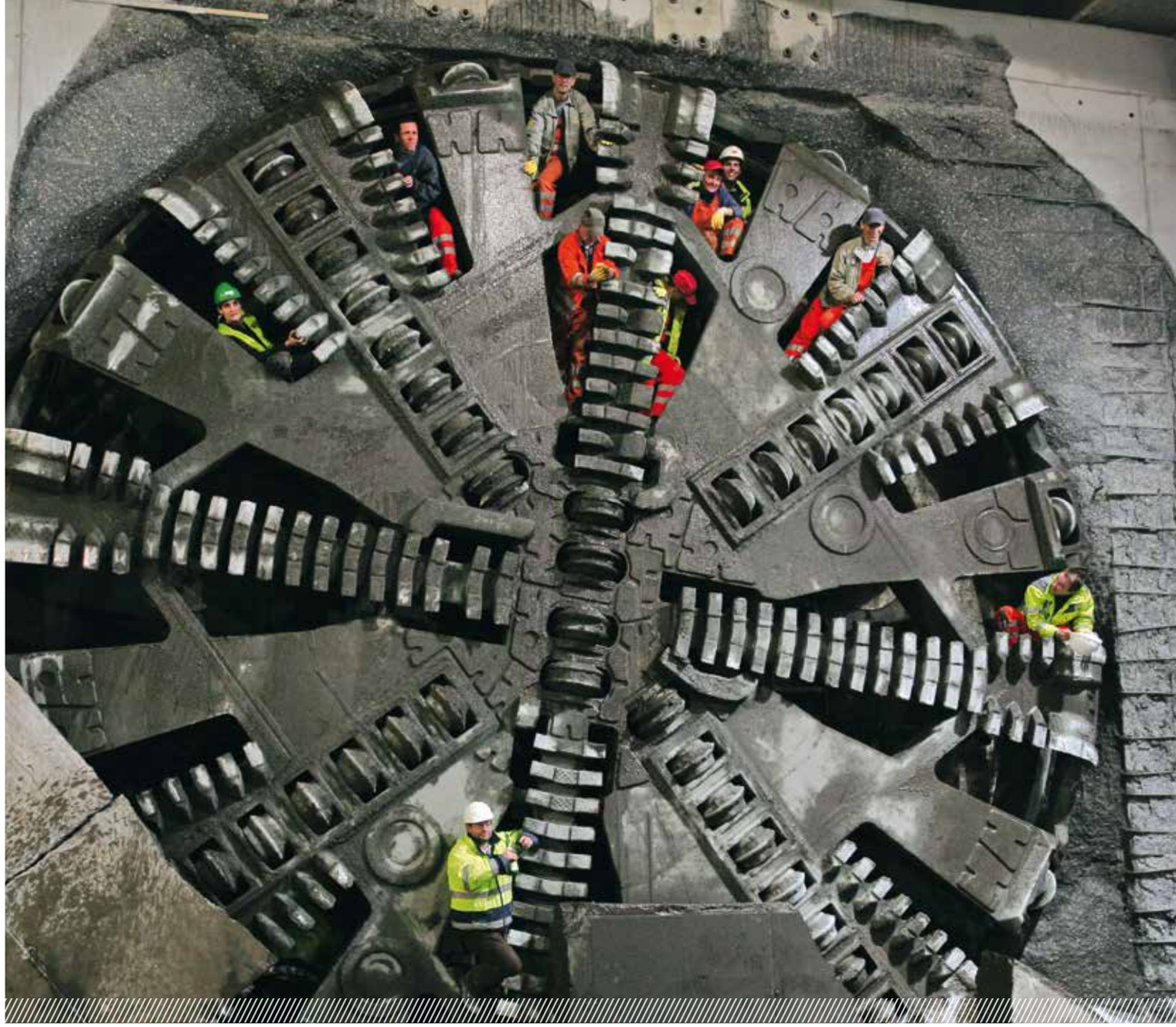
Herrenknecht

A world leader in groundbreaking tunnelling technology.

Herrenknecht is a technology and market leader in the area of mechanized tunnelling systems. As the only company worldwide, Herrenknecht delivers cutting-edge tunnel boring machines for all ground conditions and in all diameters – ranging from 0.10 to 19 meters. Under the umbrella of the Herrenknecht Group, a team of innovative specialists has formed to provide integrated solutions around mechanized tunnel construction with project-specific additional equipment and services.
Pioneering technology by Herrenknecht is always involved when paving the way for the future underground – whether for tunnelling, mining or exploration. Herrenknecht ensures safe and fast progress when constructing modern infrastructures in all areas of application. Exactly where they are needed.

Headquarters in Germany, active worldwide. With more than 3,100 project references, we are a market leader all around the globe.



Pioneering Underground Technologies

HERRENKNECHT SSP

Making the invisible visible with Sonic Softground Probing

HERRENKNECHT
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HERRENKNECHT
Tunnelling Systems

Herrenknecht SSP
Discovering safety-relevant obstacles.

