



FRENZEL-BAU®



DURFLEX® - Ballast foaming on the track

Innovative track system for railborne traffic
for reducing maintenance and sound emissions
through the injection of elastic polyurethane foam

DURFLEX®

funded by the German Federal Ministry of Economics and Technology



low in emissions + durable





DURFLEX® - Superstructure and acoustics

Transfer of rail load through train journey and induction of load to the train wheel sets

The aim of the system is to reduce noise

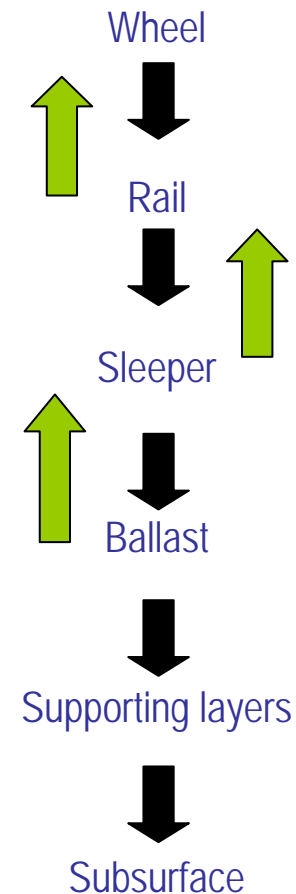
- Generated by a complex variety of causalities and interdependencies within the entire 'superstructure' system; this must always remain in focus
 - Currently, main focus is on wheel/rail contact
 - Total roughness is seen as main parameter of acoustic behaviour

But this is the result of a number of areas of action:

- A: wheel – wheel set – vehicle body
- B: rail – sleeper – superstructure body
- Components also contribute to noise directly, even without an effect on roughness

The issue I wish to discuss:

Role of superstructure form, and experiences with the **DURFLEX®** system





DURFLEX® - The system

- New **DURFLEX®** superstructure form entails foaming of the ballast in the load transfer area
- **DURFLEX®** consumes oscillation energy through pore-buffer structure (elasticity) with damping effect through covering of the ballast rubble
- **DURFLEX®** also prevents the generation of noise through quiet positioning (stability) of superstructure elements
- Reduces rail roughness and additional noises (cracking, striking of sleepers; crunching of ballast etc.)
- Causality not yet recorded in full detail, but the measured results provided verify effectiveness
- In any case, the following must be noted: compared to the other typical superstructure forms...
 - for the ballast superstructure, the behaviour of the loose rubble is set against an elastoplastic composite form unit for the ballast
 - for the fixed track, the behaviour of an impact resistant concrete plate is set against the elastoplastic composite form unit



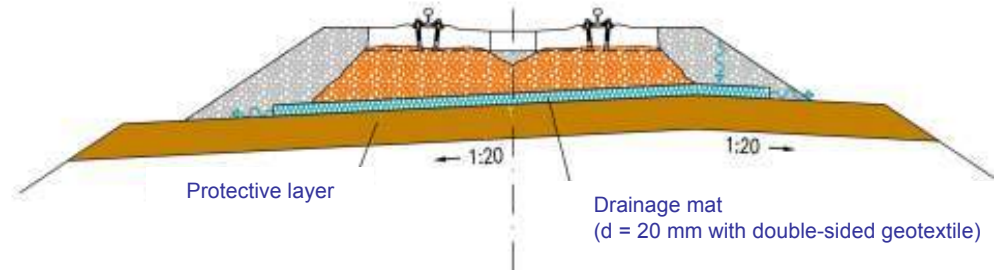


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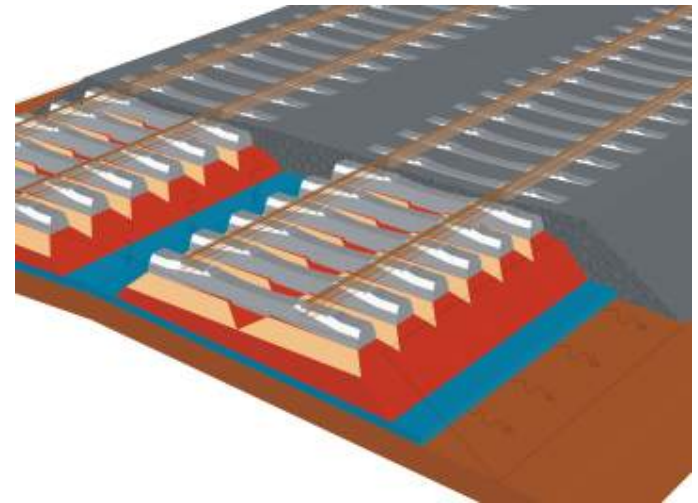


