

Pseudo-static Test on Mechanic Behavior of Pile with Pre-Hole filled by Foam in IABs

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1 Abstract

Comparing with the conventional jointed bridges, integral abutment bridges (IABs) have not the typical durability problems of expansion joints and bearings and could have better seismic performance due to the high redundancy and integrity. The concrete piles supporting the abutments are often considered as the most vulnerable component in IABs under longitudinal deformation of superstructure caused by temperature variation and seismic load. The pre-hole method could be adopted to absorb the longitudinal deformation transferred from superstructure to the piles. Therefore, how to improve the energy dissipation of concrete piles to reduce the influence of seismic load is the key issue in IABs. In this paper, a technology based on piles with pre-holes filled by damping material (called pre-hole isolation pile) is proposed to improve the seismic response of IABs. The piles supporting the abutments of one real integral abutment bridge were chosen as case study. Pseudo-static tests of two model piles with the scaled factor of 1/12.5 considering soil-pile interaction (SPI) were performed. Foam was chosen as damping material. It could be found that compared with conventional piles, the hysteresis curve and the equivalent viscous damping ratio of pre-hole isolation pile considering SPI was fuller and larger. According to the obtained results, the pre-hole filled with foam technology could improve the energy dissipation of the concrete piles in integral abutment bridges and their seismic performance.

Keywords: integral abutment bridge; pre-hole isolation pile; soil-pile interaction; foam; pseudo-static test; failure mode; hysteresis curve; equivalent viscous damping ratio.