

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

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

Personal information	
Name	David Noel Maxime Grünewald
Student number	5397685

Studio		
Name / Theme	Architectural Engineering / 1 Million Homes	
1 st mentor	Mauro Parravicini	Design
2 nd mentor	Ger Warries	Building Technology
3 rd mentor	Pieter Stoutjesdijk	Thematic Research
Argumentation of choice of the studio	<p>I am convinced that digital design and manufacturing, and the implementation of the circular economy in the construction industry, can contribute to solving climate change and the lack of affordable housing. The Architectural Engineering Graduation Studio allows me to expand my knowledge of the latest developments in these fields, and to develop an approach that helps tackling the challenges that we are facing. For me, the studio presents a unique opportunity to learn from experts who are pioneers in the new field of circular building. Moreover, I want to use my graduation project to solidify my position in this transitioning industry, whilst being independent from real world constraints such as hierarchy, cost coverage, and common practice. This is important to me since architects in my generation will take a central role in shaping a more sustainable future.</p>	

Graduation project	
Title of the graduation project	Affordable and Sustainable Homes for the Middle-Income Group in Arnhem
Goal	
Location:	Merwedeterrein: Arnhem, NL
The posed problem,	The Dutch construction industry is currently facing several challenges at the same time. On the one hand, there is a growing demand for more sustainable solutions to minimize the immense waste production and greenhouse gas emissions, and on the other hand, the ongoing housing crisis creates a massive need for new homes. Citizens who are mainly affected by the crisis belong to a middle-income group who cannot find subsidized housing and cannot afford the expensive rents in Dutch cities. For these people, there is a need for affordable, yet high quality homes that are sustainable and create a sense of community.
Research Question (Design)	How can affordability and sustainability be combined within a mixed-use residential building at Merwedeterrein, Arnhem?
design assignment in which these result.	Designing an affordable and sustainable mixed-use residential building at Merwedeterrein, Arnhem that provides high quality homes and fosters social cohesion.
Process	
Method description	

The objective of my graduation project, is to develop a sustainable mixed-use housing concept for the Merwedeterrein Arnhem, whose rents are affordable for middle-income earners. The design framework consists of open systems whose components can be disassembled without wear.

A robust structure and climatic envelope withstand the forces of nature and are use-open enough to host adaptive infill and installation systems. This framework will contribute to an extended lifespan, cost-efficient repairs, and the accessibility of the residual value of materials at the end-of-life of the building.

Within the economic model of cooperative private commissioning, adaptive and durable infill components such as partition walls and intermediate ceilings can be leased from the producer through the users. In this way, waste can be reduced and both parties benefit financially from the use of high quality components in the long term. This topic is explored further in the thematic research by mapping out design strategies for value retaining infill components. To meet circularity goals, a database of all building elements is used, which can be accessed via QR-codes during construction and dismantling. For each element, a post-use scenario is worked out with the help of the circular R-strategies.

In the specific case of Arnhem, around 5% of the population is currently over 75 years old. This percentage is estimated to increase to 8% by 2026 and to 14% by 2050. Therefore, special emphasis must be placed on the inclusiveness of older people. In addition to an increased attention to accessibility and soundproofing, areas such as a vegetable garden, an open workshop or Hamam must be created, where communication with other residents can take place, thus strengthening the entire house community.

Some of these functions could even support the project financially. Either directly through revenue from business, or by communalizing spaces like kitchens or dining rooms, with spacious, light filled communal areas that can host these functions instead of the private apartment.

To create a healthy building, the focus is on bright, spacious rooms that invite residents to adapt them to their own needs. A pleasant indoor climate must be created by using high-quality materials and avoiding the use of adhesives. The air quality should be excellent, thanks to lots of greenery and a passive climate Concept.

