

Cementation

SKANSKA

Further information:
Cementation Skanska
skanska.co.uk/cementation
cementation@skanska.co.uk

Jet Grouting

Application

Structural

- Ground improvement
- Basement slabs
- Excavation support
- Underpinning
- Tunnelling.

Groundwater control

- Dam cut-offs
- Contaminated ground.

Advantages

- Vibration free.
- Applicable to a wide range of ground conditions.
- Slabs and supporting struts can be formed below the water table and before bulk excavation.
- Single process allows programme advantages compared to other techniques.
- Predictability of in-situ strength and permeability.



Jet grouting is a versatile and effective technique which can be used across a wide range of ground conditions. It involves the in-situ mixing of soils with cement grout to form a predetermined strength / permeability matrix. The inclusions formed by this process may be used for structural support, or for the control of groundwater.

Process

Cementation Skanska developed Jet Grouting in the 1960's for ground water control applications in the Middle East and Africa. The process involves the insertion of a special drilling tool to the required depth using a rotary drilling technique, followed by carefully controlled grout injection whilst rotating and withdrawing. The column is formed by the action of the high pressure grout eroding the in-situ ground perpendicular to the angle of insertion to a predetermined radius around the tool. The eroded material is mixed with the grout to form a soil-grout matrix.

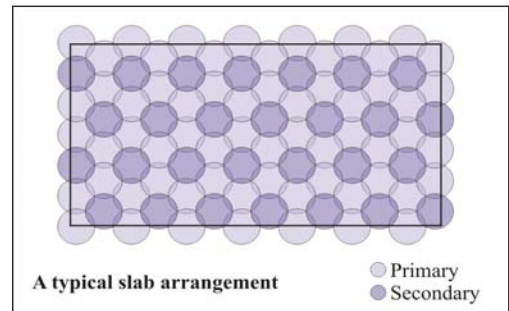
The strength and permeability of the columns can be controlled by the water / cement ratio and the addition of admixtures to the grout. The diameter of the columns is controlled by the rotation and lift speed of the drill tool.

Jet grouting systems are traditionally divided into three categories, depending on the number of injection nozzles and the medium used to erode the soil:

Single system - Grout is pumped down through the drilling rods and exits horizontal nozzles in the tool at high velocity. This causes erosion of the ground and the placement and mixing of grout in the soil. This method produces the most homogeneous soil-cement element with the highest strength and the least amount of grout-spoil return, but can cause heave problems in certain ground conditions.

Double system - A two-phase internal system is employed for the separate supply of grout and air down two different, concentric nozzles. Grout is used for eroding and mixing with the soil. The air shrouds the grout jet and increases erosion efficiency. The double system is more effective in cohesive soils than the single system. However, the presence of the air reduces the strength of the column as compared to the single system, and the air produces greater spoil returns.

Triple system - Grout, air and water are pumped through three different lines to the tool. High velocity coaxial air and water form the



means that it is ideally suited to congested city centre locations.

Excavation support - Jet grouting can be used to construct basement slabs and supporting struts for deep excavations. Overlapping columns can be formed below the water table and before bulk excavation minimising access constraints.

erosion medium. Grout emerges at a lower velocity from separate nozzles below the erosion jet. This somewhat separates the erosion process from the grouting process and yields a higher quality inclusion. The triple system is the most effective system for cohesive soils, and because the grout replaces a substantial portion of the eroded soil, it is less likely to cause heaving of the ground.

Tunnelling - Break out zones for tunnelling machines may be formed using overlapping columns adjacent to launching chambers. This locally stabilises the ground, enabling the tunnelling machine to complete the initial ring construction in conditions of controlled water ingress and ground movement. The technique is also used to stabilise tunnel crowns during open face tunnelling methods.

Applications

Plant

Groundwater control - Often used for the control of groundwater around dams or areas of contaminated ground, the jet grouted columns are overlapped to form a continuous barrier of known thickness. Ground permeabilities can be reduced to the order of 10⁻⁹m/s.

Cementation Skanska's plant depot and workshops are centrally located in the UK and provide first class support to sites and projects nationwide. Bentley Works, our traditional home, houses and maintains our large fleet of specialist plant in the UK.

Ground improvement - Columns are installed on a regular grid to improve the global stiffness and bearing capacity of the soil mass.

From the origins of our patented cementation process during the early years of the last century, Bentley Works has been central to our growth and development into the modern, well-equipped company we are today, providing sophisticated grouting solutions and equipment for a variety of contracts.

Underpinning - The technique is extensively used for the improvement of existing shallow foundations. It is possible to drill through existing footings, forming a new jet grouted column underneath. The small size of the plant required

