown sandy clay	CH	-	3	3	20	74	63	37	-	-	-	-	-
Bari	41 08 N 16 47 E	MB	Surface: Runway - gravel, oiled Runway - tufa Taxiway - oiled	South taxiway	2 ft depth	Brown clay	CL	-	0	1	13	86	31	13	-	-	-	-	-
				North of runway	2 ft depth	Brown clay	MH	-	0	0	7	93	58	26	-	-	-	-	-
				South taxiway	2 ft depth	Brown clay & crushed rock	CL	-	-	-	-	-	36	13	-	-	-	-	-
Venosa	41 00 N 15 52 E	MB	Surface: Runway - PSP Taxiway - gravel	Near runway	-	Brown clay (organic)	CH	-	2	3	12	83	61	41	-	-	-	-	-
				-	-	Brown clay (organic)	CH	-	1	3	13	83	61	36	-		-	-	-
				North taxiway	-	Brown clay (organic)	OH	-	0	4	10	86	57	26	-	-	-	-	-
Spinazzola	40 57 N 16 15 E	MB	Surface: Runway - PSP on tufa Taxiway - tufa	-	-	Brown sandy clay	CH	-	0	0	24	76	57	23	-	-	-	-	-
				South taxiway	-	Dark brown clay	CL	-	0	1	14	85	39	19	-	-	-	-	-
				North taxiway	-	Brown sandy clay	CL	-	0	4	22	74	46	23	-	-	-	-	-
Gioia	40 47 N 16 56 E	MB	Surface: Runway - tufa Landing strip - oiled Taxiway - caliche	North taxiway	2 ft depth	Brown silt	ML	-	0	1	11	88	26	6	-	-	-	-	-
				-	2 ft depth	Brown silt(?) with crushed rock	ML(?)	-	0	2	15	83	-	-	-	-	-	-	-
				South taxiway	2 ft depth	Brown clay with crushed rock	CL	-	0	2	12	86	32	12	-	-	-	-	-
Brindisi	40 39 N 17 57 E	MB	Surface: Runway - conc. with asphalt topping and PSP extension Landing strip - caliche Taxiway - PSP, tufa and asphalt	South taxiway	2 ft depth	Brown sandy clay	CL	-	0	0	43	57	26	11	-	12	120	10	Low
				Near asphalt runway	2 ft depth	Red brown tufa	GM	1-1/2	87	7	5	1	23	2	-	11	119	40	Low
				Near landing strip	2 ft depth	Red brown sandy clay	CL	-	0	1	50	49	23	11	-	10	125	10	Low
				-	2 ft depth	Red brown sandy clay	CL	-	4	10	30	56	27	11	-	11	120	10	Low
Grottaglie	40 31 N 17 24 E	MB	Surface: Runway - caliche Landing strip - sod Taxiway - tufa	Runway	2 ft depth	Red brown clay	CL(?)	-	0	0	9	91	-	-	-	-	-	-	-
				West taxiway	2 ft depth	Brown clay	CH	-	3	3	14	80	54	29	-	-	-	-	-
				Landing strip	2 ft depth	Brown clay	CL	-	0	2	8	90	39	17	-	-	-	-	-
				East taxiway	2 ft depth	Red brown clay with marine fossils	CL	-	0	0	8	92	43	18	-	-	-	-	-
Manduria	40 26 N 17 38 E	MB	Surface: Runway - oiled tufa Landing strip - sod Taxiway - tufa	East taxiway	2 ft depth	Sandy clay	CL	-	1	9	29	61	31	12	-	-	-	-	-
				Runway	2 ft depth	Red brown sandy clay	CL	-	0	1	23	76	35	18	-	-	-	-	-
				West taxiway	2 ft depth	Red brown sandy clay	CL	-	0	5	23	72	38	14	-	-	-	-	-
San Pancrazio	40 26 N 17 51 E	MB	Surface: Runway - soil cement & stone-asphalt Taxiway - soil cement & tufa	Runway	2 ft depth	Brown sandy clay	CL	-	0	1	24	75	43	19	-	-	-	-	-
				North taxiway	2 ft depth	Brown sandy clay	CL	-	0	2	26	72	38	12	-	-	-	-	-
				East taxiway	2 ft depth	Red sandy clay	CL	-	0	1	20	79	45	20	-	-	-	-	-
Lecce	40 14 N 18 08 E	MB	Surface: Runway - asphalt with tufa extension Taxiway - tufa	East taxiway	2 ft depth	Brown sandy clay	CL	-	0	2	41	57	26	12	-	-	-	-	-
				-	2 ft depth	Red brown sandy clay	CL(?)	-	0	0	43	57	-	-	-	-	-	-	-
				Runway	2 ft depth	Red brown sandy clay	CL	-	0	4	29	68	29	13	-	-	-	-	-
Ciampino	41 48 N 12 35 E	MT	No information	-	-	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-
Cercola	40 52 N 14 21 E	T	Surface: Oiled	-	-	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group C: Africa

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes							Mod. AASHO Compaction				
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	PI	Spec. Grav.	Opt. W %	Max. γ_d	CBR	Swell
(1) RIO DE ORO																			
Cabo Juby	27 57 N 12 56 W	T	Description missing	Center of field	-	Tan fine sand	SP	-	0	8	92	0	N P		2.71	13	101	30	Low
(2) FRENCH MOROCCO																			
Marrakech	31 37 N 08 02 W	VED	Description missing	Original runway	Base course 3 ft depth	Red clayey sandy gravel	GC	1	48	16	16	20	24	8	-	-	-	-	-
				Present runway	Base course 6 ft depth	Red silty sandy gravel	GM	1	67	12	9	12	21	6	-	-	-	-	-
				Borrow Area	Base course 4 ft depth	Red silty sandy gravel	GM	1	53	26	12	11	21	5	-	11	110	-	-
Casas	33 34 N 07 40 W	HT	Surface: Asphalt macadam runway & taxiway	Ends of runway	Composite subgrade	Brown sandy clay	CL	-	2	10	24	64	30	13	2.71	-	-	-	-
				Runway shoulders	Composite subgrade	Black sandy clay	CL	-	12	12	23	53	28	12	2.79	-	-	-	-
				Borrow pit	Fill	Gray sandy clay	CL	-	0	1	33	66	29	9	2.69	-	-	-	-
				Quarry	-	Gray crushed rock	GP	3/8	78	19	3	0	N P		2.61	-	-	-	-
Ben El Ma	34 00 N 05 09 W	MS	Description missing	-	-	Red silty sandy gravel	GM	3/4	51	9	13	27	-	-	-	-	-	-	-
				-	-	Brown silty sandy gravel	GM	3/4	35	7	18	40	20	2	2.70	-	-	-	-
				-	-	Brown clay	CL	-	0	3	14	83	45	25	2.69	-	-	-	-
(3) ALGERIA																			
(a) Oran Area																			
La Senia	35 38 N 00 37 W	VED	Surface: One paved runway	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marais	- -	M	Surface: Asphalt coal cent runway Base: None Subgrade: Graded earth. Rock 2-1/2 ft below ground	Centerline runway	1 ft depth	Red brown sandy clay	CL	-	0	5	25	70	30	9	-	-	-	-	-
				Centerline runway	2 ft depth	Red brown sandy clay	CL	-	0	3	28	69	33	11	-	-	-	-	-
				Centerline runway	2-1/2 ft depth	Rock	GW	1-1/2	75	9	11	5	N P		-	-	-	-	-
Lourmel	35 31 N 00 39 W	MD	Description missing	Runway shoulder	1 ft depth	Gray clay	CH	-	0	1	13	86	53	28	2.70	-	-	-	-
				Runway shoulder	2 ft depth	Gray clay	CL	-	0	2	12	86	47	26	2.70	-	-	-	-
				Runway shoulder	3 ft depth	Gray clay	CL	-	0	1	13	86	41	19	2.66	-	-	-	-
Bouvion	35 40 N 00 11 W	-	Incomplete	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Frahn	- -	M	General: Emergency field, no runway	-	1 ft depth	Red clay	CL	-	0	0	10	90	33	14	2.69	-	-	-	-
				-	2 ft depth	Red clay	CL	-	0	0	8	92	42	21	2.70	-	-	-	-
				-	2-3/4 ft depth	Red clay	CL	-	0	3	6	91	37	17	2.73	-	-	-	-
Gapas	- -	M	General: Emergency field, no runway	-	-	Brown clay	CL	-	0	0	4	96	44	21	2.67	-	-	-	-
				-	-	Brown clay	CL	-	0	0	6	94	44	20	2.68	-	-	-	-
				-	-	Brown clay	CL	-	0	0	6	94	36	13	2.70	-	-	-	-
La Passet	36 10 N 00 26 E	MD	Surface: PSP runway	Runway shoulder	-	Red brown sandy silt	ML	-	0	3	53	44	17	3	-	-	-	-	-
				Runway shoulder	-	Red brown sandy clay	CL	-	0	3	42	55	20	7	-	-	-	-	-
				Runway shoulder	-	Red brown silty sand	SM	-	0	4	65	31	N P		-	-	-	-	-
(b) Algiers Area																			
Blida	36 30 N 02 48 E	MD	Surface: One hard surfaced runway Subgrade: Sand and clay soil General: Firm & wet after rains. Good cond.	-	-	Brown clayey gravel	GC	1	68	6	4	22	26	9	-	-	-	-	-
				-	-	Brown clayey gravel	GC	1-1/2	82	3	3	12	25	10	-	-	-	-	-
				-	-	Tan silty gravel	GM	-	-	-	-	-	22	5	-	-	-	-	-
Maison Blanche	36 42 N 03 13 E	HT	Surface: Asphalt runway	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
La Reghaia	36 45 N 03 23 E	MD	Surface: Red & bar landing mat on runway Subgrade: Clayey sandy soil, heavy after rains	-	-	Tan silty sand	SM	-	2	7	57	34	21	3	-	12	118	16	Low
				-	-	Tan coarse to fine sand	SW	-	1	24	70	5	21	3	-	-	-	-	-
				-	-	Tan coarse to fine sand	SW	-	2	42	48	8	21	5	-	-	-	-	-

