TILTS

# CONSTRUCTION OF BORED PILES

“TILTS” Ltd operates on a field of civil engineering and manufacturing. The company was founded in 1989. It specializes in design, construction and reconstruction of bridges, viaducts, tunnels and other engineering structures, located on roads and railways. The company also produces reinforced concrete and metal constructions.

“TILTS” Ltd offers construction of Bored Piles since 2001. The company’s service yard is equipped with the most modern and powerful drilling machineries in the Baltic. In combination with the experience and expertise, this enables the quality conduction of works on constructing foundations, supporting walls, huge wells and other constructions of any difficulty level.

“TILTS” Ltd cooperates with BAUER Maschinen GmbH, one of the world’s leading manufacturers of drilling machines. “TILTS” Ltd owns four drilling rigs for Bored Piles construction: BAUER BG 15, BG 23, BG 24, BG 28, BG 39 and BG 45.

**“TILTS” Ltd offers construction of Bored Piles according to the following technologies:**

| FDP (Full Displacement piles) |
|---|
| (no soil excavation) |
| Ø 320 / 410 / 450 / 520 / 620 |
| ↕ up to 40.2 m |

| FDP “Lost bit” |
|---|
| (no soil excavation) |
| Ø 510 / 550 / 620 / 710 |
| ↕ up to 40.2 m |

| CFA (Continuous Flight auger) |
|---|
| Ø 450 / 550 / 600 / 750 / 880 / 1000 / 1200 |
| ↕ up to 31 m |

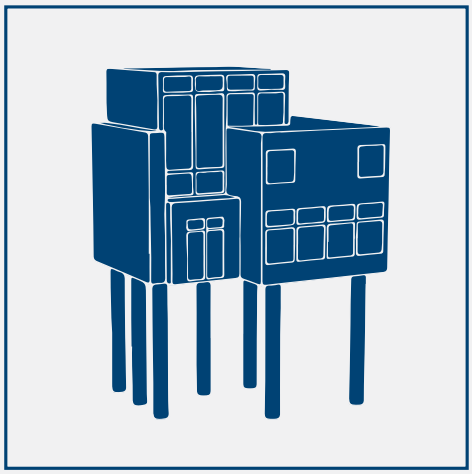
| KC “Kelly-Casing” |
|---|
| single piles/bored pile walls |
| Ø 620 / 750 / 880 / 1000 / 1180 / 1200 / |
| Ø 1300 / 1500 / 1800 / 2000 |
| ↕ up to 96 m |

| CCFA (Cased CFA piles) |
|---|
| single piles/bored pile walls |
| Ø 420 / 510 / 620 / 710 / 750 / 880 / 1000 |
| ↕ up to 25 m |

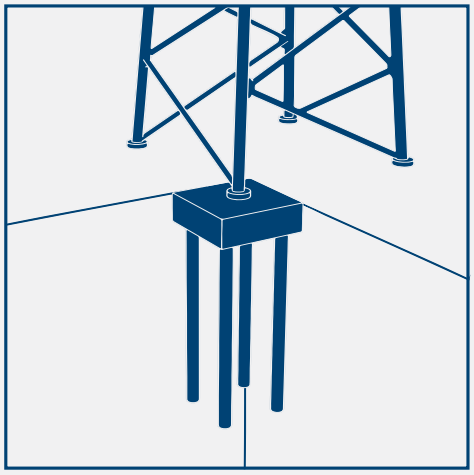
Ø Diameter, mm ↕ Length, m

**Depending on the load distribution, the bored piles are used in the following ways:**

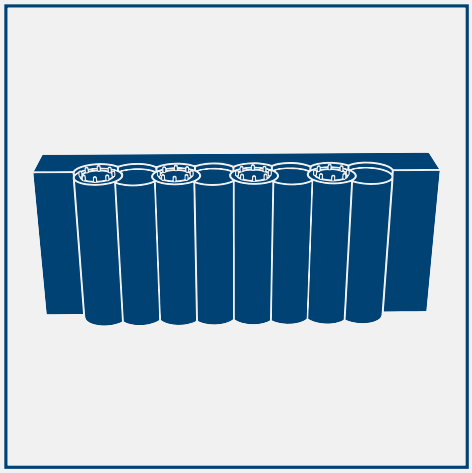
**1** Single piles



**2** Pile groups



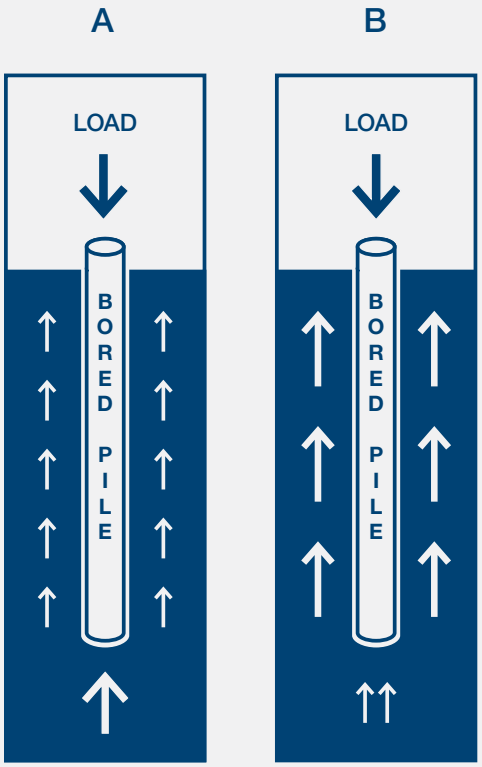
**3** Bored pile walls



**The Advantages of Bored Pile Construction are as follows:**

- The opportunity of pile construction down to the depth of 96 m
- The required bearing capacity and strength
- Pit is not required to construct Bored Piles, and they may also be used as fencing structures
- Bored Piles are constructed without vibration and with no effect on the buildings situated nearby the site

**The ways of application and construction of Bored Piles**

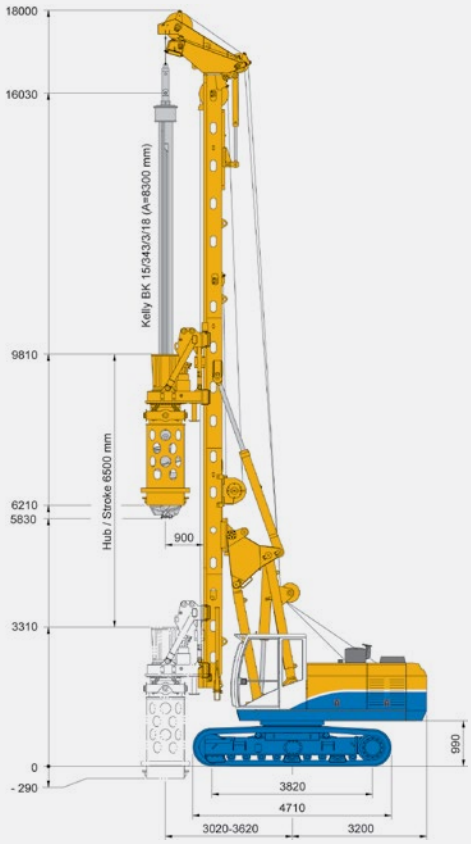



**A** End-bearing pile

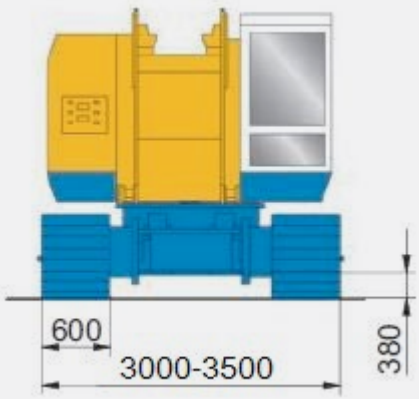
Its lower end (pile foot) rests upon a low-compressible soil

