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_research centre for green technology

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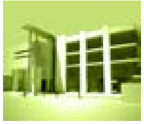

carbon minus

a research centre for green technology

focussing on resource
efficiency to achieve a
carbon minus footprint

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by Andri Fourie

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_submitted in fulfilment of part of the requirements for the degree Magister in Architecture [Professional] in the Faculty of Engineering, Built Environment and Information Technology, University of Pretoria, South Africa.

November 2008

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intro-duction

_abstract

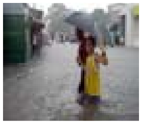
Sustainability requires a new pathway and our industry must evolve to be a contributor to finding the right answer, rather than delivering the trusted solutions that have served us well in an industry of unconstrained resources.

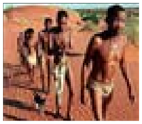
Aspiration of initiating a dialogue about our professional responsibility:
the dialogue must engage with matters beyond engineering and find relevance in the disparate academic research, to drive the pragmatic decision making required by industry.

This thesis is not intended to be the final word, but rather a contribution to the body of knowledge that can be used to focus dialogue in this important area.

Our current methods of evaluating design fall a long way short of meeting the needs of a sustainable future. We have an obligation to embrace the search for ways of quantifying the impacts of our design decisions.

Will it be nirvana? No, but it will be a world considerably more decent and durable than what lay in prospect in the early 20th century.





"The earth cannot keep up with the demands [our] economy is placing on its ecological assets. Evidence is mounting that the sheer volume of resources flowing through the global economy has become todays key environmental challenge. With the world's population set to increase to 10 billion in 2050 and as human demand for resources grow; the earth's life-supporting natural capacity will be liquidated at ever-increasing rates. Signs of ecological pressure include climate change, collapsing fisheries, specie extinction, deforestation and desertification."
[WWF 2007 publication: 'Sustainability - one planet business-creating value within planetary limits.']

The following document considers a theory perceived by Ralph Abraham, a professor at the University of California and pioneer of the Chaos Theory. He explores Hesoid, a trinity made up of the Chaos, the Gaia and the Eros theories.

Chaos theory [born in 1975] is the branch of mathematics that provides models for intrinsically irregular natural processes. *The Gaia hypothesis* [formulated in 1973] suggests that the Earth, as a whole, is a complex system capable of self-regulation. *Erodynamics* [appearing in 1989] applies the theory of dynamical systems to human societies, the creative impulse, the spiritual medium that links Chaos and Gaia. The chaos theory provides us with new tools to understand these global complex systems by translating the context into a concrete form - sustainability. It teaches us to spot biospheric changes through discontinuities, unperceived tendencies, domino effects and vicious circles.

Rene Passet, one of the fathers of bio-economy, declared we should concern ourselves not with the sustainability of things but with the sustainability of functions. The Cartesian notion of the world, makes us believe that the only draw back of late reaction is to operate from a less favorable position, but in reality the process of unsustainability is life with discontinuities in which slow variations alternate with lightning-quick changes.

Arthur Battram, in Navigatin Complexity, reminds us possibilities is created by means of a language. It is not important for its capacity to describe the world, instead to invent new worlds. It is in this time that we can shed inappropriate paradigms and acquire suitable skills. He suggests a few aspects to reform: - the instinct to an integrating vision, humanity forms an inseparable part of nature; and transformation is an intrinsic property, it will outlast individual memory which proves we have the capacities to be sustainable, to build healthier societies.

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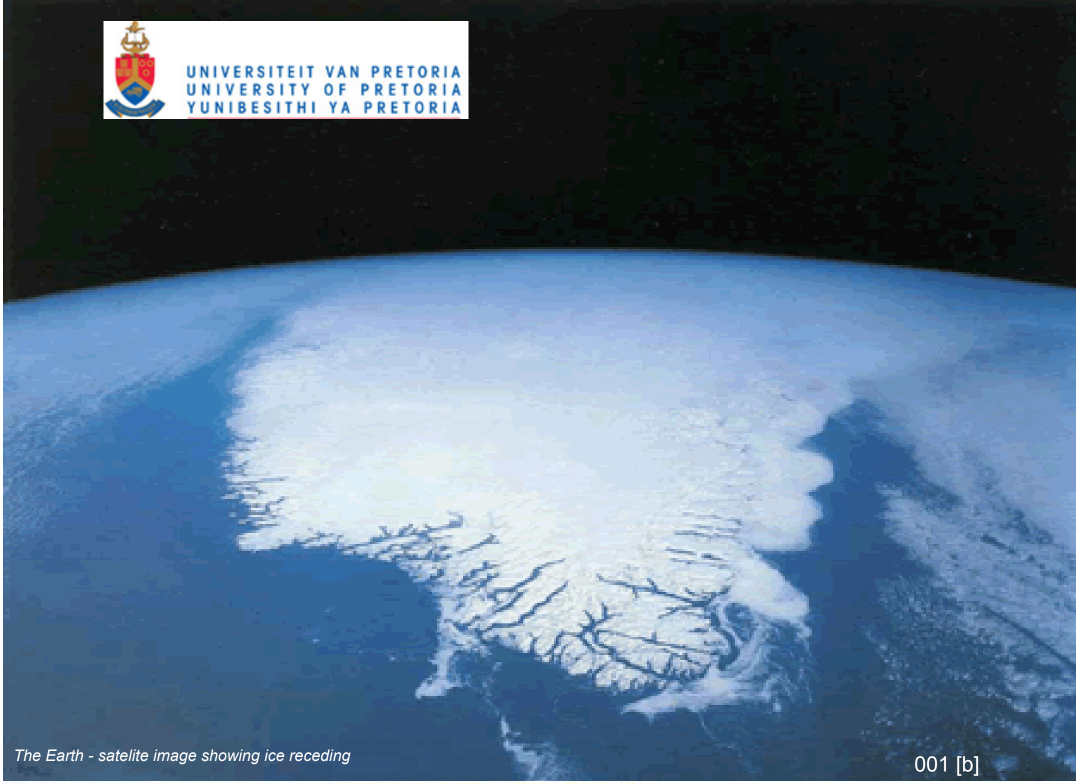
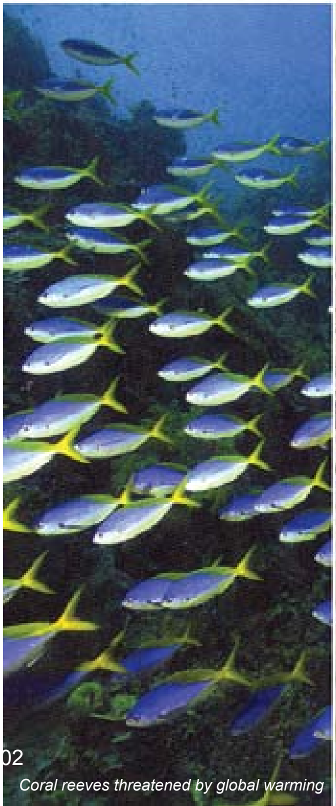


The Earth - satelite image showing ice receding

001 [b]



002

Coral reeves threatened by global warming

003

Biodiversity is threatened

004

Iceland - Glaciers melting

A new social, cultural and political attitude, beyond the skeptical rejection ism of the recent late-century, will spur more qualitative construction environments. If we express our territory through the construction of environments, an optimistic belief in the capacity for innovation, in the possibility of combining research and creation in new operative concepts, would generate knowledge and promote new criteria for new methodologies towards evolutionary action. This expresses the growing importance of areas of knowledge and the need for institutions promoting positive innovation of the environment. It allows for productive settings, which entails reflection on new technological challenges of the digital society, translating into re-equilibrium.

_the sustainable design challenge - project S.O.S:

It's a serious environmental emergency and results in an extreme imbalance in our planet's ecosystem.   With this in mind, responding to the pivotal issue, at the core of our every action, is not something which can be bolted onto our comfortable lifestyles - ruled by constant technological innovation, an advance phenomena, ensuring continuous forms of change in every single field. A function holding the key to a promising future, if applied in a proper manner, but currently one of the causes of our biggest concerns; climate change. To establish an equilibrium of the ebbs and flows of these ecosystems, we need to add some effort, recognize our interdependency on these resources and start to integrate these facets socially and economically - naturally applying it to all scales of life. In essence, the challenge becomes a design challenge, and we as designers have to evolve from being individual authors to facilitators of change. To plan and develop high-performance resource efficient infrastructure networks combined with cohesive neighbourhoods to support a healthy urban life as a post carbon twenty-first century society.
The concept of sustainable development is not new, but it needs to find a path in society, fitting within the framework as an opportunity for implementation.

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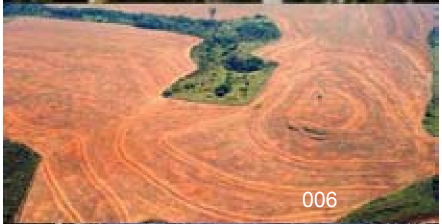
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Modernist architecture is architecture, starting from an illusion, focussing on the aesthetic end-product, instead of a resource efficient product. Creative solutions through innovative, advance technological design, is essential to enable us to achieve an environmental friendly design. It all depends on how the technology is used, and right now, its used in insufficient isolated packages, not available to the public society, remaining in scientific laboratories, not reaching its prime audience. A facilitator with an integrated system, connecting the data and the facts is needed in order to allow us to "get wired" and see the connections, to design a resource efficient project as our optimal goal, [Technology: The application of practical or mechanical sciences to industry or commerce; scientific methods used in a particular field [Collins English Dictionary].

_climate change - nature or human nature?

Climate change, a phenomena becoming the greatest challenge in our lifetime, proving global warming is no longer a myth, but instead, a well-known reality we need to address. Although this prognosis has complex and contradicting viewpoints, we have to start realising the degree of importance. Climate change is a threat with physical evidence, which can alter the natural world of human society - how we provision ourselves with food, shelter, energy and water. It can revolutionize economies, shift from energy efficiency to hyper-efficiency, culminating in a world powered by sunlight, solar energy and biomass. The design revolution will grow from disciplines we call industrial ecology, natural systems, biomimicry and ecological engineering. An urgent matter we have to act on, otherwise, we will face dire consequences in the blink of an eye. Whether its a natural process in a sequence of climate changes or a human driven act, the relevant question remains: how is the human race going to adapt and embrace these changes?

evidence

storms

There has been a definite increase in the severity and frequency of storms over recent decades. In 2000 Mozambique experienced catastrophic floods, repeated in 2001. In 2002 devastating floods occurred across Europe, creating one of the worst flood catastrophes cities like Prague has ever seen.

floods

014

008

009
Thunder storm

011
Magnetic storm

012
Satelite view of storm

010
Increase in severity of storms

- *Southeast Asia experienced exceptional rainfall in 2004, leaving 30 million Bangladesh citizens homeless.*
- *El Nino has produced severe effects due to the warming of the Pacific ocean. Sea temperatures in the Antarctica are rising at five times the global average. An increase of 2.5C since 1940. Antarctic summers have lengthened by 50 percent since 1970, resulting in receding of polar ice and rapid flora expansion. In Iceland Europe's largest glacier is breaking up, likely to slide into the north Atlantic, threatening the sea levels* **[The Observer, 22 October 2000].**
- *The sea level has risen 250 mm since 1860, due to thermal expansion.*
  At the same time massive melting of the Alps glaciers occur, losing 50 per cent of their ice.
- *The Himalayas are also receding faster than anywhere else on earth.*
- *In Alaska general thinning of sea ice due to warmer winters, leading to a change in migration patterns and numbers of wildlife species, posing threats to Eskimos* **[New Scientist, 14 November 1998].**
- *Since the later nineteenth century, the global mean surface air temperature has increased between 0.3 and 0.6 C. In 1998, the temperature surpassed the previous record in 1995 by 0.2C - the largest jump ever recorded* **[Worldwatch Institute in Scientific American, March 1999].**
- *According to NASA scientists, Greenland landbased ice sheet is thinning by 1m per year, which leads directly to a rise in sea level, threatening coastal regions* **[Nature, 5 March 1999]**
- *Spring in the northern hemisphere is arriving at least one week earlier than 20 years ago, with extreme heat episodes especially in the summer of 2003.*
- *Oceans, being our largest carbon sink, are becoming less efficient as a result of a temperature increase.*

ice melting

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015
Specie extinction


016


017
Alaska - thinning ice pose threats to Eskimos


018
Antartica - rising sea temperatures


019
Antartica - receding polar ice and rapid flora expansion

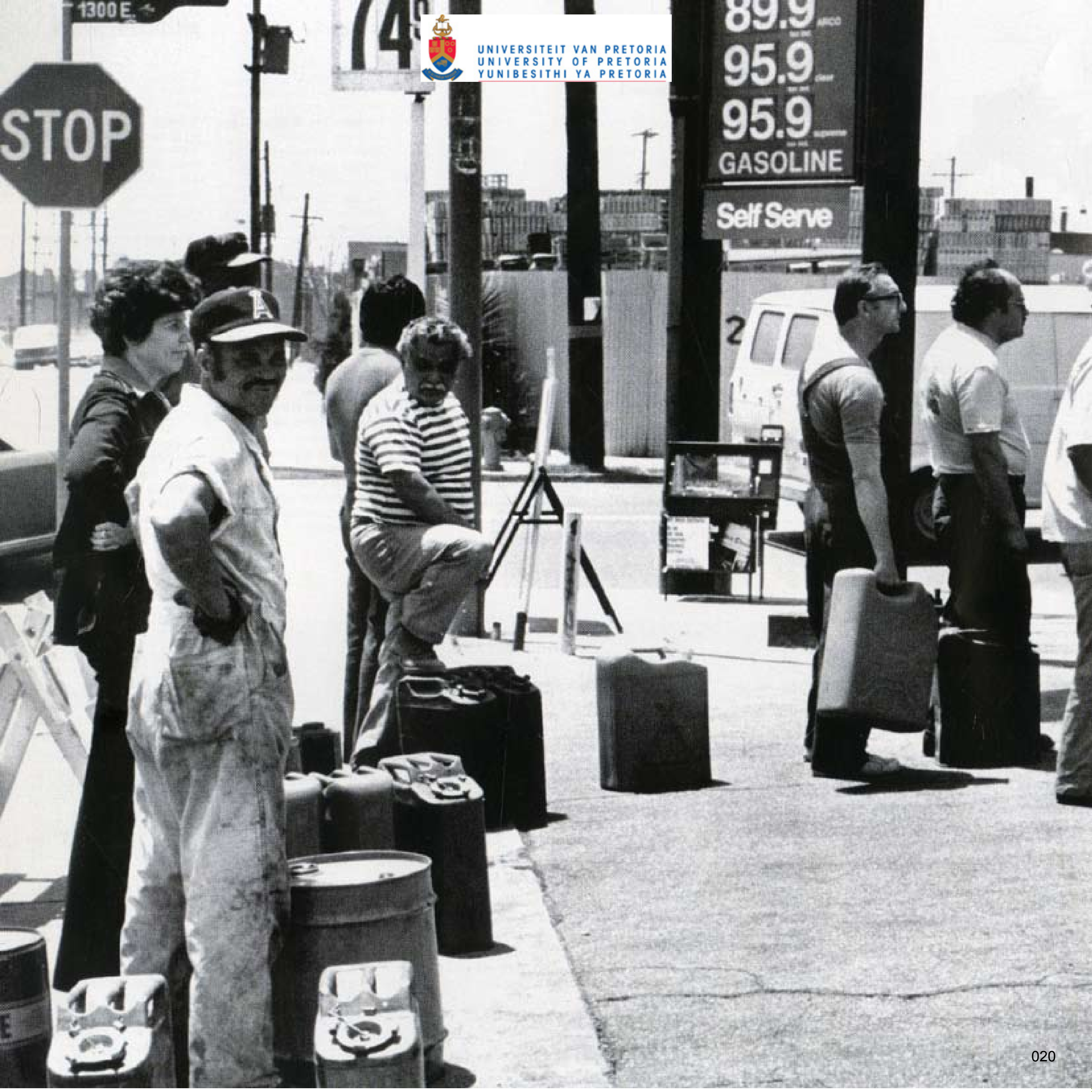
Thomas Jefferson - Architect [1789]: *"I say earth belongs to each generation. No generation can contract depths greater than may be paid during the course of its own existence."*

Albert Einstein 1956: *" The world will not evolve past its current state of crisis by using the same thinking that created the situation."*

_the nature of the problem

Scientists continue investigating the complicated relationship that govern the Earth's climate and temperature, and even with hard core evidence, the occurrence of natural disasters all over the globe, society is still struggling to commit to resource efficient living. The key element for life on Earth, Carbon, forms the basis of micro-organisms, plants, and animals. These compounds play a major part in ensuring the planet's temperature is warm enough to support its rich diversity. But, true to our human nature, addicted to the luxuries of life provided by fossil based energy, this delicate balance is disrupted. Under natural conditions, the release of carbon is equalised by the absorption of CO_2 by plants. Our interference overturns this delicate balance and in the process adds a further 6 billion tonnes of carbon to the atmosphere above the natural flux each year.

The sooner the vastness of the serious threat can be understood, the sooner we can commit to renewable energy sources and bioclimatic architectural design.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GASOLINE
Self Serve

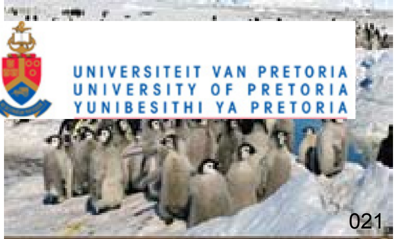
But even if the severity of our current situation is understood, there are still several factors prohibiting to commit in this regard. The main three factors are:

_political:

On October 18, 1973, newspapers announced the end of a period of growth and prosperity. Arab countries decided to impose an embargo on oil exports, to Western nations supporting Israel in the forth Arab-Israeli War. The price of oil doubled, followed by an economic crisis altering the production system. Initially researchers started experimenting with alternative renewable energy resources, but after the second oil crises in '79, the oil price declined and the necessity to find alternative energy sources was gradually forgotten. The reason, limitless development was driven by particularly cheap oil, defined as the age of Hydrocarbon man - a turning point in the field of architecture. Allowing the human race to maintain the lifestyle of energy addicts, not realising these luxuries come at a high price. Today, faced with a recurrence of the same problem, its obvious we haven't learned from our previous mistakes, and history repeats itself. Except todays energy problem is accompanied by a heightened environmental crisis.

_psychological:

A good law does not necessarily make a good citizen, especially where the awareness-raising consensus varies from one country to the next, from one belief system to another. What instruments can be used to persuade the global society to live according to resource efficient lifestyles, prompting them to forget the luxury of choice in order to work towards a twenty-first post carbon society? There is no magic formulae, in some cases coercion is necessary, in other persuasion or incentive. The most convincing way is to demonstrate, create awareness among the public realm. In short, educate and inform our new generations to be able to find futuristic solutions for our current problem situation. We need to turn the "system" around, and that entails proper communication with the next generation.



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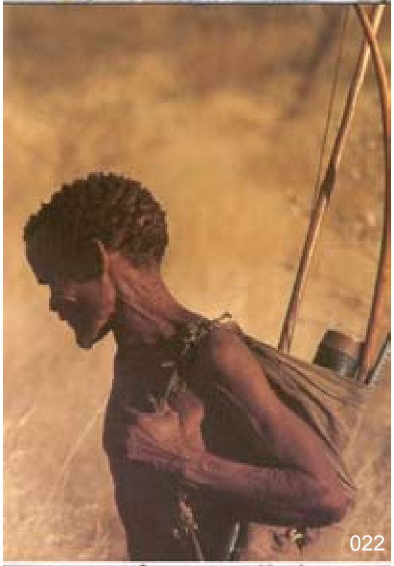

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_cultural:

We are part of nature, and all changes to nature have a direct impact on us, making this challenge partly cultural. We are currently stuck in a certain traditional belief system, bewitched by a high entropy concept of quality, a luxury, using astronomical amounts of energy to achieve. A paradigm shift should question the assumptions we've made towards our lifestyles. Rather evolving our typical social patterns into a better combination of solutions towards sustainable living. In Africa, the San-khoi khoi's traditional respect for the environment was always shown. Their believe system revolve around the knowledge that we're not the masters but only a part of the cosmos. They are able to adapt to change, even though their political and economic problems do tend to gain the upper hand. These basic cultural principles need to be applied to all cultural groups. We have to create a new cultural-aesthetic way of looking at life and how we live it, embrace these changes, sacrifice our living standards to enable ourselves to prepare for a position in which we can accommodate the global challenges that await us.

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timeline

_the roots of green architecture

The polarization between views on the topic of green, sustainable architecture, reflects two profoundly opposed philosophical approaches. For some, through radical change, with economic growth ceasing, a shift back to simple community-based lifestyles - resulting in local vested solutions. Others believe innovative technology might be the answer, if practiced in an ‘appropriate’ manner. They prefer the formation of new structures and communities, instead of delving in the past, resulting in a more interventionist approach to solve our ecological disaster.

Neither of the above mentioned views will prevail. If we can find a middle ground between these strong view points, turn it into a coherent strategy, it might lead us to an equilibrium.

_post modernity ecologicalism:

_resource efficiency:
Apart from a few exceptions, Frank Lloyd Wright and Mies van de Rohe, the International movement did not take resource efficiency into account. While post-modern buildings, has developed a more energy conscious regard to quantity, type, location and renewable resources.

_replace what is displaced:
Frank Lloyd Wright viewed land as a resource, connecting the building with its surrounding environment. The rest merely placed the building within the landscape, functioning as an external expression. The Post-modern movement tend to integrate the building with the landscape. Either through, under or over the building, using its natural qualities to filter the air, convert carbon dioxide and assist in a healthy micro-climate less reliant on mechanical and artificial systems. The building takes some responsibility to achieve resource self-sufficiency. Harvesting energy, recycle it and apply it for re-use, min mising the ecological footprint of the building. Hence, the building becomes co-responsible for its energy consumption.

_flexibility:
The International movement, did not facilitate society’s needs, merely projected their view of architecture as an object set within the landscape. Instead the movement focussed on designing sculptural architecture, not able to adapt and change through time, Post-modern buildings accept the future use of buildings might change, and design accordingly. Enabling the skin and internal functions to change without affecting the structural integrity.

_transforming society views:
While the Modern Movement focused on social transformation, the Post-modern movement recognised the existence of different world views, allowing and encouraging society to participate and designers to open the building to self-express the users needs and opinions. This encourage users to add something to the building and subsequently retract something from it, making it more than just and object, becoming a memory through its making and its use.

To follow is a time-line, describing green architecture’s roots and its evolution through time:

1771

INDUSTRIALIZATION AND TRANSFORMATION OF ARCHITECTURE

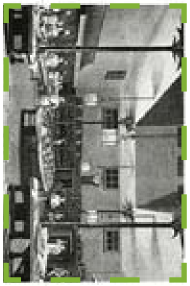

028

1771: Society of Engineering established
1799: Iron-framed cotton mill at Salford

SIGFRIED GIDEON IN SPACE, TIME AND ARCHITECTURE:
"The industrial revolution, the abrupt increase in production brought about...introduction of the factory system and the machine, changed the whole appearance of the world..."

Middle of the 19th century, new methods of construction exploited ever more ambitious structures. Distinction between engineering and architecture firmly established.
NIKOLAUS PEVSNER and SIGFRIED GIEDION - great historians of the origin of the Modern Movement, based their claims on material use, structure and construction methods.
The authority of technology, the tectonic aspects of Architecture.

1818: John Nash; Royal Pavilion at Brighton.
Establish the institute of Civil Engineering.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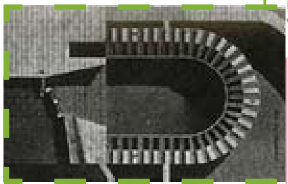
ROBERT BRUEGMANN: The first environmental-service was introduced to buildings - the control of heating and ventilation.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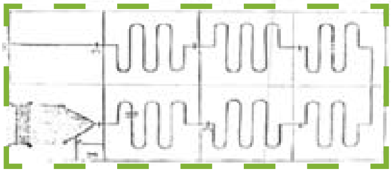
ORIGINS: TECHNOLOGY AND ARCHITECTURE OF THE 19th CENTURY

1750-1900: Critical phase in development of new industrial methods. During this time power of steam and cool-gas production were invented and the generation of electricity perfected.

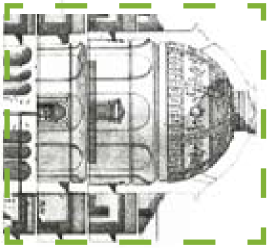
Over these years Western man's relationship changed with the environmentand natural resources.
Late 18th century: Cockle-stove heating system, after Bruegmann


027

1784: William Cook, steam heating system.
1792-1825: Sir John Soane, conventional Georgian town house using a centralized heating system.
1831: Pressurized hot-water system, Jacob Perkins, USA engineer

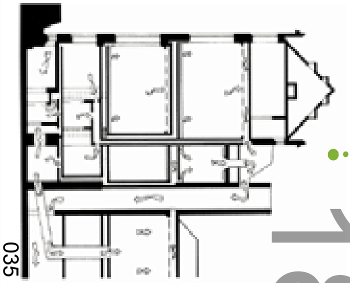

030

1837: Robert Adam, Edinburgh Register Office, showing Perkins hot-water-heating system.


031

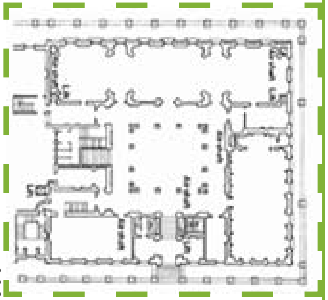
1829: House of Parliament, design ventilation; Charles Barry

1841



035

1835-1852: Charles Barry, architect, David Boswell Reid, engineer Houses of Parliament, London, front heating and ventilation system; after Hawkes.



032

1841: Ground floor plan showing air shafts
Charles Barry, Reform Club, London; after Olley.

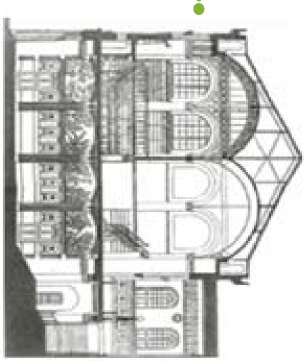
036

1841-1854: Cross-section showing ventilation ducts
H. L. Elmes, architect, David Boswell Reid, engineer, St. George's Hall, Liverpool; after Olley.

THE MODERN MOVEMENT AND THE NEW SYNTHESIS

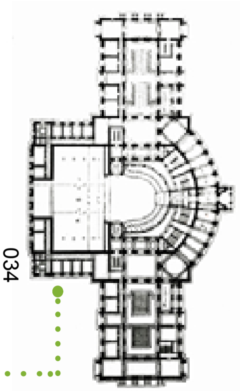
033

1843-1850: Synthesis of new technology and architecture. Labrouste - at the forefront to apply new environmental tools.



037

1858-1868: Fully integrated warm-air system
Henri Labrouste, Bibliotheque Nationale, Paris.

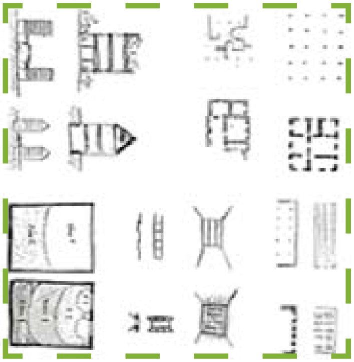


034

1874: Used advanced systems of heating, ventilation and cooling. Network of collecting mixing heating chamber from which air mix into an appropriate temperature.
[Gottfried Semper, Hofburg Theatre, Vienna.]

1925

1925: Le Corbusier, Cinque points d'une architecture nouvelle, Load bearing wall-punctured by window openings, with structural frame and light, largely transparent enclosing skin. Distinct technical function are given expression through specific and separate elements of the composition.



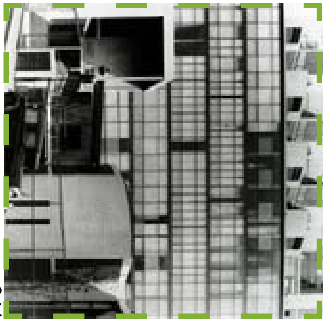
038

040

1919: Mies van der Rohe, glass skyscraper project, Berlin; after Hawkes

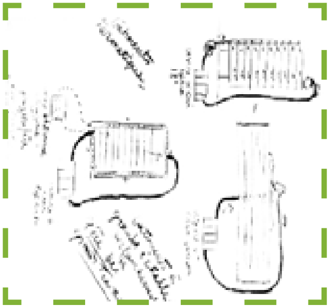
Building envelope reduced to faceted transparent skin. Building to be habitable , they would have to be serviced by environmental mechanisms of sophistication that did not exist at the time

1929-1933: A sealed glass facade with a full air-conditioning system, which supplies and extracts tempered and filtered air. This was to be maintained at 18 C with the aim of achieving a universal environmental standard.



041

1929: Drawing to illustrate the fundamentals of the system Le Corbusier proposed.



039

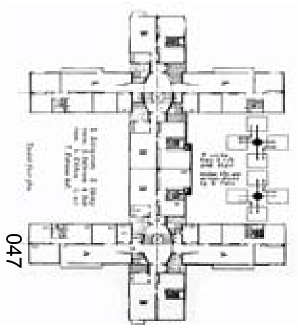
CONCEALED POWER VERSUS EXPOSED POWER

1929: Le Corbusier, Villa Savoye, Ppoissy, living room Illustrating the new synthesis of the 20th century meant that the status of service installations within the visible order of architecture was open for reconsideration.

Linear light fitting is the key element, without con-cealing the cast iron radiators. It would be equally possible visually to reveal the apparatus of heating, ventilation and artificial lighting.

042

046



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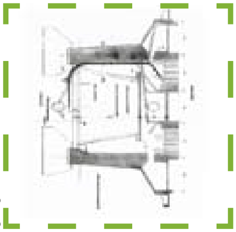


048

Le Corbusier, Cite de Refuge, interior:
Status of service installations within the visible order of Architecture was open for reconsideration.
Now it was possible to express the difference between
the building structure and its enclosure.
Discreet accommodation of the system in use.