DURFLEX® - The superstructure system

DURFLEX® preserves the ballast structure after dynamic stabilisation passage
Durable prevention of twisting and setting



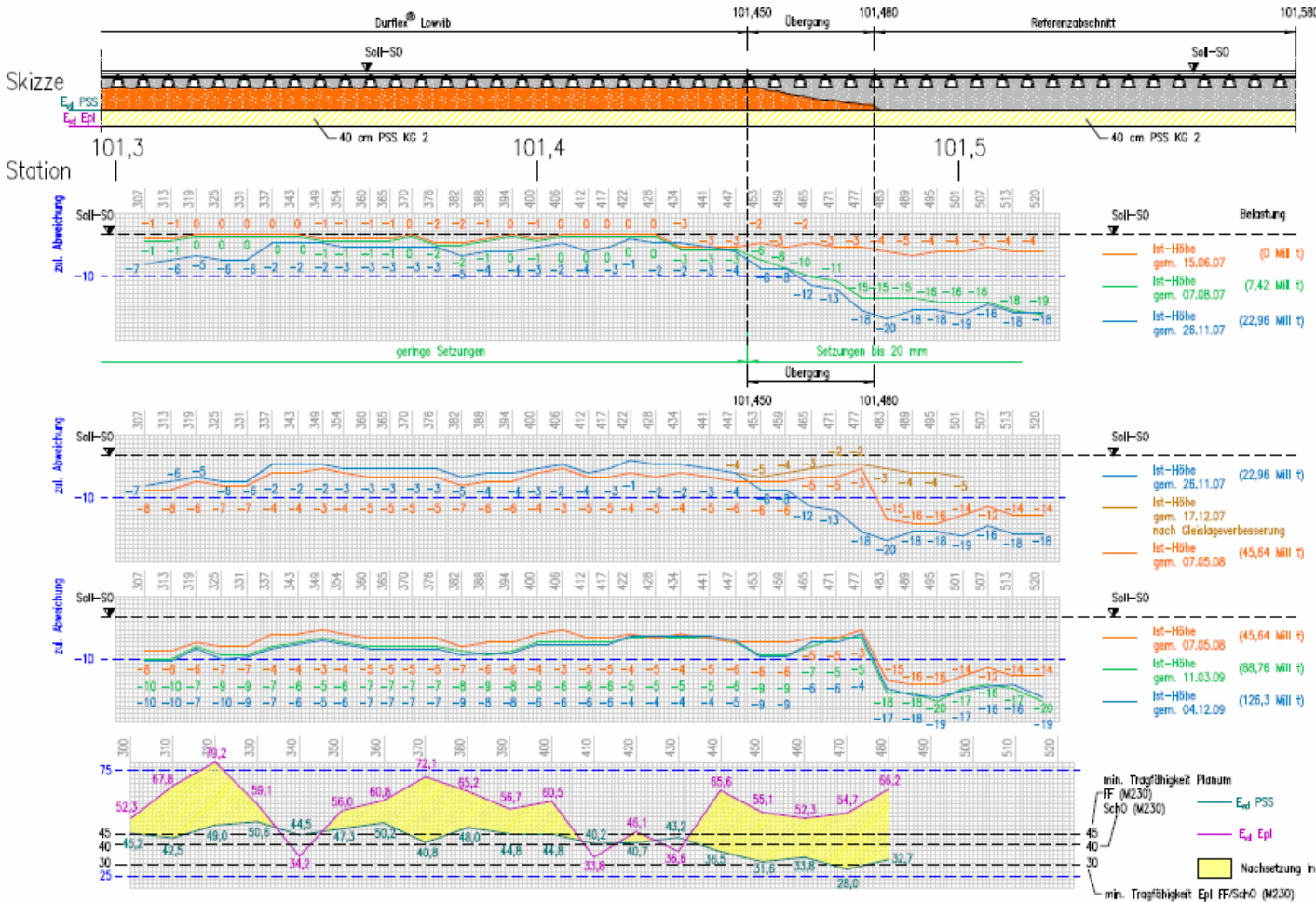
DURFLEX® track system





DURFLEX® - The superstructure system

Entwicklung der Höhenlage Versuchsbaustelle DURFLEX®, Gleis Bad Bevensen - Uelzen M 1:100



