

Geotechnical Core Logging

This GSL volume focuses on underwater or subaqueous landslides with the overarching goal of understanding how they affect society and the environment. The new research presented here is the result of significant advances made over recent years in directly monitoring submarine landslides, in standardising global datasets for quantitative analysis, constructing a global database, and leading international research projects. This volume demonstrates the breadth of investigation taking place into subaqueous landslides, and shows that while events like the recent ones in the Indonesian archipelago can be devastating they are at the smaller end of what the Earth has experienced in the past. Understanding the spectrum of subaqueous landslide processes, and therefore the potential societal impact, requires research across all spatial and temporal scales. This volume delivers a compilation of state-of-the-art papers covering topics from regional landslide databases to advanced techniques for in situ measurements, to numerical modelling of processes and hazards. High-resolution automated measurement of the geotechnical and geoacoustic properties of soil at the U.S. Geological Survey (USGS) is performed with a state-of-the-art multi-sensor whole-core logging device. The device takes measurements, directly through intact sample-tube wall, of p-wave acoustic velocity, of soil wet bulk density, and magnetic susceptibility. This paper summarizes our methodology for determining

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soil-sound speed and wet-bulk density for material encased in an unsplit liner. Our methodology for nondestructive measurement allows for rapid, accurate, and high-resolution (1 cm-spaced) mapping of the mass physical properties of soil prior to sample extrusion.

Landslides in sensitive clays represent a major hazard in the northern countries of the world such as Canada, Finland, Norway, Russia, Sweden and in the US state of Alaska. Past and recent examples of catastrophic landslides at e.g. Saint-Jean-Vianney in 1971, Rissa in 1979, Finneidfjord in 1996 and Kattmarka in 2009 have illustrated the great mobility of the remolded sensitive clays and their hazardous retrogressive potential. These events call for a better understanding of landslide in sensitive clay terrain to assist authorities with state-of-the-art hazard assessment methods, risk management schemes, mitigation measures and planning. During the last decades the elevated awareness regarding slope movement in sensitive clays has led to major advances in mapping techniques and development of highly sophisticated geotechnical and geophysical investigation tools. Great advances in numerical techniques dealing with progressive failure and landslide kinematic have also lead to increase understanding and predictability of landslides in sensitive clays and their consequences. This volume consists of the latest scientific research by international experts dealing with geological, geotechnical and geophysical aspects of slope failure in sensitive clays and focuses on understanding the full spectrum of challenges

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presented by landslides in such brittle materials.

Weak rocks encountered in open pit mines cover a wide variety of materials, with properties ranging between soil and rock. As such, they can provide a significant challenge for the slope designer. For these materials, the mass strength can be the primary control in the design of the pit slopes, although structures can also play an important role. Because of the typically weak nature of the materials, groundwater and surface water can also have a controlling influence on stability. *Guidelines for Open Pit Slope Design in Weak Rocks* is a companion to *Guidelines for Open Pit Slope Design*, which was published in 2009 and dealt primarily with strong rocks. Both books were commissioned under the Large Open Pit (LOP) project, which is sponsored by major mining companies. These books provide summaries of the current state of practice for the design, implementation and assessment of slopes in open pits, with a view to meeting the requirements of safety, as well as the recovery of anticipated ore reserves. This book, which follows the general cycle of the slope design process for open pits, contains 12 chapters. These chapters were compiled and written by industry experts and contain a large number of case histories. The initial chapters address field data collection, the critical aspects of determining the strength of weak rocks, the role of groundwater in weak rock slope stability and slope design considerations, which can differ somewhat from those applied to strong rock. The subsequent chapters address the principal weak rock types that are encountered in open pit mines, including

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cemented colluvial sediments, weak sedimentary mudstone rocks, soft coals and chalk, weak limestone, saprolite, soft iron ores and other leached rocks, and hydrothermally altered rocks. A final chapter deals with design implementation aspects, including mine planning, monitoring, surface water control and closure of weak rock slopes. As with the other books in this series, *Guidelines for Open Pit Slope Design in Weak Rocks* provides guidance to practitioners involved in the design and implementation of open pit slopes, particularly geotechnical engineers, mining engineers, geologists and other personnel working at operating mines.

