

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Personal information	
Name	Thijs Ronald von Barnau Sythoff
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Studio		
Name / Theme	Graduation Studio: Adapting 20 th Century Heritage / Resourceful Housing	
Main mentor (<i>Design</i>)	Uta Pottgiesser	Heritage & Technology
Second mentor (<i>Building Technology</i>)	Paddy Tomesen	Architectural Engineering & Technology
Third mentor (<i>Research</i>)	Telesilla Bristogianni	Structural Design & Building Engineering
Argumentation of choice of the studio	The combination of dwelling and a focus on resource consciousness / circularity.	

Graduation project	
Title of the graduation project	Renovation with reused materials as feasible alternative to reconstruction.
Goal	
Location:	Nolensstraat 6-154, Geuzenveld-Slotermeer, Amsterdam (Amsterdam Nieuw West)
The posed problem,	Global warming and resource scarcity. The building industry is accountable for 40% of global greenhouse gas emissions. 15% of global greenhouse gas emissions are due to the production of building material. The current postwar housing stock is in need of renewal. Current stock is facing large scale demolition and reconstruction to meet modern energy efficiency standards. The environmental cost of new construction is almost never taken in consideration. Renovation of the current stock would be a fitting solution to achieve modern energy efficiency standards while keeping environmental construction costs relatively low. Still, renovation requires a lot of added building material. The application of reused materials could offer a solution to further minimize the environmental costs of construction. The combination of both strategies: renovation and reusing building materials, involve more complexity than conventional reconstruction which can harm its chances for successful implementation.
research questions and	<p>"How can renovation with reused materials become a feasible alternative to reconstruction of the current housing stock?"</p> <p>What are the interests of the stakeholders in a renewal task of existing housing?</p>

	<p>What are the barriers to choosing renovation in a renewal task of existing housing?</p> <p>What is the relative ecological impact of renovation versus newly built construction?</p> <p>What is the relative ecological impact applying reused materials in a renovation project?</p> <p>What are the technical challenges for applying reused materials in a renovation project?</p> <p>What are the logistical challenges for applying reused material in a renovation project?</p>
design assignment in which these result.	<p>In 1953, Willem van Tijen, designed an ensemble of building blocks as part of the General Extension Plan by Cornelis van Eesteren. The three last remaining porch flat buildings, known as the 'Van Tijenflats' were demolished in 2022. The reconstruction is planned to be finished in 2024. The case is exemplary for the current course of events in renewal tasks. The (unofficial) monumental buildings are demolished and replaced with new construction without consideration towards environmental construction costs and architectural heritage.</p> <p>An alternative plan of interventions will be designed for the 'Van Tijenflats'. These interventions will be centered around a radical preservation of building structure and minimal use of new building material while improving energy efficiency, general quality of living space and integration on a neighborhood scale. The values incorporated in Willem van Tijen's vision on "city living" will be translated to meet modern time needs.</p>

Process

Method description

To gain insight on environmental consideration between renovation and reconstruction, a literature review has been conducted. To gain insight on environmental consideration between conventional renovation that uses new building material and a circular renovation alternative that uses as much reused materials as possible, a case study has been conducted. A renovation design by Superuse Studios for a 1930 dwelling complex in the Hague has been compared with a circular alternative that was designed for the purpose of this research. The design process forms an integral part of the research. The environmental burden triggered by the production of building materials needed to realize both proposals was then calculated and compared on total building level, per building element and per material type. Interviews were conducted in addition to the literature review and the quantitative

data comparison to put the findings in perspective and to gain qualitative insight on practical challenges and barriers in the building industry in regards to sustainability and material reuse.

The findings of this research have resulted in a set of recommendations for designers and other stakeholders involved in a renewal task. These recommendations will be used as guidelines for the design assignment concerning the 'Van Tijenflats' that was described earlier. The design assignment will function as a case study where these recommendations can be tested.

