Report CEDR Noise Barriers

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Subgroup report Noise barriers

- Based on the results of the latest innovative research information within CEDR member states and the reports QUESTIM and DISTANCE from the CEDR Noise Call 2012

- Noise barriers are the most widely used form of noise mitigation
- Not the most cost-efficient measure (high cost) but sometimes the only possible way to reach the wanted reduction
- NRA: Good value for money

Report CEDR
Noise Barriers

- What are the working principles of a noise barrier?
- How can you check the correct installation of a new barrier?
- What are the possibilities to check the lifetime?
- Are their interesting new innovative barriers?

What are the working principles of a noise barrier?

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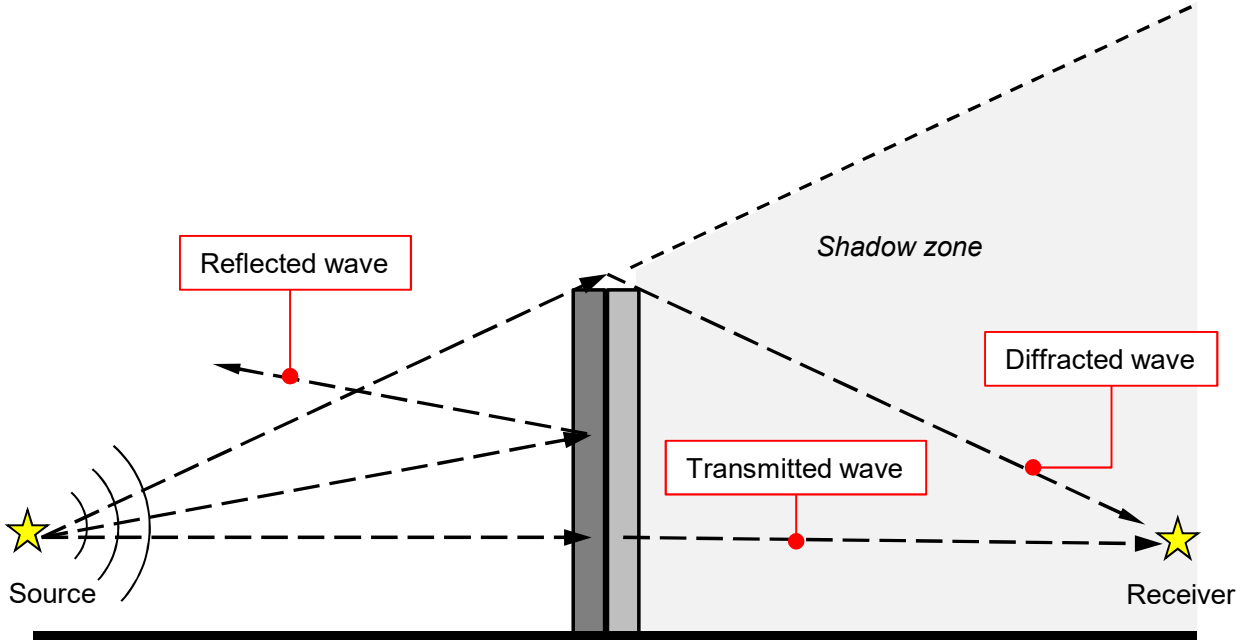
Working principles



- Transmitted wave => insulation
- Reflected wave => absorption
- Diffracted wave => length and height + shape top edge

Source: QUESTIM

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Insulation

Most important:

- Mass
- Thickness

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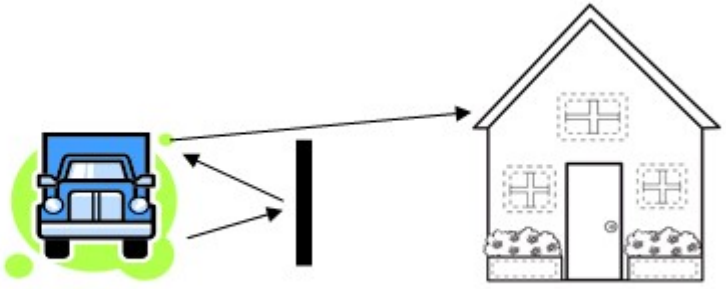
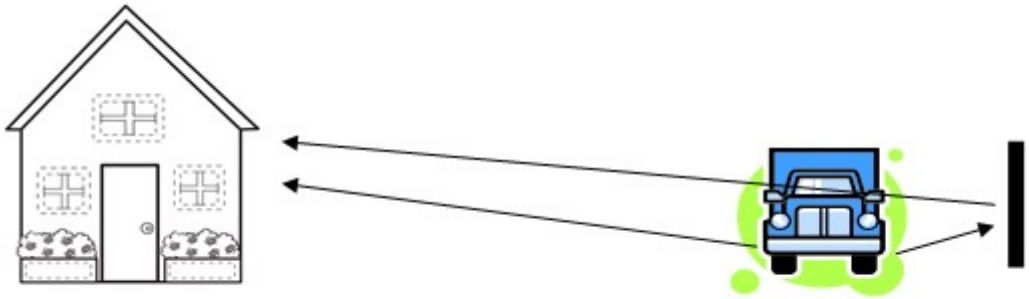
Absorption

Reflection between noise barrier and passing heavy vehicles:



Reflection to opposite receivers:



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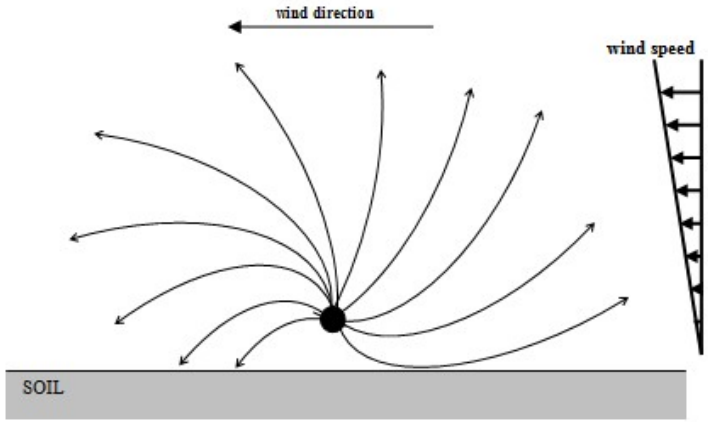
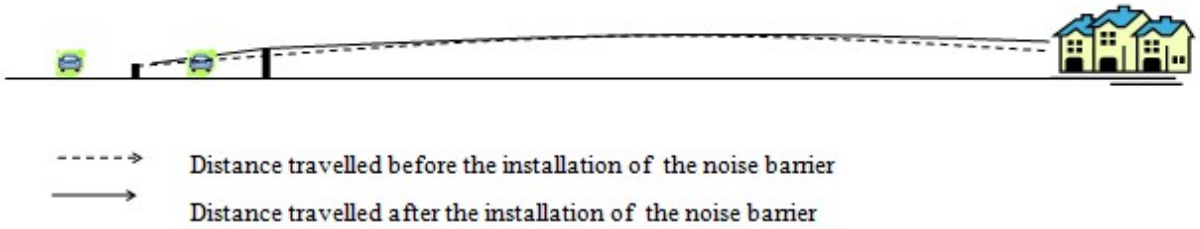
Influence factor: wind

Shadow zone and zone of increased noise level due to the wind:



Effect of a noise barrier for a receiver at a far distance:



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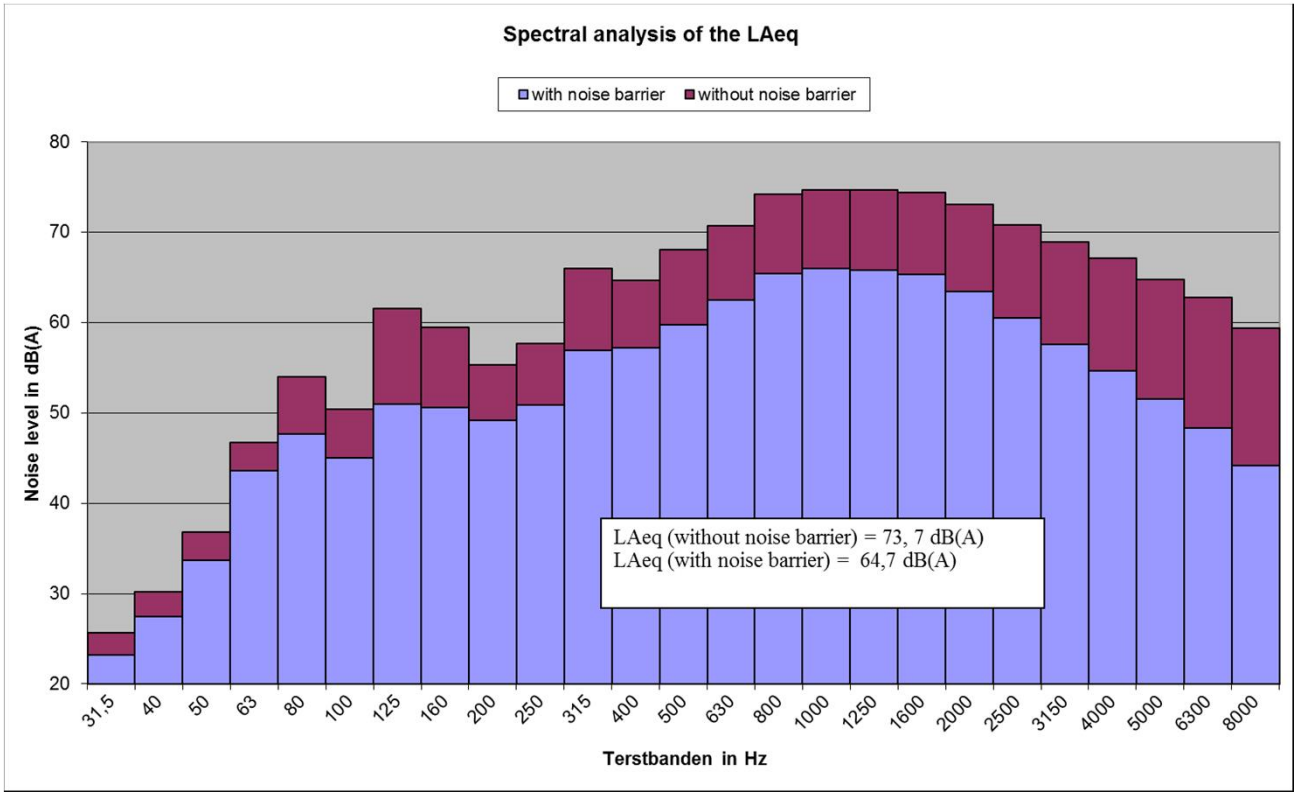
Effect of a noise barrier

Distance between receiver and road	Expected noise reduction after installing a noise barrier	Experience by the human ear
30 m	12 dB(A)	Felt to be 'half as loud' as before
50 m	10 dB(A)	Felt to be 'half as loud' as before
100 m	5 dB(A)	The reduction is readily detectable, but the influence of the wind direction plays an important role
250 m	3 dB(A)	The reduction is just detectable. But because the influence of the wind direction might be greater than the noise reducing effect of the noise barrier, the receivers don't always perceive this as a reduction

Influence: spectral

Measurement: 4 m high noise barrier – height mirophone 5 m – 20 m behind barrier



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Informing the public

- Effect, price,…

- Information meetings
- Brochures
- Noise maps
- Audiotapes
- …

=> to avoid misunderstandings afterwards

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How can you check the installation of a new barrier?

