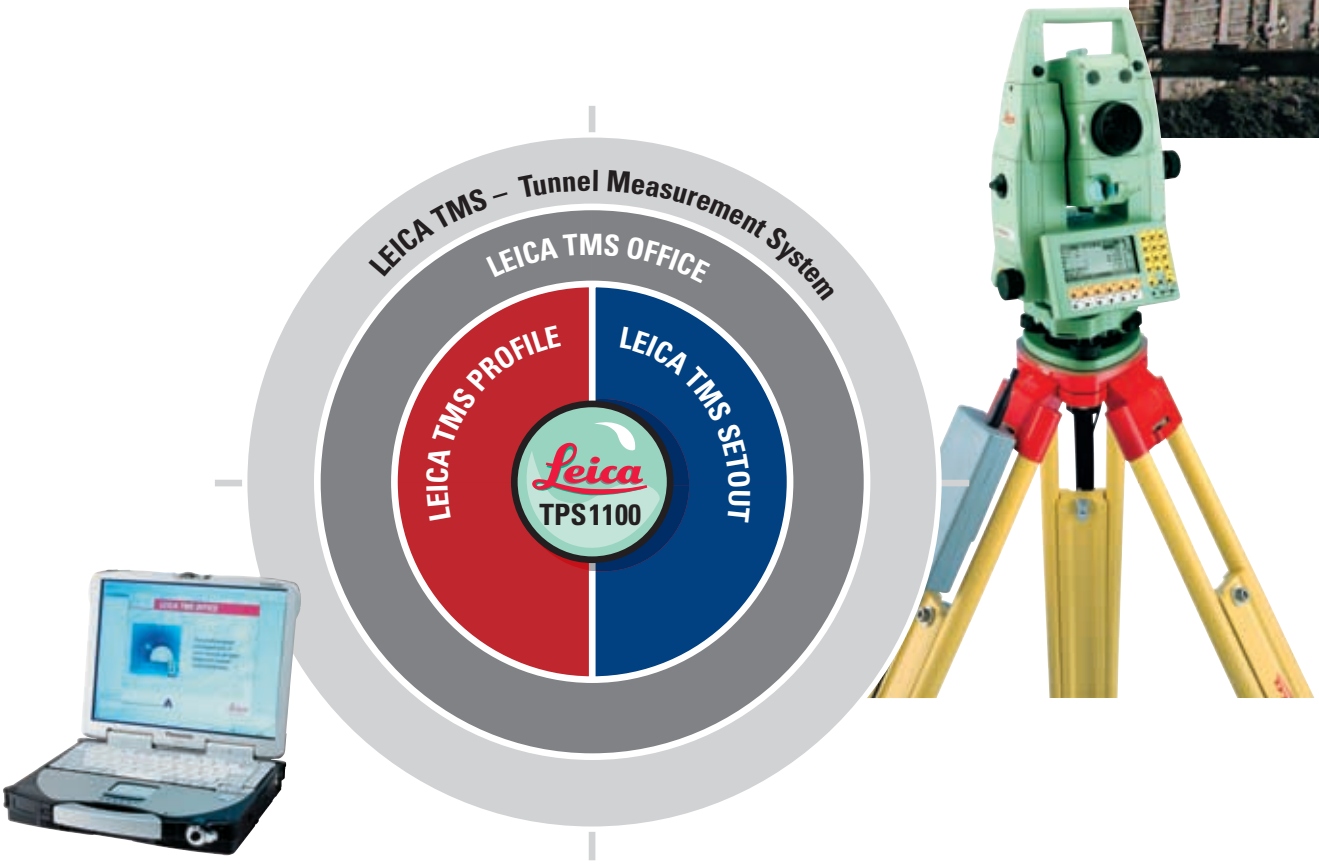
LEICA TMS – Tunnel Measurement System

One challenge – one system – one solution

Leica Geosystems

LEICA TMS – Surveying for Tunnelling Professionals

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

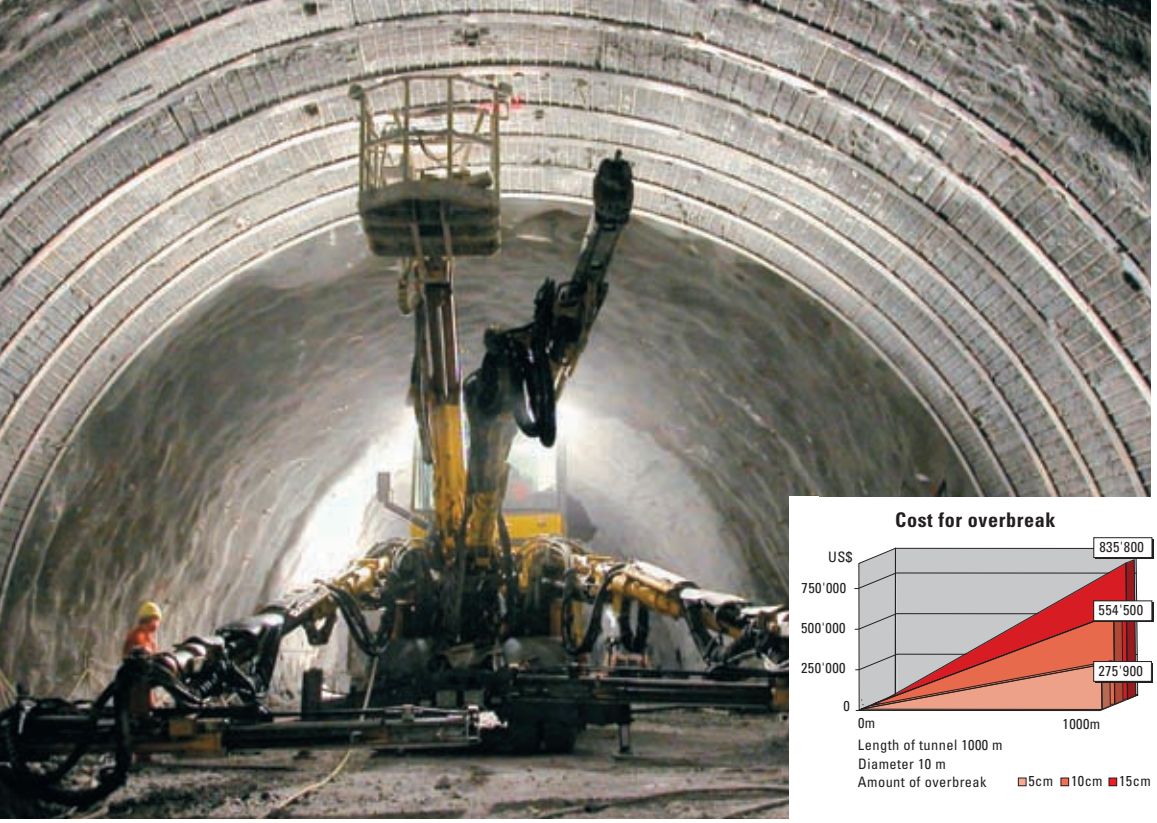


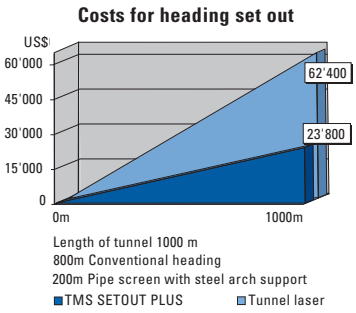
Today's tunnel construction challenges with ever more complex project demands and massive capital investment on the one hand, and steadily growing pressure on price and completion deadlines on the other, demand cost-saving solutions, yet without sacrificing precision and quality.

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***

LEICA TMS: 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 LEICA TMS speak for themselves: precision and production optimisation.

Using LEICA TMS PROFILE in a typical 1000m tunnel with in-situ concrete lining, a reduction of over-break of just 10cm will result in potential cost-savings of well over 0.5 million US$.

LEICA 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.

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

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

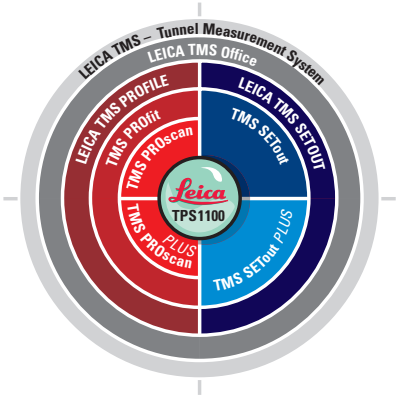
Flexibility: With all the project data on board, it is possible to switch between various construction tasks seamlessly. And should ad hoc work arise while tunnelling, LEICA TMS has the solution ready to hand.

