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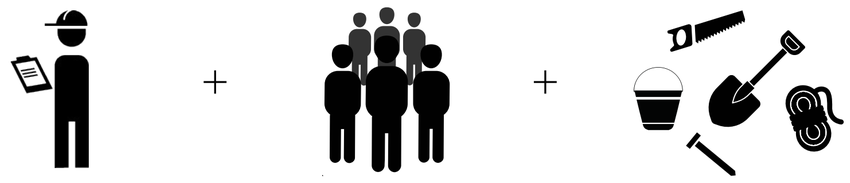
Architectural Engineering Graduation studio
Building Technology

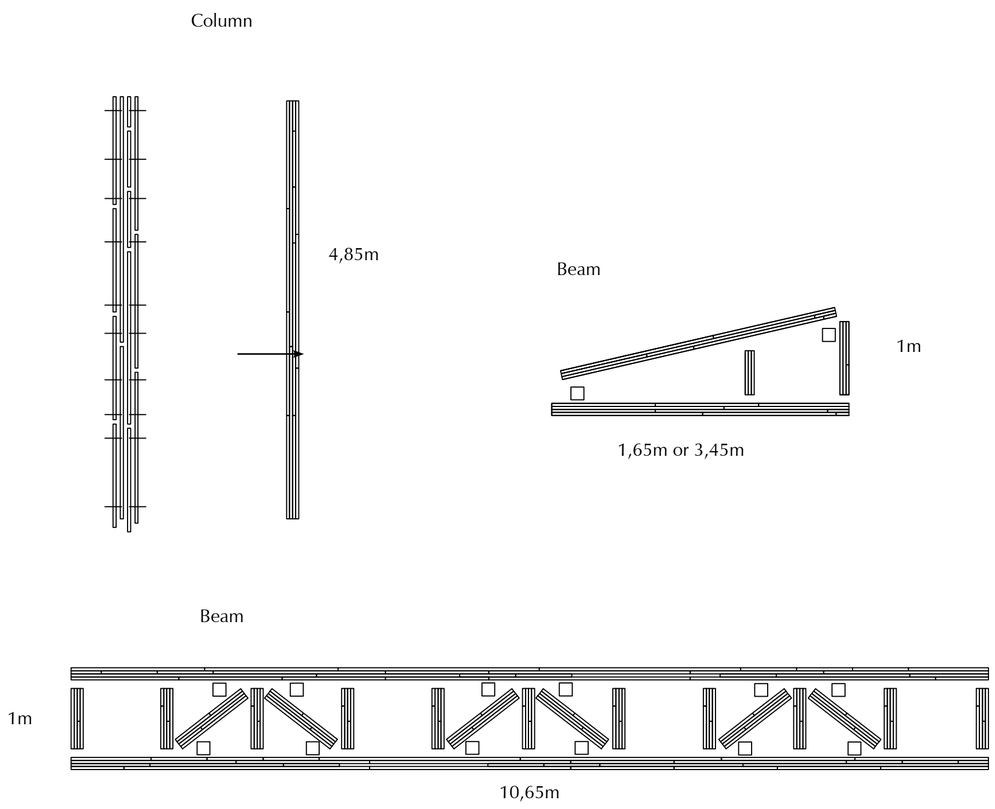
Denise Stevens 4222970 03-12-2019

CONCEPT BUILDING PROCESS

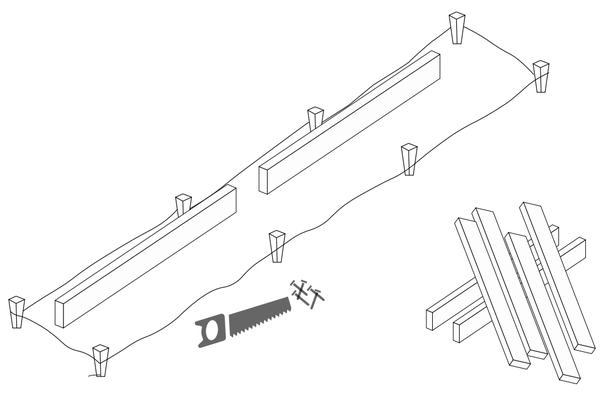


CONCEPT MATERIALS

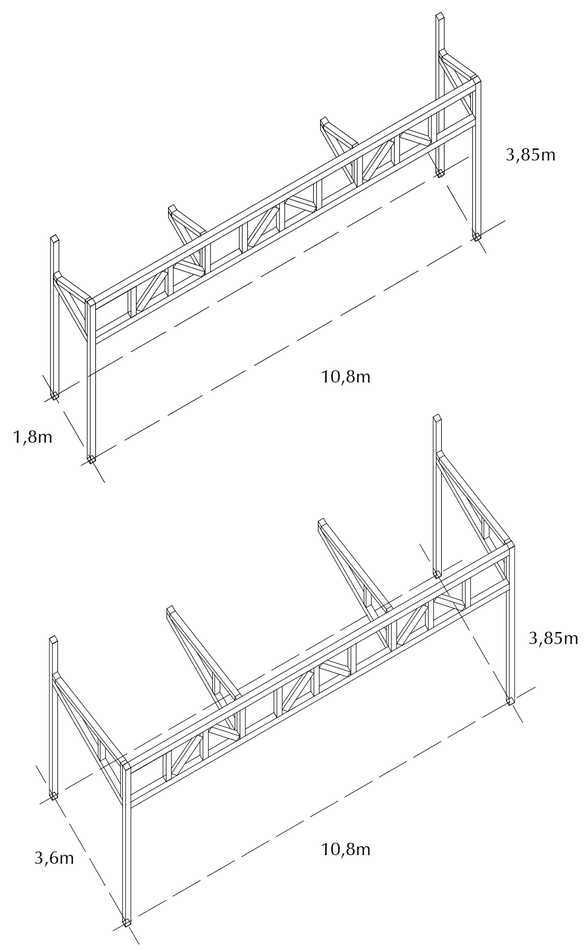
LOAD BEARING CONSTRUCTION & MODULE



Construction parts



Using a mold for creating construction parts



Different sizes module

LOAD BEARING STRUCTURE & STABILITY 1:200

Floorplan

The columns are placed in a set grid of 1,8 and 3,6m. Only the far right part of the building is an exception.

The stability is taken care of with the use of wooden frameworks. These are placed in between the columns, and the finishing of the facade or inner wall is attached to this framework.

Stability

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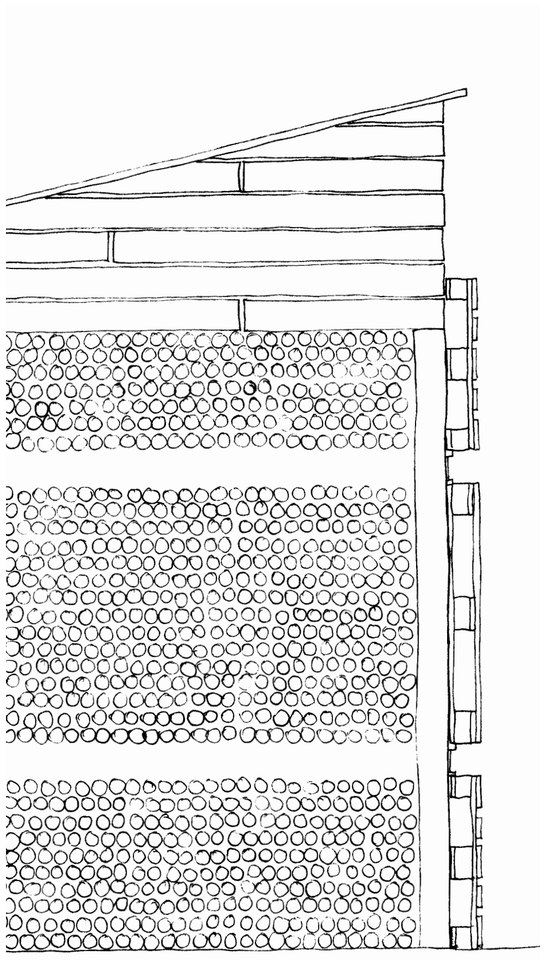
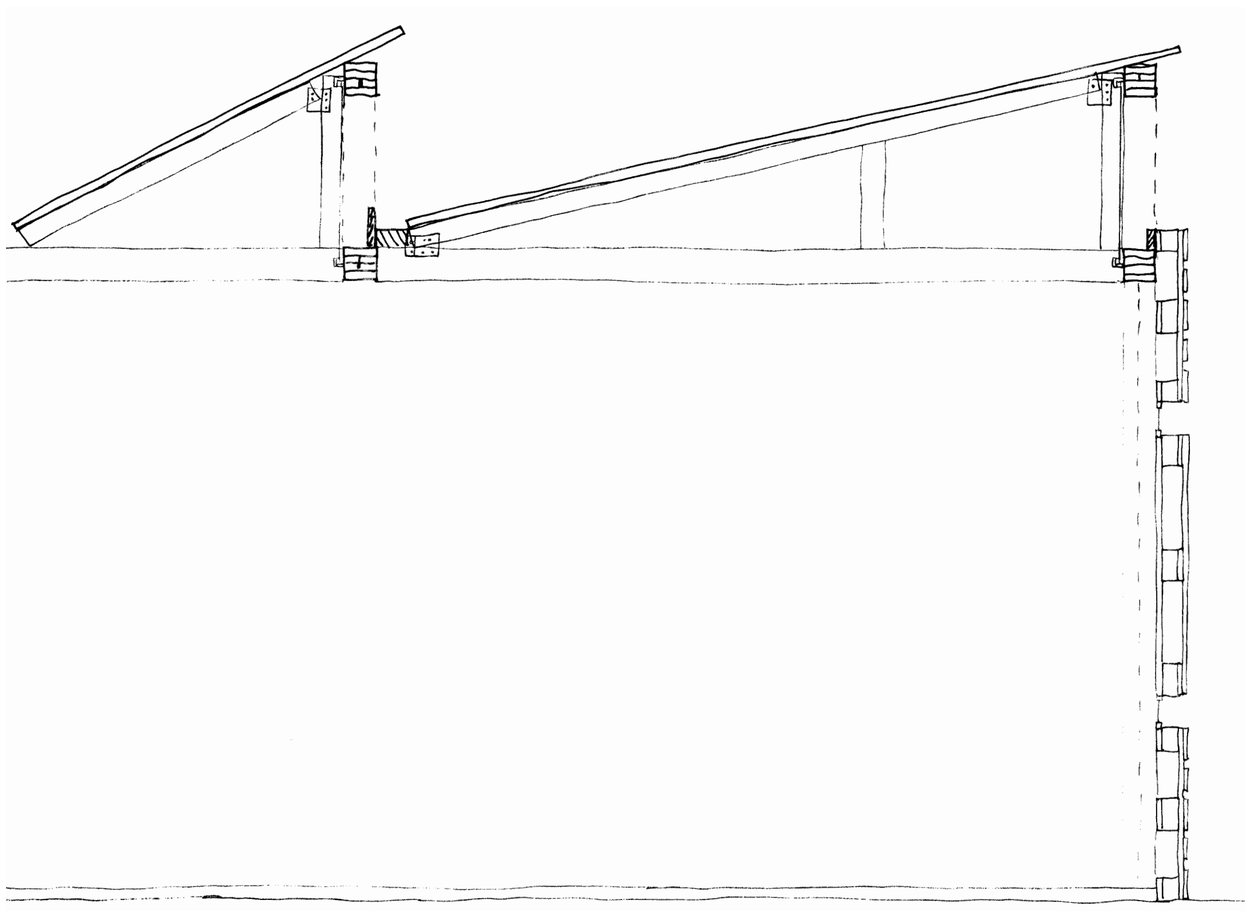
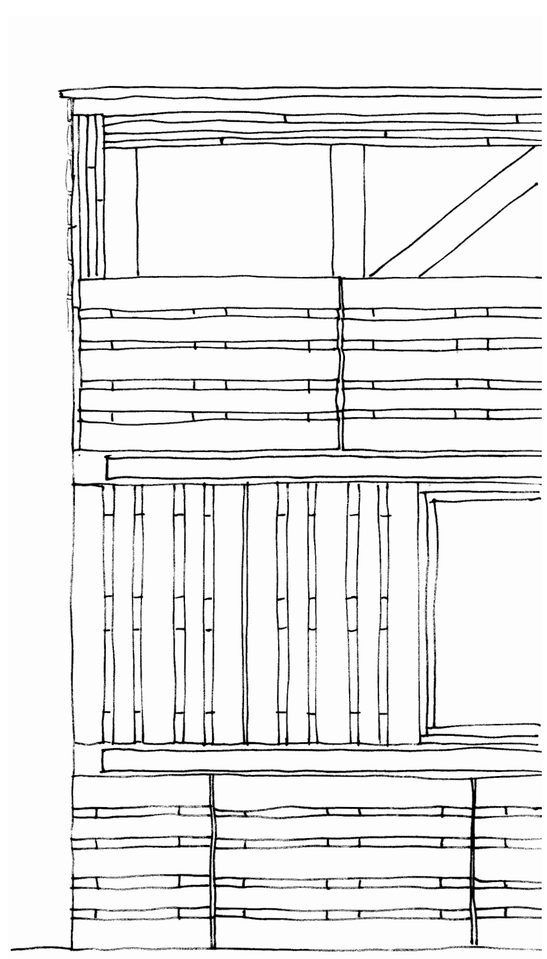
VERTICAL FACADE FRAGMENT & SECTION 1:20

