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Growing urban ecosystems: **A food market in Menlyn**

by Fransa van Zyl

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University Of Pretoria
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Submitted in partial fulfilment of the requirements for the degree of Magister in Architecture (Professional) in the Faculty of Engineering, Built Environment and Information Technology

Abstract

This study responds to the effect that current food production has on the natural environment, by researching urban systems and ecosystems. In reaction to the findings, a new food production system and the urban buying and retail culture are investigated. A food market and hydroponic production building is designed to serve as an alternative to the supermarket and conventional food production.

Hierdie studie reageer op die uitwerking wat huidige voedsel produksie op die natuurlike omgewing het, deur stedelike stelsels en ekostelsels te bestudeer. In reaksie op die bevindings word 'n nuwe voedsel produksie stelsel en die stedelike koop-en-verkoop-kultuur ondersoek. 'n Varsprodukte mark en hidroponiese produksie-gebou word ontwerp om 'n alternatief te bied vir die supermark en konvensionele voedselproduksie.

Vir my Skepper en Kompas, Jesus Christus, dankie vir talent en krag.

Vir my ouers, dankie vir onwrikbare geloof in my vermoëns en ondersteuning.

Vir Grové, dankie vir liefde, begrip en moed inpraat, elke dag.

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Full dissertation title:	Growing Urban Ecosystems: a Food Market in Menlyn
Submitted by:	Fransa van Zyl (Ms)
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Course coordinator:	Jacques Laubscher (Dr)
Degree:	Master of Architecture (Professional)
Department:	Department of Architecture
Faculty:	Faculty of Engineering, Built Environment and Information Technology
University:	University of Pretoria
Project summary	
Programme:	Food market and production
Site description:	Precinct within the boundaries formed by Garsfontein Road, Atterbury Road, Genl. Louis Botha Avenue and Lois Avenue
Client:	The City of Tshwane
Users:	Commuters of the new proposed Gautrain station, businesspeople of the area and the general public
Site location:	Erf 68, Menlyn
Address:	c/o Mercy, Frikkie de Beer and Amarand Roads, Pretoria, South Africa
GPS Coordinates:	S 25 47'09.7 E 28 17'00.0
Architectural theoretical premise:	Researching a new food production system and the buying and retail culture
Architectural approach:	Primarily the development of a food market, secondarily the creation of productive landscapes in the area and hydroponic food growth
Research field:	Environmental potential

In accordance with Regulation 4(e) of the General Regulations (G.57) for dissertations and theses, I declare that this thesis, which I hereby submit for the degree Master of Architecture (Professional) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

I further state that no part of my dissertation has already been, or is currently being, submitted for any such degree, diploma or other qualification.

I further declare that this dissertation 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.

The dissertation is 14 155 words long (excluding the scanned items).

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Fransa van Zyl

This chapter introduces the author's theoretical argument, followed by real-world problems that led to the proposed programme. Urban systems and its shortcomings inspire this dissertation. A short introduction to food systems and retail casts light on the project aims and objectives.

Introduction 1

Introduction

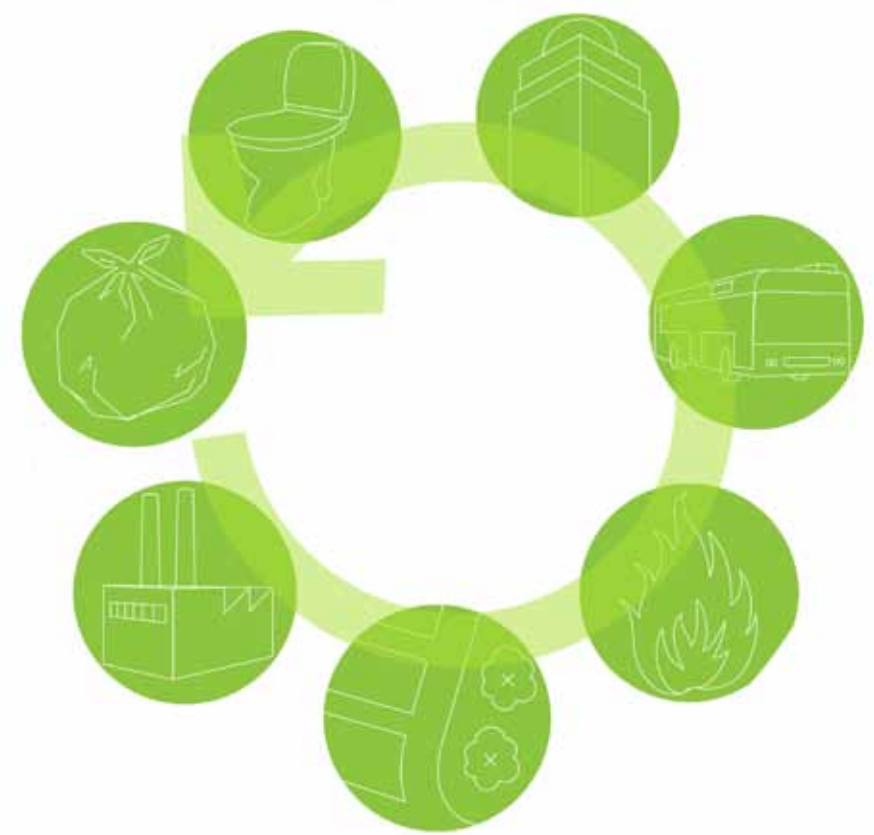
"The significant problems we face today cannot be solved by the same level of consciousness that created them". – Albert Einstein (1946)

The human population is less knowledgeable than desired in the field of sustainability. In the 21st century, agriculture should be integrated into the fabric of the city. This dissertation will cast light on the cultivation, procession and distribution of food within urban areas, and the creation of continuous interaction between the fresh food production system and the living system. The goal of this dissertation is to discover new and rediscover old ideas on more successfully sustainable cities and food production within the urban realm.

Opposed to Modernist architecture from the 20th century, which drew inspiration from the machine, I believe future architecture should draw its standards and insight from the natural world.

The vision for Pretoria is to become a more sustainable city, and accommodate more sustainability-conscious citizens. Research is necessary on how to promote the growth of more sustainable urban systems and nodes. Architecture does not have to guard against change, or be wasteful, but should adapt to the changing man-made natural environment. Ways in which the urban environment could be adapted in order to respond more sensitively to the realities of global warming, should be discovered. By introducing a fresh produce market and an urban farming ecosystem, this study will show the intertwining of humans and the natural environment. Even in an urban context it is necessary to allow sustainable growth and coexistence.

When food is produced closer to the user, within the urban context, a new buying culture could be started. An alternative to the supermarket need be implemented into our cities to give urban citizens the opportunity for a healthier life, more towards nature. The implementation of fresh food markets throughout our city removes the divide between humans and nature, also the social divide between different groups in our society could be minimised, as food markets are platforms for interaction and community building.



>>1: Current urban system/cycle.

1.1. An Urban Food System

Our current food system is slowly starting to change, not so much on remote farms that still provide us with the majority of our food, but in cities, neighborhoods and towns. This is a good change, and we as designers should support this change. In the publication '*Farmers' markets: the small business counterrevolution in food production and retailing'*(2006: 6), Alan Cameron states that food production can be woven into the fabric of our cities by using open green spaces as productive landscapes, and rooftops as farmland. This is a revolution that is providing all urban citizens with an important safety net where they can grow some nourishment and income for themselves and their families. Moreover it is providing an oasis for the human spirit where urban people can gather, preserve something of their culture through produce and foods, and teach their children about food and the earth. The revolution is taking place in small gardens, under railroad tracks and power lines, on rooftops, at farmers' markets, and in the most unlikely of places. It is a movement that has the potential to address a multitude of issues: economic, environmental, personal health, and cultural(Cameron, 2006: 6).

This revolution is slowed down and killed by the supermarket culture. Supermarkets have immense power over the way we grow, buy and eat our food. They are shaping our environment, our health and the way we interact socially. This situation has remained unchallenged because consumers have been sucked into supermarket lifestyles; persuaded that the opportunity to select from four different brands of cubed carrots at eight in the evening represents choice and value. However, the tide may be turning.

Currently more people realise that the produce bought from the local supermarket is untraceable. They search for the word 'organic' on any fresh product. By personal experience, this word somehow immediately enjoys superiority over the average packet of carrots. Where did it come from? How was it grown? What pesticides and insecticides were used, or was it grown organically? When one buys one's vegetables and fruit directly from a local farmer, not only will one know the answers to these questions, but one will also contribute to minimising the carbon footprint by buying locally.

Unease about the real cost of our daily bread is spreading among consumers. As consumers and designers we must start looking at alternative sources. An urban food system that has the agenda to guide the development of a sustainable and integrated system of food production, processing, distribution, marketing, consumption and waste management in an urban landscape, might be an answer. According to Grimm(2009: 8), food production must be included into the daily activities of all community residents through recreation and communal gatherings.

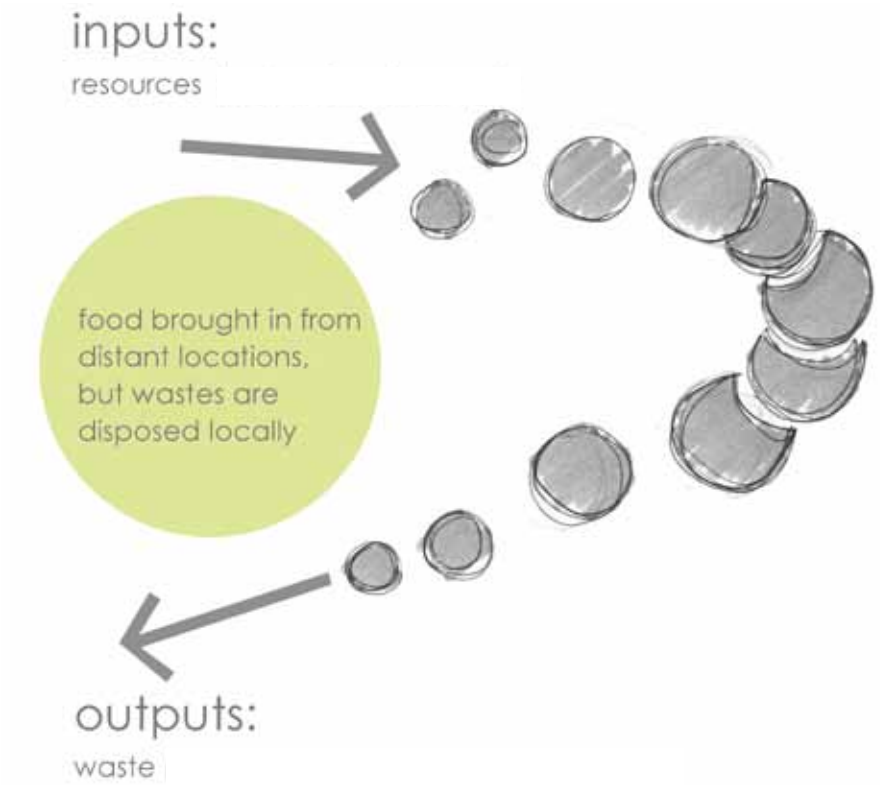
1.2. Mimicking Ecosystems in Urban Food Production

When looking at ways of introducing a healthy and effective food system, a good theoretical foundation should inform the design and proces. Nature can be mimiced, as nature has what is needed to function properly. The theory of drawing inspiration from nature is termed Biomimicry.

In this dissertation inspiration will be gathered from nature's ecosystems, and the way that the City of Tshwane's urban systems could relate to it. Refinement of urban systems, with design decisions taken carefully, could contribute towards changing these systems to become more like ecosystems. Current systems in our city are open ended: food is brought in from afar, and wastes are disposed of locally. By discovering the missing link in urban systems, we can close systems to become urban ecosystems.

According to statistics, 80% of the world's population will be living in cities by the year 2050. "Africa is projected to more than double its population by 2050. While Africa is still predominantly rural, much of coming growth will be in urban areas – from 294 million in 2000 to 742 million in 2030." (Mc Keegan, 2010) The impact this should have on cities like the City of Tshwane, will be more far-reaching than one would think. Food will be one of the issues related to this, together with a higher concentration of CO_2 emissions. These factors should be taken into account when designing buildings in urban areas, such as the proposed food market.

The missing link in urban systems, that I propose to investigate, is what happens between waste disposal and food production. Inputs and outputs of the urban system should be linked so that a closed system can be created. *(See illustrations 2 and 3.)*



>>2: Broken Urban systems. Inputs and Outputs.

>>3: The vision – closing urban systems – designing the missing link.

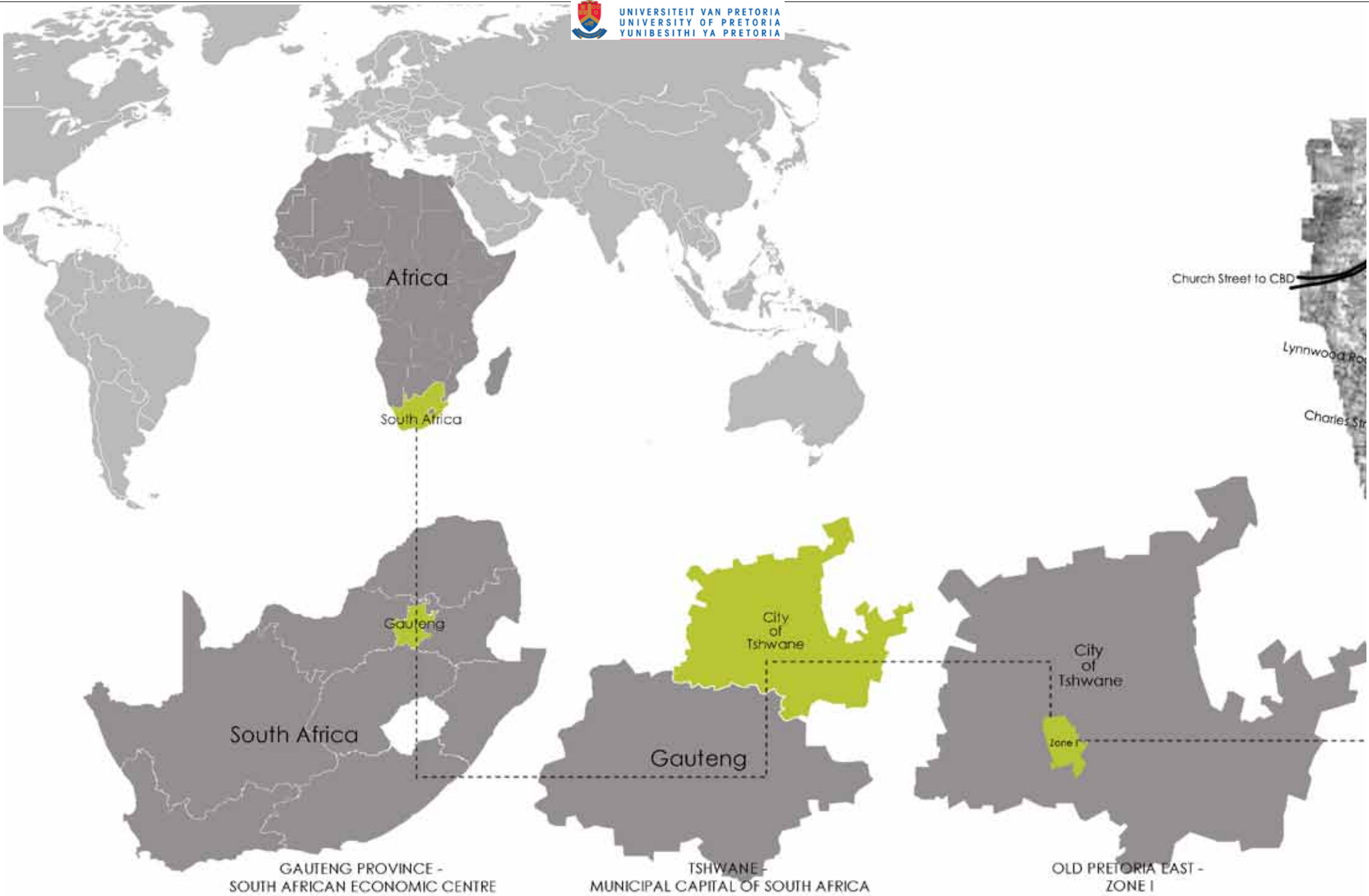
1.3. The Proposed Project

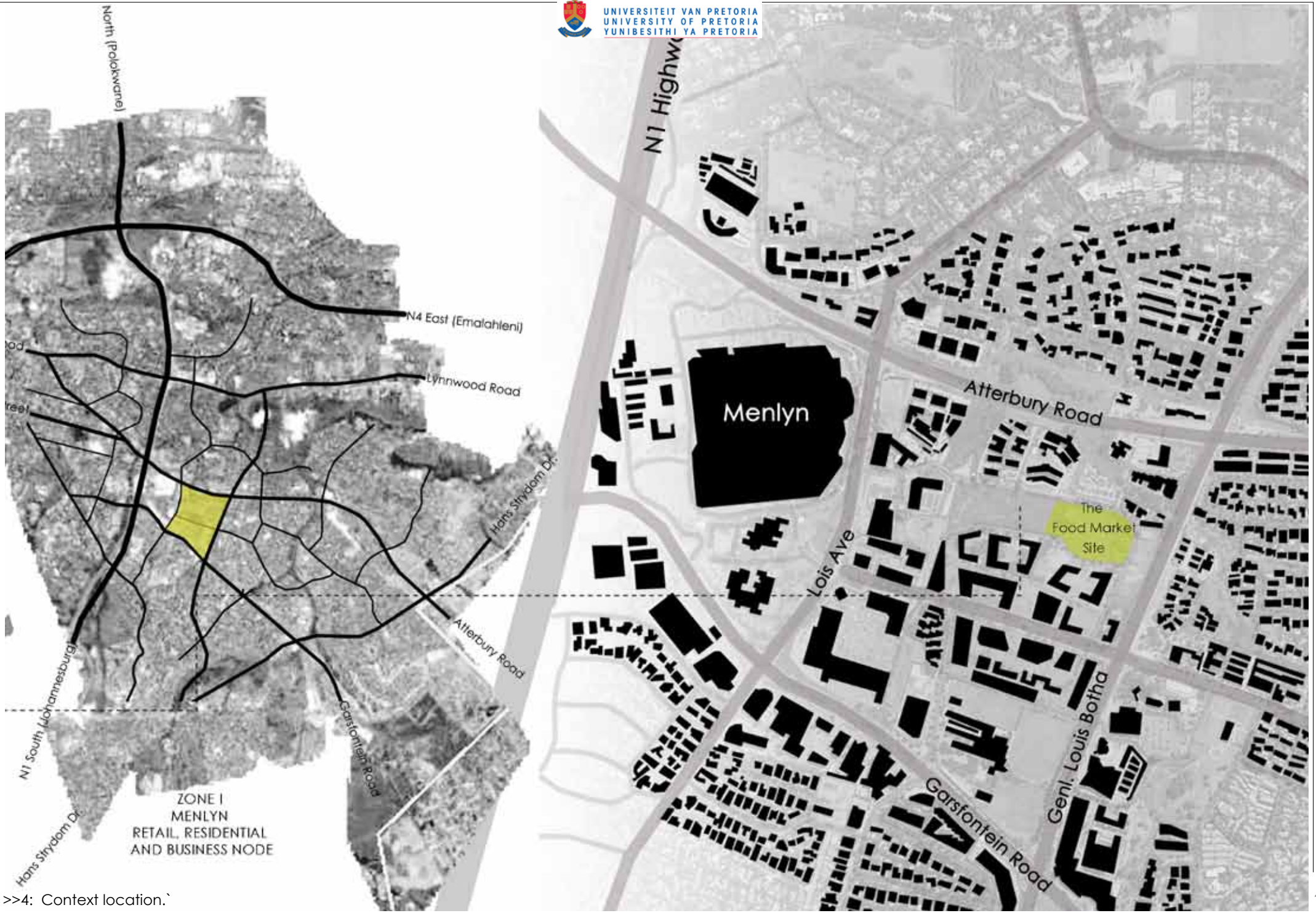
The chosen site for this proposed food market is within the boundaries formed by Garsfontein Road to the south, Atterbury Road to the north, Genl. Louis Botha Ave. to the east and Lois Ave. as the western boundary.

The focus is on daily fresh food supply for pedestrian users of the Green Precinct, business people from the Menlyn business node and commuters that use the new public transport node. Produce will be sold at the proposed fresh produce market. The aim is to reduce vehicular distances travelled by farmer suppliers outside Gauteng, and to create closer communities within this area.

This urban food system integrates live, work, and play into the activities of a productive landscape.

A multi billion rand 'green-city' precinct development is also situated within the above-mentioned boundaries. A mixed-use development is proposed to be housed in this precinct, with retail, housing and office opportunities. A newly proposed intermodal transport interchange development is envisioned for this precinct, off which the involved fresh food market will feed, reasoning that this will become an energy node in the City of Tshwane. Anticipated users of this precinct would be: pedestrians, working class and business class, people of the low- and high income bracket of the population of Pretoria.


Africa
South Africa
Gauteng
South Africa
City
of
Tshwane
Gauteng
City
of
Tshwane
Zone I
Church Street to CBD
GAUTENG PROVINCE -
SOUTH AFRICAN ECONOMIC CENTRE
TSHWANE -
MUNICIPAL CAPITAL OF SOUTH AFRICA
OLD PRETORIA EAST -
ZONE I



>>4: Context location.`

1.4. Problem Statement

Current urban systems do not allow for food production within the urban realm. An alternative to food production and supermarket buying needs to be researched and introduced to allow for a more sustainable urban environment, better social communities and a sustainable local economy.

1.5. Research Questions

In this dissertation, the following research questions need be answered:

- Does the incorporation of productive landscapes into the urban realm create a more sustainable city?
- Will this fresh food market feed positively off the transport interchange node closeby?
- Can an intervention like this revitalise and regenerate the environment?

1.6. Programme

Marketplace

Fresh produce production (hydroponics)

Bakery and butchery

Restaurants and 'slow-food' take aways

Fresh produce packaging area

24-hour activity outdoor space

Educational facility for street vendors

1.7. Importance of Project

- To instigate interaction between buyers and sellers, opposite to supermarket buying.
- To create a sense of community between the whole hierarchy of users, by introducing courtyard spaces for social interaction.
- To establish relationships between urban dwellers.
- To widen people's view on life – turn life towards nature / organic living.
- To create a sense of ownership – allotment gardening (productive landscapes).
- To create the opportunity for all age groups, income groups, institutions, businesses and schools to become entrepreneurs.
- The market should replace the artificial, impersonal, unsociable supermarket outings with natural, sociable and personal experiences.
- It should showcase sustainability and a greener life and raise awareness.

1.8. Project Aims

The food market intervention should

- provide a platform for a life more towards nature;
- create spaces to inspire community gatherings;
- provide a platform (market) for entrepreneurs to sell produce / food;
- inspire community involvement through productive landscapes;
- provide safer areas by means of passive surveillance – active productive landscapes; and
- establish specific relationship/community building opportunities for users.

1.9. Research Methods

Research will be done by the study of precedents. Little information is available on market design, but there are a few markets that could be used as precedent studies to inform design decisions. These markets will be visited in order to see how they function. Theoretical resources like books and published works will be consulted for agricultural background. As urban farming is a relatively new concept, there is not an abundance of examples of urban farms that are already built, and in a complete 'off the grid' state, but loads of research and prototype research designs have been done. These are valuable information resources.

In this chapter, research and its findings are discussed, to inform solutions to the problem statement in Chapter 1. Urban food systems and its flaws are researched in more detail to create a better understanding to what is needed for change. Retail trends and shortcomings are discussed to have better insight in its social implications. A new food system is proposed to be implemented in this area, complementing urban agriculture and open space management. Finally, a design task is formulated to address all the relevant issues.

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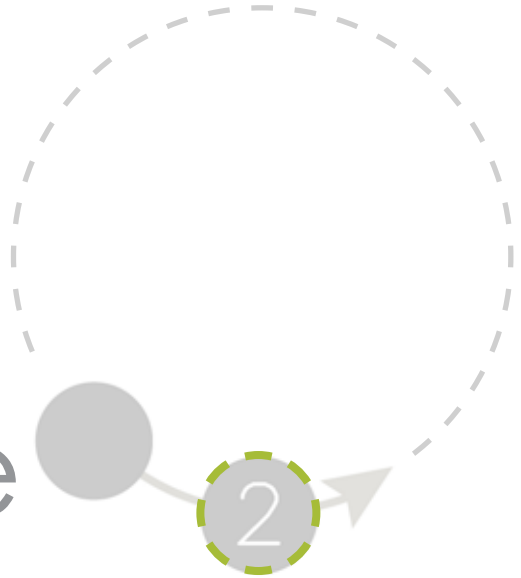
Research+Response



2.1. Background and Rationale

A general ignorance about the availability of food is found in areas like Pretoria East where resources like food seem inexhaustible. By growing fresh produce locally, within the urban areas, awareness could be raised about how, where and when crops are grown and the production techniques involved.

Urban agriculture (in as much as it produces food), increases food availability and contributes to the overall urban food supply.

In food production, three main sustainability issues can be highlighted:

- food shortages in developing countries
- unhealthy eating habits, little fresh produce
- CO_2 emissions by importing produce from far away

Urban farming tackles all three issues. It could relieve strain on the worldwide food supply, potentially driving down prices. The influx of fresh vegetables increases the basic health of the population, and the closer to home you shop for fresh produce, the smaller the impact on your environment will be.

2.2. Theory: Ecosystems/Ecomimesis

Nature is local and doesn't create waste. And we need to learn how our local ecosystems have adapted to their environment to radically change the way we design everything.
- Owings & Merrill, CASE, Serengreenity

When designing a building like a fresh produce market and the surrounding urban area in the study area, Menlyn, it should be in harmony with nature, learning from nature and respecting nature. These objectives can be found when studying the theory of Biomimicry, which was chosen as one of the fundamental design and research generators for this dissertation.

The biomimicry theory is based on the concept of the buildings we live and work in, designed to function like living organisms, specifically adapted to place, which means that this intervention should have the ability to draw all of its requirements for energy and water from the surrounding sun, wind and rain.

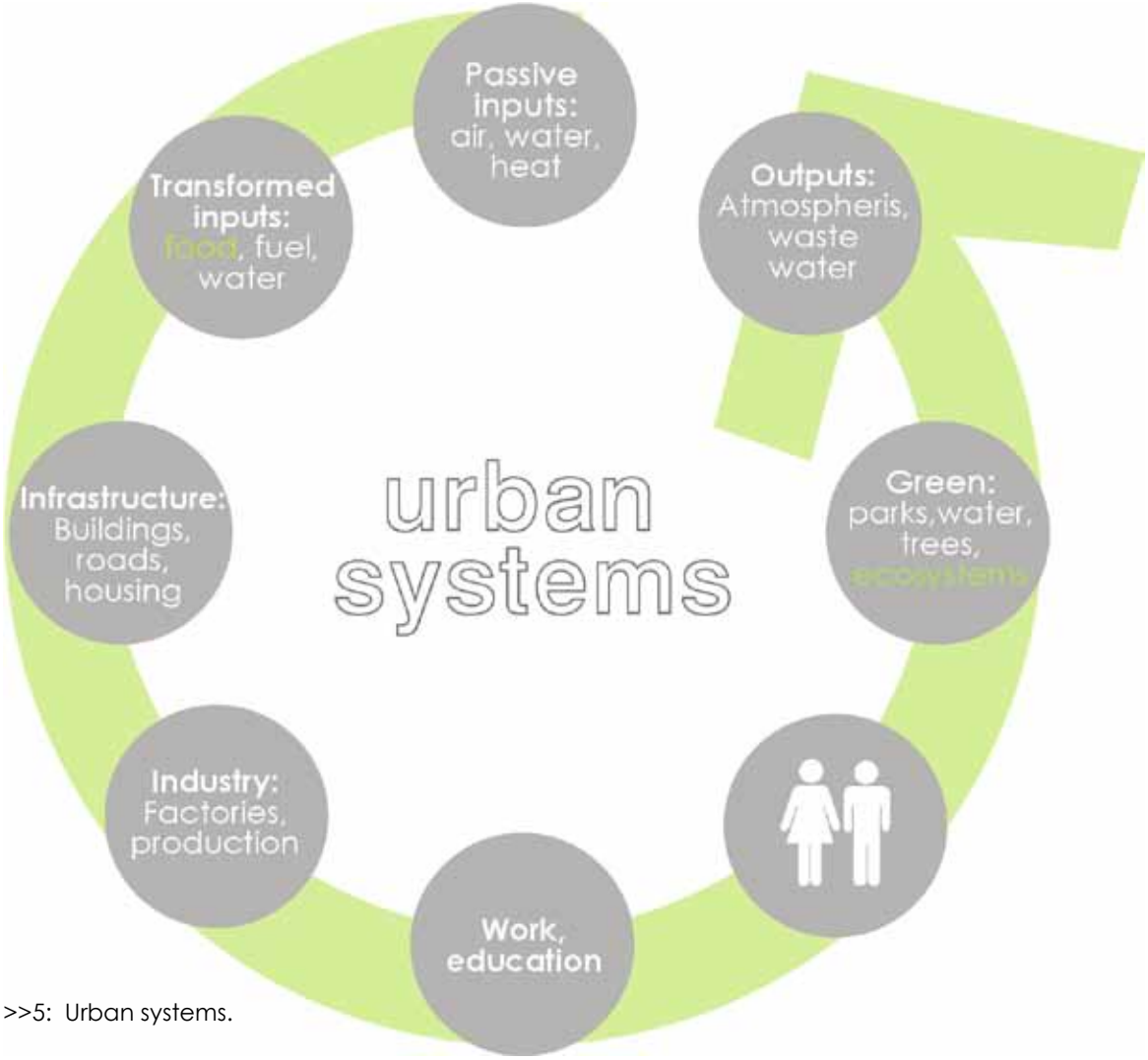
'Ecological design theory – by nature of the interconnected and holistic characteristics of the earth's ecosystems – affects all aspects of human activity that have an impact on the natural environment.' (Yeang, 1995:viii)

Urban ecosystems are the cities, towns, and urban strips constructed by humans. This growth in the urban population and the supporting built infrastructure has affected both urban environments and areas which surround urban areas.

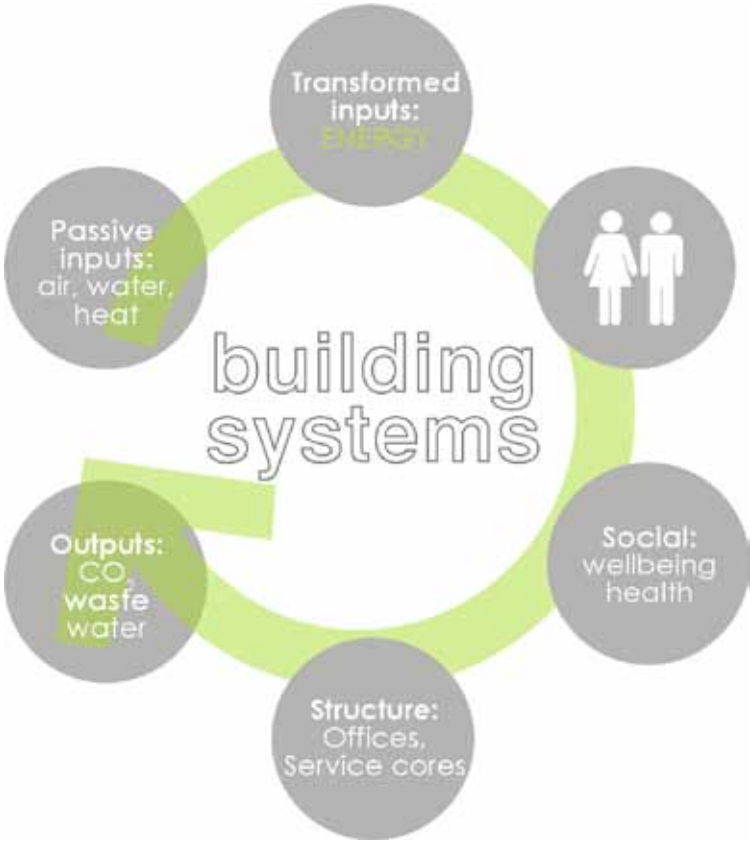
Urban system fail: Food are brought into the city from distant locations, but wastes are disposed locally.

Ecosystems have no waste. Everything is recycled within. Thus by imitating this, our built environment will produce less waste. Most of the emissions and products are continuously reused, recycled within and eventually reintegrated with the natural environment, in tandem with efficient use of energy and material resources. Designing to imitate ecosystems is ecomimesis (Yeang, 2006:22).

The proposed food market will form part of the missing link within this system, within this area of Pretoria East, by producing food and reusing wastes. The growth of fresh produce in open spaces within the urban area creates productive urban landscapes, which bring food closer to the user. This assists in minimising the gap between food production and waste or outputs, by reusing building waste.



>>5: Urban systems.



>>6: Building systems

2.3. Supermarket Culture

Being urban citizens means little free time, valuable time lost in traffic, busy lifestyles and buying food as time-effectively as possible. The supermarket is the only resort for busy urban citizens, however this might not be the best option. The arrival of the supermarket has changed consumers shopping habits as well as the shopping experience. Consumers can get all their shopping in a 'one-stop shop'. Whereas shopping may have once been a fairly sociable experience in the market place or small independent shopping outlet, communication between supermarket shoppers is kept to a minimum by their deliberate design which emphasizes efficient circulation of shoppers and exposure to a wide range of products. The separation of employees from customers contributes further to low rates of social interaction.

With the continuous new developments of shopping malls around every second corner, we are losing a focal point for community life and a place for meaningful interaction between people of different classes, cultures, ages and lifestyles. Many supermarkets have lately started to mimic the idea of independent deli-style food counters with 'expert' sales people. This, however, can in no way replicate the sense of community created at fresh produce markets, nor the level, range and quality of employment(Haese & Van Huylenbroeck, 2005: 99).

These social issues can be addressed by the introduction of more fresh produce markets within the City of Tshwane, which means that consumers, the urban inhabitants, might have a higher quality of life and create a new sense of community within the study area and between all citizens. Age, gender, class and culture will no longer be the divide between the inhabitants of the City of Tshwane.

As published in the South African lifestyle magazine *House and Leisure* (Issue 154), the 'market movement' is becoming more popular, even though it is still far from a main stream food trend: "Markets are the new malls"; "The 'market movement' is a reaction to confined, commercial, artificially lit, air-conditioned shopping centers and is in line with the international trend towards meaningful living. An antidote to malls, markets offer a laid-back, sociable outing. Plus they provide the opportunity to buy from small, specialised stores that offer great products…" (Buitendach, 2007:123)

2.4. Urban Food Production

A healthy urban food system means a healthy and sustainably growing community that is economically, environmentally and most importantly a socially productive community. New food production strategies should be applied in the study area, for example on the ample open roof spaces on existing buildings, open spaces within urban areas and also in local gardens. These principles can include various aspects:

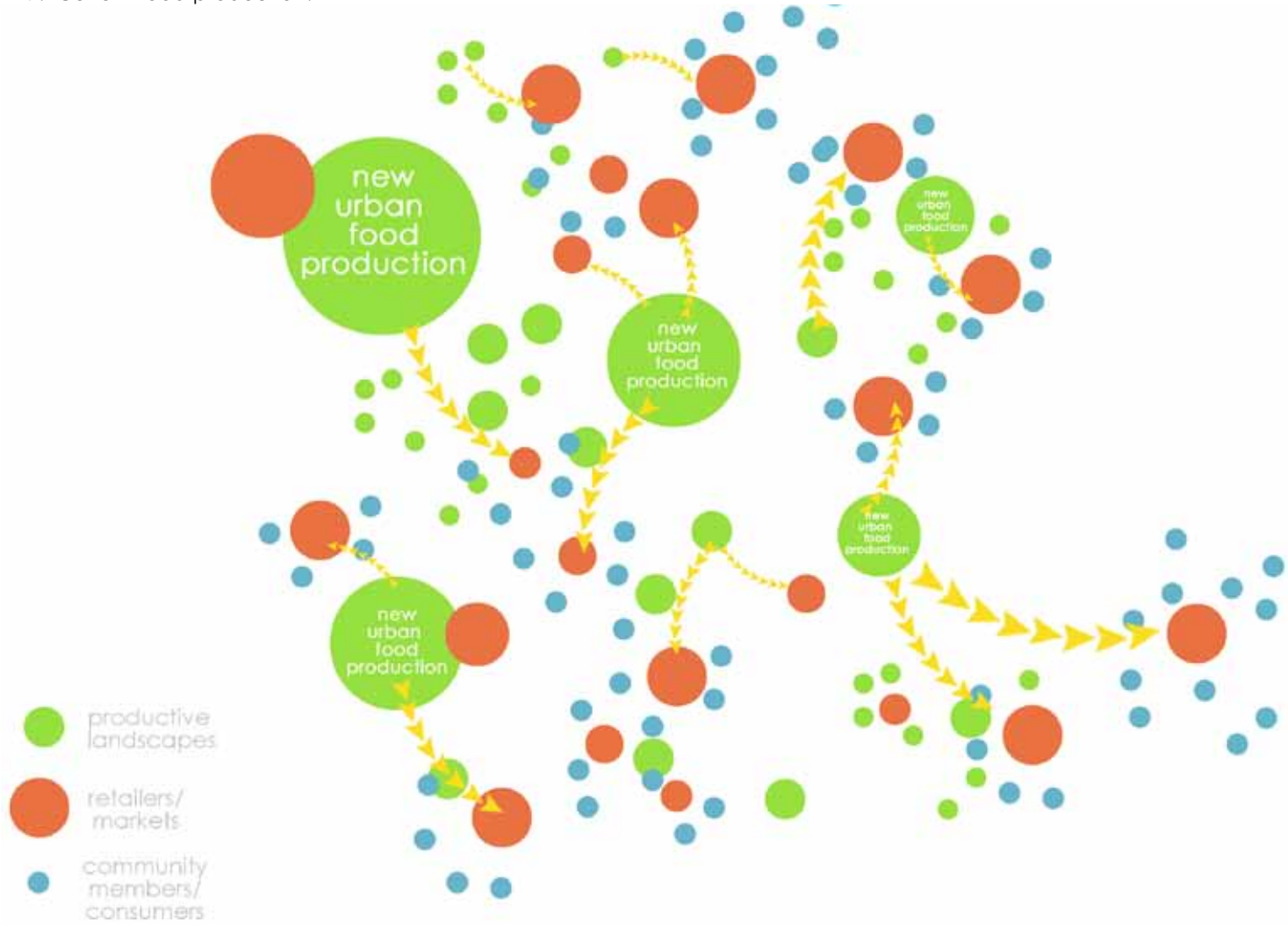
- local food production
- regional supply
- eat 'local' and 'slow' foods initiatives

Marketing food directly from producers to consumers, so circumventing the 'middlemen' in the food supply chain, has many potential benefits. For consumers, direct marketing initiatives are providing people with locally grown, fresh, healthy and, in many cases, organic food at affordable prices. Through buying locally grown produce, consumers are giving their support to local producers as well as helping to revitalise local economies.

Local suppliers such as spaza shops could not meet this demand, thus creating the need for a mechanism that meets the aforementioned demand. This led to the rise of supermarkets.

Urbanisation and the possibility for supermarkets to provide a wider variety of food at lower prices have contributed greatly towards the rapid rise and growth of supermarkets. Supermarket development is strongly correlated with the increase in population growth and industrial development. As the population increased in size, the demand for processed food increased. (Reardon, 2003:1142)

>>7: Current food production.



>>8: New urban food production (this is not a factual diagram, but conceptual)

2.5. Research: Current and new Food Systems

2.5.1. Fresh Food Retail

By personally visiting different food retailers, an interesting comparison was drawn between the social and physical environment of supermarkets and farmers' markets in the City of Tshwane mainly. On the semantic differential, the farmers' markets were perceived as more friendly, personal, rural, smaller, and happier settings than were the supermarkets. More than three-quarters of the supermarket shoppers arrived alone while at the farmers' markets, more than three-quarters arrived in the company of others. Interaction counts showed a similar number of conversations in the two settings but more social and informational encounters at the farmers' markets. The lack of extended interaction in supermarkets is seen as a function of its social organisation, relatively low density, and traffic-dominated architectural layout(Sommer, 1981:13).

>>9-14: Current fresh produce retailers.

2.5.2. Current Fresh Produce Retailers

Supermarkets – Checkers, Spar, Pick 'n Pay, Woolworths, Shoprite(these include convenience stores eg. Kwik Spar, Woolworths Food Stops).

Fresh produce supermarket – Fruit & Veg, local fresh produce retailers (eg. Housewives Market), Fruit Spot.

Fresh- and slow-food markets – 'Die Boeremark', 'Hazelwood Food Market', 'Irene Market'.

Below is a matrix of results after visiting the three main fresh food retailers.

Table 1: Personal retail experiences.

2.6. Urban Open Spaces

In the Tshwane Open Space Framework(OSF) Volume 3, published in November 2005, a strategy for urban open spaces within Tshwane has been formulated. The proposed food market will be dependent on open spaces for the production of fruits and vegetables. The Open Space Framework informed the dissertation and has direct relation to it.

Based on the OSF, a few important guidelines were formulated for this specific project:

- reactivating open spaces
- **creating high quality environmental spaces through agricultural gardens**
- **designing a world class market and facilities for fresh produce production and retail**
- incorporating placemaking strategies, for example courtyard spaces, to the precinct framework, to encourage communities to form
- developing agricultural activities to activate deserted open spaces by means of **passive surveillance,** which will result in **safer pedestrian routes** through suburban and business areas
- providing healthier food options provide for better personal health and wellbeing

These factors will aid in creating an environmental awareness and responsibility within the study area. Incorporating the OSF structuring principles into an urban design project like the new food market, will help us conserve our green areas. The OSF encourages interconnected green spaces and the intervention can possibly do this by creating productive landscapes that all connect to the intervention site in some way, even if it is not physically. Current open spaces in the area do get used, but only by a few pedestrians. Placemaking of green areas make these areas more desirable for users(Tshwane, 2005: 2-3).

2.7. Agriculture, Mass Production and Resource Exploitation

When research is done on fresh food production within urban areas, it is valuable to have a look at agriculture and food production, in its current state, and the issues it brings forward. Agricultural production has changed drastically over the past couple of decades with food production increasing rapidly due to new innovative technology, mechanisation of agriculture, increases in chemical use and specialisation.

