



FPInnovations

Creating forest sector solutions

www.fpinnovations.ca



CLT – Acoustic Performance

Sylvain Gagnon, Eng.

February 8, 2011

Vancouver

Acoustic Performance



Handbook

FPIinnovations 



Acoustic

Acoustic performance of
cross-laminated timber assemblies

CHAPTER 9

Authors
Sylvain Gagnon, Eng., FPIinnovations
Jean-Luc Kouyoumji, Ph.D., FCI, France

Outline

- **Building Code Requirements**
 - **Sound Transmission Class (STC)**
 - **Impact Insulation Class (IIC)**
 - **Flanking Transmission**
- **Recent Work Performed at FPInnovations**
 - **Collaboration with FCBA – France**
- **Some Solutions for CLT Floor and Wall Systems**

Outline

- **Building Code Requirements**
 - **Sound Transmission Class (STC)**
 - **Impact Insulation Class (IIC)**
 - **Flanking Transmission**
- **Recent Work Performed at FPInnovations**
 - **Collaboration with FCBA – France**
- **Some Solutions for CLT Floor and Wall Systems**

Building Code Requirements

- Adequate levels of sound control in multi-family buildings are **mandatory** requirements of building codes in Canada and USA.
- The National Building Code of Canada (**NBCC**) states that a dwelling unit shall be separated from other space in a building by construction providing a Sound Transmission Class (**STC**) of at least **50 dB**. (*55 dB near elevators*).
- NBCC has no specific requirement for Impact Sound Insulation Class (**IIC**), but provides a recommendation of **55 dB** or better.

Flanking Transmission

- **Flanking transmission** may be defined as the airborne sound that reaches a building occupant by certain paths around or through an acoustical barrier between walls or floors.
- **Flanking transmission** can be particularly annoying in multi-family buildings.
- **Adequate detailing** shall be specified early in the design and construction phase of the building.

Flanking Transmission

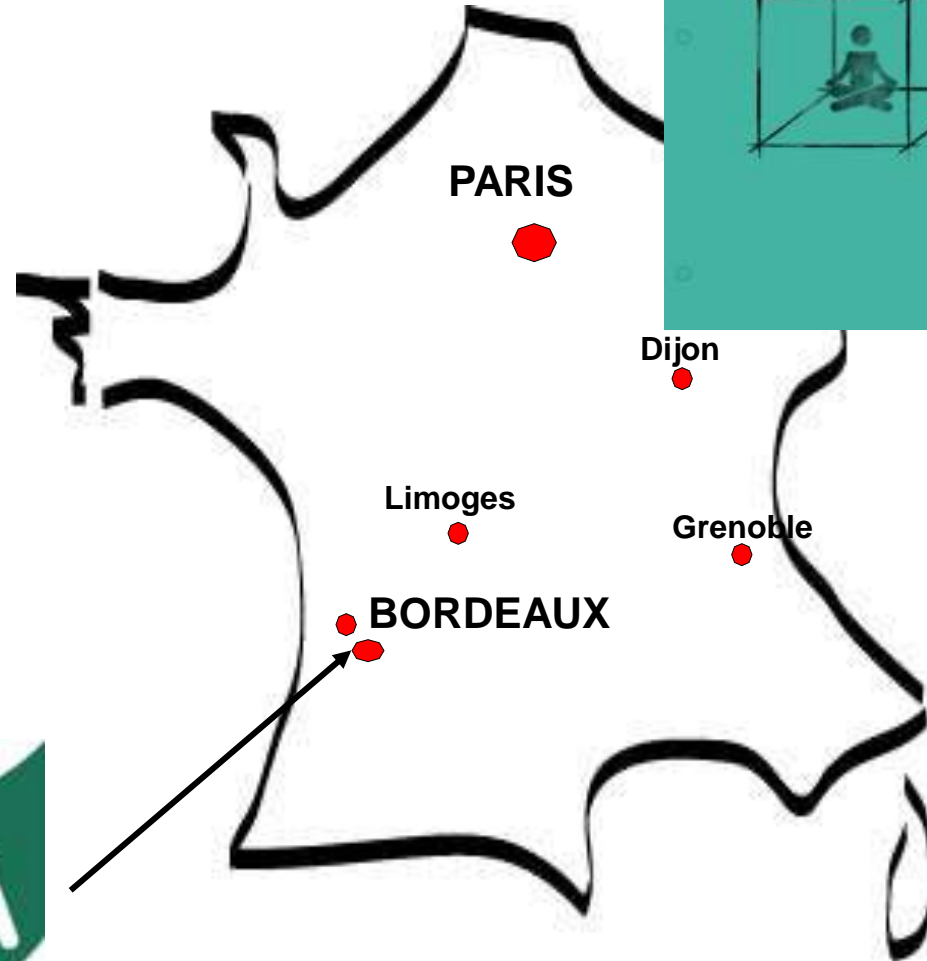
- Then, simply specifying a high performance generic floor or wall system **will not guarantee** an adequate **STC**.
- Different aspects of the floor or wall assemblies must be carefully considered such as windows, partition walls, light switches, telephone outlets and lighting fixtures, plumbing systems, etc.

Outline

- **Building Code Requirements**
 - Sound Transmission Class (STC)
 - Impact Insulation Class (IIC)
 - Flanking Transmission
- **Recent Work Performed at FPInnovations**
 - **Collaboration with FCBA – France**
- **Some Solutions for CLT Floor and Wall Systems**

