Chapter 8

Technical concept

Technical intention/ contribution

Material pallet

Technical development

Technical structure

Technological concept:

The existing church building is placed close to a vleiland, allowing for the contrast between building and nature. The new design becomes the buffer or mediation between the man made rigid north and the natural organic south. The design is also the connection between old and new as well as battered and healed. The users as well as the nature is to undergo a pilgrimage of healing.

The ecology is currently fractured and a regenerative concept is introduced. The building is multifaceted and within a community with economic struggles a phased approach must be taken. It is proposed to firstly build the clinic, spa and homeless shelter. These buildings are located at the edge of the design and creates a threshold between the public and semi private spaces. As the ecology needs intervention, the open spaces will become gardens that can feed the community and regenerate the soil. Trees are to be planted within the courtyards spaces to allow shade and enough time for them to grow before the development is constructed. Bamboo plantations are grown to become a building material with can be used by the community and a cost effective way to build the veil or shading devices.

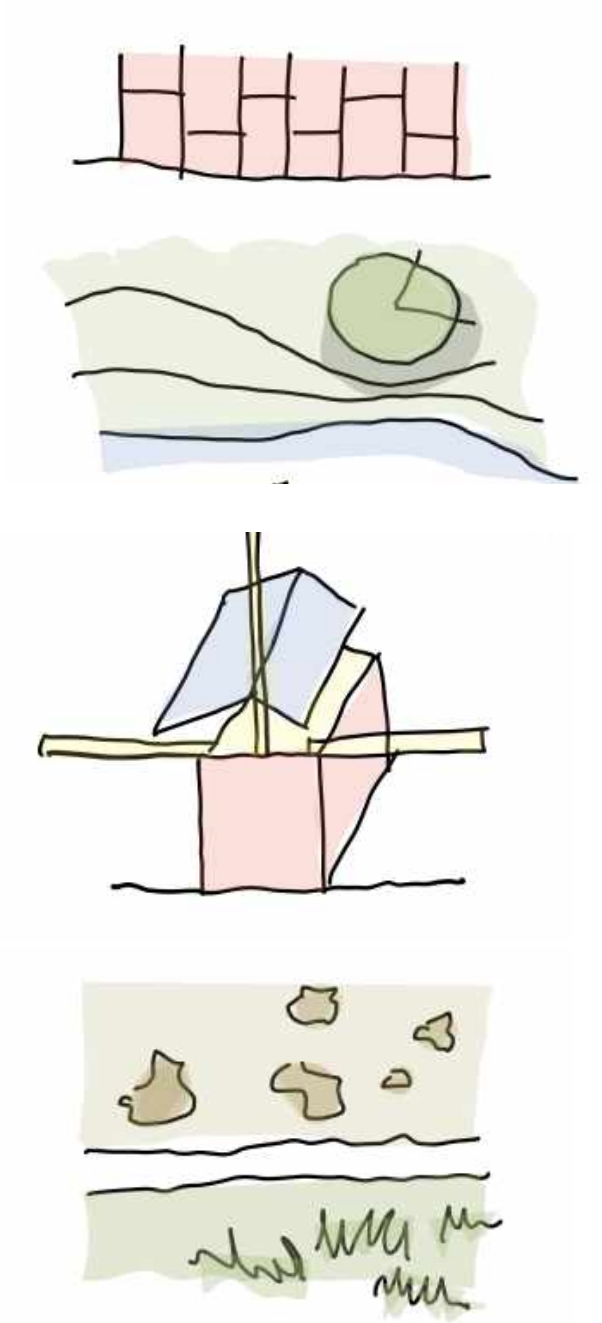
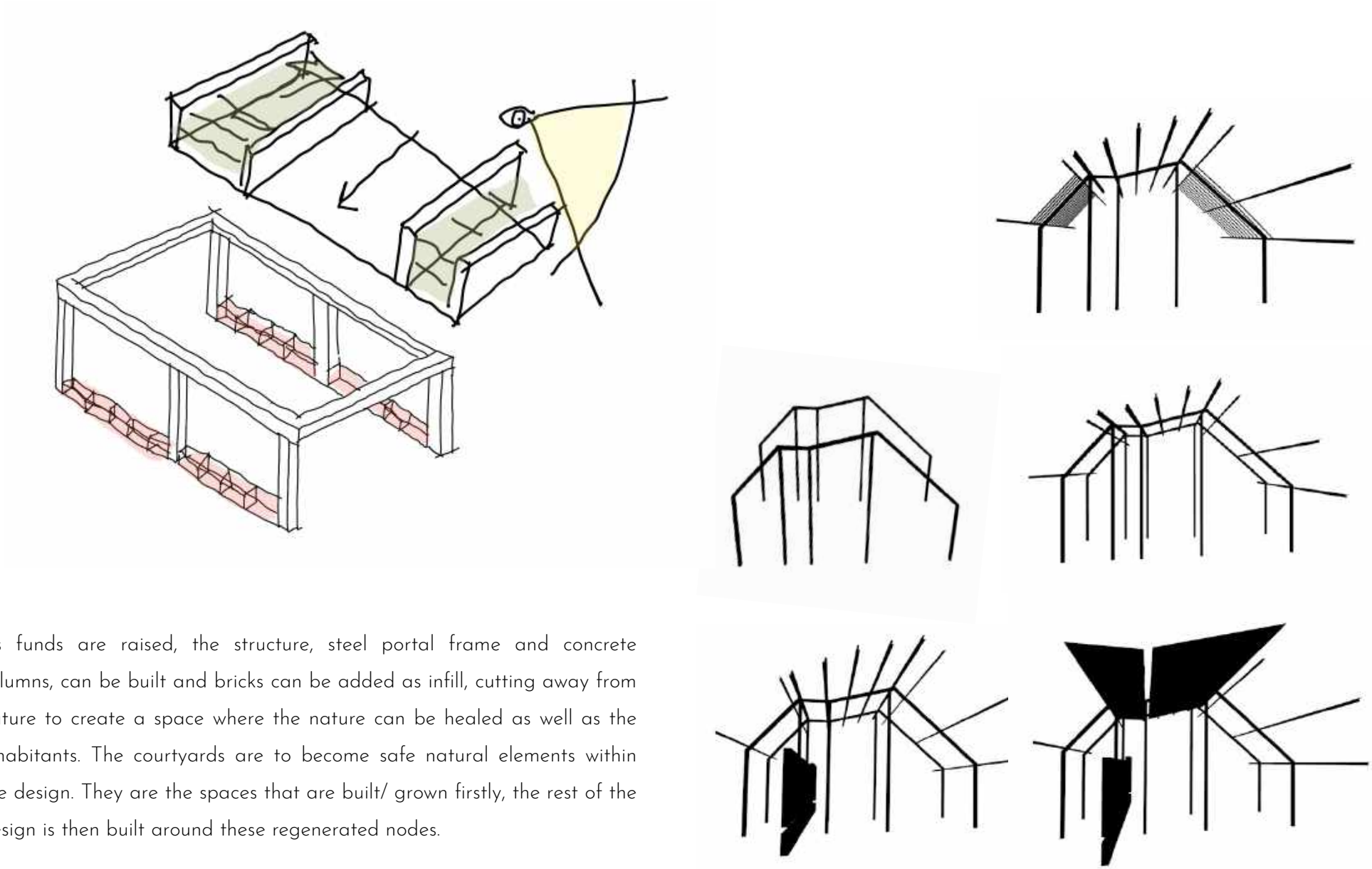


Figure 75: Technological concept by Author 2021



As funds are raised, the structure, steel portal frame and concrete columns, can be built and bricks can be added as infill, cutting away from nature to create a space where the nature can be healed as well as the inhabitants. The courtyards are to become safe natural elements within the design. They are the spaces that are built/ grown firstly, the rest of the design is then built around these regenerated nodes.

Figure 76: Structural system by Author 2021

The steel tectonic portal frame structure is to be built in the first phase, the clinic and homeless shelter are constructed out of the portal frame with supporting steel purlins and brick infill, covered with a galvanised steel IBR roof sheeting.

The ground condition progresses throughout the design form lightly toughing the earth with a light steel frame at the clinic and homeless shelter, as this is a building used for short term interactions and allows the nature to be moderately undisturbed towards the gbv centre which is cut 2m into the ground, creating a safe cavelike environment, with an accessible planter roof to see, but not be seen (prospect and refuge theory). The church expansion towards the east is cut 1,5 m into the ground allowing an elongated pilgrimage route and amphitheatre/ outdoor church. The existing church is on the natural ground level, and stays undisturbed as a beacon in the landscape. The day care centre as well as the pulpit, become the threshold between the two contrasting ground conditions.

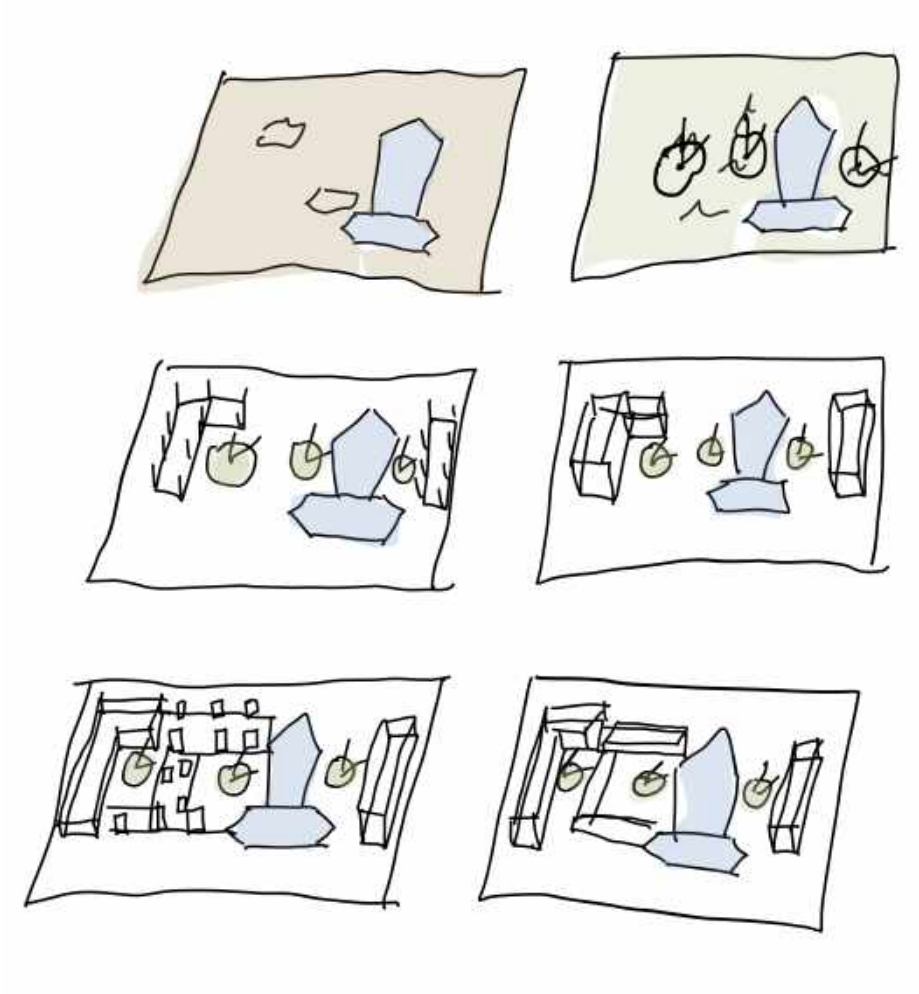


Figure 77: Phased approach by Author 2021

Technological intention:

The technological intention would be to immolate a feeling of safety within the design, by not creating barriers that exclude, but by creating threshold spaces that can allow for healing of the user and the fractured nature. No walls are used within the design, only buildings filled with program allowing the design to become the threshold upon threshold of safety. The old must not be disregarded, but developed to keep its relevance. Within a community where funds are limited, community buildings must have a multifaceted program to aid the inhabitants. Materials used within the community are to be used as it is the most accessible and a vernacular style of Eersterust can be developed. A variation between low technological connections and high tech materials are to be made to show inhabitants how alternative construction methods can be used.

