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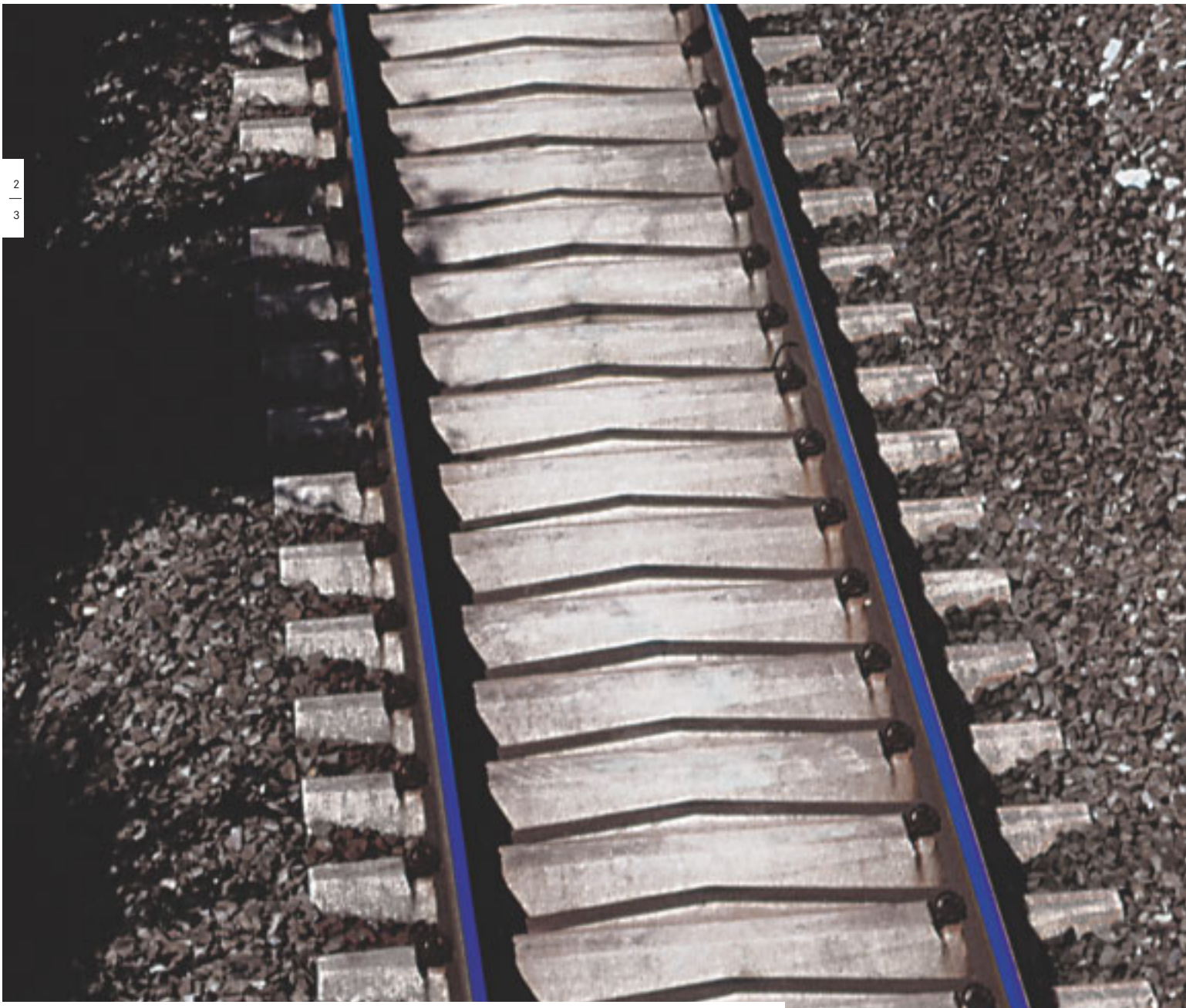
Pfleiderer track systems

