

BAUER

Bored Piles



BAUER Bored Piles

are adapted precisely to your requirements and constructed to a consistently high quality.



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In earlier times the location of a new building was highly depended on the foundation soil being suitable. Today unfavorable subsoil conditions or buildings adjacent to the plot of land no longer represent an obstacle. A range of different drilling methods and equipment ensure that an optimal solution can be found for any area of application. The increasing urbanization of today's world demands a high level of planning

creativity and extensive experience for the construction of new buildings or the remodeling of existing ones. BAUER Spezialtiefbau GmbH is your reliable partner when it comes to planning and performing specialist foundation works to an extremely high standard. Let's build the future together because we have the passion for progress.

Pile Boring Technology at Bauer



1920 The first Benoto pile drilling rig is employed, a technique that is used until the 1970s

1976 First heavy-duty rotary drilling rig BAUER BG 7

1981 Bauer launches the continuous flight auger pile on the market and in doing so introduces a highly productive method for pile construction

1993 In China, Bauer drilling rigs are used to bore piles with a diameter of 3,000 mm and depths down to 65 m

1995 With the aid of roller bit core barrels, Bauer drilling rigs manage to socket piles with a diameter of 1,200 mm into extremely strong rock

2005 In Dubai, the foundations of the Burj Khalifa, which opened in 2010 and is the world's tallest building, are constructed using 850 piles down to a depth of 50 m

2011 Installation of a 23 m deep offshore monopile with a diameter of 2 m at a submerged depth of 37 m for a tidal energy turbine

2012 Construction of the biggest pile diameter to this date of 3,500 mm for the Market Street Tower Development in Singapore

2013 The foundations for what will be the world's next tallest building, the Jeddah Tower in Saudi Arabia, are built using 270 piles, of which 72 are in the center, down to a drilling depth of 110 m

2013 The foundations for Europe's future highest building, the Lakhta Tower in St. Petersburg, are constructed using 262 piles down to a depth of 84 m

2017 Construction of 20,000 lin.m of secant bored pile wall down to a depth of 25 m for remediation works of the old Kesslergrube landfill site in Grenzach-Wyhlen, Germany

2018 Foundation works for the One Bangkok building complex in Thailand using 700 bored piles drilled down to a depth of 80 m

2019 Foundation works for the KLCC Lot L, M & N in Malaysia using piles up to 150 m long





Areas of Application

Bored piles are cylindrical elements of concrete (with or without reinforcement) that are installed into the ground using various methods. They transfer high structural loads to lower, load bearing

soil layers. Arranged in a row or overlapping, bored piles form a supporting wall for an excavation pit or an embankment and seal off groundwater where necessary. The length, diameter, mate-

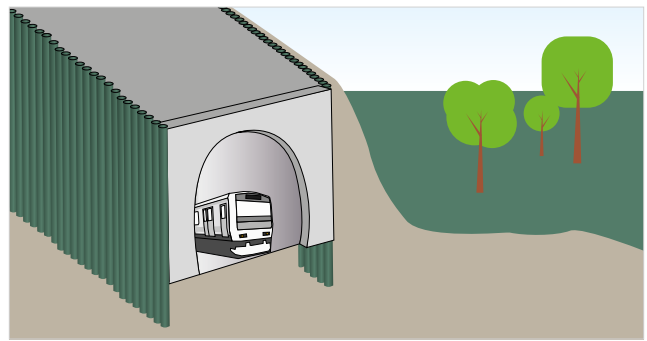
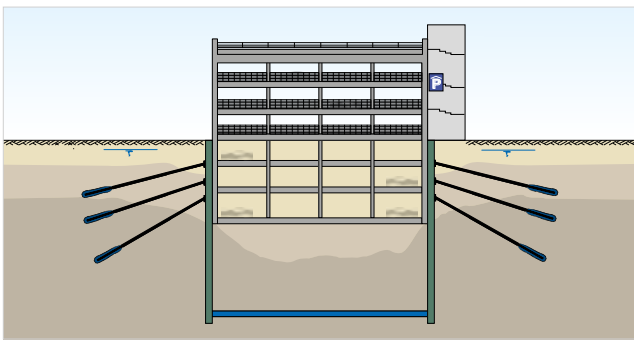
rial, configuration and arrangement of the piles can be modified according to the intended use.

Retaining- and Cut-off Walls

Bored pile walls serve a structural and/or sealing function and can be used both as a cut-off wall for an embankment or excavation pit or to stabilize or encapsulate construction structures.

Secant bored pile walls are produced using the pilgrim step method in which the so-called primary piles – so every other pile – are constructed first, followed by the secondary piles intersecting

in-between the primary piles. The product is forming a continuous, rigid and water-resistant bored pile wall.

