INFRASTRUCTURE TUNNELS

AMBERG ENGINEERING

SIGNIFICANCE OF INFRASTRUCTURE TUNNELS

Increasing building density and the continuous growth of urban areas require not only effective supply and disposal routes, which are suitable for the future, but also new solutions for the transport of goods. Increasingly, residential areas and transport links must be protected from environmental influences such as flooding. Even research institutes can no longer meet their needs with kilometre-long facilities above ground. Whatever the requirements, the solution is often an infrastructure tunnel. These facilities are quite often in an urban environment and have to be built and operated without impact on the surface.

The challenge of infrastructure tunnels

Often, the supply and disposal networks, which have grown up over time, no longer meet the requirements of a modern community. The limited space available in built-up areas, both above and below ground, push such infrastructure underground. Implementation requires observing stringent requirements on site installations, construction methods and monitoring. At the same time, the solutions may not limit operation of existing supply and disposal systems, traffic routes or habitation. Vibration, noise, dust and surface settlements should be kept as low as possible.

More urban surfaces lead to higher run-off peaks for drainage systems. Residential areas and transport links must be protected. Where no additional retention volume can be created above ground, the water must be diverted through flood-relief tunnels. Such tunnels are usually close to the surface lakes and rivers where the safety of people and property must be handled with the greatest care.

The challenge for research facilities and other infrastructure is to correctly recognise the requirements resulting from research purposes and technical equipment, so that a technically sound but cost-effective solution can be found. This is an iterative process.

Experienced in every matter – also in dealing with your needs

Without proven knowledge in small diameter tunnel construction, such projects can be expensive and time-consuming. Amberg Engineering has many years of experience in small diameter tunnel design and construction. This knowledge and our continuous search for innovative solutions enables us to take into account the latest developments when delivering our services, to create an appropriate solution for the requirements – for example in the field of materials technology in co-operation with Hagerbach Test Gallery Ltd.

Responding to the needs of clients, users and operators is of central importance to us. We are used to working in interdisciplinary teams no matter whether the co-operation is with nuclear physicists, mechanical engineers, hydraulic engineers or wastewater specialists.

SERVICES IN DETAIL

Amberg Engineering realises innovative, customised solutions for infrastructure 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

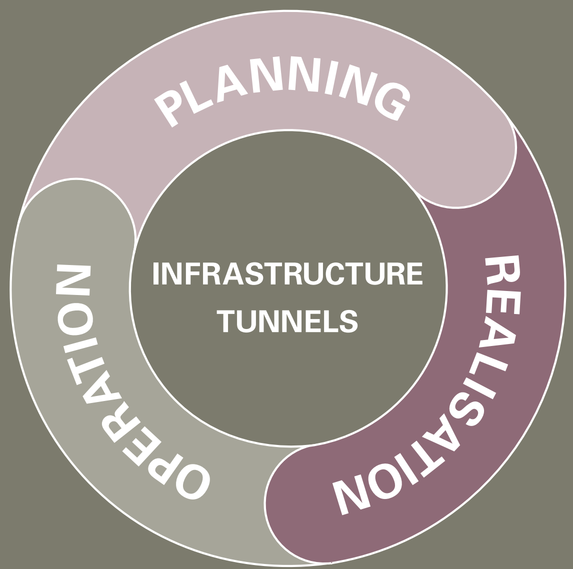
- Detailed design
- Construction supervision
- Project direction
- Control surveying
- Vibration and shock monitoring
- Resource planning
- Quality management

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



Hardhof sewers Zurich – Switzerland

FUNCTIONING PERFECTLY – EVEN AFTER 70 YEARS

The wastewater system in the Hardhof area is around 70 years old. To enable the infrastructure to function continuously, the sewers must be refurbished and partially relocated. The sections to be renewed have an overall length of around 1,200 m. A section in the groundwater protection area is converted into a utility duct. Parts of the system are taken out of service. The general contractor put Amberg Engineering in charge of design, supervision of construction and monitoring the quality of the refurbishment activities.

The challenge

Part of the wastewater system is situated in a groundwater protection zone. In addition, the existing system passes underneath an inner-city motorway. All activities are carried out with the system being operational.

The solution

The cross section of the structure consists of four channels – two for wastewater and two for drainage. During refurbishment, the concrete cover is removed using high-pressure water and replaced with a new watertight mortar surface. The joints are sealed. Through these measures, seepage of contaminated water into the groundwater is avoided. The load bearing capacity of the existing tunnel is maintained by carrying out the removal work in stages. The wastewater system is kept in operation by temporary local closure and diversion measures. The access shafts are adapted to meet the latest guidelines for maintenance. Tunnels that are no longer needed are filled in completely.

Uze flood-relief tunnels – Switzerland

SAFETY VIA FLOOD-RELIEF

The towns Uzwil and Niederuzwil were repeatedly affected by devastating floods. A flood protection scheme was set up for this reason, containing a near-natural refurbishment of the open course of the Uze stream and an approximately 1.5 km long flood-relief tunnel with intake and outlet structures. Amberg Engineering was responsible for design and supervision of construction of the tunnels.

The challenge

The safe undercrossing of existing buildings and a fish pond was a challenge. The overburden is 15 to 25 m. Due to the small diameter of the tunnel of 3.5 m, only limited space was available for excavation. The construction site and the portal are separated by a river so the site requirea extensive protection from flooding.

The solution

The tunnel has a length of 1,350 m and is located in a fresh water molasse. The tunnel was built using a tunnel boring machine and single shell shotcrete. The machine was converted so that the support could be installed directly behind the cutting wheel. Exploration drillings were carried out for the under-crossing of the buildings. With the results, the excavation and lining work could be carried out quickly and without risk. A monitoring station measuring depth and precipitation was set up for flood protection. The alarm and evacuation concept defined the actions to be taken depending on the incident.

Further references for infrastructure tunnels:

– Zurich Airport luggage gallery (Switzerland)
– Rosenberg Tunnel, water supply (Switzerland)
– Uetliberg Tunnel, transport tunnel (Switzerland)
– Calderona water supply tunnel (Spain)
– Lucerne utility duct for the Reussport and Sonnenberg tunnels (Switzerland)
– Tesla linear accelerator and XFEL x-ray laser (Germany)
– ILC linear accelerator for fundamental physical research (Switzerland/France)
– Fuchsloch wastewater tunnel (Switzerland)
– Bràfonà wastewater tunnel (Czech Republic)

AMBERG ENGINEERING

Amberg Engineering Ltd.
Trockenloostrasse 21
P. O. Box
CH-8105 Regensdorf-Watt
Switzerland

Phone +41 44 870 91 11
Fax +41 44 870 06 20
info@amberg.ch, www.amberg.ch

Branches: Regensdorf, Berne, Sargans, Chur, Brno (CZ), Bratislava (SK) Singapore (SG), Madrid (ES)
Associated companies: Amberg Technologies AG (CH), Hagerbach Test Gallery Ltd. (CH)