

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	Barbara Foolen de Oliveira	
Student number	4484592	

Studio		
Name / Theme	AR3B025 Sustainable Design Graduation Preparation	
Main mentor	Mauro Overend	Structural Design
Second mentor	Arie Bergsma	Façade Design
Argumentation of choice of the studio	<p>A façade is where many parts of the building come together. It needs to account for climate issues, structural elements, weather proofing while also being aesthetically pleasing. And all these fundamental components need to come together harmoniously in a small façade detail. Finding this balance in an intricate detail has been my fascination since the beginning of my studies. This topic and studio are thus the perfect match to continue the dive in the process of optimizing such detail and finding the balance between all the elements.</p>	

Graduation project	
Title of the graduation project	Slim Skins: A search for the most transparent unitized and sustainable façade system

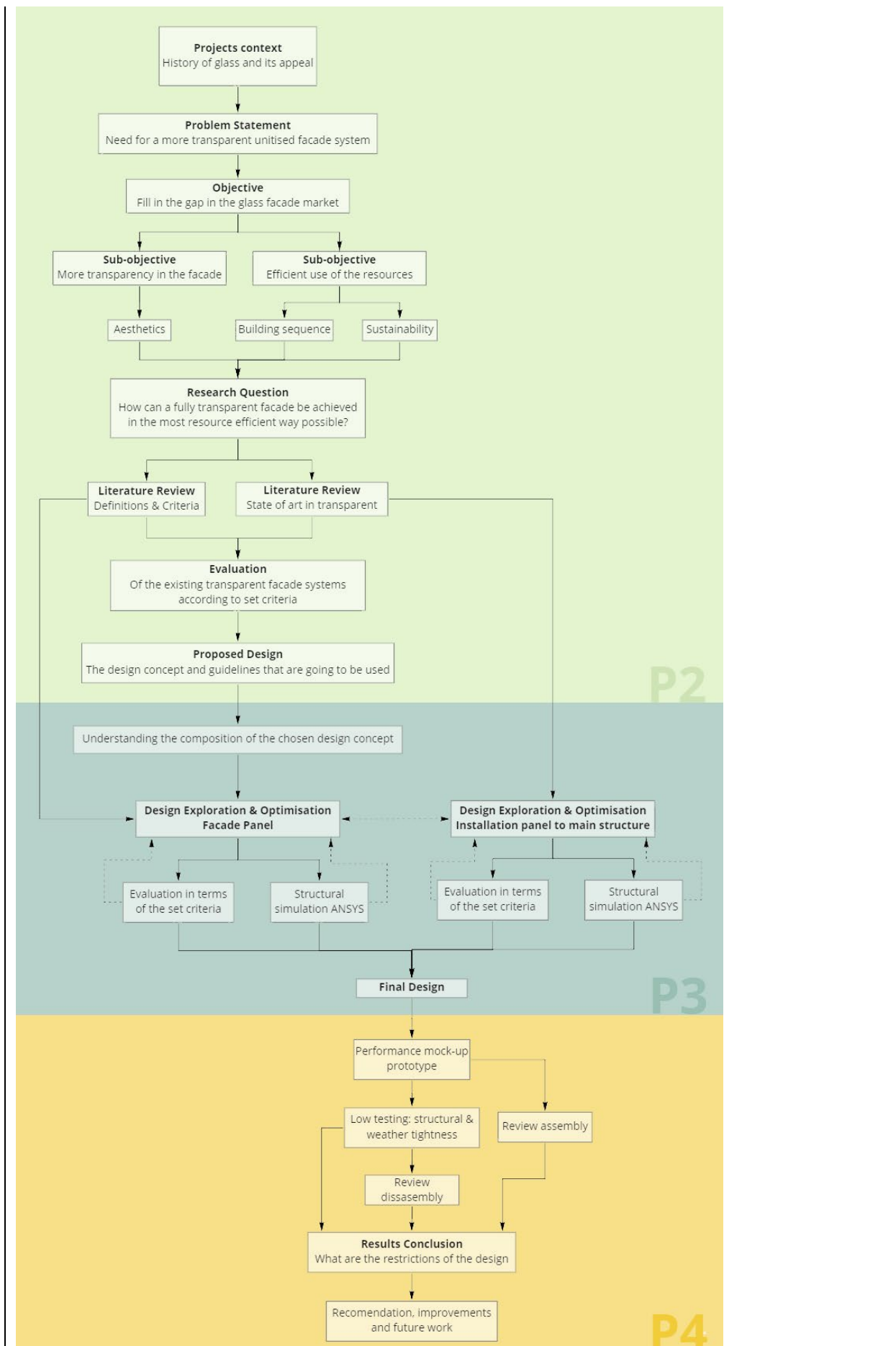
Goal	
Location:	Netherlands
The posed problem,	<p>Throughout the years improvements were made to the glass facades in order to achieve full transparency. Nowadays the most commonly used system are the curtain walls. However, due to its protruding frame it does not meet the wishes, in terms of transparency, for many users.</p> <p>In some occasions the desired level of transparency can be achieved through a frameless system, using structural glass. Nonetheless, this is not an ideal solution as it is an inefficient use of materials and time consuming to design, produce and assemble. Which then can lead to a higher environmental impact.</p>

