

TunnelMap™

Digital tunnel inspections



What is the condition of your structure right now?



What is the condition of your structure? What type of damage is present? How have these developed since the last inspection? Is there a threat to safety and operations? How much must be budgeted for maintenance?

Questions like these preoccupy persons responsible for the maintenance of tunnels. Rising requirements regarding safety and tunnel accessibility together with growing cost pressure place ever higher demands on the entire tunnel management process. Amberg Technologies, in close cooperation with experts from the tunnelling industry, has taken on this problem to develop the innovative TunnelMap™ inspection solution. In addition to the overall advantages of a modernised maintenance process, the operator benefits from:

- Optimised inspection process with time savings during tunnel inspections of up to 40%
- Increased quality of tunnel assessments thanks to standardised data collection and analysis
- Cost savings through digital inspection procedures of up to 50% in comparison to traditional methods
- Reliable database for professional asset management, timely maintenance planning and accurate budgeting



By utilizing sophisticated information and inspection technologies, TunnelMap™ provides:

Optimised inspection procedures:

- Time saving management of structures
- Office based pre-inspections by use of laser scanner images
- Consistent inspection database

High quality condition assessments:

- Standardised definition and illustration of damage, materials, structural features and equipment
- Objective inspections and comparisons of structural conditions over time

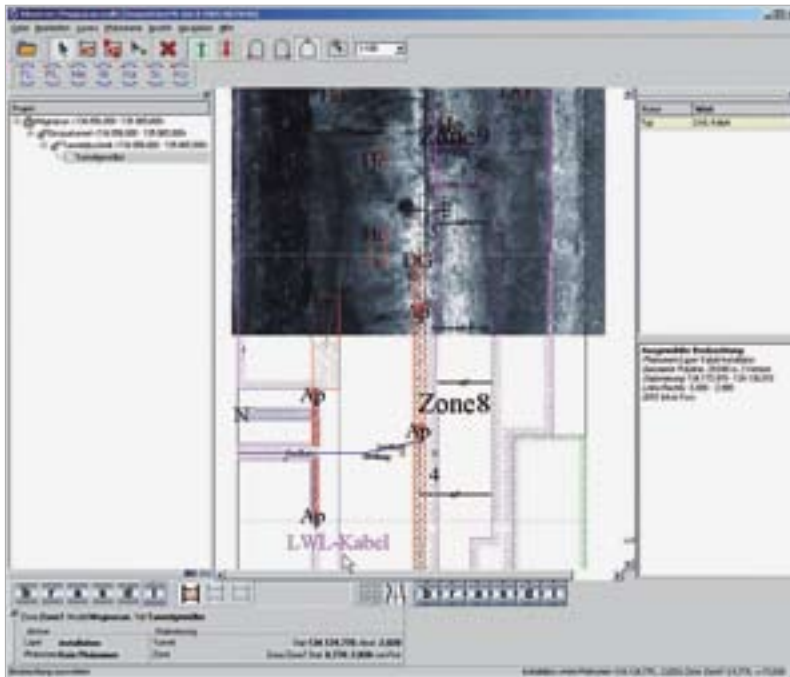
Significant cost savings:

- Reduced on-site inspection time
- Direct data collection without post-processing
- Database system for multi-user applications

Basis for economic lifecycle management:

- Centralised and comparable condition data
- Unlimited availability and retrieval of data

TunnelMap™ - software for digital tunnel inspections



With its modular design, TunnelMap™ provides a comprehensive inspection platform – for the (recommended) pre-inspection with scaled image data, inspections in the field and subsequent evaluations for maintenance planning and asset management in the office.



TM Observer simplifies the on-site data acquisition with a robust touch-screen computer. Fast, simple and accurate. Without the additional efforts and quality loss caused by post-processing in the office.



TunnelMap™ – the modern software, open for innovative technologies and inspection processes, e.g. integration of scanner images of the Leica GRP5000 scanner system.

TunnelMap™ Software modules

TunnelMap™ combines traditional structural inspections with latest digital information technology. The user benefits from the modular software architecture. This allows a cost optimised system configuration in exact accordance with the needs of the client's inspection process and employee organisation. The following modules form the TunnelMap™ inspection solution:

TM Manager



The database module for the effortless set-up and administration of tunnel structures. Object-oriented, clearly structured and extremely flexible.

TM Observer:



The inspection module for the standardised graphical collection and processing of the inspection data. Once collected, information is consistent, to scale and therefore comparable.

