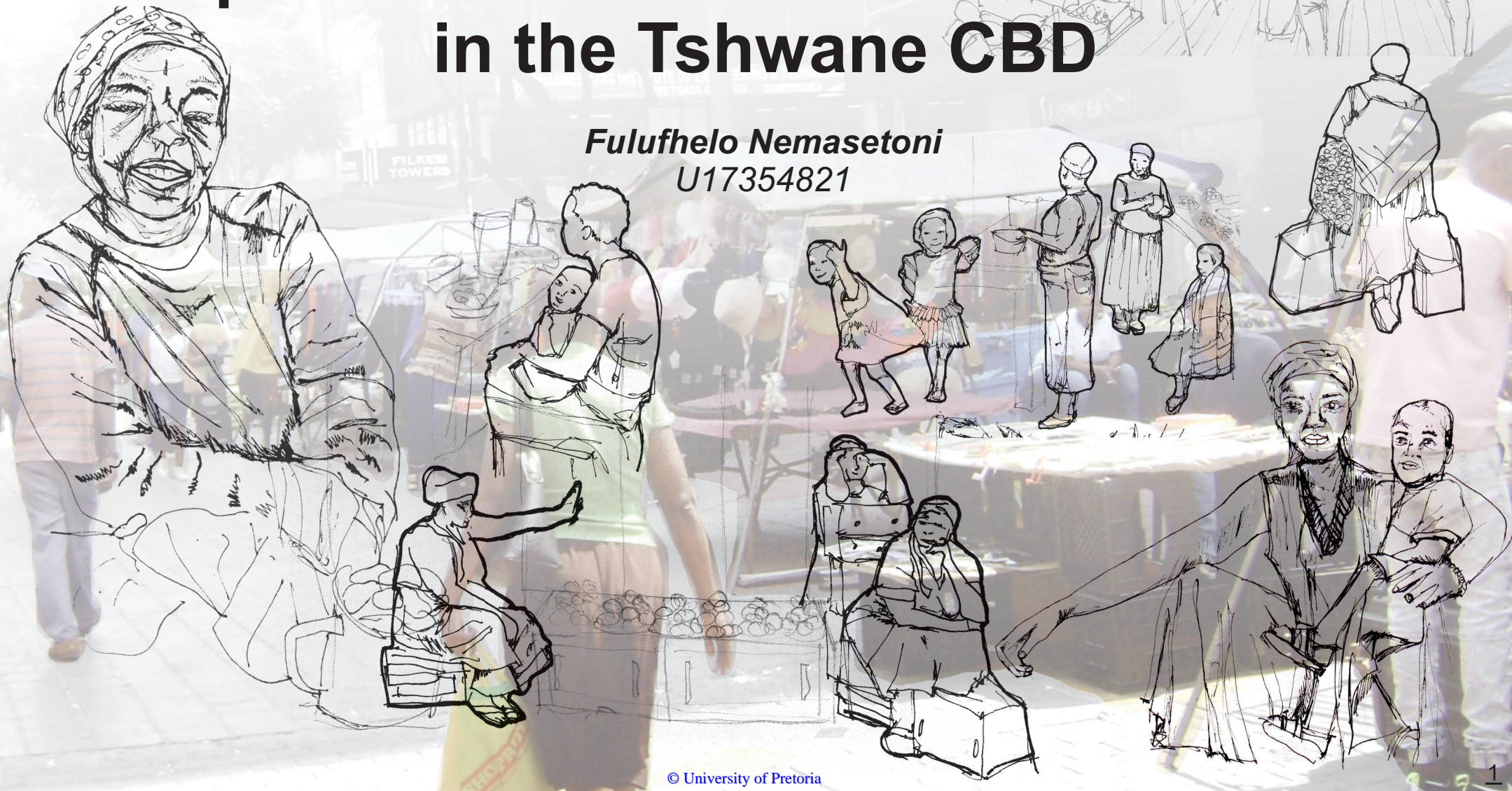


## ARCHITECTURE AS INFRASTRUCTURE

# A Market and Urban Farm for the Empowerment of Women Street Traders in the Tshwane CBD

*Fulufhelo Nemasetoni*  
U17354821



## Declarations

1. I understand what plagiarism is and am aware of the University's policy in this in this regard.
2. I declare that this essay is my own original work Where other people's work has been used (either from a printed source, internet or any other source), this has been properly acknowledged and referenced in accordance with departmental Requirements



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**SIGNATURE**

**15 Novemeber 2021**

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**DATE**

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No part of my thesis has already been, or is currently being, submitted for any such degree, diploma, or other qualification. I further declare that this thesis is substantially my own work. Where reference is made to the works of others, the extent to which that work has been used is indicated and fully acknowledged in the text and list of references provided.

**Fulufhelo Nemasetoni  
November 2021**

Submitted to fulfil part of the requirements for the degree of Master of Architecture (Professional), Department of Architecture, Faculty of Engineering, Built Environment, and Information Technology (EBIT), University of Pretoria

**University of Pretoria, 2020**

## Acknowledgements

Firstly, I would like to thank God for giving me strength to keep going. I would like to thank my family for their continued support throughout my architecture journey. Special thanks go to my husband and my parents.

This dissertation is dedicated to my biggest source of inspiration, my daughter Onalenna. You inspire me to be the best that I can be so that I can be a good example for you.

I would also like to thank my study leader, Mr Cobus Bothma for the great guidance and encouragement. You are much appreciated.

## Dissertation Abstract:

The informal economy is growing at a rate at which the formal economy is failing to accommodate workers and opportunities. This phenomenon can no longer be seen as just a temporary condition.

Although arising from the failure of the formal, the informal could be the way to urban resilience in that it supports and promotes local economies, brings social capital as well income generation. It is adaptable, flexible and always responsive to the current condition using very little, often recycled means.

Women are the most marginalised members of this sector, often being pushed into small-scale survivalist activities due to the many household and childcare responsibilities. Women street traders often have more challenges than their male counterparts such as being seen as easier targets for crime as well as harassment. Mother street traders often have to take their children to work. The aim of this dissertation is for the design of a safe market space for women street traders which also has play learn areas suited to small children.

The concept of architecture as infrastructure was explored in order to design a building that would be a valuable resource in the Bosman Street Station Precinct in the Tshwane CBD. The idea of urban farming in this context was explored as a way to also address the growing food security concerns affecting the poor and vulnerable. The project aims to be an empowerment tool for women street traders.

## Project Details

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<b>Programme:</b>	Informal Market and Urban Farm
<b>Study Area:</b>	Bosmanstraat Station Precinct
<b>Location:</b>	Tshwane CBD

### Client:



Fig 1: A sketch of a mother holding her small child (Nemasetoni 2021)

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# ARCHITECTURE AS INFRASTRUCTURE

## Essay 1: Position and Situation



Fig 2: A Sketch of the Church Street Market (Nemasetoni 2021)



## Introduction

High rates of urbanization have led to the influx of people into the CBD in search of employment, opportunities and a better quality of life. The formal system cannot cater for their needs leaving this new urban community often marginalised having to find other means for survival such as the informal economy, due to its ease of entry and low start-up cost.

The informal economy is growing at a rate at which the formal economy is failing to accommodate workers and opportunities. This phenomenon can no longer be seen as just a temporary condition.

Although arising from the failure of the formal, the informal could be the way to urban resilience in that it supports and promotes local economies, brings social capital as well income generation. It is adaptable, flexible and always responsive to the current condition using very little, often recycled means.



Fig. 3 Sketch of a woman migrating to the city (Nemastoni 2021)



## General Issue

It is important as the researcher to understand what is deemed as informal. The word itself implies that the informal is a reaction or some kind of deviation from the formal but in a negatively connotative way. In the South African context, it can be said that, the informal is somewhat unwanted and is seen as arising from the failure of government to develop the formal economy to accommodate its citizens. This view suggests that the informal sector should diminish as more development and economic growth takes place.

Informal businesses include street trading, hawking, various production, services and construction. According to research, street trading is the biggest informal trading industry constituting 41.5 % of the informal economy. Although informal businesses are often unregistered and unregulated, they contribute millions to the economy. According to stats SA the informal economy provided 5,2 % of the total South African GDP in 2015.

This shows that the informal sector is important and an integral part of the overall economy and is a way in which the poor often marginalized people of the country can be active participants in the economy. Thus, more efforts must be made to properly understand this sector in order to accommodate it spatially as well as in economic policy and law making.

When dealing with informality, law makers and planners often have the goal of either “formalising the informal”, (2018) restricting activities of informality or investing in the formal in attempt to absorb the people in the informal sector. The fact is that South Africa is a developing country and as long as this is the case, informality will always take place .

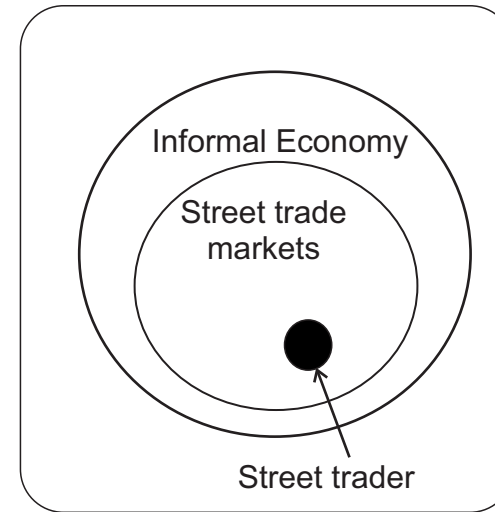


Fig. 4 An image showing the position of the street trader within the informal e e economy (Nemasetoni 2021)



Fig 5. Infographic showing the value of the informal economy in South Africa (StatsSA 2019)

## Urban Issue

Most activities in the informal economy take place on the city streets and other public areas. Empty sidewalks along a busy pedestrian route or close to urban infrastructure such as transport nodes provide opportunity and easy access to market.

These street markets are growing at a very fast pace and are fast becoming the normal street condition as seen in the diagram. Research shows that government does not offer effective support to the informal economy. Street markets have a big impact on the urban morphology and legibility in the CBD and thus must be planned and designed for.



Fig 6. A sketch of street trader's structures on Sisulu Street in the Tshwane CBD (Nemasetoni 2021)



Fig 7. An image showing street trade in the CBD (Nemasetoni 2021)

## Urban Issue (How street trading affects how people experience the city):

Street Trade has an impact on our urban experience of the CBD and there are some positive and negative perceptions:

Fig 8. Image showing the positive aspects and negative perceptions of street trade within the CBD (Nemasetoni 2021)

### Negative Perception



Seen to destroy the character of the area.



Streets become dirty with litter and other wastes.



Unhygienic Environments. Sidewalks can become congested with obstruction to pedestrian flow.



**\* As a result of street trade activities being disregard and not accomodated and planned for In the Tshwane Municipality SDF plan.**

### Positive Aspects



Provide Passive Surveillance on Sidewalk and other Public Spaces



They provide employment or 'space' for the very poor who are often marginalized in the city.



Supply of affordable goods such as food and other products in an easily accessible and convenient way saving pedestrians time.



Increase in social interaction aiding in the creation on a sense of community.



They bring public life and increase activity on the streets of the City.



They add to the character and sense of place.

## **Research Questions & Methodology:**

How can Infrastructure become architecture that facilitates and supports the activities of the street trade industry as well as act as a catalyst for its development in the Tshwane CBD?

### **Research Sub questions and Intentions**

1.4.1 What are the needs of the street trade industry and what types on infrastructures are needed for its development?

1.4.2 What is Architecture as Infrastructure. How can Architecture function as infrastructure and vice versa?

1.4.3 What lessons can be learnt from the existing street markets that can inform the type of architecture and infrastructure needed?

1.4.4 Case Study Analysis. What lessons can be learnt from existing projects that cater for the informal economy and the street trader?

### **Research Methodology**

The research will be focussed on analysing street trade activities in various scales ranging from an overall understanding of the street trade activities within the CBD, street trade markets as well as the street trader him/herself. This will be a qualitative study. The main methodological framework will be that of the ethnographic study. This methodology was appropriate for this study in that it allowed direct interaction with the phenomena being investigated. Detailed information is extracted through analysis of collected data. The data collected should provide detailed accounts describing the entity's behaviours and experiences over a set period of time. (LeCompte & Schensul, 2013:12-16)

### **Data Collection**

The primary data is collected by the researcher on site in the form of field notes, interviews and observations and this information can be extracted graphically through drawings and photographs. On site sketching and photography will be the main method used by the researcher. This will be guided by methods detailed in architectural graphic anthropology which aims to merge the two disciplines, namely, architecture and anthropology, to explore a new kind of understanding between social and spatial contexts. This involves observation of participants to understand the social interactions between users and between users and the spaces they occupy. The data uses principles of inscriptive practices such as orthographic, architectural drawings (plans, sections and elevations) as well as sketches which are then analysed to uncover more meaningful and diverse understanding of people and the built environment. (Lucas, 2020:14)

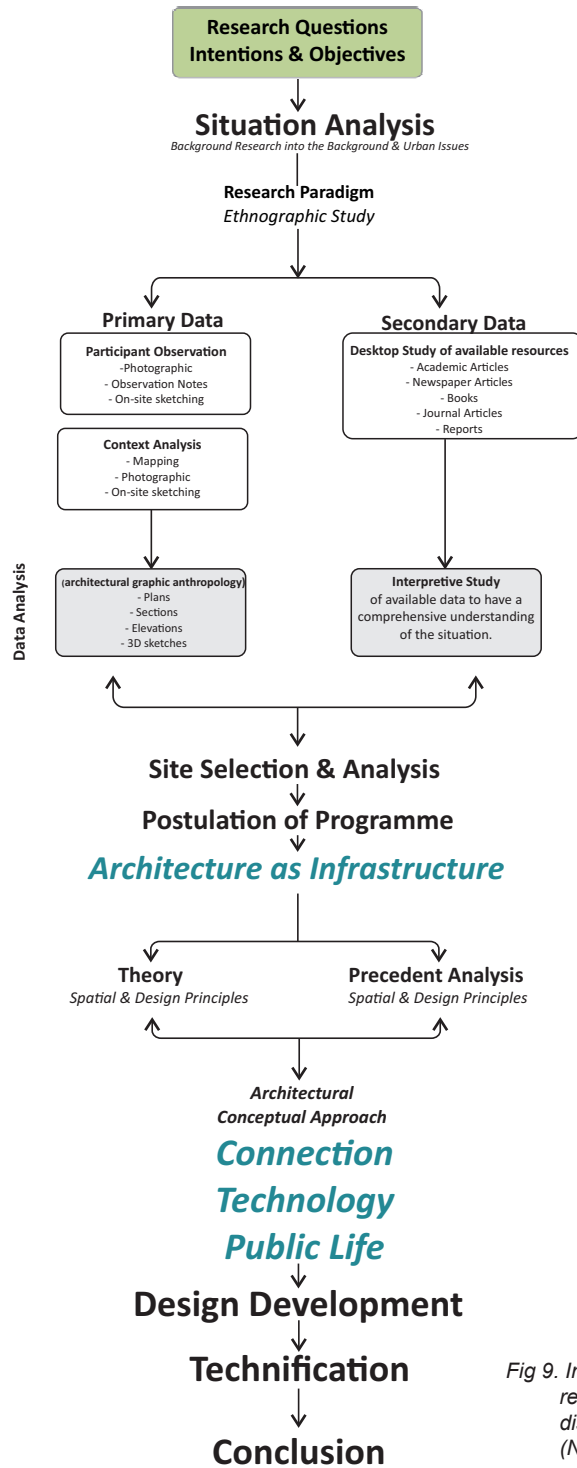


Fig 9. Image showing diagram of research methodology and dissertation research plan (Nemasetoni 2021)  
© University of Pretoria

## Relevance of Study:

The projects intention to be an intervention that aims to empower the most vulnerable group in the street trade community, namely women. Due to this intention, spatial justice theory be used as a normative position as well as the framework for the study.

Spatial justice can be described as a way of distributing space in a way that is equitable. It is a theory that essentially an 'analytical framework' use to investigate how justice and injustice are represented spatially and geographically. (Dufaux, 2009:3-5) By looking at the city through a spatial justice lens, one can ascertain where injustices exist and what strategies can be implemented to undo these injustices.

The aim of spatial justice is to strategize how space can be distributed and planned to ensure that all have access to this valuable resource. In order to achieve this, advantage must be given to the poor. The least advantaged, most vulnerable and marginalised must take priority in city planning. Spatial justice must be prioritized in the planning of the post-apartheid city context as a means to undo the discrimination, segregation and marginalization of the poor and vulnerable groups in South African society. Spatial justice becomes more of a process to facilitate the undoing of apartheid planning principles that still perpetuate inequality and exclusion in the capital city, Tshwane CBD.

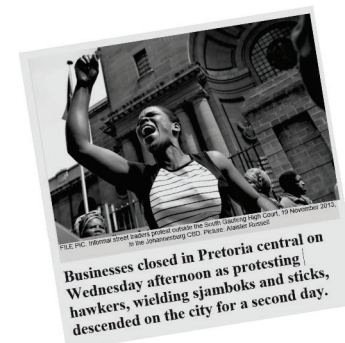


Fig 10. Image showing newspaper cutouts showing some of the challenges street traders are faced with on a daily basis (Nemasetoni 2021)



## Street Trading in the Tshwane CBD (Mapping Data):

Street trading were mapped during a walkthrough of the CBD and this was documented as seen in fig11. This mapping also shows how street trading happens in most areas of the city with higher intensity street markets located within close proximity to important economic, institutional and educational nodes.

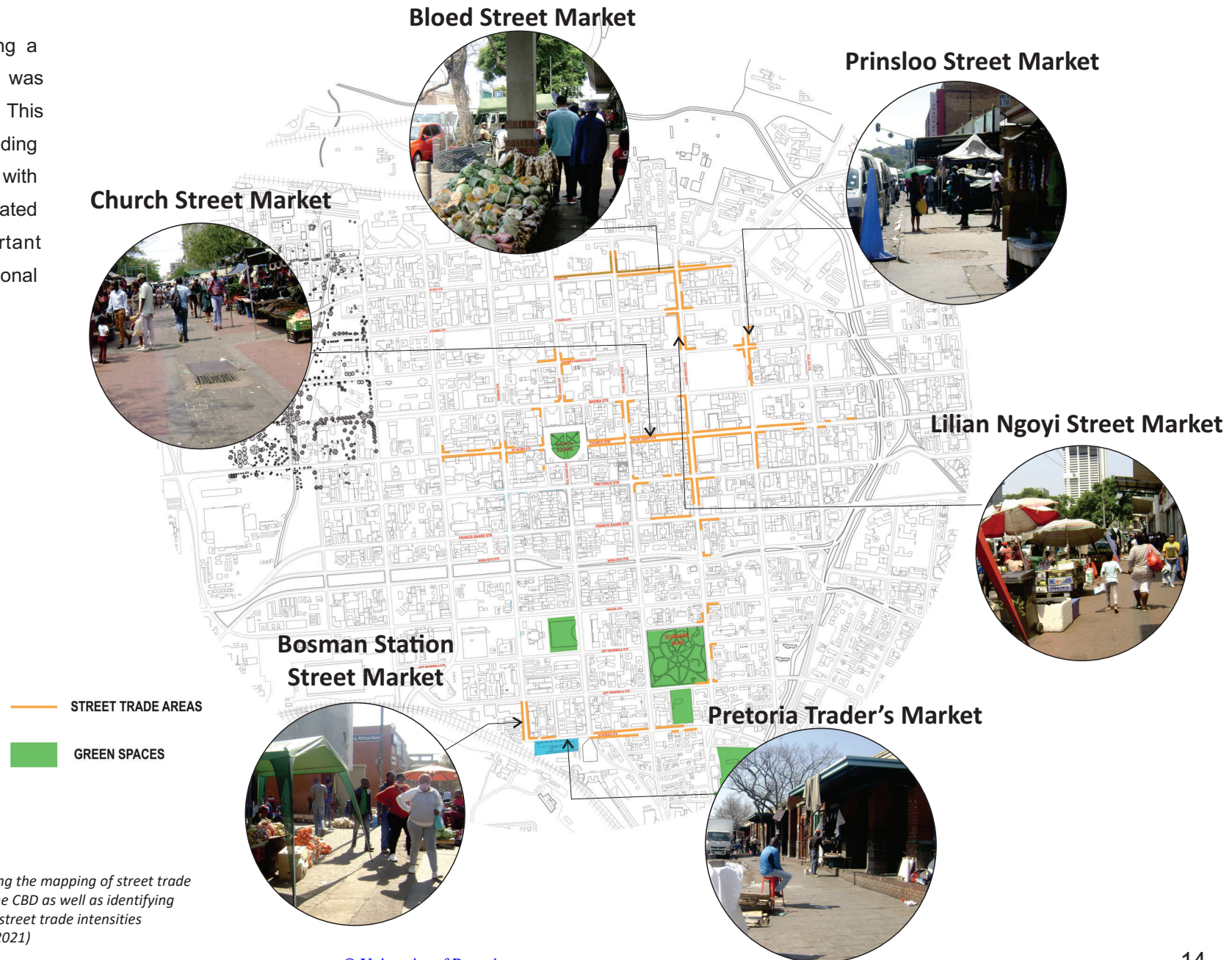


Fig 11. Image showing the mapping of street trade activities in the CBD as well as identifying areas of high street trade intensities (Nemasetoni 2021)

Street Trading in the Tshwane CBD (Mapping Data):

**An Architectural and Graphic Anthropological Study of 6 Informal Street Markets in the Tshwane CBD**

**1. Threshold**

*Architect Herman Hertzberger describes the threshold as being the space that 'provides the key to the transition and connections between' two different spaces with different spatial qualities.*

- **Quality of interactions/ Interactions**
- **context**
- **Space that allows for 'negotiation, display and demonstration.'**
- **Spaces of communication**
- **Spaces of illegality and informality and the legal.**

**2. Temporality**

*Analysis of permanent and temporal zones in the space and the transition between the 2.*

*How temporal spaces are 'constructed' and unassembled.*

**3. Mobility and Circulation**

*Analysis of permanent and temporal zones in the space and the transition between the 2.*

*How temporal spaces are 'constructed' and unassembled.*

**4. Practice/ Skills**

*Network of spaces connecting sites of production with those of negotiation.*

**5. Territory**

*How spaces/ boundaries are defined and articulated.*

- *Study of Boundaries*
- *Study of surfaces*

**6. Materiality**

*Analysis of creative use of materials.*

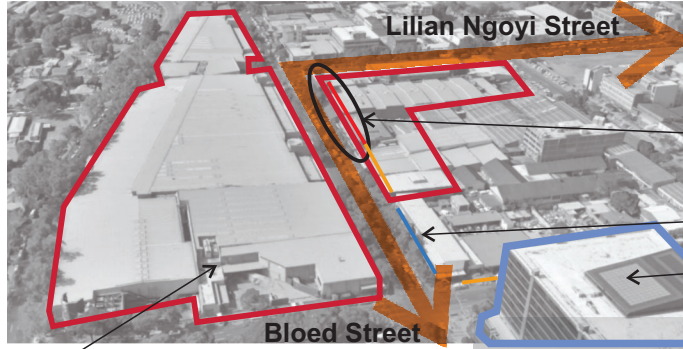
- *Analysis of what materials are used.*
- *Where these materials are sourced.*
- *The lifecycle of these materials*

**7. Links between Formal and Informal Economic Spaces**

*Analysis of context and how the informal street markets are located in relation to formal economic spaces on a macro and micro scale*



# 1. Context: Formal & Informal



**Secondary Anchor**  
 - Street is a major access route and main economic street in the city.

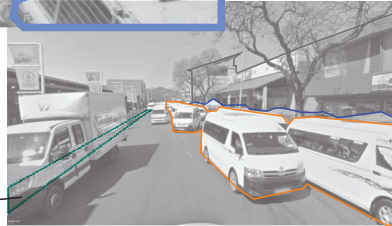
- Active edge/ more openings to formal shops. More informal activity is present.

- Closed built edge, less activity.

**Major Institutional Building**

**Bloed Street Mall:**  
 Main anchor  
 - Major economic space  
 - Transport infrastructure. (Major Taxi Rank)

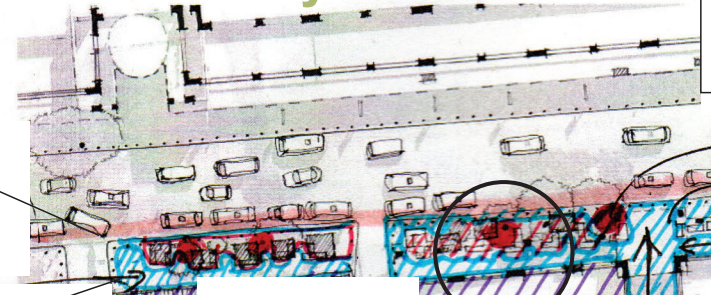
Informal Activity is prohibited on this edge due to mall surveillance and pavement



# 2. Threshold



# 3. Territory & Circulation



Common Spaces for informal traders

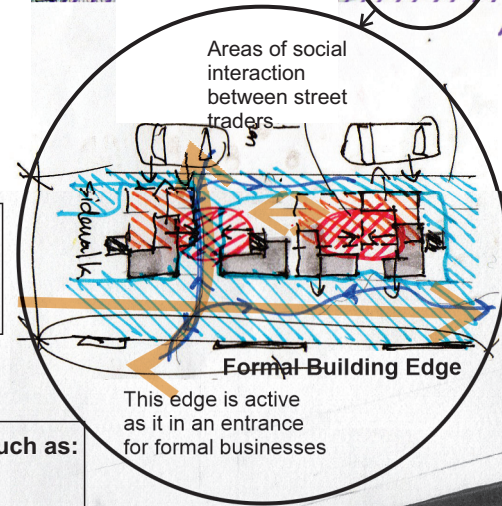
Spaces for social interaction.

Trade organized around formal entrances

Street edge is a waiting area for commuters

The sidewalk is no longer a linear element but becomes organic

Wayfinding/Walking becomes more organic where one has to weave themselves through the urban

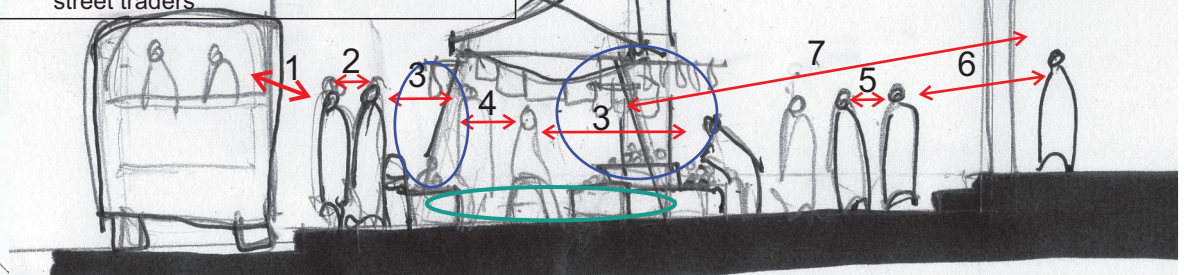


**Formal Building Edge**

This edge is active as it is an entrance for formal businesses

# sections

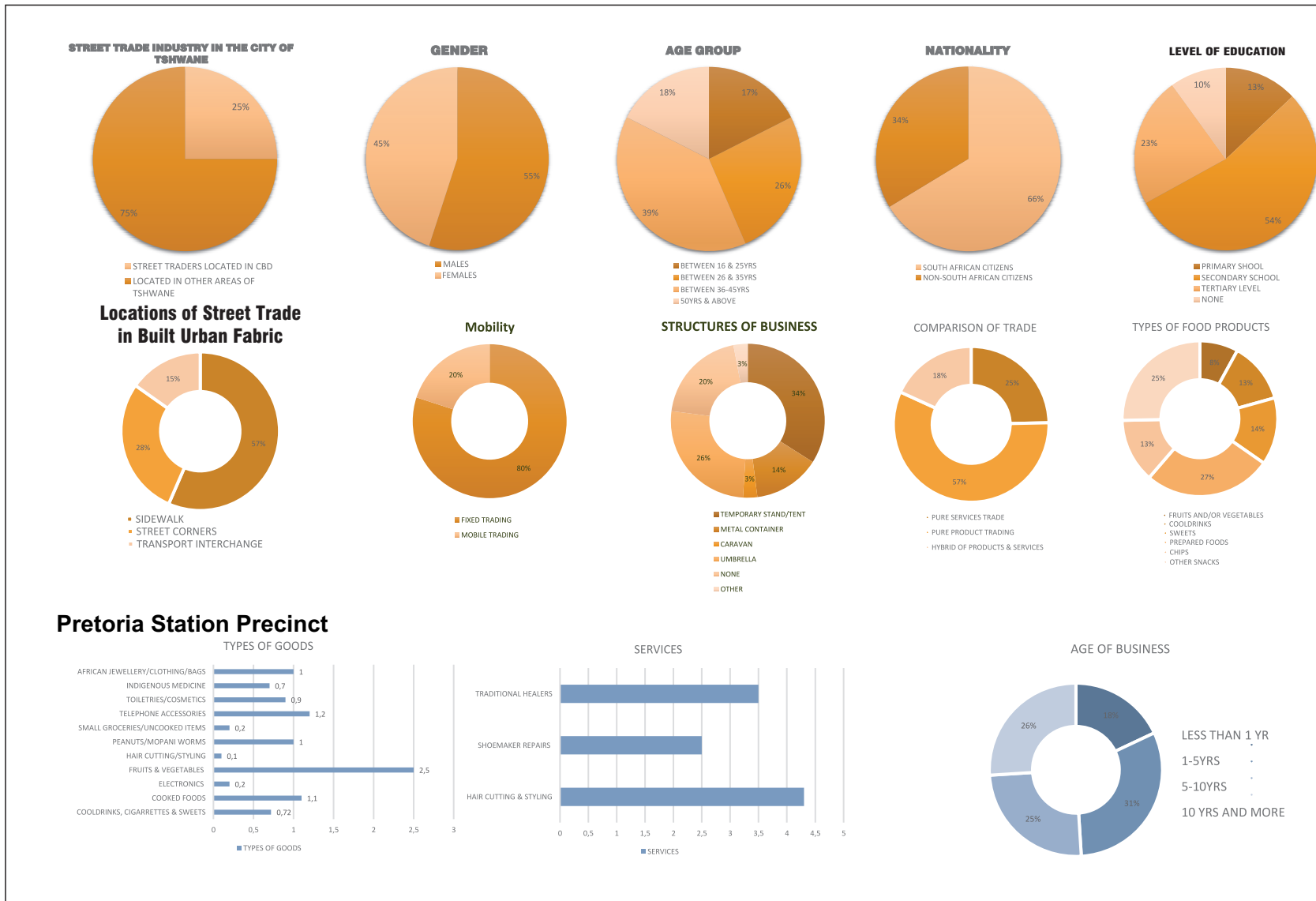
- ↔ **Various Social Interactions occur such as:**
1. Between commuters and drivers
  2. Between commuters
  3. Between commuters and street traders
  4. Between street traders
  5. Between persons in urban communities
  6. Between customers and formal business owners
  7. Between formal business owners and street traders



Essay 1

Fig 12: This is an image showing a sample of the data collected during the street trade mapping and analysis of spatial qualities (Nemasetoni 2021)

## Types of Street Trading in the Tshwane CBD Demographics:



**OPPORTUNITY FOR BUSINESS SKILLS TRAINING,**

**NEED FOR BASIC LITERACY SKILLS (ADULT EDUCATION)**

**ONLY 7% HAVE ACCESS TO ELECTRICITY**

**83% OPERATE FROM TEMPORARY STRUCTURES.**

**97% HAVE NO FORMAL TRAINING.**

Fig 13. An image showing graphs of street trader demographics in the Tshwane CBD as well as the Pretoria Station Precinct (Nemasetoni 2021)

## 1. The survivalist

Activities are started to generate income for an immediate need or not being able to find employment. It's seen as a temporary measure as a means of survival until employment becomes available. In order to best assist this type of street trader, there must be a focus on improving their standard of living and thus their welfare needs. There needs to a focus on making basic needs such as food, health services and ablutions accessible.



## 2. The self-employed

Persons in this sector have skills and are able to offer a service such as cooking, shoe repair and sewing but are unable to find employment in their fields. They have very little start-up capital to open a formal business. This type of trader would need more intervention aimed at improving their skills so that they can offer better services or produce better products. Skills such as business and financial management would also be beneficial.



## 3. Micro-enterprise

These enterprises have potential to grow and contribute to the overall economy. These are often linked to emergent markets. Persons in this industry choose the informal sector due to low start-up costs and less regulations and restrictions. This type of street trader would need access to business and entrepreneurship management training as well access to affordable spaces to trade and services such as water and electricity.



According to Rogan and Skinner (2018), 73% of street trade activities are survivalist and 27% micro-enterprises who have growth potential and intention.

**There are also other people who play an important supportive role to the street trader and industry.**

**These include the following:**

### 1. Trolley Transporters

People who use wheel barrows, shop trolleys and carts to transport goods from storage spaces to the trader and are paid a fee for this service by the trader.



### 2. Security Guards

Safety is seen as an "economic necessity" due to the fact that crime scares prospective customers and tourist. It also hinders good trading if the trader and their goods are also at risk. Some traders pay 'security guards' to guard their trading areas as well as overnight storage areas. Costs are often shared amongst a community of traders in the same area.



### 3. Drivers

These are persons who own taxis and bakkies who have a business agreement to transport traders to areas such as pension pay points or from places where they buy stock.



## Focus on Women Street Traders Challenges:

According to research, black women make up the majority of street traders in the informal economy. The most vulnerable group in the street trader community is women. (Berry , 2009:14) Because of the high rate of unemployment, women have been found to participate in more survivalist informal street trading activities that are less profitable keeping them stuck in a cycle of poverty, vulnerability and marginalisation. This is because female street traders often have more roles and responsibilities than their male counterparts, such as being the primary caregiver of children as well having more responsibilities in the household. Male street traders can be seen to have more advantaged and often make more from informal street trade activities than their female counterparts.

As mentioned before, the intention of this dissertation is to use the theory of spatial justice as a lens of enquiry. Women will thus be the focus of the study as they are the most vulnerable group as well as being a group earmarked for economic empowerment in the country.

### Challenges faced by female street traders

#### 1. Household and Children Responsibilities

Women street traders often do not have access to affordable childcare services due their low income. Street trade working hours are very long beginning very early in the morning and ending late. Most creches do not operate at these hours and many women street traders have to take their small children with them to work. This poses many risks to the development, health and safety of small children in these situations. (Berry , 2009: 14)

Women have more household responsibilities and also spend more time doing

household chores such as cooking and cleaning which gives them less time to trade and grow their businesses than male street traders.

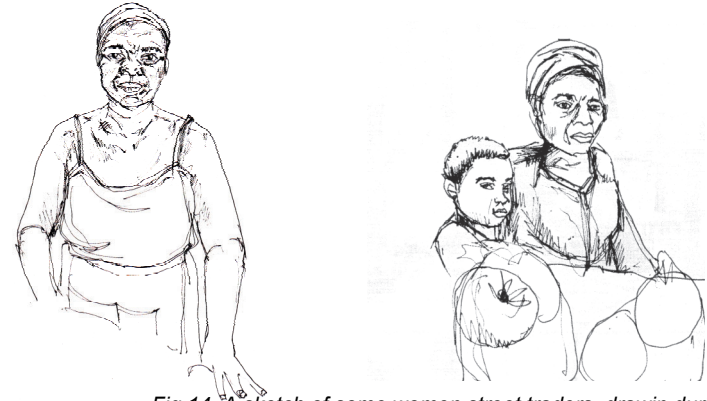


Fig 14. A sketch of some women street traders drawn during mapping of the existing street trade market on Scheiding street (Nemasetoni 2021)

#### 2. Legislation

Women are more affected by poverty than any other group in that they are seen to have lower positions in society due to the patriarchal nature of South African Society. According to Berry, most government departments are already under resourced and thus cannot address challenges specific to women. There is also little legislation and policy that aims at protecting women in the informal sector in the economy. (Berry , 2009:15)

Government interventions are not adequate to accommodate the increasing number of street traders and in some cases create more problems than they solve. This can be seen in the case of the recently built Bree Street Traders Mall which only caters for 500 street traders. It was found that there were thousands of street traders in the Johannesburg CBD who were not accommodated for in the project. The excluded traders became displaced and faced more

## Focus on Women Street Traders Challenges:

harassment from officers as a result of having to operate outside of the trader's mall. (Berry , 2009:16)

### 3. Funding

Informal businesses get no assistance from the formal finance system that is more in support of formal big business. Informal traders find it difficult to access capital from banks which makes it very hard to grow their businesses. This also due to the lack of assets that can be used as surety to be able to access credit. This affects women more in that woman often have to spend more of their earnings on the household needs more than their male counterparts. It has been found that men spend 3x more capital to start their businesses than women are able to making them more disadvantaged by being more underfunded. (Berry , 2009:20)

### 4. Lack of Infrastructure

The lack of infrastructure affects both male and female street traders alike. This includes the lack of weather protected trading areas and structures available at strategic areas such as around transport interchanges and places with public spaces with high foot traffic. There is also a lack of basic services such as clean water, electricity, toilets and waste management in public areas. This affects women more in that lack of hygienic basic services affect women's health more.(Berry , 2009:23)

Due to their physical limitations, women are not able to carry as much goods as men can. Transport costs are also very high which causes women to sell smaller less profitable goods than their male counterparts

### 5. Crime and Harassment

According to Berry, women are more affected by crime than men. This is due to women being more vulnerable and seen as easier targets. South Africa still has high rates of gender inequality with more women being victims of gender-based violence than men. Women also face more harassment from law enforcement officers. (Berry, 2009: 23)

The support and development of the street trade industry in South Africa has the potential to become a viable instrument that can be used to improve the lives of marginalised women by empowering them economically as well as socially.

The approach should be that of enablement and support, as opposed to regulation and control. Interventions should be aimed be very diverse to cater to the diverse needs of this very diverse sector. It is imperative that the researcher has an understanding of the different types of street trader as well as their reasons for entering the informal economy.

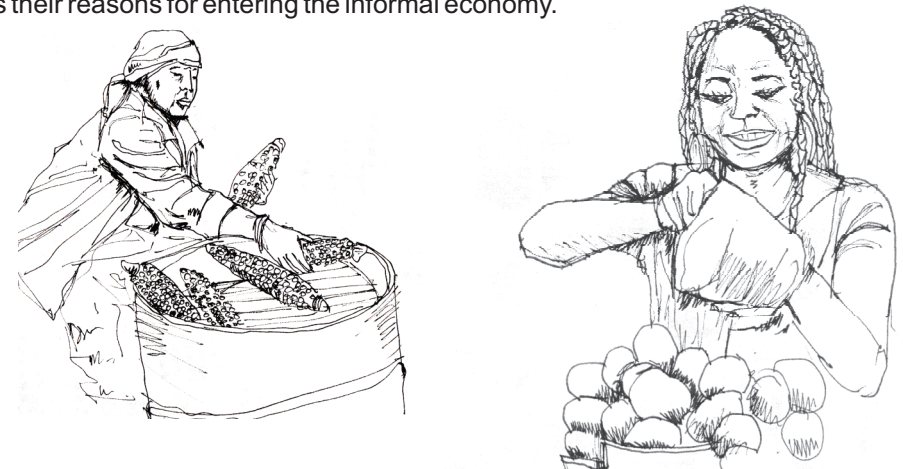


Fig 15. A sketch of some women street traders drawn during mapping of the existing street trade market on Scheiding street (Nemasetoni 2021)

## Site Selection Criteria

There are certain criteria that make a space more conducive for street trading. These include the following:

1. Close proximity to public transport node or area that has a high number of daily commuters passing by.
2. High foot traffic area.
3. Places of historical or cultural importance that could attract tourists.
4. Spaces close to other major formal economic nodes such as a major shopping centre.
5. Possible access to public ablutions and water.
6. It was also important that the area already have existing informal trading.

