

Outcomes of a Student Research Project on Circular Building Systems

Focus on the Educational Aspect

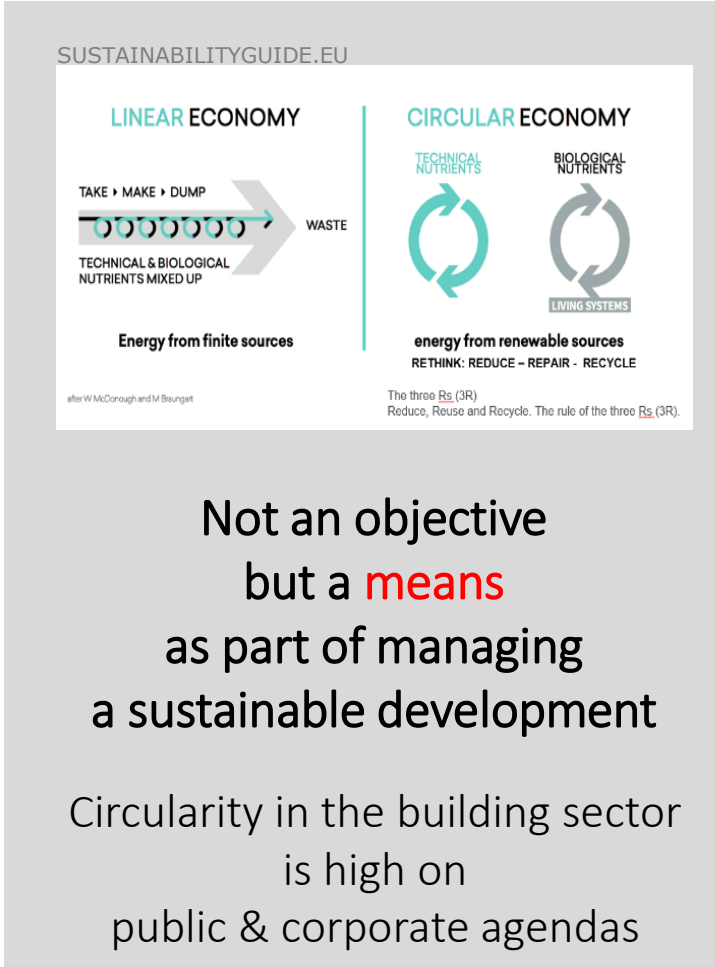
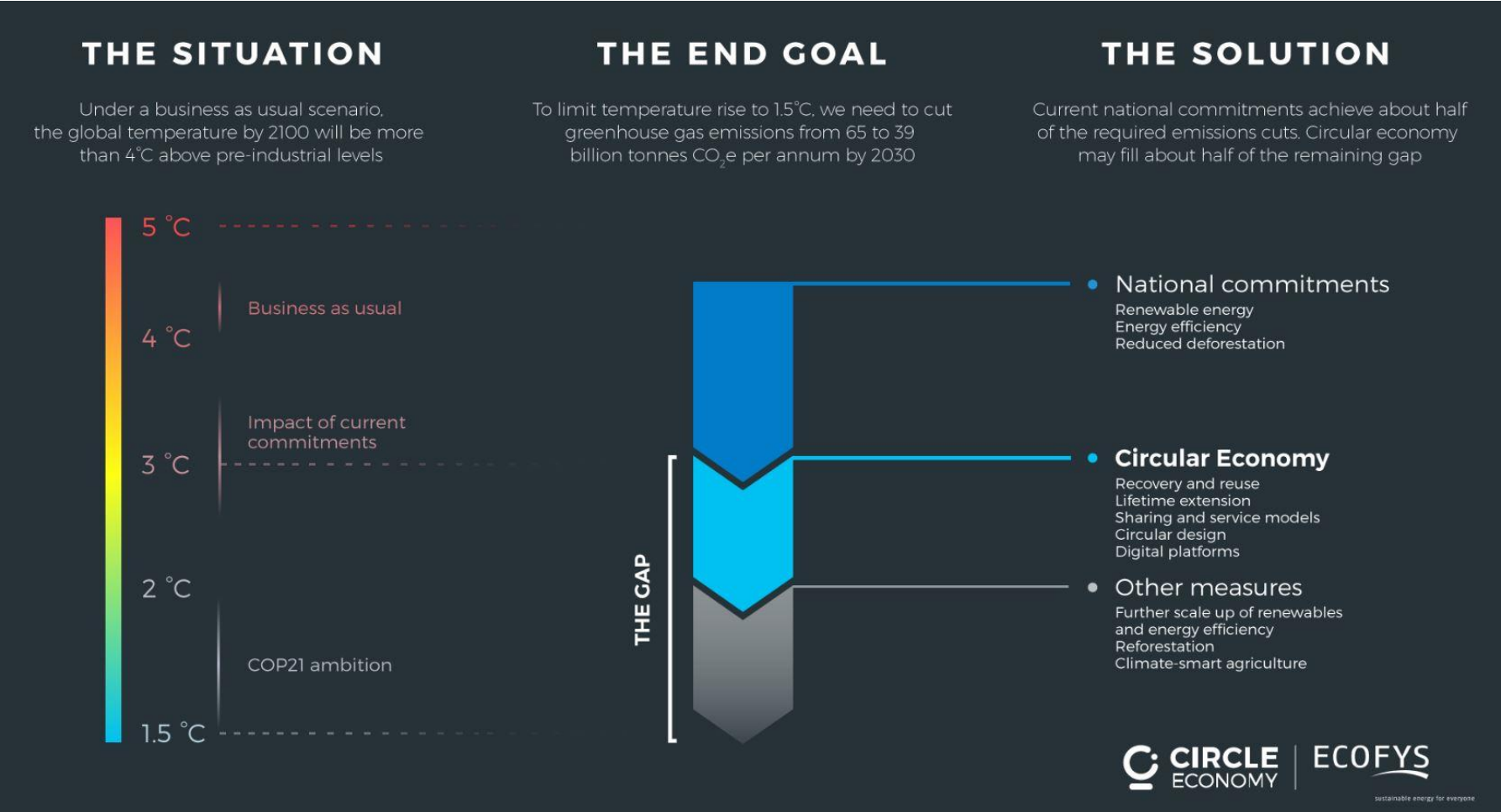
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Context



