INTERNATIONAL UNION
OF RAILWAYS

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Railway Noise State of the Art

10th UIC Noise Workshop

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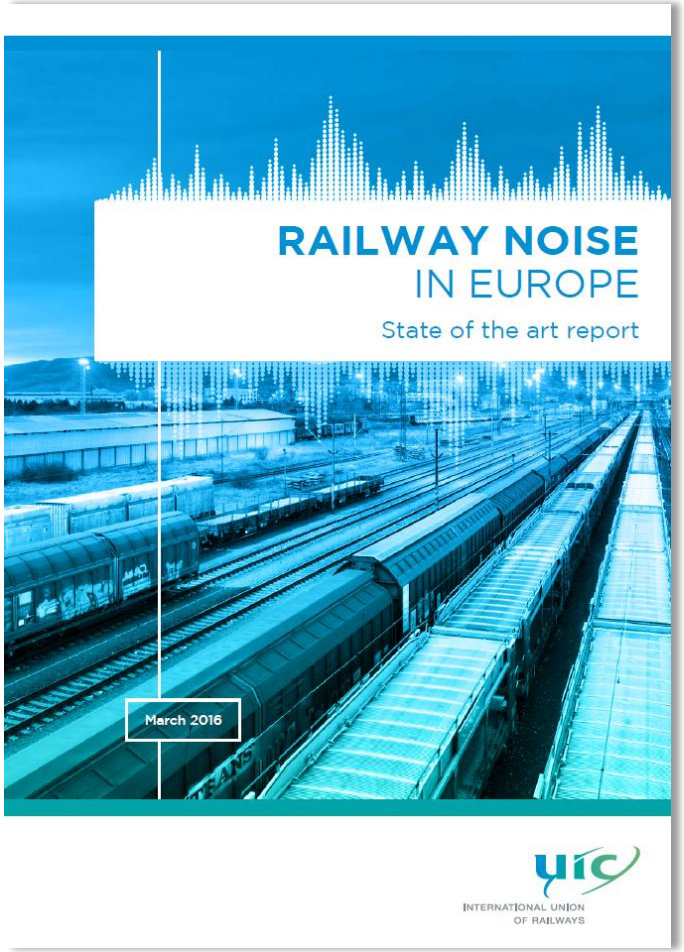
The Sate of the Art Report

- **Aware of a great number of stakeholders involved in the discussion on railway noise**
- **Communication on noise issues can be challenging, technically complex & emotive subject**

The Sate of the Art Report

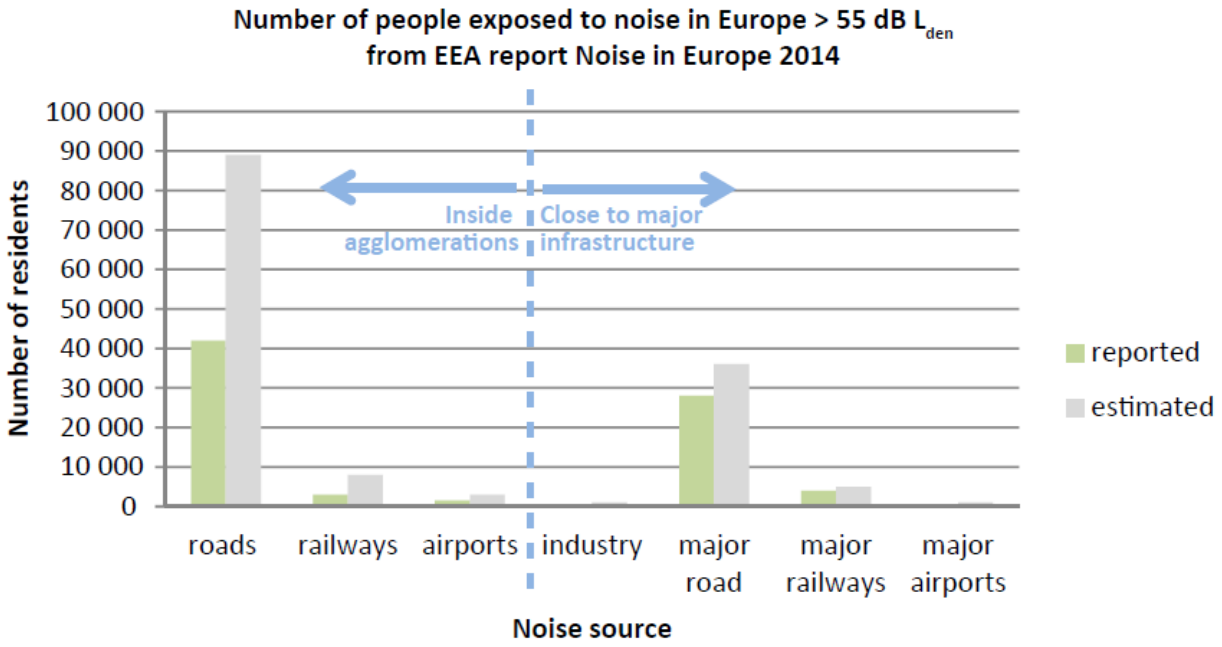
- **It is important that noise discussions are well informed & the sector can demonstrate a proactive technical program to manage the issue;**
  - alleviate unnecessary worry / frustration
  - to build understanding & constructive dialogue
  demonstrate progress (including modernisation)
  - show what is possible / practical



