Architectural Engineering Graduation Studio

# SHELTERRA

Reconfigurable Masonry
Settlements for Refugees

## Reflection

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This document aims to explain the preliminary results of the research and design of this graduation project by looking back and reflecting on the used methods, procedures and concepts. This is done in order to understand whether the initial approach worked, to explore the interconnections of the design decisions through the «how and why», to reveal how the design was changing throughout the course of the work and how the feedback of the tutors influenced it. It also reveals the learning achievements gained through the process and the relation of the design to various spheres and the value that it adds to the socio-economic but also academic framework. First, the key aspects are touched upon by answering the reflection questions about the project. Afterwards, an overall personal reflection is presented.

**Questions Key Aspects**

1. *What is the relationship between research and design in this project?*

During the research phase of the graduation studio, my main focus was to figure out the different methods to construct funicular vault-like structures while using the least additional materials/elements/connections possible. The 2.5D and 3D principles that are explained in the research paper came out to be the two solutions to the problem. Further, I looked into the possibility of designing a specific set of blocks for reconfigurable construction and the methods to do so, which led to the result of producing the specific step by step plan of how it could be done. The knowledge that was gained from the research phase is clearly seen in the design: both of the construction principles are used in the project for the different elements within the design. Of course, the research didn't stop after the «research phase» as there are a lot of topics that had to be dived into in order to create the design in mind and to further better it. For example, a lot of study went into the topic of CEB production and the low-tech methods of earth testing to ensure proper structural properties. At the same time, the research regarding the vernacular traditions, such as the composition of the settlement, rooms within the building structure and even the cooking methods and appliances used for it was done. However, not all the elements in the design are strictly bound to the chosen geographical area. Some, like the heating system for the bath houses, was taken from studying the medieval roman hypocaust systems. Overall, research and design go hand-in-hand during the whole process. When one does the research – they can apply it into the design and when one produces the design, a lot of elements arise more questions on which research has to be done.

2. *What is the relation between your graduation (project) topic, the studio topic, your master track (A), and your master program (MSc AUBS)?*

The topic that I have chosen for my MSc Graduation goes with one of the themes of the Architectural Engineering – 1 Million Homes. Even though it doesn't focus on classic urban and densely populated sites like the Netherlands, it definitely tries to solve the housing problem for the less fortunate people, that found themselves to be forcibly displaced because

of the political economic conditions in their country. It helps ensure the basic human right to adequate housing formulated by the Office of the High Commissioner for Human Rights [OHCHR]. Applying the principles of modularity makes the construction process more understandable and simpler for the users, even if they don't have the previous knowledge in masonry. It also allows for mass castomization, where the users can make their own decisions on which types of spaces they need. Figuring out the shelter design on the different scales: starting from the shape and stacking principles of the blocks to the cluster and settlement levels go along with the focus of the chosen graduation studio. By choosing for the sustainable and locally found materials, respecting the vernacular traditions and addressing the urgent societal problem, the project also falls under some of the main current research aims of the Architectural track in the TU Delft MSc AUBS program.

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

I believe that using the computational design methods in Architecture is the future of the field. Currently, the application of these methods is only at the start of its popularity. By not solely looking at one of the departments, but rather the intersection of the various fields, such as Architecture, Urbanism, Structural Design, Computational Modelling etc, it is possible to open new horizons for all of them. Together with that, there is rising need for high tech sustainable solutions because of the climate change.

In the field of Architecture, my project adds to the knowledge about the compressed earth masonry structures and formation of (semi) permanent settlements. In the scientific framework, it increases the awareness of the use of participatory principles and topological design in architecture and the design of compression only structures. On the social scale, it helps solve the problem of absence of shelters for refugees in by providing a solution that can be both temporary and permanent. The shelter can be assembled relatively fast and without any prior knowledge or training, so it is available to use for anyone. Taking on a challenge of designing with the minimal number of additional non-reusable elements and using earth as the main structural material not only created a zero-waste and zero-CO2 shelter design solution (if not taking into account the emissions needed to transport the one manual compression machine needed) but also a more economically sustainable solution.

4. *Were there ethical issues and dilemmas that you encountered during the process?*

Just like any other, Afghanistan has its own history, culture and traditions. As a Muslim country, some of these traditions were not that easy for me to understand and «encourage» by my design. Specifically, in traditional Islamic buildings and housing, men and women have their own separated spaces, sometimes even having different entrances. When reading about

the positioning of functions, it was uneasy for me to see that «female» spaces were those for cooking or sewing and were positioned inside. There are even some inner courtyards places specifically for women to meet so that they don't meet in public. I had to make a partially ethical decision of what is more important: personal values and strong advocacy for equality and feminism or supporting the cultural traditions. As a non-Muslim woman, it was difficult to understand the correct answer and not look neglecting to these values. In the end, I made a choice to not make a female-male separation. I believe that it is better to create a settlement that could strengthen the while community and bring it closer together, especially when it comes to the vulnerable people in need of shelters. The only place where I applied this is in the bath houses and toilet structures.

5. *What is the potential application of the results of the research and design in practice?*

This project was designed with a focus on applicability and useability. It is not just a conceptual vision, but a direct example of how the shelter solutions which are now used as merely temporary patch-on solutions can be better from many different viewpoints: economical, ecological, social etc. The proposed design showed the possibility of the shelter in it becoming something more than just a structure, but a real new home. Organizations such as the UNHCR may use such designs and by that save a lot of finances which are usually spent on a large number of temporary tents and constant need of additional packages flow. Instead, this money may go towards the research of similar solutions for more contextualized and more durable solutions. The proposed design of the shelter doesn't only have to be used in Afghanistan but in other countries with a similar topography where the earthy materials can be easily found and collected and there is a high number of internally displaced people.

**Overall Reflection**

Looking back to the beginning of the graduation, I am surprised to see how much my ideas and the project changed and evolved through the year. I had quite a clear understanding of what I wanted to do from the beginning so I sometimes couldn't imagine how my tutors could help if I didn't have very specific questions. However, it amazed me every time how with just regular conversations about the project could open up a completely different viewpoint for me which I didn't think about before. I strongly believe that I am very fortunate to have gotten exactly the teachers that I did. Pirouz sparked up the already existing love that I had for the computational design methods, was involved much more than he «had to» and helped with any design aspects that I was interested in. Especially regarding the topological design, he was constantly finding and sending new articles, books, projects and sharing them, which is how I came to find a lot of the most important literature for my research. Mo challenged me to look beyond just the structure and dive into the settlement scale and the many sustainable flow possibilities that could be applied or thought of, which is how I came to

think about the farming space, the various solutions for toilets in the rural environment and how everything could be reused and repurposed even more. She also kept reminding everyone to set your ambitions high. Paddy also helped me a lot, especially with the knowledge of using waste materials, such as plastic, tires, doors, bottles etc as elements for architecture. This introduction to earthship architecture opened up a completely new view on the possibilities of my design project to me.

With this project I really pushed myself into a completely new environment for myself by choosing the topic of my interest regarding both, the research and design aspects. I definitely learned a lot about the masonry construction and the computational design possibilities in it. Unfortunately, this project only lasts for one year, so it is impossible to produce a more in-depth research and computation of the structure. This is the only thing that I feel like I didn't fulfill completely from the initial goals that I set for this project. However, this motivated me to continue studying the topic in the research position setting in the company or by doing a PhD after the completion of the Master Architecture Program.