

Series on Rock and Soil Mechanics
Vol. 3 (1978) No. 3

HANDBOOK
ON
MECHANICAL PROPERTIES
OF ROCKS
– Testing Techniques and Results –
Volume IV

by

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FOREWORD

The subject of rock mechanics has gained increasing acceptance as a necessary input in the design of mining and civil engineering works. In addition of these traditional fields of application, changing political and economic conditions have resulted in the need to store oil and other materials underground, to dispose of nuclear waste materials and to develop underground factories and car parks in order to preserve the surface environment.

These ever growing demands have created an urgent need for the development of a variety of design methods and practical solutions in rock mechanics and these needs have generated a demand for information on all aspects of the behaviour of rock and rock masses. This information is currently scattered throughout the scientific and technical literature and the design engineer or research worker is faced with the formidable task of locating such information before embarking upon a specific study.

The authors of the four volumes of the "Handbook on Mechanical Properties of Rocks" have done a commendable service in bringing together a significant proportion of the available information on rock and rock mass behaviour. This compilation of data is all the more useful because the authors have not attempted to impose too many of their own interpretations upon the information but have presented data accompanied by a range of possible theoretical explanations. This approach makes these volumes useful as a starting point for the research worker or for the design engineer who does not wish to rely on the few standard text book solutions which are available.

This volume, containing discussions on the mechanical behaviour of jointed rock and the classification of rock, touches on the very heart of practical rock mechanics which is more concerned with the response of the rock mass than with the behaviour of laboratory specimens. Because of the practical difficulty and enormous expense of full scale in situ tests on rock mass behaviour, the understanding of this subject has been built up from model studies on equivalent materials and from theoretical models of the interaction of the elements which form the rock mass. The major studies which have contributed to this field of knowledge have been summarised in this volume and it is hoped that this summary will encourage others to carry out further work to enhance our understanding of this important subject.

February 1978

DR. EVERT HOEK
Principal, Golder Associates Ltd.
(Formerly Professor of Rock Mechanics,
Imperial College, London).

PROCEEDINGS FIRST CONFERENCE ON ACOUSTIC EMISSION/MICROSEISMIC ACTIVITY IN GEOLOGIC STRUCTURES AND MATERIALS

By **H. Reginald Hardy, jr., and Frederick W. Leighton**

1977, 490 pages, 235 figures, 480 references, US Dollar 40.00 (sFr. 100.00)

The rationale for organizing this conference developed from the feelings of the conference co-chairmen that the time had come to bring together the ideas and experiences of various workers involved in the application of acoustic emission/microseismic activity in the geomechanics area. It was clear that there were a considerable number of persons, throughout the world, who were actively engaged in basic and applied research in this area including, amongst others, those involved in such widely varying interests as the following:

- | | |
|---|-------------------------------------|
| – Rock Burst Mechanics | – Slope Stability Monitoring |
| – Underground Gas Storage | – Fundamental Behavior |
| – Reservoir Stability | – of Geologic Materials |
| – Stability of Earth Filled Dams | – Strata Control in Coal |
| – Earthquake Mechanics | – and Hardrock Mines |
| – Hydrofracturing Research | – Comminution |

The proceedings include an introductory section presenting an historical review of the subject, the full text of all papers presented at the conference, general concluding remarks, a master bibliography, and a list of the conference participants and their affiliations. The proceedings represent the most comprehensive review of the subject published to date. In all a total of 25 papers are included. These deal with a wide range of laboratory, field and analytical aspects of acoustic emission/microseismic activity in the areas of **mining, petroleum, and civil engineering**, and in **geology and geophysics**.

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Series on Rock and Soil Mechanics
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SOIL MECHANICS FOR OFF-ROAD VEHICLE ENGINEERING

By **Leslie L. Karafiath**, Grumman Aerospace Corporation, Bethpage, New York, and **Edward A. Nowatzki**, University of Arizona, Tucson, Arizona

1978, 520 pages, 204 figs, US Dollar 54.00 (sFr. 135.00)

The ability to move vehicles over natural terrain is of paramount importance to a wide variety of disciplines, for example, automotive, military, mechanical, aerospace, construction and agricultural engineering. Workers in these disciplines would have to evaluate an enormous quantity of soil mechanics publications to extract the information that is useful for them. Recognizing this difficulty, the authors attempt to assess the value of published soil mechanics and other related literature from the viewpoint of off-road locomotion and to present a balanced discussion of the most important ideas.

