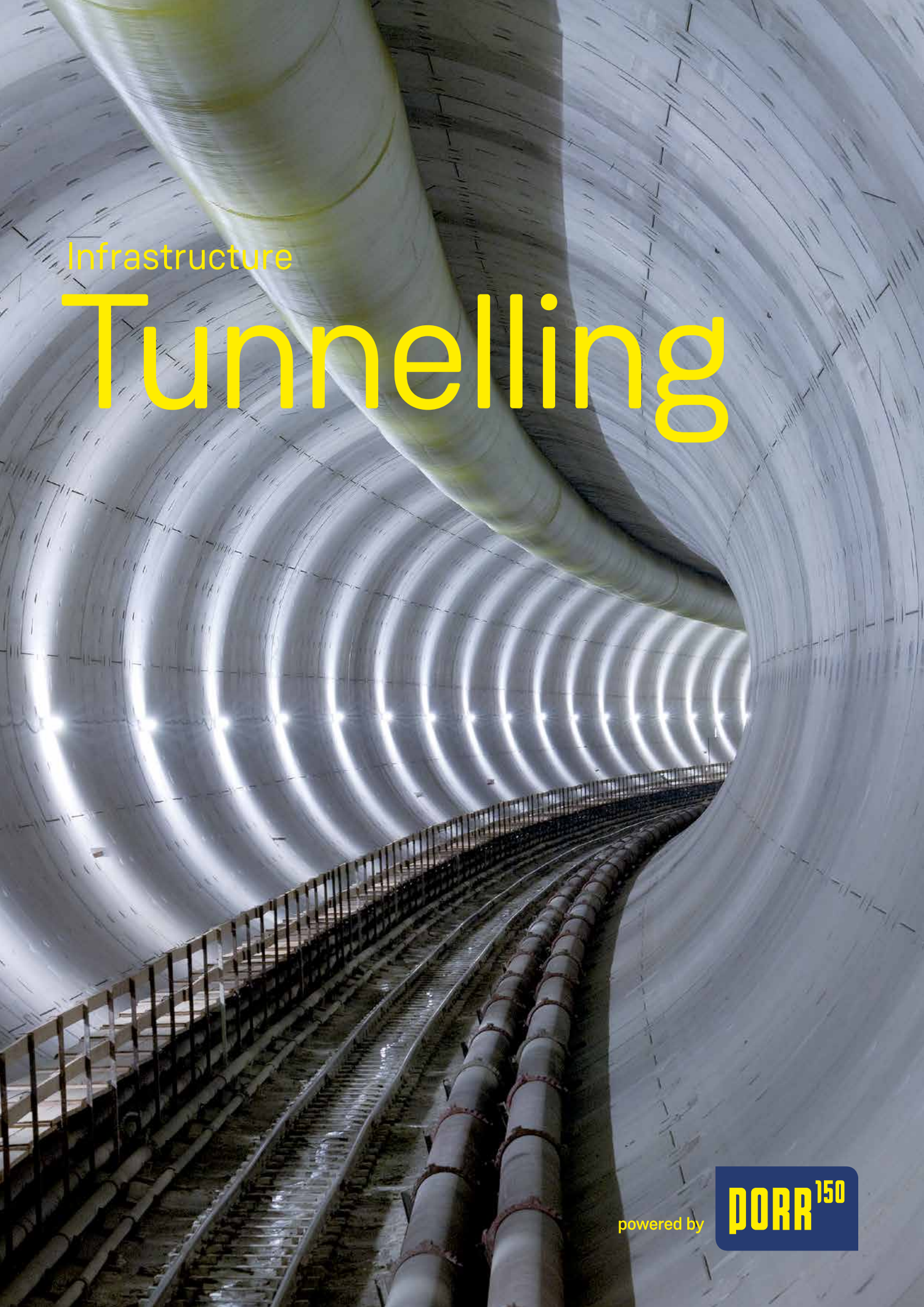
