

**Create, preserve, destroy**

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**Create, preserve, destroy**  
**From farmhouse and temple to refugee island**

Advanced Studio Landscape: Building Bangladesh: from farmhouse to refugee island?

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## Abstract

**BUILDING BANGLADESH** To reduce CO<sub>2</sub> emissions in the building sector we need to build more with natural materials and also look back on building materials we used to use earlier and start to improve them.

This semester was about building sustainable with as minimal resources as possible. We thought about what we really need to create a liveable environment and what creates qualities.

To start the semester and get familiar with the surroundings we looked at Rudrapur a small village in the northwest of Bangladesh. Using the method of Claystroming we designed a farmhouse for a widow and a temple for the community. During the designing process, it was important to always keep the house affordable and also buildable for people who are not trained construction workers. We learned a lot about the materials bamboo and clay. We looked into how to build resilient and somehow luxurious with only a little budget.

During the seminar week we went into the woods and built a nest only with materials we could find in the woods.

In the next step, we scaled up. We looked at the refugee camp in Kutupalong and the Bhasan Char island where it's planned to relocate a total of 100'000 Rohingya refugees.

We thought about the urban qualities of the island and how they should change in the future. Then we replanned the whole settlement. The island should get away from being like a prison and become a liveable place.

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## Introduction

Following the example of western countries more and more people in Bangladesh start building in bricks, concrete, or other highly industrialized materials.

But are those actually the materials that bring qualities to houses or are there other materials that could respond to their needs even better.

In the future, we should get away from highly industrialized materials and start using again the resources we can find locally. This could for example be mud. This material is at the moment seen as a waste product of excavation and muds buildings are considered outdated and only for poor people. But that's not true. Mud buildings can bring so many qualities with them.

In the Landscape Studio Building Bangladesh in we looked at the qualities of mud and bamboo. The goal of our groups design was to create a house that gets rid of the stigma that mud houses are only for poor people. The houses should have something extra, something "luxurious" but at the same time be affordable.

With the temple design we wanted also to show that you don't need bricks to show that a building is special or valuable.

While designing the question of how it would be built and how much it would cost was always very present. But at the same time it was very important to create houses that are individual and have qualities.

In the second half of the semester, we didn't only look at the qualities of a single house but at the qualities that are needed in a whole refugee camp. "Houses" in refugee camps are always built a temporary construction but if you look at statistics you can see that refugees often stay in a camp for several years. Especially in the refugee camp of Kutupalong it will be very long as at the moment it doesn't look like the Rohingyas can go back to where they came from.<sup>1</sup>

This brings up why not build houses that feel like real homes. With mud exactly this could be done and if the refugees leave the camp the houses can be left or torn down without any harm to nature.

But the refugees need more than good houses. We analyzed the urban qualities of the Bhasan Char island. The government of Bangladesh is in the process of relocating 100'000 refugees from Cox's Bazar to Bhasan Char, which at the moment seems like a prison. We rethought the whole island and came up with a design that would make living on Bhasan Char more liveable.

<sup>1</sup> Mikulec (2022).

1 Inputs

## Bangladesh

Bangladesh is a country in South Asia. Bangladesh has one of the highest population densities.<sup>1</sup> Land in Bangladesh is very precious. Especially because there are a lot of rivers and a lot of the land is low land and only 10 m above sea level. This means that in the monsoon season about half of the land is flooded.<sup>2</sup> Bangladesh will be affected a lot by the rising sea level.<sup>3</sup> At the same time, Bangladesh is one of the poorest countries.



## Rudrapur

Rudrapur is a small village in the northwest of Bangladesh. Like a lot of other rural areas, it's affected by rural migration. But there are development organisations trying to keep people in their village with projects such as public buildings for example schools.<sup>4</sup>

<sup>1</sup>Ruby (2017).

<sup>2</sup><https://en.banglapedia.org/>

<sup>3</sup>Wheeler, Gravgaard (2009).

<sup>4</sup>Heringer (2022).

fig.1-2 Bangladesh

## Mud

Mud is a material that is available all around the world.

In the past it was used a lot to build houses. But somehow we forgot about it and if we think about it we tend to think it's a material for the poor people.

But actually, mud is a very convenient material. It's not only available everywhere it also creates a very good room climate. But that's not all mud can also be recycled endlessly without any loss of quality as long no cement is mixed with the mud.

Mud buildings can be very durable if we take care of them and if they have a good foundation and a good roof. Because the worst thing that can happen to a mud building is if the walls get wet from the inside. There are mud buildings that are already about 500 years old.<sup>1</sup>

There are a lot of different ways to build in mud. One way would be the rammed earth. This construction is not very suitable for building cheap and simple as you need a very strong formwork.

Another construction method is the COB which is just the clay mixed with a little bit of straw. The mud can be mixed with buffalos or people. After mixing the mud mixture is stacked to form a wall. In the end, the walls are cut down on the sides to create a smooth surface.

A third way of constructing with mud would be adobe bricks. With this method, the clay is filled into a formwork to form bricks. Then the bricks will be laid out in the sun until they are dry. Then they can be used to build a house as normal bricks. To connect the bricks a wet mixture of clay can be used. To hide the brick structure it's also possible to plaster the walls.



fig. 3 mixing COB



fig. 4 COB

<sup>1</sup> Unesco, 2022



## Bamboo

### *Growing bamboo*

Bamboo is a pioneer plant which means that they don't compete with food crops for ground. Bamboo can even prevent soil erosion.

Bamboo is a colony plant. This means once planted, around the first culm many more will shoot up. And the new ones shooting up will be bigger than the one which was initially planted. After about five years the maximum height of a clump is reached.

Bamboo is the fastest growing plant. In spring the plant will shoot and grow extremely quick. The bamboo culm will only grow for about 2-3 months. After that, it won't grow in height or diameter. Nevertheless in the following years the fibers will grow stronger. When the bamboo is 3-5 years old the bamboo is mature and it's time to harvest it. If you harvest it later the strength of the fiber will have decreased again.<sup>1</sup>

### *Harvesting bamboo*

When harvesting the bamboo it's very important to only harvest poles that are mature. Else they won't be able to carry as much weight. It's important to especially harvest the poles in the middle of the clump as new ones often grow on the outside. Old poles should be cut out as well as they are more vulnerable to diseases.

When cutting down the poles the plant won't die. In the following season new bamboo poles will grow. That's also why usually a few bamboo culms are left standing like this the new culms have culms to lean on until they get stronger.

To protect the plant the poles should be cut just about the first or second node. Like that the water can't come into the culm.<sup>2</sup>

If you leave bamboo untreated it will only last for 2-3 years. But if you treat it properly it can last up to 30 years.<sup>3</sup>



*fig. 5 bamboo lashing*



*fig. 6 bamboo*

<sup>1</sup> <https://lewisbamboo.com> (2022).

<sup>2</sup> <https://www.guaduabamboo.com>, (2022).

<sup>3</sup> <https://www.mrfixitbali.com> (2022).

## Claystorming

The method of claystorming is a very quick method to bring first ideas into shape. While modelling the clay it's a lot about what feels right.

We started the workshop by making a bowl first with the eyes open. Later on we had to make one with closed eyes. In a second step, we were asked to think about our favorite childhood memory and then create an environment in clay that we would have liked to be in as a child.

We then started to rotate and work on each other's clay models to free our minds and not get stuck too much on one idea. Another thing we did to prevent that was the thing called "shiva" which means that you or someone else destroys your model partially or completely and then you restart with what you have got.

We then started to connect our "models" and worked on them as a group. We modeled without talking to each other we just went with the flow and did whatever felt like.

The final exercise was to create a landscape with houses following the topography given by the clay lump. We worked in a group on one model but we didn't talk to each other. Everyone just started at a place and at some point our settlements grew together.



fig. 7 Claystorming



*fig. 8 Claystorming: creating landscapes*

## Building in refuge camps

with Livia Mikulec

In a workshop we tried out different ways to create a frame that is as stable as possible but at the same time uses as little material as possible. At the same time, the construction should be as easy as possible, as the refugee camps are not built by trained construction workers.



fig. 9-11 frames made in the workshop put together to a "room"

## Seminar week "Architects meet woods"

During the seminar week we went into the woods. The idea was to create a nest out of the materials we would find in the woods. We tried out different ways of constructing to find the most stable construction. We experienced the most basic way of building. We were children again for three days and could refer to our urge of building things.

On the first day, we cleared the area and made some mock-up models of what the construction could look like. Afterwards we started to collect the material we needed and started to build some first elements. I found it very interesting how we got more and more into the flow and how we gained the courage to also take bigger trees.

On the second day, we really started to do the construction and also connected the bigger poles with smaller ones. We also started off doing weaving to create walls. On the last day, we did some final touches. We cleared out the inside and put down some moss. On the outside, we wove in some smaller branches that it looked more like a nest.

I spent the last night with three other students in the nest and it was a really nice experience how such a simple construction could actually give you comfort. I felt much safer when I was in the nest.

Based on what we experienced in the woods we all wrote a manifest which we presented in the nest on the last day.

On the first day of the seminar week, we got a rammed earth tour in Schlins. To get to know the material better we also got to make little rammed earth cylinders. The cylinders are in blue and yellow because we wanted to sell them to raise money for Ukraine.

First, we had to mix the material with the pigments and create the form-work. Then we could fill in the mud and start ramming.



fig. 12-14 ramming earth to raise money for the Ukraine



fig. 15-16 "the nest"



*fig. 17-19 "the nest"*



## Manifest

*Today building is a lot about a lot of space and fancy materials. Where they come from usually isn't that important. We are generalizing everything and following this, a lot of local knowledge gets lost.*

### 1. Be aware of local building materials

*Taking building materials from far away is not only harmful to the environment but also doesn't really take the local space into consideration. That's why we should use local resources. They have a deep connection to the building site and define our designs through their abilities. If we are close to the origin of a material and we know where it was grown it becomes more valuable.*

### 2. Be aware of local techniques

*A lot of beautiful crafts are getting lost due to generalizing and making higher profits. But usually, there is a reason why people chose to build in a certain way in a certain region. We should be aware of these crafts and take advantage of them.*

### 3. Complexity through reduction

*We should try to reduce our construction as much as possible and face the complex problems we get there and not try to overload our constructions.*

### 4. Beauty through materials

*Architects tend to change materials a lot often to a point where at first sight it's hard to tell what kind of material it actually is. If we leave materials raw it takes fewer resources and the real beauty of the material can unfold. The beauty of purity.*

### 5. Be aware of the user

*Architects tend to let their dreams come true in designs and often the user gets somehow forgotten. We should never forget the users and their needs. And include them more in the design process.*

*All these points result in an architecture that is more aware of local resources and their possibilities. Following this the building itself will also be more sustainable.*



fig. 20 primary structure of the nest

# 2 Farmhouse

## Rudrapur

Rudrapur is a small village in the northwest of Bangladesh. Most inhabitants are farmers and grow their food in the fields around the village. The housing areas are a little bit elevated that they don't get flooded in the monsoon season. The fields are around the housing areas and get flooded regularly in the monsoon season. The big pond is where the people of Rudrapur get the mud for building.



fig. 21 Rudrapur situation

## Farmhouse „Towards west“

The farmhouse is located in Rudrapur and should be built for Omica and her two children. Omica is a widow. Her daughter will soon get married and move out. Her son will start his own family soon as well. So in the future, Omica and her son's family should be able to live in the farmhouse.

At the moment there are several smaller houses, but we wanted to integrate all the needs of the family into one building.

While designing the farmhouse the main concept of our design was to take away volumes to create rooms. We thought of the farmhouse as one massive block of mud and then started to take away volumes. We played with the massivity of the materials and used this to create niches in the walls.

In front of the farmhouse, there is an edge to create a courtyard that is covered. Integrated into the thick walls there is also a niche for cooking. The covered outdoor space is very important and is used very often as it's warm most of the time. If it's hot people also sometimes sleep on their veranda.

If you then enter the farmhouse with a few steps you come into the common space. On the sides, there are the sleeping niches. They are a bit elevated to create some privacy. Towards the west, there is a big opening that can be closed with a curtain. When the light comes in through the fabric of the curtain a special atmosphere is created in the common room.

From the common room, you can enter the workshop. This room can at the moment be used by the daughter to do some tailoring. In the future, this room could become an additional sleeping room. As this room is also accessible from the outside it would also be possible to separate this room from the first room.

On the other side of the house, there is the stable. The stable is turned a little bit to give a bit more space in the kitchen area.