Because the field of off-road vehicle engineering is expanding so rapidly, this book is not the final word on the topic. It is, however, the first to bring together in one place the results of efforts in a wide variety of disciplines and to present the latest technically sound concepts on the subject. In short, it provides a rational basis for the analysis of off-road locomotion problems and, as such, is a "must" for workers in the field of vehicle mobility. Because of this departure from some of the more conventional methods of soil-structure analysis it is also recommended for workers in the field of soil mechanics.

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In preparation

Series on Rock and Soil Mechanics
Vol. 3 (1978/79) No. 5

ROCK MECHANICS

By **Alfreds R. Jumikis**, Professor of Civil Engineering, Rutgers University
The State University of New Jersey

About 300 pages, 105 figures, 17 tables.
Expected publication date: February/April 1979

In this volume, the author presents an introductory segment to the relatively new civil engineering discipline known as engineering rock mechanics. This subject is presented here from the viewpoint of a civil engineer to civil engineers.

The content of this book deals with rock as an engineering construction material by means of which, upon which, and within which civil engineers build structures in rock. This discipline thus pertains to hydraulic structures engineering; to highway, railway, canal, foundation, and tunnel engineering; as well as to earthworks of, and substructures in, rock of all kinds in any way associated with engineering.

The main purpose of this book is to assist interested readers in understanding some of the basic rock mechanics principles as they apply to rock engineering. Hence, the book is developed basically as a guide in engineering rock mechanics.

In essence, this unique volume emphasizes understanding. It gives a practical orientation to basic rock mechanics; provides a background as well as an outlook that motivates to further study; and will allow the reader to profit from his later studies of more comprehensive and complex publications on engineering rock mechanics than what is presented in this text.

Please ask for further information.

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Series on Rock & Soil Mechanics
Vol. 2 (1974/77) No. 4

THE PRESSUREMETER AND FOUNDATION ENGINEERING

by **F. BAGUELIN, J. F. JÉZÉQUEL, D. H. SHIELDS**, France and Canada

January 1978, 624 pages, 314 figs, US Dollar 52.00 (or sFr. 130.00) cloth

PREFACE

The design and construction of foundations require a thorough knowledge of the behaviour of soils and rocks in the field. Since even elaborate laboratory tests on large subsurface samples can at best only approximate the field conditions, in-situ tests are often preferable. The pressuremeter is probably the most versatile in-situ testing device available at present for investigating static and cyclic strength and deformation properties of soils and rocks.

Based on the authors' comparisons between the results of standardized pressuremeter tests and both static and standard penetration tests under different site conditions, the merits and limitations of the various methods of field investigations can readily be assessed. At the same time the extensive experience gained by these reliable, practical and semi-empirical methods of using pressuremeter data becomes available to other types of field investigations to their mutual benefit. These approaches require mature engineering judgment and sound experience based on performance observations on structures during and after construction. In this way pressuremeter tests can lead to safe and economical solutions to many geotechnical problems, as shown in this warmly recommended book.

G. G. MEYERHOF

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Series on Rock and Soil Mechanics
Vol. 1 (1971/74) No. 3

FOUNDATION INSTRUMENTATION

By **Dr. Thomas H. Hanna**, Professor of Civil and Structural Engineering,
University of Sheffield, England

1973, 372 pages, 251 figures, 520 references, price: US \$ 35.00 hard cover

Contents

- | | |
|------------------------------------|--|
| 1. Introduction | 6. Data from Instrumented Foundations |
| 2. Load Measurement | 7. The Recording and Processing of Field Data |
| 3. Pore Water Pressure Measurement | 8. Instrumentation of Laboratory Scale Foundations |
| 4. Earth Pressure Measurement | 9. Appendix |
| 5. Measurement of Ground Movements | |

"The book represents a fine help and a welcome treasury of methods and devices for every civil and structural engineer concerned with the design and construction of civil engineering works, since the ground always affects the stability and performance of these structures. It can be recommended warmly to students and civil engineers in the field of design, construction and research."

