# Spoortrillingen

1-12-2022

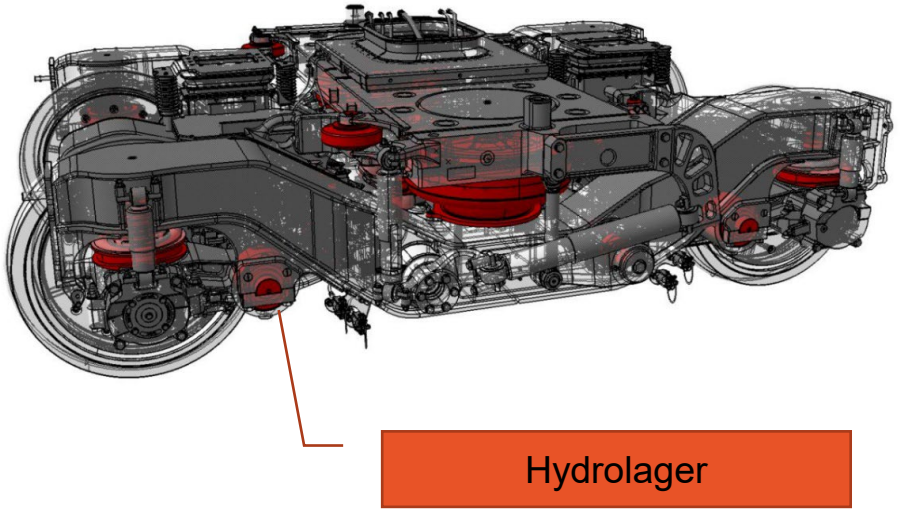
Vibration control

# Trillingen

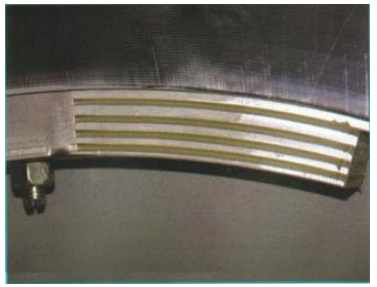
- Wat kun je doen aan trillingen (en geluid)?
  - Constructies stijver maken
  - Massa toevoegen
  - Passief Isoleren / Dempen met rubber
  - Oplossen zo dicht mogelijk bij de bron

# Expertise

- Expertise spoortrillingen:
  - Isoleren en dempen van trillingen in de draaistellen.
  - Specifieke voorbeelden van productontwikkelingen:
    - Hydrolagers:




    - Geluidsdempers:



Vibration control

# Ideeën

Met onze expertise kunnen we een deel van de oplossing inbrengen.

- Randvoorwaarde: **Samenwerken en expertise delen** is cruciaal en is de basis voor succes. We passen dit principe reeds succesvol toe in de Hightech industrie.
- Welke expertise hebben we nodig:
  - Zowel infra als rollend materieel.
  - Ondergrond / bodem.
  - Bestaande oplossingen en ervaringen, ook vanuit andere sectoren.
  - Testen en meten.
  - Bouw en constructie.
  - Materialen en eigenschappen.

GMT Railway Vehicle Technology

# HYDRALL®

## Hydraulic Axle Guide Bearing

# Agenda

- Requirements
- Functionality
- Variants
- Installation

# Requirements

Technical requirements on the wheel set guidance in the bogie

- Stable operation at high speed
- smooth in curves
- rail-friendly

- Problem: design conflict between driving stability and smooth curve behavior

- GMT solution: HYDRALL®
- Frequency-dependent stiffness in the wheel set guidance

# Requirements

## Advantages:

- Reduction of striking angles between wheels and rails
- Reduction of forces between wheels and rails
- Reduction of wear on both wheels and rails
- Reduction of noise

Reduction of wear in narrow curves

Reduction of energy input in curves

# Functionality

## Functional Principle of HYDRALL®

- Elastomer spring with integrated hydraulic system

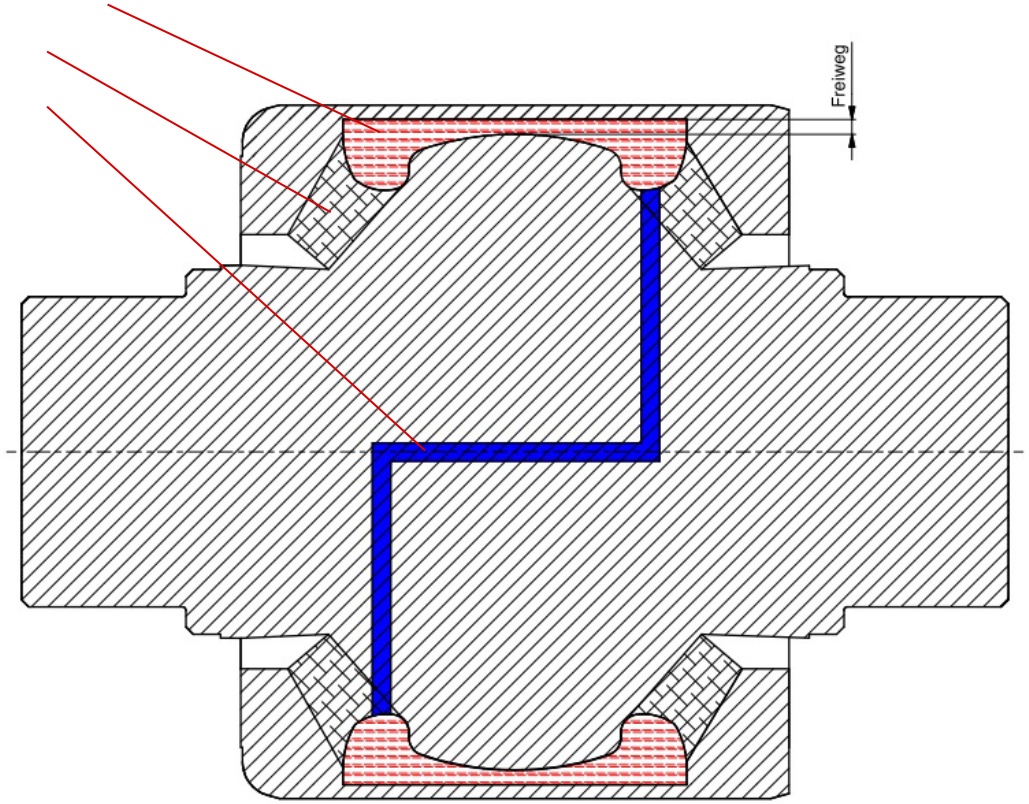
- Low stiffness – soft in curve rides
- Fluid flow restricting duct