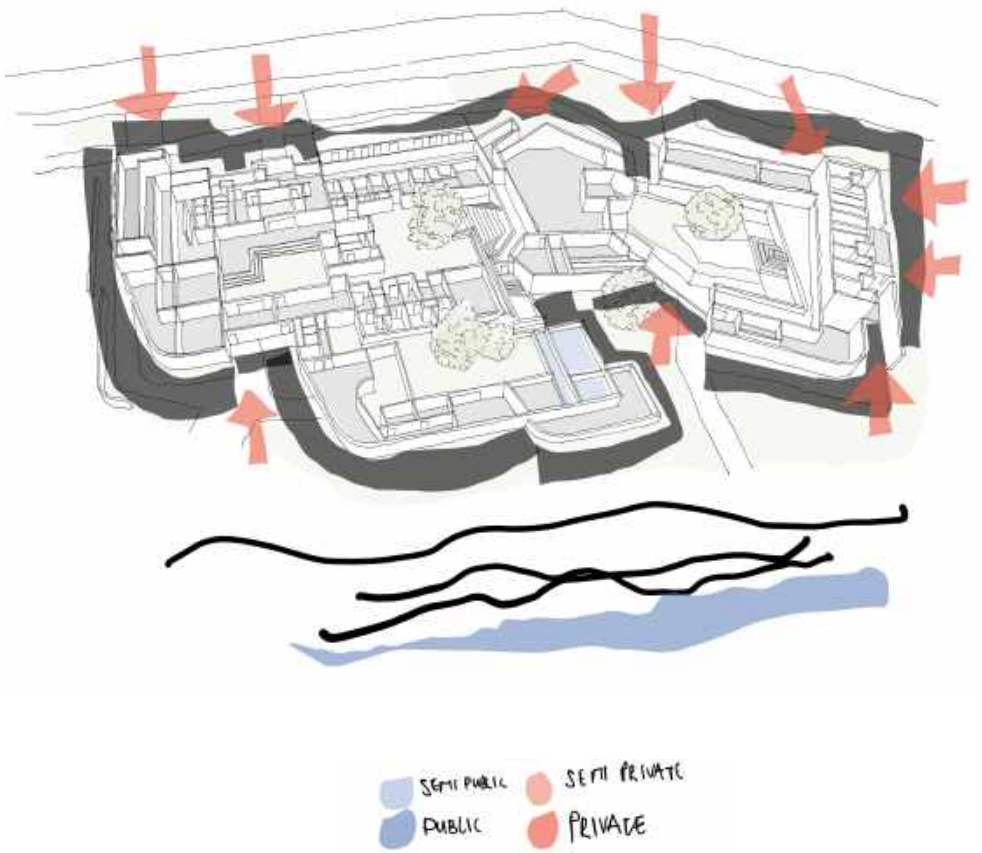


Figure 78: Technological intension by Author 2021

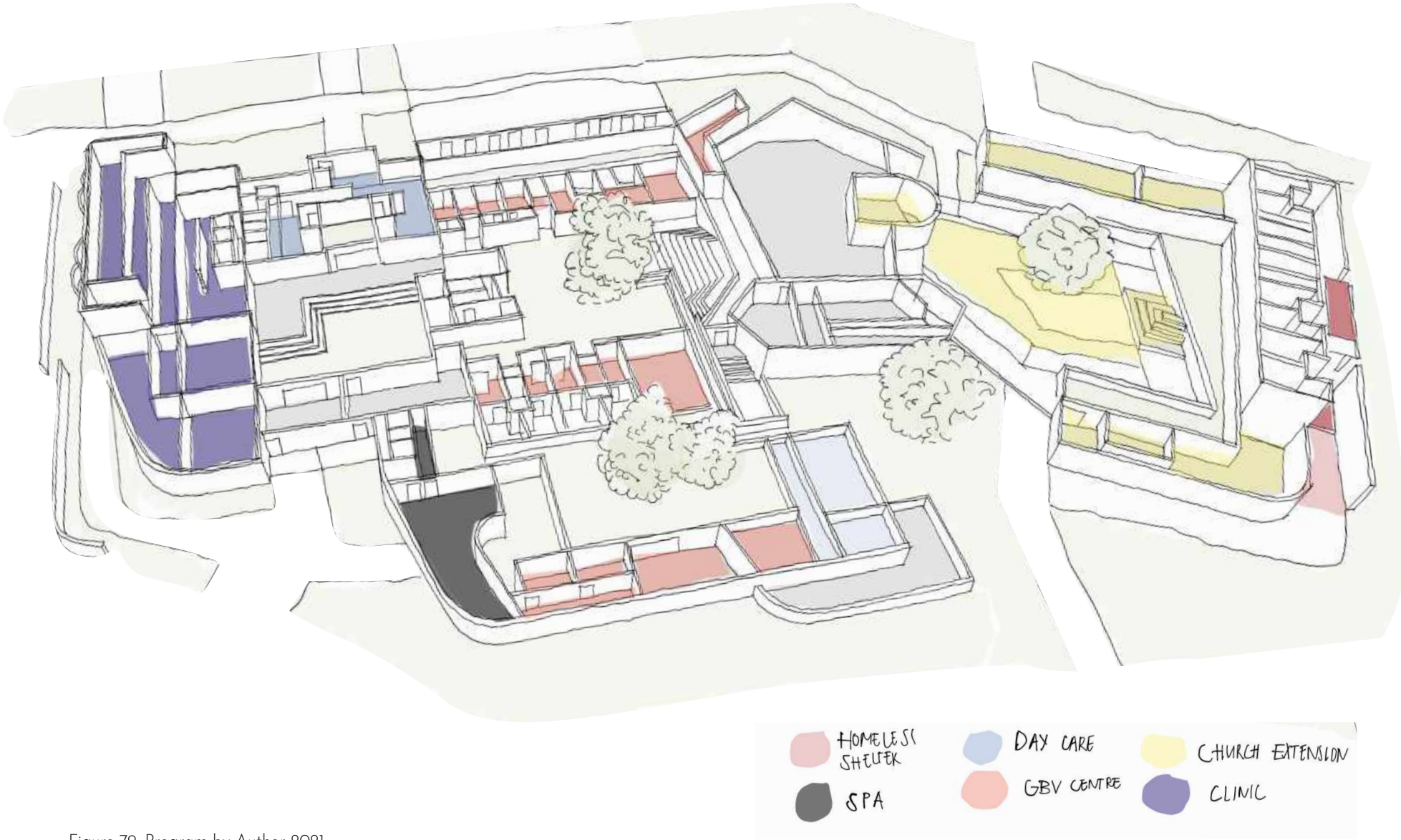
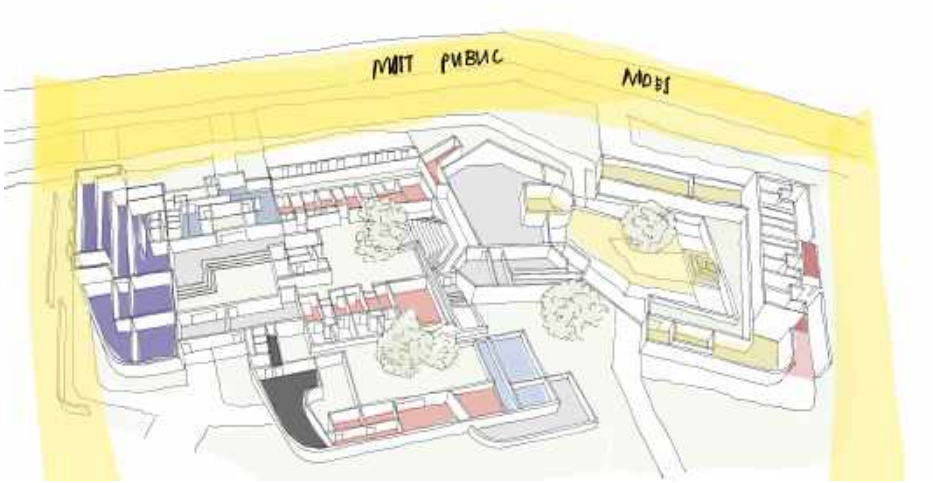


Figure 79: Program by Author 2021

On the most public interfaces of the design materials found within the community is incorporated. IBR roof sheeting is used, steel frame structures, tyres for retaining walls and timber poles for shading devices. The timber poles are integrated with bamboo slats as the bamboo plantation grows. The existing church roof is echoed in the design through imitating the angle and materiality in a contemporary way.



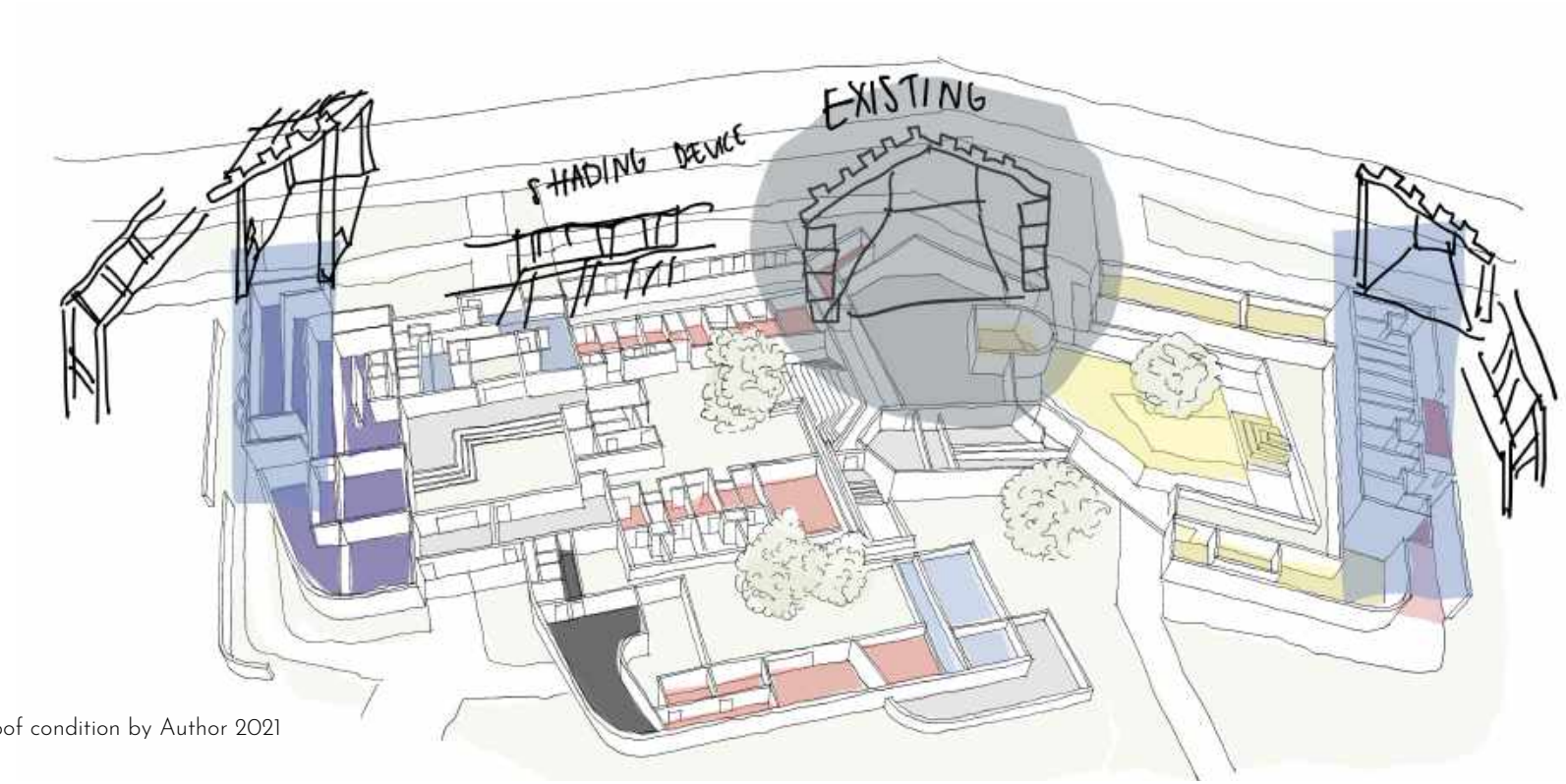


Figure 80: Roof condition by Author 2021

Local materials:

The existing church makes use of a brick structure, using a stretcher bond and a tectonic roof material made out of corrugated iron sheeting. The community mainly uses brick and the variation of corrugated sheeting or clay roof tiles. Tires are sold around the community and many street corners can be found with stacks of tyres. Sand and timber is sold within the community. A new informal settlement has started to develop from last year after the covid pandemic, timber slats and corrugated iron sheeting is used to build homes. The community is polluted, with open parks as dumping sites, rubbish can be found along the streets. Silverton is the neighbouring community and has a more industrial ethos, steel is a predominant material within this suburb.

The unemployed rate within Eersterust and the neighbouring Mamelodi is astronomically high. The Department of Public Works (2009), started an initiative to transfer skills, create job opportunities and improve infrastructure. The Expanded Public Works Programme (EPWP) was created in 2003 through the Growth and Development Summit (GDS), this is a way to educate the community on building techniques and create a true community building. The work force must include 65% youth, 55% women, 2% disabled, resulting in 90% of the employees to be from the area. The budget must be divided so that 46% is spent on equipment and materials, 35% on wages, 18% on project management, 2% on training and education on skill development, 1% wages and community facilitation (Mathews 2017:212).

Figure 81: Local materials by Author 2021

Technical development:

The technical development can be understood in terms of the roofs and the phases in which they are built.

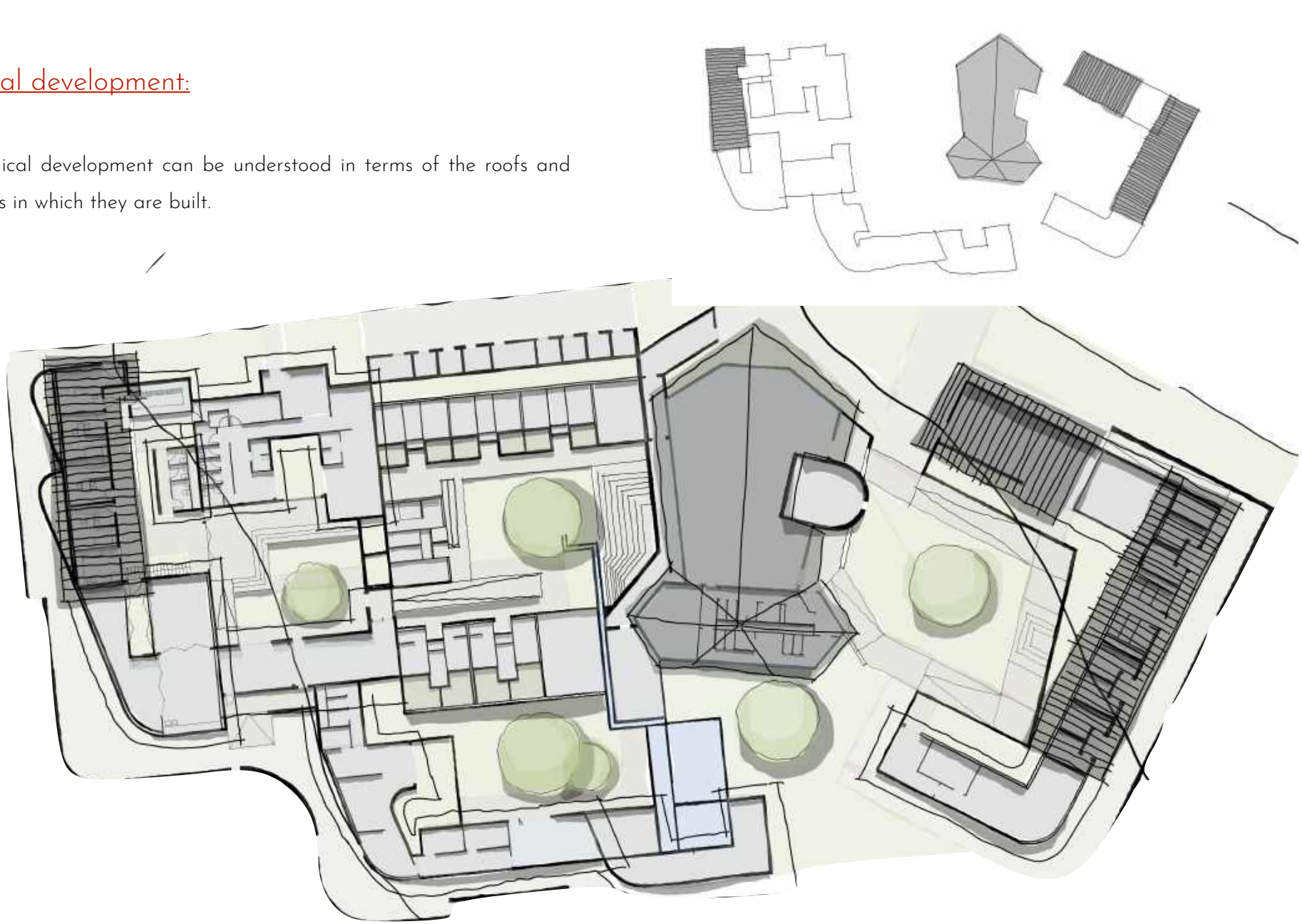
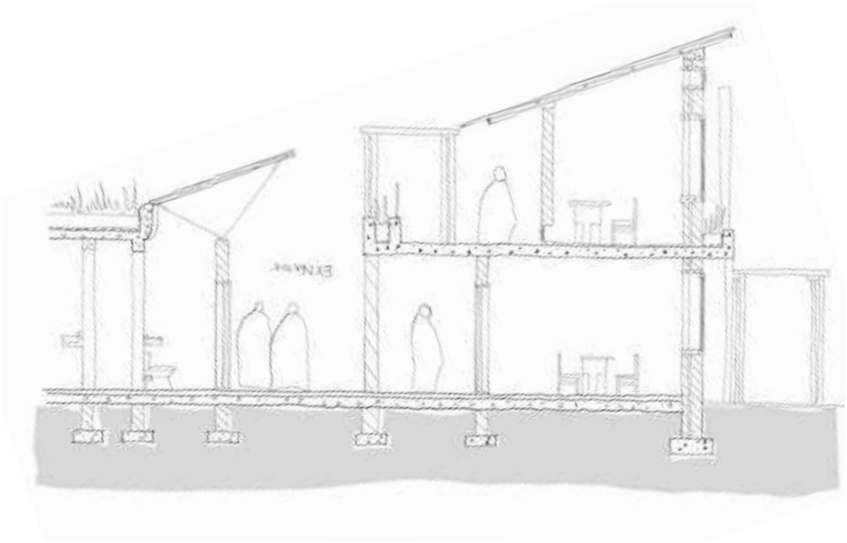
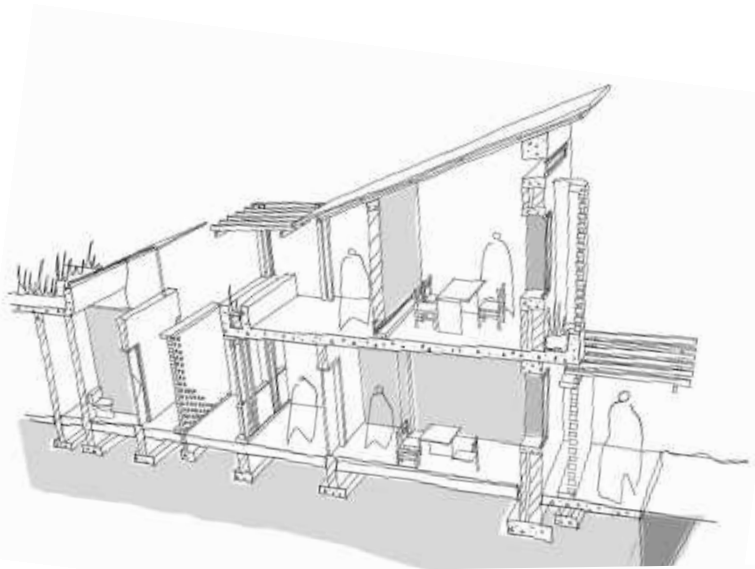


