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understanding mobility

Vossloh Fastening Systems

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Trends in Rail Fastening Systems

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Requirements for Rail Fastening Systems

Project requirement

- **Reliability**
- **Low Maintainability**
- **Damping**
- **High toe load/ creep resistance => Safety**
- **Simple handling**

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Fastening System W

W series systems are installed worldwide since more than 45 years on more than 86.000 km

Fastening System 300

for Urban Transport, High Speed Lines and Heavy axle load application since more than 20 years on more than 4.000 km

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Requirements

Customer Request

- Higher availability of track
- Reduction of maintenance
- Increasing of speed
- More driving comfort
- Noise and vibration reduction
- Cost

Achieved by higher elasticity in the fastening system, thereby

- Protection of substructure
- Protection of superstructure
- Protection of rolling stock
- Damping of vibration and shock loads
- Reduction of rail seat forces

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Elastic Fastening Systems

To be considered

- Rail bending
- Life time of elastomeric pads
- Reduction of rail seat forces
- Limiting of rail tilting
- Abrasion/wearing of rail pads
  in particular in tight curves and while using small rail foot

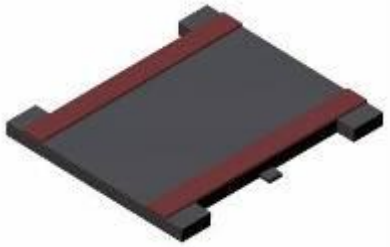
Elastic Fastening Systems

Control of Rail Tilting/ Increasing of Life Time

To be considered in the design of elastic fastening systems

► Tilting limiting design of guide plate with plastic nose reaching under the rail foot reduces wearing and plastic deforming of elastic rail pads at high rail tilting or vertical deflection

► Control of rail tilting



► rail pad with reinforced borders decreases rail tilting

► high quality material
e.g. microcellular EPDM

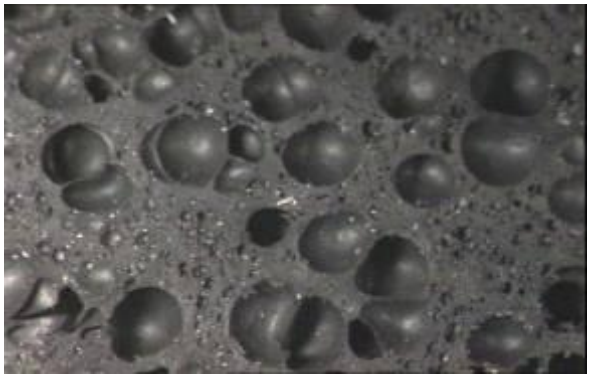
Elastic Fastening Systems

Control of Rail Tilting/ Increasing of Life Time

To be considered in the material choice of elastic fastening systems

Material quality of elastic elements

- low stiffening factor
- high damping effect
- long life time
- equal elasticity via a wide range of temperature
- oil, grease and water resistance



Microcellular EPDM

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Development of Fastening Systems

Fastening System W Type	Elastic	Fatigue Limit	Rail Pad	Static Elasticity
System W 3	Skl 3	1,4 mm	Wood or EVA	stiff
System W 14	Skl 14	2,0 mm	Elastic	> 50 kN/mm
System W 30	Skl 30	2,2 mm	Elastic	> 50 kN/mm
System W 21	Skl 21	2,5 mm	High Elastic	> 30 kN/mm

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Development of Fastening Systems

Fastening System Ribbed Plate Type	Elastic	Fatigue Limit	Rail Pad	Static Elasticity
System K	Clamping Plate	stiff	Wood or EVA	stiff
System KS	Skl 3/ AEKP/ 12	1,4 mm	Elastic	> 200 kN/mm
System KS 24	Skl 24	2,5 mm	Elastic	> 40 kN/mm

Skl 12

Skl 3

Skl 24

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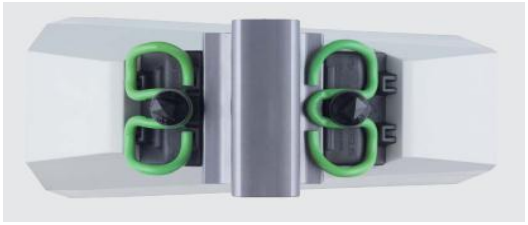
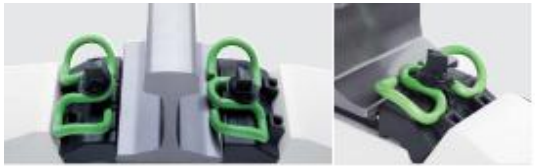
Development of Fastening Systems