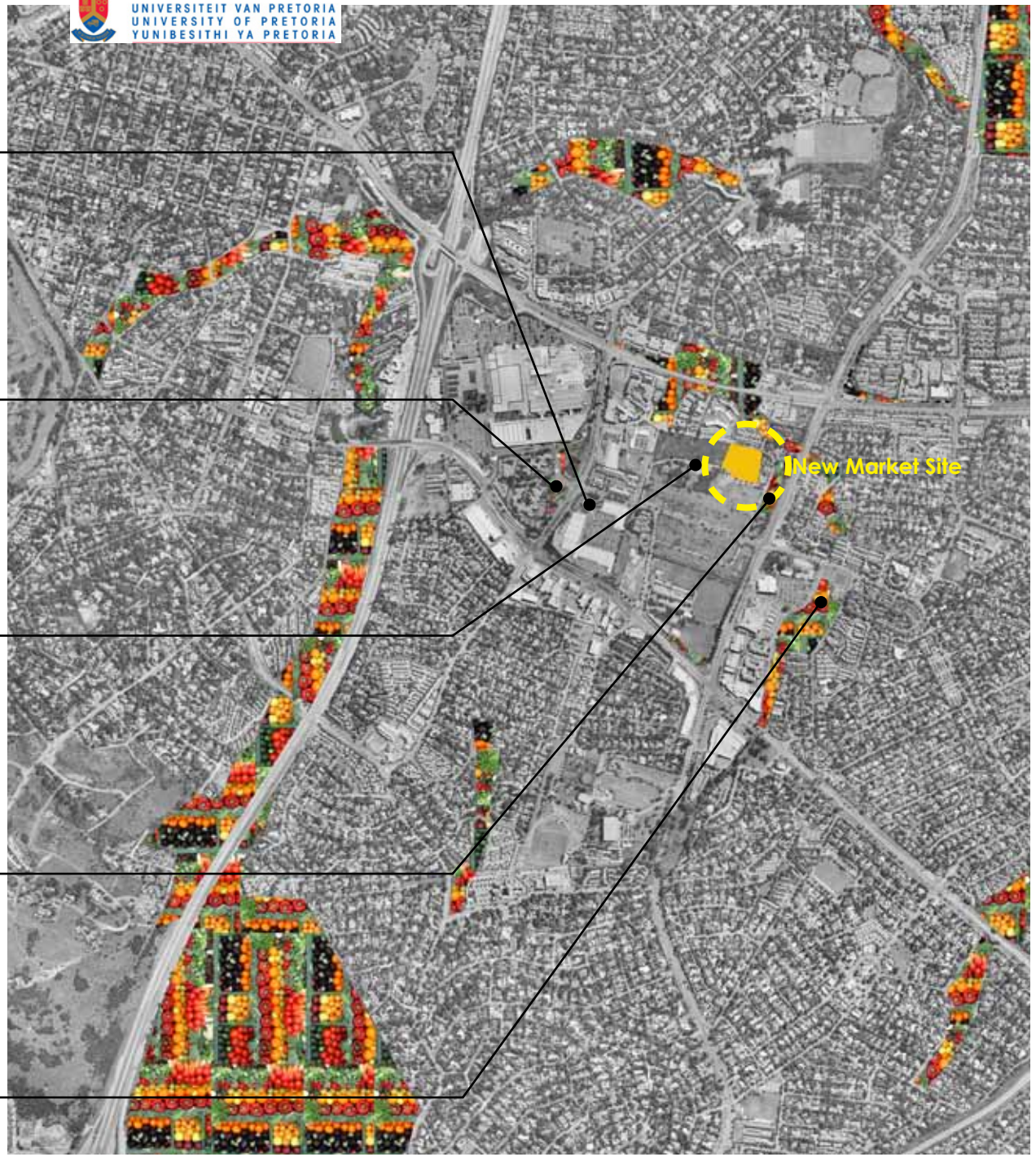
Supermarket cheap food policies put local producers at a disadvantage because they cannot compete with produce from areas where land or labour costs less. Long distance transportation of food produces vast amounts of pollution, requires excessive packaging and use of chemical preservatives, uses up large amounts of non-renewable fossil fuels and thus contributes significantly (and needlessly) to climate change (Freemantle, 2008: 15).

The above-mentioned issues in agriculture and food production can be almost eliminated when fresh food is produced within the urban realm. The new food market can contribute in minimising resource exploitation, only by producing food closer to the consumer. Growing food organically reduces the use of chemicals and pesticides. This food production landscapes will not harm ecosystems or biodiversity in the Menlyn area.

>>16: Urban open spaces – proposed productive landscapes.

>>15: Fresh produce retail locator in area.

>>17-21: Open spaces in close proximity to proposed site.



>>22: Proposed productive landscapes within context of Menlyn area.

2.8. Productive Landscape Typologies

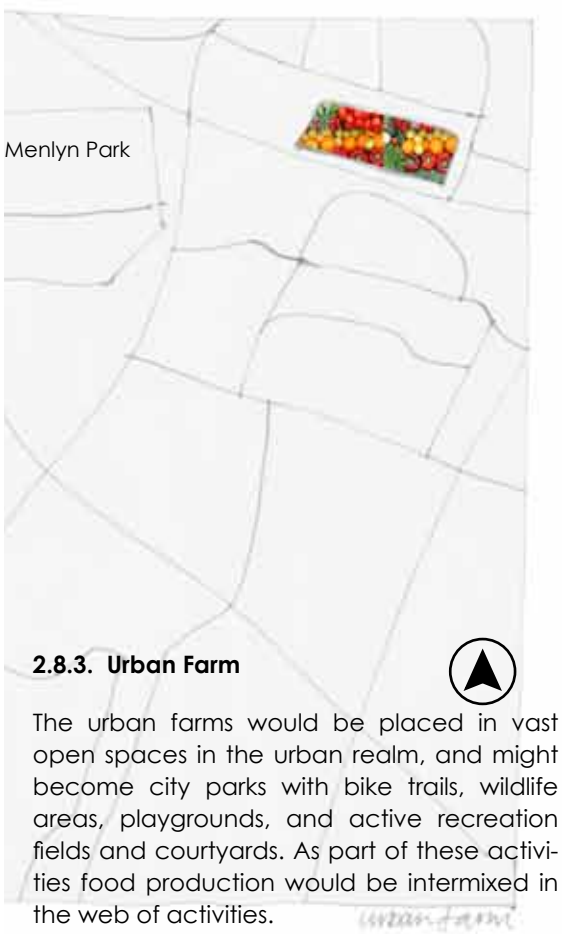
2.8.1. Food Boulevard

Instead of walking along a busy street and a harsh building edge, pedestrians could follow a food boulevard and become part of the production process. The food boulevard would create a safe route for pedestrians and children.

2.8.2. Private Residence Garden

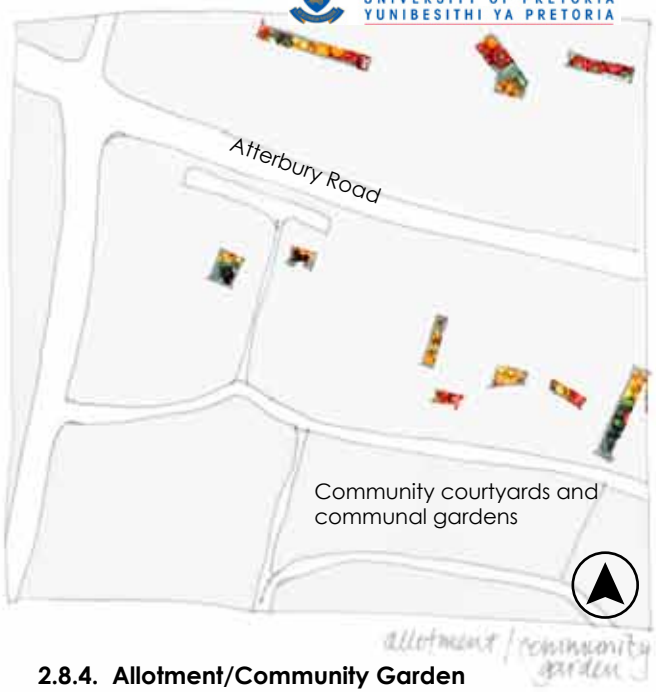
Private residence owners could supplement their vegetables and fruits with those they grow in their own yard, or sell at the market.

>>23: Productive landscape typologies.



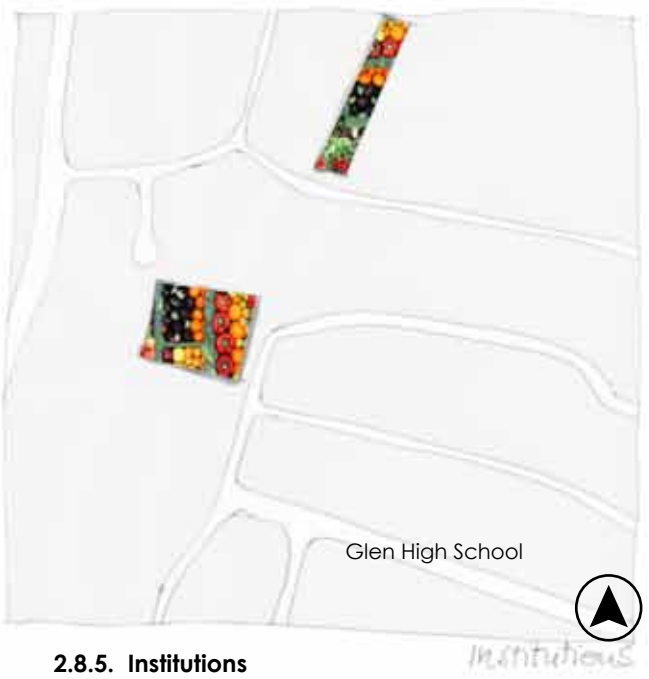
2.8.3. Urban Farm

The urban farms would be placed in vast open spaces in the urban realm, and might become city parks with bike trails, wildlife areas, playgrounds, and active recreation fields and courtyards. As part of these activities food production would be intermixed in the web of activities.



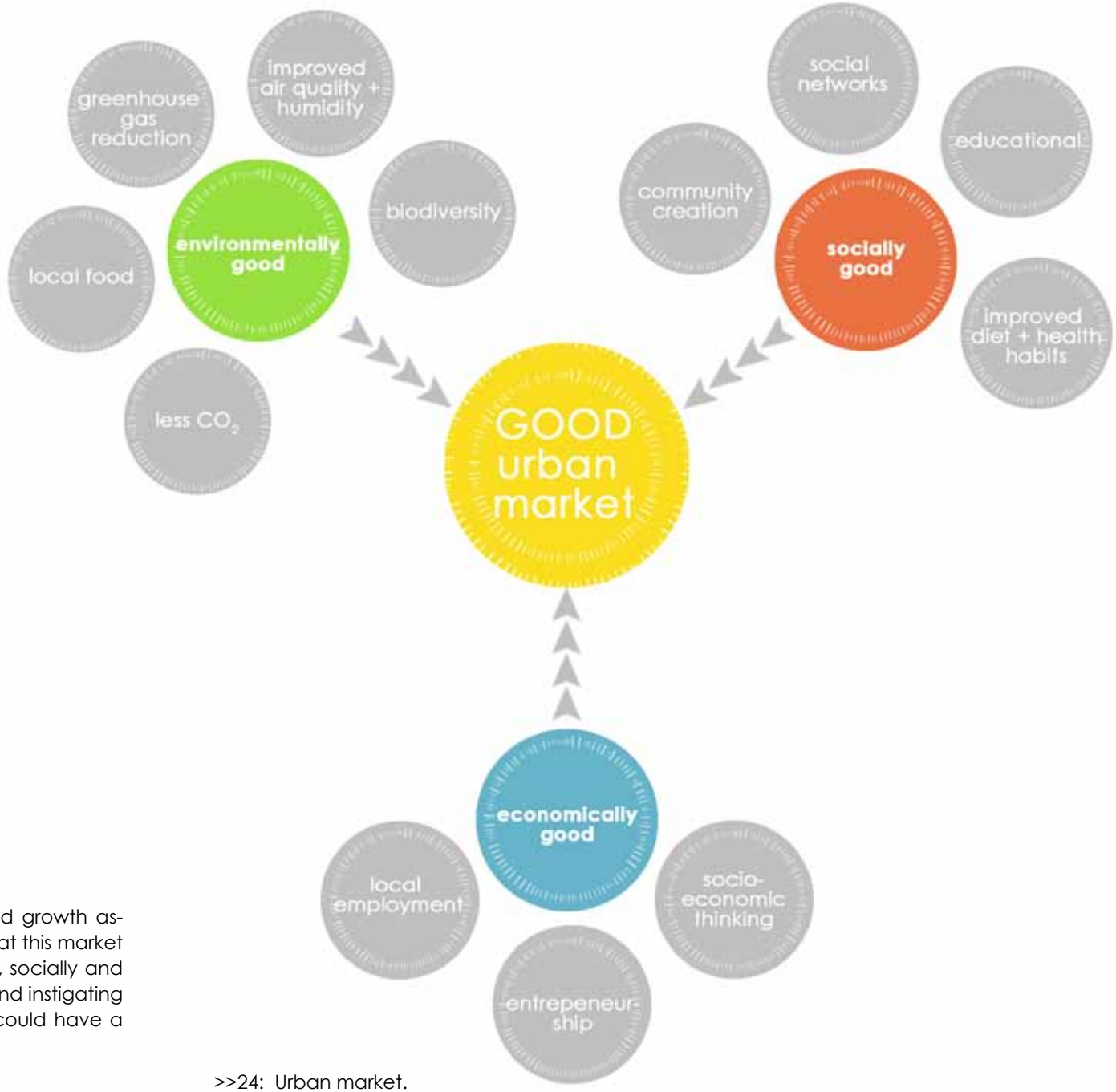
2.8.4. Allotment/Community Garden

Community/allotment gardening on the market site and surrounding areas would allow individuals to work and socialise together while working on each other's plots, creating an income.



2.8.5. Institutions

Institutions like Glen High School might provide services to the community including beginning farmer training, home food processing classes etc, and raise funds by supplying the market with produce.



>>24: Urban market.

Conclusion

After researching the specific food retail and food growth aspects of urban systems, a conclusion was made that this market could contribute on three levels: environmentally, socially and economically. Through designing a food market and instigating the growth of fresh produce in urban areas, this could have a good influence on our overall urban landscape.

2.9. The Design Imperative

This urban food system will be commercially productive and will incorporate open spaces, parks and community gardens into its network.

The new food market and activity node should create a foundation for the marketing of products within the urban food system. This food node or fresh food market is important to the urban food system because it becomes a centre were products within the urban food system can be marketed to the greater city population. The greater city population is now in close proximity because of the new transport interchange node next door. Outdoor markets, retail facilities, performances, nightlife activities and other commercial activities should be located at this node because this is now an intersection of circulation. Diverse nodes and markets can create an active streetscape at every hour.

Aside from the physical and productive sectors of the current food system, food access and health serious concerns both in the country and city. There are very few points of food access for community members. Local pedestrians, community members and businesspeople of the area are dependent on Menlyn Park Shopping Centre for buying food and this limits variety. The new food market will create a platform for marketing for any producer.

This fresh produce market should contribute to the face-to-face ties between producers and consumers and should be seen as a central component of the local food system. The trust and social connection will characterize the new food market, and distinguish the local food system from the global food system.

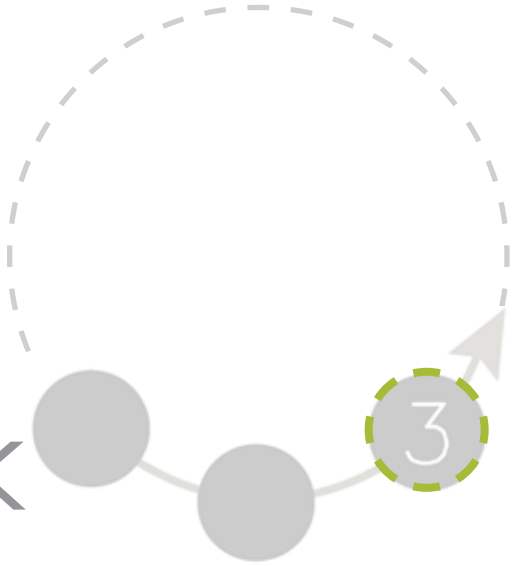
Buying healthy food should be a pleasurable experience to all, so market layout and design should be refined to offer exactly that. The market should be accessible to all to buy and sell produce. The market will not be an informal market, but very well structured to create easy and even flows throughout. Communal and social gatherings should be possible, where food can be enjoyed together within the market and in the park.

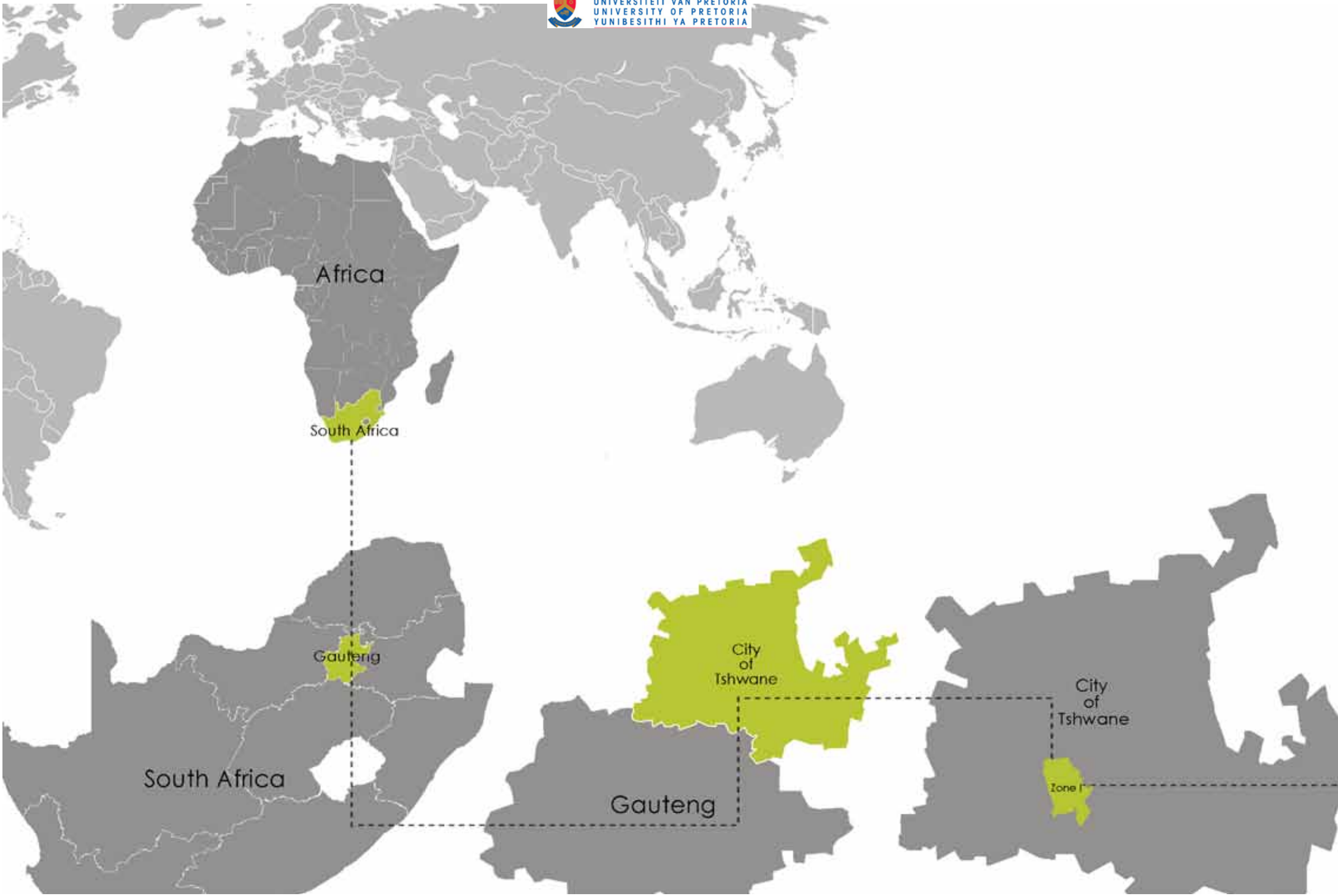
The market building should offer easy access to and from the new transport interchange building. Stopover times should be used to buy food or have a quick bite. Visible building systems and circulation, from within and outside the market building, should create an honest and easily understandable building.

It should be possible to move market stalls around within and to the outside of the market to rearrange spaces according to needs.

In this chapter, a study is done on the macro and micro scale context, to get an informed understanding of the study area. According to the findings, a framework is proposed in which the proposed project will function. As the study area is in the initial phase of major new developments, this framework could set a standard for all new development in the precinct and adjoining areas, creating a quality urban environment.

Context+Framework




Africa
South Africa
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City
of
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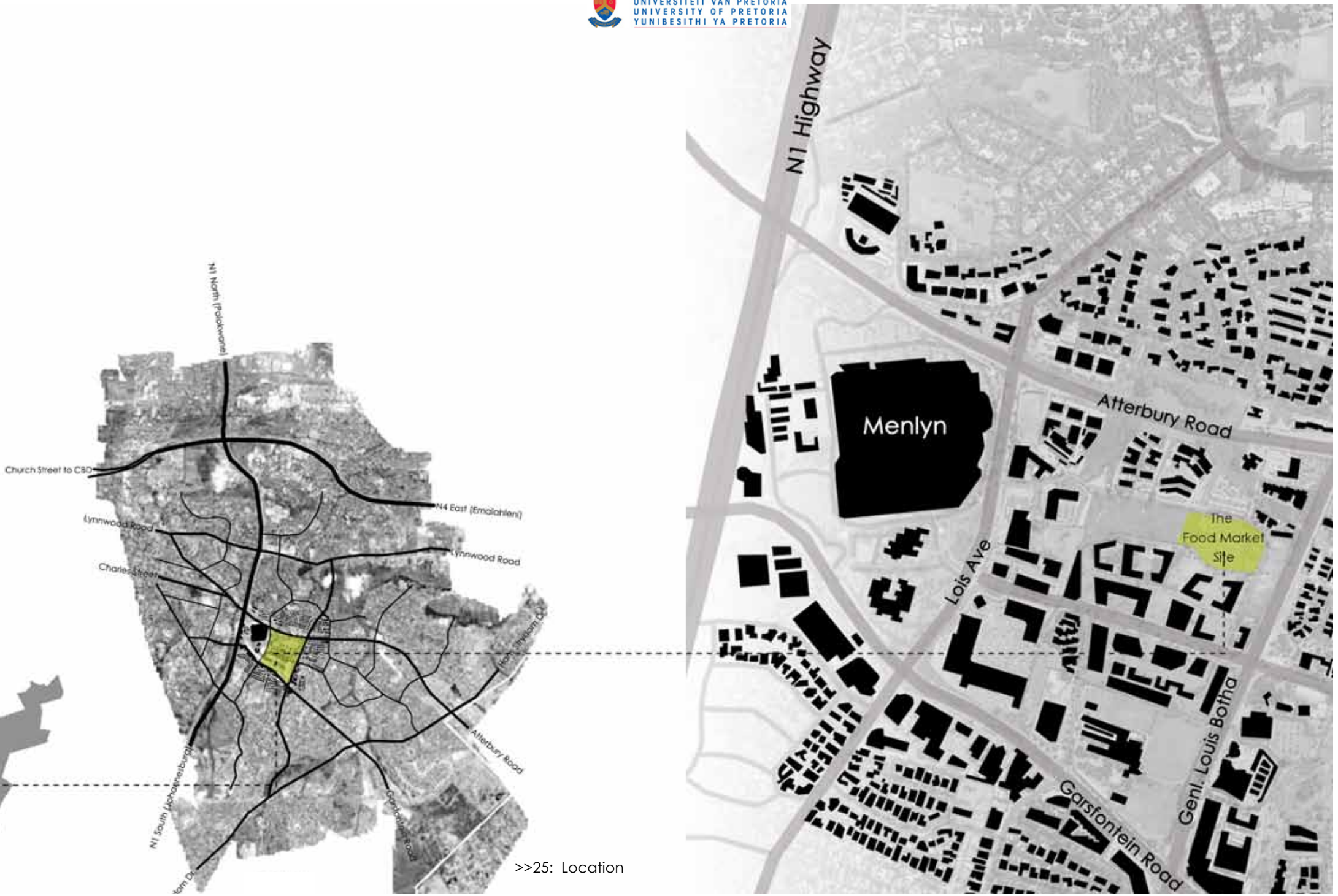
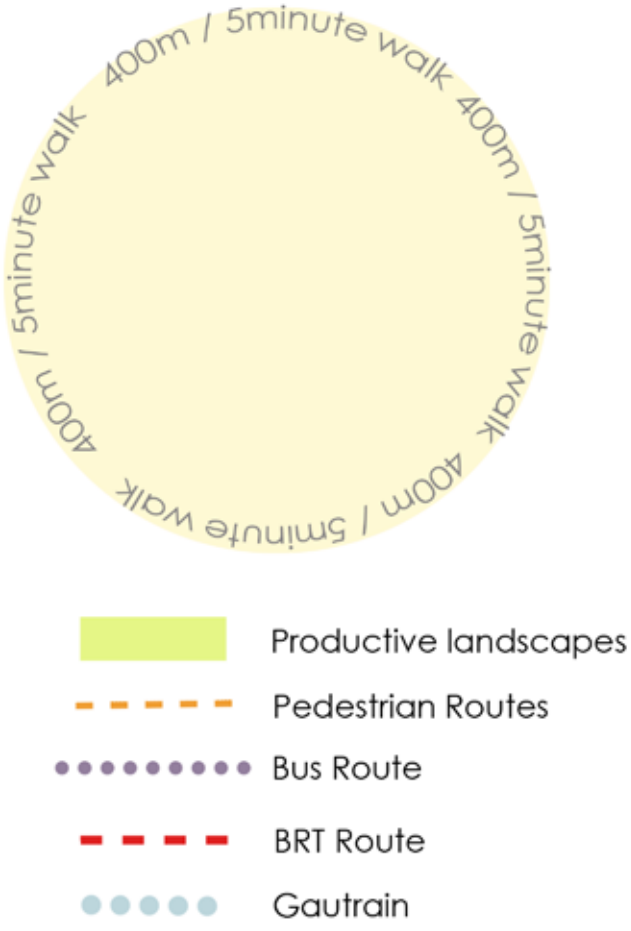
of
Tshwane
Zone I


N1 North (Polokwane)
Church Street to CBD
N4 East (Emalahleni)
Lynnwood Road
Lynnwood Road
Charles Street
Atterbury Road
N1 South (Johannesburg)
Garsfontein Road
N1 Highway
Menlyn
Atterbury Road
Lois Ave
The Food Market Site
Genl. Louis Botha
Garsfontein Road

>>25: Location

3.1. Routes and Landmarks in Macro Scale Environment

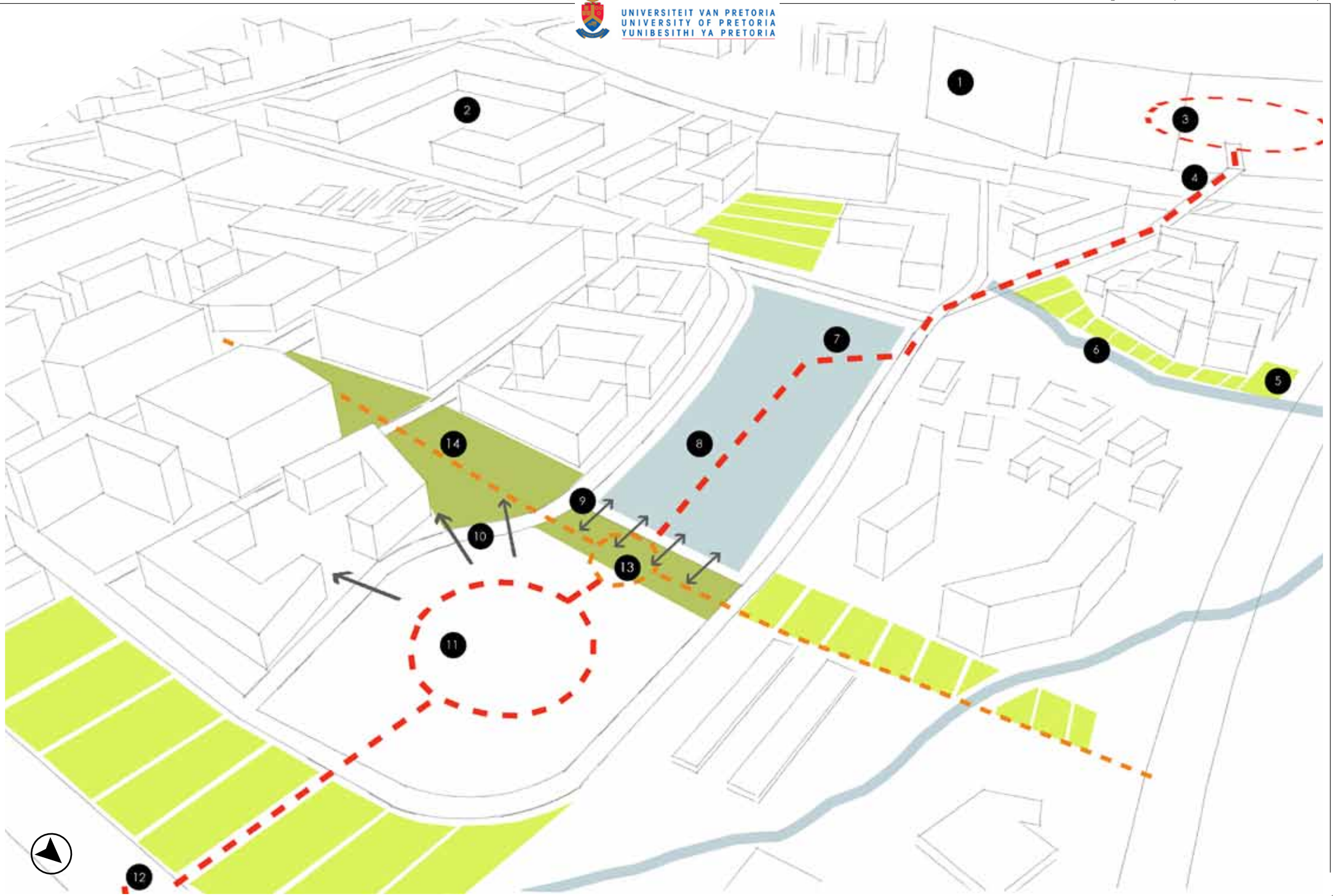


1. Moreletaspruit
2. New Dallas Road extension to Atterbury Road
3. Menlyn Park Shopping Centre
4. Proposed pedestrian bridge
5. Informal Trade Boulevard
6. Proposed Menlyn Intermodal Transport Exchange
7. Proposed site for new Fresh Produce Market
8. Proposed area for new BRT stop
9. Proposed new Taxi Rank
10. Safe pedestrian crossing
11. Menlyn Retail Park
12. Glen High School
13. Damelin College
14. Menlyn Maine
15. CTI College

>>26: Routes and important landmarks on site.

3.2. Pedestrian Routes and Micro Scale Environment

1. Menlyn Park Shopping Centre
2. Menlyn Retail Park
3. Menlyn Park Food Court
4. Proposed new pedestrian bridge over Lois Lane
5. Area adjacent to Moreletaspruit developed into productive landscape
6. Moreleta spruit
7. East - West pedestrian boulevard
8. Proposed new Intermodal Transport Interchange
9. Link Food Market and New Intermodal Transport Interchange
10. Establish connection between Food Market and Menlyn Main mixed use development
11. Civic space/Food court/courtyard hosting pedestrian boulevard
12. Create safe pedestrian crossing over Genl Louis Botha boundary
13. Emphasize connection of two pedestrian axes by means of landscaping
14. Menlyn Maine North - South pedestrian boulevard

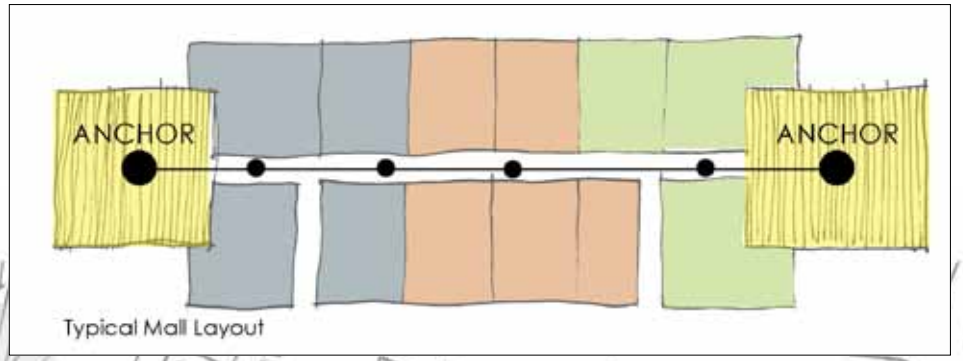


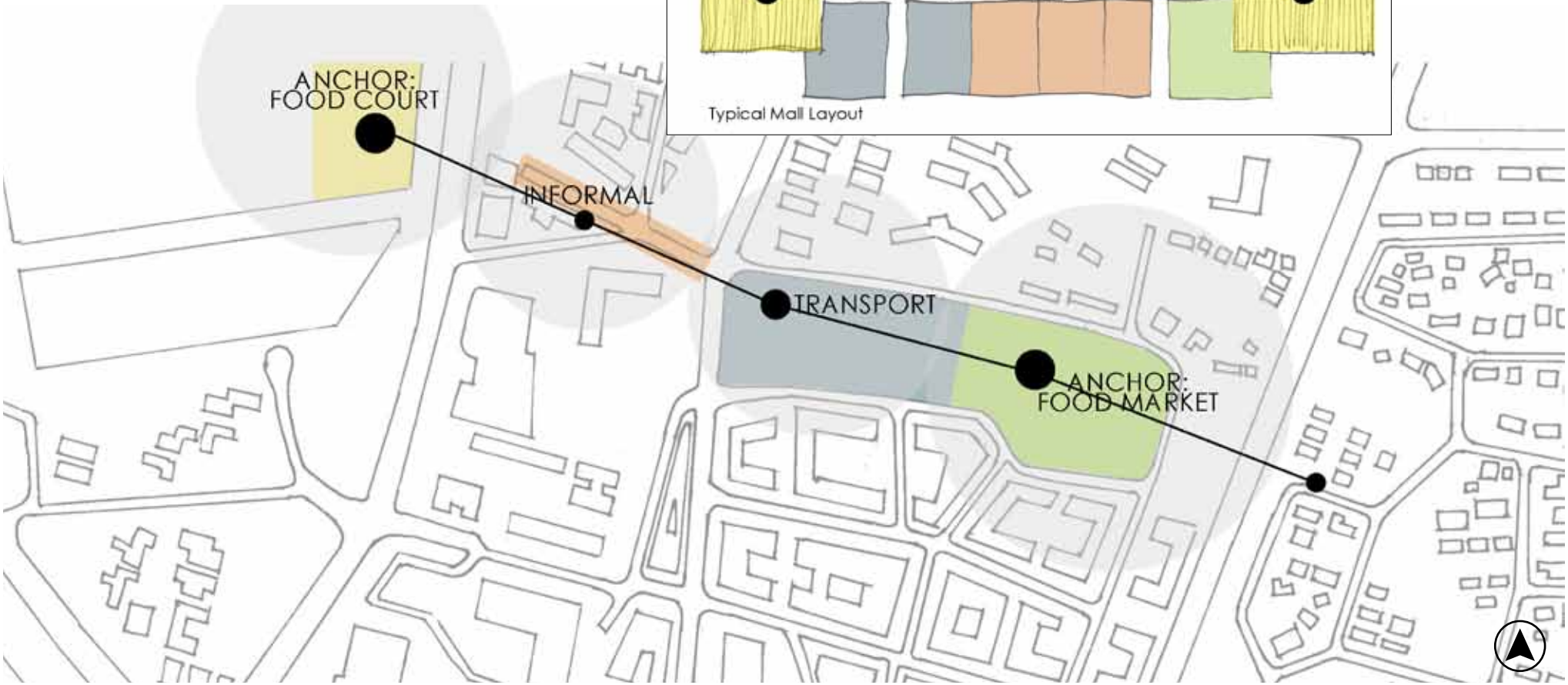
>>27: Main pedestrian route and interventions.

3.3. The "Shopping Mall" Concept

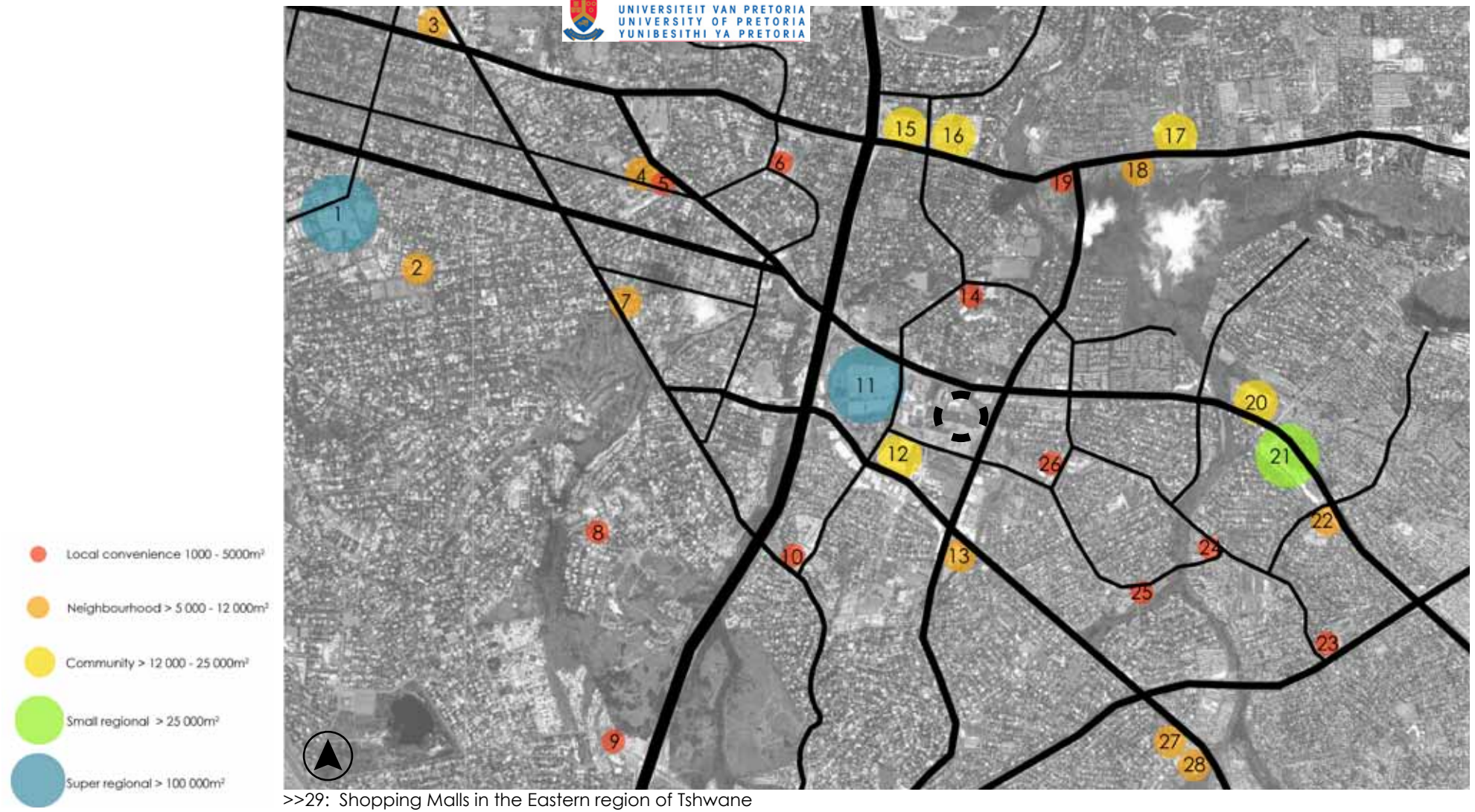
The "shopping mall" concept is one of the most successful commercial property models, and a building type which has a significant impact on everyday urban life. Mall designs must respond to user needs, climate, design and planning trends. A mall, in essence, mimics a market by appropriating the old functions and packaging them into an experiential, air-conditioned utopia (Beceri, 2004:2). In a traditional market or the downtown street where shops densely line the street, you stroll along the tiny alleys, and come into contact with other people, public amenities and institutions, for everything in the public realm is woven into the same urban fabric.

These faux urban marketplaces (malls) try to achieve the same effect but they do so by privatising public space and putting all these elements in a fenced area independent of everything outside of it. Shopping malls mimic what people want from urban life. As this eastern region of Tshwane is known for the vast amount of shopping malls, successfully attracting urban users by the thousands, shopping mall design principles guided the Menlyn Framework for this scheme.





>>28: Mall principles applied to framework.



