

METROS

TUNNEL CONSTRUCTION STRAIGHT THROUGH LARGE CITIES REQUIRES SPECIAL SKILLS

Underground railways are fast, environmentally friendly, efficient and an ideal solution for moving people, particularly in densely populated areas. However, undercrossing urban areas presents a particular challenge for tunnel construction.

Complex from planning to maintenance

Metros are complex facilities that must be built and operated without interfering with urban activity. In urban areas, it is especially important that the area crossed by tunnel construction does not sink (or sinks only minimally) and vibration and noise emissions are kept low. This is difficult because construction usually takes place in water saturated soft ground. A further complication is that the metro tunnels may not touch building foundations and must be compatible with all underground pipelines.

Access from the surface must also be built for metros – from very large ones for stations to small shafts and connections for emergency exits. In overbuilt areas, there is often not enough space for this.

Whoever builds an underground railway system must already consider during planning the future maintenance of the tunnels. Metros, unlike main line railways, have only small breaks in operation during the night and there are hardly any possibilities for diverting trains, thus maintenance options are limited.

These challenges can only be mastered by a partner familiar with the complexity of building metros.

Experienced specialists in all matters

Amberg Engineering has many years of experience in all types of soft ground tunnel construction, both conventionally and with tunnel boring machines. We have gathered our knowledge by building metros around the world and deepened it by closely co-operating with researchers and industry. This means we are able to select the right technology for the particular local requirements.

So, our experts work with the most appropriate tunnelling methods, select the correct lining and deliver you the optimum alignment. In addition, we develop safety concepts and emergency planning, and design the ventilation for metro tunnels and stations.

Once the metro is in operation, we also have the knowledge and technical means – despite shorter breaks in operation – to carry out inspections and maintenance work. To conserve value, we offer periodic state assessments, strategic value-conservation planning with budgeting and programming, as well as overall planning and supervision of maintenance, refurbishments and conversions.



SERVICES IN DETAIL

Amberg Engineering realises innovative, customised solutions for metros. 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

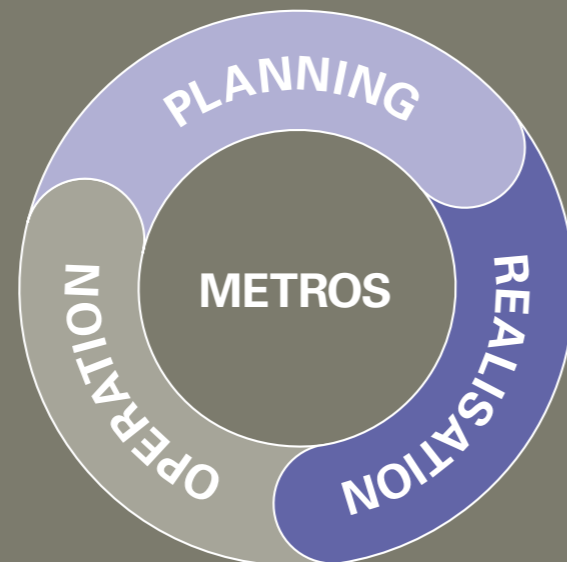
- Detailed design
- Construction supervision
- Project direction
- Control surveying
- Vibration and shock monitoring
- Resource planning
- Quality management

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



Zurich airport passenger transport system (PTS) – Switzerland

AS FAST AS FLYING WITH THE SKYMETRO TO THE MIDFIELD TERMINAL

The volume of traffic at Zurich Airport has risen sharply in the last few years. To keep up with this increase, the airport is modified and extended. At the core of this extension is the midfield terminal, with 27 extra gates between the two runways. Passengers travel from the existing airport to the new terminal in the “Skymetro” a metro-like system. Amberg Engineering is responsible for design and construction supervision.