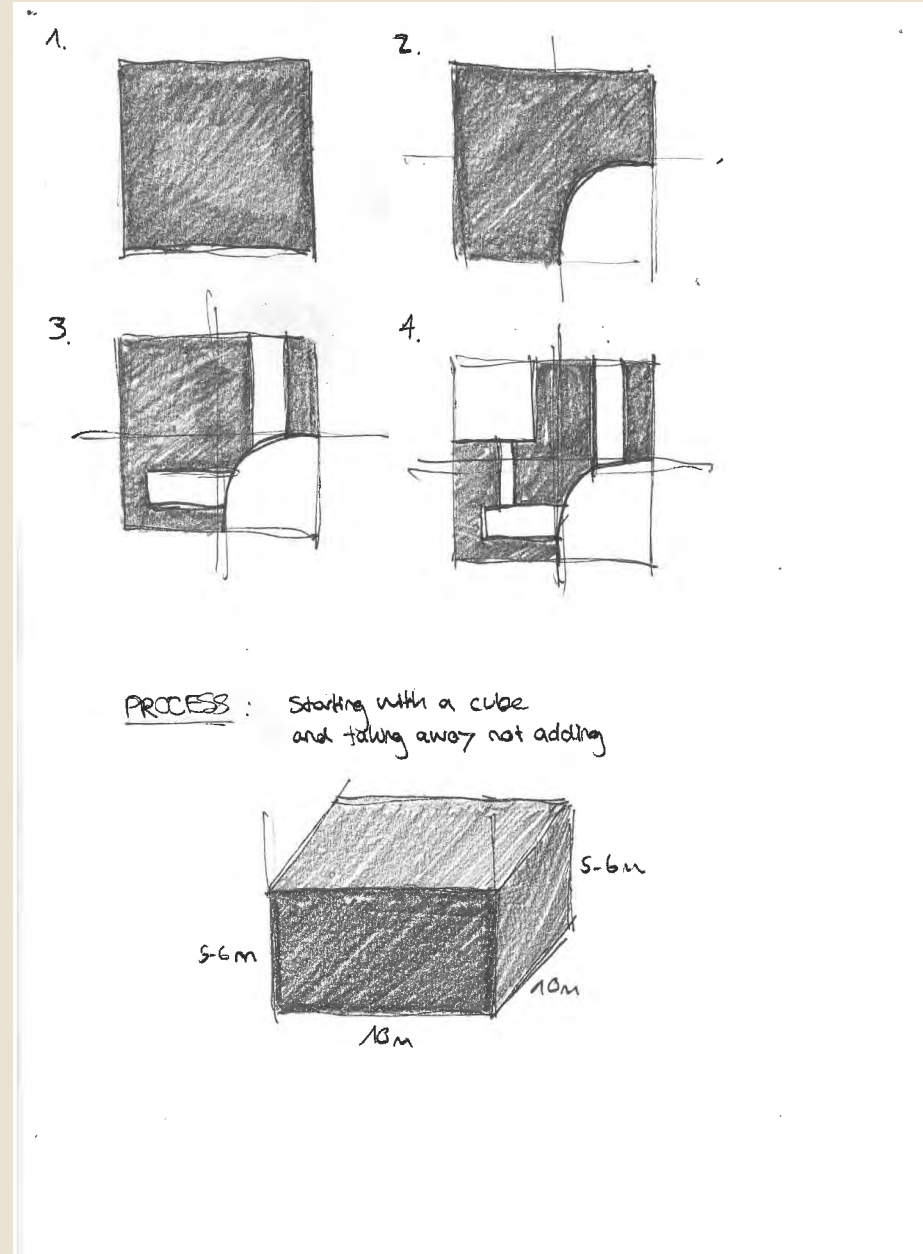
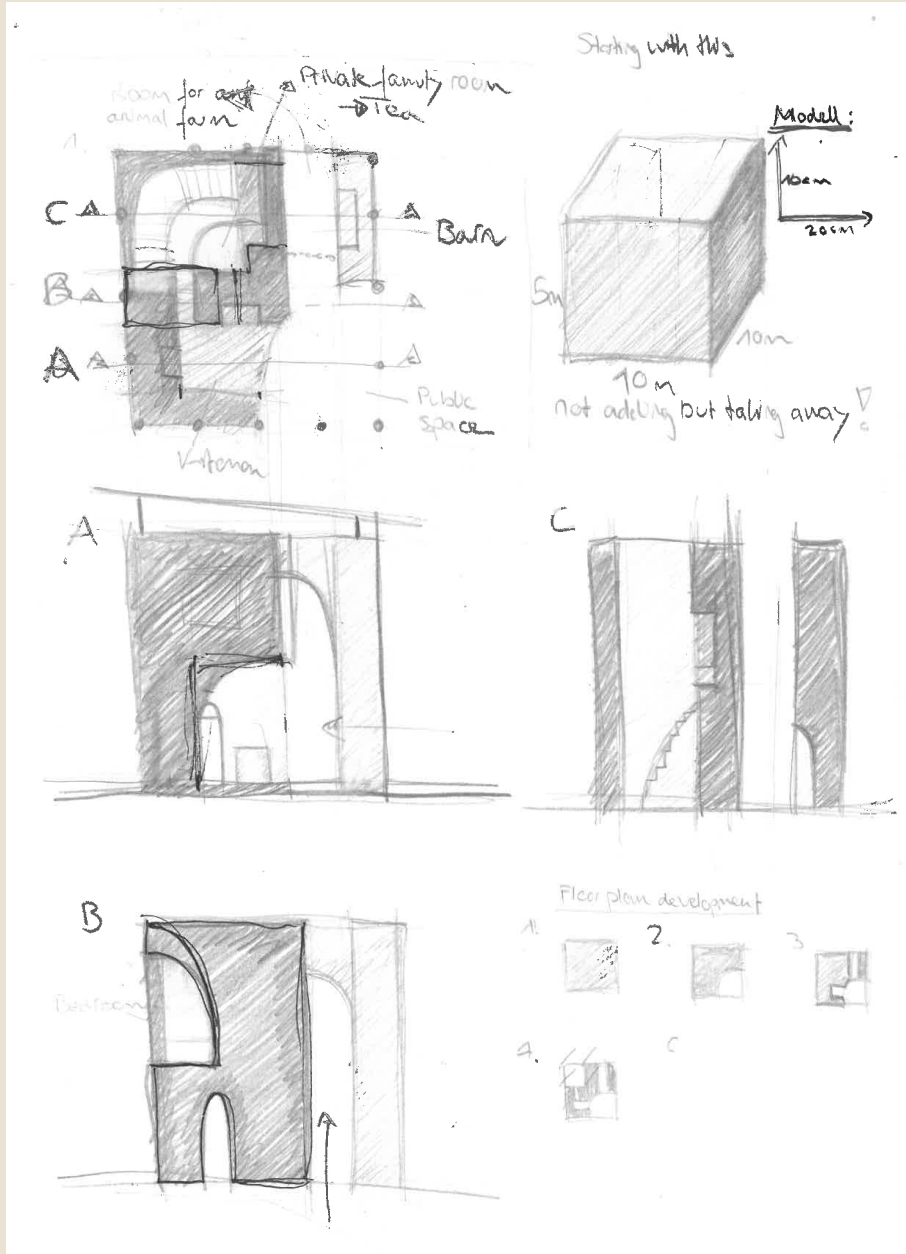
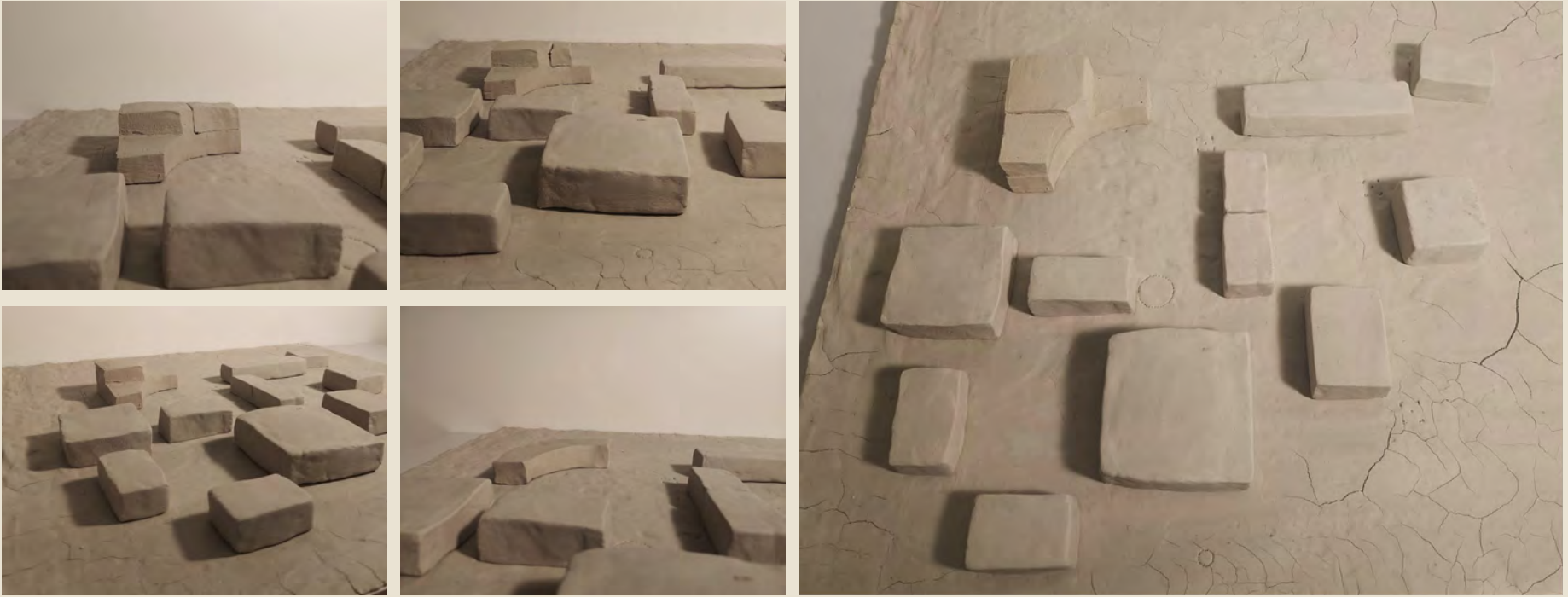


fig. 22-23 concept sketches



*fig. 24-28 trying out different typologies*

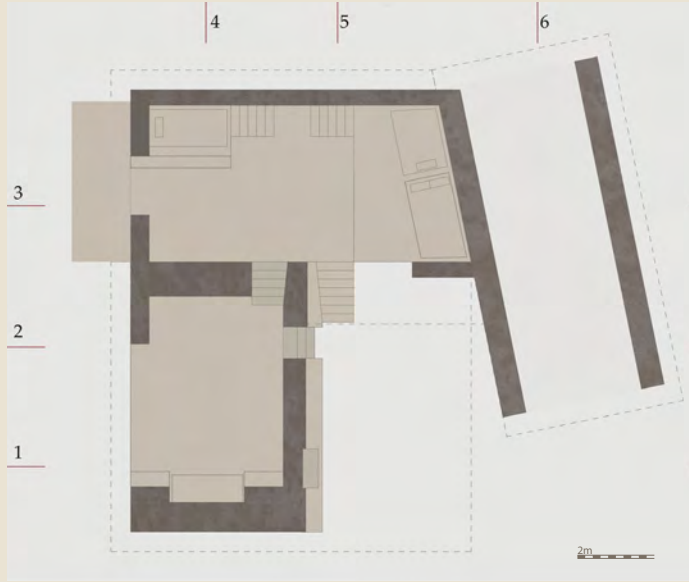


fig. 29 second floor

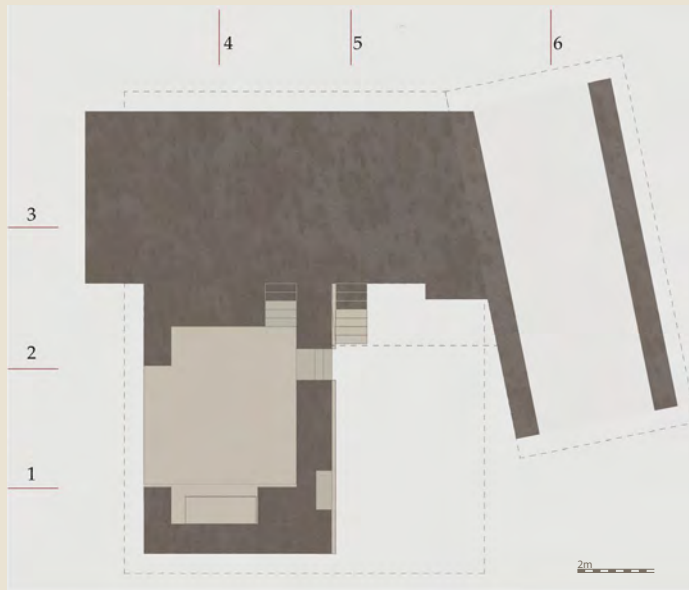


fig. 30 ground floor



fig. 31 situation



fig. 32 sections



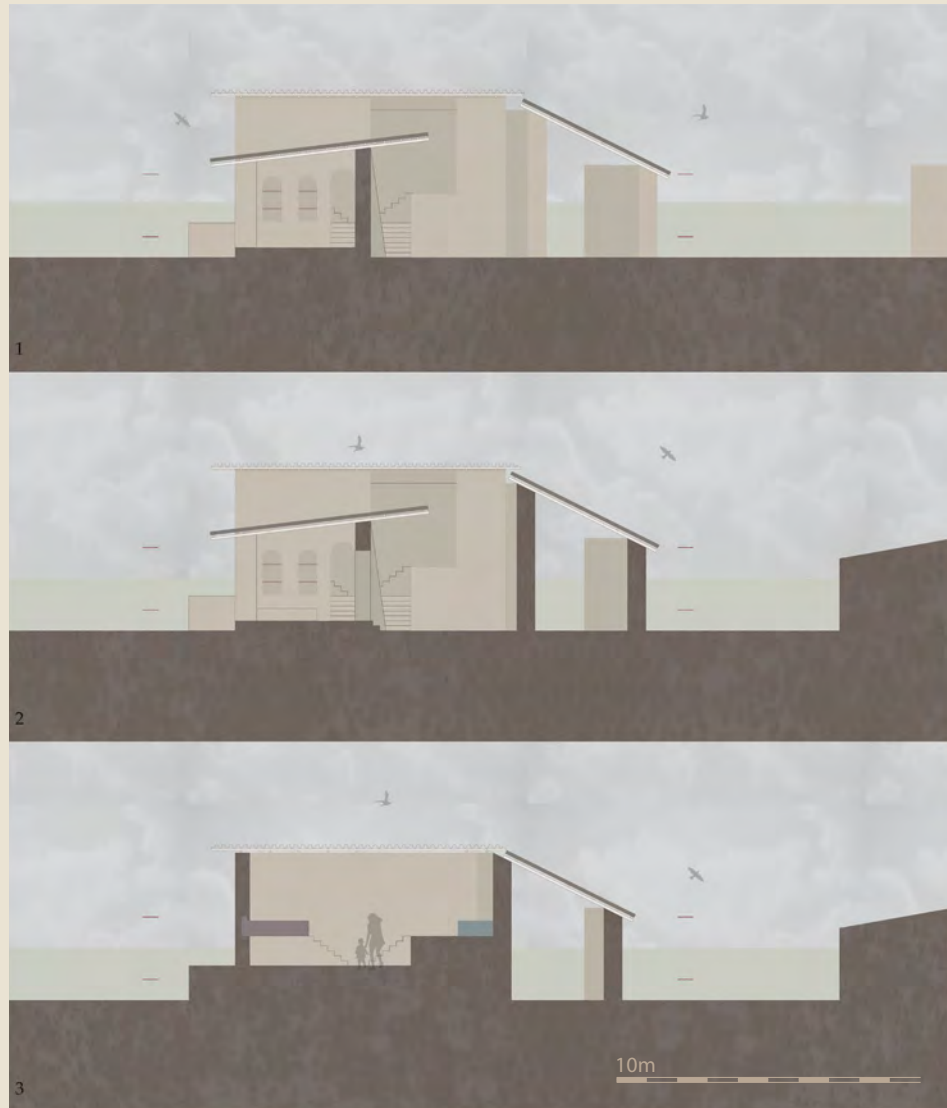
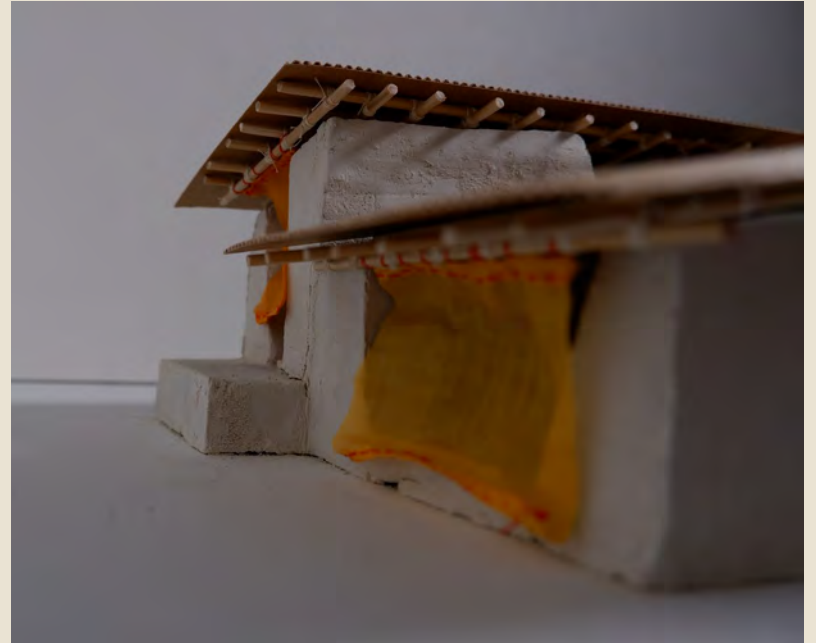


fig. 33 sections



*fig. 34-35 farmhouse model 1:50*



*fig. 36-37 farmhouse model 1:50*



fig. 38-39 situation model 1:200

## Construction

The farmhouse is built in COB. This is a mixture of mud and straw. The roof is constructed with bamboo and covered with tin. As this is easier to be maintained.