Rail Fastening System 304



- Stable gauge and height adjustment
- Tilting protection of the rail through the middle bend of the tension clamp and a special design of the angled guide plate



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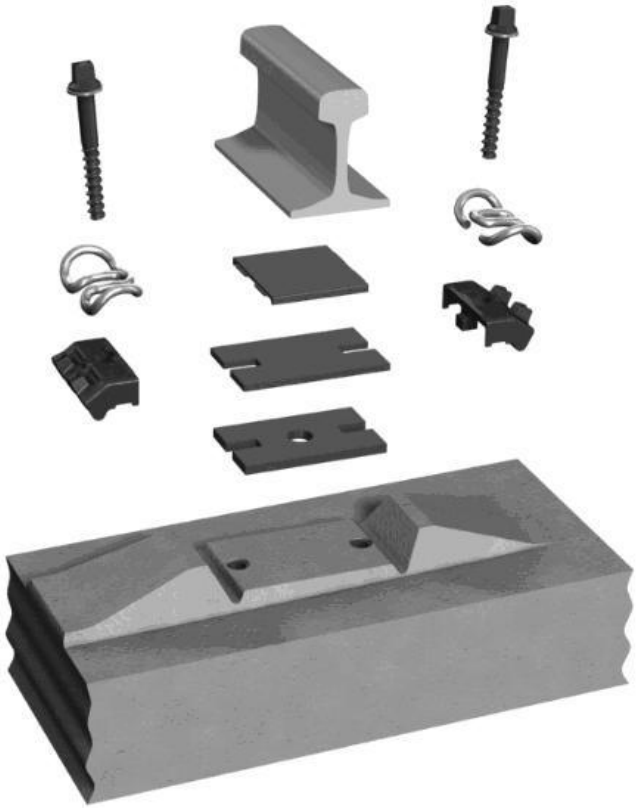
Development of Fastening Systems

Rail Fastening System 304



Rail Fastening System 300-1

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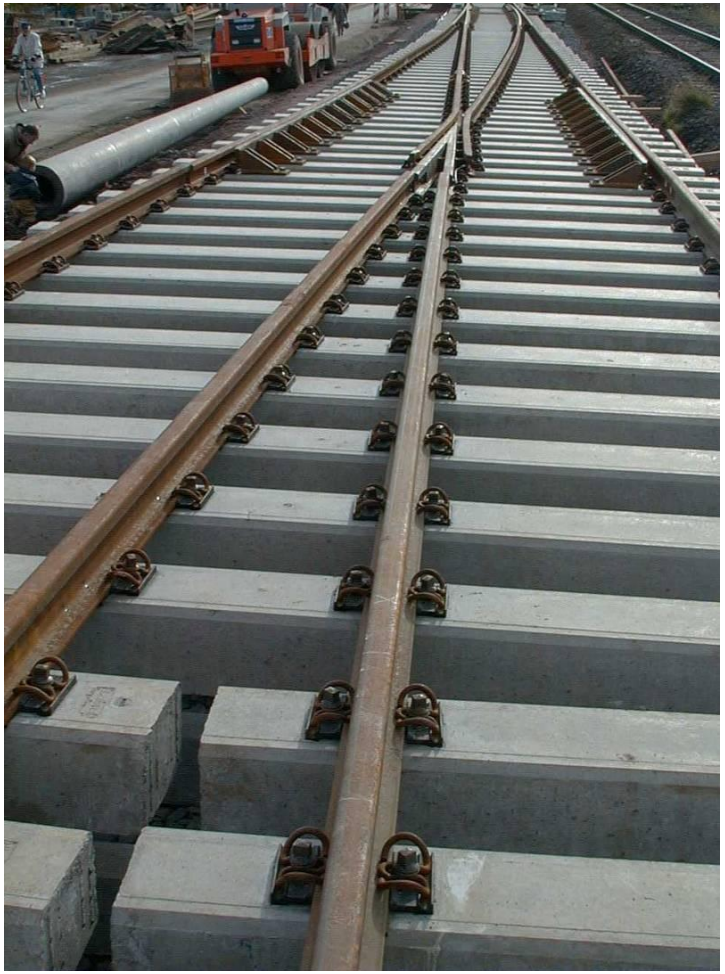
Fastening System W in Turnouts