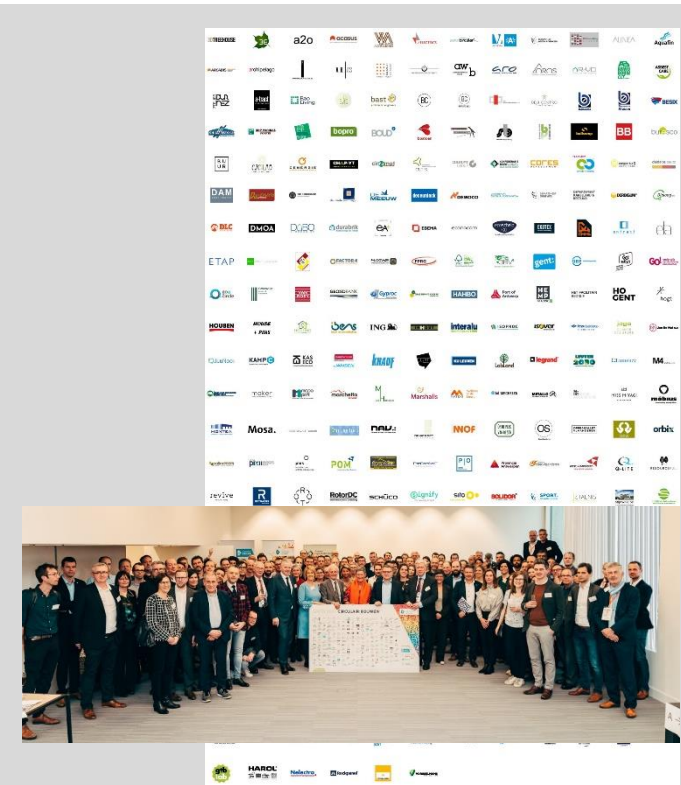
Introduction



Problem statement

Producers of building materials and construction systems are rapidly taking the first steps and develop or redevelop products in view of the requirements for circular building.

