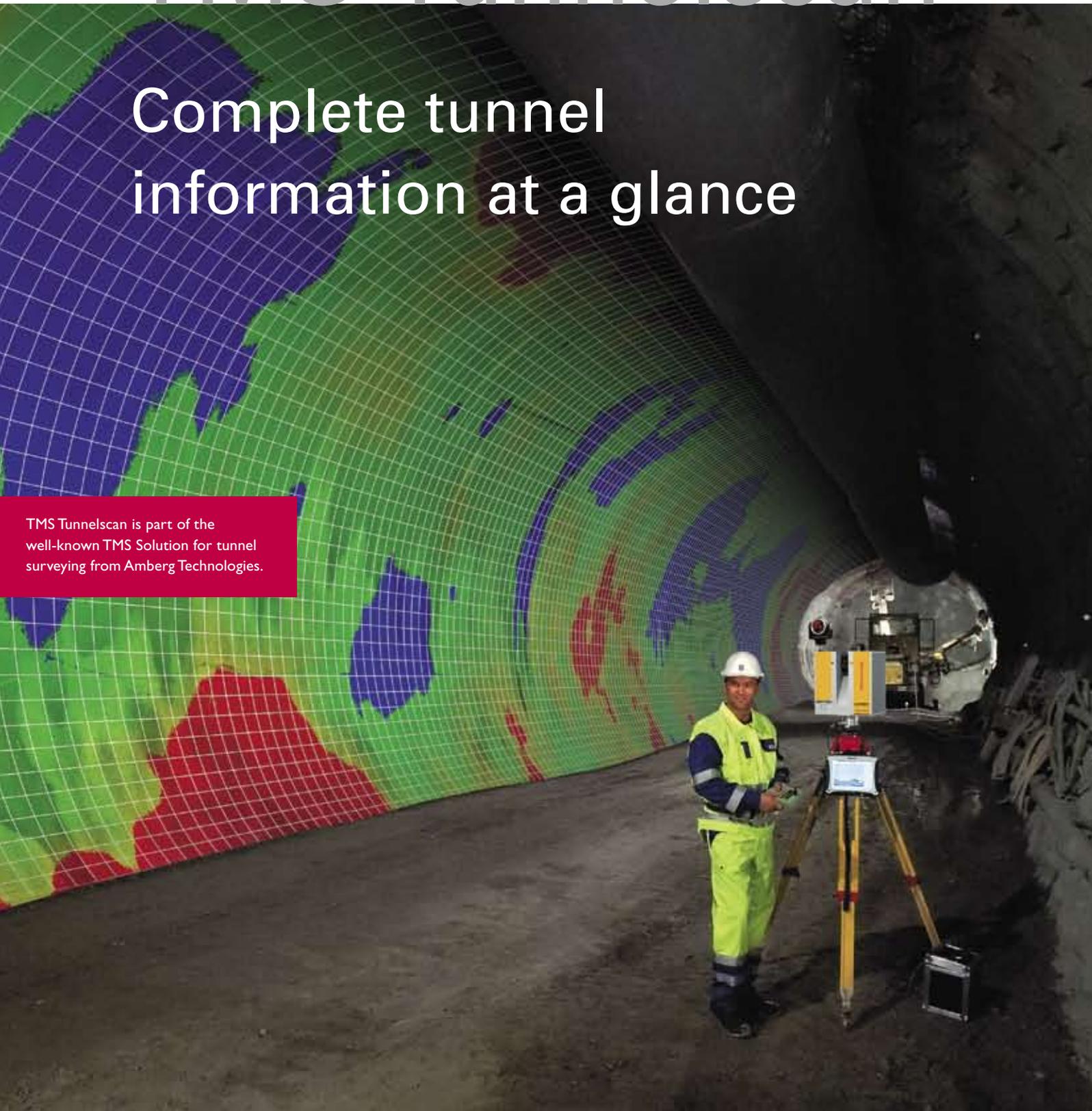


# TMS Tunnelscan

Complete tunnel  
information at a glance

TMS Tunnelscan is part of the well-known TMS Solution for tunnel surveying from Amberg Technologies.