- Similar Fastening System for Turnouts
- Direct Fastening System without Baseplate



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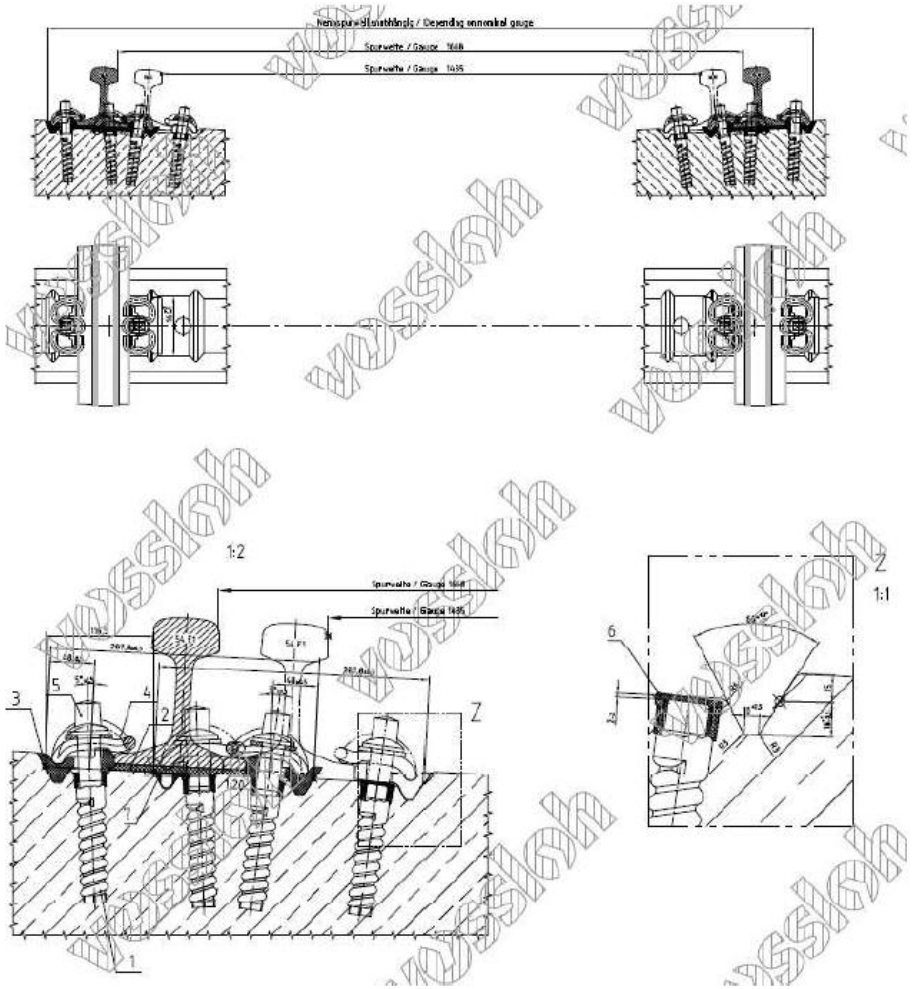
System W/ Polyvalent



