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VITALITY SQUARE

Creating a healthy environment in the Pretoria CBD

A Verster 24017486

Studio Master: Jacques Laubscher
Study Leader: Rudolf van Rensburg
Mentor: Gary White

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SINOPSIS

Hierdie skripsie handel oor die skep van holistiese gesonde omgewings in 'n stedelike konteks.

Die Pretoria Sentrale Besigheidsdistrik is die fokusarea, omdat dit is waar baie mense hul werksure in kantore deurbring. Die skripsie stel 'n lewensentrum voor, waar gesonde omgewings en gesonde lewenswyses aan die gebruikers beskikbaar gestel word. Dit behoort 'n stedelike oase te word wat lewenskragtigheid van die verstand, liggaam en siel aanmoedig.

Die hipotese argumenteer dat die probleme wat met ongesonde omgewings verband hou, opgelos kan word deur die nouer verband tussen die mens en die natuur. Die fokus is nie net op die fisiese nie, maar ook op die metafisiese kwaliteit van argitektuur en sy invloed op die gebruiker. Die vier elemente van die natuur (lig, lug, grond en water) word in die gebou verwelkom. Hulle assosiatiewe kwaliteite word uitgebuit om 'n bewustheid van die aanwesigheid van die natuur te skep, self in 'n stedelike omgewing.

Op 'n fisiese vlak impliseer dit die gebruik van daglig, natuurlike ventilasie en kontak met die natuur in die bou-omgewing.

ABSTRACT

This thesis deals with the creation of holistically healthy environments in an urban context.

The Pretoria Central Business District (CBD) is the focus area, as this is where many people spend their working hours in offices. This thesis proposes a vitality centre where healthy environments and healthy lifestyles are made available to these workers. This should become an urban oasis which caters to the vitality of the mind, body and spirit.

The hypothesis argues that the problems associated with unhealthy environments in buildings can be alleviated through the connection of people with nature and its forces. The focus is not only on the physical, but also on the metaphysical quality of architecture and its influence on the user. The four elements of nature (light, air, earth and water) are invited into the building. Their associative qualities are exploited to create an awareness of the presence of nature, even in an urban context.

On a physical level, this association implies the use of natural light, natural ventilation and contact with nature in the built environment.



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1

In considering what constitutes a healthy environment, the theories of Ando, Pallasmaa, Millet and Norberg-Schulz were consulted.

THEORY

1 THE PROBLEM

The issue of health is a primary concern in contemporary society. Stress, unhealthy eating habits and lack of exercise are all contributing to the degradation of health. In South Africa, about 33 people die per day as a result of heart attacks; 60 because of a stroke; and 32 men and 68 women die as a result of being overweight (www.heartfoundation.co.za).

THE RAT RACE

Health is closely linked to lifestyle. Life in contemporary society is often rushed, stressed and unhealthy. For those with careers, life is focussed on work, and on being successful. The healthy work/play balance very often tips more towards the work side. Consequently, workers often suffer from stress and related illnesses. Only in the absence of health does it become a priority - often too late.

As a result of this stressful lifestyle the issue of personal health is a popular subject. Various forms of media deal specifically with this issue, such as the Shape, Longevity and Men's Health magazines; television programmes like *Your Good Health*; and dedicated websites like www.health24.com. People are concerned about their health and need to become pro-active in order to improve it.

WORKING IN THE CITY, LIVING IN THE SUBURBS

The physical shape of the city also impacts on lifestyle. In Tshwane, residential and work areas are mostly segregated. The Pretoria CBD is traditionally a mono-function city, and workers commute into the city from the suburbs. Heavy traffic to and from the CBD means that workers spend many hours a day commuting between work and home. In addition to this, there is also a scarcity of amenities catering to the needs of professionals in the city. Due to this scarcity, activities that could be done in lunch hour have to be done outside office hours, and in residential areas. This leaves even less time for home life, leaving people emotionally unfulfilled. The link between emotions and health is well-known. More time spent with family results in happier, healthier workers.

In addition to stress, workers may also suffer from mental fatigue. While stress is caused by anticipation of a dreaded event, mental fatigue is the result of constant work. To combat mental fatigue, workers need a healthy work/play balance (Kaplan & Kaplan, 1989: 178).

A healthy balance between work and play and a healthy home life is very important to maintain overall wellbeing.



BUILDING ENVIRONMENTS

Human environments may also contribute to the degradation of human health. Workers spend many working hours inside office buildings. These office buildings often host artificial environments, inadequate lighting and ventilation, and are disconnected from their surroundings. Some of these buildings may also suffer from Sick Building Syndrome (SBS). Sick building syndrome causes chronic symptoms (such as sinus and dry eyes) and detracts from employee productiveness (Day, 1993: 36). Unhealthy environments contribute to feelings of lethargy in their users, and even lead to depression in some cases.

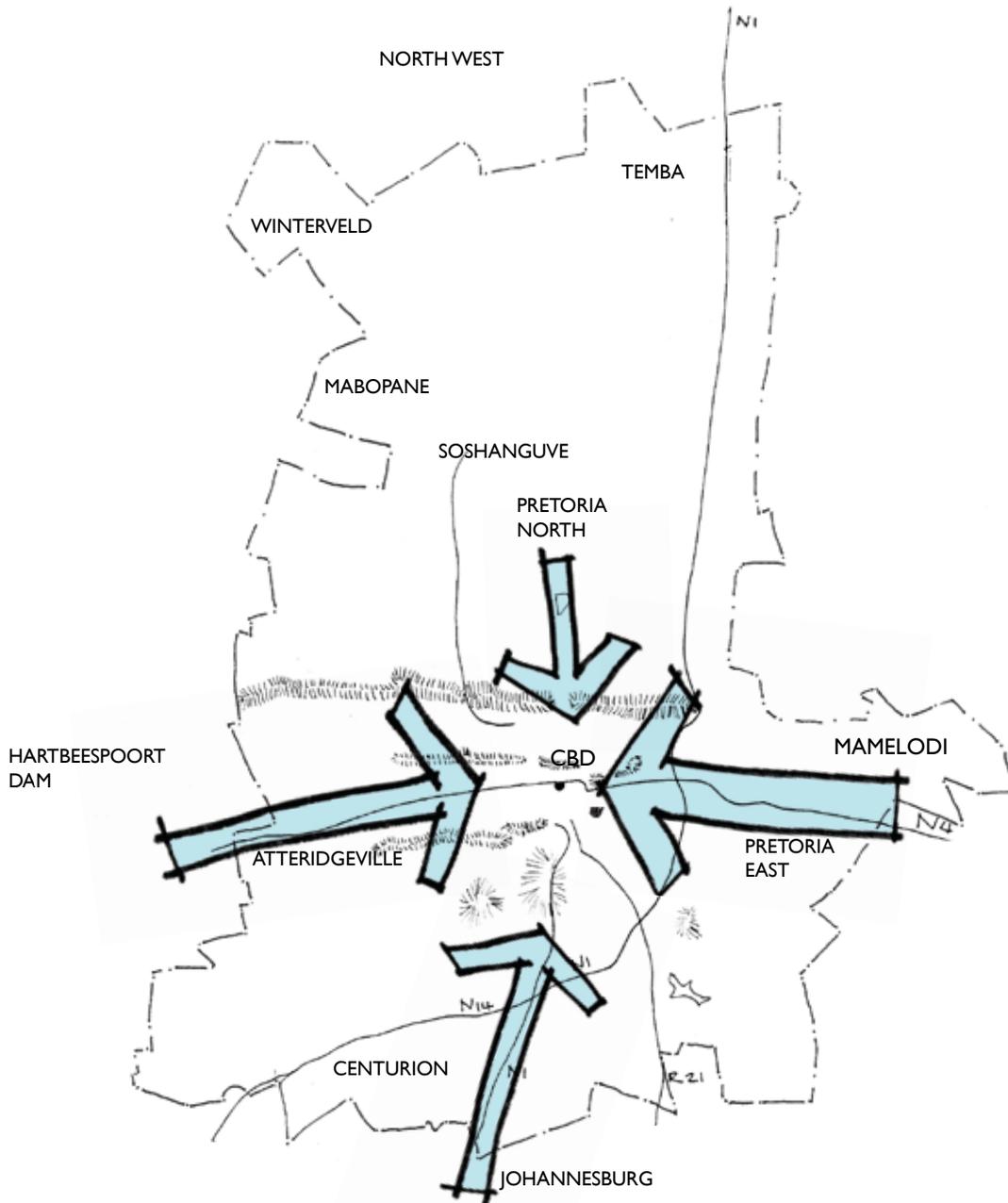


Fig 1.3 DAILY COMMUTING INTO THE CBD



2 THE SOLUTION

SHIFTING THE FOCUS FROM ILLNESS TO WELLNESS

Health is defined by the *Oxford Dictionary* “the state of being free from illness or injury.” This is the view often held about health in society. An alternative and more holistic definition of health is provided by *Mosby’s Dictionary of Complementary and Alternative Medicine* as “a state of well-being that takes into account an individual’s physical, mental, and emotional vitality and desires”. Health should be viewed as a positive aspect of life, which encompasses all actions, and which is involved in all facets of life.

Alexander (1977:252) advocates this focus on wellness and not on illness: “A system of health care which is actually capable of keeping people healthy, in both body and mind, must put its emphasis on health, not sickness.” Focussing on health means focussing on daily activities which promote health.

The practice of health must be made into a habit. There are many facets to health, including exercise, social contact and stress-relief. In order for people to live healthier lives, these facets need to be introduced into their daily routines in the CBD.

Instead of spending lunch hours inside, working (which contributes to stress), workers should have the opportunity to spend this time improving their health, be it physically or emotionally. Lunch hour could be better utilised to include exercise and de-stressing. The extra time usually spent on these activities after office hours can be utilised by relaxing at home. This extra time for relaxation will also contribute to a healthier lifestyle.

Health is not just related to illness. Health should be seen as a lifestyle.

HEALTH PROMOTION

The concept of *health promotion* has been present in the international arena since the mid-1980s. ‘Health promotion’ is defined (www.wikipedia.org) as “the process of enabling people to increase control over their health and its determinants, and thereby improving their health.”

Many international companies have implemented health promotion policies. These policies ensure that employees exercise healthier behaviour, which has a positive impact on their productivity.

Health promotion is possible on a bigger scale. Instead of individual companies implementing policies, a central scheme catering to the employees of many companies can benefit a whole area.

SICK BUILDING SYNDROME

Sick building syndrome can be avoided by careful design. Natural resources such as the wind (natural ventilation) and the sun (daylighting) may be used to create thermal and physical comfort in buildings. Architecture needs to support the health of its occupants, not detract from it. Architecture has the possibility to uplift its occupants, and this opportunity should not be missed. Architecture should never be the source of illness or misery; it should promote the well-being of those who use it.

3 THEORY

INTRODUCTION

The negative legacy of the Modern is a preoccupation with functionality, which led to deep buildings, regulated thermally by central mechanical ventilation. This deep module is still widely used in commercial architecture in South Africa. These buildings often have no connection to their context, and their occupants are wheels in a cog, only there to be as productive as possible. These buildings often house passive spaces in which the occupants are unconscious of their environment.

Ando (1991: 18) states that “up to now, society has not allowed the building of things which cannot be explained in terms of functionality.” He argues that the ‘irrational’, seemingly non-functional quality of allowing nature into architecture is important. He also contests the view of building-occupants as production machines - “...people are not just parts to be plugged into functional spaces but creative, active beings” (Ando, 1991: 18). These ‘creative beings’ need to interact with the spaces they find themselves in.

In contemporary architecture, the focus seems to have shifted from functionality to commercial viability. Spaces are planned to allow for maximum use, and quality is often disregarded in order to cut costs. The comfort and health of the final occupant is very often a neglected component in the design of these buildings. Many of these spaces are too small for comfortable occupation, and are of a generic character.

A new vision is needed, in which architecture concentrates on the wellbeing of the human occupant. Although the current preoccupation with ‘sustainable’ practices often leads to more habitable, occupant-friendly buildings, it is still focused on technology instead of the occupant. In this thesis the author will argue for an architecture centred on the *experience* of architecture which is centred on the occupant, and not on the technology.

Life in contemporary society is often disconnected from the natural environment. Various external stimuli in present-day living also contribute to a disconnection from the self. In order to be truly healthy, humans need to *feel* healthy. Quality of architectural spaces may contribute to this feeling of health.

In order to create an awareness of the self, spaces need to be activated, and a dialogue established between the architecture and the occupant. Awareness of the self will facilitate the awareness of health. Healthy architecture should aim to bring humans in contact with nature, and to make them aware of their own being. For architecture to possess and encourage life, it must engage the user in experiencing the architecture. Pallasmaa (2005: 11) refers to ‘life-enhancing’ architecture, which has to “address all the senses simultaneously and fuse our image of self with our experience of the world.”

In this theoretical discussion, the theories of Tadao Ando on Nature; Juhani Pallasmaa and Christian Norberg-Schulz on Phenomenology and Marietta S. Millet on light are predominantly used as points of reference. The focus is on the metaphysical aspects of healthy buildings, and the author suggests that a deeper connection to nature and to the self contributes to overall health.

METAPHYSICAL ASPECTS OF HEALTHY BUILDINGS

The everyday life-world contains the tangible as well as the intangible (Norberg-Schulz, 1979: 6). In the same way, health is not only a physical state, but also has emotional facets. Physical health can be improved through architectural ergonomics and physically healthy buildings, while the emotional side of physical health is connected to metaphysical aspects of the architecture.

Phenomenology opposes the Modern idea of purely functional architecture, and the house as a “machine for living in” (le Corbusier). Norberg-Schulz (1979: 6) argues that architecture contains meaning, which is evident in the concept of existential space (the basic relationship between man and his environment). Another dimension exists in architecture, which relates to the psychological experience of architecture.

This experience cannot be quantified.

Day (1993: 16) discusses the importance of both the physical and metaphysical aspects of healthy environments: “Architecture has responsibilities to minimize pollution and ecological damage, responsibilities to minimize adverse biological effects on occupants, responsibilities to be sensitive to and act harmoniously in the surroundings, responsibility to the human individualities who will come in contact with the building, responsibilities not only in the visual aesthetic sphere and through the outer senses but also to the intangible but perceptible ‘spirit of place.’”

Norberg-Schulz places a lot of emphasis on the spirit of place (*genius loci*), and its effect on the human experience of architecture. Places have meaning resulting from their association with certain events, uses and history. His concept of *existential space* refers to the basic relationship between man and his environment. He (Norberg-Schulz, 1979: 8) refers to ‘place’ as a “...qualitative, “total” phenomenon, which we cannot reduce to any of its properties... without losing its concrete nature out of sight.”

Pallasmaa (2005: 7) agrees with this notion, stating that “[t]he way spaces feel, the sound and smell of these places, has equal weight to the way things look.”

In order to create a holistically healthy architecture, this metaphysical, connotative aspect of architecture needs to be addressed. A healthy environment should appeal to the psyche, and should *feel* healthy to its occupants.

Kaplan & Kaplan, in the publication *The Experience of Nature: A Psychological Perspective* (1989) investigate the psychological experience of nature, and concludes that contact with nature, even in the smallest degree, has healing properties. Patients in hospital rooms with a view on the outside, recovered faster than those in rooms with windows facing other buildings (Ulrich 1984 cited in Kaplan & Kaplan, 1989). This proves that being in contact with nature makes humans *feel* healthier.



This psychological effect of nature on human health will be exploited in this thesis, in order to create an *emotionally healthy architecture*.

CONTACT WITH NATURE

Nature is often absent in cities. Urban sprawl leads to city centres that are many kilometres away from ‘natural’ amenities. Urban parks and landscaping connect humans to nature to some extent, but in these are irregular connections. Norberg-Schulz states that “[f]or modern urban man the friendship with a natural environment is reduced to fragmentary relations” (1979: 21).

The contemporary city overwhelms humans with information. Cities contribute to visual and aural over stimulation. This detracts the attention from the inner self and disperses it on the cluttered surroundings. In order to reconnect with their inner being, so that they can benefit from true emotional health, humans need to reconnect with nature. The healing power of nature has been proven by Kaplan & Kaplan (see above), and in order to experience this power, humans need to form a new bond with nature. Ando (1991: 460) states that “human life is not intended to oppose nature... but rather to draw nature into an intimate association in order to find union with it.”

The Pretoria CBD is especially disconnected from nature, as it has an incoherent open space system, and many of these open spaces are underutilized due to lack of maintenance and security risks (Sindane, 2006).

Connection to nature may be re-introduced into this urban context in delicate ways. On an urban scale, the *Discover Pretoria* framework aims at reconnecting open spaces in the CBD, and on an architectural scale, this thesis suggests reconnecting to nature by engaging in a subtle dialogue with it. The connection between man and nature need not be explicit; the glimpse of a ray of light is enough to make the occupant aware of nature. The four elements of nature - earth, fire (light), wind (air) and water – may be used to emphasize the role of nature in the man-made environment of the city.

“...man is an integral part of the environment, and ... it can only lead to human alienation and environmental disruption if he forgets that”

Norberg-Schulz, 1979: 23.

UTILISING THE FOUR ELEMENTS OF NATURE TO FACILITATE CONTACT WITH NATURE

The classic four elements of nature emphasize the connection between man and nature. Ando (1991: 19) believes that “nature in the form of water, light and sky restores architecture from a metaphysical to an earthly plane and gives life to architecture”

Of the four elements – earth, light, air and water, the main focus is on light as form-giver, as it has a long legacy in architecture. The author believes that light plays an integral role in the experience of space, and in human health.

EARTH

The presence of earth is given significance by the contrast with the sky. Earth is what grounds us; sky is what sets us free. Norberg-Schulz states that “[t]he sky primarily has “cosmic” implications, whereas the earth may satisfy man’s need for protection and intimacy” (Norberg-Schulz, 1979: 24). This contrast between earth and sky make them inseparable from each other. Neither can exist in the absence of the other.

Norberg-Schulz states that man dwells *between* earth and sky. Thus, the focus of a space may be either on the earth, or on the sky, while at the same time incorporating both.

AIR (WIND)

In this case, 'air' may be translated into 'natural ventilation'. Artificial environments often rely solely on air conditioning for the flow of clean air, but the author believes that natural ventilation is a healthier alternative, especially considering the presence of Sick Building Syndrome in many air-conditioned buildings.

WATER

Places which host water attract people. Properties surrounding dams are sought-after. In the absence of a large body of water, smaller water features may be introduced to connect humans with the healing effect of water. Ando holds the opinion that there is a profound relationship between water and the human spirit (1991: 12).

Water has many characteristics - "it becomes a point of gathering, a source of power, a place of culture and reflection, or a place of limits and imagination" (Betsky, 1995: 12). Architectural properties of water include reflection, movement, tension and acoustic buffering.

The sound of falling water is serene; reflections in water reconnect humans with their environment; the presence of water has a cooling effect on its surroundings. Children play in water on summer days, while parents watch from the sidelines. Water can be both a tranquil and an interactive element.

Betsky proposes the use of water in architecture to oppose the disconnection between humans and nature. She (Betsky, 1995: 11) states that "...if buildings divorce us from nature, both to protect us from the elements and to erect a more rational human realm in its stead... the sensual play of water reconnects us."

LIGHT (FIRE)

Light possesses an almost spiritual quality. It reflects the passage of time, and has physical healing properties, as it produces vitamin D in the body (www.ajcn.org). Light can have a significant presence in architecture. Except for its physical qualities, light also possesses metaphysical qualities.

The intensity of light influences the experience of space. Dark spaces appear to be mysterious; illuminated spaces exhibit their contents. The contrast between the two forms a psychological barrier. Light may be focussed on one spot to emphasise it or diffused to create a homogenous quality of light. The combination of these uses contributes to the complexity of the experience of architecture.

Different levels of light suggest different activities and different levels of interaction with the space. The contrast and manipulation of light and shadow holds many possibilities for the architecture. Pallasmaa (2005: 47) states that "in great architectural spaces, there is a constant deep breathing of shadow and light; shadow inhales and illumination exhales light."

Light is connected to the temporal rhythms of nature. The quality of light changes as the day progresses, and transforms with the seasons. This passage of time is visible in the aging of materials; the play of shadows on a wall. Involving the occupants of the architecture in the passage of time enhances their experience of nature. Ando (1993, cited in Heneghan, 1993: 10), states that "the isolated fragments of light suggest the entire natural world."



Fig 1.6 - 1.8 LIGHT + SKY

“...light, moving in compliance with time reveals the existence of an architecture that is profoundly implicated in the interrelatedness of man and nature”

Tadao Ando, 1993: 24.

INTERACTION WITH SPACE/ AWARENESS OF THE SELF/ DIALOGUE WITH THE OCCUPANT

Body-awareness and awareness of being-in-the-world are pre-requisites to health-awareness. Pallasmaa (2005:64) articulates this: “We behold, touch, listen and measure the world with our entire bodily existence, and the experiential world becomes organised and articulated around the centre of the body.”

An architecture that establishes a dialogue with the occupant makes that occupant aware of his experience and may be used to make him aware of his role in his own health. Pallasmaa states that “architecture articulates the experience of being-in-the-world and strengthens our reality and self” (2005: 11).

This interaction with the environment may be exploited to both ends of the spectrum: *interactive spaces* that make the occupant aware of his own being, and *contemplative spaces*, in which the occupant is unaware of the self. In-between spaces may also exist, in which the occupant is alternatively aware and unaware of his environment.

“Our bodies and movements are in constant interaction with the environment; the world and the self inform and redefine each other constantly. The percept of the body and the image of the world turn into one single continuous existential experience; there is no body separate from its domicile in space, and there is no space unrelated to the unconscious image of the perceiving self.”

Pallasmaa, 2005: 40



CONCLUSION

Architecture influences the daily lives of its occupants. This places a great responsibility on architects, which has often been neglected. Building environments need to support the health of their occupants, and not to negatively influence it.

A healthy environment is one where the occupant is aware of the environment. This refers to two aspects – the natural environment, and the passing of the hours and changing of the seasons; and the immediate physical and metaphysical environment, which is the quality of the architecture.

The metaphysical aspect of architecture may be embraced to expose the spirit of nature and health to its occupants. Connecting humans with their natural environment should contribute to their sense of health and contentment.

Pallasmaa (1995: 71) states that “architecture reflects, materialises and eternalises ideas and images of ideal life.” In this case, the ‘ideal life’ is a healthy life, and architecture has the potential to exhibit this ideal. A healthy life is an interactive life, which is connected to the self, and to nature.

From a psychological point of view, contact with nature has many benefits, including being satisfying to experience; supporting human functioning; permitting people to move about and to explore with comfort and confidence; and fostering the recovery from mental fatigue (Kaplan & Kaplan, 1989: 196).

“Architecture emancipates us from the embrace of the present and allows us to experience the slow, healing flow of time.”

Pallasmaa, 2005: 52.



3 LITERATURE STUDY + RESEARCH METHODOLOGY

Health in an architectural sense relates to the physical as well as the metaphysical. Thus, the author followed two divergent paths in sourcing information. The first collection of information relates to theory on architecture (metaphysical) and the second collection relates to the technical aspects (physical) of creating healthy environments.

For the theoretical investigation, the focus is mainly on nature, and inviting nature into architecture. Phenomenology and psychological data are used as supporting theories on the metaphysical aspects of space, and how they influence the occupant, and thus also his health.

Three authors were identified and examined. Tadao Ando, the acclaimed Japanese architect, theorises about the role of nature in architecture. Various writings by Ando were consulted, including the publication *Tadao Ando: Buildings Projects Writing (1984)* by Kenneth Frampton.

Marietta S. Millet is a professor of architecture at the University of Washington in Seattle. She is a partner in Loveland/Millet Lighting Consultants, and has received many awards for her work with lighting. Her publication *Light Revealing Architecture (1996)* was consulted.

Christian Norberg-Schulz is an architect and theorist, who is interested in Phenomenology. He theorizes about the metaphysical realm of architecture, and the genius loci of places. His book *Genius Loci: Towards a Phenomenology of Architecture* explores these concepts.

Juhani Pallasmaa is an architect and former professor of architecture at the Helsinki University of Technology. The author consulted his book *The Eyes of the Skin: Architecture and the Senses (2005)*, and his article *Hapticity and Time: Notes on a Fragile Architecture (2000)* on the metaphysical aspect of architecture.

A questionnaire (see Appendix C) was formulated in order to quantify the factors which people perceive to detract from or improve their working environments. The opinions of one hundred people were analysed, and these conclusion were made: interior environments which have no contact with the outside; allow for no social interaction; and host artificial environments are perceived to be 'unhealthy', while environments which allow the users control over thermal comfort; allow for views to the outside; and are conducive to social interaction are perceived to be 'healthy'.

Where the technical aspects of healthy environments are concerned, passive systems were researched via *Naturally Ventilated Buildings: Buildings for the Senses, the Economy and Society (1997)* by Clements-Croome and *Sustainability at the Cutting Edge: Emerging technologies for low energy buildings (2007)* by P.F. Smith. A senior researcher at the Council for Scientific and Industrial Research, and one of the creators of the South African Green Star rating tool, Llwellyn van Wyk, was also consulted for advice on sustainability issues.

Materials were researched by consulting the web sites of material suppliers. Sizes of structural members were calculated from formulas from *Building Construction Illustrated* by F.D.K. Ching and C. Adams, and standard steel members were sourced from *South African Steel Construction Handbook by the South African Institute of Steel Construction (1987)*.

2



This chapter outlines the aims of the project; programme of the building; as well as the client and financing of the project.

BRIEF

1 AIMS

- _ Creating a tranquil space within the urban context
- _ To reconnect humans with nature
- _ Physically healthy building which contribute to the occupants' health, instead of detracting from it
- _ Making the practice of wellness into a daily activity/ritual

2 DESIGN PROBLEM

Design an urban sanctuary, which people can visit to improve their health. This building must contribute to stress relief, and must provide ample opportunity for social interaction and for meditative isolation. Engage the user in the architecture and in the experience of improving their health. Facilitate a conversation between the user and nature. Use the elements of nature to support this conversation.

Create a physically healthy building, which employs natural ventilation and daylighting. Design spaces on a human scale, to react to human comfort.

3 CLIENT + FINANCING

The client is Discovery Health, the medical aid division of the Discovery group. Working on the principle of 'an apple a day keeps the doctor away', Discovery Health offers the Vitality wellness programme. This programme rewards members for leading healthy lifestyles. Points are earned for every healthy choice members make, such as visiting the gym, running a marathon or buying healthy food.

Discovery Health aims to expand their Vitality programme to include wellness centres, which their members (as well as members of the public) may visit in order to score Vitality points, but more important, to benefit from overall health.

Discovery Health benefits from having healthy members, thus it is in their interest to promote healthy lifestyles to them.

As an authorised financial service provider, the Discovery Group will finance the project privately.

4 PROGRAMME

A vitality centre with the following spaces:

BODY

- _ Health food shop (eg. Fresh & Wild)
- _ Health shop (natural medicine)
- _ Restaurant
- _ Change rooms
- _ Exercise studio
- _ Gymnasium

Sustenance
Healing
Social interaction
Cleansing
Exercise
Exercise

MIND

- _ Book shop + reading room
- _ Media room
- _ Staff room

Learning
Relaxation
Social interaction

SPIRIT

- _ Massage studios, eg:
 - _ Reiki
 - _ Aroma therapist
 - _ Reflexologist
- _ Yoga/Pilates/Thai Chi studio
- _ Contemplation spaces
- _ Group contemplation space

Relaxation

Holistic exercise
Introspection
Social interaction;
Spiritual/Community
meetings/Music recitals, etc.

OPEN SPACES

- _ Semi-public square
- _ Private garden

Social interaction
Relaxation/ Introspection



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Fig 2.1 (top to bottom) PROGRAMME - HEALTH FOOD SHOP; YOGA STUDIO; READING ROOM; SQUARE



3



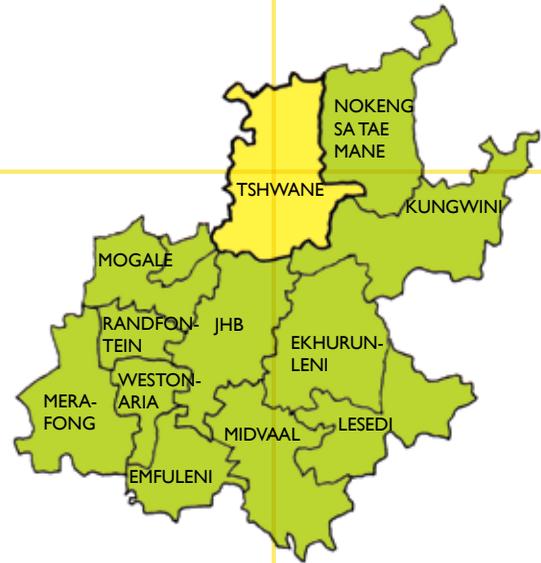
In order to understand the nature of the site, a study was done to analyse the surrounding context.

CONTEXT

Fig 3.1 PROVINCES OF SOUTH AFRICA, GAUTENG AS FOCUS AREA



Fig 3.2 GAUTENG WITH TSHWANE AS FOCUS AREA



1 GREATER CONTEXT

The site is situated in the Republic of South Africa, in the province of Gauteng, in the greater municipal area of Tshwane, in the Pretoria CBD (see figures 3.1 - 3.4).

PHYSICAL ATTRIBUTES - GROUND

GEOLOGY

Andesite and shales of the Pretoria Group underlay the Pretoria CBD (Purnell: 14). This group slopes 30° to the north. Shale is a clay-based soil, which means that foundations to any building in this area must be raft foundations to prevent cracking.

TOPOGRAPHY

Pretoria is situated on the Highveld escarpment. The CBD falls between the Daspoortrand in the north and the Skurweberge to the south. Pretoria is on average 1320m above sea level, with a general slope downwards towards the north (Purnell: 14).

The site is situated 1317m above sea level. It slopes down 1m from the south-western corner towards the north-eastern corner.

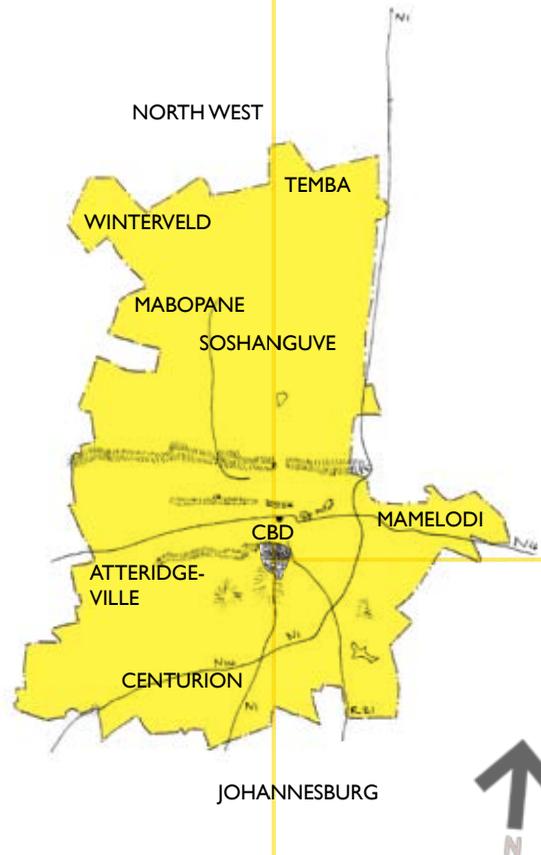


Fig 3.3 GREATER TSHWANE MUNICIPAL AREA; PRETORIA CBD AS FOCUS AREA

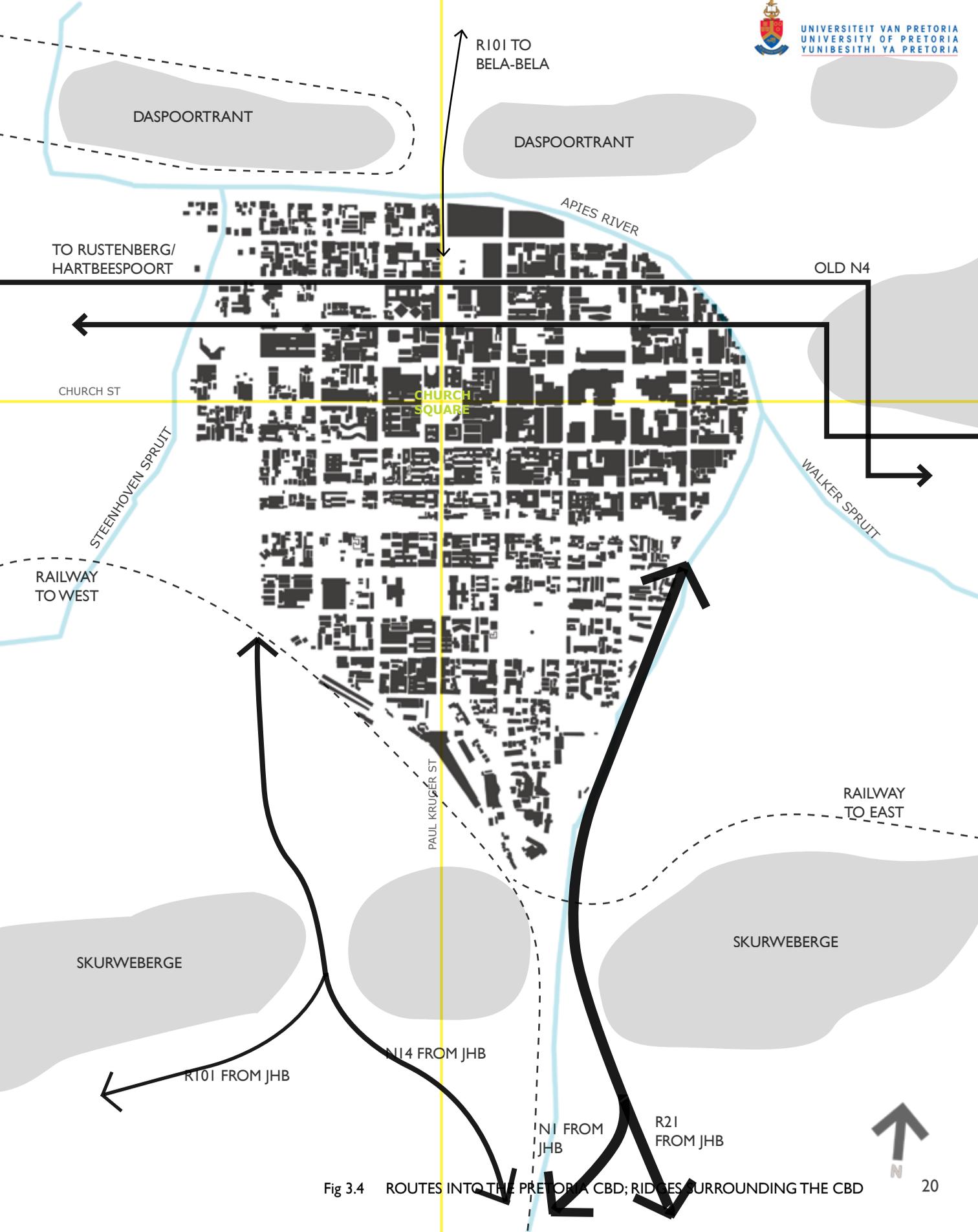


Fig 3.4 ROUTES INTO THE PRETORIA CBD; RIDGES SURROUNDING THE CBD

Ground water generally moves from south-east to north-west in the Pretoria CBD area. Most of the discharge of the Fountains Valley springs is used for water supply to the Pretoria CBD area. This results in ground water which is dependent on rainfall. Ground water levels thus rise and fall according to the amount of rain that the area has received, being shallow in times of high rainfall and deeper in times of drought (Purnell: 10).

The ground water level in the Pretoria CBD is very shallow, ranging between 3m and 6m below natural ground level (Purnell: 11). Basement structures need to be pumped to prevent the ingress of ground water.

2 THE SITE

The CBD is the focus area, as it hosts an abundance of offices, most from the middle and late twentieth century, and most in the preferred typology of the time – deep buildings with fluorescent lighting and air-conditioning. The CBD desperately needs an injection of healthy buildings as an alternative to these environments.

The area north of Church Square, which hosts, among others, the Palace of Justice, the Supreme Court, the Pretoria News offices and the Reserve Bank, is the focal point.

The site is situated on the corner of Mutual Street and Vermeulen Street, north-east of Church Square. It is a greyfield site – it is currently used as a parking lot. There is a slight slope from the south-west corner towards the north-eastern corner of the site. The site is orientated 5 degrees west of north.



Fig 3.5 SITE AND SURROUNDING FABRIC



Fig 3.6 NORTHERN ASPECT - VIEW FROM VERMEULEN STREET



Fig 3.7 NORTH-WESTERN ASPECT - VIEW FROM VERMEULEN/MUTUAL STREET CORNER



Fig 3.8 WESTERN ASPECT - VIEW FROM MUTUAL STREET

3 THE USER

The site was identified for its proximity to the user, as well as for its urban nature.

The user is a white-collar worker in the CBD. Thousands of professionals commute to the CBD for work every day. The Reserve Bank alone hosts 1896 employees (www.magnetcommunications.com). Due to the scarcity of amenities available to them, lunch hours are spent indoors, at workstations, or at one of the three coffee shops in the vicinity (Van Niekerk & Van Niekerk. 2009). There is a gap in the market for amenities catering to the needs of professionals.

According to Van Niekerk & Van Niekerk (2009), buildings frequented by those in the legal profession (see figure 3.9) include:

1. Supreme Court
2. High Court Chambers
3. New Court Chambers
4. Palace of Justice
5. Registrar of Deeds
6. Magistrates' Court
7. Munitoria
8. Law Society

Amenities visited regularly include:

- a. Tribeca coffee shop
- b. Cafe Riche
- c. Wimpy
- d. Restaurant in the High Court Chambers
- e. Cafe at New Court Chambers

Users usually park:

- i. Hallmark Building
- ii. Schubart Street (for Magistrates Court)

It is clear that the amenities and workplaces of the users are concentrated in a small area. The site is ideally situated to cater to the needs of these users.



Fig 3.9 OFFICES, PARKING AND AMENITIES WITHIN A 5 MINUTE WALKING DISTANCE 1:5000 24

4 PHYSICAL ATTRIBUTES

BUILDING FUNCTIONS

Traditionally, the buildings around Church Square host financial functions (banks) and public functions (theatre; government buildings). Buildings in Vermeulen Street host offices and courts of justice, with commercial uses on the ground floor of most buildings.

PRETORIA NEWS

The Pretoria News building comprises commercial uses on ground floor, and 7 storeys of Pretoria News offices above. This building is in the International Style, with a reflective glass façade. Four protruding columns provide vertical emphasis, while metal kick plates accentuate the horizontal aspect of the building.

PIERNEEF MUSEUM

The Pierneef Museum is a two-storey building from the early twentieth century. It was originally used as a cigarette factory, namely the Eureka Factory. Today it houses the Pierneef Museum, exhibiting some of the work of the artist by the same name. Built in an eclectic mix of styles, this building showcases the rare use of the residential atop a commercial use in old Pretoria (Botes & Le Roux. 1991: 62). This building has significant heritage value.

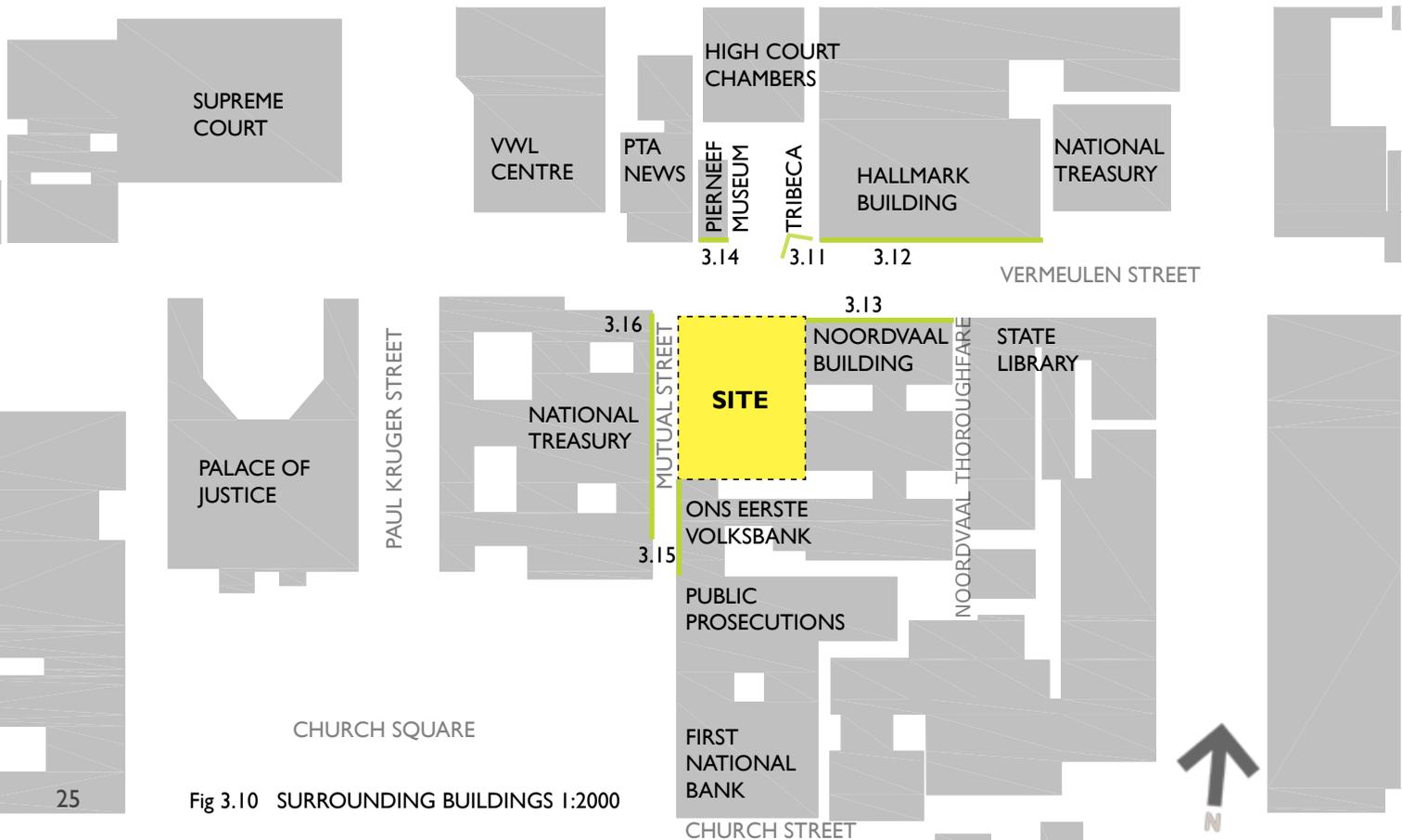


Fig 3.10 SURROUNDING BUILDINGS 1:2000

TRIBECA CAFÉ

Situated on the ground floor of the High Court Chambers, and spilling out into the courtyard between the High Court Chambers and the Pierneef Museum, Tribeca is a café which has a very tranquil ambience despite being situated very close to the bustling Vermeulen Street.