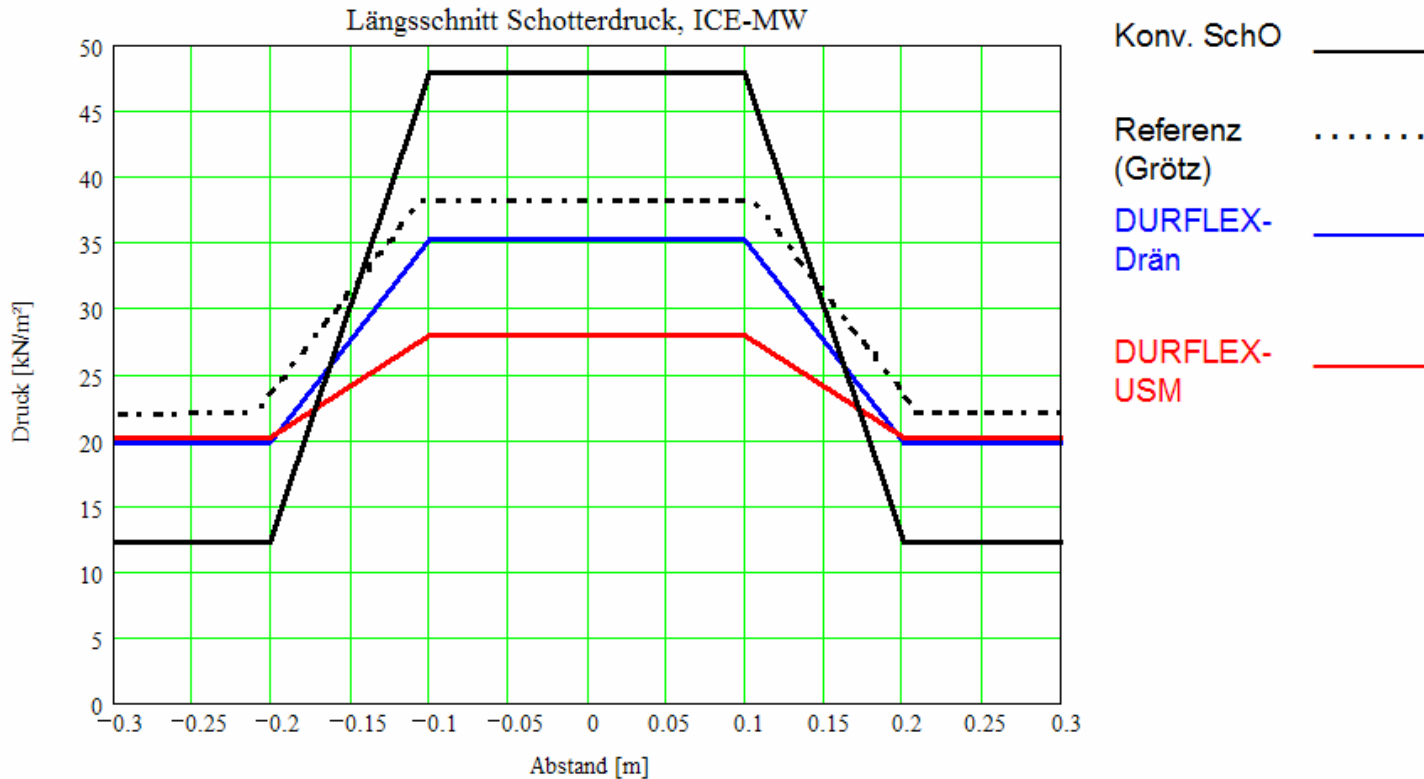
Setting records Uelzen section (Hamburg-Hannover) since 06/2007 Daily 140,000 t, 25 t axle through steel transport and $v \leq 200\text{km/h}$

DURFLEX® secures usability of the ballast bed over long time periods with no extra interventions and service interruptions (for plugging, alignment, cleaning etc.)



