AIRCRAFT GROUND-FLOTATION INVESTIGATION

PART II. DATA REPORT ON TEST SECTION 1

W. BRABSTON, A. RUTLEDGE, and W. HILL

*** Export controls have been removed ***

This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Vehicle Equipment Division (FDF), Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio 45433.

Approved for Public Release
The investigation described herein constitutes one phase of studies conducted during 1964 and 1965 at the U. S. Army Engineer Waterways Experiment Station (WES) under U. S. Air Force Project h10-A, NFP No. AS-4-1-177, "Development of Landing Gear Design Criteria for the C1-HL5 Aircraft." (The C1-HL5 is now designated C-12A.) This program was sponsored and directed by the Landing Gear Group, Air Force Flight Dynamics Laboratory, Research and Technology Division, Mr. R. J. Parker, Project Engineer.

These tests were conducted by personnel of the WES Flexible Pavement Branch, Soils Division, under the general supervision of Messrs. W. J. Turnbull, A. A. Harwell, and R. G. Ahlvin, and the direct supervision of Mr. R. H. Brown. Other personnel actively engaged in this study were Messrs. C. D. Burns, D. M. Ladd, W. N. Brabston, A. H. Rutledge, H. H. Glary, Jr., L. J. Smith, Jr., and W. J. Hill, Jr. This report was prepared by Messrs. Brabston, Rutledge, and Hill.

Director of WES during the conduct of this investigation and preparation of this report were Col. Alex S. Sutton, Jr., CE, and Col. John R. Oswalt, Jr., CE. Technical Director was Mr. J. R. Tiffany.

Publication of this technical documentary report does not constitute Air Force approval of the report's findings of conclusions. It is published only for the exchange and stimulation of ideas.

FOR THE DIRECTOR

GEORGE A. SOLT, JR.
Acting Chief, Mechanical Branch
Vehicle Equipment Division
AF Flight Dynamics Laboratory

Approved for Public Release
ABSTRACT

This data report describes work undertaken as part of an overall program to develop ground-floatation criteria for the C-5A aircraft. A test section was constructed to a width adequate for two test lanes. Each lane was divided into three items having different subgrade CBR values. Two items were unsurfaced, and the remaining item was surfaced with modified 211 aluminum landing mat. Traffic was applied to the lanes using a 104,000-lb load on a twin-wheel assembly consisting of two 56.00-16, 36-ply aircraft tires with inflation pressure of 800 psi. Wheel spacing was 37 in. c-c for one lane and 24 in. c-c for the other.

This report presents the data collected on soil strengths, surface deformations and deflections, and drawbar pull. The traffic-coverage level at which failure was evidenced on each test item is also given.
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECTION I: INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>SECTION II: DESCRIPTION OF TEST SECTION AND LOAD VEHICLE</td>
<td>2</td>
</tr>
<tr>
<td>Description of Test Section</td>
<td>2</td>
</tr>
<tr>
<td>Load Vehicle</td>
<td>2</td>
</tr>
<tr>
<td>SECTION III: APPLICATION OF TRAFFIC AND FAILURE CRITERIA</td>
<td>3</td>
</tr>
<tr>
<td>Application of Traffic</td>
<td>3</td>
</tr>
<tr>
<td>Failure Criteria</td>
<td>3</td>
</tr>
<tr>
<td>SECTION IV: BEHAVIOR OF ITEMS UNDER TRAFFIC AND TEST RESULTS</td>
<td>5</td>
</tr>
<tr>
<td>Lane 1</td>
<td>5</td>
</tr>
<tr>
<td>Lane 2</td>
<td>7</td>
</tr>
<tr>
<td>SECTION V: PRINCIPAL FINDINGS</td>
<td>9</td>
</tr>
</tbody>
</table>
ILLUSTRATIONS AND TABLES

Table
1. Summary of Traffic Data, Test Section 1 .......................... 10
2. Summary of CRB, Density, and Water Content Data, Test Section 2 .......................... 11

