



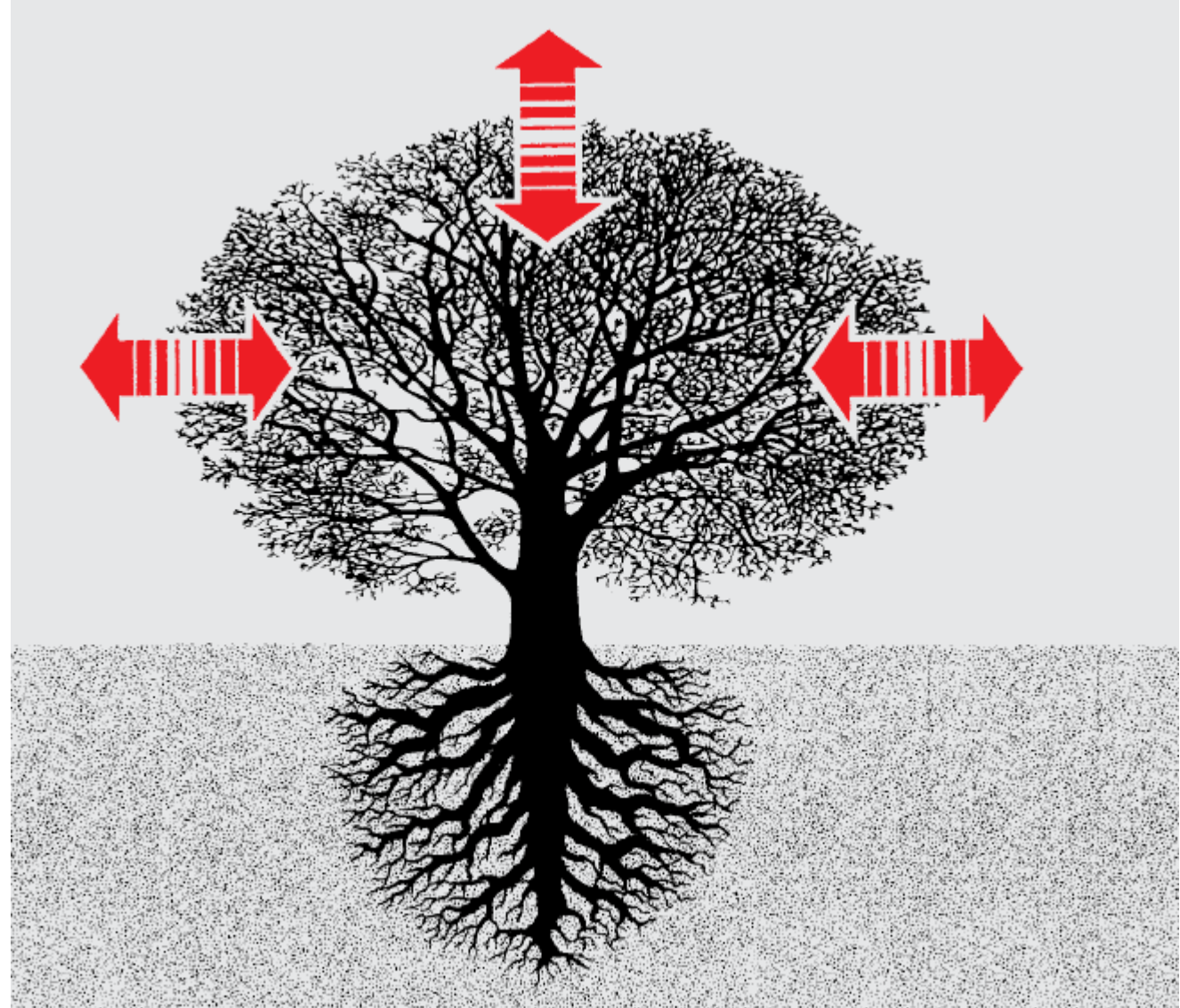
## A Super Micropile

### What are the limits of a micropile?

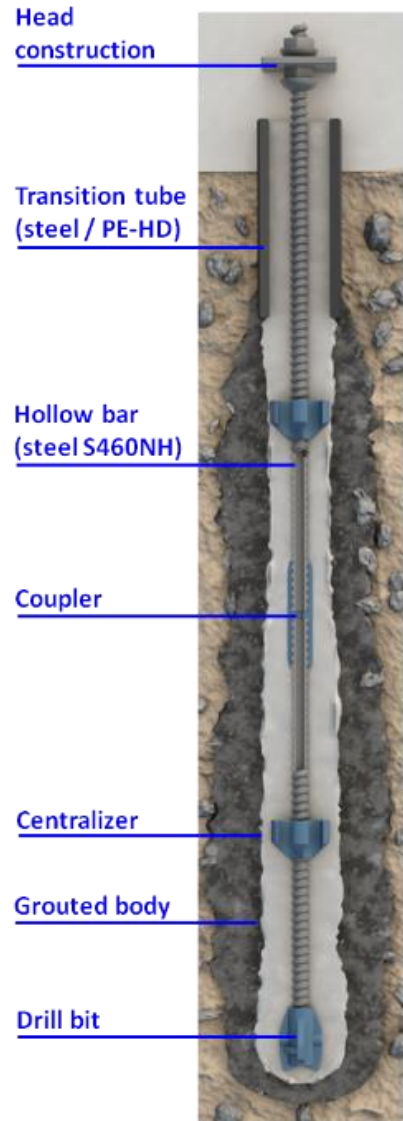
Speaker:  
Dipl. Wi.-Ing. Björn Ischebeck  