Two factors are extremely important in mechanized tunnelling: underground safety, to ensure there is no danger to personnel or machinery and rapid construction progress, to ensure that the project time and costs are not exceeded. To support both of these, it is essential for the underlying geological conditions to be known as exactly as possible. Despite intensive preliminary geological investigations, the ground along in the tunnel route repeatedly throws up safety-relevant surprises. These are primarily boulders or artificial obstacles, such as old sheet piling.

A clearer view in unconsolidated ground.

Using Sonic Softground Probing (SSP), Herrenknecht is able to make geological hazards in unconsolidated ground visible. A major advantage of this procedure is that it is largely integrated in the boring process, enabling continuous preliminary exploration parallel to tunnelling. The measured data is processed and evaluated in near real time. SSP detects awaiting geological and geotechnical peculiarities at an early stage, enabling the machine crew to initiate a prompt response. This largely avoids unforeseen interruptions, increases safety for personnel and machinery and also ensures swift tunnelling operations.
A three-year research project – AUTOSEIS, funded by the German Ministry of Education and Research (BMBF) – was instrumental in the further development and improvement of SSP.

SPONSORED BY THE:
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PRODUCT HIGHLIGHTS

Continuous preliminary exploration without delaying tunnelling.

Reliable detection up to a distance of 40 m.

High degree of safety for personnel and machinery.

Simple system design.

Robust hardware.

High level of machine integration.

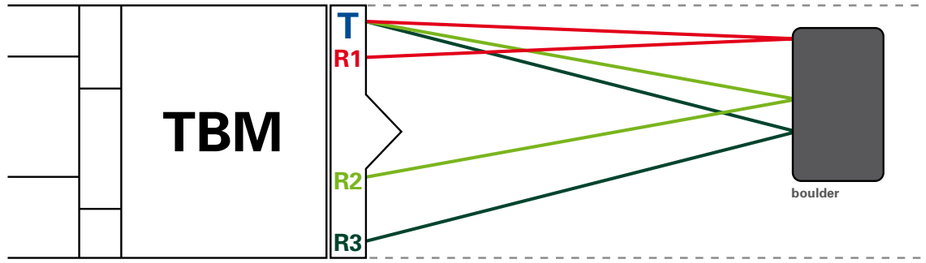
TECHNICAL DATA

- **Rock type:** unconsolidated ground
- **Machines:** Mixshield
- **Measurement principle:** reflection seismics
- **Measured variables:** amplitudes and travel time of sound waves
- **Measurement:** 3-D ground model of relative reflection energies
- **Range:** in direction of drive around 40 m
- **Resolution:** > 0.5m

Sonic Softground Probing (SSP) – the functional principle.

With SSP, the required transmitter (T) and receivers (R1, R2, R3) are directly integrated in the cutting wheel of the tunnel boring machine. As the TBM advances, a signal is sent from the SSP transmitter in the cutting wheel into the soil. The signal energy is propagated at the relevant wave speed of the unconsolidated ground and is reflected from any occurring geological or artificial interfaces. The reflected signals are received by a number of receivers and evaluated. On the basis of the detected density contrasts, it is possible to obtain three-dimensional visualization of the soil up to 40 meters in advance of the TBM, making obstacles visible.
SSP has been specifically designed for continuous monitoring of unconsolidated ground ahead of the tunnel face, parallel to tunnelling.

Functional principle of SSP:



REFERENCES

4. Elbe Tunnel, Hamburg, Germany:
Mixshield, S-108
- Shield diameter: 14,200 mm
- Tunnel length: 2,560 m

Lefortovo, Moscow, Russia:
Mixshield, S-164
- Shield diameter: 14,200mm
- Tunnel length: 2,222m

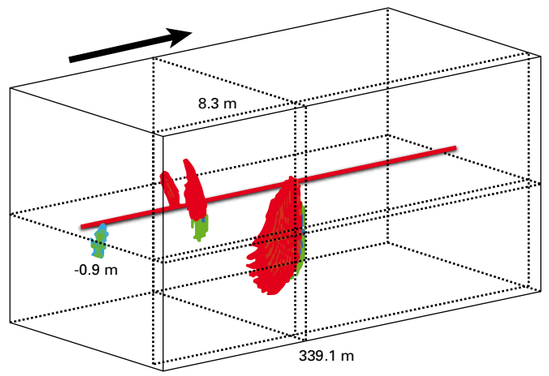
Randstad Rail,
Rotterdam, Netherlands:
Mixshield, S-293
- Shield diameter: 6,780 mm
- Tunnel length: 4,677 m

City Tunnel Leipzig, Germany:
Mixshield, S-326
- Shield diameter: 9,000 mm
- Tunnel length: 2,489 m

Karlsruhe Kombilösung, Germany:
Mixshield, S-869
- Shield diameter: 9,290 mm
- Tunnel length: 2,046 m

Zhuhai Hengqin Tunnel, China:
Mixshield, S-950
- Shield diameter: 15,000 mm
- Tunnel length: 2x 1,080 m

SSP result: 3-D visualization of the reflectors in the soil



The measured data is processed and evaluated in near real time. The SSP result shown in a 2-D and a 3-D diagram visualizes obstacles in unconsolidated ground up to 40 meters in advance of the TBM.