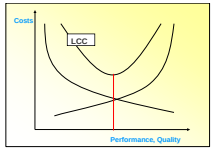
Modern Turnout Technology for High Speed

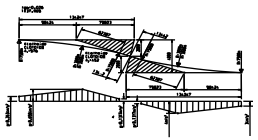
DI Heinz Ossberger
Head of Corporate Engineering and R&D
voestalpine VAE GmbH

TER Workshop Vienna, 18th of October 2016

Content



General



High Speed Turnout Geometry

High Speed Turnout Technology

Switching Technology for High Speed

Conclusion

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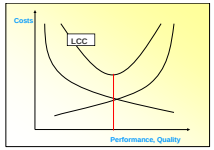

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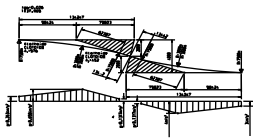

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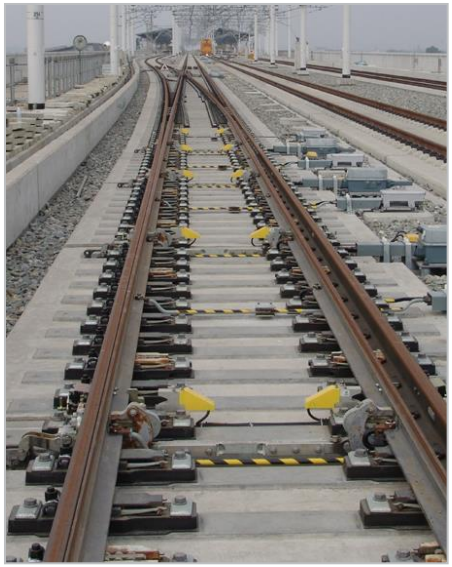
HIGH SPEED

The VAE Group as a Main Supplier of High Speed Turnout Technology Systems Worldwide

台灣高鐵
TAIWAN HIGH SPEED RAIL



한국철도시설공단

VAE - High Speed Turnouts used in:

Germany, Austria, Switzerland, Finland, Netherland
Turkey, Spain, Taiwan, China, Korea

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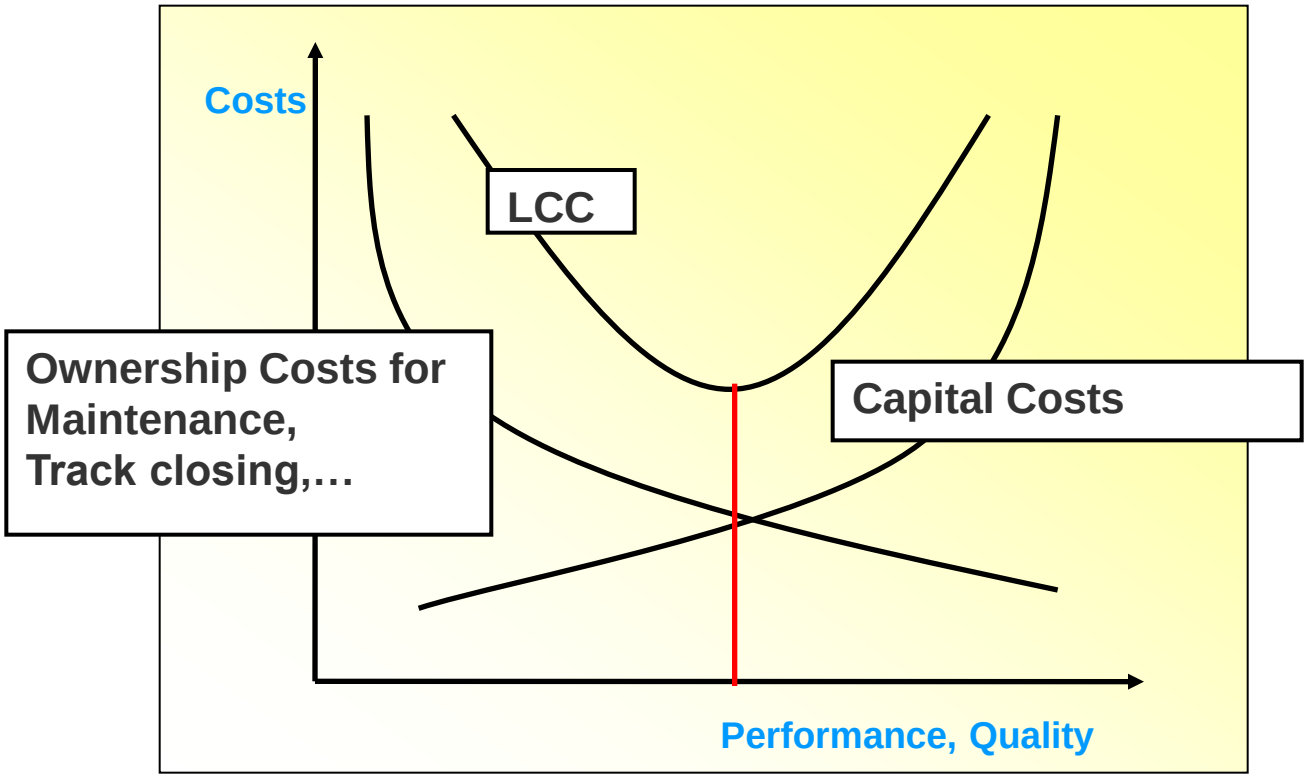
Primary Goal of LCC Optimisation