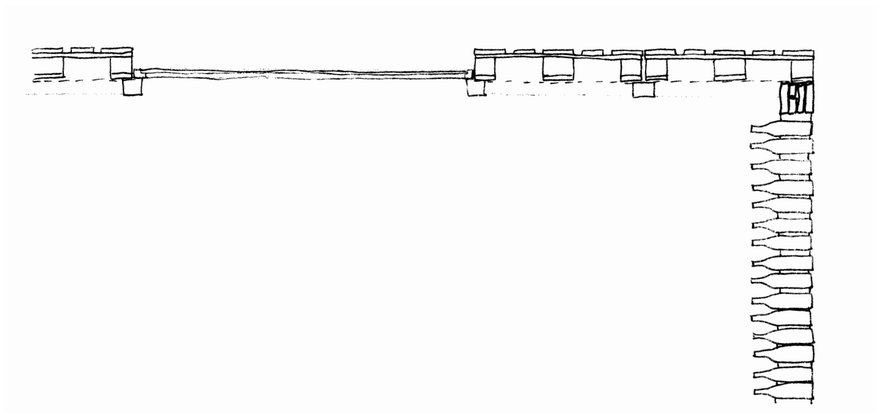


West facing facade

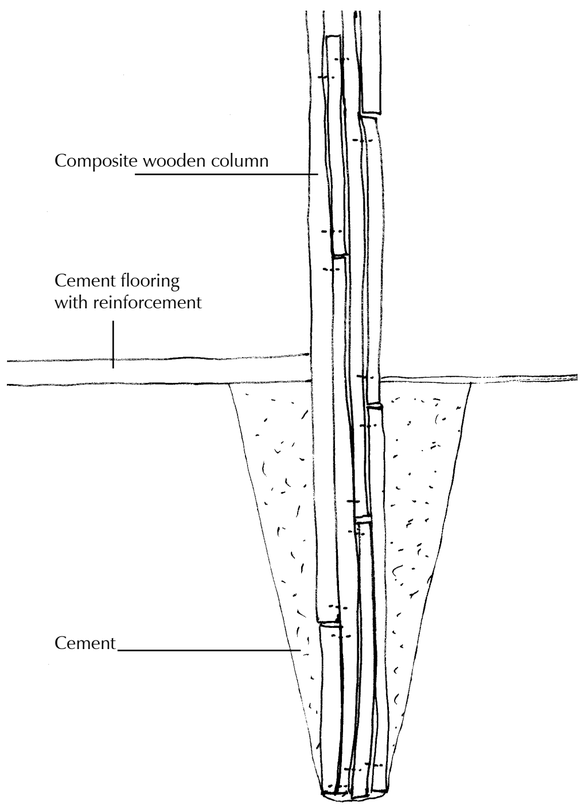




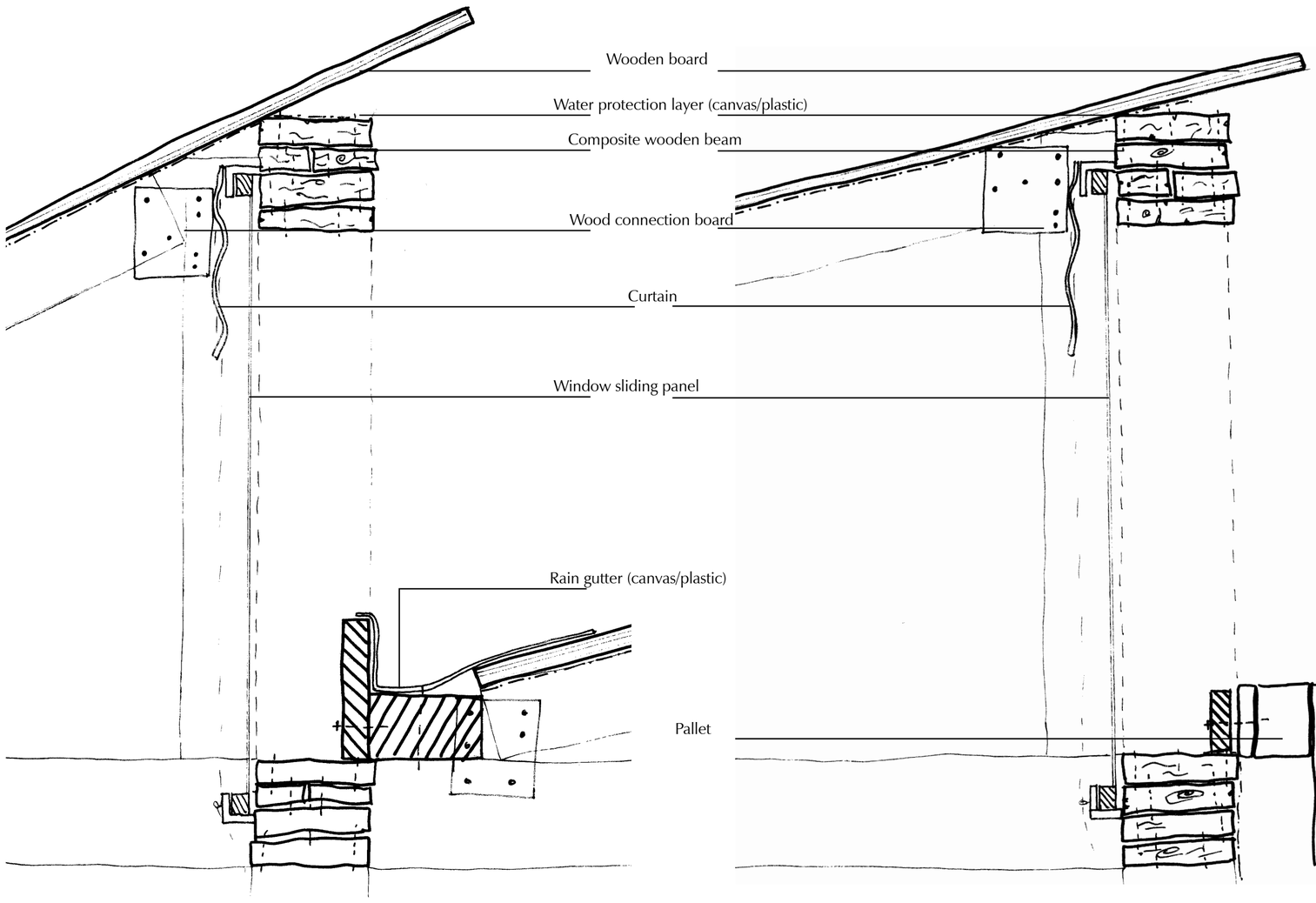
South facing facade



FOUNDATION DETAIL 1:10



ROOF DETAILS 1:5



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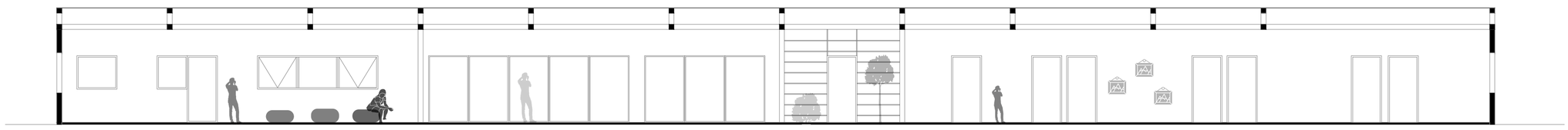
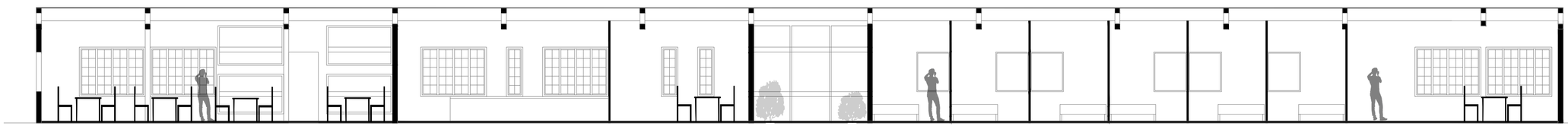
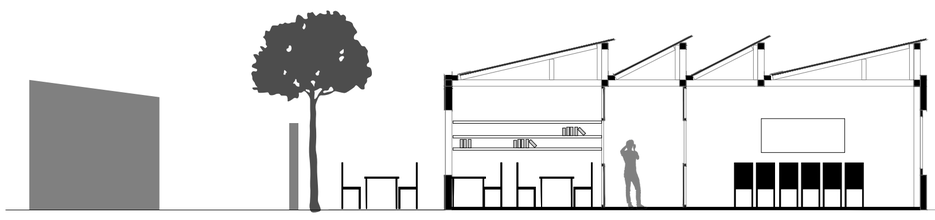
SECTIONS 1:100



