Stocks and flows of buildings

Analysis of stock, demolition and construction of buildings in Tampere between 2000 and 2018
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Image: Tiia Monto
Purpose of the study

Create awareness for the potential of building stock and construction waste

→ reduce greenhouse gas emission in the building sector

→ carbon neutral Tampere by 2030
About the study

• Observations on demolished and newly constructed buildings 2000 – 2018 in Tampere
• Comparison between building types, sizes, ages and building material
• Considering existing building stock
Studied material

- Finnish National Register: dataset on existing and demolished buildings in Tampere (49,148 records)
- City of Tampere: - dataset on existing buildings (49,263 records)
  - dataset on demolished buildings (8,539 records)

Used for study (after processing)

- buildings demolished 2000 - 2018: 3,134 records (local and national datasets)
- existing buildings: 43,639 records (national dataset)
  - built 2000 - 2018: 8,317 records (national dataset)
data tables contain information on:

- building type
- coordinates
- year of construction (/ demolition)
- building material
- size

GIS (Geographic Information System)

Every dot = one building:

- building type
- year of construction (/ demolition)
- building material
- size
- …
Data processing

| 1st | data tables | graphs and statistics |

<table>
<thead>
<tr>
<th>Number of buildings</th>
<th>Cinema</th>
<th>Bank</th>
<th>Retail</th>
<th>Storage</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>10</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>30</td>
</tr>
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<td>5</td>
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<td>5</td>
<td>2</td>
<td>12</td>
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<tr>
<td>Bank</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Retail</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>13</td>
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<tr>
<td>Storage</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>13</td>
</tr>
</tbody>
</table>

11.9.2019
Data processing
Data processing

grid map by building type combines several dots
- size
- number of dots

"heat map" grid
colours indicate e.g. amount and total size of buildings
Results  General

- Demolished buildings between 2000 and 2018: 3,122
- New construction between 2000 and 2018: 8,294

- Total floor area demolished: ~1,000,000 m²
- Total floor area new constructed: ~4,500,000 m²
Results average age

average age / building type for buildings demolished 2000 - 2018

- average age for buildings demolished 2000 – 2018 is 50 years
- average age of existing building stock is 39 years
Results

average age

average age / building type

• Make approx. 75% (~740,000m²) of total demolished floor area

• Average age only 37 years

• Detached houses (64 years) and Blocks of flats (65 years) only make approx. 8% of total demolished floor area
Increase of life expectancy

> 50 years
Results average age

Highest average ages / building type

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Average Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detached houses</td>
<td>64</td>
</tr>
<tr>
<td>Blocks of flats</td>
<td>65</td>
</tr>
</tbody>
</table>

Lowest average ages / building type

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Average Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Row houses</td>
<td>33</td>
</tr>
<tr>
<td>Commercial and office buildings</td>
<td>36</td>
</tr>
<tr>
<td>Warehouses</td>
<td>34</td>
</tr>
</tbody>
</table>

- Blocks of flats and office buildings are structurally similar

→ Average age correlates with function
Results average age

average age for building materials
of buildings demolished 2000-2018

- wood and brick traditional (oldest) materials
- Concrete and steel relatively new materials
- Detached houses’ (91% wooden) average age 64 years (10 years above wood)

→ Average age correlates with function rather than building material
Results: stock and building materials

Floor area (m²) for building materials by decade of construction for current building stock.
Results material composition

material composition for buildings demolished after 2000

material composition for buildings built after 2000

Planning for deconstruction and adaptability

either

or

→
Results \text{number of buildings and size}

- 2.5x more construction than demolition
- Floor area of new construction is approx. 4.2 times higher than demolition

- New buildings mostly become larger

→ A reason for demolition is demand for larger buildings
Planning for extension
Building stock whole

- Tampere region
Building stock whole

- Tampere city area
Demolition
whole
after 2000

- Tampere city area
  - hide little demolition
  - clusters of high demolition
  \ (~525,000 m² = 50% of all demolition)
Demolition

Commercial buildings after 2000

- Tampere city area

-clusters of high demolition
Demolition
Residential buildings after 2000
• Tampere city area
- clusters of high demolition
Construction whole after 2000

