

# Enabling reuse of structural components through documentation of quality

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# Enabling reuse of structural components through documentation of quality

**PROJECT**

Grand Solution,
Structural Reuse

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The reuse of building components, and especially the basic components of a building structure, (walls, beams, columns, etc.), is almost non-existent today, but needs to be scaled up to fully implement circular principles. In addition, the potential reuse of structural components represents a significant environmental benefit as the structural frame alone can account for up to 80% of the embodied carbon in a building[1]. The lack of systems for standards, certification, and documentation is a barrier to the reuse of structural components and creates a significant burden in terms of paperwork and economic risk for owners who choose these components for a building.

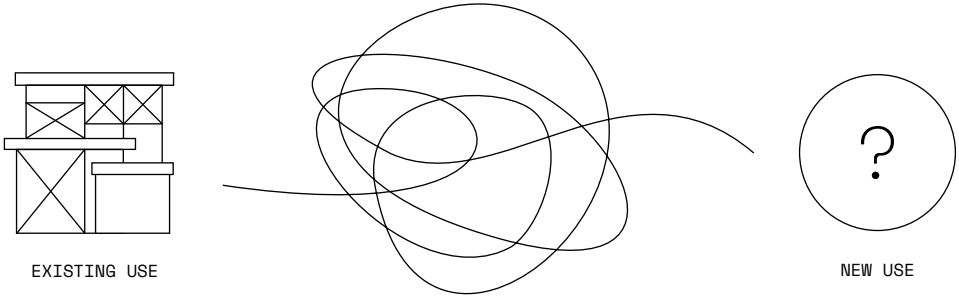
The objective of the Structural Reuse project is to overcome this barrier by developing much-needed systems and methods to make the choice between second-life building components and new components equivalent.
To fulfill the purpose, the project has four specific aims, to: (I) develop and standardize a requirements classification system for reuse of concrete, wood, and steel components; (II) develop and standardize non-destructive tests (NDT) for documentation of the technical quality of components; (III) provide know-how and data for inclusion of NDT methods in technical guidelines in the Joint Technical Property; and (IV) perform three full-scale tests as a baseline for developing a methodology to quantify the environmental impact from reuse options.

The existing requirements for materials and components have been mapped as part of systematizing how they

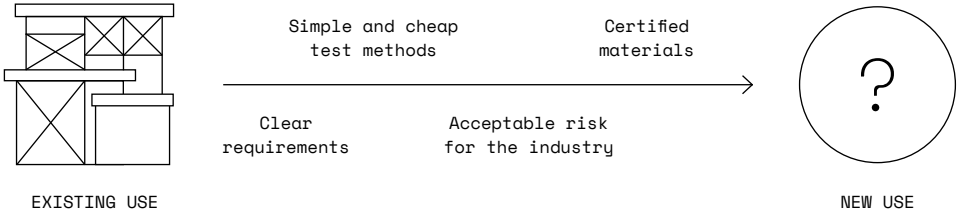
can be applied to reused components within acceptable risk thresholds[2]. The requirements are grouped into legislative requirements at the product level, standard terms for processes, Joint Technical Property, and voluntary arrangements. In parallel, a classification framework has been developed for the reuse of structural elements based on pre-assessment (element history and in-situ condition), functional requirements and parameters, and a categorization based on structural, environmental, and dimensional parameters[2]. A classification for concrete has already been developed[3]., while one for steel is ongoing at the CEN level. For timber, the work is underway and is combined with a parallel industrial PhD project on fire properties of reused timber[4].

The use of NDT methods for evaluating other potential purposes within structural elements has been mapped both in the scientific literature and the methods used by practitioners with widely-available equipment (these mappings are currently pending publication). The first in-situ pilot-scale tests with ultrasound pulse velocity and Schmidt hammers on concrete columns have been performed. These tests, together with other ongoing and planned pilot-scale tests, will form the foundation for a detailed description of procedures for in-situ documentation and data treatment to determine actual concrete strength classes. These procedures will then be developed into guidelines and further analyzed in full-scale tests which will be performed before the project's conclusion.

## CURRENT PROCESS




## THE FUTURE PROCESS




**REFERENCES:**

[1] **Seunghyun son** , kwangheon park, heni fitriani, and sunkuk kim, 20. January 2021
Https://www.Mdpi.Com/2071-1050/13/3/1060/htm
[2] **Structuralreuse midway conference publication (2023)** https://data.Dtu.Dk/articles/online_resource/structuralr
[3] Euse_midway_conference_publication/23043551
[4] **Fire performance assessment methodology** to ensure second life potential of reused load bearing timber elements – welcome to dtu research database