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New barrier installations

- Before installation: Check the test reports of acoustic characteristics (insulation and absorption)

- During installation:

  Often problems arise during installation: weakest point are the joints between panels, foundation and post

New barrier installations

=> Check the conformity and correct installation (visual inspections)

- After installation: Do a total visual and audible inspection + control in situ measurement when this will be the reference

Check before installation

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Insulation

- Laboratory method

Source: QUIESST

- Most used method
- EN 1793-2
- Reverberation chamber
- Diffuse sound field
- Reverbant conditions: eg. tunnels, deep trenches or under covers
- DL_R
- A good barrier => $DL_R \geq 25$ dB

- In situ method

Source: QUIESST

- New method
- EN 1793-6 (since 2012)
- Open sound field – outside
- Direct sound field
- Non-reverbant conditions: eg. along roads
- DL_{SI}

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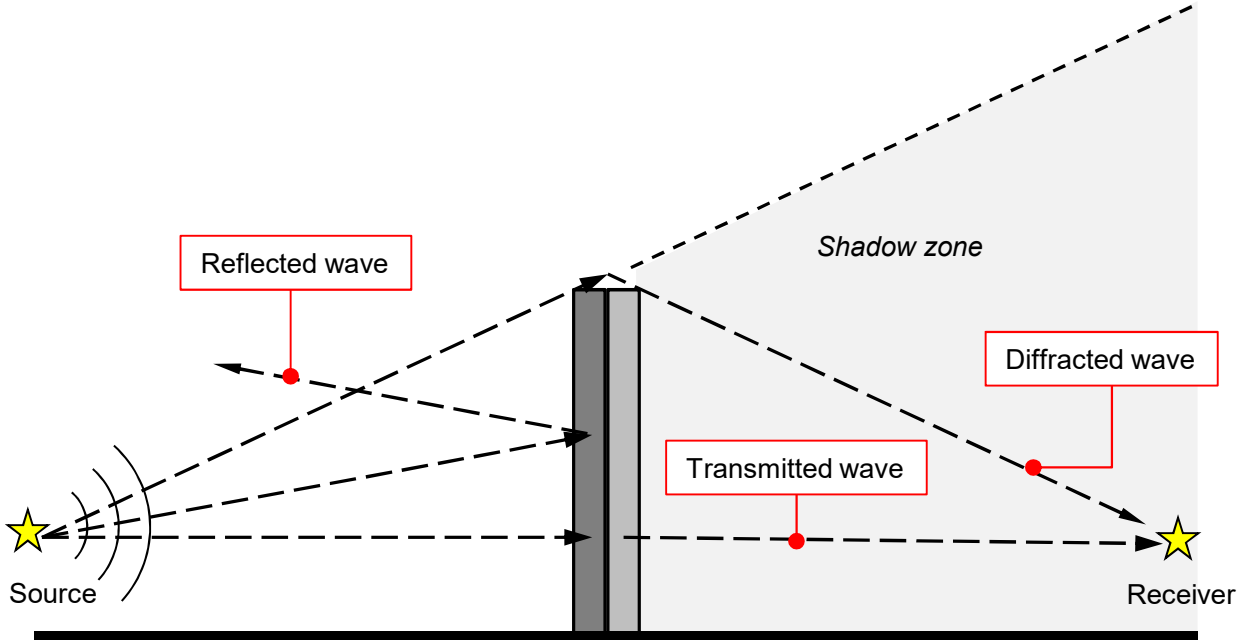
Insulation: labo

- Why $DL_R \geq 25$ dB?



- In case of very high noise barriers or receivers very close to the barrier the value must be higher

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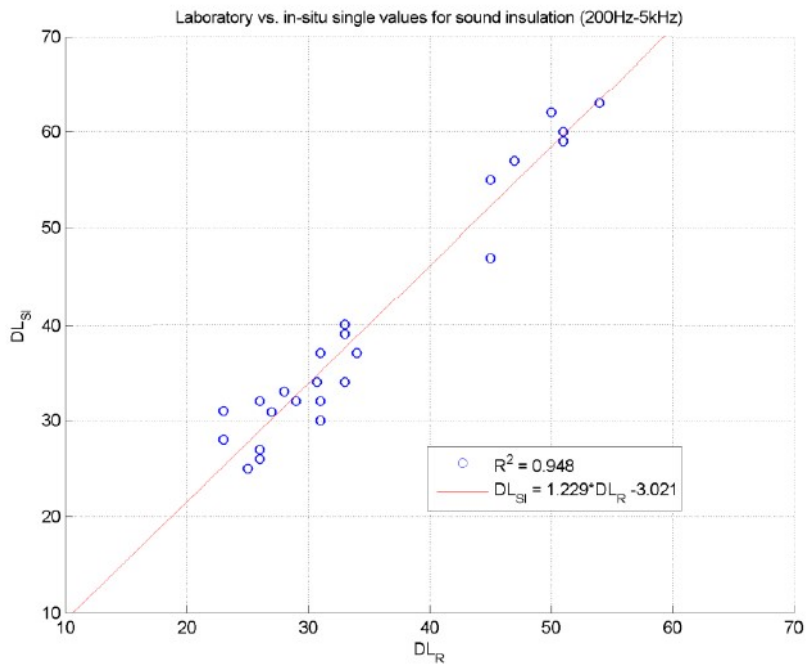
Insulation: in situ?

