

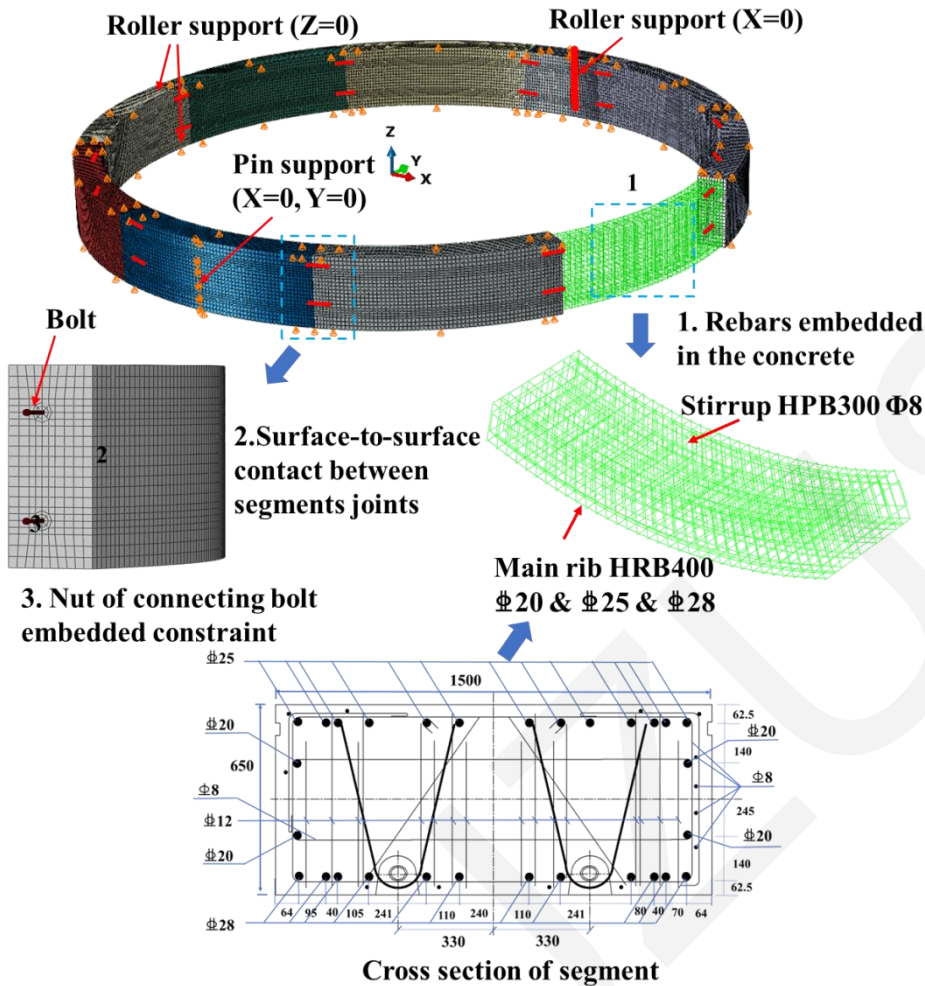
Investigation of mechanical failure performance of a large-diameter shield tunnel segmental ring

