THE INFLUENCE OF SOIL PLUGGING ON THE DRIVING RESISTANCE AND BEARING CAPACITY OF OPEN-ENDED STEEL PILES

C. Slominski, R. Cudmani
Bilfinger Berger Civil, Structural Design Geotechnics, Wiesbaden, Germany

1. General

During the installation of open-ended piles two mechanisms of penetration can occur depending on the ground conditions, load type and the dimensions of the pipe: 1) The soil enters continuously into the pipe, 2) a soil plug develop, which impedes subsequent entry of soil. From the practical point of view, soil plugging have the positive effect of increasing the bearing capacity of the pipe towards that of a closed-ended pile. At the same time, the driving resistance can become considerably larger than that expected for unplugged conditions.

At the present, the calculation of the driving resistance and bearing capacity of open-ended piles are based on empirical assumptions and does not consider the effect of soil plugging properly. The common procedure for geotechnical design consists in assuming plugged conditions for driveability analysis and unplugged conditions for the determination of bearing capacity. Obviously, this approach is conservative and may lead to heavier driving equipment and too long piles and thus, may result in uneconomical design. Methods which apply empirical reduction factors to the equivalent capacity of a closed-ended pile are questionable and unsafe, as ground conditions, pile dimensions and load conditions of the pile cannot be rationally accounted for.

In this contribution a model is proposed for both the prediction of soil plugging during driving and the evaluation of the bearing capacity depending on plugging conditions. The model is validated using experimental data from the literature. The application of the proposed approach is shown exemplarily by means of a case study.