Risk Analysis of the Mabian Tonggu Dangerous Rock Belt in Sichuan Province by Using Semi-Quantitative Method Finite Difference Method FLAC and Discrete Element Method 3DEC

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Abstracts: Sichuan MabianTonggu dangerous rock belt is located in a typical red beds area, with a large drop and obvious deformation and damage, threatening the lives and property of nearly 150 people. In order to comprehensively analyze the threat of the Tonggu dangerous rock belt to nearby residents, Using semi-quantitative collapse risk assessment, FLAC3D stability assessment and 3DEC simulation of dangerous rock movement to analyze its risk. The semi-quantitative method of collapse risk proposed by Pierson was used to evaluate the possibility of falling rocks reaching threat area; FLAC3D was used to analyze the stress distribution characteristics of dangerous rock under rainfall conditions, determine the stress concentration area and unstable rock mass; A set of bedding planes and two sets of joint planes was used to cut the unstable rock mass in 3DEC, simulated rainfall caused the cohesive force to decrease to zero after the fracture was saturated, obtained the movement of the unstable rock mass, the farthest movement distance and the affected area. In detail, the collapse of the Tonggu dangerous rock belt has been repeated many times in history, its lithology is Cretaceous Wokoushan Formation (K_1w) quartz sandstone intercalated with mudstone, it belongs to falling dangerous rock. The terrain of the dangerous rock belt is steep, and the steeply inclined joints are 22°∠78°, The main control structure surface and the layer work together to cut and fracture the rock mass. The Tonggu dangerous rock belt often collapses during the rainy season every year, disadvantage structural planes were discovered by stereo-graphic analysis, combined with the semi-quantitative risk assessment, the Tonggu dangerous rock belt is in an unstable state, and it is prone to collapse under heavy rain and earthquake. Finite element and discrete element numerical simulations were used to verify it, the dangerous rock mass is located on the shoulder of the slope and is subjected to a stress of about 3 MPa, The farthest movement distance of dangerous rock is about 700m, so we recommend that

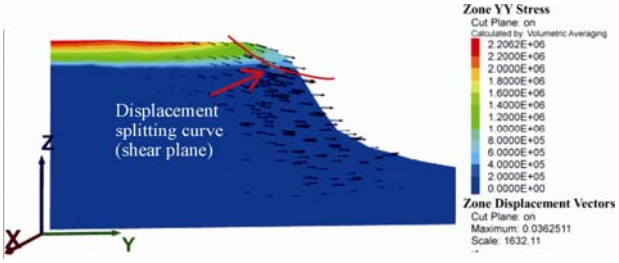

Fig. 1. YY Directional Stress on Rock Mass in FLAC3D6.0.

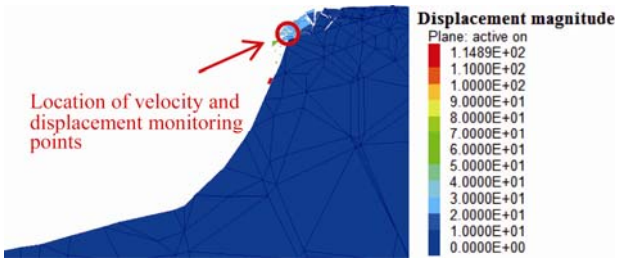

Fig. 2. Dangerous Rock Movement in 10,000 Time Steps.

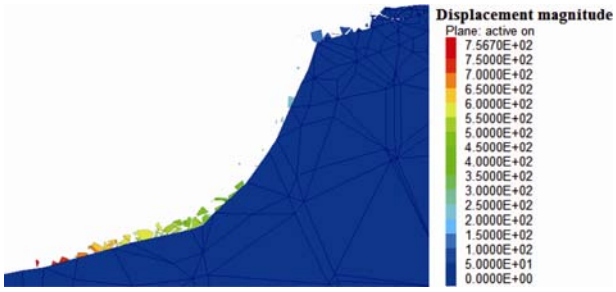

Fig. 3. Dangerous Rock Movement in 80,000 Time Steps.

