

#### THE HALL-FAMILY

HALL has proved to be convincing in many applications and has proved itself. Meanwhile various designs of HALL with partially significant different requirements and properties are in use, further designs are under development at present.



# TRELLEBORG

Using advanced polymer technology, Trelleborg's Antivibration Solutions (AVS) operation specializes in the field of rubber-to-metal bonding for the removal of unwanted noise and vibration. Part of the Industrial Solutions business area of Trelleborg Group, we harness over 100 years of experience to solve a wide range of application and environmental challenges in sectors including rail, marine, industrial and off highway. Focused on isolation, attenuation and suspension solutions of unrivalled quality and reliability, we have a reputation for high quality, outstanding performance and long service life. Our commitment and expert polymer technologies optimize comfort, health and safety while creating maximum business value through improved longevity, productivity and cost effectiveness.

[WWW.TRELLEBORG.COM/ANTIVIBRATION-SOLUTIONS](http://WWW.TRELLEBORG.COM/ANTIVIBRATION-SOLUTIONS)



twitter: TrelleborgAVS  
linkedin.com/company/8877546

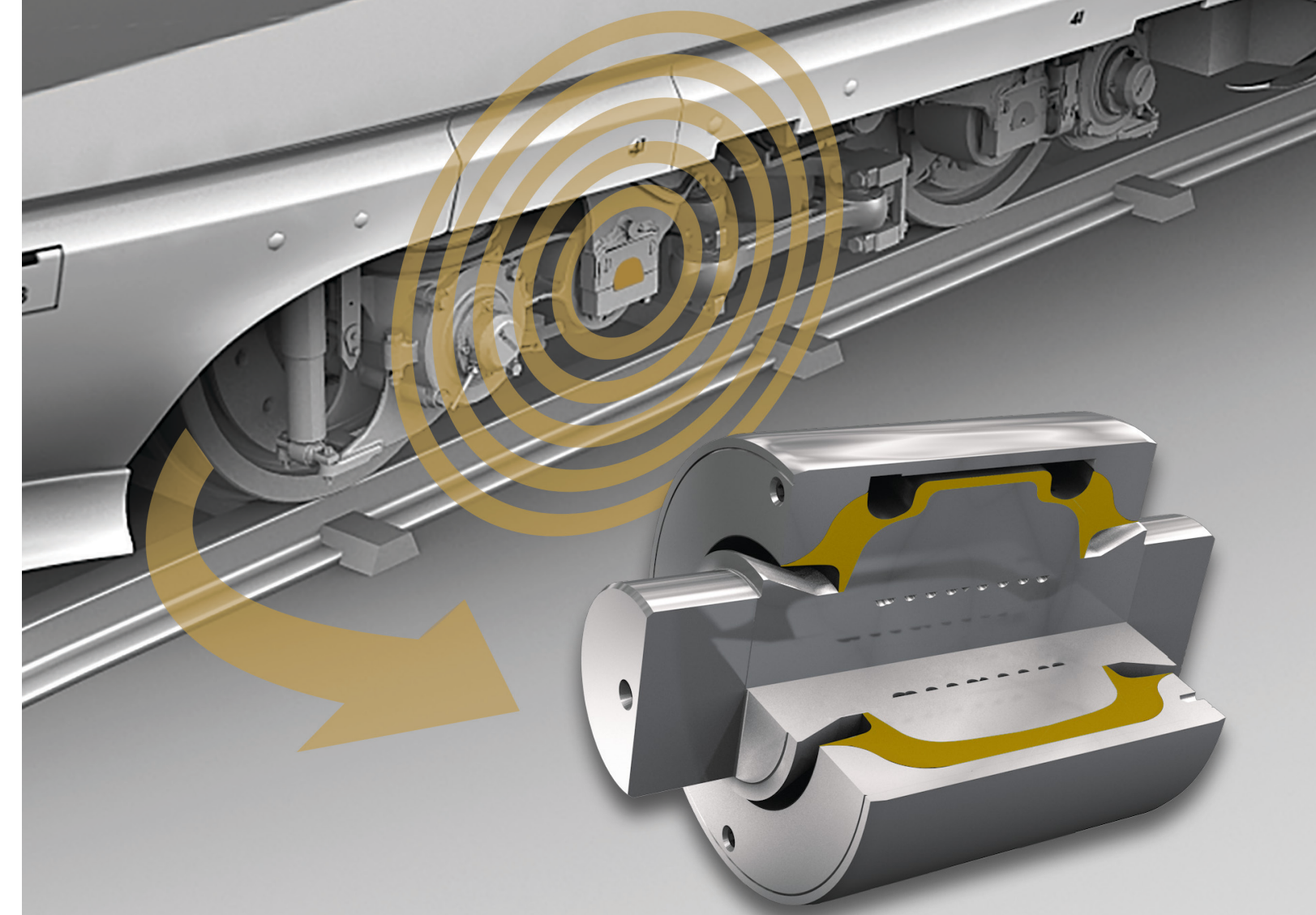