Figure
1. Sequence of traffic application for uniform coverages .......................... 3
2. Lane 1, item 1, at two passes (failure) .......................... 12
3. Lane 1, item 2, at 20 coverages .......................... 12
4. Lane 1, item 2, at 300 coverages (traffic suspended, no failure) .......................... 13
5. Lane 1, item 3, prior to traffic .......................... 13
6. Lane 1, item 3, at 200 coverages (failure). Transverse straightedge shows roughness .......................... 14
7. Lane 1, item 3, at 300 coverages (failure). Longitudinal
   straightedge shows deformation .......................... 14
8. Lane 2, item 1, prior to traffic .......................... 15
9. Lane 2, item 1, at two passes (failure) .......................... 15
10. Lane 2, item 2, prior to traffic .......................... 16
11. Lane 2, item 2, at 300 coverages (failure) .......................... 16
12. Lane 2, item 3, prior to traffic .......................... 17
13. Lane 2, item 3, at 40 covers (failure). Longitudinal straightedge shows deformation .......................... 17
14. Lane 2, item 3, at 40 covers (failure). Transverse straightedge shows deformation .......................... 18
15. Lane 2, item 3, failed area at 68 coverages (28 post-failure coverages) .......................... 18
16. Lane 2, item 3, at 68 coverages (28 post-failure coverages). Longitudinal straightedge shows roughness and net deformation .......................... 19
17. Test load vehicle .......................... 19
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.</td>
<td>Layout of Test Section 1 and Summary of Test Results</td>
<td>20</td>
</tr>
<tr>
<td>19.</td>
<td>Layout of Surfaced Item, Test Section 1, Lanes 1 and 2</td>
<td>21</td>
</tr>
<tr>
<td>20.</td>
<td>Tire-Print Dimensions and Tire Characteristics, Test Section 1, Lanes 1 and 2</td>
<td>22</td>
</tr>
<tr>
<td>21.</td>
<td>Average Cross-Sectional Deformations, Test Section 1, Lanes 1 and 2</td>
<td>23</td>
</tr>
<tr>
<td>22.</td>
<td>Permanent Profile Deformations, Test Section 1, Lanes 1 and 2</td>
<td>24</td>
</tr>
<tr>
<td>23.</td>
<td>Deflections, Test Section 1, Lanes 1 and 2</td>
<td>25</td>
</tr>
</tbody>
</table>
SUMMARY

Tests on Section 1 are one phase of a comprehensive research program to develop ground-flotation criteria for heavy cargo-type aircraft. Section 1 consisted of two similar traffic lanes, lanes 1 and 2, each of which was divided into three items (Fig 18). Each item was constructed to a different subgrade CBR value. Items 1 and 2 were unsurfaced, and item 3 (Fig 19) was surfaced with modified Till aluminum landing mat.

Traffic was applied to the two lanes using a twin-wheel assembly with 200-psi tire inflation pressures and 104,000-lb test load. As used in both lanes, the wheel assembly consisted of two 56.0-16, 15-ply aircraft tires spaced 37 in. c-c and 24 in. c-c for trafficking lanes 1 and 2, respectively. Fig 20 gives pertinent tire print dimensions and tire characteristics. The lanes were trafficked to failure in accordance with the criteria designated in Part I of this report. Data were recorded throughout testing to give a behavior history of each item.

Using the test criteria mentioned above it was possible to directly compare the effects of trafficking with the two assemblies. Basic performance data are summarized in the following paragraphs.

Lane 1

Item 1

The average subgrade CBR for the top 12 in. of soil was 10 prior to traffic. Two passes of the test vehicle produced severe rutting and failure of the item due to excessive roughness.