This new edition has been completely revised to reflect the notable innovations in mining engineering and the remarkable developments in the science of rock mechanics and the practice of rock engineering that have taken place over the last two decades. Although "Rock Mechanics for Underground Mining" addresses many of the rock mechanics issues that arise in underground mining engineering, it is not a text exclusively for mining applications. Based on extensive professional research and teaching experience, this book will provide an authoritative and comprehensive text for final year undergraduates and commencing postgraduate students. For professional practitioners, not only will it be of interests to mining and geological engineers, but also to civil engineers, structural mining geologists and geophysicists as a standard work for professional reference purposes.

Guidelines for Evaluating Water in Pit Slope Stability is a comprehensive account of the

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hydrogeological procedures that should be followed when performing open pit slope stability design studies. Created as an outcome of the Large Open Pit (LOP) project, an international research and technology transfer project on the stability of rock slopes in open pit mines, this book expands on the hydrogeological model chapter in the LOP project's previous book *Guidelines for Open Pit Slope Design* (Read & Stacey, 2009; CSIRO PUBLISHING). The book comprises six sections which outline the latest technology and best practice procedures for hydrogeological investigations. The sections cover: the framework used to assess the effect of water in slope stability; how water pressures are measured and tested in the field; how a conceptual hydrogeological model is prepared; how water pressures are modelled numerically; how slope depressurisation systems are implemented; and how the performance of a slope depressurisation program is monitored and reconciled with the design. *Guidelines for Evaluating Water in Pit Slope Stability* offers slope design practitioners a road map that will help them decide how to investigate and treat water pressures in pit slopes. It provides guidance and essential information for mining and civil engineers, geotechnical engineers, engineering geologists and hydrogeologists involved in the investigation, design and construction of stable rock slopes.

Guidelines for Open Pit Slope Design is a comprehensive account of the open pit slope design process. Created as an outcome of the Large Open Pit (LOP) project, an international research and technology transfer project on rock slope stability in open pit

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mines, this book provides an up-to-date compendium of knowledge of the slope design processes that should be followed and the tools that are available to aid slope design practitioners. This book links innovative mining geomechanics research into the strength of closely jointed rock masses with the most recent advances in numerical modelling, creating more effective ways for predicting rock slope stability and reliability in open pit mines. It sets out the key elements of slope design, the required levels of effort and the acceptance criteria that are needed to satisfy best practice with respect to pit slope investigation, design, implementation and performance monitoring. Guidelines for Open Pit Slope Design comprises 14 chapters that directly follow the life of mine sequence from project commencement through to closure. It includes: information on gathering all of the field data that is required to create a 3D model of the geotechnical conditions at a mine site; how data is collated and used to design the walls of the open pit; how the design is implemented; up-to-date procedures for wall control and performance assessment, including limits blasting, scaling, slope support and slope monitoring; and how formal risk management procedures can be applied to each stage of the process. This book will assist in meeting stakeholder requirements for pit slopes that are stable, in regards to safety, ore recovery and financial return, for the required life of the mine.

This book is Volume 1 of the EUROCK 2018 proceedings. Geomechanics and Geodynamics of Rock Masses contains contributions presented at EUROCK

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2018, the 2018 International Symposium of the International Society for Rock Mechanics (ISRM 2018, Saint Petersburg, Russia, 22-26 May 2018). Dedicated to recent advances and achievements in the fields of geomechanics and geotechnology, the main topics of the book include: - Physical and mechanical properties of fractured rock (laboratory testing and rock properties, field measurements and site investigations) - Geophysics in rock mechanics - Rock mass strength and failure - Nonlinear problems in rock mechanics - Effect of joint water on the behavior of rock foundation - Numerical modeling and back analysis - Mineral resources development: methods and rock mechanics problems - Rock mechanics and underground construction in mining, hydropower industry and civil engineering - Rock mechanics in petroleum engineering - Geodynamics and monitoring of rock mass behavior - Risks and hazards - Geomechanics of technogenic deposits Geomechanics and Geodynamics of Rock Masses will be of interest to researchers and professionals involved in the various branches of rock mechanics and rock engineering. EUROCK 2018, organized by the Saint Petersburg Mining University, is a continuation of the successful series of ISRM symposia in Europe, which began in 1992 in Chester, UK.