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group C: Africa

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes								Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel > No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines < No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	Max. γ_d	CBR	Swell
(a) Constantine Area																			
Bougie	36 44 N 05 03 E	N	Surface: Turf Subgrade: Recent clay alluvium, heavy and soft after rains General: Sandstone south of site	- - -	- - -	Brown clay Brown clay Brown clay	CL CL CL	- - -	0 2 2	5 7 4	9 10 7	86 81 87	49 44 50	21 21 26	2.65 - 2.70	- - -	- - -	- - -	- - -
Djidjelli	36 49 N 05 45 E	N	Surface: Turf Subgrade: Sandy clay, boggy after rains	- - -	- - -	Black sandy clay Black sandy clay Black sandy clay	CL CL CL	- - -	0 0 0	3 5 5	20 26 25	77 69 70	39 31 33	17 14 17	2.61 2.63 2.63	- - -	- - -	- - -	- - -
Tabor	36 47 N 05 52 E	-	Surface: PSP runway Subgrade: Clayey sandy soil General: Grassy	- - -	- - -	Tan silty sand Gray clay Gray clay	SM(?) CL CL	- - -	4 2 0	45 5 0	24 7 7	27 86 93	- 48 45	- 22 20	- 2.69 2.72	- - -	- - -	- - -	- - -
Philippeville	36 51 N 06 57 E	F	Surface: Originally PSP, now sand & gravel Subgrade: Clay soil General: Sand & gravel runway usable all the time by light aircraft	- - -	- - -	Red silty sand Gray & tan silty sand (Organic) Dark gray clay	SM SM -	- - -	0 4 -	15 10 -	69 54 -	16 32 -	N P N P -		2.61 2.53 -	- - -	- - -	- - -	- - -
Bone	36 50 N 07 49 E	NB	Surface: Bituminous runways. Half of one runway & taxiway are PSP Base course: Macadam Subgrade: Clay soil, boggy after rains	- - -	- - -	Gray clay Gray clay Gray clay	CL CH CL	- - -	3 0 0	3 0 0	8 3 3	86 97 97	47 55 44	25 30 23	2.67 2.62 2.66	- - -	- - -	- - -	- - -
Biskra	34 48 N 05 44 E	NB	Subgrade: Sandy soil General: Subgrade dusty when dry, soft & wet after rains. Muddy & ruts deeply	- - -	- - -	Tan sandy clay Tan sandy clay Tan sandy silt	CL CL ML	- - -	- - 0	- - 0	- - 35	- - 65	25 34 21	9 14 6	2.64 2.69 2.71	- - -	- - -	- - -	- - -
Bavarin	36 05 N 05 48 E	N	Subgrade: Light clay soil General: Subgrade heavy, soft & wet after rains. Muddy & unusable after heavy rains	- - -	- - -	Black clay Brown clay Whitish gray sandy clay	CL ML ML	- - -	0 0 7	3 5 13	6 6 14	91 89 66	47 45 40	22 16 12	2.69 2.66 2.65	- - -	- - -	- - -	- - -
St. Denet	36 06 N 06 00 E	N	General: Usable all the time	- - -	- - -	Tan sandy gravelly silt Tan sandy gravelly clay White rock	ML ML GP	3/4 3/4 1-1/2	31 36 93	3 5 4	24 14 3	42 45 0	25 31 N P	3 7	2.59 2.60 2.62	- - -	- - -	- - -	- - -
Chateaudun du Rhumel	36 10 N 06 08 E	N	Subgrade: Calcareous clay, rocky. Heavy after rains	- - -	- - -	Tan sandy gravelly clay Tan sandy silt White sandy gravel	CL ML GW	1/2 - 1/2	37 10 54	5 8 23	13 15 17	45 67 6	32 N P N P	10	2.64 2.68 2.67	- - -	- - -	- - -	- - -
Timselet	36 10 N 06 10 E	N	Description missing	- - -	- - -	Tan sandy clay Tan sandy gravelly clay Tan sandy clay	ML ML CL	- 1/2 -	0 38 7	0 4 6	30 11 9	70 47 78	35 43 33	9 11 10	2.65 2.66 2.67	- - -	- - -	- - -	- - -
Telergma	36 06 N 06 22 E	NB	Surface: Asphalt runway Base course: Crushed rock Subgrade: Tuff soil, muddy after rains	- - -	- - -	Brown sandy gravel White & gray rock White sandy clay	GW GP CL	1 2 -	80 95 10	19 3 11	1 2 18	0 0 61	N P N P 36	13	- - 2.68	- - -	- - -	- - -	- - -
Bertoux No. 1	36 06 N 06 27 E	N	Subgrade: Calcareous clay, heavy after rains	- - -	- - -	Tan & brown clay Brown clay Brown clay	MH MH CH	- - -	1 1 0	4 3 0	13 11 7	82 85 93	50 53 50	13 23 23	2.57 2.62 2.64	- - -	- - -	- - -	- - -
Bertoux No. 2	36 06 N 06 28 E	N	Subgrade: Calcareous clay, heavy after rains	- - -	- - -	Tan sandy clay Tan sandy gravelly clay Tan sandy clay	CL ML ML	- 3/4 -	3 39 0	12 8 0	43 12 32	42 41 68	33 34 31	11 7 7	2.59 2.62 2.61	- - -	- - -	- - -	- - -
Ain M'Lila	36 01 N 06 35 E	N	Subgrade: Clayey soil, soft & heavy after rains General: Area flooded after heavy rainstorms of spring & autumn	- - -	- - -	Dark gray clay Light gray clay Light gray sandy clay	CL ML CL	- - -	0 5 4	2 4 7	5 10 12	93 81 77	48 35 36	20 8 12	2.65 2.69 2.69	- - -	- - -	- - -	- - -

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group C: Africa

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes								Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	Max. γ_d	CBR	Swell
Le Kroub	36 18 N 06 41 E	-	Subgrade: Clay-sand, soft after rains General: Usable all the time. Half of runway is of stone. Incomplete	-	-	Black sandy clay	CL	-	0	7	20	73	41	18	2.63	-	-	-	-
				-	-	Black sandy clay	CL	-	0	7	18	75	43	21	2.65	-	-	-	-
				-	-	Black sandy clay	CL	-	0	7	19	74	39	15	2.65	-	-	-	-
Levasseur	- -	N	Description missing	-	-	Red clay	CL	-	0	3	7	90	43	17	2.63	-	-	-	-
				-	-	Red clay	CL	-	0	2	8	90	39	15	2.67	-	-	-	-
				-	-	Red clay	CL	-	0	3	12	85	45	18	2.67	-	-	-	-
Courcebert	35 51 N 07 06 E	N	Surface: Rolled earth strip Subgrade: Light quick drying tuff soil, soft after rains	-	-	Brown & gray sandy clay	CL	-	0	4	18	78	38	17	2.76	-	-	-	-
				-	-	Brown sandy clay	CL	1/4	10	1	9	80	36	15	2.65	-	-	-	-
				-	-	Brown clay	CL	-	0	3	12	85	34	13	2.64	-	-	-	-
Montesquieu	36 05 N 07 32 E	N	Subgrade: Clay & tuff soils General: Runway graded with scrapers. Usable after rains with precautions	-	-	Tan sandy clay	CL	-	0	7	19	74	41	15	2.67	-	-	-	-
				-	-	Tan sandy clay	CL	-	1	8	18	73	40	16	2.64	-	-	-	-
				-	-	Tan sandy clay	CL	-	0	5	17	78	38	13	2.65	-	-	-	-
Youks le Bains	35 30 N 07 56 E	F	Description missing	-	-	Tan clay	CL	-	0	0	3	97	42	19	-	-	-	-	-
				-	-	Tan clay	CL	-	0	0	8	92	45	24	2.66	-	-	-	-
				-	-	Tan clay	CL	-	0	0	6	94	41	19	2.66	-	-	-	-
Tebessa	35 25 N 08 08 E	N	Subgrade: Clayey soil General: Usable only in dry weather, dangerous even after light rains. Undulating slick surface	-	-	Brown clay	CL	-	0	1	3	96	44	18	2.64	-	-	-	-
				-	-	Brown clay	CL	-	0	0	5	95	49	24	2.67	-	-	-	-
				-	-	Brown clay	CL	-	0	0	0	100	45	22	2.67	-	-	-	-
(d) Ghardaia Area Laghouat	33 45 N 32 52 E	N	Subgrade: Clayey sand General: Firm after rains	-	-	Gray clay (Organic)	OL	-	-	-	-	-	31	6	-	-	-	-	-
				-	-	Gray clay (Organic)	CL	-	-	-	-	-	35	14	-	-	-	-	-
				-	-	Gravelly sand	SW	3/4	45	26	20	9	N P		-	-	-	-	-
(e) Touggourt Area Touggourt	-	N	Description missing	-	-	Tan fine sand	SP(?)	-	-	-	-	-	N P		-	-	-	-	-
				-	-	Tan fine sand	SP(?)	-	-	-	-	-	N P		-	-	-	-	-
				-	-	Tan silty sand	SM	-	0	3	83	14	N P		-	-	-	-	-
(4) TUNISIA Djebel Ahed Bofsa	-	N	Surface: None General: Plowed field at present	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Utique	-	N	Surface: None General: Plowed field at present	-	-	Tan clay	CL	-	0	0	6	94	40	21	-	-	-	-	-
				-	-	Tan clay	CL	-	-	-	-	-	37	18	-	-	-	-	-
				-	-	Tan clay	CL	-	-	-	-	-	39	20	-	-	-	-	-
Protville No. 2	-	N	Surface: None General: Plowed field at present	-	-	Brown clay (Organic)	CL	-	0	0	5	95	48	27	-	-	-	-	-
La Sebala No. 1	-	N	Surface: None General: Plowed field at present	-	-	Tan clay (Organic)	CL	-	0	0	5	95	42	22	-	-	-	-	-
				-	-	Tan clay	CL	-	-	-	-	-	45	24	-	-	-	-	-
				-	-	Tan clay	CL	-	-	-	-	-	31	13	-	-	-	-	-
La Sebala No. 2	-	N	Surface: None General: Plowed field at present	-	-	Brown clay (Organic)	CH	-	0	0	9	91	56	33	-	-	-	-	-
				-	-	Brown clay	CH	-	-	-	-	-	52	30	-	-	-	-	-
				-	-	Brown clay	CL	-	-	-	-	-	49	27	-	-	-	-	-
Djedeida No. 1	36 32 N 09 [illegible] E	NB	Surface: Asphalt paving	-	-	Tan clay	CL	-	0	0	5	95	46	25	-	-	-	-	-
				-	-	Brown clay	CL	-	0	0	6	94	40	24	-	-	-	-	-
				-	-	Brown clay	CL	-	0	0	2	98	40	21	-	-	-	-	-
Djedeida No. 2	36 49 N 09 57 E	NB	Surface: Asphalt paving	-	-	White sandy gravel	GW	1-1/2	83	11	6	0	N P		-	-	-	-	-
				-	-	Brown clay	CH	-	0	0	5	95	60	39	-	-	-	-	-
				-	-	Brown clay	CH	-	0	0	5	95	63	40	-	-	-	-	-
Souk el Khemis No. 1	36 32 N 08 56 E	N	Surface: None General: Plowed field at present	-	-	Brown clay	CL	-	0	0	13	87	46	27	-	-	-	-	-
Souk el Khemis No. 3	36 30 N 08 59 E	N	Surface: None General: Plowed field at present	-	-	Brown sandy clay	CL	-	0	2	24	74	34	16	-	-	-	-	-
				-	-	Brown sandy clay	CL	-	-	-	-	-	35	16	-	-	-	-	-
				-	-	Brown sandy clay	CL	-	-	-	-	-	36	20	-	-	-	-	-

