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Modelling various floor and wall assemblies and comparisons to measured values

Introduction

- Wood is good for the future but still we need to provide more knowledge ➔ stronger industry
- The acoustics and vibrations always decide the dimensions of a floor structure (and wall structure)
    - Why is it always 250 mm of concrete in a floor structure?
    - Why is it 200 mm concrete in a wall?
    - Why do we need HD/F 265
    - Etc etc
    - Because …. With these measures you always fulfill sound class B
- Why do we need 500 mm in the floor structure of o wooden building?
- **It is always the acoustics and vibrational characteristics that decide the structural dimensions**

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Calculation models are certainly needed and the ability to calculate have to be promoted !

- What are we doing?
- Modelling wooden structures and improve the accuracy of calculated values
  - Also dependant on the workmanship (same problem for measurements as for calculations)
- Complicated structures ➔ tricky to predict... Or are they complicated because they have never been predicted...?
- Using FEM and SEA in a combination to cover a full frequency spectrum
- Compile a database with solutions for timber structures
  - www.lignum.ch

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- Modelling acoustic performance of timber structures is very complicated – but so are measurements
- The aim is to facilitate the modelling, overcome obstacles..
- Current presentetaion is from a master thesis project –
  - a number of various floor and wall assemblies that were measured in an accredited laboratory, were calculated using SEAWood
- We have a helpful tool but material data is needed for many structures.
  - Or we use the modelling to promote solutions that are predictable?

Method

- SEAWood – a software provided by InterAC, which is a research partner in STB. Combining SEA with FEM to cover a wider freq range.

- Simulations have been made for both airborne and impact sound for various elements

- However, the impact sound source is not yet modelled perfectly in the software

- Calculations in this work have been made using

R_w

$R_w + C_{50\text{-}3150}$

$L_{n,w}$

$L_{n,w} + C_{I,50\text{-}2500}$

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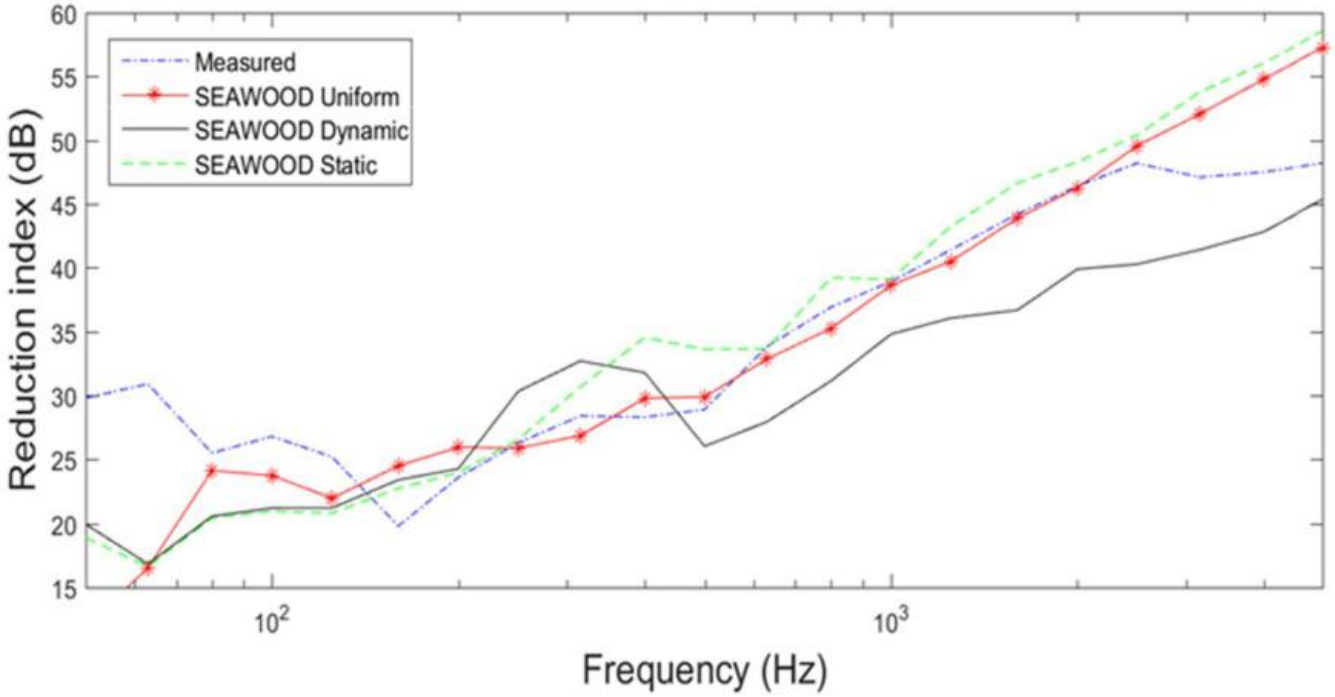
Results