The foundation is done with the rat trap construction. This way of assembling the bricks uses only minimal material.

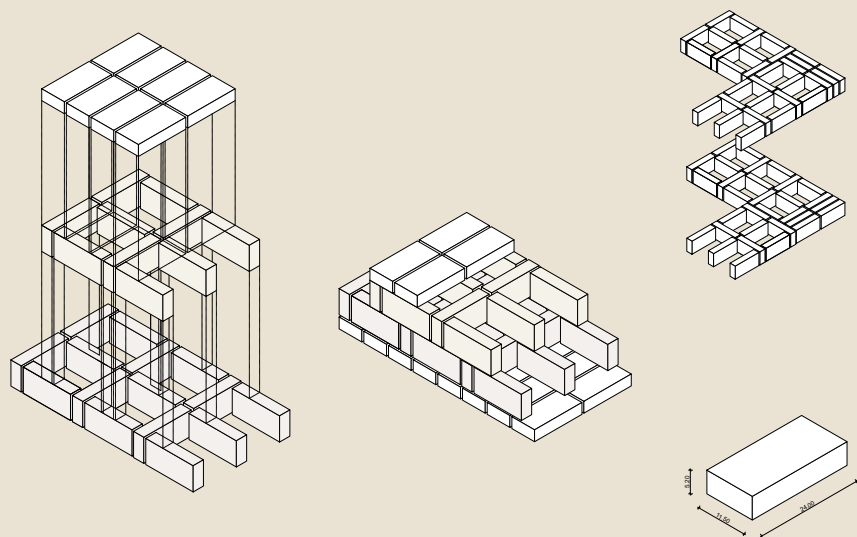


fig. 40 foundation

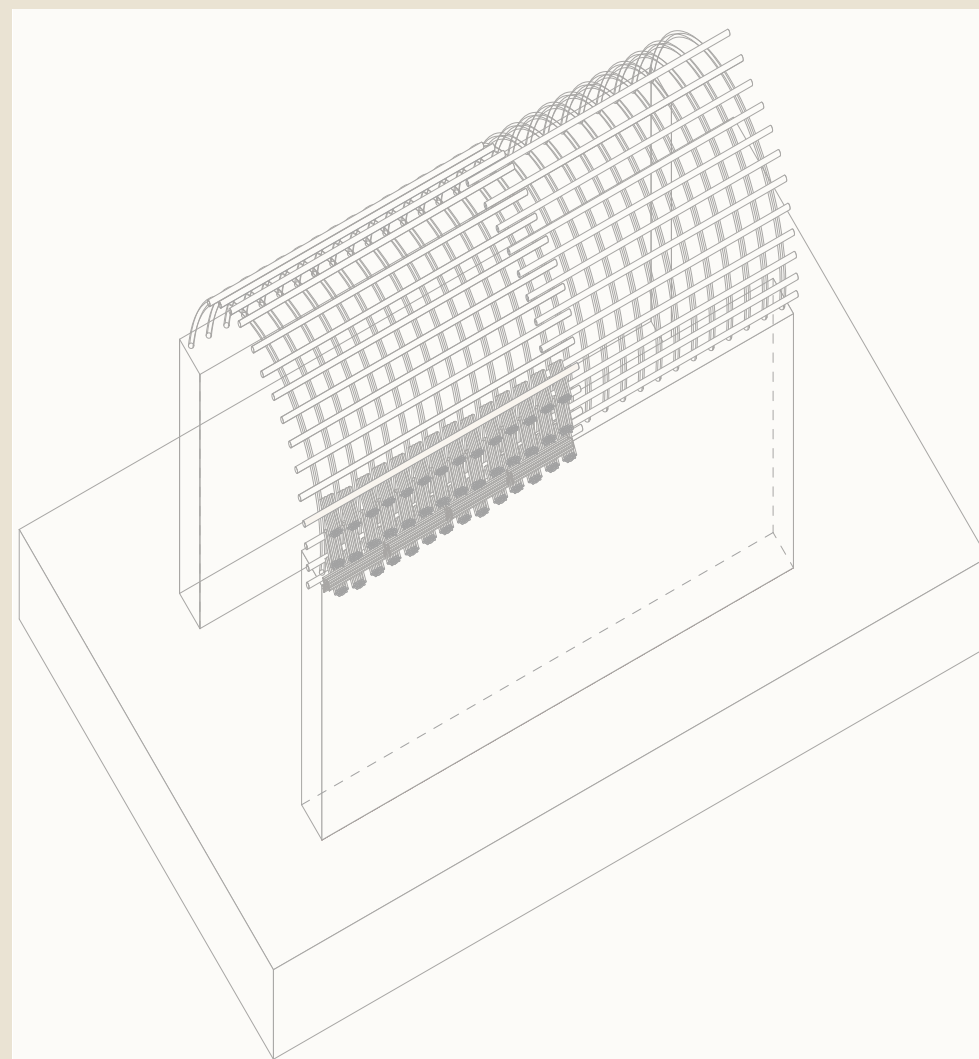


fig. 41 axonometry of the first stable construction

## Calculations

*How much land do we need?*

4 m<sup>2</sup> per plant  
after the 5<sup>th</sup> year about 2 poles to harvest<sup>1</sup>  
=> 2m<sup>2</sup> per pole

Poles needed farm house:	41
Poles needed temple:	27
Total:	68 poles

Land needed:  $68 \times 2 = \underline{136\text{m}^2}$

*Proportions land : house*

every 20(-30) years the bamboo has to be replaced  
=> 20 families can share the same land

ca. 70 poles per year  
=> 140 m<sup>2</sup> needed

$140/20 = \underline{7\text{m}^2}$  bamboo grove per house

*Costs farm house*

**Bamboo**  
380 Tk = 4.40 USD/pole<sup>2</sup>  
 $41 \times 4.40 = \underline{180.40 \text{ USD}}$

**Rope**  
1kg = 200Tk = 2.32 USD<sup>2</sup>  
3m of rope per knot  
 $21\text{kg} \times 2.32 = \underline{48.70 \text{ USD}}$

**Tin sheet**  
1m<sup>2</sup> = 440Tk = 5.10 USD<sup>2</sup>  
 $100\text{m}^2 \times 5.10 = \underline{510 \text{ USD}}$

**Mud**  
1m<sup>3</sup> = 560 Tk = 6.45 USD<sup>2</sup>  
 $175.8\text{m}^3 \times 6.45 = \underline{1133.90 \text{ USD}}$

**Ring beam**  
1 pack (50kg = 26.5l) = 500 Tk = 5.75 USD<sup>2</sup>  
barn 0.932 m<sup>3</sup> = 932l  
 $(932/26.5) \times 5.75 = \underline{202.20 \text{ USD}}$

Total costs farm house: 2075.2 USD

<sup>1</sup> <https://www.agrifarming.in/> (2022).

<sup>2</sup> Haselsberger (2022).

3 Temple

## Temple „create, preserve, destroy“

In a second step, we designed a Kali temple for the Rudrapur community. We started with the same idea we had for the farmhouse. We took a volume and subtracted masses.

During this process, we figured out that we wanted to tell a story while people walk through the temple. We then decided that we could take the idea of taking away a step further and take away that much that we get columns.

Those columns have different sizes and through the placement of the columns, we created different spaces.

In Hinduism, there are three stages. They are: create, preserve and destroy. Following them, we wanted to design three rooms. One for each of the stages.

The first room is the create room. The columns have big masses and it's the entrance of the temple. It gives space and resources to create things. In the evening the sun shines directly into this room.

The second room is dedicated to preservation. This room is smaller and more closed. It's an introverted room that should protect the existing things.

The third room then opens up in comparison to the first two rooms. There are bigger openings and it's dedicated to Kali the goddess of destruction. When entering the room you go up a step which means you are even closer to the god.

This room is facing the east. This means in the morning when the sun rises you can see it from that room. The sun symbolizes the cycle. Because in Hindu culture destruction is something good as it also gets rid of bad things and if you destroy things there is space for new things to come.

Through the spaces between the columns, you can always see the landscape around the temple. And if you leave the temple you are in front of the pond.

The temple creates rooms but at the same time, you are still outside. You can only go through between the columns in the entrance and the last room.

Through the increase of height and the narrowness, tension is built up walking through the temple which is then relieved in the last room.

Niches in the columns can be created and covered up again in whatever way the people would like to have them. The niches can not only be done on the inside but the outside of the temple as well.

The columns themselves create bigger niches where people can meet outside the temple and hang out.

The columns and the floors are completely made out of mud. They create a reference to nature which is a very important feature in the Hindu religion.

The water flows off the roof of the temple in two directions. If it's raining heavily you have to enter the temple through a water curtain. This means that you and your soul get cleaned while entering the temple. As the water in Hindu culture is the source of life as well as there to clean the soul.