Trelleborg Antivibration Solutions  
Email: [antivibration@trelleborg.com](mailto:antivibration@trelleborg.com)

TRELLEBORG ANTIVIBRATION SOLUTIONS



# Hydraulic axle guide bearing



Innovation for the axle guide linkage

# Hydraulic Axle Bearing Guide

## INNOVATION FOR THE AXLE GUIDE LINKAGE

The hydraulic axle guide bearing (HALL) is an innovation for the axle guide linkage. It combines the seemingly disparate requirements of longitudinal stiffness in a novel solution.

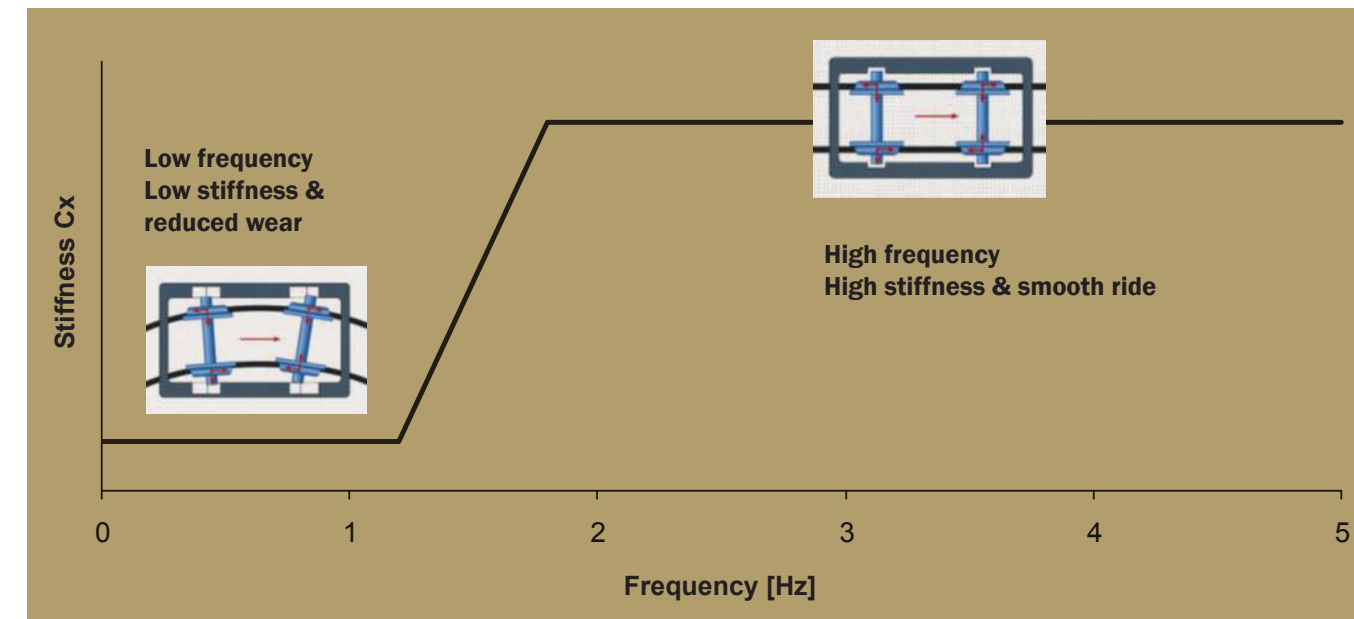
With HALL, it is possible for Trelleborg Antivibrations Solutions to combine the low longitudinal stiffness for curves with the high longitudinal stiffness for movement in a straight line in a single component. The hydraulics integrated in the HALL leads to frequency dependent changes of the longitudinal stiffness. Thereby the hydraulic axle guide bearing can be designed in such a way that a low stiffness is automatically available during steady adjusting movements when entering or exiting a curve. The bearing stiffness increases during dynamic excitation at higher speeds. As the HALL fits in the existing space for conventional axle guide bearing, it can be integrated in new as well as existing vehicles without structural modifications to the bogie.