Economy: Thanks to its ingenious operational concept, LEICA 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.

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

Simplicity: Logical, straightforward operation makes LEICA TMS the surveying solution for skilled and non specialist users alike.

LEICA TMS – Tunnel Measurement System – seamless compatibility



The LEICA TMS surveying solution brings together perfectly coordinated system components. The hardware is based around the LEICA TPS1100 total station, while LEICA TMS OFFICE provides the software platform for data management. A wide range of software application modules and standard accessories makes your surveying tasks simpler and more productive.

LEICA TPS 1100plus

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

- *Automatic profile measurement and pinpoint setting out thanks to **reflectorless distance measurement***
- *Setting out tasks become a one man operation using **Power Search***
- *The **RCS1100 radio remote control** enables effortless control of the Totalstation from any position*
- *Control point targeting even under very difficult light conditions, thanks to **ATR automatic target recognition***
- *Convenient transfer of project and measurement data via the **PCMCIA-card***
- *Also does duty as a motorised tunnel laser in production operation*

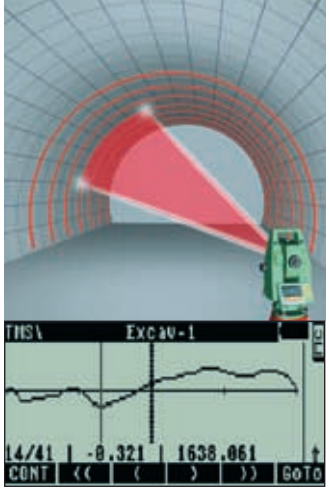
Accessories

The LEICA TMS system is based on standard Leica components. These are augmented by accessories specially developed to meet tunnel construction needs, for even greater productivity and operational reliability.

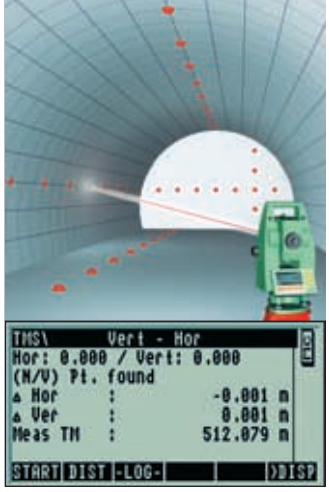
- *Convenient wireless remote control using the **RCS1100 controller / TCPS26 radio modem***
- *Water and dustproof safe storage for the RCS1100 controller, plus battery charging facilities direct at the tunnel drive thanks to the **TMS SB1100 service-box***
- *Uninterruptible power supply and continuous system availability in production operation thanks to the **AMT UPS12 power supply***

Application software on-board

On-board the Leica TPS1100 total station: LEICA TMS SETOUT and LEICA TMS PROFILE. These powerful, tried and tested application programs set new benchmarks in tunnel surveying. The modular LEICA TMS system architecture means the system configuration can flexibly adapt to meet project needs.



LEICA TMS PROFILE
Automatic profile measurement: for precise geometric information, exact profile compliance and reliable calculations for quantity surveying. LEICA TMS PROFILE delivers the facts to build on.



LEICA TMS SETOUT
A versatile set out tool. Whether on a mobile tripod for automatic one man set out, or as a stationary, console-mounted round-the-clock surveyor, LEICA TMS SETOUT brings efficiency, flexibility and project cost savings through tunnel surveying.

LEICA TMS OFFICE data management

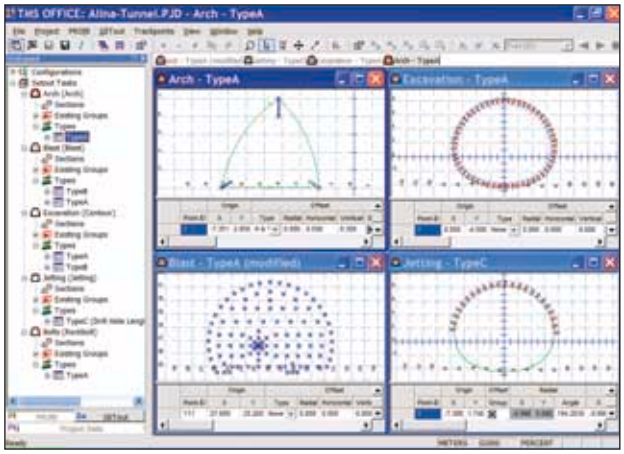
Multiple LEICA TMS applications, all running within a single software platform. This is the concept behind the systematic data management principle of LEICA TMS OFFICE. Management of all measurements, set out and survey point data for every TMS software application module takes place here. That brings numerous benefits:

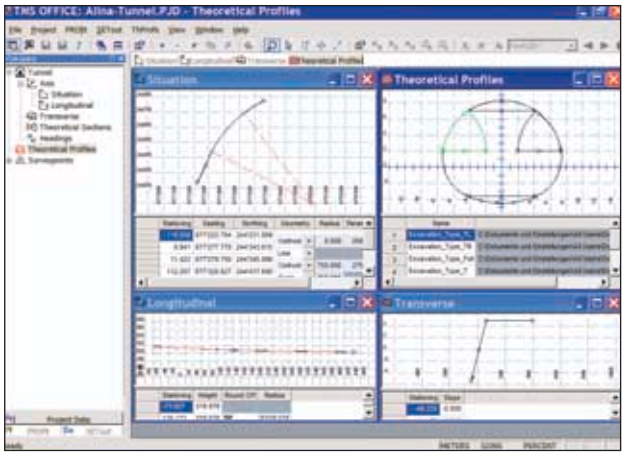
Project data management

- *Define or import project data just once*
- *Interactive project data entry with a graphic online display of all project elements*
- *Define complex point groups (including sub-group management) and assign positions for automatic set out*
- *Hierarchic data management for flexible project data editing*
- *User-defined, project-specific menu displays for the tunnelling crew*
- *Data import/export in ASCII, DXF, GSI and Bever Team formats*
- *PCMCIA card for exporting project data to the Totalstation*

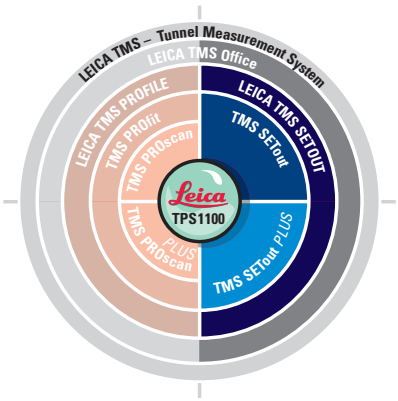
Design calculation functions

- *Point offset from tunnel laser*
- *Interval point calculation for axis points and axis-referred point perpendiculars*
- *Axis-referred interval point calculation*





LEICA TMS SETOUT –
The versatile set out tool

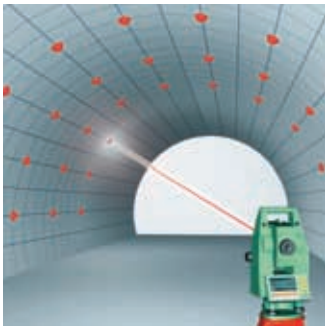


LEICA TMS SETOUT brings exceptional functionality, flexibility and productivity to tunnel surveying. Performance plus: As well as the TMS SETout basic module, there is TMS SETout PLUS, which enables the tunneling crew to perform routine set out tasks themselves.

Whether for daily surveying tasks or special challenges – LEICA 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*

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



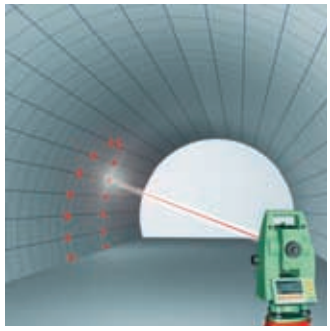
Systematic anchoring
Automatic, manual or time controlled set out of the rock bolt drilling pattern, or radial points

TMS SETout – flexible deployment

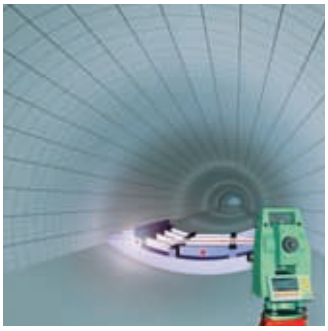
No need to gaze through the telescope: With TMS SETout and a mobile tripod, tasks using predefined set out coordinates become routine. Using TMS SETout intelligent ACTIVE MODE and reflectorless distance measurement makes for high-precision, rapid, reliable point positioning.