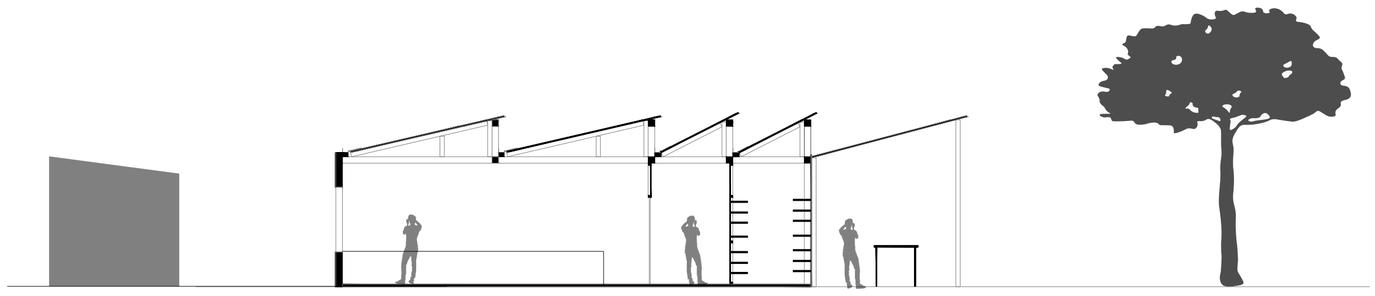
Hallway



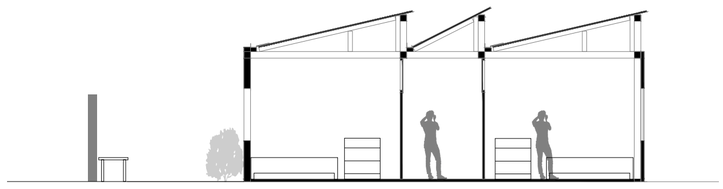
Length of building



Study area and multifunctional room

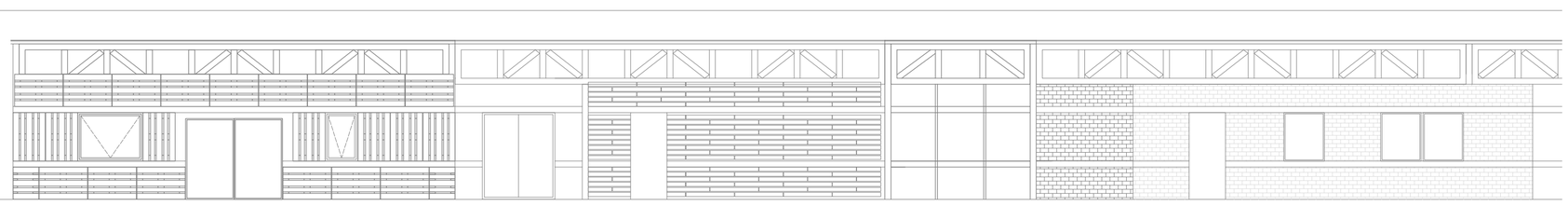


Kitchen, storage and workplace

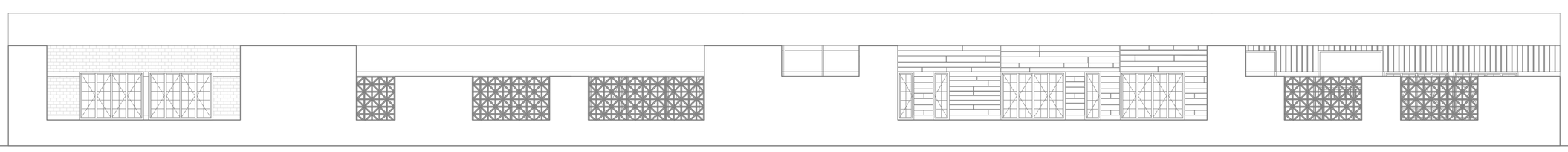


Shelter rooms

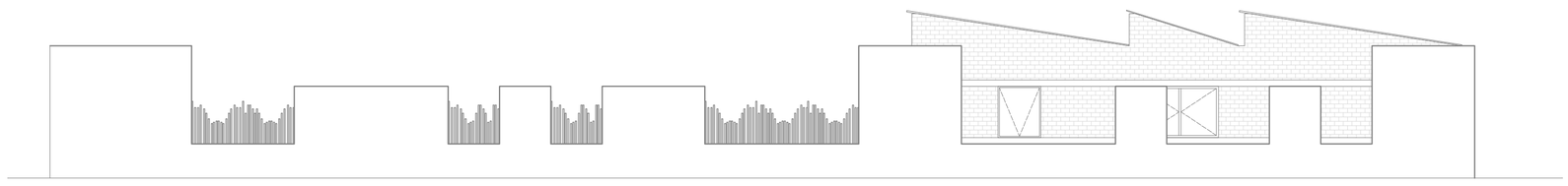
FACADES 1:100



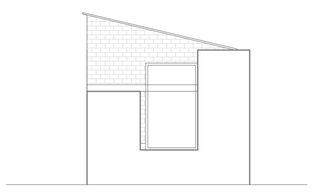
South view



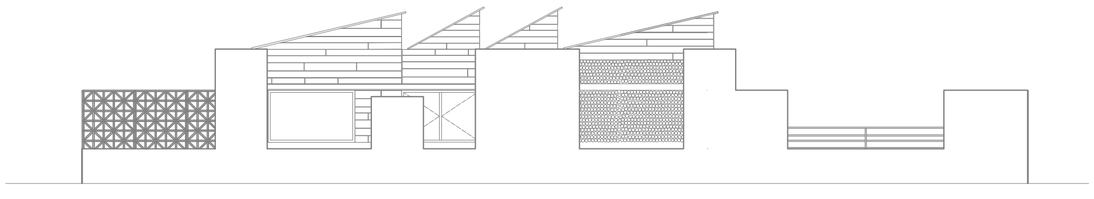
North view



South-east view



East view



West view

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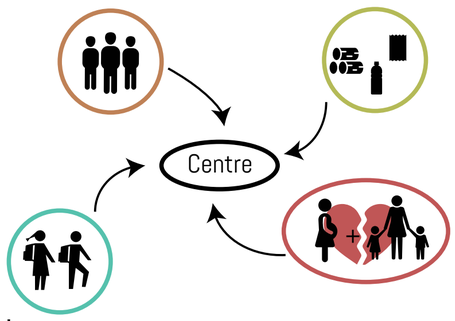
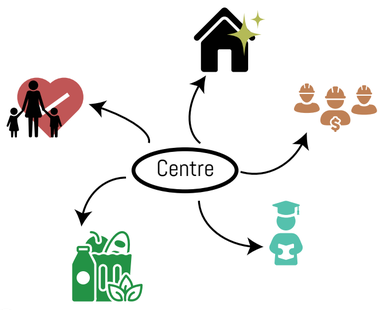
CONCEPT COMMUNITY CENTRE



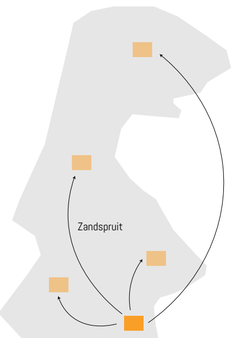
Input

- Students
- Young mothers
- (Un)employed community members
- Community members bringing waste/building materials



Output

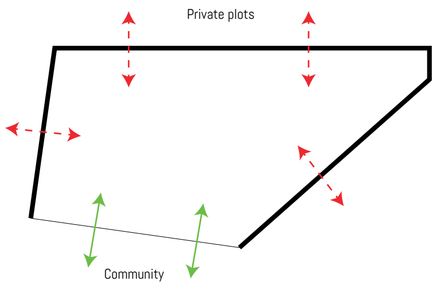
- More graduates
- Mothers with stable life
- Higher employment rate
- Improvement of living conditions
- Lower rate of food insecurity



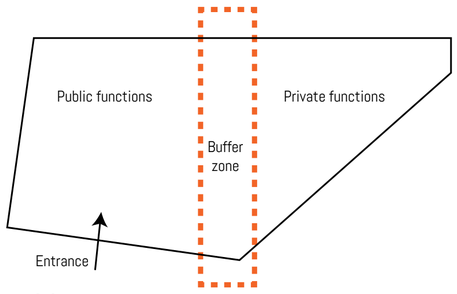
Transferable concept

Settlements know the same type of problems, which can partly be tackled by the functions of the community centre. The community centre concept can therefore be applied to more areas in the settlement Zandspruit, or even be applied to other settlements.

