REVIEWS

The Geotechnics of Structurally Complex Formations

Reviewed by Syd S. Peng, Department of Mining Engineering, West Virgina University, Morgantown, W. Va.

REFERENCE: *Geotechnics of Structurally Complex Formations*, Vol. 1, ed. Associazione Geotechnica Italiana, 1977, 470 pages, 110 000 lire. Order from Litho Delta di Pietra Ezio, Via Baldo degli Ubaldi, 6-20156 Milano, Italy.

This book is the proceedings of the International Symposium on the Geotechnics of Structurally Complex Formations, which was held in Capri, Italy, in July 1977. There were 48 papers presented; all are included in the proceedings.

According to the various authors, structurally complex formations are those that exhibit four kinds of characteristics: first, anisotropy resulting from abrupt changes of lithologic composition both laterally and vertically; second, joints or fracture planes or both that are either regular or irregular—that is, with or without filling materials—caused by folding and faulting tectonics; third, complex basaltic flows; and fourth, structurally nonuniform soils or weathered formations. A majority of the papers focus on the second item listed.

With the exception of a few papers that deal with the origin of structurally complex formations, most of the papers describe the stability of various types of structures (for example, dams, penstocks, and tunnels) and artificial slopes in structurally complex formations. To be exact, eleven papers discuss either the stability of slopes where some types of structures are located or the origins of landslides; five describe methods of designing and excavating tunnels and instrumentation for evaluating tunnel stability; and three deal with foundation formations and the geomechanical behavior of dams.

Most of the papers are case studies but several theoretical papers are included on such topics as the derivation of stresses in folded rocks and modeling the progress of rock failure. Two papers discuss methods of rock classification, one concentrating specifically on shale and the other treating sedimentary rock in general. There are also papers that deal with methods of evaluating the physical properties of both laboratory-sized specimens and rock masses that require large-scale in-situ tests. A parametric study of surface subsidence and resulting landslides induced by underground coal mining is included. One paper advances the idea that the existence of a soft layer around an underground opening reduces the stress concentration in the surrounding rocks. This principle can be used to locate the optimum position of the tunnel.

Since this book mostly contains case studies, it would be most useful to practical geotechnical engineers. Unfortunately, there is no index.

Handbook on the Mechanical Properties of Rocks

Reviewed by Syd S. Peng, Department of Mining Engineering, West Virginia University, Morgantown, W. Va.

REFERENCE: Lama, V. D. and Vutukuri, V. S., *Handbook on the Mechanical Properties of Rocks, Vol. 2: Testing Techniques and Results*, Trans Tech Publication, Clausthal, West Germany, 1978, 481 pages, $52.00.

This book is the second volume of the authors' *Handbook on the Mechanical Properties of Rocks;* it is devoted entirely to the static and dynamic constants of rock. Volume 2 contains two chapters, Chapter 6, "Static Elastic Constants of Rock," and Chapter 7, "Dynamic Elastic Constants of Rock," as well as an appendix, the second for the series, "Laboratory Mechanical Properties of Rocks." In the appendix, laboratory values for the mechanical properties of rocks are compiled for more than 2000 rock types from around the world. The parameters listed include density, modulus of elasticity, Poisson's ratio, compressive strength, and tensile strength.

In Chapter 6, laboratory values for static elastic constants such as Young's modulus, Poisson's ratio, and compressibility are described, as are instruments for measuring deformation of rock specimens. The influence of various factors on these elastic properties is discussed in detail. These factors include specimen geometry, platen condition, rate of loading, temperature and confining pressure, pores and cracks, and anisotropy.

In Chapter 7, dynamic elastic constants, especially Young's modulus and Poisson's ratio, obtained both in the laboratory and in situ are described and compared. Resonance and ultrasonic pulse methods are described as a method for determining elastic wave velocities in the laboratory. The resonance method in the flexural mode is also discussed in detail. Tables in this chapter show the effects on wave velocity in rock of such parameters as rock type, texture, density, porosity, anistropy, stress level, water content, and temperature. The dynamic tensile strength of rock is also discussed in detail.

In short, this volume presents an exhaustive list of tests results for static and dynamic constants of rocks and the test methods and instruments used in many papers and books published around the world. It will no doubt serve as a useful reference for engineers and researchers in the field of rock mechanics.

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The following reviews have been prepared by the Soil Mechanics Information Analysis Center for the U.S. Army Corps of Engineers Waterways Experiment Station in Vicksburg, Miss.