# TMS Solution

## Surveying for tunnelling professionals

**Tunnel construction technologies are continuously evolving to achieve better performance. The latest developments allow tunnelling projects to be successful in increasingly challenging engineering and commercial environments. State-of-the-art machines, tight deadlines and budget constraints put the highest demands on the tunnelling process and all parties involved. Smooth construction is the key to successful project realisation.**

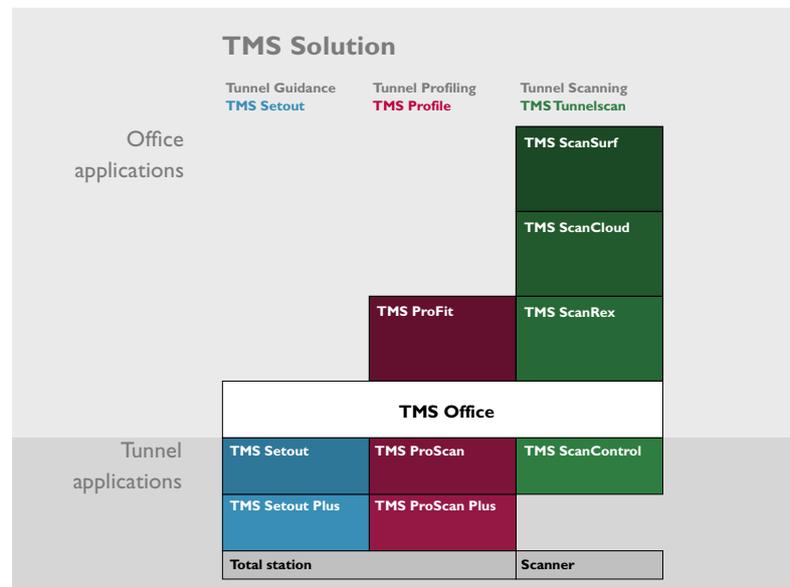
### **More importance placed on tunnel surveying**

Continuously on-call, highest flexibility and availability combined with fast and precise surveying – a real challenge for the surveyor and the surveying technology.

#### **TMS Solution – The universal tunnel measurement system for tunnelling professionals**

With powerful modules for:

- Tunnel setting out
- Profile measurement
- Tunnel scanning
- Structure dimensions



### **TMS customers benefit from:**

- «24h surveyor» for the highest standard of automatic tunnel guidance
- Use of standard hardware components – robust, precise, exchangeable on demand
- Intuitive software for tunnel surveyors
- Automatic evaluation routines
- Pinpoint accuracy of results in real time
- Highly detailed as-built records
- Relevant results at a glance

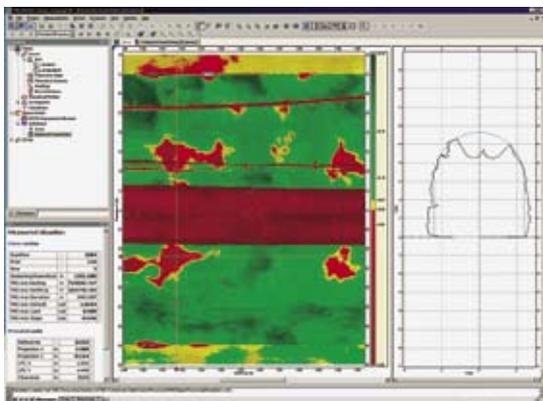


# TMS Tunnelscan

## Comprehensive tunnel as-built analyses

### Fast, precise, meaningful

TMS Tunnelscan is the powerful data collection and evaluation software for laser scanner measurements in tunnel projects. Together with the Profiler 5003 high-performance imaging scanner from Amberg Technologies, TMS Tunnelscan forms the most powerful system solution on the surveying market for tunnel as-built documentation and analysis. Based on more than 25 years experience in the development of measuring technology for tunnel construction, TMS Tunnelscan is the tunnel measurement system designed by tunnel experts for tunnel experts.