Literature and general practical preference

Thematic Research Paper:

My Thematic Research Paper explores considerations about residual value and value retentive design, that come with commercializing interior partition walls "as a Service". Due to poor construction techniques and short lifespans, interior partition walls are a major contributor to waste production. Commercialized within certain Product as a Service (PaaS) models, most of this waste could be eliminated, the product quality increased, and users, as well as companies, would benefit from it

financially. Therefore, the residual value must be optimized. Within a cross industry research, Residual Value Forecasting (RVF) methods are analyzed, and decisive parameters are extracted. Based on these parameters, a Multi-Criteria Decision Analysis (MCDA) is performed on case studies, leading to a catalog of design strategies for value retentive circular interior partition walls.

Integration:

I want to integrate my findings from the Thematic Research Paper in the design of value retentive interior partition walls, that are marketed through PaaS. Hereby, costs can be reduced for residents, whereas flexibility is increased.

In general, I am interested in the topics Modularity, Remountability, Design for Disassembly (DfD), Change (DfC), or Reuse (DfR). Furthermore, I have been researching the concepts of Open Building, and Shearing Layers of Change.

Apart from the technical aspects, I want to integrate ideas such as the concept of the 15-Minute-City, and create a new urban hub that connects the outrigger neighborhoods of Arnhem to the city center.

Literature selection:

Rau, T; Oberhuber, S. (2016). *Material Matters: Wie wir es schaffen, die Ressourcenverschwendung zu beenden, die Wirtschaft zu motivieren, bessere Produkte zu erzeugen und wie Verbraucher und die Umwelt davon profitieren.* Econ. Düsseldorf, Berlin, DE

Dömer, K., Drexler, H., Schulz, J. (2014), *Affordable living. Housing for everyone.* JOVIS Verlag. Berlin, DE.

Habraken, N.J. (1985) *De Draggers en de Mensen: Het Einde van de Massawoningbouw.* Stichting Architecten Research.

Lorenzen, C. (2019), *Wohnbauten entwerfen. Ein Handbuch zur Lehre. (Designing Residential Buildings. A handbook for teaching.)*. JOVIS Verlag. Berlin, DE.

Gehl, J. (2010). *Cities for People.* Island Press. London, UK.

Jacobs, J. (1961). *The Death and Life of Great American Cities.* Random House. New York, USA.

Van Vliet, M.; Van Grinsven, J.; Teunizen, J. (2019). *Circular Buildings; Meetmethodiek Losmaakbaarheid.* Alba Concepts. 's-Hertogenbosch, NL.

Guy, B.; Ciarimboli, N. (2005). DFD – Design for Disassembly in the Built Environment: A guide to closed-loop design and building. Pennsylvania State University. Seattle, USA

Openbuilding.co (2021) *Manifesto Openbuilding.co*. Retrieved from: <https://www.openbuilding.co/manifesto>

Reflection

Affordability is the most crucial factor when it comes to making housing accessible for everyone. Sustainability in construction, however, is indispensable for reducing CO² emissions and waste. My graduation project is an attempt to connect these two in a housing scheme, that could possibly become an inspiration for other architects. In this way, I am connecting to the 1 million homes initiative, which is searching for ideas to tackle the housing crisis.

Another goal is to foster social cohesion through architectural solutions such as community spaces, sports facilities, e.g. The community does not have to stop at the gates of the building. With its advantageous position in the city, the building can form a connective hub between the peripheral residential areas and the city center of Arnhem.

The concept of Product as a Service subscription models for building components is a relatively new one. With my Thematic Research Paper, I am evaluating design strategies for interior partition walls, that can facilitate their implementation of them in a PaaS model.

The design of the graduation project can serve as an inspiration for architects regarding how to integrate sustainability with affordability.

Time Planning

After P2 (Meso level)

- > Formulating the design ideas from P2 into a concrete building design.
- > Using physical, 3d, parametric modelling
- > Integrating the different systems in building technology (Skin, Structure, Space Plan)

After P3 (Micro level)

- > Creating the final building design.
- > Detailing the building further.
- > Detailing the flexible interior wall system.
- > Building a 1:1 prototype.

After P4 (Micro level)

- > Graphic enhancements of the project.
- > Finalizing the design and drawings.