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# Tunnelling Projects

Robert Amstutz

In recent years regular travellers on the Bözberg Line between Basel and Brugg, and on the Aarau-Olten lines of the SBB will have seen various construction projects in progress. The old Bözberg tunnel is being replaced by a new parallel one, whilst a new tunnel is under construction through the Eppenberg on the route between Aarau and Olten.

## Bözberg Tunnel

The new Bözberg tunnel is part of the 4m high profile north-south corridor along the Gotthard transit route, which will allow more commercial vehicles to transit Switzerland by rail. This is in line with established Swiss government policy to reduce the number of transit goods vehicles on the roads. The new double-track tunnel will be 2,693m long (the old tunnel is 2,526m), conform to the EBV4/S3 height profile and will have a cross bored safety passage to the old tunnel roughly every 480m. Signalling will be to ETCS level 1; electric power will be provided by a power rail mounted on the tunnel roof (instead of traditional catenary). Trains will be able to run at 125 km/h. The old tunnel will be converted into a service and rescue tunnel.

Preparation of the construction site began in October 2016, with the first 108m of the tunnel being dug out by excavator through loose stone. In March 2017 construction of the tunnel-boring machine commenced and the machine entered the tunnel and became operational in late July 2017. The new tunnel is lined with pre-cast reinforced concrete segments. Spoil is extracted by conveyor belt and temporarily stored about 1.5 km away. The tunnel is expected to be in operation by 2020. The boring machine is over 90m in length; weighs 1920t; the cutting shield alone weighs 282t. The cutting profile is 12,360m in diameter and under optimal conditions the machine can bore 22m/day. There has been a lot of discussion locally about the environmental impact of the building works. The SBB had originally planned to remove the 570,000t of spoil by road but has been forced to come up with a plan to move the spoil from the temporary storage facility by rail across the valley to the Wildeggen cement works. They will use the spoil to backfill one of their old quarries.

The sourcing and transport of the concrete tunnel liners was also a subject of much discussion. The tunnel liners are prefabricated in Sengental in Germany, transported by rail some 450km to South Baden (Germany) and transferred to road for the last 80 km to Bözberg. This will result in 3,000 heavy vehicle movements being necessary. Unfortunately, with the continued removal of freight infrastructure on the SBB network, a more suitable transshipment solution could not be found. Despite being in the middle of the building site, the well-known Rösti restaurant, situated opposite the former Schinznach Bad station, continues to do good business (but you need a car to get there).

## Eppenberg Tunnel

The 3,114m double-track Eppenberg tunnel is at the heart of a project to create a 4 rack railway between Aarau and Olten and bypass the current bottleneck at Schönenwerd. Track layout, signalling and passenger facility changes at Dülliken, Däniken and Olten finalise this project, which is scheduled to be completed by the end of 2020 and will bring more capacity for regional, express and goods traffic.

This tunnel-boring machine is 115m long and weighs 2,400t and has commenced working from the eastern portal at Wöschnau outside Aarau. The geology is different to the Bözberg tunnel and so a "mixshield" tunnel-boring machine is being used. After 1,700 metres of hard rock the cutters needed to be changed in order to bore through a wetter rock strata. This break in construction was used to allow the general public to visit the site and walk through the tunnel to the massive machine. In contrast to Bözberg, the construction company has sourced its tunnel liners from a production site in Klus, on the Oensingen-Balsthal railway, and transport to the Eppenberg site is entirely by rail.

As much of the 750,000t of spoil as possible has been recycled on-site. The rest will be used to cover the site of the former hazardous waste landfill site at Kölliken on the Lenzburg to Zofingen line. Again, owing to the lack of available SBB freight infrastructure the material will be moved by road to Kölliken. No major problems have occurred on the project but just recently a 6m by 3m hole appeared in a field above the tunnel exactly at the critical transition point between the differing rock strata. No one was injured and spoil will be used to fill it in again. 