HIGH COURT CHAMBERS

This office tower of 30 storeys hosts the chambers of the High Court. Lower levels of the building in exposed concrete protrude from the ground floor, and step up with terraces until they merge with the main façade on the sixth floor. The verticality of the tower is balanced by the horizontal emphasis provided by exposed fair-face concrete strips, which alternate with reflective glass strip windows.

HALLMARK BUILDING

The Hallmark building has a 3 storey street front, which hosts commercial uses on ground floor. Stepped back from the street is a 25 storey tower, which hosts the offices of the Department of Health. The building has basement parking below. On the street façade, a tiled concrete canopy cantilevers from the first floor to provide shade to the space below. Horizontal metal strips screen the façade from the street and terminate against a tiled concrete coping on roof level.

NOORDVAAL BUILDING

The Noordvaal Building comprises an exposed concrete frame with yellow face brick infill. An exposed aggregate concrete canopy screens the sidewalk from the sun. The street façade comprises steel frame strip windows with alternating painted metal kick plates.

The building consists of 3 north-facing blocks connected in the middle of the blocks with narrow face brick corridors. Steel fire escape stairs are attached to the south- west side of each block.

This 8 storey building hosts commercial uses on ground floor and the Water and Sanitation department of the City of Tshwane Metropolitan Council above. The Noordvaal arcade runs through this building on ground floor level, parallel to Mutual Street, and provides a pedestrian connection between Vermeulen Street and Church Street.



Fig 3.11 HIGH COURT CHAMBERS + TRIBECA



Fig 3.12 HALLMARK BUILDING



Fig 3.13 NOORDVAAL BUILDING

ONS EERSTE VOLKSBANK

This 2 storey building was built of small, red Kirkness face brick. It has a hipped roof of red tiles. The Ons Eerste Volksbank has heritage and cultural value because of its association with the rise of Afrikaner nationalism in the 1930s. It was built as part of the drive to enhance the Afrikaner economy and culture in the Great Depression (Botes & Le Roux. 1991: 70). The building is currently unoccupied, and belongs to the National Treasury.

NATIONAL TREASURY (PREVIOUSLY THE RESERVE BANK)

The National Treasury is a 5 storey building, with its main façade facing Church Square. Designed by Sir Herbert Baker, and built in 1926 in the Italian Renaissance style, its rough sandstone base forms a 2 storey plinth which becomes a balustrade wall above (Botes & Le Roux. 1991: 68). The façade above is of smooth sandstone blocks. A hipped tiled roof covers the building. This building has heritage value.

DIRECTOR OF PUBLIC PROSECUTIONS

The Church Square façade of this narrow 8 storey building consists of polished granite on ground floor and terrazzo on the levels above. Protruding columns create a strong vertical articulation of the façade (Botes & Le Roux. 1991: 71). This building hosts the offices of the Public Prosecutor.

5 METAPHYSICAL ATTRIBUTES - LIGHT + AIR

Environments do not only consist of physical elements. Metaphysical elements, such as environmental quality, also contribute to the overall environment. The author investigated internal environmental quality as well as the environmental quality of surrounding streets.

Fig 3.14 PIERNEEF MUSEUM



Fig 3.15 ONS EERSTE VOLKSBANK



Fig 3.16 NATIONAL TREASURY



INTERNAL QUALITY OF SURROUNDING BUILDINGS

Three of the surrounding buildings were investigated - the Noordvaal Building; the High Court Chambers and the Pretoria News. Aspects which were investigated are lighting; ventilation; contact to nature and general atmosphere.

Overall, the quality of internal spaces may be classified as 'unhealthy'. In all of the buildings, interiors have a generic quality. The Noordvaal and High Court Chambers buildings have internal corridors and offices to both sides, while the Pretoria News has many open plan offices, and only certain offices boxed off. This open plan system is a slight improvement to the central corridor model, as it offers all workers access to a piece of nature (sky), and invites sunlight deeper into the building. All three buildings make extensive use of fluorescent lighting and air conditioning for environmental comfort.

Inadequate solar shading is provided, and is compensated for by the use of air conditioning (all buildings) and curtains (Noordvaal and High Court Chambers). Windows on the Pretoria News facades are tinted, which provides some level of glare control. Windows are mostly either inoperable (Noordvaal), or left closed, as they interfere with the air conditioning. These are the only contact with nature (sky). Some of the employees think that the buildings they work in are very unhealthy, as the conditions are dry and uncomfortable. Many suffer from dry eyes, sneezing, coughing and chronic cold symptoms (see Appendix C).

SURROUNDING ENVIRONMENTAL QUALITY

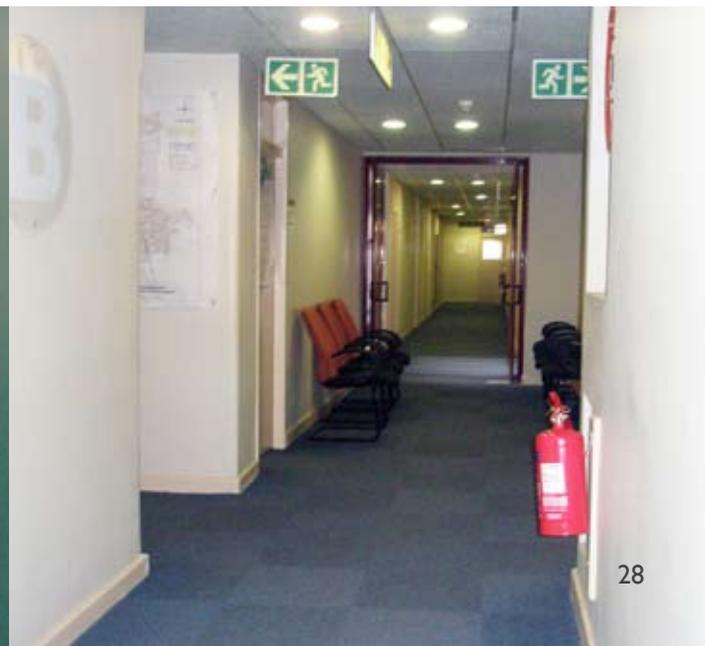
Streets in the vicinity of the site either have a harsh, urban quality to them, or an inviting quality. This may be attributed to the presence of street trees. In the immediate area surrounding the site and to the south thereof, most of the streets have hard interfaces, which are very urban and do not invite the elements of nature in (see figure 3.19 next page).

Although some street trees occur in Vermeulen Street, this street mainly has a harsh quality to it, which may be attributed to its use as an artery from the CBD to the east of Pretoria. Mutual Street does not have street trees, and has a harsh interface, but the southern edge of the street is softened by the view towards Church Square.

Fig 3.17 PRETORIA NEWS INTERNAL QUALITY



Fig 3.18 INTERNAL QUALITY OF NOORDVAAL BUILDING



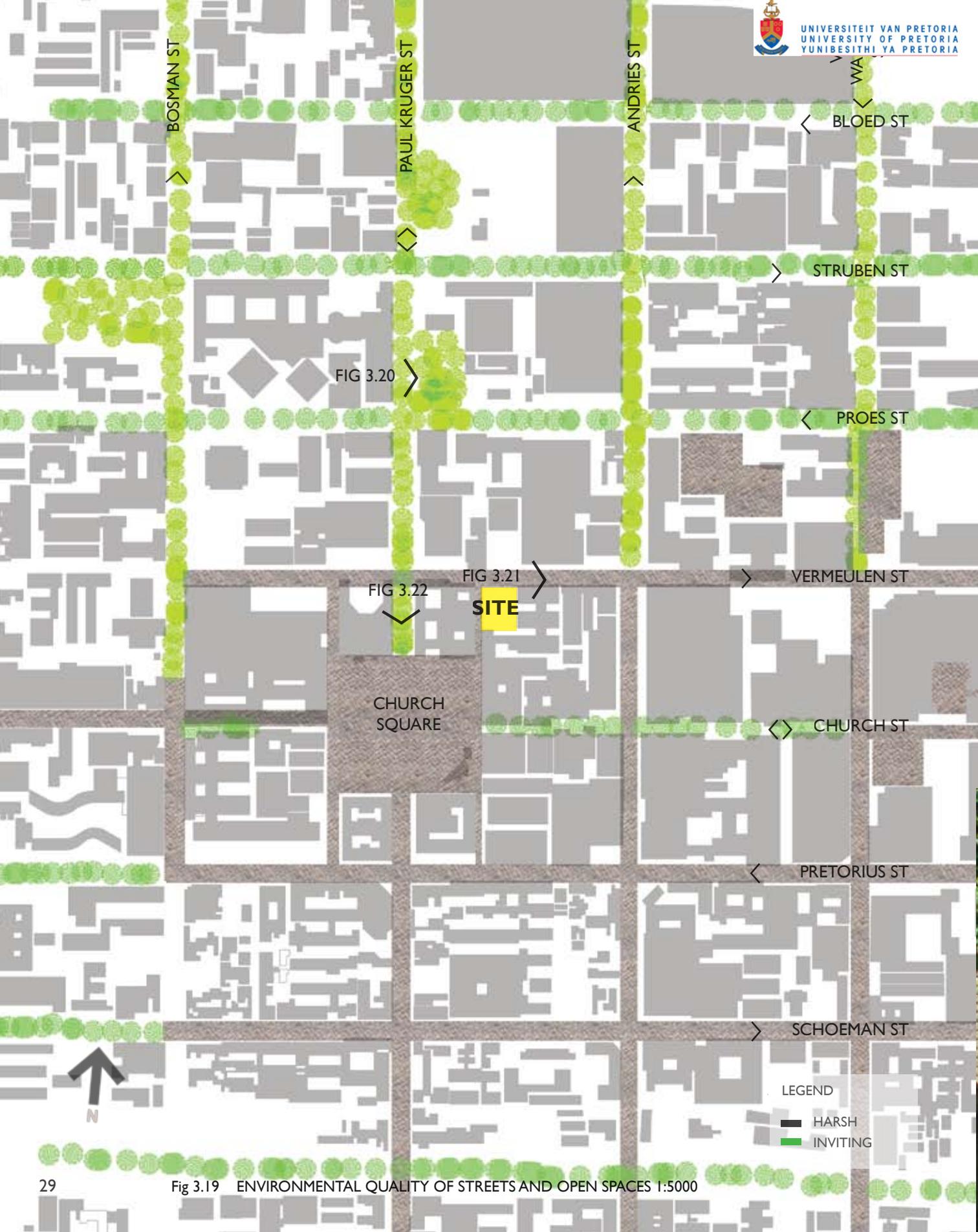


Fig 3.19 ENVIRONMENTAL QUALITY OF STREETS AND OPEN SPACES 1:5000



Fig 3.20 PAUL KRUGER STREET - GREEN SPACE



Fig 3.21 VERMEULEN STREET - VIEW TOWARDS THE EAST. HARSH ENVIRONMENT



Fig 3.22 PAUL KRUGER STREET - VIEW TOWARDS CHURCH SQUARE NORTH - INVITING ENVIRONMENT

The massing and height of buildings in the area exhibit the preferred typology of the period they were designed in. Different models of the 'ideal city' were followed throughout Pretoria's history. Buildings from the 19th and early 20th century form a continuous street edge, and are generally between 2 and 8 storeys high. The height also reflects the importance of the area they surround; buildings adjacent to Church Square were higher than most others of the time.

In the middle and late 20th century, Le Corbusier's ideal of a 'city in a landscape' was followed. This was the era of the motor car, and the city was designed for them. Towers were the preferred typology in the middle and late 20th century, as the High Court Chambers and VWL centre show.

In contemporary urbanism, the focus has shifted from the fast-moving motor car to the pedestrian, who experiences the city at a slower pace, and from eye level. Interactive street edges and human scale is important, and will enhance the quality of this urban environment.

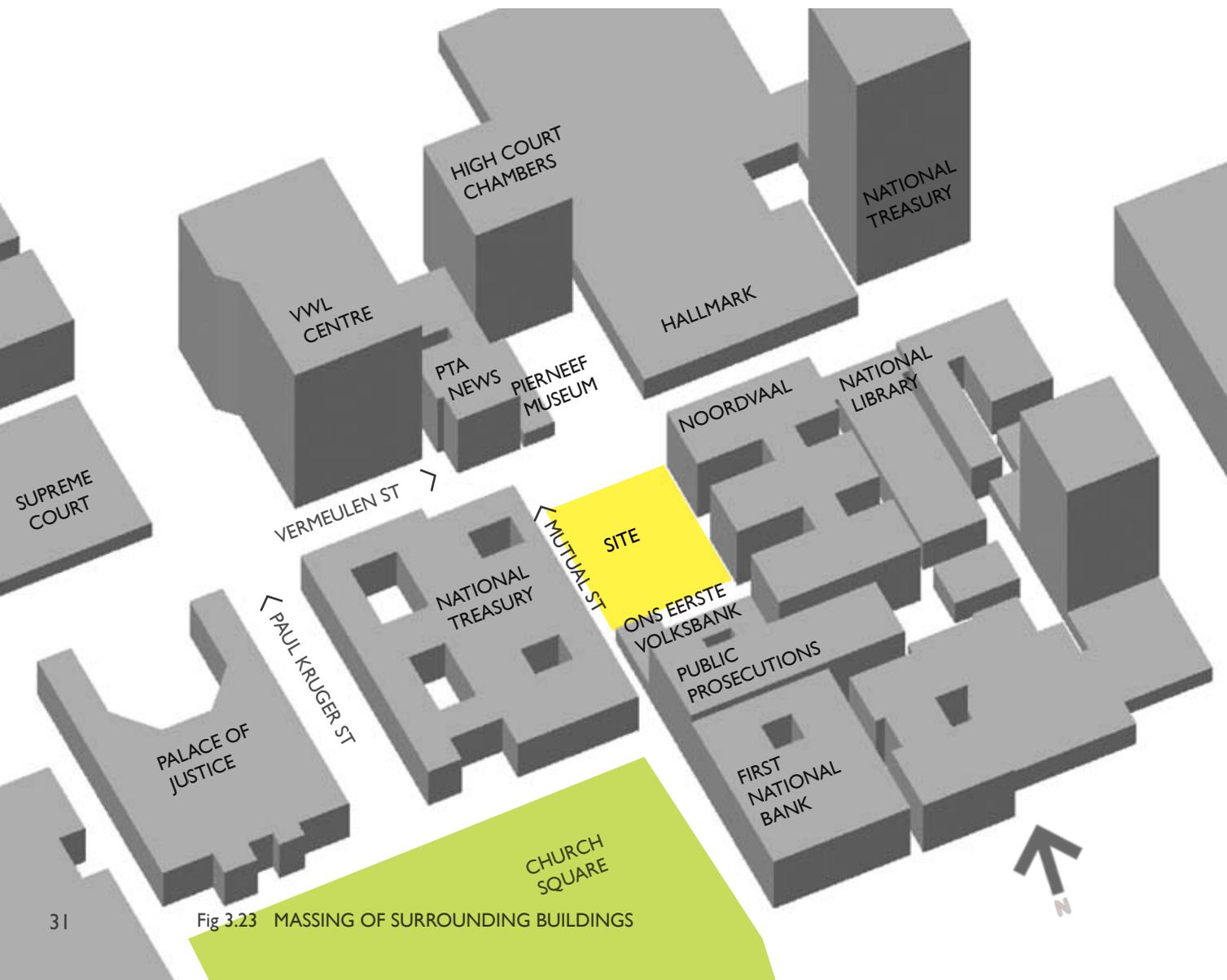


Fig 3.23 MASSING OF SURROUNDING BUILDINGS

MACRO CLIMATE

LIGHT

Pretoria is situated in the Highveld eco-region, which has a temperate climate. The average summer maximum temperature (January) is 29°C; the average minimum 18°C. In winter (June), the average maximum is 19°C; the minimum 5°C. Pretoria receives an average of 13.7 hours of sunshine per day in January, and 10.6 hours in June (Schulze. 1980: 22). The quality of daylight in Pretoria is bright, and can often be harsh. Façades which are exposed to direct sunlight thus need to provide solar shading in order to avoid glare and to prevent the interior of the building from heating up too much.

WATER

Pretoria has an average yearly rainfall of 674mm, with summer rainfall, between December and February. January has the highest average rainfall in 24 hours, which is 160mm. Rainfall in this area is characterised by thunderstorms (big amounts of rainfall in a small amount of time) and the area tends to suffer from drought periodically (Schulze. 1980: 23). To cater to these conditions, rainwater outlets and down pipes must be adequate, and rainwater harvesting may be utilised to cater for the dry months.

AIR

Pretoria is a wind-calm region. Average wind speeds in summer are 5.5km/h and 2km/h in winter. During thunderstorms, NNE winds reach around 6km/h, but wind is mostly in the ESE direction in summer and SSE direction in winter. On winter afternoons, winds can reach up to 12km/h in the NNW to WNW direction (Schulze. 1980: 235).

METAPHYSICAL IMPACT OF THE CLIMATE

HEALTH IMPACT OF THE TEMPERATE CLIMATE

Pretoria is situated in the Highveld grassland biome. Many different species of grasses, as well as of flowering plants occur in this region. These flower in the spring, and cause the onset of hay fever and related symptoms, such as watery eyes, a runny nose and sneezing (Boon et al. 2006: 729). Warm summer weather can also cause heat fatigue and fainting.

The Highveld winter is associated with the onslaught of upper respiratory infections - people are more prone to viruses such as the common cold and influenza during this season (De Beer. 2009).

The design of a building thus needs to react to the climate to avoid extreme temperatures, and in order to create a thermally comfortable and healthy environment.

The climate of Pretoria influences the way people use spaces. In summer, people in the CBD walk under canopies for the shade it provides, and gather in shaded spaces. Shadows provide psychological relief from harsh sunlight (Millet, 1996:17). When late-afternoon thunderstorms suddenly break out, the city buzzes with people running for cover and opening umbrellas. In winter, people tend to look for sunny spots to bask in the sunshine.

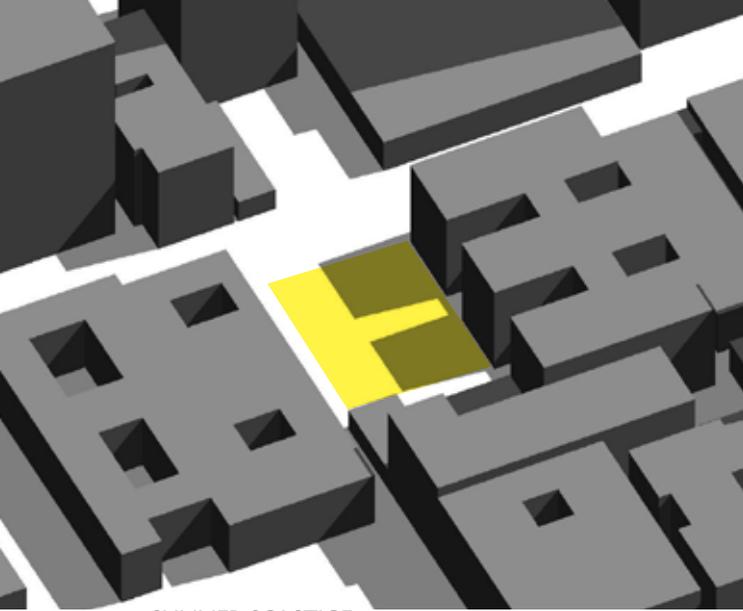
Covered stoeps are popular in South African culture because of their relation to the pleasant climate. The temperate climate of Pretoria makes it enjoyable to spend time outdoors. For a building to relate to the climate, it should also relate to the way people use spaces in that climate.

MICRO CLIMATE

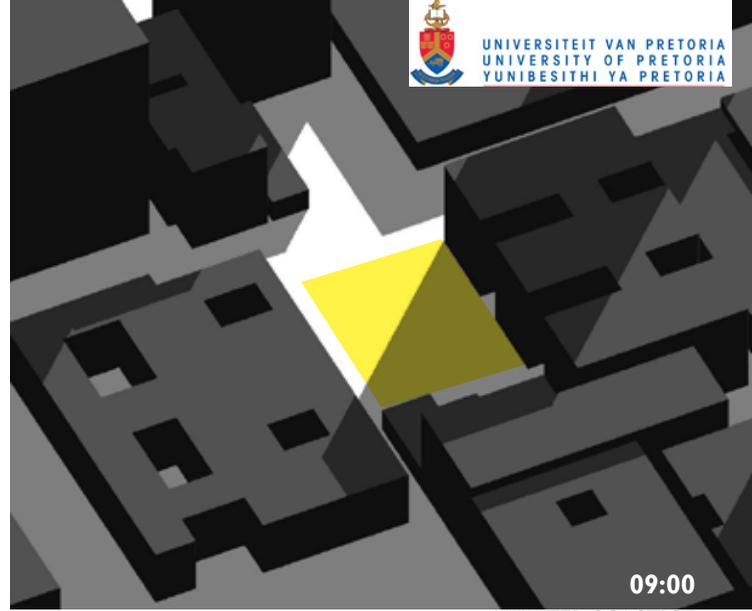
The site is protected from prevailing winds by adjacent buildings. The site receives ample sunlight in summer, and is partially in shade most of the day in winter (see shadow study, figure 3.25).

Summer tends to be hot and wind-still in Pretoria, thus the building needs to make use of solar shading and cooling devices. Although winter temperatures are mild, the building will be in shade for most of the day, and should make use of suitable heating devices.



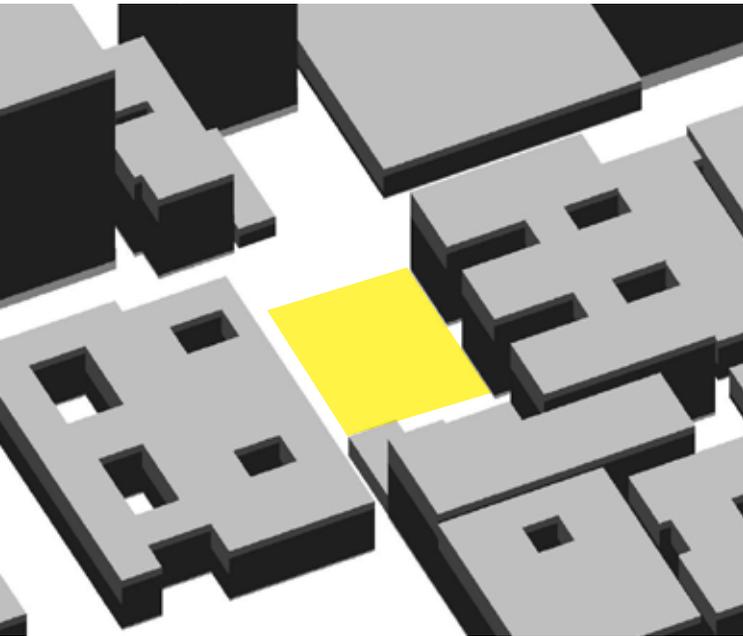


SUMMER SOLSTICE

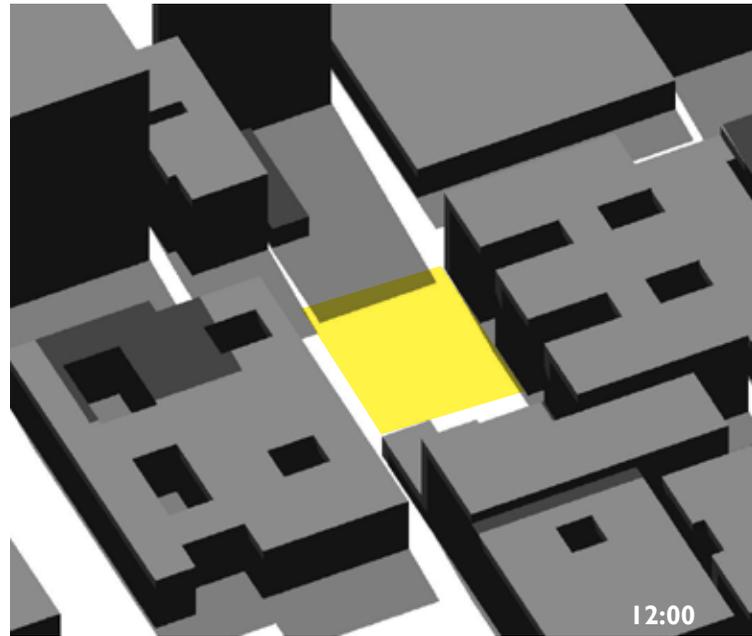


09:00

WINTER SOLSTICE

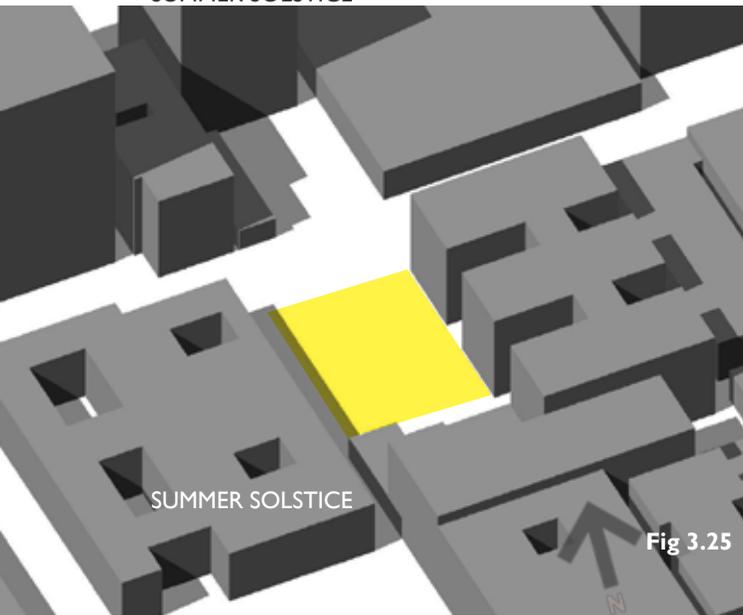


SUMMER SOLSTICE



12:00

WINTER SOLSTICE



SUMMER SOLSTICE



15:00

WINTER SOLSTICE

Fig 3.25

SHADOW STUDY - SUMMER + WINTER SOLSTICE



SWOT ANALYSIS

The SWOT (Strengths Weaknesses Opportunities Threats) analysis presents the strengths and weaknesses of the site. An analysis of the noises in the area and ground floor uses are also illustrated.



Fig 3.26 SITE STRENGTHS 1:2000

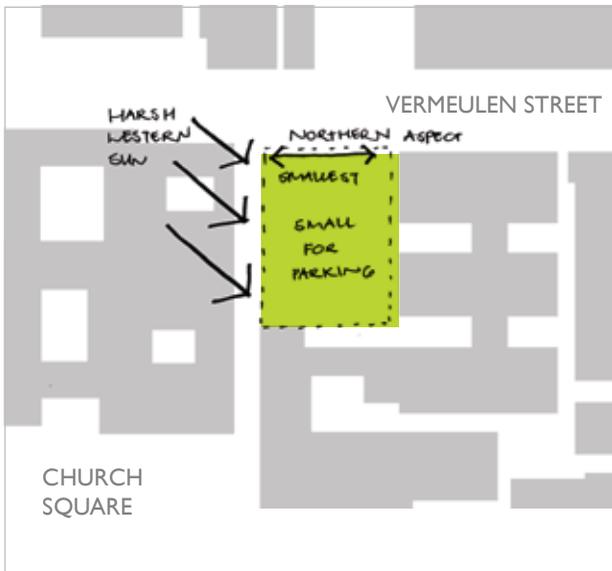


Fig 3.27 SITE WEAKNESSES 1:2000

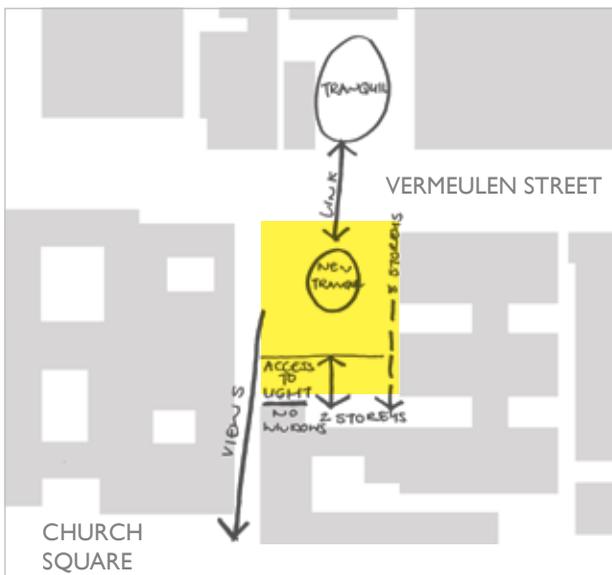


Fig 3.28 SITE STRENGTHS 1:2000

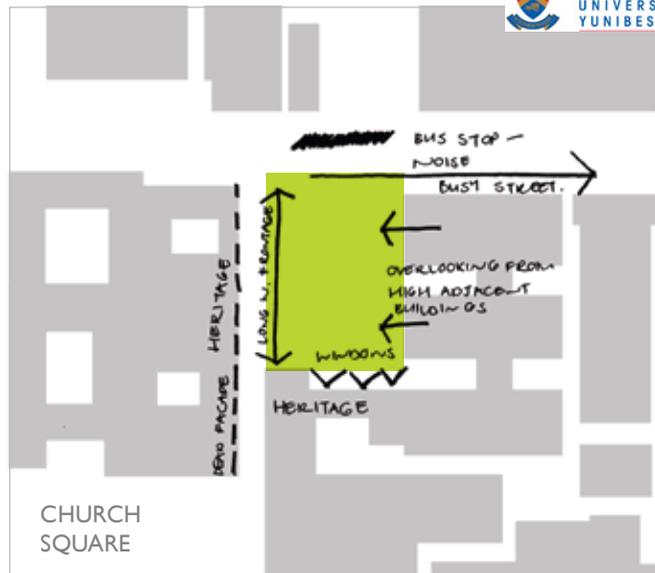


Fig 3.29 SITETHREATS 1:2000

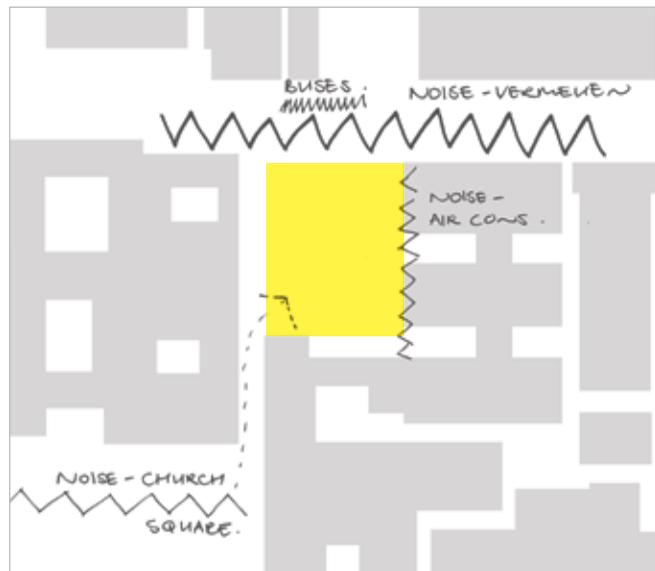


Fig 3.30 NOISE POLLUTION 1:1000



Fig 3.31 GROUND FLOOR USES 1:1000



9 LEGAL SITE INFORMATION

OWNERSHIP

Erven 1/3381 and R/3381 were consolidated in 1991. The servitudes for light and access to R/3381 were cancelled in this process. In 2005, the National Treasury bought the site for R3million, and is currently using the northern part of the site (previously R/3381) for visitors' parking. The Ons Eerste Volksbank (see below) on the previous erf 1/3381 is currently unoccupied, although the National Treasury plans to move some of its offices into the building.

This thesis is based on the assumption that the National Treasury sub-divided Erf 3381 into the previous erven 1/3381 and R/3381. The site for this study is Erf R/3381, which borders Vermeulen Street. It is also assumed that the previous servitudes will be valid once more.

STATUTORY REQUIREMENTS

The site is located in Zone 6: Business 1. Height zone 1 applies, as well as Coverage Zone 1.

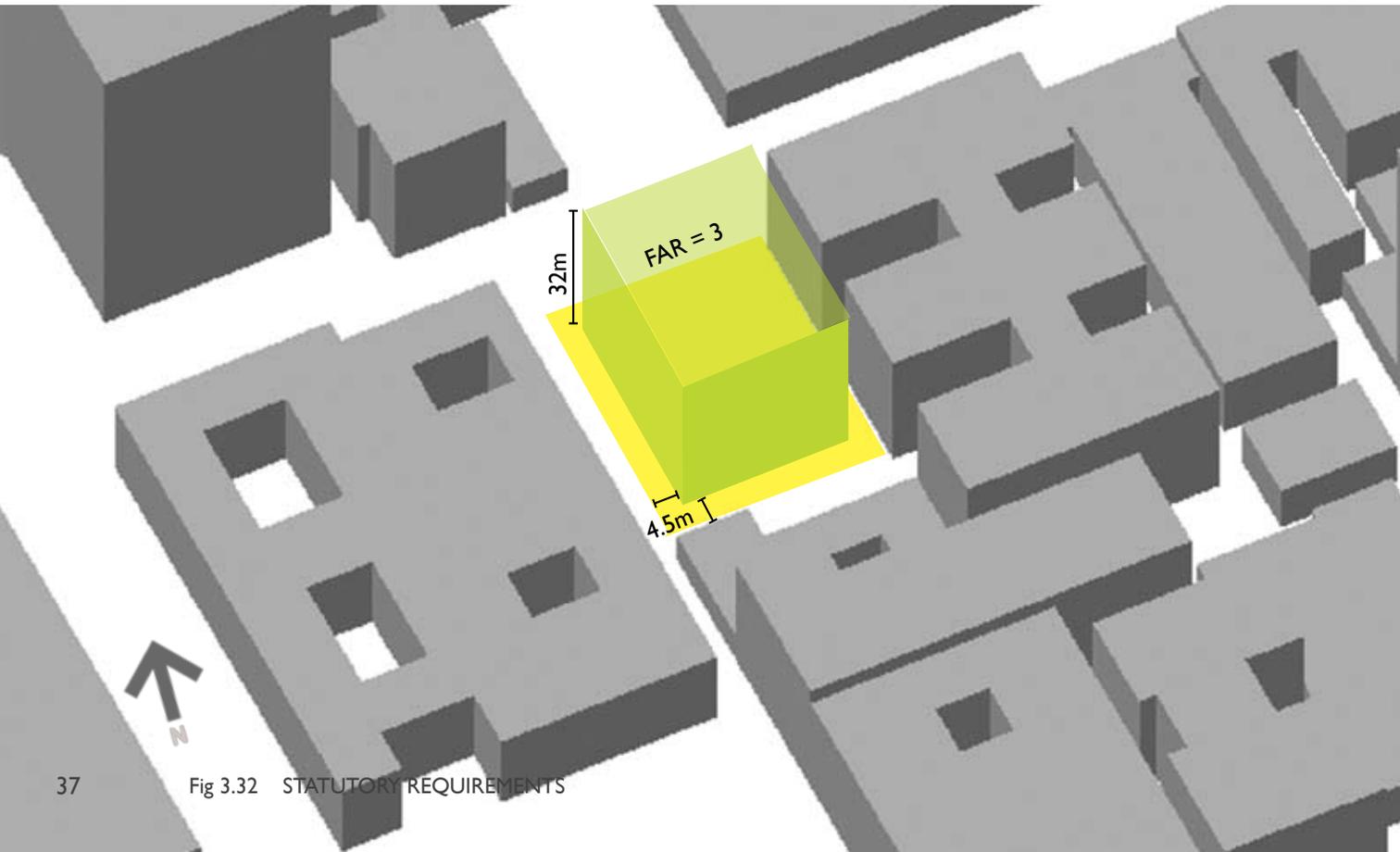
A Floor Area Ratio (FAR) of up to 3 is acceptable. ($1612\text{sqm} \times 3 = 4836\text{ sqm}$).

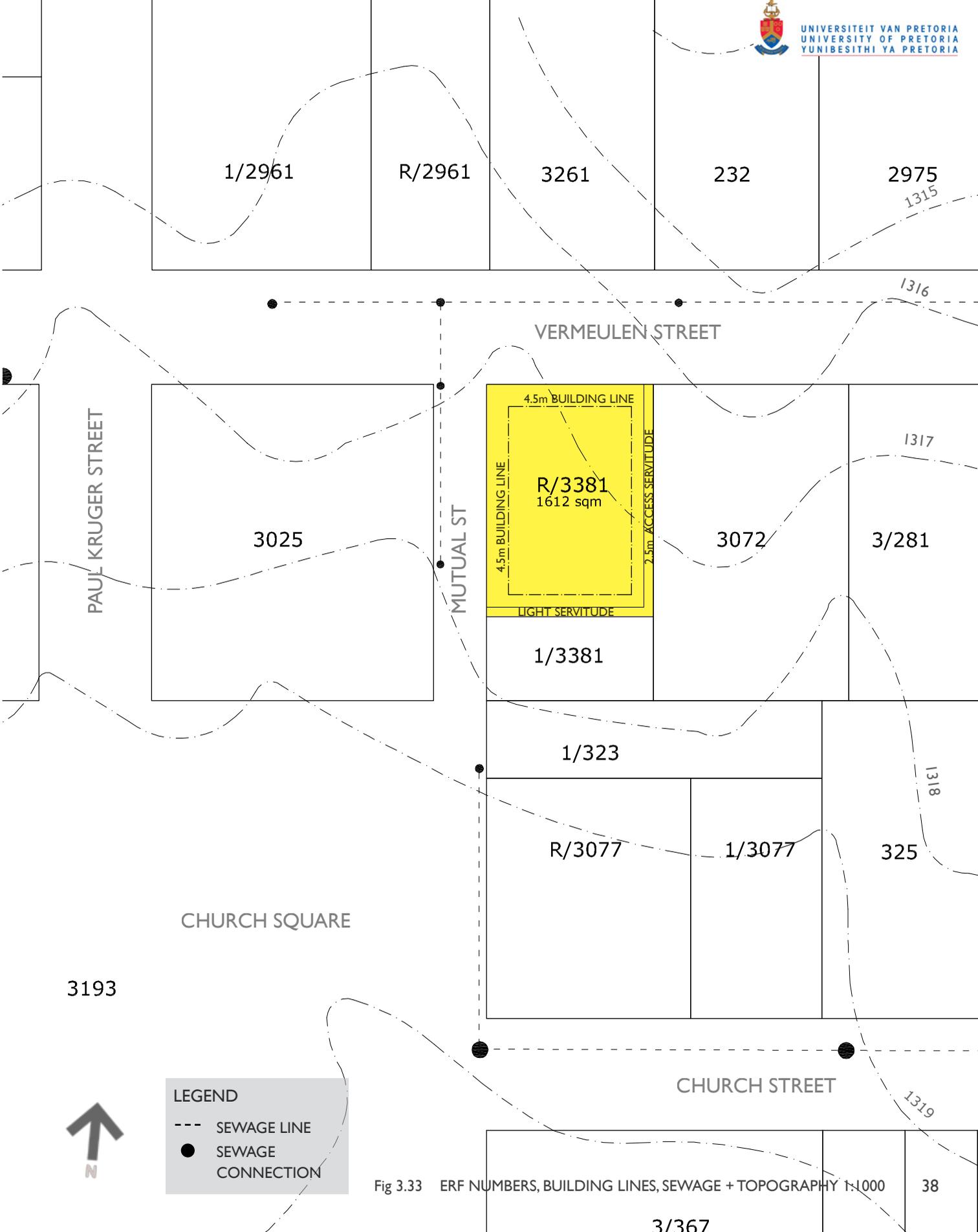
Height max 32m (around 10 storeys)

80% coverage

Building lines 4.5m all around (to be relaxed).

No parking is required on the site, as it falls in Zone A of the Tshwane Town-Planning scheme (see Appendix A).





LEGEND

- SEWAGE LINE
- SEWAGE CONNECTION

Fig 3.33 ERF NUMBERS, BUILDING LINES, SEWAGE + TOPOGRAPHY 1:1000

4

This study of relevant precedents is divided into 3 categories: typological; theoretical and structural. The aim was to get a better understanding of these projects, and to learn from them.

PRECEDENTS

1 TYPOLOGICAL PRECEDENTS

THE ORIGIN OF WELLNESS CENTRES - ANCIENT ROMAN PUBLIC BATHS

The public baths of the ancient Romans (*thermae*) may be viewed as the original wellness centres. These promoted overall health in two components – mind and body. Spiritual health was provided in temples, which were usually situated close to the baths, but did not form part of the bath precincts. Going to the *thermae* was a daily routine for both men and women in ancient Rome (www.vroma.org).

Visiting the baths was a daily ritual and followed a specific pattern. Patrons entered the baths and then changed from their street clothes into suitable clothes for exercising and bathing. Next, they took a dip in a cool pool, before proceeding to the central courtyard (*palaestra*) for exercise. This was surrounded by a shaded *portico*, which led to the baths. After exercising, dirt would be scrubbed off their bodies, and then they would proceed through the various rooms. These rooms ranged from warm dry rooms to hot wet rooms and cold wet rooms. After this leisurely bathing ritual, bathers would proceed to the gardens, library or lecture halls to listen to, and take part in debates, literary readings or to buy a snack from food vendors.