Co-Author: Freddy Lopez  
FRIEDR. ISCHEBECK GMBH  
Ennepetal, Germany



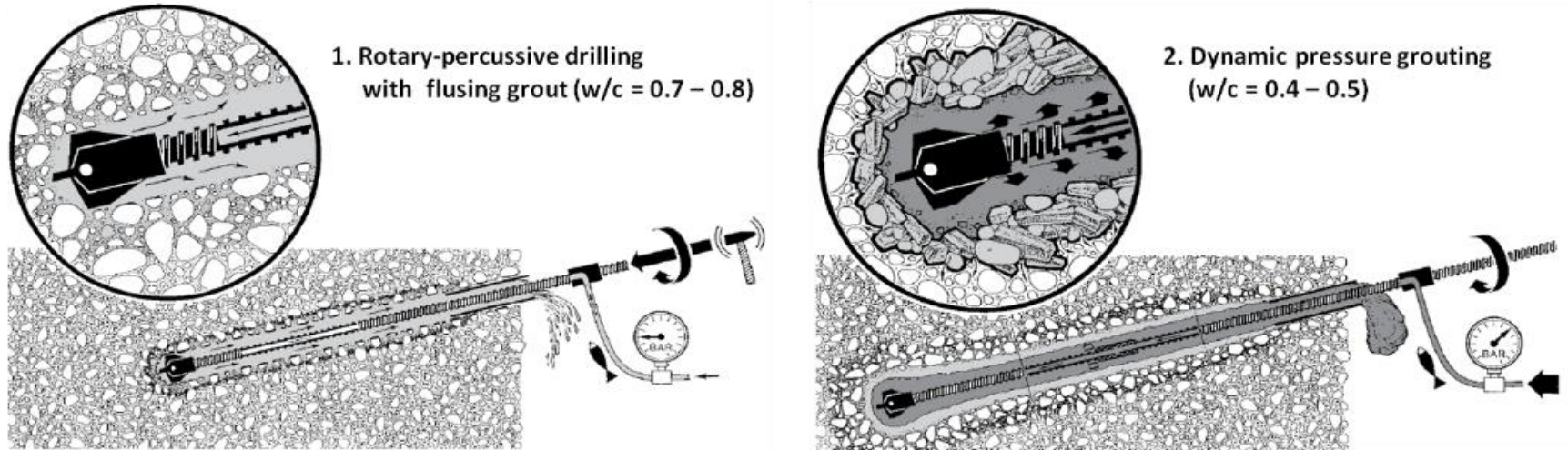
1. Hollow Bar Micropile
2. Feasibility Study
  - Production
  - Installation
  - Design
3. Outlook



