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**STRAIGHT  
FORWARD  
DRILLING**



## GROUND STABILIZATION IN DIFFICULT GEOLOGY BY JET GROUTING COLUMNS

**A storage building has been constructed in Hässleholm, Sweden. The ground needed stabilization as the geology presented sand and friction soil in different layers above the bedrock. Wassaras jet grouting hammer made the operation possible as it combines a water-powered W100 DTH hammer with a grouting monitor.**

### Building on difficult geological conditions

Bergendahl Foods in Skåne, Sweden, is expanding their storage capacity by constructing a new 32 meter high automated storage building in Hässleholm. The storage will have a total area of 4 000 m<sup>2</sup> and host up to 18 000 pallets. Decision was made that the concrete floor shall be 1 m thick so it can withstand a load of 10 800 metric tons. The ground conditions required stabilization as the formation above the bedrock consisted of sand and friction soils coming in different layers.

### The ground stabilization

A total of 288 columns were needed to stabilize the ground. Since the worksite is surrounded by buildings, vibrations and settlements must be kept at an absolute minimum in order to avoid damage and disturbance. A decision was made to form jet grouted columns, the only soil stabilization technique that would work equally well in plastic clays as in granular materials, although compressive strengths and load capacity are typically higher in granular materials.

Since the formation included boulders, the drilling sequence must be performed with percussive drilling technique. Pre-drilling with air-powered DTH was not an option as it would require separate rigs for the grouting and drilling processes, and risk ground settlements. The consultant WSP and the contractor PEAB concluded that the water-powered drilling was the most appropriate technology for this project.

### Jet grouting with Wassara

Where stones, boulders and other obstacles have made jet grouting complicated, Wassaras patented jet grouting hammer makes it easier. The water-powered DTH hammer makes its way through any stone or boulder present in the formation. Water, dense clay or wooden logs in the formation doesn't affect the drilling. Since the drill string is complete with all necessary tools, no changing of equipment is required during the whole operation. The hammer and jet grouting monitor are powered by separate pumps and can be controlled independent of each other.

The whole jet grouting operation is completed in two steps:

1. Drilling down
2. The following jet grouting takes place on the way up

### Testing the technology

A test was performed to see if the grout columns' diameter would be sufficient for the piling. After performing a test with the Wassara Jet Grouting hammer, a Ø 120 cm column was excavated and examined. Core samples were taken to verify the composition and strength.

The project was designed for columns with diameter Ø 80 cm, why the grout pressure was lowered from 400 bar to 200 bar. The grout nozzles were also changed, from two Ø 4 mm nozzles to one Ø 5 mm nozzle.

## CASE STUDY

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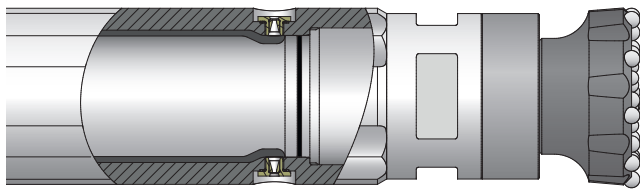
### Conclusion of the work

288 columns were created in situ with an average size of 5.5 meters in length and Ø 80 cm in diameter. The average production capacity was 15-20 grout columns per day. The sequence of drilling down to bedrock took 7-8 minutes with an average rate of penetration of 1 meter per minute while the grouting sequence took 14-15 minutes.

### Pleased contractor

Fredrik Toresson was the Drilling Manager and Dag Karlsson was the Site Manager during this project. They both work for the Swedish contractor PEAB and agree in their conclusion of the grouting operation:

- *The realization of this project would have been close to impossible without the water-powered jet grouting hammer from Wassara. The time savings are at least 50%, compared to conventional technologies, if they had managed the task at all.*



The jet grouting hammer has four nozzle sockets for multiple configurations and backup



The jet grouting hammer

Equipment used	
DTH hammer	Wassara Jet-grouting hammer W100 JG
Drill bit	Ø 153 mm
Drilling fluid	Clean water from public source
Drill tube	Duplex drill tube, 114 mm
Rig	MDT 450
Water pump	WASP 150 Diesel
Jet grout pump	Tecniwell model TW352
Borehole length	5.5 meters in average
Scope of drilling	1 600 meters
Geologic formation	Sand, friction soil and rock
Project time	May-July 2013



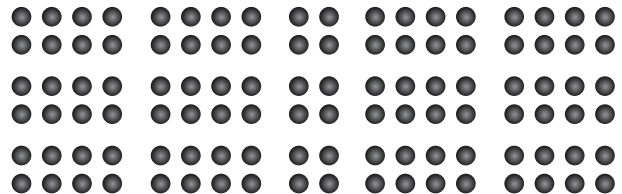
Jet grouting in progress



The jet grouting hammer after completing one column. Some grout is still seeping from the monitor.



The Ø 120 cm test column



Part of the drill pattern for the jet grouting project. Column center distance: 3 m