Manual on **Subsurface** Investigations

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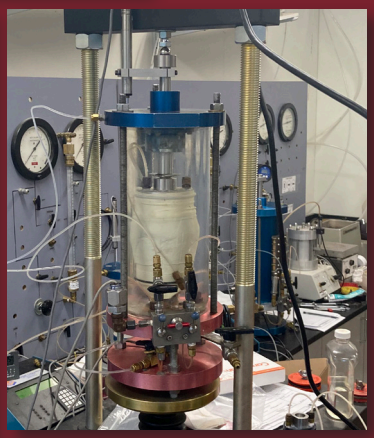

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1. Drilling on Steep Slope with Difficult Access Using Skid-Rig and Temporary Platform. Photo courtesy of Federal Highway Administration.
2. Determining Shear Strength of Soil Specimen Using Triaxial Testing. Photo courtesy of Federal Highway Administration.
3. Investigating Embankment Slope Failure. Photo courtesy of Federal Highway Administration.
4. Setting Up Electrical Resistivity Line and Electrodes. Photo courtesy of Federal Highway Administration.
5. Collecting Magnetic Survey Data. Photo courtesy of Federal Highway Administration.
6. Cone Penetration Testing (CPT). Photo courtesy of ConeTec.
7. Mud-Rotary Drilling. Photo courtesy of North Dakota Department of Transportation.

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Table of Contents

List of Tables

List of Figures

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Abstract

The primary purpose of geotechnical subsurface investigations in transportation projects is to collect data that will help transportation engineers and planners identify, assess, and address risks associated with subsurface conditions; select appropriate design parameters; and monitor performance during construction and operation phases of a project's life cycle. The results of the research performed for NCHRP Project 21-10 have resulted in a complete revision and update to the 1988 American Association of State Highway Transportation Officials (AASHTO) *Manual on Subsurface Investigation* that reflects the changes in the approaches and methods used for geotechnical site characterization that the geotechnical community has developed and adopted in the past 30 years. The updated manual provides information and guidelines to help geoprofessionals plan and execute a sound geotechnical site investigation program; use the results to develop a ground model for planning, design, construction, and asset management phases of a project; and report and document the results in a manner that facilitates peer review, communication with stakeholders, and potential future uses.

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Summary

Subsurface investigation plays a critical role in all phases of transportation project development—planning, design, construction, and operations—as it provides information that is needed to ensure public safety and to make cost-effective decisions. For the past 30 years, transportation engineers and planners have relied on the AASHTO *Manual on Subsurface Investigation* (1988) to provide guidance on best practices for planning and conducting geotechnical subsurface investigations. However, in the past 30 years, significant advances have occurred in the geophysical, *in situ*, and laboratory methods used by geoprofessionals to conduct subsurface investigations. There are also new design approaches (e.g., load and resistance factor design, or LRFD) and project delivery methods (e.g., design–build) that impact subsurface investigations.

These changes in geotechnical practices, design approaches, and project delivery methods warrant an update to the AASHTO *Manual on Subsurface Investigations* to reflect the current state of the practice. The objective of the efforts to update the 1988 manual was to develop a concise, comprehensive document that will be invaluable for planning, executing, and using subsurface investigations and geotechnical characterizations for planning, designing, constructing, maintaining, and managing assets of transportation facilities.

The organization of the updated AASHTO *Manual on Subsurface Investigations* is described in Chapter 1.

The results of the research performed for NCHRP Project 21-10 have resulted in a complete revision and update to the 1988 AASHTO *Manual on Subsurface Investigation*. The updated manual defines a reasonable minimum standard of practice for modern geotechnical site investigations and will enable geoprofessionals to develop cost-effective geotechnical design and construction solutions while optimizing project life-cycle costs, ensuring public safety and environmental sustainability, minimizing contract disputes and cost overruns, and accelerating construction.

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Chapter 1

Introduction

1.1 Purpose

The primary purpose of geotechnical subsurface investigations in transportation projects is to collect data that will help transportation engineers and planners identify, assess, and address risks associated with subsurface conditions; select appropriate design parameters; and monitor performance during construction and operation phases of an asset's life cycle. Geotechnical risks generally pose the greatest risk to transportation projects because adverse subsurface conditions can have significant impacts on public safety, project schedules, life-cycle costs, and environmental sustainability. A sound subsurface investigation program can mitigate these risks and yield significant dividends for state transportation agencies in terms of cost savings and timely completion of projects. Thus, it is prudent for transportation agencies to include geotechnical investigations as a part of their project development process.

This manual provides information and guidelines to help geoprofessionals (i.e., geotechnical engineers, geological engineers, geologists, and engineering geologists) plan and execute a sound geotechnical site investigation program; use the results to develop a ground model for planning, design, construction, and asset management phases of a project; and report and document the results in a manner that facilitates peer review, communication with stakeholders, and potential future uses.

1.2 Organization of the Manual

The organization of the manual mirrors how the subsurface investigations are typically performed:

- Planning the investigation (Chapters 2 and 3)
- Executing the investigation (Chapters 4 through 8)
- Reporting and presenting the results of the investigation (Chapter 9)

Supplemental information is presented in appendixes that are broadly grouped into three categories—investigative, administrative, and interpretive. Appendixes A through C contain information regarding investigations that are not typically conducted as part of the routine subsurface investigations but are conducted during either construction or operation to monitor performance and assess the condition of existing geotechnical features. Appendixes D through H contain information pertaining to administration