

# CAY

# HILL

The possibilities of creating a synergy between an informal settlement,  
local craftsmanship and cultural economic opportunities on Sint Maarten  
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Danique Landburg  
Architectural Engineering - 2019 | 2020



Sint Maarten, the friendly island

**EVERY 6 YEARS**

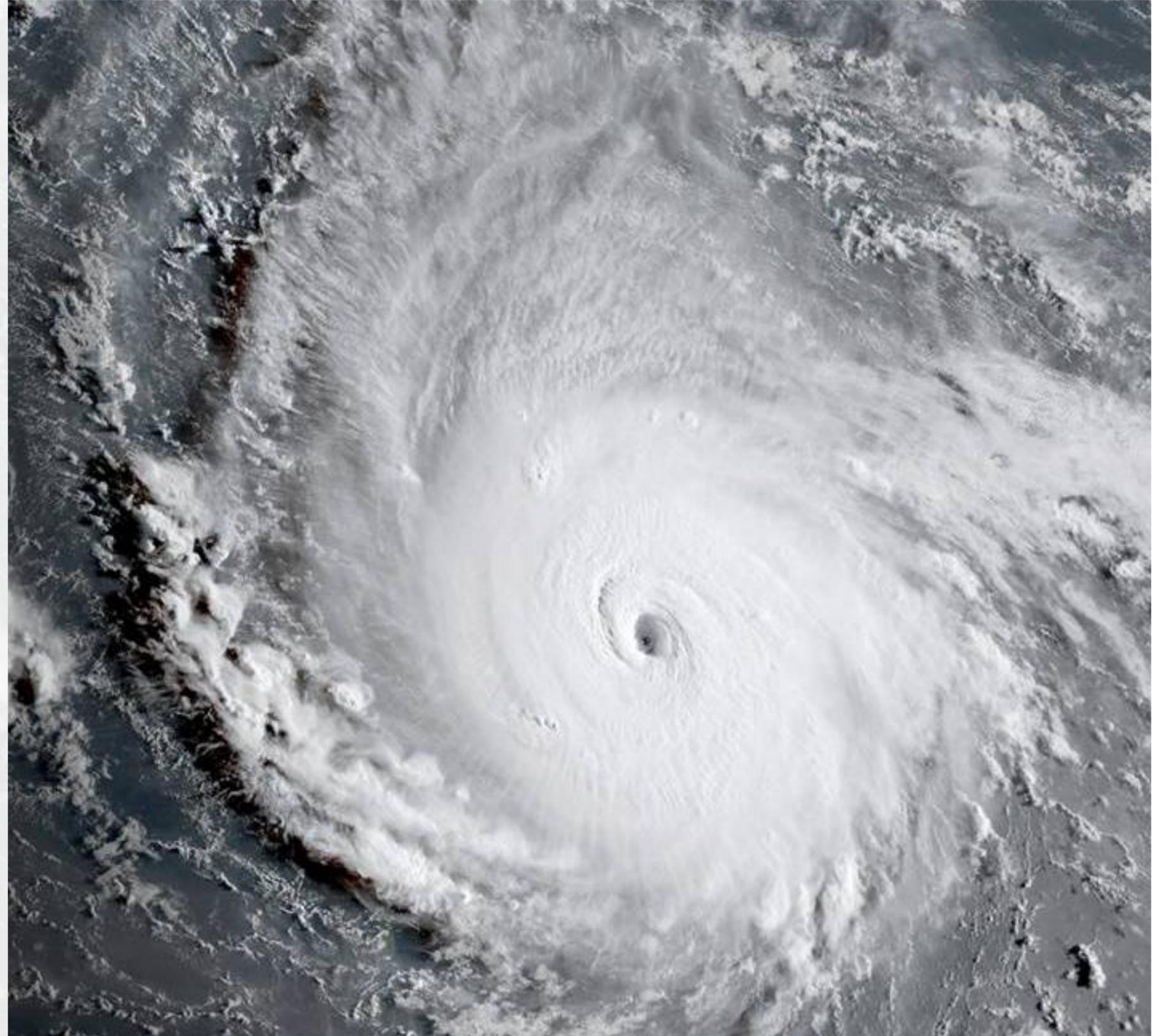
Sint Maarten has to deal with a hurricane once every six years. It costs 130 dead.

**CATEGORY 5**

This is the highest intensity on the Saffir-Simpson scale.

**WINDS OF  
180 MPH**

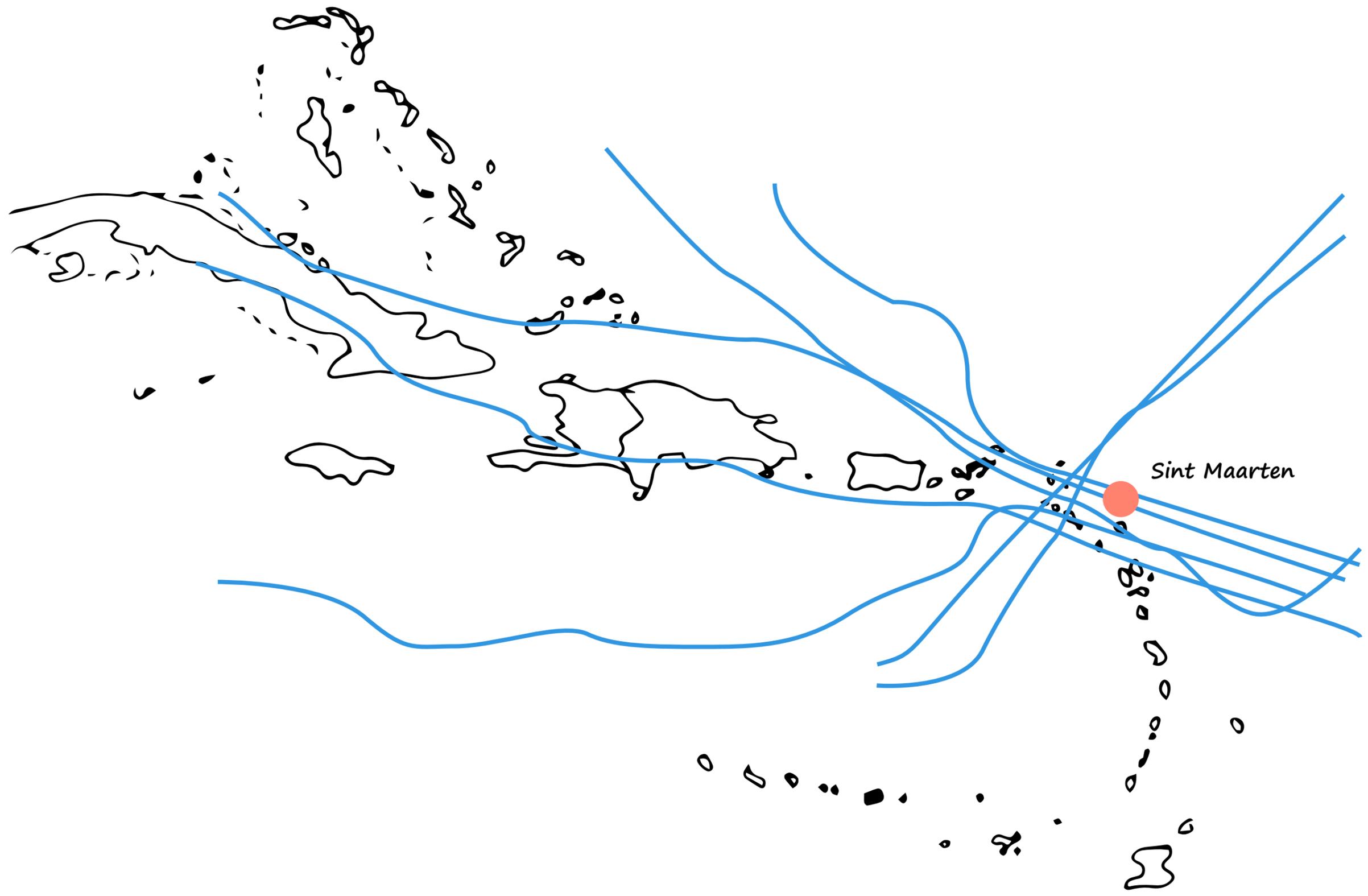
The winds blow at over 180 miles / hour.



Hurricane Irma  
September 6, 2017



Part of the Caribbean islands



Sint Maarten

Centre of hurricane paths

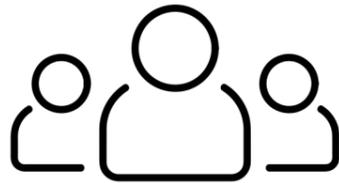


Informal settlements affected the most



4 bn

*Loss total damage*



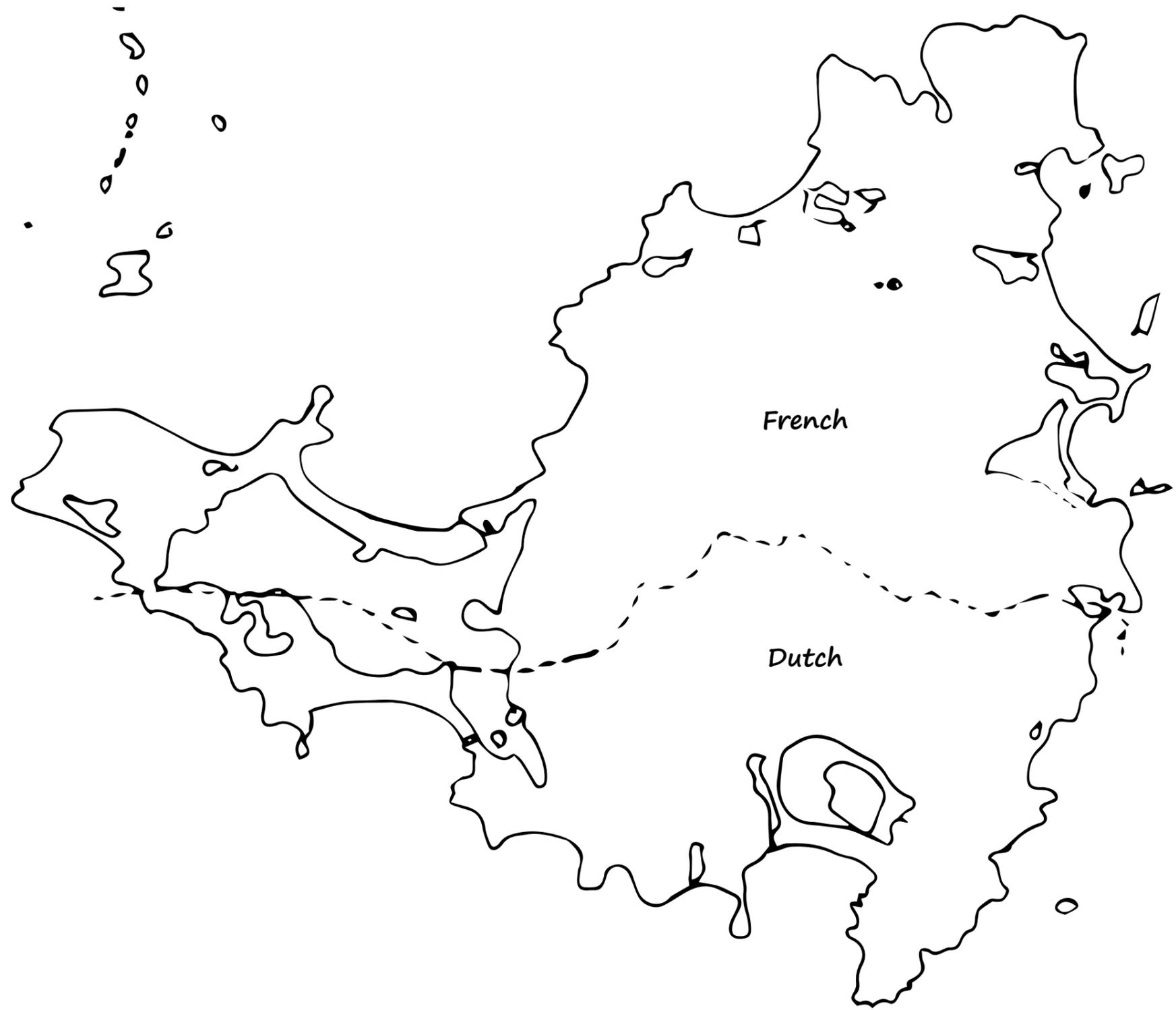
70 000

*People affected*



20 000

*Households affected*



Hurricane damages and losses



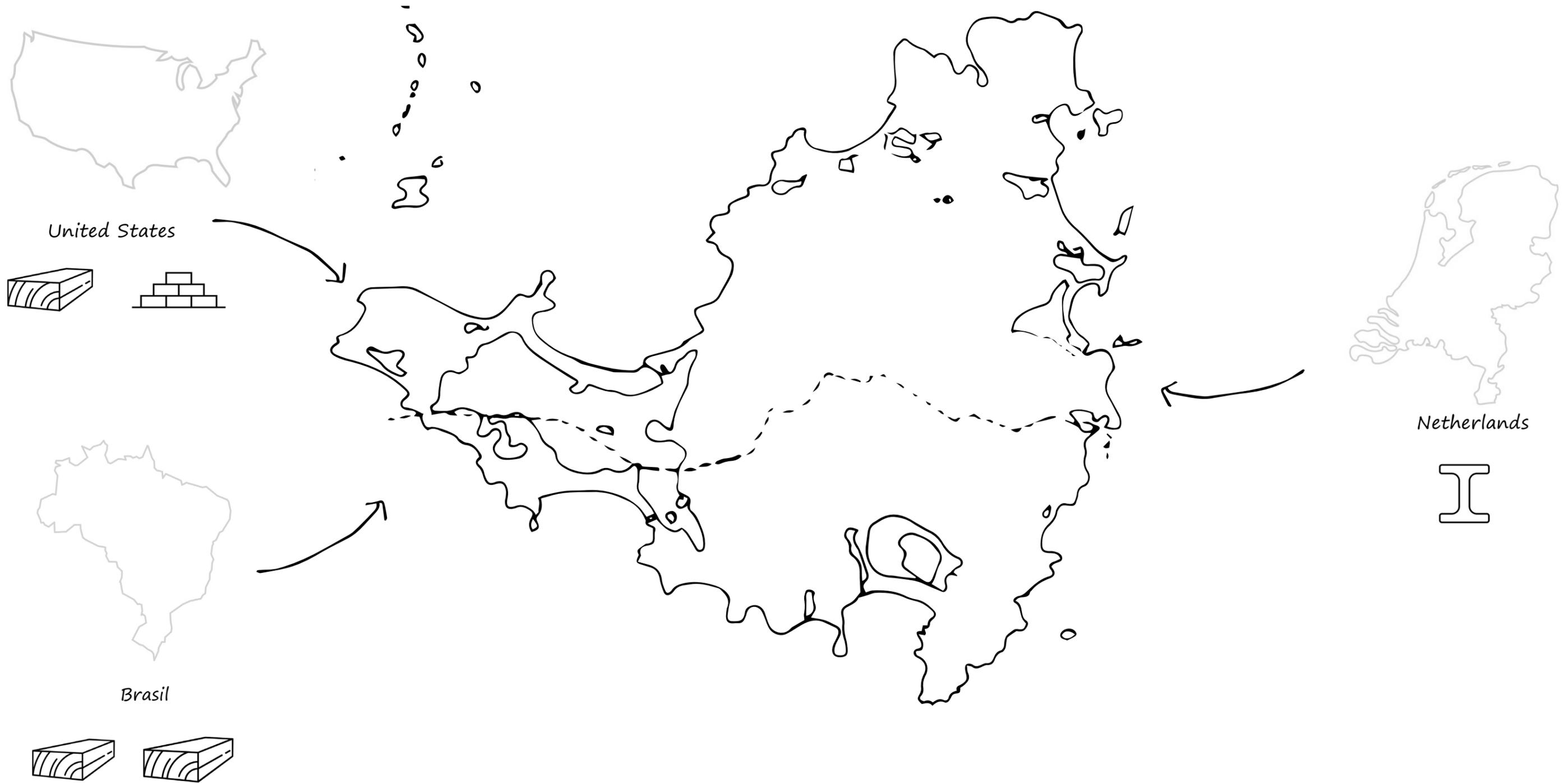
Red Cross



Landfill smoke



● Most vulnerable informal settlements Red Cross

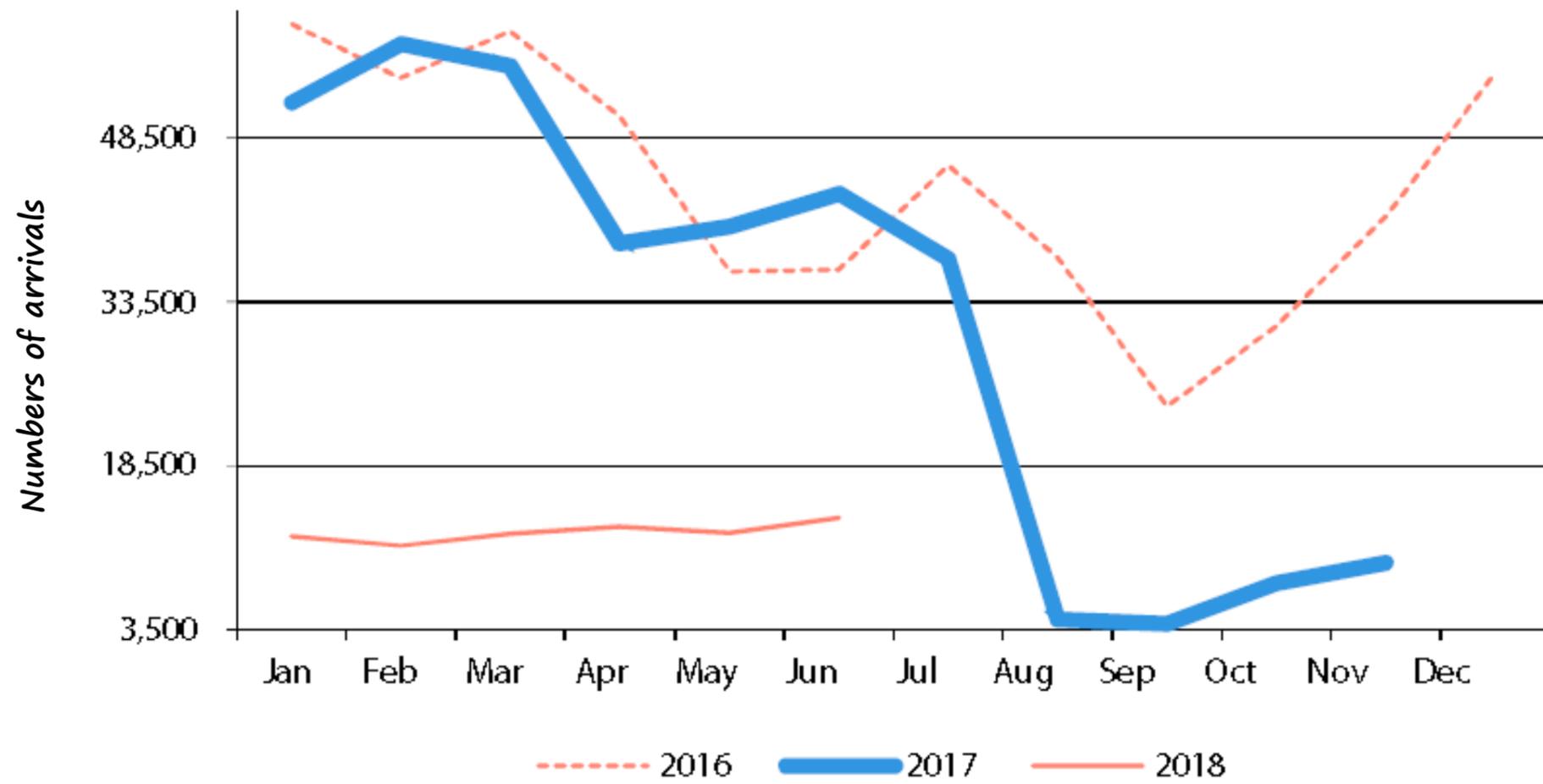


Lots of building material gets imported

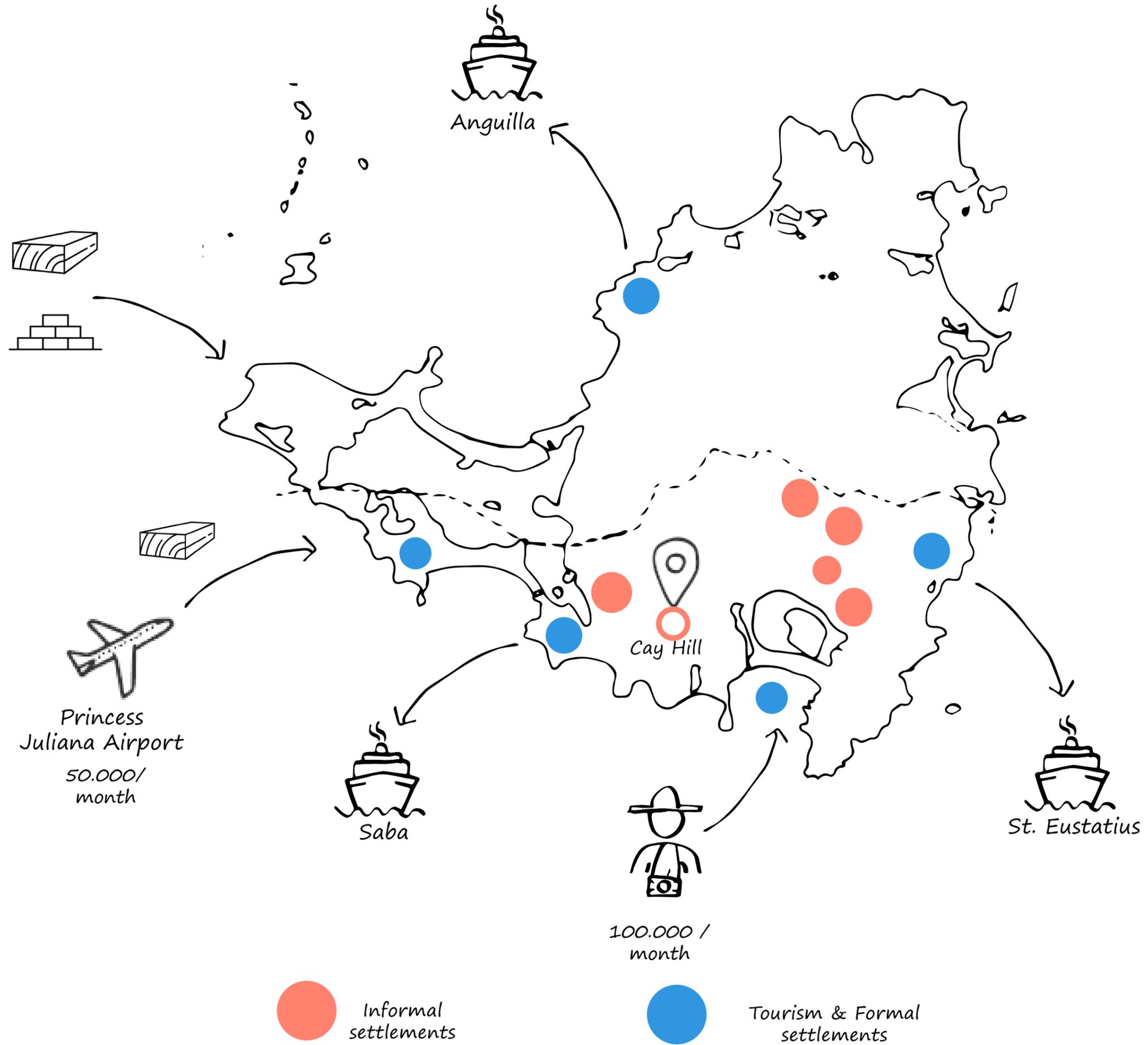


The hurricane also affected the tourism-led economy

Visitor arrivals in Sint Maarten



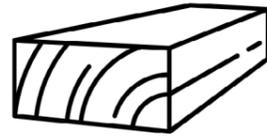
Number arrivals decreased



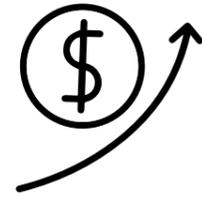
## PROBLEM STATEMENT



Dangerous  
and unsafe house



Lack of local  
and affordable building resources



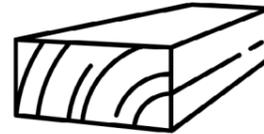
Lack of cultural  
economic opportunities



GOAL



Create safe and  
affordable housing



Local building resource  
and knowlegde



Local economic  
cultural opportunities



## RESEARCH QUESTION

How to create co-operative and affordable housing for people of informal settlement Cay Hill, considering their climate, traditional Caribbean architecture and cultural economic business opportunities?

What are the characters of an informal settlement, such as Cay Hill?

What can we learn from traditional Caribbean architecture and their climate?

Which business model creates new cultural economic opportunities?

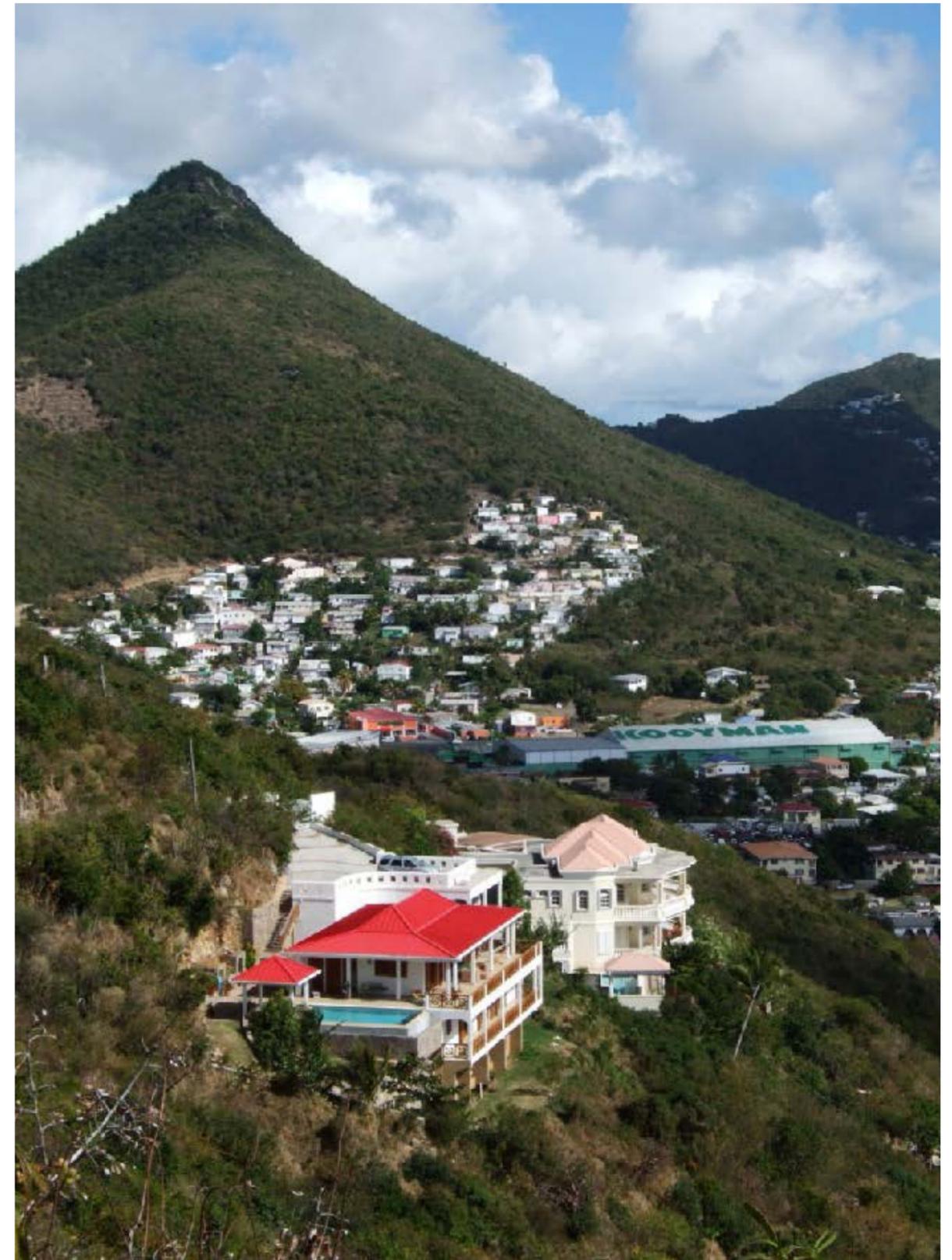
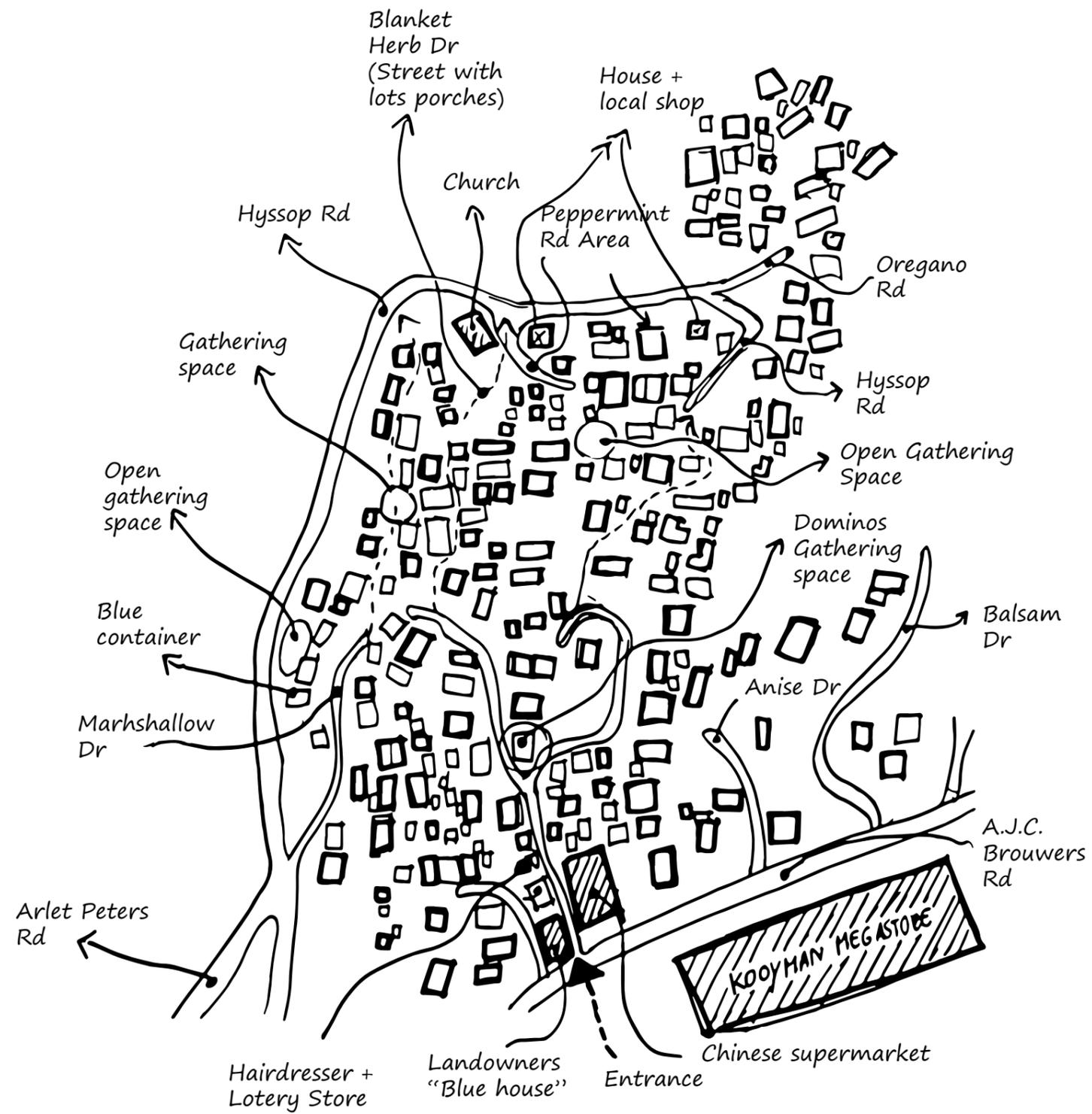
## **INFORMAL SETTLEMENT CAY HILL**

### **What is an 'informal settlement'?**

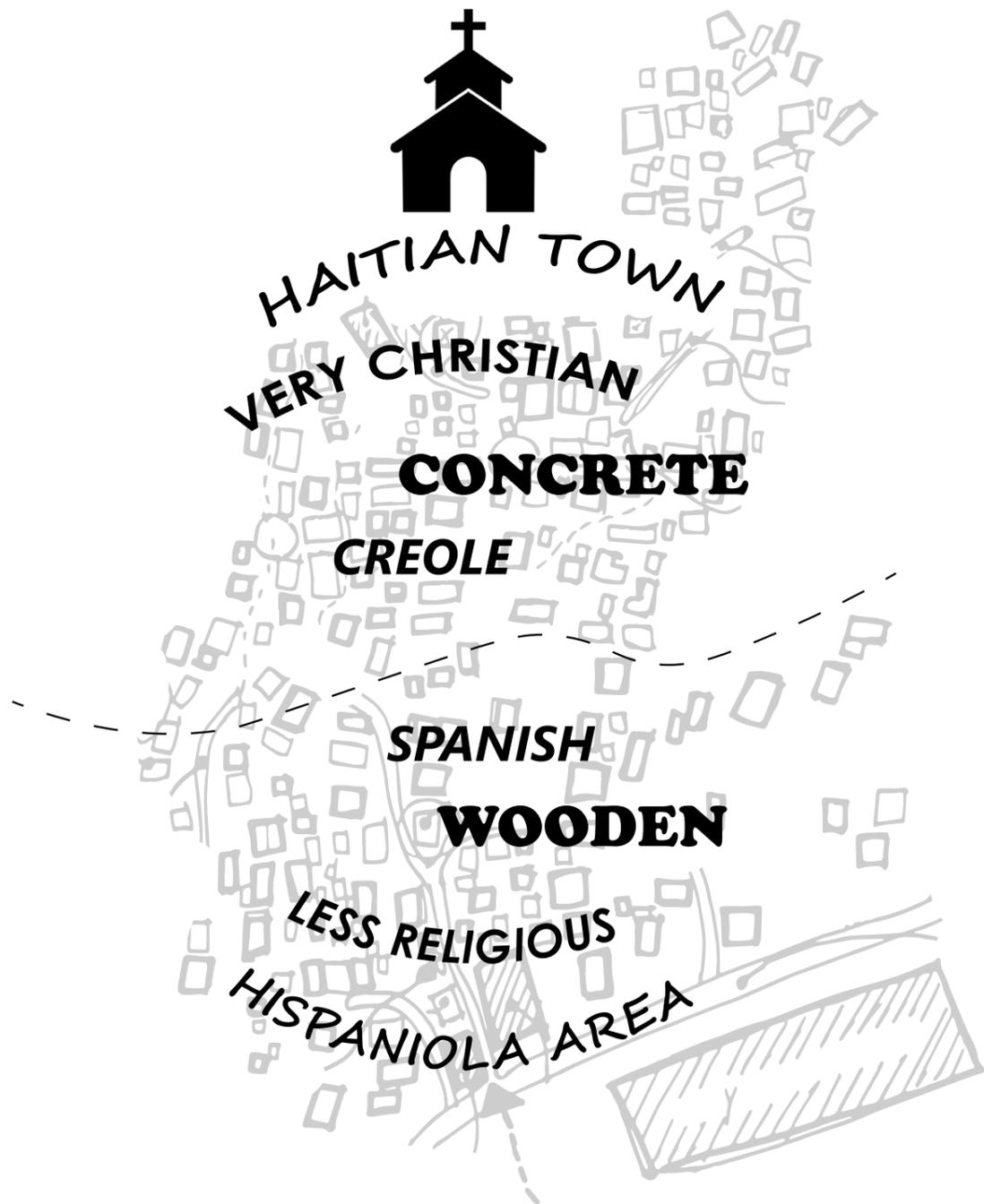
areas where groups of housing units have been constructed on land that the occupants have no legal claim to, or occupy illegally;

Glossary of Environment Statistics, Studies in Methods, Series F, No. 67,  
United Nations, New York, 1997.