Figure 82: Tectonic structure by Author 2021





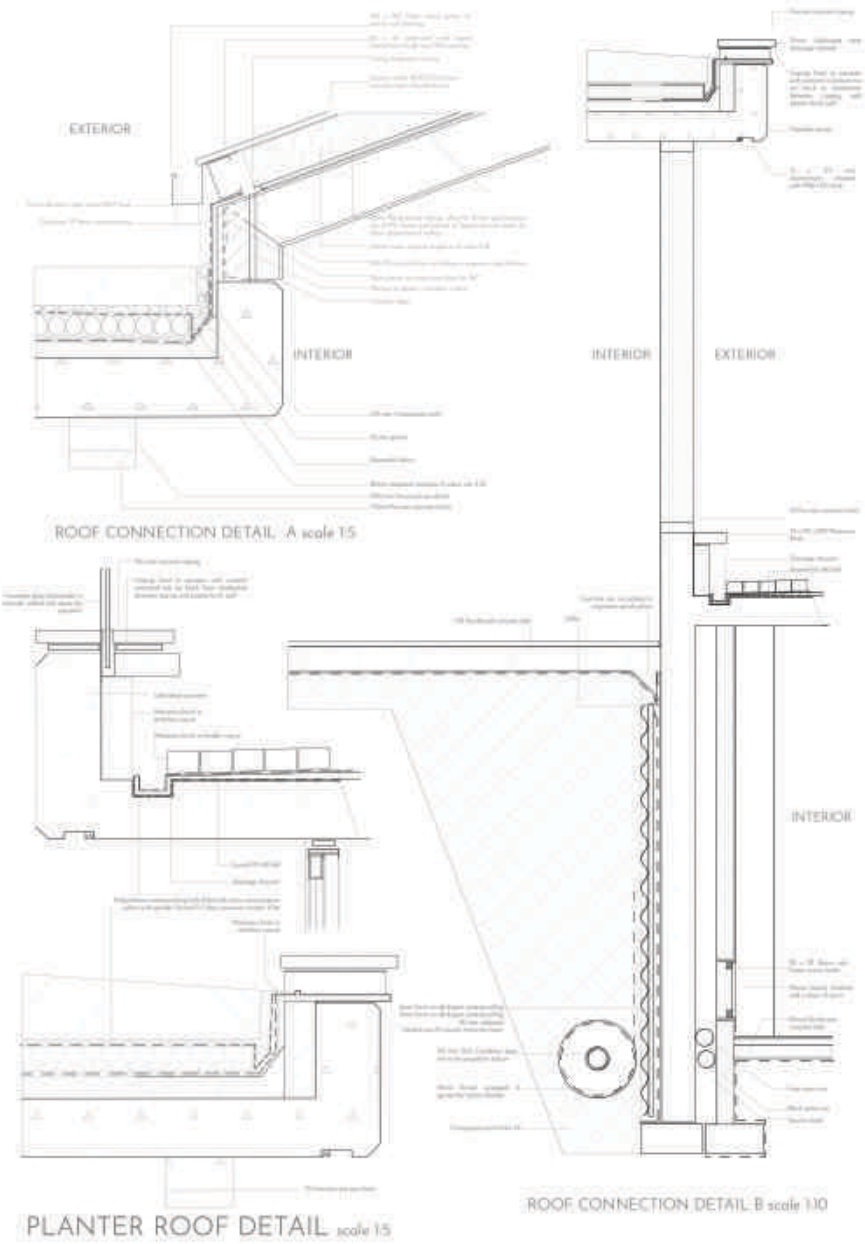
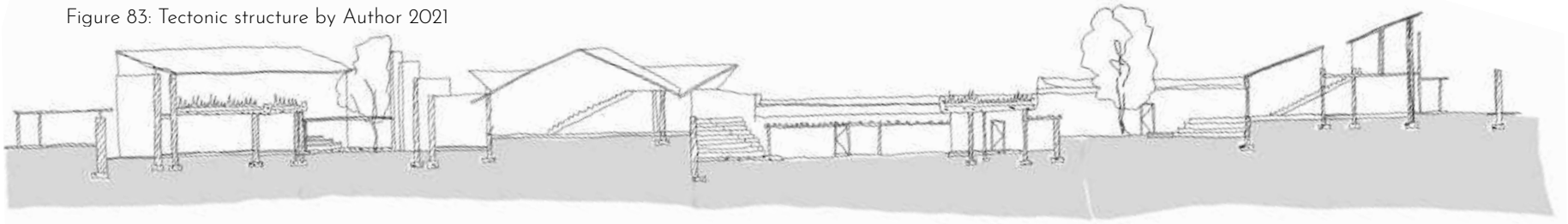
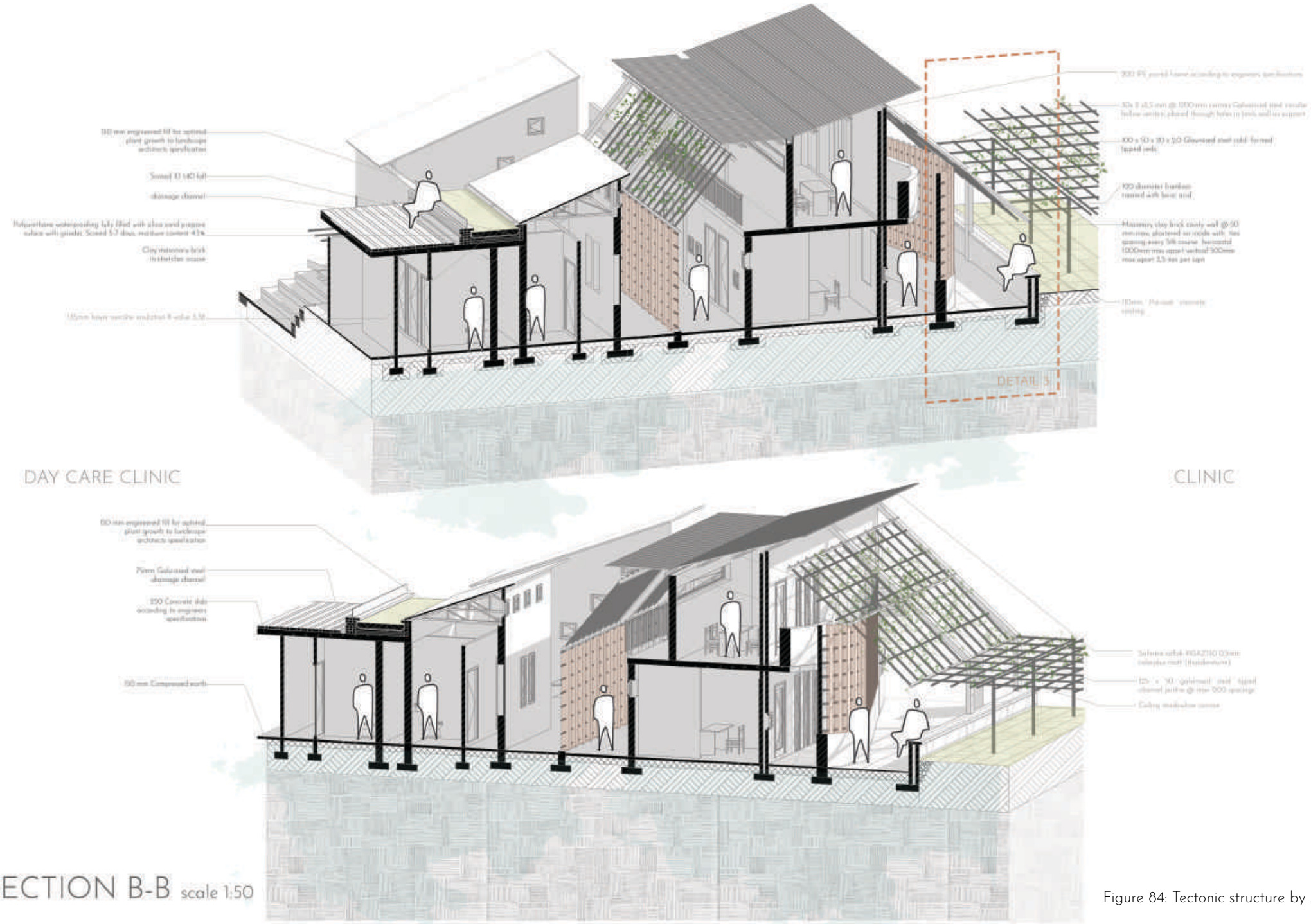


