

Effect of ground scattering on noise barriers efficiency

Noise in built environment, Ghent Belgium, 29-30 April 2010

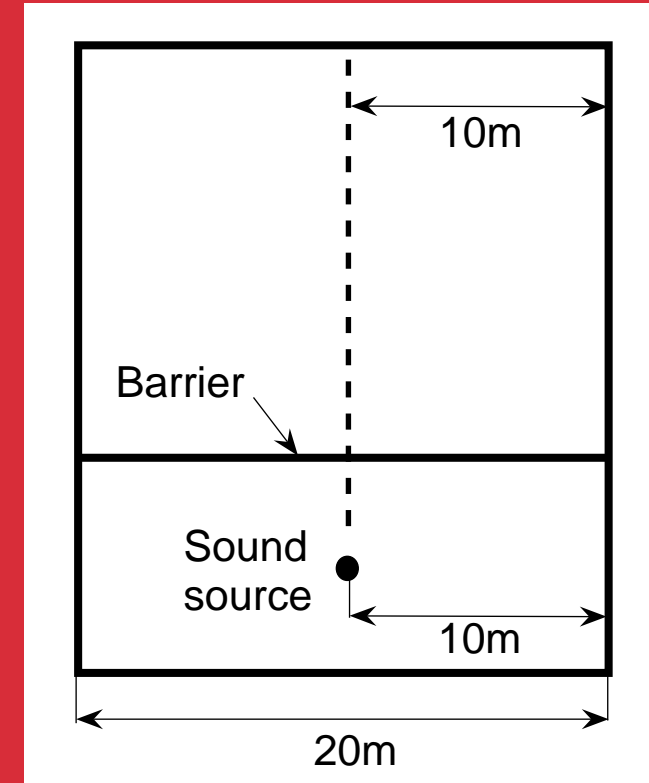
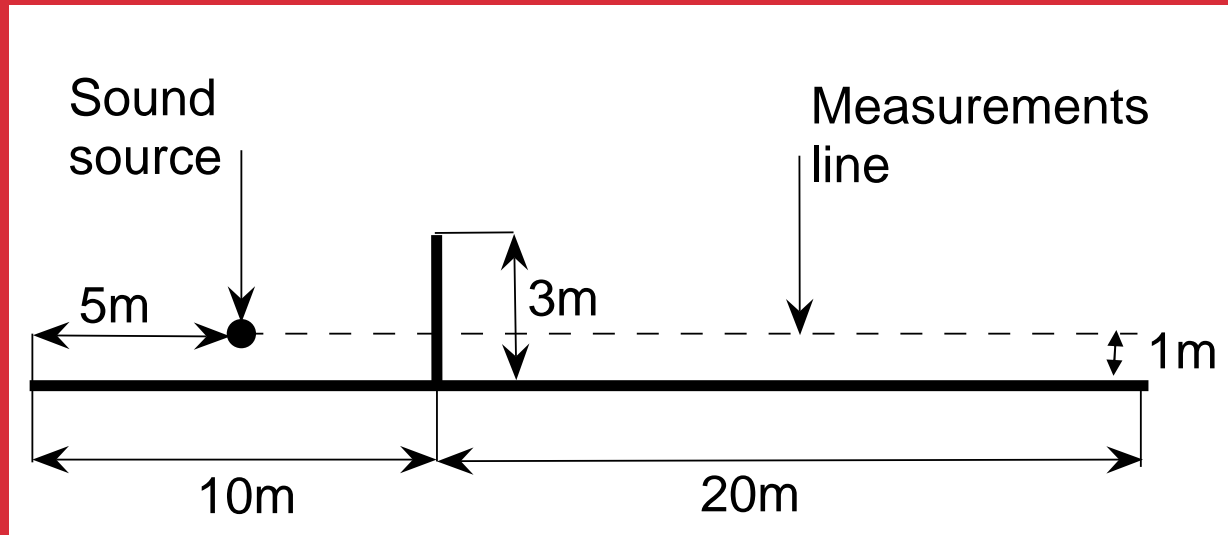
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1. Introduction

- Noise barriers popular solution for traffic noise;
- Numerous results:
 - in-situ measurements;
 - scale models measurements;
 - empirical and analytical prediction models;
- Works concentrated on
 - barriers shape;
 - barrier material.
- Impact of the ground's scattering on noise barriers efficiency
- Experiments on a 1/10th scale model