Modernist virtues: natural light
fresh air
large windows - cross ventilation
concealed radiant ceiling heating
accessible ducts for plumbing and electrical services

1935: Berthold Lubetkin, Highpoint flats, Highgate London. Environmental and services installations

REYNER BANHAM, ARCHITECTURE OF THE WELL TEMPERED ENVIRONMENT
It consisted of two approaches:
Physical incorporation of plant and services into the building fabric
1. Concealed Power
2. Exposed Power
Banham predominantly suggested systems in the Modern Movement to conceal services

1938: Berthold Lubetkin, Finsbury, Health Centre, London - Showing integration of services
Four distinct technical systems:
Construction; heating; electrical; plumbing

1938

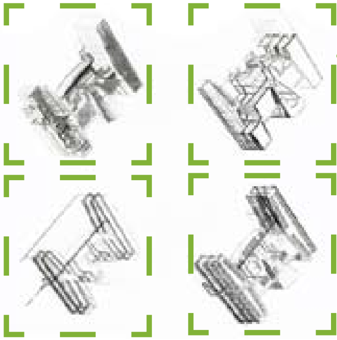
Radiant heating panels on ceiling
Ventilation at head of fixed light
Reinforced concrete walls, forming service ducts to the exterior of the building

Structural and service system diagrams:
systems located in a void between the main structural beams and curtain walling

KENNETH FRAMPTON: STUDIES IN TECTONIC CULTURE

Mies: suspended ceiling covering services
representation of 'abstract materiality'
CONTRADICTION TO
actual materiality of his structures and natural material of floors

1958: Seagram Building, New York
Vision of seamless, imperceptible, but ideal environment. Invisible supplied brought to complete realization.



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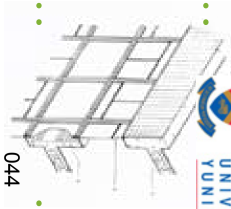

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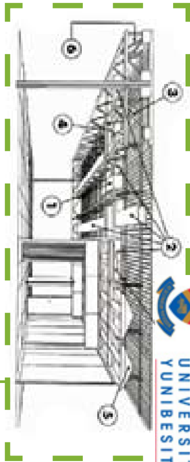

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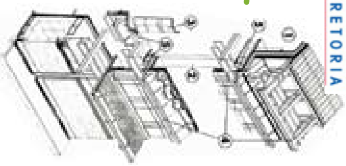

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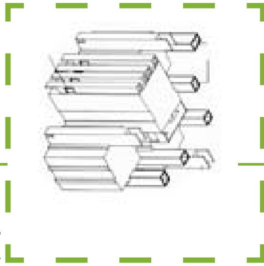
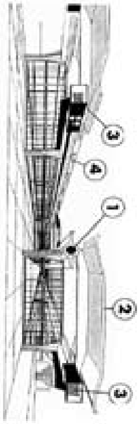


051

1964: Cut-away section showing relation of structure and mechanical system, Marco Zanusso, Olivetti Factory, Argentina.

Explore new ways to express the relationship between structure and services. Exposed air-conditioning plugged into hollow tubular roof beams. Roof becomes a combined structural and environmental canopy over the of space.



052

1961: Cut-away axonometric showing services ducts integrated into facade, Franco Albini, Rinascente department store, Rome.

Services carried in voids formed within the precast concrete cladding

053

1966: SCSD school prototype, roof space acting as return air plenum
USA - exploitation of environmental-design given utilitarian expressions the programme.

Structure - a light steel roof over a deep-planned space, offering alternative service arrangements.
All serviced by artificial lighting and air-conditioning supplies. This speaks loudly of the triumph of technology over nature, artificial environment replace local climate conditions.

1961: Louis Kahn, Richards Memorial Laboratories, Philadelphia
Axonometric showing service towers.

Louis Kahn: " I do not like ducts, I do not like pipes. I hate them really thoroughly, but because I hate them so thoroughly, I feel that they have to be given their place. If I just hated them and took no care, I think that they would invade the building and completely destroy it. "

1972: Louis Kahn, Kimbell Art Museum, Fort Worth
Section perspective showing relation of structure and services - 'served' and 'servant' spaces.

054


055

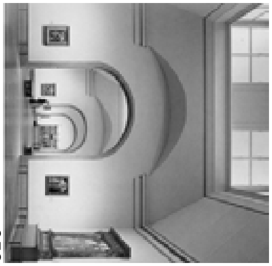
1977: Renzo Piano and Richard Rogers, Pompidou Centre, Paris
East 'service' facade

The influence of Kahn can be traced, but it was adapted in a completely different approach. Questioning the materiality and the representation of it.

1984: Richard Rogers, Lloyds Building, London.
Postmodern Movement, preoccupied with new kinds of interpretation over the tectonic.
Questions of environmental control and system organization received little attention.


056

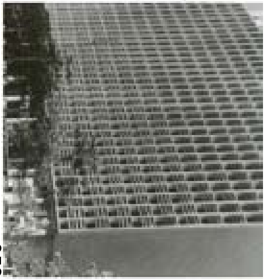
1991: Robert Venturi, Sainsbury Wing, National Gallery, London.
Postmodern environment can be characterized as the scenographic over the tectonic.
Although lighting and air quality are crucial for the safe display of art, an illusion of constant natural light is created through an artificial light source.


058

THE EVOLVING ENVELOPE

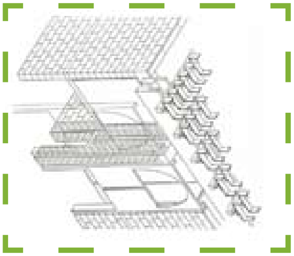
1930: Le Corbusier added a new element to Modern Architecture - BRISE-SOLEIL

1936-1945: Le Corbusier and Luciio Costa,
Ministry of Education
Rio de Janeiro.


059

The brise-soleil, added to the standard repertoire, signalling the beginning of the external envelope of the modern building in service of environmental control.

1959-1061: Louis Kahn, Project for US Consulate, Luanda, Angola. Axonometric cut-away showing environmentally layered envelope.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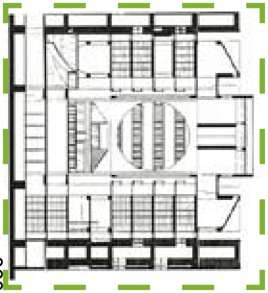
Envelope combines areas of solid and void in proportions appropriate to the building function.
A sun-roof provide shade and promote natural ventilation, responding to the equatorial climate.

1965-1972: Louis Kahn, Library, Philips Academy, New Hampshire.
Enclosed envelope, with distinct environmental zones, create a stable interior environment easy to maintain.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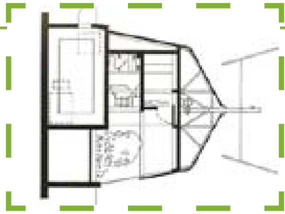

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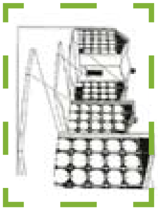

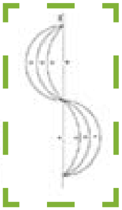

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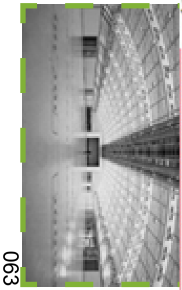

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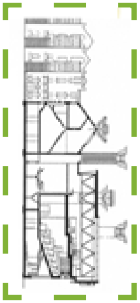

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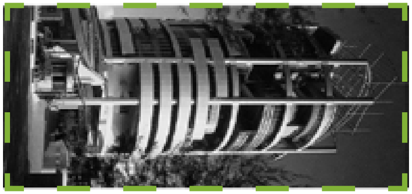


065

NATURAL VERSUS MECHANICAL ENERGY

The 'Vitruvian model of environmental design - this paradigm survived Modernism. International Style, Le Corbusier, proposing one house for all countries. 20th century building trends confirmed this idea. But the last quarter of the 20th questions the continuing of it. Awareness of fossil fuel resources, continued consumption with irreversible consequences. Therefore a new perspective emerge - Methods of Environmental control

1963: 'Interlocking field of climate balance, after Victor Olgyay
Design with the climate, strengthen the relationship between Architecture and the climate.

1963: 'Flattening the curve, after Victor Olgyay
Establishing the balance between environmental-function of Architecture and technology. Define stages by which variations climate might be modified

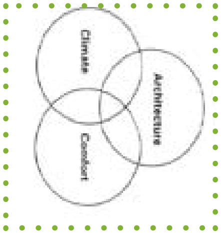
Steve Baer House, New Mexico - bioclimatic architecture, working with nature, using passive solar power for heating requirements. Cambridge Autonomous House Project, cross section 'Autonomy', where dwelling's servicing needs could be met without dependence on main services.

1991-1993: Norman Foster, Lycee Plyvalent, France.
Respect for orientation
Cross-section manipulated to promote controllable natural ventilation

1989-1993: Short Ford, Queen's Building, De Montfort University, Leicester, UK
Combine brick tradition with natural ventilation stacks.

1986-1994: Thomas Herzog, Congress and Exhibition Hall, Linz, Austria.
The arched roof form pro motes natural ventilate

1989-1992: Ken Yeang, Menara Mesiniaga, Selangor, Malays. Bioclimatic Skyscraper with a systematic approach - design an envelope to bear extreme climate conditions.



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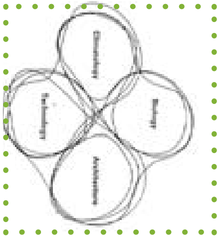
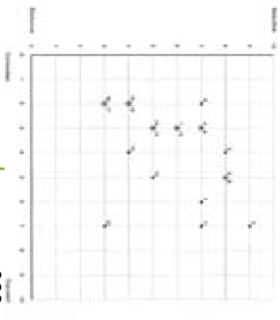


067

A TAXONOMY OF ENVIRONMENTAL ARCHITECTURE

Environmental design is a combination of expanded tectonian environmental repertoire. Contemporary practice exhibits a greater diversity than ever before. The basis of this diversity rests on the relationship between environment function of form and fabric of building combined with mechanical service system.



068

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urban context

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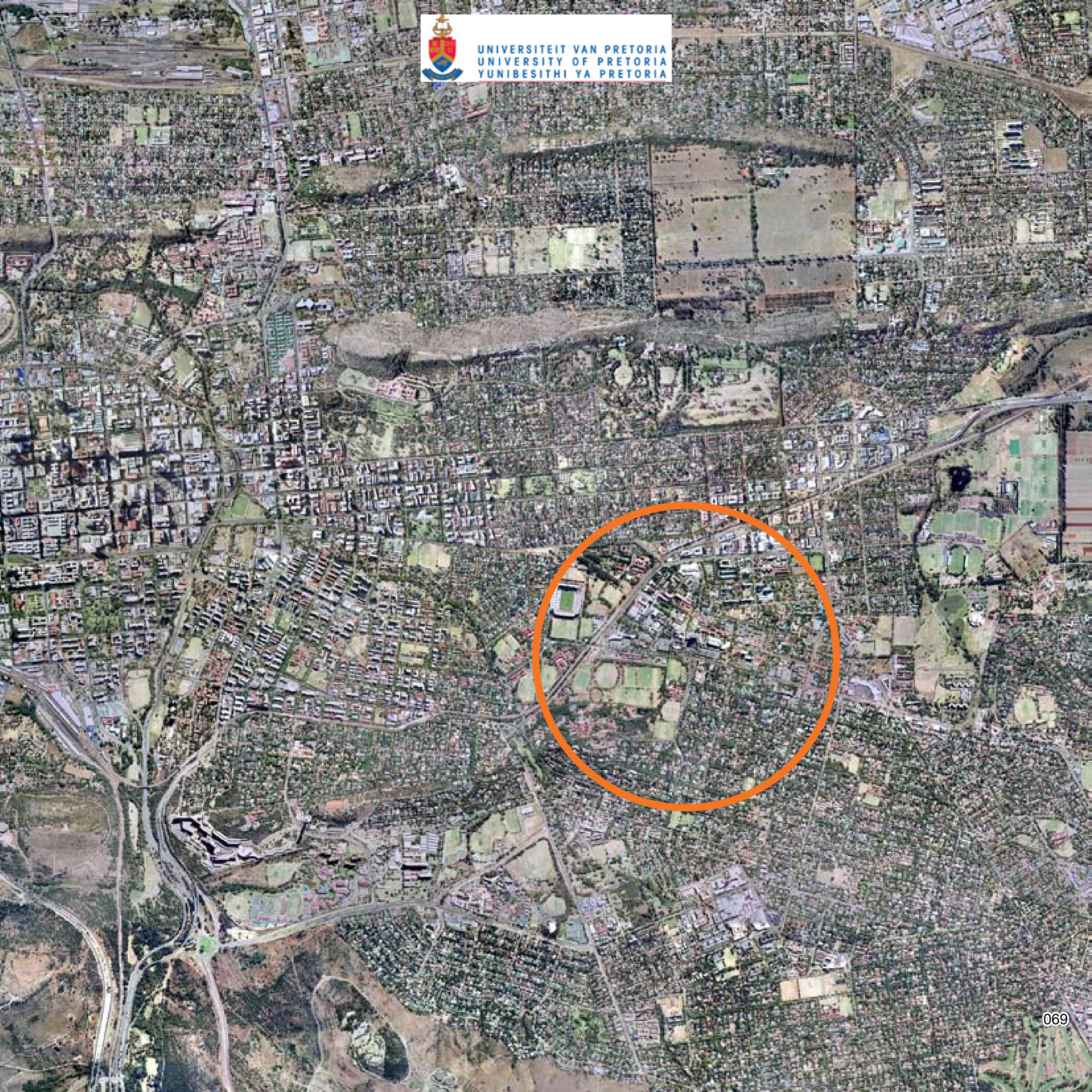


"From primitive times to modern-day, man has been attached to the environment in which he finds himself. By distinguishing and naming certain parts of this environment, he formulates a visual image of his surroundings, in order to move with ease through it. If such reference should be disturbed, if wayfinding cannot occur, mobile man is filled with the terror of being lost." **[Lynch 1982; p123-125]**

africa

south africa

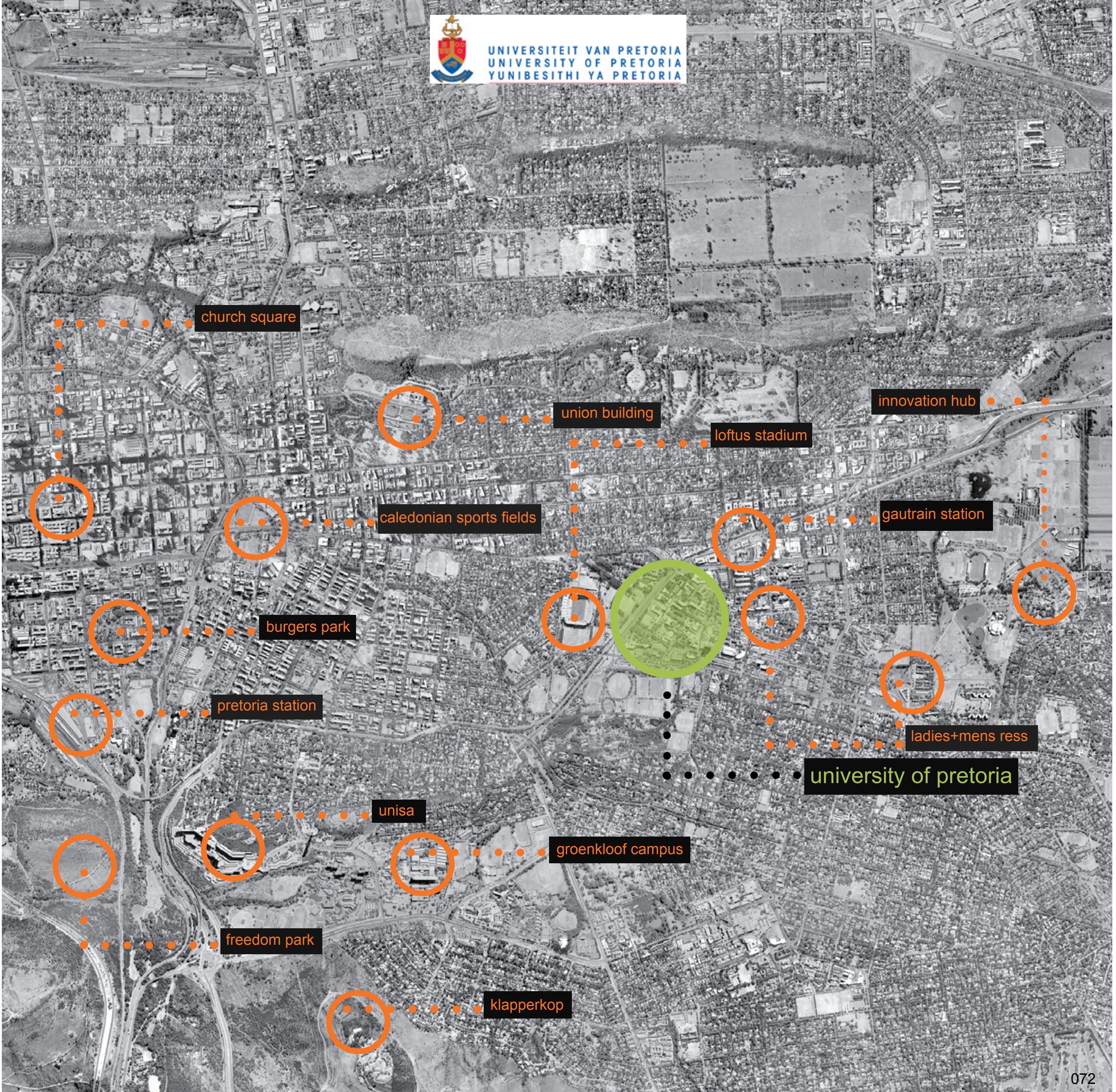
gauteng

_city wide context:

The proposed site to be investigated is located in the South African Province of Gauteng, in the city of Pretoria, established in 1855 as the seat of the ZAR government. The city functions on an orthogonal street grid, with its focal point in Church Square; a historical meeting place. In 1875, a piece of the original farm Elandspoort, east of the Apiesriver, was sold and renamed to Sunnyside. Twists between neighbours led to government taking control of the land and establishing the Transvaal University College in 1889, today known as the University of Pretoria. Situated within the Hatfield precinct - a small commercial, educational and residential district. Recently, its development increased by a rapid speed led by the new Gautrain platform, ensuring an escalation in economic growth.

Hence, the need for transparent logic in terms of orientation becomes a basic human necessity. To be able to identify with a specific environment through intrinsic logic by the user, feeling at ease and familiar within new environmental conditions.

In order to transform transparent logic into a spatial order, Kevin Lynch proposed five physical elements contributing to strengthen the orientation of the user within an unfamiliar environment. Each of these elements adds to the identity and character of a place, ensuring a clear city image is created, producing a rich urban fabric, exploring the latent potential of the district. These elements should be used within the context of the human interrelationship with nature within the bigger precinct.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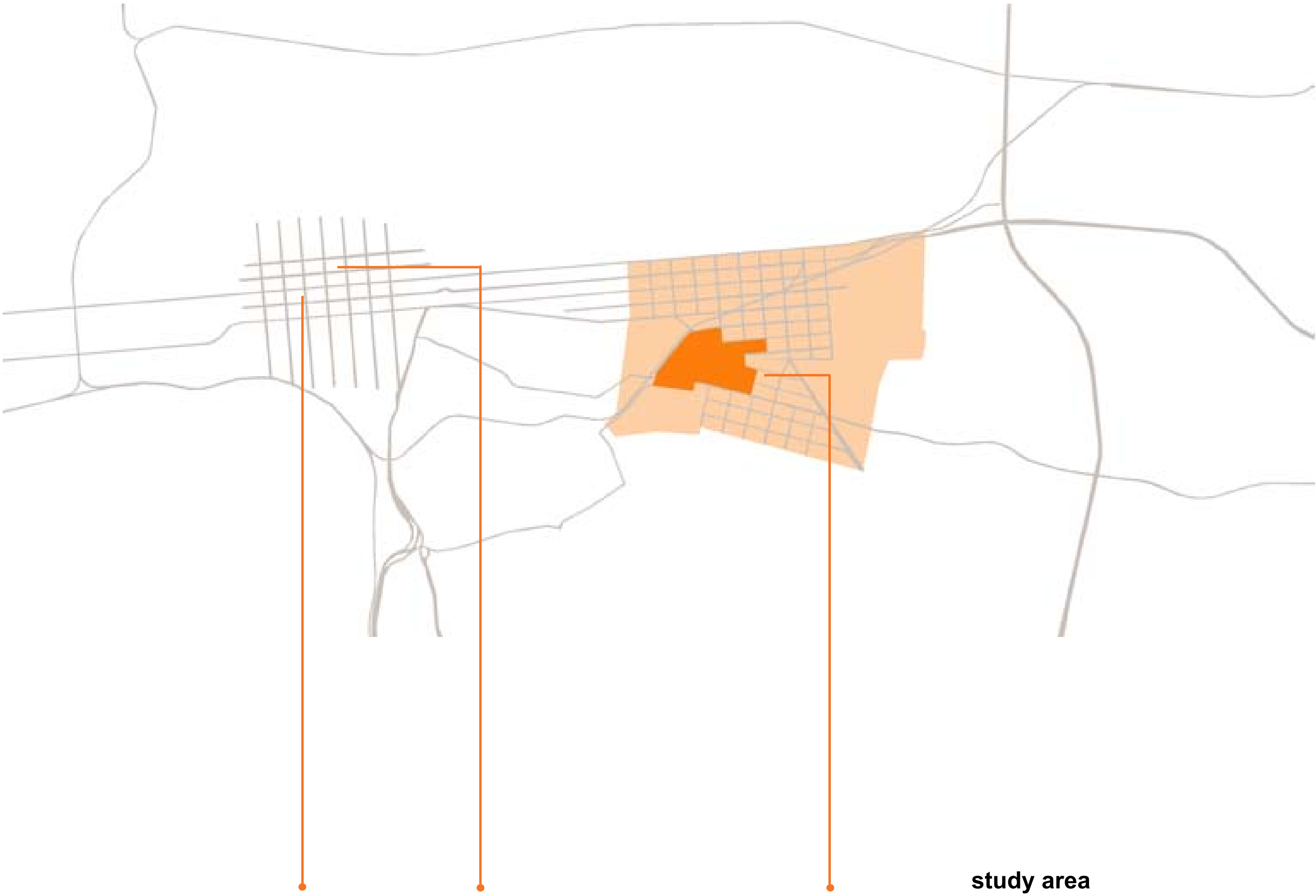
church square
union building
loftus stadium
innovation hub
caledonian sports fields
gautrain station
burgers park
pretoria station
ladies+mens ress
university of pretoria
unisa
groenkloof campus
freedom park
klapperkop

076



study area

073

074

075

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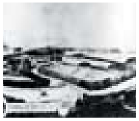
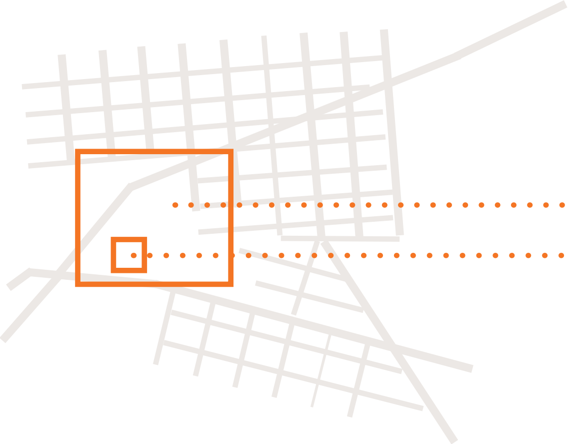


study area



The Hatfield district differs greatly from the rest of Tshwane in terms of its urban fabric, social context, form and, use, showing signs of vibrant student life - one of the key aspects and economic driving forces behind the rapid development and growth taking place in the precinct. The newest addition, the Gautrain station, holds a guarantee for further development. Interventions proposed in the group study framework, aim to stitch the Hatfield precinct to these new developments as well as with the rest of the city. Visualizing the urban regeneration of the study area holds an opportunity for thorough integration between campus life and life outside.

By looking at the two figure ground studies on the following page, one can see the main campus of the University of Pretoria offers an opportunity to densify. The building forms are quite diverse and scattered within the formal grid of the campus structure. The ratio of the buildings opposed to vacant land indicate that this area is underdeveloped and should therefore take on a more urban character with a definite human scale.

KEY

primary gateway

heart of campus

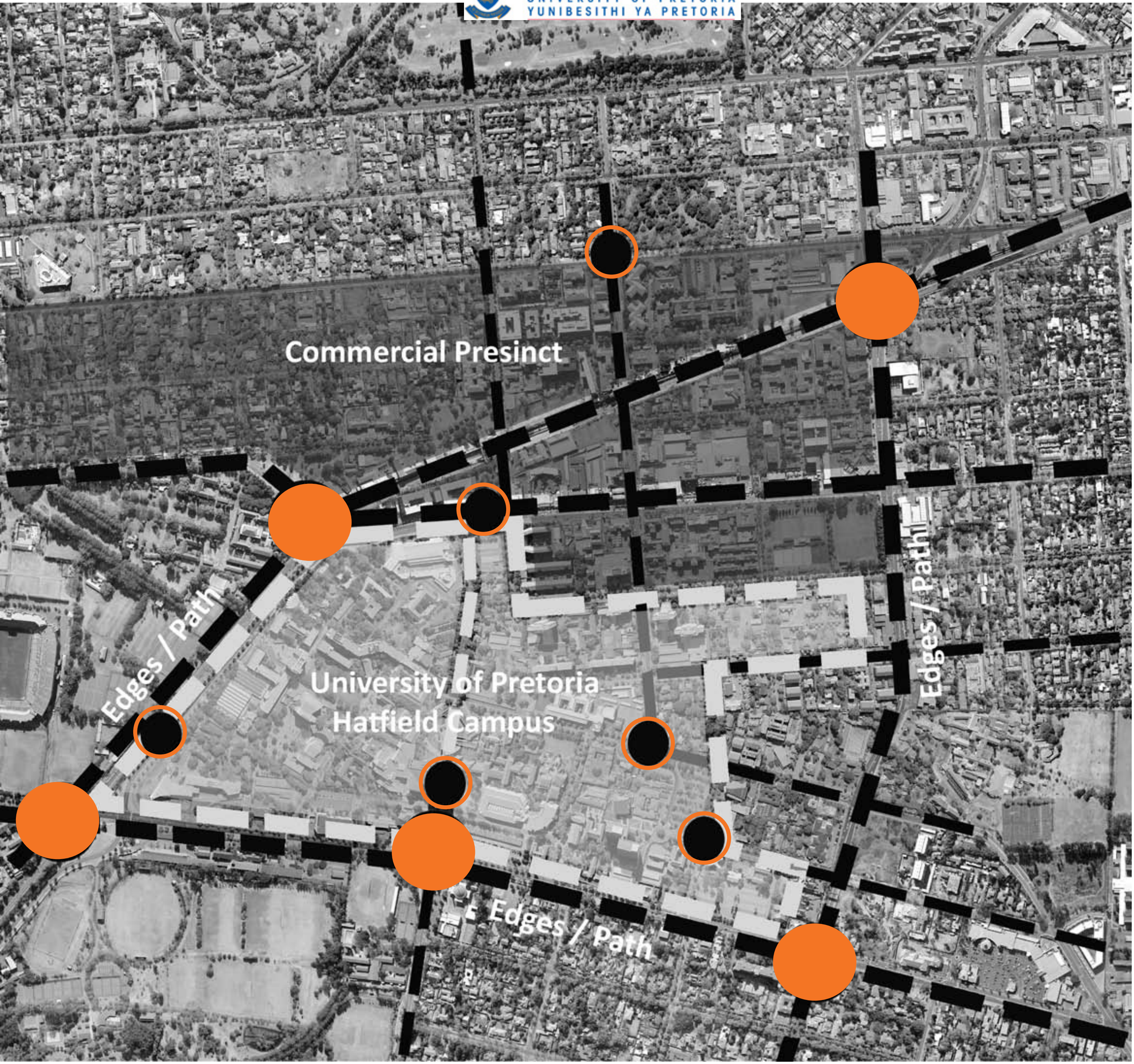
campus entrance

secondary gateway

campus boundary

direct pedestrian routes

access roads to UP


Commercial Presinct
University of Pretoria
Hatfield Campus
Edges / Path
Edges / Path
Edges / Path

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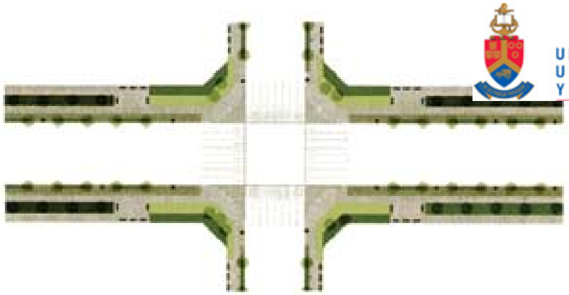
vision

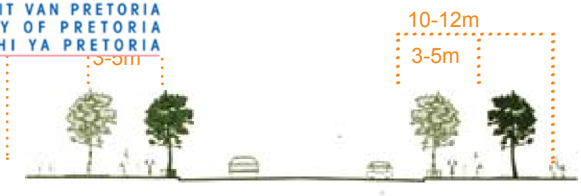
083

_group vision statement:

"TRANSFORMING THE UNIVERSITY OF PRETORIA FROM AN ISOLATED FRAGMENTED KNOWLEDGE PRODUCTION INSTITUTE, TO A UNIVERSITY CITY, A CITY OF INNOVATION."

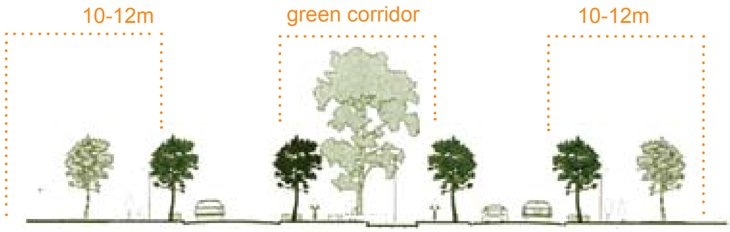
Removing physical, social and virtual boundaries, constraining both the University and the Hatfield precincts growth, to allow South Africa's premiere Academic institute to grow into a social amalgam, celebrating South African culture. The unification of these two distinct identities must not allow the dissolution of either's unique identity but rather reinforce each others key strengths and opportunities to allow a true city of knowledge to be born - a "UNIVERSITY CITY".