TMS Tunnelscan – an integral part of the TMS system solution. Smooth interaction of all TMS modules for the highest measuring performance and optimum support of tunnelling works.

#### Powerful software routines:

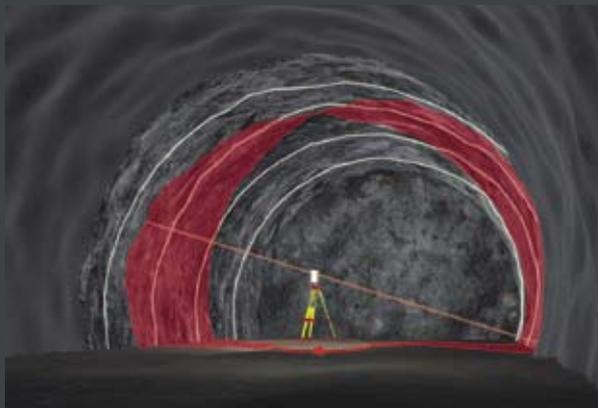
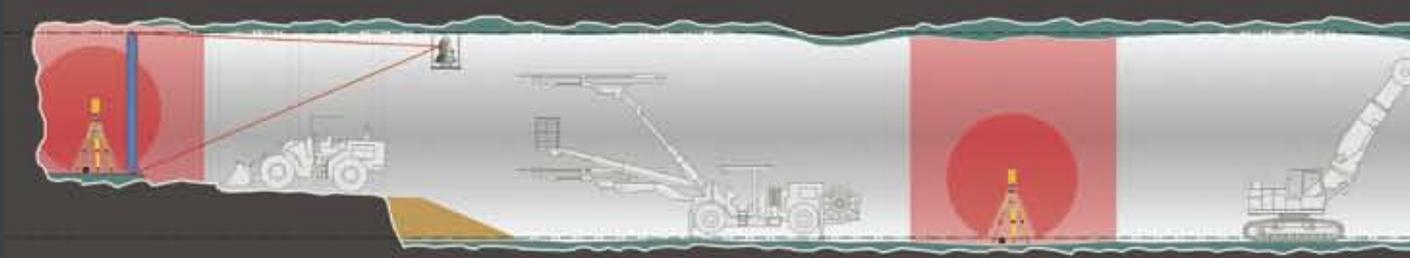
- Record the geometry and image of the entire tunnel structure during each construction phase
- Determine all areas of under and overbreak
- Calculate detailed excavation quantities
- Compare measurements taken at different times for determination of sprayed concrete layer thicknesses and spatial deformations
- Check the conformity of undulation of tunnel surface layer
- Process geo-referenced scanning data from other scanner types through standard PTS data interface

#### TMS Tunnelscan users benefit from:

- Automatic data acquisition and evaluation software specially designed for tunnelling works
- Highest performance with up to 500'000 measured points per second (Profiler 5003)
- Unique measuring speed at highest data density – up to 10'000 times more powerful than conventional methods
- One set of data for geometric and digital image documentation of the tunnel
- Mobile, autonomous and modular system design for optimal integration into the construction process

# TMS Tunnelscan

## Scanner technology for tunnel construction



### Tunnel excavation:

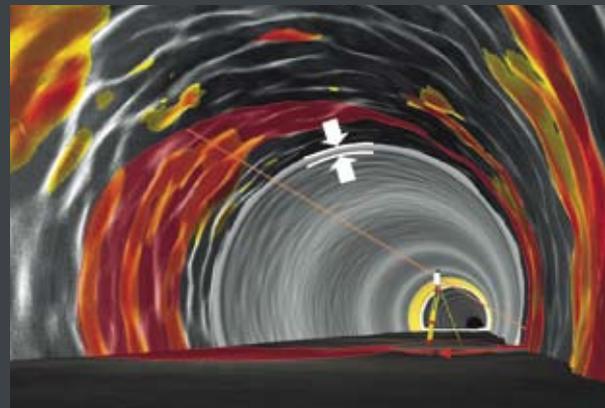
- Excavation profile control
- Documentation of support measures (e.g. steel supports, rock bolts)
- Excavation volumes