Literature and general practical references

Literature:

Alba-Rodríguez, M. D., Martínez-Rocamora, A., González-Vallejo, P., Ferreira-Sánchez, A., & Marrero, M. (2017). Building rehabilitation versus demolition and new construction: Economic and Environmental assessment. Environmental Impact Assessment Review, 66, 115–126.

De Larriva, R. A., Rodríguez, G. C., López, J. M. C., Raugei, M., & Fullana-i-Palmer, P. (2014). A Decision-making LCA for energy Refurbishment of buildings: Conditions of comfort. Energy and Buildings, 70, 333–342.

Decorte, Y., Van Den Bossche, N., & Steeman, M. (2022). Guidelines for defining the reference study period and system boundaries in Comparative LCA of Building Renovation and Reconstruction. The International Journal of Life Cycle Assessment, 28(2), 111–130.

Fahlstedt, O., Salaj, A. T., Lohne, J., & Bohne, R. A. (2022). Holistic Assessment of Carbon Abatement Strategies in Building Refurbishment Literature — A scoping review. Renewable & Sustainable Energy Reviews, 167, 112636.

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Hasik, V., Escott, E., Bates, R., Carlisle, S., Faircloth, B., & Bilec, M. M. (2019). Comparative whole-building life cycle assessment of renovation and new construction. Building and Environment, 161, 106218.

Icibaci, L. (2019). Re-use of Building Products in the Netherlands [PhD]. Delft University of Technology.

Jongert, J., Bergsma, J., Humbert, M., & Superuse Studios. (2023). Renovatieplan Complex 70 Weigeliaplein Den Haag.

Kapur, A., & Graedel, T. E. (2004). *Industrial ecology. Encyclopedia of Energy*, 3, 373-382.

UNEP - UN Environment Programme. (2022) *2022 Global Status Report for Buildings and Construction*. retrieved from: <https://www.unep.org/resources/publication/2022-global-status-report-buildings-and-construction>

Marique, A., & Rossi, B. (2018). *Cradle-to-grave life-cycle assessment within the built environment: comparison between the refurbishment and the complete reconstruction of an office building in Belgium. Journal of Environmental Management*, 224, 396–405.

Troyan, V. D., Gots, V., Flatt, R. J., & Angst, U. (2024). *Rehabilitating instead of rebuilding aged or damaged pre-fabricated concrete buildings for reducing CO2 emissions: the case of Ukraine. Materials and Structures*, 57(1).

Van Der Meulen, V. (2022). *Bouwen met een positieve footprint*.

Van Stijn, A. (2023). *TU Delft. Developing circular building components. Between ideal and feasible*.

General practical references:

Affinity with avoiding the global ecological disaster was mainly obtained through an earlier internship at Superuse Studios. An interest in the opportunities and challenges concerning the reuse of materials originated here and was further developed throughout my studies. The collaboration with Superuse Studies, and with Jan Jongert especially, concerning the graduation research, is a large contributor to the practical knowledge used.

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 focusses on exploring a radically sustainable alternative to conventional building practices. Its main relation to the studio topic 'resourceful housing' is its high consciousness on resource use and the fact that it concerns dwelling typologies. The master track 'Architecture' focusses on "dealing with the technical, social and spatial challenges encountered in the built environment". (*Track: Architecture. 2024. TU Delft*) The global ecological issue that my graduation project addresses will have great influence on technical, social and spatial aspects of our surroundings. The proposed solutions, and their challenges, operate in these areas also. The master 'Architecture, Urbanism and Building Sciences' blends knowledge and skills from design practice, the physical and social sciences and technology and engineering. The programme explores innovative ways to create more sustainable development. (*MSc Architecture, Urbanism and Building Sciences, 2024, TU Delft*). My graduation topic focusses on sustainable alternatives for

conventional development strategies.

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

My graduation work operates in a very relevant field. Resource use and the environmental burden of the linear systems that dictate our everyday life are a relevant topic in both the architectural profession as in a larger scientific framework. Strategies concerning circularity within the built environment are in full development. Exploring the impact and feasibility of combining material reuse with the preservation of buildings is new to this study. It fills a relevant gap in the knowledge on available strategies for sustainable renewal.