These baths thus had three parts – exercising, bathing and learning. They catered to the body and mind. The baths played an important part in daily life as social and cultural centres (Gardner. 1975: 225). This grouping of these uses together, and the procession through them, emphasised the interconnection between the mind and body, and epitomised the ideal Roman way of a healthy life (Yegül, 1992, cited in www.vroma.org).

CONTEMPORARY WELLNESS CENTRES

The term ‘wellness centre’ may refer to more than one type of function. It is used to describe cosmetic salons; gymnasiums; and spas. This thesis supports the alternative, holistic view of wellness, and views ‘wellness centres’ as places where holistic wellness is promoted; that is, the health of mind, body and spirit.

Typically, wellness centres manifest in one of two types: in natural settings, with mainly spa and cosmetic functions, which are visited once a month; or in existing buildings in urban settings, which usually only cater to the body; with gyms or sports facilities. Many of these centres follow specific aesthetic approaches. The former is generally characterised by the excessive use of stone cladding and other ‘natural’ materials. In the South African context, these wellness centres are usually spas. They also tend to be overly symbolic, and to make excessive use of African traditional architectural styles or materials. These spas are visited at random intervals and do not form part of daily life.

The latter is mostly present abroad, and generally has a very clean and almost clinical character. Gleaming white tiles, bright colours and fluorescent lighting are employed to aid this clinical character, while the interior is no different to a typical gym. Although these wellness centres are visited routinely, they only cater to the needs of the body, and not the mind or spirit.

Neither of these typologies or aesthetics is relevant to holistic wellness. The architecture employed in most of these centres does not relate to healthy environments. Holistic wellness reaches beyond the human realm into the environmental realm, and this should be apparent in these buildings.

THE ALTERNATIVE SOLUTION

This thesis proposes that holistic wellness practices should form part of people’s daily rituals. At the moment, visiting a gymnasium is a daily activity for the user. This activity can be expanded to not only include health of the body, but also of the mind and spirit.

The author proposes a return to the original concept of wellness as an all-encompassing state of being.

TYOLOGICAL PRECEDENT: PROGRAMME

WELLNESS WAREHOUSE KLOOF STREET, CAPE TOWN

**CRAIG MUNNIK (STORE DEVELOPMENT DESIGNER)
2008**

The Wellness Warehouse was conceptualised by Sean and Carlos Gomes. It aims to promote a balanced lifestyle, combining aspects of mind, body and spirit in the programme. The Gomes brothers saw a gap in the market, and researched the concept extensively in South Africa and abroad (www.sacs.co.za).

The Kloof Street store is a 2000m² shop, which hosts six different departments - EatWell, a foodmarket and appliance store; BeWell, the health department, which hosts a pharmacy, NaturalMed dispensary and WellClinic; LiveWell, which supplies environmentally-friendly household products ; LoveWell, which supplies environmentally-friendly baby merchandise; LookWell which sells environmentally-friendly beauty products and houses the WellSpa; and MoveWell, which sells fitness equipment and beds and offers massages. All of these departments also house educational books and DVDs which relate to the topic of the department. This is the first project in the world to combine these different aspects in one shop (www.sacs.co.za). Homeopaths, nurses, dieticians and chiropractors are available at these departments to assist clients. The Warehouse promotes the use of natural medicine as a supplement or alternative to conventional medicine.

The concept behind the design for this store was 'shops within shops', which breaks up the monotony of the big space, and creates visual interest (www.sacs.co.za). Wellness Warehouse won the Retail Design and Development Award for the store design category in 2008, which is awarded by the South African Council of Shopping Centres (SACSC).

Wellness Warehouse specialises in organic produce and environmentally-friendly products and packaging. Here, wellness is not only promoted as a human requirement, but also stretches to include the natural environment, and its health. According to Gomes (www.thepropertymag.co.za), "Our aim for clients is to promote balance in work and play, balance in relationships with themselves, others and the environment." This balance epitomises the concept of holistic wellness.



Fig 4.1 INTERIOR OF WELLNESS WAREHOUSE



Fig 4.2 UMKHUMBANE COMMUNITY HEALTH CENTRE - CHARACTER (top), COURTYARDS (bottom) + CIRCULATION (right)

TYPOLOGICAL PRECEDENT: HEALTHY ENVIRONMENTS

UMKHUMBANE COMMUNITY HEALTH CENTRE CATO MANOR, KWAZULU-NATAL

ROBERT JOHNSON ARCHITECT AND ASSOCIATION IN ASSOCIATION WITH ZAI CONSULTANTS

1993

The Umkhumbane Community Health Centre is a public health facility with an alternative view on health. The centre was conceptualised around the idea of a 'place of wellness', and focuses on health instead of illness. This centre combines multi-faceted aspects of health, and offers counselling on such elements as nutrition, diet and exercise, and also offers urban agriculture. It aims to be a place of "learning, teaching and intellectual exchange" (Anon, 2005: 38).

Different functions are accommodated, such as a maternity unit; eye clinic; pharmacy; physiotherapy and dentistry departments; and occupational therapy workspace. It also offers traditionally 'non-medical' functions, such as an exercise lawn, a community vegetable garden; seminar rooms, research facilities and community rooms (Anon, 2005: 1).

The architects conceived a new health centre typology, which relates to the human condition, and feels healthy instead of sterile. The organisation is also much more straightforward than that of typical health centres.



Fig 4.3 LAYOUT - PLAN 1:1000

The building is organised along a central spine, from which the central functions branch off. Alternating with the health facilities are pockets of open space, which allow sunlight and fresh air into the building, and allows for a connection with nature. The architecture engages the users, instead of alienating them. This results in “places so celebratory that church assemblies gather there on Sundays” (Saunders, 2006:17).

The Umkhumbane Health Centre exhibits health as an everyday activity. Its multi-functional programme encompasses wellness as a holistic concept: the focus is on health instead of illness (Saunders, 2006:17). This building invites the elements of nature into it, and utilizes them as healing elements. This association with nature does away with the clinical sterility which is usually associated with health centres, and creates a humane, healthy environment.

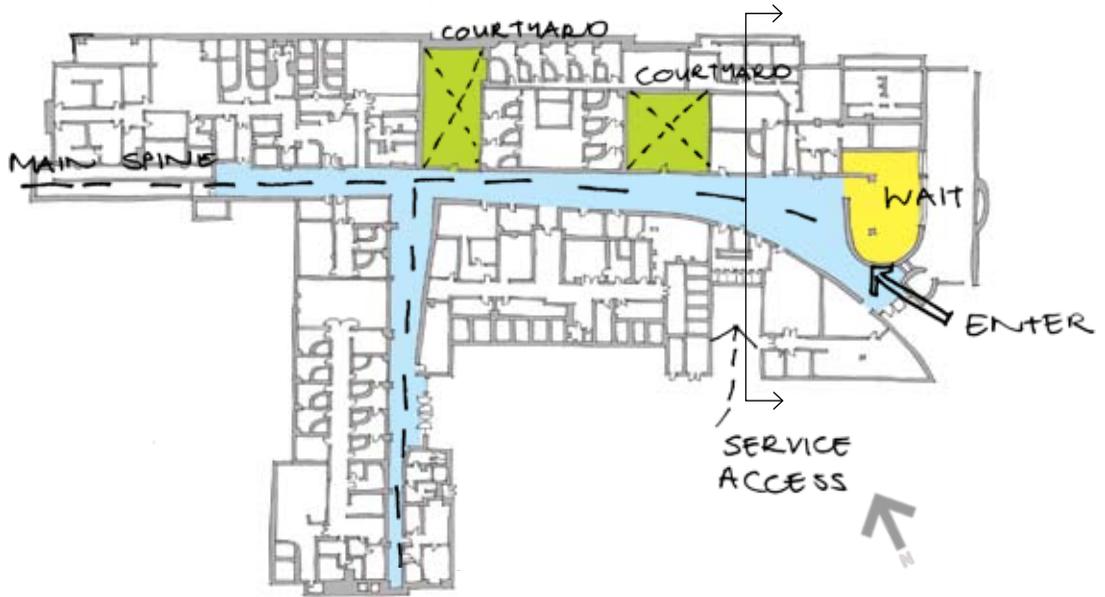


Fig 4.4 CIRCULATION - PLAN 1:1000

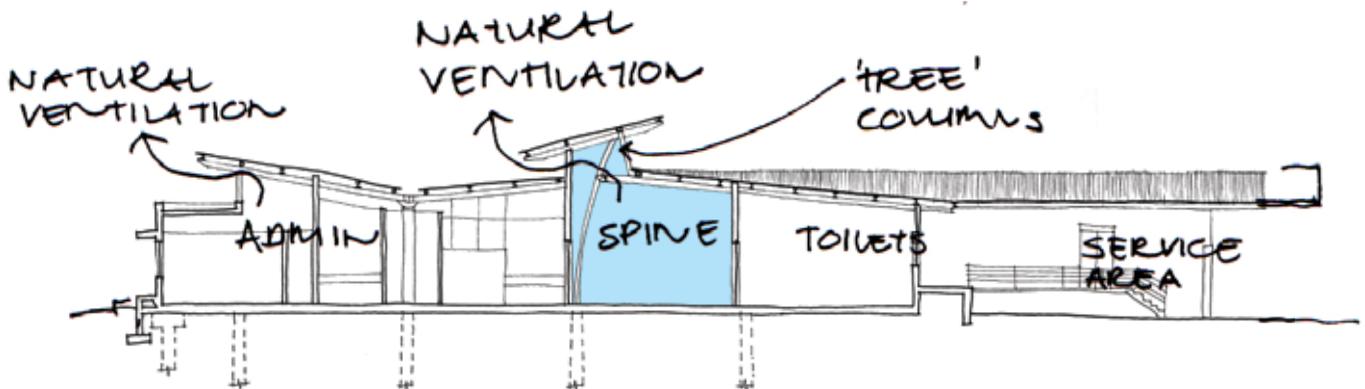


Fig 4.5 LAYOUT - SECTION (n.t.s)

Fig 4.6 LIGHT-FILLED SPACES; THRESHOLDS





Fig 4.7 LA TOURETTE -DIFFERENT QUALITIES OF LIGHT (top + middle); VIEW FROM THE SOUTH (bottom)

2 THEORETICAL PRECEDENT

MONASTERY OF SAINTE MARIE DE LA TOURETTE EVEUX-SUR-L'ARBRESLE, NEAR LYON, FRANCE

ATELIER LE CORBUSIER
1952-59

The Dominican Order of the Catholic Church commissioned Le Corbusier in 1952 to design a monastery near Lyon; a place of retreat, prayer and study (Copans, 2001). The site is situated outside the town on a hill, which is surrounded by open fields on the south and west side, and by trees on the north and east. The site has a view over the valley towards the town. It houses a training school for monks; living quarters (cells); contemplation spaces; a library and a refectory. In addition to these private functions, more public functions are provided, including a church and town hall. Dominican monks live a life of isolation and contemplation, but also serve the community in which they live. Le Corbusier emphasises this duality as juxtaposition in the design of the monastery.

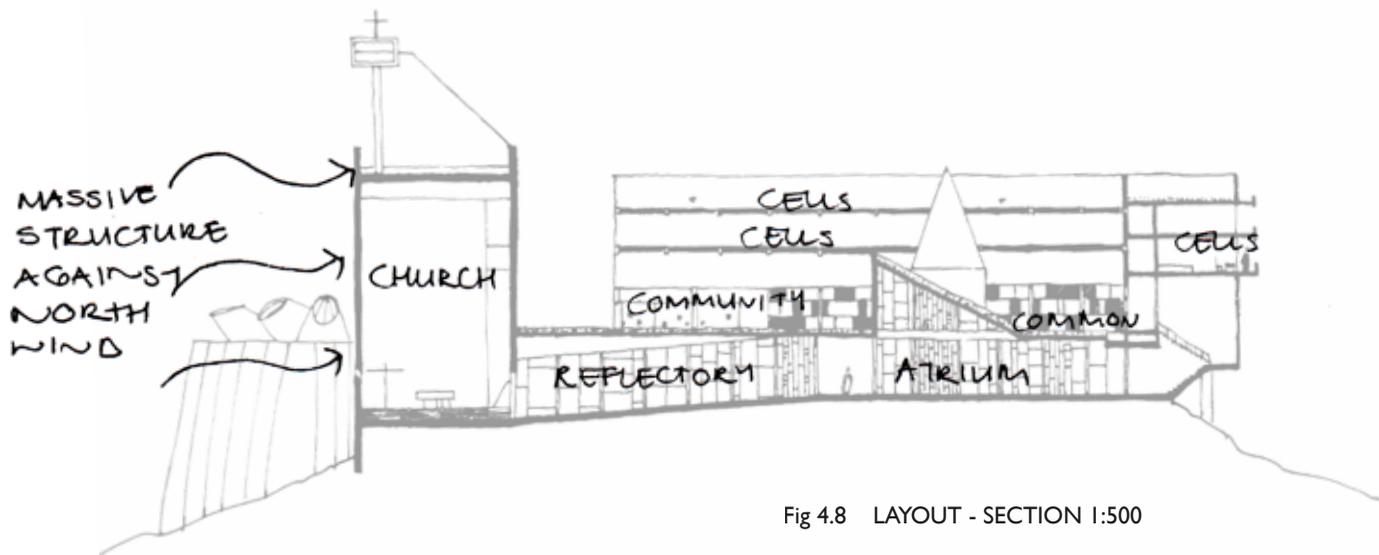


Fig 4.8 LAYOUT - SECTION 1:500

LEVELS OF PRIVACY

The plan of the monastery is a simple form - a courtyard building, with its northern wing (the church) slightly disconnected from the rest of the building. The church, a public building, is physically and psychologically separated from the monastery. Its expression is different from that of the monastery – it is a concrete box with no apparent openings. The façades of the monastery are mostly glazed. This disconnection emphasises the contrast between the public church and the private monastery.

Another layer of privacy is between the individual and the collective. Collective spaces which host interaction, such as the refectory, have unrestricted views towards the landscape. The monks' private cells are long, narrow spaces which are orientated directly towards the landscape, and offer framed views. This treatment of varying levels of privacy and interaction is visible on the north elevation.

Traditionally in monasteries, the courtyard is an open space surrounded by a colonnade which leads to the surrounding wings. This courtyard, however, deviates from the tradition in that it is not open, but houses bridges connecting the different wings. Varying conical shapes form part of this walkway. This creates visual tension, and is in stark contrast with the quiet landscape which surrounds the building. This juxtaposition signifies the contrast between man (courtyard) and nature (outside). Man is chaotic, while nature is calm (Copans, 2001).

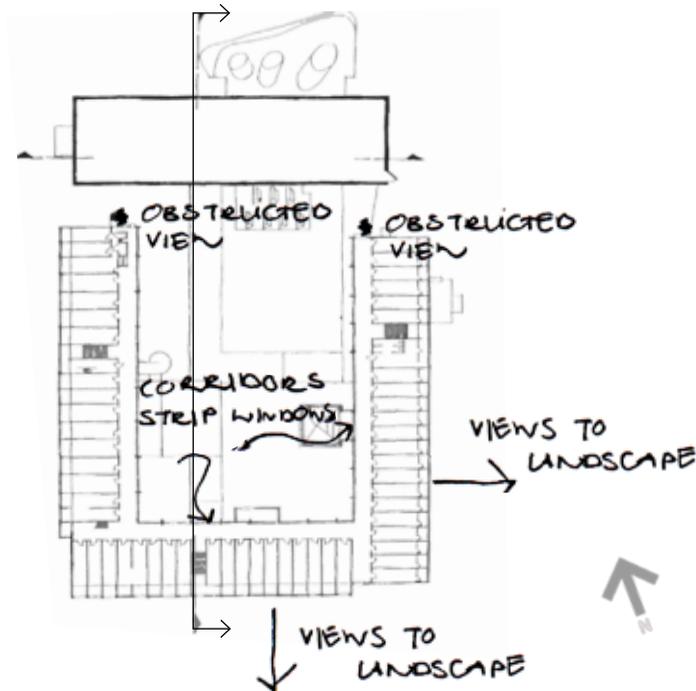


Fig 4.9 VIEWS - OBSTRUCTED, FRAMED + UNLIMITED - PLAN 1:1000

LIGHT + NATURE

Light and nature are interwoven in the monastery at La Tourette. Each part of the building is articulated according to the time of day that it receives light. Le Corbusier refers to this as the “orchestration of light”, which expresses progressive degrees of intimacy (Millet, 1996: 76). Le Corbusier used daylight to emphasize the connection between the monks and nature, and to facilitate their contemplative lifestyle.

At the entrance bridge to the monastery, the flood of daylight and the view towards the landscape create a symbolic break from the secular world. The church also highlights this disconnection. The monks access the church via the walkway, while the public access it on the north eastern corner through a small entrance. The interior of the church is dark, with light in specific locations. Upon entering the church, visitors have to wait a moment to adjust their eyes to the contrast with the bright outside light. This serves as a psychologically separation between the church and the monastery (Millet, 1996:79).

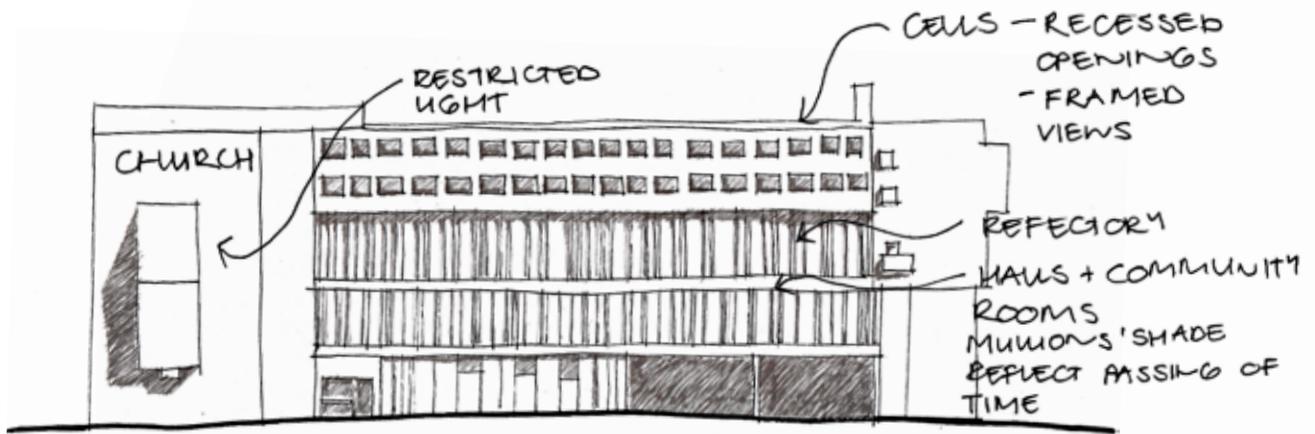


Fig 4.10 QUALITY OF LIGHT - WEST ELEVATION 1:500

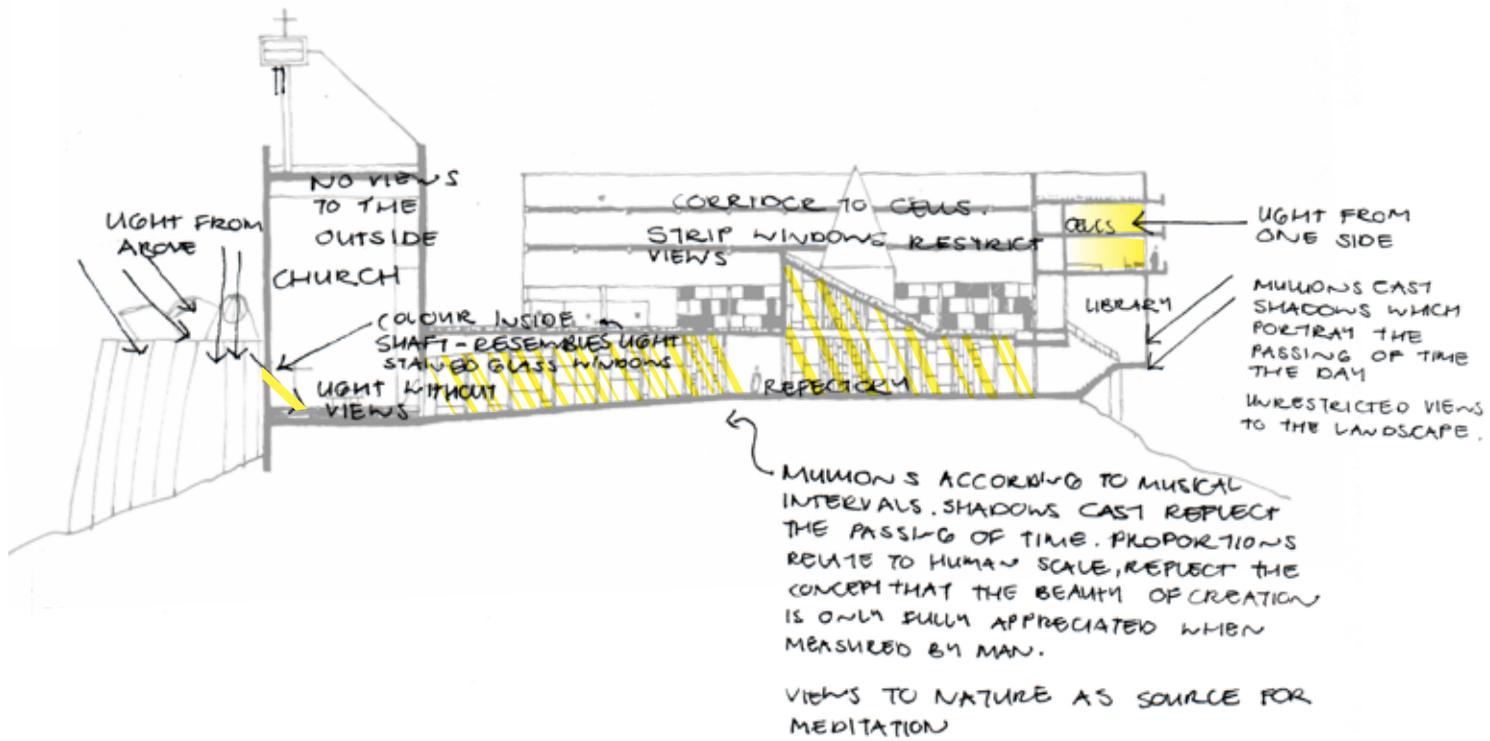


Fig 4.11 QUALITY OF LIGHT - SECTION 1:500

In the church, light is mostly from above (skylights) and from horizontal and vertical slits in the walls. Vertical slits show the rising of the sun, while horizontal slits catch the light of the setting sun (Millet, 1996: 77). The interior surfaces of the horizontal slits are painted in bright colours and the light they shed resembles the light cast by stained glass windows in traditional churches. The canonical hours which are strictly adhered to in the Catholic Church are made more profound by the awareness of the time that the light of the rising sun sheds on prime (the first service of the day; held at sunrise) and the setting sun on the final service, the vespers.

Light creates hierarchy in this austere space. The Chapel of the Holy Sacrament is perceptually the brightest part of the church, due to three light-cannons above it (Millet, 1996: 78). This also serves as a division between the congregation and the monks. These light cannons are directed to shed direct sunlight on the Holy Sacrament at noon and at equinoxes – another way in which light exhibits the patterns of nature and highlights the significance of the occasion.

Many different methods of allowing light into a building are present in the church. At the public entrance, a vertical slit shows the rising sun; two slots separate the northern part of the church from the main body; and three punctures surround the confessional (Millet, 1996: 78). Behind the monks' pews, horizontal slits let in light. Above the Chapel of the Holy Sacrament at the centre of the church, three light-cannons allow diffuse light in. The nave is defined by light from light-cannons above the sacristies on both sides. Conical skylights are present above the private altars. All of these allow different qualities of light to enter the church.

Le Corbusier used views of nature to emphasize man's connection to nature. This is based upon the idea that nature can only be appreciated when viewed in relation to man (Millet, 1996:77). Various parts of the monastery react differently towards nature. The monks' cells have balconies which focus on and reach out to nature. The refectory and chapter have glass walls, of which the mullions reflect musical intervals. Movement of the shadows cast by these mullions make the users aware of the passing of the day. This allows for the study of nature as a source of contemplation.

Light in the student brothers' and common rooms is more subdued. Only the interior wall facing the courtyard is glazed, and is shaped by a checkerboard configuration of glazed and opaque panels, which diffuse light entering the room (Millet, 1996: 78).

Light quality and views change as the user moves through the monastery. These elements reflect the use of the spaces they occupy, and add to the experience of those spaces.

CONCLUSION

Monks living in the monastery are disconnected from the contemporary world and its inhabitants, yet are connected to the environment. Le Corbusier utilized light to emphasise this connection of man to nature.

La Tourette illustrates how subtle changes of light or views can give meaning to a space, and can support the function of that space. It illustrates how light possesses metaphysical qualities – it may be used to create hierarchy; to lend an air of mystery, as in the church; to connect the user to the patterns of nature, as in the refectory; or to emphasize levels of privacy, as in the entrance to the monastery.

This central concept of light and nature is visible in the plan, section and elevation of La Tourette, and exhibits the potential that lies in these subtle elements.



Fig 4.12 WESTERN FACADE; SOUTHERN FACADE; INTERNAL COURT YARD; INTERNAL VIEW OF CONNECTING BRIDGE (to bottom)

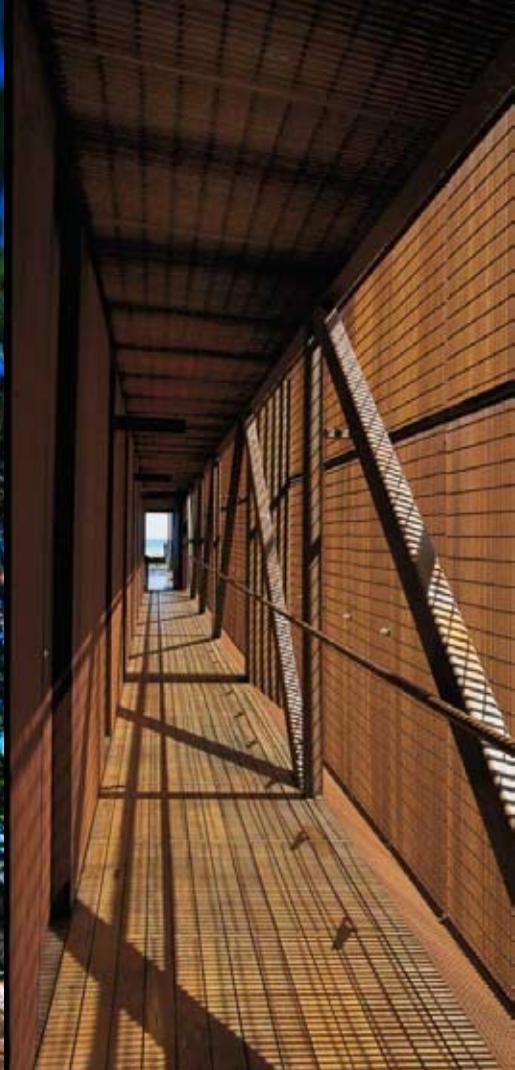


Fig 4.13 WEEKEND HOUSE - VIEW FROM THE EAST (top left); SKIN (right top + bottom); BRISE SOLEIL (bottom left)

3 STRUCTURAL PRECEDENT: SKIN

Weekend House at St Andrew's Beach Victoria, Australia

Sean Godsell Architects
2006

The clients of this project requested a weekend retreat which would reconnect them to nature after they'd spent many hours in air conditioned, fluorescent-lighted office spaces during the week (Schittich, 2007: 502). The architect conceptualised a linear building, which reaches out to the views on both ends. The building is organised around a corridor on the northern edge, which also acts as a ventilated skin and offers solar protection to the western façade. The width of the building is wrapped in a weathered steel mentis grating skin.

The corridor is covered by the weathered steel grating skin, which exposes its users to the elements of nature as they pass between rooms.

STRUCTURE

The structure of the building is from pre-oxidised steel to accommodate the weathering process of the weathered steel. Welded connections are used throughout. A simple material palette of weathered steel, timber and glass is employed throughout the building.

The main structure consists of two open web trusses which support the floor and roof. This structure is supported by four square pre-oxidised steel columns which carry the load to the ground (see fig.4.14).

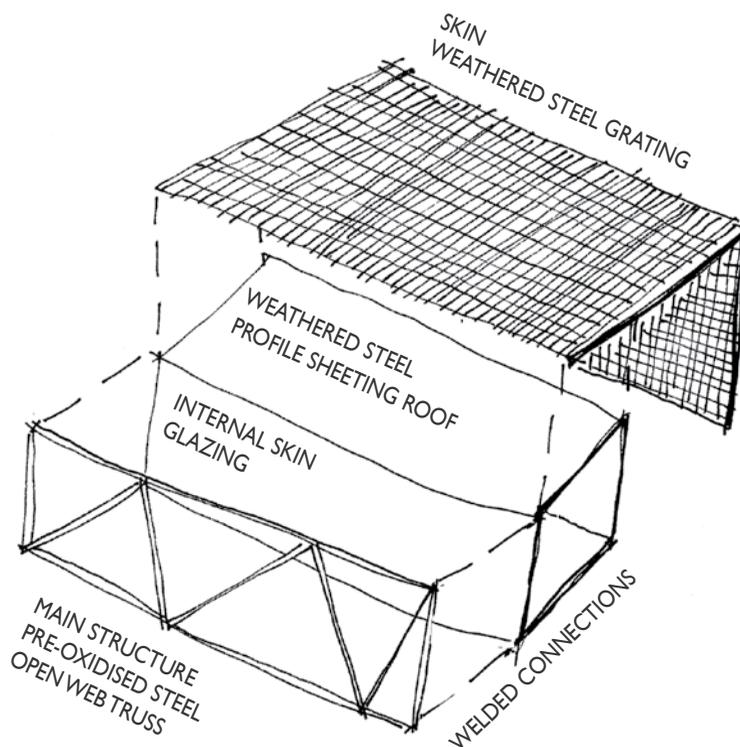


Fig 4.14 DIAGRAM OF STRUCTURE

5

This chapter explores the design process. It illustrates the principles followed in order to implement the theory, and highlights issues which shaped the design.

DESIGN PROCESS

1 INTRODUCTION

The design aims for the practical interpretation of theory on healthy environments. In order to create holistically healthy environments, two scales have to be considered – an urban scale and an architectural scale. This chapter illustrates how the theory was interpreted and implemented on these scales.

HEALTHY ENVIRONMENTS

URBAN SCALE

The physical shape of the city influences the metaphysical realm thereof, and thus influences the quality of people's lives. The *Discover Pretoria* framework (see Appendix A) proposes to make Pretoria CBD a tourist destination by following these principles:

- _ enhancement of the CBD's unique identity
- _ orientation of the user
- _ enhancement of movement on a pedestrian scale
- _ creation of gateways to the inner city
- _ definition of the CBD precinct & its unique character
- _ definition of main routes and creation of new pause spaces
- _ enhancement of visual clarity

In addition to this, the author proposes the following in order to improve the health of the city:

- _ residential areas closer to work/amenities - this means less commuting, more time for family and relaxation
- _ more public transport, which results in less pollution
- _ pedestrian-friendly streets which also facilitate exercise
- _ more safe public spaces
- _ more lungs for the city, from pocket parks sizes to big urban parks

The implementation of these principles will positively impact on the health of the Pretoria CBD.

ARCHITECTURAL SCALE

On architectural scale, the design influences the user directly.

- _ no more artificial environments
- _ contact with nature, by bringing in the elements of nature - nature is not confined to the countryside, but envelops us
- _ the use of materials from sustainable sources
- _ designing to human scale
- _ human comfort
- _ allowing users control over thermal comfort of spaces – not centrally controlled.



TRANSLATING THEORY INTO ARCHITECTURE

An architecture which does not detract from health not only has physical properties, but also relates to the metaphysical realm. Nature may be invited into a building in subtle ways.

Architecture has qualitative value, which evokes the senses and has an effect on the emotions. A subtle change in light, material or enclosure, affects the human spirit. For architecture to be soothing, it should have an austere quality, and should not contain an overload of information.

The habitation of the architecture may be revealed by the progression of space, emphasized by the changing of the quality of light and of the materials used. This creates subtle thresholds. Framed, unlimited or no views emphasize these changes, and facilitate a direct contact with nature. The senses may be evoked by the use of materials with different tactile qualities, smells and associative values.

The design should implement six principles to create a healthy, tranquil environment:

- _ natural ventilation
- _ natural light
- _ tranquil exterior spaces, with views onto them
- _ the use of materials with tactile and aural qualities
- _ utilising the elements of nature, eg. the quality of light
- _ engaging the users, and allowing them to control their own environments.

DESIGN MANIFESTO

Architecture is the threshold between man and the city, and should reconnect man with nature.

This is a subtle art. Architecture exists between light and shadow; in texture and in smell.

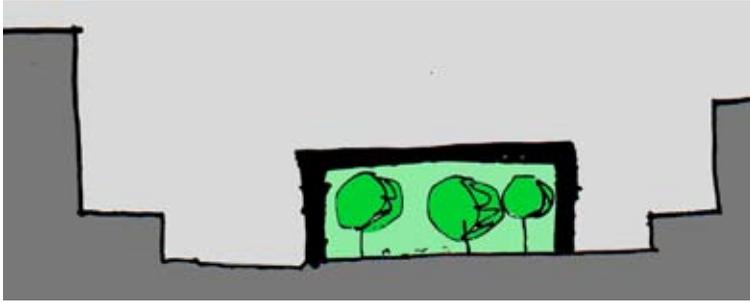
It engages or ignores its users, and does not dominate or manipulate, but allows them freedom to control their own environments.

Architecture which excludes the elements of nature causes a disconnection from the natural world.

Fig. 5.0 REFLECTING NATURE (left); PEDESTRIAN-FRIENDLY CITY - LONDON (right)

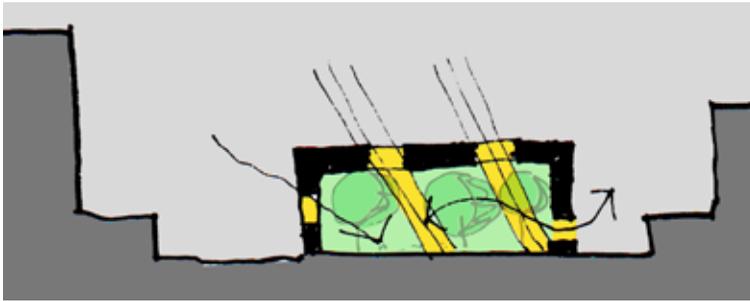


2 CONCEPT



THE BUILDING AS A WALL

To keep out the chaos of the city.



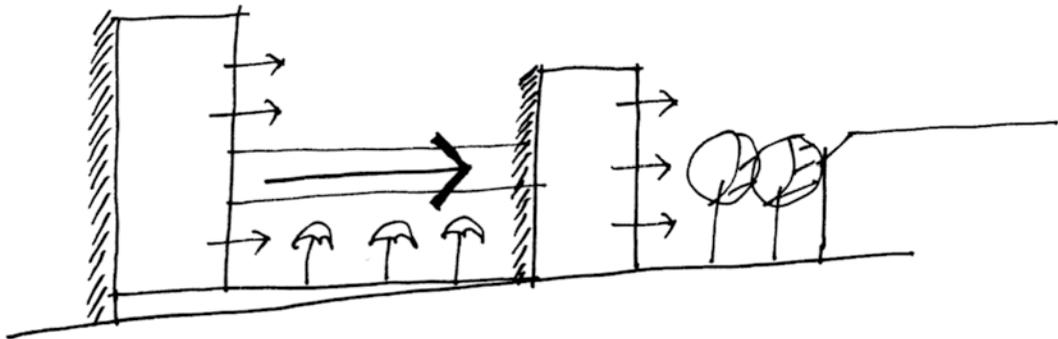
PERFORATED

To invite in the elements of nature.

Fig. 5.1 CONCEPT

An oasis in the urban environment. A life-enhancing environment which caters to relaxation, social interaction and stress relief.

PARTI DIAGRAM



3 REACTION TO SITE

STREET EDGE

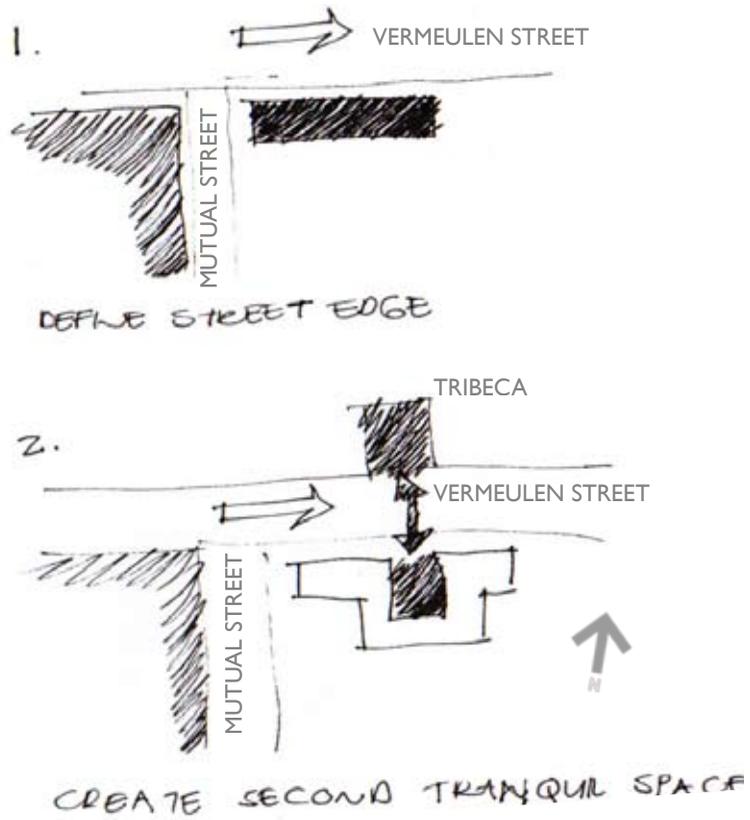


Fig. 5.3 STREET EDGES

HIERARCHY

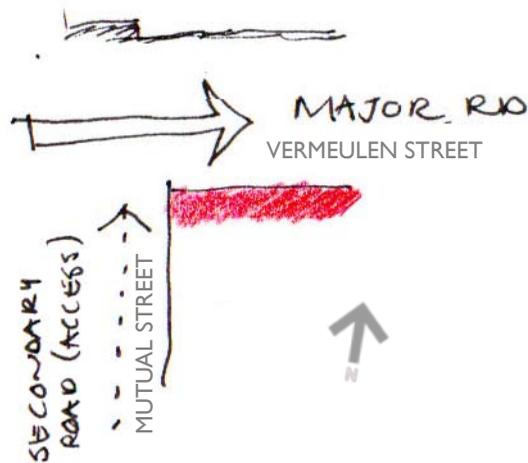


Fig. 5.4 HIERARCHY

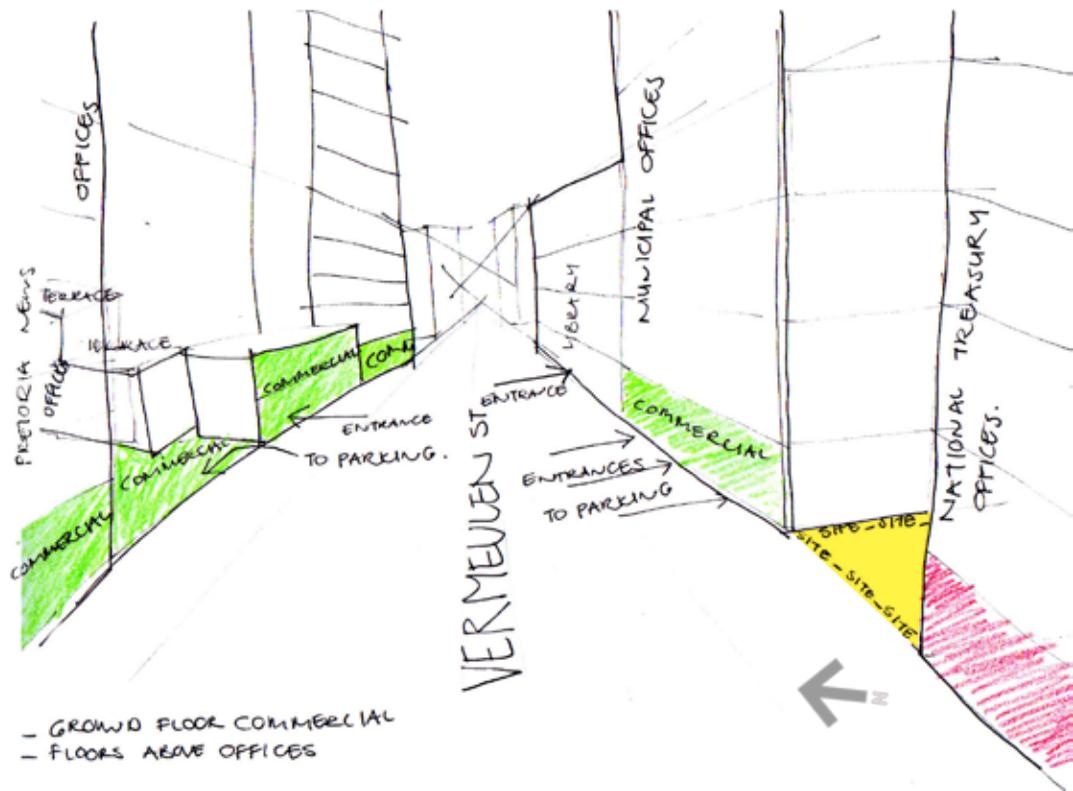
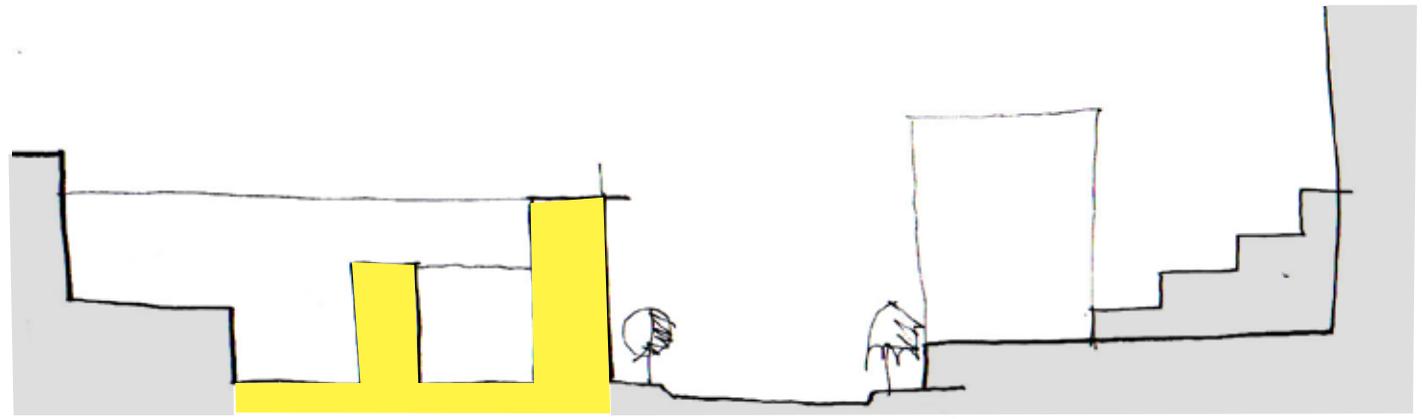


