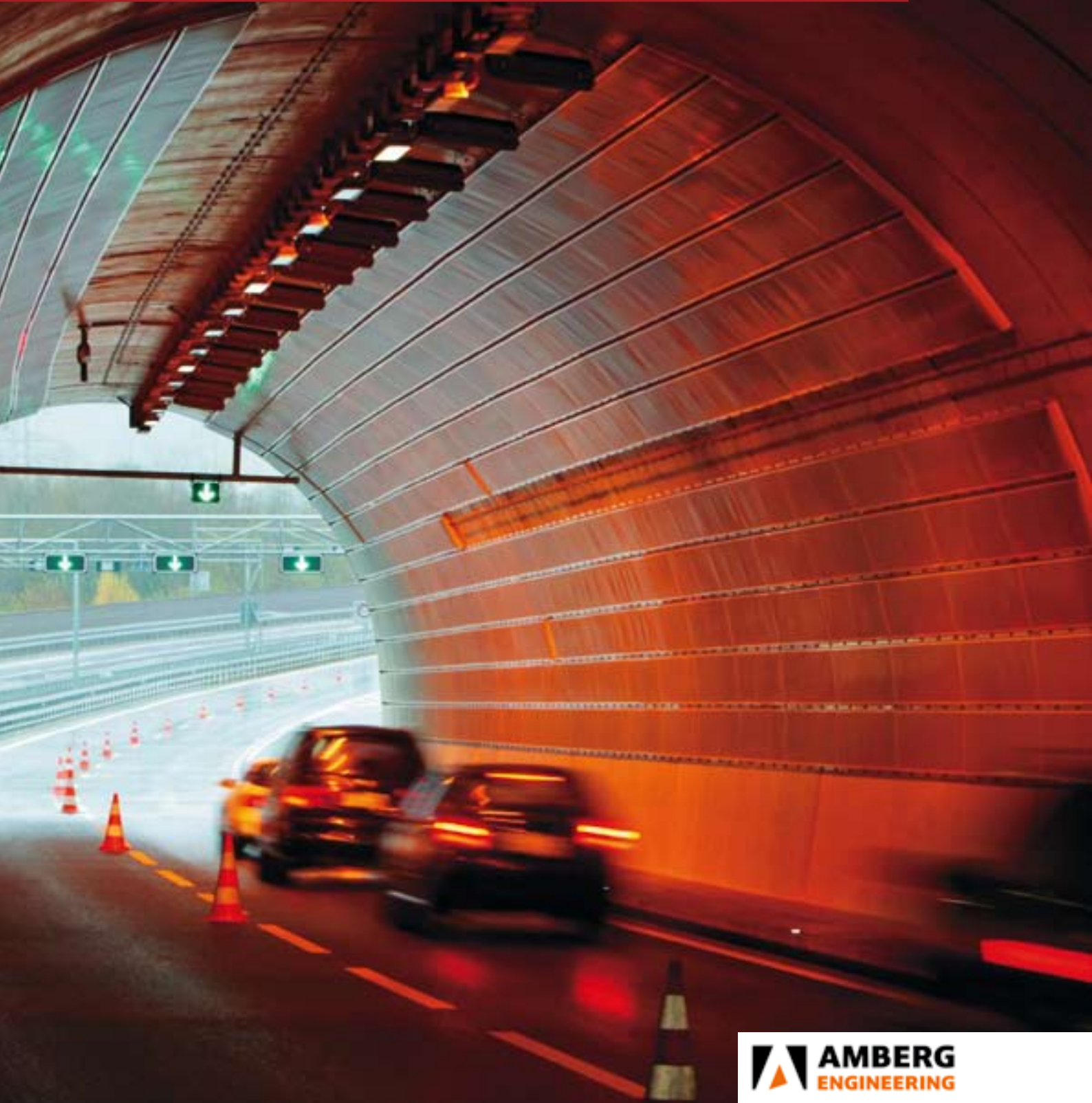


# ROADS



## ROAD TUNNELS FOR INCREASING MOBILITY

With constantly increasing traffic volumes, the need for traffic infrastructure also increases. As this infrastructure should be implemented in harmony with the communities involved and the environment, road tunnels are often the chosen solution. Using tunnels reduces traffic on narrow roads in city centres without using additional land – a big bonus for city inhabitants' quality of life.

### **Quality and safety**

One priority for every structure is quality and durability. The requirements for tunnel operation are to be considered in design already. Particularly special structures like utility ducts, escape galleries, cross passages, ventilation shafts and plants need to be considered in a comprehensive design.

