

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	Ruowen Gao
Student number	5055067

Studio		
Name / Theme	Architectural Engineering: Second Life	
Main mentor	Anne Snijders	material flow, energy resource
Second mentor	Olga Ioannou	circular economy
Argumentation of choice of the studio	<p>The studio 'Second Life' especially focusses on the 'not so desirable buildings' of the existing stock. Apart from their non-present architectural quality, most of them also cannot meet the current energy standard. Leaving the buildings vacant is a waste in form of material waste and energy consumption. The adaptive reuse of these building stock is a complex issue. It brings together many aspects: the history of the building, the place in the city, architecture, the life cycle of buildings, management for planning, investing and organizing, and so on. An adaptive re-design of these buildings is a challenging subject that requires creativity, inventiveness and visionary thinking from a broad spectrum. Overall, the studio second life subject requires challenging, exciting, multidisciplinary yet practical design approach that matches my personal interest well.</p>	

Graduation project	
Title of the graduation project	Office Building Transformed into Collective Self-organized Housing: How does Circular Business Model Affect Design Decisions on the Adaptive Reuse of T4 Tax Office, Leeuwarden.
Goal	
Location:	Leeuwarden, the Nederland.

The posed problem	Energy inefficiency and costly refurbishment have caused an excessive stock of vacant office buildings in the Nederland (Remøy et al., 2011). These vacant buildings seek new business opportunities, as the convention of demolition and new construction contradict the principles of Circular Economy (CE) (Ascott, 2021). Meanwhile, the lack of affordable housing urges Nederland's housing market to inquire about new possibilities (Housful Project, 2020). New models are required to increase circularity levels in combination with affordability, durability, safety, health and comfort (3XN architects, 2016). Repurposing vacant office buildings into collective self-organized (CSO) housing (Di Giulio et al., 2013) projects using circular design strategies might offer opportunities to mitigate both problems (Geraedts et al., 2016). However, only limited refurbishment projects or CSO housing construction explicitly examined and applied circular principles; it remains a niche market (Eikelenboom et al., 2021). One of the most crucial reasons is that linear business models are outdated and can no longer support the changing needs of the Circular Built Environment (CBE) (Dokter et al., 2021).
research questions and	Therefore, new feasible and compatible business models are needed to support the transition to the CBE. The research aims to find a feasible circular business model to help achieve circularity in a transformed CSO housing project.
design assignment in which these result	How does business model affect management decisions, and how do management decisions further affect architecture, engineering and construction (AEC) decisions? The circular design is the embodiment of its circular business model. The design question is to transform vacant office building into CSO housing guided by a long-term feasible circular business model.
Process	
Method description	
<p>Research about design (P1):</p> <ol style="list-style-type: none"> 1. Literature study <p>read relevant academic literature and scientific articles, providing an overview of existing acknowledge regarding: the risks and potential of building transformed into housing, retrofit principles and strategies of office building into housing.</p> 2. Case study on building adaptive reuse <ol style="list-style-type: none"> a. Kleiburg Klusflat, Amsterdam. (low-budget housing conversion, DIY housing) b. Westplantsoen, Delft. (same floor layout, adaptability of the structure) 	

- c. Eendrachtsskade, Groningen. (same pre-fab concrete slab floor)

Research for design (P2):

3. Literature review

read relevant academic literature and scientific articles, providing an overview of existing knowledge regarding: circular built environment, circular design principles, collective self-organized housing models, building code such as fire safety/façade insulation/noise level/air pollution level, building code, rules and regulations hinder reusing building materials.

1. Case study on circular building material and components

- a. The Temporary Court House, Amsterdam. (life-cycles, change functionality)
- b. The Circl Pavilion, Amsterdam. (material bank, dfd)
- c. Substrate Factory Ayase, Tokyo. (high adaptability and flexibility)

2. Case study on CSO housing

- a. Vrijburcht, Amsterdam.
- b. L'espoir, Brussels.
- c. Altes Schule Karlshorst, Berlin.
- d. Ostello Linda, Milan.
- e. [Ro*Sa]22, Vienna.
- f. Refugio, Berlin.
- g. Warmbachli, Bern.
- h. Vinzirast-Mittendrin, Vienna.
- i. Mail de Fontenay Building, Paris.

3. Site visit

To assess building's status-quo (structural stability, noise level, airtightness, service system, necessary material accounting).