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group C: Africa

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes								Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	Max. γ_d	CBR	Swell
El Bathan	36 48 N 09 51 E	M	Surface: None General: Plowed field at present	-	-	Brown clay	CL	-	0	0	5	95	34	15	-	-	-	-	-
Massicault	36 43 N 09 55 E	MB	Surface: None General: Plowed field at present	-	-	Brown clay	CL	-	0	3	13	84	46	26	-	19	102	8	Low
Oudna	36 38 N 10 06 E	-	Surface: Asphalt paving	-	-	Brown clay	CL	-	0	3	3	94	46	24	-	-	-	-	-
Depienne	36 25 N 10 02 E	MB	Surface: Asphalt paving	-	-	Brown clay	CL	-	0	1	7	92	39	12	-	16	112	10	Low
Pont du Fahs	36 20 N 09 50 E	M	Surface: None General: Plowed field at present	-	-	Brown sandy clay	CL	-	0	2	19	79	33	16	-	13	117	10	Low
Le Sers	36 02 N 09 18 E	M	Surface: None General: Plowed field at present	- - -	- - -	Gray clay (Organic) Gray clay Gray clay	CH CH CH	- - -	0 0 -	1 1 -	7 7 -	92 92 -	55 52 50	31 29 30	- - -	- - -	- - -	- - -	- - -
Le Kouif	-	M	Description missing	- -	- -	Brown clay Tan gravelly sandy clay	ML ML	- 1/2	0 15	0 13	8 12	92 60	34 35	9 8	2.71 2.65	- -	- -	- -	- -
				-	-	White gravelly sand	SW	3/8	43	36	15	6	N P		2.64	-	-	-	-
Ariana	-	M	Description missing	-	-	Brown clay	CL	-	0	0	14	86	27	10	-	12	121	7	Low
La Marsa	-	M	Surface: None General: Plowed field at present	- - -	- - -	Gray sandy clay Tan silty sand Tan silty sand	CL SM SM	- - -	0 0 0	0 1 11	41 71 78	59 28 11	39 N P N P	22	- - -	- - -	- - -	- - -	- - -
Tunis (Possibly El Aouina)	-	-	Description missing	-	-	Silty sand	SM(?)	-	0	0	72	28	-	-	-	-	-	-	-
Fock	-	M	Surface: None General: Plowed field at present	-	-	Brown clay	CL	-	0	0	9	91	40	23	-	15	114	13	Low
Solimna No. 1	-	M	Description missing	- -	- -	Clay Brown gravelly sand	CH SW	- -	0 45	0 19	5 30	95 6	56 N P	30	- -	19 -	105 -	7 -	Low -
Solimna No. 2	-	M	Surface: None General: Plowed field at present	- -	- -	Brown clay Gray clay	CL CH	- -	0 0	0 0	6 0	94 100	43 53	21 35	- -	- -	- -	- -	- -
Solimna No. 3	-	M	Surface: None General: Plowed field at present	- -	- -	Brown clay Brown sandy clay (Organic)	CL CL	- -	0 1	4 5	14 17	82 77	42 39	24 20	- -	- 14	- 116	- 7	- Low
Grombalia	-	M	Surface: None General: Plowed field at present	-	-	Brown clay with small shells	CL	-	0	0	11	89	46	25	-	13	114	8	Low
El Haouaria	-	M	Surface: None	-	-	Gray sandy clay, cemented, with small shells	CL	-	0	0	54	46	32	16	-	-	-	-	-
Menzel-Temime	-	M	Surface: None General: Plowed field at present	-	-	Brown sandy gravel (white rock)	GP	1	54	10	30	6	N P		-	13	116	50	Low
Bir Messouda	-	M	Surface: None General: Plowed field at present	-	-	Red-brown sandy clay (Organic)	CL	-	0	5	53	42	25	10		12	118	7	Low
Korba	-	M	Surface: None	-	-	Red sandy clay	CL	-	0	8	48	44	24	10	-	-	-	-	-
Bassmat	-	M	Surface: None General: Plowed field at present	-	-	Brown clay	CH	-	0	1	3	96	75	48	-	23	100	5	High
(5) LIBYA																			
Mellaha (Tripoli) Alemlie Field	32 54 N 13 16 E	-	Surface: Asphalt runway, taxiway & aprons	- - -	Subgrade Subgrade Base course	Tan sandy silt Tan silty sand Gray crushed rock	ML SM GP	- - 1-1/2	2 0 100	2 2 0	51 59 0	45 39 0	N P N P N P		- - -	10 14 -	117 106 -	25 20 -	Low Low -

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group C: Africa

AIRFIELD				SAMPLE				SOIL TESTS										
								Grain Sizes								Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	Max. γ_d	CBR	Swell
(6) FRENCH WEST AFRICA:																			
Ballard (Dakar)	14 44 N 17 30 W	80,000 lb gross	Description missing	Apron	-	Gray rock	GP	1-1/2	100	0	0	0	N P		-	-	-	-	-
				N-S runway	-	Gray silty sand	SM	-	0	30	57	13	N P		-	-	-	-	-
				E-W runway	-	Gray rock with asphalt	GP	1-1/2	100	0	0	0	N P		-	-	-	-	-
(7) GOLD COAST:																			
Takoradi	04 54 N 01 46 W	MB	Description missing	East edge of runway at mid-point	1 ft depth	Red sandy clay	CL	1/2	14	1	35	50	32	13	2.77	-	-	-	-
					2 ft depth	Red clayey sandy gravel	GC	1	40	3	20	37	31	13	2.93	-	-	-	-
					3 ft depth	Brown sandy clay	CL	-	0	3	45	52	24	8	2.74	-	-	-	-
Accra	05 35 N 00 10 W	VHB	Description missing	North edge at approx. center of runway	1 ft depth	Red sandy clay	CL	-	0	8	38	54	26	9	2.62	-		-	-
					2 ft depth	Red sandy silt	ML	-	5	9	38	48	23	2	2.62	-	-	-	-
					3 ft depth	Red sandy silt	ML	-	0	9	39	52	26	5	2.62	-	-	-	-
(8) FRENCH EQUATORIAL AFRICA:																			
Pointe Noire	04 49 S 11 51 E	75,000 lb gross	Description missing	North edge at approx. center of runway	1 ft depth	Gray silty sand (Organic)	SM	-	0	9	74	17	N P		2.58	-	-	-	-
					2 ft depth	Gray silty sand (Organic)	SM	-	0	9	74	17	N P		2.59	-	-	-	-
					3 ft depth	Gray silty sand (Organic)	SM	-	0	9	74	17	N P		2.60	-	-	-	-
(9) BELGIAN CONGO:																			
Leopoldville	04 20 S 15 18 E	100,000 lb gross	Description missing	North edge at approx. center of runway	1 ft depth	Black silty sand	SM	-	0	10	78	12	N P		2.60	-	-	-	-
					2 ft depth	Dark gray silty sand	SM	-	0	10	75	15	N P		2.63	-	-	-	-
					3 ft depth	Light gray silty sand	SM	-	0	6	75	19	N P		2.60	-	-	-	-
Elizabethville	11 39 S 27 28 E	72,000 lb gross	Description missing	-	1 ft depth	Tan sandy gravelly clay	CL	-	18	7	8	67	36	15	-	-	-	-	-
				-	2 ft depth	Tan sandy gravelly clay	CL	-	-	-	-	-	32	15	-	-	-	-	-
				-	3 ft depth	Tan sandy gravelly clay	CL	-	-	-	-	-	28	9	-	-	-	-	-
(10) NIGERIA:																			
Apapa	06 26 N 03 23 E	26,000 lb gross	Description missing	East edge at approx. center of runway	1 ft depth	Tan coarse to fine sand	SW	-	0	48	52	0	N P		2.63	-	-	-	-
					2 ft depth	Tan coarse to fine sand	SW	-	0	58	39	3	N P		2.62	-	-	-	-
					3 ft depth	Tan coarse to fine sand	SW	-	0	50	50	0	N P		2.62	-	-	-	-
Maiduguri	11 52 N 13 06 E	VHB	Description missing	North edge of approx. center of NE-SW runway	1 ft depth	Tan silty sand	SM	-	0	9	65	26	N P		2.63	-	-	-	-
					2 ft depth	Tan silty sand	SM	-	0	10	61	29	N P		2.66	-	-	-	-
					3 ft depth	Tan silty sand	SM	-	0	10	56	34	N P		2.66	-	-	-	-
Kano	12 03 N 08 32 E	VHB	Description missing	North edge of center of NE-SW runway	1 ft depth	Reddish silty sand	SM	-	0	4	69	27	N P		2.62	-	-	-	-
					2 ft depth	Red silty sand	SM	-	0	2	66	32	N P		2.61	-	-	-	-
					3 ft depth	Red silty sand	SM	-	0	2	62	36	N P		2.62	-	-	-	-
(11) ANGLO-EGYPTIAN SUDAN:																			
El Gemaim	13 27 N 22 26 E	VHB	Description missing	-	-	Tan coarse to fine sand	SW	-	0	41	54	5	N P		-	8	127	75	Low
El Fasher	13 38 N 25 20 E	VHB	Description missing	-	-	Brown silty sand	SM	-	0	9	69	22	N P		-	9	125	44	Low
Wadi Seidna	15 47 N 32 32 E	VHB	Description missing	-	-	Brown sandy silt	ML	-	0	14	41	45	25	6	-	10	127	6	Low
(12) ERITREA:																			
Asmara	15 18 N 38 56 E	130,000 lb gross	Description missing	-	-	Brown sandy clay	ML	-	0	9	16	75	45	14	-	21	104	12	Low

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group C: Africa

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes								Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. w %	Max. γd	CBR	Swell
Gura	15 01 N 39 04 E	RD	Description missing	-	-	Tan sandy clay	CL	-	0	34	22	44	27	9	-	[illegible]	[illegible]	[illegible]	Low
(13) EGYPT: Payne Field (Cairo)	30 06 N 31 24 E	VRD	Description missing	Samples missing	-	-	-	-	-	-	-	-	-	-	-		-	-	-

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group D: Near East, India, Burma, China