### TMS Tunnelscan:

- Extremely fast and flexible measuring system  
Amberg Profiler 5003: Typical survey < 2 min.
- Complete data collection for profile, volume and image documentation
- Direct evaluation of individual profiles
- Central project geometry data – as basis for guidance and as-built documentation
- Tunnel-optimised positioning method

### Customer benefits:

- Minimum impact on tunnelling operations during measurements
- Results of profile controls directly on site
- Optimised sprayed concrete operations (quality, cost)
- Precise calculation of quantities for billing
- Comprehensive construction data for optimum progress
- Objective record of applied construction materials



### Completion of excavation support:

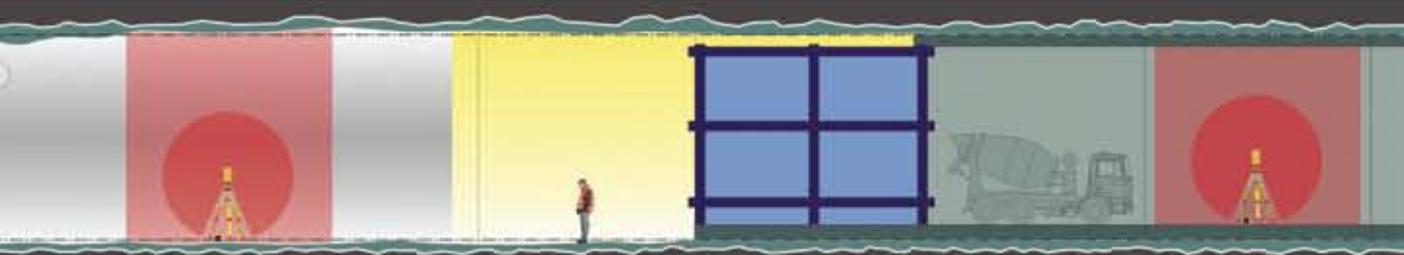
- Profile control of sprayed concrete
- Determination of sprayed concrete layer thickness
- Undulation checks of tunnel surface
- Image documentation of excavation support
- Tunnel surface deformation measurements

### TMS Tunnelscan:

- Typical 1 x 1 cm point grid on tunnel surface
- Genuine one-man system using APM™ geo-referencing method
- Automatic analysis of entire tunnel surface (profile, undulation)
- Comparison of two different scans for spatial analyses (sprayed concrete layer thickness, spatial deformation)
- On-screen digitalisation of non-compliance areas (e.g. underbreak) for set out preparation

### Customer benefits:

- Complete record of the constructed tunnel
- Tunnel scanning performance of up to 130 m per hour (Amberg Profiler 5003, APM™, trolley, automatic tripod)
- Flexible operation without additional supporting infrastructure (e.g. lighting, external power supply, additional reference points)
- Intuitive, automatic evaluation software for tunnel surveyors – not only for scanner experts



### Acceptance of primary lining:

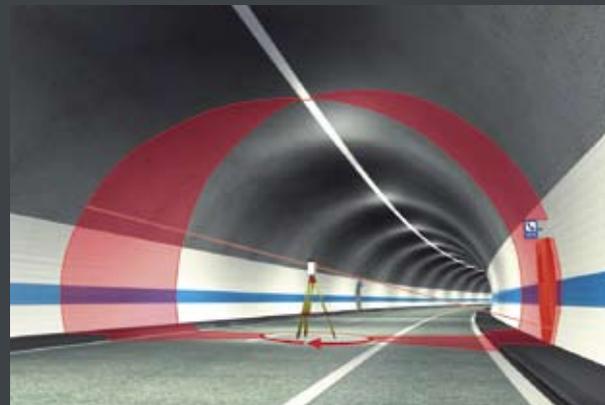
- Lining acceptance check before installation of waterproofing and secondary lining
- Complete profile approval
- Final documentation of undulation of sprayed sealing
- In-situ concrete volume calculation for logistics

