Circular Economy in Building Construction in Tampere, FIN

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Buildings as Material Banks, Current Recycling Possibilities and Future Steering Instruments

Purpose of Study

Create an awareness for potential of building stock and construction waste and enable circularity of building construction in the City of Tampere, Finland.

Image: Tiia Monto

Methods

1. Material Flow Analysis

(built and demolished buildings between 2000 – 2018)

Image: Pixaby/ Shutterstock

Image: torgethotel.fi

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- The material flow analysis was conducted in GIS and it is based on the building and dwelling registers in Tampere.
- Among other things, data gives overview of volume and development of activities by building type. It is possible to identify areas of 'replacement' to understand drivers of demolition better.

2. Current recycling possibilities

- Review of literature and industry websites for current and emerging practices

3. Future steering instruments, criteria for selected instruments

- Based on reviewing current Finnish literature regarding steering instruments for circular economy and low carbon construction

1. Material Flow Analysis

Studied Material

Datasets provided by Finnish National Register and City of Tampere

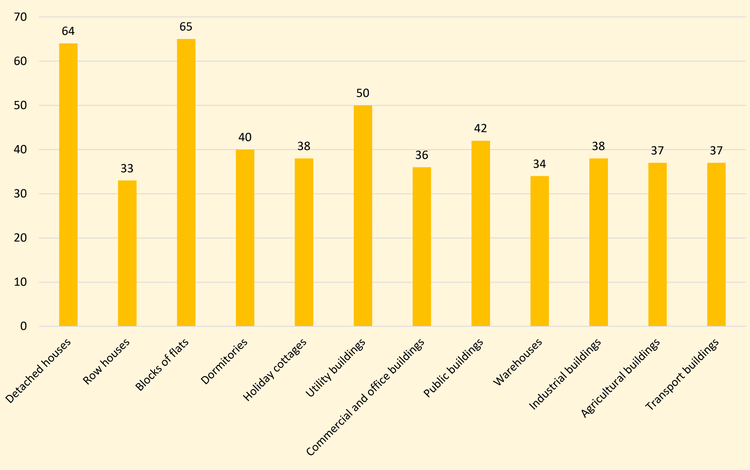
- buildings demolished 2000 – 2018: 3.134 records
- buildings built 2000 – 2018: 8.317 records
- existing building stock: 43.639 records

General

Floor area demolished 2000 – 2018: 1.053.459 sqm

Floor area built 2000 – 2018: 4.429.880 sqm

Average age / building type for buildings demolished 2000 - 2018



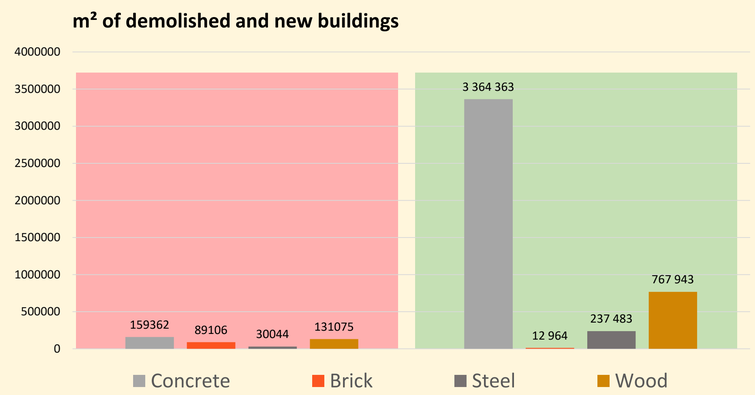
Average age total: 50 years (correlates with nation-wide average)

Average age total existing building stock: 39 years

Note!

