

Structural Behaviour of Concrete Energy Piles in Thermal Loadings

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Abstract : The thermo-mechanical behaviour of concrete energy pile foundations with different single and double U-tube shapes incorporated was analysed using the Comsol Multi-physics package. For the analysis, a 3D numerical model in real scale of the concrete pile and surrounding soil was simulated regarding actual operation of ground heat exchangers (GHE) and the surrounding ambient temperature. Based on initial ground temperature profile measured in situ, tube inlet temperature was considered to range from 6°C to 0°C (during the contraction process) over a 30-day period. Extra thermal stresses and deformations were calculated during the simulations and differences arising from the use of two different systems (single-tube and double-tube) were analysed. The results revealed no significant difference for extra thermal stresses at the centre of the pile in either system. However, displacements over the pile length were found to be up to 1.5-fold higher in the double-tube system than the single-tube system.

Keywords : concrete energy piles, stresses, displacements, thermo-mechanical behaviour, soil-structure interactions

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