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes								Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	Max. γd	CBR	Swell
(1) NEAR EAST:																			
(a) Turkey																			
Etimesgut Ankara	39 57 N 32 41 E	RB	No information	Runway	Subgrade	Brown clay	CH	-	0	0	6	94	66	42	-	18	106	5	Low
				Taxiway	Subgrade	Brown clay	MH	-	0	0	0	100	63	34	-	22	96	5	High
				Apron	Subgrade	Brown clay	CH	-	0	0	4	96	106	82	-	23	100	2	High
Civil Airport Ankara	39 57 N 32 46 E	T	No information	East taxiway	Subgrade	Brown clay	CH	-	0	0	3	97	59	34	-	18	110	5	Low
				Runway	Subgrade	Gray sandy clay	CL(?)	-	2	15	23	55	-	-	-	-	-	-	-
				West taxiway	Base course	Gray sandy gravel	GW	1	72	27	1	0	N P		-	7	128	60	Low
(b) Syria (Lebanon)																			
Beirut	33 52 N 35 29 E	T	No information	-	-	Brown fine sand	SP	-	0	10	90	0	N P		-	-	-	-	-
(c) Palestine																			
Lydda	32 00 N 34 54 E	RB	No information	-	Subgrade	Brown clay	CL	-	0	2	6	92	42	20	-	-	-	-	-
				-	-	Brown sandy clay	CL(?)	-	4	36	17	43	-	-	-	-	-	-	-
(d) Iraq																			
Habbaniya	32 23 N 43 35 E	RB	No information	Runway intersection	-	Tan sandy gravelly clay	CL	3/4	34	5	16	45	28	7	-	-	-	-	-
				South end long runway	-	Brown silty gravelly sand	SM	1/4	20	18	49	13	N P		-	-	-	-	-
				South end short runway	-	Black silty sandy gravel	GM	3/4	48	9	22	21	22	1	-	-	-	-	-
(e) Iran																			
Abadan	30 22 N 48 15 E	VRB	No information	South end short runway	-	Black sandy clay	CL	-	-	-	-	-	34	11	-	13	111	10	Low
(f) Saudi Arabia																			
Bahrein (Muharraq Island)	26 16 N 50 38 E	T	Two runways: (a) PSP on sand-asphalt base (b) Natural ground (sand) graded and rolled	PSP runway	Soil typical of entire island	White silty sand	SM	-	0	15	64	21	N P		-	-	-	-	-
Khalith Oasis (Aden Protectorate)	12 52 N 44 58 E	VRB	No information	-	-	Brown silty sand	SM	-	-	-	-	-	N P		-	-	-	-	-
Salala (Sultanate of Oman-Muscat)	17 03 N 54 04 E	RT	No information	-	-	Tan sandy silt	ML	-	10	20	23	47	22	5	-	9	128	7	Low
Nizwah (Sultanate of Oman-Muscat)	20 40 N 58 54 E	RB	No information	-	-	Brown sandy silt	ML	-	1	14	38	47	17	3	-	8	134	12	Low
(2) INDIA:																			
(a) United Provinces																			
Agra	27 08 N 77 58 E	RB	Two runways: Surface: Asphalt macadam Base: Stone (3" diameter and larger) General: Heavy traffic (RB & T). Condition excellent	Short runway southeast end	-	Brown sandy silt	ML	-	0	0	50	50	N P		2.66	9	120	12	Low
				Short runway center	-	Tan sandy silt	ML	-	0	0	45	55	N P		2.68	10	122	7	Low
				Long runway northeast end	-	Brown sandy silt	ML	-	0	0	40	60	19	1	2.66	-	-	-	-
(b) Bombay																			
Karachi	24 54 N 67 09 E	RB	Surface: 6" conc. - 10" conc. extension Base: Compacted subgrade material General: Edge of desert; no water table Heavy traffic (RB & T). Cond. excellent	Borrow area	-	Tan coarse to fine sand	SP	3/4	14	51	35	0	N P		2.68	-	-	-	-
				Borrow area	-	Tan sandy gravel	GW	1	72	25	3	0	N P		2.68	-	-	-	-
				West of runway	Subgrade	Tan silty gravelly sand	SM	1/10	35	24	18	23	17	2	2.68	5	138	35	Low
				South approach to runway	-	Tan silty sand	SM	-	13	28	29	30	-	-	2.68	8	134	-	-
				Disposal area	-	Tan sandy silt	ML	-	2	10	46	42	N P		-	-	-	-	-

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group D: Near East, India, Burma, China

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes								Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	Max. γ_d	CBR	Swell
(5) Bengal																			
Gaya	24 45 N 84 57 E	MB	2 runways: 4" conc. on original tarmac surface Turnaround: North-South runway: Surface: 6 in. concrete Base: 3" layer of sand & crushed rock over 6"-8" layer of large stone General: Low ground with water table near surface. Concrete broke up under medium traffic	Turnaround	Upper base course	White & black rock	GP	1-1/2	96	3	1	0	N P		-	-	-	-	-
				Turnaround	Subgrade	Gray clay	CL	-	1	6	-	66	30	13	-	10	125	10	Low
Cuttal	[illegible] N [illegible] E	MB	2 runways: 5" conc. on 3" tarmac on 6" stone Test pit: Surface: 6"-7" conc. on 3" tarmac on two courses of brick General: Medium traffic. Cond. excellent	Runway	Tarmac layer	Crushed gray & red laterite	GW	1-1/2	88	7	5	0	N P		-	-	-	-	-
				Runway	Subgrade	Gray clay	CH	-	0	0	11	89	50	30	-	17	112	5	Low
Kiamsota	2[illegible] 40 N [illegible] 20 E	VHB	Surface: 7" conc. over original runway surface, 9" conc. on runway extension Base: Runway extension: 5" (stone?)	N end runway	-	Tan silty sand	SM	-	1	54	28	17	N P		-	[illegible]	111	-	-
				-	-	Red sandy clay	CL	-	0	17	37	46	25	11	-	-	-	-	-
				-	-	Tan sandy silt	ML	-	0	15	29	56	13	3	-	-	-	-	-
Chamalia	22 27 N 86 42 E	VHB	North-South runway: Surface: Original runway: 11" concrete; extension: 10" concrete Base: Original runway: 6" base course; extension: stabilized subgrade East-West runway: Surface: Original runway: 6" concrete; extension: 9" concrete Base: 6 in.	E-W runway	Subgrade	Red clayey sandy gravel	GC	1/2	51	23	10	16	27	11	-	7	135	69	Low
				E-W runway	Base course	Red silty gravelly sand	SM	1	40	22	22	16	N P		-	5	136	54	Low
Kharagpur	22 16 N 87 19 E	VHB	Surface: 5" conc. over original runway surface, 10" conc. on runway extension Base: 6" laterite (extension)	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barrackpore	22 46 N 88 22 E	MB	Surface: 2 layers PBS No. 6 on 3 courses of brick Base: No base course General: Ganges delta; water table 2-4' below ground. Deformation of runway under heavy traffic due to wet soft subgrade	Runway	Subgrade	Gray clay	ML	-	0	1	4	95	29	1	2.65	-	-	-	-
Dum-Dum	22 39 N 88 27 E	HT	North-South runway: Surface: Original runway: 1 brick course on 6" conc. on 2 brick courses. Runway extension: 9" conc. Base: Extension: 5 in. East-West runway: Tarmac on brick General: Ganges delta; water table 2-4' below ground. Heavy traffic (MB & T). Condition good	N-S runway	Subgrade	Gray clay	CH	-	0	0	0	100	50	27	-	-	-	-	-
Tezgaon	23 47 N 90 23 E	HT	Surface: 3 courses of cement-grouted brick General: Undulating topography; no water table. Medium traffic. Cond. excellent	S-E taxiway	Subgrade	Red clay	ML	-	2	2	13	83	37	12	2.56	-	-	-	-
Chaschermagar	24 26 N 91 55 E	HT	Surface: 6 in. concrete Base: Compacted subgrade General: Tea land, no ground water problem. Medium traffic. Condition excellent	Runway	Subgrade	Red sandy clay	ML	-	0	2	31	67	39	11	2.64	-	-	-	-
Lalmanirhat	25 53 N [illegible] 26 E	T	Surface: 5"-7" concrete Base: 6"-8" stone base course General: River valley; water table 3-6' below ground. Medium traffic. Condition excellent	Runway	Subgrade	Gray silt	ML	-	0	0	6	94	N P		-	-	-	-	-

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group D: Near East, India, Burma, China