## Site Possibilities:

### 1. Madiba Street Market Precinct



### 2. Boom Street Precinct



### 3. Bosman Station Forecourt and Precinct



## Final Site Selection

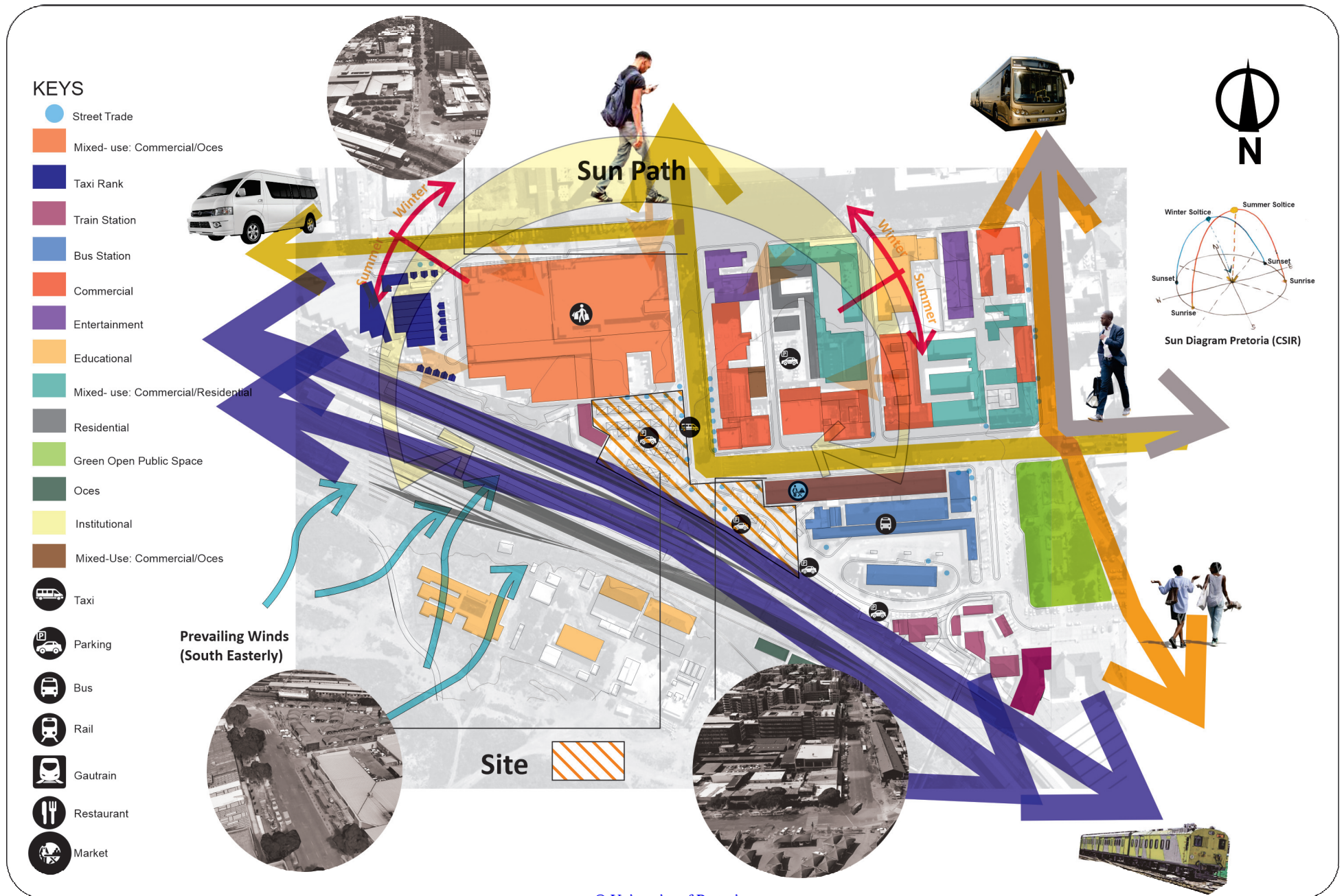


Option 3 was chosen in that it possesses all the criteria as well as a good level of complexity and varying urban conditions that one can respond to. The chosen study area is the main and biggest transport node and interchange in the CBD with a wide variety of public transport of varying scales and types and user groups making it one of the most diverse and vibrant areas in the CBD. Transport modes in close proximity to the site:

1. Pretoria Train Station
2. Bosman Train Station
3. Bosman Taxi Rank
4. Reya Vaya Rapid Transit Bus (various bus stops in close proximity)
5. Gautrain Station

Site Analysis:

Fig 16. Image showing site analysis (Nemasetoni 2021)



Site Selection:



Site  
Study Area

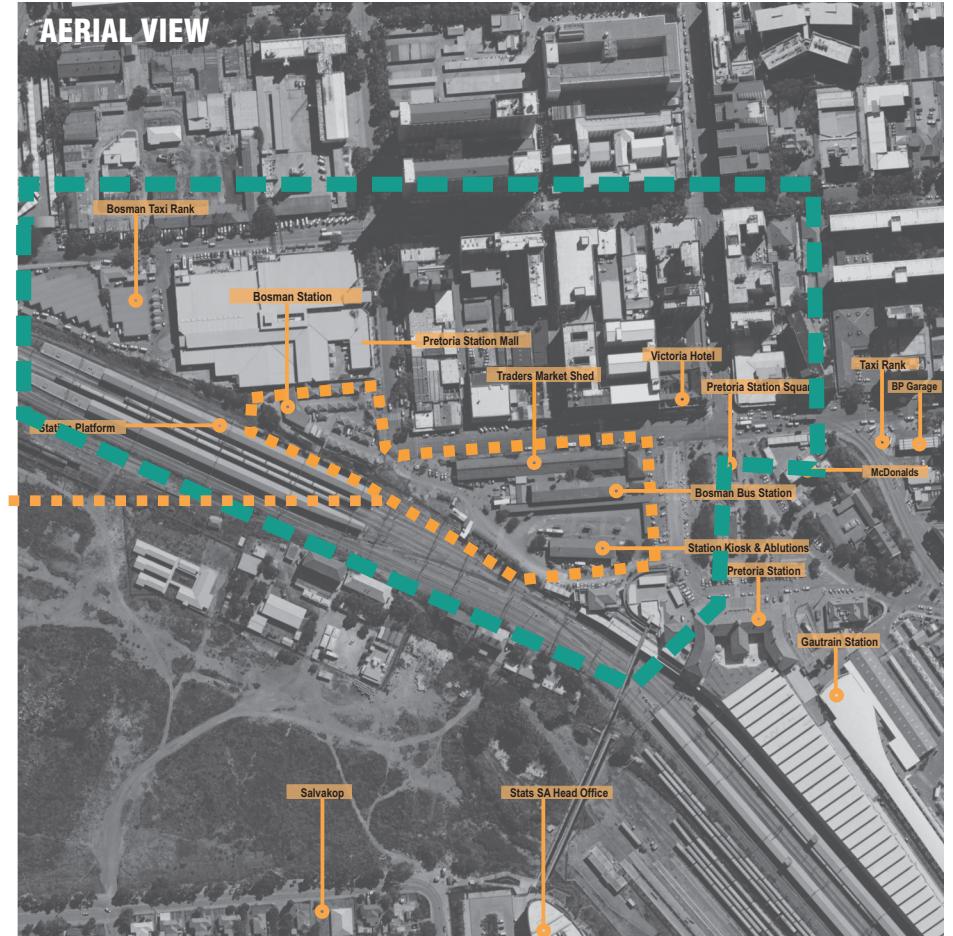


Fig 17 Image showing selected site (Nemasetoni 2021)





## Bosman Station Precinct Collage



Fig 17. Image showing study area collage (Nemasetoni 2021)

### The Study Area: The City's Southern Gateway

This area is known as the 'southern gateway' and is the main entrance or threshold space into the Capital City from the south.

The study area is along the train track from the Bosman taxi rank to the area just before the Pretoria station forecourt and building. The site will then extend up Paul Kruger Street to Bosman Street and then back to the Bosman Taxi Rank.

The main infrastructure will be located in the Bosman Train Station Forecourt, which is currently a parking space. This building will extend into the existing Pretoria Station Informal Market building which is a heritage building. This building will be part of my intervention and will be redesigned while maintaining its heritage value.

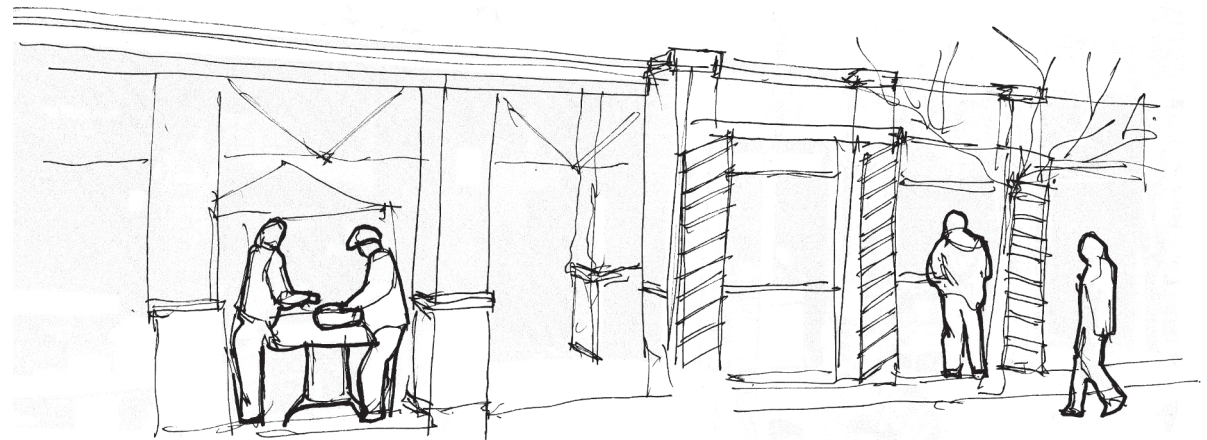


Fig 18. Sketch of study area activities on Scheiding Street (Nemasetoni 2021)

## Site Analysis:

### Vehicular Roads and Parking Areas

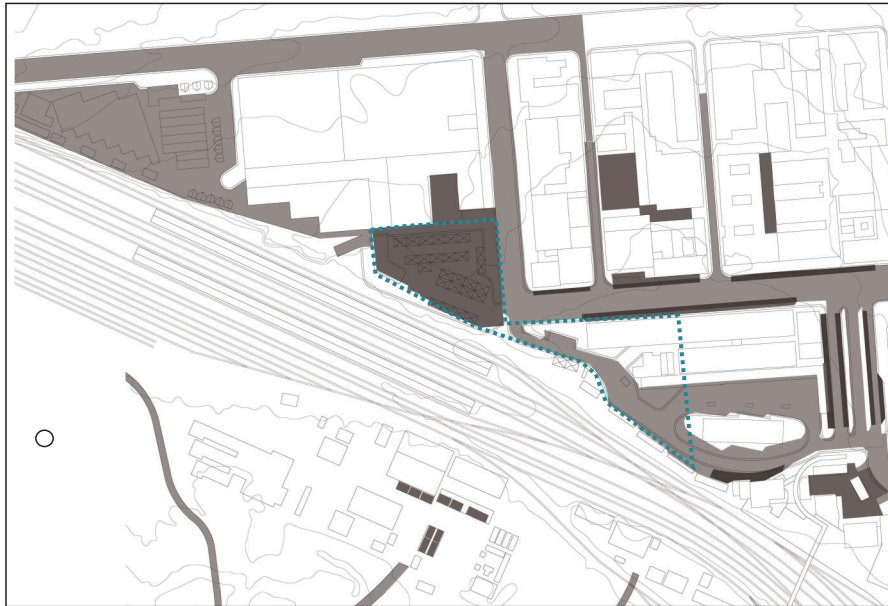


Fig 19. Parking and roads in the study area (Nemasetoni 20210)

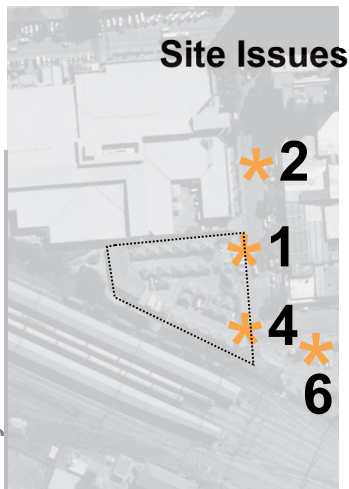
The site is currently used a parking space for metrorail employees. Most of the roads have sight parking bays along them. Because of the high number of public transport modes available, users of the space are predominantly pedestrians. The high number of vehicles in the space makes it an uncomfortable and unsafe reducing activity along the sidewalk. Visibility and navigation is affected.

### Pedestrian Routes Mapping



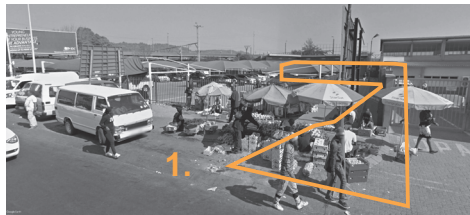
Fig 20. Mapping of pedestrian routes (Nemasetoni 2021)

Most pedestrian movement happens along informal routes mainly from important nodes to Pretoria Station, Bosman Station and Bosman Taxi ranks. Other important pedestrian movements happens to the Pretoria Station mall which is the most important economic node in the area and along Bosman Street. Other important pedestrian movement magnet is the traders market which houses a cooking and eating area which is active especially during lunch hours.

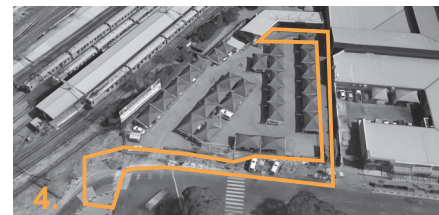


### Site Issues

#### 1. Lack of Connection

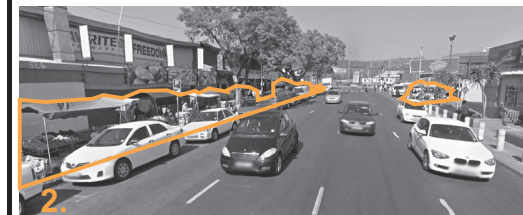


- Between transport nodes



- Between the CBD and Salvakop  
- Between 'Southern Gateway and important nodes and landmarks.  
© University of Pretoria

#### 1. Lack of support for street traders & informal economy



-Lack of services such as water, electricity, sanitation and waste disposal.

## Main Transport Routes, Bus and Train



Fig 21. Image showing main public transport routes in the study area (Nemasetoni 2021)

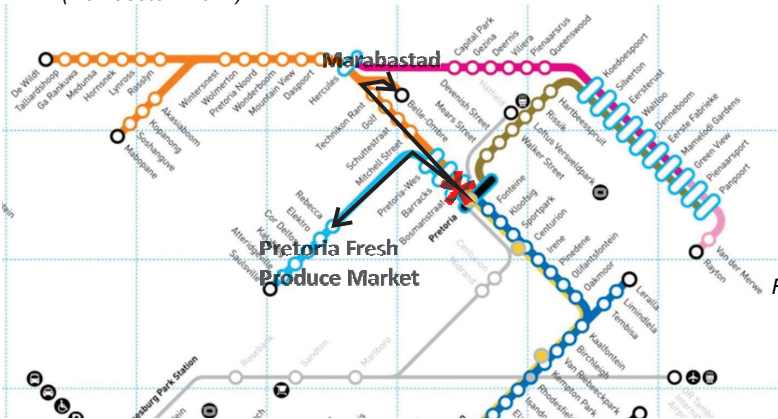
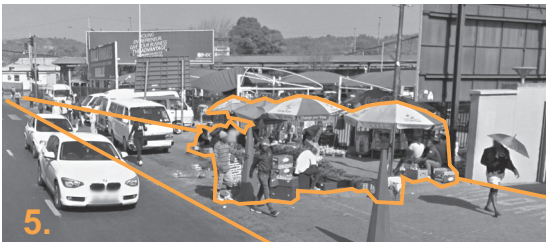


Fig 22. Image showing the mapping of trees and green spaces in the study area (Nemasetoni 2021)

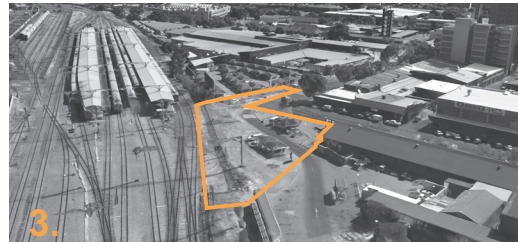
Green areas are limited in the area. Spaces between buildings is often unkept and becomes wasted space and making the precinct look unpleasant and dirty. There are trees and this area but these can be increased to have more shaded public spaces in the area with seating provided to create pause spaces for the various employees who work in the area.

Fig 24 Image showing where Bosman Street Train Station is positioned within the Tshwane Rail Network (Nemasetoni 2021)

## Lack of Public Space for Public Life



- Lack of adequate structures in appropriate areas.
- Lack of spatial planning and demarcated informal trader areas.
- Lack of financial, technical and administrative support and training.



- Many left over/open spaces in the city that are not programmed and left unkept and become hotspots for crime and other illegal activities.

## Heritage Building (Older than 60yrs)

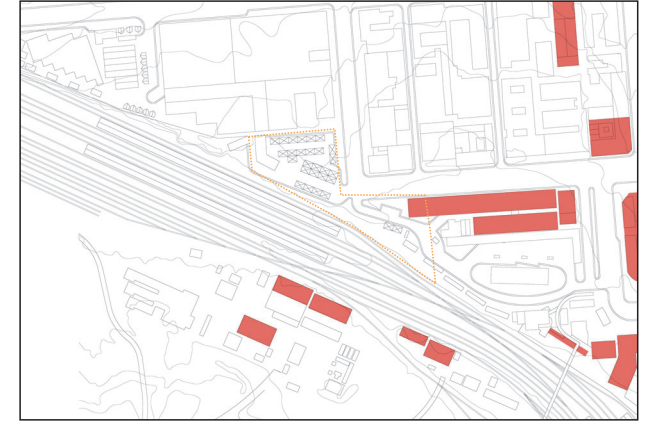


Fig 23. Image showing building older than 60yrs in the study precinct (Nemasetoni 2021)

There are some heritage buildings in the precinct that are very valuable in terms of the history of the CBD. There is very little navigation and info points about these buildings.

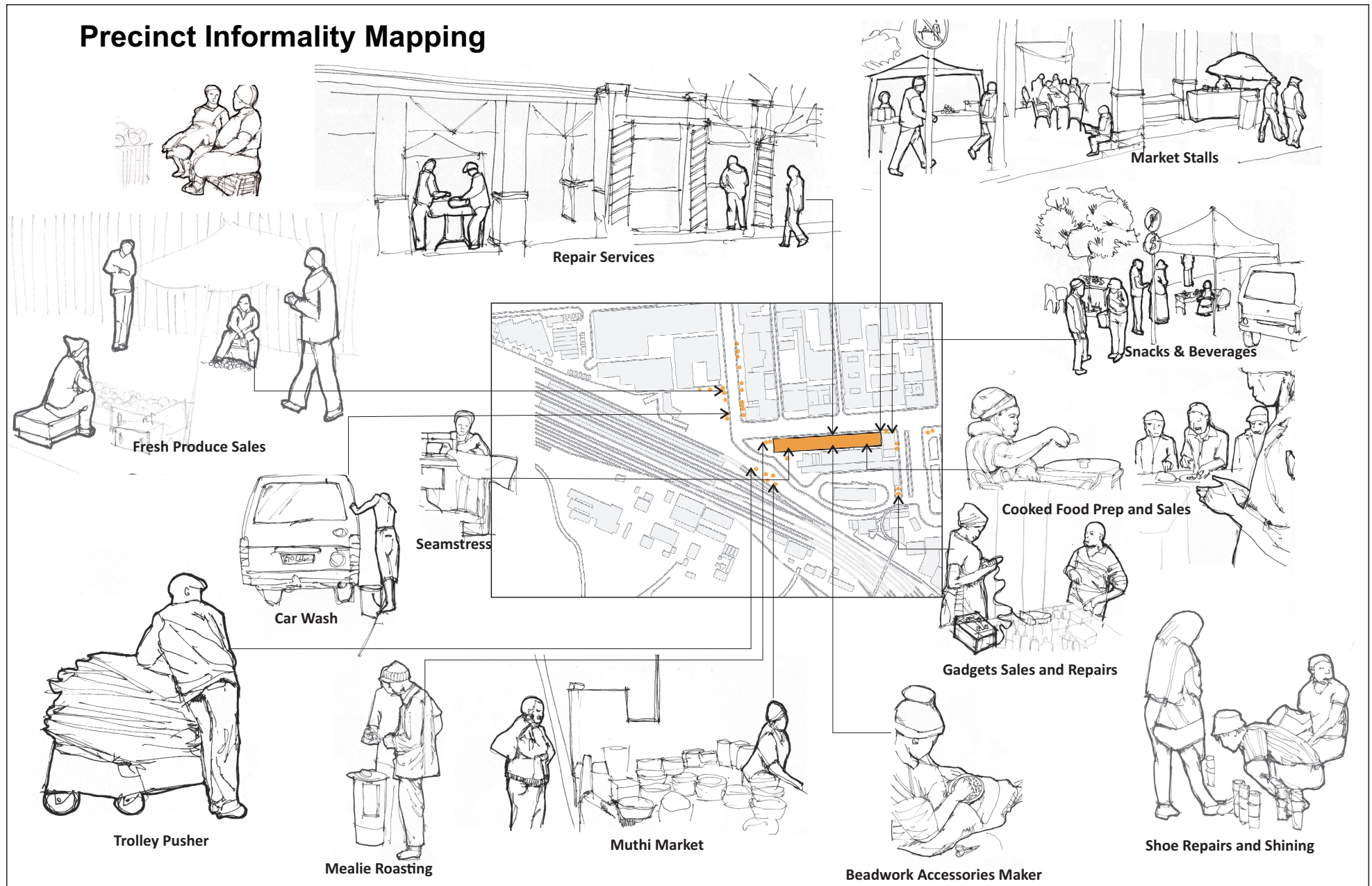
Areas around these heritage sites are developed as public spaces that cater to tourists.



- These areas are wasted space and have potential to become valuable and needed public space and add to public life and community in the CBD.
- LACK OF PUBLIC LIFE/ CULTURAL SPACE IN THE PUBLIC REALM

Site Analysis:

Fig 25. Image showing the mapping of street trading in the study area (Nemasetoni 2021)

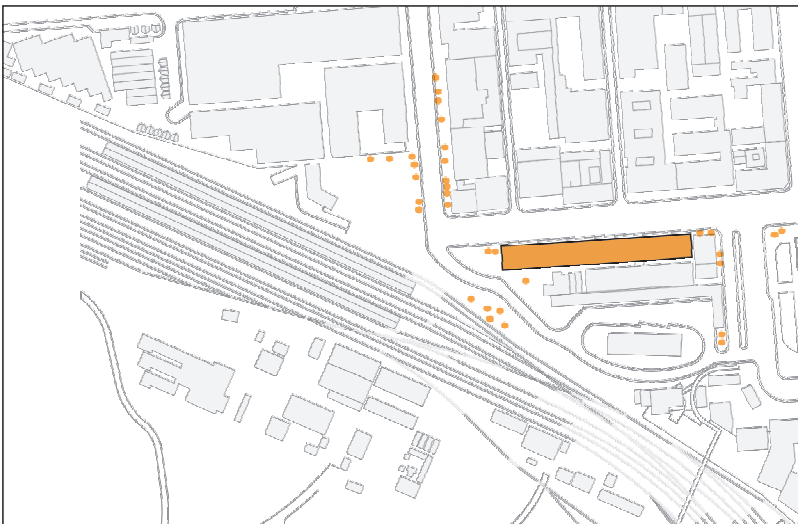


# Connection between formal and informal Trade networks

This area is very important in the informal economic system of the CBD. Firstly, it has the biggest and one of the few informal trader market in the City of Tshwane. The precinct has direct connections to areas such as Marabastad and Pretoria West where Informal traders mainly source their goods.

The existing rail network makes this area very connected to important surrounding areas and also reduces transport costs for informal traders due to the low rail fare to where they source goods and also where they live.

Informal trade has become an integral part of the urban environment in this area and is a destination area especially for urban and surrounding dwellers looking for goods and services not available in the formal market such as muthi (traditional African medicines), indigenous dishes and delicacies and ingredients such as mopani worms and morogo. Other services include barbers, seamstresses, shoe repairs and even car parts and repairs. The informal economy is very important as it responds the immediate needs of the market and can even cater to niche markets and a more diverse specific kinds of people from differing cultures and backgrounds.



## Formal Traders

Main formal trading happens along the southern end of Bosman Street. Most of these are retail stores selling clothing as well as small household wares. Thresholds (pavement areas) become spill out areas where goods are displayed to attract more customers into the shops.

The major formal trading happens in the Station Mall which contains many of the formal supermarket and retail chains in South Africa.



## Informal Traders

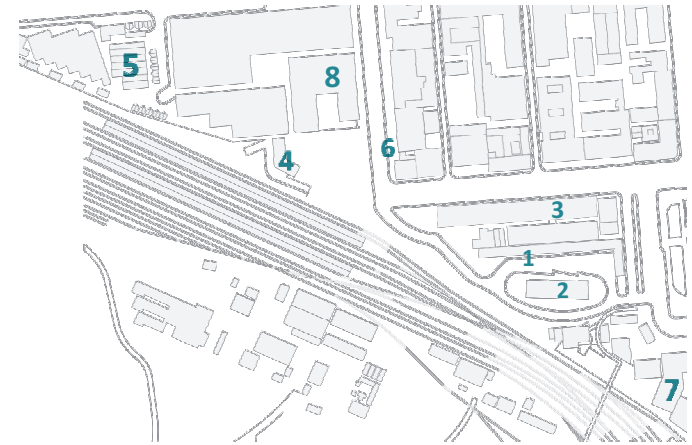
Informal traders in this area constitute 21% of all informal traders located in the CBD. Most are located in the traders market building and its edges due to this being a destination for those seeking products found in the informal market.

Other informal traders are located along both formalised and informal high pedestrian movement paths. Others happen along the main streets creating a secondary street market along the formal shops located along the main roads.

Walls, fences, pavements and other existing infrastructure become appropriated using temporary structures to create stalls and markets.



# Existing Infrastructure: Built Form



## 1 Important Public Transport Infrastructure:

**Bosman Long Distance Bus Station:**  
This is the main bus station into Pretoria from all areas of the country. This space is not adequately designed as it lacks public seating and amenities for the waiting commuters.



## 2 Formal Economic Infrastructure: Bus Station Building 2

This building houses some ticket offices for the bus station as well as a restaurant and restrooms. These, however, are often left un-maintained and inaccessible.



## 3 Informal Economic Infrastructure: Pretoria Station Informal Market Shed:

A refurbished workshop houses the informal market. The Heritage architectural structure has been maintained. The interior comprises of containers that house areas for cooking etc.

The building edge is relatively closed off from the street with most activities being houses inside. The informal traders complained about this space saying it is disconnected from pedestrian and is also too dark and unhygienic.



## 4 Important Public Transport Infrastructure: Bosman Station:

This station is also frequented daily by many commuters and is an important access route to the CBD.



## 5 Important Public Transport Infrastructure: Bosman Taxi Rank:

This taxi rank is the main taxi rank that links the Tshwane CBD to Johannesburg and surrounds. It is a very busy terminal with lots of foot traffic daily.



## 6 Important Access Route: Bosman Street

Important North-South axis in the city and major entry route into the centre of the CBD by both pedestrians and vehicles, public and private. This is a very active street offering various stores, services and institutions.



## 7 Important Transport Infrastructure: Pretoria Train Station:

This train station is the main railway station in the CBD with commuters coming into the CBD and is often called the 'Southern Gateway.'



## 8 Formal Economic Infrastructure: Station Mall

This is the most important economic node in the precinct with various formal stores and services being offered.

Fig 26. Image showing the existing urban built fabric in the CBD.

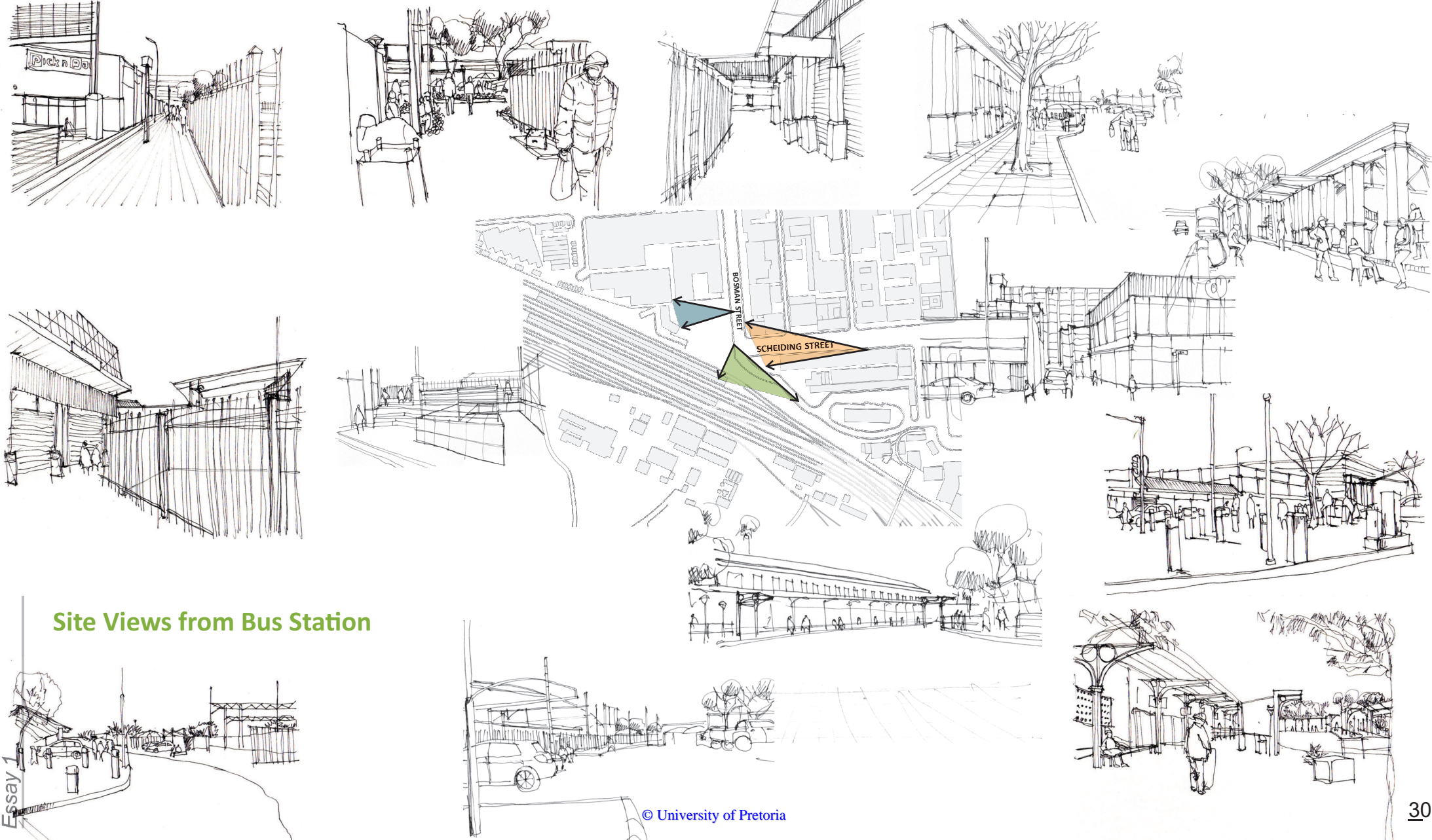
# Site Views

Site Analysis:

Fig 27. Sketches of site views (Nemasetoni 2021)

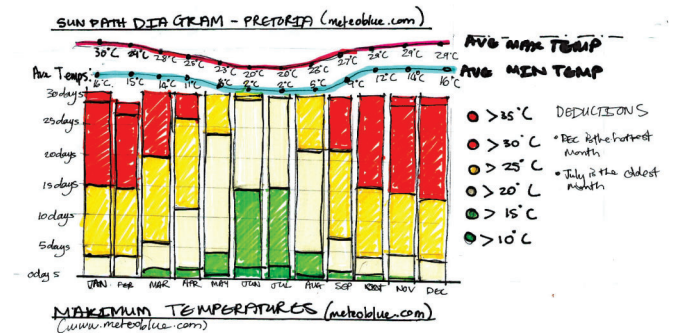
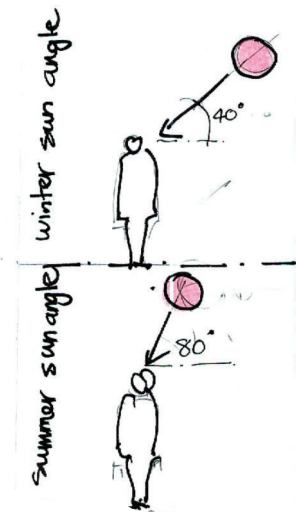
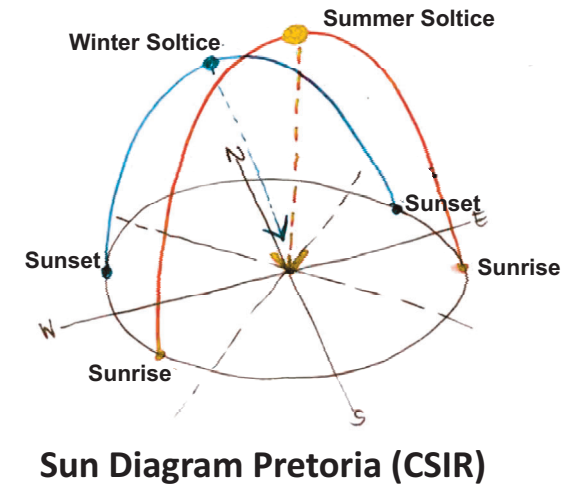
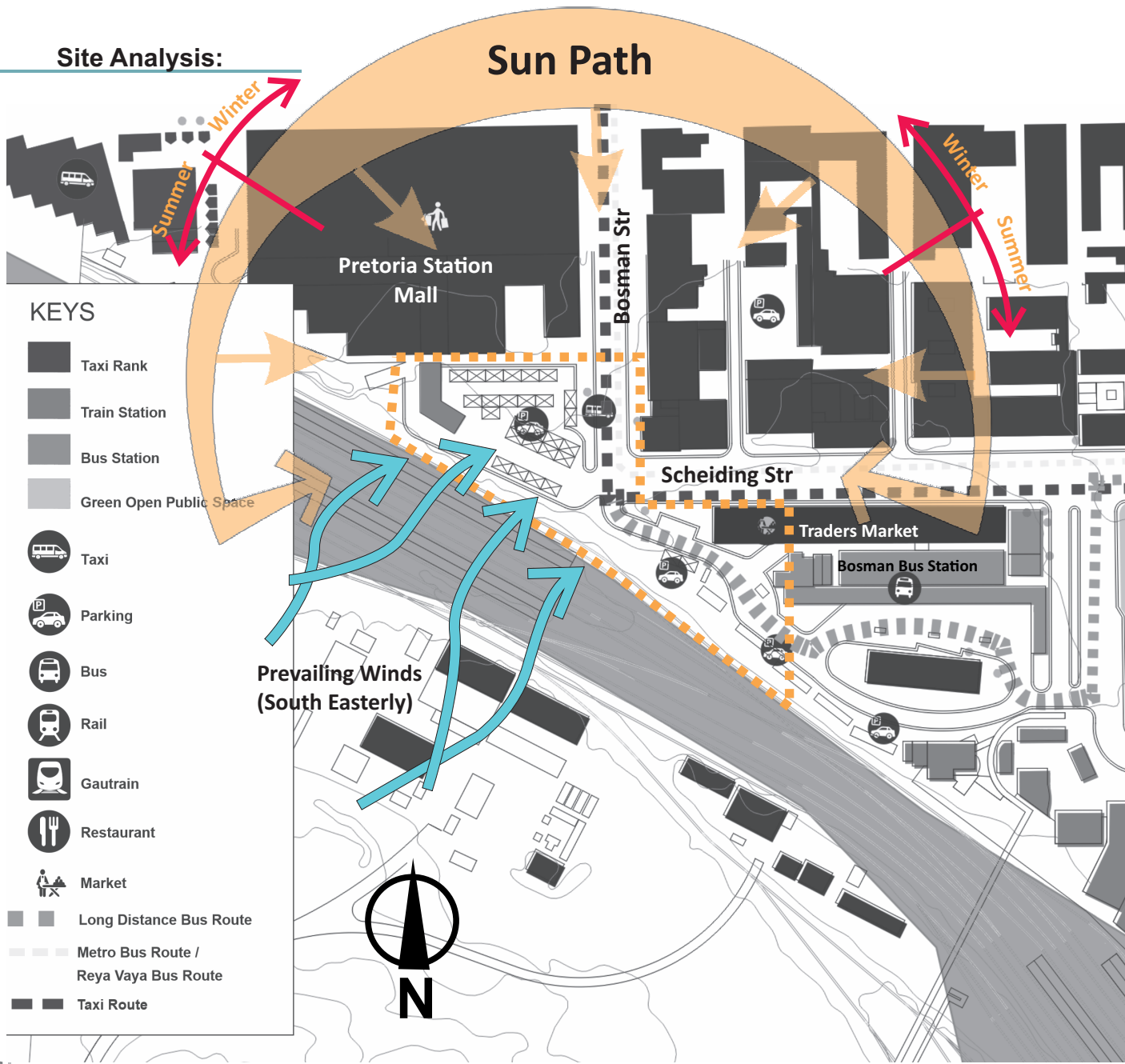
## Site Views from Bosman Street Train Station

## Site Views from Scheiding Street



## Site Views from Bus Station

Fig 28. Image showing siteclimatic conditions (Nemasetoni 2021)





## Place-making:

Placemaking is the collective re-invention of public space as a communal space for the surrounding community. This is a process whereby where the connection between the shared public space and its users is reinforced in a way that makes it more valuable and meaningful and a place where people are naturally attracted to where they can have meaningful interactions. The "physical, cultural and social identities" that people already attach to that particular space are investigated and improved on and become the foundation on which developments are planned with an aim to highlight these attributes. (Project for Public Places, 2020)

The city ground floor plain is essentially a public space where various people from diverse backgrounds meet and move on a daily basis. This is a space to sell, buy, interact, meet and a myriad of other activities. It is an ever-changing space where city dwellers express themselves as individuals as well as a collective.

A space must be designed as a destination. A certain identity and image that differentiates the space from others must be highlighted as a way to attract people to an area. Within this destination space, there must be other focal points within it. Project for Public Spaces (PPS) states that a space must have at least 10 things to within it that encourage public engagement in order for it to be successful.

According to Project for Public Spaces (PPS), there are 4 spatial attributes that need to be focussed on for the creation of a 'great place.' (Project for Public Places, 2020) These include the following:

### 1. Sociability

- The space must encourage the meeting of friends and acquaintances as well as interaction between strangers.
- Seating must be placed in such a way that it encourages meetings of various scales of groups.
- The area must exude a certain identity that reflects its users to create a sense of belonging and community.
- Public information points where community members can share information encourages a sense of togetherness.

### 2. Uses and Activities

- Availability of play areas for children
- Activities such as public chess boards etc. are located in the space.

- Performance spaces with public seating where artists can perform in front of an audience.
- Public Art preferably by local artists will encourage people to also use the space for the expression of their cultural identity.
- Availability of public infrastructure that support the local economy will increase activity in a space.

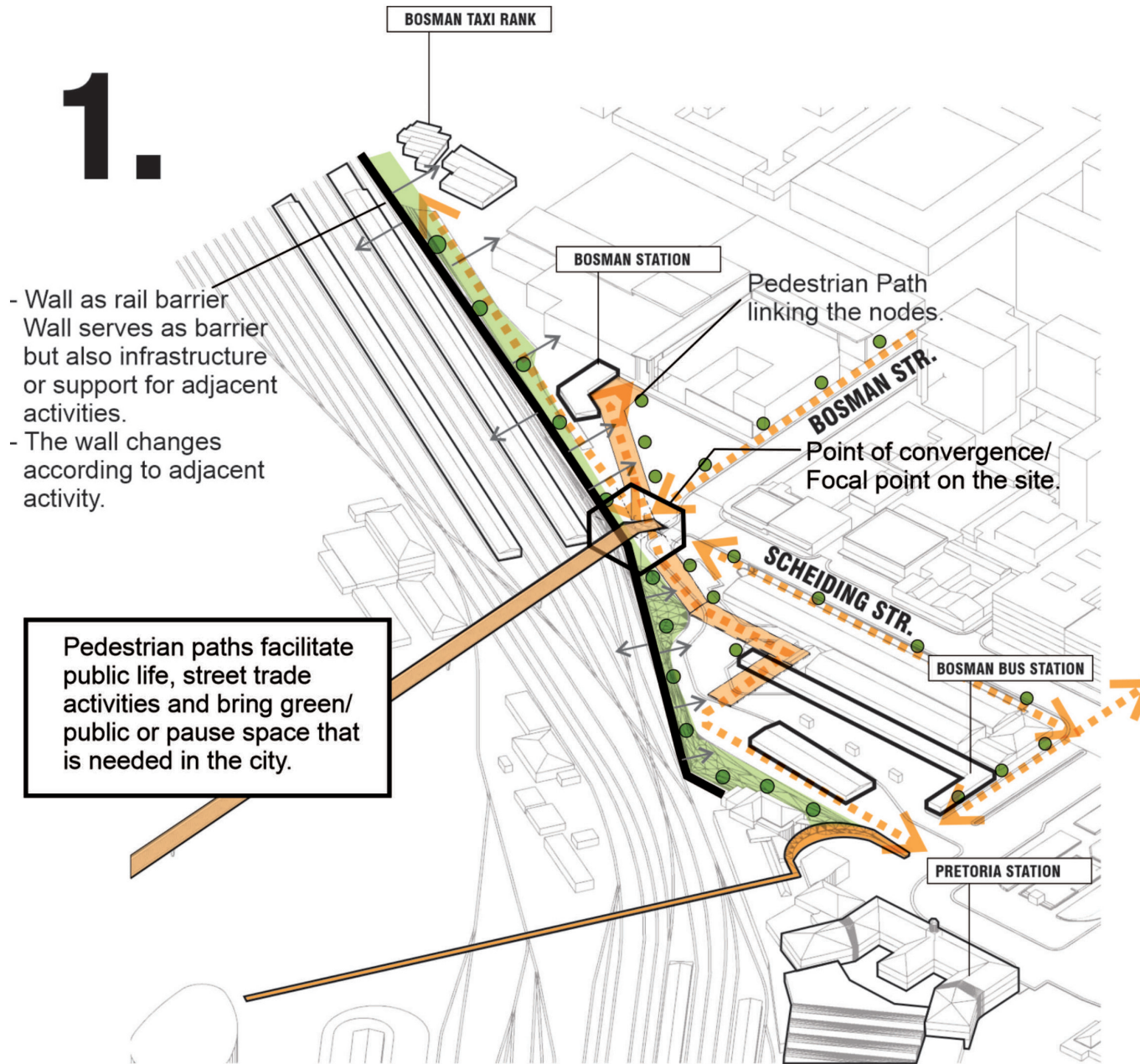
### 3. Comfort and Image

- Improve perception of safety and cleanliness.
- There should be adequate public seating and pause spaces.
- There should be some weather protected areas available.
- Adequate waste bins must be available.
- Public amenities such as water, public toilets and wifi must be available.
- Street lights must be placed to increase visibility and safety at night.
- Vegetation and water features make the space more pleasant and attractive.

### 4. Access and Linkages

- Areas of importance are well connected through visual links, signage and pedestrian routes.
- Pedestrian routes between important areas are safe, pedestrian friendly, clean, unobstructed and convenient to use.
- Movement routes must accommodate people with disabilities
- Different transport modes in the area are interconnected by formal walkways making it easier for commuters to navigate between the various different modes.
- Building edges are designed as active threshold spaces with public seating, trees and shelter.
- Commuter waiting areas and pick up points must be formalised with seating and shading to enhance the use of public transport.
- Street must be designed to accommodate pedestrians, cyclist and vehicles in a safe, appropriate and pleasant way.
- The space must be very walkable to reduce the need for the use of cars and parking.

Fig 29. Axonometric view of masterplan interventions (Nemasetoni 2021)



**Physical & spatial connection between transport nodes.  
Towards an integrated multi-modal transport interchange.**

## Place-making: Precinct Development Plan

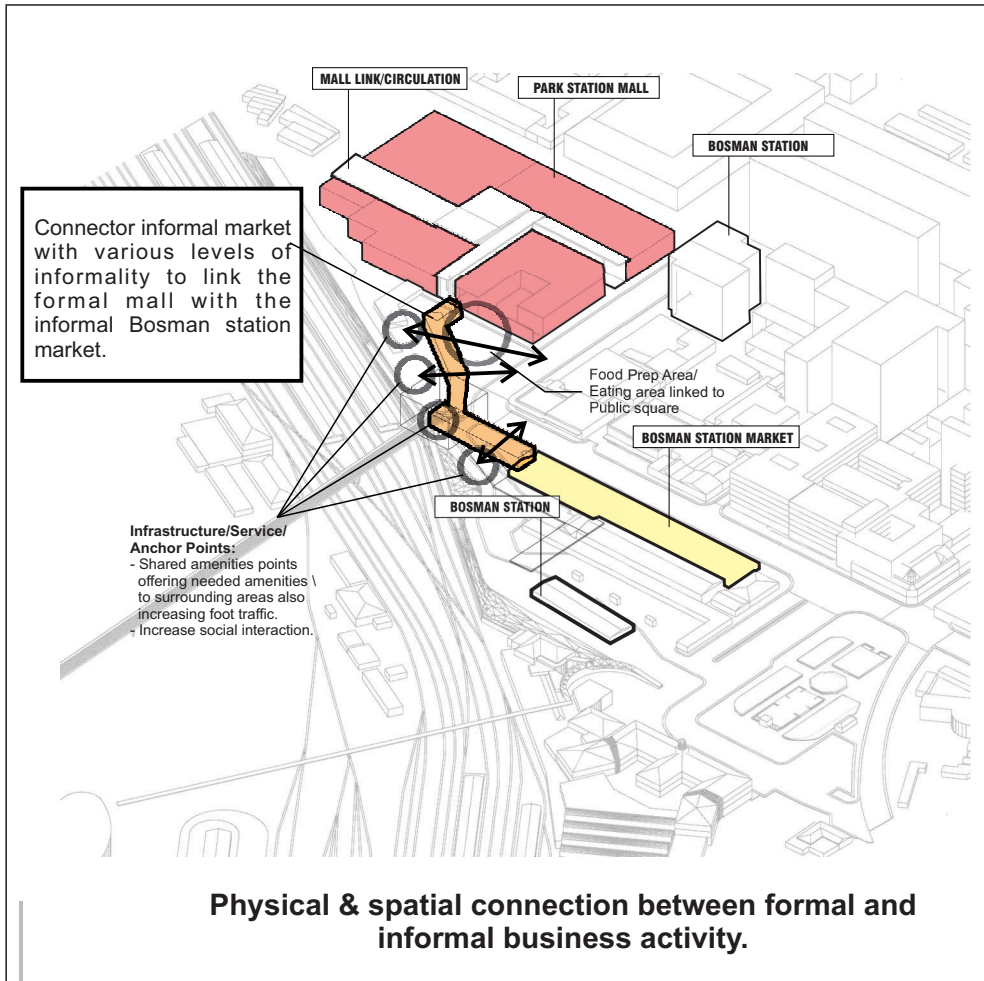


Fig. 30: Axonometric view of study area with development plan interventions .

