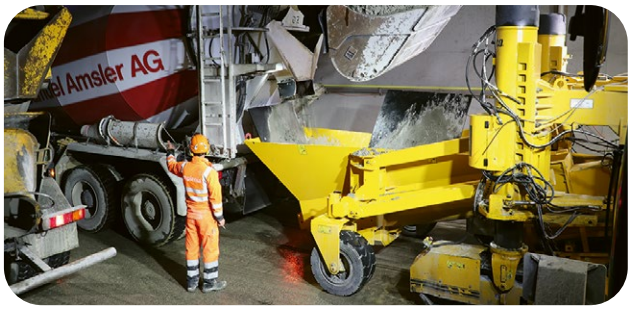
MASTER® BUILDERS SOLUTIONS

MasterGlenium® SKY 652
MasterAir® 302
MasterSet® R 400LENT

Track embedment concrete
Bözbergtunnel



The project

Some 150 years after the construction of the Bözberg railway tunnel, work to construct a second double-track tunnel, parallel to the first, began. To shift more transalpine freight from road to rail, Swiss Federal Railways (SBB) is expanding the line from Basel to Ticino into a 4-metre wide corridor by 2020 for the Swiss Confederation so that semi-trailers with a corner height of 4 meters can be transported. The largest single project is the construction of the Bözberg tunnel with construction costs of around. 350 million Swiss francs. The new, 2.7 km-long tunnel connects to the old tunnel, which will eventually become a rescue and safety tunnel, with cross passages. The tunnel boring machine mined from Schinznach to Effingen from spring 2017, breaking through at the end of November. The concrete lining was then cast using a inner lining shutter. In Spring 2019, installation of the track, signaling and systems began.

The task

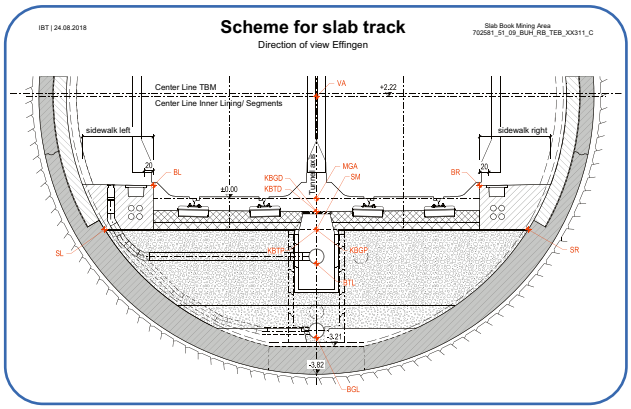
The LVT (Low Vibration Track) method was chosen for the slab track. The advantages of this system is that it provides better track position stability and requires less space. The required elasticity of the system is usually achieved by mounting elastic materials between the superstructure and the substructure. Two concrete mixes were required, one for the substructure, the other to go around the concrete LVT sleepers. The two concrete types are part of the Bözberg Tunnel Concrete Specification. Tests conducted at an early stage assured that the mixes met special requirements such as carbonation, alkali-aggregate reaction (AAR) resistance and freeze-thaw (FT) resistance. An additional requirement was a flexural tensile strength of at least 5.5 N/mm^2 after 28 days.

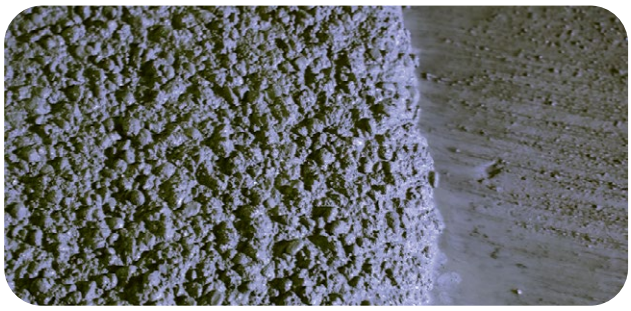
Proposed solution

To lay the substructure, or base layer, the contractor converted a Gomaco paver to place the concrete as easily and accurately as possible. Once the two halves of the substructure were complete, the concrete sleepers, consisting of LVT blocks in a rubber shoe, were laid on top and the secondary concrete cast around them. The first half of the tunnel width is being paved from the Effingen side, supported by a central formwork, with the second half paved from the Schinznach portal. For the section paved from the Schinznach portal, the secondary concrete was delivered by rail, rather than by truck.

Procedure

The two types of concrete were adjusted initially at the concrete plant, owned by Samuel Amsler AG, so that they met all the requirements. Fine-tuning of the D231-OT type concrete for the base layer was then carried out with the converted paver at the project site at Bözenegg. A short test section was laid twice to simulate paving in a narrow tunnel. It was important to find the right consistency so that it could be delivered by conveyor belt, had the right early-age stability and achieved the right surface finish. The secondary concrete was adjusted to the right consistency during the first installation stage.





The result

The first half of the base layer was poured in 5 days from the Effingen side, as was the second half, again from Effingen. In November the first part of the secondary concrete could be poured. At the end of January 2020, the final section of concrete was successfully completed. Now work continues on the installation of the railway systems. If all goes to plan, the tunnel should be open for train traffic at the end of 2020.

Added value

- Expert support to develop and optimise the concrete mix and its production
- Requirements and specification consistently met
- Reliable service

Master Builders Solutions® – a plus for your project

- Optimal combination of products
- Interdisciplinary and interregional cooperation
- Experience gained worldwide
- In-depth knowledge of local building requirements
- Use of innovative and economical technologies

Information about the recipes

Track support plate approx. 2500 m^3:

Concrete type:	D231-OT carriageway
Concrete designation:	C25/30 D_{max} 32 C3 XC4, XD1, XF2
Cement/SCM:	Optimo 4/fly ash
Superplasticizer:	MasterGlenium® SKY 652
Air-entraining agent:	MasterAir® 302
Retarder:	MasterSet® R 400LENT

Track casting concrete approx. 3000 m^3:

Concrete type:	D261-O
Concrete designation:	C25/30 D_{max} 16 F5 XC4, XD1, XF2
Cement/SCM:	Optimo 4/fly ash
Superplasticizer:	MasterGlenium® SKY 652
Air-entraining agent:	MasterAir® 302

Project partners

Client	Swiss Federal Railways SBB, 3000 Bern 65
Civil Engineer	IG Bözberg plus c/o Amberg Engineering, 8105 Regensdorf
Building contractor	Implenia Schweiz AG, 8050 Zurich
Track construction company	Rhomberg Bahntechnik AG, 8048 Zurich
Concrete supplier	Samuel Amsler AG, 5107 Schinznach

Picture credits	Samuel Amsler AG, 5107 Schinznach

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