>>29: Shopping Malls in the Eastern region of Tshwane

1. Brooklyn Mall - 115 000 m²
2. Waterkloof Corner – 8 620 m²
3. Hillcrest Boulevard – 8 240 m²
4. Greenlyn Village Centre – 8 900 m²
5. Menlo Centre – 4 100 m²
6. The Hillside – 2 584 m²
7. Hazelwood – 5 550 m²
8. Club Shopping Centre – 2 250 m²
9. Waterkloof Rand Centre – 4 000 m²
10. Newlands Plaza – 4 270 m²
11. Menlyn Park Shopping Centre – 120 000 m²
12. Menlyn Retail Park – 19 200 m²
13. Waterglen Park Shopping Centre – 12 128 m²
14. Glenwood – 2 100 m²
15. Lynnwood Bridge Retail – 15 000 m²
16. Glenfair Shopping Centre – 14 800 m²
17. Lynnridge Mall – 15 870 m²
18. Gift Acres – 8 850 m²
19. Glen Gables – 5 230 m²
20. Pick n Pay Hypermarket Faerie Glen – 21 000 m²
21. Atterbury Value Mart – 40 400 m²
22. Atterbury Decor Centre – 5 800 m²
23. Eastdale – 3 000 m²
24. Meadowlands Square – 2 750 m²
25. Garsfontein Village – 1 180 m²
26. Serene – 1 370 m²
27. Moreleta Square – 8 400 m²
28. Moreleta Plaza – 7 940 m²

3.4. Linking Courtyards

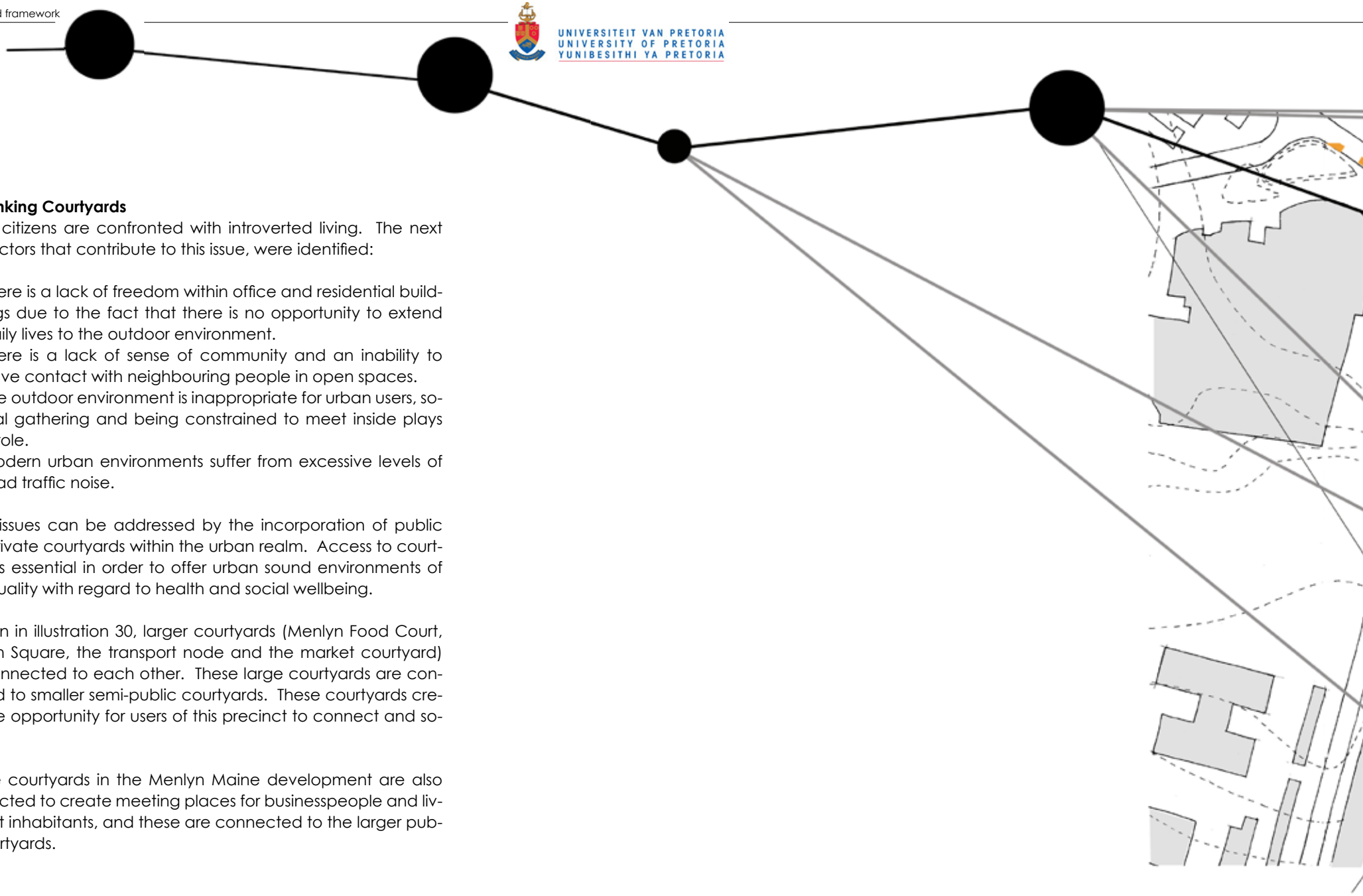
Urban citizens are confronted with introverted living. The next four factors that contribute to this issue, were identified:

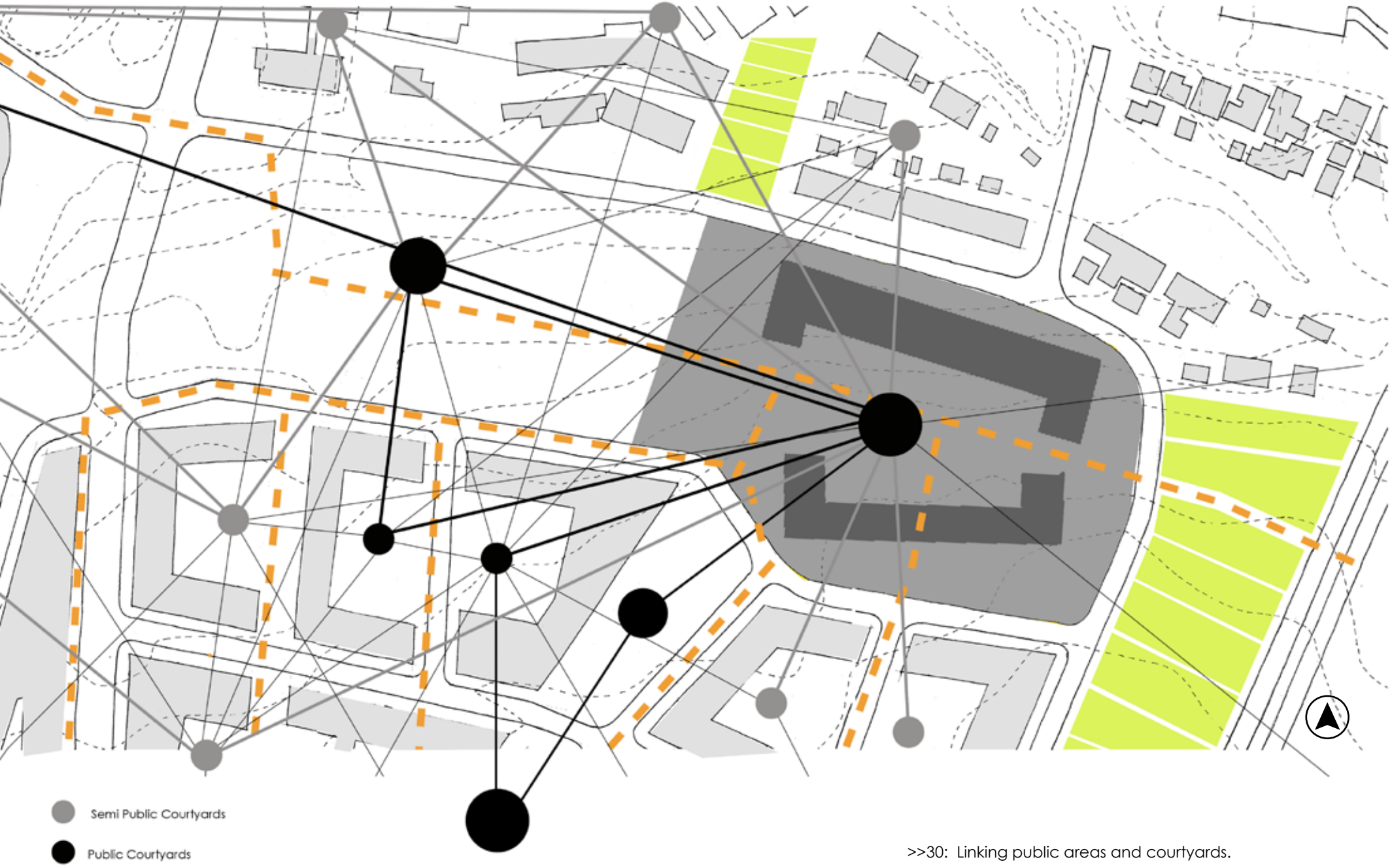
- There is a lack of freedom within office and residential buildings due to the fact that there is no opportunity to extend daily lives to the outdoor environment.
- There is a lack of sense of community and an inability to have contact with neighbouring people in open spaces.
- The outdoor environment is inappropriate for urban users, social gathering and being constrained to meet inside plays a role.
- Modern urban environments suffer from excessive levels of road traffic noise.

These issues can be addressed by the incorporation of public and private courtyards within the urban realm. Access to courtyards is essential in order to offer urban sound environments of high quality with regard to health and social wellbeing.

As seen in illustration 30, larger courtyards (Menlyn Food Court, Menlyn Square, the transport node and the market courtyard) are connected to each other. These large courtyards are connected to smaller semi-public courtyards. These courtyards create the opportunity for users of this precinct to connect and socialise.

Private courtyards in the Menlyn Maine development are also connected to create meeting places for businesspeople and living unit inhabitants, and these are connected to the larger public courtyards.





>>30: Linking public areas and courtyards.

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UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

3.5. Climate

Climate Data for Pretoria

Month	January	February	March	April	May	June	July	August	September	October	November	December
Recorded High	36	36	35	33	29	25	26	31	34	36	36	35
Average High	29	28	27	24	22	19	20	22	26	27	27	28
Average Low	18	17	16	12	8	5	5	8	12	14	16	17
Recorded Low	8	11	6	3	-1	-6	-4	-1	2	4	7	7
Precipitation (mm)	136	75	82	51	13	7	3	6	22	71	98	110
Average Precipitation Days	14	11	10	7	3	1	1	2	3	9	12	15

Table 2: Climate data of Pretoria

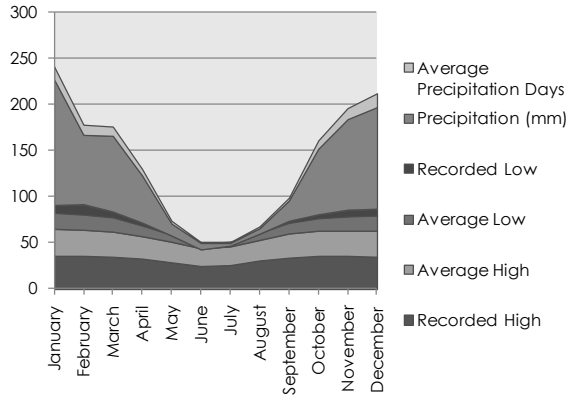
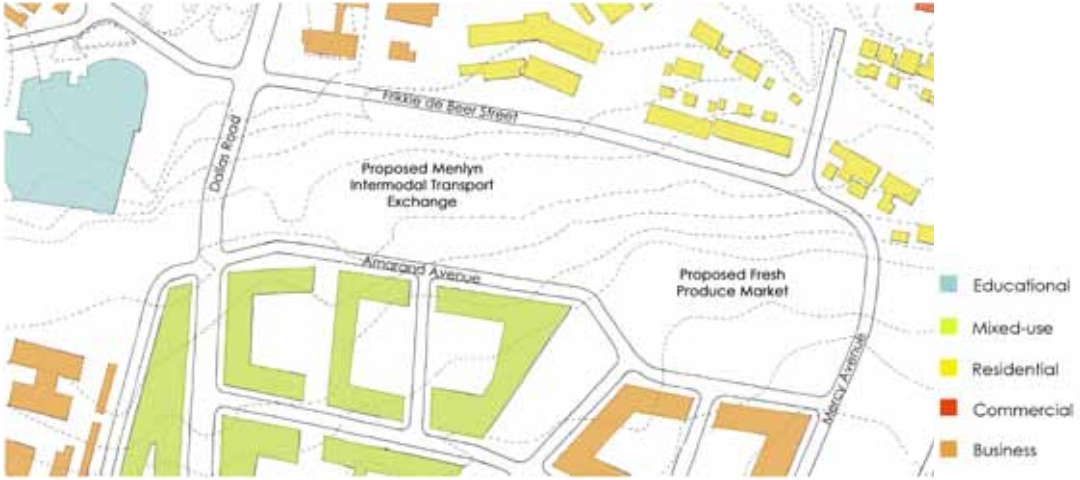


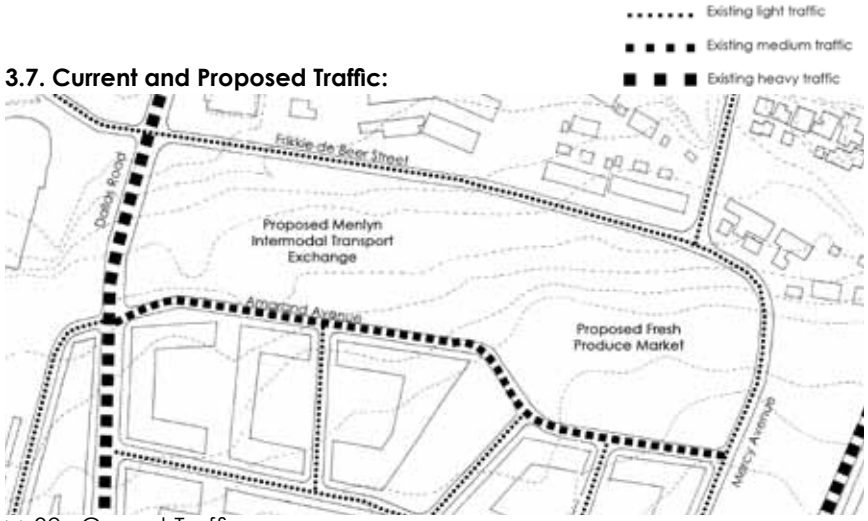
Table 3: Rainfall in Pretoria

3.6. Current Land Use:

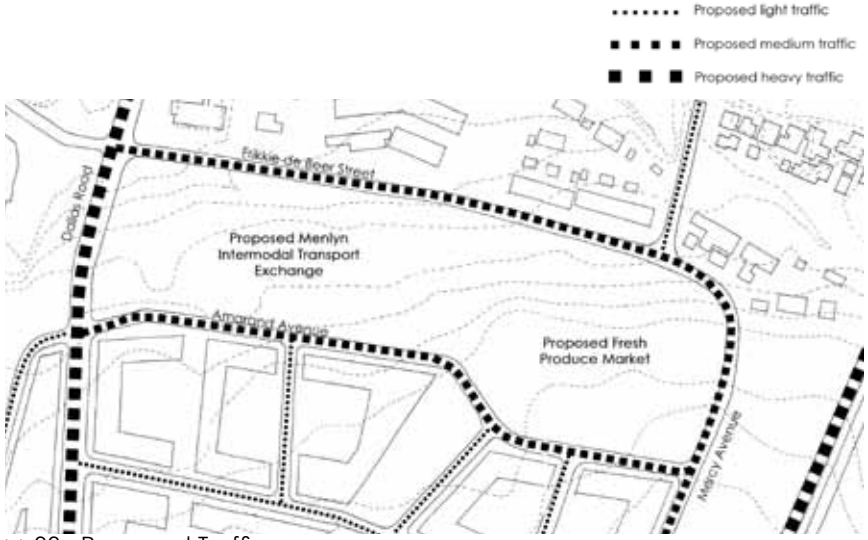


>>31: Current Land Use

3.7. Current and Proposed Traffic:



>>32: Current Traffic



>>33: Proposed Traffic

3.8. S.W.O.T. Analysis:

Strengths:

- mixed-income user group
- large user base
- mixed-use zoning – residential, commercial, business, institutional
- current development
- ample green/open space

Weaknesses:

- low density
- little/inefficient public transport infrastructure
- introverted public spaces
- beggars and homeless people inhabit the area
- pedestrian unfriendly

Opportunities:

- increase density
- provide public transport infrastructure
- create outside public spaces
- create opportunities to uplift
- use abandoned spaces for productive landscape
- create pedestrian friendly infrastructure

Threats:

- crime
- boundaries (arterial roads) not able to be bridged
- taxi industry not adhering to new infrastructure

>>34: Collage of images taken as part of SWOT analysis.

3.9. Existing Frameworks:

3.9.1. Menlyn Node Development Objectives

In the study brief for the Menlyn Node as defined by the City of Tshwane, the proposed development objectives are:

- Allow for expansion and intensification of **economic, social** and **residential** activities.
- Alleviate the pressure for horizontal expansion of economic activities into surrounding residential space by focusing on optimally utilising the vertical space available in the Menlyn Node.
- Combat leap-frog development – Menlyn Node was identified as a 'very high intensity area' by the SDF of Tshwane – increase development intensity.
- Development restrictions include the provision of high rise buildings (up to 24 storeys) (Tshwane, 2011:67)

The Menlyn precinct will become a transport node where the following modes of transport will be connected:
pedestrians, motor vehicles, taxis, busses, BRT and the Gautrain. (Cameron, 2009:10)

3.9.2. Menlyn Maine Development Framework

Menlyn Maine follows the basic principles of holistic design, uplifting and regenerating the existing. The precinct's identity combines a vibrant urban character with sound environmental principles. The proposed food market will fit into this framework, set by Menlyn Maine. Special attention was given to the next aspects in the framework:

- Connectivity: Open street systems that promote pedestrian movement and interaction. Physical and visual permeability are important.
- Mixed land use: Creating a 24 hour used area, attracting people of all walks of life.
- Legibility.
- Walkability.
- High density area.
- Security: Visibility of others and people being visible to others (MenlynMaine, [12-13]:2010)

3.10. Proposed Group Framework Guidelines

3.10.1. Accessibility

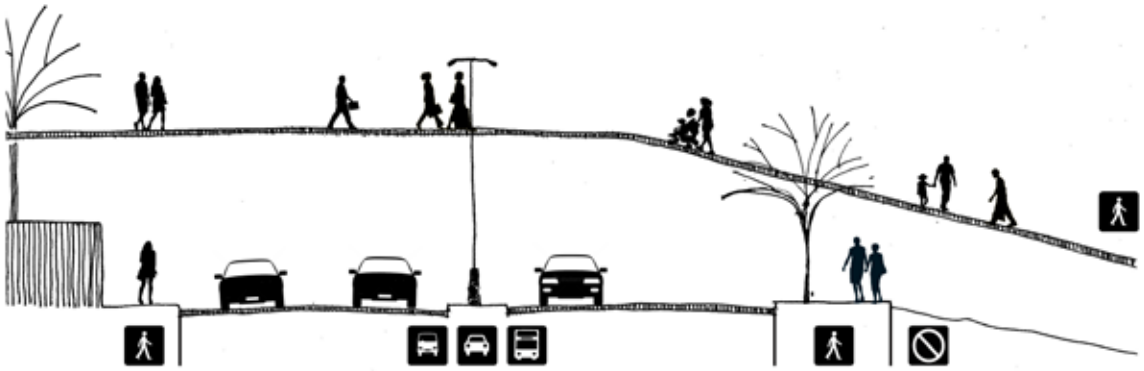
The site should be accessible for both vehicular and pedestrian movement from all sides of the greater city block, defined by Atterbury Road to the north, Genl. Louis Botha Drive to the east, Garsfontein Road to the south and Lois Avenue to the west. A pedestrian bridge from the Menlyn Park Shopping Centre, pedestrian traffic lights and crossings are allocated on the northern, eastern and southern sides. Vehicular movement is improved through the introduction of a new traffic light on Genl. Louis Botha Drive. The main roads passing the new intermodel transport exchange are linked with all four major roads defining the periphery of the framework as well as the proposed Menlyn Maine Framework – as indicated on plan. All entrances and roads are accessible to delivery and emergency vehicles without controlled access on the periphery. General vehicular traffic and pedestrian movement would, ideally, be separated to the benefit of the pedestrian.

3.10.2. Pedestrian Movement

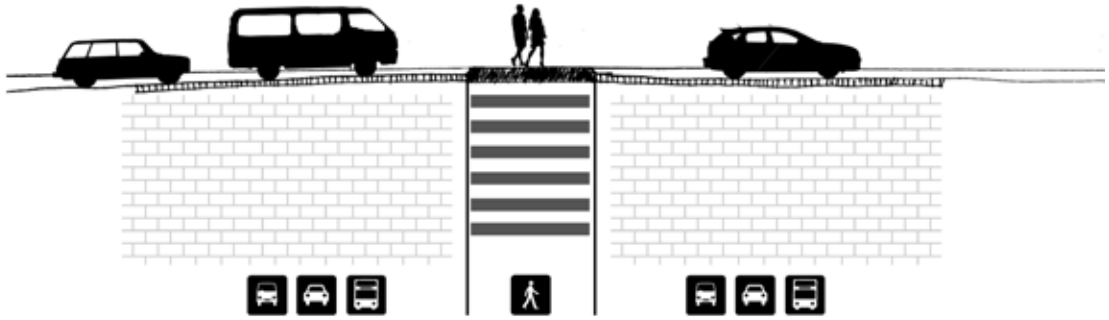
Green walkways are introduced to ease pedestrian movement throughout the site. At least one side of a road should have a pedestrian walkway, consisting of ample, paved walking space, seating and is landscaped according to the framework guidelines.

3.10.3. Storm Water Management

Grass bricks are introduced in order to assist with storm water management – water run-off from new pedestrian hard surfaces. Storm water management will make out part of each individual design with a zero run-off policy throughout.



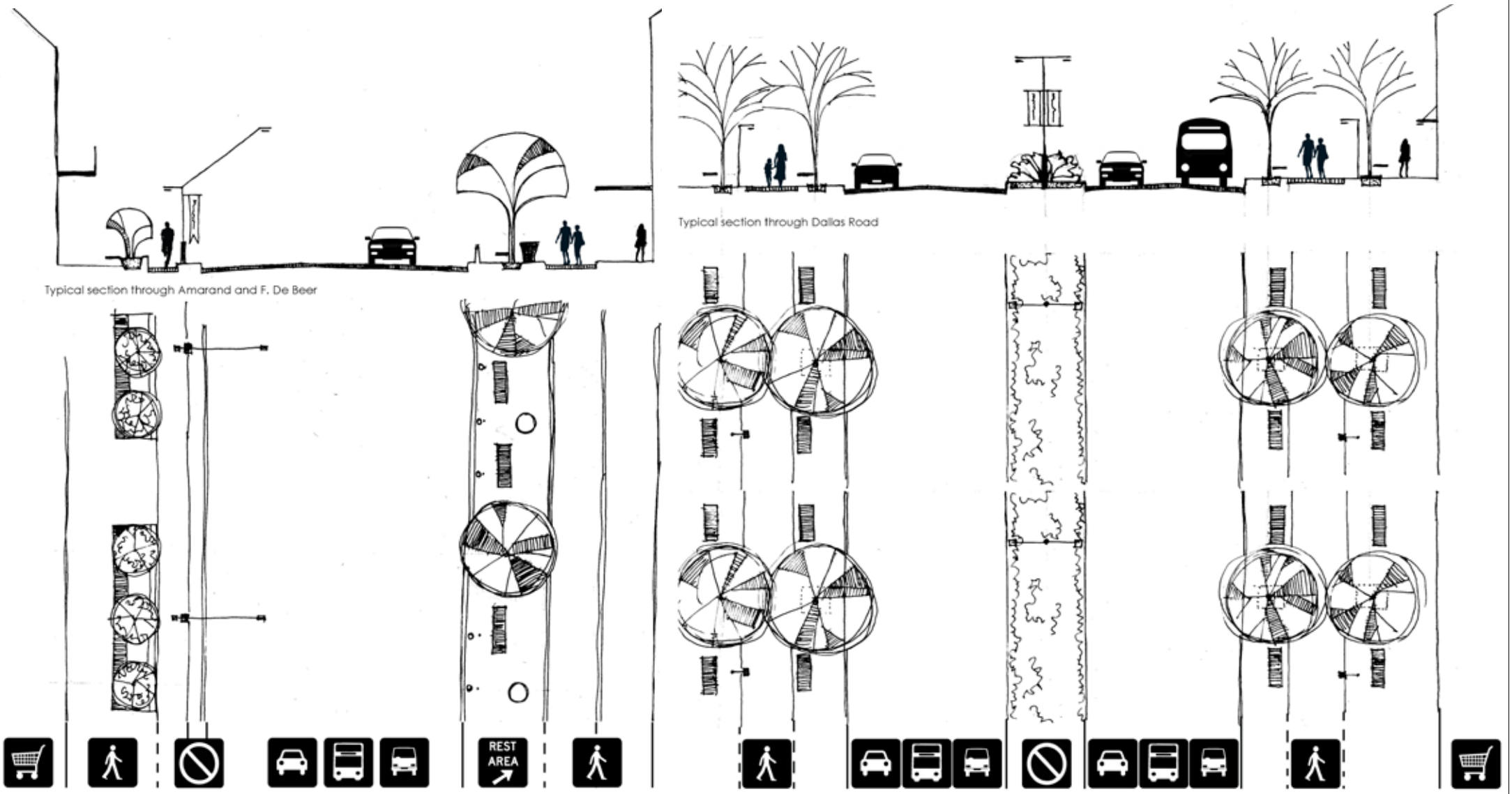
Lois Avenue pedestrian bridge crossing



Genl. Louis Botha Avenue raised pedestrian crossing

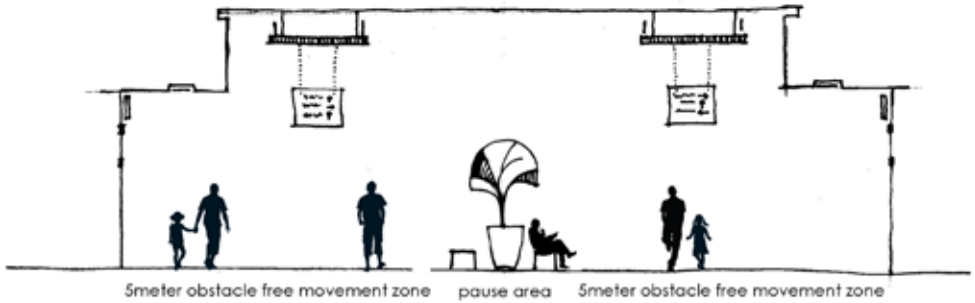
PEDESTRIAN FRIENDLY BOUNDARY CROSSINGS

>>35: Diagrams of micro scale interventions on site.

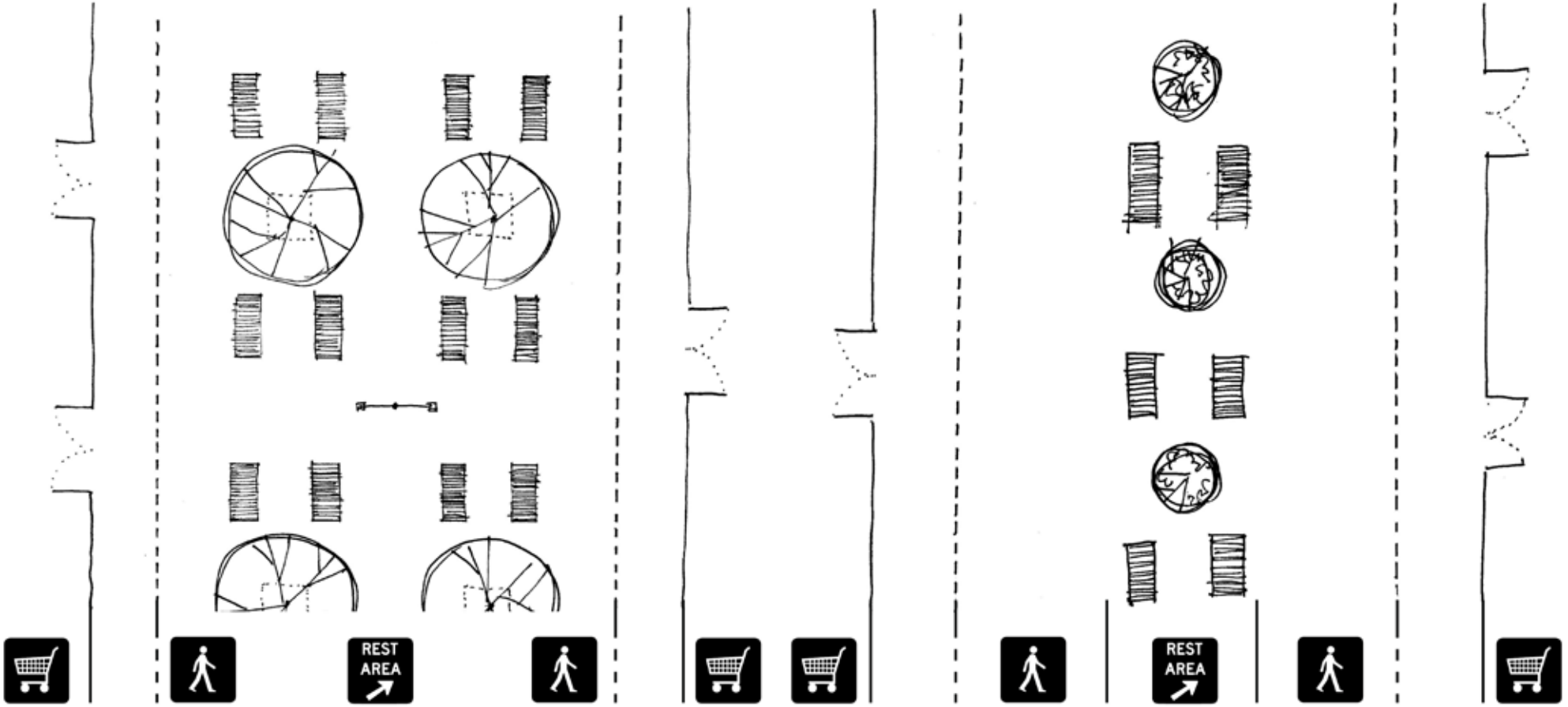


>>36: Diagrams of micro scale interventions on site.

Typical Pedestrian Boulevard Section



Typical Mall Section



>>37: Diagrams of microscale interventions on site

3.10.4. Street Furniture

- All street furniture should be low cost, low maintenance and vandal proof.
- In boulevards, seating and refuse bins should be provided on 100 m intervals on alternate sides of the boulevard, synchronised with street lamp spacing.

3.10.5. Landscape Guidelines

- Ample shading – Indigenous tree species at 10-12 m intervals.
- Hard and soft surfaces – minimum 1 200 mm paved walkways framed with 300 mm grass brick paving.
- Suitable seating – at most 400 m apart.
- Lighting – regular street lights for vehicular movement, to be combined with pedestrian scale lighting on sidewalks.
- All street lighting to be fitted with solar panels to assist in power supply.
- Pedestrian walkway lighting remains consistent throughout the framework. Adjacent to streets, lighting is to be 20 m apart. In the pedestrian boulevards, lighting should be provided no more than 10 m apart. All street lighting is to be vandal proof, yet accessible for maintenance.

In this chapter, information was gathered from relevant local and international precedent studies. Specific research was done on the way markets function in terms of circulation and its spatial relationships.

Food Lover's Market
Woodlands Boulevard, Pretoria, South Africa

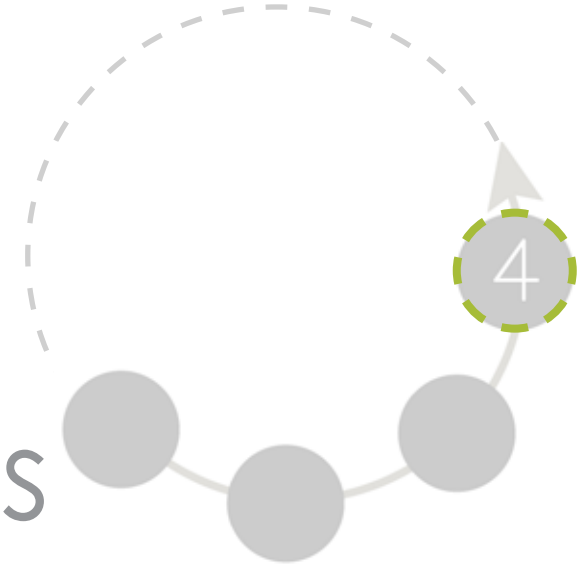
Boeremark
Silverton, Tshwane, South Africa

Tshwane Fresh Produce Market
DF Malan Drive, Pretoria West, Tshwane, South Africa

Hazel Food Market
Greenlyn Village Centre, Menlopark, Tshwane, South Africa

Market Hall
Laurens Quarter, Rotterdam, Netherlands

Santa Caterina Market
Barcelona, Spain, Europe



Precedent Studies

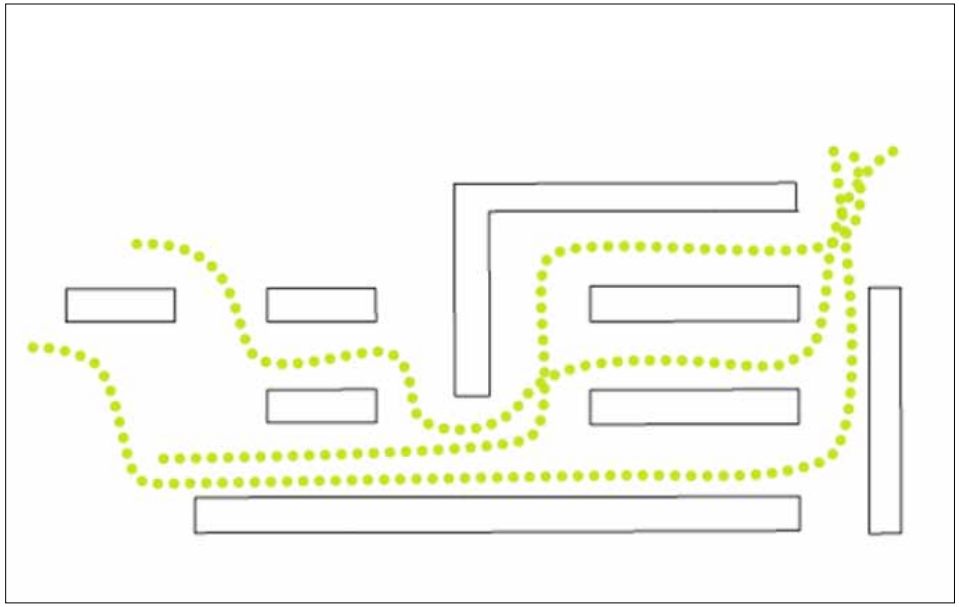
Food Lover's Market

Woodlands Boulevard, Tshwane, South Africa

Since November 2011
Food emporium
Size 4 000 m²
Operating times: 08:00/09:00 – 18:00/19:00 daily
by LPArchitects
Owned by Sandro Gastaldi

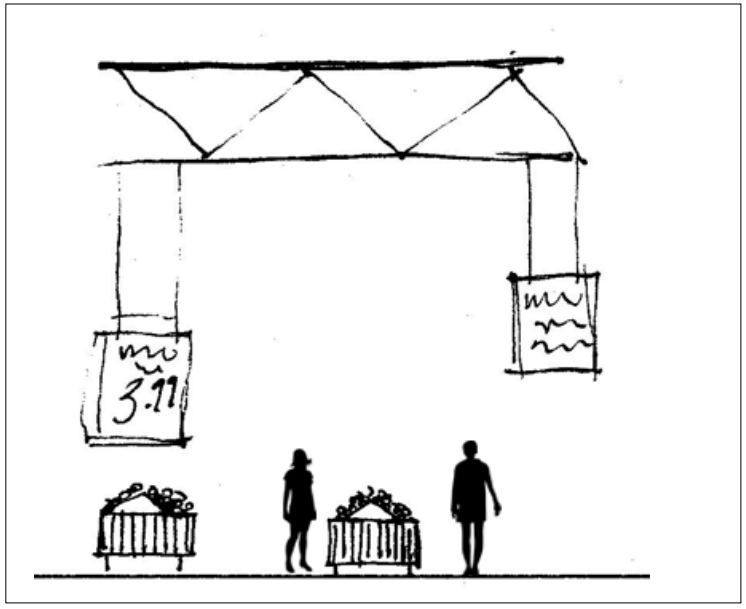
The new Food Lovers' Market in the East of Pretoria attracts thousands of customers daily. The main focus of this fresh food store is fresh produce, fruits and vegetables, but it also boasts a wide variety of departments that cater for every taste and need. These departments includes a fishmonger, a large gourmet butchery with expert blockmen who cut and prepare meat according to customer specifications, a biltong island, a bakery and confectionary, a chocolatier and an international deli and cheese section. More than just a fresh produce supermarket, Woodlands Food Lover's Market offers ready-made meals to take home.
The shop has a 5 m high open ceiling, with exposed steel trusses and ducting, which gives an open and spacious feel. These high open spaces turn into more intimate areas, where bulkheads are suspended over the pause areas, for example the sushi bar, butchery etc. The shop is designed in such a way that the layout promotes easy flow throughout.

>>38: Footprint of market building in context

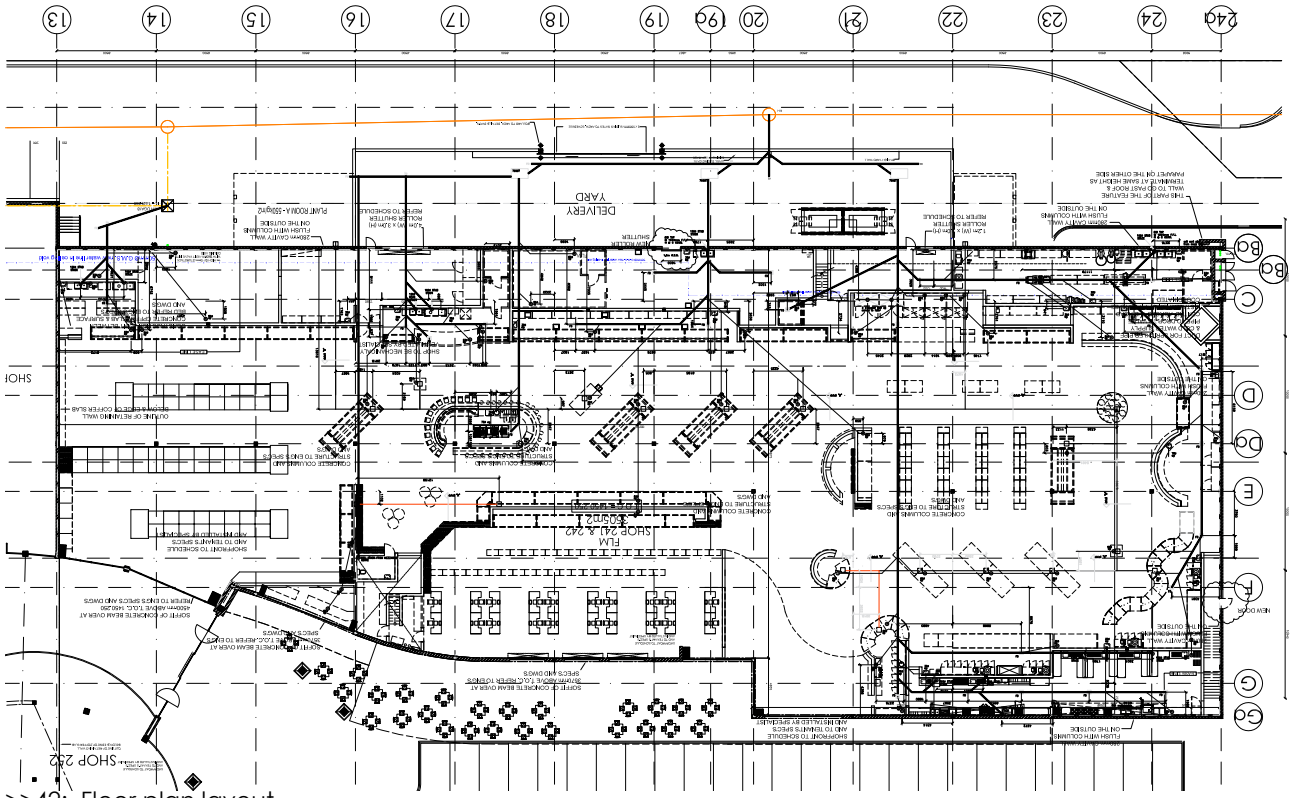


>>39: Movement around produce display.

>>40: Collage of images taken in Food Lover's Market, Woodlands Boulevard.



>>41: Diagrammatical proportions.



>>42: Floor plan layout

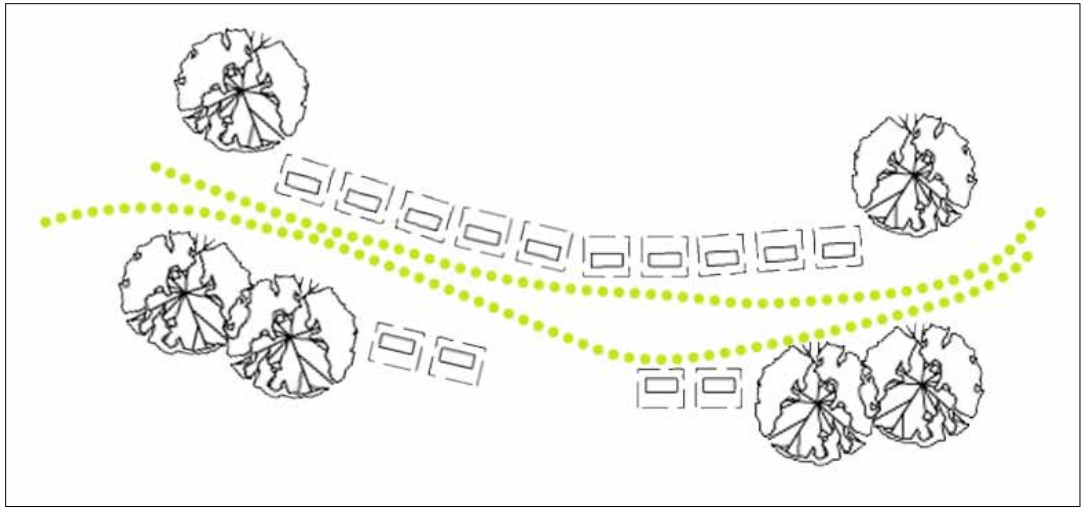
Boeremark

Silverton, Tshwane, South Africa

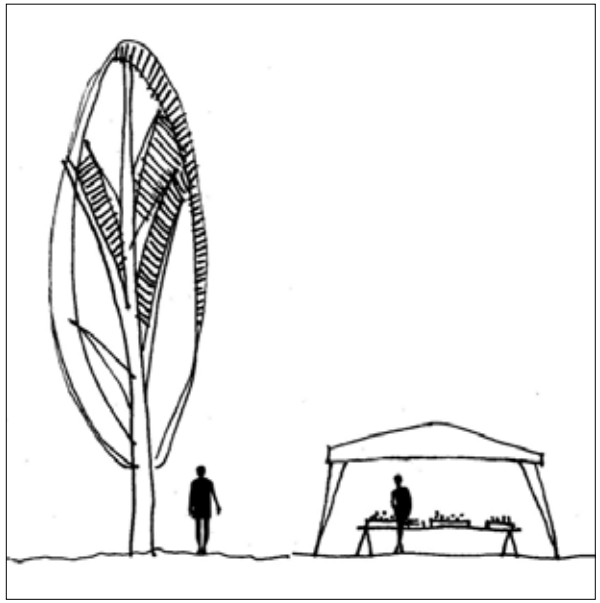
Since 1992
Farmers Market
Operating times: Saturdays 05:00 – 10:00
Area: +- 10 000 m²
Administered by: 'Transvaal Landbou Unie van Suid Afrika'

The smell of fresh coffee awaits you when entering the premises for a very early Saturday morning outing. Friendly farmers greet you – the social interaction starts and only ends when getting back into your car. This is an event where anyone is welcome and it attracts people of all groups. People come from far to take part in this, whether it is to buy weekly groceries, a puppy or to interact socially. At the Boeremark, the farmer, baker, butcher and craftsman interact personally with every client, selling his/her product. The social interaction forms bonds and creates a sense of community.
The Boeremark is an informal market and takes place under the poplar trees. Each stall owner needs to put up his own stall, on a spot hired for about R100. The stalls are manned from 05:45 until 10:00. A natural flow through the market is guided by the way the stalls are arranged, to avoid an accumulation of people. The trees create intimate spaces where food and music are enjoyed. A wide variety of products are available here, from flowers and plants to breads and cheeses, to puppies and dog food.
The market is held on the Pioneer Museum grounds, that serve as a picnic area during the week.

>>43: Footprint of market in context.



>>44: Movement around produce display.



>>45: Diagrammatical proportions.

>>46: Collage of images taken at the Boeremark.

Tshwane Fresh Produce Market

DF Malan Drive, Pretoria West, Tshwane, South Africa

Since 1918
Fresh produce market
Operating times: 04:00 – 13:00 daily
Area: Market premises: 32,8 hectares
Market halls: 58 950 m²
Administered by: Tshwane Municipality

The vision Tshwane Fresh Produce Market (TFPM) has is to be a world leader in the marketing, supply and distribution of fresh produce. TFPM provides a platform for farmers to sell their produce, through market agents.
The Tshwane Market has a national and international client-base. On the procurement side produce is obtained from producers country-wide and on the supply side the market is supported by buyers from all walks of life in South Africa and neighbouring countries. Prices are formed on the basis of supply and demand and set the trend for prices nationally.
The market terrain is neat, clean and well kept. The TFPM sells produce out of two main halls, one mainly for fruit, the other for vegetables. Produce gets delivered to these halls from the farmers, and redistributed throughout the halls, whereafter retailers and the public can buy produce. The TFPM has a daily turnover of R7 million to R10 million. TFPM is a cashless market which provides for a safe environment. A produce smartcard are used throughout the market, to simplify transactions.
Apart from the market, TFPM consist on site of

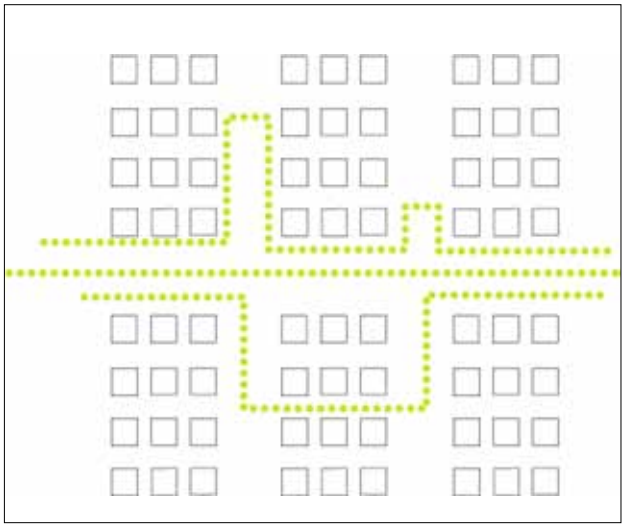
- fresh produce wholesalers;
- packaging wholesalers;
- processing businesses;
- the Housewives' Market;
- an egg depot;
- a soft drink wholesaler;
- a meat retailer;
- flower wholesalers;
- restaurants; and
- a bank/autobank.

