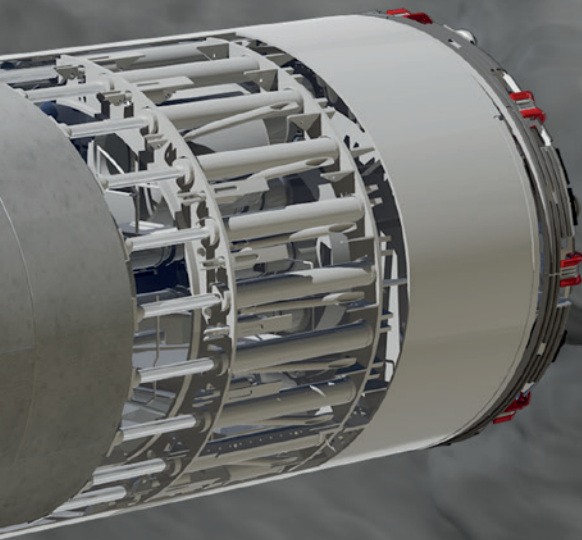


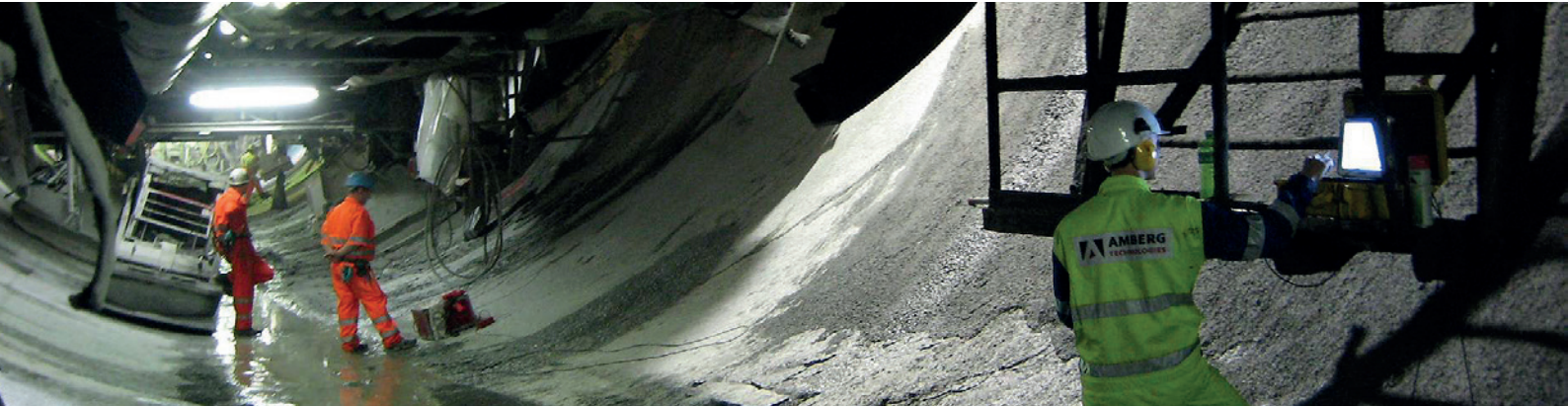
# TSP 303

See ahead – build safer



# TSP 303

## 3D Tunnel Seismic Prediction



Successful tunnel builders rely on high-performance, yet capital intensive tunnelling equipment. Unknown geological and geotechnical hazard zones can seriously decrease production efficiency and thereby significantly increase costs and construction time for tunnelling operations. Advance knowledge of the spatial dimensions of geological fault zones, cavities, water bearing formations and changes in rock mechanical properties are key factors for sound risk management, consistent operational safety and timely planning of construction countermeasures.

### TSP Tunnel Seismic Prediction

TSP 303 – the world's most successful seismic prediction system – comprises the wealth of more than 20 years of experience in Tunnel Seismic Prediction. Specially designed for underground construction, TSP 303's outstanding advantages help you stay ahead of your project objectives.