Item 2

The average subgrade CBR for the top 12 in. of soil was 15 prior to traffic. Traffic was suspended at 300 coverages without reaching a failure condition on the item because the subgrade CBR was increasing with traffic (30 OMP after 300 coverages). The surface was slightly rutted, but the overall condition of the item was good. The rated CBR for the item was 27.
Item 3

Item 3 was surfaced with modified Till aluminum landing mat. Failure of the item occurred at 300 coverages due to roughness and general mat deterioration. The rated CBR for the item was 7.4.

Lane 2

Item 1

The average subgrade CBR for the top 12 in. of soil was 10 prior to traffic. As in item 1 of lane 1, two passes of the test vehicle produced severe rutting and failure of the item due to excessive roughness.

Item 2

The item was considered failed at 130 coverages due to excessive roughness. Some CBR increase occurred in the item with trafficking (average CBR values of 15 and 22 at 0 and 130 coverages, respectively). The rated CBR for the item was 15.

Item 3

Item 3 was surfaced with modified Till aluminum landing mat. The item was considered failed after 40 coverages due to roughness and mat deterioration. The rated CBR for the item was 8.7.

viii

Approved for Public Release
AIRCRAFT GROUND-FLotation INVESTIGATION

PART II DATA REPORT ON TEST SECTION I

SECTION I: INTRODUCTION

The investigation reported herein is one phase of a comprehensive research program being conducted at the U. S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Miss., as part of U. S. Air Force Project 410-A, MIPR No. AS-2-177, to develop ground-flotation criteria for the C-4A, a heavy cargo-type aircraft. Specifically, the tests reported herein are part of a series of tests to determine the degree of interaction of the wheels of multiple-wheel landing-gear assemblies with landing mat and unsurfaced soils under various conditions of loading.

Prosecution of this investigation consisted of constructing two identical traffic lanes and subjecting them to equal test loads with twin-wheel landing-gear assemblies using different wheel spacings for the two lanes.

This report presents a description of the test section and wheel assemblies, and gives results of traffic. Equipment used, types of data and method of recording them, and general test criteria are explained and illustrated in Part I of this report.
SECTION II: DESCRIPTION OF TEST SECTION AND LOAD VEHICLE

Description of Test Section

The test section (Fig. 18) was located within a roofed area in order to allow control of the subgrade CBR (California Bearing Ratio) in the test items. Construction of the test section was accomplished by first excavating a 54- by 80-ft area to a depth of 24 in. The excavated area was backfilled to the original grade level in compacted lifts with a heavy clay soil (classified as CH according to the Unified Soil Classification System). The fill material used was a local clay (buckshot) with a plastic limit of 27, liquid limit of 58, and plasticity index of 31. Gradation and classification data for the subgrade material are given in Part I. The surface of the section was graded and then smoothed by rolling with a 10-ton steel-wheel roller.

Two 12-ft-wide traffic lanes divided into three items each were constructed in the section. Different subgrade strengths were obtained in the items (Fig. 18) by controlling the water content and compaction effort. Items 1 and 2 were unsurfaced, and item 3 (Fig. 19) was surfaced with modified T-11 aluminum landing mat which was embedded in the subgrade by rolling with a 70,000-lb rubber-tired roller. The landing mat used is described and illustrated in Part I.

Load Vehicle

The load vehicle is shown in Figure 17. Details of construction and linkage of the load compartment and prime mover are given in Part I. For trafficking lanes 1 and 2, the load compartment was weighted to produce a load of 104,000 lb on a twin-wheel tracking assembly. For trafficking, the load wheels were spaced 37 and 84 in. c-c for lanes 1 and 2, respectively. Two 56,00-16, 36-ply, type VII aircraft tires with tire inflation pressure of 200 psi were used on the wheels. Tire-print data and pertinent tire characteristics are given in Figure 20.
SECTION III: APPLICATION OF TRAFFIC AND FAILURE CRITERIA

Application of Traffic

The load vehicle was operated to produce uniform traffic coverage on the test lanes. The load cart was driven forward and backward along the same track longitudinally along the test lane, then shifted laterally, and the forward-backward operation repeated. Positions 1, 2, and 3 were track fliers; the cart was then shifted and positions 4, 5, and 6 were track fliers. In this manner, two coverages of traffic were applied to the test lane as the vehicle progressed from one side of the lane to the other. Figure 1 shows the general method of applying uniform coverages on the test lane.