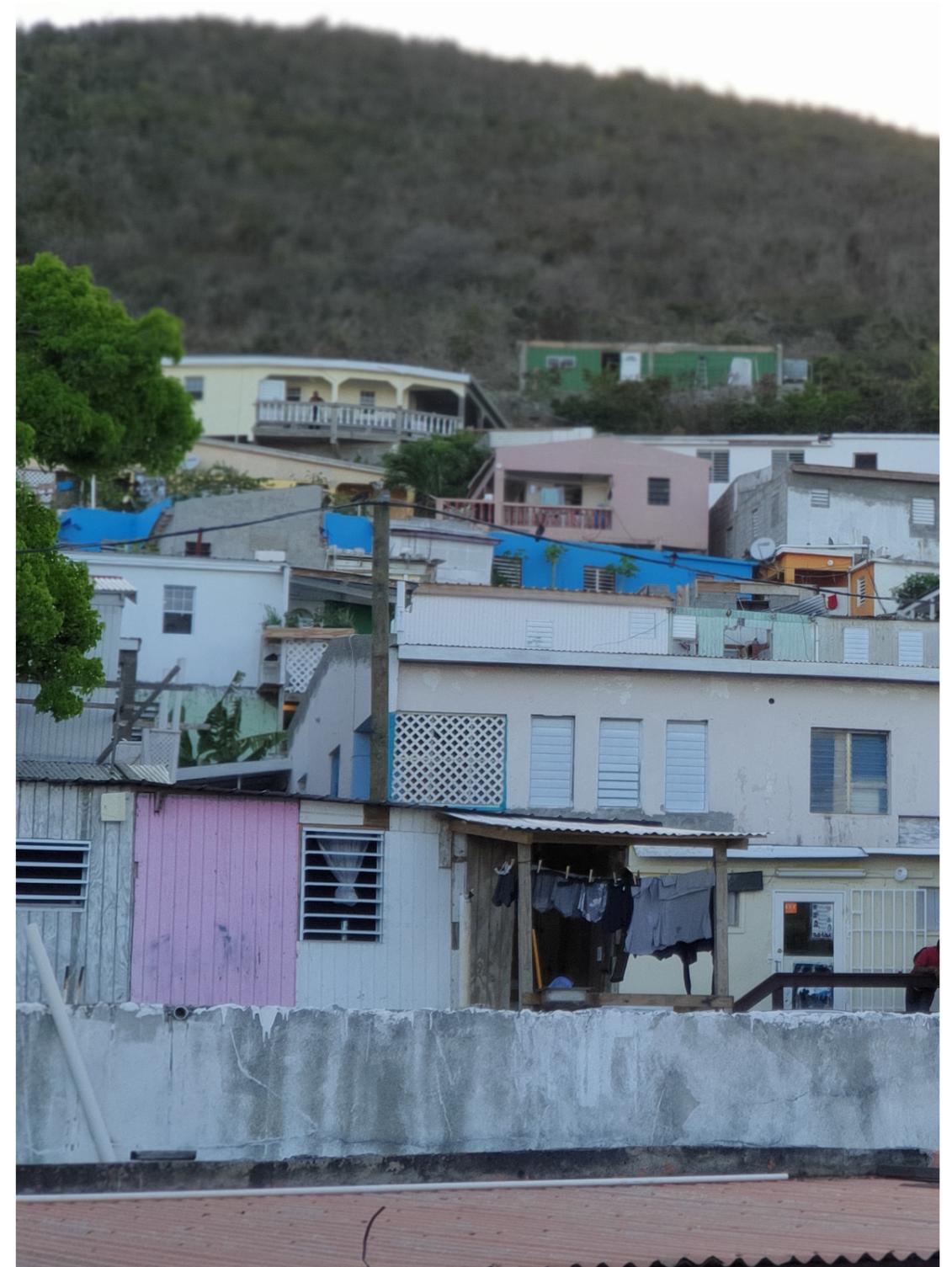




Findings of Cay Hill



Half concrete and half wood



View of a King

**Cultural patterns**



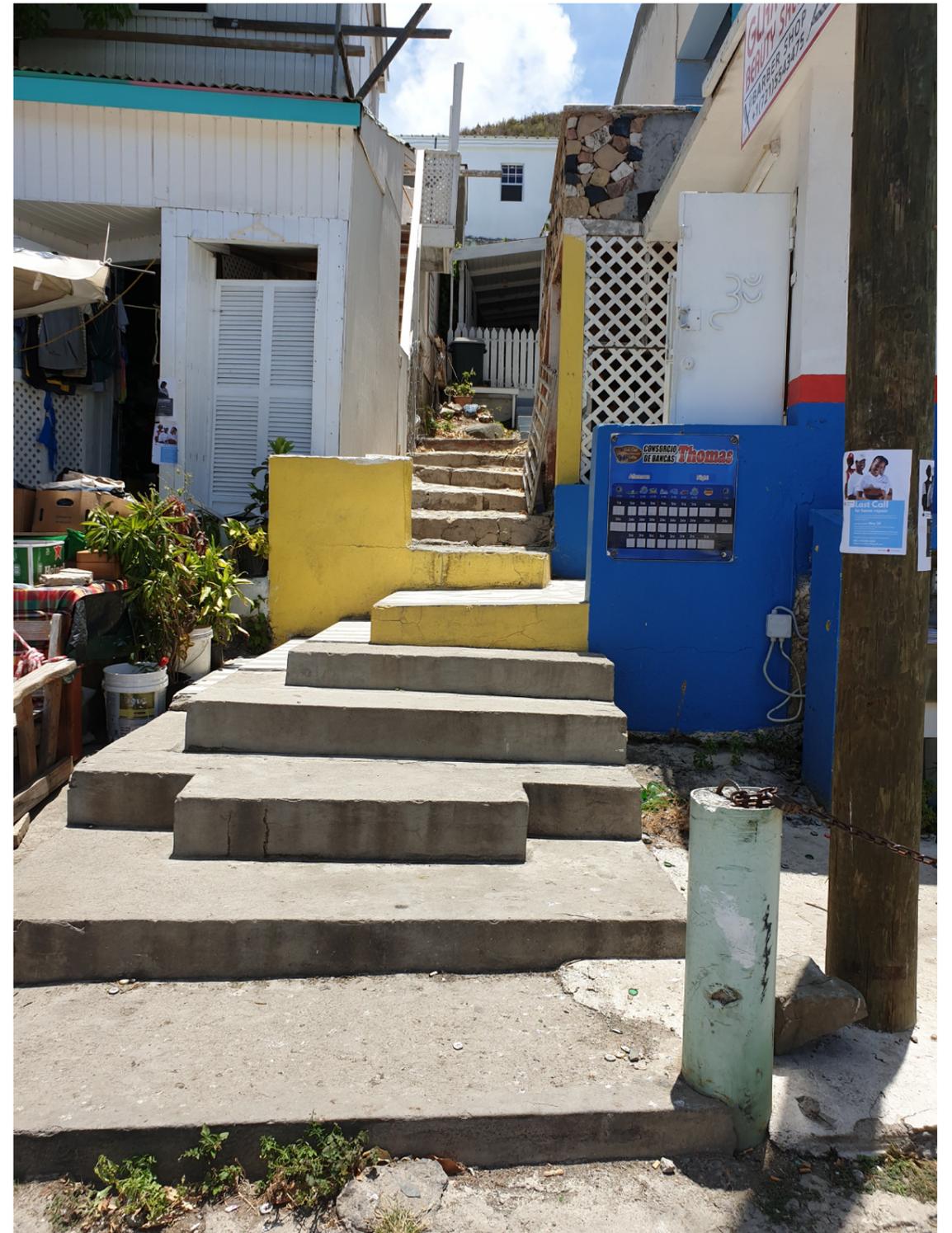
Shophouses



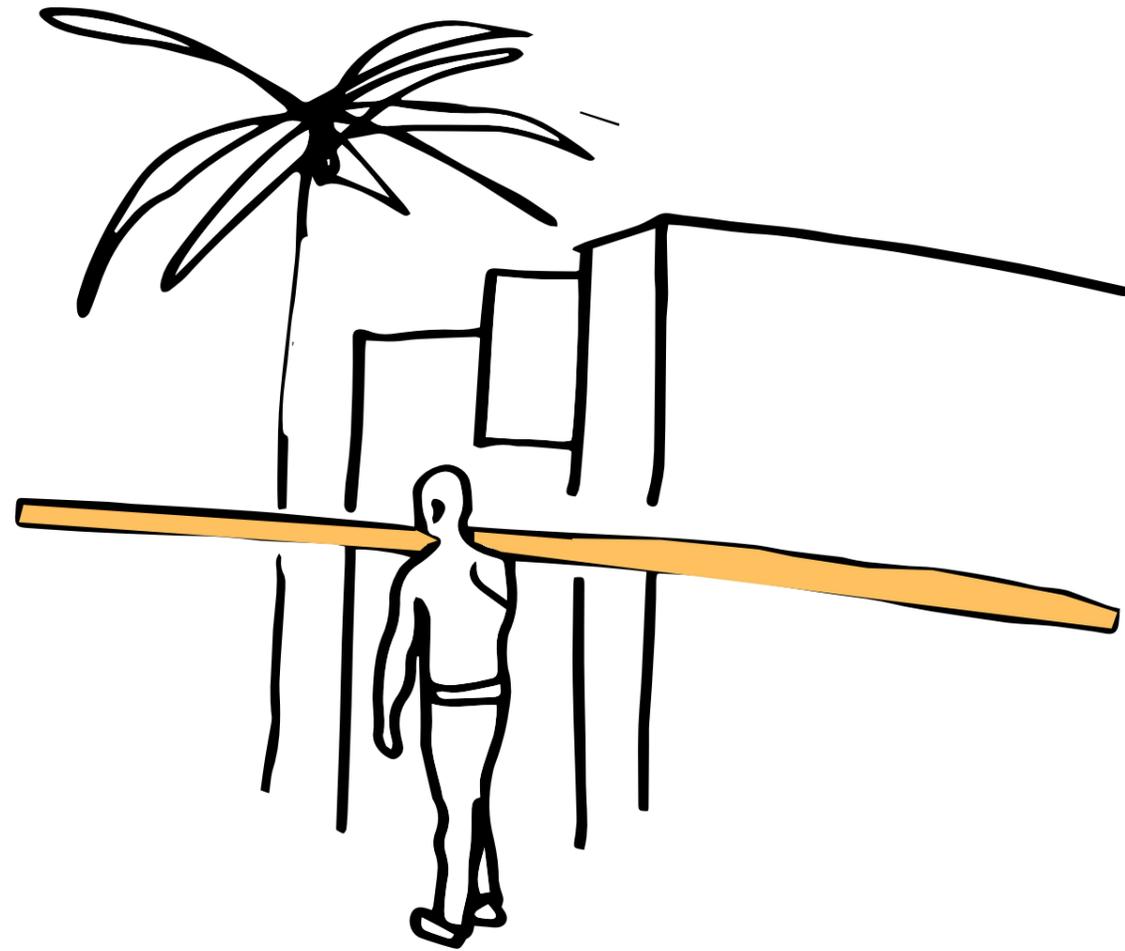
Verandah's



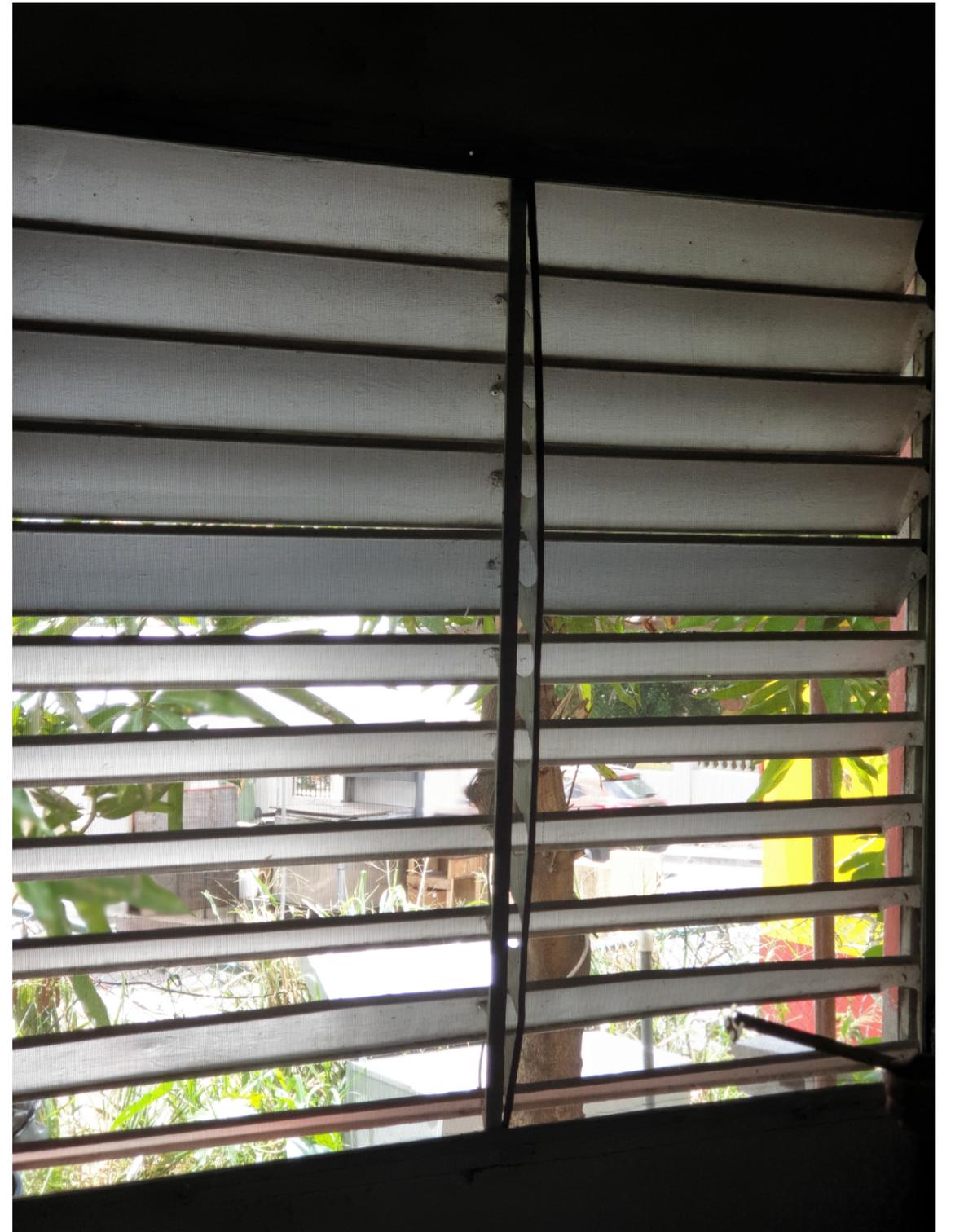
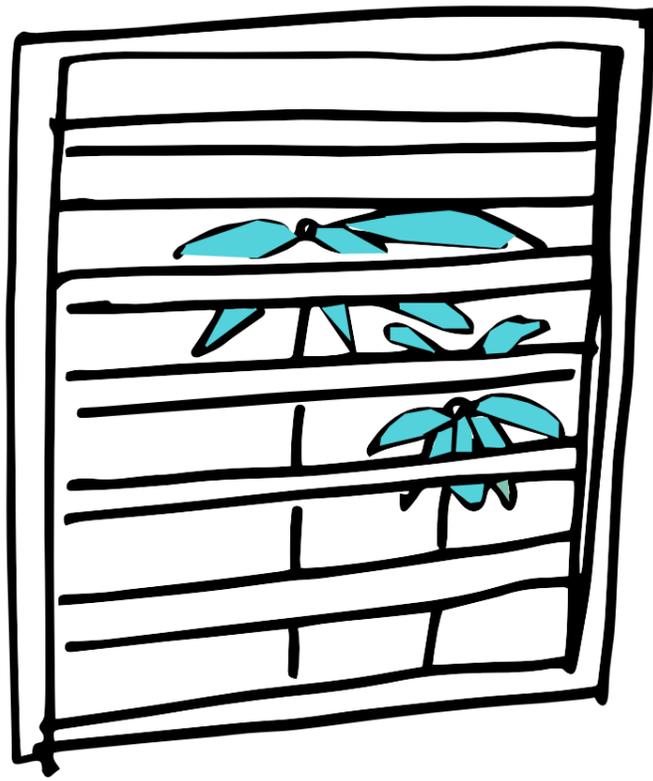
'Suprising' hidden courtyards  
Terrazzo, wood, concrete housing. Self-help community.



Public stairs



Small street and self-help community



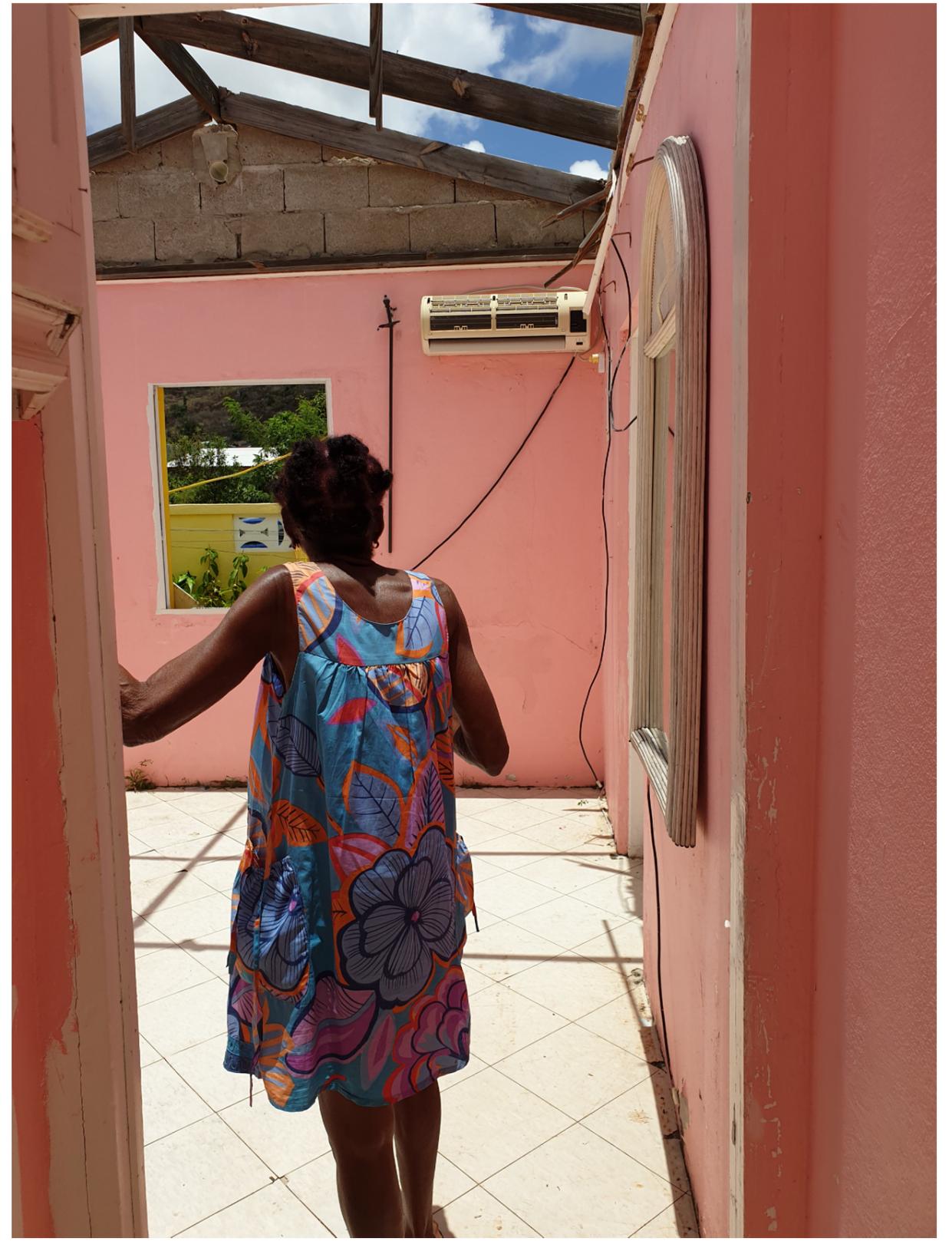
Small windows and dark atmosphere



Scared for the hurricane



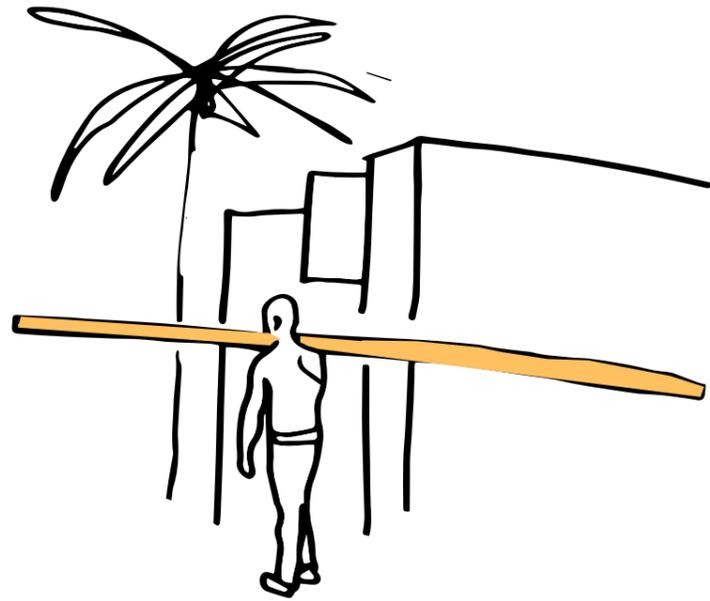
Dameged housing





Hopeful

# Opportunities



Self-help community



Public stairs



Colourful atmosphere



Shophouses



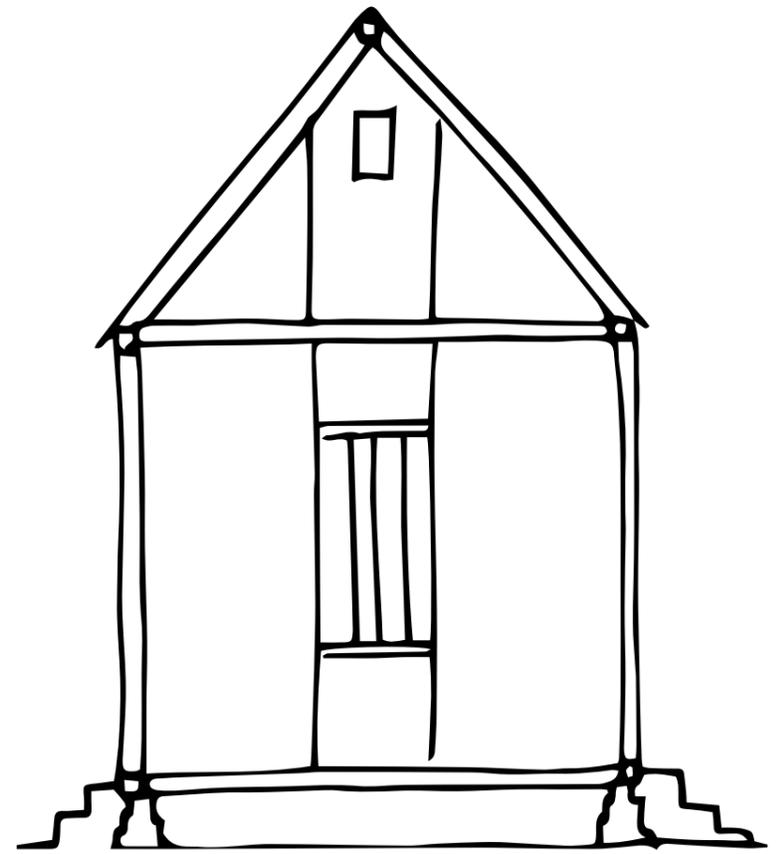
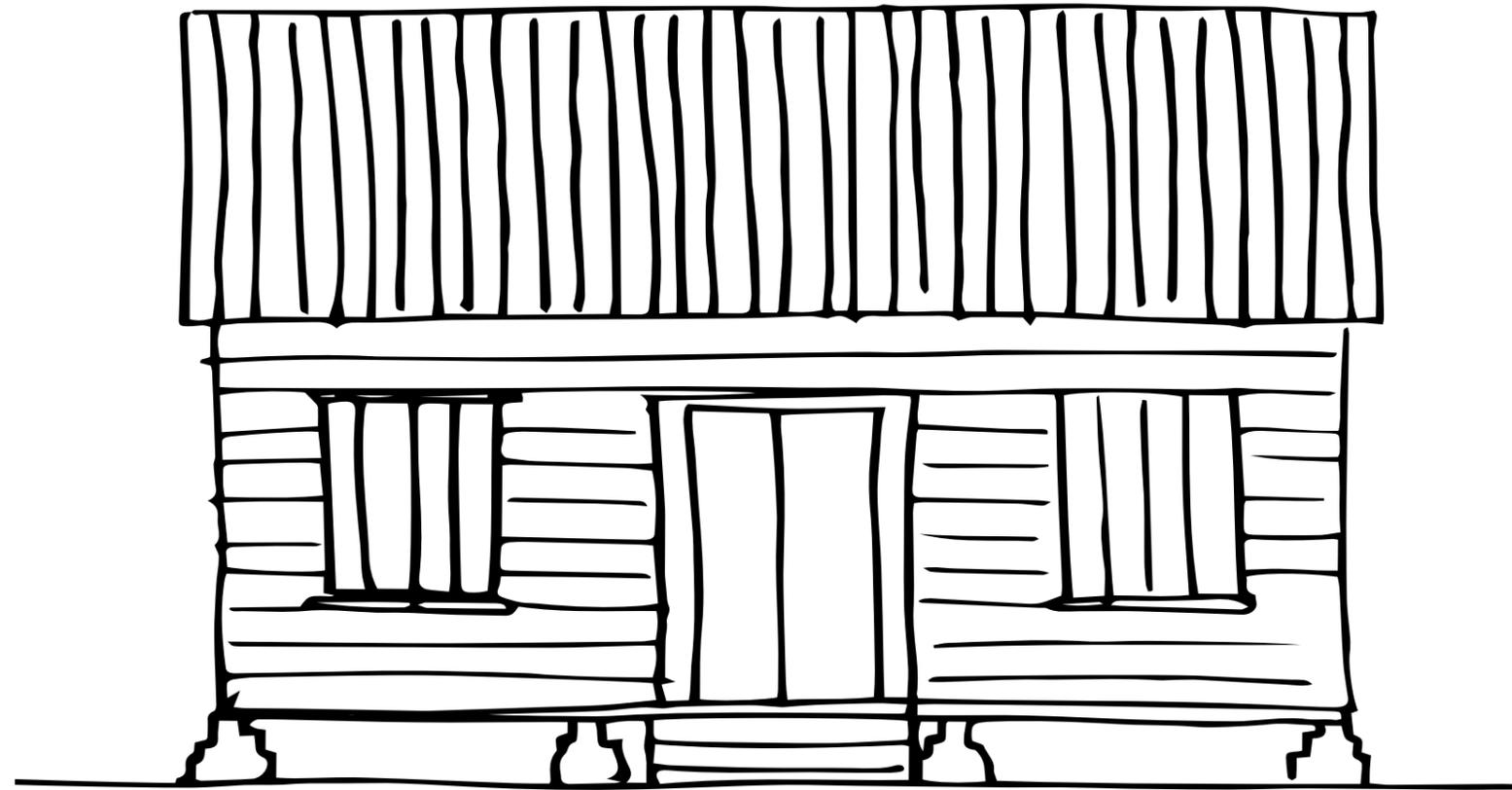
'Suprising' hidden courtyards



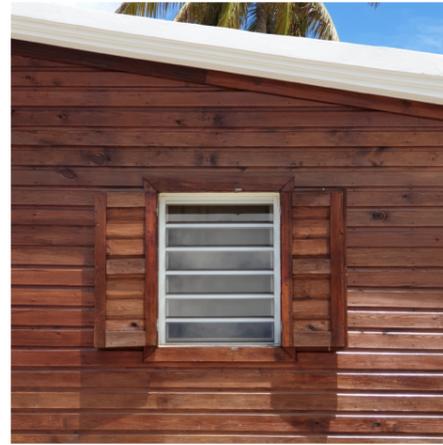
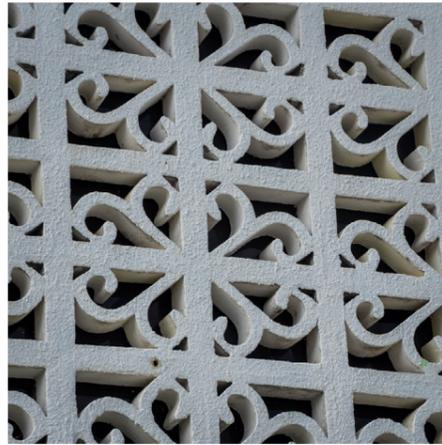
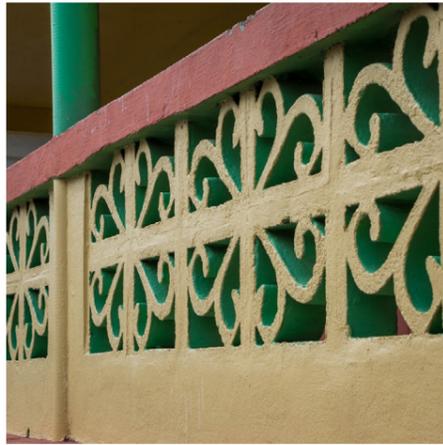
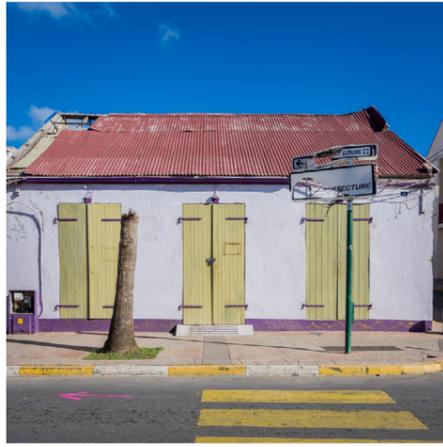
Verandah's

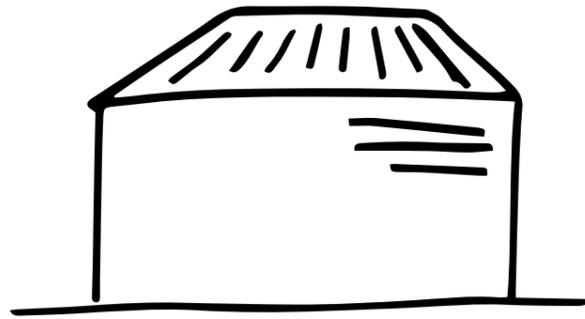
## **TRADITIONAL CARIBBEAN ARCHITECTURE**











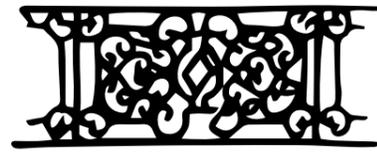
### Rectangular shape

The houses are mostly shaped in a rectangular form with a hipped or saddle roof.



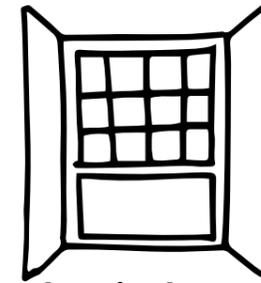
### The verandah

It is part of the house, but not of the main structure. It is a dominant feature and makes the house more attractive. Protects against rain and sun. The decoration expresses the taste of the owner.



### Ornaments

Traditional Caribbean ornaments are used for staircases, balustrades etc.



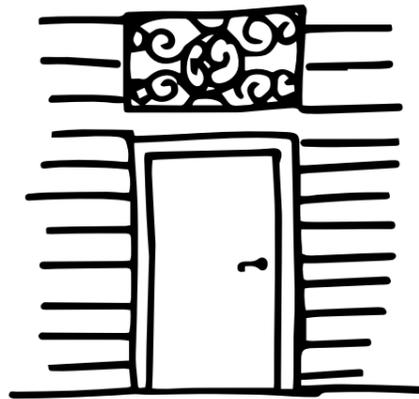
### Sash-windows

These type of windows protect against the strong winds. Both top and bottom windows are movable.



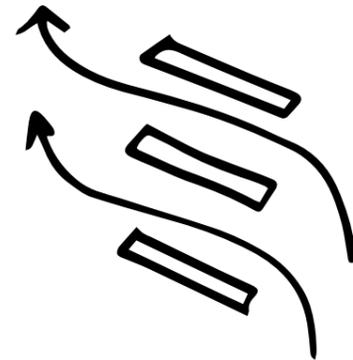
### Colours

To protect against the climate and for decorative purpose. The colours are personal touch to the owner. The walls are usually in a light colour. The shutters, verandahs and balustrades are mostly in a dark colour.



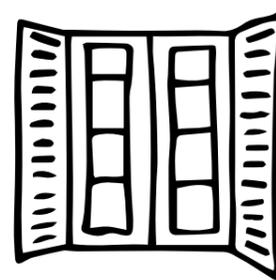
### Wooden grill

The wooden grill is used for cross ventilation. The rooms are divided by wooden partitions set across the rectangle.



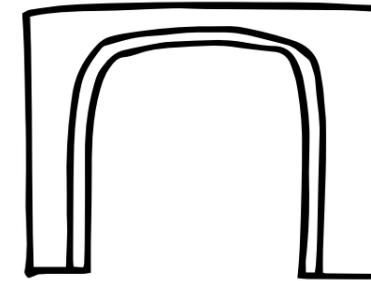
### Shutters

Opening elements to maximize the airflow.



### French windows

Another type is the french window. They function as a curtain and for ventilation. Iron hooks make it storm proof.



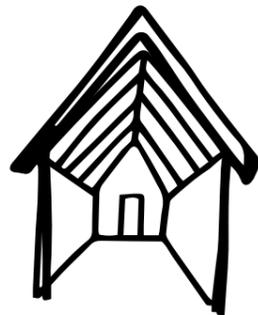
### Sham segmental arch

This is a form of interior decoration.



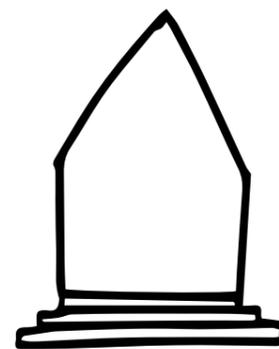
### Windward ceiling

The windward ceiling is a form of decoration and expresses luxury.



### The roof

Sloping roofs serves to collect water. It is mostly covered with wooden shingles or red corrugated iron sheets. From the inside the wooden structure is shown.



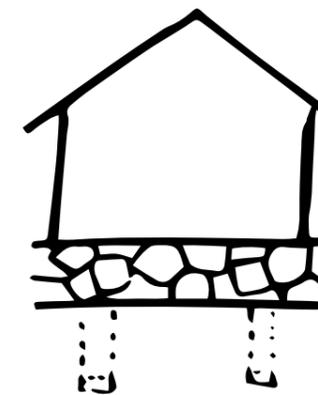
### Substructure

Houses are build on a natural foundation out of stone or wooden piles. To ward off sub-soil damp, insect + animals. The higher the substructure the more impressive the house is.



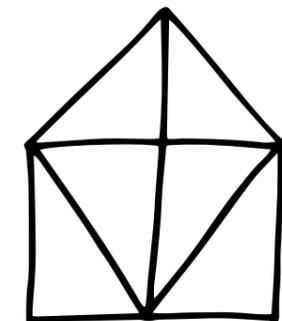
### Stairs

The stairs and balustrades are decorative parts. Some are skilled carpentry. They are either placed on the frontside, inside, or side stairs house.



### Material

The walls are either build with natural stone or wood. The combi is mostly used. The substructure is mostly build of wood.



### Wooden structure

It has a balloon frame system. With skeleton of wallposts and girders. In a small or large house the frame is always visible inside.