fig. 42-49 first quick ideas



fig. 50 facades 1:100

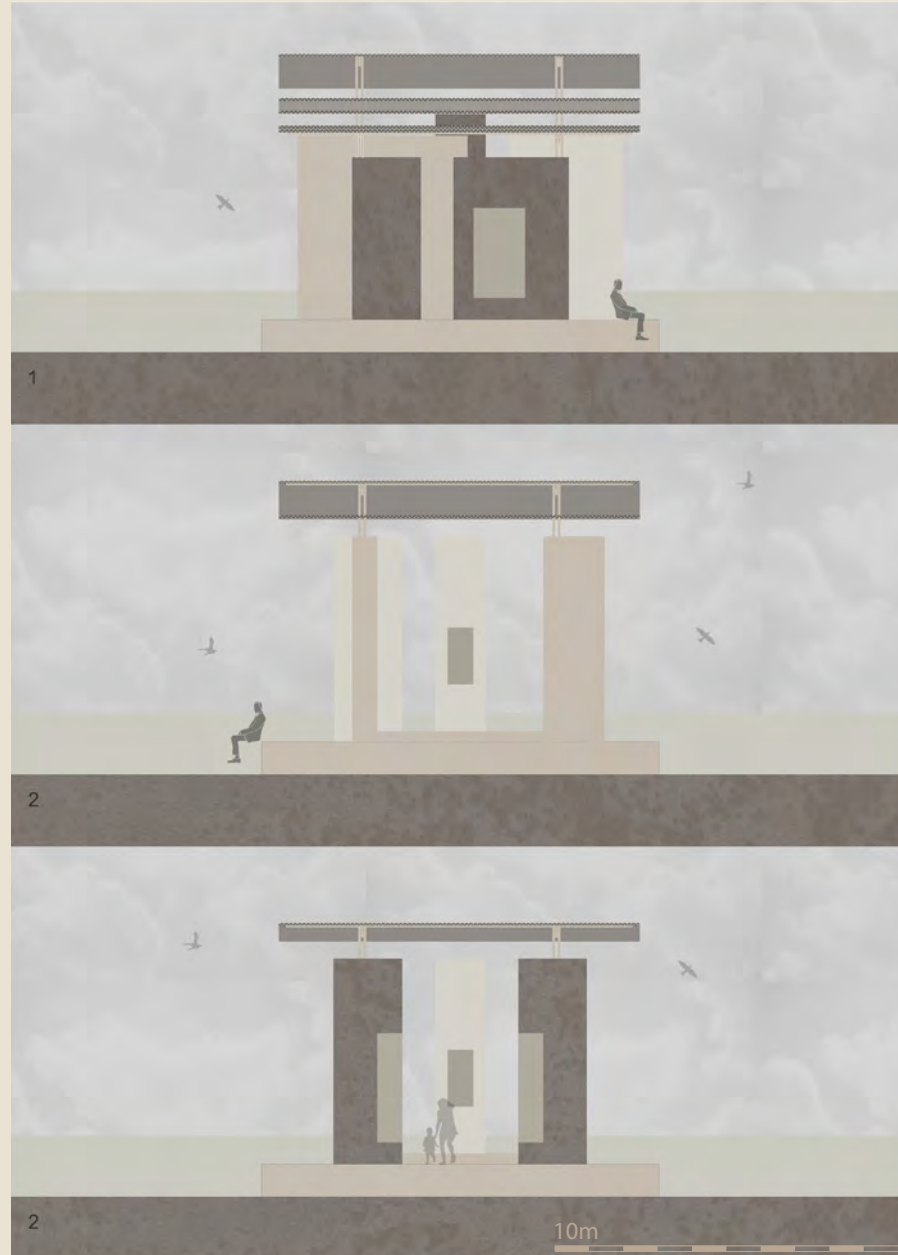


fig. 51 section 1:100

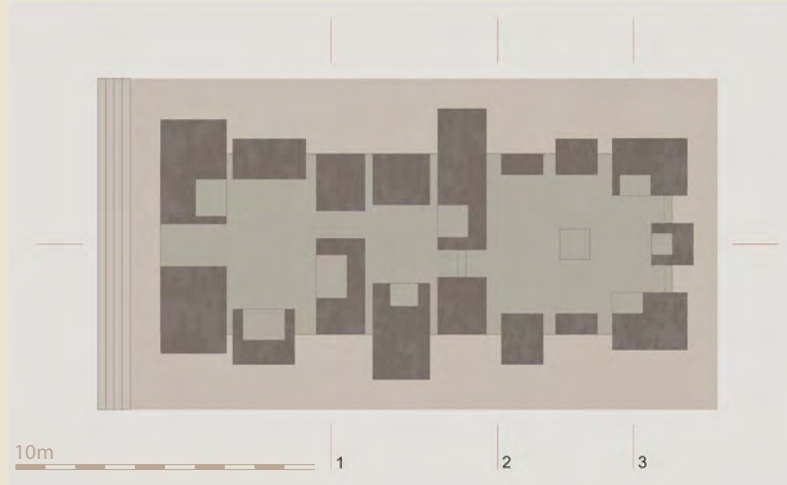


fig. 52 floor plan



fig. 53 situation

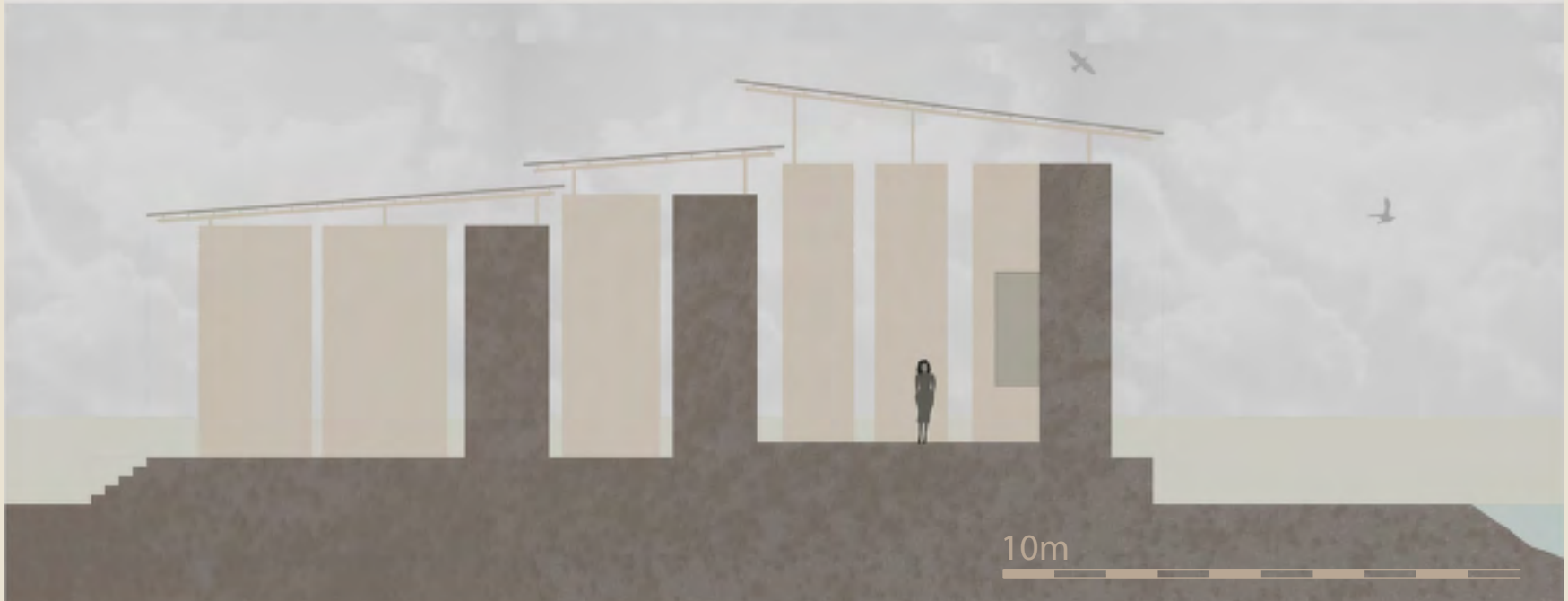


fig. 54 section

## Construction

The columns are completely built out of mud. The roof is a bamboo construction covered with a tin roof. The goal was to show that a temple can also be special and be different from the residential houses without being built in a “special” material like bricks.

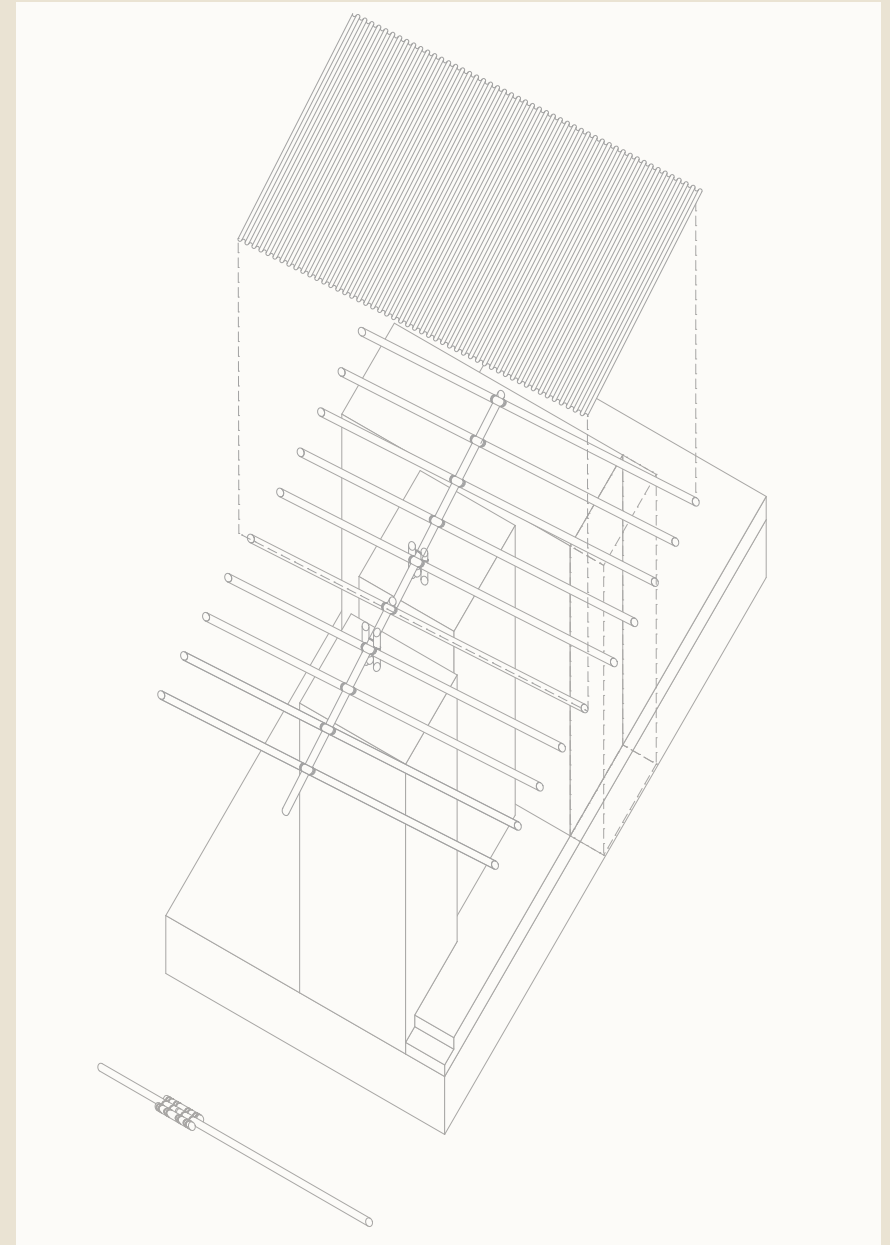
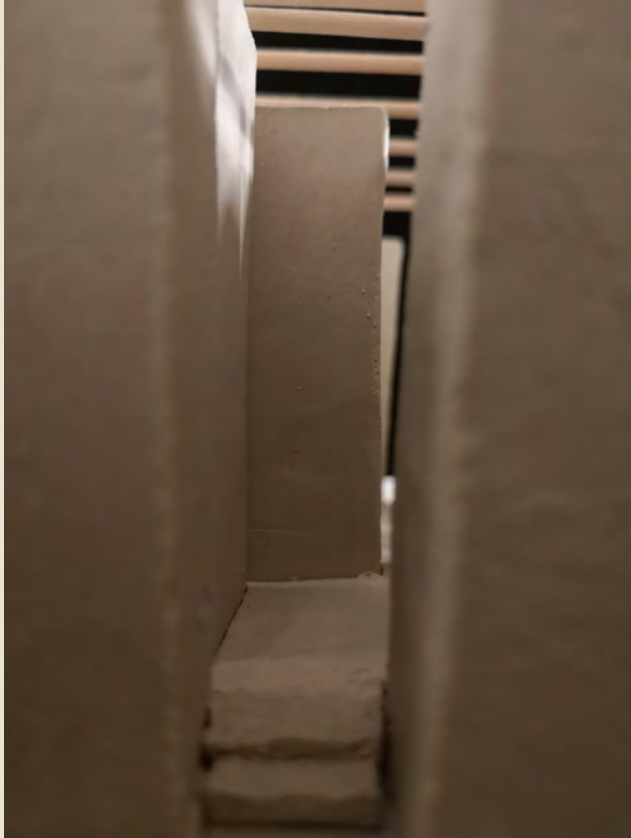


fig. 55 axonometry of the construction



*fig. 56-58 model 1:50*



*fig. 59-61 model 1:50*



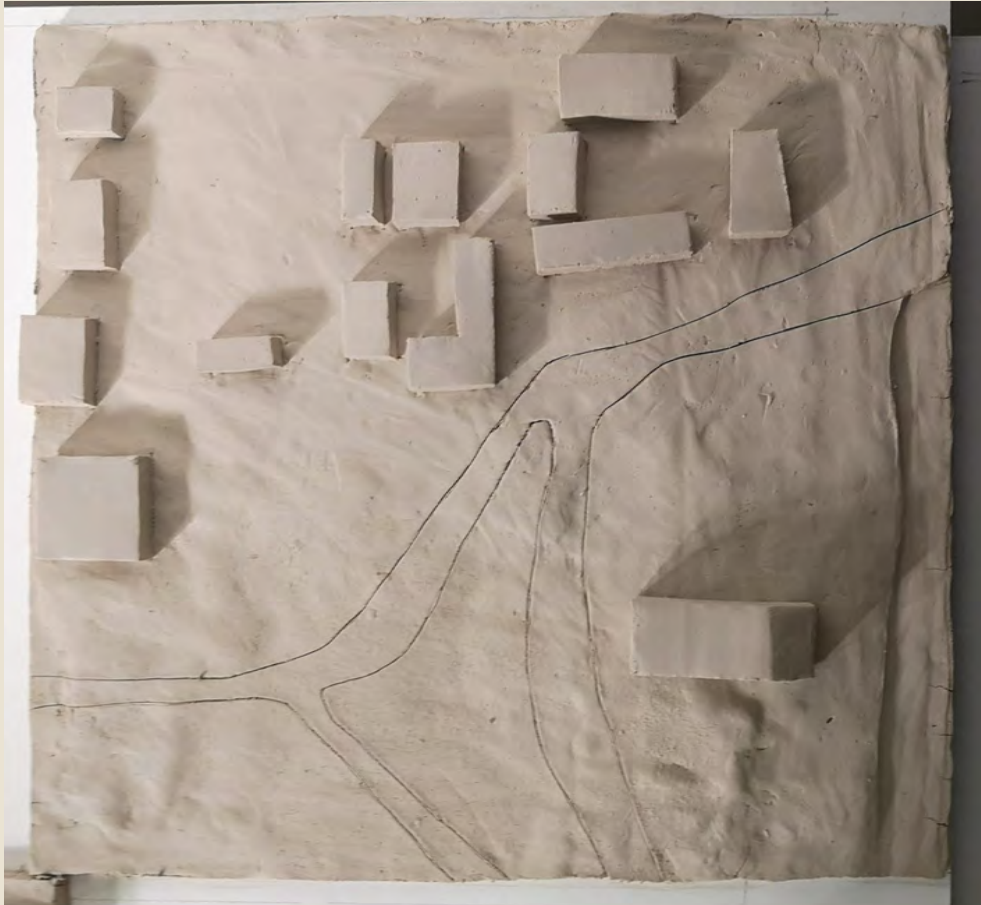


fig. 62-64 situation model 1:200

## Calculations

*Costs temple*

### Bamboo

380 Tk = 4.40 USD/pole<sup>1</sup>

27\*4.40= 118.80 USD

### Rope

1kg = 200Tk<sup>1</sup> = 2.32 USD

3m of rope per knot

17.4kg\*2.32= 40.35 USD

### Tin sheet

1m<sup>2</sup> = 440Tk<sup>1</sup> = 5.10 USD

Tempel: 215m<sup>2</sup>\*5.10 = 1096 USD

### Mud

1m<sup>3</sup> = 560 Tk<sup>1</sup> = 6.45 USD

100m<sup>3</sup>\* 6.45 = 645 USD

Total costs tempel: 1900.15 USD

<sup>1</sup> Haselsberger (2022).

4 Refugee camp

## Bhasan char description

Bhasan Char is an island in the Gulf of Bengal. It's a silt island that first occurred in 2005. The island has grown since then but it also changed its shape a lot. Bhasan Char is vulnerable as it's where Cyclones hit land for the first time as well as it's in danger because of the rising sea level.

There are not many safe places to go and if the weather is bad the island is cut off from the mainland. Most planes can't land on the island and the ship takes three to five hours to get to the island.<sup>1</sup>

The government of Bangladesh wants to relocate about 100'000 Rohingya refugees from Cox's Bazar on the mainland to Bhasan Char island as land is very rare in Bangladesh. At the moment there have been about 26'000 refugees relocated to Bhasan Char.<sup>2</sup>

About 1400 houses have been built. All in the same style. On every twelve houses, there is one higher building which is the cyclone shelter. Around the settlement, a protection wall has been put up. There is also a hospital and a police station.

The Bangladeshi government says that they only relocate people that want to do so. But some people on Bhasan Char say that they did not want to go or that they were promised other things.

The refugees say that the houses are better on Bhasan Char but they say that there is a food shortage and they have problems with the health center.