AIRFIELD				SAMPLE				SOIL TESTS										
								Grain Sizes								Mod. AASHO Compaction		
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	Max. γ_d	CBR	Swell
(4) Assam																			
Tezpur	26 43 N 92 48 E	MB	Surface: Sand-asphalt on 4" concrete Base: No base course General: River valley; water table near ground surface. Original conc. surface broke up, necessitating sand-asphalt topping	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chabua	27 28 N 95 04 E	MT MB?	Surface: 6 in. tarmac Base: 6 in. stone on sand cushion General: Tea land; water table close to surface. Very heavy traffic. Condition excellent	Taxiway Runway	Surfacing Subgrade	Gravel and asphalt Tan sandy silt	- ML	- -	- 0	- 1	- 31	- 68	- -	- -	- 2.69	- -	- -	- -	- -
(e) Mysore																			
Bangalore	12 57 N 77 38 E	F MB?	Surface: Sand-asphalt on cement-grouted stone General: Undulating ground; no water problem. Medium traffic. Condition excellent	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(3) BURMA:																			
Shingbwiyang	26 41 N 96 12 E	T FT	Surface: Asphalt surface treatment. Base: Stabilized gravel General: Jungle area; no ground water problem. Medium traffic. Cond. good	Runway Runway Runway	Surface Base course Subgrade	Gravel and asphalt Gray sandy gravel Brown sandy clay	- GW CL	- 2 -	- 75 2	- 5 6	- 13 23	- 7 63	- NP 43	- NP 16	- 2.65 2.62	- - 18	- - 107	- - 10	- - Low
Mitkyina South	25 23 N 97 21 E	T	Surface: 1" asphalt surface treatment Base: Mechanically stabilized clay-gravel	Runway Runway Runway	Surface Base course Subgrade	Gravel and asphalt Brown silty sandy gravel Brown silty gravel	- GM GM	- 2 1-1/2	- 65 58	- 7 1	- 13 6	- 15 35	- NP -	- NP -	- 2.67 2.67	- - -	- - -	- - -	- - -
Prome	24 16 N 97 15 E	T	Surface: 1" asphalt surface treatment Base: Mechanically stabilized clay-gravel	Runway Runway Runway	Surface Base course Subgrade	Gravel and asphalt Brown silty gravelly sand Brown sandy clay	- SM CL(?)	- 1/2 -	- 20 -	- 18 -	- 23 -	- 39 -	- - -	- - -	- 2.64 -	- - -	- - -	- - -	- - -
Lashio	22 59 N 97 15 E	37,000 lb gross	Surface: 3/8" asphalt surface treatment Base: Crushed rock	Runway Runway Runway	Surface Base course Subgrade	Gravel and asphalt Crushed rock Red clayey sand	- GW SC	- 1 -	- 87 6	- 7 26	- 4 35	- 2 33	- NP 55	- NP 22	- 2.85 2.78	- - 26	- - 94	- - 16	- - Low
(4) CHINA:																			
(a) Shensi Province																			
Hsian (Sian)	34 16 N 108 45 E	35,000 lb gross	Base: Telford, 7" to 8" thick General: Heavy traffic. (MB, T & F)	-	-	Gray sandy clay	CL	-	1	16	38	45	26	6	-	-	-	-	-
Wuchuaze	33 16 N 107 16 E	35,000 lb gross	Base: Water-bound gravel, 8" thick General: Light traffic. (MB, T & F)	-	-	Brown sandy clay	CL	-	0	8	37	55	26	9	2.73	-	-	-	-
Hanchong	33 06 N 107 03 E	64,000 lb gross	Base: Telford, 16" thick General: Moderate to heavy traffic. (MB & T)	-	-	Brown sandy silt	ML	-	0	3	31	66	20	5	2.72	-	-	-	-
(b) Szechwan Province																			
Pungchangpaw	30 42 N 104 05 E	21,000 lb gross	Base: Water-bound gravel, 8" thick General: Severe drainage problems. Moderate traffic. (F & T)	-	-	Brown & gray gravelly clay	CL	1/10	20	2	6	72	43	22	-	17	112	7	Low
Shuang-Liu	30 33 N 103 54 E	21,000 lb gross	Base: Water-bound gravel, 8" thick General: Soft in wet weather. Light traffic (F)	-	-	Gray clay	CL	-	0	4	9	87	41	20	2.81	-	-	-	-
Hsin-Ching	30 25 N 103 49 E	140,000 lb gross	Surface: Single asphalt treatment Base: Water-bound gravel, 20" thick General: Very heavy traffic. (VHB)	-	-	Gray clay	ML	-	0	0	3	97	41	8	2.76	13	112	[illegible]	[illegible]

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TABLE 1: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group 2: Near Lett, India, Burma, Ch'na

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes								Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	Max. γd	CBR	W.C.
Pai-Shih-i	29 32 N 106 22 E	50,000 lb gross	Base: Water-bound gravel, 14" thick General: Heavy traffic. (MB, T & F)	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Lu-Hsien	29 51 N 105 21 E	64,000 lb gross	Surface: 6" cement-bound macadam Base: Water-bound gravel, 10" thick General: Heavy traffic. (T)	-	-	Brown sandy silt	ML	-	0	3	40	57	25	4	2.74	-	-	-	-
(c) Hunan Province Hsu-P'u	27 52 N 110 34 E	MB	Base: Telford, 14" thick General: Light traffic	-	Subgrade	Red sandy clay	CE		0	12	17	71	51	25	2.71	-	-	-	-
Chih-Chiang	27 28 N 109 36 E	35,000 lb gross	Base: Telford, 14" thick	-	Subgrade	Brown clay	CL	-	-	-	-	-	32	11	2.82	-	-	-	-
(d) Kweichow Province Chiu-Chou	26 57 N 107 42 E	35,000 lb gross	Base: Water-bound gravel, 12" thick General: Moderate traffic. (MB & F)	-	Subgrade	Tan sandy clay	CL	-	0	6	20	74	30	11	2.67	-	-	-	-
Ching-Chou	26 35 N 106 25 E	35,000 lb gross	Base: Telford, 12" thick General: Moderate traffic. (F & Lt. T)	-	Subgrade	Tan clay	CH	-	0	0	8	92	54	31	2.71	-	-	-	-
Tu-Shan	25 46 N 107 31 E	35,000 lb gross	Base: Telford, 12" thick General: Light traffic. (Light T)	-	Subgrade	Grey sandy silt	ML	3/8	11	9	11	69	23	6	2.66	-	-	-	-
(e) Yunnan Province Chan-i	25 37 N 103 50 E	64,000 lb gross	Base: Telford, 28" thick General: Heavy traffic	-	Subgrade	Red clay	CL	-	0	4	12	84	39	17	2.70	-	-	-	-
Lu-Liang	25 00 N 103 38 E	140,000 lb gross	Base: Telford, 18" and 10" thick General: Heavy traffic. (VHB)	-	Subgrade	Brown clayey sand	SC	-	0	26	50	24	42	8	-	23	127	20	low
(f) Kwangsi Province Liuchow	24 18 N 109 14 E	VHB	Base: Telford, 20" thick General: Twice destroyed and rebuilt. Heavy traffic of all types	-	Subgrade	Tan sandy clay	CL	-	0	18	30	52	32	18	2.68	-	-	-	-
Nanning	22 49 N 108 17 E	Lt. T F	Base: Telford and brick, 14" and 10" thick General: Destroyed and rebuilt twice. Moderate traffic	-	Subgrade	Tan sandy clay	MH	-	0	14	12	74	52	21	2.69	-	-	-	-

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group K: Pacific Islands

AIRFIELD				SAMPLE				SOIL TESTS										
								Grain Sizes							Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel > No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines < No. 200 Sieve	Atterberg Limits LL	PI	Spec. Grav.	Opt. W %	Max. γd	CBR	Swell
(1) PHILIPPINES:																			
(a) Luzon																			
Laoag	18 11 N 120 32 E	F, MB T	Surface: Bank-run gravel with penetration asphalt Base: Sand & gravel, thin. (4" base plus surface Subgrade: Up to 6' fine arkosic sand overlying coarse uniform beach sand General: Terrain: Flat coastal plain, grassland surrounded by rice paddies. Drainage problems during rainy season Maximum monthly rainfall: 26" in August Water table: 8-15' depth Condition & use: Surface unsatisfactory under heavy planes, necessitating patching	- - - -	Base course: 4" thick Principal upper subgrade: 0-3' thick Intermediate subgrade: 0-6' thick Lower & intermediate subgrade: 1/2 - 3-1/2' thick	Brown coarse to fine sand Dark brown silty sand Tan silty sand Gray silty gravelly sand	CW SM SM SM	- - Test incomplete 1	11 0 - 24	43 16 - 17	40 53 - 35	6 31 - 21	N P N P N P N P	2.6[illegible] 2.64 2.7[illegible] [illegible]	- 1[illegible] 14 -	- 127 11[illegible] -	- - 4[illegible] -	- - Low -
Mangaldan	16 03 N 120 23 E	ED	Surface: Road oil treatment Base: None Subgrade: Pot yellow to brown clay General: Terrain: Low flat plain. Grassland Maximum monthly rainfall: 23" in August Water table: 4-6' depth Condition & use: Abandoned invasion field now overgrown with grass	- -	Surface: 3" thick Typical soil	Oiled soil Brown sandy clay	- CL	- -	- 0	- 10	- 28	- 62	- 4[illegible]	- 1	- 2.71	- 1[illegible]	- 11[illegible]	- 10	- Low
Lingayet	16 02 N 120 20 E	ED	Surface: Steel mat over asphalt treatment Base: 6" mix of river gravel & subgrade soil Subgrade: Uniform beach sand General: Terrain: Beach area; strip parallel to gulf; grassland Maximum monthly rainfall: Same as Mangaldan Water table: 4-6' depth Condition & use: Good, but surface wavy	- - -	Base course: 6" thick Upper subgrade: 0-2' thick Lower subgrade & fill	Brown gravelly sand Brown fine sand Gray & tan fine sand	GP SP SP	1-1/2 - -	45 0 0	13 1 1	38 99 97	4 4 2	N P N P N P	2.6[illegible] 2.73 2.[illegible]	- 11 -	- 10[illegible] -	- 21 -	- Low -
Clark	15 11 N 120 33 E	YMB	Surface: West runway: asphalt. East runway: PSP over asphalt. Aggregate: crushed river gravel < 3/4" Base: Thin layer of andesite porphyry gravel & sand Subgrade: Poorly graded arkosic sand with some fines & organic matter in upper zone. Topsoil stripped. Selected fill imported General: Terrain: Flat to gently rolling; grassland with a few rice paddies. Surface sands easily erodible Water table: At great depth Condition & use: Runways in good condition. Under very heavy traffic of all types	East runway East runway East runway East runway East runway	Typical base course Typical fill: 1/2 - 3-1/2' thick Upper subgrade: 0-3' thick Lower Subgrade Typical topsoil	Gray silty sandy gravel Gray clayey sand with pumice Gray sandy silt (Organic) Gray silty sand Black sandy silt	GM SC ML SM ML	1-1/2 - - 3/8 -	35 - 1 10 2	13 - 7 29 13	25 - 48 48 42	24 - 44 13 43	N P - N P N P N P	- 2.64 2.61 2.75 2.62	- - 17 11 14	- - 96 117 107	- - 16 45 25	- - Low Low Low
San Marcelino	14 58 N 120 12 E	MB	Surface: None Base: Well-compacted 4" decomposed andesite course (in effect clay-gravel course) Subgrade: Upper - fine gray organic sand (stripped in center of runway); lower - essentially a coarse arkosic sand General: Terrain: Flat valley surrounded by mountains; grassland. Probably partially flooded during heavy rains Use: Advance fighter strip. Dry weather runway	- - -	Selected fill & surfacing: 4-6' thick Upper subgrade: 0-1' thick Lower subgrade	Tan sandy silt Brown silty sand Gray gravelly sand	ML(?) SM SW	- - 1/2	6 6 18	22 24 37	29 58 44	43 12 1	- N P N P	- 2.69 2.68	12 6 11	121 111 105	25 33 31	Low Low Low