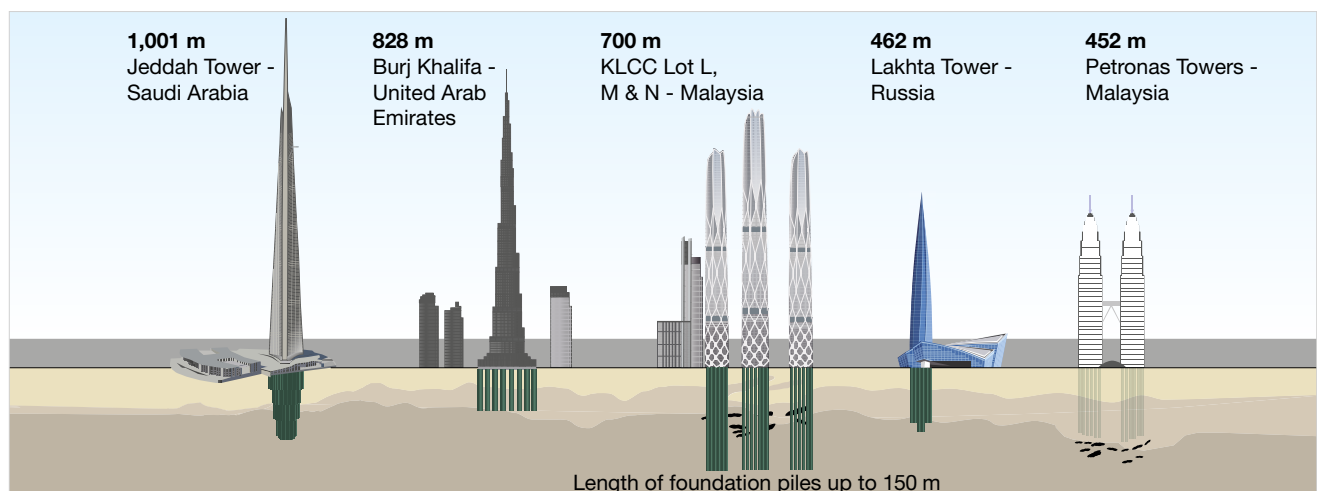


Foundation Works

In tendency the loads of modern structures are becoming higher nowadays, and these structures are increasingly being built having unfavorable subsoil conditions with low load bearing capacity. Pile foundations down to considerable depths allow even high loads to be reliably transferred into competent subsoil formations. Bauer Spezial-

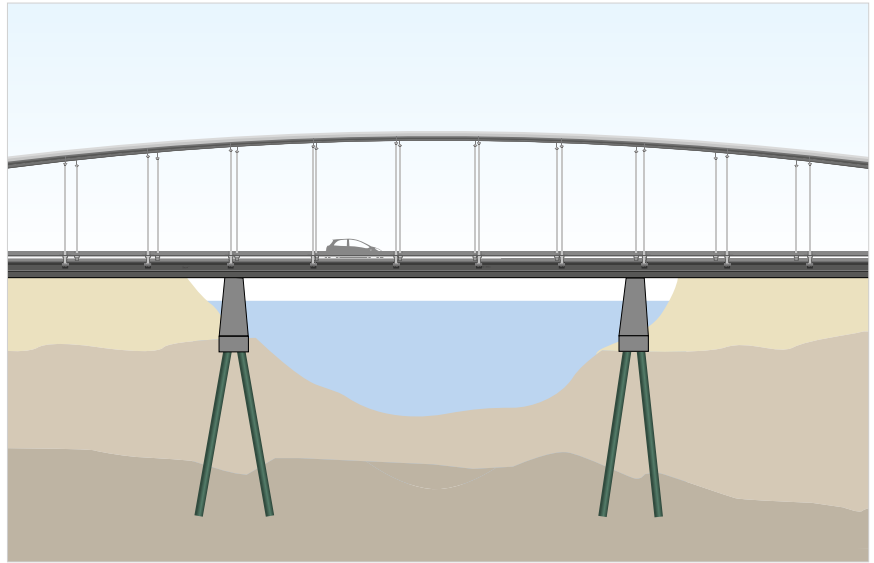
tiefbau constructs bored piles down to depths well over 100 m and with diameters much larger than 2 m – including base and skin grouting or bell-outs if necessary. Diaphragm wall panels, Mixed-in-Place elements or grouting underground cavities and weathering zones by injections and fillings offer further options for

dissipating structural loads. In addition, foundation piles can be thermally activated. As the geothermal energy lines are supported in a reinforcement cage, these energy piles represent an economical and efficient way of tapping geothermal energy.