Applied Mechanics Reviews

"This most interesting book includes a very large number of references and a list of instrument suppliers. It will probably become one of the most widely used tools for soil and foundation engineers who understand the need for performance evaluation."

Canadian Geotechnical Journal

"The book can obviously be recommended to all people dealing with foundations, earth and rockfill dams, tunnels, and soil mechanics in general."

Water Power

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Series on Rock and Soil Mechanics

Vol. 1 (1971/74) No. 2

The Science of Rock Mechanics

PART 1

STRENGTH PROPERTIES OF ROCKS

By Prof. Dr. **W. Dreyer**, Technical University Clausthal, Germany

1972, reprinted 1973, 500 pages, 200 references, 86 tables, 137 figures,
price: US \$ 30.00 hard cover

International Standard Book Number: 0-87849-002-7.

Library of Congress Catalog Card Number: 78-149276.

The present volume is the first — in itself complete — part of the monography "The Science of Rock Mechanics". It comprises primarily the relationship between state of stress, strength of rocks and their determining textural data. As the description of the mechanical behavior of rocks under compressive load is extremely incomplete without adequate consideration of the petrographic parameters such as mineral composition, mineral interlocking, granulation, grain density and porosity, the author has treated the mineral content of all investigated rock samples quantitatively and formulated them mathematically.

The operation of caverns in salt deposits for the purpose of storage requires intimate knowledge of stability and convergence behavior of an underground system. The solution to this highly complex rock mechanics problem is discussed in a special chapter.

"Originality in its true and good sense of the word is the great advantage of this book. Here, a professor has not written a seventh book out of six others, but a researcher has presented his field of interest and especially the results of his own studies, extending over almost two decades, among them many to be published for the first time."

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HANDBOOK ON MECHANICAL PROPERTIES OF ROCKS

CONTENTS

Volume I

1.	Specimen Preparation for Laboratory Tests	
1.1.	Introduction	1
1.2.	Sampling	1
1.3.	Preparation of Specimens	3
1.3.1.	Regular Specimens	3
1.3.2.	Irregular Specimens	4
1.3.3.	Special-shape Specimens	5
1.4.	Number of Specimens to be Tested	7
1.5.	Summary and Conclusions	9
	References	10
2.	Compressive Strength of Rock	
2.1.	Introduction	13
2.2.	Stress Distribution in Specimens under Compression	14
2.3.	Mode of Failure of Specimens in Compression	26
2.4.	Failure Mechanism of Specimens in Compression	28
2.5.	Friction Between Platens and End Surfaces	29
2.6.	Specimen Geometry	32
2.6.1.	Shape	32
2.6.2.	Height-to-diameter Ratio (h/d Ratio)	33
2.6.3.	Size	38
2.7.	Rate of Loading	44
2.8.	Environment	50
2.8.1.	Moisture	50
2.8.2.	Liquids	57
2.8.3.	Temperature	61
2.9.	Mineralogy, Grain Size and Porosity	61
2.10.	Post-Failure Behaviour of Rock in Compression	61
2.11.	Indirect Methods for Estimating Compressive Strength of Rock	68
2.11.1.	Testing of Irregular Specimens	68
2.11.2.	Protodyakonov Test	73
2.11.3.	Impact Strength Test	77
2.12.	Summary and Conclusions	80
	References	82