Binyong GAO, Renpeng CHEN, Huaina WU, Chengcheng ZHANG, Meng FAN, Chao XIAO

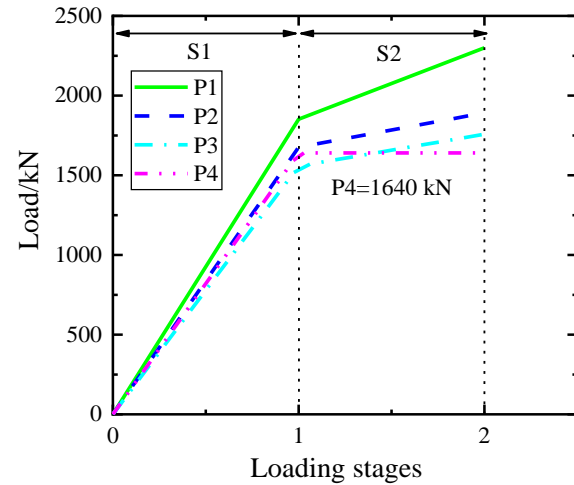
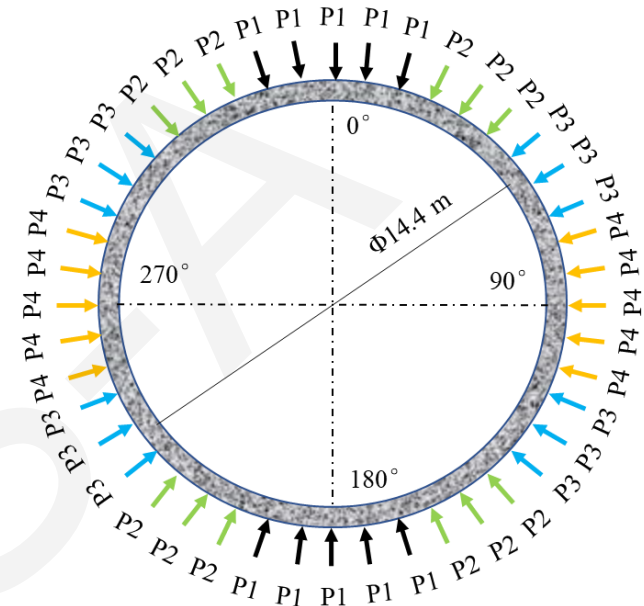
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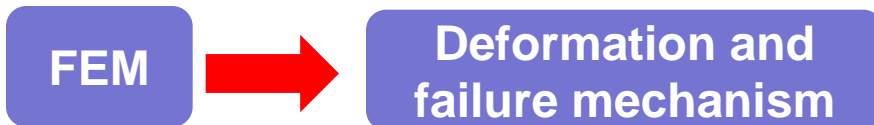
Research Method



Finite element model

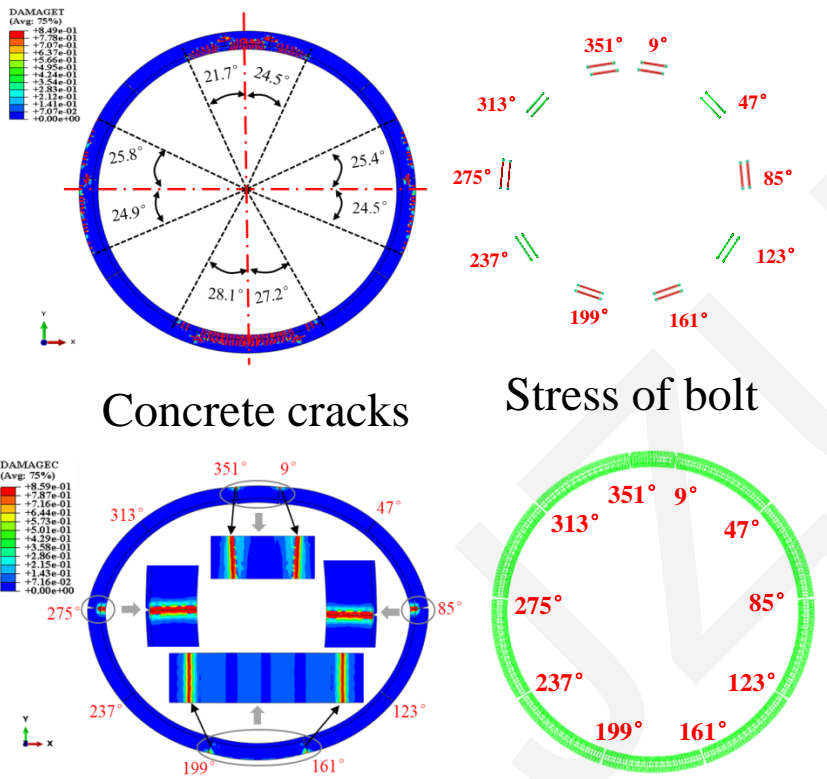


Loading method



Research Innovation Points

■ By establishing a refined numerical model, the deformation and failure mechanism of the segment ring in large-diameter shield tunnel was analyzed

