

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences

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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	Gideon de Graaf	
Student number	4598318	

Studio		
Name / Theme	Architectural Engineering graduation studio	
Main mentor	Yannick Warmerdam	Architecture (Design mentor)
Second mentor	Pieter Stoutjesdijk	Architecture & digital manufacturing (Research mentor)
Argumentation of choice of the studio	The Architectural Engineering studios sparked my interest because it focusses on a technical approach to architectural solutions. The studios approach is flexible allowing students with plenty of room for exploration. Additionally, research by design and prototyping are commonly known methods used in this studio. This hands-on approach is very appealing to me.	

Graduation project	
Title of the graduation project	Empowering Students: A Timber Self-Build Housing Solution
Goal	
Location:	TU Delft campus, the Netherlands

<p>The posed problem,</p>	<p>The city of Delft is coping with a significant housing shortage that particularly affects students, a situation expected to worsen in the coming years. Delft currently faces a shortage of around 1,500 homes, projected to increase to 3,600 by 2028 (Hoger Onderwijs Persbureau, 2021). With TU Delft planning a 40% expansion, the student housing shortage will further grow. Despite the urgency, efforts to develop new housing have been slow, with no new student homes added to the campus since 2017. This leaves students dependent on slow third-party procedures for accommodation.</p> <p>Moreover, TU Delft's ambition to become a "living lab" aims to create a campus that facilitates work, study, and social interactions. However, this vision, centred around daytime activities, leads to an abandoned campus in the evenings and weekends. The plans do not address the critical housing shortage. The municipality emphasises that TU Delft must take responsibility for the impact of insufficient housing on its students and explore on-campus housing solutions. There is an urgent need to rethink the built environment, promoting architectural designs that align with both the immediate housing needs and the university's long-term vision for a vibrant, inclusive campus.</p> <p>But what if students could tackle their housing problem independently, on campus creating a more vibrant area?</p>
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research questions and	<p>Main research question: What is required from a timber building system to have students build their own housing?</p> <p>Sub Q1: What assessment methods can be used to quantify the ease of self-building?</p> <p>Sub Q2: How can criteria of existing methods be adjusted to be used for self-building?</p> <p>Sub Q3: What is required from an assessment method for Design for Self-building (DfSB)?</p> <p>Sub Q4: How useful is the assessment method for DfSB for creating guidelines?</p>
design assignment in which these result.	<p>Provide students with the opportunity to build their own adaptable housing on campus by means of self-building while simultaneously create more social interaction, initiating the transformation from a business district to an urban living environment. This opportunity consist of a timber building system that is designed using the guidelines that resulted from the thematic research.</p>
<p>The aim of the research is to explore the topic of self-building by designing an assessment tool to evaluate the ease of self-building. Validation through case study analysis provides the designer with guidelines to design a timber building system meant for self-building. Moreover the assessment tool can be used in the next phase to test the design during prototyping.</p>	
Process	
Method description	

The research for this architectural engineering project focusses on the topic of self-building, especially for the timber building systems. The goal is to create guidelines for the ease of self-building with the creation of an assessment tool for Design for Self-Building (DfSB). The primary research method is literature review, which examines different methods for designing for assembly (DfA), disassembly (DfD) and user-friendliness. In addition to the literature, case studies to investigate current timber building systems and are analysed on their ability and ease to self-build. This was done by creating simple wall structures using all three systems in 3D software and analysing the steps of assembly. Existing methods were merged and criteria were refined and added to further accommodate the context of self-building. In collaboration with architects and personal building experience the criteria were given hierarchy and value by implementing a Multi-Criteria-Decision-Making (MCDM) method using a Pairwise Comparison Chart (PCC). Then the assessment was used to evaluate three building systems. Two that are designed for self-building. And one that uses conventional timber construction, that is used as a control group to validate the method. Results of the research indicate correlation between criteria and provide insight in the key requirements for a timber building systems that is designed for self-building.