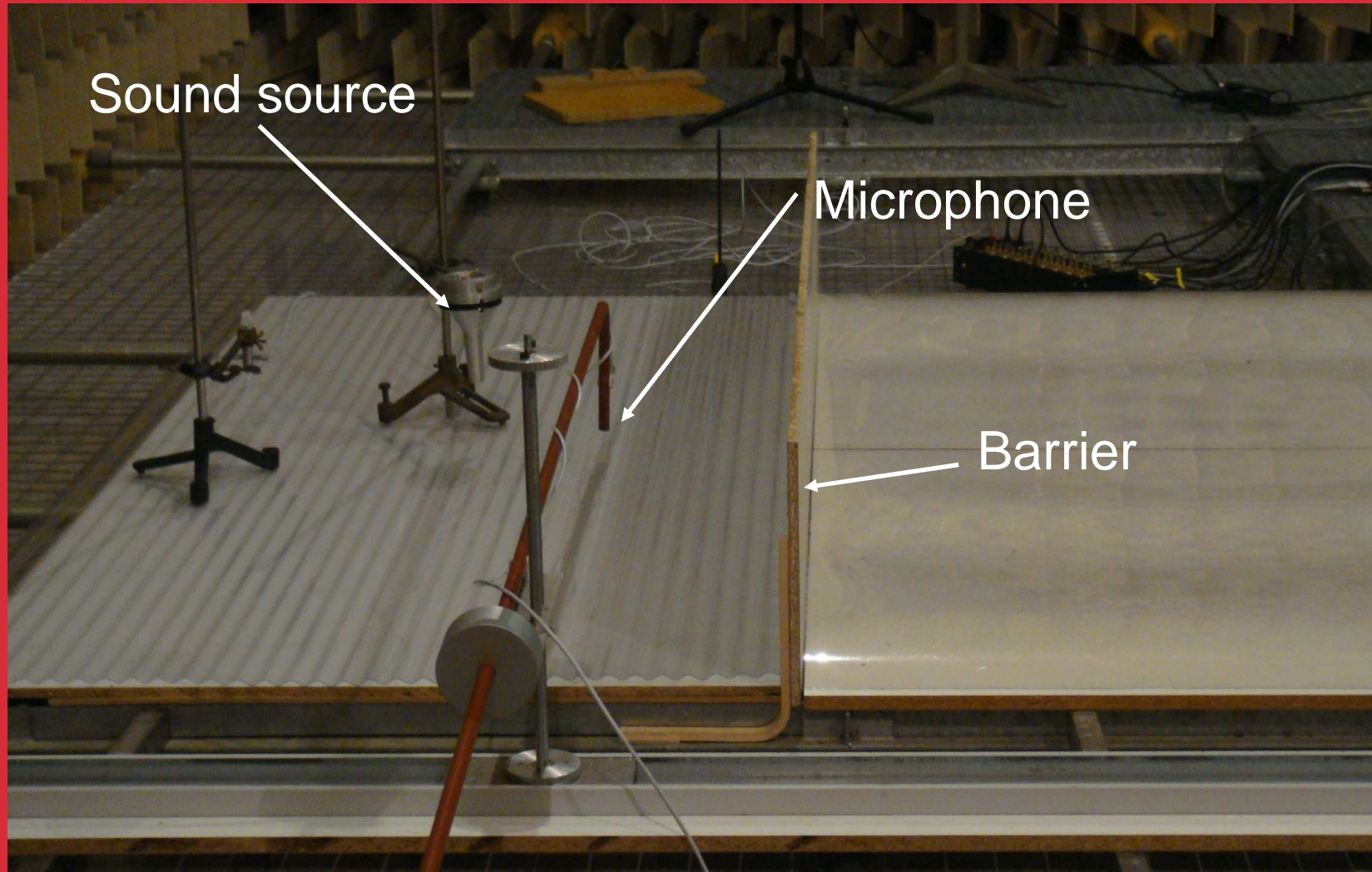
2. Experimental set-up

- 1/10th scale model



- Full scale dimensions
- Laminated plywood
- Omnidirectional sound source
- Mobile microphone