## ADVANTAGES

- Frequency dependent stiffness
- Wide range for selecting stiffness and switching frequency
- Greater stability reserves for higher speeds
- Waiving of yaw damper possible
- Exchangeability with conventional bearings (Retro-Fit-Suitability)
- Immediately usable - without modifications to vehicles
- Reduction of wear to wheel and rail
- Protection of vehicle and platform
- Reduction of track charges (depending on country where used)
- Conservation of energy due to lesser friction and thereby reduction of life cycle costs

## IDEAL STIFFNESS PROFILE

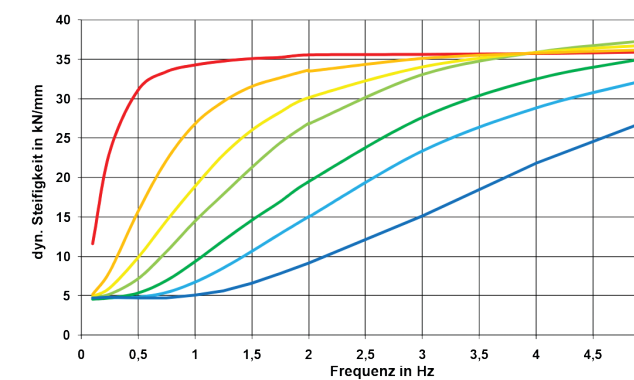
An ideal axle guide bearing is flexible at low loading speeds (curving) and thereby enables the positioning of the wheel set in the curve. At the same time, it is comparatively stiff at higher loading speeds to ensure a safe run of the bogie on the rails.



## STIFFNESS PROFILE OF HALL

Conventional bearings necessitate a compromise between these two target variables.

However HALL achieves the required combination of properties exactly and thereby resolves the conflict of objectives!



## PROPERTIES

Conventional bearings possess a longitudinal stiffness in the range of approx. 10-40 kN/mm. HALL provides longitudinal stiffness of only 2.5 to 7.5 kN/mm in the field of slow deformations. This longitudinal stiffness increases dramatically during faster movements above 1.5 to 3 Hz at 25 to 70 kN/mm.

The simultaneous lowering of static stiffness and increase of dynamic stiffness provides a better curvature and additionally an increase of the stability reserve of the bogie, which can be used for increasing the velocity without further steps at the vehicle.

A further possibility for taking advantage of this stiffness and the increase in stability exists in the elimination of an existing

yaw damper. As the yaw damper is often the dominating mechanical path of vibration between the bogie and the body, it leads to a significant enhancement of comfort via lowering of the sound level in the body.

The further stiffness of HALL corresponds to the conventional bearings and is not dependent of frequency.

The stiffness and the range in which the change of stiffness in the longitudinal direction occurs can be customised in a wide range for individual requirements of the project through structural variants of HALL.