Geomechanics and Geodynamics of Rock Masses contains contributions presented at EUROCK 2018, the 2018 International Symposium of the

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International Society for Rock Mechanics (ISRM 2018, Saint Petersburg, Russia, 22-26 May 2018). Dedicated to recent advances and achievements in the fields of geomechanics and geotechnology, the main topics of the book include: - Physical and mechanical properties of fractured rock (laboratory testing and rock properties, field measurements and site investigations) - Geophysics in rock mechanics - Rock mass strength and failure - Nonlinear problems in rock mechanics - Effect of joint water on the behavior of rock foundation - Numerical modeling and back analysis - Mineral resources development: methods and rock mechanics problems - Rock mechanics and underground construction in mining, hydropower industry and civil engineering - Rock mechanics in petroleum engineering - Geodynamics and monitoring of rock mass behavior - Risks and hazards - Geomechanics of technogenic deposits Geomechanics and Geodynamics of Rock Masses will be of interest to researchers and professionals involved in the various branches of rock mechanics and rock engineering. EUROCK 2018, organized by the Saint Petersburg Mining University, is a continuation of the successful series of ISRM symposia in Europe, which began in 1992 in Chester, UK.

Frontiers in Offshore Geotechnics II comprises the Proceedings of the Second International Symposium on Frontiers in Offshore Geotechnics (ISFOG),

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organised by the Centre for Offshore Foundation Systems (COFS) and held at the University of Western Australia (UWA), Perth from 8-10 November 2010. The volume addresses current and emerging challenges

Rock Mechanics and Rock Engineering: From the Past to the Future contains the contributions presented at EUROCK2016, the 2016 International Symposium of the International Society for Rock Mechanics (ISRM 2016, Ürgüp, Cappadocia Region, Turkey, 29-31 August 2016). The contributions cover almost all aspects of rock mechanics and rock engineering from theories to engineering practices, emphasizing the future direction of rock engineering technologies. The 204 accepted papers and eight keynote papers, are grouped into several main sections: - Fundamental rock mechanics - Rock properties and experimental rock mechanics - Analytical and numerical methods in rock engineering - Stability of slopes in civil and mining engineering - Design methodologies and analysis - Rock dynamics, rock mechanics and rock engineering at historical sites and monuments - Underground excavations in civil and mining engineering - Coupled processes in rock mass for underground storage and waste disposal - Rock mass characterization - Petroleum geomechanics - Carbon dioxide sequestration - Instrumentation-monitoring in rock engineering and back analysis - Risk management, and - the 2016 Rocha Medal Lecture and the 2016 Franklin

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Lecture Rock Mechanics and Rock Engineering: From the Past to the Future will be of interest to researchers and professionals involved in the various branches of rock mechanics and rock engineering. EUROCK 2016, organized by the Turkish National Society for Rock Mechanics, is a continuation of the successful series of ISRM symposia in Europe, which began in 1992 in Chester, UK. This publication includes 82 technical papers presented at Rocscience International Conference (RIC) 2021, held online on April 20 and 21, 2021. Rocscience created this event to bring geotechnical academics, researchers and practitioners together to exchange ideas as part of celebrating 25 years of the company's existence. The papers in these proceedings were from keynotes, panel discussions and papers, selected after careful review of over 100 technical submissions delivered at RIC 2021. The technical papers were grouped into sessions based on their subject areas. The conference aimed to stimulate discussions that could help the industry work towards overcoming geotechnical engineering limitations today. It also sought to foster creative thinking that will advance the current states of the art and practice. The keynote addresses, panel discussions and technical presentations tried to examine geotechnical problems and situations from fresh perspectives. RIC 2021 hopes that the proceedings will continue to enrich our thinking and contribute to achieving a critical mass of

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change in our practices and approaches. We look forward to significant improvements in our industry.

A thorough knowledge of geology is essential in the design and construction of infrastructures for transport, buildings and mining operations; while an understanding of geology is also crucial for those working in urban, territorial and environmental planning and in the prevention and mitigation of geohazards. Geological Engineering provides an interpretation of the geological setting, integrating geological conditions into engineering design and construction, and provides engineering solutions that take into account both ground conditions and environment. This textbook, extensively illustrated with working examples and a wealth of graphics, covers the subject area of geological engineering in four sections: Fundamentals: soil mechanics, rock mechanics and hydrogeology Methods: site investigations, rock mass characterization and engineering geological mapping Applications: foundations, slope stability, tunnelling, dams and reservoirs and earth works Geohazards: landslides, other mass movements, earthquake hazards and prevention and mitigation of geological hazards As well as being a textbook for graduate and postgraduate students and academics, Geological Engineering serves as a basic reference for practicing engineering geologists and geological and geotechnical engineers, as well as civil and mining

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engineers dealing with design and construction of foundations, earth works and excavations for infrastructures, buildings, and mining operations.