Figure 1. Sequence of traffic application for uniform coverages

Typically, the lane widths used were not exact multiples of the tracking tire widths and spacings so that it was necessary to determine a coverage factor for each lane to compensate for small overlaps or gaps in the coverage pattern. In all cases, the coverage levels indicated in the text and on the data sheets represent the coverage levels determined in this fashion.

Failure Criteria

Failure criteria used in this investigation and descriptive terms used in presentation and discussion of data in all reports in this series are presented in Part I. A general outline of types of data collected is given in the following paragraphs. Details on apparatus and procedure for obtaining specific measurements are given in Part I.

CBR, water content, and dry density

CBR, water content, and dry density of the subgrade soil were measured for each test item prior to application of traffic, at intermediate coverage levels, and at failure or suspension of traffic if no failure condition was reached. After traffic was concluded on an item, a measure of subgrade strength termed "rated CBR" was determined. Rated CBR is generally the average CBR value obtained from all the determinations made in the top 12 in. of soil during the test life of an item. In certain

Approved for Public Release
instances, extreme or irregular values may be ignored if the analyst de-
cides that they are not properly representative.

Surface roughness, or
differential deformation

Surface roughness, or differential deformation, measurements were
made using a 10-ft straightedge at various traffic-coverage levels on all
items. Rut depths were measured for unsurfaced items, and dishing effects
of individual mat panels in the mat-surfaced items were recorded.

Deformations

Deformations, defined as permanent cumulative surface changes in
cross section or profile of an item, were charted by means of level read-
ings at persistent traffic-coverage levels.

Deflection

Deflection of the test surface under an individual static load of
the load-wheel assembly was measured at various traffic-coverage levels
on both mat-surfaced and unsurfaced items. Level readings on the item
surface on each side of the load wheels and on a pin and cap device di-
rectly beneath a load wheel provided deflection data. Both total (for one
loading) and elastic (recoverable) deflections were measured on unsurfaced
items. All mat deflection was for practical purposes recoverable, i.e.,
total deflection equaled elastic (spring-back) deflection. Subgrade de-
flexion (both total and elastic) directly beneath load wheels was deter-
mined at intervals by utilizing a pin and cap device, as illustrated in
Part I. The pin and cap device was applied to the subgrade or surfaced
items through a hole (existing or cut) in the mat.

Rolling resistance

Rolling resistance, or drawbar pull, measurements were performed
with the load vehicle over each test item at designated coverage levels.
Three types of drawbar measurement were taken: (a) maximum force re-
quired to overcome static inertia and commence forward movement of the
load car, termed "initial DRP"; (b) average force required to maintain
a constant speed once the load vehicle is in motion, termed "rolling DRP";
and (c) maximum force obtained during the constant speed run, termed
"peak DRP."

Mat breaks

Mat breaks on the surfaced items were inspected, classified by
type, and recorded on the data sheet at various coverage levels.
SECTION IV: BEHAVIOR OF ITEMS UNDER TRAFFIC AND TEST RESULTS

Lane 1

Behavior of items under traffic

Item 1. The average subgrade CBR was 10 for the top 12 in. of soil in item 1 prior to traffic. The test vehicle caused severe rutting after two passes made in an attempt to record 0-coverage drapser pull values. Rut depths exceeded 6 in., and the item was considered failed at two passes (Figure 2).

