

IAEG Commission Progress Report

Commission Name: [Engineering Geomechanics for Rock Mass]

Commission Number: [C40]

Reporting Period: [Month, Year – Month, Year]

Submitted by: [Bao Han, General Secretary]

Date of Submission: [20/08/2025]

1 Key Achievements

1.1 Major Contributions to the Field:

- Established the theoretical system of "Statistical Rock Mass Mechanics", advocating for rock mass engineering parameter calculation techniques and the formulation of computational standards.
- Proposed a method for rapid parameter prediction for rock mass and in-situ test.
- Established a dynamic risk-assessment and prevention-and-control system for rock collapse based on multi-source information.

1.2 Completed Research/Studies:

- [Study on the interaction between unstable rock mass collapse disasters and transportation structures] – [This study focuses on rock collapse geohazards around the highways or bridges. It develops a rock– transportation structure coupled analysis model for the entire process and establishes a dynamic risk-regulation theory based on multi-source information fusion]
- [Study on rock mass multi-scale structural state and structural control theory] – [This research primarily focuses on the development of novel in-situ testing equipment and the construction of multi-parameter models for rock masses]

1.3 Publications (if any):

- ✧ Zhong, Z., Song, Z., Li, B., Elsworth, D., Hu, Y., Zhang, F., & Chen, Z. (2025). Controls of gouge heterogeneity on cyclic reactivation of fault-valve systems. *Geophysical Research Letters*, 52, e2025GL115092.
- ✧ Changgen Yan, Jinhui Zhao, Zhuolong Jia, et al. (2025). Experimental study on hydrophysical properties and slope planting of ecological composite material solidified loess, *Journal of Environmental Management*, 374, 123817.
- ✧ Zhang, Y., Zheng, H., He, H. et al. (2024). Measurement of Elastic Bi-modulus of Rock-type Materials: Insight from comparative and parallel tests. *Bulletin Of Engineering Geology And The Environment*, 83, 247.

- ✧ Yixin Pan, Yingying Zhou, Lujia Chen, Liping Deng, Yue Zeng, Peng Sha, (2024). Stabilization of nanoscale zero-valent iron with mordenite for remediation of hexavalent chromium from groundwater in dynamic columns, *Journal of Water Process Engineering*, 6, 106558.
- ✧ Chenlin Ji, Hengxing Lan, et al. (2025). Slope effects on soil moisture migration and evolution in shallow layers of loess high-fill slopes in the Gully Land Consolidation, *CATENA*, 258, 109206.
- ✧ Jiale Xie, Peijie Yin, Xiaohua Yang, et al. (2025). Study on the damage mechanism of water and mud inrush in a tunnel with water-rich fault zones based on experiment and numerical modeling, *Tunnelling and Underground Space Technology*, 161, 106575.
- ✧ Rao, Z., Lan, H., Yan, C., Liu, C., & Liu, S. (2025). Discrete element modeling method for anisotropic mechanical behavior of biotite quartz schist based on mineral identification technology. *Bulletin of Engineering Geology and the Environment*, 84(1), 1-21.
- ✧ Lv, H., Lan, H., Liu, C., Li, L., Chen, W., ... & Liu, S. (2024). Evaluation method of grotto rock mass deterioration based on infrared thermography. *Journal of Cultural Heritage*, 70, 323-334.
- ✧ Liu, C., Lan, H., Li, L., Chen, W., Lv, H., ... & Liu, S. (2024). Bedding effect on progressive crack propagation in layered sandstone grotto roof. *Tunnelling and Underground Space Technology*, 152, 105914.
- ✧ Hu, Q., Lan, H., Yan, C., Sun, W., Liu, S., ... & Wang, J. (2024). Spatio-temporal evolution law of anisotropic shear damage on rock mass joint surface affected by joint morphology. *Engineering Failure Analysis*, 165, 108820.

1.4 Conferences, Workshops, and Meetings Organized:

On April 12, 2025, The 2nd Wang Lecture & The 4th Shaoxing International Symposium on Rock Mechanics & Engineering Geology was held in the Shaoxing, Zhejiang, China. Experts from more than 20 units.



