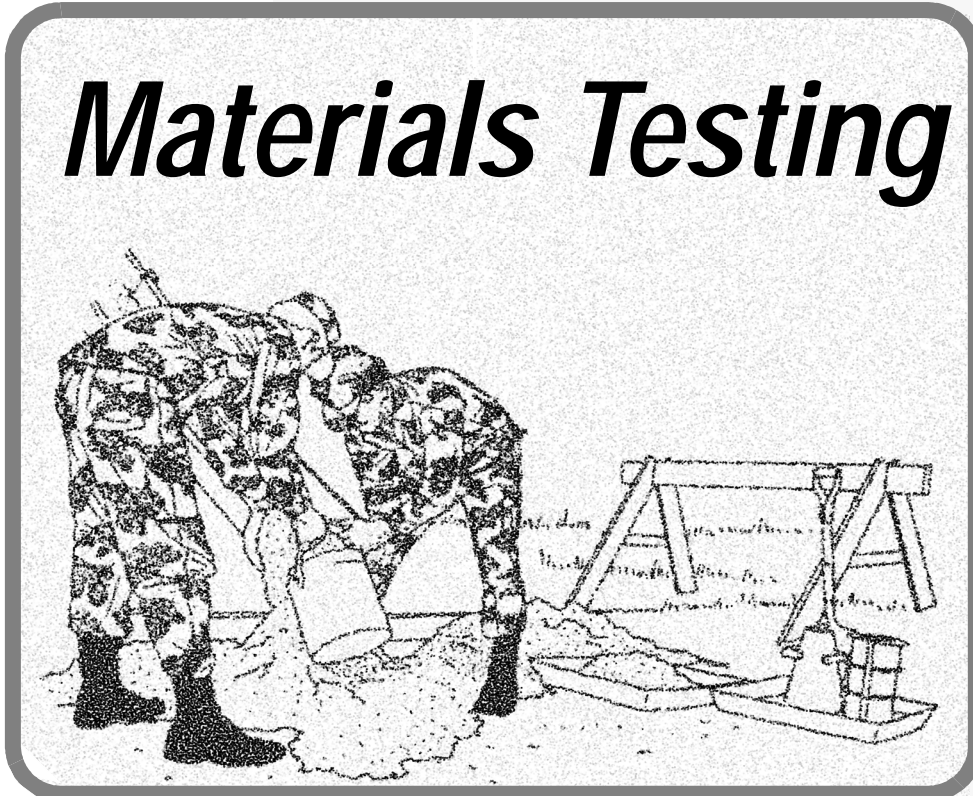


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Materials Testing



HEADQUARTERS,
DEPARTMENT OF THE ARMY

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MATERIALS TESTING

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Preface

Field Manual (FM) 5-472 provides the technical information necessary for military personnel to obtain samples and perform engineering tests and calculations on soils, bituminous paving mixtures, and concrete. These tests and calculations are required to achieve proper design with these materials and adequate control over their use in military construction.

This manual covers soils, aggregates, bituminous cements, bituminous paving mixtures, portland-cement concrete, and stabilized soil including stabilizing agents such as bitumens, cements, lime, fly ash, and chemical modifiers. The manual gives detailed instructions for taking adequate representative test samples and step-by-step procedures for making physical-properties tests and for recording, calculating, and evaluating test results. The manual explains methods for designing bituminous paving mixtures and for stabilizing soil. It also gives the procedures and tests required to control the manufacture of these mixtures. The manual describes the tools and equipment for performing these tests and contains general instructions for the care, calibration, and use of test equipment.

FM 5-472 is adopted for use by Navy personnel. Certain tests and procedures prescribed differ in principle or method and are more detailed than counterpart tests currently required by the Navy for new construction at Navy installations, including those in forward areas. Although this manual provides general guidance for materials and soils testing, the design of new structures and facilities will be based on the results obtained from methods and procedures outlined in Naval Facilities Engineering Command Design Manual (NAVFAC DM)-7.1 and NAVFAC DM-7.2. When methods and procedures prescribed by the Navy differ from those in this manual, the Navy's methods will take precedence.

The test procedures and terminology used in this manual conform to the latest methods and specifications of the American Society for Testing and Materials (ASTM), the American Concrete Institute (ACI), and the Portland Cement Association (PCA).

The tests listed in this manual also apply to arctic construction. However, cold-weather effects present different problems and additional tests will be required for correct evaluation of the materials. These additional tests and the considerations associated with arctic construction are in Technical Manual (TM) 5-349.

Appendix A contains an English-to-metric measurement conversion chart.

The proponent of this publication is HQ TRADOC. Send comments and recommendations on Department of the Army (DA) Form 2028 directly to Commander, USAES, ATTN: ATSE-TD-D, Fort Leonard Wood, Missouri 65473-6650.

Unless this publication states otherwise, masculine nouns and pronouns do not refer exclusively to men.

Chapter 1

Materials Testing Overview

Military engineers develop and maintain—

- Transportation facilities.
- Housing and special structures.
- Sanitary facilities.
- Military defenses.

Transportation facilities include roads, railways, airports and landing strips, pipelines, and harbor structures. These structures and facilities are built on and sometimes use the local soil, so engineers must know the type and characteristics of the soil at the site to design them. For example, in designing a road or an airfield, engineers must determine whether the soil can withstand the loads to be transported, including vehicle weights. They must also determine whether soil stabilization or paving will be needed. If the road or airfield requires pavement, then the engineers establish the suitability of available aggregate materials, since speed and efficiency of construction dictate the use of nearby sources. Bituminous paving mixtures and portland-cement concrete are made at or near the work site under the control of the local engineering officers. The engineers must design the mix and test the finished product's performance. They must have basic data concerning the properties of these materials to use them effectively in construction. Such data are obtained from the tests described in this manual.

MATERIALS TESTS

The properties of all materials are determined by their chemical composition and the physical structure in which the constituent compounds are arranged. Earth minerals and cementing materials are very complex, and the nature of the forces that bind them together is poorly understood on an atomic or molecular scale. However, the strength, stiffness, stability, and resistance to wear, erosion, or weathering can be determined by tests on the bulk material. Laboratory research related to field observation and experience with such materials enables engineers to establish limiting values of the measured properties to ensure satisfactory performance in service. Materials specifications based on this research give such limits. Tests of representative samples of a particular material available for engineering use are made, and the results are compared to the specifications to decide whether the material is adequate for the intended application. Materials tests also are used to identify or classify materials on the basis of their physical properties. These tests also provide basic data on the aggregates and cements necessary for the design of bituminous mixtures, stabilized soil, or portland-cement concrete.