

Ernst Ischebeck

Drilled and Dynamic Grouted Titan Soil Nails



DRILLED AND DYNAMIC GROUDED MICROPILES TITAN MEAN:

1. Rotary-percussive drilling in soft soils without casing.
2. Simultaneous tremi grouting with cement grout $W/C = 0,7 \div 0,4$ supports the drill hole; similar as in diaphragm wall construction.
3. 30 % better shear bond for the surface friction grout body / soil compared to non-pressure grouted micropiles Typ II in France. Based on the FOREVER test programm done by CEBTP.
4. Improved skin friction of the TITAN micropile reduces the displacement required to less than 5 mm to carry the safe working load.

TITAN Micropiles can be used instead of permanent anchors without preloading and free anchoring length.

Permanent anchors can be replaced by permanent TITAN tension piles without need for prestressing and without free length.

5. Improved shear bond between the grout body / steel surface reduces cracks in cement to less than 0,1 mm.

If the steel stress is limited to 275 N/mm^2 , just 20 mm cement grout cover is sufficient for permanent anchoring applications of TITAN micropiles on tension.

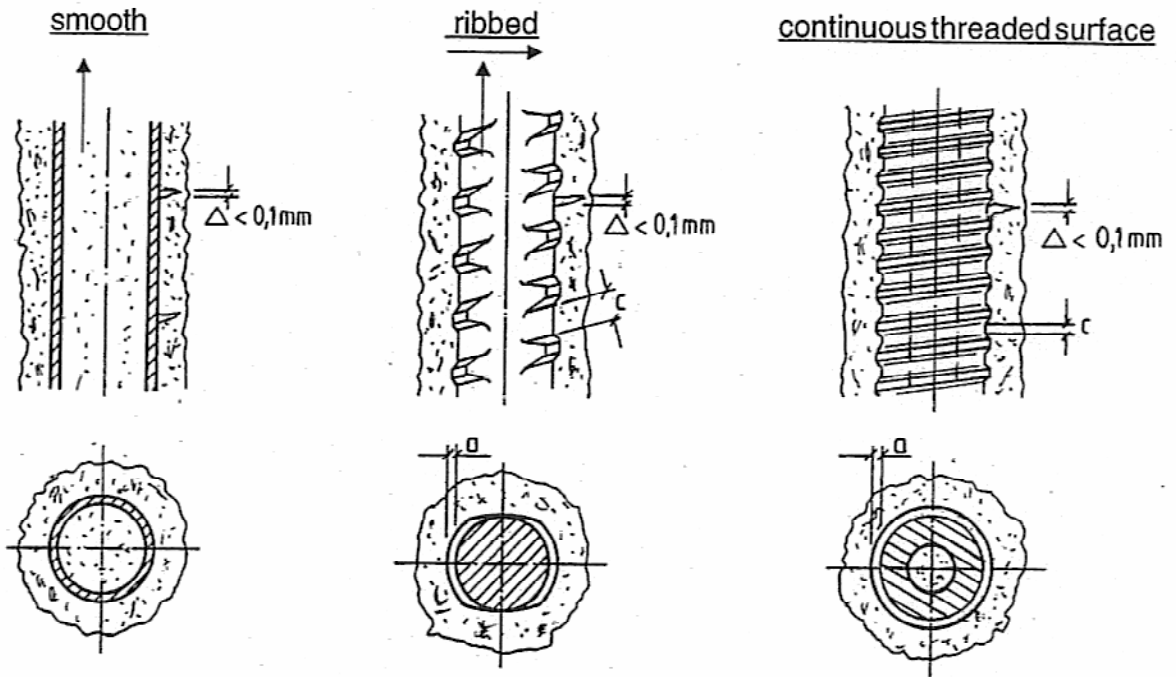
No double corrosion protection is necessary!

Double corrosion protection becomes obsolete.



Only cement cover of min. 20 mm for permanent application.

technical development of micropiles:
 cement cover W/C = 0,4 (B 25 quality)



