

TMS Solution

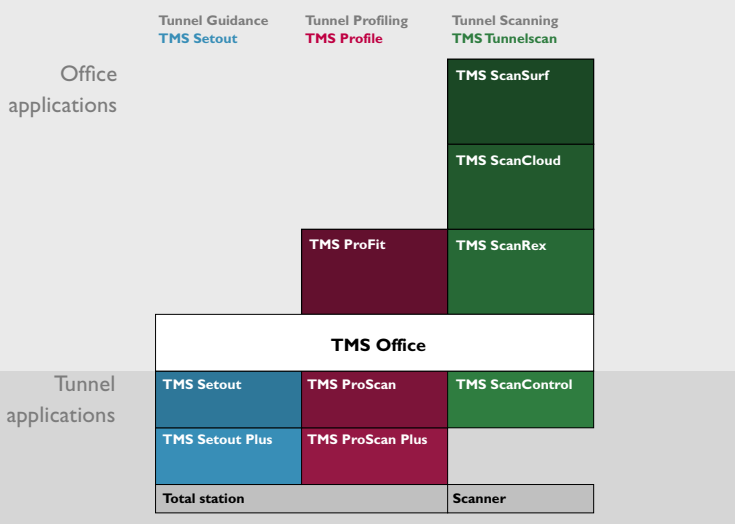
Surveying for
tunnelling professionals



TMS Solution Surveying for tunnelling professionals



TMS Solution



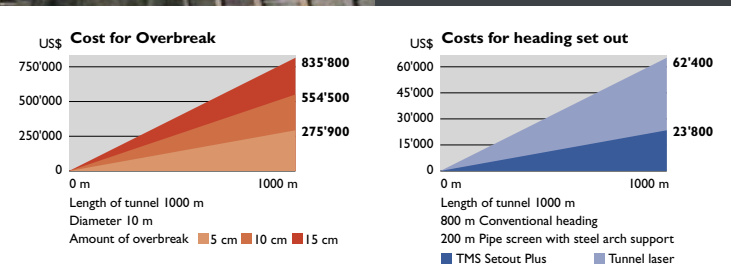
Tight budgets, tough quality demands and enormous time pressures require total efficiency from all aspects of tunnelling. Now, Amberg Technologies offers a surveying solution that sets new benchmarks in measurement and automation for conventional tunnelling: TMS Solution.

Today's tunnel construction challenges with ever more complex project demands and massive capital investment on the one hand, and steadily growing pressure on price and completion deadlines on the other, demand cost-saving solutions, yet without sacrificing precision and quality.

Therefore, successful tunnel builders increasingly rely on intelligent surveying solutions as an integral part of their tunnelling equipment:

- Effortless transfer of complex planning data
- Short preparation times
- Multifunctional and flexible operation
- Optimal support for all tunnel construction processes
- Round-the-clock availability

The TMS Solution: an integrated system brings together these benefits in one surveying solution, resulting in efficiency and precision in all phases of conventional tunnel construction.



Cost reduction benefits of the system

Two examples – one system. The benefits of TMS speak for themselves: precision and production optimisation.

A reduction of over-break of just 10 cm at a typical 1000 m tunnel will result in potential cost-savings of well over 0.5 million US\$.

The results of TMS profile survey solutions, TMS Profile and TMS Tunnelscan, are the basis for the successful quality and budget control of your tunnelling project.

TMS Setout Plus compared to traditional stake-out methods can achieve optimised production procedures with considerable cost savings in personnel, set-out and profile compliance and by reduced down time.

TMS is the measurement solution for tunnelling professionals. With good reason:

Efficiency

TMS adopts an on-board philosophy: Permanent access to all project data and geometric elements directly on the total station – regardless of location. Therefore no need for separate field computers and time-consuming coordinate calculations.

Economy

Thanks to its ingenious operational concept, TMS supports the tunnelling crew to perform routine surveying tasks automatically. The result: optimised working procedures, reduced down times, increased productivity and reduction of overall project costs.

Simplicity

Logical, straight-forward operation makes TMS the surveying solution for skilled and non specialist users alike.