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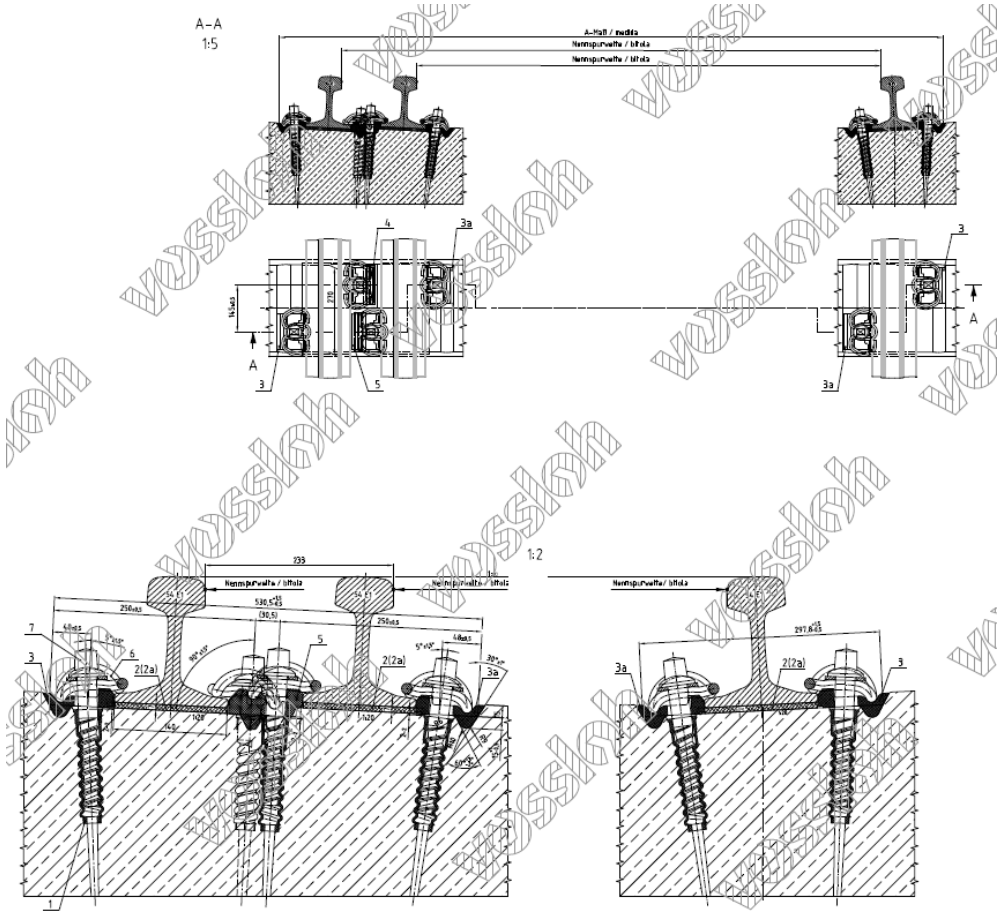
System W/ Dual Gauge



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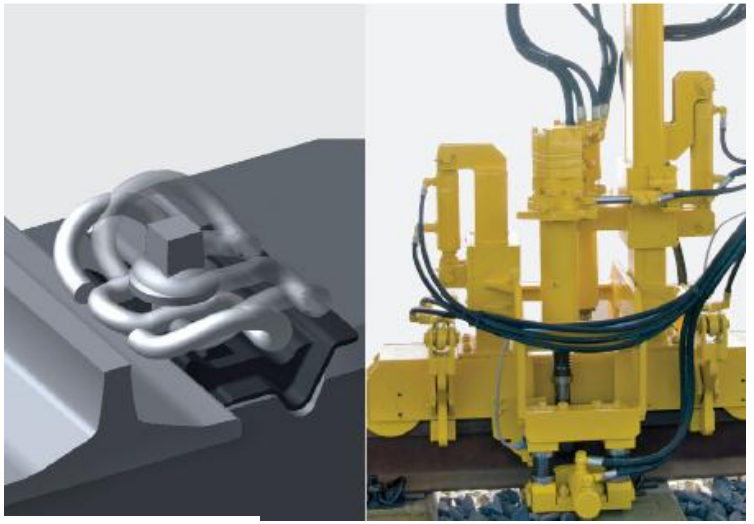
Installation – VosMat System Rapid



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Requirements Rail Fastening Systems

Project requirement

- **High axle load**
- **Extreme Track Alignment**
- **Severe Environmental**

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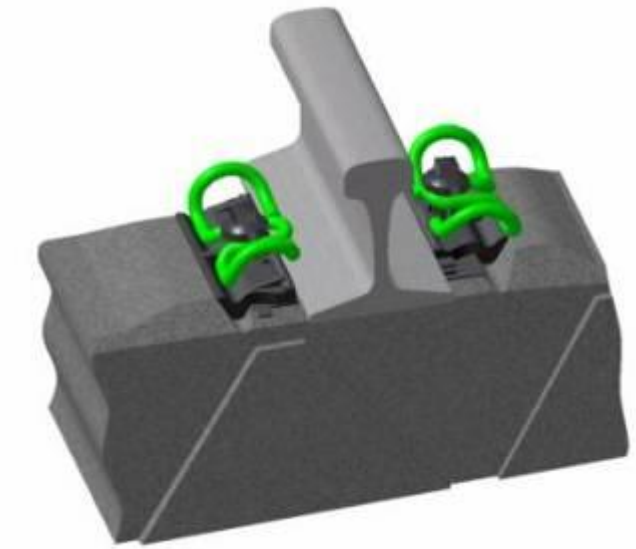
Heavy Haul Fastening Systems