*"Warehousing refugees on Bhasan Char has created systems of dependency on external support. While an agreement between the UNHCR and the government of Bangladesh in October 2021 opens the door to humanitarian assistance on the island, serious concerns remain as the deal offers no guarantee that Rohingya will be permitted to move freely to the mainland or engage in economic activities on Bhasan Char or contribute to the economy of Bangladesh."*<sup>3</sup>



fig. 65 air view Bhasan Char at the moment

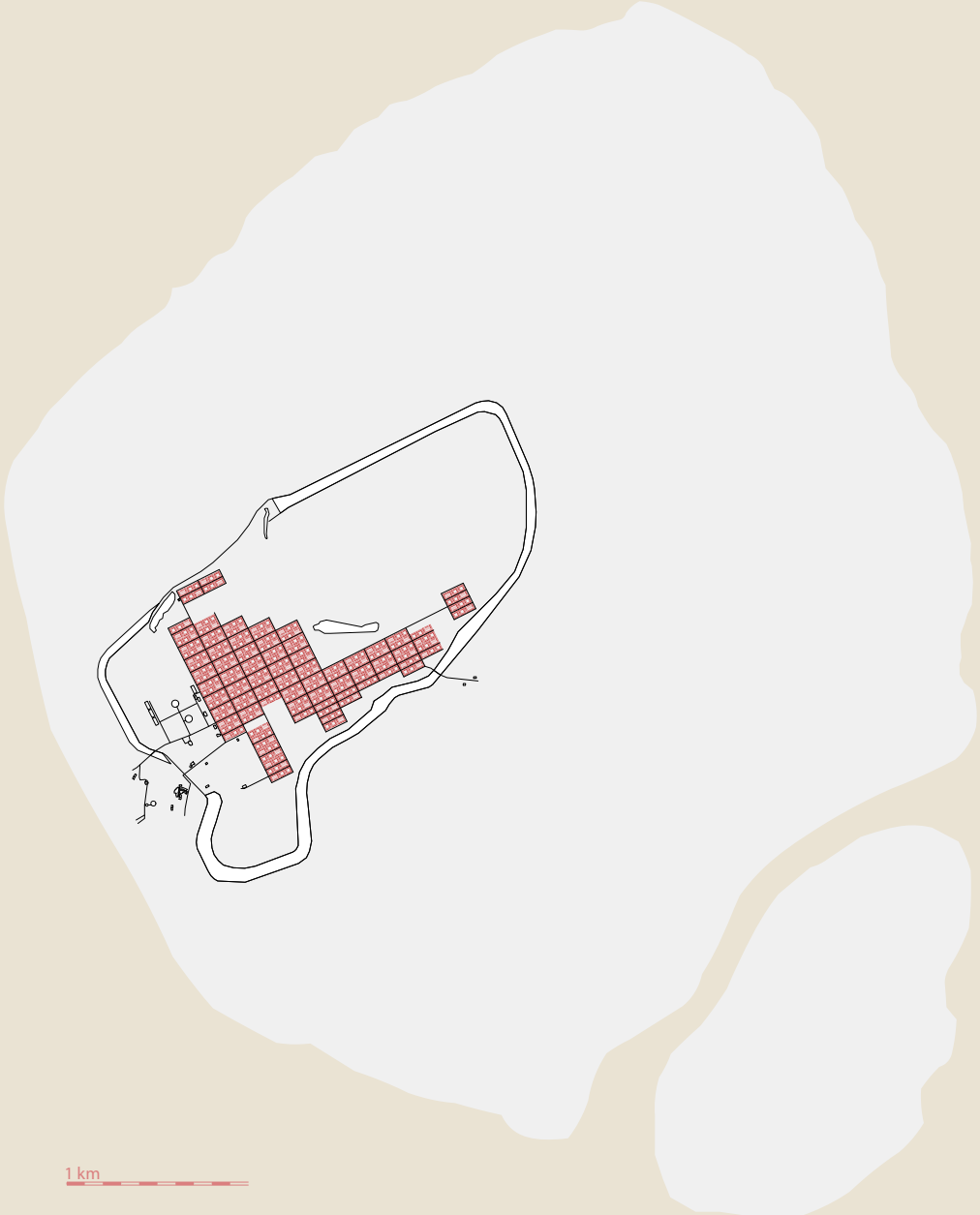


fig. 66 Bhasan Char at the moment

<sup>1</sup> Human Rights Watch (2021).

<sup>2</sup> UNHCR (2022).

<sup>3</sup> Nguyen, Lewis (2022, para. 9).



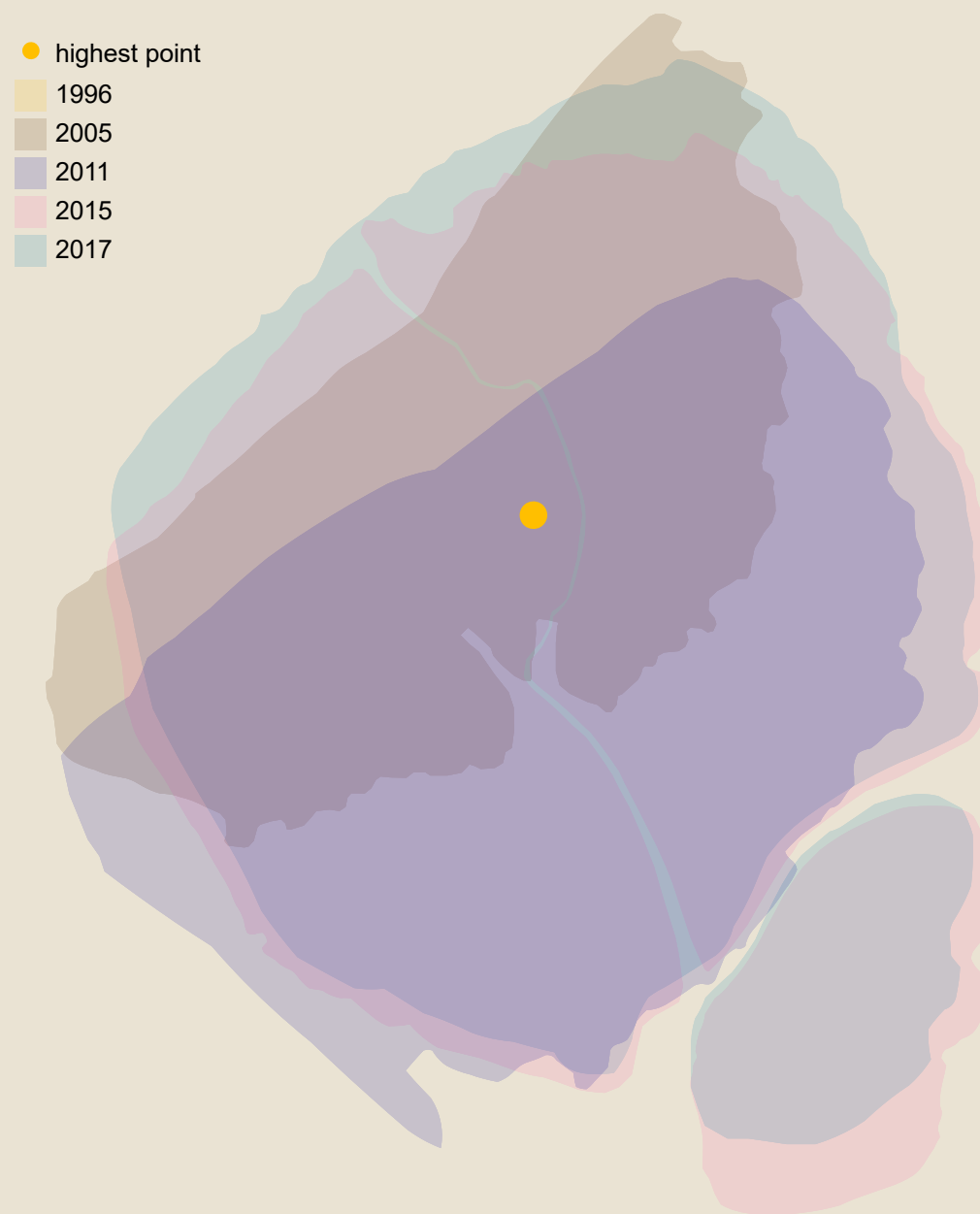
1 km

fig. 67 Bhasan Char existing structure

## Soil on Bhasan Char

The Bhasan Char island consists mostly of silt. Silt is eroded stone in this case from the Himalayas. The size of the granules is between sand and clay. As silt tends to be compressed easily heavy vehicles shouldn't drive over fields. Silt is fertile but the quality of the soil can be improved with compost. Often some nutrients have to be added in order to make the silt ground more fertile as pure silt ground is not that fertile. Cabbage vegetables, berry bushes, cucumbers, and fruit trees are all plants that grow well in silt soil. But in general, many plants can grow on silt soil.

To gain more land in the 1960s the Bangladeshi government built cross dams. The silt then stayed there and started building up new land called "Char". After about 10 years it was possible to build first infrastructure on the Chars. Later the people were able to move there.<sup>1</sup>



<sup>1</sup> Wheeler, Gravgard (2009)

fig. 68 change of the Bhasan Char island since the formation

## Rohingya refugees

The Rohingyas are Muslims who lived in the west of Myanmar. Because of their religion, they have been discriminated and excluded. The government of Myanmar doesn't see the Rohingya as their people. That's why Rohingya people have no citizenship.<sup>1</sup> In 2017 the situation in Myanmar escalated and the Rohingyas had to flee from their home. Since 2017 around 800'000 refugees have arrived in Bangladesh. To be more precise in Cox's Bazar.<sup>2</sup>

The government of Bangladesh is hoping that the Rohingyas will go back to Myanmar. Which is at the moment very unrealistic. The Bangladeshi government tolerates the refugees but tries really hard that the Bangladeshis and the Rohingyas don't mix. They are only allowed in their camps, they are not allowed to work and for NGOs it's prohibited to set up schools.

In 2018 the government started the relocating project to Bhasan Char.<sup>3</sup> They built an enormous amount of infrastructure and started to relocate a part of the refugees.

The government of Bangladesh likes to show off this project to demonstrate how generous they were and how good they look after the refugees. At the same time, a lot of NGOs criticize this project as it resembles a prison very much. The island is very young and it is exposed to many natural hazards.

### Demographic

Most of the refugees came in family sizes of 4-5 people. But there are also quite a lot of refugees coming in smaller groups/alone. There are about 3% of unaccompanied children and about 16% of the families are lead by a single parent which is usually the mother.<sup>2</sup>

**4.7** is the average family size of the total registered population.

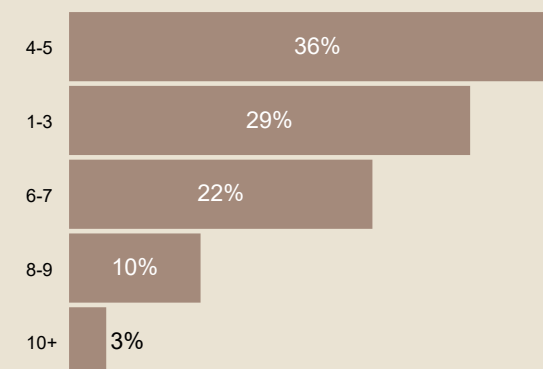


fig. 69 Family size breakdown<sup>2</sup>

<sup>1</sup> Sudheer, Banerjee (2021, p. 2)

<sup>2</sup> UNHCR (2022)

<sup>3</sup> Islam, Islam, Alam, Hussain, Haque (2021)

## Bhasan Char urban qualities

The Bhasan Char island lacks a lot of urban qualities at the moment. Everything is very monotonous and there is not much space to unfold your individuality. Everything has been planned into a very strong grid. But the problem of Bhasan Char is not only how the buildings were built. It has also a lack of perspectives. On the island at the moment there is not really a way how the people can make money or interact with the people on the mainland. As the island is only accessible by a three-hour boat ride at the moment the Bhasan Char island is very much like a prison.<sup>1</sup> For the Rohingyas there is no way to leave the island or physically interact with people on the mainland.

With our design we want to give the refugees a space to unfold themselves and a space that they can identify themselves with. It should be a place that's worth living in, a space that's related to their culture and pride.

We decided to reduce the number of inhabitants from the originally planned 100'000 to 50'000. This gives more space to the individual not only for living but also for agriculture.

We want to give the island a new structure. The new structure consists out of several settlements in which different housing types addressing different needs can be found. Between the houses, there are courtyards for private as well as common use. There are community centers where people can meet.

Each of the settlements is specialized in a certain area due to their location e.g. fishing, agriculture, or fabric production. But this doesn't mean that you can only be a farmer if you live in the farmer's village and the other way around. The idea is to create a circular economy where the Rohingyas can trade and earn money.

Through this perspectives for personal as well as social life are formed.

<sup>1</sup>Human rights watch (2021).



## Urban qualities<sup>1</sup> now

### Centrality

Logistic centrality: very low, as the island is quite remote and there is no regular boat connection to the island

Functional centrality: there is only a very minimal amount of infrastructure, therefore this quality is also low

Symbolic centrality: the island is well known, but mostly associated with a prison

### Diversity

Diversity of use:

The existing structure is very monotonous and is only to live in. There are other buildings with other functions e.g. cyclone shelters or hospital

Social diversity: As the people living on the island are all Rohingya refugees they share the same religion and culture. The only diversity that exists is in age and gender. This results in a lack of a diverse social structure and increases the risk of ghettoization.

Diversity of property: All the houses have been built by the Bangladeshi government and are still owned by the government. This means there is no diversity in properties.

### Interaction

Social denseness: The social denseness is very high as the island is very crowded. The streets are the only common spaces.

Intensity of interaction: Depends a lot on the people and how they interact. But there are barely any spaces where people can meet and interact.

Length of interaction: Also this varies a lot. But it will probably only happen in a smaller circle. Because as mentioned before there is no structure which is made to meet people.

### Accessibility

Porosity: the porosity is low as the building structure is very dense and rigid.

Regulation: This is quite high as the access to the island is very controlled. The same applies to the shelter buildings.

Contextuality: The structure doesn't refer to the surroundings and also inside the structure there are not really links between the parts.

### Adaptability

New use: As the buildings are simple it's possible to use them for something different than housing.

New meaning: To give a new meaning to this place is really hard. The structure gives this prison-like feeling which is hard to get rid of and create something positive out of it.

Physical adaptability: The existing structure is very dense and built out of concrete. Without any destruction it will be very hard to adapt.

<sup>1</sup> Kretz, Kueng (2016).

**Appropriation**

Openness to different uses: The buildings are made to live in, but they are fairly simple which would make it possible to use the houses differently.