TM Statistician



The statistical module for numerical evaluations and the quantification of the current structural data and condition, as well as for the condition over time.

TM Reporter



The drawing module for automatic graphical presentation and structured export of structural data.

TunnelMap™ – the basis of information for professional asset management

Standardised tunnel inspections as basis

Standardised inspections, detailed observations precisely recorded directly in the tunnel, consistent definitions and presentation, all linked with the newest database technology – for tunnel specialists, these are the key features of the TunnelMap™ system solution.

More than just a digital tunnel book

From the collection of data through analysis and the subsequent planning of technical solutions, TunnelMap™ provides powerful tools which:

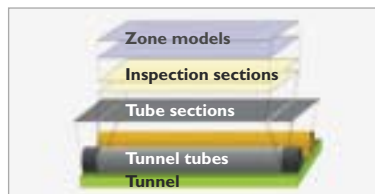
- make data collection easier, faster and more accurate
- eliminate the time-consuming step of post-processing raw inspection data
- provide automatic graphical and numerical evaluation and documentation of damage and its development over time

Basis of information for asset management

Customer-specified, binding inspection catalogue guarantees consistent data acquisition, statistical analysis and assessment of tunnels. Thanks to centralised data administration, inspection epochs and comprehensive tunnel inspections become quantifiable and comparable – the key for tunnel asset management.

1

Inspection preparations



TM Manager

Tunnel management

- Object-oriented definition of the structure into a hierarchal tunnel model with
 - tunnel tubes
 - tube sections
 - inspection areas
 - zone models
- User definable mapping grid for precise and scaled data input directly into the tunnel model

Your benefit:

- Accurate model of the current tunnel condition – including consideration of any structural changes
- Detailed geometrical basis for quick and accurate mapping of damage

2

Pre-inspection



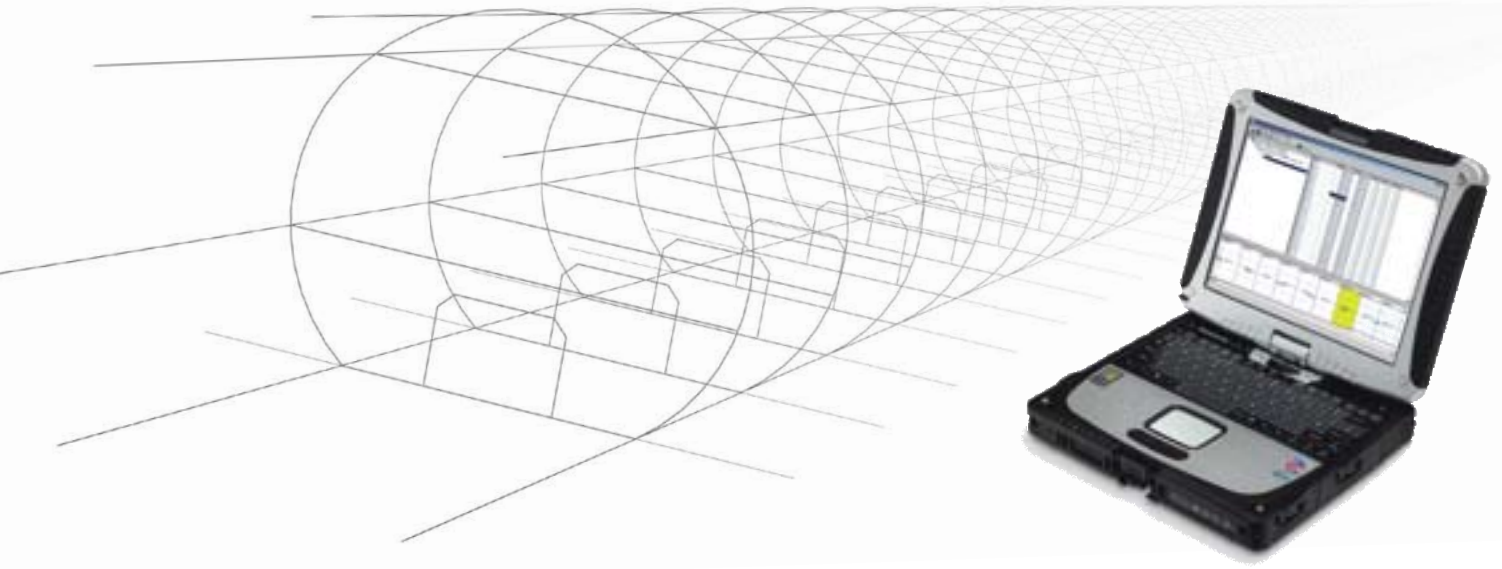
Optional:

TM Observer – Image data evaluation

- Administration of inspection epochs
- Import of highly detailed and scaled tunnel image as background information layer
- Preliminary investigation and precise digitalisation of recognisable damage, structural features and equipment.

