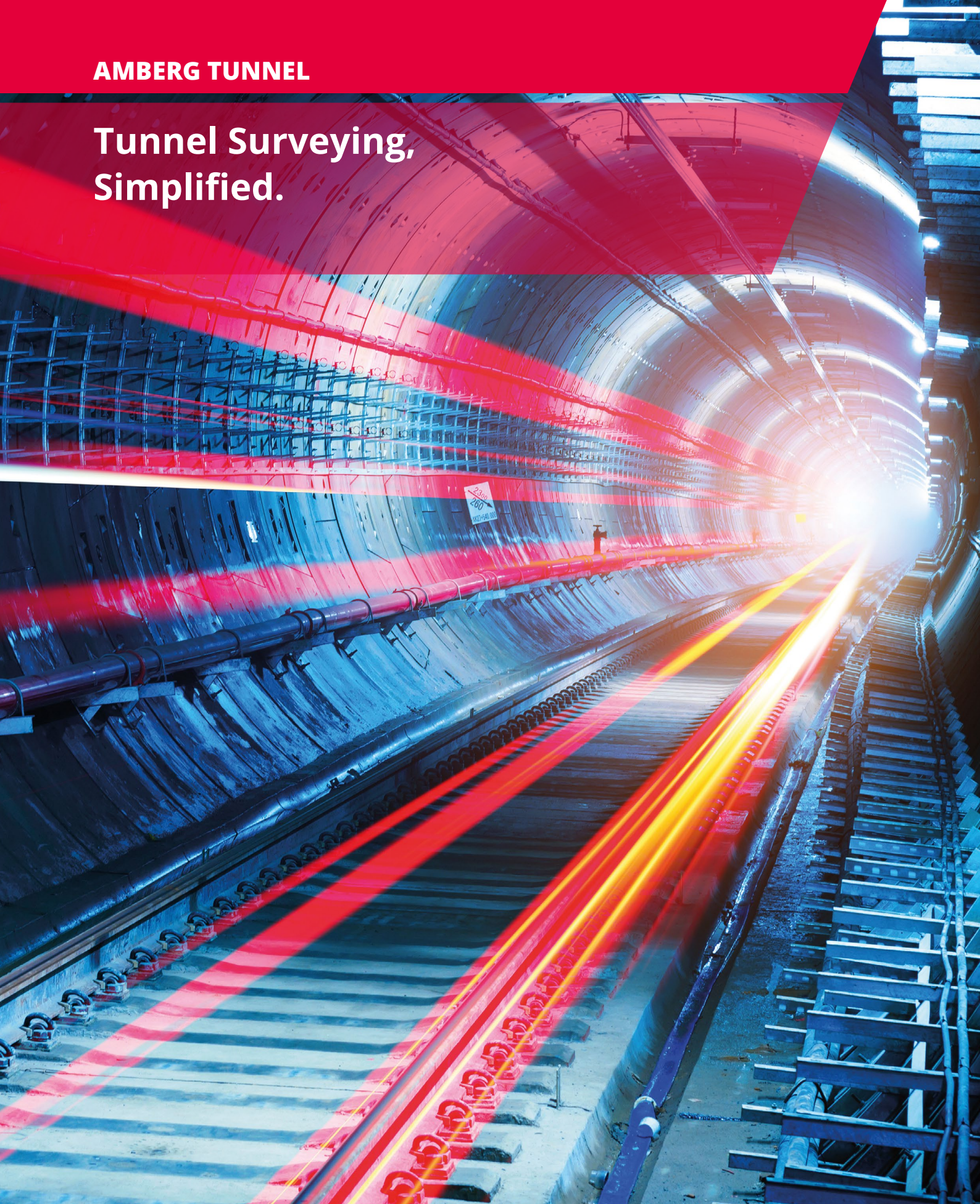


AMBERG TUNNEL

**Tunnel Surveying,
Simplified.**



AMBERG TUNNEL

TUNNEL SURVEYING, SIMPLIFIED.



Challenges in Modern Tunnel Construction

Modern tunneling projects require companies to balance the complexities of project execution with the need to meet tight deadlines, manage costs, and uphold rigorous safety and quality standards. The primary goal is to streamline tunnel excavation processes and workflows without sacrificing precision or safety. This demands cost-effective, efficient surveying solutions that are tailored to specific project needs and are user-friendly for on-site crews.