Configurability: This quality is very low, as the uniformal built structures as well as the fact that several families share a house don't really allow individual changes.

Symbolic openness: There is a constricting and restricting atmosphere because of the rigid concrete structure.

## Urban qualities<sup>1</sup> future

### Centrality

**Logistic centrality:** Even though Bhasan Char is still a remote island, we want to build up logistic centrality by setting up an economy and improving the existing port so that trade with the mainland is easy.

**Functional centrality:** Through building up basic infrastructure in the settlements and on the island all needs can be covered within walking distance.

**Symbolic centrality:** We aim to provide a good life quality that is associated with a new start and a perspective for the future. Through this, we hope to change the negative connotation of Bhasan Char to a positive one.

### Diversity

**Diversity of use:** It's our goal to create a diverse structure in which people, work, sleep and come together. Therefore there are some workshops integrated into the houses and there are a lot of common spaces.

**Social diversity:** In the first years social diversity probably won't change much. But the hope would be that some Bangladeshi or other people of different origins would move there because they think it's a liveable place.

**Diversity of property:** The diversity of property will increase a lot as every family will build their own house.

### Interaction

**Social denseness:** By reducing the planned number of inhabitants as well as making the protected space bigger the denseness will decrease. At the same time, we are creating places where people can meet, but we also create private spaces.

**Intensity of interaction:** By creating common spaces where people can meet and share their interests the intensity of interaction increases.

**Length of interaction:** Creating public spaces where people can spend time increases not only the intensity but also the length of interaction.

### Accessibility

**Porosity:** Porosity will increase by letting the settlements grow more organically.

**Regulation:** By creating smaller settlements where people know each other regulation by police can be reduced and will probably be replaced by social control.

**Contextuality:** The new structure takes into consideration the existing structure of the island. Also, the new structure gives space to create connections between (the different parts of) the settlements.

### Adaptability

**New use:** Everyone can decide how they want to use their house. With small changes, a house can be adapted to new use.

**New meaning:** By changing the houses also a new meaning can be given to the house.

<sup>1</sup> Kretz, Kueng (2016).

Physical adaptability: The new buildings are built in mud and bamboo which makes it easier to change them. The materials can even be reused.

### **Appropriation**

Openness to different uses: There will be different structures that can be adapted by the people.

Configurability: The common spaces, as well as the houses, are built by the people living there and using them. This means it's always possible to adapt them and this could already happen while building.

Symbolic openness: The new more organic structure will be the new home and have a strong identity.

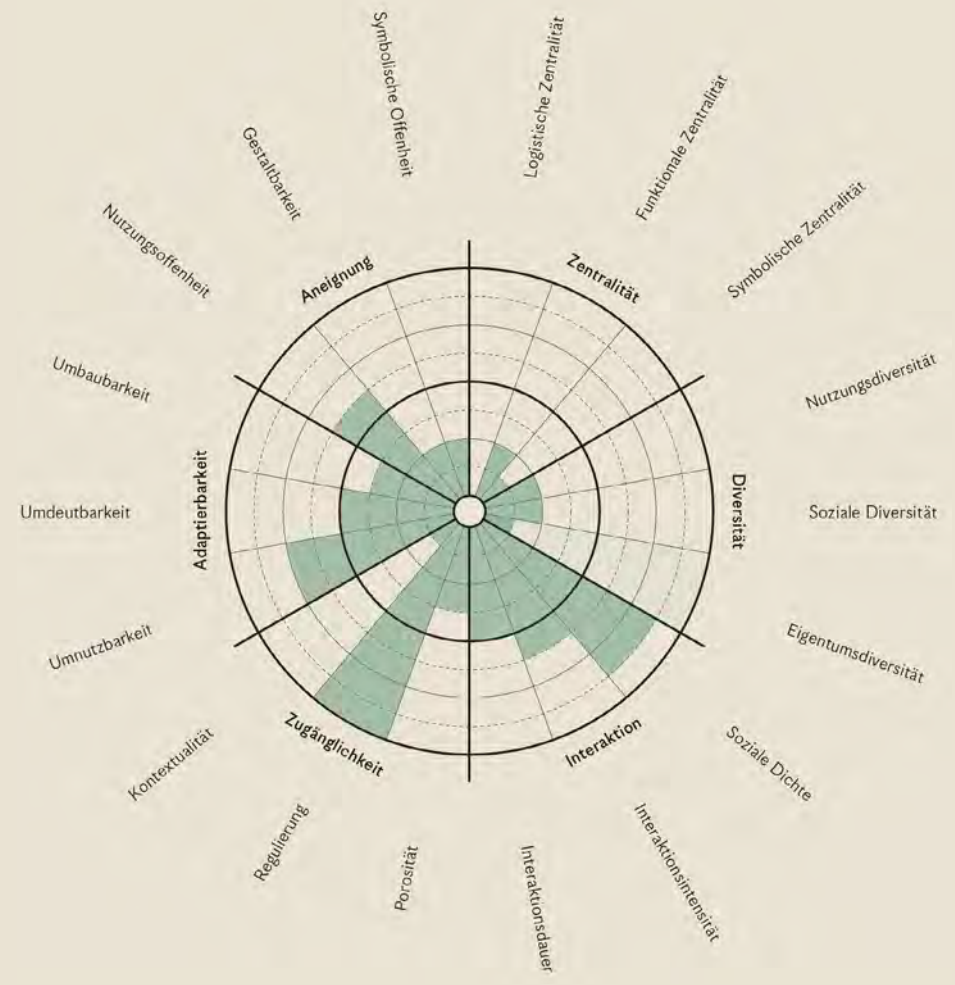


fig. 70 urban profile at the moment

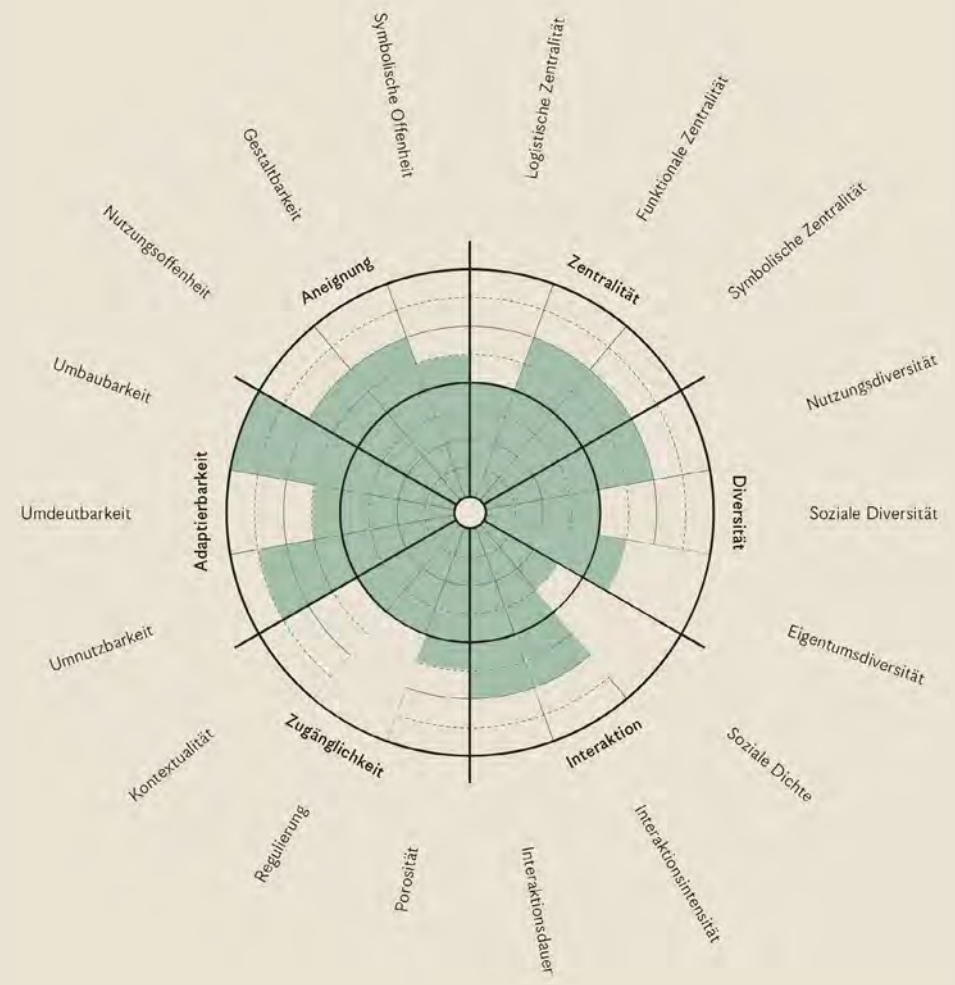


fig. 71 urban profile after our intervention

## Process of development of Bhasan Char

In order to bring the island from its current state to the one we have planned, we have planned a process that involves the current residents.

We think that only if the people who are supposed to live there are involved in the process of reorganizing the island it's possible to create a place where they want to live.

We decided to see the change of the island as a process as there are already about half of the people that should live there in the end living on the island.

### The process

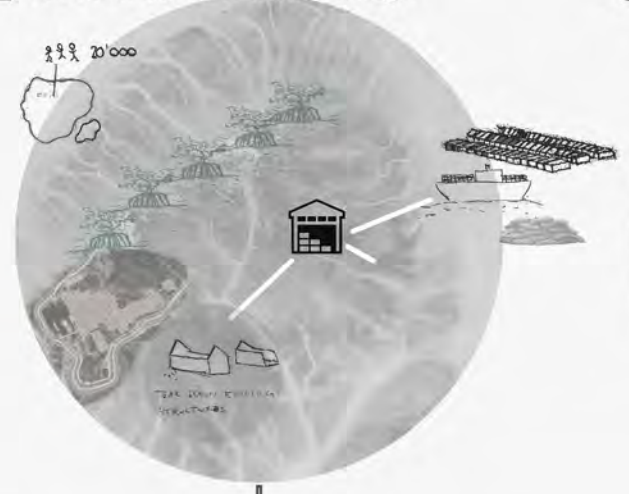
- 1. Situation**  
Situation at the moment: 20'000 refugees live on the island, there is no work, they live in the brick houses
- 2. Protect**  
Starting to grow more mangroves to better protect the island & to have material to build with
- 3. Production**  
Production of adobe bricks on the mainland (in the Kutupalong refugee camp as well as in other places that also the Bangladeshi can profit). Bamboo has to be planted on the mainland as well.
- 4. Supply**  
Ship the adobe bricks and bamboo to Bhasan Char
- 5. Material storage**  
Start building up a material storage => adobe bricks, sandbags, bamboo
- 6. Build**  
The refugees on Bhasan Char build their own new settlement (like this people identify themselves stronger with the place)
- 7. Resettle**  
Refugees move into the new settlement
- 8. Work**  
Refugees start working as fishers, tailors, etc. => some as construction workers to build other settlements
- 9. Production sites**  
Following that people start working. Fields and meadows will emerge as well as workshops in the villages where they can produce fabrics.
- 10. Earning money**  
Ideally, the people on the island can trade with the mainland => earn money
- 11. Recycle**  
Old structures can be torn down => this material can then be used for roads, to extend the protection walls and the bricks that aren't broken can be used for the foundation.
- 12. Grow**  
More refugees move to Bhasan Char
- 13. Independence**  
In the most ideal scenario, Bhasan Char becomes a "Rohingya country" that functions as autonomously as possible.  
=> maybe even an own currency could be introduced