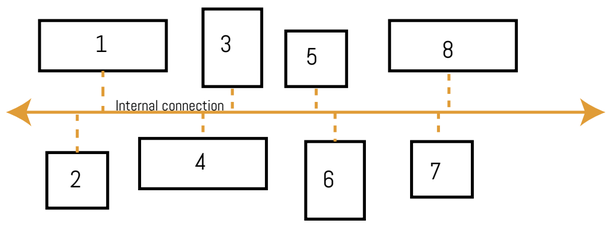
CONCEPT DESIGN



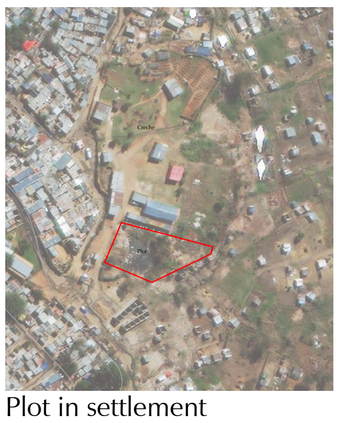
Open - closed



Public - private



Internal connection

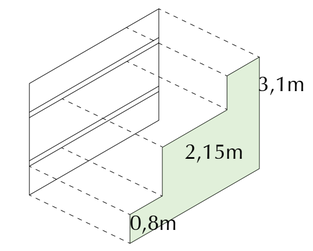


Plot in settlement

PROGRAM OF REQUIREMENTS

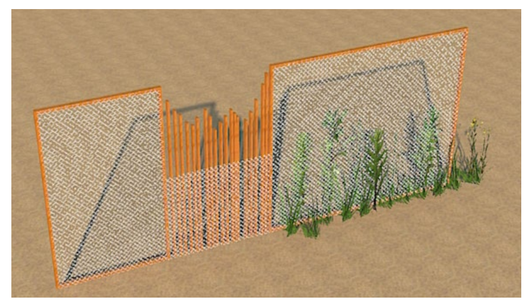
Study area	Minimum of 24 students	30 M²	Office	Working 3 desks at the same time	10 M²
Women shelter	10 private rooms	110 M²	Skills centre	Multifunctional room for a minimum of 30/40 people	45 M²
Kitchen	Cooking for minimum 24 students Helping +- 30 families with food bags	30 M²	Toilet	Total of 4 toilets	6 M²

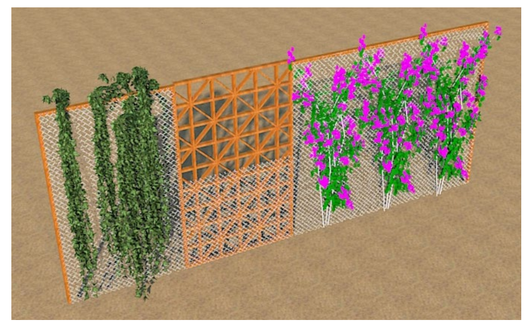
CONCEPT WALL



Height

Greenery





FLOORPLAN 1:100

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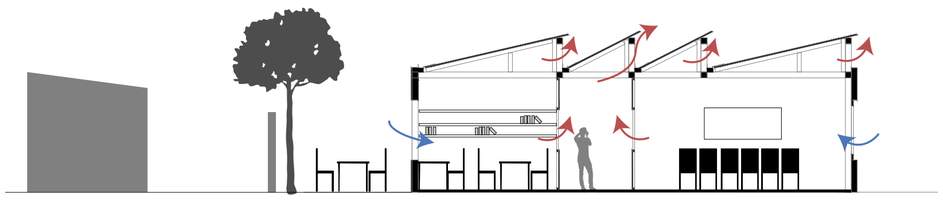
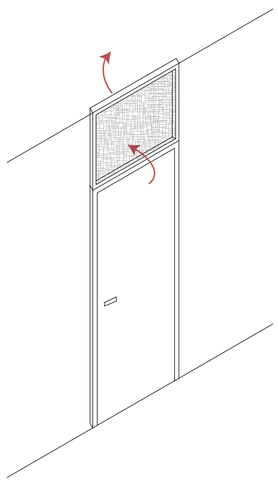
PASSIVE VENTILATION

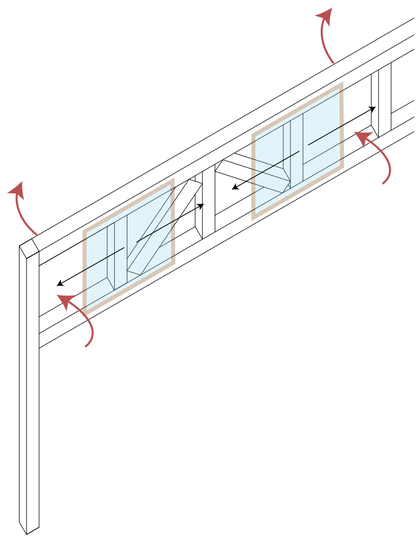
Floorplan 1:200



Section 1:100



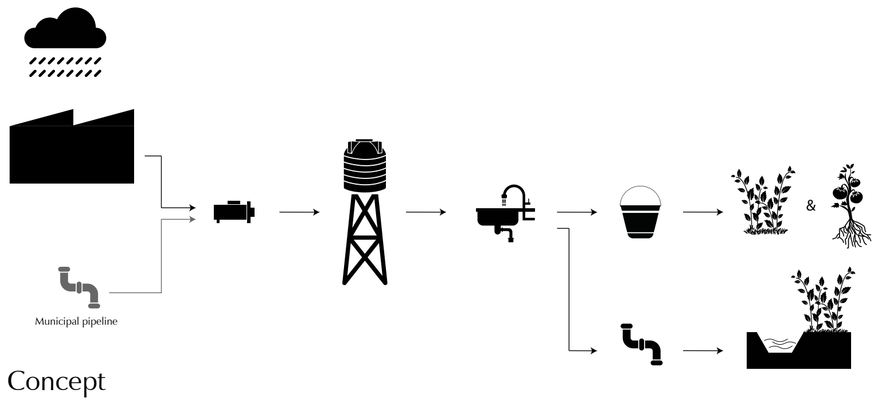
Netting above door



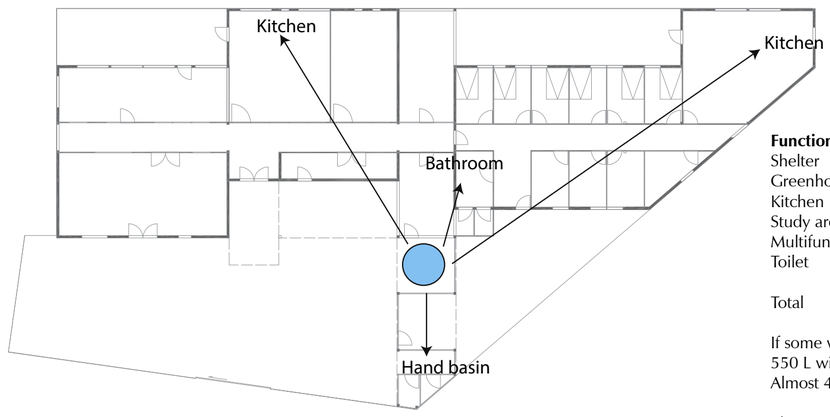
Window sliding panel

Passive ventilation is used because of the context. There is no money available to regulate the ventilation with mechanical systems.
The hallway with openings on both end will create a good circulation. Each room will have windows that can be opened to let fresh air enter. The used air can be transported outside via the hallway or the lattice girders. These will have sliding panels which can be opened according to the need of ventilation.
Doors will have netting above them to stimulate the circulation of used air towards the hallway.

WATER SYSTEM



Concept

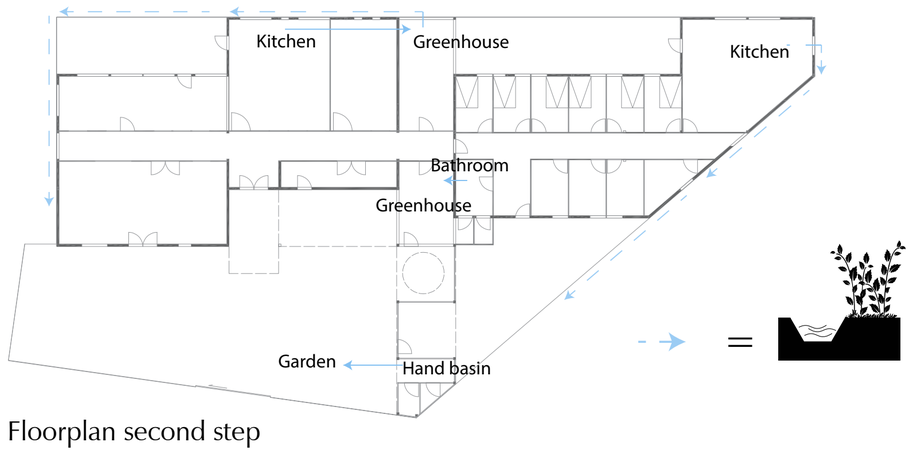


Floorplan first step

Function	Total of water per day
Shelter	390 L
Greenhouse	60 L
Kitchen	80 L
Study area	10 L
Multifunctional	10 L
Toilet	70 L
Total	620 L

If some water is used a second time, around 550 L will be used per day.
Almost 4000 L used in a week.

Place a 5000 L water tank
size: h= 2,25m d=1,82m



Floorplan second step

The watersystem of the plot will run first on rainwater that is being collected in a water tank. Rain comes very irregular, and to run the building only on rainwater, a very big tank is needed, for which the plot is too small. Therefore I chose to create a buffer of around a week. When there is not enough rainwater, the tank can be filled with water coming from the municipal pipeline.
Certain functions require water, which can be called the first step of the water system. The water that is being used here, can be used for a second time, in the garden or greenhouse. If it will not be used, the water will find its way to the ditch around the plot. The water will feed the plants that create the wall.