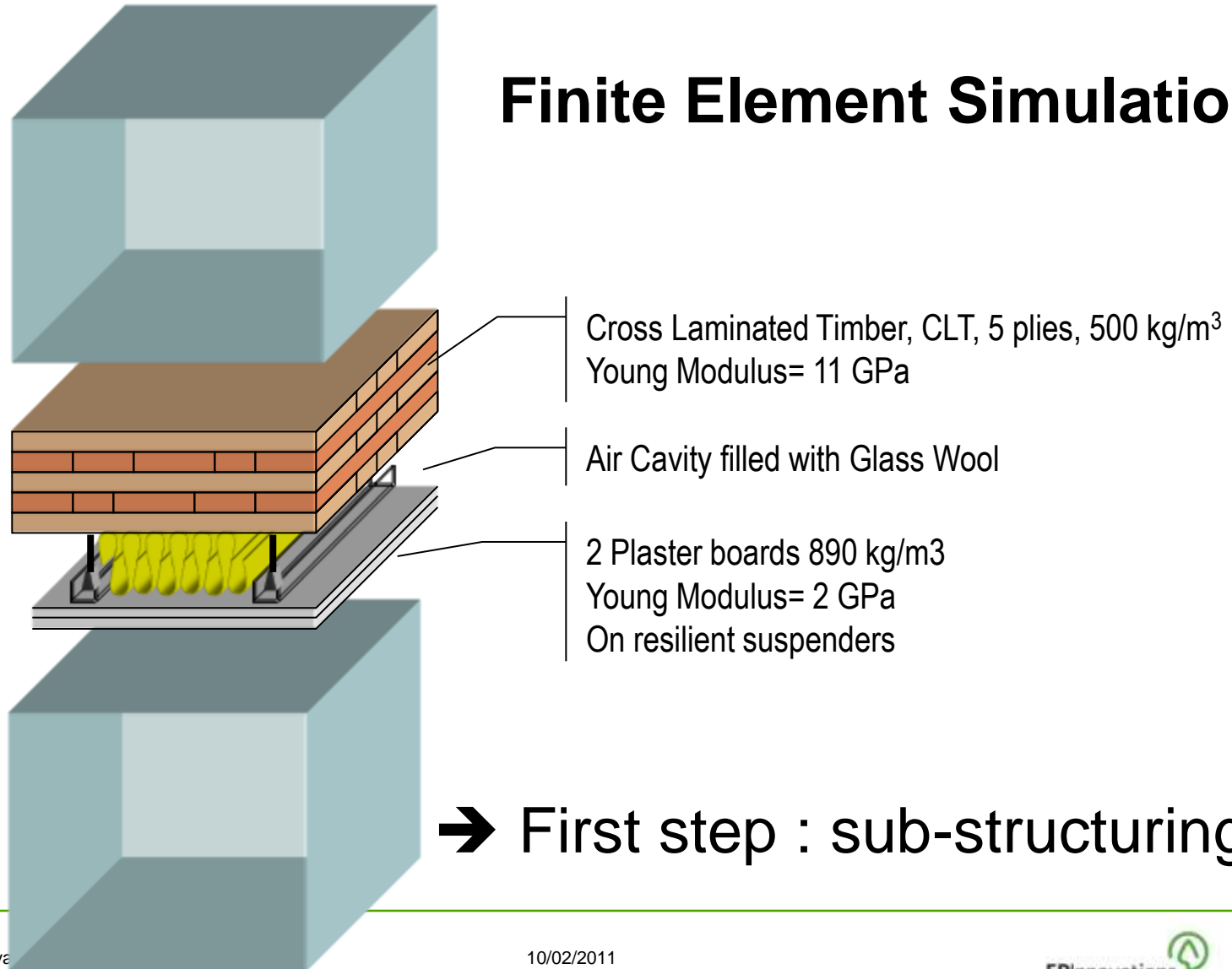
Collaboration with FCBA - France

French Institute of
Technology for
Forest-Based and
Furniture Sectors



SEA-Wood for Acoustic Prediction

Finite Element Simulations



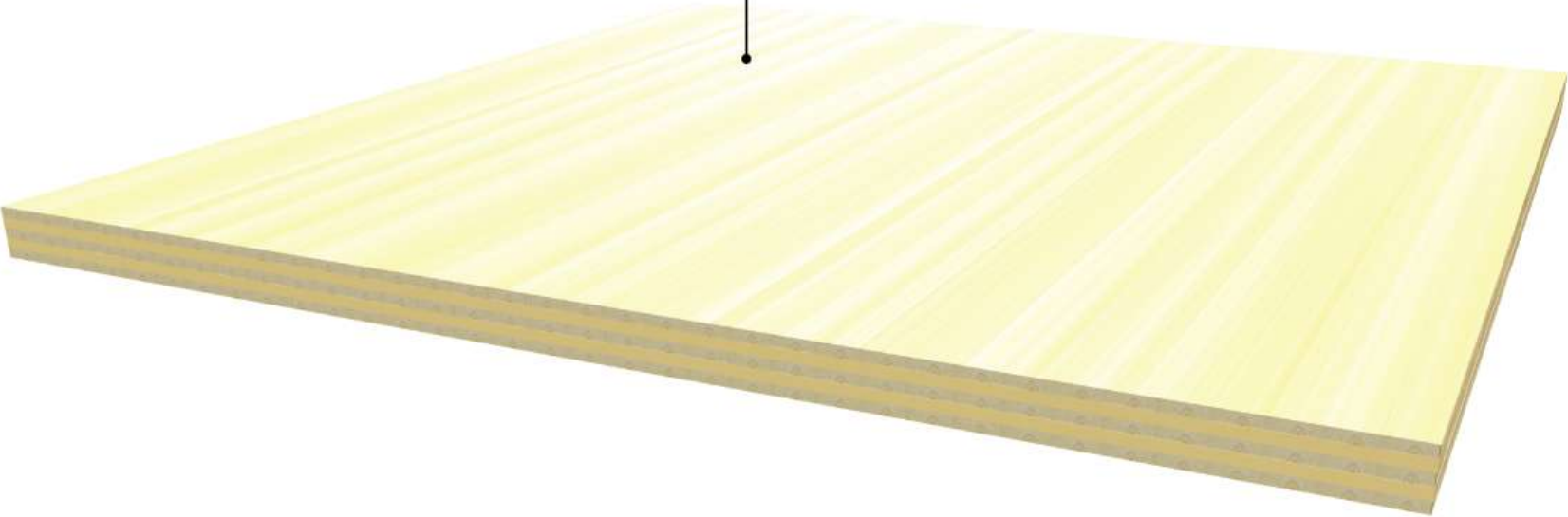
Floor Tests in Laboratory (France)



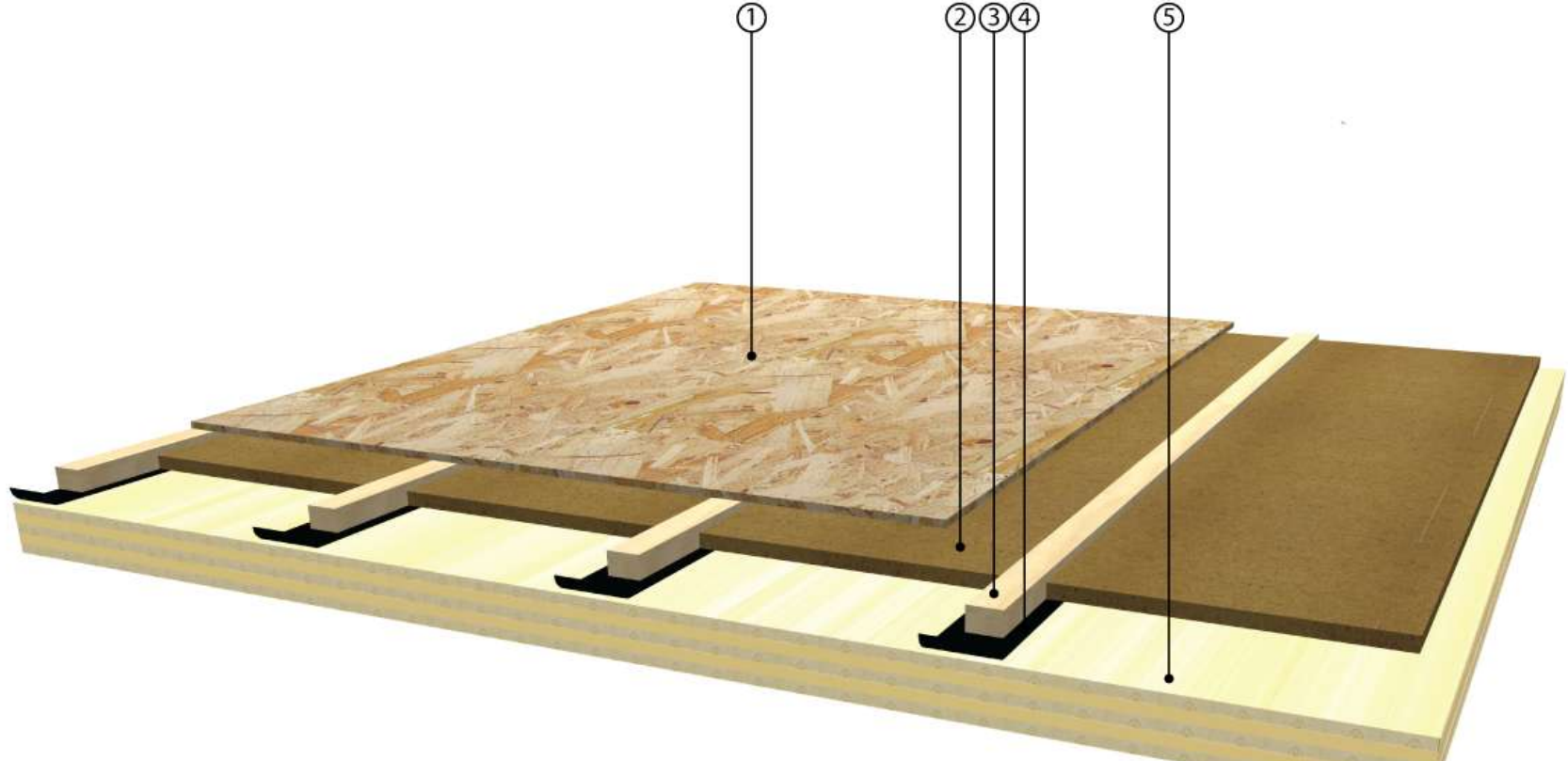
Outline

- **Building Code Requirements**
 - Sound Transmission Class (STC)
 - Impact Insulation Class (IIC)
 - Flanking Transmission
- **Recent Work Performed at FPInnovations**
 - Collaboration with FCBA – France
- **Some Solutions for CLT Floor and Wall Systems**