Identification of the optimal component on the base of LCC



Three Key Factors for a Successful High Speed Turnout Technology

Minimizing of Forces

- Turnout Geometry
- Elasticity
- Inclined Running Table

Most Suitable Turnout Component Design

- TOZ Switch
- Swingnose Crossing
- Roller Systems

Robust Drive, Locking and Detection System

- Hydrostar DLD System

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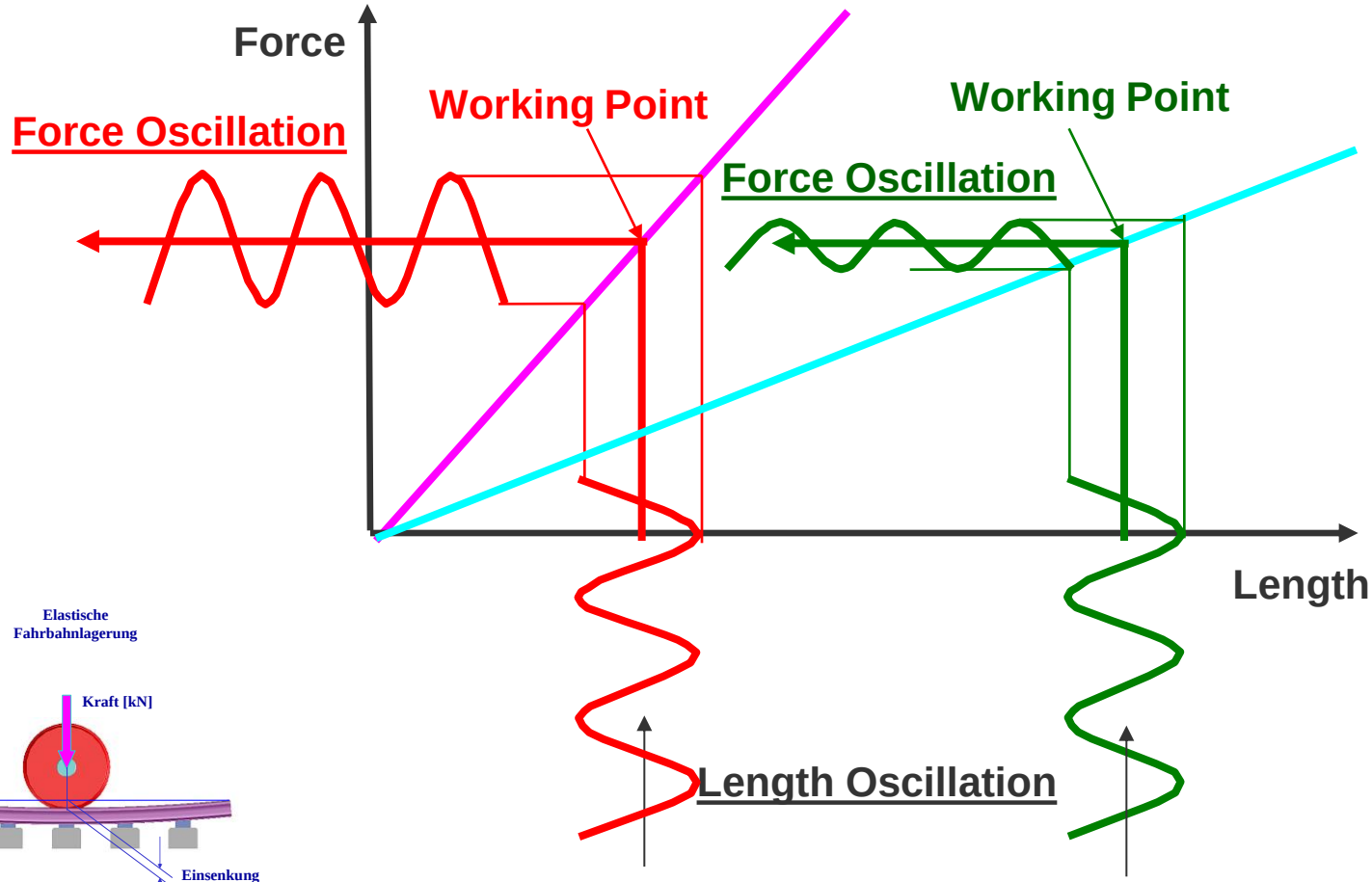
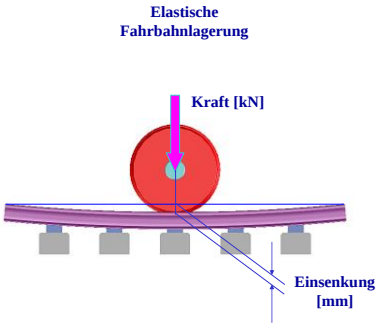
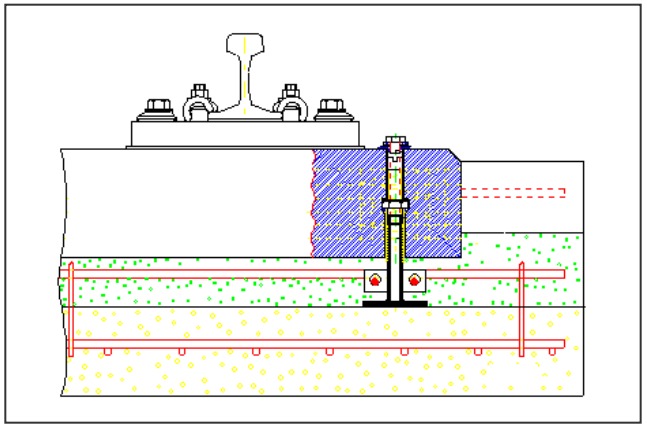




Force Oscillation in relation to the Spring Rate

High Speed Turnouts with Rheda Classic - Germany



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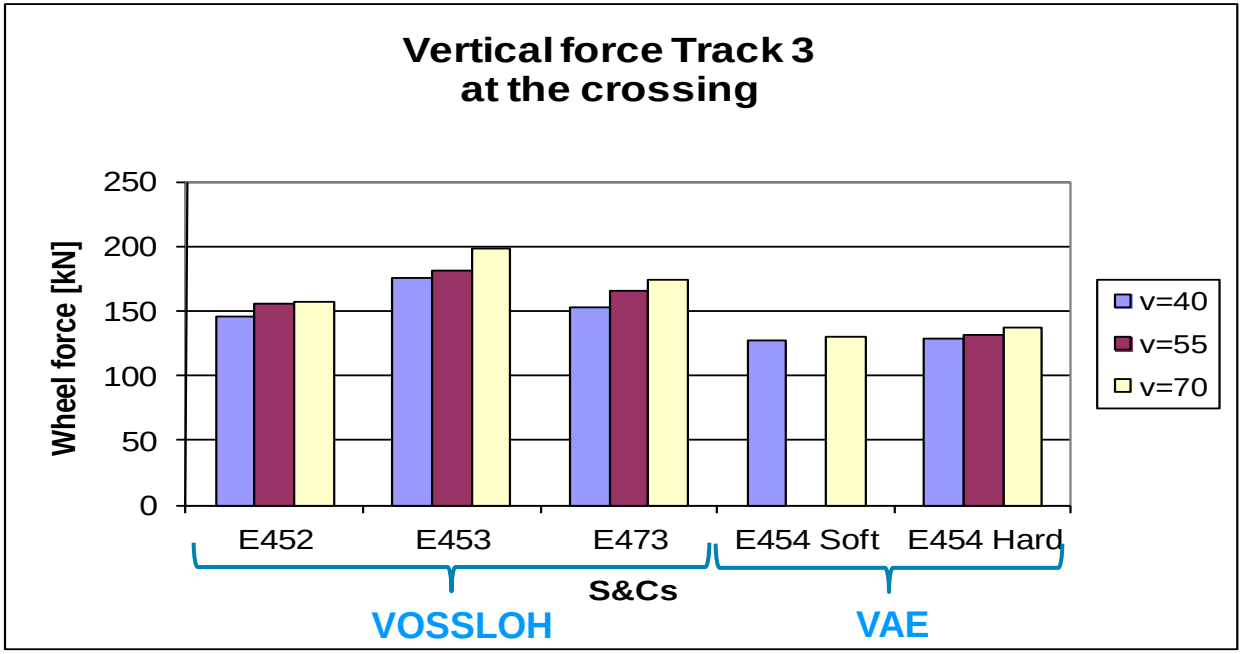
INNOTRACK – Results SP3 Switches & Crossings

Results of demonstrator installation:

- Significant reduction of contact forces by means of KGO and optimized elasticity (soft pads) in S&C
- VAE S&C has the lowest vertical force for the crossing (T/O E454)



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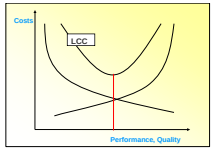

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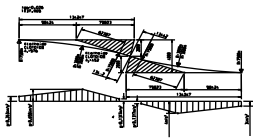