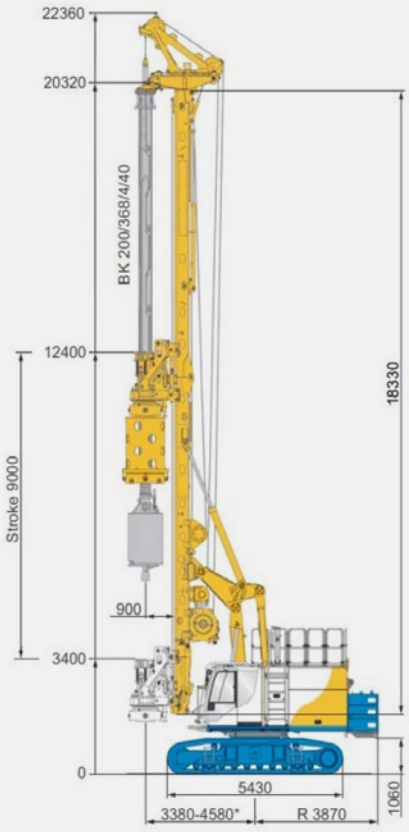
**B** Friction-bearing pile

Its lower end rests upon a compressible soil, and the loading is transferred into the soil due to the resistance of the lateral surface of the pile and under its foot

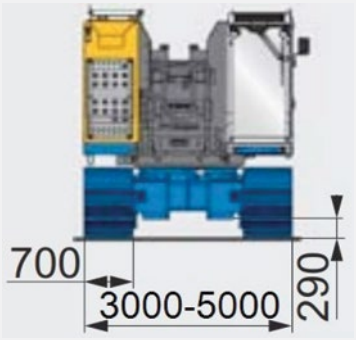



| Bauer BG 15 drilling rig for pile construction |
|---|
| Mast height (with extension)<br>21.92 m (26.21 m) |
| Operating weight (with kelly bar)<br>69.2 t |
| Transporting weight<br>65 t |
| Torque<br>151 kNm |

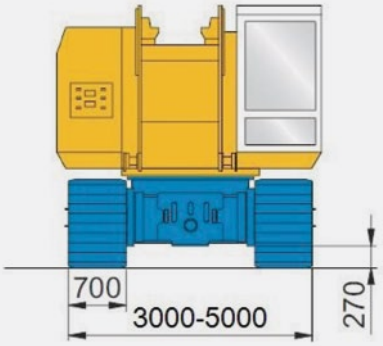


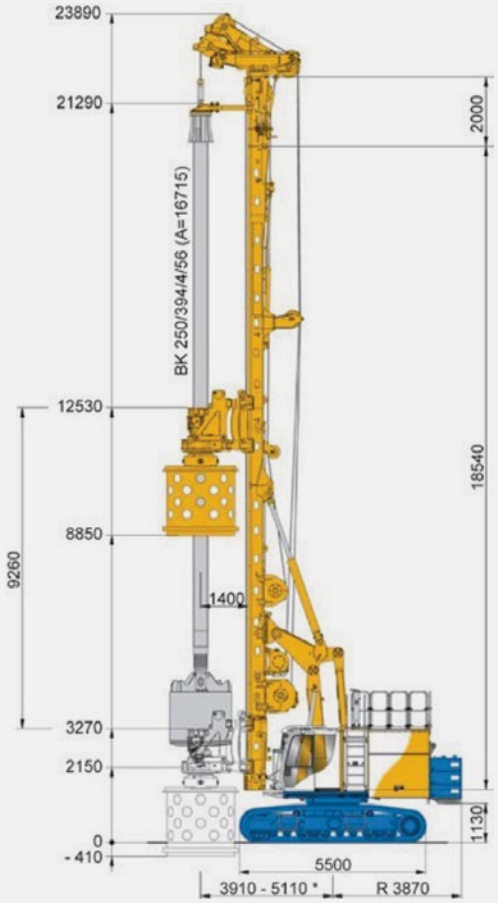




| Bauer BG 23H drilling rig for pile construction |
|---|
| Mast height (with extension)<br>22.360 m (26.21 m) |
| Operating weight (with kelly bar)<br>75.2 t |
| Transporting weight<br>63.5 t |
| Torque<br>235 kNm |

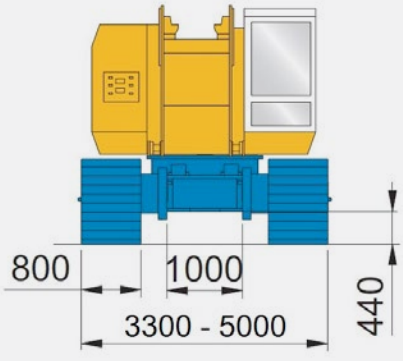


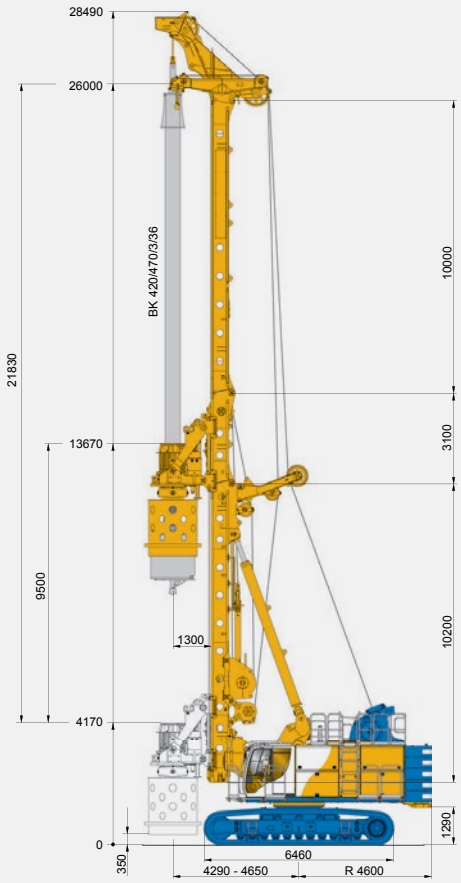
| Pile drilling rig Bauer BG 24 |
|---|
| Mast height (with extension)<br>23.89 m (30.91 m) |
| Operating weight (with kelly bar)<br>85 t |
| Transporting weight<br>64 t |
| Torque<br>276 kNm |