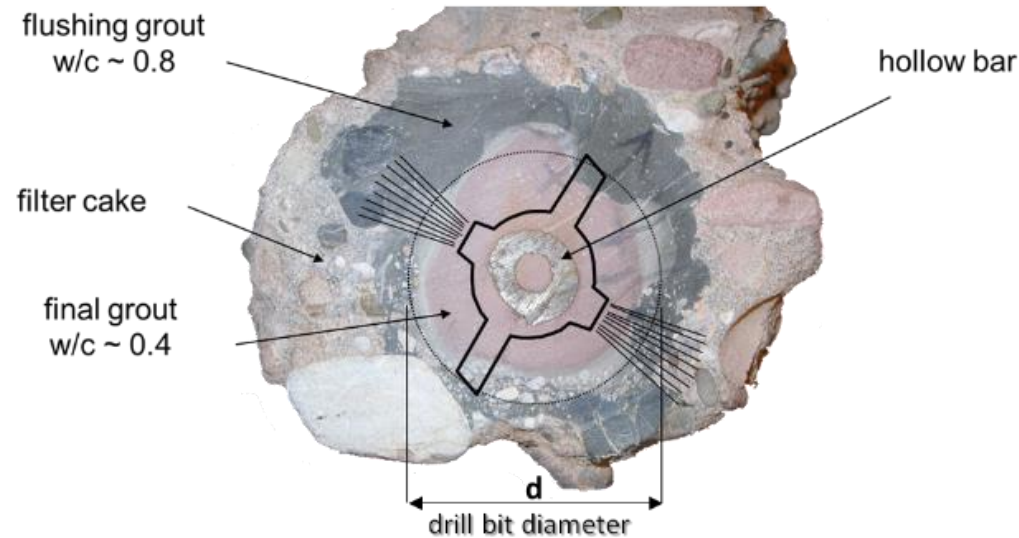
## COMPONENTS



## INSTALLATION PROCESS



## GROUTED BODY



## Benefits and limitations

- Small equipment for installation (limited access, limited headroom)
- Easy and fast installation process (one visit only)
- Quality assurance (drilling to final depth, filling the bore hole)
- Versatile (all soils, all inclinations, compression and tension load => micropile, tension pile, soil nail)



## Design Assumptions for Micropiles

- preliminary axial loads transferred through friction
- end bearing capacity neglected
- Axial loads in tension, compression and alternating loads as well as seismic situations
- Proof of inner and outer capacity, bending, serviceability and group effects



Designation	Unit	TITAN 30/16	TITAN 30/11	TITAN 40/20	TITAN 40/16	TITAN 52/29	TITAN 52/26	TITAN 73/56	TITAN 73/53	TITAN 73/45	TITAN 73/35	TITAN 103/78	TITAN 103/51	TITAN 103/43	TITAN 127/103
Effective crossection $A_{eff}$	mm <sup>2</sup>	336	415	730	900	1050	1250	1460	1615	2239	2714	3140	5680	6025	3744
Ultimate load $F_u$	kN	236	326	523	673	813	899	1056	1258	1574	1864	2244	3665	4155	2320
Characteristic load-carrying capacity $R_k$ (5%-fractile)	kN	190	260	430	530	640	730	865	975	1220	1390	1800	2540	3132	2015
	<b>kip</b>	<b>43</b>			<b>120</b>			<b>200</b>			<b>704</b>				

## A super Micropile



## A Super Micropile –

- Offshore – a single pile is preferred over a group of Micropiles



## A Super Micropile –

- Offshore – a single pile is preferred over a group of Micropiles
- Limited access – replacing a bore pile