Fig. 5.5 VERMEULEN STREET



SECTION - VERMEULEN



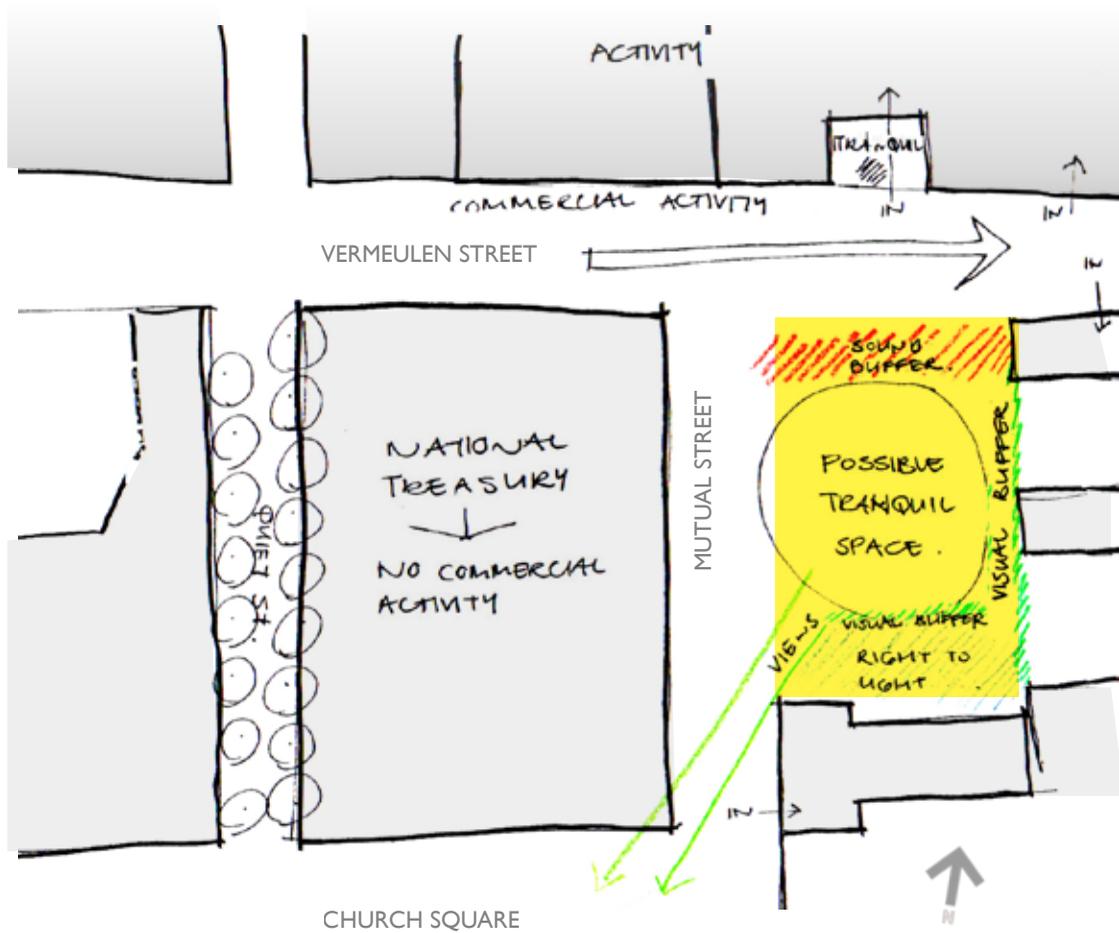
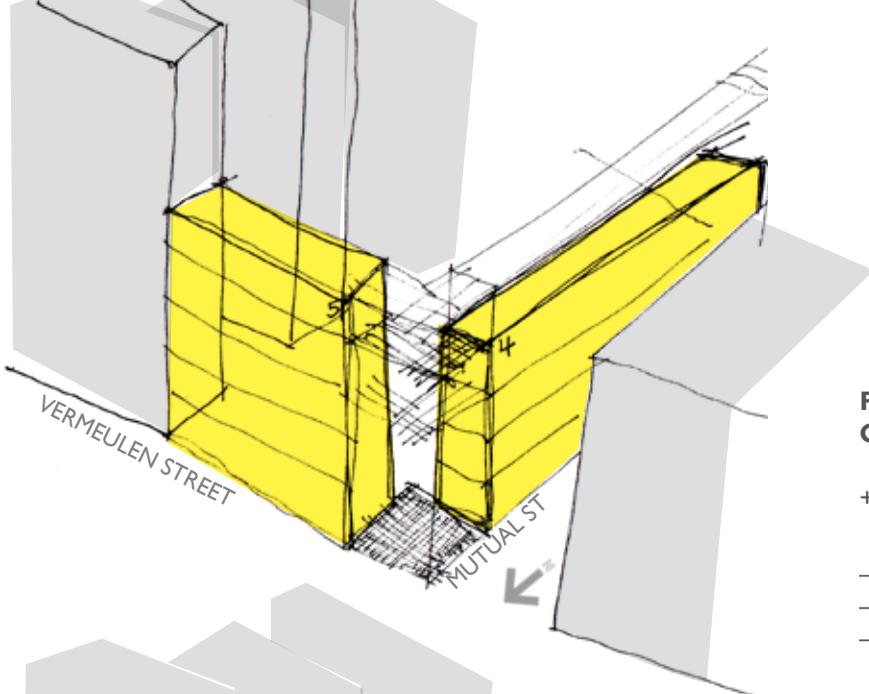


Fig. 5.7 SITE PLANNING

There is no need to emphasize the corner, as a hierarchy already exists between the two streets. Vermeulen Street is an artery road, allowing for fast-moving traffic, while Mutual Street is a secondary exit from Church Square; has low traffic volumes and has a calm atmosphere.

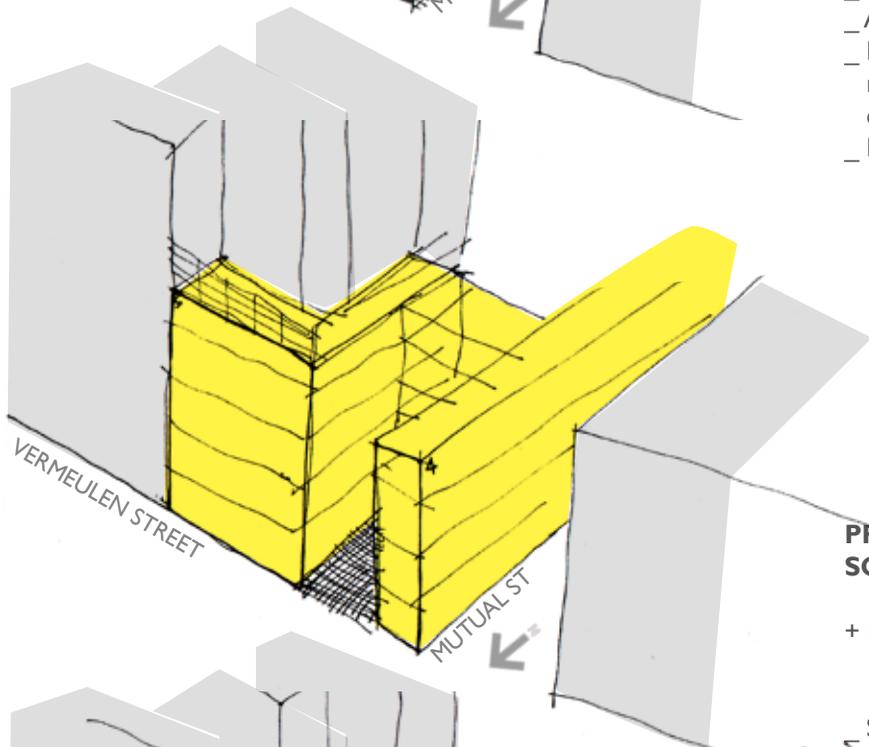
Building uses in Vermeulen Street are mostly commercial functions (semi-public) on ground floor and offices (private) above. The proposed building will continue this pattern.

Massing of the proposed building should relate to the urban context, but also to human scale. It should define the street edge and allow for an open space. The Ons Eerste Volksbank has windows on its northern facade, which borders on the site. The proposed building thus cannot be directly adjacent to this building, but has to allow light to reach this facade of the building.



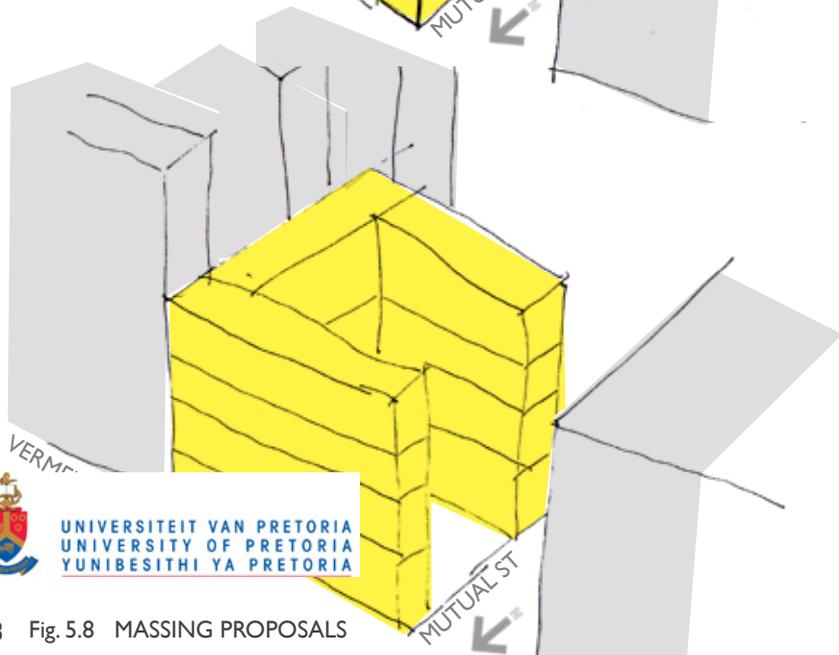
**PROPOSAL 1
CORNER SQUARE**

- + Emphasizes corner
- _ Ambiguous levels of privacy
- _ Adjacent to busy street - not calm space
- _ May become part of movement route rather than pause space (pedestrians cutting the corner)
- _ Long western facade



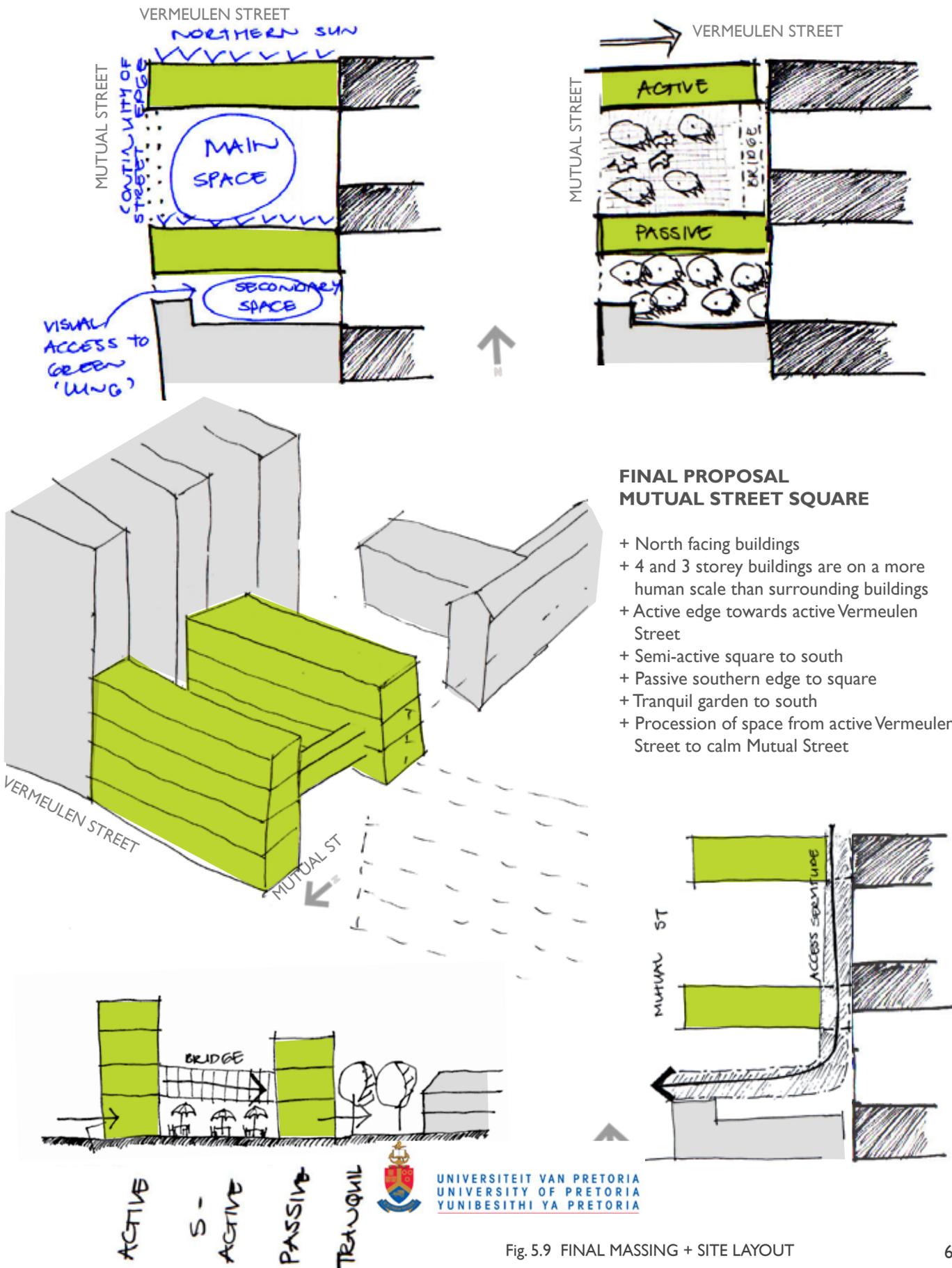
**PROPOSAL 2
SQUARE ON VERMEULEN STREET**

- + Relates to Tribeca square (across Vermeulen street)
- _ Severed from Church Square
- _ Faces onto busy Vermeulen Street
- _ Two parts of building with western aspect



**PROPOSAL 3
SQUARE ON MUTUAL STREET**

- _ Western facade
- + Square faces onto calmer street
- + Visual relation to Church Square



**FINAL PROPOSAL
MUTUAL STREET SQUARE**

- + North facing buildings
- + 4 and 3 storey buildings are on a more human scale than surrounding buildings
- + Active edge towards active Vermeulen Street
- + Semi-active square to south
- + Passive southern edge to square
- + Tranquil garden to south
- + Progression of space from active Vermeulen Street to calm Mutual Street

Fig. 5.9 FINAL MASSING + SITE LAYOUT

4 CONCEPT DEVELOPMENT

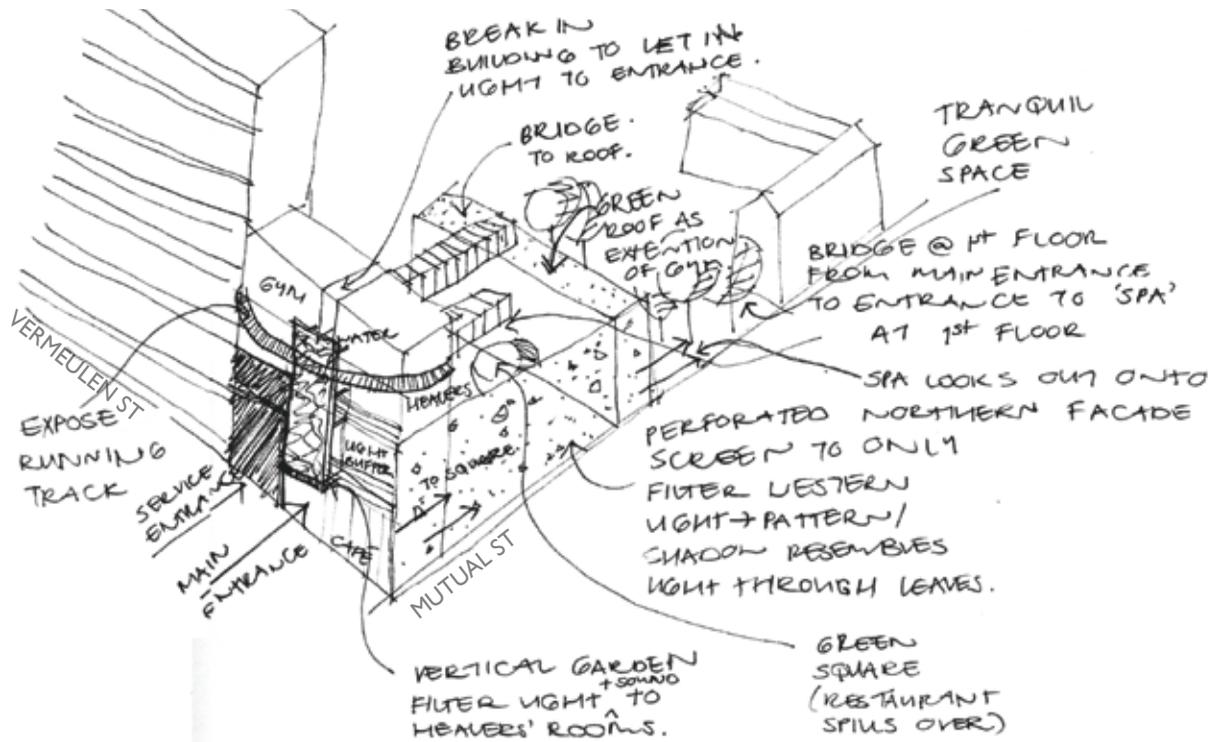
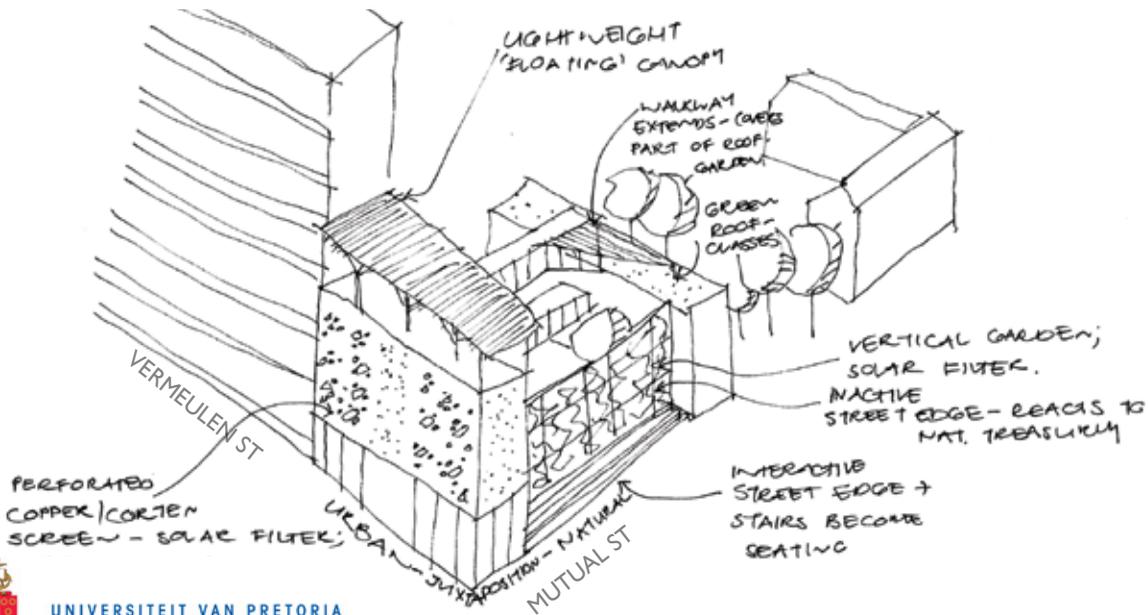
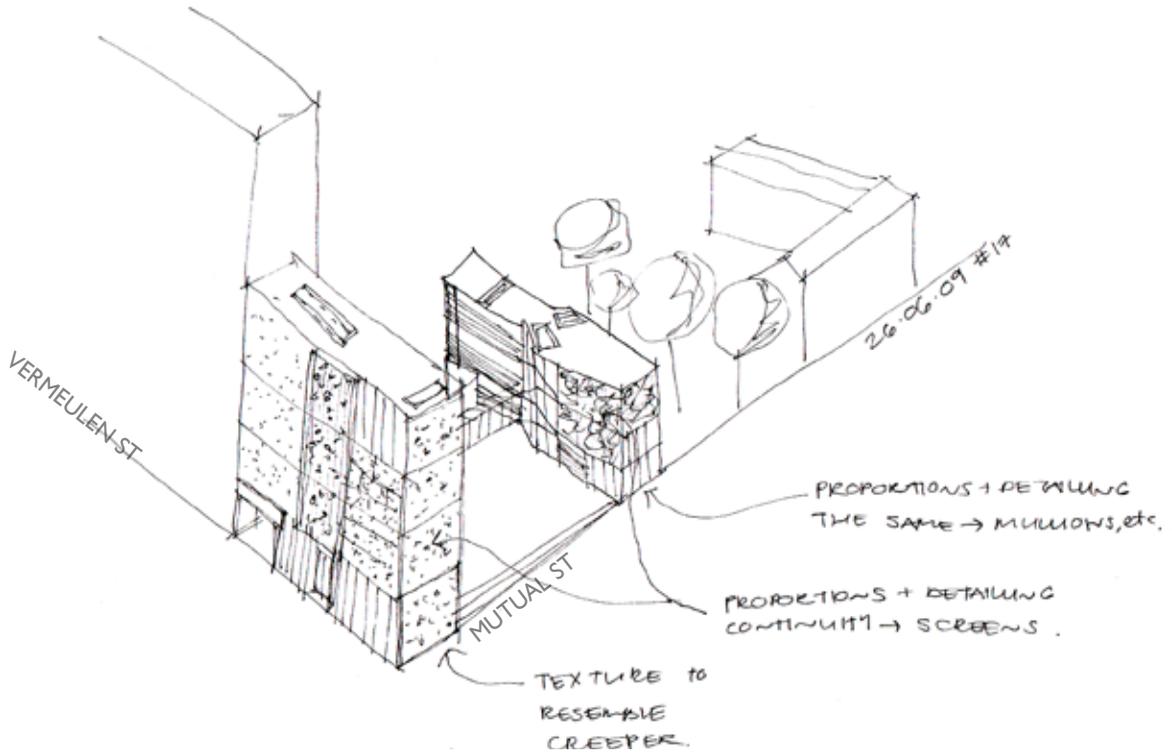


Fig. 5.10 | 13 May

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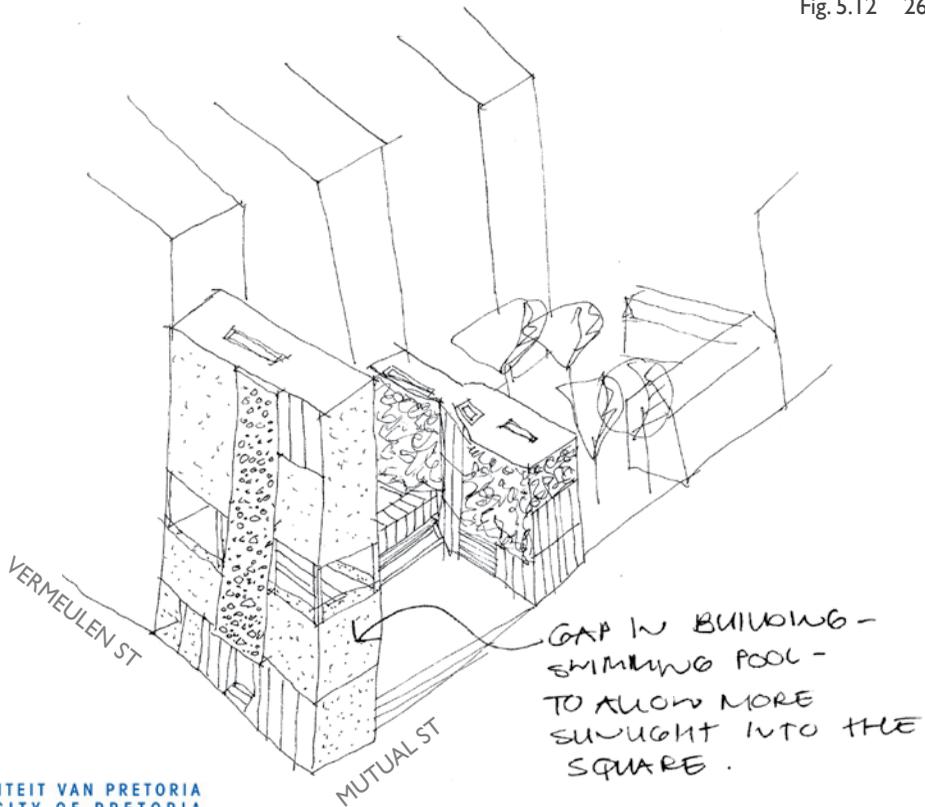


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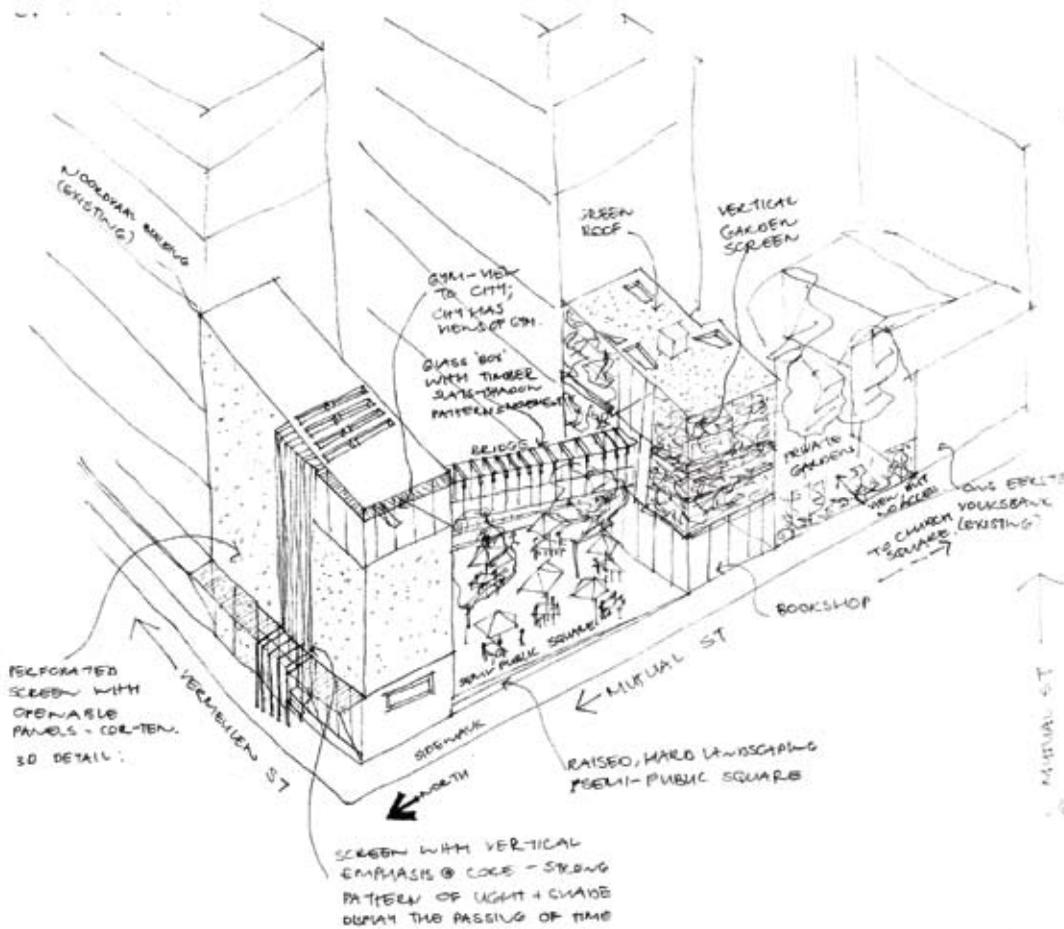


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Fig.5.12 26 June

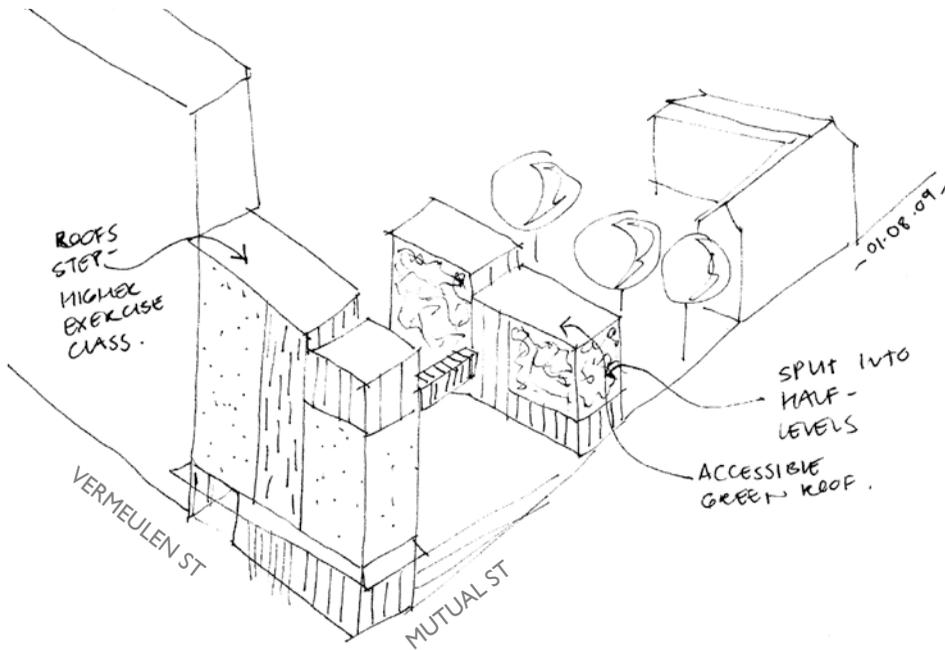


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Fig. 5.14 15 July



6



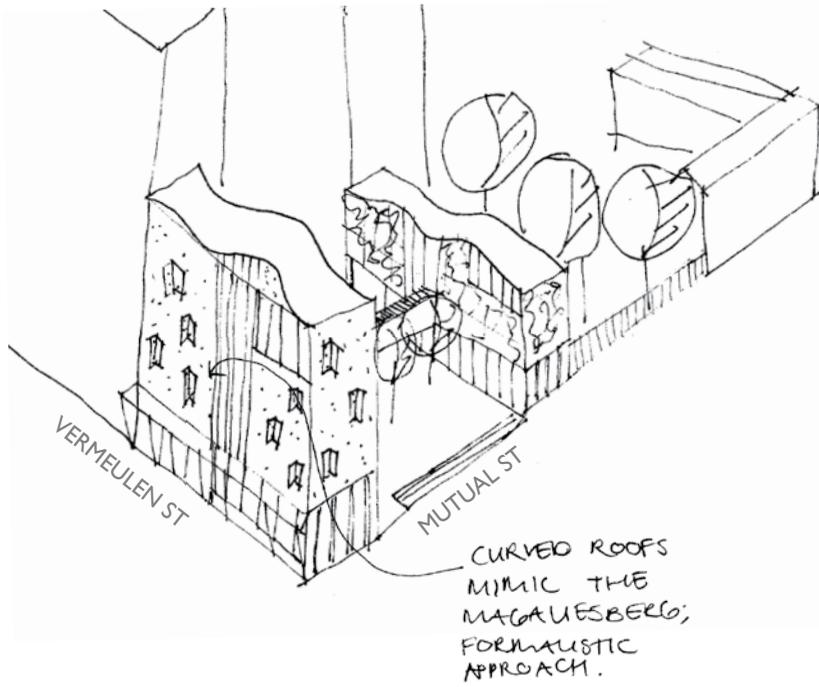


Fig. 5.16 6 August

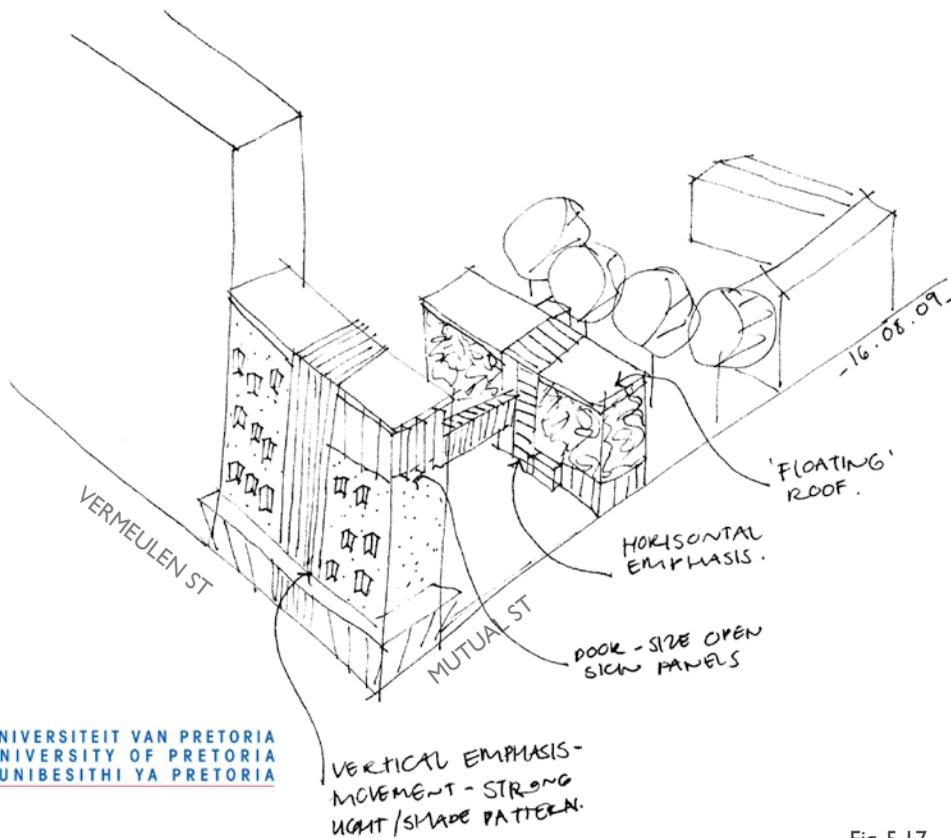


Fig. 5.17 16 August

5 PRINCIPLES

SKIN

A skin wraps around the northern and western façades of both buildings. Both these act as solar screens, and also filter light into the building. The skin of the northern building visually distances the interior environment of the building from the chaos of the city street; and is a metaphor for the city, as the weathered steel ages with time; and in juxtaposition to this city image, light patterns from perforations in the skin cast leaf-like shadows on the interior. The vertical garden skin of the southern building provides a soft edge to the square; perceptually distances the building from the activity in the square; and signifies nature, which renews itself each year.

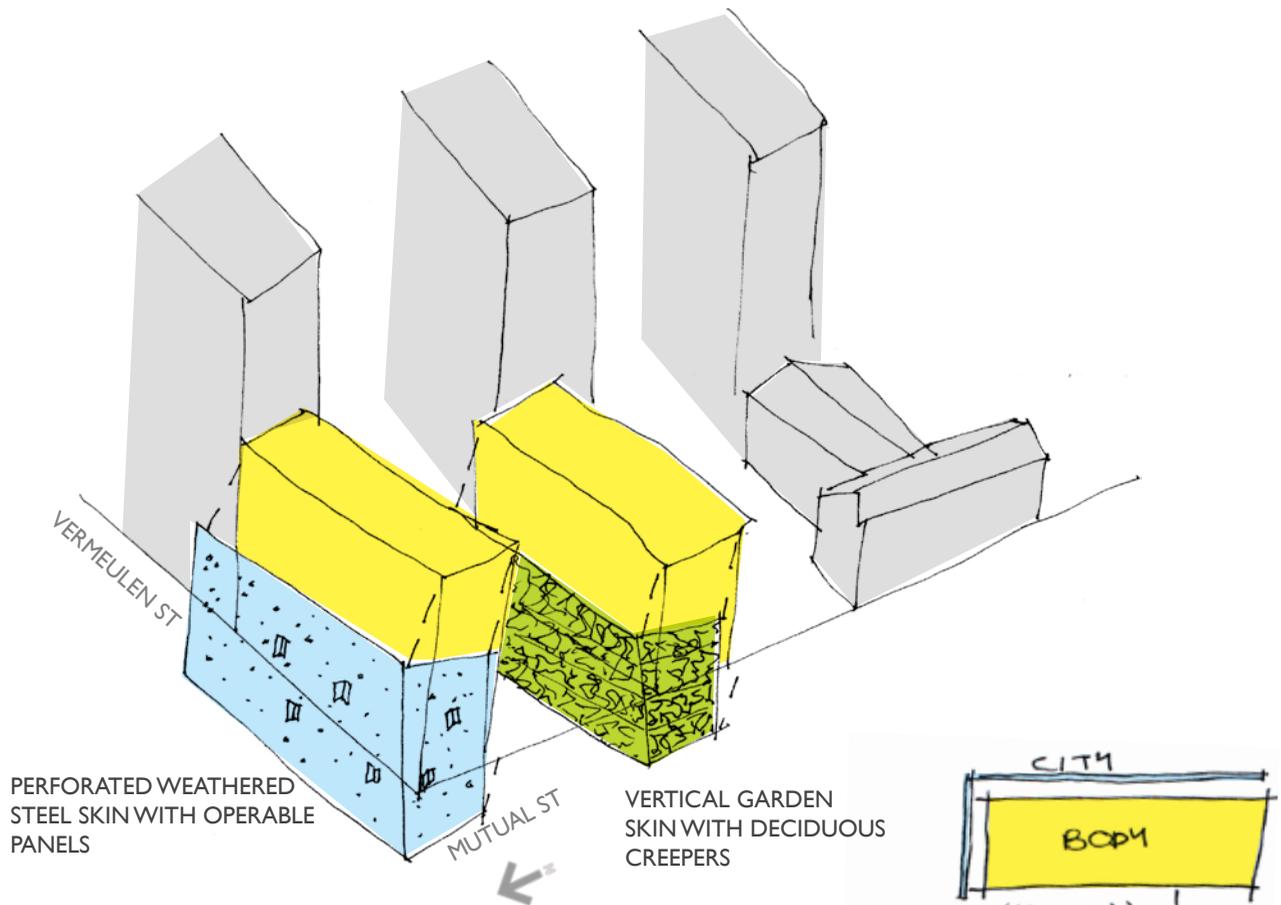


Fig 5.18 SKINS

The northern building hosts programmes relating to the body, while the programmes in the southern building relate to the mind and spirit.



FAÇADE STUDIES

SURROUNDING BUILDINGS

Several historic buildings surround the proposed building. The homogenous skin that wraps around the proposed building not only perceptually distances it from the city, but also places it in juxtaposition to these historical buildings.

The proposed building reacts to the composition of adjacent buildings by employing their façade ordering principles, which comprises of three parts – plinth, body and roof; and by picking up some of the lintel heights as new floor heights.

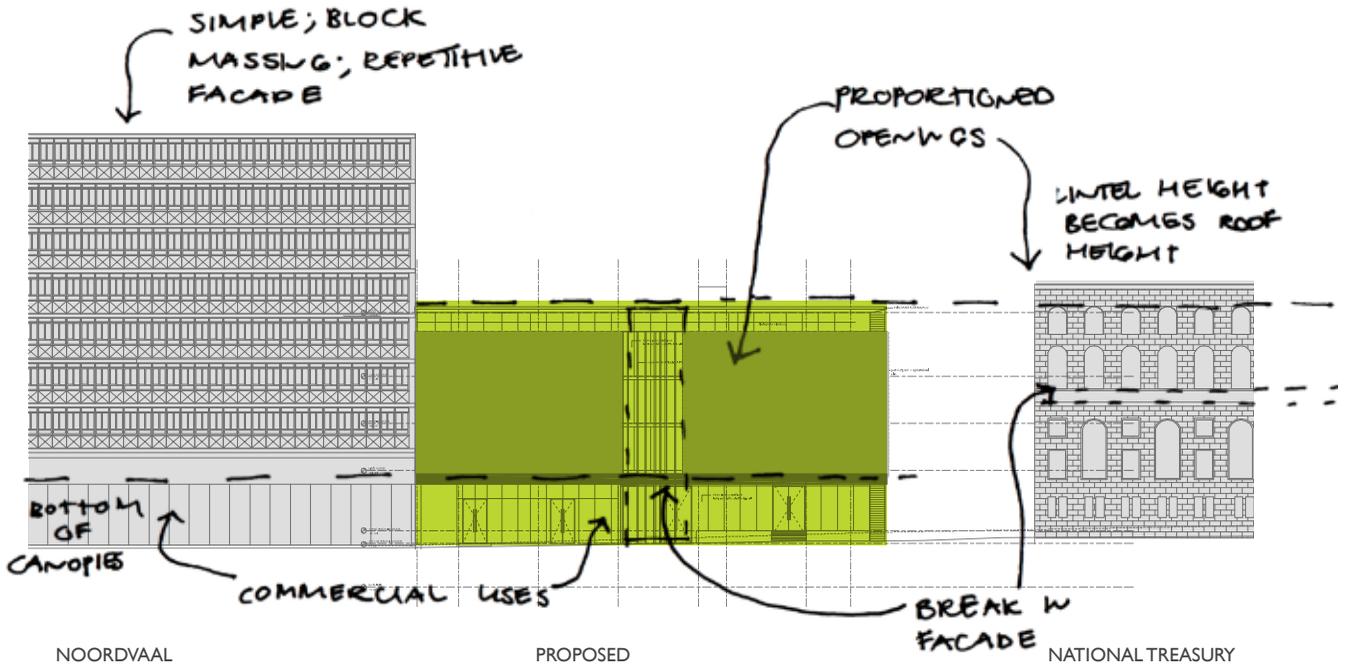


Fig 5.20 VERMEULEN STREET (NORTH) FAÇADE REACTION n.t.s.

