

Chapter 1 Introduction

1-1. Purpose

This manual is a discussion of the principles, equipment, procedures, and limitations for obtaining, handling, and preserving soil samples for geotechnical investigations in support of civil and military projects. It is not a comprehensive textbook on soil sampling; the treatment of this subject cannot be substituted for actual experience. Rather, it is a summary of commonly accepted soil sampling practices and procedures which are intended to assist geotechnical personnel performing actual field operations or those personnel functioning as contracting officers' representatives. In most instances, equipment and procedures must be tailored to individual projects and site conditions.

1-2. Applicability

This manual is applicable to HQUSACE elements, major subordinate commands, districts, laboratories, and field operating activities.

1-3. References

The material presented herein has been drawn from many sources. Wherever possible, specific references are cited by the surname of the author(s) or performing agency and date of publication. Appendix A contains a list of required and related publications.

In general, the procedures and practices have been taken from the experience of the U.S. Army Engineer Divisions, Districts, and Laboratories, the U.S. Naval Civil Engineering Laboratory, the U.S. Bureau of Reclamation, standards obtained from the American Society for Testing and Materials (ASTM), and published literature, including textbooks, conference proceedings, periodicals, and professional journals.

1-4. Rescission

This manual supersedes EM 1110-2-1907, dated 31 March 1972.

1-5. Background

Soil sampling operations are routinely conducted in support of geotechnical investigations to determine those conditions that affect the safety, cost effectiveness, and

design of a proposed engineering project. The design of the proposed project demands an accurate knowledge of the subsurface conditions and the physical and engineering properties of the foundation materials. The least disturbed "undisturbed" samples are required to determine these properties. Extreme care in the application of sampling methods is demanded to obtain the highest quality undisturbed samples.

Proper sampling of soils and soft or weathered rocks is a combination of science and art. No single sampling device or procedure will produce satisfactory samples in all materials. Different devices and techniques have been developed for drilling and sampling geotechnical materials ranging from soils to rocks. Although many procedures have been standardized, modifications of techniques are often dictated by specific investigation requirements. The highest quality samples are often obtained at the least cost by using a variety of equipment and techniques applied with experience and sound judgment as dictated by the soil type and subsurface conditions.

1-6. Organization and Scope

This manual establishes guidance for conducting soil sampling operations and handling and storage of samples obtained in support of geotechnical investigations for civil and military projects. It is not meant to be an inflexible description of investigation requirements. Other techniques may be applied as appropriate. Only those soil sampling and handling and storage methods which District or Division staff offices can be reasonably expected to employ have been included. In general, in situ testing methods are not included herein.

Chapter 2 provides guidance for sampling requirements and suggests types of sampling devices which are best suited to obtain samples of various soil types encountered during geotechnical investigations in support of civil and military projects. Chapter 3 discusses drilling equipment that is commonly used during field subsurface investigations. Chapter 4 discusses drilling fluids and additives to enhance drilling and sampling operations. Chapters 5 and 6 present equipment and procedures for obtaining undisturbed soil samples from boreholes. Chapters 7 and 8 present equipment and procedures for obtaining disturbed soil samples from boreholes. Chapters 9 and 10 provide guidance for coring frozen soils and underwater sampling of soils, respectively. Chapter 11 provides guidance for obtaining samples from test pits, trenches, and accessible borings. Chapter 12 suggests procedures for obtaining representative samples from stockpiles and transportation units. Chapter 13 presents guidance for borehole logging

and the handling and storage of samples. Chapter 14 offers guidance for backfilling boreholes and excavations. Appendix A lists the references cited in the manual; a bibliography of publications related to sampling operations and procedures is also contained in this appendix. Appendix B presents procedures for conducting the Standard Penetration Test and obtaining disturbed samples with the split-barrel sampling device. Appendix C discusses the use of the Becker hammer drill as an in situ test for assessing the geotechnical engineering properties of gravelly soils. Appendix D suggests a procedure for freezing ground artificially prior to soil sampling

operations for geotechnical investigations. Appendix E provides a methodology for visual classification of soil.

This manual does not purport to address all of the safety problems associated with its use or the requirements for sampling, handling, transporting, and storing soils known or suspected to be contaminated with toxic or hazardous materials. It is the responsibility of the user of this manual to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to its use.