Flexibility

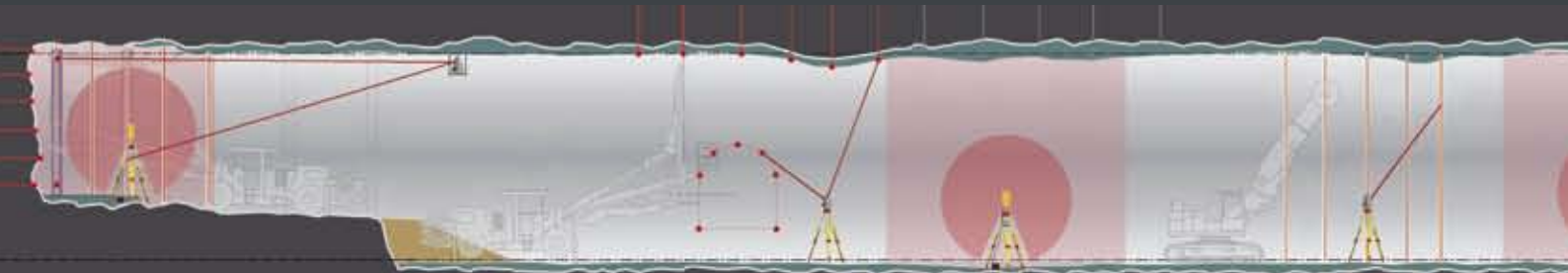
With all the project data on-board, it is possible to switch between various construction tasks seamlessly. And should ad hoc work arise while tunnelling, TMS has the solution ready to hand.

Modularity

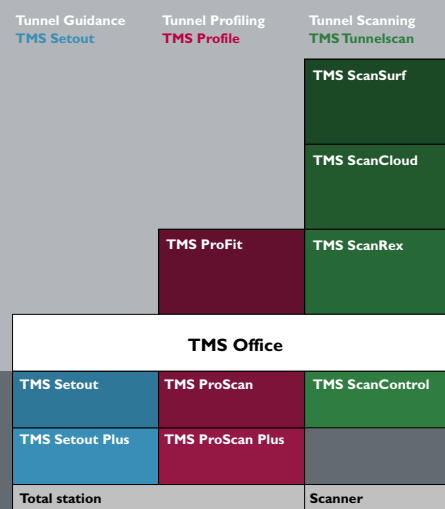
The modular TMS system architecture enables the most suitable and economical system configuration to be chosen.

TMS Solution

Tunnel surveying from heading to final



TMS Solution



TMS Solution – The complete solution for tunnel surveying

TMS from Amberg Technologies is the modular tunnel surveying solution with powerful modules for:

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

The TMS surveying solution brings together perfectly coordinated system components. First class scanners as the Amberg Profiler 5003 or Leica total stations TPS1100/1200 build the hardware platform, while the TMS Office provides the software platform for central data management. A wide range of software application modules and tunnel survey accessories makes your surveying tasks simpler and more productive.

TMS Hardware

The state-of-the-art hardware used in the TMS system solution has unrivalled productivity and reliability.

Amberg Profiler 5003:

- Latest technology for tunnel scanning
- Highest data performance combined with increased accuracy
- Perfectly integrated to fit to demanding tunnelling environment
- Compatible with Leica HDS6000 and Imager 5006 from Z+F

Leica TPS total stations:

- Motorised and reflector less TPS1100/1200 fully compatible with TMS Solution – ATR automatic target recognition recommended for TMS motor laser operation
- Robust RX1220 / RCS1100 radio remote controls for easy control of the total station during tunnelling

TMS Accessories

Amberg TMS accessories complement the standard hardware to meet tunnel construction needs, for even greater productivity and operational reliability.