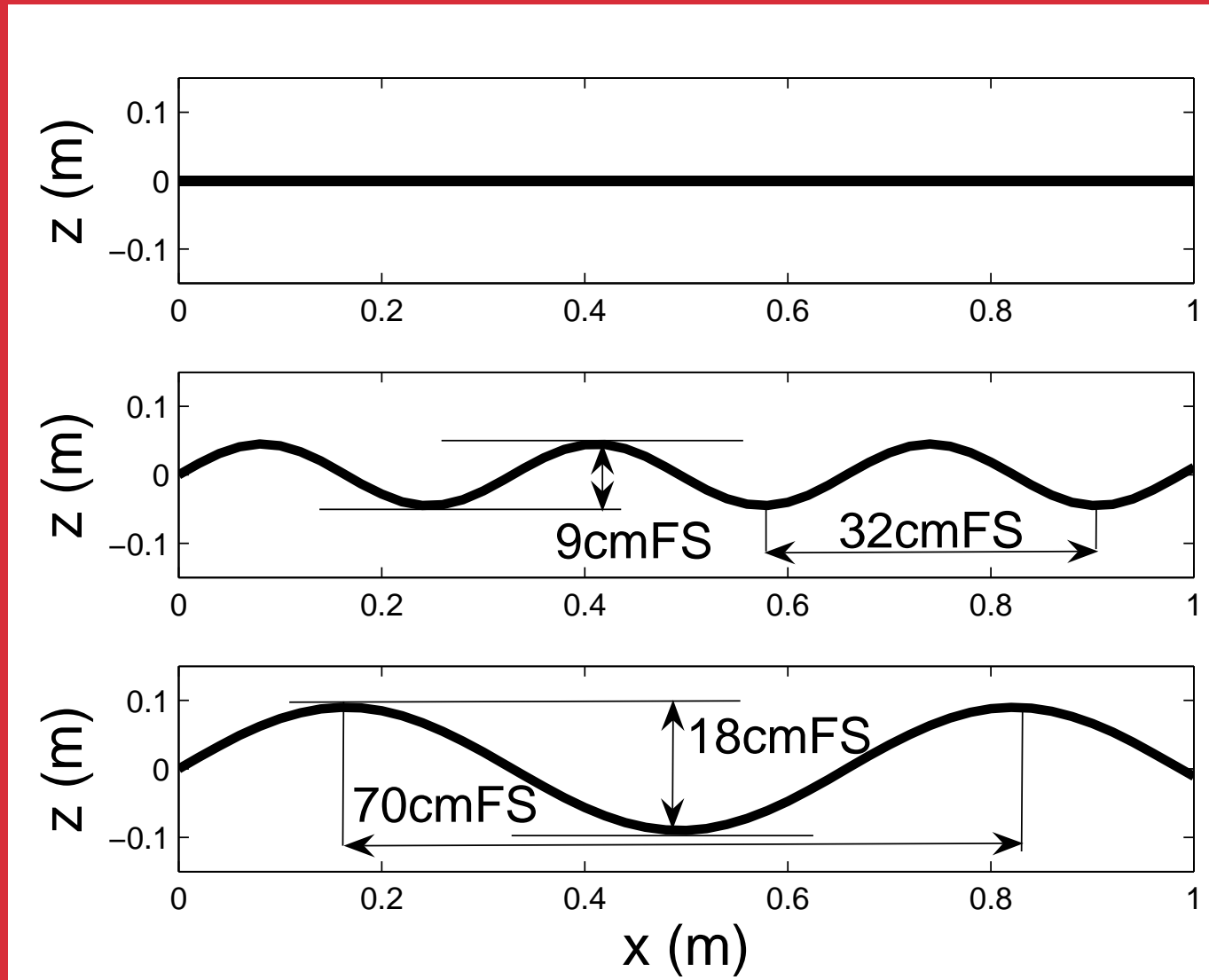
2. Experimental set-up



- Three octave bands: 125, 250 and 1000HzFS

2. Experimental set-up

- 3 ground profiles in rigid material (Plexiglas)



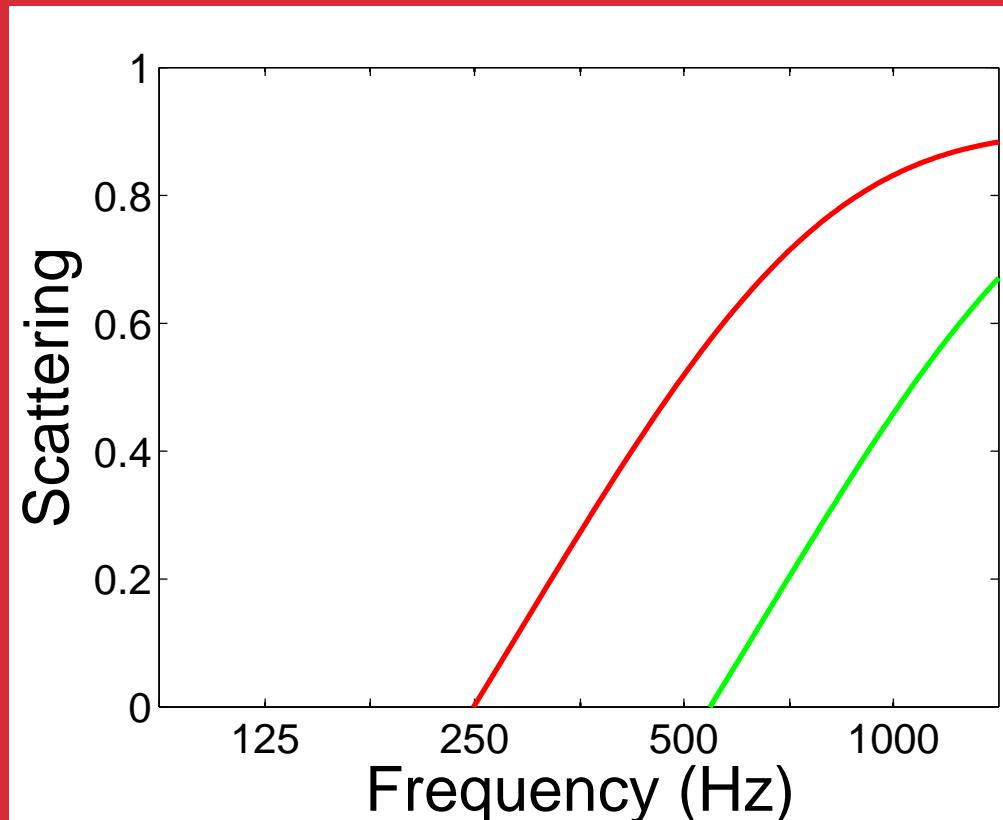
Flat ground

Small Scatterers

Big scatterers

2. Experimental set-up

- Theoretical scattering evaluation [Embrechts, 2005]