- Five different floor and wall assemblies will be presented
  - Bare CLT 140
  - 20 mineral wool and 60 Cement Screed on CLT 140
  - Bare CLT 320
  - CLT (with and without gypsum board on top) + CLT (aimed for volumes)
  - CLT 140 and 320 (impact)

Bare CLT 140 - airborne

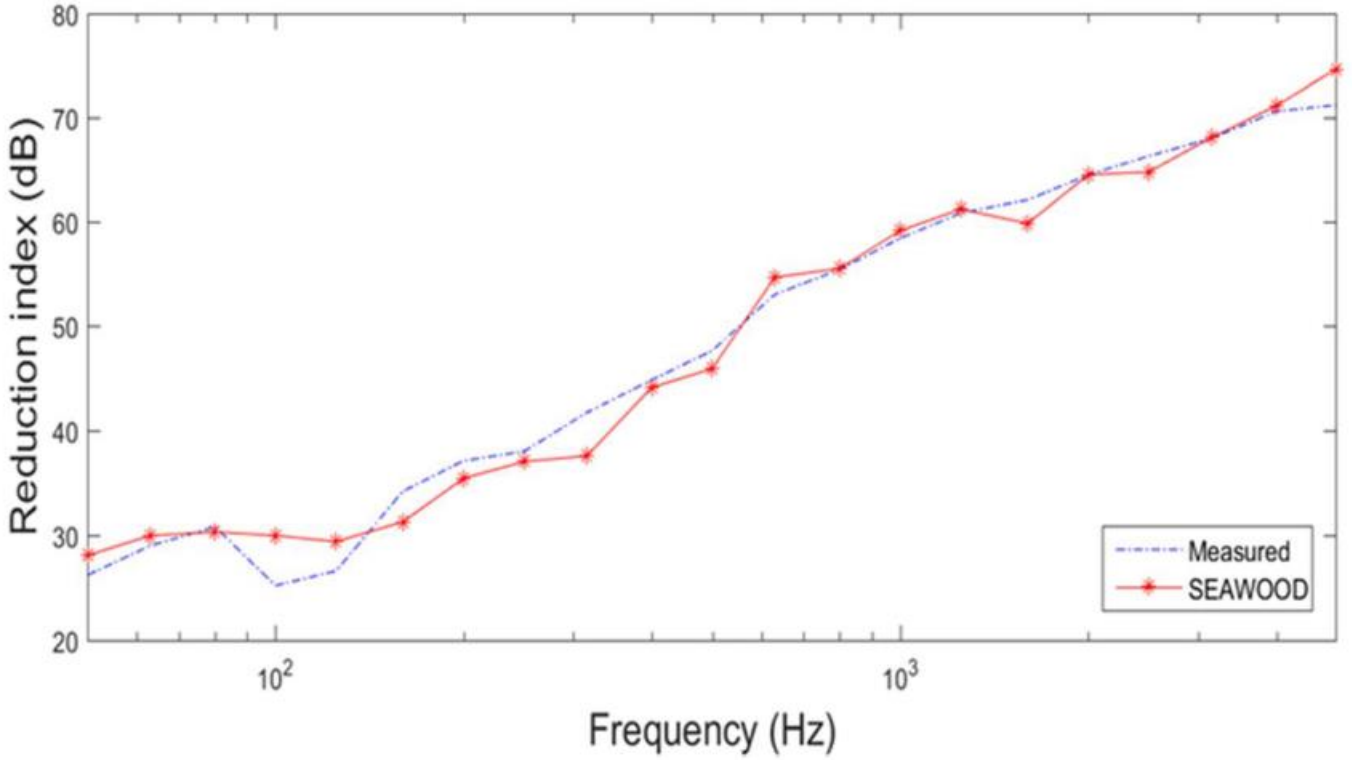
R_w = 36 dB and $R_w+C_{50\text{-}3150}$ = 35 dB (measured)