- The risk is high that in the rush to quickly develop products, **claims of circularity are made too easily.**
- As circular building will become key in the professional field, **it is necessary that architecture students are being prepared.**



Flemish policy action:
Green deal – Circular building

Objective

- study the potential for circular building of specific building systems
- by master students in architecture of the Faculty of Architecture and Arts of Hasselt University.

Aims

- ✓ Educational: trigger and train students
 - to become architect-designers with a strong **focus on circularity**
 - to conduct research in a **collaborative and critical way**
- ✓ Research methodological
 - exploring possibilities for actively involving architecture students in research on building-technical aspects (**nexus education – research**)
- ✓ Innovation & development
 - **building-technical niche development** with a societal relevance, in this case building systems that enable circular building and enhance a circular economy model

Aim paper/presentation

- ✓ present and discuss the **concept of the student research**
- ✓ present **tentative and illustrative outcomes** of selected circular building systems

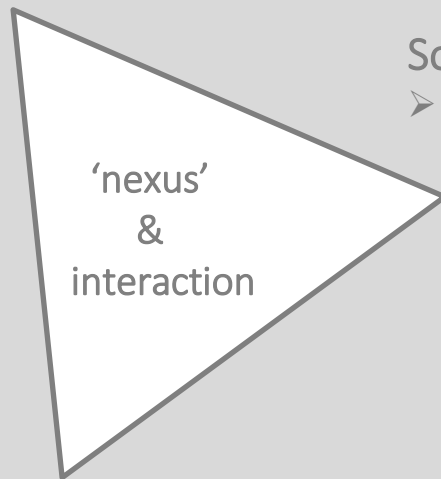
Concept of the research

Description of the assignment

Positioning within the curriculum / Fac-Ark

Education

- Research Seminar 'Building Concept'
- Mastersthesis
- Design & Build -studio



Societal service

- Design & Build LAB

Research

- Arck Sustainability Research Team

2 years of the seminar form a complementary journey

Every year combines design, hands-on activity and research

Year 1, the concept of circularity is explored through

EXPERIMENT



Year 2, focus is on a

REALITY CHECK



Concept of the research

Description of the assignment

REALITY CHECK

The assignment as such

“in-situ testing and improving circular building systems for cavity walls”

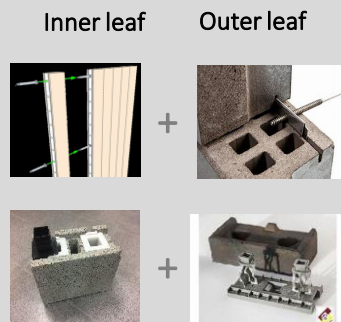
- by the act of building
- backed by an assessment with an existing framework of evaluation criteria for design for change

The assignment evolves from hands-on explorations, over analysis and assessment by desk-top research, to the formulation of improvements by design & build research.

