Contractor China Overseas Engineering Group Co. Ltd (COVEC, Nepal branch), represented by China Railway No. 2 Engineering Co. Ltd (Chengtong branch), is responsible for the 12.2 km headrace tunnel and is aware of the challenges associated with tunnelling in tough geology. The Siwalik range is projected to consist of mainly sandstone, mudstone and conglomerate, requiring a TBM that can withstand squeezing ground, rock instability, possibly high ingress of water and fault zones. Maximum cover above the tunnel is 820 metres.

Due to the challenges in the young geology of the Himalayas, difficult ground solutions have been incorporated into the machine's design. A stepped shield has been designed to move through squeezing ground. There is a probe drill in the rear that probes through the gripper shield in 14 places. Ports were added in the forward shield for drilling too. There are eight ports around the circumference for hand drilling. There are also six ports in the top 100 degrees of the shield for forepoling. Other machine modifications included 35 mm (70 mm on the diameter) of possible overcut for gage cutters and additional ports in the forward shield for dewatering.

Muck removal will be achieved by muck cars. Robbins will provide field service to support the machine erection, testing, commissioning and boring of the first 500 metres. The tunnel will be lined with hexagonal precast concrete segments.

The project owner, the ministry of irrigation (MoI), has chosen a TBM over the traditional method of drill and blast due to the faster mobilization and rate of advance offered by mechanized mining. The reason a TBM was chosen for this project was because using the drill-and-blast method could have taken at least 12 years for project completion due to only one excavation heading with no possibility of launching multiple operations using adit tunnels.

The success of the BBDMP, a national pride project, is paramount for the country as well as the TBM industry. It is expected to help aide the food crisis in the mid-western region of Nepal by increasing agricultural yields and invigorating socio-economic development in the region.

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Norway

Drilling and blasting completed at Oslo wastewater treatment plant

Last May, the excavation and support works were finished for the extension of the Bekkelaget sewage treatment plant in Oslo, the first of the three contracts to expand the Bekkelaget wastewater treatment plant carried out by VAV (Oslo city's water and wastewater agency, or Vann og Avløpsaten in Norwegian).

The Bekkelaget treatment plant needs expansion from the current capacity of 290,000 residents to approximately 490,000 people. The extension is built in the mountains north and south of the existing rock facility.

The three contracts are as follows:

• excavation and support carried out by Ossa of Spain;
• civil works (structures, concreting, etc.) carried out by AF Gruppen; and
• installations and systems to be done by Porr.

The treatment plant expansion works include the construction of seven large caverns with cross-sections varying from 300 m² to 500 m² and a total length of 1,000 linear metres as well as more than 1,500 metres of tunnels for access, transport and ventilation and shafts of different cross-sections. The caverns will be equipped with technical installations (digesters, sludge treatment, fat receptions, etc.).

All in all, more than 450,000 m³ were excavated in 30 months of work, where night time working was restricted due to the urban location of the work.
The contract, worth approximately €55 million, was carried out by OSSA. The completion of these works has ensured the continuity of the second public works contract being carried out by AF Gruppen. The third installation and commissioning contract for the new treatment plant is due to be completed by 2020.

![Excavation of the Bekkelaget sewage treatment plant by drilling and blasting.](image)

**Serbia**

**Breakthrough made in Serbia's longest road tunnel**

*Koridori Srbije* announced on 2 August that the breakthrough has been made in the Manajle tunnel's right tube. The 1,804 m tunnel is part of the southern leg in Serbia of the European corridor X on the section Caricina Dolina-Vladicin Han section of the E75 highway.

Apart from being the longest road tunnel in Serbia, it also proved the most demanding to build. Koridori Srbije invested great efforts and thanks to the significant and constant support from the ministry of construction, transport and infrastructure, "the problems encountered during the works have been successfully overcome".

These problems were due to "extremely unfavourable hydrogeological conditions".

Previously, in September 2016, the breakthrough was made in the tunnel's left tube.

Consortium Alliance X, a consortium of Bulgarian builders, was contracted to carry out the works for €36.2 million. See newsletters #158 orange p. 19 and #168 orange p. 44.

The tunnel will be equipped with modern telecommunications, traffic and signalling equipment, video surveillance, a radio communication system, SOS stations, rest areas for broken down vehicles, a fire detection system, a system for monitoring and detecting the level of toxic gases and one for speed measurement.

The tunnel's tubes will be interconnected with evacuation cross-passages, meant for pedestrians and emergency vehicles.

The work on the tunnel is expected to be completed in late 2017.