

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 P4 at the latest.

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

Personal information	
Name	Hein van der Helm
Student number	4875060

Studio		
Name / Theme	AR3AE100 Architectural Engineering	
Main mentor	Yannick Warmerdam	Architecture and the Built Environment, Architectural Engineering and Technology
Second mentor	Jos de Krieger	Research tutor, Architecture
Building Technology mentor	Paddy Tomesen	Architecture and the Built Environment, Architectural Engineering and Technology
Argumentation of choice of the studio	In my opinion, Architectural Engineering makes the connection between technology and architecture, which are ultimately interwoven in this field. Exploring the relationship between technology and innovation on the hand, and bringing that into practice in architecture on the other hand, is the challenge I would like to take on in the studio Architectural Engineering. This studio enables a hands-on approach in a field of experts, where architecture and innovative solutions closely align with practice. Therefore I am motivated to have a hands-on approach in this studio and connect with the current expertise.	

Graduation project	
Title of the graduation project	Circular design: Different process for optimal reuse in architecture
Goal	
Location:	<p>This research and design continues on the thoughts and conclusions that for both materials and space, it is essential to start with what already exists.</p> <p>A research into existing residual spaces and transformation projects within the 'Oude Westen' in Rotterdam is worked</p>

	<p>out in a categorization and map of existing urban spaces that have potential for transformation, based on earlier research by Tillie et al (2018).</p> <p>The finally selected location has a building that offers potential for the design location of this graduation project, which is located in the neighbourhood 'Het Oude Westen'. The current function is an Asian Supermarket, but it used to be a theatre.</p> <ul style="list-style-type: none"> - West-Kruiskade 26, 3014 PN Rotterdam  <p><i>Figure 1 Design project location (by author, 2025)</i></p>
<p>The posed problem</p>	<p>In the traditional linear economy where materials are extracted, utilized and disposed the industry contributes to environmental concerns. According to research 40% of all materials are used in the construction industry, where at the same time the industry is responsible for 40% of all waste. Moreover, the emissions for the construction of buildings are largely influenced by how we build and design (Malabi Eberhardt et al, 2020).</p> <p>Despite efforts to reuse and recycle materials there is a lack of reusing and designing with used building products (Gorgolewski, 2018). Pioneering architects prove that reuse can contribute to a circular building industry. However, the reuse of building materials</p>

	<p>remains a specialized practice, with challenges such as uncertainties about materials and a different design process, which is unfamiliar and unique per project (Kozminska, 2019).</p> <p>So there is a need to rethink the design process to prioritize the reuse of existing building components and materials, thereby reducing CO₂ emissions and waste in the building industry.</p> <p>These problems highlight the urgency for architects and the construction industry to adopt circular design principles and integrate material reuse strategies into the design phase.</p>
research questions and	<p>Design question:</p> <p>How can architectural reuse principles guide the transformation of an existing building (Amazing Oriental Supermarket) in Rotterdam into a collaborative centra for learning, testing and showcasing innovative applications of reused materials?</p> <p>Research question:</p> <p>What design principles can be developed to enable architects to effectively integrate reuse on different scale levels during the design phase?</p> <p>Sub questions:</p> <ul style="list-style-type: none"> • How can reused materials be defined in the building industry? • What are main factors that influence the potential for reuse? • What are challenges for architects to select reused building components and materials for a design project? • How can we design with reused materials that have irregularities and imperfections due to a previous use?
design assignment in which these result.	<p>The design objective is to provide a space were:</p>

	<p>[1] Stakeholders in the building sector can be encouraged to learn more about circular building methods on reuse;</p> <p>[2] professionals and architects can test materials (building products) from construction waste to innovate and to assess the reuse potential;</p> <p>[3] materials and reuse strategies are showcased to the public.</p> <p>The simplified program will contain of: offices, small material hub, material library, meeting spaces, testing space, and a space for exhibitions.</p> <p>All these activities foster the reuse of materials becoming the new norm for architects and the public. Therefore, the location enhances the visibility and approachability of reuse in architecture for the public.</p> <p>The design principles from the research will be implemented in the process and the design itself.</p>
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Process

Method description

Thematic research methodology:

The research will be conducted by studying academic and non-academic literature and performing interviews with architects, see references. Qualitative data on defining definitions and current factors are investigated by literature research. Qualitative data on design principles and different methods in reuse are investigated by interviews and literature studies. Moreover, informal sessions with experts and visiting the Circularity Conference 'The Future Envelope 15' (2024) gained a broader understanding of the project topic.

Instead of looking at individual case studies, which are unique, this research focuses on the approach and design principles that were taken into account by architecture firms to come to the final design. How can we learn from existing strategies applied by pioneering architecture firms that have successfully designed a circular building using mainly reused materials.

The overall design question and design will be addressed and developed by applying the design principles from the research into the design process for this graduation project. Moreover, parallel to the design process other methods will be used: research by design, reference analysis, context research, site investigations and design by making.