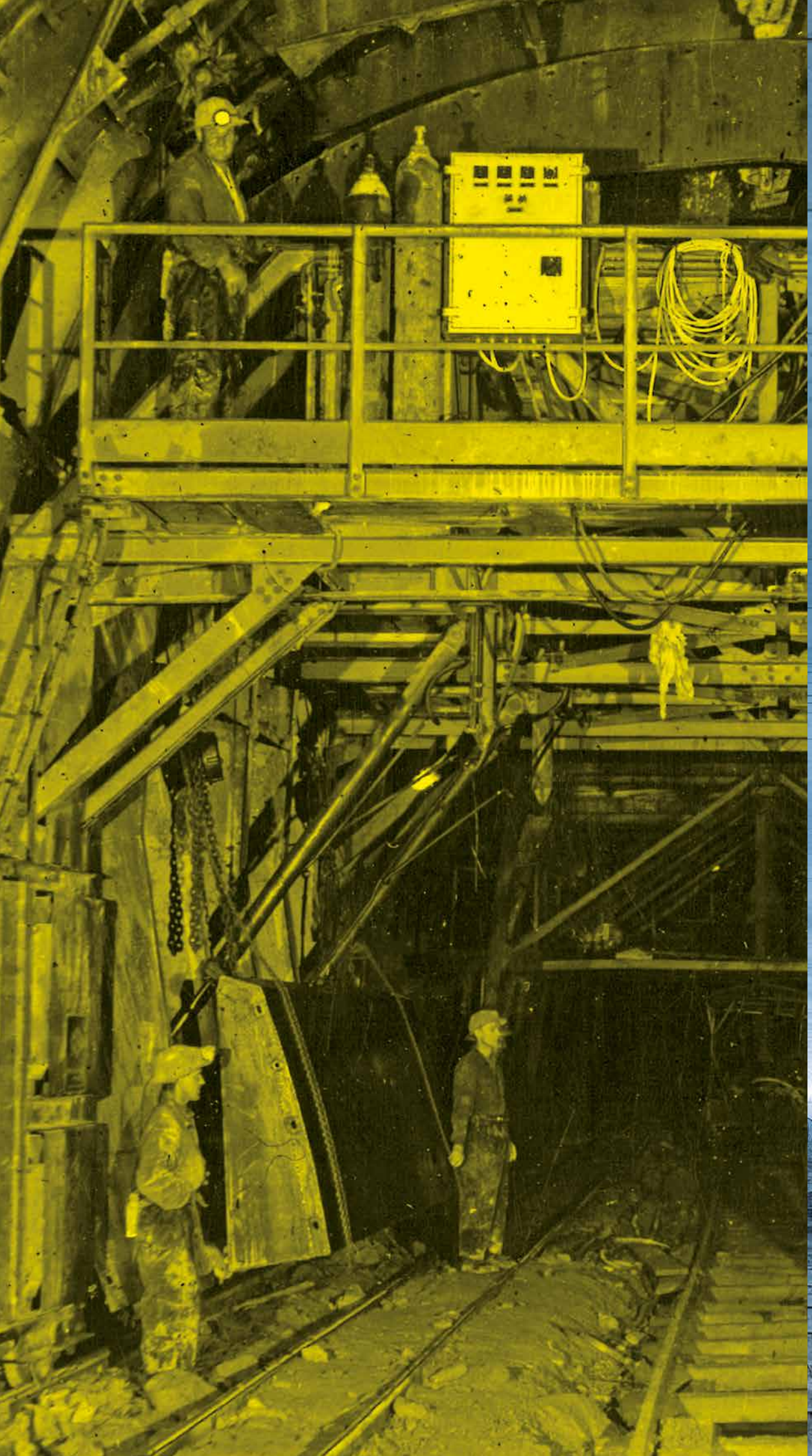