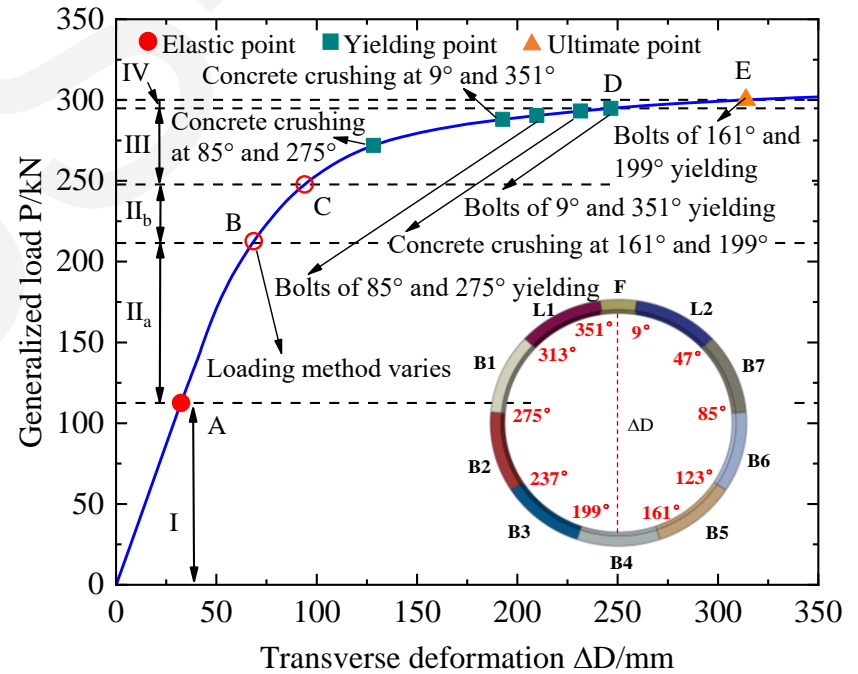


Concrete cracks

Stress of bolt

Compression distribution

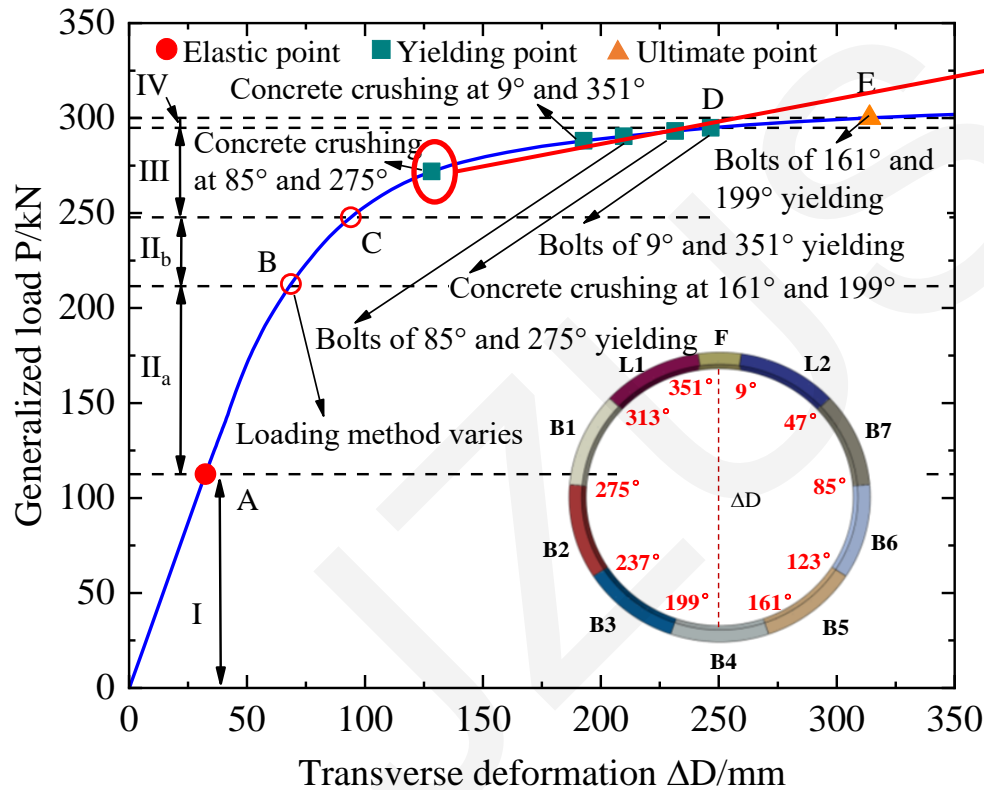
Stress of rebar



Formation process of macro performance points

Research Innovation Points

■ Proposed deformation control standards applicable to large-diameter shield tunnel segments (8‰)



Control point (8 ‰)



Ensure safe operation of tunnels

Formation process of macro performance points.

Conclusions

- The transverse deformation of a large-diameter shield segmental ring can be divided into four stages: i) linear growth stage (Stage I); ii) quasi-linear growth stage (Stage IIa, Stage IIb); iii) nonlinear growth stage (Stage III); iv) failure stage (Stage IV).
- The transverse deformation during the formation of the first semi-plastic hinge (i.e., the first yield point) of the structure is selected as the deformation control value for large-diameter shield tunnel segments and is equal to 8‰ of the segment's outer diameter. This control value can serve as a reinforcement standard for preventing the failure of large diameter shield tunnel segments.