IBES Baugrundinstitut GmbH

Beratende Ingenieure und Geologen für Bauwesen

The IBES Baugrundinstitut GmbH is a modern service industry with a broad and impressive performance profile. It was founded in 1977 by Mr. H.-J. Rauch in Neustadt an der Weinstraße, Germany, and is still a family-run business.

The service spectrum we offer includes the fields of geotechnique, specialized civil engineering, environmental engineering, hydrogeology, and consultation in the planning and implementation as well as the execution of numerical computations. These numerical computations are used mainly to solve difficult and demanding tasks. We place a lot of emphasis on working closely with our customers in all phases of these computations.

Current efforts are being made to introduce Hypoplasticity with intergranular strains as well as Visco-Hypoplasticity and the related laboratory experiments in order to determine the parameters. The goal of intrucing these high-quality constitutive equations for cohesive and non-cohesive soil, is a continuous improvement in the quality of predictions. Possible areas of application for these procedures are for example: the simulation of ground liquefaction as a result of an earthquake, the cyclic stress as well as the prediction of creep deformation and creep breakage with clay soil. There is a strict separation into material parameters and state variables. Material parameters can be determined independently from the state variables in simple laborary tests.

In some cases however, with the help of simple elastic-plastic constitutive equations, realistic results ca be achieved.

Horizontal Pile Load Testing

In Germany, noise barrier walls are normally founded on driven piles because they are mainly loaded horizontally by the force of wind. Under these circumstances; shallow foundations are often uneconomical. In order to guarantee the practical suitability, the pile-head deformation is limited to a maximum of 10mm. Since the subgrade reaction method (Winkler Foundation) only produces exact results for bending measurements, in order to calculate the horizontal pile deformation, the finite-element calculations are applied. In some cases, in order to control the calculation results, also horizontal load testing is carried out to test the strain-performance of the piles.

In the case presented here, numerical calculations were applied with an elastic-plastic constitutive equation due to a limited budget. In spite of using this very simple constitutive equation, the results of the calculations match the measured pile head displacement very well, without a subsequent adjustment to the parameters. The calculations are carried out on a symmetrical three-dimensional model.

Particularly in the case of high loads, even better results can be achieved by using a more complex constitutive equation (Hardening-Soil, Hypoplasticity, Visco-Hypoplasticity) by taking the compression level into consideration.

