

DEEP CEMENT-SOIL MIXING Ground Improvement Technique

Technical Reference No. M07/00

DEEP CEMENT-SOIL MIXING (DCM) METHOD

In construction of various structures on compressible, saturated soils like soft clay, low bearing capacity and excessive settlement are a common problem to deal with. The ground improvement technique using deep cement-soil mixing (DCM) is one of the most suitable methods to overcome this problem. The sole purpose of DCM is to improve shear strength of soil by in-situ mixing the soil with cement grout. Application of ground improvement method using DCM method allows excavation works, construction of embankments for highways, reservoirs, and use of soil foundation system in soft soil environment.

TYPICAL APPLICATIONS

DCM method has been successfully applied in various projects. DCM are typically used as ground improvement system in -

- Foundation for construction of road, railway, embankment, airport and ports
- Industrial projects
- Excavation works for foundation and basement construction.

CHARACTERISTICS OF DCM

DCM is mixing cement binder with in-situ soil forming individual columns or in a block. Column sizes of 0.6m to 1.2m in diameter can be constructed.

Two main components of DCM serve the following functions;

- Increase shear strength of soil
- Reduce permeability of soil



DCM work in progress to improve foundation soil of a highway.

EQUIPMENT

DCM equipment can be developed to suit the soil condition, installation depth, specified scope of work and required production rate.

Installation Rig

Type of Base Machine	: Crawler mounted pile driver or drilling rig, DH-408, 508, RTC
Weight	: 40-50 ton
Mast Height	: up to 23m

Typical Auger Drive

Rotation Speed	: 14-28 rpm
Penetration Rate	: 0.5-2.0m/min
Maximum Installation Depth	: 21m (depend upon soil condition).

Typical Grout Pump

Flow rate	: 50-300 l/min
Injection Pressure	: 2-10bars

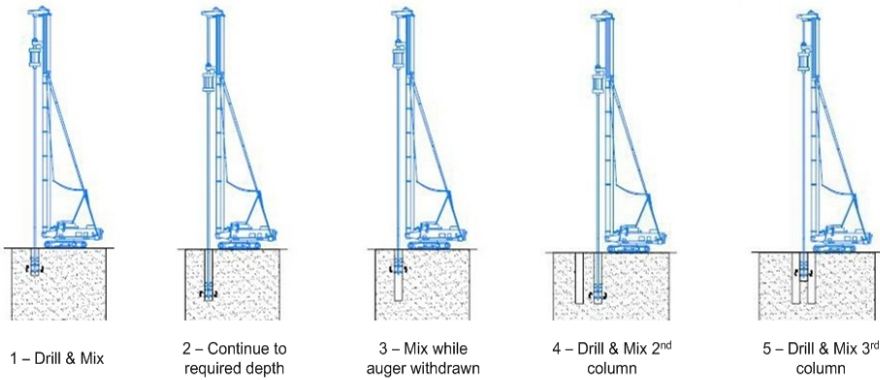
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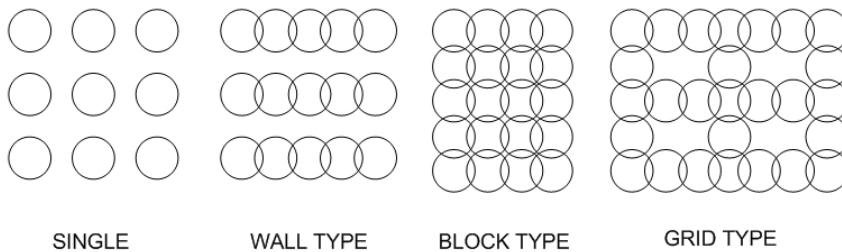
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Installation sequence.



Basic DCM treatment patterns.



QUALITY CONTROL IN INSTALLATION

- Use appropriate auger with mixing blades, rotation speed, penetration and grout injection rates.
- Use computer system for monitoring installation parameters, including grout volume.
- Computer control grout batching and mixing.
- Check verticality and horizontal position during installation.



Soil retaining with DCM columns for basement excavation and construction in soft clay.

QUALITY CONTROL TEST FOR DCM MATERIAL

- Core sampling
- UCS test on core samples
- Grout samples and UCS test.
- Extraction of columns
- Static load test on columns
- CPT test on columns



REFERENCES:

- FHWA-RD-99-138. (2000), "An Introduction to the Deep Soil Mixing Methods as Used in Geotechnical Applications", published by US Department of Transportation, Federal Highway Administration.
- DOH and JICA (1998). "Manual for Design and Construction of Cement Column Method", Final Draft. Japan- Thailand joint Study Project on Soft Clay Foundation.