Infrastructure

Tunnelling

powered by PORR 150



02 Pioneering spirit in tunnelling

06 Conventional tunnelling

Building the Albula Tunnel II

ATA (Steinbühl Tunnel)

Brenner Base Tunnel H51

Stuttgart 21 . Obertürkheim and Untertürkheim

S10 Tunnel Götschka

12 Mechanical tunnelling

Emscher Section 40

Tunnel Lower Inn Valley Railway Section H3-4

ÖBB KAT 3 . Koralm

Stuttgart 21 . Filder Tunnel

Metro Green Line

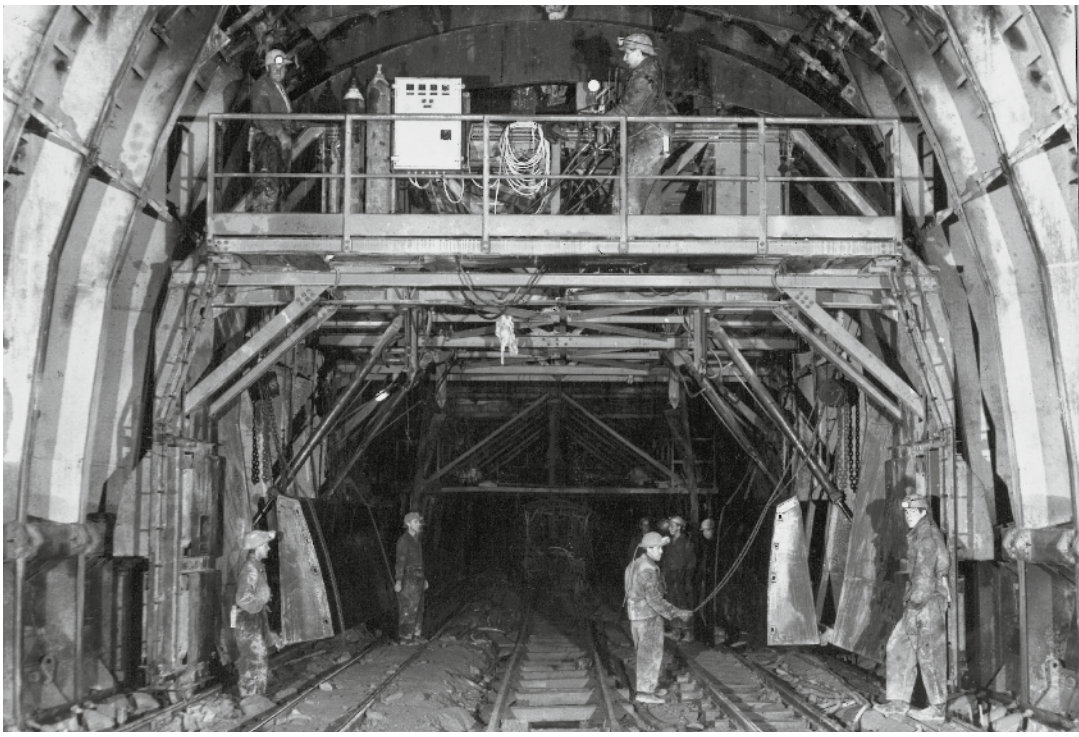
18 Power station construction

River Inn joint power plant . Maria Stein construction section

Reisseck II pumped-storage plant

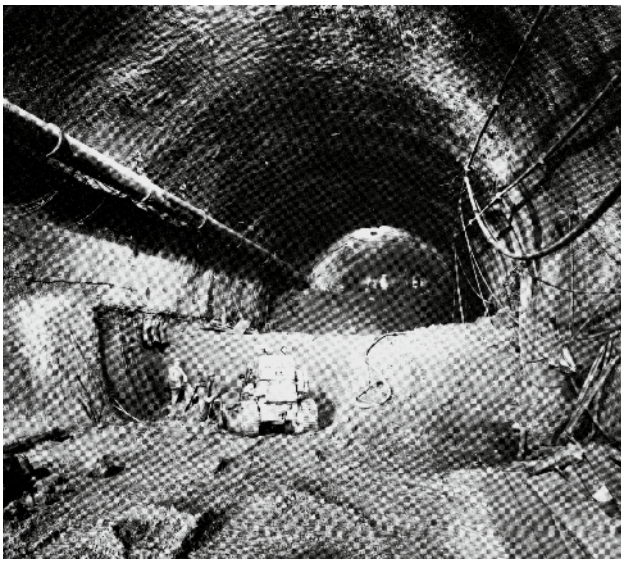
Limberg II pumped-storage plant

Pioneering spirit in tunnelling



1967

Felbertauern Tunnel
The 5,313m long Felbertauern Tunnel is a keystone of a comfortable, safe Alpine crossing



1975

Tauern Tunnel
PORR was using the New Austrian Tunnelling Method as early as the 1970s. Here, to build the motorway route through the Alps

