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**STRAIGHT
FORWARD
DRILLING**



BRENNER BASE – JET-GROUTING FOR TUNNEL BETWEEN AUSTRIA AND ITALY

The Brenner Base Tunnel is one of Europe's most comprehensive and important infrastructure projects in modern time. LKAB Wassara's W120 water-powered hammer played a decisive role in the making of the tunnels going under the river Isarco, near Fortezza in Italy.

Background

The Brenner Base Tunnel (BBT) is the main segment of a new railway line that will connect Munich with Verona. BBT runs between Innsbruck and Fortezza. The new tunnel will lead to an improvement for, above all, the truck traffic through the so-called Brenner Pass. The two-tube tunnel system will be 55 km long, making it the longest underground railway stretch in the world

Stabilization of the ground

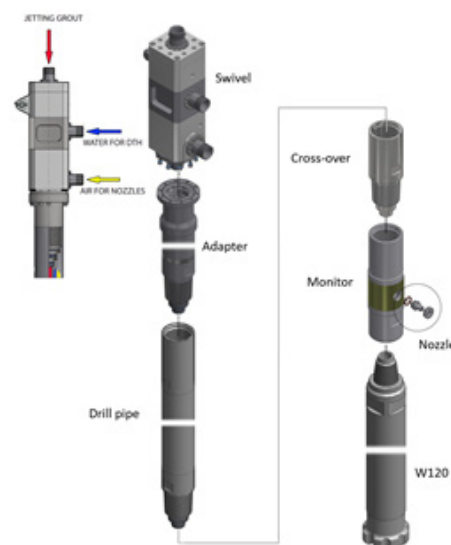
The excavation of the tunnel started from 4 shafts on the riverbanks, two on each side (see the main picture above). Before the excavation of the shafts could start ground improvement by jet-grouting was needed. The jet-grouting was to be performed both to stabilize and to seal of the water in the shaft, as well as improving the ground from the surface before excavating the tunnels.



Brenner Base Tunnel location

Columns were made with the Wassara W120 hammer

The columns were made up to 40m in one single pass. LKAB Wassara's W120 water-powered hammer with a Ø152mm drill bit was used for this. Above the W120 hammer a monitor was mounted. The monitor worked both as a nozzle holder for the Jet-grouting and a flow diverter that diverts water from the water channel in the drill pipe to the hammer. The monitor is of a double flow type where compressed air is used to improve the performance of the jet-grouting. The water, air, and jet grout are supplied through a 127 mm triple wall drill tube securing that the fluids are not mixed.



PREFERRED SOLUTION - Water-powered drilling

Rotary-Drilling - Rotary drilling is normally used when jet-grouting, but was discarded due to the complicated soil conditions with frequent boulders and large blocks. Water-Power drilling solved the problem of drilling through the block and boulders.

Air DTH technology - In a comparing test in the beginning of the project, Wassara's water-powered hammer outperformed a pneumatic DTH hammer, drilling more than double as fast as the pneumatic hammer.

A 36-meter deep hole was drilled with the two different techniques. The Wassara hammer drilled the 36 meters in 40 minutes and the pneumatic DTH hammer used 1 ½ hour for the same depth. Each rig could now produce 7-8 columns per day during 24-hour operation. The low performance of the air hammer was most likely caused by the high water-table.

“The Wassara DTH technology outperformed other alternative methods.”

Magnus Hörman, Senior Engineer, LKAB Wassara.

Special thanks to:

Antonio Celot /Project Manager at Webuild and Valerio Salvi, Research & Development, CRM



Left: W120 Hammer and monitor, Middle: Monitor and triple fluid rods, Right: Solimec SM 28 in action

Equipment used	
DTH Hammer	W120, with integrated check valve
Water Pump	Electric 400 L/min, 180 Bar, PTC
Drilling fluid	Clean water
Rig	SM 28, Soilmecc
Drill rods	Triple fluid 127 mm, CRM
Drill bit	Ø 152 mm
Monitor	Double fluid air/grout, CRM
Swivel	Grout-Water-Air, CRM
Total meters drilled/grouted	250 000 m
Borehole length	Up to 40 m
Formation	Loose deposits, gravel, rounded sand, boulders and large granite blocks
Project year/time	2018 and ongoing (per March 2022)