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Systèmes de voie à coûts réduits Rheda 2000 et Getrac A3.

Low-cost track systems RHEDA 2000® and GETRAC® A3

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Growing passenger and goods traffic in European railways has led to more stringent requirements being placed on railway tracks. Ballastless track systems offer low maintenance, smooth running, high availability and – as a top priority – greater safety.

Although a number of ballastless track systems have been developed in recent years in Germany, only a few systems are still under consideration for new construction of ballastless track facilities. The preferred ballastless track systems in Germany are RHEDA 2000®, a monolithic concrete system and GETRAC®, a directly supported asphalt system. Incorporation of the systems RHEDA 2000® and GETRAC® A3 into the diverse typology of the ballastless railways technology is shown in Figure 1. Both systems have also been developed to offer reduced system height for low-cost tracks.

The RHEDA 2000® system is based on the well-known and successfully implemented RHEDA system in operation with German Railways since 1972. RHEDA 2000® combines the advantages of the original RHEDA system, with new developments for greater quality, safety and system simplification. Design principles include the

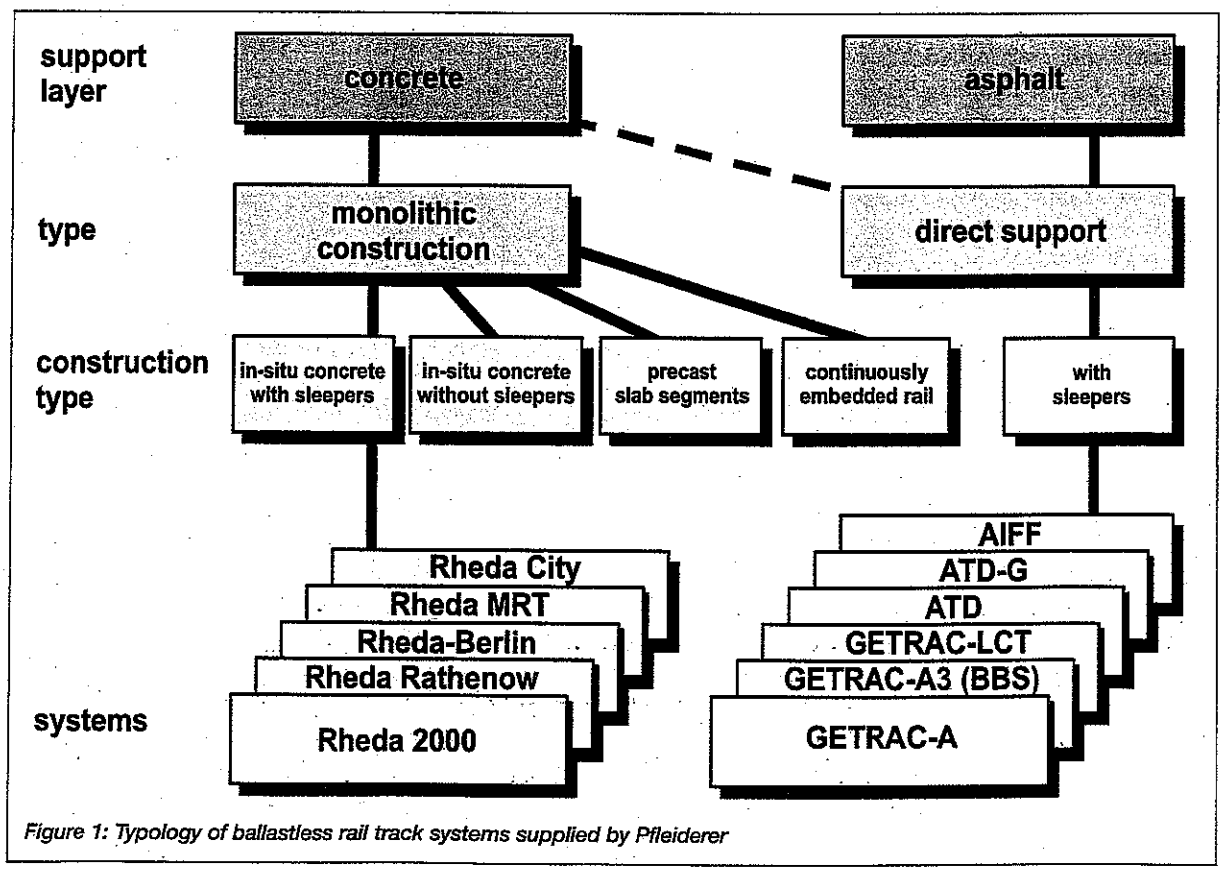

Figure 1: Typology of ballastless rail track systems supplied by Pfleiderer

optimisation of the monolithic track-supporting layer by using bi-block sleepers with lattice truss girders, as well as uniform single-layer concrete with low construction height. This system is available for