- Recommended to use in the future (along roads)
- QUIESST database: good correlation laboratory vs. in-situ single values DL_R and DL_{SI}
- First suggestion: $DL_{SI} \geq 28$ dB



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Absorption

- Laboratory method

- Most used method
- EN 1793-1
- Reverberation chamber
- Diffuse sound field
- Reverbant conditions: eg. tunnels, deep trenches or under covers
- DL_{α}
- A good absorber => $DL_{\alpha} \geq 10$ dB

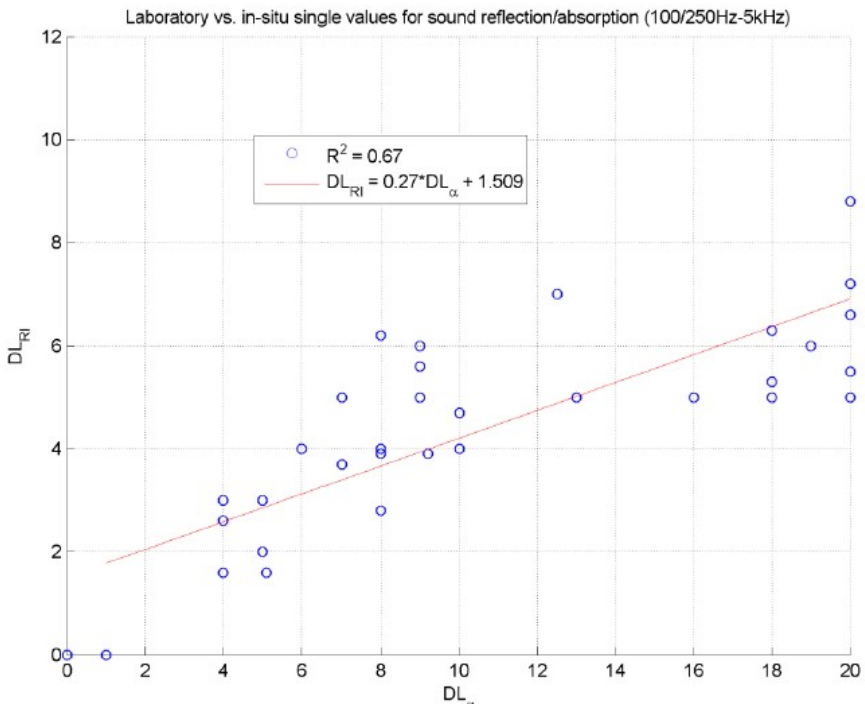
- In situ method

- New method
- EN 1793-5 (since 2016)
- Open sound field – outside
- Direct sound field
- Non-reverbant conditions: eg. along roads
- DL_{RI}

Absorption

- Recommended to use in the future
- QUIESST database: moderate correlation laboratory vs. in-situ single values DL_{α} and DL_{RI}

- Further research needed



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Insulation and absorption: in situ? Is the market ready?