Railroad Track Stabilization

REFERENCE: Blacklock, J. R. and Lawson, C. H., *Handbook for Railroad Track Stabilization Using Lime Slurry Pressure Injection,* FRA/ORD-77/30, prepared at Graduate Institute of Technology, Little Rock, Ark., and revised by R. H. Ledbetter, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Miss., U.S. Department of Transportation, Federal Railroad Administration, Washington, D.C., June 1977, revised April 1979, 55 pages.

This report deals with the technology of lime injection for surface and subsurface soil exploration and laboratory testing, and covers environmental considerations and safety precautions. A lime slurry section gives a complete description of the state of the art of the technique of lime slurry pressure injection. Major revisions made at the Waterways Experiment Station are concerned with injection techniques and with field and laboratory testing to evaluate a subgrade soil's potential for dispersal of the injected slurry and improvement of stability by the injection techniques. 30 references.

Geotechnical Fabrics for Embankment Reinforcement

REFERENCE: Haliburton, T. A., Anglin, C. C., and Lawmaster, J. D., *Selection of Geotechnical Fabrics for Embankment Reinforcement,* prepared under contract for U.S. Army Engineer Mobile District, School of Civil Engineering, Oklahoma State University, Stillwater, Okla., May 1978, 138 pages.

Twenty-seven commercially available petrochemical-based geotechnical fabrics and one fiberglass fabric were tested and evaluated for suitability as reinforcement in an embankment test section to be constructed on soft foundation at Pinto Pass, Mobile Harbor, Alabama. Both woven and nonwoven fabrics were evaluated. All fabrics were subjected to initial testing in uniaxial tension and fabrics meeting or exceeding strength criteria established by the project sponsor were subjected to additional testing for determination of creep behavior, soil-fabric frictional resistance, and effects of immersion and water absorption on developed tensile strength. The effects of specimen width and testing strain rate on uniaxial tension test results were also investigated. Four woven geotechnical fabrics plus the woven fiberglass fabric were found to meet or exceed the required tensile strength criteria.

Laboratory Strength of Sands

REFERENCE: Townsend, F. C., and Mulilis, J. P., *Liquefaction Potential of Dams and Foundations—Report 6, Laboratory Strength of Sands Under Static and Cyclic Loadings,* Research Report S-76-2, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Miss., March 1979, 93 pages.

The strength decrease caused by increased pore pressure (previously referred to as liquefaction potential) of four sands, for which laboratory standard penetration tests (SPT) had previously been performed, was evaluated by cyclic triaxial tests at comparable relative densities and confining pressures. Stress-controlled monotonic $\bar{R}$ tests were performed on one sand to compare potential for strength loss caused by increasing pore pressure under static versus cyclic loading. The object of both test series was to develop correlations between SPT N values and the potential for strength loss caused by increasing pore pressure. Results of the cyclic triaxial tests revealed that as the mean grain diameter and uniformity coefficient decreased, so did the resistance to achieving 100% pore pressure response. The elastic-plastic constitutive model qualitatively predicts behavior in monotonic $\bar{R}$ tests.

Geological Testing Guidelines for Nuclear Facilities

REFERENCE: Franklin, A. G. and Marcuson, W. F., *Proposed Guidelines for Laboratory Testing of Geological Materials for Nuclear Power Facilities,* Miscellaneous Paper GL-79-9, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Miss., April 1979, 36 pages.

This report discusses requirements for laboratory facilities and test apparatus, handling and storage of samples, selection and preparation of test specimens, and procedures that should be followed in testing. It gives special emphasis to testing for dynamic response analysis of soils and discusses sources of error in performing and interpreting cyclic tests. A table is provided in which various test methods for soil and rock are listed together with references to published standard or preferred test methods and other important or useful publications. 37 references.

Back Pressure Saturation Techniques and Triaxial Compression Tests

REFERENCE: Donaghe, R. T. and Townsend, F. C., *Effects of Back-Pressure Saturation Techniques on Results of* R *Triaxial Compression Tests,* Miscellaneous Paper GL-79-12, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Miss., May 1979, 58 pages.

Corps of Engineers soil laboratories achieve 100% saturation of R and $\bar{R}$ triaxial compression test specimens by use of back pressure applied in small increments concurrently with an increase in chamber pressure. The objectives of this investigation were to determine the effects of the magnitude of back pressure and the procedure by which it is applied on the stress deformation characteristics of soils. These objectives were achieved by comparing results of tests performed on compacted specimens of both Vicksburg loess (clayey silt) and Vicksburg buckshot (plastic clay) in which the back pressure saturation procedure was varied with results of tests performed on specimens of Vicksburg buckshot consolidated from a slurry in which the magnitude of the total back pressure was varied. Results indicate that variations in the technique of applying back pressure may significantly affect test results. However, there are no significant effects on test results if procedures outlined in the Corps of Engineers manual are followed.