### TMS Tunnelscan:

- Undulation checks according to standard sphere or bar method
- Volume calculations section by section according to station intervals
- Fully automatic documentation of results with colour-coded tunnel mapping (isoline map)
- Scaled grey-scale image of the tunnel surface – provides additional information layer for assessing potential critical tunnel sections

### Customer benefits:

- Objective facts about performance and quality of the tunnel structure
- Cost savings and improvements in quality through optimised construction planning and logistics
- Well structured and scaled presentation of results
- Accepted as-built record formats



### Tunnel commissioning:

- Acceptance checks of profile dimensions and secondary lining thickness
- 3D documentation of tunnel equipment
- Handover documentation of concrete lining

### TMS Tunnelscan:

- Complete 3D as-built documentation
- Scaled image
- Interactive export of detailed point data including attributes such as 3D coordinates, deviations from theoretical profile, etc.
- Image data interface for transfer of existing structural data, e.g. to an asset management system

### Customer benefits:

- Objective documentation of the condition of the structure
- Savings in tunnel maintenance costs

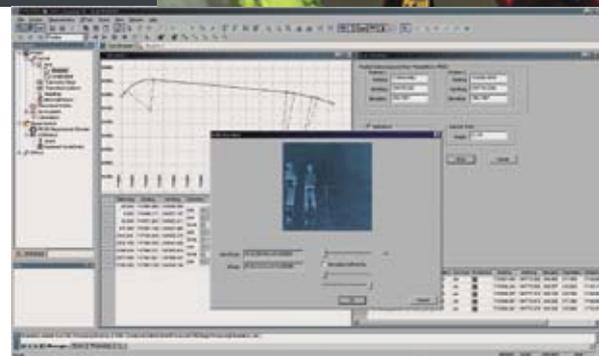
# TMS Tunnelscan

## Complete documentation and analysis

**TMS Tunnelscan – the powerful tunnel scanning module is an integral component of the TMS Solution – one solution from tunnel guidance to as-built documentation:**



- Powerful measuring and evaluation modules
- Tunnel-optimised measuring process
- Intuitive software for tunnel surveyors
- Automatic analysis, meaningful results



TMS ScanRex Automatic geo-referencing process

### TMS ScanControl

Using the fastest scanner system Profiler 5003 means tunnel surveying with up to 500'000 points per second. An outstanding performance in the demanding tunnelling environment that allows surveying without obstructing tunnelling works.

Typical point grid	1 x 1 cm
Measured points per set-up	12.5 million
Measuring duration per set-up	< 2 min.
Performance per hour	up to 130 m

TMS ScanControl is the module to obtain the most efficient tunnel as-built survey with the Profiler 5003 using the Amberg Positioning Method (APM™).

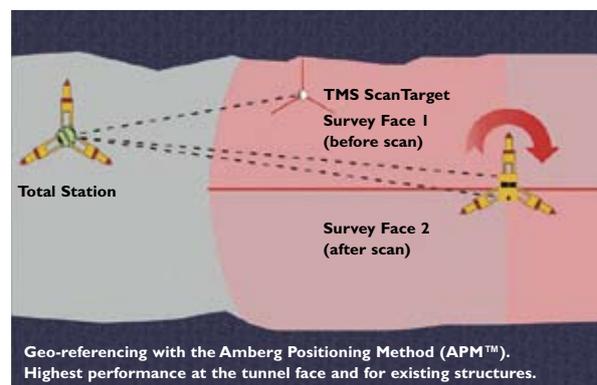
The measuring system is referenced with a total station, optionally with a TMS motorised laser.