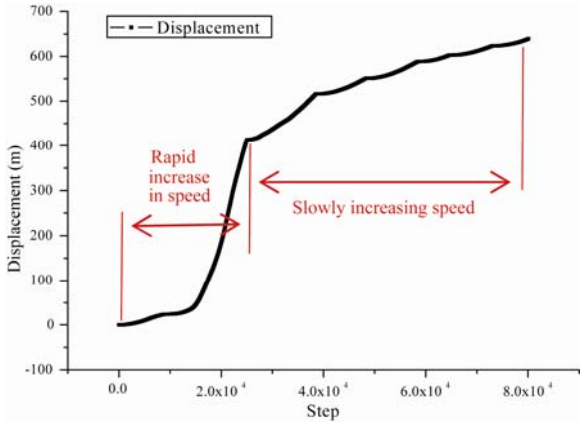

Fig. 4. Displacement-time of dangerous rock curve.

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Table 1 Quantitative Scoring of Possibility Impact Factor of Rockfall Reaching Threat Areas

Quantitative or qualitative description			
>100	100-50	50-20	<20
>75	75-50	50-35	<35
Linear, concave, convex and polygonal, with general fluctuation of slope surface	A convex slope with a large undulating surface	A concave slope with a large undulating surface	Upper convex and lower concave, surface undulation is obvious
Bedrock exposed or slope excavation, hardened ground, etc.	A small amount of accumulated debris, rocks, sparse vegetation, mainly weeds	More loose deposits accumulated on the slope, shrubs and weeds clumped, fewer trees.	The surface of the slope is thick with shrubs and trees.
globular	Lump	Columnar	Flake
>3	3-1	1-0.3	<0.3
Frequent rockfall	Extreme rockfall	Occasional rockfall	Few rockfall
Continuous structural plane tends to be not conducive to slope stability, with clay filling or scratches visible; development of free surface	Discontinuous structural planes tend to be not conducive to slope stability, showing a straight shape and good air-facing conditions.	Discontinuous structural planes, random tendency, It fluctuates in a wavy shape and has general air-facing conditions.	Discontinuous structural plane tends to be favorable for slope stability and assumes rough and irregular shape.
High-intensity rainfall and long-term ice age or slope has always had water and long freezing period	High-intensity rainfall or long freezing periods or slopes always have water	Medium-intensity rainfall or short freezing period or discontinuous water on slope	Less than moderate rainfall or no freezing period, slope drying
Can not capture body collapse	A small amount of capture body collapse	Part of the captured body collapse	Well capture body collapse
Slope cutting and blasting	No protection	General protection	Effective protection
27	9	3	1

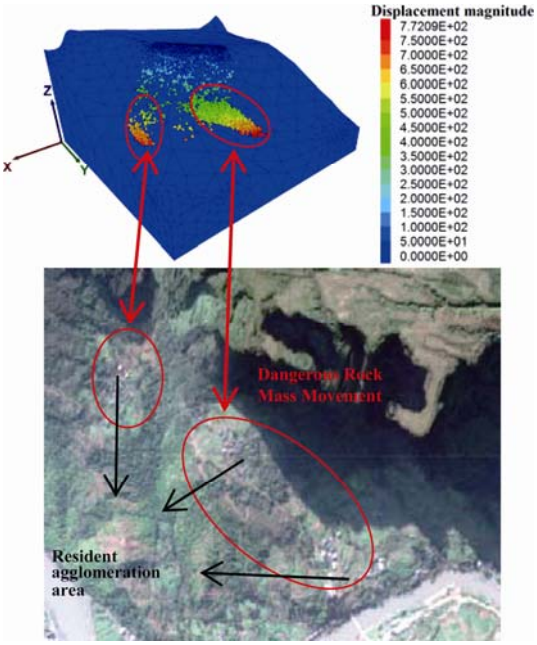

Fig. 5. Dangerous Rock Movement Affected Areas.

residents in the dangerous rock movement area relocate.

Key words: Collapse, Dangerous rock, Semi-quantitative, FLAC3D, 3DEC, Risk, Stability, Instability movement, Disaster prevention

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