The Amberg Tunnel Solution

Amberg Tunnel offers a comprehensive solution that supports all phases of tunneling. By integrating precise measuring instruments, such as total stations and laser scanners, with task-specific applications, Amberg Tunnel delivers significant time savings, consistent reporting, and error-free results throughout the entire project lifecycle.

Why Choose Amberg Tunnel?

- **Unified Platform:** One software platform for heading guidance, excavation control, and surveying across the entire tunnel construction process.
- **User-Friendly Workflows:** Illustrated, intuitive, and easy-to-understand workflows enable efficient execution.
- **Empowerment of Tunnel Crews:** The system allows the tunneling crew to perform measurements independently, enhancing productivity.
- **Proven Expertise:** With 40 years of experience in developing tunnel surveying solutions, Amberg Tunnel is a trusted leader in the industry.
- **Full Integration:** Complete integration into the construction process, from planning to direct data exchange, ensures seamless project execution.

AMBERG TUNNEL

PRODUCT PORTFOLIO



The Amberg Tunnel product portfolio is a comprehensive, integrated solution designed specifically for the complex demands of modern tunnel construction. This portfolio is divided into three core components: Office Software, Field Software, and Cloud Tools. Each component is tailored to optimize different aspects of tunnel surveying, construction, and inspection, ensuring that every phase of your project is managed with precision and efficiency.

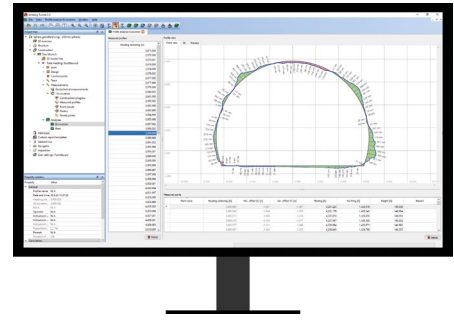
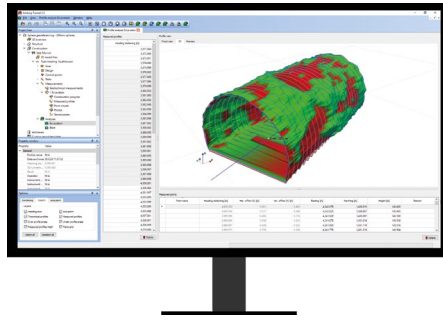
- **Office Software:** Powerful modules that support detailed as-built analysis, reporting, and the management of all data related to tunnel construction.
- **Field Software:** Tools designed to streamline and automate surveying tasks directly on-site, allowing both surveyors and non-surveyors to carry out critical tasks with ease.

- **Cloud Tools:** Cloud-based solutions that facilitate seamless collaboration and real-time data synchronization between the field and office, ensuring that everyone is working with the latest information.

Together, these tools enable tunneling professionals to maintain strict construction tolerances, document the entire process, and deliver projects that meet the highest standards of quality and safety.

AMBERG PROFILE

PRECISION IN AS-BUILT PROFILE ANALYSIS



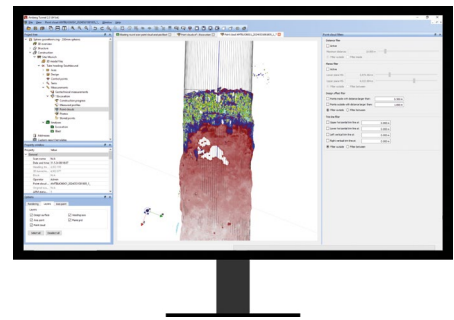
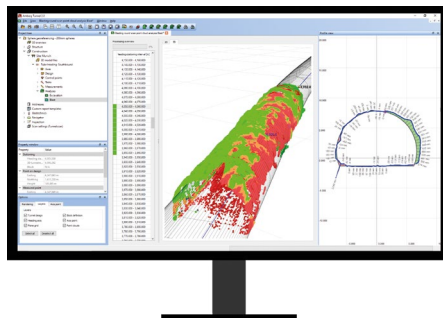
Amberg Profile enables you to quickly and efficiently analyze as-built tunnel profiles against the theoretical design. The module manages large quantities of profile data with ease, instantly converting measurements into comprehensive reports. Whether you're importing data from Amberg Navigator Tablet, Amberg Applications, or other sources, Amberg Profile simplifies the analysis process and ensures that your results are both accurate and easy to interpret.