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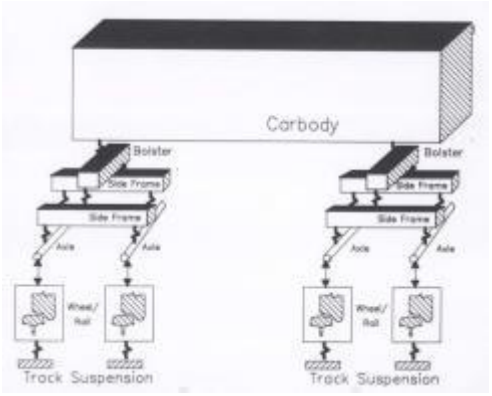
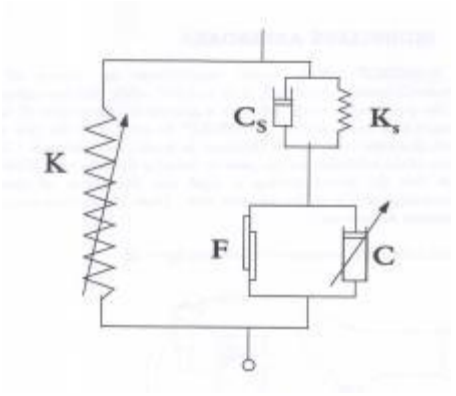
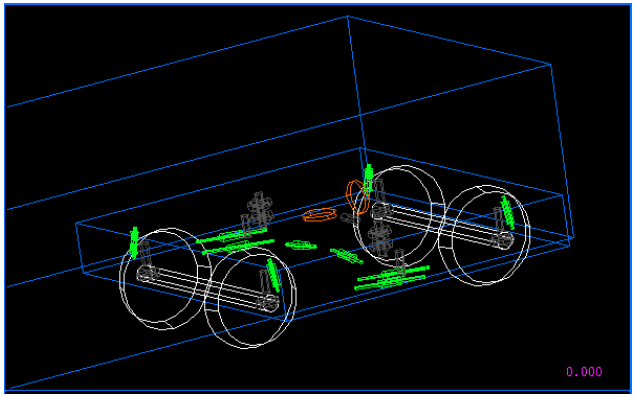
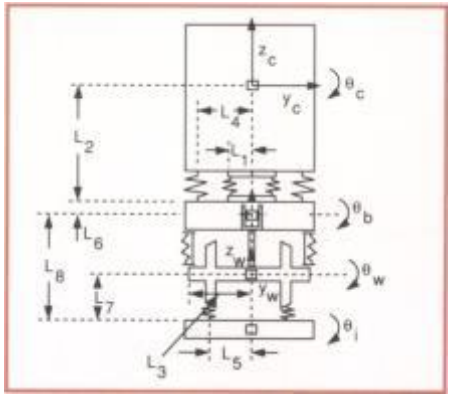
SYS File Railway Vehicles Model