Not in report

- Since 2016 in Belgium in situ acoustical requirements in public procurements
  - $DL_{SI,panel} \geq 28$ dB
  - $DL_{SI,post} \geq 26$ dB
  - $DL_{RI} \geq 5$ dB
- In the beginning a lot of resistance
- Today 5 manufactures in Belgium with approved test reports
- Materials: Concrete with wood-fibre/cement composite or stone gabions, aluminium and PVC
- Test Belgium 2016: 20 in situ measurements along old and new barriers => results see presentation Jean-Pierre Clairbois

Product specification
CE marking

- EN 14388
- Since 2013 CE-marking is mandatory
- Overview of declared (or not) values of acoustic, non-acoustics and long-term performance characteristics
- Last version: 2015 (no declaration of EN 1793-5 yet)
- Be aware: “No performance determined” (NPD)

Attention points
Checking test reports of acoustic characteristics (insulation and absorption)

- During tendering process, before installation!
- Are the barriers tested according the EN standards (EN 1793-1, 2, 5 and 6)? Check the test method and report!
- Do the values comply with the tender specifications?

Check during and after installation

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Attention points
Checking conformity and correct installation

- Is the product correct installed in accordance with manufacturer/supplier instructions?

- Is the installing product the same as the tested one?

Attention points
Visual and audible inspections

- Whole barrier
- On both sides
- What (visual and audible!)
  - Physical defects in/damage to the materials
  - Quality/correct placement of seals between acoustic elements, acoustic elements and posts, acoustic elements and bottom NRD
  - Stability of posts
  - …
  - => see presentation Sébastien Marcocci

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Attention points
Control in situ measurements

- Recommended when in situ will be the reference (already implemented in Belgium)
- **Timing**: as soon as possible after installation (within 1 – 2 months) preforable when hard shoulder or outer lane is still closed and impact protection vehicles are still provided
- **Quantity**: at random at 1 or 2 positions (eventually based on input of visual inspections)
- **Cost**: x thousand € for 3 measurements (reflection + insulation panel + insulation post)

Diffraction
Added devices

- Extra component on the top of a noise barrier
- In situ test method available (EN 1793-4)
- Because of the higher costs, only recommended on bridges and fly-overs where the height is limited because of wind and static load

What are the possibilities to check the lifetime?

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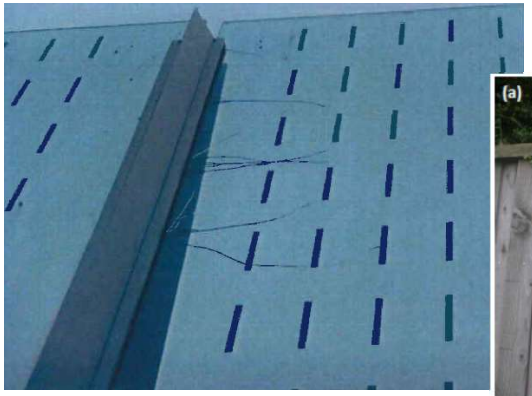
Why checking on the long term?
Some (bad) examples…



Why checking on the long term?

- Lack of data – no information
- To get basic information on the future maintainance cost
- How?
  - lifetime monitoring programme
  - Visual and audible inspections
    - => see presentation Sébastien Marcocci
  - In situ noise measurements
    - => see presentation Jean-Pierre Clairbois

Are their interesting new innovative barriers?

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Combined noise and safety barriers

- Free-standing (no foundation)
- Lower operating width is needed
- Maximum height is limited
- More expensive: only recommended when really necessary (cable zone, no space,…)

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Photovoltaic noise barriers

- Proven and readily to implement
- but depends on the situation (climate, potential use of energy, maintenance,…)

- => see also presentation on noise barriers and electricity production (Giles Parker)

Noise barriers with TiO_2 coating

- Helps to convert NOx into stable compounds
- Limited success
- Ok in labo
- In real life circumstances very difficult

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Sonic crystals

- New type of barrier
- A set of cylinders structured in a way that optimizes noise reduction in specific frequency regions
- Further research is needed

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Buildings as noise barriers

- Good idea

In Denmark a common carport facility was constructed as a two storey high noise barrier

Coverage or tunnels

- Very impactful solution
- But expensive and hard landscaping

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Report: http://www.cedr.eu/publication-three-technical-reports-noise/

Questions?

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