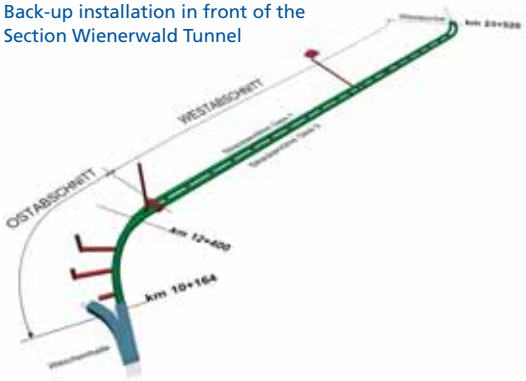
backup

rowa TUNNELLING LOGISTICS

Wienerwald Tunnel, Austria (2 TVM-Back-up Installations)

Back-up installation in front of the Section Wienerwald Tunnel



Project Participants

Builder-owner:
ÖBB – Infrastruktur Bau AG

Planing:
Planergemeinschaft Wienerwaldtunnel
iC Consulenten, Basler & Hofmann,
Dr. B. Strobel, Pöyry Infra

Execution:
Arge Wienerwaldtunnel
- Porr Tunnelbau GmbH
- Bilfinger Berger Baugesellschaft m.b.H
- Bilfinger Berger AG
- Porr Technobau und Umwelt AG
- Züblin Tunnelbau
- Hochtief Construction AG
- Jäger Bau AG
- Swietelsky Baugesellschaft m.b.H.

Supplier Heading Installation:
Herrenknecht AG
Rowa Tunnelling Logistics AG

Editorial

Ladies and Gentlemen

This edition is dedicated to the project Wienerwald, a particularly interesting venture. The following summarizes an overview of the project and Rowa's installations effected therein.

Project and Objective

The Project

The Wienerwald tunnel is a major construction of the Austrian National Railway (ÖBB) for the Western Railway's four-track expansion between Vienna and St. Pölten. The traveling time of the trains is to be reduced drastically with two one-track tubes with a length of 10,75 km each, an excavation diameter of 10,6 m and cross passage connections every 500 meters. This tunnel construction basically consists of two very long one-track tubes and one 2,4 km long double-track tube on the Vienna side of the Wienerwald tunnel. The inside diameter of the lining segment sleeve socket amounts to 9,65 m.

Assessment of the Client

Joint Venture Wienerwald Tunnel, Mr. Diewald, Project Manager, Porr Tunnelbau GmbH

The Wienerwald tunnel project made very high demands on the two heading systems. With the development and supply of two back-up systems via innovative solutions, Rowa has satisfied very stringent requirements within the given time frame. The flexible train station area, which enables a parallel high performance transloading of supply material (such as lining segments, gravel and mortar components as well as invert concrete), should especially be mentioned. Supply capability is designed for transloading lining material for two lining segment rings at a time. Operationally, the two back-up systems have proven to be very successful.

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Back-up installations ready for the heading

The concept for these tunnels provides for construction of two single-track tubes with segment lining. The lining segment length amounts to a considerable 2,25 meters. Furthermore, invert concrete will be built into the heading area. The interior timbering and walling takes place in various phases behind the back-up and mainly consists of the in situ concrete interior sleeve, the cable pan with the arrangements of the wiring and the rail bed floor. Cross passages are built between the heading and the above mentioned final timbering and walling. The two tunnel heading machines are in operation since autumn 2005 and early 2006. The tunnel boring machines from Herrenknecht AG are in operation together with the two 240 m long back-up installations from Rowa Tunnelling Logistics AG in Wangen, SZ. This is the first time that tunnel heading machines of such a diameter range are being used in Austria.

The back-up system is fit for double-track passage over the entire length of the train station. Thereby both, the heading supply as well as the invert lining supply, are equally ensured.

