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# Influence of Buckling at the Rod Micropiles

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**Abstract**

This paper has in purpose contribute to design micropiles [1,4] from views buckling, then for end bearing micropiles. More approach generally exist, how the buckling calculate - from classical concrete practice (without soil resistance) until past procedure from concrete theory with influence coefficient *k* - background reaction. When you use computing software systems (eg. GEO 4), results of this calculation display of micropile aberration (horizontal deformation) when you enter the load at the ultimate skin friction (ie. design is not check). Ischebeck company [3] recommend approach for design of micropiles. This approach contents coefficients, equations and graphs, which display maximum load for soils describe total cohesion $c_u$. Nevertheless from tabular result, that for some type soil (cohesion, soft consistence (or very soft) with $c_u$ 25-40 kPa) isn't need consider risk buckling and therefore was perform sample calculation for micropile with impact these relations.



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*Keywords:* micropile; buckling; numerical modelling

## 1. Introduction

Parameters of micro piles are based on the the default design used by corporation Ischebeck. Size of the grouting part of the soil depends on the soil type in which the piles are applied (see. Table 3). When the pile diameter e.g. 32 and 38 mm diameter is thus grouting area

$D = d_k$ x 1,5 for soils class. Gr and Sa

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D = $d_k$ x 1,4 for fine soils
where $d_k$ – diameter of drill bit (for diameters of rod $d_k \cong 70-90$ mm)

Fig. 1. The dug TITAN 73/53 micropiles illustrate the pile diameter to about 2-times larger than the diameter of the drill bit. It is obvious indentation injecting into the surrounding soil and cover with cement stone without soil and even cohesive soil (e.g. alluvial marl)

## 2. Calculation of load for friction micropiles (type TITAN) according to the company Ischebeck

For design are considering various shaft frictions $q_s$ depend on type of soils (see table. 1)

Table 1. Shaft friction.

| Type of soil | $q_s$ /kPa/ |
|---|---|
| Sand and sandygravel | 200 |
| Cohesive clay (clay, marl) | 150 |
| Weathered sandstone, silt | 100 |

by DIN 1054-100

Values of shaft friction $q_s$ can be evaluate by the penetration resistance SPT (Standard Penetration Test) (see table 2.)

Table 2. Various values shaft friction by SPT (by Bustamante).

| N (SPT) | $q_s$ /kPa/ |
|---|---|
| $\mathbf{N \leq 5}$ | 0 |
| $\mathbf{N < 10}$ | 7,2 x N + 6 |
| $\mathbf{N > 10}$ | 4,1 x N + 37 |
| For clay and silt, N – number of blows SPT | |

Simple example: if you choose silt soil where number of hit by SPT is N = 12, calculation shaft friction of micropile is (see table 2.)

$$\mathbf{q_s = 4{,}1 \cdot 12 + 37 = 86}\ \text{kPa} \quad (1)$$

by DIN 1054-10 (see table 1.)

$$\mathbf{q_s = 100}\ \text{kPa} \quad (2)$$