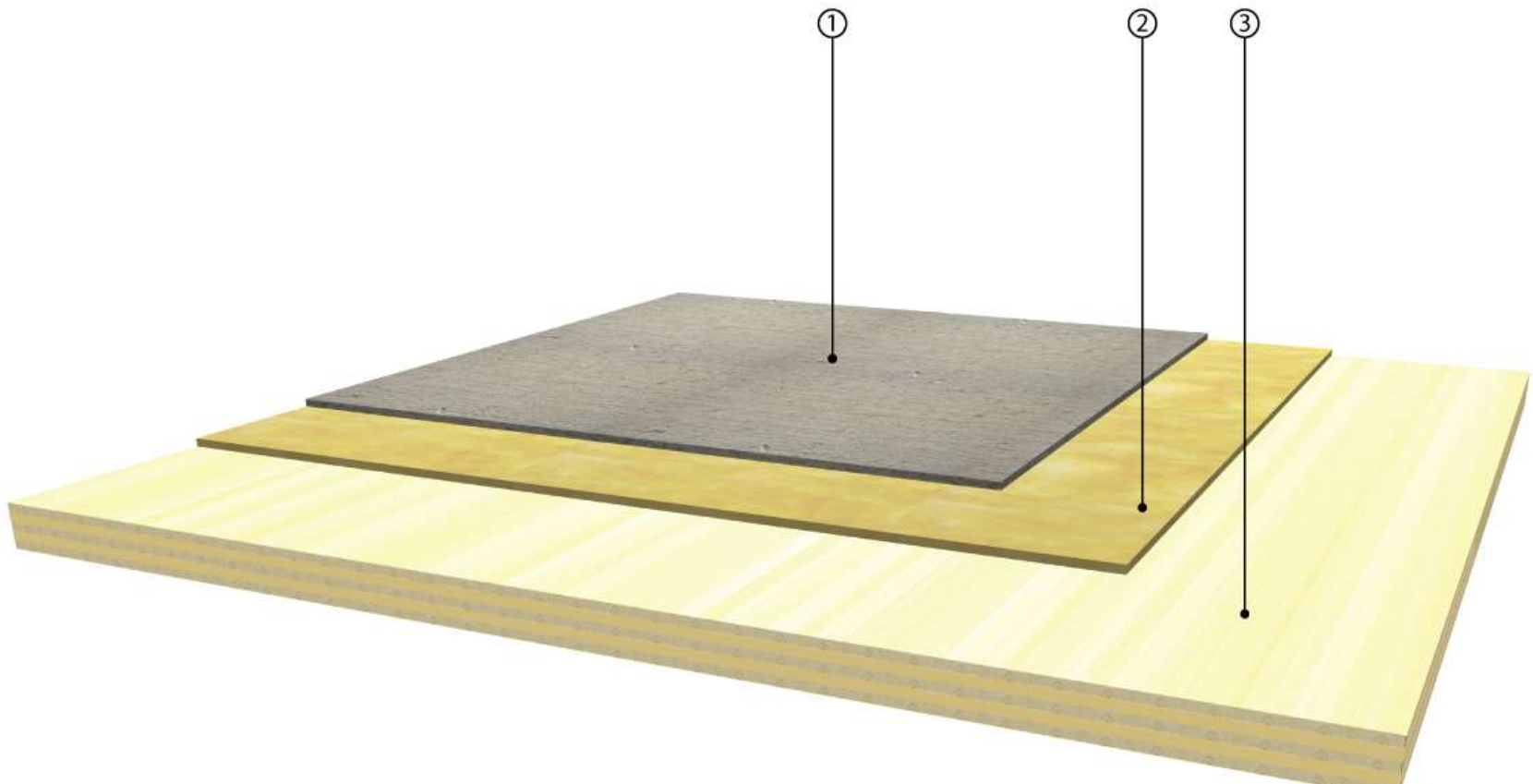
Bare CLT Floor



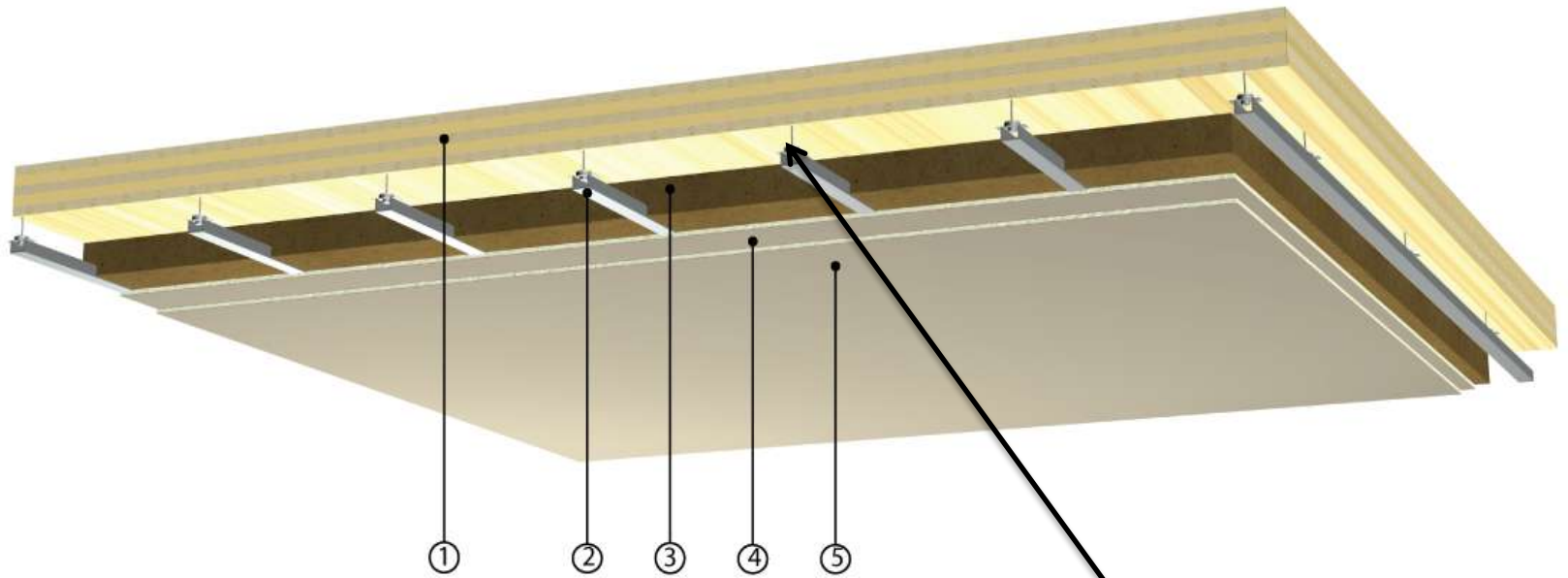
Floor Composition	Airborne (STC) dB	Impact (IIC) dB
5-layer CLT panel 146 mm	39	24



Floor Composition		Airborne (STC) dB	Impact (IIC) dB
1	Particleboard panel 22 mm	52	45
2	Sound insulation material (\approx 40 mm)		
3	Lumber sleepers		
4	REGUPOL underlayment		
5	5-layer CLT panel 146 mm		

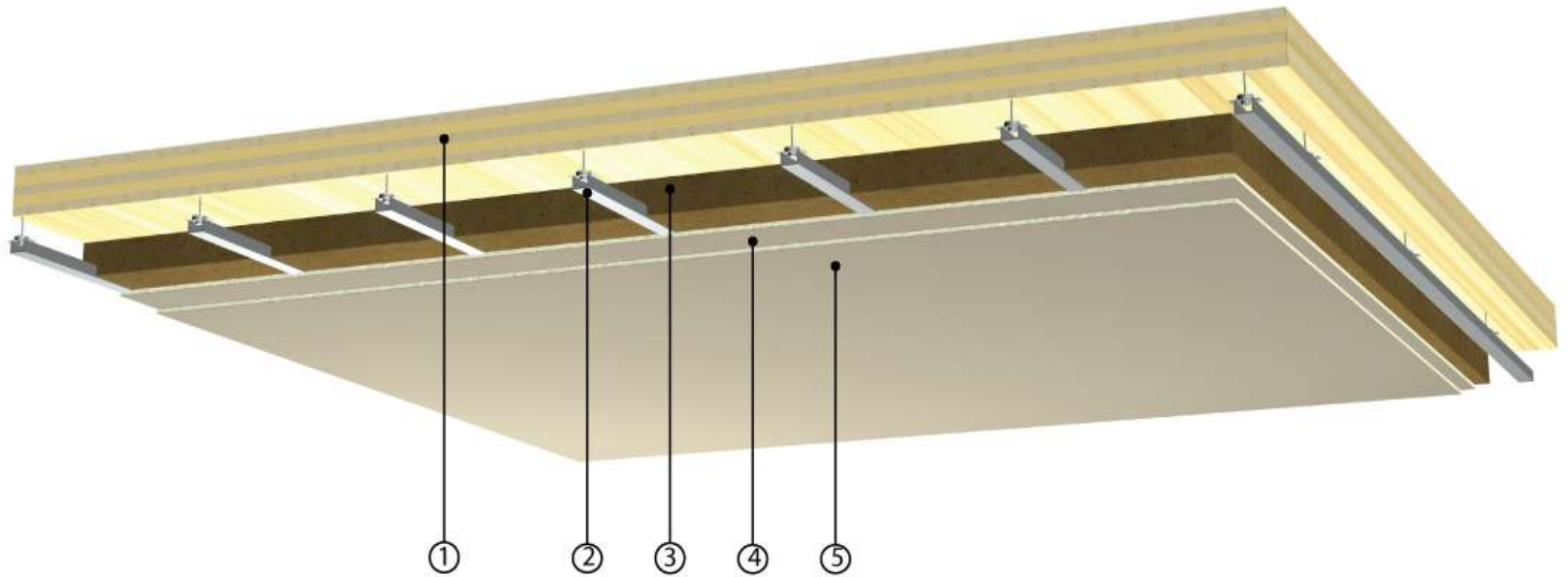


	Floor Composition	Airborne (STC) dB	Impact (IIC) dB
1	Gypsum fibre board FERMACELL 25 mm	≤ 53	≤ 49
2	Sub-floor ISOVER EP3 20 mm		
3	5-layer CLT panel 135 mm		