► In several countries the importance of freight traffic, with axle loads up to 35 to and more, increases the availability and reduction of maintenance is as important as for passenger traffic

Captive systems are required:

- ► High toe load
- ► Reduction of wear
- ► Load transmission
- ► Abresive rail pad material



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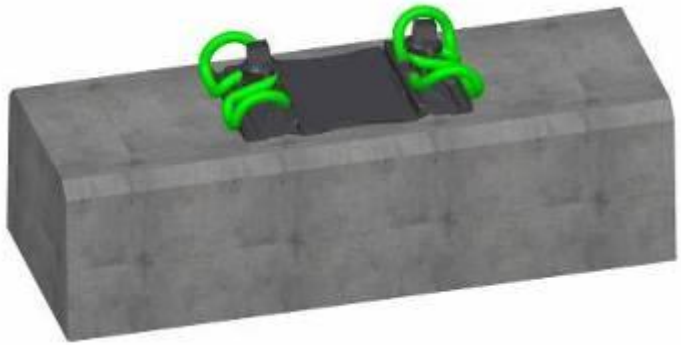
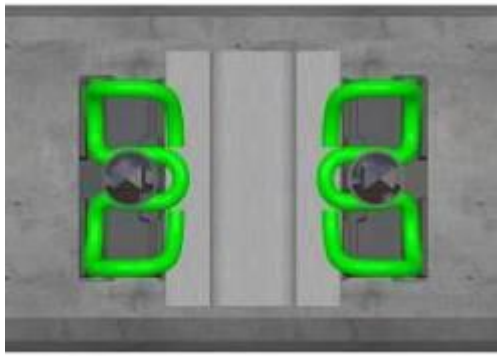
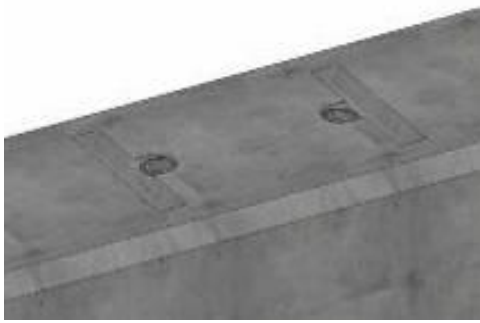
Heavy Haul Fastening Systems

- Same fastening type to be used

in the complete line as well as in the turn-out







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Challenge of Increasing of Axle Loads

The requirements of known standard are related to concrete sleepers for an axle load of 35 to.

For higher axle loads as required for e.g. mine tracks no test requirements existing

Parameter	EN 13481-8	AREMA- Test	Severe Service Load Test (AREMA)	Standard AU
Maximum Loading $P_V/\cos(\alpha)$ in kN	108	133.5	163.0	110.9
L/V		0.36	0.52	0.53
α^0	40	20°	27.5°	27.9°
Loading Position Rail X	75	0	0	15