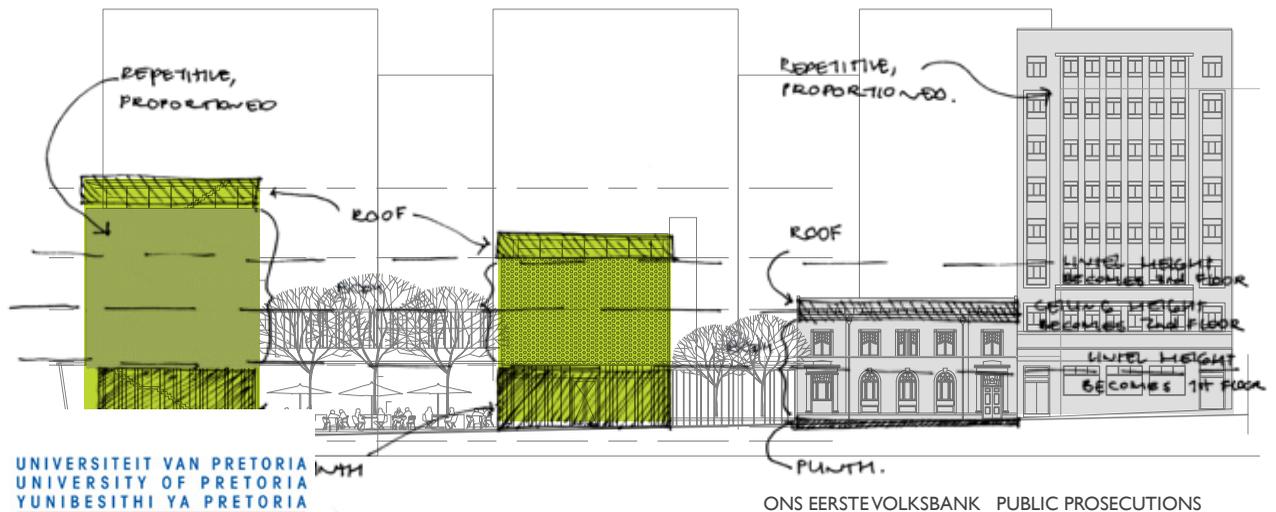
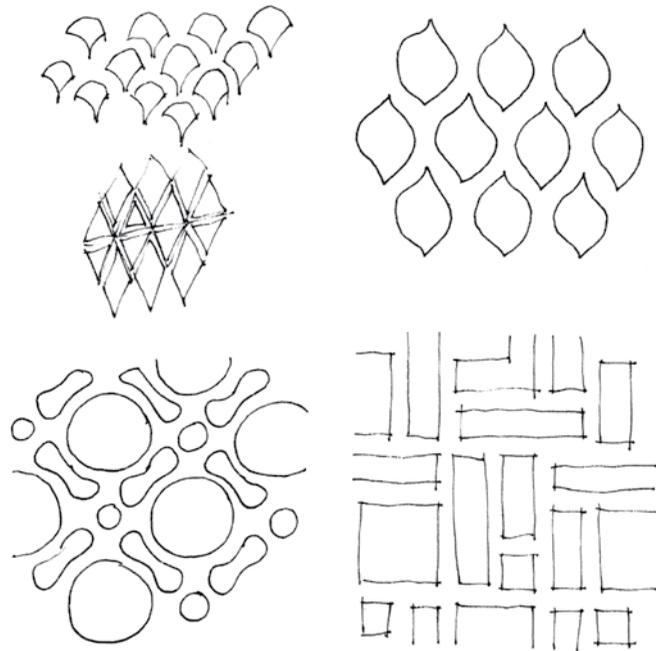


Fig 5.21 MUTUAL STREET (WEST) FAÇADE REACTION n.t.s.



BUILDING SKINS IN PRETORIA

A study was done on historic building skins in the study area and surrounds - Pretoria CBD, Arcadia and Sunnyside.



- PRIVACY SCREENS } @ STAIR CORES
- SAFETY SCREENS }
- MODULAR UNITS, FIXED TOGETHER WITH MORTAR.
- MASONRY / PRECAST CONCRETE.
- THIN PROFILE - 85mm AND THINNER.
- GEOMETRIC PATTERNS.

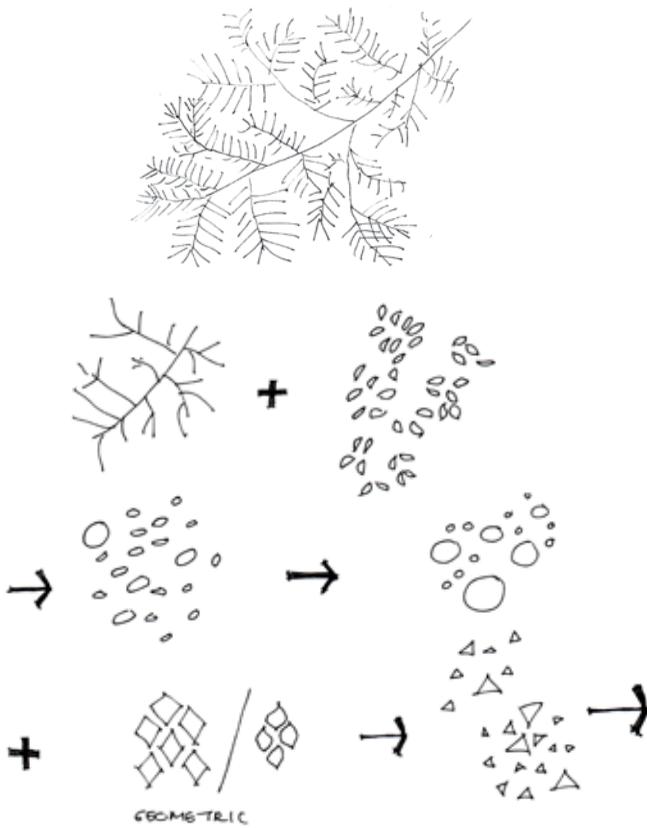
Fig 5.22 ANALYSIS OF PRETORIA SKIN PATTERNS

SKIN PERFORATION PATTERN DEVELOPMENT

The perforations were designed to cast shadows that suggest the filtering of light through the leaves of a tree. The composition of a tree branch was used as base, and then abstracted and combined with the typical geometric from the historical analysis.

The panel size was based on brick modules; ergonomics and the buildings proportioning system (1:2:3, see Proportioning System). Opening sizes were also based on this proportioning system, as well as on the desired pattern of light and shadow; and on allowing light through without allowing views to the street. The random pattern of openings breaks the Pretoria tradition of ordered modules, and refers to the seemingly random nature of leaves on a tree.

Fig 5.23 (left) SKINS IN THE PRETORIA CBD, ARCADIA + SUNNYSIDE



PROPORTIONING SYSTEM

The design makes use of a proportioning system, which is implemented from the structural grid, through to balustrades, scaled down all the way to the sizes of the weathered steel skin perforations. This creates a rhythm which emerges on all scales in the buildings. The system was derived from the structural system, and comprises the relationship 1:2:3.

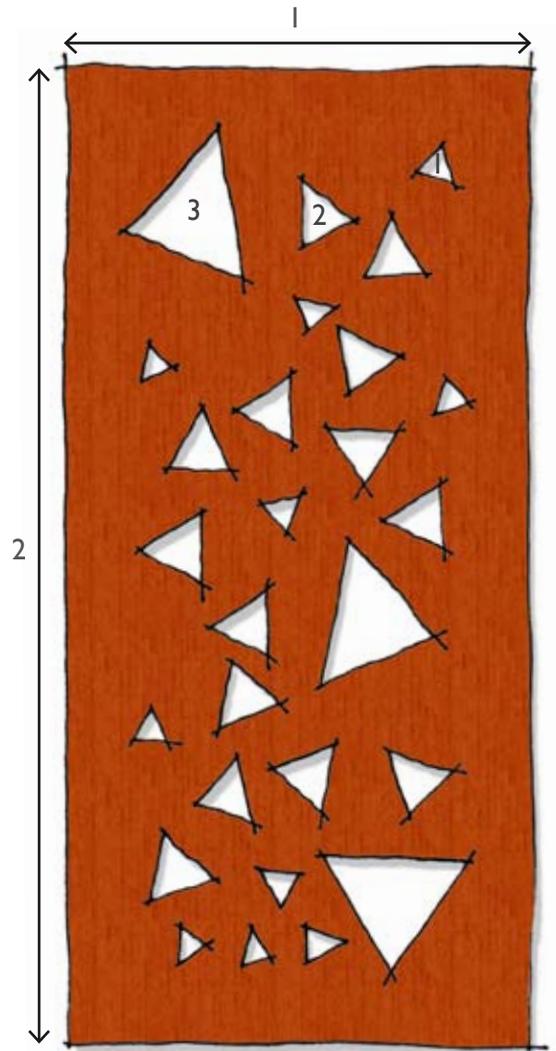
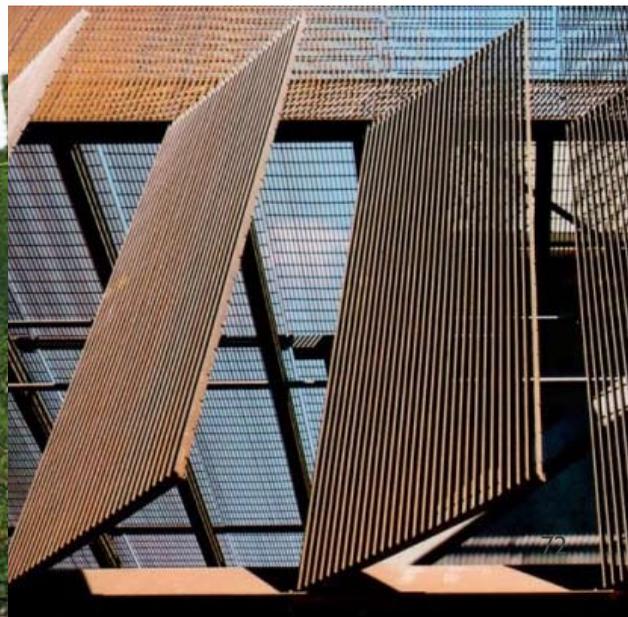


Fig 5.24 (above, left) PATTERN DEVELOPMENT
 Fig 5.25 (above, right) PERFORATED PANEL DESIGN

Fig 5.26 (below) CONTEMPORARY LIGHT WEIGHT BUILDING SKINS



NATURE IN THE CITY

RELATIONSHIP BETWEEN INSIDE + OUTSIDE

Nature is invited into the building in varying degrees. The building cores both face south towards the square or the garden, allowing unlimited views thereof. Different programmes have different levels of interaction with the surrounding environment. As an example, the yoga studio has low level windows towards the north (square), only allowing in the light filtered by the vertical garden, while on its southern façade folding stacking doors open up towards the garden. The four elements of nature regulate this relationship between inside and outside.

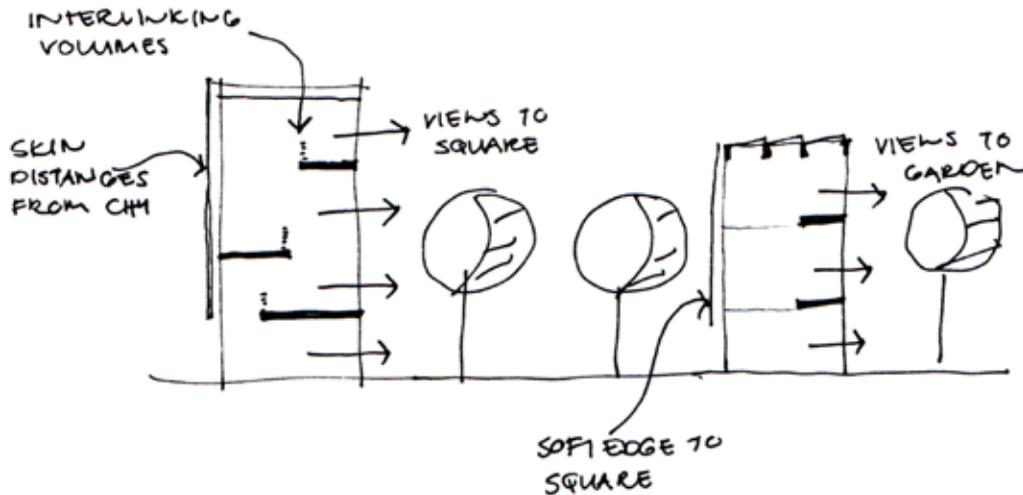
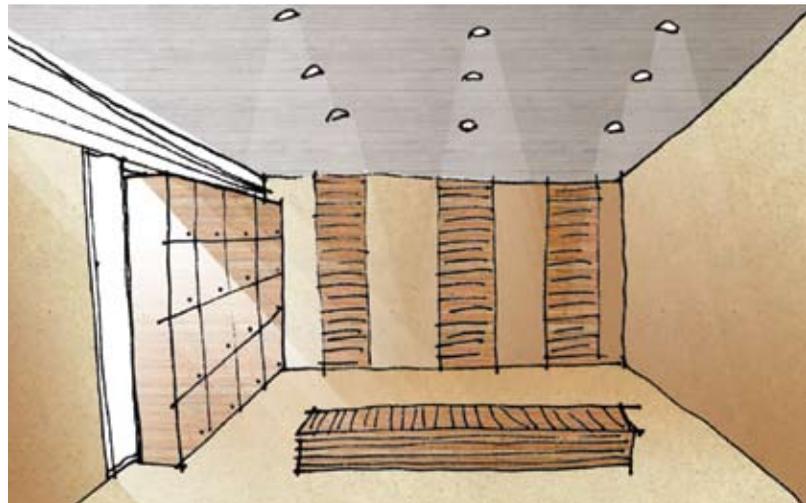


Fig 5.27 SECTION - RELATIONSHIP BETWEEN THE INSIDE + OUTSIDE

LIGHT

Light levels indicate different levels of interaction with space and with nature. In the gym, for example, ample daylight reaches the room through windows at different levels, as this is an environment charged with activity and awareness. In the big contemplation space, light enters from a high point on one side, leaving the other side of the room in relative darkness, which contributes to the contrast between the scales in the room (see fig. 5.28).

Fig 5.28 (below) CONTEMPLATION SPACE (left)+ CHANGE ROOMS (right) QUALITY OF LIGHT



Strong patterns of light and shade indicate the passing of time, which is apparent in the cores, where beams with sky lights in between allow light to enter from above; and in the bridge, where a rhythmic pattern of columns will cast strong shadows which will move as the day progresses.

Media rooms need diffuse light for a more homogenous internal light quality. Timber louvers will provide this, and allow for ventilation to take place. The reflection of light lends a tranquil air to a space. Light will be reflected by pools of water at the entrance of the change rooms, which will emphasise the split between the outer and the inner worlds. Light will filter through the skins to produce leaf-like patterns in both buildings, which will remind users of the presence of nature in the city.

AIR

Natural ventilation is employed in the buildings, and more openings (and thus more air movement) is provided in more active spaces, such as the gym and exercise room, and less in rooms with less activity, like the media rooms.

WATER

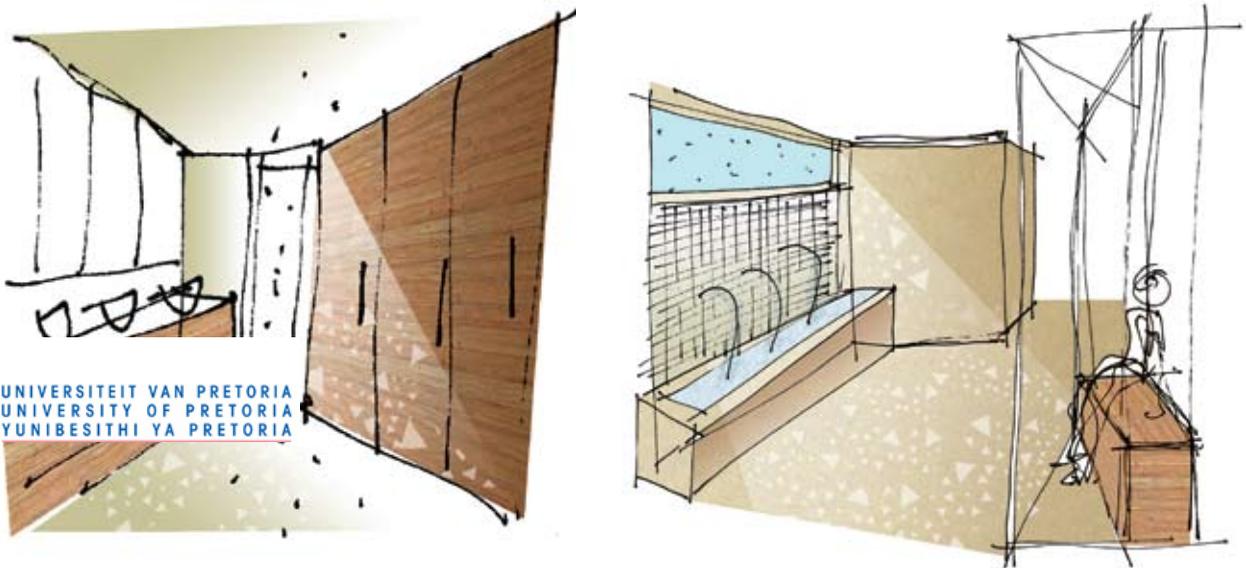
Water is utilised in the design of the square as well as in the entrance to the change rooms. In the square, a fountain provides white noise to filter the noises of the city, while the reflection pool reflects the sky and connects it to the earth (the square). In the change room entrance, water symbolises the cleansing process, and reflects filtered patterns of light from the external skin into the room.

GROUND

The square and garden connect the design to the ground by emphasizing the distance of the sky in relation to high surrounding buildings. The user becomes aware of the height of surrounding buildings and their perceptive disconnection from the sky.

Paley Park in New York City was used as a precedent for the size and ordering of the square.

Fig 5.29 (below) CHANGE ROOMS - WASH ROOM (left), ENTRANCE (right)



**Paley Park
New York, USA**

**Zion and Breen Associates
1967**

Paley Park is situated in the New York City urban landscape. It nestles between three high buildings, and is popular as a lunch-time retreat. Paley Park is only 390m² big, which classifies it as a vest pocket park.

The park is defined on three sides by walls, and on the fourth edge the street invites the user in. The opposite edge houses an 8m high waterfall, which provides white noise to fade out the noises of the city. Ivy creeps up the other walls, and trees provide shade in summer. These elements soften the edges of the park, and add to the serenity of the space (www.pps.org).

The park is situated on a slightly higher level than the street, which lends a degree of privacy to its users. Paley Park illustrates how even a very small park or square can have a positive impact on the surrounding area.

PROPOSED SQUARE

The proposed square will be 390m² big (23m x 17m). The square has three levels of privacy and interaction – the western component, onto which the restaurant spills; separated by trees, the next level houses the reflection pond and seating, which is less active; and beyond this a dividing wall screens off the service yard.

Due to the site slope from south west to north east, the square starts at the same level as the street at the south western corner, and ends at 700mm above street level. Stairs lead to this higher level, which can also become seating.

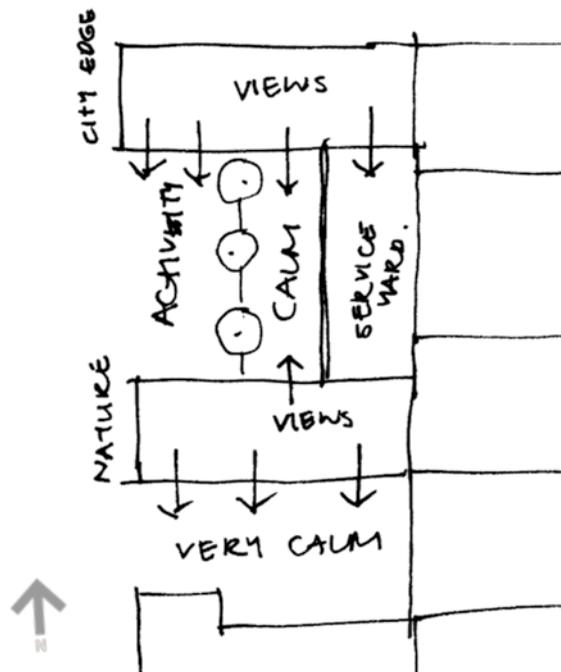


Fig 5.30 SQUARE - LEVELS OF INTERACTION

Fig 5.31 (below, left to right) PALEY PARK: SOCIAL GATHERING SPACE; LONGITUDINAL SECTION - LEVEL DIFFERENCES



CONVERSATION BETWEEN BUILDINGS

The buildings are similar in their façade articulation (skins which wrap around two façades) and basic organisation – a central core creates a break in each building and in its skin, and a floating roof articulates their connection to the sky.

The difference between the buildings occurs in their cores, where the most movement takes place. The northern building caters to programmes relating to the body, and its core consists of simple interlinking volumes, which contribute to the legibility of the building. The southern building caters to programmes relating to the mind and spirit, and its core is a more intuitive space – a single volume which grows towards the heavens, with overlapping staircases hanging centrally from the space. Shading structures cast strong patterns of light and shadow in both cores. These patterns articulate the passing of time, and activate the spaces. These shading elements have a vertical emphasis in the northern building, and a horizontal emphasis in the southern building.

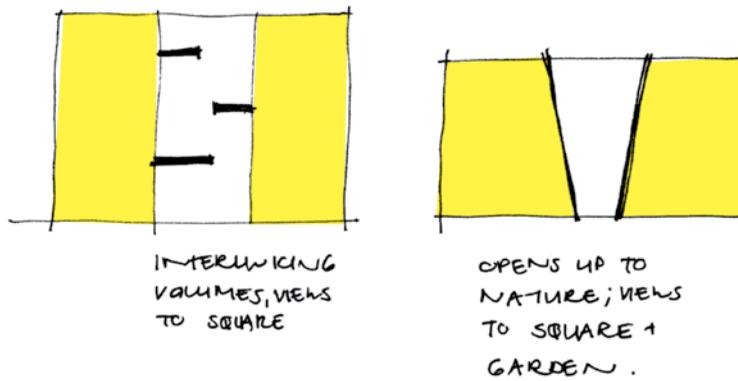


Fig 5.32 DIFFERENCE IN CORE TREATMENT - NORTHERN BUILDING (left) + SOUTHERN BUILDING (right)

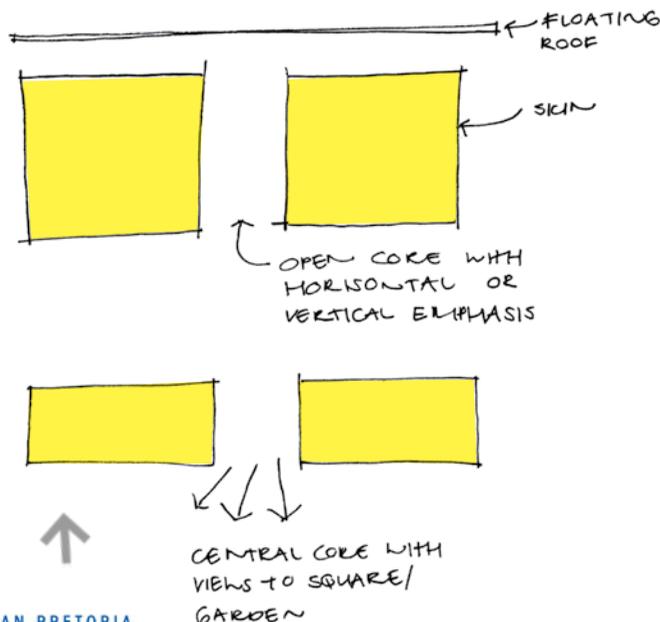


Fig 5.33 MASSING OF BUILDINGS - ELEVATION (top) + SECTION (bottom)

6 ORGANISATION

LEVELS OF PRIVACY

The design progresses from public to private from north to south; from bottom to top; and in the buildings from west to east. The southern building is detached from the activity in the square by its entrance on the first floor, through the bridge from the northern building, with only maintenance access on the ground floor. The square is made more private from the street (semi-public instead of public) by a slight difference in height between the pavement and the square.

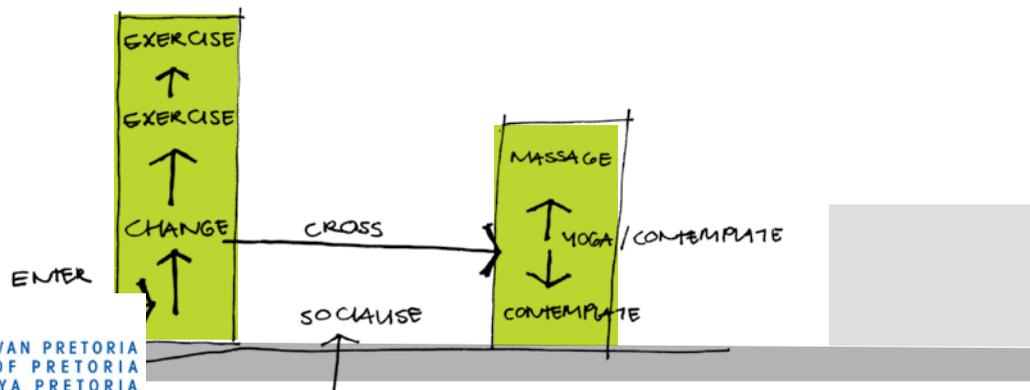


Fig 5.34 SECTION - LEVELS OF PRIVACY

PROGRESSION OF SPACE

The design is an intermediate space between busy Church Square to the south, busy Vermeulen to the north, and calm Mutual street in between. It reacts to this by a series of layers (see Levels of Privacy, above). As one approaches it, the design will reveal itself to you – from the west: first the rusted façade of the northern building, then the square, then the vertical garden which shields the southern building; then the garden; and then the Ons Eerste Volksbank building, which leads one into Church Square.

On an architectural scale, the procession into the building follows the ritual employed in the ancient Roman baths (see Chapter 4 Precedents), which starts with a cleansing process in order to enter further into the building. This creates a metaphysical separation between the city chaos and the inner world of this urban sanctuary. Thus, when the users enter, they go to the change rooms to change into suitable attire first, after which they proceed to the main functions of the building (see fig. 5.34).





6

This chapter illustrates the final design resolution.

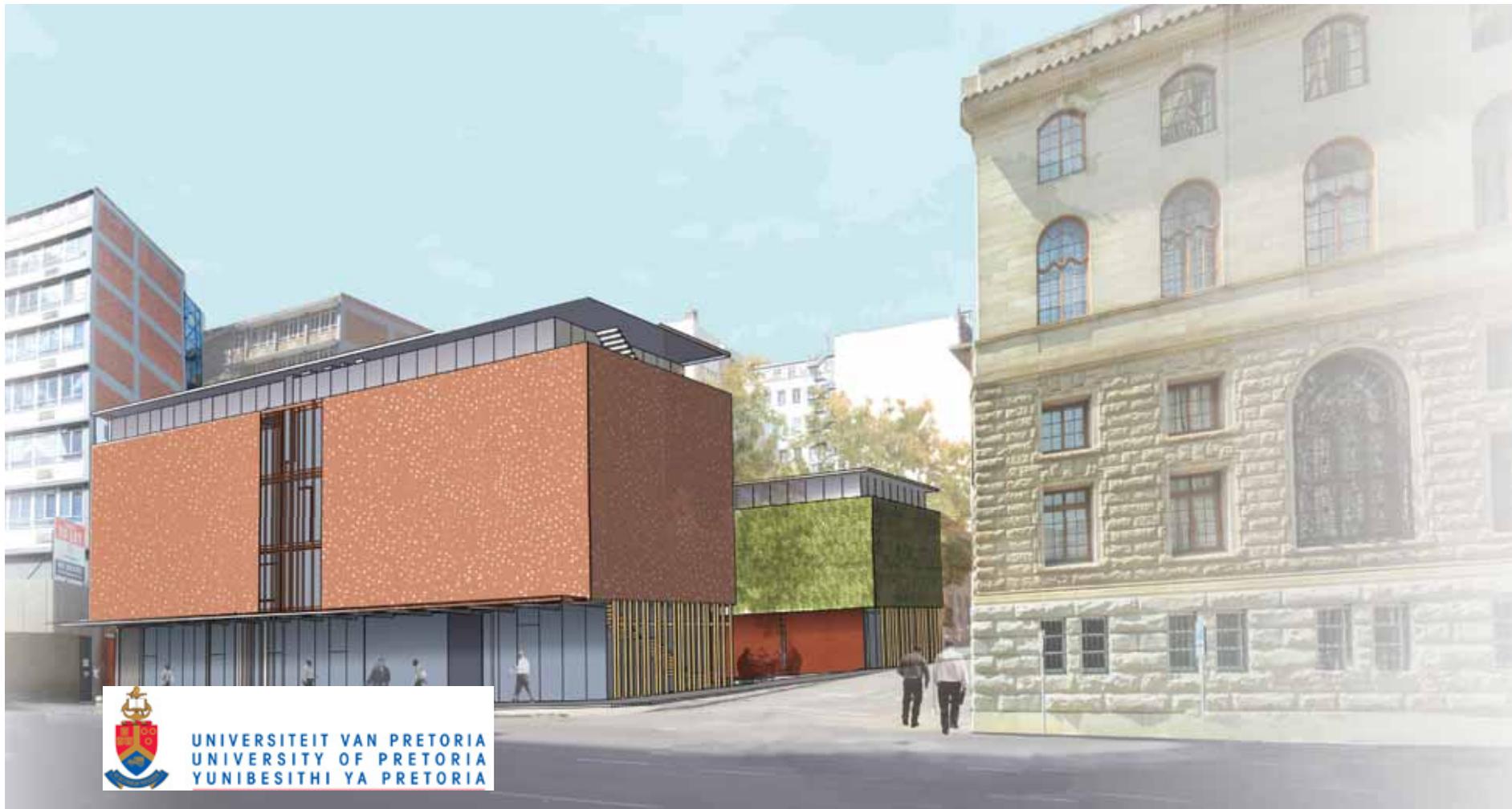


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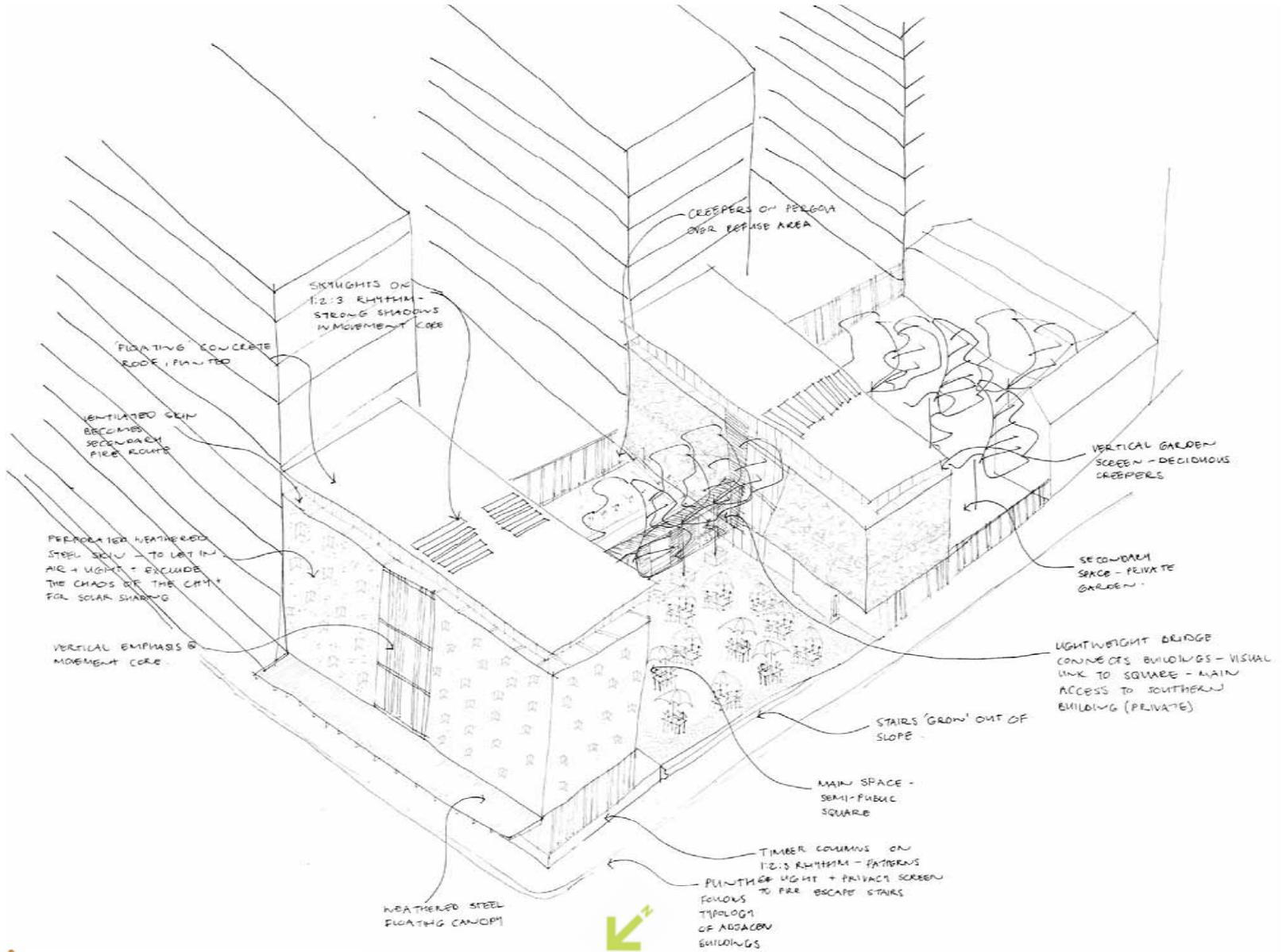
FINAL DESIGN

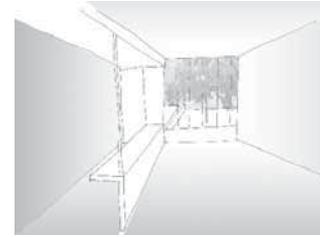
VITALITY SQUARE

creating a healthy environment in the pretoria cbd



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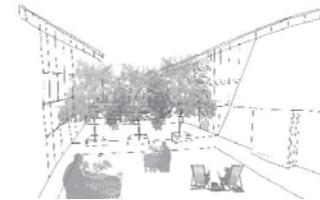




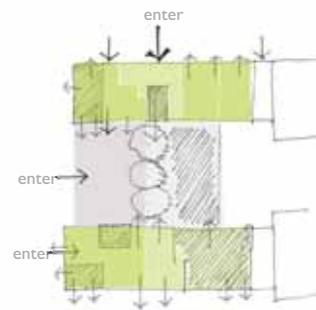
main entrance
north building



group contemplation space
south building



square to east



thresholds, levels of
privacy + views

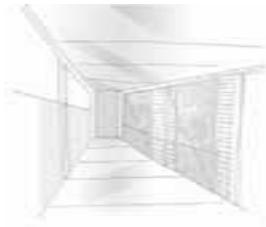


- public
- semi-public
- semi-private
- private
- very private





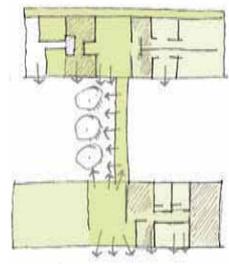
toilet interior south building



bridge interior



change rooms toilet interior



thresholds, levels of privacy + views



- public
- semi-public
- semi-private
- private
- very private

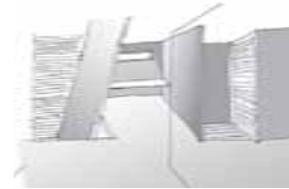




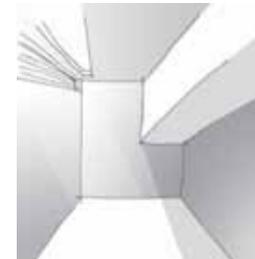
second floor plan
n.t.s.



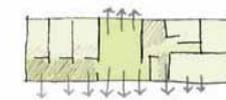
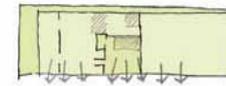
waiting room - massage
south building



waiting room
south building



contemplation space
south building

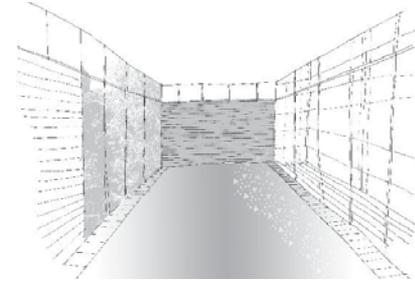


thresholds, levels of
privacy + views

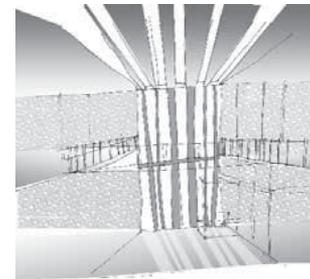


- public
- semi-public
- semi-private
- private
- very private

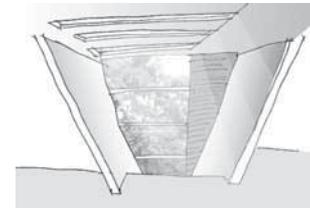




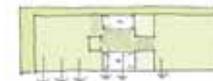
gym interior view



northern building core



southern building core



thresholds, levels of privacy + views



- public
- semi-public
- semi-private
- private
- very private





section aa
n.t.s.





section cc
n.t.s.



Fig 6.1 PHYSICAL MODEL



UNIVERSITEIT VAN PRETORIA NELS
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA





This chapter illustrates the materials and systems used in the design.

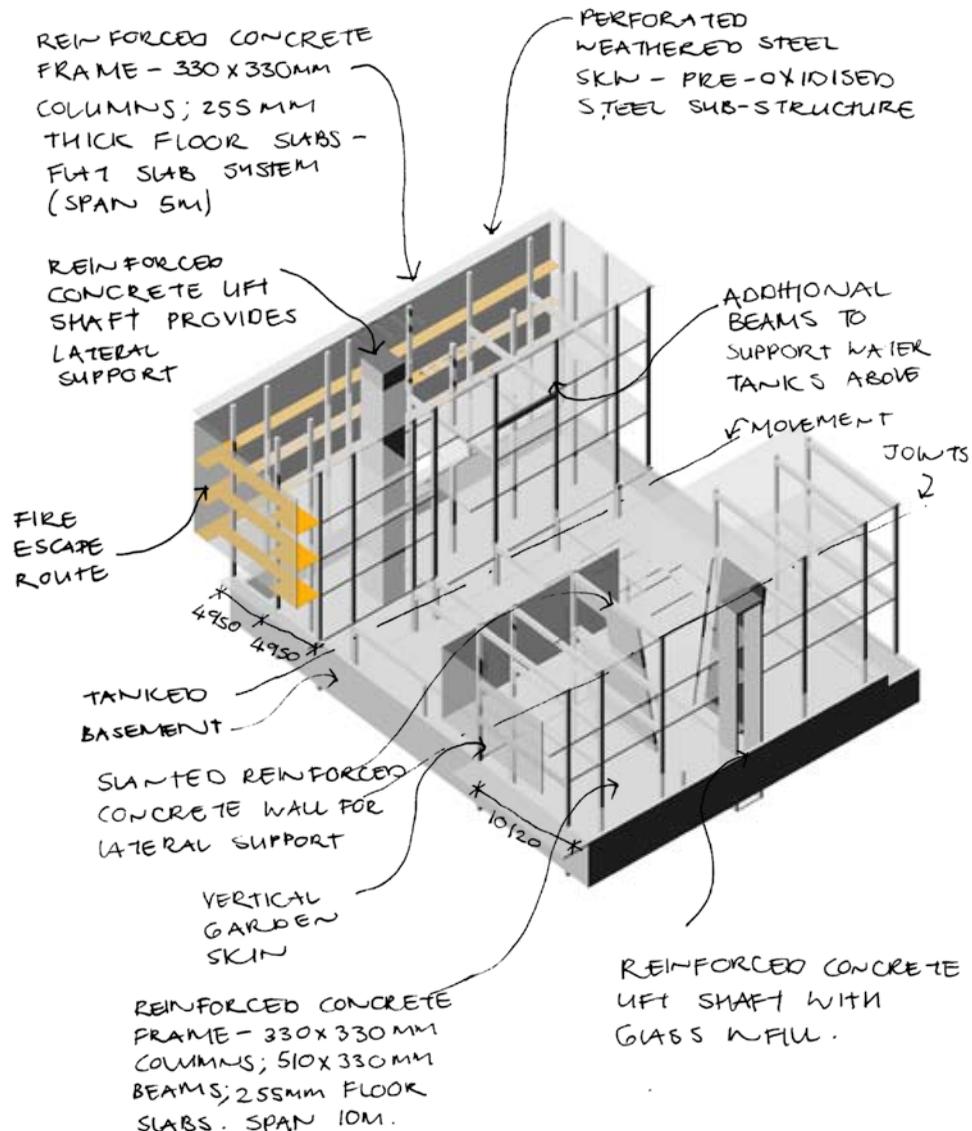
TECHNICAL INVESTIGATION

1 INTRODUCTION

'Healthy environments', on a technical level, implies the use of materials which do not detract from human health (by for example releasing noxious gases) or from the health of the environment (sourced from unsustainable sources). The physical building should also not be inclined to sick building syndrome. This chapter discusses the construction of the design in different levels, relating to structure; skins; systems and materials used with the objective of creating a healthy environment. The Sustainability Building Assessment Tool (SBAT) rating system was implemented to quantify the sustainable potential of the building.