#### Advantages include:

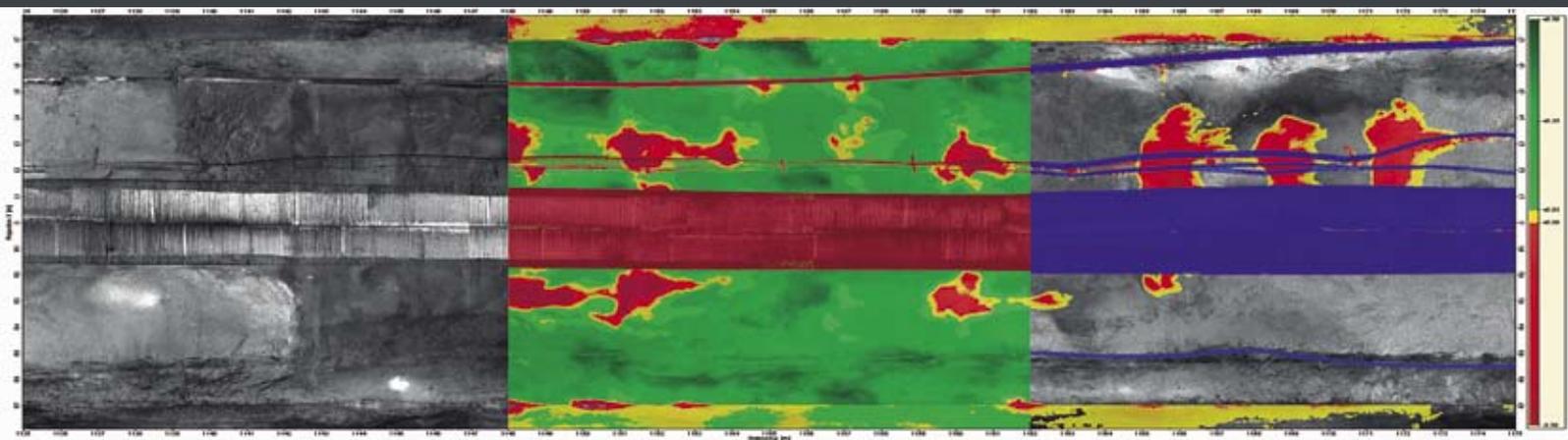
- Highest measurement performance of up to 130 m/h
  - One-man operation
  - Highest flexibility during measurements
  - Additional reference points in scanned area not required
- Optionally scanner measurements can also be carried out and referenced using manufacturer's standard software.

### TMS ScanRex

TMS ScanRex is the module for the geo-referencing of measurements in accordance with the APM™ process and the extraction of individual profiles directly from the scanned point clouds. Intelligent algorithms reduce the number of measured points from millions directly into individual cross sections, whilst retaining the critical profile sections.



- Fully automatic individual profile extraction directly from referenced scanned point cloud
- Individual profile extraction with freely-definable point density, profile intervals and critical point detection
- Transfer directly into TMS ProFit module for as-built analysis – ideal for evaluation on site



Scaled grey-scale image:  
Detailed project information

Complete results:  
Complete quality record

High quality data:  
From work preparations until billing of quantities

### TMS ScanCloud

TMS ScanCloud is the powerful analysis module for geo-referenced scanned data. Operation is designed to meet the requirements of the tunnel surveyor. Expert knowledge of complex scanned data handling or 3D CAD operation is not required. TMS ScanCloud is the basis for highest productivity and reliability in the challenging tunnelling process.

#### TMS ScanCloud provides the following analyses:

- Profile control of the entire tunnel shell
- Comparison of two independent scans to determine:
  - Layer thickness
  - Spatial deformation
- Scaled image documentation of the tunnel surface
- Detailed calculation of quantities – including section by section in-situ concrete volumes
- Undulation check of the tunnel waterproofing layer (requires TMS ScanSurf module)