- High stiffness – hard at straight forward motion
- High frequency sinusodial run blocks the fluid flow

- Stiffness and frequency transitions may be adjusted by variants of the restrictor duct

## Functional Principle of HYDRALL® - Design

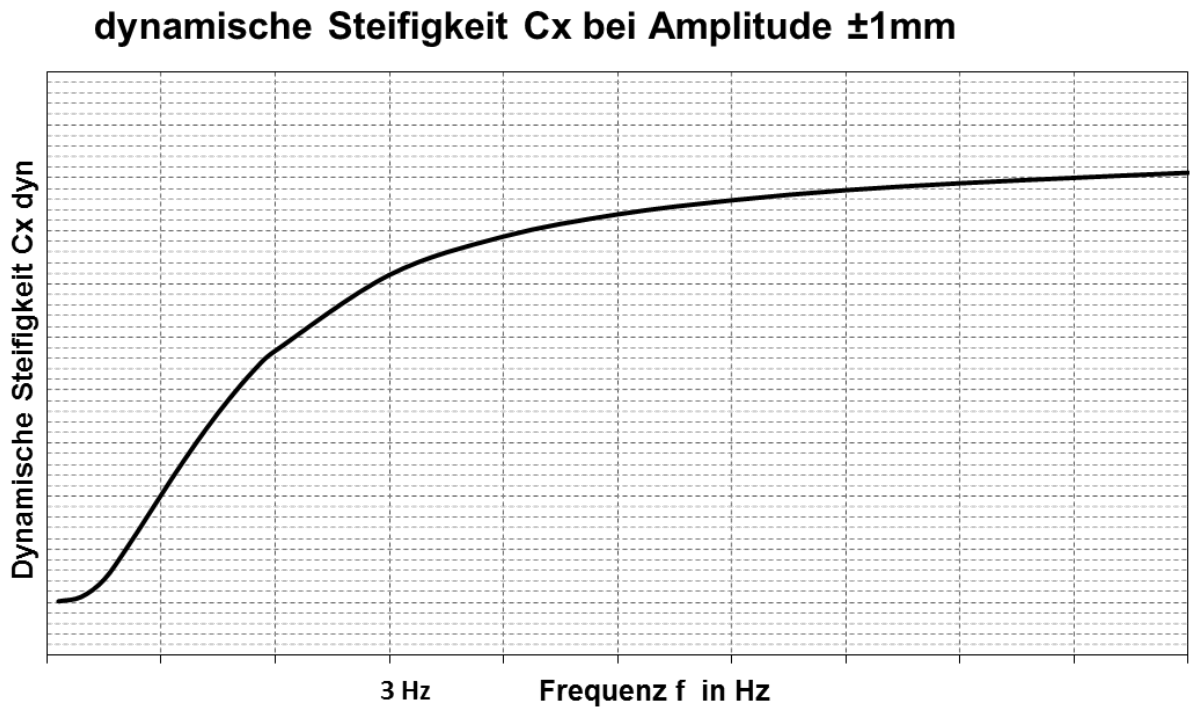
- Hydraulic chambers
- Elastomer body
- Connecting duct



# Functionality

## Functional Principle of HYDRALL® - Dynamic Stiffness

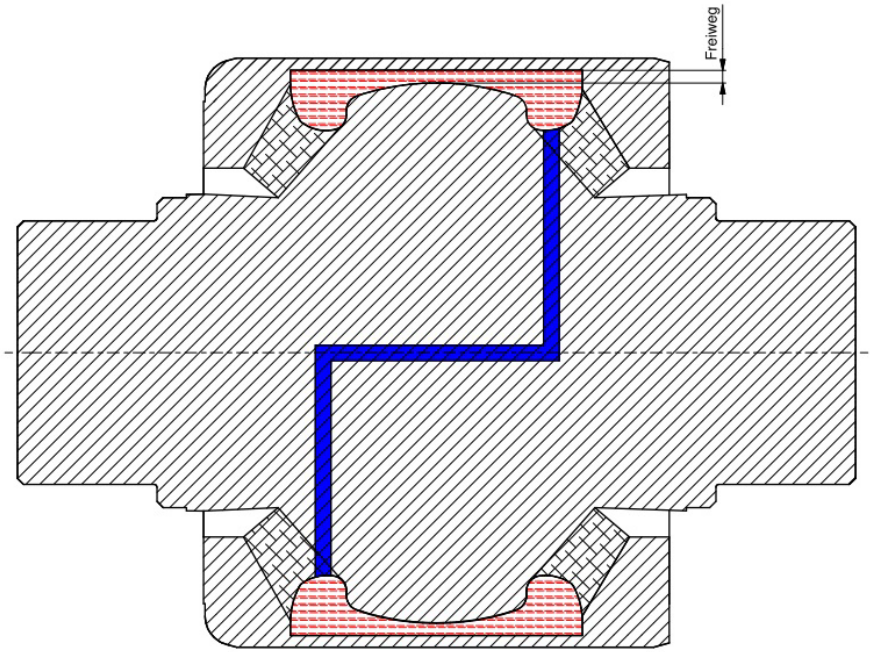
- Low static stiffness at low-frequency excitations
- High dynamic stiffness at excitation frequencies above ~3 Hz.



