Railway Noise Control in Germany -
a Success Story and an Example for Europe

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Internoise 2016 - Satellite
Berlin, 26.08.2016
- Sustainable Transport: shift to rail
- Main obstacle to shift: noise impairments and complaints
- German railway noise abatement strategy:
  - Precautionary acoustic planning → new infrastructure
  - Noise remediation programme → existing infrastructure
  - Retrofitting programme → existing freight wagon fleet
- European railway noise policy
- Conclusions: evaluations and recommendations
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Sustainable Transport: shift to rail 1

- In many aspects rail transportation is the most sustainable transport mode (safety, climate protection, air quality, area consumption etc.)

- Emissions (Germany, UBA 2016):

  Normalised specific emissions from freight transport means - Germany 2014

<table>
<thead>
<tr>
<th>GHG emissions</th>
<th>Nitrogen oxides</th>
<th>Particulates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail freight</td>
<td>inland water transportation</td>
<td>Lorries</td>
</tr>
<tr>
<td>1</td>
<td>4.2</td>
<td>6.9</td>
</tr>
<tr>
<td>1.3</td>
<td>5.7</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

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### Sustainable Transport: shift to rail 2

- **Political consensus**: shift to rail
- **Modal share targets** in freight transport:

<table>
<thead>
<tr>
<th>Target</th>
<th>percentage</th>
<th>year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift of lorry transportation &gt; 300 km → rail, inland water transportation</td>
<td>30</td>
<td>2030</td>
<td>EU-Commission White Paper Transport 2011</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>2050</td>
<td></td>
</tr>
<tr>
<td>Modal share of rail</td>
<td>25</td>
<td>2015</td>
<td>German Government 2012</td>
</tr>
<tr>
<td></td>
<td>(in fact 17)</td>
<td></td>
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</tr>
</tbody>
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Main obstacle to shift: Noise impairments and complaints: Example middle Rhine valley

Max. levels in the middle Rhine valley: $L_{\text{eq,night}}$ up to 81 dB(A), $L_{\text{max}}$ up to 109 dB(A)

„Rail noise makes sick“

Demonstration on 07.05.11 in Rüdesheim, Rhine valley

„Nighttime ban for freight wagons“

Poster of citizens‘ initiative in the middle Rhine valley (27.02.2012, Bingen)
Main obstacle: noise impairments – END results in Germany

Exposed persons in Million

- Lden > 55 dB(A)
  - Road 2007: 6.74
  - Road 2012: 9.51
  - Rail 2007: 4.56
  - Rail 2014: 6.18

- Lden > 65 dB(A)
  - Road 2007: 1.82
  - Road 2012: 2.23
  - Rail 2007: 0.95
  - Rail 2014: 0.6

- Lden > 70 dB(A)
  - Road 2007: 0.7
  - Road 2012: 0.72
  - Rail 2007: 0.32
  - Rail 2014: 0.23

- Lnight > 50 dB(A)
  - Road 2007: 4.29
  - Road 2012: 5.48
  - Rail 2007: 3.72
  - Rail 2014: 4.94

- Lnight > 55 dB(A)
  - Road 2007: 2.09
  - Road 2012: 1.37
  - Rail 2007: 1.91
  - Rail 2014: 0.89

- Lnight > 60 dB(A)
  - Road 2007: 0.82
  - Road 2012: 0.47
  - Rail 2007: 0.67
  - Rail 2014: 0.67
Noise impairments: conclusions

- **1,91 Mio. persons exposed to health risks** (EU28: 5,38 Mio.)
  (night levels above 55 dB(A))
  (road: 2,85 Mio. persons).

- **6,18 Mio. persons highly annoyed** (EU28: 15,2 Mio.)
  \( L_{den} > 55 \) dB(A))
  (road 10,2 Mio. Menschen).

- **Impacts at night** for road and rail in the same range, though transport performance of rail freight is \( \frac{1}{4} \) of the road performance
  → **specific** (performance related) **impacts** for rail higher than for roads
  → shift to rail – without measures - would increase the total impairments

- **Delays** in the construction of new railway tracks: example upgrading railway line Basel-Karlsruhe (Rheintalbahn) – section near Freiburg: plan approval decision delayed by about 12 years
Main obstacle: noise impairments in Europe

Disturbance by rail transport in percent of the population

<table>
<thead>
<tr>
<th>Country</th>
<th>Disturbance</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU28</td>
<td>13</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>14</td>
</tr>
<tr>
<td>Poland</td>
<td>10</td>
</tr>
<tr>
<td>Austria</td>
<td>19</td>
</tr>
<tr>
<td>Netherlands</td>
<td>22</td>
</tr>
<tr>
<td>Italy</td>
<td>16</td>
</tr>
<tr>
<td>France</td>
<td>13</td>
</tr>
<tr>
<td>Germany</td>
<td>15</td>
</tr>
<tr>
<td>Denmark</td>
<td>20</td>
</tr>
</tbody>
</table>