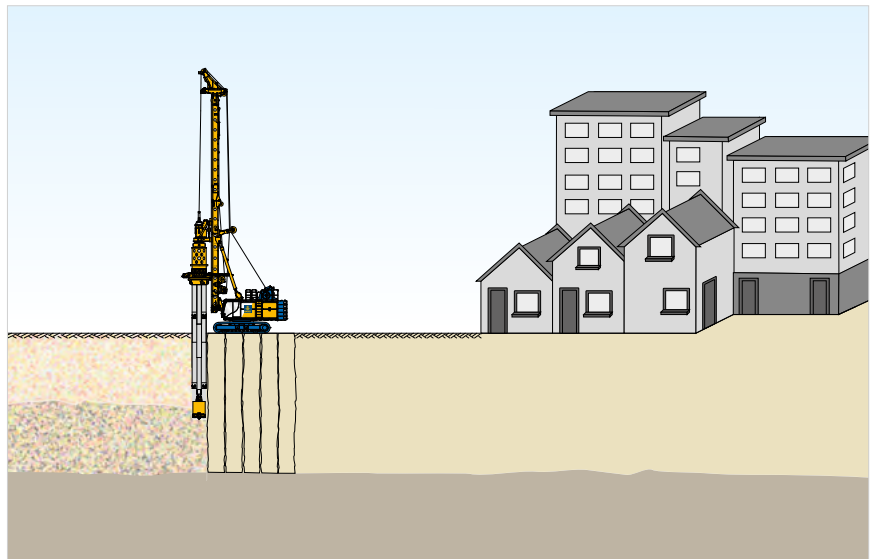
Offshore Bridge Foundation Works

Infrastructure projects nowadays call for increasingly complex specialist foundation engineering solutions. This also applies to bridge foundations. Ever longer bridges and greater span widths mean that more and more foundation works have to be carried out in water on pontoons or barges. Bauer Spezialtiefbau also offers optimal solutions for all requirements in the field of offshore bridge foundations.



Replacement Boring

To meet the increasing demand for building plots, more and more former industrial sites are being used for new construction projects. However, the soil of such sites is often contaminated. Bauer Spezialtiefbau has a vast array of methods up its sleeve to remove and properly dispose of and remediate contaminated soil and replace it with clean material.



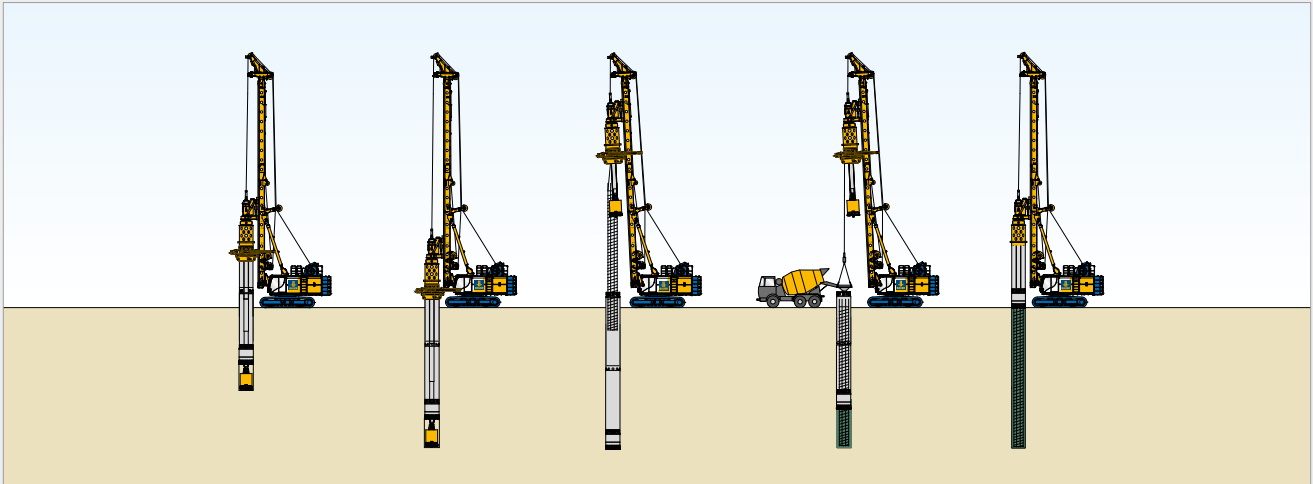
Methods

Kelly Pile – Cased and Partially Cased Drilling

Cased and partially cased drilling is performed using the Kelly drilling method. The drilling tool is attached to a telescopic Kelly bar and the soil

is gradually removed from within the casing whilst the drill casing is continuously twisted into the subsoil until the final depth is reached. The rein-

forcement cage is then installed and the drill casings are removed during the concreting process.