# Functionality

Functional Principle of HYDRALL® - Functioning

- Free fluid exchange between the hydraulic chambers at low frequencies
- The basic stiffness of the elastomer body takes effect
- Fluid exchange between the hydraulic chambers at high frequencies is blocked
- The higher bulking stiffness (Blähsteifigkeit) of the elastomer body takes effect

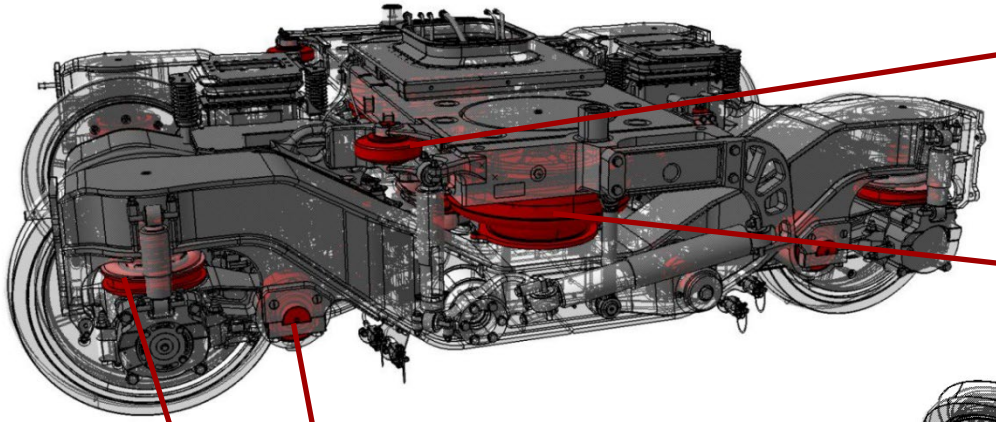


# Variants

## HYDRALL® Variants

- Diameters of existing axle guide bearing: Ø190
- Possible variation of connection geometry and width
- Static stiffness relation Cx/Cy 3.5/8; variable by elastomer
- Dynamic stiffness relation: Cx/Cy 35/8; variable by restrictor
- Static/ Dynamic stiffening increase from Cx from 0.5 to 1.5 Hz