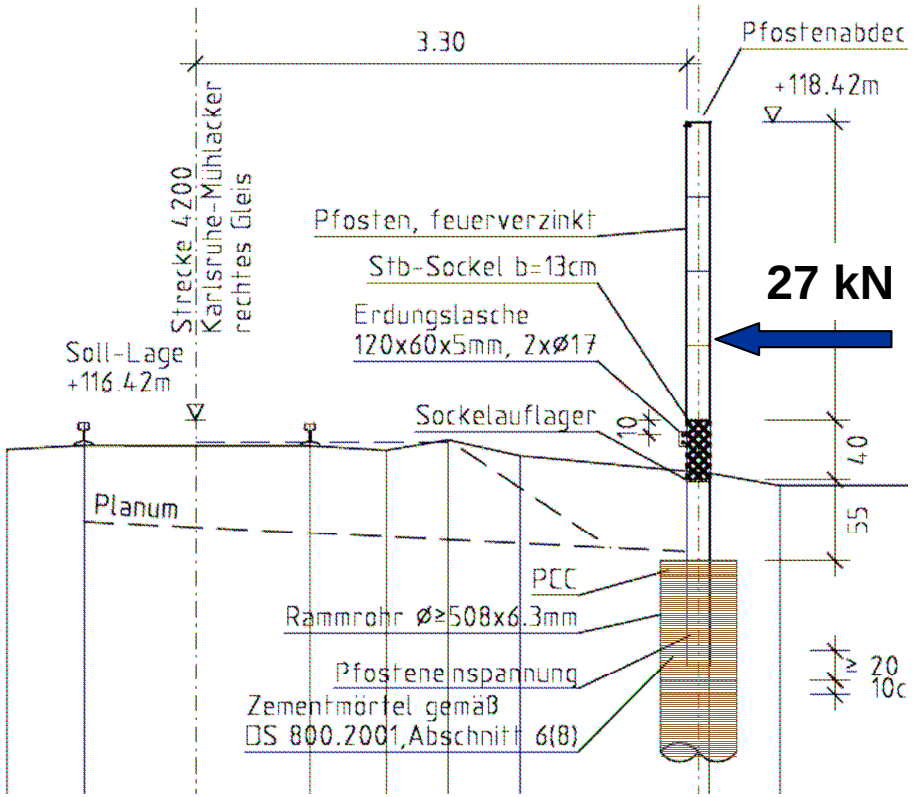
Horizontal Pile Load Testing

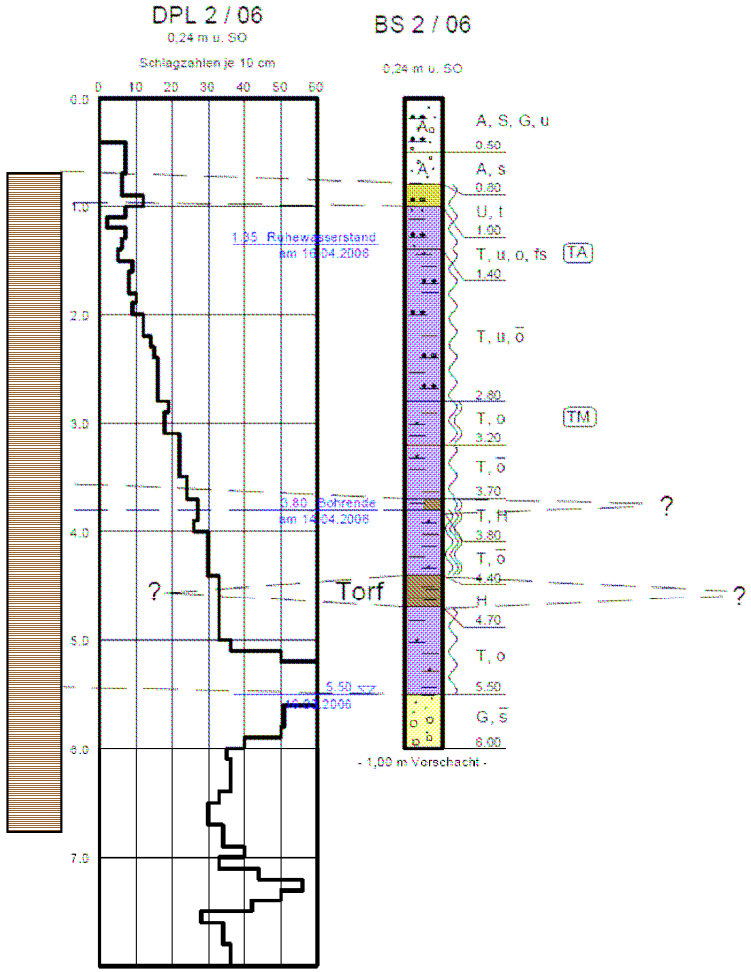
- Noise barrier in soft and organic soils with driven-pile foundation
- Pile load testing to estimate the horizontal displacements due to service loads

Typical view of noise barrier
Distance between piles: approx. 5 m
Wall height: approx. 3 m
Wind loads

Horizontal Pile Load Testing

- Cross-section, Underground conditions





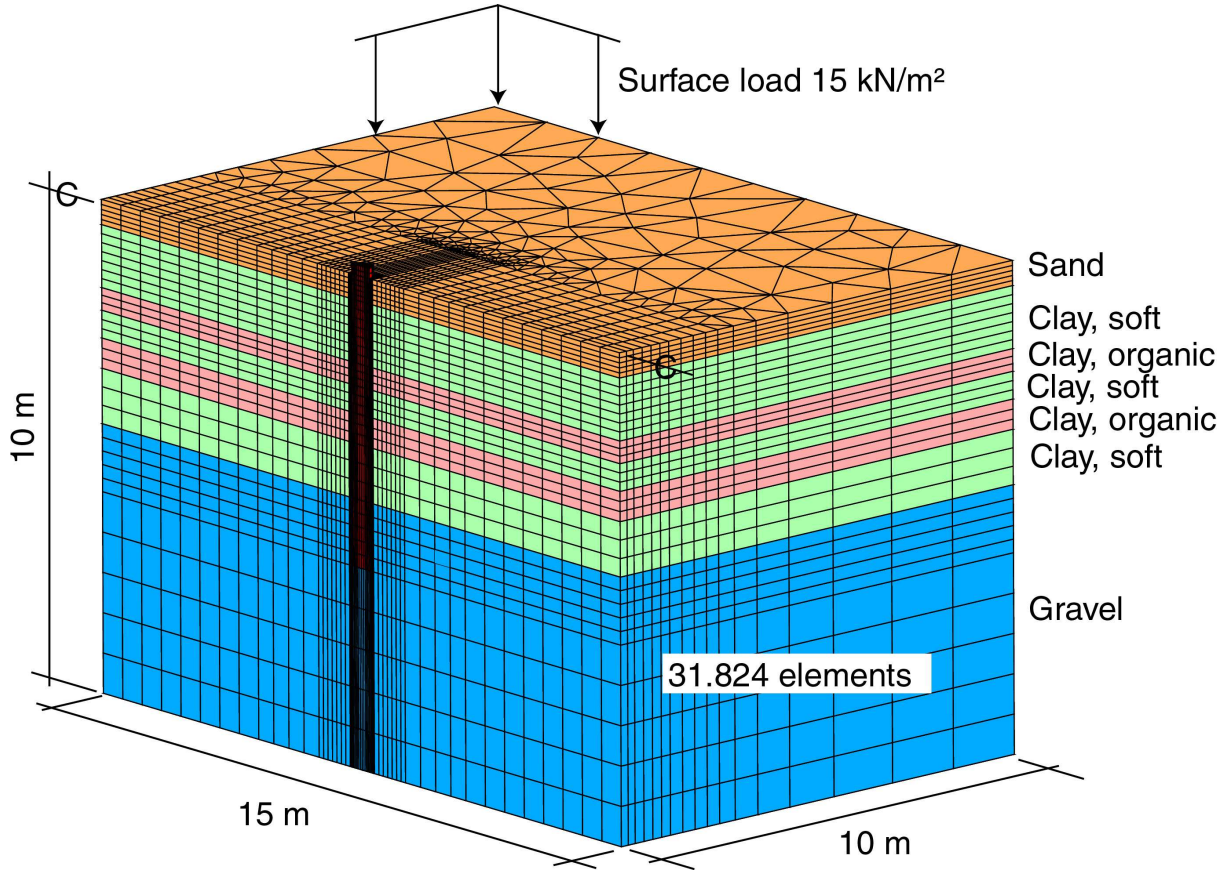
Driven piles (steel) , d = 530 mm,
th = 8 mm, l = 6,0 m