#### The user benefits from:

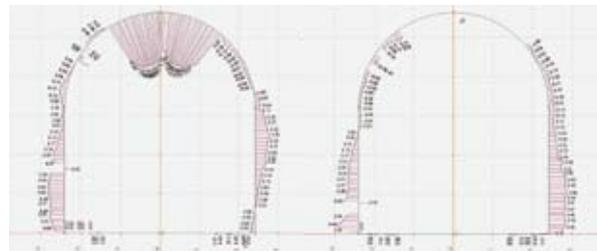
- Intuitive operation of complex data analyses
- Smooth data flow and processing
- Flexible PTS data interface for the analysis of geo-referenced data of other scanner types, e.g. Leica HDS3000
- Direct access to central project geometry data in TMS Office module
- Automatic linking of individual point clouds
- Automatic comparison of scanned data against the theoretical tunnel model according to the project specifications
- Data filters for automatic and intentional exclusion of specified areas in the tunnel cross section (e.g. ventilation in the roof, service ducts)
- Practical on-screen digitalisation for preparation of setting out of non-compliance areas on the tunnel surface

### TMS ProFit

TMS ProFit is the proven TMS analysis module for tunnel profile measurement data. Deviations of the measured profile from the theoretical profile are displayed in real time.

#### TMS ProFit provides:

- Direct analysis of the extracted tunnel profiles from TMS ScanRex and TMS ScanCloud
- Powerful reporting features



TMS ProFit: Results of individual profile extraction – with and without data filter.

### TMS ScanSurf

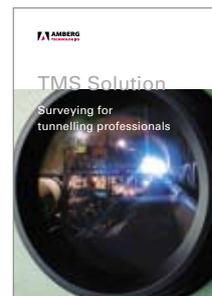
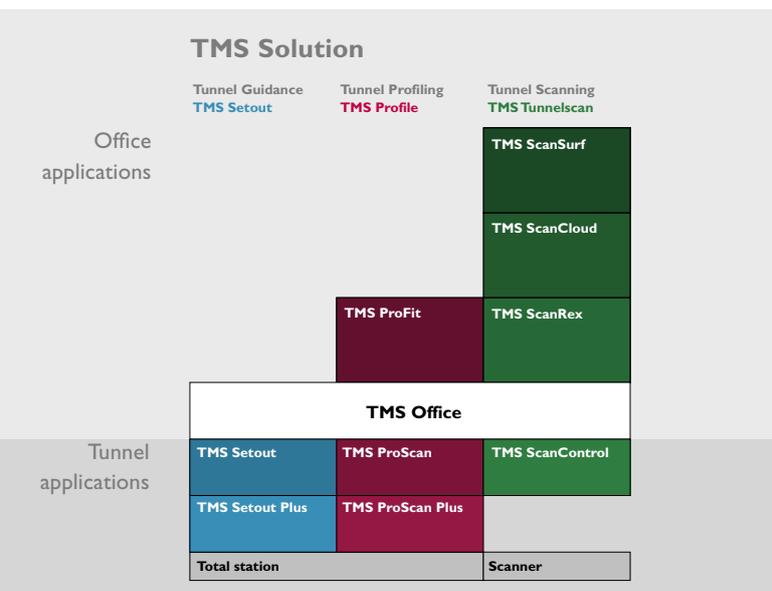
TMS ScanSurf, the optional analysis module for checking the undulation of the tunnel surface (waterproofing layer), provides:

- Accepted algorithms for undulation checks using the standard sphere or bar method
- Flexible setting of analysis parameters, such as sphere diameter, bar length, ratio of bar distance to bar depth

# TMS Tunnelscan – The valuable scanning solution for tunnelling professionals.

## Comprehensive tunnel as-built analysis: Fast, precise and meaningful

- Complete profile control
- Determination of all areas of under and over break
- Layer thickness determination
- Conformity check of undulation of tunnel surface layer
- Scaled image documentation
- Detailed calculation of quantities



Learn more about the tunnel surveying solutions from Amberg Technologies in the separate TMS Solution brochure.

Further information about the TMS Solution from Amberg Technologies are available from your local distributor or by e-mail: [tunnel@amberg.ch](mailto:tunnel@amberg.ch)

Amberg Technologies is a leading provider of specialised rail and tunnel measurement systems since more than 25 years. This unique combination of industry knowledge and engineering expertise has produced innovative and flexible systems, based on practical designs and user-friendly software. With worldwide support and service, these solutions have won the trust and respect of both the rail and tunnelling industry.

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