Vehicle influence on interior and exterior noise

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Main noise sources at 250 km/h

- Aerodynamic (flow) noise
- Rolling noise
Rolling noise reduction

- Smooth running surfaces on rails and wheels
- Typically the track contribution exceeds vehicle contribution
- Vehicle based measures
  - Low noise wheel design
  - Wheel noise absorbers

Not investigated in the Gröna Tåget programme
Aerodynamic noise reduction

- Smooth surfaces including closure of inter-car gaps
- Careful design of train front
- Careful design and integration of pantograph and other roof equipment
- **Bogie skirts**, in particular on leading bogie
Source identification - mic array

- “Acoustic camera”
- 96 microphones

- Pantograph
- Leading bogie
- Wheel-rail
Results from mic array

275 km/h (w and w/o bogie skirt on leading bogie)

-5 dB
Bogie skirt

- Reduced aerodynamic noise from leading bogie cut-out
- Shielding of bogie generated noise
- Difficult to put bogie skirts on existing trains due to gauge limits – an option only for new train designs
- Considerable noise reduction for exterior noise - no interior noise increase noticed
Interior noise

- Identification and ranking of structure-borne noise transmission paths

- Influence of
  - Soft bushings
  - Mechatronic bogie
  - Bogie skirts
  - PM traction motor
Transmission path analysis

Figure 5.2.3: Analysis of the transmission behaviour of the bogie

- Dominating paths
  - Yaw damper
  - Vertical damper
Influence of PM motor

- Traction motor noise is relevant only for interior noise
- Negligible contribution at high train speeds
- The PM motor tends to be quieter than conventional asynchronous motors in speed interval 0-70 km/h (see spectrograms below)
Future scenarios

- More relevant to speak about **sound quality** than dBAs to describe the interior sound comfort
- No benefit to go below 65 dBA for future limit settings
- Balance between privacy and conversation intelligibility of importance
- Possibly use artificial masking sound
Thank You!

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