Wood-Concrete Sandwich Beam

Structural Optimization

Project „VelOpt“

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The Beam

Layers

1: Concrete (SCC)

2: Wood-Concrete (Velox)

3: Wood (CLT)

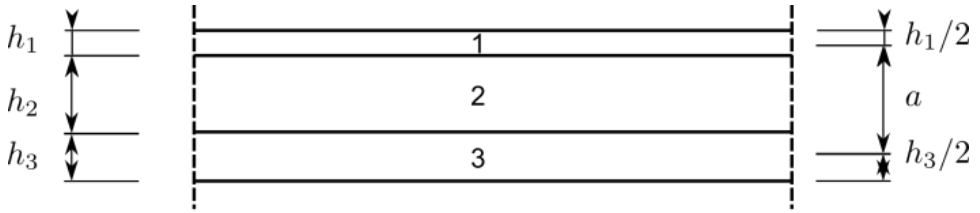
The Analogy

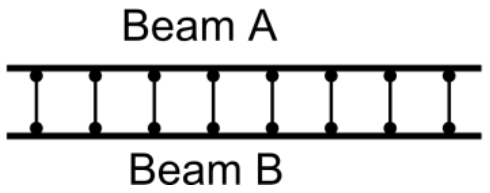
Materials and Layers:

1: Concrete (SCC)

2: Wood-Concrete (Velox)

3: Wood (CLT)





Calculation:

Deflection and stresses of the beam are calculated with a finite element method.

The Optimization Algorythm:

Goal:

optimal dimensions for minimum costs or weight

Iteration Algorythm:

Conmin

Objective function:

$\text{costs}(h_1, h_2, h_3)$

$\text{weight}(h_1, h_2, h_3)$

6 Constraints:

$h_{1,2,3} \geq 3\ cm$

$u_{max} \leq \frac{l}{400}$

$\sigma_c \leq f_{c,d}$

$\sigma_w \leq f_{m,d}$

The Solution:

Experienced data:

- Optimizing for costs, Velox thickness goes to minimum and concrete goes to a maximum
- If optimized for costs Velox has to be cheaper than 80€/m^3 to be considered at all
- Optimizing for weight, thickness of wood goes to maximum and all others to minimum

Conclusion:

- Velox has a bad ratio of material properties to its price
- To improve the results this ratio has to improve too