

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Danai Moutou
Student number	5354838

Studio		
Name / Theme	Facades & Products/Circular Building Design	
Main mentor	Thaleia Konstantinou	Facades & Products Design
Second mentor	Abdullah Alattas	GIS Technology
Argumentation of choice of the studio	I am very passionate about circularity and the possibilities that it has in the building sector. I also took an extra course about circularity to understand the fundamentals of it and I have included the circularity aspects to all my master's projects up to now. Through my thesis, I would like to further explore these possibilities and find an optimum solution in order to minimize the time and the cost that is needed for a façade renovation with demountable and reusable components designed with circular principles. Moreover, I find BIM technology particularly useful for the design stage of a building project and it can further facilitate the application of circular design. Especially, a BIM library can make the decision-making during the design stage easier and more efficient.	

Graduation project	
Title of the graduation project	A Circular BIM Components Library for Energy Renovation Design.
Goal	
Location:	Europe
The posed problem,	A very large percentage of the European residential building stock is aging and does not comply with current energy regulations. The need to complete short-term energy upgrading on these buildings to improve their performance and meet the current regulations presents a great challenge. Moreover, the construction sector represents one of the most significant sources of waste generation in the EU, Increasing resource efficiency with the circular economy through slowing, closing, and narrowing material and energy loops, is key to moderate climate change. There are many gaps in the existing circular design frameworks. Most authors recognize the need for a systematic, and integral approach but, very few provide such

	<p>frameworks. There is a missing link between more comprehensive frameworks that offer concrete design options.</p> <p>Designing a sustainable renovation for the existing buildings requires a comprehensive and systemic management approach of the buildings' characteristics and the design parameters. Further standardization of renovation products and processes is needed, and digital and automation capabilities should be developed.</p> <p>BIM can support and promote circularity in the building environment and especially in the energy façade renovations, but it hasn't been fully used yet for that purpose.</p> <p>Also, there is any developed standardized prefabricated circular facade system that can be adjusted and flexible And there is any BIM tool specifically for circular renovation design.</p>
research questions and	How can a BIM components library facilitate the design of a circular standardized renovation facade system that meets the energy-saving measures and it is adjustable?
design assignment in which these result.	The development of a BIM object library with standardized circular components, with a level of flexibility, for energy façade renovations. This tool will be able to suggest the optimum circular façade system for each building project.

[This should be formulated in such a way that the graduation project can answer these questions.
The definition of the problem has to be significant to a clearly defined area of research and design.]

Process

Method description

In this thesis, a design-based research approach is adopted to answer the research questions that are defined in the introduction phase. The research phase consists of six main parts:

Part 1: Literature review and evaluation

Part 2: Data collection and current practices research

Part 3: Design methodology formulation with the requirements and generic design tools and principles

Part 4: Finalization of the design

Part 5: Verification of the design with its application in a case study

Literature and general practical preference

This research selects and evaluates the literature on three fields of study: The Energy Renovation, the Circular Economy, and the BIM technology. Scientific articles, Studies, Books, Reviews and Studies has been consulted. The information has been obtained through "Google Scholar".

Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?
2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

1. This graduation topic is a more technical and more software-oriented approach to the studio topic: "Adjustable, circular prefabricated system for Sustainable Building Renovation". Since the thesis is about the development of a tool with the use of BIM software, that will facilitate the design process of energy renovation façade projects and it is based on the principles of circularity, it is strongly related to the BT master track and the field of sustainable architecture in general.

2. Scientific relevance: The project is about the design of a BIM components library that can create a standardized façade system with a certain level of flexibility. With this design tool, the energy façade renovation projects can be optimized and simplified to an extent, with the implementation of the circular design principles. By creating a BIM library with circular components for energy renovation design, circular design can be promoted effectively and applied to renovation design with a variety of different parameters. This BIM library will contribute to a more sustainable and circular building environment and will help Europe to achieve the goals for 2050.

Societal relevance: Many people can be benefitted from this project. The energy renovation will reduce the buildings energy demands. Residents of buildings that will be refurbished will benefit from the energy retrofit of the building, which will result in a better quality of living. Engineers and architects also benefit, since there are a lot of residential buildings that need to be refurbished. The circularity approach helps the overall environmental situation and with the standardization helps the stakeholders by reducing the time and the materials needed for the renovation and especially the construction companies to be more efficient and have less waste materials. BIM makes the design process easier and keeps the design choices up to date and makes of the stakeholders to be involved to the renovation from the early stage which is crucial for the high quality of the end result.