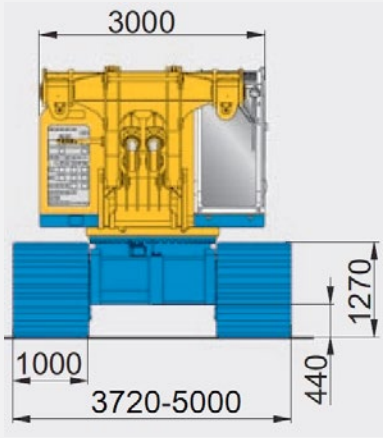



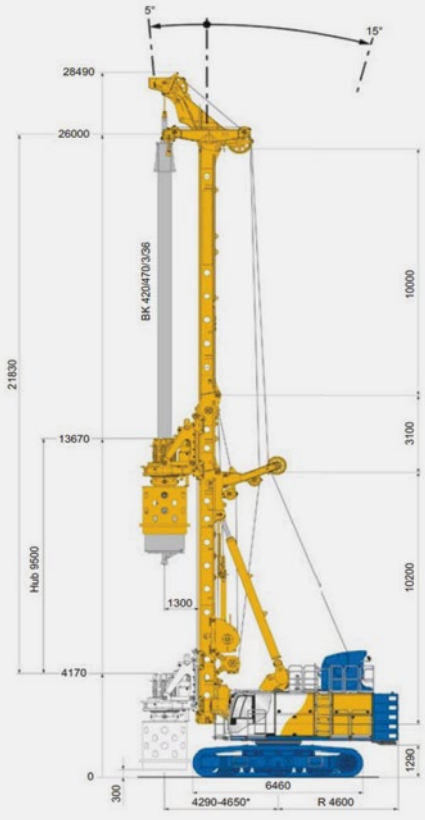

| Bauer BG 28 drilling rig for pile construction |
|---|
| Mast height (with extension)<br>25.39 m (33.96 m) |
| Operating weight (with kelly bar)<br>99 t |
| Transporting weight<br>84.4 t |
| Torque<br>294 kNm |



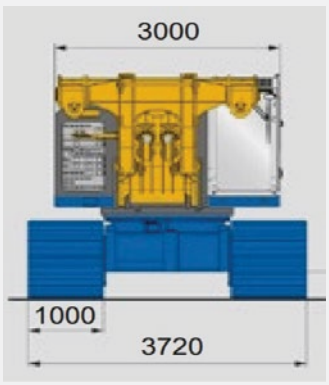




| Bauer BG 39 drilling rig for pile construction |
|---|
| Mast height (with extension)<br>28.49 m (48.53 m) |
| Operating weight (with kelly bar)<br>147 t |
| Transporting weight<br>89 t |
| Torque<br>389 kNm |



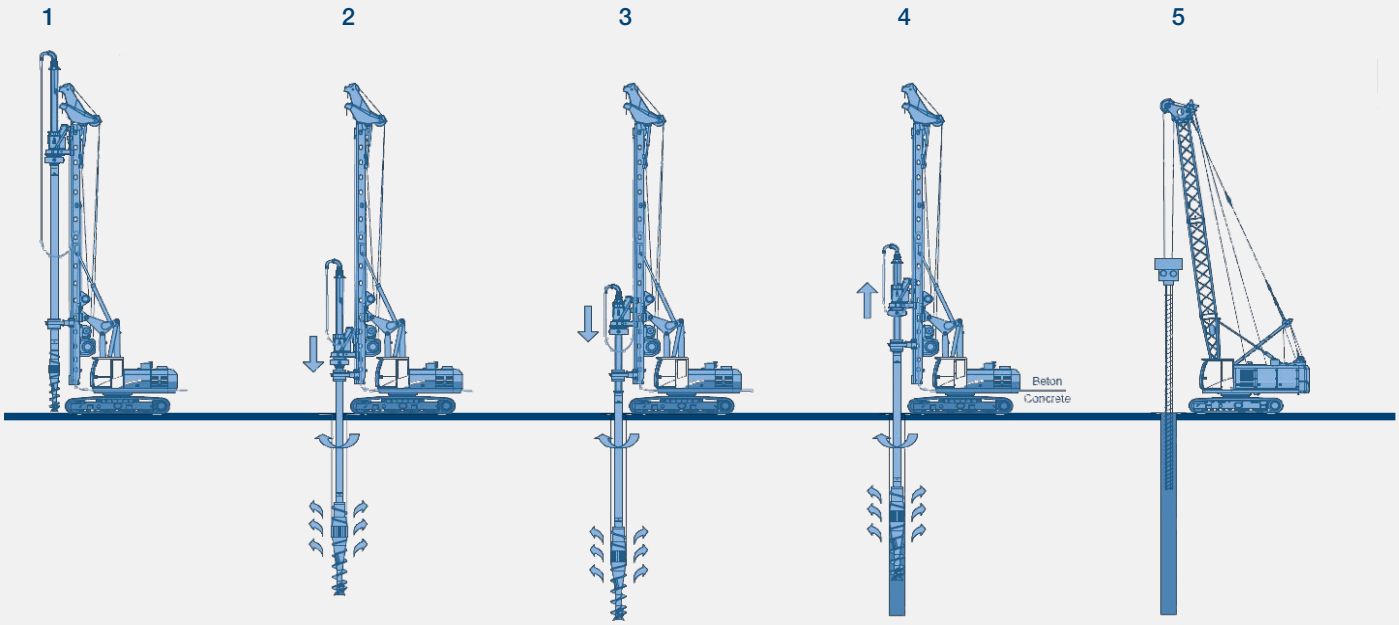

| Bauer BG 45 Premium line driling rig for pile construction |
|---|
| Mast height (with extension)<br>42.00 m (47.00 m) |
| Operating weight (with kelly bar)<br>150 t |
| Transporting weight<br>91 t |
| Torque<br>461 kNm |



**Advantages:**

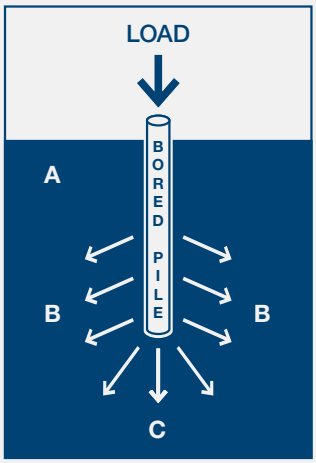
◆ the opportunity of piles construction without soil excavation ◆ recommended for use with soils that have cone resistance value qc lower than the nominal one - 10 MPa ◆ no vibration occurs during drilling ◆ high efficiency of pile construction ◆ The absence of excavated soil secures cleanliness of the site ◆ Minimal concrete consumption ◆ Increased bearing capacity of piles ◆ The opportunity to change the pile length during construction ◆ The piles are concreted under pressure from the bottom of the borehole ◆ Depending on the soil condition, the length of the used reinforced framework may reach up to 18 m

Construction of FDP Bored Piles
Diameter: 320 / 410 / 450 / 520 / 620 mm
Length: 40.2 m

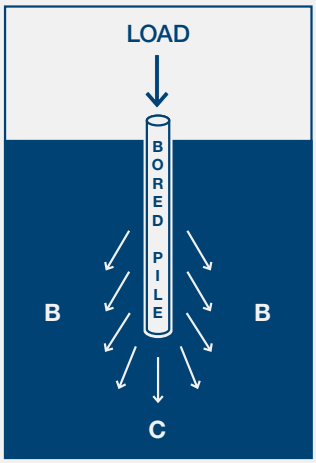



❶ Installation of a drilling machine onto a drilling position ❷ Drilling of the displacement tool into the ground by rotaring and pushing of the tool. The soil is loosened by the starter auger and then pushed laterally into the surrounding soil by the displacement body. ❸ The drilling depth depends on the mast length and on the bearing soil depth ❹ Concrete is pumped with a concrete pump under pressure from the borehole bottom ❺ Installation of reinforcement cage into the concrete. Vibration is used if necessary