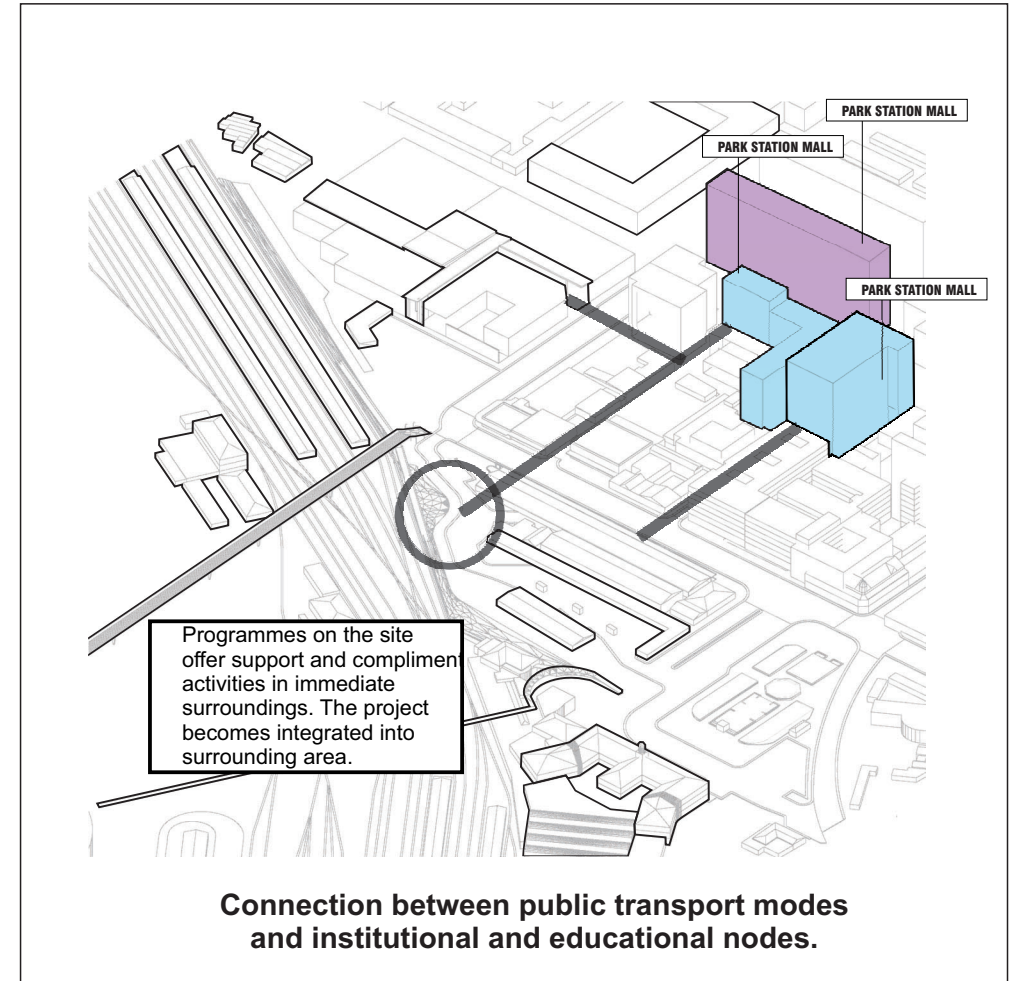
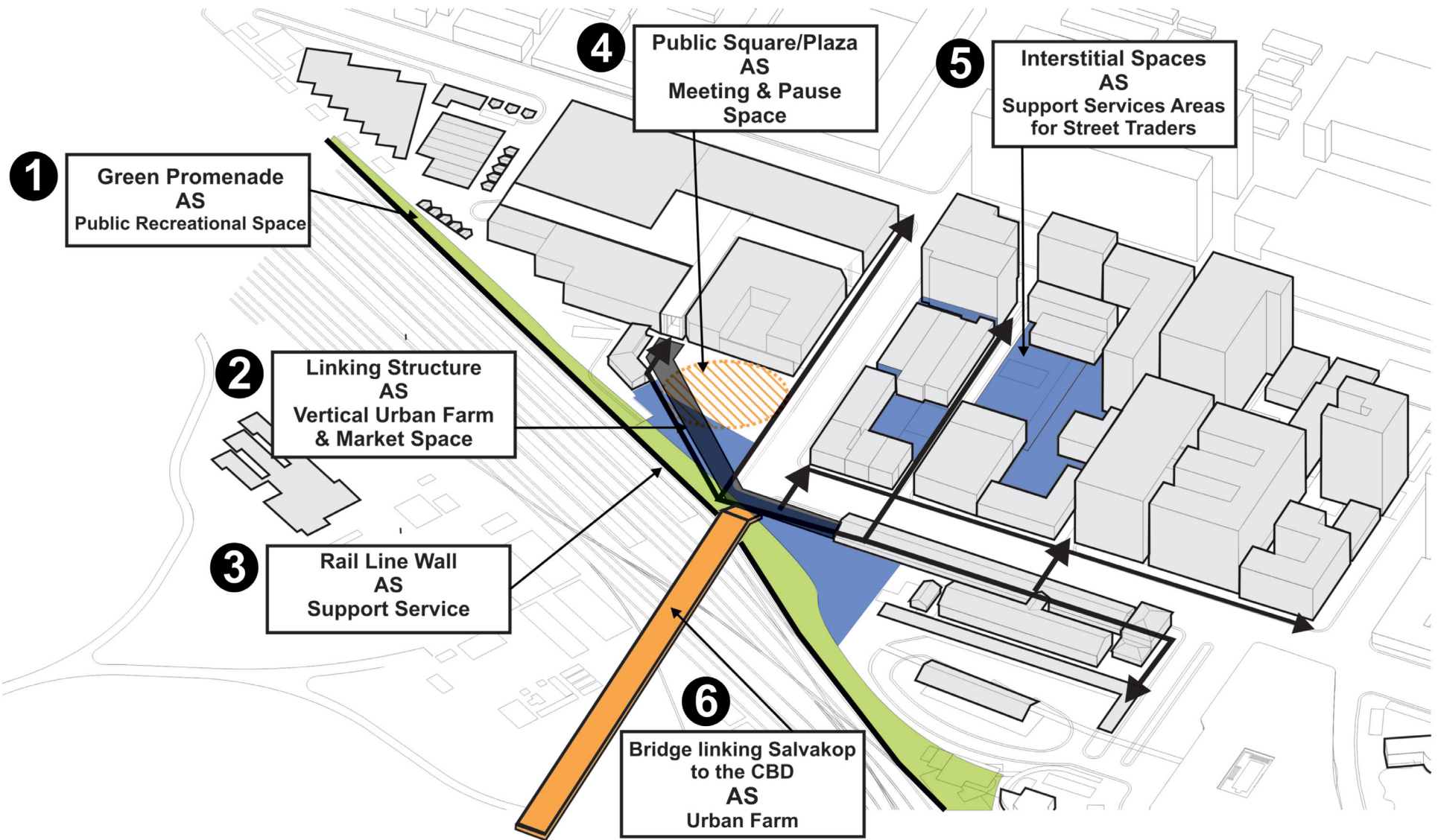


Fig. 31: Axonometric view of study area with development plan interventions .



# Precinct Master Plan

Fig 32. Image showing axo masterplan interventions (Nemasetoni 2021)

# Street Design Guidelines (On-Street Trading) (based on City of Johannesburg Complete Streets Design Guideline Document)

There has been a rapid increase in street trading over the years. There is a need for formalised and demarcated on-street trading space on the city streets. Presently, street trading is largely unregulated and thus

Attribute	Guideline
Location	Sufficient spacing of approximately 5m must be provided between on-street trading facilities to provide effective circulation and increased effective walkway width;
Security	Stalls should not be designed in such a way that criminal activity can be facilitated. They should not be that close together or be placed dark at spaces.
Street Character	Stalls should seek to enhance the street amenities and local character
Environmental considerations	Care should be taken that trading zones areas are still attractive for walking and should not be placed in an disorderly way
Pollution and waste management	Wherever trading stalls are introduced, proper plans should be in place for waste management, pollution control and control of rodents
Uniformity	In general a standard design should be strived for all trading stalls throughout the City taking into consideration the type of goods to be sold, environmental considerations and safety However some precinct could modify such designs linked to the overall look and feel of the precinct
Economy	Trading stalls should minimize the use of space as much as possible to accommodate other street furniture like street lights, bollards, benches, etc. Again at all times a minimum width of 1.5m should be reserved for a pedestrian walkway.

Fig 34. Table showing street design guidelines (Complete Streets Design Guideline, 2019)

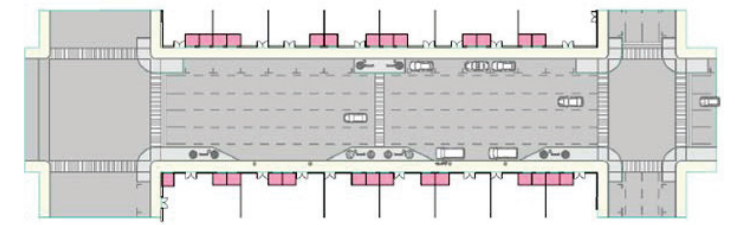


Fig 33. Image showing street plan where street trading is accommodated (Complete Streets Design Guideline, 2019)

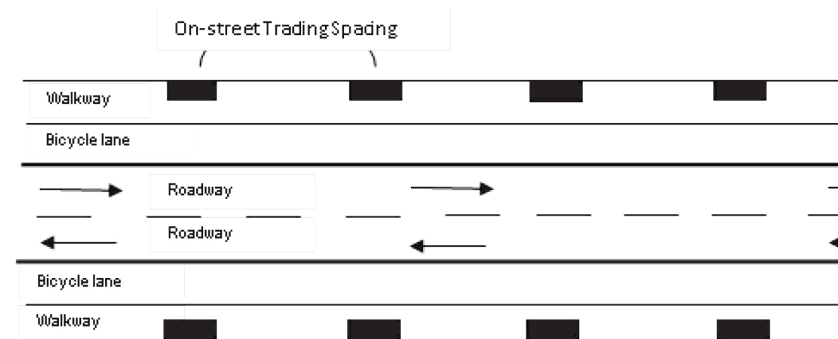


Fig 35. Image showing street plan where street trading is accommodated (Complete Streets Design Guideline, 2019)

# CBD Road/Activity Street - 25m Road Reserve (One Way)

## Street Section



Fig 36. Image showing street design guidelines implementation (Complete Streets Design Guideline, 2019)

## Street Plan



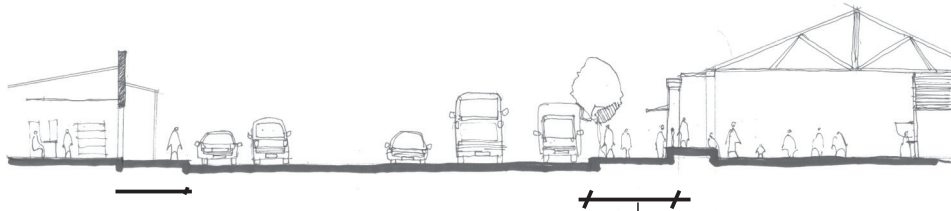
Fig 37. Image showing street plan where street design principles should be implemented (Complete Streets Design Guideline, 2019)

## Complete Streets Sidewalk Elements

1. Street Lighting
2. Street Furniture
  - Banners
  - Waste Bins
  - Tree Grates
  - Bollards
  - Seating
- Public Art & Sculptures
- Way Finding & Information Signage
- Vegetation

# Existing Street Analysis

## Section through Scheiding Street



Narrow Pedestrian way leaves little room for public life

Parked cars create an unsafe threshold space by blocking visibility.

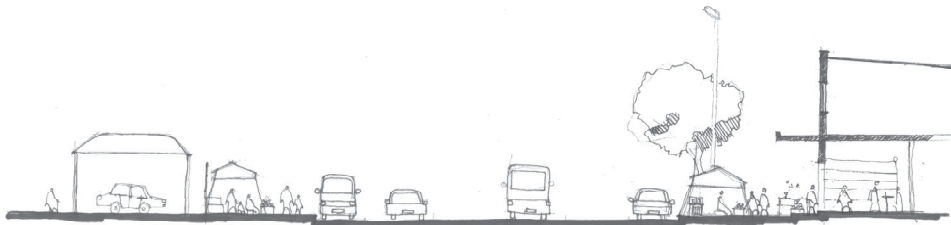
Adequate wide walkway lacking street furniture and amenities such as waste bins, seating and lighting.

This space has become a loading bay area creating an unfriendly pedestrian space.

Existing street trade activities in the market are closed off from the street.

Open corner space is a natural gathering open space but has no street furniture, lighting or public amenities

## Section through Bosman Street



Street Trade structure take over most of the public walkway affecting pedestrian movement.

Street trade structures arranged along the fence

Taxi drop off point has become a parking area for taxis instead.

Public life is not accommodated for.

Public walkway is broken and unkept

Wide Pavement . There is street lighting on the site.

Temporary structures erected on the pavement mainly selling fresh produced and cooked meals.

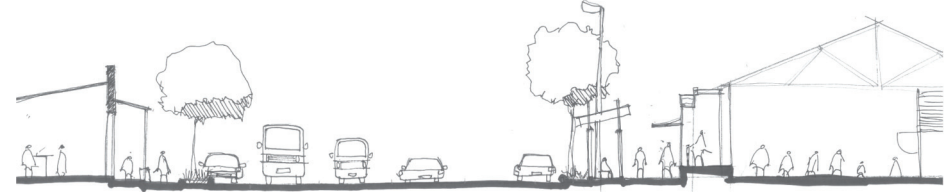
High number of traders to cater to the high commuter numbers.

Formal shops on Bosman spill into the walkway where goods are displayed and smaller items sold in some instances.

There is an arcade created between the traders and retail shops.

# Street Vision

## Section through Scheiding Street



Trees and planters to be added between parallel parking spaces.

Dedicated loading bay and prohibition of truck parking in this area.

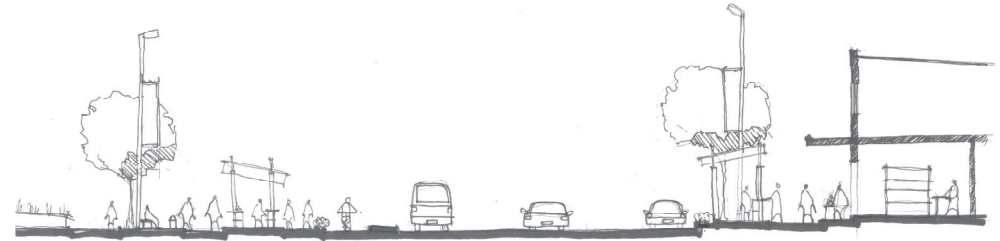
Side parking prohibited.

Formal canopy on the sidewalk.

Street lighting, planters public seating and waste bins

Existing street market upgrade. More wall openings to Scheiding street to allow for more light and open this threshold.

## Section through Bosman Street



Design of public square with planters and public amenities as a pause space in this area

Dedicated cycle lane with taxi drop off island

Taxi drop of area

Creation of double walkway on either side of trader stalls open on either side.

Street lighting and other street furniture on the side walk.

Planters to be added between side parking bays.

Trade stalls to be built creating an arcade.

Stalls can be adjusted to just become shaded areas when stalls are not in use.

Fig 38. Street Sections showing existing street edge conditions as well as edge condition proposals (Nemasetoni 2021)

## Client Justification:

### **Client Justification**

This project should be a joint venture between the Municipality of the City of Tshwane as well as the the main client is the Tshwane Economic Development Agency which is a state-owned company established by the City of Tshwane Metropolitan Municipality. The company has a department that facilitates investment into the agriculture and agro-processing developments aimed at being catalysts for development and economic growth in the city. The other client is the Department of Small Business Development which is also a government body.

There are various funding bodies that are part of the Department of Small Business Development specifically aimed at the informal sector: These include the following:

1. National Informal Business Upliftment Strategy (NIBUS), which provides funding through the Shared Economic Infrastructure Facility (SEIF) for the development of new informal trading infrastructure as well as the maintenance and upgrading of existing infrastructure. (Socio-Economic Rights Institute of South Africa, 2018)
2. The Informal and Micro Enterprise Support Programme (IMESP) is focusses on skills training for informal traders and provides funding for the development of such facilities. (Socio-Economic Rights Institute of South Africa, 2018)

## Towards a Programme Intention:

### **1. Public Market for Women Informal Traders**

The intention of this project is to create a safe market space that is designed to cater to the needs of women street trader. The market will have a focus on childcare, health and welfare services for women and small children. Advantages of Markets in the Urban Context:

### **2. Urban Agriculture Farm**

Food insecurity is also a major driver of why the number of street traders in rapidly increasing. More and more people need to enter the informal economy due to the lack of job opportunities to be able to feed themselves and their families. (Adetutu, 2021)

In a recent study conducted by the NIDS-CRAM (National Income Dynamics Study- Coronavirus Rapid Mobile Survey), it was found that approximately 2.3 million South African Households did not have adequate food and often went to bed hungry. An IPSOS ( ) study approximated that more than 40% of the South African population were affected by food insecurity.

### **Effects of Covid-19 Pandemic on Street Traders**

1. Stringent movement restrictions which were implemented in the beginning of the pandemic affected street traders in that could not acquire special permits to be able to source their goods. Although food supply was classified as an essential service, street traders were excluded.
2. Major job losses resulted in street traders losing many customers. Many experienced loss of goods that became rotten due to lower demand.

The pandemic perpetuated a vicious cycle leading many street traders deeper into poverty and in desperate need of food assistance themselves.



Technology needs to be introduced into this space as a resource for addressing the city's intention of taking issues of climate change and sustainability seriously and becoming an agent of change. By introducing technology which addresses some of the of the major effects of climate change, namely, food insecurity and water shortages, this project can be a valuable resource in the urban fabric. Food insecurity is already a big problem especially for the large number id South African urban citizens living in poverty.

### Vertical Urban Agriculture

During a study done by the School of Development Studies in the University of Natal, it was found that most of the goods sold by street traders were not produced by themselves. This causes their prices to be high due to costs of procuring and transporting their goods. Often, they are competing with larger retailers who have access to large capital and can procure goods at much lower prices. Profit margins for street traders are very low hindering their ability to be able to grow their businesses and earn good incomes. Many of the street traders expressed their desire to be able to acquire skills where they can be producers of their own goods so as to be able to cut costs as well as acquire more skills. This is where the concept of urban agriculture becomes a good solution. By providing urban agriculture infrastructure and space to the street traders, they can produce their own produce, learn new skills, cut their costs as well as reduce the amount of pollution and water wastage that occurs with traditional farming practices.

According to Resh, urban agriculture is a method of farming where food is produced, processed and distributed within an urban setting for the urban market (Resh, 2013:106-121). This type of agriculture mainly uses soilless processes such as hydroponic(water) and aeroponic (vapour) ways of growing food .These are more economic, social and environmental benefits gained by producing food in this way in present times due to high costs of producing food in the following ways:

## Motivations for Urban Vertical Farming

### Purpose for the Urban Vertical farm

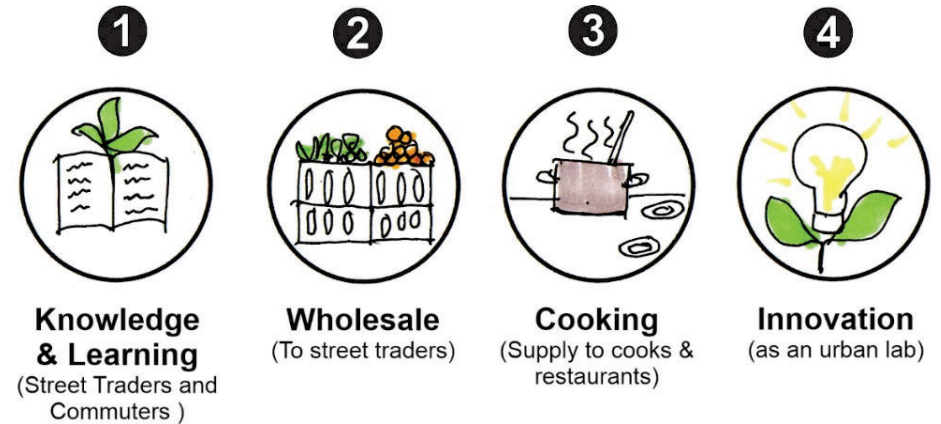


Fig 39: Image showing design programme intentions of urban farming on the site (Nemasetoni 2021)

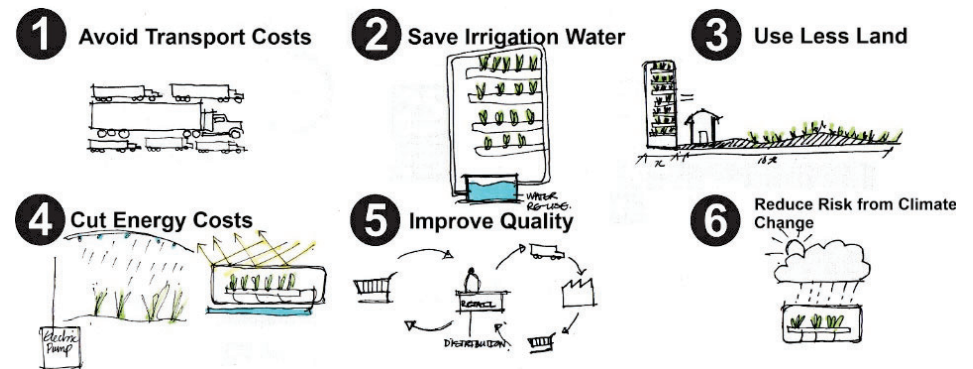


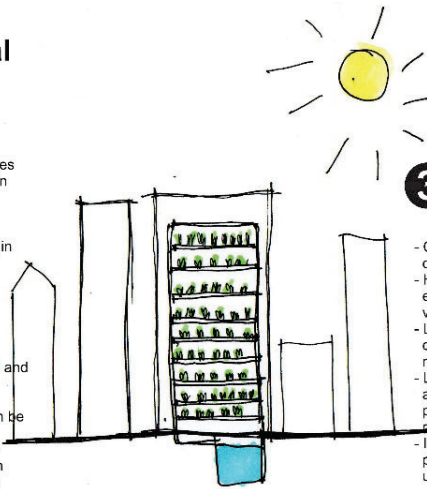
Fig 40: Image showing reasons vertical urban farming is more advantageous than traditional farming methods (Nemasetoni 2021)

## 1 Environmental

- Huge water savings are achieved
- Reduction of water pollution
- Save of land due to vertical and concentrated nature of operations.
- Bring biodiversity into urban landscapes while preserving existing biodiversity in surrounding areas.
- Reduction of air pollution to less fuel consumption.
- Aids in urban heat reduction resulting in cooler cities and buildings

## 2 Social

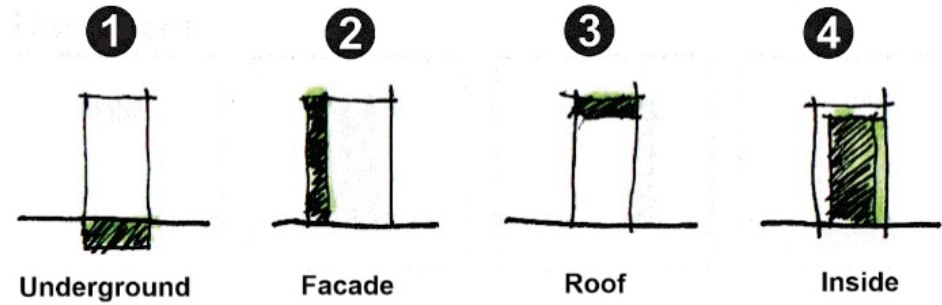
- Creates opportunities for employment and generating incomes
- Raises social capital of an area by bringing different people and can even be made into a community activity.
- Urban citizens are made aware of the processes that go into food production thus bringing a new awareness to the agriculture sector and its importance.



## 3 Economic

- Cost of food price is high due to depletion of available natural resources.
- Hydroponic farming methods are more efficient and yield higher numbers of vegetables in shorter periods of time.
- Less wastage and risk as climate is controlled with extreme climate changes mitigated.
- Less need for transportation, refrigeration and preservative due to the close proximity of produce to the market thus reducing food prices.
- Increase the value of surrounding properties and bring revitalization to the urban landscape

Fig. 41: Image showing the environmental, social and economic advantages of vertical urban farming (Nemasetoni 2021)



Hydroponic  
(water)

Aquaponic  
(symbiotic  
between water  
and aquaculture)

Aeroponic  
(mist)

Fig. 42: Image showing the various types of vertical urban farming as well as different positions where produce can be cultivated within a building (Nemasetoni 2021)

# ARCHITECTURE AS INFRASTRUCTURE

## Essay 2: Design Research

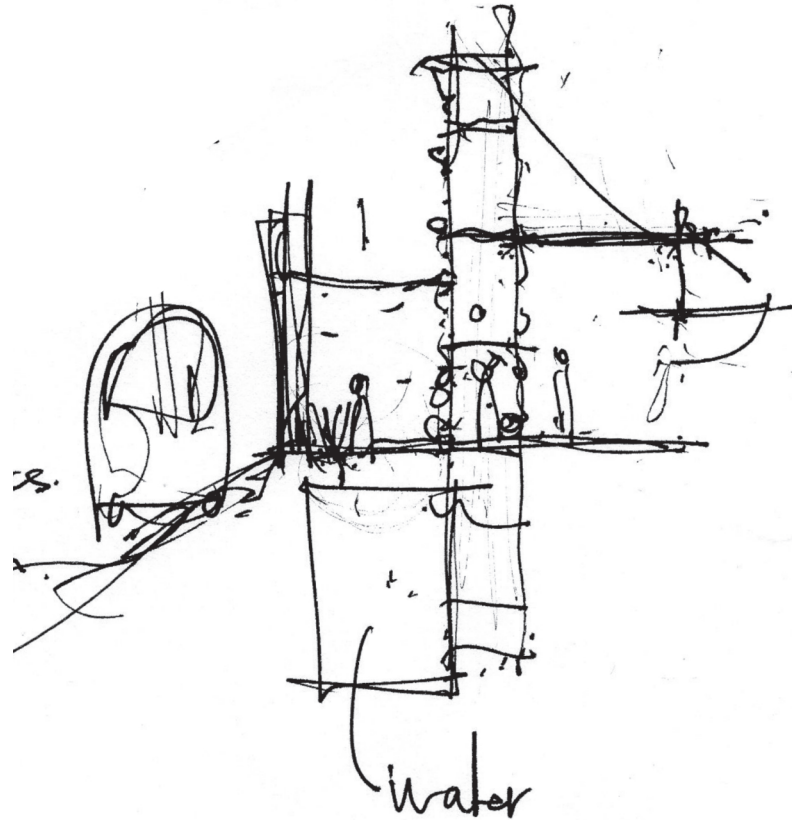


Fig. 43: Sketch of vertical farm structural concept (Nemasetoni 2021)

## Architectural Approach:

The proposed project intends to explore the concept of architecture as infrastructure as a way of designing an architecture that brings value to the urban fabric by becoming an enabling or support structure that addresses some of the contemporary urban issues faced by our post-apartheid cities, for example, the Tshwane CBD, in a more effective way. A structure that enables can be thought of as one that 'allows individuals to grow' and develop. It 'empowers' a group to be able to act more effectively and also 'removes a barrier to action.'

When looking at the study area, the intention is to look at the under-used, under-developed, open and in-between spaces that exist in the city block and explore how infrastructure can be designed into these spaces. These spaces will then function as urban resources that are used to address vulnerabilities and urban challenges. What type of infrastructure can be used to revitalised the un-used pieces of land in a way that uplifts the street traders of the CBD who are in dire need of support services, the vast number of commuters that use and walk through this area on a daily basis as well as the wider growing urban community in need of public space and services for the building of resilient urban communities?

## Architecture as infrastructure

By definition, Infrastructure is the most direct way to address basic human needs within the city. Traditionally, the word denotes to physical components such a roads, highways, cable and pipes.

In current discourse, there is no definitive architectural framework that guides an 'architectural approach to architecture' and according to Seewang, this could be due to how infrastructure is perceived on a much bigger more urban scale, whereas architecture is often understood more on a human scale. (2013) The effects of infrastructure are often perceived in a sort bird's eye view metropolis perspective whereas architecture tends to focus on the human eye perception of form and space. For the purpose of this dissertation, a new way of unpacking how infrastructure can be implemented architecturally will be developed using different perspectives. A desktop study of contemporary theory and ideas of what infrastructure could become was conducted in an attempt to create a framework that would guide the architectural design process.

## Framework for Infrastructure as Architecture

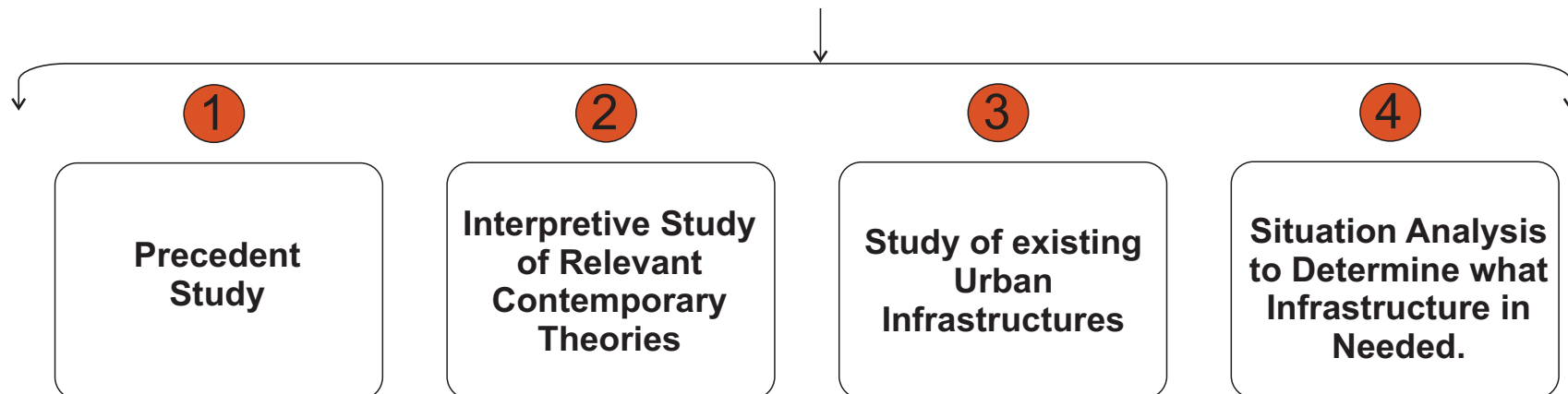
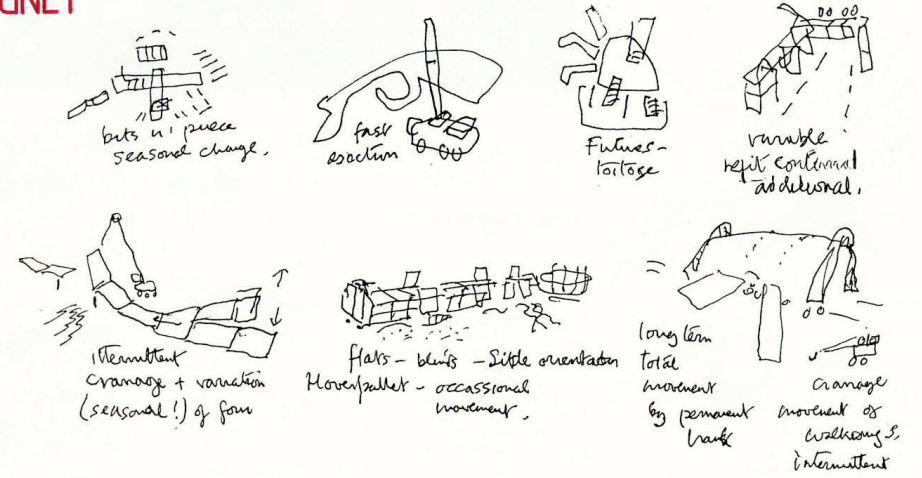


Fig. 44: Diagram of design approach informants (Nemasetoni 2021)

# MAGNET



1

## Theoretical Precedent:

### Infrastructure as Architecture Concept Precedent

Cedric Price started his practice in 1960 with a focus on designing 'facilities, possibilities and activities,' with a focus on how his structures could be 'removed, re-used or demolished.'

His project named Magnets (1996) is a proposal of a 'series of structures which would be paid for by local authorities. These structures would be used to bring public amenities and spaces for public moment located in spaces not usually used as public spaces. Places such as the space above roads, spaces like streets, parks, lakes and railways. These interventions would bring something new to these sites such as information, 'sanctuary,' 'views and safety.' The aim was to take underused and overlooked spaces and bring better use and socially beneficial programmes (Iqbal Aalam. Architecture, planning, arts and crafts. 2012)

These structures are designed to be 'adaptable, mobile and re-usable.' (Iqbal Aalam Architecture, planning, arts and crafts. 2012). Traditionally infrastructural elements such as cranes, scissor lifts are used as the structures and adapted making these interventions both 'pragmatic' and complex for the benefit of the public (Iqbal Aalam. Architecture, planning, arts and crafts. 2012).

All the projects are contextualised in typical urban conditions such as shopping streets, major roads, parks, railways and shopping centres and offer this such as access and mobility, information and recreational programmes such as views and sanctuaries or pause spaces (Iqbal Aalam. Architecture, planning, arts and crafts. 2012).

The word Magnets speaks to the intention of these interventions to draw people and provide some much-needed social needs for the public. As much as these are structural components they can be seen as soft infrastructure added to the existing hard infrastructure in the city.

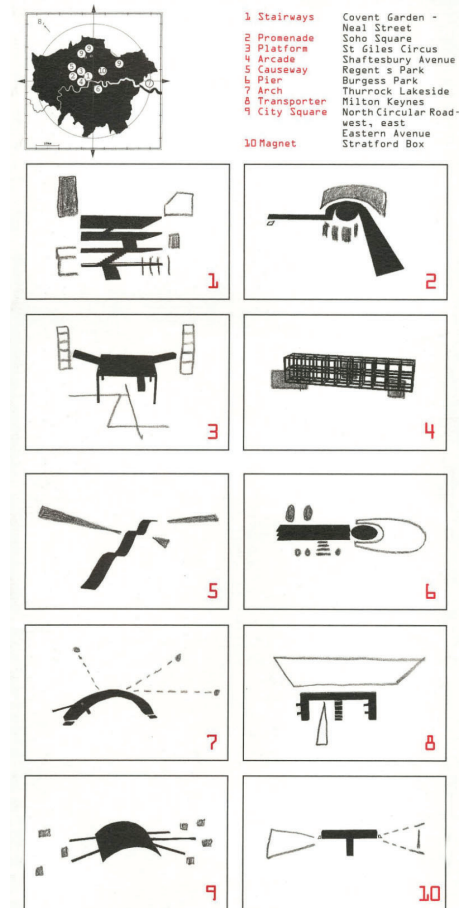
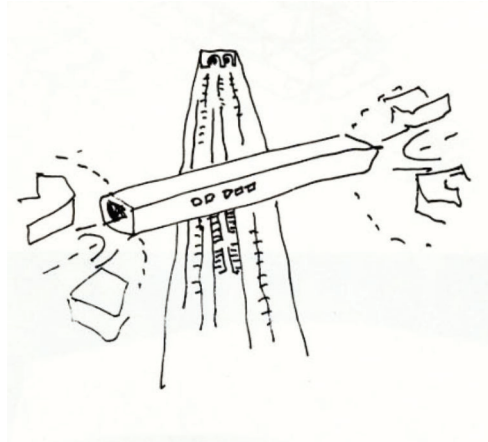


Fig. 45: Images of the Magnets (1996) project by Cedric Price ((Iqbal Aalam. Architecture, planning, arts and crafts, 2021)



2

**Architectural as Infrastructure: Towards a Definition:**

By definition, Infrastructure is the most direct way to address basic human needs within the city. Traditionally, the word denotes to physical components such a roads, highways, cable and pipes. Other concepts of what infrastructure could be the following:

1. Infrastructure must address the evolving needs of societies.
2. Infrastructure gives order to the city and symbolizes its culture.
3. Infrastructure is a civic project.
4. Infrastructure has the ability to offer a framework. (Connections between a system, its context and constituents).
5. Can be used to propose responsive strategies that address the predominant challenges facing urban economies today.
6. Infrastructure acts as the agent between social life and the architecture that accommodates it.



Fig. 46: Image of definition of infrastructure (Nemasetoni 2021)

3

**Study of Urban Infrastructures :**

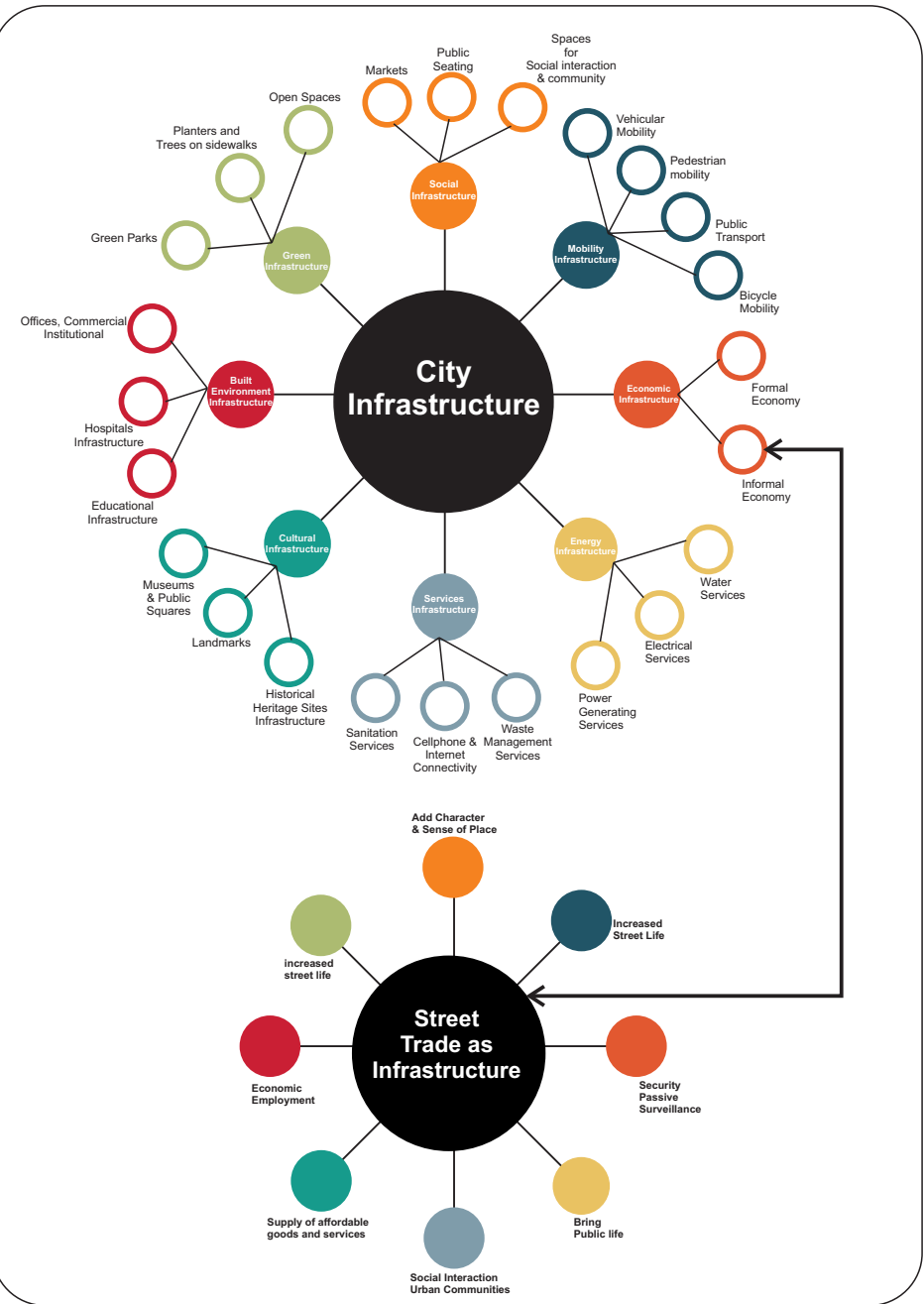


Fig. 47: Infographic of infrastructures in the city (Nemasetoni 2021)

## Architecture as Infrastructure: Other Contemporary Theories

### People as Infrastructure

(Synthesis of article by AbdouMaliq Simone, *People as Infrastructure: Intersecting Fragments in Johannesburg*)



1. Peoples activities in the city become the infrastructure.
2. Economic collaboration through social intersections create new opportunities for prosperity and opportunities dependent on these interactions.
3. Allows for economic opportunities that the marginalized would not be able to access in the formal system.
4. Collaborations and communities are diverse and not based on commonality of cultures and identities but rather on the commonality of purpose which is to survive and develop themselves. This leads to a more diverse, cohesive more inclusive urban experience.
5. These complex, multi-layered connections and networks work well based on the common goal to survive and develop oneself based on constant negotiation about ownership and individual and group responsibilities.