SUN + ENERGY

Activities

	Morning	Afternoon	Evening
Shelter			
Sorting & cooking			
Studying			
Counselling / courses			
Office meetings			
Theory classes			
Practical workshops			
Community activities			

Share space

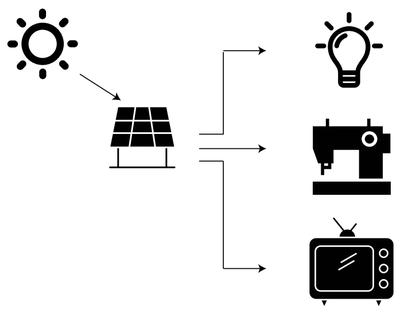
Share space

Spaces

	Morning	Afternoon	Evening
Shelter			
Kitchen			
Study			
Multi purpose			
Office			
Skills centre			

Temperature Johannesburg, SA

Principle



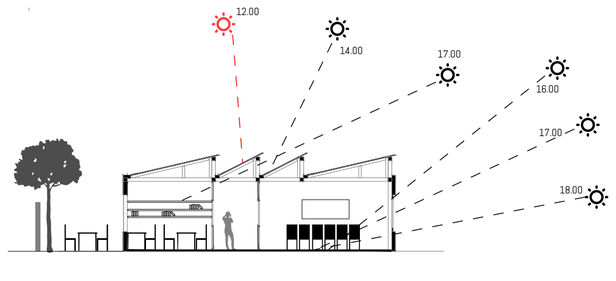
Appliances	Usage per year	Total needed	Total usage per year
Light bulb	60W	62	4799 kWh
Old TV	100 kWh	2	200 kWh
Projector	78 kWh	1	78 kWh
Sewing machine	53 kWh	10	530 kWh
PC	234 kWh	3	702 kWh
Music installation	25 kWh	2	50 kWh
Total			6359 kWh

Total of 30 solar panels

Sun entering rooms 21-06 08.00-12.00

Sun entering rooms 21-06 12.00-17.00

Sun entering rooms summer



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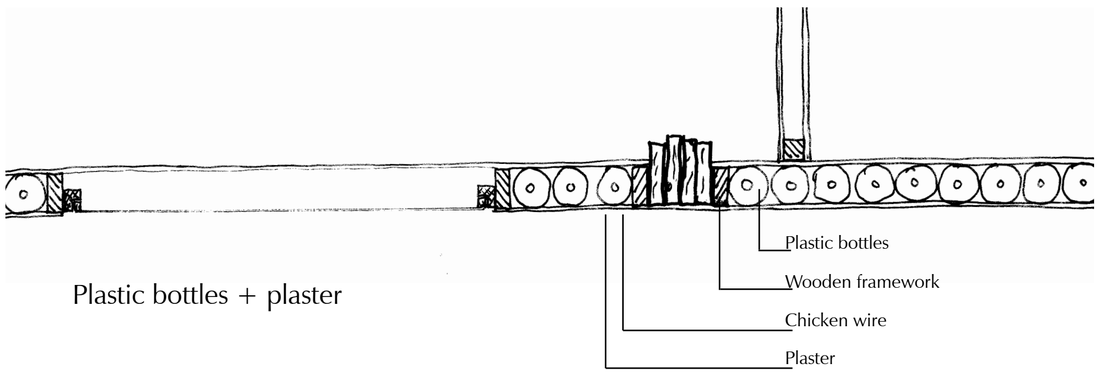
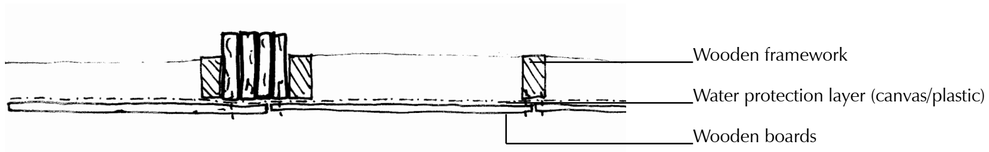
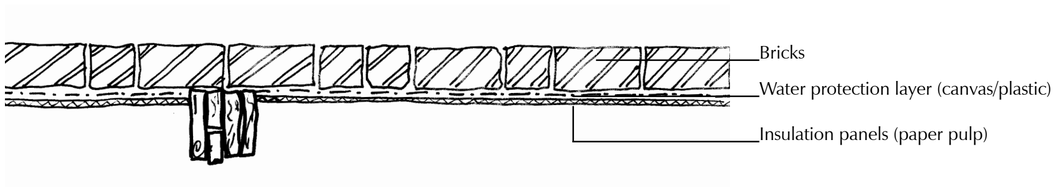
Outer wall 1:10



Plastic bottles + plaster

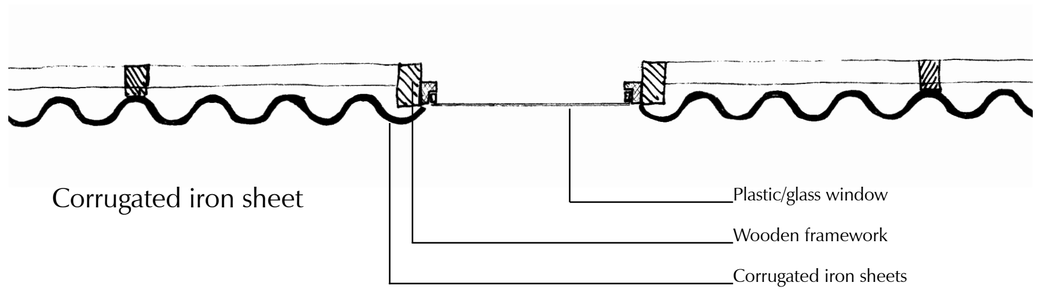


Wood finishing

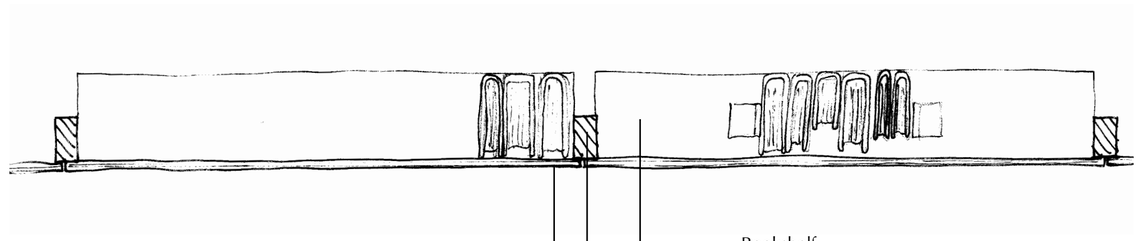


Brick

Inner wall 1:10



Corrugated iron sheet



Bookshelf

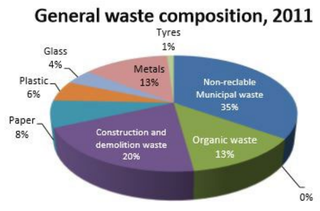
MATERIALISATION

Already available materials






Second hand building materials + waste materials



Only 16 % of construction & demolition waste recycled

Table 5: Tonnages of general waste imported and exported in 2017 (in tonnes)

Waste type		Waste Generated	Imports	Exports	Total
GW01	General waste	1 770 009	2	4	1 770 009
GW10	Commercial and industrial	3 179 157			3 179 157
GW13	Brine				-
GW14	Fly ash and dust				-
GW15	Bottom ash				-
GW16	Slag				-
GW 17	Mineral waste				-
GW 18	WEEE				-
GW 20	Organic waste	1 166 731	4 048	298	6 656 234
GW 21	Sewage sludge				
GW30	Construction and demolition	2 172 319			5 360 556
GW50	Paper	3 571 632	58 548	129 375	3 635 825
GW51	Plastic	787 924	6 988	34 794	2 247 323
GW52	Glass	176 829	39 928	11	1 395 103
GW53	Metals	4 160 641	27 976	68 192	3 345 565
GW54	Tyres	165 763			221 751
GW99	Other	684 737		1 003	14 868 997
	Total general waste (t)	25 287 037	137 490	258 557	42 680 520

Choice of material matched with functions

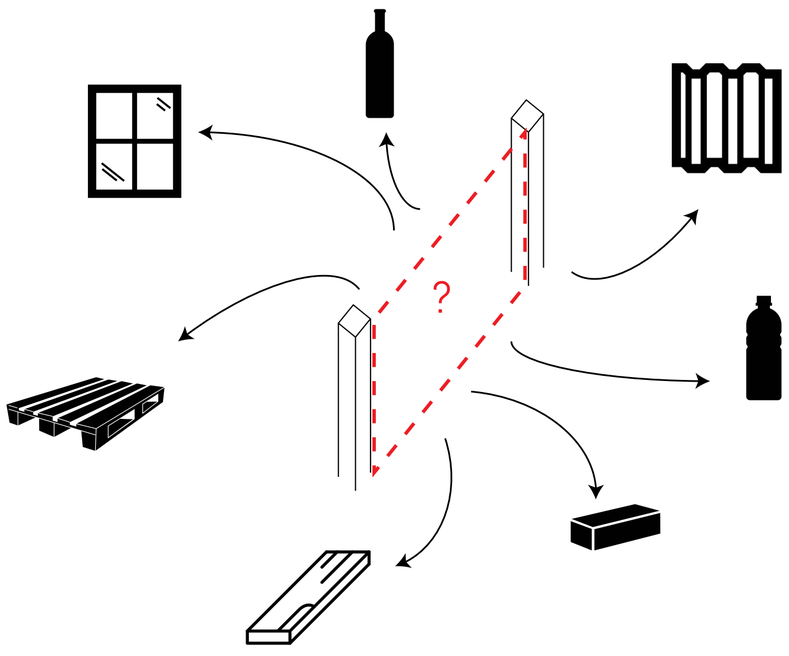
- Public functions
- Experimenting
- Inspiration

- Pallets
- Plaster to paint
- Wood

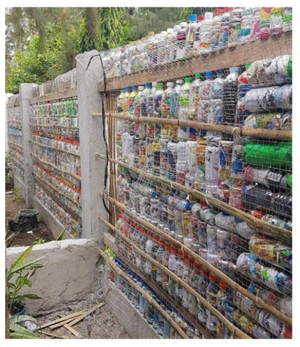
- Private functions
- Peaceful
- Homely
- Insulation