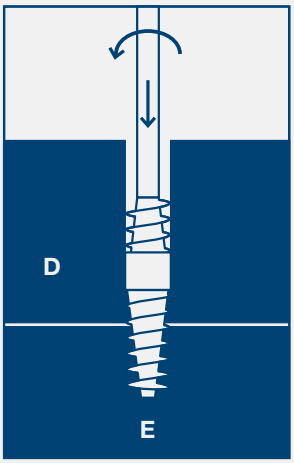
FDP pile work principle




Bored pile with no soil extraction




Bored pile with soil extraction




**A** Compacted soil
**B** Friction force
**C** Base resistance
**D** Displaceable soil
**E** Non-displaceable soil

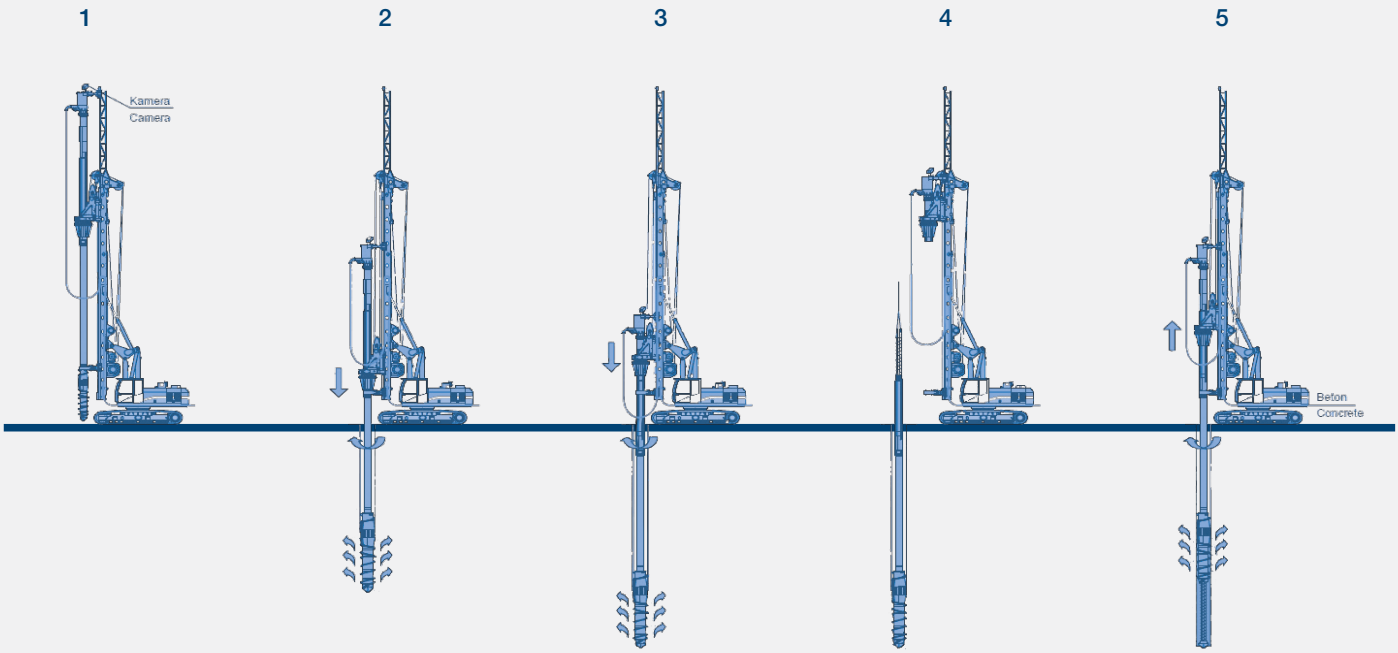
Non-displaceable soil:
➔ dense, very dense soil (sand, gravel and others)
➔ clayey soil
➔ rocky soil

# Construction of Bored piles according to the FDP (Full Displacement piles) technology “Lost bit”

**Advantages:**

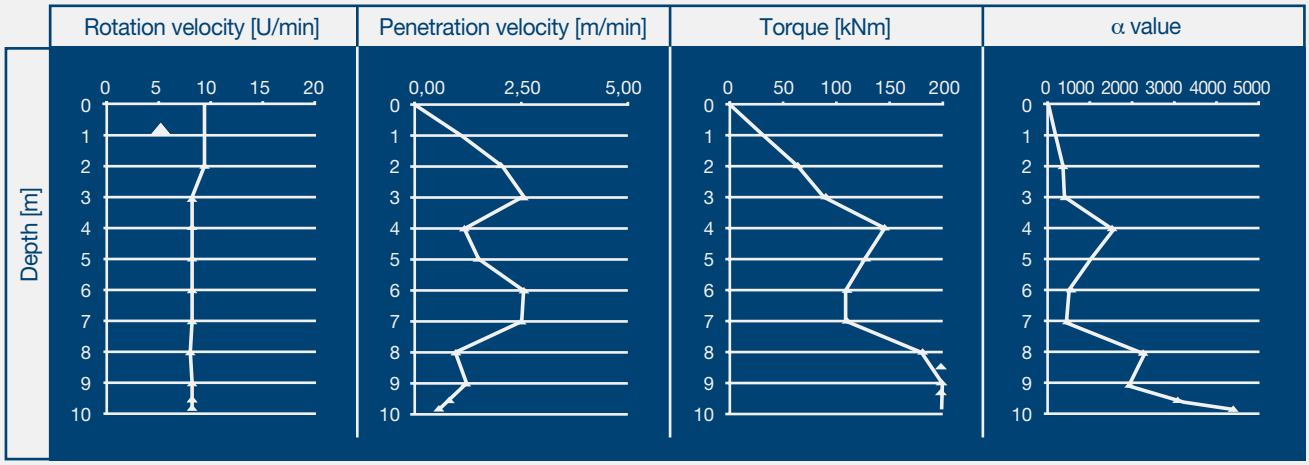
◆ the opportunity of pile construction without soil excavation ◆ recommended for use with soils that have cone resistance value qc lower than the nominal one - 10 MPa ◆ no vibration occurs during drilling ◆ high efficiency of pile construction ◆ Minimal concrete consumption ◆ Increased bearing capacity of piles ◆ the opportunity to use the reinforcement cage along the entire length of the pile ◆ The opportunity to change the pile length during construction ◆ The absence of excavated soil secures cleanliness of the site

FDP “Lost bit” Bored Pile construction
Diameter: 510 / 550 / 620 / 710 mm
Length: 40.2 m




❶ Installation of a drilling machine onto a drilling position and attaching removable shoe ❷ Drilling of the displacement tool into the ground by rotaring and pushing of the tool. The soil is loosened by the starter auger and then pushed laterally into the surrounding soil by the displacement body. ❸ To use Kelly extension makes it t possible to increase the drilling depth ❹ The reinforcement cage is inserting into the hollow drill stem. At the beginning of concreting the removable shoe remains at the borehole bottom ❺ Concreting is done through a hollow drill stem simultaneously lifted drilling tool at a steady speed.