Key Capabilities:

- **Efficient Data Management:** Handles large volumes of as-built profiles, ensuring smooth data processing and organization.
- **Comprehensive Reporting:** Offers detailed analyses, including measured vs. design and layer thickness.
- **Flexible Export Options:** Supports 2D and 3D DXF, as-built mesh, ASCII, and PDF formats for seamless integration with other tools.

AMBERG TUNNELSCAN

ADVANCED POINT CLOUD ANALYSIS FOR DETAILED DOCUMENTATION



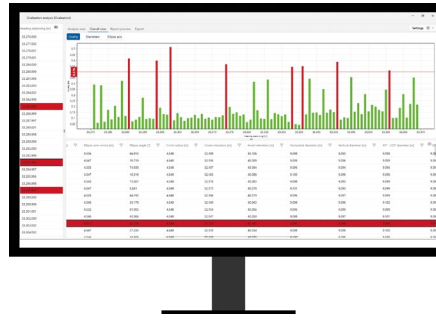
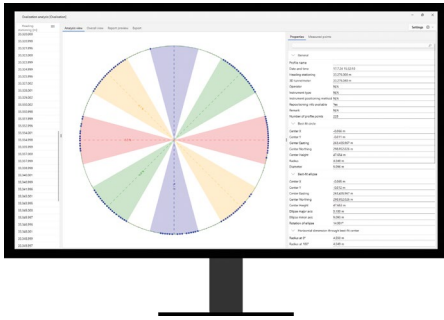
Amberg Tunnelscan allows you to georeference, filter, and analyse point cloud data against the theoretical design. In addition, other tunnel specific analyses and reporting are included, including layer thickness, undulation (surface smoothness), and more.

Key Capabilities:

- **Comprehensive Point Cloud Processing:** Georeference and filter point clouds with ease.
- **Comprehensive Reporting:** Powerful analyse including measured vs. design, layer thickness, undulation, and more.
- **Deliverables:** Produce unrolled deviation maps, extract profiles, volume, and area reports.

AMBERG STRUCTURAL DEFORMATION

OVALITY ANALYSIS OF TBM SEGMENTAL RINGS



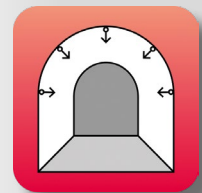
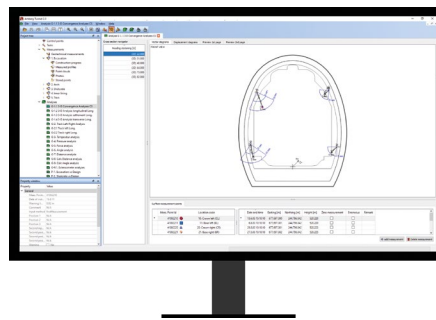
Amberg Structural Deformation focuses on analyzing and reporting segmental lining deformations, particularly ovality (out-of-roundness) in TBM tunnel rings. This module streamlines the extraction of deformation data from as-built profiles, supporting both laser scanning and total station workflows. It ensures compliance with construction tolerances and provides clear, actionable reports.

Key Capabilities:

- **Ovality Analysis:** Automatically calculate inner diameter measurements at specific angles to determine ovality based on International Tunnelling Association (ITA) guidelines.
- **Comprehensive Reporting:** Generate clear reports with export options in Excel, DXF, and PDF formats.
- **Outlier Detection:** Automatically filter out non-relevant data points for accurate analysis.

AMBERG GEOTECHNICS

COMPREHENSIVE GEOTECHNICS AND CONVERGENCE REPORTING



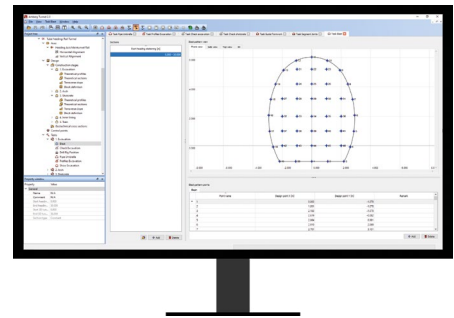
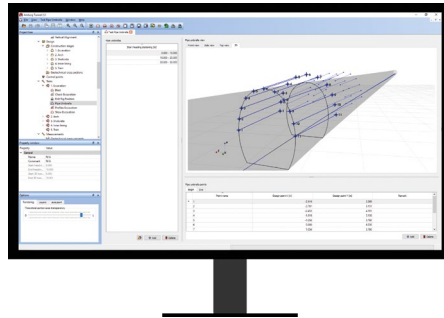
Amberg Geotechnics provides a powerful solution for cross-section and longitudinal-based geotechnical analyses, with a particular focus on 3D convergence monitoring. The module supports a wide range of sensors, including extensometers, hydro cells, and temperature sensors, to deliver detailed and actionable insights.