R_w = 36 dB and $R_w+C_{50\text{-}3150}$ = 35 dB (calculated value using uniform, see below)



20 mineral wool and 60 Cement Screed on CLT 140

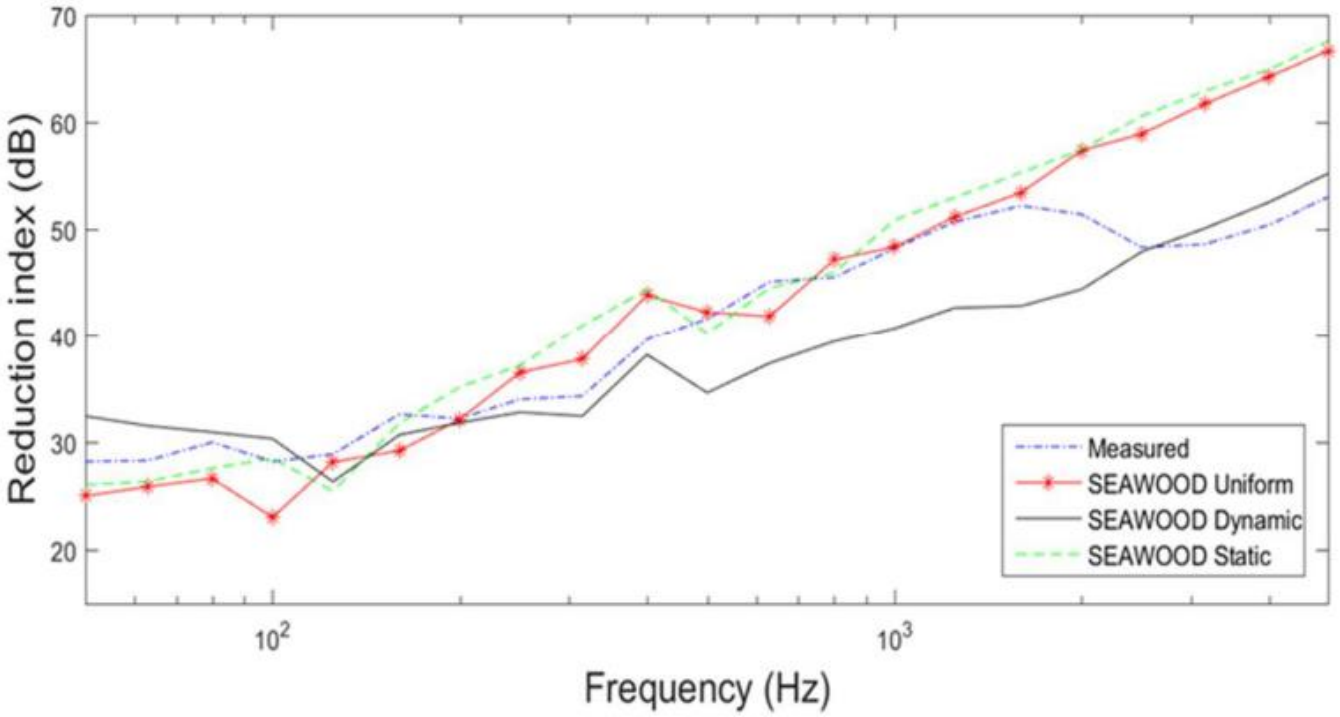
R_w = 49 dB and R_w+ $C_{50\text{-}3150}$ = 47 dB (in both cases)