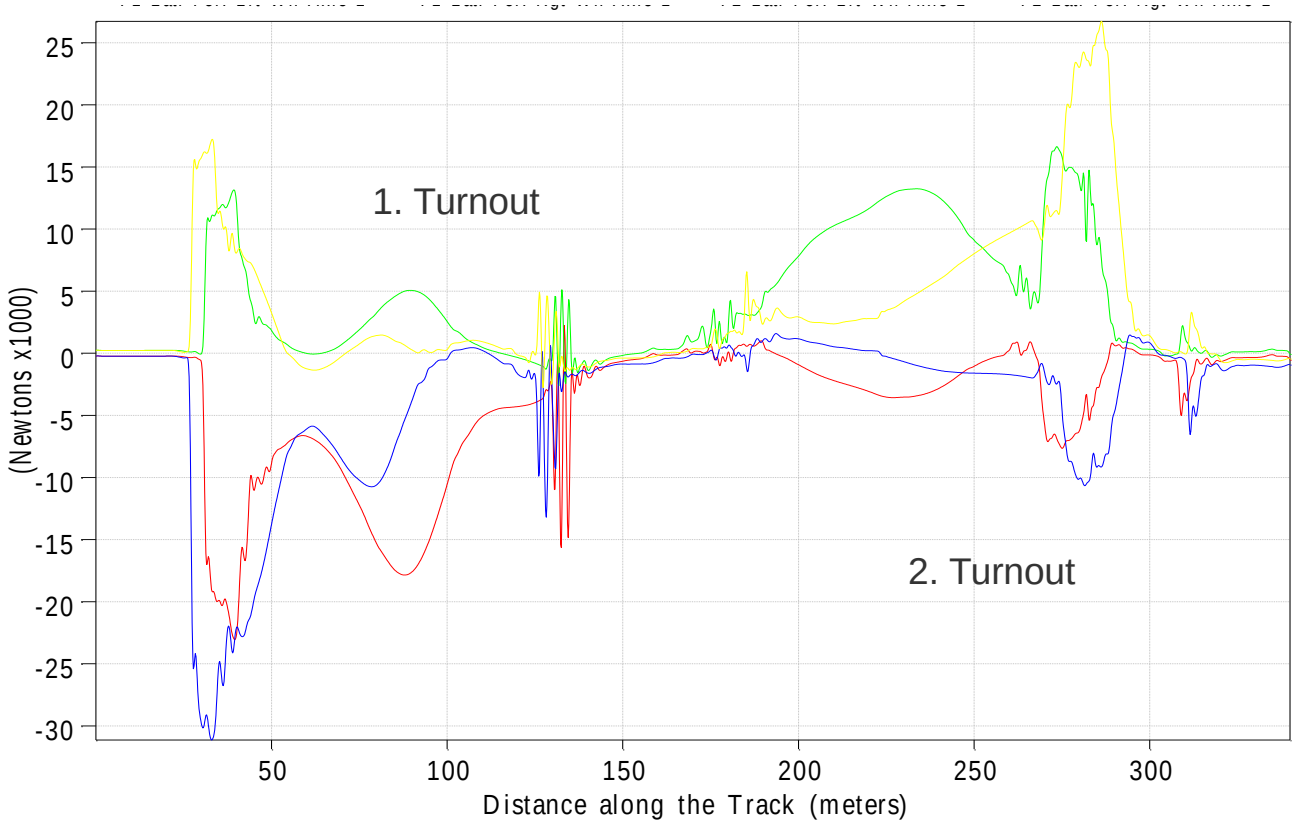






Lateral forces

At the wheel rail interface with a speed of 160 km/h



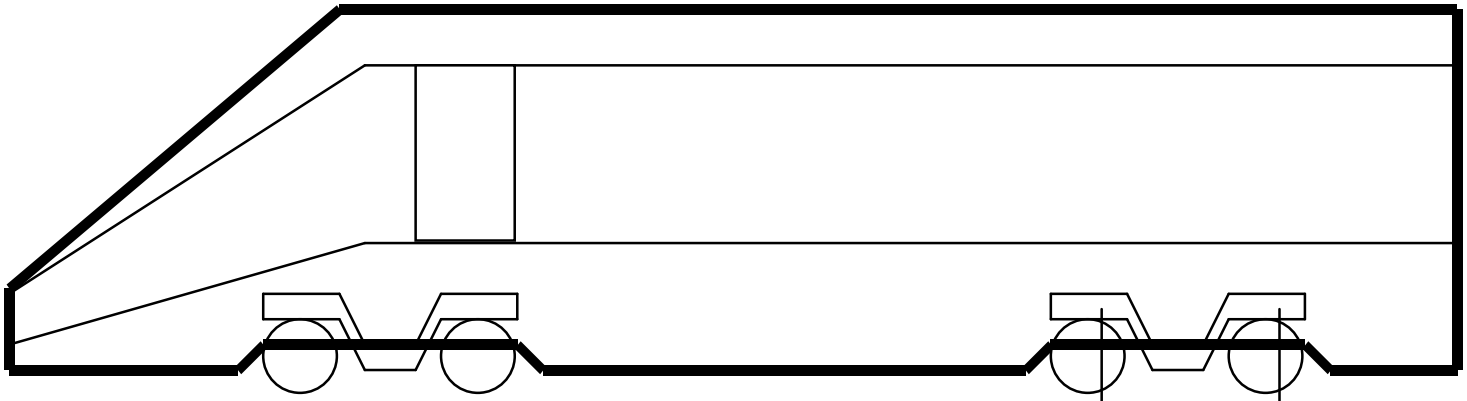
Parabolic Geometry LH-Wheel

VAE Clothoid Geometry LH-Wheel

Parabolic Geometry RH-Wheel

VAE Clothoid Geometry RH-Wheel

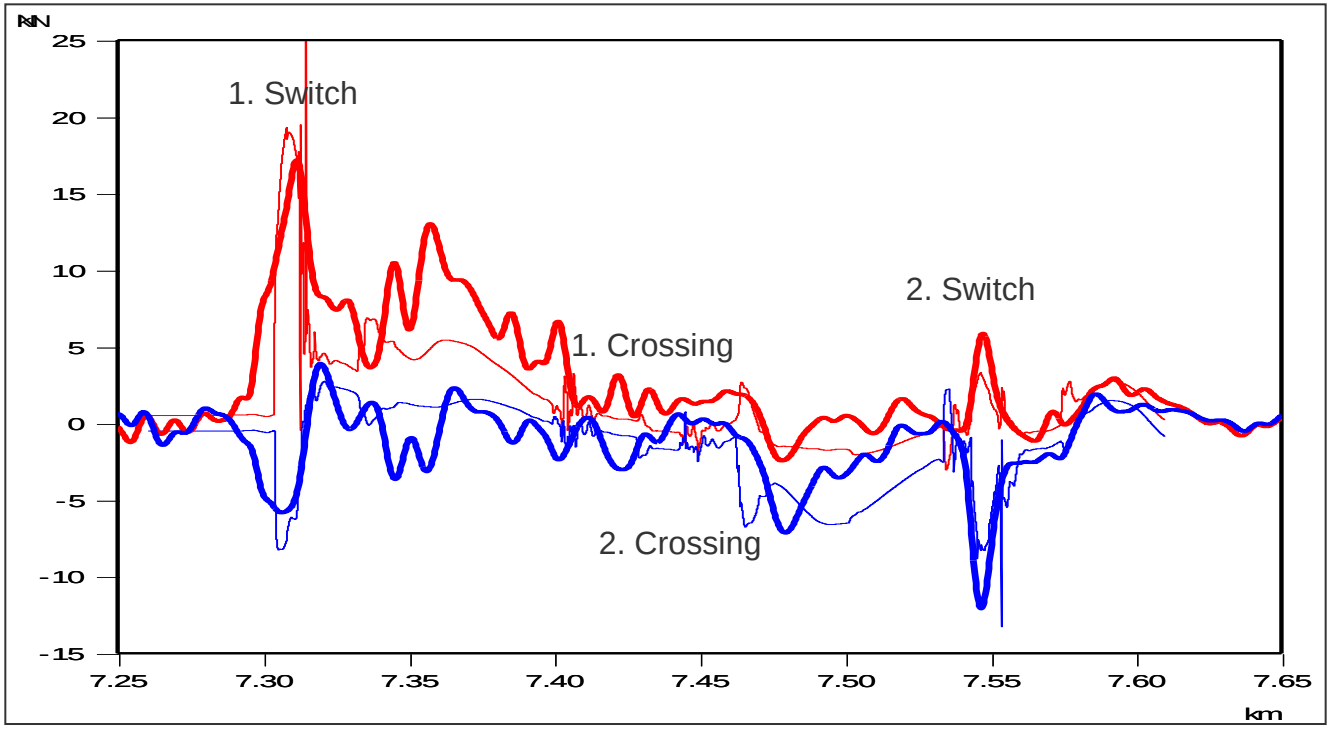
Measuring Locations on the Vehicle



Motrice ETR 500 Politensione 404 501-2

Y31	Y41
Y32	Y42
Q31	Q41
Q32	Q42

Simulation- Measurements



Lateral forces: speed 178km/h, axle 3, deviating track

Highspeed Crossover Gallese/Italy

UIC60-7500/3000/15000-tg 0,026

Results in Comparison with the Parabolic Geometry Turnout tg 0,022

- Maximum lateral forces are reduced by 25%
- Maximum accelerations are reduced by 36%

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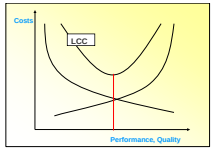

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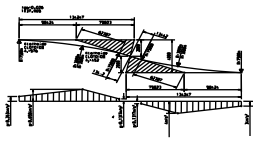