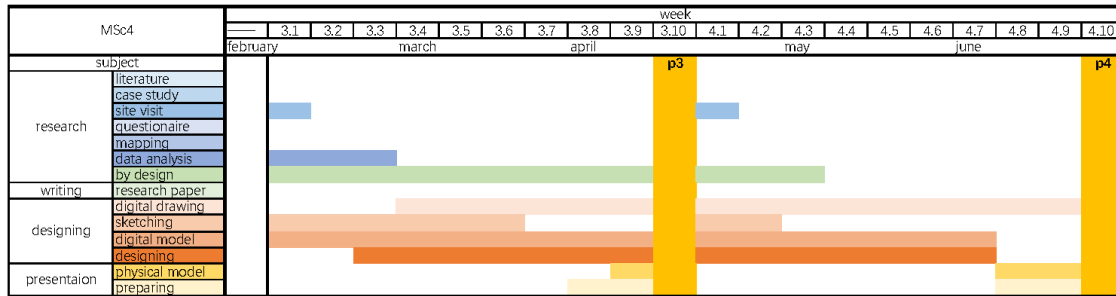
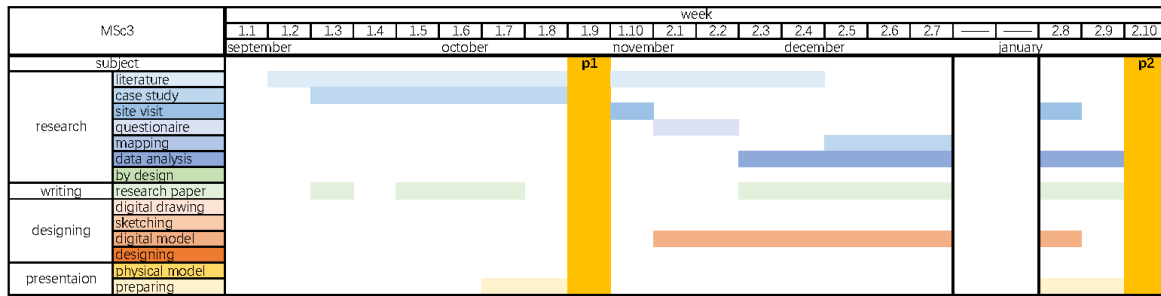
4. Material inventory+ data analysis

Translating the original drawing of the building via BIM into a 3D model, which will help to create an inventory of the existing building components and also after the transformation, makes the accounting for material feasible and controllable. After accounting existing materials, the amount of new material can be estimated.

Research by design (P3&P4):

1. Digital model
2. Physical model
3. Digital drawing
4. Sketch

Planning



Literature and general practical preference

1. Remøy, H., de Jong, P., & Schenk, W. (2011). *Adaptable office buildings*. Property Management, 29(5), 443–453.
2. Ascott, E. (2021). *Turning Empty Offices into Apartments: Are We Finally Leaving the Wasteful Linear Economy Behind?* Allwork.Space.
3. HOUSEFUL Project. (2020). *Circularity at the core of public, cooperative & social housing-indicators & methodologies* | Housing Europe.
4. 3XN architects. (2016). *Building a Circular Future*. 3rd ed. GXN Innovation.
5. Di Giulio, R., Bennicelli Pasqualis, M., Bektas, E., & Brouwer, J. (2013). *CSO Glossary*. PROFICIENT.
6. Geraedts, R. P., Remøy, H., & de Kat, N. (2016). *Success Factors & Bottlenecks in the Transformation of Vacant Office Buildings into Student Housing: A tool to support the decision process in the initiative*. Green Lines Institute for Sustainable Development.
7. Eikelenboom, M., Long, T. B., & de Jong, G. (2021). *Circular strategies for social housing associations: Lessons from a Dutch case*. Journal of Cleaner Production, 292, 126024.
8. Dokter, G., Thuvander, L., & Rahe, U. (2021). *How circular is current design practice? Investigating perspectives across industrial design and architecture in the transition towards a circular economy*. Sustainable Production and Consumption, 26, 692–708.

Reflection

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)?

The graduation topic 'second life' focused on adaptively reuse vacant office building. Apart from the aesthetic aspect, the nature of redesigning an existing building means it will eventually lead to a solution that requires high level of architectural engineering skills. Additionally, my personal thematic research focusses on management issue, which will coordinate the design from top-down. Coordination from top-down while

providing bottom-up answer, this kind of integral approach is what I think distinguished architects from other tracks.

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

Building industry need to act on the Sustainable Development Goals (SDGs) call to reach the goal by 2030. Built environment need to transform into a resource-effective one to address these challenges. With a big building portfolio offered by studio 'second life' and a nearing deadline of 2023, with the problem of material scarcity and the depletion of scarce sources, the problems are piling up. The research is a supplement for the research field that needs more attention from the designers: conversion from non-residential to residential buildings. The result of this research is case-specific yet widely applicable, since the construction materials used in buildings in the Nederland are similar during a certain time period (1960-1990). Moreover, it shows a way of how can architect contribute to a more circular world and architects should start to realize their radically changing roles and responsibilities.