Horizontal Pile Load Testing

- Pile installation and pile load testing equipment

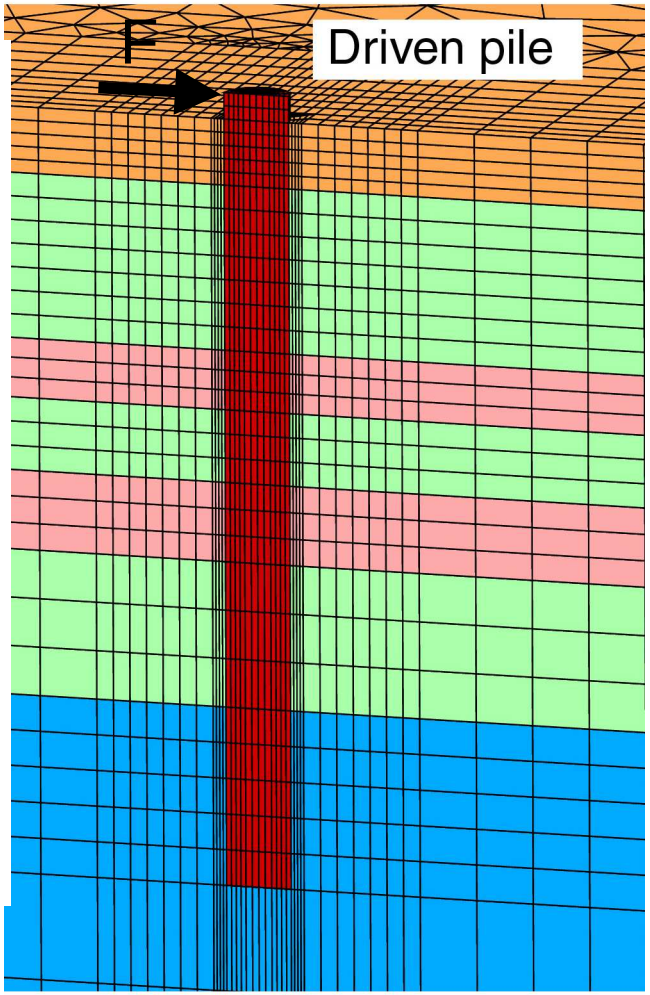
Horizontal Pile Load Testing

- FEM-Simulation



8-node and 6-node elements, without contact

Detailed View



Horizontal Pile Load Testing

- Parameters: soil (Mohr-Coulomb) and pile (elastic)

Material	γ	γ'	φ	c	ψ
	[kN/m³]	[kN/m³]	[°]	[kN/m²]	[°]
Sand	19	-	35,0	3	5,0
Organic clay	-	6	17,5	0	0,0
Gravel	-	10	35,0	0	5,0

Strength

(tension-cut-off)