- In-situ concrete layer (reinforced) with direct connection to the sleeper (TCL)
- Bi-block sleeper B355.3 W60M with elastic rail fastening

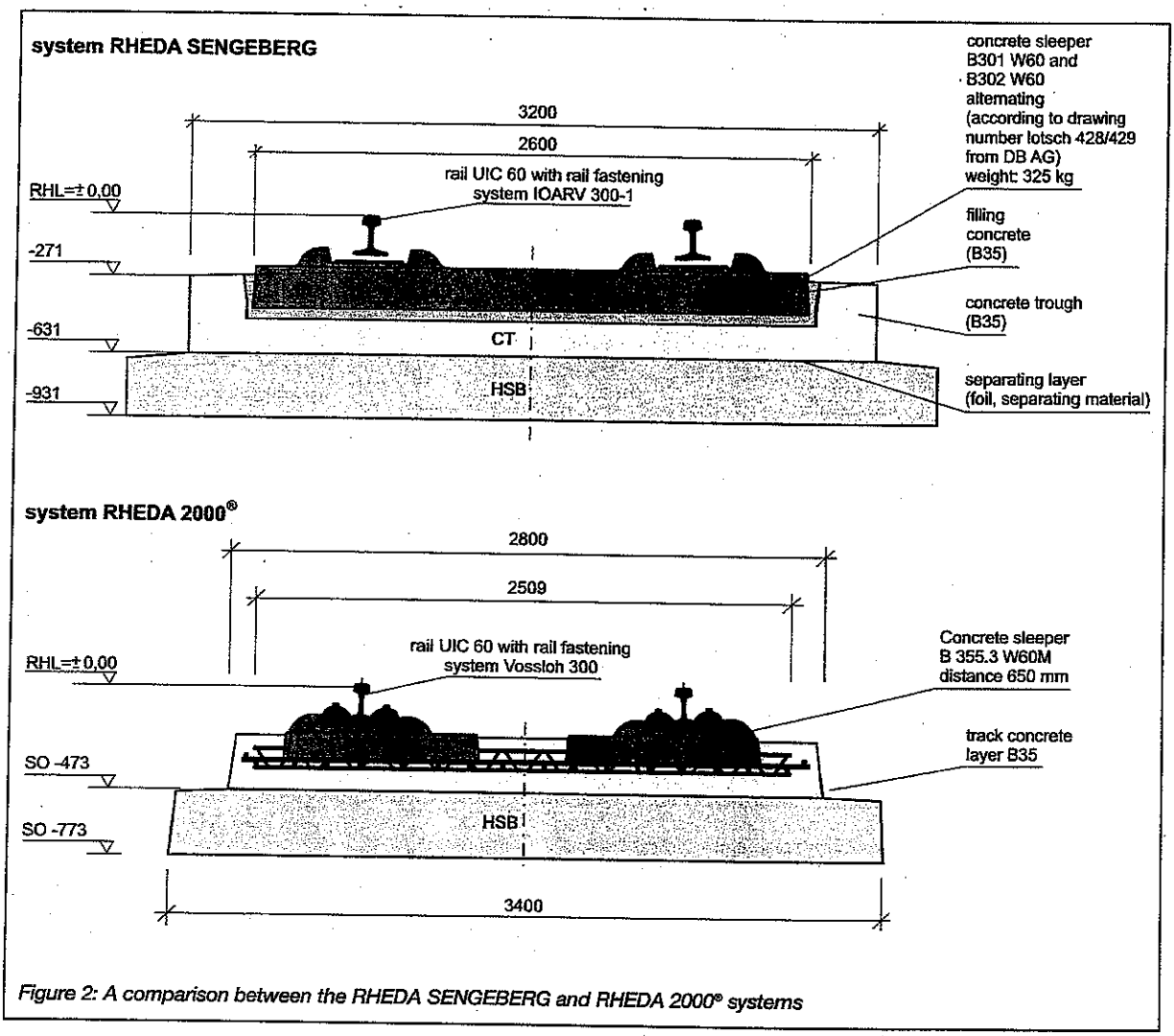

Figure 2: A comparison between the RHEDA SENGEBERG and RHEDA 2000® systems

applications on earthworks, over bridges, in tunnels and for turnout sections.