Figure 83: Tectonic structure by Author 2021





SECTION B-B scale 1:50

Figure 84: Tectonic structure by Author 2021

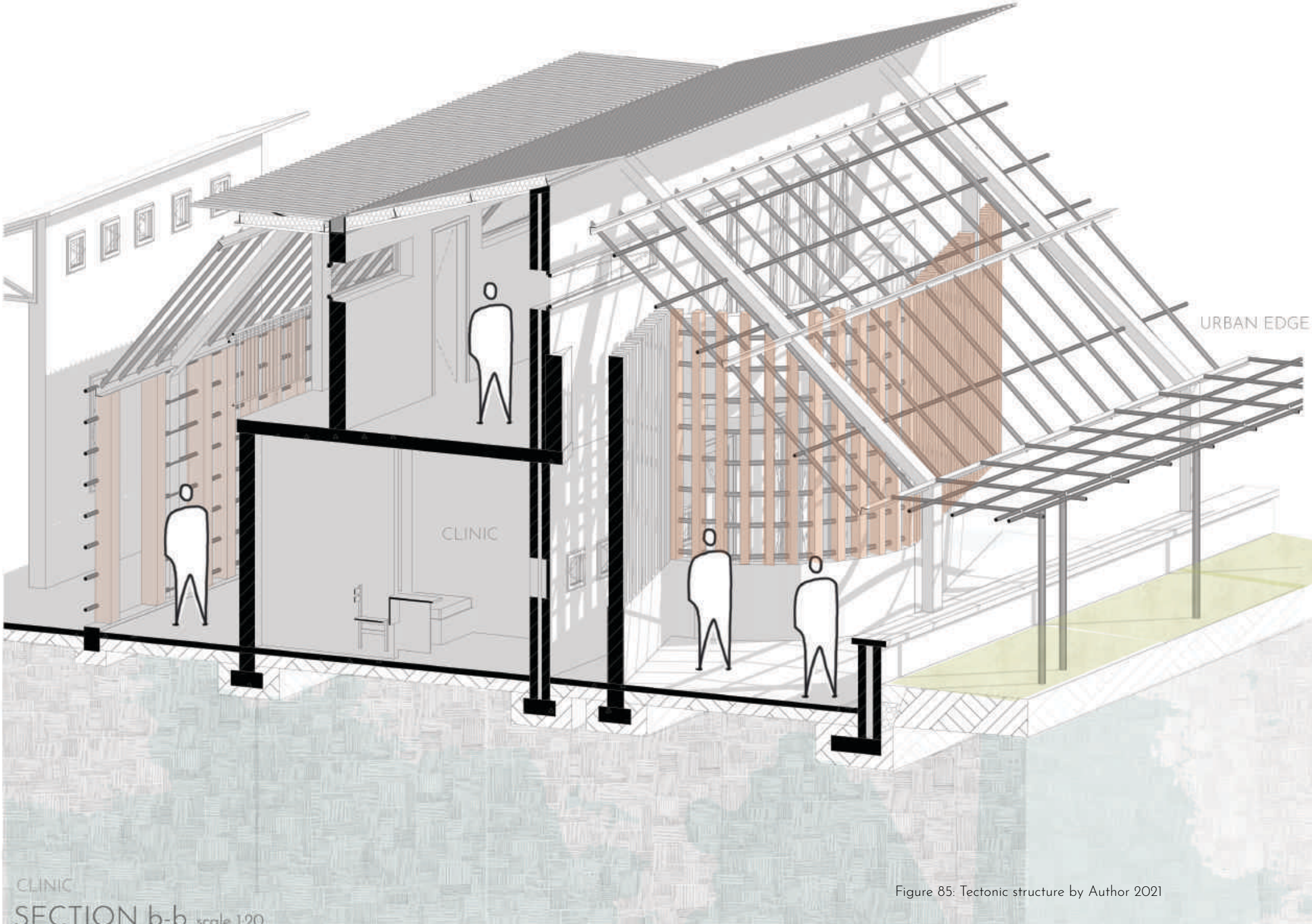
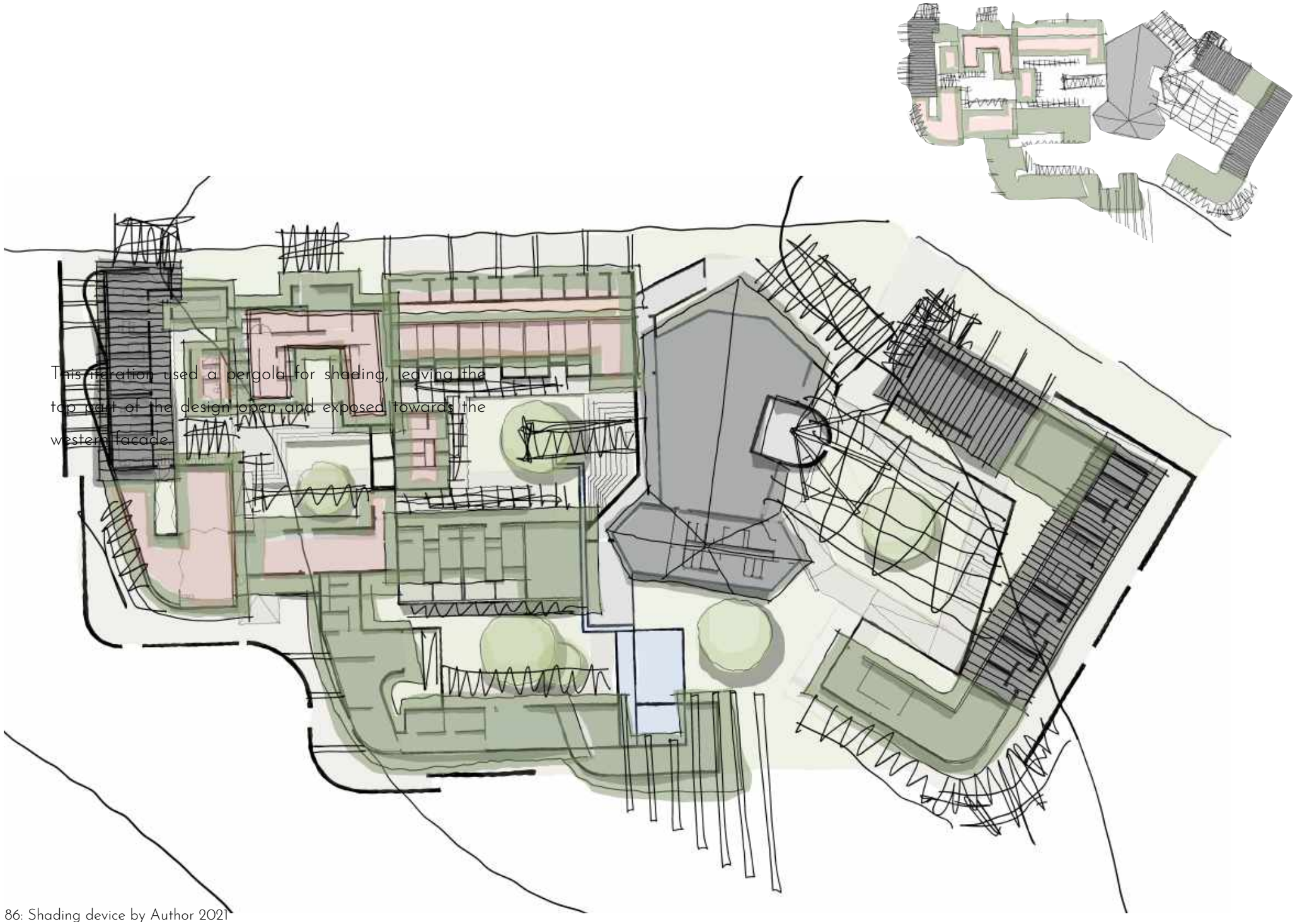
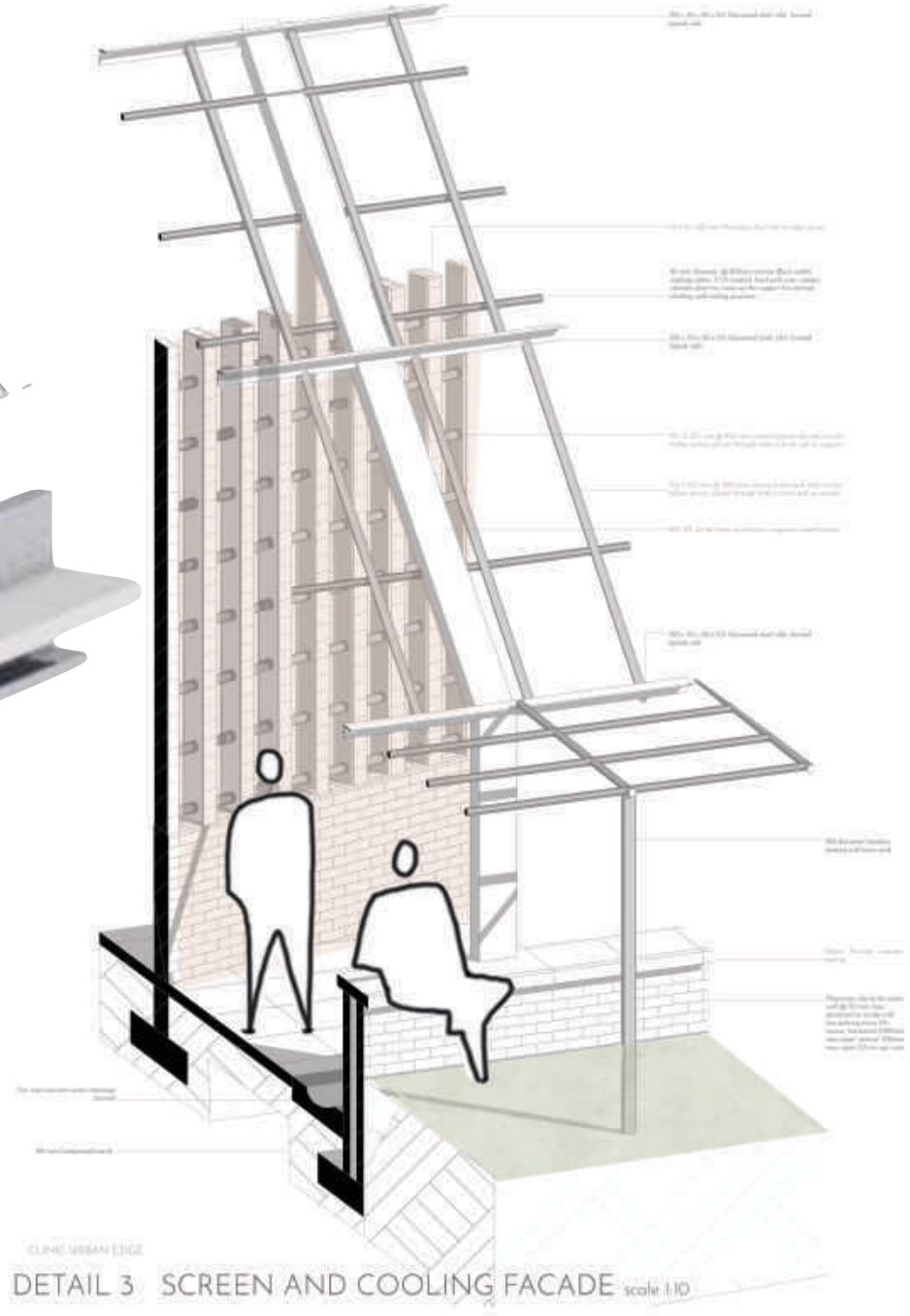


Figure 85: Tectonic structure by Author 2021



This iteration used a pergola for shading, leaving the top part of the design open and exposed towards the western facade.

Figure 86: Shading device by Author 2021



The shading device is used for ventilation purposes, to cool the air before it enters the building. A cavity wall is placed on the eastern and western side of the building to ensure for a better thermal comfort within the building. The steel portal frame supports the shading device on the western edge as well as the eastern edge and becomes a natural mediation between the building and the man made scale route that passes towards the vlei land. The shading device is to be filled up with bamboo reeds that are planted within the community garden. The reeds are to be further covered with plants growing over it, creating a very natural edge condition.

Figure 87: Shading device by Author 2021

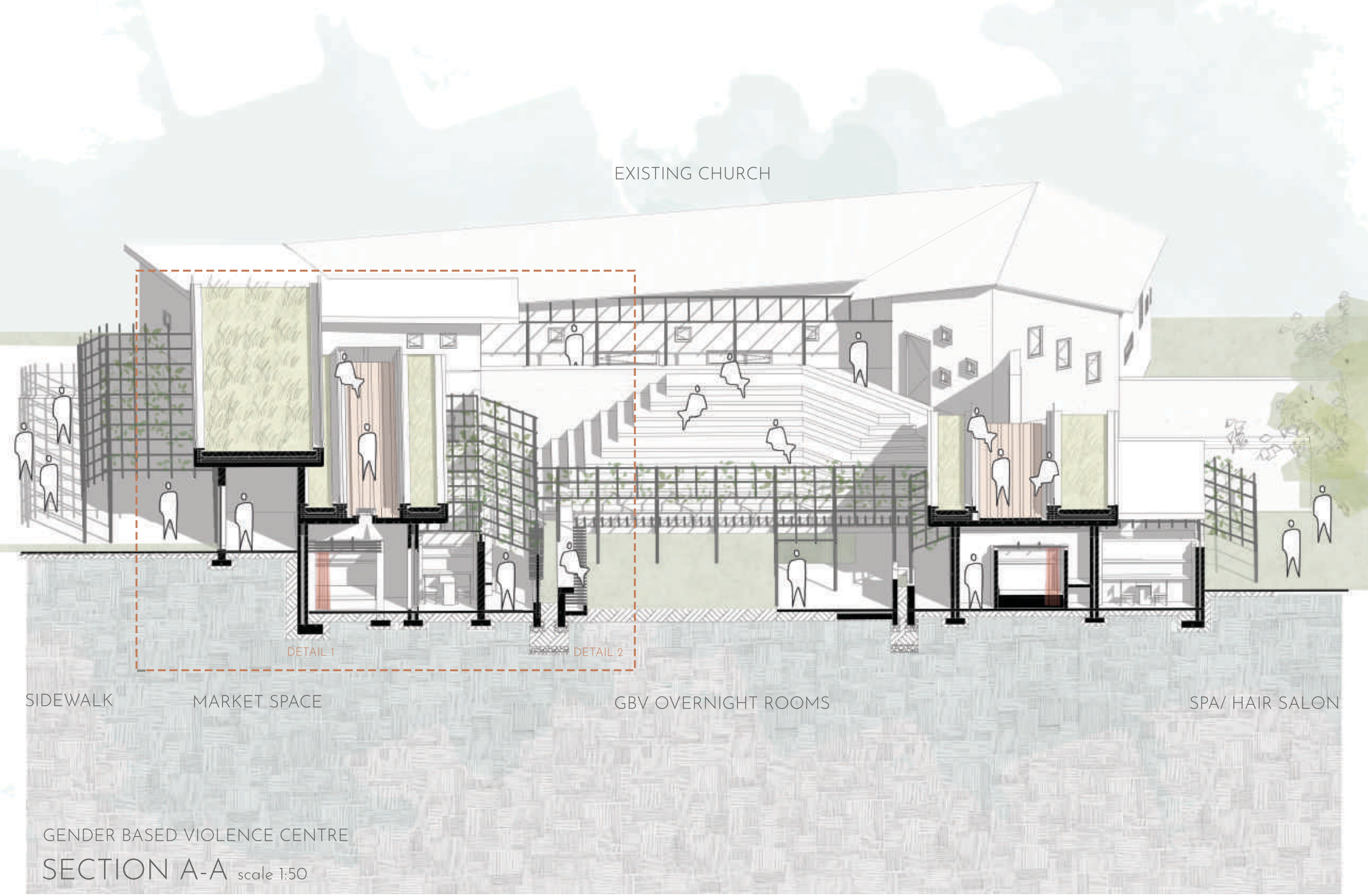
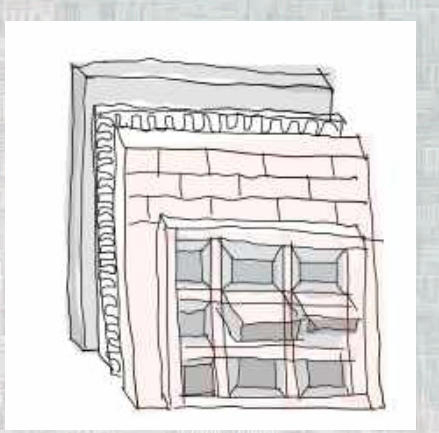


Figure 88: Shading device by Author 2021

This space is for the gender based violence victims. A cave like safe and secure space is created