	As can be seen from the growth of the curtain wall market, there is a demand for a more unitized façade system (Reports and Data, 2019). Together with the wish for a fully transparent façade, it can be said that there is a gap in the market for fully transparent unitized façade systems.
research questions and	<p>The main research question this paper will explore is:</p> <ul style="list-style-type: none"> - How can a fully transparent façade be achieved in the most resource efficient way possible? <p>To help answering the main research question the following sub-questions will be addresses first:</p> <ul style="list-style-type: none"> - What characterizes a transparent façade and an efficient use of resources? - What is the stat of art in façade systems to create maximum transparency? - What design concept could be the best to achieve the desired façade composition? - How can the design concept be optimized to improve in such a way that it achieves the desired façade composition? - How can the designed panel be installed to the main structure of the building? - What is the best way to evaluate the optimized design in terms of resource efficiency? - What is the best way of prototyping the created design?
design assignment in which these result.	<p>The main objective of this research is to fill in the gap in the current market by designing a façade system with a high percentage off transparency which at the same type is efficient though a unitized system.</p> <p>With this there are also a few sub objective that should be achieved.</p> <ul style="list-style-type: none"> - Develop an understanding of the existing glazed facades in order to determine which elements can be used into the design. - Create a façade system that achieves the set performance criteria. - Determine which performance test will be used in order to validate the created design. - Produce a prototype of the created design.
Process	
Method description	
<p>Firstly the research framework needs to be set. To do this a background study is conducted to get more insight into the history of glass facades and why glass it is so popular. Afterwards the problem statement is made together with the objectives and research question.</p>	

With a literature review into the performance criteria and state of art an evaluation can be done on the existing transparent façade systems through the use of case studies. This will stir the design in a good direction together with the concept of the proposed design.

When this has been presented at the P2 the design exploration & optimisation phase can begin. To start there is a need for a better understanding of the proposed design concept, so the composition of the element will be analysed and compared to the set performance criteria. Further along this phase there will be a back and forward of optimising the design, testing it structurally in ANSYS and evaluating. This will be done for the façade panel and for the installation to the main structure. The final design will have been optimised enough by the time the P3 comes around.

The last stage of this research will be all about prototyping the model at half or one third of the actual size. This prototype will then be going through a low intensity structural test and weathertightness to validate the design. Together with the review of its assembly and disassembly it will be discussed on the results conclusion. Lastly the recommendations for improvements and future work are done.



Literature and general practical preference

Afghani Khoraskani, R. (2015). Advanced Connection Systems for Architectural Glazing. SpringerBriefs in Applied Sciences and Technology, PoliMI SpringerBriefs.

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Balog, V. (2019, December 13). Innovative Facade Types – The Closed Cavity Façade. Glass on Web. <https://www.glassonweb.com/article/innovative-facade-types-closed-cavity-facade>

Corbusier, L. (1986). Towards a New Architecture. New York: Dover Publications, 229-265.

Cordero, B., García-Santos, A. & Overend, M. (2015). Thermal performance of novel frame-integrated unitised curtain wall. Journal of Construction, 14(1), 23-31.

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Mills Friha, E.D. (1957). Curtain Walling. The Architect & Building News, 2961, 4-7. London: Iliffe & Sons Limited.

Mordor Intelligence (2020). Flat Glass Market - Growth, Trends, COVID-19 Impact, and Forecasts (2021 - 2026). Mordor Intelligence. <https://www.mordorintelligence.com/industry-reports/flat-glass-market#faq>

Murray, S. (2009). Contemporary curtain wall architecture. New York: Princeton Architectural Press.

Patterson, M. & Patterson, M. (2011). Structural Glass Façades and Enclosures: A Vocabulary of Transparency. New Jersey: John Wiley and Sons Ltd.

Reports and Data (2019). Glass Curtain Wall Market To Reach USD 89.03 Billion By 2026.

Steiner, H. & Veel, K. (2011). Living behind glass facades: Surveillance Culture and New Architecture. Surveillance & Society, 9 (1/2), 215-232.

Stender, M. (2006). En nation af vindueskiggere: Glashuse til debat. Arkfokus.

Whiteley, N. (2003). Intensity of Scrutiny and a Good Eyeful: Architecture and Transparency. Journal of Architectural Education, 56, 8-16.

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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)?

This topic is related to my master track (Building Technology) in the following ways:

- Developing a better understanding of façade system technologies
- Not only designing something but validating in through different methods (numerical and physical testing)
- Create a new system which performs well on a structural level

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

As we spend more and more time inside our buildings the wish for transparent facades continues to increase. Although fully transparent facades are already in use, they are not available for everyone. This can be attributed to higher costs in custom designing and testing these facades. With designing a type of façade that is very transparent and at the same time a more unitized system a broader group of people could profit from it.

Furthermore this design would be an addition to the existing façade types architects and engineers can choose from. Besides that it also offers a more resource efficient way of creating as much transparency as possible.