Initiatives:
Spoilt produce are processed to compost and worked into Tshwane's municipal gardens.
An educational facility provides for the upliftment of street vendors, small enterprise owners and entrepreneurs by providing training in the following aspects:

-informal trade
-entrepreneurial skills
-products and organic food production
-financial management
-safety, hygiene and store management

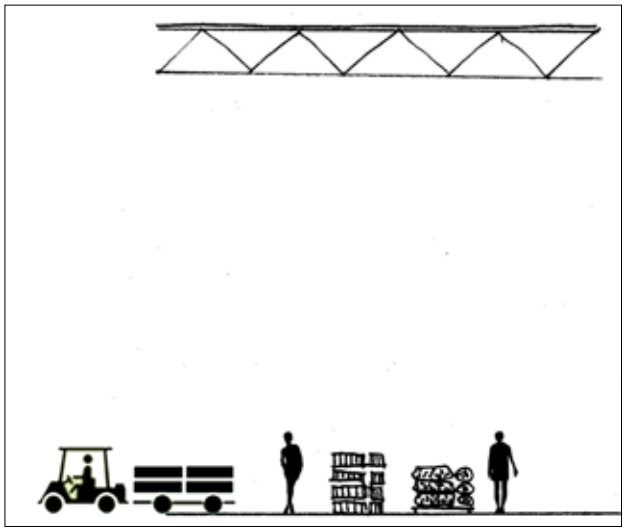
(Wannenburg, 2011)

CITY OF TSHWANE
"we are the same"



>>47: Movement

>>48: Footprint of market building in context



>>49: Diagrammatical proportions.

>>50: Aerial view.

>>51: Images taken at Tshwane Fresh Produce Market.

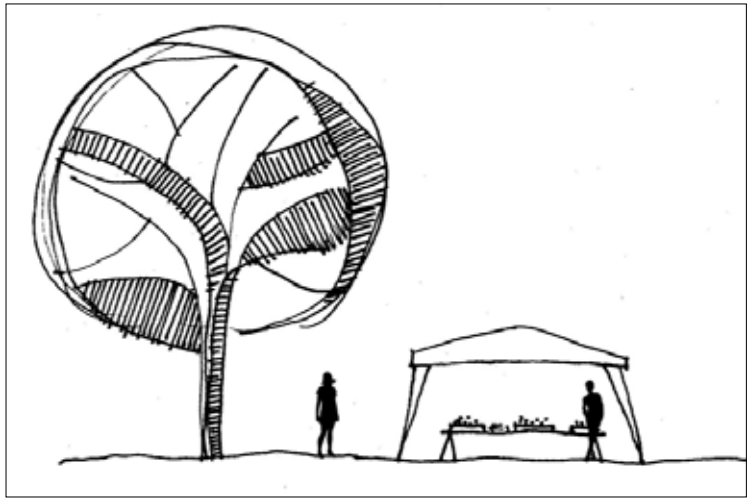
Hazel Food Market

Greenlyn Village Centre, Menlopark, Tshwane, South Africa

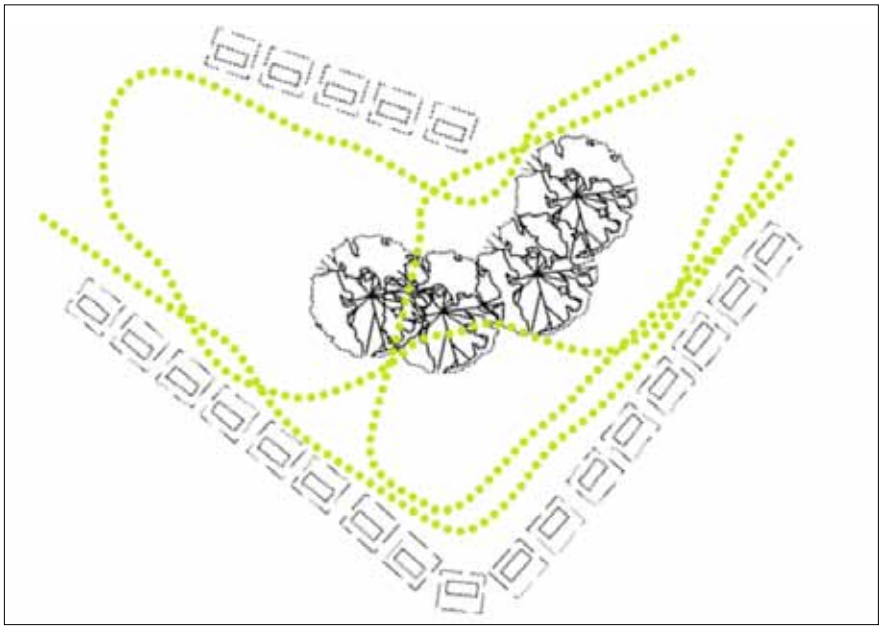
Since 2009
Gourmet market
Operating times: Saturdays 07:00 – 12:00
Area: 2 000 m²
Administered by: Retha van der Hoven

This informal market provides for large amounts of excitement under its users. It is an open air market; each seller is responsible for his own stall setup. This market hosts almost 60 stalls every Saturday. It is imperative for the producer to be present at the market and be the one selling the goods as this enhances the atmosphere and social interaction of the authentic food market. A weekly amount of R200 is charged per stall.
(Van der Hoven, 2010.)
The Hazel Food Market's producers bring a variety of tastes and flavours to Pretoria's Old East every Saturday morning. Stalls range from fresh flowers and vegetables to meat, cheese, freshly baked breads, herbs, Indian cuisine, Italian food, biltong, all types of freshly baked delicacies and coffee. Stalls are placed in such a way that movement through them are easy and results in good flow patterns. The stalls are placed on the edges of the market site, with a rest area in the middle under the trees, where people sit together at big tables, enjoying their food. Social interaction in this area creates new communities. Jumping castles and fun activities are provided for children.

>>52: Footprint of market in context.



>>53: Diagrammatical proportions.



>>54: Movement around produce display.

>>55: Collage of images taken at Hazel Food Market.

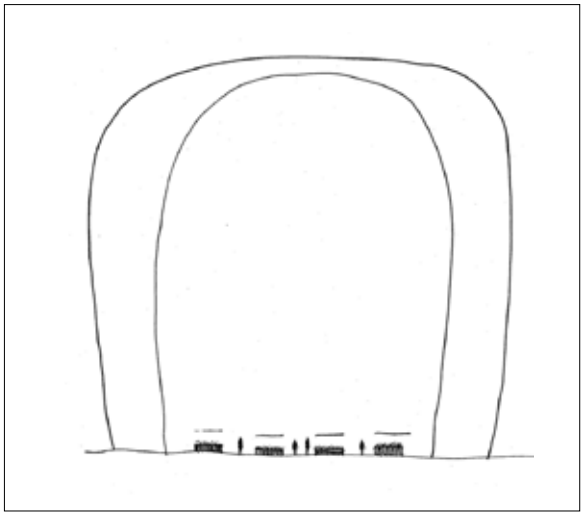
Market Hall

Laurens Quarter, Rotterdam, Netherlands

Will be opened in 2014
Food market
Area: 1 800 m²
By: MVRDV Architects
Administered by: Provast

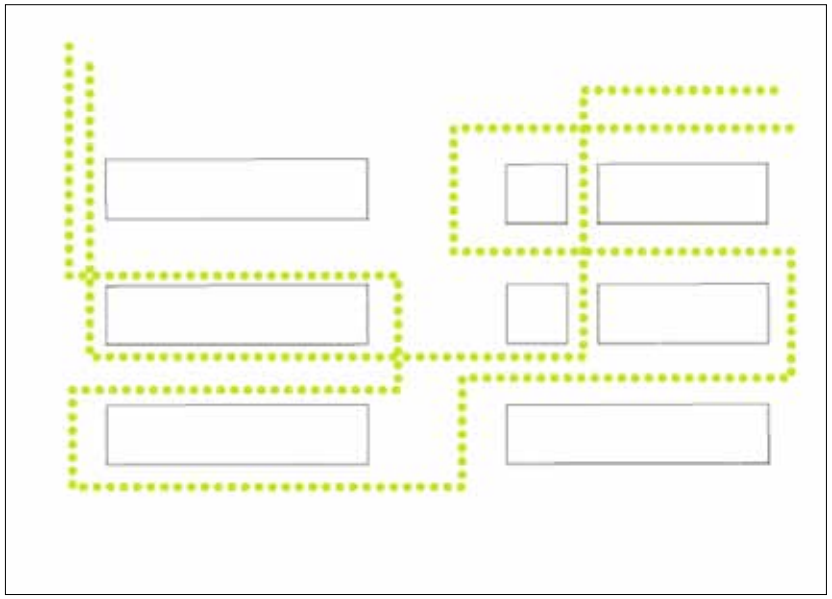
Different to the very original 'Hollandse markt' we are used to, MVRDV Architects came up with a very modern market design for the newly proposed Market Hall. In Netherland, the market plays an important role in the daily lives of inhabitants. These markets become more than only the retailing of fresh produce, but rather an event in itself.
This design provides for a covered market place, with mainly permanent produce stalls. This arched building will function most importantly as an apartment building, with the market area on ground level. The arch will be open on two ends of the building, covered with a very light glass structure. Large amounts of natural light should still enter the market, which will give it the original 'markt' feel. During the day, the hall serves as a market, but by night the area becomes the living space of the apartment inhabitants. A number of restaurants are situated on the first floor that will keep this area vibrant and alive, untill late. The development provides about 1 800 m² for market stalls, 3 000 m² for retail space and 1 600 m² as catering areas. (MVRDV: 2008)
The project will only be completed in 2014.

>>56: Footprint of market building in context.



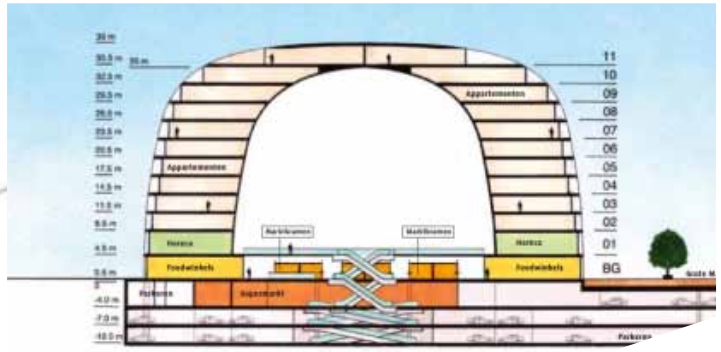
>>57: Diagrammatical proportions.

>>58: Floor plan layout.



>>59: Movement around produce display.

>>60: Artists impression.



>>61: Section.

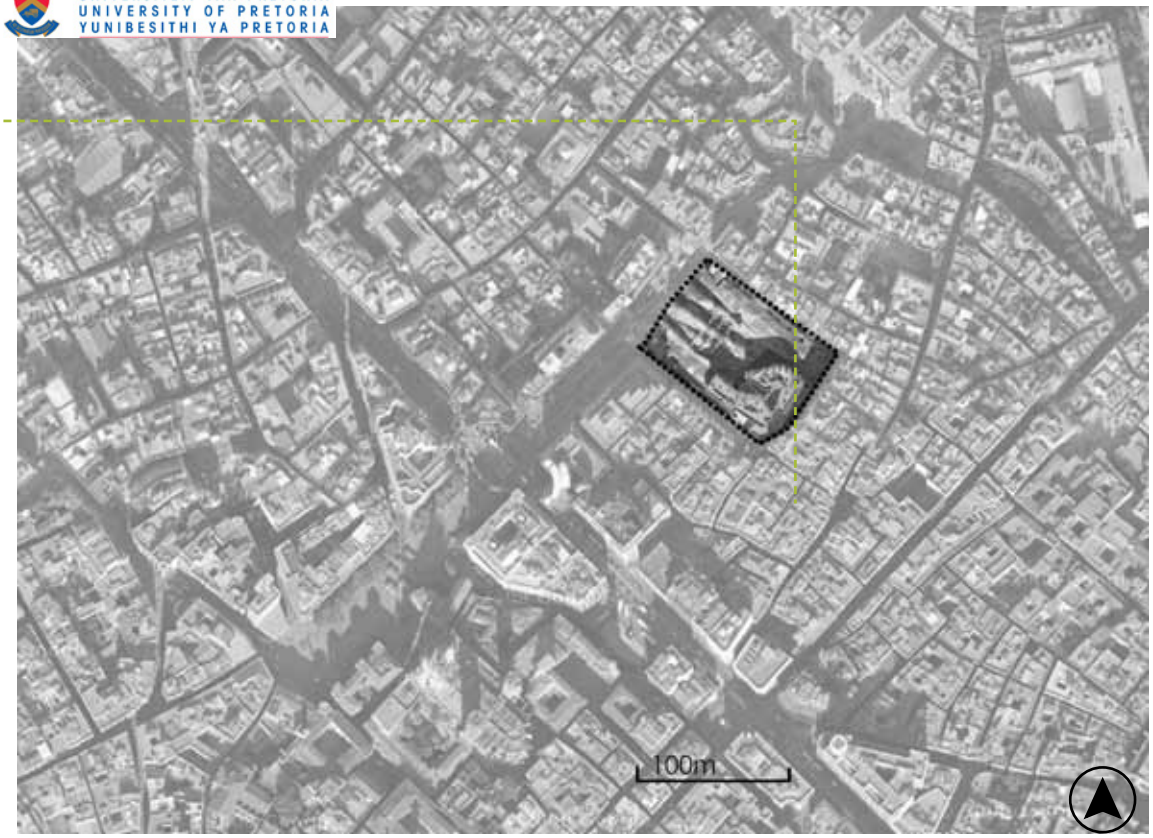
>>62: Daily market activities.

Santa Caterina Market

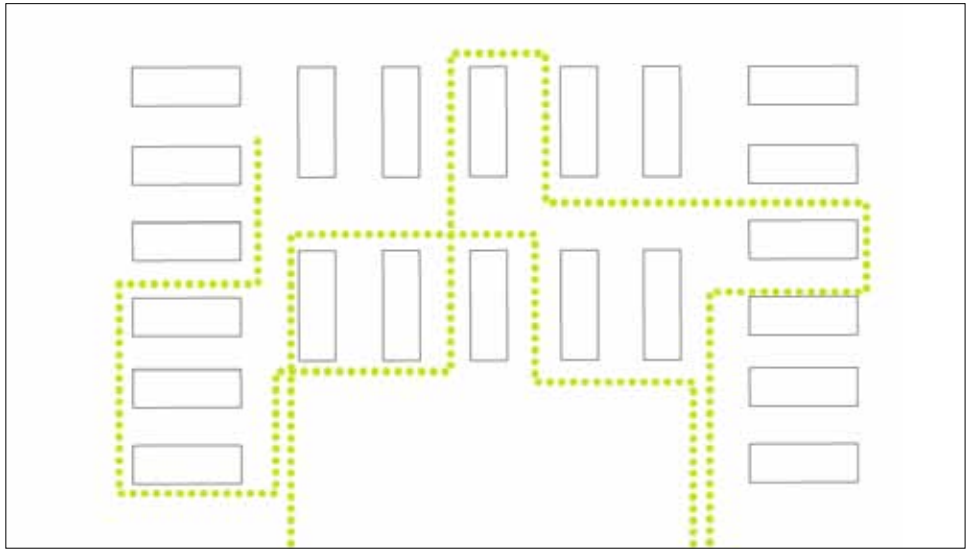
Barcelona, Spain, Europe

Since 1844, new structure 2003
Everyday food market
Area: 5 000 m²
By: Enric Miralles & Benedetta Tagliabue EMBT
Administered by: Mercats de Barcelona

The Santa Caterina Market was designed by Josep Mas Villa in 1844. The market building became run down and underutilised. EMBT studio had a new concept for the market building: incorporating the complexity of the context, the initial market, new social housing public spaces and parking. The vision was that this would regenerate the neighbourhood. The historical significance was important, while a new character was needed. The new intervention had to consider the important artery, Francesc Cambo Street, and the public interface.
A new theatrical roof is covered by a colourful display of 325 000 ceramic tiles, that rests on a steel and timber frame. Long column spans allows for changing stall configurations. The market provides for about 100 stalls and 250 car parks. Below ground is an organic waste depository that supplies compost to the surrounding neighbourhood and municipal gardens.
This market is a catalyst for this area and a signal for the freshness and vitality that is housed under the colourful roof. A place is created where visitors are encouraged to love and nurture a way of life, as well as good, healthy food. (Glancey: 2005)



>>63: Footprint of building in context.

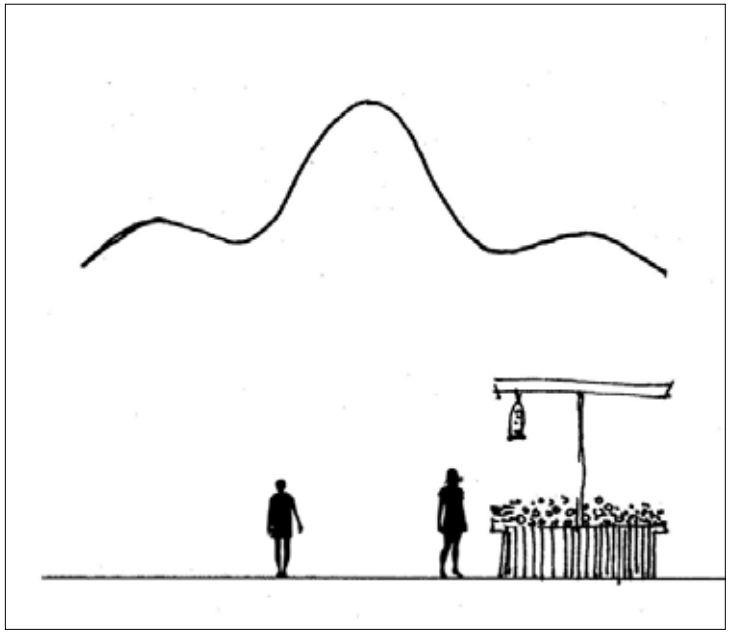


>>64: Movement around produce display.

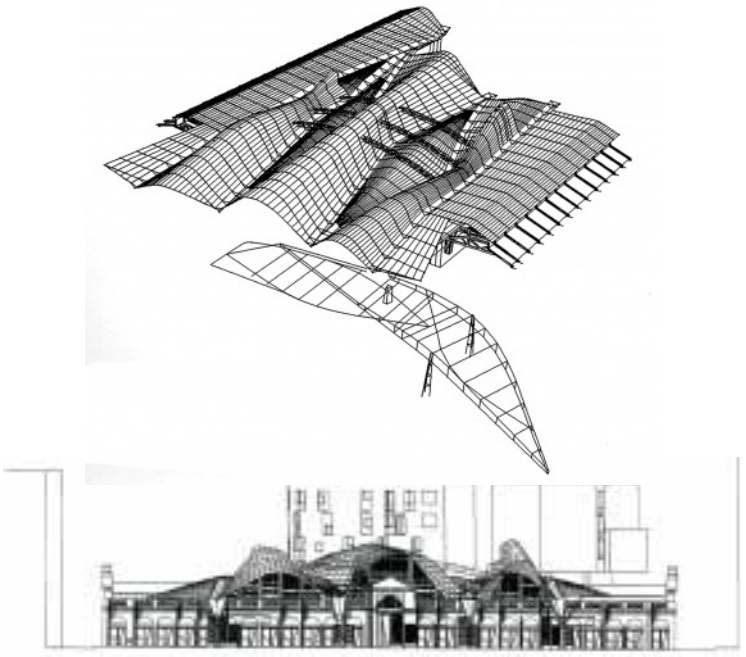
>>65: Unique roof covering.

>>66: Aerial view.

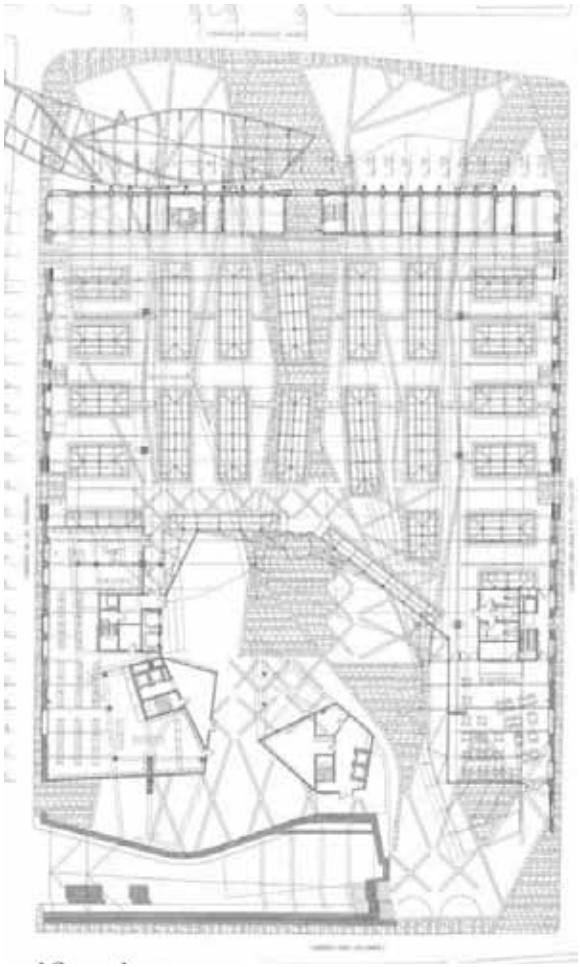
>>67: Street view.



>>68: Diagrammatical proportions.

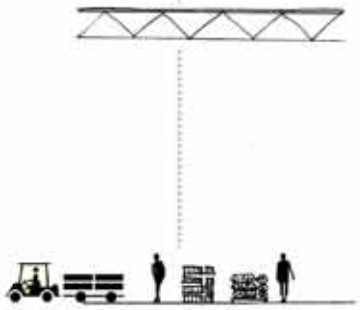


>>69: Architects drawings.

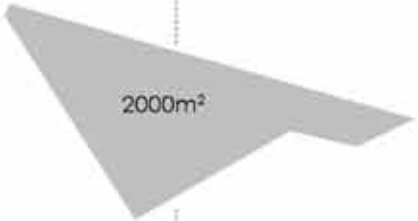


>>70: Floor plan.

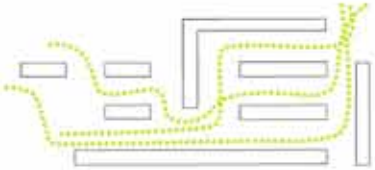
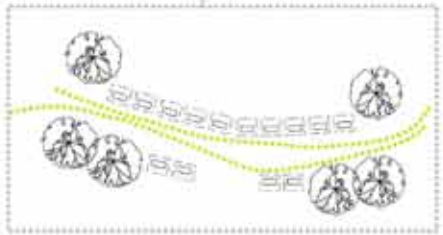
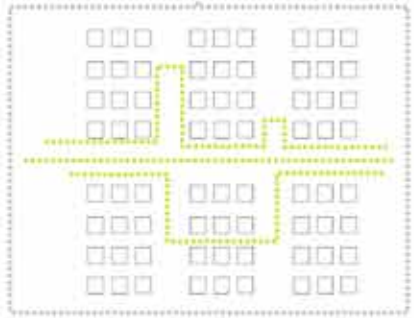
LOCAL MARKETS

Food Lover's Market	Boeremark	Tshwane Fresh Produce Market	Hazel Food Market
			

OVERHEAD STRUCTURE

Food Lover's Market	Boeremark	Tshwane Fresh Produce Market	Hazel Food Market
			

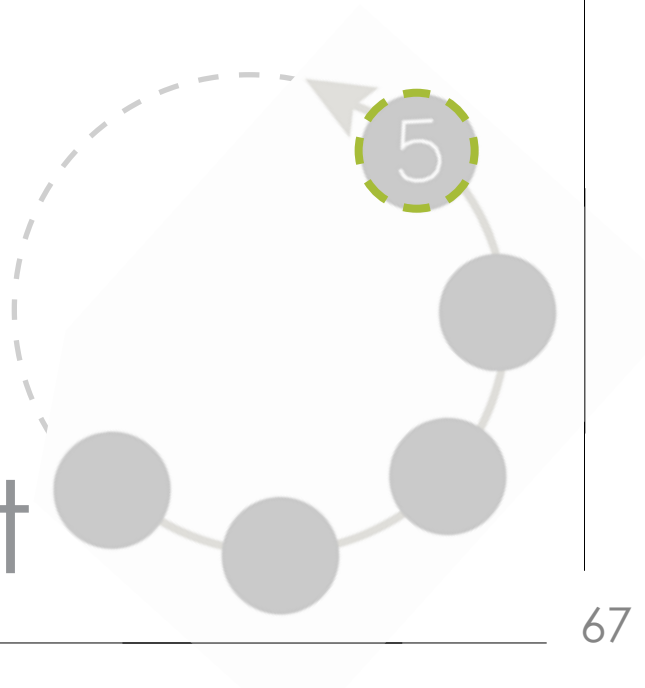
AREA

Food Lover's Market	Boeremark	Tshwane Fresh Produce Market	Hazel Food Market
			

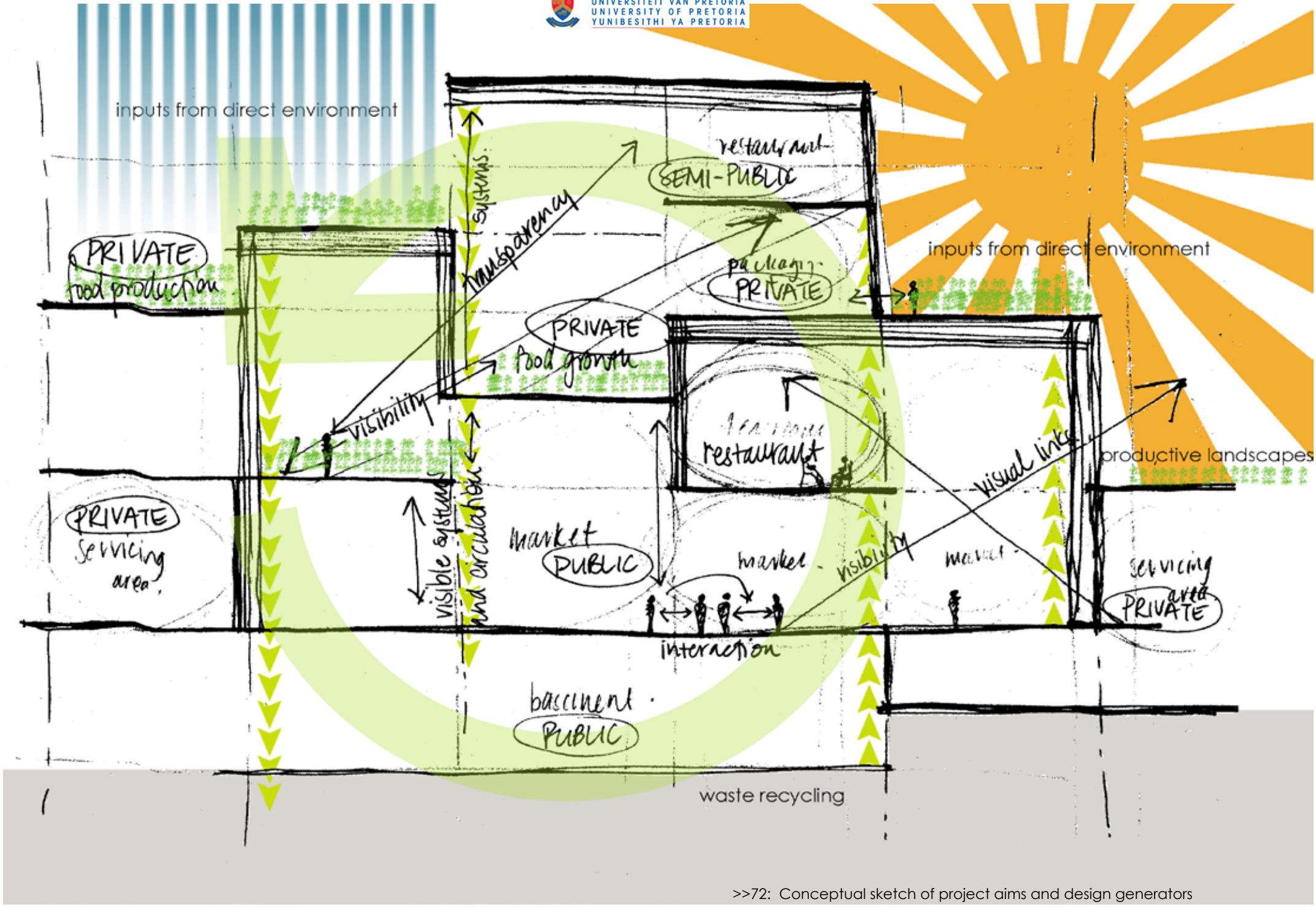
FLOW THROUGH STALLS

>>71: Comparison of precedent studios with market intervention

In this chapter, a final design proposal and the development thereof is discussed, to support design decisions. Spatial and floorplan development are informed by structural design decisions. The structure of this building is the design focus, because of the systemic nature of the project. Building transparency and honesty creates an easily accessible and understandable market. This chapter prepares for the final design as shown in Chapter 7.



Design Development



>>72: Conceptual sketch of project aims and design generators

5.1. Project Description - A Summary of The Project Aims and Design Proposal

This market platform and park will be an outdoor meeting place and transitional space for commuters, business people and people from every walk of life. Healthier living should be promoted by better food options than the everyday supermarket. The market park creates a 24-hour node, that is also an alternative to the supermarket.

The proposed project will offer a fresh food market that feeds off the hydroponics and urban agriculture in the building and study area, as discussed in Chapter 4. By means of passive surveillance, this will be a precinct with safe outdoor spaces and activity areas.
Fruits and vegetables will be processed and packed within the market building. Added to the freshly grown produce, a bakery, butchery, deli and dairy section complete this as a fresh food stop.

For street vendors and small business owners, an educational facility with classrooms is provided, to be taught on informal trade, entrepreneur skills, hygiene, financial management etc. This initiative will help spread healthier living to more areas in the City of Tshwane.

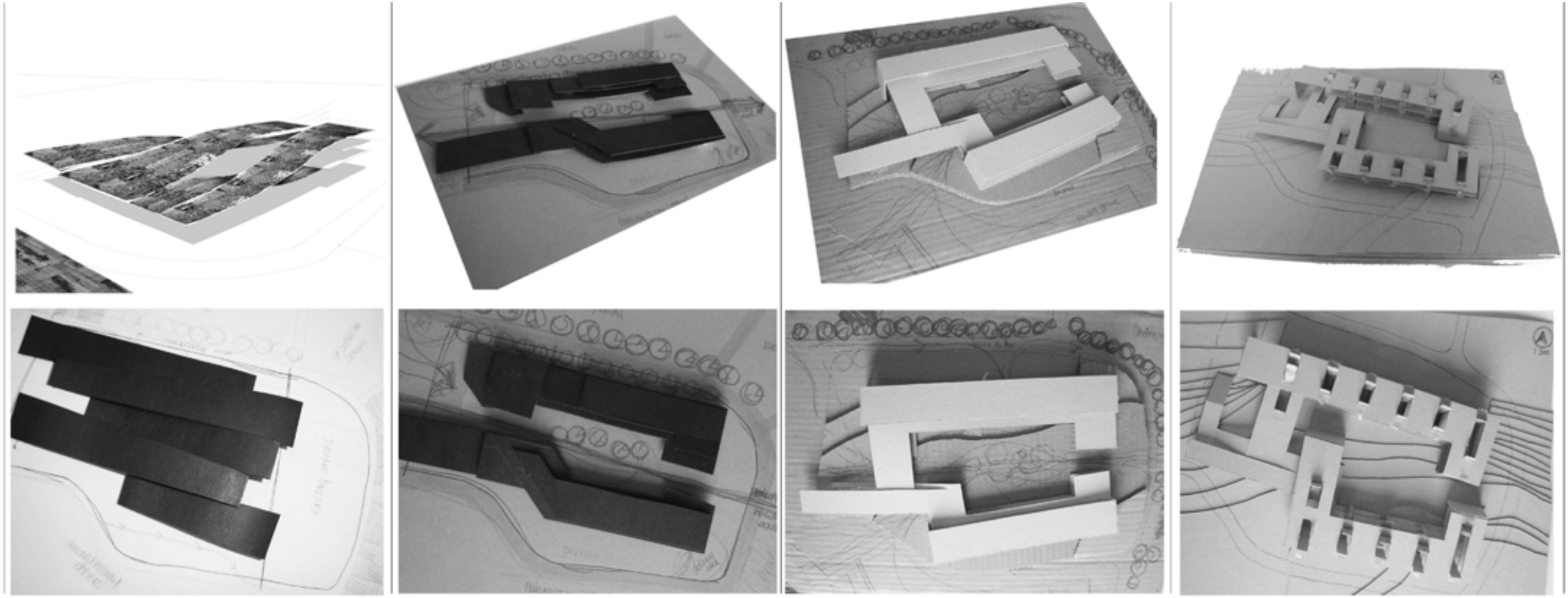
In the park/courtyard area, ample space and trees create the opportunity for informal market activities. For example the Hazel Food Market can now be held here on Saturdays.

The market and open spaces will be a platform for new relationships to be formed between all people, irrelevant of age, race and income group. A sense of community and ownership will be cultivated. Jobs will be created through the keeping of productive landscapes. This will be an opportunity for all to become entrepreneurs. The market should replace the artificial, impersonal, unsociable supermarket outings with natural, sociable, personal experiences.

Within the market building: although the market, restaurants and hydroponics will not all be situated on one floor, and should be separated mainly for factors like humidity, a visual link between different functional spaces is very important. This will showcase how this building works as an ecosystem: creating and using waste, generating and using energy, collecting and distributing water, producing, using and selling food.
Visibility of systems and circulation within this building is an important design generator.

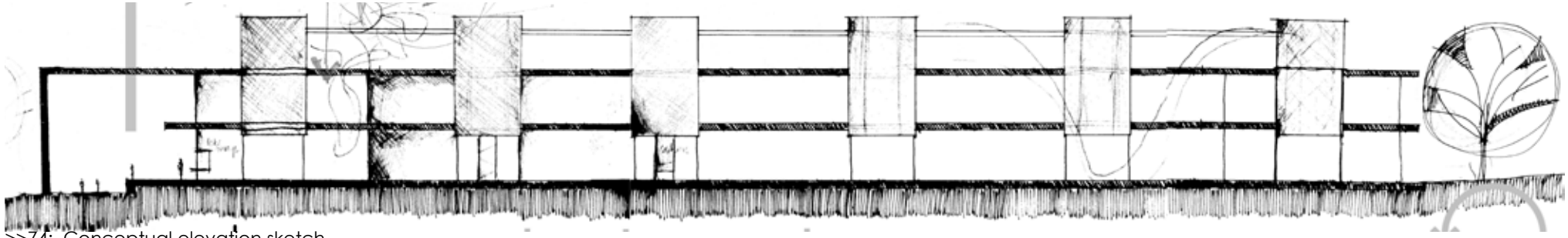
5.2. Development of Building Form

Spaitial and form development through working models.



March-April | May | June | July

>>73: Conceptual model development.



>>74: Conceptual elevation sketch.

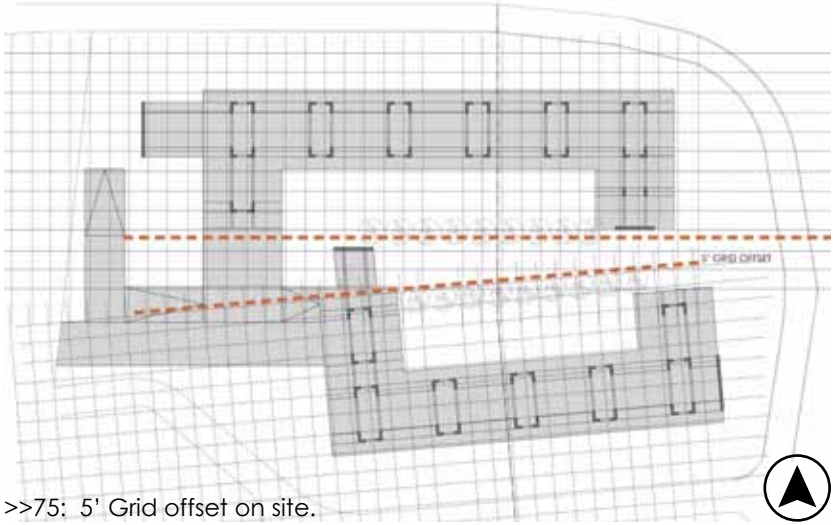
5.3. Form Development Around Courtyard

People living and working in the urban environment, especially in the Menlyn area, are confronted with introverted living, as discussed in Chapter 4. Many social and emotional issues can be excluded when the wellbeing of business people are considered, therefore the importance of a life more towards nature, even during office hours.

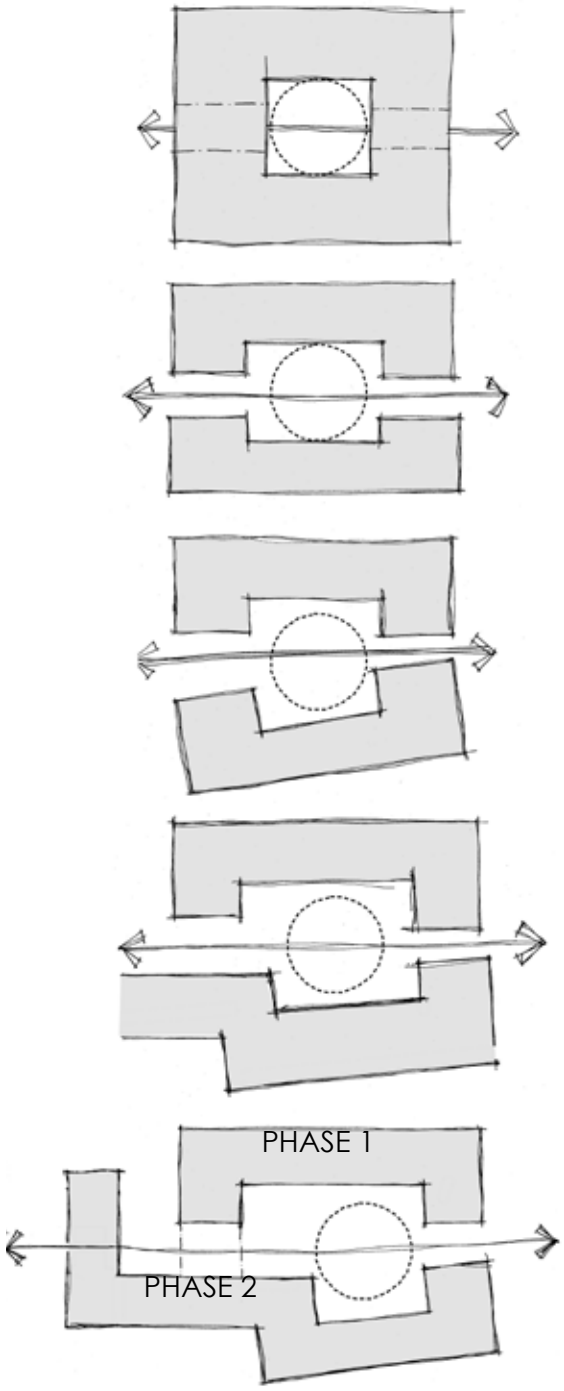
Linking smaller private courtyards with semi-private and larger public courtyards creates a network of social connectedness in the intervention precinct. A public courtyard was the design generator of building form for the market.

The market building will be phased, therefor the northern part forms phase 1. Growth in this precinct will encourage the erection of phase 2.

The next important area on site is where the grid is set off with 5 degrees. This meeting point of the grids is emphasised with trees and building offset as seen on the site plan. The building creates a courtyard space which becomes a public space/park.

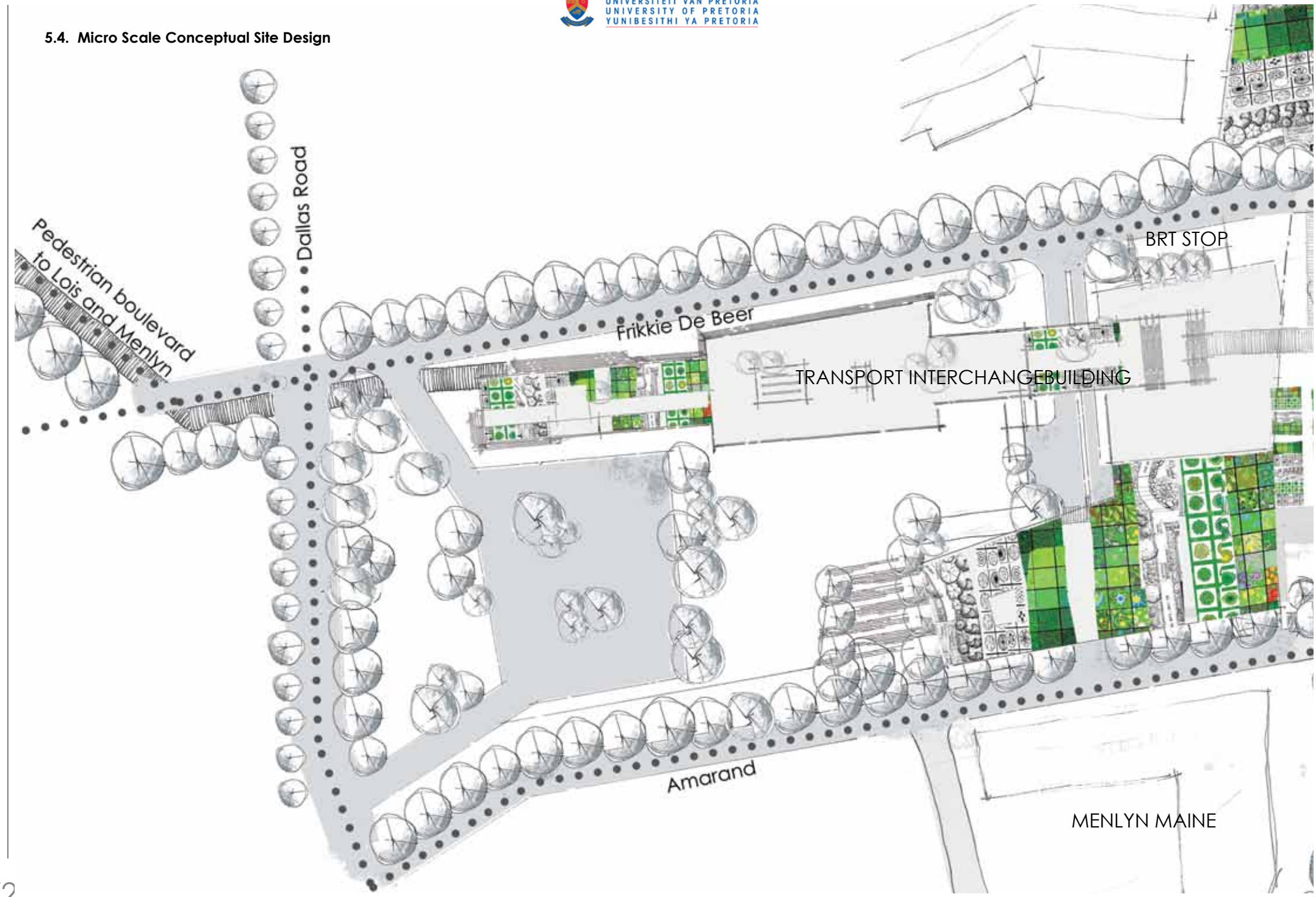


>>75: 5' Grid offset on site.