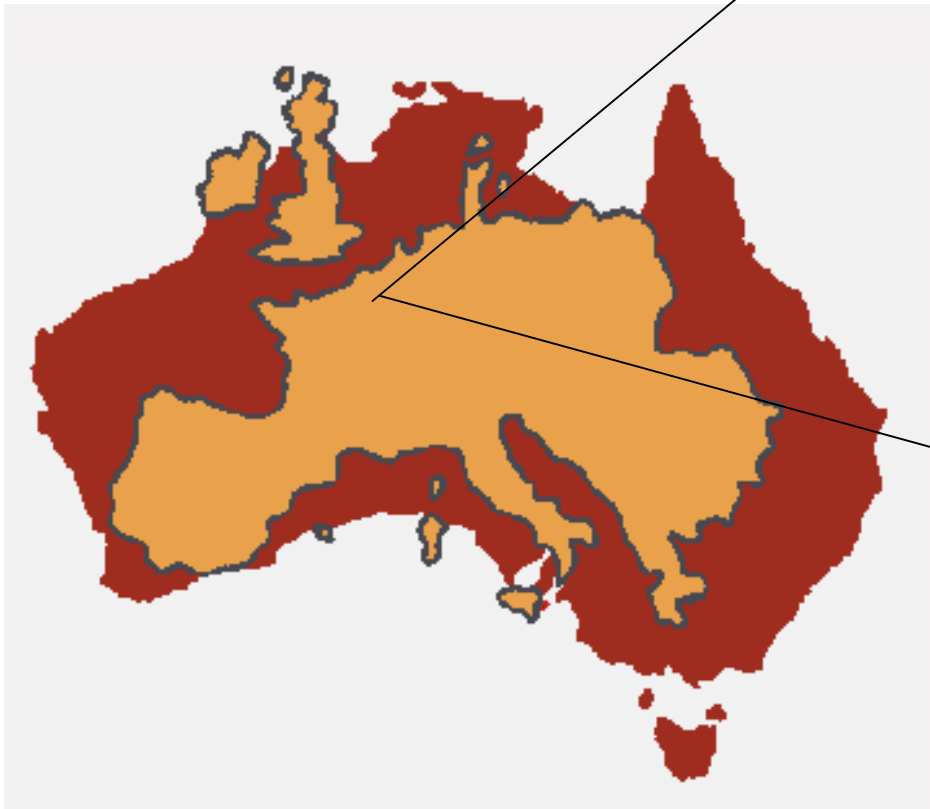
## A Super Micropile –

- Offshore – a single pile is preferred over a group of Micropiles
- Limited access – replacing a bore pile
- Increased logistic effort - replacing a bore pile



## A Super Micropile – a feasibility study

- Production test successfully realized



**Quelle: Australien-info.de**

## A Super Micropile – a feasibility study

➤ Production test successfully realized

hollow bar 196/130, 3,00m; S460NH, right-hand thread

outer diameter 196

inner diameter 130mm;

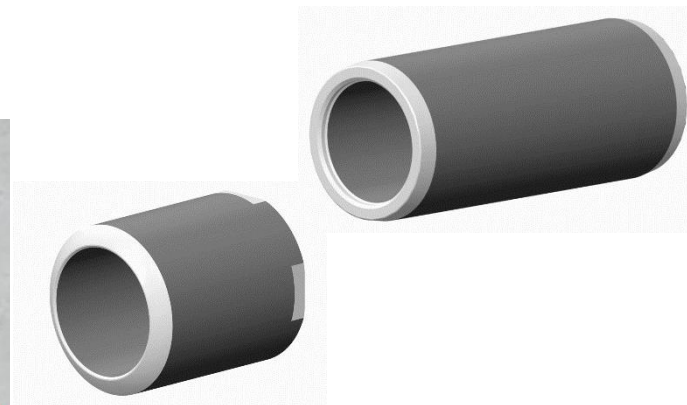
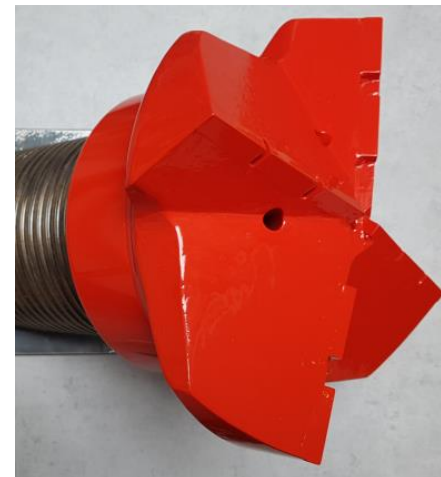
cross section 16077mm<sup>2</sup>