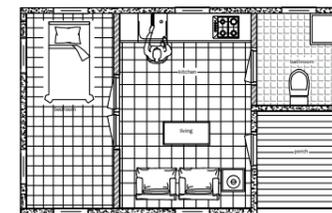
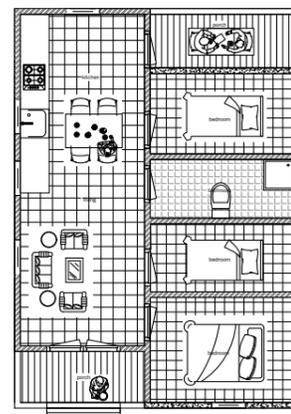
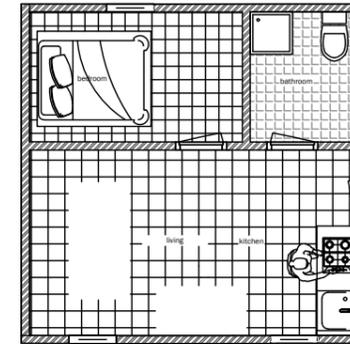
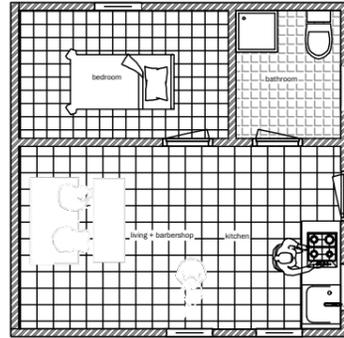
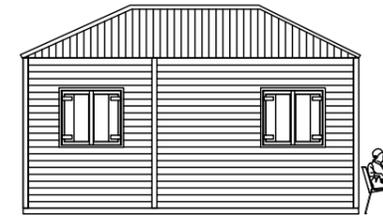
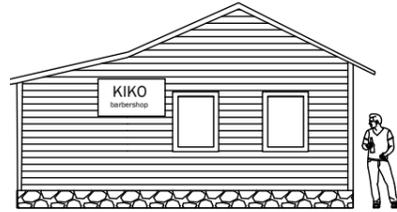


Damaged wooden house



From wood to concrete blocks





From wood to concrete blocks

## WHAT IF?

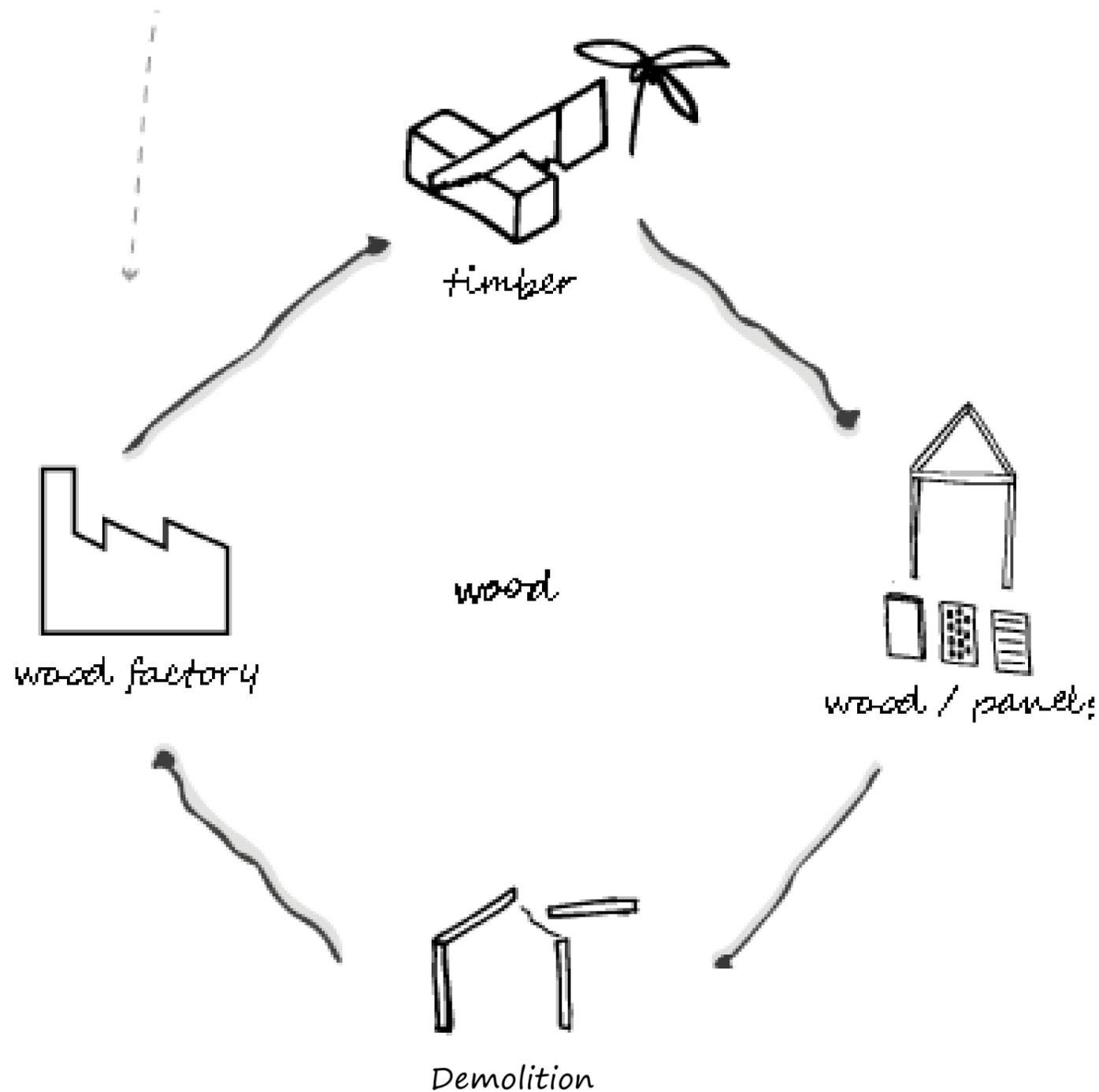
sustainable + co-operative housing + bottom up approach  
= desirable environment

reused local wood, create a new type of brick as alternative  
for concrete and design the shophouses. To anchor itself into  
the urban environment and local strategies.



Linear to circular business model

## WOOD STRATEGY

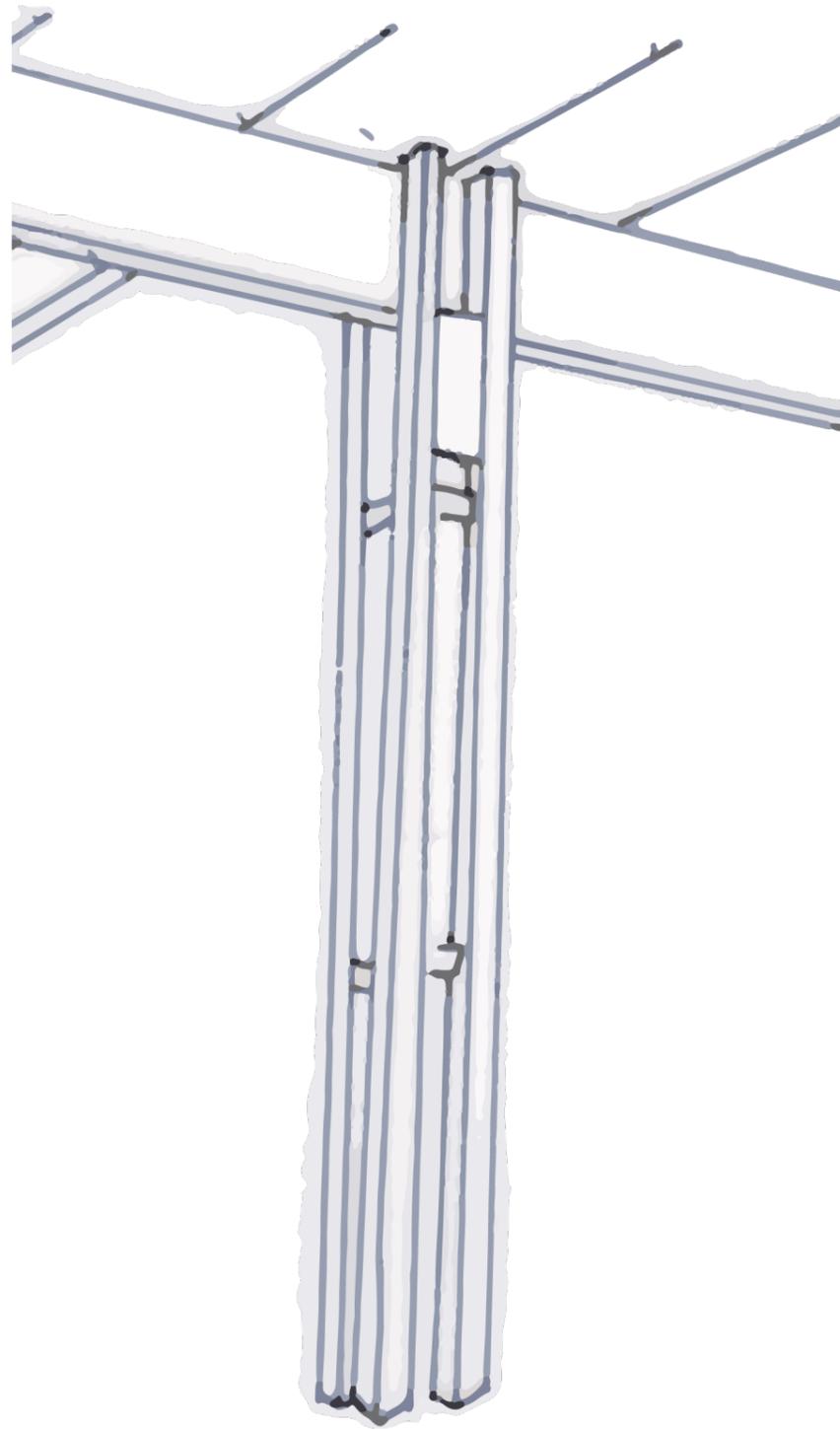




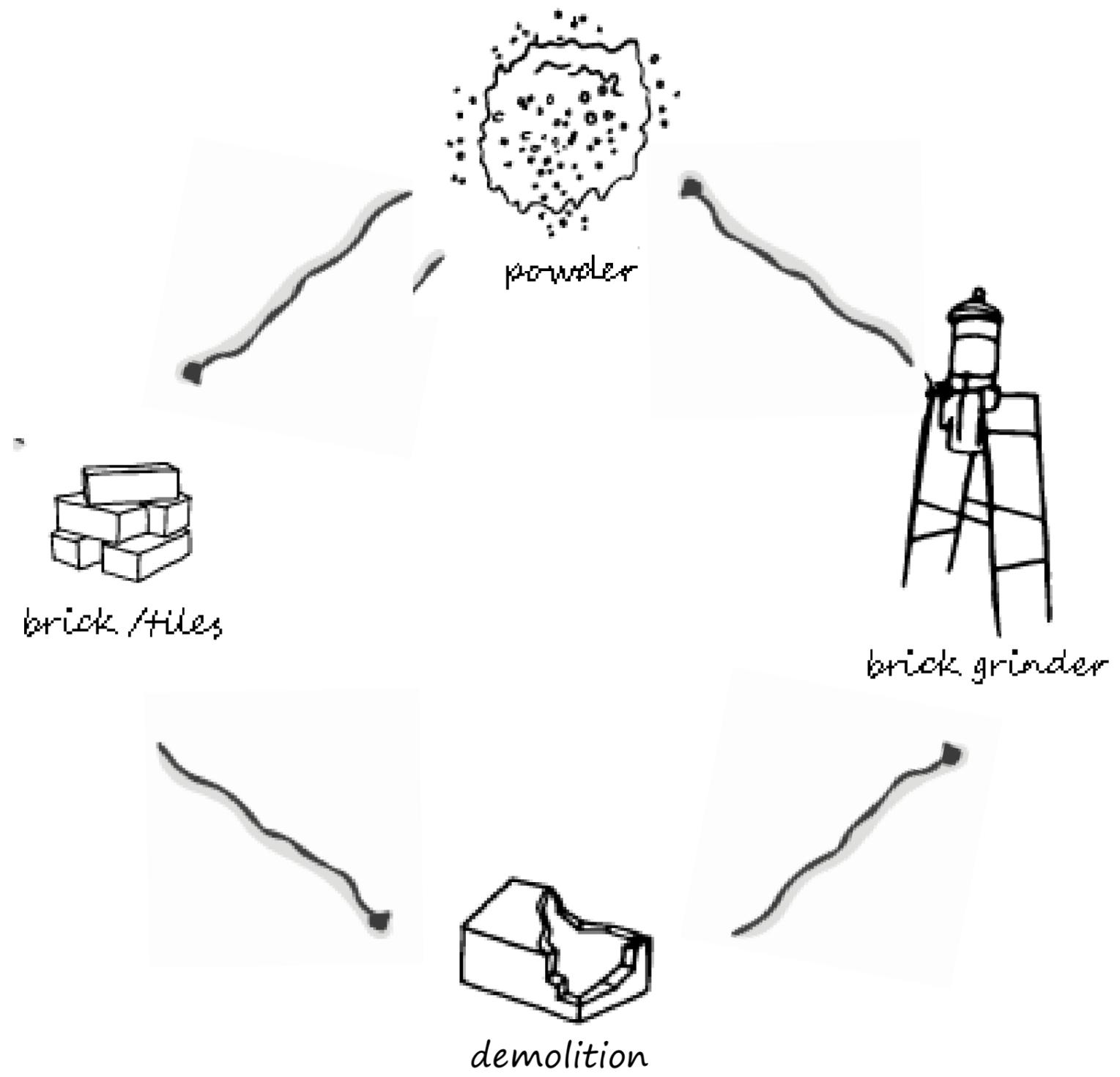
Work together with local wood factory Kooyman



Re-use the waste to created new material



## **BRICK STRATEGY**

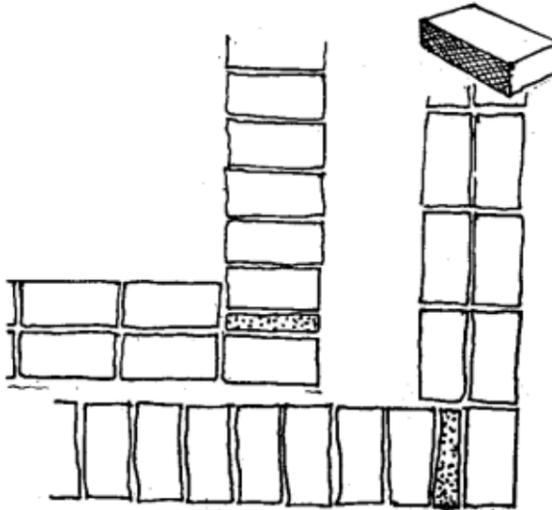
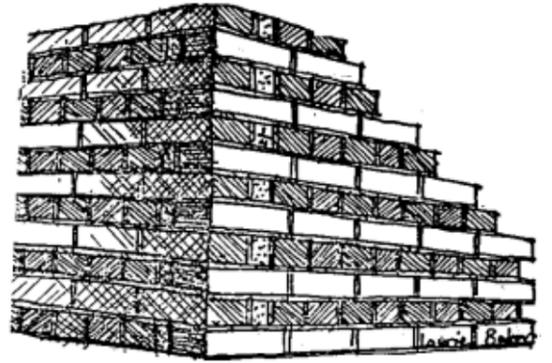


Stonecycling inspired



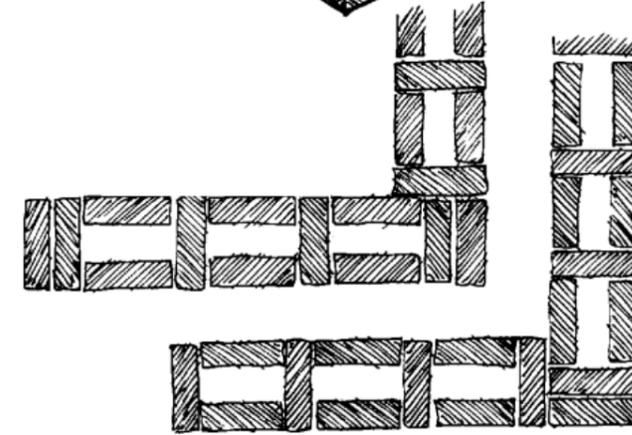
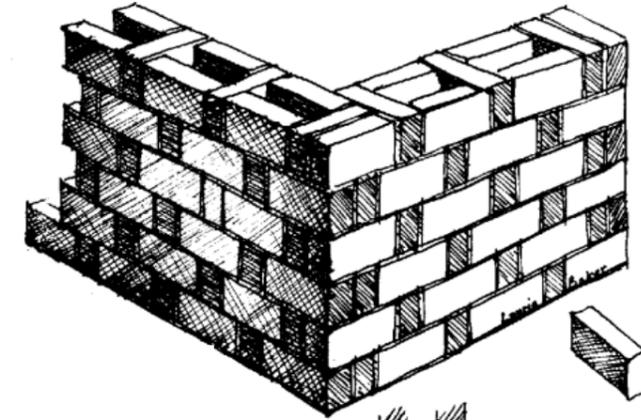
Grind and clours





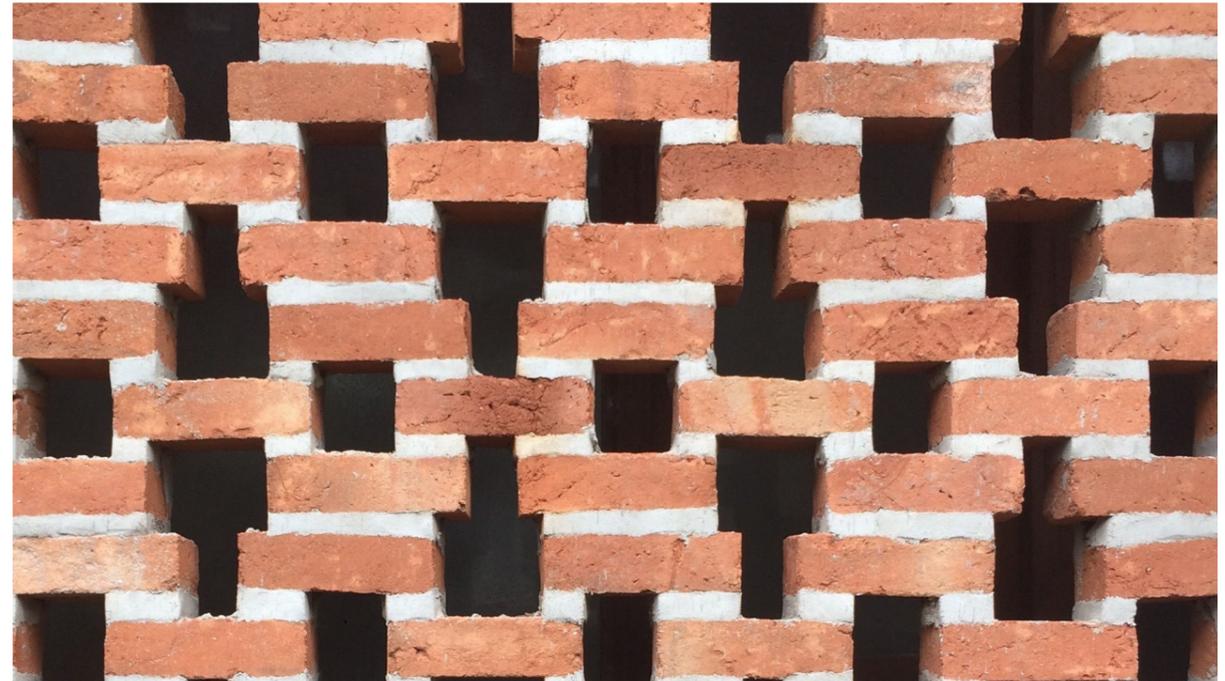
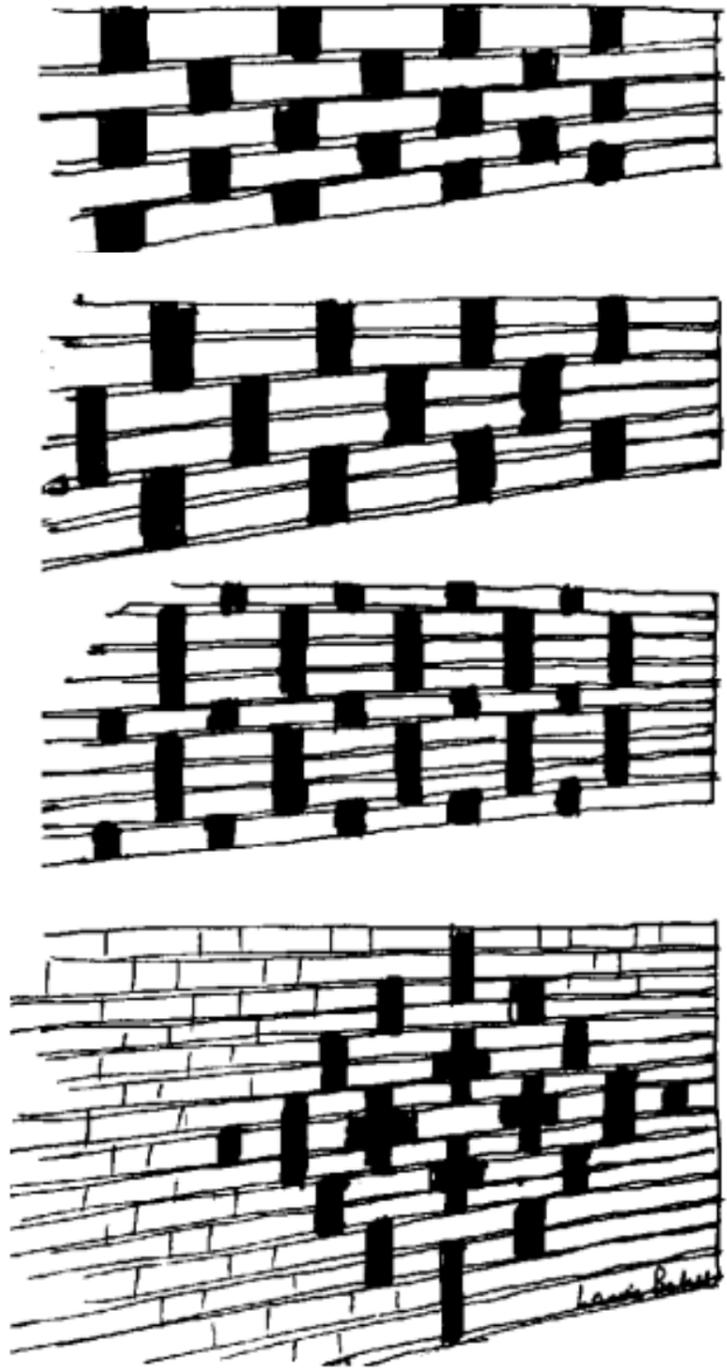
Stretcher bond

Typically used in  
Sint Maarten



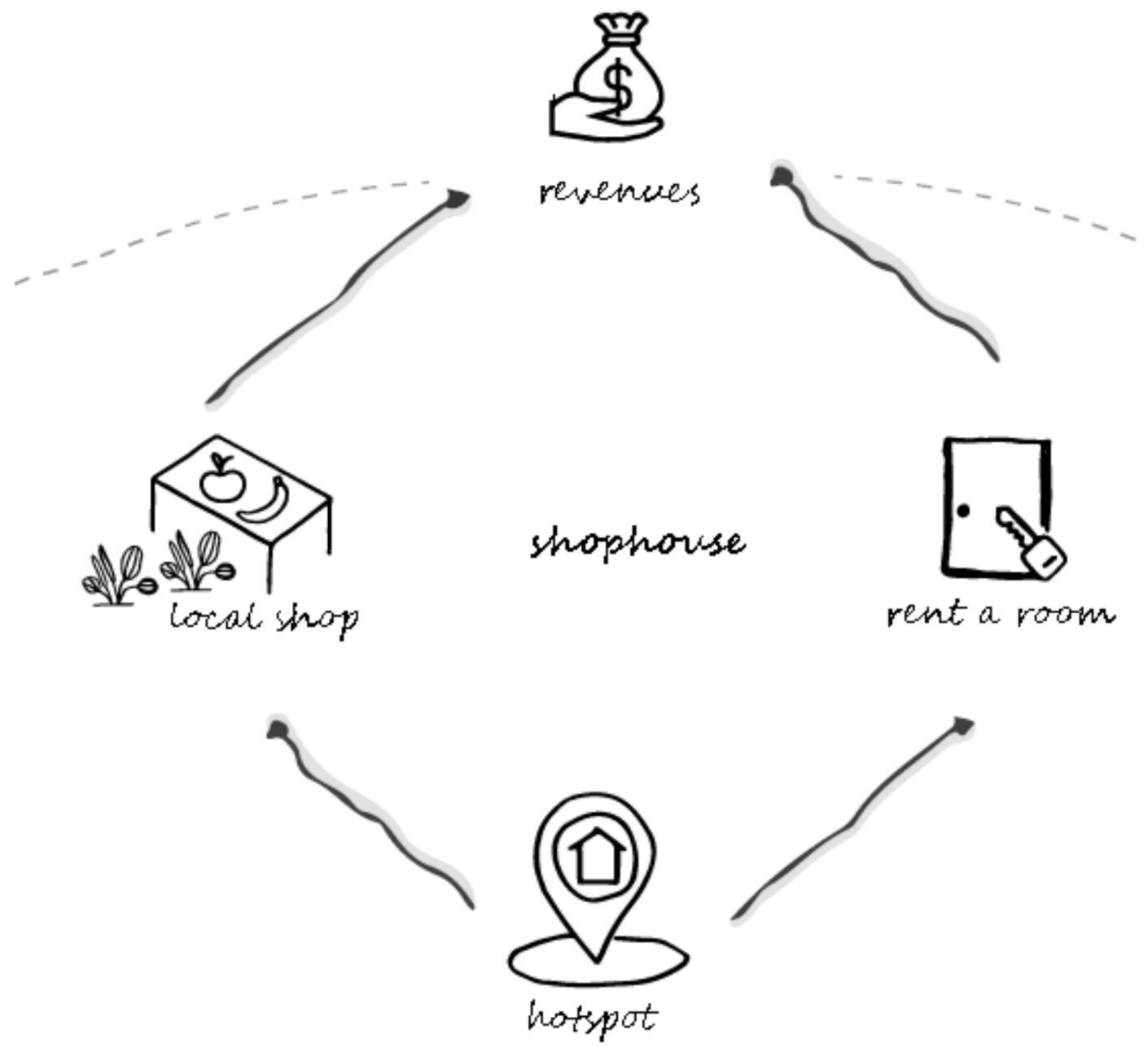
Rat trap bond

It is as strong as the other bonds but  
uses 25% LESS bricks and mortar.  
Because of rain, damp and stability



Laurie Baker  
inspired  
brickwork

## **HOTSPOT STRATEGY**



**What is a 'hotspot'?**



Fruit vendor in front of home

**Kim | Local host interview**

Originally from St. Lucia. Has been living in Sint Maarten for 15 years. Owns a travel agency. She organizes local tours, flights, accommodation in the Caribbean area. She rents out her house in the area Cole Bay to tourists for extra income.

**How are you related to tourism?**

I own a travel agency, called Caribbean Travel Movement. It is kind of a travel consultant. We organize everything travel related, tours, flights, accommodation, almost everything. 80 Percent of my tourist are Caribbean, 10 percent European and 10 percent American. We organize trips to almost all the Caribbean islands and most of it is arranged online. I work together with basically all tourism related services provides, taxi drivers, tour operators, tour guides, airlines. It depends on what the customers need is at that time.

**What is your general opinion about tourism on this island?**

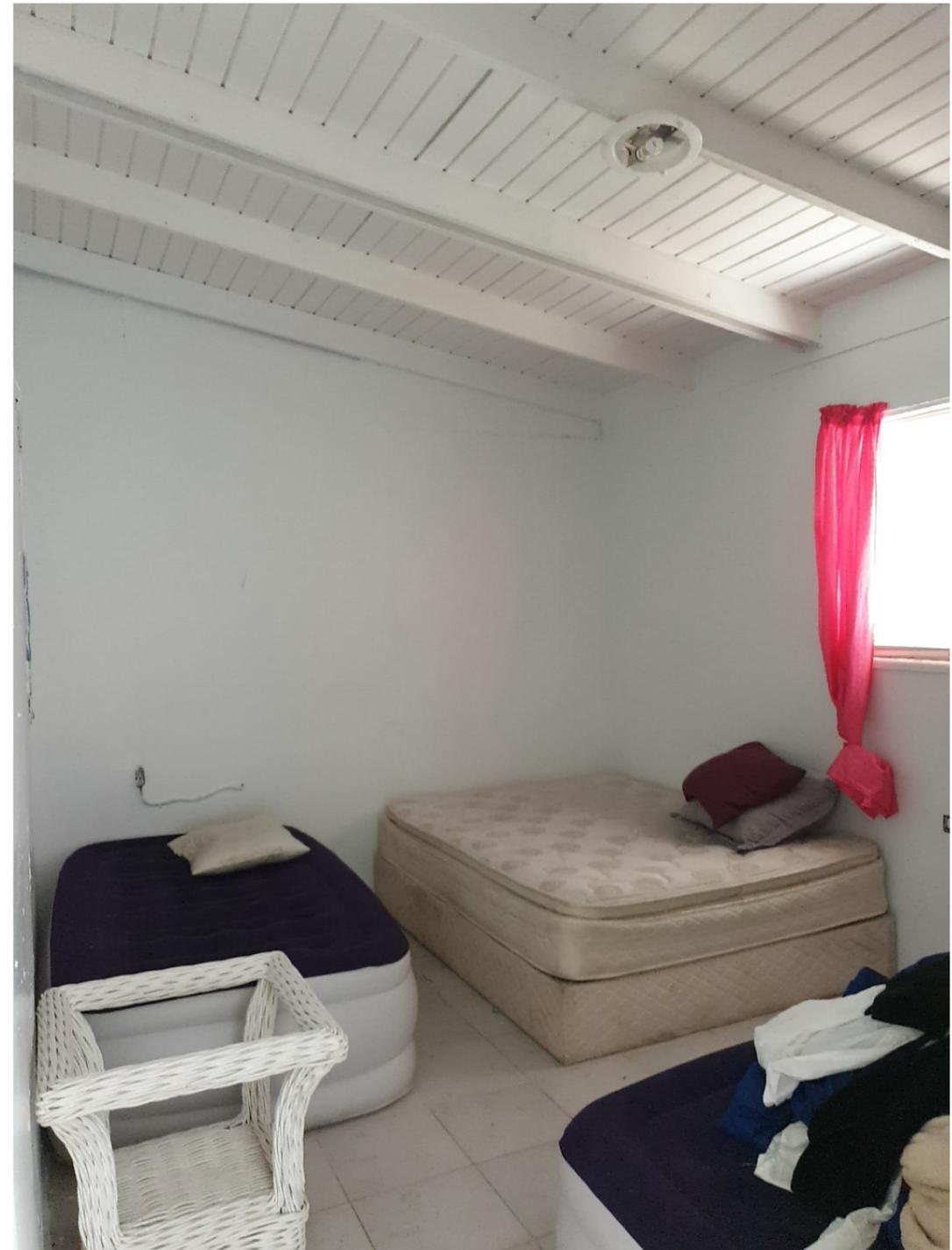
I think it is good for the island. It's good because it has a small economy. How it is managed is a different story. The island is open and duty free. How it is managed by the government that is a totally different thing. I would say 50 % is managed in



a good way and the other 50% is very bad. There are a lot space and areas for improvement and there a lot of spaces and areas that are doing good.

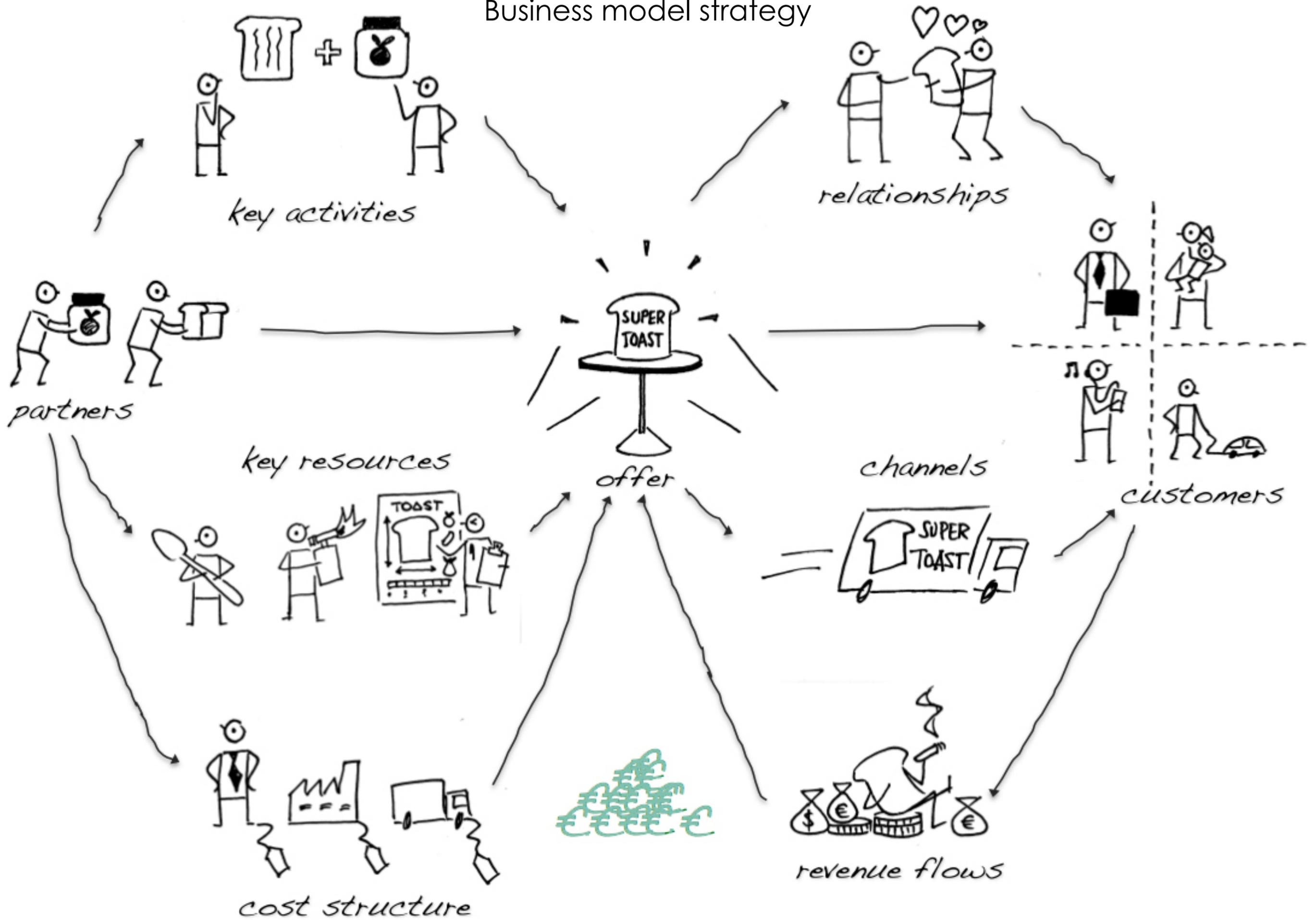
**What could be a good improvement for the tourism industry?**

The government should train people. There is a need for customers service at different institutions like resorts and hotels. Six different cruise ships dock on the island and then you just have the few small stores next to the beach. Sint Maarten lacks good customers services. You have very few people who take there time to know and understand the history of the island. People who don't know the history are given wrong information.



Interview local host - room to rent

# Business model strategy





The rent that a homeowner living in a shantytown needs to pay varies between \$200 - \$400 dollars. In Cay Hill it is about \$75 - \$85 dollars per m2. A tourists pays for the shantytown around \$10-\$20 dollars per night. How much they pay for fruits and goods is unsure.