Objectives for Heading Installations

The heading installations consist of two single shield hard rock tunnel boring machines and two back-up installations.
Rowa Tunnelling Logistics AG has received its assignment from Herrenknecht AG. The assignment covers the development, production, installation and starting up of two mirror inverted TVM back-up installations with the following features:

- Segment lining with a length of 2,25 m
- Logistics for maximum performance of 54 m per day
- In situ concrete invert lining with slide finisher, integrated into the heading
- Minimum amount of personnel to operate the heading machines

Mobile cross over switch with lowest possible construction height

Additional Deliveries for Supply Logistics

The supply logistics for the headings from the interim storage in front of the portal requires various special installations and equipment. The following equipment has been delivered by Rowa directly to the joint venture Wienerwald Tunnel:

- 4 pcs. of mobile cross over switches for the crossover on both sides behind the heading installations
- 15 pcs. of gravel transport silos, load capacity 11,6 m^3
- 8 pcs. of sand- and bonding agent silos, net content sand 5,7 m^3, bonding agent 1,9 m^3
- 40 pcs. of invert concrete transport containers, net content 4,5 m^3

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Unloading of invert concrete transport container (4,5 m³) with special crane

A high performance transloading crane with basket discharge installation (360°) supplies the floor lining construction site with fresh concrete

Transloading place for special consoles (for back-ups) and lining segments behind the lining segment magazine

Gravel transport silo, 11,6 m³ net content

Project-Data

Country	Austria
Tunnel Length Total	2 x 10,75 km TBM heading 1 x 2,4 km conventional heading
Type of Heading	Single Shield-TBM
Gradient	max. 0,28%
Excavation Diameter	10,64 m
Lining Segment Interior Diameter	9,65 m
Segment Lining	Without screws, without sealing
• Segment Thickness	350 mm
• Segment Width	2'250 mm
• Quantity	5+1 Pieces
Invert Lining	In situ concrete in the back-up
Interior Timbering and Walling	In situ concrete interior sleeve behind the back-up
Double-Track Supply	2 x 900 mm track
Removal	Tunnel conveyor continuously expandable to back-up

The Concept

For its realization, the various required operation sequences had to be analyzed in detail and suitable installations had to be developed. The result is an innovative back-up concept. The realized solution contains the following highlights:

- Automated lining segment transloading over long distances and automatic transloading of the back-up tracks with special consoles
- Just in time wet mortar production on the back-up from three components
- Disentangling of heading and floor lining
- Highly mechanized invert concrete transloading and -installation in the back-up.

The Logistics Concept of the Back-up Installation

Supply of the heading installation is secured via double rail. Lining segments, gravel for the annular gap back filling, sand and bonding agents for the mortar back filling of the lining segments in the floor area are transported to the TVM with only one train. At the same time, the base invert concrete is carried over with basket-cars. Deliveries of continuous conveyor elements, pipelines and supply material are executed separately in the back-up area. A continuous conveyor from the heading installations to the interim storage at the portal area ensures the removal of the muck material. The back-up 3 makes up the rear end of the heading installation. This part contains the infrastructure for the supply of electrical energy, cooling and industrial water and fresh air. Additional elements of the back-up 3 worthy to be mentioned are a generous installation for additional injections and the continuous conveyor installation.

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Lining segment transloading over open shafts in the train station area

Simultaneous transloading of sand and bonding agents with invert concrete transloading

Just installed concrete floor ready for rail construction

The back-up 2 consists of the transloading train station with double rail for unloading the various trains and the floor lining construction site with a slide finisher. In the upper area, the transport route for the heading supply has been spatially separated. Finally, the interim storage and the installation area for the lining segments, the four components for the annular gap back filling and the track installation with special consoles for the back-up, are placed in back-up 1. The infrastructure of the shield machine is placed on the middle deck.

Particularities

A total of three processes have been automated in the back-up installations. The lining segment transport from back-up 2 to back-up 1 over a stretch of 180 m has been automated. The rail- and console transport from back-up 3 to back-up 1 over a stretch of 225 m has been automated. The just in time production of wet mortar on the back-up from the following three separate components has been automated:

- sand soil-moist
- bonding agent open-dry
- water

The reduction in operating personnel is a direct result of automation. Besides the reduction of personnel cost, additional advantages are achieved through automation. The potential of human errors when operating machines is markedly reduced. Subsequently, breakdown of equipment due to operating mistakes is equally minimized. Therefore, a higher availability of the entire operation and increased working safety are achieved. In case of sudden failure of the automated operation, an immediate switch to a manual operation is possible.

Remarks

The afore-mentioned heading installations are an example for the current development in tunnel construction mechanization. The implementation of a 2,25 m long lining segment is a new achievement. It improves the relation between heading time and ring construction time and, therefore, increases the heading performance. The consistently implemented mechanization and partial automation of the working sequences have led to two high performance state of the art heading systems.

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