# Installation



lateral rolling bumpstop

air spring system

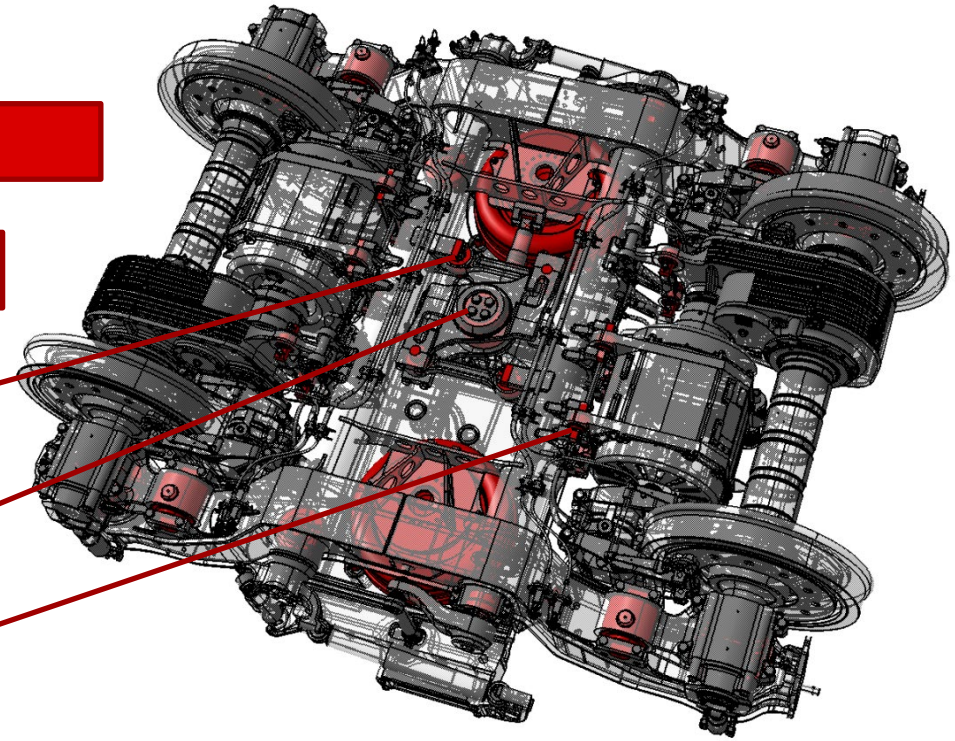
HYDRALL ®

spring washer

longitudinal rod

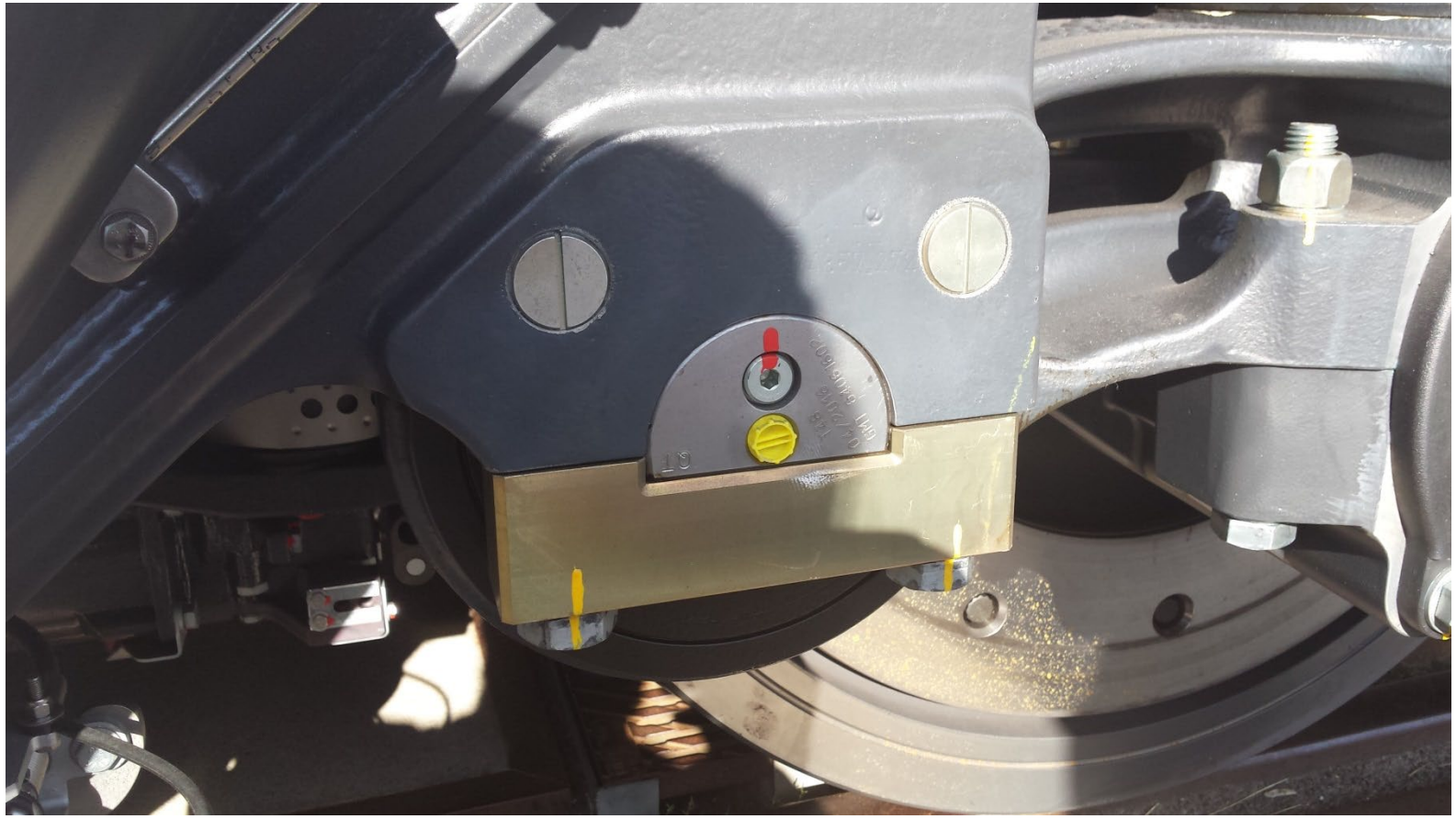
pivot bearing

gearbox mounting



# Installation

HYDRALL® wheel set guidance of swing arm Ø190 mm

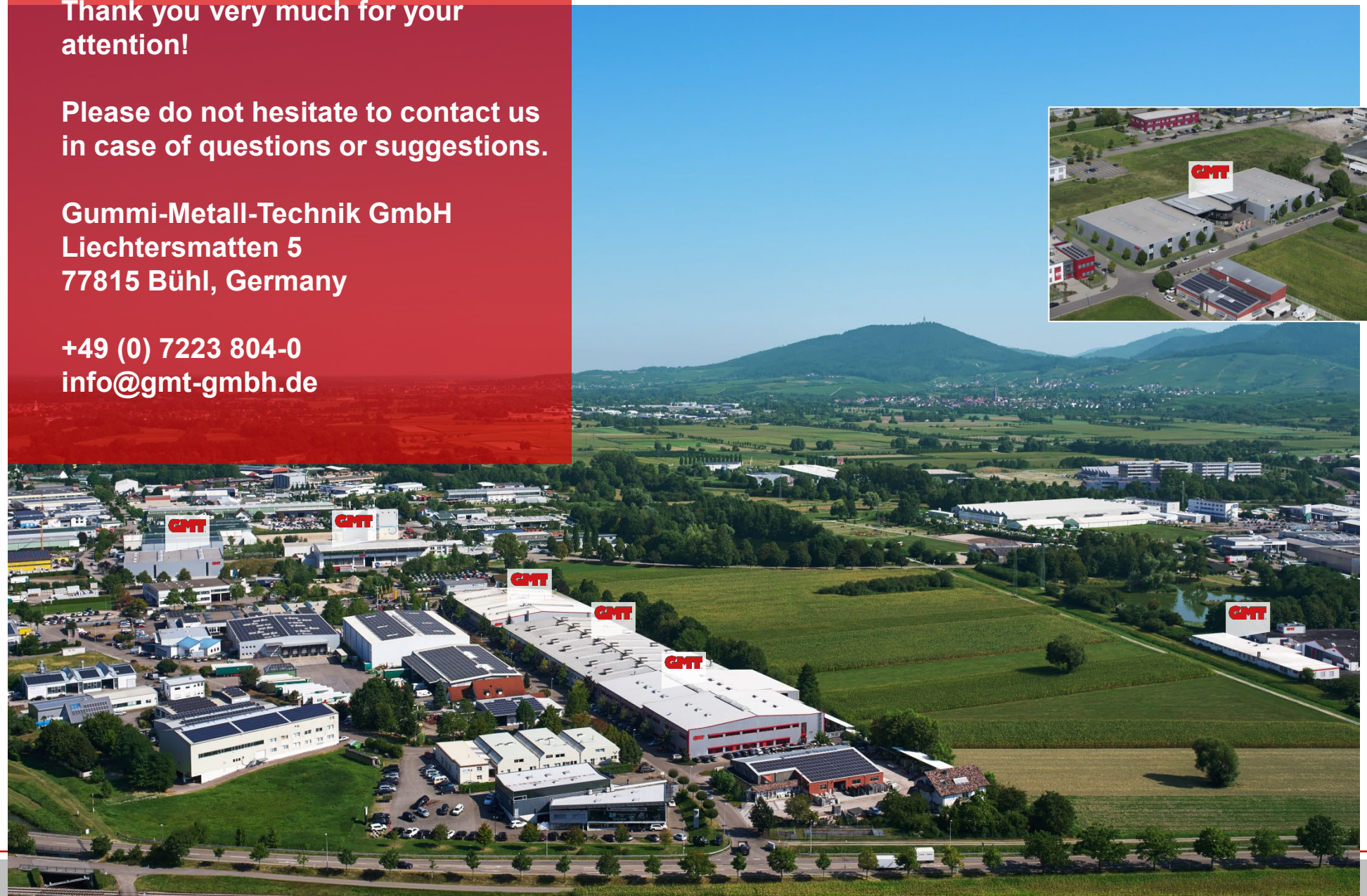


**Thank you very much for your attention!