This carefully targeted and rigorous new textbook introduces engineering students to the fundamental principles of applied Earth science, highlighting how modern soil and rock mechanics, geomorphology, hydrogeology, seismology and environmental geochemistry affect geotechnical and environmental practice. Key geological topics of engineering relevance including soils and sediments, rocks, groundwater, and geologic hazards are presented in an accessible and engaging way. A broad range of international case studies add real-world context, and demonstrate practical applications in field and laboratory settings to guide site characterization. End-of-chapter problems are included for self-study and evaluation, and supplementary online materials include electronic figures, additional examples, solutions, and guidance on useful software. Featuring a detailed glossary introducing key terminology, this text requires no prior geological training and is essential reading for senior undergraduate or graduate students in civil, geological, geotechnical and geoenvironmental engineering. It is also a useful reference and bridge for Earth science graduates embarking on engineering geology courses.

The International Conference on Ground Control in Mining has a rich history of

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advancing ground control techniques and knowledge. It provides a unique platform for researchers, regulators, consultants, manufacturers, and mine operators to present and exchange challenging industry topics as well as to expedite solutions to ground control problems that require immediate attention. This proceedings from the 37th International Conference is no exception. It includes 47 peer-reviewed research papers from industry experts covering topics of importance for today and the future.

This book comprises select proceedings of the First Indian Symposium on Offshore Geotechnics. It addresses state of the art and emerging challenges in offshore design and construction. The theme papers from leading academicians and practitioners provide a comprehensive overview of the broad topics encompassing various challenges in offshore geotechnical engineering. It covers various aspects pertaining to offshore geotechnics, such as offshore site investigation, soil characterization, geotechnics related to offshore renewable energy converters, offshore foundations and anchoring systems, pipelines, and deep sea explorations. This volume provides a comprehensive reference for professionals and researchers in offshore, civil and maritime engineering and for soil mechanics specialists.

Developments in Engineering Geology is a showcase of the diversity in the science and practice of engineering geology. All branches of geology are applicable to solving engineering problems and this presents a wide frontier of scientific opportunity to engineering geology. In practice, diversity represents a different set of challenges with

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the distinctive character of the profession derived from the crossover between the disciplines of geology and engineering. This book emphasizes the importance of understanding the geological science behind the engineering behaviour of a soil or rock. It also highlights a continuing expansion in the practice areas of engineering geology and illustrates how this is opening new frontiers to the profession thereby introducing new knowledge and technology across a range of applications. This is initiating an evolution in the way geology is modelled in engineering, geohazard and environmental studies in modern and traditional areas of engineering geology.

This edition provides geoscientists with a thorough account of coring methods and the interpretation of data gathered from core observation and analysis.

The study of the solid part of the earth on which structures are built is an essential part of the training of a civil engineer. Geotechnical processes such as drilling, pumping and injection techniques enhance the viability of many construction processes by improving ground conditions. Highlighting the ground investigation necessary for the process, the likely improvement in strength of treated ground and testing methods *An Introduction to Geotechnical Processes* covers the elements of ground treatment and improvement, from the control of groundwater, drilling and grouting to ground anchors and electro-chemical hardening.

This SME classic is both a reference book for the working engineer and a textbook for the mining student. This hardcover edition gives a brief history of surface mining and a

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general overview of the state of surface mining today--topics range from production and productivity to technological developments and trends in equipment. This extremely useful text takes the approach that exploration and mining geologists must be expert in a number of fields, including basic finance and economics, logistics, and pragmatic prospecting. Readers will find material on all these topics and more. The book's nine chapters include: Introduction, Exploration and Geology Techniques, Ore Reserve Estimation, Feasibility Studies and Project Financing, Planning and Design of Surface Mines, Mine Operations, Mine Capital and Operating Costs, Management and Organization, and Case Studies. The book is fully indexed.

This book provides a detailed overview of the operational principles of modern mining geology, which are presented as a good mix of theory and practice, allowing use by a broad range of specialists, from students to lecturers and experienced geologists. The book includes comprehensive descriptions of mining geology techniques, including conventional methods and new approaches. The attributes presented in the book can be used as a reference and as a guide by mining industry specialists developing mining projects and for optimizing mining geology procedures. Applications of the methods are explained using case studies and are facilitated by the computer scripts added to the book as Electronic Supplementary Material.