Item 2. The average subgrade CBR was 15 for the top 12 in. of soil in item 2 prior to traffic. Slight rutting of the surface resulted from two passes of the load vehicle during 0-coverage drapser pull tests. After 20 coverages, the entire item had depressed in the tracked lane approximately 1 in. and the surface was relatively flat and in very good condition (Figure 3). A reduced rate of soil depression continued throughout the traffic period. At 40 coverages, the average CBR had increased to 3/4 for the top 12 in. of soil. Slight rutting of the surface was evident when traffic was suspended at 300 coverages, but the overall condition of the item remained good (Figure 4) and it was not considered failed. The traffic was discontinued because the CBR was increasing with traffic, and an excessive amount of time would have been required to develop a failure. The rated CBR of the item was 27 after 300 coverages of the test vehicle.

Item 3. Item 3 prior to traffic is shown in Figure 5. After 20 coverages, there were slight differential mat deformations along with an initial soil depression of about 1 in. No significant mat damage was evident with continued traffic to 100 coverages. At 135 coverages, sheared rivets and increasing differential deformations were noted. At 200 coverages, cracks appeared in the mat surface, but the item remained in serviceable condition. Traffic was continued to 300 coverages, at which time the mat was considered failed due to excessive roughness and mat deterioration (Figures 6 and 7). The rated CBR for the item was 7/4.

Test results

Table 1 summarizes traffic data recorded on each item of lane 1 during testing. Soil test data are given in table 2.

Item 1. No uniform traffic coverage was possible on item 1, as failure due to severe rutting occurred during preliminary passes made for drapser pull measurements. The values recorded for drapser pull are shown in table 1. A cross-section plot showing average soil deformation at failure is shown in Figure 21.
Item 2. Traffic was suspended at 300 coverages without reaching a failure condition on item 2. Average CBR values in the top 12 in. of soil increased with application of traffic. The following information was obtained from traffic tests on item 2.

a. Roughness. The maximum average differential deformation (transverse) attained was 1.60 in. with no severe ruts developing. Differential deformation measurements at various coverage levels throughout the test are presented in table 1 along with rut measurements.

b. Deformation. Average soil deformation increased uniformly during trafficking. A maximum average deformation of 3.3 in. was measured at 300 coverages when traffic was suspended. Figures 21 and 22 show average cross-section and profile surface deformations at various coverage levels.

c. Deflections. Average total soil deflections (total for one loading) are shown in Fig 23. Maximum deflections under the load wheels were 1.0 and approximately 0.5 in. at 0 and 300 coverages, respectively. Elastc soil deflection was 0.1 and approximately 0.4 in. at 0 and 300 coverages, respectively.

d. Rolling resistance. Initial, peak, and rolling drawbar pull values (Table 1) decreased during the first 135 coverages. Thereafter, initial and peak drawbar pull increased, and at 300 coverages the values exceeded those recorded at 0 coverages. Rolling drawbar pull increased slightly from 135 to 300 coverages, but never equaled the 0-coverage value.

Item 3. Item 3 was considered failing due to roughness at 300 coverages. The following information was obtained from traffic tests on item 3.

a. Roughness. At 300 coverages, longitudinal, transverse, and diagonal differential deformations were 2.0, 1.75, and 2.25 in., respectively (see Table 1).

b. Deformation. Net deformations are shown in Fig 21. The net cross-section progressively assumed a trough shape as trafficking proceeded, reaching a maximum deformation of 2.6 in. Development of longitudinal deformation is indicated in Fig 22. The maximum deformation measured along this direction was 3.0 in.

c. Deflection. Deflection of the mat under the load wheels increased to the 200-coverage level and decreased thereafter. The maximum deflection of 2.3 in. occurred with the wheel assembly centered over panel joints. Fig 23 shows deflections measured with the wheel assembly in several positions relative to the mat joints.

d. Expenditure. The mat within the limits of the traffic lane was almost fully embedded in the subgrade after 300 coverages.
c. Rolling resistance. Drawbar pull values (table 1) showed an increase up to the 130-coverage level and remained relatively unchanged thereafter.

Lane 2

Behavior of items under traffic

Item 1. Item 1 prior to traffic is shown in Figure 8. The average subgrade GCR for the top 12 in. of soil in item 1 was 10 prior to traffic. The test vehicle caused severe rutting after two passes were made in an attempt to record 0-coverage drawbar pull values. But depths exceeded 4 in., and the item was judged failed at two passes Figure 9.

