Smart City Mindtrek 2020
Carbon neutral building & energy,
Room 7: Towards carbon neutral building through carbon calculating
Tuesday 28th January 2020 at 13.15 – 13.45

Finnish Multi-Story Timber Frame Buildings

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Growth of Finnish forests

Kotimaisen puun käyttöä voidaan lisätä kestävästi


120 110 100 90 80 70 60 50 40 30 20 10 0

milj. m³

Total increment
Kestävät hakkuumahdollisuudet
Teollisuuden puun käyttö
Tuontipuu
Kotimaisen puun käyttö teollisuudessa

13.8.2015
LÄHDE: Luke, Metsäteollisuus ry
The forest sector is extremely important for Finland’s national economy.

- Employs 200,000 Finns
- 5% of the gross domestic product
- 20% of Finland’s export income
- Produces 70% of the renewable energy in Finland
Leisure time buildings 99 %
Detached houses, 85%
Building types of housing in Finland

Detached houses (Red)
Row houses (Green)
Block of flats (Blue)
Finnish multi-story timber frame houses

YLÖJÄRVI, 1996;
3 buildings, 19 apartments

ROVANIEMI 2019;
1 house, 103 apartments
APRT Architects

- 1.9.1997: max. high 4-storeys
- 15.4.2011: max. high 8-storeys

Built until 28.1.2020:
- 87 houses
- 2 505 apartments

Arkve Oy
Architect Jussi Vepsäläinen
Multi-story wooden apartment buildings in Finland

Situation January / 2020

Tampere University
Finnish Timber Council
Ministry of Environment

Coming: over 11,000 apartments in wooden multi-story apartment buildings!
The construction systems used in multi-story timber frame houses in Finland

- Slab elements
- Pillar-beam frames
- Modular elements
Finnish multi-story timber frame houses (January 2020); 87 houses, 2 505 apartments

Height = Amount of floors

- 3 floors: 25 buildings (29%)
- 4 floors: 44 buildings (51%)
- 5 floors: 3 buildings (3%)
- 6 floors: 8 buildings (9%)
- 7 floors: 2 buildings (2%)
- 8 floors+: 5 buildings (6%)
Finnish multi-story timber frame houses (January 2020); 87 houses, 2,505 apartments

Frame

- Platform-frame: 48 (55%)
- CLT based volumetric elements: 23 (27%)
- Pillar-beam frame: 8 (9%)
- CLT based slab elements: 7 (8%)

+ 1 Log frame house
Finnish multi-story timber frame houses (January 2020); 87 houses, 2,505 apartments

Form of ownership

- Rental: 1,328 units (53%)
- Private owned: 864 units (35%)
- Right-of residence: 282 units (11%)
- Semi-privately owned: 31 units (1%)
Platform-frame (55 %)
LVL-post and beam-construction (9 %)
After year 2013 about 56 % of Finnish multi-story buildings are made by CLT- elements
Wood framed volume elements
Volume elements; typical sizes: 
4 500 (w) x 3 000 (h) x 13 500 (l)
Joensuun Elli, Light House; 14 floors
Wooden tower for students,
LVL-based vertical frame and CLT-based horizontal frame
4-floors high log-house; Naava Chalet, Ähtäri, 2016; 1 house, 16 leisure-time apartments
Vantaa Kivistö Housing Affairs Area 2015; 1 house, 186 apartments

Kuva: Tiia Sorsa, RKL Reponen
Architecture of wooden multis-story buildings?
Wooden "skyscrapers"?

Ho-Ho Wien, Austria
24 floors, 2019

Mjøstårnet, Brummuddal
Norway, 18 floors, 2019

Bergen, Norway
14 floors, 2015
Water mist sprinkler system; 0,5 mm water / 1 m² / minute

Cost is about 100 € / h-m²
Main fire-codes in timber multi-storey buildings in Finland (after 1.1.2018-)

To use timber frame and/or wooden facades in 3 - 8 storey buildings:

• max. height: 8 storeys, 28 meters
• residential sprinkler-system
• fire-(smoke)detectors in every apartment
• non-combustible (A1) or “almost non-combustible”(A2) warm-insulation-material (=glasswool or rockwool)
• non-combustible (class B, s1, d0) inside-covering on ceilings and on walls (f.ex. gypsum-board) >>> wood is allowed in sauna and on the ceiling of bathroom and in all floors and in all non-load bearing walls and in all non-fire section walls
• fire stops in facades
• fire safe eaves
Sound insulation

Impacts sounds
$L'_{n,w} \leq 53 \text{ dB}$

Airborne sounds
$R'_{w} \geq 55 \text{ dB}$
Concrete: 2 500 kg / m³

Wood: 370 - 500 kg / m³
Long term durability
Houses for people

Good architecture
Wood or concrete?

• Concrete:  
  - 2500 kg / m$^3$
  - About 200 € / m$^3$

• Wood:  
  - Stock 60 – 70 € / m$^3$
  - Sawn timber 200 € / m$^3$
  - CLT 500 – 750 € / m$^3$
Speed

Cost efficiency
The environmental impact of producing different construction materials and building will be taken into consideration in 2025 in Finland.
Bioeconomy: The next economic wave

The value of bioeconomy in Finland is 60 miljards euros

About half of Finland’s bioeconomy consists of forest bioeconomy
Changing global trends in construction:

- Prevention of climate change
- Sustainable development
- Carbon footprint
- Resource efficiency
- Energy efficiency
- Recycling economy
- Bio-economy

Timber construction could be the common denominator of all of these