Abstract

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The usage of classic analytical methods for the design of sheet pile walls even today continues to be a common and extended tool due to its simplicity and reliability. The hypotheses adopted for the classic methods along with an extension of the 20% of the depth of penetration obtained, favors the stability of the combination sheet pile wall-soil, but what remains unknown is how far away the breakage situation gets from the stress-strain state that is produced.

On the other hand, the development of the method of finite elements has allowed to integrate in the same calculation, the particular features that rule the behavior of the different materials involved in the problem. The final result is a more realistic stress-strain state which lets the responses of the different elements be compatible, such as sheet pile wall, soil and anchorage involved in the design of the sheet pile walls.

As a result, the target of this minor thesis consists of setting a comparison between the behavior of the sheet pile walls according to the prediction that the classic methods establish, and the results given by the finite elements, setting a criterion that may provide more realistic values regarding the safety factor.

Firstly, a review of the classic methods of calculation was made, usually used in the design of sheet pile walls appearing in the minor thesis, highlighting not only the methodology of the calculation but other concepts and the hypotheses they are based on.
Next comes an outline of the operation of the commercial program of finite elements Plaxis and the way the sheet pile walls problem has been handled. From the analysis of the studied cases, cantilever sheet pile walls and one-level-anchored sheet pile walls, we obtain the conclusions that are summarized below.

In cantilever sheet pile walls the main differences are found in the stress state, where the influence of the elastic range of stresses absorbed by the sheet pile wall can be observed as well as the confinement effect linked to the increase of the passive force. The safety factors obtained indicate a gradual increase of its value as it is compared to the finite elements and parameters such as cohesion are taken into account. By this means, generally speaking, it can be stated that the safety factors double if the classic methods are compared to the finite elements, being in the case of considering the cohesion effect, as much as three times bigger.

In the case of the one-level-anchored sheet pile walls, the behavior moves away regarding classic methods because of the existence of the anchorage. It can be observed that the final force in the anchorage depends on the starting force applied during excavation and the moment it is applied, modifying the stress-strain state of the ground and its breakage mechanism, resulting from an intermediate process between the hypothesis of the loose base and fixed base. The safety factors obtained double the ones obtained exclusively by the classic methods showing that the application of bigger anchorage forces doesn’t mean changes on the safety factor in the same proportion.