

BOMBARDIER

CHALMERS



Introduction to the rolling stock aspects on ground vibration and the simulation of vehicle influence

The RIVAS Final Conference
Brussels November 21, 2013

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Introduction



The vehicle sub-system



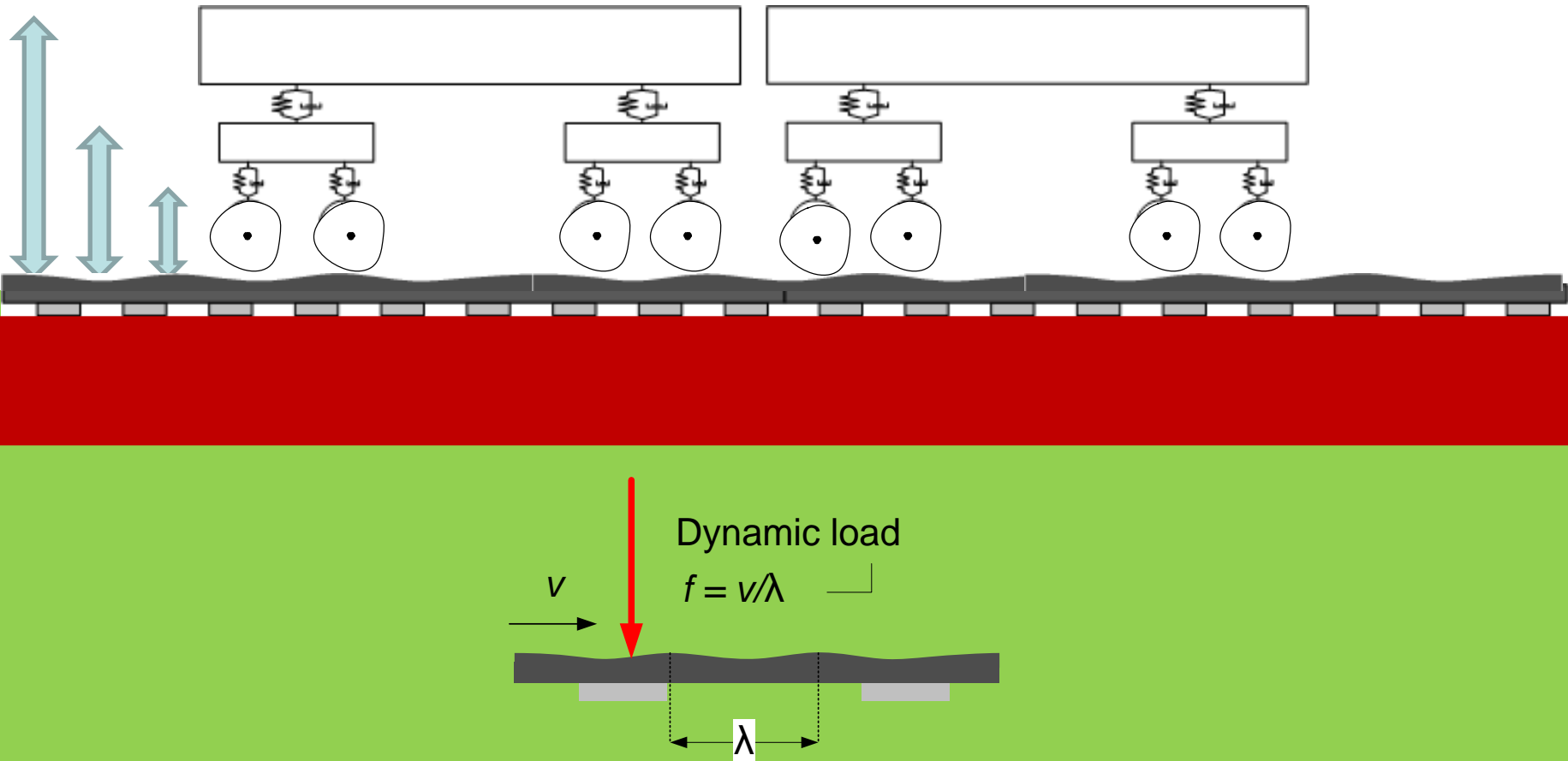
Vehicle categories

Locomotives

Powered
coaches

Trailer coaches and
freight wagons

Relevant vehicle parameters