CONTENTS

3.	Tensile Strength of Rock	
3.1.	Introduction	87
3.2.	Direct Method	87
3.3.	Indirect Methods	95
3.3.1.	Bending Tests	95
3.3.2.	Hydraulic Extension Tests	103
3.3.3.	Diametral Compression of Discs	105
3.3.4.	Miscellaneous Methods	123
3.4.	Testing of Specimens of Irregular Shape	131
3.4.1.	Direct Test	131
3.4.2.	Hydraulic Extension of Irregular Ring	132
3.4.3.	Compression of Irregular Specimens	132
3.5.	Comparison of Results Obtained by Different Methods	133
3.6.	Summary and Conclusions	136
	References	138
4.	Shear Strength of Rock	
4.1.	Introduction	141
4.2.	Method of Determining Shear Strength by Torsion	142
4.3.	Methods in which the Normal Stress on the Shearing Plane is Zero	146
4.3.1.	Single Shear Test	146
4.3.2.	Double Shear Test	146
4.3.3.	Punch Test	147
4.3.4.	Discussion	147
4.4.	Methods of Determining Shear Strength with Compression ..	148
4.4.1.	Single Shear with Compression of Cylindrical Specimen	149
4.4.2.	Single Shear with Compression of a Cube-shaped Specimen ..	154
4.4.3.	Double Shear with Compression of a Prismatic Specimen	154
4.4.4.	Single Shear with Compression between Bevelled Dies	158
4.4.5.	Method of Constricted Oblique Shear	164
4.4.6.	Triaxial Test	165
4.5.	Estimation of Shear Strength Employing MOHR'S Representation of Uniaxial Tensile and Compressive Strength	166
4.6.	Comparison of Results Obtained by Different Methods	167
4.7.	Summary and Conclusions	170
	References	172

CONTENTS

5.	Strength of Rock Under Triaxial and Biaxial Stresses	
5.1.	Introduction	175
5.2.	Testing Techniques	175
5.3.	Conventional Triaxial Test	176
5.3.1.	Stress Distribution in Specimens under Triaxial Compression.	177
5.3.2.	Measurement of Strain	180
5.3.3.	Testing Equipment	181
5.3.4.	Results	189
5.3.5.	Modes of Failure of Rocks	216
5.4.	Polyaxial Test	219
5.4.1.	Results	221
5.5.	Miscellaneous Tests	283
5.5.1.	Torsion of Solid Cylinders under Compression	223
5.5.2.	Punching under Confining Pressure	224
5.5.3.	Brazilian Test under Confining Pressure	224
5.5.4.	Hollow Cylinders under Compression	225
5.6.	Strength of Rock under Biaxial Stress	230
5.6.1.	Hollow Cylinder Subjected to External Hydrostatic Pressure and Axial Force	230
5.6.2.	Cube Compressed Simultaneously between Two Pairs of Its Faces	231
5.6.3.	Results	231
5.7.	Determination of Shear Strength from Triaxial Tests	233
5.8.	Failure Criteria	236
5.8.1.	Coulomb-Navier Criterion	238
5.8.2.	MOHR's Criterion	241
5.8.3.	GRIFFITH's Criterion	242
5.9.	Summary and Conclusions	247
	References	248
 Appendix		
	Stiff Testing Machines	253
	Concept of Stiff Testing Machines	253
	Stiffness of a Testing Machine	256
	Development of Stiff Machines for Testing of Rocks	262
	References	266
	About the Authors	268
	Author Index	270
	Subject Index	274

HANDBOOK ON MECHANICAL PROPERTIES OF ROCKS

CONTENTS

Volume II

6.	Static Elastic Constants of Rocks	
6.1.	Introduction	1
6.2.	Definitions of Terms	1
6.3.	Test Requirements	3
6.4.	Measurement of Deformation	5
6.4.1.	Mechanical Gauges	9
6.4.2.	Optical Gauges	10
6.4.3.	Electrical Gauges	14
6.4.3.1.	Linear variable differential transformers	14
6.4.3.2.	Electrical resistance strain gauges	20
6.4.4.	Extensometers Using Electrical Gauges	37
6.5.	Calculation of Elastic Constants from Tests	43
6.5.1.	Simple Compression and Direct Tension	43
6.5.2.	Bending	46
6.5.3.	Brazilian Test	51
6.5.4.	Compression of Square Plates	54
6.5.5.	Triaxial Test (Solid and Hollow Cylinders)	54
6.6.	Deformation of Rock	57
6.7.	Factors Influencing Stress-Strain Curves for Rocks	62
6.7.1.	Specimen Geometry	62
6.7.2.	Platen Conditions	64
6.7.3.	Rate of Loading	66
6.7.4.	Temperature, Pressure and Brittle-Ductile Transition	80
6.7.5.	Stress Level	97
6.7.6.	Influence of Pores and Cracks	99
6.7.7.	Rock Fabric and Modulus — Anisotropy	105
6.8.	Poisson's Ratio of Rocks	117
6.9.	Compressibility of Rock	148
6.10.	Shock Hugoniot of Rocks	164
6.11.	Dilatancy in Rocks	170
6.12.	Summary and Conclusions	180
	References to Chapter 6	182
	Uncited References to Chapter 6	192

