

Manapouri

Back-up system: year of construction 1998



Tunnel boring machine and back-up system in front of the portal

About the project

The hydraulic power station Manapouri is the biggest supplier of electric power in New Zealand. Its expansion will allow to increase power production from 565 MW to 760 MW. The second tailrace tunnel of Manapouri is located in one of New Zealand's nature reserves. Therefore, ecological considerations had to be integrated carefully into the overall planning. Right from the start, special circumstances had to be taken into consideration, like the nature of the soil, the hardness of rocks, possible rock falls, fault zones and areas with brittle rock. In addition, heavy water penetrations had to be reckoned with.

Project details

Country:	New Zealand
Plant owner:	Electricity Corporation of New Zealand
Contractor:	FDI Fletcher Construction, New Zealand Dillingham Construction, USA ILBAU Bauholding GmbH, Austria
Demand of the plant owner:	Construction of a second tailrace tunnel for the hydraulic power station Manapouri for the production of electric power
Demand to Rowa:	Engineering and production of a high-performance back-up system
Task of the back-up system	- Consolidation - Supply and removal

The opinion of the contractor:

Hans A. Treichl, Executive Director Tunnelling Division, ILBAU GmbH, representative of the joint venture Fletcher Dillingham ILBAU (FDI)



"The back-up system which was designed by Rowa in cooperation with our specialists to comply with the special circumstances in Manapouri, has proven itself perfectly. The partners of the joint venture are of the opinion that the higher investment costs were justified; Rowa was not the cheapest supplier. The plant owners, their representatives as well as international experts are fully convinced of the validity of Rowa's design."

The opinion of the plant owner:

Siegfried W. Keis, Site Representative Meridian Energy



"The plant owners and their representatives, Tom Martin and Sigi Keis, are convinced that the contractor charged with the construction of the second Manapouri tailrace Tunnel FDI Joint Venture, could only manage the very difficult conditions - caused for instance by the high volume of mountain water - thanks to the well-designed back-up system of Rowa."

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About the logistic system

In order to cope with the difficult conditions to be expected during the advance works, Rowa developed a special up-to-date logistic system, made-to-measure for the Manapouri project. This system takes care of the consolidation, consisting of steel reinforcement, rock bolts, reinforcement grids and shotcrete, as well as of supply and removal.

The back-up system consists of two main parts, the back-up train 1 with a consolidation and an infrastructure area, and the back-up train 2 with a suspension platform and supply removal equipment. The whole back-up train 1 is mounted on a stepper system, which is stationary during the advance work and which is moved forward together with the tunnel boring machine. The back-up system is trailed by the tunnel boring machine and sliding on the stepper system, which can adapt itself to lateral displacements. Supporting parts such as steel arches, steel supports and rock bolts can be stepped over easily.

As a separating equipment for the excavated material Rowa has developed a special vibrating gutter with a finger screen. This is situated between the transfer conveyor and the back-up conveyor. Its task is to discard all the rocks larger than 250 mm, while the rest of the material is evacuated by the back-up conveyor and the towing conveyor. The big rocks are taken through a channel to the tunnel floor, broken up into parts smaller than 150 mm and then delivered to an elevator situated between the tunnel floor and the lower platform. This elevator lifts the material and throws it onto the back-up conveyor.

Technical description of the tunnel

Tunnel length:	9'600 m
Inclination:	-12,5 % / + 1 ‰ / + 3,5 %
Outbreak diameter:	10,05 m
Outbreak area:	78,5 m ²
Finished diameter	9,6 m
Specific gravity of the rock:	2,8 t/m ³ fixed
Geological conditions:	gneiss, granite, amphibolit
Water penetration	max. 150 l/sec at the tunnel boring machine max. 1,5 m ³ /sec in the tunnel (cumulative)

Technical details of the back-up system

Length of back-up train 1:	50 m (starting from discharging area of the tunnel boring machine)
Length of back-up train 2:	65 m
Towing conveyor	420 m
Total length	420 m (both back-up trains and dismantling platform)
Total weight	446 to (weight of Rowa installation)
Available power:	950 kW
max. muck capacity:	880 t/h

Functions / Innovations*

- Anchorage of the system
- Shotcrete application*
- Stepper system*
- Suspension platform*
- Supply and removal
- Wireless train track surveillance system
- Vibrating gutter with finger screen for separation of the excavated material*