The cross-sections in Figure 2 show the most essential development steps taken between the popular systems RHEDA SENGEBERG, with mono-block sleepers and the RHEDA 2000®. They are as follows:

- Construction of track layer in one process cycle as a monolithic concrete body with integrated prefabricated rail supports (concrete sleepers); i.e., no need for initial provision of a trough
- The use of concrete bi-block sleepers, whose reinforcement protrudes past the bottom surfaces and the ends of the concrete blocks

The system consists of the following basic elements:

- A hydraulic sub-base (HSB only on embankment)/constructed foundation surface

For the RHEDA 2000® system, the track concrete layer (TCL) is provided in one working step. The essential difference here, in comparison to the original RHEDA systems, is the use of B355.3 W60M bi-block sleepers especially modified for this system. The reinforcement of this sleeper consists of two lattice-shaped beams which protrude beyond the ends and lower surfaces of the blocks. The longitudinal reinforcement is guided through the lattice-shaped reinforcement of the sleepers and fastened to it.

The sleepers are produced in a factory and are transported on a just-in-time basis to the section of rail line being constructed. On-site, they are then adjusted with a specially-developed track surveying and alignment system, and are then installed in place; i.e., cast into a concrete ballastless supporting layer. In this process, the rail tolerance is a maximum of 1 mm in height and

position, and a maximum of 2 mm in gauge width. The top-down process part of the RHEDA construction system optimally observes these strict requirements.

The configuration of the track concrete layer (TCL) on embankments is linear, which is also maintained for superelevated sections. The superelevation is determined in the sub-base (Figure 3). This facilitates general dimensioning principles and reduces costs.

The light weight of this system fulfils the requirements for automation of installation processes – essential for cost-effective application in large construction projects.

For less stringent requirements with significantly lower speeds (i.e., below the designed speed of 300 km/h), reduction in thicknesses of the contiguous layers is possible. Especially in old tunnels with small cross-sections and rock as sub-base, hydraulic sub-bases (HSB) will not be relevant. Thickness reductions are also feasible in dimensioning of in-situconcrete layer with direct connection to the sleeper (TCL). The cross-section in Figure 4 shows a tunnel with reduction in height for the system RHEDA 2000®.