Item 2. Item 2 prior to traffic is shown in Figure 10. Except at the transition between item 2 and the previously failed item 1, the item showedno severe distress prior to 100 coverages, but it deteriorated rapidly thereafter. At 130 coverages the item was considered failed due to roughness and shear deformation in the soil (Figure 11). A slight increase in GCR (from 15 GCR to 22 GCR) occurred with trafficking. The rated GCR of the item was 10.

Item 3. Item 3 prior to traffic is shown in Figure 12. At 20 coverages, rivet breakage had begun, and there was evidence of subgrade material being extruded upward through the joints of the mat. The greatest rivet damage was along the center lines of the individual mat panels. At 40 coverages, item 3 was considered failed due to roughness and mat deterioration (Figures 13 and 14). The rated GCR of the item was 5.7.

To observe the rate of mat deterioration under postfailure conditions, an additional 20 coverages of traffic were applied to item 3. Severe mat damage was rapid, and panels separated along their center lines (Figure 15). Shearing of drive rivets in end connectors occurred just outside the traffic lane, allowing the panel end joints to open (Figure 16). At 68 coverages, movement of the load vehicle over the item had become difficult, and traffic was suspended.

Test results

Table 1 summarizes traffic data recorded on each item of lane 2 during testing. Soil test data are given in table 2.

Item 1. No uniform traffic coverage was possible on item 1, as failure due to severe rutting occurred during preliminary passes of the load vehicle. The only data recorded were the 0-coverage drawbar pull values and rut depth shown in table 1.

Item 2. Item 2 was considered failed due to roughness at 130 coverages of the test vehicle. The following information was obtained from traffic tests on item 2.

7

Approved for Public Release
A. Roughness. At failure, the maximum transverse and diagonal differential deformations (table 1) were 3.38 and 3.13 in., respectively.

b. Deformation. Average cross section and profile deformation plots are shown in figures 21 & 22, respectively. A maximum average cross-section deformation of 3.5 in. was measured at failure. Along the centerline profile, maximum average deformation was 3.2 in. Rutting in item 2 was more pronounced on the south and adjoining the previously failed item 1 due to progression of ruts from the transition.

c. Deflection. Total soil deflections under the load wheels are shown in Fig 23. Maximum total deflection of about 0.4 in. was measured beneath the load wheels at 130 coverages. Maximum elastic soil deflection (table 1) was 0.4 in. at 130 coverages.

d. Rolling resistance. Drawbar pull values were recorded at 0 and 130 coverages (table 1). At failure, the initial drawbar pull value showed an increase of about 8 kips over the 0-coverage value. Peak and rolling drawbar pull values were less at failure than at 0 coverages.

Item 3. Item 3 was considered failed due to roughness at 30 coverages, but traffic was continued for 28 postfailure coverages. The following information was obtained from traffic tests on item 3.

A. Roughness. At failure the maximum longitudinal, transverse, and diagonal differential deformations (table 1) were 2.29, 1.75, and 2.31 in., respectively.

b. Deformation. Average cross-section deformation plots are shown in Fig 21. A maximum deformation of 2.0 in. was measured at failure. A profile deformation plot is shown in Figure 22.

c. Deflection. Deflection of the mat under the load wheels increased throughout traffic. The maximum average deflection of 3.4 in. occurred at failure with the wheel assembly centered over panel joints. Fig 23 shows deflections with the wheel assembly in several positions relative to mat joints. Each of these deflection plots reflects a smooth, concave cross section. Elastic subgrade deflection at failure was 1.8 in. After 28 postfailure coverages, the elastic subgrade deflection was 1.7 in.

d. Rolling resistance. Initial, peak, and rolling drawbar pull values (table 1) recorded at 30 coverages showed significant increases over values measured at 0 coverages.

