Essay 3:
Synthesis: Technification

Fig. 90: Elevation Concept Sketch

Technical Design Intentions and Informants:

The aim is to design a structure that explores how infrastructure can become architecture in the chosen context. Infrastructure is often thought of being a system often determined by engineering structural principles as a conduit to deliver some service or perform some action to cater for an urban need or to solve an urban problem. Architecture has to do more with how people live and inhibit space. The aim is to design an intervention that provides a solution for a problem while being inhabited by people.

Overview of Technical Design Informants

Main technical design intentions will include the following:

a. Urban Farm Greenhouse

b. Water harvesting and recycling

c. Flexible Architecture

d. Market Architecture that accommodates women street traders and small children.

e. Contemporary African Architecture (Francis Kere)

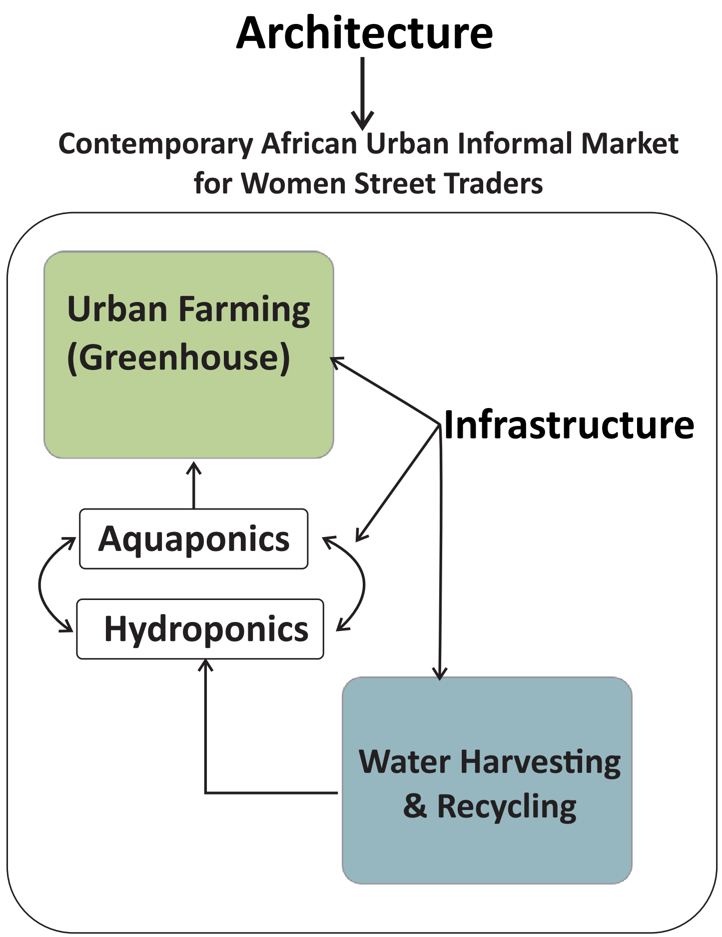


Fig. 91: Diagram showing main technical systems (Nemasetoni 2021)

Technical Design Precedent:

Project: Lycée Schorge

Client: Stern Stewart Institute & Friends

Location: Koudougou, Burkina Faso

Year Completed: 2014-2016

Size: 1,660 sqm (built area)

Architect: Francis Kere

Project Description

This high school is located in the city of Koudougouv in Burkina Faso. The buildings are arranged around a central courtyard protecting this gathering space from excessive dust and wind. This area is very dry with little vegetation around to do so. There is a central amphitheatre created by steps that accommodate a number of activities, not just for the students, but for the surrounding community at large (Kere Architecture, 2019).

Materials

Walls: Modular units are made out of laterite stone which is sourced locally. (Naturally have a deep red colour)

These give the building a good thermal mass that absorbs the very hot daylight from solar radiation and radiates that heat into the spaces in the evening. There is a secondary façade which 'wraps' around the classrooms. The spaces between this façade and classroom walls become and in-between or threshold space where students can sit and while waiting for classes or during break time. This secondary façade is made of locally sourced eucalyptus wood arranged vertically, giving this intermediary space a very organic, ever-changing feel due to how light enters through the eucalyptus wood screen and the various shadows it creates onto the walls and into the space (Kere Architecture, 2019).

Technology and Innovation

Each classroom ceiling is made from 'perforated plaster vaults.' These allow sunlight into the space as well as creating a barrier that block the heat from entering the space (Kere Architecture, 2019).

Wind towers are used to allow the hot air that builds up in the space to escape and these are located at the back of the classrooms. These wind towers also function as landmark structures as they are higher than the building itself as well as surrounding structures in the larger precinct.

Seating and furniture are designed to be an integral part of the thermal comfort strategies and are also made from local materials and off cuts from the steel used in the roof (Kere Architecture, 2019).

Fig. 92: Photograph of the Lycee Schorge Project (Kere Architecture, 2019)

Technical Precedent Study:

Fig 93: Photograph showing perforated plaster vaults (Kere Architecture 2019)

Fig 94: Photograph of intermediary space between the eucalyptus wood screen and classroom walls (Kere Architecture 2019)

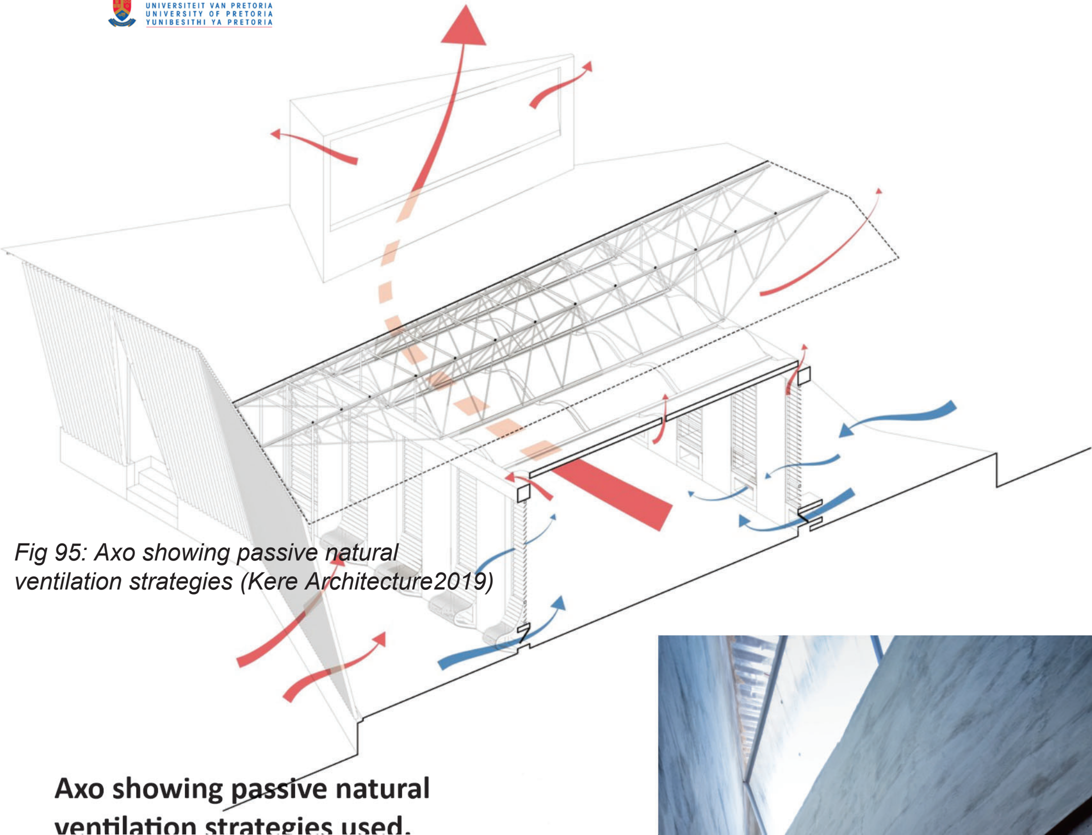


Fig 95: Axo showing passive natural ventilation strategies (Kere Architecture2019)

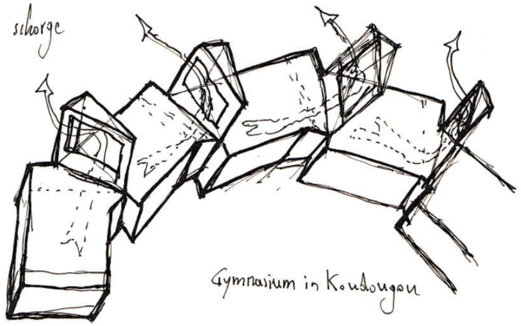


Fig. 96: Sketch showing how wind towers are used in the design as well as air flow by Francis Kere (Kere architecture 2019)

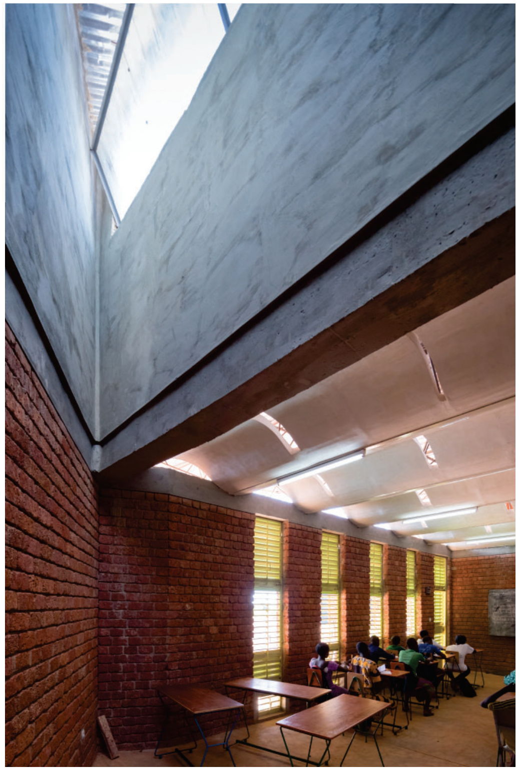


Fig. 97: Photograph of wind towers located at the back of each classroom (Kere Architecture 2019)

Technical Design Concept Development:

Floor Plan

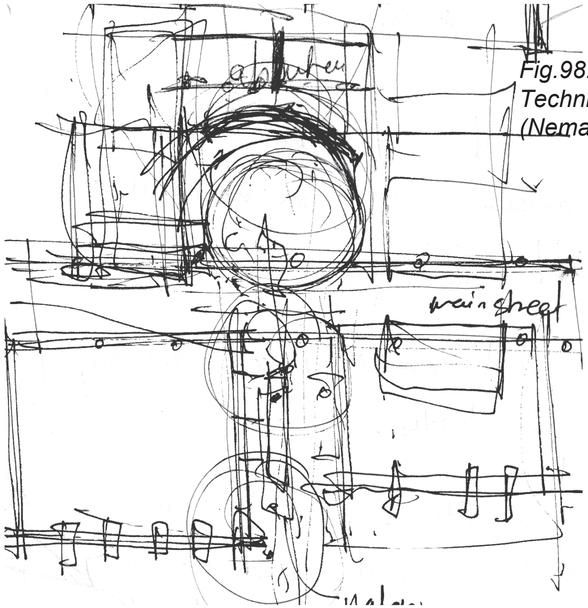


Fig.98: Sketch of Plan Technical Concept (Nemasetoni 2021)

Materiality and Textures

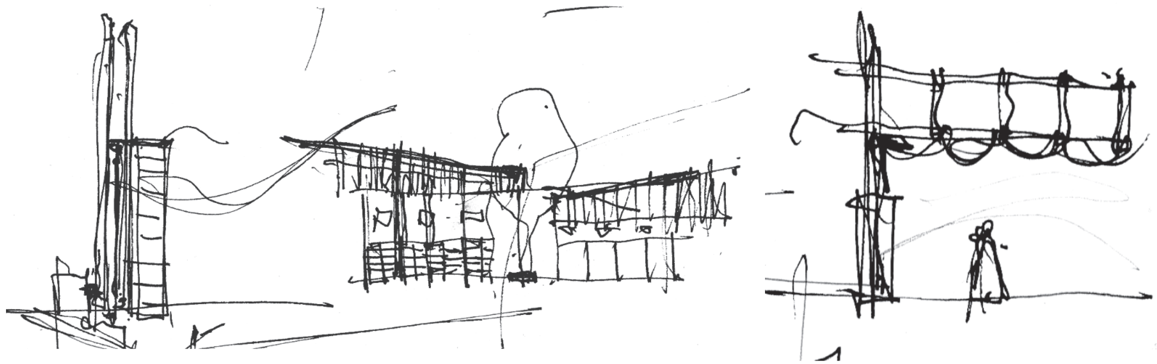


Fig. 100: Sketch of the sectional concept showing boundaries and facade materiality (Nemasetoni 2021)

Services and Systems

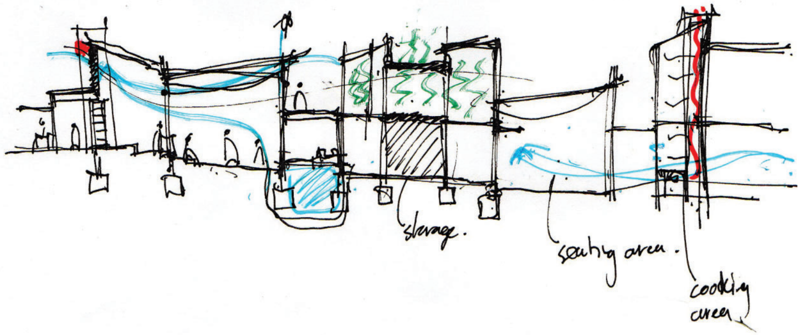


Fig. 99: Sectional sketch showing the water harvesting and urban farming concept (Nemasetoni 2021)