**

**Please do not hesitate to contact us in case of questions or suggestions.**

**Gummi-Metall-Technik GmbH**
**Liechtersmatten 5**
**77815 Bühl, Germany**

**+49 (0) 7223 804-0**
**info@gmt-gmbh.de**



Gummi-Metall-Technik GmbH

# Wheel Noise Absorber

# Agenda

Wheel Noise Absorber (WNA)

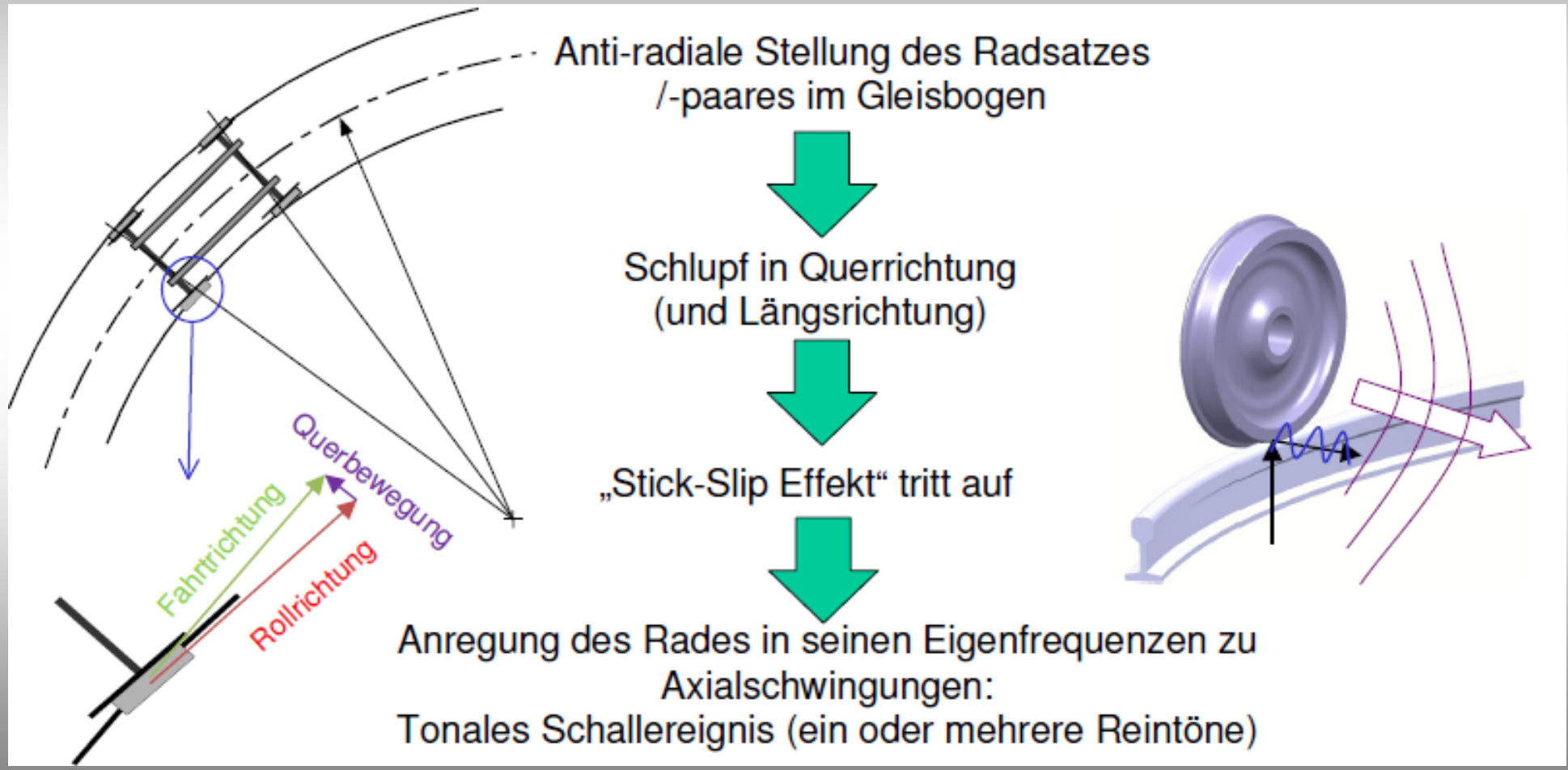
- Requirements & Solutions
- Working principle of the WNA
- Built-in & Application examples