weight per unit: 382kg;

coupling ø 254mm x 600mm; 101kg

collar nut ø 254mm x 300mm; 49kg

carbide cross cut drill bit ø 340mm; 46kg

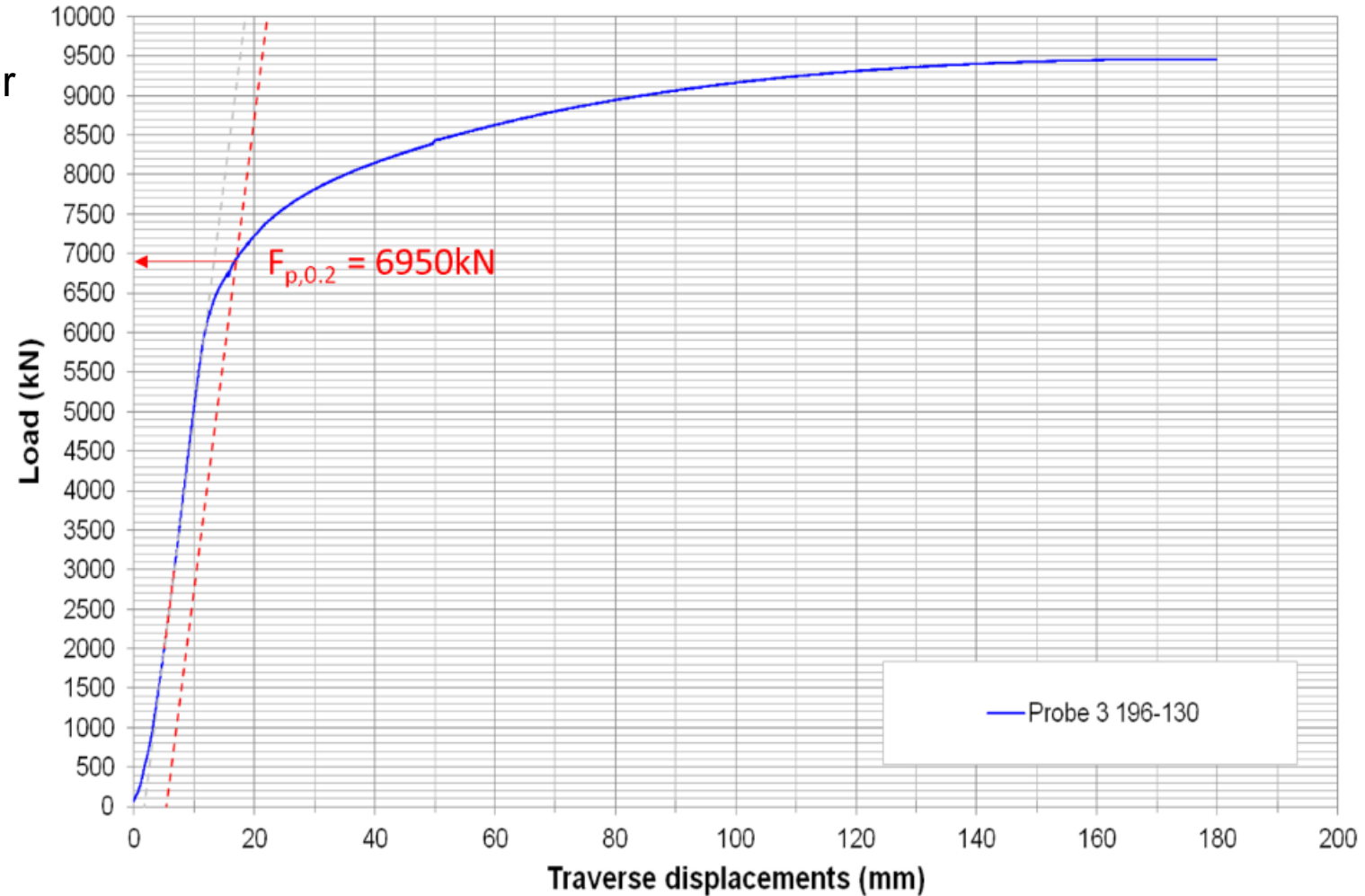


## A Super Micropile – a feasibility study

- Tension Test at University of Hannover



Load - Displacement Diagram



## A Super Micropile – a feasibility study

### ➤ Installation Test

#### **Drill Rig**

Casagrande C8

#### **Drifter**

Klemm Typ KD 1828 R

Torque 7,0 kNm

Impulse energy 900 Nm

#### **Pump**

Scheltzke Verpressstation