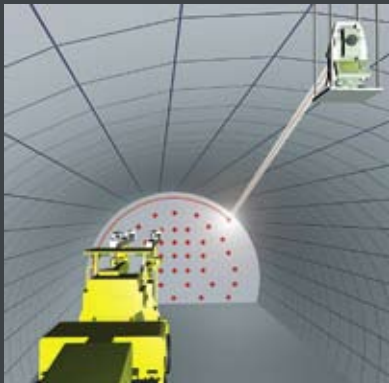
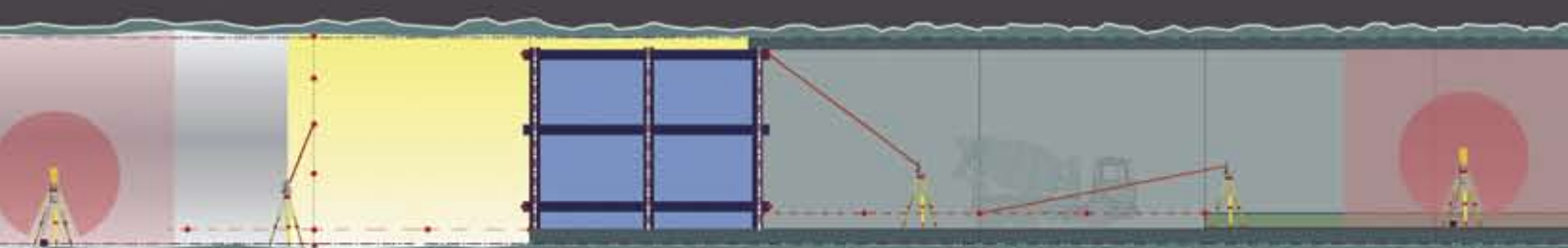
- UPS 212 – uninterruptible power supply for continuous system availability in production operation

TMS Software

The Amberg TMS Solution is the tunnel measurement system designed by tunnel experts for tunnel experts.

- Tunnel application programs – powerful, tried and tested – providing results just-in-time
- Office application programs – the reliable back office – supporting the survey work, transferring data to valuable information

al installations



TMS Setout

TMS Setout Plus:

- Motorised laser functionality for automatic setting out of
 - Excavation profiles
 - Blast pattern
 - Jetting and pipe umbrella
- Automatic steel arch positioning and profile check

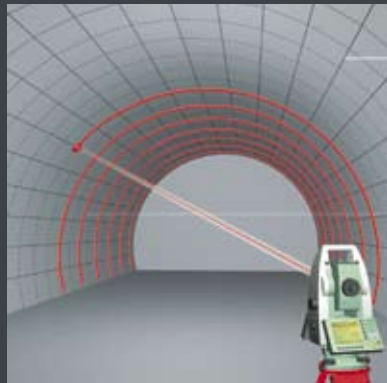
TMS Setout:

- Automated setting out of
 - Banquettes
 - Axis
 - Height reference points

Benefits

Efficient, flexible and cost saving set out tool for:

- Reduced tunnelling costs due to perfect construction precision
- Optimised production due to reduced waiting and down time
- Faster surveying thanks to new, automatic set out routines



TMS Profile

TMS Profile:

- Automatic 3D profile checks
- Flexible single profile measurements during tunnelling
- Powerful reporting of profile control including volume calculation

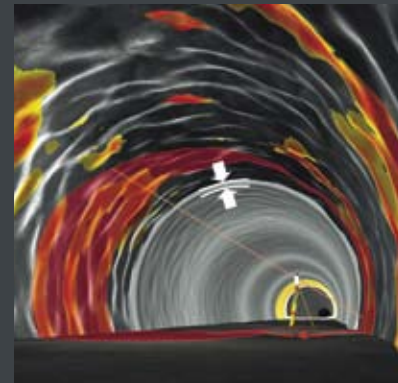
TMS Profile Plus:

- Automatic 3D profile checks with real-time results – incl. visualisation of underbreak
- Direct as-built checks after arch installation

Benefits

Precise, exact and reliable profiling tool for:

- Information just-in-time
- Perfect profile compliance
- Reduced down time as TMS Profile plus allows real-time surveying



TMS Tunnelscan *

TMS Tunnelscan:

- Complete profile checks
- Layer thickness determination
- Tunnel surface analyses
- Scaled image documentation of tunnel surface and installations
- Determination of quantities

TMS Tunnelscan for Cyclone:

- PTS interface for smooth data import of georeferenced points clouds
- Tunnel as built analyses based on data from scanner models e.g. Leica HDS, Faro LS, Riegl LMS

Benefits

Fast, correct and convincing tunnel scanning for:

- Automatic detection of all areas of under and overbreak
- Complete structure information including dimensions, volumes and scaled images
- Minimum impact on tunnelling operations

* Find detailed information about tunnel scanning with TMS from Amberg Technologies in the extra TMS Tunnelscan brochure.

