

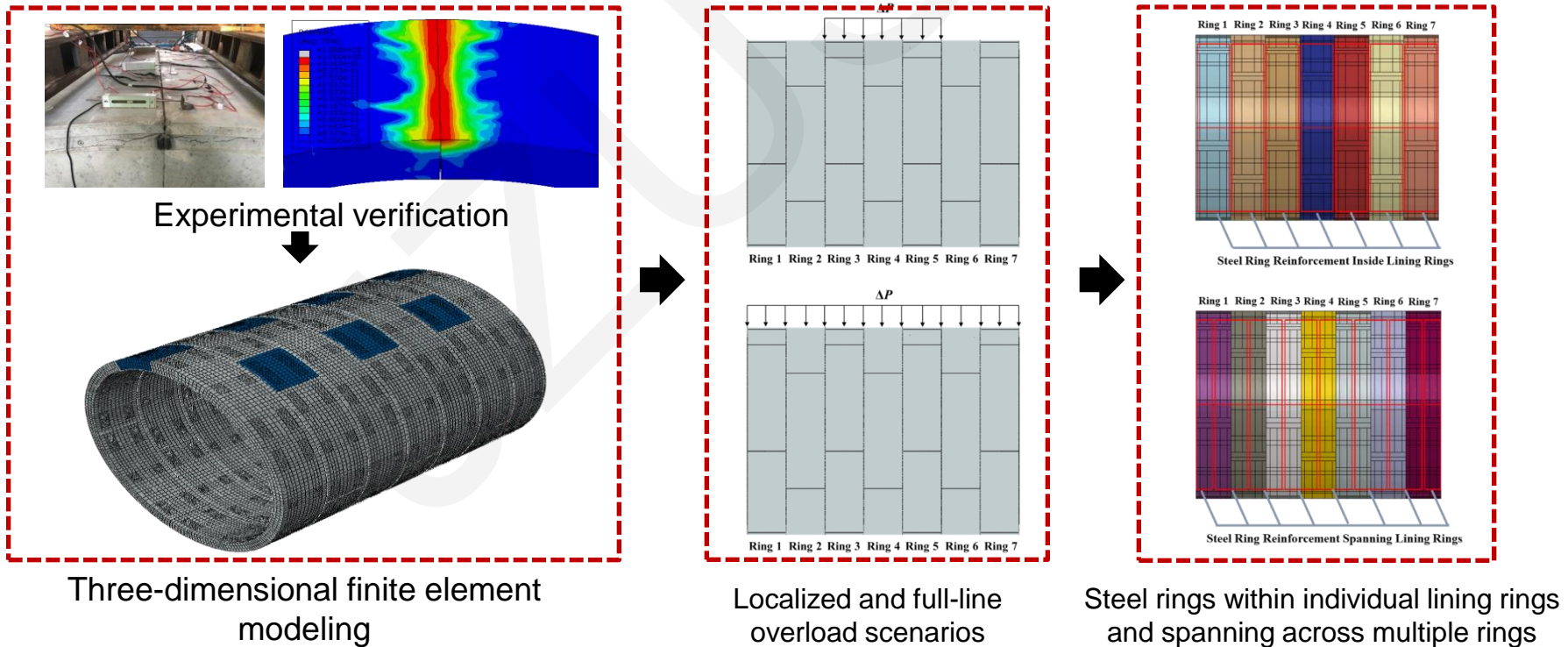
# **Numerical study on the failure characteristics and reinforcement effects of shield segmental linings subjected to localized overload**