>> Problematic: missing test conditions for higher axle loads

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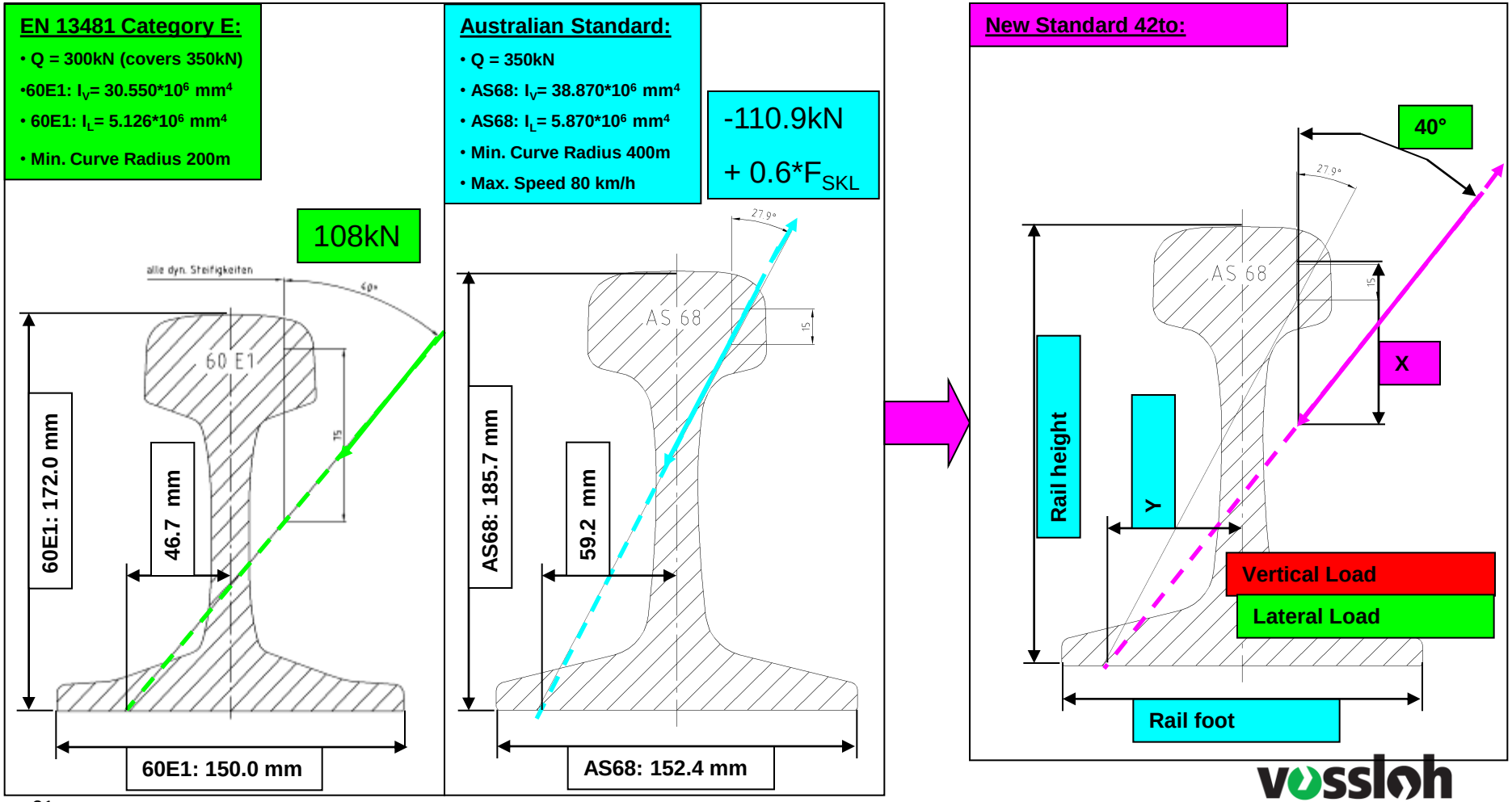
Challenge of Increasing of Axle Loads

>> Problematic of missing test conditions



Project E: Figure of combined extrapolations/ scaling (Worst case)

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Challenge of Severe Track Alignment

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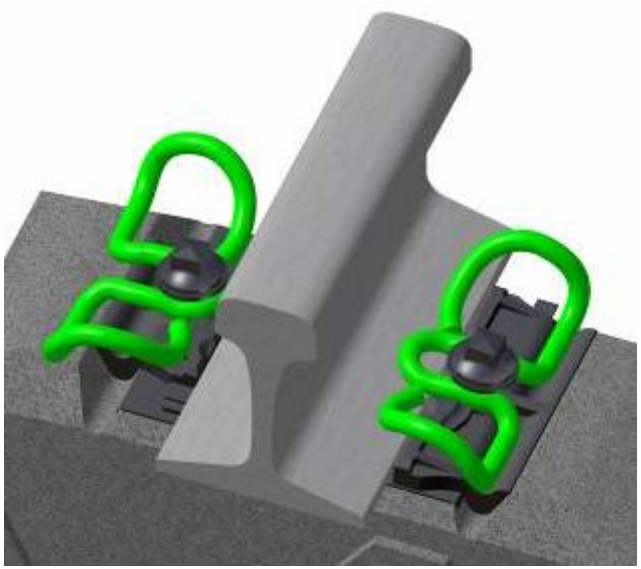
Challenge of Severe Track Alignment

High vertical and lateral rail deflection in sharp curves (R = 200 m) in Heavy Haul tracks and using of breaking sand