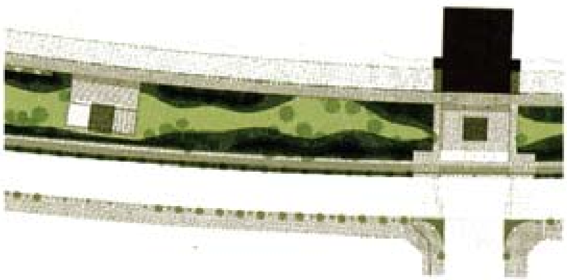


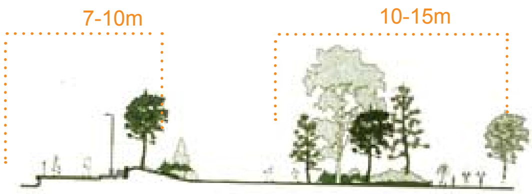
RING ROAD

primarily vehicles



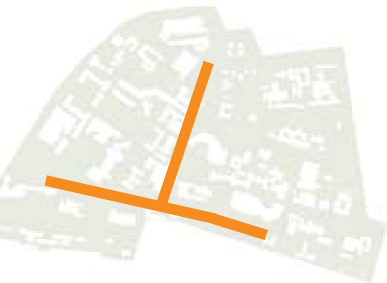
UNIVERSITY ROAD





RING ROAD

primarily pedestrian



The streets on campus are planned with a graduated hierarchy of widths to support the varying intensity of urban activity. Each scenario is designed with a unique sense of character, rhythm and comfort. The network is classified into types, each differentiated by setback, street wall, sidewalk width, landscaping and use.
All the options are designed to act as buffer zones to mediate and harmonize the linkages between the streetscape and buildings, creating a safe environment for pedestrians to access these routes. Trees create a spatial framework and visual identity and at the same time provide shading and pause areas within the 5 minute walking circle area.

_urban design proposal:

[The following urban proposal is a group proposal, and submitted as a group framework for the research precinct]

"…the relationship between different buildings; the relationship between buildings and streets, squares, parks and waterways and other spaces which make up the public domain; the nature and quality of the public domain itself; the relationship of one part of a village, town or city, with other parts; and the patterns of movements and activity which are thereby established: in short, the complex relationships between all the elements of built and unbuilt space"
Department of the Environment (1997) Planning Policy Guidance

The Initial interventions (Phase 1) comprise the implementation of various urban design strategies and protocols. The guiding objectives behind these principles are as set out in the `Vision Statement` for the University`s proposed future development strategy. The interventions at the urban level on the campus include the implementation of pedestrian network development guidelines, proposal and guidelines for densification and development as well as the re-use of underutilized threshold green spaces.

_pedestrian streets:

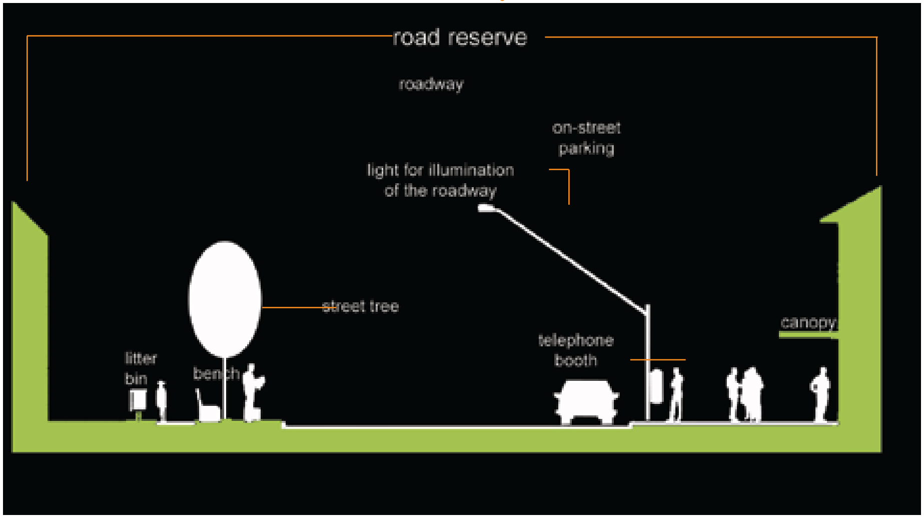
"Streets are the arteries of our communities – a community's success can depend on how well it is connected to local services and the wider world. However, it is all too easy to forget that streets are not just there to get people from A to B. In reality they are the tissue that connects and keeps alive the urban body of the campus. They form vital components of residential areas and greatly affect the overall quality of life for local people."

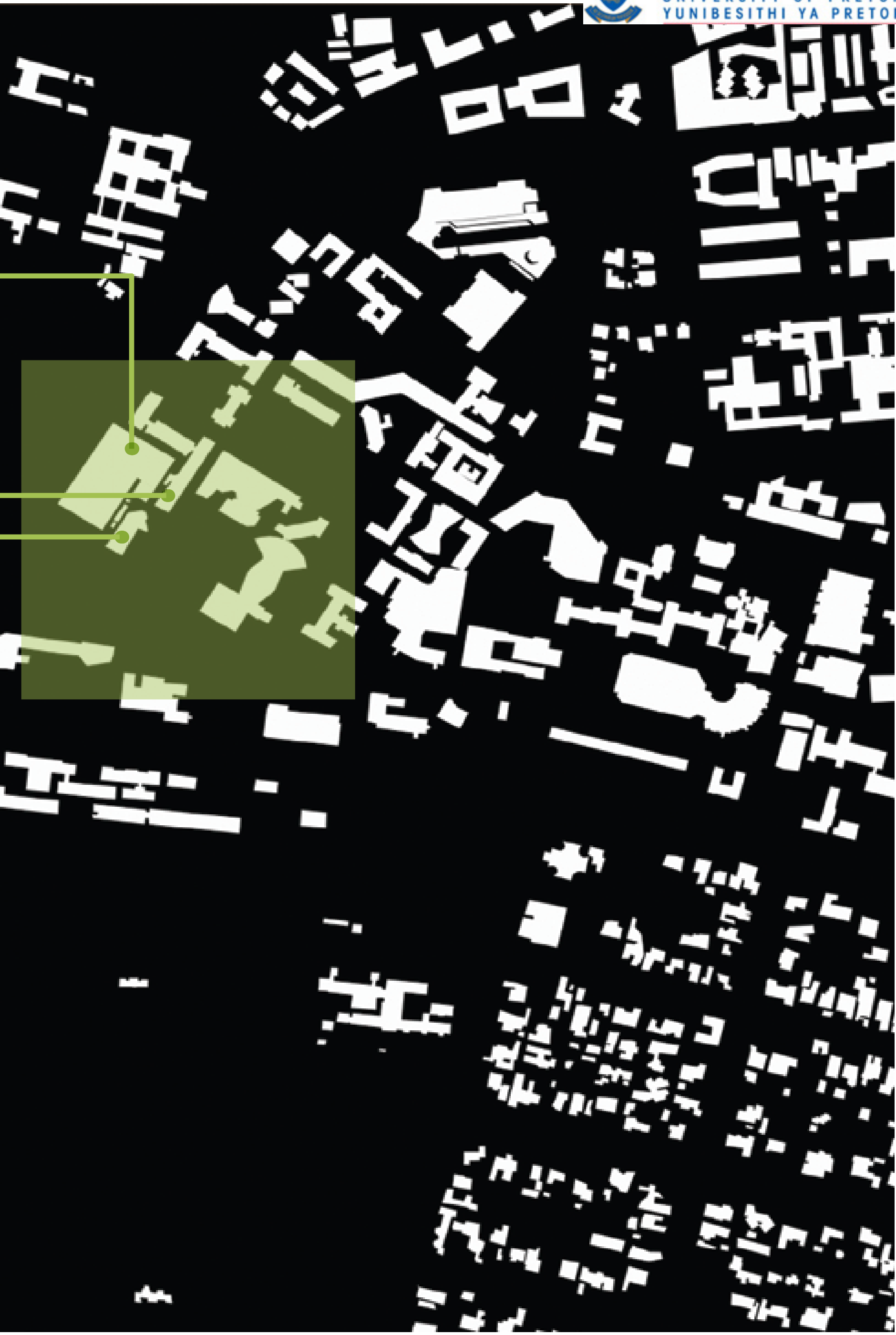
As stated in the UK`s Department of Transport manual for street design, streets are more than just routes from a to b, and nowhere is this more true than on a campus.
We have proposed three scales of intervention at a street level, each of them suited to a different pedestrian environment. **One at a main artery scale**, to accommodate pedestrians comfortably with high speed traffic, **secondly at campus ring road scale** to accommodate both intercampus vehicle and pedestrian traffic with prominence being given to pedestrians and **thirdly at a pedestrian only scale.**

_heavy machinery laboratory

_engineer building II

_micro-electronic building

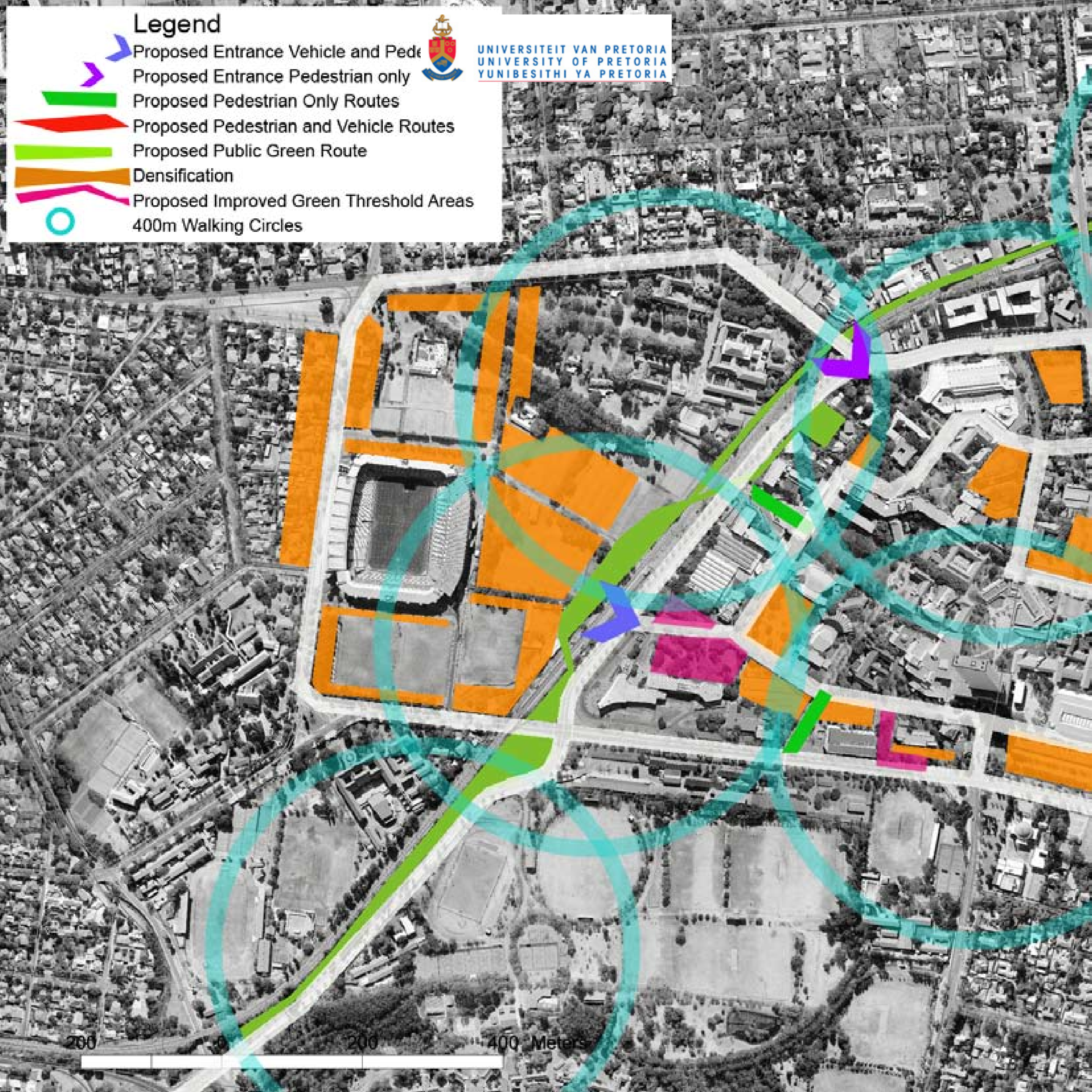




082

_research precinct development:
The establishment of a research precinct on the University's ground is based on numerous positive objectives. The improvement of access and connection to enhance scientific and academic collaboration and interaction is the key driver to a successful precinct development. The new precinct will serve to develop and sustain a collegial research community where interaction and interdisciplinary research with the community is implied. The new precinct will help to streamline the research processes by, allowing for resource, facility allocation and sharing. The proposed research precinct is located in an area of the campus that has established research facilities in the Microelectronics research building, the Engineering research facility and heavy machinery laboratory, however it is located in an area of the campus that affords the precinct a large area of underutilised space for future developments. Lastly the research precinct is located adjacent to the established arts precinct on campus; the framework is to encourage design that facilitates interaction between these two diverse fields of study, opening up new avenues of study and collaboration.

Proposed Parking Structure:
The proposed parking structure is to accommodate current and future campus parking requirements; it is to act as a base structure for future development on the site. The future development should conform to the requirements as set out in the research precinct and urban development frameworks. The parking structure will consist of one basement level and two semi – lower ground levels, it will serve as parking for students, faculty and visitors to the campus as well as the general public during sporting events. The structure should be designed as such to allow flexible planning parameters (structure, services and access) for the future proposed covering development.


Legend
Proposed Entrance Vehicle and Pede
Proposed Entrance Pedestrian only
Proposed Pedestrian Only Routes
Proposed Pedestrian and Vehicle Routes
Proposed Public Green Route
Densification
Proposed Improved Green Threshold Areas
400m Walking Circles
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200
0
200
400 Meters

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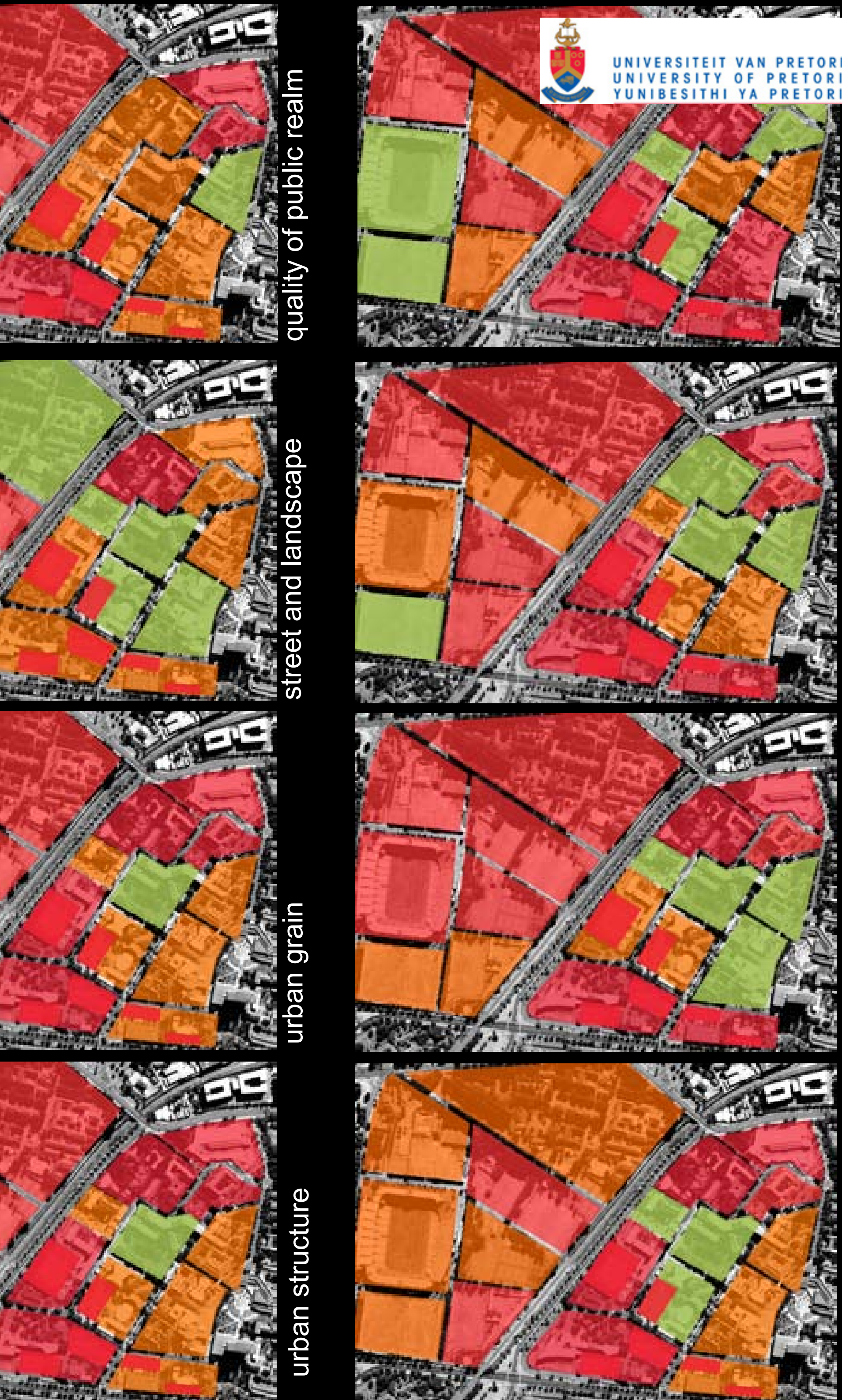
_densification:

The University of Pretoria's main campus is riddled with low density low efficiency land use in the form of parking areas and unused threshold green spaces. These areas have been identified as areas that are underutilized and have good development potential without impacting on the community environment that is being developed on campus. The proposed developments on these areas are highlighted in our opportunities section of this framework.


adaptability
density and mix
facade and interface
building type
details and material
facade and interface
character
diversity
height and massing
continuity and closure
ease of movement
legibility



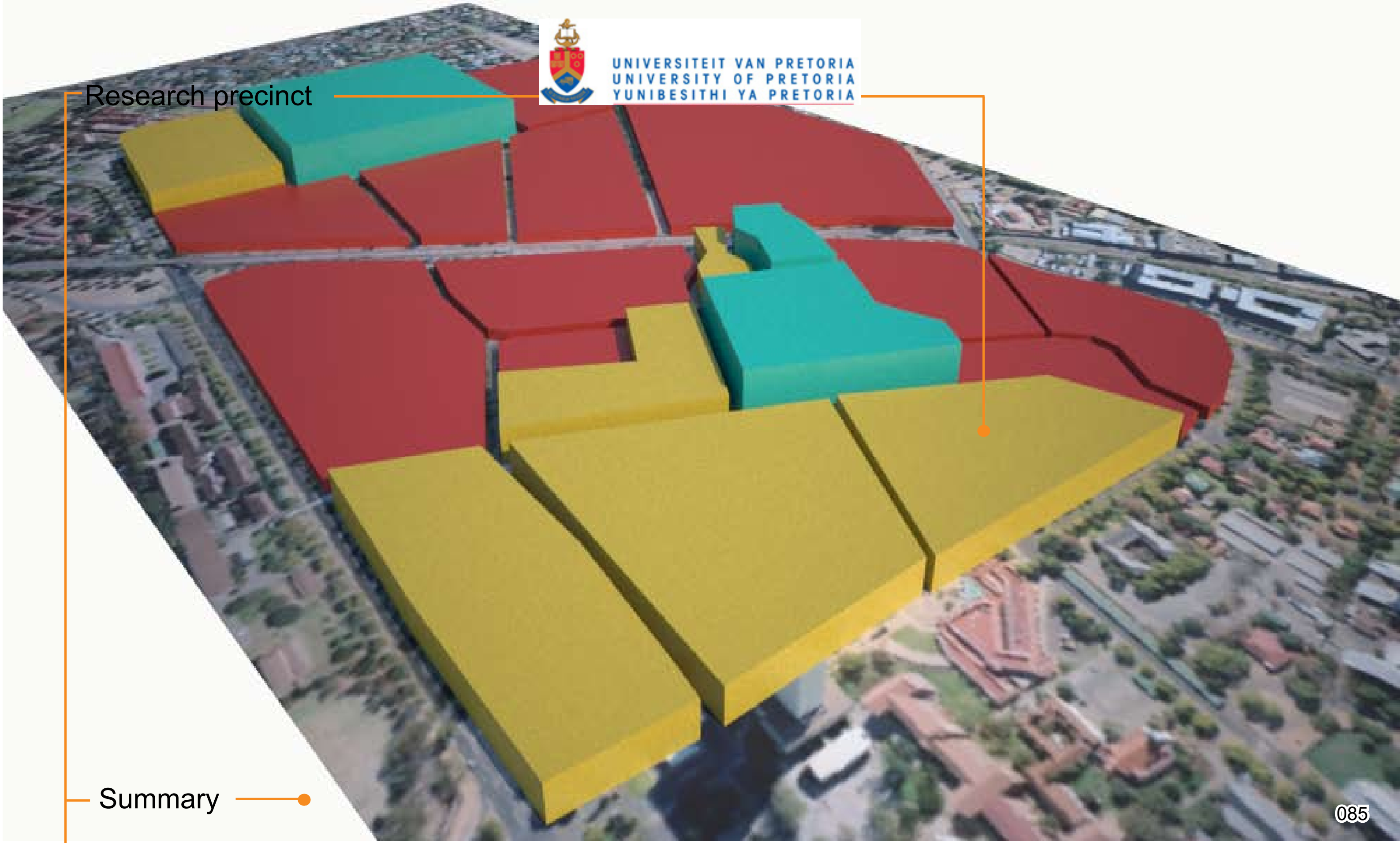
legend

good

average

poor

Successful streets, spaces, villages, towns and cities tend to have specific qualities in common. These qualities are abstract theoretical concepts, designed to ensure the inclusion of strategies to obtain a proper design product, based on urban design principles. When applying design principles to a particular part of a project, it needs to be placed into the broader context of the city. The principles are not rigid and should be applied in a flexible manner, specific to the design proposal. A good design results from a consideration of the widest range of concerns and issues - imaginative, creative resolution of potential conflicts. The fundamental qualities of successful places, which all development must contribute to, are summarized through the use of a figure ground study of the precinct. The areas were subdivided into smaller zones and analyzed according to the specific criteria guidelines [mentioned on the following page]. These results were assessed, combined into a summary specifying the opportunities and problems, which can and need to be applied in the specific zone. Each zone was graded [good, medium, bad] to specify the level or degree of change that needs to be applied.



the subdivision of the area into small development parcels
Density and mix - *the range of use*

Permeability - *move and connect*
Vitality - *exciting places; the spice of life*
Variety - *diversity; 'the spice of life'*
Legibility - *ease of understanding*
Robustness - *change and adapt as required*
Character - *sense of place and history*
Continuity and enclosure - *clarity of form*
Quality of public realm - *sense of wellbeing and amenity*
Ease of movement - *connectivity*
Diversity - *ease of choice*
Urban structure - *the essential diagram of a place showing*
Urban grain - *the nature and extent of*

Height and massing - *scale of building in relation to*
Building type - *setback, floorplate size, relation to context*
Facade and interface - *relationship of building to the street*
Details and materials - *appearance of building*
Streetscape and landscape - *the design of the spaces, ecology and biodiversity*
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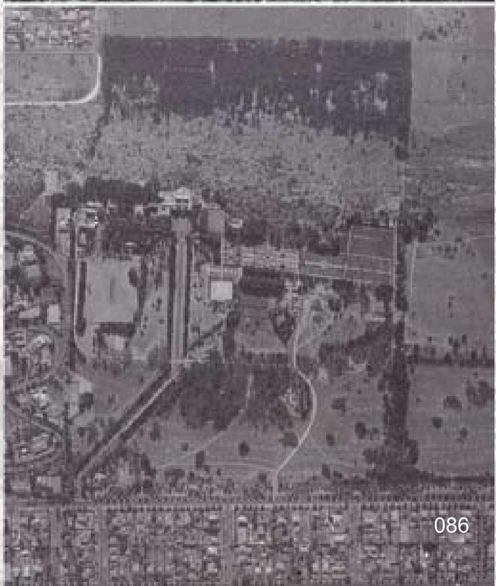
historical context

1939

1950



1954

General Jan Smuts, one of the co-founders of the University of Pretoria advocated the idea of a campus specifically located in Pretoria. Separated from the old Transvaal University College in Johannesburg, it converted to an Afrikaans-language institution in 1930 under the influence of Gerhard Moerdyk. He initiated the new site layout plan for the Pretoria campus in 1940, which involved the history of the site of the proposed project. The department of Human Movement Science was initiated in 1946 on the south-westerly part of campus. This part of campus hosted sport fields since 1947 under the supervision of prof. C. Smit. Most of the buildings initially were placed in a random order with no specific guidelines or relationship with each other. In 1953, the specific issue was addressed by adding the Maths- and Natural Science buildings as well as the Engineering platform to create a relationship between the existing and the new. In1958 the Aula was built forming the start of the Arts precinct. The new music department would add to this precinct, with Mr. Brian Sandrock in charge of designing a three storey music department as well as an open air theatre [the amfi-theatre, 3000 seats] and the music hall [the musaion, 500 seats], replacing the athletic field and other sport facilities. The new administration building was added in 1968 in the south-westerly corner of the campus for easy access by the public and in the process replacing a few tennis courts. This building became one of the campus's landmark buildings. During this time the University experienced rapid growth and an additional wing was added in 1973. One of the most significant developments on campus was the Engineering tower, hosting many functions, this building had to be placed central to share its facilities with other departments. In 1975 this ten storey building was ready for occupancy by 700 students.

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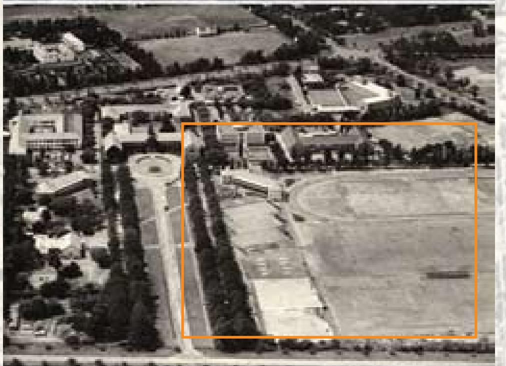
1954



Aula 1958

1967

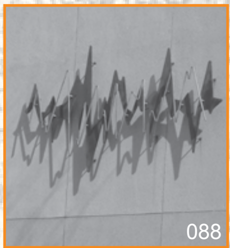
114

1990

115

2004

1970



088

089

1985

Musaion 1959

091

1987

090

Amfi theatre 1960

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social context






	Economic	Social	Environmental
Local character	Helps promote and give identity to cities and regions Contributes a competitive edge by offering difference	Reinforces a sense of identity Encourages people to become actively involved in managing their neighborhoods Offers choice among a wide range of distinct places and experiences	Helps protect limited natural resources
Connections	Increase the success of local service shops and facilities Makes a site or area easier to access, increasing land value	Improves security Encourages walking and cycling leading to health benefits	Reduces vehicle emissions
Mixed use	Increase value for those preferring a mixed-use neighbourhood Uses parking and transport networks more efficiently Increases the success of local shops and facilities Lowers people's spending on transport	Improves access to essential facilities and activities Encourages walking and cycling leading to health benefits Reduces the need to own a car Increases personal safety	Reduces car use
High-quality public areas	Attracts people and activity leading to an improved economy	Increases involvement in community and cultural activities Increases use of public space Gives a greater sense of personal safety Attracts social interaction	

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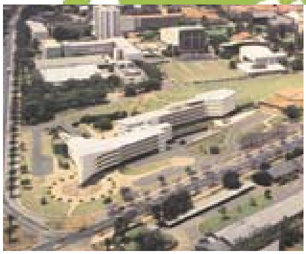
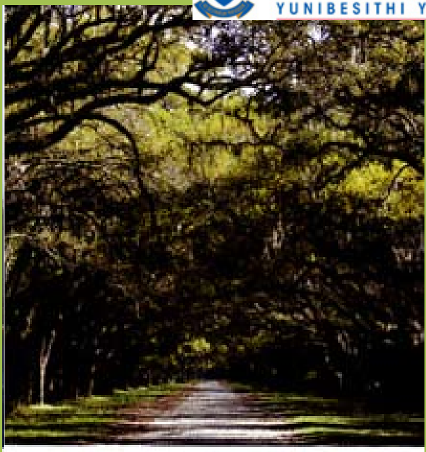
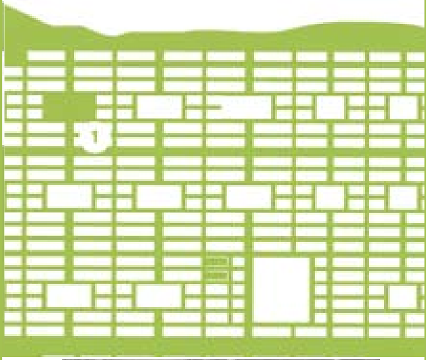
site analysis



LANDMARK

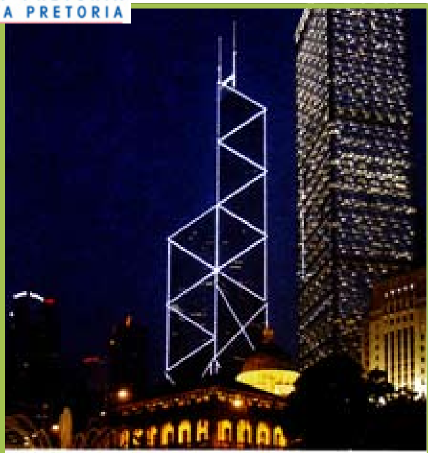
SYDNEY:
cultural center
1 - sydney opera house
2 - port jackson
UNIVERSITY
1 - the administration building





PATH

SAVANNAH:
garden
1 - cellular unit
2 - garden
UNIVERSITY
1 - green square in front of the Aula

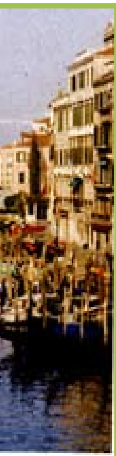


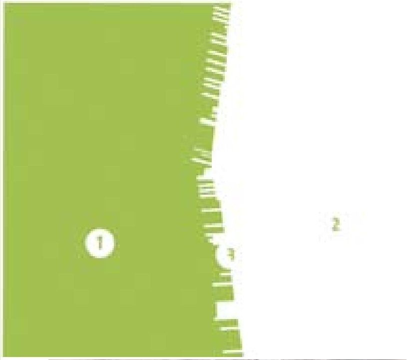
LANDMARK

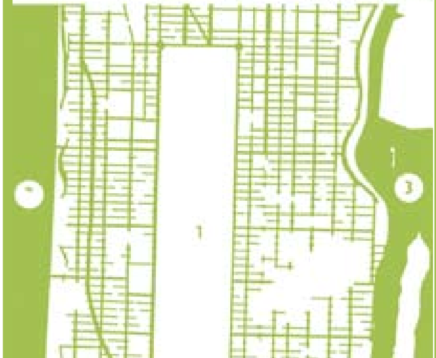
HONG KONG:
iconic tower
1 - bank of china
UNIVERSITY
1 - engineering tower

EDGE

VENICE:
canals
1 - grand canal
UNIVERSITY
1 - trees for a natura
edge on site







DISTRICT

NEW YORK CITY:
waterfront
1 - hudson river
2 - manhattan
UNIVERSITY
1 - the Hatfield district surrounding campus

NODE

NEW YORK CITY:
central park
1 - central park
2 - hudson river
UNIVERSITY
1 - proposed project; centre for green technology

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The application of Kevin Lynch's five elements was used to create a point of orientation which is of extreme importance to know oneself within a specific frame of reference. These five elements, path, edge, node and district, is applied in the design to ensure proper orientation strategies are in place;

The proposed site to be developed as an architectural response to the project objective, is located on the main campus of the University of Pretoria.