Key Capabilities:

- **Cross-Section and Longitudinal Analyses:** Perform detailed geotechnical evaluations across different sections of the tunnel.
- **3D Convergence Monitoring:** Track tunnel convergence in 3D for enhanced stability assessments.
- **Sensor Integration:** Utilize data from extensometers, hydro cells, and temperature sensors for comprehensive monitoring.
- **Displacement and Vector Diagrams:** Visualize and analyze displacement data with detailed vector diagrams for precise reporting.

AMBERG TUNNEL NAVIGATOR

STREAMLINED FIELD TASKS FOR NON-SURVEYORS



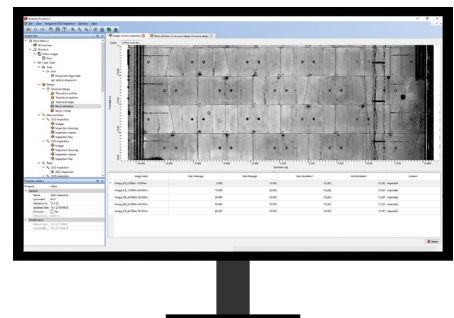
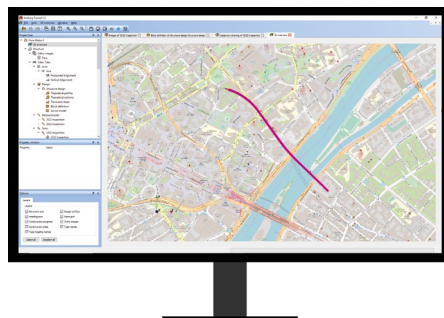
Amberg Tunnel Navigation is the companion module to Amberg Navigator Tablet, the field solution. It is specifically designed for defining and managing all tasks to be executed on the Amberg Navigator Tablet, such as scanning, as-built profiling, stakeout, and machine guidance. This tool empowers non-surveyors to carry out routine survey tasks with ease, reducing the need for specialized surveyors while ensuring complete control over field workflows.

Key Capabilities:

- **Empowering Non-Surveyors:** Enables non-surveyors to perform routine survey tasks, reducing reliance on specialized surveyors.
- **Complete Task Control:** Maintain consistency and accuracy in task execution throughout the tunnel.
- **Automatic Data Management:** Automatically store field data in the correct part of the project, organized by tube and construction stage.

AMBERG TUNNEL INSPECTION

DESKTOP MODULE FOR INSPECTION PROJECT SETUP AND MANAGEMENT



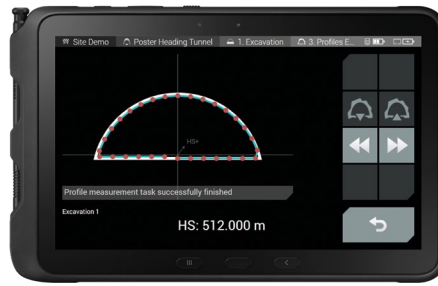
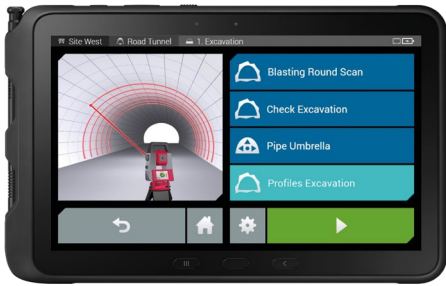
Amberg Tunnel Inspection is the desktop module for visual tunnel inspections. This module focuses on setting up inspection projects, including defining project structures, preparing high-resolution tunnel surface images, and creating custom defect catalogs. As the initial step in a broader inspection ecosystem, it integrates seamlessly with a web portal for detailed visual inspections and a field app for on-site validation.