Lichtenfels, Germany

Two BG 39 drilling rigs were used to construct 486 nos foundation piles for the construction of a production hall, powerhouse and administration building in Lichtenfels. Over a period of four months, a total of more than 3,300 lin.m bored piles were constructed using the Kelly drilling method in addition to 4,000 lin.m piles using the CFA method.

Lakhta Tower, St. Petersburg, Russia

In St. Petersburg, Bauer installed the foundations for Europe's highest building – the Lakhta Tower. 264 nos partially cased piles with a diameter of 2,000 mm were built down to 82 m depth using the Kelly method, with four BAUER BG 40 and BG 28 drilling rigs. With the aid of a special underreaming drilling tool, the nominal diameter of the piles could also be achieved underneath the casing in the uncased part of the pile.

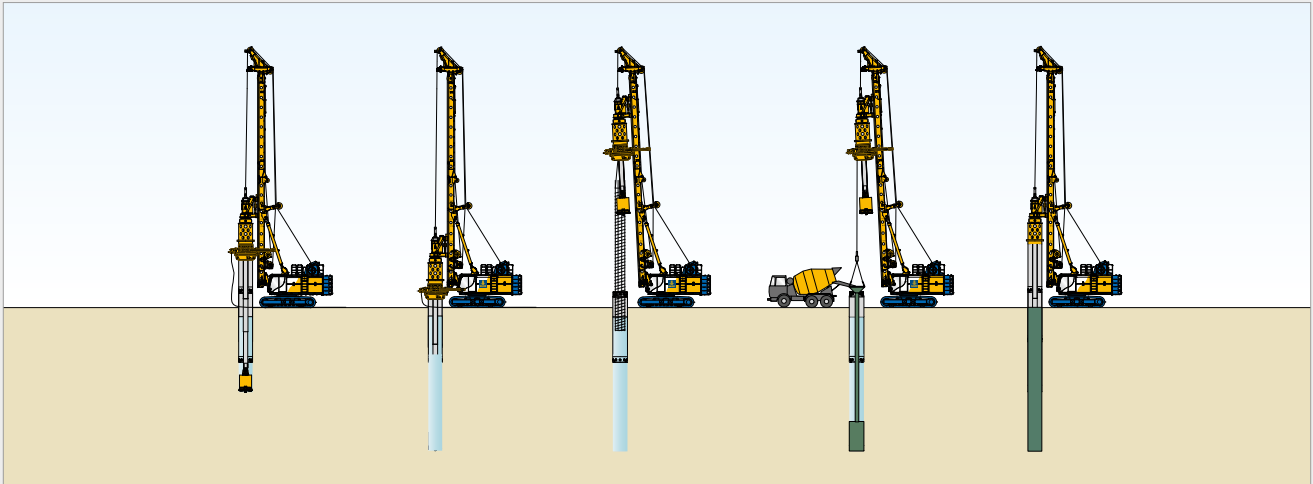


Kelly Pile – Slurry Supported Drilling

The Kelly method is also used to create slurry-supported bores, where a bentonite- or polymer slurry is preventing the borehole from collapsing.

The slurry is balancing out the earth pressure exerted on the openly excavated borehole. After installing the reinforcement cage, the concrete is

casted from bottom upwards via a tremie pipe. During the concreting process, the slurry is replaced and suctioned off.



Champlain Bridge, Montreal, Canada

The Champlain Bridge over the St. Lawrence River in Montreal had to be reconstructed due to considerable wear and corrosion damage. Bauer constructed 200 nos foundation piles with diameters of 1,300 and 2,000 mm, of which 10 piles were realized from barges offshore on the St. Lawrence River.



Jeddah Tower, Jeddah, Saudi Arabia

What will become the world's tallest building, the Jeddah Tower, is under construction in Saudi Arabia. Bauer built the foundations of the large-scale project, installing a total of 270 nos piles with diameters of 1,500 and 1,800 mm down to a depth of 109 m. The specific challenge of this project consisted in developing and manufacturing the world's longest Kelly bar to that date – a fivefold Kelly bar measuring 110 m in length.