_path:

The site was selected for its close proximity to the new Western entrance and the EBIT faculties. At the moment the proposed site has merely a single function; as a ground parking area.

_edge:

The shape of the site is defined by the main transportation route on campus, the ring road, together with the positioning of existing trees.

_node/landmark:

The ring road surrounds the site on both the Southern and Western edge. This creates an intersection, acting as an entry point, and marks the opportunity to function as the Beacon of the Western entrance. A hierarchy of pedestrian routes, give a choice of direction, access to several view points. Proposing several way-finding options to specific destinations, and acts as a mediator between the new Western entrance and the buzz of student-life within.

_district:

Situated between several existing public facilities, the Aula, Amphitheatre and the Musaion, new forms and functions are weaved into the existing context, creating civic spaces, bringing an identity to the overall research precinct. The Modern architecture, surrounding the site, carries a large degree of symbolic content. Green courtyards display the typical modernistic approach, setting the building back from the site boundary, allowing for spill-out space into a semi-public green corridor. The interplay between defined constraints, determined the final outcome and ensured the important presence of the proposed project blend with the existing building fabric. The relationship between surface and shape is further intensified by an even more dramatic treatment of hard and soft surfaces reflecting internal uses and spaces. Direct links between two proposed projects exists. A pedestrian link on the southern edge and a public transportation link on the western edge. Allowing pedestrian access from the western corridor. The proposed building aim not to dominate the existing relationships with its neighbours, but merely react towards the existing context. Obtaining its own identity but manage a delicate balance between existing and new.

_boundaries:
The rectangular site, orientated in a north-westerly direction, is fronted by the campus ring road on both the western and southern sides. This road has the ability to become an important guiding tool for the design process. Recent development concerning the engineering tower, led to the relocation of the Western campus entrance. This entrance offers the possibility to establish a bridge crossing the University road, forming an important pedestrian link directed towards the proposed site.

Other boundaries are formed by the existing building structures; the Aula on the northern side [to form a direct and decidedly valuable link between the proposed facility and the main activities on campus]; the Musaion and Amfitheatre on the eastern side [forming solid barriers, with only a few existing access links].

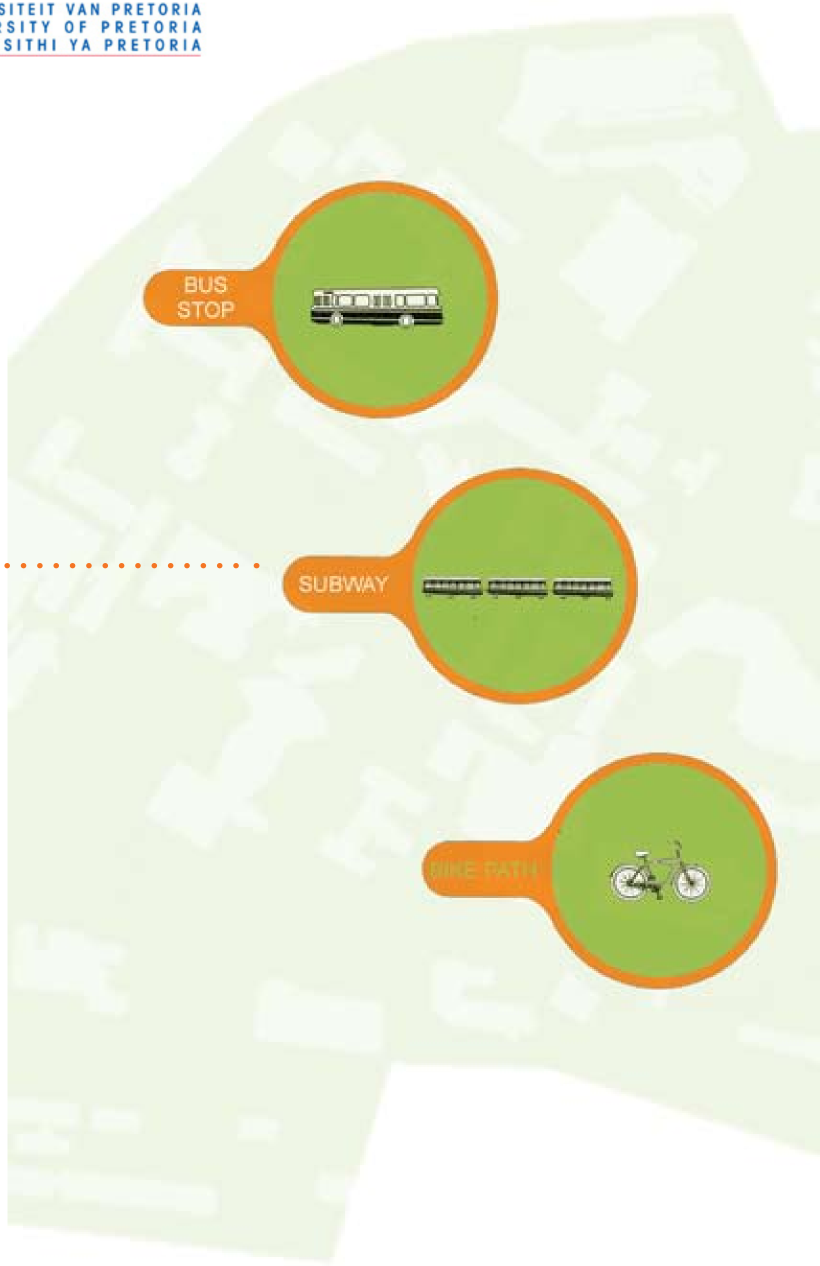
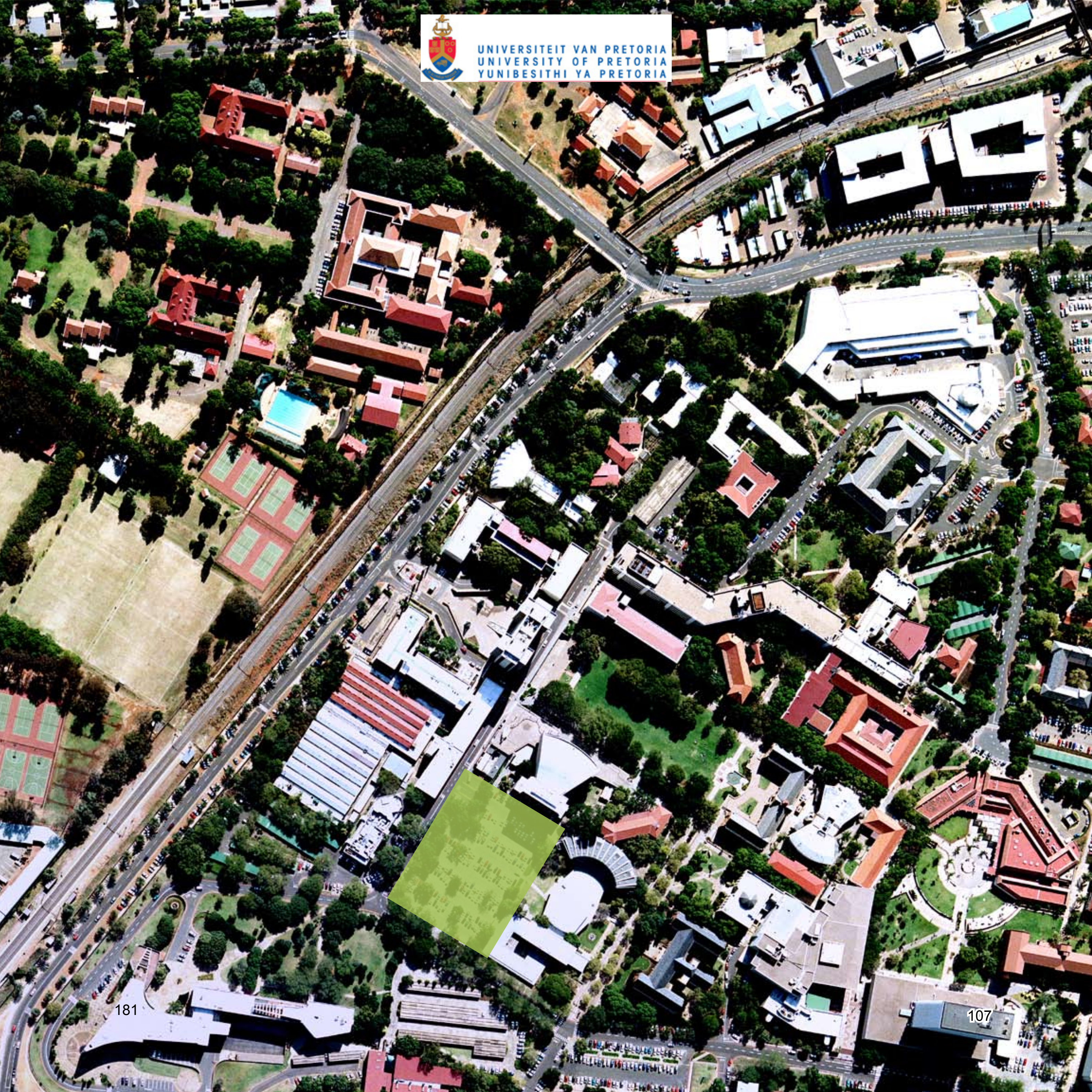


Fig.106 _public transport

space stretches in front of the administration building, currently not defined and under utilised, offering an opportunity to generate recreational activities. On the eastern side, another student project proposal defines the southern edge with a direct pedestrian link running past the musaion and amfi-theatre on the eastern side.

The proposed research precinct of campus is currently only used for spill-over parking, marking this end of campus as a dead zone. This scenario will change dramatically with the relocation of the western entrance, offering the opportunity to become a much more vibrant, interactive space, generating activities to spur social interaction, within close proximity of the proposed site. As a result pedestrian circulation, redirected towards the proposed site, will ensure the Green Technology Research Centre, becomes a circulation node for students to pass through towards their end-destination. The application of public facilities on the ground floor will reinforce the ability of the facility to allow these users to engage actively with its public facilities. Providing this area with a stimilus of activity.

Currently the proposed site is a hard surface treated area, with several existing trees, used for parking by university employees and visitors. This prohibits the optimal use of semi-private areas around the existing buildings; the natural flow of pedestrian circulation prompting the users to follow other more safe and secure pedestrian routes; further distances needs to be covered; and the area imposes on the visual link between existing buildings. Therefore, a circulation spine needs to be designed within the proposed building to cater for all users as a safe harbour against traffic as well as a fast effective alternative to reach a specific location.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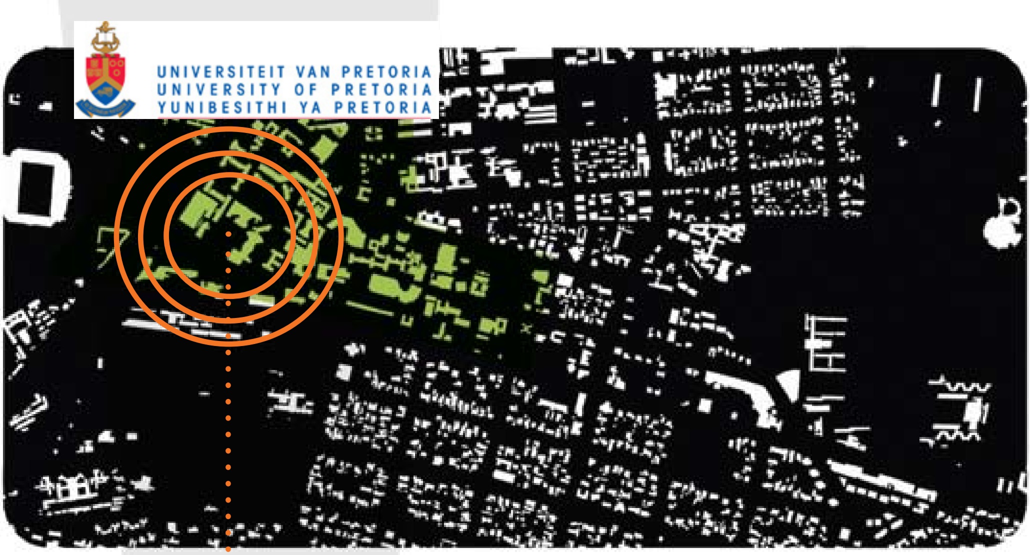
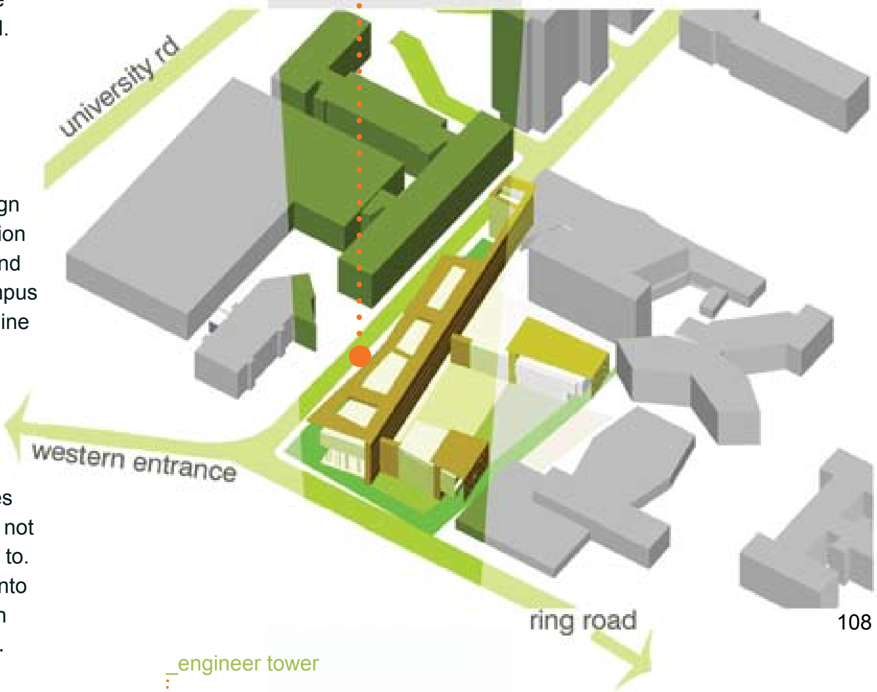
_path
The administration building, a valued historic building on campus, celebrates the western corner of campus. Positioned between two main roads linking campus to the rest of the city. Lynnwood, in the south-eastern direction and University road in the north-western direction. The proposed project, enable pedestrians to reach destinations without vehicular interference.

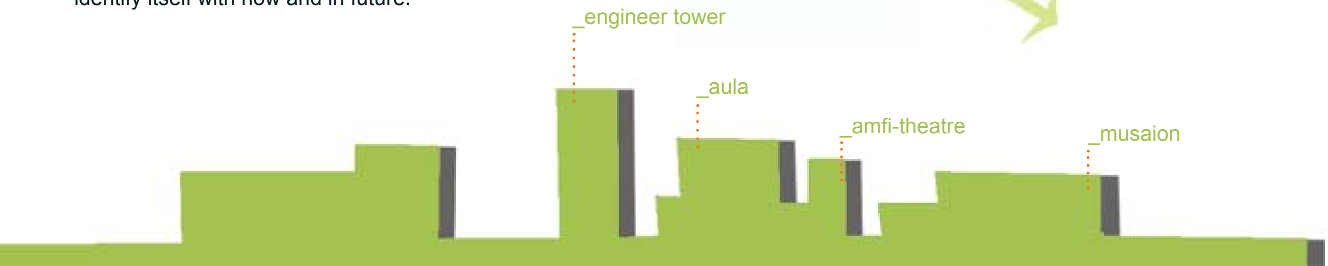
_edge
The railway, accommodating both metro rail and the Gautrain forms the north-western edge of the entrance. The proposed site itself is reinforced by a natural-edge of existing fever trees, developing a threshold between the proposed building and the ring road.

_node/landmark
The proposed projects strengthen the legibility of the corner as a design tool to direct the users. An orientation component in the public network, and a point of orientation within the campus precinct. Generating the activity spine towards the proposed building.

_district
A rich architectural language creates the unique form of campus identity, not yet integrated with city life, but able to. Blending the existing and the new into a timeless composition the user can identify itself with now and in future.







southern edge

fever trees
[acacia xanthophloea]

ring road

western edge
[site corner]

_site character

Despite vehicles, parked on every inch of open space, the site and its surroundings can be described as calm, serene and confined, with giant fever trees, emphasising the human scale factor forming the site boundary, guiding the pedestrian to its destination point, ensuring the site remains an inviting space to experience nature within the city.

_the aula:

The Aula, known as one of the most prominent buildings on campus, was designed by Karel Jooste in the architectural firm of Philip Nel. Hosting University and public functions on a regular basis, this facility is used to its fullest potential. Unfortunately no specific space is allocated for social gatherings after public functions. This gives the opportunity for the proposed project to cater for this specific need, to establish a social link between the existing and new.

_the amfi theatre:

Used mainly by University of Pretoria student activities, the facility can be put to much better use. The form of the theatre resembles the history of the site [previously an athletic field], celebrating its context. This theatre can be used as an additional outdoor theatre by the proposed project for presentation sessions i.e. pecha-kucha night [a presentation containing 20 slides shown in 20 seconds to sell a design idea]. This will ensure a 24/7 use of the proposed facility, relating to its neighbouring buildings and at the same time extending its use beyond the typical campus hours.

_the musaion:

Initially, this single storey facility was designed by architect Brian Sandrock, and a few years later the expansion ensured the addition of two more storeys, hosting office facilities for lecturers. This facility hosts indoor events, such as choirs and musical shows. Seated next to the music department, these facilities integrate their use successfully, but it appears there is a need for social integration with the rest of campus, to focus attention on this department to ensure active engagement from the student's side.

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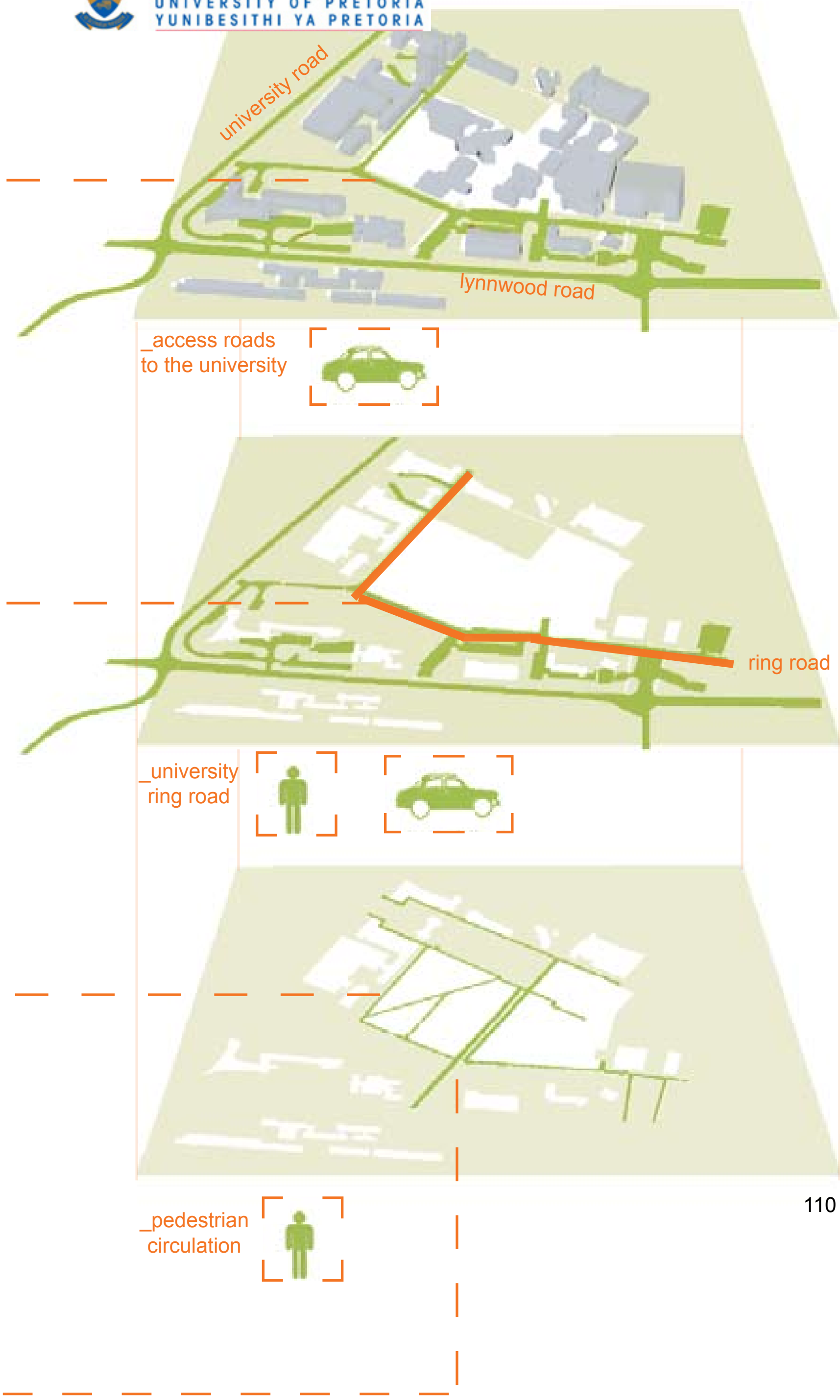
southern edge
[music department]

fever trees
[acacia xanthophloea]

western edge
[engineering faculty]

eastern edge
[musaion+amfi theatre]



CIRCULATION

DIRECT ROAD LINKS

CIRCULATION

DIRECT ROAD LINKS

CIRCULATION

INDIRECT ROAD LINKS

DIRECT PEDESTRIAN LINK

BUILDING ENVIRONMENT FACULTIES

INDIRECT PEDESTRIAN LINK

PUBLIC BUILDINGS

NEIGHBORING BUILDINGS

RING ROAD

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project proposal

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_the opportunity of the new:

'In doing a memorial I started with a room and a garden. That was all I had. Why did I choose a room and a garden as a point of departure? Because the garden is a personal gathering of nature, and the room is the beginning of architecture. The garden has to do with nature as it applies to a place that has been chosen by man and is developed for man's use in a certain way. The architect becomes the advocate of nature, and makes everything in the deepest respect for nature. He does this by not imitating it at all, and not allowing himself to think that he is a designer - if he imitates how, let us say, the bird plants the tree. But he must plant the tree as man, a choosing, conscious individual. The room is not only the beginning of architecture' it is an extension of self. ...The large room and the small room, the tall room and the low room, the room with the fireplace and the room without, all become great events in your mind. You begin to think, not what are the requirements, but rather what are the elements of architecture that you can employ to make an environment in which it is good to learn, good to live, or good to work. Also marvellous in a room is the light that comes through the windows of that room and that belongs to the room. The sun does not realise how wonderful it is until after a room is made. A man's creation, the making of a room, is nothing short of a miracle. Just think, that a man can claim a slice of the sun.' **[Louis Kahn,. From Between Silence and Light by Joh Lobell, [1979]. Reprinted by arrangement with Shambhala Publications, Inc., 300 Massachusetts Ave., Boston, MA 02115.]**

Glass
The recycling of glass benefits the environment. According to a Glass Recycling company one glass bottle is sufficient to power a 100W glass bulb for up to an hour.
[www.theglassrecyclingcompany.o.za

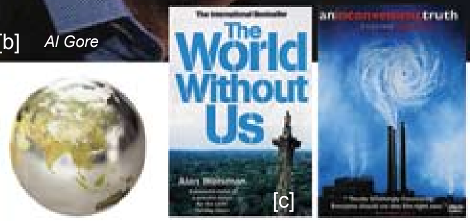
Uniross - rechargable batteries
Replacing disposables with rechargeables will eliminate 333 000 tonnes of waste worldwie.
I has up to 30 times less impact on ozone pollution,
28 times less impact on climate warming, 9 times less impact on air acidification and consume 23 times less non-renewable natural resources, fossils and minerals.

One pack replaces 93 packs of disposables.

Paper
For each ton of paper that is recycled we can save 17 pine trees and three m2 of landfill space, reduce air emissions in paper making by 70% and use 40% less energy, which translates to enough electricity for 512 homes for an entire year.
[Paper Recycling Association of South Africa, www.paperpickup.co.za, www.sappi.co.za, www.nampak.co.za]

093 [a] *green cities of the future*

[b] *Al Gore*



[c] *publications prompting society to change their views*

132 *alternative renewable energy source - solar plant*

[e]

[d]

urban sprout

[f] *non-renewable fossil fuel energy*

[g] *hybrid cars - the face of the future*

[h] *recycle + re-use*

contributors to a 21st century green society

THE BUILDING INDUSTRY CONTRIBUTES TO NATURAL RESOURCE DEPLETION

17% fresh water withdrawal

25% wood harvest

33% of the CO2 emissions

"Green" sustainable living is the hot new topic in many fields, from politics - Al Gore, to fashion, to the building industry. Buildings, being one of our heaviest consumers of natural resources, have a responsibility to ensure that the built environment contribute to a turnaround in global warming. According to the US Green Building Council [USGBC]:*" ...buildings account for 17% of fresh water withdrawals, 25% of the wood harvest, 33% of the CO2 emissions and 40% of material and energy use."* To prevent further degradation of our planet, sustainable building practices need to be adopted. This led to the emergence of the green building, backed by scientific research, this approach can hold a promise for the future, having an ecological footprint, measuring the consumption of natural resources against the ability of the planet to recover from the activities depleting its natural supplies. The measurement is indicated by the amount of productive land area needed to support and sustain such human activity. We've now exceeded the earth's biocapacity to recover from excessive consumption by more than 25%, increasing the ecological stress. Key resources and services taken into account are food, fiber, timber, land for development, and vegetated land to absorb carbon dioxide release from burning fossil fuels. With organisations voicing the way to go about it, into the mainstream, [LEED, U.S., BREEAM, U.K., and Green Building Council of Australia], setting guidelines to pin down what it means, a platform is given to speak to an attentive audience.

There are many different measures which can be taken to design a more resource efficient building. When a building qualifies as a efficient design, it can reduce operating costs by increasing productivity and using less energy, and ultimately - reducing their impact on the environment.

GREEN DESIGN VERSUS SUSTAINABLE DESIGN:

What is a sustainable design?
"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs"
[Brundtland commission, 1987]

Sustainable designs sustain functions of energies, its flexible, endures and function when nonrenewable energies are unavailable.
It consists of three main components, illustrating the interdependence of the elements, community [social], economy and ecology. [fig.]
They act as three spheres, illustrating their spatial relationship, depending on the connectivity critical to sustainable design, and requires dimensional solutions.

"A green building is one that is energy efficient, resource efficient and environmentally responsible. It is a building which "significantly reduces or eliminates its negative impact on the environment and its occupants " **[Green Building Council of Australia].**
"Such a building can reduce energy consumption by as much as 70%, while having a dramatic impact on greenhouse gases and climate change."
[Green Building Council of South Africa].

4 star rating

5 star rating

6 star rating

142

"Australia, like other countries around the world, is facing an immense challenge - to create sustainable cities for the future. As one of the most urbanised countries in the world, with water shortages, transport congestion and high energy demands, Australia must take action now to address how our cities might develop in the future."

094

Its an element of sustainable design, incorporating ecological sensitive materials, efficient systems and high-performance technologies to create healthy buildings with strategies for addressing:

1. energy efficiency;
2. greenhouse gas emission abatement;
3. water conservation;
4. waste avoidance, re-use and recycling;
5. pollution prevention - noise, water, air, soil and light;
6. enhanced biodiversity;
7. reduced natural resource consumption;
8. productive and healthier environments; and
9. flexible and adaptable spaces.

_green building practices:

The goal is to achieve a building with the lowest possible ecological footprint, to minimise its effect on nature and the environment. To restore some of the energy it uses and function as an entity on its own. Minimising its reliance on government's forms of energy use.

By considering the following when a green building is developed, this objective can be achieved:

Location - avoid fragile landscaping, near mass transportation, not contributing to urban sprawl.

