An Analytical Approach to Calculate Thermo-Mechanical Stresses in Integral Abutment Bridge Piles

Authors : Jafar Razmi

Abstract : Integral abutment bridges are bridges that do not have joints. If these bridges are subject to large seasonal and daily temperature variations, the expansion and contraction of the bridge slab is transferred to the piles. Since the piles are deep into the soil, displacement induced by slab can cause bending and stresses in piles. These stresses cause fatigue and failure of piles. A complex mechanical interaction exists between the slab, pile, soil and abutment. This complex interaction needs to be understood in order to calculate the stresses in piles. This paper uses a mechanical approach in developing analytical equations for the complex structure to determine the stresses in piles. The solution to these analytical solutions is developed and compared with finite element analysis results and experimental data. Our comparison shows that using analytical approach can accurately predict the displacement in piles. This approach offers a simplified technique that can be utilized without the need for computationally extensive finite element model.

Keywords : integral abutment bridges, piles, thermo-mechanical stress, stress and strains
Conference Title : ICSMGE 2018 : International Conference on Soil Mechanics and Geotechnical Engineering
Conference Location : New York, United States
Conference Dates : June 03-04, 2018