The minimum wage of people in Shantytown is less than \$500 dollars per month



## **GAPS AND LIMITATIONS OF CURRENT MODEL**

Not flexible enough

One fits all system

Only short stay visitors

No relationship with users

Work as individuals

No fixed price

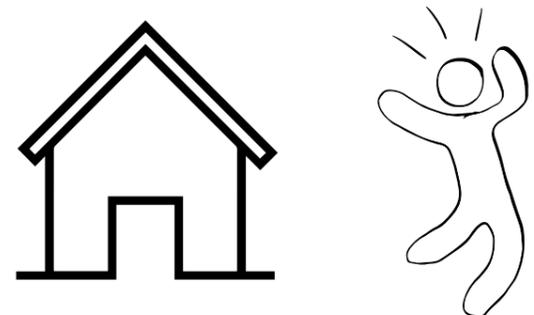
Difference per household

No fixed channels

No partnerships in particular

Only cost- driven

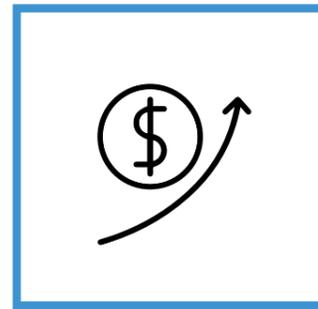
Rely on human skills



SUSTAINABLE HOUSING



Environmental protection



Economic effectiveness



Social inclusion and participation



Cultural adequacy

## PROPOSITIONS FOR THE NEW BUSINESS MODEL



### Environmental protection

Reduce, reuse & recycle

Improve environment & energy performance

Resilient urban settlements

Efficient use of resources

**Resilient to natural and human-generated hazards**

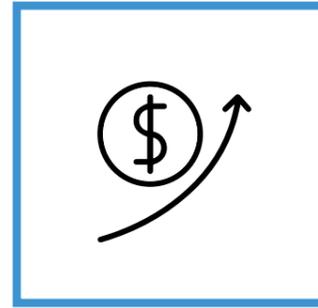
Green spaces around and within housing areas

Compact housing settlements with planned growth

Waste management treated as integral part

Encouragement of healthy living through

Existing houses that are retrofitted, as much as possible, for the efficient use of resources



### Economic effectiveness

Flexibility between owning and renting

**Local solutions, labour and local materials**

Appropriate technologies in such a way as to generate employment

Housing construction performed based on the use of building codes & standards and support building safety

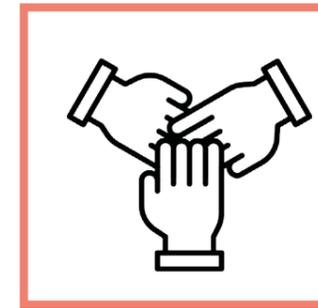
Combat energy poverty by supporting energy efficiency

Increased investment in sustainable housing promoted through private and public investments

Compact housing settlements with planned growth

Waste management treated as an integral part

investment in housing and the promotion of secure land and housing tenure



### Social inclusion and participation

Support for adequate housing solutions for people affected by natural & human-made disasters

Adequate, healthy, safe and affordable housing, including access to basic utilities and services

**Promote social cohesion and contribute to meeting the housing needs of various social groups**

Increased availability of housing options, particularly affordable and social housing

encourages socially mixed communities

Research and exchange of knowledge on all aspects of sustainable housing

Effective, clear, and transparent governance at all levels

Housing that support social justice



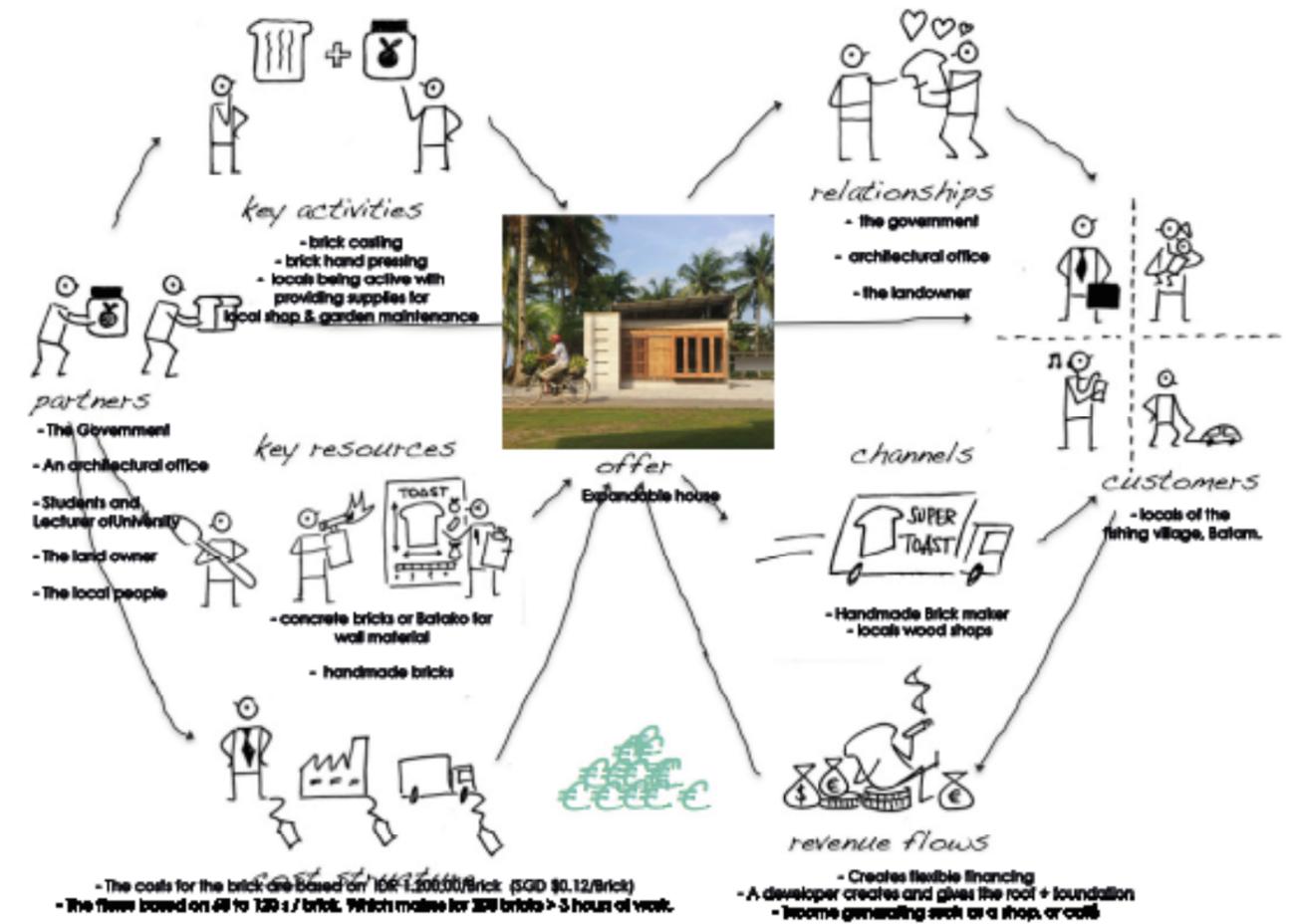
### Cultural adequacy

National housing policies that support the protection and enhancement of landscapes, heritage and culture

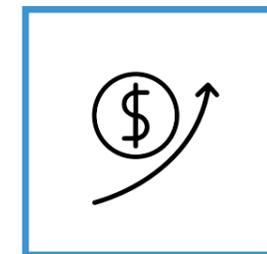
Emphasizing the development of public spaces for cultural and social activities;

**Housing that takes into consideration the background and culture of inhabitants**

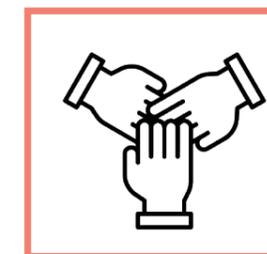
Houses designed and actively maintained in order to enhance emotional wellbeing, including by involving local communities in this process.



Environmental protection



Economic effectiveness

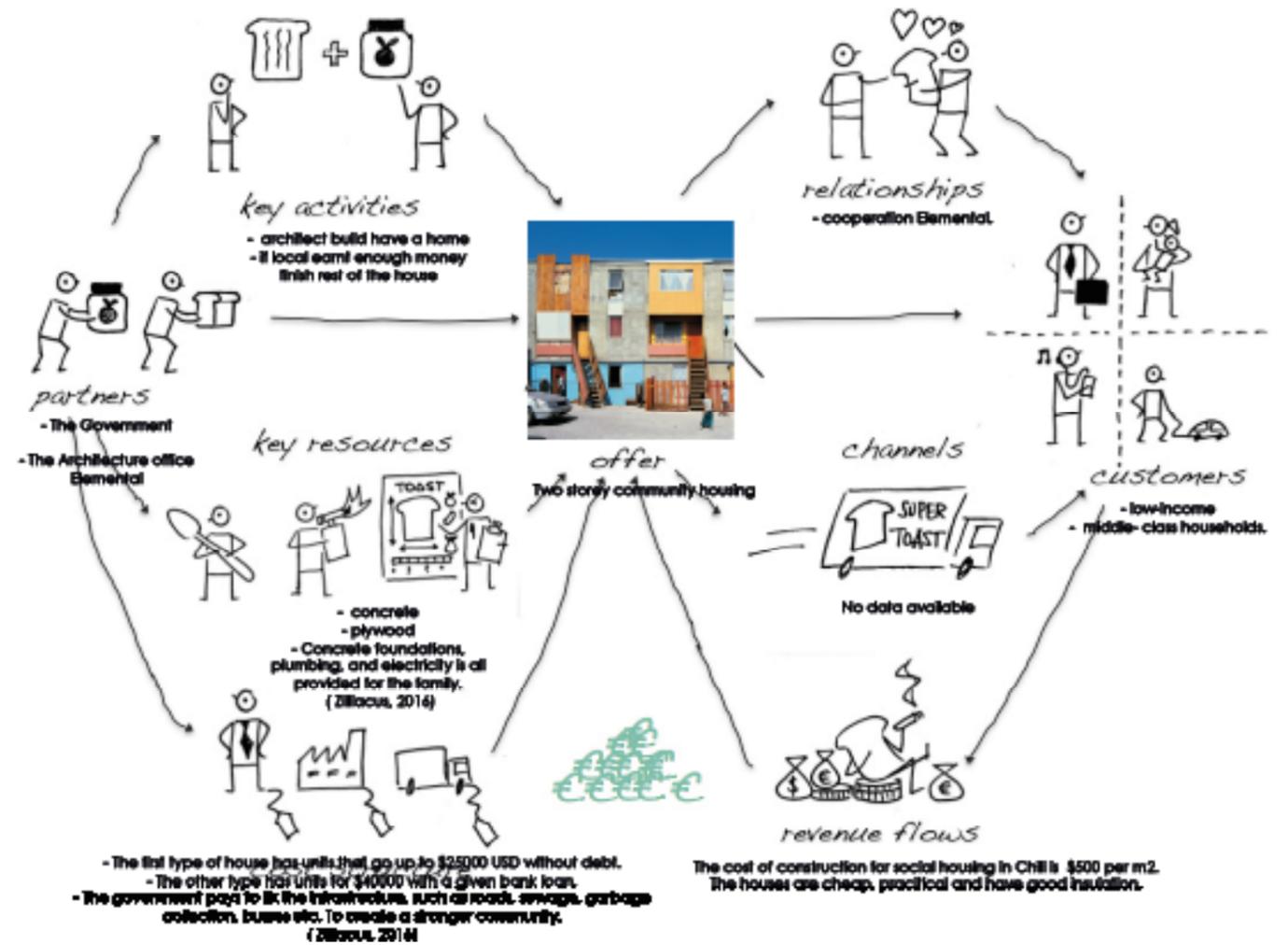


Social inclusion and participation

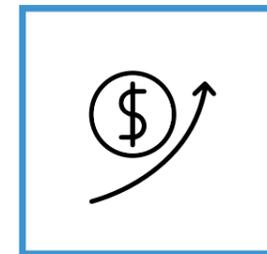


Cultural adequacy

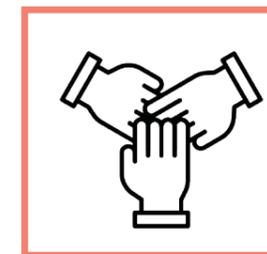
Case study - Rumah Tambah



Environmental protection



Economic effectiveness

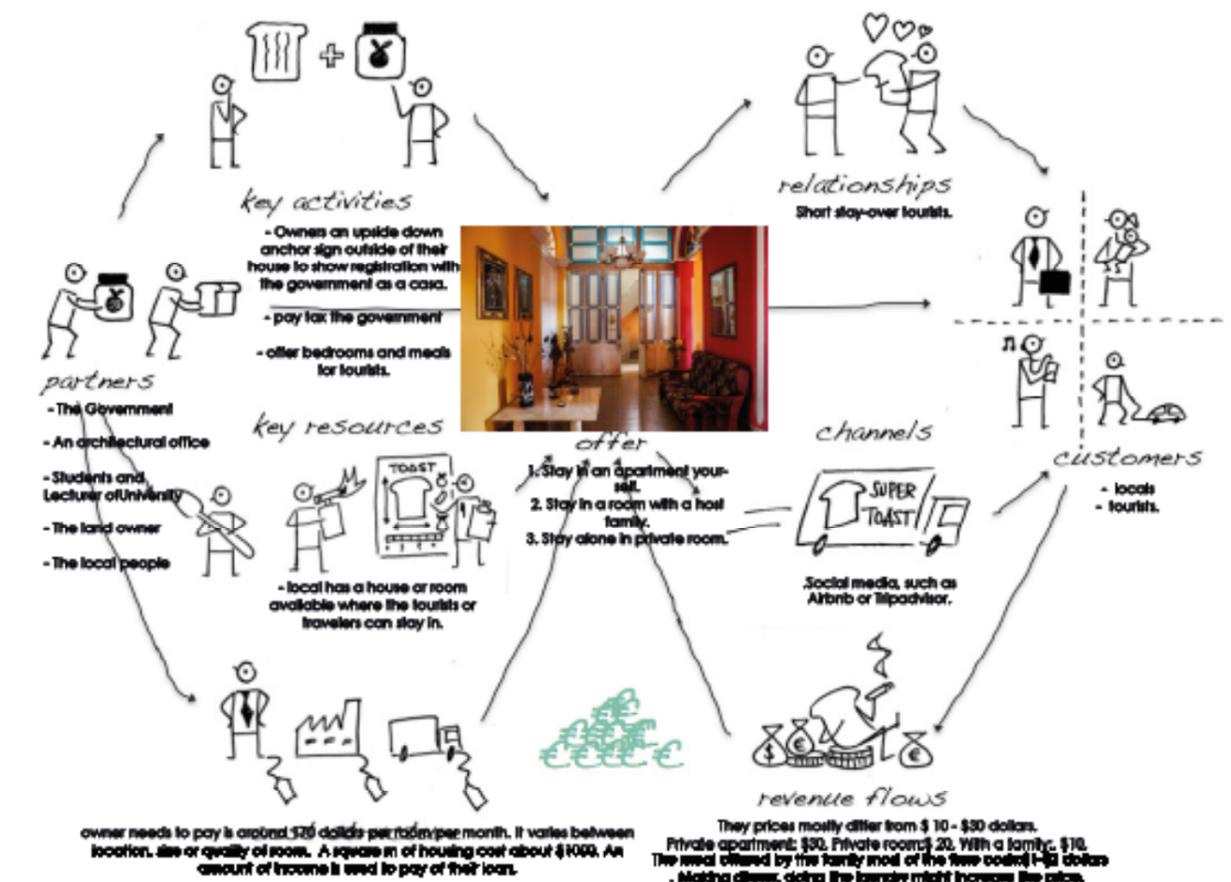


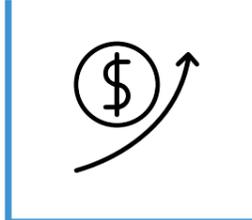
Social inclusion and participation



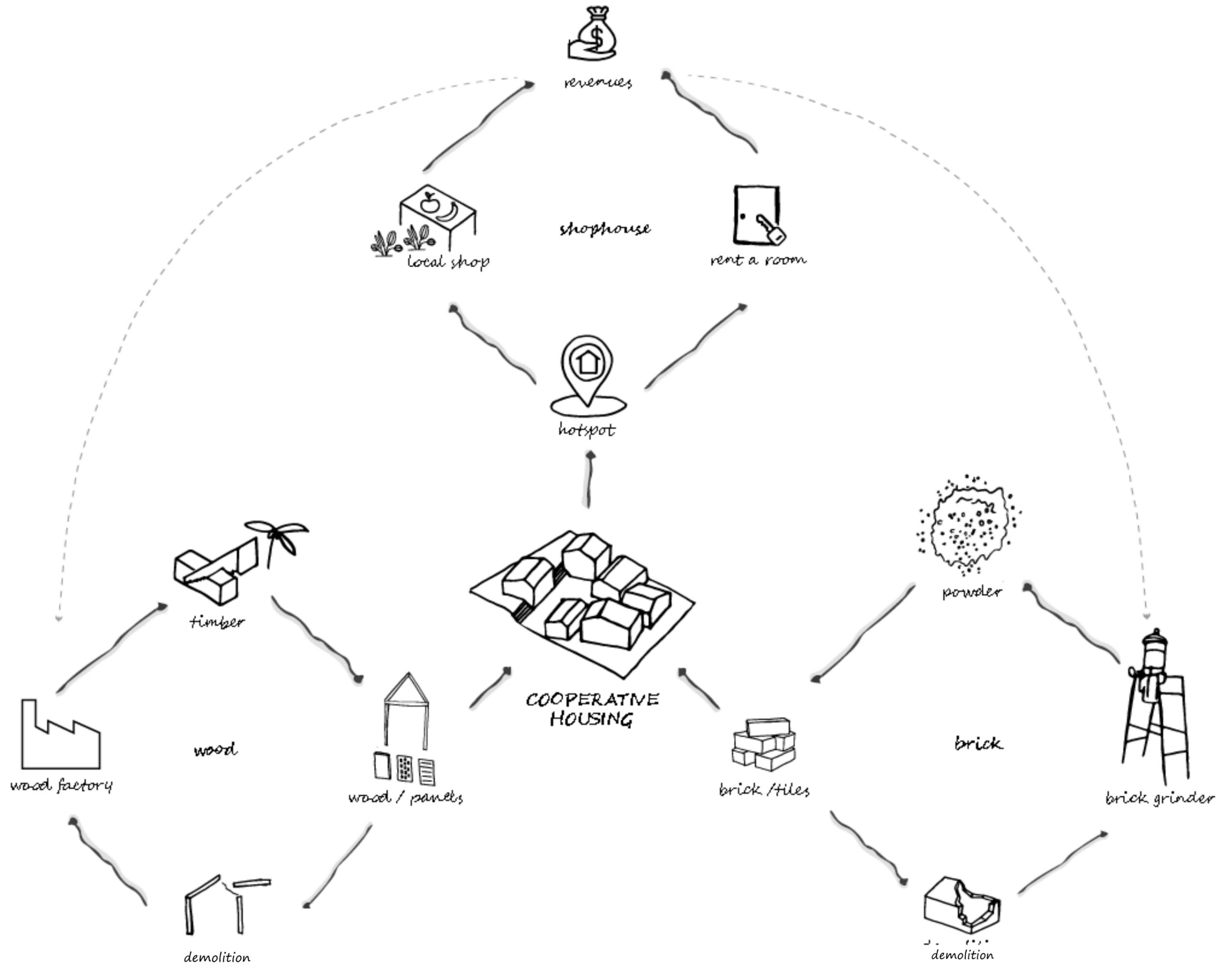
Cultural adequacy

Case study - Half a house Aravena



			
<p>Environmental protection</p> <p>Existing houses that are retrofitted, as much as possible, for the efficient use of resources</p>	<p>Economic effectiveness</p> <p>Flexibility between owning and renting</p>	<p>Social inclusion and participation</p> <p>Promote social cohesion and contribute to meeting the housing needs of various social groups</p> <p>encourages socially mixed communities</p>	<p>Cultural adequacy</p> <p>Emphasizing the development of public spaces for cultural and social activities;</p> <p>Housing that takes into consideration the background and culture of inhabitants</p>

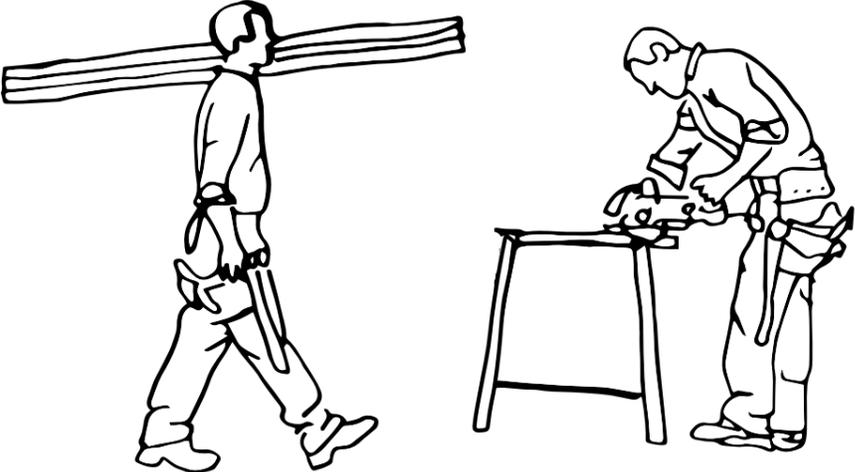
Case study - Casa particular



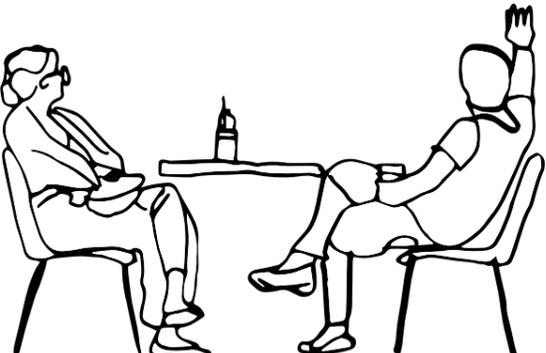
faces of the new business model



locals



local workers

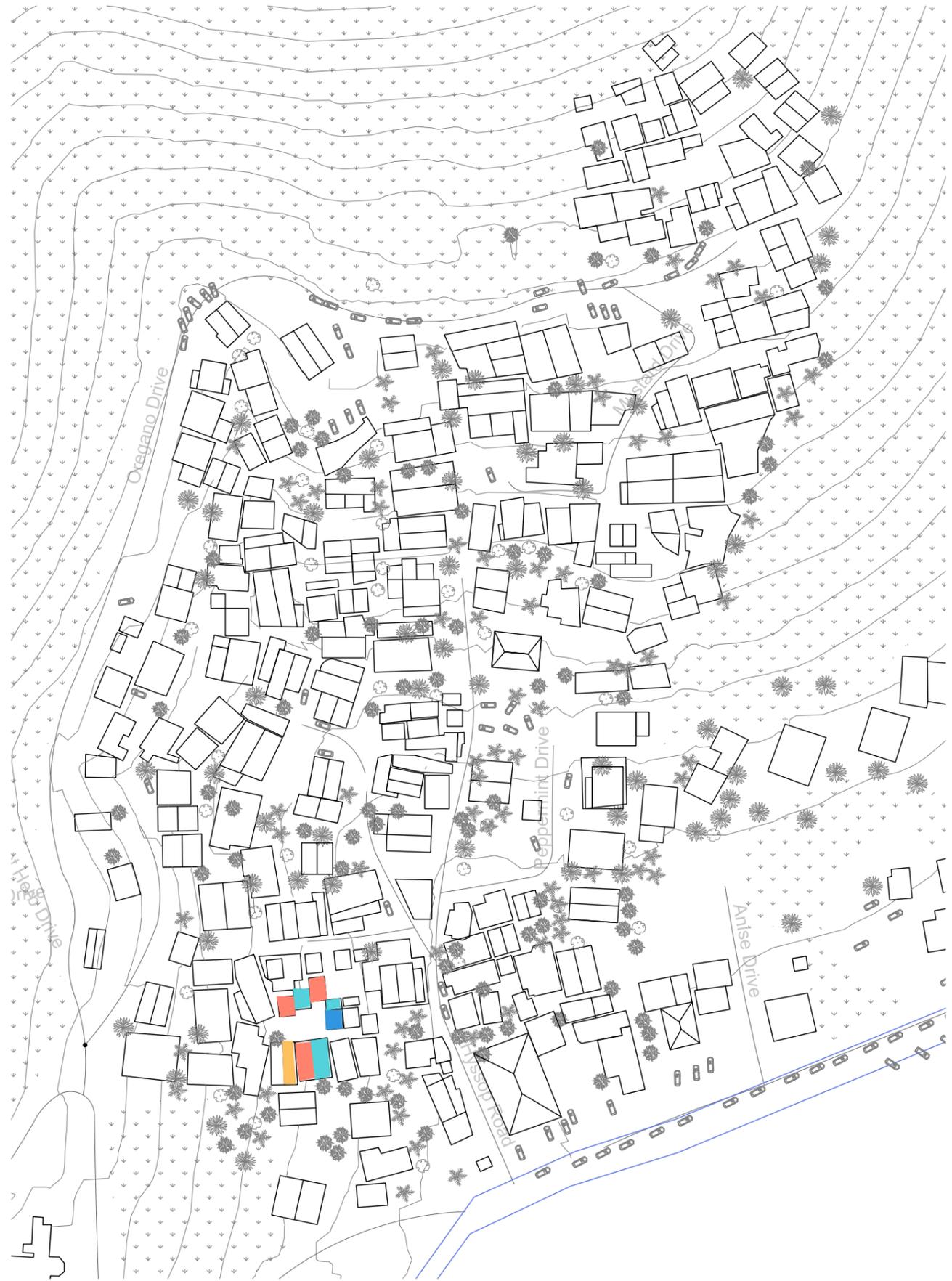


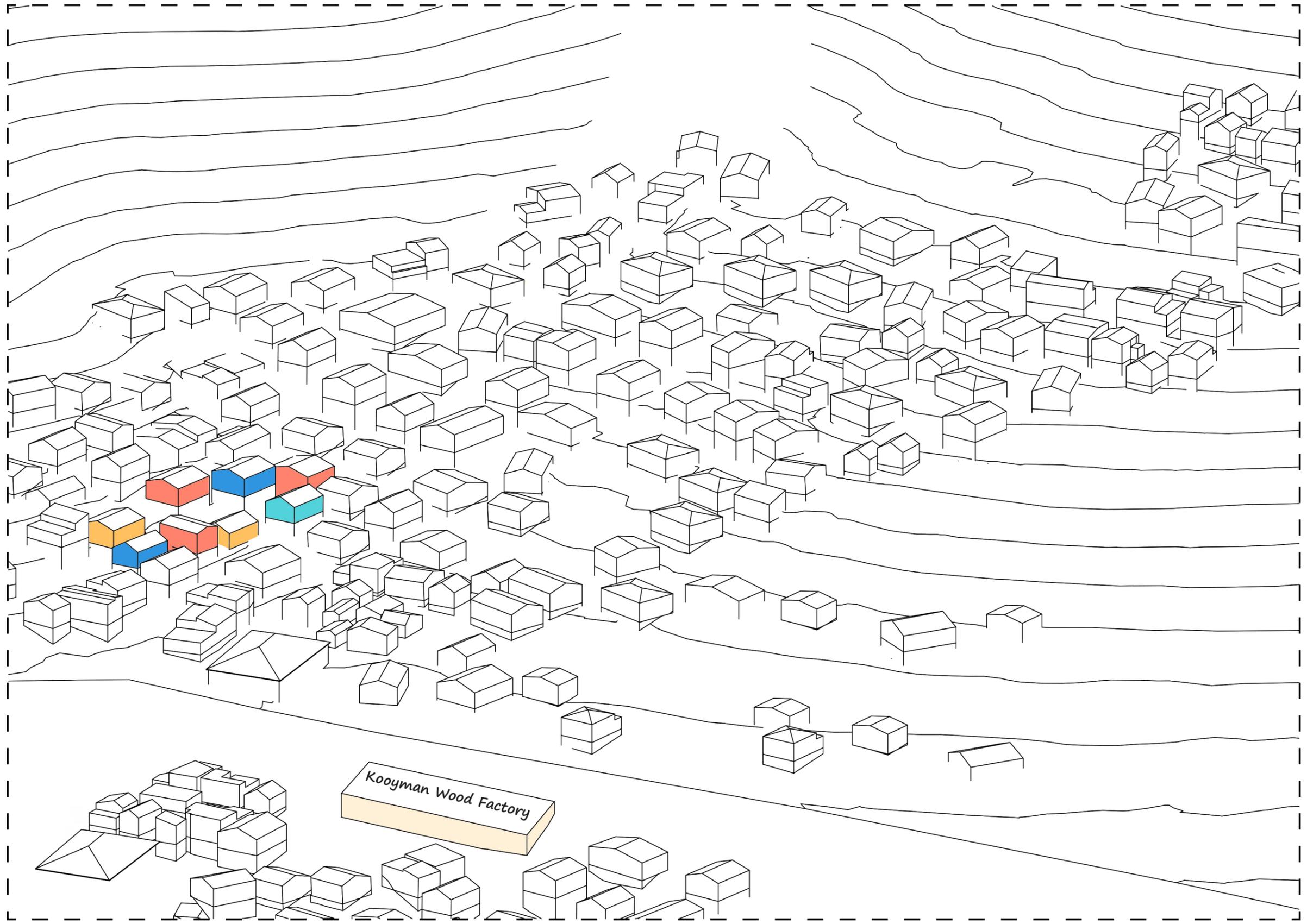
tourists



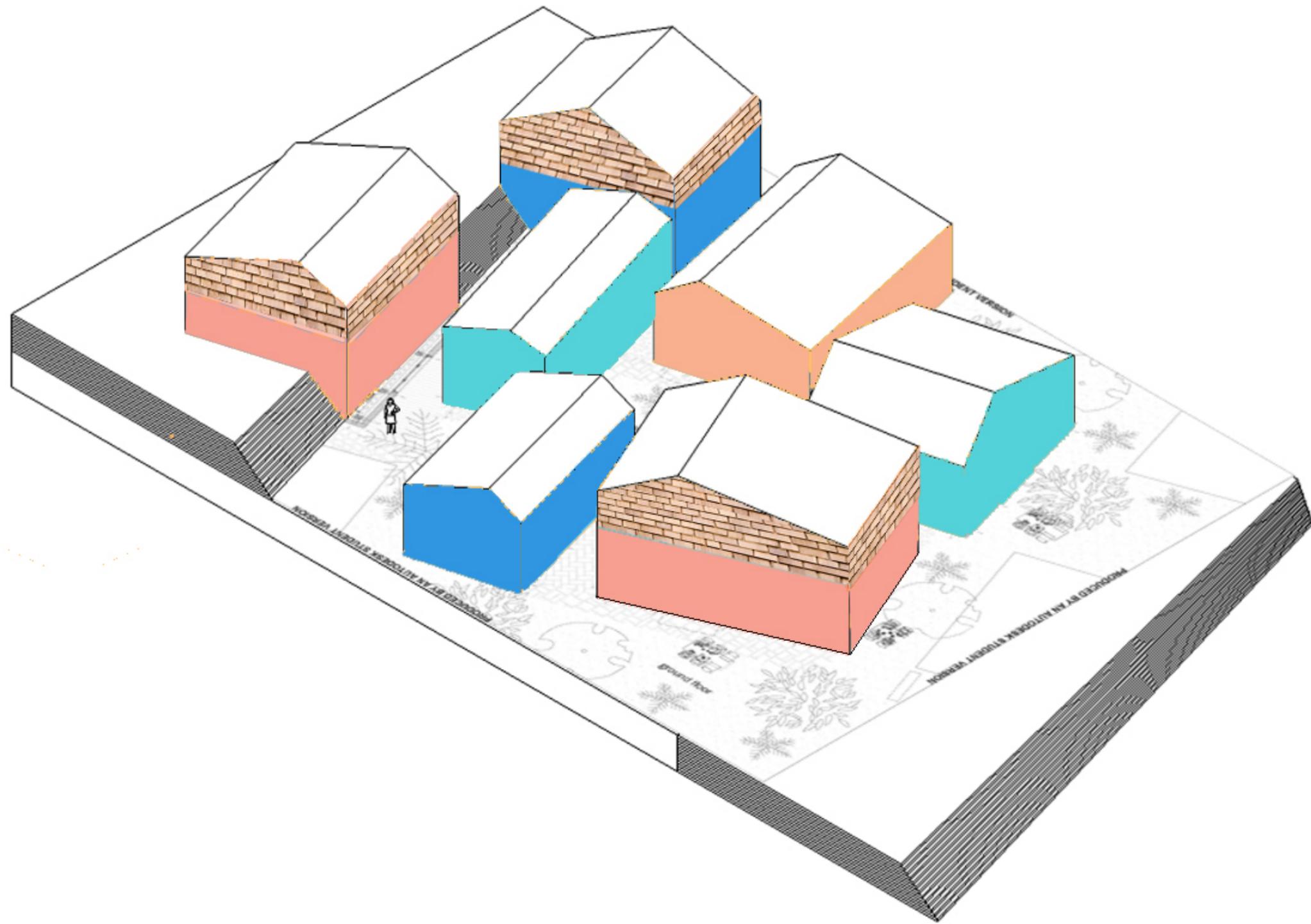
entrepreneurs

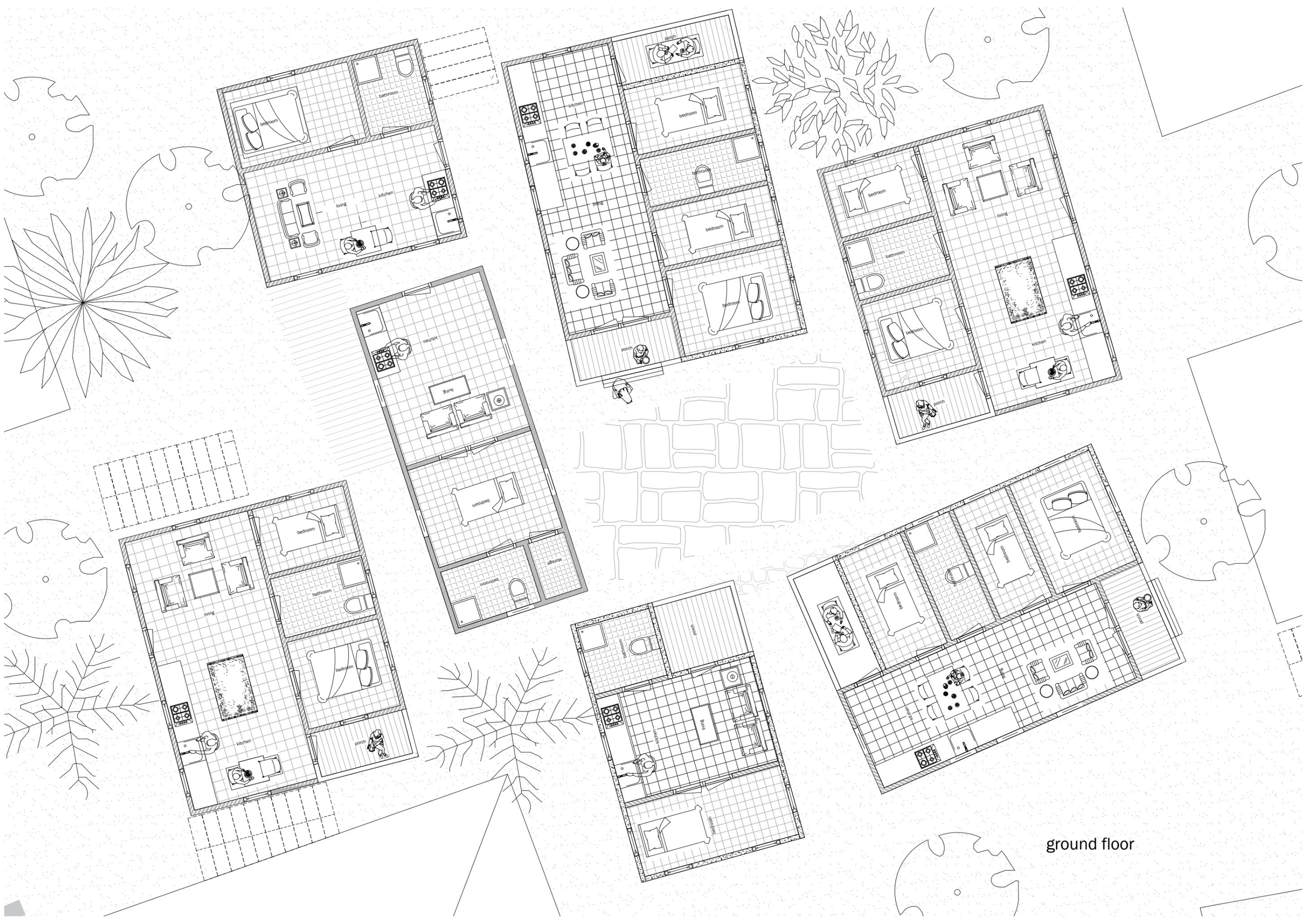
**Design**





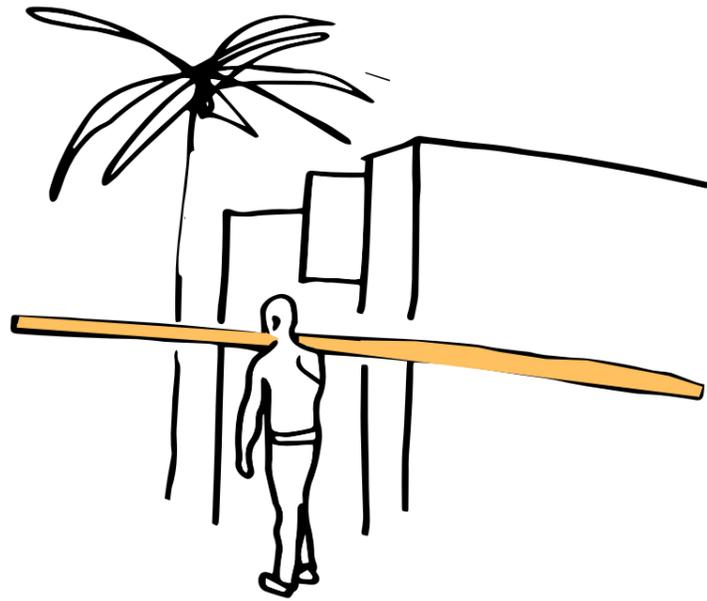
Kooyman Wood Factory





ground floor

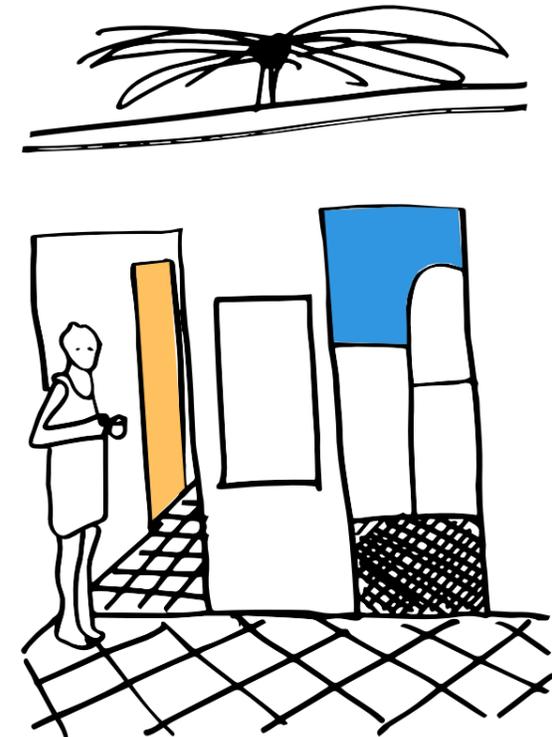
Opportunities



Self-help community



Public stairs



Colourful atmosphere



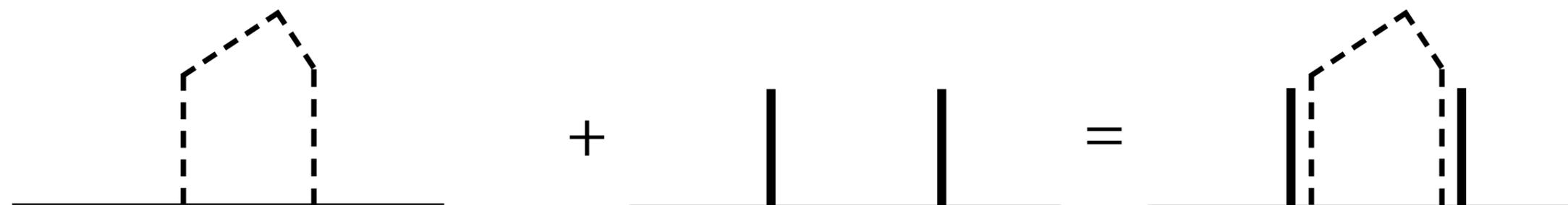
Shophouses



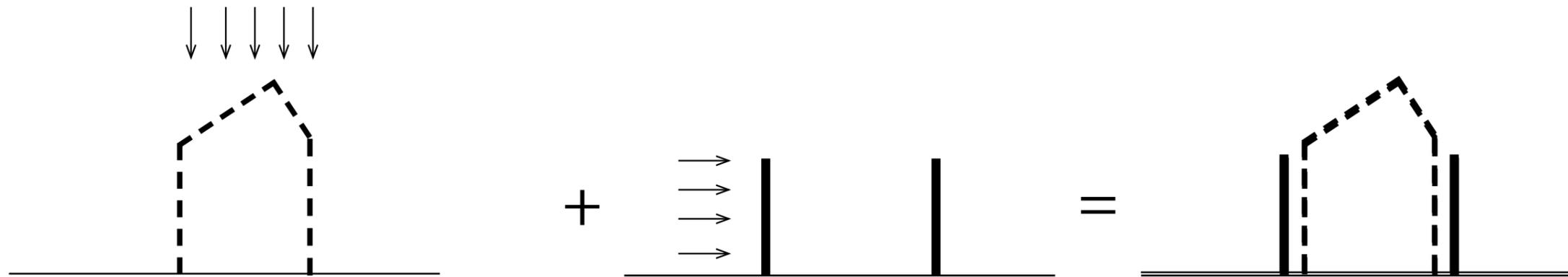
'Suprising' hidden courtyards



Verandah's



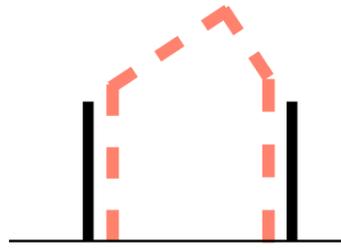
wood + bricks + (hotspot) adaptability = community