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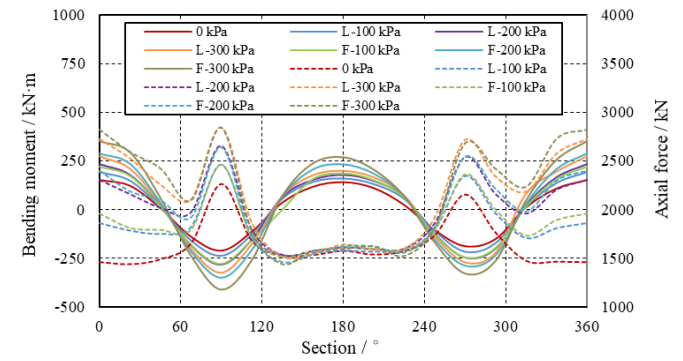
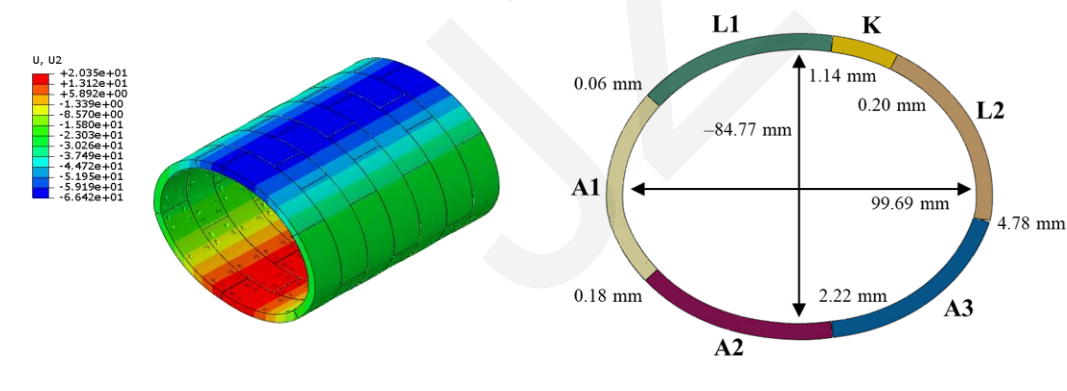
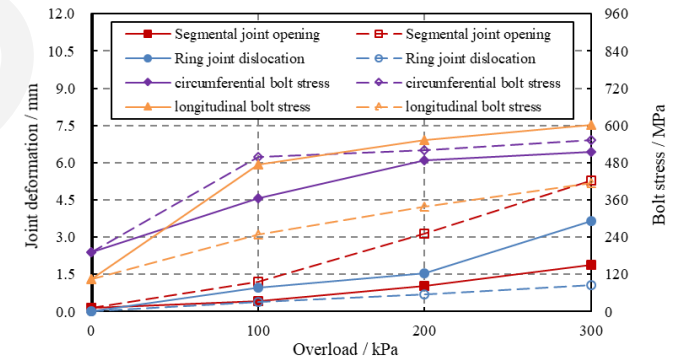
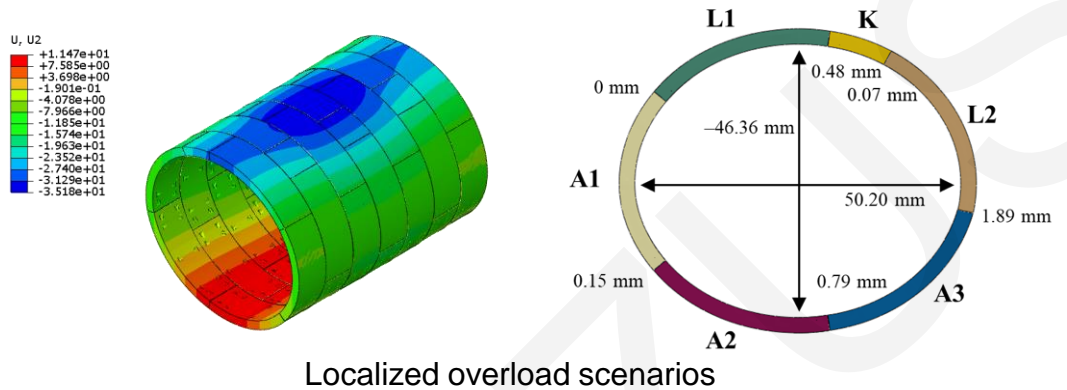
# Purposes and Method

- Investigating the mechanical performance and failure mechanisms of shield linings under localized overload conditions, and comparing the results with full-line overload scenarios.
- Discussing the impact of reinforcing shield segmental linings with steel rings to address the issues arising from localized overloads.



