Harmonisation of Running Behaviour and noise measurement sites

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Abstract

Measurement sites are autonomous local installations which provide information about the running behaviour (e.g. forces, loads, wheel out-of-roundness, etc.) and the noise emission of a passing train. The information about the physical effects of the interaction between wheel and rail is measured by sensors in the track.Commercial benefits for the railway system is given for Railway undertakers and Infrastructure managers. The difference between the payload stipulated in the transport contract and the real load becomes transparent. Improved wheel condition leads to a reduction in infrastructure deterioration (e.g. damage to track and bridges).
The track access fee can be automatically evaluated including adjustments for overloading, track-friendly and low noise vehicles.Categorization of interoperable measurement sites is the key issue in the Project HRMS.

Commercial benefits for the railway system

Railway undertakers: The difference between the payload stipulated in the transport contract and the real load becomes transparent.

Infrastructure managers: Improved wheel condition leads to a reduction in infrastructure deterioration
(e.g. damage to track and bridges).
The track access fee can be automatically evaluated including adjustments for overloading, track-friendly and low noise vehicles.

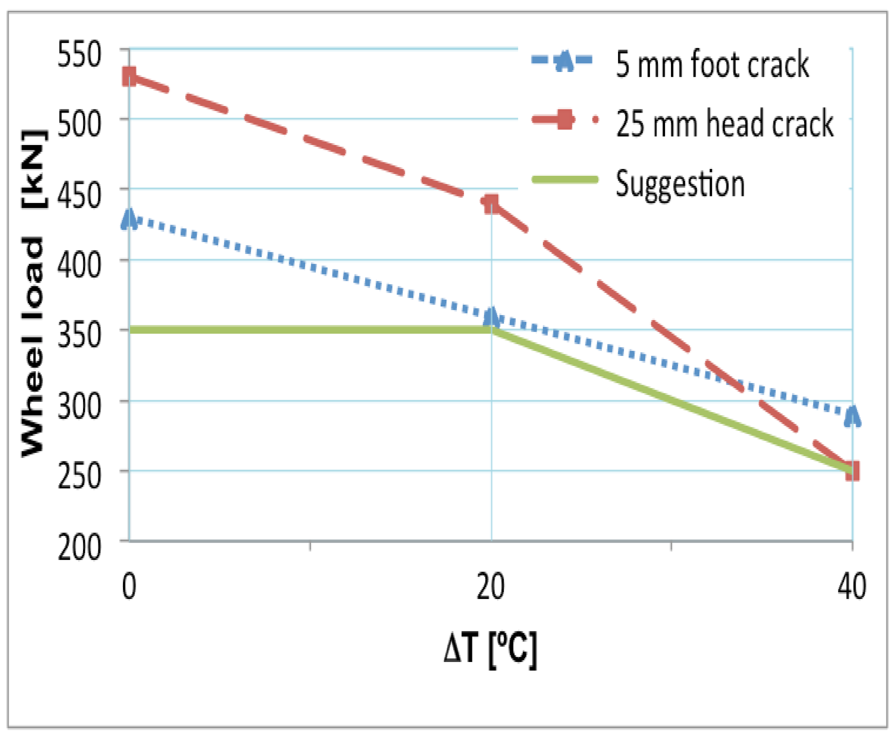
Rolling stock manager: The detection of wheel defects extends the service life of vehicle components and reduces the LCC. Unexpected failure which can bring a vehicle to a standstill can be avoided. The maintenance process can be improved by using condition-based maintenance instead of periodic maintenance. Manual inspections (measuring wheel roundness) can be replaced by automatic axle-load checkpoint measurements. When monitoring a special fleet of rolling stock it is possible to observe damage trends and tendencies. Noise emission can be used as early warning system for vehicle defects

Categorization of interoperable measurement sites:
Instability risk in straight line. Derailment risk, rail and wheel set loading (stress) in curves lateral wheel forces
Vertical wheel forces (steady-state and dynamic), overloading

Measurement sites are able to give exact results. These results are however valuable only if they can be linked to the right vehicle, axle or wheel and are properly transmitted and exchanged between the right actors of the system.´Today several countries are working with "Vehicle identification systems" on a national base. The aim for this is to define needs and to harmonize this on a European level.

Some European Railways use different measurement and assessment concepts in the measurements of wheel forces and corresponding quantities. Many of these systems were developed to meet local or national demands. The results from these systems are partly not comparable. The relevant existing standards do not meet all the needs of interoperability. In an on-going trail Austria and Switzerland are already exchanging data pro vided by measurement sites just before the border to inform the infrastructure owner of the other country in what shape the trains are before passing on to the other country.

Key letters of prefix		Measurement targets
Wheel load Q, Lateral wheel force Y, Longitudinal wheel force T, Derailment E	Q Y T E	Forces, derailment coefficient
Wheel Flats, Out-of-round wheels U	F U	Boundary conditions of the force effects
Noise, Vibration	N V	Effects
Bending, shearing, longitudinal stresses S	S	Stresses
Contact forces, Creep waves, Cracks	C C C	Boundary conditions of the contact effects
Buckling of rail	B	Effects
Blocked brakes F	F	Temperature of the brake shoes
Hot box detection	H	Temperature of the axle bearing
Detection	O	Detection
System	A	System
Hot Disk brake detection	D	Temperature of the brake discs

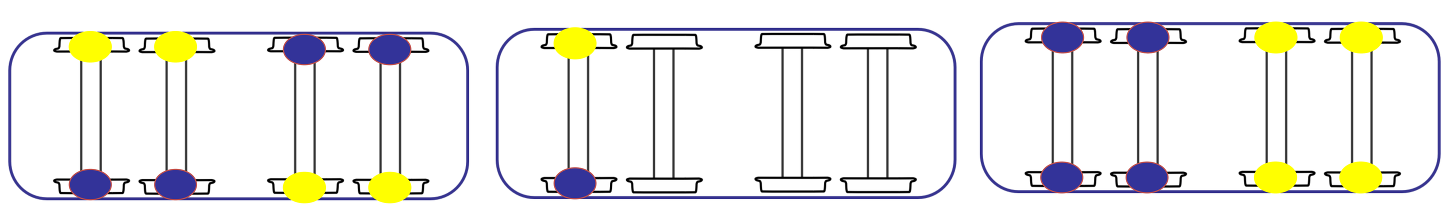


Proposed alarm limits for vertical peak loads, and corresponding critical loads for selected lengths of foot and head cracks. Here $\Delta T = T_0 - T$ where T is the current and T_0 the stress free temperature.

HRMS WP2 has developed a structured limit assessment approach that sets out from established numerical models validated in full-scale field test. Influencing parameters are analysed and "bad case scenarios" are defined. Limit values on measured parameters are then suggested and operational consequences may be assessed

Limit values related to skew loading to prevent flange climbing

Here is the maximum axle load imbalance (maximum quotient between forces on left/right and right/left wheels for all axles of a wagon) and the longitudinal imbalance (largest of the quotient between sum of forces on front/rear or rear/front bogie of a wagon). Further k = –0.25 and m = 2.05.
In addition a maintenance limit for skew imbalance is proposed as , and a stop limit as where I_d is the largest quotient between forces on diagonally mounted wheels.



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