- *A single tool for all set out work*
- *Automatic, efficient one man set out thanks to predefined set out data and radio remote control*
- *With on board project data, even ad hoc work is no problem*

Take everything with you: All project data is on board

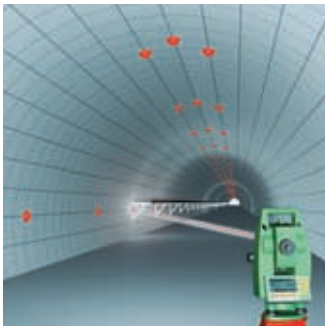


Cross passages / niches
Automatic setting out of niches and cross passages



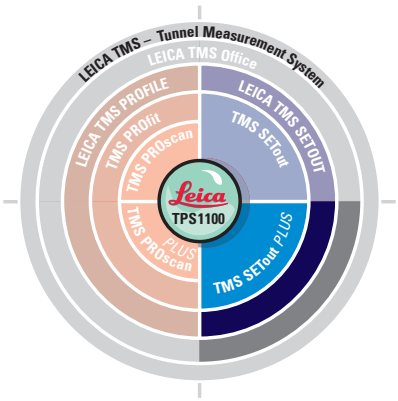
Base formwork
Set out and positioning of the base formwork

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

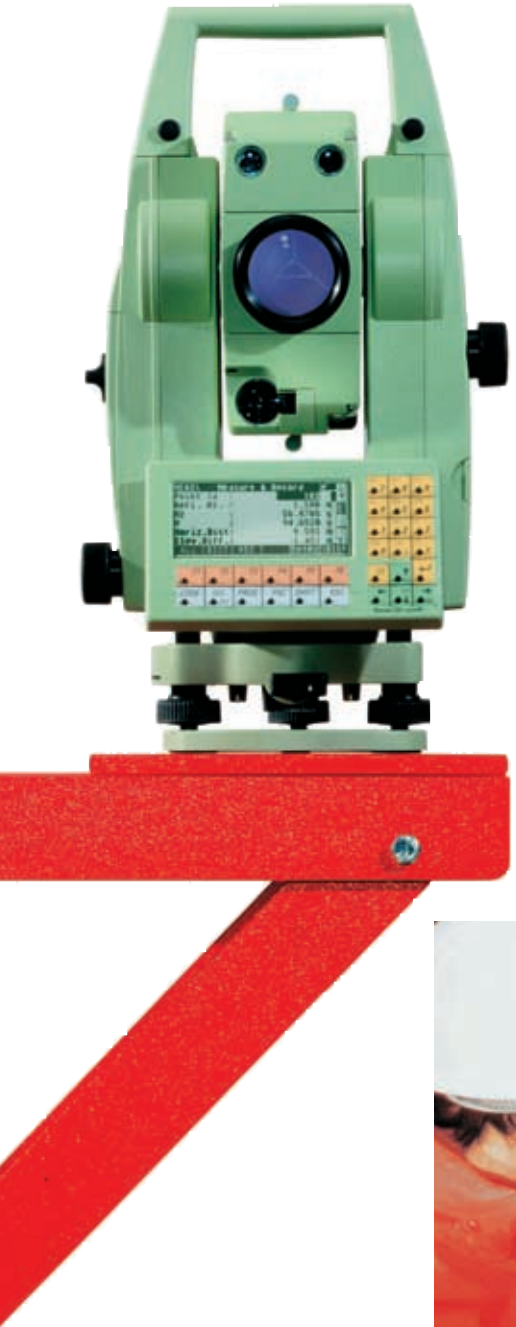


Installations
Automatic set out of single or interval points for precise positioning of tunnel installations

LEICA TMS SETOUT PLUS:
The round-the-clock surveyor for routine set out work



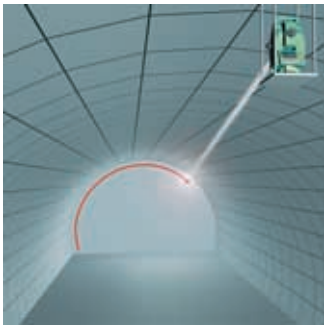
No exaggeration: TMS SETout PLUS, with its ingenious operating concept, adds a round-the-clock surveyor to your tunnelling crew. Once the tunnel surveyor has set up the system, the crew can perform routine surveying tasks themselves, using the total station as a motorised tunnel laser. That makes for 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.

