

## ➤ Research information

**Key words**

design support, renewable resources, sustainable building, circular design, energy, materials

**Introduction**

- The main principles of circular design are not new [1,2,3,4,5,6]. However, up to now, only vague definitions or general and broad principles exist. No clear criteria, indicators, and no hands-on guide to support architects when designing buildings within a circular paradigm are developed so far [7]. there are problems related to:
  - Calculation of material quantities (average 3 weeks for a mid-size project 2000 m2).
  - Life Cycle Assessment LCA for materials.
  - Use of very complicated software.
- The research will focus on the study of energy and materials because the positive impact can only be achieved through the deliberate use of resources (energy and materials).
- Develop a methodology to guide architects during early design within the circular design paradigm and empower Belgian architects in their design practice.

**Objectives**

The operational objectives of the research project are formulated as follows:

- Development of a carrying framework for circular design.
- Providing an overview and recommendations for circular building design in Belgium.
- Translation of this framework into a methodology that will guide architects during early design within a circular design paradigm.
- Validation and dissemination of the guiding methodology in education.
- The expected outcome visualizations are a guide which is setting standards of circular building design for Scientific researchers, Students, and Architects with designing software for this purpose.

**Methodology**

The work packages of this PhD research are divided into:

- **WP 1:** Identification of general principles, strategies and performance metrics for circular building design.
  - The literature review starts with a broad review of circular design.
  - An overview of existing performance metrics and indicators will be made.
  - The scope is narrowed down to energy and materials as these are the focus of this PhD.
- **WP 2:** Classification and characterization of circular design in Europe.
  - Defining the selection criteria of circular buildings.
  - Develop the inventory classification based on case studies analysis and literature review.
  - Classification and characterization of existing circular projects will provide the conditions for further development steps and will show the potential for the environmental and economic feasibility of circular building.
- **WP 3:** Performance evaluation and optimization of certain design strategies and measures for circular design.
  - From the case study analysis and literature review in WP1 and WP2, should be evaluated so that they can be translated into practical guidance on circular design.
  - Create practical guidance on circular design for architects.
  - Develop a reference building to test several design options.
  - The result of WP3 is a database that is used to complement the framework on the circular design.
- **WP 4:** Development of a guiding methodology for circular design.
  - By means of interviews and group discussions, the needs and barriers when designing within a circular paradigm are identified: Sensitivity analysis for structure, Sensitivity analysis for the envelope and overheating hours & thermal mass calculation.
  - The first version of a guiding methodology will be developed to allow architects to follow a systematic and logical approach for circular design.
- **WP 5:** Validation of the guiding methodology, dissemination and publication.
  - The guiding methodology will be validated and fine-tuned by means of a specific design exercise with students and a workshop with practicing architects.

- Test the methodology and record its merits and shortcomings.
- Use both students and practicing architects' inputs to iteratively improve the guiding methodology.

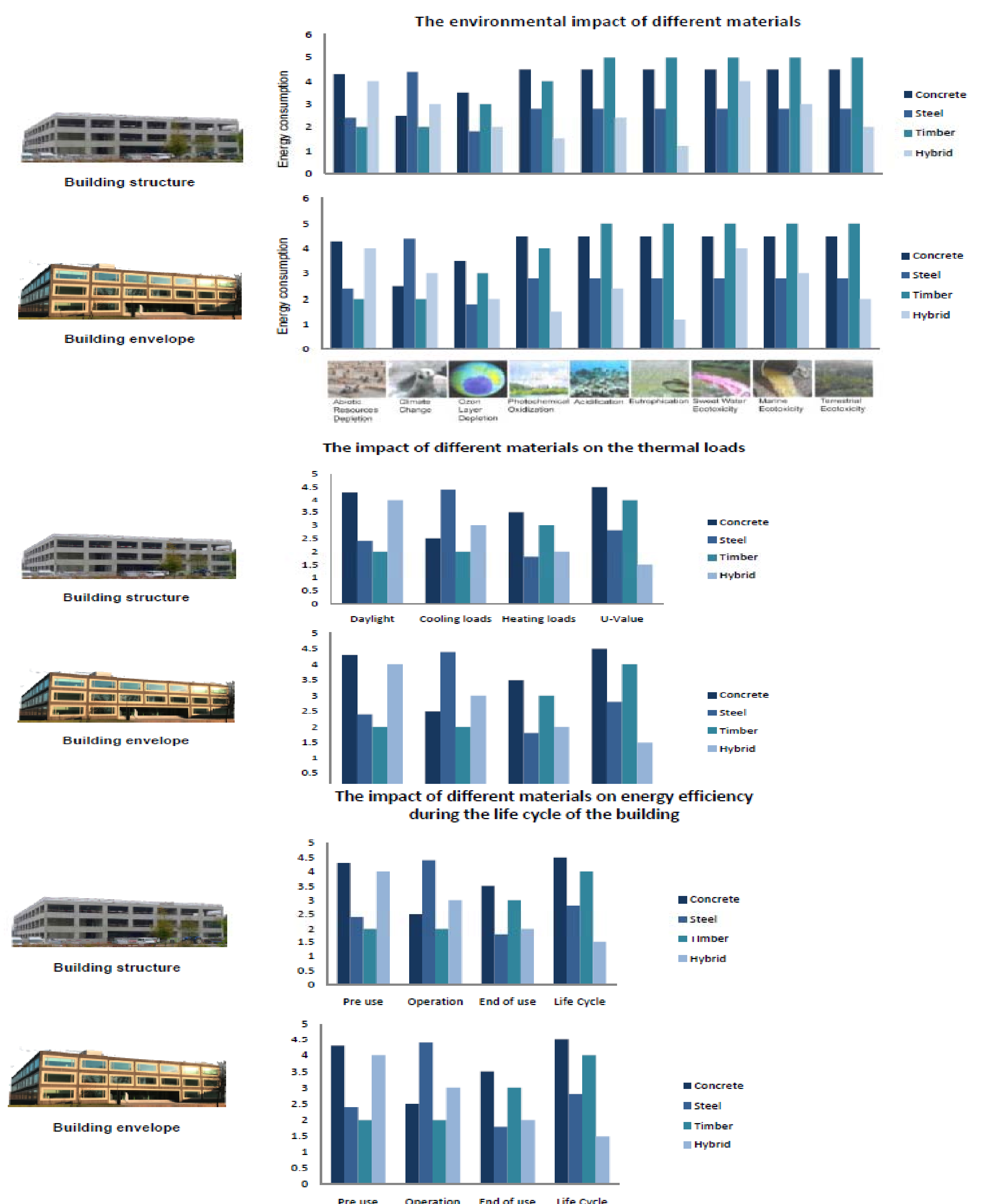


Fig. 1: Expected outcome (Examples).



Fig. 2: Expected Outcome Visualizations.

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