

Rock Mechanics and Engineering Geology Problems in B&R

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The route of One Belt and One Road need to across Europe and Asia, so the basic construction, element of B&R, will faces many complicated geological conditions. The geology disasters, such as landslide of slope, rock burst of deep tunnel or roadway, excavation subsidence and earthquake, are likely to appear. At present, the challenges, which need to find countermeasures, can be classified as three types: Monitoring of landslide and active fault, Prevention of mining subsidence, Prevention of rock burst;

Both landslide and earthquake can be shown in a model of double-blocks separated by a sliding plane. The key point for geo-disaster prediction is the Newton force variation along the sliding plane. However, measurement of the Newton force on the sliding plane is extremely difficult. Therefore, most of the current researches on earthquake and landslide rely on monitoring the displacement between the two blocks. The relative displacement between the two blocks is considered the necessary condition but not the sufficient condition for the occurrence of the earthquake and/or landslide. This may be the reason for the general recognition of the limitation on geo-disaster prediction. The Newton force is the necessary and sufficient conditions for initiating a geological disaster due to the block motion, using the so-called constant-resistance and large-deformation (CRLD) cable with negative Poisson's ratio (NPR) effect. Hence, the double-block mechanics (DBM) model of geological disaster based on the Newton force variation detection method provides theoretical and practical base for the monitoring pre-warning and control of similar geological disasters.

Underground mining produces mining pressure, which interaction with strong support can result in mining subsidence. The root is that conventional mining method (excavating two roadways with one pillar left for mining a working plane, called as 121 mining method) has not suitable. The countermeasure is find a new mining method (excavating only one roadway and leaving no pillar for mining one coal seam, called as 110 mining method), which has appropriate support and can utilizes mining pressure to release energy. This method can be implemented using cutting cantilever beam theory (CCBT) and the key technologies, including the directional pre-splitting roof cutting, CRLD bolt/cable supporting system with NPR effect material; remote real-time monitoring technology. The roof cutting not only optimizes the stress distribution but also cuts the path of stress transition, which reducing the mining pressure of roadway.

The rock burst will bring out greater threats to the underground openings and its mechanism and criteria have been investigated through laboratory experiments. The prevention of rock burst must meet following requirements: absorbing energy and bearing large deformation. The CRLD bolt/cable not only has the two requirements but also can keep constant. So, the rock burst can be prevented by designing the number and distribution of CRLD bolt/cable.

Hence, the countermeasures also have been found to meet the challenges of rock mechanics and engineering geology in B&R strategy.