

# Geotechnical Behavior of Rocks Based on the Strength

## ABSTRACT

**Introduction:** The geotechnical behavior of rocks plays a critical role in civil engineering, influencing the stability and safety of various structures. Understanding factors such as grain size, mineral composition, and degree of weathering is essential for designing resilient infrastructure. Blast-induced ground shocks have emerged as a significant concern due to their impact on rock behavior and structure stability.

**Aim:** This study aimed to comprehensively investigate the mechanical, physical, and mineralogical properties of rocks classified as hard soils – soft rocks. The primary objective was to enhance understanding of how these rocks behave under different conditions to improve engineering solutions for construction projects.

**Methodology:** Rock samples were collected and subjected to laboratory testing, including uniaxial compressive strength (UCS), triaxial compressive strength, and point load strength tests. Physical properties such as density, porosity, and water absorption were measured. Mineralogical analysis was conducted using X-ray diffraction (XRD) and petrographic microscopy. Numerical simulations were performed to model rock behavior under dynamic loading conditions.

**Results:** The UCS values ranged from 15 MPa to 80 MPa, with cohesion values between 5 and 25 MPa and internal friction angles from 20° to 35°. Density varied from 2.4 g/cm<sup>3</sup> to 2.8 g/cm<sup>3</sup>, and porosity ranged from 5% to 15%. Quartz-rich samples exhibited higher strength, while clay-rich samples showed higher porosity. Numerical simulations revealed varying degrees of deformation, with weaker rocks exhibiting higher susceptibility to dynamic loads.

**Conclusion:** Understanding the geotechnical behavior of rocks is crucial for designing stable and resilient engineering structures. The findings of this study provide valuable insights for engineering design in complex geological environments, emphasizing the importance of considering mineral composition and physical properties in construction projects.

**KEYWORDS:** Geotechnical Behavior, Rocks, Stability, Resilience, Infrastructure, Mineralogical Properties.

# Engineering Behavior Of Rocks

**I.W. Farmer**



## **Engineering Behavior Of Rocks:**

*Engineering Behaviour of Rocks* I.W. Farmer, 2012-12-06 The first edition of this book was received more kindly than it deserved by some and with some scepticism by others It set out to present a simple concise and reasonably comprehensive introduction to some of the theoretical and empirical criteria which may be used to define rock as a structural material The objectives reinforced by the change in title remain the same but the approach has been changed considerably and only one or two sections have been retained from the first edition The particular aim in this edition is to provide a description of the mechanical behaviour of rocks based firmly upon experimental data which can be used to explain how rocks deform fracture and yield and to show how this knowledge can be used in design The major emphasis is on the behaviour of rocks as materials although in the later chapters the behaviour of discontinuities in rocks and the way in of rock masses is considered which this can affect the behaviour If this edition is an improvement on the first edition it reflects the debt lowe to numerous people who have attempted to explain the rudiments of the subject to me I should like to thank Peter Attewell and Roy Scott in particular I should also like to thank Tony Price and Mike Gilbert whose work at Newcastle I have used shamelessly

**Engineering Behaviour of Rocks** Ian W. Farmer, 2012-12-06 The first edition of this book was received more kindly than it deserved by some and with some scepticism by others It set out to present a simple concise and reasonably comprehensive introduction to some of the theoretical and empirical criteria which may be used to define rock as a structural material The objectives reinforced by the change in title remain the same but the approach has been changed considerably and only one or two sections have been retained from the first edition The particular aim in this edition is to provide a description of the mechanical behaviour of rocks based firmly upon experimental data which can be used to explain how rocks deform fracture and yield and to show how this knowledge can be used in design The major emphasis is on the behaviour of rocks as materials although in the later chapters the behaviour of discontinuities in rocks and the way in which this can affect the behaviour of rock masses is considered If this edition is an improvement on the first edition it reflects the debt lowe to numerous people who have attempted to explain the rudiments of the subject to me I should like to thank Peter Attewell and Roy Scott in particular I should also like to thank Tony Price and Mike Gilbert whose work at Newcastle I have used shamelessly

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and the application of their study in the field of engineering      **Engineering Behaviour of Rocks** I.W. Farmer,2011-12-14

The first edition of this book was received more kindly than it deserved by some and with some scepticism by others It set out to present a simple concise and reasonably comprehensive introduction to some of the theoretical and empirical criteria which may be used to define rock as a structural material The objectives reinforced by the change in title remain the same but the approach has been changed considerably and only one or two sections have been retained from the first edition The particular aim in this edition is to provide a description of the mechanical behaviour of rocks based firmly upon experimental data which can be used to explain how rocks deform fracture and yield and to show how this knowledge can be used in design The major emphasis is on the behaviour of rocks as materials although in the later chapters the behaviour of discontinuities in rocks and the way in of rock masses is considered which this can affect the behaviour If this edition is an improvement on the first edition it reflects the debt lowe to numerous people who have attempted to explain the rudiments of the subject to me I should like to thank Peter Attewell and Roy Scott in particular I should also like to thank Tony Price and Mike Gilbert whose work at Newcastle I have used shamelessly      Engineering Behaviour of Rocks I. W. (Ian William).