Grouted steel tube pile

$$f_R = 0$$

safe working stress
 75 N/mm²

to avoid axial cracks
 and radial cracks
 not larger 0,1 mm

GEWI pile

$$f_R = 0,56 \times \frac{a}{c}$$

safe working stress
 165 N/mm²

to avoid axial cracks
 and radial cracks
 not larger 0,1 mm

TITAN soil nail

$$f_R = \frac{a}{c}$$

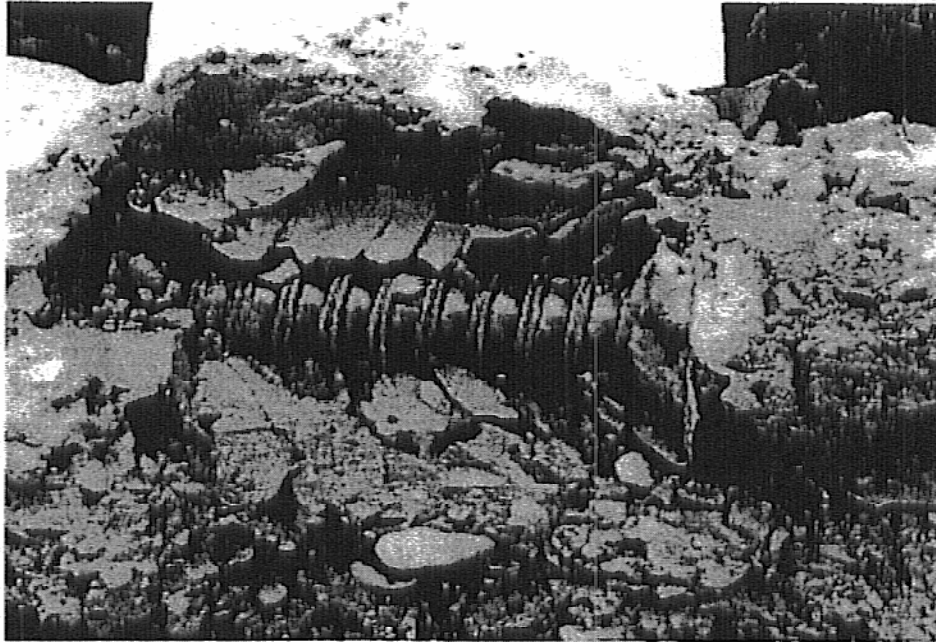
safe working stress
 275 N/mm²

to avoid axial cracks
 and radial cracks
 not larger 0,1 mm

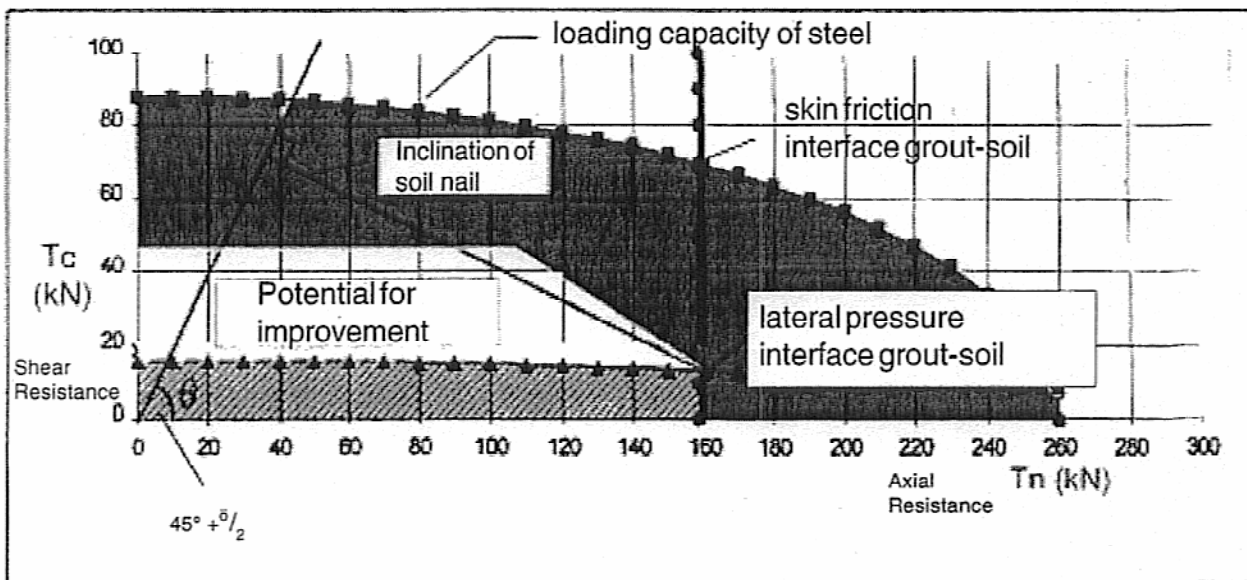
Improved shear bond by continuous threading with $f_R = 0,13$ allows only cement cover of min. 20 mm for permanent application of TITAN soil nails.

