ON LONG TERM BEHAVIOUR OF OVERLAPPING PILE FOUNDATIONS

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Summary

Piles are used world wide as foundation or as a soil strengthening method. The purpose of this thesis is to analyse how a system of overlapping piles, as a foundation technique, behaves over a design life of 100 years. Commonly piles are installed as either floating or end bearing which both have their advantages and drawbacks. In the early sixties a new technique was introduced which combined the two traditional methods in order to cope with the disadvantages from using one method alone. Overlapping piles have been used widely in Mexico City but in Sweden this piling system has only been used in a handful of projects, all constructed within the last decades. The idea of analysing overlapping pile systems with traditional pile systems was brought alive with the project of Regionens Hus located in the center of Gothenburg. The analysis is carried out with the finite element software Plaxis 2D together with the soil model Creep-SCLAY1S in order to capture long term behaviour of the clay. Soil model parameters are derived from the soil, CRS and triaxial tests conducted at Regionens hus. Several models, of both overlapping piles and more common floating pile systems, are created and compared in order to study the differences in terms of forces, settlements and soil response. As long term behaviour is dependent on soil loading history, the installation effects from pile driving are considered. It is shown that the most suitable way of modelling overlapping piles in Plaxis 2D is with the use of plate elements in a plane strain environment. With these it is possible to capture some installation effects as well as settlements, force distribution and load transmission. However, when using plate elements in 2D plane strain analysis Plaxis will consider piles as rigid walls. This wall effect will create a soil response that in some cases are not realistic. To capture the installation effects, without compromising the result, it is shown that a suitable method is to replace a volume of soil around the pile with remodelled soil. It is also shown that if overlapping piles are used it is possible to either shorten the floating piles about 50 % or increase the spacing between them about seven times compared to a system with floating piles only. This thesis indicates that there might be something to the idea of overlapping piles in terms of capacity and suitability, but more studies have to be conducted in order to confirm it, for example a study of economics as the price in most cases govern what

foundation technique is going to be used. Additionally, the results from this thesis should ideally be verified and compared to real measurements and more advanced models.