

Introduction

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This *Guide to Earthwork Construction* has been prepared to provide construction engineers and technicians with information on all aspects of earthwork construction. Although it is not intended to be a design manual, it does contain considerable background on the design concepts that are necessary for good earthwork construction. Most of the sections contain information on specific field problems, and a number of references are included to provide construction engineers with additional detailed information.

As used in this guide, earthwork consists of roadway excavations and embankments and all associated items of work such as foundations, drainage, stabilization and reinforcement, environmental factors, and instrumentation. Earthwork encompasses all types of materials excavated and placed in highway embankments, including soil, rock, intermediate materials, and other natural and man-made materials including wastes. Also included in the broad category of earthwork are clearing and grubbing, scalping, removal of existing structures and obstructions, channel excavations, preparation of foundations and embankments, disposal of excavated material, borrow excavation, preparation of subgrade, proof rolling, and placement of granular subbase and base courses, structure backfills, and instrumentation.

Uniformity of earthwork throughout the project is necessary for adequate stability and satisfactory long-term performance. To obtain an acceptable product, the owner or agency is obligated to provide adequate design and specifications as well as competent construction inspectors. The contractor must provide proper equipment and construction procedures for all materials and conditions encountered during the project. Construction engineers and inspectors must work with the contractor to establish the most appropriate construction methods and procedures, consistent with the specifications, in order to obtain an acceptable product at the least cost. As noted by Johnson (1964), a key factor in achieving these goals is competent testing and monitoring during construction, a

primary responsibility of the construction inspection team.

The ultimate goal of earthwork construction is to make the final product or facility adhere as closely as possible to the designer's intent. The key to achieving this goal is the knowledge, experience, and understanding of all aspects of earthwork construction that field engineers and inspectors bring to the project. In order for a project to be successful, it is essential that field personnel recognize situations in which field conditions differ in important ways from the design assumptions, and in such situations, react quickly and effectively. It is hoped that this guide will facilitate recognition of these situations and encourage rapid and effective reaction by field personnel.

GENERAL REFERENCES AND BACKGROUND

A good basic reference on earthwork construction is Section 14 in Woods's *Highway Engineering Handbook* (Gregg 1960). Johnson and Sallberg (1960) present a detailed discussion of the factors that influence field compaction, and later they discuss the factors that influence compaction test results (1962). The Proceedings of the ASTM (1964) Symposium on Compaction of Soils contains much useful information, as does *NCHRP Synthesis of Highway Practice 8: Construction of Embankments* (Wahls 1971) and the *Earth Manual* (USBR 1974, currently being rewritten). Hilf (1975) has an excellent treatment of compacted fill. Monahan's (1986) book *Construction on Compacted Fills* contains information particularly useful for field engineers and inspectors. *Earthworks* (Horner 1981), an Institution of Civil Engineers (ICE) construction guide, discusses earth-moving and compaction practice, in addition to equipment commonly used in the United Kingdom. Related Federal Highway Administration publications include those by Konya and Walter (1985) on blasting, Christopher and Holtz (1985) on geotextiles, and Golder Associates (1989) on rock slopes.

Textbooks such as those written by Taylor (1948), Terzaghi and Peck (1967), Sowers and Sowers (1979), Holtz and Kovacs (1981), and Spangler and Handy (1982) also contain useful information on the theory and methods of compaction, earthwork and compaction equipment, and field compaction control and specifications.

REFERENCES

ABBREVIATIONS

- ASTM American Society for Testing and Materials
FHWA Federal Highway Administration
USBR U. S. Bureau of Reclamation

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