Wood Wool Cement

A pathway towards more fire-resilient communities?

Martin Twer
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Image: Baux

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Wood Wool Cement Board (WWCB)

Cement Excelsior Board (CEB)

a mineral-bonded natural fiber (mbnf)

Main dimensions:

- Thickness: 0.6” – 4”
- Width x Length: 2’ x 8’-10’

Inputs

- Ingredients: wood, water, OPC Portland cement (Type III)
- Most common species: pine, spruce, aspen
- Small diameter logs
- Log diameter: *4” – 11”*
- Length: *6’ – 15’*

https://www.youtube.com/watch?v=iYhEh2IUYi8

Consumption

- Input ratio of wood:water:cement (b/w) 1:1:2 (plus 1-2% Waterglass)
- Consumption: approx. 20 tons of wood (@25% MC) per shift
- Annual consumption per shift: approx. 6,000 tons (6dww)
- Plant production capacity per day/shift: up to 43,000 ft^2

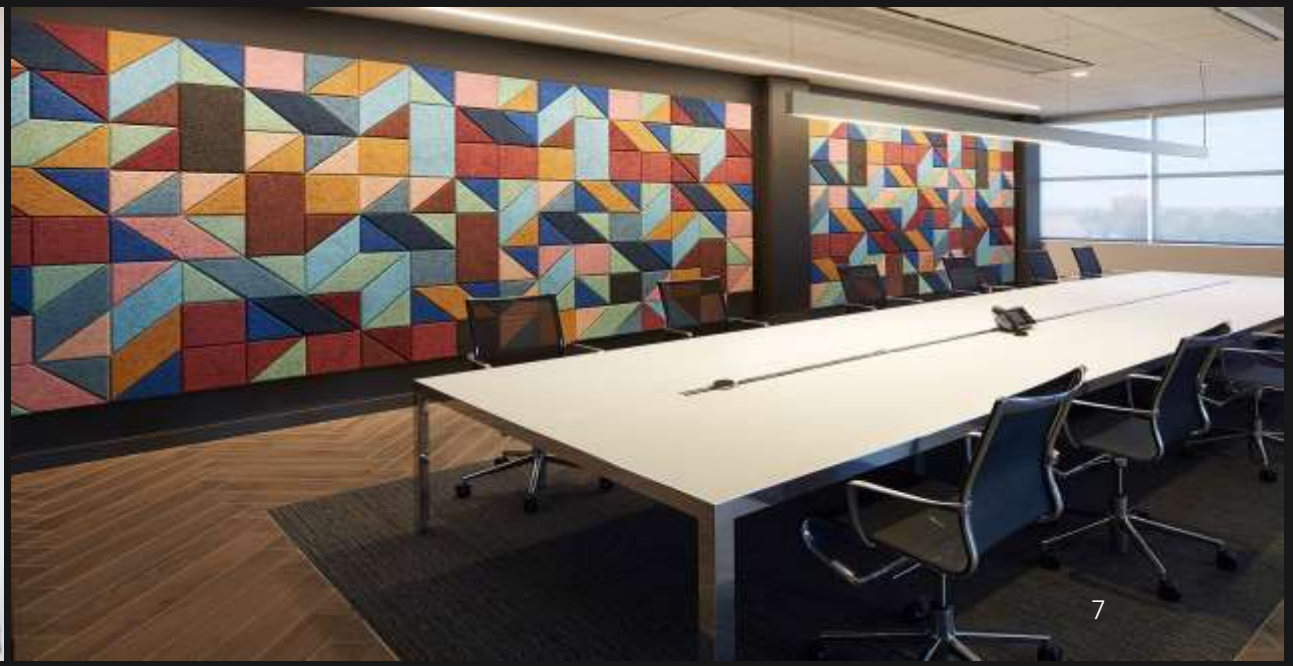


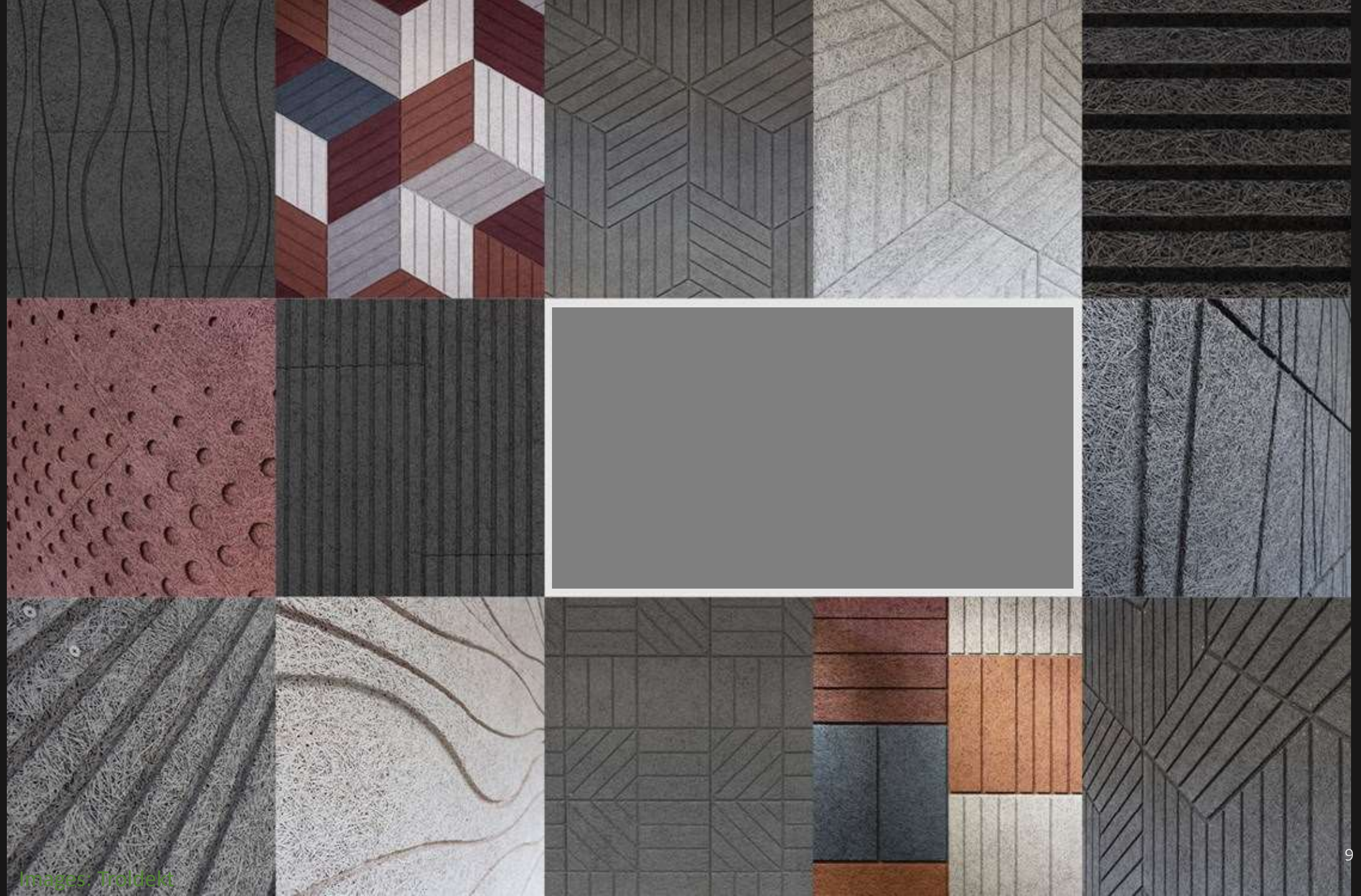






B





Images: Troldekt

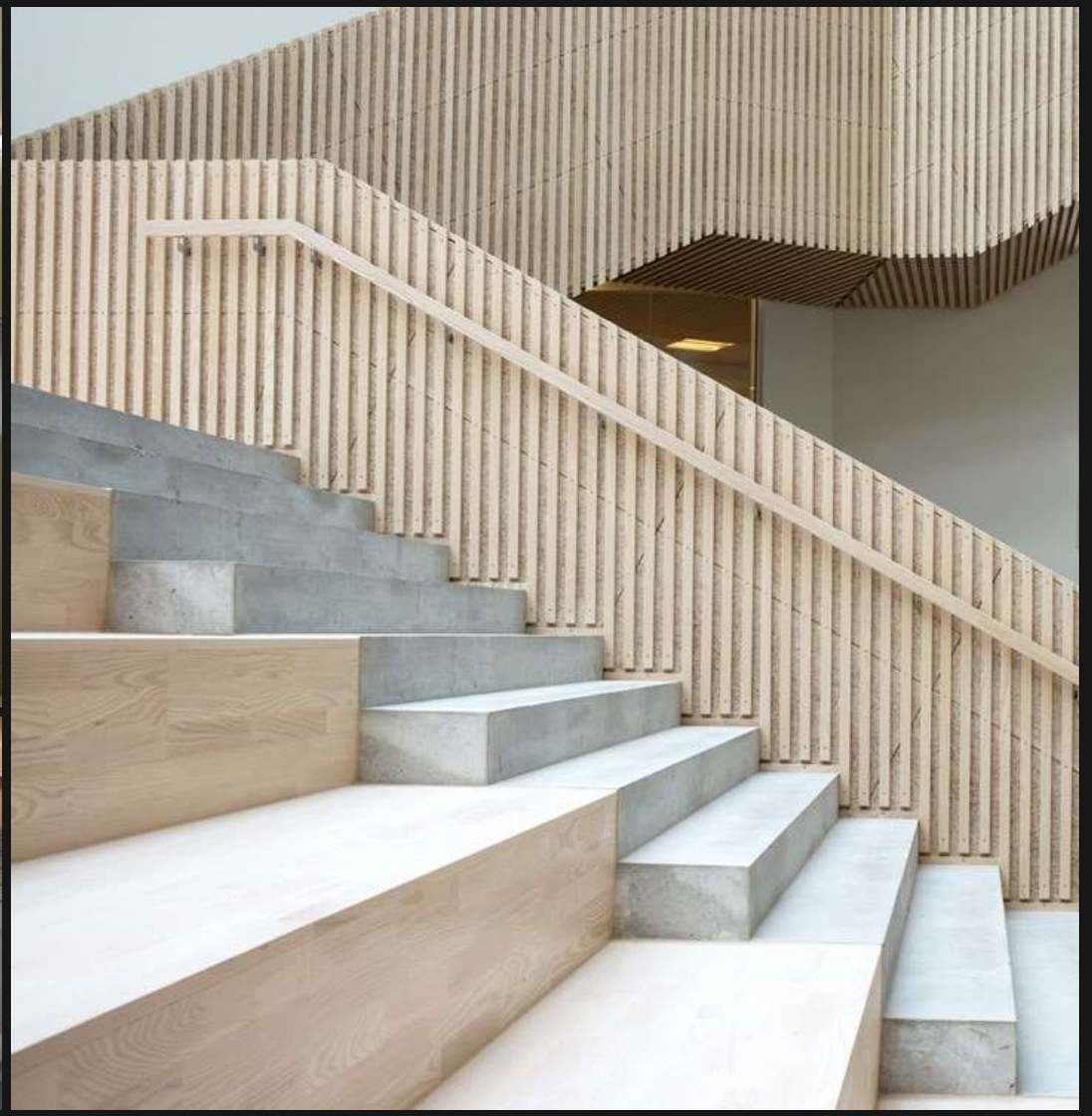


Image: Traullit

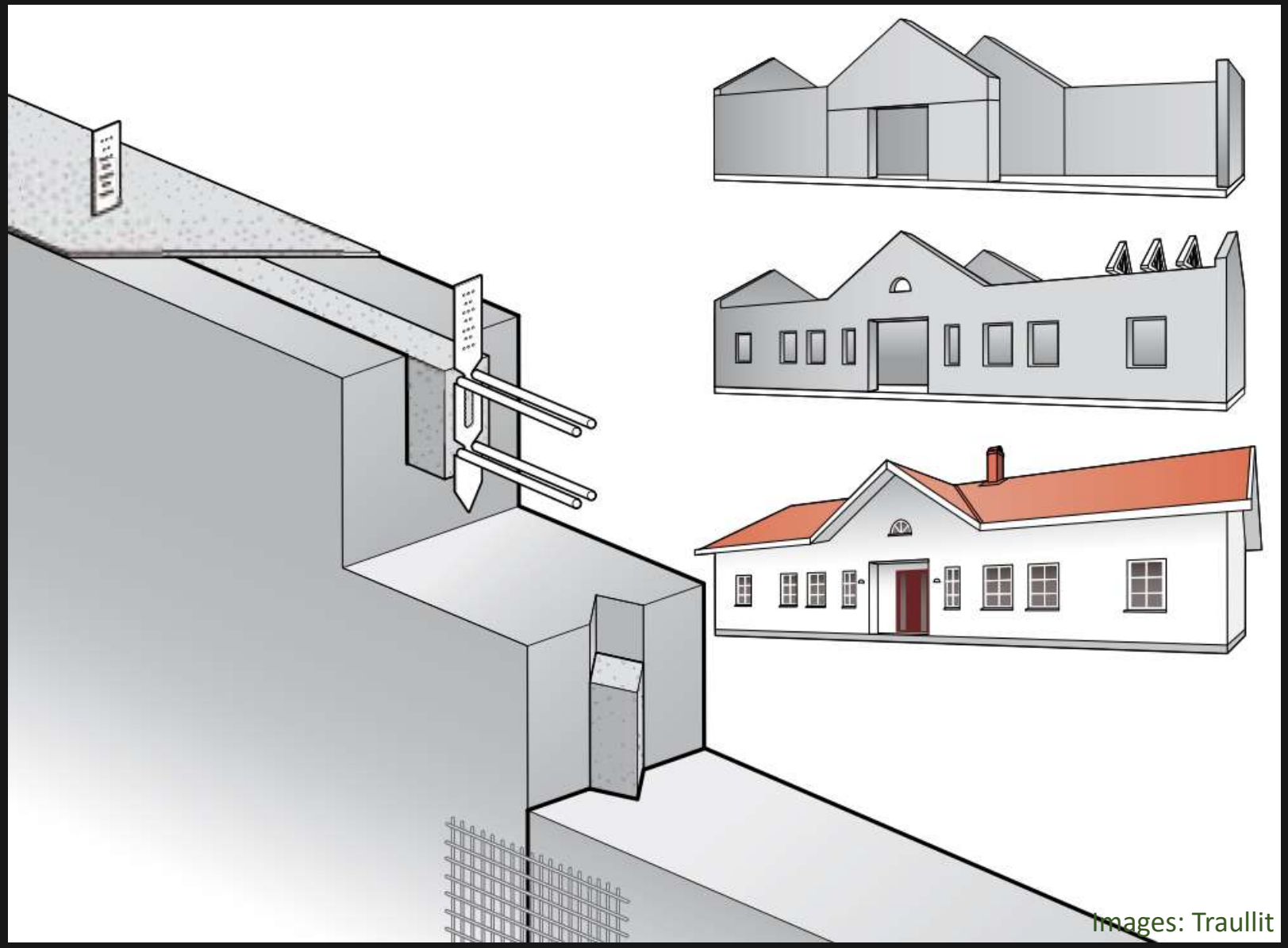
Large WWC Wall Elements

developed by
Träullit, Sweden

Main dimensions:

- Thickness: 1’ to 1’-8“
- Length: up to 20’
- Width: up to 9’ – 10’

Image: Traullit



Images: Traullit

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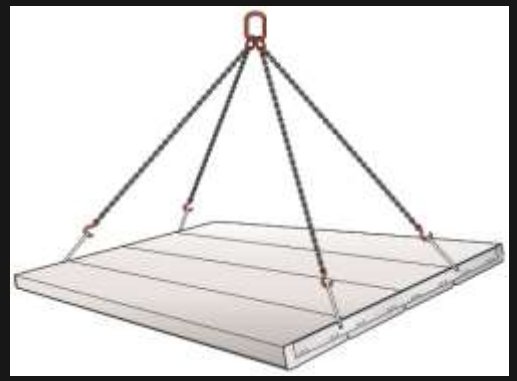
red dot = 2,6 kN/m²
= 54 psf roof load

R-value = ~10

Gobi (1950 kg)