Source: Eurobarometer 420, Sept. 2014
Sustainable Transport: shift to rail
Main obstacle to shift: noise impairments and complaints

German railway noise abatement strategy:
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European railway noise policy
Conclusions: evaluations and recommendations
Precautionary acoustic planning of new and upgraded rail infrastructure

- **Outdoor noise reception limits** in force since 1990; residential areas:
  - Till 2014: $L_{eq}$ of 64/54 dB(A) day/night
  - Since 2015: $L_{eq}$ of 59/49 dB(A) day/night (elimination of the so-called rail bonus (Trams 2019))

- **Priority for active measures** (source, propagation) but in case of low efficiency **passive measures** (sound insulation windows) are applied

- **Lines with level increase due to operational changes** (speed, traffic volumes): No application of the reception levels

- **Conflicts:**
  - Opposition against rail bonus and passive measures
  - $L_{eq}$ as indicator criticised
  - Claims for the inclusion of operational changes
  - Opposition against rail freight lines through towns (and if: claim for tunnels instead of high barriers)
- Sustainable Transport: shift to rail
- Main obstacle to shift: noise impairments and complaints

**German railway noise abatement strategy:**
- Precautionary acoustic planning $\rightarrow$ new infrastructure
- **Noise remediation programme** $\rightarrow$ existing infrastructure
- Retrofitting programme $\rightarrow$ existing freight wagon fleet

- European railway noise policy
- Conclusions: evaluations and recommendations
Railway noise remediation programme 1

- **Start** in 1999 (federal roads; 1978!)
- **Responsible**: German Ministry of Transport MoT, supported by the German railway agency EBA
- **Implementation**: DB Netz (Infrastructure)
- **Measures**:
  - **Active**: Noise barriers, grinding, rail absorbers etc.
  - **Passive**: sound insulation windows
**Threshold outdoor levels** for residential areas (no reception limits creating legal claims!)

- 1999 to 2014: $L_{eq} > 75/65$ dB(A) day/night
- 2015: $L_{eq} > 70/60$ dB(A) day/night (elimination of so called rail bonus)
- 2016: $L_{eq} > 67/57$ dB(A) day/night (corresponding to levels in the federal road remediation programme)

**Results** (by the end of 2015):

- Remediation for **1500** track-km finished (still remaining **2200** track-km with high exposures)
- **610** km noise barriers
- **55,300** apartments with sound insulation windows
- Competent authorities for major railways up to 2014 in most regions in Germany: communities

- First stage of noise action plans NAP (deadline 2008): besides land-use planning communities not capable of implementing measures

→ since 2015 the German railway agency EBA in charge of the NAP for major railways

- EBA designed a pilot NAP in 2015 not complying with the END
  - No target levels
  - No concrete actions for specific local problems

- Harmonisation between the remediation programme and the NAP still missing

→ For major railways END did not yet contribute to the noise abatement
Sustainable Transport: shift to rail
Main obstacle to shift: noise impairments and complaints

German railway noise abatement strategy:
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European railway noise policy
Conclusions: evaluations and recommendations
Retrofitting of freight wagons with cast iron block brakes (CI)

- **Freight wagons:** highest emissions, nighttime operation
- **Long lifetime (40 years):** sound emission limits for **new** wagons (TSI Noise) **not sufficient**

→ **retrofitting of the existing fleet:** substitution of the cast iron (CI) blocks – roughening the wheels - by composite blocks (K and LL)

K-blocks: Switzerland 2007

LL-blocks. Labelling, DB 2013
Retrofitting: Reduction potential

- **Reduction potential** as function of rail surface roughness (!)
  - **German** calculation scheme Schall 03;2015: 5 to 8 dB(A)
  - **Swiss** calculation scheme sonRAil CH: 8 to 13 dB(A)

### Sound emissions for different brake types and rail roughness in sonRail

- **Rail Roughness high**
- **Rail Roughness medium**
- **Rail Roughness low**

![Graph showing sound emissions for different brake types and rail roughness](image)

<table>
<thead>
<tr>
<th>Brake Type</th>
<th>Rail Roughness</th>
<th>L_{PA} in dB(A) (80 km/h; 7,5 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI</td>
<td>high</td>
<td>92, 91.3, 91.3</td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>84, 79.5, 78.1</td>
</tr>
<tr>
<td></td>
<td>low</td>
<td>83.1, 77.4, 74.8</td>
</tr>
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German retrofitting programme

- Based on an agreement between the German Ministry of Transport (MoT) and the Deutsche Bahn (Infrastructure) in 2011
- Start in 12/2012, end: 31.12.2020
- Two elements (see next slide):
  - State subsidies for retrofitting
  - Cost neutral noise differentiated track access charges NDTAC
  - Open for all railway undertakings RU and wagon keepers (WK) operating in Germany
  - Financing based on the investment costs for LL-brakes
- Target: By the end the programme no more CI-wagons operating in Germany (agreement of the current government coalition of 2013)
  - MoT prepares a corresponding act
  - Main problem: not to violate the European right of the free movements of goods
German retrofitting programme: two elements