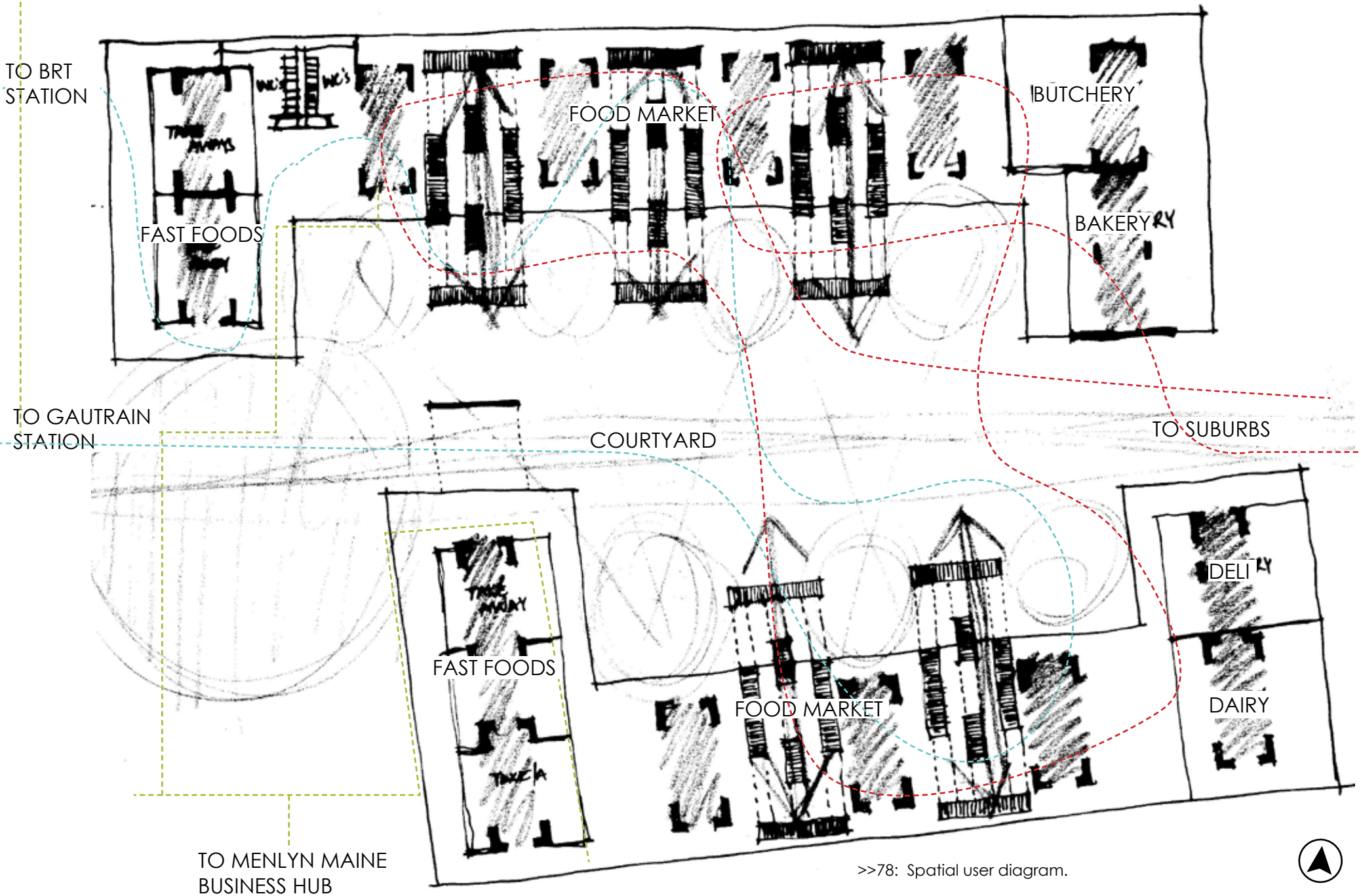


>>76: Form development diagrams.

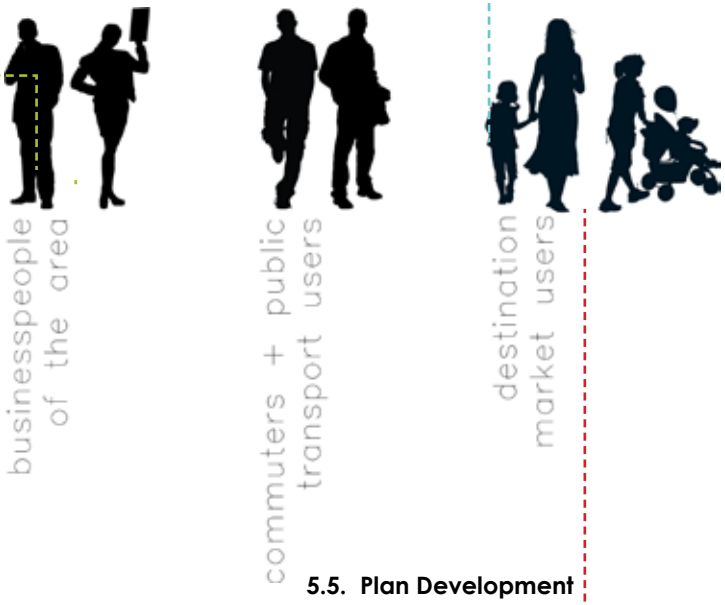
5.4. Micro Scale Conceptual Site Design



>>77: Conceptual site development plan.



>>78: Spatial user diagram.



5.5. Plan Development

To the WESTERN part of the groundfloor, you will find all the take aways and the quick help food zone for the business people from the area, and most importantly the commuters and users of the transport node and taxi rank.
To the EASTERN part of the market close to the parking area, the butchery, bakery, deli and dairy are placed for easy access for those to whom this is a destination, who does daily shopping at the market.
In the CENTRAL part is the market area. By day the market becomes part of the park by being moved outside on a track system, and by night the groundfloor can be locked up. These market stalls creates smaller courtyards within the market, for more intimate gathering spaces. These smaller courtyards are linked to the bigger courtyard and also public courtyards within the precinct.

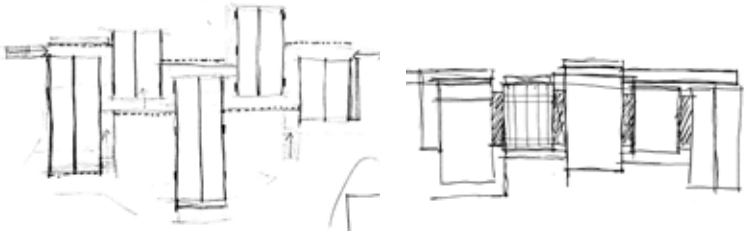
BASEMENT FLOOR - The contours perfectly lends itself to be carved away, creating a basement floor, that is directly accessible and open from the street. This floor houses delivery space, parking, coolrooms, storerooms and recycling depot.
FIRST FLOOR - This floor has less pedestrian traffic and houses restaurants, an educational facility for street vendors, packaging and food processing rooms.
ROOFTOP - Productive roofscape – the top floor is a vegetated area where fruit and vegetables are grown in monitored areas by using hydroponic systems.

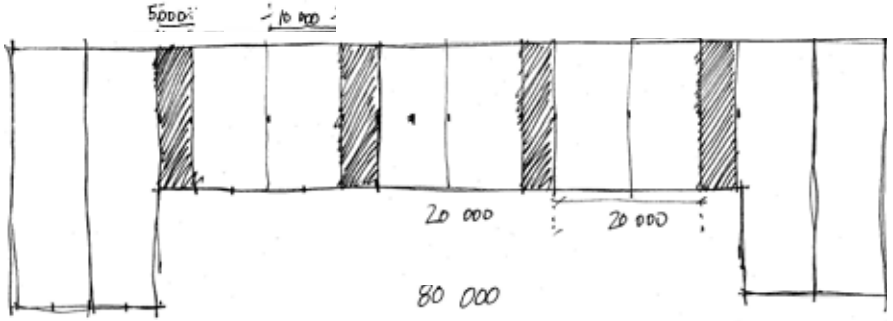
5.6. Phase 1 Form and Floorplan Development

As this market building should work like an organism in producing and using waste and fresh products, an ecosystem, it is very important for the systems to be visible to the general public and building users. Therefore a steel and glass service core box was designed and placed at 20 m intervals. These 5 x 18 m glass boxes house the following functions:

-circulation and movement (stairs and lifts)
-service ducts (hydroponic water circulation, vertical electrical ducts, waste pipes, water circulation)
-ventilation chimneys
-produce service lifts

On the market floor, the service core boxes create a division between different produce sections, although it does not create a barrier, as open and continuous flow on the market floor is very important.
On hydroponic and restaurant floors, the service core boxes become barriers for humidity and access control between public and growth areas, although not a visual barrier.
Between the service core boxes, portal frames are distributed on 10 m intervals, discussed in the detail in section 6.6.





>>79: Floor plan conceptual development.

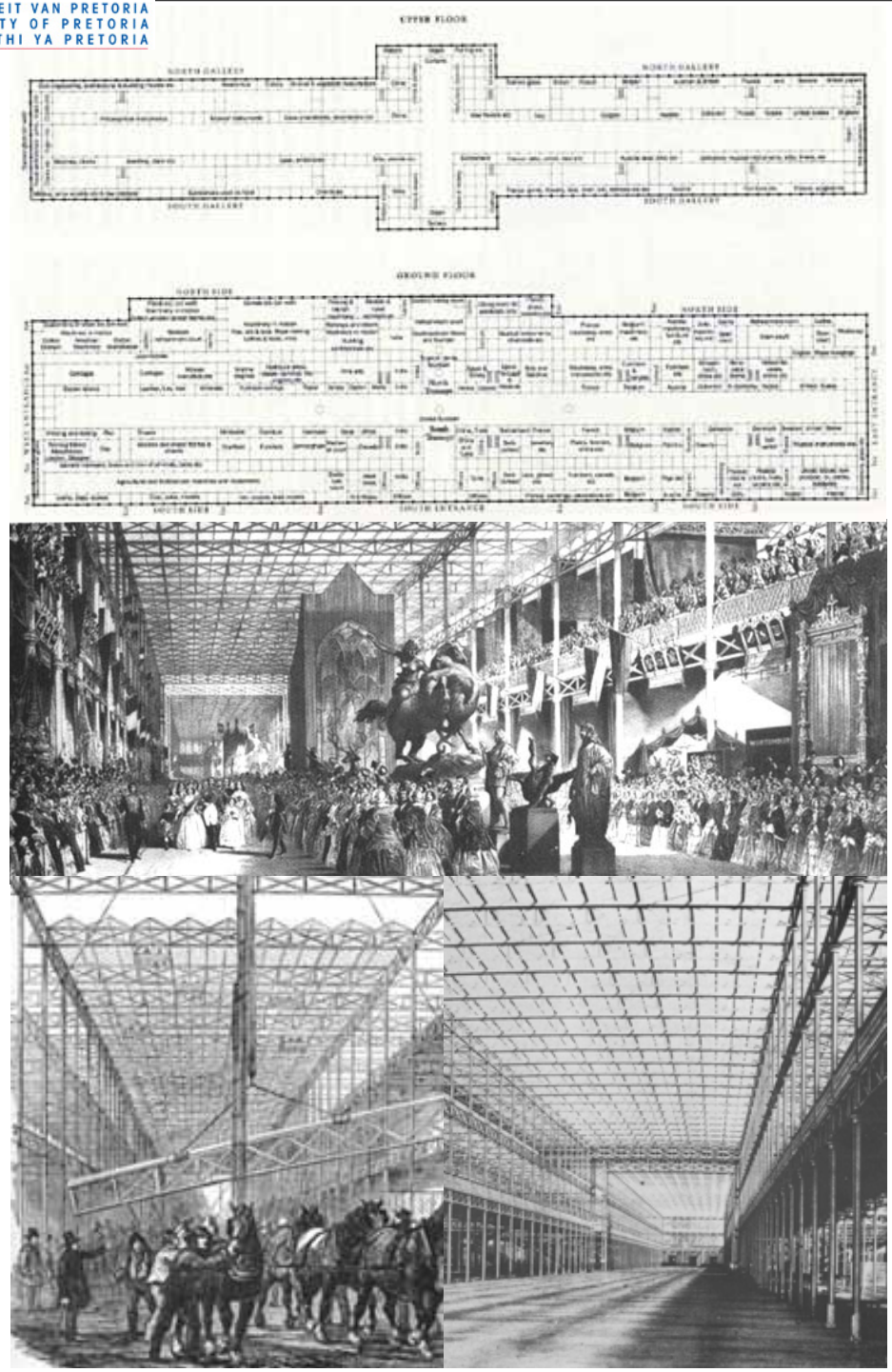
5.7. Structural and Spatial Precedent Study

An appropriate building to use as a precedent study regarding structure and spatial qualities, is the **Crystal Palace**, in essence a large greenhouse and exhibition area. I find this example suitable, because a market could be seen as an exhibition of food products, as display is an important aspect of retail.

The Crystal Palace was a cast-iron and glass building originally erected in Hyde Park, London, England, to house the Great Exhibition of 1851. The Crystal Palace's creator, Joseph Paxton, had experimented with glass and iron in the creation of large greenhouses, and had seen something of their strength and durability, knowledge that he applied to the plans for the Great Exhibition building.
The final dimensions were 563 m long by 139 m wide. The building was 41 m high, with 72 000 m^2 on the ground floor alone. The large expanse of overhead glass that serves as the enclosure and lighting systems and gives the building its nickname allowed excessive amounts of light and heat into the exhibition spaces (Rourk, W: 2001)

- It was large enough to accommodate tens of thousands of exhibitors and visitors.
- It fostered the orderly display of exhibits.
- It could be manufactured and assembled in a timely manner.
- It clearly demonstrated the nation's industrial and manufacturing competence.
- Lastly, the Crystal Palace was a departure from the past and a vision of the future.

Ventilation: The Crystal Palace's large expanses of glass turned sunlight into heat necessitating an extensive system of louvres for cooling and ventilation. The louvres are located in the top 1 m of the wall panels on each floor and the bottom 1,5 m of the wall panels on the ground floor.



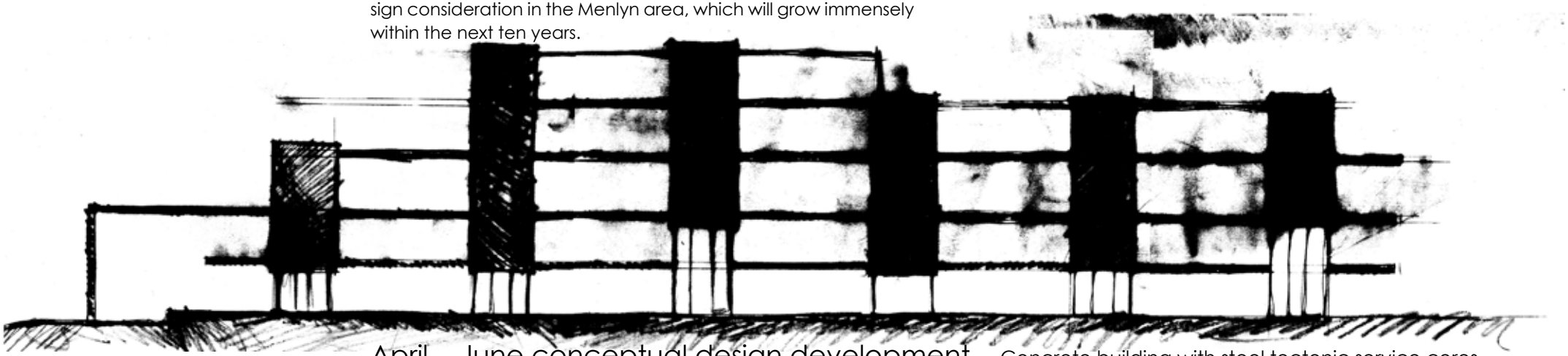
>>80: The Crystal Palace Floor Plan and structural design.

5.8. Structural Development

When the design started developing from a conceptual idea into a building, it seemed as if a concrete structure should be the best solution to the design problems. In the process of designing this structure, I realised that the concrete structure was very heavy and dark, opposite to the light and open feel the market should have. Experimenting with steel became much more festive and seemed to be a better choice for the structure of this market.

Designing with steel offers the opportunity for architectural expression, as well as structural versatility and adaptability.
Designing a steel structure for this market building was decided on after a few advantages was evident. At first, the modular nature of its parts, that is adaptable to growth, an important design consideration in the Menlyn area, which will grow immensely within the next ten years.

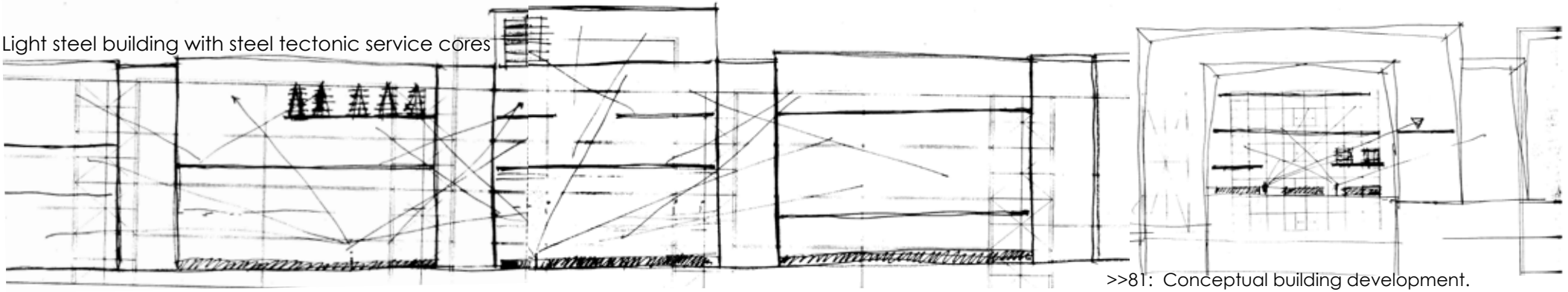
The second most important design need was to have open market floors without too many columns blocking the way. Steel has a very large span capability, which makes it a highly advantageous material. The reuse of elements or components by unbolting provides for adaptability in the future, when next phases of the market building will be erected.



April - June conceptual design development

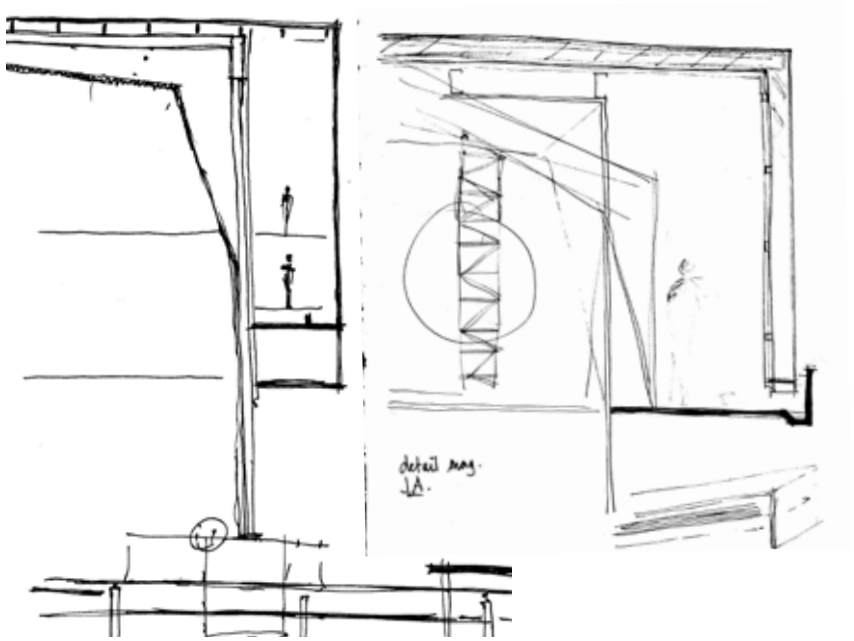
Concrete building with steel tectonic service cores

Light steel building with steel tectonic service cores



>>81: Conceptual building development.

The architectural function of steel is that of slenderness and lightness, which became important in the design process of this building. A building that has a light and festive feel to it was required to house a successful market. Architecturally, steel has many advantages. The lightness was accentuated by openings in steel portal frames, and using slender tubular sections as tension members. Expressively designed steel connections brings the complete design together to a refined whole. By exposing the structure of this building, the idea of transparency and honesty is achieved. The repetition of structural elements, e.g. portal frames, creates a rhythm and harmony throughout the building. Diagonal bracing is used for structural stability between the portal frames, but also for visual expression of the structure.
Portal frame structures were first developed in the 1960's and have now become very common in structural spans of 20 – 60 m. (Trebilcock, 2004:31) Portal frames are generally fabricated from hot-rolled steel sections and normally braced in the orthogonal direction. In their general application, portal frames provide little opportunity for expression, but with detail design, these elements can become something beautiful and enlightened. In the market building, a tapered portal frame is used, with tubular steel lattices as tension members. In its common application, the portal frame structure doesn't support multi-storey buildings, but rather large barns and storage buildings. For this building design the best option was to implement suspended floors, hung from the portal frame itself. A few options were explored in terms of the structural and material choices that should be made, including a steel grid structure or steel trusses as flooring supports. These options were both space limiting and thus inappropriate. Lightweight concrete floors were the best choice, because of its thin floor depth.



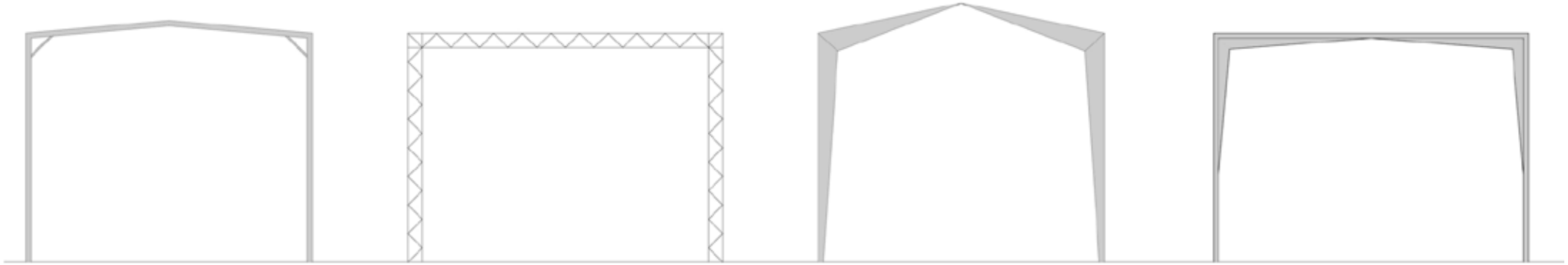
>>82: Structural development

Suspended lightweight concrete floors

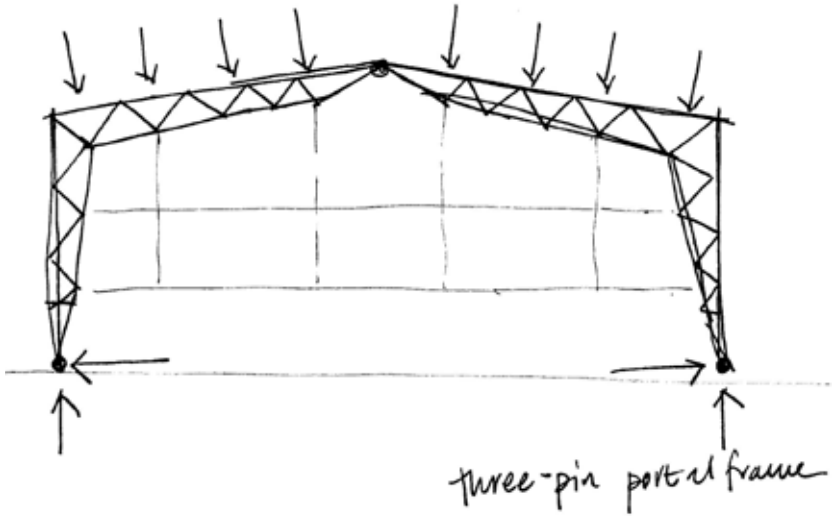
There is quite a few lightweight concrete flooring slab systems that could be used in this design, of which the best was SVF flat slab system. These floor slabs will be suspended from the portal frame with 25 mm diameter galvanised steel cables, fixed to the concrete slabs with a conic anchor. Large span concrete flat-slab systems with internal spherical void formers (SVF) can be successfully designed in accordance with SANS 10100-1 (SABS 2000).

Suspended floors ensure that this market can grow with the precinct by adding floors, or moving the portal frames upwards by adding to the height of basement concrete columns.

"PORTAL: A structural framework consisting of c[illegible] by two columns to which it is connected with sufficient rigidity to hold unchanged the original angles between the intersecting members".



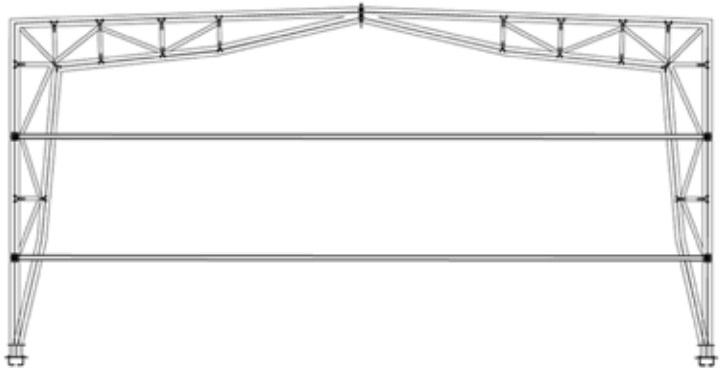
>>83: Portal frame typologies.



Three-pin portal frames:

The three-pin portal frame is incomparably the most common type. It is stable against horizontal forces in its own plane and statically determinate, which means that the moment distribution is not affected by uneven subsidence of the foundations or by unforeseen deformations in joints and connections. Further, the three-pin frame is hinged into the foundations, which simplifies their basic construction. In poor soil conditions the horizontal reactions at the supports can be taken up by tension members between the foundations (within or under the slab). The load on the substrate is then principally vertical.

>>84: Portal frame design development.



>>85: Final Portal frame design.

5.9. Factors of Influence in Successful Market Design

5.9.1. Location

a) **Location of Population Movement Generators**

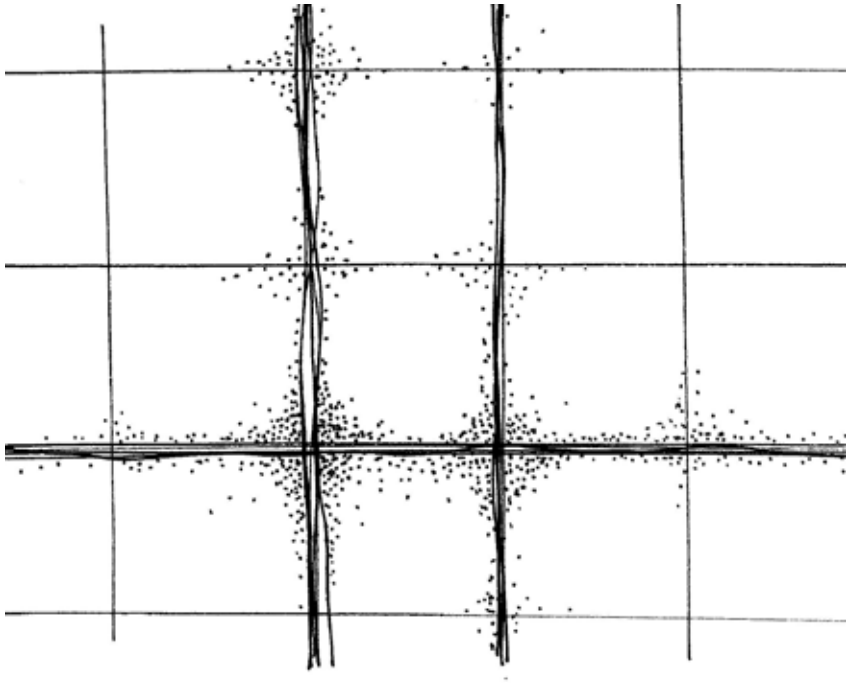
Markets are extremely sensitive to flows and concentrations of pedestrians and traffic – the most successful locations are therefore in close proximity to larger generators of population movement. (Dewar, 1990: 23) The proposed new market building will be located next to the new Menlyn intermodal transport interchange, housing the new Gautrain station. This public transport node will attract thousands of users. Another generative node of movement would be the new Menlyn Maine development, providing 44 000 m² new retail space, 143 000 m² new office space and 100 000m² new residential space within the precinct. The development team foresee an extra 20 000 people using this precinct, on a daily basis. (Bowen, 2011)

b) **Sources of Supply**

The second most important factor of determining the location of a market is the siting in relation to other sources of supply. In this instance, the market is located close to newly introduced productive landscapes, and the hydroponic component of the market building.

c) **Location of Consumers**

From a planning point of view, a third factor which should influence decisions on market location is the need to serve the city's consumers as equitably as possible. Given that the Menlyn intermodal transport interchange would house a taxi rank, Bus Rapid Transit, Tshwane Bus system and Gautrain, people of all walks of life would meet here. This site is therefore perfectly located to serve urban citizens equally.



>>86: Pedestrian concentrations

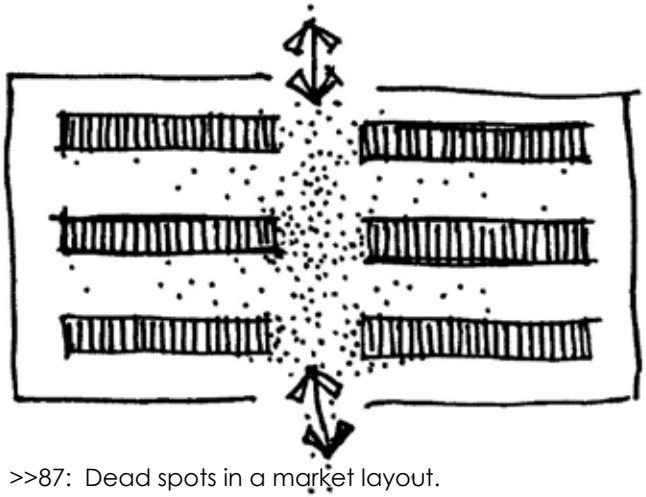
5.9.2. Market Layout

a) **Spatial Marginalisation**

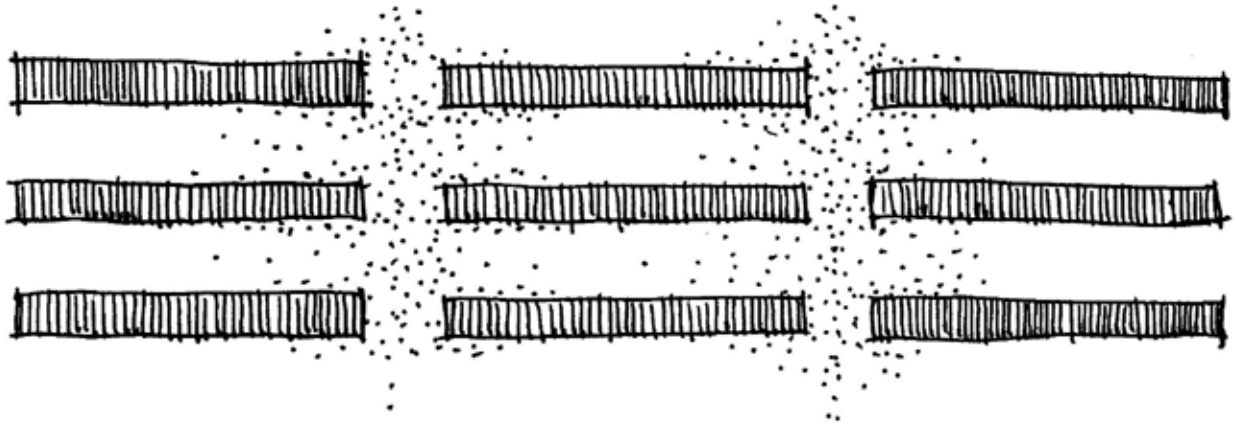
This might be the most common problem directly related to physical layout. Abandoned, unused and low profitable stalls, mainly because they are avoided by customers for some or other reason. This happens when stalls are not exposed to sufficient flows of pedestrian movement. The most optimal market place is created when intense flows are diffused across the entire trading area, and where 'edge' or 'cul-de-sac' conditions are minimised. Dead spots should be avoided in the market area. Smaller stalls or stalls that are not a destination should be placed en-route to destination areas such as fruit and vegetables or meat and dairy products. These stronger elements draw customers through the market, creating a continuous flow and 'buzz'. In shopper behaviour, it is known that people seek to reduce energy expenditure when searching for products. The most direct movement channels are the ones that draw energy in their pattern of search. (Dewar, 1990:42) Another important factor in the successful layout of a market is visibility or visual contact. The tendency to which certain parts of a market are used is strongly related to the degree to which it is visually observable from other parts of the market. Vertical separation between functions can break the flow and dynamics of the market, thus openness and visual connectedness are of utmost importance.

Dead spots are the result of the following layout conditions:

- non-contiguous or fragmented market form
- small formal shops having to compete with informal markets
- in the middle of excessively long, unbroken stall runs
- non-selling sides of stalls



>>87: Dead spots in a market layout.



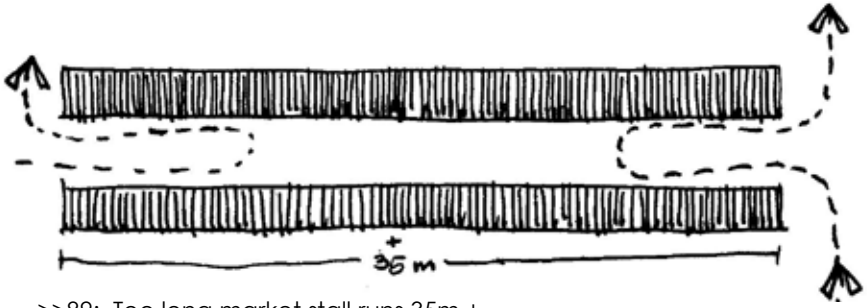
>>88: Dead spots in too long stall runs.

b) **Length of Selling Runs**

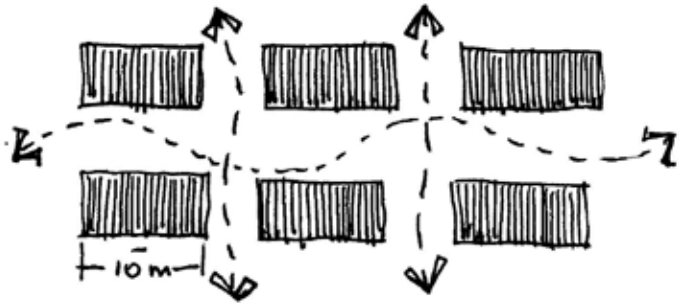
Market performance is significantly affected by the length of unbroken stall runs of adjacent sides. Unbroken runs must be long enough to facilitate comparative buying and to generate a strong sense of vibrancy and activity. When the runs are too short, activity levels are scattered, and when the runs are too long the ability of users to switch between runs are impaired, and selection gets restricted. As discussed previously, lengthy runs create dead spots to the middle. Therefore runs will be avoided. Observing market and shopper behaviour shows that an optimum run length would be between 18 m and 25 m. Stalls should never be longer than 35 m or shorter than 10 m. (Dewar, 1990:52)

c) **Width of Circulation Space**

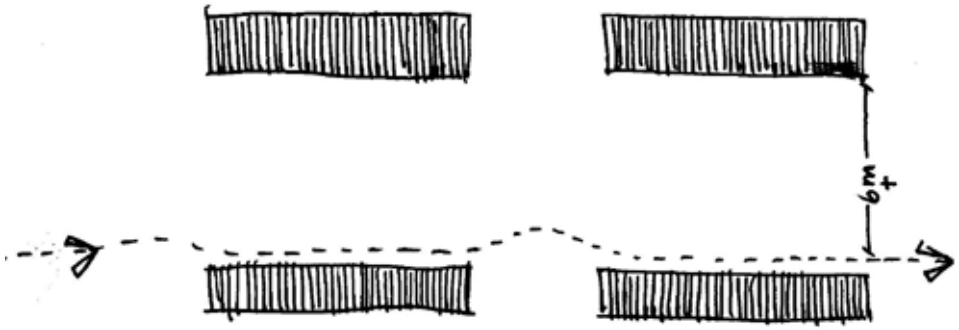
The best situation would be if shoppers could engage in both sides of the circulation channel in the process of product selection and comparison. A clue of the perfect channel width range can be derived from the layouts of informal and spontaneous markets. These conditions show that a width of 1,5 m is optimal for pedestrian movement and shopping. A design issue is how to create the possibility of expanding the volumes of spaces with changing intensities of pedestrian flow over different times of the day or week. By creating expanded circulation areas or knuckles at intersections and movement spaces, congestion can be minimised.



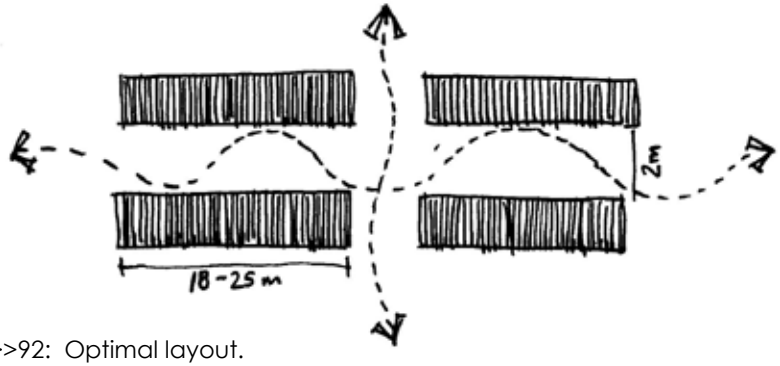
>>89: Too long market stall runs 35m +.



>>90: Too short market stall runs 10m -.



>>91: Market runs too wide apart 6m+.



>>92: Optimal layout.

5.9.3. Market Infrastructure

a) *Cleanable floor surface.*
Fresh produce easily gets trampled into the floor, therefore floors should not be very porous and easily cleaned with water.

b) *Water.*
For regular cleaning, washing of produce and drinking.

c) *Electricity.*
Preparation of food, fridges and freezers and lights.

d) *Public toilet facilities.*

e) *Shelter for informal market in park area.*
The type of shelter is affected by:
1) climate
2) urban context
3) environmental impact
4) market permanence
5) cost
In this instance large trees would be appropriate for providing shelter at the informal or spontaneous market in the landscape.

f) *Selling and display areas.*

g) *Storage.*
Storage in this market will be provided for in the basement cold store, accessed through goods lifts and staircases.

h) *Cleaning and garbage removal.*
Wet waste areas will be allocated close to heavy vehicle delivery and collection area.

5.10. Cash System

The market will be a cash free area, for safety and planning reasons, also this will be the way forward with intelligent systems like smart cards. Congestions will be minimised at peak hours, making the shopping experience as pleasurable as possible.

Each customer buys a smart card once, and afterwards loads value via electronic transfer, debit order or cash payment at one of the three cashiers or vending machines in the market.
Each stall owner, restaurant or take away shop will have a wireless device where the card will be swiped so the payment can be made for items bought. This will be an easy and effective system.
Gautrain commuters will be able to use the Gautrain Gold card to buy at the market, as each commuter should have one to be able to travel. This is also a smart card on which you can top up value to use for train and bus rides.

Drop safes will be situated at each cashier and cash will be collected by an independent cash collection service, at least twice daily.

>>93: Smart card system.

5.11. Hydroponics

Hydroponics is a way of growing plant life without soil, only by using water and mineral nutrient solutions. Terrestrial greenery can be planted and grown with its roots in the solution of mineral nutrients or in other mediums such as mineral wool or gravel.

According to Despommier, D.(2005), the advantages of hydroponic farming include:

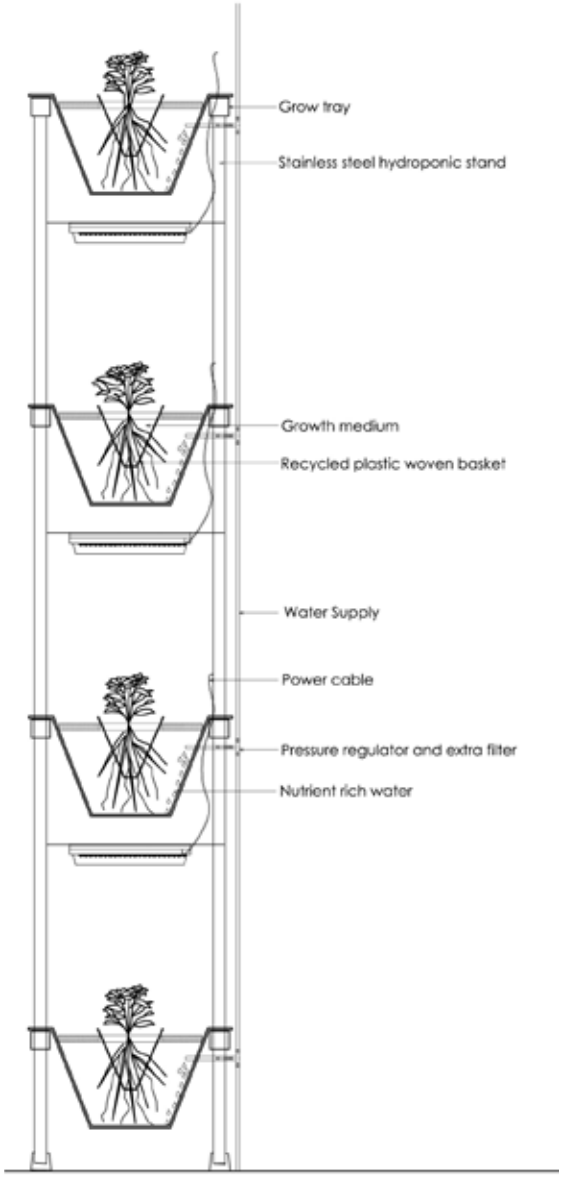
- year-round crop production
- the elimination of agricultural runoff
- significantly reduced use of fossil fuels (farm machines and transport of crops)
- the use of abandoned or unused properties
- no weather-related crop failures
- the possibility of sustainability for urban centres
- the conversion of black and gray water to drinking water
- adding energy back to the grid via methane generation
- creating new urban employment opportunities
- reducing the risk of infection from agents transmitted at the agricultural interface
- returning farmland to nature, helping to restore ecosystem functions and services
- controlling vermin by using restaurant waste for methane generation

Upon many, a decision was taken to use mainly three ways of hydroponic food production. A short discussion on each follow:

1) Nutrient film technique: This system has a continuous nutrient solution flow, which does away with timers for the submersible pump. This solution is slowly pumped into the grow tray, often or usually a tubular element, which then flows over the plant roots, whereafter the remaining water returns to the reservoir. Typically there is no growing medium, other than air, used in this system. The plant is normally supported in a little basket, and the roots dangle down into the solution.

