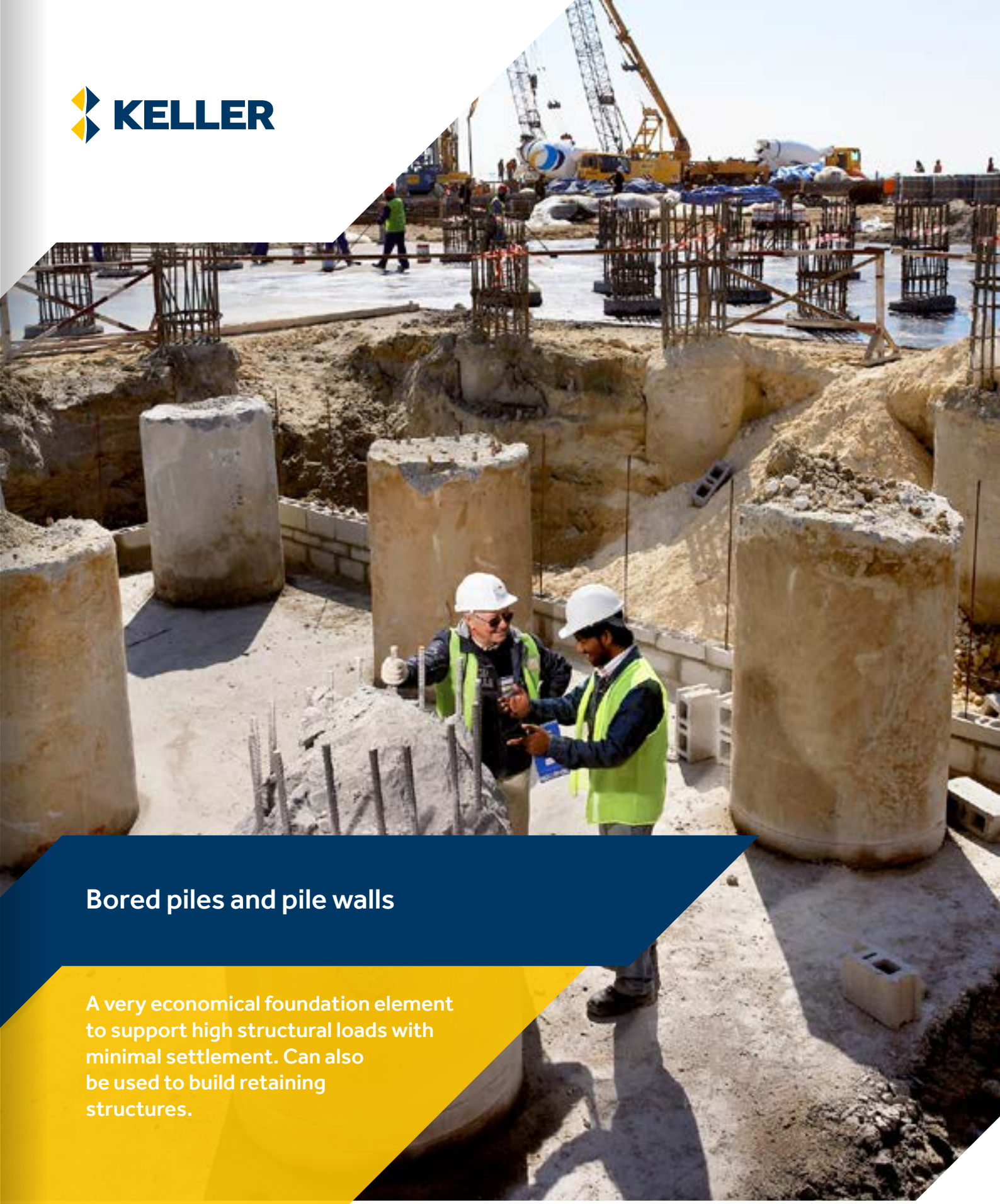
KELLER



Bored piles and pile walls

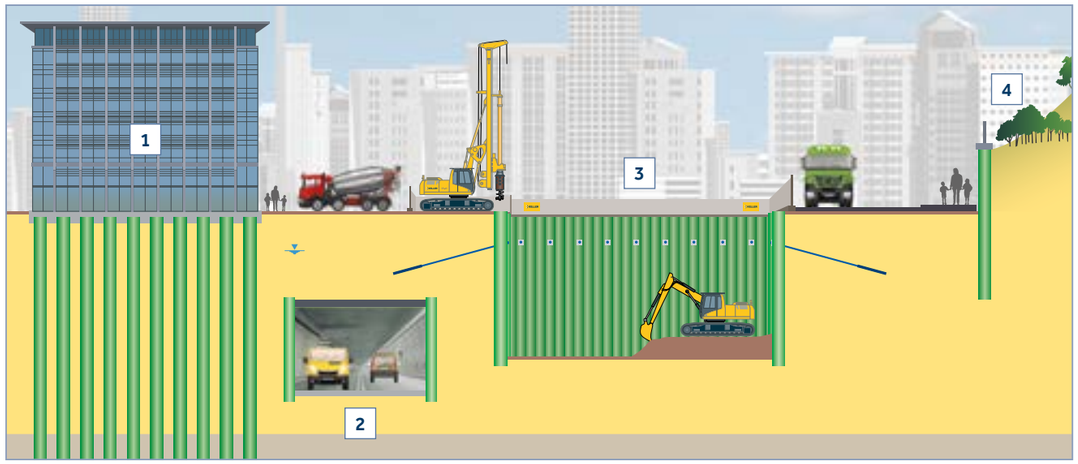
A very economical foundation element to support high structural loads with minimal settlement. Can also be used to build retaining structures.

Applications

Bored piles are a very effective, state-of-the-art construction element with many applications in foundation and civil engineering. They can be used as heavy foundations, securing deep excavations especially close to existing buildings as well as stabilising and retaining slopes.

Thanks to the variety of construction methods and the large range of diameters and tools, bored piles can transfer foundation loads through a variety of overburden soil to stronger underlying bedrock stratums.

Casing installation and concreting



1. Foundations
Large diameter bored piles are extremely effective in transferring and withstanding high loads.

2. Infrastructure
Large bored piles can be used in a variety of infrastructure projects such as tunnelling, road or bridge construction as well as flood protection.

3. Excavation pits
Bored piles are an approved method to retain ground alongside an excavation pit or close to adjacent buildings and are often combined with other techniques such as ground anchors or soil nails.

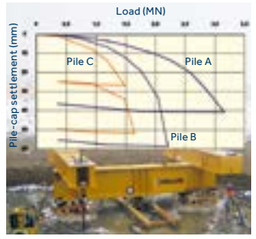
4. Slope stabilisation
Large diameter bored piles are used to prevent landslides or protect existing buildings.