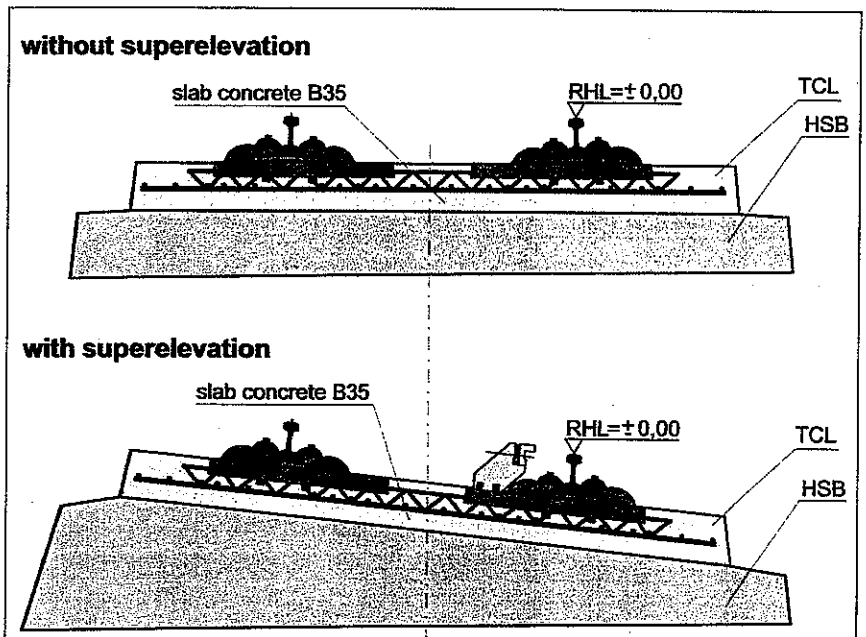

Figure 3: Cross-section of a superelevated and non-superelevated track

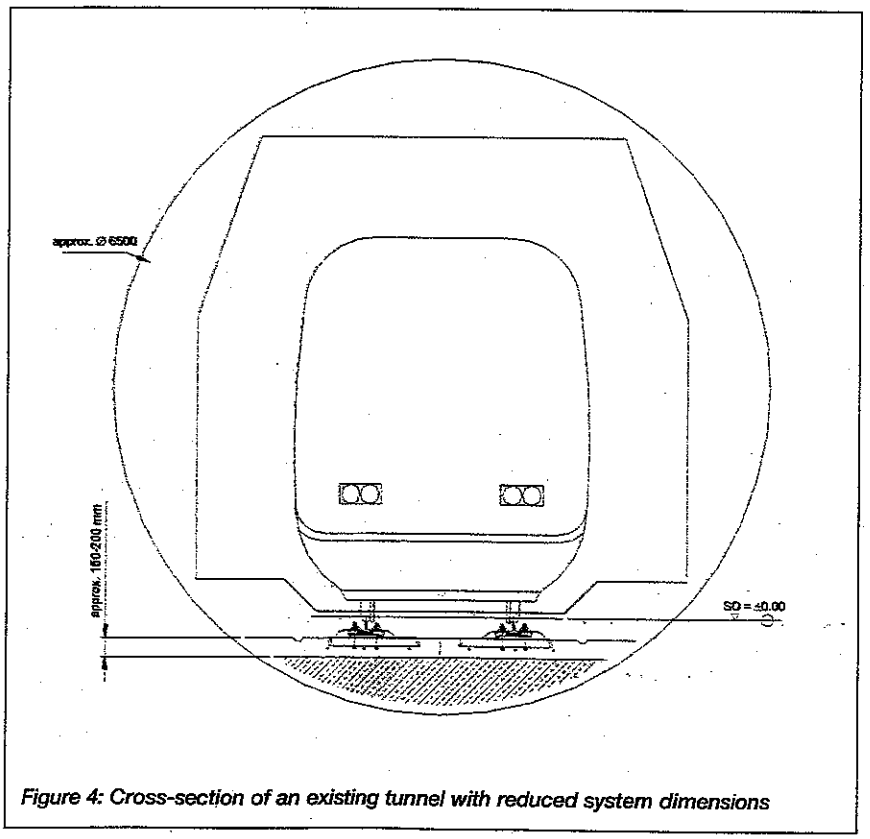

Figure 4: Cross-section of an existing tunnel with reduced system dimensions

GETRAC® A3

The ballastless track system GETRAC® A3 is a system with direct support of the concrete sleeper track on a multi-layer asphalt support (ATS). The safe and durable position of the GETRAC® track on the asphalt support layer is ensured by effective composition of the individual asphalt layers and by sufficient anchorage of the track to the asphalt surface layer. At the same time, however, the concrete sleepers will remain partially flexible on the asphalt layer by virtue of special anchor blocks. This system transfers the horizontal forces from the track to the support layer. The vertical lifting forces affecting the track are compensated for by the great track weight. One major advantage of GETRAC® A3 is its minimum construction height due to appreciable reduction in vertical pressure at the top of the asphalt layer. This leads to low maintenance costs over the service life cycle, with low installation costs. Especially in tunnels and for turnout sections, GETRAC® A3 is

one of the highest-performance ballastless tracks available.

With direct support of the track on a bituminous layer, the GETRAC® A3 system demonstrates the following primary characteristics:

- Use of asphalt as an easily-installed and long-lasting support-layer material
- Almost immediate availability of the track after installation
- Rail support over concrete sleepers, and therefore on geometrically accurate points of support
- Long-lasting track geometry through elastic connection of the track framework with the asphalt supporting layer by means of rubber collars
- Shorter and relatively problem-free installation due to:
  - Fewer steps of work
  - High degree of mechanisation and small number of work steps in laying the track panels
  - Use of conventional road and track-laying construction devices, with conventional laying and alignment techniques
  - Almost immediate availability of the asphalt supporting layer after installation

