Railway noise control in urban areas

Jakob Oertli, SBB Infrastructure, Noise Abatement; Chair UIC Noise Groups
Contents.

1. Railway noise situation
2. Policy and legislation
3. Noise reduction technology
4. Economics of railway noise control
5. Railway noise control strategy
6. Problematic trends
7. Outlook
The railway noise picture

- Railways are a sustainable and climate friendly means of transport
- Noise is the major environmental issue of the railways
- Noise questions must be solved to keep environmental advantage
- The railways have a long history of noise reduction, considerable progress has been made, however more effort necessary
Rail noise in comparison to road noise

→ Railway noise is less annoying than road noise
→ Railway noise is restricted to narrow corridors
→ Overall fewer people are affected by railway noise than by road noise
Noise situation varies throughout Europe

- **Western Europe/Italy**: High population density, much transit traffic, high political pressure, decreasing acceptance by inhabitants
- **Central Europe**: High rail freight market share, tyred wheels cannot be retrofitted with composite brake blocks
- **Northern countries**: Smaller problem than rest of Europe
- **North Eastern Europe**: Wide gauge in Finland, Estonia, Latvia and Lithuania: Cooperation with Russia necessary
- **United Kingdom**: Much traffic with composite brake blocks or disc brakes, however not in compliance with the rest of Europe
- **Spain and Portugal**: Wide gauge except high speed, composite brake blocks because smaller fire risk
- **Other areas**: Do not have significant rail traffic
European policy, noise legislation and incentives

- **Policy**
  - Sustainability policies include promoting railways
  - Railway noise reduction is a concern

- **European Noise Legislation**
  - Technical Specifications for Interoperability (TSI)
  - Environmental Noise Directive 2002/49/EC
  - Recast of Directive 2001/14/EC provides legislative basis for noise differentiated track access charges

- **European research framework programs include railway noise**

- **Financing for silent freight rolling stock may be possible through Connecting Europe Facility**
  - 20% of eligible costs, 2014 - 2020
National legislation differs throughout Europe

- Reception limits for existing lines
  - Switzerland, Italy, Norway
- Reception limits for additional areas
  - Norway: Indoor noise
- Legislation providing for financing or incentives
  - Noise differentiated track access charges: NL, D, CH
- Noise abatement not stipulated by legislation
  - Considerable amounts spent on existing lines: D, A, F
- Specifications for rolling stock
  - Swiss plan to prohibit cast iron brake blocks by 2020
Noise control possibilities

→ Different possibilities exist for controlling railway noise
  ▪ at the source
  ▪ between source and buildings
  ▪ near the buildings

→ Railways have a long history of noise control
  ▪ numerous national projects
  ▪ many international projects
    - Examples: TWINS, OFWHAT, Eurosabot, Silent Freight, Silent Track, Cost Benefit studies, STAIRRS, Harmonoise, Imagine, Silence, Q-City, STARDAMP, Acoutrain…

Measuring track decay rates to determine effectiveness of rail dampers
Retrofitting with composite brake blocks

→ Railway rolling noise is caused by rough wheels on rough rails

→ Smooth wheels are obtained by replacing cast-iron brake blocks with composite brake blocks
  - K-blocks, homologated, but require adapting wheel set
  - LL-blocks, homologation likely soon, no wheel set adaptation necessary
    - EuropeTrain tests LL-brake block on 200’000 km

Rough wheel: cast-iron brake blocks
Smooth wheel: composite brake blocks
Noise barriers

- Large amount of construction in past years
  - Until 2007 at least 1000 km in Europe
  - € 150 – 200 Million is spent annually in Europe
- Problems
  - High cost, also follow-up costs for maintenance and replacement
  - Limited effectiveness with high buildings
  - Negative influence on land and cityscape

[Images: wooden noise barrier in scenic area, protest graffiti against barrier in Switzerland]
Other noise control possibilities

- Noise insulated windows
  - Effect only if window closed

- Low height noise barriers
  - However problems with maintenance and safety

- Rail dampers
  - Effect depends on local parameters (0 – 3 dB)

- Wheel absorbers

- Proper maintenance

- Acoustic rail grinding
  - Must be repeated often

- Measures against curve squeal
  - Usually friction modifiers

- Measures against noise from parked trains
  - Expensive adaptations on rolling stock

- Measures in rail freight yards
  - Brakes with sinter ceramic elements
Economics of railway noise control

- STAIRRS Project shows that retrofitting has highest cost-benefit ratio
- Noise barriers have poor cost-benefit ratio
- Considerable overall savings possible, if money is transferred from infrastructure to rolling stock
Noise differentiated track access charges

- Noise differentiated track access charges main incentive proposed by EU and several European countries (CH, NL, D)
- EU Directive 2001/14/EC is basis for NDTAC
  - Revision accepted by EU parliament on July 3rd, 2012
- To date little effect, may increase with larger participation
- Risks:
  - Wagon owners different from operators
  - Unclear if NDTAC cover additional LCC costs
Railway noise control strategy

→ Reduce the noise of all new freight vehicles by introducing TSI limit values

→ Promote the retrofitting of existing freight vehicles with composite brake blocks

→ Build noise barriers and install insulated windows

→ Pursue further solutions in special cases
  - acoustic rail grinding, rail dampers, wheel absorbers, measures against curve squeal etc.
UIC efforts

→ Vision 2050:
  - The European railways strive towards noise no longer being a problem for railways or neighbors

→ UIC Noise Network
  - Information exchange (specialist meetings, delegates to other organizations, regular workshops, contact with EU)

→ UIC projects (compare presentation tomorrow)
  - Bearable noise limits, justification of rail bonus, follow up costs on noise abatement measures, noise reduction by freight wagon retrofitting, toolbox for noise mitigation etc.

→ Strong involvement in LL-brake block homologation, EuropeTrain

Is rail bonus justified?

Europe train in winter conditions in Sweden
Problematic trends

→ Protecting capital instead of people
  ▪ Compensations for home owners based on property values
  ▪ Decision to implement noise control influenced by property values
  ▪ Cross-subsidies: Areas with good cost-benefit ratio measures help protect adjacent areas with low cost benefit ratio

→ Whole noise system optimizations rare
  ▪ Optimal mix of rolling stock retrofitting and noise barriers rarely considered

→ Exaggerated expectations from certain technologies
  ▪ Manufacturer promises rarely met (e.g. rail dampers)

→ Failure to consider big picture
  ▪ Trade off between noise control and modal split
  ▪ Urban zoning that does not consider noise

→ Simplifications may lead to wrong conclusions
  ▪ Generalized noise reductions for certain measures often depend on local conditions
Outlook

→ Railways have become quieter and will continue to do so

→ Retrofitting freight rolling stock with composite brake blocks is most cost effective measure
  ▪ LL-brake blocks to be homologated in 2013
  ▪ Noise differentiated track access charges may support financing
  ▪ Ban of cast-iron brake blocks being discussed

→ Expect more noise barriers

→ Additional measures e.g. rail dampers most useful in hot spots