DURFLEX® - The superstructure system

DURFLEX® ground pressure





DURFLEX® - The superstructure system

DURFLEX® measurements show significant noise reduction

Table comparing total levels [dB(A)]

	ICE – 200 km/h	IC – 185 km/h	Regional train – 160 km/h	Freight train – 100 km/h
AB measurement	80.6	82.8	79.9	92.5
B measurement	79.9	83.3	80.5	90.6
RB measurement	81.0	83.8	80.5	95.6
Difference RB-AB	0.4	1.0	0.6	3.1
Difference R – B	1.1	0.5	0.0	5.0

Taken from measurement report in Dec. 2009



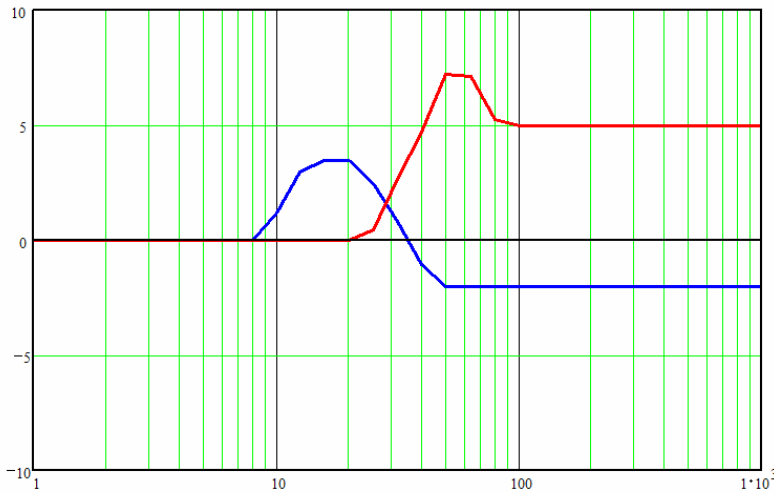
DURFLEX® - The superstructure system

DURFLEX® measurements also show significant oscillation reductions

Vibration Einfügungs-dämmung

Einfügungs-dämmung [dB]

günstige Auswirkung



ungünstige Auswirkung

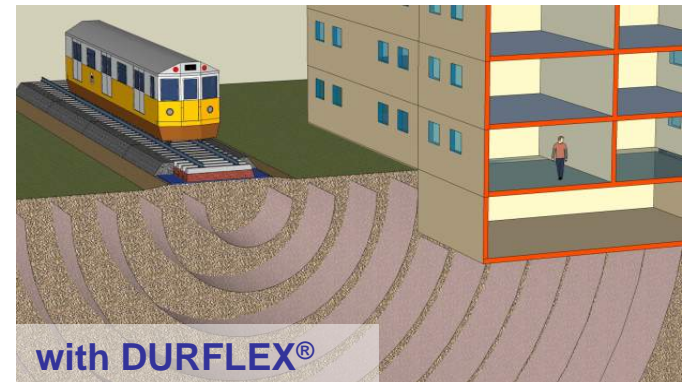
Frequenz [Hz]

DURFLEX USM

DURFLEX Drän

USM: Günstige Wirkung im Frequenzbereich 8 Hz -35 Hz, sehr wichtig für Erschütterungseinwirkungen auf Menschen

Drän: Physikalisch unvermeidbare geringfügige ungünstige Auswirkung im höheren Frequenzbereich (analog HGT, jedoch hier geringere Auswirkung)





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DURFLEX® - Pride of place in the DURSYS® family

Following these positive experiences with **DURFLEX**®, further possible applications are being researched and developed for the superstructure in cooperation with www.hyperion-ip.eu.

Foundations for development

- Use of recycling / reusable products
- Combination with modern materials
- Environmental compatibility
- 100% recycling
- Long-term usability – lifespan
- Lowering of LCC / improved economic scheduling
- Reduction of maintenance costs
- Increase in track usability / efficiency
- New materials can protect, form, absorb sound and adhere

LCC • Noise reduction • Maintenance • Use of resources • Environmental compatibility • Efficiency