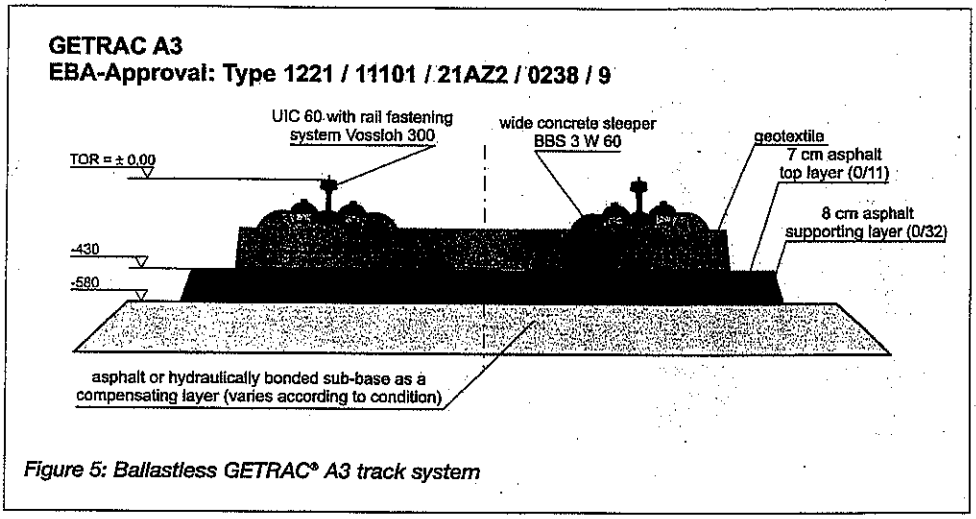

Figure 5: Ballastless GETRAC® A3 track system

  - Weather-independent installation techniques
- Continuous improvement of track positioning over time due to its slightly plastic behaviour (levelling of the load peaks)
- System structure from the bottom upward that satisfies the required tolerances in the exactness

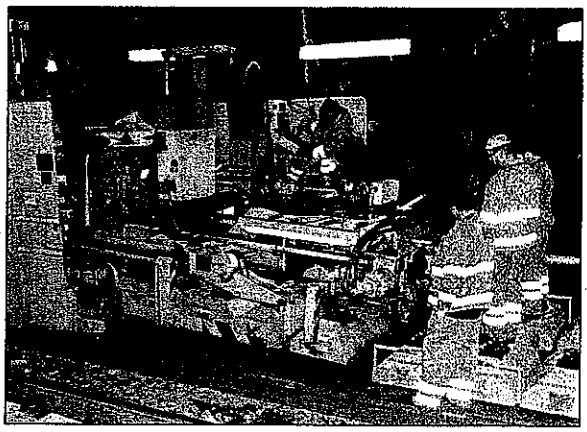

Figure 7: Sleeper installation at the Heiligenberg Tunnel project, Germany

of each step of work, with regards to the structure of the asphalt support layer and the concrete sleeper element

- High stability with high shifting resistance, both cross and lengthwise
- Long life cycle with little maintenance
- Good track drainage using asphalt as support layer
- Quickly restored availability of the track in case of damage

The system consists of the following basic elements:

- A hydraulic sub-base (HSB) on embankment
- Asphalt supporting layer
- Wide concrete sleeper BBS 3 W 60

The bottom structure of the ballastless track GETRAC® A3 is composed of two asphalt layers. Both layers are installed with conventional road finishers with application of force that assures the necessary compression over the entire track width.

In a finished and installed asphalt surface layer of about 7 cm thickness, square or differently shaped blockouts result at exactly specified intervals. Blockout production usually takes place at the same time as finishing of the asphalt surface layer. The holes not to be filled are prepared with a stamping form.