Site planning - use less surface water, indigenous landscaping, create more green space

Building - orientation, facade treatment

Exterior - use alternative energy systems, green roofs, use natural light and minimise glare

Interior - use recycled materials and renewable resources, flexible layouts, occupant controls heat and light, abundant natural light and fresh air.

site planning

144

alternative energy systems

145

facade treatment

146

In order to establish an internationally recognised rating system for South Africa, co-ordination and consistency from the relevant government party's and departments are needed to make the implementation of such a system efficient and effective [fig. 097]. The system needs to be reinforced by the building code of South Africa, to enable the building industry to set minimum environmental standards for future projects. For further support, these new building regulations should be recognised internationally as a South African labelling for materials, and lastly a range of green building educational programs will increase the uptake of green building practices in South Africa. On a social level, some of these strategies are already in place. A few Green building conferences have been held over the past years, but its a costly exercise to gain the knowledge and to apply it. This issue needs to be addressed to ensure the successful implementation of the system in South Africa.

_benefits:

Saving energy and water usage [quantifiable]

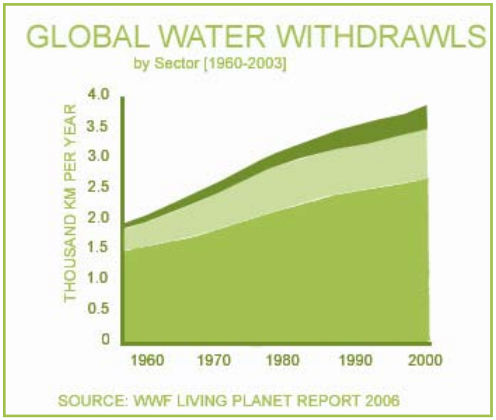


Figure 095: Improved indoor environmental quality, which relates to improved occupant satisfaction, wellbeing and productivity.

Environmental - beyond dispute deliver a suite of compelling economic and social benefits that conventional buildings do not.

_problems:

- A major barrier is the perceived cost
- Lack of industry skills
- Cost and availability of green products and materials
- Cheap pricing of water and energy [starting to change]
- Lack of incentives for demonstrating best practice
- Conflicting government regulation

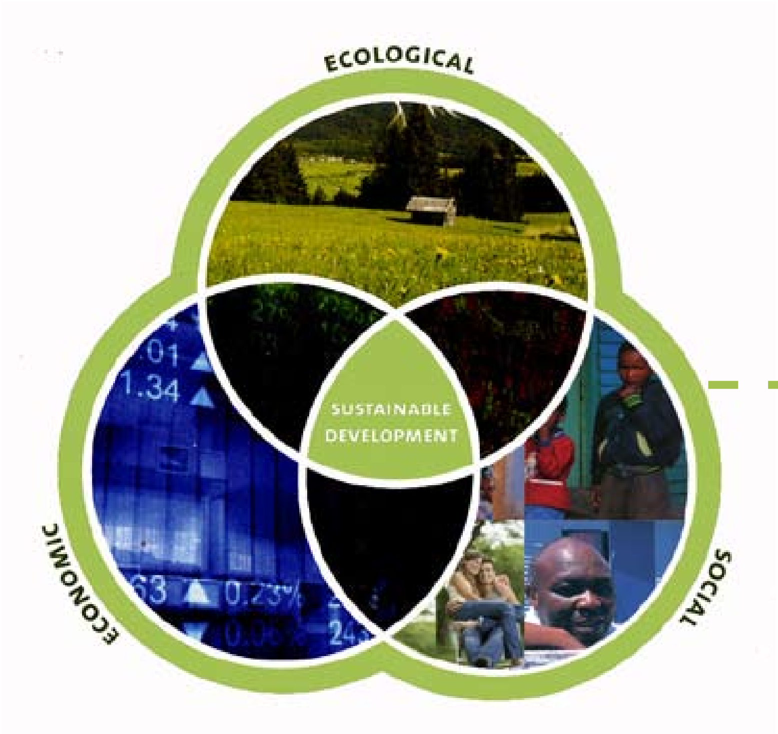


Figure 096: Three main components, illustrating the interdependence of the element

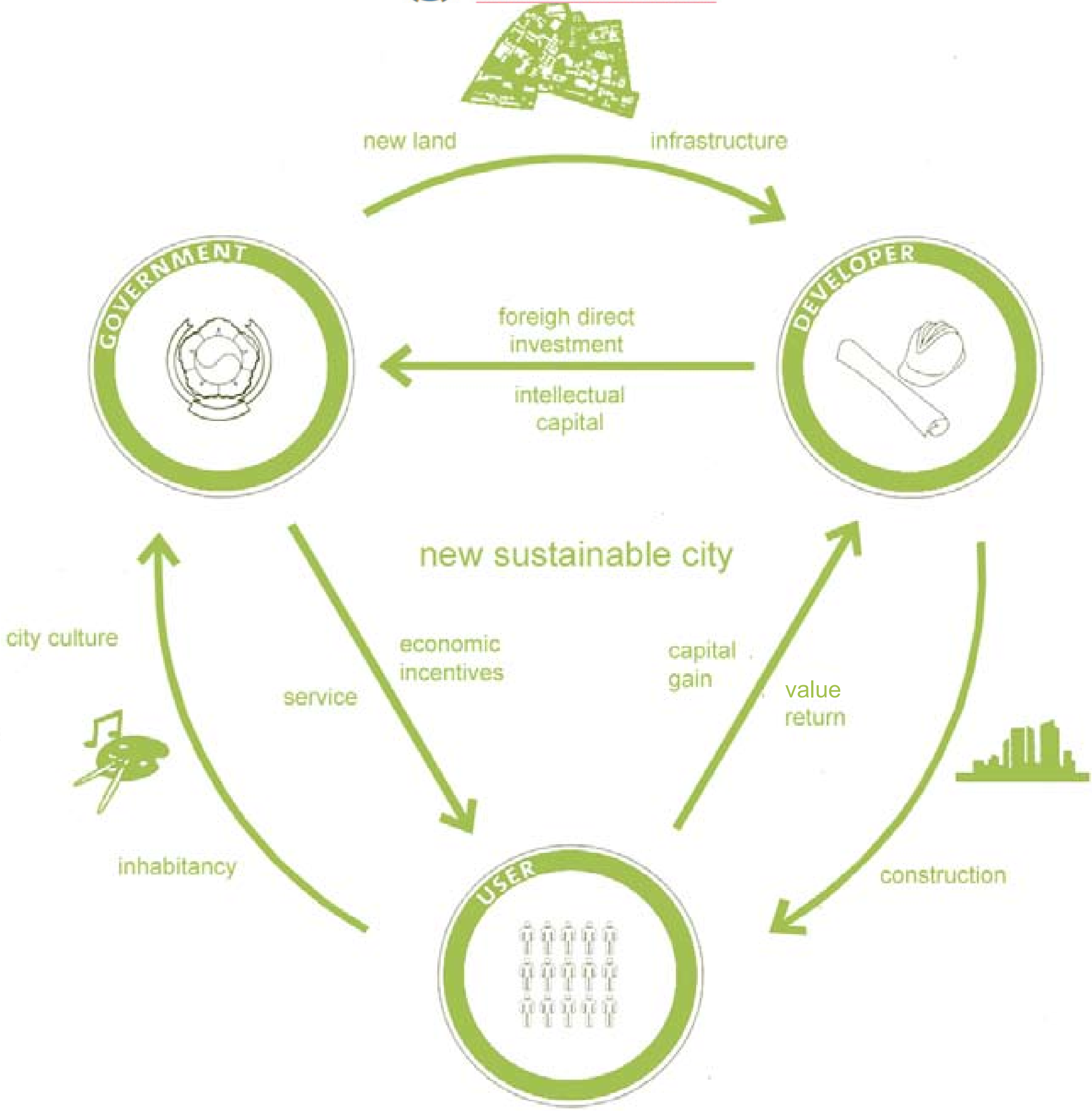


Figure 097: the strategy to follow to ensure a successful new sustainable city

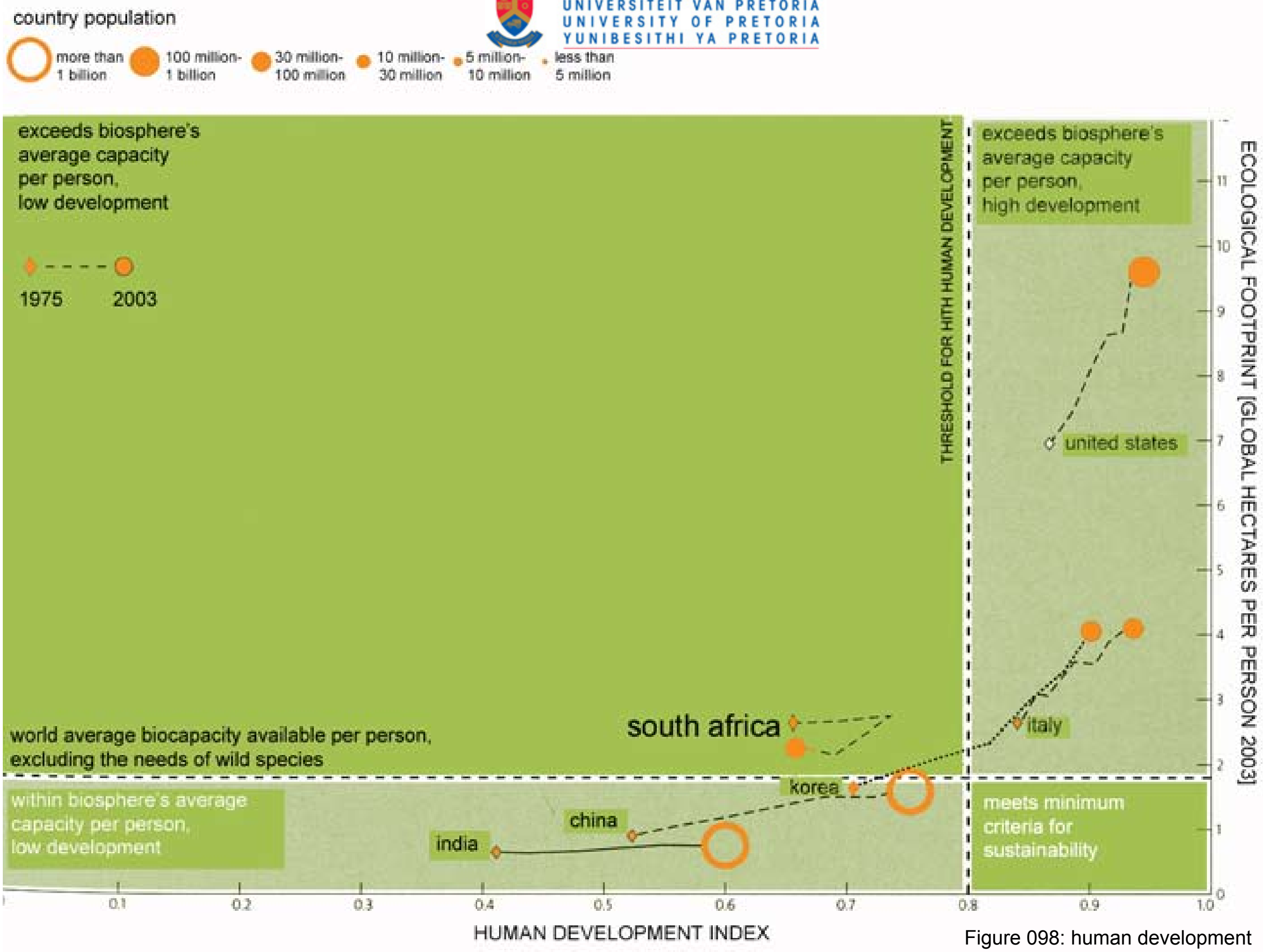
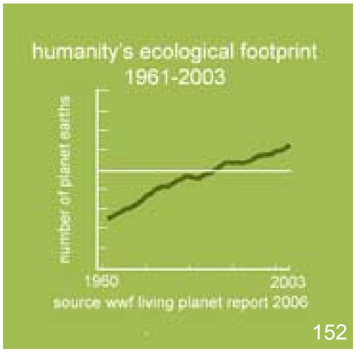


Figure 098: human development index



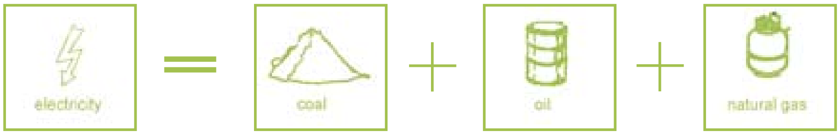
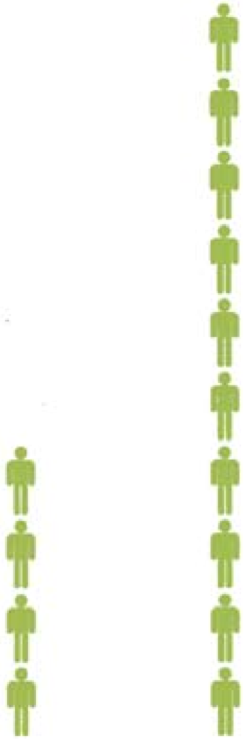
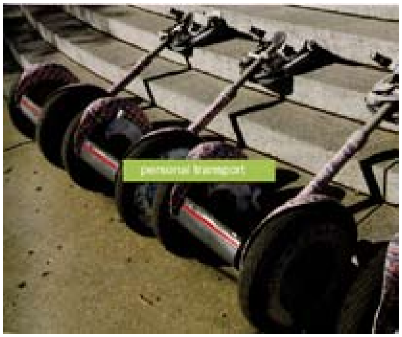


Figure 099: more stress on our natural resources is a direct result of rapid population growth [figure 100]



1950 20,356,000 → 2007 49,044,790

population

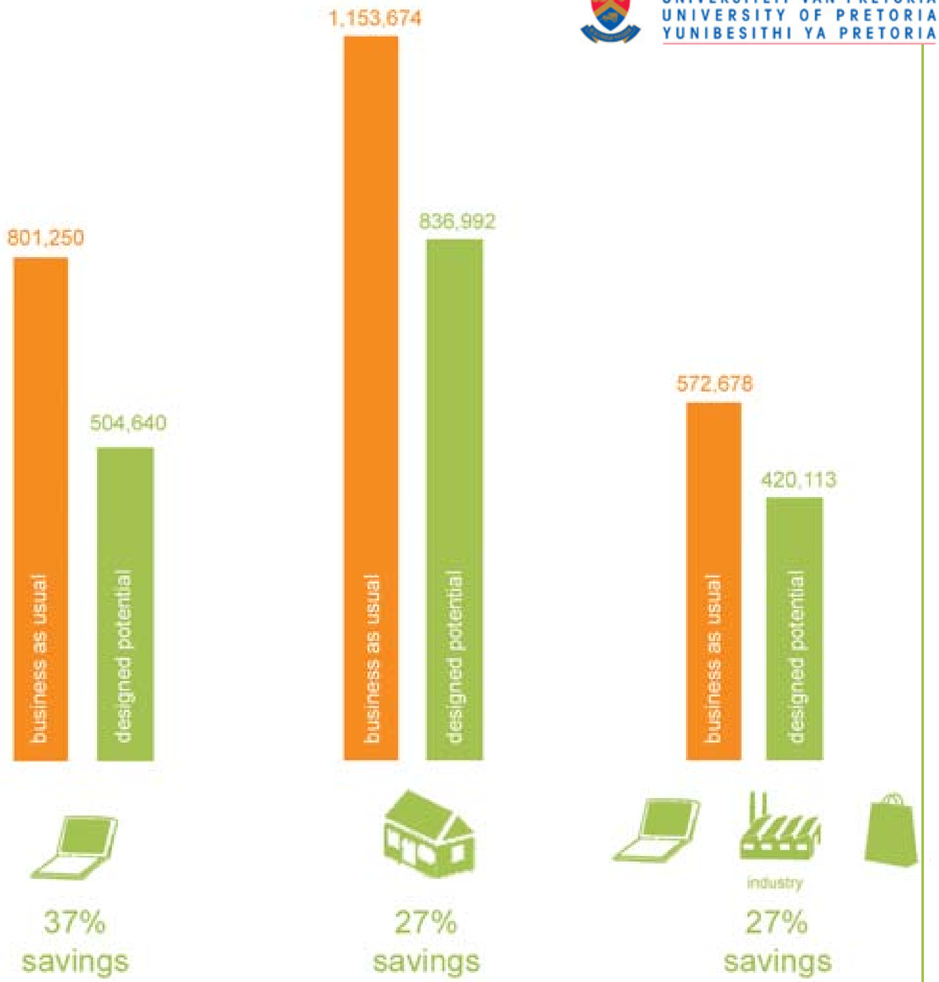


1960 520 → 2000 13,300

GDP per capita

1980 1.7 → 2001 8.1

energy consumption



_burdens of the modern city

Worldwide, more people live in cities than on rural land. Almost half of the South African population is concentrated in these metropolitan areas. According to the UN-HABITAT 2006 Annual Report, an estimated 93% of global urban growth will occur in Asia and Africa. This rapid growth increases water and air pollution, increasing our burden on the already scarce energy resources. Therefor, specific guidelines need to be incorporated into city developments to ensure a vibrant, healthy city, functioning as a sustainable city.

client

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_client profile

The client profile consists of two parties; The University of Pretoria [UP] and The Council for Scientific and Industrial Research [CSIR]. Both parties specialize as research facilities and have the financial and technological resources to assist the proposed programme.

The CSIR functions as a leading multi-disciplinary research and technological innovation facility. Constituted by an Act of Parliament in 1945, its main site is situated in Pretoria. As experts on many fields, including the build environment, they aim to create a better future through science. Knowledge is generated through research activities by means of technology and skilled personnel.

The CSIR has clients in both the private and public sector. They foster partnerships and network organizations as part of a global sphere of influence on matters of technology. The CSIR has strong emphasis on relevant and developmental work in various communities and institutions as a funding agency.

STRIKING A CORD

It's a brilliant idea: a power strip that lights up to show how much electricity your gadgets are using.

DESIGNED TO REINVENT THE WHEEL

Even renowned designer Zaha Hadid still goes to the office sometimes. Her hydrogen-powered, three-wheeled, two-seater concept has an adjustable suspension that raises and lowers the cabin, depending on driving conditions.
www.zaha-hadid.com

_the University of Pretoria

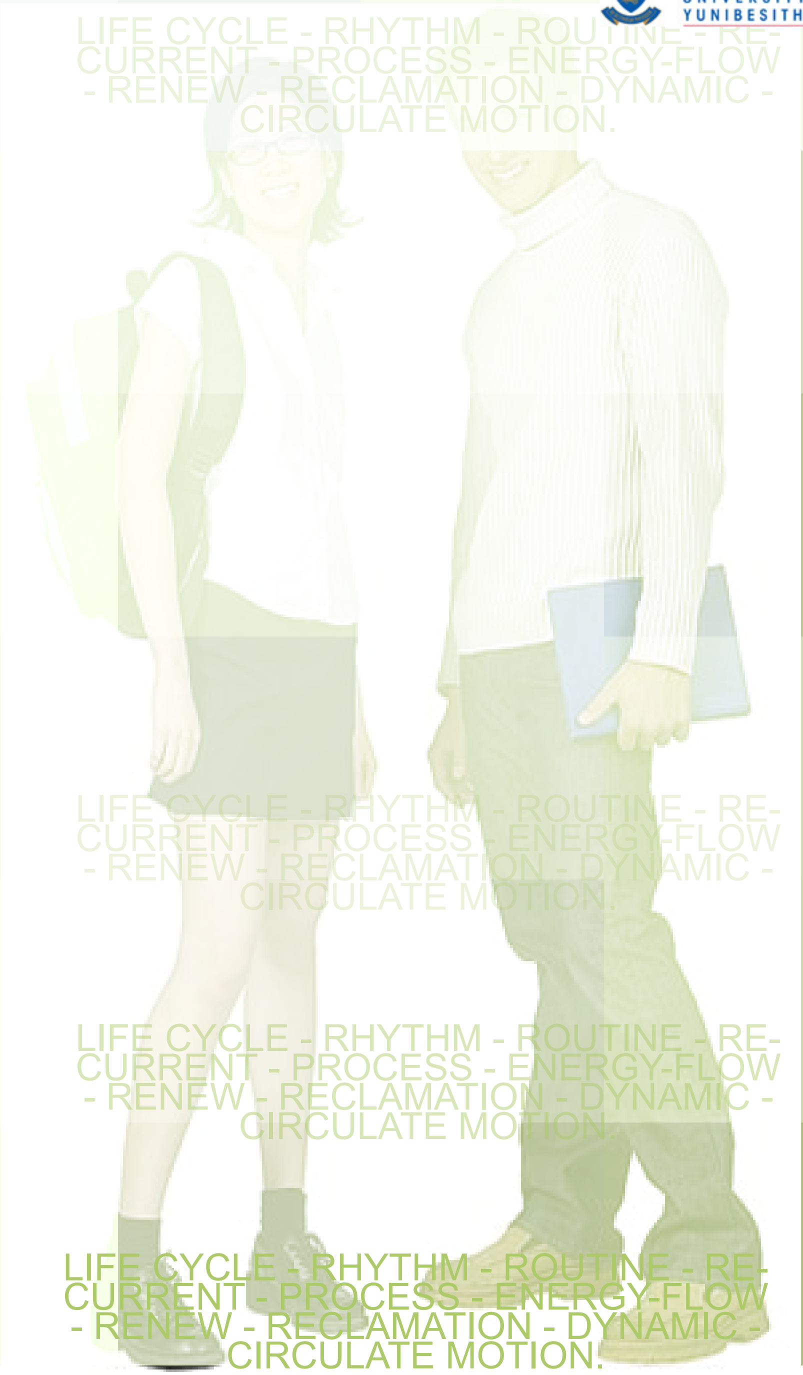
The University of Pretoria's offers the prospect to a new, interdisciplinary vision, focussing on creativity and innovation as the art of creative problem-solving. Its an international credible tertiary facility with state-of-the-art facilities. A creative 'capital' with ample innovative thinkers whose ideas can be turned into valuable products for the future, focusing on the emerging of technology and design. Via cutting edge research and development in engineering, the built environment and information technology, the traditional intellectual processes can be stretched beyond the normal narrow confines. Shifting the focus to problem solving; enabling the students to develop their skills and to better themselves.

The University of Pretoria is committed towards promoting innovative technology, as it resembles growth and prosperity. In a world in which the nature of global conflict shifted from a military focus to an economic one, it's becoming increasingly important to adopt the notion of competitiveness on a national- and international level. The University offers the student the opportunity within an educational medium, to reach the essence of innovation - renewal and continuous improvement. A powerful skill, driving competitiveness, fuelled by creative energy.

user

LIFE CYCLE - RHYTHM - ROUTINE - RE-CURRENT - PROCESS - ENERGY-FLOW - RENEW - RECLAMATION - DYNAMIC - CIRCULATE MOTION.

LIFE CYCLE - RHYTHM - ROUTINE - RE-CURRENT - PROCESS - ENERGY-FLOW - RENEW - RECLAMATION - DYNAMIC - CIRCULATE MOTION.



LIFE CYCLE - RHYTHM - ROUTINE - RE-CURRENT - PROCESS - ENERGY-FLOW - RENEW - RECLAMATION - DYNAMIC - CIRCULATE MOTION.

LIFE CYCLE - RHYTHM - ROUTINE - RE-CURRENT - PROCESS - ENERGY-FLOW - RENEW - RECLAMATION - DYNAMIC - CIRCULATE MOTION.

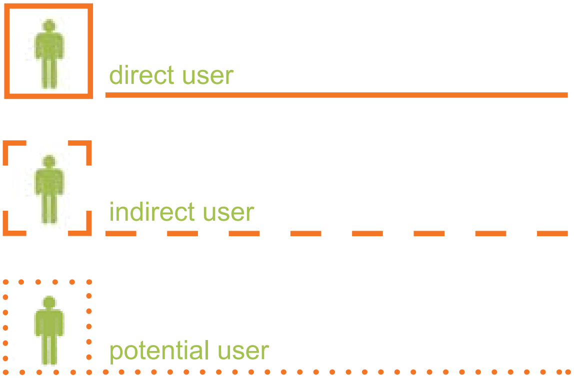
LIFE CYCLE - RHYTHM - ROUTINE - RE-CURRENT - PROCESS - ENERGY-FLOW - RENEW - RECLAMATION - DYNAMIC - CIRCULATE MOTION.

education .... experiment

awareness

innovate .... integration

interaction ....



_three categories of users can be identified:

the direct user - this category addresses students qualifying for their post graduate degree [honour, master or doctorate] using the facility for educational purposes. This user will occupy the facility on a daily basis, making use of all the available facilities within the centre;
the indirect user - this category applies to all students of the University of Pretoria, using the public amenities within the building, merely as social gathering space or a circulation node through which to reach their end-destination;

the third category includes *potential users* of the city [the public, primary and high-school children, other institutions]. These users will only have access to all the facilities, if the user is registered as a public member of the facility. If not the user only qualifies to participate in the public amenities within the centre. The main focus is to increase this category of users, to spread the word on the specific topic and to assist the public with guidelines on how to create a sustainable living within a post carbon city.

The proposed project should allow easy access and distribution of the information researched within the centre, to ensure the advanced innovative technology doesn't remain behind closed doors, but shared with the public, ensuring a thorough integration between the facility and all its users. Continual participation will contribute to achieve the point of connectivity between the two parties. The activities provided and generated should encourage the user to participate in the proposed programme.

_types of activity:

The proposed facility will cater for different outdoor activities for its various users, to establish the facility as a vibrant point of connectivity on the campus. To generate energy, connecting flows as a nucleus of interaction.

According to Jan Gehl, the user profile can be divided into three types of outdoor activities:
_the necessary activities which occur independently of the facility;
_optional activities as a result of favorable exterior conditions. This category can be enhanced through thorough planning and design of the exterior spaces to encourage these optional activities to happen in and around the building.
_lastly, the social activities, active or passive which results in conjunction with the first two activities.
[Gehl, 1987:p. 11]

“It is also possible to create sensibility by improving the human ability to perceive the environment...One may educate users to attend to their environment, to learn more about it, to order it, to grasp its significance”
[Lynch, K. 1981: p, 147]

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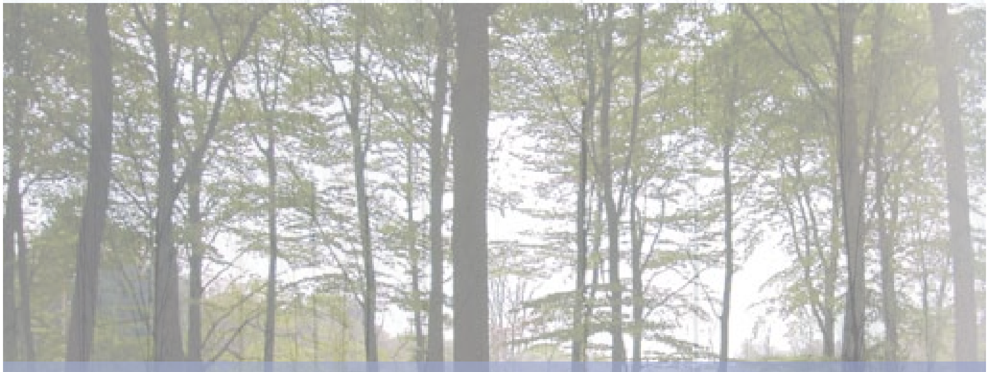
design proposal



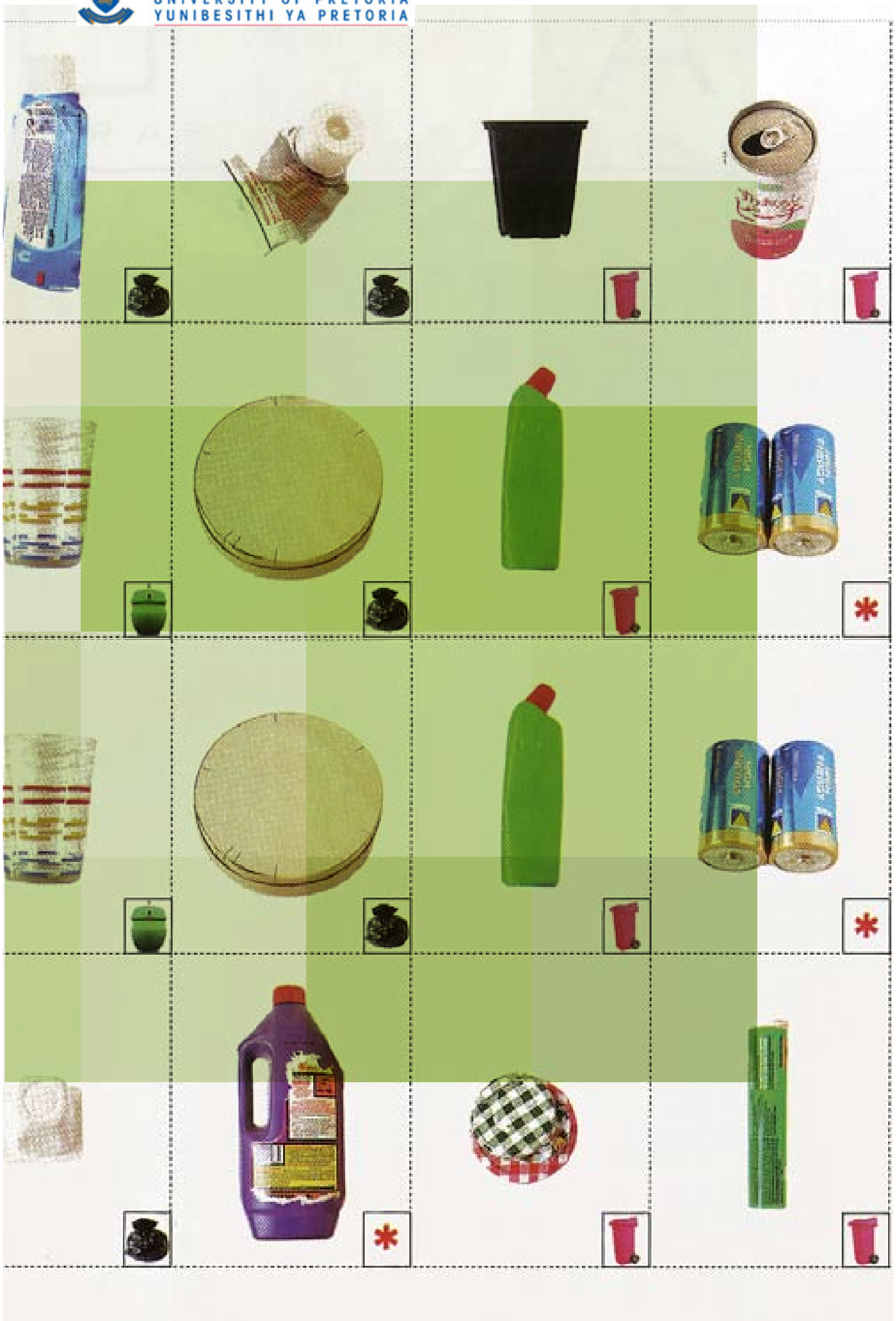
In an era when visual communication plays an enormous role, architecture is becoming a powerful medium for the transmission of knowledge on green sustainable design within the built environment. The need to encourage awareness is becoming increasingly evident, locally and internationally.
To rethink some of the principles of a 'good design' such as functionality, symbolism, cultural belief systems and industrial technologies. Design must be redirected towards an ethical attention on quality, leading towards a rooted awareness with a relation between human artefacts and nature - one that is lived in partnership, not domination. A point of reference for the new production model, increasing the output and lower the consumption of natural resources.