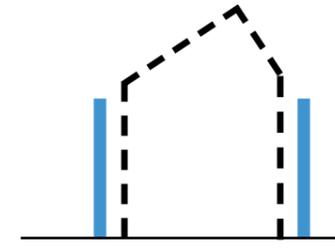
vertical weight > wood & horizontal weight > brick

# Abstract principles

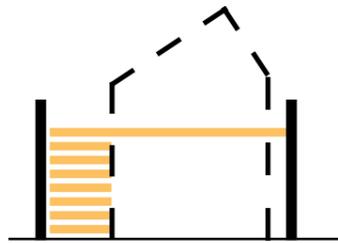
- Light structure for flexibility



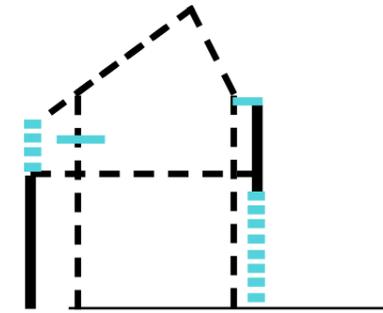
- Heavy structure for safety and individual expression



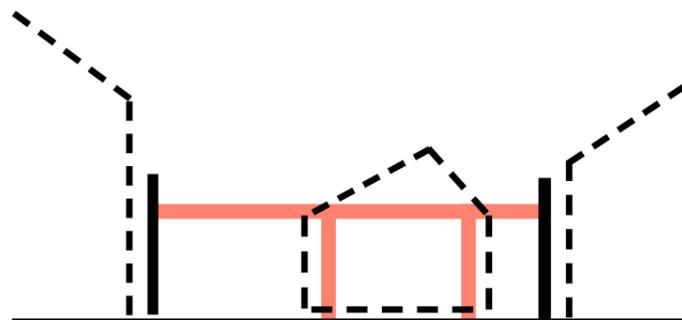
- Max. 2 levels for view and access (adding floor+stair)



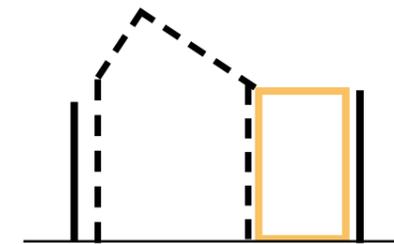
- Permeability for public/private and daylight (shophouse+garden)

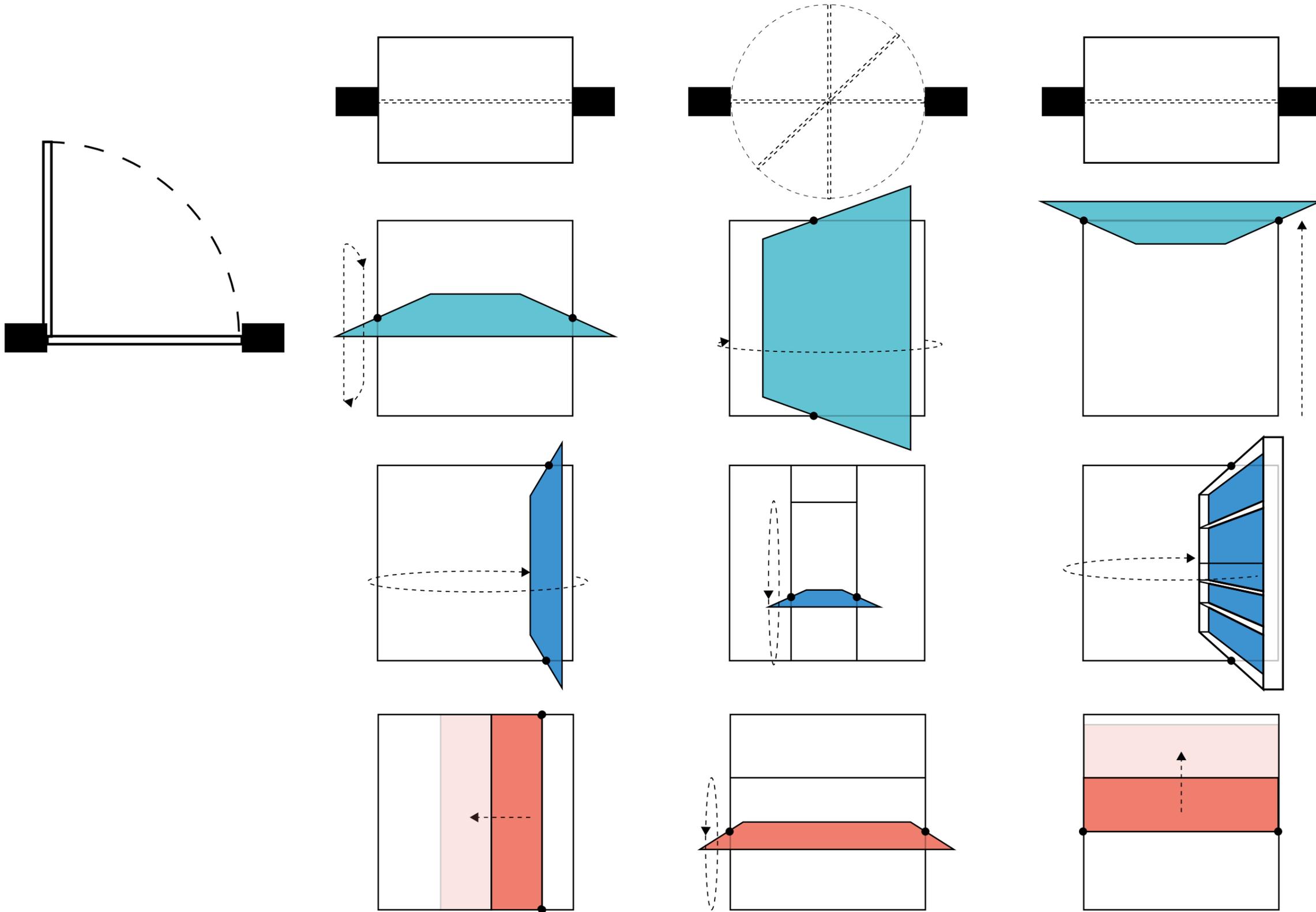


- Light structure in the courtyard (shared communal space)

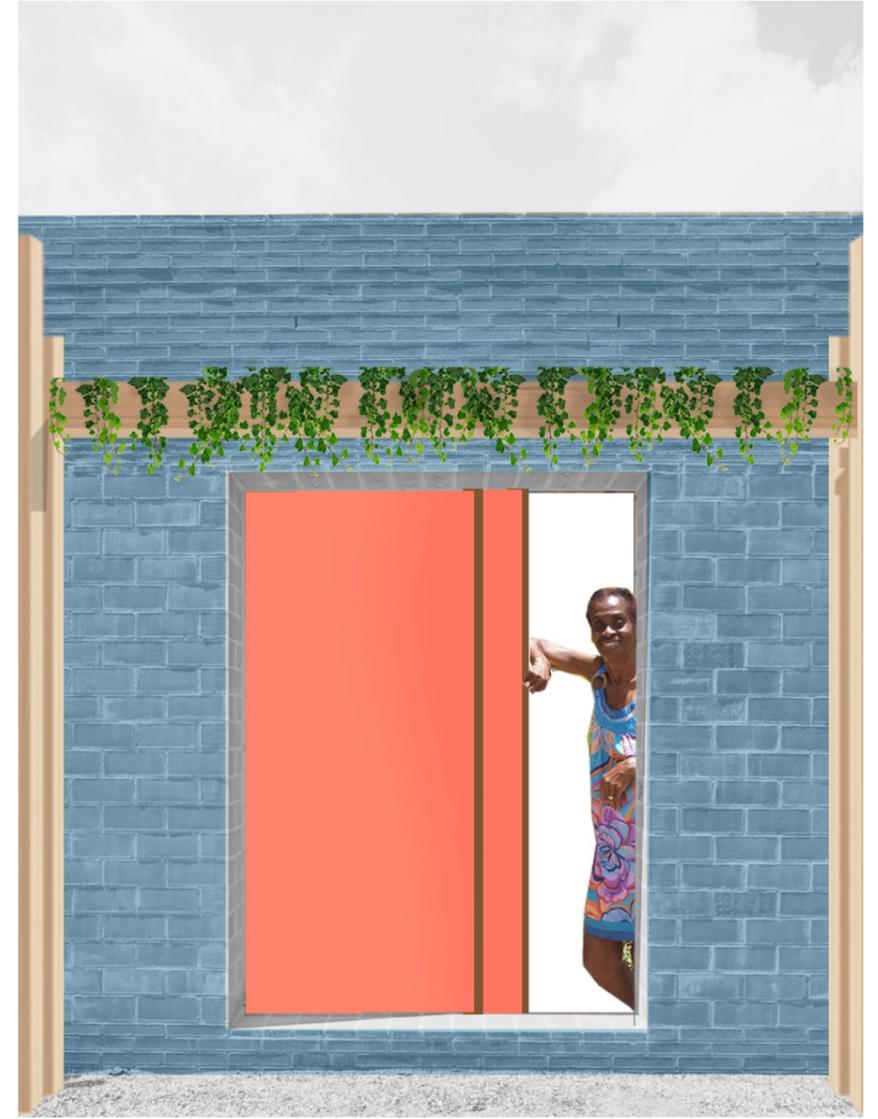
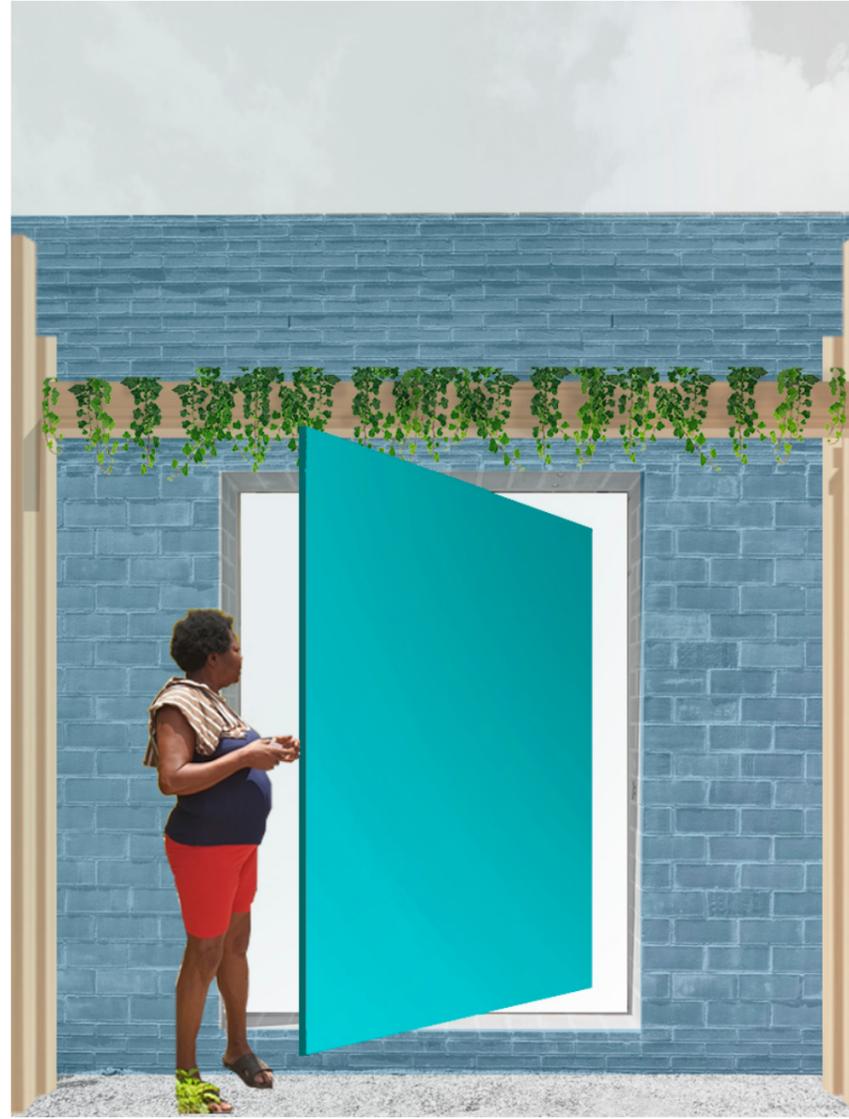


- Expanding existing house





three flexible wall principles . Rietveld and Steven Holl.



## Typologies

Large house :  
One family (two floors)

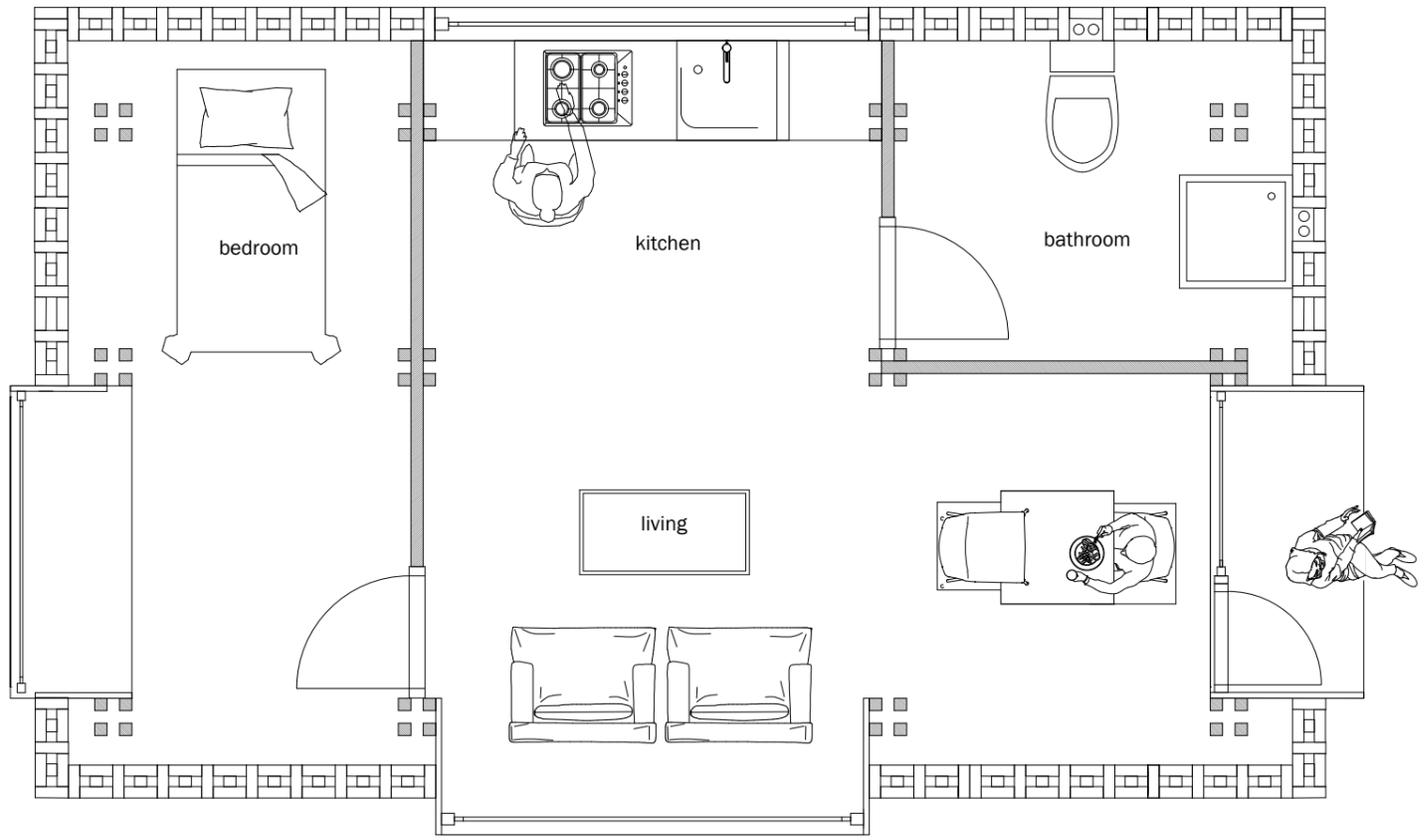
Medium house 1:  
two family houses (two floors)

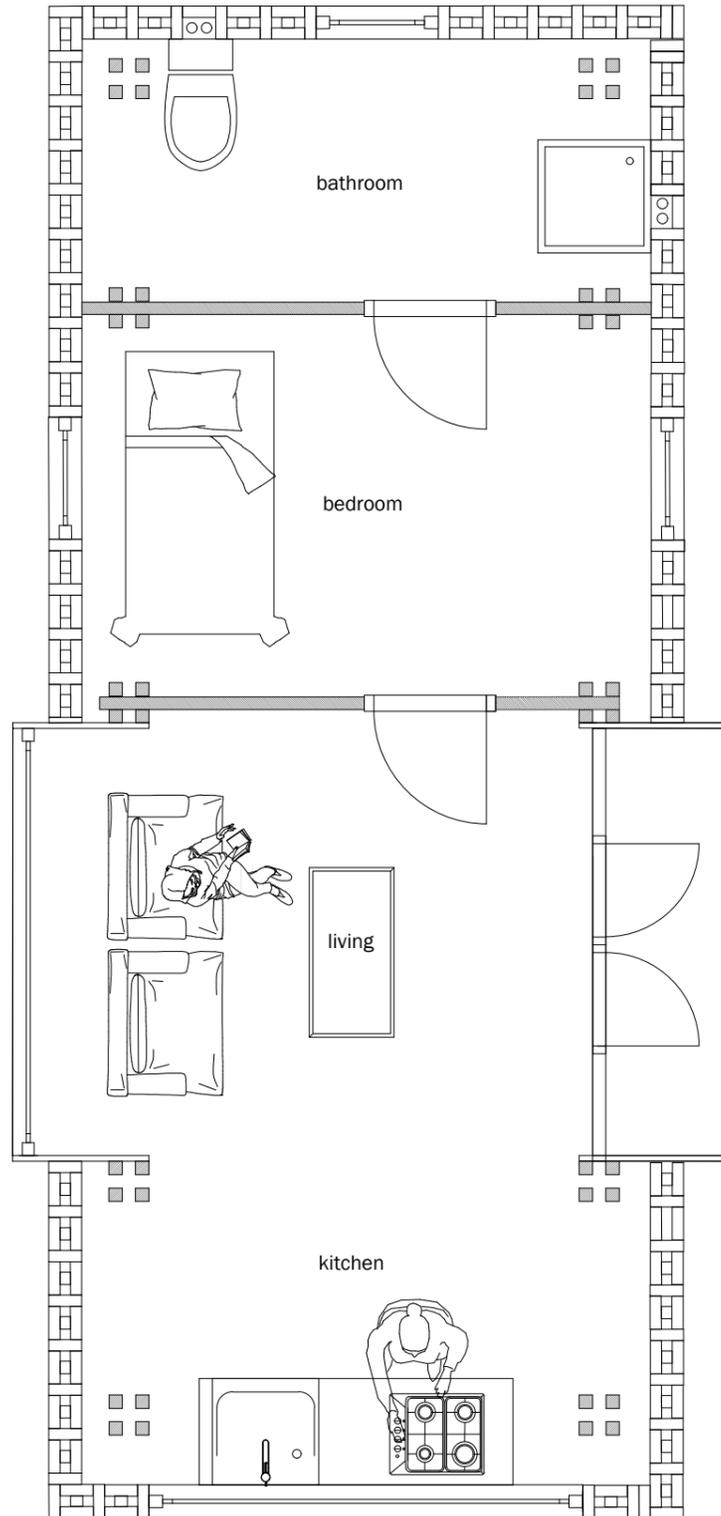
Medium house 2:  
one family, one room to rent (two floors)

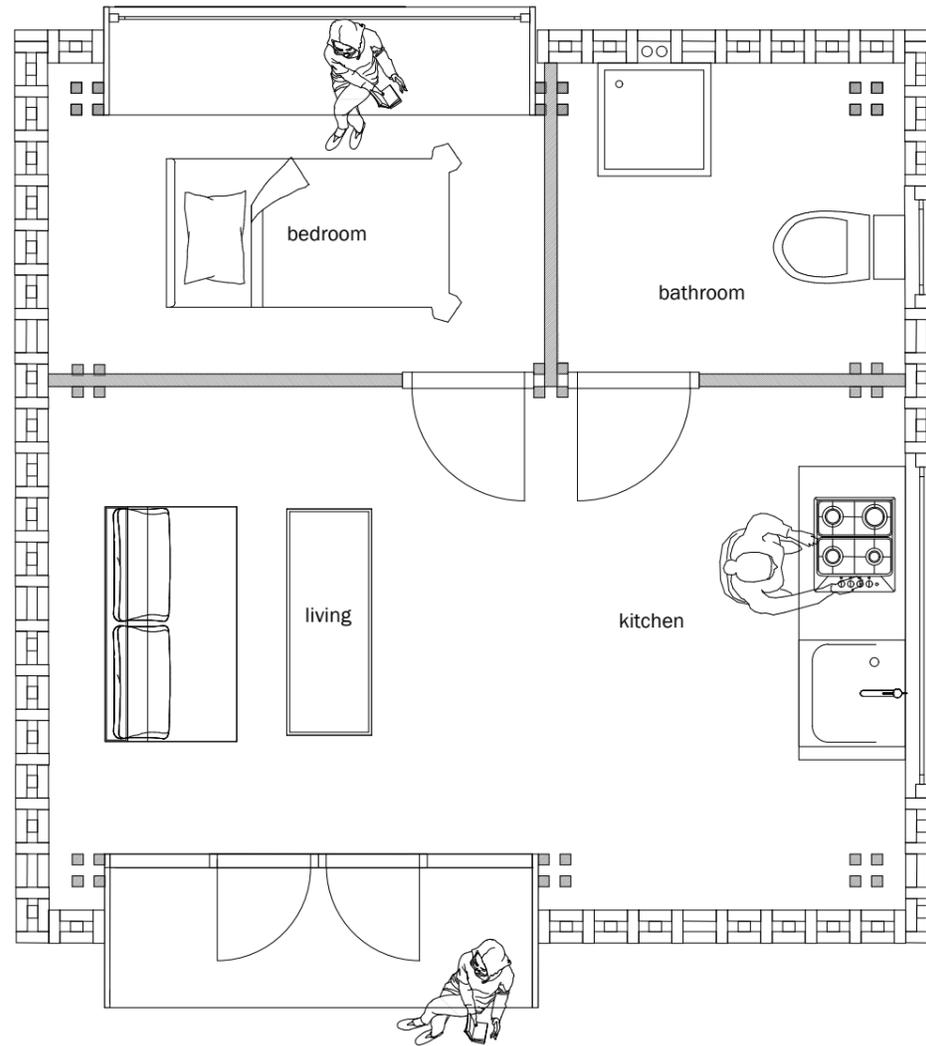
Small house 1:  
One family

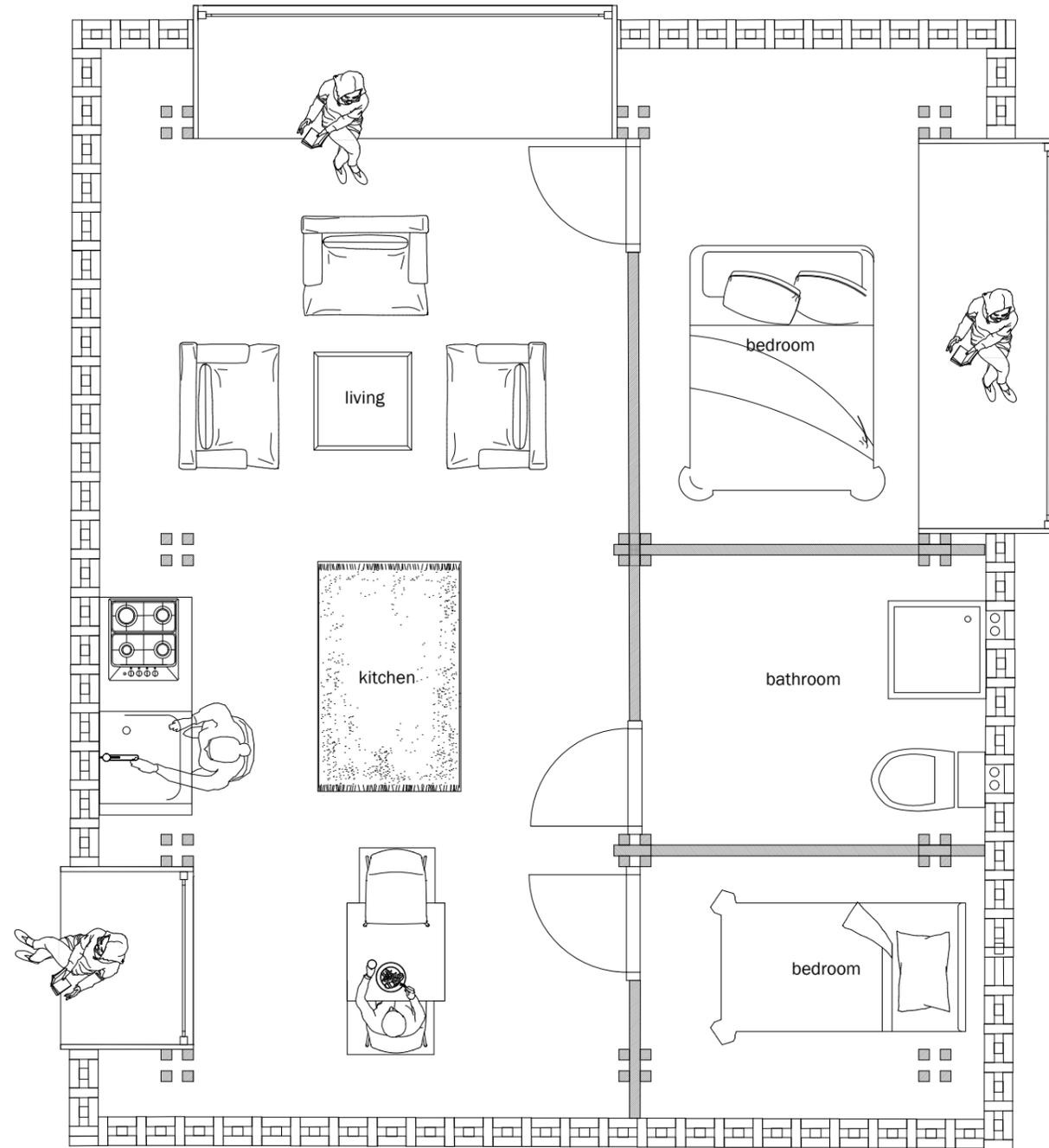
Small house 2:  
One family, one room to rent

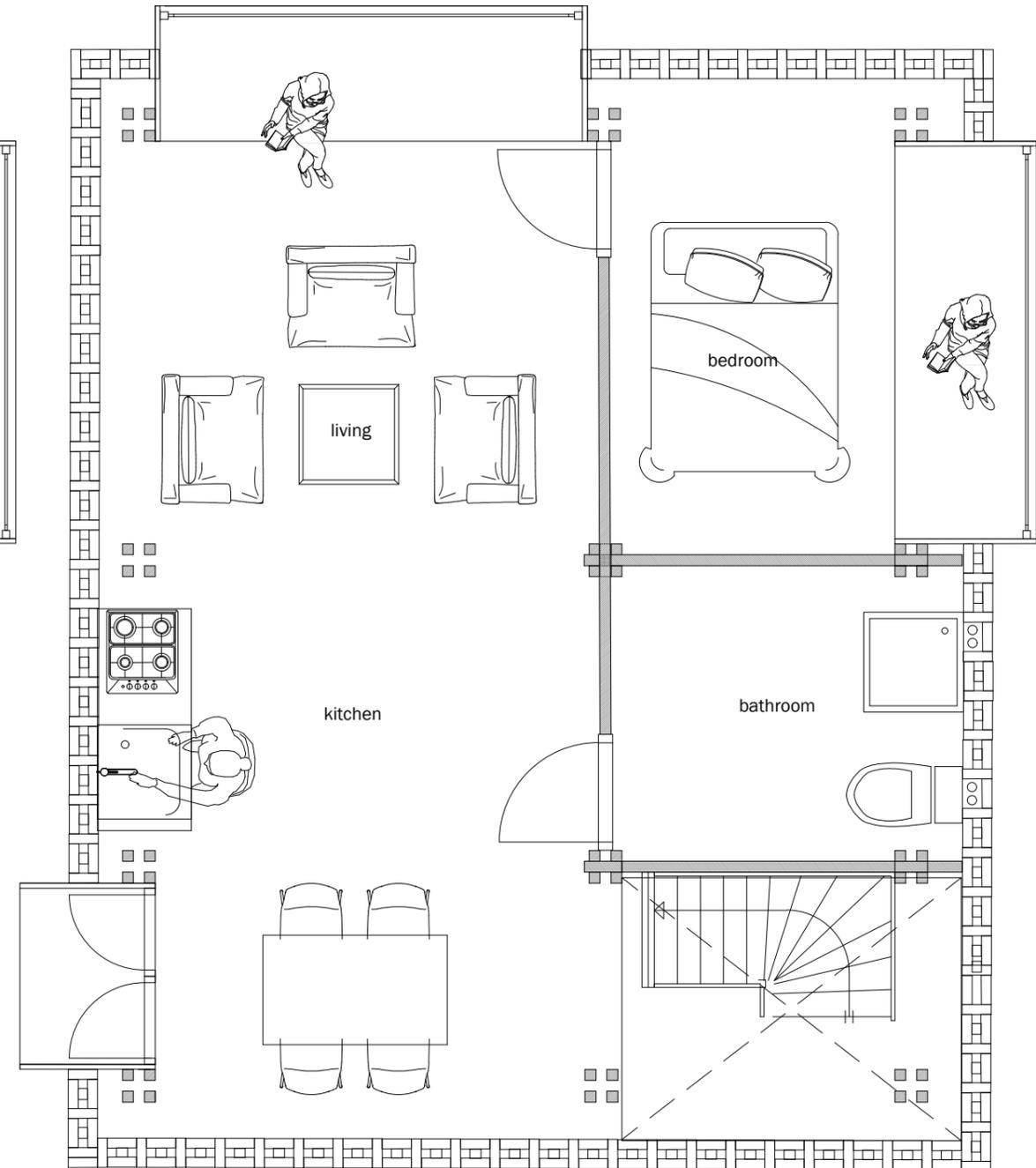
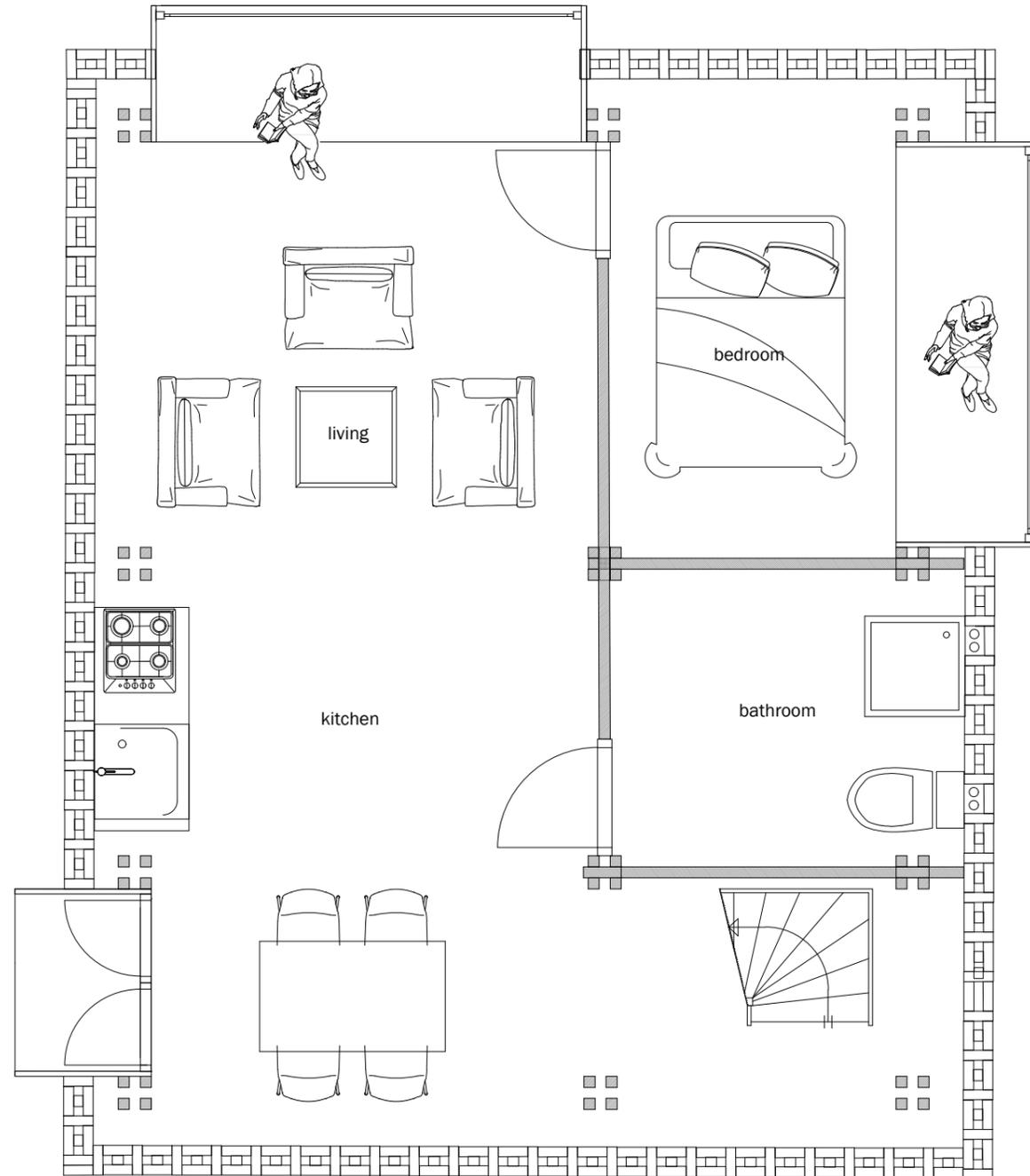
Tiny house:  
One person or couple