Key Capabilities:

- **Project Setup:** Define project structures, prepare surface images, and create custom inspection catalogs.
- **Web Portal Integration:** Synchronize images and data with the web portal for defect digitization and analysis.
- **Field Validation Support:** Integrate with the field app for on-site inspection and validation of findings.

AMBERG NAVIGATOR TABLET

STREAMLINED FIELD SOLUTION FOR NON-SURVEYORS



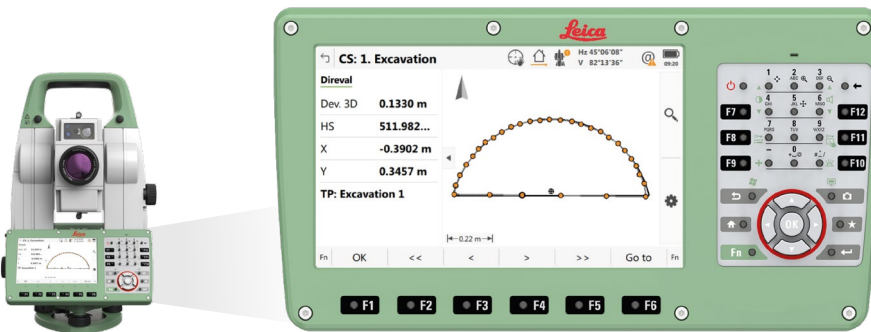
Amberg Navigator Tablet is the essential field software component of the Amberg Tunnel solution, designed to streamline on-site surveying tasks. This user-friendly tool empowers non-surveyors to carry out routine field tasks such as scanning, as-built profiling, stakeout, and machine guidance with ease and precision. By simplifying complex surveying operations, Amberg Navigator Tablet reduces the need for specialized surveyors, optimizing your field resources.

Key Capabilities:

- **Empowering Non-Surveyors:** Simplifies routine survey tasks, allowing non-surveyors to perform them without requiring specialized skills.
- **Task Execution:** Provides precise and consistent execution of tasks, ensuring high-quality data capture in the field.
- **Real-Time Data Sync:** Seamlessly synchronizes data with office software for immediate analysis and reporting.

AMBERG APPLICATIONS

SPECIALIZED ONBOARD APP FOR LEICA CAPTIVATE



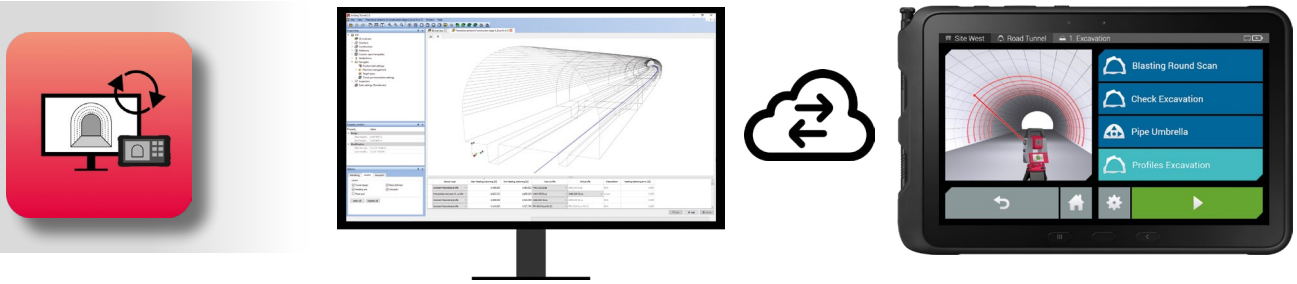
Amberg Applications is a powerful onboard app for Leica Captivate total stations, streamlining tunnel surveying tasks directly on the instrument. This application automates profile measurements and tunnel stakeout making it an essential tool for efficient fieldwork. The app features a simple resection routine without the need for manually picking control points, ensuring quick and accurate setup.

Key Capabilities:

- **Automatic As-Built Profile Measurement:** Automates the measurement process, increasing efficiency and accuracy.
- **Tunnel Stakeout:** Simplifies tunnel stakeout operations with direct control from the total station.
- **Seamless Workflow Integration:** Works in harmony with the Amberg Profile module, ensuring smooth data transfer from the tunnel to the office.