# 1. Requirements (for Railway traffic)

- The requirements from Regulations & Laws, because of scope and feasibility, do have a strong effect on the contruction of train wheels.

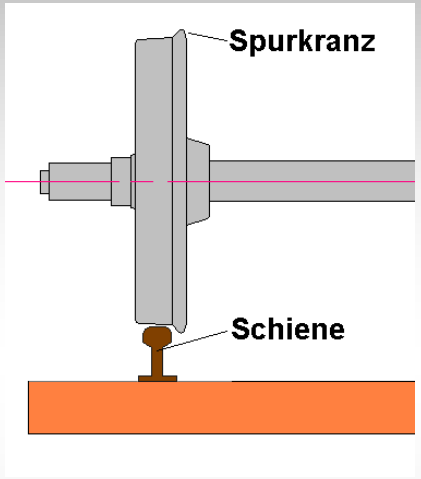
  - **EN 13979-1**: Accoustic evaluation of the wheel
  - **TSI Noise** & **TSI HGV**: Noise emmision from new trains

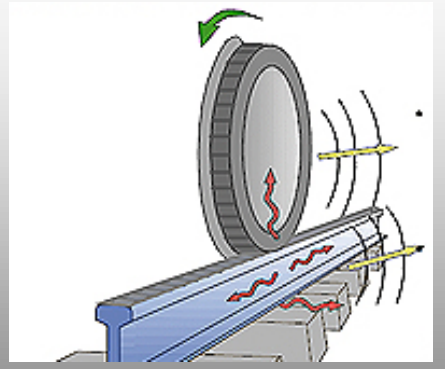
# 1.1 Problem: Noise Development



# 1.1 Problem: Influencing factors in case of curve squeek

- Bow Radius
- Speed
- Approach angle
  (misalignment of the inside wheel)
- Friction conditions in the wheel/rail contact
- Axial vibration behaviour of the wheel