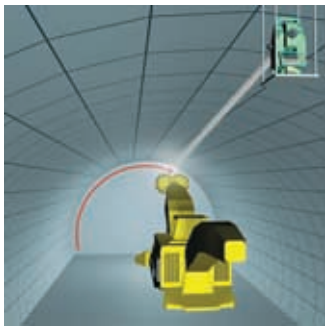
- *The TPS1100 total station is set up as a stationary, console mounted, motorised construction laser*
- *Lean working procedures at the tunnel face using predefined automated functions*
- *Reduction of the surveyor's on-site requirement by as much as two thirds*
- *Two operating modes: DESIGN MODE for 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*

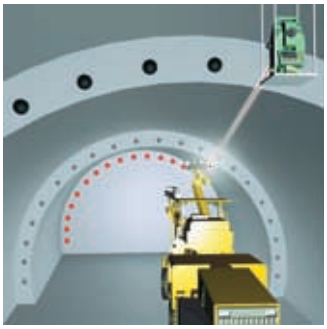


Extremely simple user menu guidance on the RCS1100 remote control

Drill and blast (BLAST)
Automatic, manual or timer controlled display of blast pattern

Conventional advance (CONTOUR)
Automatic, manual or timer controlled profile contour display



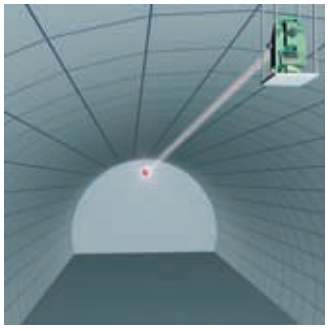


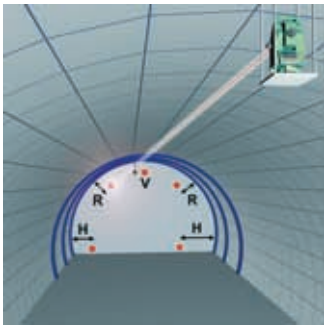
Roadheader advance (CONTOUR)
Automatic, continuous display of the excavation profile

Jetting and pipe umbrella (JETTING)
Automatic set out of drilling points and orientation of the drilling carriage

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 a project-specific menu display, the tunnelling foreman selects a task rapidly and directly by pressing the function keys on the RCS1100 remote control.

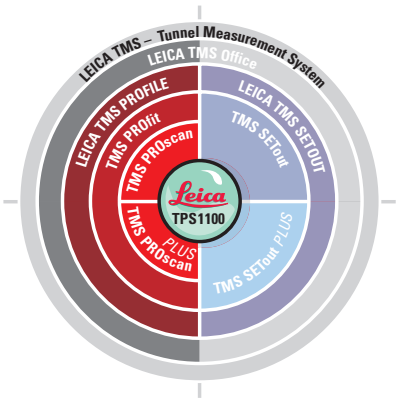




Alignment laser (LASER)
Uses the red laser as a tunnel laser with preset orientation

Position arches (ARC)
Automatic positioning of steel arches in XYZ axes with freely definable set out offsets

LEICA TMS PROFILE –
Profiling for profit

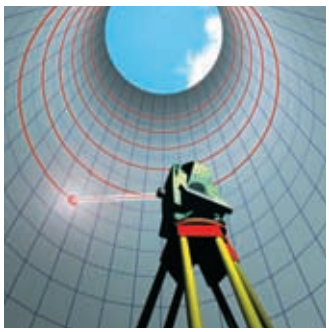


Efficiency from the first round of advance to finished lining is the goal of any tunnel construction project. A key factor for project success is accurate excavation profile. The system LEICA TMS PROFILE and the intelligent analysis software TMS PROfit is the solution.

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. LEICA TMS PROFILE is the systematic approach to profile accuracy: precise geometric data, continuous comparison of design vs. actual profiles, and reliable quantity calculations.