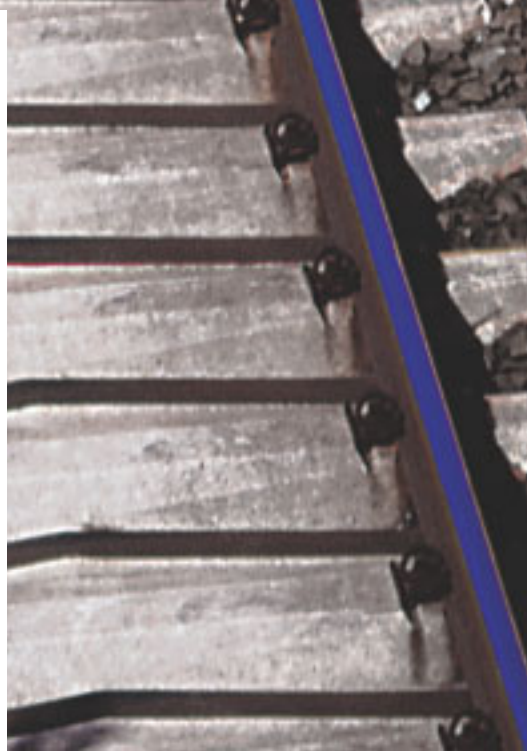
the way to go

Wide sleeper track



Wide sleeper track makes a very attractive visual impression and is most suitable for railway station track and urban applications.

The excellent, permanent position of the track is the result of a large sleeper bedding area and the heavy weight of the track panel.



Wider, faster: more powerful

The wide sleeper superstructure combines the advantages of ballastless track and of conventional ballasted superstructure. This makes this form of superstructure an economical alternative for the most varied applications.

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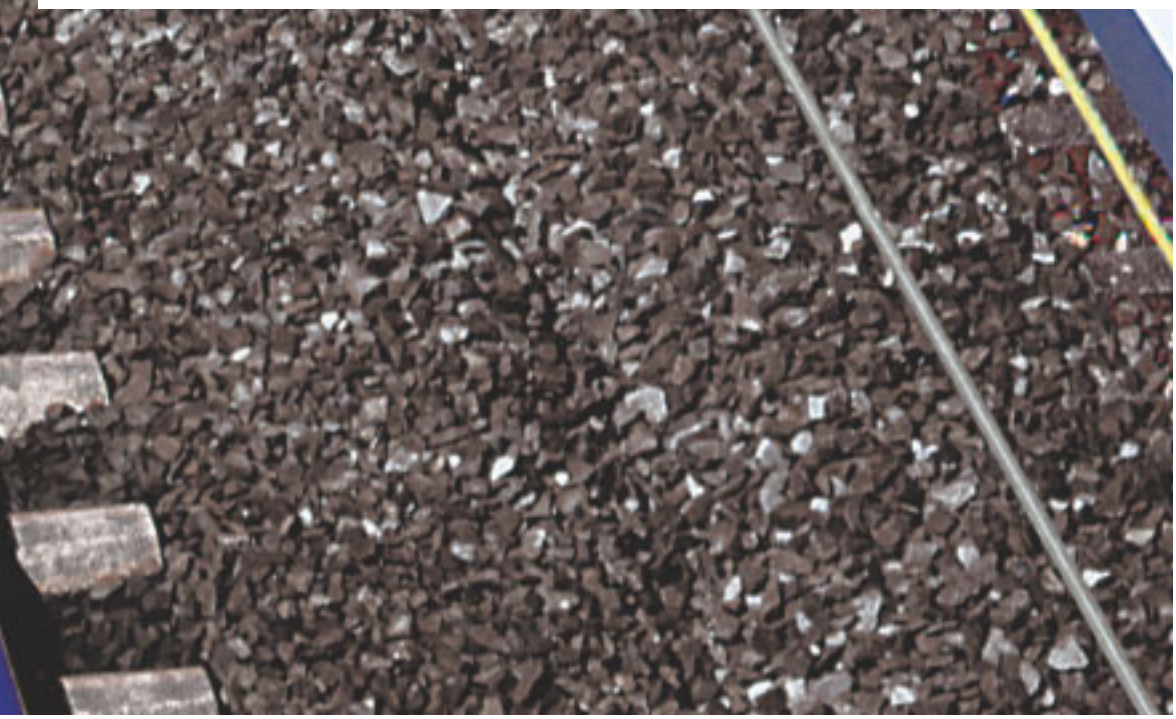
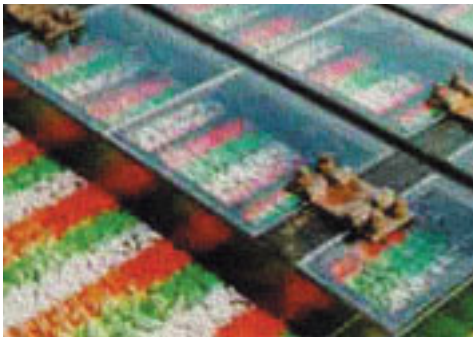
New tracks are being laid in Europe: frontiers are falling, countries are growing closer together. More than ever before, today economical and environmentally friendly systems are required in order to ensure mobility for tomorrow. A future that is inconceivable without rail traffic. In competition with other forms of transport the crucial factors will be higher rolling and axle loads, improved railway line availability and life cycle costs. Pfleiderer track systems offers efficient and customer-oriented solutions in all areas of railway infrastructure – for greater economy and safety, greater convenience and environmental compatibility.

