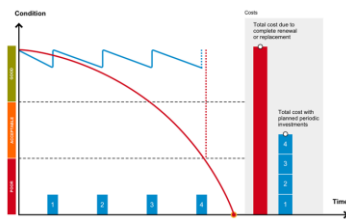


RENEWAL & REHABILITATION

The structural safety and serviceability of underground infrastructure must be ensured throughout its life cycle. Minimal shutdown times, optimal usage of available finances and a long-term plan for measures and investments are at the top of most operators' wish lists.

As part of the condition assessments, we accompany the value conservation of underground infrastructures, starting with the data acquisition, followed by analysing the data and concluding with designing of any remedial measures.

This allows for detailed budget planning and foresighted prioritization of the measures for ensuring operational safety.



Comparison of life cycle costs with and without periodic maintenance



Inspection of a road tunnel



Use of a touchpad for tunnel inspection



Visual inspection of the ceiling in a road tunnel

Our Services

We place great emphasis on methodical, structured and seamless recording of the structural condition to enable long-term reliability in planning for you. Costs are provided realistically and transparently, thereby providing a high degree of budget reliability.

PHASE 1 - Preparation

- Acquisition of the owner's data of the structure, such as:
 - Layout drawings
 - Detailed drawings
 - Construction documentation
 - Engineering documents
- Organization & coordination of Phase 2

PHASE 2 – Data acquisition

- Laser scanning
- Visual inspection using high-resolution grey-scale images
- Recording of defects on site using TunnelMap recording software on a tablet
- Material samples and tests

PHASE 3 – Assessment / Analysis

- Direct export of the recorded data to a database
- Full-coverage surface and clearance envelope analysis
- Customizable evaluations and statistical analysis
- Inspections of the structure (material tests, detailed structural safety analysis, etc.)

PHASE 4 – Recommendation of measures

- Determination of the structural condition
- Classification of the tunnel condition
- Suggestions for structural measures
- Presentation of solution options
- Time schedule and cost estimation
- Documentation by means of digital inspection data, CAD drawings and documents
- Recommendations for further investigation and monitoring
- Design and Planning for value conservation and remedial measures
- Comprehensive reporting

Our Competence

- Profound knowledge of the procedures, execution and evaluation involved in state assessments
- Interdisciplinary collaboration of experts from the fields involved
- In-house expertise in digital recording and analysis of data for state assessments (engineering, measurement technology and materials laboratory)
- Overall concept for standardized inspections

Your Benefits

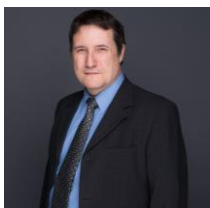
- Safeguarding of structural safety and serviceability, thereby ensuring maximum availability
- Ensured operational safety
- Reduction of shutdown times
- Safeguarding of operational safety
- Expenditure optimization in logistics
- Appraisal as basis for planning, operation and maintenance of a structure
- Time savings and comparability of digitally captured data
- Complete validation documentation for operating permits from FOT, FEDRO and cantons



Selected References

Project	Lucerne city ring road, Lucerne Switzerland	Project	Charnadūra tunnel, Celerina Switzerland
Services	Motorway tunnel	Services	Renovation of the 449 m long, single-track railway tunnel
Client	FEDRO, Zofingen Office	Client	Rhätische Bahn AG, Infrastructure
Project	Butzentunnel, Andermatt-Nätschen, Oberalp Pass Switzerland	Project	Intra-urban, 2-tube road tunnel, 2 and 3-lane, one tube with intermediate ceiling Switzerland
Services	Butzen tunnel renovation, loop tunnel with rack track	Services	State assessment, review and recommendation of measures
Client	Matterhorn Gotthard Bahn Infrastruktur AG (MGB)	Client	City of Zurich, Switzerland
Project	Main inspection of 30 Rhaetian Railways tunnels Switzerland	Project	Central Railway tunnel inspections 9 tunnels with a total length of: 7,066 m Switzerland
Services	Survey of defects, damage and changes in the structure or immediate vicinity with the "TunnelMap" software	Services	Visual inspection, state assessment, scanning and clearance envelope analysis of masonry-wall and reinforced concrete tunnels
Client	Rhaetian Railways, Chur	Client	zb Zentralbahn AG, Stansstad

**We are pleased to advise you in detail.
Contact us.**



Flavio Modetta
Site Manager Sargans
Head of Swiss Market

fmodetta@amberg.ch



Amberg Engineering AG
Trockenloostrasse 21
8105 Regensdorf Watt, Switzerland
Tel: +41 44 870 91 11
information@amberg.ch, www.amberg.ch

Regensdorf, Sargans, Chur, Nyon (Switzerland),
Brno (Czech Republic), Madrid (Spain),
Lysaker (Norway), Gurgaon-Haryana (India),
Kuala Lumpur (Malaysia), Bratislava (Slovakia)