- Brick
- Plastic bottles -> Plaster

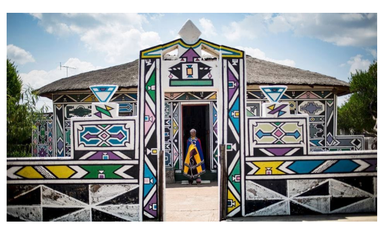
Variety of options




Corrugated iron sheet

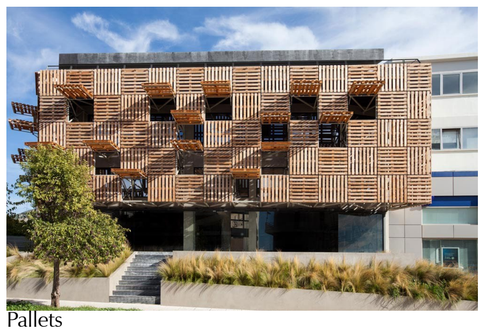

Plastic bottles


Plaster

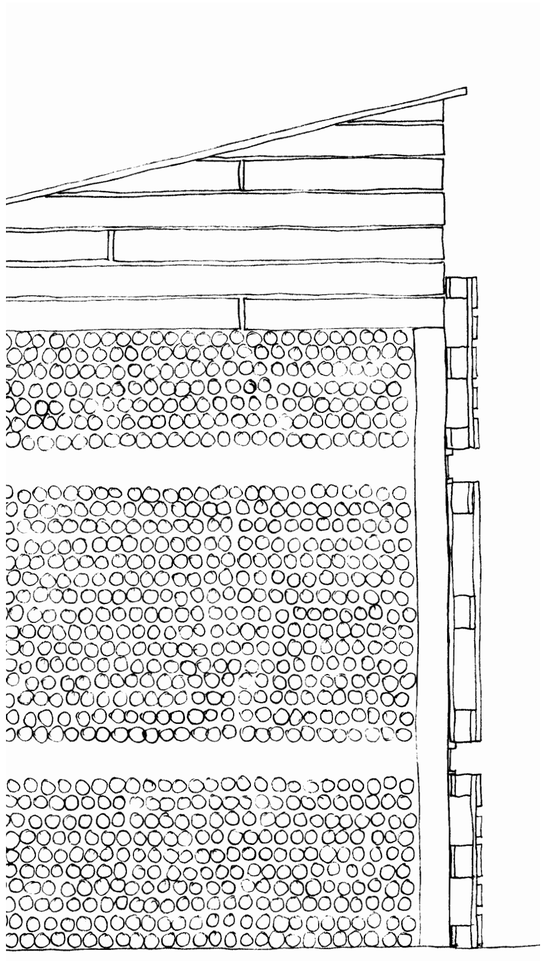

Paintings


Glass walls

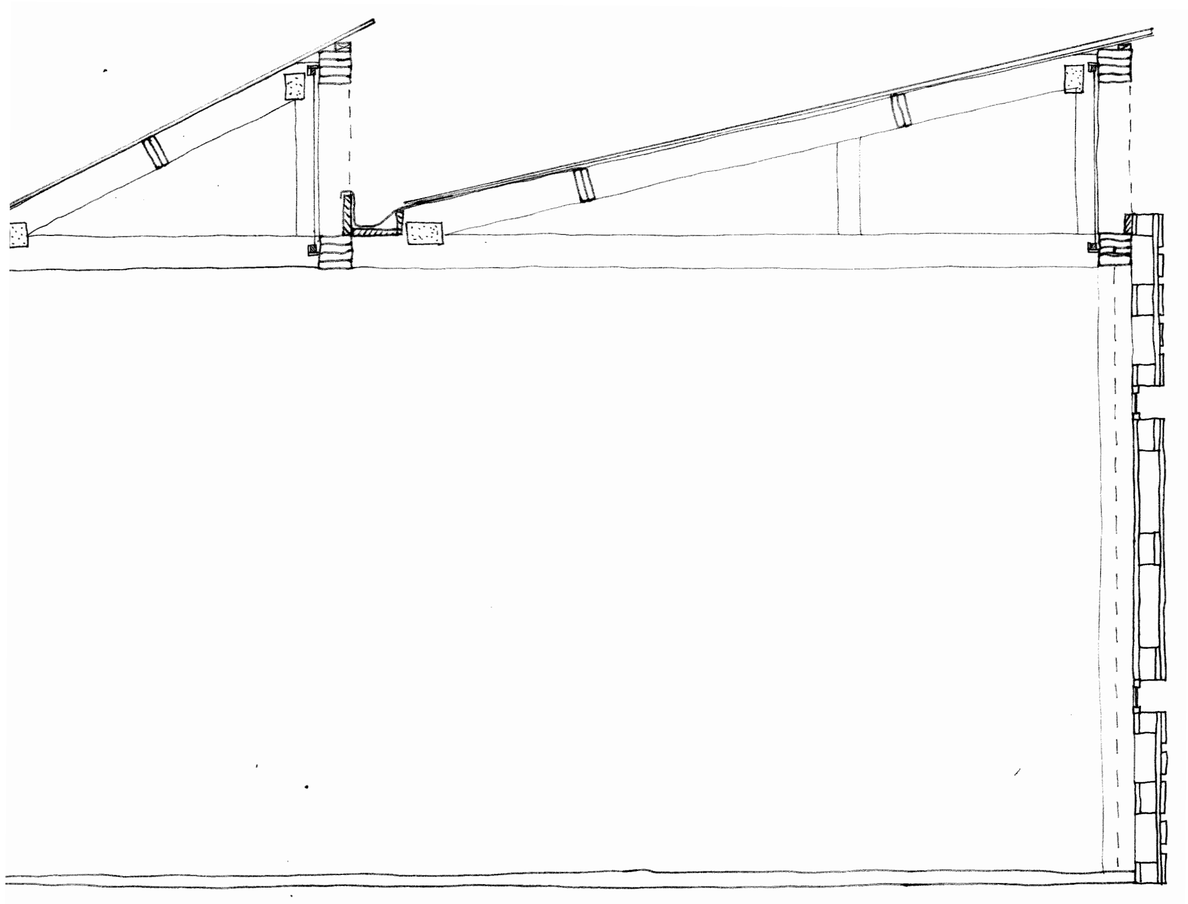

Glass bottles

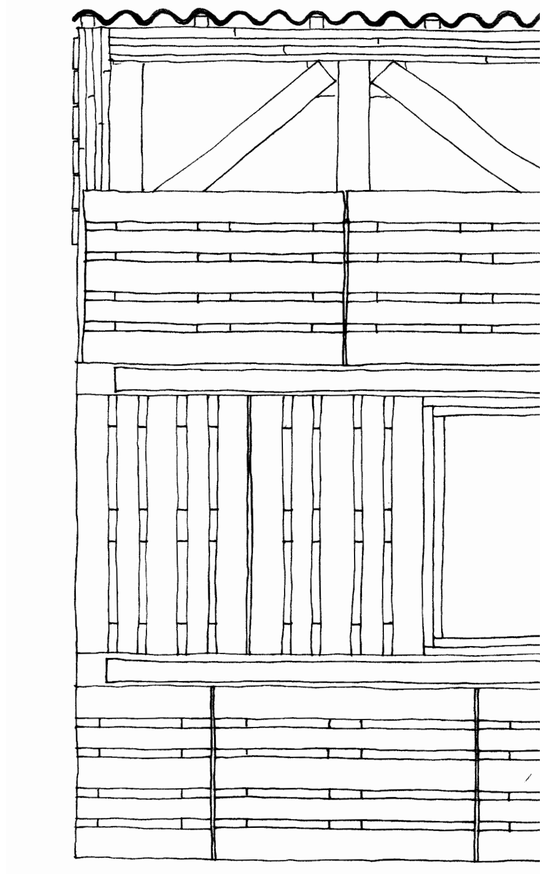

Pallets

VERTICAL FACADE FRAGMENT & SECTION 1:20

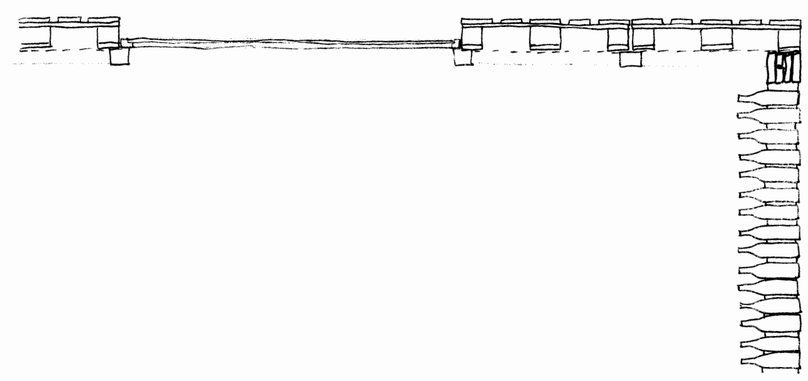


West facing facade

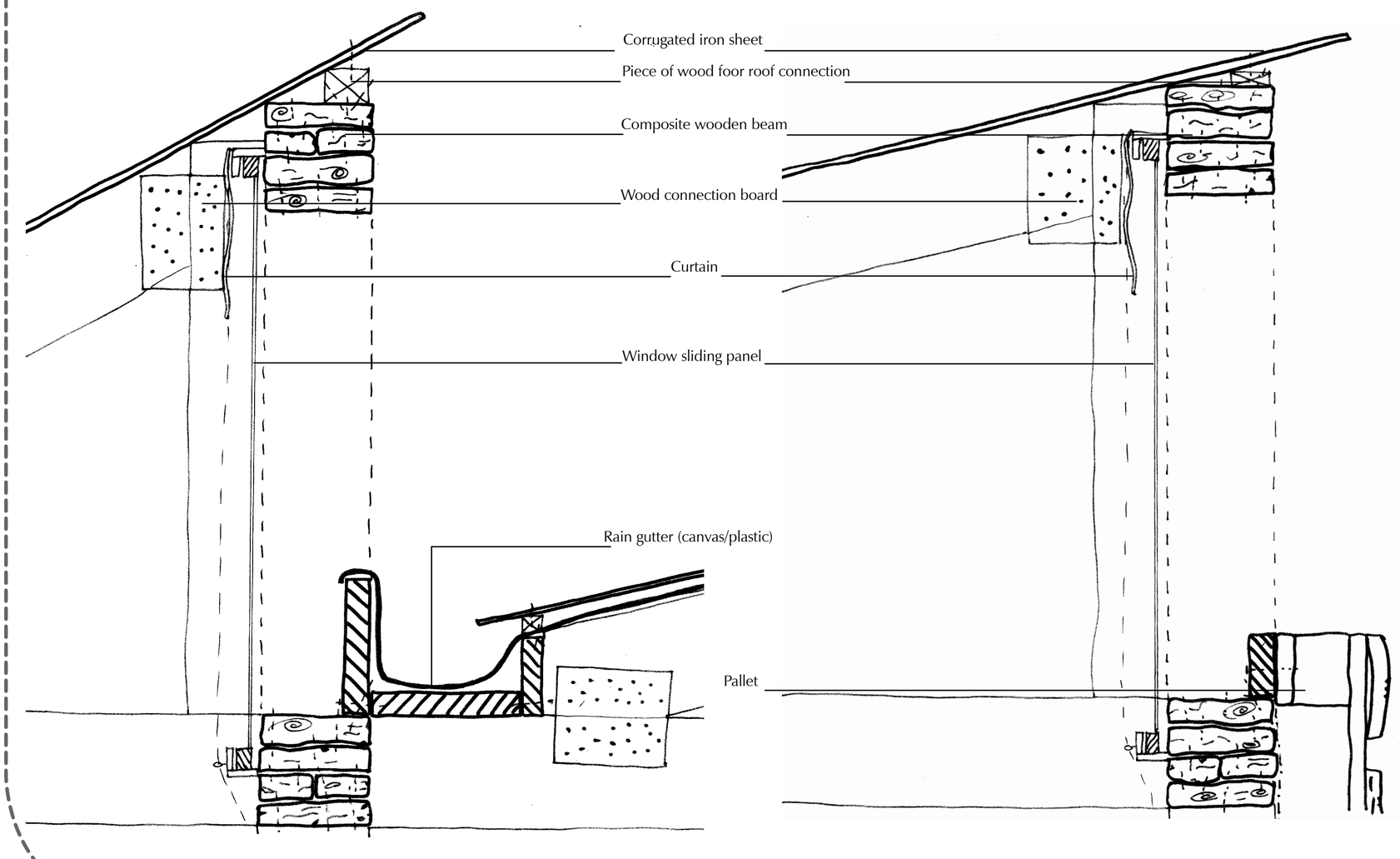




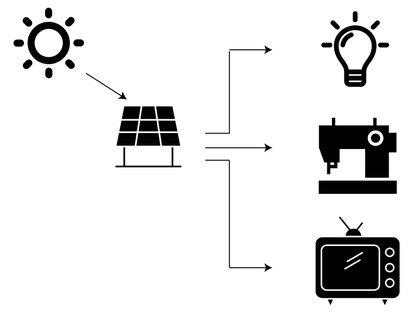
South facing facade



ROOF DETAILS 1:5



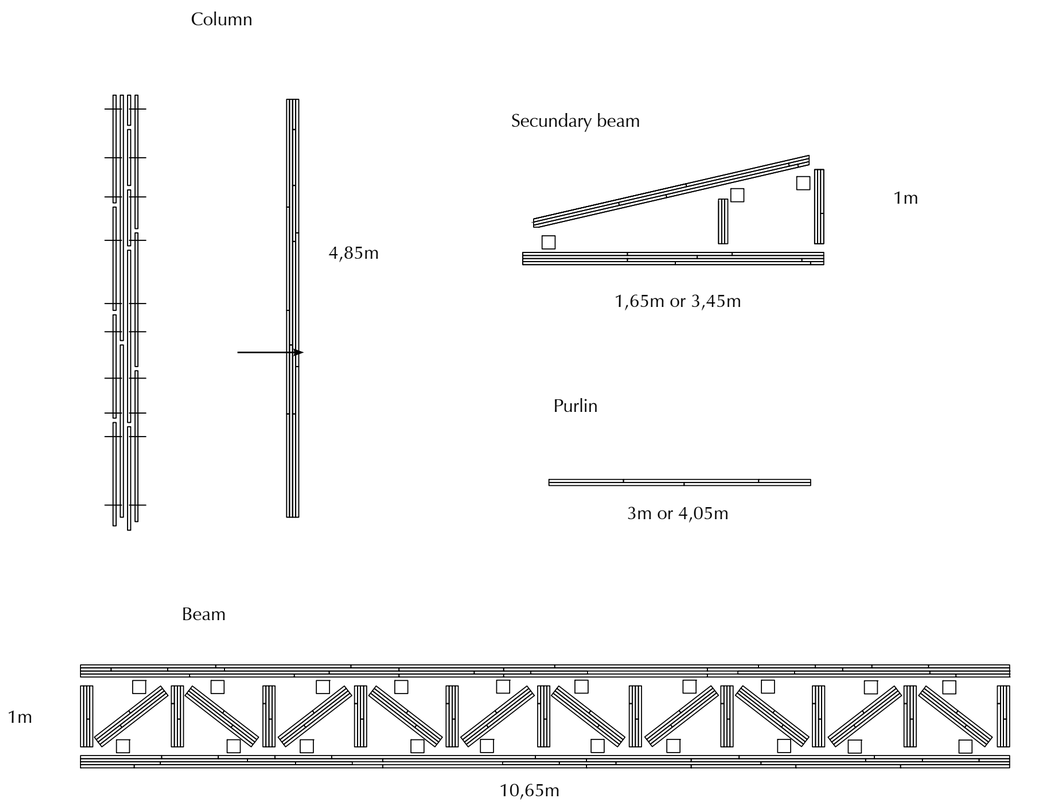
ENERGY



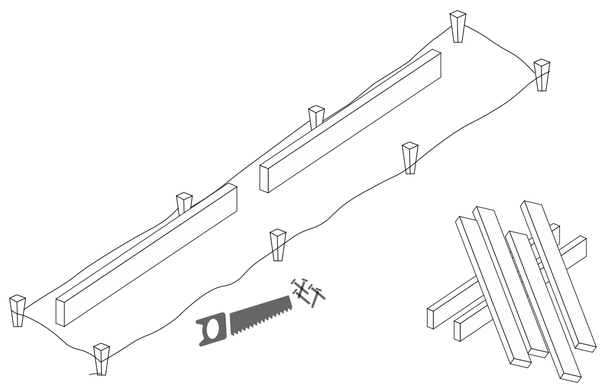
Appliances	Usage per year	Total needed	Total usage per year
Light bulb	60W	62	4799 kWh
Old TV	100 kWh	2	200 kWh
Projector	78 kWh	1	78 kWh