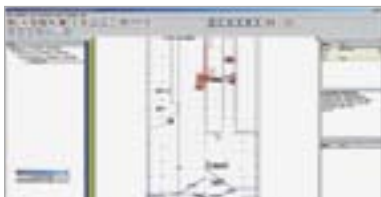
Your benefit:

- Significantly increased operational availability due to reduced on-site inspection time
- Image-based damage mapping to support the detailed inspection in the field
- Better calculability of time, machinery and human resources



3

Tunnel inspection



TM Observer

Graphical diagnosis

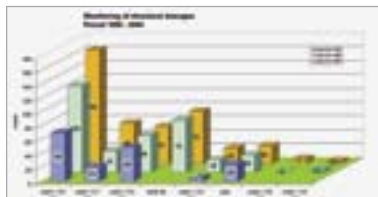
- Direct graphical data collection into structured data layer
- Consistent collection through use of standardised inspection catalogue
- Direct mapping of the observations with help of the mapping grid and online dimensioning
- Simultaneous data collection with several inspectors (e.g. for the left and right side of a tunnel)

Your benefit:

- Clear, comparable condition data – even with different inspection personnel and inspection epochs
- Precise length and area quantities
- Significantly shorter inspection times
- No post-processing of data

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Evaluation & analysis



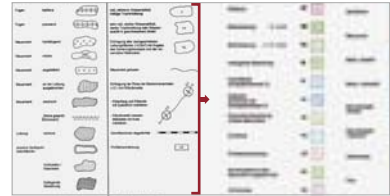
TM Reporter – Drawing module
TM Statistician – Statistic module

- Automatic generation of inspection result overviews
- Comprehensive filtering routines for goal-oriented analysis (damage types, quantities, tunnel areas)
- Statistical comparison of up to three inspection epochs
- Visual comparison of two inspections
- Structured DXF data export
- Exportable statistical data

Your benefit:

- Structural condition and development trend – retrievable on demand
- Economic lifecycle management through timely maintenance planning
- Exact quantities and evaluations for reliable cost estimations

Configuration



Customer-specific configuration

- Individual development of standard inspection catalogues according to customer specifications
- Individual definition of the symbols and illustration rules for phenomena (observations)
- Adaptation of statistical and result templates

Your benefit:

- Guarantee of company-wide consistency and comparability of data
- Future-safe investment
- Adaptation to individual inspection needs

Fit for the future

TunnelMap™ allows individual modifications and integration into existing company information data systems. More information by email at: tunnel@amberg.ch.

TunnelMap™

Proven success in the field

TunnelMap™ is a dynamic technology which is constantly undergoing further development in cooperation with our clients. In this way, new requirements in the area of tunnel inspection can be addressed to extend the scope of functionality of the TunnelMap™ product. Our clients profit from the concentrated inspection know-how of the TunnelMap™ solution which will enable further optimisation of your own inspection process. TunnelMap™ is an essential inspection tool which guarantees significant increases in efficiency for small companies as well as large infrastructure operators. A short extract of our references indicates the wide spectrum of applications of the TunnelMap™ system solution:



**German Railways (DB AG), DB Region South,
High speed line Nuremberg-Ingolstadt
Technical approval before commissioning**

Transfer of all existing analogue tunnel data and inspection on the new high speed line on short notice before start of operations to serve as a basis for quality claims and to ensure long-term maintenance management.

**Portuguese Railways (REFER)
Modernisation of tunnel maintenance management**

Switch to digital tunnel inspection methodology for all tunnel structures with complete transfer of condition data and inspection history to modernise the existing tunnel maintenance management system – including the newest inspection processes and technologies.

**Midsize engineering firms, Switzerland
Periodic tunnel inspections for Swiss railway
companies and road authorities**

Systematic inspections, transfer of analogue condition data for detailed condition assessments and planning of engineering solutions.
Usage to achieve more efficient project realisation.

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