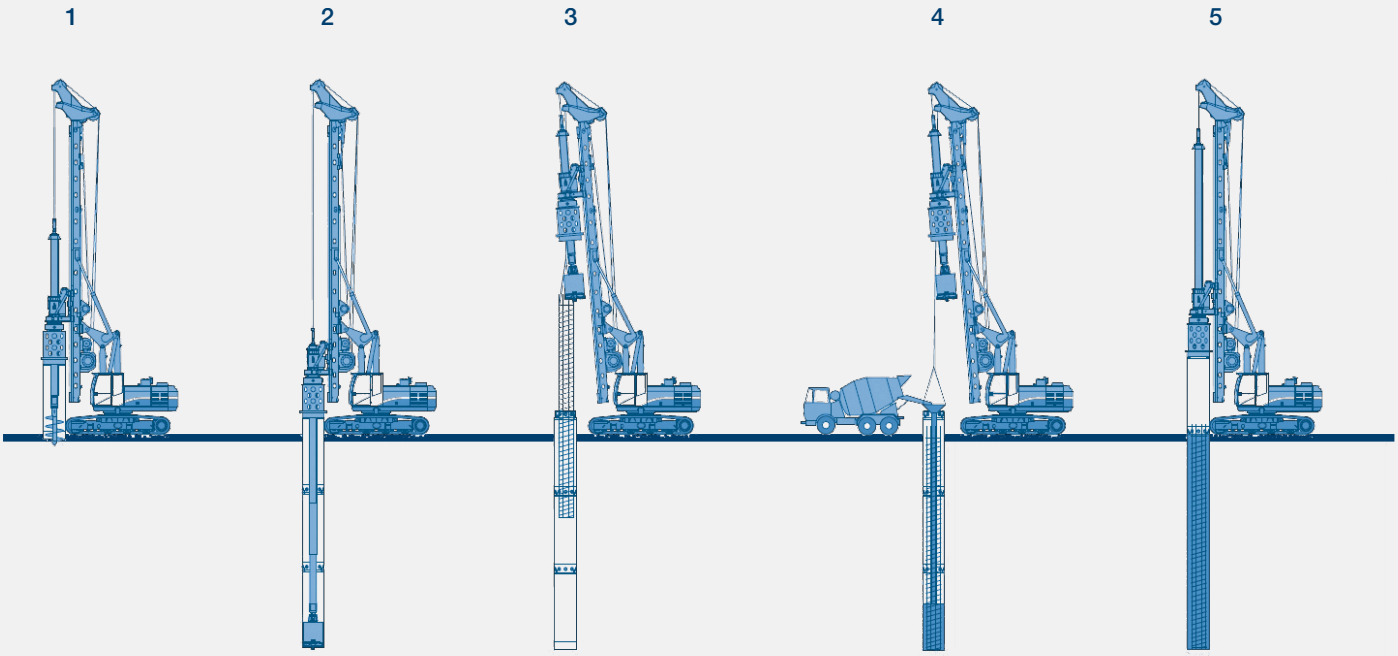
The FDP pile length is determined by relative value α, which is an indicator of the bearing capacity or density of soil (the α value is determined according to the initial data of the drilling rig).



**Advantages:**

◆ can be used in all soil conditions ◆ Opportunity to drill single piles and bored pile walls ◆ no vibration occurs during drilling ◆ due to the casing of the borehole walls are protected from collapsing and soil layers mixing ◆ Opportunity visual comparison extracted soil with project specified

Construction of Bored piles with the Kelly-Casing
Diameter: 620 / 750 / 880 / 1000 / 1180 / 1200 / 1300 / 1500 / 1800 / 2000 mm
Length: 96 m



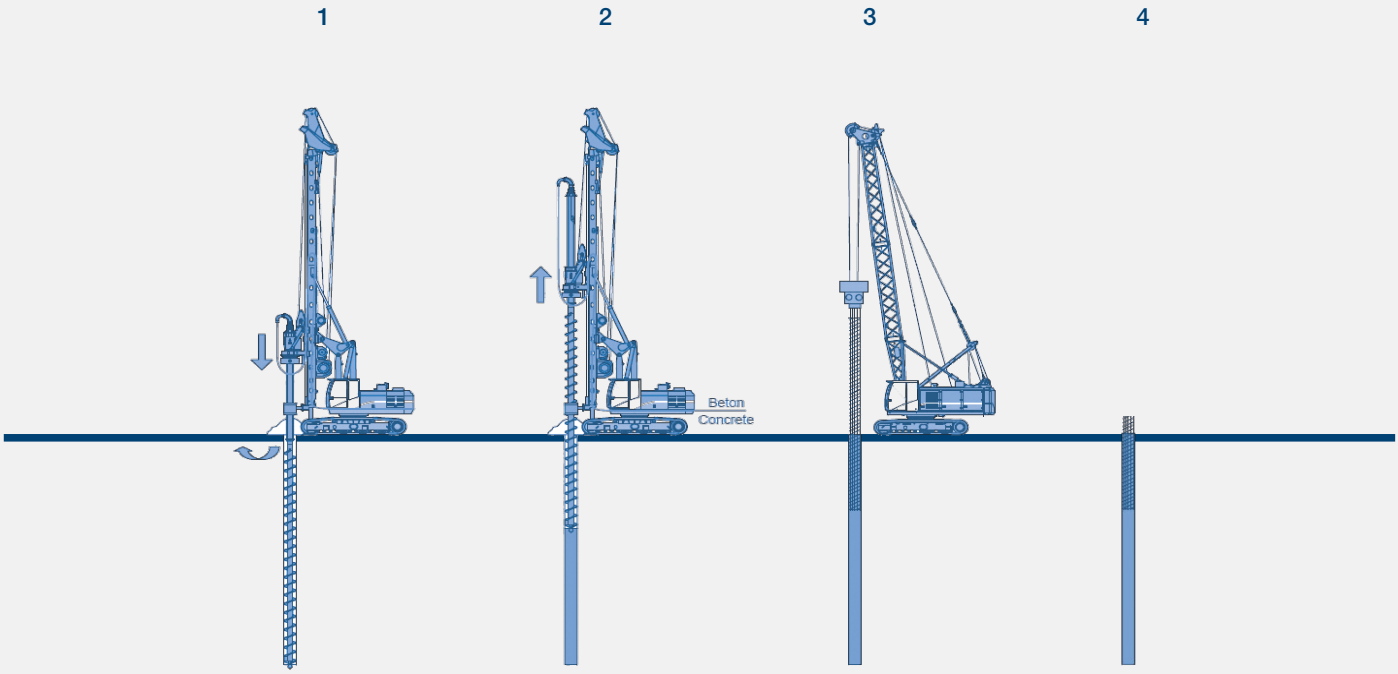

❶ Casing installation (pushing and rotating) ❷ Soil drilling by auger and drilling bucket. Stabilize the soil wall of the bore with casings. ❸ Install reinforcement cage into borehole with the auxiliary winch. ❹ Pile concreting through the tremie pipe ❺ Casings extraction during concreting

# Construction of Bored Piles according to the CFA (Continuous Flight auger) technology

**Advantages:**

◆ can be used practically in any kind of soil ◆ high efficiency of pile construction ◆ no vibration occurs during drilling ◆ The piles are concreted under pressure from the bottom of the borehole ◆ Depending on the soil condition, the length of the used reinforced cage may reach up to 18 m

Continuous flight auger (CFA) pile construction
Diameter: 450 / 550 / 600 / 750 / 880 / 1000 / 1200 mm
Length: 31 m