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group E: Pacific Islands

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes					Atterberg Limits			Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	LL	PI	Spec. Grav.	Opt. W %	Max. γ_d	CBR	Swell
Porac	15 03 N 120 32 E	MB(?)	Surface: Asphalt. Aggregate from Porac River Base: 6" to 2-1/2' thick rock base course & fill from Porac River. Well-compacted Subgrade: Poorly graded arkosic sand (similar to Clark Field) General: Terrain: Typical of Clark Field area Maximum monthly rainfall: 19" in August Water table: About 14' depth Condition & use: Excellent. Fighter plane traffic. Now out of use	-	Base course & fill: 1/2 - 2-1/2' thick	Brown sandy gravel	GW	1-1/2	65	13	15	7	N P		-	-	-	-	-
				-	Upper subgrade: 2 - 3' thick	Black silty sand	SM	-	0	15	47	38	-	-	2.68	10	125	27	Low
				-	Typical subsoil: 0 - 2-1/2' thick	Brown coarse to fine sand	SW	-	0	40	57	3	N P		-	10	120	43	Low
Floridn Blanca	14 59 N 120 30 E	VHB	Surface: Asphalt. Rock aggregate from Gumain River Base: 6" thick. Well-compacted mix of subgrade sands & Gumain River gravel Subgrade: Similar to Clark Field General: Terrain: Flat grassland with few rice paddies. Controlled drainage required to prevent erosion Maximum monthly rainfall: 14" in July Water table: About 8' depth Condition & use: Constructed March 1945. Principal traffic: F, HB, VHB. Surface in good condition	-	Base course: 6" thick	Brown silty gravel	GM	1	70	6	9	15	23	2	2.66	-	-	-	-
				-	Typical topsoil: 0 - 2' thick	Black silty sand	SM	-	0	21	46	33	N P		2.73	12	120	33	Low
				-	Intermediate subgrade: 1 - 2' thick	Brown silty sand	SM	-	3	15	47	35	N P		2.70	9	130	28	Low
				-	Lower subgrade	Brown silty sand	SM	-	14	40	32	14	N P		2.89	8	132	50	Low
Bailoun	14 33 N 121 01 E	F	Surface: Asphalt extension of concrete hardstand. Asphalt aggregate: crushed rock Base: About 6" thickness of black sandstone or of volcanic ash-river gravel mix Subgrade: Runway ends on volcanic tuff outcrop; in central fill section natural soil is heavy black organic clay overlying volcanic ash. Fill: recompacted volcanic tuff from cut sections General: Terrain: Low plateau SW of Pasig River. Grassland & old rice paddies Maximum monthly rainfall: 16" in August Water table: Deep, but perched water tables found throughout area Condition & use: Completed in spring of 1945. 75 planes per day (F, MB, T)	Central fill section	Typical fill: 1 - 10' thick	Gray clayey sand (volcanic tuff)	SC	-	8	33	30	29	50	8	2.50	24	86	22	Low
				Central fill section	Upper soil: 0 - 3' thick	Brown sandy clay	CL	-	2	7	20	71	48	21	2.54	22	99	-	-
				Central fill section	Subsoil: 0 - 3' thick	Gray clay	CH(?)	-	0	4	12	84	-	-	-	-	-	-	-
				Southwest end runway	Fill: 1 - 2' thick	Brown clayey sand (volcanic tuff)	SC(?)	-	0	17	62	21	-	-	-	13	114	25	Low
				-	Subgrade & outcrop	Yellowish-brown clayey sand (volcanic tuff)	SC(?)	-	0	23	53	24	-	-	-	-	-	-	-
Nichols	14 32 N 121 01 E	VHB	Surface: Asphalt. Crushed rock aggregate probably from Los Banos andesite quarry Base: 3" thickness of volcanic tuff & river gravel; good when well-compacted Subgrade: Typically a mantle of black organic clay overlying partially weathered volcanic tuff which has been reworked by marine action. Fill up to 2' depth at each runway end is compacted volcanic tuff General: Terrain: Flat to undulating; grassland & old rice paddies. Many small surface drains traversing field Maximum monthly rainfall: 16" in August Water table: Close to surface Condition & use: Asphalt surface in good cond. after 6 months use by all types except B-29	-	Typical base course	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-
				-	Principal topsoil: 0 - 3' thick	Gray clay	CH	-	0	0	12	88	91	56	-	27	93	3	High
				-	Intermittent topsoil: 0 - 2' thick	Gray sandy gravelly clay (from volcanic ash)	CL(?)	3/4	18	2	14	66	-	-	2.65	29	85	4	Low
				-	Upper subgrade: avg. 3' thick	Brown clay (volcanic tuff)	CH	-	1	2	9	88	77	27	2.68	38	78	3	High
				-	Typical subsoil	Tan silty sand (from volcanic ash sandstone)	SM	-	0	16	49	35	-	-	-	-	-	-	-
				-	Selected fill: 0 - 2-1/2' thick	Gray sandy gravelly clay	ML	3/4	27	4	14	55	44	15	-	21	87	7	Low

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group E: Pacific Islands

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes								Mod. AASHO Compaction Max.			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	γ_d	CBR	Swell
(b) Minsore Elmore	12 27 N 121 01 E	MB	Surface: Rolled natural ground (vegetation stripped) Base: None Subgrade: Highly plastic dark brown clay General: Terrain: Gently rolling terrace above river; grassland with little natural drainage Maximum monthly rainfall: 22" in August Water table: 6-8' depth Condition & use: Advanced fighter base used January-May 1945. Dry weather use only	-	Typical subgrade	Gray & tan clay	CL	-	0	2	8	90	40	18	2.68	15	115	5	Low
Hill	12 23 N 121 03 E	MB	Surface: Compacted soil Base: None Subgrade: Highly plastic brown clay. Small amount of fill (sand-gravel-clay) borrowed to bring low spots at north end to grade General: Terrain: Flat to gently rolling grassland with old rice paddies. Drainage difficult Maximum monthly rainfall: 22" in August Water table: About 4' depth Condition & use: Advanced fighter base. Dry weather use only. Now abandoned	-	Typical subgrade	Brown clay	CH	-	0	3	14	83	53	35	2.70	-	-	-	-
				-	Selected fill: 0 - 1' thick	Tan sandy clay	CH	-	0	18	16	66	50	27	2.65	15	114	3	Low
Martin	12 25 N 121 06 E	MB	Surface: PSP on asphalt & rock chips Base: Sand-clay-gravel mix. Appears to be poorly compacted Subgrade: This layer of black organic clay (stripped) over medium to highly plastic clay General: Terrain: Flat to gently rolling grassland with a few cultivated areas Maximum monthly rainfall: 22" in August Water table: About 10' depth Condition & use: Extensively used for 9 months in 1945. Good cond. except at south end where base course failed causing rutted surface	-	Base course & fill: 1/2 - 1' thick	Brown & gray medium gravel	GW	1	86	10	4	0	N P		2.68	-	-	-	-
				-	Typical subgrade	Brown sandy clay	CL	-	0	6	25	69	42	23	2.69	14	116	9	Low
McGuire	12 22 N 121 02 E	MB	Surface: PSP on asphalt topped with crushed gravel Base: 6-12" thickness of clay-gravel mix. Rounded gravel grading from 1-1/2 to 6" Subgrade: Thin layer of fine sand overlying medium to coarse beach sand containing 3/4" gravel at about 5-ft depth. Apparently no cut or fill required General: Terrain: Flat sandy beach. Grassland with few rice paddies nearby. Erosion problem Maximum monthly rainfall: 22" in August Water table: About 8' depth Condition & use: Used since December 1944, intensively in period March-May 1945, and limited use since. Runway in excellent condition	-	Base course & fill: 1/2 - 1-1/2' thick	Tan clayey gravel	GC	1-1/2	57	5	9	29	37	15	-	11	125	25	Low
				-	Typical lower subgrade: 2 - 2-1/2' thick	Gray & tan sandy gravel	GP	3/4	54	34	12	0	N P		-	14	111	40	Low

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group E: Pacific Islands

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes					Atterberg Limits			Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size in.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	LL	PI	Spec. Grav.	Opt. W %	Max. γ_d	CBR	Swell
(c) Palawan Puerto Princesa	09 44 N 118 45 E	MB	Surface: Steel mat on Jap conc. runway & on base course of runway extension Base: Mixture of crushed coral, clay, & beach gravel. Thickness: 6" over coral bedrock, 12" over residual clay Subgrade: Coral bedrock; and residual red clay, medium to high plasticity, 0-6' thick between coral outcrops General: Terrain: Flat coastal plain on coral reef, surrounded by coconut groves & rain forests Maximum monthly rainfall: 21" in December Water table: About 8' depth Use: Moderate	-	Base course: 1/2 - 1' thick	Crushed coral and clay	-	Samples missing		-	-	-	-	-	-	-	-	-
				-	Subgrade: 0 - 6' thick	Red clay	CH	-	0	2	8	90	75	47	2.92	31	93	8	Low
(d) Bagras Bacolod	10 39 N 122 56 E	F	Surface: Rolled crushed rock, no binder Base: Hand-placed river cobbles up to 12" diam. Voids filled with crushed rock & sand Subgrade: A mixture of clay, sand, & silt. Upper several feet oxidized. South runway end: fairly coarse beach sand at surface General: Terrain: Gently rolling grassland with fair drainage Maximum monthly rainfall: 7" in October Water table: 3-4' depth Condition & use: Built early 1945 & used by F & U. S. Now used by commercial planes. Much of crushed rock surfacing gone	Northern 2/3 of runway	Upper subgrade: 0 - 4' thick	Gray sandy clay	CH	-	0	6	26	68	59	37	2.69	15	107	-	-
				Northern 2/3 of runway	Lower subgrade	Gray clay	CH	-	0	3	10	87	75	41	2.68	27	92	5	Low
				Southern 1/3 of runway	Subgrade: 0 - 4' thick	Gray & tan silty sand	SM	-	5	22	57	16	N P		2.60	15	109	43	Low
				-	Selected fill: 1' thick	Cobbles & sand-clay	-	Samples missing		-	-	-	-	-	-	-	-	-	-
(e) Cebu Lahug	10 20 N 123 54 E	MB	Surface: Rolled clay-coral Base: Crushed coral & clay mix, 4-6" thick Subgrade: 0-18" black highly plastic organic clay over 0-24" brown medium plastic clay over brown clay of low plasticity containing varying amounts of sand & gravel General: Terrain: Gently sloping piedmont plain; grassland & cultivated fields Maximum monthly rainfall: 7" in October Water table: About 12' depth Condition & use: Built early 1945 & used as F & MB base. Light traffic now by civilian planes. Excellent dry weather surface, but very slippery & ruts easily when wet	-	Base course: 4 - 6" thick	Crushed coral	CP	3/4	49	14	34	3	N P		2.67	-	-	-	-
				-	Upper subgrade: 0 - 1-1/2' thick	Black gravelly sandy clay	CL	3/8	17	15	19	49	32	13	2.67	14	109	7	High
				-	Intermediate subgrade: 0 - 2' thick	Gray sandy clay	CL	-	0	6	20	74	44	20	2.66	-	-	-	-
				-	Lower subgrade: 1-1/2 - 3' depth	Sandy clay	CL	-	5	15	23	57	39	19	2.79	16	113	5	High
Opom (Mactan Island)	10 17 N 124 00 E	MB	Surface: Compacted crushed coral Base: Coral rocks, 8-10" diam., hand-placed by Japs. About 1/3 removed by U.S. & replaced with well-graded crushed coral Subgrade: Massive coral over entire area General: Terrain: Gently rolling grassland near center of island Maximum monthly rainfall: 7" in October Water table: About 5' depth Use: Operated after capture early 1945. Turned over to Navy after cessation of hostilities	-	Base course	Crushed coral	-	-	3	11	17	69	N P		-	-	-	-	-