- Wearing of angled guide plate



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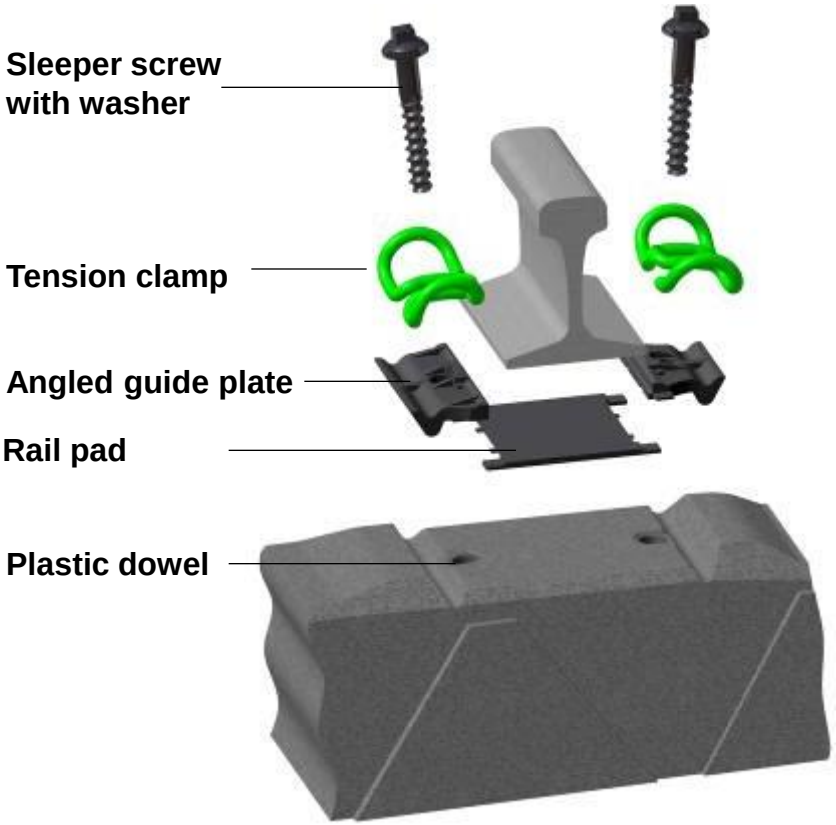
Challenge of Severe Track Alignment



- Higher fatigue strength of the complete system against lateral and vertical rail deformation / movement
- Toe load up to 14 kN
- Vertical fatigue strength >2.8mm
- Lateral fatigue strength +/- 1.0mm
- Abrasion resistance
- Guide plate with long guiding/ support surface of rail
- Tilting limitation within the system

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Challenge of Severe Environmental Conditions

Track Installation and operation in desert environmental

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Challenge of Severe Environmental Conditions

Investigation of assembling of fastening systems covered with sand:

Fastening System covered with sand

Greased screws covered with sand

Mounting of the Fastening System

Tightening the screw

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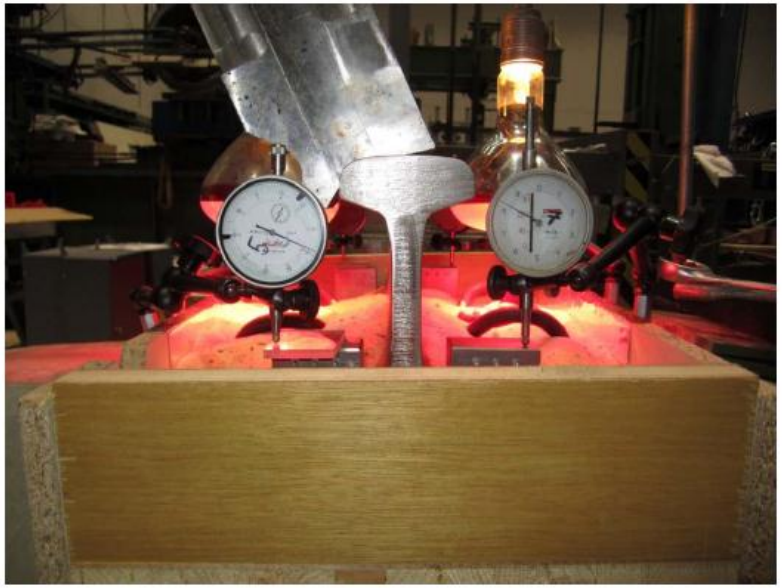
Challenge of Severe Environmental Conditions

Testing of the fastening system according to DIN EN 13481-2
with influence of temperature and sand



Repeated load test with sand and
increased temperature of 50° C

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