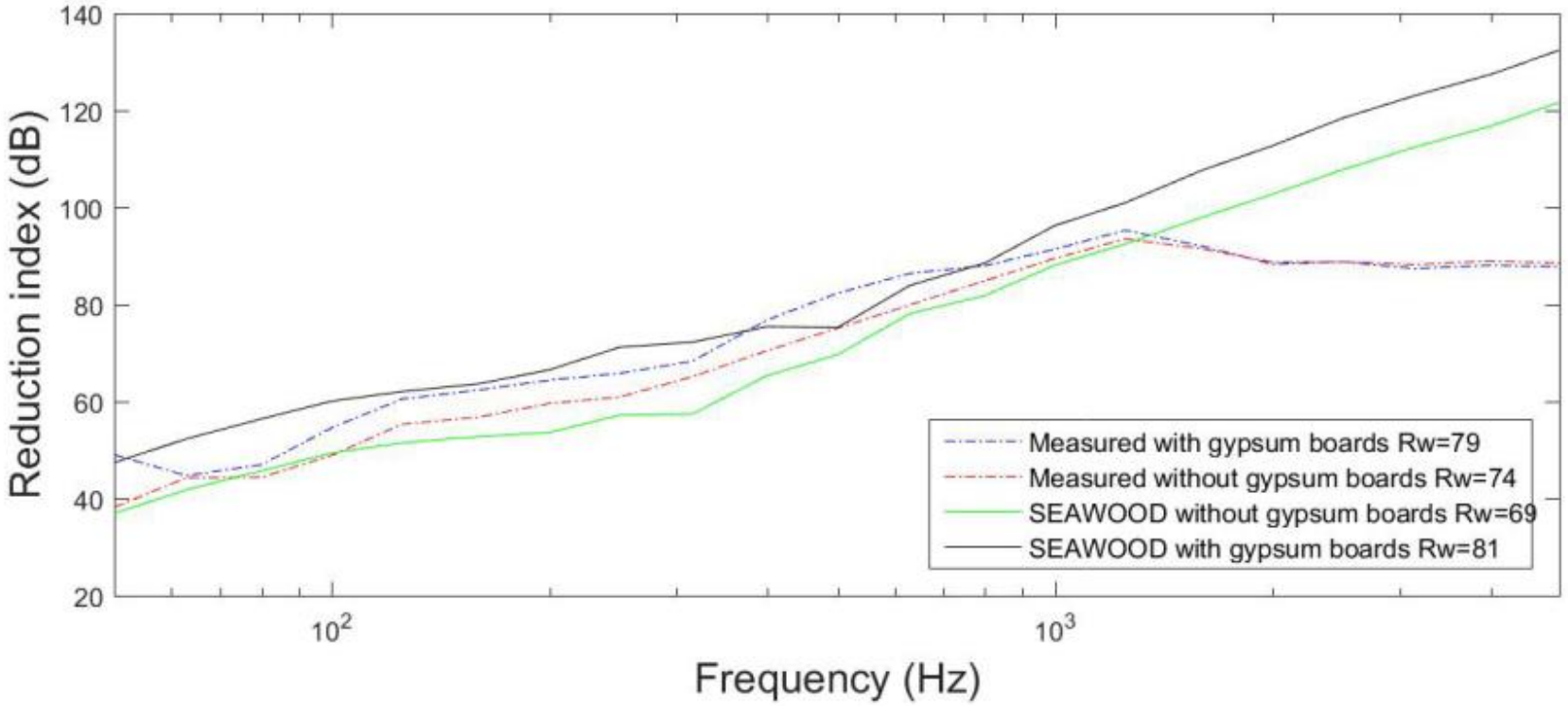
Bare CLT 320 - airborne

R_w = 45 dB and $R_w+C_{50\text{-}3150}$ = 43 (measured)