34

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group E: Pacific Islands

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes								Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	Max. γ_d	CBR	Swell
(f) Leyte Tacloban	11 06 N 125 01 E	MB	Surface: Steel mat on coral sprayed with penetration asphalt Base: 6" thickness crushed coral, partially weathered & containing yellowish brown clay Subgrade: Fine poorly-graded beach sand General: Terrain: Flat coastal plain; grassland, erodible sand soil Maximum monthly rainfall: 14" in December Water table: About 4' depth Use: Built late 1944; F & MB base during campaign. Now abandoned	-	Typical base course	Crushed coral	-	1-1/2	59	13	25	3	N P		2.62	-	-	-	-
				-	Typical subgrade	Gray fine sand	SP	-	0	20	80	0	N P		2.80	14	107	.18	Low
Tacloban	11 13 N 125 01 E	MB	Surface: Steel mat on coral sprayed with penetration asphalt Base: 6" to 2' crushed coral (the greater depth to meet fill requirements) Subgrade: Thin clay layer at surface overlying fine poorly-graded beach sand General: Terrain: Flat coastal bar surrounded by water on 3 sides; grassland; erodible sand soils; surface drainage problem due to low elevation Maximum monthly rainfall: 14" in December Water table: About 3-1/2' depth Use: Former commercial field enlarged by Japs & later by U.S. Considerable traffic of all types	-	Typical base course: 3" to 18" thick	Crushed coral	-	1/2	46	32	20	2	N P		2.75	-	-	-	-
				-	Typical subgrade	Gray fine sand	SP	-	0	8	91	1	N P		2.80	15	111	19	Low
Dayao	10 59 N 125 02 E	MB	Surface: PSP Base: Very thin layer of bank-run river gravel Subgrade: 1/2-4' of brown sandy clay over more plastic black clay General: Terrain: Flat flood plain; grassland Maximum monthly rainfall: 14" in December Condition & use: Advanced fighter base. Abandoned. Surface uneven & rutted	-	Upper subgrade	Brown sandy clay	ML	-	0	3	25	69	42	13	2.70	26	97	7	Low
				-	Lower subgrade	Black sandy clay	ML	-	0	4	29	67	48	17	2.67	23	101	7	Low
Dulag	10 57 N 125 02 E	MB	Surface: PSP sprayed with penetration asphalt Base: 6-12" thickness beach sand & river gravel. Cobbles up to 8" diam. used Subgrade: Highly plastic yellow alluvial clay General: Terrain: Flat coastal & flood plain; natural drainage; grassland Maximum monthly rainfall: 14" in December Water table: About 5' depth Condition & use: Built by Japs; enlarged by U.S. & used as F & MB base. Surface rough & uneven due to poor subgrade	-	Typical base course	Sandy gravel	GW	1	80	11	9	0	N P		2.91	-	-	-	-
				-	Typical subgrade	Brown clay	MH	-	2	6	10	82	70	31	2.65	25	91	7	Low
(g) Samar Guiuan	11 02 N 125 43 E	MB	Surface: Penetration asphalt on coral Base: Coral subgrade scarified & recompacted Subgrade: Massive coral, somewhat weathered at surface & mixed with yellow clay General: Terrain: Flat, but drained satisfactorily; surrounded by rain forests Maximum monthly rainfall: 14" in December Water table: About 7' depth Use: Built late 1944. Used as F & MB base. Presently Naval air base. Capacity: all types. Traffic: 75 planes per day	-	Typical base course	Coral with yellow clay	-	1	68	6	10	16	N P		2.66	-	-	-	-

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group E: Pacific Islands

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes							Mod. AASHO Compaction				
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Opt. W %	Max. γ_d	CBR	Swell
(h) Mindanao Titcomb (Malabang)	07 37 N 124 03 E	MB	Surface: Steel mat over asphalt Base: 3-6" thickness of coarse beach gravel Subgrade: About 18" brown silty sand over coarse poorly-graded volcanic sand General: Terrain: Flat coastal terrace; low-scrub & coconut plantations Monthly rainfall: 4" average June thru December Use: Advanced F & MB base. Now on reserve status	- -	Upper subgrade Lower subgrade	Brown silty sand (flood plain) Black silty sand (volcanic)	SM SM	- 3/8	6 13	24 37	48 40	22 10	N P N P	2.69 2.79	17 22	102 84	48 31	Low Low
Morotai	06 56 N 122 04 E	MB	Surface: Asphalt, using beach gravel for aggregate Base: Hand-placed coral rocks bound with rolled crushed coral, 6-12" thick Subgrade: Generally 1-5' black organic clay overlying highly plastic yellow clay. At east end a reddish-brown silt up to 3-1/2' thick covers these soils General: Terrain: Flat coastal plain; rice paddies & coconut groves. [illegible] well-drained Monthly rainfall: 4" average June thru December Water table: About 3' depth Use: Prewar field enlarged by Japs & later U.S. Used as F & MB base. Now on limited status	- - East end of runway -	Asphalt aggregate Base course binder: 6"-12" thick Upper subgrade: 1 - 5' thick Upper subgrade: 0 - 3-1/2' thick Lower subgrade	Samples missing Crushed coral Black clay Brown clay Brown & tan clay	- - CH ML CH	- 1/4 - - -	- 10 0 0 0	- 13 0 2 0	- 21 7 17 8	- 56 93 81 92	- 28 72 41 72	- 9 46 13 48	- 2.66 2.58 2.66 2.72	- - 20 12 17	- - 100 112 106	- - 4 6 4	- - High Low High
(2) PALAU GROUP: Peleliu Island Peleliu	06 60 N 134 14 E	MB(?)	Surface: Rolled coral Base & subgrade: Coral bedrock General: Terrain: Flat coastal plain; well-drained artificially; grassland surrounded by rain forests & swamps Use: Built after recapture & used as bomber base. Now a permanent Naval air base	Coral pit	Surfacing	White coral	-	3/4	66	20	9	5	N P	-	13	113	78	Low
(3) ADMIRALTY ISLANDS: Los Negros Island Momote	02 03 S 147 28 E	MB	Surface: Rolled coral Base & subgrade: Coral bedrock General: Terrain: Flat coral reef; surrounding area covered by rain forests Use: Built after recapture & used as bomber base. Now a permanent Naval air base	Coral pit	Surfacing	White coral	-	1/2	51	30	15	4	N P	-	16	110	54	Low
(4) NEW GUINEA AREA: Biak Island Sorido	01 10 S 136 03 E	VHB	Surface: Rolled coral Base & subgrade: Coral bedrock General: Terrain: Flat coastal area surrounded by coconut groves & rain forests Use: Built after occupation of island. Was one of major airfields in SWPA. Now under Dutch control	Coral pit	Surfacing	Coral	-	-	2	21	29	48	N P	2.56	14	11[illegible]	52	Low

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group F: Hawaiian Islands, Alaska, Aleutians

AIRFIELD				SAMPLE				SOIL TESTS											
								Grain Sizes					Atterberg Limits			Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	LL	PI	Spec. Grav.	Opt. W %	Max. γ_d	CBR	Swell
(1) HAWAIIAN ISLANDS:																			
Oahu: Kahuku	21 43 N 157 57 W	HB	No information	NW-SE runway Sta 19+00	Base course	Coral rock	-	1	43	36	18	3	N	P	-	-	-	-	-
				NE-SW runway	Subgrade 1 - 4' depth	Black clay	OH	-	1	2	8	89	84	18	-	44	68	-	-
				NE-SW runway Sta 35+00	Base course	Coral rock & sand	-	3/4	47	5	34	14	N	P	-	10	117	80	Low
				NE-SW runway	Subgrade 1-1/2 to 3-1/2' depth	Coarse to fine sand	SP	1	13	37	50	0	N	P	-	14	111	50	Low
				Coral pit, 3 mi southeast	Pitrun base course	Coral rock	-	3	84	4	9	3	N	P	-	-	-	-	-
Wheeler	21 29 N 158 04 W	HB	No information	Runway "B"	Subgrade 1 - 2-1/2' depth	Red sandy clay	MH	-	0	4	21	75	64	24	-	34	89	8	Low
				Runway "C"	Subgrade 3 - 6' depth	Red clay	MH	-	0	7	9	84	67	32	-	33	89	5	Low
Kipapa	21 27 N 158 04 W	HB	No information	NNE-SSW runway	Subgrade 2 - 4' depth	Red sandy clay	MH	-	0	5	17	78	52	19	-	24	98	13	Low
				SSW-NNE runway	Subgrade 0 - 2' depth	Red sandy clay	ML	-	0	13	20	67	47	13	-	27	95	8	Low
Kaneohe Highway near Bickham Field	21 20 N 157 58 W	-	-	-	Pitrun base course	Coral rock	-	1	55	17	21	7	N	P	-	-	-	-	-
(2) ALASKA: Point Spencer	65 12 N 167 00 W	-	Surface: PSP Base: Two types of base course: (a) 2" well-graded sand with cut back treatment over 3" road mix sand-gravel-bunker oil. (b) 5" mix 30% crushed gravel - 70% pitrun gravel with treatment of oil and cut back Subgrade: 1 to 4" tundra with 6 to 12" muskeg in deeper swales overlying smooth gravels (< 1-1/4") & clean sands. Tundra removed if less than 18" below finished grade. Fill consisting of coarse gravel & sand-gravel mix used to bring runways up to grade General: Located on narrow spit. 6-7' msl. No frost heave. Permafrost 30" in gravel & 6-12" under the tundra. 1' ice dams found 500' west of runway	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nome (CAA)	64 31 N 165 27 W	-	Surface: Concrete Base: Mine tailings Subgrade: Tundra overlying silt soil. Tundra was probably stripped to some minimum depth below finished grade	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ladd Field (Fairbanks)	64 50 N 147 38 W	VHB	Surface: 4 to 6" asphaltic concrete Base: 50 to 60" gravel General: Flat valley with alluvial deposits of gravels, sands and silts. Organic matter in varying depths & order. All types of traffic. Performance good but some localized settlement attributed to poor compaction of base course	Borrow pit #5	Base course	Brown sandy gravel	GP	2	73	5	20	1	N	P	2.67	-	-	-	-
				Borrow pit #6	Aggregate	Brown sandy gravel	GP	2	80	3	17	0	N	P	2.70	-	-	-	-
				Borrow pit #7	Base course	Sandy gravel	GP	1-1/2	65	8	27	0	N	P	2.69	-	-	-	-
				North edge SW parking apron	Subgrade	Brown micaceous silt	ML	-	0	0	7	93	N	P	2.69	22	94	15	Low
				West edge SE parking apron	Subgrade	Brown micaceous silt	ML	-	0	0	10	90	N	P	2.71	17	100	15	Low
				South edge south runway	Subgrade	Brown silty sand with mica	SM	-	0	0	63	37	N	P	2.71	18	98	13	Low
				North edge north runway	Subgrade	Brown sandy silt with mica	ML	-	0	0	57	43	N	P	2.71	-	-	-	-
				South end north runway	Subgrade	Brown micaceous silt	ML	-	0	0	18	82	N	P	2.72	20	98	10	Low
				North end north taxiway	Subgrade	Brown sandy silt with mica	ML	-	0	0	22	78	N	P	2.73	20	99	9	Low
				North runway	Subgrade	Brown sandy silt with mica	ML	-	0	0	53	47	N	P	2.72	17	103	17	Low