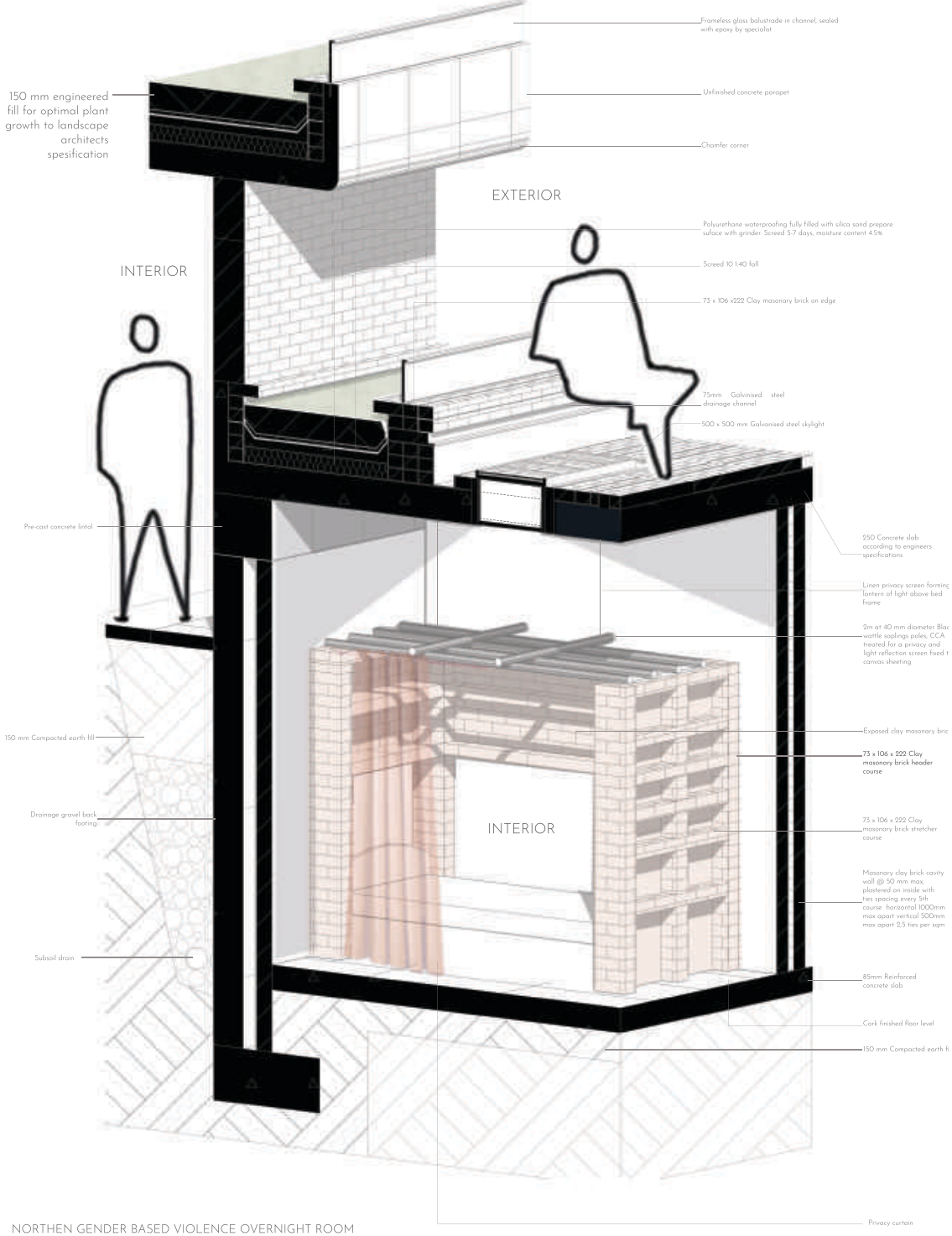
MARKET SPACE

GBV OVERNIGHT ROOMS

DETAIL 1

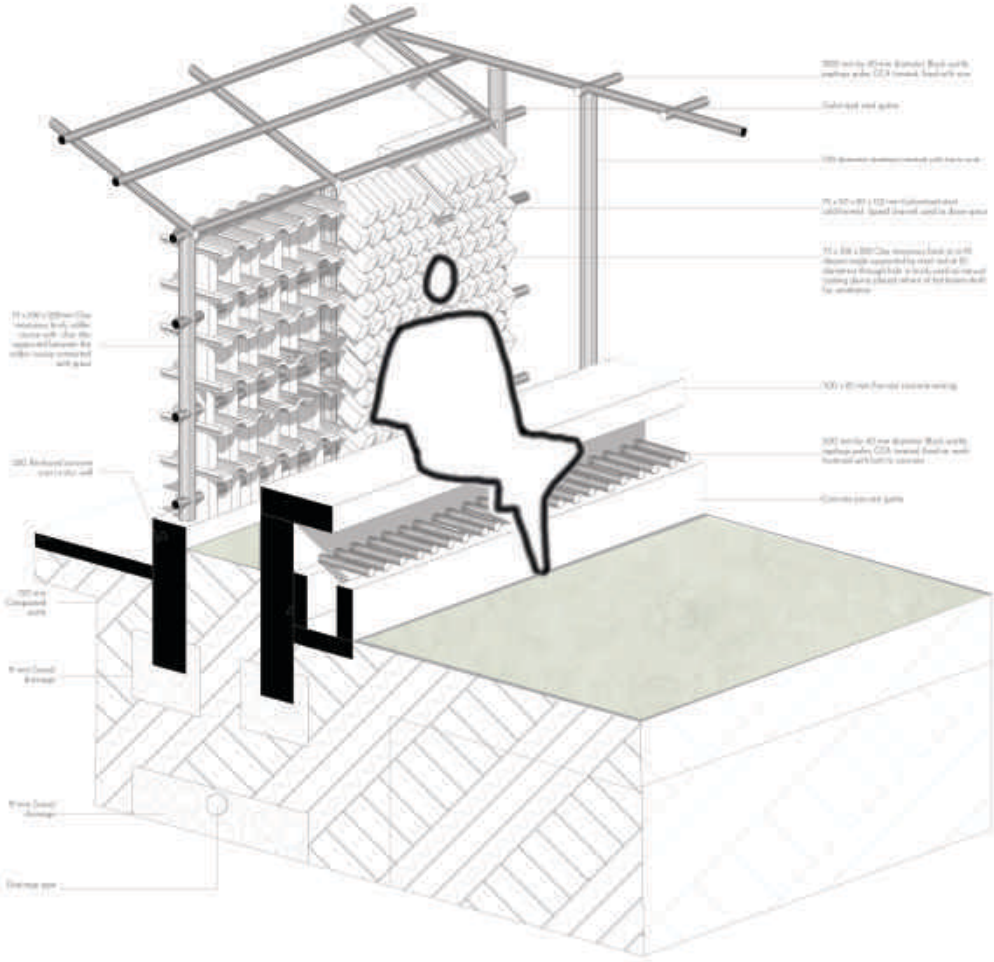
DETAIL 2

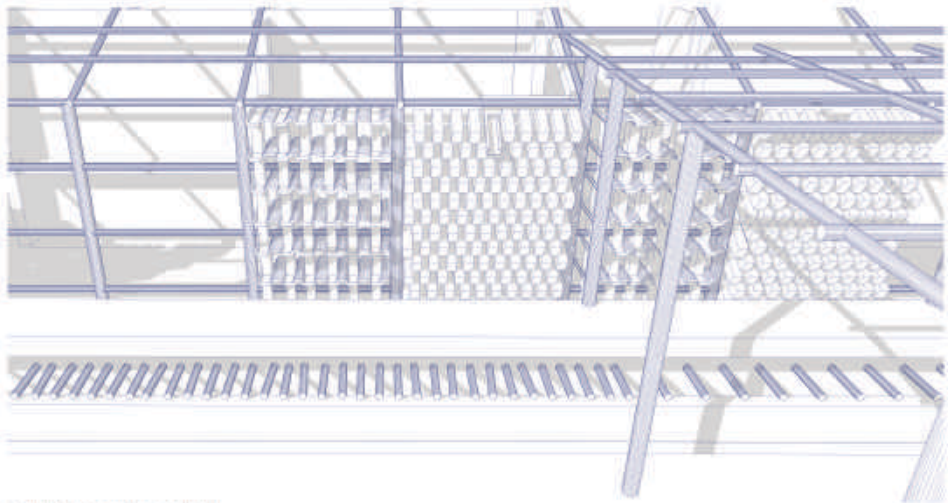
SECTION a-a scale 1:20



NORTHEN GENDER BASED VIOLENCE OVERNIGHT ROOM

DETAIL 1 bed frame scale 1:20





PROSPECT AND REFUGE PRIVACY SCREEN

DETAIL 2 SCREEN AND WATER HARVESTING SYSTEM scale 1:10

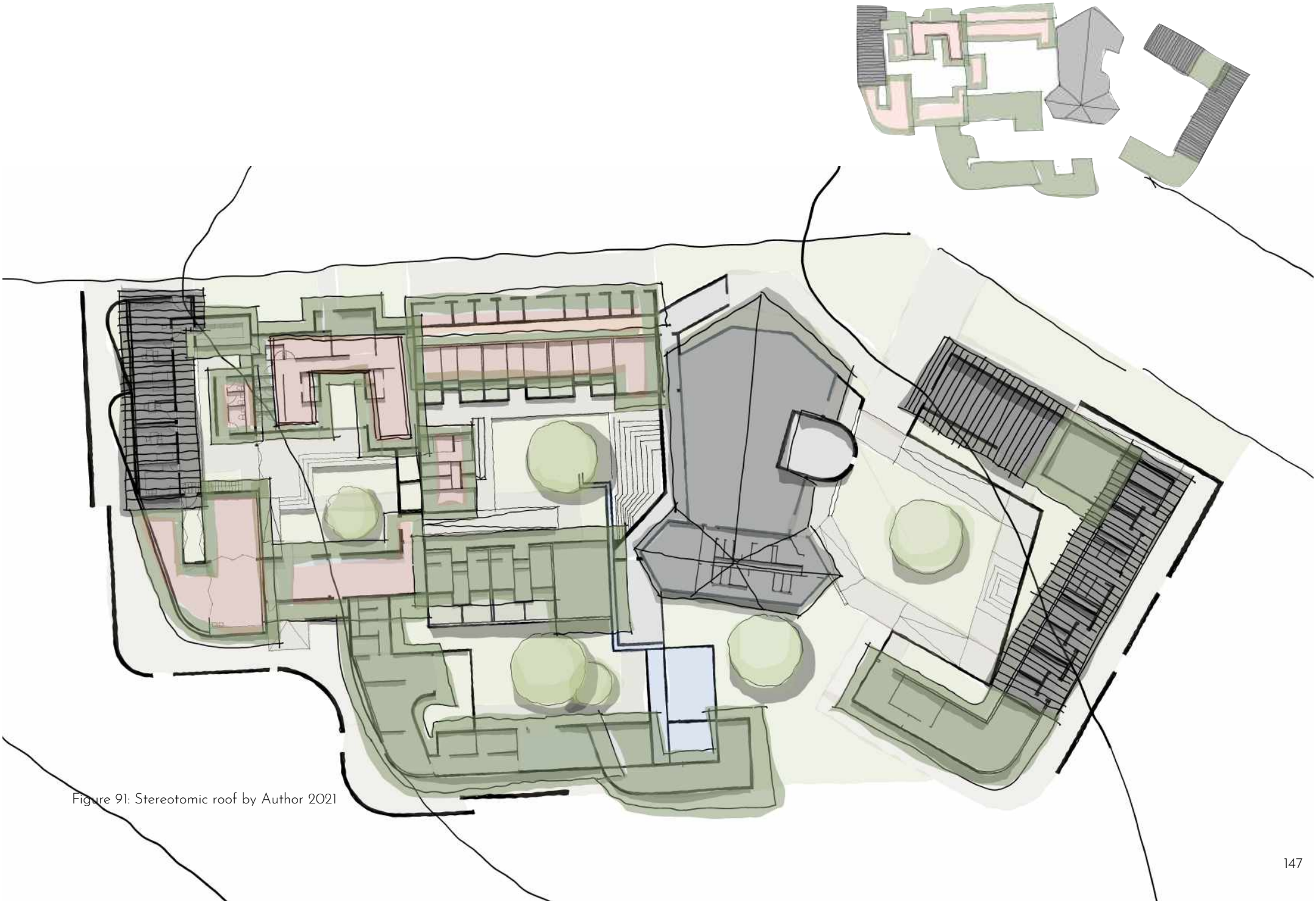
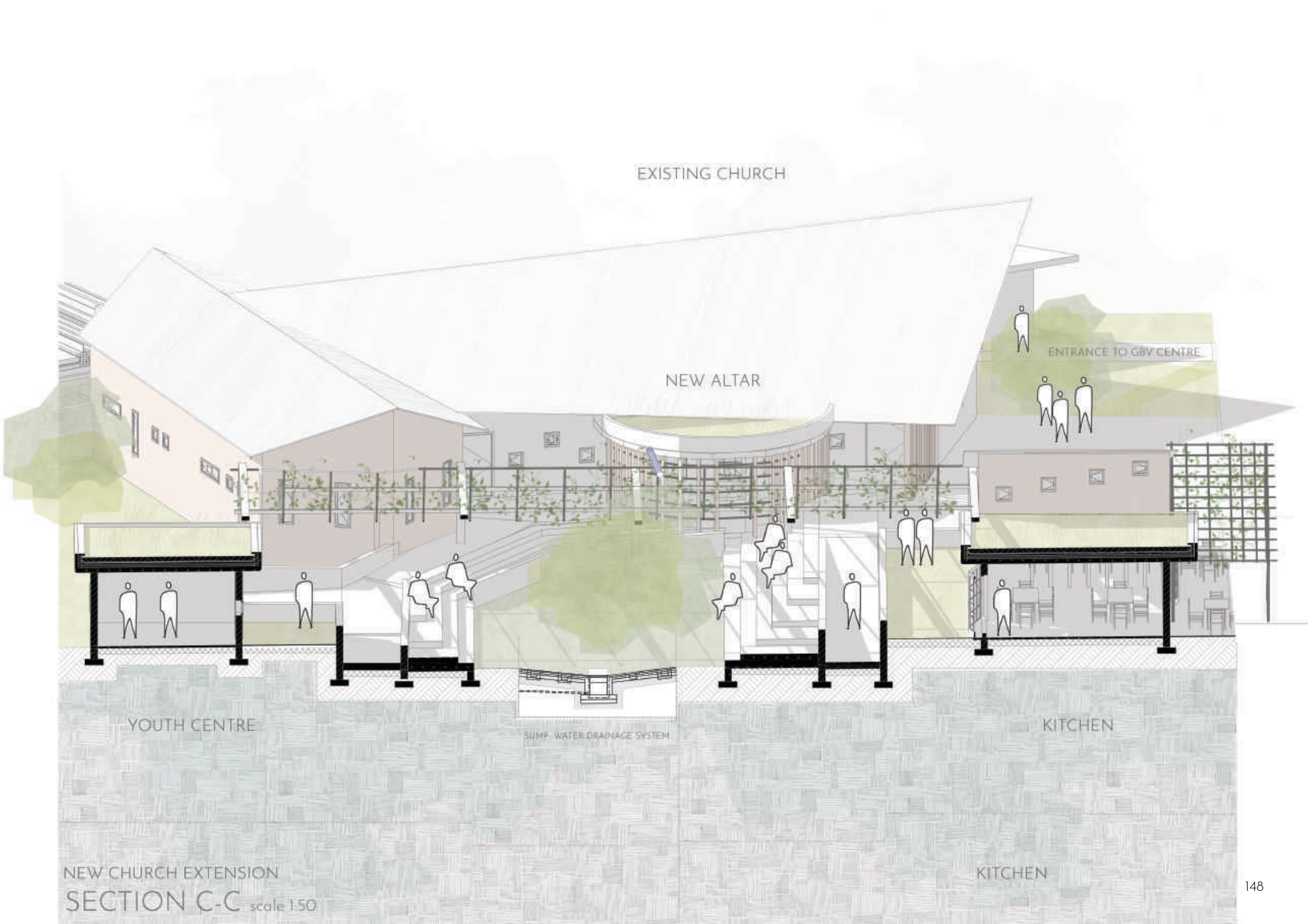