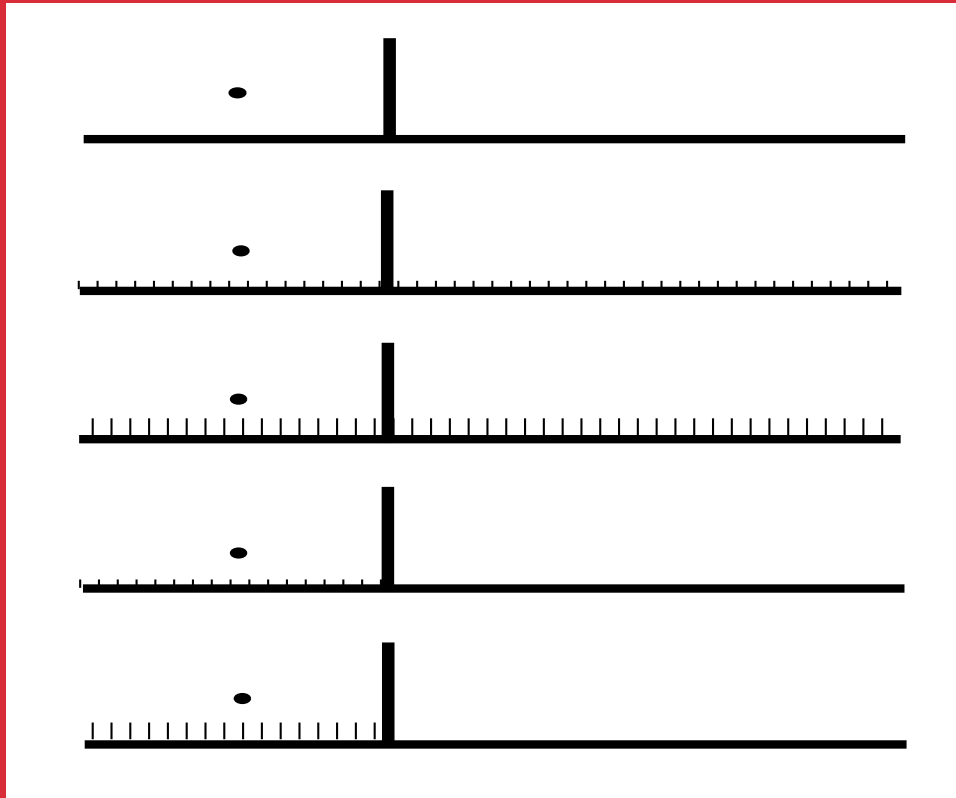


- Holford-Urusovskii model
- 1D infinite sine-shaped surface
- Random incidence of the acoustic waves

Scattering occurs for $f > 250\text{Hz}$.