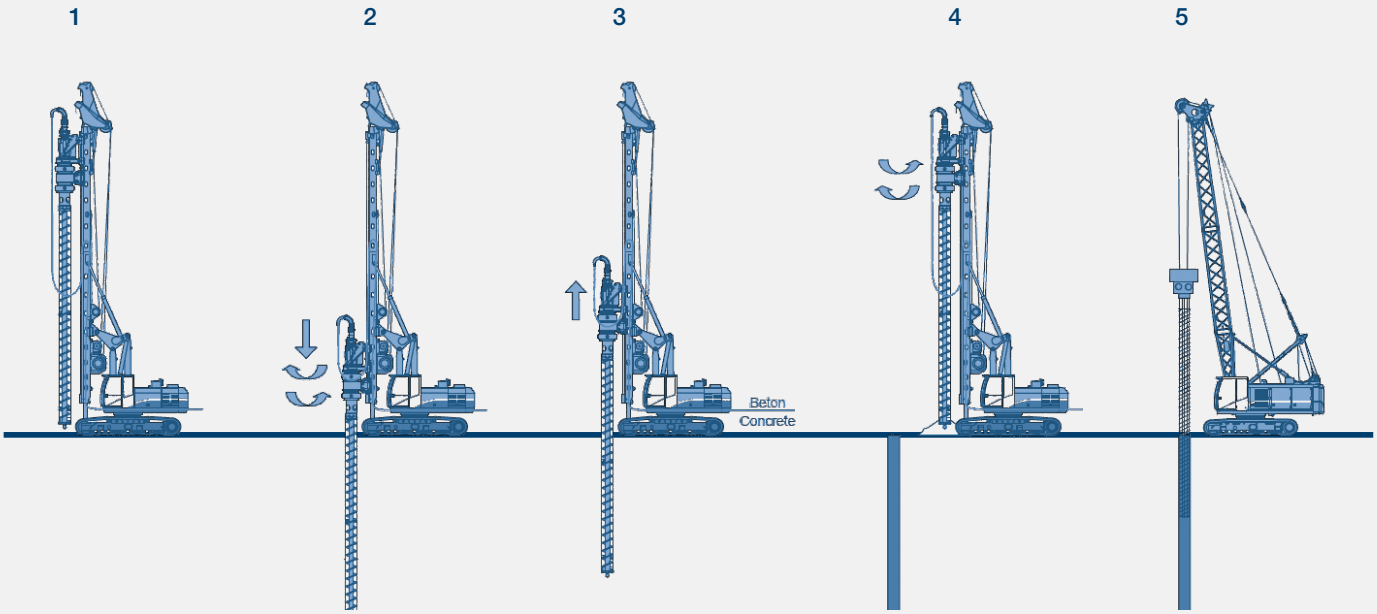



❶ Drilling with CFA auger to the requried depth ❷ Concreting from the borehole bottom ❸ Install reinforcement cage into the concrete. Vibration is used as necessary ❹ Pile completed

**Advantages:**

◆ can be used practically in any kind of soil ◆ Due to the casing the borehole walls are protected from collapse and soil layer mixing ◆ no vibration occurs during drilling ◆ high efficiency of pile construction ◆ the opportunity to drill in hard-to-reach places ◆ Opportunity to drill single piles and bored pile walls ◆ The piles are concreted under pressure from the bottom of the borehole

Construction of Bored piles and support bored pile walls according to the CCFA technology
Diameter: 420 / 510 / 620 / 710 / 750 / 880 / 1000 mm
Length: 25 m




❶ Installation of a drilling machine onto a drilling site ❷ Drilling with a screw auger with the presence of a casing down to the required depth ❸ Concreting from the borehole bottom ❹ The drilling screw is released from the soil, and the drilling spot is filled with concrete ❺ Installation of reinforced framework into the concrete. Vibration is used as necessary

**Kinds of bored pile wall construction**

Primary and secondary piles are reinforced

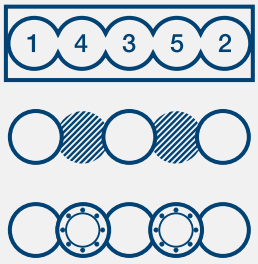
**Types of bored pile wall construction**

Contiguous pile wall

Secant pile wall

Two-stage pile wall

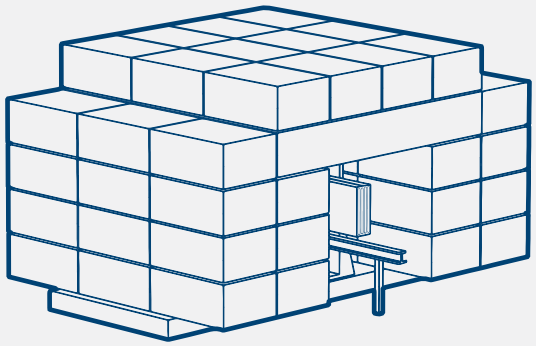
**The sequence of pile construction in a bored pile wall**



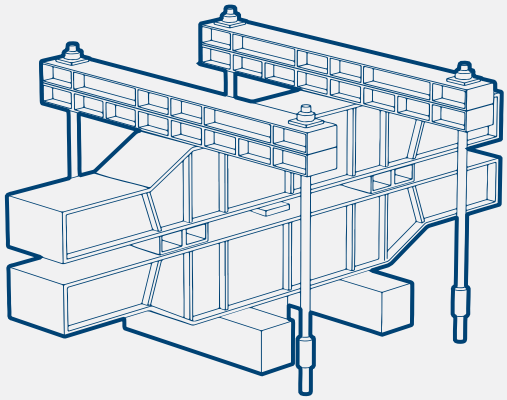
# Pile testing methods

1. Static testing - bearing capacity check of the pile. The static pile testing may be conducted:

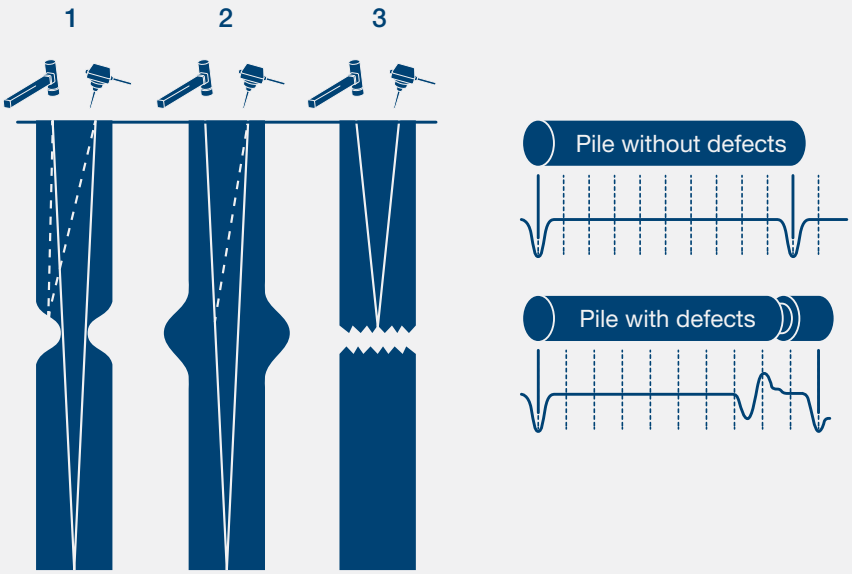
**A** using reinforced concrete blocks



**B** Using additionally arranged anchor piles



2. The Pile Integrity Test - PIT - this method enables to detect the defects of single piles (ruptures, broadenings, narrowings, hollows resulting from the effect of soil, holes) and to determine the pile length.