2 STRUCTURE

The main building structure consists of reinforced concrete made with Eco Cement and fly ash. Eco Cement contains magnesium oxide, which absorbs carbon dioxide from the atmosphere. Fly ash is a by-product of the combustion of coal, which is used in manufacturing electricity. Fly ash improves the strength of concrete, and decreases the amount of cement needed in the mix.



External skins wrap around the northern and western façades of both buildings. These skins protect the interior skins from excessive heat by acting as shading mechanisms, and also allows for ventilation to take place for the cooling of these façades. Interior skins provide thermal insulation to the interior of the building.

A ventilated gap separates the two skins in both buildings to minimize heat gain from the external skins, and to cool the buildings.

I EXTERNAL SKINS

The northern building skin consists of perforated weathered steel, while the southern building skin consists of prefabricated vertical garden panels.

PERFORATED WEATHERED STEEL SKIN WITH OPERABLE PANELS

This flexible operable panel system allows the users a degree of control over their environment, as they can choose the degree of openness or enclosure. Sheet metal radiates heat quickly, which frequent perforations counter by allowing ventilation to take place. These perforations also filter light into the building, and cast shadows on the interior which mimic patterns of light through the leaves of a tree. A ventilated air gap separates the skin from the interior skin, and this allows space for a secondary fire escape route. This skin also visually distances the interior environment of the building from the chaos of the city street.

PROPERTIES OF WEATHERED STEEL

Weathered steel is an alloy of steel and copper, and weathers from a smooth steel to a coarse rusted texture over time. Oxidation causes a layer of rust to form on the surface of the plate. Once equilibrium is reached, this oxidation process stops, and the rust layer protects the material from further degradation. Run-off from this material stains surrounding areas, and thus a gutter is provided to catch run-off from this skin and to direct it into the storm water system. The dark colour and rough texture of this material results in less glare to surrounding buildings.

Weathered steel sheets come in standard sizes of 1.225m x 2.5m x 1.6mm. Each such plate will provide nine façade panels. The perforations will be laser-cut into these panels, and then fixed to the sub-structure.

SUB-STRUCTURE

Weathered steel may have an effect on the premature weathering of other metals. This can be prevented by either separating weathered steel from other metals, or by employing pre-oxidised steel sub-structure and welding connections.

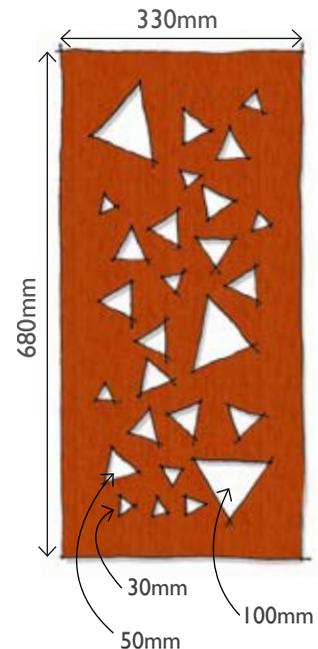


Fig 7.2 PANEL I:10

VERTICAL GARDEN SKIN

The G-Sky prefabricated vertical garden system is employed as exterior skin on the southern building. *Clematis brachiata* (traveller's joy), an indigenous deciduous creeper, protects the interior skin from excessive sunlight in summer while allowing sunlight to penetrate into the building in winter. This creeper flower in summer, and the flowers may be used in traditional medicines to treat colds and headaches. This skin provides a soft edge to the southern edge of the square, and also perceptually distances the southern building from the activity in the square.

The vertical garden system will be irrigated with a drip irrigation system, which will source water from a rainwater tank on the top floor of the building. The sub-structure of the system is from stainless steel (see figure 7.3). The G-Sky system consists of panels which can be maintained and replaced easily.

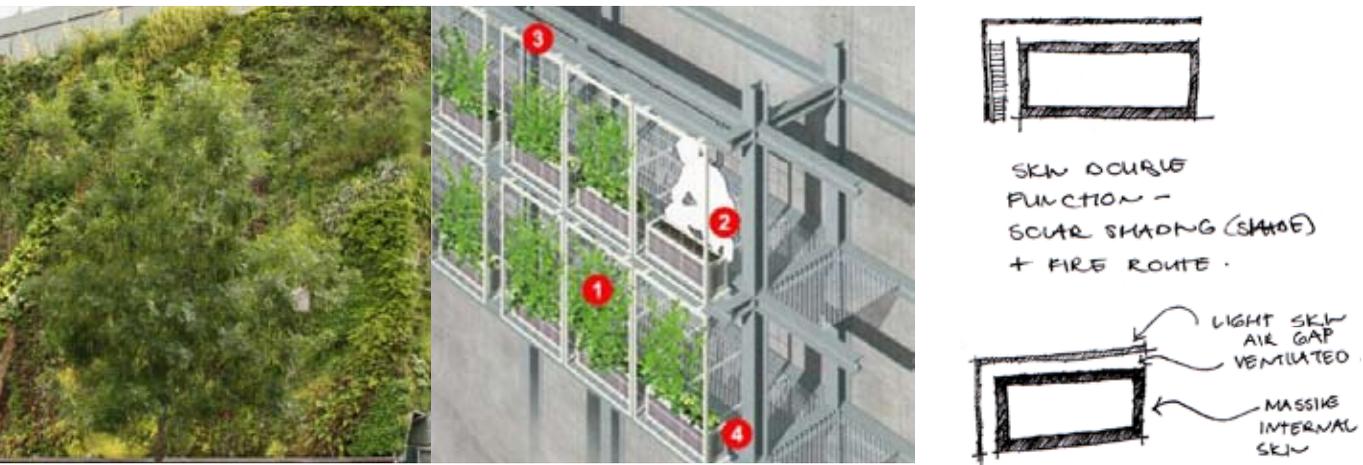


Fig 7.3 G-SKY VERTICAL GARDEN SYSTEM (left); FUNCTIONING OF SKINS

2 INTERNAL SKINS

The internal skins of both buildings will consist of a combination of masonry cavity walls and low emissivity glass curtain walls.

MASONRY SKIN

Masonry cavity walls reduce the ingress of moisture into a building, thus reducing the chances of fungal growth. Cavity walls also have lower U-values than double skin walls (220mm). An un-plastered 220mm brick skin has a U-value of $3.25 \text{ W/m}^2\text{k}$, while a cavity wall, consisting of two 110mm brick walls separated by a 50mm cavity, has a U-value of $2 \text{ W/m}^2\text{k}$ (see Appendix B). A lower U-value means better resistance to heat transfer, thus a cavity wall is well suited to function as an internal skin.

GLASS SKIN

A low emissivity Smartglass will be used to minimize heat radiation and glare in the building, and for thermal insulation. The Intruderprufe Low E in the ColourVue E range admits 82% of daylight, while having a 0.74 shading coefficient. It has a U value of 3.4, and eliminates 99% of UV rays (see Appendix B).

The core of the building will have a low-emissivity glass facade, while the rest of the building will have a combination of the cavity masonry wall skin and low-emissivity glass windows.

WATER MANAGEMENT

RAINWATER HARVESTING

Water from both roofs will be harvested to supplement the use of municipal water on the site.

Pretoria receives 674mm of rain in a year (Schulze. 1980: 23). This means that 230kl of water can be harvested from each roof each year (see Appendix B), which translates into a possible 600l per day.

Rainwater from the roof of the northern building will be harvested into a 500l tank on the top floor. Additional rainwater will be diverted via the wet service cores to seven 1000l rainwater storage tanks in the basement. After filtering, this water will contribute to the flushing of water closets in the building; 500l can flush 83 water closets.

The southern building will also house a 500l rainwater storage tank on the top floor. This will be utilised for the irrigation of the vertical garden and the planted roof, as well as for supplementing the flushing of water closets in the building.

When these rainwater tanks become empty, water from the basement rainwater storage tank can be pumped up to fill them. Water from this basement tank will also be used for the irrigation of the garden. Run-off from hard surfaces will be filtered and stored in this storage tank.

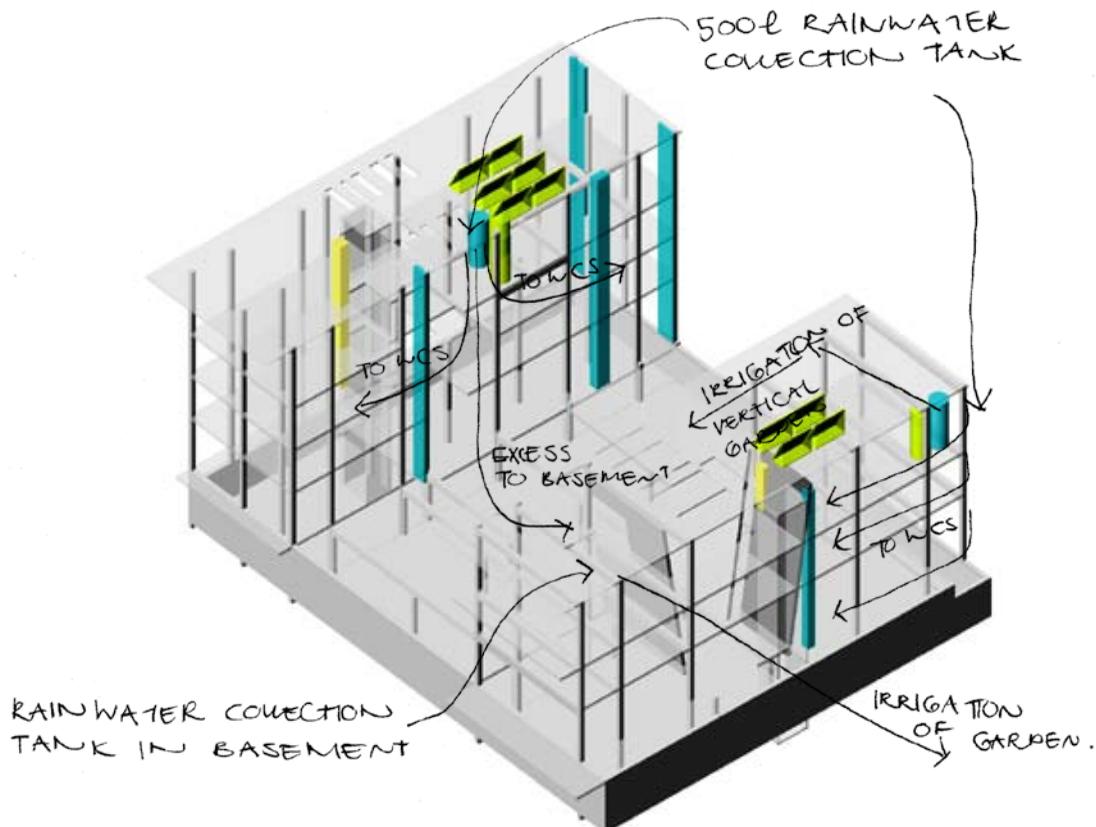


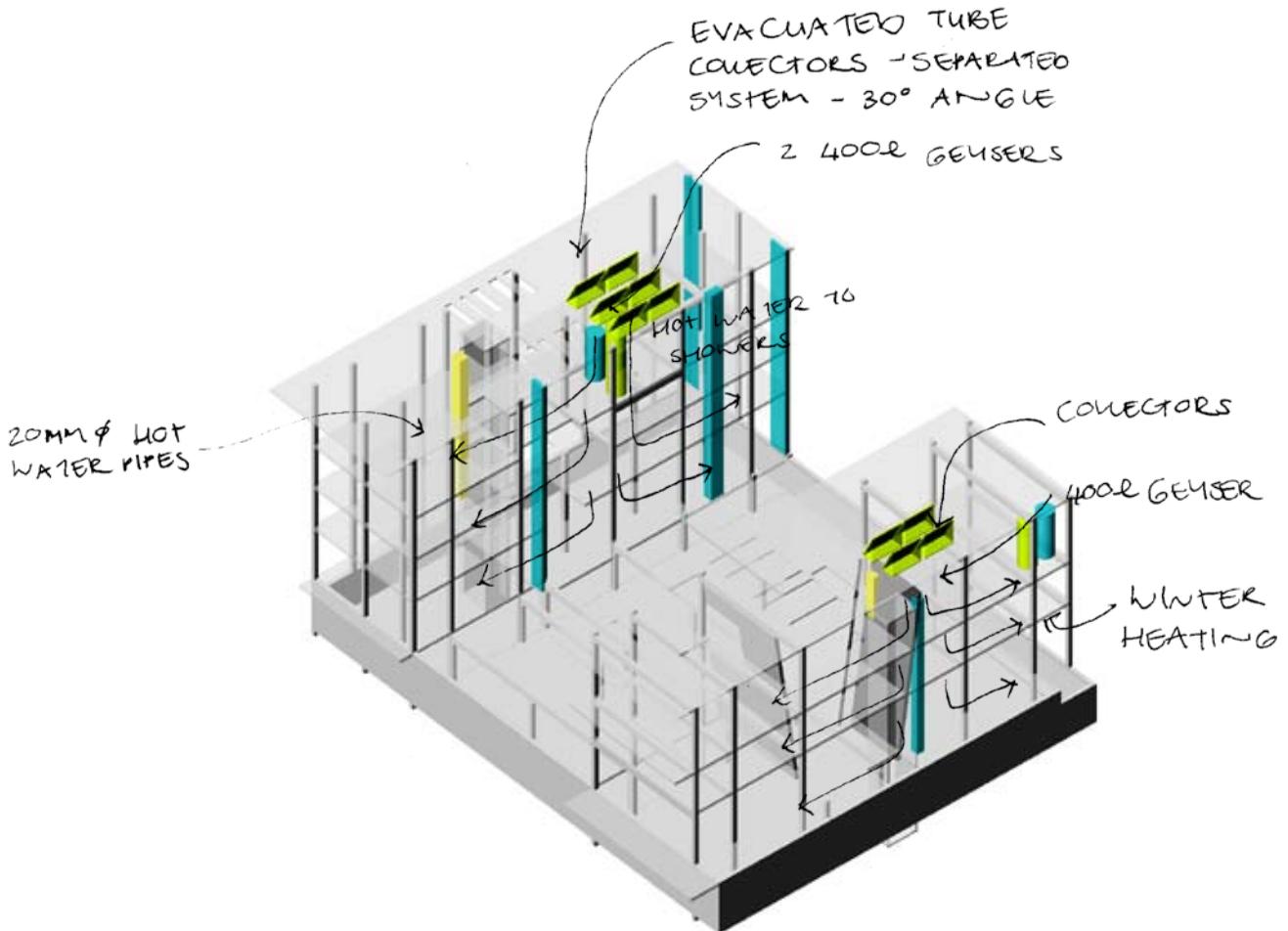
Fig 7.4 WATER SYSTEM

SOLAR WATER HEATING

Evacuated tube indirect solar water heating systems will be employed in both buildings. In the northern building, these will heat water for the showers in the change rooms on the first floor. In winter, this hot water will also be pumped through the building for radiant heating (see Heating + Cooling). In the southern building, the solar water heating system will be used for radiant heating in winter.

Evacuated tube solar collectors will be located on both roofs (see fig. 7.5). In this system, solar collectors are separated from geysers, which will be located on the third floor both buildings. Anti-freeze fluid is reticulated through the collector tubes, and this is used to warm water in the geyser. For the northern building, four collectors will be needed to heat two 400l geysers, while the southern building will need two collectors to heat one 400l geyser (see Appendix B).

Solar collectors will be angled at latitude (25.7 degrees) plus 5 degrees for better winter orientation, thus 30 degrees facing north.



NATURAL VENTILATION

Both buildings and the basement will be naturally ventilated. To achieve thermal comfort with natural ventilation in summer, the following need to be implemented (Clements-Croome, 1997: 116):

- _ insulate the envelope insulation of the envelope
- _ effective and adjustable shading
- _ high levels of thermal mass
- _ operable windows
- _ tall floor to ceiling heights, to allow warm air to collect above head height.

As naturally ventilated environments react to outside temperatures, internal temperatures may be higher than comfort levels allow in very hot conditions. This is acceptable for 10% of the time (Clements-Croome, 1997: 110).

Areas of 'closer comfort' and 'looser comfort' (Clements-Croome, 1997: 153) were identified (see fig. 6.6). In areas of 'closer comfort' the user will be able to regulate shading and ventilation, while in areas of 'looser comfort', the building management will be in charge of shading and ventilation (and thus it will be slower to respond to a change in weather).

'Closer comfort' is needed in areas which will be used 90% of the operational time of the building, such as offices and the gym. 'Looser comfort' can be provided in circulation areas and the core, which will only be used intermittently.

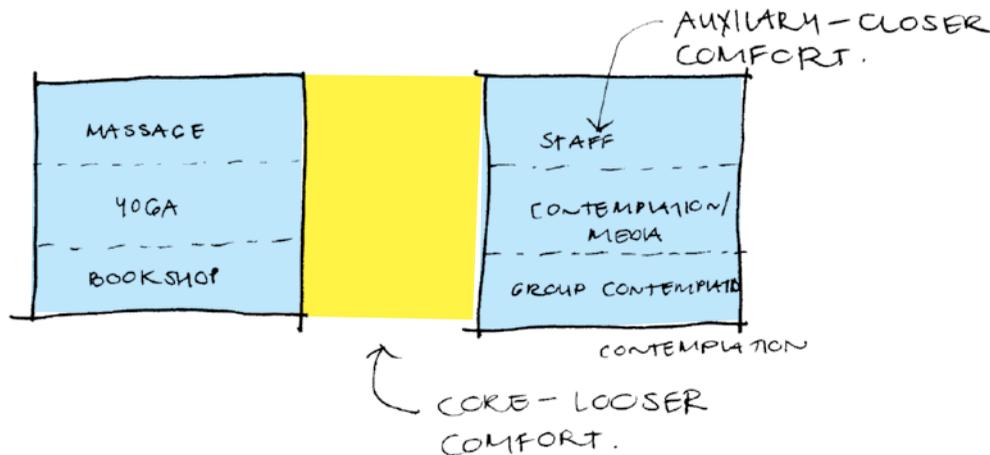


Fig 7.6 CLOSER + LOOSER COMFORT

NIGHT-TIME COOLING

Night-time cooling, working in conjunction with natural ventilation, will cool the building at night. Windows will be left open at night to admit the cool night air, which will cool the exposed thermal mass of the building. During the day, warm air will be vented to the atmosphere. According to Smith (2007: 40), the system works best when internal solar gains are kept to a minimum, and also in thin buildings, with less than 15 metres between façades. The proposed buildings are both shaded on the north and west façades, and are both 10 metres deep. Night cooling of high thermal mass structures can reduce the peak temperature by 2-3°C (Smith, 2007: 40).

WINTER HEATING STRATEGY

During winter, hot water from the solar water heaters will be reticulated through 20mm pipes in the cavity of the southern wall of both buildings. The brick walls will absorb heat from these pipes and radiate it into the interior of the building.

The southern building will also make use of passive solar gain during winter, as the deciduous creepers on the vertical garden will lose their leaves and allow sunlight to penetrate into the building.

GREEN ROOF

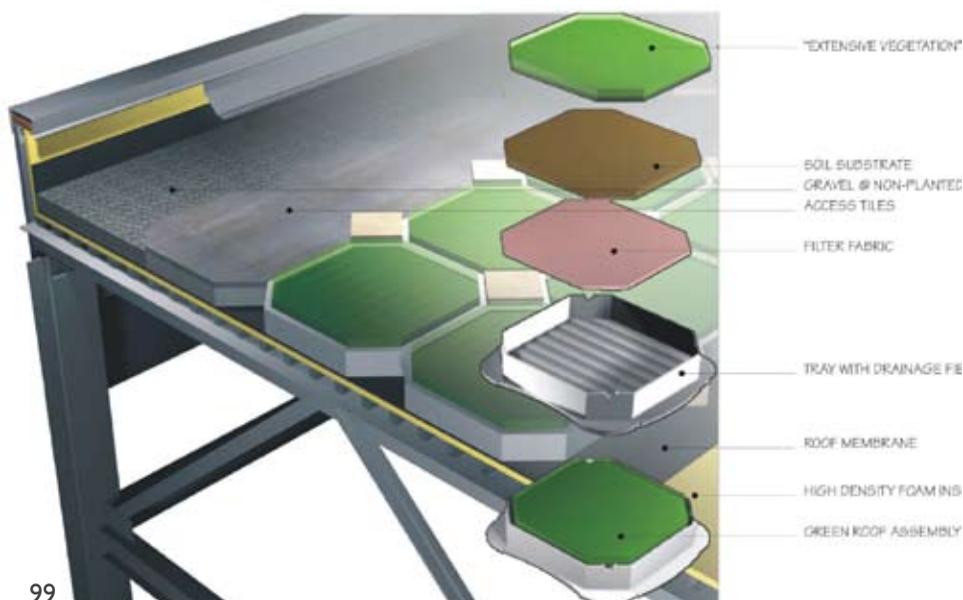
Planted roofs will be applied to both buildings. A modular, pre-grown extensive system will be employed which is easier to maintain; applies a lighter load; and allows for easier roof maintenance access than traditional (intensive) systems.

Water wise indigenous ground covers with shallow root systems, for example *Duchesnea indica* (wild strawberry); *Asparagus asparagoides* (cape smilax); *Lamium maculatum* (lamium); *Plectranthus madagascariensis* (madagascar spurflower) and *Plectranthus verticillatus* (money plant), to landscape architect's specification, will be planted. Drip irrigation will be used, and water will be pumped up from the rainwater tanks on the top floors of both buildings.

BENEFITS OF GREEN ROOFS

- Green roofs (www.greenroofs.org):
- _ reduce the urban heat-island effect
 - _ improve thermal insulation of roofs
 - _ increase biodiversity in the city
 - _ aid storm water retention
 - _ protect roof surfaces

Fig 7.7 EXTENSIVE GREEN ROOF SYSTEM



The northern building has two escape routes – one via the central core and another via the building skin, with stairs on the western façade. The southern building only needs one escape route (SABS0400 TT16.2), as it is 3 storeys high and its top floor has an occupation of less than 25 people. One fire hose reel and one portable fire extinguisher will be provided on each floor (SABS 0400 TT35.2 + TT 37.4).

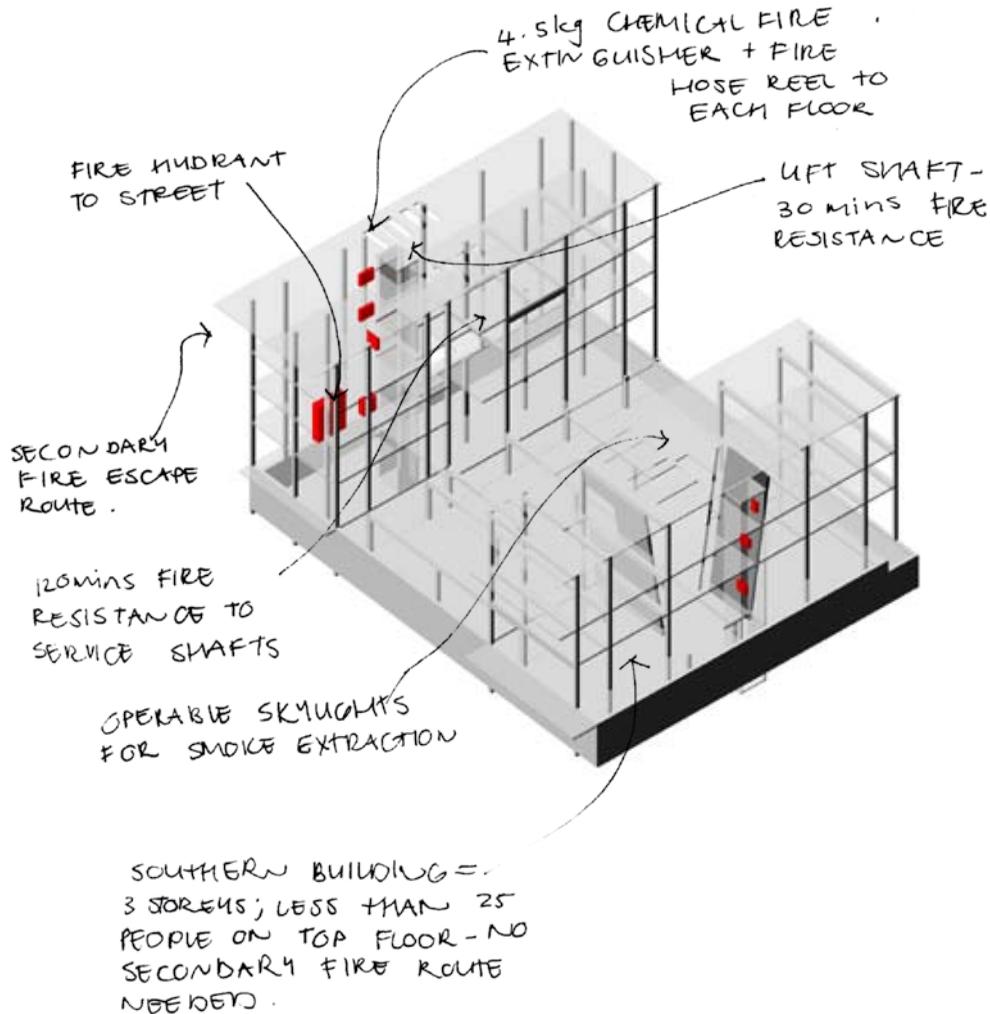


Fig 7.8 FIRE SYSTEM

5 MATERIALS

Materials were sourced for their sustainability; their non-intrusion on human health; for their tactile quality and for their contribution to the austere character of the design.

On an urban scale, this project suggests the use of Titanium dioxide-embedded concrete pavers on new sidewalks and as a second paving material for the square, as this absorbs noxious nitrogen dioxide (NO₂) from vehicle emission and converts it into harmless NO₃ (www.treehugger.com).



MATERIAL PALLETE

REINFORCED CONCRETE

STRUCTURE; STAIRS

BENEFITS

- _ Fly-ash reinforced concrete with crushed concrete aggregate
- _ Use EcoCement in mix - absorbs CO₂ from the atmosphere
- _ Massive - retains heat or coolness - flywheel effect

IMPLICATIONS

- _ Mouldable; shuttering - chamfered edges; drip joints; waterproofing
- _ Shuttering leaves texture on soffit surface

WEATHERED STEEL

NORTHERN BUILDING SKIN

BENEFITS

- _ Forms protective layer
- _ Minimises glare to surrounding buildings
- _ Low maintenance

IMPLICATIONS

- _ Manage run-off to minimise staining (gutter skin system)
- _ Adjacent materials of pre-oxidised steel + welded connections

VERTICAL GARDEN

SOUTHERN BUILDING SKIN

BENEFITS

- _ Carbon sink + renews itself
- _ Releases oxygen to building
- _ Deciduous creepers filter sunlight in summer + let it through in winter

IMPLICATIONS

- _ Drip irrigation needed
- _ Divided into panels for easy maintenance - GSKy system

FACE BRICK (Mahoni Satin FBA)

INTERNAL SKINS

BENEFITS

- _ Local material
- _ Good thermal insulation
- _ Low maintenance

IMPLICATIONS

- _ Standard brick modules (85 x 110mm)

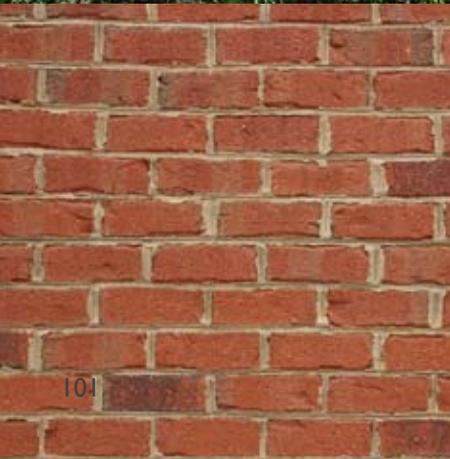


Fig 7.9 MATERIAL - CONCRETE;WEATHERED STEEL;VERTICAL GARDEN;
FACE BRICK (top to bottom)

GRANITE COBBLESTONES

SQUARE

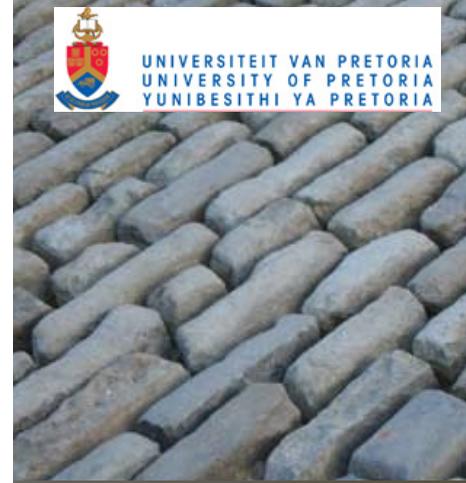


BENEFITS

- _ Natural material
- _ Local material

IMPLICATIONS

- _ Drainage to inlets
- _ On concrete screed laid to fall towards inlets



RHINOLITE GYPSUM PLASTER CONTEMPLATION SPACE

BENEFITS

- _ Smooth finish; paint with EnviroLite paints

IMPLICATIONS

- _ Apply oil based paint bonding liquid before painting

PIGMENTED PLASTER CHANGE ROOMS

BENEFITS

- _ Rough finish

IMPLICATIONS

- _ Seal with acrylic matt sealant



EUCALYPTUS MICROCORYS TIMBER LIGHT STRUCTURES

BENEFITS

- _ Renewable material
- _ Hard wood

IMPLICATIONS

- _ External use - treat with a pressure impregnated preservative
- _ Use standard sizes and lengths



GREEN ROOF

CONCRETE ROOFS

BENEFITS

- _ Prevents roof from becoming heat island
- _ Insulates building
- _ Encourages biodiversity

IMPLICATIONS

- _ Extensive system - lighter load; easier maintenance
- _ Irrigation needed; maintenance access



Fig 7.10

MATERIAL - GRANITE COBBLES; GYPSUM PLASTER; PIGMENTED PLASTER; TIMBER; GREEN ROOF (top to bottom)



EPOXY COATED SCREED

SEMI-PRIVATE SPACES

BENEFITS

- _ Massive - flywheel effect
- _ Smooth finish

IMPLICATIONS

- _ Control joints at 3x3m intervals + around columns



BAMBOO FLOORING

PRIVATE SPACES

BENEFITS

- _ Renewable material
- _ Tactile quality

IMPLICATIONS

- _ Laid on 60mm non-absorbent foam pad with latex glue
- _ 20mm expansion joint at wall junctions



FROSTED GLASS

SEMI-PRIVATE SPACES

BENEFITS

- _ Light transmission without compromising privacy
- _ Glass is fully recyclable

IMPLICATIONS

- _ Safety glass minimum 6mm thick
- _ Lightweight aluminium frame; glass fins for lateral stability



BAMBOO WALL CLADDING

PRIVATE SPACES

BENEFITS

- _ Renewable material
- _ Natural material

IMPLICATIONS

- _ Laminated veneer on composite board base
- _ Panels fixed to masonry wall with countersunk stainless steel self-tapping screws + wall plugs



Fig 7.11 MATERIAL - EPOXY COATED SCREED; BAMBOO FLOORING; FROSTED GLASS; BAMBOO WALL FINISH (top to bottom)

6 SBAT RATING

The Sustainability Building Assessment Tool (SBAT) was implemented to rate the sustainability of the design; the construction process and the management of the building.

Many of the criteria in the SBAT was not relevant to a thesis project, so certain assumptions were made, for example regarding the management of the building.

Points were awarded for each division, and three marks were awarded out of 5. The project rated 4.6 for social performance; 4.3 for economic performance and 3.7 for environmental performance. The overall rating was 4.2, which rates as 'excellent'.

The graph below illustrates the performance of this project:

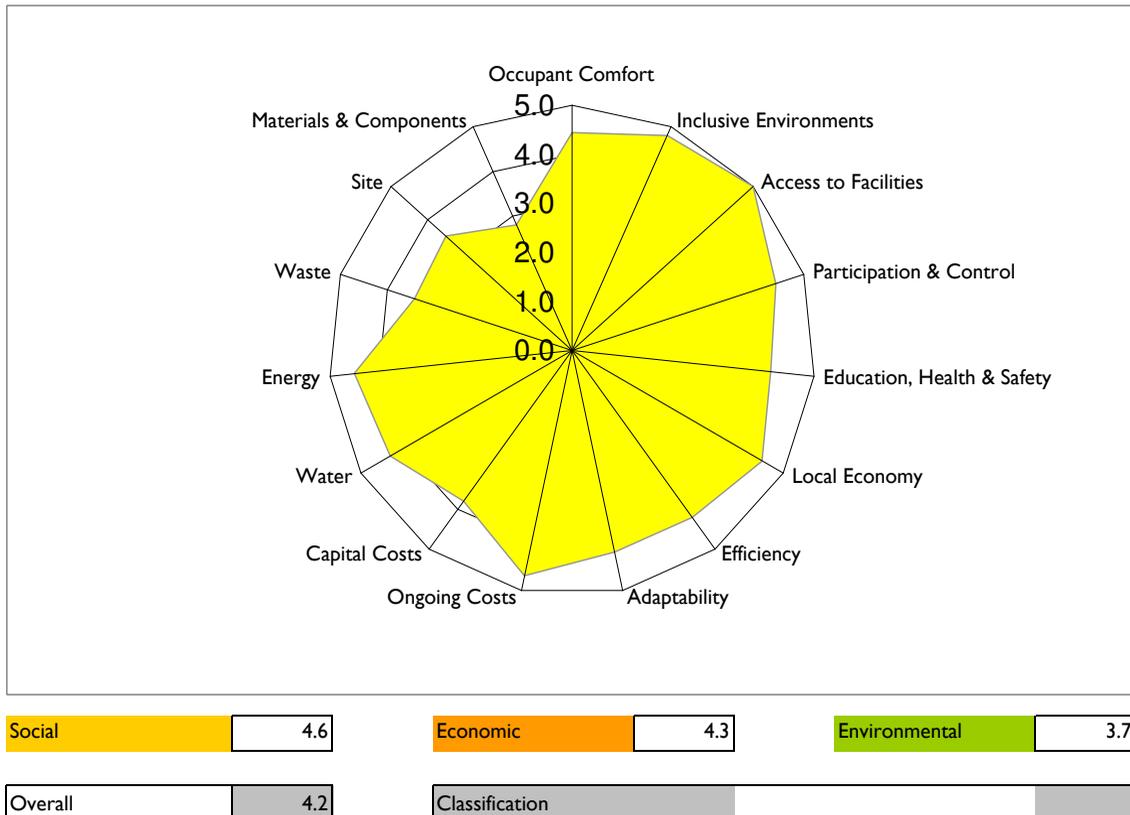


Fig 7.12 SUSTAINABLE BUILDING ASSESSMENT TOOL RESULTS



This chapter illustrates the resolution of the design on a technical level.