2. Experimental set-up

- 5 configurations tested



Flat ground

Small scatterers homogeneous

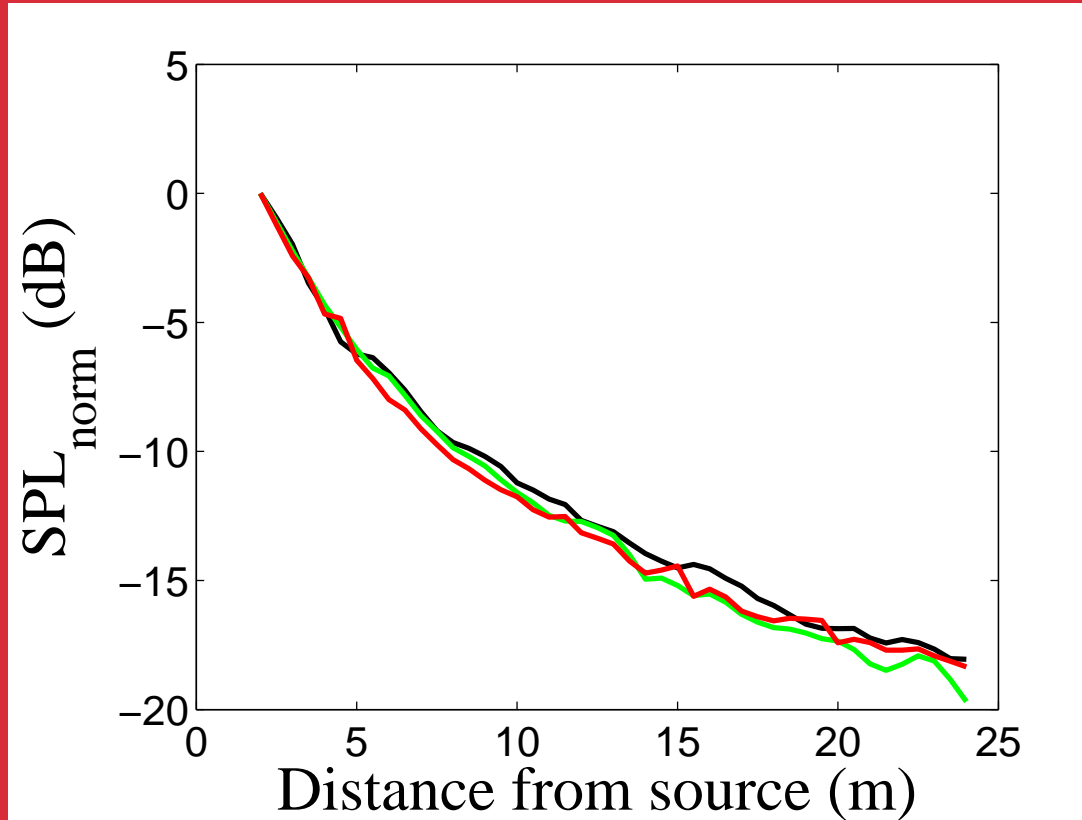
Big scatterers homogeneous

Small scatterers upstream

Big scatterers upstream

3. Results

■ Without sound barrier



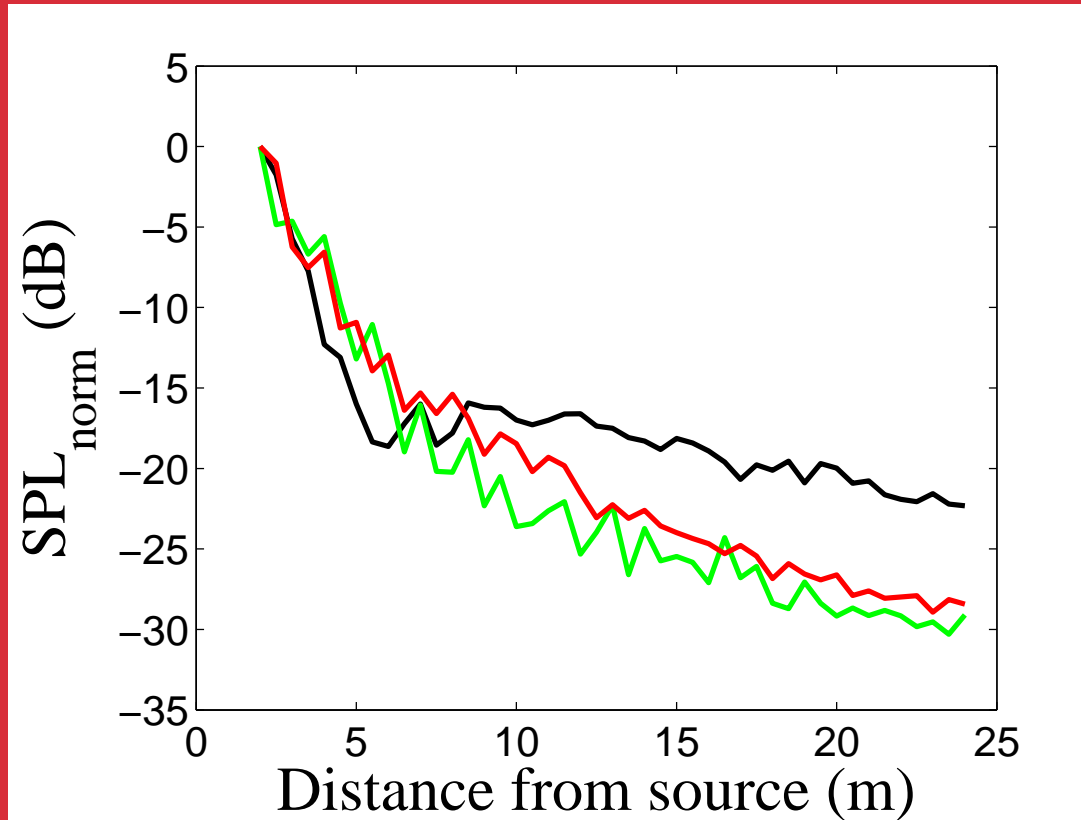
125HzFs



At 125HzFS, propagation is independent on ground scattering.

