

Digital Reuse: Leveraging technology for a circular built environment

Arlind Dervishaj, PhD Candidate Division of Sustainable Buildings Kjartan Gudmundsson, Assoc. Prof. KTH Royal Institute of Technology

Buildings are major contributors to climate change. Reusing buildings and materials in a circular economy is a promising solution, but we need methods and tools to support it. Therefore, we develop digital innovations to support the reuse of concrete, a ubiquitous construction material that represents 7-8% of global CO₂ emissions.

Part of a European project:





Cooperating academic institutions







The built environment accounts for:



40 % of global carbon emissions



50% of all extracted materials



By 2060, building stock will double



11% of global emissions are from materials

By 2060 global material use will double

and construction



- Example of Kingdome in Seattle, built in 1976 and demolished in 2000. Sometimes structures have a short life span.
- Demolition poses health and safety risks, and considerable costs, produces waste, and requires careful planning and cleanup.

Digital tools and steps that facilitate the reuse process for buildings

Disassembly of a building

Assembly of a new building

Disassembly

& storage

Storage of

materials

Reconditioning

Further testing

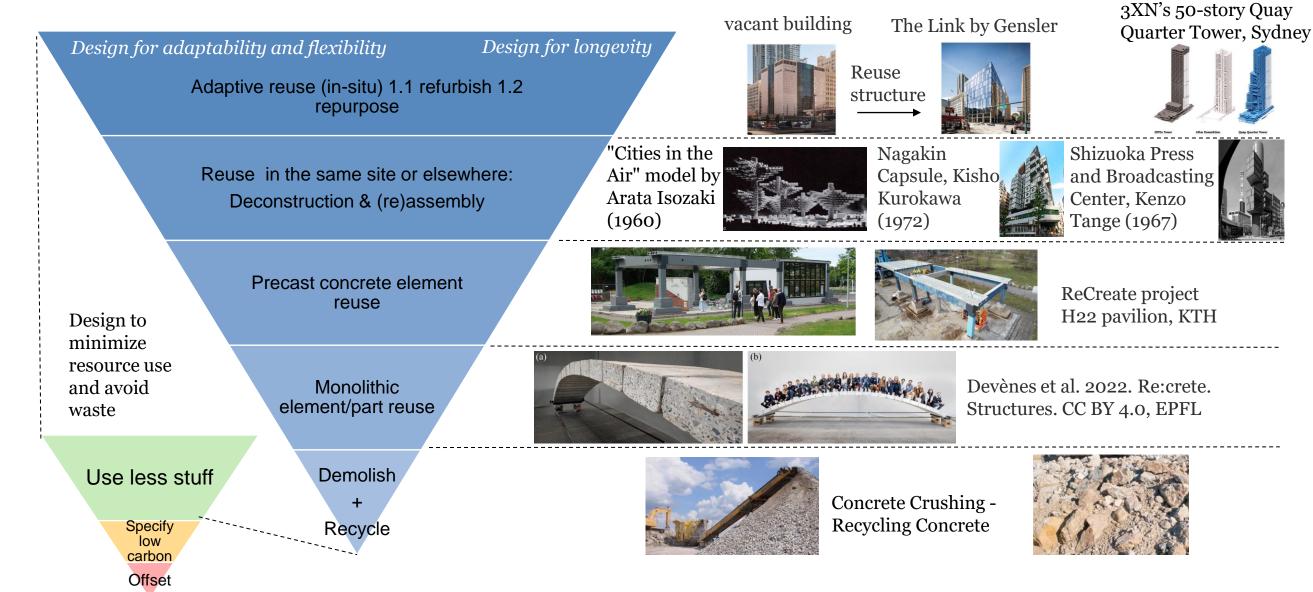


- Buildings as Material banks
- Mapping through GIS & BIM
- Data capture for reuse
- Documents • Photos
- Scan-to-BIM • Ground Penetrating Radar (GPR)
- Cores and lab tests
- Digital Twins
- Track & trace with smart tags
- Material passports • Digital templates
- Data sharing
- Marketplace sharing
- - Automation in design process e.g., connectors, location, cut
 - Design algorithms

Design

 Carbon & circularity of design scenarios

Perspective on reuse of buildings: Where do we stand?



- In many cases, concrete buildings are demolished for reasons other than structural capacity
- Concrete has the potential for a very long lifespan (durability, reuse, interventions).

Digital reuse guidelines – taking the EN 17412 standard a step forward

Milestone

Sharing in the

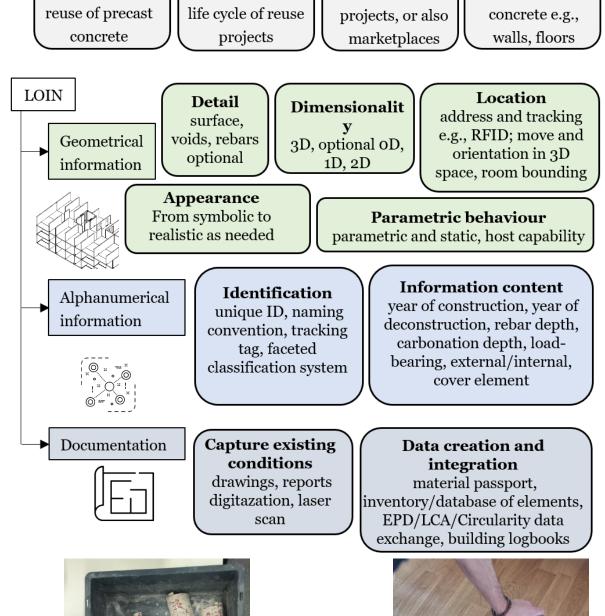
Level of Information Need (LOIN)

Actor

Stakeholders in

Object

Reusable precast





Purpose

Digital models for

Destructive tests Carbonation Chlorides

Toxic metals



Non-destructive Visual inspection GPR

Contact

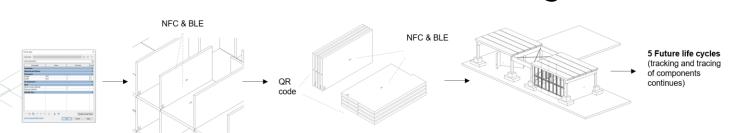
Arlind Dervishaj arlindd@kth.se Kjartan Gudmundsson kjartan@kth.se



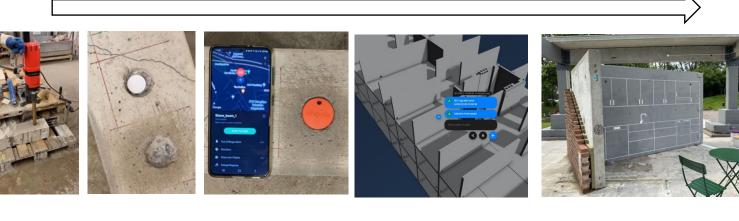


Our work on concrete tracking

New digital workflows, towards 3D model-based data flows & management



Testing of smart tags









Marketplace/

information

sharing





References

Paper on

tracking

Passport



Material

Paper on digital



Digital

twins



KTH Royal Institute of Technology