As an alternative to the classic cross sleeper track we have developed wide concrete sleepers in close collaboration with Heinrich Cronau GmbH, which also holds the principle patents. Following eight years' experience and a traffic density of over 150 million load tonnes, in December 2002 the German Federal Railway Authority (Eisenbahn-Bundesamt) issued official approval. In addition to the excellent experimental values, the relief to the ballast and the substructure was given particularly positive mention. Furthermore, the wide sleeper is eminently suitable for carrying higher axle loads (25t axle) and greater temperature stress (eddy current brake). German Railways (Deutsche Bahn AG) is currently investigating the areas of application for the wide sleeper superstructure. The main focus is on sections with high track loads and speeds. Wide sleeper technology is also considered to have good chances at an international level: problematic soil conditions and the reduced amount of high quality ballast required give it an interesting market potential.





The front tamping was tested for efficiency by means of special plexiglass sleepers through which it was possible to trace the movements of the colour coded ballast.

From the idea to implementation

Intensive development and the use of modern superstructure machine technology facilitated a compatible solution for modern railways in the form of wide sleeper technology.

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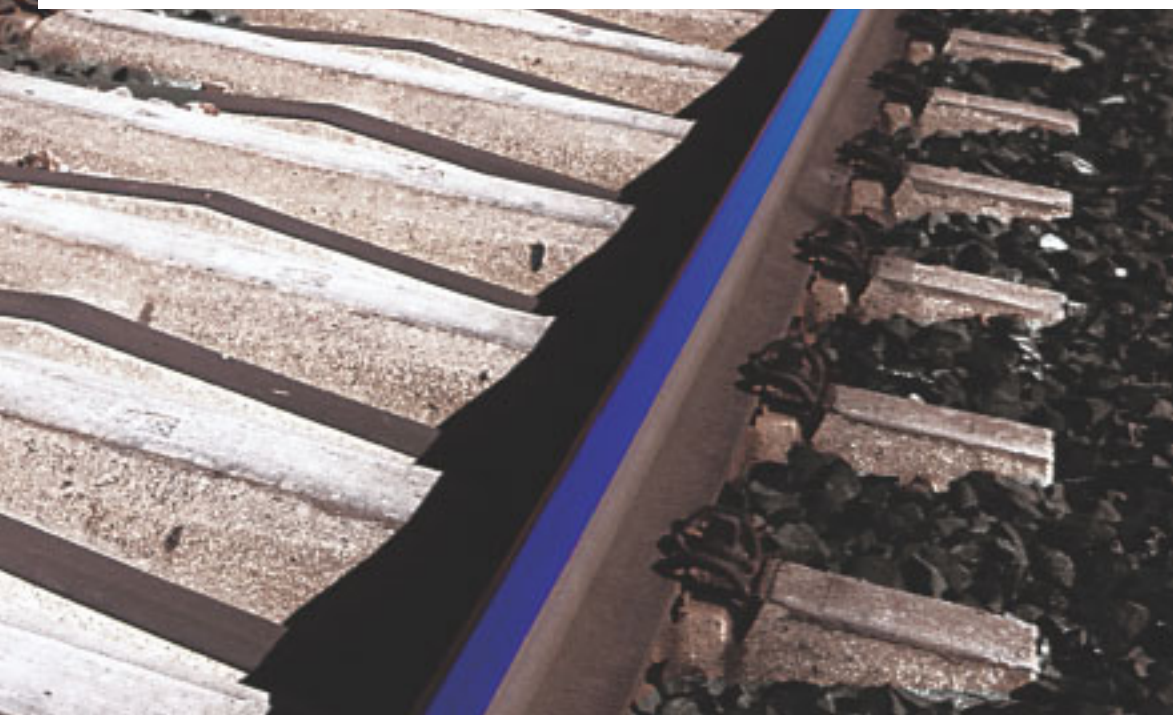
Basically, the wide sleeper superstructure is not an innovative technology. The fundamental advantages of a larger sleeper bedding area and homogenous loading of the ballast was already recognised a long time ago. In China and former Czechoslovakia test sections were built with so-called “slab sleepers”; and the former Reichsbahn (German Imperial Railway in the former German Democratic Republic) specialists were also working on this type of superstructure. However, these initial attempts failed because of track maintenance, e.g. due to tamping exclusively on the head end of the sleepers.