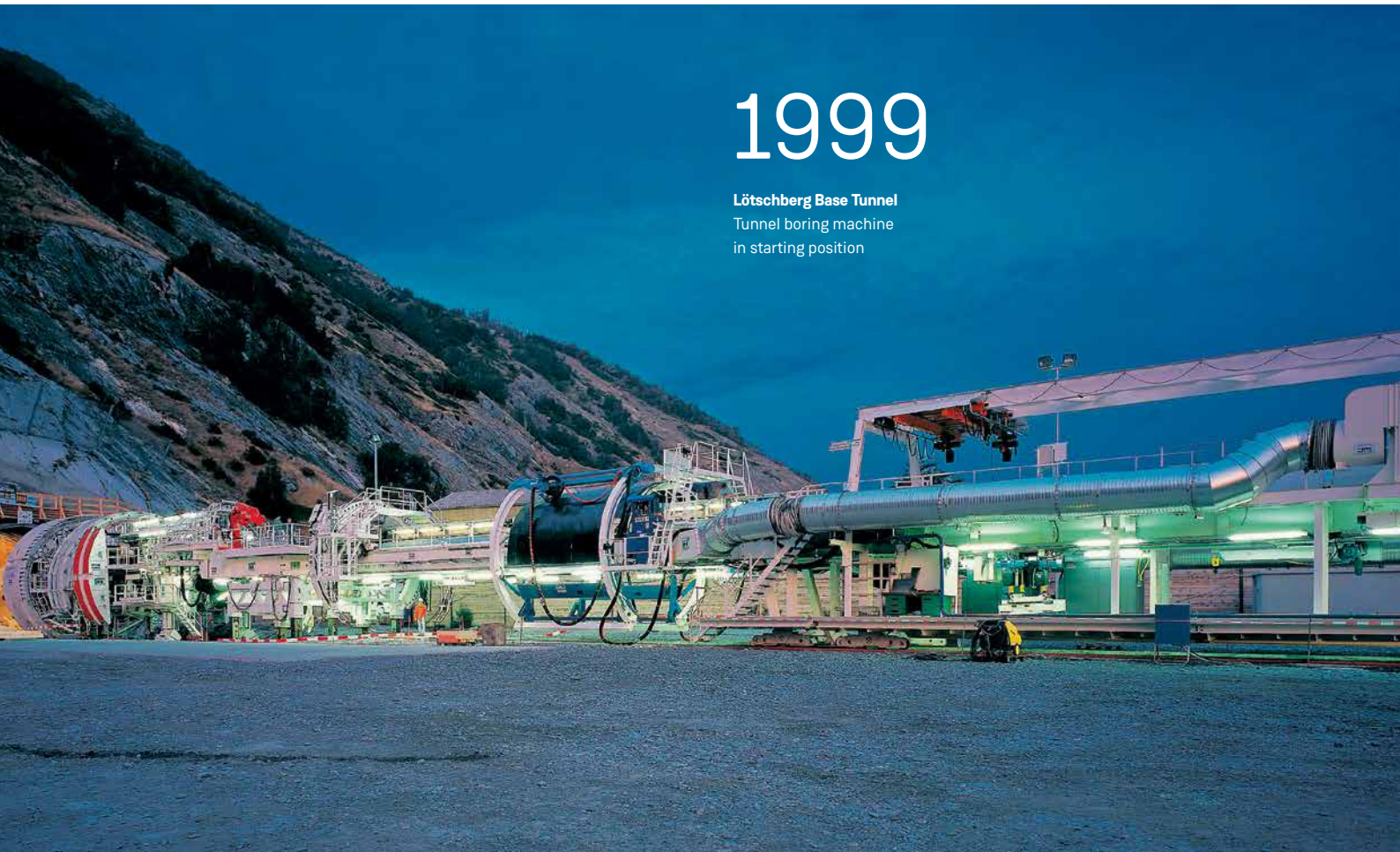
PORR Tunnelling is one of the PORR Group's specialist departments. It is a leading provider in Europe for all elements of underground mining work, from conventional tunnelling methods to mechanical tunnelling using sophisticated modern technology.

PORR Tunnelling pools the commercial and technical skills and capacities from three prestigious companies: PORR AG, TEERAG-ASDAG AG and Hinteregger. Together, the firms can draw on over 100 years of combined experience.

Tunnelling is one of the most demanding disciplines in the construction industry. In addition to expertise and problem-solving skills, it requires a strong focus on protecting the environment and saving resources, and on occupational health & safety.

In decades gone by, working down in the tunnels under the cold, artificial lights was physically demanding and often dangerous; today, however, we combine state-of-the-art technology and innovative construction methods with new digital techniques, with the result that safety is improving all the time.

Over the years, PORR has built up an impressive pool of competence in this field. When the New Austrian Tunnelling Method (NATM) was developed back in the 1950s, PORR was a major contributor. The NATM would revolutionise tunnelling all over the world.