- Tampere city area
  - hide little construction
  - clusters of high construction
  ~3.35Mio m² = 75% of all construction
Construction
Residential buildings after 2000

- clusters of high construction

Tampere city area
Construction
Commercial buildings
after 2000
• Tampere city area
- clusters of high construction
Comparison whole demo. – constr. after 2000

- Tampere city area
  - clusters of demo. and constr.
    - clusters contain:
      - 71% of demo.: commerc. buildings
      - 66% of constr.: residential buildings
      - 22% of constr.: commerc. buildings
Results residential buildings

- detached houses built after 2000 approx. twice as big as demolished ones
  - trend towards larger homes sustainable?

- new blocks of flats approx. 3,6 times larger
  - higher demand on living space due to "modern" households?

![Image: Vuores, Tampere/ oikotie.fi]
Results residential buildings

- demolition of mainly old houses (heritage?)
- demand for larger houses
- modernization of homes

- size of demolished blocks of flats has changed from the 1940s to 1950s
Results holiday cottages

- average size and amount of holiday cottages built after 2000 almost doubled compared to demolished ones
Results holiday cottages

- Higher replacement for Mökki typology?

-possibly due to spatial qualitative need
Results commercial & office buildings

-平均尺寸约为新建筑的3.6倍高于拆除的建筑
-数量大致相同

Commercial centres instead of smaller shops?
**Results** commercial & office buildings

- Small number of large business premises replaces large number of smaller ones
- Structural change of business
  → centres & hypermarkets
Results commercial & office buildings

- 1970s buildings with repair and upgrading needs

Commercial and office buildings from the 70s are already outdated? How can we make buildings more adaptable to their changing needs?
Results public buildings

- Average size has almost doubled compared to demolished buildings
- Number of new buildings as increased by 40%
  - High amount of residents has an increased demand for public buildings
Results public buildings

- Kauppi area (university hospital)
  - Large demolition
  - Large new construction
Results industrial buildings, warehouses

- average sizes almost equal for demolition and construction
- half the demand on warehouses

Construction for disassembly?

Image: TAKO, Tampere/ Andras Varga
Results: warehouses

- Peaks in demolition correspond to high construction of other building types

→ high replacement rate for commercial & office space and blocks of flats
Results industrial buildings

- Demolition corresponds with new construction
- Relocating of industrial buildings

Relocation possible without demolition?
Demolition - Construction
after 2000 – Ratina/ Kalevanharju/ Iidesranta

44 buildings/ ~50,000 m² demolished
80% commercially used

64 buildings/ ~300,000 m² constructed
40% blocks of flats
50% commercially used

Image: etuovi.com
Demolition - Construction
after 2000 – Ratina/ Kalevanharju/ Iidesranta
Demolition - Construction
after 2000 – Kaleva/ Kalevanrinne

30 buildings/ ~50.000m² demolished
  85% commercially used
39 buildings/ ~140.000m² constructed
  70% blocks of flats
  10% commercially used
  15% public buildings

Image: toimitilat.kauppalehti.fi
Demolition - Construction
after 2000 – Härmälä

75 buildings/ ~87,000m² demolished
72% commercially used
8% residential buildings

106 buildings/ ~185,000m² constructed
98% blocks of flats

Image: Skanska Oy
Goals

• Extend buildings’ lifespans in order to save resources and emissions
  – Maintenance
  – Refurbishment
  – Design for functional and spatial adaptability

• In the case of Tampere:
  – design for extension
  – Design for adaptation
Goals

• Extend building materials’ lifespans in order to save resources and emissions
  – Design for deconstruction (Reuse of building components)
  – Recycling and reuse of construction material

• If using virgin resources, consider embodied energy, reusability and scarcity

• In the case of Tampere:
  – Strategies for carbon intensive materials such as concrete and steel
  – Considering the use of wood and other less carbon intensive materials
Tools

• Analysis based on local data
  – Spatial analysis based on data to discover future potentials
  – (needs further development)

• Masterplans
  – Stir new construction based on existing building mass

• Building policies
  – Change from one-size-fits all solutions to location specific policies
  – Implement Circular Economy principles in the planning process
Kiitos!