Fig. 48: Image showing how people can function as infrastructure through the urban networks they create (Nemasetoni 2021)

### Streets as a Stage

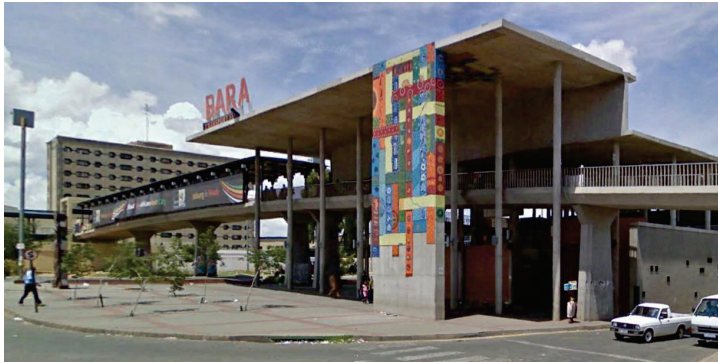


1. The streets have become the site of these exchanges as they are the ultimate public space accessible to all and used by all and are the only means that everyone in the City moves from point A to B.
2. The streets are spaces of production of resources that sustain its residents through collective collaboration within its existing systems. (Simone, 2004)

Fig. 49: Image showing how the street is a stage for the various urban networks (Nemasetoni 2021)

## Precedent 2: Programmatic Precedent

Fig. 50: Photograph of the main Bara Transport Interchange Entrance (Nemasetoni 2021)



<b>Project:</b>	Baragwanath Transport Interchange and Traders Market
<b>Client:</b>	Metro Council Capital Budget Projects
<b>Location:</b>	Soweto, Johannesburg
<b>Year Completed:</b>	2008
<b>Size:</b>	17000m <sup>2</sup>
<b>Architect:</b>	Ludwig Hansen Architects and Urban Designers

### Project Description:

This project formalises and provides Infrastructure the busiest transport interchanges in Gauteng and is used by approximately 70% of all commuter who travel to and from Soweto. The design or layout intention of the project was the creation of an arcade that stretches 3000m<sup>2</sup> along Old Potch Road, which is the main road that connects all the areas within Soweto as well as links to major nodes in the city.

The Arcade is 50m wide to accommodate the large number of commuters that walk through it. This arcade acts as a 'structural spine' along the site which connects the various elements of the development with functional and support infrastructures that attach to it. This arcade also accommodates 500 'street traders' as well as support infrastructure for these informal traders such as storage facilities and stalls. These stalls would be of varying sizes to accommodate the different types and scales of street trading activities. These are interspaced with public amenities such as ablutions to increase the number of people walking along the spine. (Ludwig Hansen Architects and Urban Designers , 2020)

The spine also provides public transport public transport infrastructure and facilities with 20 bus ranking facilities for both long and short distance service providers as well as 12 taxi operators and provides space for 800 ranking taxis as well as 'holding bays.' In this way the project brings together mobility and commuters to public amenities as well as informal trade or economic activities. There are also public service buildings located at points along the site. (Ludwig Hansen Architects and Urban Designers , 2020)

Various focal points are located at different areas and

function as landmarks structures to further emphasize 'public entry points' as well as to serve for better orientation and navigation on the site. These landmarks are towers that are decorated by local artists that give the area a sense of place, identity and sense of ownership in the community. (Ludwig Hansen Architects and Urban Designers , 2020)

The main material used is concrete due to its robust and sense of permanence. This is a very long structure and so effort was made to explore different ways and shapes that can be made from concrete to bring diversity and break the monotony. Thus, the experiential quality of the space changes along this route and offers different options on how to inhabit the space. (Ludwig Hansen Architects and Urban Designers , 2020)

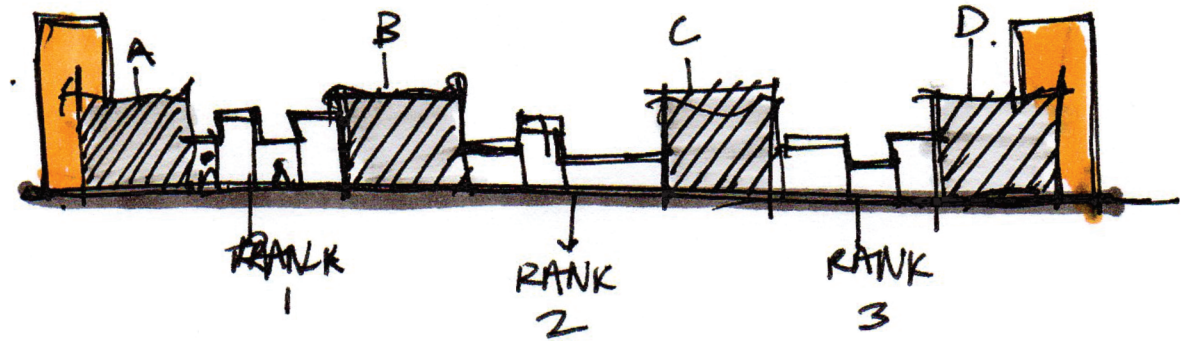
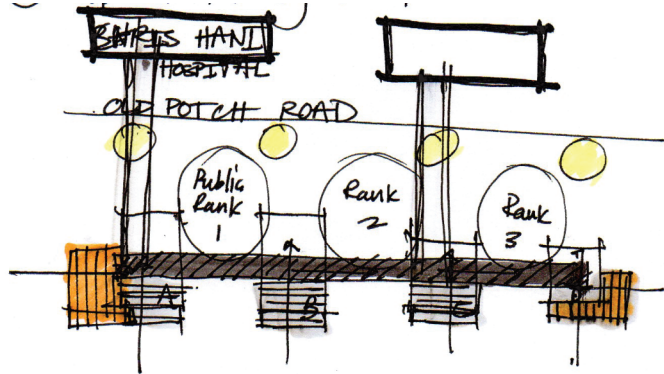




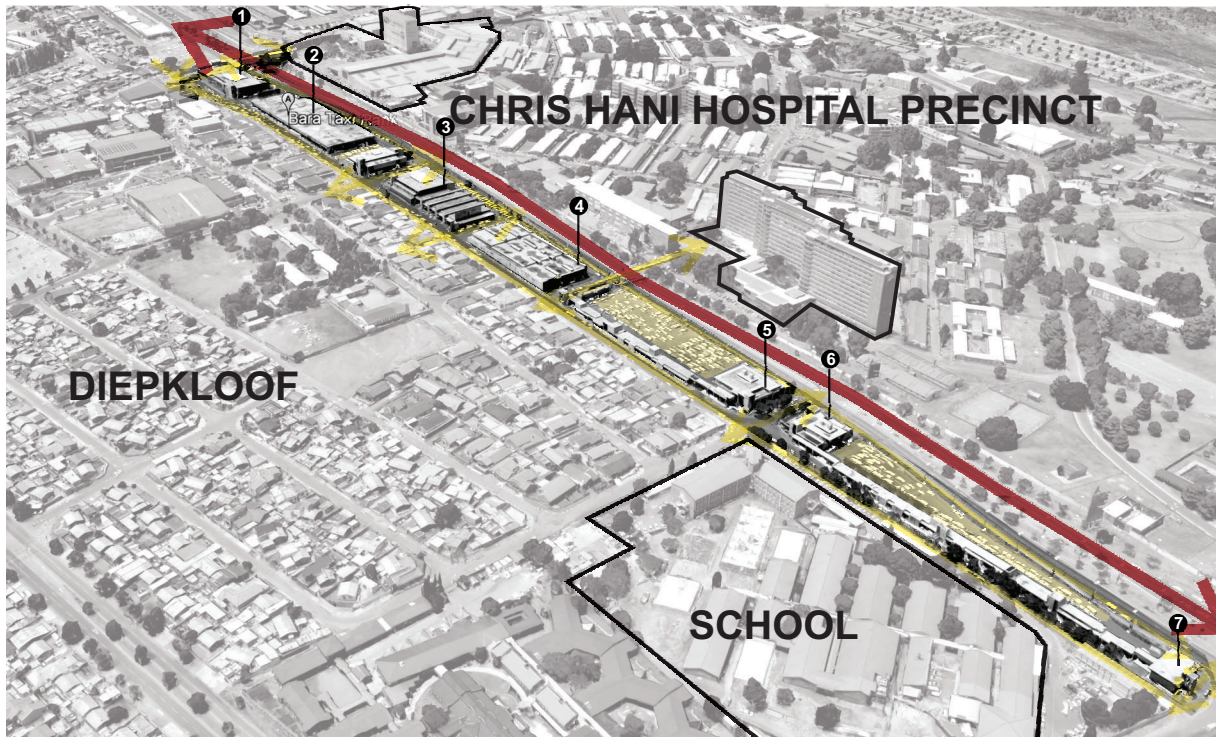
Fig. 51: Image showing precedent study analysis of Bara Transport Interchange (Nemasetoni 2021)

**Precedent 2: Baragwanath Transport Interchange**

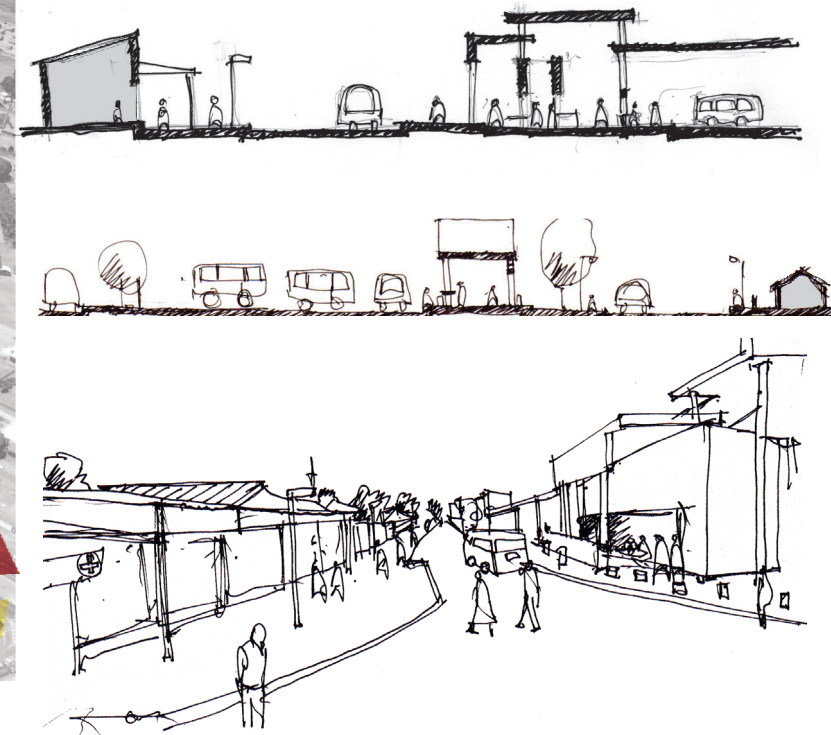
**1. Spatial Planning Principles/ Building Concept**



**2. Context**



**Context Scale, Boundaries & Edges**



Birds eye view showing project in context and the various connections and accessibility.

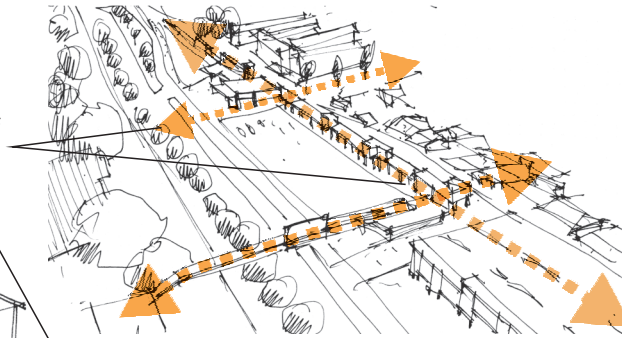
Fig. 52: Image showing precedent study analysis of Bara Transport Interchange (Nemasetoni 2021)



### 3. ACCESS AND ACCESIBILITY + CIRCULATION

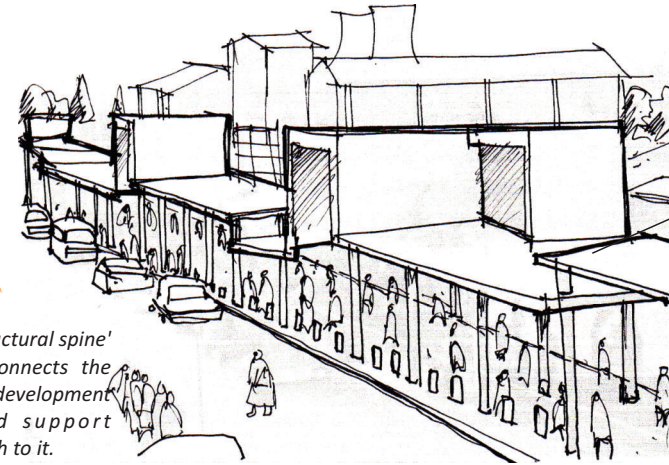
Strong east west axis is emphasized as main circulation space which is parallel to Old Potch Road. This is the primary route with secondary north south connections made by how the site is divided as well.

Direct links are made over the main road to the Chris Hani Hospital creating a safer access route from the public transport to the hospital.



This arcade acts as a 'structural spine' along the site which connects the various elements of the development with functional and support infrastructures that attach to it.

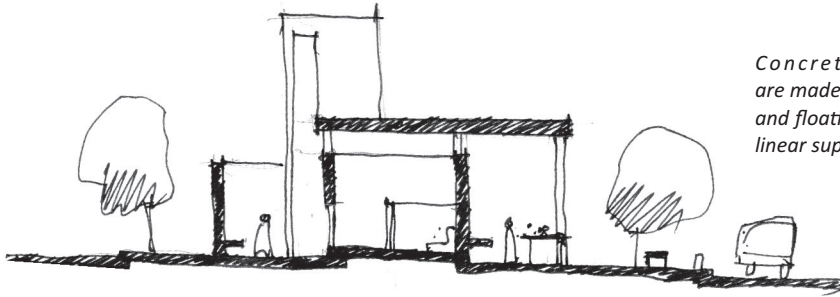
### 4. LIGHT AND SHADOW



Vibrant, dynamic floating concrete roof gives different spatial experience to commuters walking along the walkway.

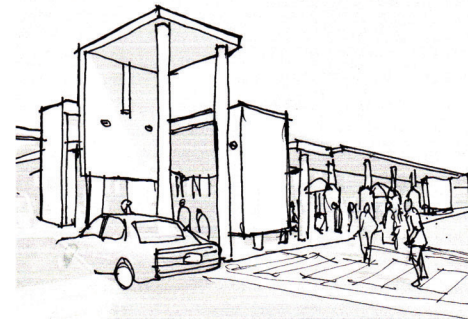
This walkway is wider and has a good civic scale. Varying height of the roof bring different scales along the route as a signifier of the types of programmes that happen along the route.

### 5. CONSTRUCTION AND MATERIALITY

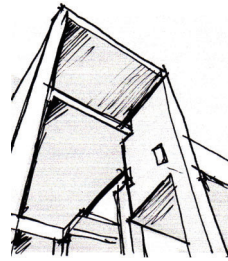


Concrete flat roofs are made to appear light and floating by long thin linear supports.

### 6. BUILDING USE/ PUBLIC LIFE/ INFORMAL ECONOMY



Seating areas are attached to walkway area which also provides street trader stalls across creating a pause area.



Concrete is explored for its versatility and robust quality.



The main material used is concrete due to its robust and sense of permanence. This is a very long structure and so effort was made to explore different ways and shapes that can be made from concrete to bring diversity and break the monotony. Thus, the experiential quality of the space changes along this route and offers different options on how to inhabit the space.

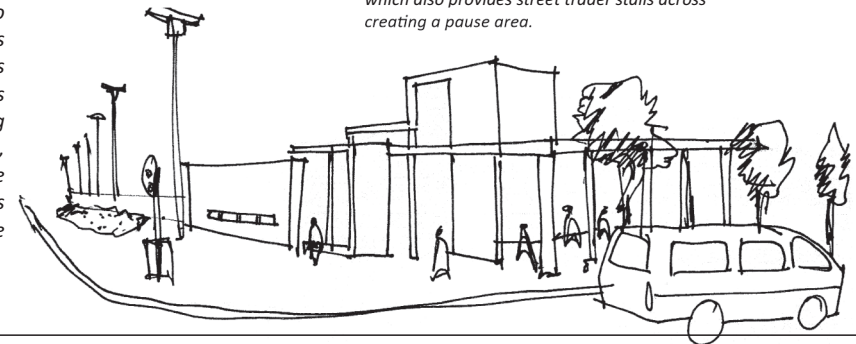
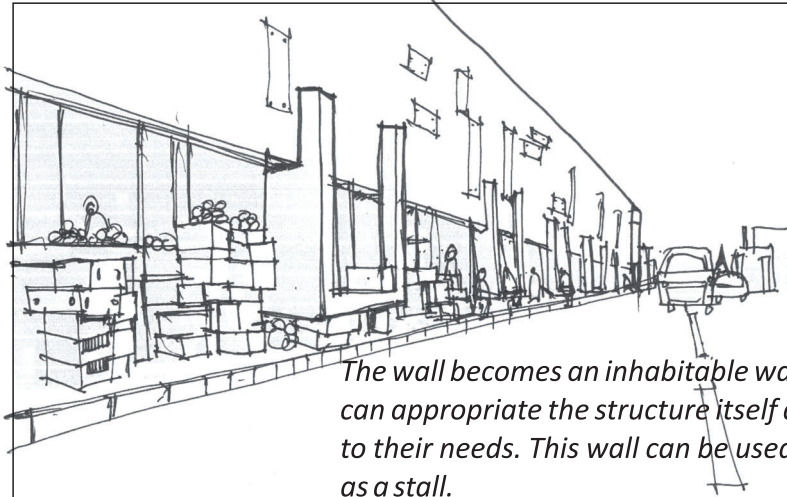
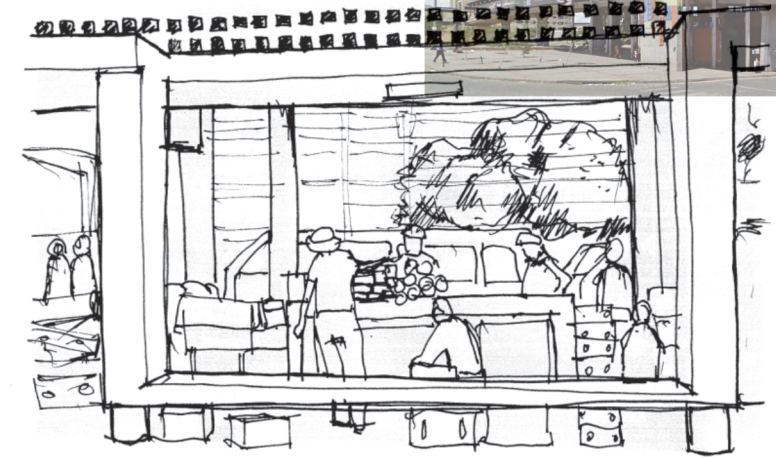


Fig. 53: Image showing precedent study analysis of Bara Transport Interchange (Nemasetoni 2021)

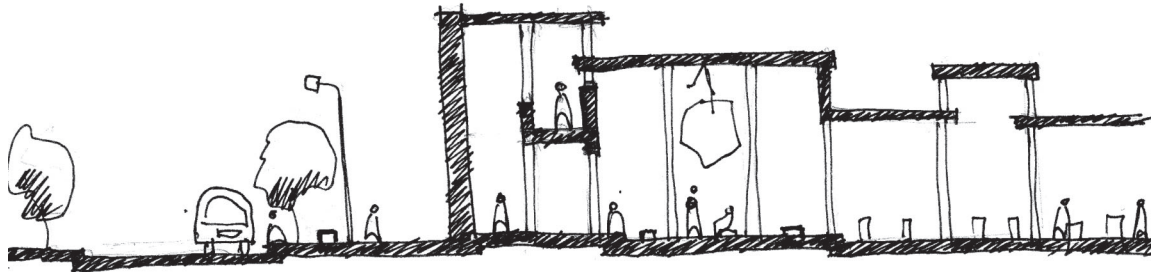


*The wall becomes an inhabitable wall along the route where the users can appropriate the structure itself and the space around it according to their needs. This wall can be used for seating, storage, display and as a stall.*

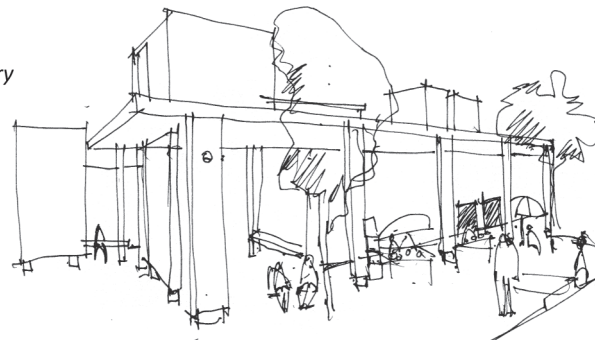
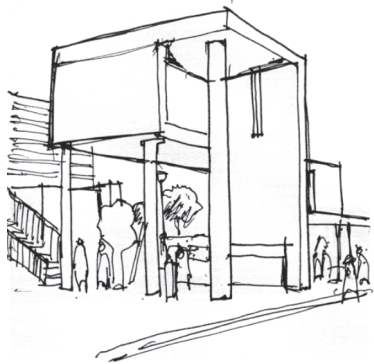


*Sketch showing how concrete wall is used for seating and stalls bringing public life and the informal economy together.*

## 7. BOUNDARIES AND SPACE



*Landmarks are created at entry points for better orientation and navigation and define the boundary of the development.*



*Various focal points are located at different areas and function as landmarks structures to further emphasize 'public entry points' as well as to serve for better orientation and navigation on the site. These landmarks are towers that are decorated by local artists that give the area a sense of place, identity and sense of ownership in the community.*

## Precedent 2: Refilwe Business Node Upgrade

Fig. 54: Photograph of Refilwe Business Node Upgrade (New Urban 2016)



**Project:** Refilwe Business Node Upgrade  
**Client:** Neighbourhood Development Partnership Grant (NDPG), National Treasury in the Metsweding Area, City of Tshwane  
**Location:** Refilwe, Cullinan, Tshwane  
**Year Completed:** 2009-2014  
**Architect:** Holm Jordaan Architects and Urban Designers

### Description:

Located in the Refilwe Township in the City of Tshwane, this project is part of a larger network of planned upgrades aimed at being a catalyst for the wider economic development of this small township. The upgrades are funded and supported by the Neighbourhood Development Partnership Grant (NDPG) and funds from National Treasury. (New Urban, 2016)

This project is an example of how urban acupuncture can be used to revitalise and catalyse development of a

larger area through the use of 'small-scale interventions. The first step in the design process was an extensive site investigation which involved the community to decide what kind of interventions would make the most valuable impact and support the existing activities and community around the site which included informality and informal economic activities, residential as well as more formal shops in the area. These interventions would also link and formalise existing networks and increase the sense of connection in the area. (New Urban, 2016)

The project features an 'open-ended' structure that is essentially a floating roof along the threshold of existing shops and residential houses. Along the structure at various points, basic amenities are provided, such as seating, water points and male, female and paraplegic ablutions. (New Urban, 2016)

The roof or structure in itself becomes or acts as a framework for other programmes and uses to happen along and branching from it. There is also SASSA pay point and this structure provides shelter, ablutions and seating space for pensioners waiting for their grants. As such, the structure becomes a gathering space as well as an economic space where informal traders can have access to market as well as appropriate the space and use the available space as display, shelter

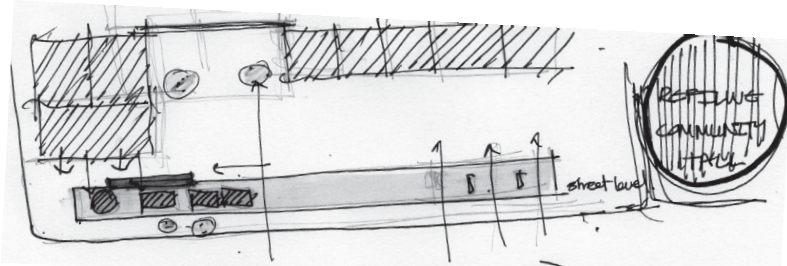
and service space. Programmes such as car washes, taxi drop-offs, pause space and many more can spontaneously activities can happen along this framework. Other recreational activities such as a chess board and moraba-raba are added to this space making this a play space catering to a wider range of ages and people in the community. (New Urban, 2016)

The structure is raised on a 'plinth' and makes a prominent feature and landmark in the space and gives this area a greater sense of place and identity. The public space around the plinth is 'formalised' with paving and planting with the upgrading of the space in the front of existing shops. (New Urban, 2016)

Fig. 56 Image showing precedent study analysis of Refiloe Business Node (Nemasetoni 2021)

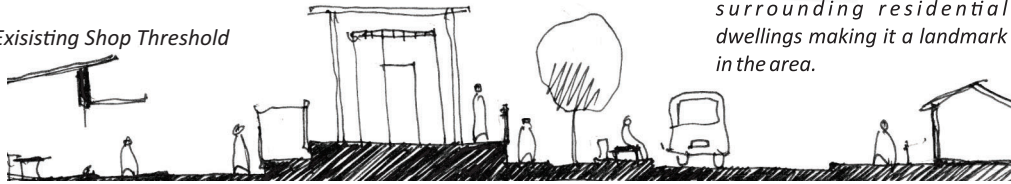


## 1. SPATIAL PLANNING PRINCIPLES/ BUILDING CONCEPT



Structure is slightly raised above surrounding residential dwellings making it a landmark in the area.

Existing Shop Threshold



## Context Scale, Boundaries & Edges



Photograph showing the structure sitting on a plinth. The structure becomes a landmark in the area and a gathering and recreational space for the community.

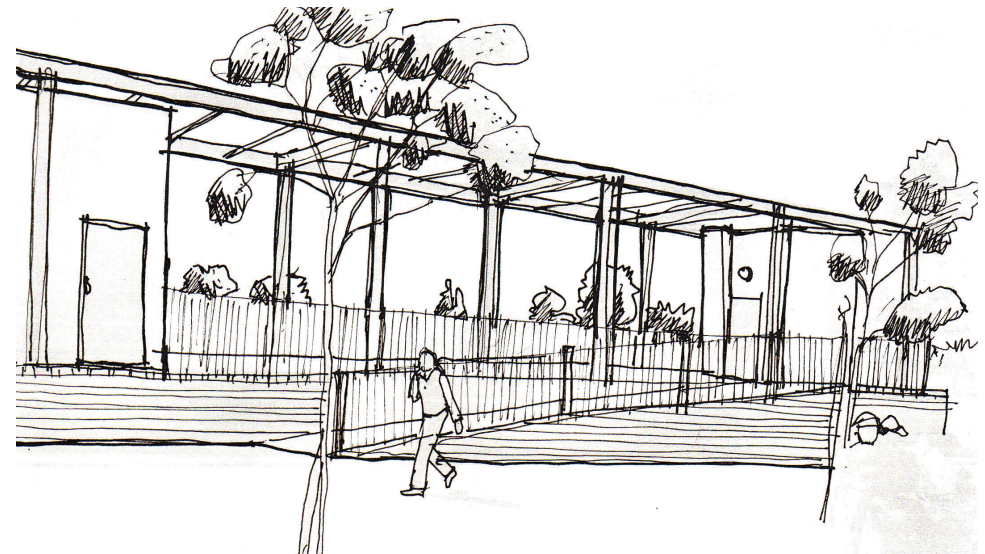
The structure is raised on a 'plinth' and makes a prominent feature and landmark in the space and gives this area a greater sense of place and identity. The public space around the plinth is 'formalised' with paving and planting with the upgrading of the space in the front of existing shops.

## 2. CONTEXT: SCALE, PROPORTION



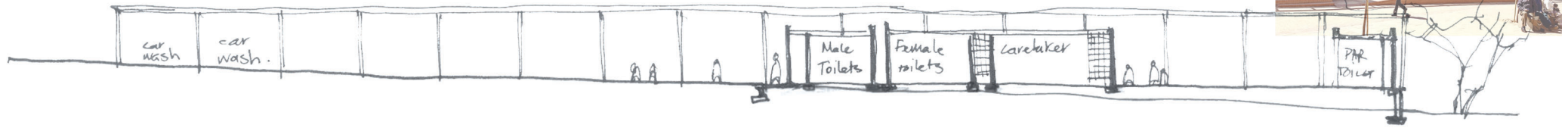
Bird's Eye View showing how the development sit in the context and how it relates to its surroundings. (New

## 3. ACCESS AND ACCESIBILITY + CIRCULATION

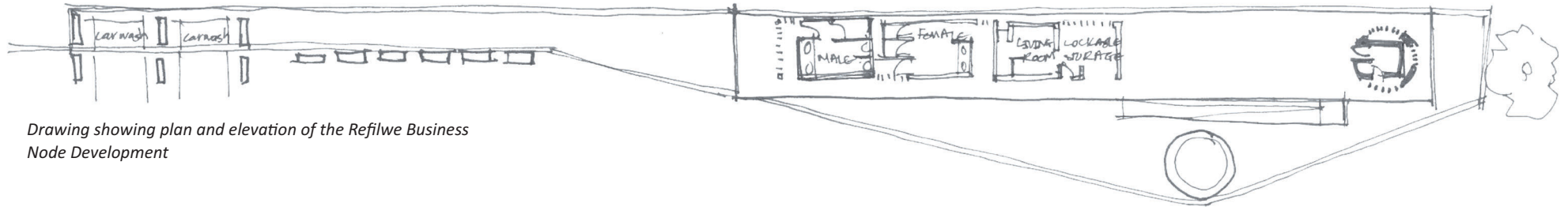


The project features an 'open-ended' structure that is essentially a floating roof along the threshold of existing shops and residential houses. Along the structure at various points, basic amenities are provided, such as seating, water points and male, female and paraplegic ablutions.

## 5. CONSTRUCTION AND MATERIALITY



Open ended framework structure. The roof is a hanging canopy detached from the structure housing the public amenities.



Drawing showing plan and elevation of the Refilwe Business Node Development

The roof or structure in itself becomes or acts as a framework for other programmes and uses to happen along and branching from it. There is also SASSA pay point and this structure provides shelter, ablutions and seating space for pensioners waiting for their grants. As such, the structure becomes a gathering space as well as an economic space where informal traders can have access to market as well as appropriate the space and use the available space as display, shelter and service space.

## 7. BOUNDARIES AND SPACE



Photograph showing amenity buildings sitting separate from the frame structure. (New Urban, 2016)



Public space around the structure is paved and landscaped. (New Urban, 2016)

## Precedent 4: Contextual Precedent

Fig. 59. Photograph of Traders stalls in warwick junction (Markets of Warwick 2019)



<b>Project:</b>	Warwick Junction Market
<b>Client:</b>	eThekweni Municipality
<b>Location:</b>	Durban, South Africa
<b>Year:</b>	1995 and ongoing
<b>Architect:</b>	Architects Collaborative cc

### Description:

The Warwick Junction Renewal project commenced in 1995 and is one of the few projects in South Africa that recognised the importance of street trading as an integral part of the city economy and employment of many of its residents. Here, street traders are catered for in the urban planning and spatial development. Street traders are considered as an asset to the urban morphology and the architects and planners aim to enhance their activities by providing appropriate

infrastructure suited to their needs.

The Junction is also a very important Transport Interchange with frequented by over 480 000 commuters on a daily basis. It also provides infrastructure for 1550 taxis and 300 buses operating from 19 taxi ranks and 5 bus terminals. There are an estimated 5000 to 8000 informal traders who operate from this interchange daily. These informal traders are spread out along the various roads, pedestrian bridges and walkways that connect the various public transport modes. There are also 8 different informal markets located at strategic covered public spaces at pivotal points of the various pedestrian routes. Each Market has a unique quality with some markets specifically selling limited types of products.

Similarly, to the project site, this location is not located 10 minutes away from the centre of the CBD and is the main connection point into and out of the city of Durban.

A small childcare centre that accommodates 70 children was also provided in a cordoned off area to ensure the safety of the children.

Fig. 60. Image showing precedent study analysis of Warwick Markets Development (Nemasetoni 2021)



## 1. SPATIAL PLANNING PRINCIPLES/ BUILDING CONCEPT

The Junction is also a very important Transport Interchange with frequented by over 480 000 commuters on a daily basis. It also provides infrastructure for 1550 taxis and 300 buses operating from 19 taxi ranks and 5 bus terminals. The Junction is also a very important Transport Interchange with frequented by over 480 000 commuters on a daily basis. It also provides infrastructure for 1550 taxis and 300 buses operating from 19 taxi ranks and 5 bus terminals.

There are also 8 different informal markets located at strategic covered public spaces at pivotal points of the various pedestrian routes. Each Market has a unique quality with some markets specifically selling limited types of products.

### 1. PROJECT CENTRE

This area is the main planning and admin space of the Junction. Routes to this space are lined with informal traders selling a wide variety of products

### 2. FRESH PRODUCE MARKET

This market is located at the intersecting point of 3 taxi ranks. Temporary shelters are erected where fresh produced packaged in smaller convenient packs are sold.

### 3. THE BOVINE HEAD MARKET

Located by the main eating area. It is an open covered structure where cooks line the edges and sell cooked meals. Benches and tables are provided where anyone can sit and eat in the middle space.

### 4. MIXED TRADING STRIP

Located along a busy pedestrian route from the Bovine Market on route to the Train Station. A wide variety of products is sold ranging from snacks to cigarettes. Traders sell items based on the time of day and the needs of the passers by. Some spaces are used by 2 or 3 different traders in one day based on this.



CIRCULATION/ FORMAL PEDESTRIAN ROUTES BETWEEN THE MARKETS

### 5. THE EARLY MORNING MARKET

670 lock-able trader stalls are located in this renovated building. The building has been adapted to allow good ventilation to keep the fresh produce fresher for longer. Here traders sell mainly fresh produce acquired from the Durban Fresh Produce Market which is relatively far from consumers.

### 6. THE MUSIC BRIDGE

This market is located along a wide pedestrian bridge linking the early morning market with the bus terminal and station. The side barrier of the bridge has been made into a sloping shelf where music cd's are displayed. Performances also happen in this space.

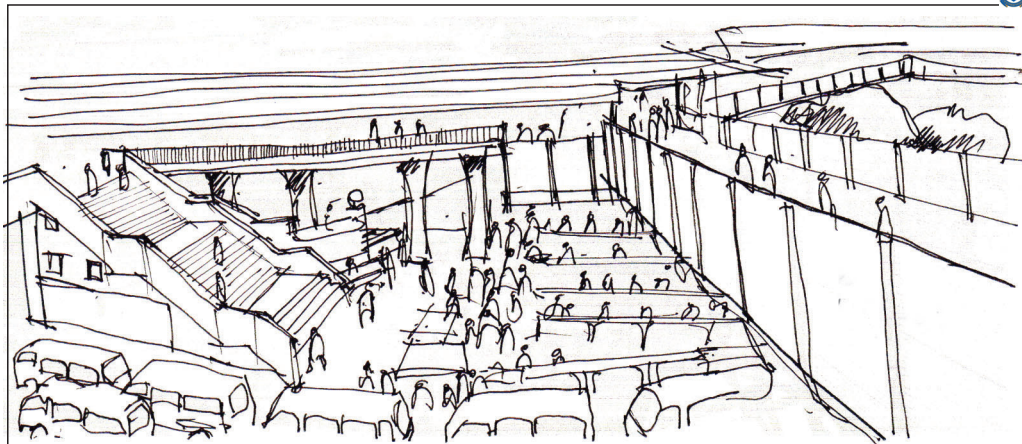
### 7. THE TRADITIONAL MEDICINES MARKET

This market is located along a quieter less busy route so there is some level of privacy where people can come consult and buy traditional medicines for their healing

### 8. THE BROOK STREET MARKET

This market is a covered wide street with a mezzanine floor made by the access bridge from the muthi market. Here passers by look over into the busy space where mostly clothing is sold. The side wall has been adapted into storage space for the traders.





Routes between the different types of public transport modes are formalised, developed and articulated using bridges, paving, walkways, staircases and ramps.

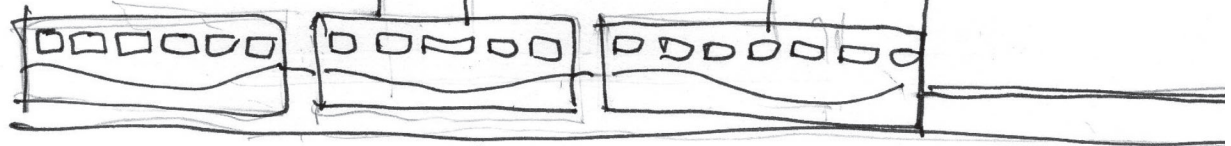
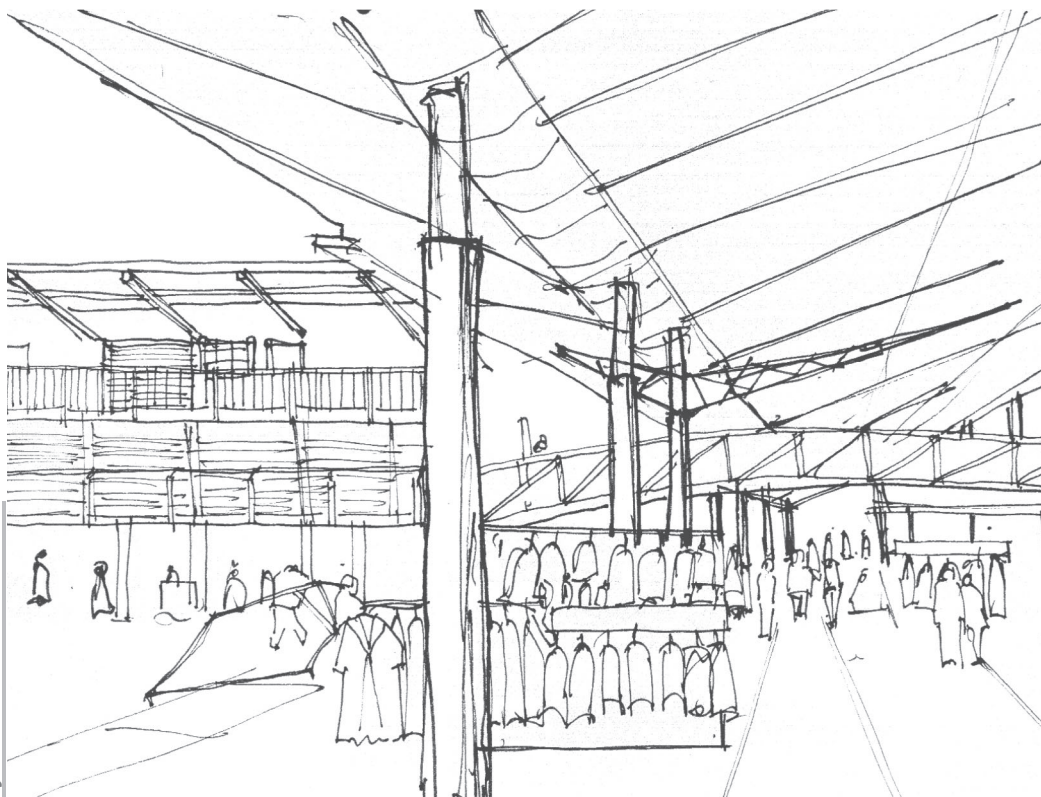


Fig. 61. Image showing precedent study analysis of Warwick Markets Development (Nemasetoni 2021)



Pedestrian bridges and access routes have been adapted into stalls. These bridges become more safe as side barriers are used as stalls creating a buffer zone. Passive surveillance is very prevalent in this space also increasing safety and activity.



Most formal markets are housed under open roofed structures which provide shelter and weather protection. Traders can then appropriate the space through a process of negotiation and organisation.

Traders appropriate space as needed and create boundaries, thresholds and edges using whatever materials they deem as appropriate and serves the purpose of storage and display etc.

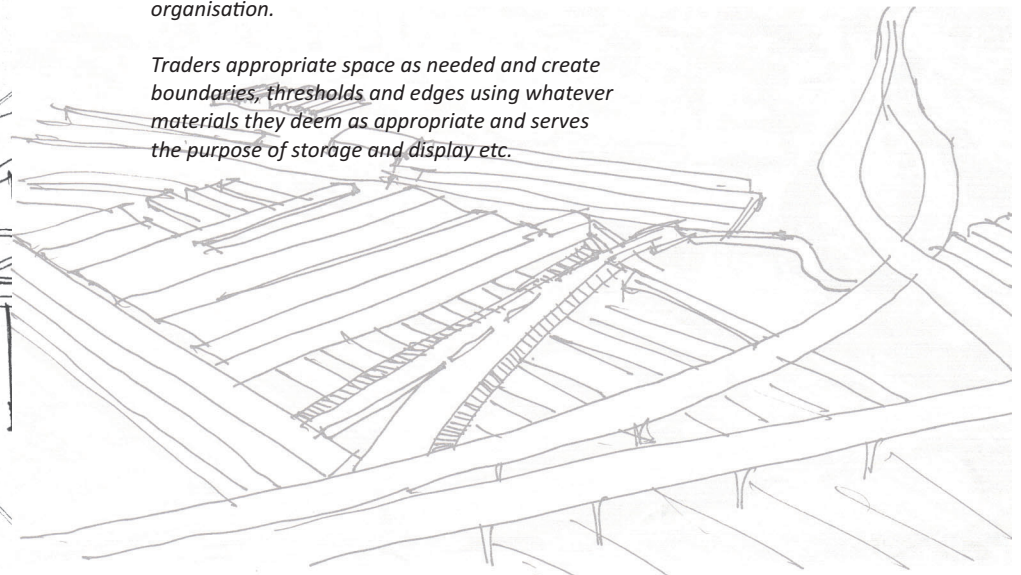
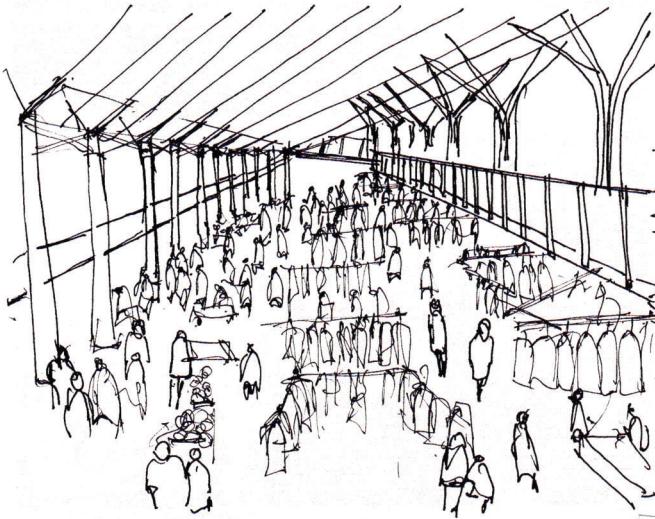


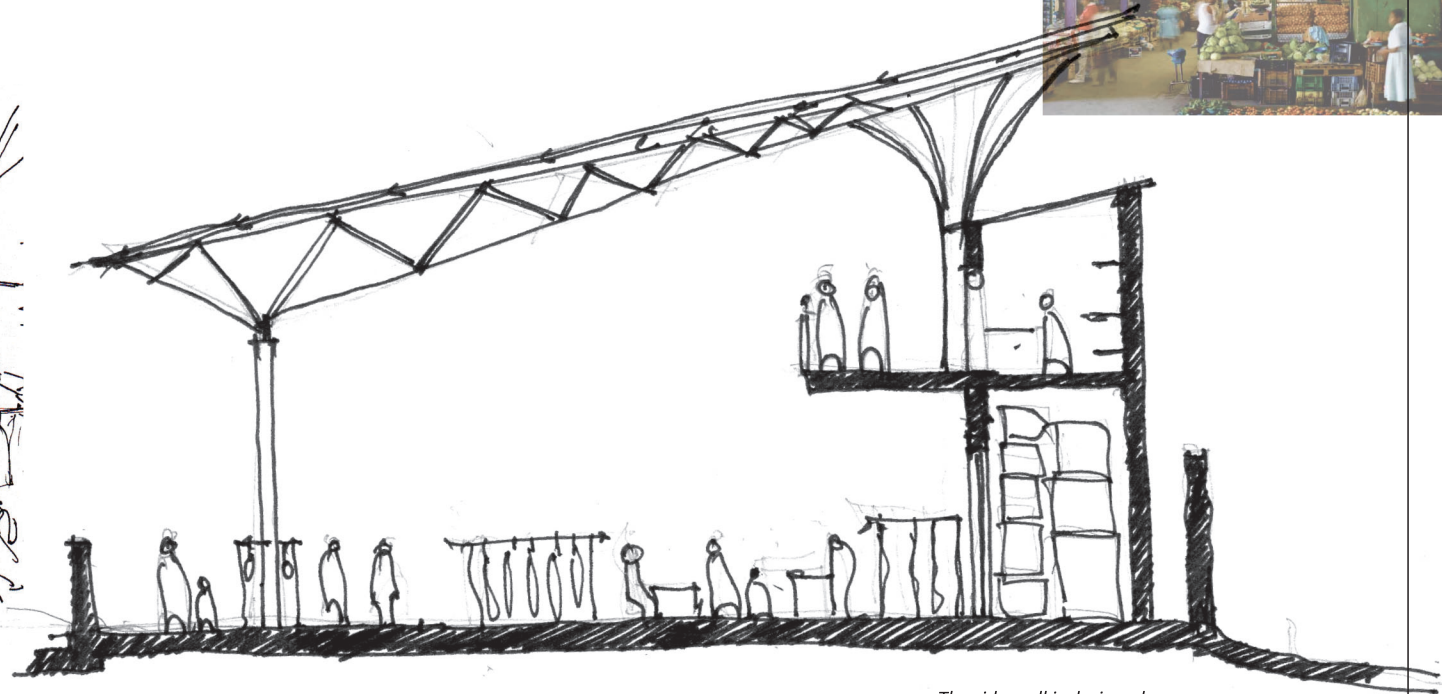
Fig. 62. Image showing precedent study analysis of Warwick Markets Development (Nemasetoni 2021)



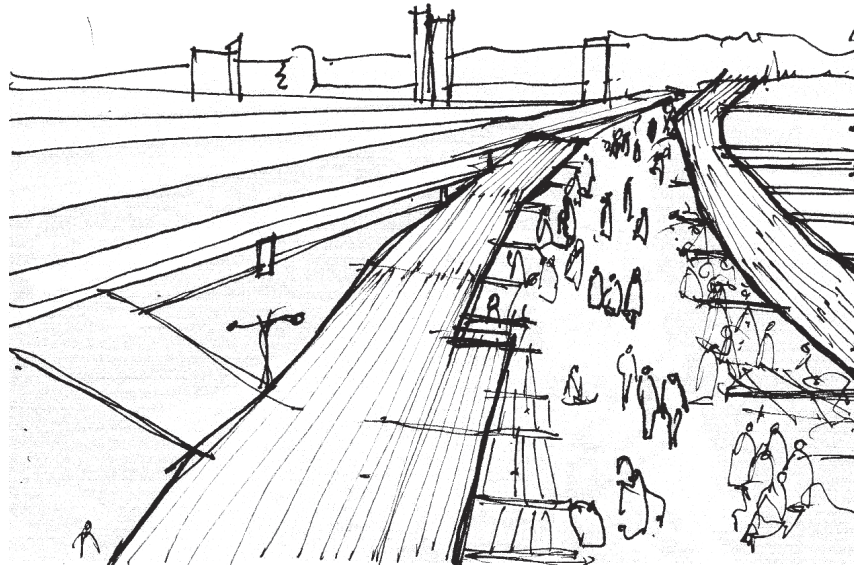
## The Brooke Street Market



Walkway is located on the mezzanine floor and gives this market passive surveillance element making this a safer space.