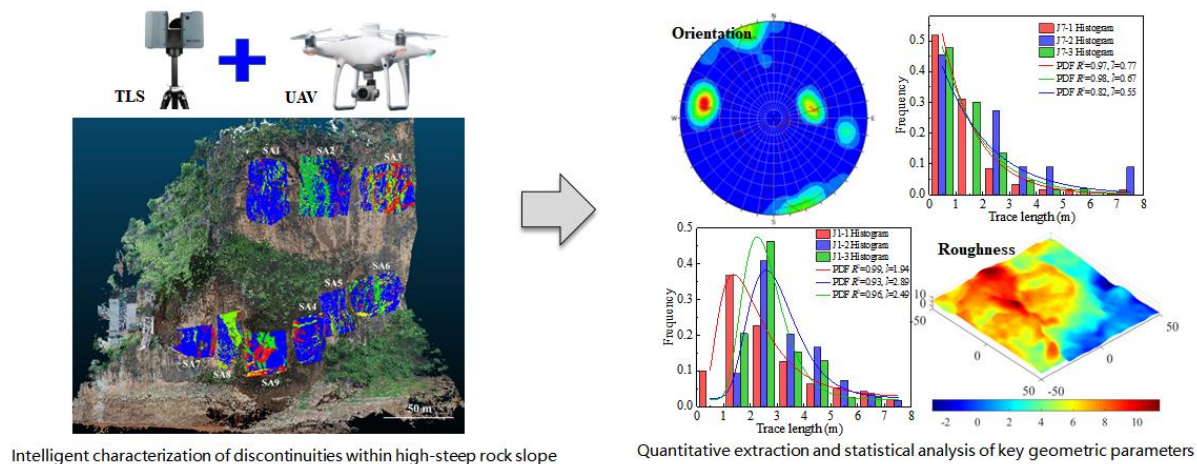
Photo of the Yangtze River Delta Urban Engineering Geology Forum

2 Ongoing Activities

2.1 Current Research/Projects Underway:

- Intelligent characterization of discontinuities and heterogeneity evaluation of potential hazard sources in high-steep rock slope by TLS-UAV technology

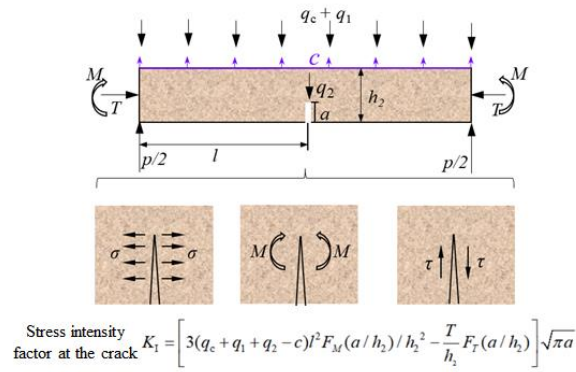
Rock discontinuities within TLS-UAV datasets were systematically identified, enabling quantitative extraction and statistical analysis of key geometric parameters, including orientation, trace length, spacing, and roughness.



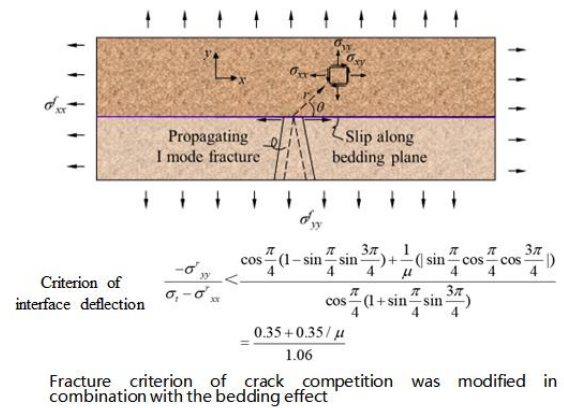
(Liu et al., **Journal of Rock Mechanics and Geotechnical Engineering**, 2025)

- Bedding effect on progressive crack propagation in layered sandstone grotto roof

A fracture mechanics model for crack propagation in layered roofs was established considering the bedding effect, and the criteria for vertical expansion of cracks in grotto roofs was derived. Moreover, the fracture criterion of crack competition was modified in combination with the bedding effect.