MPS 100

Volumenstrom 160 l/min

#### **Excavator with**

**Manipulator** IMB GMA 250



# Hollow Bar Micropile



**Granular infill**  
▼ -5.5m

**Claystone**  
▼ -25.5m

▼ -24m



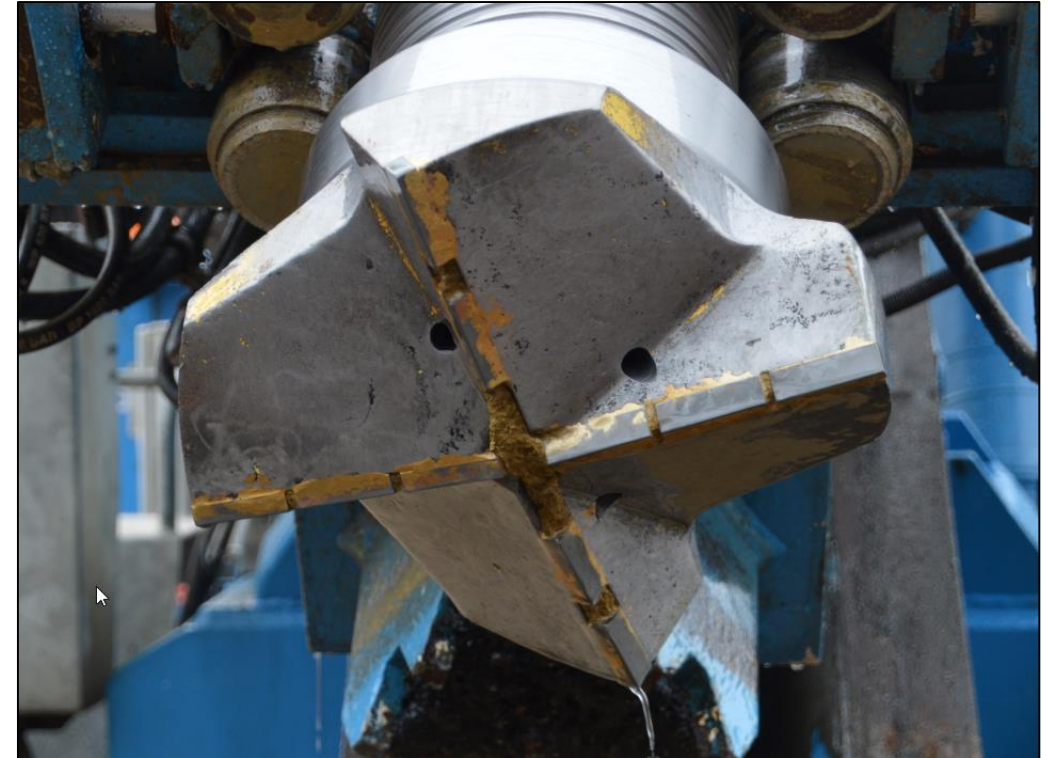






# Hollow Bar Micropile

Depths [m]	Drilling time [min]	Drilling mode	comment
	Test 1		
3	4:10	rotary	
6	5:13		
9	6:47	Rotary percussion	
12	8:59	Rotary percussion	Strong resistance
15	9:48		
18	7:50		
21	5:50	Rotary percussion	Soft layer
24	4:45		