Boundaries, Form, Space and Volume

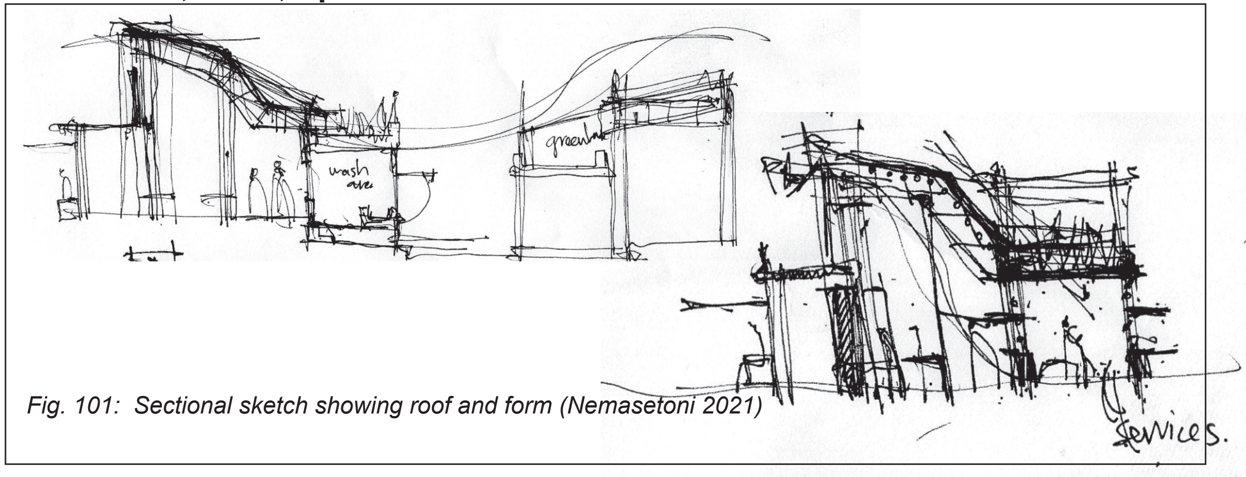


Fig. 101: Sectional sketch showing roof and form (Nemasetoni 2021)

Final Technical Concept and Exploration Model:

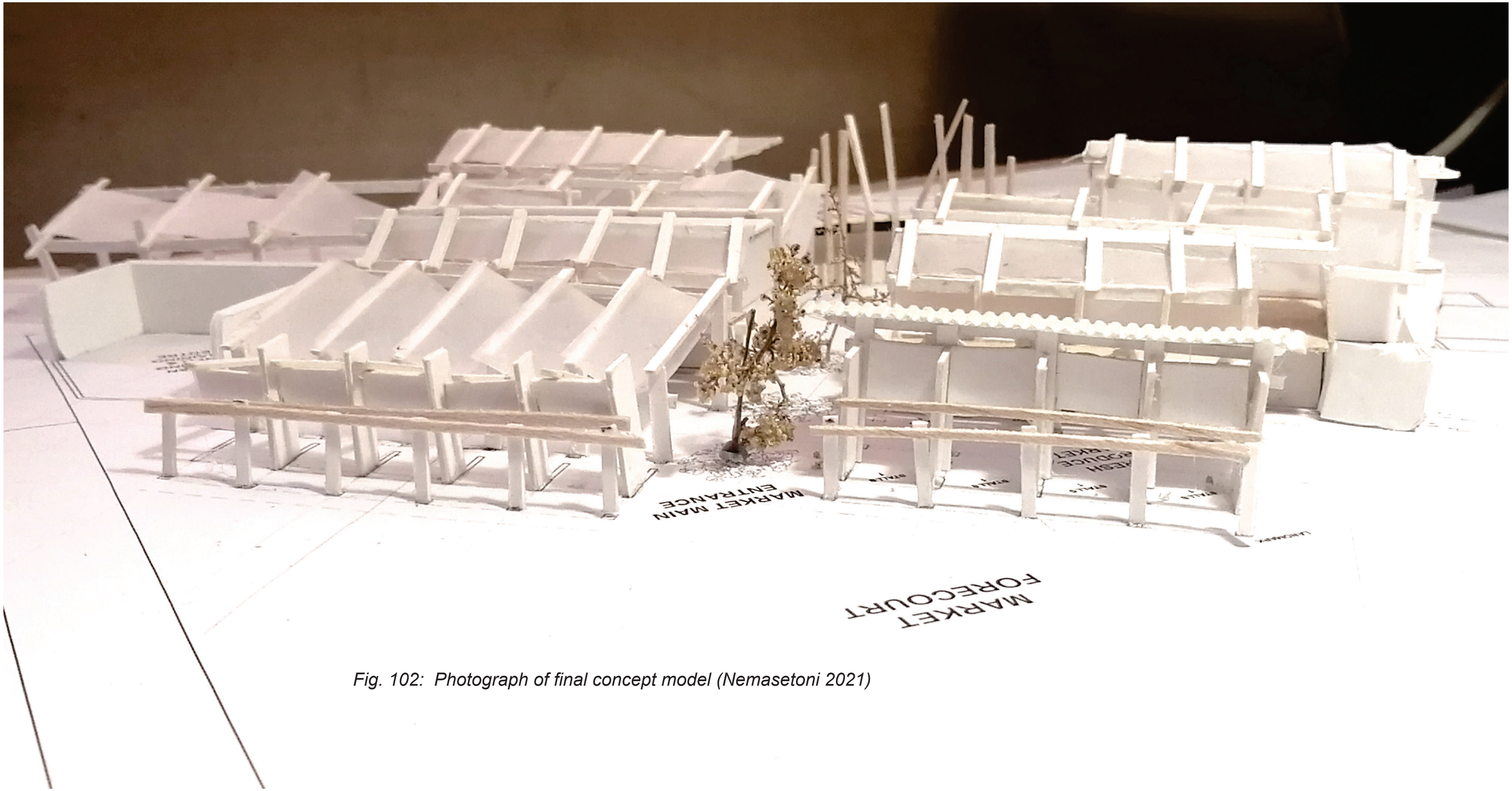
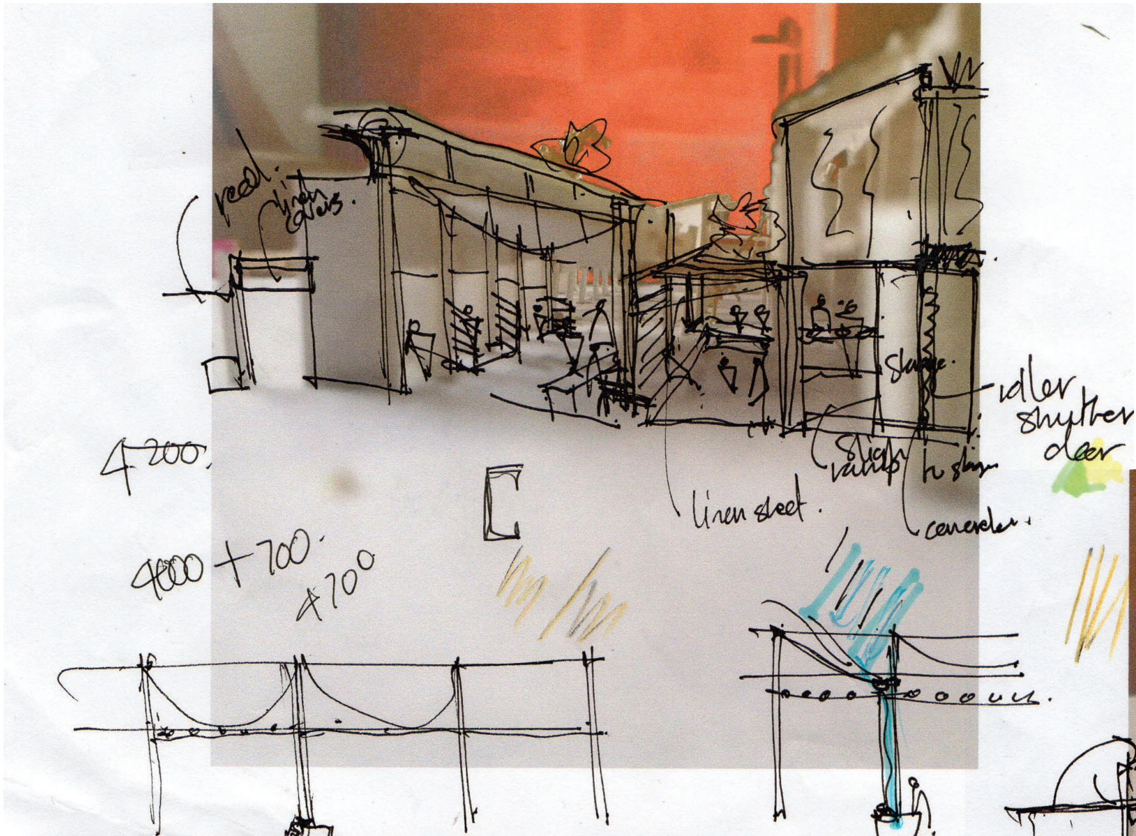
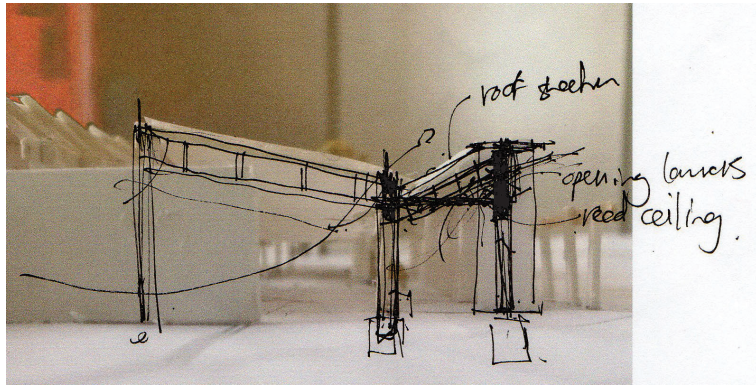


Fig. 102: Photograph of final concept model (Nemasetoni 2021)





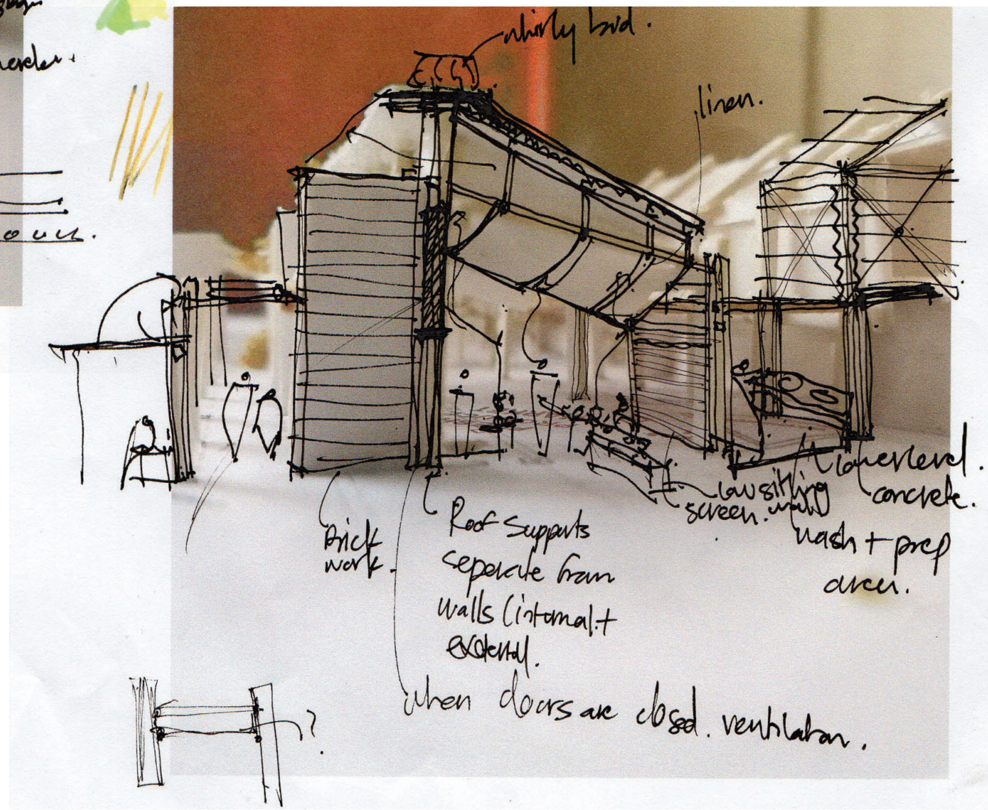


Fig. 103: Photograph of final concept model with notes (Nemasetoni 2021)

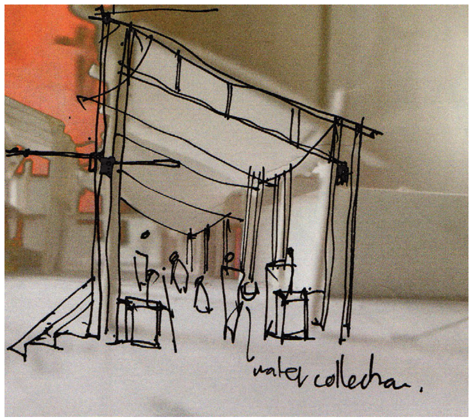


Fig. 104: Photograph of final concept model (Nemasetoni 2021)

Fig. 105:   Photograph of final concept model (Nemasetoni 2021)

Spaces and Flow of Movement:

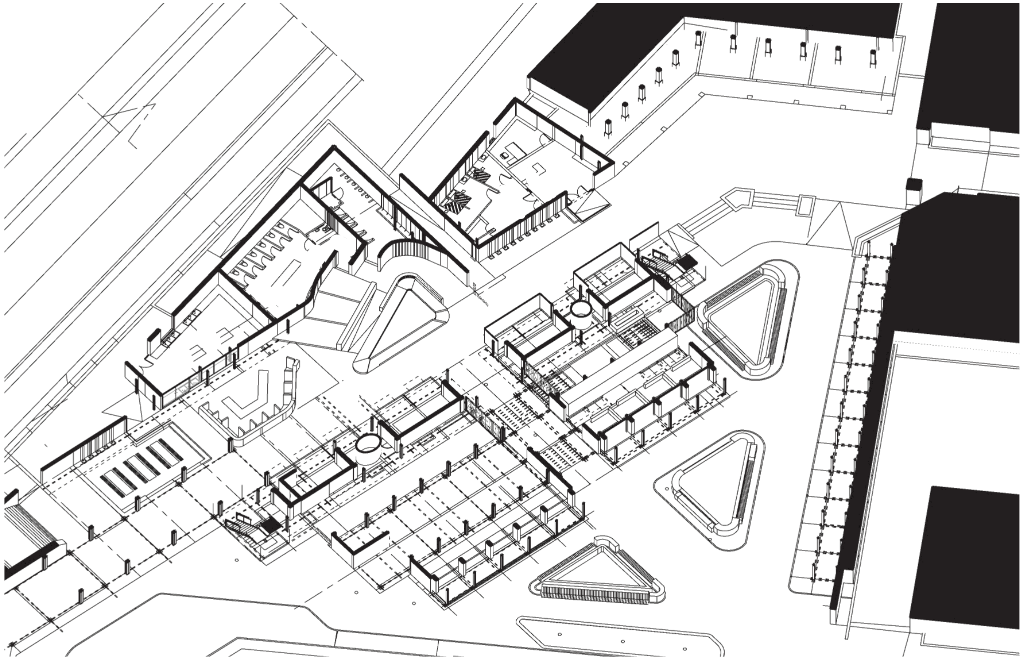


Fig. 106: Plan Axo of the ground floor (Nemasetoni 2021)

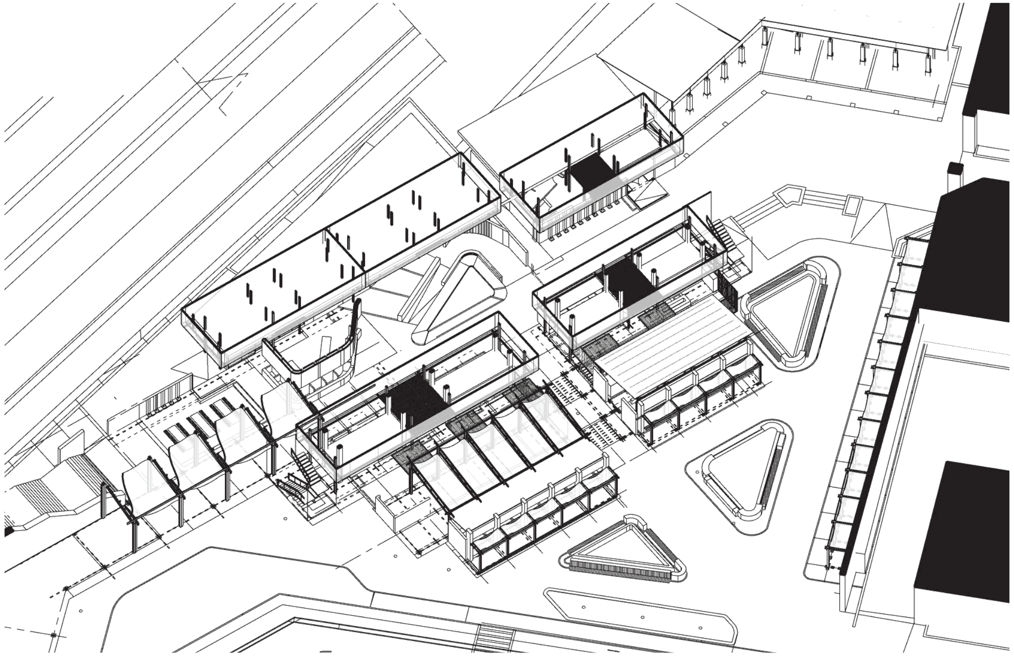


Fig. 107: Plan Axo of the first floor (Nemasetoni 2021)

Context Materiality:

1. Traders Market



Roller Shutter Doors

Steel Mesh Panel in Steel frame

Steel Roof Trusses

Separate Lockable Containers

Steel Roof Sheeting Canopies

Face-brick Walls

Concrete Blocks

Concrete Up-stand Beams

Steel Frame Shutters

2. Bosman Train Station


Contrasting Face-brick Walls

Steel Sheeting facade infill steel frame

Steel Columns

Steel Frames with Bracing

Plastic (polycarbonate) Sheeting

Proposed New Building Materials Pallette

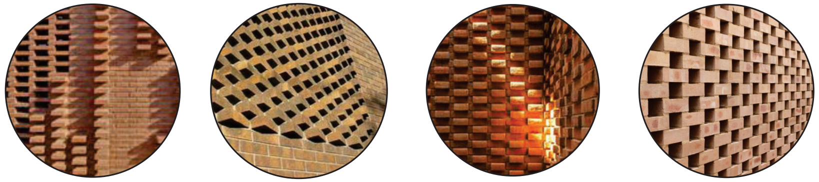
Proposed Materiality:

Primary Building Structure (Load Bearing)

1. Concrete Frame

2. Steel Frame

Secondary Building Structure

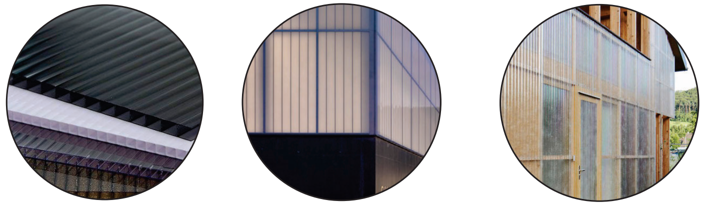


1. **Brick Infil:** Various Textures of Bricks are explored to offer various layers of privacy and bring textured light into the spaces

Secondary Structure

1. Timber Framing. Timber profiles will be used to cover some of the steel columns as a design feature

Facade Materials



1. Polycarbonate sheets of various transparencies Steel sections will be used to create the various frames that will be arranged to create various patterns.

Fabric Sun Shading

1.Thick, strong weather protected linen textiles will be used as sun shading in the open and public areas of the building

Urban Farming Spatial Design Requirements:

Plant Sunlight Requirements

(Plants need sun exposure to grow, however, the minimum amount needed for optimum growth varies with each type of plant) Below is a table showing the minimum hours required by the shown plants to grow optimally according to industry standards (Resh, 2013):

Full Sun *(6hrs/day +)*

Tomatoes

Green peppers

Part Sun *(3-6hrs/day)*

Cabbages

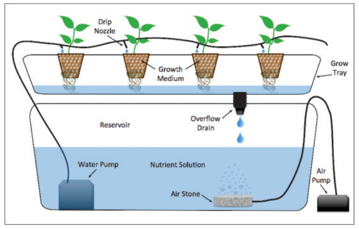
Full Shade*(3hr/day or less)*

Lettuce

Spinach

Tilapia

Hydroponics



Description:

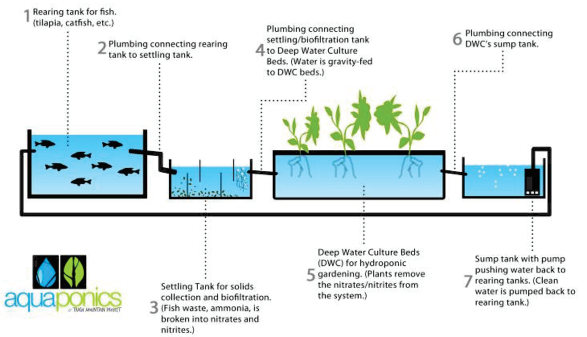
Hydroponic farming is a farming method where plants are grown without using soil. The growing method consist of a "mineral nutrient solution" which is dissolved in water. The plants grow in a supporting structure which allows the roots to be exposed to this solution. (Resh, 2013)

In this project, the NFT System will be used where the nutrient solution tank is separate form the growing structure. This will allow more space and also easier maintenance. (Resh, 2013)

Aquaculture

Description

This is the controlled farming of fish and other aquatic products in tanks. Fish can be grown in both freshwater and saltwater in an environment that is conducive for good grown where food is provided. In this project freshwater fish will be cultivated. (Resh, 2013)



Aquaponics

The project will combine both hydroponic and aquaculture into one growing systems where the wastes and outputs of one system will be the inputs of the other and vice versa.

The waste from the aquaculture system such as excretions from the fish as well as Co2 will be used as nutrients for the nutrient growing solution for the plants and pumped into the plant growing system. The plants will then consume these nitrates purifying the water and also adding O2 which will then be pumped back into the aquaculture tanks. (Resh, 2013)

Urban Plant Production and Aquaculture Spatial Layout on Site:

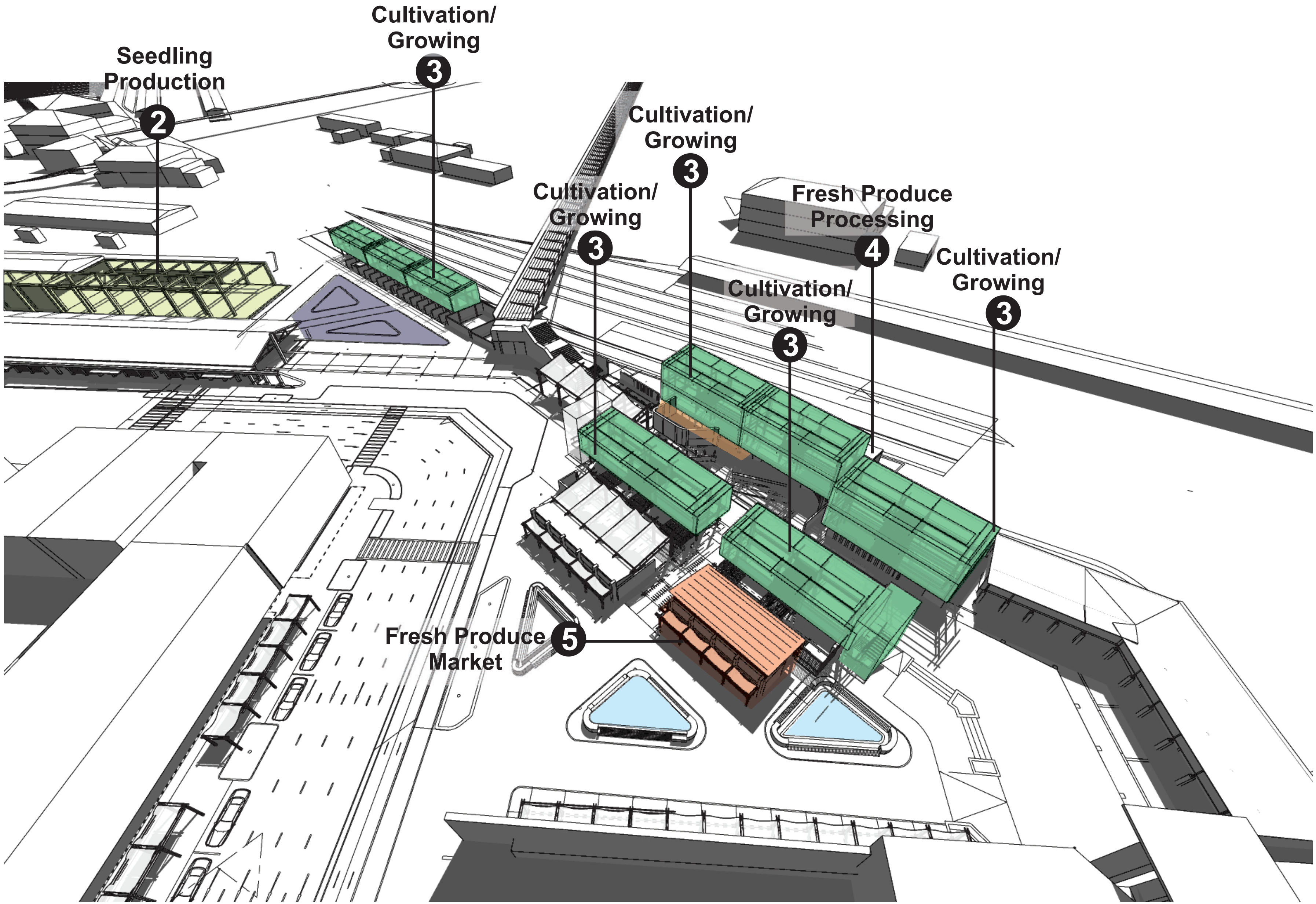


Fig. 108: Bird eye view of site showing the spatial layout of plant production process (Nemasetoni 2021)

Water System Calculations:

Determining the Water Demand for the Growing Spaces (Greenhouses)

Available Growing Space

Space	Room Dimensions	Room Area	Units	Total Area
Greenhouse 1	6m x 7m	42m2	1	**42m2**
Greenhouse 2	6m x 7m	42m2	1	**42m2**
Greenhouse 3	6m x 7m	42m2	1	**42m2**
Greenhouse 4	11m x 6m	66m2	1	**66m2**
Greenhouse 5	15m x 4m	60m2	2	**120m2**
Greenhouse 6	14m x 4m	56m2	2	**112m2**
Greenhouse 7	28m x 4m	112m2	2	**224m2**

Total Planting/Greenhouse Area: 649m2

Planting Quantities per Planting Cycle

Vegetables	Planting Area	Plant Quantities	Water Needed per Plant	Total Water Needed for Plant Type
Tomatoes	200m2	2 550 plants	9L per plant	22950 L
Green Peppers	100m2	1680 plants	5L per plant	8400 L
Cabbages	100m2	1680 plants	4L per plant	6720 L
Lettuce	100m2	2000 plants	4L per plant	8000 L
Spinach	150m2	3360 plants	4L per plant	13440 L
Total:	650m2	11270 plants		**59 510 L**

Tilapia Cultivation (Aquaculture) Water Demands

Tilapia Fishes Cultivated per Tank	**30-40 Fishes**
Tank Water Volume	**500 L**
Tank Dimensions	**1620mm (D) x 1160mm (H)**
Number of Tanks	**40**
Total Water Demand (Constant)	**20 000 L**

