

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	Niels Edward Teunissen
Student number	5068541

Studio		
Name / Theme	Architectural Engineering (aE)	
Main mentor	Stephan Verkuijlen	Architecture & Research
Second mentor	Mo Smit	Architecture & Research
Argumentation of choice of the studio	Working on the interface of technology and aesthetics, of form versus function, that is what inspires me. To use technology as a tool for current societal problems. The Architectural Engineering Graduation Studio provides the space to explore subjects linked to these themes. Additionally, the studio offers the freedom to explore one's own role in the architectural field, giving opportunity to the potential of personal interests and knowledge.	

Graduation project	
Title of the graduation project	Towards sustainable façade culture The development of a modular façade system for plug-and-play installment using eco-friendly materials
Goal	
Location:	Beatrixgebouw, Jaarbeursplein Utrecht
The posed problem,	Current façade construction culture in the Netherlands can be considered as damaging to the environment. The problem is threefold: 1. Intensive use of materials and energy 2. Emission of damaging and toxic chemicals 3. Lack of proper design for longevity
research questions and	Main research question: How can a modular façade system be developed with sustainable architectural tectonics theory, designed for Dutch housing, office space and retail? Part 1: What are the requirements for: 1. the facade's structure and how can it be standardized for the circular economy? 2. the facade's materials and how can it consist of as much renewable materials as possible? 3. the facade's building physics and how can it be customized for wellbeing?

	Part 2: How can the insights of 1-3 be combined in a design for an integral facade system?
design assignment in which these result.	To deploy the designed façade system in a building, where it can meet the building's and location specific requirements.
Out of the problem statement, three solution paradigms arise, which are to the problem statement respectively: 1. Circular economy principles (structure) 2. Renewable materials (materials) 3. Climate design for wellbeing (use/experience) Architectural tectonics offers a frame to structure the research accordingly (structure, materials, use/experience).	
Process	
Method description	
Part 1 comprises the theoretical foundation by literature research and use of database analysis. Part 2 employs research by design (sketching, CAD, prototyping) as a method to develop a façade system based on the theoretical foundation.	

Literature and general practical preference
MAIN LITERATURE For part 1, Literature includes the following: - Material database analysis: Ansys, Inc. (2023). [Dataset; Digitale dataset]. Ansys Edupack. - Digital information on product or material specific properties - Theoretical literature on modularity, open building and joinery: Brand, S. (1997). How buildings Learn: What happens after they're built. http://ci.nii.ac.jp/ncid/BA23638003 Engel, H. (1985). <i>Measure and construction of the Japanese house</i>. http://ci.nii.ac.jp/ncid/BA01114381 - Theoretical literature on façade climate physics: Kuijpers-Van Gaalen, I. M., Van Der Linden, A. C., & Zeegers, A. (2018). Bouwfysica (8e druk) [Paperback]. Thiememeulenhoff. Hofkes, K., Rentier, Ch., Reijmers, J., & Salden, M. W. R. (Reds.). (2011). <i>Hogere bouwkunde Jellema. 4, Bouwtechniek: omhulling B, Gevels</i> (3e druk) [Paperback]. Thiememeulenhoff. For part 2: - Sketching - CAD (computer aided design) - Prototyping
Reflection
1. Relation between: Graduation project topic – master track Architecture The façade is one of the most visual and aesthetic aspects of a building. In designing the façade system, the eventual focus is on both technology and aesthetics. The outcome is on the interplay between both, and in this regard the architecture produced creates a design language as a result of the technology. Graduation project - master programme AUBS Additionally, the graduation work touches upon topics of urban design and building sciences in respect to their relation with façade design. Through different scales, it delves into the interplay of façade and building technology, public/urban space and landscape design.

2. Social relevance: goal is to apply the developed façade system to new construction, as well as renovation projects aimed at housing, office space and commercial space. In doing so, the work aims to contribute to resolve the Dutch housing crisis by urban densification and renovation. Moreover, modularity and open building principles allow changes in building program relatively easily, responding to specific program demand changes.

Professional relevance: the graduation project comprises work based on the latest trends and insights in the construction industry. With renovation as part of the research scope, the results can be applied to existing building stock, which currently can be considered as the larger construction challenge of the Netherlands. The use of biobased materials is in line with the material transition in the professional field, which has to ramp up to 30% in 2030 (NABB).

Scientific relevance: the graduation work explores the potential of upscaling and industrializing the use of straw-panels as the core modular system. It attempts to construct a framework on which industrial processes and biobased materials can be integrated, closing in the research gap between them.