Simulation of Ground Source Heat Pump(GSHP) System at One New Change retail center, London

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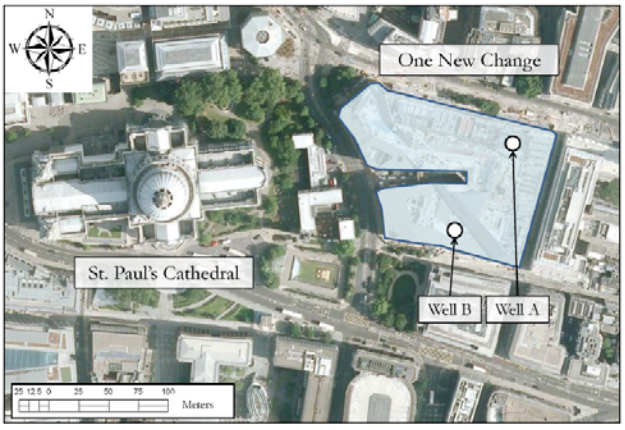
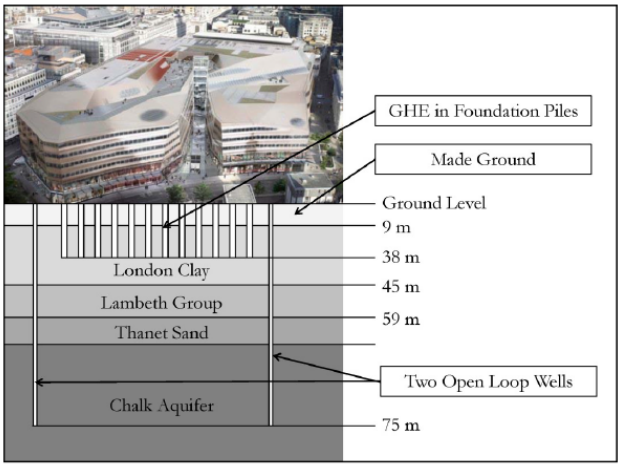
Ground Source Heat Pumps (GSHPs) are a technology which can be utilized to offer low carbon emissions heating/cooling and hot water supply. However, due to the many uncertainties involved in the design of GSHP systems, designers prefer to use unnecessarily high factors of safety when designing a system, which in turn leads to high installation costs. Hence it is important to reduce these uncertainties and improve design procedures of GSHP systems in order to maximize the advantages of this technology and make it more competitive in the market. This paper presents a case study of a GSHP system installed in the One New Change retail development in London, UK.



(a)



(b)

Figure 1: GSHP used in One New Change Retail Centre: (a) Plan view; (b) Side view

The GSHP system was simulated using both the TRNSYS energy simulation platform and the in-house FE based simulation tools. Commercially available codes, like TRNSYS, can only model conventional configurations of horizontal and vertical GHE pipes buried in the soil. Another approach is to model GSHP using a finite element GHE model that allows complex geometry and boundary conditions to be modelled.

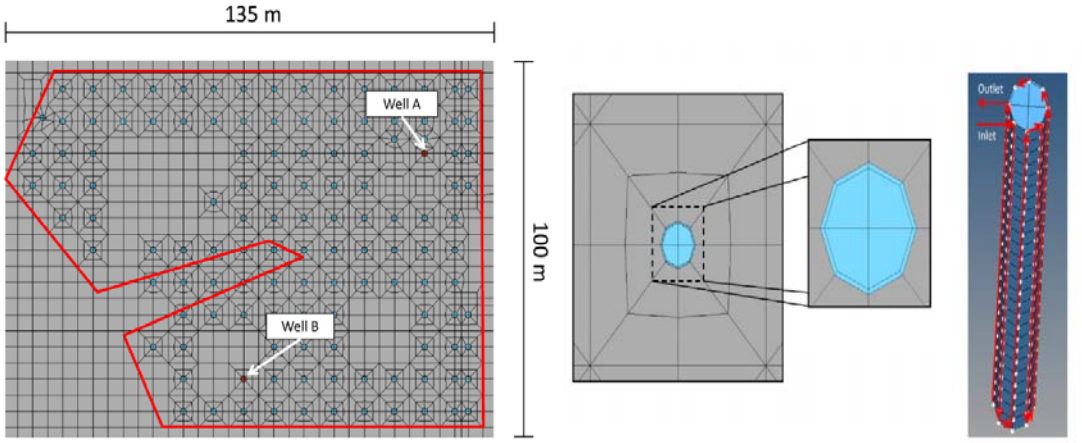


Figure 2: Finite element model of One New Change Retail Centre

The good match between the modelled results and the monitoring data, as shown in Figure 3, demonstrates the ability of the FEM code to simulate thermal-pile systems with a reasonable level of accuracy. The main advantage of the FEM code is its flexibility and the ability to model non-conventional geometries for heat exchanger foundations or thermal piles distributed in a complex grid. The code is unique because of its ability to model irregular GHE geometry and to incorporate GSHP system components and its control logic within the code.

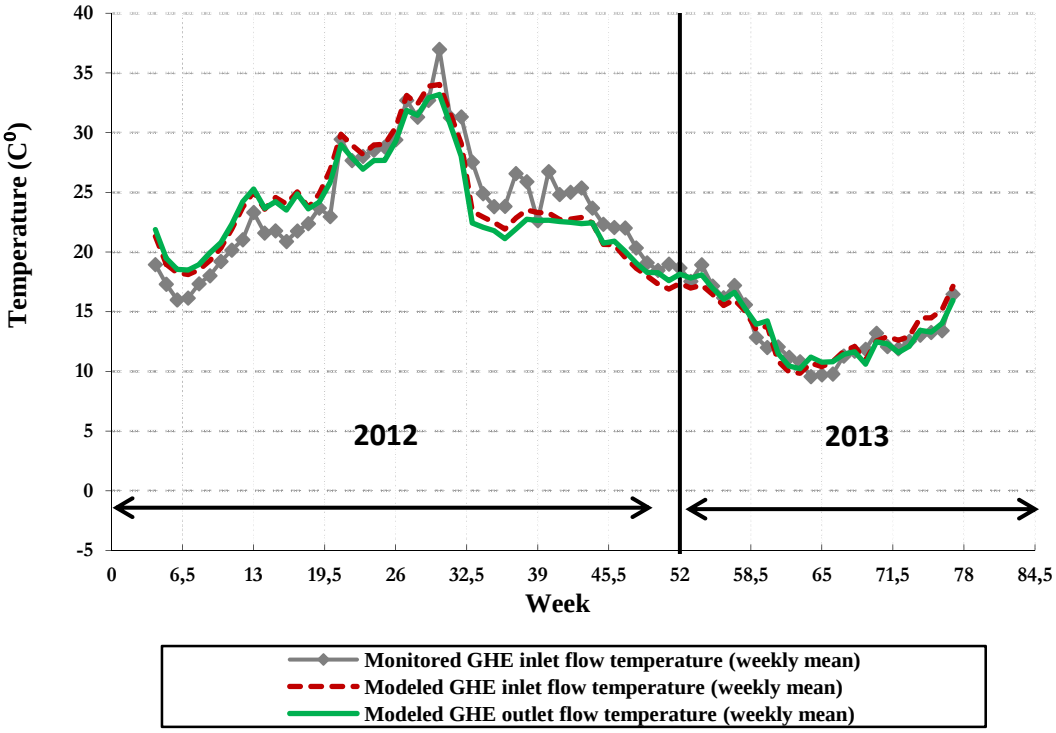


Figure 3: Inlet and outlet temperature of the thermal piles