

BROKK®

SORB GROUP

CASE STORIES



When standing in front of the famous opera house in Paris it's hard to believe that just some metres under your feet a new link for the Paris underground is being built-up by among others Brokk.

Brokk – a tunnelling alternative that offers a high degree of safety in hard layers of soil

Brokk machines in Napoleon's footprints

Paris is, as you know, one of the biggest cities in Europe, with more than 8.5 million inhabitants. Paris was among the first European cities to construct its underground railway system. Today France is a model i.a. with respect to infrastructure. Its motorway system is well developed and of high quality as is its railway system with the well-known express train TGV.

"PARIS MÉTROPOLITAIN", the name of the underground in Paris, is quite old and is being extended to cope with its increasing population and the growing demands for improved communications.

For several years, the city centre of Paris has gone through several large-scale extensions and reconstructions. The development of the underground system is part of this gigantic construction project.

Since April of 1994, four new underground stations have been under construction. An extensive public works scheme that consists of several new sections of underground and railway tunnels, boarding and disembarking subway stations, escalator shafts, etc. The new tunnels and passages are being built at six levels on top of each other.

These constructions are being made by the French consortium Fougerolle consisting of eight companies. After carrying out the geotechnical investigations, it turned out that in this district of Paris, near the Opera House, the ground mainly consists of different types of loose, medium-hard and hard soil and loam.

The use of conventional drilling equipment in the upper layers of soil, that is down to some 50 m (55 yd), would have involved great risks. Very much so, because where the new underground project is being carried out there are old

tunnels in service. If extra precautionary measures were not taken, there might be great risks of landslips and existing undergroundlines might collapse and ruin the new ones under construction.

M Théodore Percie du Sert, who is one of the responsible managers and who works for Entreprise Pico SA, says that Brokk machines were the only conceivable equipment that could be used for a large portion of the shallow tunnelling job.

He found out about these machines from an advertisement in an international magazine and got in touch with the French representative of Brokk AB. After testing, he concluded that the Brokk machine matched their demands for equipment.

– Together we have long experience of both construction and demolition. We have also specialized in this type of underground work, says M Théodore Percie du Sert.

– We were looking for a machine with four main characteristics. It should be small and compact to be able to negotiate the narrow underground passages. It should be very powerful and have a good reach and be agile enough to replace manual labour. Finally, it had to be remote-controlled to enable the operator to place himself at a safe distance from an unreinforced section part. Brokk meets these requirements to the full, M Percie du Sert adds.

The two Brokk machines have now been working for the past eight months on the subway tunnels, crossings, new railway and underground tunnels. Brokk plays a principal role in this work. As the risk of a landslide is imminent it is not possible to break down more than 1–1.5 m (3–5 ft) at a time. For the breaking itself, Brokk with a Montabert BRH 125 hydraulic breaker is used. Fitted with a bucket, Brokk removes the rubble. Tunnel supports are placed with the help of Brokk after each metre of tunnel broken. Then this section part is cemented before continuing the next breaking phase. In this manner, they work their way through, slowly but steadily.

M Théodore Percie du Sert says that they sometimes make witty remarks that they are at the levels where Napoleon, the



Emperor, once walked. To a geologist, the profile of the layers of soil is typical. The upper layer is the second thickest and consists of rather loose material. Then there is a little harder material that consists of sedimentary deposits and packed silt. The third and hardest layer of soil has a solidity of approx 800 bars. Although this layer consists of compacted loam, it can be almost as hard as porous rock. A Brokk fitted with a powerful breaker is able to break it quite easily. The bottom layer down to some 40 m (44 yd)

consists of coarse limestone. In this layer, there may also be some boulders. Its solidity is approx 700 bars.

In total, 76 people are engaged in the extension of the underground at the Étoile station. Work is going on also on other sections. There are five trained Brokk operators. Totally some 335.000 cubic metres (438.000 yd³) of material have so far been broken down and removed. Brokk has done approximately 10.000 (13.000 yd³) of this volume. It should be added that the long tunnel sections that are part of the work are being broken still deeper down where there is less risk of a landslide. Therefore conventional tunnelling equipment can be used.

The whole project that also includes a new station called "Condorcet" was ready by the end of 1997. Condorcet is an underground and railway junction.



Brokk AB
P.O. Box 730
SE-931 27 Skellefteå • Sweden
Tel +46 910 711 800
Fax +46 910 711 811
E-mail: info@brokk.com
www.brokk.com