Ultrasonic pile inspection

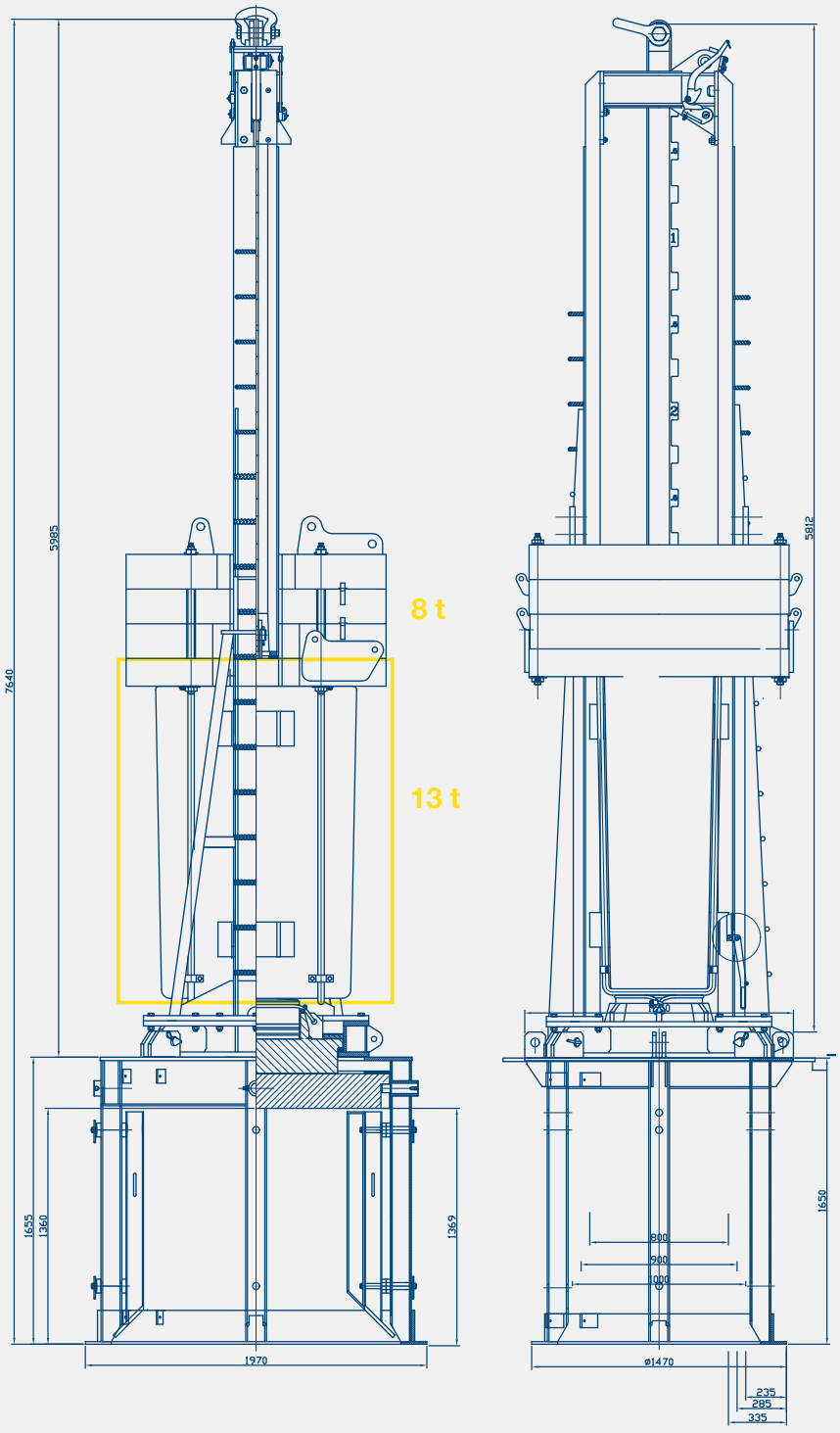
**1** **2** Broadening **3** Rupture Hammer Receiver

Maximal possible lengths of arranged Bored piles, m

| Pile type / Ø, mm | 320 | 410 | 420 | 450 | 510 | 520 | 550 | 600 | 620 | 710 | 750 | 880 | 1000 | 1180 | 1200 | 1300 | 1500 | 1800 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CCFA | | | 22,9 | | 22,9 | | | | 22,9 | | | | 22,9 | | | | | | |
| Kelly-Casing | | | | | | | | | 96,0 | | 96,0 | | | | | | | | |
| CFA | 14 | | | 31,0 | | | 31,0 | | | | 31,0 | | | | 31,0 | | | | |
| FDP | | 40,2 | | 40,2 | | 40,2 | | | 40,2 | | | | | | | | | | |
| FDP-“Lost bit” | | | | | 40,2 | | 40,2 | | 40,2 | | | | | | | | | | |

3. **The dynamic test (DLT)** allows to determine the piles foundation and side surfaces bearing capacity, to evaluate the piles integrity as well as their subsidence. The measurements are analyzed in real time using special software. One of the test results is a simulation of the static test in a form a calculated load-test curve.

The test is performed with manufactured by Slovenian company **SLP d.o.o.** a free-fall hammer, which we have owned since 2021.