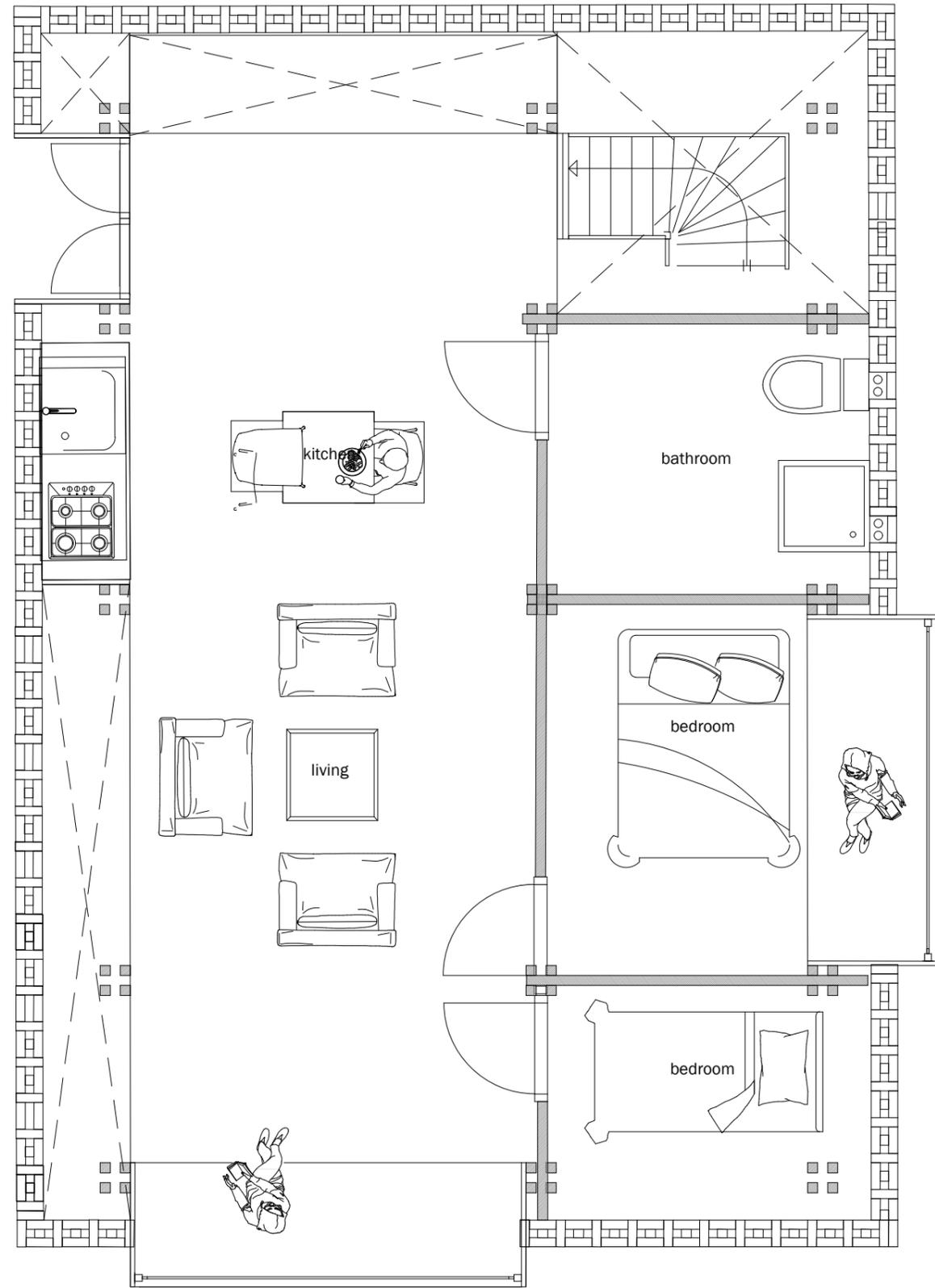
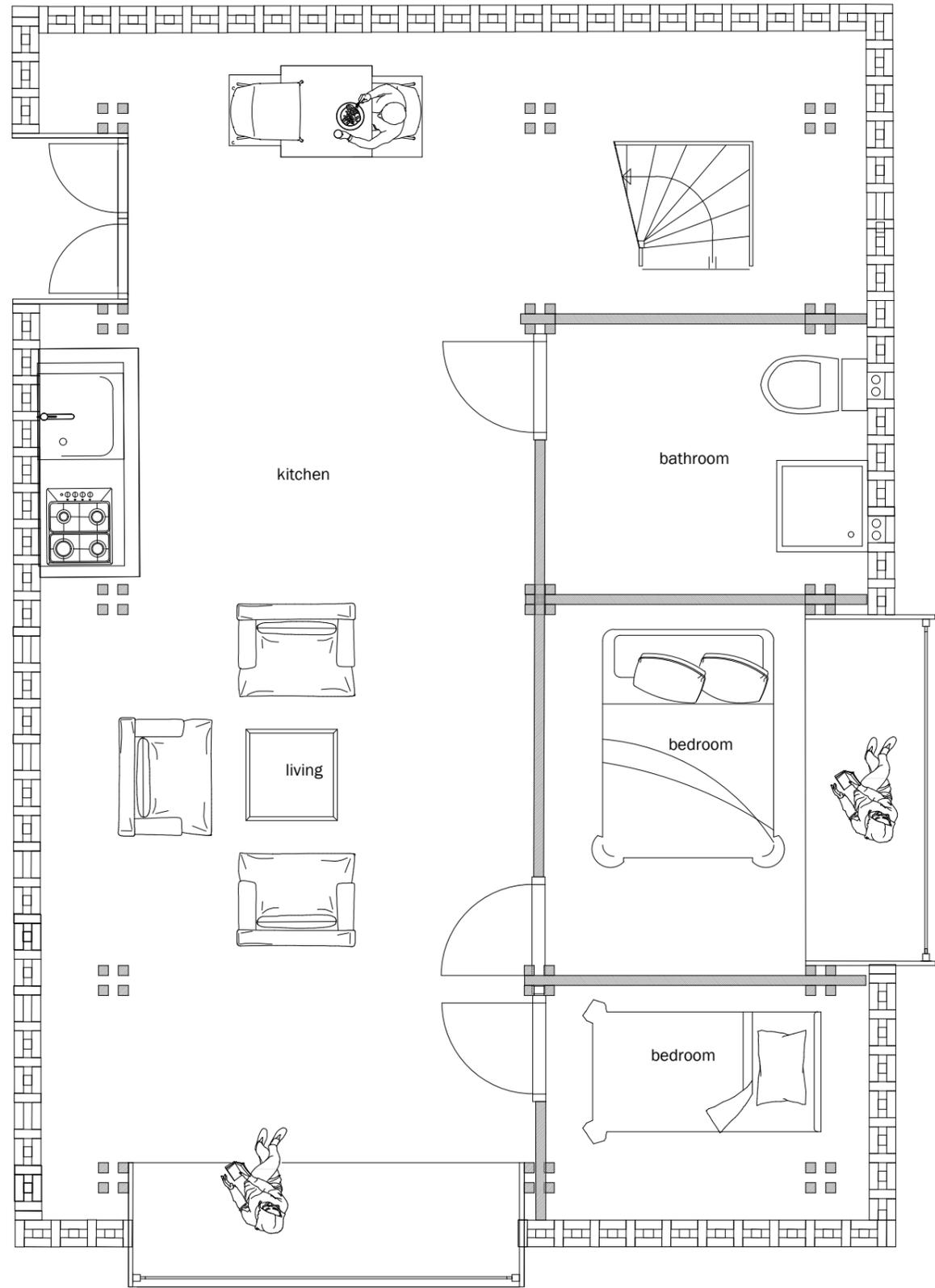


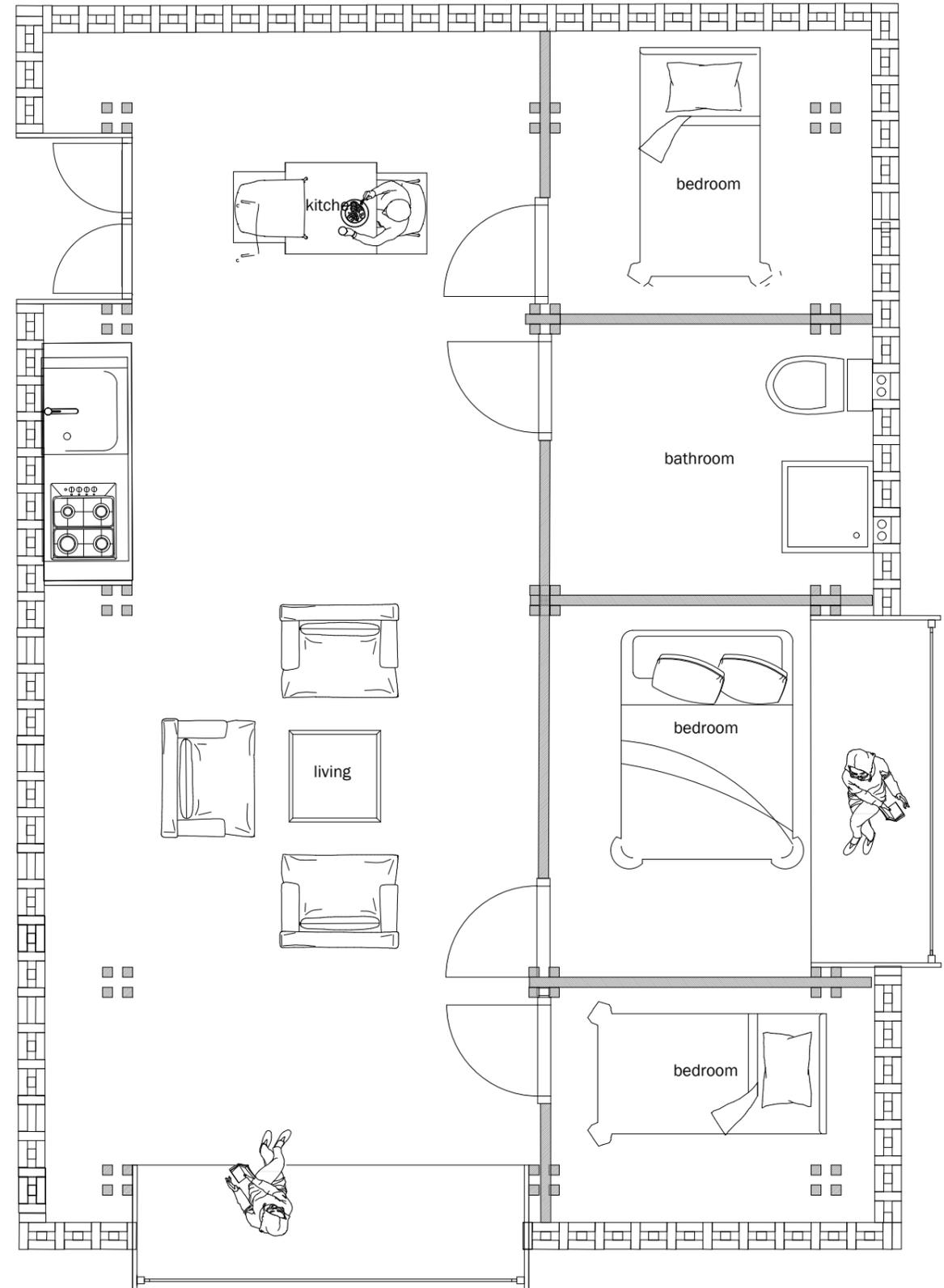
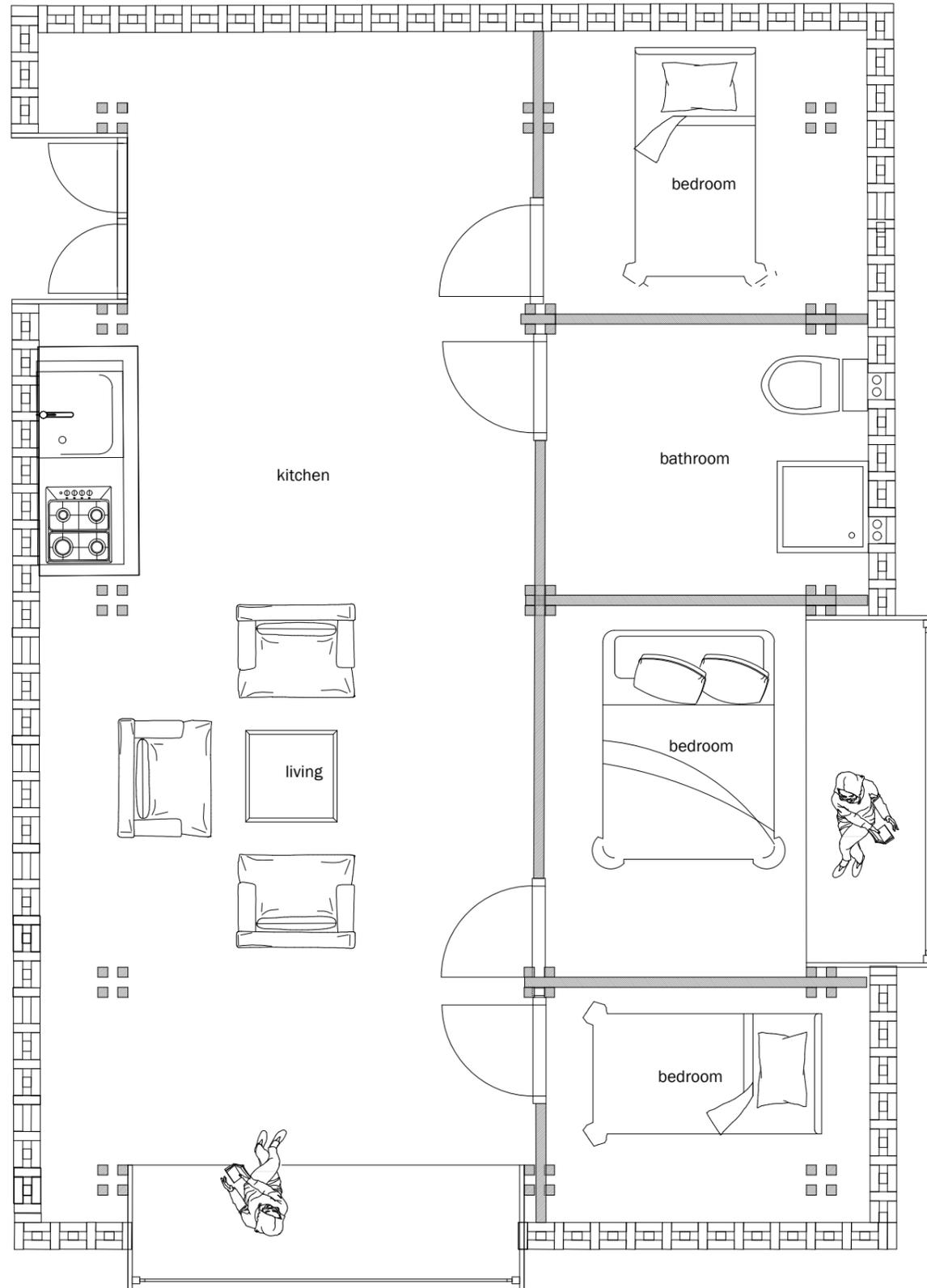