Additionally, the design research includes a context analysis, which includes in-person site visits and the investigation of future plans of the TU Delft Campus. Furthermore, literature studies have shown the positive influence of self-building in the social context. Self-building stimulates the sense of community engagement and empowerment, as individuals become actively involved in shaping their living environment.

The next phase of graduation, which will mostly be designing, will focus on the development of a timber building system that can be built by students, to create a multi-storey housing development. This will mainly be done by prototyping and using the assessment tool to guide decision making along the way.

Literature and general practical preference

Current assessment methods

- Berends, M. (2021) 'An evaluation method to assess user-friendly design for assembly and disassembly of modular infill systems'. Available at: <https://repository.tudelft.nl/islandora/object/uuid:7ac01108-8281-4634-a895-2f365c693784/datastream/OBJ4/download>
- Lieser, M. (2022) 'Measuring the ease of assembly for demountable partition wall systems'. Available at: [https:// repository.tudelft.nl/islandora/object/uuid:7ac01108-8281-4634-a895-2f365c693784/datastream/OBJ5/download](https://repository.tudelft.nl/islandora/object/uuid:7ac01108-8281-4634-a895-2f365c693784/datastream/OBJ5/download)

Assessment for Design for Self-Building (DfSB)

- Berends, M. (2021) 'An evaluation method to assess user-friendly design for assembly and disassembly of modular infill systems'. Available at: [https:// repository.tudelft.nl/islandora/object/uuid:7ac01108-8281-4634-a895-2f365c693784/datastream/OBJ4/download](https://repository.tudelft.nl/islandora/object/uuid:7ac01108-8281-4634-a895-2f365c693784/datastream/OBJ4/download)
- Lieser, M. (2022) 'Measuring the ease of assembly for demountable partition wall systems'. Available at: [https:// repository.tudelft.nl/islandora/object/uuid:7ac01108-8281-4634-a895-2f365c693784/datastream/OBJ5/download](https://repository.tudelft.nl/islandora/object/uuid:7ac01108-8281-4634-a895-2f365c693784/datastream/OBJ5/download)
- Architects M. van der Berg and C. Smink (Dondervink)
- Architect Y. Warmerdam

Context

- van Dorst, M.J.; Vink, Jacques; Groen, E.J.; van Delden, J.M.; de Haan, A.L.; Tijchon, L.A.J.; van den Boomen, V.J.M.; Zijlstra, R.S. (2023). Campusvisie 2040
- Qiqiwoudsma. (2024, 9 april). *Gebiedsvisie Campus Midden*. TU Delft Campus. <https://www.tudelftcampus.nl/nl/campus-development/gebiedsvisie-campus-midden/>

Next phase: Timber building system development

- Kaufmann, H., Krötsch, S., & Winter, S. (2018). *Manual of Multi-storey Timber Construction*. Detail.
- de Graaf, G. (2024) 'An evaluation method to assess design for self building of timber building systems'

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)?

My graduation topic of self-building housing by students, or non-professionals, works towards being able to tackle the quickly increasing housing demand that is currently a prominent problem in the Netherlands, and in this context Delft, while simultaneously creates more social interaction through participation. The design relates to the studio of Architectural Engineering due to the detailing and innovation that is required for a timber building system that is meant to be build by students, or non professionals. Introducing a new way of conceiving architecture and built environment.

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

The graduation project works towards creating an innovative, yet simple, timber building system that students, or non-professionals, can use to create housing. In the context of the TU delft campus, where space is scarce, the need for densification pushes for a multi-storey development. Current timber building systems that allow owner-user to construct their own housing are limited to either one or two stories. This project aims to bridge the gap between multi-story timber buildings and self-building. Self-building challenges the way of constructing buildings like we are used to. Building with minimal tools and knowledge encourages to design with simple components to create qualitative housing. Moreover, since individuals become actively involved in shaping their living environment, self-building can be used as a social driver for housing development, which can strengthen a sense of community.