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	Marina-Catalina Persunaru
Student number	6082866

Studio		
Name / Theme	Architectural Engineering	
Main mentor	Thomas Offermans	Architectural Design
Second mentor	Paddy Tomesen	Building Technology
Third mentor	Nico Tillie	Research
Argumentation of choice of the studio	Architectural Engineering graduation studio focuses on emerging challenges within the built environment and addresses them through technical design solutions. I have decided to join this studio because its values align with my own interests, as I mostly enjoy the fine line between architecture and engineering, and the way they blend in carefully considered proposals. This approach, complemented by the freedom to choose the site and research topic allowed me to delve deeper into the field I am interested in – materials' behaviour, their self-protective mechanisms and capacity to adapt to various climatic factors.	

Graduation project	
Title of the graduation project	Layers of resilience
Goal	
Location:	The Hague
The posed problem,	The built environment has proved over time that it is one of the most dynamic man-made entities, and the climate plays a key role in this process, as it is the main cause of its weathering and decay. While climate change is becoming an increasing threat, making buildings more vulnerable both externally and internally, there seems to be no consistent research on how natural elements commonly believed to

	lead to decay (e.g. climatic factors and microorganisms) can have constructive outcomes as well - for instance the creation of biological finishes which protect buildings. Furthermore, there is no set of design strategies aimed at integrating and facilitating these bioprotective processes in a holistic manner.
research questions and	How can materials' protective mechanisms be integrated with design strategies into a holistic design approach that extends a building's lifespan in a changing climate? Sub-question 1: What materials have self-protective mechanisms and in which environmental contexts are they triggered? Sub-question 2: How can architectural details facilitate the creation of environmental conditions that are beneficial for materials' self-protective mechanisms?
design assignment in which these result.	The design assignment is to integrate the materials with protective behaviour with design strategies that facilitate it. The aim is to create a building that becomes stronger in time through the ecological dynamics that take place on its skin, allowing it to be responsive to the surrounding environment and have a longer lifespan in a changing climate. The research conclusions are going to be implemented in the design of a rehabilitation center situated in the coastal area near the Hague. This programme ties in with the idea that a continuous transformative process can have beneficial outcomes as well.

Process

Method description

In order to answer the proposed research question and following sub-questions, a thorough analysis of the latest research papers on material behaviour and the protective mechanisms which are triggered when they are exposed to various climatic factors is undertaken. A key aspect is understanding the specific environmental

conditions in which these processes take place and the potential for long-term durability.

Literature and general practical references

The research on material weathering is closely tied to the study of microorganisms and their relationship with the built environment, often overlapping. For this reason, the theories and key words which have been used to find appropriate literature are: bioprotection, bio-receptivity, biomineralization, self-healing, and weathering.

The key articles which underpin the research paper are:

- Mostafavi, M., & Leatherbarrow, D. (1992). *On Weathering: A New Surface Out of the Tracks of Time*. MIT Press.
- Gadd, G. M., Dyer, T. D. (2017). Bioprotection of the built environment and cultural Heritage. *Microbial Biotechnology*, 10 (5), 1152-1156. https://doi.org/10.1111/1751-7915.12750
- Jonkers, H. M. (2011). Bacteria-based self-healing concrete. *Heron*, 56(1/2), 1-12
- Jroundi, F., Gonzalez-Muñoz, M. T., & Rodriguez-Navarro, C. (2021). Protection and consolidation of stone heritage by bacterial carbonatogenesis. In Joseph, E. (ed.), *Microorganisms in the Deterioration and Preservation of Cultural Heritage*. (281-299). Springer. https://doi.org/10.1007/978-3-030-69411-1
- Veeger, M., Nabbe, A., Jonkers, H., & Ottele, M. (2023). Bioreceptive concrete: State of the art and potential benefits. *Heron*, 68(1), 47-76. http://heronjournal.nl/68-1/4.html

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 my graduation project addresses the issue of accelerated material decay in a changing climate and aims to find a solution through the lens of the Architectural Engineering graduation studio by focusing on the materiality and technical details of the façade. While the conclusions stem from a technical approach, they can benefit the entire architecture field as they can be implemented on a wide scale within the built environment, changing not only its design strategies, but its aesthetic values as well. The implications of a large-scale implementation would have consequences for all the fields related to the architecture industry, such as urbanism, building technology, landscape and management in the built environment as well.

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

   From a scientific point of view, the project can be a stepping stone for integrating all the research on constructive material behaviour under an umbrella term, such as "bioprotection", in order to keep track of all the information which

can benefit this concept. Moreover, the underpinning idea of this project is that weathering is not only acknowledged, but it rather becomes a key feature that increases the aesthetic value of architecture as well. Thus, the lifespan of the building is prolonged not only due to its material longevity, but due to the increased value that it has in the eyes of its users as well, aspect which motivates them to maintain it and refrain from demolishing it in the future.