**State**

50 %, max. 152 Mio. €

**DB Netz**

1 % increase of track charges for noisy freight trains *

**Bonus pot 1**

0.5 Cent/axle-kilometer
Max. 211 €/axle

**Bonus pot 2**

0.5 Cent/axle-kilometer
Max. 211 €/axle

**Wagon keeper**

**RU**

**Market mechanisms**

* 06/14 1.5%, 12/14 2%, 12/15 2.5%, 12/16 3.0%, noisy freight trains: > 20 % Cl-wagons (> 10 % since 12/14)
German retrofitting programme: mid-term results

- **National vehicle register:**
  - 172,476 wagons
  - Wagons with composite blocks by 18.05.2016: 38,532 (≈ 22.3 %)

- **Retrofitting register:** about 166,000 registrations from 39 companies in 8 countries (April 2016)

- **Low-noise freight trains:** 16 % of the track-kilometers (2015)

- **Commitment** of two major wagon keeping groups to comply with the 2020 target (representing about 2/3 of the wagons operating in Germany)
  - DB Schenker Rail (60,000 wagons): End of 2016 32,000 low-noise wagons
  - VPI: association of private wagon owners (60,000 wagons): End of 2016 30,655 low-noise wagons

- MoT plans 15 **monitoring stations** to prove the retrofitting and procurement progress
Further fleet related instruments

- German MoT plans a **scraping bonus** („Innovationspraemie TSI+“):
  - Scrapping of an old noisy wagon
  - combined with the **acquisition** of new wagons with emissions **below the TSI Noise limits**
  - will be funded by the state
  - Currently MoT designs the **funding guidelines**
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European railway noise policy
Conclusions: evaluations and recommendations
EU made **important contributions** to the reduction of railway noise

- **Introduction of sound emission limits** in 2002 (new high speed trains) and 2005 (new conventional vehicles), (compare: road vehicles 1970!): de facto ban of new CI-wagons

- **Merged** within the TSI Noise of 2014, slight reduction of limits (except for freight wagons)

- **Introduction of voluntary Noise Differentiated Track Access Charges** NDTAC in 2012 (Commission had preferred a mandatory introduction)

- **Implementing Regulation** (EU) 2015/429 on optional introduction of noise-differentiated track access charges (NDTAC) (harmonizing NDTAC schemes)

- **Introduction of funding** the retrofitting of CI-wagons (within the Connecting Europe Facility 2014: 20 % of the investment costs)
Most recently: European Commission’s Staff Working Document (SWD(2015) on the effective reduction of rail freight noise (Originally a Communication was planned)

Most important proposal: Application of the TSI Noise limits to existing freight vehicles (without defining the date of the entry-into-force; planned Communication 2022 for internationally operating freight wagons, 2026 for all freight wagons)

Currently a Task Force of the European Railway Agency ERA develops the necessary TSI Noise revision.
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Evaluation of the German railway noise policy

- Much progress has been achieved:
  - Elimination of the rail bonus
  - Improvements in the remediation programme (lower thresholds, considerable increase of the financial volume)
  - Currently planning of new and upgraded lines with protection levels beyond legal requirements (Rheintalbahn)
  - Retrofitting programme: Complete elimination of national CI wagons by 2020 is realistic

- Deficits, remaining problems
  - Remediation threshold levels have been too high and passive measures too often applied to create acceptable situations (middle Rhine valley)
  - Retrofitting of foreign wagons by 2020 not ensured
  - NDTAC limited to the retrofitting of freight wagons
  - Reduction of the track emissions still at discretion of DB Netz
Evaluation of the European railway noise policy

- **Progress**
  - Introduction of sound emission limits
  - CEF funding for retrofitting
  - NDTAC guidelines and harmonisation
  - Considering bans for CI wagons

- **Deficits, remaining problems:**
  - Emission limits do not activate the current reduction potential
  - CEF funding: still unclear if in addition to national funding
  - NDTAC not mandatory, introduction only in Germany and the Netherlands (and Switzerland)
  - Bans: entry-into-force still unclear and possibly too late
Conclusions: evaluations and recommendations 3

Recommendations - German policy:

- Updating of the remediation programme – solving the problem of different protection levels; harmonisation with noise action planning
- Activation of the full reduction potential of NDTAC (locomotives, low emission railbound vehicles)
- Better regulation of track quality (improved grinding schemes)
- Legal improvement of the precautionary acoustic planning: legalise the new approaches (i.e. Rheintalbahn)
Recommendations - European policy:

- **European ban of Cl wagons** the most effective instrument and better than national regulations: it should be introduced as soon as possible

- Other **member states** should follow the German retrofitting example (better European support?)

- **Economic aspects**: retrofitting a financial burden for the railway sector (increased operating costs, limited funding)

  → Strengthening the railway competitiveness by **internalising the external costs** for all transport modes

- Creation of an **innovative rail freight transport system** with low emissions and energy consumption and high productivity (full interoperability, improved logistics)

- **Activation of the potentials of traffic avoidance**
Thank you for your attention!

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