Safety installations such as smoke extraction ventilation including detection systems and escape routes shape the design of modern traffic structures. Additionally, hard shoulders, service bays and escape route signs for tunnel users are important project features. The flawless interaction of all safety installations ensures the very best conditions for rescue in an emergency. As a result of these safety measures, large asymmetric tunnel cross sections are often necessary, the construction of which is particularly difficult in soft ground.

Even existing tunnels must be improved to meet the continually increasing requirements. Apart from safety and environmental demands, design should also take into account that construction work is usually to be carried out while traffic is moving.

With many years of proven experience, Amberg Engineering is able to master these challenges.

### **Comprehensive know-how under one roof**

From planning and realisation to maintenance, Amberg Engineering and its specialists provide you with support throughout the entire lifecycle of a road tunnel. We have over 40 years of experience in underground construction. This know-how enables us to offer our customers holistic and comprehensive services from under one roof.



# SERVICES IN DETAIL

Amberg Engineering realises innovative, customised solutions for road tunnels. From planning and realisation to operation, our specialists will support you throughout the entire lifecycle of a structure.

## Phase 1 – Planning

- Geological survey
- Feasibility study
- Preliminary and schematic design
- Invitation to tender, tender documents
- Geotechnical and structural analysis
- Stability analysis and evaluation
- Dynamic analysis
- Fire protection concepts and evaluation
- Safety concept
- Evacuation planning

## Phase 2 – Realisation

- Detailed design
- Construction supervision
- Project direction
- Control surveying
- Vibration and shock monitoring
- Resource planning
- Quality management

## Phase 3 – Operation

- Facility inspection
- State assessment
- Conservation of value planning
- Maintenance planning
- Renewal and refurbishment
- Modification

## Services in all phases

- Project review
- Project management as the client representative
- Controlling
- Risk management
- Consulting
- Training
- Safety evaluation



San Bernardino Tunnel – Switzerland

## REFURBISHMENT OF THE OLDEST FREEWAY TUNNEL THROUGH THE SWISS ALPS

After more than about forty years in service, the 6.6 km long San Bernardino road tunnel needed complete refurbishment. As well as showing signs of water inflow and concrete damage due to sulphate in the groundwater, the oldest alpine tunnel in the Swiss national road network also suffered structural damage to the carriageway due to road salt. In addition, safety for the users had to be improved. Amberg Engineering is responsible for project management of the entire project as well as design and construction supervision for specific aspects.

### The challenge

How can the forty-year-old concrete carriageway structure be refurbished while keeping traffic flowing? How can the quality and durability of the concrete structure be ensured? And how can a cost-effective escape route be constructed?

### The solution

Carriageway construction refurbishment was carried out in stages, with two independent construction sites staggered consecutively in each lane. In this way, 90 m of carriageway is renewed every week. The newly erected structure has to be suitable for traffic use after 24 hours. Using various tests, a concrete mix design and a corresponding curing process suitable for the conditions of the alpine tunnel were established.

The ventilation was converted to a semi-transversal ventilation system. The space gained in the fresh-air duct beneath the carriageway is converted into an escape tunnel. The escape tunnel is made accessible from the traffic tunnel using new ramps.





Dobrovského Tunnel – Czech Republic

## COMPLEX TUNNEL CONSTRUCTION IN THE CITY CENTRE OF BRNO

The approximately 1.25 km long two-tube Dobrovského road tunnel is built in the city centre of Brno. Pilot galleries have been built to explore the geological and geotechnical conditions. Two approximately 300 m long cut and cover structures are planned in front of the western portal. Amberg Engineering is responsible for the entire project and supervision of construction of the pilot galleries.

### **The challenge**

Due to a very low overburden of 6 to 18 m and high building density on the surface, conditions are very demanding since the settlements of the structures on the surface may not exceed defined limits.

### **The solution**

To meet the specific challenges, Amberg Engineering carries out complex settlement analysis to define the structural measures. These enables engineers to deal with subsidence, inclination and formation of cracks in the buildings on the surface in a safe manner. Pipescreens or jet columns are built in sections with low overburden or where strict requirements for low settlement levels apply. In addition, Amberg Engineering continually monitors the construction sites and approximately 160 houses with comprehensive measurements. The tunnels are excavated with the core method using a tunnel excavator. Shotcrete and steel arches provide initial support.

**Further references for road tunnels:**

- Flims bypass (Switzerland)
- Cassanawald Tunnel (Switzerland)
- Gubrist Tunnel (Switzerland)
- Uetliberg Tunnel (Switzerland)
- Klimkovice Tunnel (Czech Republic)
- Borik Tunnel (Slovakia)
- Shaanxi Tunnels (China)
- Jihlava Tunnel (Czech Republic)
- Višňové Tunnel (Slovakia)



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