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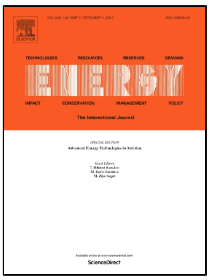

Comparing heat flow models for interpretation of precast quadratic pile heat exchanger thermal response tests

Maria Alberdi-Pagola, Søren Erbs Poulsen, Fleur Loveridge, Søren Madsen, Rasmus Lund Jensen

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Comparing heat flow models for interpretation of precast quadratic pile heat exchanger thermal response tests

Maria Alberdi-Pagola*, Department of Civil Engineering, Aalborg University.
Søren Erbs Poulsen, VIA Building, Energy & Environment, VIA University College.
Fleur Loveridge, School of Civil Engineering, University of Leeds.
Søren Madsen, Department of Civil Engineering, Aalborg University.
Rasmus Lund Jensen, Department of Civil Engineering, Aalborg University.

*Corresponding author:
M. Alberdi-Pagola
E-mail address: mapa@civil.aau.dk
Address: Department of Civil Engineering, Thomas Manns Vej 23, 9220 Aalborg Ø, DK.

Abstract

This paper investigates the applicability of currently available analytical, empirical and numerical heat flow models for interpreting thermal response tests (TRT) of quadratic cross section precast pile heat exchangers. A 3D finite element model (FEM) is utilised for interpreting five TRTs by inverse modelling. The calibrated estimates of soil and concrete thermal conductivity are consistent with independent laboratory measurements. Due to the computational cost of inverting the 3D model, simpler models are utilised in additional calibrations. Interpretations based on semi-empirical pile G-functions yield soil thermal conductivity estimates statistically similar to those obtained from the 3D FEM inverse modelling, given minimum testing times of 60 hours. Reliable estimates of pile thermal resistance can only be obtained from type curves computed with 3D FEM models. This study highlights the potential of applying TRTs for sizing quadratic, precast pile heat exchanger foundations.

Key words

Thermal response test, pile heat exchanger, heat flow model, inverse modelling, thermal conductivity, pile thermal resistance.