Literature and general practical references

Literature references:

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2. Baker-Brown, D. (2017). *The Re-Use Atlas: A Designer's Guide Towards the Circular Economy*. RIBA Publishing.
3. Circle Economy Foundation. (2024). *The circularity gap report 2024*.
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15. Irwin, T. (2018) The Emerging Transition Design Approach, in Storni, C., Leahy, K., McMahon, M., Lloyd, P. & Bohemia, E. (eds). Design as a catalyst for change - DRS International Conference 2018, 25-28, <https://doi.org/10.21606/drs.2018.210>
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17. Maas, W., Mvrdv, & Van Manen, S. (2021). Dakencatalogus, néerlandais ; Flamand.
18. Malabi Eberhardt, L.C., Van Stijn, A., Rasmussen, F.N., Birkved, M., Birgisdottir, H. (2020). Towards circular life cycle assessment for the built environment: A comparison of allocation approaches. IOP Conference Series: Earth and Environmental Science, 588(032026). <https://doi.org/10.1088/1755-1315/588/3/032026>
19. PBL Netherlands Environmental Assessment Agency. (2017). Circular economy: Measuring innovation in the product chain (PBL publication number 2544)

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In depth interviews with architects:

- Josse Popma - Popma Ter Steege Architecten (17-5-24)
 Josse Popma is architect and partners at Popma Ter Steege Architects, specialized in sustainable architecture with a focus on reuse and environmentally friendly design.
- Halbmeijer, M. – Apto Architects (14-05-24)
 Mark Halbmeijer is architect and partner at Apto Architects, and since the last years active as pioneering architect in the field of reuse and building circular designs.

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)?

The topic of 'Circular design: Different process for optimal reuse in architecture' touches all the programmes of the broader master of Architecture at TU Delft. Overlaps are visualised in the schema (see figure 2), mainly on the topics of circularity, design and materiality. However, the broader topics of architecture and the social and environmental issues in this field are in the end also part of the research and design.

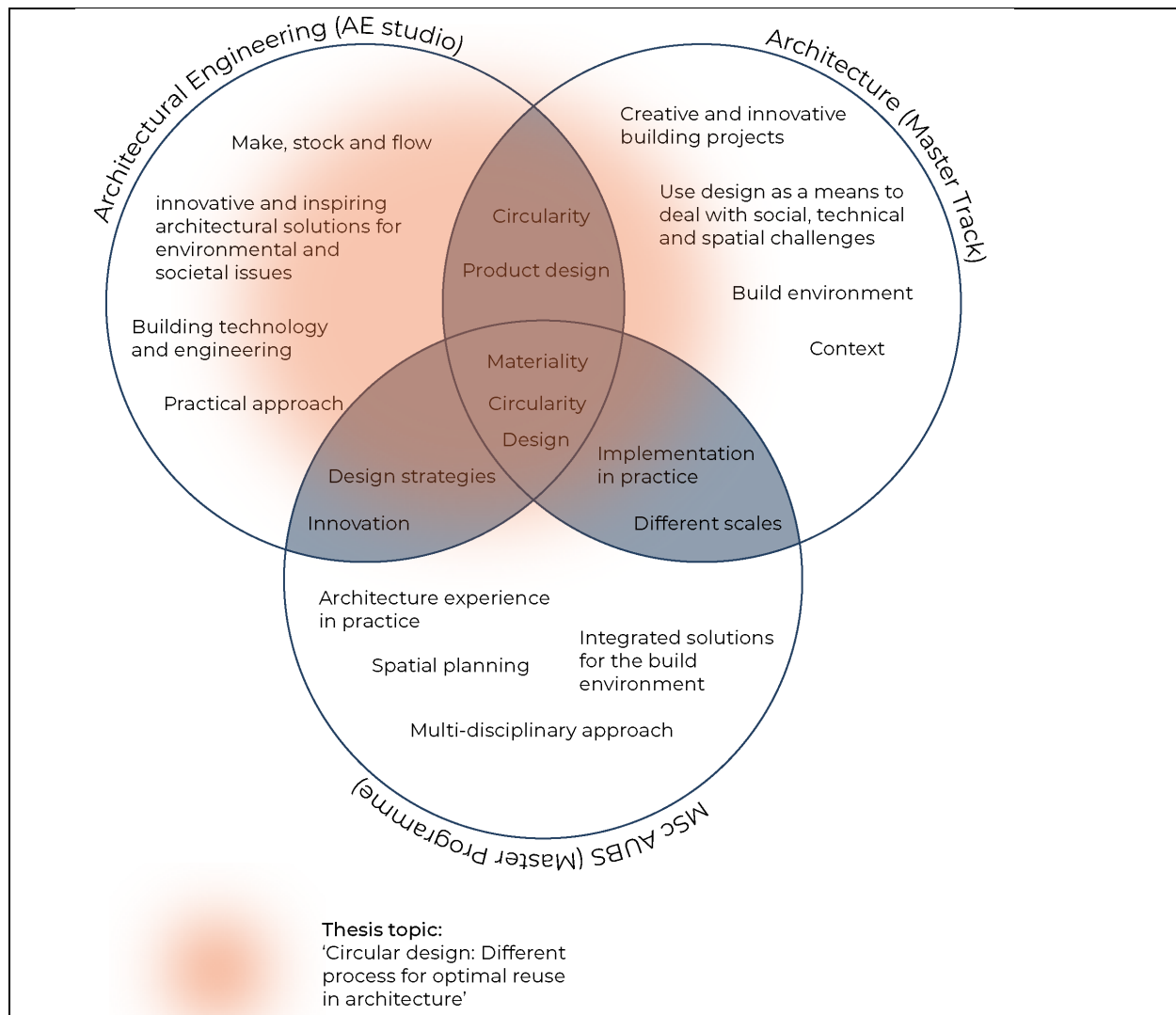


Figure 2 Scheme to illustrate the relation between thesis topic and the AE master studio, master track and master programme at TU Delft.

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

Currently reuse of used building products becomes a visible topic on conferences. Today, architects come up with creative solutions or develop their own products in order to make optimal use of reuse in architecture. However, these unique approaches will not be the solution for a circular building industry.

The research thesis and design will provide insights in a broader understanding of how the architects can use design principles in the design process to make optimal and efficient use of used building products. Architects can make a distinction between principles to apply in the design phase and between consequences of applying reused components for the architecture that comes with it. In this way the thesis and design

will provide insights in what stakeholders are important and how to implement these design principles for the architecture firm of the future, where reuse is the new norm.