Optimisation of sleeper / rail / wheel / acceptance interfaces

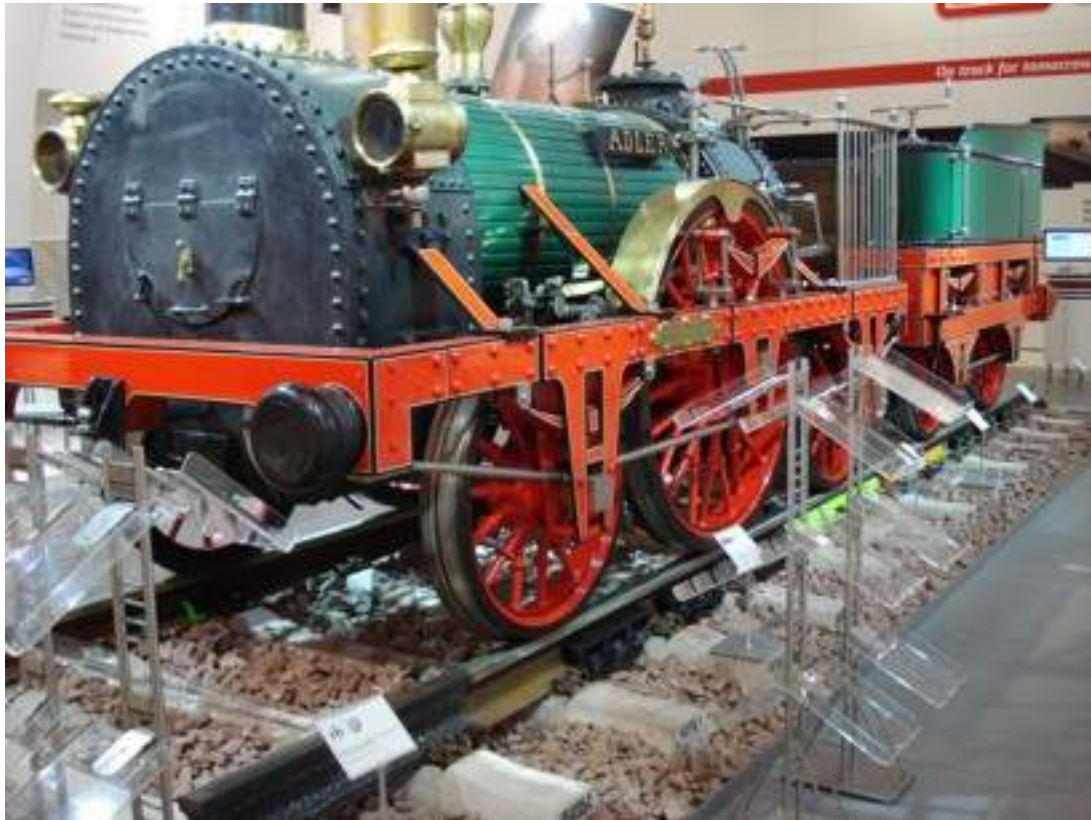


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DURSYS® family in cooperation with Hyperion

DURCOAT® for damping rail webs on InnoTrans as shown at the DB AG stand



DURCOAT® oscillation-damping coating for sleeper and rail





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DURSYS® family in cooperation with Hyperion



DURCOAT®

Oscillation-damping surface coating for wheel, axle and housing

Coating and/or covering for protection from impacts, corrosion, external substances, noise

DURCOAT®

Simple

- to apply
- to recycle
- to form
- to dimension
- accompanying coatings function at all times and in all places





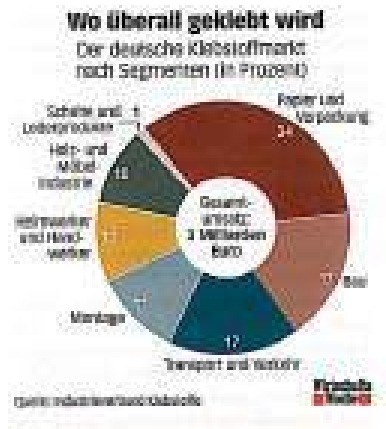
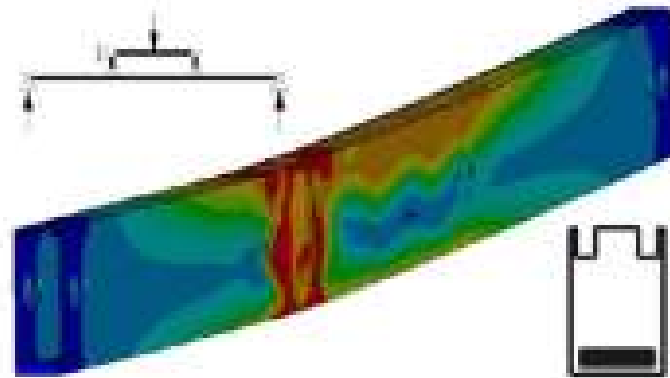
DURSYS® family in cooperation with Hyperion