1999

Lötschberg Base Tunnel
Tunnel boring machine
in starting position

Tunnelling covers a wide spectrum extending from road and rail tunnels for transport infrastructure to tunnels for drinking water, district heating and waste water pipes. This spectrum also includes metro construction – and it is precisely in this field that PORR was awarded what was at the time its biggest contract ever: PORR worked with local partners to build the Green Line metro in Qatar's capital Doha, at a cost of 1.9 million euros. The new metro is one of the most modern metro systems in the world.

At home in Austria, the Group has equally impressive evidence of its tunnelling competence. For example, PORR was awarded the contract to build the third section of the Koralm Tunnel, and in 2018 it was part of a consortium that won Austria's biggest tunnelling contract, the Brenner Base Tunnel.

The Group's tunnelling expertise is also frequently in demand internationally, in cooperation with local partners.

In future, tunnelling will become increasingly important to construction: in heavily populated conurbations, space is steadily becoming more of a premium. At the same time, we humans are sensitive to heavy traffic in our urban habitats. In order to manage the traffic issues in city centres and meet the growing demand for motorways, express roads and rail networks, we will find ourselves digging beneath the surface more and more.

2007

Wienerwald Tunnel
Tunnel boring machine breaks through to the emergency ventilation cavern

2016

Bossier Tunnel
Supply train entering the tunnel

Building the Albula Tunnel II
In the Swiss canton of Grisons, PORR is working on one of the highest underground Alpine Crossings

Conventional tunnelling

Adapting experience to new circumstances. Conventional tunnelling methods face constantly changing challenges.

Highly diverse rock conditions mean that our engineers and technicians are obliged to keep developing new, innovative techniques and construction methods to guarantee solutions that are perfectly adapted to the particular underground structure being built.

We use the following conventional tunnelling techniques:

- **Drill & blast**
- **Mechanical approach** with tunnel excavators and roadheaders
- **Special tunnelling methods** where support systems are required ahead of the advance: piperoof, injections, anchors, lowering groundwater levels or ground freezing

We are continually developing our techniques and incorporating new logistics concepts. In this way, we are able to combine the flexibility of conventional tunnelling with the advance rates of modern high-performance techniques.

PORR takes into account subsoil conditions, structural geometry and scheduling. We build on the New Austrian Tunnelling Method (NATM) that we were instrumental in developing. In this method, the hollow spaces in the surrounding rock take on a load-bearing function. This reduces the need to use products such as jetcrete for stabilisation, and consequently lowers construction costs. Its advantages have led to the NATM becoming a benchmark for modern conventional tunnelling.

The new Albula Tunnel II

ATA (Steinbühl Tunnel)

Brenner Base Tunnel H51

Stuttgart 21 . Obertürkheim and Untertürkheim

S10 Tunnel Götschka

Albula Tunnel II
Working all year round on a construction site high in the mountains requires special solutions when planning access roads and site facilities

Brenner Base Tunnel H51
PORR won the contract for the central element of the Brenner Base Tunnel: section H51. This is the biggest tunnel construction contract to be awarded in Austria to date

Steinbühl Tunnel
Laying concrete in the Steinbühl Tunnel
(New DB Stuttgart – Ulm line)

Stuttgart 21 . Obertürkheim and Untertürkheim construction sections
The Ulmerstrasse shaft was used for supply and spoil removal for four advances

S10 Tunnel Götschka
Portal to S10 Tunnel Götschka, with treatment plant for recycling tunnel spoil into concrete aggregate and embankment material

Mechanical Tunnelling

Each day of an advance, unexpected situations may arise. They must be handled professionally and correctly, with safety as top priority.

PORR uses sophisticated modern technology and logistics systems for mechanical advances.

We achieve top performance by ensuring our tunnel boring machines (TBMs) are perfectly adapted to the subsoil conditions. We bring our pooled experiences from earlier projects to every element of each new scheme, from the cutter head design to the TBM assembly plans. To supply the TBMs and remove spoil, we use either conveyor systems and multi-service vehicles, or track-based systems, depending on the project-specific boundary conditions. Our mechanical engineering department works closely with experienced site supervisors to develop new, creative, high-performance solutions. These help us to overcome any unexpected geological challenges and ensure that our advance rates keep improving.

We employ the full range of available technologies:

- **Hard-rock TBMs**
- **Hydroshield, EPB shield, multi-mode machines**
- **TBMs for pipe ramming**

We continue to build on our years of accumulated experience, enabling us to extend the operational limits of our TBMs and shorten project completion times. We develop innovative solutions at the interfaces between construction technology, mechanical engineering and logistics.