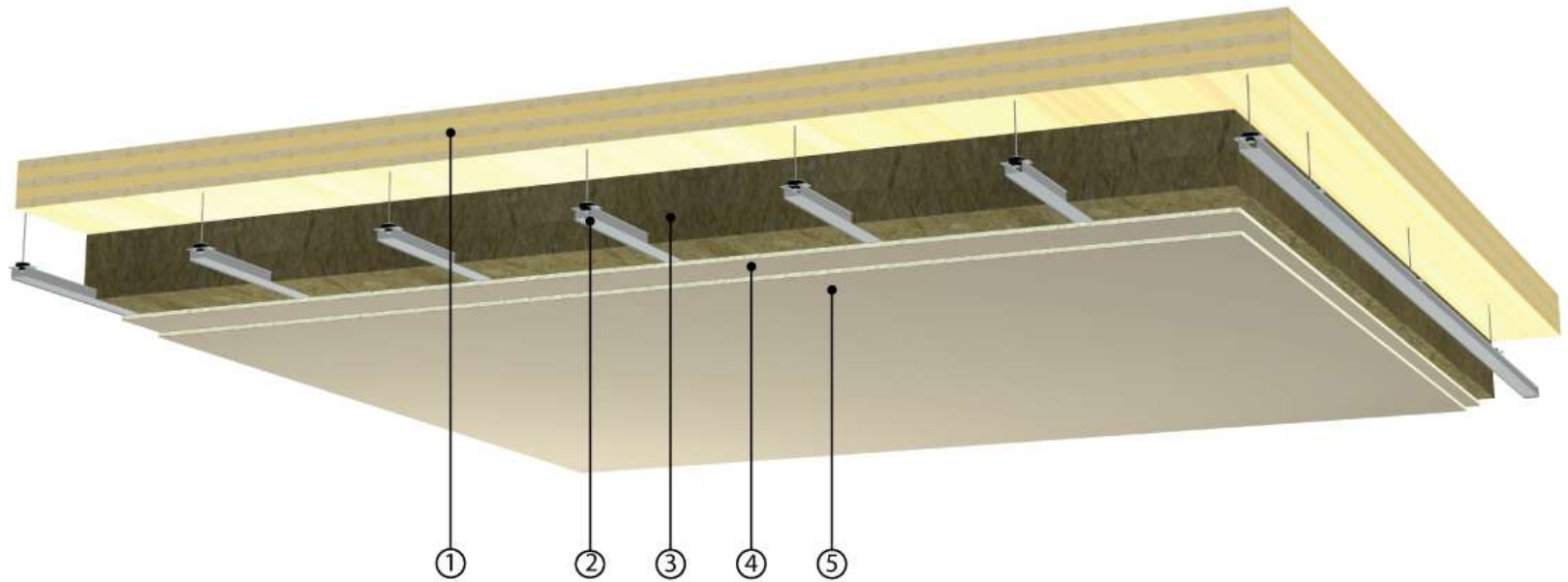


Resilient supports, rails and sound insulation material

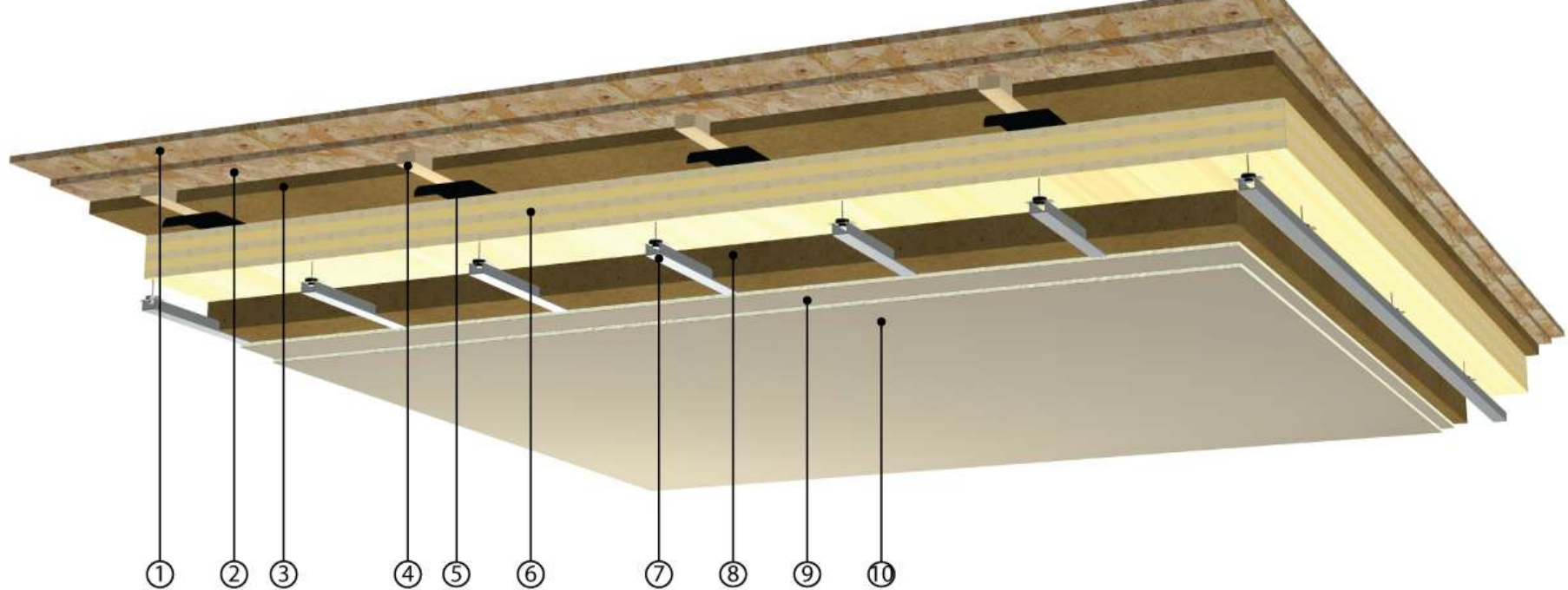




Floor Composition	Airborne (STC) dB	Impact (IIC) dB
1 5-layer CLT panel 146 mm 2 Resilient supports and rails (100 mm) 3 Sound insulation material (100 mm) 4 Gypsum board 13 mm 5 Gypsum board 13 mm	<div style="border: 2px solid red; border-radius: 50%; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center; margin: 0 auto;">64</div>	59