The new form of superstructure with wide sleeper technology causes a considerable reduction in pressure on the ballast and stress on the substructure. The vibration values for the rolling material, the railway and the surrounding area are reduced, maintenance intervals and life cycle are prolonged. Furthermore, the closed surface makes it easier to care for the vegetation surrounding the track.

The individual development steps:

- Design and dimensioning of the wide sleeper
- Adaptation of the machine technology for laying track and head end tamping
- Optimisation of production technology for innovative pre-stressed concrete sleepers
- Tests at the Technical University Munich substantiate the load bearing capacity of the sleepers
- Approval of the Federal German Railway Authority (Eisenbahn-Bundesamt)
- Design of the test phase and assessment of the test results



System structure and components

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Functional and safe technology

By comparison with the B70 sleeper, for the pre-stressed mono-block sleepers with additional slack reinforcement, only the weight, width and length were altered. With regard to the geometric data of the track, i.e. height, gauge and supporting points, the wide sleeper corresponds to the technical specifications of this standard sleeper. There are also no special requirements for the fastening materials: the track is mounted on the wide sleeper with the W14 track fastening elements from Vossloh with elastic intermediate layers.

The sleepers are laid without ballasted space between them, but with uncovered middle zones. These are located underneath the sleepers and do not contribute to the load transfer. In order to prevent the transmission of negative moments, an approximately 2 cm thick hard foam slab is embedded in the concrete. Water drainage channels are formed along the lateral edges of the sleeper to drain the surface water off towards the ends of the sleepers.

When the sleepers are laid on average 60 cm apart, a 3 cm wide gap is created between the sleepers. This can be sealed with an elastic cover. Water and dirt are thus prevented from penetrating the rail track. Ballast cleaning is restricted to the edge of the sleeper and the reduced penetration of moisture in the supporting substructure indicates the probability of high position stability. Even at low temperatures it is not possible for the rail to freeze over and frost damage is very unlikely.