Monthly Urban Farm Production Process Water Demands (Excluding Growing/Greenhouse Areas)

Seedling & Germination	**3500 L per planting cycle**
Seeding Production Space	**5000 L per planting cycle**
Produce Washing Areas	**10 000 L per planting cycle**
Total Water Demands:	**18500 L Per planting Cycle**

Total Water Demand for Plant Production Process: 78 500 L per planting cycle
(This water is constantly in the system and so can be recycled and re-used for the next planting cycle)

Total Water Demand for Tilapia Production Process: 20 000L
(This water is constantly in the system and so can be recycled and re-used for the next planting cycle)

Water System Calculations:

Drinking Water and Hand Washing Points. Potable Water Demands

Person	Daily Number	Number of Days a Month (Ave)	L per Person	Total water needed per month
Street Traders & Support (Security & Assistants)	120 persons	22	3 L	7920 L
Market Customers	500 – 3000 persons	22	2 L	(22 000 L- 132 000 L) Average 60 000 L
People using main walkway	800 Persons	22	1 L	17 600 L
Clinic Visitors	20 Persons	22	2 L	880 L
Clinic Employees	5 Persons	22	3 L	330 L
Urban Farm Workers	20 Persons	22	3 L	1 320 L
Aquaponics Workers	5 Persons	22	3 L	330 L
Admin Office	3 Persons	22	3 L	198 L
Total Potable Water Demand	2473	22		90 000 L

Monthly Other Market Water Demands (Potable)

Cooking Area	10 000 L per month
Wash and Prep Areas	50 000 L per month
Total Water Demands:	60 000 L per month

Monthly Other Market Water Demands (Recycled Water)

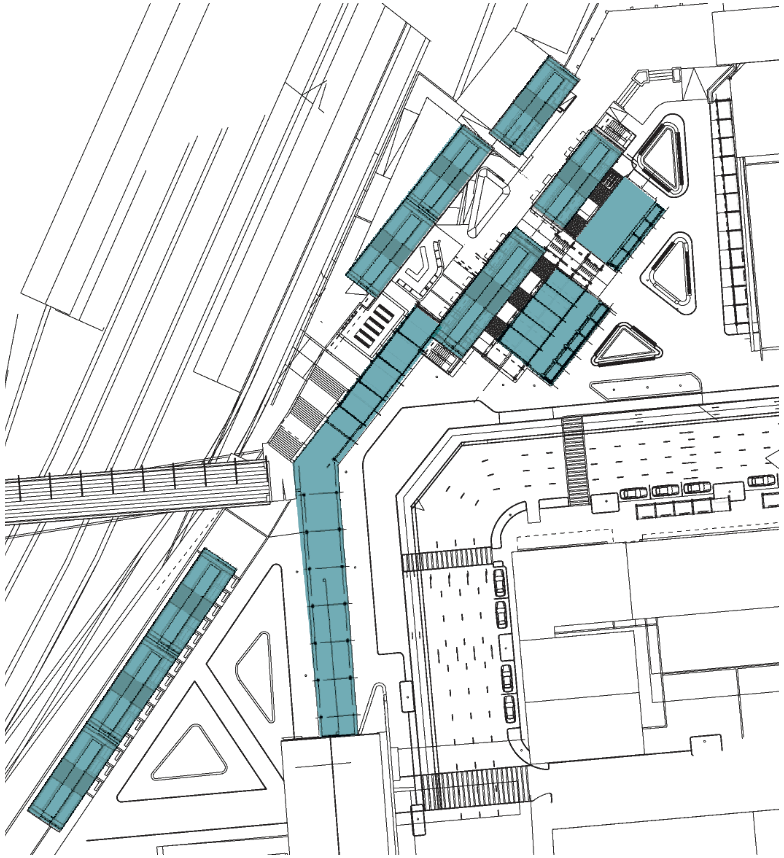
Cleaning and Washing Floors	5000 L per month
Irrigation	20 000 L per month
Total Water Demands:	25 000 L per month

Site Rainwater and Paved Area Yield Calculations:

Pretoria Average Annual Precipitation = 650mm

Rainwater will be harvested using the following systems:

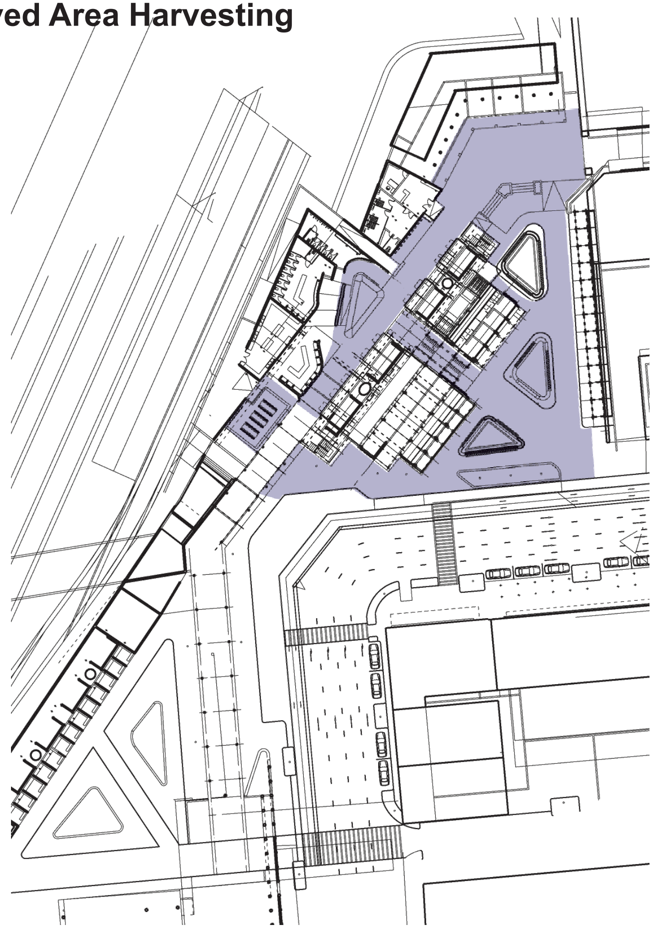
Roof Water Harvesting



Total Roof Rainwater Harvesting Area = 1 237 m2

Fig. 109: Site plan showing roof rainwater harvesting areas (Nemasetoni 2021)

Paved Area Harvesting



Total Roof Rainwater Harvesting Area = 929 m2

Fig. 110: Site plan showing paved rainwater harvesting areas (Nemasetoni 2021)

Site Rainwater and Paved Area Yield Calculations:

Tshwane Precipitation Table

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Annual
Average Precipitation mm (in)	3 (0.1)	6 (0.2)	22 (0.9)	71 (2.8)	98 (3.9)	150 (5.9)	154 (6.1)	75 (3)	82 (3.2)	51 (2)	13 (0.5)	7 (0.3)	732 (28.8)
Precipitation Litres/m² (Gallons/ft²)	3 (0.07)	6 (0.15)	22 (0.54)	71 (1.74)	98 (2.4)	150 (3.68)	154 (3.78)	75 (1.84)	82 (2.01)	51 (1.25)	13 (0.32)	7 (0.17)	732 (17.95)
Number of Wet Days (probability of rain on a day)	1 (3%)	1 (3%)	3 (10%)	7 (23%)	11 (37%)	12 (39%)	12 (39%)	10 (35%)	10 (32%)	5 (17%)	3 (10%)	1 (3%)	76 (21%)
Percentage of Sunny (Cloudy) Daylight Hours	89 (11)	89 (11)	76 (24)	70 (30)	66 (34)	67 (33)	62 (38)	57 (43)	63 (37)	74 (26)	87 (13)	85 (15)	74 (26)

Fig. 111: Table showing the Tshwane Precipitation Table (Meteoblue 2021)

Annual Total Rainwater Harvesting Potential Yield:

	Total Harvesting Area	Total Collected Precipitation
Roof Rainwater Harvesting Area	1237m2	185 000 L
Paved Areas	929 m2	139 000 L
	Total Collection	324 000 L

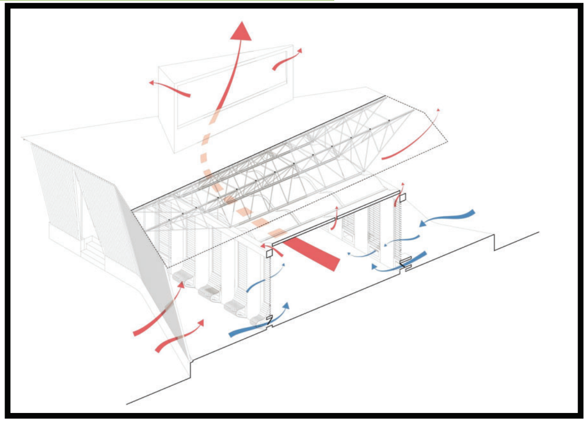
Fig. 112: Table showing the water rainwater harvesting annual amounts(Nemasetoni 2021)

Paved Area Harvesting

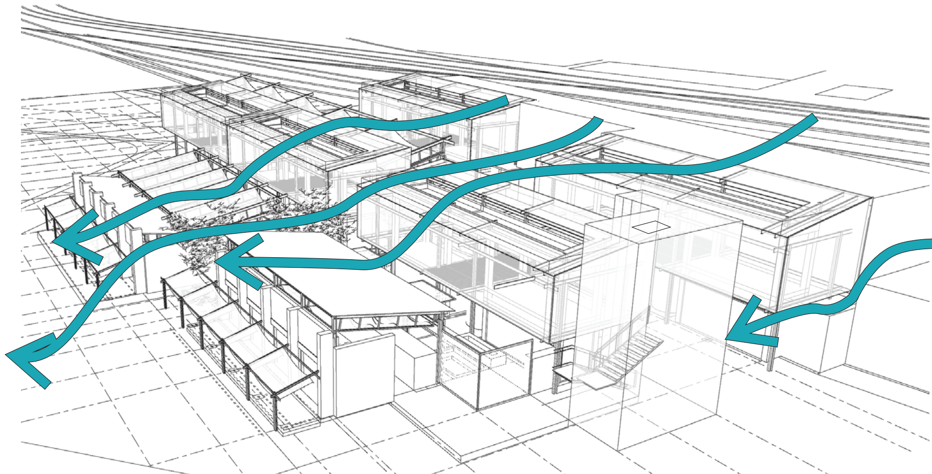
Month	Pretoria Average Monthly Precipitation (mm)
Jan	150
Feb	154
March	75
April	82
May	51
June	7
July	3
August	6
Sep	22
Oct	71
Nov	98
Dec	150
Total Annual Precipitation	732

Fig. 113: Table showing the water rainwater harvesting annual amounts (Nemasetoni 2021)

Natural Ventilation System:

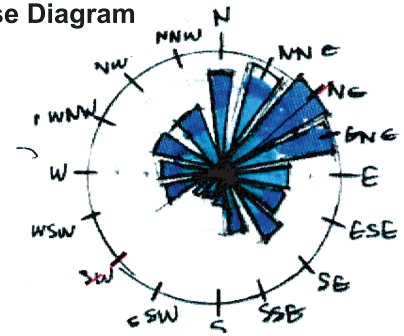


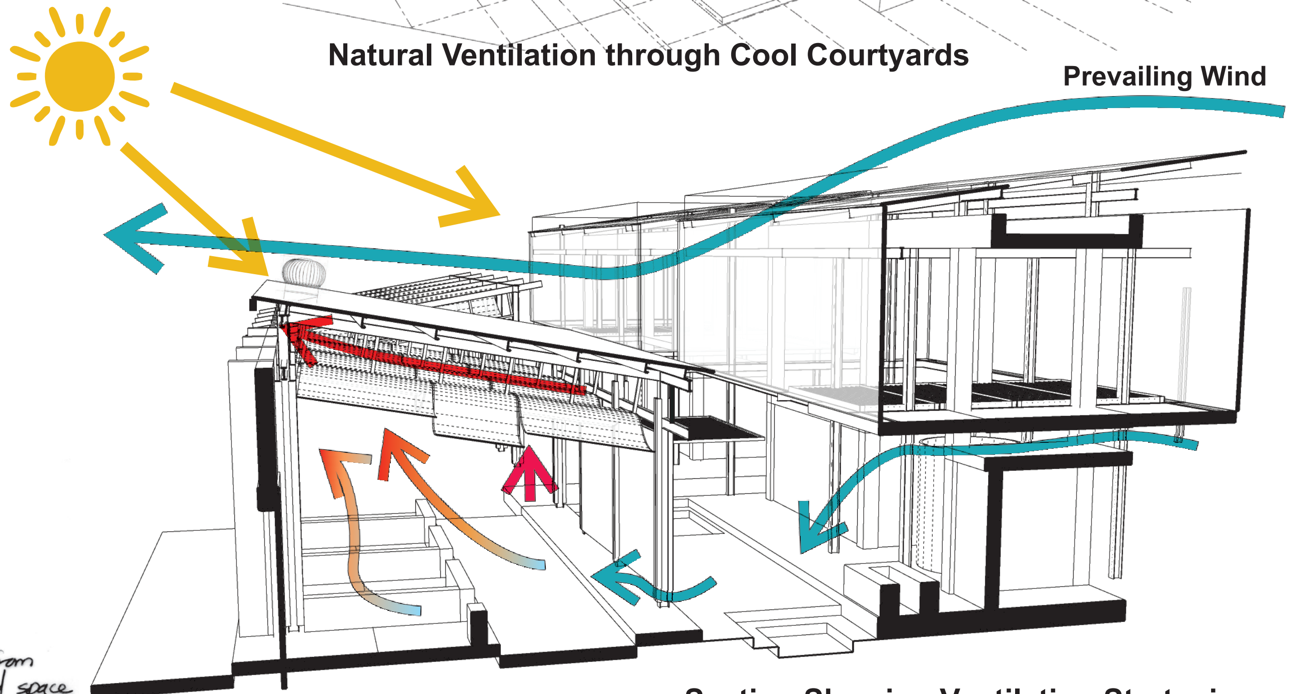
Lycée Schorge by Francis Kere, *Koudougou, Burkina Faso*