Context

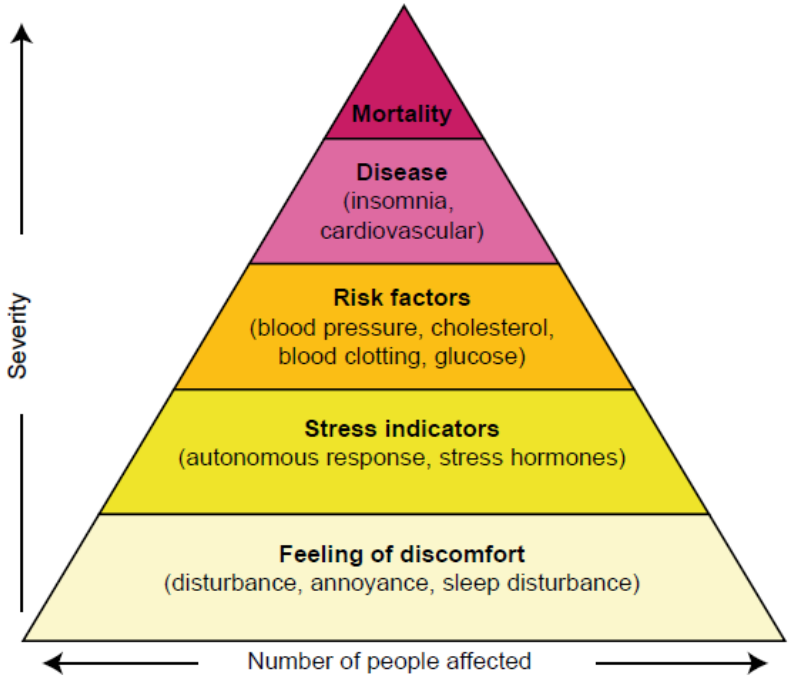
- Rail is the most environmentally friendly major mode of transport with very low external costs (safety / congestion)
- Railway noise remains an important issue
- Political sensitivity to noise varies between countries, with particular concern along the Rhine-Alpine corridor
- Greater acceptance of rail transport is a necessary prerequisite for expanding modal share and through this reducing the overall environmental impact of transport

Current noise exposure



Graph 4. Reported (green) and extrapolated (grey) numbers of people (in millions) exposed to noise over 55 dB L_{den}, for roads, railways, airports and industry, within and outside urban areas (from: Noise in Europe, EEA, 2014)