TECHNICAL RESOLUTION



VWL CENTRE

HIGH COURT
CHAMBERS

PTA NEWS

PIERNEEF
MUSEUM

TRIBECA

HALLMARK



NATIONAL TREASURY

VITALITY SQUARE

NOORDVAAL

ONS EERSTE VOLKSBANK

PUBLIC PROSECUTIONS

CHURCH SQUARE



LOCALITY PLAN
1:1000

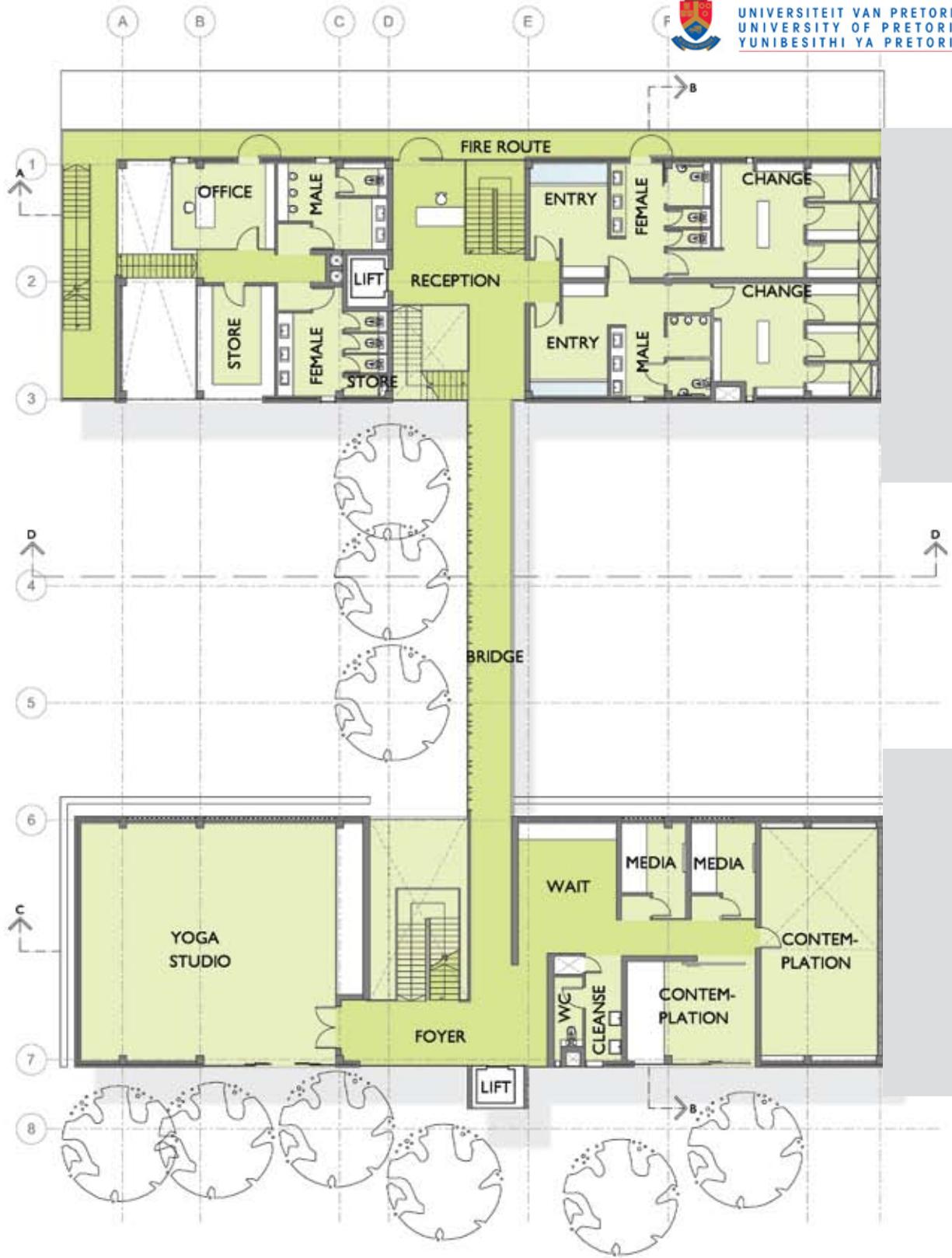


BASEMENT PLAN
1:200





GROUND FLOOR PLAN
1:200



FIRST FLOOR PLAN
1:200





SECOND FLOOR PLAN

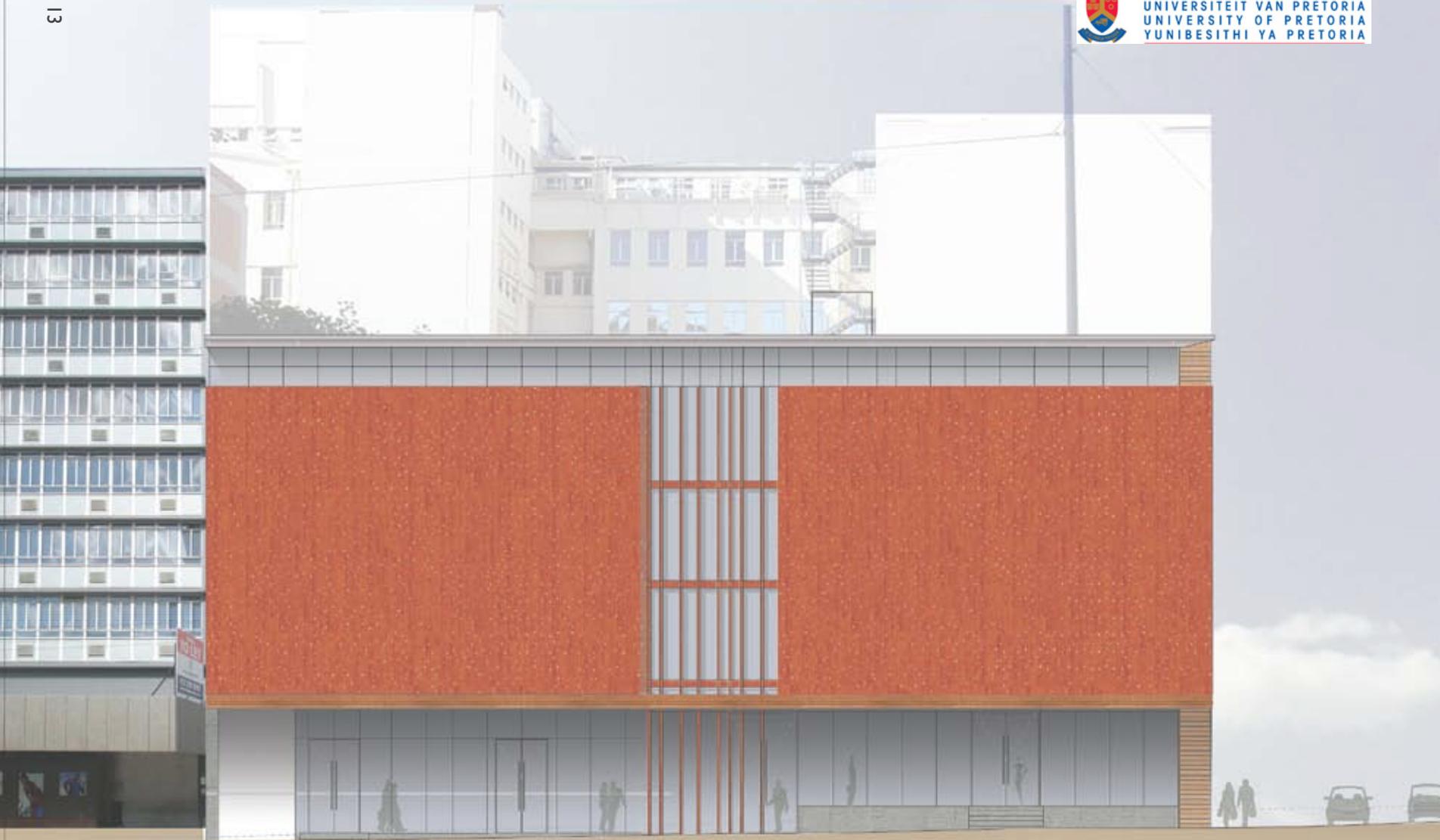
1:200





THIRD FLOOR PLAN
1:200





NORTH ELEVATION - NORTH BUILDING
1:200



SOUTH ELEVATION - NORTH BUILDING
1:200

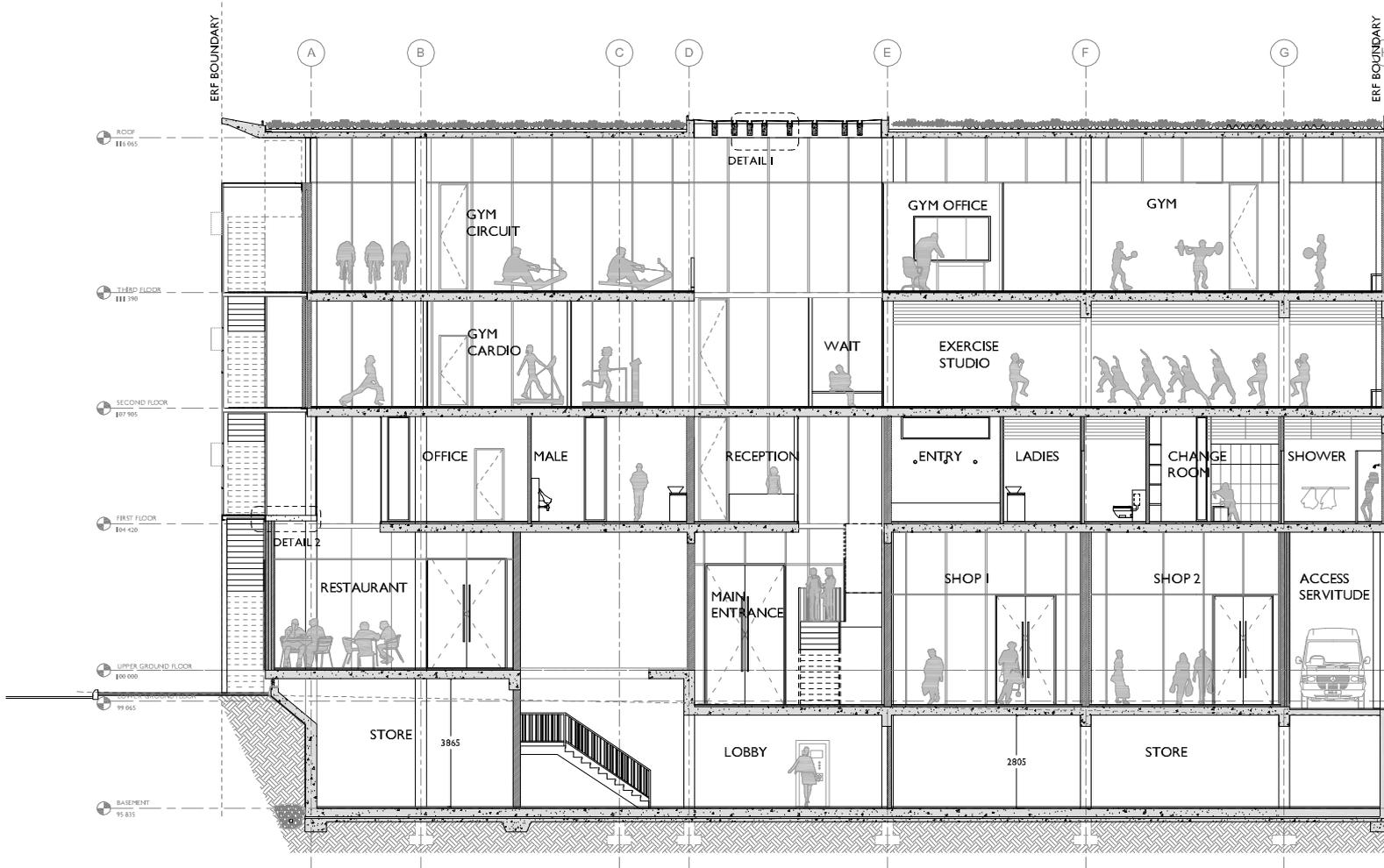


NORTH ELEVATION - SOUTH BUILDING
1:200

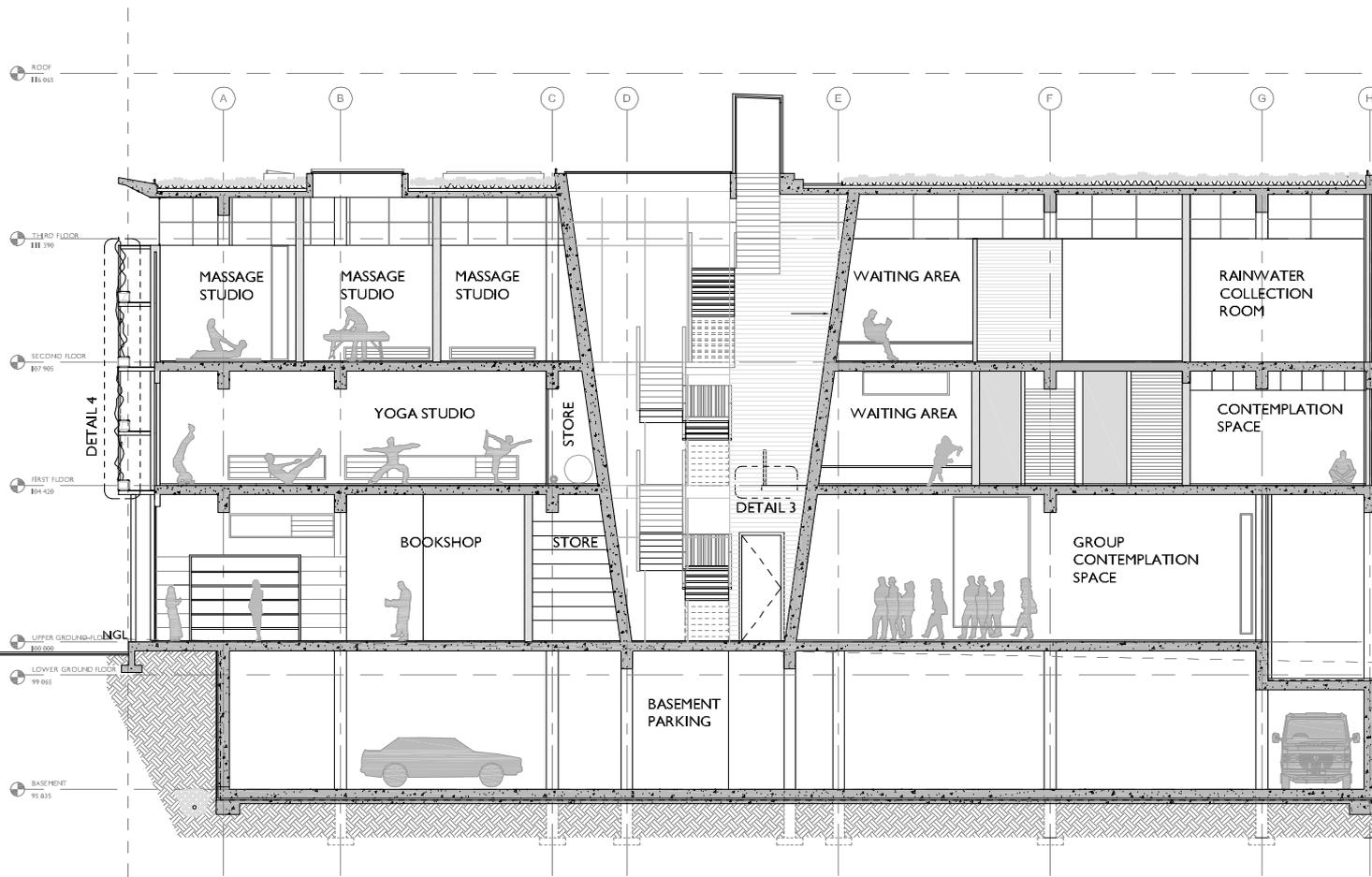


SOUTH ELEVATION - SOUTH BUILDING

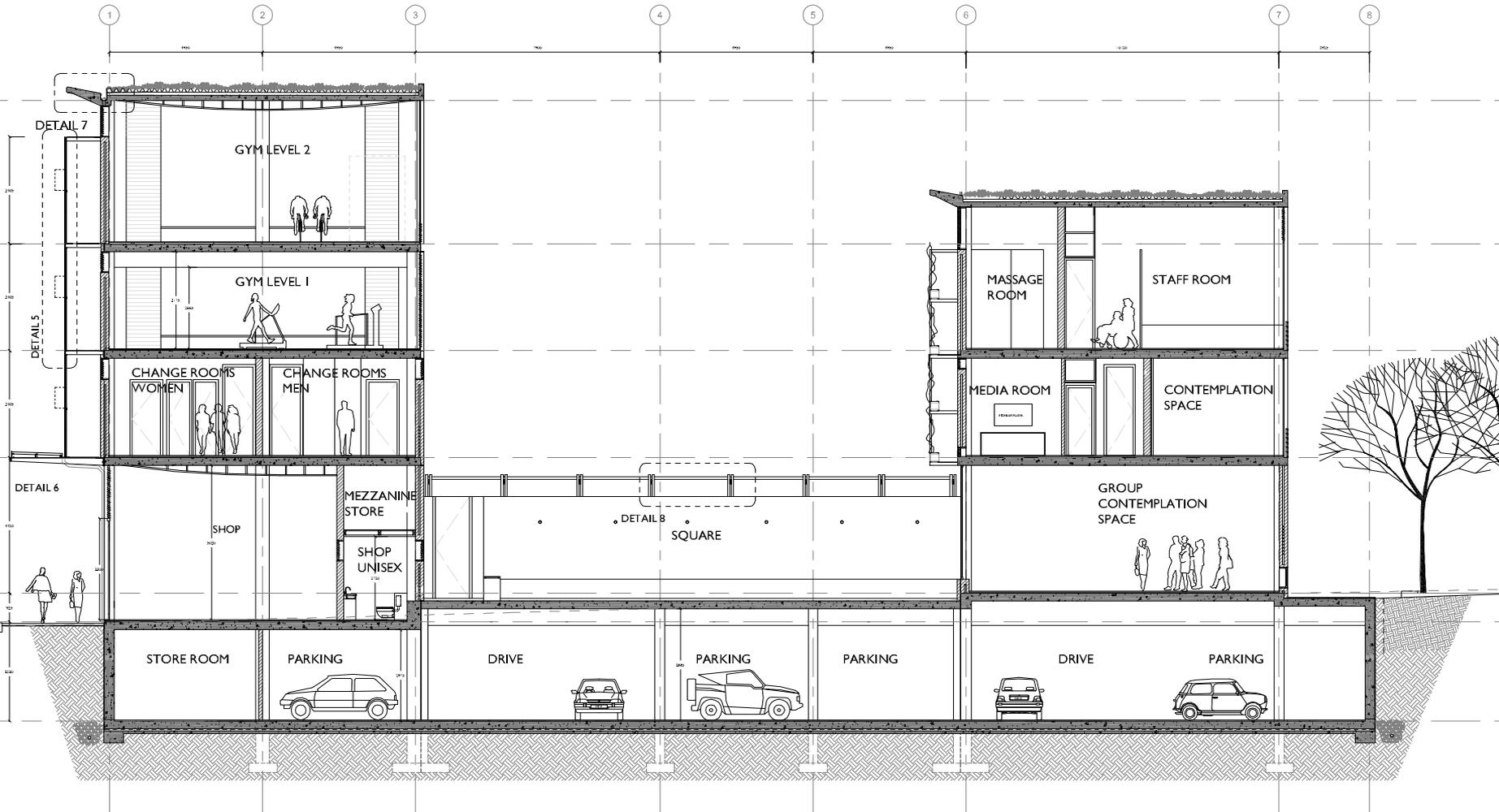
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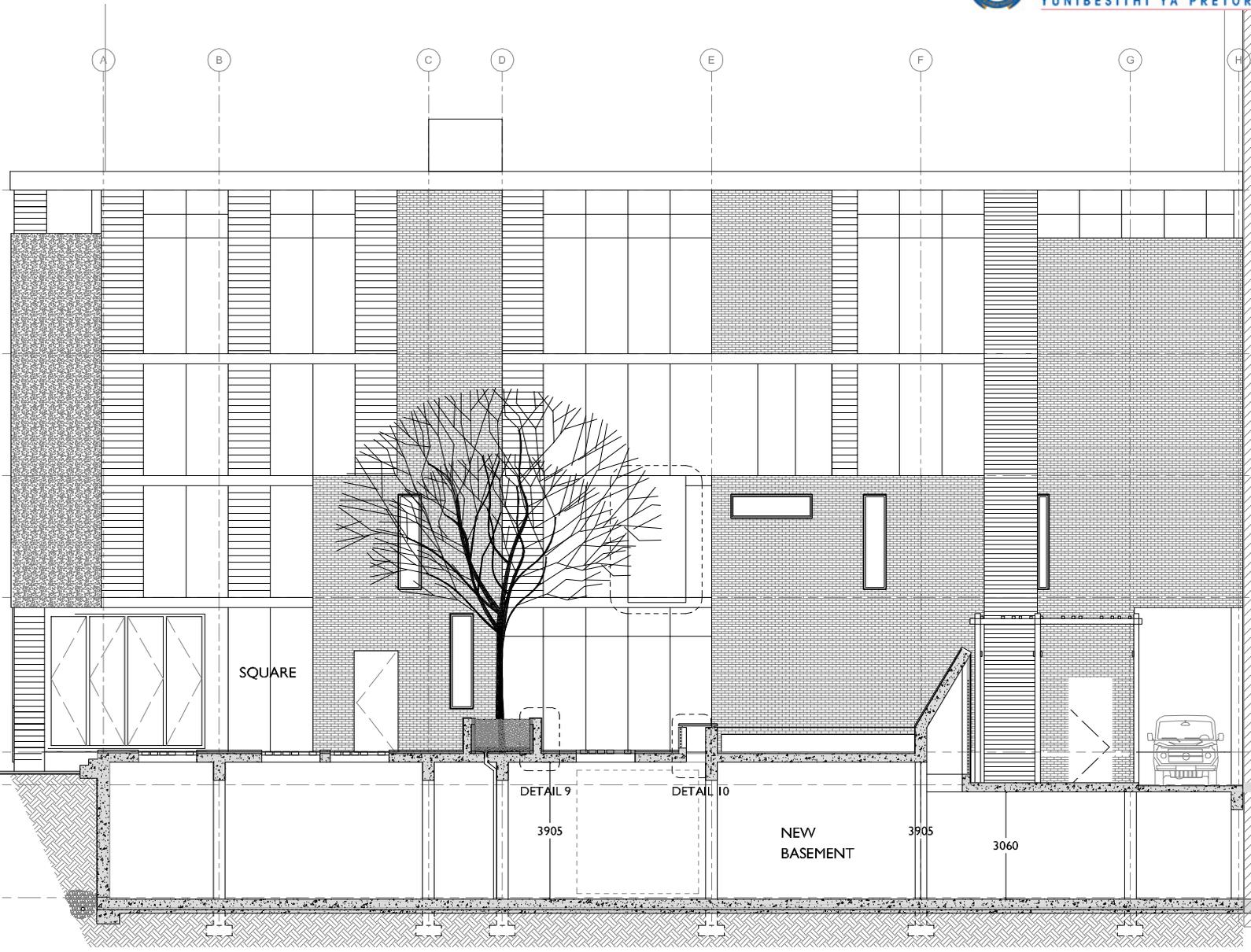
SECTION AA
1:200



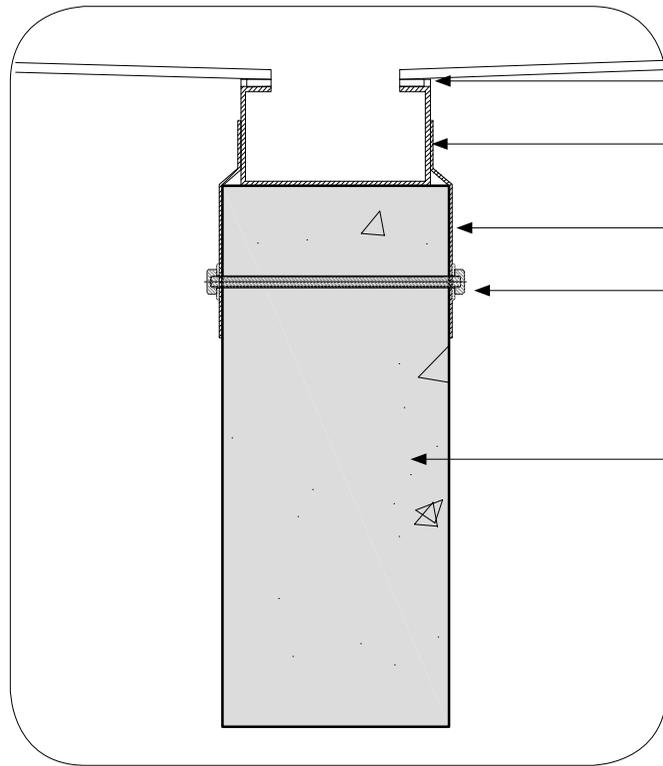
SECTION BB
1:200



SECTION CC
1:200



SECTION DD
1:200



6mm safety glass sky light fixed to channel with double sided tape, sealed

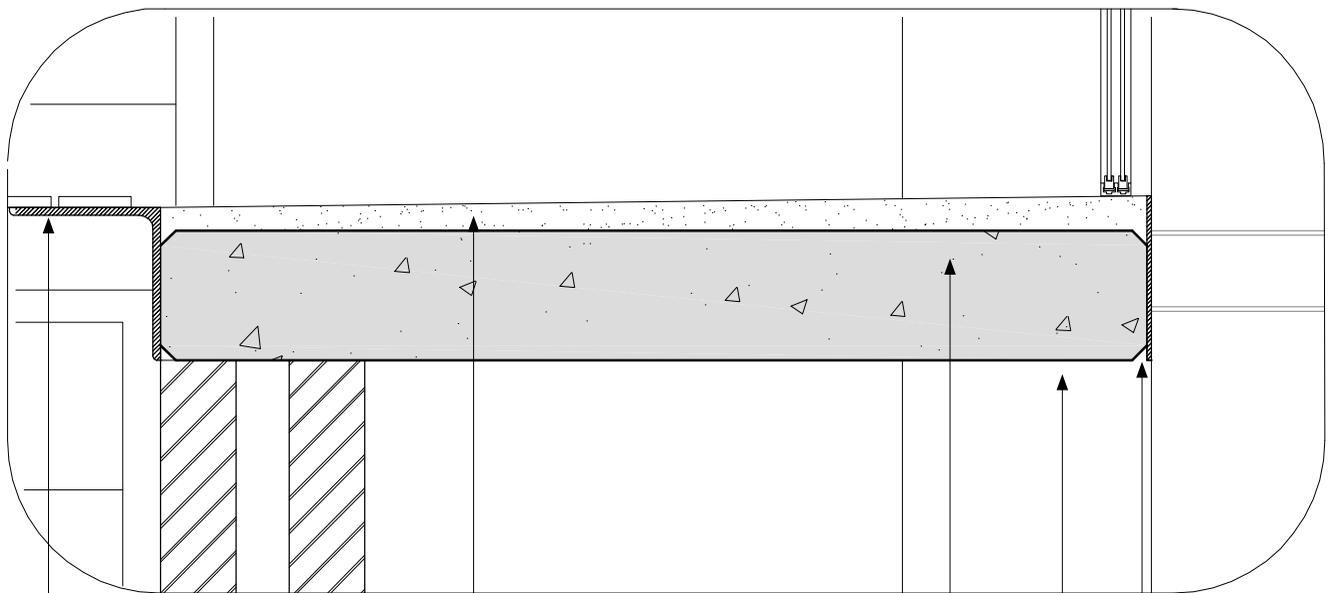
125 x 75 x 20 x 2mm galvanized steel lipped channel gutter, sloped minimum 1:200 towards waterproofed roof

2mm custom-made steel gutter plate, painted

M8 galvanized steel threaded rod, cast into concrete, gutter plate fixed with galvanized steel nut

150mm x 340mm reinforced concrete beam, to engineer's specification

**DETAIL 1
SKYLIGHT 1:5**



200 x 200 x 10mm painted steel equal angle, fixed to reinforced concrete slab with M10 chemical bolts

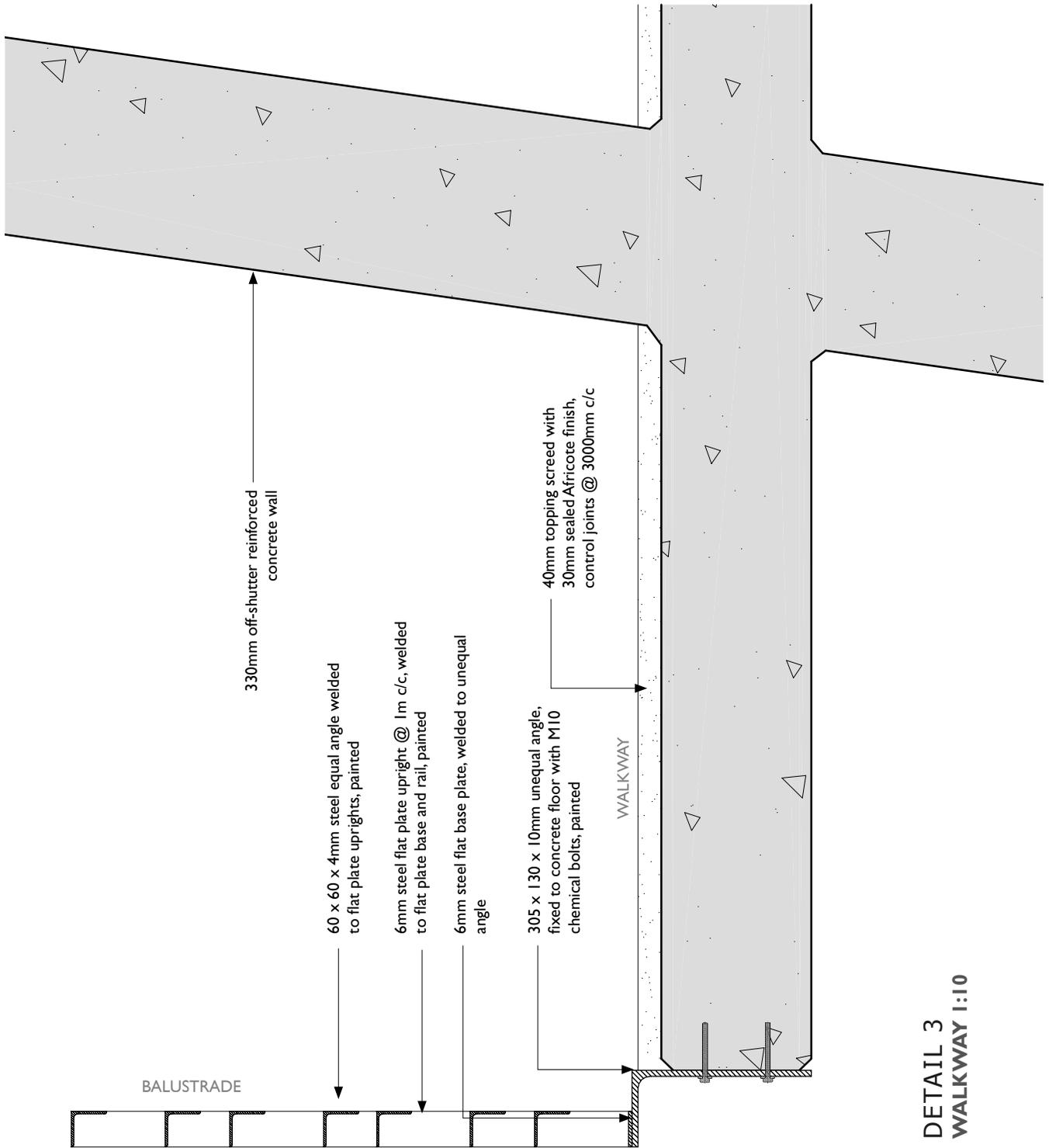
30mm concrete screed, sealed

170mm reinforced concrete slab to engineer's specification

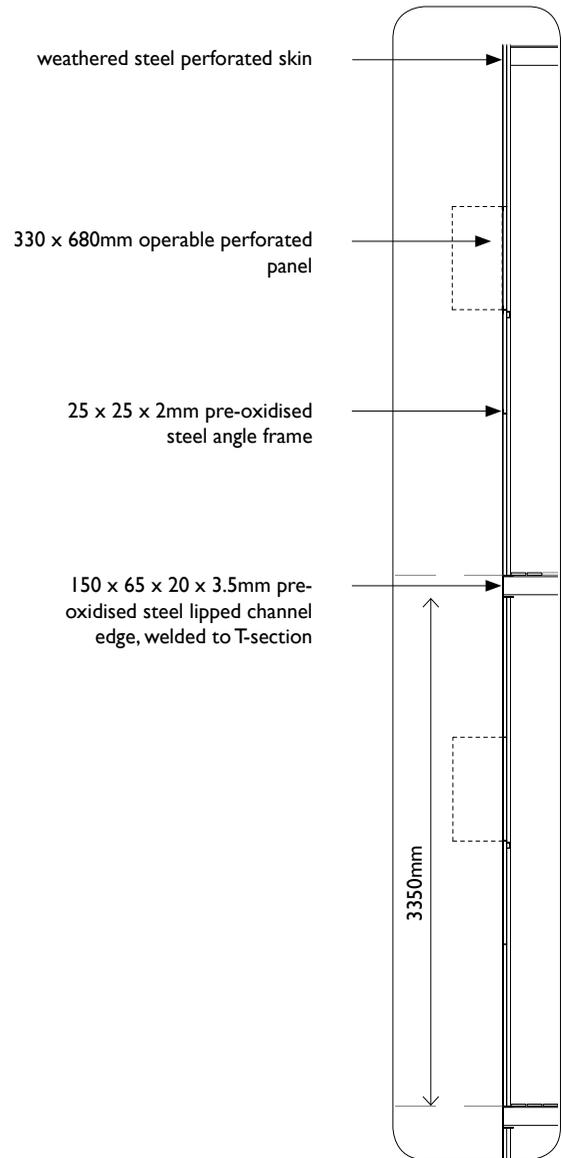
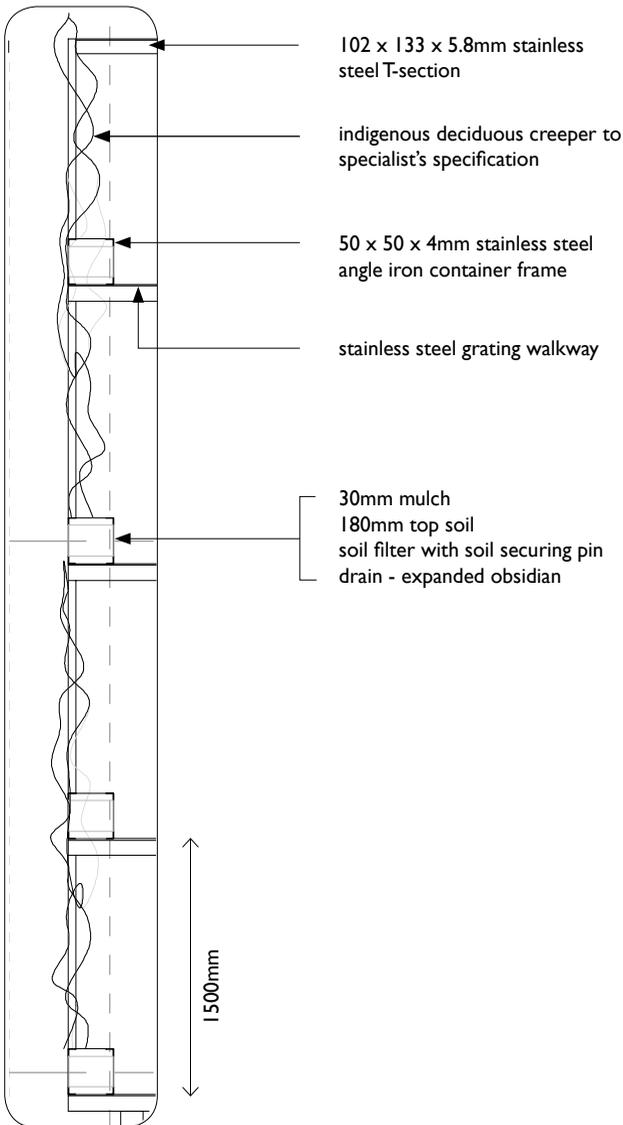
330 x 330mm reinforced concrete column behind

6mm painted steel plate edge, bolted to slab with M10 chemical bolts

**DETAIL 2
WALKWAY 1:20**

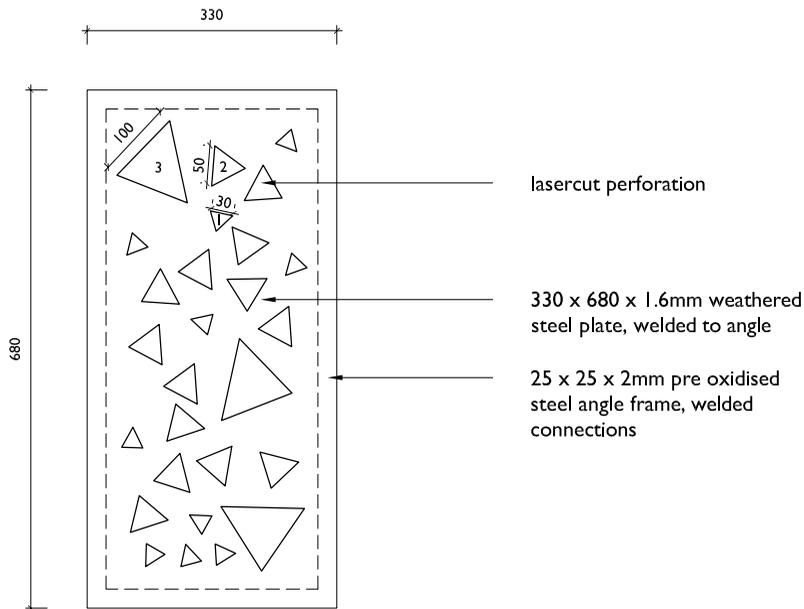


DETAIL 3
WALKWAY 1:10



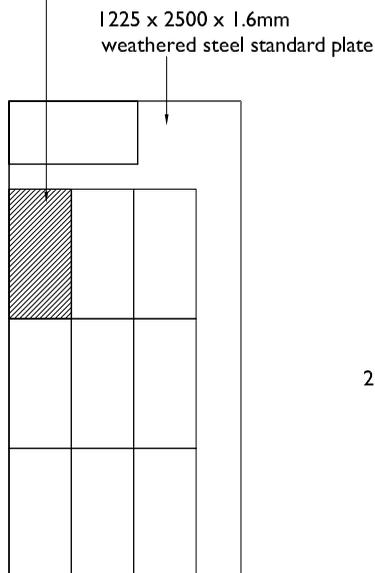
DETAIL 4
VERTICAL GARDEN TO G-SKY
MANUFACTURER'S SPECIFICATIONS
1:50

DETAIL 5
PERFORATED WEATHERED
STEEL SKIN SECTION n.t.s.



OPERABLE PANEL ELEVATION 1:10

10 operable panels cut from 1 sheet, excess used for cold formed sections and hinges



WEATHERED STEEL SHEET
1:50

25 x 25 x 2mm pre oxidised steel angles welded together to form custom made T section, welded to horizontal

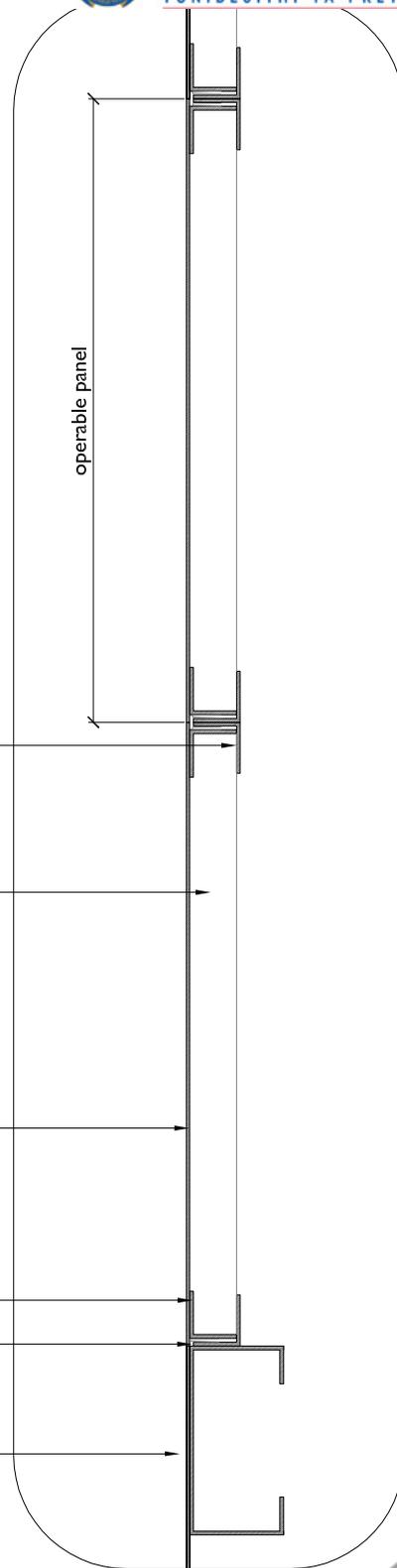
25 x 25 x 2mm pre oxidised steel angle horizontal support, welded to

330 x 680 x 1.6mm perforated weathered steel plate, welded to angle frame

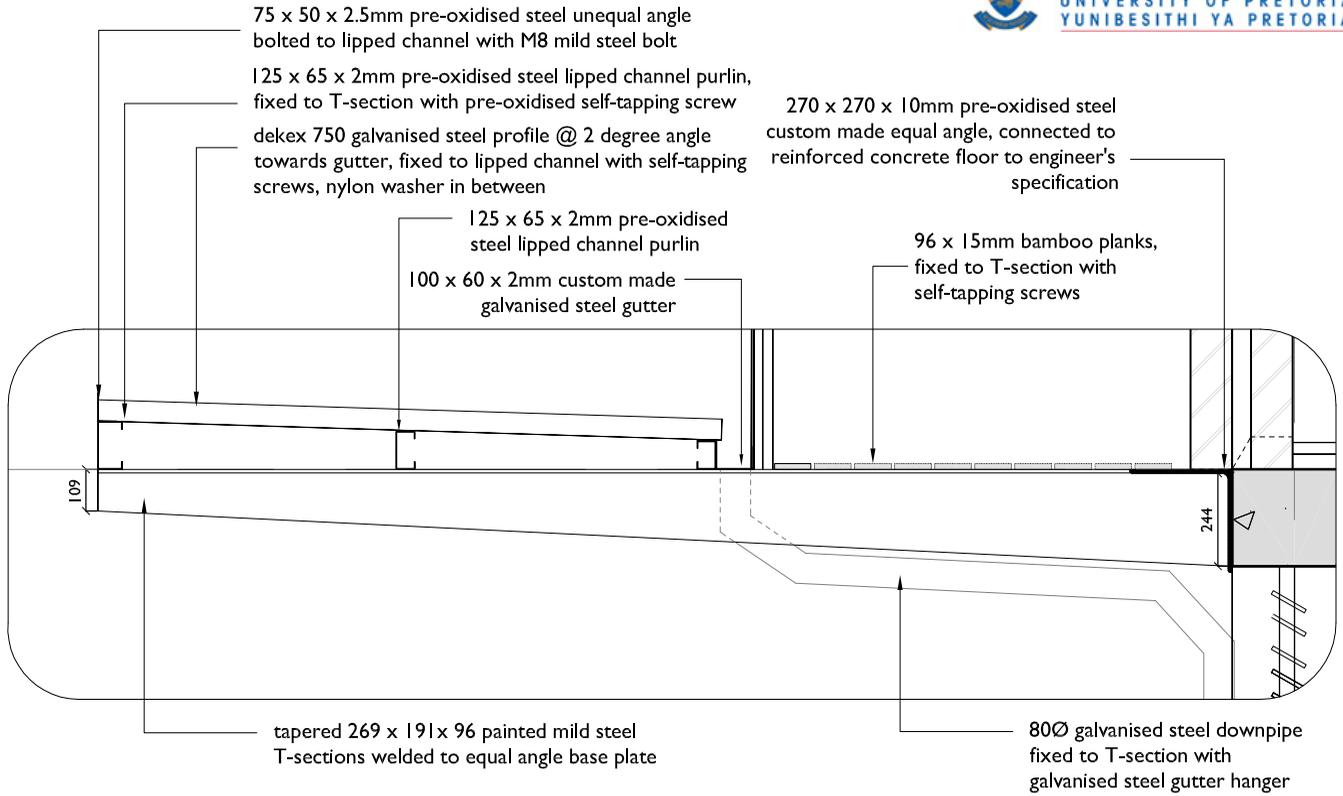
25 x 25 x 2mm pre oxidised steel angle, fixed to angle frame with pre-oxidised steel hinge to detail

25 x 25 x 2mm pre-oxidised steel angle, welded to lipped channel

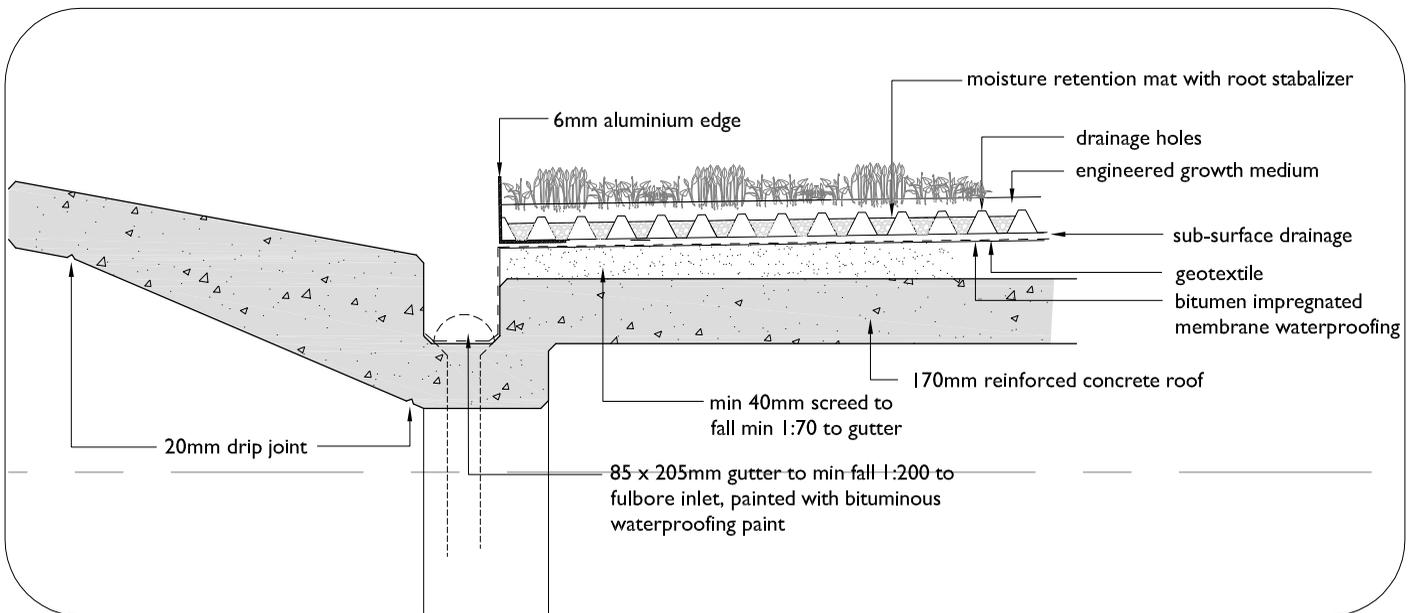
100 x 50 x 2mm pre-oxidised steel lip channel column, welded to pre oxidised channel



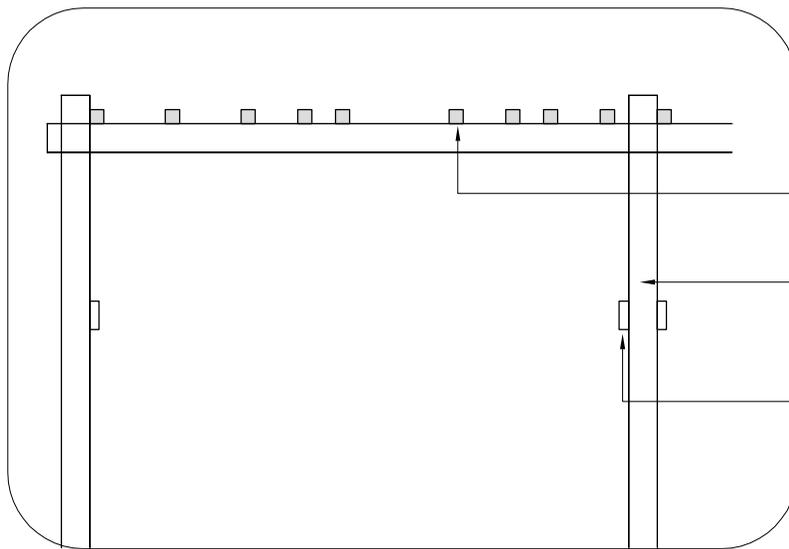
PLAN PERFORATED WEATHERED STEEL SKIN 1:50