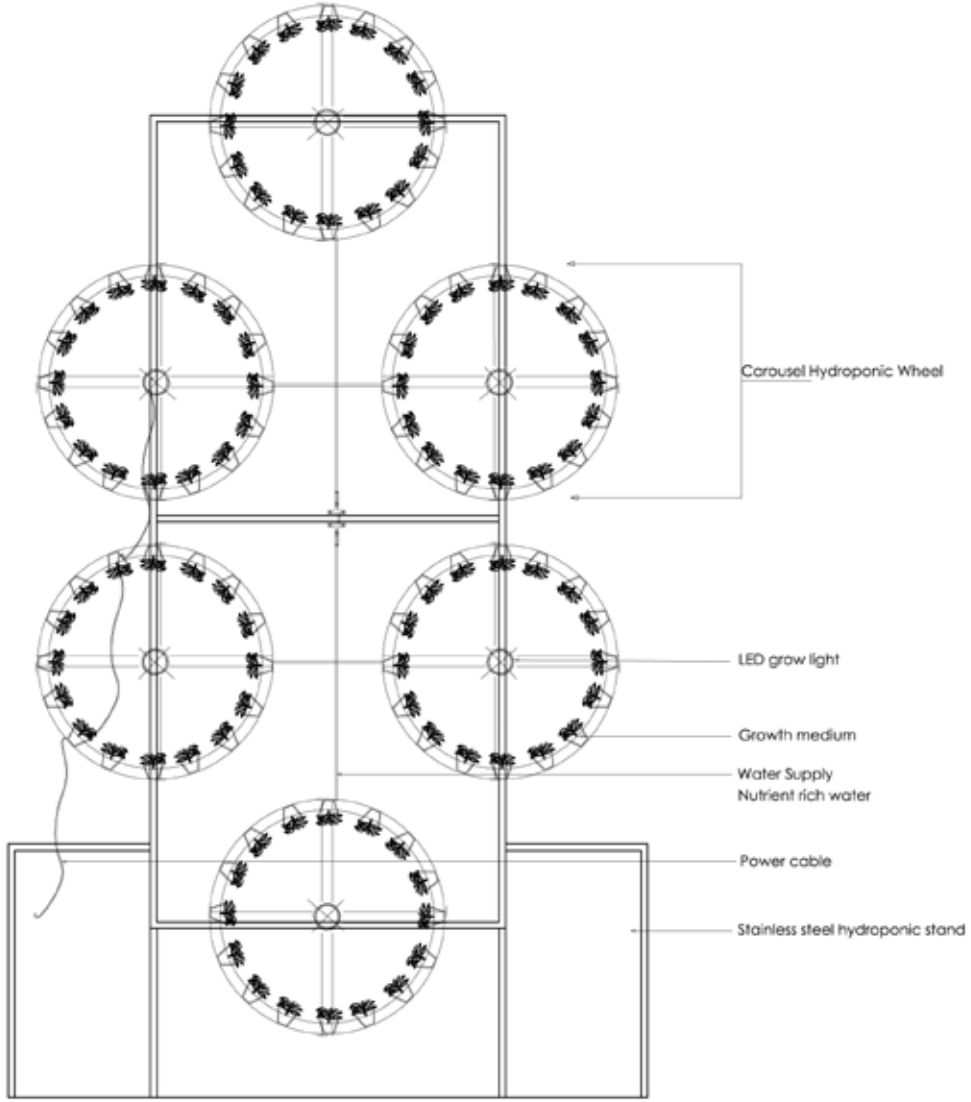
2) Omega carousel hydroponic systems: This is a system based on hydroponics that consists out of a few rotating cylinders made of stainless steel, that houses about 3 000 plants each. These cylinders rotate around LED light sources, and still get five times more food per watt than conventional farming does.

3) Aquaponics: It is the grouping of aquaculture and the above-mentioned system called hydroponics. Fish and plants are grown simultaneously in one integrated, soil free system, called aquaponics. The waste produced by the fish, provides a source of food for the greenery, and the greenery form a natural water filter for the habitat of the fish. Harmless, fresh, organic fruits and vegetables are produced by the system of aquaponics.
(Hydroponics and organics, 2010 & Simplyhydro, 2010)

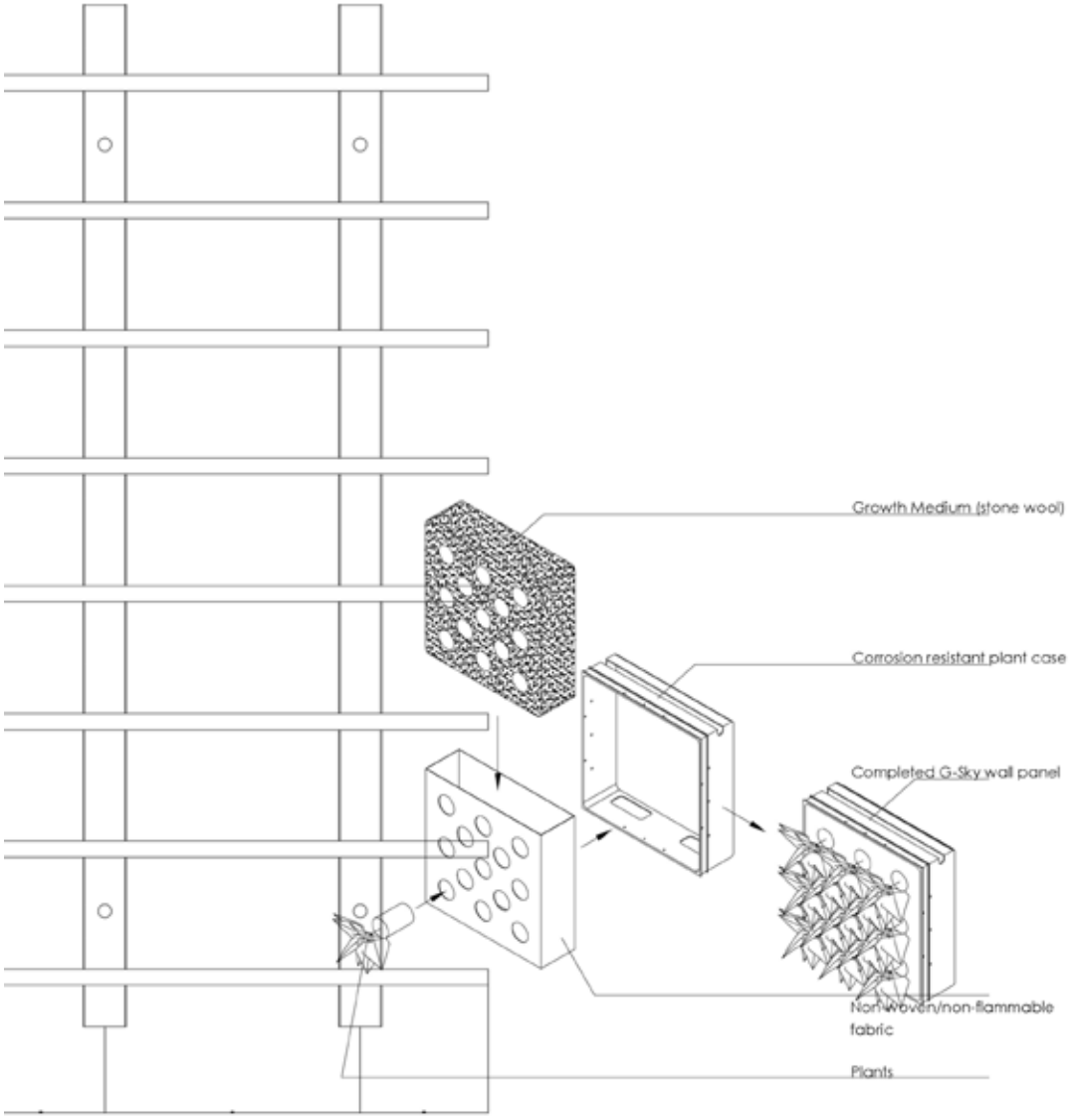


>>94: Nutrient film trays

>>97: Collage of urban farming and hydroponic typologies.



>>95: Omega carousel wheel.

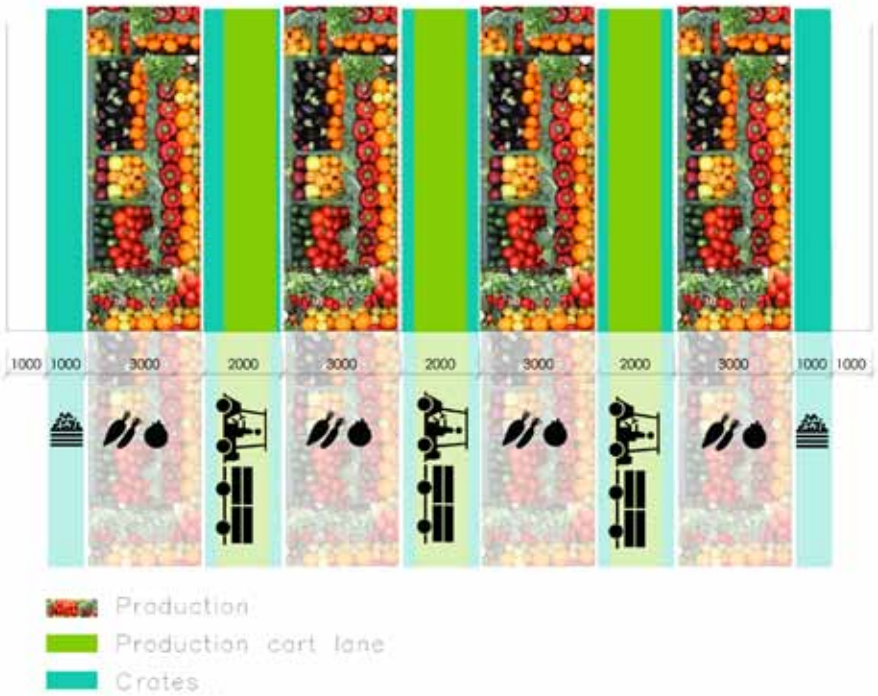


>>96: Green wall construction.

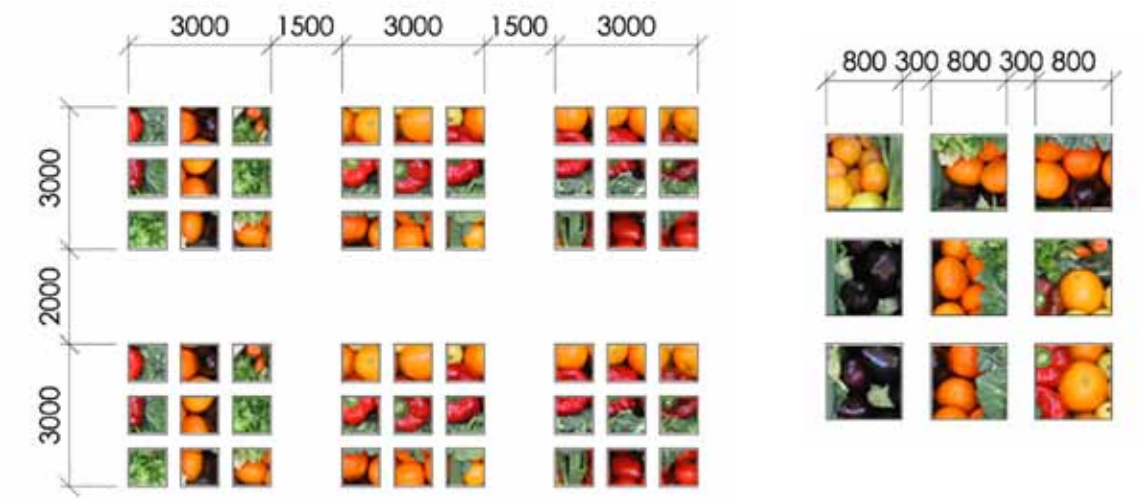
5.12. Productive Landscapes

As discussed earlier in Chapter 2, open spaces in the area will be utilised to produce fruit and vegetables. These areas will be let out as allotment gardens to individuals or institutions, and on the site itself gardening boxes will be built, that also serves as seating. The productive landscapes will be watered with rainwater that is collected from rooftops, and fertilised with compost created from market and building waste.

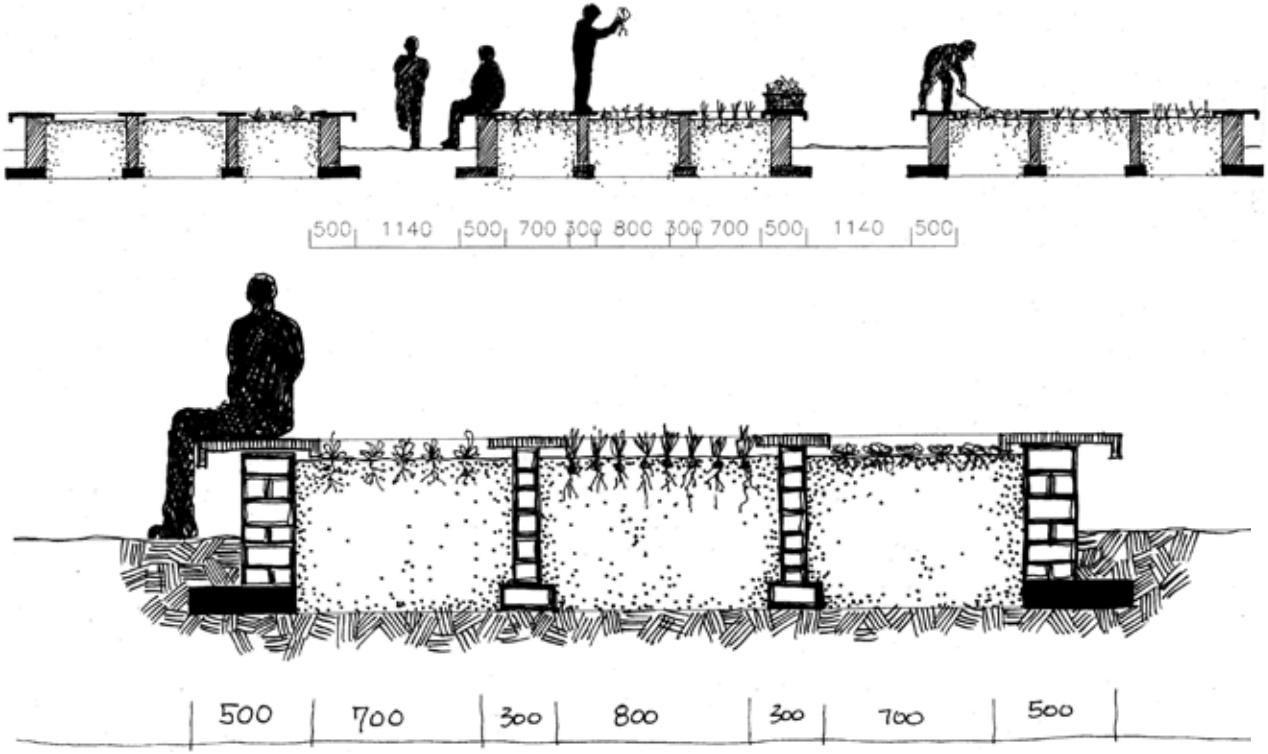
See image below for a layout plan of productive landscapes lanes and zoning. These will be the landscape layouts for the larger areas of open land, in the area and on the market site. The gardening boxes are placed closer to the building where public surveillance is possible from the market itself, to protect the produce from being stolen, as this is a reality today.



>>98: Productive landscape lane allocation



>>99: Gardening boxes layout

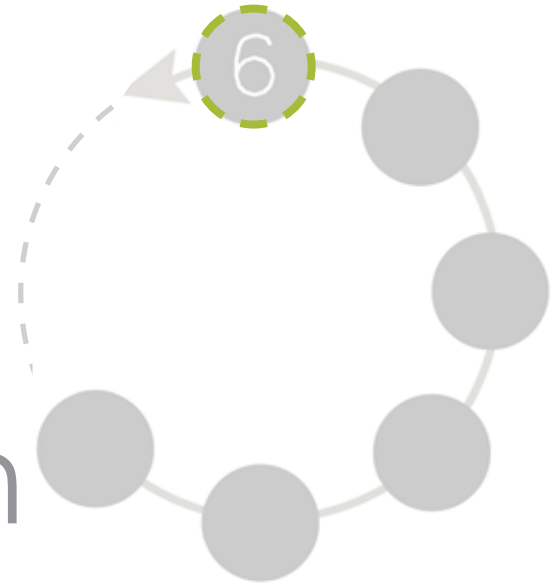


>>100: Gardening box design

Table 4: Monthly growth of produce groups

"Good detailing is a function of the spatial arrangement of the elements, their slenderness and lightness, and the connections between them." (Trebilcock, 2004:1)

In this chapter, a visual presentation of the final design and material choices will give expression to design decisions that were taken in the previous chapters.



Design

>>101: Rendered market floor plan.

- TAKE AWAYS
- BAKED GOODS + CONFECTIONARY
- READY MEALS
- SWEETS + NUTS
- FRUIT + VEGETABLES
- SALADS
- SEAFOOD + SUSHI
- DAIRY + CHEESES
- DELICATESSEN
- CUT FLOWERS + PLANTS
- BUTCHERY
- BAKERY

GROUNDFLOOR PLAN

>>102: North-eastern view of market building and aquaponic pond

>>103: South-western view from market courtyard

>>104: View of take away area and visible building systems in service cores

List of Accommodations

Groundfloor:

	Market	**1944m2**
	including circulation areas	
	West wing:	**760m2**
	Take Aways	**304m2**
	T/A1	38m2
	T/A2	40m2
	T/A3	30m2
	T/A4	53m2
	T/A5	34m2
	T/A6	36m2
	Service ducts	25m2
	Wet waste	23m2
	Storage	25m2
	East wing:	**760m2**
	Public toilets	125m2
	Butchery	135m2
	Bakery	203m2
	Service corridor	90m2

First floor:

	East Wing:	**760m2**
	Food Processing and Packaging	**409m2**
	Wet waste + storage	80m2
	Food Processing 1	92m2
	Food processing 2	75m2
	Packaging room	92m2
	Distribution area	70m2
	Central area:	**2130m2**
	Including circulation and atrium areas	
	Restaurant 1	**400m2**
	Kitchen area	65m2
	Outside seating	80m2
	Hydroponics	380m2

	West wing:	**760m2**
	Office 1	45m2
	Office2	23m2
	Kitchenette 1	6m2
	Boardroom	15m2
	Public toilets	94m2
	Educational Facility	
	Classroom 1	102m2
	Classroom 2	100m2
	Kitchenette 2	12m2
	Store room	40m2

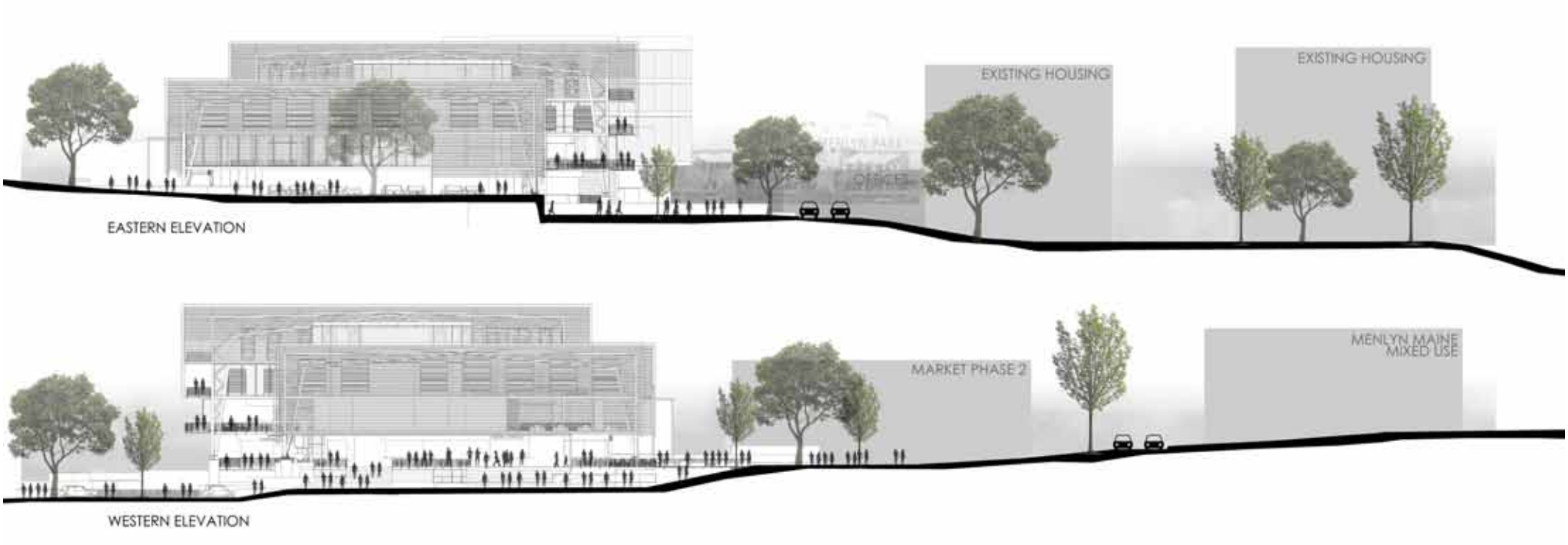
Second floor		3688m2
	Hydroponics + circulation	**3100m2**
	Hydroponics1	1720m2
	Hydroponics2	862m2
	Restaurant 2	310m2
	Kitchen area	63m2
Basement -1	**Basement Parking**	**2600m2**
	36 parking bays	
	Service rooms and storerooms	250m2
Basement -2	**Basement Parking**	**2600m2**
	36 parking bays	
	Service rooms and storerooms	250m2
Basement -3	**Storage floor**	**2080m2**
	Cold rooms	1200m2
	Storage spaces	800m2
	Service areas	80m2
	Productive landscapes	
	Total building area:	**18 392m2**
	SITE AEA:	19 930m2
	PHASE 1 BUILDING AREA:	4 625m2 (23% COVERAGE)
	PHASE 2 BUILDING AREA:	2 350m2
	TOTAL BUILDING AREA:	9 675m2 (49% COVERAGE)

>>105: View from BRT and Transport interchange building.

>>107: Interior view of nutrient film grow trays in hydroponic zone, second floor.

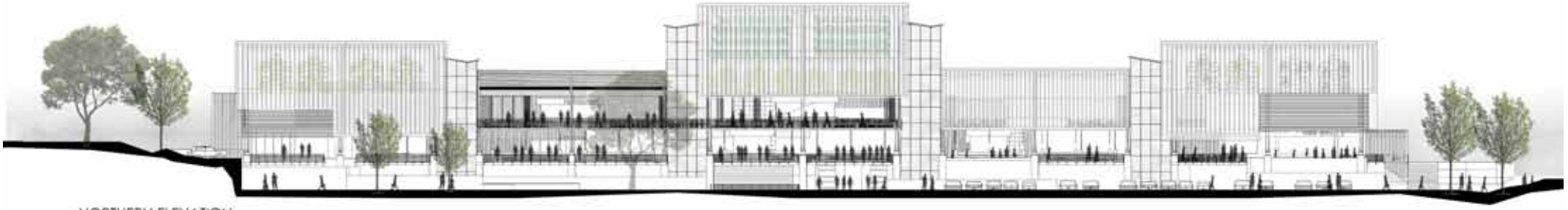
>>106: Interior view of restaurant area on first floor.

>>108: Market floor with courtyard communal space.



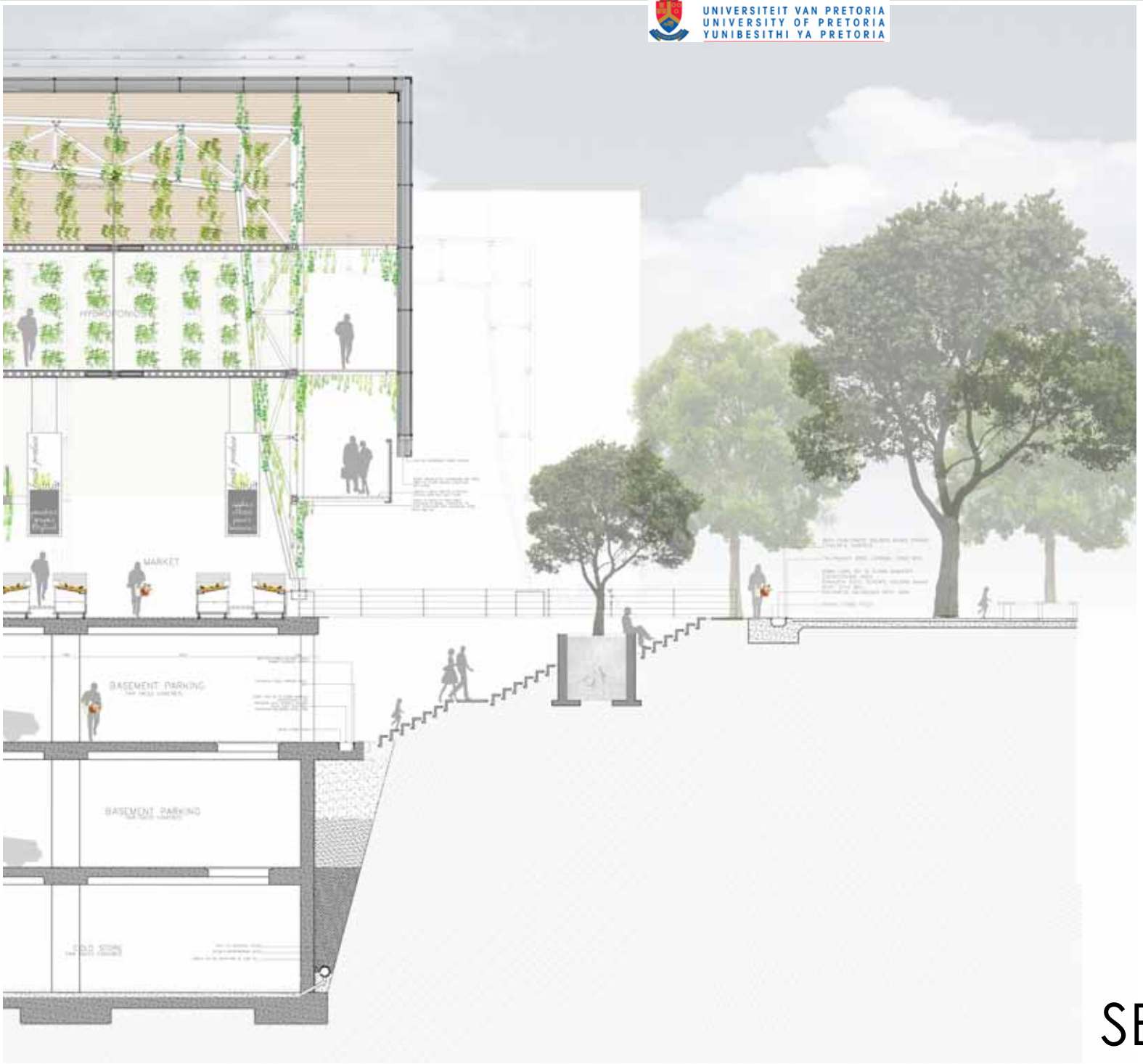
 >>109: Rendered elevations.

SOUTHERN ELEVATION



NORTHERN ELEVATION

>>1010: Rendered section.



SECTION A-A

	MATERIAL	COMPOSITION	STRENGTH	SIZE	FINISH	DESCRIPTION	CARBON FOOTPRINT kgCO2/kg
Substructure / STEREOTOMIC							
Basement floor slab	Reinforced In-situ cast concrete	Cement Aggregates Steel Fly Ash Water	30MPa	300mm depth	Polished concrete	Steel reinforced concrete	0.256
Retaining walls	Reinforced In-situ cast concrete	Same as above	25MPa	500mm width	off shutter	Heavy duty waterproofing membrane	0.256
Concrete floor slabs	Reinforced In-situ cast concrete	Same as above	25MPa	300mm depth	polished concrete floor surface; off shutter soffit		0.256
Concrete columns	Reinforced In-situ cast concrete	Same as above	25MPa	600 x 600mm	off shutter	edges chamfered	0.256
Waterproofing	Reinforced bitumen waterproofing mebrane	Polyester non-woven fabric Bitumen		3mm thick sheets		Sika BlackSeal T-130 PG is a 3mm thick, torch-on sheet waterproofing membrane based, reinforced bitumen, with a sand broadcast surface	unknown
Superstructure / TECTONIC							
PORTAL FRAMES							
I-beams	Hot rolled I sections	Iron	270MPa	300mm x 300mm x3mm	Hand painted	Assembly on site of different parts	2.78
Tension members / struts	Hot rolled circular hollow sections	Iron	205MPa	114mm dia x 1.8mm	Hand painted	Final assembly of part on site	2.5
SUSPENDED FLOORS							
Lightweight concrete floors	Post tension reinforced concrete	Cement Aggregates Fly ash Steel	20MPa	320mm depth	polished concrete floor surface; off shutter soffit	Large span concrete flat-slab systems with internal spherical void formers (SVF)	0.256
Steel cables	Suspension wire ropes	Non-alloy carbon steel	3304kN	25mm diameter	Contained in coloured PVC pipe		5.4
Steel Anchors	Stay cable anchorage system	Steel Stainless steel	4500kN		none	conical steel pipe (bond socket) supporting a wedge plate where the strands are anchored with wedges	unknown

MATERIALS

	MATERIAL	COMPOSITION	STRENGTH	SIZE	FINISH	DESCRIPTION	CARBON FOOTPRINT
ROOF STRUCTURE							
Plexiglass	Roof panels	acrylic thermoplastic	69 MPa	2000mm x 10mm	none	lightweight, rigid and weather-resistant thermoplastic	6
Glass	Laminated float glass panels	Silica Sand polyvinyl butyral interlayer		6.38mm thickness (3 + 0.38 + 3)	none	safety glass for use in roof structures etc	1.27
Power Glass™	Glass laminated with a transparent, thin-film polymer photovoltaic layer	Silica Sand Polymer photovoltaic layer		6.38mm thickness (3 + 0.38 + 3)	none	energy generation through solar radiation	4.9
SUN SHADING DEVICES							
Aluminium louvres	Extruded aluminium louvre blades	Bauxite	250MPa	2mm wall thickn	none	Sun shading devices	11.2
Wood Slat louvres	Wood plastic composite	waste plastics recovered saw dust	38.2MPa	25mm x 75mm	none	Eva-tech is a low-maintenance product which requires no costly stains, sealants or other environmentally-harmful products to maintain	2.5
GLASS CURTAIN WALLS							
Glass sliding doors	Aluminium framed glass sliding doors	Laminated Float glass Extruded aluminium frame		4000mm x 2500n panels	none	Large manually operated sliding doors	3.7
BALUSTRADES							
Posts	Aluminium vertical posts	Bauxite	250MPa	40mm x 40mm x	none		11.2
Steel Cables	Horisontal elements in balustrade	Non-alloy carbon steel	300MPa	10mm diameter			
MARKET STALLS							
Framework	Welded steel frame	Iron	n/a	design specific	hand painted	Purpose designed market stall, see detail	2.2
Cladding	Wood plastic composite	waste plastics recovered saw dust	n/a	25mm x 50mm	none	Market stall cladding, see detail	2.5
STAIRS							
Thread	Wood plastic composite	waste plastics recovered saw dust	n/a	1500mm x 250mm x 75mm	none	Heavy duty and easy maintainable stairs	2.5
Structure	Welded steel frame	Iron	200MPa	5mm wall thickn	hand painted		2.2
Balustrades	Aluminium vertical posts Horisontal elements in balustrade	Bauxite Non-alloy carbon steel	250MPa 300MPa	40mm x 40mm x 2mm 10mm diameter			11.2 5.4

Green Strategies

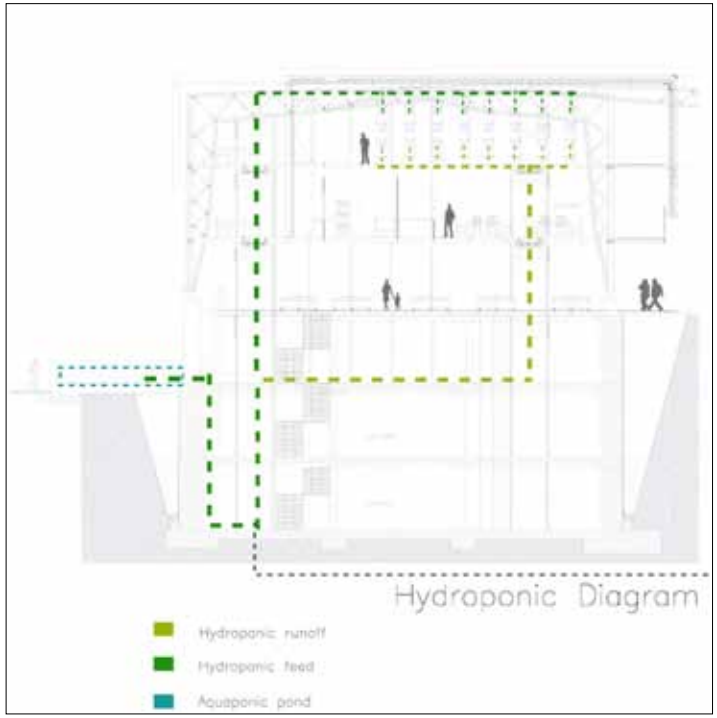
New technologies are constantly being developed to aid and complement standard practice with regard to greener structures. The general purpose of these technologies is that green or more sustainable buildings are designed so that the built environment's impact on the natural environment and human health is reduced. The following ideas are implemented in sustainable building design:

- efficiency in the use of water, energy and other valuable resources
- the cutback in waste, environmental degradation and pollution
- protecting the health of occupants and improving employee efficiency

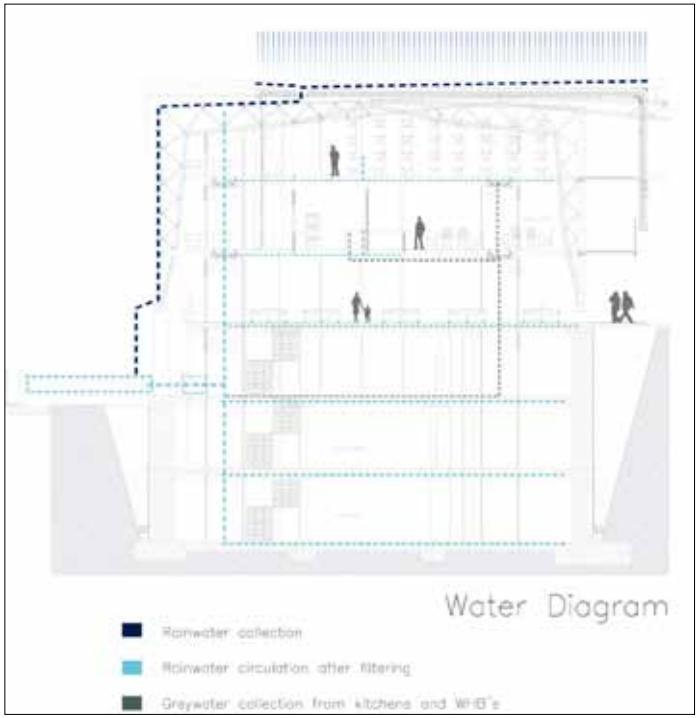
Waste water treatment and reuse:
"Urban hydrology will have an increasing role to play in the sustainability of human societies. Urban population is growing at an accelerating pace and, simultaneously, sources of water supply decrease or, at the best, remain constant in quantity, but decrease in quality." (Niemczynowicz, 1999)

Rainwater collection:
Rainwater harvesting is mainly used for potable water, as this is a clean and nutrient-rich source of water, which can also be used for irrigation of productive landscapes and hydroponics.

Grey and black water cleaning system:
Grey water can be stored in cisterns to be used in non-potable water provision systems within the building and on-site.
Black water (from toilets) is treated with an anaerobic reactor and methane gets excluded from the system and put into the energy cycle. Partly filtered water is then put through a system with an anoxic reactor. Hereafter the water is filtered through a system with aerobic reactors and deposited into an aquaculture tank. This water can then be partly used to feed the hydroponic systems, and the rest filtered even further by being purified in a clarifier. Materials that reside are then deposited into the anaerobic treatment system, or used as compost in the productive landscapes. (Redwood, 2009)



>>111: Hydroponic water circulation diagram.



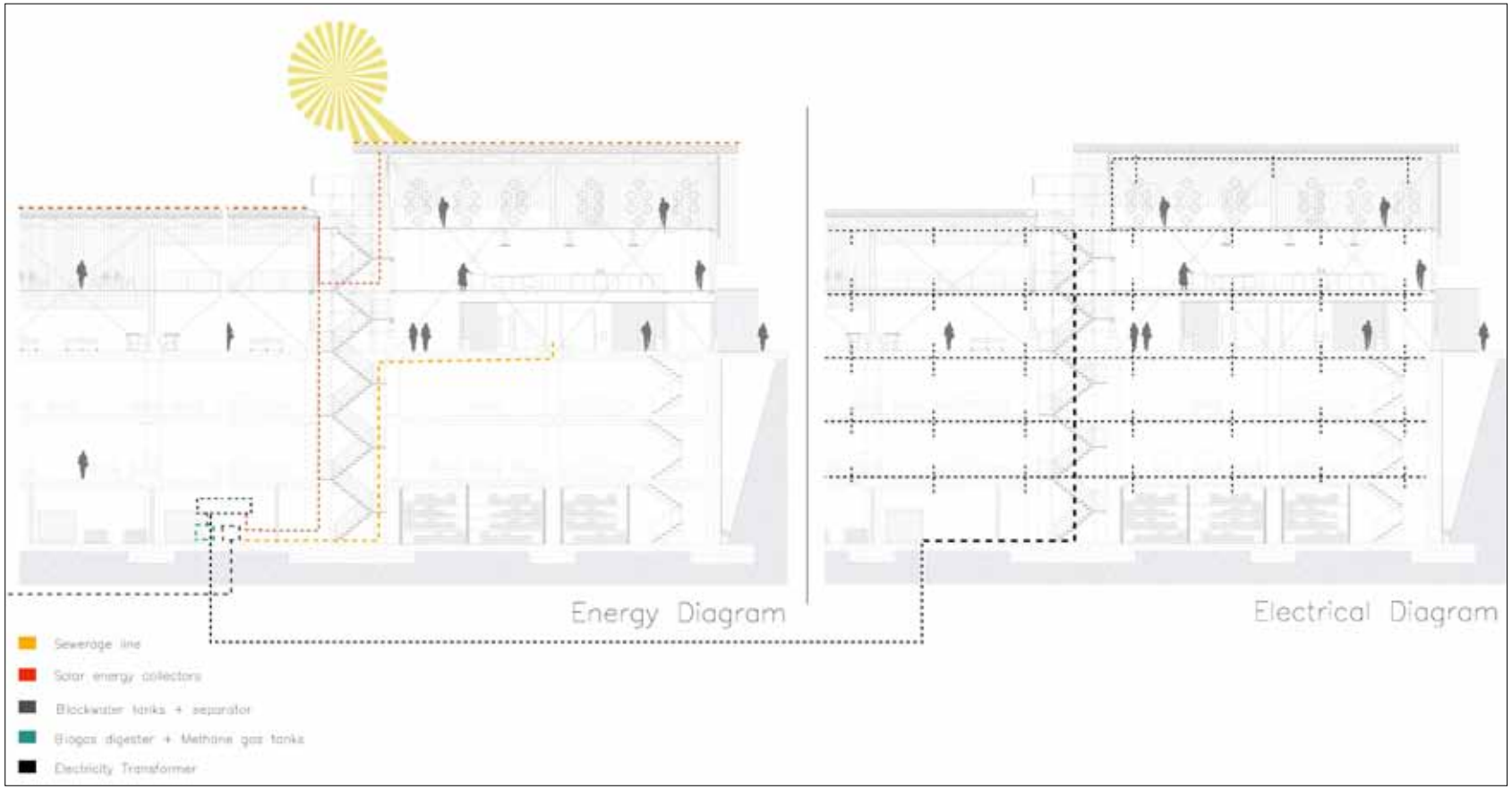
>>112: Greywater and rainwater collection diagram.

Energy use and production - alternative supplemental energy:
There are two main energy demanders in a hydroponic plant. The first includes infrastructural components that are required for the actual growth for the crops – LED grow lights etc. The second energy demand is the storage and harvesting of the crops – cold rooms and packaging. (Taylor, 2006)
Anaerobic digestion technology (methane digester) can assist in reducing the discharge of greenhouse gasses in a few ways:

- replacement of fossil fuels
- reduction of waste treatment plants' energy footprints
- methane emissions
- vehicular movements and displacement of industrially created chemical fertilisers

The essential element of an anaerobic biogas plant is the enclosed container, called the digester, which is an airtight tank filled with organic waste, emptied of processed slurry with a way of catching up the produced methane gas, which is then pumped into the energy cycle to produce biogas. (Omer, 2009).

Added to the production of biogas, solar power will be harvested by means of Power Glass™ (glass laminated with a transparent, thin-film polymer photovoltaic layer), solar cells operating at as much as 50% the efficiency of conventional opaque amorphous solar cells, yet costing as little as 25% of the conventional cell's price to produce. (Cascio, 2005) Solar panels collect solar energy or radiation from the sun and dynamically convert that energy to electricity, also to be used in general for crop production etc.



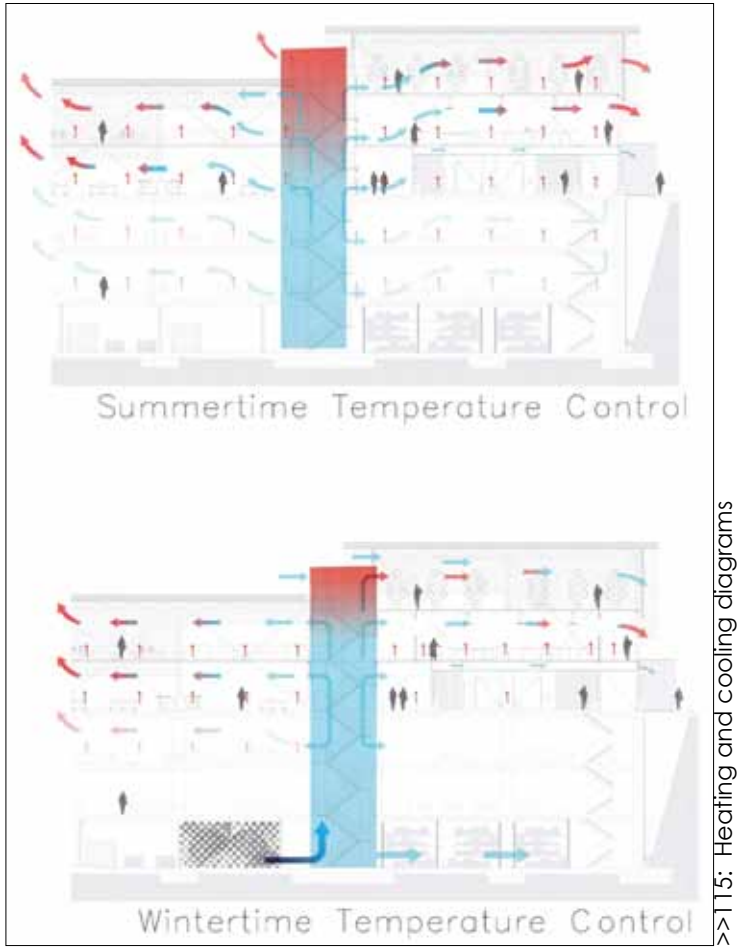
>>113: Energy collection and electricity distribution diagrams.

