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Summary: Settlement prediction of loading plantes and shallow foundations on the basis of a deformation modulus depending on bearing capacity

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SUMMARY

Settlement prediction of loading plates and shallow foundations on the basis of a deformation modulus depending on bearing capacity

The object of the present work is to develop a new method for the settlement prediction of loading plates and rigid foundations. The new method takes into account the important influence of nonlinear plastic settlements neglected up to now in the geotechnical calculation of shallow foundations.

Basing on an evaluation of the results from known loading tests, and in connection with statistical investigations, a variable mathematical deformation modulus has been derived and introduced into the settlement prediction. This mathematical deformation modulus is not a constant, but depends on the ratio of mean loading pressure to bearing capacity. In this way the nonlinear plastic settlements depend on the following parameters: foundation width, ratio of foundation width to foundation length, foundation depth or lateral overburden, mean loading pressure, modulus of elastic deformation (initial value), bulk density, angle of internal friction, and cohesion.

The mathematical deformation modulus has been derived on the assumption of rigid foundations uniformly loaded, together with a sufficient layer thickness for the unhindered formation of sliding surfaces in the soil beneath the foundation.

It has been shown that a settlement prediction based on the proposed mathematical deformation modulus can explain quite well the phenomena of the nonlinear plastic settlements of rigid foundations and loading plates observed by experiment.

Furthermore, some improvements of the conventional methods for settlement prediction of shallow foundations are proposed. They concern new formulae for vertical stresses under the corner point of a flexible foundation, taking into account the spatial stress state. Other formulae proposed are suitable to estimate by layers the mean settlements of rigid foundations (mean value over the loading area) in a limited depth of integration according to the results of known experimental investigations (active

zone, critical depth). Together with the mathematical deformation modulus, these formulae can be used approximately to interpret the loading plate tests and to transmit the results to shallow foundations.

Some hints are given for a general application of the proposed improvements in practice. They concern the determination of the deformation parameters, the procedure in connection with the limited calidity of the principle of superposition as well as the evaluation of the contact pressure distribution, taking into account nonlinear plastic settlements. This means a further improvement of the well-known calculation methods, using a modulus of restraint deformation.

In order to test the proposed improvements, especially the set-up of the mathematical deformation modulus, a lot of parameters have been calculated and compared with the results from experimental investigations. These parameter calculations correspond very well to the experimental investigations, regarding the observations as well of the settlements as of the contact pressure distribution of rigid foundations. In this way, it has been shown that the proposed mathematical deformation modulus is well suitable for the settlement predictions of foundations in practice, taking into account nonlinear plastic settlements.