PROGRESS: 100% - COMPLETED
AUSTRIA/2018-19

IMPROVING SAFETY BENEATH THE PLABUTSCH MOUNTAIN RANGE

Rehabilitation of the Plabutsch tunnel

Text: Thomas Exel

The consortium for the underground rehabilitation of the Plabutsch tunnel (ASPUT) was commissioned by Asfinag to construct 20 underground cross passages.

With a length of approximately 10km, the Plabutsch tunnel is the second longest road tunnel in Austria. In an effort to keep traffic disruption to a minimum, most of the works were carried out at night under challenging logistical conditions.

Project data

Employer	ASFINAG
Contractor	ARGE PORR/STRABAG/PKE
Project type	Tunnelling
Project scope	Construction of 20 underground cross passages
Construction start	01/2018
Construction end	04/2019

Background

With a length of approximately 10km, the Plabutsch tunnel is the second longest twin-tube tunnel in Europe after the Gran Sasso tunnel in Italy and the second longest road tunnel in all of Austria after the Arlberg tunnel. To handle the daily traffic volume of around 30,000 vehicles, a twin-tube route has been in operation since 2004. The Plabutsch tunnel had to be comprehensively rehabilitated by 30.04.2019 due to a tightening of the Austrian Road Tunnel Safety Act (Straßentunnelsicherheitsgesetz or STSG). In accordance with the new STSG, escape route lengths must not exceed 500m and cross passages that may be used by emergency vehicles are required every 1,500m. The consortium for the underground rehabilitation of the Plabutsch tunnel (Arge Sanierung Plabutschtunnel Untertage or ASPUT) was commissioned as a subcontractor of umbrella consortium PORR, STRABAG and PKE to construct the cross passages, five of which are accessible by vehicle, 15 on foot. The construction period was 15 months. The total tunnelling length comprised 951m.

Two construction phases

The project was executed in two separate construction phases. The first construction phase, which took approximately eight months, involved excavating all the passages from the east tunnel to the inner lining of the west tunnel and fitting the inner linings, including those of the eastern terminal blocks.

During the second construction phase, from January to April 2019, the inner linings of the west tunnel were removed and the western terminal blocks were lined.

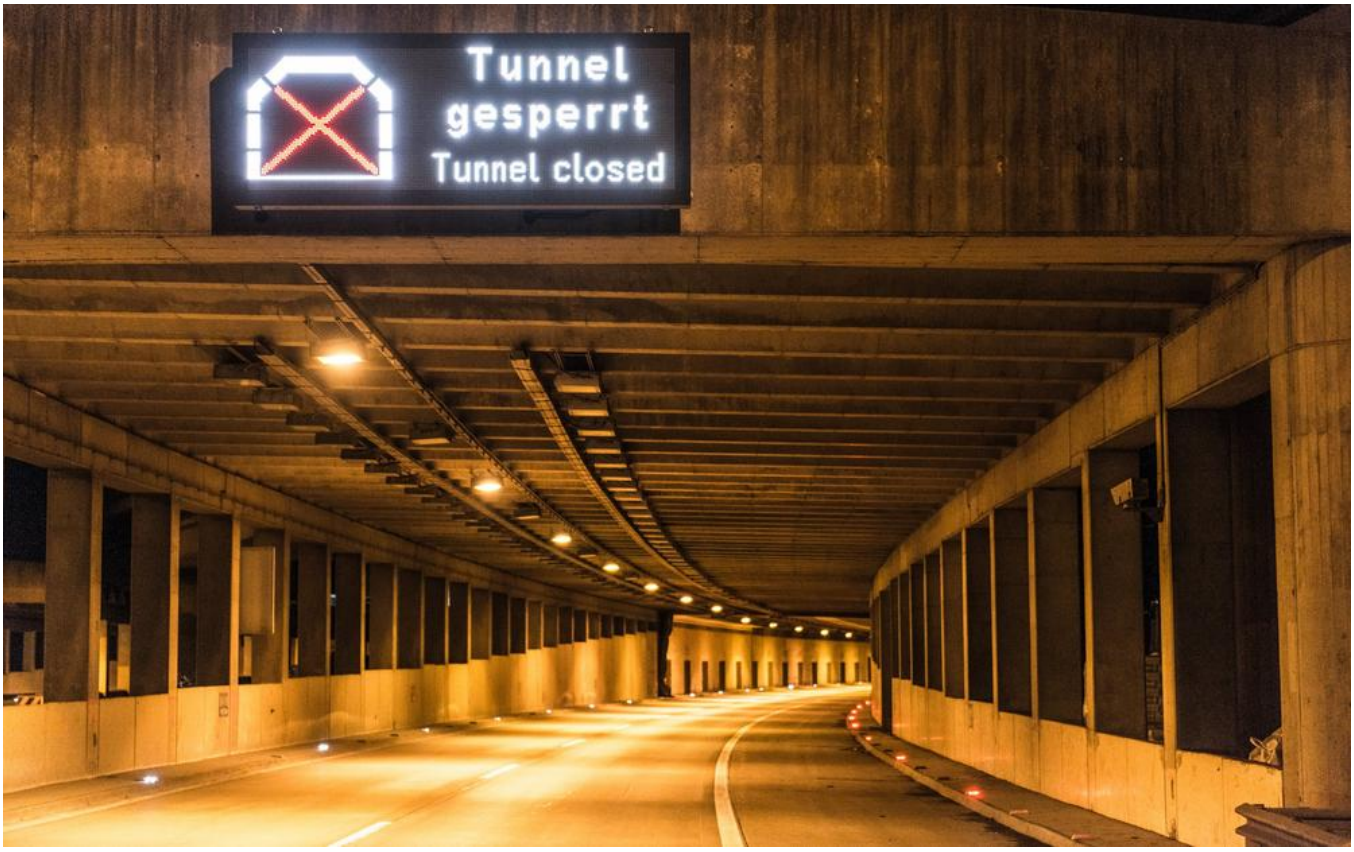
A total of 20 cross passages were constructed, five accessible by vehicle, 15 on foot. Source: Thomas Exel