AMBERG NAVIGATOR CLOUD SYNC

BI-DIRECTIONAL DATA SYNC BETWEEN FIELD AND OFFICE



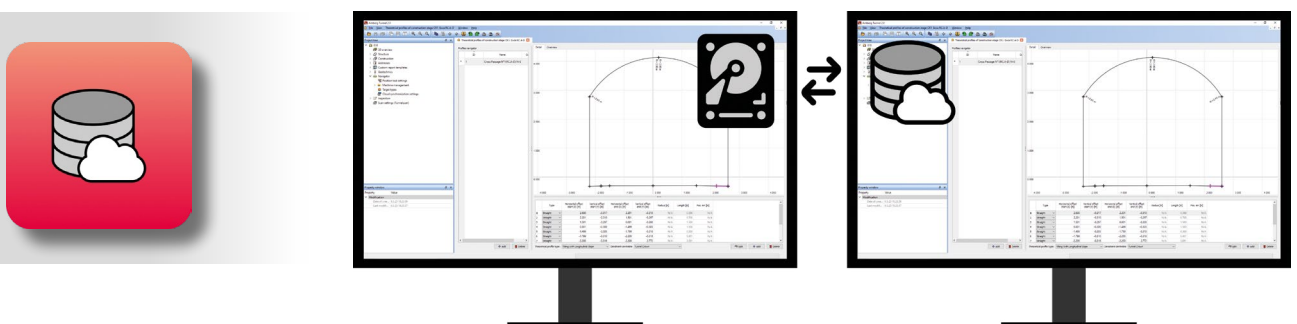
Amberg Navigator Cloud Sync enables seamless, bi-directional data synchronization between the office and field. Tasks defined in the office for the Amberg Navigator Tablet are kept in sync with the field device, ensuring the latest control points, alignment changes, and theoretical profiles are always available. As-built data from the field, including point clouds and profiles, is automatically transferred back to the office, integrating seamlessly into the correct construction stage. Detailed logs track all synced data, providing full project visibility.

Key Capabilities:

- **Bi-Directional Sync:** Keeps field and office data fully aligned in real time.
- **Seamless Data Transfer:** Automatically syncs as-built data to the office, integrating with the project.
- **Project Transparency:** Logs provide complete oversight of synced data.

AMBERG TUNNEL CLOUD PROJECT

FLEXIBLE REMOTE ACCESS TO SYNCHRONIZED PROJECTS



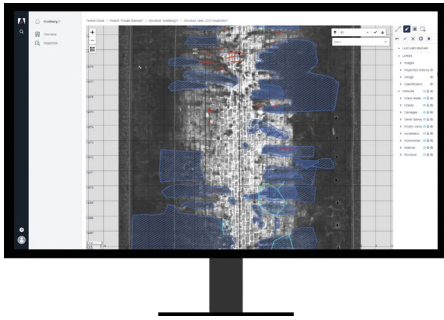
Amberg Tunnel Cloud Project allows you to keep a synchronized copy of your local tunnel project in the cloud, enabling both local and remote teams to work on the same project seamlessly. With read-write access supported for both teams, this tool offers flexibility and collaboration, ensuring that all project elements are kept up-to-date and accessible from anywhere.

Key Capabilities:

- **Synced Cloud Copy:** Maintain a synchronized cloud version of your local project, enabling remote access and collaboration.
- **Full Data Sync:** Automatically syncs design data and field measurements.
- **Flexible Collaboration:** Supports simultaneous read-write access for local and remote teams, ensuring everyone works with the latest data.

AMBERG TUNNEL INSPECTION CLOUD

MARKING AND MANAGING TUNNEL DEFECTS



Amberg Tunnel Inspection Cloud is a web-based platform designed specifically for marking and managing visual defects in tunnel inspections, such as cracks, water ingress, and other structural issues. This tool allows users to mark defects based on catalogs defined in Amberg Tunnel, ensuring consistency and accuracy across inspections. It is ideal for working with high-resolution unrolled images from point clouds generated by the Tunnelscan module.

Key Capabilities:

- **Defect Marking:** Mark visual defects such as cracks and water ingress using a predefined catalog from Amberg Tunnel.
- **Role Management:** Define user roles like inspectors and viewers, allowing clients to view inspection data with controlled access.
- **Inspection Comparison:** Build inspections over time and compare different periods side by side to monitor changes.
- **High-Resolution Image Support:** Works seamlessly with high-resolution unrolled images from point clouds for precise defect identification.