Figure 91: Stereotomic roof by Author 2021



NEW CHURCH EXTENSION

SECTION C-C scale 1:50

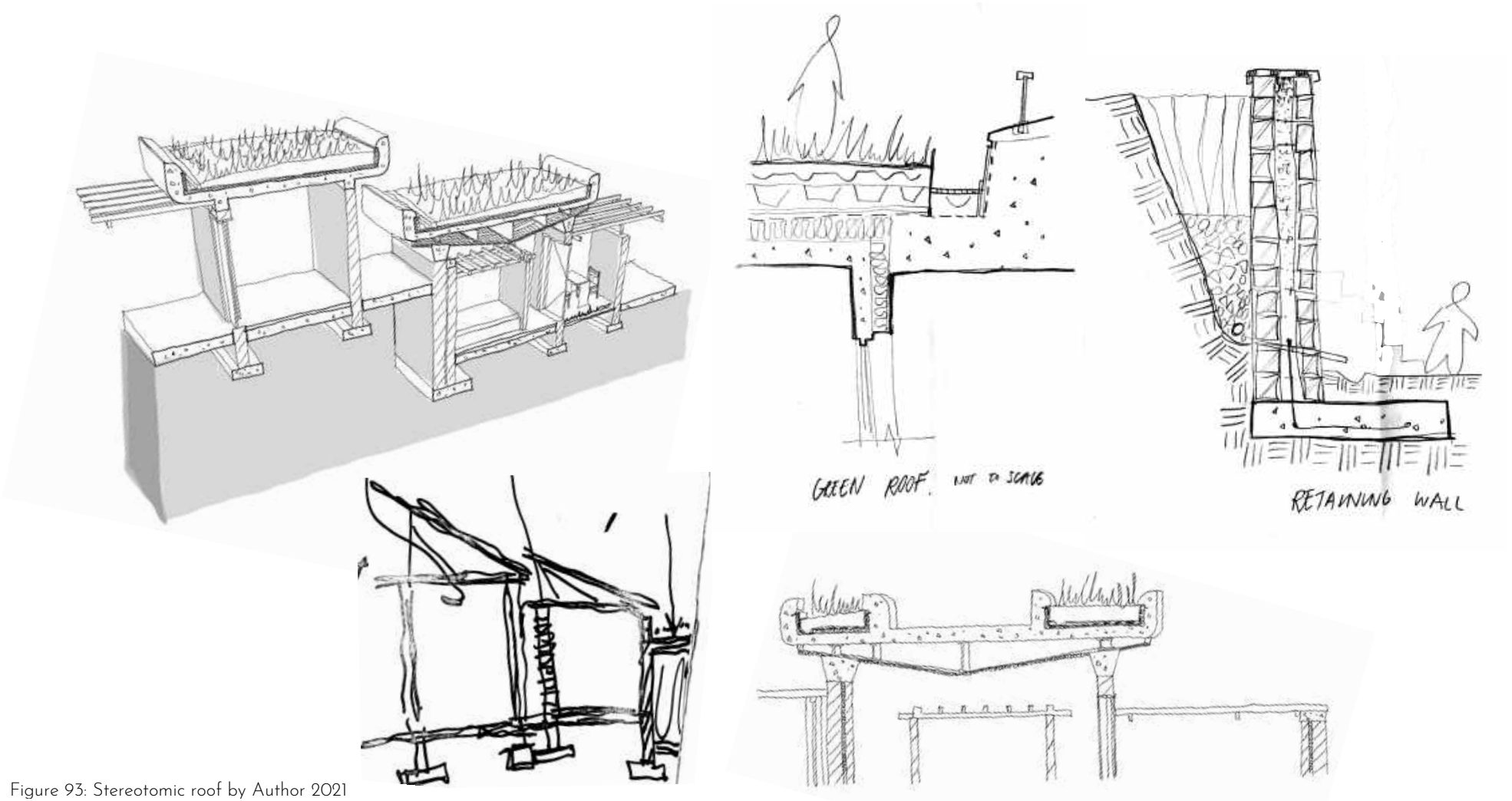


Figure 93: Stereotomic roof by Author 2021

Using the same principles used with the construction of the clinic, the eastern and western side of the homeless shelter becomes shaded by the same steel portal frame with galvanised steel purlin support and bamboo infill. The portal frame supports the brick infill used for the building, also using cavity walls to ensure a high thermal comfort. The shading device becomes part of the church extension, filtering the light and creating a public reinvented spire, towards the existing church the new altar sits towards the courtyard to allow for an outdoor sermon and bigger groups of people to attend. The shading device is more intimate and private towards this edge. the shading device does however end 1m before the altar to create dramatic lighting and a threshold between congregation and pulpit as well as old and new.

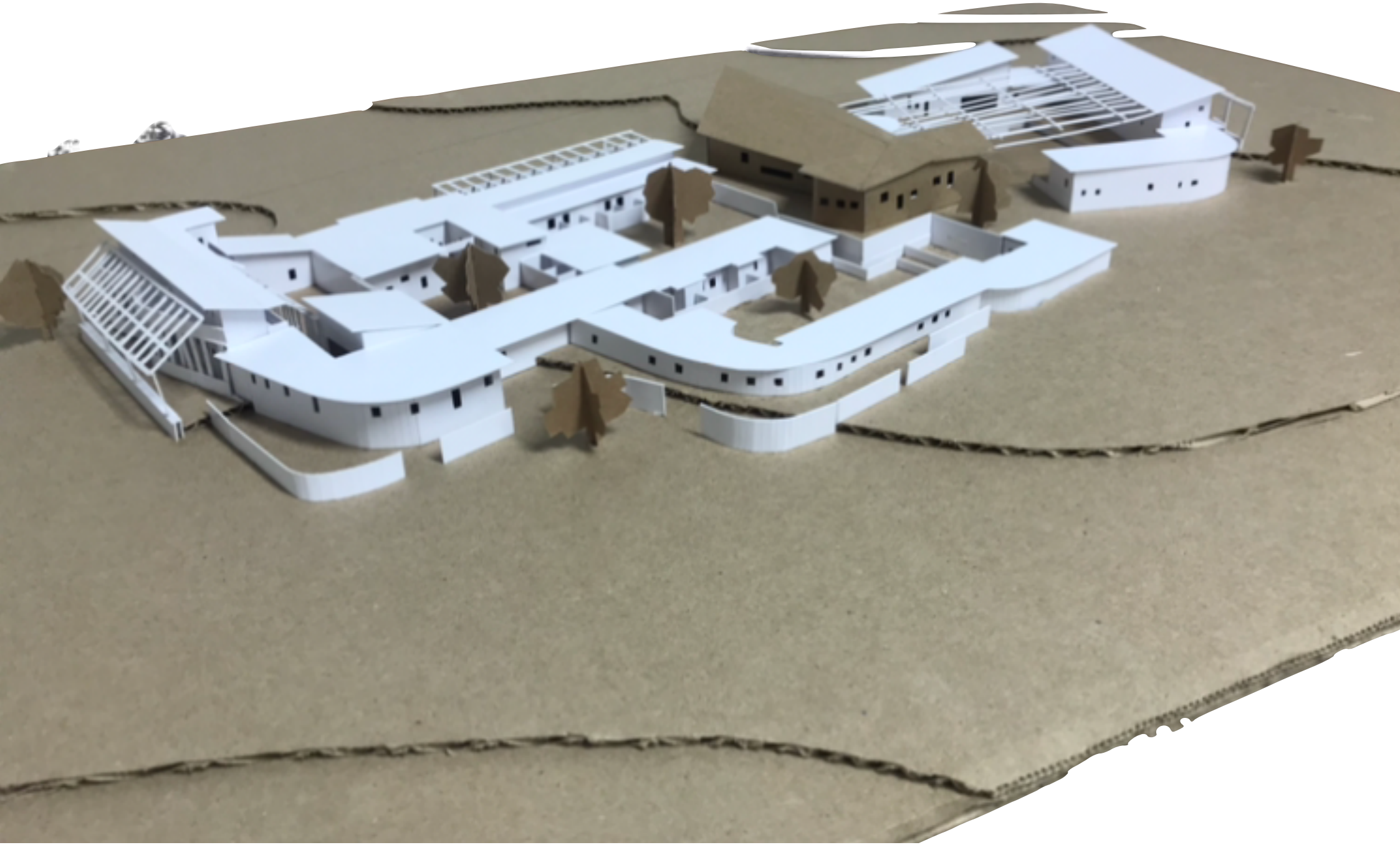


Figure 94: Model by Author 2021

Figure 95: Stereotomic roof by Author 2021

Environmental studies:

Thermal comfort is an important aspect of the design as overnight rooms are designed, where people of abuse will find solace. The design is in zone 2 with a temperate interior (Harris). A passive design approach is taken and enhanced by roof insulation, cavity walls towards the west and east. The west and east facades are horizontally and vertically shaded, to cool the air before it enters the building. The northern side of the design has a timber pergola to regulate the temperature.

Green roofs have a high thermal comfort value, and by allowing the open parts (accessible parts on roofs with planters) to be painted white, the Albedo effect can partake to cool down the roof between 2- 4 degrees Celsius.

Insulation/ thermal comfort is a good way to improve the energy efficiency of a building. When done well thermal comfort can be achieved in winter (warm) as well as summer (cool) by giving resistance to heat flow.

Insulation loses its insulating effect when in contact with moisture or air, therefore moisture barriers and sealing must be developed within the design.

The total R value for roofs within a climate 2 zone must be a minimum of 3.2. The minimum R value of the roof material and ceiling (excluding the insulation) is 0,35-0,40 and the R value of the insulation must be no less than 2,30-3,35.

SUSTAINABLE BUILDING ASSESSMENT TOOL RESIDENTIAL
1.04

	Achieved
SB SBAT REPORT	**4.1**

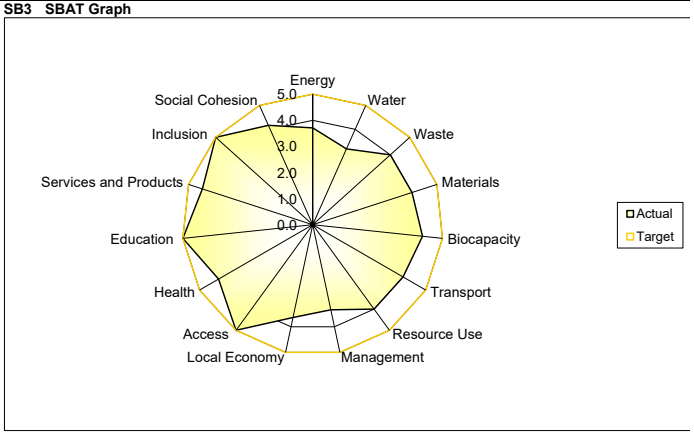
SB1 Project

0

SB2 Address

0

SB3 SBAT Graph



SB4 Environmental, Social and Economic Performance	Score
Environmental	3.8
Economic	4.0
Social	4.6
SBAT Rating	4.1

SB5 EF and HDI Factors	Score
EF Factor	4.1
HDI Factor	4.5

SB6 Targets	Percentage
Environmental	76
Economic	80
Social	91

SB7 Self Assessment: Information supplied and and confirmed by

Name Nikola Marianne Redelinghuys	Date	15/11/2021
Signature		

Figure 96: SBAT by Author 2021

Water harvesting:

Rainwater will be gathered through the roof and taken down with the help of a gutter. The gutter will release the rainwater on the courtyards where it will be taken through a sump pipe and gathered in a tank towards the lowers side (south) of the site, where water can either be filtered, used for grey water or taken towards the vleiland with the help of gravitation. The size of the tank is to be determined by the amount of water that will be harvested through the design, mainly through the roofs as well as the courtyard spaces. The anual rainfall is used to project the average expected rainfall.

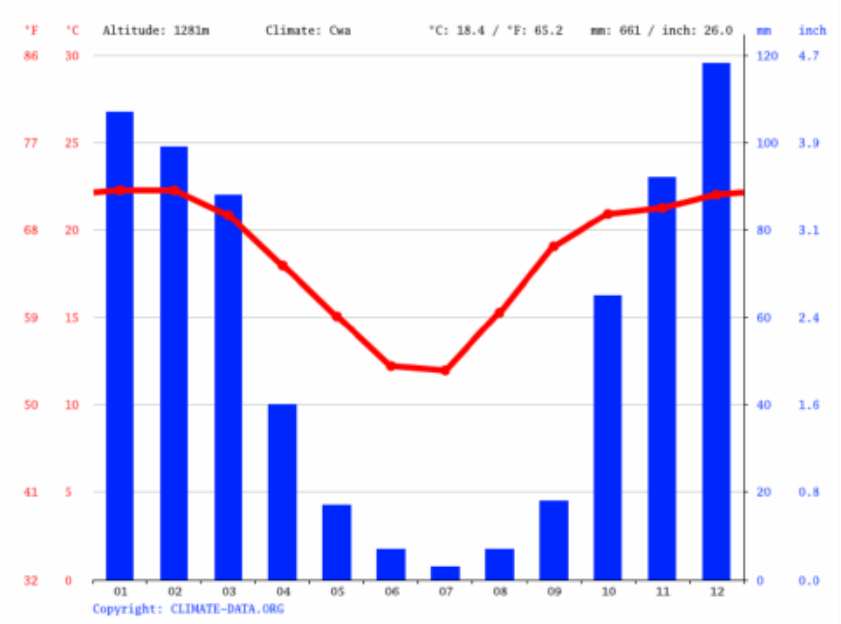


Figure 97: Rainfall by Meteoblue 2021

Total roof area: 1350m2 (A)
Run off roof coefficient= 0,9

40L x hand wash basins=800L
9L flush x 3/per day/person= 45 000L
800+ 45 000=45 800L
=45,8m3
=46m3
The courtyard surface area is 820m2.
courtyard 1 = 95m2
courtyards 2 = 181m2
courtyard 3 = 252m2
courtyard 4 = 112m2
courtyard 5 =180m2
total= 820m2

12 ml water is needed per square meter to water the garden.
820m2 x 0,012 =9,84m3
9,84x4 times per week=39m3

The roof rainwater gathering will harvest enough water for the water basins as well as the toilets within the design. In the months of May to

September, too little water will be harvested and the excess water in storage, gathered within the other months must be used.

Rainwater harvest on roof				
Month	Monthly average rainfall in Pretoria (mm) (P)	Yield = P x A x C	Demand per month (m3)	Excess/ shortage in water
January	0,154	187	46	141
February	0,075	91	46	45
March	0,085	103	46	57
April	0,051	62	46	16
May	0,013	16	46	-26
June	0,007	9	46	-37
July	0,003	4	46	-42
August	0,006	7	46	-39
September	0,022	27	46	-19
October	0,071	85	46	39
November	0,098	119	46	73
Desember	0,15	182	46	136
Total:	0,735	892	552	

Stormwater harvest on courtyard				
Month	Monthly average rainfall in Pretoria (mm) (P)	Yield = P x A x C (m3)	Demand per month	Excess/ shortage in water
January	0,154	126	39	87
February	0,075	62	39	23
March	0,085	70	39	31
April	0,051	42	39	3
May	0,013	11	39	-28
June	0,007	6	39	-33
July	0,003	3	39	-36
August	0,006	5	39	-34
September	0,022	18	39	-21
October	0,071	57	39	18
November	0,098	80	39	41
Desember	0,15	123	39	84
Total:	0,735	603	468	