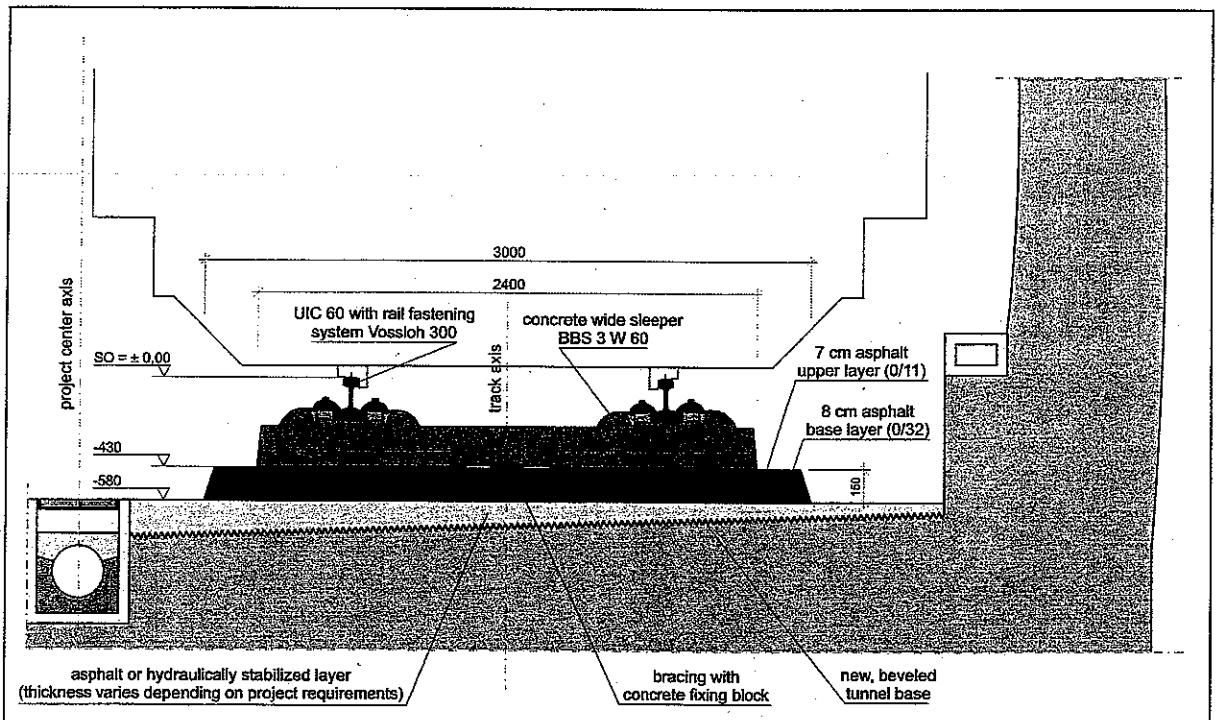

Figure 6: Ballastless track system GETRAC® A3 in tunnels

Pouring of the anchor stones can be manual or mechanical. The mortar is fast-setting, with high strength ratings, low-shrink and moisture-insensitive – which makes this process step possible in any weather. After a relatively short setting time, the sleepers are permanently fixed, and the track is ready for use.

The light weight of this system fulfils requirements for automation of installation processes – an essential factor for cost-effective applications in major construction projects.

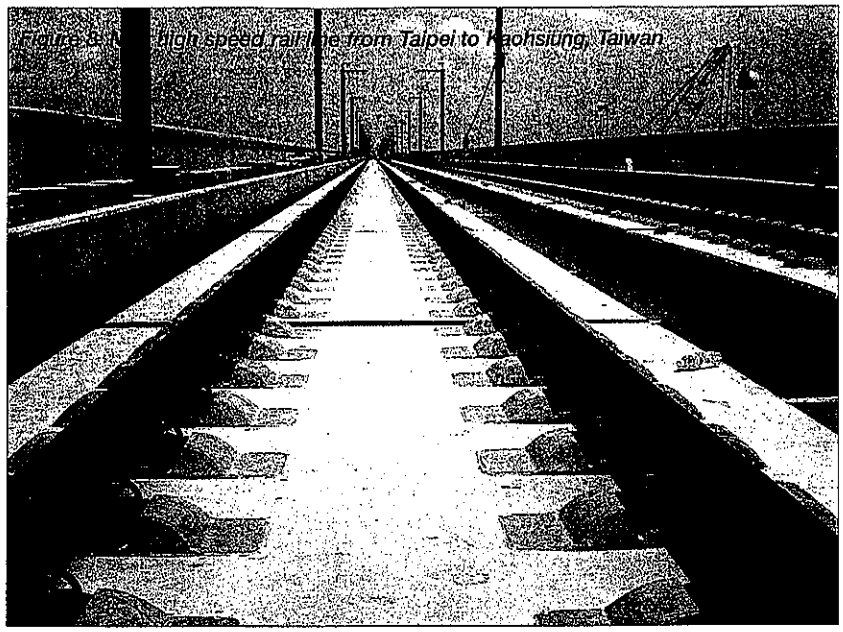

Figure 8: A high speed rail line from Taipei to Kaohsiung, Taiwan

Especially in old tunnels with reduced sub-base stiffness, the GETRAC® system offers a major advantage due to the large supporting areas of the sleepers and the reduction of vertical stresses in subsoil. The cross-section in Figure 6 shows a tunnel with low system height for the GETRAC® A3.

Conclusion

Both RHEDA 2000® and GETRAC® A3 systems have obtained comprehensive approval by the German Federal Bureau of Railways (EBA).

RHEDA 2000® and GETRAC® A3 are cost-effective and durable systems that are in construction and operation throughout the world (Figures 7 and 8). Systems with RHEDA 2000® technology are currently under construction on high speed rail lines in Germany, The Netherlands and Taiwan.■