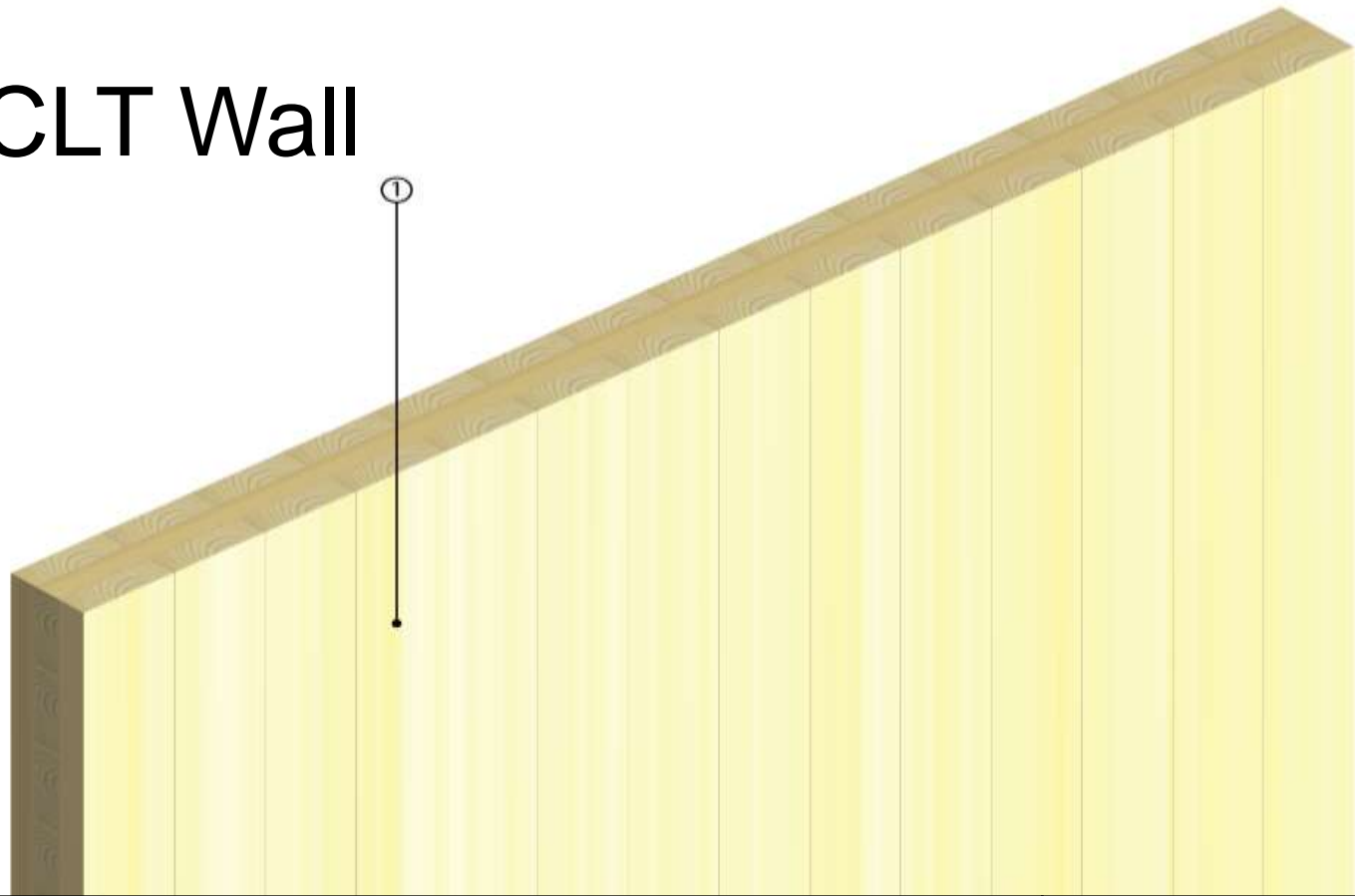


Floor Composition	Airborne (STC) dB	Impact (IIC) dB
1 5-layer CLT panel 146 mm 2 Resilient supports and rails (200 mm) 3 Sound insulation material (fibre glass) 4 Gypsum board 15 mm 5 Gypsum board 15 mm	63	62

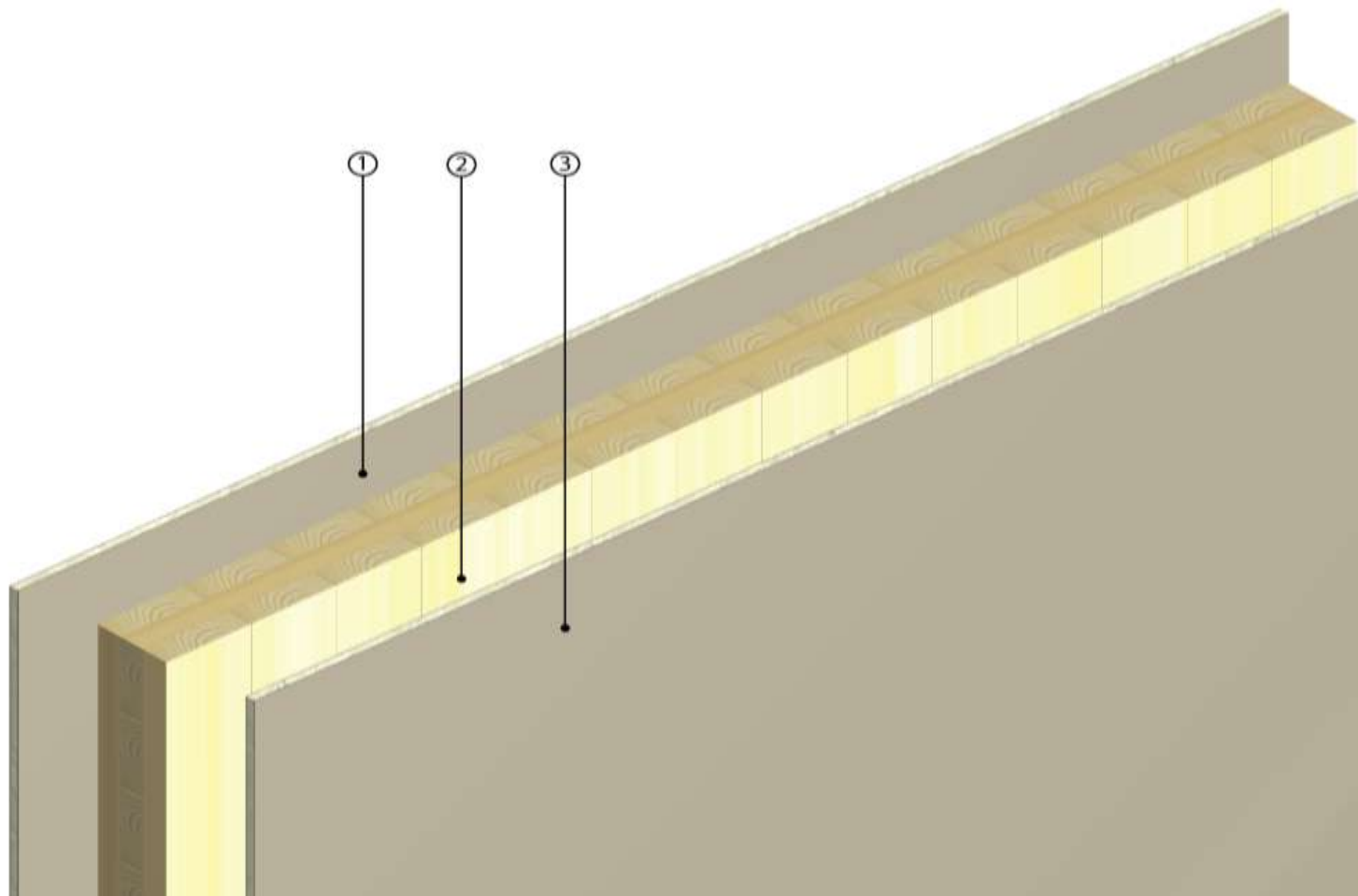


Floor Composition		Airborne (STC) dB	Impact (IIC) dB
1	Particleboard panel 22 mm	67	≥ 62
2	Particleboard panel 22 mm		
3	Sound insulation material (≈ 40 mm)		
4	Lumber sleepers		
5	REGUPOL underlayment		
6	5-layer CLT panel 146 mm		
7	Resilient supports and rails (100 mm)		
8	Sound insulation material (100 mm)		
9	Gypsum board 13 mm		
10	Gypsum board 13 mm		

