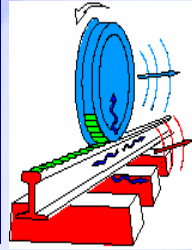


Basic targets and conditions for European railway noise abatement strategies

Analysis of the current situation (PPS §1.2-1.7)

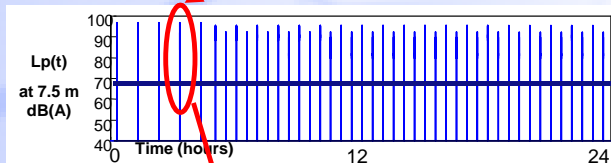
Michael Dittrich/TNO, WG 6 Member for NL



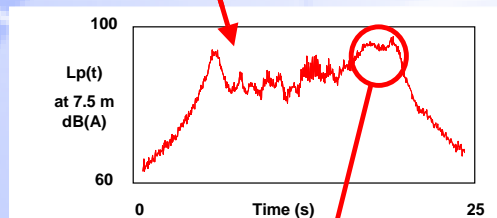
Characteristics of Railway noise



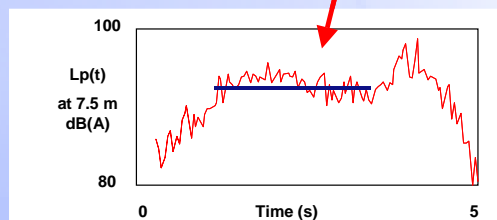
Daily average of traffic flow
Noise emission from a railway line
Noise reception at dwellings L_{DEN}



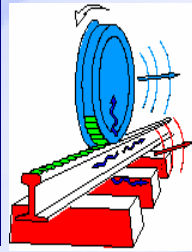
Daily average consists of multiple
passbys, different trains, speeds



