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Parametric Study on the Development of Earth Pressures Behind Integral Bridge Abutments Under Cyclic Translational Movements

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Abstract : Integral bridges are a class of bridges with integral or semi-integral abutments, designed without expansion joints in the bridge deck of the superstructure. Integral bridges are economical alternatives to conventional jointed bridges with lower maintenance costs and greater durability, thereby improving social and economic stability for the community. Integral bridges have also been proven to be effective in lowering the overall construction cost compared to the conventional type of bridges. However, there is significant uncertainty related to the design and analysis of integral bridges in response to cyclic thermal movements induced due to deck expansion and contraction. The cyclic thermal movements of the abutments increase the lateral earth pressures on the abutment and its foundation, leading to soil settlement and heaving of the backfill soil. Thus, the primary objective of this paper is to investigate the soil-abutment interaction under the cyclic translational movement of the abutment. Results from five experiments conducted to simulate different magnitudes of cyclic translational movements of abutments induced by thermal changes are presented, focusing on lateral earth pressure development at the abutment-soil interface. Test results show that the cycle number and magnitude of cyclic translational movements have significant effects on the escalation of lateral earth pressures. Experimentally observed earth pressure distributions behind the integral abutment were compared with the current design approaches, which shows that the most of the practices has under predicted the lateral earth pressure.

Keywords : integral bridge, cyclic thermal movement, lateral earth pressure, soil-structure interaction
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