Bare CLT Wall



Wall Composition	Airborne (STC) dB
1 3-layer CLT panel (95 mm ~ 115 mm)	≤ 32~34

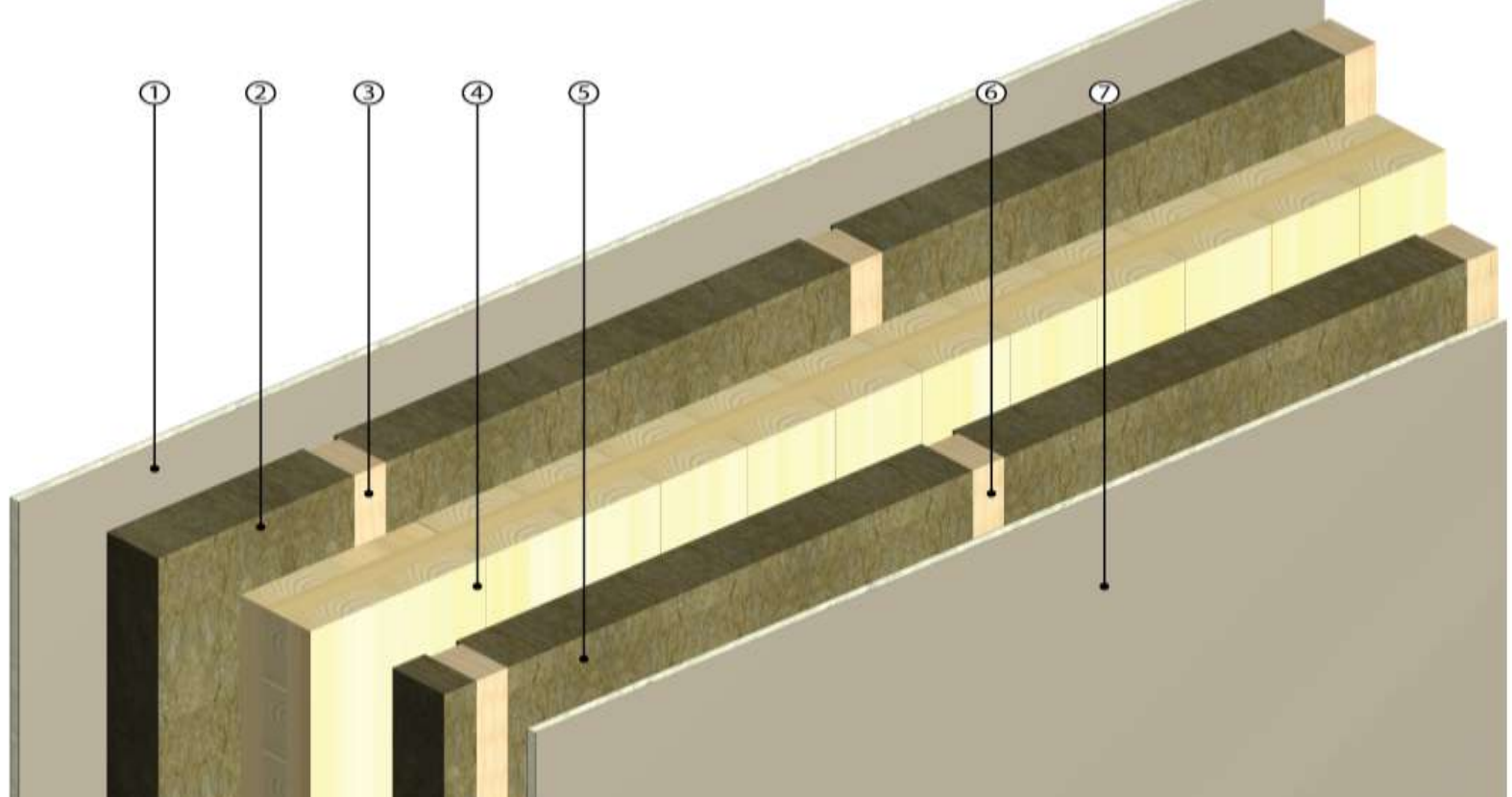


Wall Composition

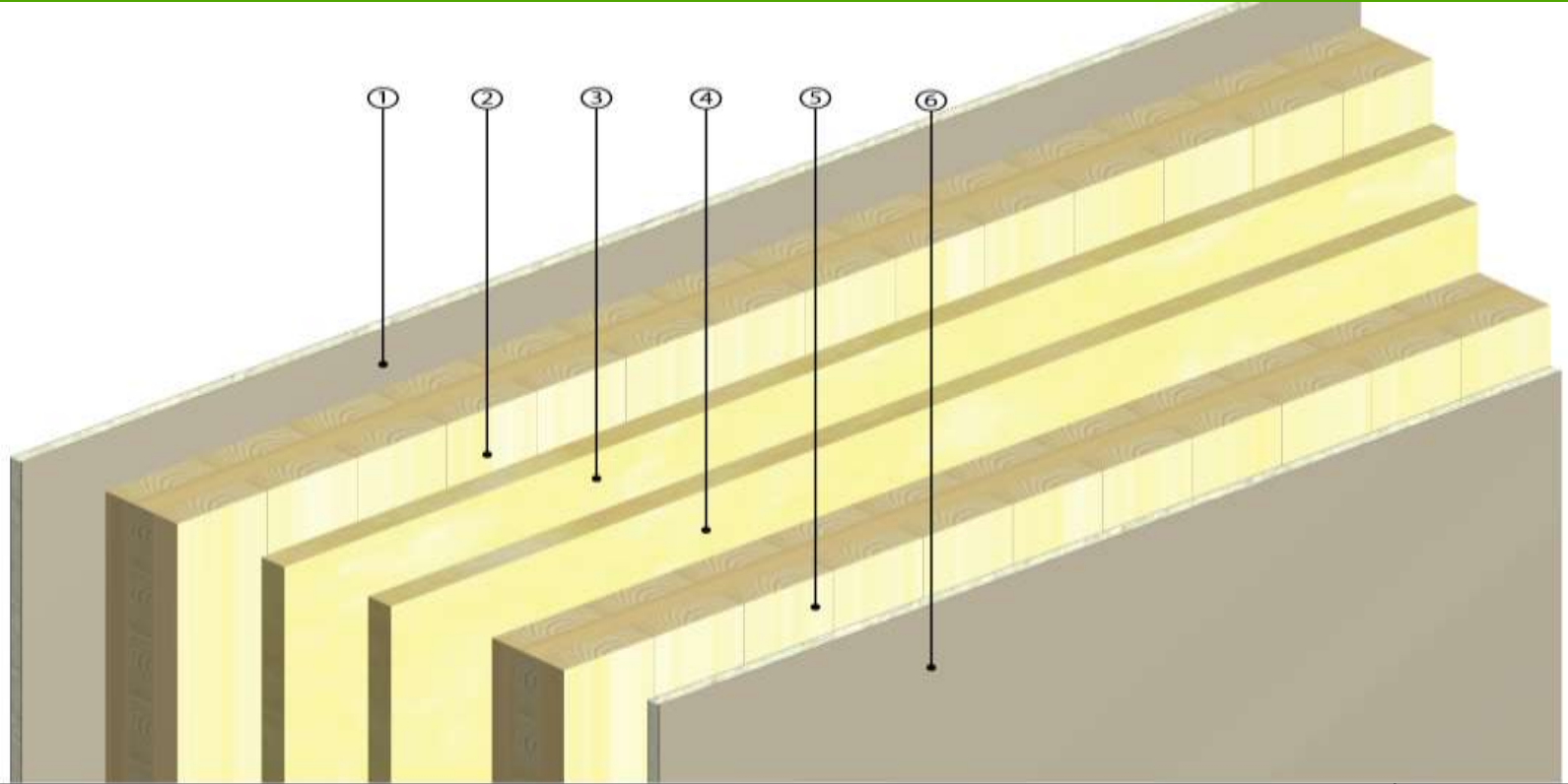
**Airborne
(STC) dB**

1	Gypsum board 15 mm
2	3-layer CLT panel (95 mm ~ 115 mm)
3	Gypsum board 15 mm

≤ 36~38

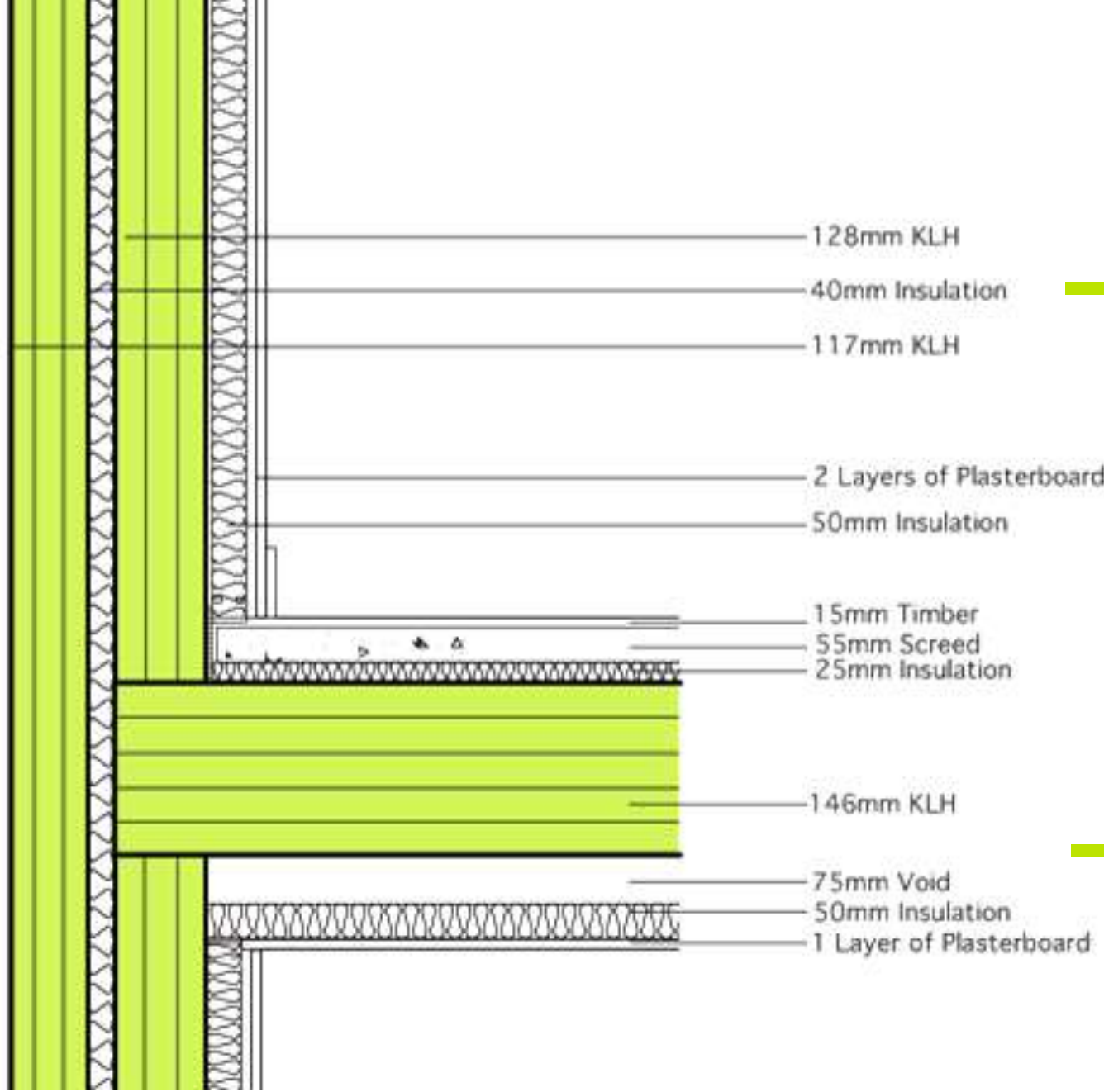


Wall Composition		Airborne (STC) dB
1	Gypsum board 15 mm	≤ 58
2	Mineral wool (~ 60 mm)	
3	Lumber studs (38 mm x 63 mm)	