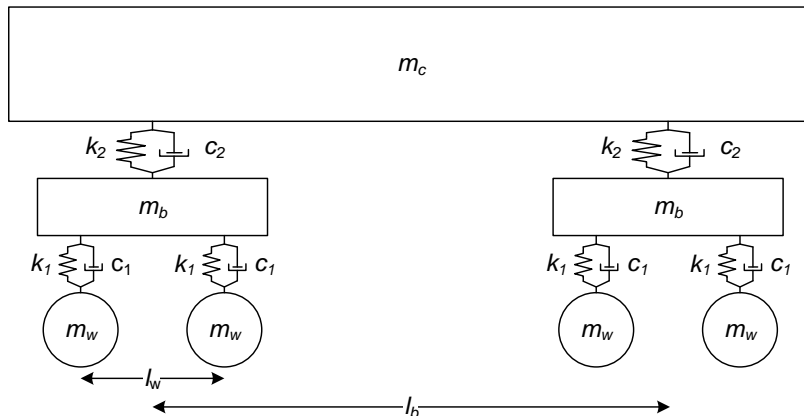
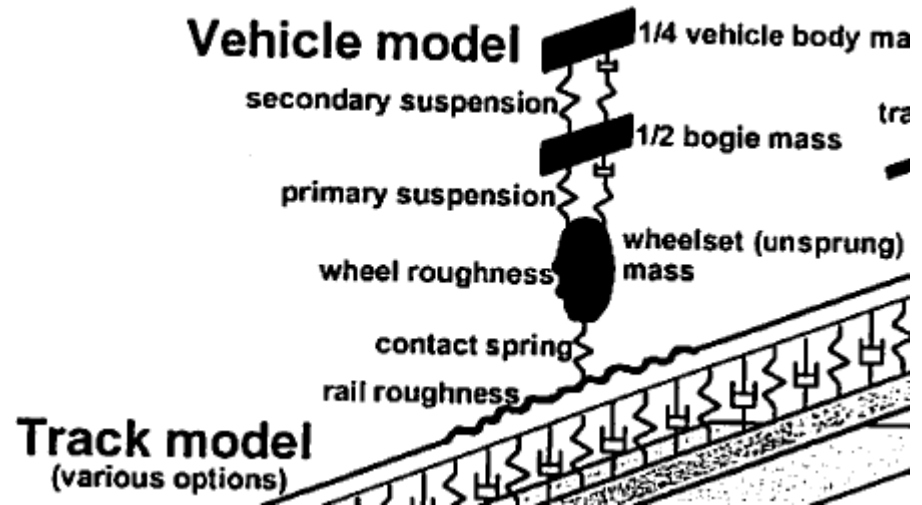


Previous work



- RENVIB II

- 1/4 vehicle model
- Primary suspension and unsprung mass
- Out-of-round wheels



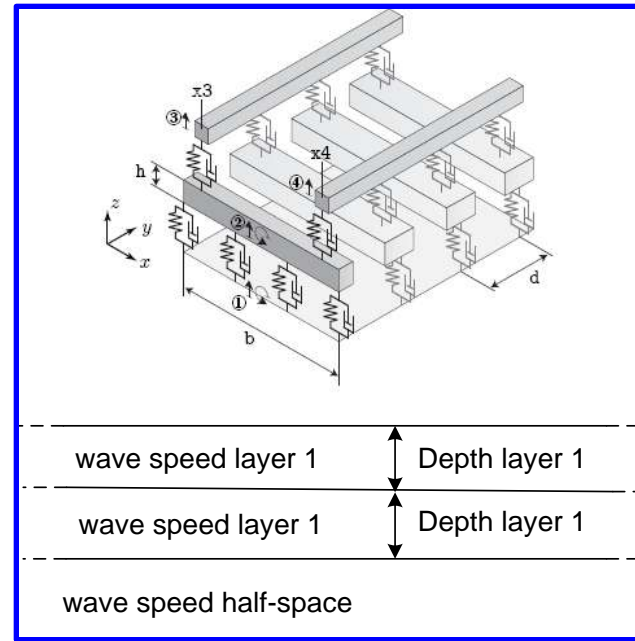
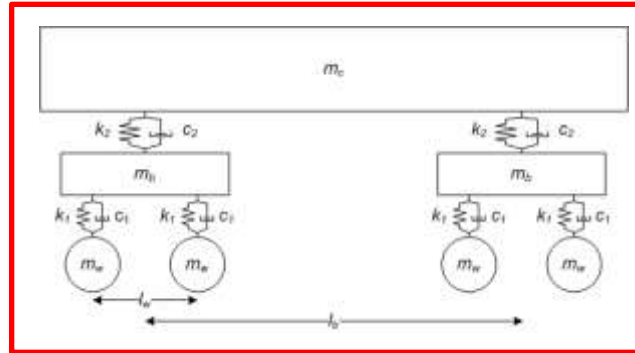
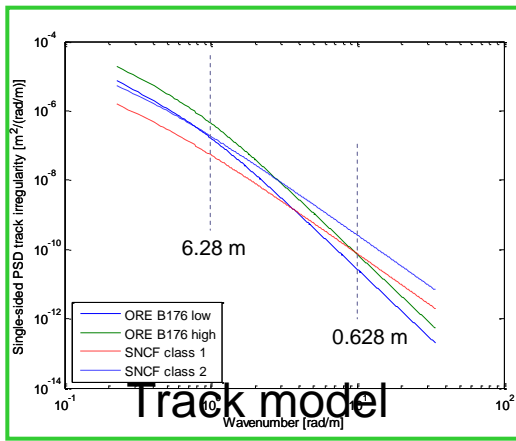
- CHARMEC

- A full vehicle model for vertical and pitch motion
- Primary susp, vehicle geometry, unsprung mass
- Extensive parameter study