The challenge

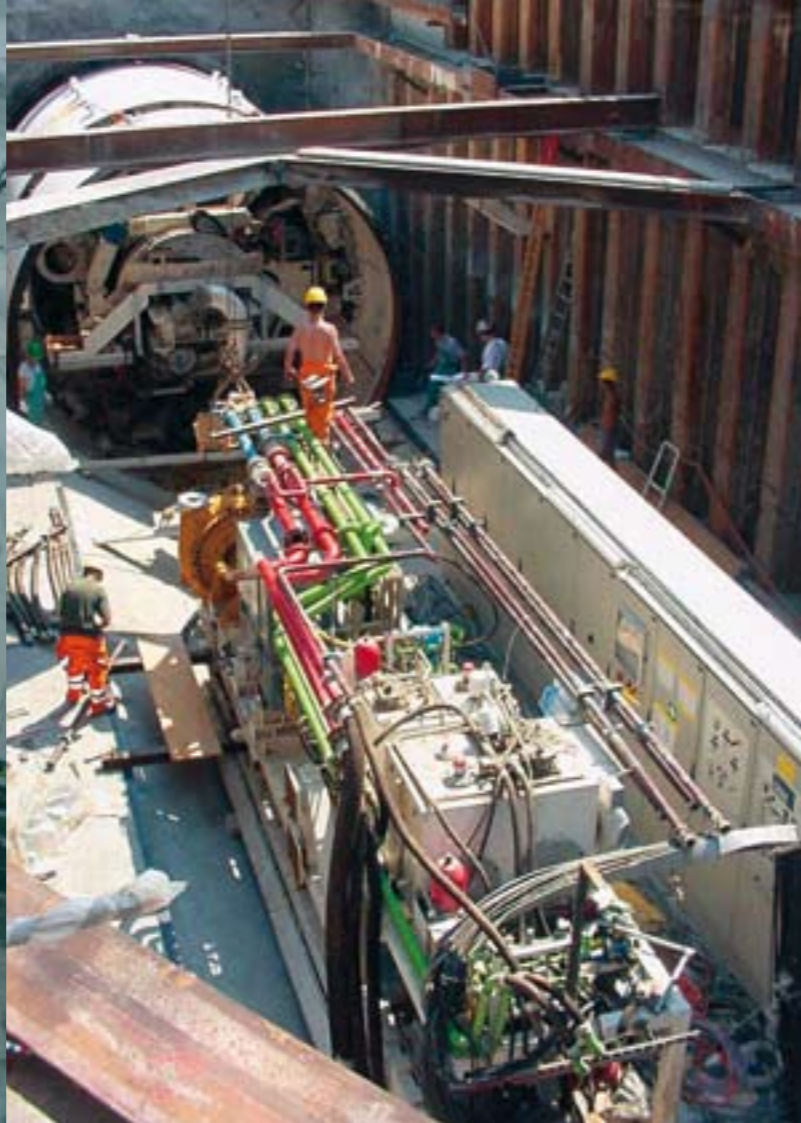
The two tunnels are completely underneath the water table in predominantly silty, sandy lake deposits. The tunnel passes below the existing Terminal A and a runway, which were continuously in operation during construction. The overburden is very low – only 1.5 m under Terminal

A and 9 m under the main runway. Therefore, for safety reasons, particular attention has to be paid to keeping the settlement very limited.

The solution

A hydro-shield machine is used for the tunnel excavation. The single-shell permanent lining consists of pre-cast concrete segments. The entire tunnelling is monitored by an automated surveying system which would send warnings and emergency messages to the runway operators. The skymetro is in operation since 2003 after a tunnelling drive which did not disturb airport operation.





Metro Barcelona – Spain

REACT QUICKLY IN A FIRE AND SAVE PEOPLE'S LIVES

In Barcelona, a new metro line, the L9, has been planned to extend the existing network. Together with partners Amberg Engineering evaluates the new L9 stations regarding safety and safety requirements.

The challenge

As construction work has already proceeded considerably, action in respect to safety is required, In particular, the planning in case of fire and the estimation of the chances of rescuing passengers and personnel have not yet been clearly defined.

The solution

To assess the safety technology and to recommend measures, design fire loads are defined for the L9. Subsequently, evacuation calculations and fire simulations are carried out for each of four representative stations and a section of the tunnel. After the calculations and simulations have been completed and the results analysed, Amberg Engineering creates a summary report with recommendations for fire protection measures, evacuation concepts in the stations and the tunnels, structural protection and strengthening of the rolling stock.

Further references for metros:

- Metro Delhi (India)
- AYA Tunnel (Singapore)
- Metro Brescia (Italy)
- m² Lausanne (Switzerland)
- Metro Valencia (Spain)
- Metro Budapest (Hungary)
- Singapore MRT, Contract 855 (Singapore)



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)