This requires a mind shift, from a linear model [design - production process - distribution and use to end of life - recycling/re-use], a systemic model, where recycling is only dealt with at the end of the process. Superceded by emissions reduced to zero.

The proposed facility aims to achieve a carbon minus footprint, consuming less energy than produced by the facility itself. Focusing on replacing, re-use and recycling of natural resources and in the process explore, interact and communicate the profession of architecture through the medium of green technology, Conveying the message via digital information systems, offering entertainment value to students. Creating a platform for discussion among built-environment professionals to-be, contributing to inform the public and future clientele. Addressing the issues at an educational facility, ensuring skill empowerment within the profession.

George Burgmans, producer of Caracas: The Informal City: *"I find architecture very interesting - it has a real relationship with what is happening in the world...it forces you to think about different perspectives at the same time."*

At student-level, thorough learning experiences and information systems should guide them to validate their choices, closing the divide between the obvious 'problem solver' and the innovative solution. Exposing the weak links, reshape them into opportunities for progress, enriching the quality of the designed product. It's too comfortable to get sucked into the familiarity of our everyday lives, losing grip on reality. To prevent this scenario, we have to ensure the students have adequate tools to tackle design problems, ensuring immediate confrontation with diverse realities both sides of the fence. Embarking on programmes where students can start to become part and parcel of resource efficient living and enable them to design accordingly. To consider



[a] windows reflecting nature

_BP headquarter - exhaus
[b]

_[c] CH2 - illustration of stacking chimneys

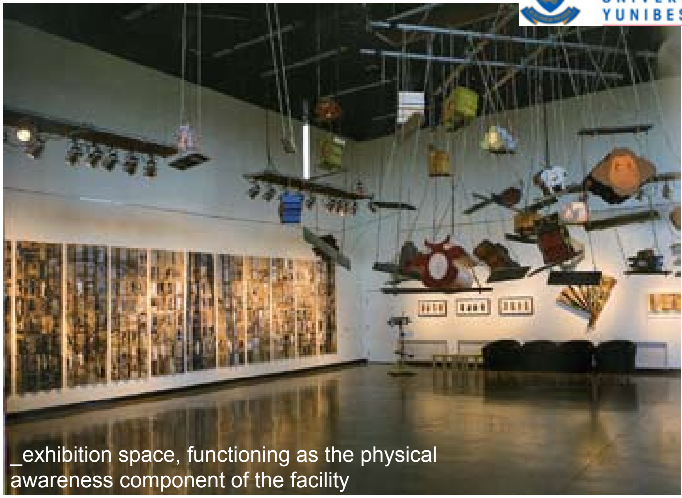
_CH2 - west facade timber louvre system power by photovoltaics fixed on roof

_fig. 112: the physical building component

how appropriate their technological interventions are and how well it fits within the environment they are creating.

Therefore, the facility displays a physical component [physical reality], built into the structure; a meta-physical [virtual reality] component, offering opportunities to connect via digital interaction systems. This could be incorporated through a campus network system, as well as a virtual global system; *[i.e. Design Indaba, a Japanese industrial designer designed a product named 'tangible earth', this product enables the user to connect to an information system, giving relevant information on any topic in real time, right there on that specific spot, at that specific moment*.]

These systems, could become the instigators to connect the students with a virtual reality network world wide. To achieve this goal, a proper understanding is needed, enriched by reality as a frame of reference, on a regular basis through both the building structure and the function it hosts.


_exhibition space, functioning as the physical awareness component of the facility


[e]


[f]

112

Andrew Makin: *"...living in the 'real reality', as opposed to the media-projected reality, would be a great advantage for us all in understanding what is really going on and living in it as opposed to judging it and imagining that we, as architects and planners, are going to fix it."*

Rob Schroder, maker of documentary Caracas: The Informal City. *"For me, architecture can only survive in the future if architects try to understand how people actually live and build. Maybe when there's a switch to thinking more about the environment and about how people actually live, then architecture can do more for the future of cities."*

A technique used as a problem solver, is linked to nature's solution to problems - Biomimicry [mimicking nature: 'What would nature do?']. Its a discipline that seeks an answer when it comes to an approach that wants to incorporates nature's mannerism to solve problems. Its a search for solutions, to manufacture safe, successful, efficient technologies. Copying nature isn't a new phenomena, its been a well-known strategy, to come up with workable solutions for a long time being.

1851, London's Crystal Palace, where Sir Joseph Paxton took inspiration from the cellulose "ribs" of a variety of South American hyacinth plants. He found the leaves have enough strength to support the weight of a person weighing 130kg.

The morphology of birds, used to conceive aeroplanes.

The self cleaning varnishes, developed by a German company, using the repellent mechanism used by lotus leaves to keep clean.

Anti-reflective and anti-reverberating auto type film developed to collect as much light as possible without reflection, taking inspiration from the eye structure of moths, used to avoid being spotted at night by predators.

Plastic micro fibres, whose electrodynamic adhesiveness is similar to the hairs on the palm of a gecko's paw.

Unfortunately, these extraordinary inventive technologies often remains hidden in laboratories, not reaching its full potential. Therefor, the proposed facility needs to reverse this action. Creating an opportunity to combine an awareness component to the function it hosts - the development of green

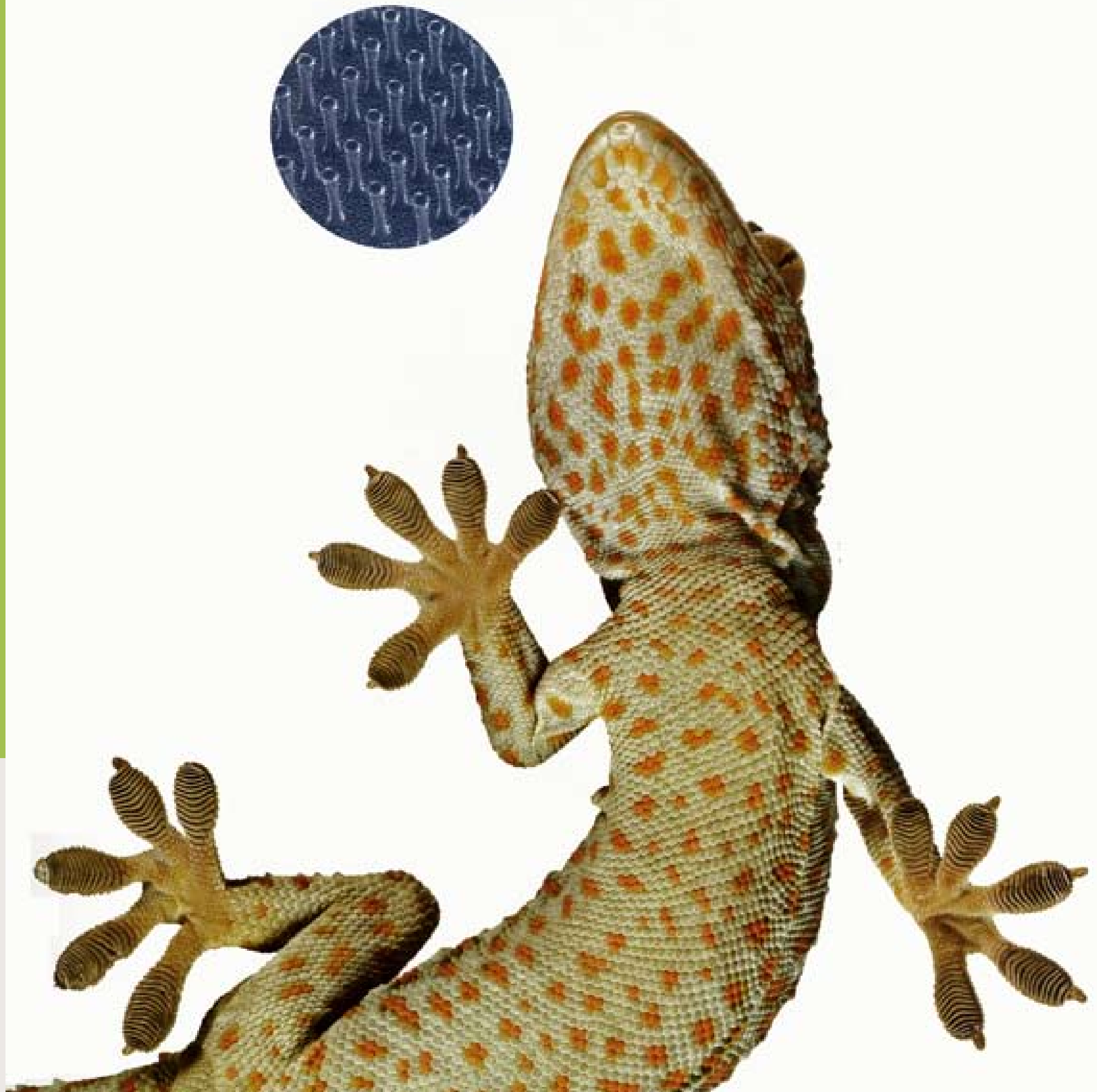


fig.112 [g]: biomimicry

technology, a structured system can be incorporate in ways, not only to view these technologies, but to experiment and test them in real life situations. To reach the prime audience and let the world outside these laboratories know how innovative human induced activities with nature's help can be. The facility would achieve this goal by creating opportunities to experiment, exhibit, allowing their economic and practical value to be evaluated and transformed into an actual manufactured product.

With organisations already in place, such as the "Innovation for Conservation Fund", who finance the industrial launch of 100 biomimicry technologies, a decisive factor for the progress and an opportunity for mass change in a stage of critical change of culture, becomes more than just a possibility. The first product benefited from the fund, was launched in Australia, an antibacterial product, created by copying the capacity of a variety of algae. A decisive factor for the progress of infection.

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concept

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_the vision:

It is in Africa
It is in South Africa
It is in the heart of the city of Pretoria
It is in the heart of the Hatfield precinct
It is in the heart of the western precinct on campus

LIFE CYCLE - RHYTHM - ROUTINE - RECURRENT - PROCESS - ENERGY-FLOW - RENEW - RECYCLE - DYNAMIC - CIRCULAE MOTION

It is a place of learning, a place of thinking, a place of discovery, a place of exploring, a place of integrating, a place of interaction

_As it stands today

- *an unknown parking area, an invisible place, an unacknowledged place*
- *an overlooked place*
- *a building site in waiting*
- *a place with immense potential to inform, stimulate, educate, move and change opinions*
- *a place with a significant attribution to make to the campus and its students*
- *a place for the people and the University to be proud of*

_what it will be

- an internationally recognised symbol of innovative research of the University of Pretoria, born from the current shortage in resources to maintain our lifestyles;
- the home of advanced green technology integrated in everyday life;
- the home of innovation and education of users and visitors in Pretoria, and South Africa.

_place-making

an urban place a place of reflection, a place of innovation, a place of study, a place of learning, a place of creating, a place of entertainment, a place of reality, a 'green' place.
Reviving the city, reviving the campus, reviving the site, reviving the user

_the building aim

eliminate the need for nonrenewables-based grid energy
increase the efficient use of the site's and region's renewable resources
improve overall energy efficiency
improve the building envelope's longevity
inform the design of the skin and envelope in order to be appropriate to the climate
reduce maintenance cost
improve quality of life
are essential to the larger community
improve the healthy environment of the users
act as a steward to the environment and the community

_the programme

As a Research centre for Green Technology, this addition to the EBIT faculty will focus the attention on environmental ly friendly innovative technology design, specifically applied to the built environment. The facility will focus courses applied to post-graduate students [classes not exceeding twenty students] in:
_green urban design;
_green technology management;
_green technology design;
_green industrial design;
_green engineering design;
_green product design;
_green architecture;
and specific modules for extra credits for all pre-graduate students.
Since technology is a phenomena applied to all fields, the facility will incorporate a digital information system [metaphysical interaction] to include all the faculties, functioning as the social sustainability component. By establishing a green campus network, applied to all courses of the University of Pretoria, research and information


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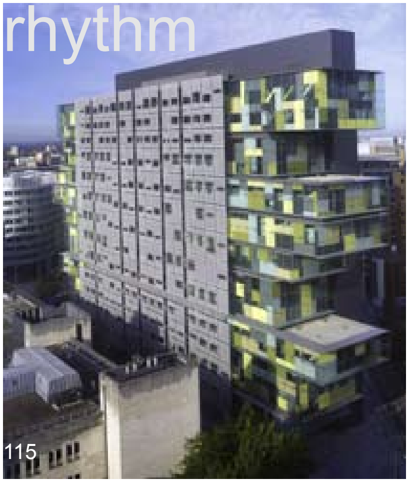

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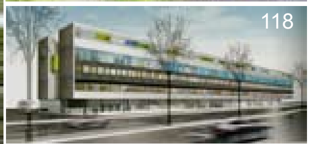
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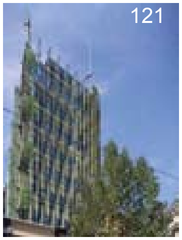
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122


123


124

activity


125

interaction
education


126

energy flow

127

can be exchanged, giving the centre the 'voice' to act as a local instigator to inform students of the innovative thinking methods needed for our survival as a post-carbon society, giving every student the opportunity to become a participant.

The facility itself [physical interaction], becomes the physical experiment, to use and replace, adapt and renew, produce and recycle every day. At the same time conveying the 'green message' to awaken awareness on the topic.

_skin
The building is mostly transparent with specifically applied techniques to control the micro-climate within the building. These mechanisms allows the building to breath, to adapt according to a climate change, a seasonal change, or a day-time change.
This transparent logic allows the user to relate to nature and activities outside the building and allows the sporadic pedestrian to view the organs of activities within the shell.

The hierarchy of the building progresses from a public- to a semi-public-, to a private area. The ground level, functioning as a public are, is slightly lifted above street- and courtyard level, Relating to the life of both: the entrance from the courtyard, into the double height exhibition space. The public area consists of public facilities including; an exhibition space, an event space, an internet cafe, a print shop, a book shop, a restaurant, green courtyards and a coffee bar. [Ground- and first floor]
The library and auditorium functions as semi-public area, accessible to private or public users. [First- and second floor]
The private are will cater for specific post-graduate students registered at the

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131

facility. This zone include; laboratories, lecture rooms, workshops, digital labs, offices, and a library. All these facilities will be controlled by secure access. Students not affiliated at the facility can register for library access.

_exhibition space:
Organic shaped pockets, will provide exhibition space for students' innovative designs as well as the hottest new topics on the green technology. The space will symbolise the 'voice' of the building, personifying the users' experience through personal log-in systems, ensuring an interactive, responsive, experience. Reinforcing the physical interaction between the facility and its users.

_event space:
Functioning as an extension of the exhibition and lobby spaces, the area acts as a spill-out and circulate-through space to accommodate big crowds gathering after public or private functions. The area is ideal for interaction purposes, can be used as additional extra exhibition space and offer the opportunity to become the portal of communication within the building, fulfilling the social sustainability function of the centre.

Brooklyn Mall; Pretoria
An image of a school of fish swimming in a coral reef is displayed on the floor by a screen monitor fixed to the top concrete slab. Movement sensor detects a pedestrian passing, and the sound of water is displayed over a speaker next to the screen monitor. This technique example could be used to convey environmental messages to the pedestrian in a subtle but effective way.


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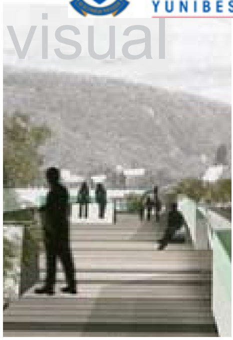

visual


central spine
134


135
transparent


136


green roof
137


connect
138


interactive
139

j
a
b

_green courtyards
The building is centred around a courtyard, functioning as a semi-private space and relates with the green corridor in front of the Musaion. Two secondary circulation routes link the three building wings with the courtyard and offer an opportunity for the facilities on the ground floor to extend into the courtyard, to form a vibrant, energetic activity hub for student recreational activities. Trees, growing from the basement, offer shading for quiet sit-down sessions in-between classes. The planted courtyard also functions as a green barrier against radiated heat instead of the normal paved option.

_library
The library will focus on green technology information in all study fields. As the expert on the topic, this facility will offer students with top of the range information. The library is further divided into two floors with controlled access points on both. Most of the information will be in digital format, ensuring the waste percentage of the facility is limited to the bare minimum.

_coffee bar
The coffee bar will function as an extension of the internet cafe as an end destination, allowing the user to visit the exhibition pockets while circulating through the building.

_internet cafe
The internet cafe will function as a fully digital cafe, to minimise any paper waste and will operate on Blackle screens from Google, saving approximately 750 Megawatt-hours a Year.

_restaurant
Situated on the first and second floor, it acts as the main link between exist-

Blackle was created by Heap Media to remind us all of the need to take small steps in our everyday lives to save energy. Blackle searches are powered by Google Custom Search. Blackle saves energy because the screen is predominantly black. "image displayed is primarily a function of the user's color settings and desktop graphics, as well as the color and size of the ope application windows; a givven monitor requires more power to display a white [or light] screen than a black [or dark] screen" Roberson et al. 2002

ing and new. Using specific recycling procedures, solar water heaters for hot water and no plastic containers for take-aways. The roof of the restaurant is converted to a roof garden and utilised as outside-seating for guests.

_lecture room

There are two lecture rooms, seating sixty students each. These rooms will be facilitated with temperature sensors, monitoring the micro-climate. If the temperature rises above twenty-one degrees, or the comfort levels is too low, the cooling system kicks in as soon as the movement detectors detect occupants arriving. As soon as the occupants leave the room, the system switches off. The lecture rooms are provided with balconies on the southern side, living out into the courtyard.

_workshop

This facility will enable the student to build a product sample to test, evolve and eventually exhibit. The workshop is provided with sufficient day-light for this specific requirement.

_laboratory

The library will function as a wet lab and is situated next to the workshop. These two facilities can be use in cohesion if needed. The laboratory has twelve stations, accommodating three students. This room is also provided with sufficient day-light as required.

_offices

The offices are situated on the third floor. They will function as open-plan offices, allowing the ventilation system to accommodate all the offices at once. Meeting rooms and private discussion tables are centred at strategically placed areas and defined by temporary wall structures.

_energy

The building's energy revolves around the sun, depending on its path, changing every day, announcing the beginning and end of a day, a season, a year. To design systems which perform harmoniously relative to the functions contained within a structure, incorporating mostly passive systems to control the micro climate, minimising the use of mechanical alternatives. Enhancing its legibility and function. Ensuring an optimum microclimate and maximise occupant comfort. Developing a relationship between the building and its immediate environment, replacing what is used, harvesting and recycling of energy, ensuring the building respects its surrounding environment, transpiring in and around it all the time.

_recycling

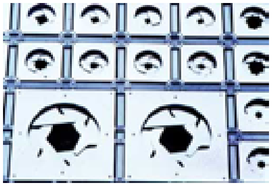
One of the principles of sustainable design is to replace what is used. Recycling derelict products, less products need to be manufactured from scratch, resulting in less energy consumption. Old materials are processed, reused as new products, relieving the necessity to supply new resources. The facility will accommodate for a fully equipped recycling centre on site. This responds to the purpose of the building, visibly reducing its energy consumption,

_light

A phenomena with the potential to set the mood and character of a space, triggering an onlooker's attention, dragging a pedestrian passing by into the building to experience the journey and function within.

natural light

_arab
[Jean Nouvel]
141



_facade light responsive
215

_selective light control

_sun controlling devices

_constitution hill 143

_light quality 144

_recycling 145

energy saving

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146

_use of natural light

147

148

223

_artificial lights requiring less energy demand

224

"Architecture is the masterly, correct and magnificent play of masses brought together in light; light and shade reveal these forms; cubes, cones, spheres, cylinders or pyramids are the great primary forms which light reveals to advantage; the image of these is distinct and tangible within us and without ambiguity." **[Le Corbusier. 1923]**

"Modern architects are negligent. They have systematically ignored the massive transformation of everyday life caused by the twin forces of mechanization and population explosion. Their endless garden-city schemes desperately provide token fragments of 'pseudo nature' to pacify ruthlessly exploited citizens. The modern city is a thinly disguised mechanism for extracting productivity out of its inhabitants, a huge machine that destroys the very life it is meant to foster. Such exploitative machinery will continue to grow until a single vast urban structure occupies the whole surface of the earth. Nature has already been replaced." **[Constant Nieuwenhuys. 1960. December 10]**

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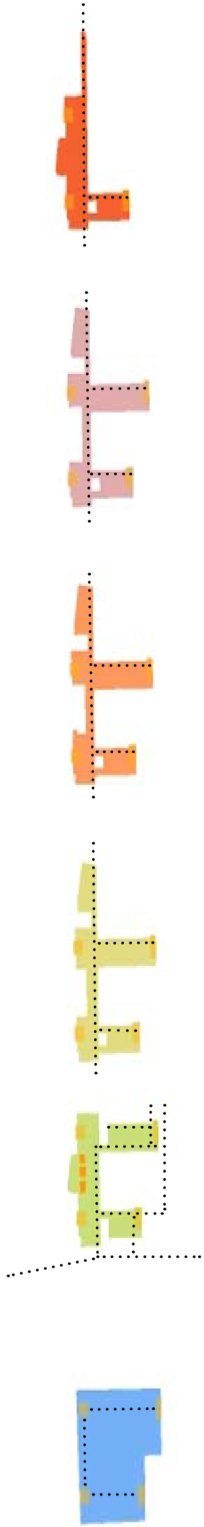
circulate



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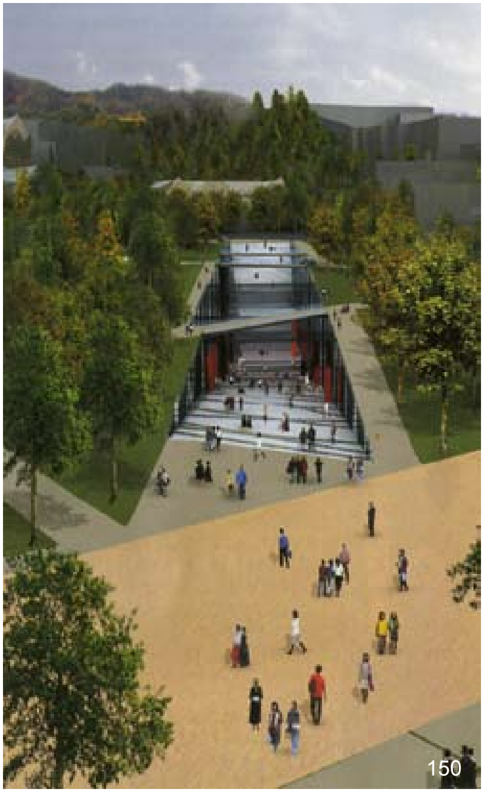


150

151

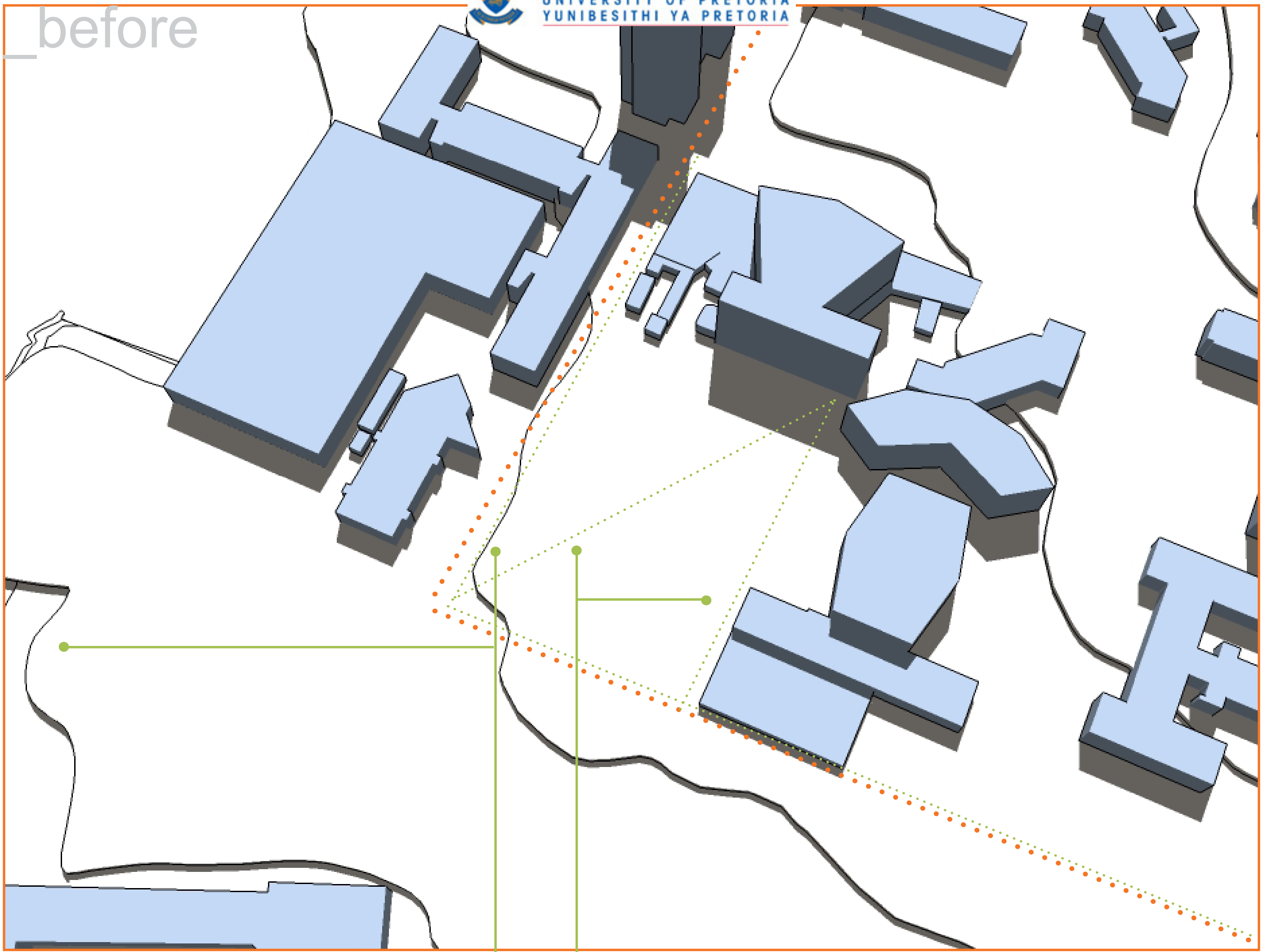
_circulation

_aim

to improve the existing circulation routes on site
redirecting pedestrian circulation through building
to ensure the building receives optimum exposure
to function as an information distribution centre
to generate energy within the building
to ensure circulation spine becomes the nucleus of the facility
to connect energy flows within and around the facility
to ensure the linear circulation spine, is experienced as a visual journey
to become a point of interaction
to function as a pro-pedestrian circulation precinct
to connect the site with the rest of campus
to establish a link between existing and new
to activate dead zones

_problem identification

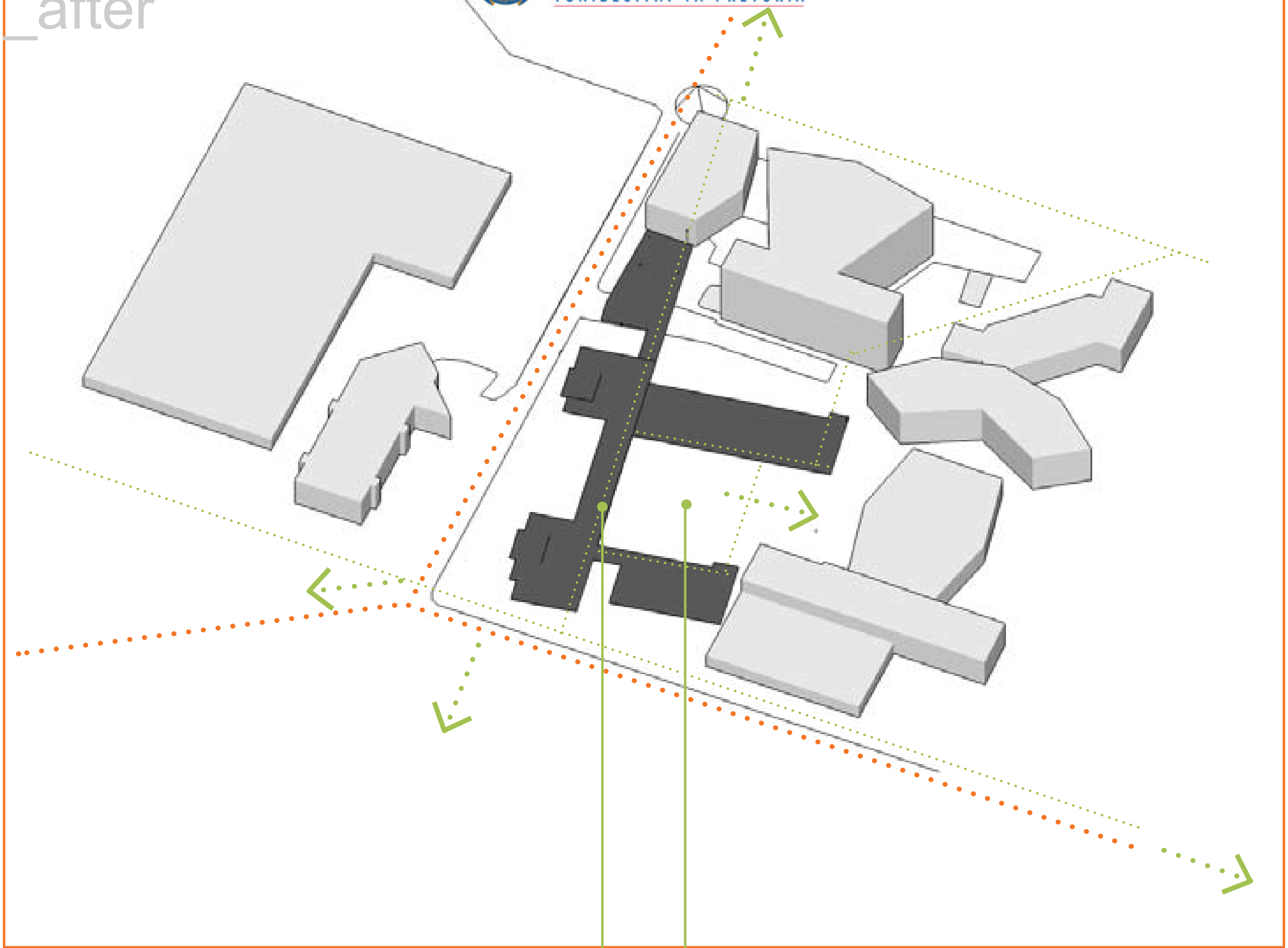
interference with pedestrian circulation - existing service delivery area
  - existing parking area
insufficient circulation space
no direct circulation routes
pedestrian functioning as a secondary user
no existing link between existing and new
unused areas on site


