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Soil Tests

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FOREWORD

The original "Soil Tests" Bulletin No. 107 was published in 1950 and was based on a paper presented by Major Bertram at the 47th Annual Convention of the American Road Builders' Association. A continuing demand has necessitated five printings. In 1960, it was revised by William C. LaBaugh, Jr., to bring it up to date and published by the International Road Federation in Spanish. This Spanish edition has been widely distributed in South and Central America and the continuing demand has required reprinting. Prior to this, our sixth printing, it seemed desirable to make the few changes needed to bring it up to date.

We wish again to express our appreciation to Major Bertram and the Corps of Engineers, U. S. Army, and wish also to acknowledge with thanks the cooperation of the International Road Federation and Mr. LaBaugh.

LOUIS W. PRENTISS, *Executive Vice President*
American Road Builders' Association

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Soil testing, which is usually associated with peacetime engineering projects, played an important part in military construction in overseas theaters during the war. The principal use made of a knowledge of soils was in connection with the building of airfields by the Aviation Engineers of the Army Air Force. These engineers realized that while their mission was to provide combat airfields in a hurry, it was essential that the fields so provided have a reasonable service life without excessive maintenance. In order to construct such fields with an economy of man-hours and materials, a design based on a knowledge of the engineering properties of the soils encountered was essential. These same principles apply today to the construction of roads.

Test Sets Rugged, Simple and Economical.

The principal conclusion of value to peacetime construction which can be drawn from this review of military soil testing equipment is that a more widespread use can be made of extremely simple and very economical laboratory sets. This equipment should prove of particular value to agencies contemplating airfield development or road construction projects where the facilities of large soil testing laboratories are not available.

Identification of Soils Important.

The first requirement for the military soils-program was to provide trained personnel within each battalion who could make soil surveys, collect samples of representative materials, perform the soils tests, and furnish the data for the design of airfields. Particular emphasis was placed on the identification of soils, since for hasty construction much can be accomplished if the materials are properly identified at the outset.

Rugged and Complete Equipment Required.

To perform the soil tests, it was necessary to design a soils test set for military use which was simple, rugged, and complete. In planning the set it was necessary to include not only every essential item for soil testing but sufficient tools and supplies to permit work to be carried on efficiently without recourse to any other source of supply. This included such small items as pencils, paper, gummed labels, twine, files, hacksaw blades, and even a can opener. The set as furnished is divided into three parts: (a) equipment for soil investigation, (b) equipment for soil identification, and (c) equipment for design tests.

Soil Test Procedure Made Easy.

The manual is divided into five main sections: (a) field identification of soils, (b) equipment, (c) laboratory set-ups, (d) soil exploration and sampling, and (e) test procedures. Each of the sections is well illustrated by line drawings, photographs, and charts. The reason for this type of treatment is that the manual is intended as a guide to the enlisted personnel doing the actual work of soil sampling and testing, who may not have had any previous soil mechanics experience. By providing very clear instructions, it is intended not only to assist the engineer officer in his

task of instructing his crew but also to provide a ready, understandable source of reference.

The section on field identification of soils in addition to providing information on all the visual methods of determining soil types, stresses correct soil identification and continual checking of field identification with laboratory results.

The equipment section lists and identifies all of the items contained in each of the three chests. Instructions are given for the care and adjustment of the balances, the hydraulic jack, and the gauges. Supplemental notes are included on items of equipment which can be improvised in the field.

The section on the laboratory set-up enumerates the major considerations which must be observed in setting up the laboratory equipment in a tent, semi-permanent structure, such as a prefabricated hut, or in an existing building in order to perform tests to the best advantage and protect the equipment.

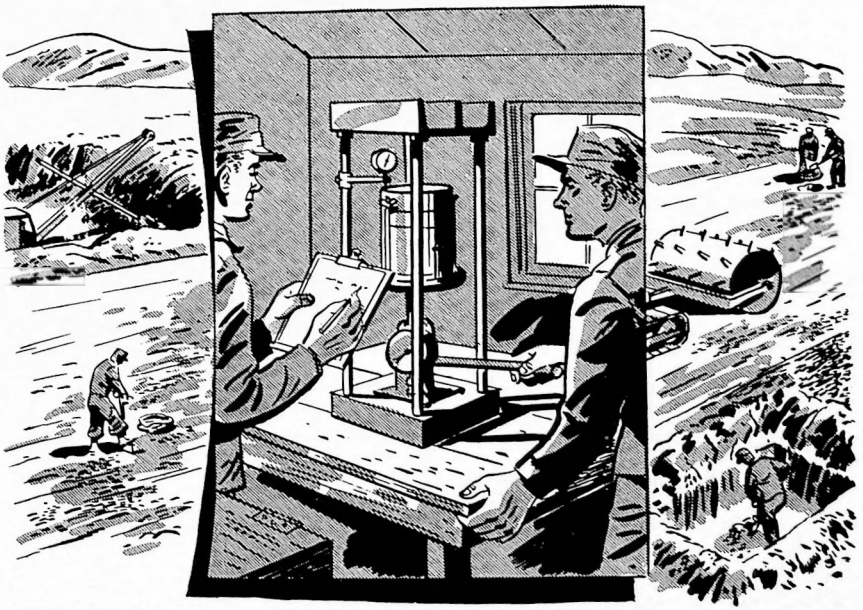
Procedures for taking bag, moisture content, and undisturbed samples are given in the soil exploration and sampling section of the manual. Instructions for taking notes, preparing layout sketches of explorations and numbering and shipping samples are included.

Soil Test Described Step-by-Step.

Perhaps the most important section of the bulletin is that on test procedures. This section begins with a list of the soil tests which can be performed with the test and a chart of the quantity of material required for each test. This chart is shown on page 32 and the adjoining page 33 of the manual, and are worthy of special study. Page 33 and others show the type of illustrations used to supplement the text. The procedure for performing each test is given in step-by-step form. Sample calculations are shown for the data, and when curves are required to be plotted examples are provided showing the method for plotting the points and utilizing the resulting graphs. Pages 56 and 57 show a double page of the bulletin outlining the plastic limit tests, which is indicative of the treatment given all the test procedures. A brief outline is included in the test procedure section on methods for making field bearing tests and traffic tests although it is considered that a discussion of such tests is beyond the scope of the manual.

SOIL TESTING EQUIPMENT AND EXPEDIENT TESTS

GENERAL



This Technical Bulletin has been prepared with the cooperation of the Graduate School of Engineering, Harvard University.