Emscher Section 40

Lower Inn Valley Railway . Section H3-4

ÖBB KAT 3 . Koralm Tunnel

Stuttgart 21 . Filder Tunnel

Metro Doha . Green Line

Emscher Section 40
Construction of a waste water drainage system with earth pressure balance shield and segment lining

Lower Inn Valley Railway . Section H3-4
Precision work assembling the 230t cutter head on the tunnel boring machine

Emscher Section 40
Assembling the second EPB shield machine to build the 10km long waste water duct through the Ruhr area

Koralm Tunnel KAT 3
TBM trailing equipment in starting position

Stuttgart 21 . Filder Tunnel
Successful TBM breakthrough in the Filder Tunnel

Metro Doha . Green Line
At the time it was awarded, the 1.9 billion euro contract to build the Green Line Metro in Doha was PORR's biggest contract ever

River Inn joint power plant
Maria Stein construction section
The tireless dedication of our team when working on the River Inn joint power plant ensured that every challenge was surmounted

Power plant

Our hydropower stations make a valuable contribution to clean energy provision.

Based on conventional tunnelling technology for various cross-sections, we have refined and mechanised old mining techniques. Our highest priority is ensuring that all dangers are overcome and guaranteeing the safety of the structure, machinery, and – most importantly of all – the people working on the site. This may mean managing e.g. water ingress, enormous rock pressures, or gas deposits.

PORR's competences in conventional and mechanical tunnelling, shaft construction and cavern construction guarantee all-round expertise for complex power plant projects at any scale.

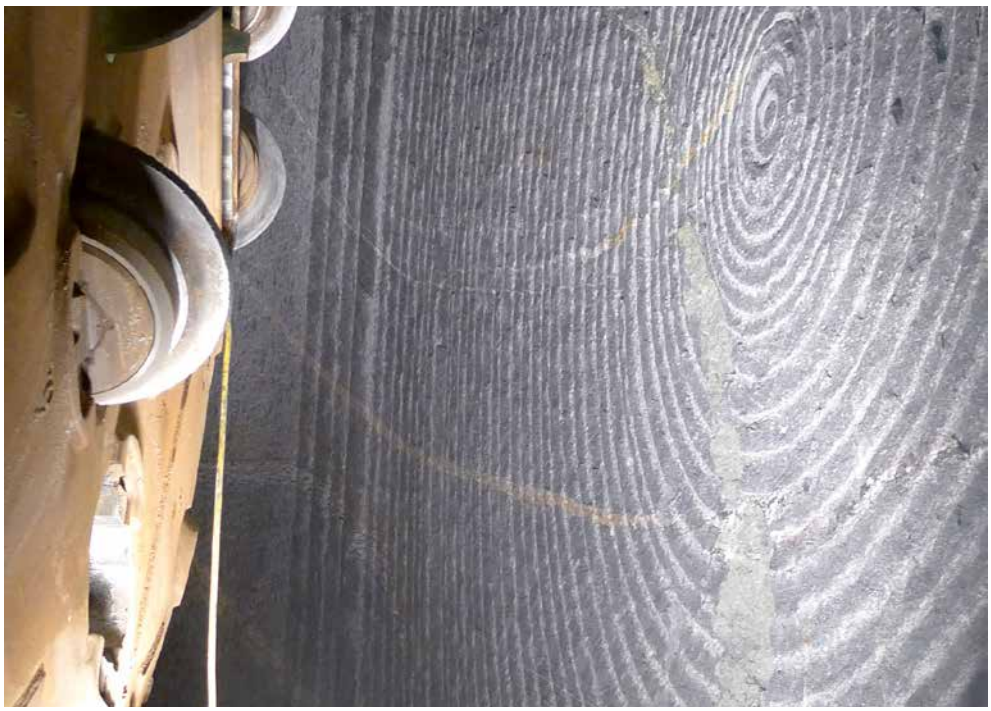
Our pumped-storage power plants store the energy generated by the wind or sun and release it when it is actually needed.

River Inn joint power plant . Maria Stein construction section

Reisseck II pumped-storage power plant

Limberg II pumped-storage power plant

Reisseck II pumped-storage power plant
Inspecting the rollers for the hard-rock TBM



Limberg II pumped-storage power plant
A 62m long, 25m wide and 43m high cavern was excavated inside the mountain for the two 240MV machines

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