High Speed Turnout Geometry

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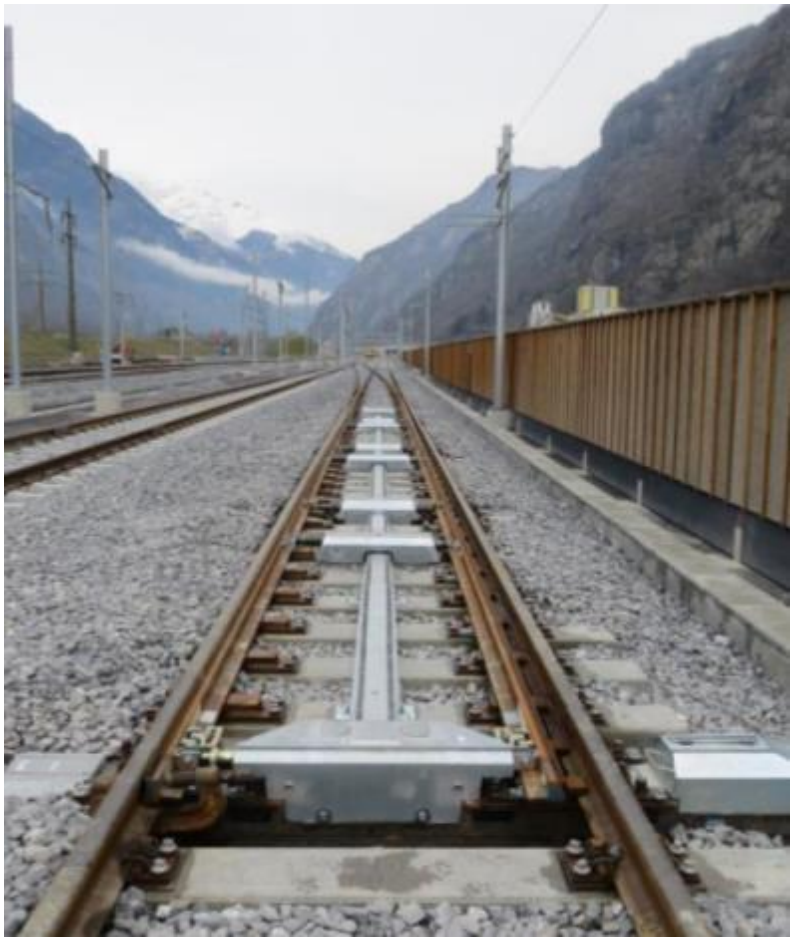
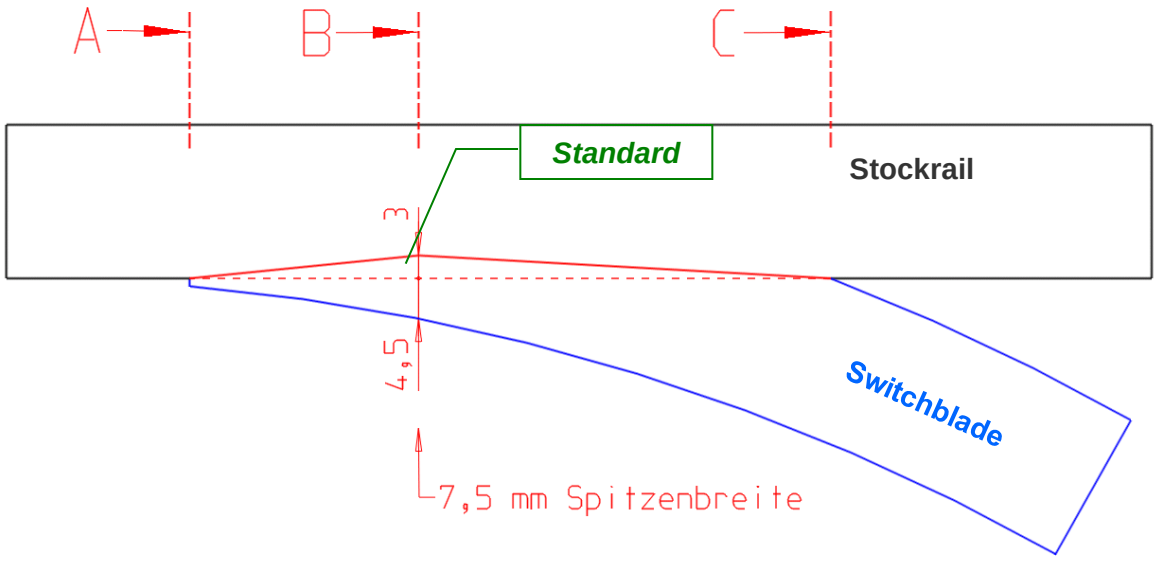
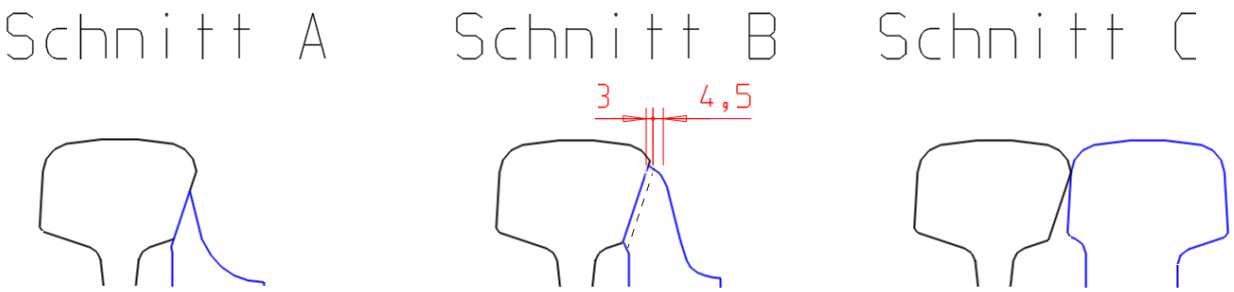
Switch Device

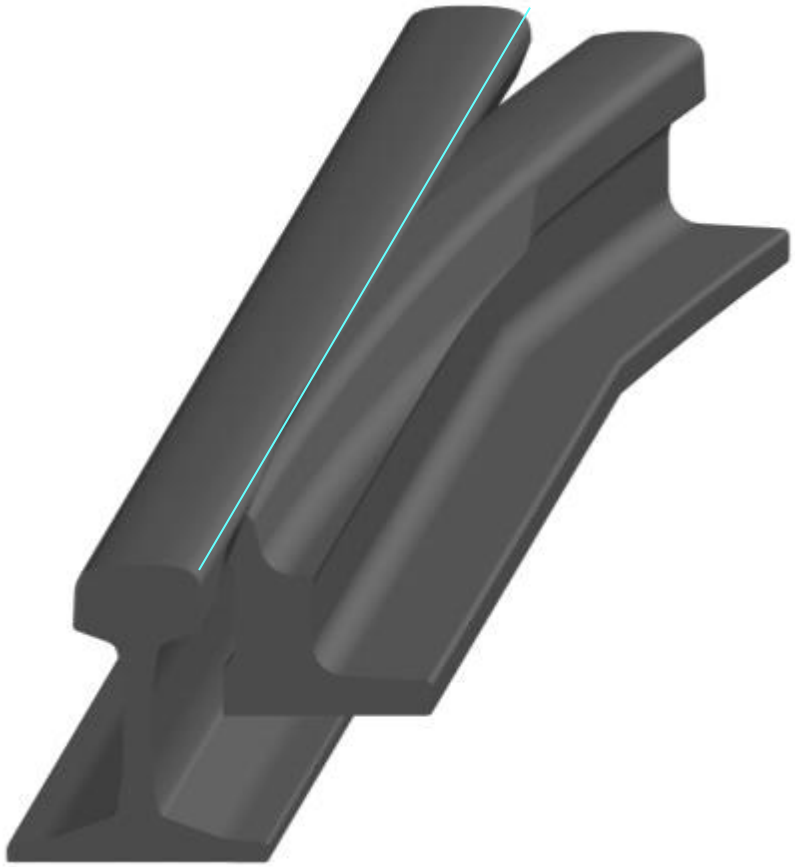


TOZ- Comparison to Standart Design





TOZ- Load Rating Optimized Switch Rails



Advantages:

- Optimal combination between switchblade thickness and stockrail thickness
- Almost no gauge widening
- Additional thickness of the switchblade in the most critical area
- Standard set of sleeper and plates are suitable
- Prolonging the service life of the product due to more material. According Swiss/SBB findings **twice the lifespan.**

TOZ- Load Rating Optimized Switch Rails

Technische Dokumentation | I-AM-EB-FT | SBB CFF FF

Herausgeber (Federführung) I-AM-EB-FT (Fahrbahntechnik) Datei: TOZ 1 H. Steiger	**Beteiligte Dienststellen**	**Klassifikation** **Ersatz für**
Datum **Inkrafttreten** sofort	**Befolgung durch** - UE - UE-TS, UE-GUP, UE-VS - BE/EOM Basel - BW Hägendorf	**Zur Kenntnis an**

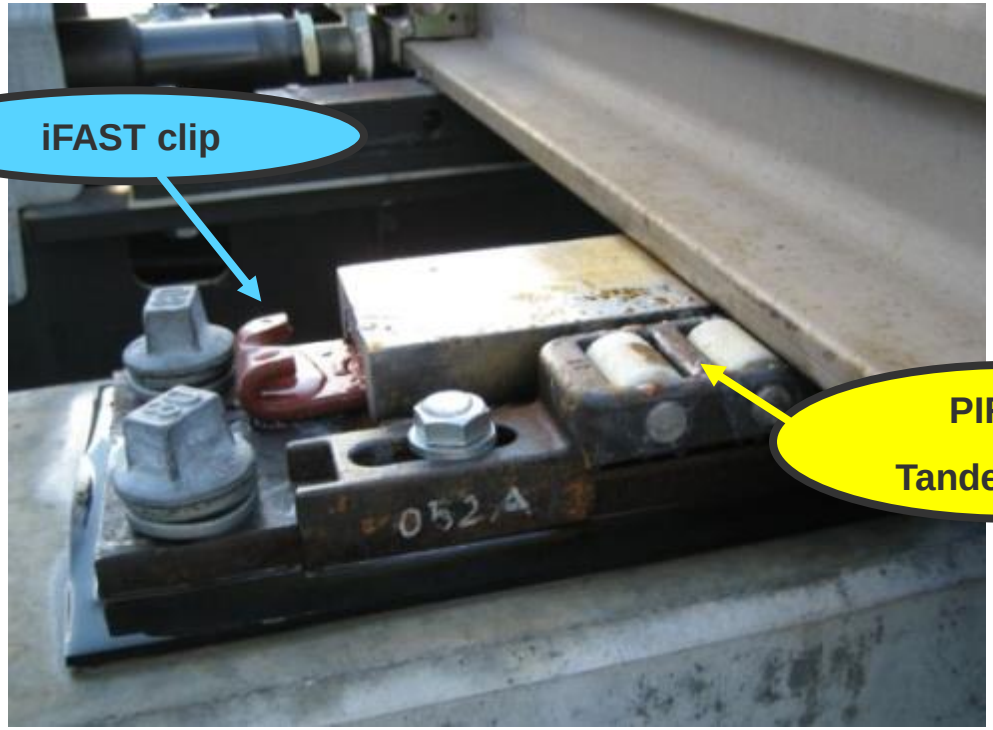
Weichen SBB IV, SBB IV/90 und SBB VI
Einführung von "Tragfähigkeitsoptimierten halben Zungenvorrichtungen TOZ"