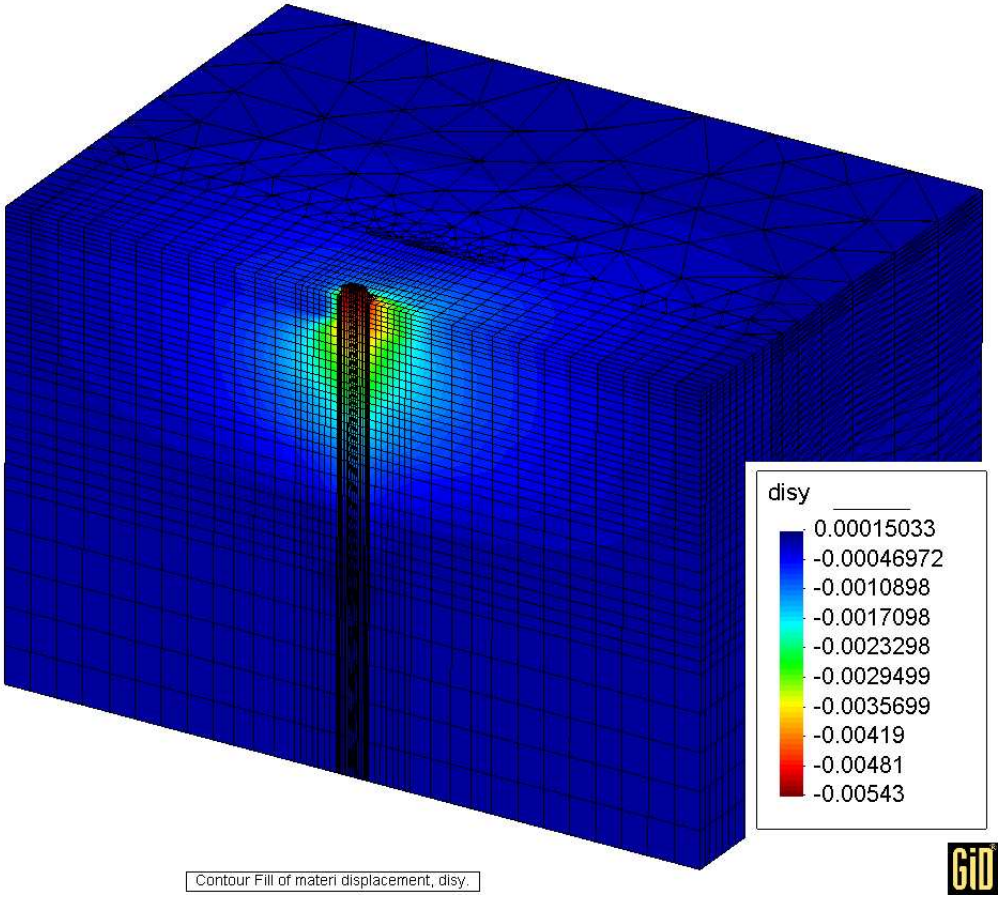
material	E	E_s	ν
	[MN/m²]	[MN/m²]	[-]
Sand	-	50	0,35
Organic clay	-	0,5 / 1,0	0,40
Gravel	-	150	0,35
Driven piles*	~30.000	-	0,20

Stiffness

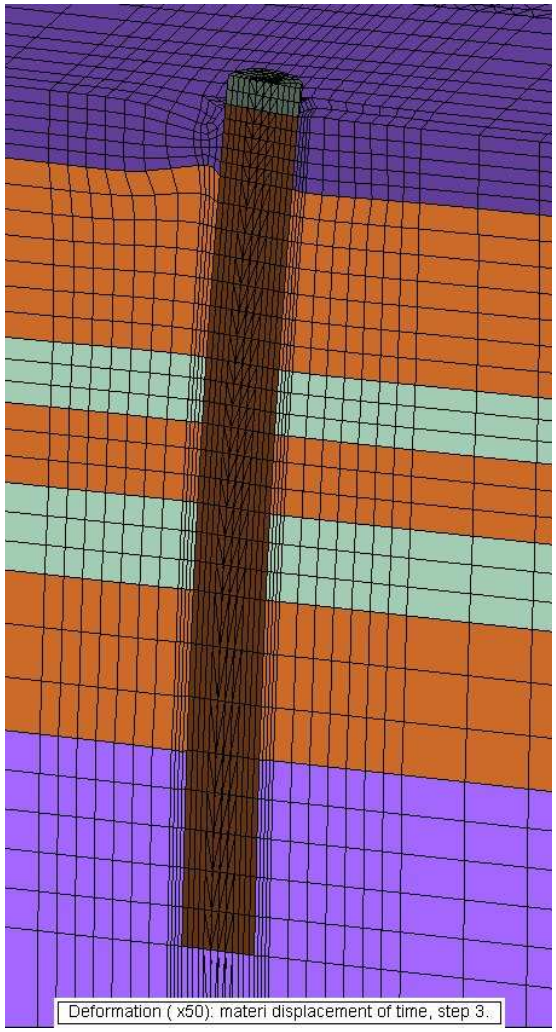
* calculated from flexural rigidity

Horizontal Pile Load Testing

- Results



Horizontal Displacements (service load)



Deformed Mesh

Horizontal Pile Load Testing

- Comparison of measurement and calculation