The subject of rock characterization is not only about the optimal length-to-diameter ratio for a compression test specimen and other similar tactical aspects

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of the testing procedures, it is also about the whole strategic concept of how to characterize naturally-occurring rock masses, which have been in existence for millions of years. They have been operating as natural process-response systems for all time and are about to be perturbed by engineers in order to achieve particular objectives. By international authors, this volume is important and useful for all geotechnical engineers and related positions who need to know the latest information to succeed.

The text broadly covers recent developments in ground control techniques, and their at operating mines, worldwide. Specific topics include: design and analysis of support and re-inforcement in metalliferous mines, mesh, shotcrete and membrane support systems, and strata control in coal mines.

In ground investigation, the description of soils and rocks forms a major input to the field log which records the materials and strata seen in any sample, core or exposure. The log is a basic element of the factual information that underpins the entire understanding and interpretation of the ground conditions on site. Practical guidance is provided for those in the field carrying out engineering geological logging of soil and rock samples and exposures. Information on the current systematic and codified approach and its use are presented in detail to ensure the defined descriptors are used in a consistent format, rendering mistakes less

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likely and the necessary communication from field to design more successful. Soil and Rock Description in Engineering Practice enables the practitioner to record and present features of the ground from the exposure in such a way as to convey a field presence to subsequent users of the data. This is important as the samples deteriorate quickly and are not usually inspected by any party other than the logger. Field logs therefore provide the only record of the ground that is available to the designer and contractor later in the construction process. The procedures, techniques and tips within this book are not only for young practitioners learning their craft, but are also relevant for their seniors and mentors, including responsible experts who sign off the logs and report on behalf of their company. Although they may have been involved in logging for many years, they need to be aware of current practices in order to avoid costly mistakes. This book will therefore be of immense value to geologists, geotechnical/ground engineers or anyone involved with ground investigations, from commissioning to interpretation.

This Second Edition has been brought up-to-date and incorporates modern developments in coring techniques and core handling. All aspects of cores are covered including cutting and recovery; wellsite handling and logging; recognition of coring damage; laboratory analysis; logging and sampling; preservation and

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storage. Logging and interpretation are dealt with in detail, encompassing structural and engineering investigations in addition to sedimentology. Emphasis is laid throughout on those features most important to the economical development of geological resources. --

This course on engineering geology applied to underground coal mining has been taught to geologists & engineers of State & Federal governments, mining companies, & consulting firms involved in designing, developing, & operating underground coal mines. Discusses in detail how the disciplines of geology & geotechnology apply to exploration, design, & operation of underground coal mines. It is intended for practicing scientists, engineering geologists, & engineers. Shows how the disciplines of geology, geotechnology, & mining engineering can be integrated & used to make underground coal mining safer, more efficient, & more environmentally acceptable.

This is the first authoritative reference on rock mass classification, consolidating into one handy source information once widely scattered throughout the literature. It includes new, previously unpublished material and case histories, presents the fundamental concepts of classification schemes, and critically appraises their practical application in industrial projects such as tunneling and mining.

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Although most mining companies have systems in place for slope monitoring, experience indicates that mining operations continue to be surprised by the occurrence of negative geotechnical events. A comprehensive and robust performance monitoring system is an essential component of the slope management program in an open pit mining operation. Yet the development of such a system requires considerable expertise to ensure that the monitoring system is effective and reliable. Written by industry experts, "Guidelines for Slope Performance Monitoring" is an initiative of the Large Open Pit (LOP) Project and the fifth book in the Guidelines for Open Pit Slope Design series. Its 10 chapters present the process of establishing and operating a slope monitoring system, the fundamentals of pit slope monitoring methods and instrumentation, monitoring system operation, data acquisition, management and analysis, and utilisation and communication of monitoring results. The implications of the increasing move to automate mining operations are also discussed, including the potential future requirements of performance monitoring. The book summarises leading mine industry practice in monitoring system design, implementation, system management, data management and reporting, providing guidance for engineers, geologists, technicians and others responsible for geotechnical risk management. Proceedings of the 31st Symposium on Rock Mechanics, held at Golden, Colo., June 1990.

