



wassara

**STRAIGHT
FORWARD
DRILLING**

(Photo courtesy of Bilfinger Spezialtiefbau)

WATER-POWERED DRILLING UNDER A NATIONAL HERITAGE BUILDING

The City Line railway project builds a six km long commuter train tunnel under the central parts of Stockholm, Sweden. The tunnel will be built in bedrock and some parts are now undergoing ground reinforcement.

One section of the tunnel will be constructed directly under a building from 1870. As it is listed as a National Heritage, it is protected by strict national laws that complicates the construction works.

A complex construction project

Plans for the City Line railway project in Stockholm, Sweden, has been made for decades. In 2006, the project started and has environmental friendliness as a top priority. A six km long commuter tunnel will go under the central parts of Stockholm. When the project is completed in 2017, the track capacity in Stockholm will be doubled.

Most of the tracks will be located in Stockholm's bedrock, ideal for tunnel constructions. In one area, the bedrock is more than 60 m below ground surface. Today's park Fatburen was once a small lake. The lake was filled with sand, mud and boulders as a part of building the railway station Stockholm South in the late 1850's,

Drilling under a National Heritage building

A building from 1870 is located close to the Fatburen park, with half of the building resting on bedrock while the other part is located on the former lake. The new railway tracks are planned to pass right under the building. It is listed as a National Heritage and protected by strict national laws that complicates the construction of the new tunnel; the building must not be demolished, moved or damaged.

Trafikverket (the Swedish Transport Administration) prescribed the use of water-powered DTH hammer for the drilling in the area. The environmental aspects included the demand for low noise level in the urban area as well as the minimal risk of subsidence.

The contractor Bilfinger Spezialtiefbau has chosen to install a total of 300 casings in to support the building. They are drilled down into the bedrock, up to 68 m down, using Wassaras water-powered DTH hammer W80. The drilling takes place in a very sensitive environment and in cramped spaces. Large oak piles and boulders were once used for foundation and must now be drilled through during the operation.

The tunnel itself is being built in reverse order, as the tunnel roof is being constructed first. After excavating down to 14 m below the building, the tunnel walls will be built before the floor construction completes the tunnel.

Ground reinforcement in an old lake

The Fatburen area is also undergoing extensive ground reinforcement due to the new railway requirements. This comprises a large amount of long holes to be drilled for jet grouting and piling in sensitive environment. When completed, a total of 4 800 grout holes, 700 RD piles and 1 200 steel core piles have been installed.

Wassaras water-powered DTH hammer W150 is used for casing advancing, a total of about 35 000 m casings are being installed. They all go one meter into competent bedrock, giving boreholes of 15-68 m. For steel core piles, underdrilling in rock to 13 m have been done.



CASE STUDY

WATER-POWERED DRILLING UNDER A NATIONAL HERITAGE BUILDING

A pleased contractor

Alexander Pätzold is Site manager at the contractor Bilfinger Spezialtiefbau.

- "The drilling with Wassara has been quite uncomplicated. We have been able to work on a very high quality level, despite the large number of holes and the uncertainty of what we would drill through in the formation. Boulders, gravel and sand layers have not been a problem to penetrate."

Water management

Incoming water for powering Wassaras DTH hammer is taken from public sources. The spill water passes through a system of sedimentation tanks with a total volume of 200 m³. Before being discharged to the public sewer system, samples are taken to ensure that local requirements are met.

Project time for the drilling

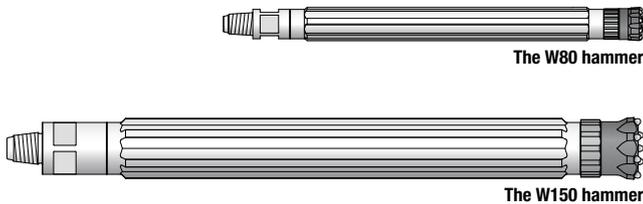
2009 - 2015



The railway tunnel in the bedrock is opening up behind what once was a small lake, now undergoing ground reinforcement.



Casing advancing with the W150 hammer in Fatbursparken



Equipment used	
DTH hammer	Wassara W80
	Wassara W150
Drill bits	Ø 178 mm (W80)
	Ø 284 mm (W150)
Rigs	Klemm models 702, 805 and 807
Pump	Wassara WASP 150
Drilling fluid	Clean water
Drill pipe	168.3 – 273 mm
Borehole length	15-68 m
Scope of drilling	8 000 m (W80)
	35 000 m (W150)
Geologic formation	Bedrock, sand, boulders, oak piles, etc

January 2014



Wassara W150 hammer, ready for casing advancing under the building. The tunnel roof is clearly visible here. (Photo courtesy of Bilfinger Spezialtiefbau)