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	Myrthe Lara Peet
Student number	4657403

Studio		
Name / Theme	Building Technology / Sustainable Structures	
Main mentor	Dr. Stijn Brancart	Structural Design
Second mentor	Ir.arch. Gilbert Koskamp	Timber Structures
Argumentation of choice of the studio	I chose to focus my graduation on sustainable structures, specifically transformative structures through scenario based design, because I am curious if the current improbability of transforming existing structures can be transitioned into an obvious first strategy in the future. My further interest in sustainability will be explored by using timber as the building material of choice.	

Graduation project	
Title of the graduation project	Transformative load-bearing timber structures, developed through scenario based design.
Goal	
Location:	n/a
The posed problem,	Buildings are objects made from different layers and parts, each with a different life span. Theoretically, with maintenance and renovation, the life span of a building could be extended endlessly (Gruis, Visscher, & Kleinhans, 2006). When buildings are no longer seen as valuable in their current state, they are most often left vacant or demolished (Wilkinson, Remøy, & Langston, 2014). On the subject of sustainability, both demolition and vacancy portray issues. Demolition and redevelopment requires much more building materials and produces more waste than transformation or renovation strategies (Itard & Klunder, 2007). Vacant buildings are more prone to vandalism, break-ins and illegal occupancy. It also conveys a negative image to the surrounding neighborhood (Remøy & van der Voordt, 2007).
research questions and	The main research question researched in this thesis is:

	- How can a transformative load-bearing timber structure be developed through scenario based design to extend the lifespan of buildings using locally sourced materials? The main question will be answered through a sequence of sub-questions, being: - How do different building strategies compare ecologically and economically? - Why is wood the most suitable building material for developing a transformative building structure? - What are design criteria for a building system suitable for transformation? - Which existing building system fits the design criteria for a transformative structure best? - Which scenarios are most probable in the Dutch building industry, or impactful on a building structure? - What are the design criteria for the most probable and impactful scenarios? - How do the design criteria translate to a design for a transformative timber structure?
design assignment in which these result.	This research will result in a framework, through which architects and building engineers can make a substantiated choice of which building system to apply to their transformative building projects. They will consider their preferred transformative design criteria, fitting their scenario, which are connected to a complementary building system. The framework will be demonstrated by further developing two probable scenarios into comprehensive structural design proposals.

Process

Method description

The research will be conducted by following a scenario based design methodology framework. Since the aim of this research is to develop a transformative timber structure, a scenario based design strategy is chosen, because it focuses on buildings being dynamic objects, instead of static.

Rosson and Carroll (2009) define the concept of scenario based design in their research as "a family of techniques in which the use of a future system is concretely described at an early point in the development process". This methodology is focused on mapping various possible configurations and predicting their potentials, performances, weaknesses, strengths and opportunities, eventually guiding the

further development of a system that fulfills the goal of the project (Eilouti, 2018; Rosson & Carroll, 2009).

This research using the scenario based design methodology consists of three phases: respectively analysis, design and evaluation.

- Analysis phase

The analysis phase begins by conducting a contemporary image of the current practice in the field of building technology, specifically focused on transformative design and timber structures. This is done through relevant literature, stakeholders and case studies. After, various scenarios are explored. Since one of the main themes of this research is focused on transformative structures, the scenarios will be thoroughly analyzed on how to transition from one scenario to another and mapped into design output components (Eilouti, 2018).

- Design phase

The goal of the design phase is to formulate a specified design vision, ideally including all the requirements for a timber building structure which can seamlessly transition from one scenario to another. The development of a design vision is done using computational tools and prototyping with physical models. The design phase is not a linear process, but rather a design loop in which design proposals will be evaluated and new criteria are defined.

- Evaluation phase

Through an evaluation matrix, characteristics of design proposals are evaluated against predefined required design output components. This evaluation is done for every design vision that results from the design phase.

Eventually, when a design vision meets the required design output components, the technical details and development of the vision are crystalized, and a concrete design solution is created. Additionally, a summative evaluation is written in which potential further research topics and remarks on the results are summarized.

Literature and general practical preference

Eilouti, B. (2018). Scenario-based design: New applications in metamorphic architecture. *Frontiers of Architectural Research, 7*(4), 530–543. https://doi.org/10.1016/j.foar.2018.07.003

Gruis, V., Visscher, H., & Kleinhans, R. (2006). *Sustainable Neighbourhood Transformation: Volume 11 Sustainable Urban Areas.* IOS Press.

Itard, L., & Klunder, G. (2007). Comparing environmental impacts of renovated housing stock with new construction. *Building Research & Information, 35*(3), 252–267. https://doi.org/10.1080/09613210601068161

Remøy, H. T., & van der Voordt, T. J. (2007). A new life: conversion of vacant office buildings into housing. *Facilities, 25*(3/4), 88–103. https://doi.org/10.1108/02632770710729683

Rosson, M., & Carroll, J. M. (2009). Scenario-based design [EBook]. In *Human-computer interaction* (1st ed., pp. 145–164). CRC Press. https://doi.org/10.1201/9781420088892

Wilkinson, S. J., Remøy, H., & Langston, C. (2014). *Sustainable building adaptation: Innovations in decision-making* (1st ed.). John Wiley & Sons, Ltd. Retrieved from https://ebookcentral-proquest-com.tudelft.idm.oclc.org/lib/delft/detail.action?docID=1597997#

The sources above refer to the main sources used during the first phase of my master thesis project and are also referenced in the answers given in the previous questions. I have used other literary sources, but these will be listed in the finished written thesis document. In the further stage of my project, I will still consult additional literary sources, but I will also begin prototyping and using computational tools to test my design proposals. Furthermore, I will discuss my findings with my tutors or connect with a specialist in the required field of research.

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)?

As my graduation topic is centred around transformative structures through scenario based design, it is focused on the design of innovative and sustainable building components. This is one of the main emphases of the Building Technology track and has played a pivotal role during past master courses. This topic bridges important themes on different scales, like urban renewal, technical details and material science. This way it relates to the master programme in Architecture, Urbanism and Building Sciences.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

There is already a lot of knowledge about transformation strategies and timber structures. This graduation project will contribute to the existing scientific field by combining the two factors. Secondly, there is a dominant approach to obsolete buildings based on functional or economic factors, while it is important to make sustainability a main guiding theme in the decision making process. By developing adaptive structures during the initial design phase, transforming a building in the future can be made less costly and less difficult. This makes owners more inclined to pick the more sustainable building strategy.
This research topic is relevant to a social framework because it eventually will help solve social issues that arise when buildings are neglected or demolished. Like mentioned before, vacant buildings have a higher chance of vandalization and illegal occupancy. In addition, by extending the life span of buildings, a stronger urban identity will be created.