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PRINCIPLES OF ENGINEERING GEOLOGY AND GEOTECHNICS

Geology, Soil and Rock Mechanics, and Other Earth Sciences as Used in Civil Engineering

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PREFACE

Application of earth sciences to the solution of civil engineering problems, or *geotechnics*, constitutes the subject of this book. The point of view is that of the engineer, and the earth sciences, particularly geology, have been brought into the engineering pattern only when they have direct bearing upon the problems under discussion. The authors' goal is to present only those basic geotechnical principles that can provide a solid basis for the solution of problems connected with the natural environment of an engineering structure, particularly the surrounding ground. Case histories have been used only for the elucidation of principles.

The book has been designed as a textbook for civil engineering and advanced geology students and as a reference work for practicing civil engineers and engineering geologists. Those portions of the book that can be omitted at the first reading and all examples are printed in small type. The book has been made more compact, and thus more convenient for use, by condensing descriptions of laboratory and field test procedures; its mathematics are reduced to a minimum by omitting the derivation of formulas. Detailed information on an item of interest may be located, however, by using the list of references appended to each chapter.

Although the book is not formally subdivided into two major parts, the first eight chapters contain geotechnical information of a general character applicable to any structure. The remainder of the book, except Chap. 19, contains applications of this general information to specific kinds of structures. This concept may be useful in subdividing the material between two semesters when the book is used for teaching purposes.

Like any new branch of human knowledge, geotechnics advances from day to day. The authors endeavored to keep the manuscript as up to date as possible. The general silhouette of geotechnics was sufficiently clear cut when the book was written; however, new theories and improved techniques constantly appear in the current technical press. Monthly issues of the *Proceedings of the American Society of Civil Engineers* separates, publications of the British Institution of Civil Engineers, quarterly issues of the English journal *Géotechnique*, and pertinent papers of the *Proceedings of the Annual Meeting of the Highway Research Board* all may be referred to in this regard. New issues of geological journals also

occasionally present individual papers and articles of considerable geotechnical interest.

Acknowledgments. Numerous books, articles in technical and geological press, and United States government publications were helpful to the authors in the preparation of this text. Portions of the text also are based not only on published but also on unpublished material and practices of the U.S. Bureau of Reclamation through the kind permission of L. N. McClellan, Assistant Commissioner and Chief Engineer, to whom the authors wish to express their appreciation. Essential advice of general character was received from Dr. W. H. Irwin, Chief Geologist, and substantial material help in the preparation of individual portions of the book was obtained from various members of the Denver staff of the Bureau. An engineer especially interested in the book was Dart Wantland, already well-known as a contributor to the Jakosky book "Exploration Geophysics." Mr. Wantland furnished most of the examples of geophysical investigations used throughout the book and collaborated in preparing the geophysics sections of Chap. 6. Ground-water specialist Thomas P. Ahrens contributed the discussion of field methods of determining the permeability of crustal materials and read over Chap. 5. The airphoto interpretation and surveying methods in Chap. 7 were reviewed by photogrammetrist Wm. H. Hatfield. The counsel of Dr. R. C. Mielenz and the late Merle E. King proved useful in the preparation of the mineralogical discussions in Chaps. 1 and 8. Whitney M. Borland and Carl R. Miller, sedimentation specialists, assisted the authors in bringing the material in a portion of Chap. 12 as up to date as current practice permits.

Many persons and organizations outside the Bureau of Reclamation also graciously contributed their time. Dr. Paul D. Krynine of Pennsylvania State University greatly assisted in the final drafting of Chap. 1, and his advice was helpful at various stages of the manuscript's preparation. Dean K. B. Woods of Purdue University contributed general criticism of much benefit. The portion of Chap. 6 on soil investigations was reviewed and amplified by Richard J. Woodward of Woodward, Clyde & Associates, Consulting Civil Engineers of Oakland, California. The Denver partner of this firm, Dr. James L. Sherard, constructively criticized the draft of Chap. 16. The original manuscript of Chap. 18 was improved according to comments by Dr. Perry Byerly, professor at the University of California at Berkeley and California State Seismologist; John E. Rinne of San Francisco, structural engineer and specialist in aseismic design; and William K. Cloud of the San Francisco office, U.S. Coast and Geodetic Survey. Henry Degenkolb, San Francisco structural engineer, was helpful in lending some material on earthquakes.

The portion of Chap. 8 on explosives was approved by the Technical

Service, Explosive Department, E. I. du Pont de Nemours & Company. The description of the bore hole camera in Chap. 6 was approved by Engineering Research Associates Division of Remington Rand Company. The legal phraseology and context of Chap. 19 were reviewed by Simon Quiat, specialist in contract law; presentations of the citations in that chapter were reviewed by the American Law Book Company of Brooklyn, New York.

The source of illustrations, other than the authors' files, receives proper recognition on the pertinent captions. Last, but not least, the authors' appreciation goes to illustrator James Vitaliano for his work in the preparation of some difficult drawings.

The authors wish to protect their willing aides by warning the reader that although these experts were responsible for certain information, the authors assume full responsibility for the presentation of this information as it appears in the book.

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