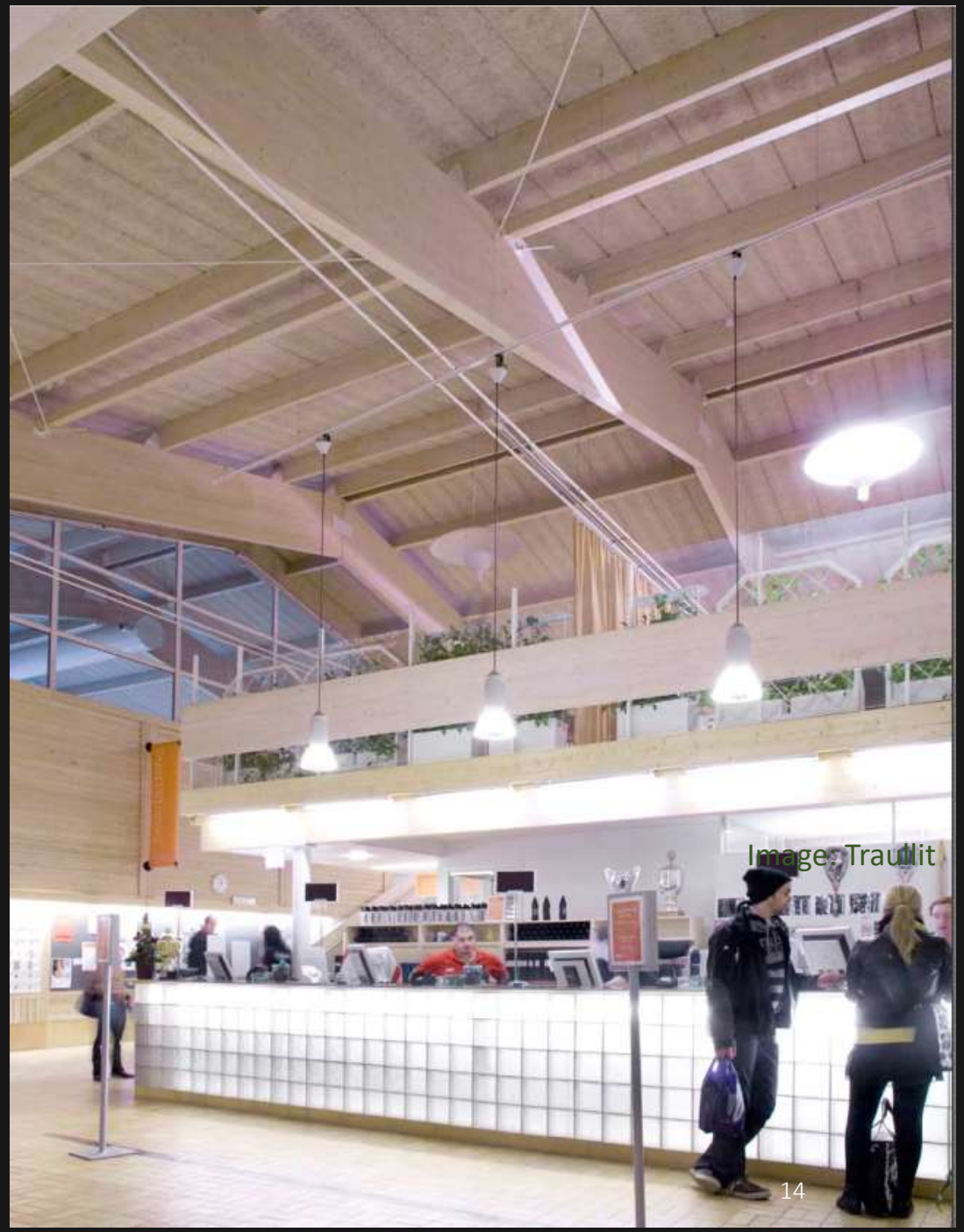


Image: Traullit











Properties

- Moderate Thermal Insulation: R-value = 1.87
- High Specific Thermal Capacity: ~2,000 J/kg K
- High Sound Insulation/Absorption
-

		ASTM C177	ASTM C423
mm	inch	R-value	NRC
38	1.5	2.63	0.55
51	2	3.50	0.60
64	2.5	4.38	0.60
76	3	5.25	0.65

VA Master Specifications - VA 03 51 13 Cementitious Wood Fiber Decks

Image: CEWOOD

Properties, ct’d

- Reaction to fire classification (EN 13501) B1-s1,d0 / A2-s2,b0
  - CAN/ULC S-102, Class 1 - Flame Spread of 0 and Smoke Development of 0 (Acoustex-Plank);
  - ASTM E-84, Class A (I) - Flame Spread Index (SFI) 25; Smoke Developed Index (SDI) 50; passed;
- Fire resilient (6-hour fire rating)
- Resistant to water, frost, termites, mold, fungi & rot
- Prefab/modular construction - little on-site waste; short construction time
- Low specific weight: 340 kg/m^3 *(21.2 lb/ft^3)*

Image: Heraklith

WWCB & Large Elements

Additional Applications

Noise Abatement


Träullit Bullerskärm
Mölnbo station
Foto Jakob Lang, Ancopy AB


218,5

	per 8-hour shift		@ 1 shift/day, 5 days/week, 50 weeks/year
Wood (@25%MC)	20 tons	44,092 lbs	5,000 tons
			833 MBF
Portland Cement	33 tons	72,751 lbs	8,250 tons
Water	22 m^3	777 ft^3	1,942 ccf
Sodium Silicate	1.4 tons	3,086 lbs	350 tons
Electric power	4.17 MWh		1,042 MWh
WWC-LE	167 m^3	5,885 ft^3	1.47 MM ft^3