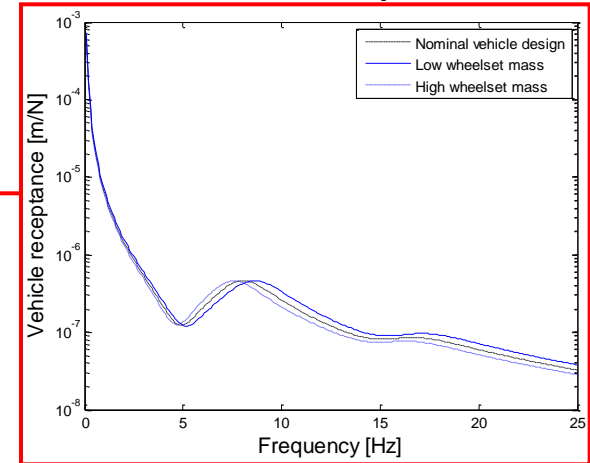
Simulations



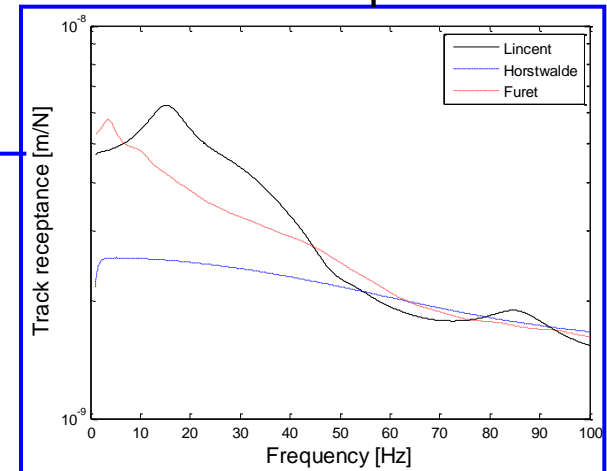
Excitation from rail irregularities



Vehicle receptance



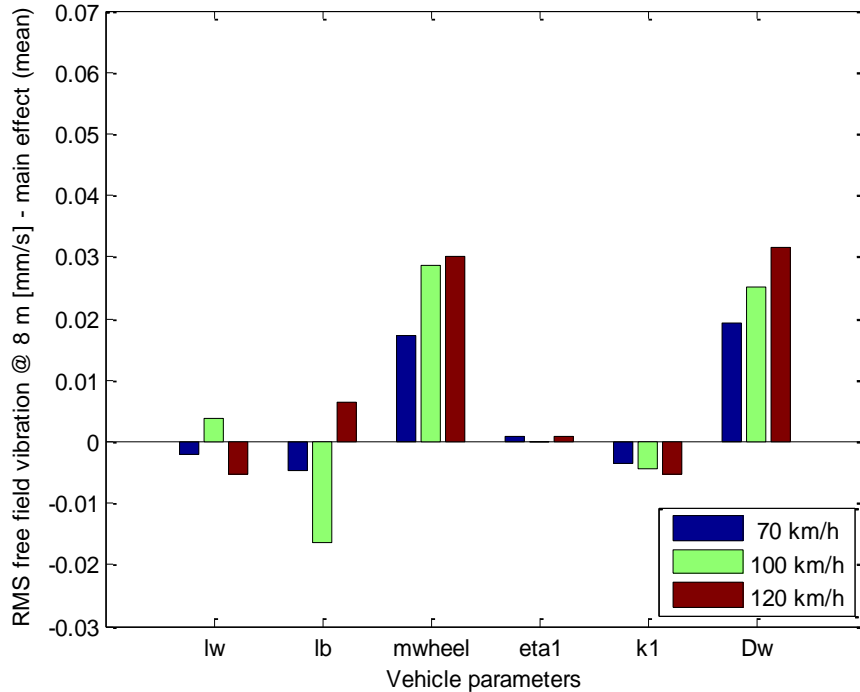
Track receptance



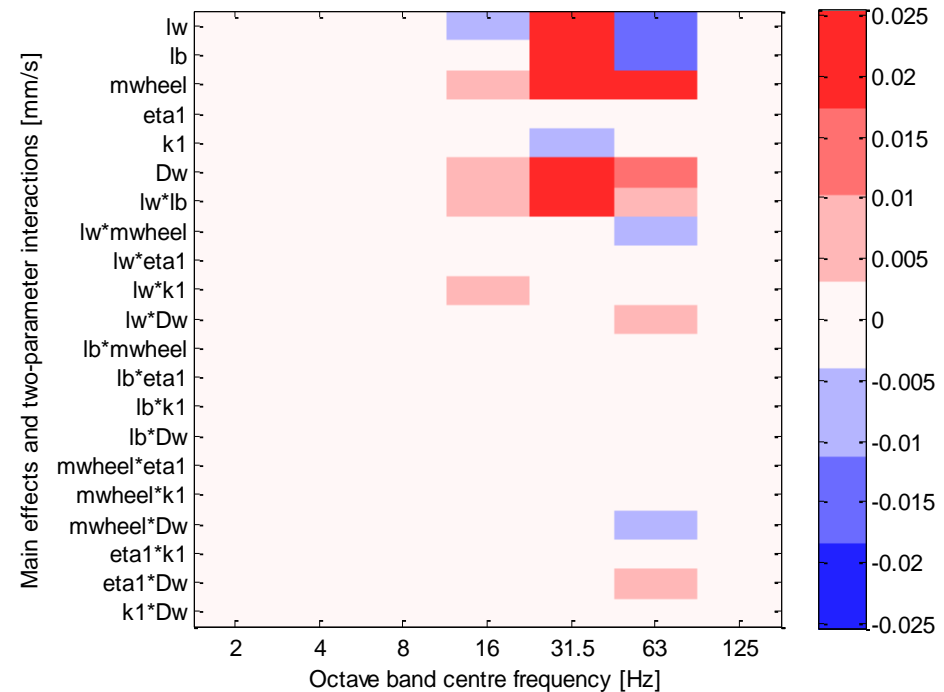
Design influence