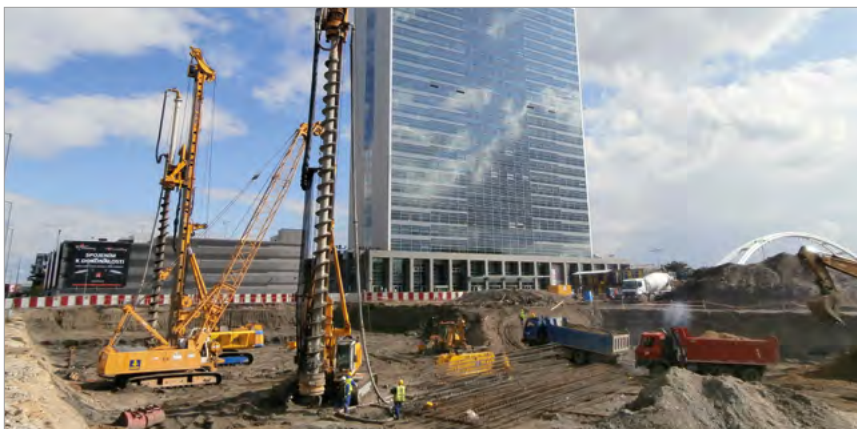
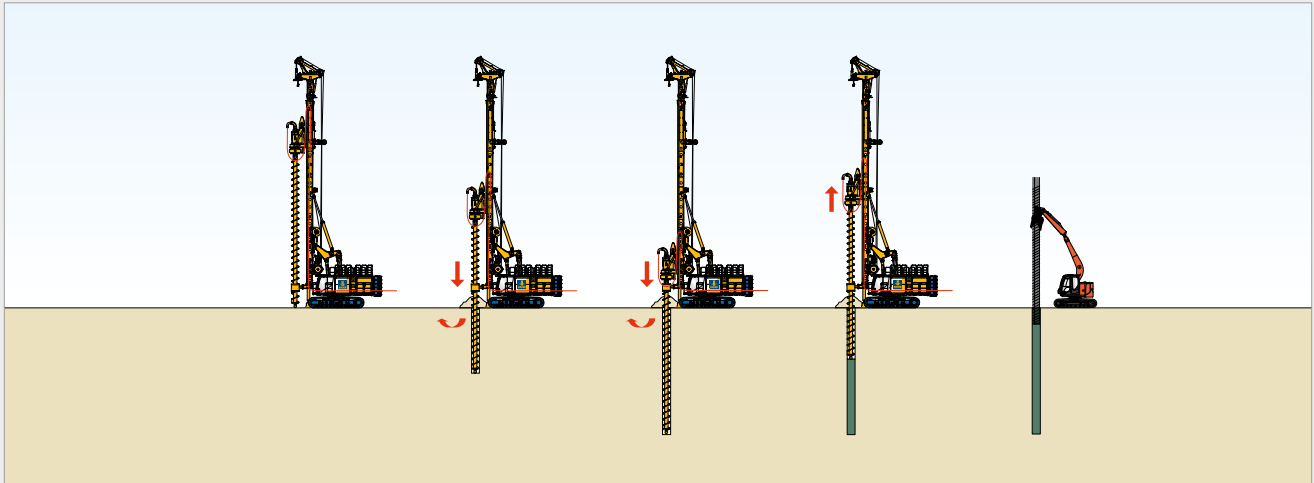
© Jeddah Economic Company (JEC)

Continuous Flight Auger Pile (CFA Pile)

The continuous flight auger method (CFA) is a high-performance rotary drilling technique. In this process, a continuous flight auger is drilled down

to final pile depth. Concrete is then pumped through the hollow stem of the CFA auger string while the auger is withdrawn. Subsequently the rein-

forcement cage is installed in the fresh concrete.



Panorama City, Bratislava, Slovakia
For the Panorama City project in Bratislava, 360 nos CFA piles were constructed using one BG 28 and one BG 40. The piles for the two 107 m tall buildings were installed to a depth of up to 27 m and completed within four weeks only.

Berlin-Marzahn cogeneration plant, Berlin, Germany

In the Marzahn district of Berlin, Bauer carried out the pile foundation works for a new gas and steam turbine cogeneration plant. Over an area of around 30,000 m², a total of 930 nos CFA bored piles were constructed down to a depth of 20 m. The works were executed using one BG 30 and one BG 28 drilling rig. The project's tight construction schedule and the client's extremely strict safety requirements posed a particular challenge.

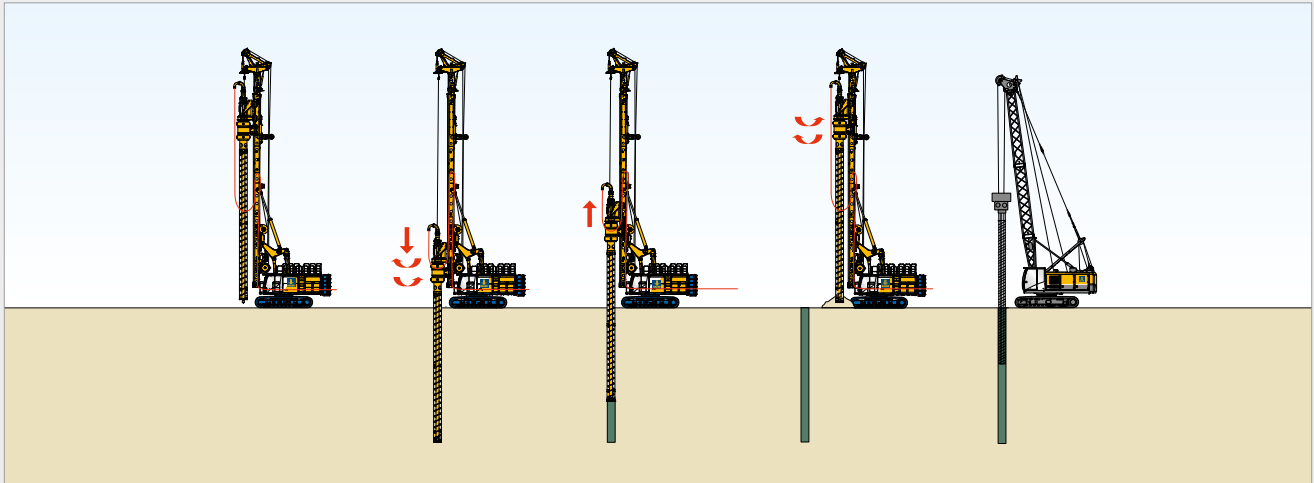


Cased Continuous Flight Auger Pile (CCFA Pile)

The Cased Continuous Flight Auger (CCFA) combines the CFA method using a continuous auger, with a casing outside the CFA auger, resulting in a cased CFA pile installation in line with

EN 1536. This method is particularly advantageous for unfavorable subsoil conditions where standard CFA drilling requires additional support to prevent soft soils from entering into the fresh

pile concrete. Installation of reinforcement cages is done similar to the CFA method, pushing or vibrating it into the freshly casted pile concrete.



Axel Springer Quarter, Hamburg, Germany

The Axel Springer house in Hamburg received a new office building. Using a BG 46 and a BG 39 drilling rig, Bauer constructed a secant bored pile wall for the excavation pit down to a depth of 27 m.



Mall of Sofia, Sofia, Bulgaria

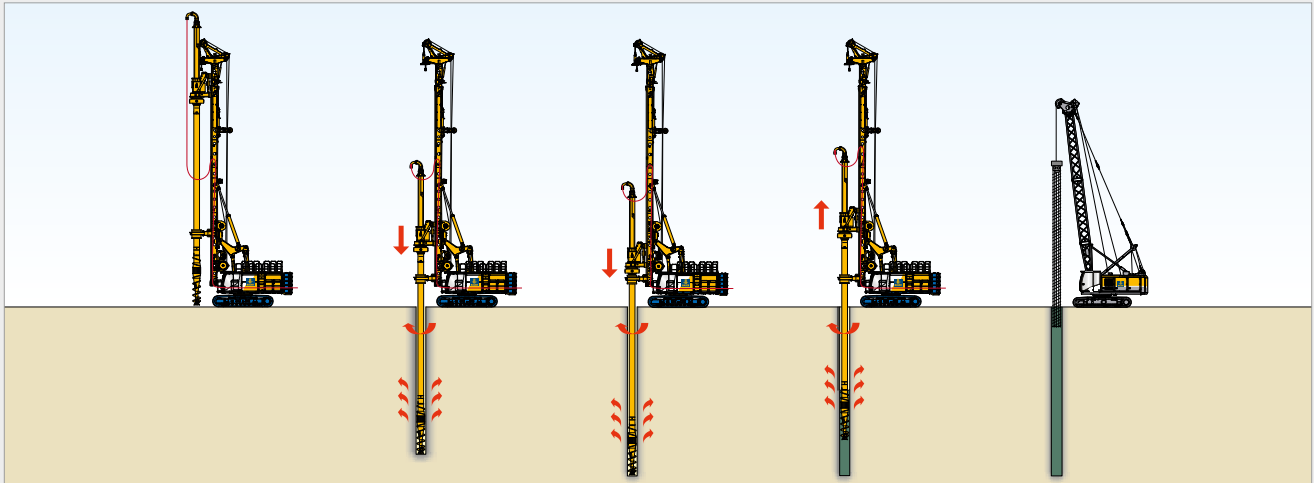
The Mall of Sofia is Bulgaria's biggest trade and business center. It is located in the center of the capital Sofia and covers an area of more than 35,000 m². Bauer constructed 6,500 m² secant pile wall for the excavation pit. One BG 42 and one BG 25 were the equipment selected for execution.

Full Displacement Pile (FDP)

Compared to the CFA method, the Full Displacement Pile system has the distinct advantage that hardly any cuttings are brought to the surface. This method is typically employed

in soft, displaceable soils. The drill string comprises of an auger starter, the displacement body above and an extension pipe. When drilling, the existing soil is laterally displaced. The

concreting and reinforcing steps are performed in a similar way as the CFA/CCFA system.



Pfeilerbahn rail viaduct, Hamburg, Germany

For the Pfeilerbahn rail viaduct in Hamburg, Bauer Spezialtiefbau realized 40,000 lin.m full displacement piles to depths of down to 16 m within 12 weeks only, using two BAUER BG 28 drilling rigs.



Groupama Aréna, Budapest, Hungary

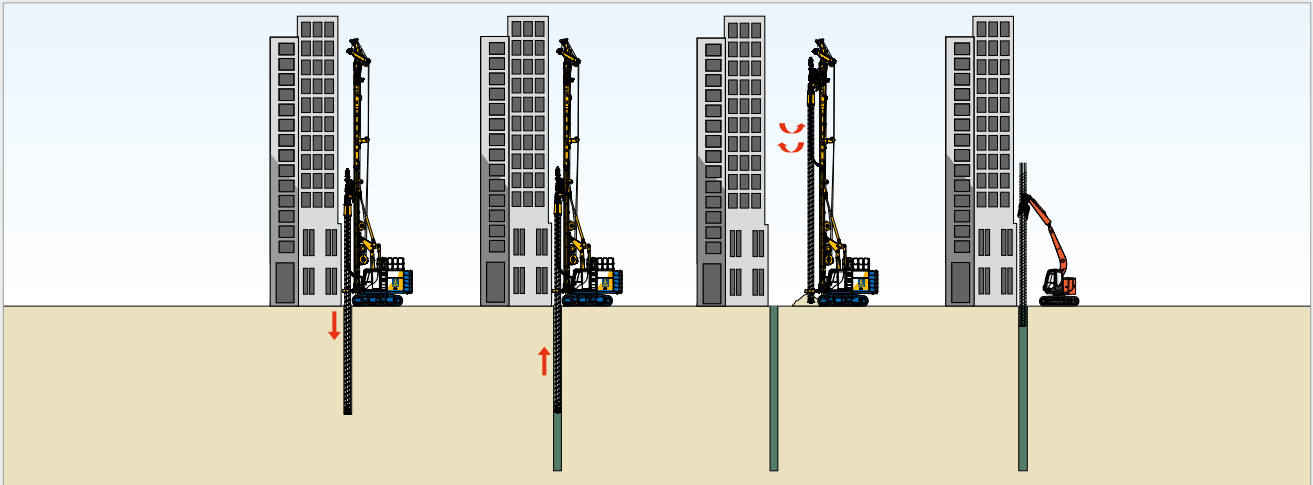
For the new FTC Budapest's football stadium, Bauer was commissioned to install foundation piles and the excavation pit retaining wall. Bauer constructed 30,000 lin.m FDP piles and 3,900 m² diaphragm wall.

Front-of-Wall Method (FoW)

Through the special design of its two rotary heads, the Front-of-Wall method (FoW) allows bores to be drilled very close to existing buildings with minimum distance, thus saving

precious space, specifically in urban environment, between existing buildings and e.g. an excavation pit. The machinery and equipment used are free of interfering edges that extend

past the casing diameter. The FoW method is a vibration-free and quiet drilling method. The means of production are the same as those for the CCFA system.



Housing development, Regensburg, Germany

Bauer created a secant bored pile wall with pile lengths between 7 and 14 m as part of the construction of a new housing development in Regensburg. As space was very tight, the excavation pit was constructed by means of a BG 24 H and the FoW method.

Erfurt, Germany

Using the FoW method, foundation piles were built down to a drilling depth of 13 m. The works were performed with a BAUER BG 24 H equipped with a FoW system.



Digitalization

Digitalization has long been a driving force of progress within the BAUER Group. Essential information can be reliably retrieved or easily made available via the Internet and the portals of Bauer's intranet from anywhere in the world. Bauer Spezialtiefbau also supports the topic of digitalization with a multitude of research and development projects. Here emphasis is being placed on the development

of a project management tool with which all information and data pertaining to a project is centrally managed and linked together on a digital platform. Digitalization presents plenty of new and interesting ideas and enables us to continue to carry out future international projects efficiently and complying with the highest quality standards.

Digital Building

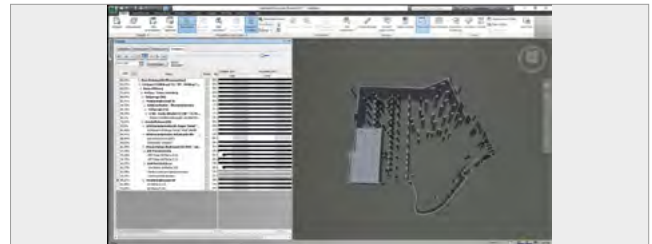
The concept BIM (Building Information Modeling) is usually understood as the digital planning process in 3D or 4D. However, until now little attention has been paid to the digital logging of quality and process data and its visualization for those involved, something that is indispensable for

subsequent process monitoring. As the context of BIM is therefore slightly broader, all digital processes within Bauer Spezialtiefbau are grouped under the heading „digital building“.

Use of 4D BIM – Planning Information on the Construction Site

The additional use of data from the planning stage for the downstream production process on the construction site plays a key role in digitalization. For this purpose, Bauer Spezialtiefbau uses the construction software REVIT together with MS Project to create weekly stage plans for construction site management. These plans help

better understand the construction workflows in terms of time and space. This visualization aids communication greatly. It enormously simplifies communication between those involved in the construction project as well as the coordination of simultaneous processes.



Tracking of Process Data – B-Tronic Activity

B-Tronic Activity is a software programme that allows the activity of drilling rigs to be recorded and combined with equipment data already captured. Through the analysis of this data, factors such as construction delays due to slow progress across the stages of the project can be identified more accurately and rectified in a better way. Thanks to B-Tronic Activity, the entire production process no longer

has to be compiled using individually recorded work steps made up of equipment data and manual logging – a time-consuming and complex task. Once the digital information for a sufficient number of projects has been entered in a central database, it can serve as a valuable basis for calculation purposes or handling follow-up work.

b-project production data management software

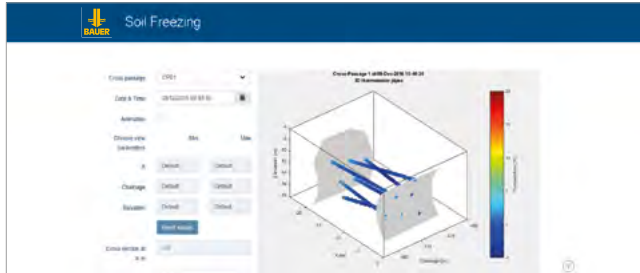
An integrated data management system was developed to manage the production and quality data. The production data management software b-project is its main tool. In particular in works with a high percentage of individual elements, the structural elements embedded in the ground require an enormous workload of manual verification and

documentation activities. The aim is to digitalize this process throughout and create a means of automatic recording and analyzing the data. Integrated data use seems the obvious choice on the basis of this data. Using this information for invoicing, managing supplemental requirements or for future projects offers great potential.

Visualization of product, measurement and process data

Web-based presentation of analyses and key performance indicators (KPI) regardless of location forms another essential part of the integrated approach. This allows quick access to aggregated performance and quality data even outside the construction site office. What is more, this standardized presentation of data makes it possible to quickly identify the current status of a project so that additional, more

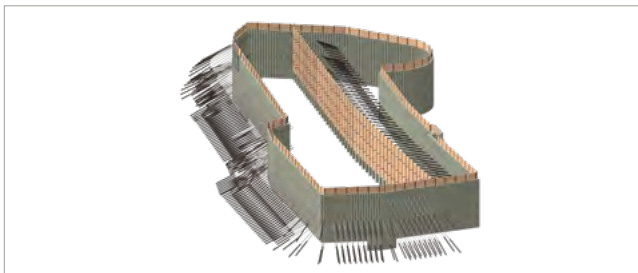
detailed analyses or process optimizations can be carried out. The visualization of measuring equipment monitoring and building progress monitoring at any location constitutes another potential use. Last but not least, the central availability of documents and image material contributes to increasing effectiveness.



Planning and Design

Suitable and efficient foundation design engineering is the prerequisite for economically efficient building. The Design Department of BAUER Spezialtiefbau GmbH takes care of all necessary steps from drafting to the structural design and the measuring of highly complex geotechnical works and provides state-of-the-art design software and useful

databases. Whether at the headquarters or planning offices of subsidiaries, the Design Department offers - based on its comprehensive expertise in specialist foundation engineering and long-standing experience - to create designs for foundations and excavation pits in the form of feasibility studies, preliminary drafts, pre-calculations, alternatives or even end-to-end implementation planning.



Technical Services

Passion for progress – the Technical Services Department of BAUER Spezialtiefbau GmbH gets right to the heart of Bauer's slogan. As an internal service provider, Technical Services supports the branches and subsidiaries in all geotechnical, measurement and construction material issues, particularly when innovative solutions are called for. Highly qualified technicians and engineers analyze construction materials and carry out quality and suitability tests and

inspections on concretes, slurries and other materials. Various pile load tests and anchor tests are also a part of the department's repertoire along with geotechnical and geodetic measurements under extreme conditions. Intensive research and development work together with renowned universities, institutes and engineering firms actively promote the development of new techniques and products or the optimization of existing ones.



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