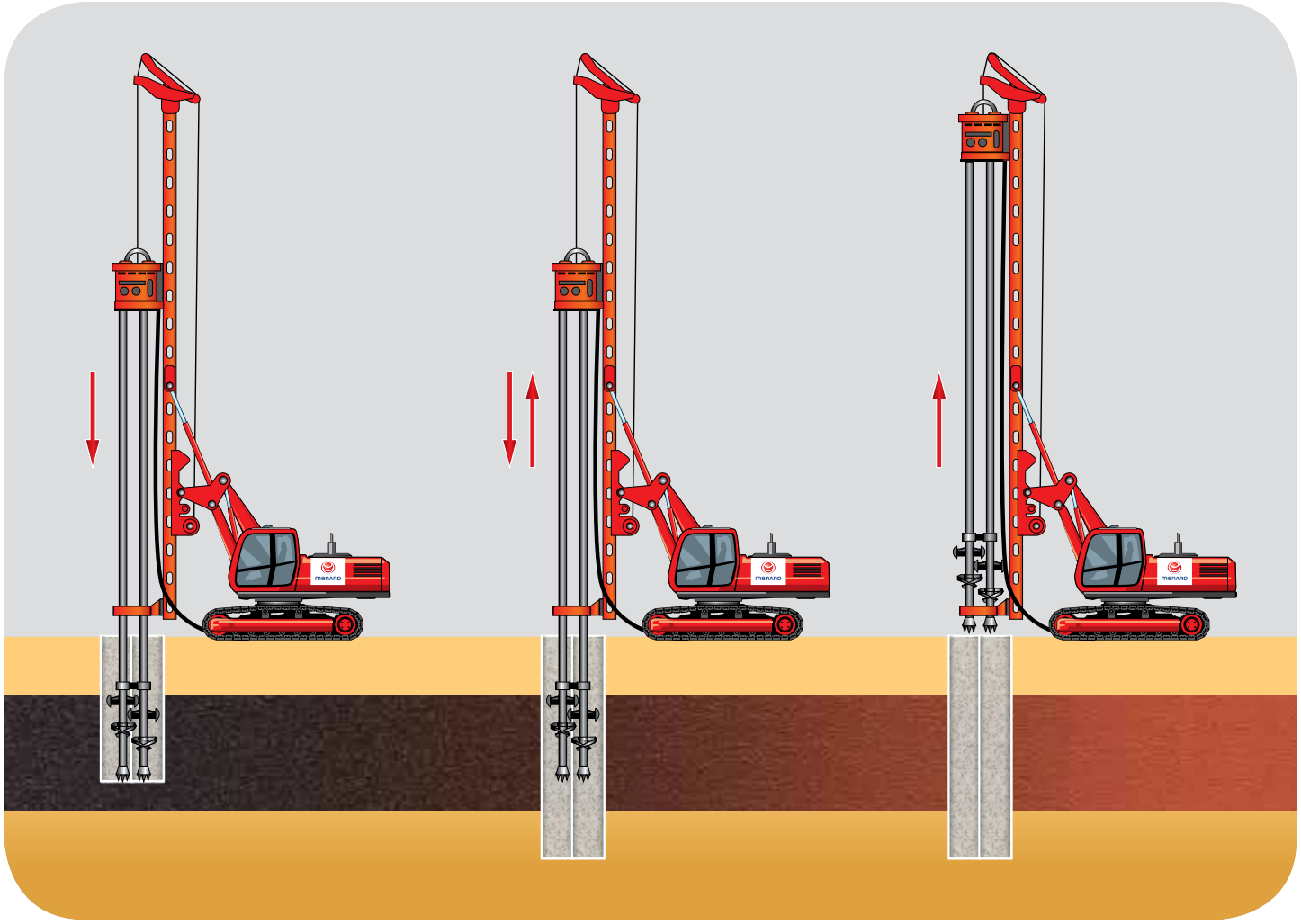
Deep Soil Mixing (DSM) columns

menard

ground improvement specialists

The method of the Deep Soil Mixing (DSM) columns was invented in Japan in 1970s and since then it has been gaining the increasing popularity all over the world as a proven and economical method of the stabilization of soils with the insufficient bearing capacity. The number of the completed tests and research related to the application of this technology made it widely popular also in Poland. Still, the research is carried out in order to improve the soil mixing process itself with the binder selection or to increase the diameter of the columns.



Technology specification

The principle of the DSM is to improve the strength properties of the soil by mixing it with the binder (e.g. cement slurry, cement-fly ash slurry or bentonite). As a result, a solidified mixture of soil and cement is created with considerably higher strength and mechanical parameters.

Deep soil mixing consists in the introduction of a rotating auger with a special design into the subsoil which destroys the soil structure and mixes it with the injected binder. For typical applications augers consisting of a drilling rod and cross bars are used. The whole process, from the start of the auger insertion to the end of the column formation, is aided by injecting the cement binder through nozzles located at the end of the drilling rod. The column formation stage starts after reaching the planned depth and usually is divided into several stages where the auger is lifted and lowered to provide equal mixing of the soil with the binder and to form a homogeneous column. The columns subjected to bending or stretching can be reinforced usually by dipping the reinforcement into the recently constructed column.

Application

The DSM columns may be successfully applied as the improvement for the hall spot footing, bridge abutments, wind turbine foundations, excavation lining and many more. Wherever silty and sandy soils exist the application of this technology is particularly beneficial. The most typical diameter of the column is 0.8 m and allows plunging the auger to the maximum depth of approximately 20 m. Due to the lack of soil movements and vibrations during the column forming process this technology is perfectly suited for stabilization of the subsoil nearby the existing buildings or facilities.
The arrangement of the columns may vary depending on the size of the load transferred to the columns and maximum allowable deformations of the structure.
In case of organic or waterlogged soils there is a possibility of the DSM column formation by applying so-called 'dry method' where a cement mixture is substituted by a dry lime or cement binder.
The DSM columns may be construct as excavation casing after completing their reinforcement with steel profile.

Projects

Enclosed buildings:

Residential buildings, office buildings:

- Residential apartment complex, Warsaw, Nocznickiego street, surface area of 2,100 m^2, approx. 3,130 lin. m.

Enclosed buildings:

Shopping centers, halls, warehouses:

- Extension of Magnolia shopping center, Wrocław, surface area of 17,000 m^2, approx. 6,200 lin. m.

Special structures:

Wastewater treatment plants, silos, tanks, wind farms:

- Wind farm, Żuromin, 4,400 lin. m.

Advantages:

- **Good matching** – due to the low stiffness ratio towards the cross section foundation slabs and spot footing can be rested directly on the DSM columns right after its routine cleaning and alignment.
- **High bearing capacities in non-cohesive soils** – the DSM columns formed in non-cohesive soils have high bearing capacity values (strength values of the cement-soil mixture up to 6 MPa).
- **Unlimited distribution pattern** – the possibility to form the columns in blocks (foundations of abutments), in groups (hall foundations) or linearly (excavation lining) and in the vicinity of the existing civil structures (no vibration and shock generation in the subsoil).
- **Multi – DSM** – the possibility to install two or more augers which significantly accelerates the work. It is particularly important in case of works related to the performance of linear improving structures.

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