Natural Ventilation through Cool Courtyards

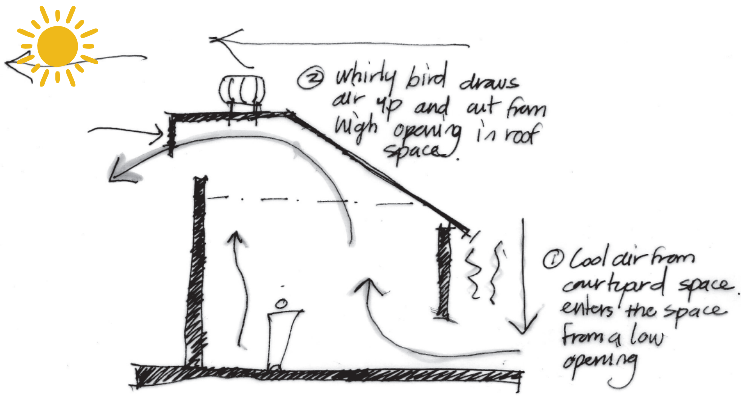
Wind-rose Diagram

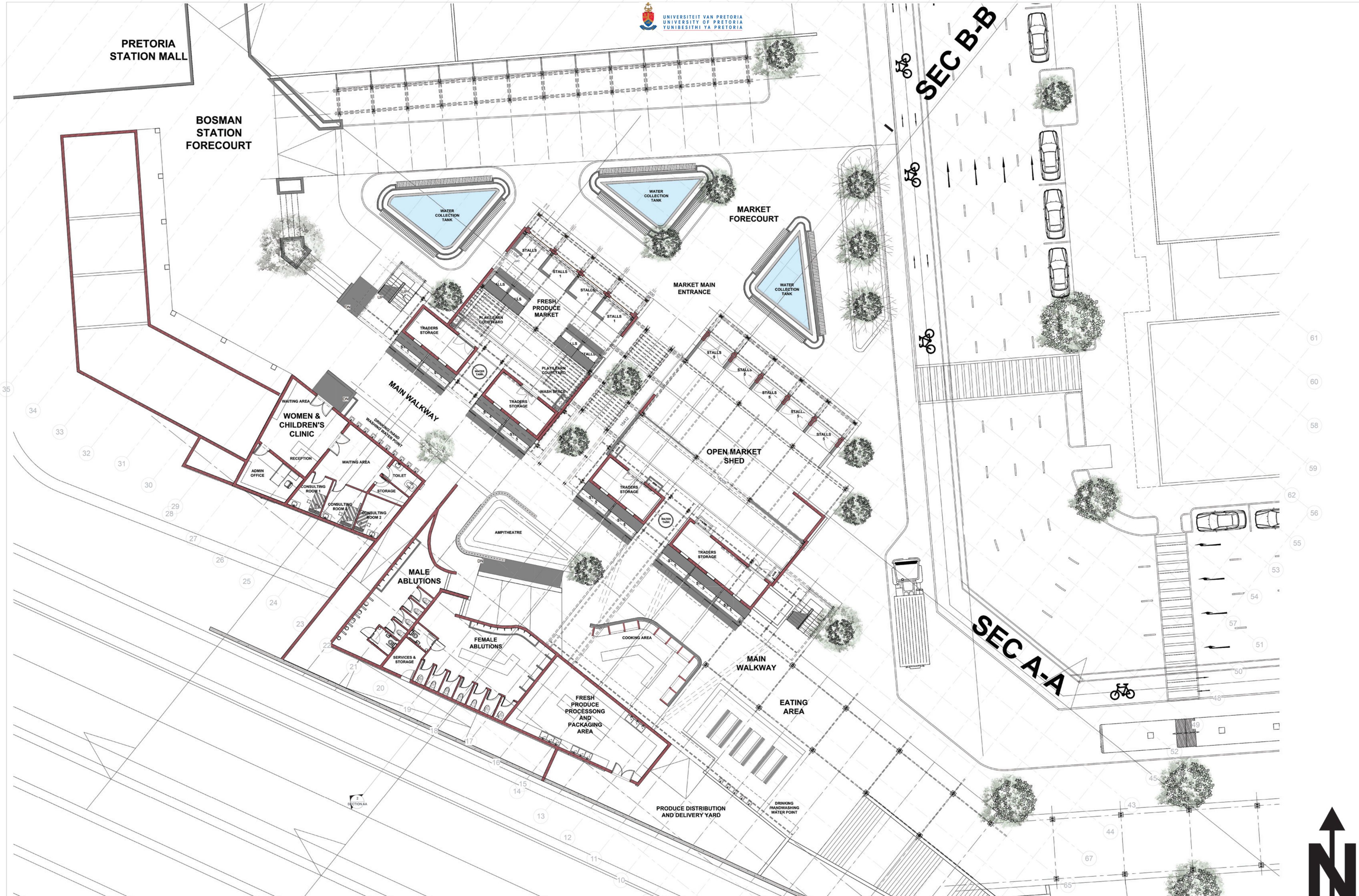




Section Showing Ventilation Strategies

Natural Ventilation Strategy





Ground Floor Plan 1:100

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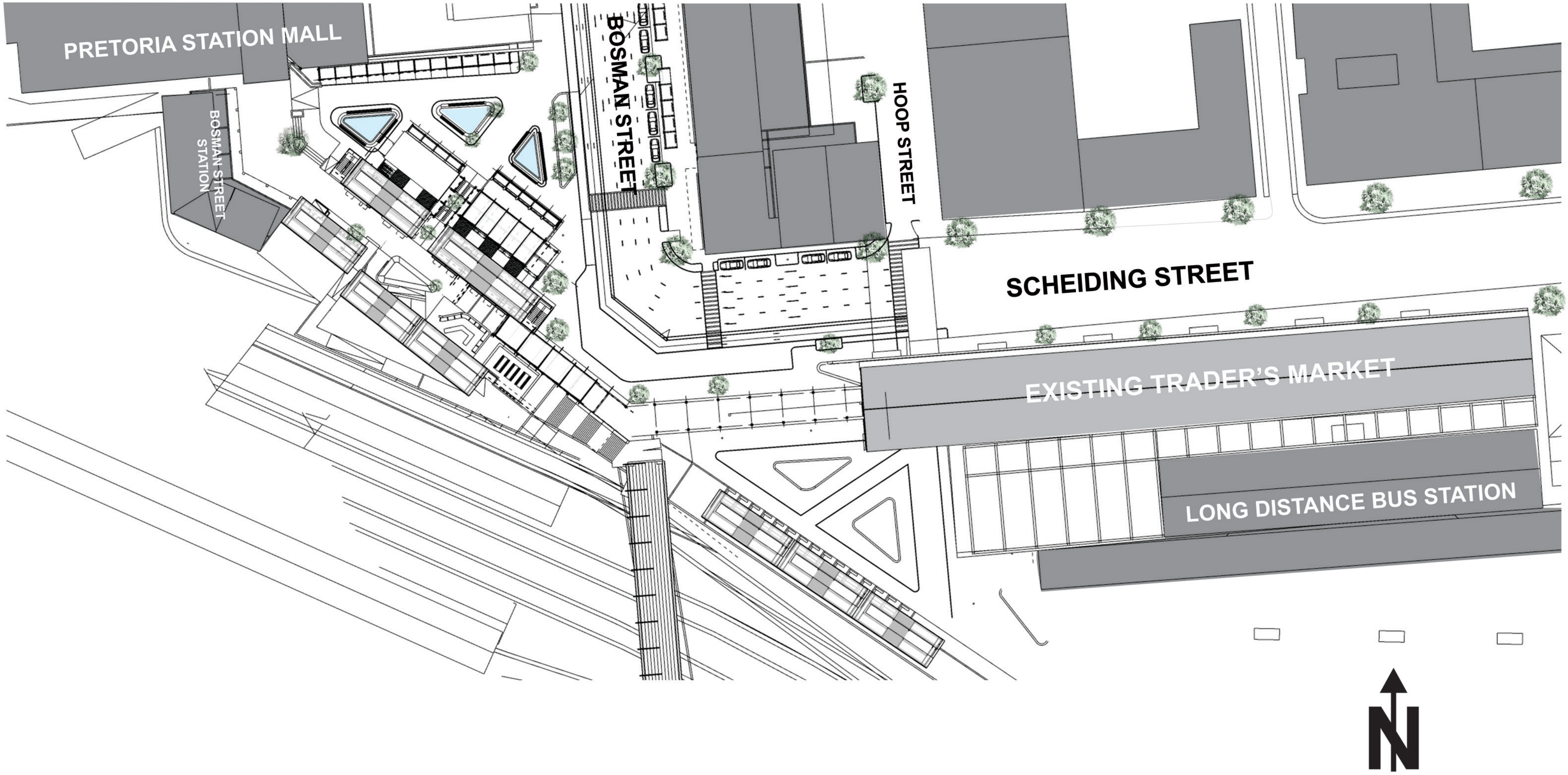
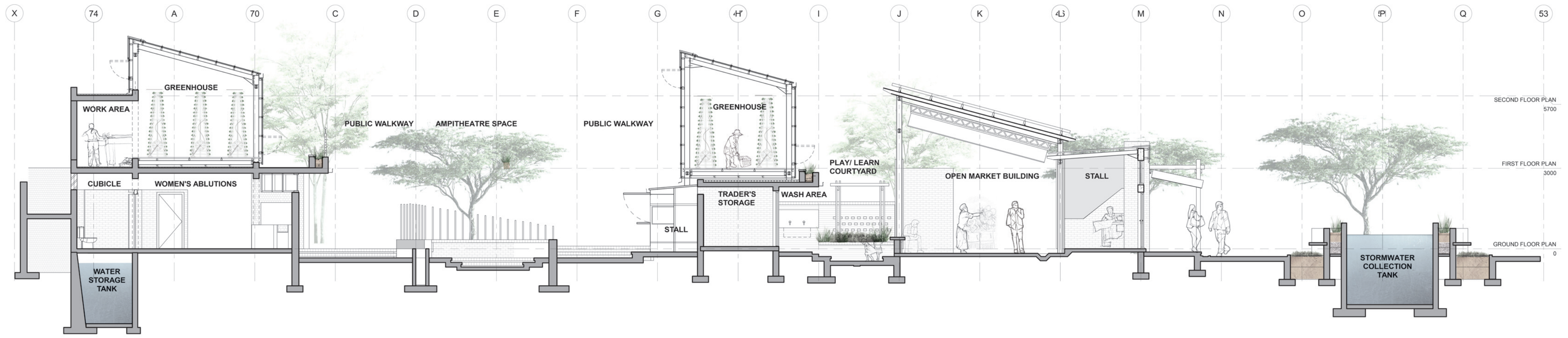
YUNIBESITHI YA PRETORIA