Each passby contains various
types of vehicle

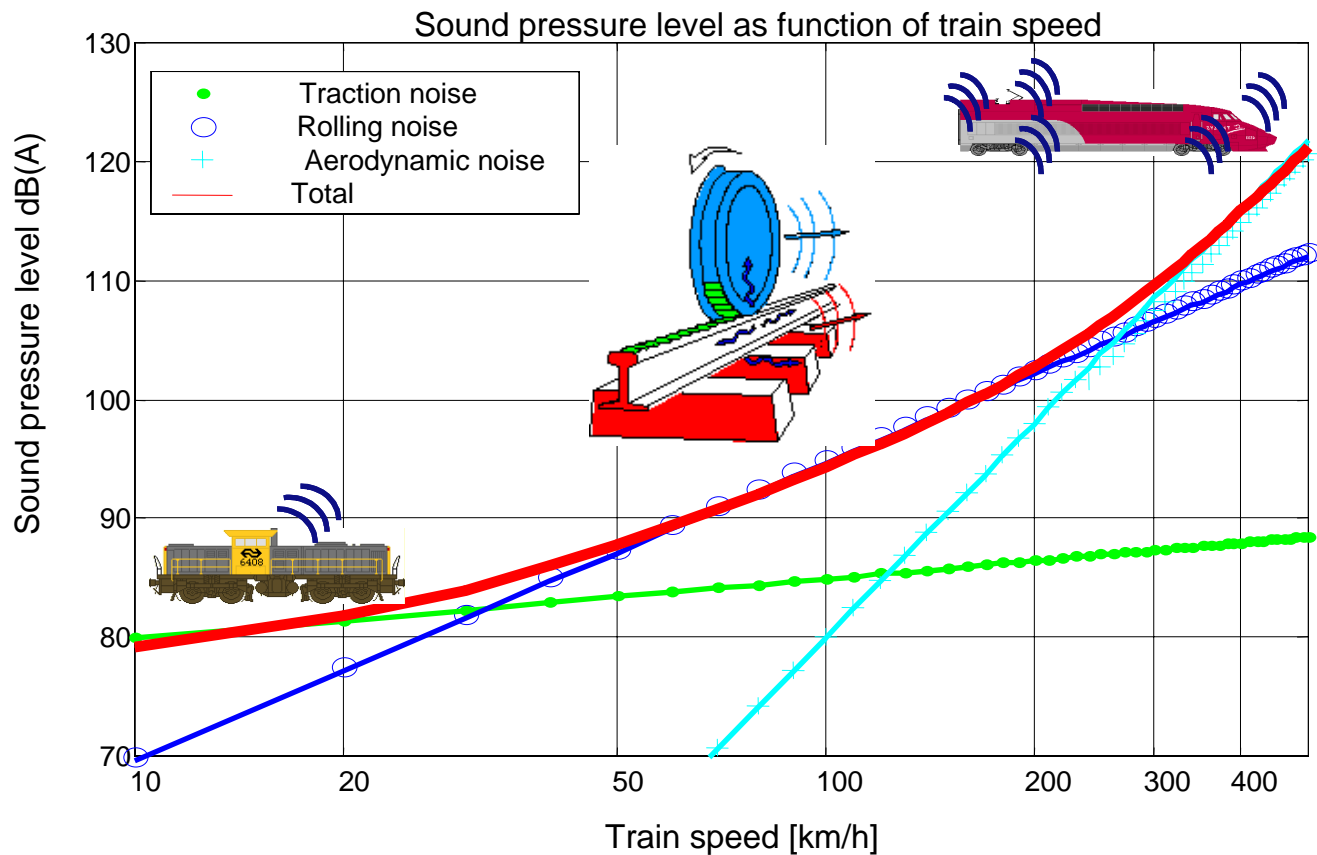


Each vehicle has characteristic
noise emission



Analysis of the current situation

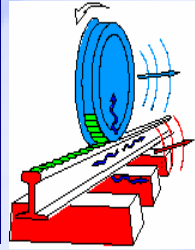
Railway noise sources



- Wheel-rail rolling noise
- Traction and auxiliary systems
- Aerodynamic noise

Local sources:

- Curve squeal
- Rail impact
- Bridges
- Others



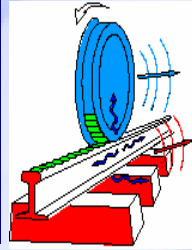
Principles and instruments for noise reduction – General

- Avoid (unnecessary or inefficient) transportation
- Shift to quieter modes of transport
- Reduce emission: Operational restrictions,

Technical measures at source: Best cost-benefit ratio

Local noise problems:

- Land use planning (esp. new/upgraded lines or residential areas)
- Measures in propagation path (barriers e.a.)
- Traffic regulation
- Building insulation (double glazing)

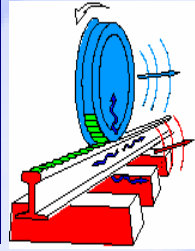


Progress in past decades

- More disc-braked vehicles (for speed reasons)
- More welded rail
- Many barriers with high cost (not always effective)
- Window insulation (limited effect)
- Insufficient stimulus, information and know-how

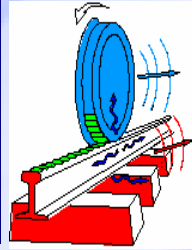
Recent developments

- More tools available and technical progress (Models, R&D, Solutions)
- New lines, high speed lines, freight at night, more light rail systems
- More noise sensitive areas, more people affected
- Local problems with curve squeal, shunting, bridges



Differences in the member states

- **Magnitude of exposure: population density, traffic, topology**
- **Awareness and policy priority given to railway noise**
- **Legislation (mostly for new or upgraded lines)**
- **Methodology: Calculation schemes, tracks and vehicle types**
- **Population density: new housing, new lines, more traffic**
- **Investment, public funding and maintenance**
- **Organisation of Railways – split responsibilities**