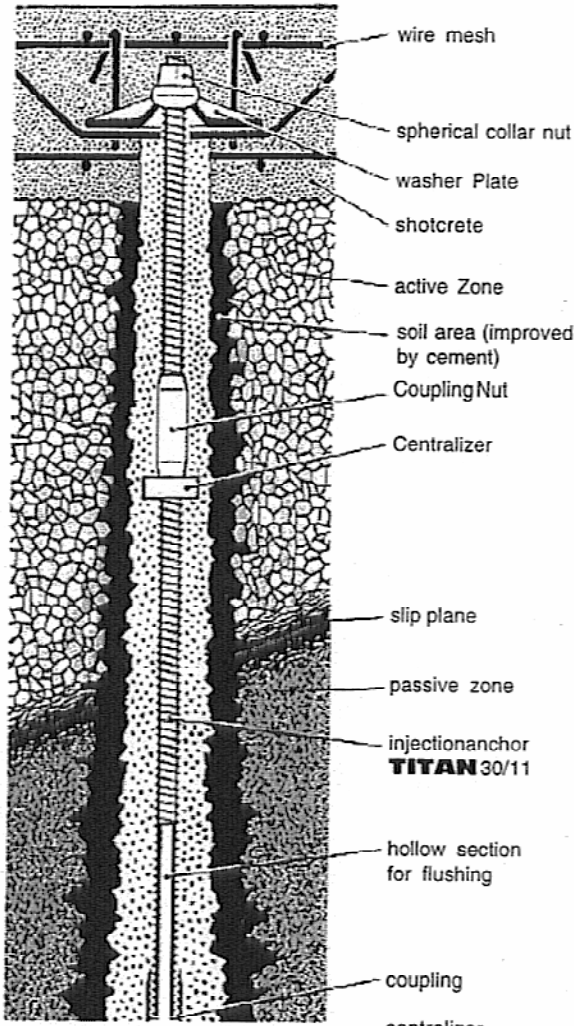
Soil nails TITAN with reduced steel stress of 275 N/mm² don't need double corrosion protection by cement cover and PE corrugated tubes.

based on expert opinion
 Prof. Dr.-Ing. Schießl, TU Munich
 B 6067 of 30.11.1999



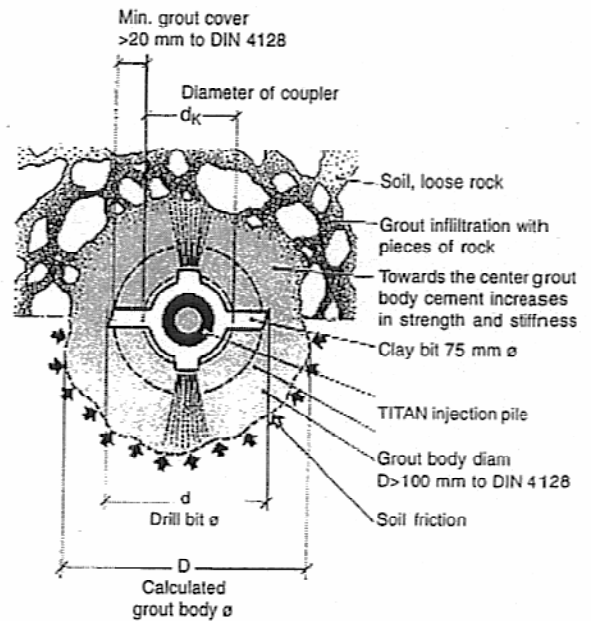
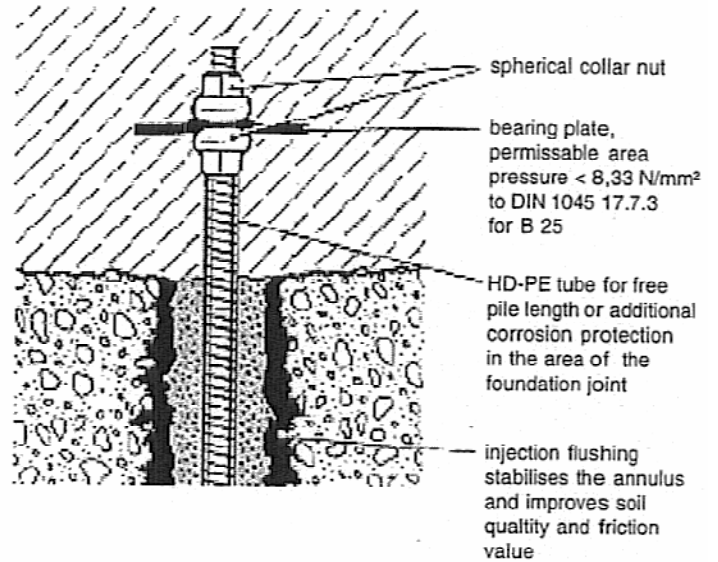
Interaction Diagramm for Axial / Shear - Resistance of TITAN 30/11 according 4 criterias of "Clouterre"



