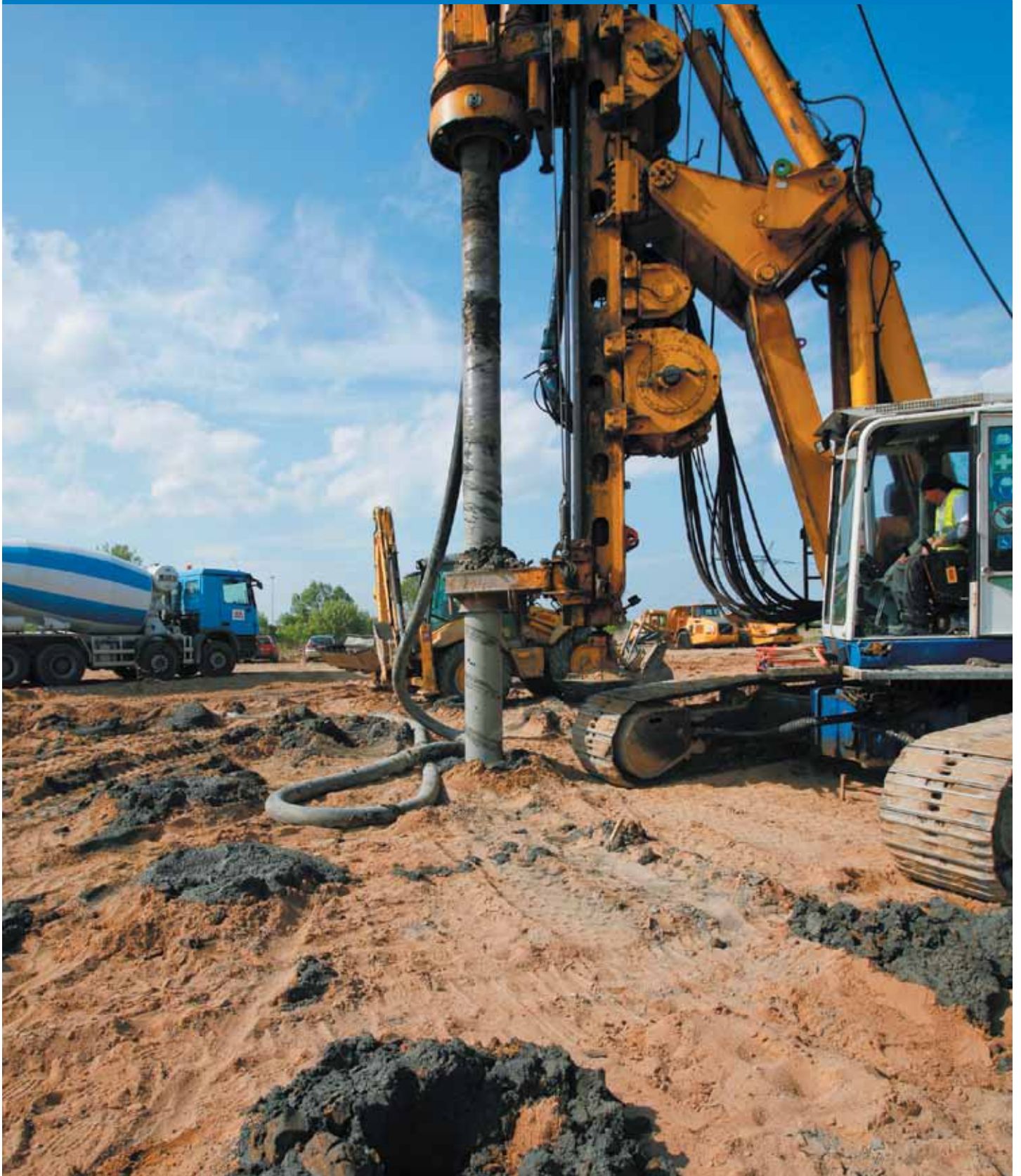


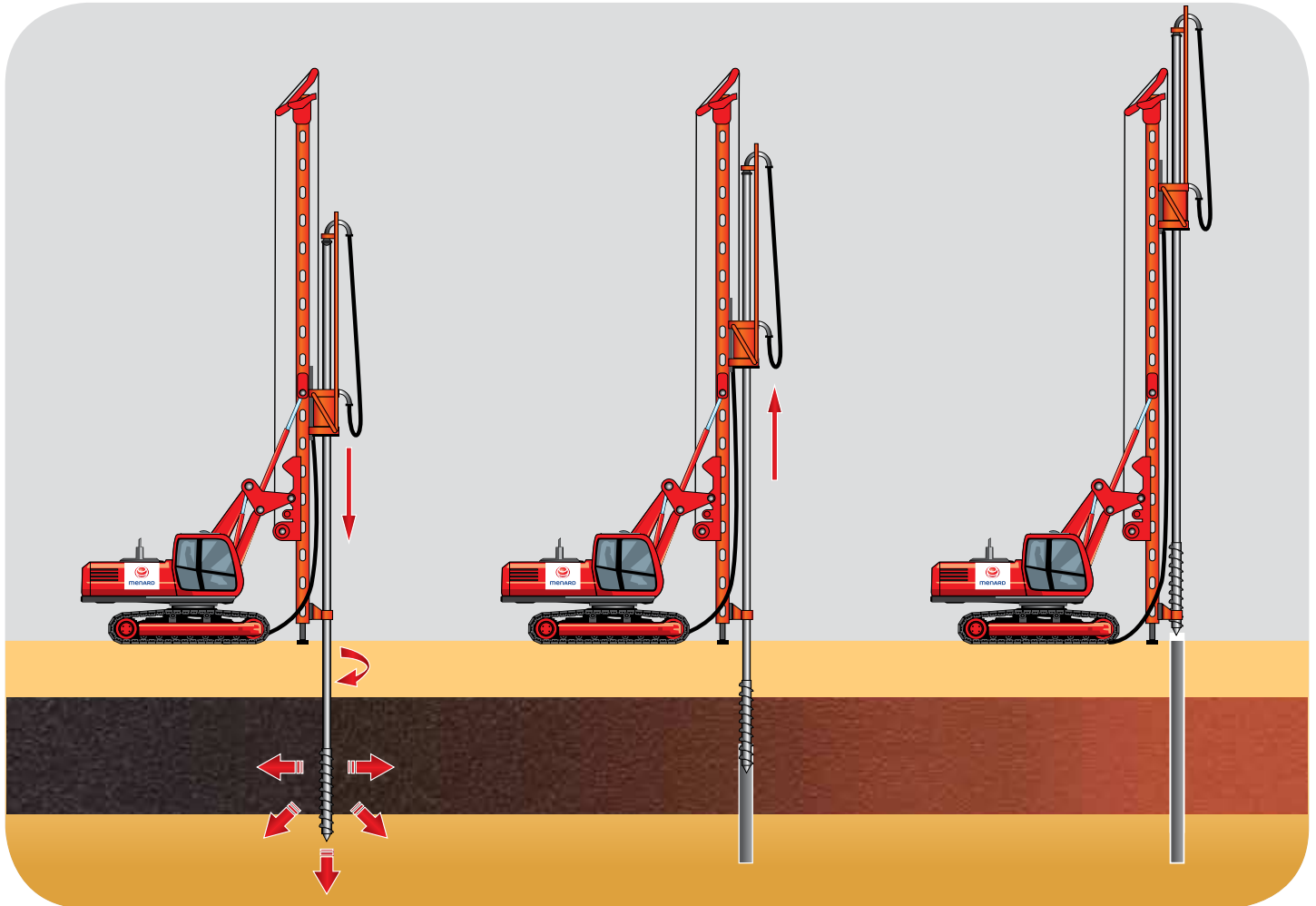
Controlled Modulus Columns (CMC)



menARD

ground improvement specialists

In the beginning of 1990s Menard Company patented the technology of concrete displacement columns - Controlled Modulus Columns (CMC). Quick time of instalation, no spoil and insignificant settlements are just some of the advantages distinguishing the CMC method over other column construction technologies. Additionally, due to the considerable bearing capacity, the CMC technology quickly became a cost effective alternative for pile foundations. At present, Menard company not only has one of the best technologies, but also posses significant experience in the CMC technology, which provides optimal and safe applications.