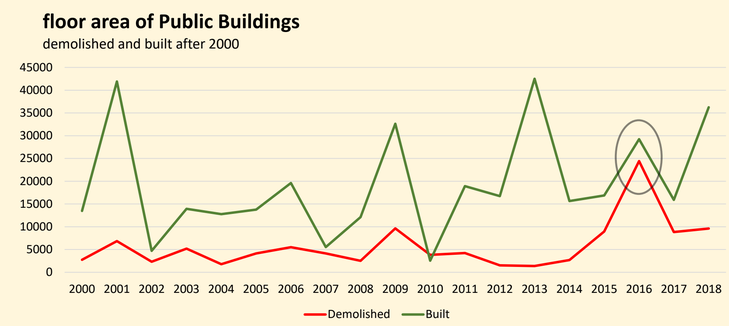
Detached houses and blocks of flats (highest average ages) make only 8% of total demolished floor area.

Building Material



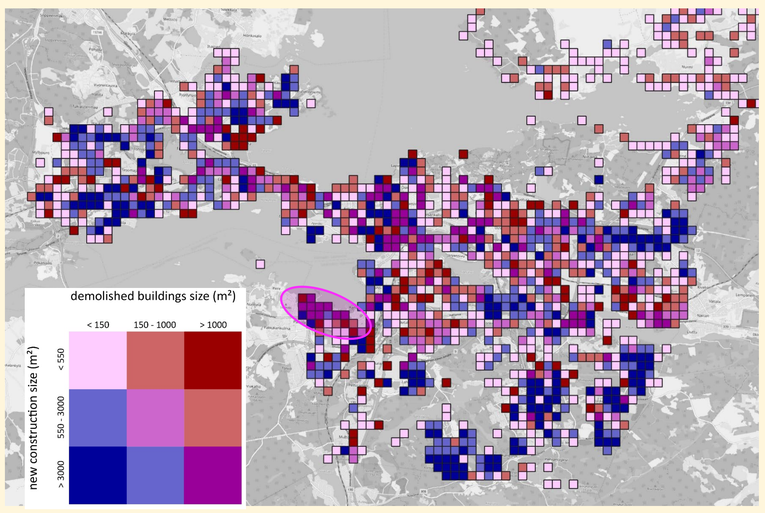
There is a significant increase in concrete as a building material in new construction. Concrete and steel buildings made in total approx. 25% of demolished floor space but more than 80% for new construction after 2000.
Since concrete and steel are carbon intensive building materials, it is important to use these materials wisely. Could the use of less carbon intensive materials like wood be more sustainable in the long run?
The average age of concrete as a building material is 36 years, which lies in the lower middle between wood (54 y.), brick (49 y.) and steel (23 y.). Due to the massive use of concrete in the 1970s and 1980s it is now important to develop strategies for these buildings in order to prevent them from being demolished and millions of cubic metres of concrete being lost.

Building Type



A more specific analysis helps to understand demolition patterns for each building type. In this case, the study shows a timely corelation between high demolition and construction in 2016. An additional spatial analysis then shows that in 2016 19.000sqm of public buildings were demolished in the same place where 12.190sqm were built.

Spatial Analysis



Map of the City of Tampere showing clusters of high demolition (red), high new construction (blue) and a high replacement rate i.e. high construction and high demolition (purple).

Härmälä, Tampere (purple circle on map above)
-75 buildings/ ~87.000sqm demolished
72% commercially used buildings
8% residential buildings
-106 building/ ~185.000sqm constructed
98% blocks of flats

Discussion for MFA

-Extend building's lifespans in order to save resources and emission
-Maintenance
-Refurbishment
-Design for functional and spatial adaptability

→ design for spatial extension (often commercial buildings)
→ design for functional adaptation (often to residential buildings)

-Extend building materials' lifespans

→ design for deconstruction (often commercial buildings)
→ recycling and reuse of construction material (especially carbon intensive materials like concrete)

→ if using virgin resources, consider embodied energy, reusability and scarcity

→ strategies for existing buildings made of carbon intensive materials such as concrete and steel
→ consider the use of less carbon intensive building materials

2. Current Recycling Practices

Concrete
Recycled into aggregates for road construction (load-bearing or isolating structural layers). Also utilized in (back)filling.

Wood
Not currently recycled. Incinerated in energy production.