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The papers cover such areas as experimental studies; conceptual, analytical, and numerical modeling; and design and construction methods. Many address practical mining problems, with particular area emphasis on co

Rock mechanics is a field of applied science which has become recognised as a coherent engineering discipline within the last two decades. It consists of a body of knowledge of the mechanical properties of rock, various techniques for the analysis of rock stress under some imposed perturbation, a set of established principles expressing rock mass response to load, and a logical methodology for applying these notions and techniques to real physical problems. Some of the areas where application of rock mechanics concepts have been demonstrated to be of industrial value include surface and subsurface construction, mining and other methods of mineral recovery, geothermal energy recovery and subsurface hazardous waste isolation. In many cases, the pressures of industrial demand for rigour and precision in project or process design have led to rapid evolution of the engineering discipline, and general improvement in its basis in both the geosciences and engineering mechanics. An intellectual commitment in some outstanding research centres to the proper development of rock mechanics has now resulted in a capacity for engineering design in rock not conceivable two decades ago. Mining engineering is an obvious candidate for application of rock mechanics principles in the design of excavations generated by mineral extraction. A primary concern in mining operations, either on surface or underground, is loosely termed 'ground control', i. e. Ore extraction through surface and underground mining continues to involve deeper excavations in more complex rock mass conditions. Communities and infrastructure are increasingly exposed to rock slope hazards as they expand further into rugged mountainous

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terrains. Energy needs are accelerating the development of new hydroelectric dams and exploit

This book is one out of six IAEG XIII Congress and AEG 61st Annual Meeting proceeding volumes, and deals with topics related to the advances made in engineering geology with emphasis on education, soil and rock properties, and modeling. The theme of the IAEG/AEG Meeting, held in San Francisco from September 17-21, 2018, is Engineering Geology for a Sustainable World. The meeting proceedings analyze the dynamic role of engineering geology in our changing world. The meeting topics and subject areas of the six volumes are: Slope Stability: Case Histories, Landslide Mapping, Emerging Technologies; Geotechnical and Environmental Site Characterization; Mining, Aggregates, Karst; Dams, Tunnels, Groundwater Resources, Climate Change; Geologic Hazards: Earthquakes, Land Subsidence, Coastal Hazards, and Emergency Response; and Advances in Engineering Geology: Education, Soil and Rock Properties, Modeling.

This practical handbook of properties for soils and rock contains, in a concise tabular format, the key issues relevant to geotechnical investigations, assessments and designs in common practice. In addition, there are brief notes on the application of the tables. These data tables are compiled for experienced geotechnical professionals who require a reference document to access key information. There is an extensive database of correlations for different applications. The book should provide a useful bridge between soil and rock mechanics theory and its application to practical engineering solutions. The initial chapters deal with the planning of the geotechnical investigation, the classification of the soil and rock properties and some of the more used testing is then covered. Later chapters show the reliability and correlations that

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are used to convert that data in the interpretative and assessment phase of the project. The final chapters apply some of these concepts to geotechnical design. This book is intended primarily for practicing geotechnical engineers working in investigation, assessment and design, but should provide a useful supplement for postgraduate courses.

Harmonising Rock Mechanics and the Environment comprises the proceedings (invited and contributed papers) of the 12th ISRM International Congress on Rock Mechanics (Beijing, China, 18-21 October 2011). The contributions cover the entire scope of rock mechanics and rock engineering, with an emphasis on the critical role of both disciplines in sustain

Rock Mechanics for Natural Resources and Infrastructure Development contains the proceedings of the 14th ISRM International Congress (ISRM 2019, Foz do Iguacu, Brazil, 13-19 September 2019). Starting in 1966 in Lisbon, Portugal, the International Society for Rock Mechanics and Rock Engineering (ISRM) holds its Congress every four years. At this 14th occasion, the Congress brings together researchers, professors, engineers and students around contemporary themes relevant to rock mechanics and rock engineering. Rock Mechanics for Natural Resources and Infrastructure Development contains 7 Keynote Lectures and 449 papers in ten chapters, covering topics ranging from fundamental research in rock mechanics, laboratory and experimental field studies, and petroleum, mining and civil engineering applications. Also included are the prestigious ISRM Award Lectures, the Leopold Muller Award Lecture by professor Peter K. Kaiser. and the Manuel Rocha Award Lecture by Dr. Quinghua Lei. Rock Mechanics for Natural Resources and Infrastructure Development is a must-read for academics, engineers and students involved in rock mechanics and engineering. Proceedings in Earth and geosciences - Volume 6 The 'Proceedings in Earth and

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geosciences' series contains proceedings of peer-reviewed international conferences dealing in earth and geosciences. The main topics covered by the series include: geotechnical engineering, underground construction, mining, rock mechanics, soil mechanics and hydrogeology.

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