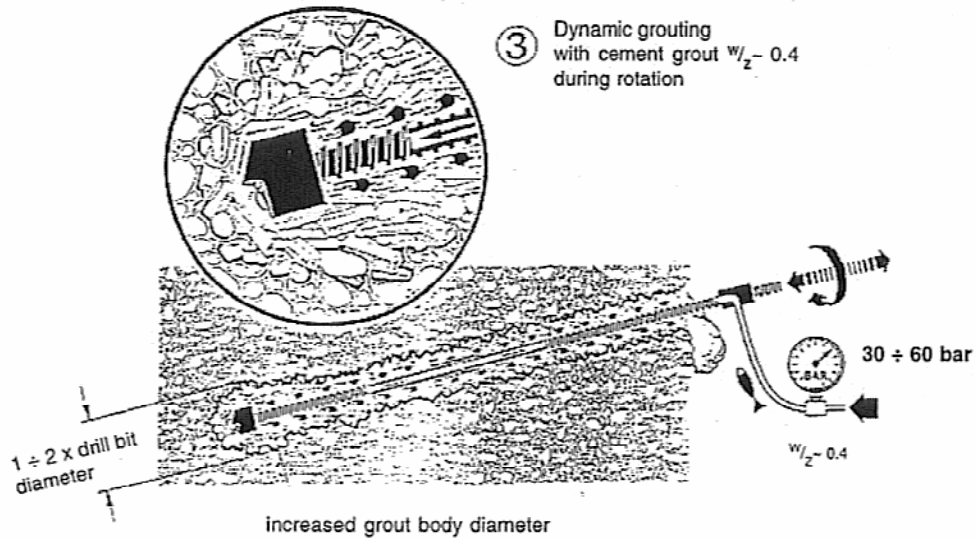
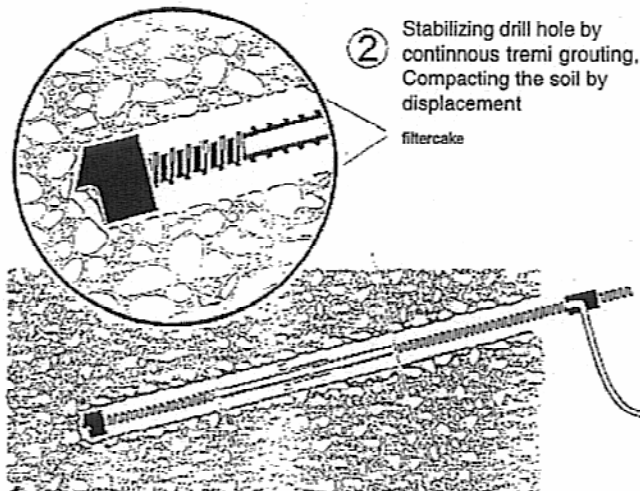
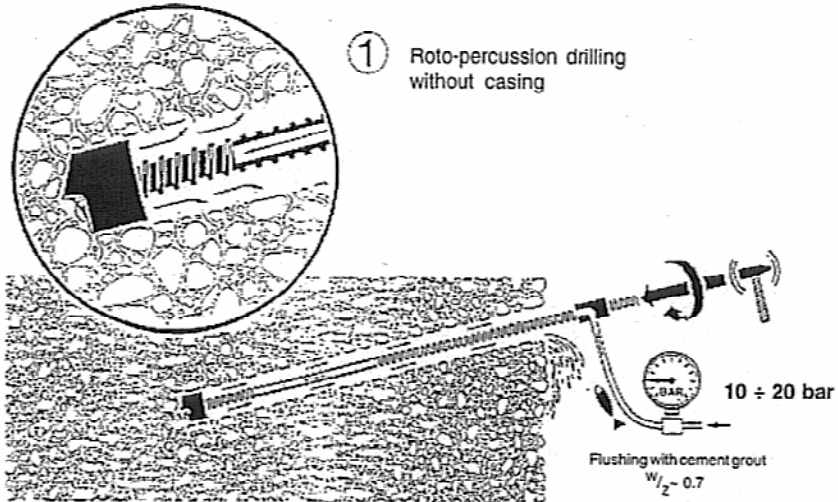