Passive Design

Site-driven indoor qualities: For this building to be able to act as a biologic entity, the building needs to be wrapped in a few layers of 'skin'. This skin consists of the three main elements namely the floor, wall and ceiling. Each has a unique finish, a structure and a material composition, which influences the energy flow within the structure. Therefore, the skin of the building plays an important role in the success of the building's micro-climate. The determining factors in an effective system include: the orientation, occupant comfort, use of a natural system, the function of the building and a need for natural ventilation. (Gerfen, 2010:62)

Natural ventilation is a very important part of hydroponic farms. A ventilation chimney from basement to top floor level will create a natural ventilation system within this building. By using a louvre system, among many, indoor temperatures will be controlled very efficiently. Ventilation stacks are a beneficial system that aids in the thermal stack effect and this promotes efficiency through thermal inertia. The double skinned glazing facade will contribute to the comfort inside the hydroponic areas. This also ensures good insulation and ample natural light.

>>114: Passive ventilation through ventilation shaft

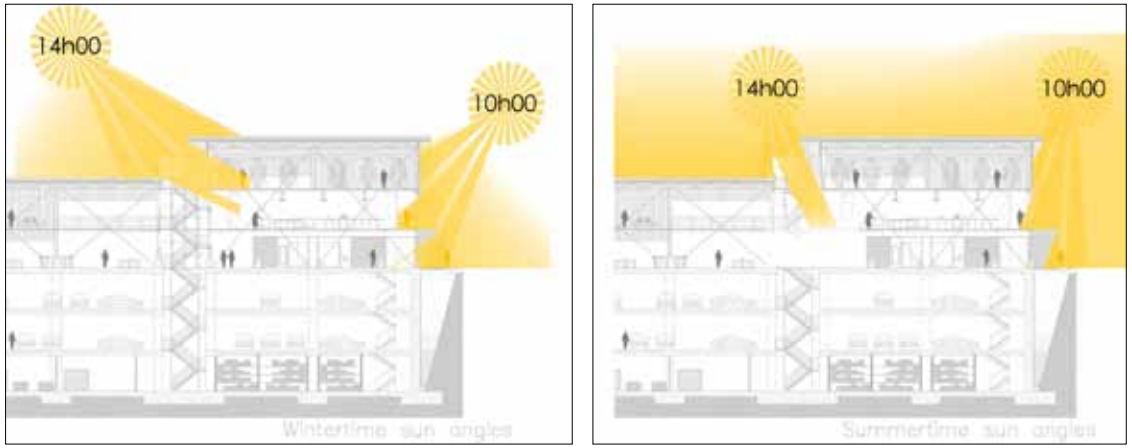


>>115: Heating and cooling diagrams

By implementing a solar energy system into these glazed facades, energy can be generated which drives the passive ventilation system, while providing a warm, humid environment for vegetation. Earth tubes are an efficient way to pull fresh air into the building through underground ducts where the ground's thermal mass provides a constant temperature, cooling the air in summer, and heating it in winter. Depleted air exits into the greenhouse to be exhausted. (Inhabitat, 2008)

In **wintertime**, a good low energy building needs to have:
a) outstanding thermal separation and low transmission losses between the inside and outside through a highly insulated building skin;
b) high quality glazing with low heat flow rate and a reasonably high total energy transmittance; and
c) heat recovery of ventilation air for very high energy efficiency standards, to become a passive building.

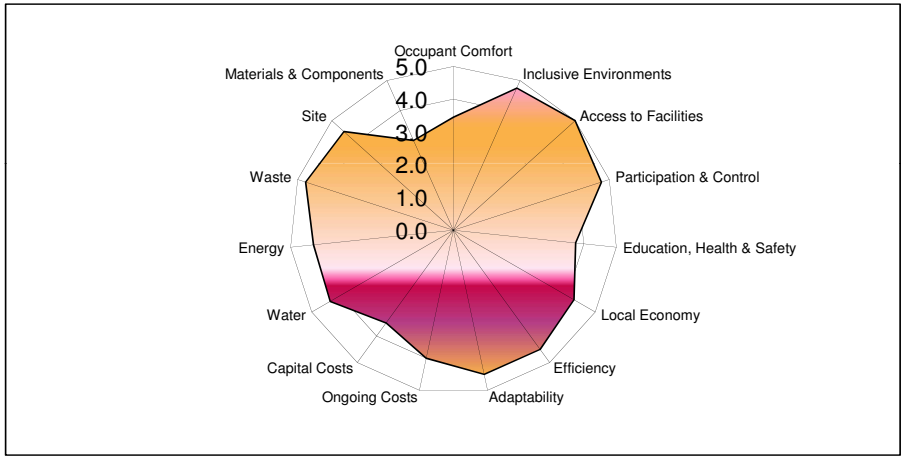
In **summertime**, on the other hand, some additional features will be necessary:
a) good sun protection through shading devices, if possible on the outside of the facade;
b) night ventilation schemes to remove at least a part of the daily loads; and
c) earth heat exchangers to precool ventilation air or to directly cool part of the building mass. (Williams, 2007:[56])



>>116: Winter and summer sun angles

SUSTAINABLE BUILDING ASSESSMENT TOOL (SBAT- P) V1

PROJECT		ASSESSMENT
Project title:	Growing urban eco-systems: a food market	
Location:	Menlyn	
Building type:	Market	
Internal area (m2):	3100	
Number of users:	400	



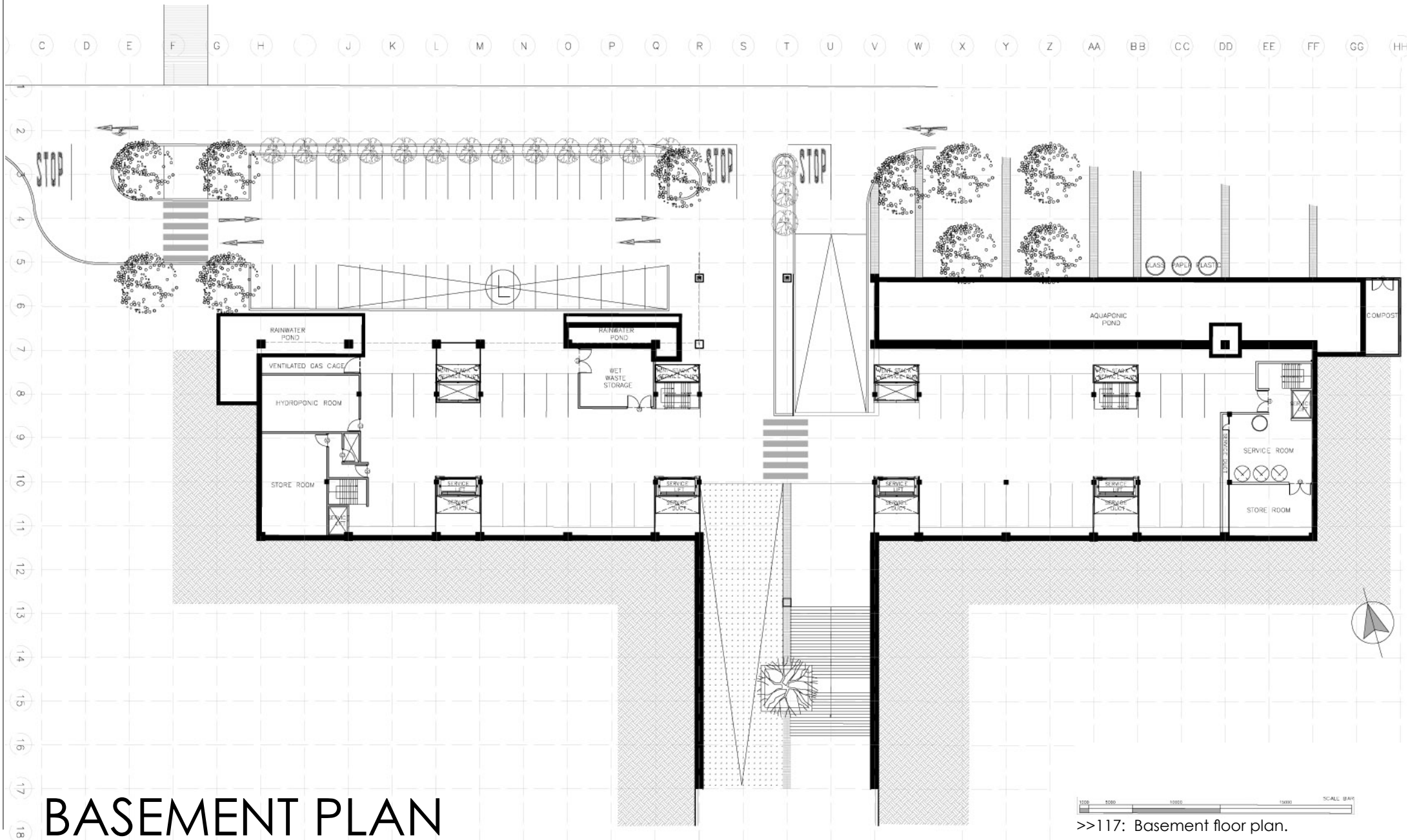
Social	4.3	Economic	4.2	Environmental	4.2
Overall	4.2	Classification			

Table 5: SBAT rating tool results

In this chapter, a complete visual technical investigation is done to cast light on the detailed design of the market building and it's components. The essence of the design lies in it's detailed connections.

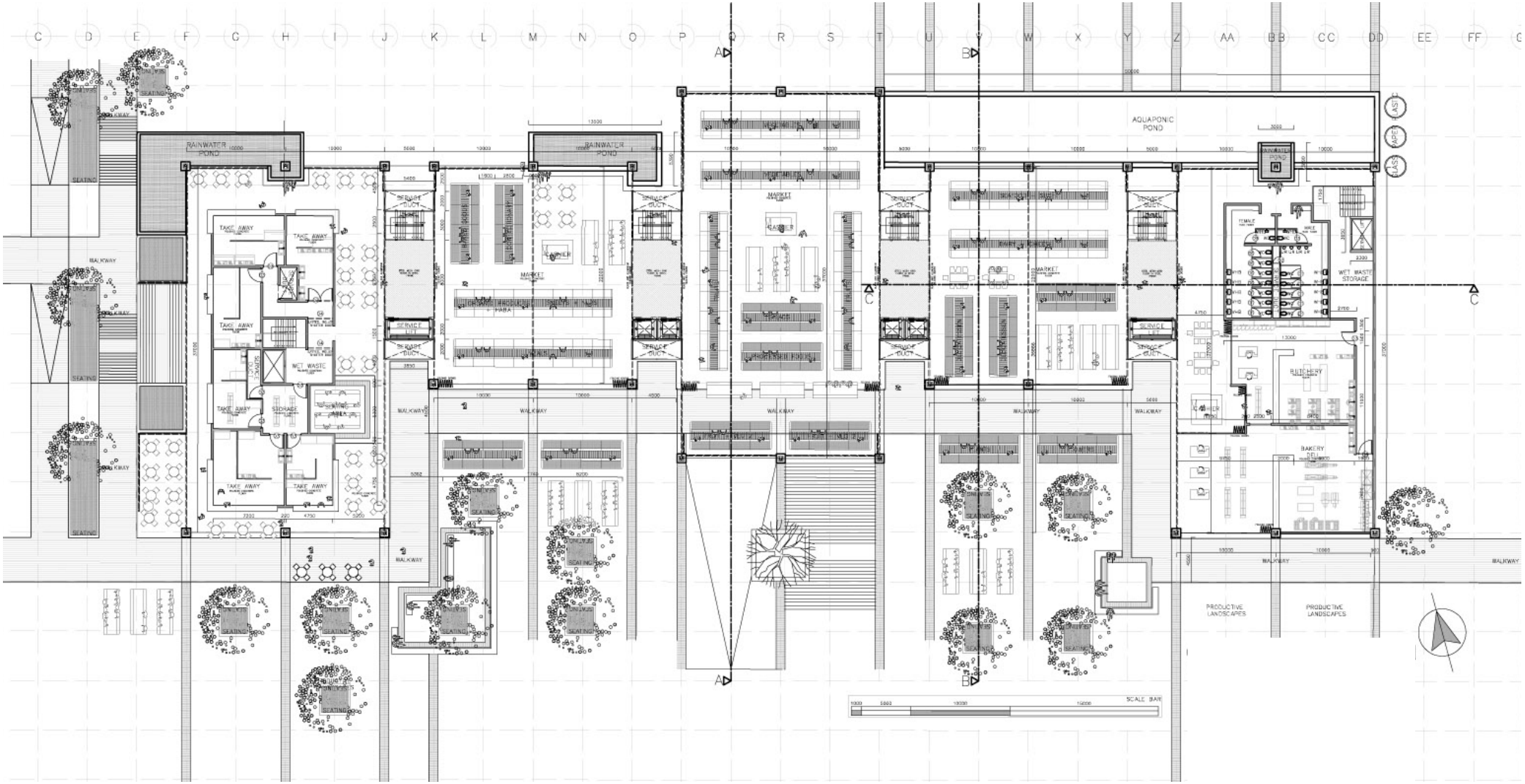
7

Technical Resolution



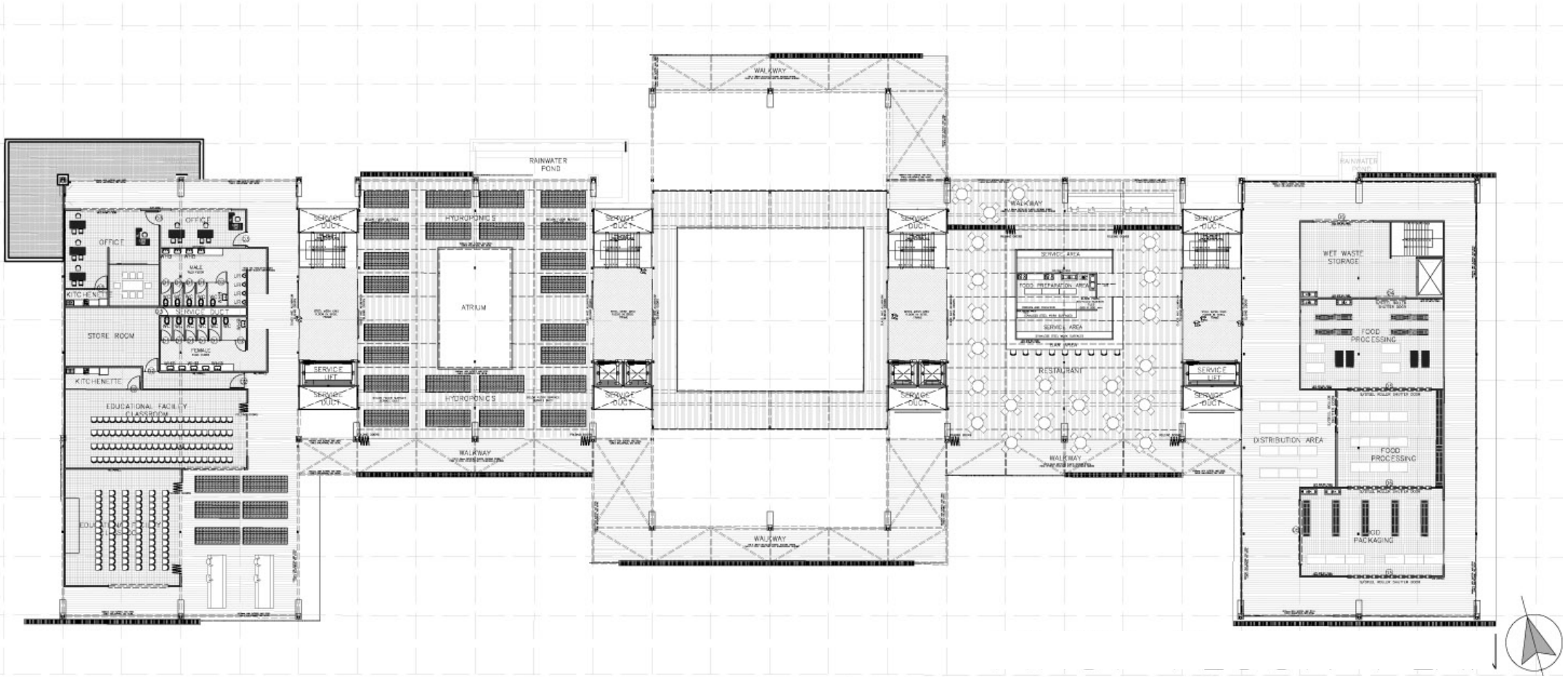
BASEMENT PLAN

>>117: Basement floor plan.



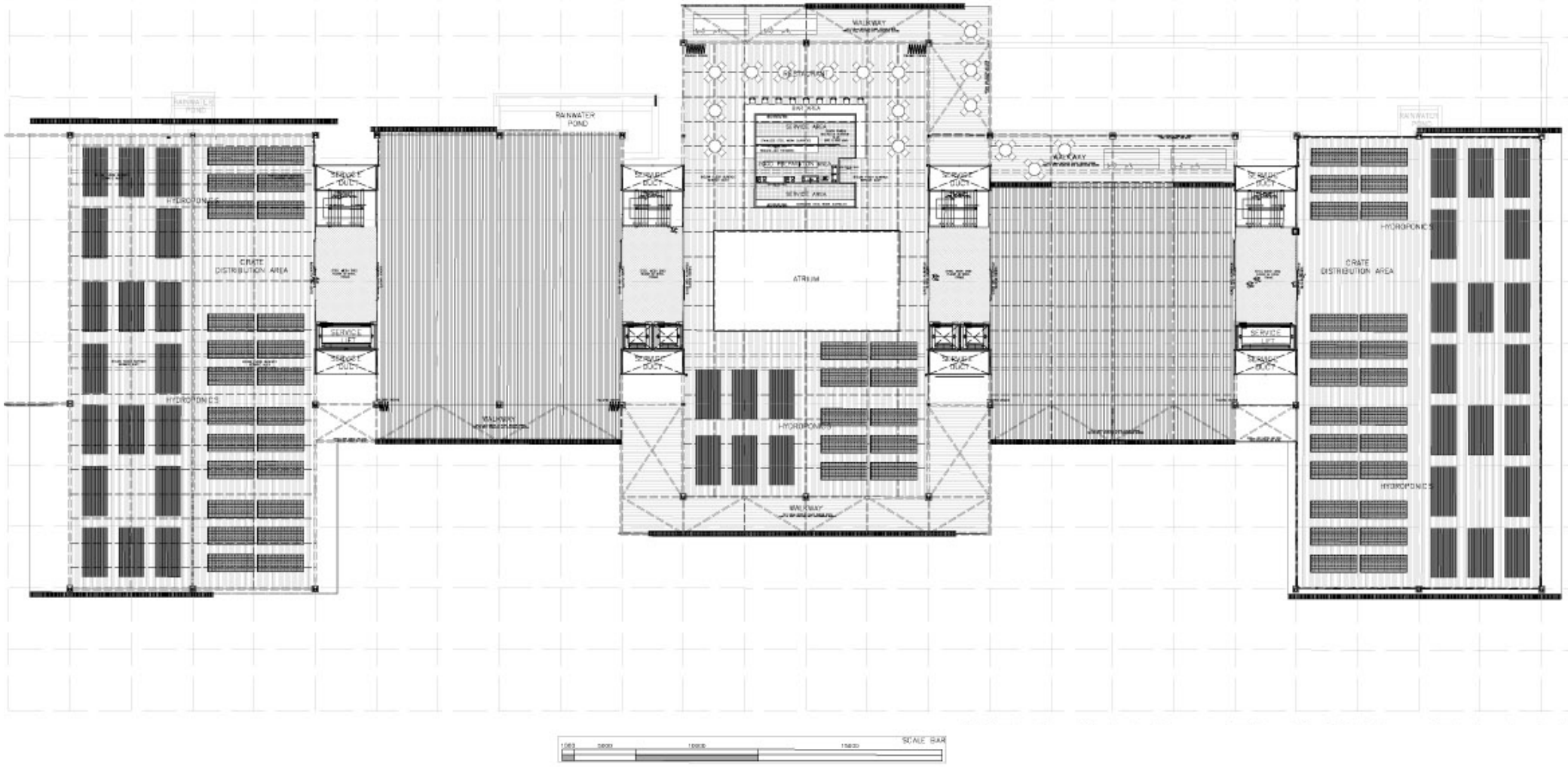
>>118: Groundfloor plan.

GROUND FLOOR PLAN



FIRST FLOOR PLAN

>>119: First floor plan.



SECOND FLOOR PLAN

>>120: Second floor plan.

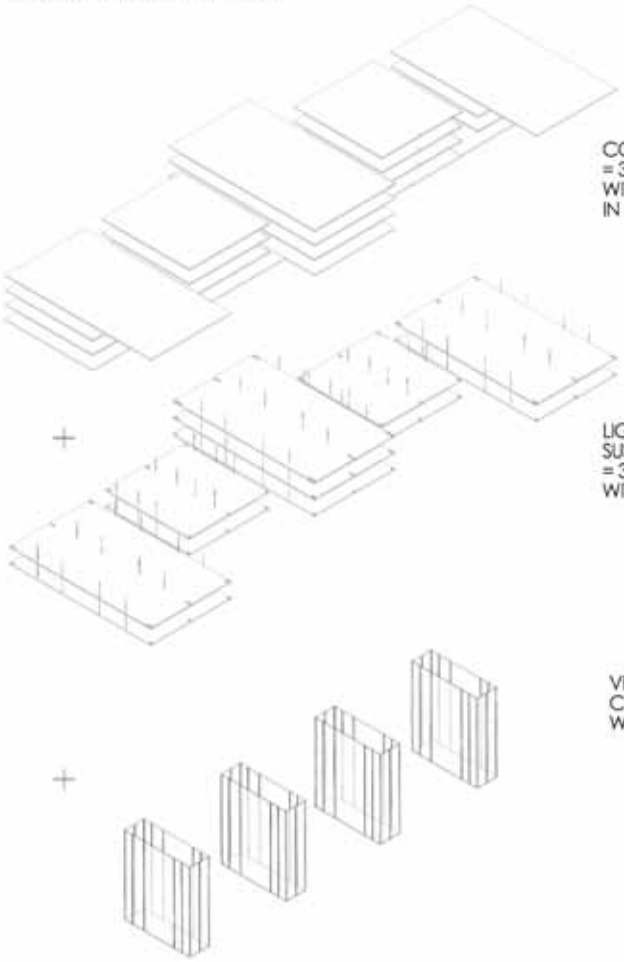
PORTAL FRAME STRUCTURE ON
800mm X 800mm CONCRETE FOOTINGS/COLUMNS

TECTONIC

+

STEREOTOMIC

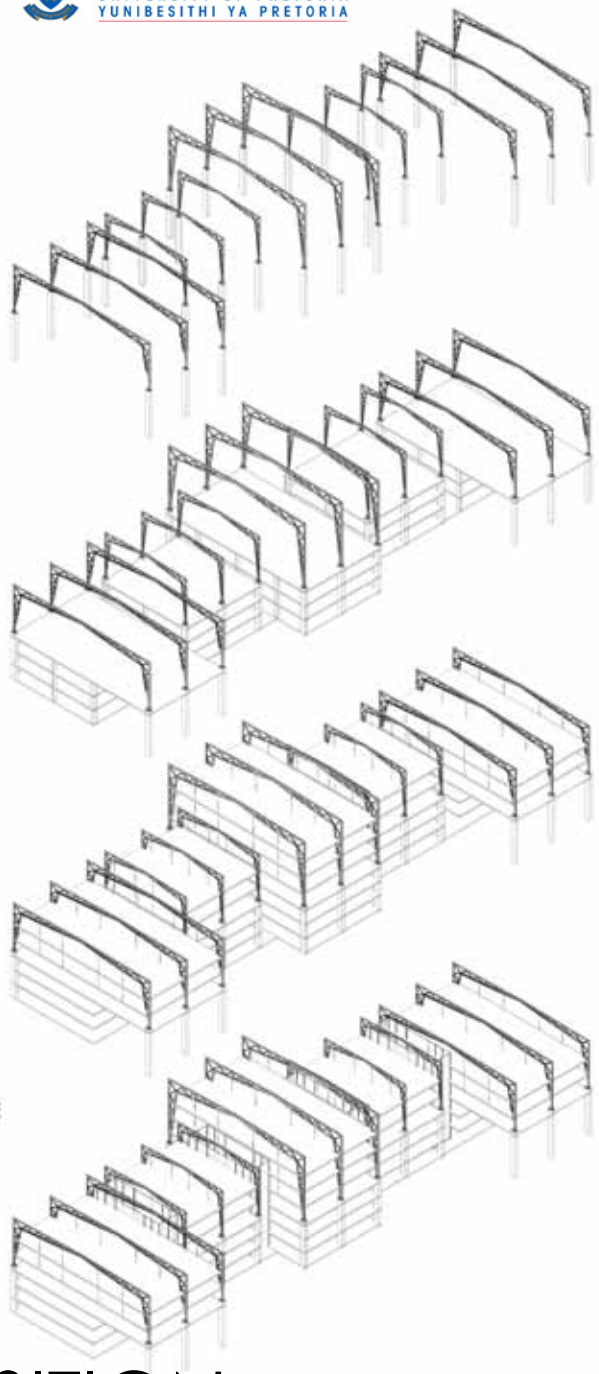
CONCRETE BASEMENT FLOORS
AND RETAINING WALLS



CONCRETE FLOOR SLABS
= 350mm DEEP
WITH 500mm DEEP BEAMS
IN BOTH DIRECTIONS

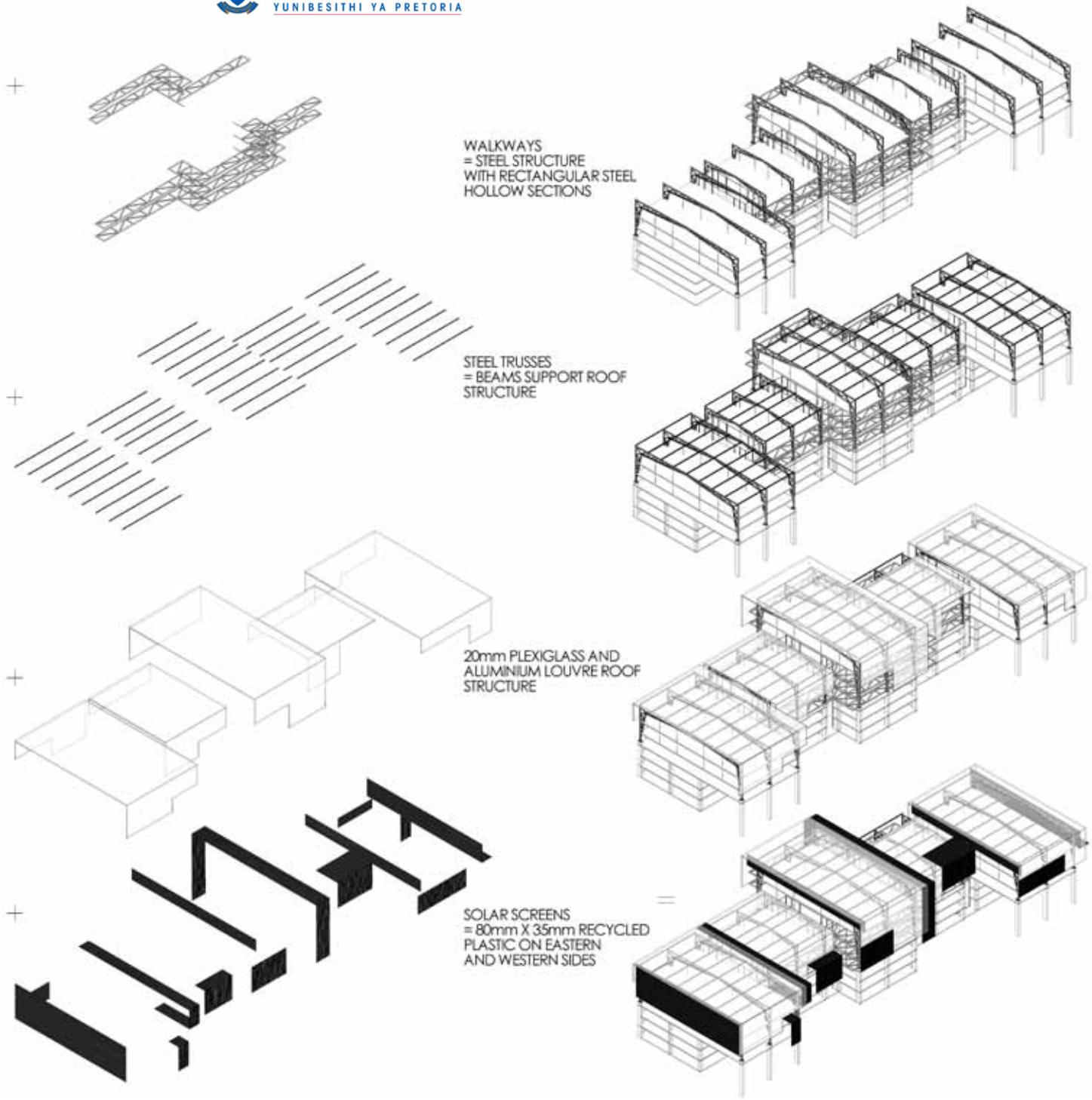
LIGHTWEIGHT CONCRETE
SUSPENDED FLOOR SLABS
= 320mm DEEP
WITH 25mm ⊖ STEEL CABLES

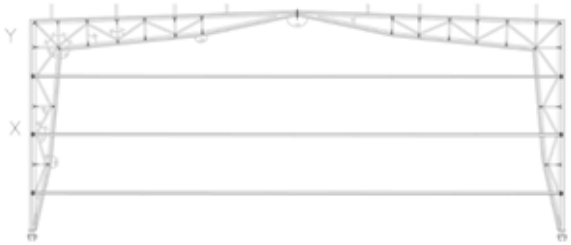
VENTILATION/CIRCULATION
CORES = GLASS CURTAIN
WALLS AND STEEL STRUCTURE



STRUCTURAL COMPOSITION

>>121: Isometric structural composition.


WALKWAYS
= STEEL STRUCTURE
WITH RECTANGULAR STEEL
HOLLOW SECTIONS
STEEL TRUSSES
= BEAMS SUPPORT ROOF
STRUCTURE
20mm PLEXIGLASS AND
ALUMINIUM LOUVRE ROOF
STRUCTURE
SOLAR SCREENS
= 80mm X 35mm RECYCLED
PLASTIC ON EASTERN
AND WESTERN SIDES



PORTAL FRAMES

L=40M
L/4=10M

FRAME SPACING = 10M

FRAME DEPTH
L/D = 35 – 40
D = 1.25M

ELEMENTS IN FRAME

H-SECTION STEEL POSTS
H BETWEEN FLOORS = 4m
h/d = 7-18
d = 300mm (est)
h/ 0.3 = 13.3 (correct)

X = HEIGHT/10
= 15000/10
= 1500mm

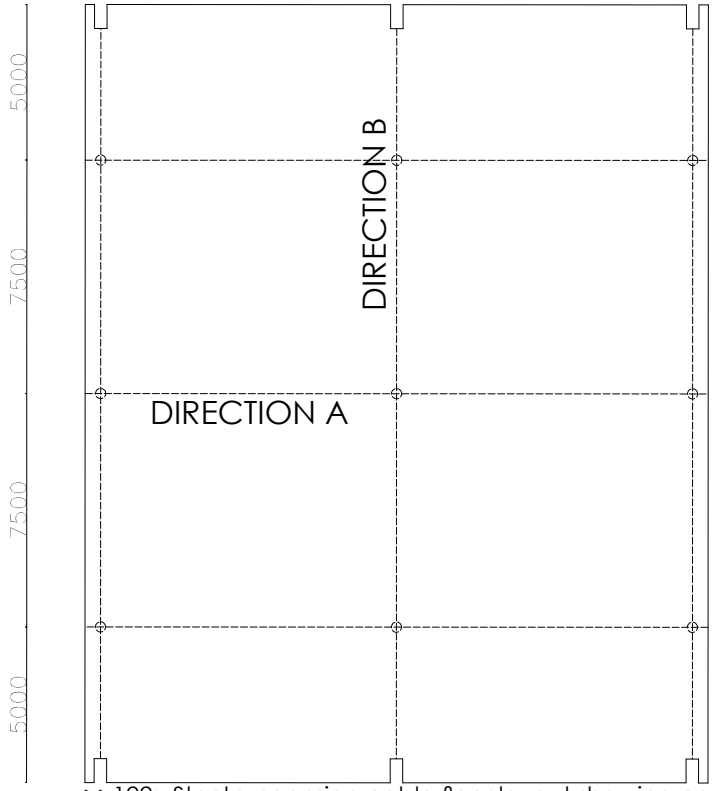
Y = SPAN/20
= 36000/20
= 1800mm

SUBSTRUCTURE

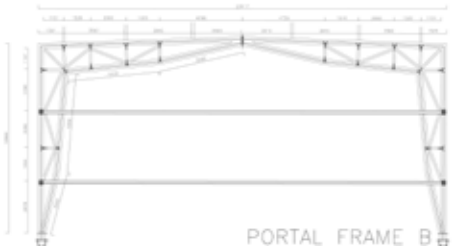
CONCRETE COLUMNS

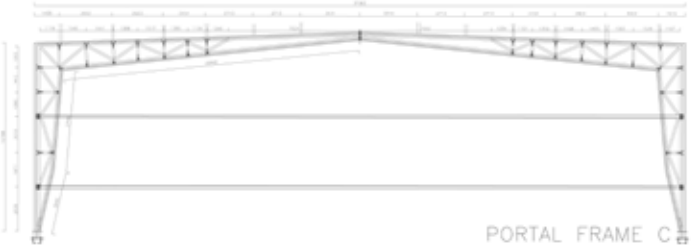
HEIGHT BETWEEN FLOORS = 4m
H/d = 6 - 15
d = 500mm (est)
4 / 0.5 = 8 (correct)

STEEL SUSPENSION CABLE FLOOR LAYOUT



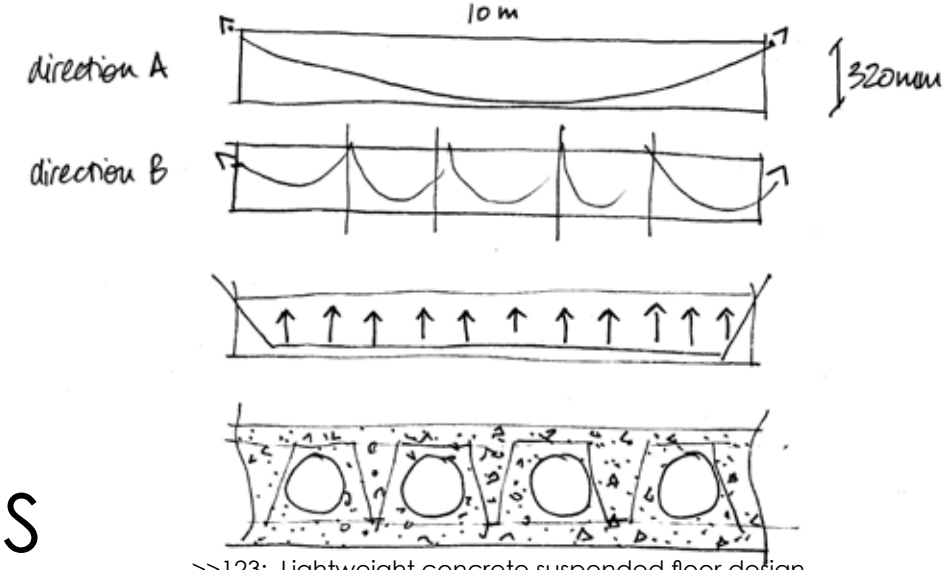
>>122: Steel suspension cable floor layout showing connection points.





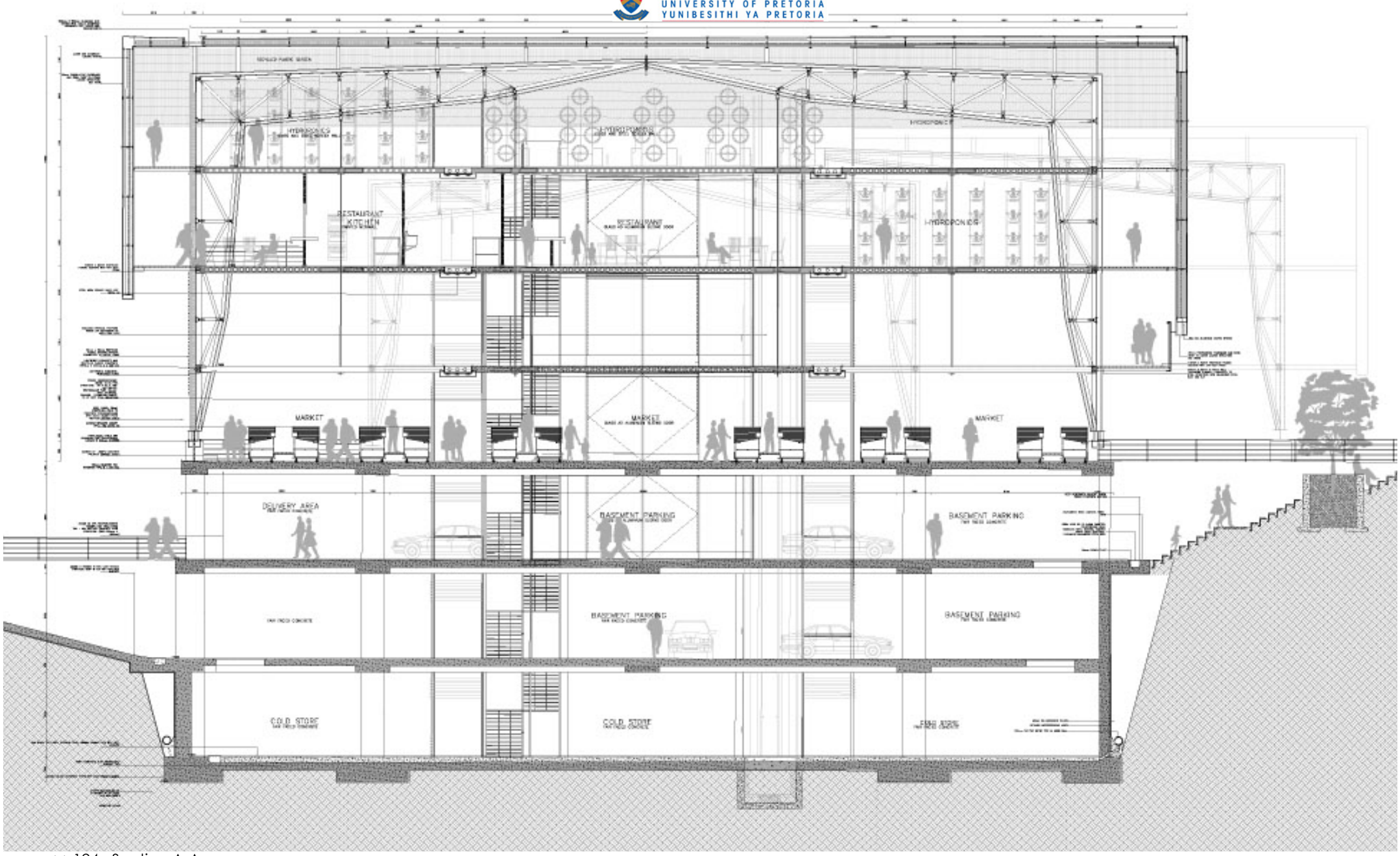
LIGHTWEIGHT CONCRETE SUSPENDED FLOORS

H = SPAN/32
= 10000mm/32
= 320mm



>>123: Lightweight concrete suspended floor design with internal spherical void formers.

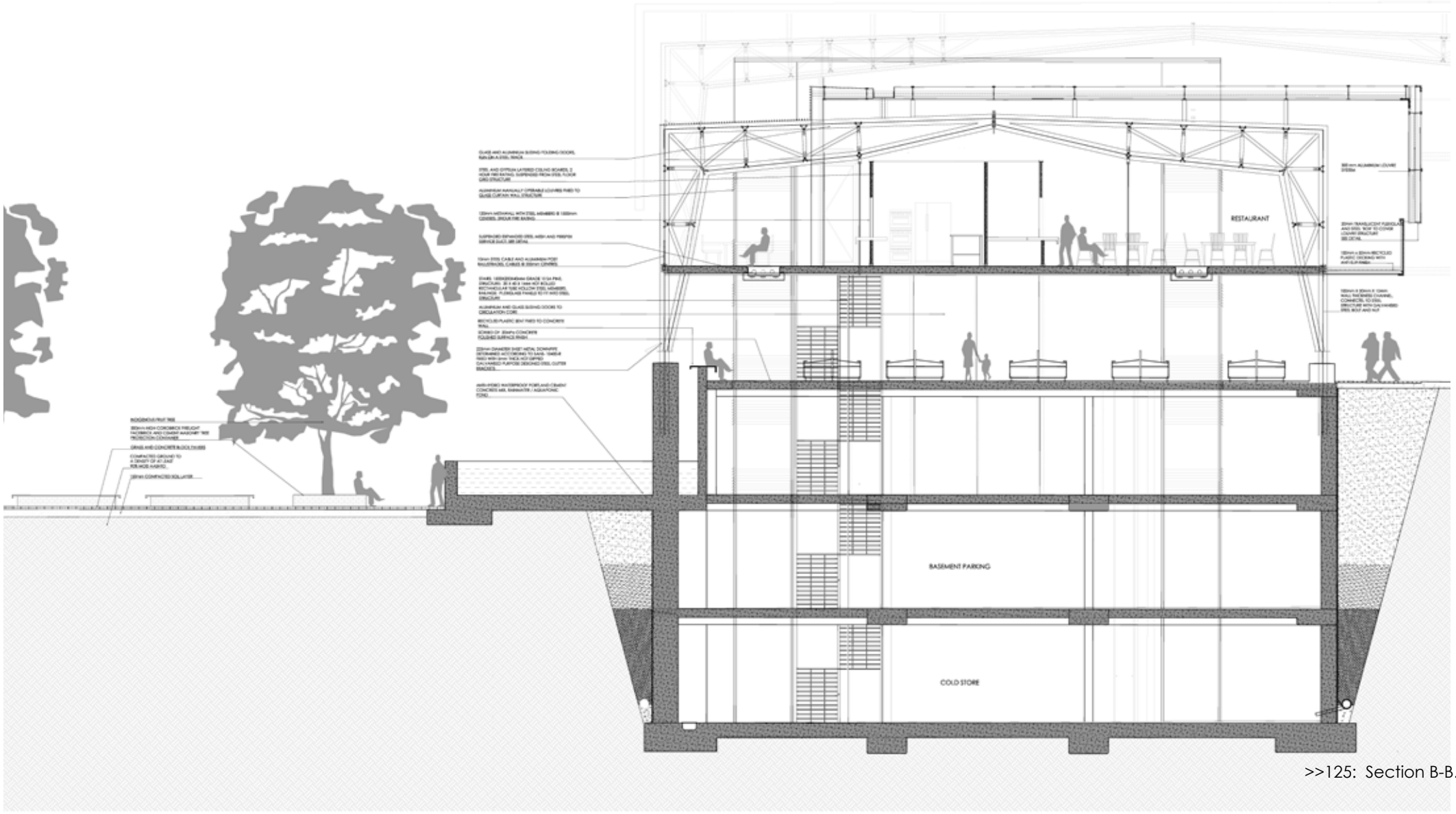
STRUCTURAL CALCULATIONS



>>124: Section A-A.