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Comparison of sleeper properties

Criterion	B 70 W	BBS 1	Differences
Sleeper length in m	2.60	2.40	- 0.20 m
Sleeper width in m	0.30	0.57	+ 0.27 m
Supporting surface in cm^2	5,700	10,260	+ 80 %
Sleeper head area in cm^2	570	830	+ 45 %
Dead weight in kg	320	560	+ 75 %

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The properties of the wide sleeper superstructure in the overview and your advantages as operators

Reduced pressure and homogeneous distribution of layer pressure to the ballast	Good track position and permanent position stability
Increased resistance to transverse shifting	Increased safety; application of eddy-current brakes possible
High supporting area	Reduction in loads applied to ballast
Less strain on subsoil and substructure	Lower investments
Smaller track width with 240 cm long sleepers	Reduced load on dams and bridges, less ballast, widening of trackbed shoulder
Less ballast required	Lower investment costs
Less loading of the ballast	Maintenance of value of investments
Closed surface	Less cleaning required and vegetation control simplified
Water drained off substructure	Increased frost resistance

Wide sleeper track

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Flexible application with attractive technology

The wide sleeper is used in long-distance and regional traffic for speeds up to and beyond 200 km/h. The system is suitable for all gauges as well as tilting train technology, passenger and goods trains with high axle loads.

BBS-SchO

Standard concrete BBS 1 wide sleepers in ballasted superstructure

On most high performance lines with speeds up to and greater than 200 km/h and high axle loads, a crucial factor is low maintenance requirements as well as a high degree of railway line availability.
The BBS 1 concrete wide sleepers on ballast meet both the high requirements of the tilting train technology and those of eddy current brakes.

BBS-FF

BBS 3 wide concrete sleepers on asphalt

Ballastless types of superstructure are an optimal solution for high speed traffic. A very effective variant is the directly supported wide concrete sleeper. The heavy unloaded weight ensures increased transverse and longitudinal resistance to displacement as well as improved position stability to resist lifting forces. The thickness of the asphalt layer can be reduced to a minimum dimension of 15 cm.

BBS-BÜ

Wide concrete sleepers for railway crossings

Owing to the strong compression from rail and road traffic, railway crossings are a weak point in the railway system. Consequently they require a disproportionately large amount of maintenance work. With the BBS-BÜ it is possible to construct a compact system. All loads affecting the track surface are dispersed homogenously into the ballast bedding without altering the position. The even, large-surfaced sleeper surface also simplifies the geometry of the road covering layers. The manufacturing costs are reduced correspondingly.

BBS-SO

Wide concrete sleepers with elastic sleeper sole pads

Sleepers with elastic sole pads additionally protect the track ballast and prolongs the useful life accordingly. They also bring about a considerable reduction in noise immission and transfer of secondary airborne noise.

Advantages for installation and operation

Distinguishing features of the wide sleeper superstructure are a mechanised installation technique and low maintenance costs.

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Installation and maintenance

- The wide sleeper is laid by means of conventional track construction technology.
- Tamping is performed with slightly modified machine technology.
- The use of wide sleepers considerably prolongs the maintenance and tamping intervals.
- The closed sleeper simplifies surface cleaning in the area of the railway station.
- The reduced maintenance costs have a positive effect on the life cycle.

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Reliability

- A larger sleeper bedding area reduces the major fluctuations in support conditions experienced with conventional ballast track.
- The quality and stability of the position of a track just installed is retained for a long time.
- The transverse resistance to displacement values are up to 70% higher.
- Line availability is considerably improved.