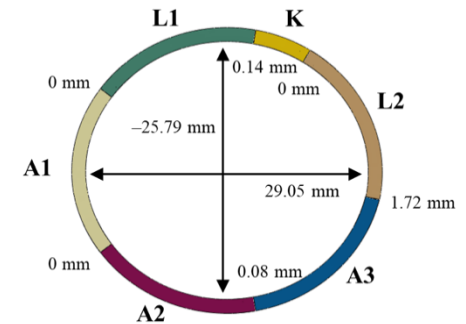
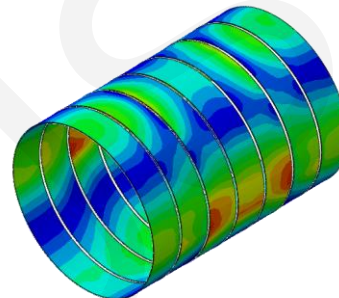
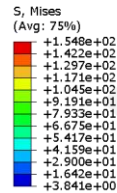
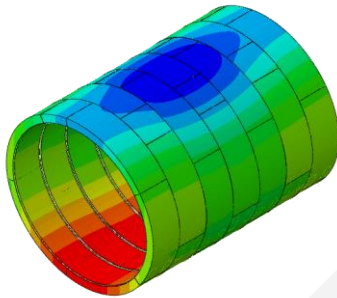
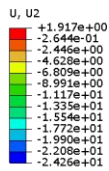
# Results

- Localized overloads lead to significant joint dislocation and higher stress on longitudinal bolts, potentially causing bolt failure, while the overall deformation of lining rings, segmental joint opening, and stress in circumferential bolts and steel bars are lower compared to full-line overloads.

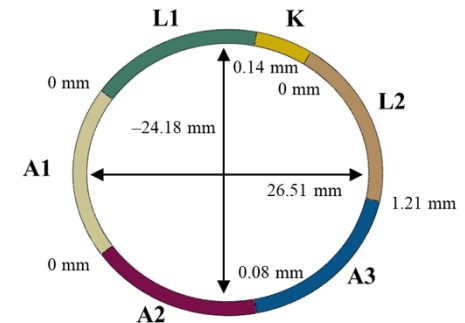
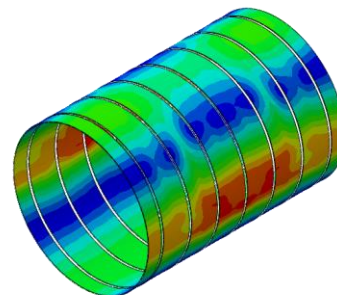
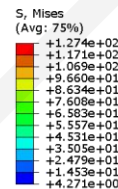
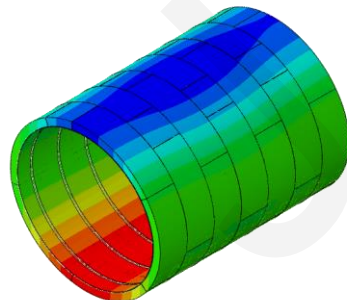
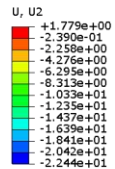


# Results

- The strategy of using steel rings that span multiple lining rings not only enhances the structural rigidity of each ring, but also mitigates the dislocation at the ring joints and reduces the stress on the longitudinal bolts.



Inside ring reinforcement scheme



Spanning ring reinforcement scheme

# Conclusions

- In scenarios where a subset of the shield segmental lining rings is subjected to overload, significant joint dislocation occurs between the overloaded and adjacent non-overloaded rings.
- It is imperative to consider the influence of ring joint dislocation and longitudinal bolt stress on the bearing capacity and failure characteristics of the linings in the more common practical scenario of localized overload.
- The reinforcement scheme involving steel rings that span across two adjacent lining rings was shown to be the more effective in reduced lining deformation and internal forces, segmental and ring joint deformation, circumferential and longitudinal bolt stress, and stress in the reinforcing steel rings.