



**Urban transport noise abatement  
Challenges for the future:  
railway noise**

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- **For the past 15 years , a significant number of topics about railway noise were addressed within **dedicated research projects:****
- Noise at source
  - TWINS model
  - “Silent Freight”, “Silent Track”, ...
- Propagation, noise barriers
  - “Harmonoise”, “Imagine”, “Euroecran”, ...
- Perception -Annoyance
  - Multiexposure, RAPS (sleep and activity disturbance), ...



- In the same time, more generally research carried out in the field of **transportation noise** provided **solutions** for the railway system
  - Noise at source
    - fan noise , engine noise, exhaust noise, ...
    - damping materials
  - Propagation
    - noise mapping, FEM/BEM computation, ...
  - Reception (annoyance)
    - psychoacoustics, multi-exposure case, ...



- **Silence IP is an important step...**
  - The target was ambitious : - **10 dB(A)**
  - **Most of the stakeholders were involved :**  
railway companies, rolling stock and track manufacturers, research institutes, laboratories, ...
  - **Solutions** were either optimised (track absorbers) and/or developed (light rail fastening system, wheel absorbers, ...)
  - The most promising **solutions were tested** on real tracks and trains
  - **Retrofitted** and **new** rolling stocks were also considered



- **Some solutions for noise reduction at the source are now available nearly “ready for use”**
  - [K-blocks for freight wagons or power cars : **- 10 dB(A)**  
(even if costs slow down the equipment of the European wagons)]
  - Rail dampers : **-3 / -4 dB(A)**  
already homologated in some countries
  - Wheel dampers : **-2 dB(A)**  
already used for light and heavy rail
  - Steel bridges



- **Some other solutions for noise reduction at the source developed in SILENCE should still be industrialised:**
  - **Optimised axial fans and radial fans : - 8 dB(A)**  
(for new rolling stocks and also retrofit)
  - **Combined rail and wheel dampers : -5 dB(A)**  
(for conventional and high speed railway)
  - **Freight wheel dampers** (without viscoelastic materials) : **-2 dB(A)**
  - **Optimised control** of the electrical power engine  
(for trams and metros)
    - Optimised **control of the Diesel engine** (common rail injection, ...)

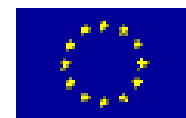
- ...



- **VAMPASS** tool developed in SILENCE should be used to :
  - Define the **best combination** of solutions for a given problem
  - Define target for further progress:
    - Quantitatively
    - Through **perception** studies
  - Also **methods** to optimise solutions should be industrialised
    - design of encapsulated power-pack
    - design of optimised multilayer damping materials
    - ...



- **Methods for noise prediction must still be industrialised**
  - **harmonised methods for noise mapping** (results of Imagine project, definition of the railway noise sources, meteorological data, ...) in an INDUSTRIAL way
  - **specific urban problems** : closed shaped streets...
- >>> interim methods only operational at the present moment
- **Groundborne vibration** addressed in many EU proposals....



- **Some solutions must be developed for dedicated sources**
  - **curve squeal**: models to be validated , for definition and validation of working solutions
  - **break squeal**: some understanding already achieved mechanical behaviour to be managed in the same time as noise
  - **switches and crossings**, ...models to be developed: present solutions (absorbers,...) potentially not effective



- **Reduction of the aerodynamic noise**
  - increase of commercial speed of high-speed trains
  - >> rolling and aerodynamic noise must be reduced together
- ✓ **Principle of solutions known: shrouds...shape optimization > management of the system issues**
- ✓ **Use of simulation in aeroacoustics : difficult but promising issues (lattice-Boltzmann methods)**
- **Optimisation of the noise barriers**
  - small sizes, close to the train, low cost



- **Annoyance**
  - consider together all the transportation noise: work in coordination with aeronautic field (SEFA and follow up project)
- **More generally** : collaborative potential with aircraft sector promising
  - Annoyance/ perception studies
  - Aerodynamic noise
  - Use of lightweight/ composite materials and associated acoustic questions



- **Acoustical performance should be maintained:**
  - Include acoustical consideration in maintenance rules for rolling stock and tracks
  - Generalize/ industrialize acoustical monitoring
    - For noise performance
    - For predictive maintenance





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**So, still many things to do....**

Thank you for your attention!



Silence - Final event – 29<sup>h</sup> of May 2008