REFERENCES



Ravi Gobin

*Tunnel Surveyor
Peace River Hydro Partners
20+ years experience in both surface and underground construction*

«Amberg Tunnel is robust, powerful and most importantly reliable. I use Amberg as it offers all the tools needed under one platform, from design to field and reporting in a neat and comprehensive manner. The interface is simple, intuitive and above all very user friendly. The support team is knowledgeable, amazing and always available when needed.»



Denard Booker

*Tunnel Surveyor
Traylor Bros., Inc. - Evansville, USA
20+ years of experience*

«I was made aware of Amberg Software from a co-worker. It was brought to for a complex excavation and design. With 20 plus years in the underground field, most tasks are heavy on the surveyor. This system does it all. I started to improve our daily workflow. We were able to make infield decisions based off real time values. We no longer had to wait hours for post processing and anyone who knows post processing knows there's millions of points within a scan file and Amberg process them in half the time. Office to field, the software is very intuitive. Can't wait to see what's next on the project, I know Amberg will have a solution.»



Ulf Sjöström

*Survey Operations Supervisor
AF Gruppen*

«With Amberg Tunnelscan, merging and analysing data from diverse sources has become seamless and efficient. The software significantly outperforms others in cleaning and processing 3D laser scans—tasks that were previously error-prone and labour-intensive. This has not only saved time but also reduced our workload by over 40%, leading to substantial cost savings. My team appreciates the integrated functionality of this platform, which eliminates the need for cumbersome data transfers.»

PORTFOLIO AT A GLANCE

OFFICE

Amberg Profile	BASIC	PLUS
Profile analysis: Measured vs design	✓	✓
Profile analysis: Measured vs measured		✓
Profile analysis: Circularity		✓
Profile analysis: Geological overprofile		✓
Export: As-built mesh		✓
Export: As-built horizontal and vertical cut lines		✓
Export: As-built 2D and 3D profiles (DXF)	✓	✓
Export: Volumes, overbreak, underbreak (ASCII)	✓	✓
Export: As-built profiles (PDF report template)	✓	✓
Amberg Tunnelscan	BASIC	PLUS
Point cloud analysis: Standard measured vs design	✓	✓
Point cloud analysis: Blast scan measured vs design (smart filter)		✓
Point cloud analysis: Measured vs measured		✓
Point cloud analysis: Undulation (surface smoothness)		✓
Point cloud analysis: High resolution image		✓
Point cloud georeferencing: Checkerboard & sphere targets		✓
Point cloud georeferencing: Amberg Positioning Method (APM)	✓	✓
Point cloud georeferencing: Cloud to cloud		✓
Point cloud cleaning and filtering toolset	✓	✓
Export: Colorized point cloud, unified point cloud (LAS, PTS)	✓	✓
Export: Volumes, areas, deviation map (PDF, ASCII)	✓	✓
Amberg Structural Deformation		
Profile analysis: Ovality		✓
Profile analysis: Internal horizontal, vertical & diagonal diameters		✓
Profile analysis: Horizontal and vertical clearance from design centerline		✓
Profile analysis: Crown and invert elevations		✓
Profile analysis: Best-fit ellipse & best-fit circle		✓
Profile analysis: Robust outlier removal (non-tunnel wall points)		✓
Profile analysis: As-built centerline vs theoretical centerline		✓
Export: Excel (all calculations)		✓
Export: DXF (layered)		✓
Amberg Geotechnics	BASIC	PLUS
Profile analysis: 3D convergence (cross section)	✓	✓
Profile analysis: 3D convergence (longitudinal)		✓
Profile analysis: Sensors (1D)		✓
Export: ASCII, DXF	✓	✓

FIELD

Amberg Navigator Tablet
Total station: Leica Viva, Nova & 1200 series (instrument requires Geocom robotic)
Laser scanner: Leica RTC360, BLK360, MS60 (requires Geocom scanning); FARO Focus; Z+F
Onboard App (Captivate)
Total station: Leica Viva & Nova instruments running Captivate

Contributing to a smart use of space

Where experience and expertise open up new horizons

The Amberg Group is a unique knowledge, engineering and technology provider of logistics, constructions and infrastructures for smart cities, hubs and networks through innovative combinations of above and underground space usage.



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■ **QAECY AG**

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■ **Hagerbach Test Gallery Ltd.**

The Underground Future Lab

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