Sewing machine	53 kWh	10	530 kWh
PC	234 kWh	3	702 kWh
Music installation	25 kWh	2	50 kWh
Total			6359 kWh

Total of 30 solar panels

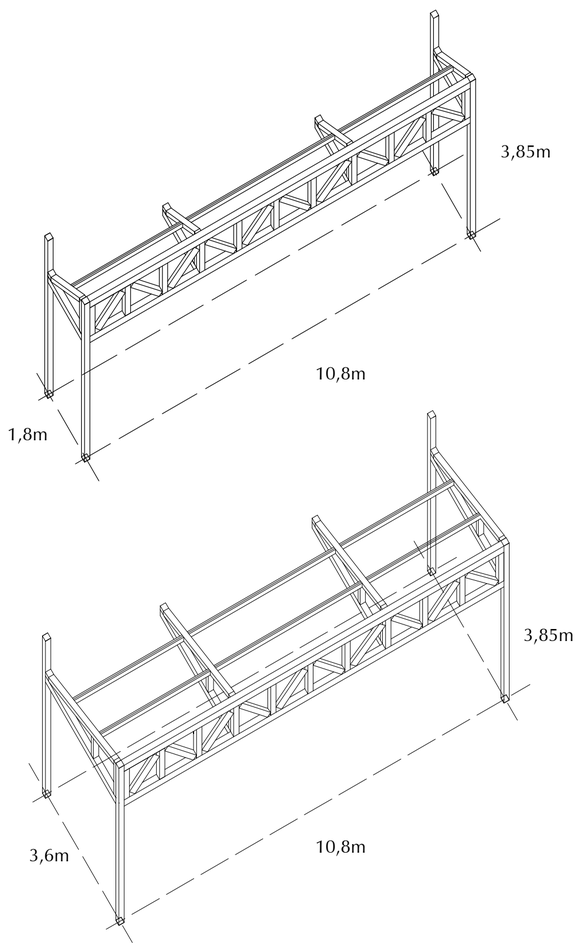
LOAD BEARING CONSTRUCTION & MODULE



Construction parts

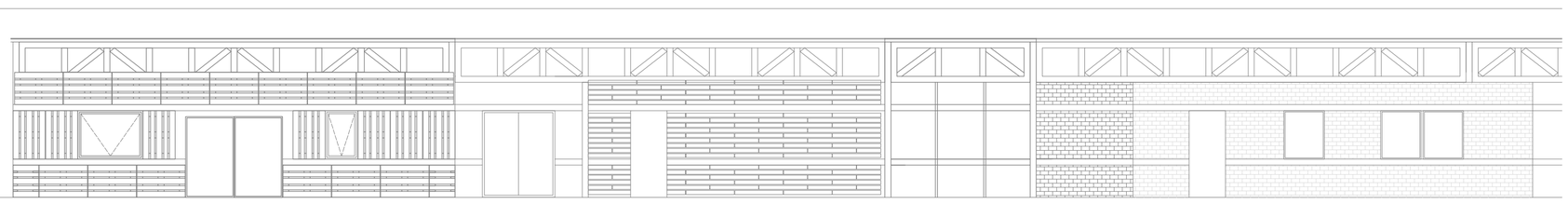


Using a mold for creating construction parts

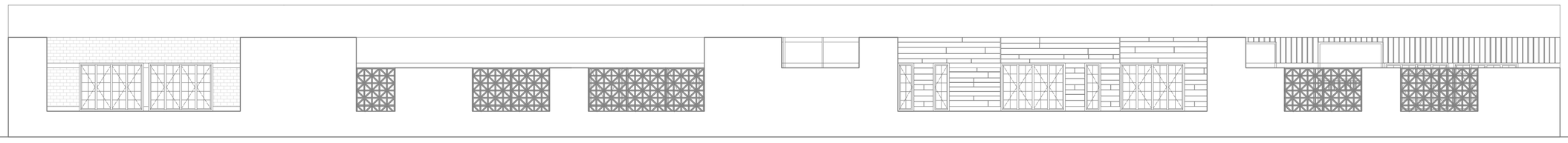


Different sizes module

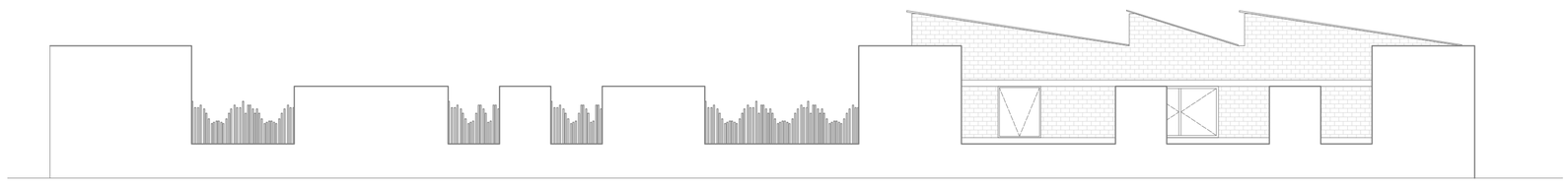
FACADES 1:100



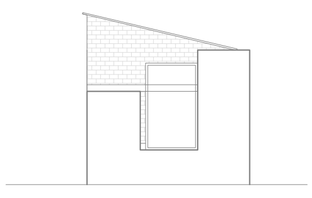
South view



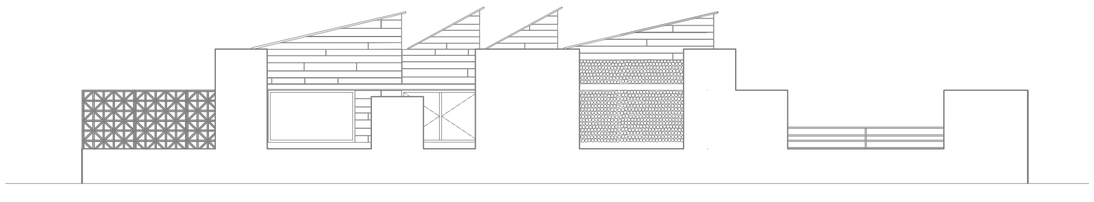
North view



South-east view



East view



West view

SUN

Activities

	Morning	Afternoon	Evening
Shelter	■		■
Sorting & cooking		■	
Studying		■	
Counselling / courses	■		
Office meetings	■	■	
Theory classes	■		
Practical workshops		■	
Community activities		■	