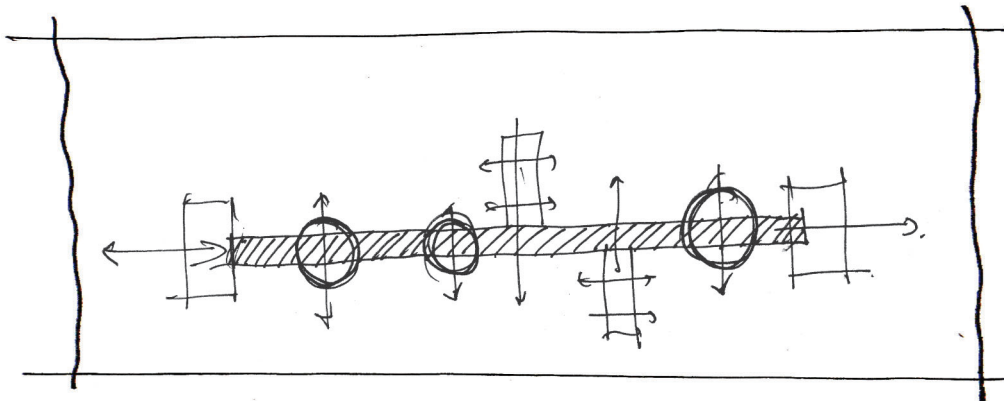


The side wall is designed as a storage area for the traders, located under the mezzanine walkway.

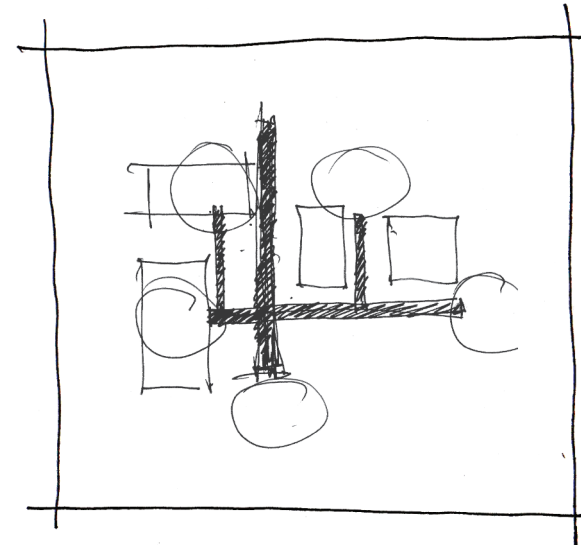


Most walkways and pedestrian bridges have been adapted into stalls bring more activity, safety and convenience for commuters.

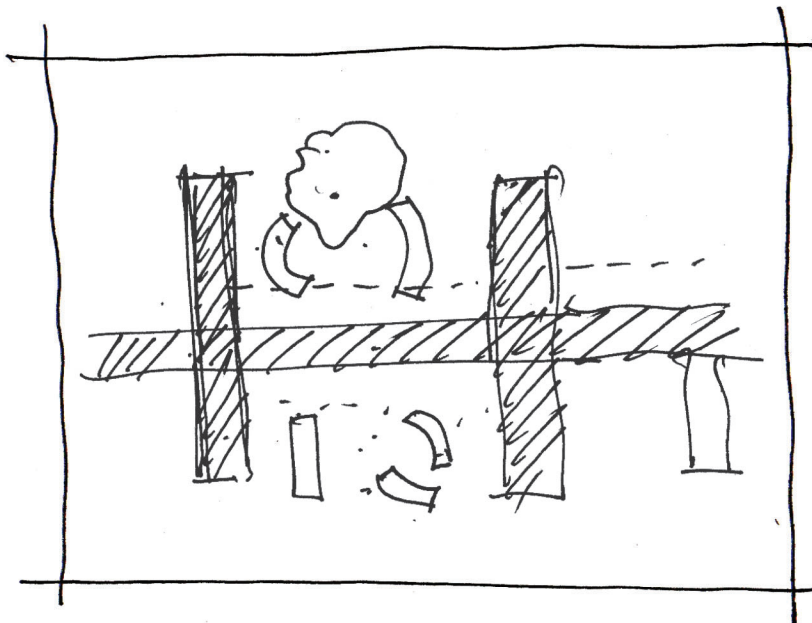
**Design Principles from Analysis of Precedent Study:**



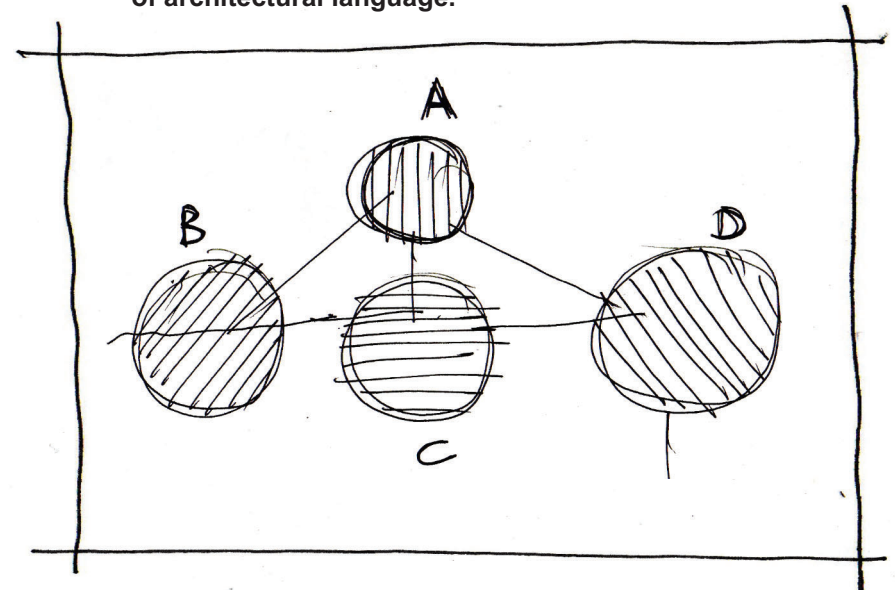
1. The use of a connecting 'spine' as the main ordering principles with other structures growing from it.



2. Links to important nodes in the area must be formalised and emphasized using some form of architectural language.

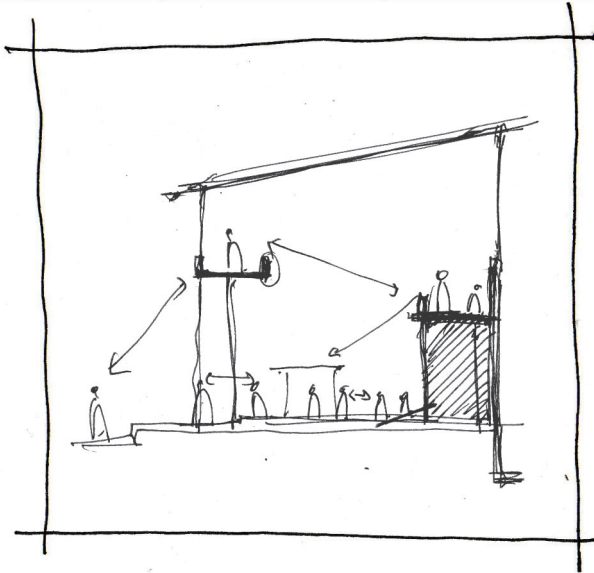


3. Courtyards to allow for smaller activities and gatherings to take place.

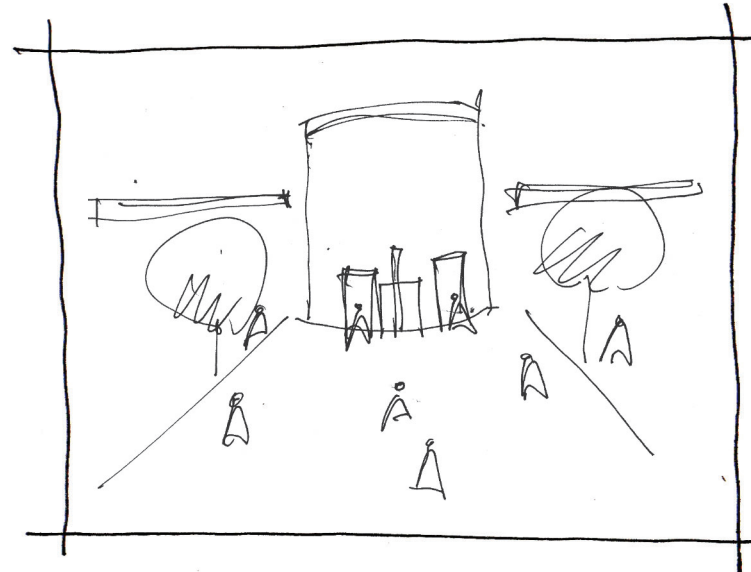


4. Different types of markets designed to cater for specific types of products sold/ specific activities. The markets must be appropriate for the context, people (passers by), time and what type of market is needed in the area of intervention.

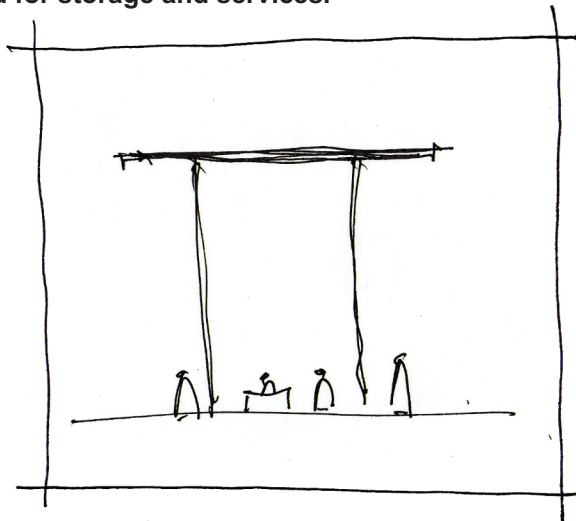
**Design Principles from Analysis of Precedent Study:**



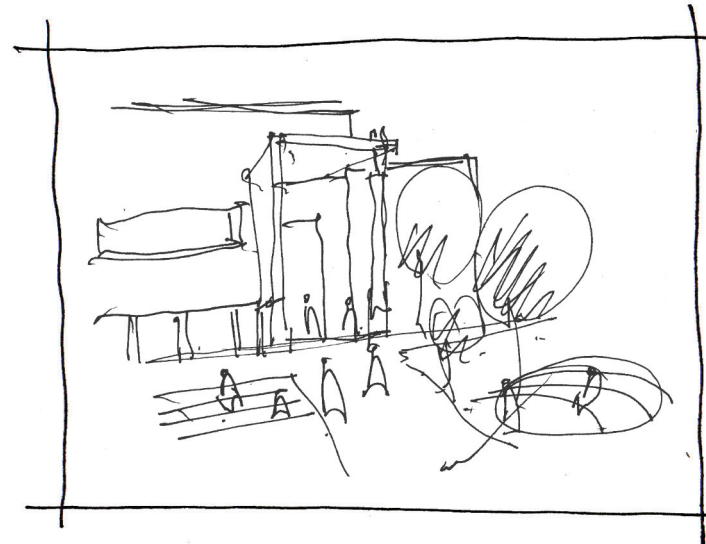
**5. Walkways should be located on different levels overlooking the market space to allow for passive surveillance and increased safety. Leftover spaces such as the underneath of walkways can be used for storage and services.**



**7. Public amenities such as ablutions should be clear and visible from the street. (separate to make them stand out)**

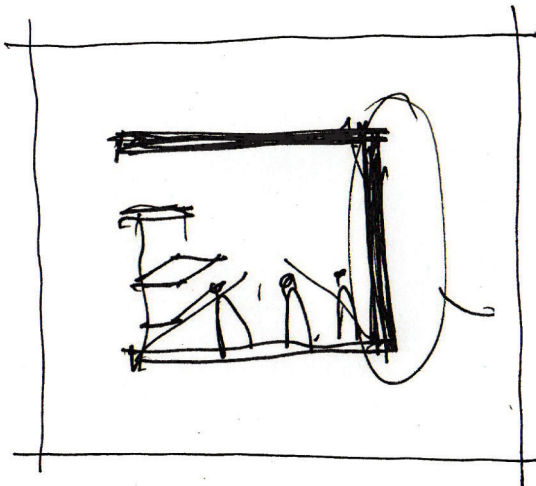


**6. The use of open-ended structures as shelters for the market spaces.**

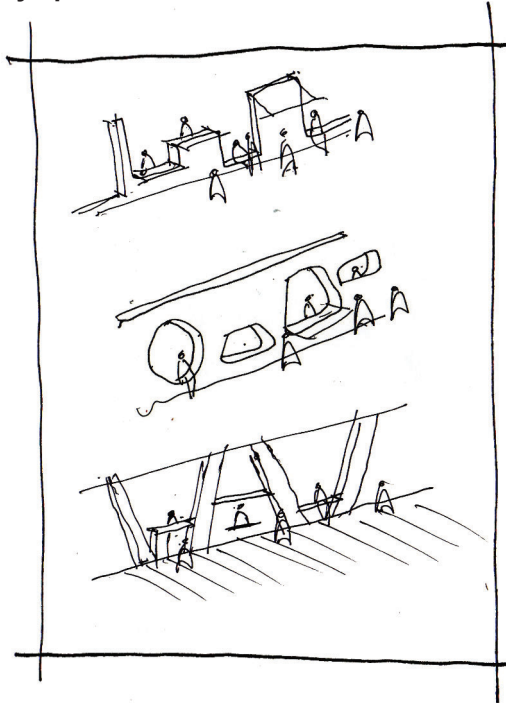


**8. Entrances/ entry points have plazas or public squares as the threshold space.**

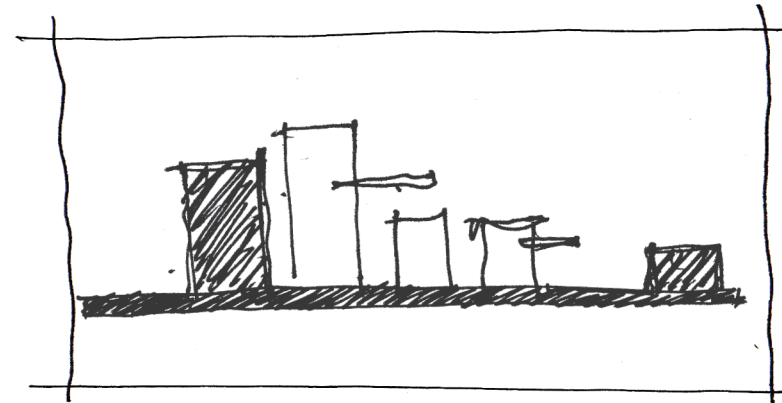
**Design Principles from Analysis of Precedent Study:**



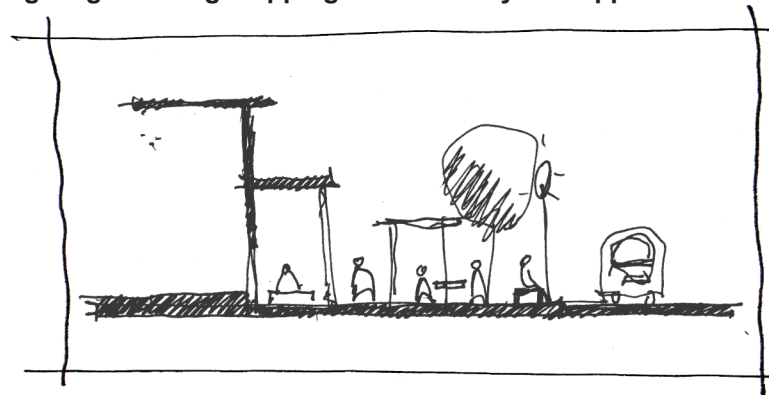
9. Barriers and balustrades along walkways should be designed as display spaces and also allow for other activities to take place.



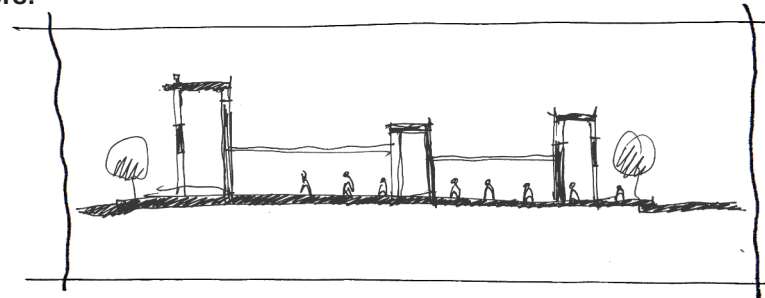
10. The use of inhabitable walls along important pedestrian routes that can accommodate various uses and activities.



11. Scale must relate to context and adjacent buildings. The intervention can be a bit higher than its surroundings. The building must be a mediating structure between surround building heights using stepping down and layered approach.








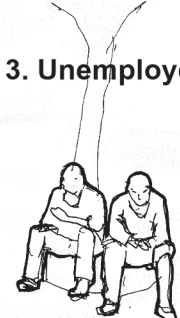
12. Edges and boundaries must be articulated to allow for spaces to be appropriated by informal traders and also allow for public life as a means to cater for public transport users.



13. Routes must be emphasized and clear by articulating important entry points as landmarks in the space. Various way finding structures/devices must be strategically placed along the route.






## User Profiles:

Fig. 63: Image showing a study project user profile (Nemasetoni 2021)

	Street Traders:			Commuters:		
	1. Survivalist	2. Self-Employed	3. Micro-Enterprise	1. Migrating to the City	2. Employees	3. Unemployed
						
<b>Reasons/ Motivations</b>	Basic Needs Survival for themselves & family <i>poverty relief &amp; upliftment</i>	Lack of jobs in the formal economy <i>Skills development</i>	Lacking capital and resources to be able to enter the formal economy <i>Support for business potential to grow</i>	In search for a better life and opportunities	Employed in various sectors in the city and commute daily from surrounds	In search of jobs both mostly unskilled labour force
<b>Welfare Needs</b>	Gov. Information Access to Free social services: -healthcare - SASSA - Adult Literacy Training - Access to Free/Affordable Day Care - Legal Advice and street trade regulations	Gov. Information Access to Free social services: -healthcare - SASSA - Adult Literacy Training - Access to Free/Affordable Day Care - Legal Advice and street trade regulations	Gov. Information Access to Free social services: -healthcare - SASSA - Adult Literacy Training - Access to Free/Affordable Day Care - Legal Advice and street trade regulations	Gov. Information Access to Free social services: -healthcare - SASSA - Adult Literacy Training - Access to Free/Affordable Day Care - Legal Advice and street trade regulations	-Gov. Information -Access to Free social services: -healthcare - SASSA	Gov. Information Access to Free social services: -healthcare - SASSA - Adult Literacy Training - Access to Free/Affordable Day Care - Legal Advice and street trade regulations
<b>Support Needs</b>	-Free/Affordable Trade stalls -Access to clean water, electricity, waste disposal, sanitation. - Storage facilities - Access to micro-finance - Access to hygienic food prep and cold room. - Basic business skills training	-Free/Affordable Trade stalls (varying levels of privacy) -Access to clean water, electricity, waste disposal, sanitation. - Storage facilities - Access to micro-finance - Access to shared Equipment and tools - Access to Up-skilling Training - Access to technology - Access to workshop space - Basic business skills training	- Business Incubation Services - Technical Skills Training - Need for links with formal Businesses - Linked to workshop space for product development - Storage space - Food Prep and packaging - Meeting Spaces - Marketing/Advertising space	-Information Board with jobs and opportunities -Access to basic needs	-Pause Spaces (Green public space) that supports public life - Clean and safe water, sanitation and waste disposal - Access to clean safe mobility infrastructure such as pedestrian paths etc. - Access to internet	-Information Board with jobs and opportunities -Access to basic needs

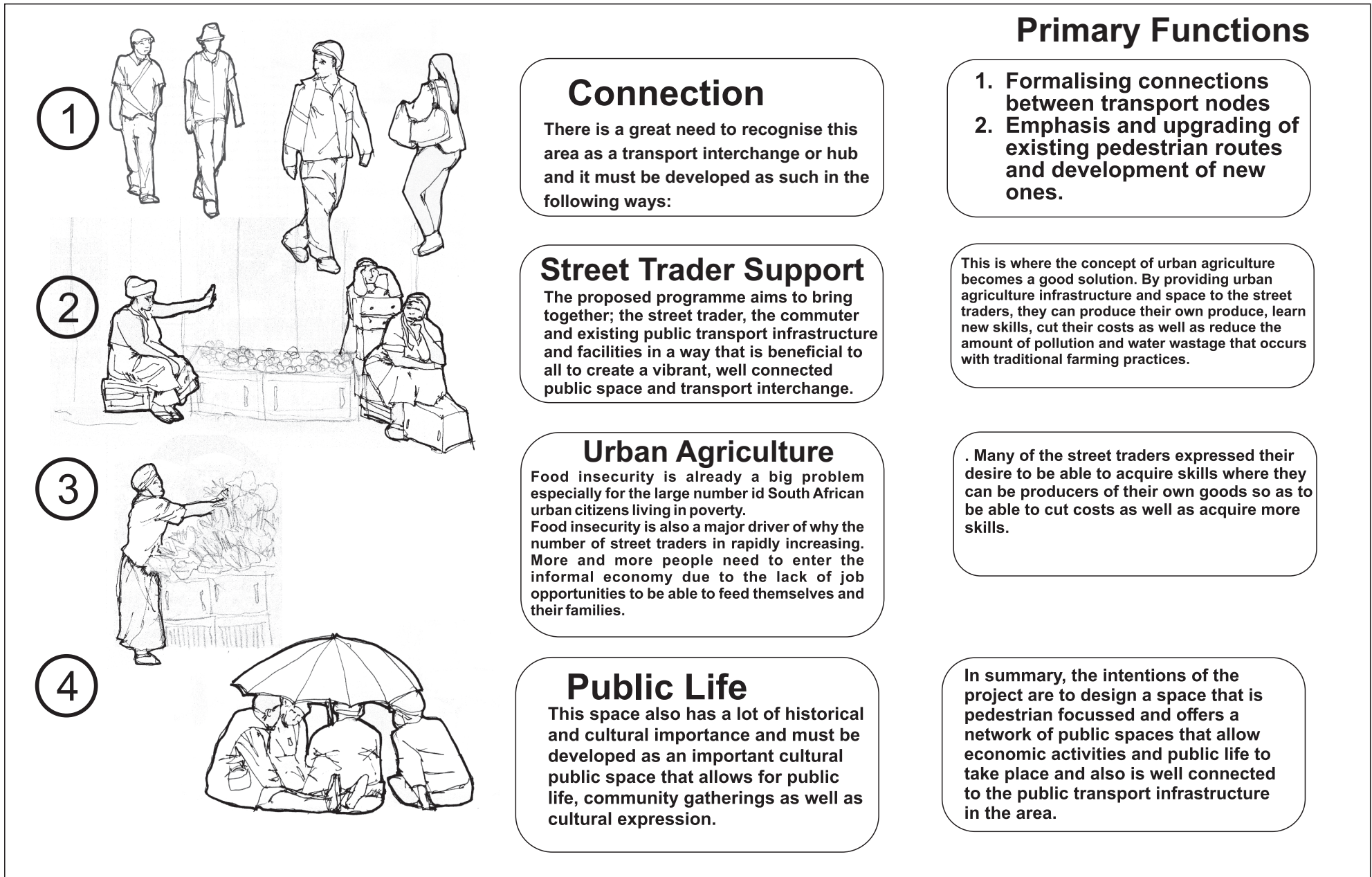
## User Profiles:

Fig. 64. Image showing a study project user profile (Nemasetoni 2021)

4. Casual Visitor	Students	Young Children	Tourists	Station Employees
				
<p>Occasionally visit the city to access services(public/private)/shopping/recreation</p>	<p>Commute daily to access a better education in the city.</p>	<p>Travel to the city with parents who are street traders due to lack of affordability of daycare.</p>	<p>Visit the city for cultural / recreational reasons</p>	<p>Daily residents of the precinct area</p>
<ul style="list-style-type: none"> <li>-Gov. Information</li> <li>-Access to Free social services:</li> <li>-healthcare</li> <li>- SASSA</li> </ul>	<ul style="list-style-type: none"> <li>-Gov. Information</li> <li>-Access to Free social services:</li> <li>-healthcare</li> <li>- SASSA</li> </ul>	<ul style="list-style-type: none"> <li>-Access to Free social services:</li> <li>-healthcare (immunization and check ups)</li> <li>- SASSA</li> <li>- Free/affordable daycare</li> <li>- safety and security</li> <li>- Access to basic needs</li> </ul>	<ul style="list-style-type: none"> <li>-Tourism Information</li> <li>-Access to local transport</li> </ul>	<ul style="list-style-type: none"> <li>-Gov. Information</li> <li>-Access to Free social services:</li> <li>-healthcare</li> <li>- SASSA</li> </ul>
<ul style="list-style-type: none"> <li>- Eating area</li> <li>- Recreational/cultural space</li> <li>- Access to local transport routes</li> <li>- Information (locating important institutional/ cultural sites)</li> </ul>	<ul style="list-style-type: none"> <li>- Eating area</li> <li>-Public green space/Pause area</li> <li>- Access to free internet</li> <li>- Access to information (career etc)</li> <li>- Access to computers, printers etc</li> <li>- Access to public seating and tables</li> </ul>	<ul style="list-style-type: none"> <li>-Safe and secure play areas</li> <li>- Spaces for learning</li> <li>- Access to basic needs</li> <li>- Adequate and comfortable classrooms</li> </ul>	<ul style="list-style-type: none"> <li>- Access to recreational/ cultural spaces</li> <li>- Access to tourism artifacts</li> <li>- Access to clean and safe eating areas</li> <li>- Access to public green spaces</li> <li>- Access to clean drinking water, sanitation and waste disposal</li> </ul>	<ul style="list-style-type: none"> <li>- Eating area</li> <li>-Public green space/Pause area</li> <li>- Access to free internet</li> <li>- Access to information</li> <li>- Access to computers, printers etc</li> <li>- Access to public seating and tables</li> <li>- Access to upskilling training</li> </ul>

**Programme Justification:**

Fig. 65: Image showing the main programme justifications (Nemasetoni 2021)





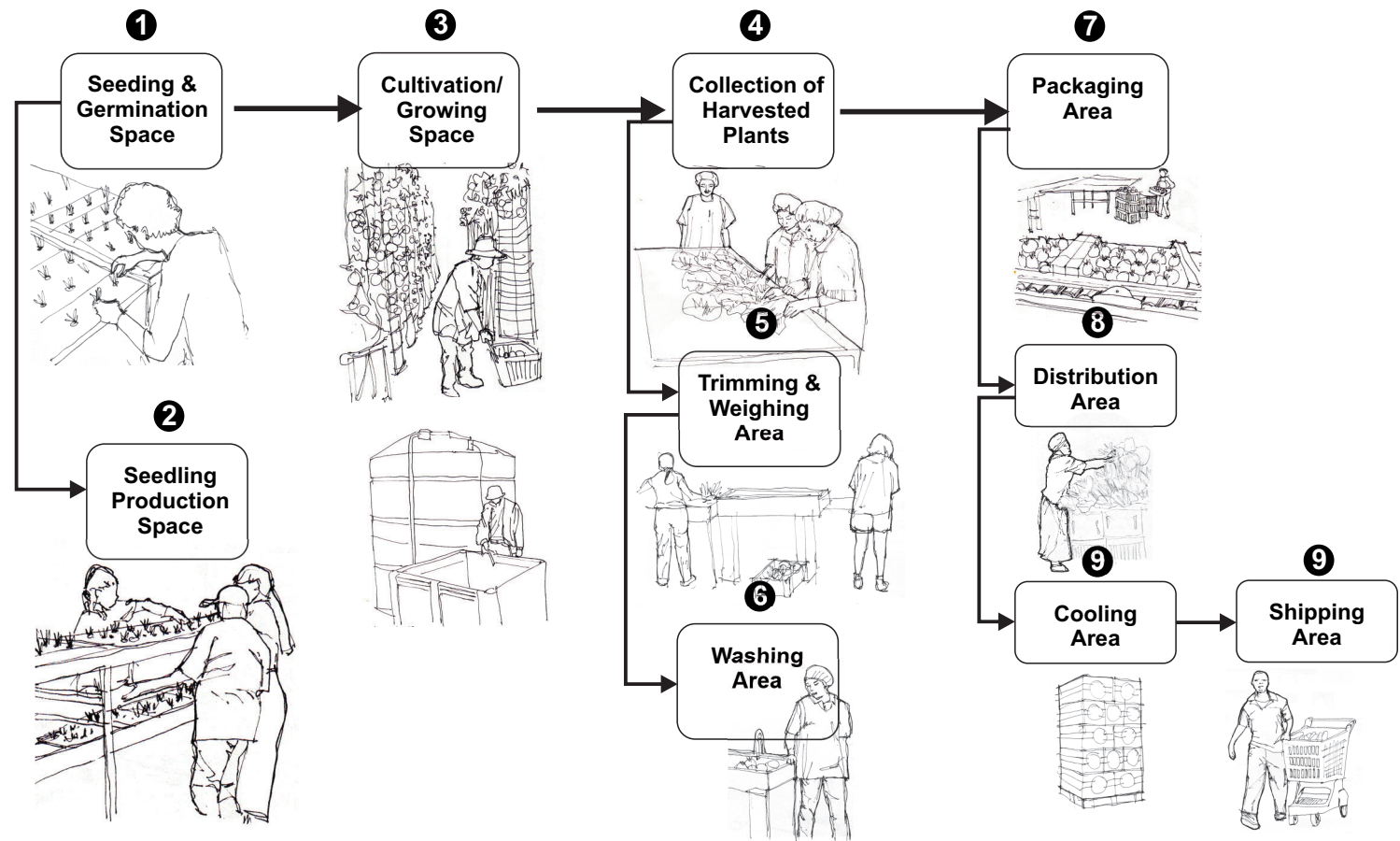
**Urban Farming Spatial Design Requirements:**

**VERTICAL URBAN AGRICULTURE INTENTIONS**

- 1 KNOWLEDGE AND LEARNING**  
- URBAN COMMUTERS  
- STREET TRADERS
- 2 WHOLE SALE TO STREET TRADERS**  
- AT LOWER COSTS BECAUSE OF NO NEED FOR TRANSPORT AND PACKAGING.
- 3 SUPPLY TO FOOD ENTREPRENEURS**  
- ENSURES LESS WASTAGE AS FOOD IS FRESH FOR LONGER AND COOKS CAN TAKE AS NEEDED AND THUS MORE PROFIT
- 4 INNOVATION**  
- NEW WAYS OF VERTICAL URBAN FARMING CAN BE TRIED AND TESTED IN DIFFERENT URBAN SETTINGS

Fig. 66: Image showing the plant production process (Nemasetoni 2021)

**//PLANT PRODUCTION PROCESS//**



**Intergrated Programme Concept and Diagrams:**

The idea of ecosystem as infrastructure will be used as a framework for how the space will be integrated on the site. The diagram shown in fig shows how energy moves through the various trophic level, namely 'producers, consumers and decomposers' where the outputs of one level become the input of another creating a complete cycle where energy and resources is not wasted (Singh, 2020) The aim is for the this project to become a self sustaining development.

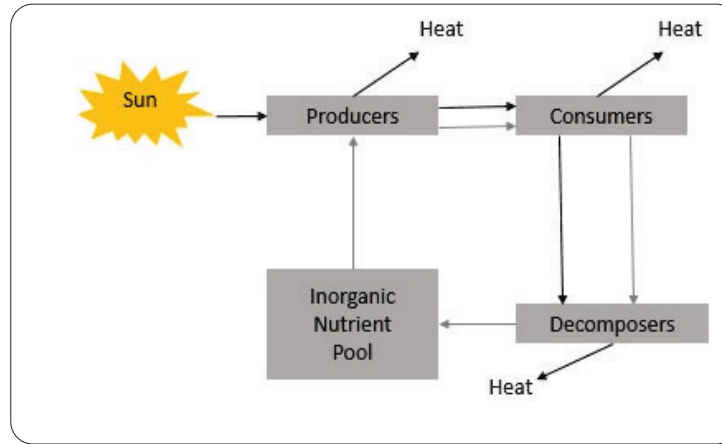
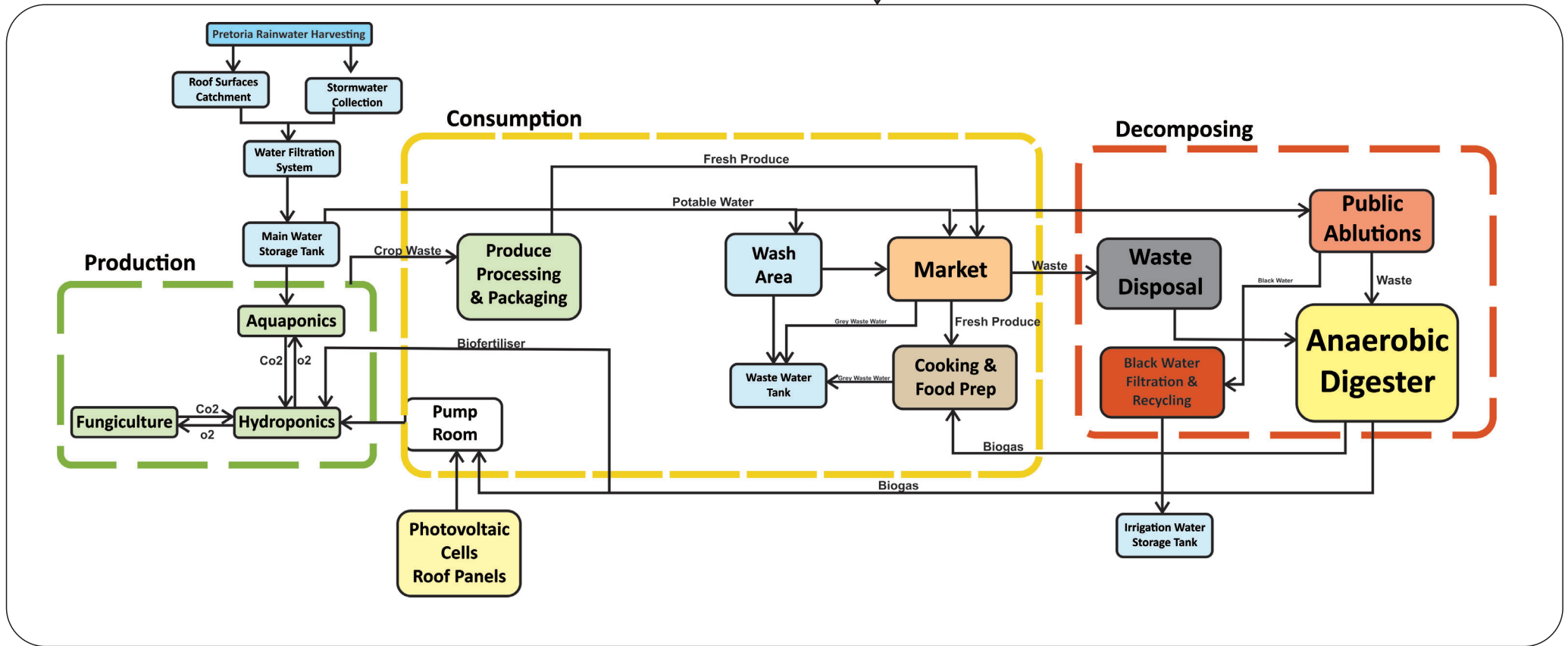


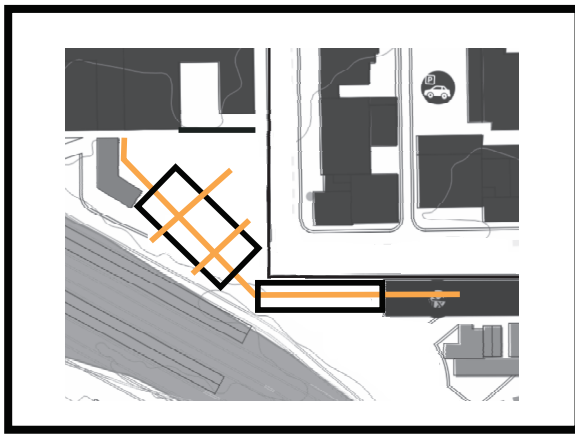
Fig. 67: Image showing the plant production process (Tutorials Point 2021)

Fig. 68: Image showing integrated programme diagram (Nemasetoni 2021)

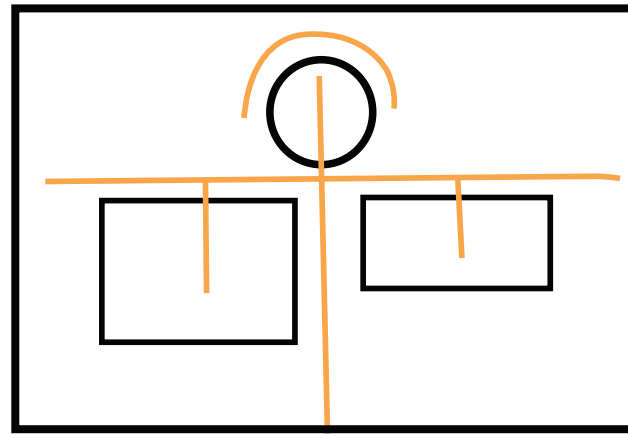


## Street Trade Mapping and Form Concept:

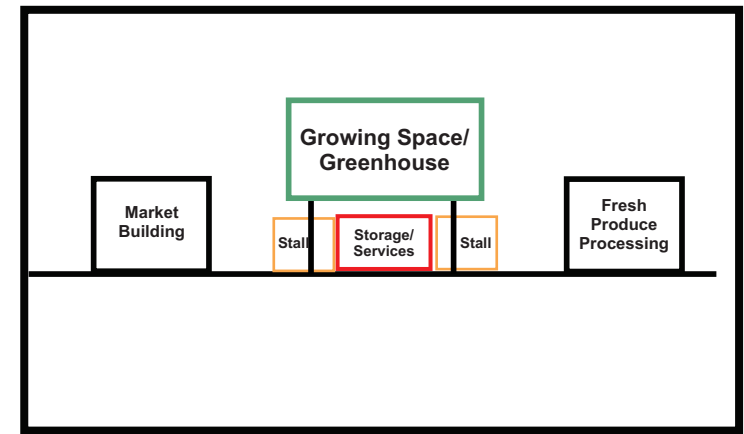
Below is a set of diagrams that shows the basic structural planning principles that will be used in the building.



**Masterplan Concept**



**Building Massing Concept**



**Conceptual Section**

*Fig. 69: Image showing design concept diagrams (Nemasetoni 2021)*

## Street Trade Mapping and Form Concept:

- 1 Informal trader structures create an organic form against the formal orthogonal backdrop of the existing built urban forms.