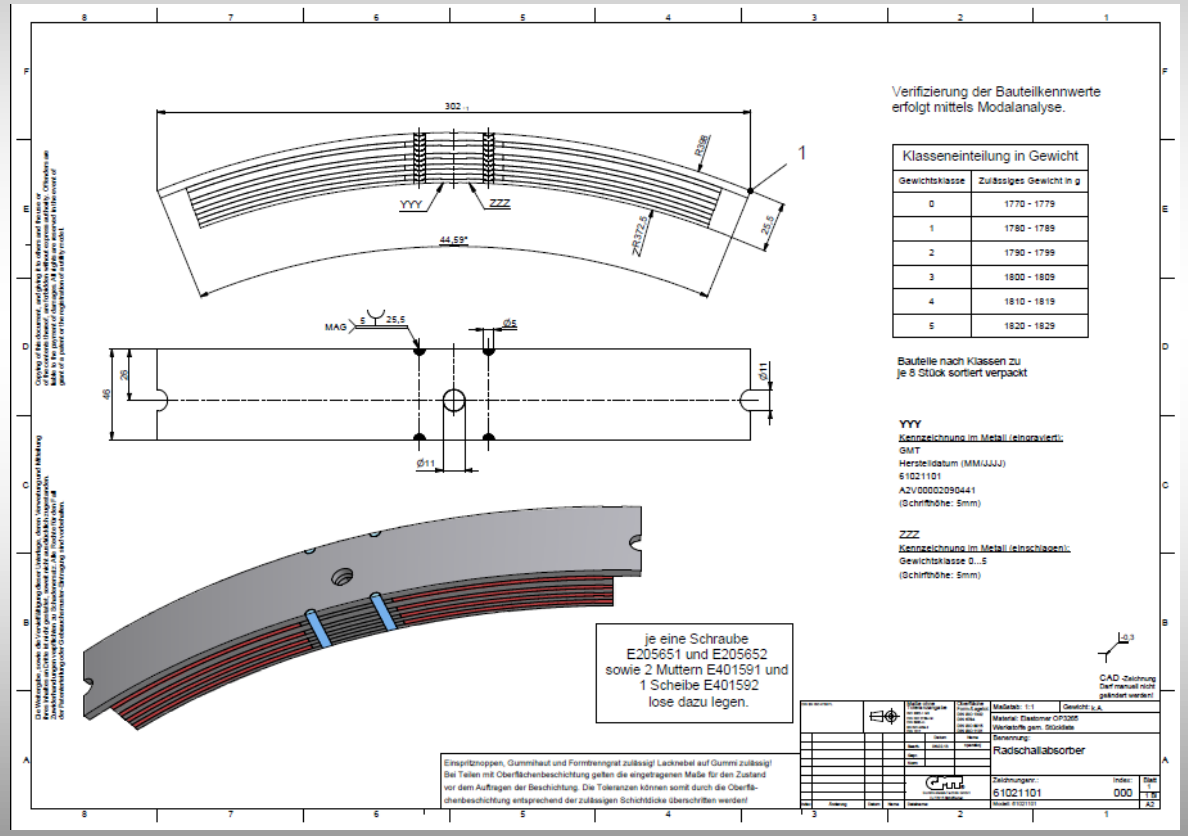


# 1.2 Solution: Wheel Noise Absorber

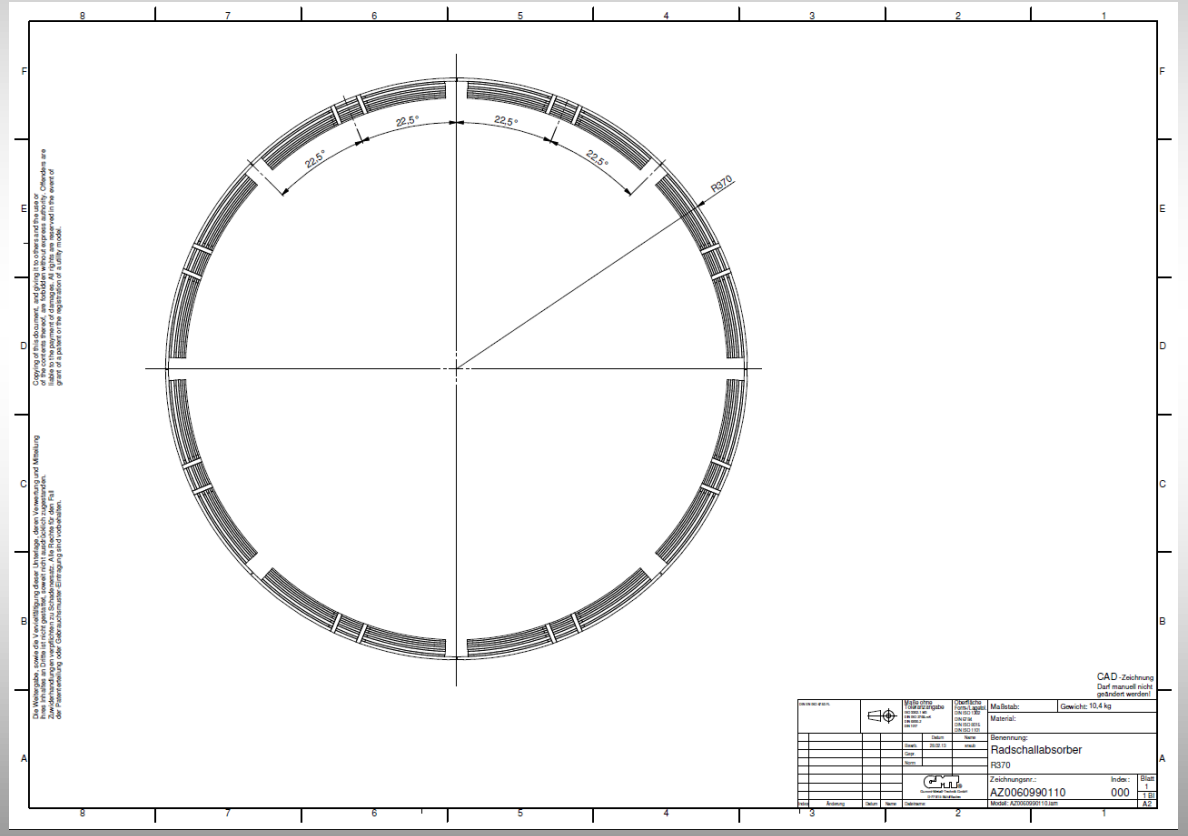
- By applying a wheel noise absorber on the wheel rim, it will be possible to reduce the rolling noise up to 8 dB (A).

# 1.2 Solution: Wheel Noise Absorber (WNA)




GMT-Drawing (Wheel Noise Absorber)

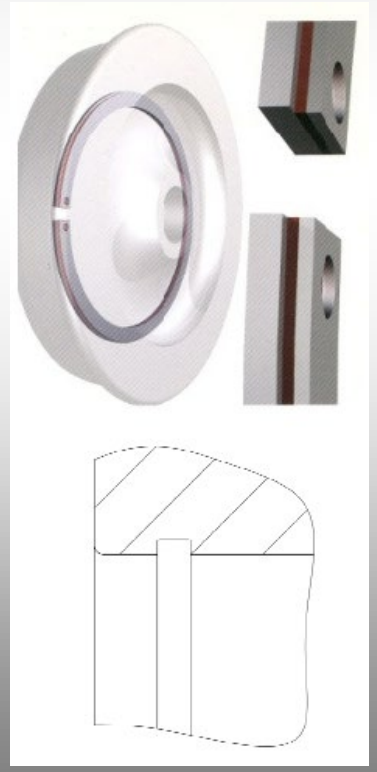
# 1.2 Solution: Radial Wheel Noise Absorbers

