



Aalto University
School of Engineering

Challenges and possibilities of concrete in the future

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Contents

- 1. Presentation of myself**
- 2. Challenges and possibilities of concrete**
- 3. (Estimated) future of concrete**

Jouni Punkki

Approaching concrete from 3 directions

TEACHING AND RESEARCH

- Aalto University
- Professor of practice, Concrete technology
- Main research themes:
 - Digitalization
 - Fiber concretes



CONSULTING

- Betoniviidakko Oy
- Material technological consulting
- 3D-technology for concrete surfaces



ART

- Concrete Art
- www.jounipunkki.fi
- Combining advanced (3D) and traditional sculpting techniques



Challenges and possibilities

Possibility #1 (Strength)

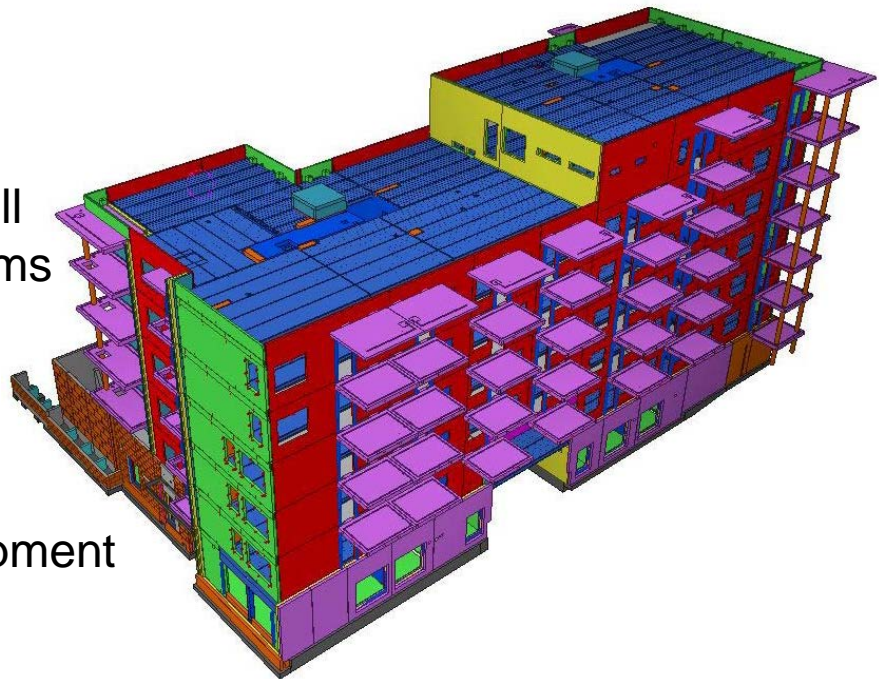
Well-known material / construction

Long experiences with concrete construction

- Well-proven solutions in design, production, details, joints etc.
- Experienced labour available
- Also limitations of concrete are well know, e.g. deterioration mechanisms

Industrial construction with concrete

- Still lot of potential, further development is needed



Challenge #1

Environmental issues

Major issues:

- CO₂-emissions of cement / concrete
- High material use of concrete
- Recycling (challenge & possibility)

The importance of construction phase will increase as energy gets green

- Possible requirements for new buildings, e.g.: CO₂-kg/m²

Alternative binders are the only significant solution (for lower CO₂)



Challenge #2

Wet construction

Moisture is getting more and more critical in construction

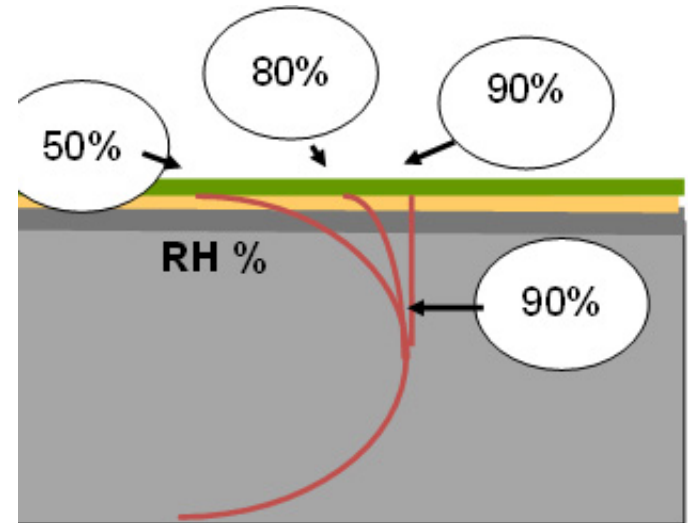
- Construction time (due to drying)
- In-door air quality