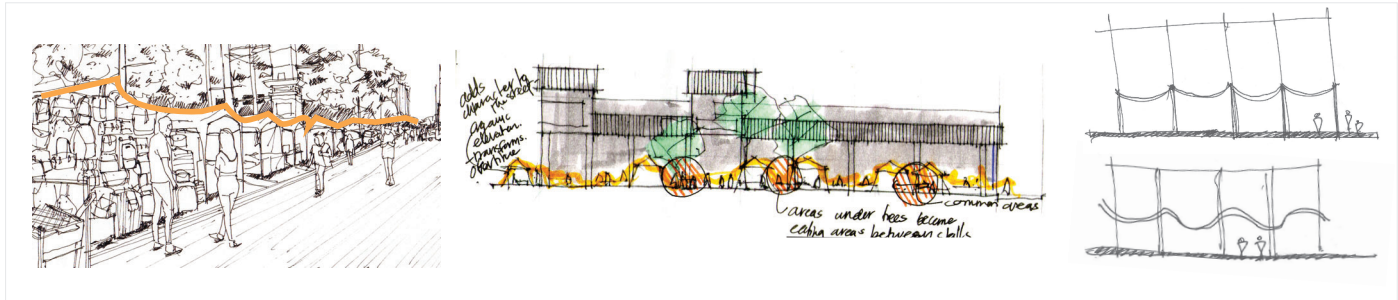


Fig. 70: Analysis of sketches of Tshwane CBD street trade mapping (Nemasetoni 2021)

- 2 Shelters and roofs are created by hanging structures, often waterproof fabrics between supports. These fabrics hang to allow water to flow off.

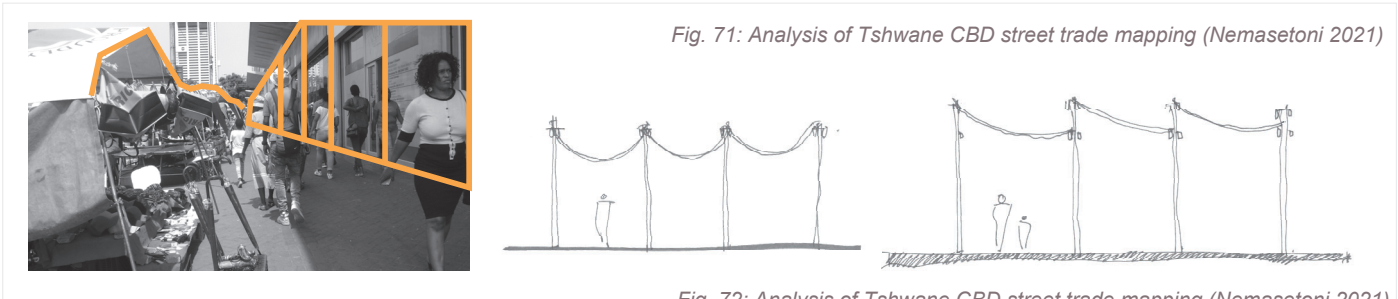


Fig. 71: Analysis of Tshwane CBD street trade mapping (Nemasetoni 2021)

- 3 Mappings of Church Street market shows how the canopy of trees along the sidewalk define the space and hover above the busy market street below.

Translated to Design: The Urban Greenhouses become like the canopy of trees hovering above 'boxes' that house the storage and support devices. These hovering greenhouse 'canopies' puncture into the public walkways as a design feature.

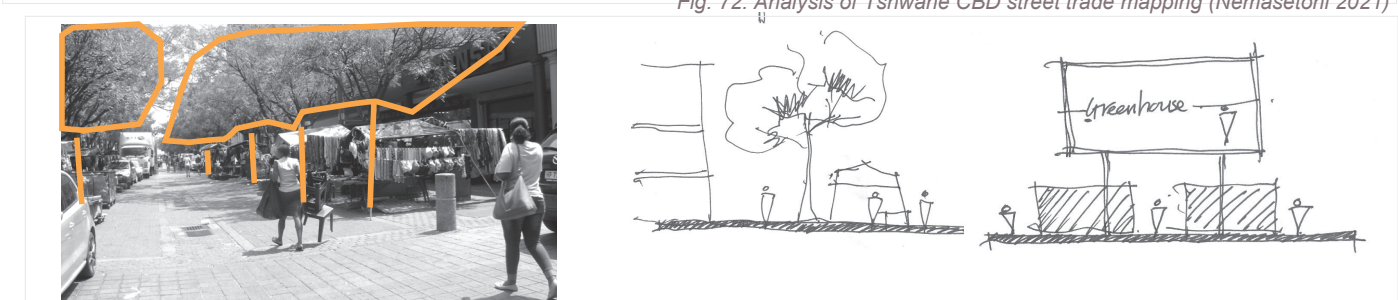


Fig. 72: Analysis of Tshwane CBD street trade mapping (Nemasetoni 2021)

- 4 Street Markets along the edge of the sidewalk create arcade space between shopfront and street markets where pedestrians have to navigate through this in-between space. In some areas, traders hang fabrics between their structures and the existing urban edges.

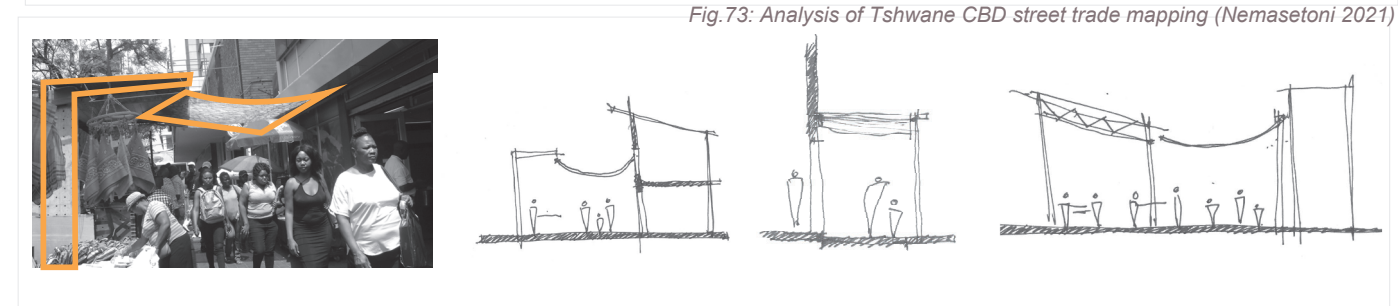
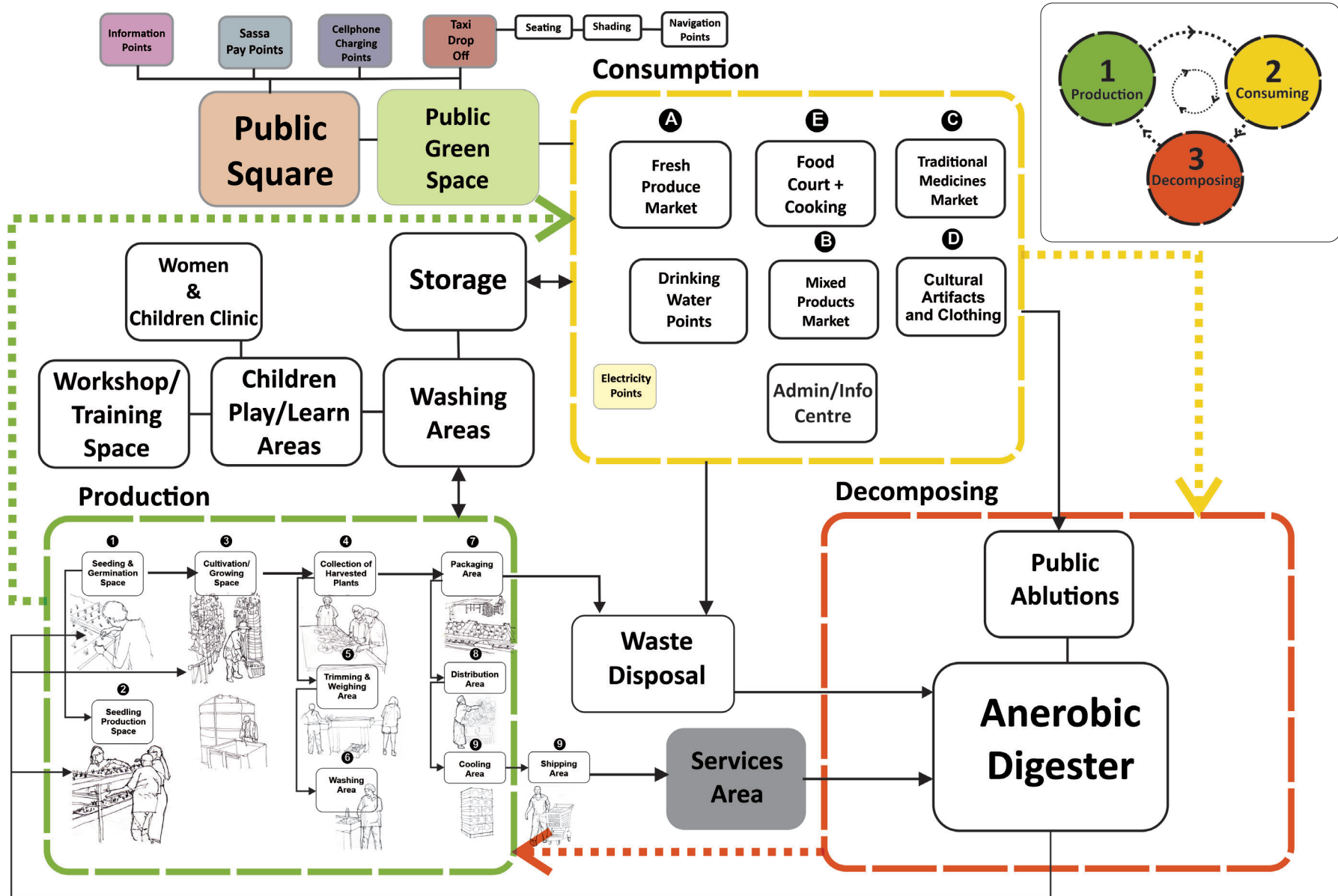


Fig. 73: Analysis of Tshwane CBD street trade mapping (Nemasetoni 2021)

**Intergrated Programme Diagrams:**

Fig.74: Intergrated Programme Diagram (Nemasetoni 2021)



**Connection, Technology and Public Life:**

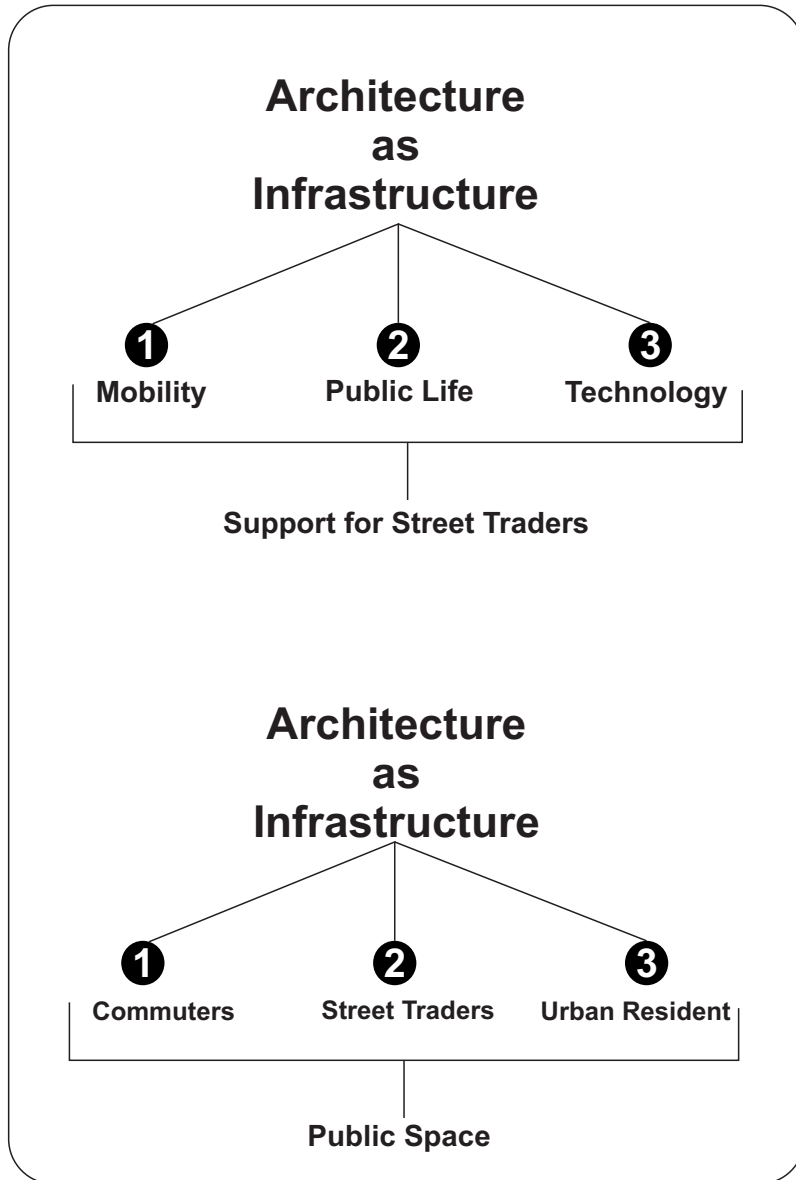


Fig.75: Project concept (Nemasetoni 2021)

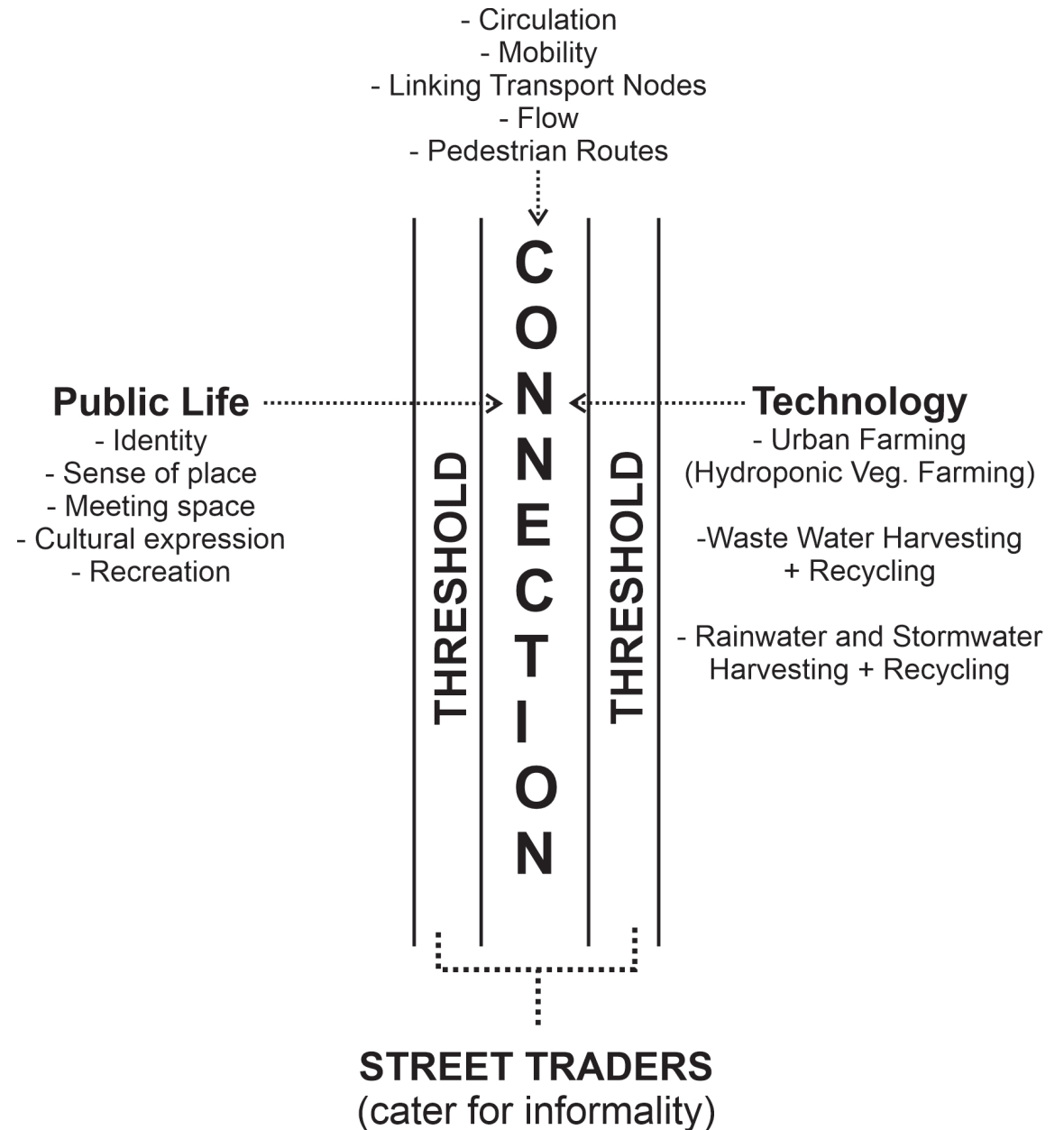
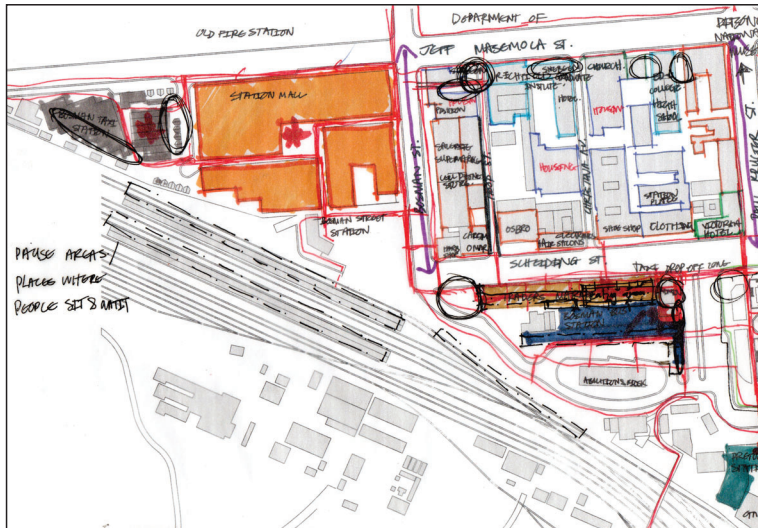
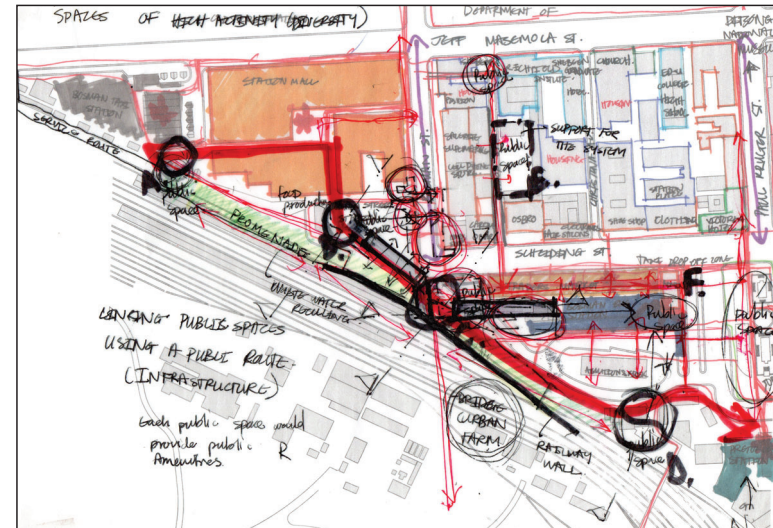


Fig.76: Project concept diagrams showing site planning principles (Nemasetoni 2021)

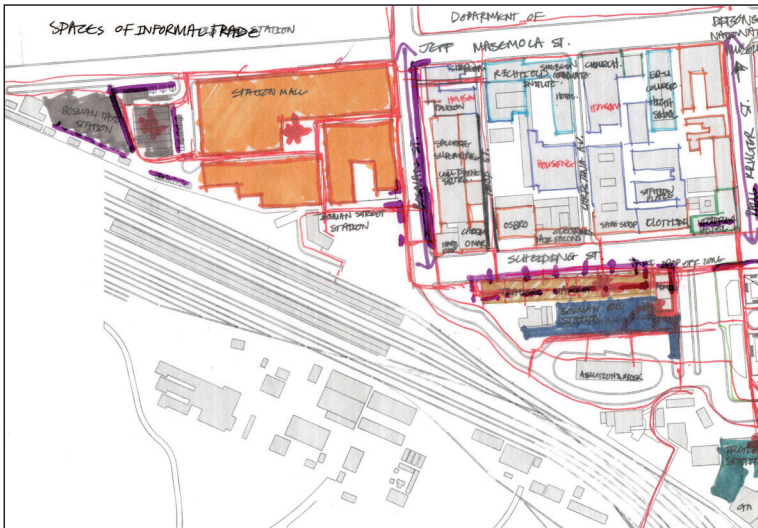
## Connection, Technology and Public Life:



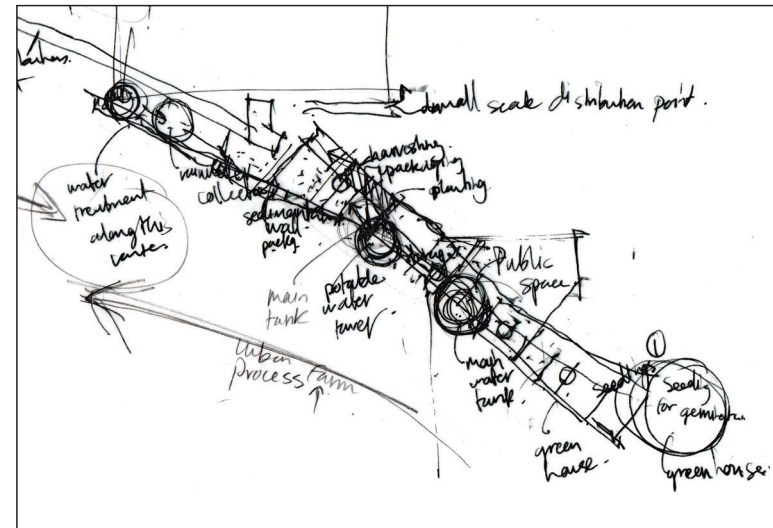
Site Mapping of spaces where people organically gather.



Site Mapping of spaces which could be developed into markets.



Site Mapping of pedestrian routes.



Spatial concept sketch.

Fig.77: Site mapping exploring how design concepts can be implemented on the site (Nemasetoni 2021)

**Application of Concepts on the Site:**

## CONNECTION

1. Connection Between Various Transport Modes formalising pedestrian pathways with paving and navigation points to assist commuter when travelling using multiple public transport modes.
2. Connection between formal (Pretoria Station Mall) and existing informal trader's market.
3. Visual connectivity from the site to other important landmarks and nodes in the CBD. This will assist in connecting the Bosman Precinct to the wider CBD context.
4. Connection to Salvokop.



## TECHNOLOGY

1. The New Concrete Rail way Line Wall will act not just be a safety and ordering device but become infrastructure in that most of the services to the various building on the site will flow along the wall.
2. The Wall (Retaining Wall) will also order the ecological services of the project such as the water filtration system where harvested and waste water will be recycled.
3. The wall will also order how the Urban Farming Greenhouse are positioned on site as they will be integrated with the proposed green promenade along the wall.



## PUBLIC LIFE

1. Street Trader stalls along Bosman Street to accomodate the numerous existing traders.
2. Activation of Scheiding Street to be more pedestrian friendly with public seating and shading.
3. Trees and seating to be added in empty un-programmed areas of the site.

Fig.78: Axo showing how planning principles will be implemented on the site (Nemasetoni 2021)





# Design Concept 1:

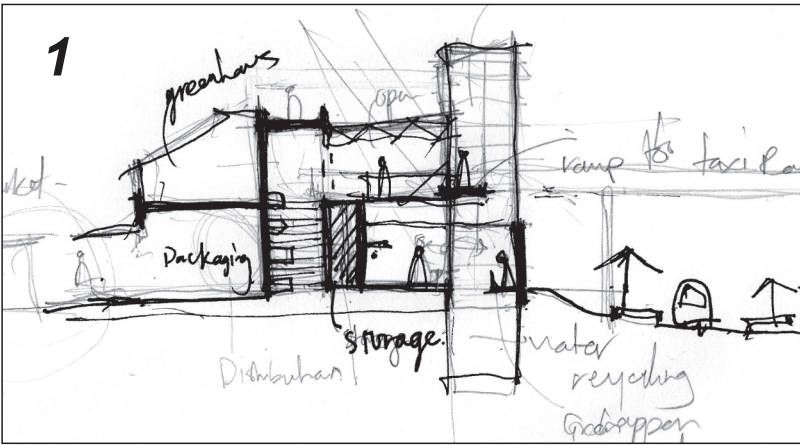


Fig. 83: Sectional sketch (Nemasetoni 2021)

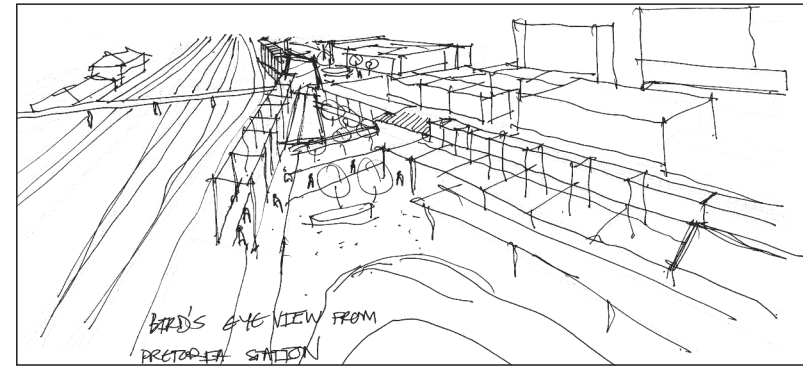


Fig. 86: Concept bird's eye view (Nemasetoni 2021)

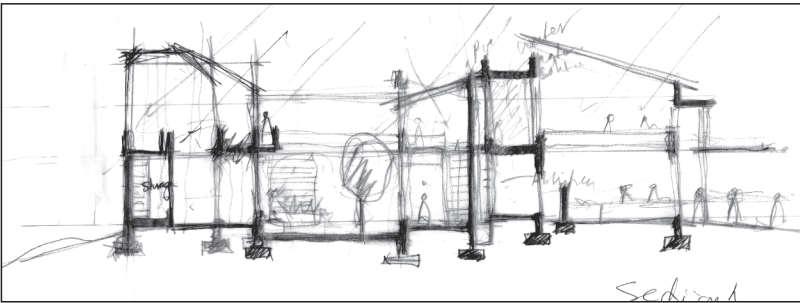


Fig. 84: Sectional sketch (Nemasetoni 2021)

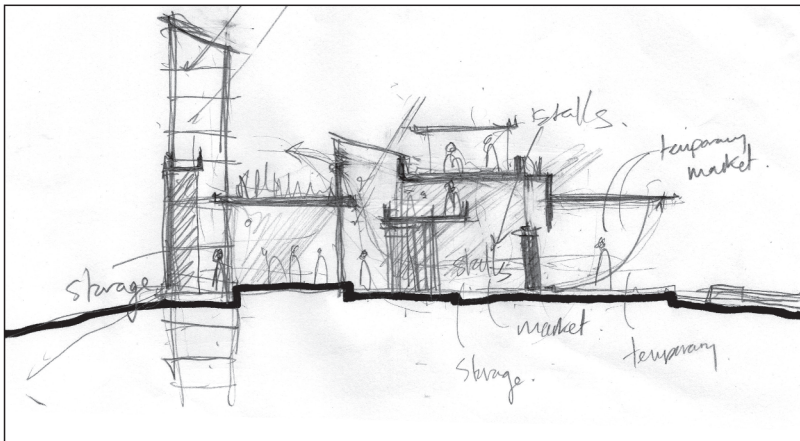


Fig. 85: Sectional sketch (Nemasetoni 2021)

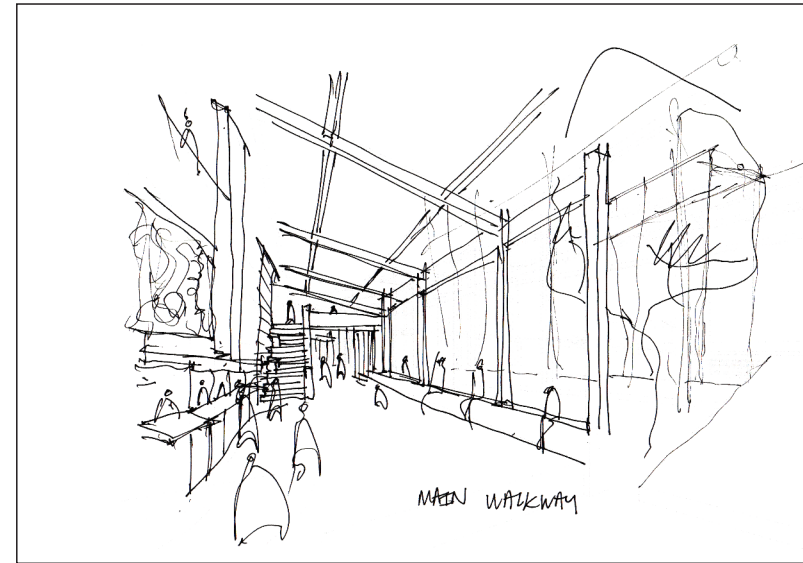


Fig. 87: Concept perspective (Nemasetoni 2021)

## Sectional Explorations:

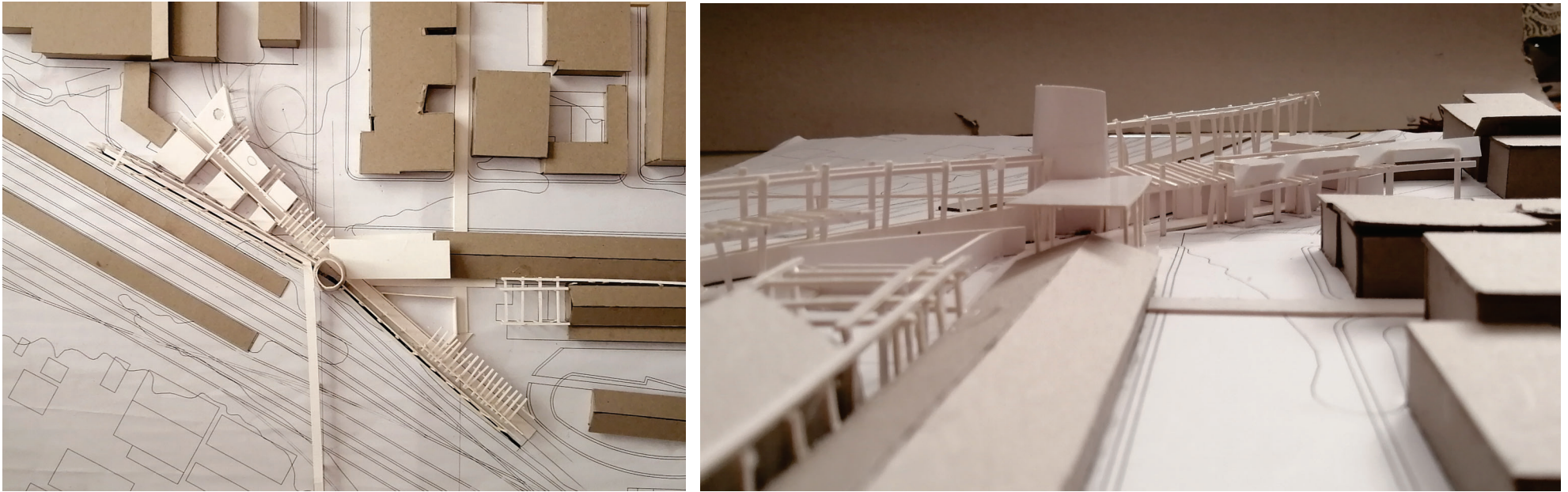


Fig. 88: Photographs of site model (1:500) (Nemasetoni 2021)



Fig. 89: Photographs of site model (1:500) (Nemasetoni 2021)

# ARCHITECTURE AS INFRASTRUCTURE

## 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 inhabit 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)

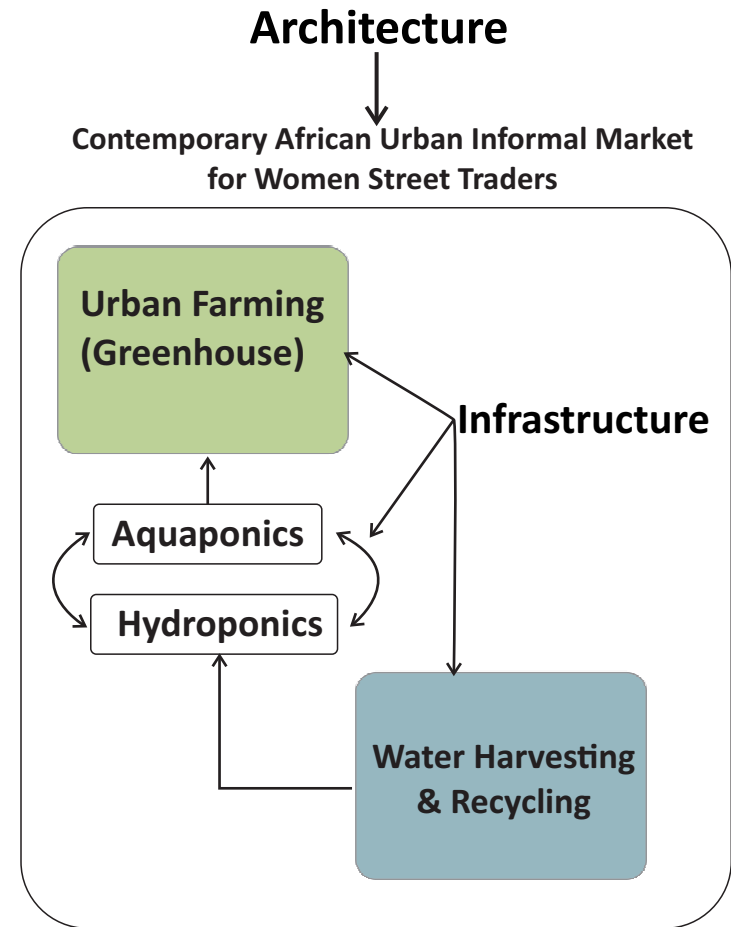


Fig. 91: Diagram showing main technical systems (Nemasetoni 2021)

## Technical Design Precedent:

<b>Project:</b>	Lycée Schorge
<b>Client:</b>	Stern Stewart Institute & Friends
<b>Location:</b>	Koudougou, Burkina Faso
<b>Year Completed:</b>	2014-2016
<b>Size:</b>	1,660 sqm (built area)
<b>Architect:</b>	Francis Kere

### Project Description

This high school is located in the city of Koudougou 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 an 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 blocks 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 Lycée 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)

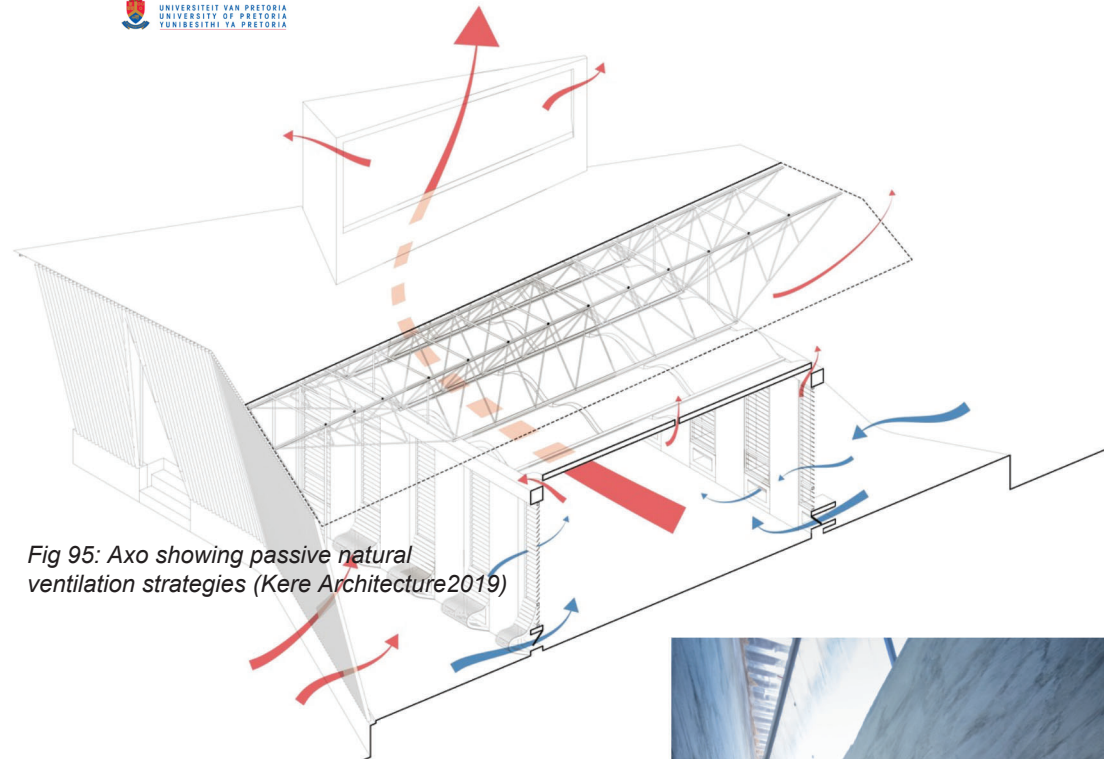


Fig 95: Axo showing passive natural ventilation strategies (Kere Architecture 2019)

**Axo showing passive natural ventilation strategies used.**

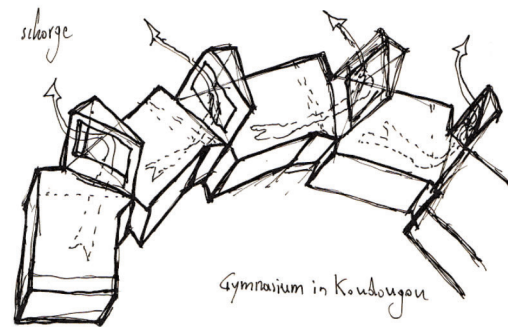


Fig. 96: Sketch showing how wind towers are used in the design as well as air flow by Kere (Kere architecture 2019)

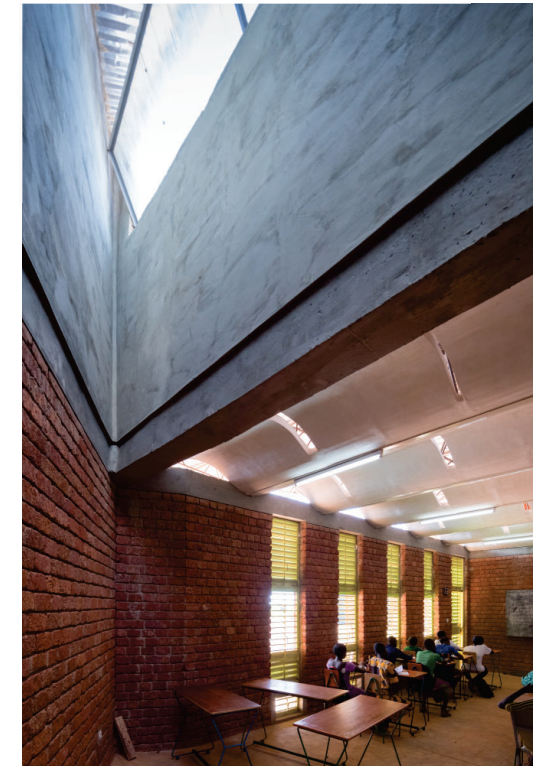
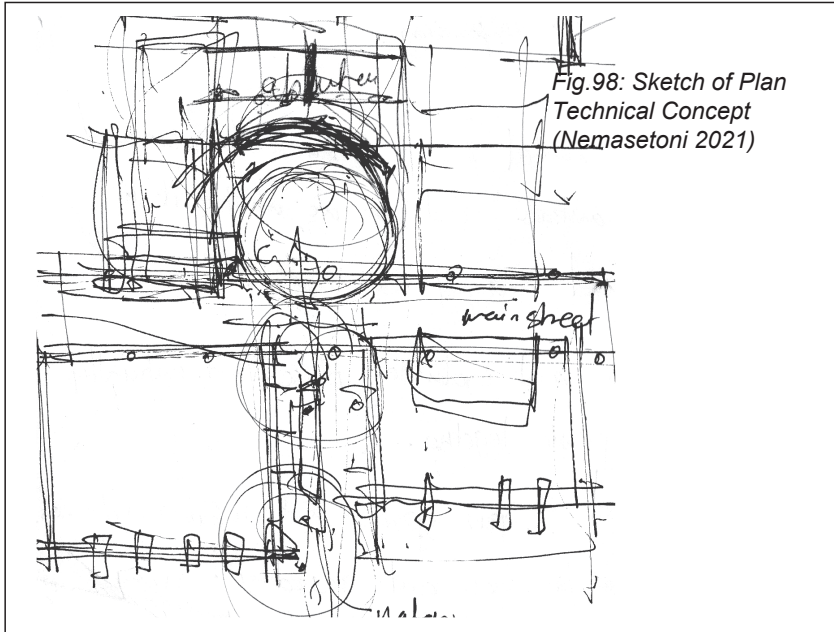


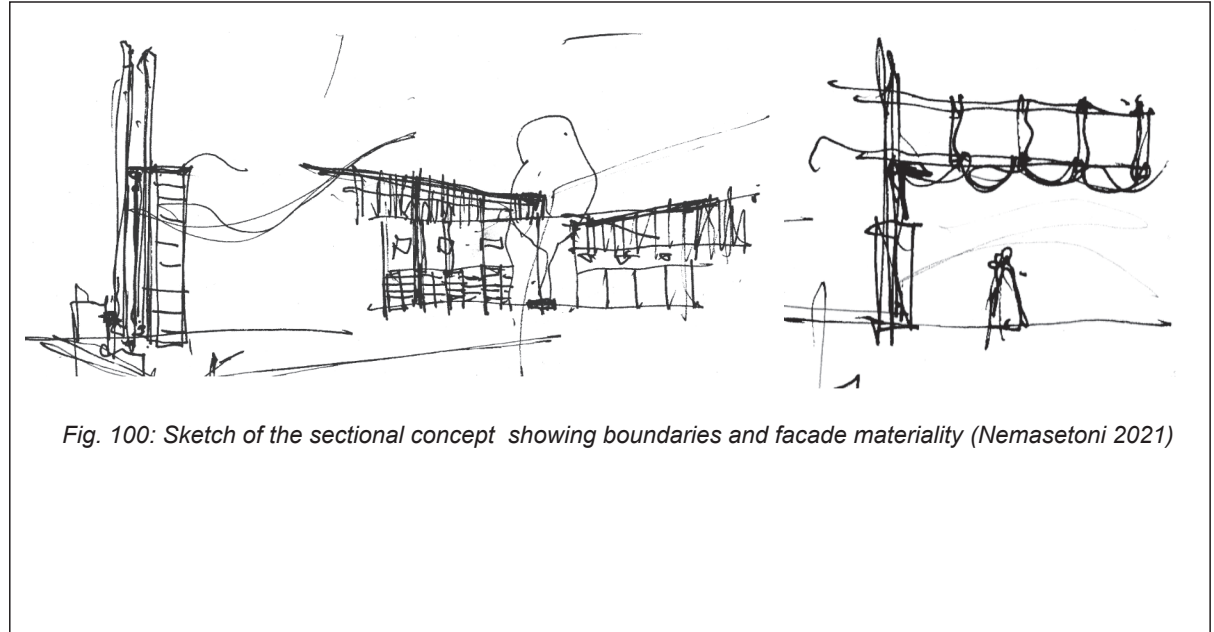
Fig. 97: Photograph of wind towers located at the back of each classroom (Kere Architecture 2019)