Analysis of the current situation

Michael Dittrich/TNO; WG 6 Member for NL

Constraints

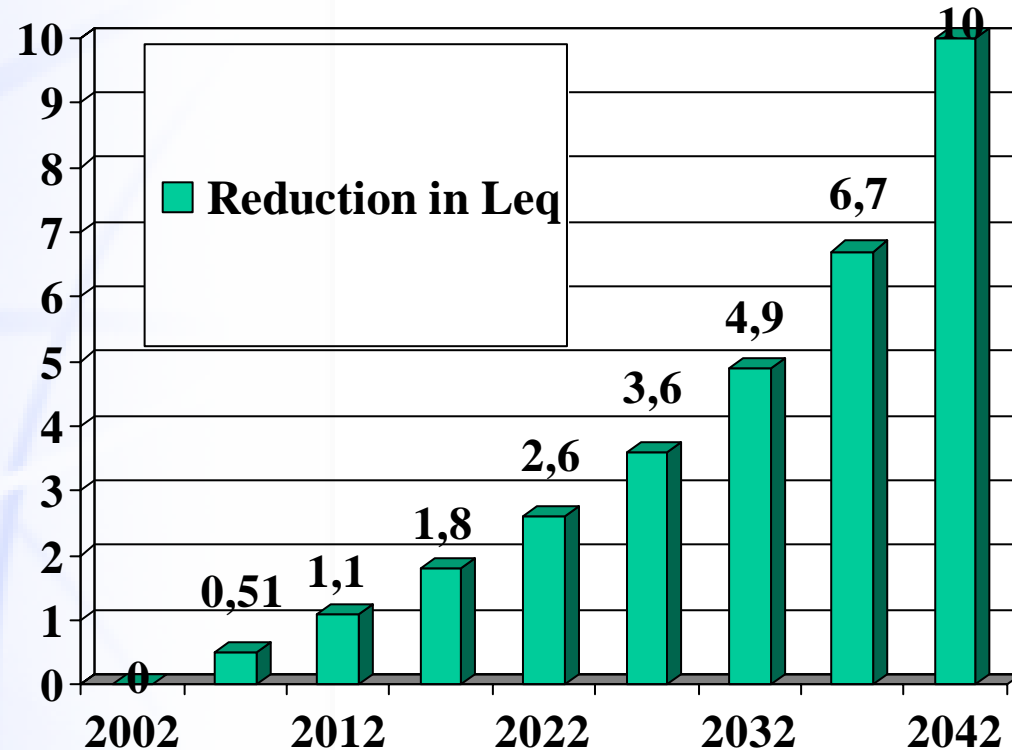
Competitive situation of the railways

Borders, interoperability

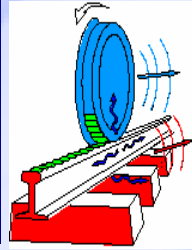
Long life of rolling stock

International character of rail transport

Vehicles of 'foreign origin'

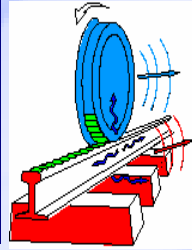


Reduction of average levels due to new vehicles with $\Delta L = 10$ dB(A) (linear substitution of old vehicles, assumed life 40 years)



Current exposure to railway noise and reduction target

- EEA TERM 2001 report:
30% Europeans exposed to road noise levels $L_{dn} > 55$ dB(A)
10% Europeans exposed to railway noise levels $L_{dn} > 55$ dB(A)
- **Night is the critical period in countries with night freight**
- **Examples:**
Germany: L_{eq} , 25m highest nighttime levels upto 79 dB(A)
Italy: Nighttime levels of L_{eq} , 25m 70-71 dB(A)
- Noise reduction target for Europe assessed at **10-15 dB(A)**, for main sources, to provide significant improvement in exposure levels
- Further action required for severe situations

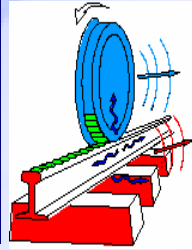


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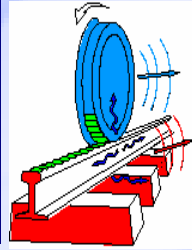
Technical measures at the source – Rolling noise

- Reduce noise generation by smooth wheels on smooth tracks
 - composite block brakes, disc or drum brakes
 - good maintenance of running surfaces
 - fewer wheels
- Reduce structure-borne noise transmission by compact, massive design, vibration isolation and high damping
 - smaller wheels and/or wheel dampers, optimised geometry
 - wheel-mounted disc brakes
 - optimised track design, or rail damping devices in combination with railpad selection
- Reduce sound radiation by shielding (secondary measures)
 - wheel-mounted, bogie-mounted or vehicle-mounted shrouds
 - low noise barriers close to the rail
- Availability: in principle all measures available
- Effectiveness: roughness most important, all measures need matching on vehicle and track



Technical measures at the source- Traction/auxiliary noise

- Diesel powered vehicles – Engine and components:
 - appropriate exhaust and intake design (high insertion loss);
 - effective engine enclosure and vibration isolation;
 - quieter components such as turbocharger, compressors, fans, valves
- Electrically powered vehicles – Fans, ducts and components
 - elimination or smoothening of obstacles in ducts, intake and outlet;
 - quieter fan design;
 - increase in fan efficiency by selecting the best working point;
 - quieter components such as compressors, fans, valves
- Gear noise: (some cases, for lower speeds)
 - improved gear meshing and design
- All above measures are available and effective



Technical measures at the source – Aerodynamic noise

- Streamlined covers for the bogies
- Avoiding extruding parts or cavities along the train
- Streamlining and covering of the pantograph and its recess area
- Streamlined front of the vehicle

Availability and effectiveness

- Recent HS trains include some of these measures
- Generally effective
- There are some design constraints:
safety, cost, access