Estimated drilling time: ca. 3 – 4 hours

Condition of drill bit: neither damages nor wearout

≈ 2:10 min/m (average)

w/c: 0,7 – 0,8

Cement consumption ca. 2 m<sup>3</sup>

Injection pressure: 6-10 bar

Measured drill diameter: Ø 390 mm

## Summary of installation test:

- TITAN 196/130 can be drilled 24 m in bedrock or weathered rock
- HM – cross cut drill bit Ø 340 mm was used twice without wear out
- The capacity of Klemm drifter KD 1828 R with 7,0 kNm torque is reached in a drilling depths of 24 m. Klemm drifter KD 2728 R with 27 kNm torque may be an improvement.

Alternative drifter: EURODRILL 8032

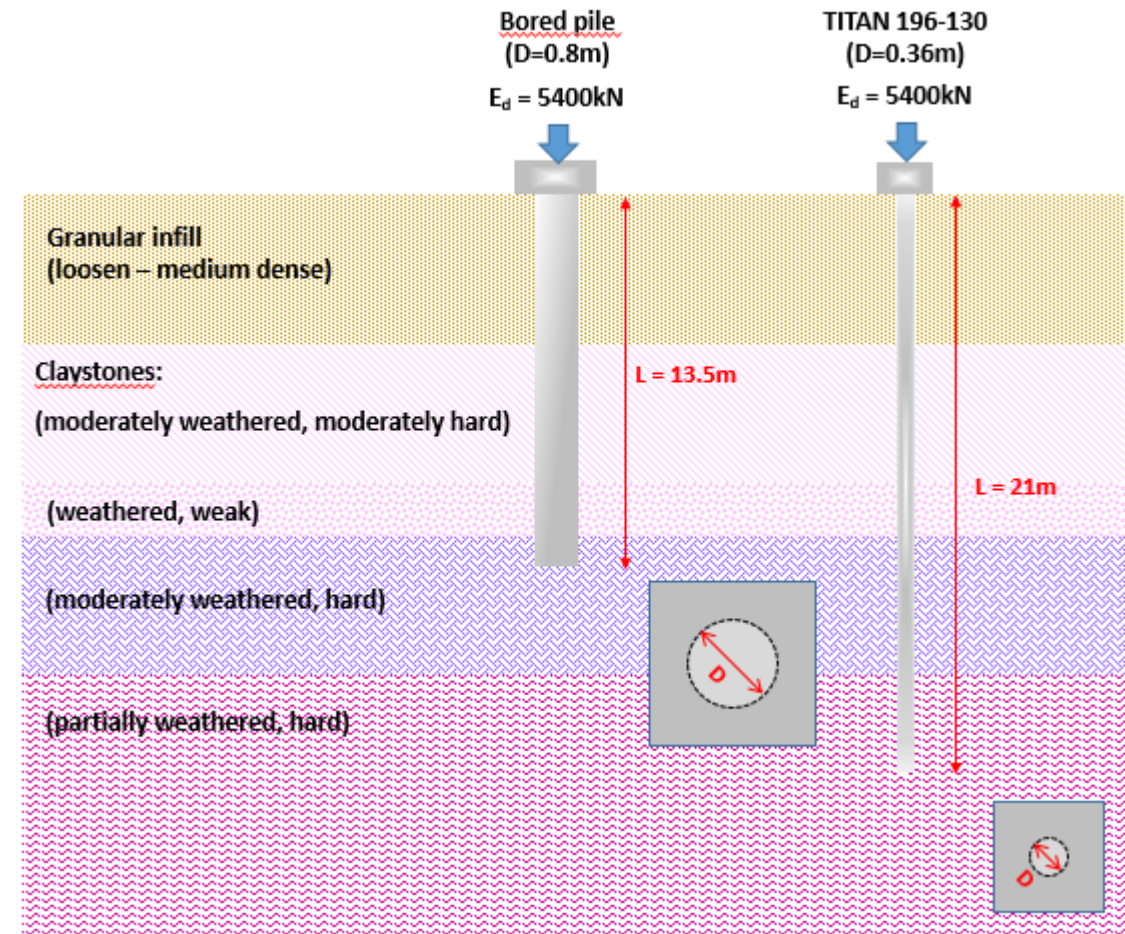
Alternative drilling rigs: Klemm KR 805-3G, Hütte HBR 609 or 610