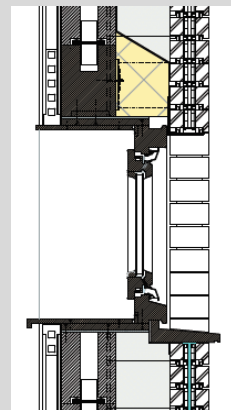
Phase 1



Phase 2



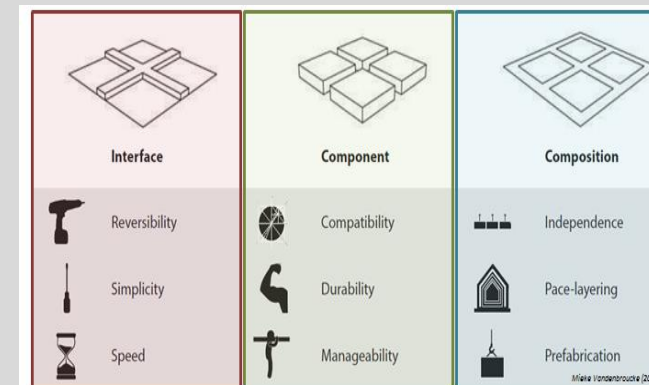
Phase 3



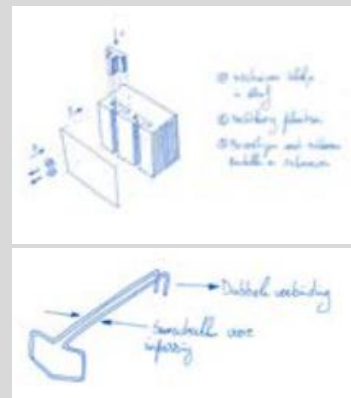
Phase 4



Phase 5



Phase 6



Selected systems, composed cavity wall ensembles and set-up building experiment



System 1: Construclick
<http://www.facadeclick.be>



System 2: Facadeclick
<http://www.facadeclick.be>



System 3: Systimber
<https://www.systimber.com>



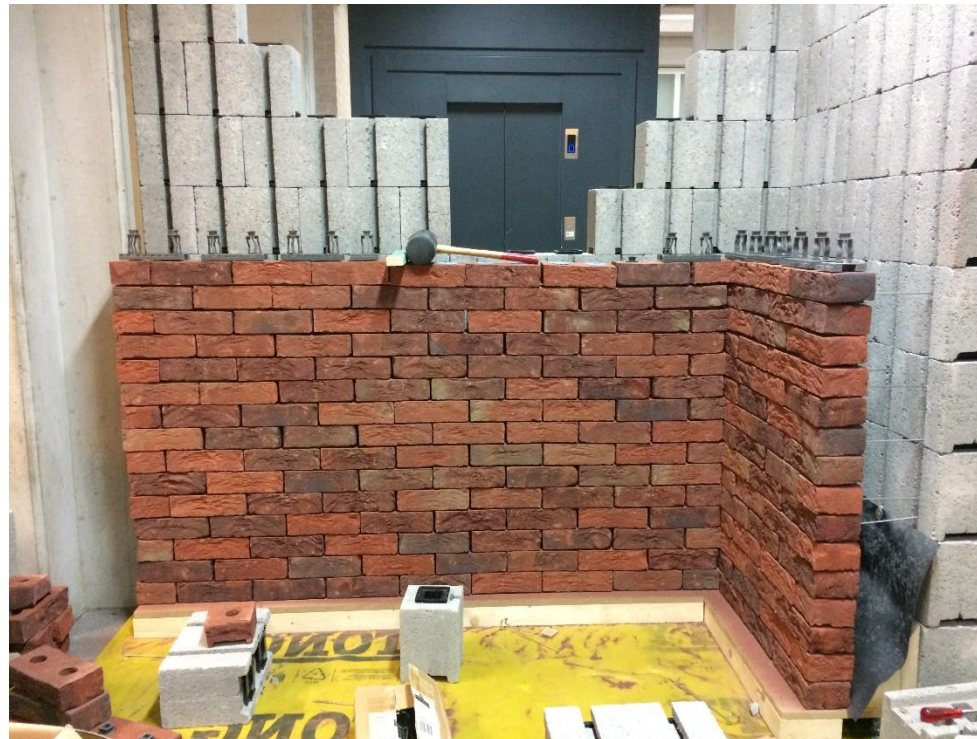
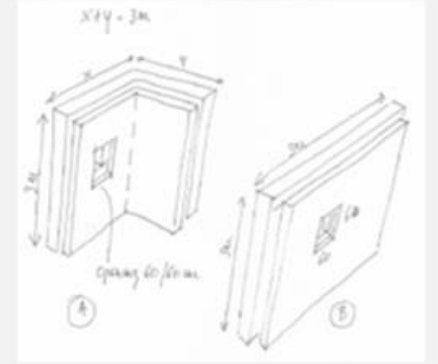
System 4: Clickbrick
<http://www.daasbaksteen.com>