3. Results

■ Without sound barrier



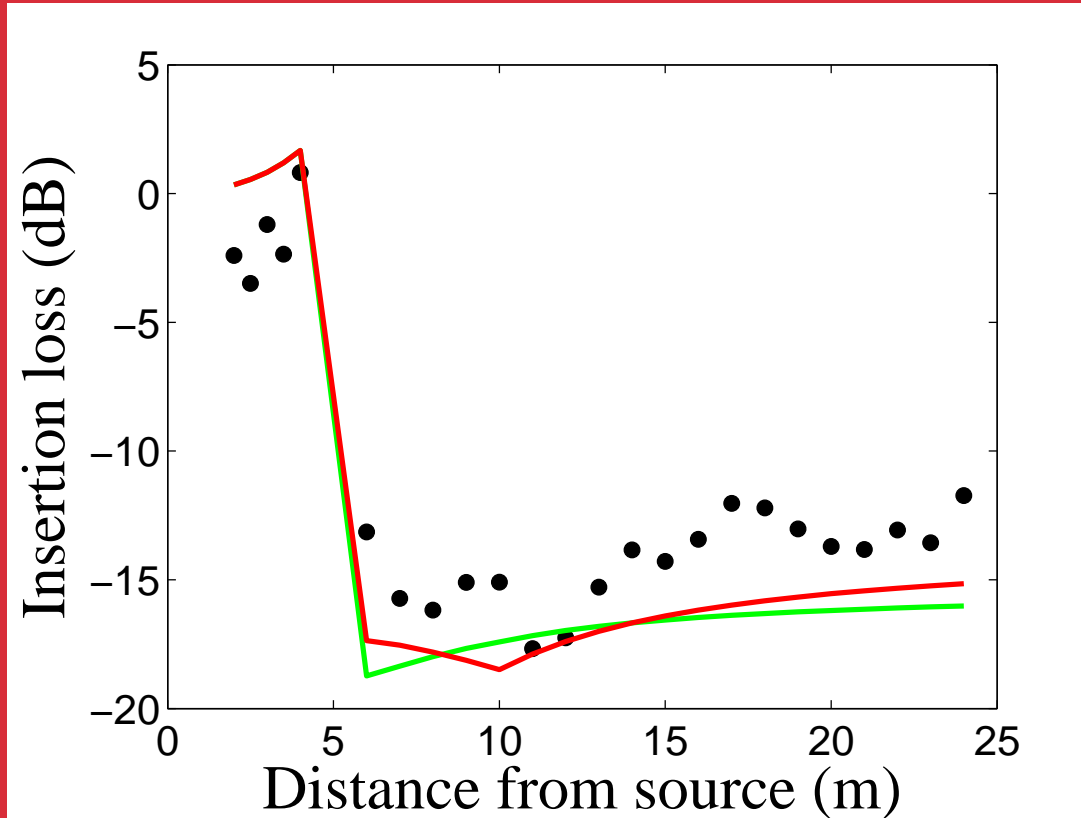
1000HzFs



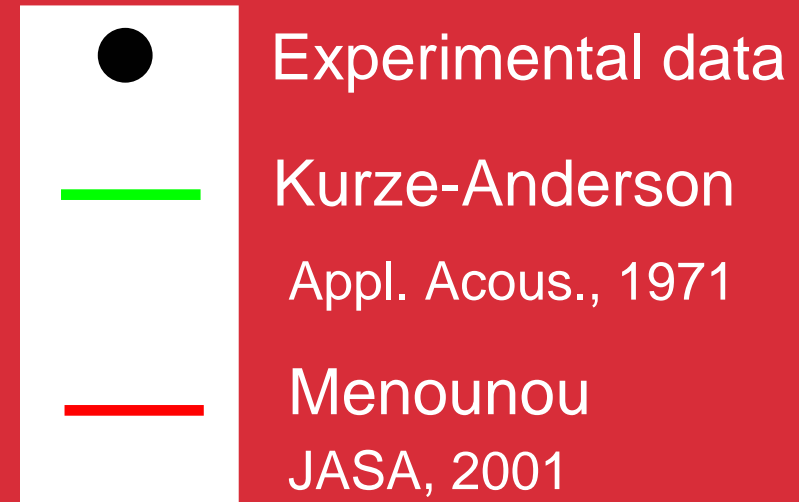
At higher frequencies, scattering increases the sound attenuation.

3. Results

- With the sound barrier for the flat ground



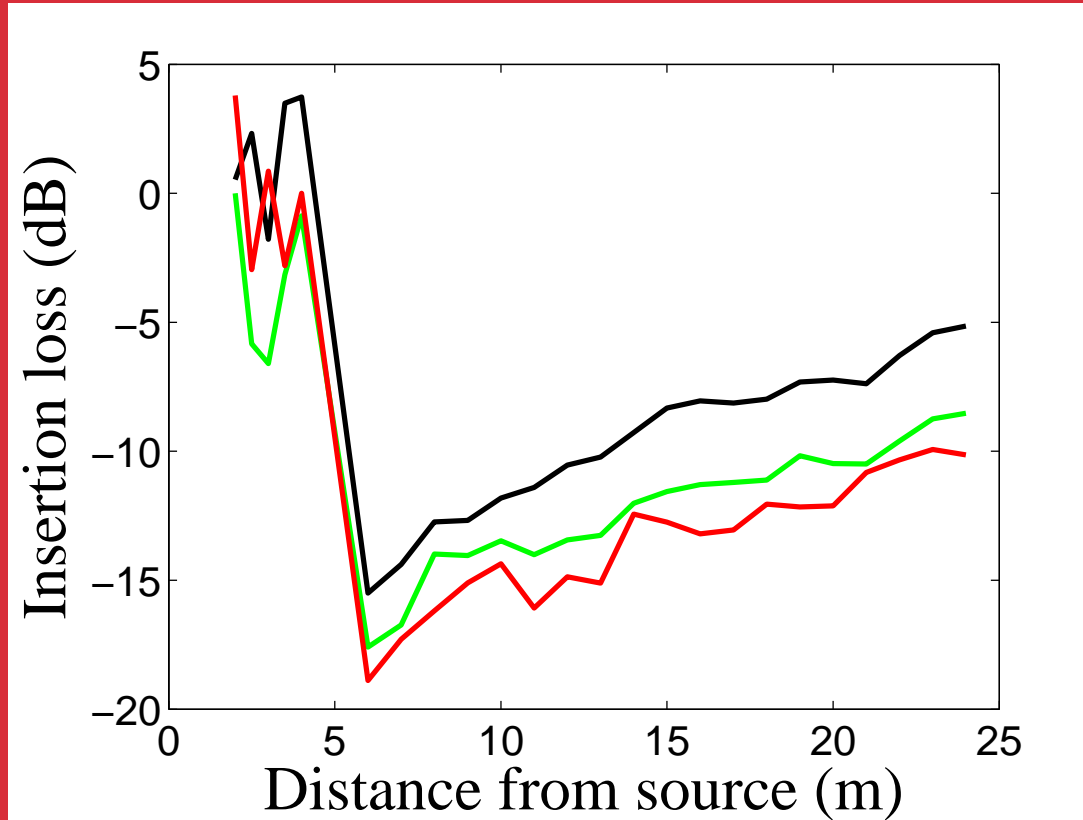
1000HzFs



Good agreement with well-kown models.