Frequency interval 1 – 200 Hz



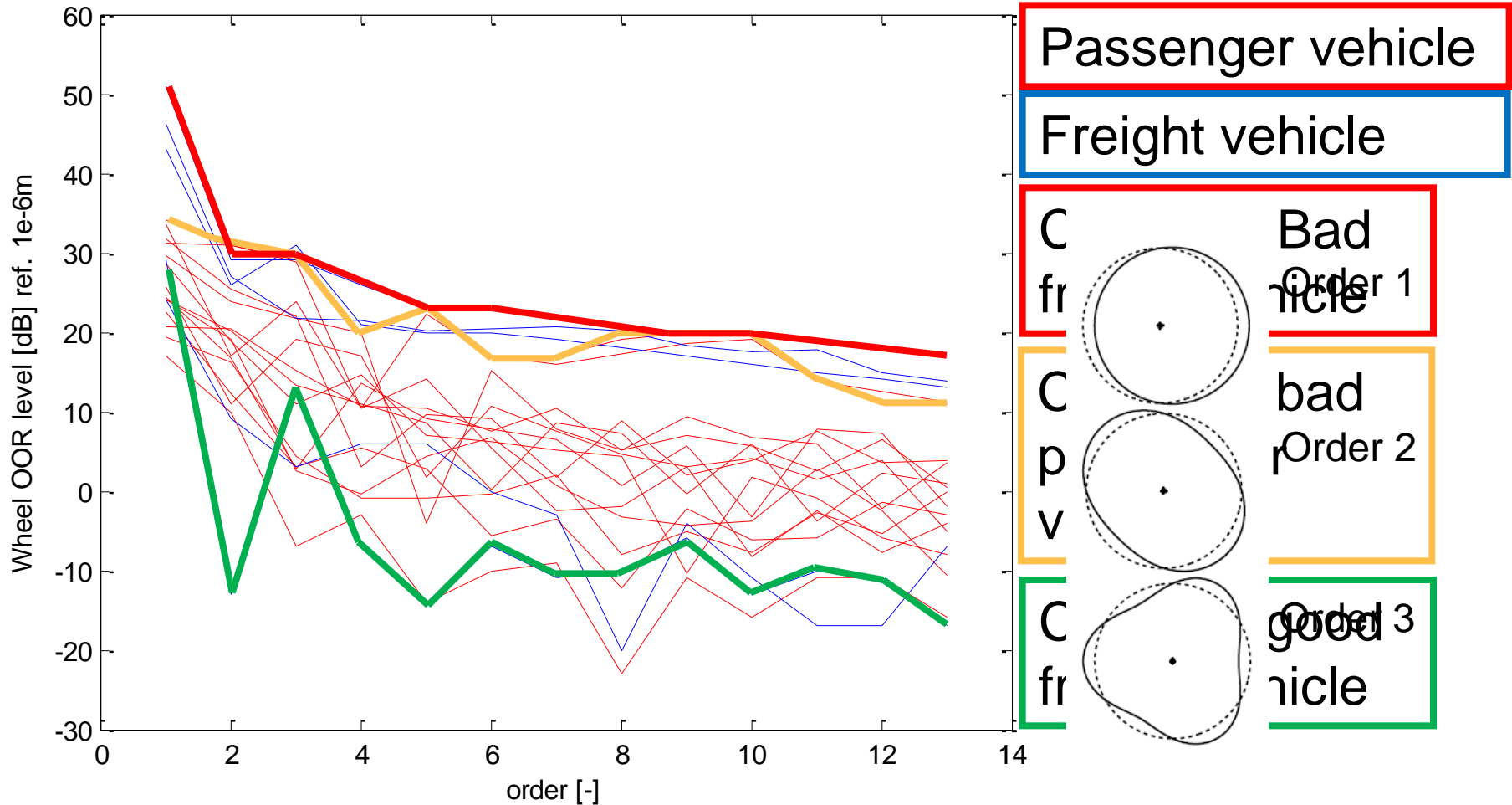
vehicle speed 100 km/h



Unsprung mass decrease from 1500 kg to 2000 kg give ~2 dB reduction

Measured data of OOR

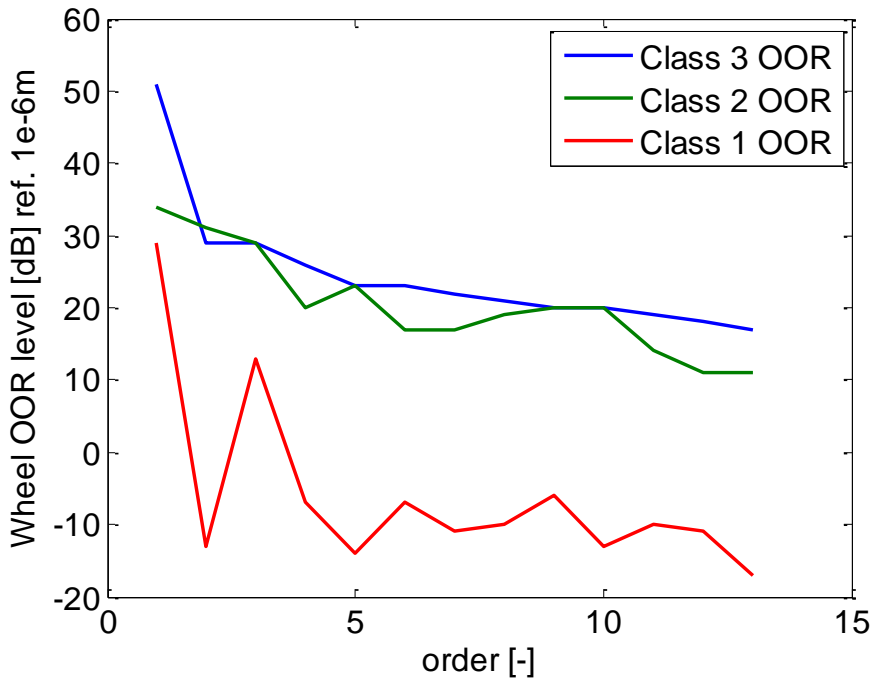
- Data measured by A. Johansson, CHARMEC