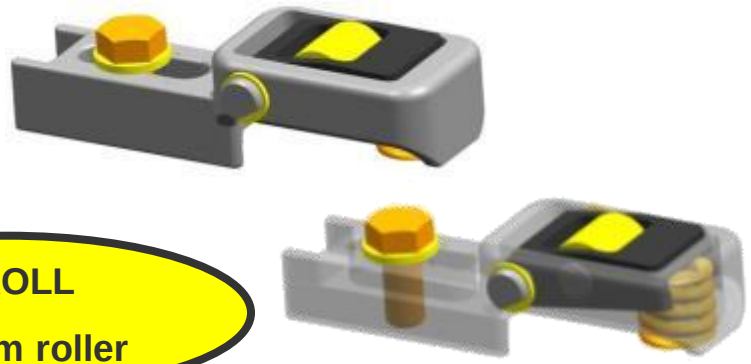
4. Ergebnisse der Versuche mit hZV-TOZ

Im Jahre 1999 begonnene Versuche haben gezeigt, dass mit hZV-TOZ die Liegedauer im Vergleich zur bisherigen Bauart mindestens verdoppelt werden kann.

A TOZ Switch gives you double the Lifespan compared to a Standard Switch!

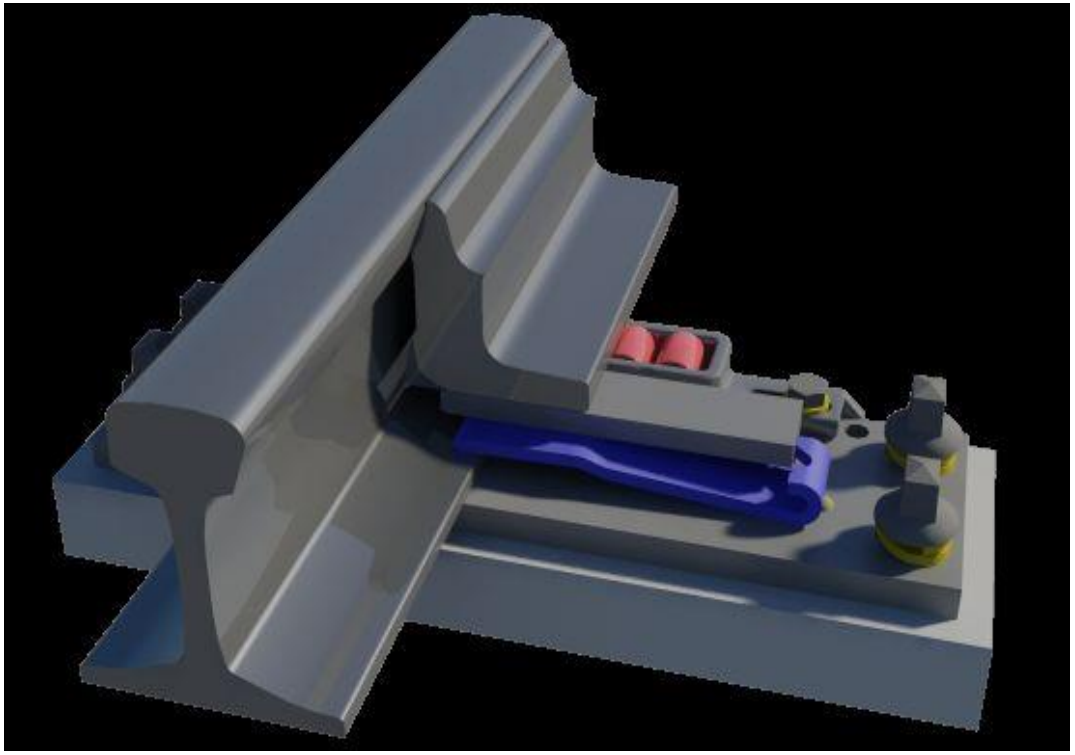
iFAST
Elastic Inner Stock Rail Fastening with Pi Rolles





PIROLL
plate integrated roller system

iFAST with PIROLL
Inner side rail fastening and switch roller



Advantages:

- Easy assembling and disassembling procedure
- Spring can be preassembled
- Flat spring rate
- Piroll fully integrated in the plate
- Plastic rollers cannot damage the switch blade when wrongly installed

Swing Nose Crossings for High Speed Turnouts

SNX with Cast Manganese Cradle:

- Sole plate consisting of:
  - 1pc Cast Manganese Cradle
  - 3pc Cast Steel Cradle
- Point and Splice Rails – Profile 60E1
- Closure Rails – Profile 60E1
- Length: 25,940m
- Geometry: 1:32,05

SNX Characteristics with Cast Manganese Cradle:

- Sole plate consisting of:
  - 1pc Cast Manganese Cradle
  - 3pc Cast Steel Cradle
- Point and Splice Rails – Profile 60E1A1
- Closure Rails – Profile 60E1
- Length: 20,390m
- Geometry: 1:38,46

Swing Nose Crossings for High Speed Turnouts

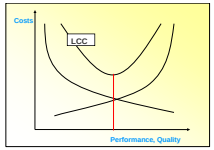
SNX with Long Wingrails:

- Long Wing Rails made out of profiles 60E1 and 60E1A1
- Point and Splice Rails – Profile 60E1
- Length: 23,013m
- Geometry: 1:38

SNX with Long Wingrails:

- Long Wing Rails made out of profile 60E1
- Forged Vee Block
- Closure Rails – Profile 60E1
- Length: 23,016m
- Geometry: 1:38

Content



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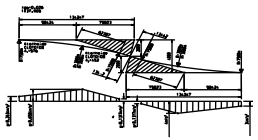

High Speed Turnout Geometry

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Conclusion

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Customer requirements for HS Setting Systems

- Pre – assembly
- One stop shop including transportation, installation, commissioning
- Easy Interface to the interlocking
- Space requirements
- Easy manual operation
- Resistant to snow, Ice, heat, sand
- Others

Possible Solutions for HS Setting Systems

- **Multiple single Point machines**
  - With/without End Position Detection
  - With local intelligent interlocking
  - every motor connected to remote interlocking
- **1 point machine for the switch, 1 for the frog**
  - Hydraulic connection
  - Mechanical rods
- **1 point machine for whole turnout – “COMBI”**
  - Hydraulic connection