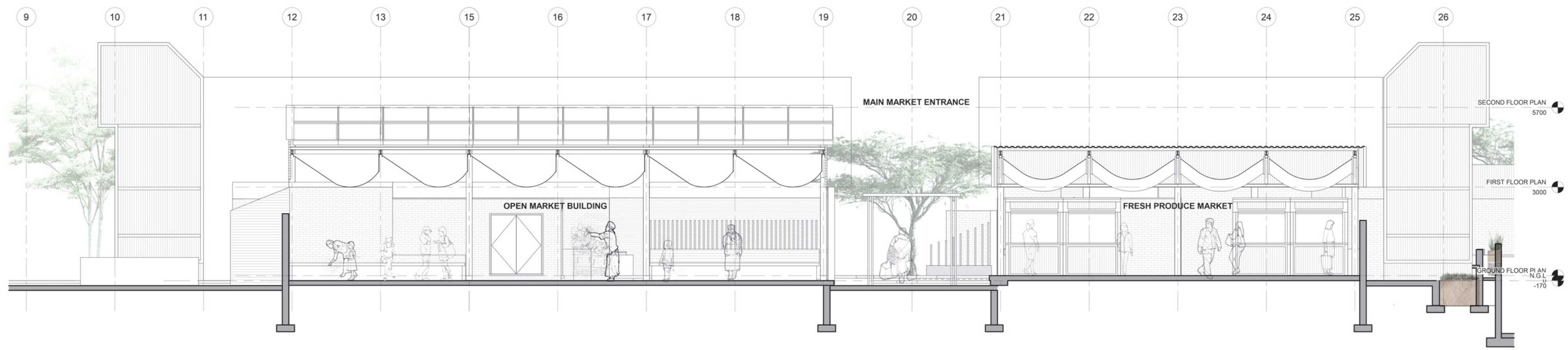


SITE PLAN 1:500

Building Sections



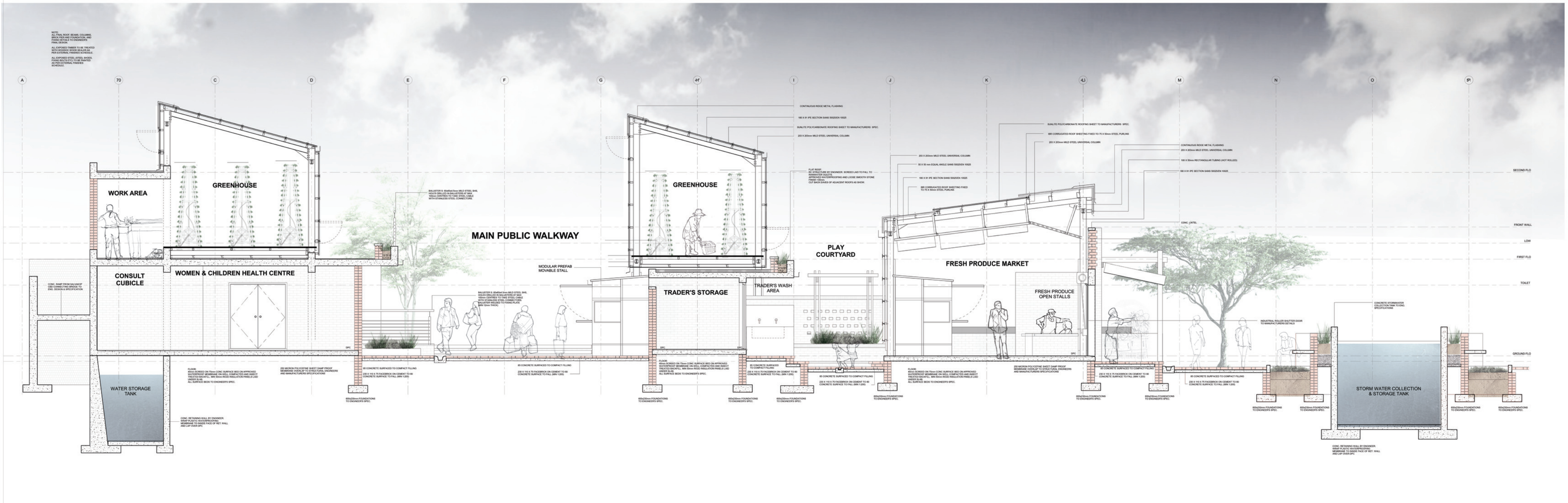
SECTION BB 1:50



SECTION AA 1:50

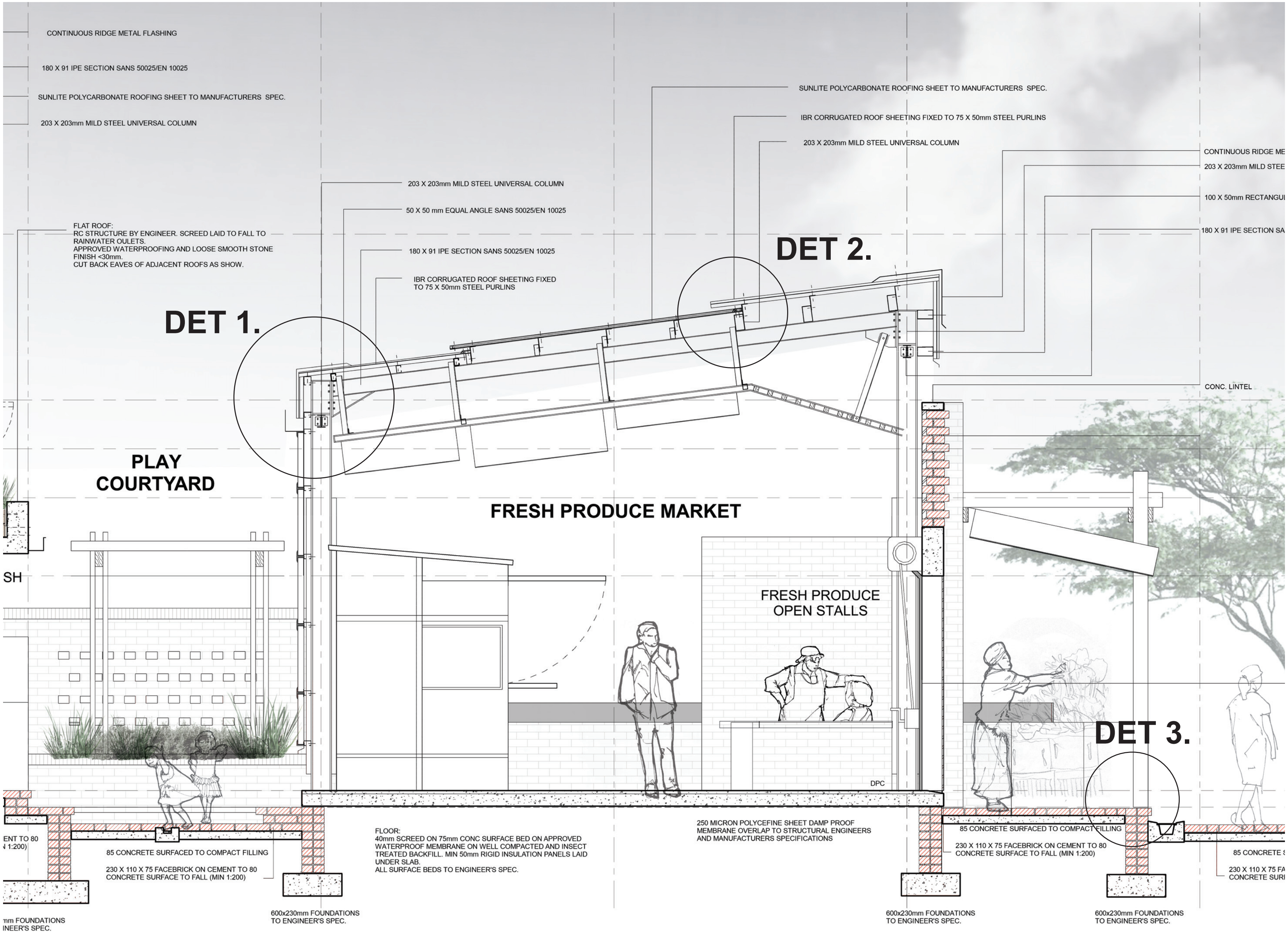
Essay 3

Project Technical Section (1 in 20):

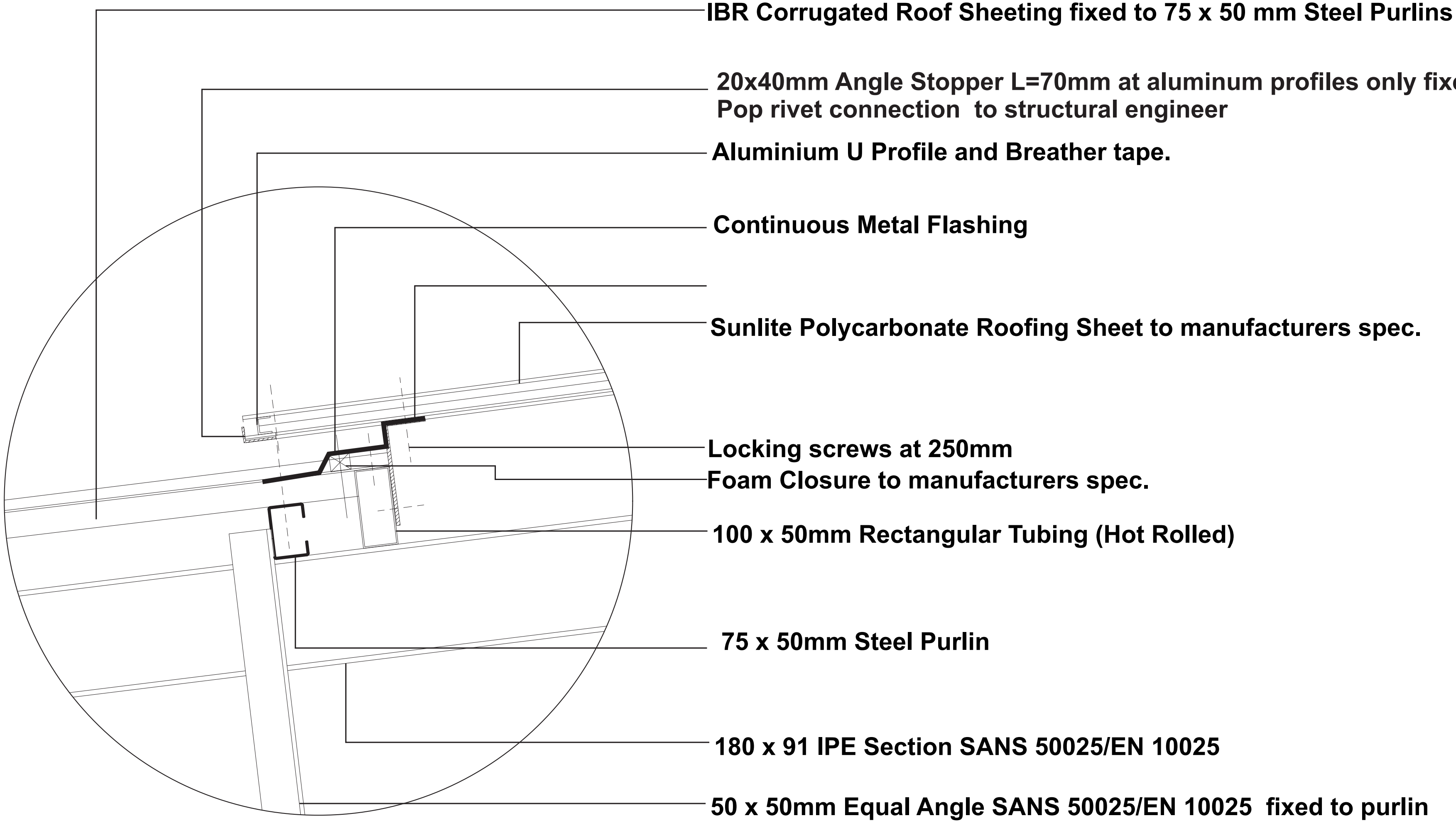


TECHNICAL SECTION AA 1:20

Building 1 Technification:

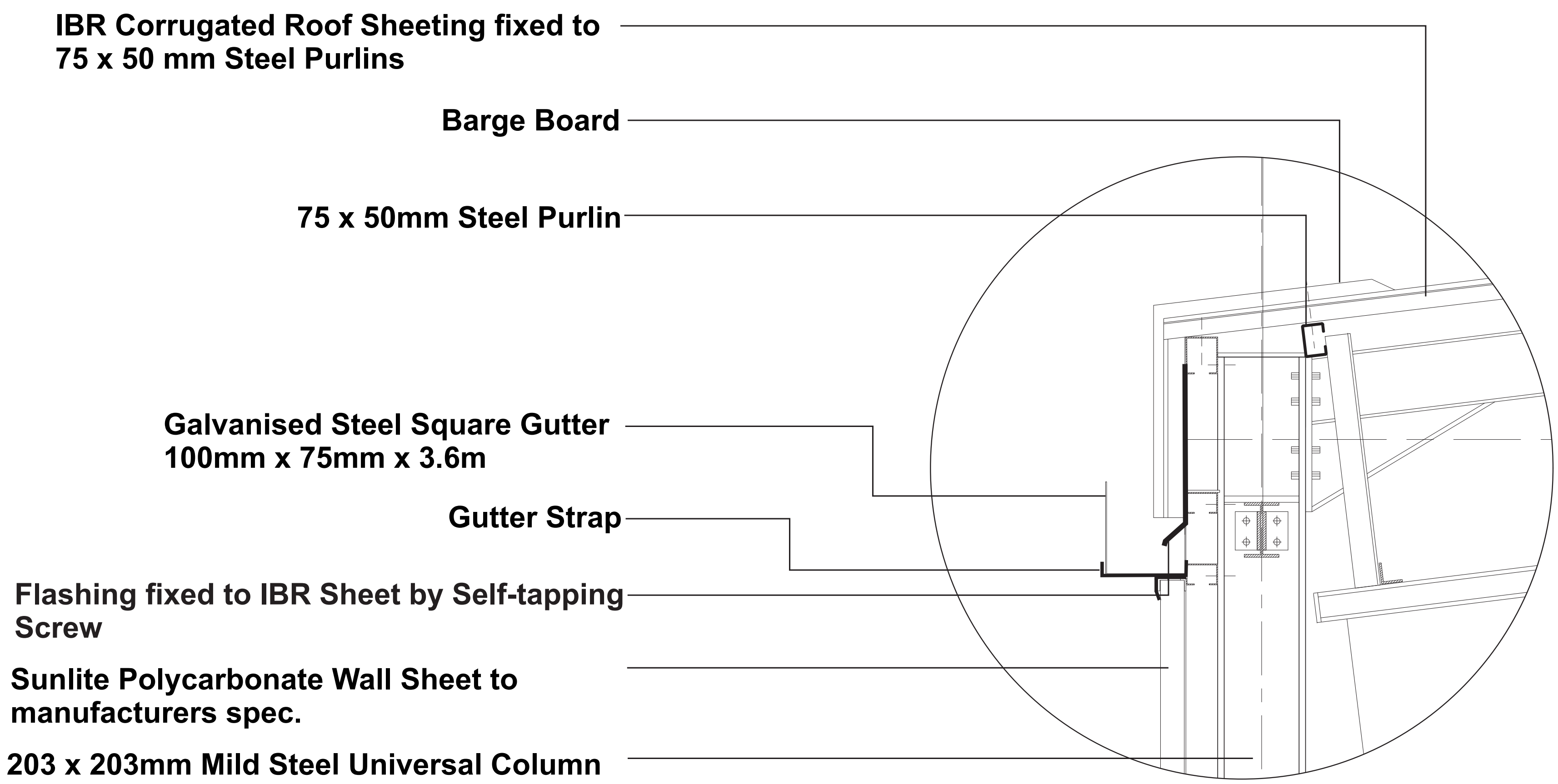


Building Detail Technification:



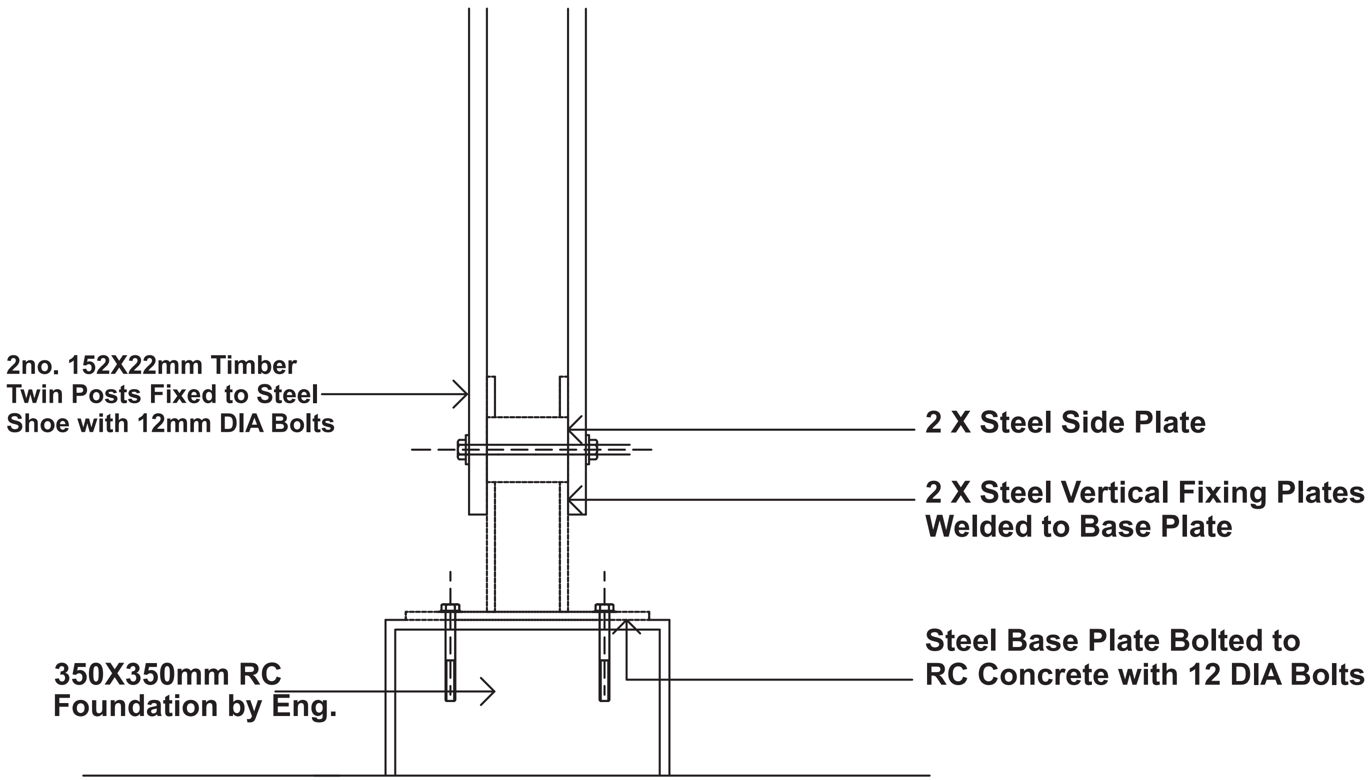
DET 1. LONGITUDINAL ROOF OVERLAP STEP DETAIL 1:5

Building Detail Technification:



DET 2. BARGE AND GUTTER DETAIL 1:5

Building Detail Technification:



DET 3. STEEL SHOE DETAIL 1:10

3D View of main walkway:

Fig. 114: Image showing 3D view of main public walkway space (Nemasetoni 2021)

3D view Fresh Produce Market Building:

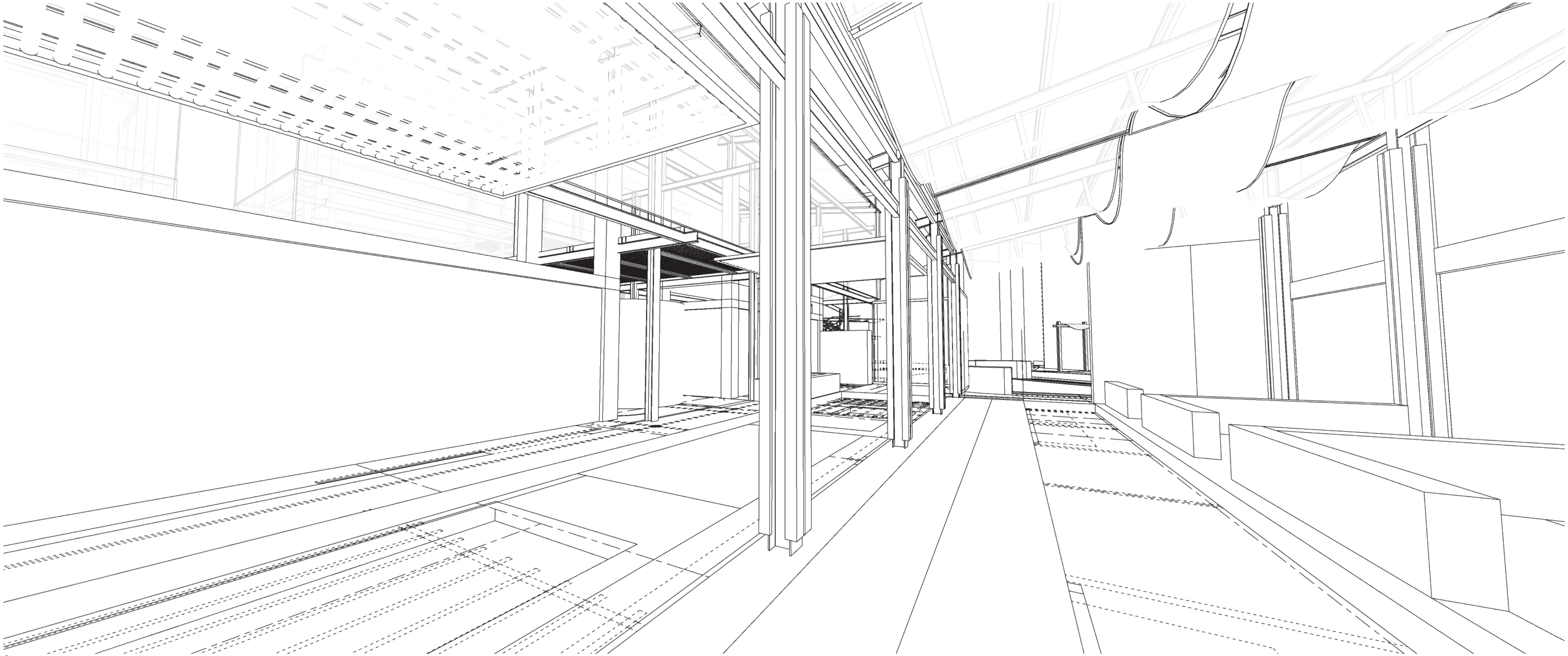
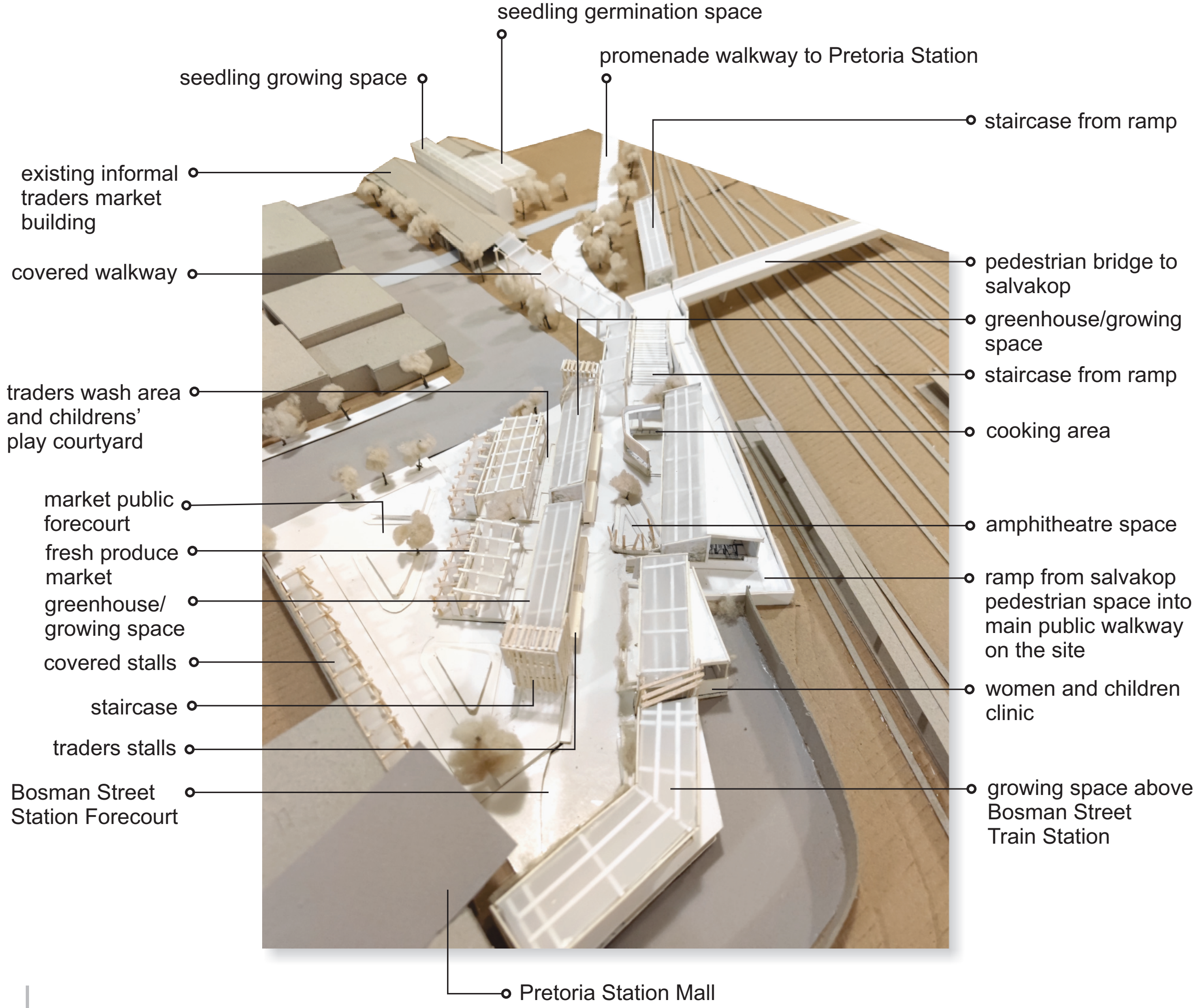


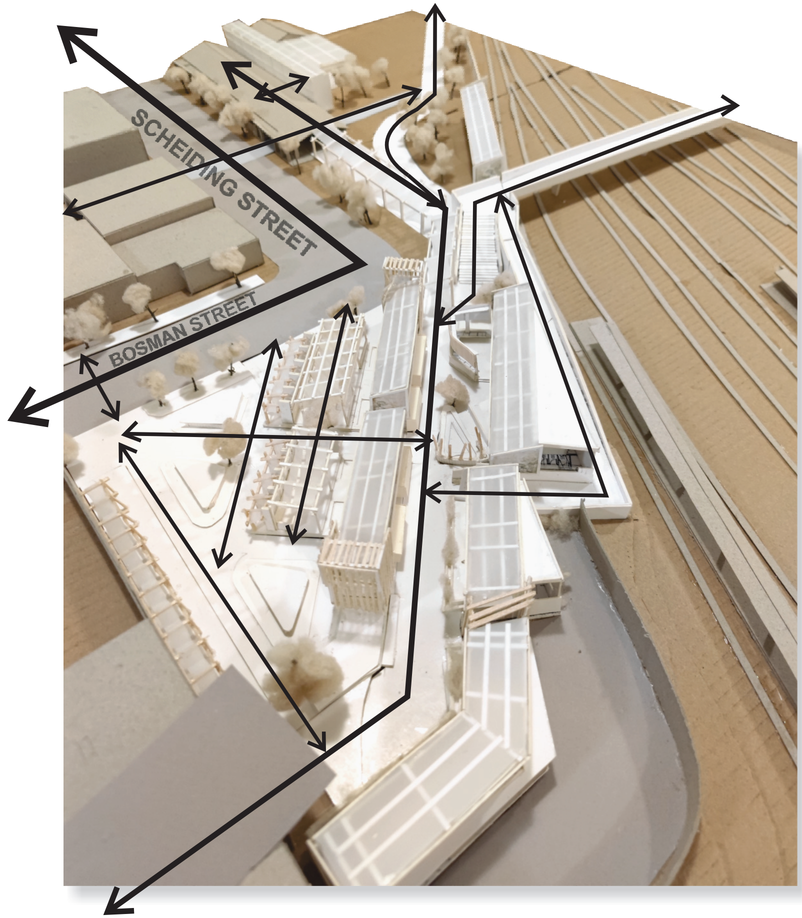
Fig. 115: Image showing 3D view of fresh produce market interior (Nemasetoni 2021)

Final Design Model:



Programme Layout and Spatial Configuration on the site.

Fig. 116: Annotated photograph of final 1 in 200 model showing spatial layout and programme on the site (Nemasetoni 2021)



Pedestrian routes, Accessibility and Movement through the site.