System 5: Steko
<https://www.steko.ch>



System 6: Facatile
<https://www.wienerberger.be>



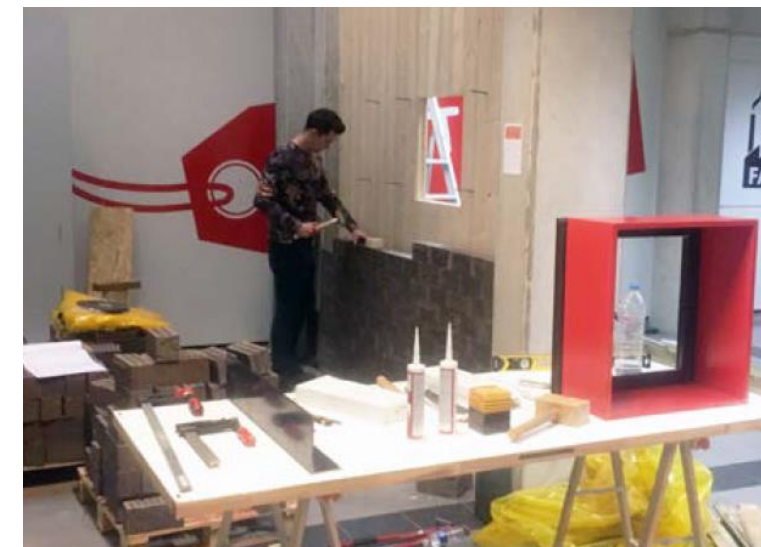
Educational aspects

Students' perspective (Based on a self and peer assessment, including a personal reflection on the assignment)

✓ Added value for the curriculum:

- The **in-depth focus** on materials and construction methods, and having the **time and space to experiment** with details of/for new ways of building with a strong societal relevance.
- The set-up of the seminar, with its structure and **balance between theory and practice**, enabled to gain good insights in circular building.
- Development of **critical thinking skills**, inter alia by including an assessment tool.

This assessment tool appeared to be both a blessing and a curse, as it was found to be time consuming.



Educational aspects

Tutors' perspective

- ✓ Labour intensive preparation (collaborations , hands-on activities, ...)
- ✓ Hands-on approach was evaluated positive
- ✓ Needs improvement:
 - Aspect of working in a group
 - Aspect of assessing in an objective way
 - Aspect of encouraging/stimulating/feeding innovation by students

Research methodological aspects in view of the nexus education – research

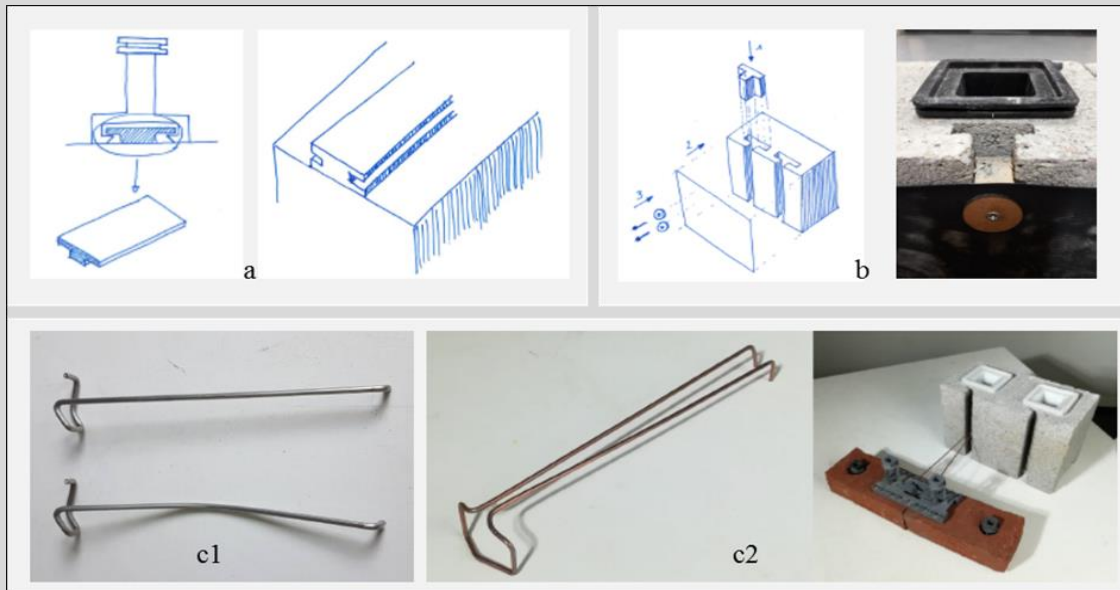
- ✓ The nexus 'research & education' worked well
 - Topic with a strong societal relevance
 - Tangible research method (hands-on)
 - Exposed outcomes (visibility)
 - Use of an assessment tool so outcomes can be validated (quantitative method is preferred)