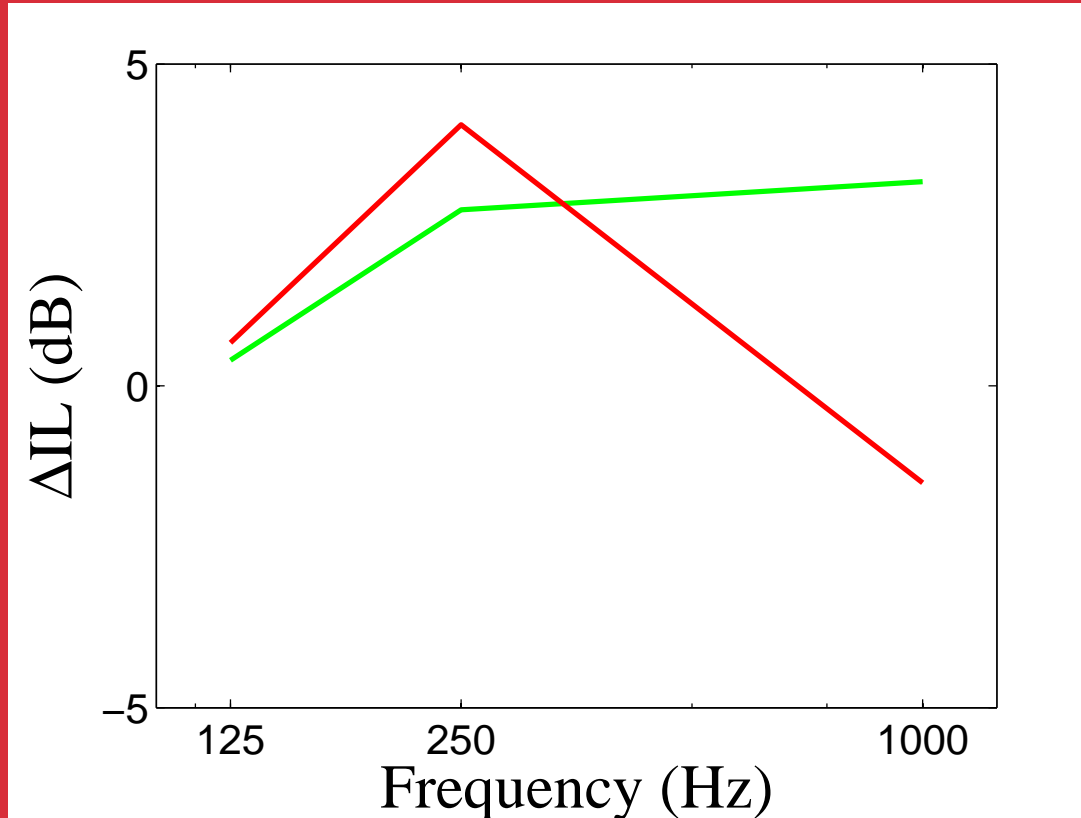
3. Results

- With the sound barrier and homogeneous ground



3. Results

- With the sound barrier and homogeneous ground



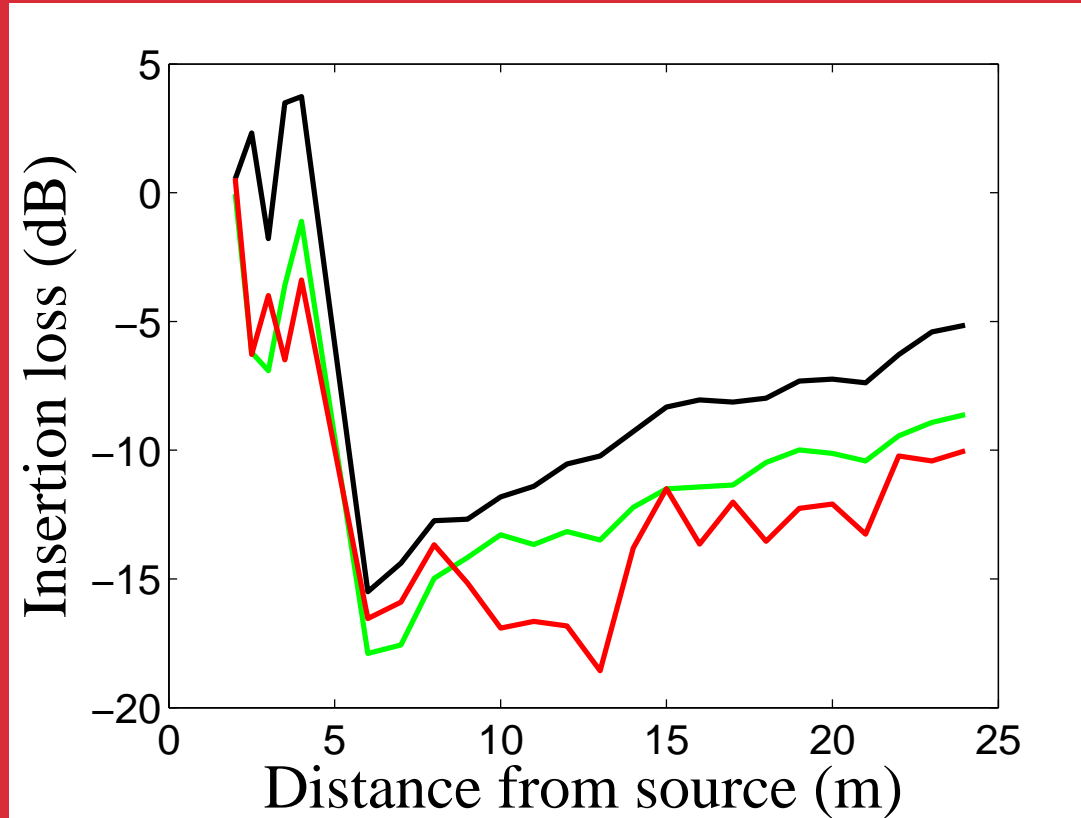
IL gain mean value behind the screen compared to the flat ground