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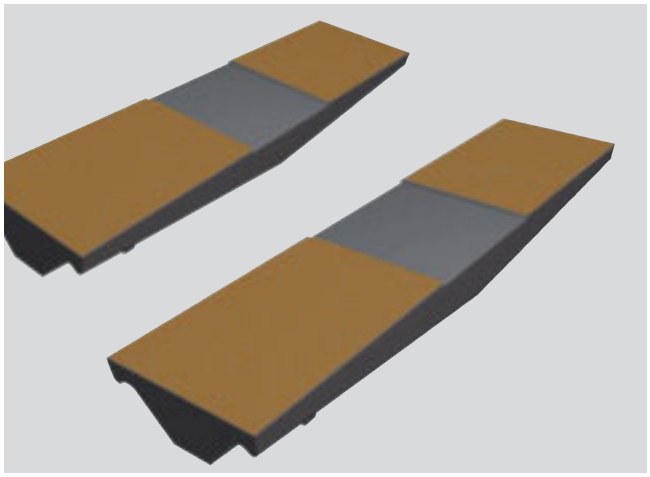
Reduced wear on the ballast bed

- High mass and continuous support in the ballast bed increase the stability of the track position.
- Further improvements result from the use of an elastic sleeper sole pad.

Automated installation of the wide sleepers

Elastic sleeper sole pads to reduce pressure to the track ballast



Advantages for the environment

The wide sleeper superstructure combines up-to-date ecology with economical track technology.

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Water protection

- Surface water and other fluids can be drained off selectively.
- Oils and lubricating fluids that must be disposed of at locomotive sidings are directed into lateral drainage channels and completely away from the subsoil.

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Vegetation control

- Owing to the closed sleeper area, vegetation control on the track is considerably simplified – undesirable plant growth between the sleepers is virtually impossible.
- There is almost no need to use herbicides – and this benefits the environment.

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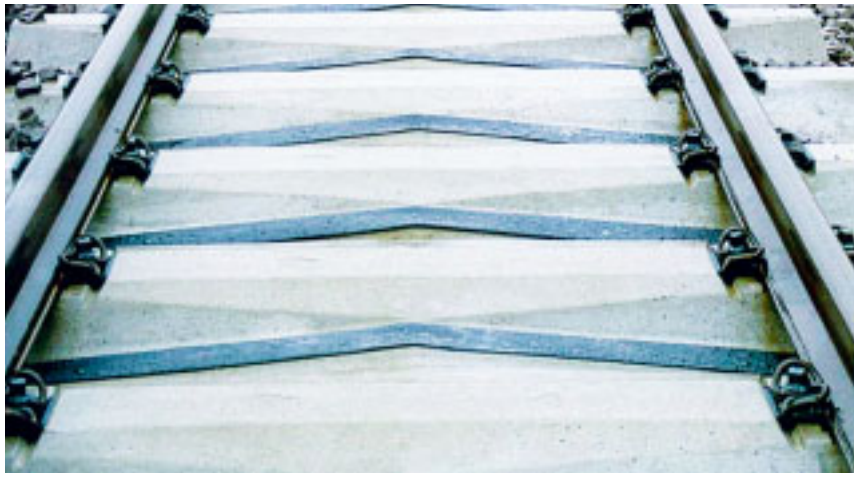
Noise and Vibration

- Tests carried out so far have shown significant reduction in disturbance from secondary airborne noise.
- The slightly higher airborne noise volume of the wide sleeper track is compensated by the lateral ballast build-up, which can be glued if necessary.

Optimum vegetation control due to closed surface



The advantages of the wide sleeper are also apparent at railway crossings. Any stress that affects the surface is deviated evenly into the ballast bed. This, in turn, remains in an unchanged and stable position owing to the wide sleeper superstructure.

Testing and experience

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Long-term investigations prove the perfect track position and the positive settlement results – even under the most adverse conditions.

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So far, the wide sleeper track has been installed over a test track section and in a pilot project over approximately 12 km. Extensive measuring programmes were defined for both projects. For the test section installed in 1996 on the Rhine Valley route with a very heavy traffic load (near Waghäusel station, mixed traffic, V ≤ 160 km/h, axle loads of up to 22.5 tonnes) to date operational loads of approximately 150 million tonnes have passed over these sections. The track position, which has been measured at regular intervals, has altered very little, there is still a maintenance reserve of more than 50% available before the point is reached when intervention is necessary.