CONTENTS

7.	Dynamic Elastic Constants of Rocks	
7.1.	Introduction	195
7.2.	Elastic Waves	195
7.3.	Methods of Determining Dynamic Elastic Constants in Laboratory	196
7.3.1.	Resonance Method	196
7.3.1.1.	Longitudinal vibration	197
7.3.1.2.	Flexural vibration	198
7.3.1.3.	Torsional vibration	199
7.3.1.4.	Calculation of modulus of elasticity from flexural resonant frequency	206
7.3.1.5.	Measuring system	207
7.3.1.6.	Identification of the vibrating mode	210
7.3.1.7.	Measurements at high temperatures	211
7.3.1.8.	Some other methods of employing resonance	211
7.3.1.9.	Practical limitations	218
7.3.2.	Ultrasonic Pulse Method	218
7.3.2.1.	Measuring system	220
7.3.2.2.	Limitations	223
7.3.3.	Comparison between Resonance and Ultrasonic Pulse Methods	223
7.4.	In Situ Test	226
7.5.	Comparison of Static and Dynamic Elastic Constants	231
7.6.	Parameters Affecting Propagation Velocity of Waves in Rocks	236
7.6.1.	Rock Type	237
7.6.2.	Texture	237
7.6.3.	Density	242
7.6.4.	Porosity	247
7.6.5.	Anisotropy	254
7.6.6.	Stress	263
7.6.7.	Water Content	282
7.6.8.	Temperature	292
7.7.	Dynamic Tensile Strength of Rock	299
7.8.	Summary and Conclusions	305
	References to Chapter 7	308
	Uncited References to Chapter 7	311
Appendix II		
	Laboratory Mechanical Properties of Rocks	315
	References to Appendix II	455

HANDBOOK ON MECHANICAL PROPERTIES OF ROCKS

CONTENTS

Volume III

8.	In Situ Testing of Rock	
8.1.	Introduction	1
8.2.	Types of Large Scale in Situ Tests	2
8.3.	Selection of Test Site	4
8.4.	Uniaxial Compressive Strength of Rock in Situ	8
8.4.1.	Specimen Preparation	9
8.4.2.	Loading and Displacement Measuring System	12
8.4.3.	Results of in Situ Compressive Strength Tests	16
8.5.	In Situ Tests for Deformability of Rock	25
8.5.1.	Plate Bearing Test	25
8.5.1.1.	Theoretical Basis	25
8.5.1.2.	Testing Technique	40
8.5.1.3.	Testing in Trenches or Open Pits	48
8.5.1.4.	Interpretation of Plate Bearing Test	48
8.5.2.	Modifications of Plate Bearing Test	58
8.5.2.1.	Compression in Narrow Slits	58
8.5.2.2.	Cable Jacking Method	63
8.5.2.3.	Goffi's Method	66
8.6.	Pressure Tunnel Test	68
8.6.1.	Theoretical Basis	68
8.6.2.	Hydraulic Pressure Chamber Test	71
8.6.3.	Radial Jacking Test	75
8.6.4.	Analysis of Results from Pressure Tunnel Tests	78
8.7.	Borehole Tests	83
8.7.1.	Borehole Dilatometers	83
8.7.1.1.	LNEC Dilatometer	90
8.7.1.2.	Yachiyo Tube Deformeter	91
8.7.1.3.	OYO Elastometer 200	91
8.7.1.4.	Calculation of Modulus of Rock from Dilatometer Tests	94
8.7.2.	Borehole Jacks	95
8.7.2.1.	Goodman's Jack	95
8.7.2.2.	C.S.I.R.O. Pressiometer	98
8.7.3.	Borehole Penetrometers	100
8.7.4.	Testing Procedure in Using Borehole Deformation Instruments	101