Niche development aspects

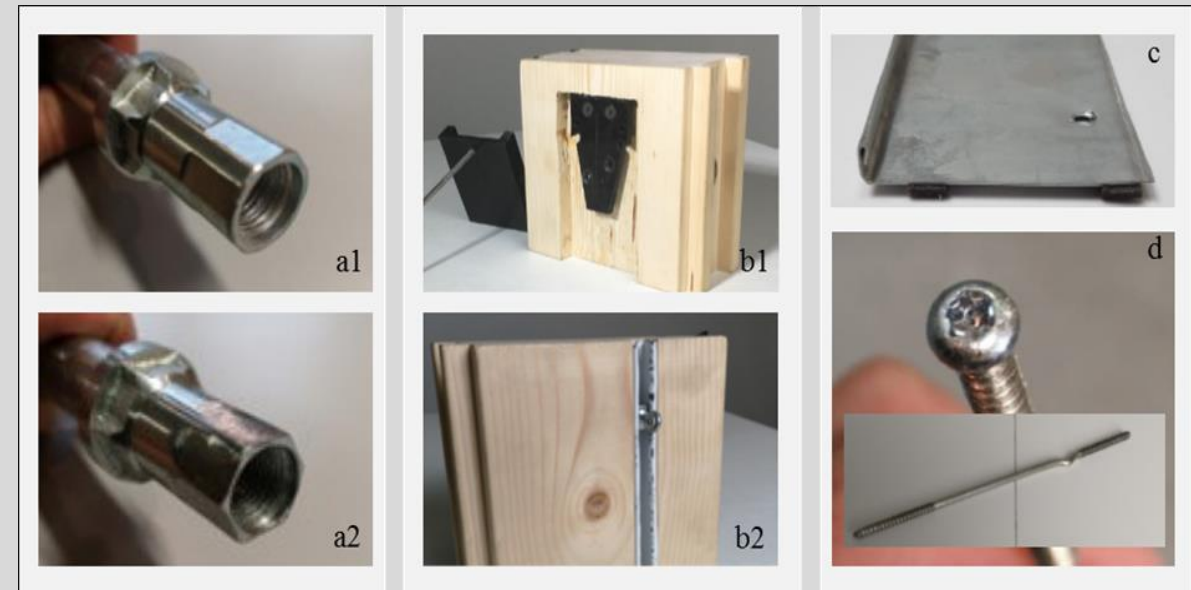
Systems 1 & 2 – composition A

- a) a mounting lath for a circular connection with the foundation
- b) a connecting block to fix the watertight slab between foundation and inner wall
- c) an alternative cavity anchor; with c1 the existing cavity anchor, and c2 an alternative cavity anchor



Systems 3 & 4 – composition B

- a) wider grip surfaces of the spacer (with a1 the existing grip)
- b) (b1 + b2) two anchoring solutions for cavity anchors
- c) metal plate for a circular connection with the foundation
- d) a screw head of the cavity anchors



- Based on reflections of both students and tutors, it can be concluded that the concept of the nexus education - research was successful and only needs minor revisions.

- Perspectives for future editions of similar student research:
 - ✓ complementing the assignment with a **real-life full design/build project**
 - ✓ including a **team building activity** in order to improve the aspect of working in a group
 - ✓ using tailored **pedagogical methods** to encourage/stimulate/feed innovation during the development of improvements by the students
 - ✓ from a research point of view, selecting a **quantitative assessment method** which avoids subjective assessments, and which is easy and quick to use by students.

➤ Concerning the circular building systems/

- ✓ all systems as such work, are easy to use and fast to assemble and disassemble
- ✓ small-scale incremental improvements on the individual system level are required.

- ✓ fundamental improvements and research regarding following aspects (non-exhaustive) are believed to be crucial for a full and successful application of the idea of circular building:
 - circular connections between circular building systems and other building components (e.g. foundation, windows, roofs)
 - compatibility (e.g. dimensions, connections) with other circular building systems,
 - watertight and vapor tight **sealing of both surfaces and joints**
 - **diversity of products** within circular building systems (e.g. tailored lintels, corner solutions)
 - broad building type (in view of needed performances) and project type **application range** (e.g. renovation)
 - **prefabrication potential**
 - **lowering the environmental impact** (e.g. especially of connecting components) of existing circular building systems, and more broadly development of new circular building systems based on renewable and regenerative resources

Thank you.



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