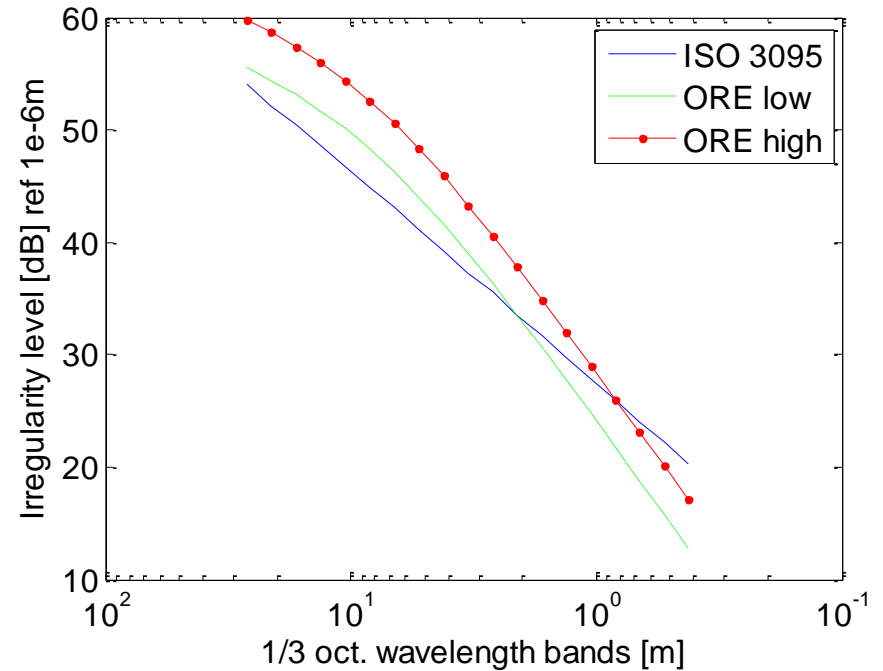
Input to simulations



Wheel

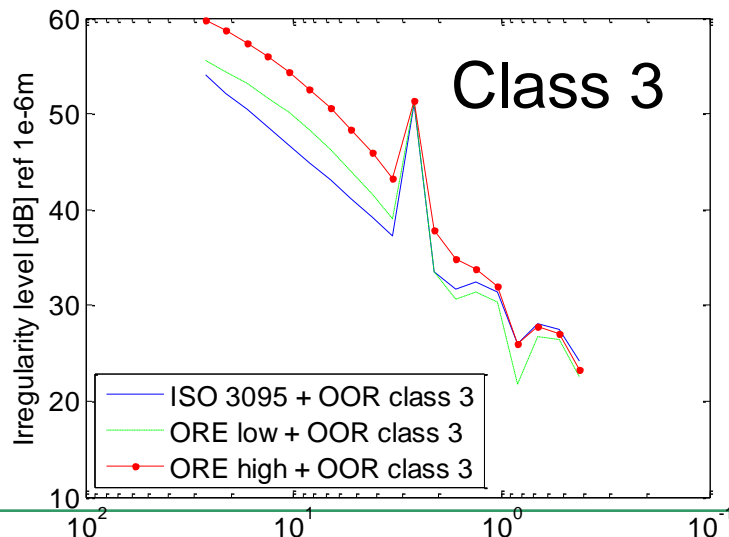
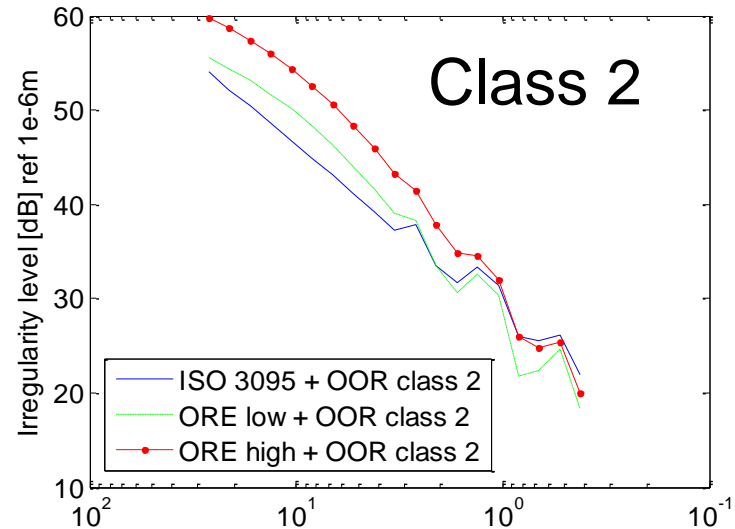
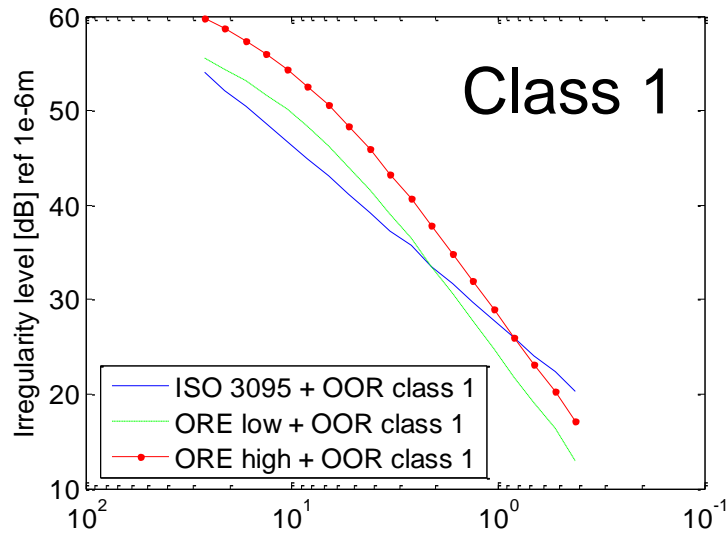


