Parameter Analysis and Design Optimization of Internally Braced Excavation Support Systems Under Asymmetric Loading: Postprint

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Abstract

Under asymmetric loading, internally braced excavations exhibit overall drift toward the lightly loaded side, which compromises excavation stability and necessitates design optimization of the retaining structure. This study employs an eccentrically loaded utility tunnel foundation pit as a case study, conducting numerical simulation using the finite element software PLAXIS 2D. The simulation results demonstrate favorable agreement with field measurement data, thereby validating model effectiveness. Subsequent parametric analysis investigates the influence of retaining structure length, equivalent thickness, and elastic modulus on both structural deformation and excavation safety. The findings indicate that when both side retaining structures are designed according to the eccentrically loaded side criteria, increasing the length of one side's structure increases its maximum horizontal displacement. Conversely, increasing either the equivalent thickness or elastic modulus of the retaining structures on both sides reduces not only the maximum horizontal displacement on that side but also the reverse displacement at the top of the retaining structure on the non-eccentrically loaded side. Based on these parametric analyses, a simple yet effective and economically viable optimization strategy for asymmetrically loaded excavations is proposed, and the optimization effect is analyzed through numerical simulation, proving the feasibility of this optimization approach.

Full Text

Preamble

The preamble section contains corrupted text that cannot be meaningfully translated.

Terminology Glossary

- machine learning
- deep learning

Note: Figure translations are in progress. See original paper for figures.