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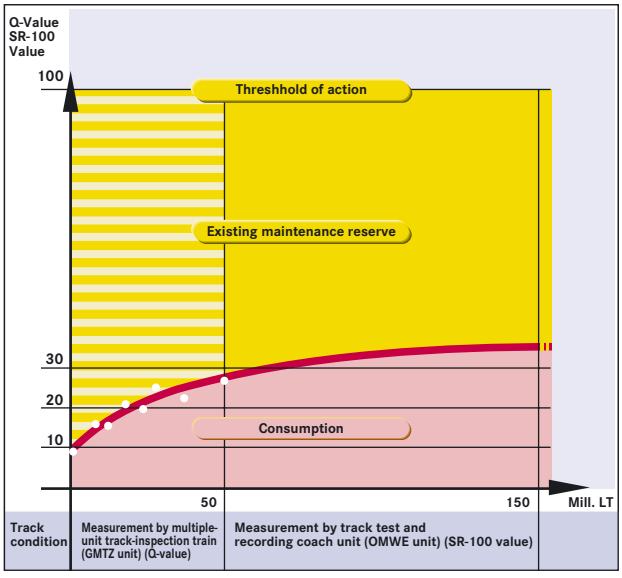
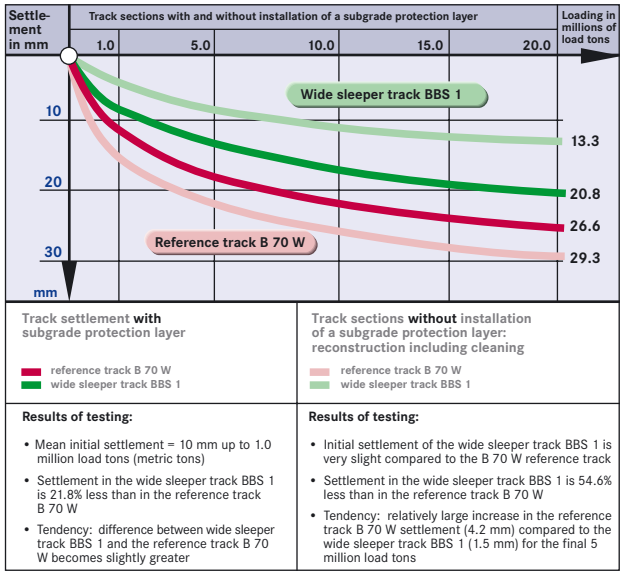
In the pilot project covering the railway section between Homburg (Saar) and Bexbach a further project was implemented within the framework of a double track renewal. In this case a wide sleeper track (pilot track) was installed alongside a standard reference track. In the course of this the subsoil protective layer was also partially renewed. This constellation gave interesting results on the settlement behaviour of the different varieties of superstructure. It showed that wide sleeper track brings substantial advantages even if the substructure is not renewed.

Long-term tests have clearly demonstrated that settelement after loading with 20 million load-tonnes are only half as great in a wide sleeper track as customarily found in reference tracks. Repeated measurements revealed that changes in track position are very slight. Apart from level crossings, there is still a very great reserve left in the track against wear after approx. 150 million load tonnes. Maintenance work has not until now been necessary. We are of course carrying on further work in optimization of the system – from sleeper manufacture to tamping techniques.



Evaluation of track position stability after operational loads of approx. 150 million tonnes (equivalent to an eight-year lying period).



Settlement process following loads of 20 million load tons (LT).
Measurement comparison between wide sleeper track BBS 1 and reference track B 70 W.

September 2004 / A01 / 0280879 / 1 / 09.04 Graf 8-)

RAIL.ONE GmbH
Ingolstaedter Strasse 51
92318 Neumarkt - Germany
Tel +49 9181 8952-250
Fax +49 9181 8952-5050
Mail info@railone.com
www.railone.com