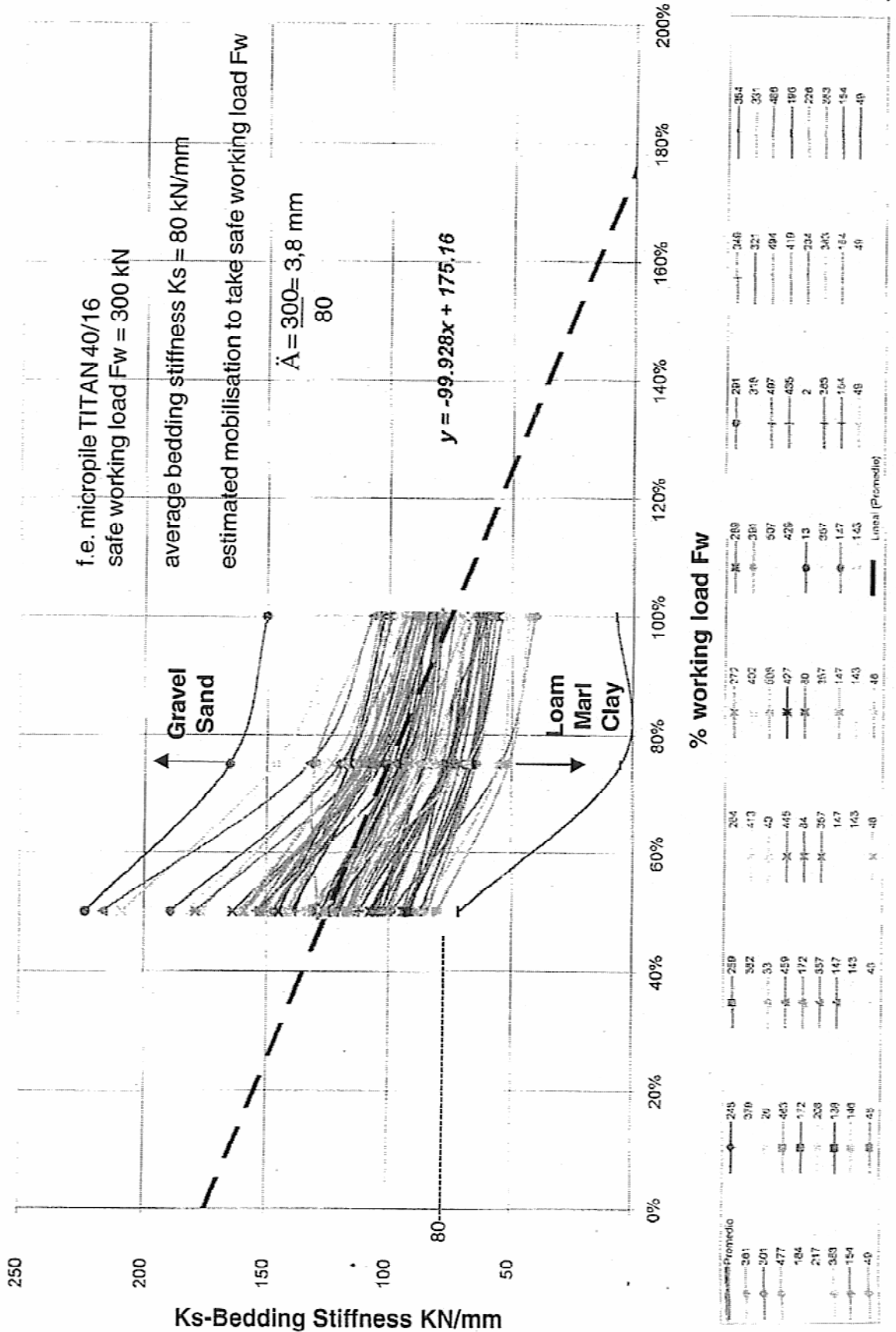
grout cover > 20 mm

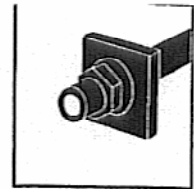
clay bit 75 mm ø



- $D \geq 2,0 \times d$ for medium + coarse cobbles
- $1,5 \times d$ for sand and gravelly sand
- $1,4 \times d$ for cohesive soil (clay, marl)
- $1,0 \times d$ for weathered sandstone, phyllite, slate







Stand: March 2000

Seismic Retrofitting with prestressed shock absorbing Micropiles

