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Numerical analysis of size effect on the deformation behavior of corrugated steel utility tunnel (CSUT)

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ABSTRACT

In utility tunnel construction, corrugated steel pipe (CSP) is emerging as an effective alternative due to its outstanding constructability and economic feasibility compared to the precast concrete method. CSPs respond flexibly to external loads and are resilient against brittle fracture. However, during installation by the cut-and-cover method, it deforms along with the surrounding ground, which can cause ground surface heave or settlement. The design of a corrugated steel utility tunnel (CSUT) considering these deformation characteristics is still not well established. In this study, three-dimensional numerical analysis was performed to investigate the size effect of CSP on the deformation behavior of CSUT. The ovaling deformation caused by varying the diameter of the CSP from 0.6 to 3 m at 0.6 m intervals was evaluated using the horizontal and vertical diameter change ratio. The ground surface displacement according to bedding height for each diameter was analyzed. As a result, it was confirmed that as the diameter increases, the ovality increases and significantly impacts the surrounding ground but is less affected at a specific bedding height. This suggests that an optimal bedding design that minimizes ovality is possible.

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