Prefabricated Tensile Façade Design and Prototyping

Graduation process

Q: How is your graduation topic positioned in the studio?

A: In my opinion the topic of evaluating and designing a tensile based façade panel is positioned perfectly within the façade and structural departments of the faculty. For this topic, I have gotten to develop new skills and insights in the field of structural engineering, trying to assess the feasibility of a tensile based façade design. Furthermore, it let me explore a wide range of prefabricated facades and their ins and outs. Broadening my knowledge of the field of Façade design as well.

Q: How did the research approach work out (and why or why not)? And did it lead to the results you aimed for?

A: The aim of this research was to assess and further develop a façade system intended to be more material-efficient, structurally stiffer, and reconfigurable, thereby improving its reusability potential compared to existing prefabricated façade systems.

Based on the outcomes of my research, I can confidently conclude that these aims cannot be achieved simultaneously. Depending on the configuration of the tensile-based façade system, at least one, two, or even all three goals must be compromised. Moreover, the system introduces additional challenges that require mitigation, especially when compared to simpler, more conventional bending based solutions. These conclusions are supported by a comprehensive series of structural simulations and physical tests conducted over the course of the project.

This is not the outcome I had hoped for, as it would have been far more rewarding to propose a solution that offered clear advantages. However, I remained optimistic and open-minded throughout the process, consistently working to improve the system wherever possible, even in the face of its limitations. What was encouraging is that, in the final round of interviews, people responded much more positively when exposed to the more experimental façade types. This suggests there is still a research gap around the system that is worth exploring.

Q: If applicable: what is the relationship between the methodical line of approach of the graduation studio (related research program of the department) and your chosen method?

A: Spending a large proportion of time in the theoretical background phase of the project, particularly in formulating specific research questions, was not the most

efficient approach for me. Since the graduation topic came with a predetermined design, I chose to spend only a brief period in this initial phase and moved into design and assessment early on. This allowed me to identify problems as they emerged and address them iteratively. This approach proved effective, as many of the challenges and corresponding research gaps were not foreseeable at the start of the project and could only be uncovered through prototype development and testing.

Q: How are research and design related?

A: They are closely related, every design alteration I made was either based on research-based reasoning, simulations, or analytical models, and each modification was subsequently verified through additional structural simulations to ensure their effectiveness.

Q: Did you encounter moral/ethical issues or dilemmas during the process? How did you deal with these?

A: Yes, I was given the task of evaluating the performance of a patented technology, and it was clear that my advisor had an interest in presenting the system as optimistically as possible throughout the process. At times, this proved challenging for me, as I gradually began to lose confidence in the system's effectiveness.

I managed this by maintaining a constructively optimistic mindset, consistently trying to make the system work wherever possible, and only drawing negative conclusions when I was certain they were justified by evidence. This approach helped me stay balanced, while respecting the intent of the project and remaining committed to scientific integrity.

Societal impact

Q: to what extent are the results applicable in practice?

A: To the extent of my findings, it is not advisable to develop a prefabricated tensile-based system if the goal is to replace existing façade substructures. However, my research does shed light on key structural principles underlying such tensile façade systems and can serve as a foundation for the development of similar systems in contexts where their unique characteristics may still offer advantages or a unique architectural style. While the final solutions proposed may become feasible, and potentially valuable to society in the future, it is too early to make any definitive claims on this now.

Q: to what extent has the projected innovation been achieved?

A: Like stated prior, the projected innovation has not been achieved and is unlikely to be achieved in such a tensile system.

Q: does the project contribute to sustainable development?

A: The aim of the project was to do so. However, as the results indicate, this is unlikely to happen with the proposed configurations.

Q: what is the impact of your project on sustainability (people, planet, profit/prosperity)?

A: There is no direct impact, other than that I now have a better understanding of tensile structures, related structural principles and prefabricated facades. This enables me to assess designs more critically and effectively than before, which will likely benefit my ability to conduct future sustainability assessments with greater structural insight.

Q: what is the socio-cultural and ethical impact?

A: not applicable

Q: what is the relation between the project and the wider social context?

A: not applicable

Q: how does the project affects architecture / the built environment?

A: This research highlights the challenges involved in designing a prefabricated tensile-based façade panel that can outperform existing prefabricated façade systems. As the findings do not support the feasibility of such an approach on most application scenario's, it is unlikely to have a significant impact on architecture or the built environment. The study suggests that developing prefabricated façade panels using this method is not advisable in most practical contexts. It might however influence architectural design in the future if the overclad or closed cavity façade are further developed and potentially deployed. Again, while it is too early to draw definitive conclusions, the research opens up an interesting perspective for future exploration of prefabricated tensile façade design.