### Major operational advantages

TSP 303 offers you advanced geological prediction to meet your daily operational needs:

- Spatial investigation ahead of the face
- Detection of hazardous fault zones & cavities
- Exploration of water bearing formations
- Discovery of changes in rock mechanical properties

### Versatile application

- All conventional tunnelling methods
- Gripper & shield TBM's
- Tunnel >2.5 m diameter
- All types of rock (excl. soft ground)

### Best-in-class performance

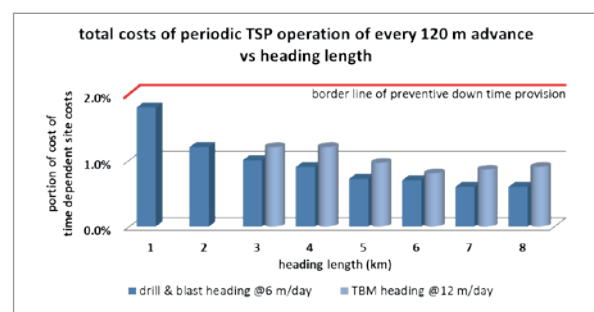
Dependent on rock characteristics, TSP 303 delivers convincing performance values:

- No face access required
- Investigation range about 150 m from face
- Spatial resolution 1 – 5 m
- Positional accuracy 1 – 5 % of target distance
- Measurement time <1.5 h
- Results within 3 h on-site

### Cost saving benefits

TSP 303 provides significant savings in many ways:

- Non-obstructive integration in construction process
- Reduction of probe drillings
- Minimised downtime for geological prediction works
- Continuous performance in production cycles
- Use rock properties for cost effective rock support design
- TSP operation always costs below 2 % down time provision



*TSP 303 – convincing costs while below downtime provisions*

### Operational benefits

Next to cost savings, TSP 303 offers convincing operational benefits:

- Increased safety at work
- Decisive information for risk management
- Timely planning for construction countermeasures
- Optimised site logistics



## TSP – the proven method

### Safe, fast, productive

- Several hundred systems operated in challenging projects and practical experience gained in thousands of investigation campaigns, experienced TSP clients combine this proven method with complementary, short targeted probe drillings
- Execute TSP measurement along with the on-going excavation every 100-150 m
- In case fault zones are detected, advance heading to the proximity of the weak zone
- Carry out a short, targeted probe drilling
- By combining TSP's 3D spatial geological mapping and rock mechanical properties with punctual petrographical data obtained from short probe-drillings, decision makers get comprehensive information and best results at lowest costs.

### Simple & quick installation

System setup and installation of the four high-sensitivity tri-axial sensors is exceptionally simple – comparable with the setting of a rock bolt.

- Drill four 2 m long,  $\varnothing$  50 mm holes in the sidewalls
- Install the receiver units housing the tri-axial sensors
- System setup and installation time totals 30 min



Like a rock bolt: Simple installation of seismic receiver unit

### Easy and safe operation in the tunnel

TSP 303 is an easy-to-operate system that you will quickly feel comfortable with.

- Complete “ready-to-use” system configuration
- Easy wizard-guided measurement sequence
- Instant quality check of recorded data
- Designed to be operated by site engineers
- Built to work under toughest site conditions

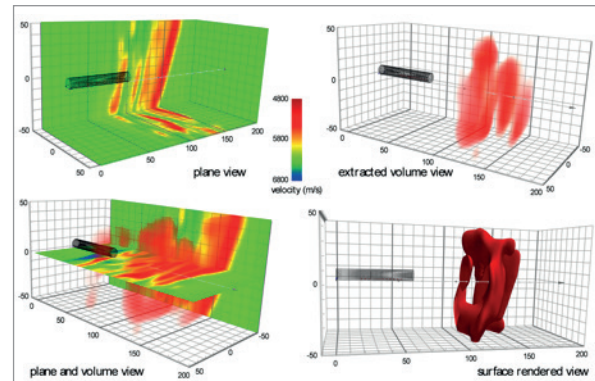


Easy, wizard-guided operation

## Powerful state-of-the-art software

The TSP 303 system software features the latest, cutting-edge technology in data acquisition and 3D seismic processing.