Rail



Combined Wheel – rail irregularity spectra

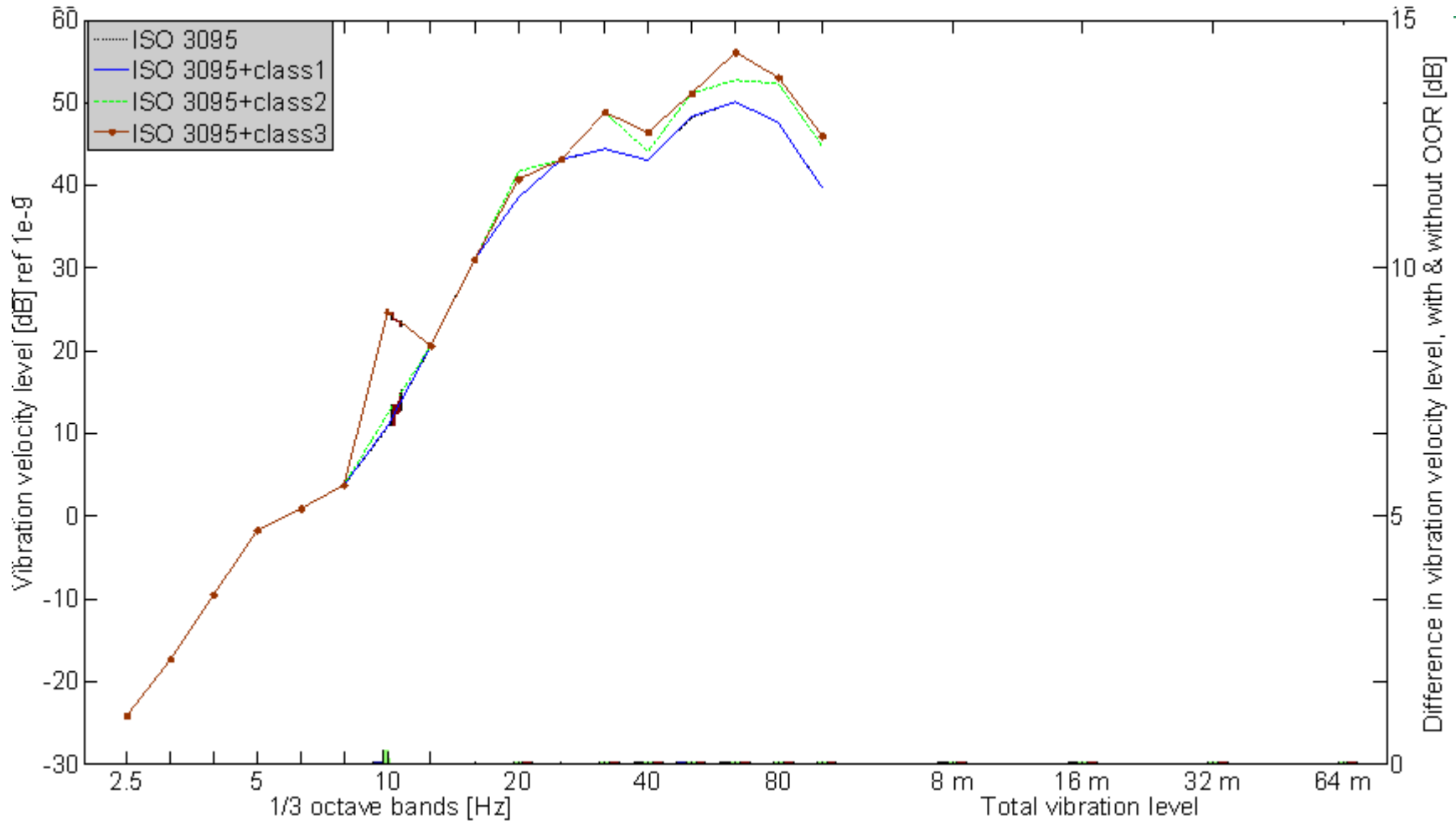
1/3 octave wavelength bands



Primary suspension
stiffness:
4 & 7 kN/mm

Unsprung mass:
1425 & 2850 Kg

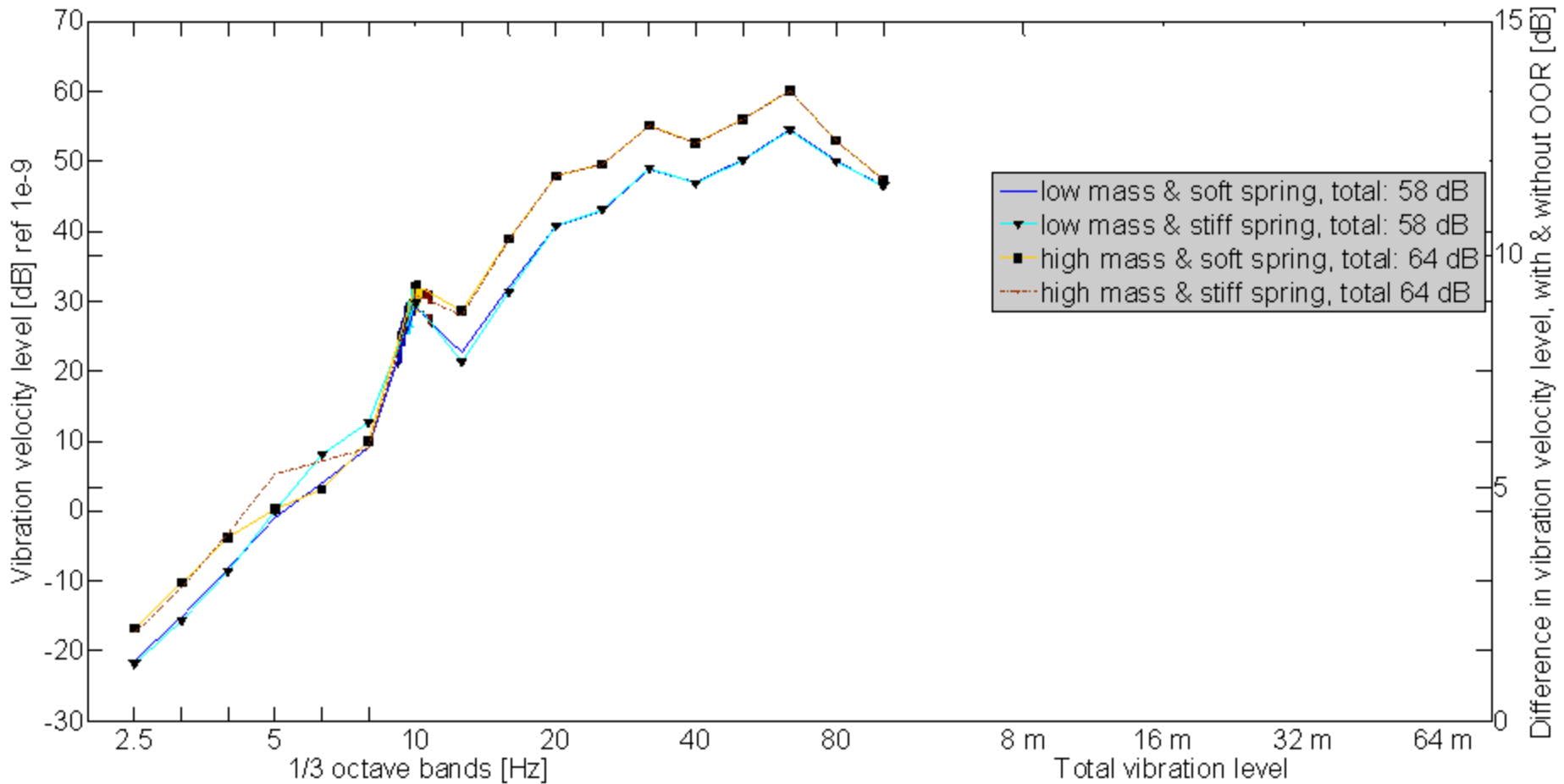
Ground vibration spectrum 8 m from the track 100 km/h, OOR class 1-3