TMS Solution

	Tunnel Guidance TMS Setout	Tunnel Profiling TMS Profile	Tunnel Scanning TMS Tunnelscan
Office applications			TMS ScanSurf
			TMS ScanCloud
		TMS ProFit	TMS ScanRex
TMS Office			
Tunnel applications	TMS Setout	TMS ProScan	TMS ScanControl
	TMS Setout Plus	TMS ProScan Plus	
	Total station		Scanner



TMS Setout – The versatile set out tool

TMS Setout brings exceptional functionality, flexibility and productivity to tunnel surveying. Performance plus: As well as the TMS Setout basic module, there is TMS Setout Plus, which enables the tunneling crew to perform routine set out tasks themselves.

Whether for daily surveying tasks or special challenges – TMS Setout offers superior system benefits:

Everything is on-board

All project data and geometric elements are permanently available on the total station

Multifunctionality

A single software solution for the full range of set out tasks in conventional tunnel construction

Economy

Automatic set out and heading control

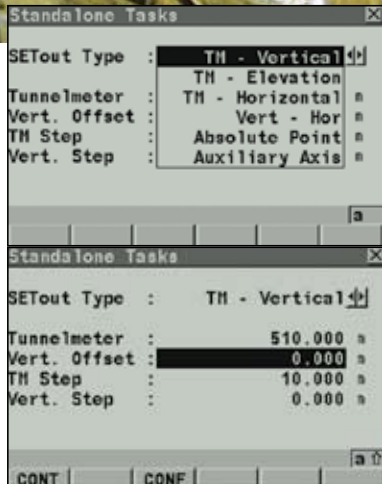
Flexibility

Can be used either on a mobile tripod, or stationary as a console-mounted, motorised tunnel laser

Precision

Reflectorless distance measurement determines each set out point precisely





Take everything with you: All project data is on-board

TMS Setout – flexible deployment

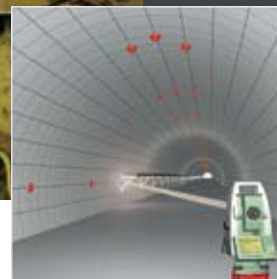
No need to gaze through the telescope: With TMS Setout and a mobile tripod, tasks using predefined set out coordinates become routine. Using TMS Setout intelligent ACTIVE MODE and reflectorless distance measurement makes for high-precision, rapid, reliable point positioning.

- A single tool for all set out work
- Automatic, efficient one man set out by use of radio remote control
- With on-board project data, even ad hoc work is no problem



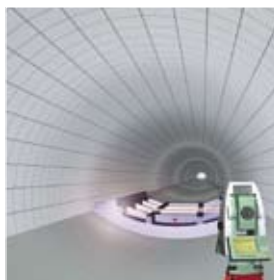
Point set out

Automatic set out of single or interval points referred to the axis or design profile



Installations

Automatic set out of single or interval points for precise positioning of tunnel installations



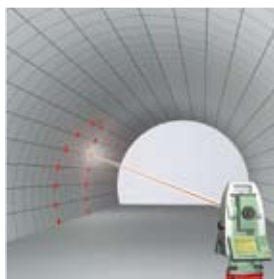
Invert formwork

Set out and positioning of the base formwork



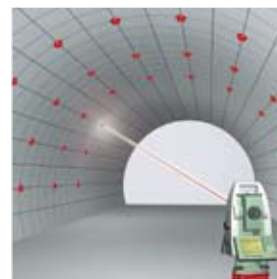
Arch formwork / joint strips

Spot-on positioning of the arch formwork and setting out joint strips



Cross passages / niches ¹

Automatic setting out of niches and cross passages



Systematic anchoring ¹

Automatic, manual or time controlled set out of the rock bolt drilling pattern, or radial points

¹ requires TMS Setout Plus

TMS Solution

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	Total station		Scanner



TMS Setout Plus – The round-the-clock surveyor for routine set out work



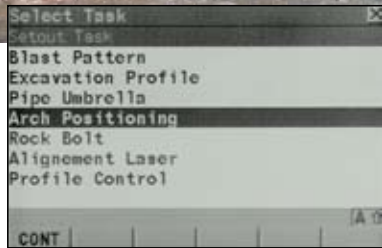
No exaggeration: TMS Setout Plus, with its ingenious operating concept, adds a round-the-clock surveyor to your tunnelling crew. Once the tunnel surveyor has set up the system, the crew can perform routine surveying tasks themselves, using the total station as a motorised tunnel laser. That makes for highly flexible and productive working, and less time on-site for the surveyor.