## Technical Design Concept Development:

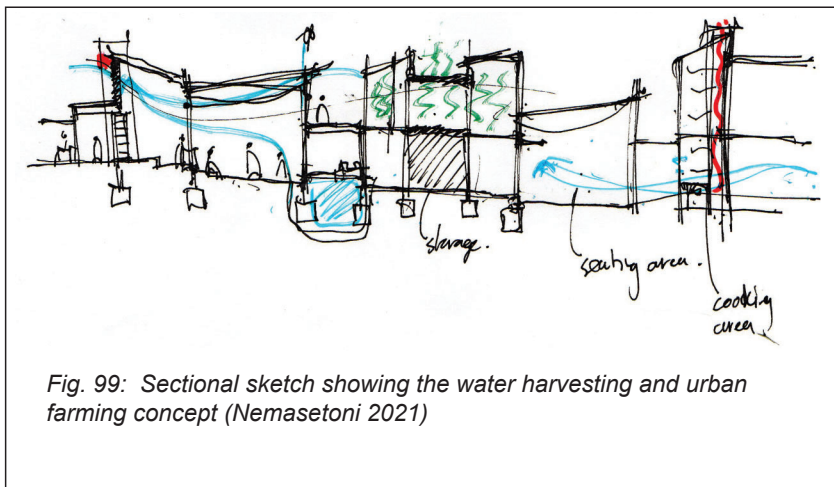
### Floor Plan



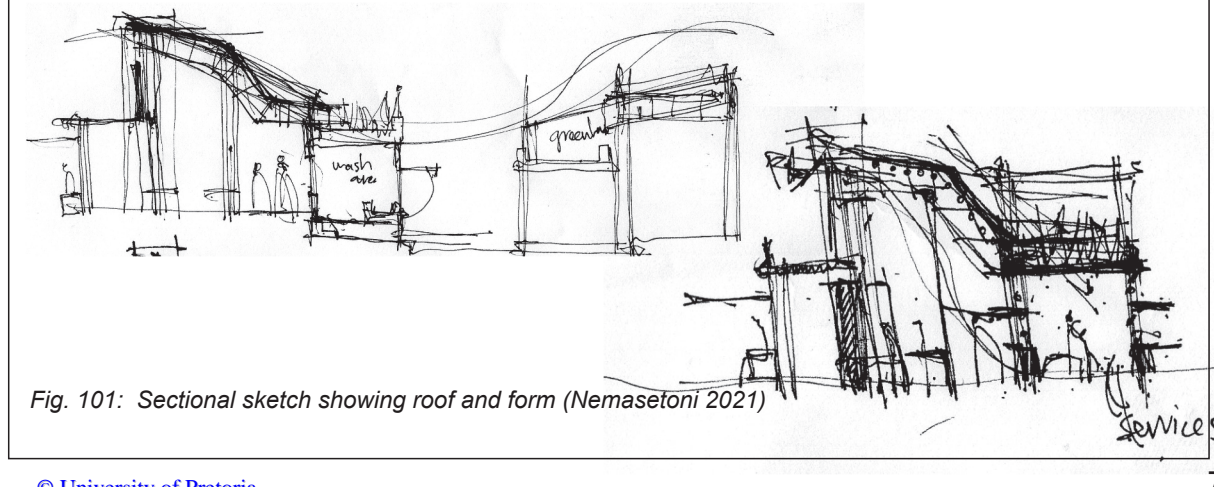
### Materiality and Textures



### Services and Systems



### Boundaries, Form, Space and Volume





**Final Technical Concept and Exploration Model:**

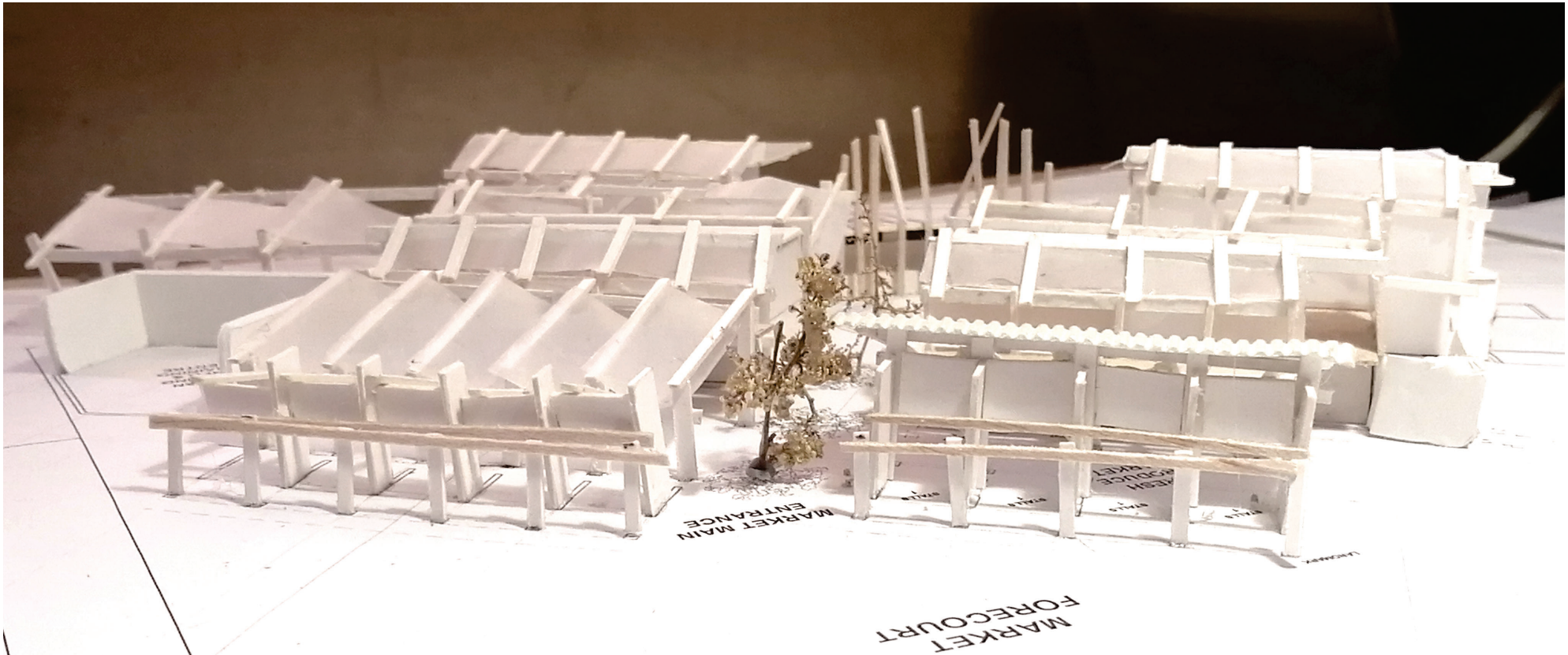


Fig. 102: Photograph of final concept model (Nemasetoni 2021)

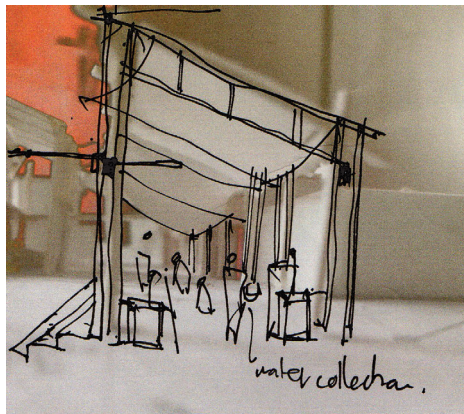
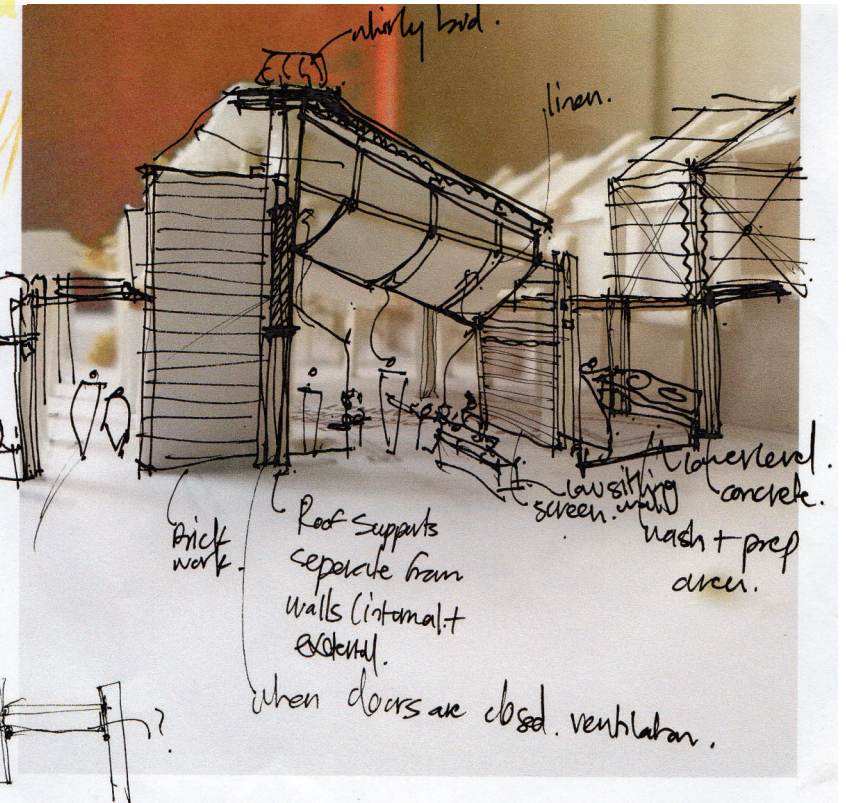
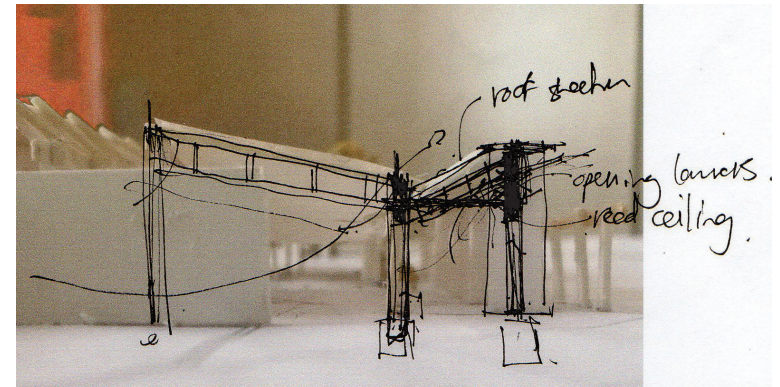
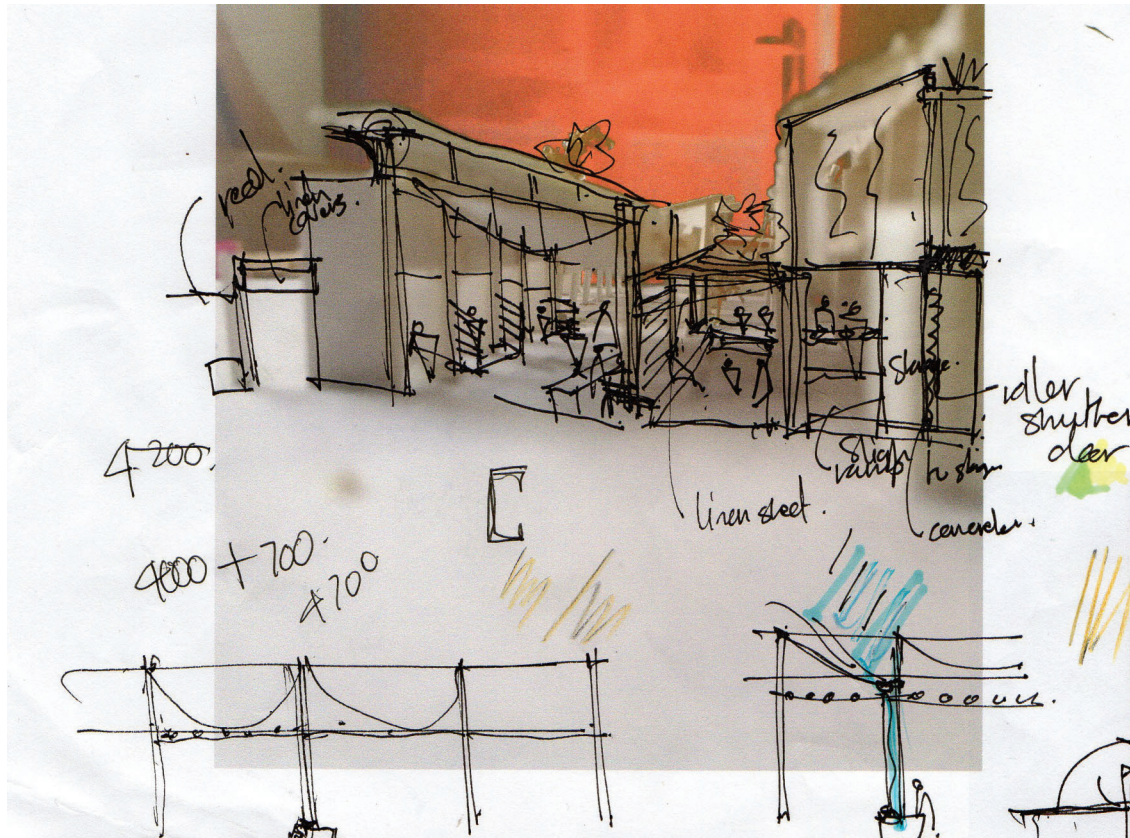


Fig. 103: Photograph of final concept model with notes (Nemasetoni 2021)

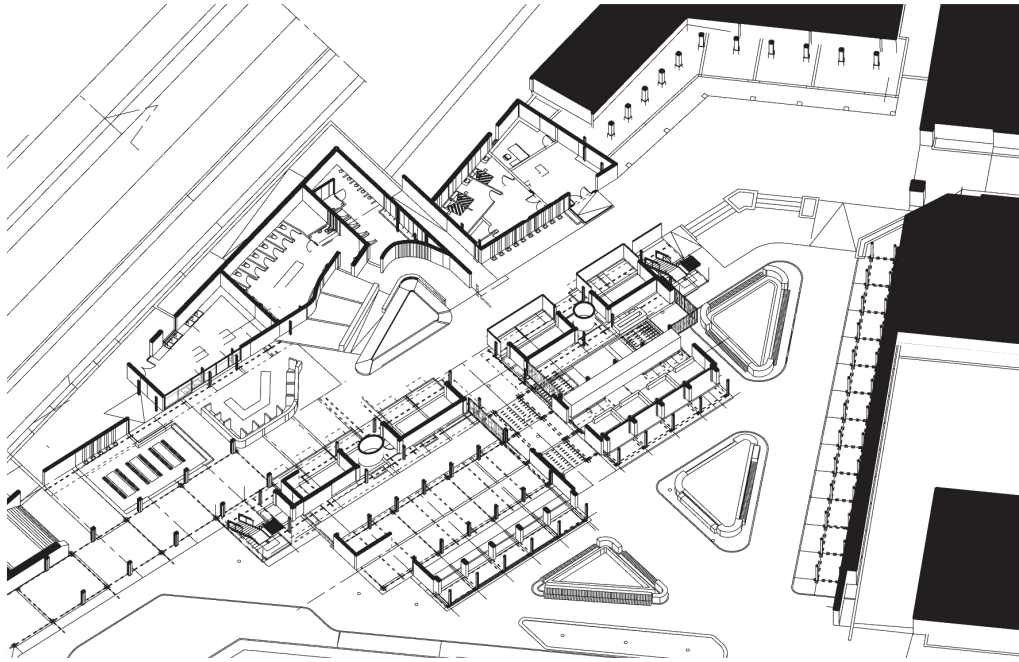


Fig. 104: Photograph of final concept model (Nemasetoni 2021)

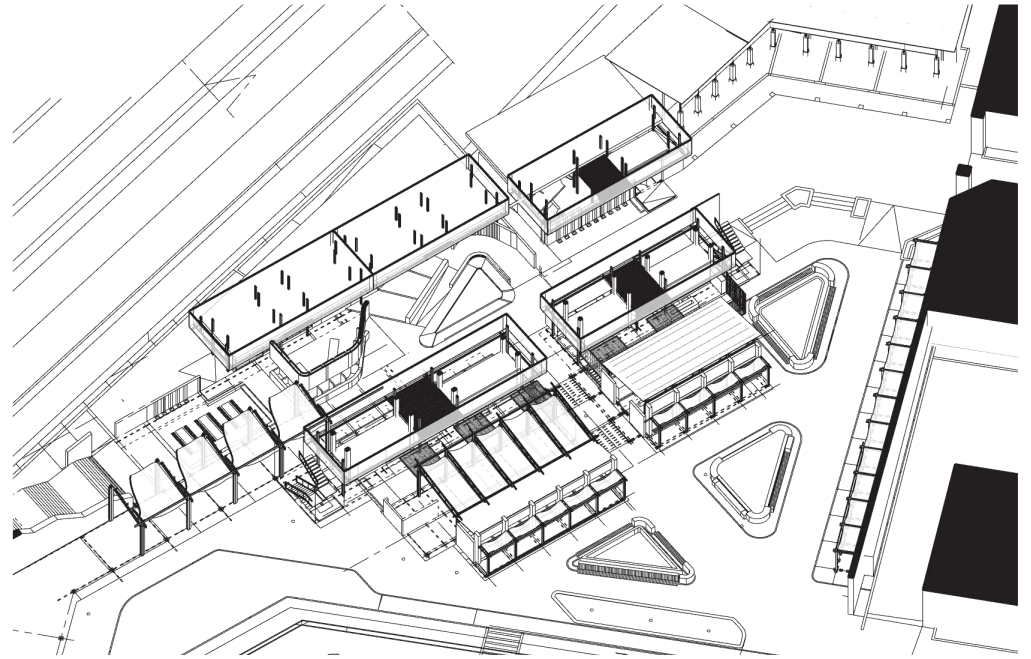


Fig. 105: Photograph of final concept model (Nemasetoni 2021)

**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 Sheetting Canopies**



**Face-brick Walls**



**Concrete Blocks**

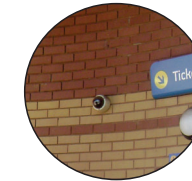


**Concrete Up-stand Beams**



**Steel Frame Shutters**

**2. Bosman Train Station**



**Contrasting Face-brick Walls**



**Steel Sheetting facade infill steel frame**



**Steel Columns**



**Steel Frames with Bracing**



**Plastic (polycarbonate) Sheetting**

# Proposed New Building Materials Palette

## Proposed Materiality:

### Primary Building Structure (Load Bearing)

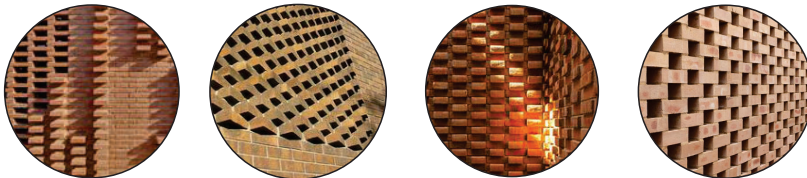


1. Concrete Frame



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

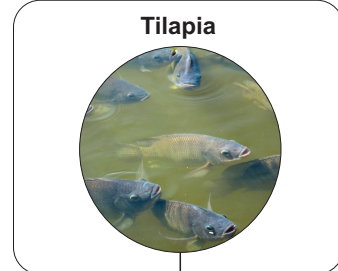
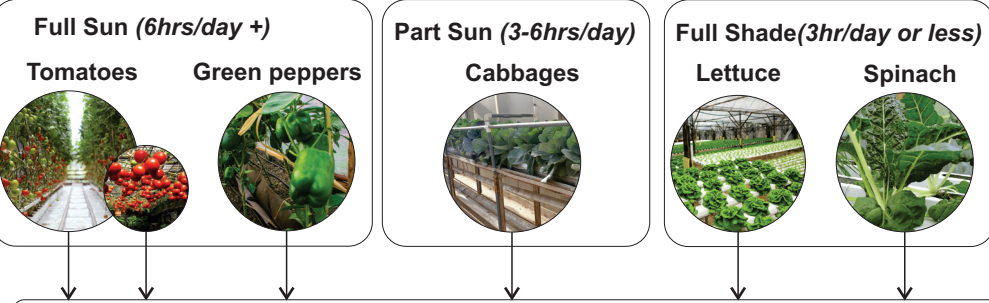


1. Thick, strong weather protected linen textiles will be used as sun shading in the open and public areas of the building


# 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):



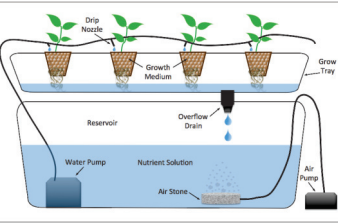
### Hydroponics




**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



1 Rearing tank for fish. (Tilapia, catfish, etc.)

2 Plumbing connecting rearing tank to settling tank.

3 Settling Tank for solids collection and biofiltration. (Fish waste, ammonia, is broken into nitrates and nitrites.)

4 Plumbing connecting settling/biofiltration tank to Deep Water Culture Beds. (Water is gravity-fed to DWC beds.)

5 Deep Water Culture Beds (DWC) for hydroponic gardening. (Plants remove the nitrates/nitrites from the system.)

6 Plumbing connecting DWC's sump tank.

7 Sump tank with pump pushing water back to rearing tanks. (Clean water is pumped back to rearing tank.)



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:

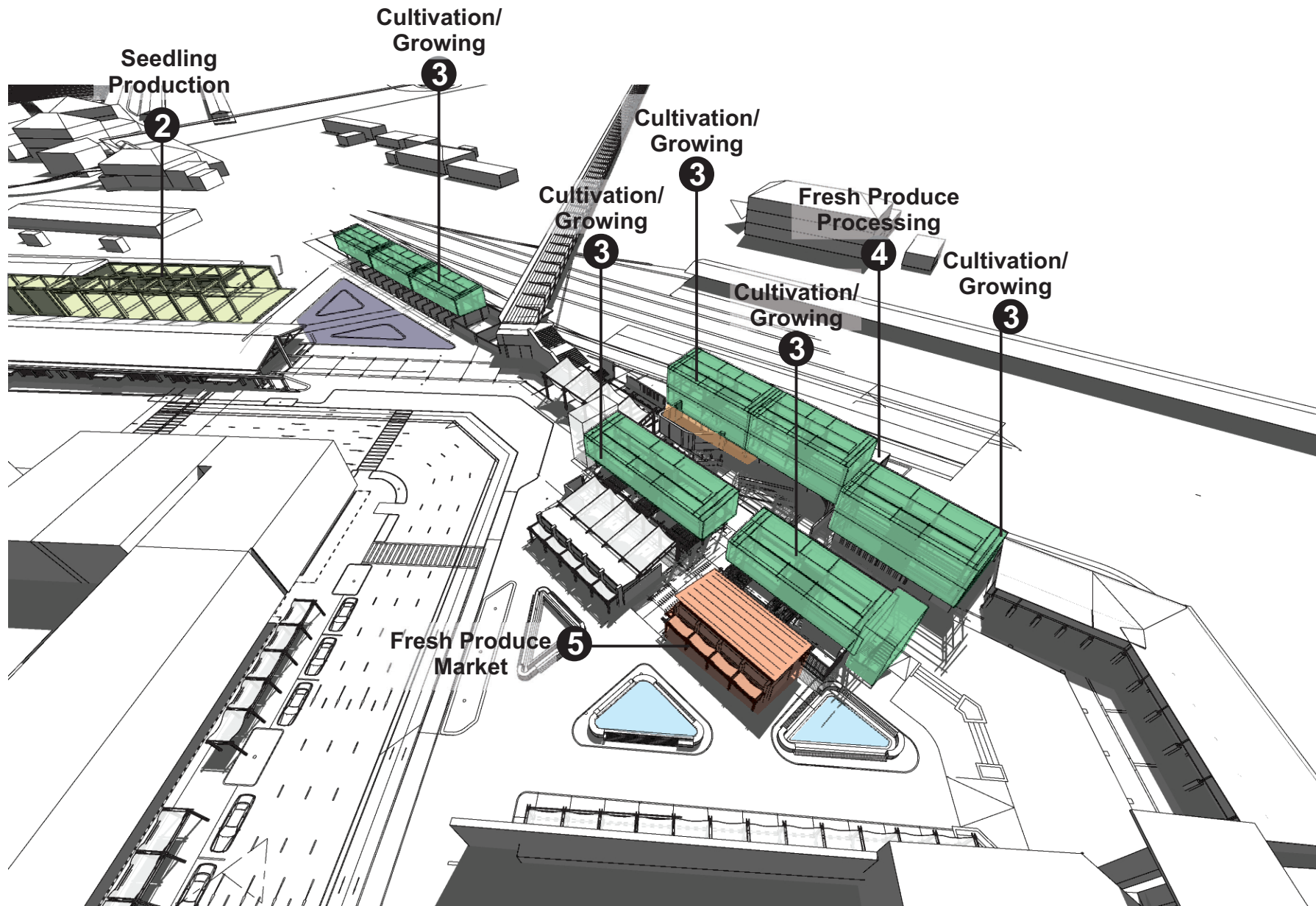


Fig. 108: Bird eye view of site showing the spatial layout of plant production process (Nemasetoni 2021)



## 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	42m <sup>2</sup>	1	42m <sup>2</sup>
Greenhouse 2	6m x 7m	42m <sup>2</sup>	1	42m <sup>2</sup>
Greenhouse 3	6m x 7m	42m <sup>2</sup>	1	42m <sup>2</sup>
Greenhouse 4	11m x 6m	66m <sup>2</sup>	1	66m <sup>2</sup>
Greenhouse 5	15m x 4m	60m <sup>2</sup>	2	120m <sup>2</sup>
Greenhouse 6	14m x 4m	56m <sup>2</sup>	2	112m <sup>2</sup>
Greenhouse 7	28m x 4m	112m <sup>2</sup>	2	224m <sup>2</sup>

**Total Planting/Greenhouse Area: 649m<sup>2</sup>**

#### Planting Quantities per Planting Cycle

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

### 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
<b>Total Water Demands:</b>	<b>18500 L Per planting Cycle</b>

**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
<b>Total Potable Water Demand</b>	<b>2473</b>	<b>22</b>		<b>90 000 L</b>

### Monthly Other Market Water Demands (Potable)

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

### Monthly Other Market Water Demands (Recycled Water)

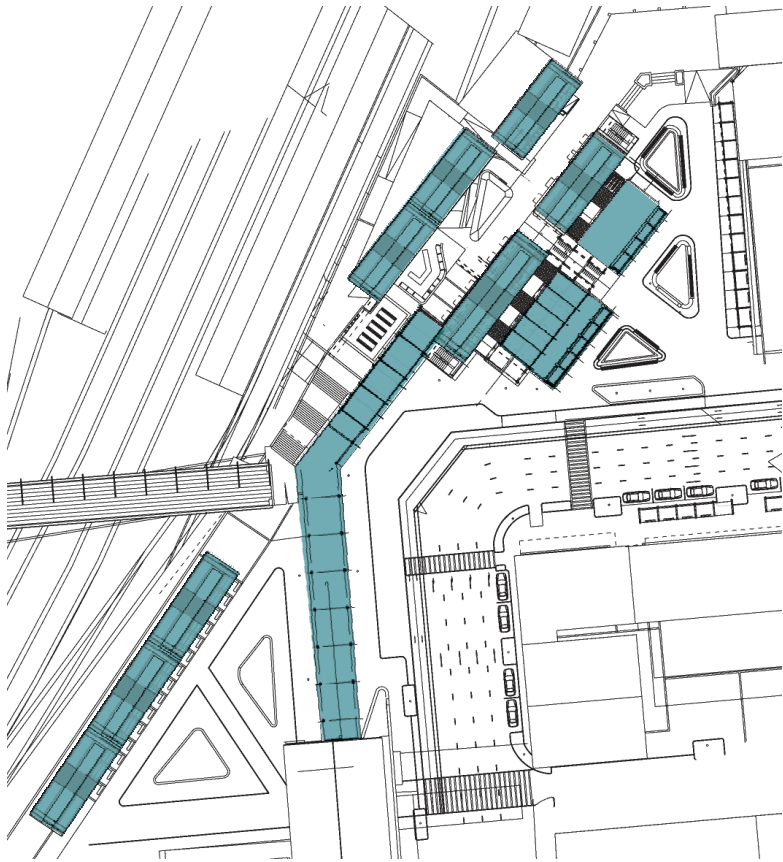
Cleaning and Washing Floors	5000 L per month
Irrigation	20 000 L per month
<b>Total Water Demands:</b>	<b>25 000 L per month</b>

**Site Rainwater and Paved Area Yield Calculations:**

**Pretoria Average Annual Precipitation = 650mm**

Rainwater will be harvested using the following systems:

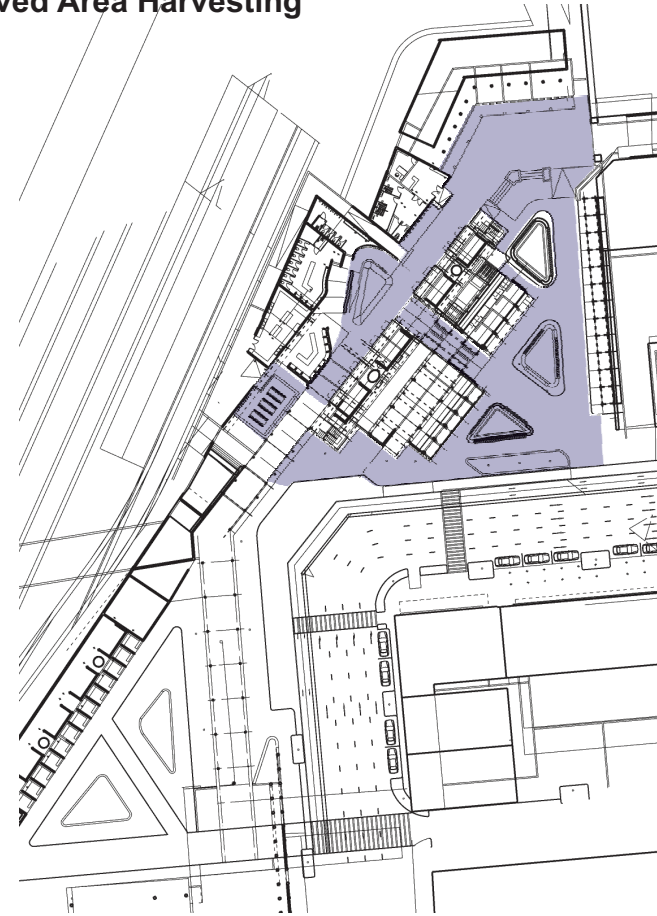
**Roof Water Harvesting**



**Total Roof Rainwater Harvesting Area = 1 237 m<sup>2</sup>**

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

**Paved Area Harvesting**



**Total Roof Rainwater Harvesting Area = 929 m<sup>2</sup>**

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/m <sup>2</sup> (Gallons/ft <sup>2</sup> )	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	1237m <sup>2</sup>	185 000 L
Paved Areas	929 m <sup>2</sup>	139 000 L
<b>Total Collection</b>		<b>324 000 L</b>

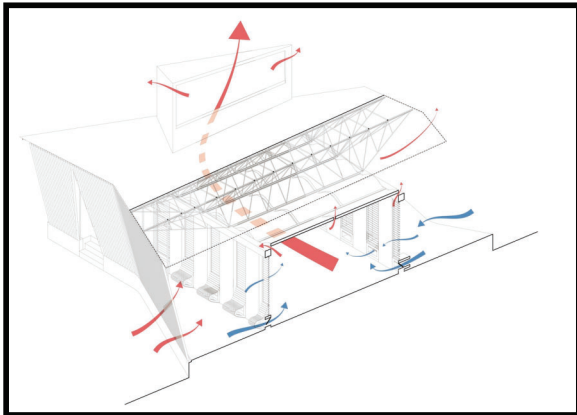
Fig. 112: Table showing the water rainwater harvesting annual amounts(Nemasetoni 2021)

### Paved Area Harvesting

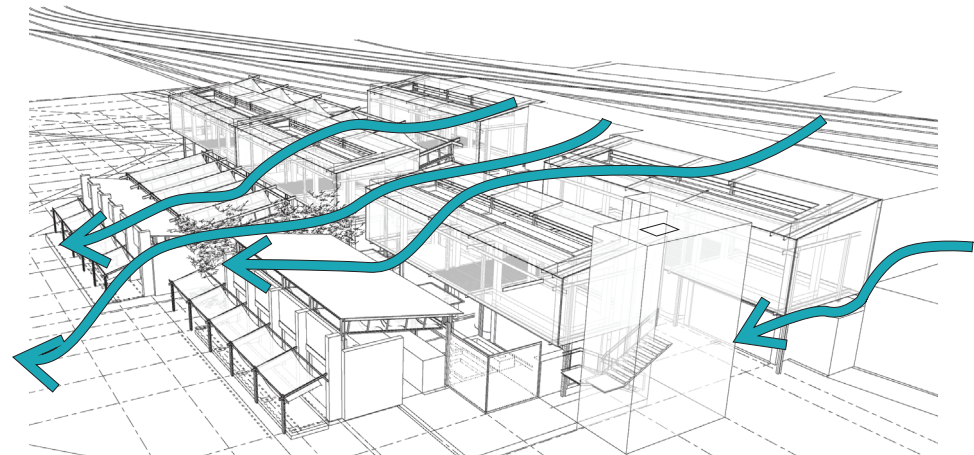
Month	Pretoria Average Monthly Precipitation (mm)
Jan	150
Feb	154
March	75
April	82
May	51
June	7
July	3
August	6
Sep	22
Oct	71
Nov	98
Dec	150
<b>Total Annual Precipitation</b>	<b>732</b>

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

### Natural Ventilation System:

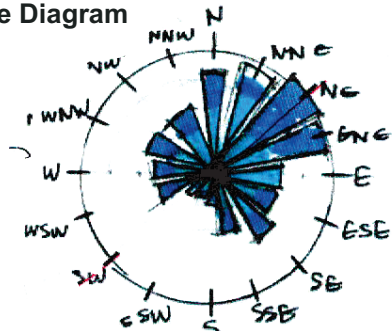


Lycée Schorge by Francis Kere, Koudougou, Burkina Faso



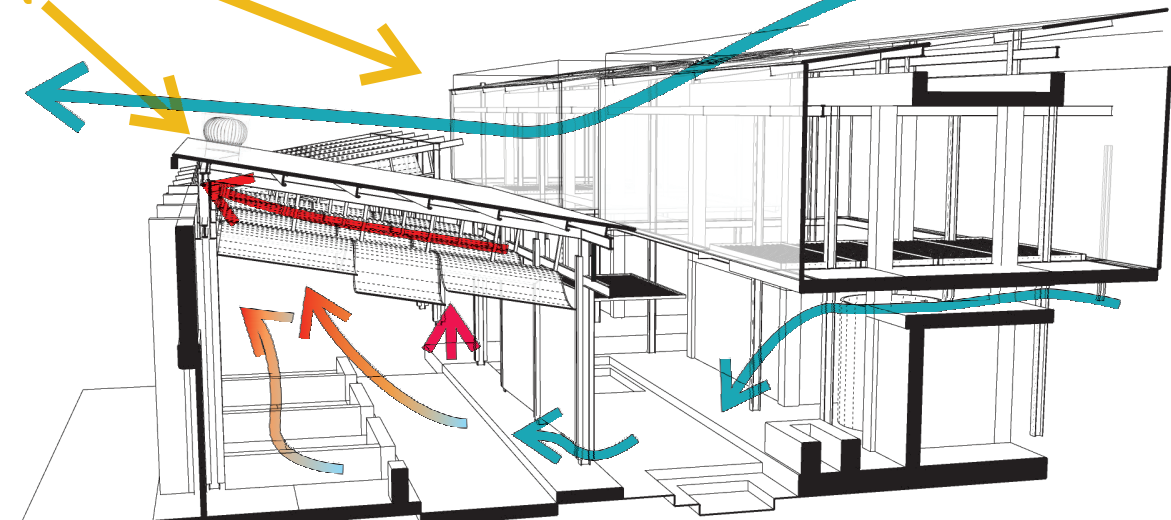
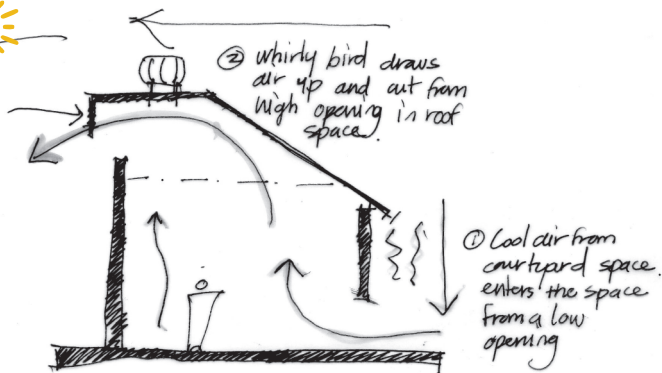
Natural Ventilation through Cool Courtyards