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Intact Rock and in Situ Rock Masses William Joel Hall, Nathan Mortimore Newmark, A. J. Hendron, 1974      **Correlation of Engineering Behavior with the Classification of In-situ Rock** Richard F. Coon, 1968 The engineering properties of soil and rock are important factors in nearly every civil engineering project Each of the conventional exploratory tests is a potential index property of the engineering properties of a rock mass but the science of rock mechanics has been impoverished by the lack of an engineering classification based on these tests      **Engineering in Rocks for Slopes, Foundations and Tunnels** T. Ramamurthy, 2010-08 With the ever increasing developmental activities as diverse as the construction of dams roads tunnels underground powerhouses and storage facilities petroleum exploration and nuclear repositories a more comprehensive and updated understanding of rock mass is essential for civil engineers engineering geologists geophysicists and petroleum and mining engineers Though some contents of this vast subject are included in undergraduate curriculum there are full fledged courses on Rock Mechanics Rock Engineering in postgraduate programmes in civil engineering and mining engineering Much of the material presented in this book is also taught to geology and geophysics students In addition the book is suitable for short courses conducted for teachers practising engineers and engineering geologists This book with contributions from a number of authors with expertise and vast experience in various areas of rock engineering gives an in depth analysis of the multidimensional aspects of the subject The text covers a wide range of topics related to engineering behaviour of rocks and rock masses their classifications interpretation of geological mapping of joints through stereographic projection in situ stress measurements laboratory and field tests stability of rock slopes foundations of structures including dams and support systems for underground excavations The Second Edition has been enriched with new topics such as minimum overburden on pressure tunnels pressure around vertical cylindrical shaft thickness of steel lining and penetration rate from joint factor What distinguishes the text is the application of numerical methods to solve various problems by discrete element and equivalent material concepts interpretations of geomechanics modelling test data excavation methods ground improving methods and use of roadheaders and TBMs The book provides an excellent understanding of how to solve problems in rock engineering and should immensely benefit students teachers professionals and designers alike      *Geomechanical Behaviors of Bimrocks* Wang Yu, 2021-04-28 This book is intended as a reference book for advanced graduate students and research engineers in block in matrix rocks bimrocks or soil and rock mixtures SRMs or rock and soil aggregate RSA Bimrocks are complex formations characterized by competent rock inclusions floating in a weaker matrix Typical types of bimrocks include a series of mixed geological or engineering masses such as malen fault rocks coarse pyroclastic rocks breccias sheared serpentines and waste dump mixture Bimrock is especially different from the general soil and rock material and the detection of the damage and fracture is still wide open to innovative research Globally there is a widespread interest in investigating the geomechanical behaviors of bimrocks such as deformation and strength characteristics damage and fracture evolution and stability prediction of bimrock construction

However the meso structural factors control the whole mechanical properties of bimrocks the source of the macroscopic deformation phenomenon is the meso structural changes Therefore evaluation of the mesoscopic physical and mechanical properties together with advanced testing technique is an attractive research topic in rock mechanics As a result comprehensive macroscopic and mesoscopic experimental investigations should be conducted to reveal the damage and fracturing mechanical behaviors of bimrocks The readers of this work can gain new insights into the meso structural changes of bimrocks subjected to different stress paths This book is expected to improve the understanding of the mesoscopic damage and fracturing mechanisms of bimrocks and can be helpful to predict the stability of rock structures where rock mass is subjected to complex loading conditions

**ENVIRONMENTAL AND ENGINEERING GEOLOGY -Volume III** Syed E. Hasan, Benedetto De Vivo, Bernhard Grasemann, Kurt Stüwe, Jan Lastovicka, Syed M. Hasan, Chen Yong ,2011-12-05 Environmental And Engineering Geology is a component of Encyclopedia of Environmental and Ecological Sciences Engineering and Technology Resources in the global Encyclopedia of Life Support Systems EOLSS which is an integrated compendium of twenty one Encyclopedias The Theme on Environmental and Engineering Geology with contributions from distinguished experts in the field discusses matters of great relevance to our world such as engineering and environmental geology and their importance in our life It also includes a discussion of some new applications of geoscience such as medical geology forensic geology use of underground space for human occupancy and geoinicators These four volumes are aimed at the following five major target audiences University and College students Educators Professional practitioners Research personnel and Policy analysts managers and decision makers and NGOs

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Engineering Geology David George Price,2009 This text is directed at the heart of Engineering Geology where geology is used to identify potential problems arising from ground conditions It describes how to investigate those conditions and to define an engineering response that will either avoid or reduce or even eliminate the problems revealed The book presents the big picture that is so often lacking when only site details are available but necessary for adequate engineering solutions

**Impact of Human Activity on the Geological Environment EUROCK 2005** Pavel Konecny,2005-05-12 This work focuses on the impact of human activity on the geological environment and contains over 100 papers dealing with laboratory and field research investigations in geomechanics geoengineering and mathematical modelling Topics covered are grouped into eight main themes response of the rock mass to human impact slope stability field research laboratory research stability of underground openings mathematical modelling stress measurements and mineral and rock disintegration

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**Mechanics** Bernard Amadei,1999      **Proceedings of the International Workshop on Rock Mass Classification in Underground Mining** Christopher Mark,Rimas Thomas Pakalnis,Robert J. Tuchman,2007

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