Surveying by the tunnelling crew:

Thanks to separate operating modes for the surveyor and tunnelling crew, TMS Setout Plus facilitates defined surveying tasks by the tunnelling crew and thus becomes an integral part of the production process. Avoiding waiting and down time quickly generates potential for time and production optimisation.

- The TPS total station as console mounted, motorised construction laser
- Lean working procedures at the tunnel face using predefined automated functions

- Reduction of the surveyor's on-site requirement by as much as two thirds
- Two operating modes: DESIGN MODE for surveying specialists, PRODUCTION MODE for use by the tunnelling crew
- Flexibility thanks to remote control
- Intelligent system monitoring functions for continuous surveillance of instrument position
- Project-specific menu display for the tunnelling crew
- User administration with password protection
- Log files for comprehensive quality control



Extremely simple user menu guidance on the remote control

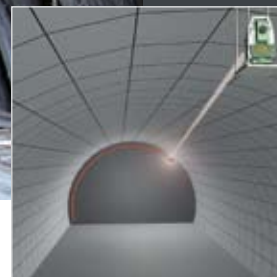
Automatic functions for the simplest possible operation

As easy as using a mobile phone, the tunnelling foreman can do the routine production surveying tasks using the TMS Setout Plus automatic functions in PRODUCTION MODE. Guided by the project-specific menu display, the tunnelling foreman selects a task rapidly and directly by pressing the function keys on the TPS remote control.



Drill and blast (BLAST)

Automatic, manual or timer controlled display of blast pattern



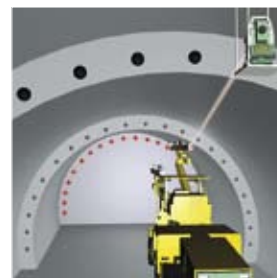
Conventional advance (CONTOUR)

Automatic, manual or timer controlled profile contour display



Roadheader advance (CONTOUR)

Automatic, continuous display of the excavation profile



Jetting and pipe umbrella (JETTING)

Automatic set out of drilling points and orientation of the drilling carriage



Alignment laser (LASER)

Uses the red laser as a tunnel laser with preset orientation

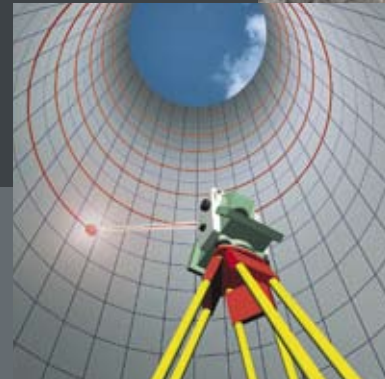


Position arches (ARC)

Automatic positioning of steel arches in XYZ axes with freely definable set out offsets

TMS Solution

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	TMS Setout Plus	TMS ProScan Plus	
	Total station		Scanner



Automatic 3D profile measurement

TMS Profile – Profile check point by point

Efficiency from the first round of advance to finished lining is the goal of any tunnel construction project. A key factor for project success is accurate excavation profile. The system TMS Profile and the intelligent analysis software TMS ProFit is the solution.

It easily adds up: Savings in excavation volume, unnecessary transport and dumping costs, rock support and concrete volume make your tunnel construction project highly cost efficient. TMS Profile is the systematic approach to profile accuracy: precise geometric data, continuous comparison of design vs. actual profiles, and reliable quantity calculations.

TMS Profile is the comprehensive, cost-saving solution for a whole series of underground construction tasks:

- Excavation monitoring
- Geological overbreak calculation
- Non-destructive concrete layer thickness control
- Determining as-built tunnel axis in TBM tunnels
- Complete information for quantity surveying and project accounting
- Base data for refurbishment projects
- Railway design envelope clearance checks
- Comprehensive as-built construction work documentation

TMS ProScan/ProScan Plus: automatic 3D profile measurement

The TMS ProScan and TMS ProScan Plus on-board software are highly flexible and work efficiently in the field.