**1 import, mangroves growing**



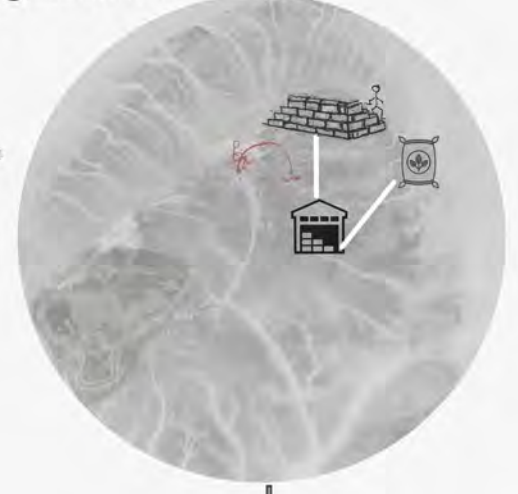
1 half year

**2 deconstructon and storage**



2. half year

**3 farmer`s settlement**



3. half year

**4 producing goods and export**



4. half year

**5 own currency, center**



5. half year

**6 Old camp is replaced**



6. half year

fig. 72 planned steps to change Bhasan Char

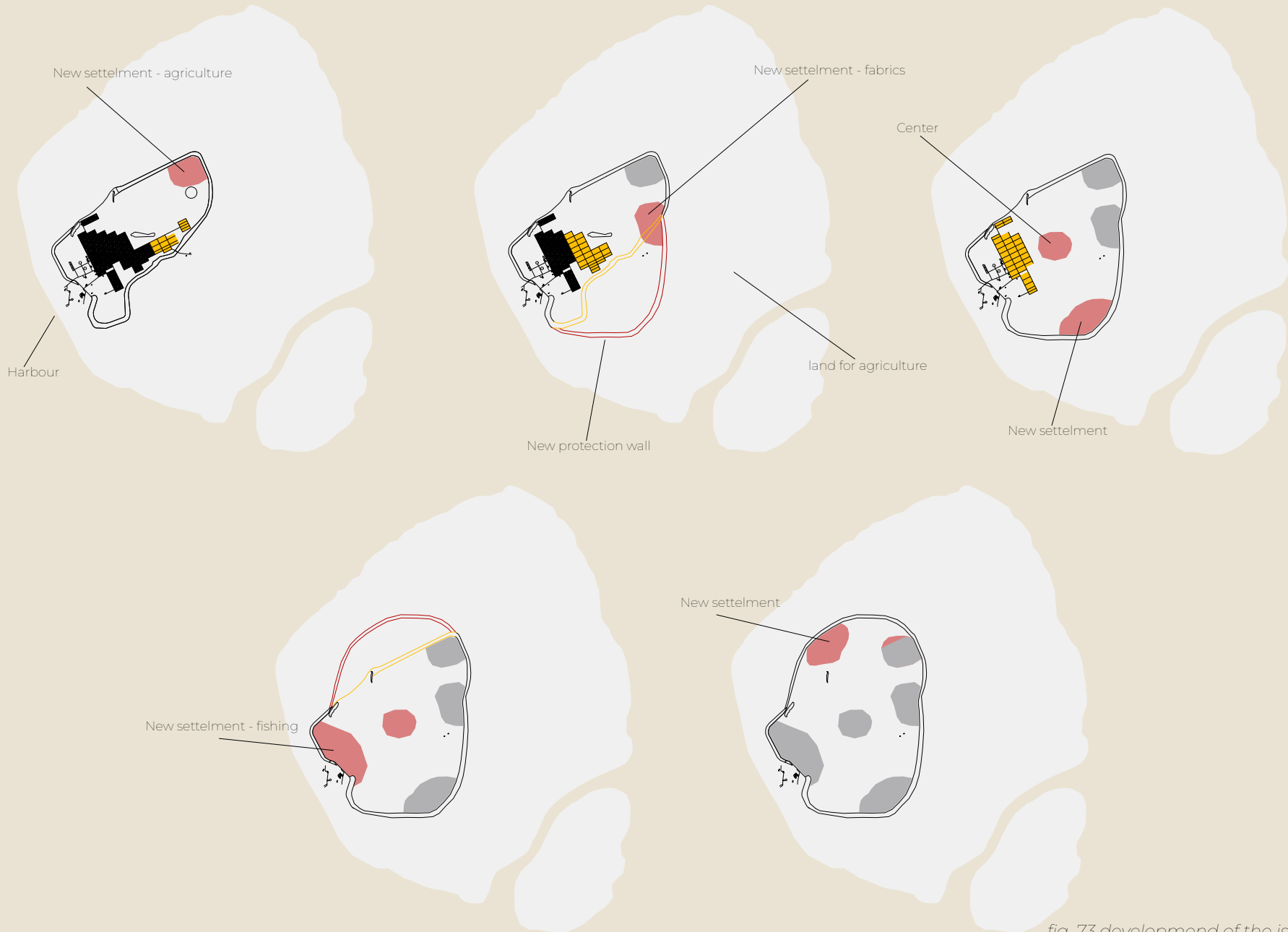
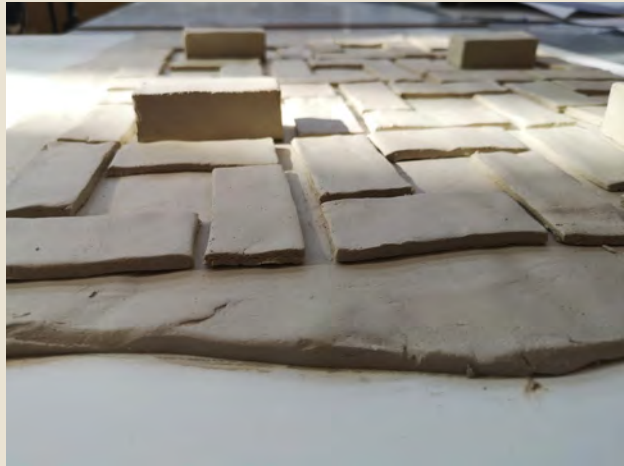


fig. 73 developmend of the island





*fig. 74-76 model 1:500 existing structure*



*fig. 77-79 model 1:500 trying out new structures*



fig. 80-82 Claystorming to find new structures



fig. 83-84 Claystorming to find new structures



*fig. 85 model 1:500 final structure of the settlement*



*fig. 89 model 1:500 final structure of the settlement*

## Re-building Bhasan Char

We see the change from the current Bhasan Char to the future one as a process. The current buildings are deconstructed in several steps while new settlements are built.

The old structure is going to be deconstructed carefully so that most of the materials can be reused. Especially the tin roof and some parts of the concrete bricks can be used again when building up the new settlements. Everything that can't be reused will be used to extend the protection wall or to make streets.

The new houses will be built in adobe bricks. Bamboo will be used for the roof ect. The bricks are produced on the mainland. In the Kutupalong refugee camp as well as in other places in Bangladesh.

Like this refugees can work but also some Bangladeshis get work and can profit from the adobe brick production. The bamboo also needs to be imported from the mainland, as Bamboo won't grow on the island, because of the salt water in the ground.

To protect the island from natural forces mangroves are planted around the island. They protect from erosion but also break big waves. The mangroves can only be used to construct smaller things that aren't loadbearing.

The new Bhasan Char island is organized in several smaller settlements. Each of the settlements is specialized in one field for example agriculture, fishing or textiles. A farmer doesn't need to live in the agriculture settlement. It's also possible for him just to go there to work or the other way around. This also gives the possibility that a woman can leave the village she lives in and go to her workplace in another settlement to do for example some stitching or sewing.

Some of the houses have integrated workshops which can be used as working places.

In the middle of the island, there is the center, where the material storage for building materials is. But there is also the big market and other central functions like the hospital.

Around the settlements there are smaller fields that can be planted by the families and there are also some free fields that can be used for play or whatever is necessary.

Inside the protection wall, there are also some bigger fields for agriculture. But most of them are outside the walls.

Just outside the walls, there are fields for the animals.

A bit further out there are the fields and then there are some bushes to protect the fields. After the bushes, there is another bit of land until the mangroves start.

- Fields
- Free space for recovery
- bushes
- Family fields/bigger gardens
- Meadows
- Mangroves
- Landscape
- Dune
- Protective wall

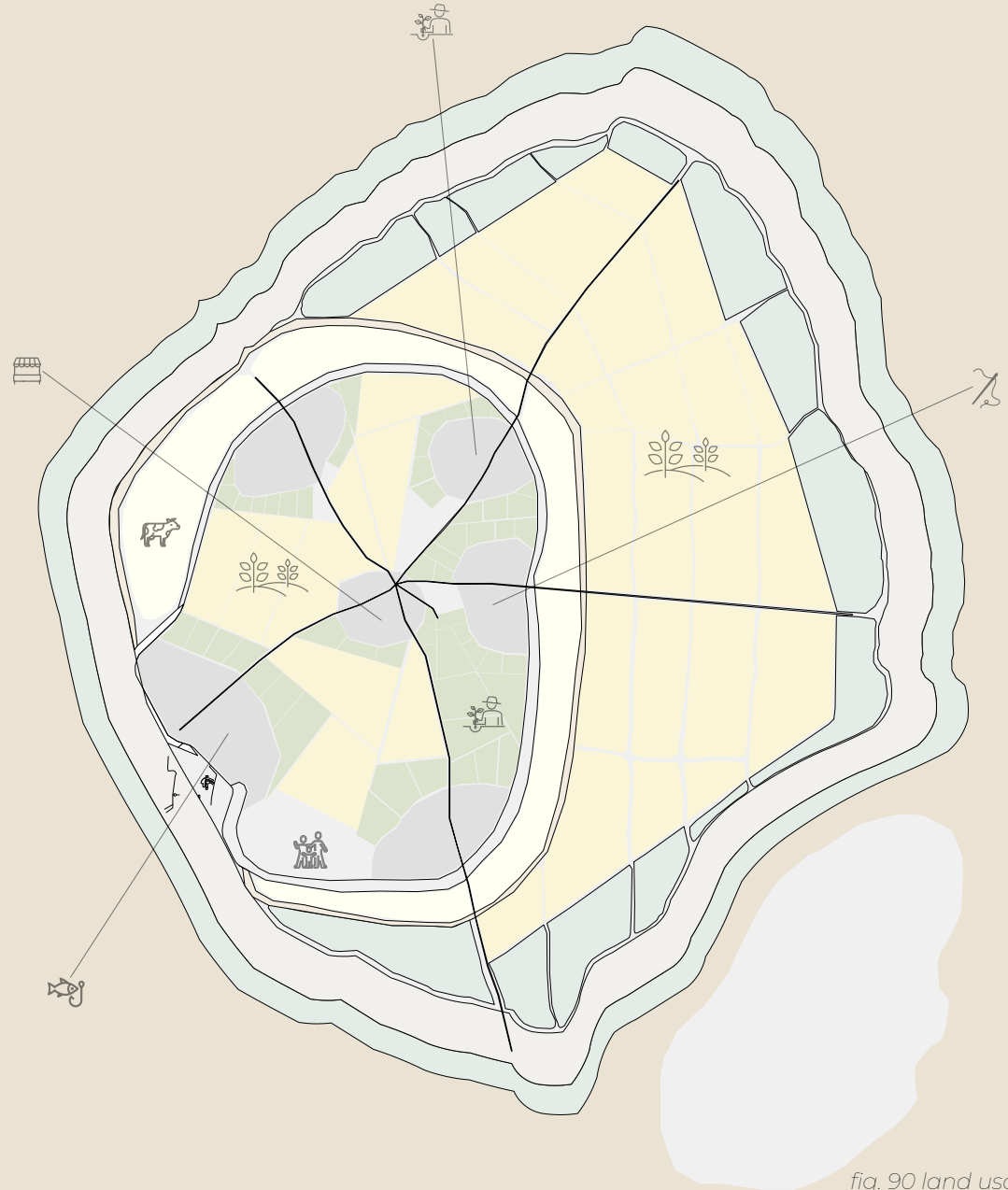


fig. 90 land usage on Bhasan Char



## Infrastructure per person<sup>1</sup>

Mosque:	one per village => 10'000 people + one in centre => several smaller places to pray e.g. in community centers
Hospital	one for all
Health center	one per settlement ca. 10'000 people
Houses (covered space)	10 Sqm per person
Toilets	one per family (min. 6m max. 50m away from house)
Water tap	one per community (80 persons) (max. 200m away)
washing places/shower	50 persons
free space outdoors	20 sqm per person
tea stalls/community centers/ emergency rooms/stores	10 sqm per person
markets	one big in the center, 1(-2) market places per village => not every day
schools	per 5000 capita => three classrooms à 50 sqm

area island: 40 km<sup>2</sup> => land you can live on at the moment 7km<sup>2</sup> => will be bigger in the future

capacity island: 50'000 people

minimum 35sqm goal 45 sqm per person of land is needed in a camp (15 sqm for housing and garden, 30 sqm for paths, school, markets, administration, water stations etc.)

These are the guidelines given by UNHCR for refugee camps. We tried to follow them. On the following page, we illustrated how much infrastructure we have in our project.

<sup>1</sup> following the guidelines of UNHCR (2018).

# A neighbourhood of 250 people

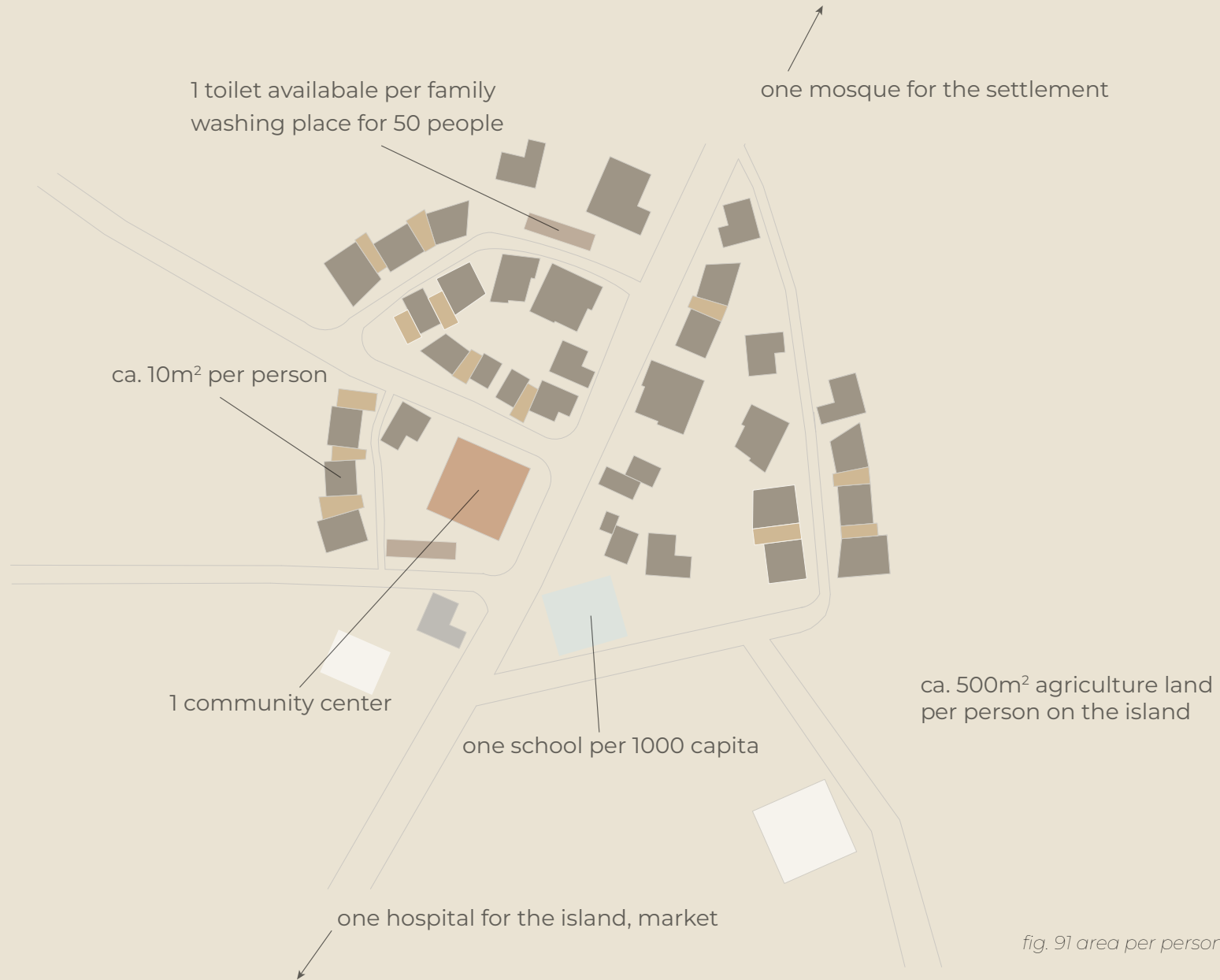


fig. 91 area per person

## Density and productive land

The population density in Bangladesh is 1265 people/km<sup>2</sup>.<sup>1</sup>

We planned a settlement on Bhasan Char for about 50'000 people. This would result in 1250 persons/km<sup>2</sup>. This means that the population density on Bhasan Char would be about the same as on mainland Bangladesh.

But in fact, the population density on the island is even higher, as it's only possible to live inside the protection wall. Which is only about 7.5km<sup>2</sup>. If we only calculate with this area the population density is 6666 people/km<sup>2</sup>.

This means inside the protection walls a total of 150m<sup>2</sup> is available per person. If we include the area outside the protection walls there are about 800 m<sup>2</sup> available per person.

From this number the area needed for public infrastructure and streets has to be subtracted.