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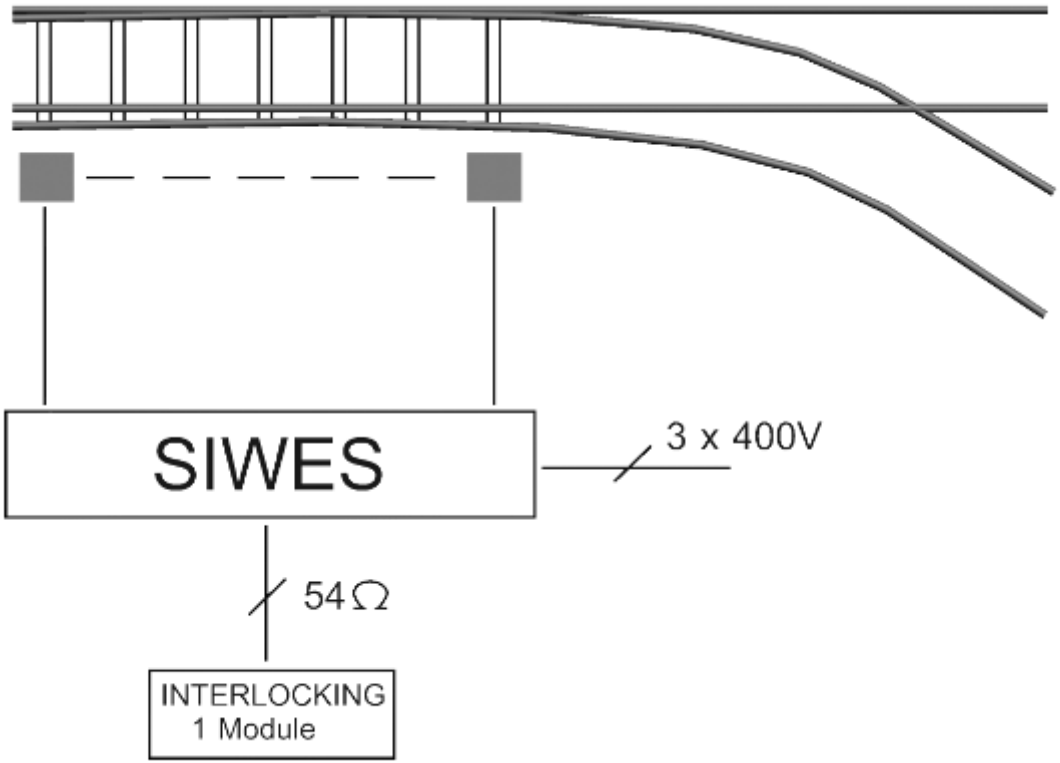
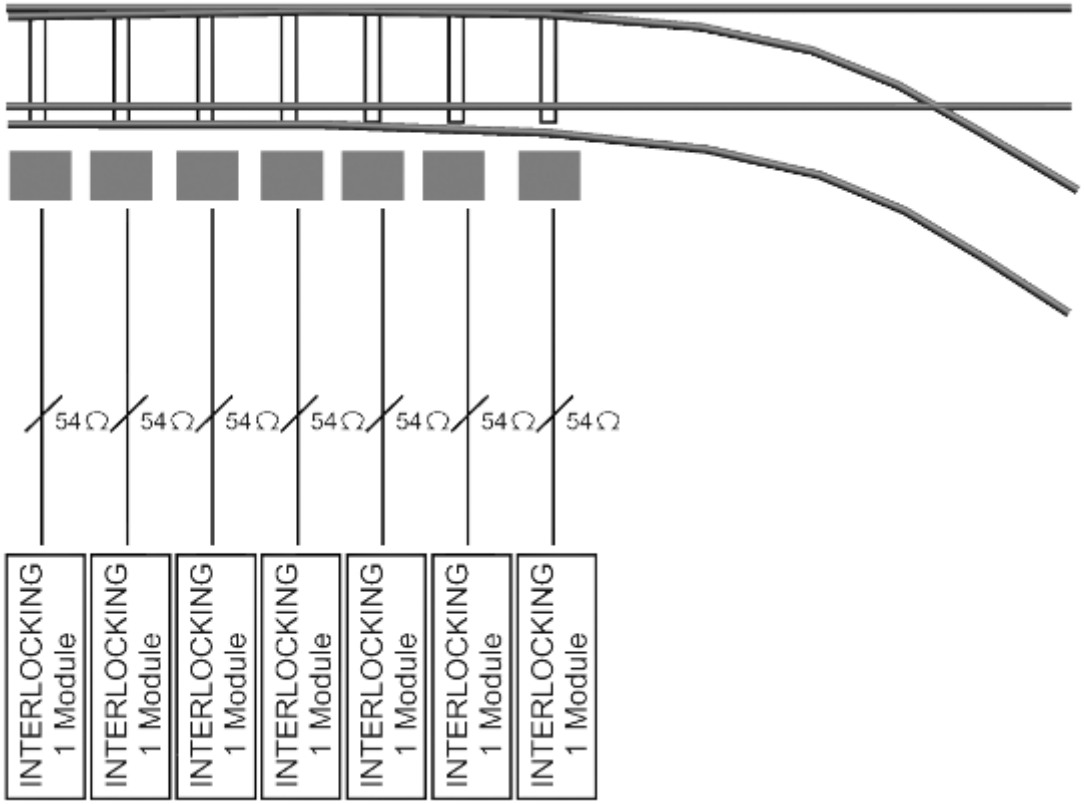
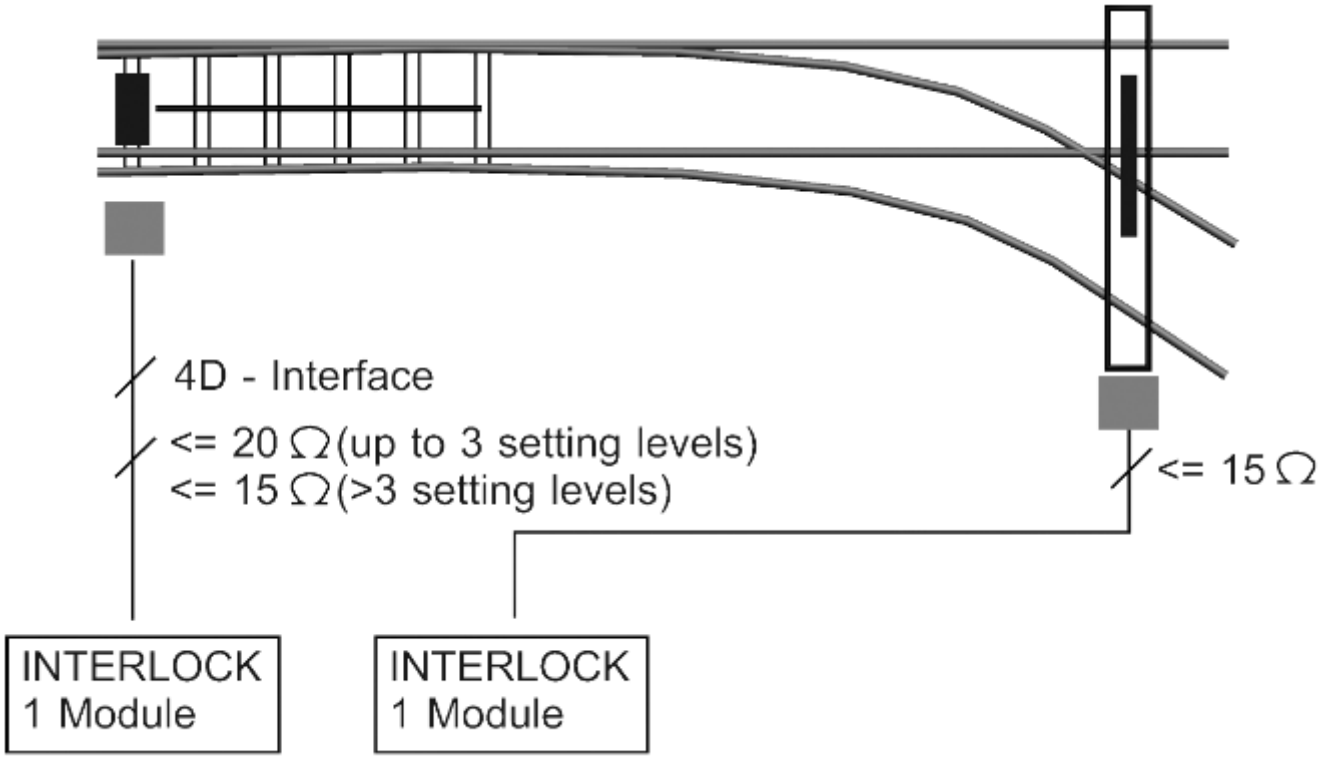
Multiple Single Drives
Connection to a “Local Interlocking Unit”