Share space

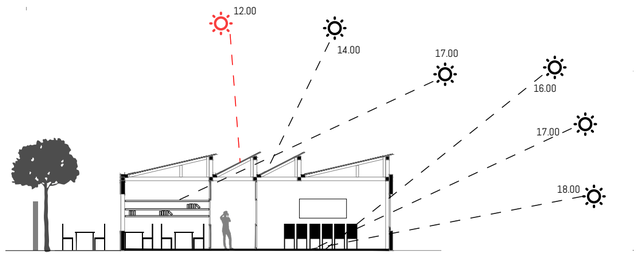
Share space

Spaces

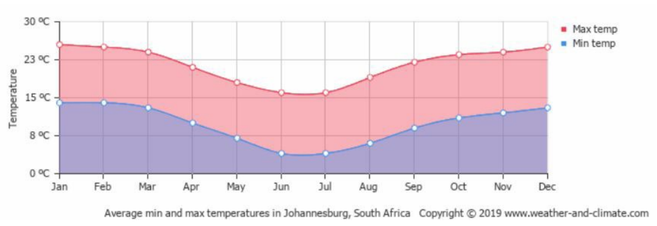
	Morning	Afternoon	Evening
Shelter	■		■
Kitchen		■	
Study	■	■	
Multi purpose	■	■	
Office	■	■	
Skills centre	■	■	

The South African summers are hot, but during winter it can get quite cold. To make optimal use of the warmth of the sun, the rooms are organized based on the path of the sun. Therefore the time of usage of the rooms are placed next to the data of the sunpath. With the result that the shelter receives sunlight during the early morning, and the public functions like the kitchen and office the entire morning and early afternoon.
Most rooms have natural (sun)light entering during the wintertime to heat up the space, but the light will be blocked during the summer to keep out most of the heat. The shape of the roof will help with this.

Sun entering rooms summer



Temperature Johannesburg, SA

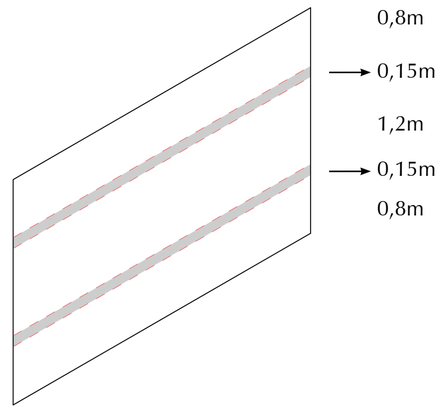


Sun entering rooms 21-06 08.00-12.00

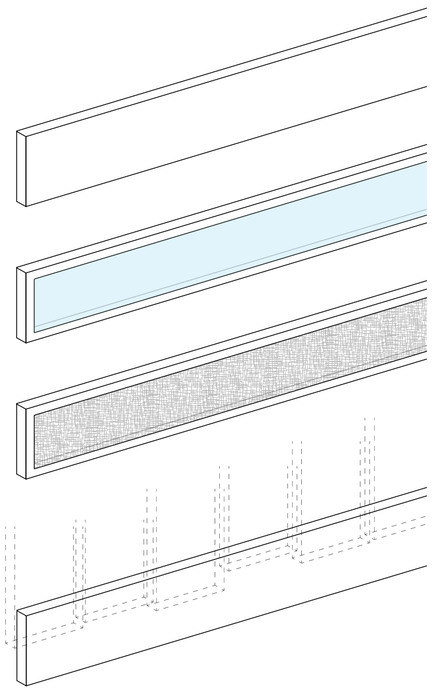
Sun entering rooms 21-06 12.00-17.00

FACADE CONCEPT

Concept horizontal line



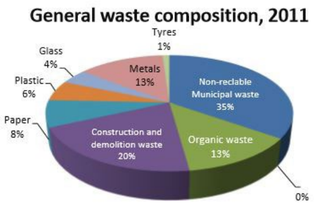
Variety of infill



CIRCULARITY OF MATERIALS

Already available materials

Second hand building materials + waste materials

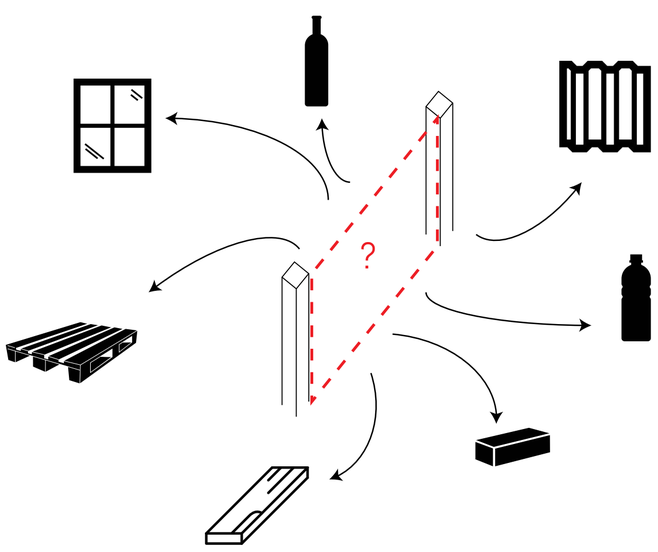


Only 16 % of construction & demolition waste recycled

Table 5: Tonnages of general waste imported and exported in 2017 (in tonnes)

Waste type		Waste Generated	Imports	Exports	Total
GW01	General waste	1 770 009	2	4	1 770 009
GW10	Commercial and industrial	3 179 157			3 179 157
GW13	Brine				-
GW14	Fly ash and dust				-
GW15	Bottom ash				-
GW16	Slag				-
GW 17	Mineral waste				-
GW 18	WEEE				-
GW 20	Organic waste	1 166 731	4 048	298	6 656 234
GW 21	Sewage sludge				
GW30	Construction and demolition	2 172 319			5 360 556
GW50	Paper	3 571 632	58 548	129 375	3 635 825
GW51	Plastic	787 924	6 988	34 794	2 247 323
GW52	Glass	176 829	39 928	11	1 395 103
GW53	Metals	4 160 641	27 976	68 192	3 345 565
GW54	Tyres	165 763			221 751
GW99	Other	684 737		1 003	14 868 997
	Total general waste (t)	25 287 037	137 490	258 557	42 680 520

Variety of options for wall design



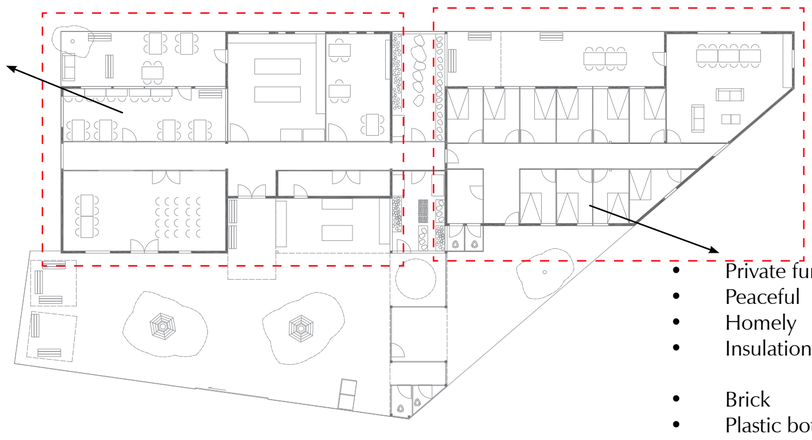
The inhabitants of Zandspruit already build following the concept of circularity, although this is mostly because of their economic situation.
For this design the same path is followed. There are already second hand building materials available as seen in the photos. The rest of the building materials will either come from demolition sites or collected as waste. Now only 16% of construction and demolition waste is being recycled, so there is a big market for circularity. Furthermore paper and plastic are big waste groups, so ideal for building.
Because of all these options, there is a wide variety of wall finishing possible. The design depends on what materials are available.

CHOICE OF MATERIALS

Choice of material matched with functions

- Public functions
- Experimenting
- Inspiration

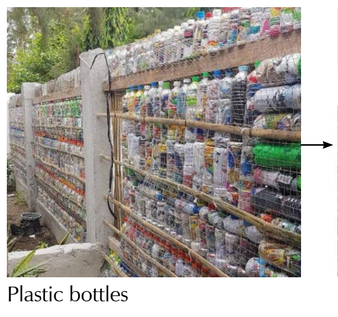
- Pallets
- Plaster to paint
- Wood



- Private functions
- Peaceful
- Homely
- Insulation

- Brick
- Plastic bottles -> Plaster

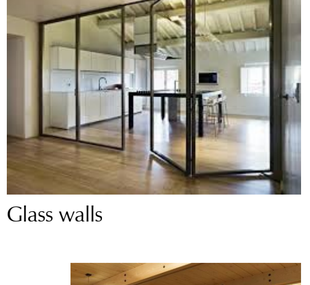
Impressions of materials used in the building



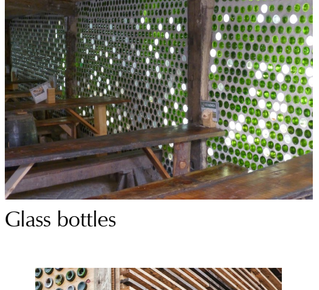
Plastic bottles

Plaster

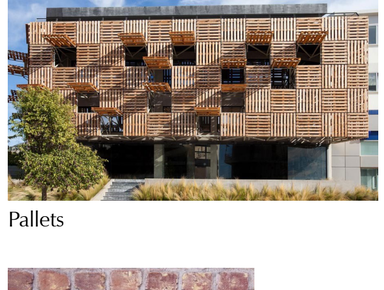
Paintings



Glass walls

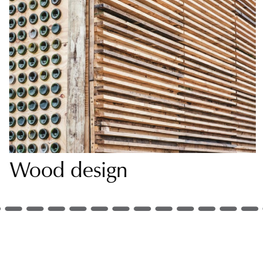


Glass bottles



Pallets

Corrugated iron sheet



Wood design

Brick facade