CERAMAH TEKNIK TECHNICAL TALK

Geological Structural Data Collection & Application in Rock Engineering

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The talk on "Geological Structural Data Collection & Application in Rock Engineering" was delivered by Dr Mogana Sundaram on 31st January, 2013 at the Department of Geology, University Malaya, Kuala Lumpur. Sdr Mogana is a true-blue product of UKM, where he did his BSc, MSc and PhD. He later moved to Australia where he has remained and worked for more than 10 years in projects involving tunnelling, rock slopes, etc, hence acquiring much experiences and expertise in these subjects – a case of Malaysia's loss and Australia's gain.

The presentation covered a comprehensive and thorough account of various techniques used in data collection for rock slopes and tunnelling applications, as practised in Australia. Details of the talk are contained in the abstract below. As usual, ample time was allocated for the numerous questions and discussions.

We thank Mogana for an interesting and enlightening talk, and look forward to more talks from him during his home-coming or "balik-kampung" trips in the future.

Tan Boon Kong,
Chairman, W/G on Engineering Geology, Hydrogeology & Environmental Geology

Abstract: Comprising of intact rock and geological defects, rock mass is complex. Due to this, it can behave as a discontinuous, in-homogenous, anisotropic and non-linear elastic medium. Its behaviour at an engineering scale is dependent on these intact rock properties and geological structural features, and their characteristics, coupled with stress and ground water conditions. It is important that the intact rock properties and defects are characterised appropriately to understand their behaviour in engineering projects.

In this presentation, the geological defects that govern the engineering behaviour of the rock mass are defined, and methods of data collection are discussed. The importance of consistent and established methods of data collection and description (e.g. ISRM) is emphasised as it is the communication tool between the geologists and the designers. Description using standardised methods will enable translation of the descriptive terms to parameters that can be applied in analysis and design.

The presentation highlights data management and processing using commercially available soft wares. Estimation of joint shear strength and geological strength index (GSI) from borehole data and utilisation of these data to estimate rock mass strength (using Hoek-Brown Criterion) and rock mass classification are also discussed (Q-System & RMR). The application of the data collected from the field and subsurface investigations, and converting those data to engineering design parameters, and subsequently the use of these data in design are demonstrated using two case studies involving design in rocks.

In the first case study, clear distinction is made between failure through defects and through rock mass for a green field site rail cutting. The data collected from boreholes and field mapping is used to determine the potential failure modes through defects (block failure) and through rock mass. In block failure model, data collected from boreholes and field were used to perform kinematic analysis and subsequently, block stability analysis. Clear distinction is made between the two analyses as the former cannot include factors such as cohesion, rock density, slope height, and forces (e.g. external load, seismic/vibration, water, stress) and does not provide factor of safety. Failure through rock mass was analysed using rock mass shear strength derived from Hoek-Brown Criterion. The implementation of the design during construction is also discussed to ensure potential failure mechanisms are identified and unstable blocks are stabilised before proceeding with further excavation.

The second case study demonstrates how the geological data gathered from orientated boreholes and field mapping were analysed and used to derive design parameters for a large cavern design and creation of block model for numerical analysis by tunnel designers.

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