### Wind-rose Diagram

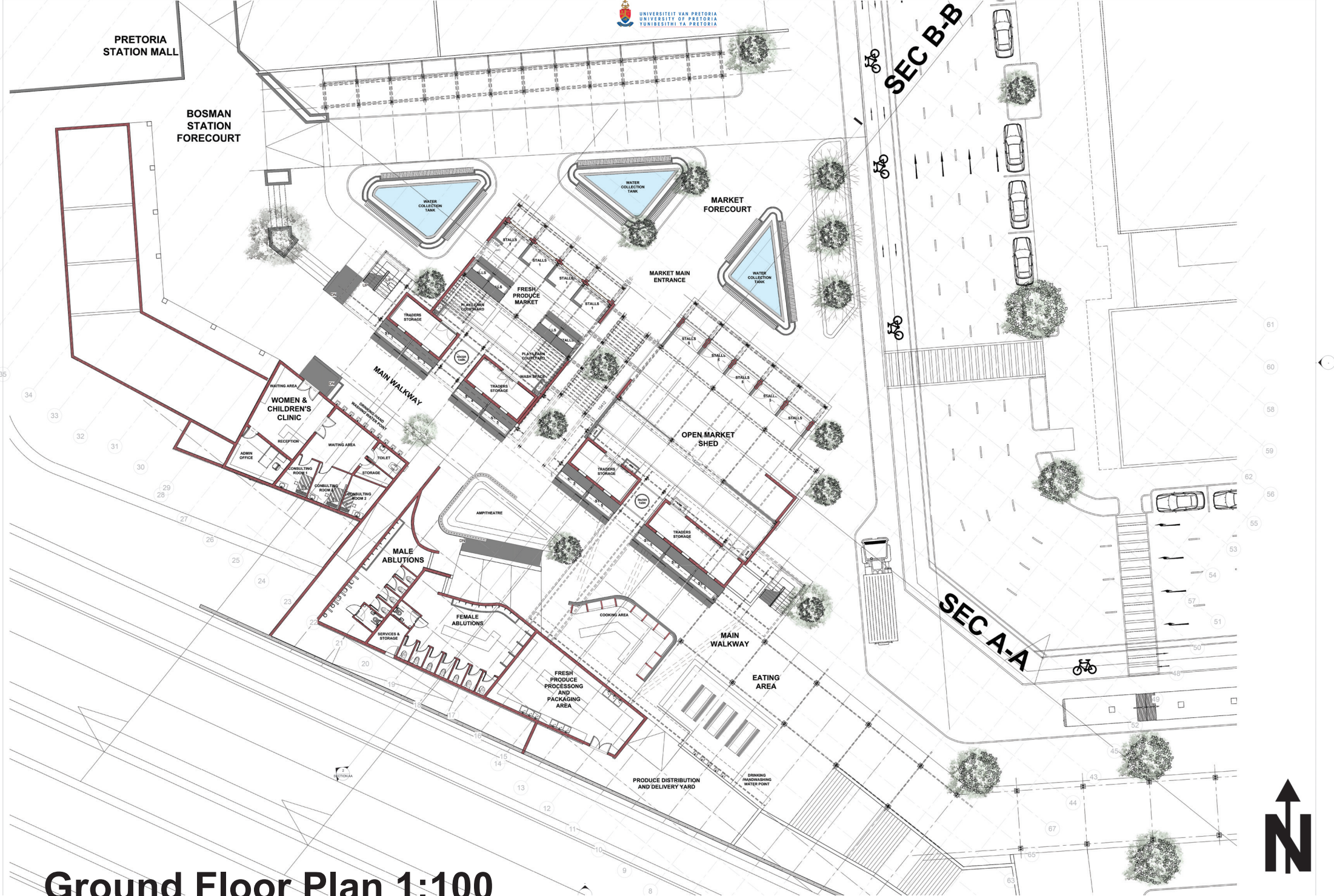


Prevailing Wind

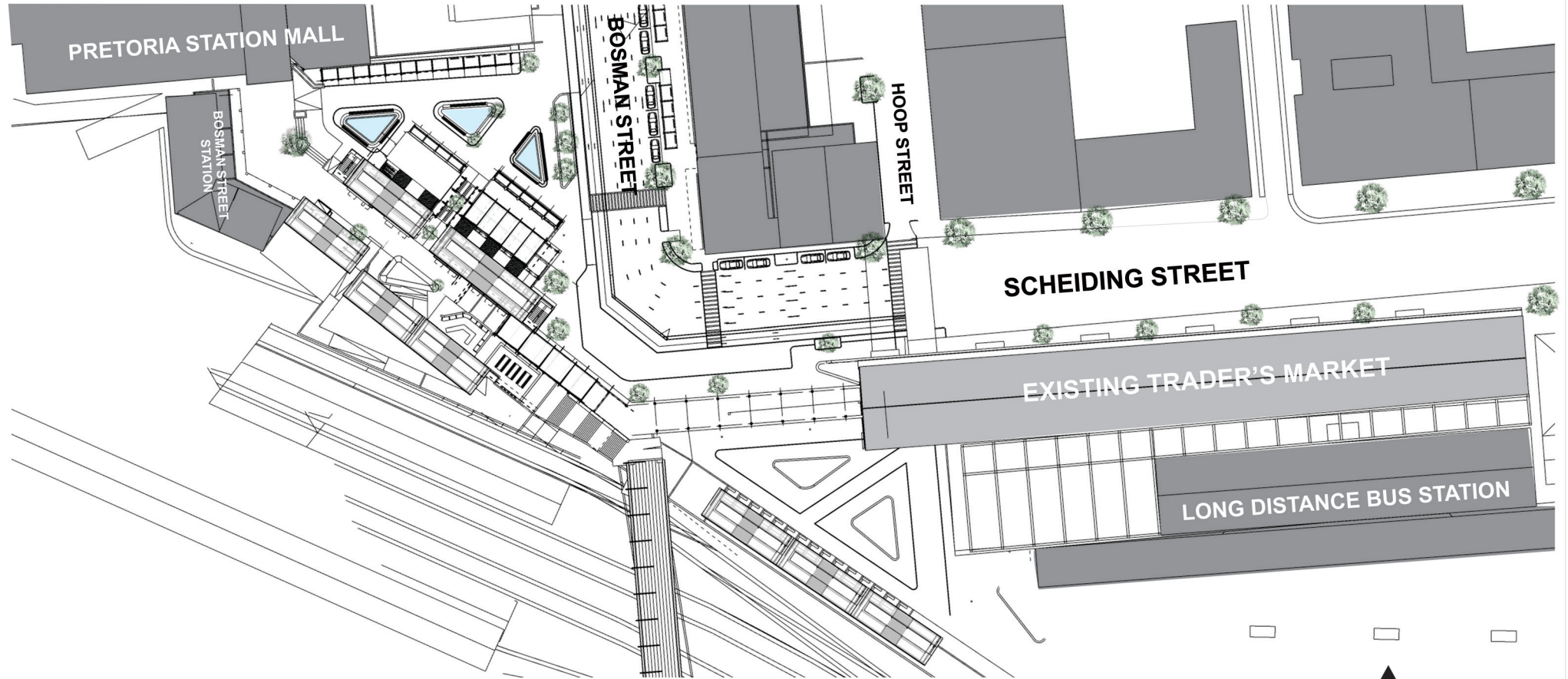
### Natural Ventilation Strategy



Section Showing Ventilation Strategies

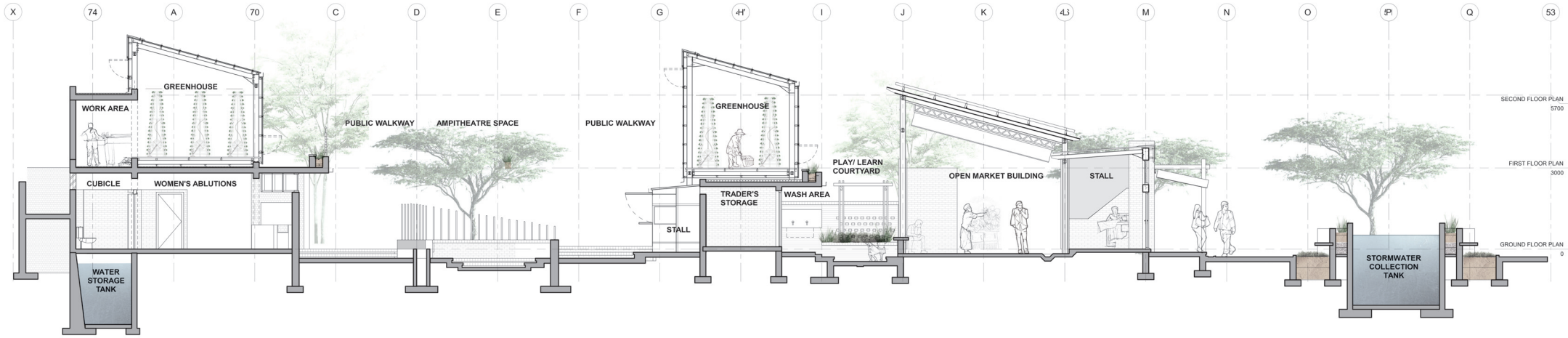


Ground Floor Plan 1:100

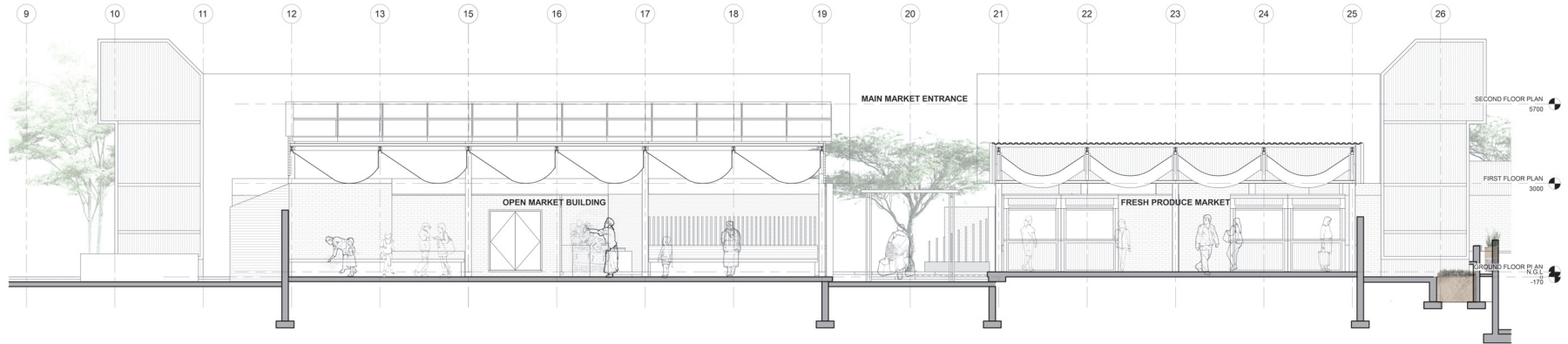


**SITE PLAN 1:500**

## Building Sections



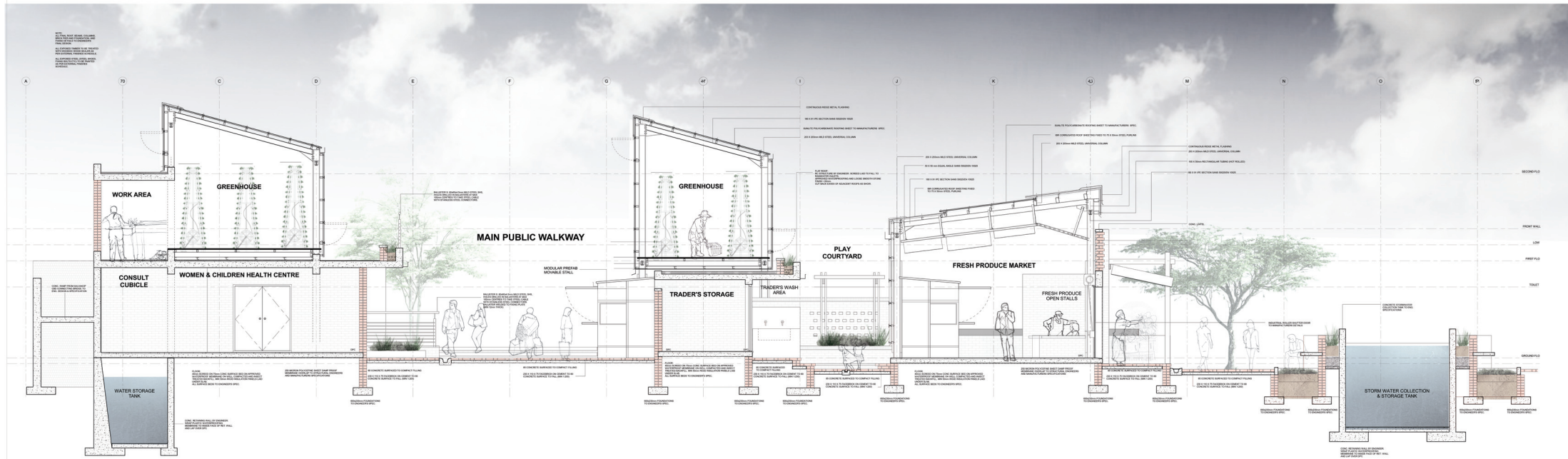
**SECTION BB 1:50**



**SECTION AA 1:50**



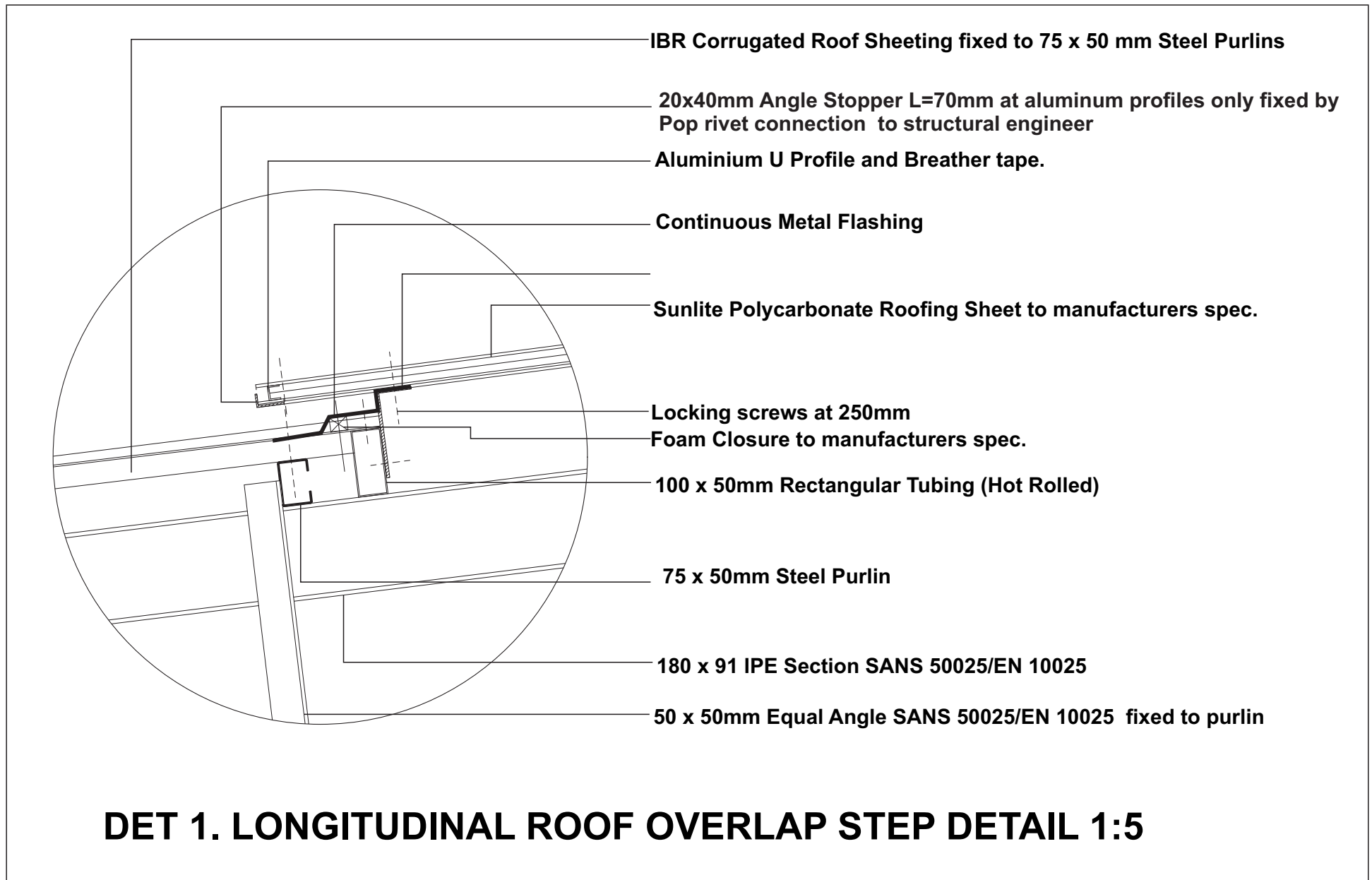
Project Technical Section (1 in 20):



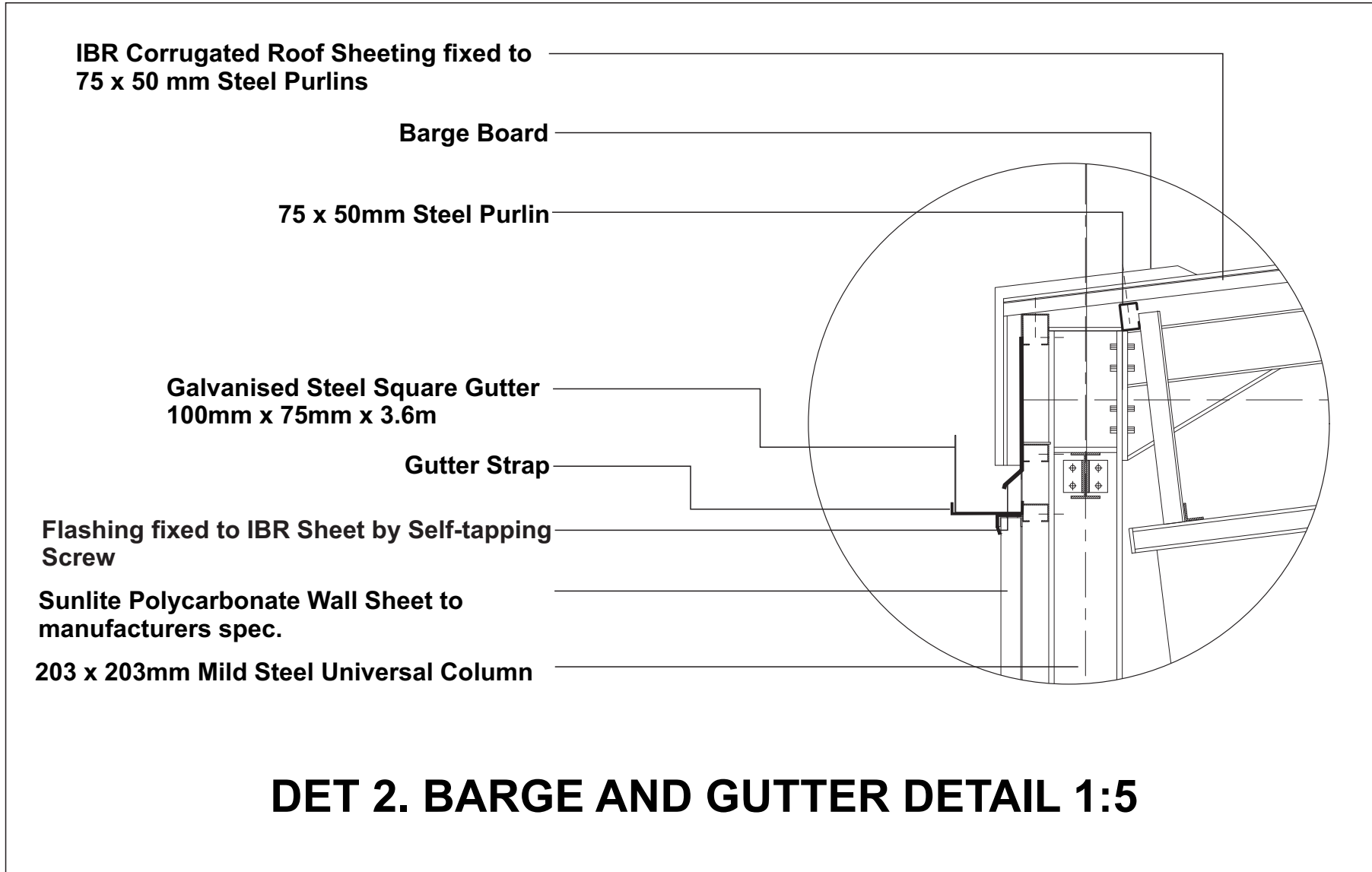
TECHNICAL SECTION AA 1:20



**Building Detail Technification:**

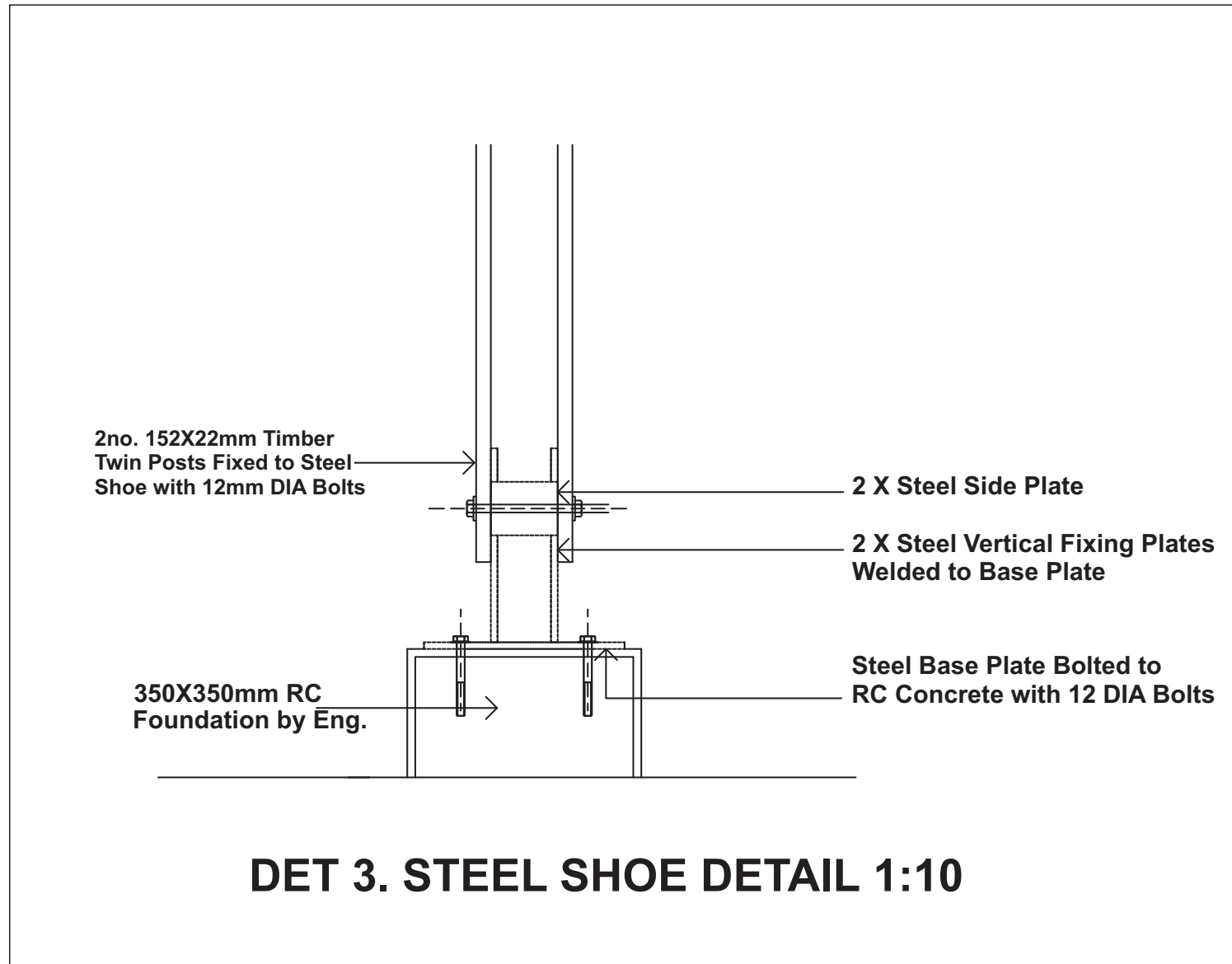


**Building Detail Technification:**



**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:

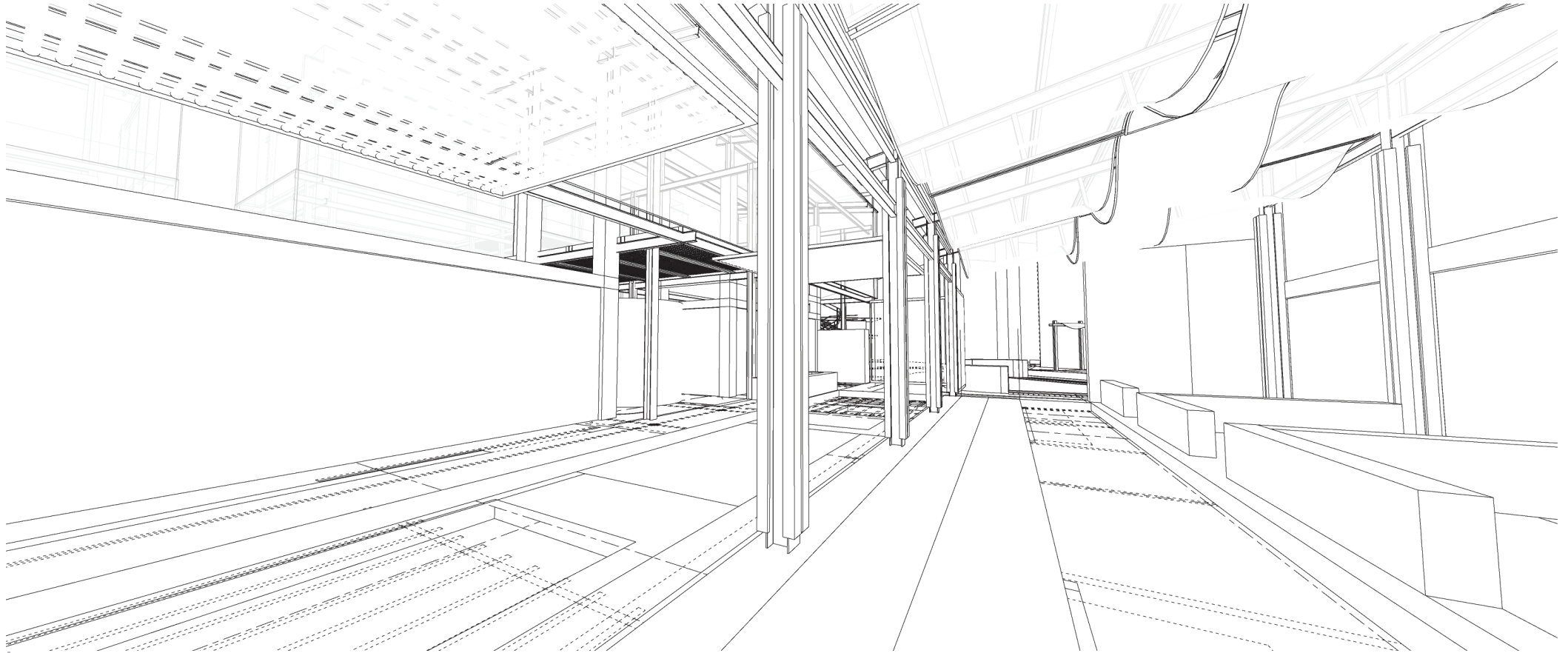
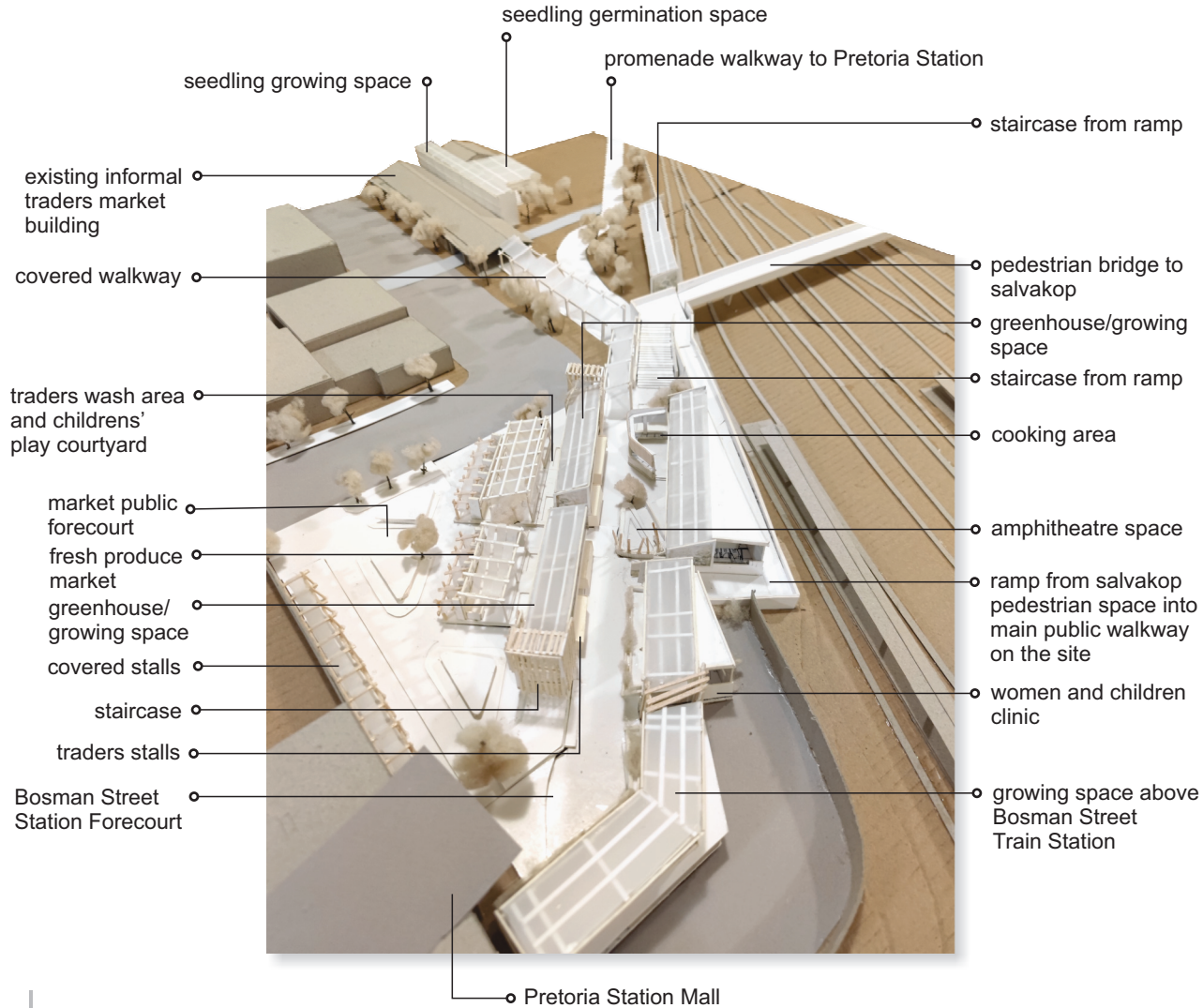
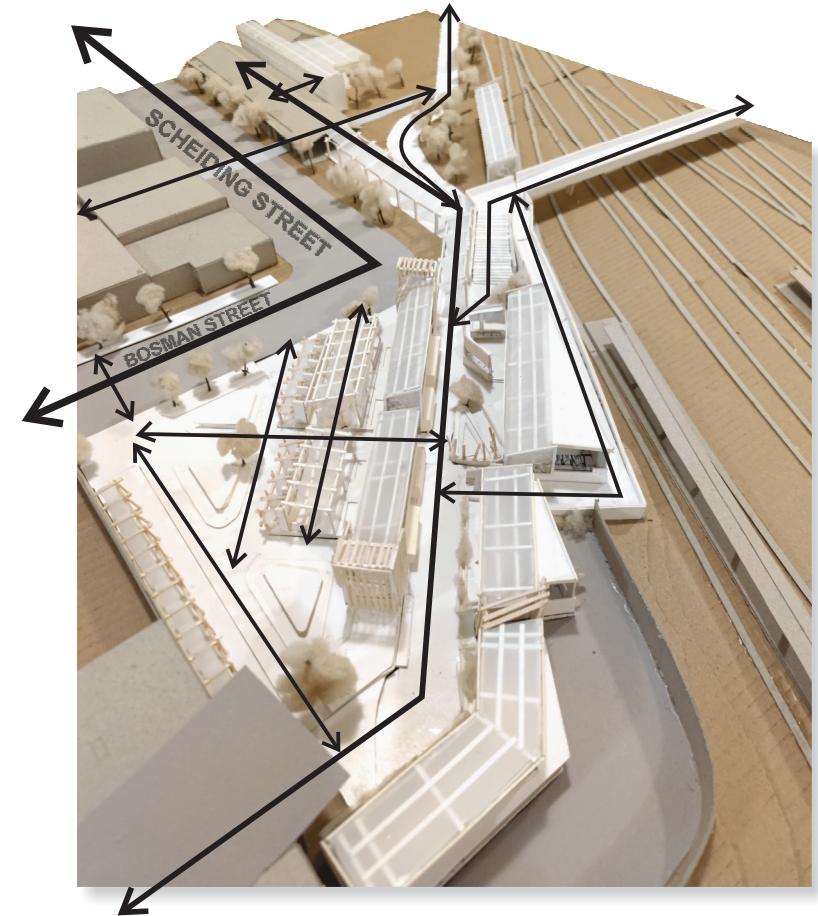


Fig. 115: Image showing 3D view of fresh produce market interior (Nemasetoni 2021)

**Final Design Model:**



**Programme Layout and Spatial Configuration on the site.**



**Pedestrian routes, Accessibility and Movement through the site.**

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

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)

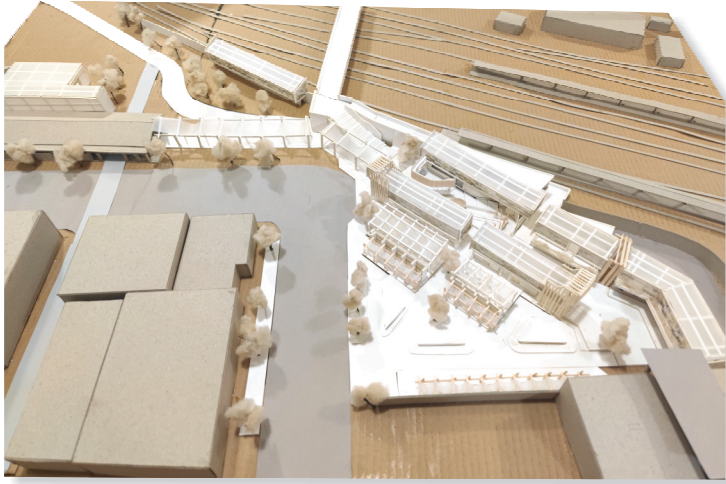
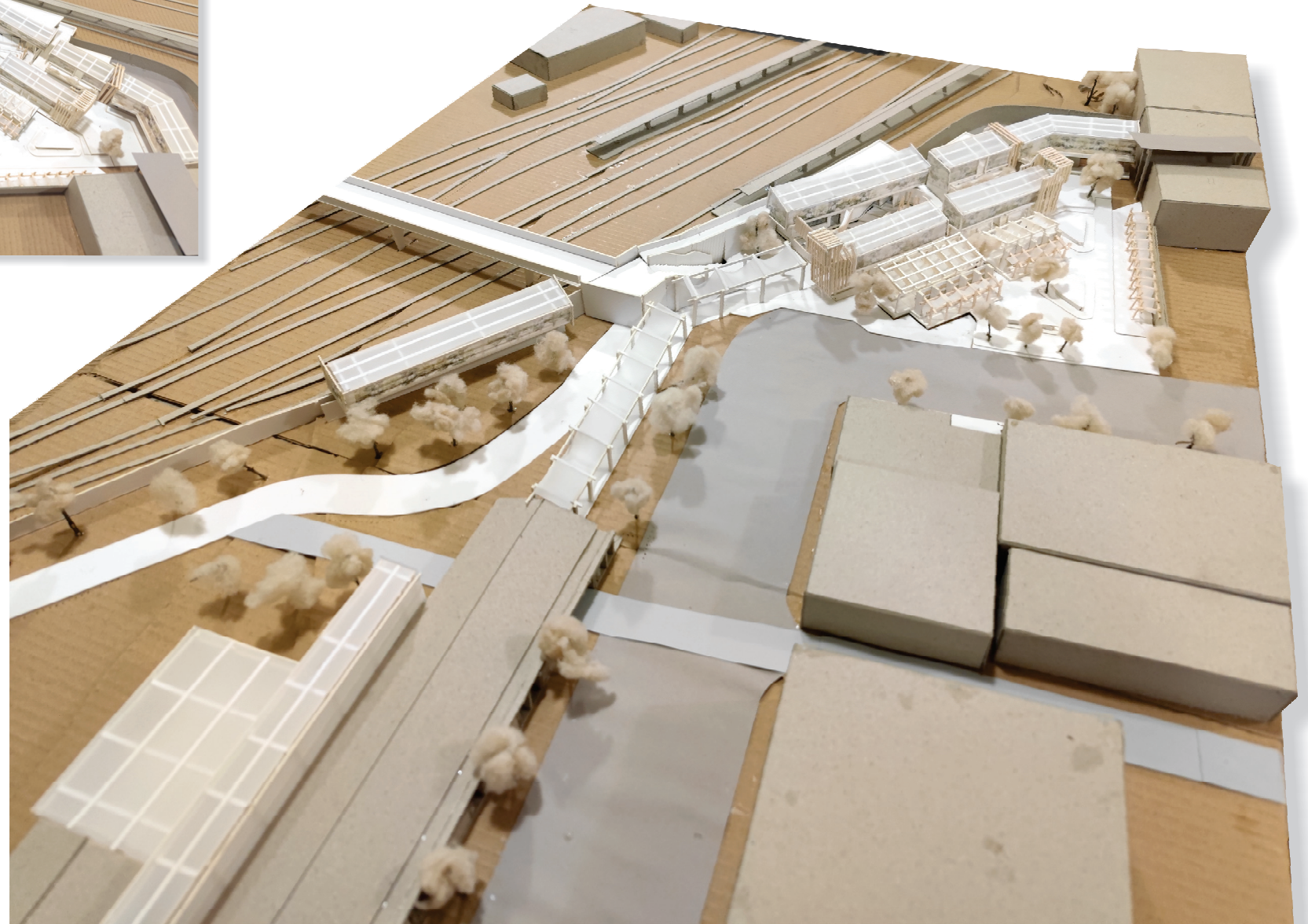


Fig. 119: photograph of final 1 in 200 site model (Nemasetoni 2021)



**Final Design Model:**

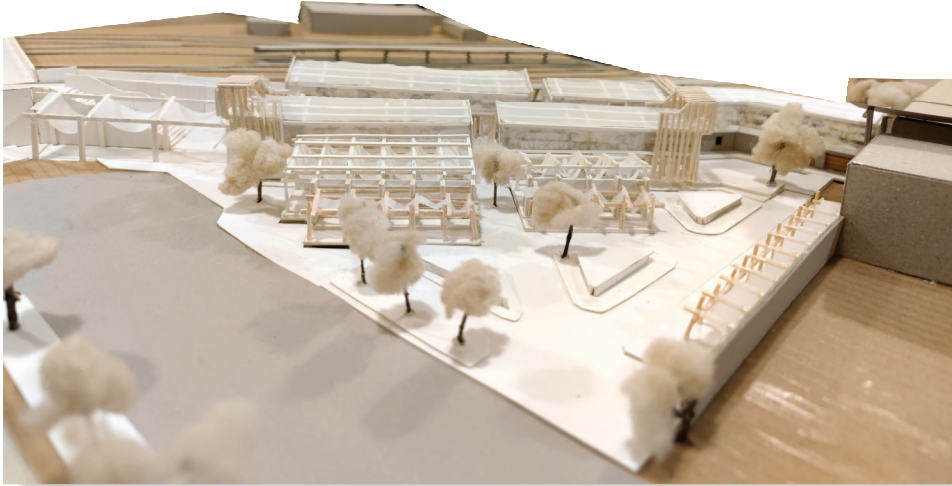


Fig. 120: photograph of final 1 in 200 site model (Nemasetoni 2021)



Fig. 121: photograph of final 1 in 200 site model (Nemasetoni 2021)

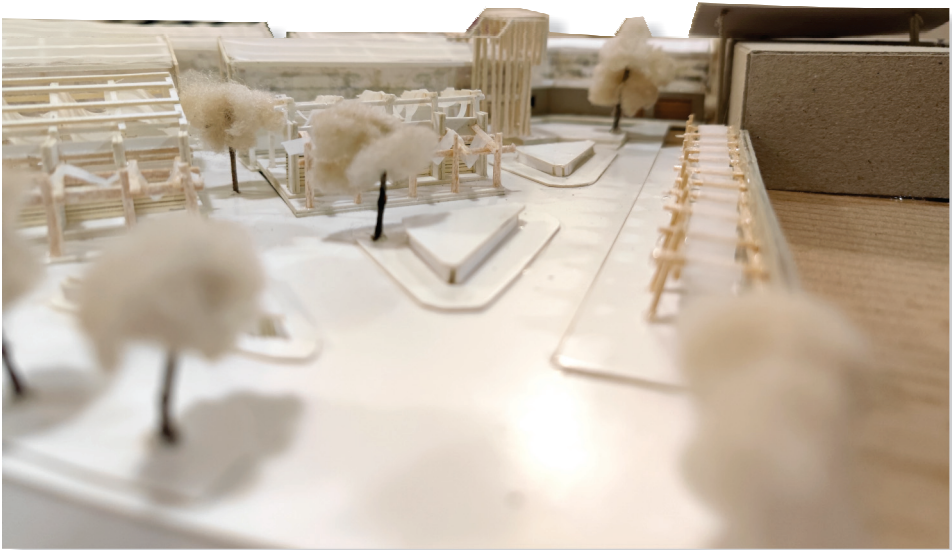


Fig. 122: photograph of final 1 in 200 site model (Nemasetoni 2021)

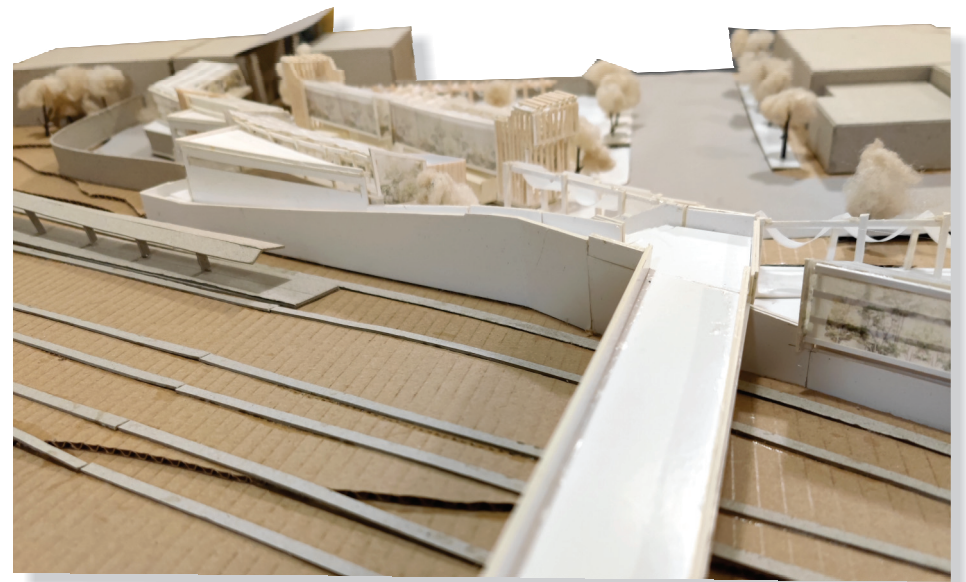


Fig. 123: photograph of final 1 in 200 site model (Nemasetoni 2021)

**Final Design Model:**



Fig. 124: photograph of final 1 in 200 site model (Nemasetoni 2021)



Fig. 125: photograph of final 1 in 200 site model (Nemasetoni 2021)

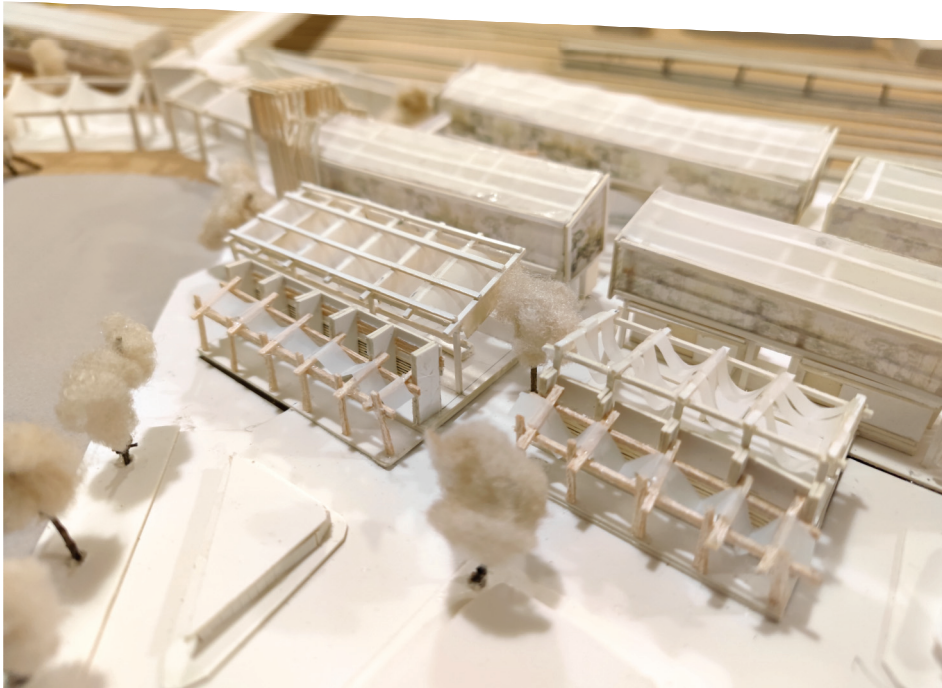


Fig. 126: photograph of final 1 in 200 site model (Nemasetoni 2021)

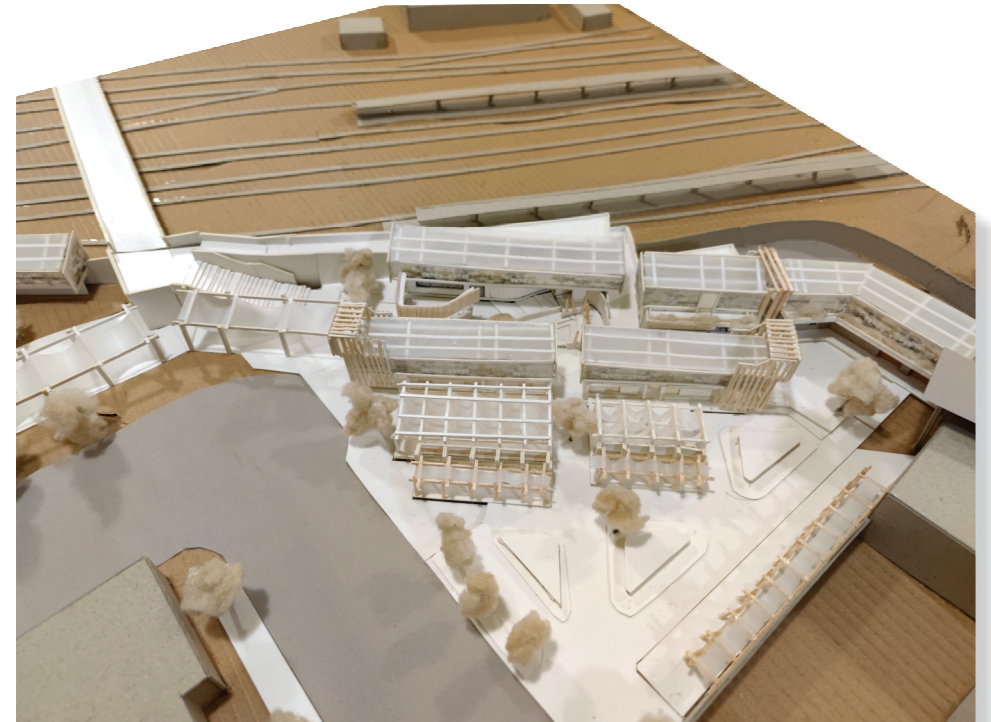


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