Fig. 117: Annotated photograph of final 1 in 200 model showing pedestrian routes and accessibility to and through the site on the site (Nemasetoni 2021)

Final Design Model:

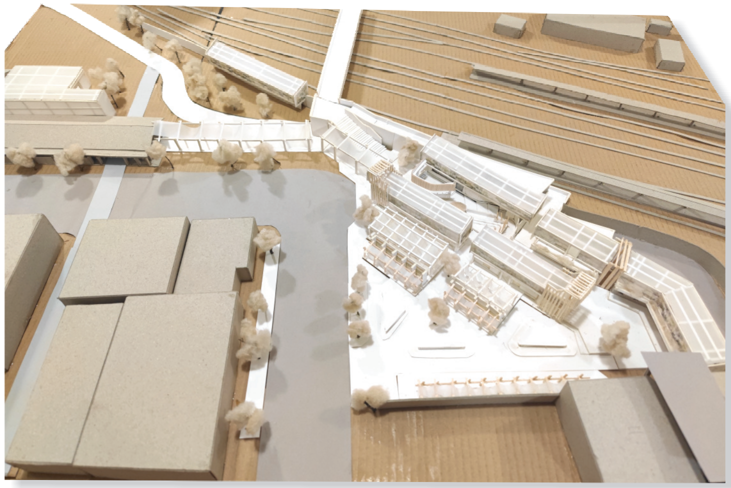


Fig. 118: photograph of final 1 in 200 site model(Nemasetoni 2021)

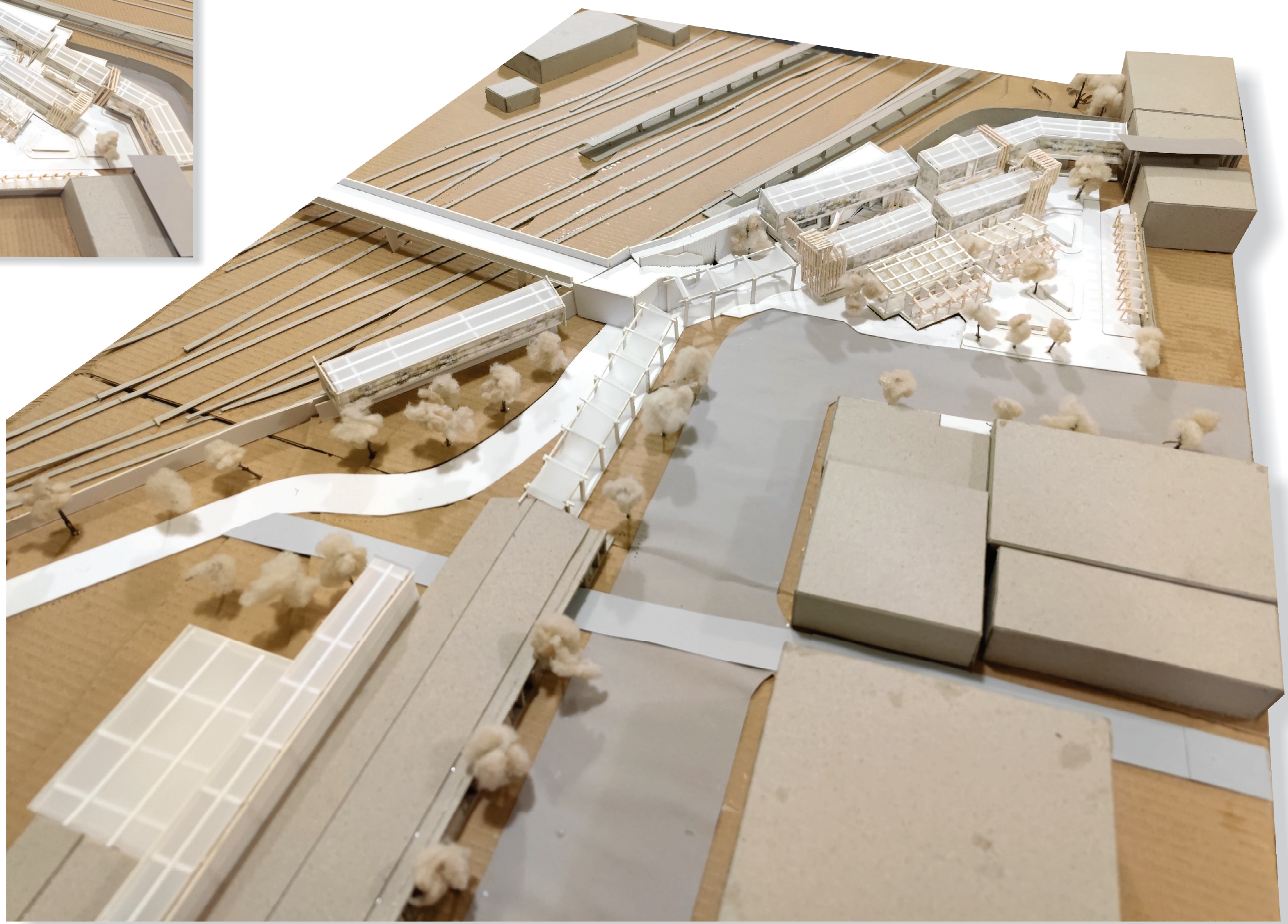
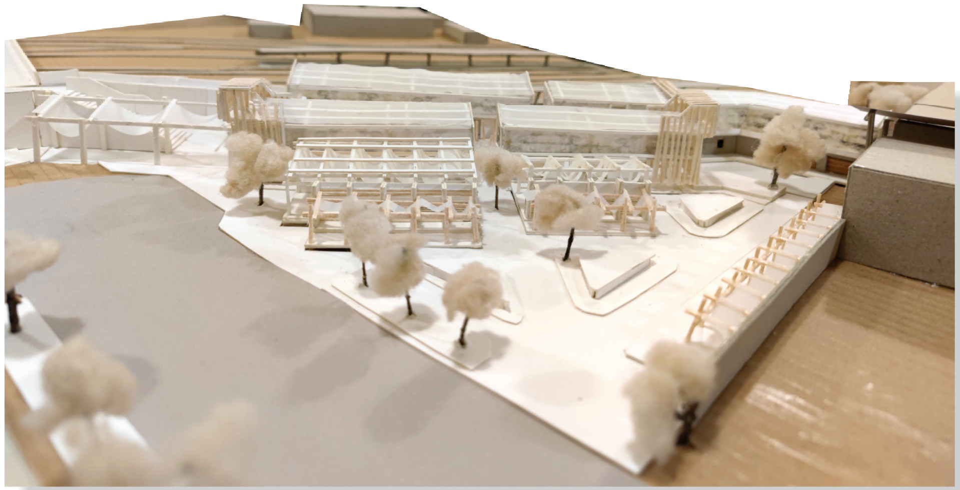


Fig. 119: photograph of final 1 in 200 site model (Nemasetoni 2021)

Final Design Model:



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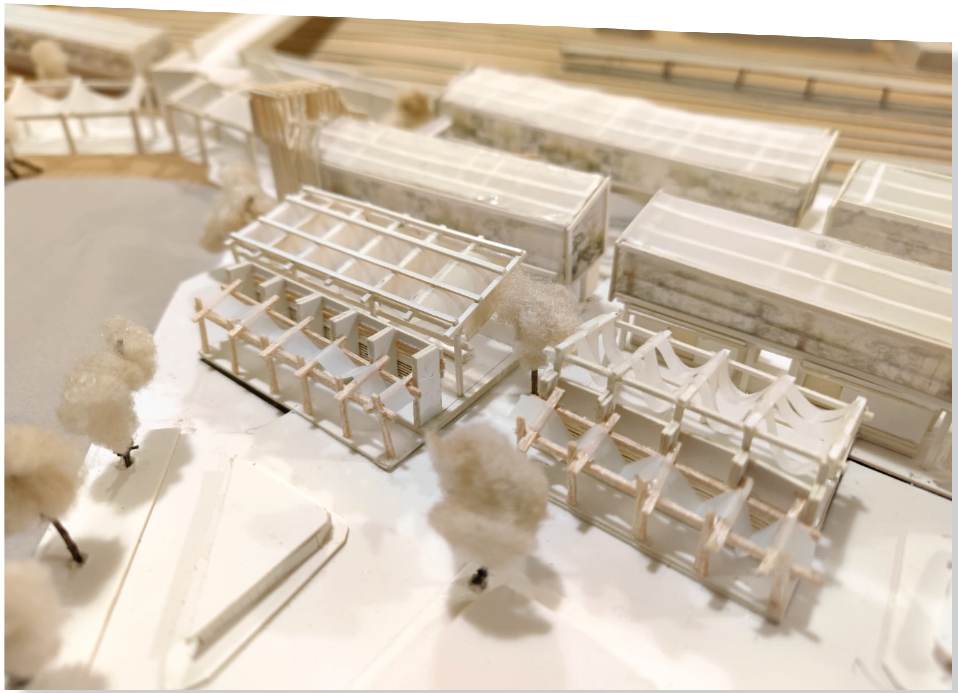

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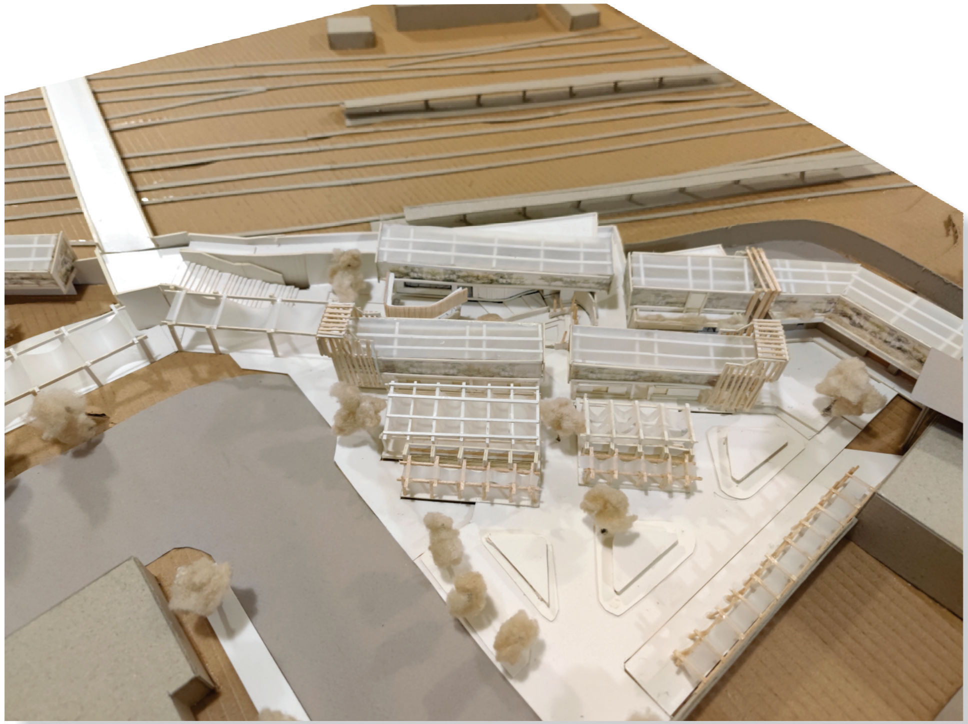

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Abebrese, B. N. & Schachtebeck, C., 2017. Street Trading in South Africa: A Case of the Tshwane Central Buisness District. Acta Universitas Danubius Oeconomica , 13(1), pp. 129-139.

Becker , K. F., 2004. The Informal Economy , Sweden : Sida .

Chen , M., 2018. 2. The South African informal sector in international comparative perspective: Theories, data and policies. In: F. C. Fourie & C. Skinner , eds. The South African Informal Sector: Creating Jobs, Reducing Poverty. Cape Town: HSRC Press, pp. 26-47.

Fourie , F., 2018. Analysing the informal sector in South Africa: Know[ledge and Policy gaps, conceptual and data challenges. In: F. C. Fourie & C. Skinner , eds. The South African Informal Sector: Creating Jobs, Reducing Poverty. Cape Town : HSRC Press, pp. 3-25.

Fourie , F. C. & Skinner , C., 2018. The South African Informal Sector: Creatting Jobs, Reducing Poverty. 1 ed. Cape Town: HSRC Press.

Hadebe , N., 2008. The Challenges of Forming Partnerships Between Informal Business in INformal Settlements and Corporate South Africa , Johannesburg : University of Witwatersrand .

Iqbal Aalam. Architecture, planning, arts and crafts. , 2012. Cedric Price, Anticipating the unexpected, Magnets.. [Online]

Available at: https://iqbalaalam.wordpress.com/2012/10/29/cedric-price-anticipating-the-unaxpected-magnets/

[Accessed 3 April 2021].

Joburg.org.za. 2019. Complete Streets Design Guideline. [online] Available at: <https://www.joburg.org.za/departments_/Documents/transport/department%20project/Complete%20Streets%20Design%20Guideline%20Manual.pdf> [Accessed 18 January 2022].

Lloyd, N. & Leibbrandt, M., 2018. 6. Entry into and exit from informal enerprise ownership in South Africa. In: F. C. Fourie & C. Skinner , eds. The South African Informal Sector: Creating Jobs, Reducing Poverty. Cape Town: HSRC, pp. 151-176.

Lucas, R., 2020. Anthropology for Architects. Social Relations and the Built Environment. 1 ed. London : Bloomsbury Publishing .

Lund, F., Nicholson , J. & Skinner , C., 2000. Street Trading. 1st ed. Durban : School of Development Studies .

Rogan , M. & Skinner , C., 2018. 4. The size and structure of the South African informal sector 2008-2014: A labour-force analysis. In: F. Fourie & C. Skinner , eds. The South African Informal Sector: Creating Jobs, Reducing Poverty. Cape Town: HSRC Press, pp. 77-102.

Ruzek, W., 2015. The Informal Economy as a Catalyst for Sustainability. Sustainability, 7(1), pp. 23-34.

SA, S., 2016. Labour Force Survey , Pretoria : Stats SA.

Socio-Economic Rights INstitute of South Africa , 2018. Towards Recommendations on the REGULATION OF INFORMAL TRADE AT LOCAL GOVERNMENT LEVEL , Johannesburg : Socio-Economic Rights INstitute of South Africa .

finitions, 2021. Definitions for enabling. [Online]

Available at: definitions.net/definition/enabling

[Accessed 12 June 2021].

Dobson, R., Skinner , C. & Nicholson , J., 2009 . Working in Warwick: Including Street Traders in Urban Plans. 1st ed. Durban: School of Development Studies UKZN.

Iqbal Aalam. Architecture, planning, arts and crafts. , 2012. Cedric Price, Anticipating the unexpected, Magnets.. [Online]

Available at: https://iqbalaalam.wordpress.com/2012/10/29/cedric-price-anticipating-the-unaxpected-magnets/

[Accessed 3 April 2021].

Ludwig Hansen Architects and Urban Designers , 2020. Baragwanath Taxi RAnk. [Online]

Available at: https://www.ludwighansen.co.za/project/baragwanath-taxi-rank/

[Accessed 14 April 2021].

Lund, F., Nicholson, J. & Skinner, C., 2000. Street Trading. 1 ed. Durban: School of Development Studies.

New Urban , 2016. Refilwe Business Node. [Online]

Available at: http://www.newurban.co.za/projects/49

[Accessed 28 June 2021].

Resh, H. M., 2013. Hydroponic Food Production. 7th ed. Florida: CRC Press.