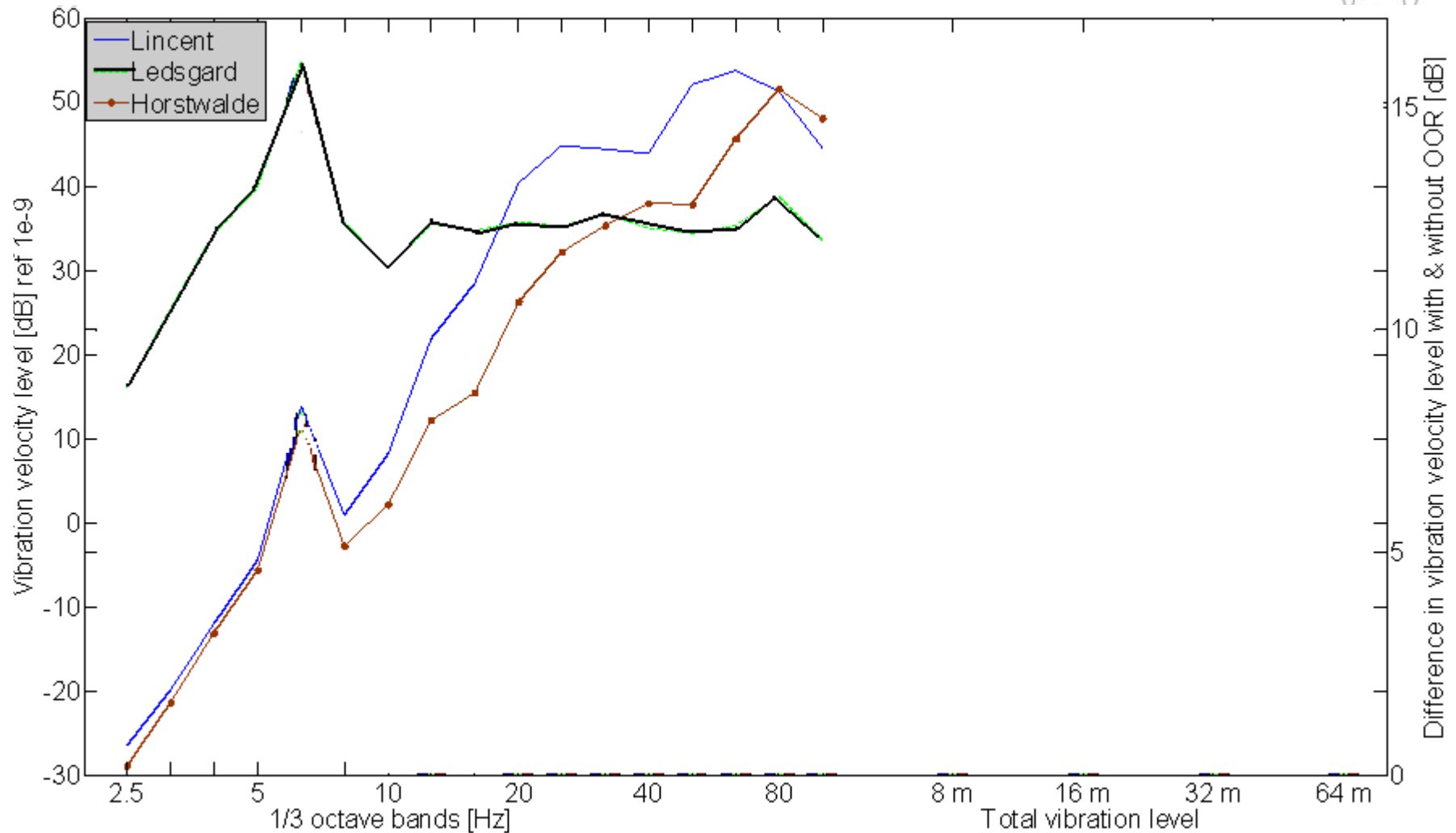
Ground vibration spectrum 8 m from the track, 100 km/h



- Influence from OOR class 3 and vehicle design. Site: Lincet



Ground vibration spectrum 8 m from the track, 70 km/h



Conclusions



- RIVAS has studied the vehicle influence on ground vibration for a range of track and soil properties
- Existing simulation tools have been used to study the combined influence of vehicle design, train speed, wheel out-of-roundness and track irregularities
- The studies have identified the unsprung mass to be the single most important design parameter and the wheel out-of-roundness to be an important excitation mechanism
- Soil properties, track quality, wheel condition of the vehicle fleet, building properties need to be considered.