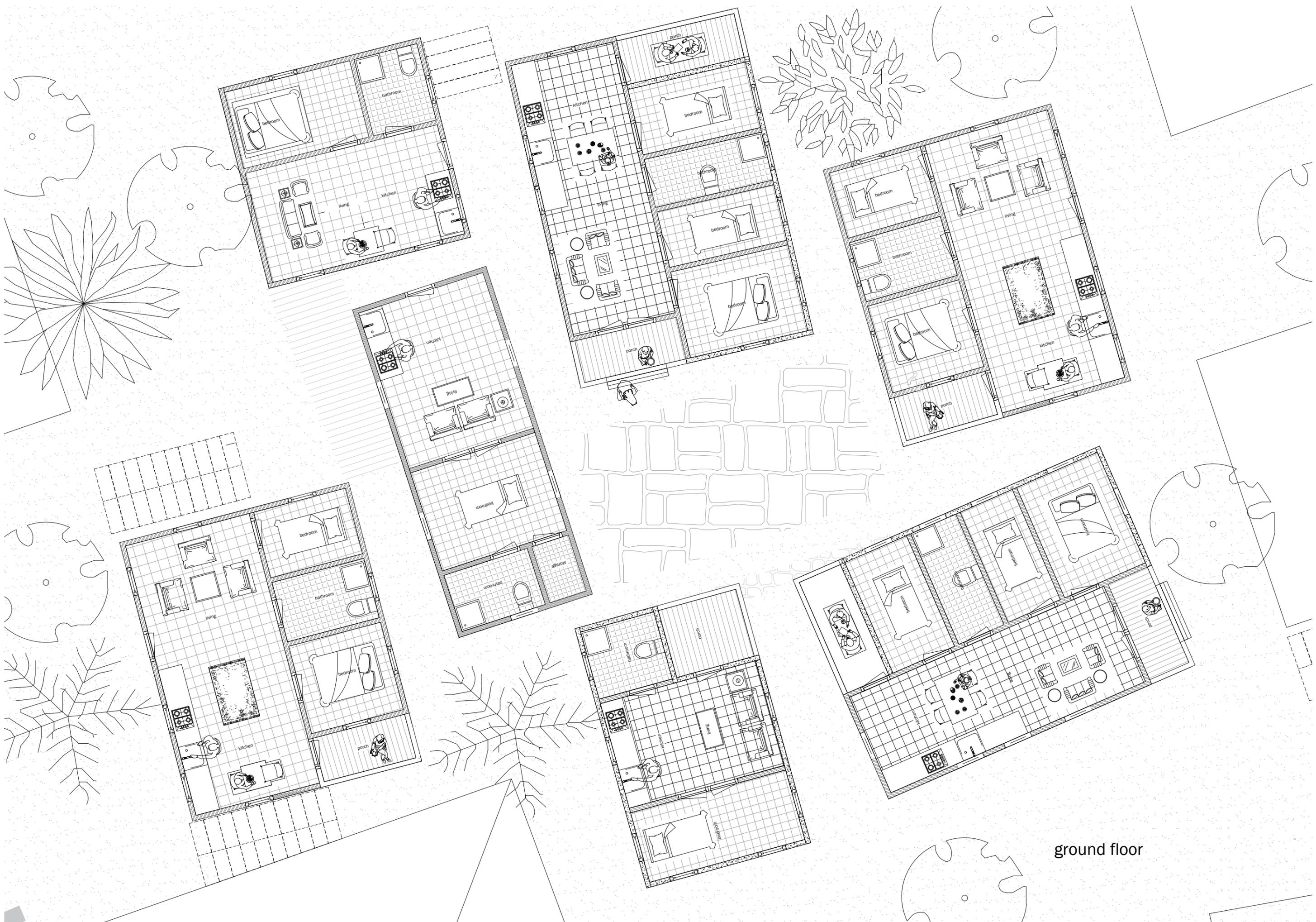




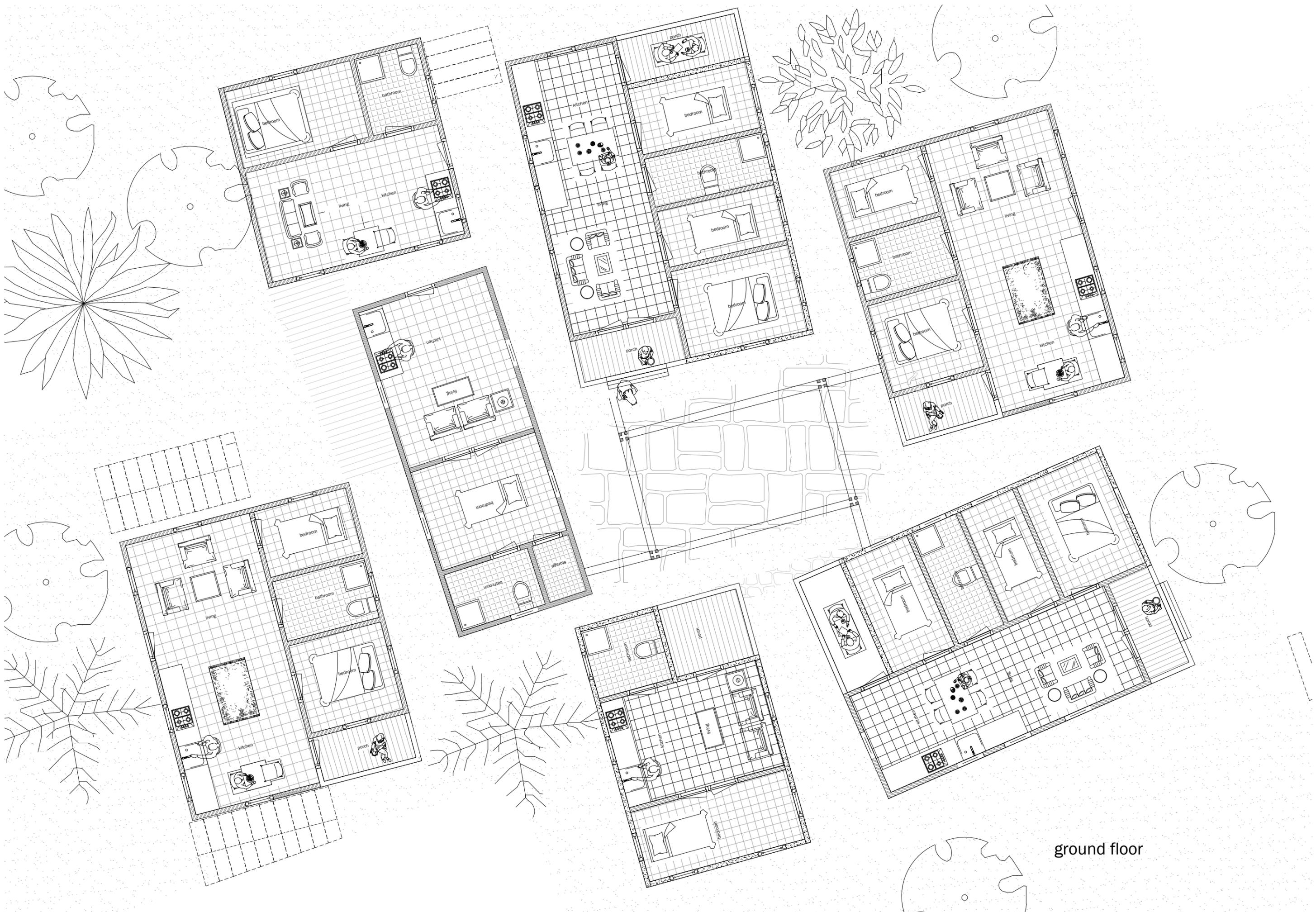




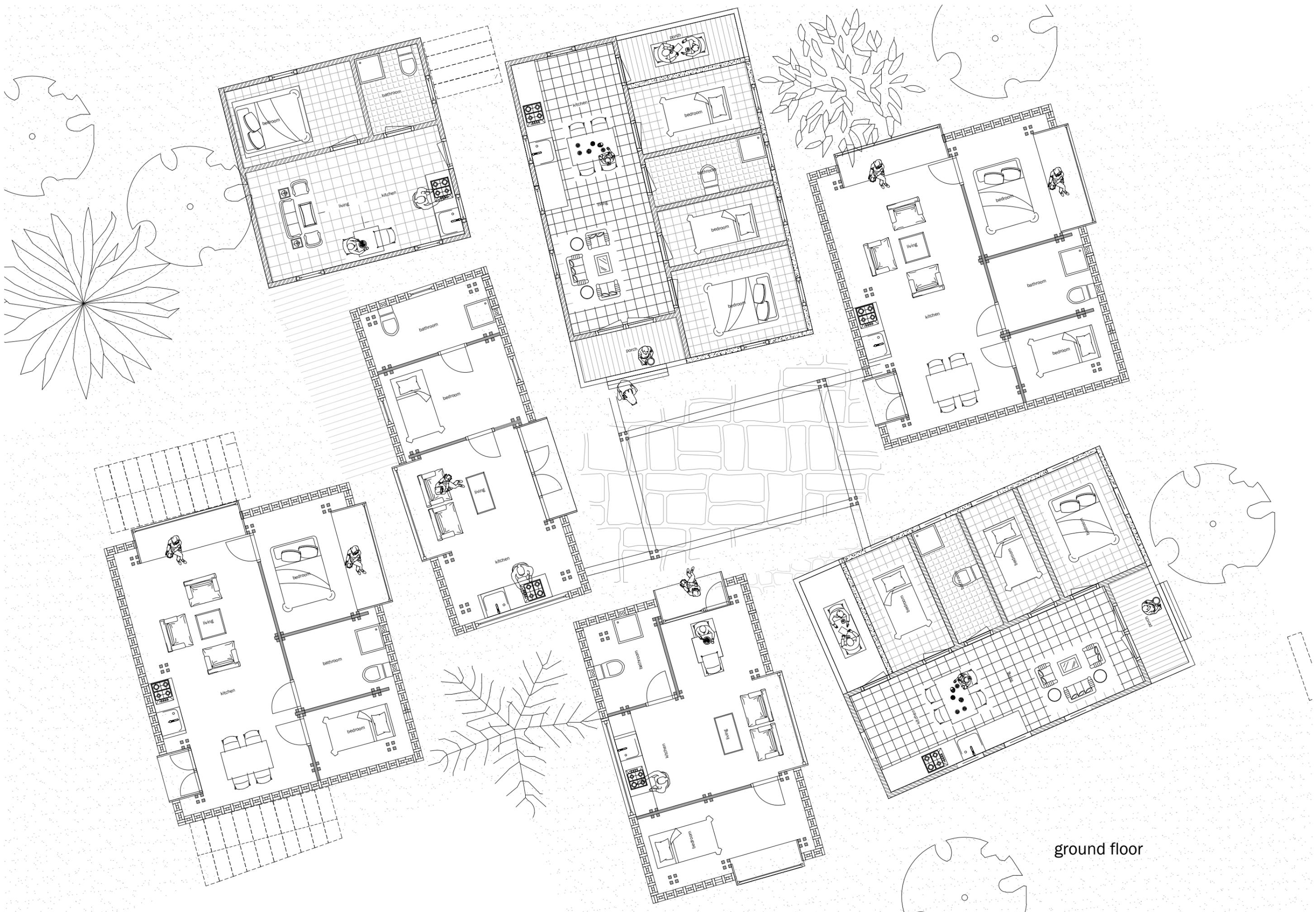




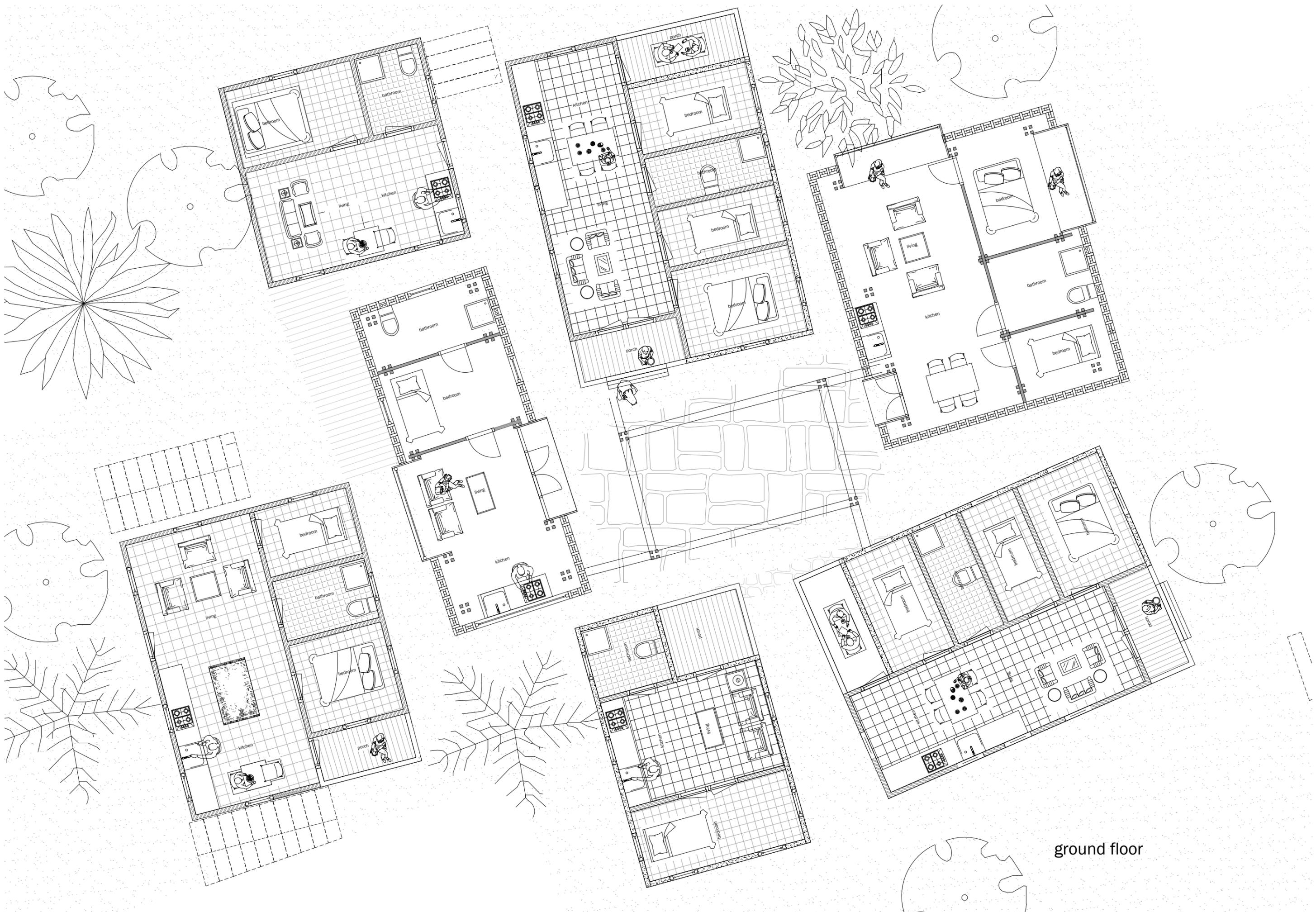
ground floor



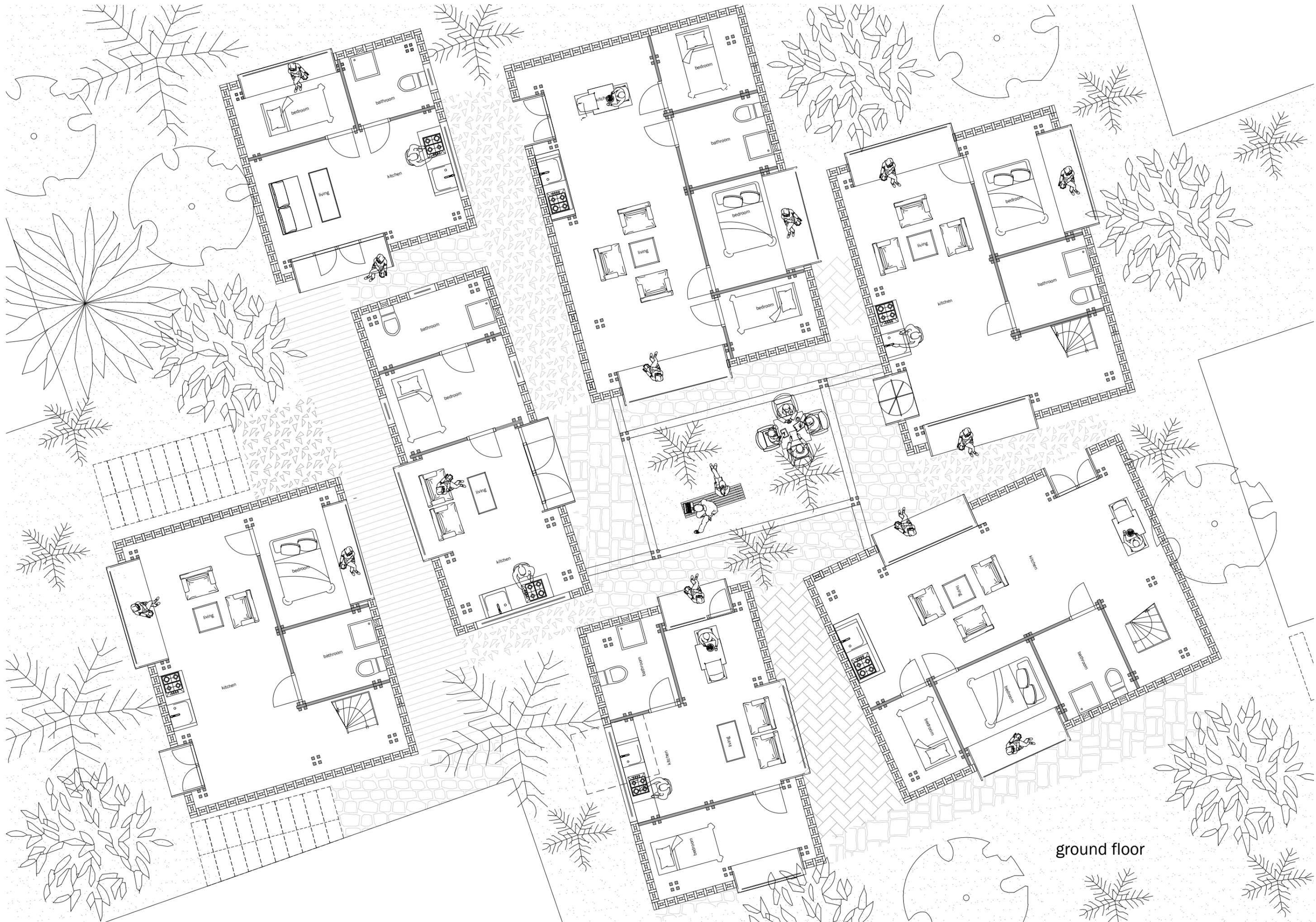
ground floor



ground floor



ground floor



ground floor



first floor

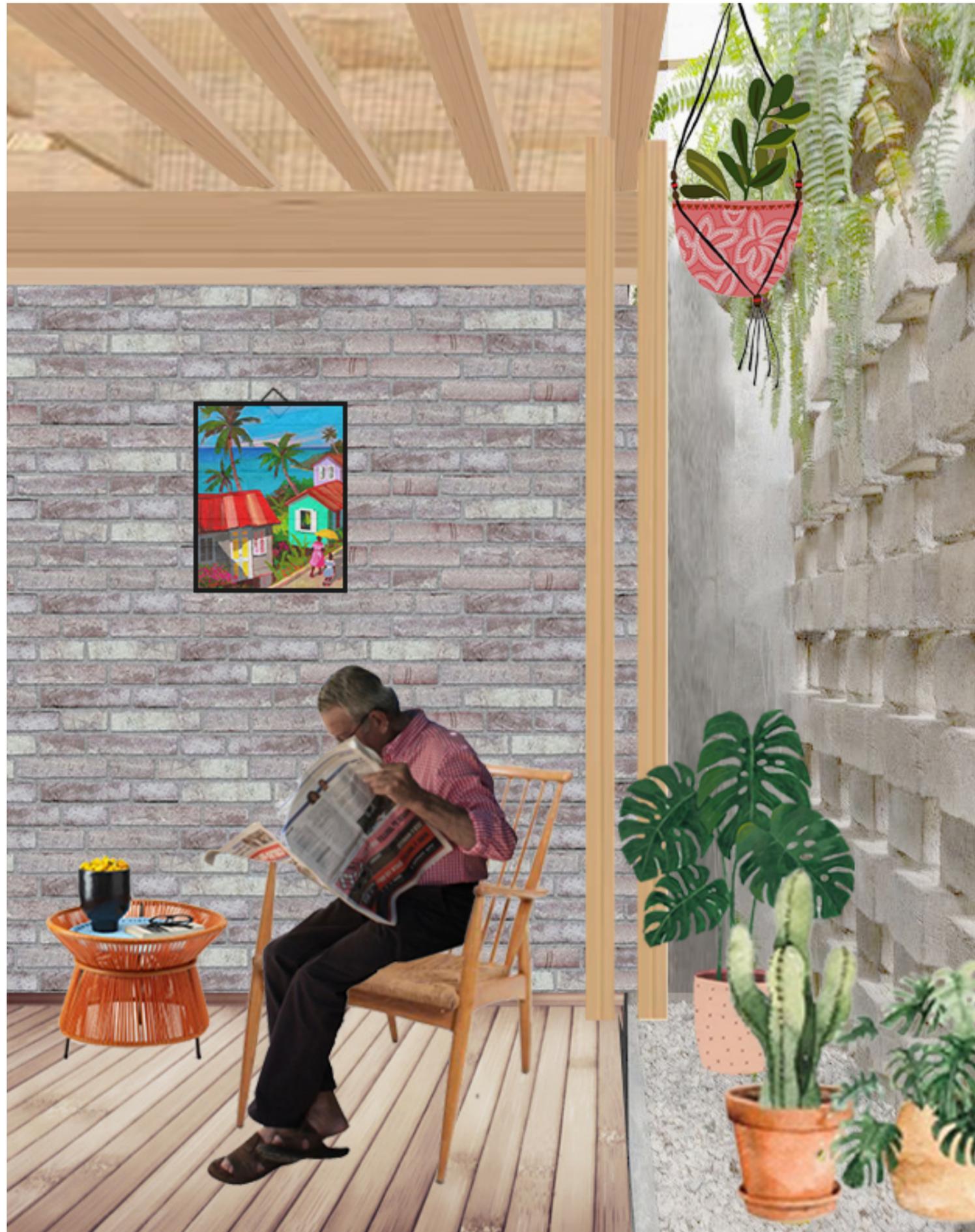




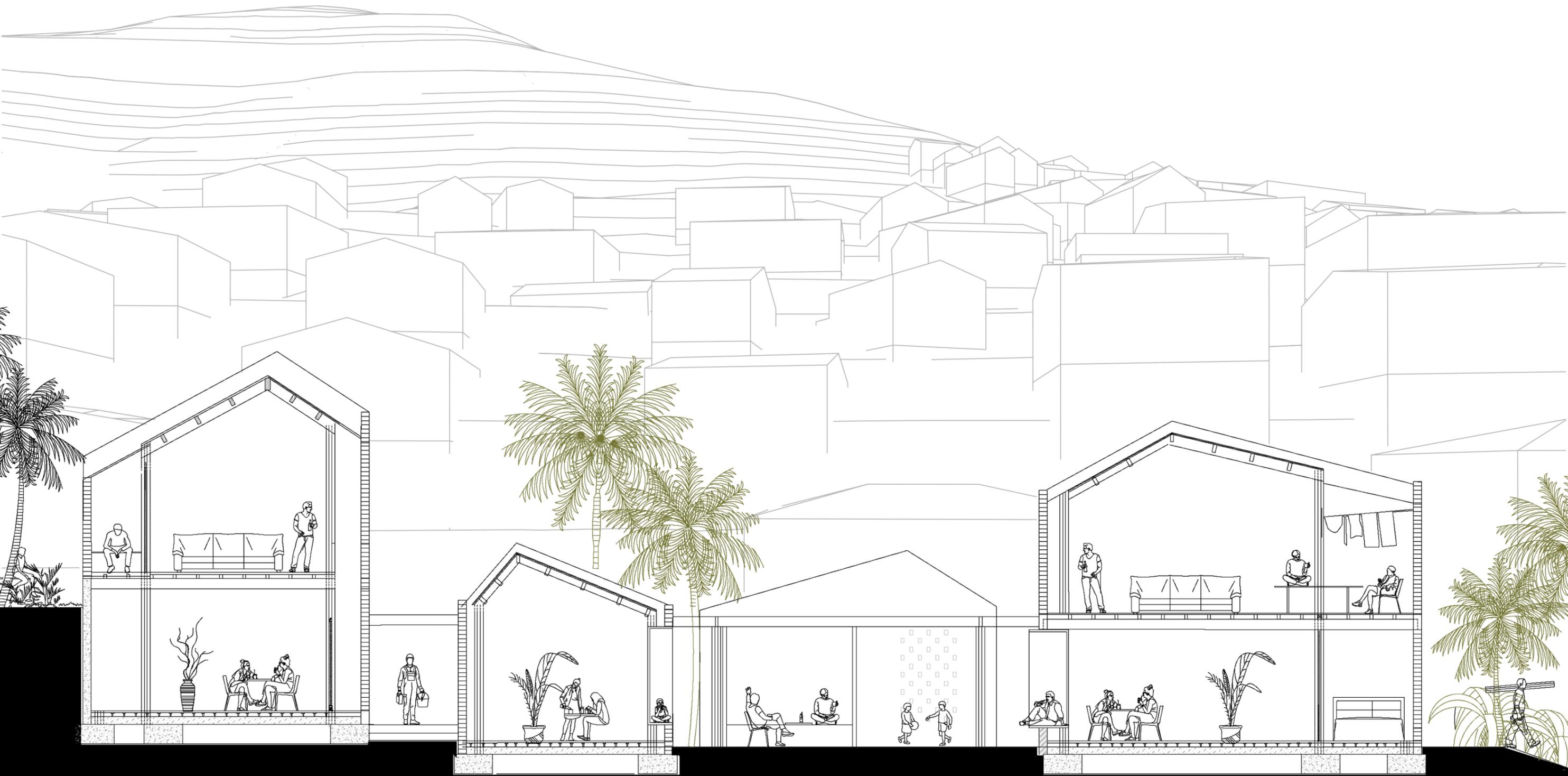


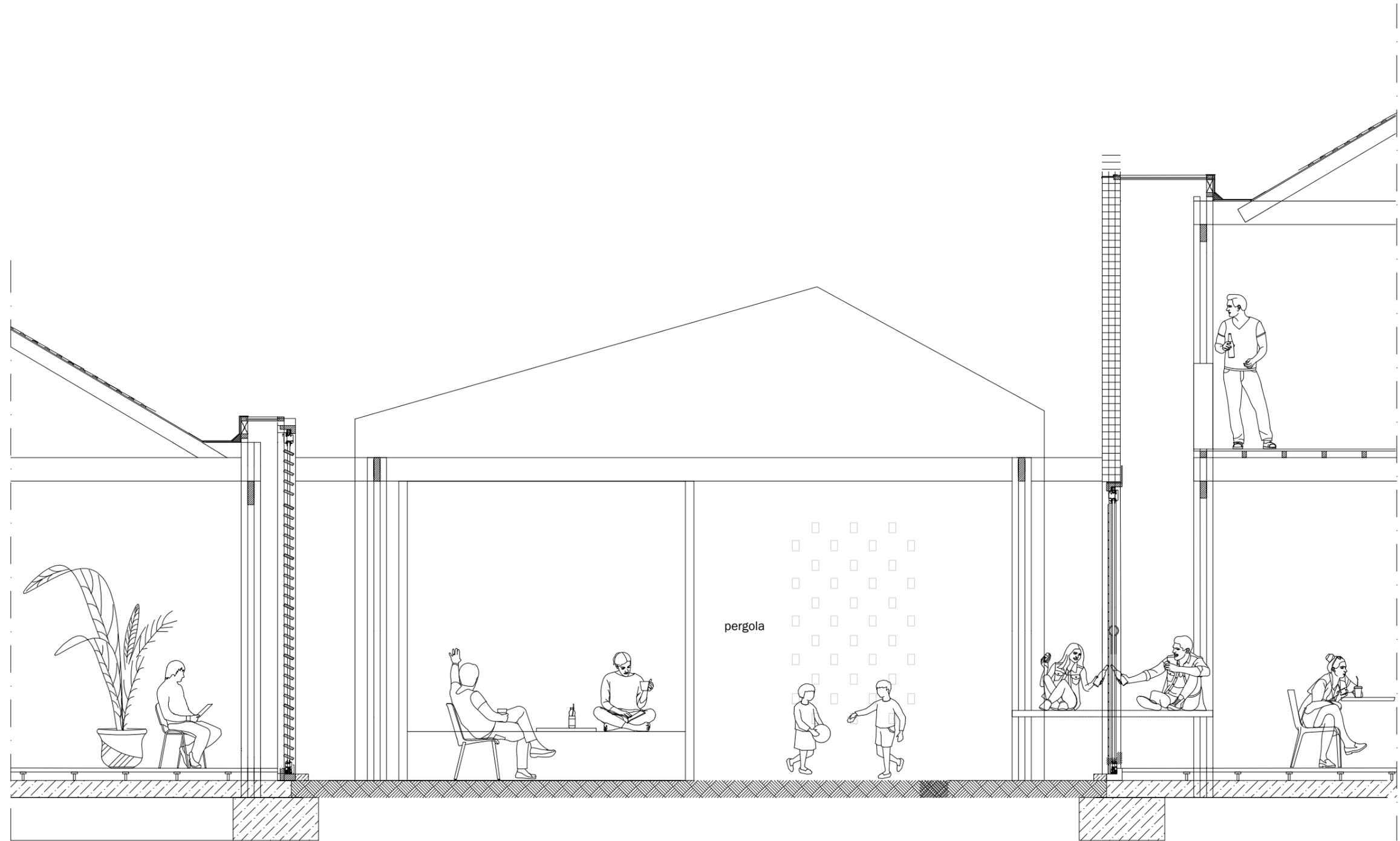


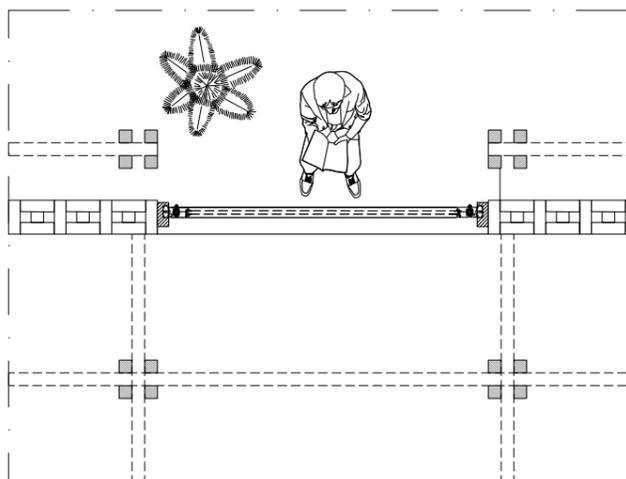
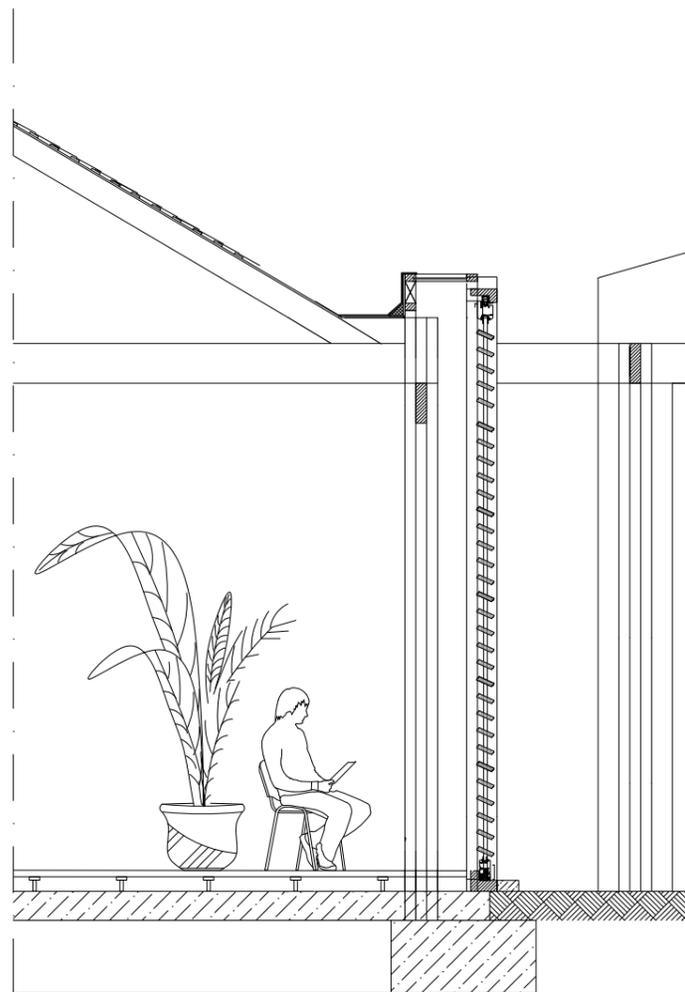
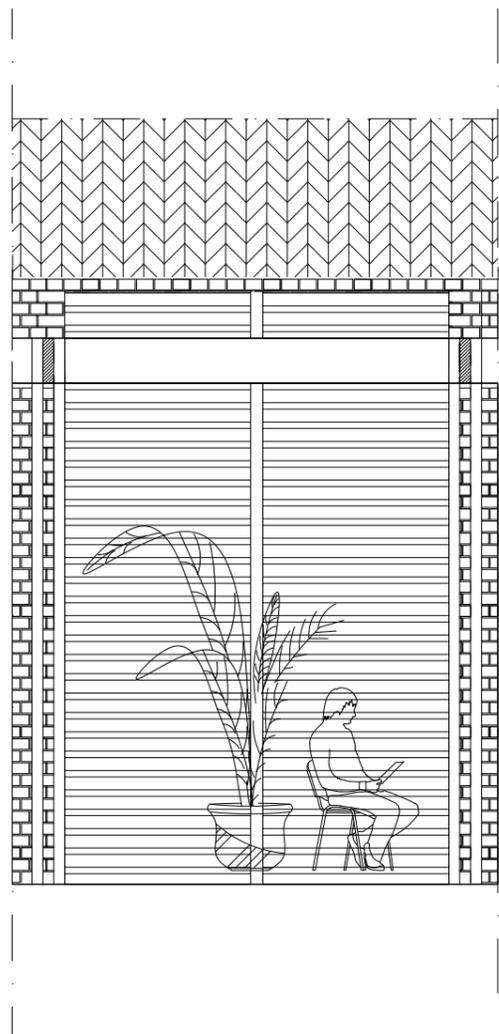


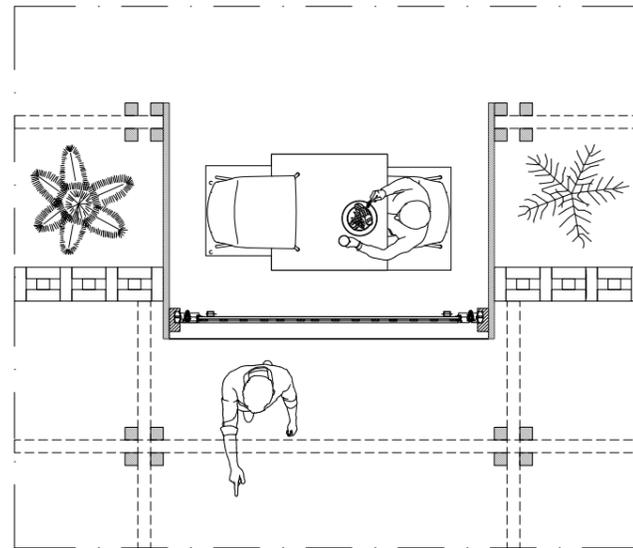
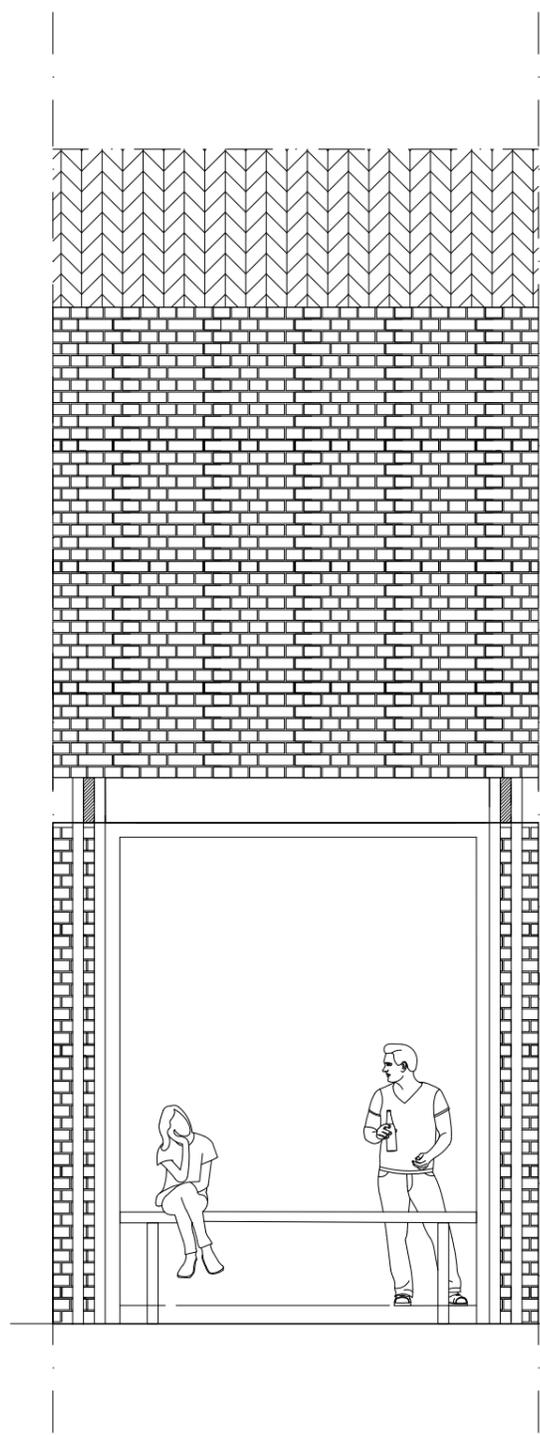
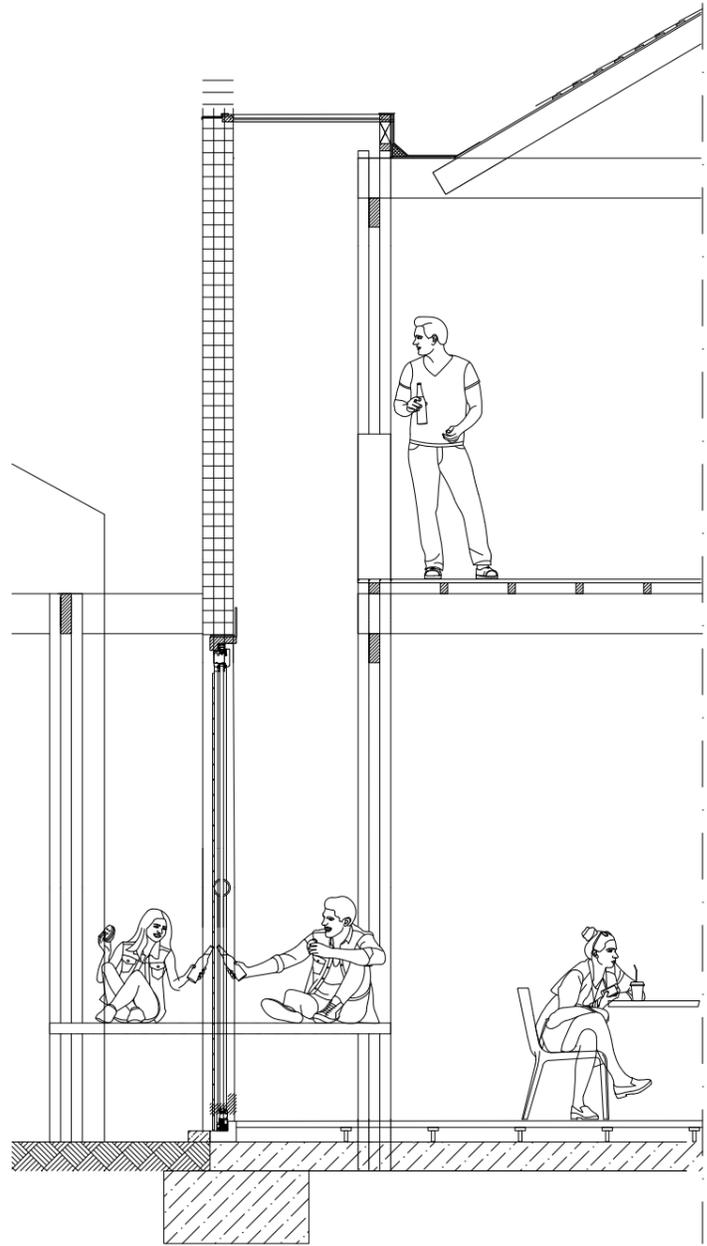


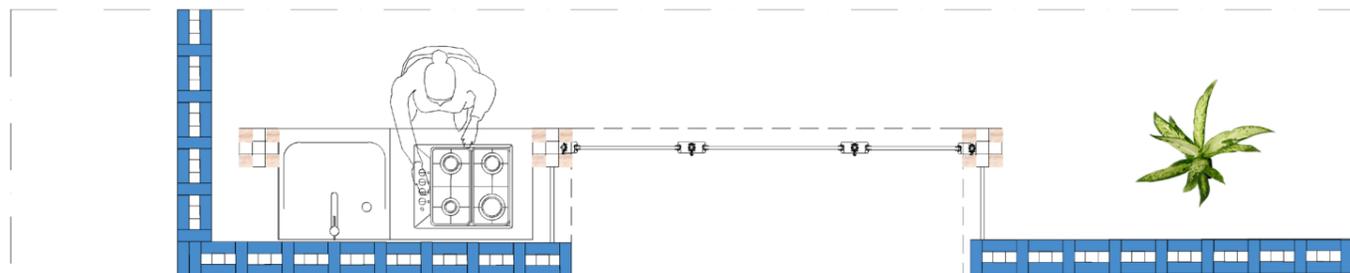
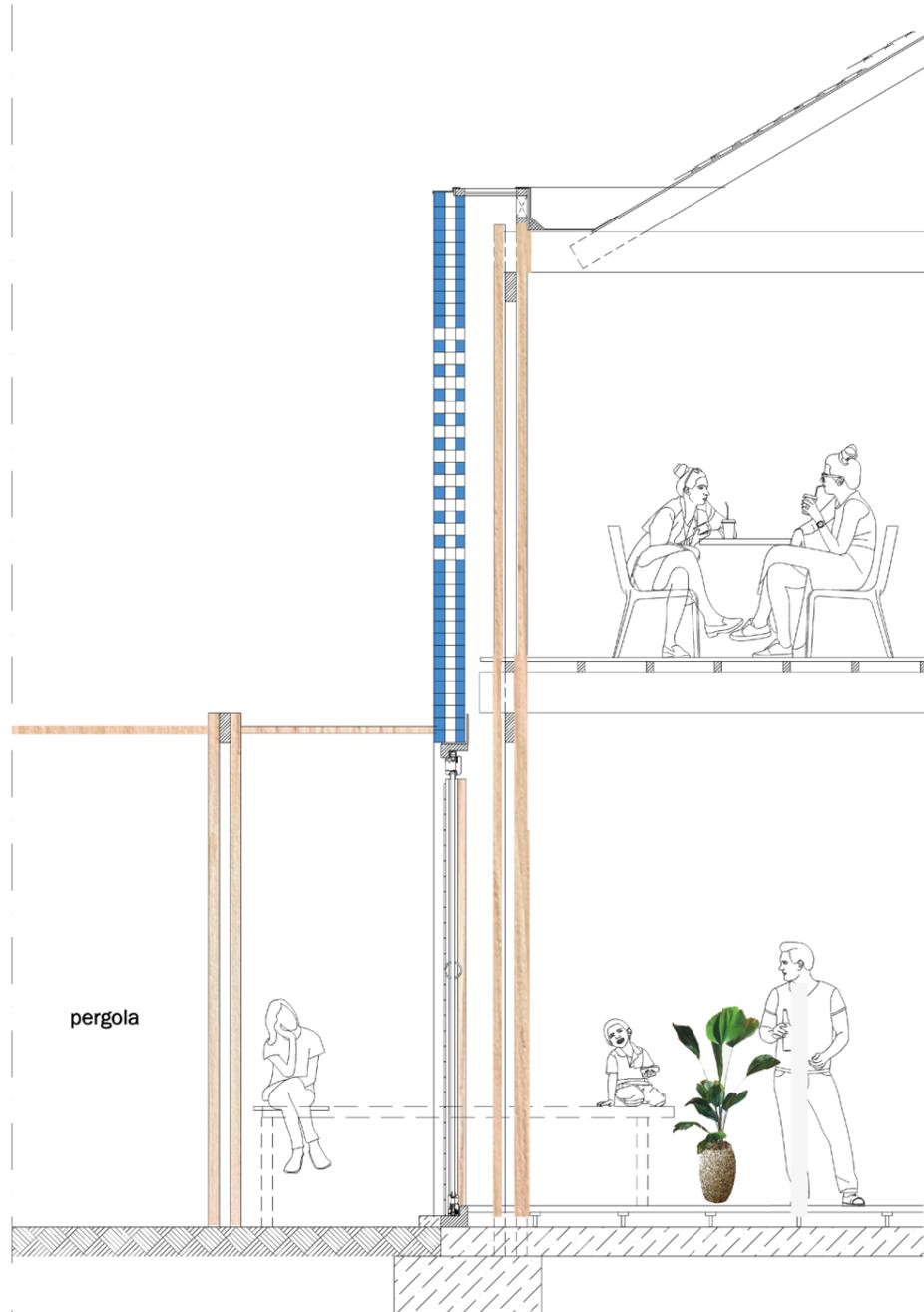
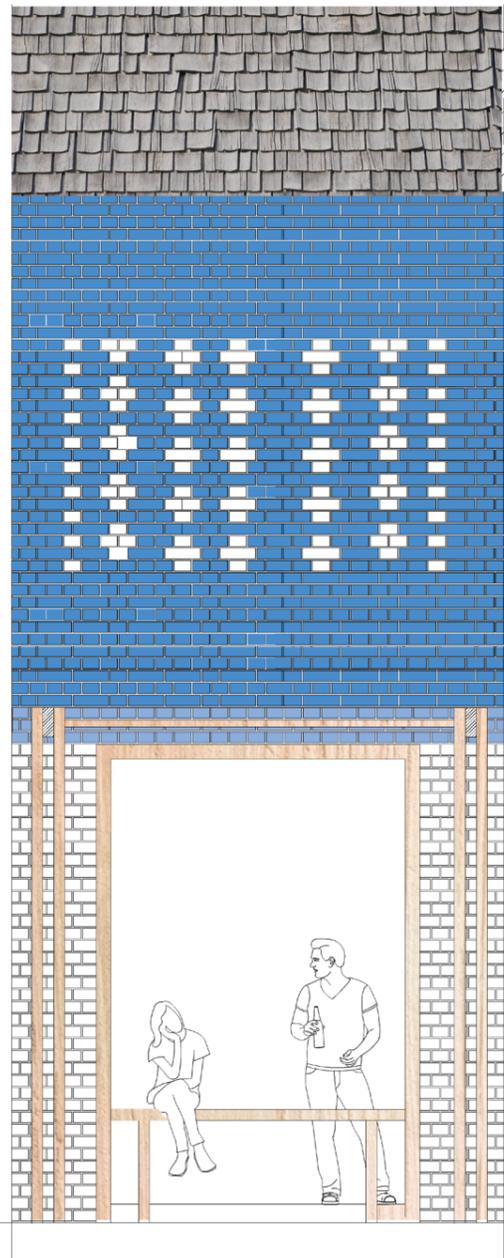
technical aspects

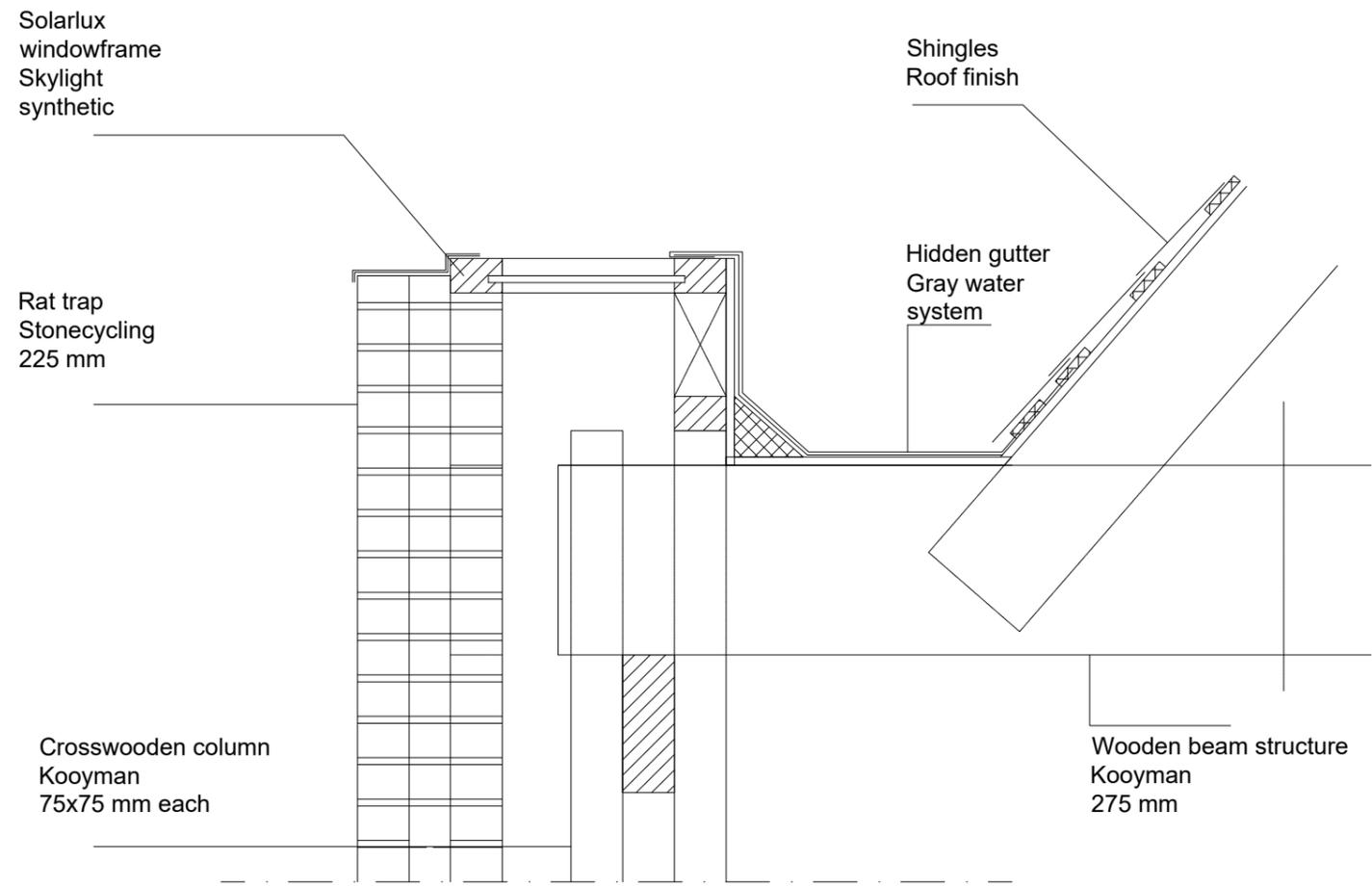












Solarlux  
windowframe  
Skylight  
synthetic

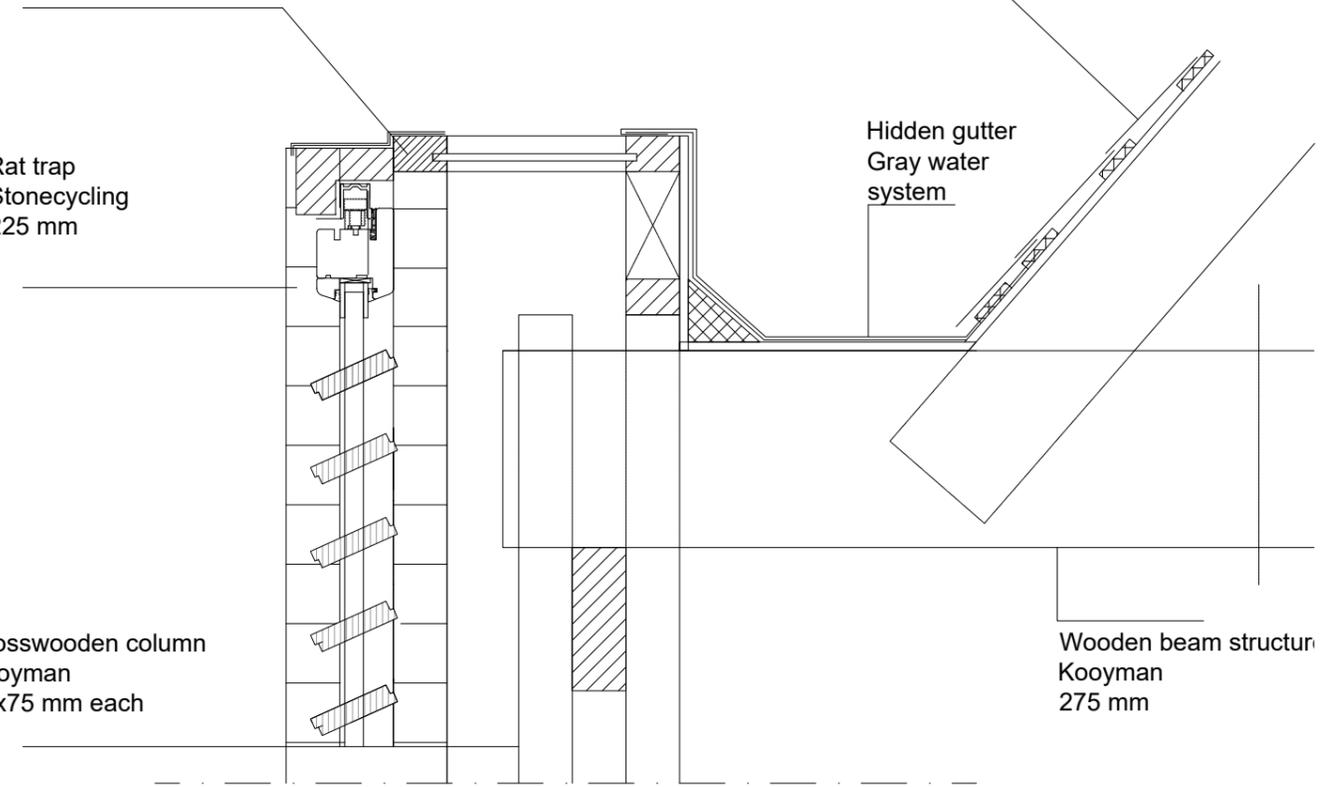
Shingles  
Roof finish

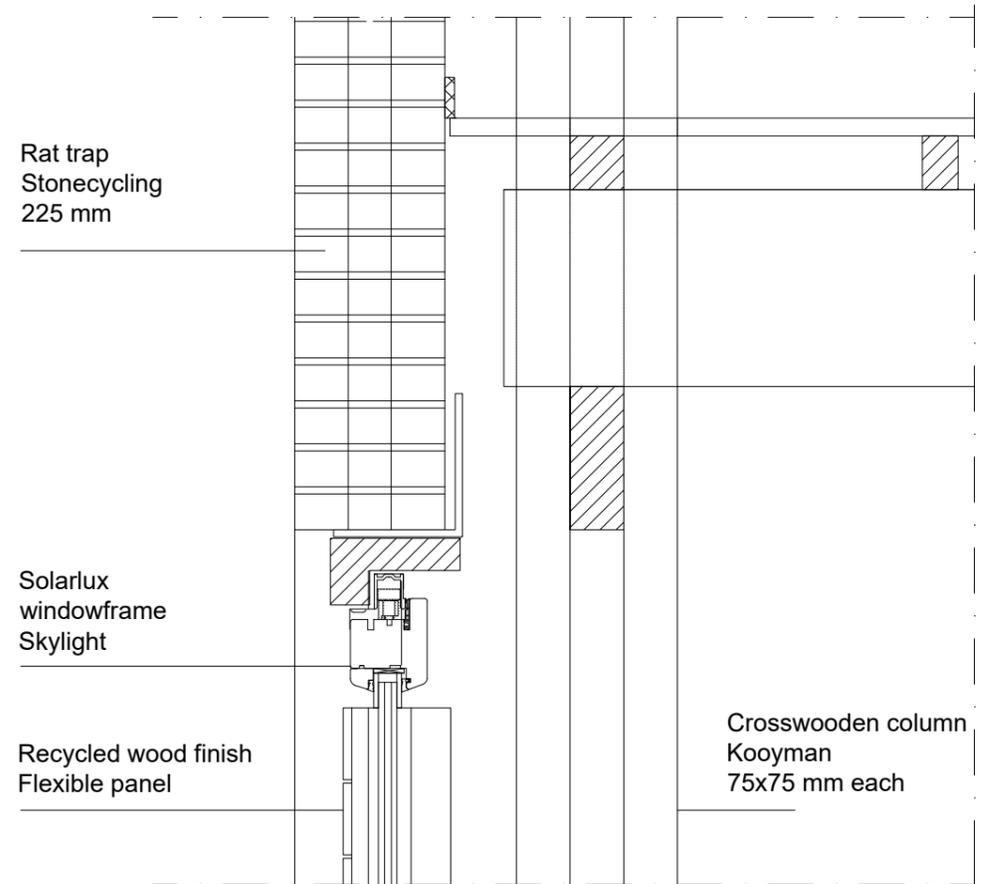
Rat trap  
Stonecycling  
225 mm

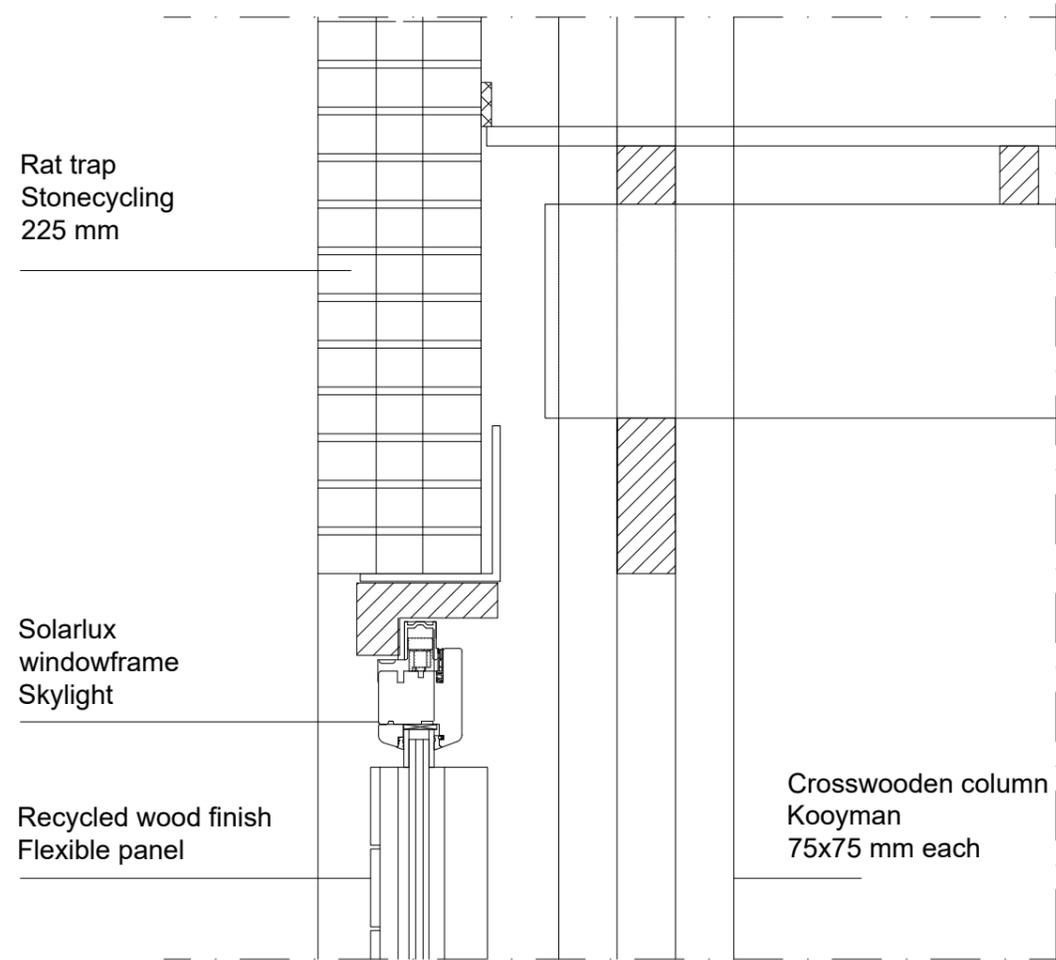
Hidden gutter  
Gray water  
system

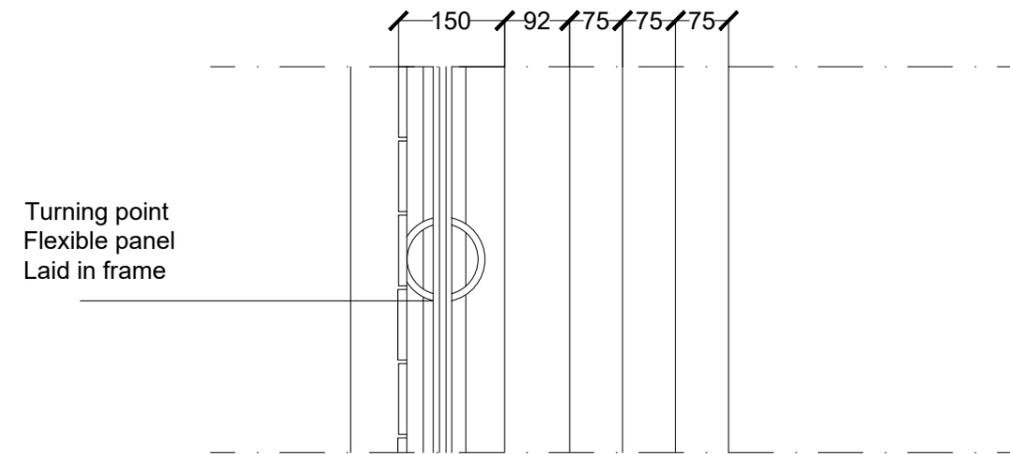
Crosswooden column  
Kooyman  
75x75 mm each

