

Support of Underground Excavations in Hard Rock



E. Hook • P.K. Kaiser • W.F. Bowden



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Xia-Ting Feng



Support Of Underground Excavations In Hard Rock:

Support of Underground Excavations in Hard Rock E. Hoek,P.K. Kaiser,W.F. Bawden,2000-01-01 The safe and economical construction of tunnels mines and other subterranean works depends on the correct choice of support systems to ensure that the excavations are stable These support systems should be matched to the characteristics of the rock mass and the excavation techniques adopted This expansive text explores the design of rockbolts dowels cable bolts and shotcrete for underground excavations in hard rock and covers key topics including rock mass classification systems and support design for overstressed rock *Support of Underground Excavations in Hard Rock* E. Hoek,P.K. Kaiser,W.F. Bawden,2000-01-01

The safe and economical construction of tunnels mines and other subterranean works depends on the correct choice of support systems to ensure that the excavations are stable These support systems should be matched to the characteristics of the rock mass and the excavation techniques adopted This expansive text explores the design of rockbolts dowels cable bolts and shotcrete for underground excavations in hard rock and covers key topics including rock mass classification systems and support design for overstressed rock *Support of Underground Excavations in Hard Rock* consultant expert mohamed taha,2021-02-02 Table of ContentsPreface vForeword vii1 An overview of rock support design 11 1 Introduction 11 2 Stages in mine development 1 1 2 1 Exploration and preliminary design 3 1 2 2 Mine design 3 1 2 3 Early years of mining 4 1 2 4 Later years of mining 71 3 Support design 72 Assessing acceptable risks in design 82 1 Introduction 82 2 Factor of safety 92 3 Sensitivity studies 102 4 The application of probability to design 102 5 Probability of failure 162 6 Problems to which probability cannot be applied 183 Evaluation of engineering geology data 203 1 Introduction 203 2 Engineering geological data collection 203 3 Structural geological terms 213 4 Structural geological data collection 223 5 Structural geological data presentation 233 6 Geological data analysis 244 Rock mass classification 274 1 Introduction 274 2 Engineering rock mass classification 27 4 2 1 Terzaghi s rock mass classification 28 4 2 2 Classifications involving stand up time 29 4 2 3 Rock quality designation index RQD 30 4 2 4 Rock structure rating RSR 314 3 Geomechanics classification 344 4 Modifications to RMR for mining 384 5 Rock tunnelling quality index Q 394 6 Using rock mass classification systems 454 7 Estimation of in situ deformation modulus 475 Shear strength of discontinuities 515 1 Introduction 515 2 Shear strength of planar surfaces 515ii Support of underground excavations in hard rock5 3 Shear strength of rough surfaces 52 5 3 1 Field estimates of JRC 53 5 3 2 Field estimates of JCS 54 5 3 3 Influence of scale on JRC and JCS 555 4 Shear strength of filled discontinuities 565 5 Influence of water pressure 575 6 Instantaneous cohesion and friction 576 Analysis of structurally controlled instability 616 1 Introduction 616 2 Identification of potential wedges 616 3 Support to control wedge failure 65 6 3 1 Rock bolting wedges

The Design and Support of Underground Excavations in Deep-level, Hard-rock Mines John W. Wilson,1971 Technical Manual for Design and Construction of Road Tunnels--civil Elements ,2010 The increased use of underground space for transportation systems and the increasing complexity and constraints of constructing and maintaining above ground

transportation infrastructure have prompted the need to develop this technical manual This FHWA manual is intended to be a single source technical manual providing guidelines for planning design construction and rehabilitation of road tunnels and encompasses various types of road tunnels P ix *Underground Mining Methods* W. A. Hustrulid, Richard L. Bullock, 2001 Reflecting the highly international and diverse nature of the industry a series of mining case studies covers the commodity range from iron ore to diamonds as extracted by operations located in all corners of the world Industry experts have contributed 77 chapters [Rock Mechanics for Natural Resources and Infrastructure Development - Full Papers](#) Sergio A.B. Fontoura, Ricardo Rocca, José Mendoza, 2019-09-03 Rock Mechanics for Natural Resources and Infrastructure Development contains the proceedings of the 14th ISRM International Congress ISRM 2019 Foz do Iguaçu 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 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

Proceedings of the 6th International Conference on Rehabilitation and Maintenance in Civil

Engineering—Volume 2 Stefanus A. Kristiawan, Keh-Chyuan Tsai, Mohamed Shahin, Abdul Rahman Mohd Sam, Pham Dinh Hai, 2025-07-07 This book presents selected papers from the 6th International Conference on Rehabilitation and Maintenance in Civil Engineering 6th ICRMCE on July 4-5 2024 at Mataram Indonesia The papers cover topics related to developing and maintaining a sustainable built environment to mitigate the environmental impacts of human activities and create a healthier and more resilient future This is achieved through infrastructure development and maintenance issues from various perspectives and is brought together under the theme of policy design construction rehabilitation and maintenance for a sustainable built environment Readers will gain a deeper understanding of how to identify and solve issues related to infrastructure design construction use and maintenance toward realizing a sustainable built environment by tapping into various fields expertise within civil engineering such as material structural geotechnical transportation water resources and construction management **Rock Mechanics and Engineering Volume 1** Xia-Ting Feng, 2017-03-16 Principles is the

first volume of the five volume set Rock Mechanics and Engineering and contains twenty four chapters from key experts in the following fields Discontinuities Anisotropy Rock Stress Geophysics Strength Criteria Modeling Rock Deformation and Failure The five volume set Comprehensive Rock Engineering which was published in 1993 has had an important influence on the development of rock mechanics and rock engineering Significant and extensive advances and achievements in these fields over the last 20 years now justify the publishing of a comparable new compilation Rock Mechanics and Engineering represents a highly prestigious multi volume work edited by Professor Xia Ting Feng with the editorial advice of Professor John A Hudson This new compilation offers an extremely wideranging and comprehensive overview of the state of the art in rock mechanics and rock engineering and is composed of peer reviewed dedicated contributions by all the key experts worldwide Key features of this set are that it provides a systematic global summary of new developments in rock mechanics and rock engineering practices as well as looking ahead to future developments in the fields Contributors are worldrenowned experts in the fields of rock mechanics and rock engineering though younger talented researchers have also been included The individual volumes cover an extremely wide array of topics grouped under five overarching themes Principles Vol 1 Laboratory and Field Testing Vol 2 Analysis Modelling and Design Vol 3 Excavation Support and Monitoring Vol 4 and Surface and Underground Projects Vol 5 This multi volume work sets a new standard for rock mechanics and engineering compendia and will be the go to resource for all engineering professionals and academics involved in rock mechanics and engineering for years to come

Rock Mechanics for Natural Resources and Infrastructure Development - Invited Lectures Sérgio da Fontoura,Ricardo Rocca,José Mendoza,2019-09-03 Rock Mechanics for Natural Resources and Infrastructure Development Invited Lectures contains the Invited and Keynote Lectures and 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 as presented at the 14th ISRM International Congress ISRM 2019 Foz do Igua u 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 where relevant themes related to rock mechanics and rock engineering are discussed This volume covers topics ranging from fundamental research in rock mechanics laboratory and experimental field studies to petroleum mining and civil engineering applications and is a must read for academics engineers and students involved in rock mechanics and engineering Proceedings in Earth and geosciences Volume 5 The Proceedings in Earth and 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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