R_w = 46 dB and $R_w+C_{50\text{-}3150}$ = 44 (calculated value using uniform, see below)



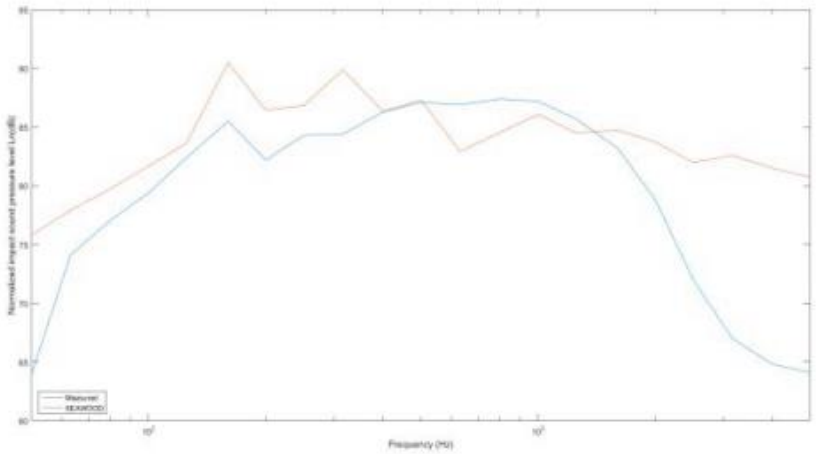
CLT (with and without gypsum board on top) + CLT (aimed for volumes)



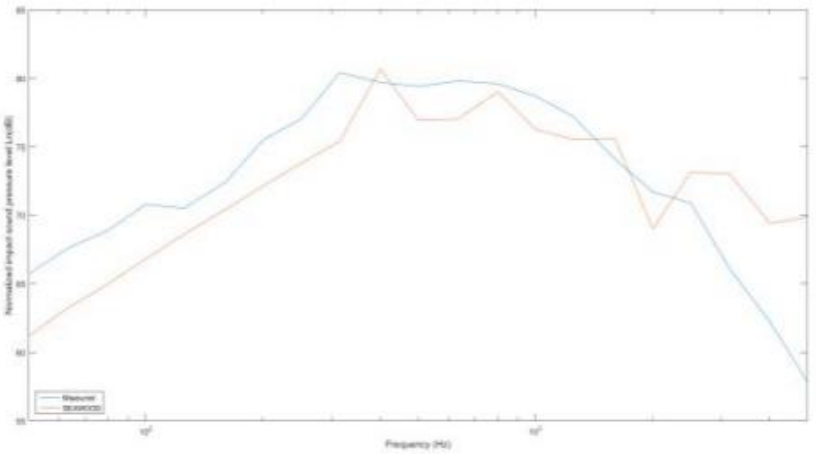
1. with Gypsum boards
   - $C_{50\text{-}3150}$= -5 dB (measured)
   - $C_{50\text{-}3150}$= -3 dB (SEAWood)

2. without Gypsum boards
   - $C_{50\text{-}3150}$= -4 dB (measured)
   - $C_{50\text{-}3150}$= -2 dB (SEAWood)

Impact CLT 140 and 320



L_{nw} = 90 dB calc and 86 dB measured



L_{nw} = 80 dB calc and 80 dB measured

Conclusions

- We need more and better material data
  - Example gravel
- The software is possible to use today, however it needs some skills (like all software)
- Impact sound (most important for timber structures), we have some remaining work
- Hope for better optimization (lower costs) ➔ we might remove one layer with enough confidence
- Design guide / reports at www.silent-timber-build.com during 2017

- Wood is nice, just consider acoustics ☺

Thanks

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