Critical aspects

- Drying of concrete structures
- Joints between the elements

Possibilities for dry / drier construction

- The whole process is needed to modify; transportation, site operations



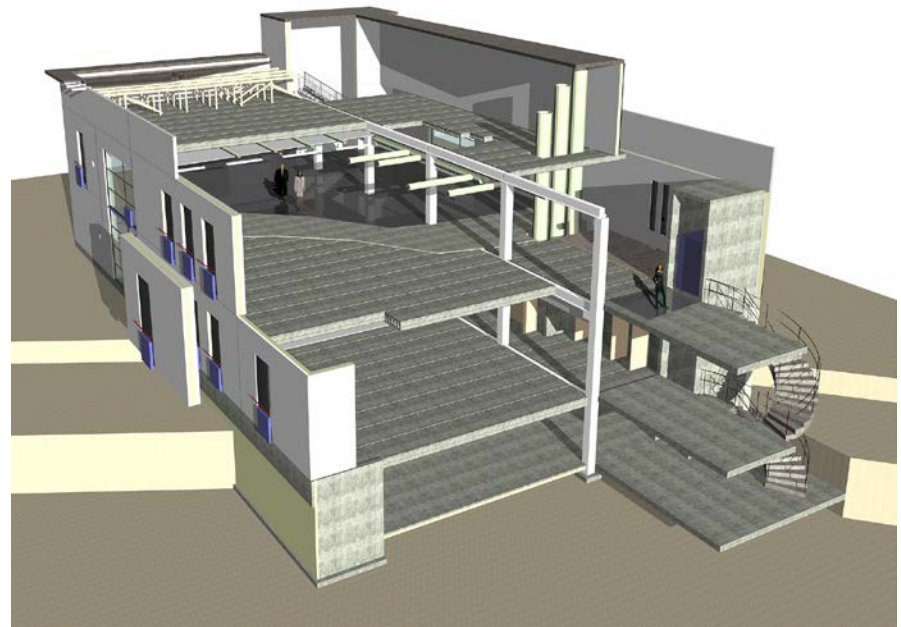
Possibility #2

Strong basic properties of concrete

Concrete has many very strong properties

- Fire resistance
- Moisture tolerance
- Sound insulation
- Thermal mass
- Strength and durability

Are we able to fully utilize all the advantages of concrete?



Challenge #3

Grey, low tech image of concrete

Concrete is having an image problem

- Not too attractive branch for many:
 - *Students*
 - *Employees*

On the other hand, (rough) concrete is appreciated

- e.g. architectural magazines, advertisements

Improving the image is challenging and time-consuming



Possibility #3

Versatility of concrete

Concrete as material gives lot of possibilities

- Strength level, density
- Types of reinforcement
- Shape and surface texture
- Color
- Production methods

Much more possibilities compared to other building materials

Still many possibilities waiting to be utilized...



Challenge #4

Low R&D&I activities of the branch

The branch is not R&D&I-oriented

- Price competition, low profit, high volumes
- Strong position in the market
- Only local competition

Risk for losing the position

- Other materials are more active
- New possibilities of concrete are not fully utilized *“Concrete is not ready yet”*

Level of automation is too low

- Digitalization & automation are key issues



Possibility #4

Local building material

Concrete is a local building material

- 95% or more of the raw materials are local (< 200 km from the site)

Weight vs. locality

- Transportation distance / costs
- Effects on competition

Move to crushed aggregates

- Challenge & possibility
- Small-scale local production of crushed aggregate
- >80% of the raw material could be very local



The future

Estimated future of concrete

1. **Use of concrete will increase globally**
2. **In developed countries the market share (also total volumes) will be reduced**
 - *In many applications **concrete cannot be replaced***
3. **Pressure due to environmental issues gets stronger**
 - *Alternative binder gets into the market, market share increases only slowly (app. 10% in 10 years)*
 - *New regulations / taxes will come*
4. **New concrete types / production methods will come**
 - *Potential exists*
 - *Depends on the development activities*



THANK YOU - ANY QUESTIONS

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