Technical highlights

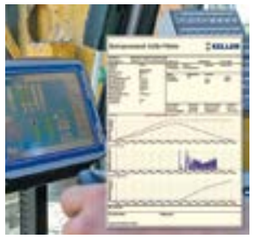
- Can support high loads
- Piles with various diameters of 450 mm to 1,800 mm
- Can ensure minimal settlement and deformation
- Minimum amount of vibration
- Quality assurance according to European Standard EN 1536

Quality assurance

Large diameter bored piles usually have to withstand high loads, and we therefore use a variety of quality-assurance methods for our products.



Common top down and bottom bi-directional pile load tests

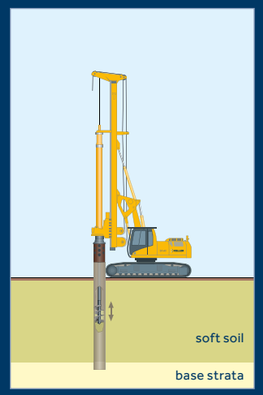


Digital recording and logging of the execution parameters

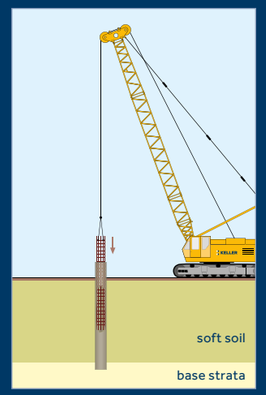
Integrity testing

Bored piles – process description

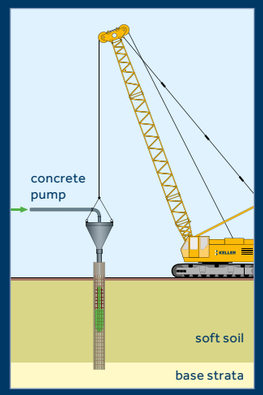
1. Installation of casing and drilling out soil by use of specialised tools
2. Installation of reinforcement cages
3. Pouring concrete
4. Withdrawal of casing



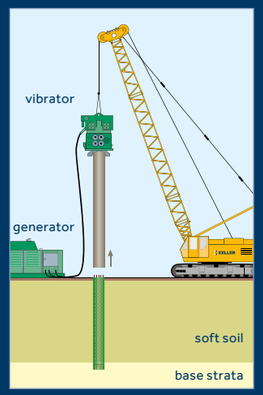
Installation of casing and drilling



Installation of reinforcement



Concreting



Withdrawal of casing

Pile walls

Several bored piles arranged in a line can form a pile wall

Purpose of bored pile walls:

- retaining system for excavation pits, tunnels and large diameter shafts,
- abutment walls for bridges or
- slope protection systems

Pile walls used as retaining structures are often supported by rows of anchors or steel strutting systems.