- An improvement can be realized with a stronger grouting pump (320 l/min), might be necessary especially in sand or gravel.

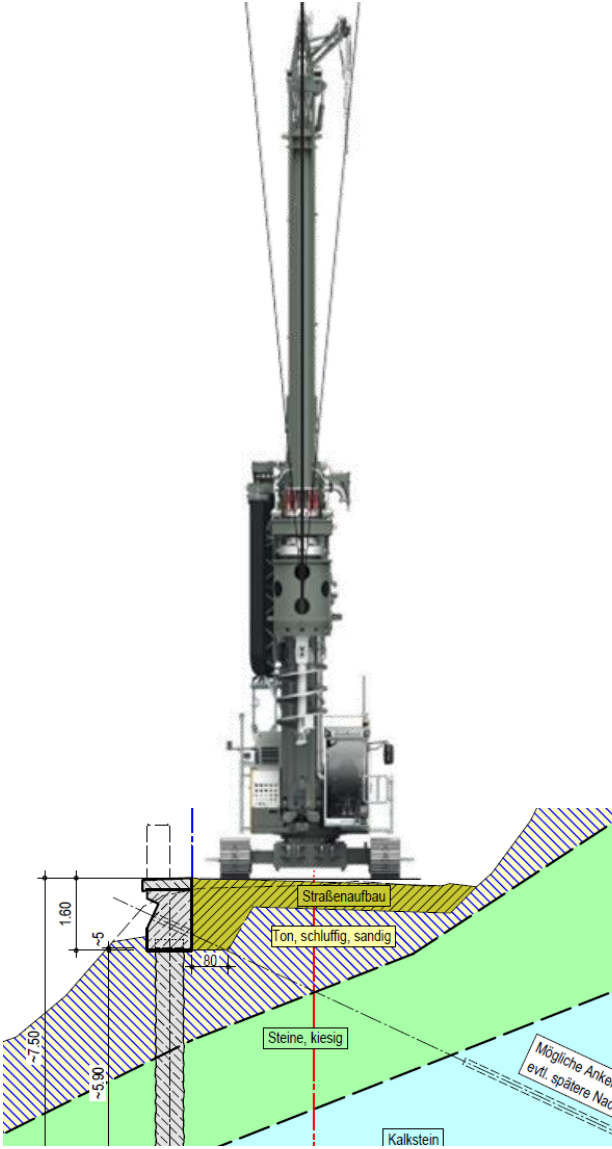
Designation
Effective crosssection $A_{eff}$
Ultimate load $F_u$
Characteristic load-carrying capacity $R_k$ (5%-fractile)

TITAN 73/35	TITAN 103/78	TITAN 103/51	TITAN 103/43	TITAN 127/103
2714	3140	5680	6025	3744
1864	2244	3665	4155	2320
1390	1800	2540	3132	2015

TITAN 196/130
16077
9601
6465



# Hollow Bar Micropile



## Conclusion/ Discussion:

- Comparison with Bored Piles
  - Job site installation/ transport cost of Equipment: 2 to 2,5 times higher than Micropiles
  - Higher Consumption of cement
  - Increased Installation speed
  - No limitation in regards to the soil/ rock
- Comparison with Micropile Group
  - Still relative small drilling equipment
  - Single (micro-) pile only

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