Editorial

Dear reader

With this issue we want to present you the project Sedrun Gotthard base tunnel, section 360. Rowa’s present and long-term objective, to mechanize conventional headings thoroughly, can be clearly demonstrated with the example Sedrun. Please read in this issue how Rowa has developed and realized the entire system of four highly-mechanized special headings for the excavation of one of the geologically most difficult sections of the Gotthard base tunnel. In addition, we would like to introduce you to the newest generation of Rowa’s rotary tippers Rotary III.

Your Rowa team

About the project

The section Sedrun 360 of the Alp Transit Gotthard base tunnel comprises the construction of a multi-functional location and of 2 tunnel tubes with a length of 6.2 km, which are part of the 57 km long Gotthard base tunnel. The section covers the geo-technically most demanding part of the entire length of the Gotthard tunnel to be excavated conventionally. The multi-functional location Sedrun is reached by a 1 km long access tunnel and two 800 m deep vertical shafts. In the multi-functional location the technical installations necessary for the rail service, the emergency stops and the crossover installations are set up. Starting from this multi-functional location, both tunnel tubes to Faido in the south and both tubes to Amsteg in the north are excavated conventionally. Supply and removal for the underground construction site are effected through the two vertical shafts. The order, with a value of about 1.2 billion CHF, was placed with the joint venture Transco-Sedrun, which consists of the building contractors Batigroup AG Zurich, Frutiger AG Thun, Bilfinger und Berger AG Munich and Pizzarotti SpA Parma.

The customer’s opinion

Dipl. Ing. ETH Luzi Gruber, Batigroup AG

«The Sedrun project is extraordinarily challenging for the tunnel constructor as well as for the manufacturer of the installations. That’s why we backed Rowa right from the beginning and developed together an installation which is made-to-measure for our construction contract. This installation will allow us to achieve the required performances, even under the most difficult conditions, while guaranteeing the maximum possible workplace safety. Rowa has taken our requirements into account in a very professional way.»

Rowa-Highlights

• Uncompromising mechanization of the excavation support
• Performance and safety thanks to two working levels
• Efficient supply with heavy-duty crane
• Creation of a second working level
Project data

Country: Switzerland
Execution: 2002 – 2009
Owner: Alp Transit Gotthard AG
Client: Arge Transco-Sedrun

<table>
<thead>
<tr>
<th>Single-track tunnel north from multi-functional location</th>
<th>Tunnel east</th>
<th>Tunnel west</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunnel length</td>
<td>1.5 km</td>
<td>1.5 km</td>
</tr>
<tr>
<td>Profile</td>
<td>60–135m²</td>
<td>60–135m²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Single-track tunnel south</th>
<th>Tunnel east</th>
<th>Tunnel west</th>
</tr>
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<tbody>
<tr>
<td>Tunnel length</td>
<td>3.6 km</td>
<td>3.6 km</td>
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<tr>
<td>Profile</td>
<td>60–135m²</td>
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</tbody>
</table>

Specific characteristics

Special rock support system
A special rock support system has to be used in Sedrun, in order to cross the pressure zones. Radial anchors and heading anchors are placed as safety elements. With driving front areas of up to 135 m² about 240 anchors of 18 m length have to be placed, overlapping in sections of 6 m. The occurring convergencies in the fault zones represent a special challenge. In order to cope with the deformations of up to 0,7 m radially, a massive steel reinforcement consisting of two interlocking rings with slide joints is used, which has to take up these convergences. No tunnel has been constructed in this way up to now. The chosen system with deformable sliding steel inserts has never been used in these dimensions before.

Rowa Tunnelling Logistics AG’s order

Already before and during the tendering period Rowa intensively investigated the particularities of the project Sedrun. A comprehensive system for the realization of the very special tunnel was developed. After the order for the section 360 Sedrun was placed with Arge Transco-Sedrun, the heading installation was further developed in close cooperation between Rowa and Arge Transco. On April 23, 2003, Rowa received the order for the development, manufacturing, supply, installation and commissioning of 4 multi-functional heading installations from Arge Transco-Sedrun.
**Construction procedure**

Essentially, the construction procedure for the tunnel consists of the following steps:

1. Drilling of the rock face
2. Blast of the rock face, muck handling, preliminary consolidation of rock face and ridge
3. Steel reinforcement
4. Consolidation of the rock face
5. Radial anchoring
6. Anti-cyclical nailing of the rock face (after every 6–9 blasts)

**Multi-functional advance Installation**

The installation consists of the special machine for rock support with working baskets, displacing arms, shotcrete robot etc., the loading installation for the loading of the muck trains, a 20 t heavy-duty crane for the supply to the workplaces, a suspended platform with installations for ventilation, cooling etc. and a supply train with infrastructure equipment.

**Special Machine for Rock Support**

With the special machine for rock support the ring beams are placed by bundle and by segment. The installed shotcrete applicator seals the profile. With two cutting scissors the previously placed heading anchors can be removed efficiently and safely after every blast. Thanks to the suspended construction and the special machine for rock support the tunnel constructor has a second working level at his disposal, as well as a clear working, manoeuvring and parking space on the invert.
Heavy-duty crane

With the heavy-duty crane with a load carrying capacity of 20 tons, the supply to the rock face and to the work places is effected in an efficient way. The crane moves on the same suspension rail as the special machine for rock support.

Infrastructure and Supply Trains

The infrastructure and supply trains, which have been designed in close cooperation with the contractor, are an important link in the chain of the mechanized advance operation. Infrastructure and material supply are at the correct location at the correct time, in correct quantities.

Suspension platform

On the suspension platform, the ventilation, the cooling and the rail dismantling equipment are installed. The suspension platform moves on the same suspension rail as the heavy-duty crane. Its movement is effected by 2 hydraulic thrust devices.

Loading system for the muck train

The Rowa loading system, with the Toro loading device, guarantees an efficient loading of the muck trains.

Rotary Tippler Rowa Rotary III

Rowa designed three rotary tipplers for the discharge of the muck trains. The rotary tippler takes up two cars with 24 m³ excavated material. The cars are centred and held automatically. The entire tippling process is controlled by the locomotive driver. During the tippling operation, the driver doesn’t have to leave the driver's platform.

Technical data rotary tippler Rowa Rotary III

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Maximum width of passage (loco, tipper wagon)</td>
<td>1'600 mm</td>
</tr>
<tr>
<td>Maximum height of passage (loco, tipper wagon)</td>
<td>2'300 mm</td>
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<tr>
<td>Track gauge</td>
<td>900 mm</td>
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<tr>
<td>Total weight per rotary tipper</td>
<td>ca. 40 t</td>
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<tr>
<td>Weight of 2 loaded wagons</td>
<td>50,8 t</td>
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<tr>
<td>Rotating mass of rotary tipper with 2 full wagons</td>
<td>ca. 80 t</td>
</tr>
<tr>
<td>Maximum revolutions per minute of rotating drum</td>
<td>2,5 min-1</td>
</tr>
<tr>
<td>Unloading time of a train with 6 wagons</td>
<td>less than 10 min.</td>
</tr>
</tbody>
</table>