Hypothetical: California Highway Noise Barriers

- 5-year average (’12-’16): 59,400 ft/year
- Height varies between 10’ and 16’, median 14’
- Dimensions Large WWC Element: 20’ x 9’ x 10”
- Potential demand: 6,600 elements per year
- Plant capacity: 25 elements per shift
- 265 working days (~ 1 year) of production

Sustainability and Life Cycle Analysis

- WWCB has a proven life-span of 100+ years
- Utilizes abundant small diameter softwood
- Fire, water, and termite resistant
- Fully recycable (composting and/or raw material for cement production)
- Environmental Product Declarations (EPD's) in accordance with ISO 14025 and CEN EN15804 are available from several European manufacturers (Celenit, Knauf, Troldekt, Traullit)

ACOUSTICAL PERFORMANCE

The following Noise Reduction Coefficients are available:

Thickness	Mounting A	C-20	C-40	D-20	E-400
25mm	0.40	0.80	0.85	0.45	0.45
35mm	0.55	0.85	0.90	0.60	0.50
50mm	0.60	0.90	0.95	0.65	0.60

ULC LISTED FSC

FIRE PERFORMANCE

Acoustex-Plank Acoustical Wall & Ceiling Panels have a Class 1 rating and are CAN/ULC S-102 tested and certified. The Natural panels have a Flame Spread of 0 and a Smoke Develop of 0. The Painted panels have a Flame Spread of 0 and a Smoke Develop of 5.

Linkages

- Resilient Forests and Landscapes
- Community Hardening
- Forest Sector Economic Stimulus

- Cellulosic Nanocrystals
- Mass timber / Engineered wood
- Wood products campus

States with most engineered wood plants in 2018[8]

	Glulam	CLT & MPP	I-joist	Structural composite lumber	Total plants
Oregon	**7**	**2**	**3**	**6**	**18**
Alabama	2	-	2	2	6
Louisiana	-	-	2	3	5
Washington	3	-	1	-	4
TOTAL U.S.	31	4	15	20	70

Facility

- Building: 200’ x 600’
- Land: 8 – 12 acres
- $5.43 MM - $7.24 MM ($10.26 MM - $10.86 MM)
- Personnel per shift: 16 - 22 (12 – 16)
- Installed Electrical Power: approx. 1,000 kVA
- Electrical Power Consumption: approx. 750 kW

Questions?

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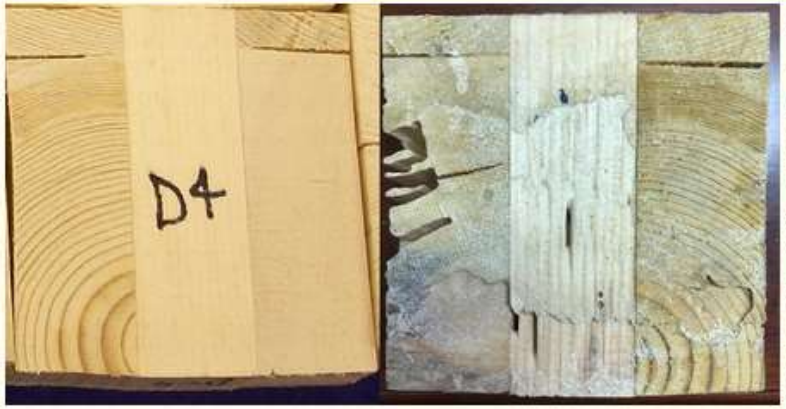
Assessing termite impact on cross-laminated timber panels



CLT sample D4 prior to (left) and following (right) eight weeks of exposure to the Formosan termite, an invasive species of subterranean termite.

Snapshot : Forest Service and Mississippi State University researchers are in the process of determining the impact of termites found in the Southeastern U.S. on cross-laminated timber (CLT), a mass timber product entering the tall building construction market. Results showed that untreated CLT is as susceptible to attack by termites as other untreated lumber. Data from this ongoing project will be used to determine native and invasive termite impact on untreated CLT in comparison with treated wood products.

Principal Investigators(s) :
Tang, Juliet D.

Research Station : Forest Products Laboratory (FPL)

Year : 2017

Highlight ID : 1279

APPLICATIONS