8

Approved for Public Release
SECTION V: PRINCIPAL FINDINGS

From the foregoing discussion, the principal findings relating test load, wheel assembly, tire inflation pressure, surface type, subgrade CBR, and traffic coverages are as follows:

<table>
<thead>
<tr>
<th>Load, Wheel Assembly, and Tire Pressure</th>
<th>Type of Surface</th>
<th>Rated Subgrade CBR</th>
<th>Coverages at Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>104,000-lb load; twin-wheel assembly; 37-in. c-c, 56.00-16, 36-ply tires at 500-psi inflation pressure</td>
<td>Unsurfaced</td>
<td>10</td>
<td>2 passes</td>
</tr>
<tr>
<td></td>
<td>Unsurfaced</td>
<td>27</td>
<td>No failure; traffic suspended at 300 coverages</td>
</tr>
<tr>
<td></td>
<td>Modified Till aluminum mat</td>
<td>7.4</td>
<td>300</td>
</tr>
<tr>
<td>104,000-lb load; twin-wheel assembly; 24-in. c-c, 56.00-16, 36-ply tires at 500-psi inflation pressure</td>
<td>Unsurfaced</td>
<td>10</td>
<td>2 passes</td>
</tr>
<tr>
<td></td>
<td>Unsurfaced</td>
<td>18</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>Modified Till aluminum mat</td>
<td>8.7</td>
<td>40</td>
</tr>
<tr>
<td>Test Item</td>
<td>Type of Surface</td>
<td>Depth Coverage (in.)</td>
<td>Number of COH, DENSITY, and WATER CONTENT DATA, TEST SECTION 1</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>----------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Unsurf.</td>
<td>0 6 10 24 9</td>
<td>28.4 10 9 21.9 100.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 11 22.0 97.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>18 7 23.0 97.5</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Unsurf.</td>
<td>0 6 14 18.5 0</td>
<td>93.9 10 18.2 96.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18 17 21.0 101.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 0 45 17.9 105.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 3 17.5 106.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 19 20.5 102.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>200 0 40 17.4 113.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 31 18.5 107.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 14 20.9 104.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>300 0 39 17.6 109.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 31 17.0 110.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 20 19.7 107.8</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Modified</td>
<td>0 6 7 28.7 0</td>
<td>99.3 6 7 22.4 99.4</td>
</tr>
<tr>
<td></td>
<td>Tilt alu-</td>
<td>12 7 21.4 103.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>minima</td>
<td>18 6 24.2 97.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>landing mat</td>
<td>200 0 7 23.2 99.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 6 21.1 101.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 6 21.3 100.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>18 7 25.3 96.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>300 0 8 21.0 103.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 8 21.2 103.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 9 20.9 103.5</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Unsurf.</td>
<td>0 0 10 28.3 0</td>
<td>96.5 6 12 21.0 101.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 9 22.8 98.9</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Unsurf.</td>
<td>0 0 14 19.0 0</td>
<td>95.1 6 17 17.3 96.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 7 19.3 99.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>130 0 22 17.6 107.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 24 17.2 108.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 21 20.5 103.9</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Modified</td>
<td>0 0 8 26.5 0</td>
<td>94.8 6 10 25.3 103.0</td>
</tr>
<tr>
<td></td>
<td>Tilt alu-</td>
<td>12 9 21.4 101.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>minima</td>
<td>18 7 25.3 96.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>landing mat</td>
<td>40 0 9 24.2 99.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 8 21.1 103.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 8 21.1 103.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>68 0 8 23.6 100.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 9 21.9 103.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 3 22.7 100.8</td>
<td></td>
</tr>
</tbody>
</table>

* Emulsified material was heavy clay (classified as CR) in all items.*

11
Figure 2. Lane 1, item 1, at two passes (failure)

Figure 3. Lane 1, item 2, at 20 coverages

12
Figure 4. Lane 1, item 2, at 300 coverages (traffic suspended, no failure)

Figure 5. Lane 1, item 3, prior to traffic

Approved for Public Release
Figure 6. Lane 1, item 3, at 300 coverages (failure). Transverse straightedge shows roughness.