4	3-layer CLT panel (95 mm ~ 115 mm)	
5	Mineral wool (~ 60 mm)	
6	Lumber studs (38 mm x 63 mm)	
7	Gypsum board 15 mm	



Wall Composition		Airborne (STC) dB
1	Gypsum board 15 mm	≤ 60
2	3-layer CLT panel (95 mm ~ 115 mm)	
3	Sound insulation material (rock wool) (~ 30 mm)	
4	Sound insulation material (rock wool) (~ 30 mm)	
5	3-layer CLT panel (95 mm ~ 115 mm)	
6	Gypsum board 15 mm	

Murray Grove



Source: Waugh Thistleton

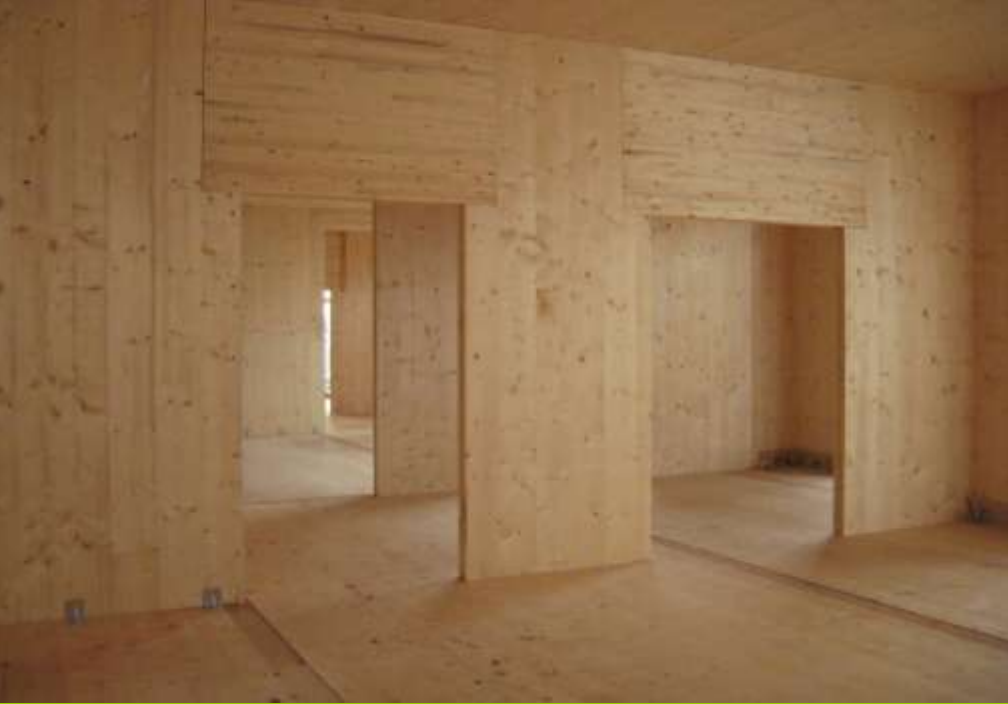
London

Murray Grove (London, England)