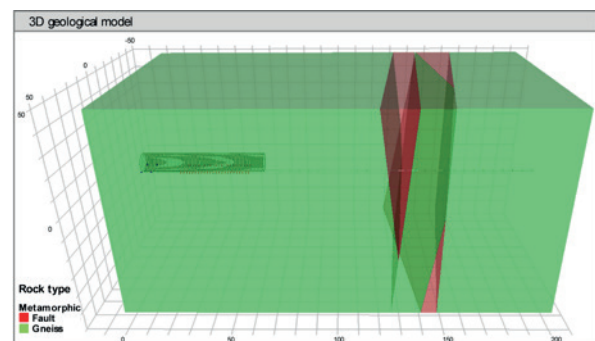
- Wizard-guided, fully or semi-automated 3D data processing
- Comprehensive rock type catalogue
- Sophisticated VMR technology consisting of velocity based 3D migration modelling with automatic reflector extraction



Sophisticated 3D velocity modelling

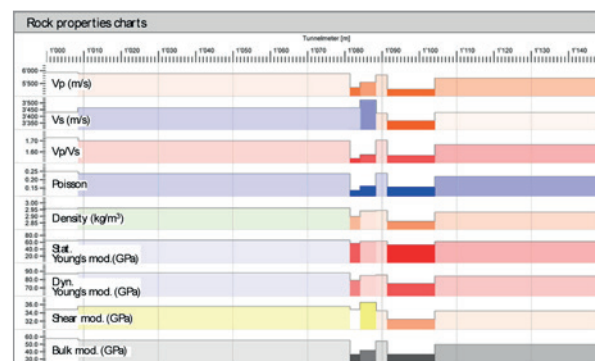
## Clear and comprehensive results output

- Comprehensive results & reports within 3 hrs – on site!
- 3D solid model rendering of geological discontinuities, dip and strike angles and intersection points referenced to tunnel axis
- User definable longitudinal-, plan- or cross-section views
- Flexible report functions for graphical output in 2D and 3D, as well as numerical and tabular output



3D geological model

- Computation of rock mechanical properties ahead of face: P- and S-wave velocity,  $V_p/V_s$  ratio, Poisson's ratio, rock density, stat. & dyn. Young's modulus, shear & bulk modulus



Comprehensive rock property chart

## SWISS EXPERTISE – REALISED WORLDWIDE

Whether it's a subway tunnel in London, the Gotthard Base Tunnel in Switzerland or a high-speed slab track railway line in China: Construction projects of this kind are nothing unusual for Amberg Technologies AG. Many demanding projects all around the globe have been realised with our customers and partners for the last 35 years.



### Professional training and support – worldwide

- A comprehensive 5-day TSP on-site system training course for your site team will ensure safe operation and reliable results
- Benefit from expert help through our qualified local partners or our support professionals via phone or web-based support tools
- Get direct access to the latest software version and take advantage of interpretation assistance and customized consulting services with our Maintenance & Support offerings.

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Professional training and support for your on-site team – worldwide

### AMBERG TSP – See ahead - build safer

Underground construction will be safer and more efficient. Risks will be better known and managed to the benefit of the tunnel builders.

Amberg Technologies has developed specialised system solutions for the infrastructure industry for more than 35 years. The resulting unique combination of systems development experience and industry know-how delivers in measurement systems characterised by precision instruments, practical system design and powerful software. Amberg Technologies' solutions have gained the trust and recognition of tunneling and railway industry experts thanks to a worldwide service and support network.

### Why choose Amberg TSP geophysical solutions?



Partnership



Ease of use



Scalability



All-in-one



Swiss quality

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