DETAIL 6
WALKWAY/CANOPY 1:20



DETAIL 7
ROOF EDGE 1:20



74 x 74mm eucalyptus microcorus timber slats, treated with a pressure impregnated preservative

75 x 150mm eucalyptus microcorus timber column, treated with a pressure impregnated preservative

50 x 150mm eucalyptus microcorus timber beam, treated with a pressure impregnated preservative

74 x 74mm eucalyptus microcorus timber slats, treated with a pressure impregnated preservative

75 x 150mm eucalyptus microcorus timber column, treated with a pressure impregnated preservative

50 x 150mm eucalyptus microcorus timber beam, treated with a pressure impregnated preservative

DETAIL 8 PERGOLA 1:20

50 x 150 x 150mm eucalyptus microcorus timber spacer, treated with a pressure impregnated preservative

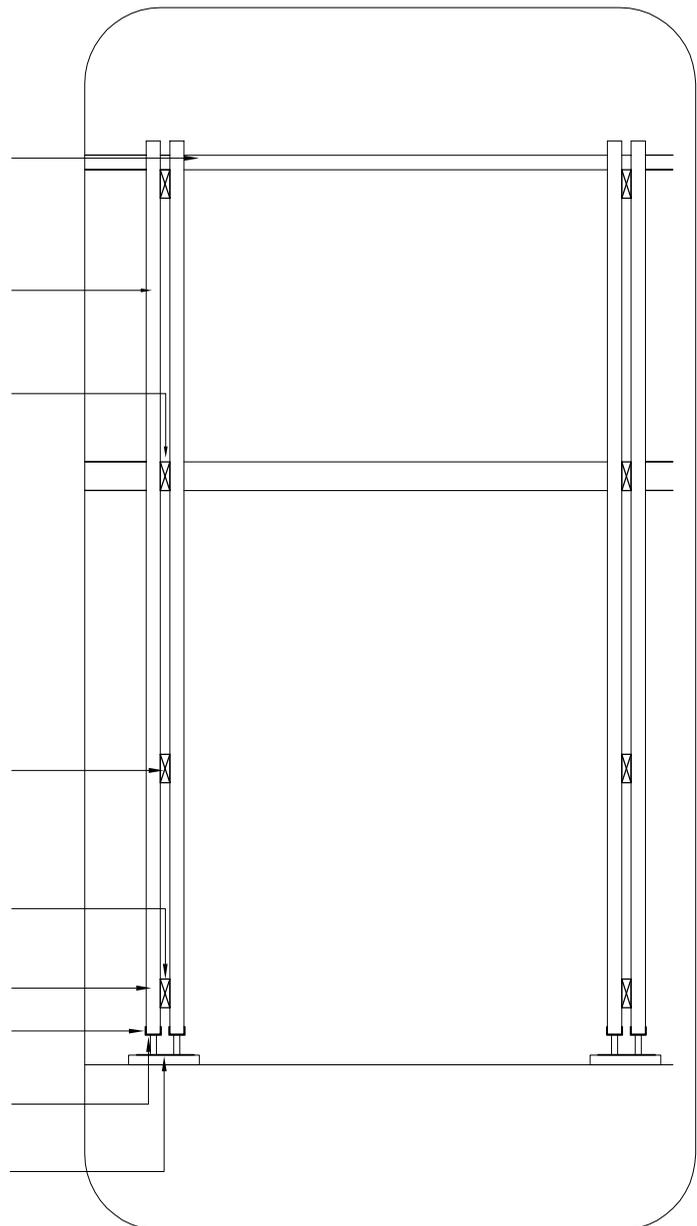
50 x 150 x 150mm eucalyptus microcorus timber spacer, treated with a pressure impregnated preservative

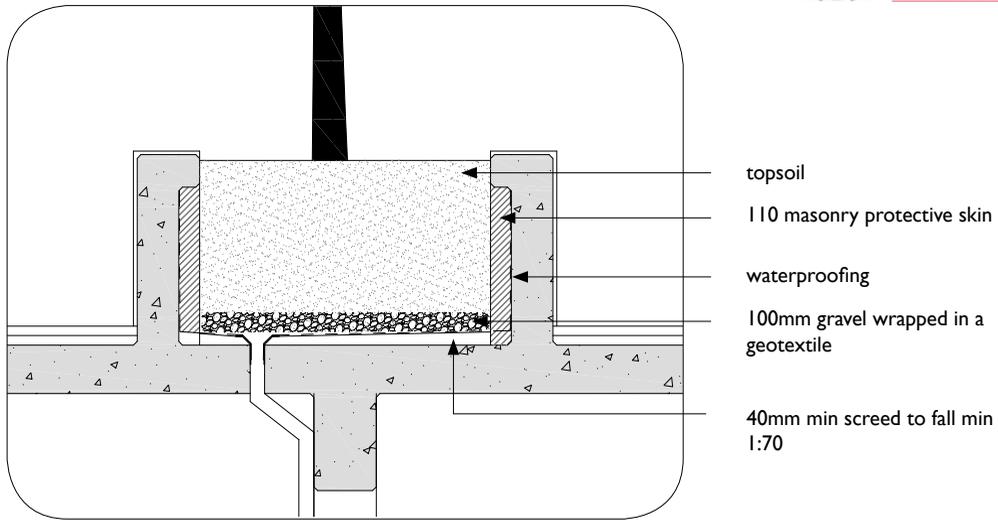
timber column fixed to steel channel with galvanised steel M10 bolt with cap nut

40 x 75 x 4.5mm painted mild steel channel, welded to hollow section

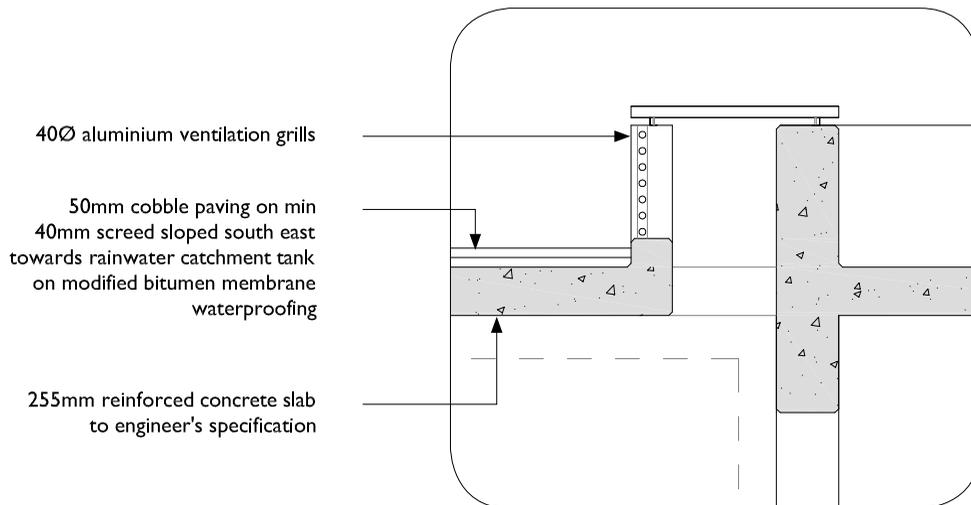
32Ø x 2mm painted mild steel circular hollow section, welded to base plate

300 x 300 x 4mm painted mild steel base plate, anchor bolted to 400 x 400 x 50mm concrete base plate





**DETAIL 9
PLANTER 1:20**



**DETAIL 10
AIRVENT/POND EDGE/SEAT 1:20**



This thesis explored the possibility of healthy environments in an urban context. The design aspired to become an oasis in the city, which would cater to health of the mind, body and spirit.

The hypothesis argued that unhealthy building environments could be counteracted by enhancing the connection between people and the forces of nature. The focus was equally on the physical and the metaphysical characteristics of the architecture and the impact thereof on the user.

The site is situated in the Pretoria CBD on a quiet exit road from Church Square. It is in close proximity to many legal offices and law courts. Insufficient amenities aimed at the white collar workers in this area made this a convenient site for a vitality centre.

The internal quality of buildings in the area was investigated, and their environments were found to be artificial, generic and users had no control over their environment. The design proposed an alternative to this mechanistic approach, in which the elements of nature are invited into the building in order to facilitate a feeling of wellbeing in its users.

The design used six principles to create a healthy, tranquil environment: the use of natural ventilation and light; tranquil exterior spaces, with views onto them; the use of materials with sensory qualities; utilising the elements of nature; and allowing users control over their own environments. These principles were based on the theories by Ando, Pallasmaa and Kaplan and Kaplan, as well as on the results of a questionnaire which the author distributed. These objectives all contribute to creating a healthy environment, but the design would have to be experienced in order for it to be proven to be so.

The design should act as a precedent for establishing healthier environments, and should have a positive effect on the health of its occupants, as well as on that of the precinct.



GLOSSARY OF TERMS

Context	All the issues and circumstances that surround a design. The setting; all the factors that influence that design, eg. land form; surrounding buildings.
Ergonomics	The study of the physical relationship between the built environment and the human body. Good ergonomics aim for a comfortable fit.
Existential space	The basic relationship between man and his environment.
Genius Loci	The spirit of a place - the character or 'feel' thereof. From the Ancient Roman belief that every being has its genius – a guardian spirit. (Norberg-Schulz. 1979:18).
Greyfield site	An undeveloped site, usually paved or asphalted, usually previously used as a car-park. <i>Archispeak</i>
Health	The state of being free from illness or injury. <i>Oxford Dictionary</i> A state of well-being that takes into account an individual's physical, mental, and emotional vitality and desires. <i>Mosby's Dictionary of Complementary and Alternative Medicine</i>
Metaphysical	The intangible. Those psychological aspects of space that cannot be quantified.
Phenomenology	Theory relating to the metaphysical aspects of architecture. The belief that spaces have connotative and emotional value. The idea that space is a relative concept based upon sensory experience.
Pretoria	Tshwane city centre, also referred to as the Pretoria CBD (Central Business District) or the 'inner city'.
Self/being	Individuality or nature of person. <i>New International Webster's Dictionary</i>
Sick building syndrome	Ailments associated with a specific building, usually a place of work. Ailments include eye, nose and throat irritation; headaches; dizziness. Usually related to indoor air quality.
Spirit	In this context, spirit does not refer to any specific religion; rather, it refers to each individual's personal growth, be it within or unrelated to religion.

Tshwane Greater metropolitan municipal area within which Pretoria falls.

Wellness A holistic view of health, which refers to health of the body, mind and spirit.



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BIBLIOGRAPHY

1 PRIMARY SOURCES

BOOKS/ ARTICLES

- Ando, T.** 1991. From the Periphery of Architecture. *Japan Architect*. Vol 1. p. 12 – 20.
- Ando, T.** 1993. In Dialogue with Geometry: The Creation of 'Landscape'. *GA Architect. Tadao Ando 1988 – 1993*. Vol 2. p. 24-25.
- Day, A.** 1993. *Places of the Soul: Architecture and Environmental Design as a Healing Art*. London: The Aquarian Press.
- Heneghan, T.** 1993. The Architecture of Tadao Ando – Predicated on Participation. *GA Architect. Tadao Ando 1988 - 1993*. 2. p. 8-23.
- Kaplan, R. & Kaplan, S.** 1989. *The Experience of Nature: A Psychological Perspective*. Cambridge: Cambridge University Press.
- Millet, M.S.** 1996. *Light Revealing Architecture*. United States of America: Van Nostrand Reinold.

2 SECONDARY SOURCES

BOOKS/ ARTICLES

- Alexander, C. (et al).** 1977. *A Pattern Language: Towns, Buildings, Construction*. New York: Oxford University Press.
- Anon.** 2005. *2005 KZ-N Regional Award Umkhumbane Community Health Centre*. KZ-NIA, 2, p.1.
- Anon.** 2005. *Umkhumbane Community Health Centre, Durban*. Digest of South African Architecture, 04/05, p 38-39.
- Betsky, A.** 1995. Take me to the water: Dipping in the History of Water in Architecture. *Architectural Digest*. Vol 65 nr 1/2. Architecture and Water.
- Botes, N. & Le Roux, S.** (ed). 1991. *Plekke en Geboue van Pretoria – 'n Oorsig van hulle argitektoniese en stedelike belang. Volume 2 – Die noord-oostelike en noord-westelike kwardrante*. Pretoria: Stadsraad van Pretoria.
- Clements-Croome** (ed). 1997. *Naturally Ventilated Buildings: Buildings for the Senses, the Economy and Society*. London: E & FN Spon.
- Gardner, H.** 1975. *Art through the Ages*. 6th ed. New York: Harcourt Brace Jovanovich Inc.

- Holick, M.F.** 2004. Vitamin D: importance in the prevention of cancers, type I diabetes, heart disease, and osteoporosis. *American Journal of Clinical Nutrition*. Vol 79 nr 3, p 362 - 371. [online] Available at www.ajcn.org [accessed 6 May 2009].
- Joffe, P.** 2003. *Creative Gardening with Indigenous Plants: A South African Guide*. Pretoria: Briza Publications.
- Purnell, D.G.** 1986. *The Engineering Geology of Central Pretoria*. MSc. University of Pretoria.
- Saunders, N.** 2006. *Umkhumbane Community Health Centre Kwazulu Natal*. Architecture South Africa, 3/4, p. 17-19.
- Schittich, C.** (ed).2007. *Weekend House at St Andrew's Beach. Detail Review of Architecture and Construction Detail – Steel Construction*. Vol 2007 (5). p 502 – 505.
- Schulze, B.R.** 1980. *Climate of South Africa Part 8 General Survey*. Pretoria: Weather Bureau.
- Smith, P.F.** 2007. *Sustainability at the Cutting Edge: Emerging technologies for low energy buildings*. Oxford: Architectural Press.
- The South African Institute of Steel Construction.** 1987. *South African Steel Construction Handbook*. 1st edition. Cape Town: The South African Institute of Steel Construction.

WEBSITES

- Ask Oxford.com.** [online] Available at www.askoxford.com/?view=uk [accessed 29 March 2009].
- Conceptual Framework Working Group of the Millennium Ecosystem Assessment.** 2003. *Ecosystems and human well-being*. [online] Available at www.citeserx.ist.psu.edu [accessed 24 February 2009].
- Fourie, J.M.** (ed). 2007. *Heart Disease in South Africa. Media Data Document*. [online] Available at www.heartfoundation.co.za [accessed on 24 February 2009].
- Magnet Communications.** nd. *South African Reserve Bank*. [online] Available at www.magnetcomm.co.za/cotf%202008/7.pdf [accessed 22 February 2009]
- Roman Baths.** 2003. *Roman Baths and Bathing* [online]. Available at www.vroma.org [Accessed 28 April 2009].
- SACS.** *Wellness Warehouse scoops prestigious store design award* [online]. Available at www.sacs.co.za [accessed 16 May 2009].
- Sindane, L.** 2006. *Joint Initiative Aims to Make Parks Safer*. City of Johannesburg [online] Available at www.joburg.org.za/content/view/1108/168 [accessed on 14 March 2009]

The Property Magazine. *Mindful living at Wellness Warehouse.* [online] Available at www.thepropertymag.co.za [accessed 16 May 2009].

Yegül, F. 1992. *Baths and Bathing in Classical Antiquity.* Cambridge: MIT. Cited in *Roman baths and bathing.* [online] Available at www.vroma.org [accessed 28 April 2009].

INTERVIEWS

Van Niekerk, A. & Van Niekerk, L. City workers. 2009. [Personal communication]. 23 February 2009.

Van Wyk, L. Senior sustainability specialist, CSIR. 2009. [Personal communication]. 6 August 2009.
6 August 2009.

DIGITAL MEDIA

Copans, R. 2001. *Baukunst: Le Couvent de La Tourette.* [DVD] France: Arte Television

IMAGES

Arcadis [online]. Available at www.arcadis.us.com [accessed 3 June 2009].

Cara Green. [online]. Available at www.caragreen.com [accessed 9 August 2009].

Courses. [online]. Available at <http://courses.nus.edu.sg/course/ecswong/trip/amsterdam.htm>

Craig Williams Plastering. [online]. www.craigwilliamsplastering.co.uk. [accessed 21 August].

Cypress Sawmill. [online]. Available at www.cypress_sawmill.co.nz_eucsleep [accessed 12 July 2009].

Denver. [online]. Available at www.cudenver.edu [accessed 15 July 2009].

Dezeen. [online]. Available at www.dezeen.com [accessed 3 May 2009].

Flickr. [online] Available at www.flickr.com [accessed between 3 March 2009 and 17 October 2009].

Google Maps. [online]. Available at <http://maps.google.com> [accessed 3 March 2009 to 12 August 2009].

G Sky Vertical Gardens [online]. Available at www.g-sky.com [accessed 2 August 2009].

Houses. [online]. Available at www.houzz.com [accessed 12 April 2009].

Lets Know About. [online]. Available at www.letsknowabout.com [accessed 23 September].

Made in China. [online]. Available at www.made_in_china.com [accessed 12 September 2009].

Presidents Medal. [online]. Available at www.presidentsmedals.co.uk. [accessed 1 April 2009]. [accessed 3 May 2009].

Rome. [online]. Available at www.throughtheoculus.blogspot.com [accessed 2 August 2009].

Salvo. [online] Available at www.salvo.co.uk [accessed 23 September 2009].

Spring Wise. [online]. Available at www.springwise.com [accessed 12 June 2009].

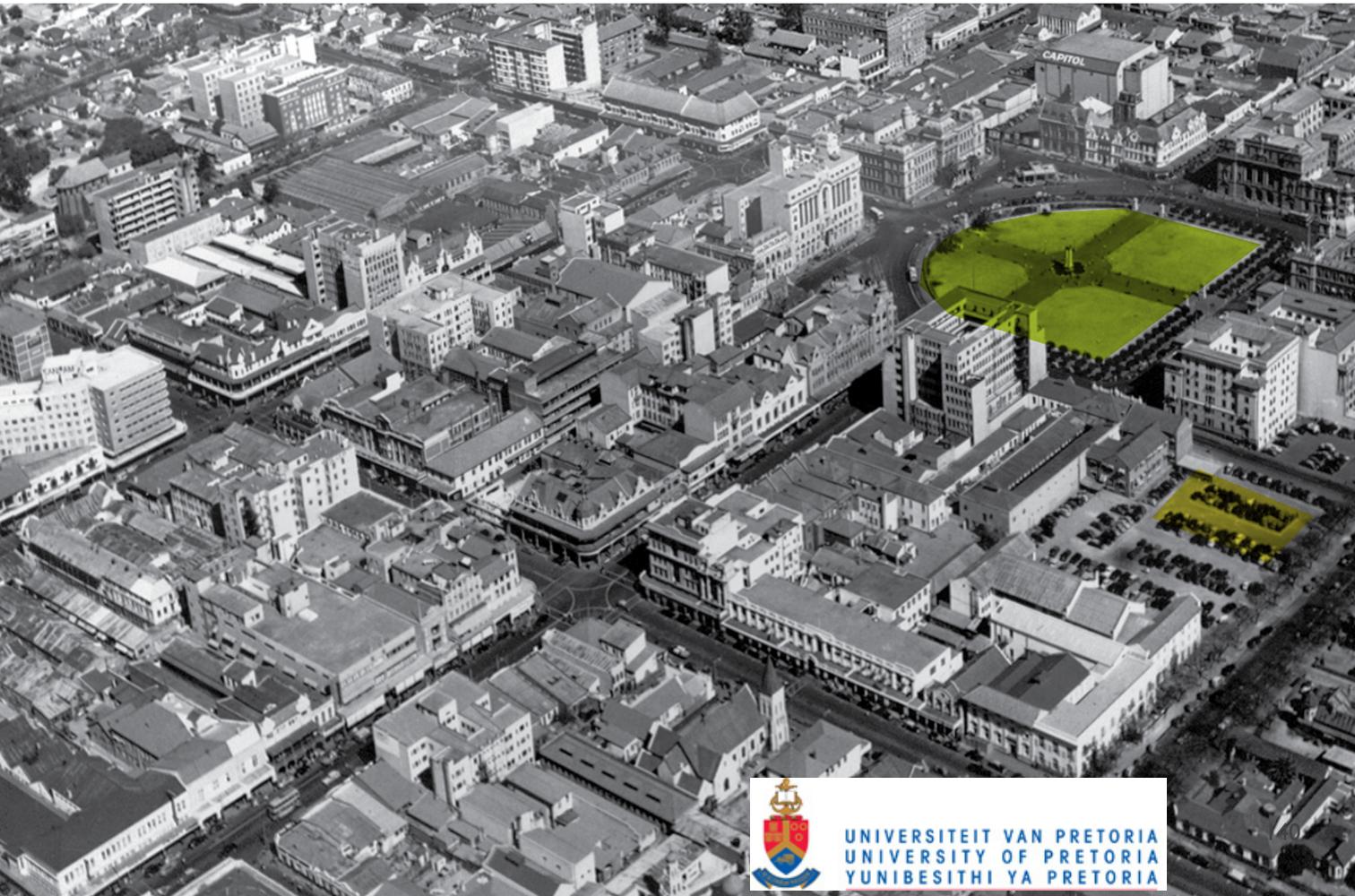
The Cultural Landscape Foundation. [online]. Available at www.tclf.org. [accessed 2 June 2009].

Victoria Park. [online] Available at www.vicpark.ws/council. [accessed 23 March 2009].

APPENDIX A: CONTEXT

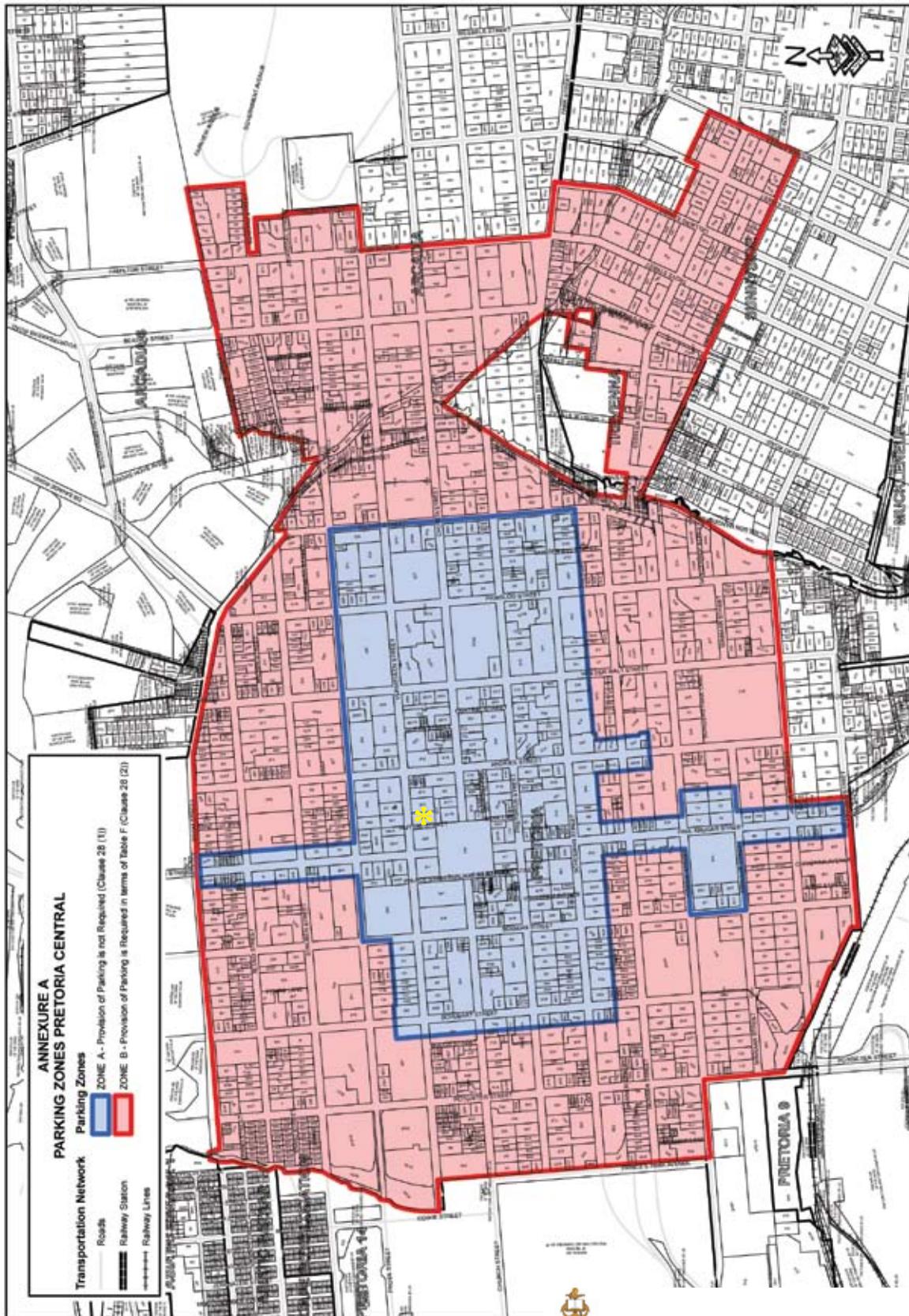
1 HISTORY OF CHURCH SQUARE

- + - 1600 Area now known as Pretoria occupied by the Ndebele tribe
- 1840 First Boers settle in the Fountains Valley and Elandspoort regions
- 1855 Pretoria proclaimed on the farm Elandspoort, big square set out at the heart of the city (to become Church Square)
- 1857 First church in Church Square inaugurated
During this time, Church Square was used as 'uitspan plek' during Holy Communion; as sports fields and as informal post office once a week. A market was also held on the southern border of the Square.
- 1860 Pretoria declared the capital of the Zuid-Afrikaan Republiek (ZAR)
- 1860s Bigger church built to accommodate more people
- 1877 Union Jack hoisted on Church Square to signal the British Occupation of Pretoria
- 1880-1 First Boer War
- 1882 Church struck by lightning and burns down; new one built in 1884
- 1883 Paul Kruger sworn in as first president of the ZAR on Church Square
- 1889 Two new government buildings, the Raadsaal and the Palace of Justice built to signify the ZAR's prosperity
- 1891 The Law Chambers are completed



1897	Queen Victoria's diamond jubilee celebrated on Church Square Old Nederlands Bank completed Work starts on the Palace of Justice
1899	Start of the Anglo Boer War
1902	British win the Anglo Boer War Palace of Justice completed, after being used as a military hospital during the Anglo-Boer War
1903	National Bank and Government Mint built
1904	Church demolished Tudor Buildings built
1905	Cafe Riche built using materials from the demolished church
1906-10	Bank of Africa (a.k.a. Kirkness building) erected
1910	Pretoria becomes the administrative capital of the Union of South Africa Cornerstone laid for the General Post Office building
1928	Reserve Bank built
1930	<i>Ons Eerste Volksbank</i> building built
1931	Pretoria achieves official city status Additions to Reserve Bank built
1939	First National Bank building completed
1954	The statue of Paul Kruger finally takes its intended place in the centre of Church Square
1961	Charles Robbert Swart sworn in as the first president of the Republic of South Africa on Church Square
1974-75	Provincial administration plans to demolish the Old Netherlands Bank building; the Law building; the Post Office building and Cafe Riche to make place for 'modern' office blocks. This proposal is met with great resistance and a mass meeting attended by 10 000 people, and these plans are stopped.
1994	First democratic elections take place; Nelson Mandela sworn in as president
2000	Municipal structures change, Pretoria falls in the Greater Tshwane municipality

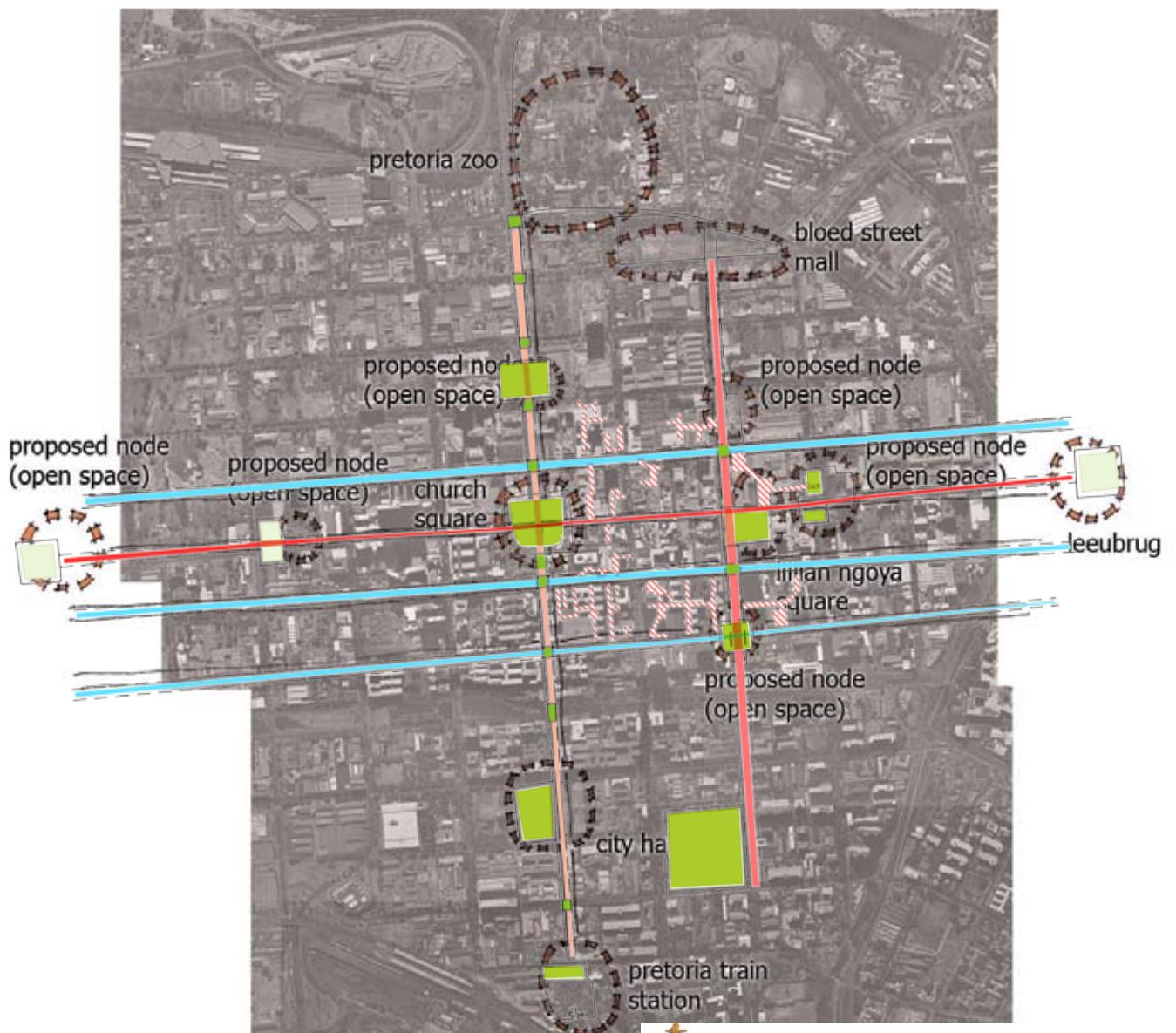
Church Square was first known as 'Market Square'.



3 DISCOVER PRETORIA FRAMEWORK

PRINCIPLES:

- _ make pretoria a destination:
 - _ enhance its unique identity
 - _ orientate the user
 - _ enhance movement on a pedestrian scale
- _ create gateways to the inner city
- _ define cbd precinct & unique character
- _ define main routes and create new pause spaces
- _ enhance visual clarity



APPENDIX B: TECHNICAL INVESTIGATION

1 U VALUES

220mm BRICK:

EXT BRICK SKIN	$k = 0.84 \text{ W/mk}$ $r = 1/0.84$ $= 0.13 \text{ m}^2\text{k/W}$
INT BRICK SKIN	$k = 0.62 \text{ W/mk}$ $R = 0.11/0.62$ $= 0.177 \text{ m}^2\text{k/W}$

U-VALUE = $1/R_{\text{total}}$
 $= 1/(0.13 + 0.177)$
 $= 3.25 \text{ W/m}^2\text{k}$

110 BRICK - 50 CAVITY - 110 BRICK:

EXT BRICK SKIN	$k = 0.84 \text{ W/mk}$ $r = 1/0.84$ $= 0.13 \text{ m}^2\text{k/W}$
AIR CAVITY	$R = 0.18 \text{ m}^2\text{k/W}$
INT BRICK SKIN	$k = 0.62 \text{ W/mk}$ $R = 0.11/0.62$ $= 0.177 \text{ m}^2\text{k/W}$

U-VALUE = $1/R_{\text{total}}$
 $= 1/(0.13 + 0.18 + 0.177)$
 $= 2 \text{ W/m}^2\text{k}$

2 REFUSE AREA

$F(g) = FA/100 = \text{volume per week}$ (www.pickitup.co.za)

Offices (1050 m²): $F = 0.2258$
Shops (450 m²): $F = 0.92353$

Offices	$0.2258 \times 1050 / 100 = 2.4$
Shops	$0.92353 \times 450 / 100 = 4.1$
Total	$6.5 \text{ m}^3/\text{week}$

Number of bins = 4×6.5
= 26 bins

Total area required = 26m²

This is divided into 5 categories:

- _ Paper - for recycling
- _ Plastic - for recycling
- _ Glass - for recycling
- _ Tin - for recycling
- _ Non-recyclables - to municipal dumping site



3 SIZES OF STRUCTURAL MEMBERS

From Ching, F.D.K. & Adams, C. 2001. Building Construction Illustrated. Canada: John Wiley & Sons.

STRUCTURAL GRID

Northern building: Max bays = 4950mm x 5640mm
Southern building: Max bays = 9900mm x 5640mm

FLOORS (CAST IN-SITU CONCRETE)

Northern building: Two-way flat plate system
125 - 305mm slab depth
Spans 3.6 - 7m
Depth = span/33
= 5640/33
= 170mm
Brick modules: 170mm

By recommendation from engineer, slabs are 255mm thick, as 170mm slabs allow for small amounts of deflection which causes floor tiles and other hard finishes to crack.

Rule of thumb for cantilevers (C. von Geiso) - 1/3 of span
Thus 1m to 1.7m (see roof overhang on section).

Southern building: Two-way flat slab plate + beam system
Span 9900mm
Slab thickness = 255mm

Beam depth:
L/d = 14 - 20
d = 495 - 707mm
d = 550mm brick modules

4 COLUMNS (CAST IN-SITU CONCRETE)

Northern building: Tributary area = 27.918m² per floor (x 3 floors + roof)
= 111.7m²
According to Ching (2001: 5.05), a 305 column can support up to 185m² of
floor and roof area
Brick modules: 330 x 330mm column

Columns in the vicinity of the water tanks (columns E2,E3,F2,F3) increased in size to 440 x 330mm to accommodate the heavier load, by recommendation from the engineer.

Southern building: Tributary area = 55.836m² per floor (x2 floors + roof)
= 168m²
Thus the same as for the northern building: 330 x 330mm column

Below square and reflection pond: By recommendation from engineer, also 330 x 330mm
columns.

5 BASEMENT CAST IN-SITU CONCRETE RETAINING WALLS

Height of walls	+ -4.3m
Thickness	205 (Ching, 2001: 1.28)
Brick modules:	220
Footing	= 0.6H = 2.6m

CONCRETE ROOF BEAMS

Northern building	Span 3650mm
	L/d = 14 - 20 (Ching, 35) d = 182 - 260mm = 255 brick modules
	Main beam span 5600mm
	L/d = 14 - 20 d = 280 - 400mm d = 425mm brick modules
Transverse beams	Span 9900mm
	L/d = 14 - 20 d = 495 - 707mm d = 550mm brick modules
Southern building	Span 4600mm
	L/d = 14 - 20 (Ching, 35) d = 230 - 328 mm = 340mm brick modules

6 FACADE PANELS

Northern building	Corten panels
	Standard brick sizes, to coordinate with sizes of openings - 330 x 680mm
	Size of corten flat sheet - 2500 x 1225 x 1.6mm
	9 panels out of one sheet
	Pre-oxidised steel T-section substructure, fixed to equal iron to floor slabs

7 T SECTION SIZE

	1.1m span (northern facade, both buildings)
l/d = 18 - 28	Take most conservative value, as it has to carry the facade
d = 1100/18	
= 61mm	
	Rounded to 127 x 76mm standard steel T section (<i>South African Steel Construction Handbook</i>)



2.2m span (western facade, northern building)
 $l/d = 18$
 $d = 2200/18$
 $= 122$
Rounded to 127 x 76mm standard steel T section

3m span (north - canopy)
 $l/d = 18$
 $= 3000/18$
 $d = 167\text{mm}$
Rounded to 178 x 171mm steel T section

Southern building - skin Span 600mm
 $l/d = 18$
 $d = 33\text{mm}$
Rounded to 60 x 40 x 4.5mm rectangular tube

Vertical structure - northern skin - Light gauge pre-oxidised steel studs
= Lipped channel 100 x 50 x 3mm profile

Height - 3485, thus needs horizontal channel bracing @ midlevel

8 OPERABLE PANELS SUB-STRUCTURE

2x ANGLES WELDED TOGETHER - 60 x 60 x 4mm hot rolled for operable panels
25 x 25 x 2mm

'WINDOW' PANEL 50 x 50 x 2mm square tubing

MASONRY CAVITY WALLS Ching p. 5.22
At changes in wall height or thickness
At columns, pilasters, and wall intersections
Near corners
On both sides of openings > 1830mm
On one side of openings < 1830

9 MOVEMENT JOINTS

Control joints in floor @ 3300mm C/C and around columns
Isolation joints at joints

Expansion joints between buildings + square (see Chapter 6)

10 BRIDGE

Span 18m
Open web joists $L/d = 15 - 25$
 $d = 18000/15$
 $= 1200\text{mm deep}$

Joist spacing < 24 x depth = 2880mm

Floor covering - 22mm plywood can span 1220mm

11 FIRE PROTECTION

According to SABS0400, section T:

TT35.2	One fire hose reel per floor
TT37.4	Portable fire extinguishers - 1 per 200m ²
TT37.5	Size - 4.5kg
TT31.2	Service shafts - 120 minutes fire resistance
TT45.1	Lift - 30 minutes fire resistance
TT16.2	Southern building 3 storeys high, less than 25 people on top floor - only one fire route needed. Northern building - two needed - skin acts as second route.

12 RAINWATER HARVESTING

Annual rainfall	674mm
Area of roof (north)	380m ²
Amount of water harvested	$380 \times 0.674 \times 0.9$ = 230kl per year
Area of roof (south)	380m ² =230kl per year
This means (230/12)	= 20kl per month = 600l per day = (600/6) WC flushes per day = 100 WC flushes per day
Rainwater from the square	390m ² = $390 \times 0.674 \times 0.9$ = 236kl per year

Two 500l water tanks will be provided for the storage of collected rainwater in the northern building,, and one for the southern building. A 39kl storage tank will be located in the basement to hold additional water.

13 SOLAR WATER HEATING

For each 400l water tanks, two 200l Kwiksol 200i collectors will be needed. The northern building will house four collectors, while the southern building will house two.

Sizing of tanks - 1 low flow shower uses 40% less than a normal shower, which is (36 x 60%) 22l per shower. 8 showers can be used at once, which is 176l. A 400l tank will thus cater to 2 series of showers. Two 400l tanks will be provided, which will cater to 4 series of showers (which is 32 consecutive showers).

200l panels of the size 1.5 x 2.5m supply heat for 200l of water. Two 400l geysers will need four panels. Another geyser will be supplied for heating in winter, which will need an additional 2 panels.

14 SIZING OF GUTTERS + DOWN PIPES

Building roof (southern and northern buildings have the same roof area)

DOWNPIPES (SABS0400 RR3.2) 100mm² per 1m² per roof area
380m² roof area
= 38 000mm² needed

Cross sectional area of 100 diameter down pipe
= πr^2
= 8500mm²

Number of down pipes needed = 38 000/8500
= 5 down pipes needed

Canopy 87m²
= 8700mm² needed
Cross sectional area of 80 diameter down pipe
= πr^2
= 5024mm²

Number of down pipes needed = 8700/5024
= 2 down pipes needed

GUTTERS (SABS0400 RR3.1) 140mm² per m²

Northern building Area A = 126m²
Gutter size = 126 x 140
= 17640mm²
= 170mm x 110mm gutter
= 205 x 85mm

Area B = 200m²
Gutter size = 200 x 140
= 28000mm²
= 140 x 200mm gutter
= 330 x 85mm gutter

Southern building Area = 340m²
Gutter size = 340 x 140
= 47600mm²
= 85 x 550mm gutter

APPENDIX C: QUESTIONNAIRE

A questionnaire was devised to determine what people associate with 'healthy' environments. This questionnaire was distributed to 100 people, and a conclusion was made.

QUESTIONNAIRE:

QUESTIONS:

1. On average, how many hours per day do you spend in your work environment?
2. Where do you go to take breaks?
3. Why do you go to the place in [2]? What about it is better than your work environment?
4. How does your work environment in make you feel?
Healthy/Unhealthy
5. Does the building support your emotional wellbeing?
Yes/No
6. Does the building envelope make you feel connected to your surroundings?
Yes/No
7. If yes, what type of connection?
Audio/Visual/ Tactile/ Smell
8. What do you think detracts from the health/emotional quality of this building environment?
9. What do you think contributes to the health/emotional quality of this building environment?

FINDINGS:

90% of people feel their work environment is unhealthy, and does not contribute to their emotional wellbeing. Of these, 80% think it is because of fluorescent lighting, air conditioning and no visual connection to the outside. The other 20% think it is because of low ventilation rates and noise. 43% of people reported having symptoms relating specifically to their internal work environment, among others sneezing, coughing, dry eyes and chronic cold symptoms.

Only 10% of people feel that their work environment is healthy. They attribute this to natural light, high ceiling heights, and a quiet environment.

Everyone answered that they go outside to relax; to either "sit beneath a tree", sit in the sunlight (get in contact with nature) or for social contact.

The results of this questionnaire support the hypothesis, and provide a quantitative base for the principles of the design.