Technology specification

A specially designed displacement auger installed on a machine equipped with a high torque and static vertical thrust head displaces the soil horizontally towards the hole centerline. After the soil displacement outside the column the cement mixture (grout) is injected under pressure. The amount of the grout is selected so that to achieve the design stiffness ratio of the column with relation to the surrounding soil. The result is a composite of the soil and columns operating as a homogeneous structure with enhanced bearing capacity. The column construction process does not cause any damage to the surface and any unsafe vibration impacting the surrounding environment. The efficiency of works reaches several hundred linear meters of the columns per shift.

During the drilling process the column construction parameters are monitored and recorded providing continuous soil condition control at a certain spot. As a result, logs are produced containing the column profile data, energy consumption during the drilling process and a torque of the auger.

Under uniformly loaded structures such as road embankments or foundation slabs, a load transfer platform is designed which evenly transfers stresses from the structure to the column heads at the same time minimizing the forces causing the cut-through. This load transfer platform is made of well compacted granular material depending on the type of the structure and the soil conditions. In some cases there is a need to reinforce the load transfer platform (rebars, geogrids), which significantly improve the operation of the stabilized soil with the structure.

Application

CMCs can be applied to various soil conditions. The technology works well in loose sands, soft loams, organic soils (peat, aggragate mud, gyttjas) with a moisture content above 100% and anthropogenic soils (uncompacted fills, heaps).

The length of the CMCs depends on the planned load values and maximum allowable settlements, which corresponds to the length of the anchorage in load bearing soils. All types of enclosed buildings, infrastructure and special structures are well suited for the CMC technology, which is an alternative to deep foundation, shallow foundation on the subsoil improved with the CMCs. Depending on the load per column the following parameters are adjusted:

- Auger diameter ranging from 0.25 m to 0.60 m
- spacing; typically ranging from 1.2 m to 2.5 m with a rectangular or triangular column arrangement.

Projects

Enclosed buildings:

Residential buildings, office buildings:

- Apartment and commercial building complex at Grójecka street, Warsaw, approx. 64,000 lin. m.

Shopping centers, halls, warehouses:

- Brico Depot warehouse, Stargard Szczeciński, approx. 5,010 lin. m.
- Helical shopping center, Wrocław, approx. 7,200 lin. m.
- Hall and residential building, Warsaw, Tysiąclecia street, approx. 11,000 lin. m.
- Czyżyny' sports arena, Cracow, approx. 56,000 lin. m.

Infrastructure:

Road and rail embankments:

- Gdańsk south ring road, approx. 700,000 lin. m.
- Gostynin ring road, approx. 42,000 lin. m.
- S5 - S10 National Road, Bydgoszcz, 21,000 lin. m.

Special structures:

Wastewater treatment plants, silos, tanks, wind farms:

- 'Czajka' Wastewater Treatment Plant, Warsaw, 2,700 m² area, approx. 3,200 lin. m.
- Wind Farm, Kobylnica, approx. 8,500 lin. m.





Advantages:

- **High bearing capacity** – bearing capacities (up to 40%) higher than in case of piles of the same diameter.
- **High performance** – the CMC technology is a highly effective method reaching even several hundred of linear meters of the installed column per day (with the use of a single drilling machine unit).
- **No spoil** – no need to transport and dispose large earth masses as the excavation material is not extracted on the ground.
- **Environmentally friendly** – the technology is noise and vibration free, therefore it can be used in the close vicinity of the existing civil and engineering structures. These features make this method environmentally friendly.
- **Versatile application** – the application to almost any soil type including compressible, organic (peat, aggradate mud, gyttjas) and anthropogenic soils.
- **Comprehensive improvement** – the CMC method improves the foundation of the building structures by reducing the overall soil compressibility. In contrary to piling where the entire load is directly transferred into piles (as stiff elements) the CMCs are designed and constructed so that to distribute the loads to the soil (ranging from 5% up to 40% of the total load) and to the columns.

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