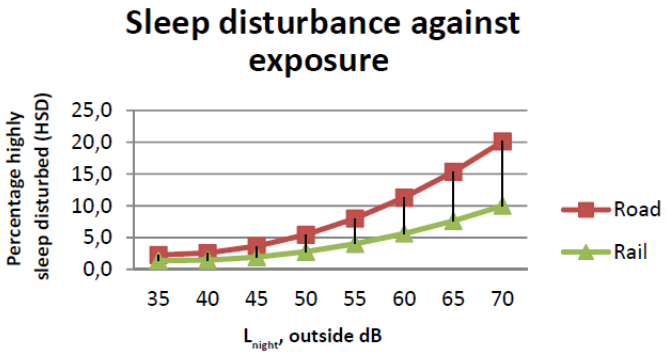
The impacts of noise & WHO guidance



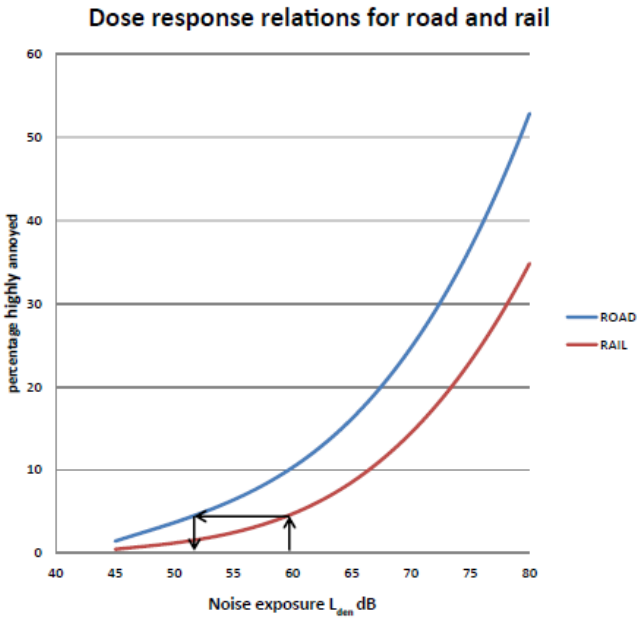
Graph 2. Effects of noise, starting from exposure (under) to health effects (top). After WHO

> **WHO recommends Member States to gradually reduce the proportion of the population exposed to levels over the interim target (55 dB L_{night}) within the context of meeting wider sustainable development objectives**
>
> **- WHO Night Noise Guidelines**

Exposure – response Road vs Rail



Graph 5 - Percentage of highly sleep disturbed persons against L_{night} (from "Night Noise Guidelines" page 78)



Graph 3. Dose effect relations: percentage of highly annoyed residents against exposure level, for road and rail noise [from EU Position Paper on dose response relationships for transportation noise]. Example: at 60 dB(A) L_{den} of railway noise about 4 % of the exposed people are expected to be highly annoyed. Similar annoyance is established by only 52 dB(A) L_{den} of road traffic noise. The difference represents the correction factor erroneously called the "railway bonus"

Structure of the rail sector & regulators

- operating companies (running the trains)
- vehicle owners (often leasing companies)
- infrastructure managers

Regulatory bodies:

- European Commission (DG MOVE) (financial incentives)
- European Rail Agency (ERA) (vehicle noise limits)
- National governments (reception limits / financial support)
- Local authorities (hot spots / compliance)

Overview of European Policy

- Transport White paper sets ambitious targets for growth of the sector
- TSI sets noise limits for rolling stock (ERA)
- END requires mapping & action plans (DG ENV)
- NDTAC sets a framework for incentivising retrofitting (DG MOV)
- CEF offers limited financial support for retrofitting (INEA)
- Switzerland will ban noisy wagons from 2022
- CER strategy on rail freight noise

Noise mapping & indicators

- Care is needed to explain the use of long term indicators & calculation rather than measurement
- Points to consider re the new common assessment method:

1) Rail roughness is required as an input parameter (use of default values is discouraged)

2) Changes to curve correction factors may have a big impact

3) Users are required build their source term (Lw) for each type of train

Research (funded by the sector & also EU)

- Long history of research ERRI / UIC / Europe Train
- UIC Rail Technical Strategy Europe
- European Rail Research Advisory Council (ERRAC)
- The Shift2Rail program will include N&V work packages

Project	Topic	Reference	Started in program
OfWhat	Optimised Freight Wheels and Track	www.uic.org/IMG/pdf/erri-summary_noise-research.pdf	
Rona, Mona, Vona	Solutions for noise from rolling stock and track	National program France	
STV	Quiet Railway Traffic	National Dutch Program, www.bibliotheek.nl/catalogus/titel.190368802.html	
Stardamp	Characterisation of rail dampers	Collaboration between DB and SNCF	2010
LZARG	Quiet train on regular track	National program Germany www1.deutschebahn.com/laerm/forschungsprojekte/abgeschlossene_forschungsprojekte.html	2010
Optimisation of Composite Brake Block Contour / Limit value for equivalent conicity	Optimisation of composite brake block contour in terms of wagon running stability	UIC B 126/DT 441 (June 2014) *Braking questions - Optimization of the contour of composite brake blocks to reduce the equivalent conicity - Synthesis of the results of final phase*	2010
LABiV	Composite brake blocks	National Program Germany www1.deutschebahn.com/laerm/forschungsprojekte/abgeschlossene_forschungsprojekte.html	2011
Europe Train	Test of composite LL brake block: Validating some solutions to prevent the fast degradation of equivalent conicity of wheel braked with LL-blocks; Verification of vehicle stability by continuous in-service measurement and track tests; Verification that LL blocks are capable of bearing all climatic, operational and topographical conditions in Europe under affordable LCC.	**UIC B 126/RP 43 (Feb. 2013)** ***Braking questions - Synthesis paper on the EuropeTrain operation with LL brake blocks - Final Report, ISBN 978-2-7461-2179-9***	2010
Innotrack	Optimised track	www.innotrack.net	FP6
RIVAS	Railway vibrations	www.rivas-project.eu	FP7
CargoVibes	Effect of railway vibrations	www.cargovibes.eu	FP6, 2011