Worldwide there are about 1,4 billion hectares of agricultural land which means that there is 2000m<sup>2</sup> of agricultural land available per person.<sup>2</sup>

It is possible to grow enough crops for one person for a year on 2000m<sup>2</sup>. You could even grow food for more than one person.

People in Bangladesh eat about 160-180 kg rice per capita per year.

3-6 tons of rice can be produced per hectare.<sup>3</sup>

If we say 25 km<sup>2</sup> could be used to plant rice on.

=> 25\*100 = 2500ha

=> 2500\*4.5t = 11250t rice per year

=> 11250/0.170 = 66'176

They could produce rice for about 66'176 people. But that would be if they only planted rice on the island and the people can't live from only eating rice.

If we say that the area needed to nourish a person for a year is about 1500m<sup>2</sup> on Bhasan Char about 16'500 people could be nourished.

In this calculation, the yields from fishing are not included.

This still means that people on Bhasan Char island will always be dependent on imports.

Depending on the point of view you look at this it's not too bad. If you think about Bhasan Char as a refugee camp then everything that has not to be imported is good.

Nevertheless, it would be interesting for them to focus on the production of special things that then can be sold quite expensive. In order to then have money to buy the food.

<sup>1</sup> <https://de.statista.com/> (2022).

<sup>2</sup> Kästner (2015).

<sup>3</sup> <https://wikifarmer.com/> (2022).

## Process of building new settlements

The new settlements should be built in several steps. These steps can be repeated until a whole settlement is built. To start a small group of refugees can go to the new settlement and start building their new home. More and more people can follow later.

### 1. streets

After deciding where people want to build. A street has to be built. The street can be used to bring the materials to the construction site.

### 2. common space/shelter

As a first building, a common space should be built. The common space is there to give shelter and a place to meet while building the other houses. Later on, it can be used as a place to gather, as a tea stall, or as anything else that serves the community.

### 3. houses

The first houses are being built next to the streets in order to guarantee good accessibility. The exact placement of the houses can be decided by the refugees. To a certain extent the people have to follow rules of what kind of buildings should be built.

### 4. school, mosque, marketplace

In order to answer all the needs and make sure that people can stay in the village, infrastructure has to be built, as soon as first people start to move there. The infrastructure would particularly be schools, a mosque, and a marketplace.

### 5. green spaces

While building the houses, spaces are left free to make gardens or have a place to play soccer.

### 6. next streets

To make the houses in the second and third row accessible more roads have to be built. Along these roads, new houses will be built.

### 7. common space

As more houses are built it's also necessary to have more common spaces. The common spaces will preferably be built along streets or in other central places.

### 8. houses, green spaces

In the following time, more and more people come to the settlement and build their new homes and green spaces.

To create the settlements those steps should be followed. How exactly houses will be positioned (and how they exactly look like) can be decided by the refugees.

There are certain rules that should be followed for example to cut the edges to provide more security as well as a bigger space to meet. The shared/common spaces should be allocated along the streets.

How many schools, mosques, ect are built is also given.



fig. 92 development of the settlement & section

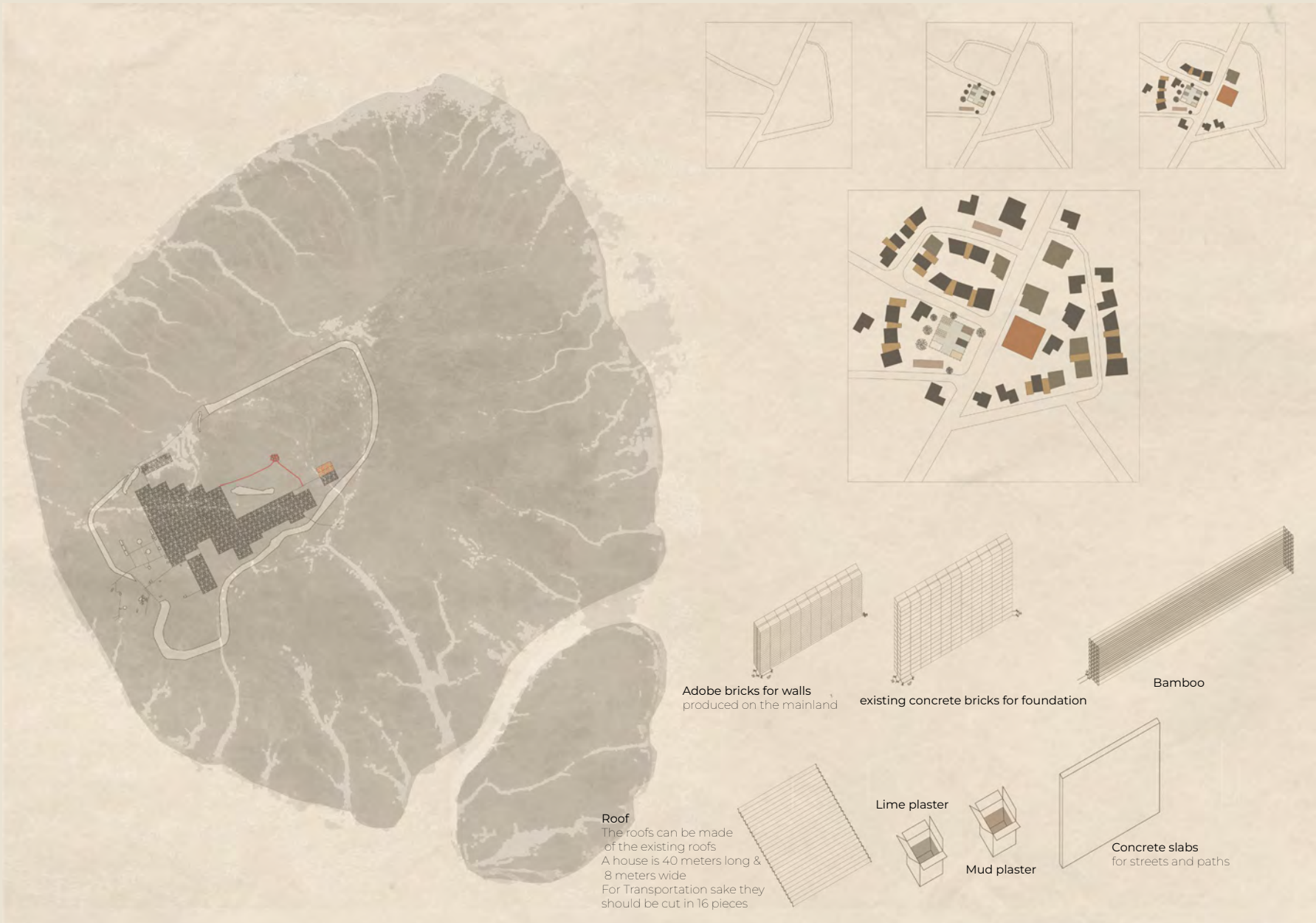


fig. 93 developmend of the storage and center of the island



fig. 94 Farmer Settlement

[Click](#) to see the video of the development of the settlement in Bhasan Char



*fig. 95 collage development of the settlement*



## Types of housing

To answer the different needs of the refugees we have come up with different housing types.

Those types have to be seen as a proposal made to the community. During the process, the houses can be changed and adapted to the individual needs of each person.

We came up with three forms of housing.

The first one is the multigeneration home. This house is a bit more independent. Besides the sleeping rooms, there is also a room that can be used as a workshop. This room could also be a working place for people not living in this house.

The second one is the multi-family home. In this home, about three smaller families can live. It would also be possible to join certain units together to have space for a big family.

The third form of living is thought for people who fled alone or as two. In this house, every (two) person has a room. They have their private space, but they share a kitchen in the covered outdoor area. Through this living together they get "a new family".

All the houses have some covered outdoor space. Most of the houses have two storeys in order to save space. This makes it also possible in case of flooding to go up and stay on the second floor.

Most of the stairs are located on the outside of the house. This gives them a social function, as this is a place where people can sit, meet and talk to each other.

On about every 250 inhabitants there is a community center which is usually used as a tea stall and gathering place. But they are also built in better structure and provide shelter when a cyclone hit the island.

In one settlement there are several schools that are accesible for everyone and there is also a mosque.

The houses are built close to each other. Like this, the space between the houses can easily be covered and be used as a kitchen and additional living space.

Some of the houses are built wall to wall like this less material is needed to build the houses.

When we designed the setting we were inspired by the temple. The columns we had in the temple were now the houses and through shifting them we wanted to create different spaces and play with narrowness and then opening up again.

The houses can be individualized by plastering them differently and adding some ornaments.

More variety is also added through the roofs that are inclined in different directions.

The fact that the houses are built in mud allows that the inhabitats change and adapt them to their needs over time. They can tear down walls and rebuild them in a different way with the same material.



fig. 96 floor plans of the different types of housing



fig. 97 zoom in floor plans of the different types of housing

## Construction

As stated before the houses are built in adobe bricks. The roofs are done in a bamboo construction covered with the tin roofs from the old buildings. These roofs allow the water can be collected and lead into a big canister.

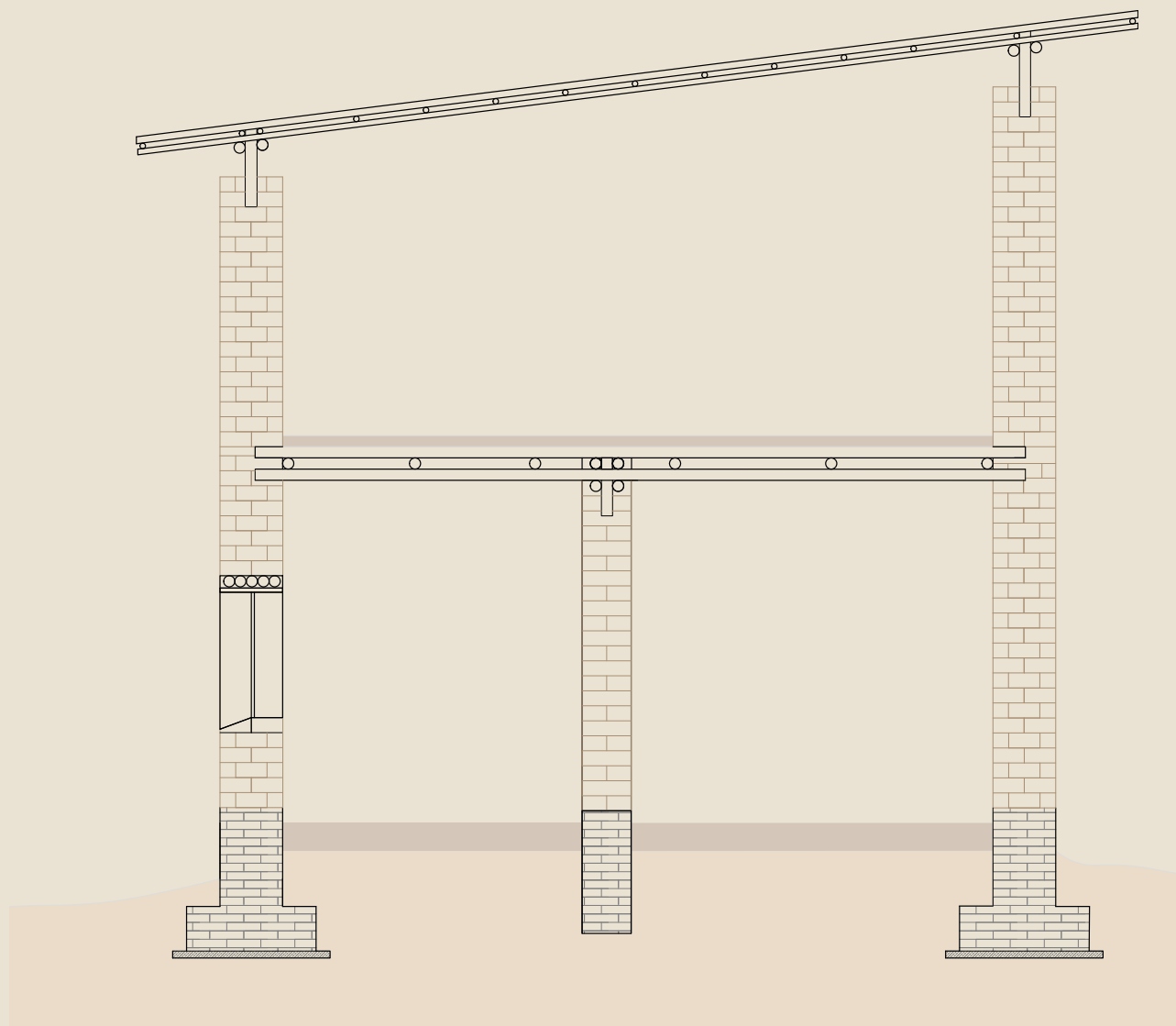


fig. 98 section of a typical house



*fig. 99-100 model new settlement 1:100*



*fig. 101-102 model new settlement 1:100*



*fig. 103-104 model new settlement 1:100*



fig. 105-106 collages of the settlement



# 5 Conclusion

## Conclusion

This semester was very diverse and inspiring. It gave me a new perspective on architecture. It's not the fancy materials or other things that make a building expensive that make a house special or liveable. It's more about the little details that are created. It's about the love that flows into a building. These little changes that can be made are what makes a building a lot more special. Be it just a small ornament that is drawn into the mud plaster.

During this semester we looked at a lot of different things.

Starting with the farmhouse where we created a house with a lot of qualities and some luxury on a small scale. But the house is still affordable for poor people as the material mud is almost free and there are only the people needed to build it.

In the design of the temple, we created out of the most basic materials and shapes a very special atmosphere that is very different from the "normal" houses.

And in the refugee camp Bhasan Char we thought about the basic needs of having a shelter and then what is needed additionally to that so people can create their future.

In all those three designs I realized that it's important to get away from thinking too much and just to feel what has qualities while claystorming and then do that. It's about the small details and the little imperfections that make it cozy.

For us, it was very difficult to design the houses and the temple for the people in Bangladesh as we don't know their culture at all and we haven't been there. So it can be questioned if the houses are designed for the people there. But I think this experience open my eyes to the fact that we need to talk to the users to find out what their needs are, even if we build in an environment that is familiar to us and you would think that you would know their needs.

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This paper has hitherto been neither submitted to an examining body in the same or similar form, nor published.

Vaduz, 14. June 2022

*[place and date]*

Lina Annika Boos

*[frist name and last name]*

A handwritten signature in black ink, appearing to read 'Lina Boos', written over a horizontal dotted line.

*Signature*