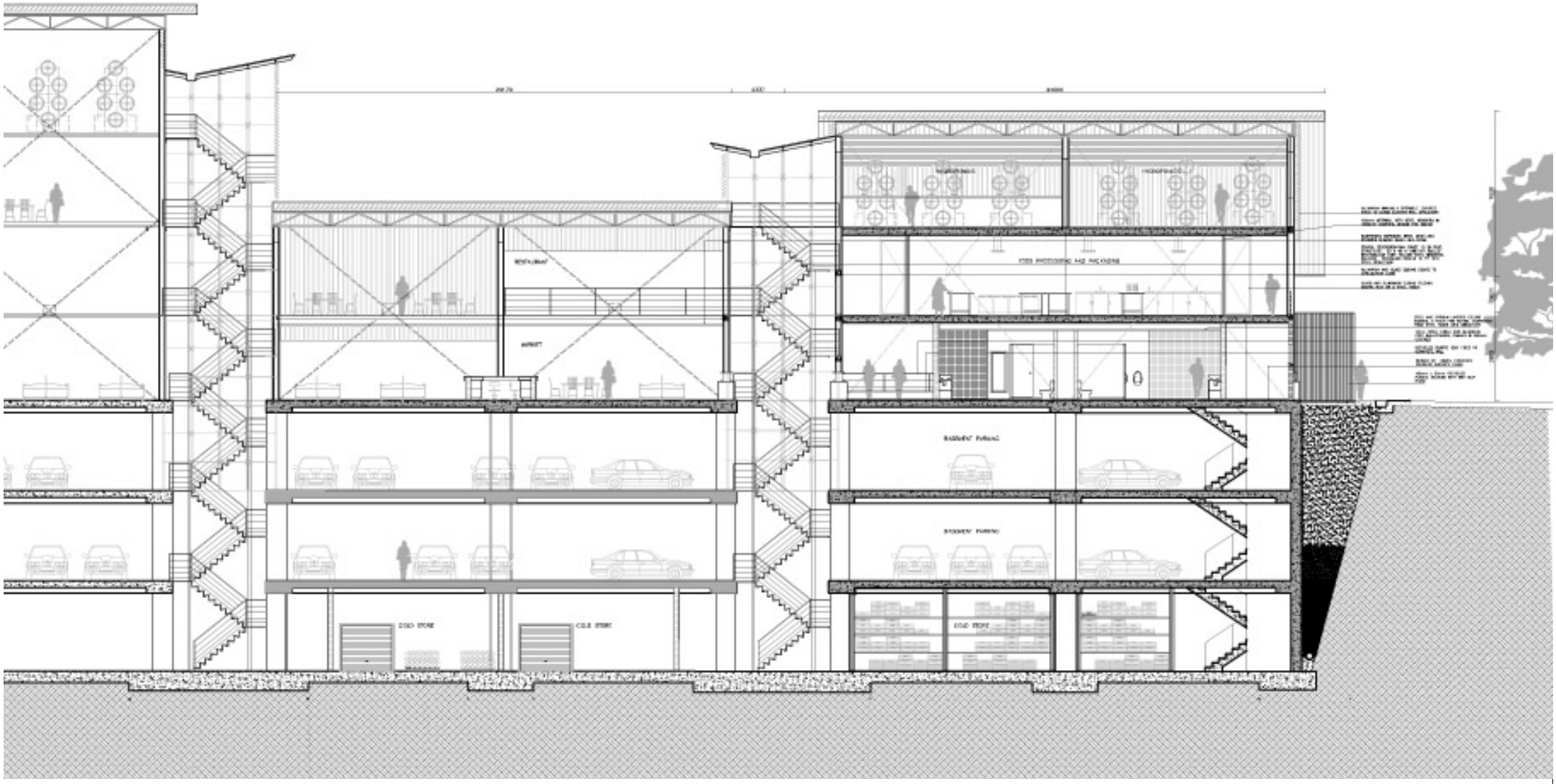
1000 5000 10000

SECTION A-A



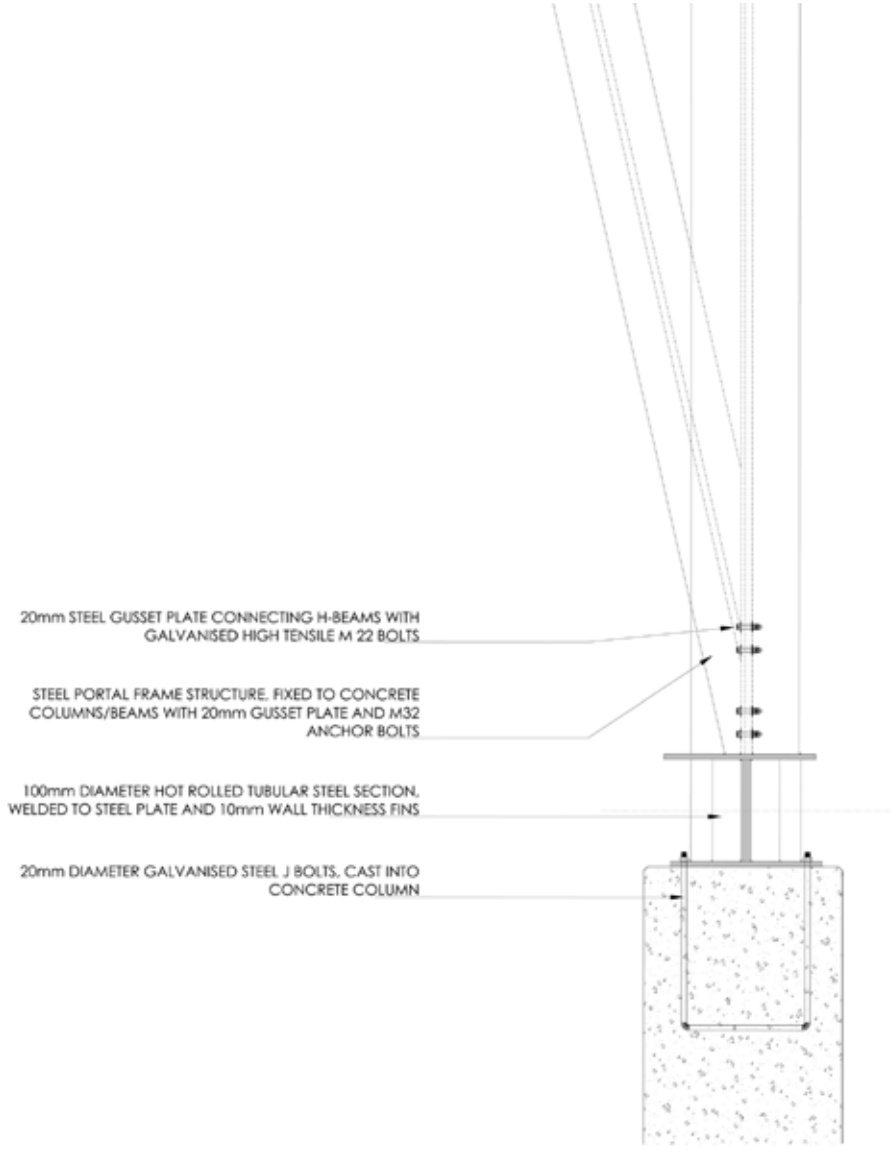
>>125: Section B-B.

SECTION B-B



>>126: Section C-C.

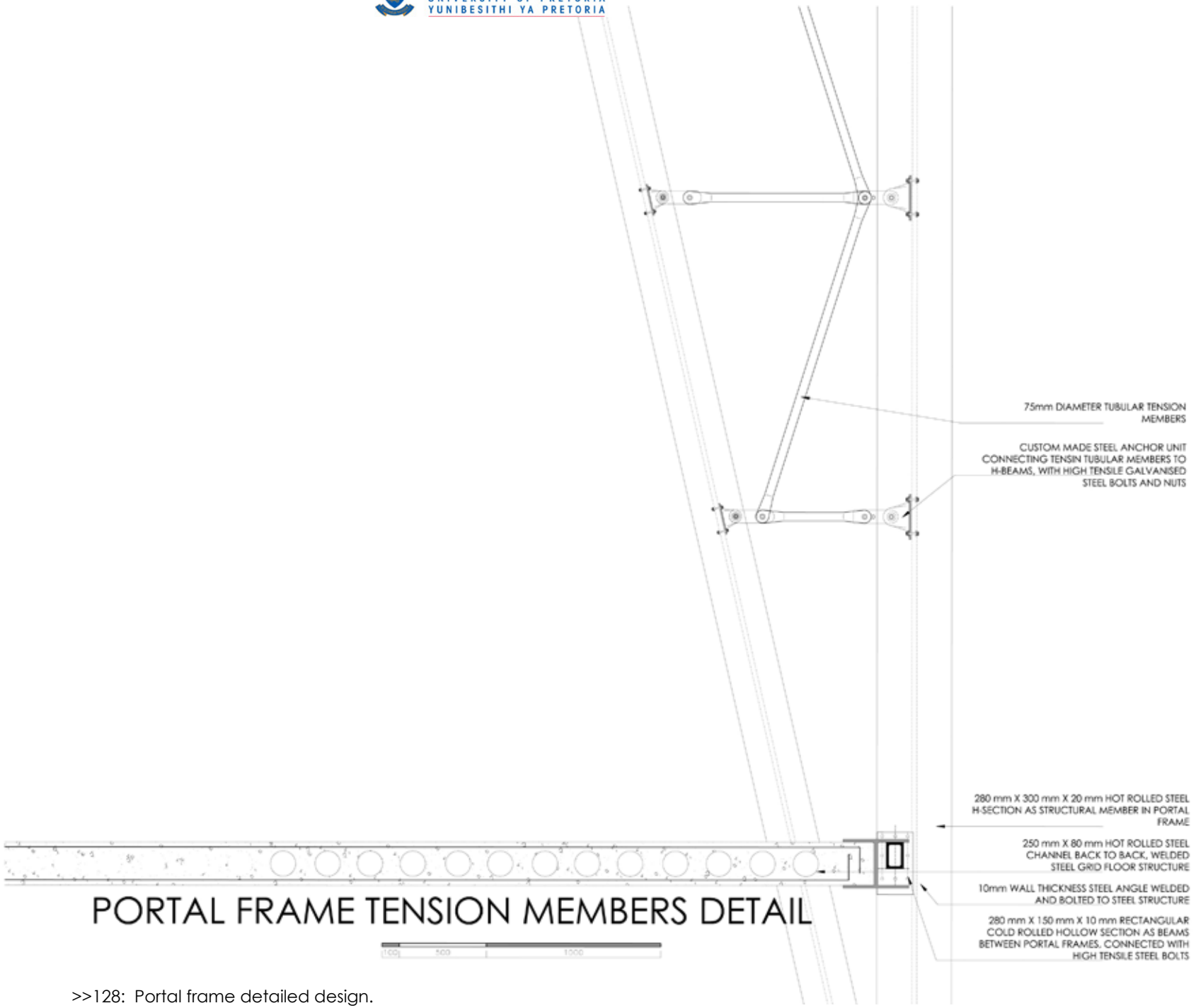
SECTION C-C



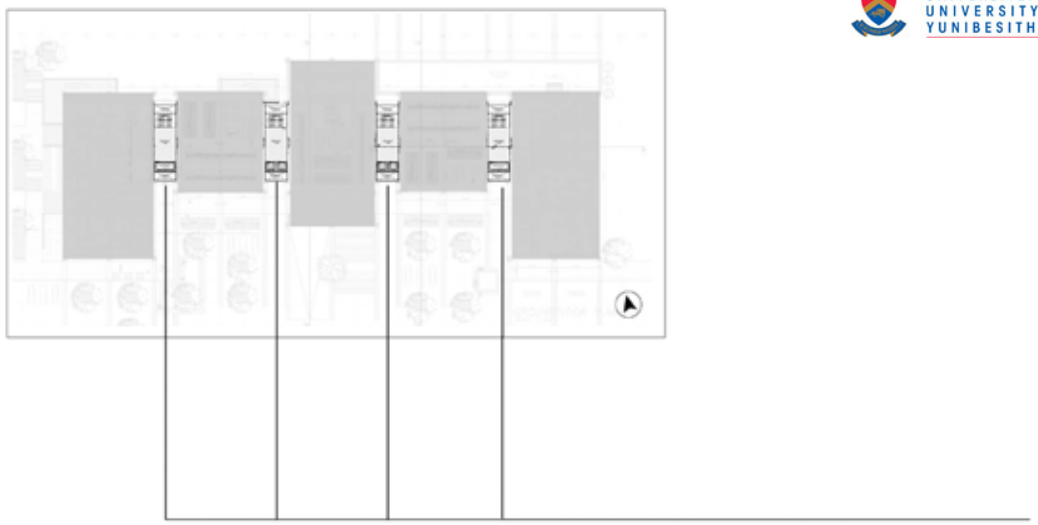
DETAILED DESIGN

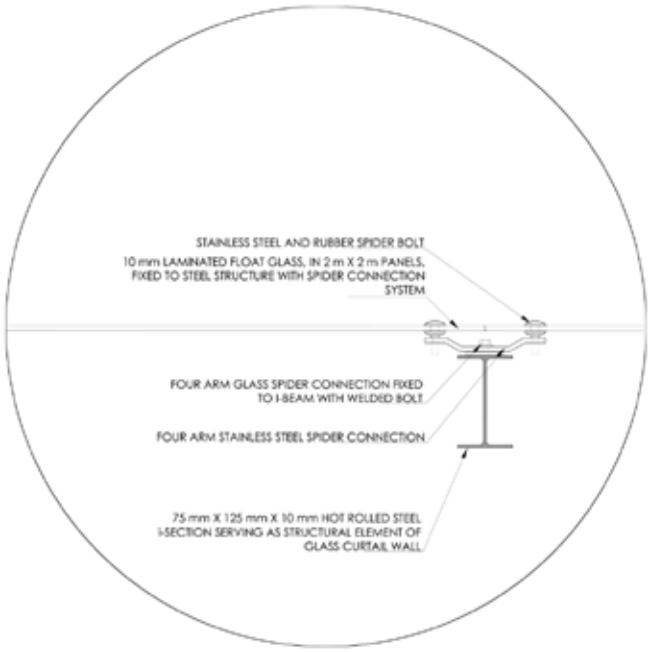
PORTAL FRAME CONNECTION TO CONCRETE COLUMN

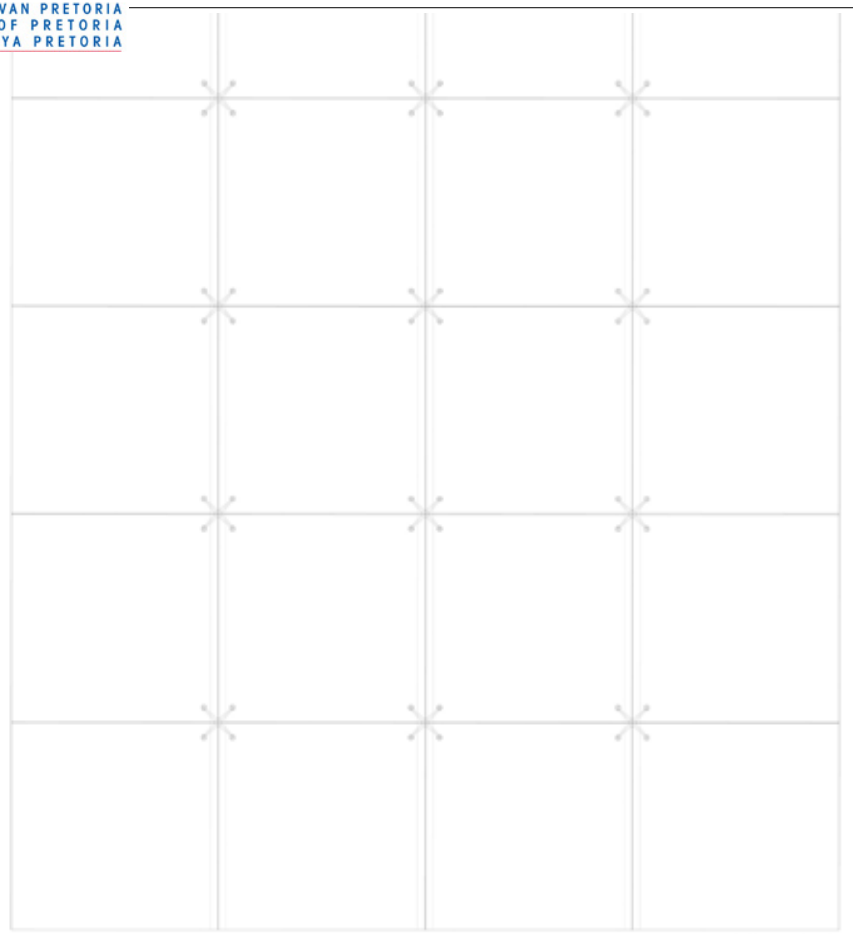
>>127: Steel to concrete connection detail.



>>128: Portal frame detailed design.







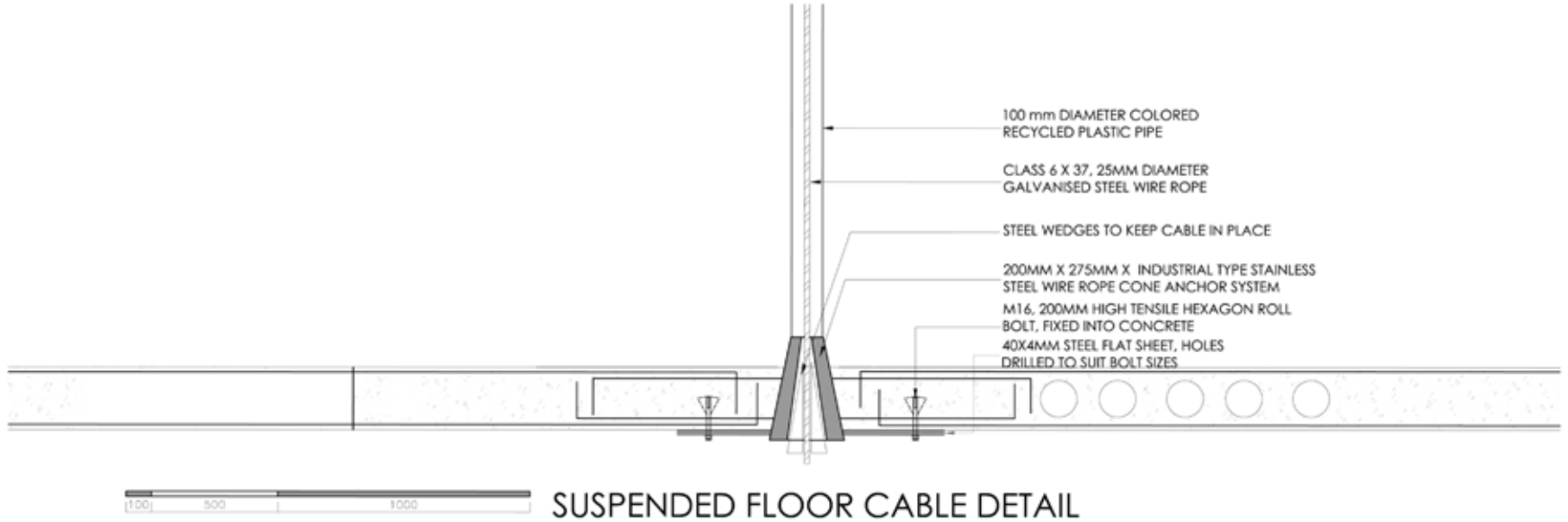
ELEVATION

PLAN

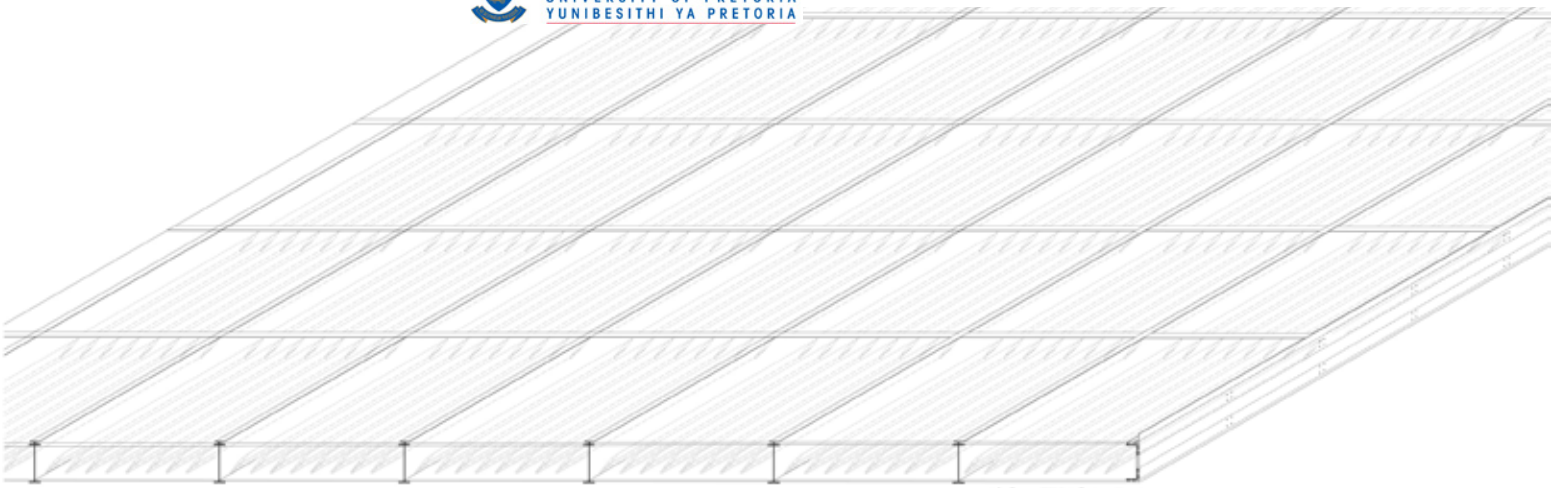
GLASS CURTAIN WALL DETAIL

>>129: Service core glass facade detail.

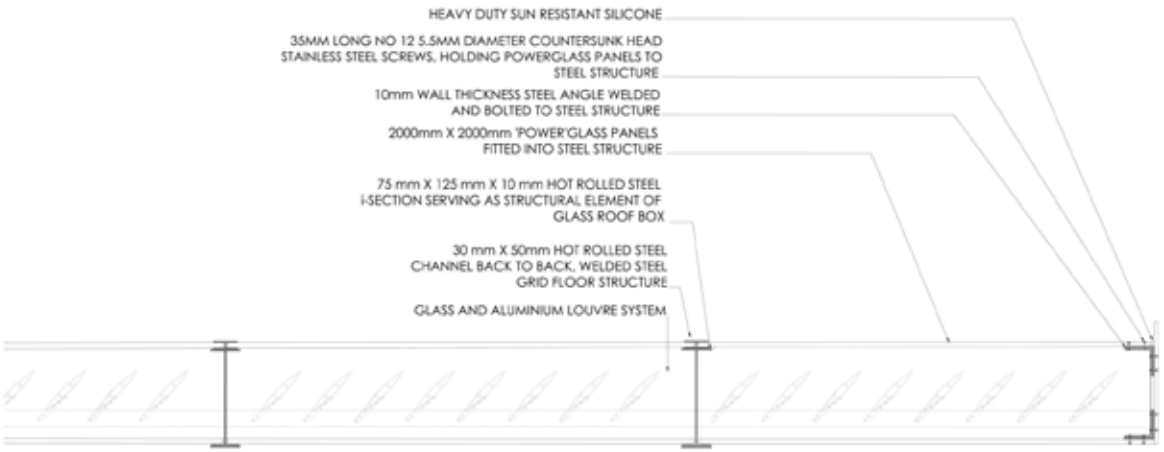
>>130: Suspended floor horisontal service duct detail.



>>131: Floor anchor detail.

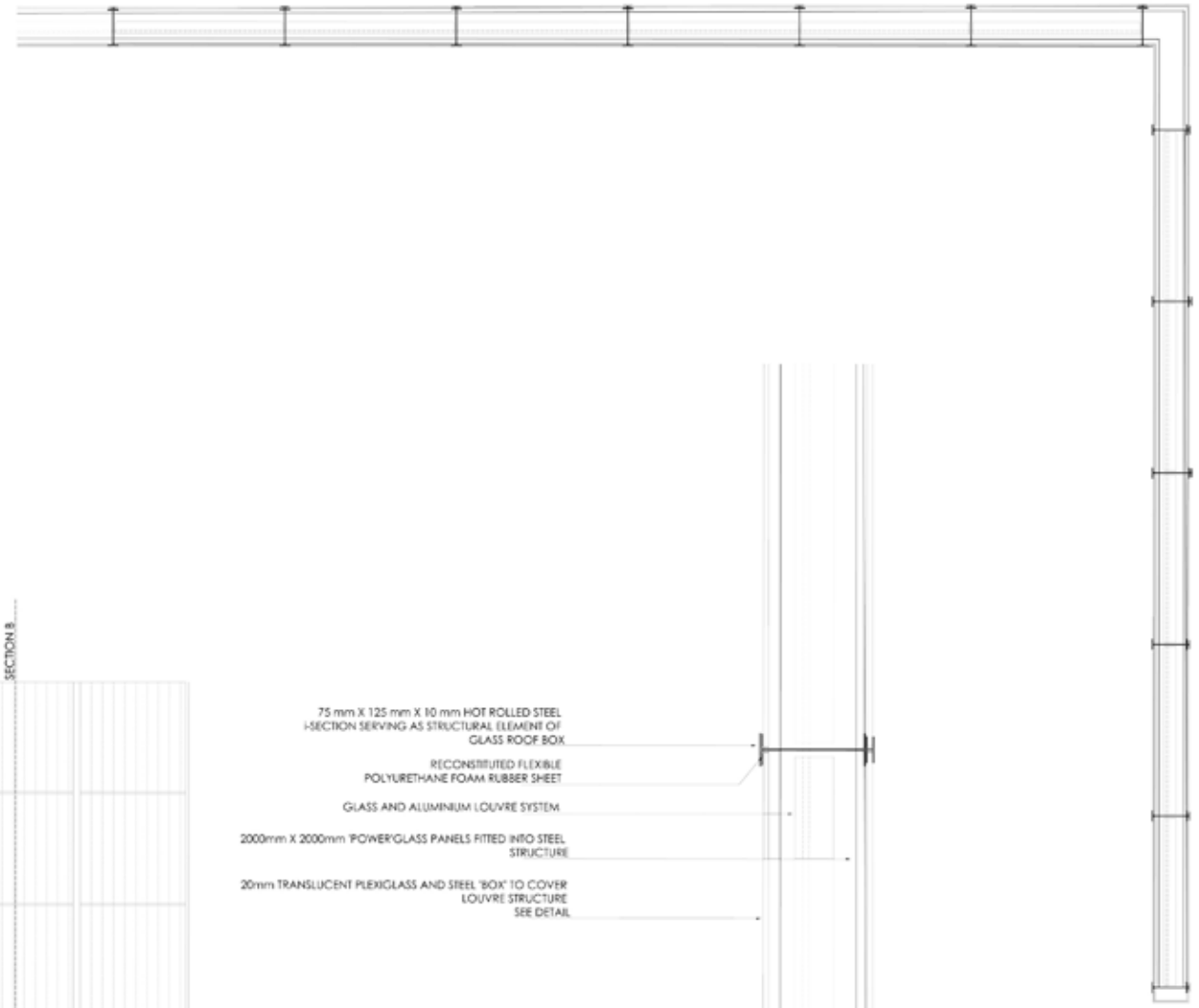


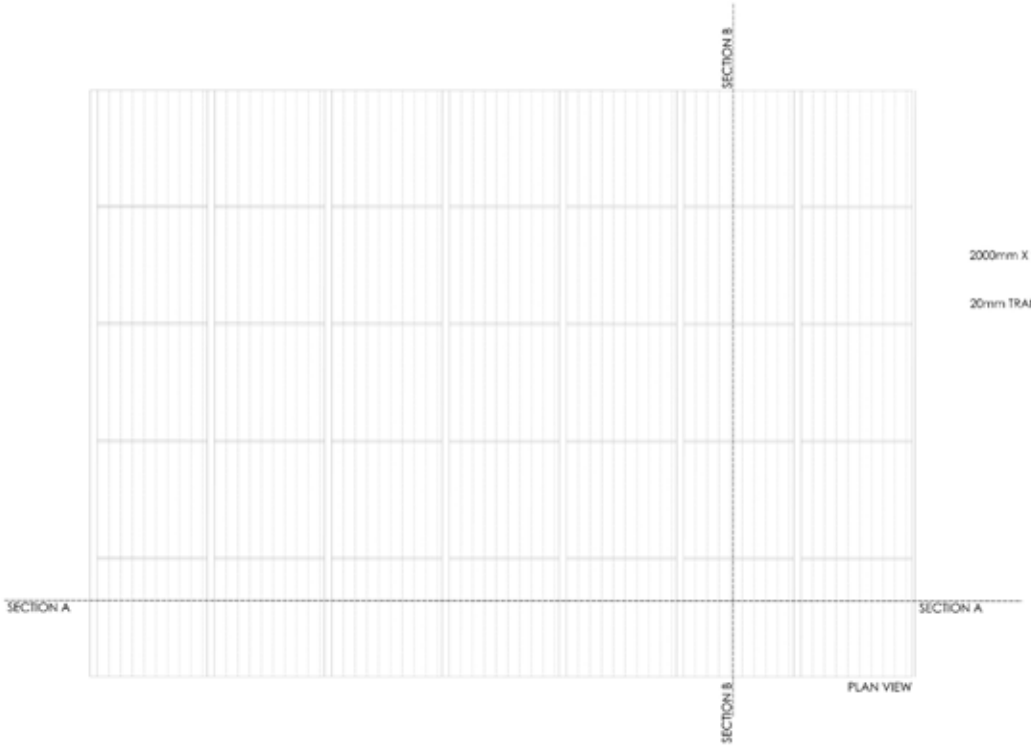
ISOMETRIC VIEW



SECTION A

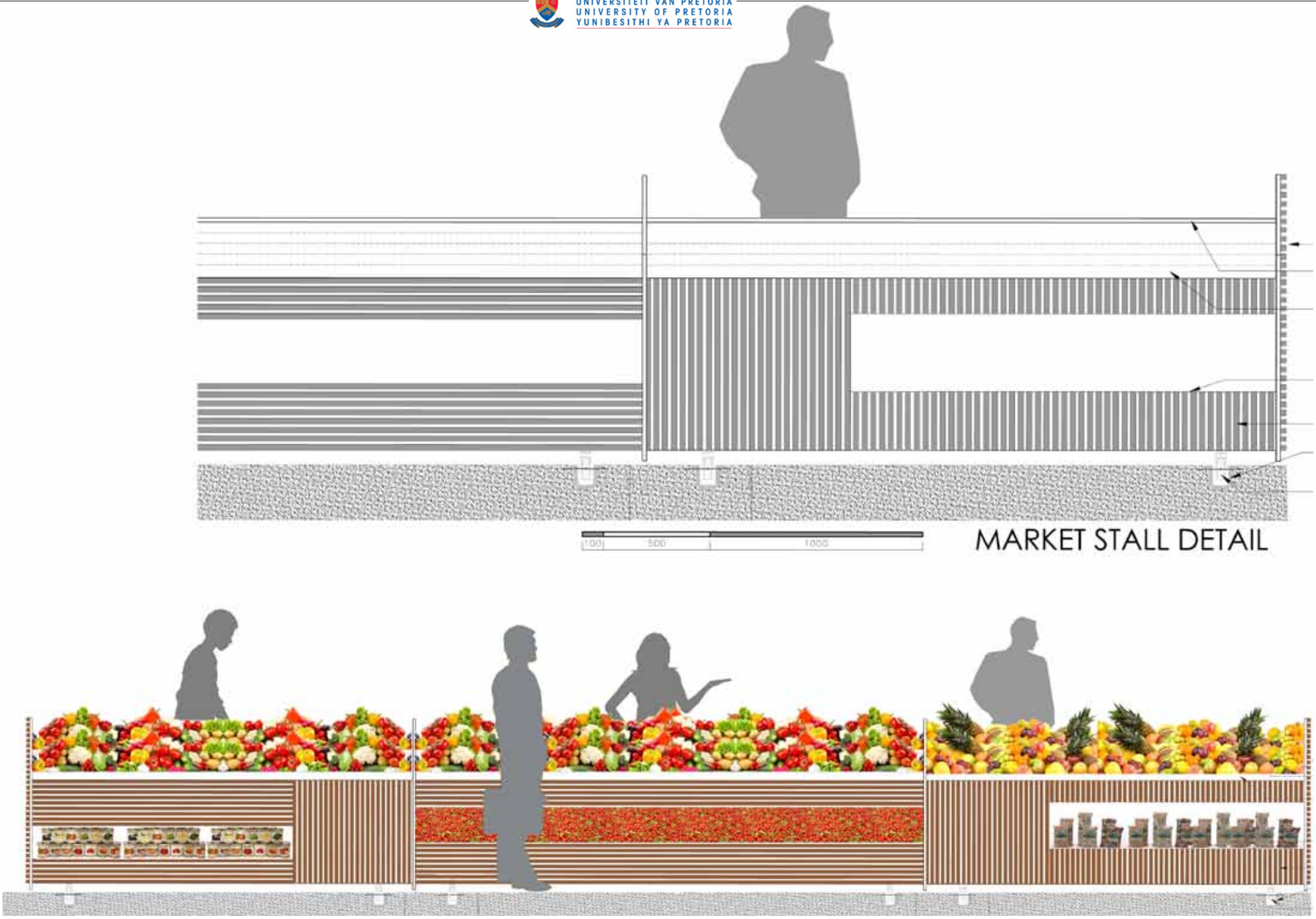
>>132: Powerglass, plexiglass and aluminium louvre roof details.

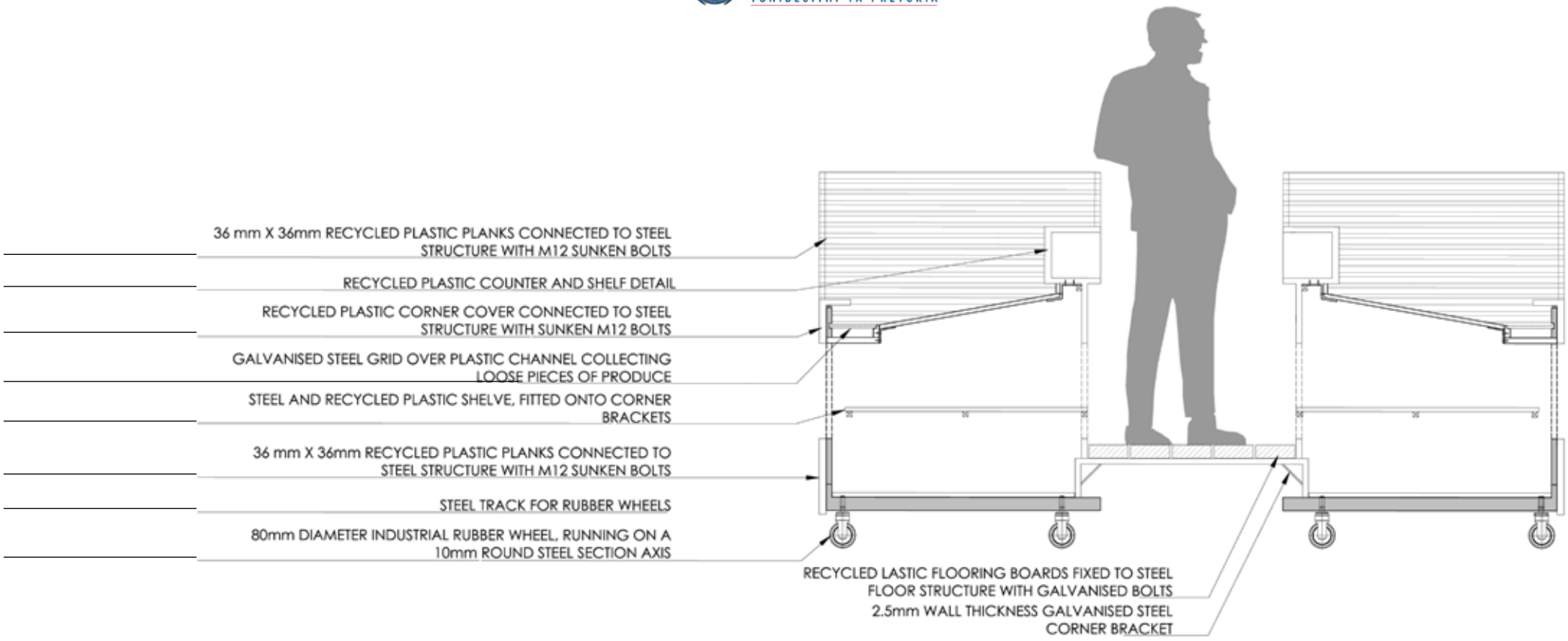


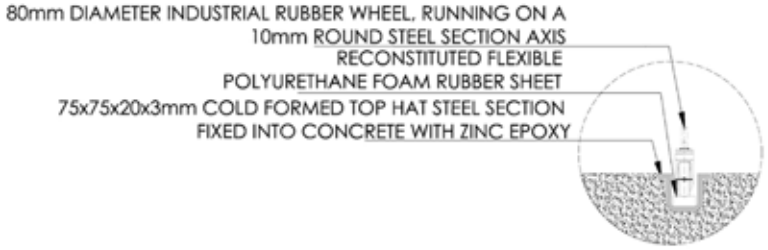


SECTION B

ROOF STRUCTURE DETAIL


100
500
1000
MARKET STALL DETAIL





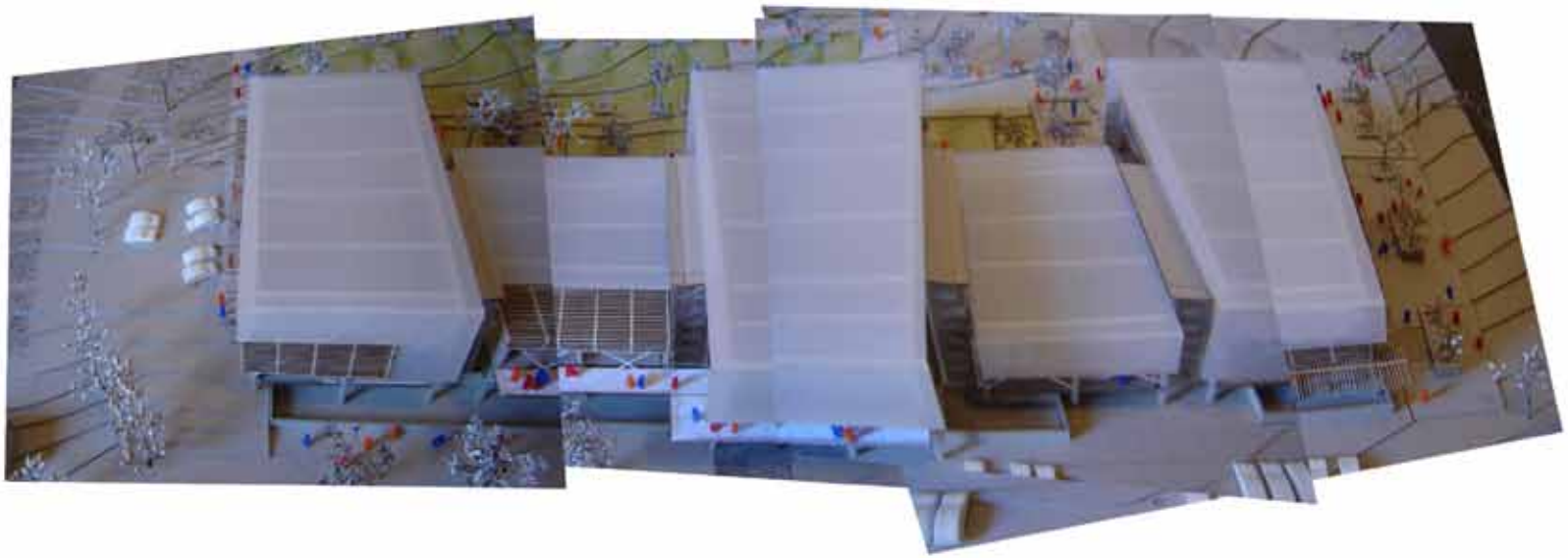
>>133: Market stall detail.









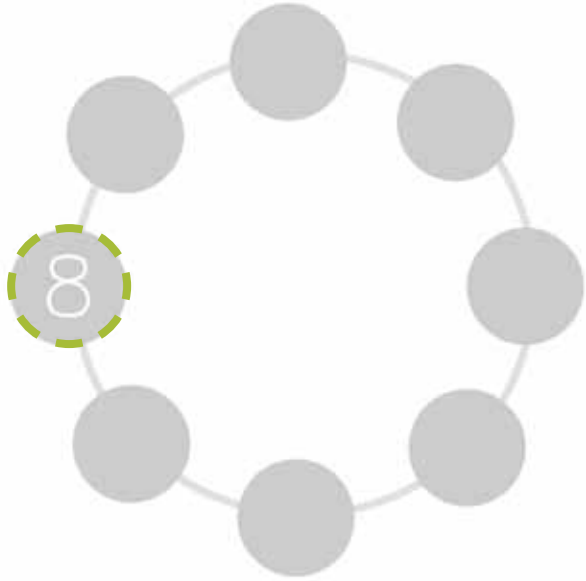


A food system failure was found in our urban systems, creating numerous problems affecting the environment and social well-being. The best way to have considered these issues in landscape and building was to design a food market. By researching food production and retail in urban areas and proposing a way to improve the current food situation, this market could now be supplied of fresh produce mainly from areas within a 10 km radius (except for dairy and meat products). This is possibly how the 21st century food market should operate. By reusing all of its waste to create for example compost and fertilisers, this building is no burden to the environment.

Food markets of the future should be honest in food production and be unpretentious in its being, opposite to the supermarkets that form part of our daily lives.
By challenging the current supermarket culture, integrity is replaced into our city, creating a healthier and more knowledgeable citizen and environment.

The social wellbeing of urban dwellers are improved by encouraging interaction between producer and user, and the creation of active communities. The market is a platform for users to interact with people of all walks of life and the environment.

The market building should be able to grow together with this precinct and new business centre of the City of Tshwane, by including flexibility into the structural design. The future of this market is to be a place of connection and health in an otherwise busy and chaotic city life. The wellbeing of users and our environment should stay the focus of this market.
The market should become a place in the city of: engagement, belonging and celebration.



Conclusion

List of Illustrations

List of Tables:

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Beceri, B. 2004. *Working in the Virtual Space: Sonae Imobiliária, the Parque Dom Pedro Shopping Mall, and beyond.* USA: Harvard Design School.

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