Source: Waugh Thistleton

Residential Unit Berlin



Acoustic Membrane



Source: Binder

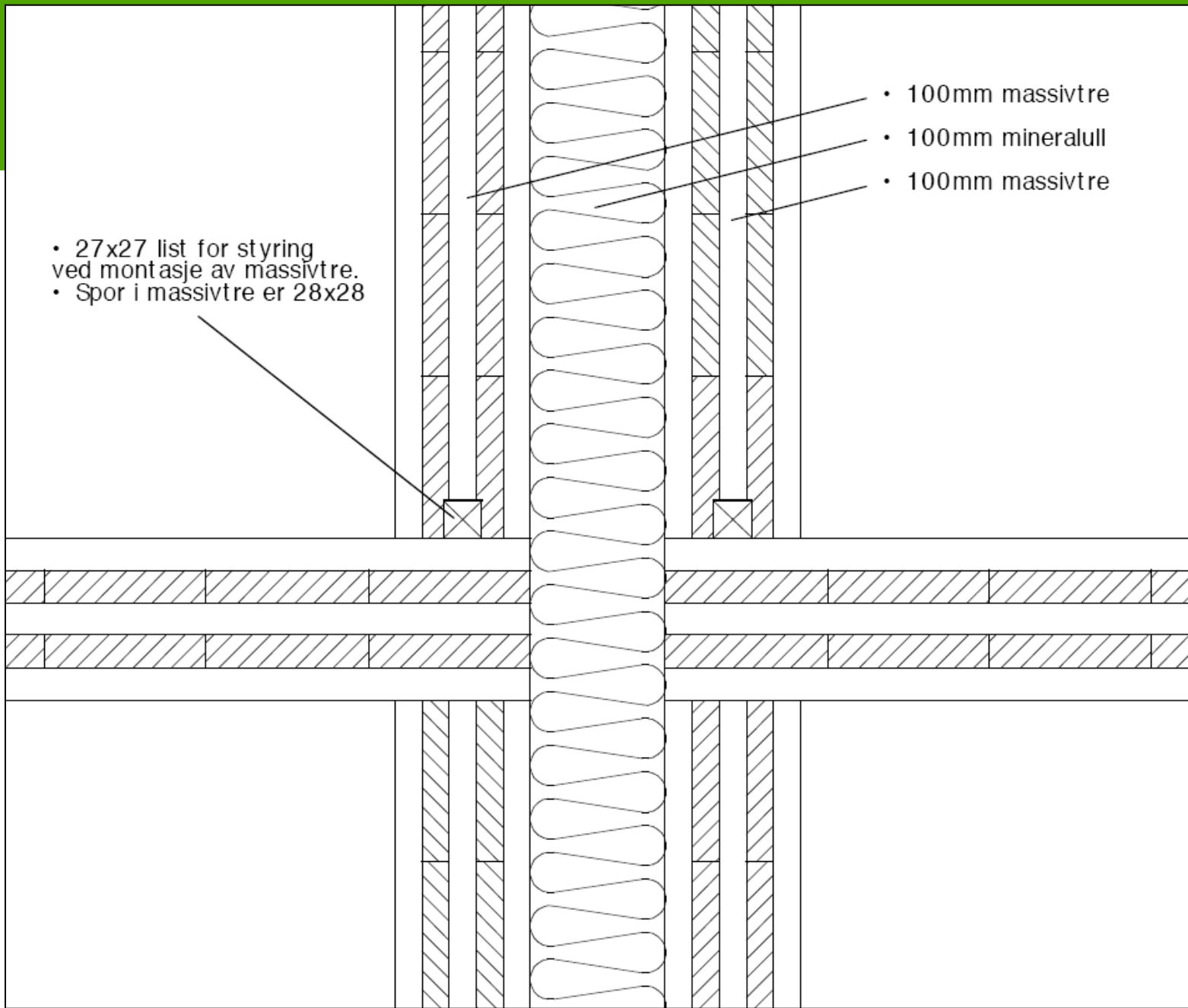
Acoustic Membrane



Source: KLH

Acoustic Membrane





Source: Brendeland & Kristoffersen



Source: Brendeland & Kristoffersen

8-Storey Building

8-Storey Buildings

City of Växjö

Sweden

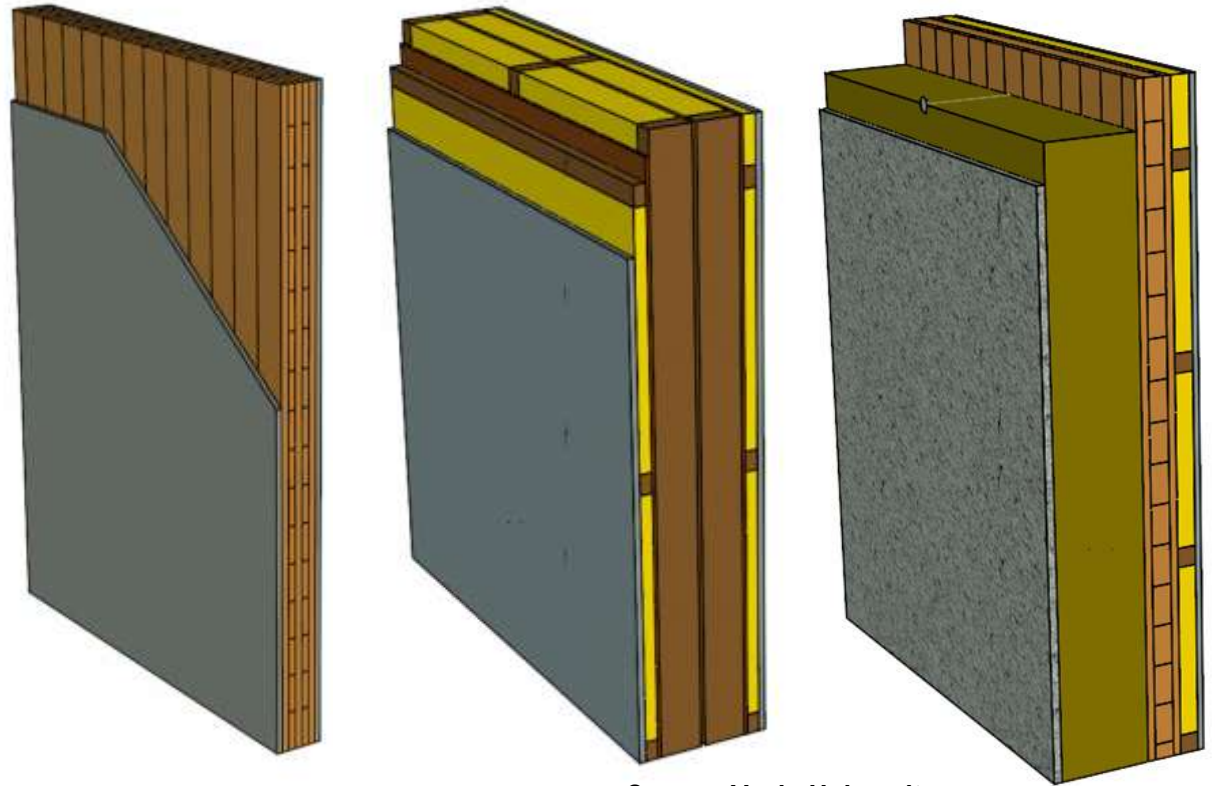


Different Wall Assemblies

8-Storey Building

City of Växjö

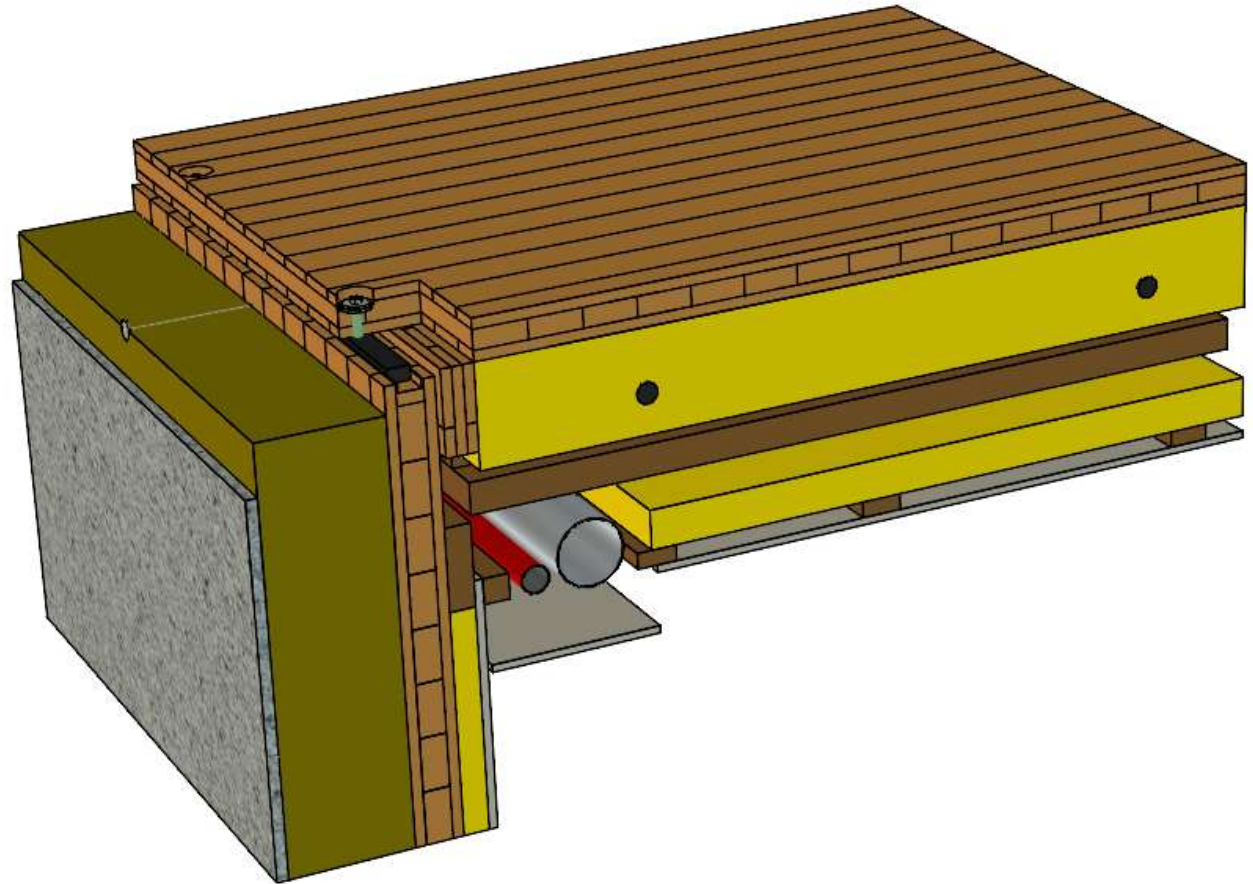
Sweden



Source: Växjö University

8-Storey Buildings

Connections between floor systems and exterior walls



Source: Växjö University





FPInnovations

Creating forest sector solutions

www.fpinnovations.ca



Thank You

February 8, 2011
Vancouver