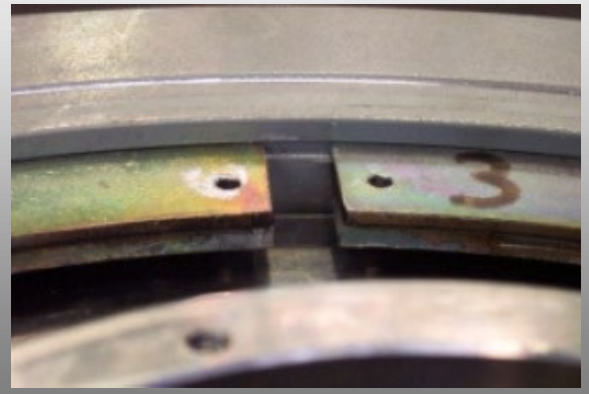



Built-in situation of the GMT-Radial Wheel Noise Absorbers

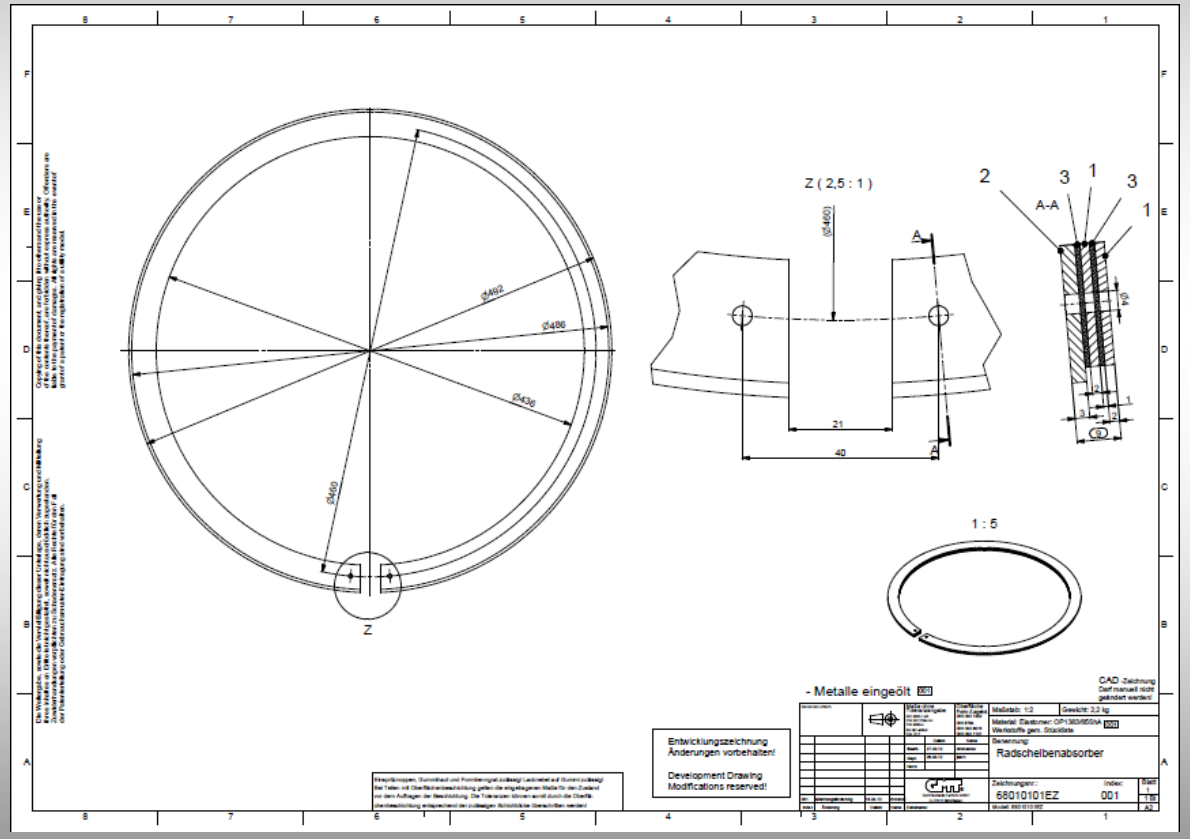
# 1.2 Solution: Axial Wheel Noise Absorber

- By applying an axial absorber on the wheel disc, it is possible to almost completely suppress squeeking noises in tight bends.





# 1.2 Solution: Axial Wheel Noise Absorber



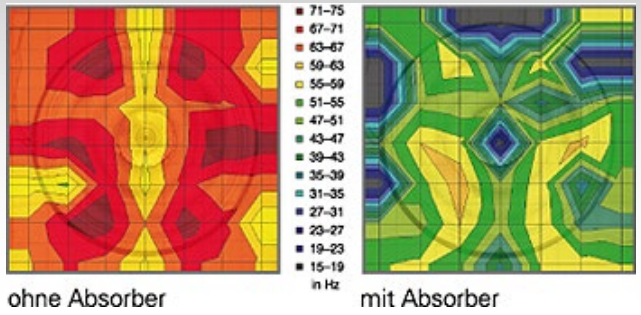

GMT-Drawing (Wheel disc absorber)

# 2. Funktional principle of the wheel noise absorber (WNA)

- Wheel noise absorbers will be tuned on the eigen frequencies of the wheel. These are built-up from metal plates separated by elastomer layers.

- The plates can move in two directions, radial and axial. As a result the damper will work in two directions.

- The effect of wheel noise absorbers is usually based on the conversion of vibration energy into heat energy and/ or on the reduction of wheel vibrations through the absorber effect.




ohne Absorber mit Absorber

# 3. Built-in & Application examples

WNA at the wheel rim

Velaro Eurostar – Siemens AG

# 3. Built-in & Application examples

WNA at the wheel disc

Avenio – Siemens AG

Gummi-Metall-Technik GmbH

Thanks for you attention!