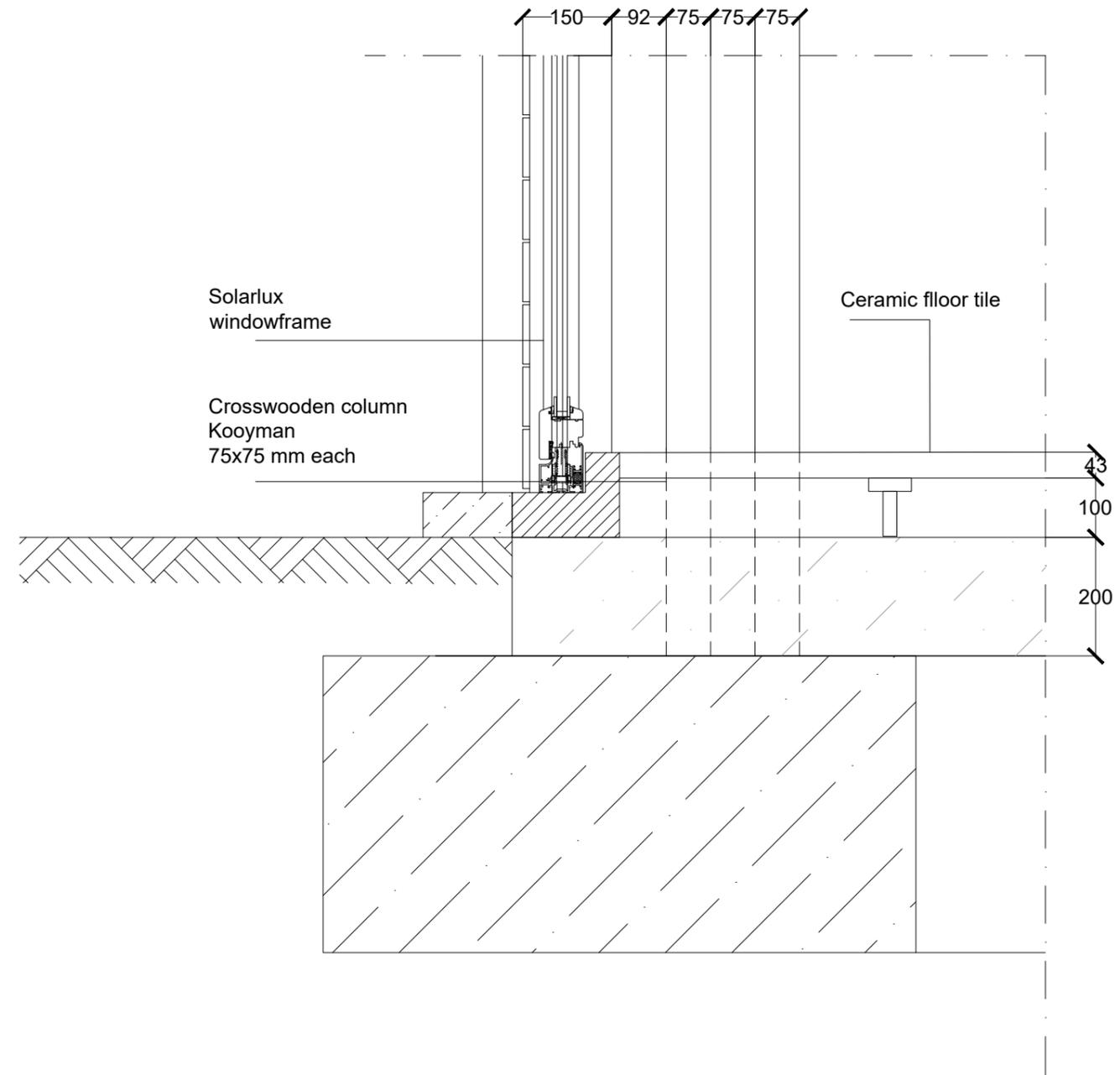
Wooden beam structur  
Kooyman  
275 mm











Solarlux  
windowframe

Crosswooden column  
Kooyman  
75x75 mm each

Ceramic floor tile

150 92 75 75 75

43  
100  
200

Hurricane proof, costs and future

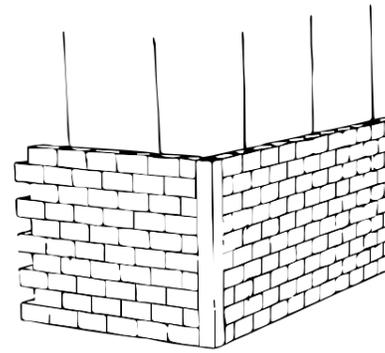
# COST

# AND

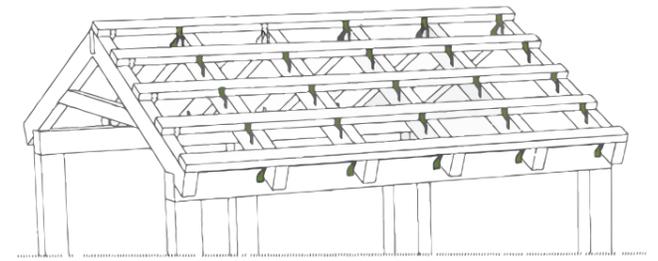
# BUILDING

# MANUAL

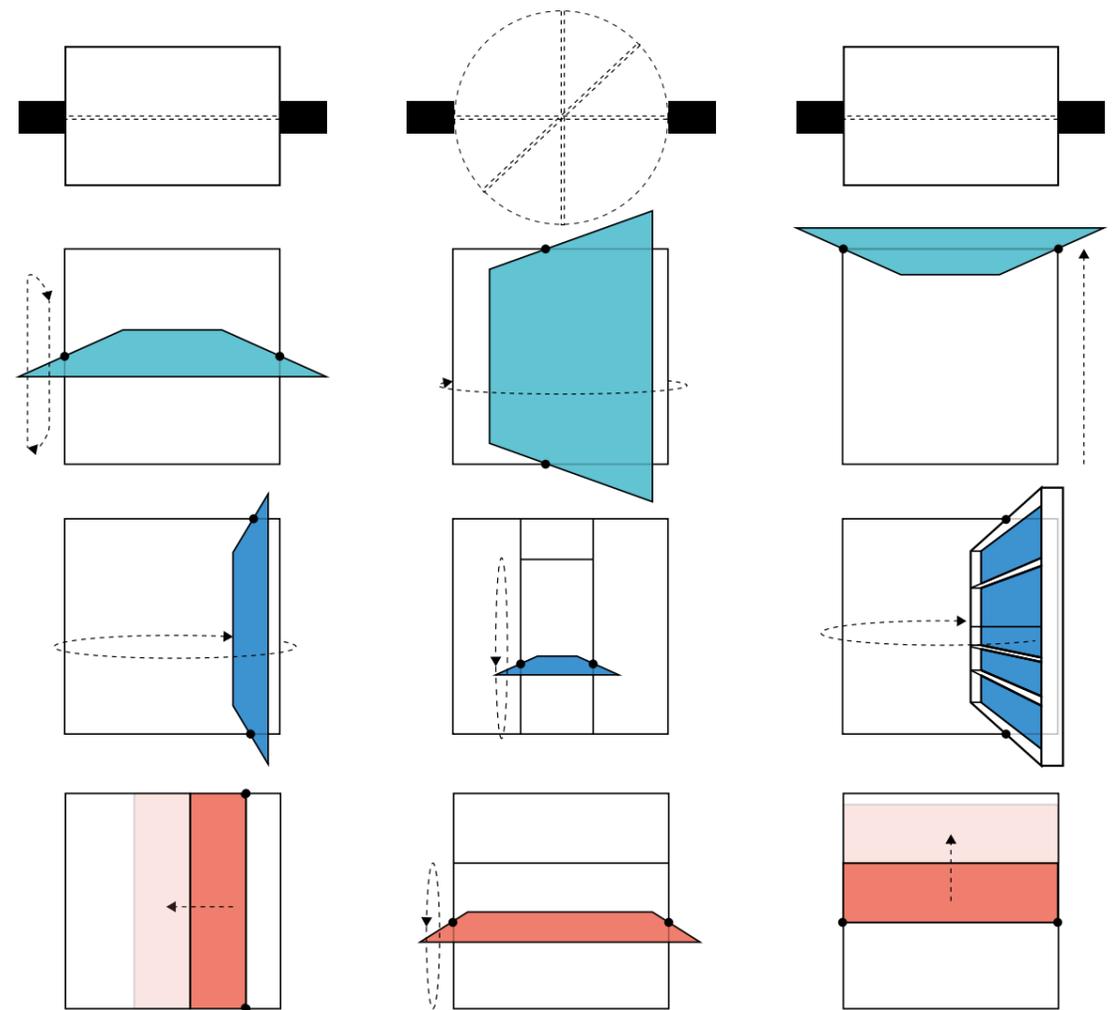
## HURRICANE AND EARTHQUAKE RESISTANCE



steel rebars

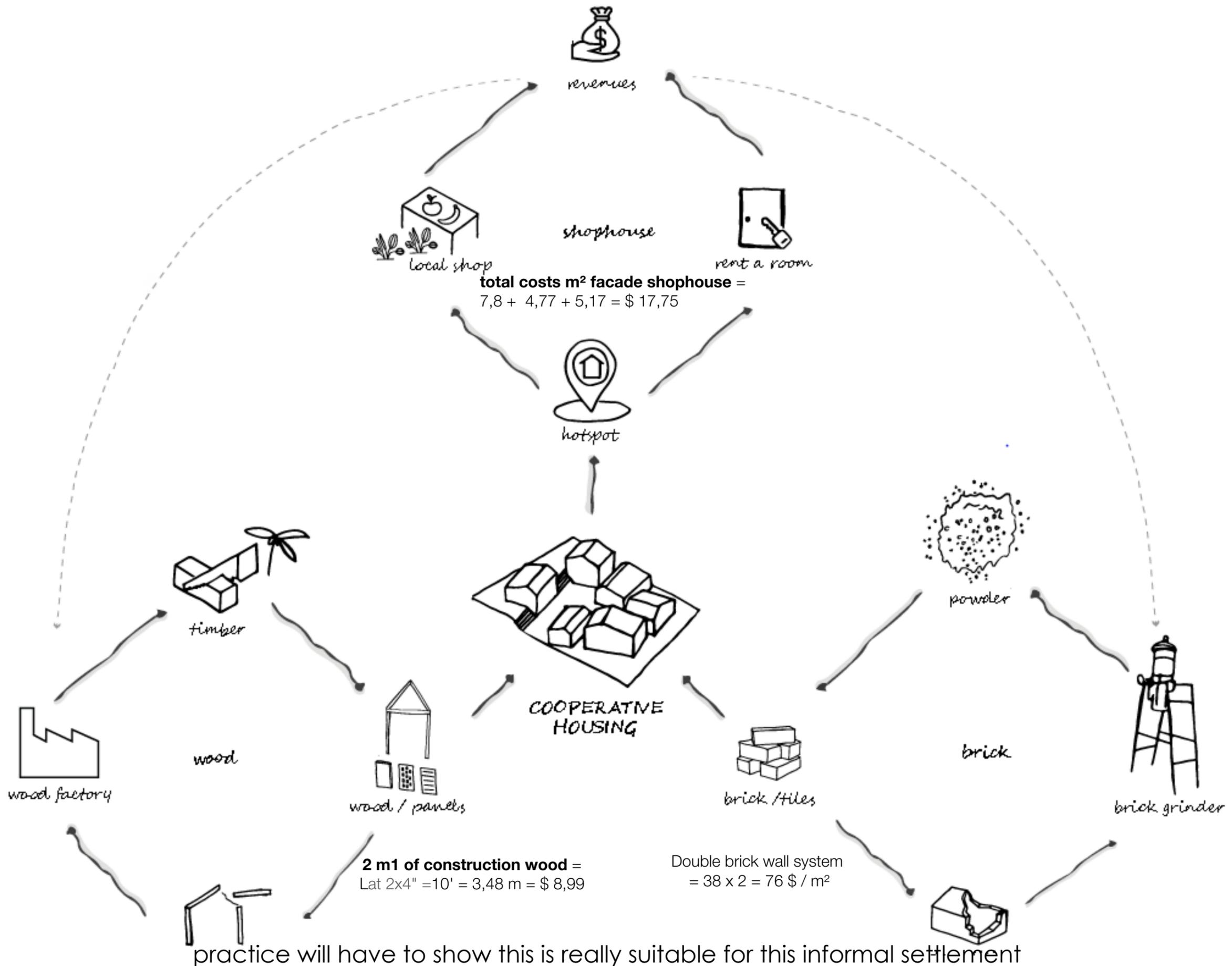


hurricane straps

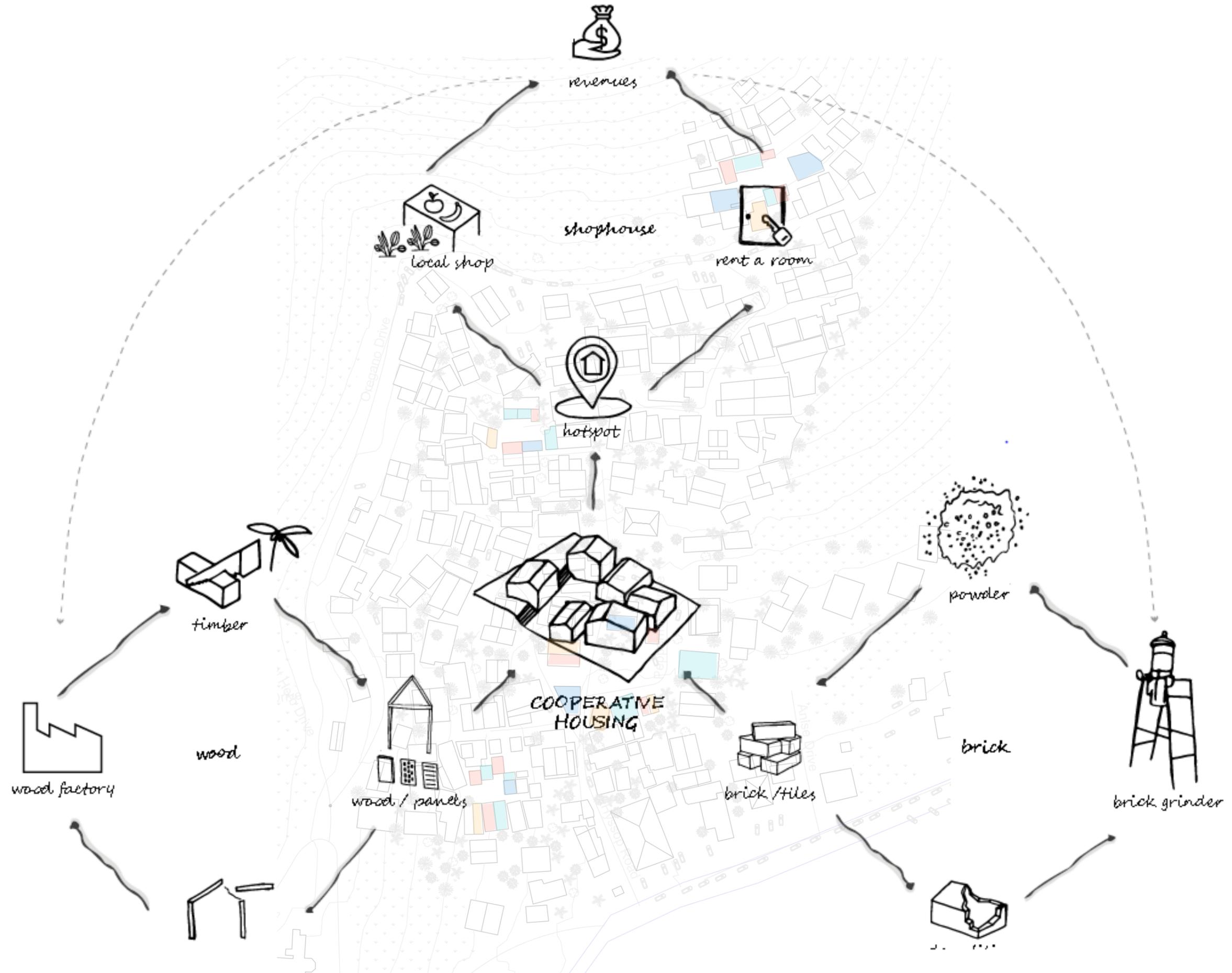


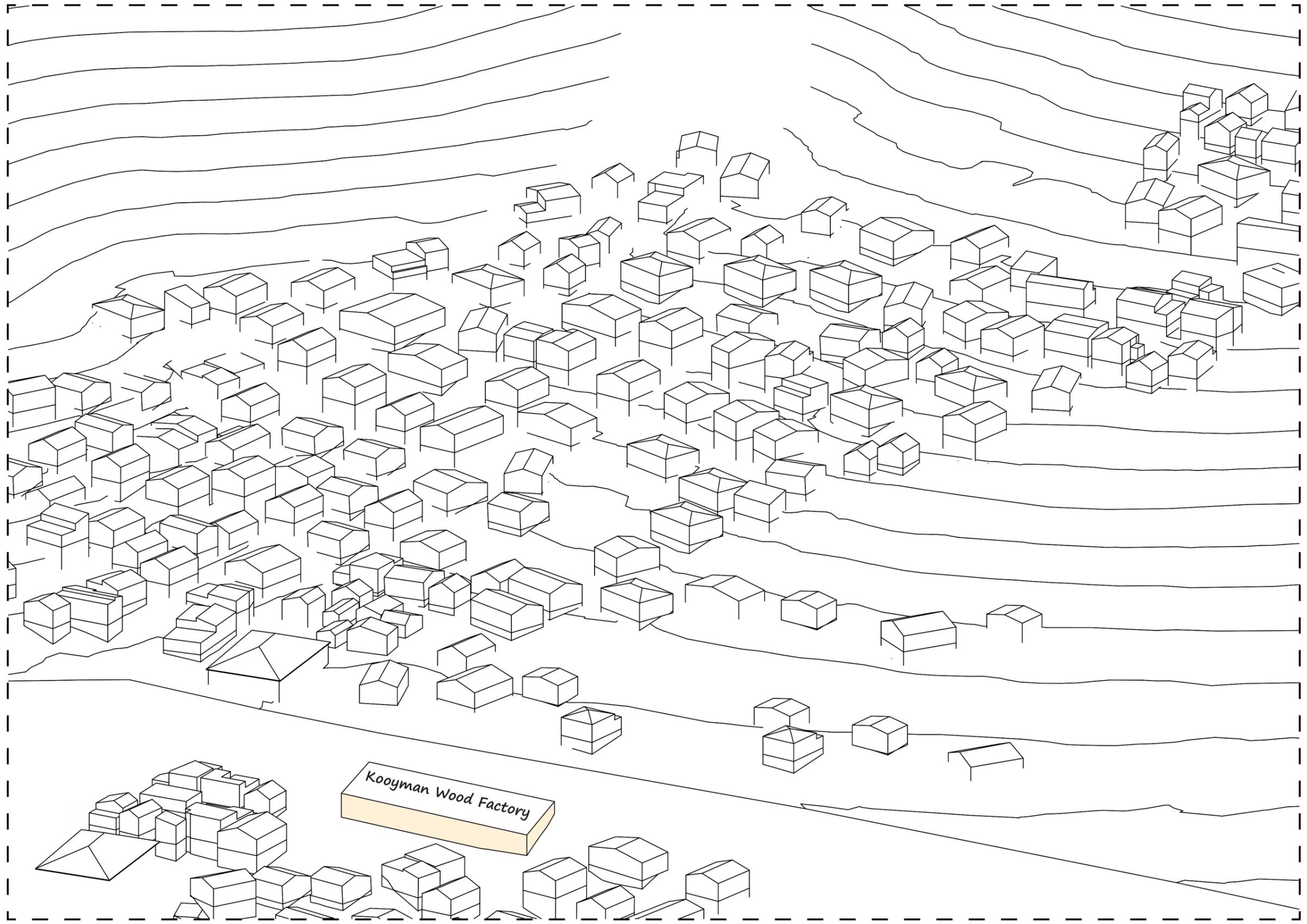
TOTAL COSTS M<sup>2</sup> FACADE SHOPHOUSE = \$ 17,75

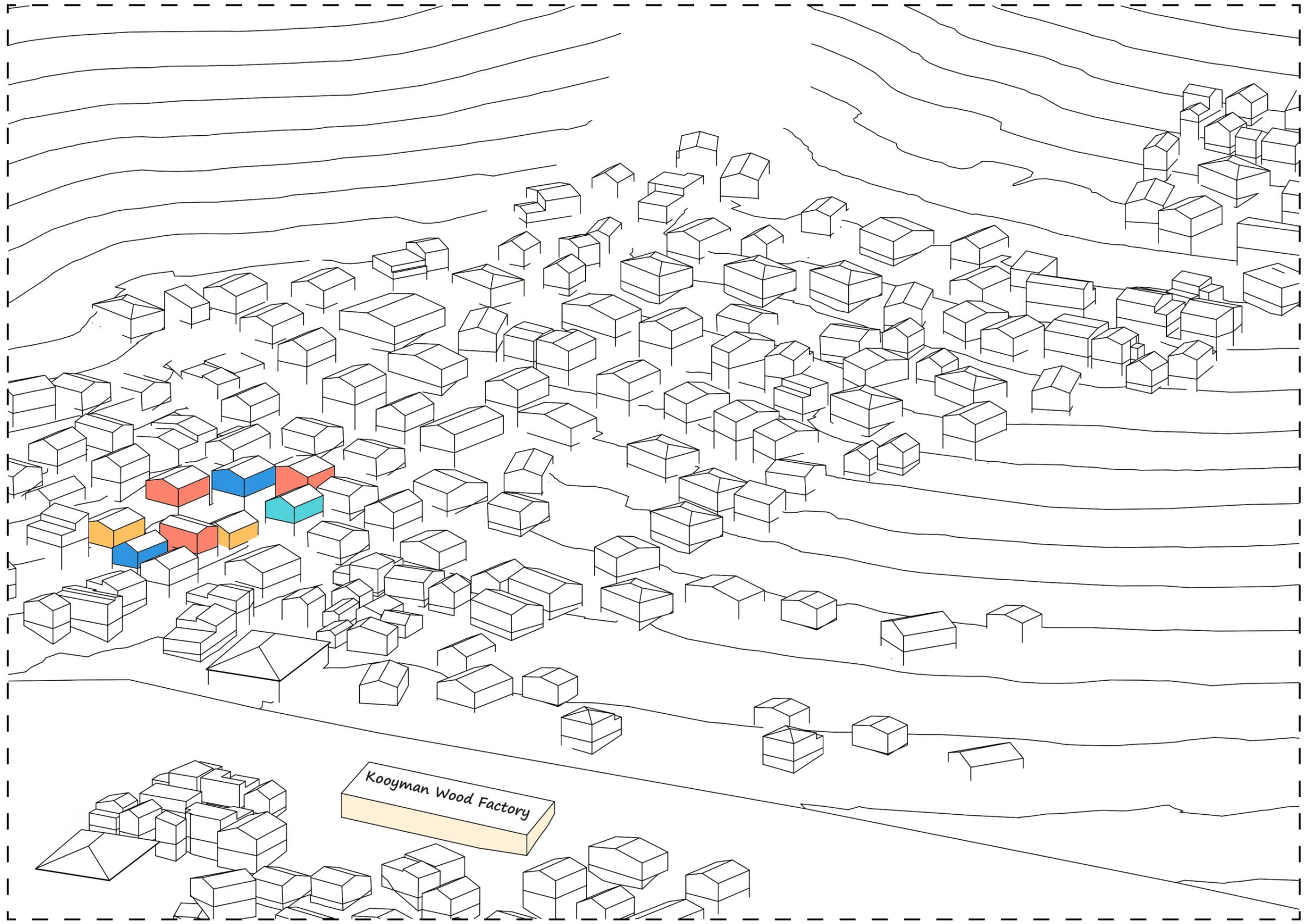
# NEW BUSINESS MODEL

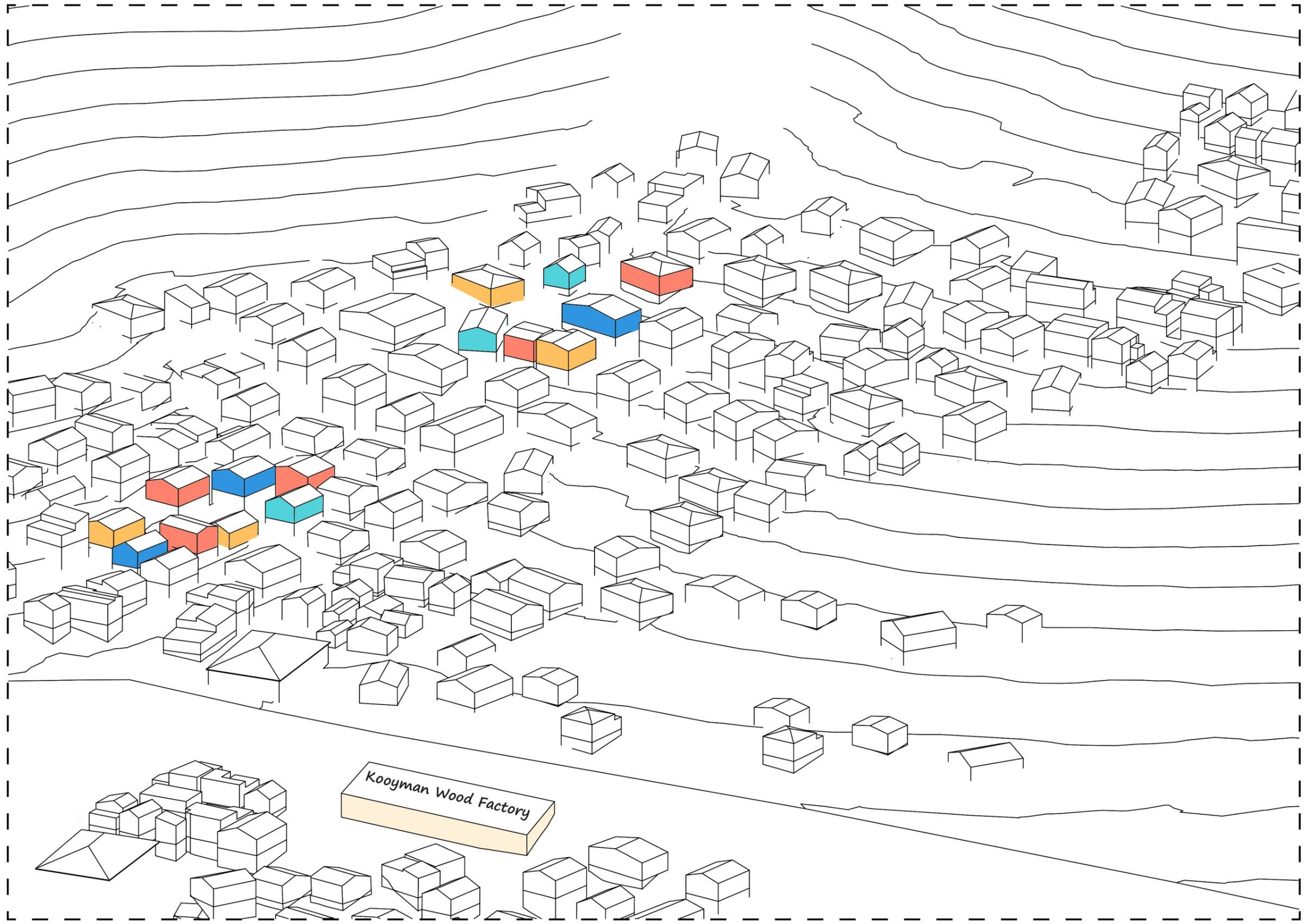


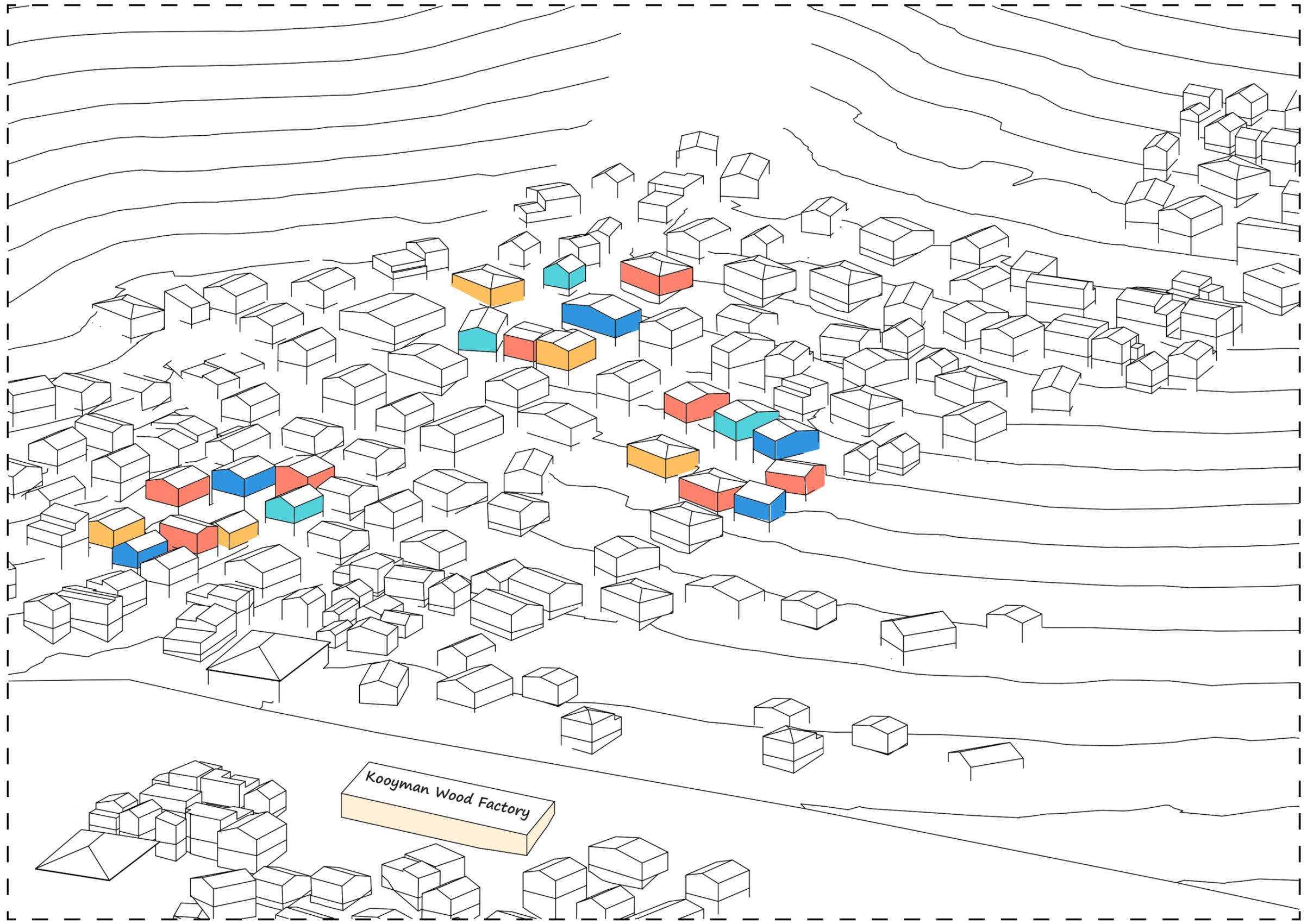
practice will have to show this is really suitable for this informal settlement

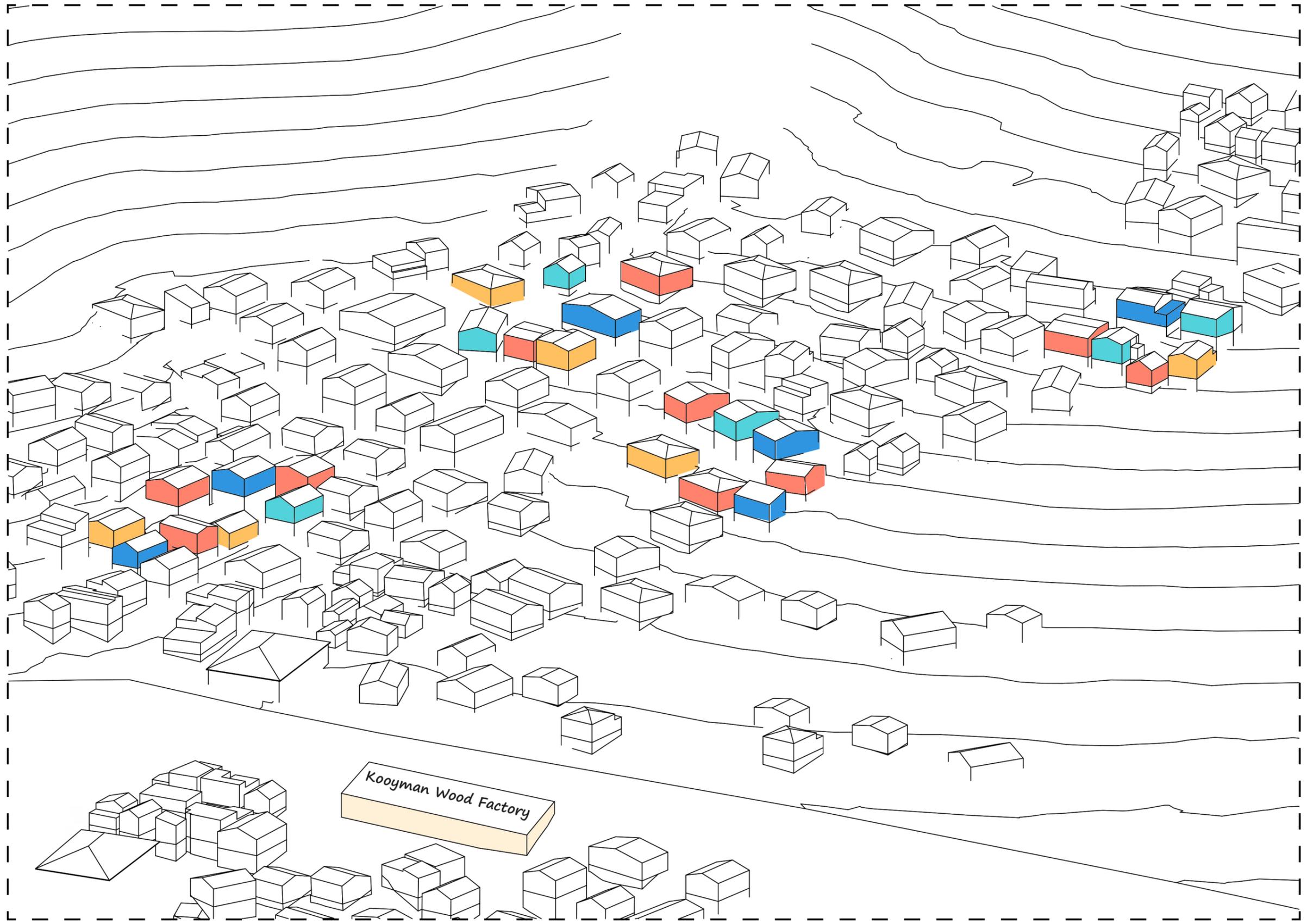














 New cooperative community housing



 Most vulnerable informal settlements Red Cross

Slow money - Jane Jacobs

Due the organic expansion model people can gradually invest in their community instead of high short investments.

Building and dwelling P.80 (Richard Sennett)

