Verification of Meyer-Kowalow curve parameters

Zygmunt Meyer, Adam Wasiluk

[1] *West Pomeranian University of Technology, Szczecin (Department of Geotechnical Engineering, chairman)*

[2] *West Pomeranian University of Technology, Szczecin (Department of Geotechnical Engineering, PhD student)*

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The static load test of a pile is the most reliable way to verify the actual bearing capacity of an executed pile. It allows collecting a set of points $\{s_i; N_i\}$ which allows plotting the load-settle curve (s_i – settlement measured for certain applied load, N_i.- load applied for each step of static load test). Test execution is based on applying loads in the pile head, generated with using a specially adapted construction, with simultaneous measurement of displacements. The curve obtained during the static load test is the actual reaction of the soil stratum and the pile on the applied loads. The settlement is clearly observed as the load increases. Unfortunately, in engineering practice there is often a problem with achieving large range of settlements during the test, especially for piles with larger diameters. In such situations, it is necessary to use methods that allows to extrapolate the curve $\{s_i; N_i\}$.

One of these methods is the Meyer-Kowalow (M-K) curve [3]. The curve is described with formula (1).

$$s = C \cdot N \frac{\left(1 - \frac{N}{N_{gr}}\right)^{-\kappa} - 1}{\kappa} \tag{1}$$

Designations, units and physical sense of constant parameters of the M-K model:

C – the inverse of the Winkler constant [mm / kN],

N_{gr} – maximum load in the head, which causes uncontrolled settlements [kN],

κ – the proportion between the resistance of the pile shaft and the base of the pile [-].

Meyer-Kowalow curve model is well-known method that allows to determine the ultimate load capacity of the pile N_{gr}, understood as the force at which the pile settles in an uncontrolled manner, based on the set of values $\{s_i; N_i\}$ obtained in the static load test. Knowledge of pile bearing capacity limit value is crucial for engineers.

Authors have an access to results of piles static load tests with large range of settlements. During these tests the limit load N_{gr} were reached, settlements had very large values with small load increments. An example of measured $\{s_i; N_i\}$ curve is shown on Figure 1. Other tests have similar characteristic, to the presented one. Results obtained in static load tests are base for verification of M-K model, including the relations between its parameters, pile geometry and soil properties [2].

For mentioned test results were also executed the analysis of the inaccuracies during static pile load tests using analytical model M-K. For purpose of this analysis were used modified M-K model curve [1], described with formula (2).

$$s_i = s_0 + C \cdot N_{gr} \frac{\left(1 - \frac{N_i}{N_{gr}}\right)^{-\kappa} - 1}{\kappa} \tag{2}$$

s_0 – assumed inaccuracy.

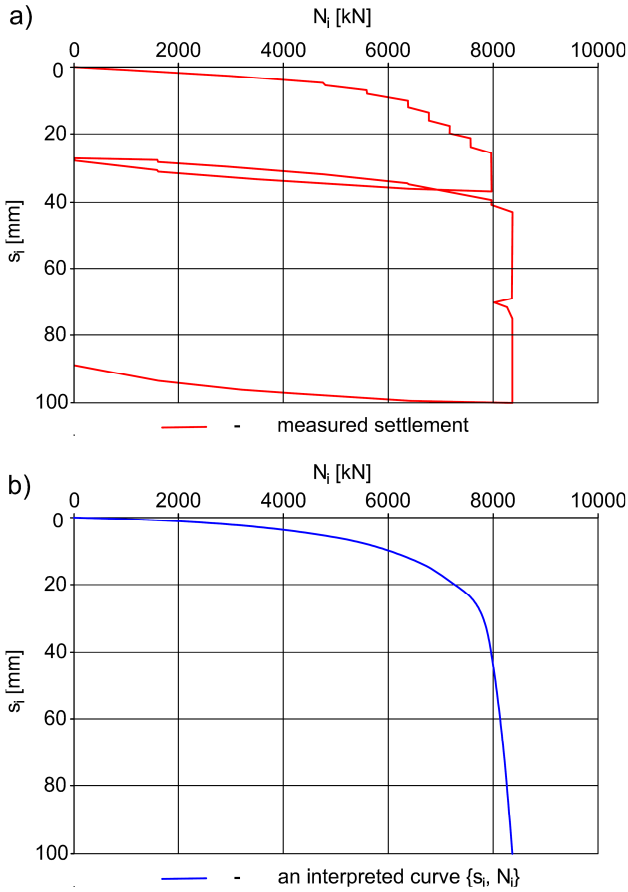

Figure 1. Static pile load test result: a) measured settlement, b) an interpreted curve

References

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