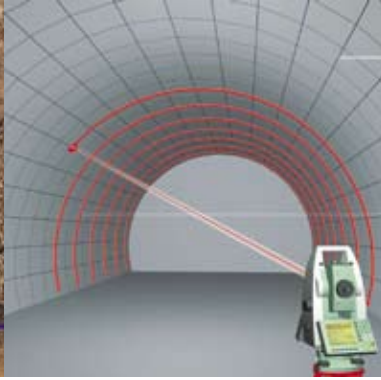
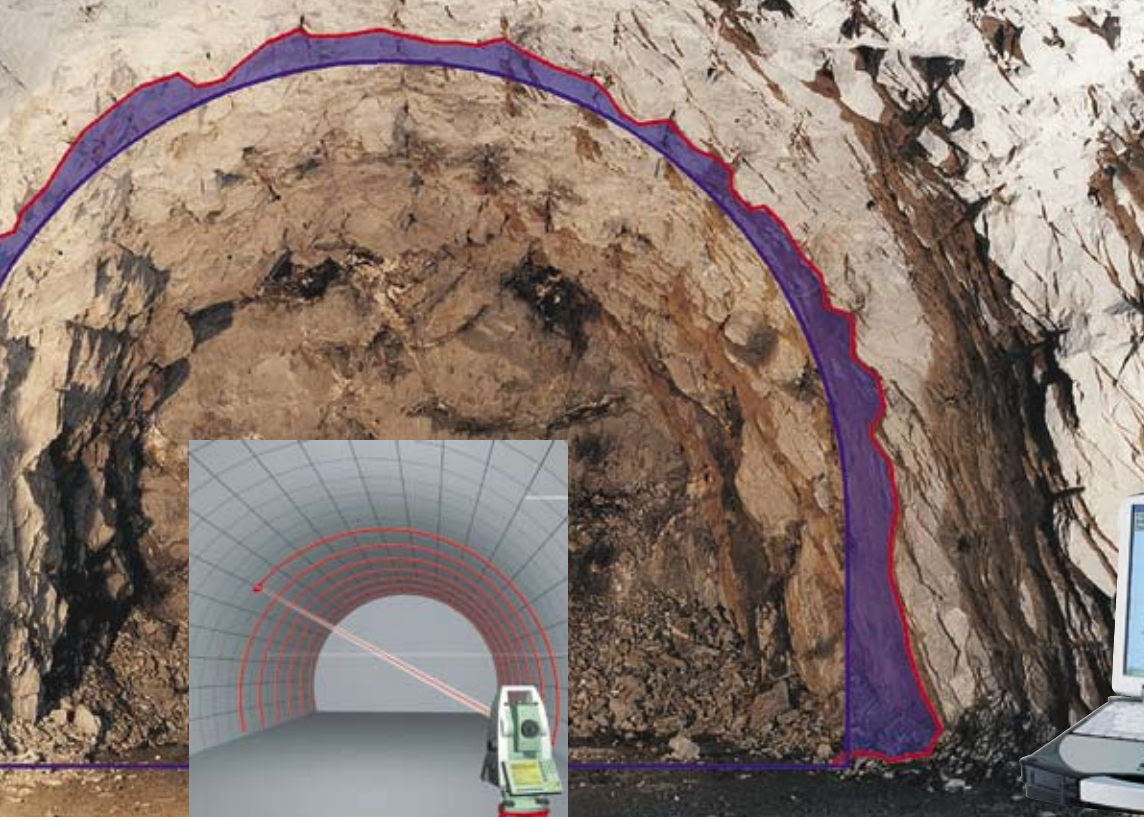
TMS ProScan:

- Automatic, reflectorless 3D profile measurement
- 6 distinct measurement modes

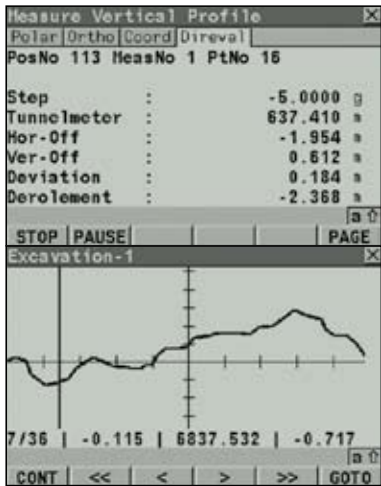
TMS ProScan Plus:

- 3D profile measurement at an automatic right angle to the project axis, thanks to the ALIGN function
- On-board analysis and visualisation directly on site, saving time and money