- Small scatterers
- Big scatterers

Improvement of the insertion loss depending on the frequency and the scatterer size.

3. Results

- Scatterers located upstream the sound barrier

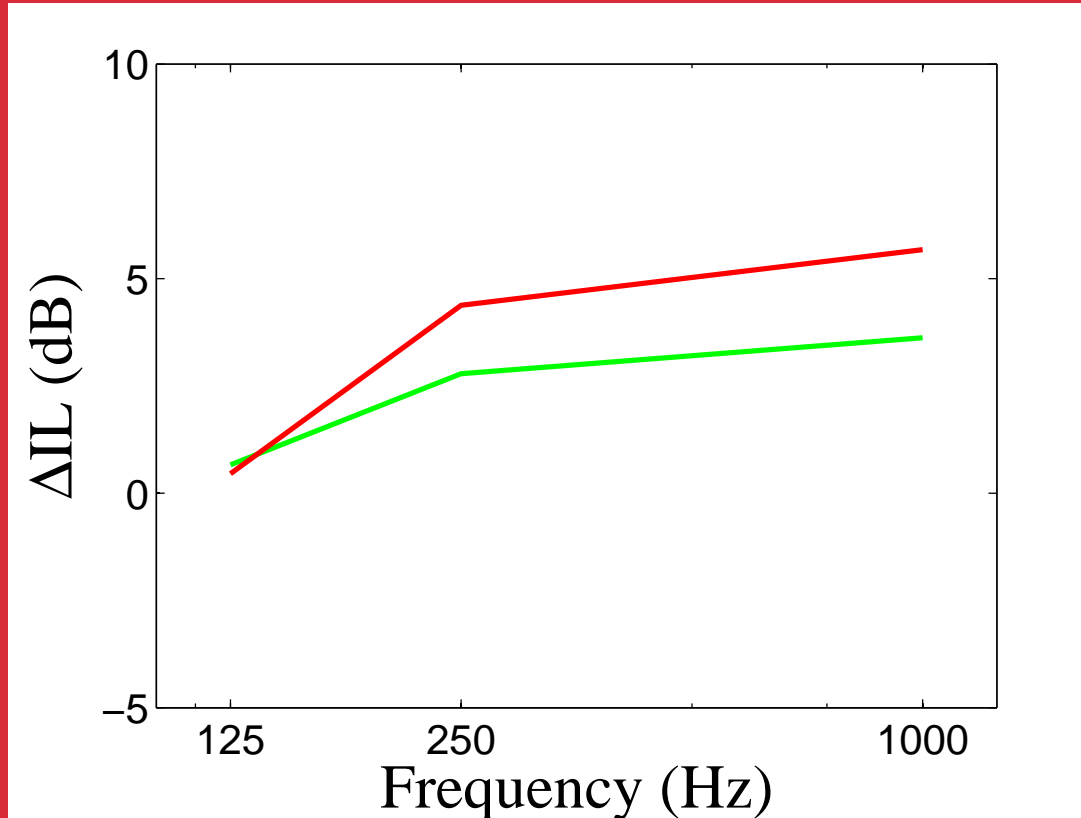


250HzFs



3. Results

- Scatterers located upstream the sound barrier



IL gain mean value behind the screen compared to the flat ground

- Small scatterers
- Big scatterers

Improvement of the insertion loss depending on the scatterer size.

4. Conclusions

- Effect of ground scattering on noise barrier efficiency
- Experiments conducted on a 1/10th scale model
- 3 ground profiles studied
- Flat ground configuration leads to a good agreement with well-known models
- Scattering can increase the insertion loss (up to 5dB) depending on:
 - the frequency;
 - the scatterers location.
- Future works: modelling the effect of the ground scattering on the sound barrier efficiency

Acknowledgements:

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