Multiple Single Drives
Connection to a Remote Interlocking



1 point machine for the switch
1 for the frog, hydraulic connection



Space Requirements for HS Setting Systems

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Space Requirements for HS Setting Systems

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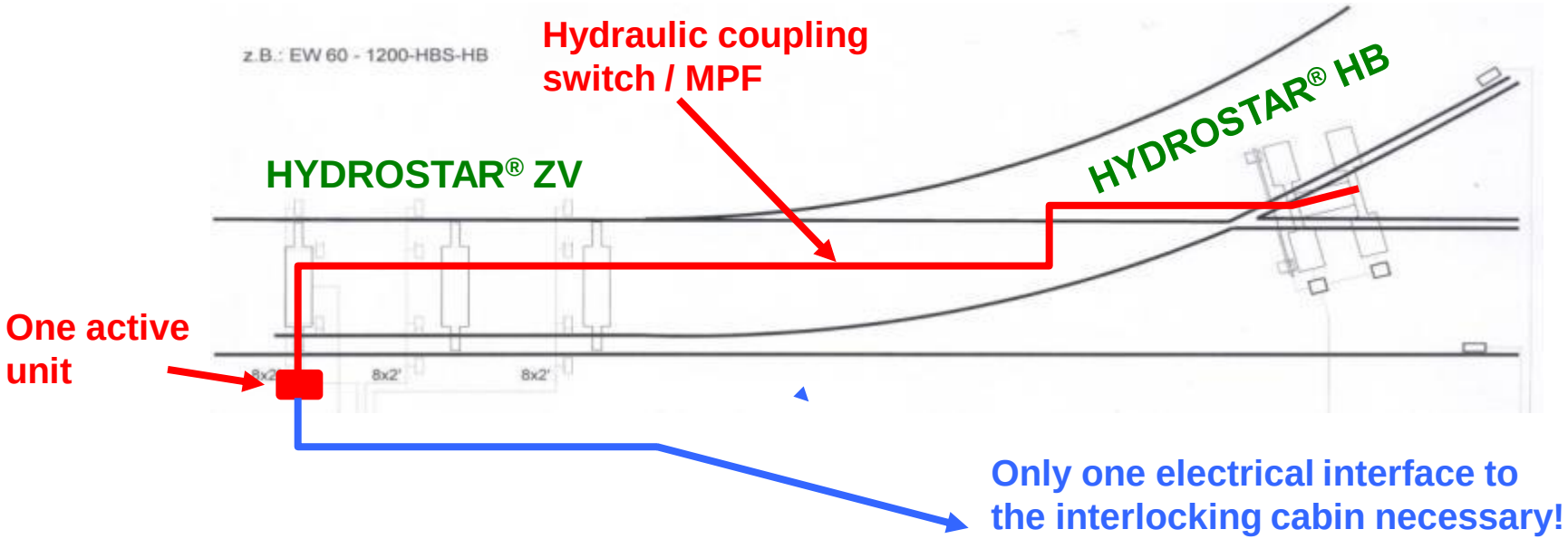
HYDROSTAR® - **Combi**

- Combines switch area and movable frog
- System solution suitable for 2+1 and 3+2 locking positions
- One active unit for switch area and movable frog



HYDROSTAR® - An Example

- **High Performance Switching System**
  - Combined modulus designed setting, locking, detection system
  - For Switch devices and Moveable Point frogs

- Requirements of innovative DLD D 3.2.5.

„…The ÖBB system has been successfully implemented on many switches. The safety level is among the highest …

Therefore thus design can be taken as a reference for the Innotrack proposal as described in the framed part…“

INNOTRACK Innovative Track Systems

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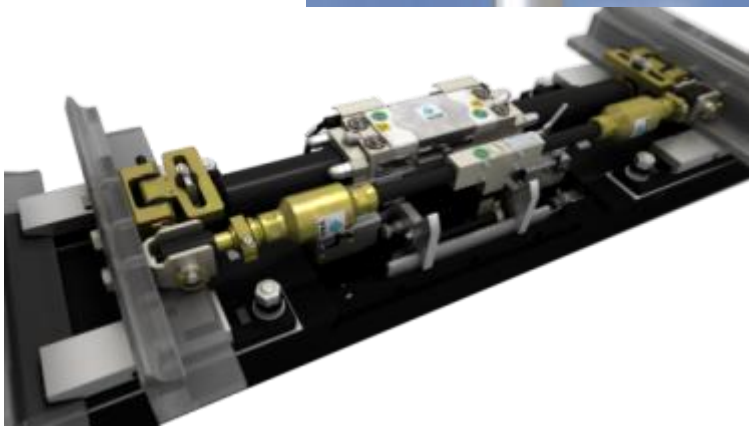
HYDROSTAR® - Overview

HYDROSTAR® - Functionality

- Applicable for turnouts with 10 setting levels in the switch device and 4 in the movable frog section
- Unique form fit locking principle
- Locks the closed and the open tongue rail => the system is not trailable
- Applicable for slab track and ballast track
- Visual end position indicators for manual operation



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HYDROSTAR® - **Technical Data**

- Gauge ≥ 1430 mm
- Switch opening: e.g. 70 / 78 / 88 / 98 / 118 mm
- Swing nose opening: 29 to 120 mm continuously adjustable
- Not trailable
- Setting time 4 to 12 seconds
- Operational temperature range: -40°C to +70°C

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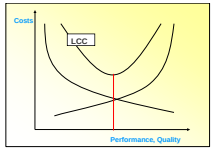
Content



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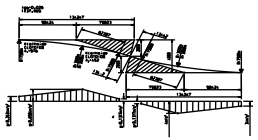

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Plug and Play Turnout with JIT Supply

- Optimal Turnout Geometry
- Most suitable component design
- Preassembled Turnout in the workshop with tight tolerances
- Just in time supply

Highest Initial Quality

- Smallest maintenance requirements
- Longest Lifespan
- Life Cycle Cost Optimisation

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Thank you!

Heinz Ossberger

Head of Corporate Engineering and R&D

voestalpine VAE GmbH