

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	Gargi Gokhale
Student number	5745292

Studio		
Name / Theme	Circular Façade Design for the End-of-Life	
Main mentor	Thaleia Konstantinou	Architectural Façade & Product (AF&P) Research Group
Second mentor	Sultan Çetin	Housing Management
Argumentation of choice of the studio	The themes of circularity and façade were my top priorities while choosing the studio topic since I had chosen these electives during my first year of the program. The topic is relevant because façade systems have multiple functions. Hence, they have evolved into complex systems which makes it difficult for the façade designers to design them while taking into account the aspect of circularity.	

Graduation project	
Title of the graduation project	Circular Façade Design for the End-of-Life stage
Goal	
Location:	The Netherlands
The posed problem	There are no design strategies and associated information that should be conveyed to the demolition contractor which guides the façade designers on how to design taking into consideration the End-of-life stages of a façade system.
research questions and	Main question: Which design strategies and associated information can support façade designers in integrating considerations for the end-of-life scenarios of a façade system during the design phase?

	<p>Sub-questions:</p> <ol style="list-style-type: none"> 1. What are the design strategies and indicators applicable for a circular façade design? 2. What information is necessary to facilitate a circular End-of-Life? 3. What is the design process to include circularity during the design stage of a façade for a circular End-of-Life? 4. Which steps taken during the design stage influence the façade circularity at the End-of-Life stage?
<p>design assignment in which these result.</p>	<p>The literature study will result in the design strategies to achieve façade circularity. These will be applied to a case study which will be evaluated according to the existing assessment methods. Along with this, the information that is needed will be formulated which is relevant with the design strategies that have been implemented.</p>
<p>[This should be formulated in such a way that the graduation project can answer these questions. The definition of the problem has to be significant to a clearly defined area of research and design.]</p>	
<p>Process</p>	
<p>Method description</p> <p>The research will be conducted in these phases –</p> <ol style="list-style-type: none"> (1) Literature review (2) Case study analysis (3) Conceptual Design Development (4) Design Evaluation (5) Final Design and Discussion <p>The literature review focuses on identifying the design strategies and assessment methods for circularity. Further, AEGIR case study will be analyzed and a conceptual design will be developed for that façade system. The design will be evaluated by different assessment methods and then the final design will be suggested along with the information that is essential to be conveyed to the demolition contractor.</p>	

Literature and general practical references

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Caroli, T. (2023). Soft Technologies for the Circular Transition: Practical Experimentation of the Product “Material Passport”. In E. Arbizzani, E. Cangelli, C. Clemente, F. Cumo, F. Giofrè, A. M. Giovenale, M. Palme, & S. Paris (Eds.), *Technological Imagination in the Green and Digital Transition* (pp. 439–448). Springer International Publishing. https://doi.org/10.1007/978-3-031-29515-7_40

Çetin, S., Rukanova, B. D., De Wolf, C., Gruis, V. H., & Tan, Y. (2021, December 9). A Conceptual Framework for a Digital Circular Built Environment The Data Pipeline, Passport Generator and Passport Pool. *The Second International Conference of Circular Systems for the Built Environment*. Circular Systems for the Built Environment, Eindhoven, Netherlands.

Çetin, S. (2023). *Towards a circular building industry through digitalisation Exploring how digital technologies can help narrow, slow, close, and regenerate the loops in social housing practice*. Delft University of Technology.

De Fazio, F., Bakker, C., Flipsen, B., & Balkenende, R. (2021). The Disassembly Map: A new method to enhance design for product repairability. *Journal of Cleaner Production, 320*, 128552. <https://doi.org/10.1016/j.jclepro.2021.128552>

Dodd, N., Donatello, S., & Cordella, M. (n.d.). *Level(s) indicator 2.4: Design for deconstruction*.

Durmisevic, E., Guerriero, A., Boje, C., Domange, B., & Bosch, G. (2021). *Development of a conceptual digital deconstruction platform with integrated Reversible BIM to aid decision making and facilitate a circular economy*.

Giovanardi, M., Konstantinou, T., Pollo, R., & Klein, T. (2023). Internet of Things for building façade traceability: A theoretical framework to enable circular economy through life-cycle information flows. *Journal of Cleaner Production, 382*.

Hartwell, R., Macmillan, S., & Overend, M. (2021). Circular economy of façades: Real-world challenges and opportunities. *Resources, Conservation and Recycling, 175*, 105827. <https://doi.org/10.1016/j.resconrec.2021.105827>

Illankoon, C., & Vithanage, S. (2023). Closing the loop in the construction industry: A systematic literature review on the development of circular economy. *Elsevier*, 76(107362), 7,9,10.

Klein, D. T., Geldermans, D. B., & Azcarate, J. (n.d.). Façade Reverse Logistics. *Master Thesis Building Technology Track, TU Delft*

Klein, T. (2013). *Integral Facade Construction*.

Rose, C., & Stegemann, J. (2018). From Waste Management to Component Management in the Construction Industry. *Sustainability*.

Van Den Berg, M., Voordijk, H., & Adriaanse, A. (2020). Recovering building elements for reuse (or not) – Ethnographic insights into selective demolition practices. *Journal of Cleaner Production*, 256, 120332. <https://doi.org/10.1016/j.jclepro.2020.120332>

van Dijk, S., Tenpierik, M., & van den Dobbelsteen, A. (2014). Continuing the building's cycles: A literature review and analysis of current systems theories in comparison with the theory of Cradle to Cradle. *Elsevier*, 23,24,25,26.

van Vliet, M., van Grinsven, J., & Teunizen, J. (2021). *Circular Buildings—Disassembly Potential Measurement Method* (Version 2.0; Circular Buildings).

Reflection

The graduation topic is related to the master track since it focuses on the aspects of façade & products and circularity which are a part of the Building Technology track. It integrates both the architectural design and the technical aspects. In this case, since design strategies are considered and evaluated to reduce the environmental impact of a façade system towards its end-of-life, the project integrates both – the technical aspects of the façade and the design aspects. In the field of building technology there is a need to consider these innovations to make the façade industry more sustainable.

The study intends to increase the circularity in the façade industry by considering the different end of life scenarios during the design stage. The study specifically focuses on the technical aspects that contribute to the circularity of the façade system. The study is relevant since it bridges the gap between the Design stage and the End-of-Life stage of a façade system. The study considers the different scenarios at the End-of-life of the façade and assists the designers to design the façade taking into consideration the design strategies and information flows that are needed at the end-of-life of the system. The research revolves around the built environment, circular economy and façade life cycle stages (Design and End-of-Life stage). Since the study intends to devise the ingredients required for the façade designers to design for the end-of-life stage, the research can be applicable to any façade designer in the context of Netherlands and is not specific to a certain company/ organization.