## REDUCTION OF WEAR

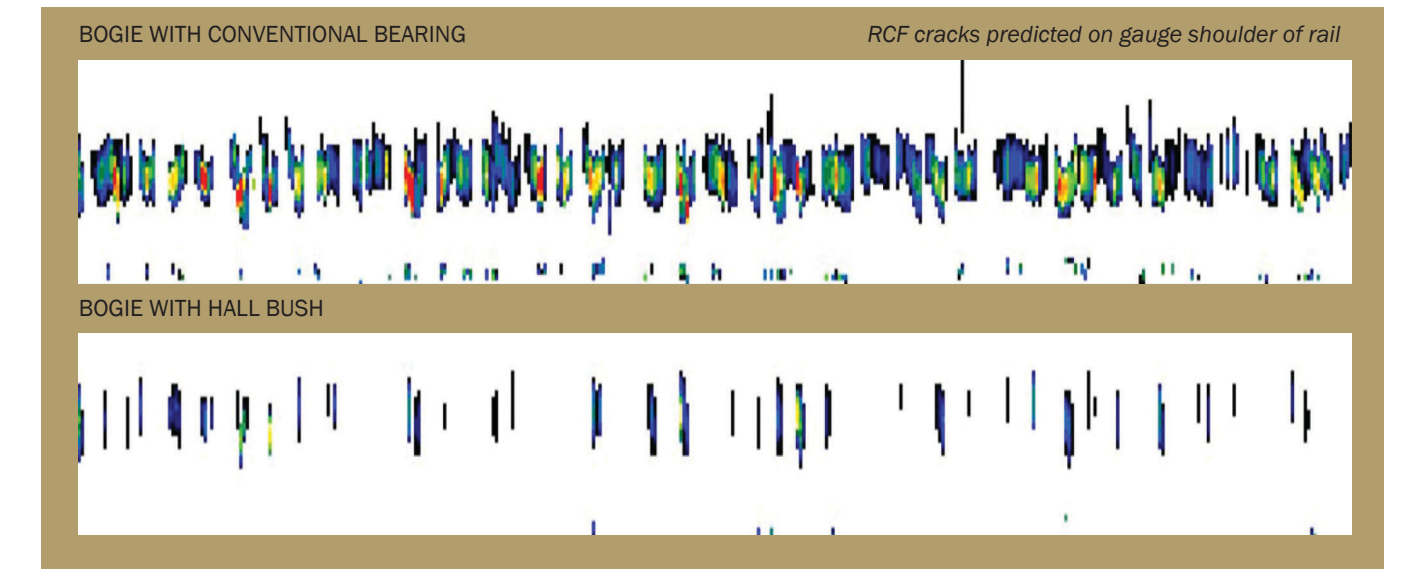
The maintenance costs for the infrastructure constitute a significant part of the overall costs of the railway operations. Increasing axle loads, higher speeds and the greater axle control stiffness required for that led to a significant increase of this cost in the previous years.

In the United Kingdom as well as in Sweden intensive studies on the relationships between the vehicle properties and the wear of wheel and rail were conducted over the years which led to new fee models for the track access. These models reward flexible axle control with lower fees.

Measurements in the vehicles secured with HALL in the United Kingdom and Switzerland show a significant regression of wear and the rolling contact fatigue (RCF) in wheel and rail by using HALL.



## COMPUTER SIMULATION OF WEAR, CURVE WITH RADIUS R = 1500m

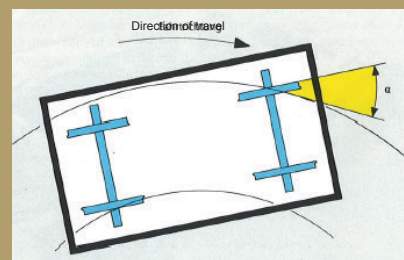


Source: NetworkRail

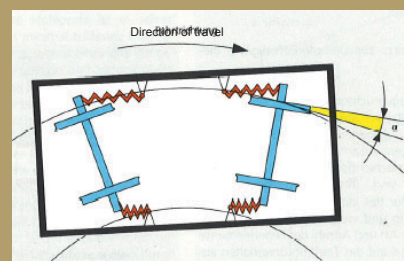
## CONSERVATION OF ENERGY

The reduction of wear generating friction between wheel and rail also implies a lowering of traction required in curves and thereby a significant saving of energy by using HALL. The amount of savings is determined by the characteristics of the routes and the number and radii of the curves travelled.

## Solution for track friendly in curves: self steering wheel sets with soft fixture of wheel sets



- Reduction of angle of attack between wheel and track



- Reduced forces between rail and wheel

- Reduced wear between rail and wheel

- Reduced noise