Figure 7. Lane 1, item 3, at 300 coverages (failure). Longitudinal straightedge shows deformation.

Approved for Public Release
Figure 8. Lane 2, item 1, prior to traffic

Figure 9. Lane 2, item 1, at two passes (failure)

15

Approved for Public Release
Figure 10. Lane 2, item 2, prior to traffic

Figure 11. Lane 2, item 2, at 130 coverages (failure)

16

Approved for Public Release
Figure 12. Lane 2, item 3, prior to traffic

Figure 13. Lane 2, item 3, at 10 coverages (failure). Longitudinal straightedge shows deformation
Figure 14. Lane 2, item 3, at 140 coverages (failure).
Transverse straightedge shows deformation.

Figure 15. Lane 2, item 3, failed area at 68 coverages
(28 postfailure coverages)
Figure 16. Lane 2, item 3, at 68 coverages (28 postfailure coverages). Longitudinal straightedge shows roughness and mat deformation.

Figure 17. Test load vehicle
Figure 18

Layout of test section I and summary of test results
104,000-lb, twin-wheel load
50-18, 36-ply tires
200-psi inflation pressure

Approved for public release
TIRE-PRINT DIMENSIONS AND TIRE CHARACTERISTICS
TEST SECTION 1
LANES 1 AND 2

Figure 20
Figure 21.

AVERAGE CROSS-SECTIONAL DEFORMATIONS
TEST SECTION 1
LANES 1 AND 2
Aircraft Ground-Flotation Investigation
Part II  Data Report on Test Section 1

April 1966

This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Air Force Flight Dynamics Laboratory (AFDDL), Wright-Patterson AFB, Ohio 43311.

This data report describes the results of work undertaken as part of an overall program to develop ground-flotation criteria for the C-5A aircraft.
INSTRUCTIONS

1. ORIGINATING ACTIVITY: Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization (corporate name) issuing the report.

2. REPORT SECURITY CLASSIFICATION: Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

3. GROUP: Automatic downgrading is specified in DoD Directive 8520.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that original markings have been used for Group 3 and Group 4 as authorized.

4. REPORT TITLE: Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parentheses immediately following the title.

5. DESCRIPTIVE NOTES: If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Also list exclusive dates when a specific reporting period is covered.

6. AUTHOR(S): Enter the name(s) of author(s) as shown on the cover of the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

7. REPORT DATE: Enter the date of the report as day, month, year. If more than one date appears on the report, use date of publication.

8. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedure, i.e., enter the number of pages containing information.

9. NUMBER OF REFERENCES: Enter the total number of references cited in the report.

10. CONTRACT OR GRANT NUMBER: If appropriate, enter the applicable number of the contract or grant under which the report was written.

11. NAME & ADDRESS: PROJECT NUMBER(S): Enter the appropriate project number, subproject number, such as project number, subproject number, system numbers, task numbers.

12. ORIGINATOR’S REPORT NUMBER(S): Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

13. OTHER REPORT NUMBER(S): If the report has been assigned any other report numbers (either by the originator or by the sponsor), also enter this number(s).

14. AVAILABILITY/LIMITATION NOTICES: Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

   (1) "Qualified recipients may obtain copies of this report from DDC."

   (2) "Foreign announcement and dissemination of this report by DDC is not authorized."

   (3) "U.S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through"

   (4) "U.S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through"

   (5) "All distribution of this report is controlled. Qualified DDC users shall request through"

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

15. SUPPLEMENTARY NOTES: Use for additional explanatory notes.

16. SPONSORING MILITARY ACTIVITY: Enter the name of the governmental project office or laboratory sponsoring the research and development. Include address.

17. ABSTRACT: Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), *(TS/RE), *(TS/REL)*, etc.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

18. KEY WORDS: Key words are technically meaningful items or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, rules, and weights is optional.