LEICA 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 documentation work documentation*



Automatic 3D profile measurement

TMS PROscan and PROscan PLUS: automatic 3D profile measurement

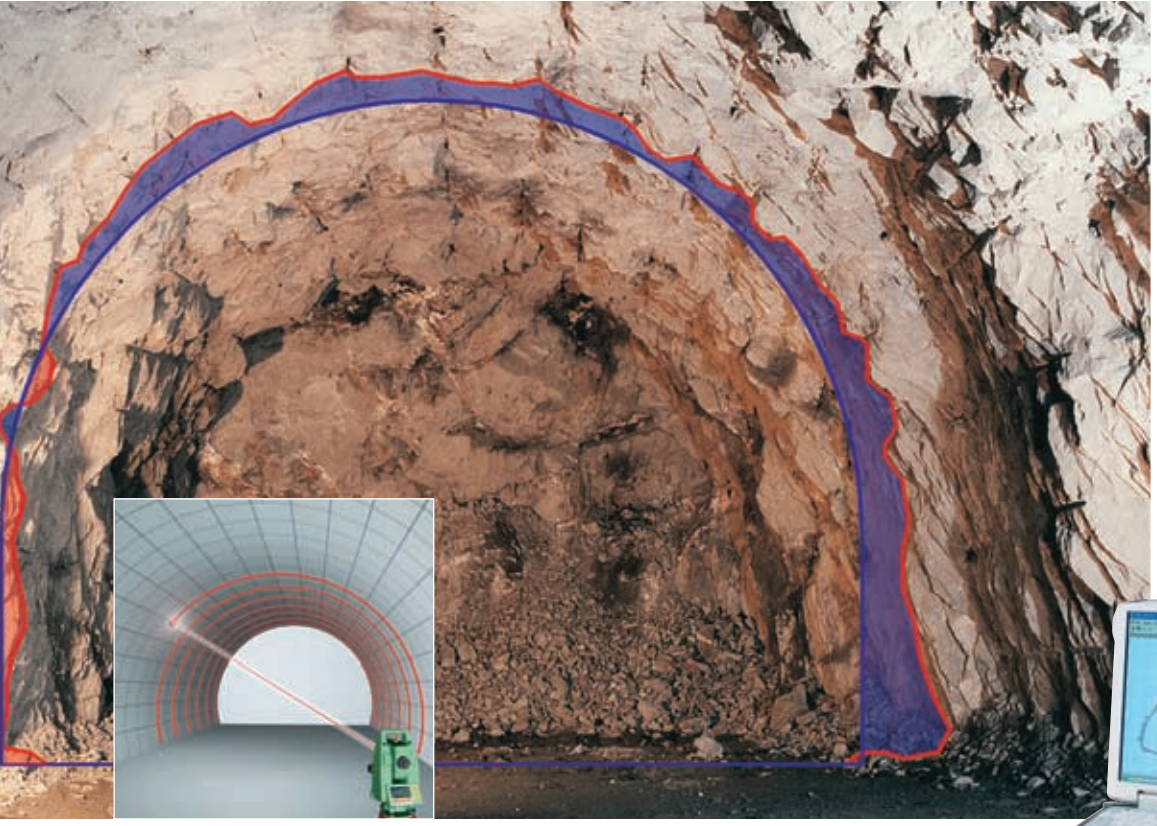
The TMS PROscan and TMS PROscan PLUS on board software are highly flexible and work efficiently in the field.

TMS PROscan:

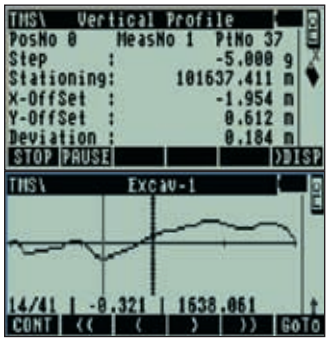
- *Automatic, reflectorless 3D profile measurement*
- *6 distinct measurement modes*

TMS PROscan Plus:

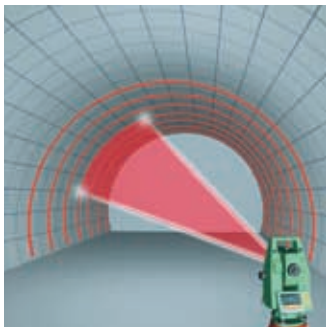
- *3D profile measurement at an automatic right angle to the project axis, thanks to the* ***ALIGN function***
- *On board analysis and visualisation directly on site, saving time and money*