AS A FULL ROAD CLOSURE WAS NOT AN OPTION, WE WERE ONLY ABLE TO WORK DURING THE NIGHT AND ON SELECTED WEEKENDS.

Thomas Exel
Site manager, PORR Bau GmbH

The ultimate challenge: "Construction in existing contexts"

The challenges of rehabilitating an existing tunnel are entirely different from those involved in building a new one, especially if, as with the Plabutsch tunnel, the existing tunnel is part of a key arterial road and full road closure was not an option. It was not possible to close each tube for work other than during the night shifts, from 8 p.m. to 5 a.m., and occasionally during the day on selected weekends. After deducting the time required for setting up, cleaning and clearing the site, this resulted in a net working period of only six hours.

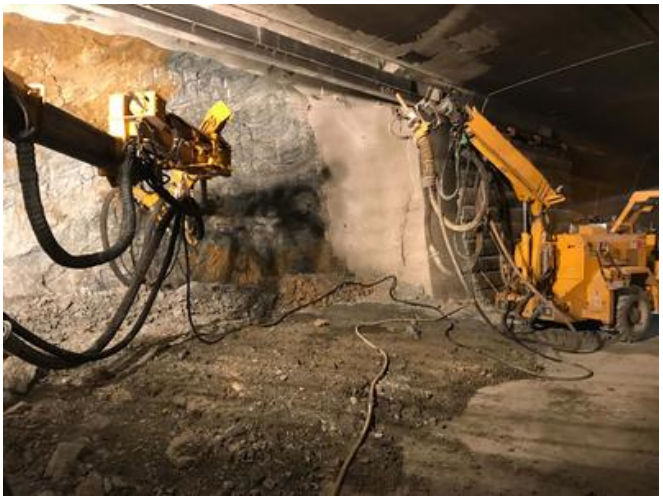


The night closure periods from 8 p.m. to 5 a.m. resulted in a net working period of only six hours. An entire round had to be completed within this time window. Source: Thomas Exel

To ensure that work ran smoothly, it was necessary to complete at least one entire "round of advance" within this very short period of time. In tunnelling, this refers to the entire process: from drilling and loading the boreholes, blasting and removing the rock, to securing the tunnel with jetcrete, reinforcements and anchor bolts. Each of these individual steps required its own equipment, which had to be parked underground in the tunnel in the breakdown bays and the cross passages currently under construction.

The two existing tunnel tubes and associated facilities such as emergency telephone recesses, cables and fire-fighting water supply lines had to be optimally protected during ongoing work. This entailed using vibration measuring devices for all the blasting operations, for example.

The passages were excavated from the east tunnel towards the west tunnel, which was still open to traffic. To avoid endangering road users, blasting operations were performed at a round length of only one metre once work had advanced to six metres before the west tunnel. Traffic was stopped during blasting. Work was carried out mechanically, using only an excavator, three metres before reaching the west tunnel.



All the blasting operations were monitored with vibration measuring devices. Source: Thomas Exel

WHILE WORK IN CONVENTIONAL TUNNELLING PROJECTS IS CARRIED OUT SEQUENTIALLY ON ONE SUBSECTION AFTER THE OTHER, THE WORK BELOW THE PLABUTSCH MOUNTAIN RANGE WAS CARRIED OUT IN PARALLEL. THIS NECESSITATES GOOD COMMUNICATIONS AND LOGISTICS.

Thomas Exel
Site manager, PORR Bau GmbH

Challenging logistics

Coordination between individual trades constituted another major difference to conventional tunnel construction projects. While the work on conventional sites is carried out sequentially on one subsection after the other, the work below the Plabutsch mountain range was carried out in parallel, requiring good communications and logistics. The length of the construction site, approximately 10km, also called for good logistical planning in advance. The long transport routes meant that each employee had to be equipped with the appropriate tools and assigned work tasks at the beginning of every shift to avoid the risk of further delays in an already very tight time window.

Work was carried out, using only an excavator, for the last few metres before reaching the west tunnel. Source: Thomas Exel

Conclusion

During the main phase, up to 50 workers per shift were working on concreting four tunnels and several cross passages. Three foremen and one shift supervisor were deployed per shift to coordinate the work.

Despite these challenging and unusual tunnelling conditions, the ASPUT consortium was able to complete the work on time and thus put Austria's second longest road tunnel on track for an even safer future.

Technical Data

951m total in 20 cross passages
Tunnel length

Driving technique ..... Blasting, mechanical tunnelling
Number of cross passages ... 15 GQ (on foot), 5 EQ (by vehicle)
Excavation cross section ..... 17m² - 61m²