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group F: Hawaiian Islands, Alaska, Aleutians

AIRFIELD				SAMPLE				SOIL TESTS										
								Grain Sizes										
Base and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fine <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec. Grav.	Mod. AASHO Compaction %	Mod. AASHO Compaction Max. γ_d	CBR	Swell
Mile 26 (Fairbanks)	64 39 N 147 05 W	VRB	Surface: Asphalt Base: Gravel Subgrade: Sand overlying gravel General: Located in flat river valley. Sedimentary soils: gravel, sand, silt, organic matter	North end parking apron	-	-	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-
				North area between runways	-	Medium gravel	GP	1-1/2	98	1	1	0	N	P	2.70	-	-	-	-
				East shoulder, east runway	-	Brown medium gravel	GW	1	88	2	10	0	N	P	2.72	-	-	-	-
				South area between runways	-	Brown silt	ML	-	0	0	12	88	N	P	2.74	12	103	12	Low
				South end parking apron	-	Brown sandy silt	ML	-	0	0	52	48	N	P	2.71	-	-	-	-
				Borrow pit #2	Base course	Brown medium gravel	GW	1-1/2	88	2	10	0	N	P	2.70	-	-	-	-
				Borrow pit #1	Base course	Gray medium gravel	GW	1-1/2	87	4	8	1	N	P	2.70	-	-	-	-
Elmendorf (Ft. Richardson, Anchorage)	61 14 N 149 49 W	VRB	Surface: Two runways: 6" reinforced & 8" reinforced concrete Subgrade: 18" topsoil stripped exposing gravel subsoil, except at west end E-W runway where 3-4' muskeg was excavated & replaced by gravel fill	South end N-S runway	Subgrade	Brown sandy gravel	GW	1	65	20	12	3	N	P	-	-	-	-	-
				North end N-S runway	Subgrade	Brown sandy gravel	GW	1	70	19	11	0	N	P	-	-	-	-	-
				East end E-W runway	Subgrade	Tan medium gravel	GW	1-1/2	90	6	4	0	N	P	-	-	-	-	-
				West end E-W runway	Subgrade	Brown sandy gravel	GW	1-1/2	70	20	10	0	N	P	-	-	-	-	-
Birchwood	61 25 N 149 33 W	NB	General: No surfacing or base course. About 18" topsoil stripped exposing gravel subsoil	Midpoint runway on center line	-	Brown sandy gravel	GW	1-1/2	77	17	6	0	N	P	-	-	-	-	-
Goose Bay	61 24 N 149 52 W	NB	General: Reconnaissance strip. No surfacing or base course. 18" topsoil stripped exposing gravel subsoil	Midpoint landing strip on center line	-	Brown sandy gravel	GW	1-1/2	72	13	10	5	N	P	-	-	-	-	-
Campbell Creek	61 10 N 149 48 W	NB	General: Reconnaissance strip. No surfacing. 18" topsoil stripped exposing gravel subsoil	Midpoint landing strip on center line	-	Brown sandy gravel	GW	1-1/2	79	12	7	2	N	P	-	-	-	-	
Cold Bay (Ft. Randall)	55 12 N 162 41 W	VRB	Surface: Two runways: 3" asphaltic concrete, 5" on turnarounds Base: (a) 2" crushed gravel over (b) 0-12" pitrun gravel (3" max. size) on (c) old runway Subgrade: 1 to 4' sand & gravel overlying sandy & silty soils	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Point Barrow	71 25 N 156 10 W	-	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bettles	67 00 N 151 30 W	-	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Galena	64 40 N 157 00 W	NB	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Big Delta	64 01 N 145 44 W	VRB	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northway	63 00 N 142 00 W	VRB	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gulkana	62 09 N 145 28 W	NB	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(3) ALEUTIAN ISLANDS: (a) Umnak Island Otter Point (Ft. Glenn)	52 23 N 167 52 W	VRB	Surface: One runway: PSP. Two runways: rolled base Base & Fill: 4-15' fill: hard, brittle, granular volcanic cinders Subgrade: Sand General: No frost action. Field used by F, NB, RB, T. Excellent performance. Maintained by blading	-	Base (fill)	Black volcanic cinders	SW	1/2	34	36	23	7	N	P	-	9	128	-	-

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TABLE 3: SUMMARY OF AIRFIELD TEST DATA (Cont.)

Group F: Hawaiian Islands, Alaska, Aleutians

AIRFIELD				SAMPLE				SOIL TESTS										
								Grain Sizes							Mod. AASHO Compaction			
Name and Location	Latitude and Longitude	Field Class.	Airfield Description	Location	Material	Description	Classification Symbol	Max. Gravel Size In.	% Gravel >No. 10 Sieve	% Coarse Sand 10 to 40 Sieve	% Fine Sand 40 to 200 Sieve	% Fines <No. 200 Sieve	Atterberg Limits LL	Atterberg Limits PI	Spec Grav.	Opt. W %	Max. γ_d	CBR	Swell
(b) Atka Island Atka	52 15 N 174 15 W	T	Surface: Steel mat runway Base: None General: Little traffic on field after 1945	South end runway	Subgrade	Black fine sand	SP	-	0	13	80	7	N P		-	-	-	-	-
				Center of runway	Subgrade	Black fine sand	SP	-	0	9	81	10	N P		-	-	-	-	-
				North end runway	Subgrade	Black fine sand	SP	-	0	15	75	10	N P		-	14	109	33	Low
				-	Typical subgrade	Black fine sand	SP	-	0	12	83	5	N P		-	-	-	-	-
(c) Adak Island Adak	51 53 N 176 39 W	VEB	Surface: 5" asphaltic conc. (aggregate crushed andesite porphyry, 1-1/4" max. size) Base: 12" crushed andesite porphyry (4" max. size) General: Moderate traffic (EB, T) with good performance	-	-	Brown fine sand	SP	-	0	8	79	13	N P		-	15	110	-	-
				-	Typical subgrade	Gray sandy silt	ML	-	8	21	[illegible]	43	N P		-	42	69	-	-
				-	Typical base course	Crushed rock	GW	3	87	3	10	0	N P		-	-	-	-	-
(d) Shemya Island Shemya	52 44 N 174 08 E	VEB	Surface: 5" asphaltic concrete Base: 7" crushed rock (2" max. size) Subgrade: Fill composed of sand, beach gravel & pitrun stone. Tundra 1 to 8' thick overlying sand was stripped to 6' below subgrade elevation General: Fair traffic (F, MB, EB, T)	Samples missing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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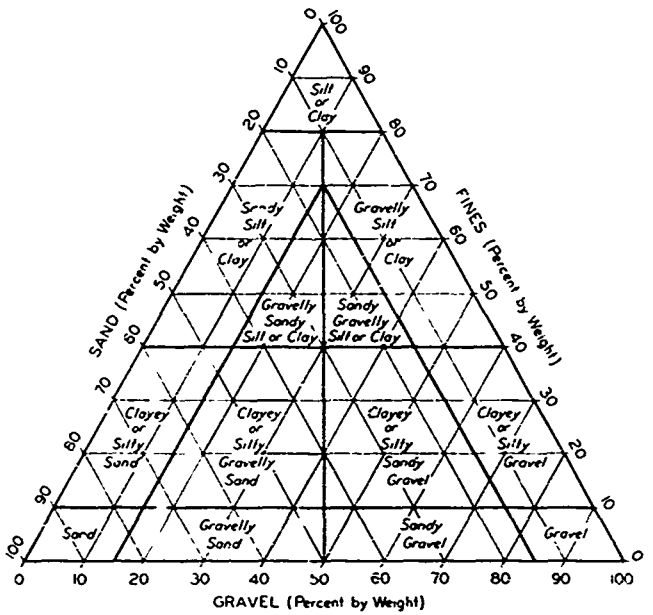

NOTES

1. Identification based on following grain size ranges
   Gravel 3 in to no 10 sieve (2.0mm)
   Sand No. 10 (2.0mm) to no. 200 (0.074 mm.)
   Fines (silt or clay) Below no. 200 (0.074 mm)
2. Soil is called "silt" or "clay" based upon Atterberg limits values of minus 40 mesh fraction as follows
   Silt LL 28 or less, and PI 6 or less
   Clay LL over 28 or PI over 6.
3. Sieve sizes are U S Standard

SOIL TRIANGLE

Figure 1

CLASSIFICATION OF SOILS

MAJOR DIVISIONS		LETTER	NAME
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Gravel or Sandy Gravel, well-graded
		GP	Gravel or Sandy Gravel, poorly-graded
		GM	Silty Gravel or Silty Sandy Gravel
		GC	Clayey Gravel or Clayey Sandy Gravel
	SAND AND SANDY SOILS	SW	Sand or Gravelly Sand, well-graded
		SP	Sand or Gravelly Sand, poorly-graded
		SM	Silty Sand or Silty Gravelly Sand
		SC	Clayey Sand or Clayey Gravelly Sand
FINE GRAINED SOILS	LOW PLASTICITY	ML	Silts, Sandy Silts, Gravelly Silts, or Diatomaceous Soils
		CL	Lean Clays, Sandy Clays, or Gravelly Clays
		OL	Organic Silts or Lean Organic Clays
	HIGH PLASTICITY	MH	Micaceous Clays or Diatomaceous Soils
		CH	Fat Clays
		OH	Fat Organic Clays
PEAT AND OTHER FIBROUS ORGANIC SOILS		Pt	Peat, Humus, and other Organic Swamp Soils

Figure 2