Immediate excavation checks



Instantaneous graphic-numeric on board analysis right at the tunnel face



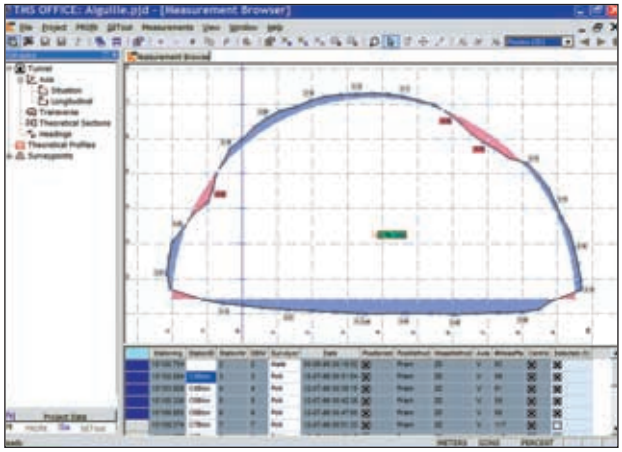
Automatic visualisation of profile anomalies with the VISU function

TMS PROfit – focused on results

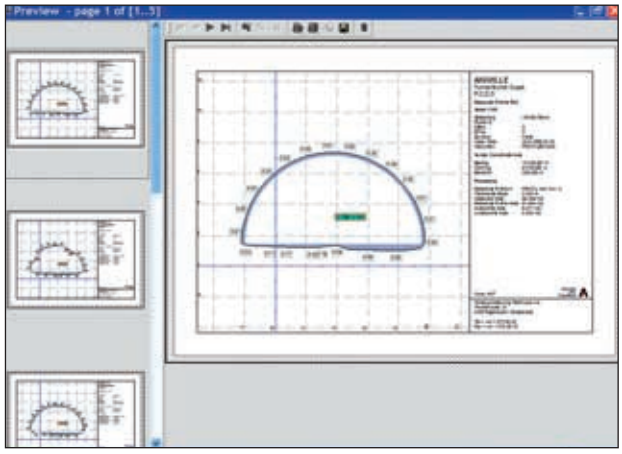
TMS PROscan delivers precise measurement data. TMS PROfit software performs intelligent, results oriented analysis.

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*

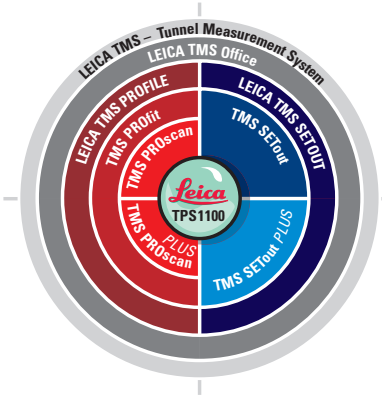


TMS PROfit – Powerful graphic-numeric analysis functions for comprehensive interpretation of measurement data



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

LEICA TMS – Tunnel measurement system



The total surveying solution for conventional tunnel construction.

The benefits:

- ***The complete software solution for surveying tasks in conventional 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***

Amberg Measuring Technique

LEICA TMS System Overview
Functional overview and technical specifications
Order no. 733 390
On-line:
leica-tms@leica-geosystems.com
www.leica-geosystems.com

LEICA TPS1100
Product brochure
Order no. 732 472
On-line:
leica-tms@leica-geosystems.com
www.leica-geosystems.com

Rangefinder (IR), ATR and PowerSearch:
Laser class 1 according to IEC 60825-1 and EN 60825-1
Laser class I according to FDA 21CFR Ch. I §1040
EGL: LED class 1 according to IEC 60825-1 and EN 60825-1

Rangefinder (RL, standard range) and laser plummet:
Laser class 2 according to IEC 60825-1 and EN 60825-1
Laser class II according to FDA 21CFR Ch. I §1040

Rangefinder (RL, enhanced range):
Laser class 3R according to IEC 60825-1 and EN 60825-1
Laser class IIIa according to FDA 21CFR Ch. I §1040

TQM
ISO 9001/ISO 14001

Total Quality Management – our commitment to total customer satisfaction.

Find out more about our TQM programme from your local Leica Geosystems representative.

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