

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	Wouter van Oekel
Student number	4594738

Studio	
Name / Theme	Architectural Engineering
Main mentor	Thomas Offermans
Second mentor	Jos de Krieger
Argumentation of choice of the studio	The main reason is that I wanted to be free in forming my own theme to research and design in.

Graduation project	
Title of the graduation project	Designing with reclaimed concrete from an end-of-life building
Goal	
Location:	Anna van Hannoverstraat 4, Den Haag
The posed problem	<p>The construction industry's environmental impact has become a pressing global concern due to its substantial contribution to CO2 emissions, resource depletion, energy consumption, and waste generation. The Netherlands highlight the urgency to achieve 50% circularity by 2030 and 100% by 2050 (Arnoldussen et al, 2020). Despite these efforts, the construction sector's environmental impact remains alarming, accounting for up to 12% of global CO2 emissions in 2020. (Buildings and Construction, n.d.)</p> <p>The need for circular solutions, particularly in material recirculation and reuse, becomes clear, providing a way to address and minimize environmental impacts. Reusing materials emerges as a promising avenue to minimize construction and demolition waste, replace primary materials, and decrease the carbon footprint of the industry. This provides not just environmental advantages, but also substantial economic potential given the large volume of construction and demolition waste being saved. (Bertin et al., 2022)</p> <p>Concrete, a widely used construction material globally, presents a significant challenge during demolition, often leading to serious amounts of waste. Notably, non-residential buildings that are</p>

	reaching their end-of-life, such as the former Ministry of Social Affairs and Employment, often contain a vast amount of concrete in their structures. To address this challenge, a sustainable approach involves exploring techniques for reusing load-bearing concrete elements, paving the way for a more environmentally conscious construction industry. (Knutsson, 2023)
research question and design question	<p>How can reclaimed concrete from end-of-life buildings be effectively integrated into new building projects and create future ease of disassembly and reassembly?</p> <p>How can the reclaimed concrete elements from the former Ministry of Social Affairs and Employment be implemented in the new building project for the Anna van Hannoverstraat 4?</p>
design assignment in which these result	<p>The former Ministry of Social Affairs and Employment has undergone a complex journey from its abandonment in 2015 to its imminent demolition, despite its notable adaptability owing to its construction and layout.</p> <p>Since the building is planned for demolition while its concrete structure still functions in a technical way, it is essential to evaluate the potential for repurposing the functional concrete elements. To assess the environmental consequences, a thorough understanding of the deconstruction processes is necessary.</p> <p>The former Ministry of Social Affairs and Employment represents a significant example of innovative construction and architectural design. Its use of prefabricated concrete elements and thoughtful spatial organization make it an ideal subject for research on deconstructing and reusing concrete elements in future construction projects.</p>

Process

Method description

Within this research, I have identified the types of buildings suitable for deconstructing their structures for reuse. Additionally, I have investigated suitable methods for this purpose and examined how these reclaimed elements can be made easier to disassemble for future deconstruction projects. This investigation is primarily based on literature from both scientific and non-scientific sources. Various case studies with similar issues to this research were also analyzed.

This theoretical framework established in the initial chapters was tested in practice through a selected case study. I analyzed the concrete structure of the former Ministry of Social Affairs and Employment using archival material and 3D models. Ultimately, I outlined a process demonstrating how this building can be dismantled to extract the prefabricated concrete elements for reuse for new structural building projects.

Now, I can apply the insights gained from this research to inform the design challenge at hand. The design process will now be a continuous balance between technique, functionality, fit and aesthetics. Continuous literature analysis will serve as ongoing validation and support for the integrated passive methods. Climate analyses of the site will guide design choices, facilitated by the utilization of 3D models. Physical model investigations will contribute insights into incorporating additional elements into the architectural aesthetic. Additionally, digital CAD software will be utilized for 3D modeling studies. Historical inquiries will provide insights into its redevelopment of the site, offering valuable context for the project. Research by Design will be the main employed to drive the project forward.

Literature and general practical preference

A selection of some (important) sources for my research:

Anna van Hannoverstraat 4: Toelichting. (n.d.).

https://www.ruimtelijkeplannen.nl/documents/NL.IMRO.0518.BP0366GAnnaHan-400N/t_NL.IMRO.0518.BP0366GAnnaHan-400N.html

Arnoldussen, J., Endhoven, T., Kok, J., Groot, P., Blok, M., & Kamps, M. (2020). *Materiaalstromen in de bouw en infra. Instituut Voor De Bouw | Metabolic | SGS Search.*

Beukers, J. M. (2022). *REUSE OF CONCRETE STRUCTURAL ELEMENTS IN PRACTICE* [Master Thesis]. Delft University of Technology.

Circulair delven van kantoorgebouw Prinsenhof. (n.d.). <https://www.gelderland.nl/themas/duurzaamheid/circulaire-economie/prinsenhof>

Ministerie van Sociale Zaken en Werkgelegenheid. (n.d.). Een nieuw gebouw voor Sociale Zaken en Werkgelegenheid : van plan tot werkelijkheid. *Bundeling Van Krantenartikelen Mbt Het Ministerie Van Sociale Zaken En Werkgelegenheid.*

Rios, F. C., Chong, W. K., & Grau, D. (2015). Design for Disassembly and Deconstruction - Challenges and Opportunities. *Procedia Engineering*, 118, 1296–1304. <https://doi.org/10.1016/j.proeng.2015.08.485>

Salama, W. (2017, March 31). *Design of concrete buildings for disassembly: An explorative review.* ResearchGate.

Van Den Brink, G. J. (2020, December 15). *Designing with recovered precast concrete elements.* Eindhoven University of Technology Research Portal. <https://research.tue.nl/en/studentTheses/designing-with-recovered-precast-concrete-elements>

www.architectuur.org. (n.d.). *Ministerie van Sociale Zaken en Werkgelegenheid, Den Haag, H. Hertzberger | Architectuurgids.* Architectuur.ORG.

https://www.architectuur.org/bouwwerk/255/Ministerie_van_Sociale_Zaken_en_Werkgelegenheid.html

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 studio Architectural Engineering encompasses a broad concept that involves the technical application of various strategies, for example handling reclaimed building materials. The master program and architecture-focused master track focus more on the design principles behind a building and its construction. These aspects play a crucial role in both the research and the design phase of this graduation project.

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

This research focuses on the construction industry's contribution to waste generation and CO2 emissions. Given the urgency of climate change and the need to reduce environmental impacts, it addresses a critical concern. It also aligns with the principles of the circular economy, a concept gaining importance in sustainability discussions. The circular economy of the construction industry emphasizes resource efficiency and reducing waste, making it relevant in the context of sustainability and circularity. This industry is a major contributor to environmental issues, thus making this research relevant not only for academics but also for different stakeholders active in the industry and policymakers seeking for sustainable solutions.