Figure 98: Rainwater by Author 2021

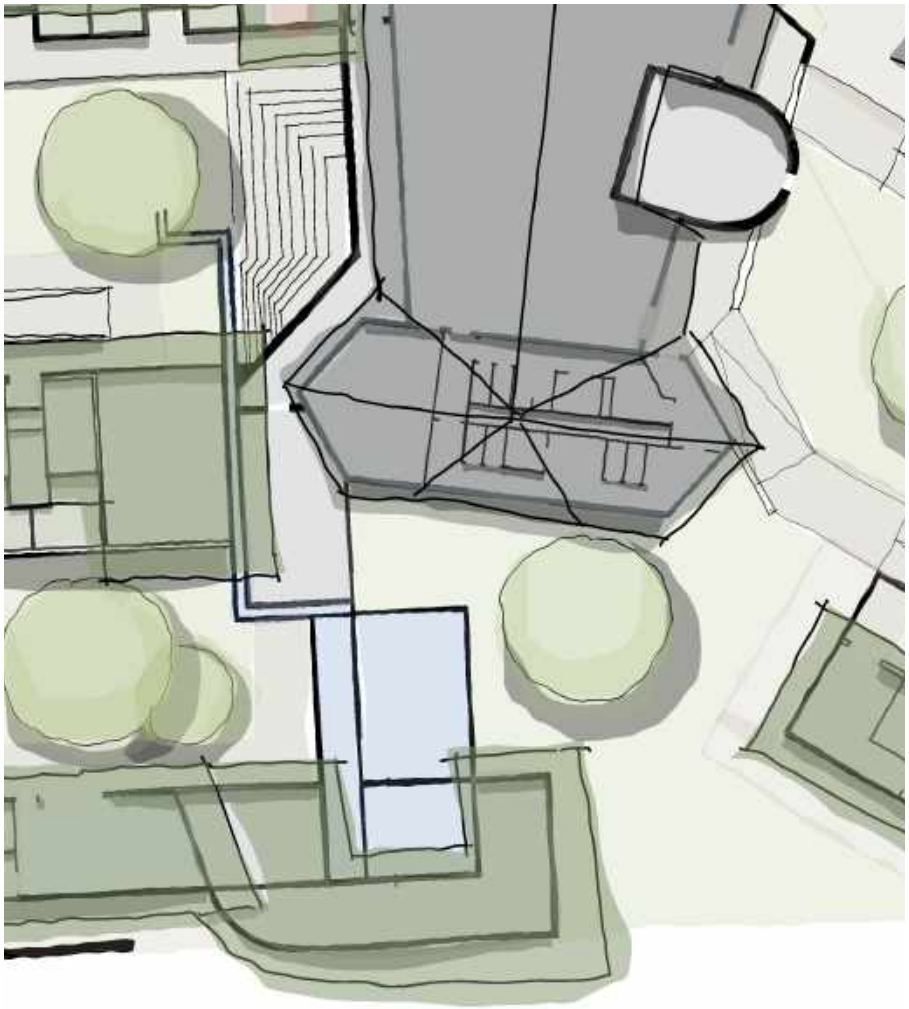
Natural swimming pool:

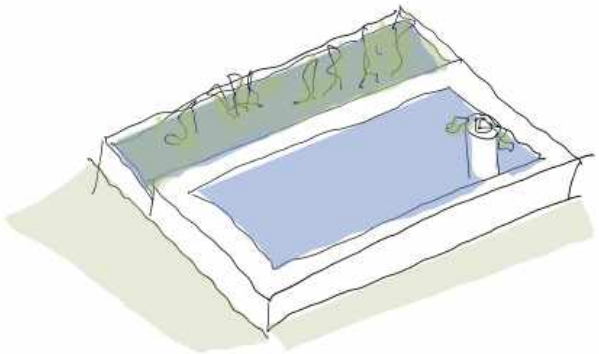
A natural wetland is to be created to filter the harvested rainwater, and spilt over to the freshwater pool (Aquadesign 2014). This is to be used within the spa area as well as for baptisms.

A skimmer is to be installed in the natural swimming pool to keep the water clear on the surface of leaves and other natural elements (Verster 2014:181).

The water is gathered within the courtyard, gravity is used to let the water flow down towards the lowest point of the site.. In the other courtyards the water from gutter systems are collected

Figure 99:Natural pool by Verster 2014:181





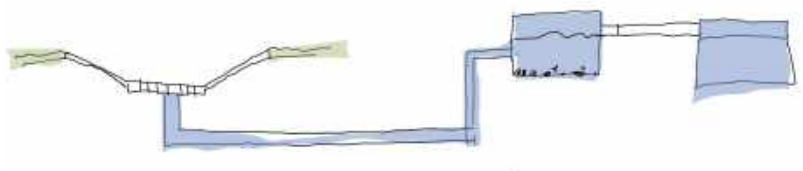
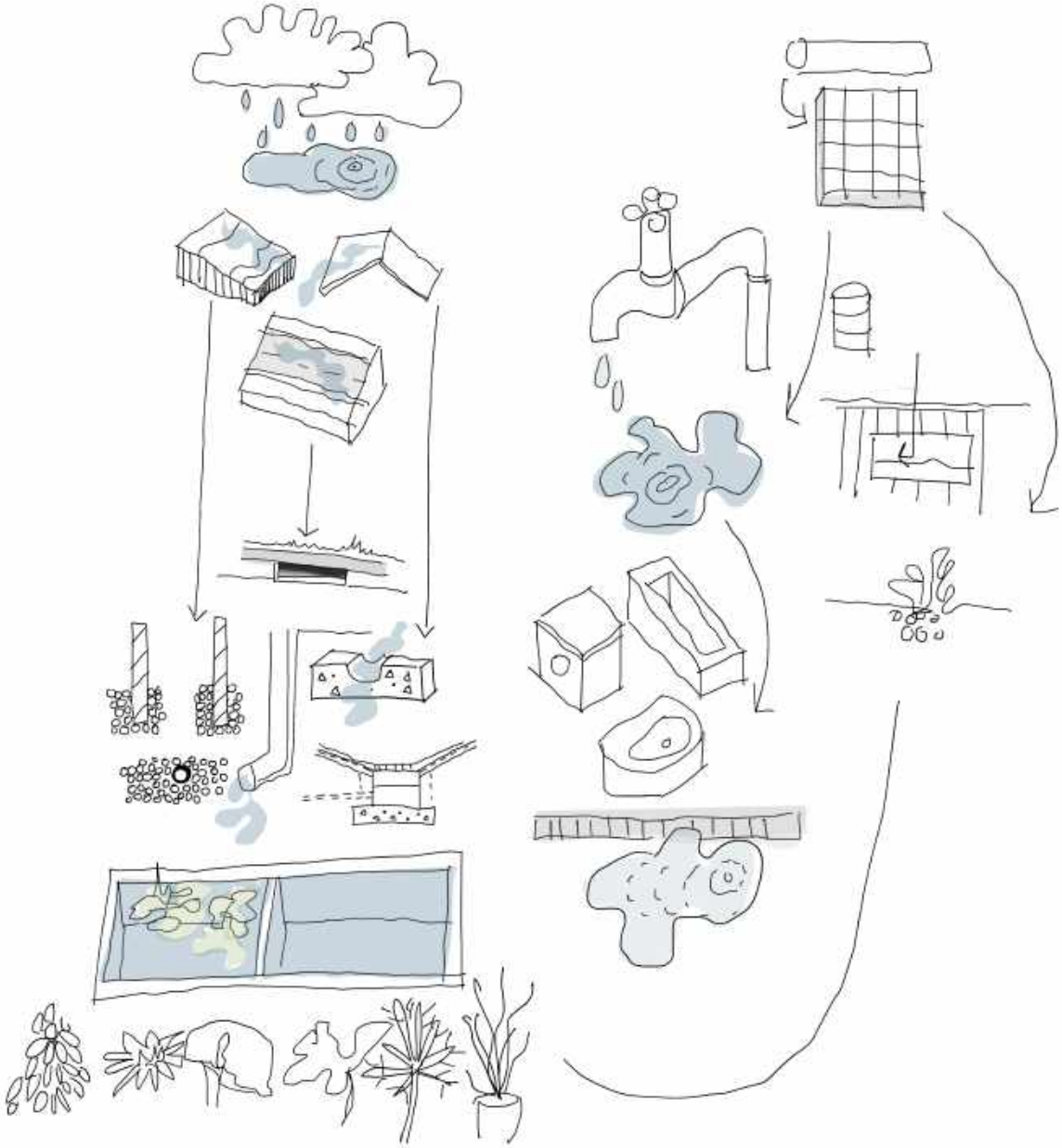
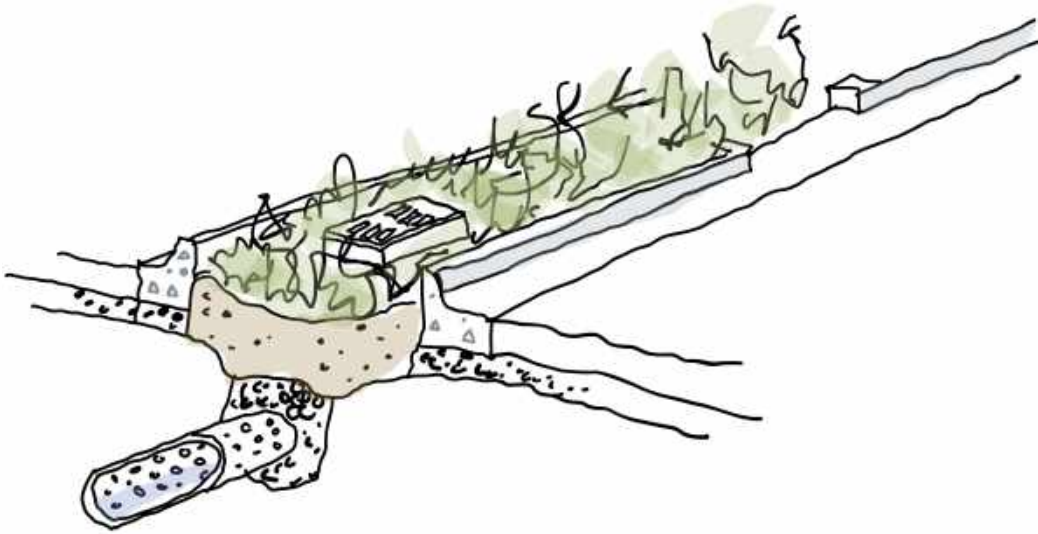


Figure 100: Water harvesting method by Author 2021





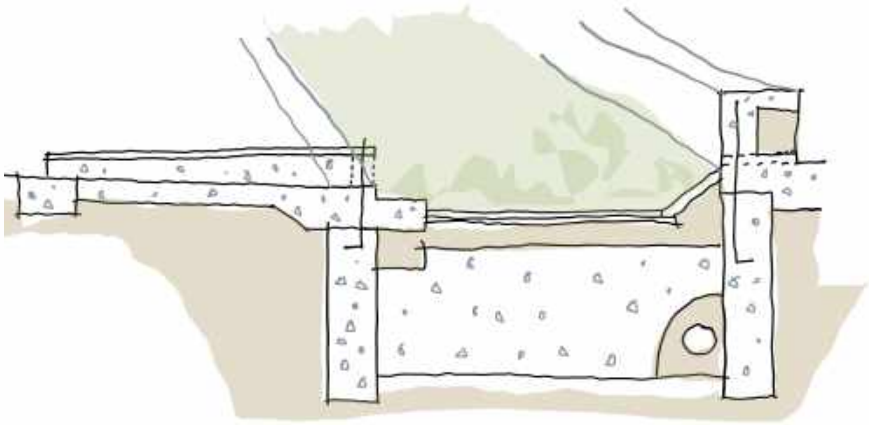
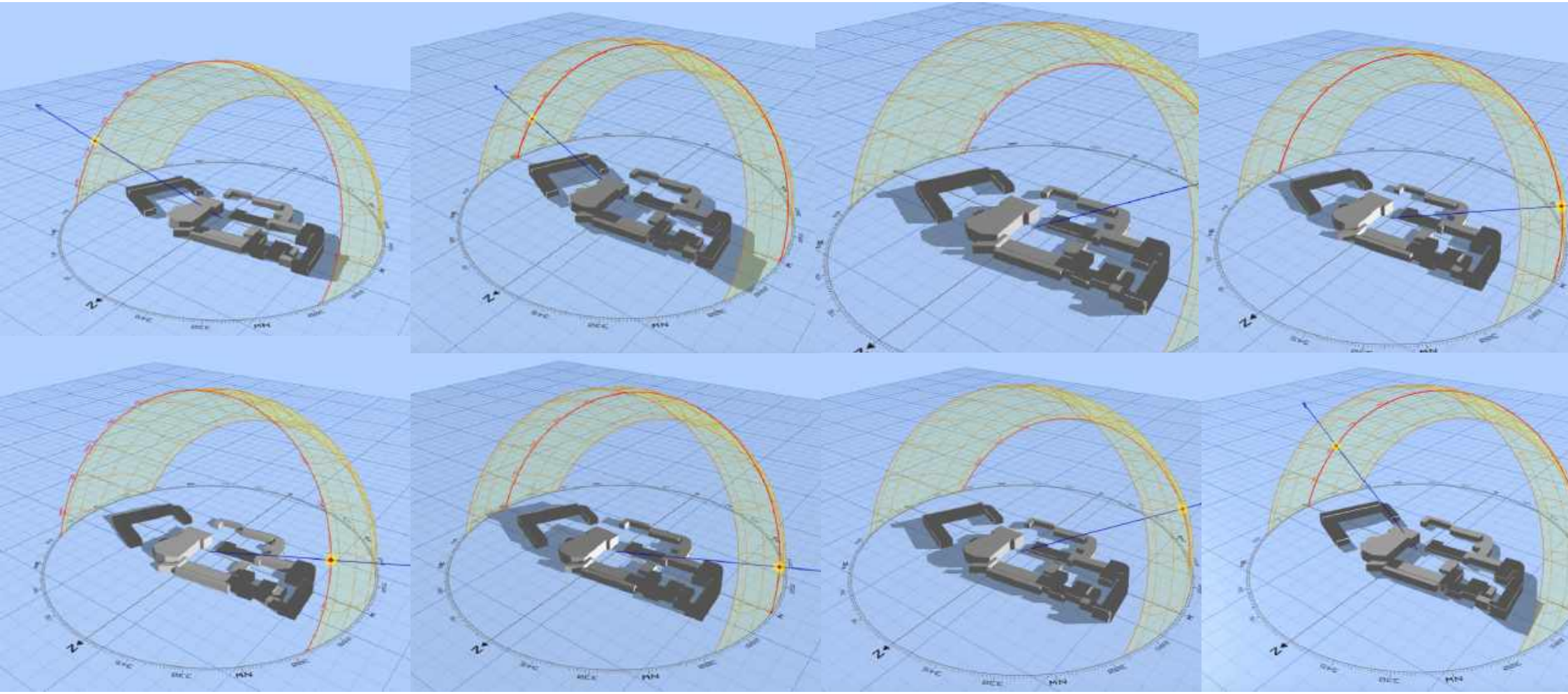


Figure 101: Water harvesting method by Author 2021

Sun study:



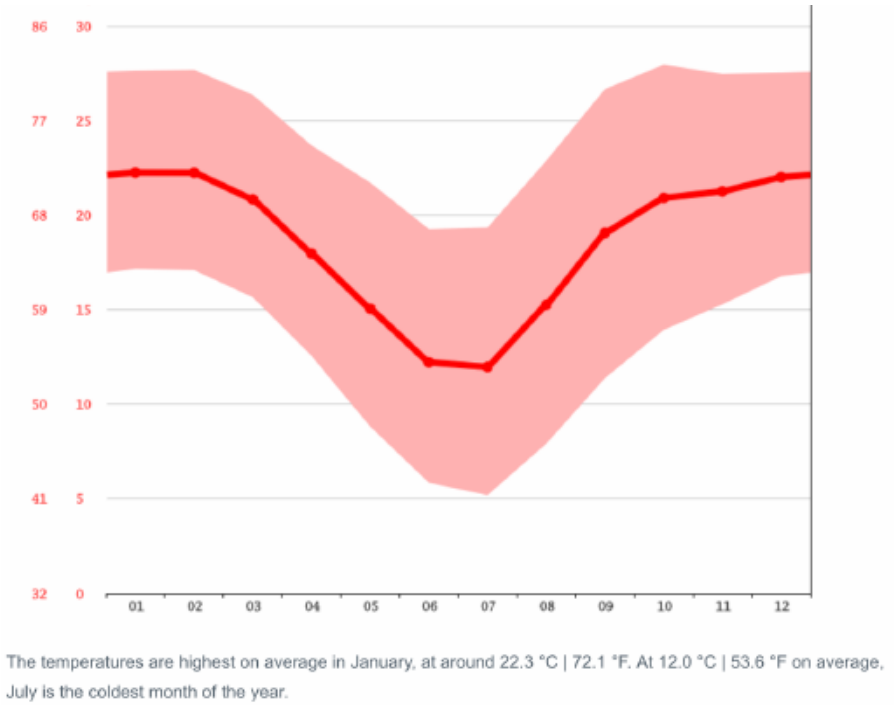
Summer solstice

Autumn equinox

Winter solstice

Spring equinox

Figure 102: Sun angle by andrew marsh.com 2021



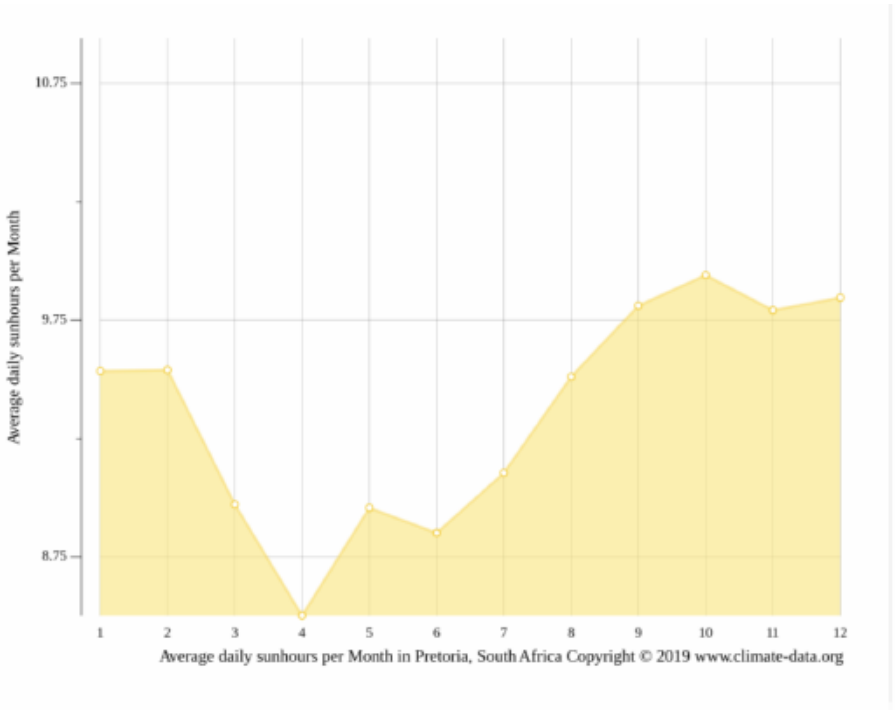


Figure 103: Rain and temperature graphs by meteoblue 2021

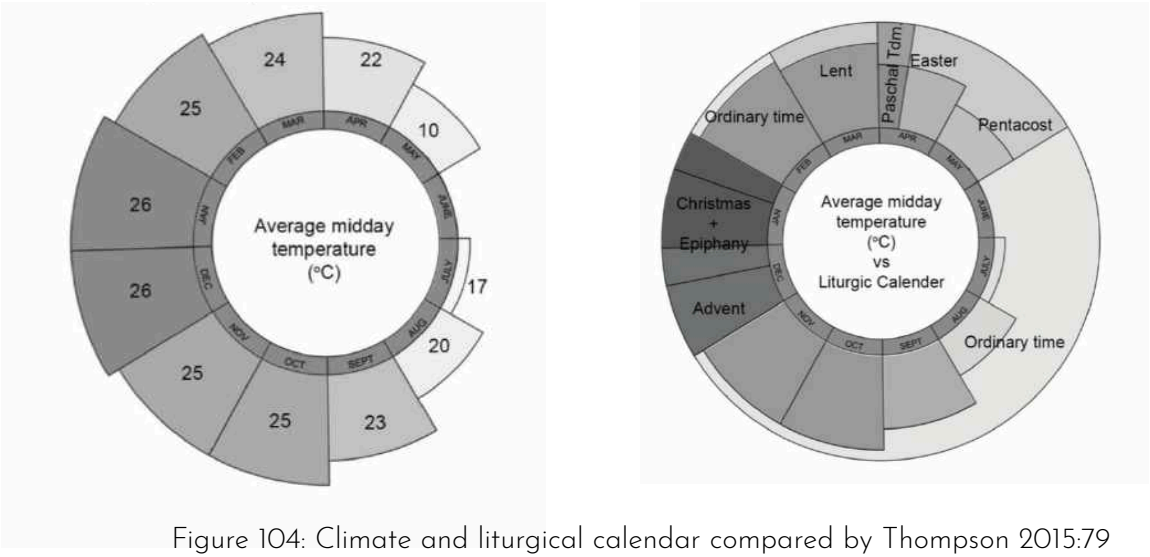


Figure 104: Climate and liturgical calendar compared by Thompson 2015:79

Within a religious building light plays an important aspect therefore the sun study was important while designing the extension of the religious program. The temperature as well as rainfall plays a role as on the important days within the liturgical calendar the church will be at its fullest and the design must accommodate this fact.

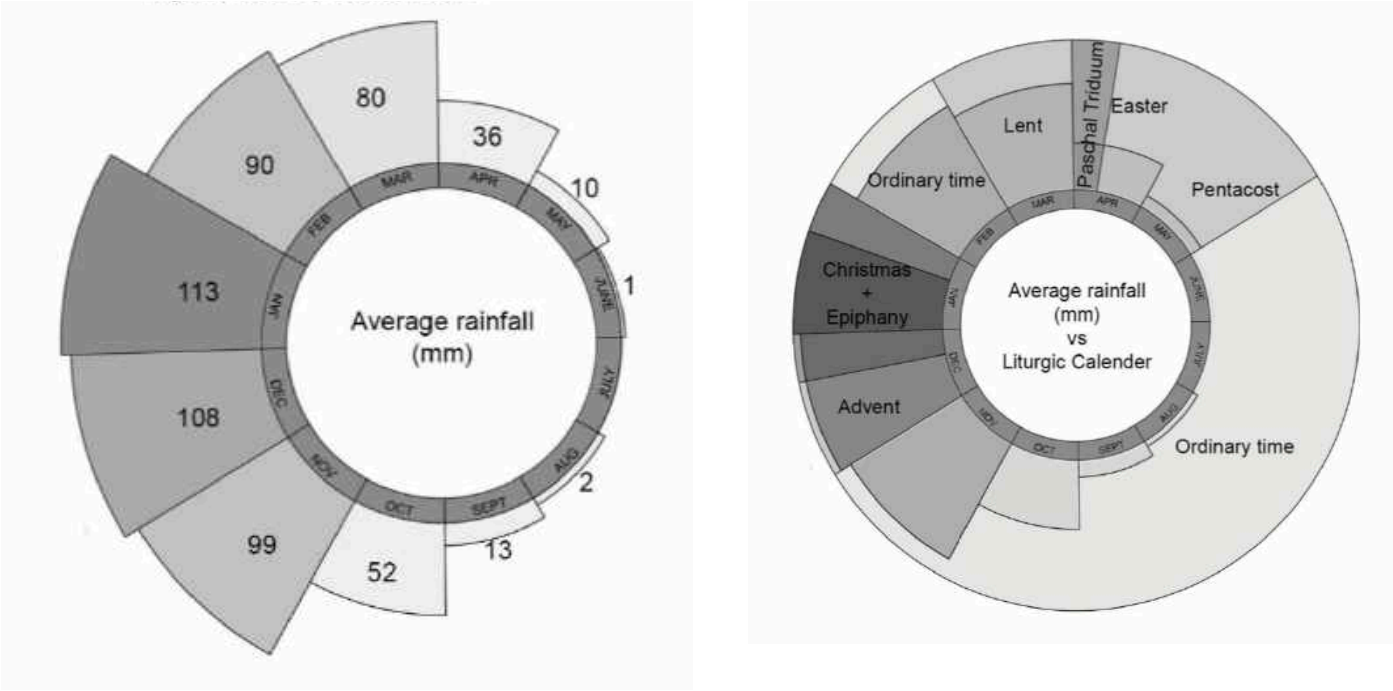


Figure 105: Climate and liturgical calendar compared by Thompson 2015:79

Ventilation stategies::

A passive design strategy is implemented, cooling the air before it enters the building as well as cross ventilation within the scheme. When the plants start to grow on the shading device the amount of cool air produced will be enlarged.

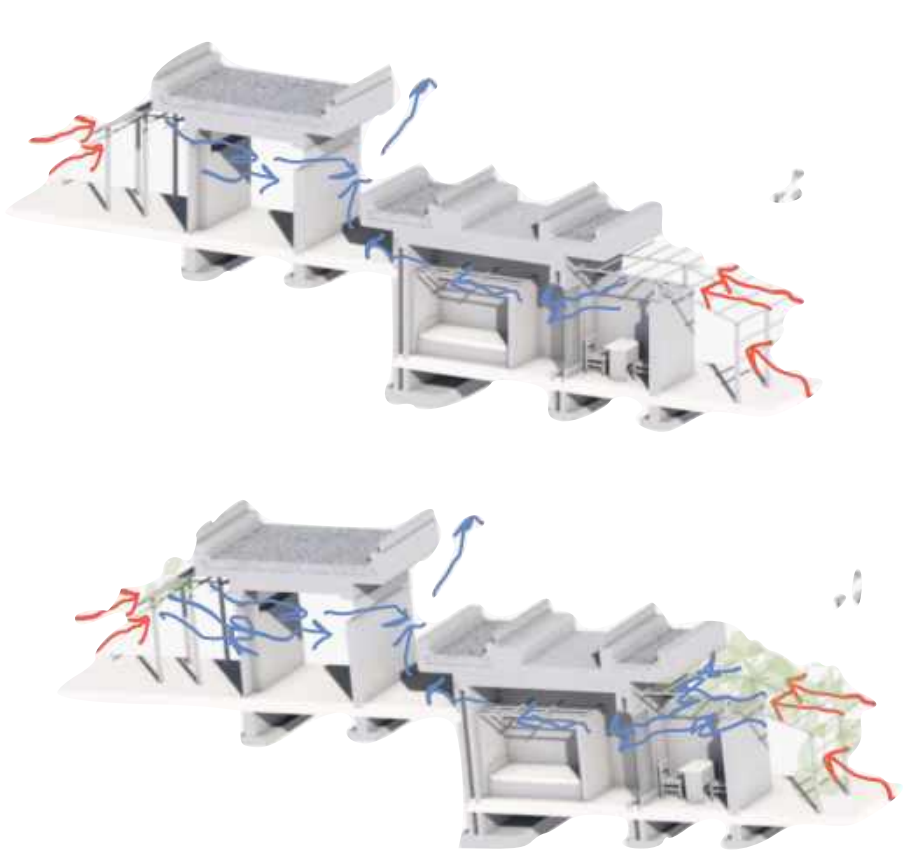


Figure 106: Passive cooling by Author 2021

Technological contribution:

To create a safe gathering space within Eersterust, allowing for an existing typology to be developed, creating a prototype and developing alternative methods of construction using a range of materials and assembly methods found within the community to serve as an educational and thought provoking building. To create a building protecting its inhabitants and the nature, healing the community.

Stark barriers are not the answer to create a safe space, by doing this more unsafe spaces are created. Design should include thresholds in thresholds to layer spaces from public to private, allowing for open spaces that are designed and integrated within the design, blurring the line between indoor and outdoor, producing spaces that are thought through and relevant as they are used as part of the program and not just designated open parks that become forgotten and unsafe. Sustainability is key, by allowing natural ventilation, thermal comfort during various seasons and water harvesting techniques to fuel the community garden and be used as grey water. The design becomes an ecosystem of the manmade and nature in harmony working together to heal the suburb prototype to prototype.

Critical reflection:

Research:

The research was routed in history, site visits and interviews with pastors, if this was expanded to interview the users rather than the users in a leadership position it would have been more helpful in hearing the direct need rather than from a secondary source. Due to covid-19 and gbv victims being part of a very sensitive group this was not possible.

To have shifted the design towards creating a new church within the community of Eersterust, the author would have been able to create a space with the direct vision of including woman more within the church building itself.

Contribution:

The issue of gbv within the community was to be further explored first hand with a local NPO, Shalom Safe Spaces ministries (part of Immaneul congressional church in Eerstersust). This crucial problem was to be attended to and create a safe space with a hotline and group consultation sessions. They have not yet achieved what they set out to do, due to covid-19 and a lack of follow through. The willingness of the group, portion of funds collected and the idea of refuge and readaptive design techniques must be further advocated within the suburb to gain a bigger following to bring the project or a similar project into fruition. This is a way forward for the design.

Design:

A smaller scale project could have been suggested, using more alternative building materials, by planting and incorporating the plants within the design as well as a bigger community garden. If the cost of the building is brought down it, the design can be built and help the community in need.

New normative position:

The idea of parasitic architecture in terms of healing and using what is already there is important when designing within a post apartheid era.

Extension towards career.

The vast process of design development which was undergone, learnt the author to pick up on existing grids, building styles, the local building materials and the needs within the community to create a more relevant design which can help solve problems through architecture.

The first idea is never to be used, but not to be disregarded as intuitive design plays a big part in the design process, this must however be scrutinised and every decision made must have a reason for being.

Architecture must be used to enhance the life of man and nature, as the middleman between them, allowing them to interact and allowing the dependance they both have on each other to help both thrive.

List of figures:

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Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie / Lefapha la BoetŠenere, Tikologo ya Kago le Theknolotši ya Tshedimošo

1 September 2021

Reference number: EBIT/74/2021

Ms NM Redelinghuys
Department: Architecture
University of Pretoria
Pretoria
0083

Dear Ms NM Redelinghuys

FACULTY COMMITTEE FOR RESEARCH ETHICS AND INTEGRITY

Your recent application to the EBIT Research Ethics Committee refers.

Approval is granted for the application with reference number that appears above.

1. This means that the research project entitled "Re-adaptation and integration of religious buildings in Eersterust" has been approved as submitted. It is important to note what approval implies. This is expanded on in the points that follow.

2. This approval does not imply that the researcher, student or lecturer is relieved of any accountability in terms of the Code of Ethics for Scholarly Activities of the University of Pretoria, or the Policy and Procedures for Responsible Research of the University of Pretoria. These documents are available on the website of the EBIT Research Ethics Committee.

3. If action is taken beyond the approved application, approval is withdrawn automatically.

4. According to the regulations, any relevant problem arising from the study or research methodology as well as any amendments or changes, must be brought to the attention of the EBIT Research Ethics Office.

5. The Committee must be notified on completion of the project.

The Committee wishes you every success with the research project.

Prof K.-Y. Chan
Chair: Faculty Committee for Research Ethics and Integrity
FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY