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# BORED PILES WHEN CONSTRUCTING FOUNDATIONS IN URBAN AREAS

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**Abstract**. The last years of development of the construction industry are characterized by a significant increase in investment in the renovation of fixed assets. Today, a wide range of equipment for pile foundations is presented at construction sites.

The experience of using different types of piles shows that large and small diameter bored piles occupy 52% of the market; driven piles – 42%; screw piles – 6%.

Bored and rammed piles of different diameters can transmit heavy loads (4000 – 25000 kN). Such piles are widely used in construction in dense urban areas, since their manufacturing technology excludes vibration and dynamic effects on nearby buildings. In construction practice, there are examples of piling in areas with weak soils, when the length of the piles reached 75m. Rotary drilling machines are used for the **installation of bored piles under the protection of mud** (Fig. 1).

Fig. 1. Hollow drill rod for delivering mud to the well.

The technology for arranging such piles is as follows: drilling a well; borehole wall fixing with clay (bentonite) solution; concreting, carried out by supplying concrete through a concrete-cast pipe, which is lowered to the bottom of the well and slowly rises with the supply of concrete. When installing long piles (30 m and more), metal frames are installed in a clay solution. The disadvantage of this method is that the clay solution weakens the adhesion of the reinforcement to the concrete.

**When installing piles with short augers**, they use installations from Klemm, Soilmec, Casagrande, EGT (Fig. 2). The technology of piling using short through augers consists in immersing the augers to the design depth, injecting concrete through the inner pipe of the auger using a concrete pump while simultaneously extracting it and then immersing the metal frame using a vibrator into a well filled with concrete. The advantage of this technology is: no vibration and shock, high bearing capacity of piles, high productivity, good quality of filling the well with concrete, which is supplied under pressure. The disadvantages include a decrease in the speed of piling when passing through refractory or semi-hard loams or clays.

**During the installation of piles with a continuous auger**, the formation of the pile occurs without additional fixing of the borehole walls (Fig. 3). The technology is irreplaceable for soils with layers that differ significantly in strength. Concrete is supplied under pressure. This technology is especially effective when driving a large thickness of sands, semi-hard and refractory loams, when the manufacture of compaction piles is impossible. The advantage of piling using this technology is high productivity and high quality of filling the well with concrete.

Fig. 2. Installation Klemm KR-70 for piling with short augers.


Fig. 3. Installation, that implements the auger technology.

The **principle of compaction rammed piles** (DDS) is to compact the soil with the rollers, which roll the soil to compact it (Fig. 4). Thus, compacted walls are formed due to soil compaction. The advantage of this method lies in the possibility of building in cramped conditions, approaching as close as possible to the existing building; when installing piles with this method, the soil is compacted, thereby improving the properties of the soil.

Fig. 4. Baue drilling rig for pile compaction and its working body.

A technological **feature of Atlas rammed piles** manufacturing is the sinking of the casing with a tip (Fig. 5).

Fig. 5. Drilling rig JUNTTAN PM-25.

When setting up a borehole, the tip remains in the base and cannot be removed. This technology allows the concrete mix to be immersed in a drywall. The sequence of production of Atlas piles is as follows: a pipe with a screw tip is screwed in, which cuts the soil when immersed, a metal frame is installed, a concrete mixture is injected with simultaneous extraction of the pipe.

Features of the device of the bored **pile of the double rotary rotator Double Rotary** consists in the presence of the system of the double rotary (Fig. 6) the upper rotator drives the continuous auger, and the lower rotates the casing in the opposite direction. After the well construction, concrete is fed from a concrete pump under pressure. This technology makes it possible to arrange piles of the following dimensions: 300, 350, 400, 450, 500, 550mm. Advantages of the method: the possibility of constructing foundations near existing buildings, no noise during the installation, high quality filling with concrete, application for all types of dispersed soils.

The technology of **piling under the protection of the casing** consists in immersing the inventory pipe using a rotator and a rotary table (Fig. 7). This technology makes it possible to produce bored piles with a diameter of 450, 600, 620, 700, 770, 880, 1000, 1200, 1500, 1800 mm. Bauer drilling rigs are used to drill a well under casing protection. Casing pipe is a section of pipes

with a thickness of 400 mm, which are rigidly connected to each other. The advantages of this technology are: the absence of dynamic and vibration effects on the soil, which makes it possible to install piles near existing buildings and structures; the possibility of piling in difficult engineering and geological conditions.

Fig. 6. Installation of bored piles using Double Rotary technology.

Fig. 7. Drilling wells under the protection of inventory pipes.

**Conclusions**. Considering the above, bored piles are promising and indispensable for the construction of buildings and structures in the cramped conditions of dense urban development.