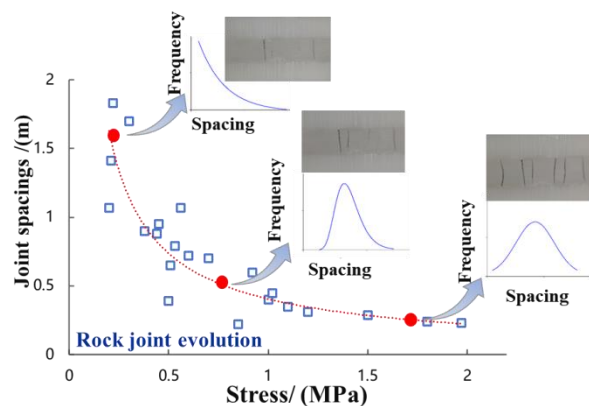
A fracture mechanics model for crack propagation in layered roofs



(Liu et al., *Tunnelling and Underground Space Technology*, 2024)

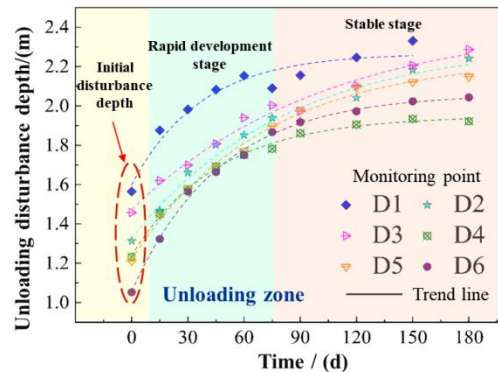
○ Rapid Assessment Method for Quality Differentiation and Evolution of Rock Masses

A three-stage evolution law of joint spacing was identified during the rock mass fracturing process, transitioning from a negative exponential distribution to a normal distribution. This reveals the temporal evolution of unloading disturbance depth and leads to the development of a differential evolution model for rock mass quality under disturbance.



Three-stage evolution law of rock joint states

Time-effect evolution model $D = \alpha + \beta(1 - e^{-\lambda t})$



Temporal evolution process of unloading disturbance depth in rock masses

(Bao et al., *Journal of Structural Geology*, 2024)

○ Failure evaluation and control factor analysis of slope block instability along traffic corridor in Southeastern Tibet

A rapid method evaluating the control effects of rock mass structures was proposed through field statistics of the slopes and rock mass structures along TCST, which combined the stereographic projection method, modified M-JCS model, and limit equilibrium theory.

14:00-14:40	Tianmin Wang (China University of Geosciences, Beijing, Postdoctoral Fellow), Numerical Simulation and Practice of SMRM
14:40-15:20	Jie Wu (Zhejiang Rock Innovation Technology Co., Ltd, Chief Engineer), SMRM Cloud Computing and Mobile App Operation
15:20-15:35	Tea break
15:35-16:00	Shenggong Guan (Shaoxing University, Lecture), Application Case Studies
16:00-16:45	Technical Seminar and Discussion
16:45	Faquan Wu, Technical Summary

- **Jointly held the Parallel Session of The 15th Asian Regional Conference (ARC-15) of IAEG with C29 and C36**

2.3 Collaborations with Other Institutions or Organizations:

- [Shaanxi Science and Technology Holding Group Co., Ltd., Jointly apply for scientific research projects and collaboratively complete project research tasks]
- [Xi'an University of Architecture and Technology, Jointly apply for scientific research projects and collaboratively complete project research tasks]
- [Beijing Capital Environment Technology Co., Ltd., Jointly apply for scientific research projects and collaboratively complete project research tasks]