DURSTICK®

Form-locking connection of rail ends achieved through adhesion in place of welding

Anticipated:

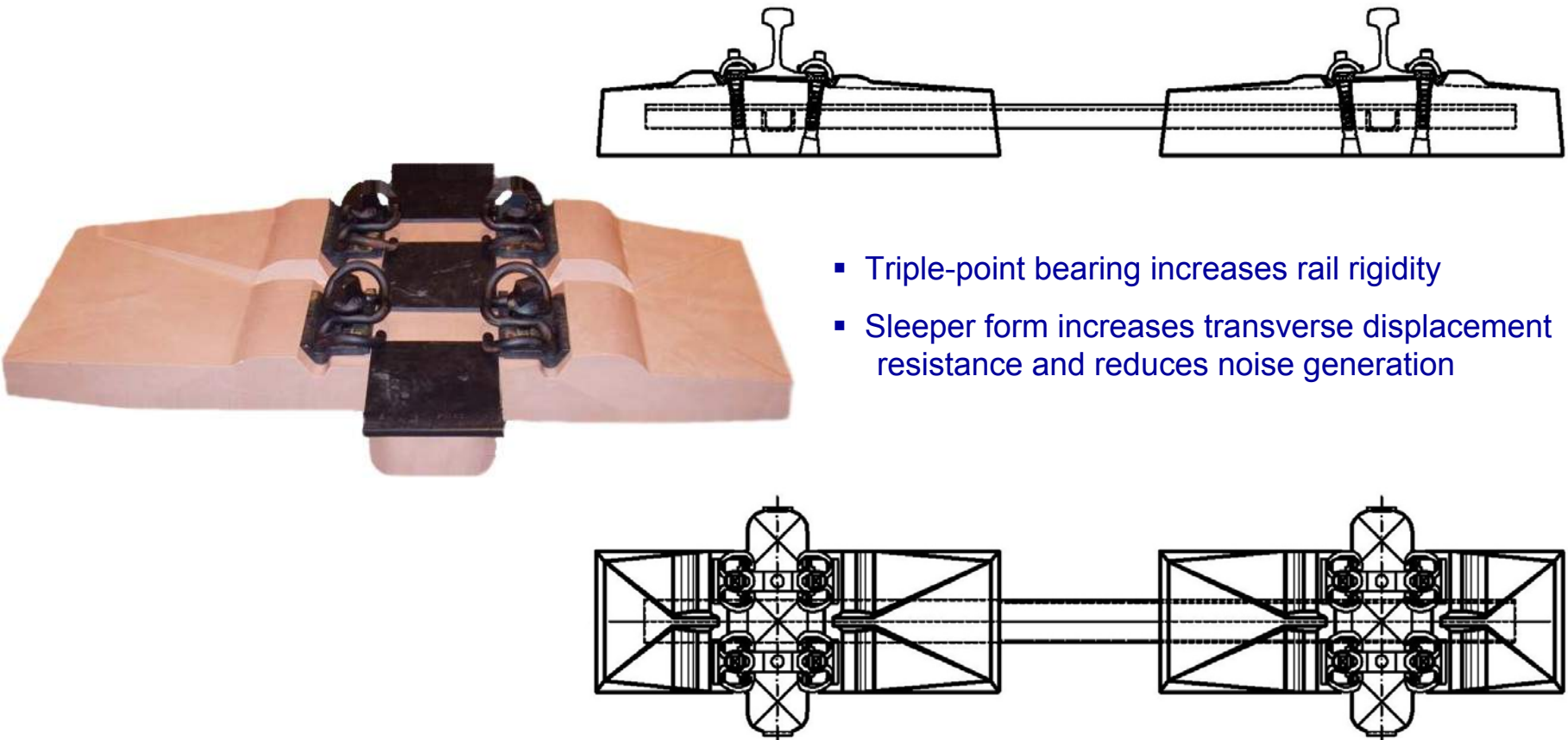
- Resistant to load and weather
- Application independent of temperature and humidity
- Reduction of tension problems
- Inclined rail joint increases quietness and reduces wear to rails/wheel
- Increased efficiency through simple process organisation





DURSYS® family in cooperation with Hyperion

DURCRET® bi-block wing sleeper, new sleeper form manufactured from plastic with noise-reducing effect





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DURSYS® family in cooperation with Hyperion

DURMINOR®, the low noise barrier as additional passive 'noise control'