Immediate excavation checks



Direct on-board analysis right at the tunnel face



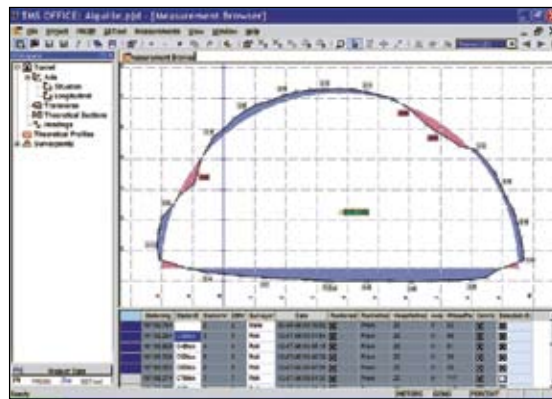
Automatic visualisation of profile anomalies with the VISU function

TMS ProFit – focused on results

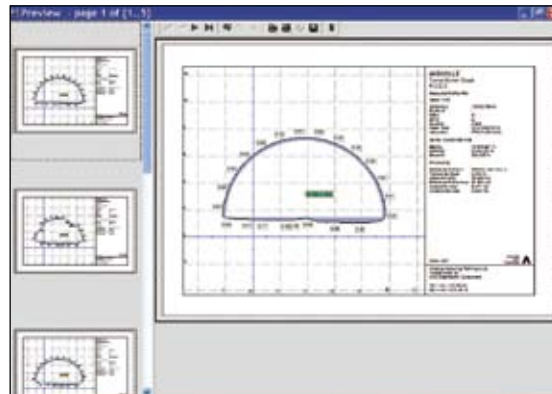
TMS ProScan delivers precise measurement data. TMS ProFit software performs intelligent, results oriented analysis.

TMS ProFit gives you:

- Comprehensive graphic-numeric comparison of design vs. actual measurement and project data
- Automatic, project-specific analyses
- Clear facts and figures for quantity surveying and project accounting



TMS ProFit – Powerful graphic-numeric analysis functions for comprehensive interpretation of measurement data

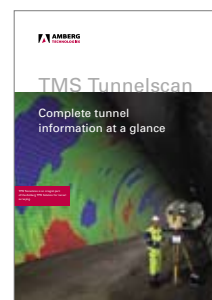
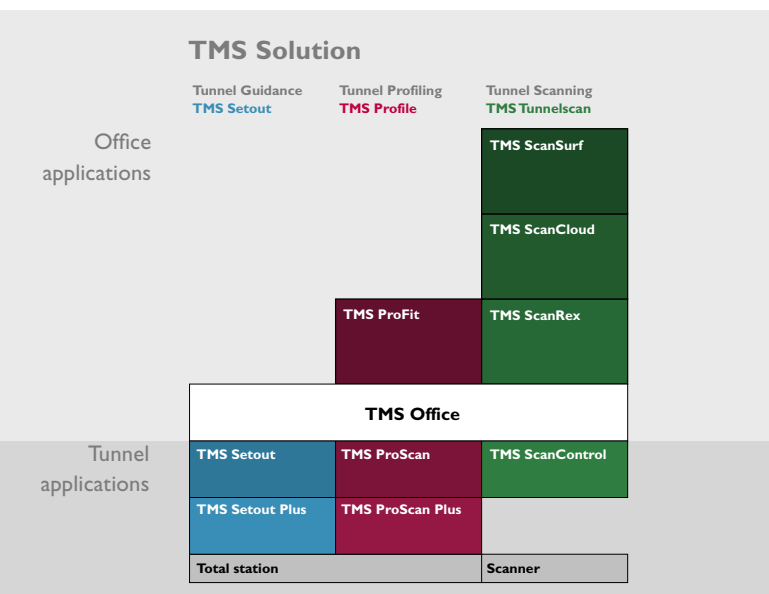


TMS ProFit – Intelligent analysis software delivers the facts and figures needed from cost management to quality assurance.

TMS Solution – Surveying for tunnelling professionals

The comprehensive surveying solution for tunnel construction

- The complete software solution for surveying tasks in tunnel construction
- All project data permanently available on-board
- Cost savings through greater profile compliance and automation of surveying tasks
- Higher productivity in tunnel advance thanks to reduced down time and optimised production procedures



Learn more about the tunnel scanning solutions from Amberg Technologies in the separate TMS Tunnelscan brochure.

Further information about the TMS Solution from Amberg Technologies are available from your local distributor or by e-mail: 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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