Project	Topic	Reference	Started in program
Euroécran	Noise barriers along railways	http://cordis.europa.eu/project/rcn/22814_en.html	FP3, 1994
Composite Brake Blocks	Development of requirements on K brake blocks and coordinate of product development	UIC B 126/RP 33 (Jan. 2004) *Fragen des Bremswesens – Einsatz von Verbundstoffbremsshlen in Güterwagen – Zusammenfassender Bericht K-Sohlen*	1999
STAIRRS	Strategies and tools based on efficiency approach	www.stairrs.org	2000
Eurosabot	Brake block materials	www.conforg.fr/internoise2000/cdrom/data/articles/000843.pdf	FP4, 1995
Silent Freight	Measures for freight rolling stock	http://cordis.europa.eu/project/rcn/30970_en.html	FP4, 1996
Silent Track	Measures for quiet track	http://cordis.europa.eu/project/rcn/34519_en.html	FP4, 1997
Renvib and Renvib II	Railway vibrations	www.fcp.at/de/projekte/renvib-railway-environmental-vibration-project	
Euro Rolling Silently	Test of brake blocks	www.2020-horizon.com/E-R-S-Euro-rolling-silently(E-R-S-)-s40357.html	2002
Silence	Transport noise control	www.silence-ip.org/site/index.html	2005
Q-City	Transport noise in urban situations	www.qcity.org	
Convurt	Vibrations from railway tunnels		
Noise Reduction	Development of requirements on LL brake blocks and coordinate of product development	UIC B 126/RP 36 (May 2009) *Braking - Use of composite brake blocks in freight wagons - Summary report on LL brake blocks, ISBN 978-2-7461-1691-7*	2005
Metarail	Measurement methods for railway noise	ftp://ftp.cordis.europa.eu/pub/transport/docs/summaries/rail_metarail_report.pdf	FP4, 1997
Acoutrain	Vertical certification of acoustic performance of new trains	www.acoutrain.eu	2011
Harmonoise	Common prediction methods for road and rail noise	http://infoscience.epfl.ch/record/120520	
Imagine	Common prediction methods for all environmental noise sources	http://cordis.europa.eu/result/rcn/47869_en.html	2006

The Noise Action Plan

- **STAIRRS project (late 90-ies & re-confirmed in 2013) concluded that the most cost effective solutions would include retrofitting, i.e. replacement of the cast iron blocks, of the existing freight fleet.**
- **Railway Noise Action Plan, agreed by UIC, UIP and, CER focused efforts on the following objectives:**

  a) Cost neutral equipping and retrofitting of wagons with cast-iron brake blocks to composite brake blocks (K/LL)

  b) Gradual introduction of “Low Noise Technology”

Established technical solutions : rolling noise

- System approach required to manage rolling noise (vehicle & track)
- Passenger trains : use of disk brakes
- New freight vehicles should meet TSI limits (composite or disk brakes)
- Existing freight vehicles can be retrofitted with composite blocks
- New track : optimized rail pads can be selected
- Existing track : surface roughness controlled by good maintenance (grinding)

Railway noise control : other than rolling noise

- Stationary noise
- Aerodynamic noise
- Curve squeal
- Brake screech
- Depots
- Shunting yards
- Steel bridges
- Ground borne vibrations

Transmission path & receiver

- **Noise barriers are the most commonly used mitigation measure; in only 7 networks overall more than 3,000 km of barriers with average height of 2 to 3 meters have been installed. Another 500 km are expected to be installed in the next 10 years.**
- **Low height noise barriers is rare, with only 10 km having been installed in Germany, the Czech Republic and the UK**
- **Sound proof glazing and ventilation is often the chosen solution in cases where barriers are not cost efficient or not sufficiently effective**