Steel
Recycling is business-as-usual.

Bricks
Mixed with concrete and recycled/utilized as concrete (see above).

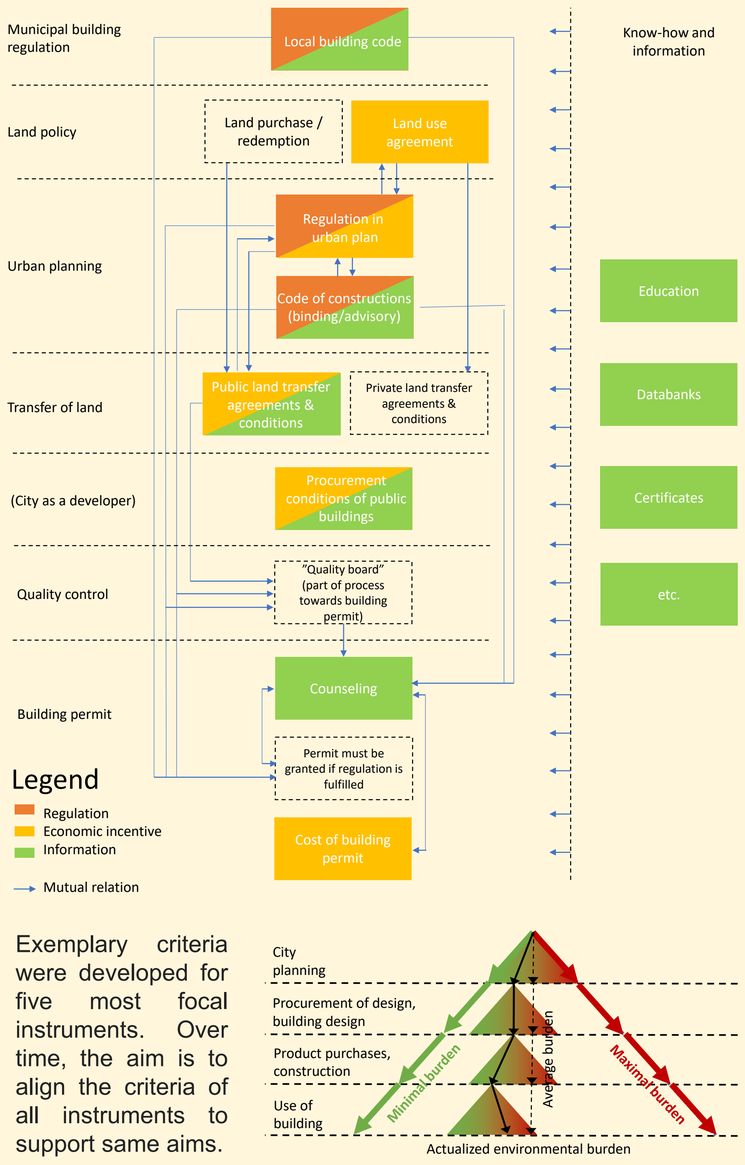
Insulation materials
Not currently recycled. Landfilled. Research into geopolymerization.

Glass
Recycled in the production of glass wool.

Gypsum boards
Possible to recycle but not recycled widely for logistical reasons.

3. Future steering instruments

A number of steering instruments were identified, reviewed and discussed. The following instruments, available to the city authorities, were found viable for steering building construction towards circularity:



Exemplary criteria were developed for five most focal instruments. Over time, the aim is to align the criteria of all instruments to support same aims.

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Publications:

Lahti, J. (2019). *Purkumateriaalien jatkokäsittelyvaihtoehdot* [Recycling possibilities of demolition waste]. Tampere: Ekokumppanit.

Huuhka, S. (2019). *Talonrakentamisen hiilineutraaliuden ohjaaminen Tampereen Hiedanrannassa kiertotalouden keinoin* [Steering the carbon neutrality of building construction in Hiedanranta, Tampere, through the means of circular economy]. Tampere: Ekokumppanit.