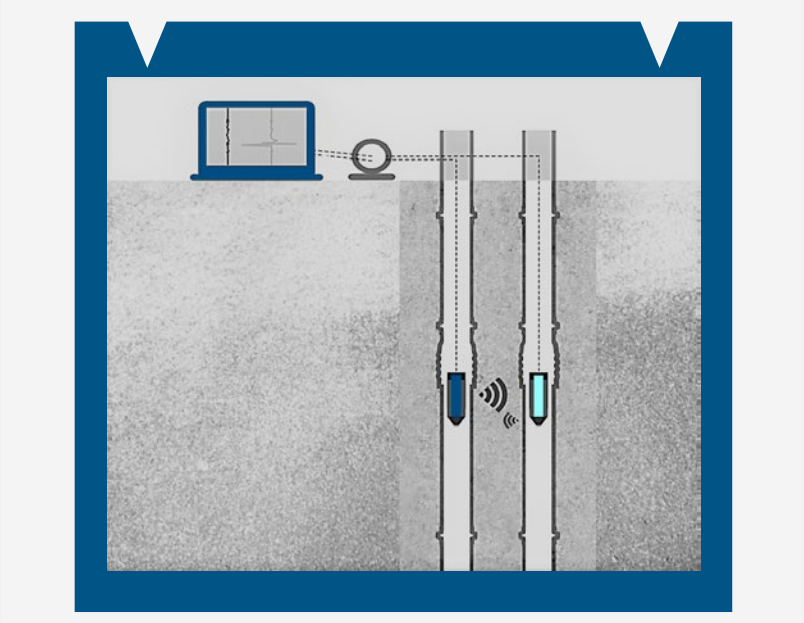



**Adapter for piles**

∅ = 0,6 m–1,5 m

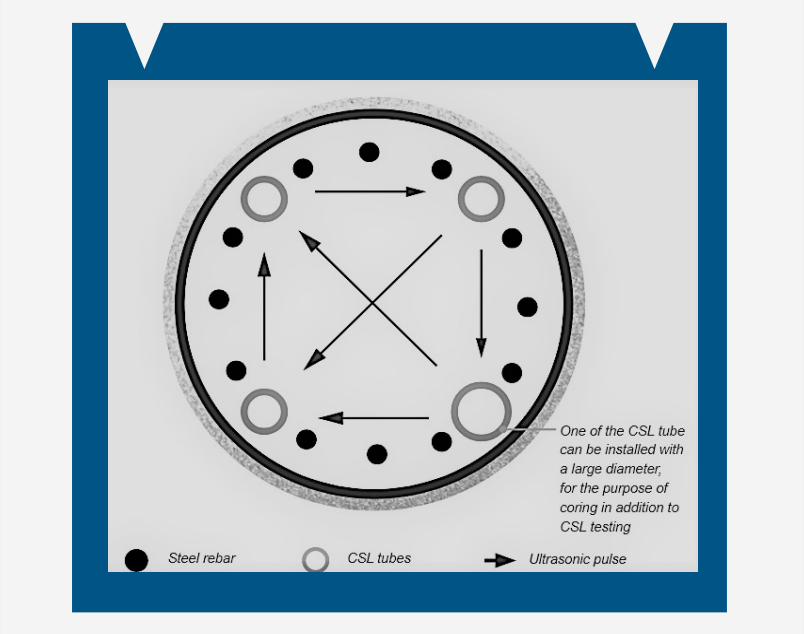
4. Crosshole Sonic Logging (CSL) is an accurate method to determine the structural integrity and homogenity of concrete within diaphragm walls, boredpiles, drilled shafts, barretes, concrete piles or augercast piles.

- Widely used for more then 30 years.
- Practical and economical for deep foundation integrity testing.



Method

The speed of sound wave propagation in concrete is dependent on the concrete material properties. Thus, the CSL measures the propagation time and relative energy of an ultrasonic pulse between an ultrasonic transmitter and receiver in two parallel water - filled tubes installed at a specific spacing within the deep foundation element during construction. The transmitter and receiver ultrasonic probes are lowered and lifted in unison in their respective water filled tubes to test the full shaft length from top to bottom.



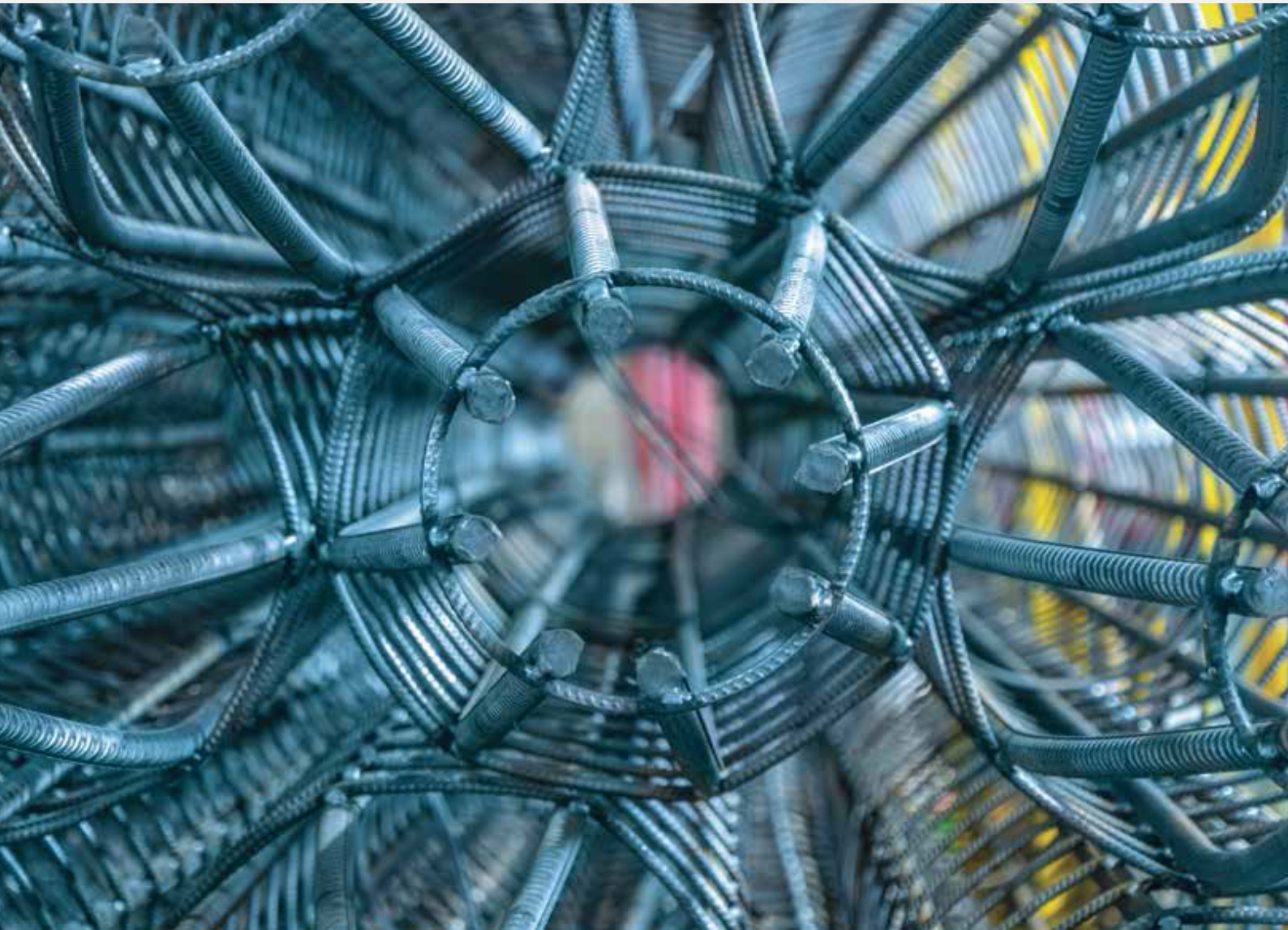

Typical tube configuration for pile (diameter 1000 to 1400 mm)

TILTS is rightly proud of the results it has achieved. Over the years the company has built more than 1,000 different projects in Latvia, Lithuania and Estonia.

Many of which have become major urban attractions:

- the pedestrian bridge and promenade in Jelgava,
- the Southern Bridge and the Eastern Highway in Riga,
- Vabaduse Bridge in Tartu,
- bridges in Carnikava, Bauska, Daugavpils, Tallin, Vilnius, Klaipeda and Narva,
- Ziedoņdārzs and Grīziņkalns park reconstructions in Riga.

Over a period of thirty years, by undertaking increasingly sophisticated projects, the employees and engineers of the company have gained unique experience that strengthens the company's competitiveness and future development in the long run.



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CIVIL ENGINEERING
& MANUFACTURING

**CONSTRUCTION OF BORED PILES**

Cell: + 371 28361116, + 371 26258173, email: piling@tilts.lv

Ltd “TILTS” Spilves street 18, Riga, LV 1055, LATVIJA
+ 371 67467919, info@tilts.lv, www.tilts.lv