_before

152

western pedestrian route too narrow
need for alternative pedestrian routes
interfere with existing service delivery area
no existing western link
underutilized area
site used for open parking
prohibit the activation of the area
no established links with existing context
existing diagonal pedestrian route
existing pedestrian route [as a result of parking area]

_after



153

circulation spine replace western pedestrian route

link to alternative pedestrian routes

no interference with service delivery area

establish western entrance link

utilize parking area

site becomes a host of a new faculty on the campus

generate activity within and around the facility

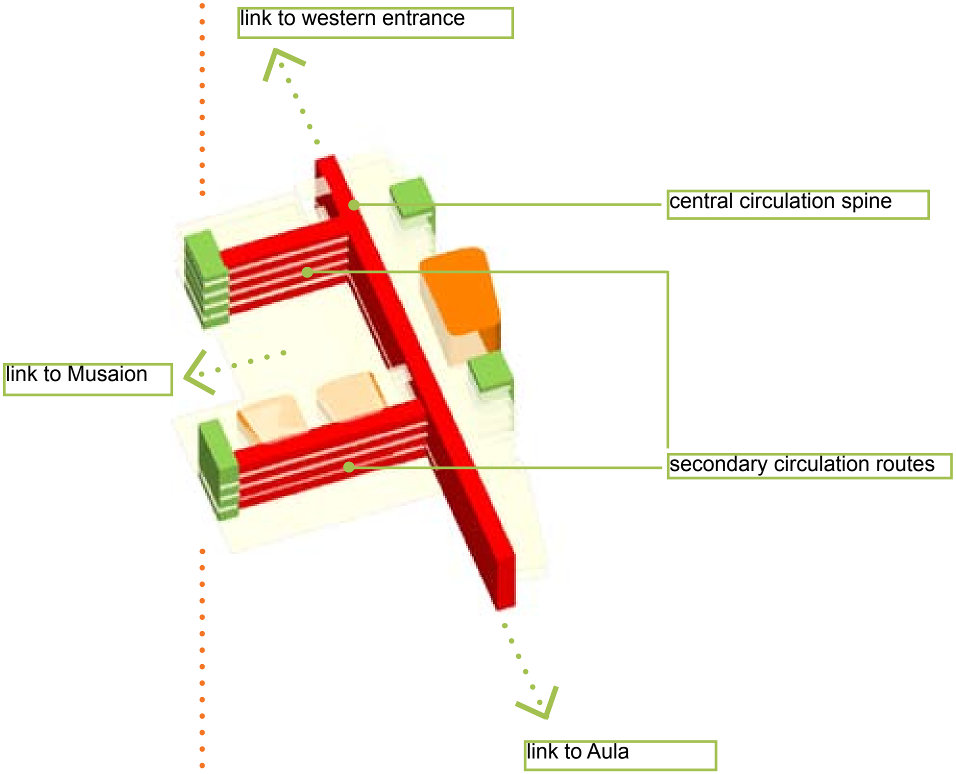
establish links with existing context [Aula; Musaion; Amfi-theatre]

replace existing pedestrian routes with safe, efficient options

site becomes a social activity hub, activating the site and its surrounding area

_circulation

Access to the building is provided by lifts and staircases attached to the west facade. Movement is a key theme of the building, with a central spine symbolising the energy flow of both the building circulation and its renewable energy sources. Its the main artery between two nodal points: the entrance and the users' end destination. This artery is emphasised by the external surface treatment, displaying the colours of life-giving forms; earth, water and nature. It becomes the obvious route to follow as it is well defined and therefor stimulates the direction of movement. Secondary circulation routes serves the two side wings, positioned at the northern end of the building wing, with fire stairs at each end. The east facade functions as the servicing zone, containing mechanical service ducts



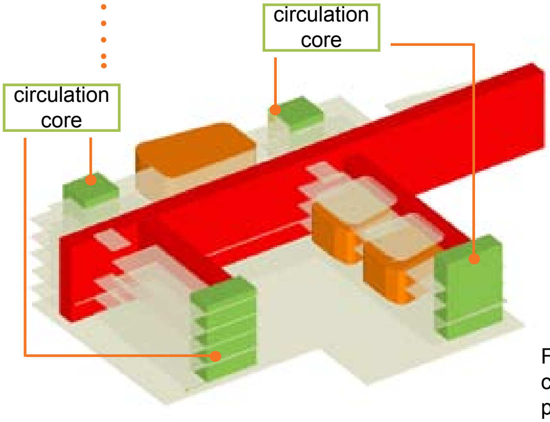


Figure154 illustrates the circulation spine through the proposed facility

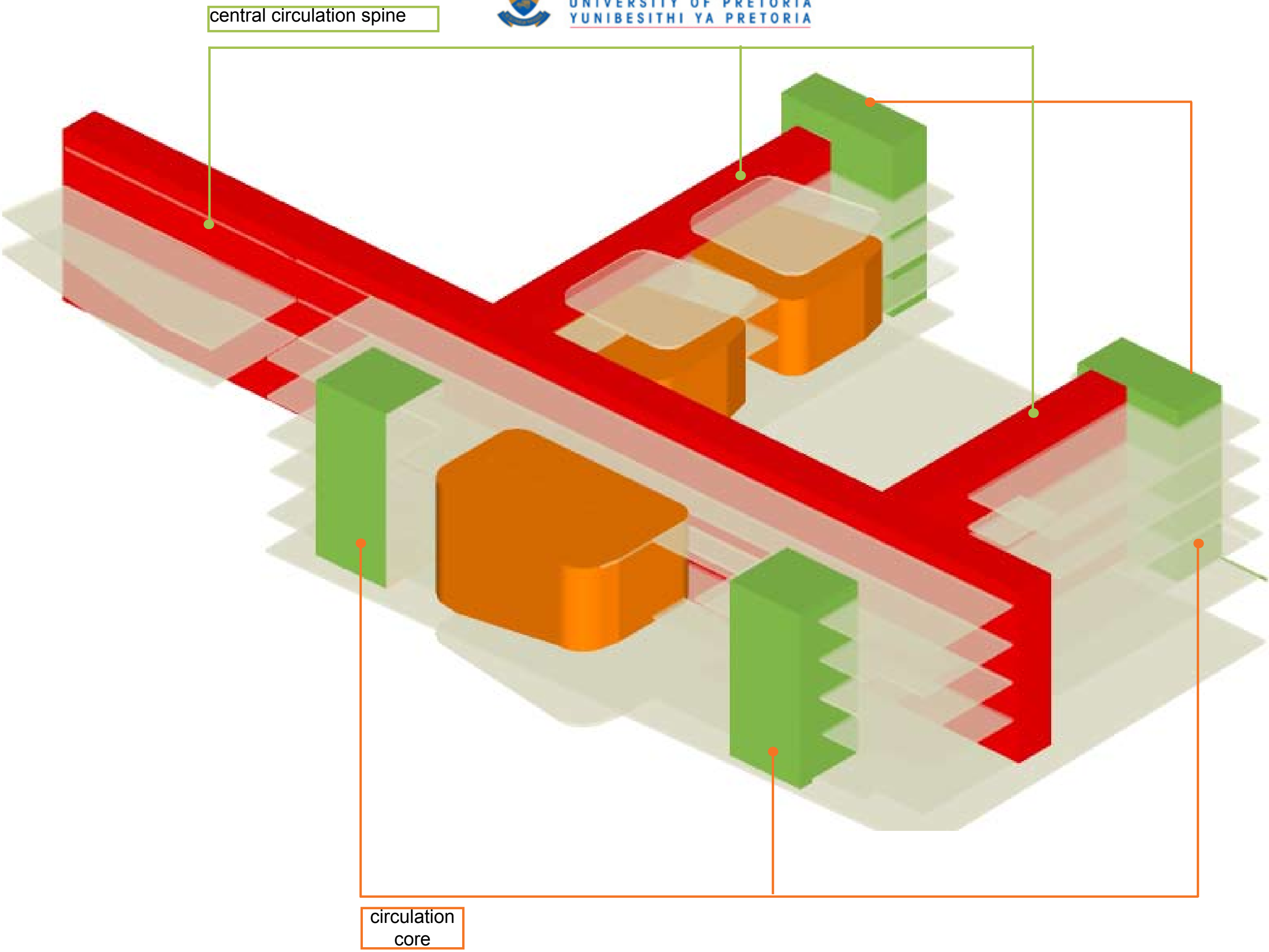


Figure 155 illustrates the circulation spine through the proposed facility in collaboration with the circulation cores

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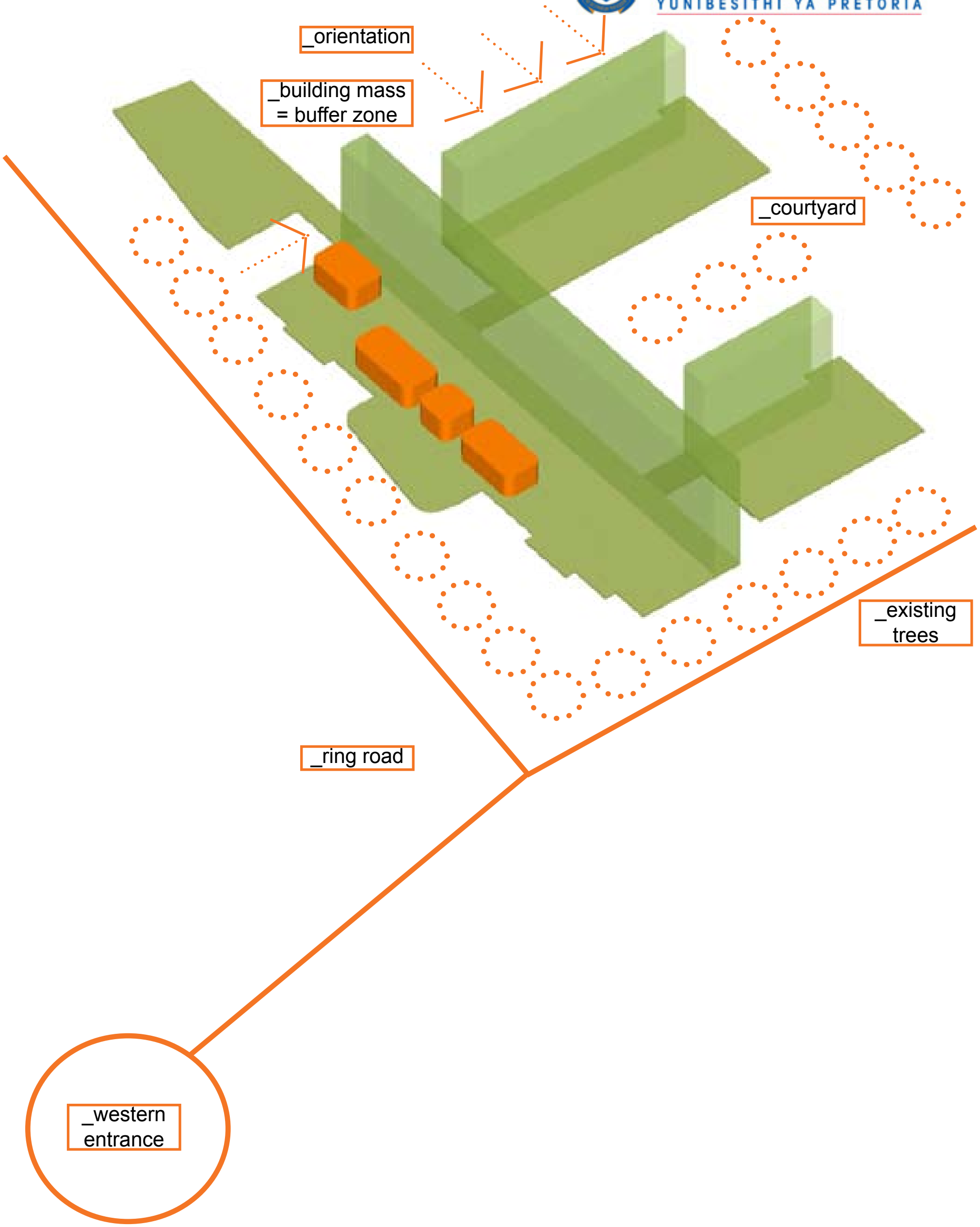
form



_form influences

_form

The building form is a result of a few factors:

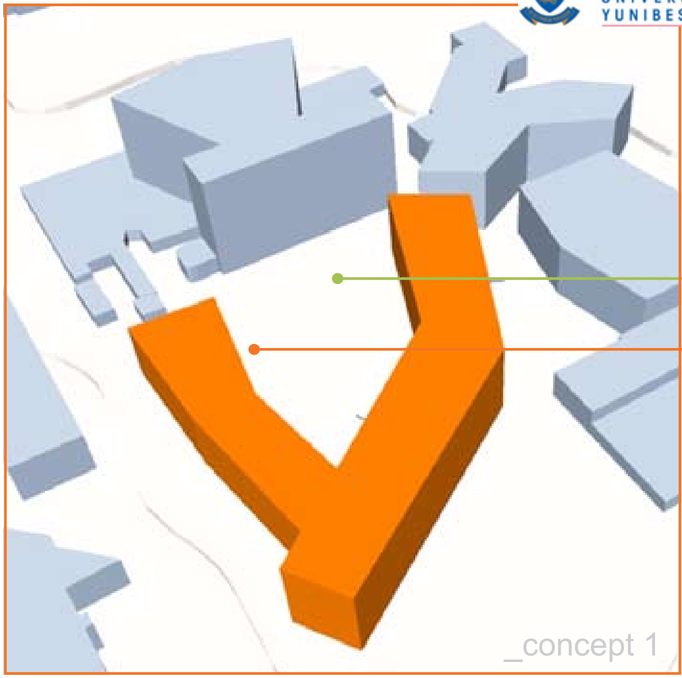
_the existing vegetation on site;
_the main circulation road serving campus [the ring road];
_the relocation of the western entrance;
_reacting to the site's existing context;
_existing pedestrian routes;
_existing service entrance;
_orientation [sun angle];
_creating an intimate semi-public space;

These factors were considered and as a result, the building was designed consisting of:

_a main wing - hosting the circulation cores and acts as a buffer to the street, connecting the two side wings;
_creating a central courtyard, functioning as a semi-public space for recreational activities and at the same time reacts to its existing context.
_the wing is positioned in a North-Westerly direction, focusing the attention on the exploration of different design techniques, to solve heat gain problems on the Western facade.
_the two side wings, [fifteen degrees north], have optimum passive heat gain opportunity, for ideal micro-climate conditions.

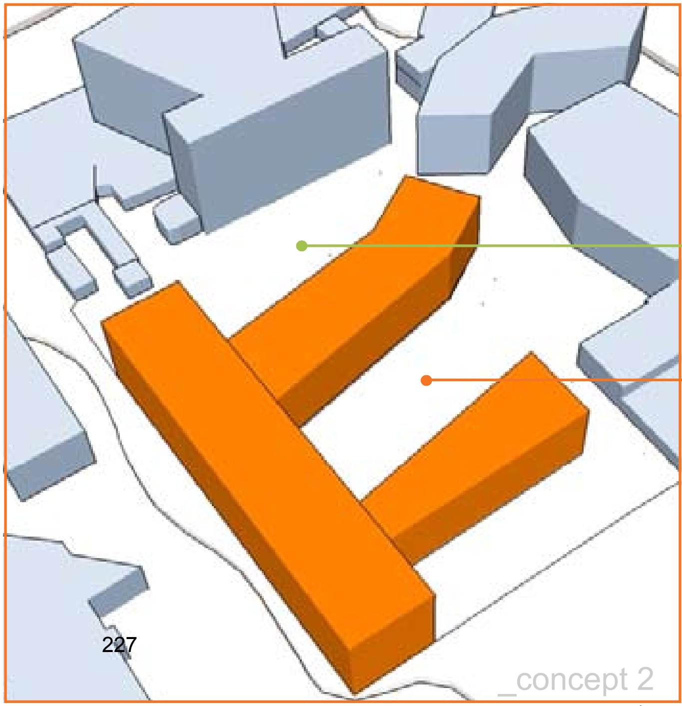
_signage

Colours interplay with a display of cafe's, bookshops, and exhibition spaces. To define these functions, and ensure the use of the facility at an optimum level, vibrant, colourful signage will send the message through, celebrating the activity, inviting the students to participate.



semi-public courtyard

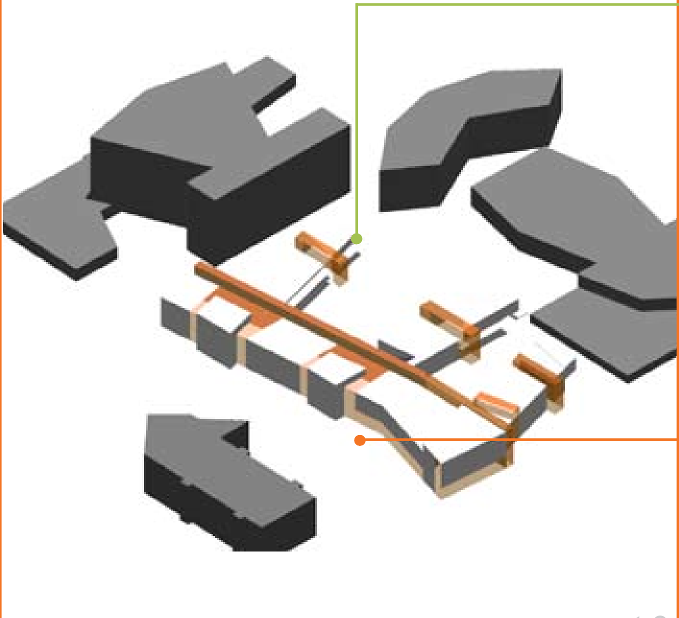
The initial form was a result of the existing pedestrian circulation patterns. The building mass would integrate existing and new, creating a single entity. The orientation of the sub-wing was problematic and the focus of the semi-public courtyard would be towards the Aula's service yard. Physical and visual linkage between the existing context were not at an optimum level.



157

service yard

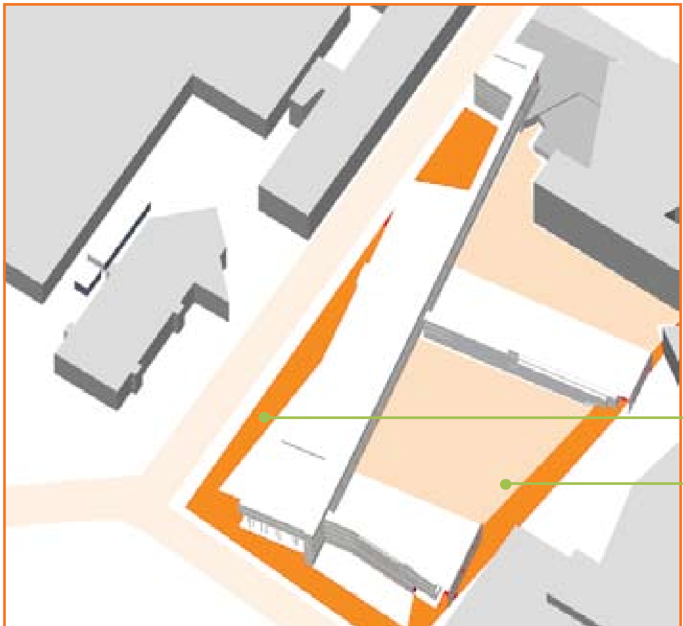
The second proposal was to use the building mass to create a buffer zone, optimizing the use of created space [private courtyard], forming a physical and visual link between the proposed facility and the musaion. The main wing's fixed form resulted in the removal of existing vegetation, which was needed as a natural shading device against the western facade.



__concept 3

third sub-wing

In the third proposal, another sub-wing was added, to divide the courtyard into two smaller spaces. Visual vistas were created to link the existing context with the new facility. These vistas were reinforced by specific placed pedestrian routes. The fixed building shape was changed to a more dynamic form, to accommodate the existing vegetation on site. The proposed facility became a circulation node, to redirect pedestrians from the western entrance towards their end-destination, offering a safe alternative to pedestrians. However, a sun-study determined the additional sub-wing added in this proposal, would be shaded most of the day during all seasons. Another problem was insufficient space for service deliveries. Hence, the third sub-wing was removed.



_concept 4

In this proposal, the two sub-wings were reshuffled to ensure optimum solar orientation. This resulted into a semi-public courtyard, forming a physical and visual link between the proposed facility and its context. The diagonal shape of the main wing, ensures the existing vegetation remains in place and functions as a natural shading device, specifically for afternoon western sun. This green buffer zone minimize radiating heat from the ring road, ensuring latent heat from the road do not penetrate the building skin.

green buffer zone

semi-private courtyard

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precedent

_convert to 'green' design

PRECEDENTS: GREEN STAR CERTIFIED PROJECTS

STUDY 1: 30 THE BOND, SYDNEY

A nine story building, with a design that ensures 30% lower greenhouse gas emissions than a typical office building.

Sustainable features include:
- *rooftop garden*
- *natural ventilation*
- *passive-chilled beam cooling*
- *fully operable shading on the facade*
- *sophisticated building management system*
- *mix-mode winter garden space*
- *specification of low Volatile Organic* Compound emission products and materials

Pre- and post occupancy evaluations: 84% of respondents felt that they were more comfortable.
Reasons for their increased comfort, the responses were:

-64% new building
-64% overall indoor environment conditions
-55% indoor air quality
-54% work space
-43% lighting
-40% air conditioning

The sustainable features incorporated into the building structure, within a city context, was one of the major attraction points of 30 The Bond, as a precedent study. This building is also one of the few with a fully post-occupancy report to monitor the success of the building. Highlighting specific areas which need to be included in the sustainable report to achieve a carbon zero footprint building.


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STUDY 2: COUNCIL HOUSE 2 [CH2], MELBOURNE

This building would act as a leader in sustainable development as the new office accommodation for the City of Melbourne.

The building's sustainable technologies are:
- a water-mining plant in the basement;
- phase-change materials for cooling;
- automatic night-purge windows;
- wavy concrete ceilings; and
- a facade of louvres [powered by photo-voltaic cells] that track the sun.

A predicament of 4.9% improved air conditioning, led to reduced sick leave, and healthier, happier staff, representing a cost saving of $1,12 million a year.

PREMIUM: it is estimated that sustainablity features added 22% to the construction cost. One of the reasons cited for the high cost was the inclusion of risk management additions such as back up mechanical plant [chillers] and the co-generational plant.
PAYBACK: the city of Melbourne took a conservative estimate of an 11 year payback time for the sustainability features to pay for themselves. However, they believe the payback period will be more in the realm of 8 years.
INTERNAL RATE OF RETURN: optimistic saving return of 7.5% per annum after slightly more than 10 years, and a return of 13.67% per annum after 20 years. The return thereafter increases to 15.17% per annum for a 50 year investment.
ENVIRONMENTAL DRIVERS: emissions will be 64% less
- reducing electricity consumption by 85%
- reduce gas consumption by 87%
- produce only 13% EMISSIONS
- reduce water mains supply by 72%

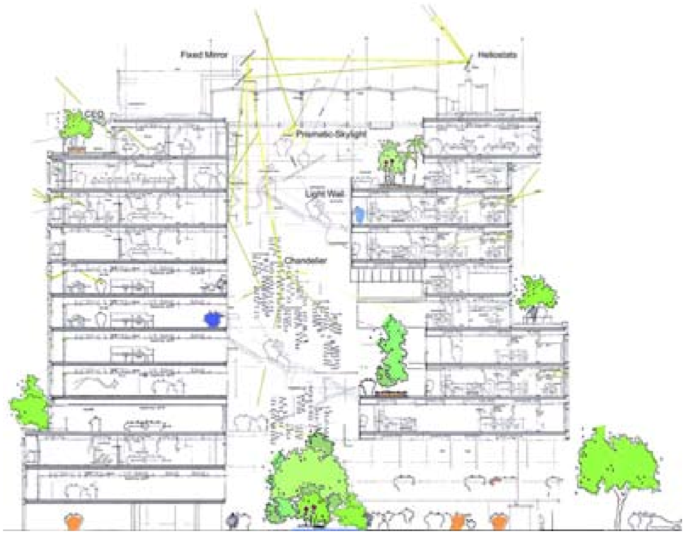
163

_strive towards an energy conscious design

Other:

- new T5 light fittings consume 65% less energy
- solar panels provide 60% of the hot water supply
- photovoltaic cells will generate about 3.5kW of solar power
- gas fired co-generation plant that will provide 60kW of electricity, meeting about 40% of the building's electricity with much lower carbon dioxide emissions
- recycle waste heat from the cogeneration plant that will provide 40% of the building's supplementary air heating/ cooling system.

Mick Pearce, one of the forefront spokes persons on the topic, resolved the envelope of this building as separate entities. Each designed according to its specific orientation and the function it hosts. This strategy ensures the building has an optimum micro-climate and an ideal occupant comfort. Increasing the quality of work delivered by the occupants, ensuring the building and its occupants co-exist in harmony. The systems in place is designed as part of the building feature. With the cooling towers changing colors, the western facade following the sun pattern and the wind turbines, painted a bright yellow, the user is well aware of the dynamic response of the building towards its climate. Conveying the environmental message in a subtle but sure manner.

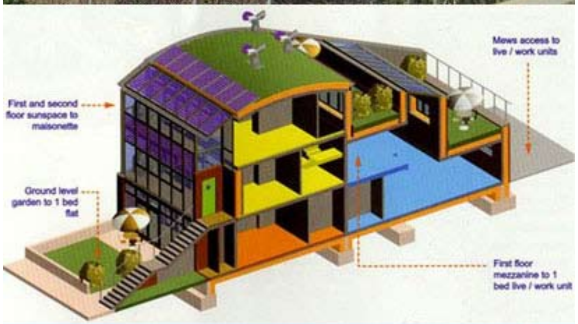


GENZYME CENTRE, CAMBRIDGE, MASSACHUSETS, BY BENISCH ARCHITECTS:

As the headquarters for a biotechnology company, the building sits on a former brownfield site. The building received a platinum LEED rating, incorporating all of the environmental-design strategies:
_energy efficiency;
_water conservation [using 32% less water than a comparable office building by waterless urinals, dual-flush toilets, automatic faucets and low-flow fixtures;
_material selection;
_urban-site selection;
_indoor environmental quality.

The high-performance curtain-wall system, has operable windows with automated control, providing for night cooling. A third of the exterior envelope is a ventilated double facade that tempers solar gains year-round. The central atrium functions as a return-air duct and a light shaft.

The sustainable features of this building is no add-on, its a vital part of the architecture.



BedZED SUSTAINABLE DEVELOPMENT, BILL DUNSTER, LONDON. UK:

This zero energy ground-breaking project proves sustainable living can be economically and technically viable but also comfortable and manageable by ordinary people. The project is based on a holistic design, embracing health, safety, water-use efficiency, recycling, waste minimization and green transport. The site is a former sewage works on the southern edge of London. The thermal performance of the building envelope is three times more efficient than the current UK regulations. Strategically placed facilities within an ideal building form enhance the passive solar heating and cooling conditions. The sustainable design aims of the facility includes:
_reduction in energy demand and renewable sourcing;
_land reuse, higher than normal urban density and biodiversity through landscape design;
_integration with existing communities;
_innovative home/work arrangements;
_locally sourced materials;
_material environmental impact embodied energy, durability and recycling;
_reduced water consumption;
_buildings as energy producers for transport.

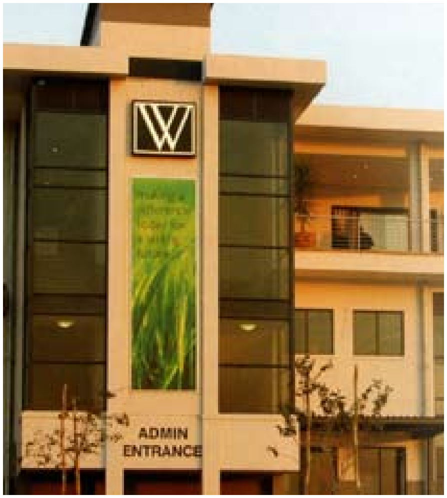
The lessons from this precedent, was absorbed and relevant strategies applied to the proposed project.

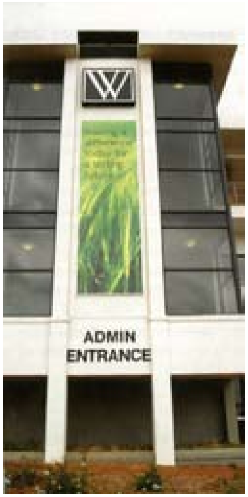
POMPIDOU CENTRE, PARIS, FRANCE, RENZO PIANO & RICHARD ROGERS:

As one of the most spectacular monuments in Paris, this building marked a complex relationship between politics and culture. Launched as a whole new approached to public building, moving away from the typical stereotype public institutions. The essence of the facility was flexibility, responding to ever changing needs of its users, accommodating a variety of facilities, all the interior spaces would be moveable within the framework provided. The facility illustrates a close relationship between the building, the piazza and the piazza facade, illustrating the centre as 'an activity container'. The facade partly responding to service needs, illustrates clearly structural and architectonic clarity. The services boldly expressed, with the use of colour, coding the various services it supplies, functioning as servicing and movement zones respectively.