Types of pile walls

Pile walls are classified into three different types:

- Secant pile wall
- Tangent pile wall
- Contiguous pile wall with timber lagging, shotcrete infill or jet-grout curtain

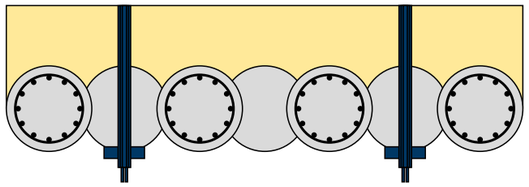
Secant pile walls

Advantages:

- Very little deformation and settlement on the outside
- Can carry high loads from surrounding structures
- Less vibration during construction
- Can be used as part of a permanent structure
- Water tightness

Secant pile walls require a reinforced concrete guide wall to ensure the correct location and alignment of the pile (x and y direction) and temporary casing to ensure required verticality (z direction).

A secant pile wall consists of several piles over-cutting each other to ensure a force-locked connection and the required water tightness.

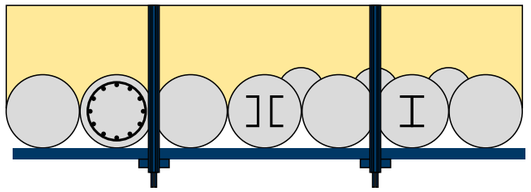


The piles are classified into primary piles and secondary piles. At the beginning several primary piles are constructed by using lower strength concrete only (without reinforcement). When secondary piles are constructed they overcut into the adjacent primary piles. Secondary piles are constructed with shaft reinforcement and higher strength concrete.

Tangent pile walls

Advantages:

- Little deformation and settlements on the outside
- Can carry load from surrounding structures
- Less vibration during construction



Tangent pile walls consist of reinforced and non-reinforced piles. The reinforcement can be provided by installing reinforcement cages, steel channel sections, I-beams or H-beams.

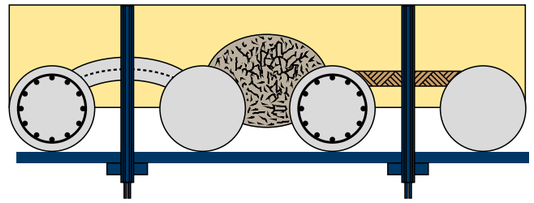
Tangent pile walls retained by anchors or strutting systems are often supported by a waler beam to distribute the loads (prevent punching of anchor/strut through the pile) and as a mitigation measure for the unlikely event of an anchor/strut not carrying the load. Such a waler beam can be constructed as a reinforced concrete beam casted towards the pile wall or by using steel profiles to be fixed to the piles and anchors/strutting systems.

To ensure water tightness injection grouting can be performed along the outside of the joint of two adjacent piles.

Contiguous pile walls

Advantages:

- Can take limited load from surrounding structures
- Less vibration during construction



Contiguous pile walls consist of piles arranged in a way that a gap remains between them. The soil between the piles can be stabilised during excavation by either installing timber lagging in front of the excavated soil or by building a reinforced shotcrete wall towards the excavated soil surface. Alternatively injection grouting can be carried out in advance of the excavation to solidify the soil between the piles.

Contiguous pile walls retained by anchors or strutting systems are often supported by a waler beam to distribute the loads (prevent punching of anchor/strut through the infill) and as a mitigation measure for the unlikely event of an anchor/strut not carrying the load. Such a waler beam can be constructed as a reinforced concrete beam casted towards the pile wall or by using steel profiles to be fixed to the piles and anchors/strutting systems.

Muharraq Sewage Treatment Plant in Bahrain

In 2014, the Muharraq Sewage Treatment Plant, located on reclaimed land in Bahrain, became fully operational. The site covers an area of about 150.000 m^2 and has a treatment capacity of 100.000 m^3/day. Keller's bored pile technology was able to solve some extremely difficult and challenging soil conditions. The scope of our work comprised of six large diameter shafts varying from 12 to 18.5 metres and 54 secant piles per shaft installed with approximately 810m^3 of concrete.

Keller Group Plc

Geotechnical solutions specialist
www.keller.com

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