This centre's main concept, the idea of people enjoying the building, makes this facility a fantastic object in its own right: expressive, colourful, and complex. The realization of the Modern Movement, a vision of the building as a machine.

_symbolising its function



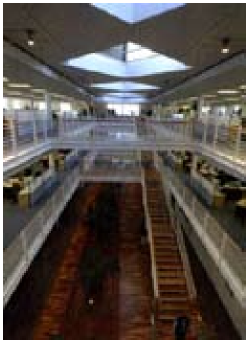


WOOLWORTHS DISTRIBUTION CENTRE, SOUTH AFRICA, GAUTENG

The Woolworth's Distribution Centre incorporated as many environmentally friendly and sustainable initiatives into the centre as was feasible, even if not all were economically viable within the short term. Of the 90 hectares site, approximately 50 hectares have been used for the new building site, while the other 40 hectares were set aside for future development and natural eco-systems.

A grey water system was installed to collect grey water in a separate waste water management system. This grey water was collected in water storage tanks, then circulated through a filtration plant and pumped into strategically placed storage tanks. The recycled water is utilised for flushing of toilets and urinals. Grey water from washing basins, showers and air conditioning plant rooms was also collected and re-used.

Solar energy is captured to generate warm water for showers- and washing basins use. There is a series of 30 solar panels, approximately 62m2 in total, enough heated water for 40 shower units at a time.



BP HEAD QUARTERS, SOUTH AFRICA, CAPE TOWN, KRUGER ROOS ARCHITECTS:

The BP's offices at the V&A Waterfront in Cape Town. Their initiative was to demonstrate their commitment to a more sustainable office operation and to develop that would reflect its brand values [green, progressive, innovation and performance-driven]. The project objectives included the reduction of energy consumption, optimising natural light and passive heat, and conserving water. The annual energy consumption target was set at 115kWh/m2 - 40% less than similar buildings.

The building management system, maintaining the micro-climate, monitoring energy use and savings. The building used photovoltaic array of 68kW, used for solar water heaters and provided 10% of the building's energy requirements.

The building facades were carefully designed to maximise the thermal mass and exterior sun devices, designed as part of the building facade, ensured natural daylight penetrates the building at the right angle.

The insulation of the building, included double glazing, unusual for the African climate, but enhance the passive-energy design. Passive and natural ventilation was incorporated as part of the air-conditioning system

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technical

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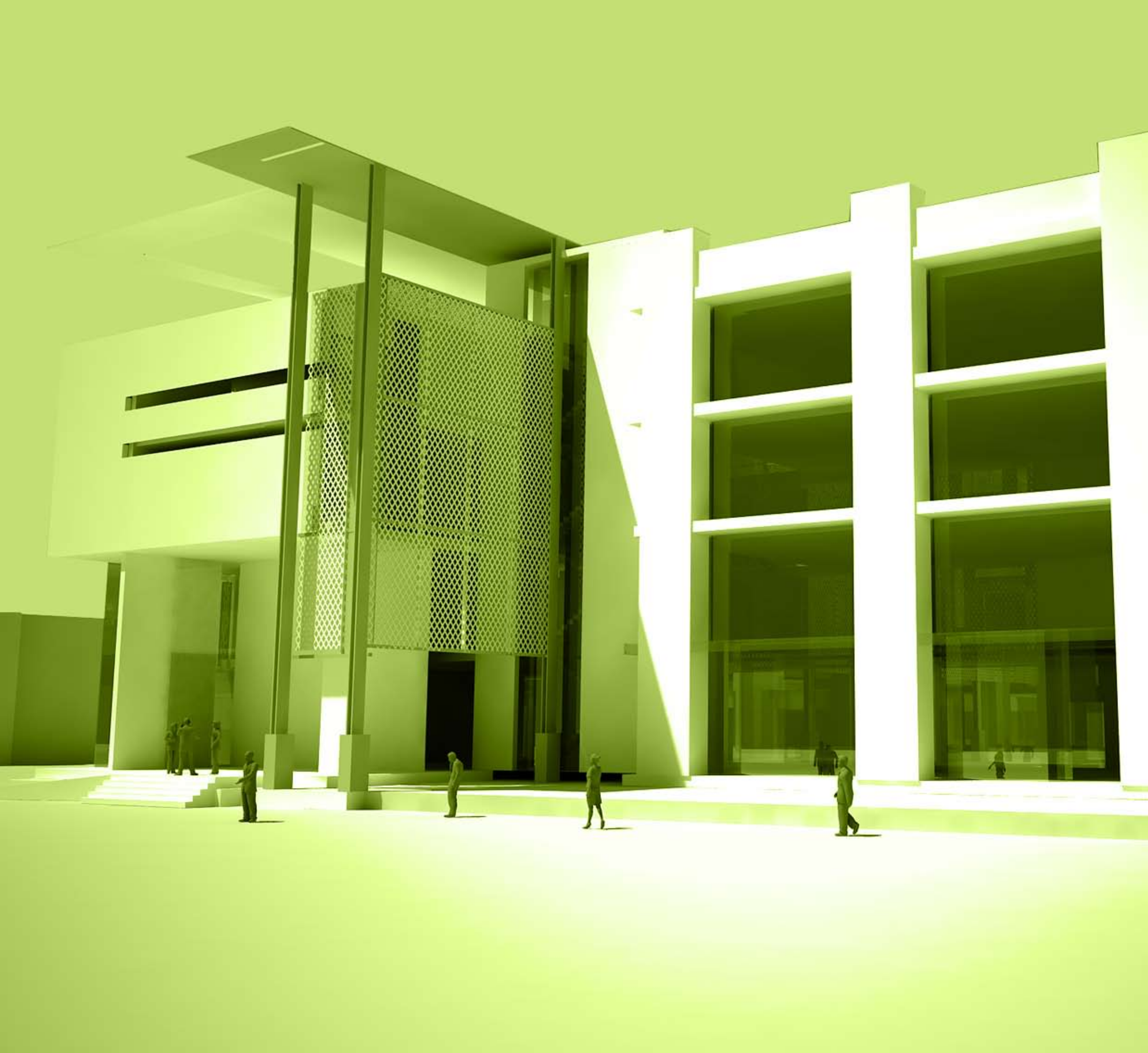

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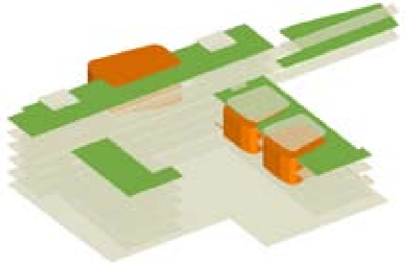
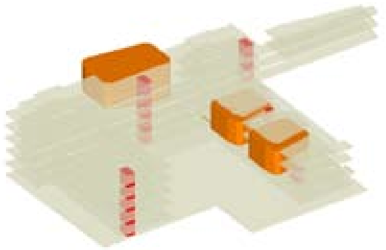
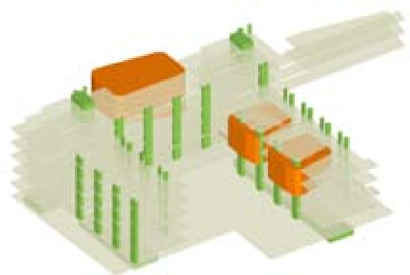
_green roof



_recycling



_ventilation



_water harvesting

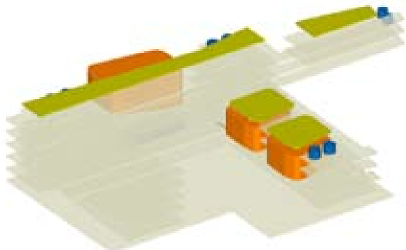


fig. 170 [a] sustainable features of the facility

The environmental benefits from building green are beyond dispute. It delivers a suite of compelling economic and social benefits that conventional buildings do not. The main objective of this study is to produce a building with a carbon minus footprint, using less energy than it consumes. This will ensure buildings in future can function on their own grid structure without any energy input other than natural resources, ensuring a more viable life span for the building. The study will investigate the possibility of this objective.

Sustainable features of the facility includes:

-Rooftop garden [fifth elevation]
-Solar water heating
-Grey water recycling and rainwater collection
-Low flush toilets
-Recycling facilities
-High recycled content of structural concrete
-Sewage plant in basement
-Natural stack ventilation
-Night cooling
-Absorption chillers
-Fully operable shading on the facade
-[West facade of louvres powered by photovoltaic cells] that track the sun [Northern facade fixed shading system]
-Wavy concrete ceilings [increasing surface area for enhanced airflow]
-Use of thermal mass to heat and cool structure
-Specification of low Volatile Organic Compound emission products and materials

"Pretoria regionalism...reflects a particular response to nature and landscape through the economical use of naturally available and industrially produced materials with an empirical response to climate..."
[Fisher, R.C. 1998: p. 123]

Inspired by Brazil Builds, many civic and institutional buildings built after the 1940's display elements such as Brise Soleil, roof gardens and fluid concrete form work. **[Fisher, R.C. 1998: p.197-229]**

_building aims

-sustainable site development
-water efficiency
-energy efficiency
-indoor environmental quality
-reduced consumption of building materials

_structure

A concrete structure was selected as the load-bearing component. This material has a high recycled content and is organized in a structural grid of 8,5 x 7,8m, to allow for the flexible use of space for its proposed and possible future uses. The building's structure originates from the basement. The facility needs to provide parking, since the public transport is not sufficient for all the building users, therefor a single level basement parking is proposed, replacing the parking of the previous site in use. Additional parking is provided by proposed parking areas, within the group framework, placed outside campus. This allows free pedestrian movement towards the site and at street level. The basement is an open drain system, offering the opportunity to catch the rainwater, stored in a water storage tank within the basement. Mechanical sumps are placed at regular intervals, regulating the surface drainage. The water storage tank has an overflow to connect to the storm water channel. The basement is raised 1000mm above the ground level to allow natural ventilation and minimising the need for mechanical systems. Additional extractor fans are installed to remove excess polluted air.
The reinforced two-way floor slabs have a 340mm thickness with reinforced columns of 300x700mm, recommended by engineer [Carl von Geyso]

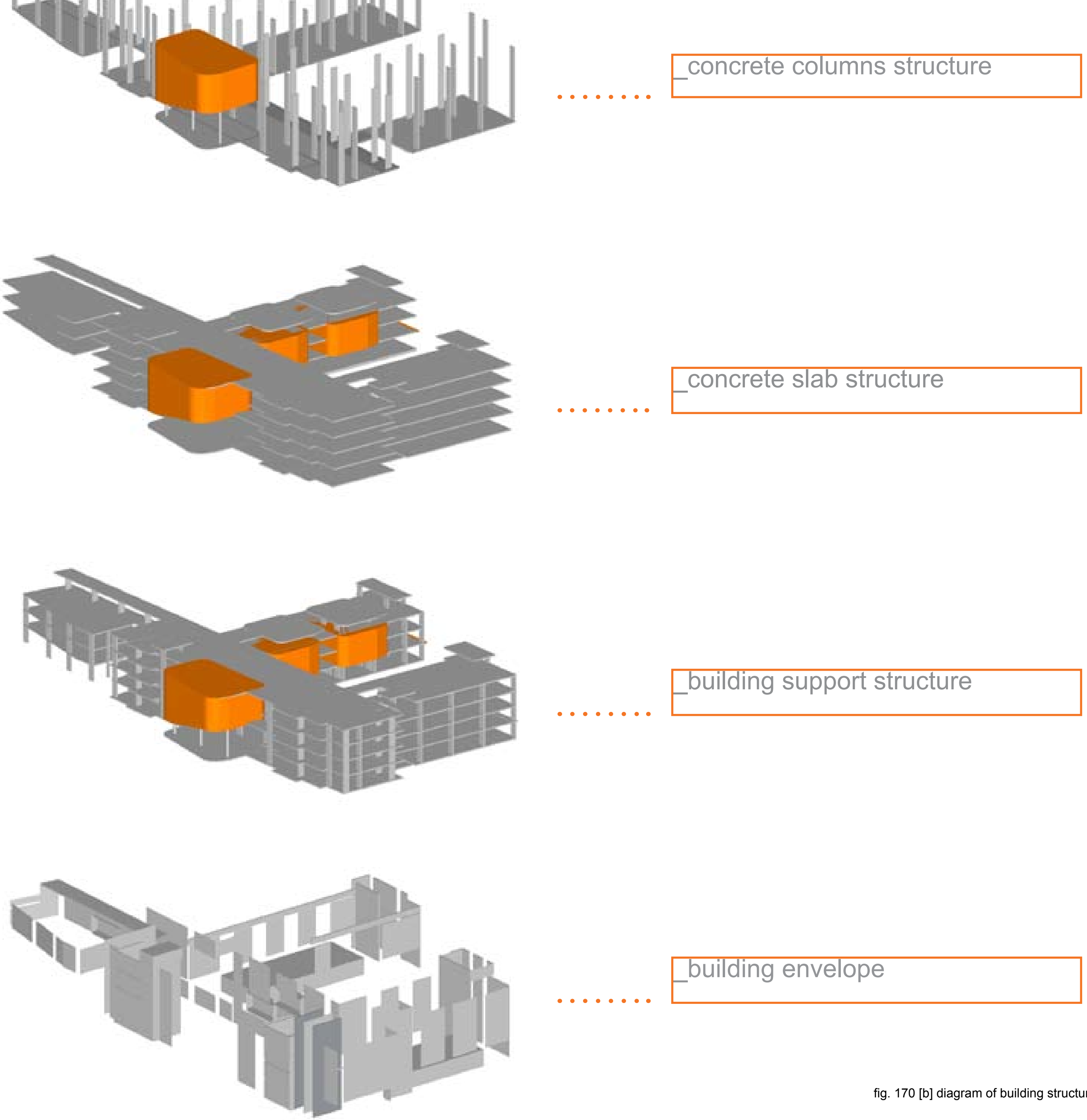


fig. 170 [b] diagram of building structure

fig. 171

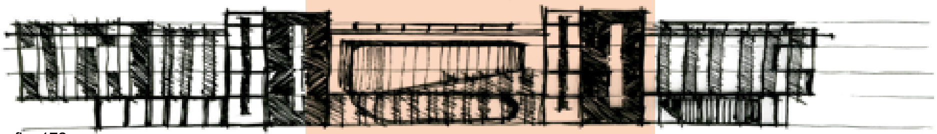


fig. 172

fig. 173

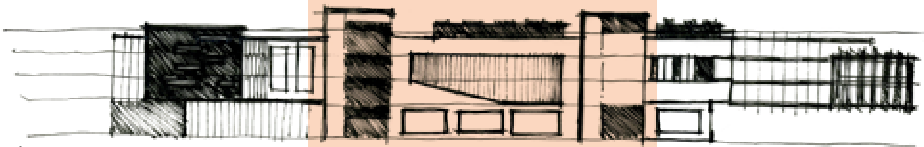


fig. 174

The concrete roof ensures sufficient insulation capacity;
offers the opportunity as an extra live-out space;
functions as a green roof;
filtering captured rainwater;
has a thermal heating and cooling capability to maintain a temperate internal environment;
allows for future development;
and respects the local Pretoria regionalism.

_the skin

For the building to act as a biologic entity, the building needs to be wrapped in a few layers of 'skin'. The skin consists of three main elements, the floor, wall and ceiling. Each has a finish, a structure and a material composition, influencing the energy flow within the structure. Therefor, the envelope of the building plays a vital role in the success of the building's micro-climate. The building envelope can be applied in different ways, depending on the specific requirements of the different building facades. Factors determining an effective system includes:
_the orientation;
_the function it hosts;
_occupant comfort;
_use of a natural or mechanical system;
_need for natural ventilation

There exists a fine balance between the tightness and breathe-ability of a building. Applying a balance between both these principles will create a stable, comfortable micro-climate.
Applying a few layers, consisting of a comfortable, self-cleaning layer placed next to the skin;
an air-confining composite;
and a moisture-, wind-, or solar protective or -responsive layer;
creates an effective, flexible symbiotic facade system.

The western facade of the main wing conveys an environmental message as a dynamic facade system following the sun. The hydraulically controlled recycled timber shutters automatically open and close depending on the sun's position. The northern facade of the two sub-wings is a fixed system, regulating specific viewpoints and light reflections specific to interior use. The east and south facades is defined by fresh-air shafts integrated from the roof down. The eastern shaft is further defined by a central circulation spine, connecting the pedestrian on ground floor with pedestrian flow on the first level. This allow the user to reach its destination without any vehicular interference and at the same time offers the opportunity to share in the entertainment value of the proposed facility.

fig. 175 [a] Transparent facade

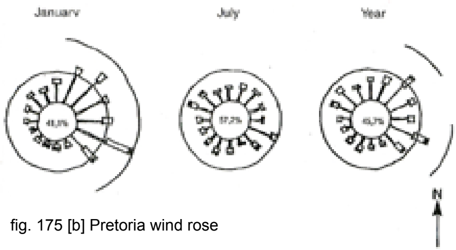


fig. 175 [b] Pretoria wind rose

_ventilation

At present, there is an increasing demand for cooling and climatisation in many parts of the world The distinct distribution of the cooling demand over the day, with a peak at noon and early afternoon, there is also a peak in electric power consumption which already leads to shortages in the electric power supply grids. The most effective method to lessen the energy demand of the building, is to eliminate the need for mechanical cooling through climate-adapted design. To be able to identify an appropriate cooling strategy for a specific building, an understanding of three things is required:

_climate;
_building type;
_pattern of operation.

_climate

The city of Tshwane is situated within a climate zone with distinct rainy and dry seasons, a large daily temperature variation and strong solar radiation. Humidity levels are moderate.

-location: 25,8' to 30,7' East and 22,0' to 25,9' South.

-temperature: the maximum diurnal variation occurs in the winter [July - 15K below the comfort zone], while the average monthly diurnal variation is 13K. Summer season the temperature extend approximately 3K above the comfort zone.

-humidity: the humidity levels are moderate and are not considered problematic. The average monthly relative humidity level is 59%.

-wind: summer winds are predominantly east-north-easterly to east-south-easterly. Winter winds are predominantly south-westerly with a fair amount originating from the north east. [D.Holm - Manual of energy conscious design]

The buildings' main ventilation system is composed of an integral two part hybrid system. The passive system, which is mechanically aided by a series of small industrial fans, air intake is located at the rooftop - to ensure the air is not influenced by radiated heat from hard surfaces surrounding the building and less polluted, clean, fresh air intake is obtained. The air is transported down by a vertical duct system, cooling the air temperature further, placed in regular intervals according to the structural grid. In the basement the air is further cooled by a geothermal pipe system made up of horizontal placed closed loop polyethylene pipes, requiring the minimum excavation of 1.5m - 2.5m. These pipes use the earth as a heat sink to provide cooling by removing heat from the air circulating through the building. The system consists of three subsystems including: a geothermal heat pump [moving the heat between the building and the circulating air]; an earth loop piping system [for transferring heat between the air and the earth]; and a distribution system [for delivering cooling air to the building]. The building footprint consists of a West-facing main wing and two North-facing sub-wings. Vertical stacking chimneys placed on the North and West facade, creates a stack effect and expel 50% of the fresh air supplied by the distribution system. The concrete floor slabs are night ventilated to cool the structure in advance. This enables the concrete slabs to radiate cool air during the early morning hours and to function as a heat sink as the interior spaces heats up during the day. As soon as the thermal mass reached its maximum heat absorbing capacity, the active system kicks in, usually during the late afternoon.

The active system, is a solar thermal cooling system with absorption chillers. The system has a lower environmental impact compared to other refrigeration devices, produced via a heat source instead of electric power. The system consists of a Direct-fired chiller [using a refrigerant - lithium bromide] or an Indirect-fired system [using a hot water source e.g solar water heater]. The latter was chosen for the proposed project. Flat plate collectors would generate the heat for driving the absorption chiller, to cut electrical peak loads during the summer and to reduce fossil fuel consumption. The operation of the Absorption Chiller, is characterised by the temperature levels of three external media [heating - 90'C hot water input; chilled - 15'C chilled water output; and re-cooling - 32'C cooling water input]. The system is based on attracting and releasing water within the loop, undergoing a two-stage process of dilution and concentration. The water flows through a four stage process of evaporation - condensation - evaporation - absorption. To move heat is an integral part of the process.

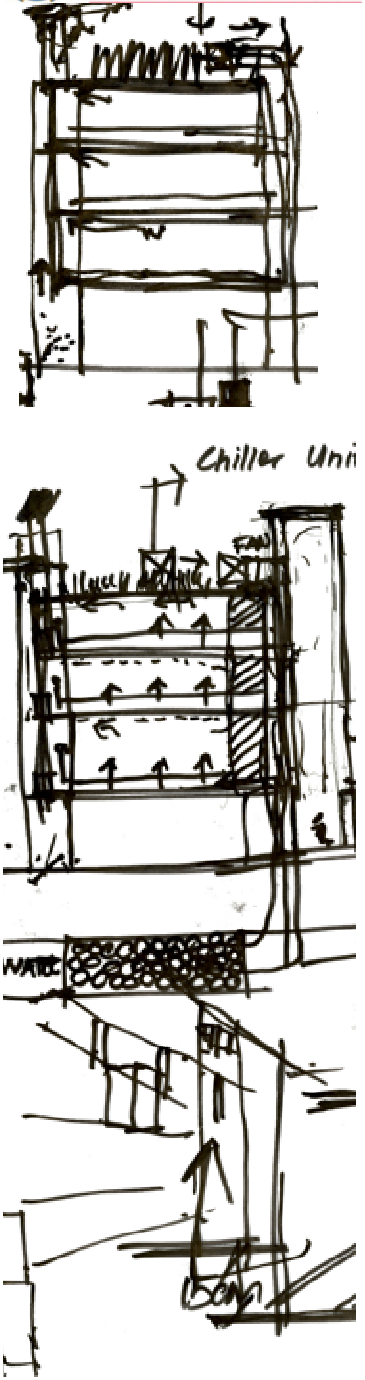


fig. 176 ventilation concept sketches

_ventilation strategy

- 100% fresh air supplying duct system;
- vertical stacking chimneys with wind turbines to expel circulated air;
- a geothermal pipe system, generating cool fresh air, circulated through the building via a distribution system;
- solar assisted air conditioning [absorption chillers];
- HVAC back-up system;
- night cooling [during summer];
- additional solar water heating [during winter].

_cooling strategy

2am-6am: 100% fresh air is supplied from rooftop via the distribution system, circulating through raised floors

to cool the concrete structure.
6am-2pm: Passive mode - Occupants arrive and air handling unit supply 100% fresh air. The air is circulated through the geothermal pipes and pumped into the raised floors by low energy fans. The cool air rises through the space, heats up and exhaust via the exhaust plenums and wind turbines on the western and northern facades respectively.
3pm: Active mode - On days with extreme conditions, the absorption chiller units is used to maintain a cool and comfortable micro-climate This method is typically employed in temperate climates, similar to Pretoria. [During malfunctioning of the systems in place, the HVAC system is activated].

_heating strategy
2am-6am: Hot water circulates through water pipes cast in the concrete floor slabs. The water is heated by solar water heaters fixed on the roof, it is stored in a central storage tank. Further head gain include the active northern and western facade, which consists of a triple glazed system to insulate the building. Functioning as a solar trap during the winter months.
6am: Occupants arrive and fresh air is supplied via the supplying duct system. The air is then transferred to the geothermal pipes and pumped through the raised floors on each floor level, heated by the floor slabs via latent heat and the solar water pipes. The warm air rises, heats up and exhaust through the exhaust plenums and wind turbines on the western and northern facades respectively. [During extreme cold conditions the HVAC system is activated].

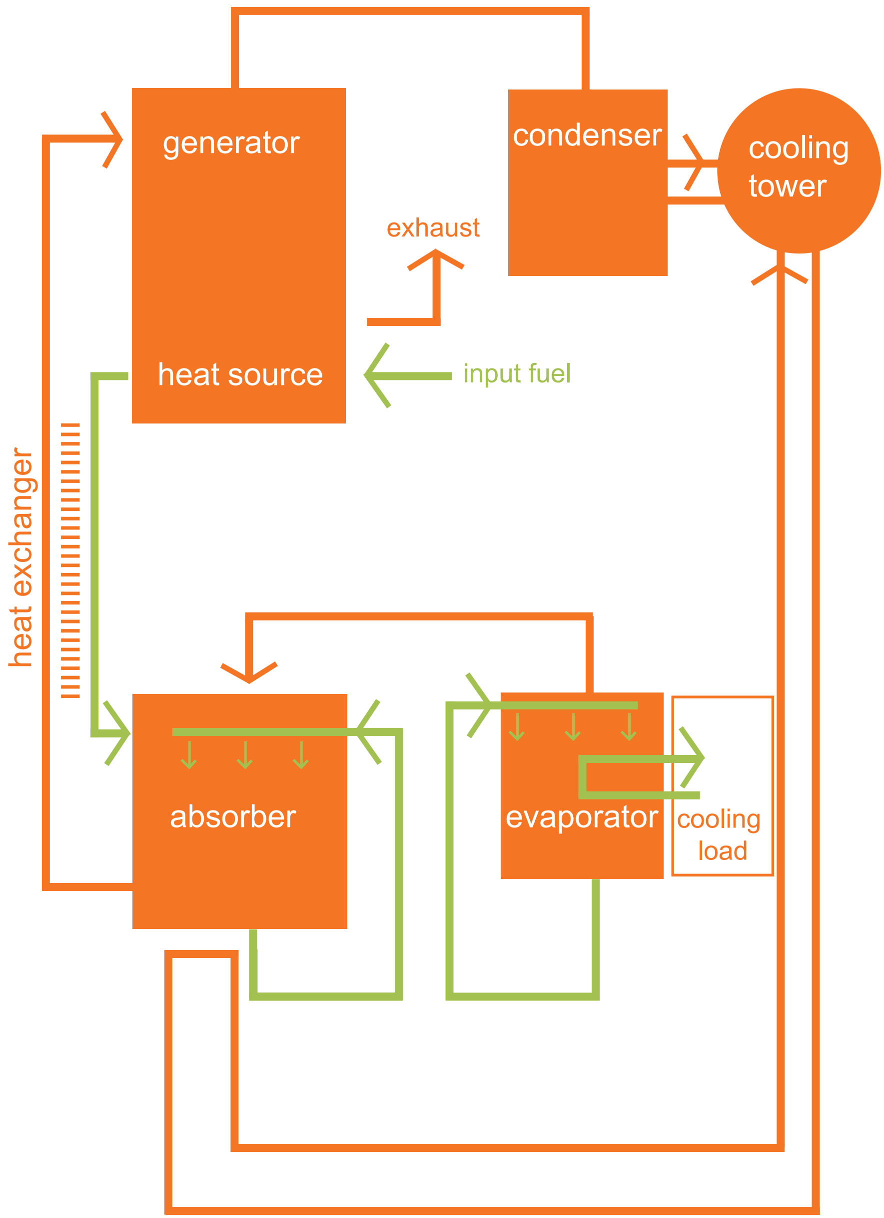


fig. 177 schematic diagram of the absorption refrigeration cycle

fig. 178 [a] night cooling

fig. 178 [b] passive mode, ventilation cooling

2 am - 6 am

NIGHT COOLING

100% fresh air circulates through the building, cooling the concrete structure.

6 am - 3 pm

OCCUPANTS ARRIVE

air-handling unit on roof turns on and supply filtered 100% fresh air

air circulates down the eastern and southern shaft to the geo-thermal pipe system

the air is cooled and pumped by high speed fans into raised floors on each floor level

the cooled air enters the space, heats up and exhaust through the exhaust shafts

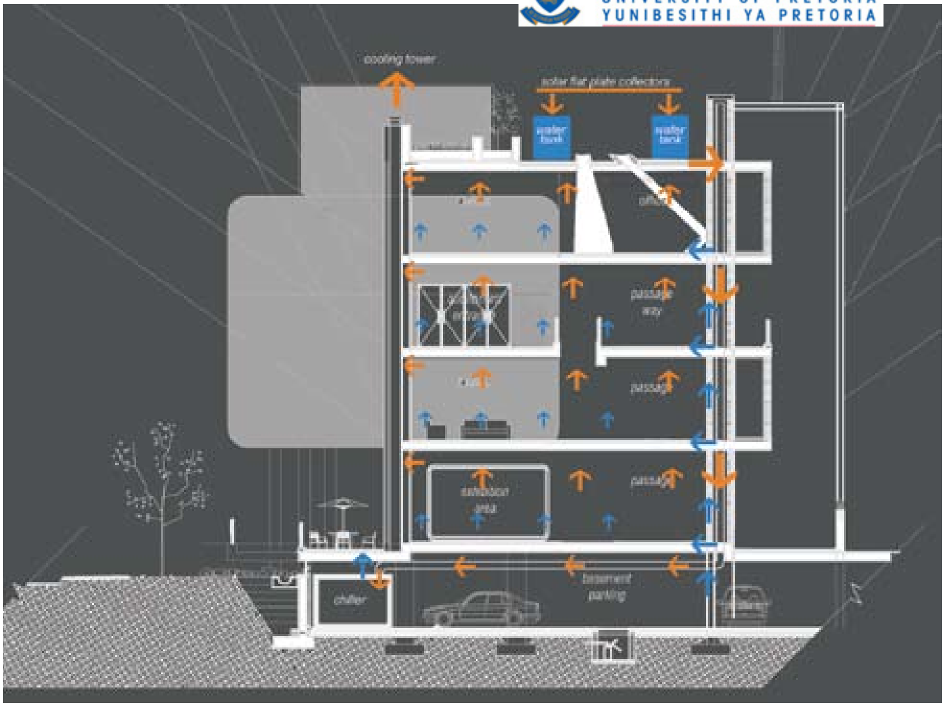


fig. 179 [a] active mode, absorption chillers

FUNCTION	AIR EXCHANGE RATE REQUIRED
Theatre	3.5 per person
Cafeteria	5.0 per person
Kitchen	17.5 per person
Retail	7.5 per person
Auditorium	5.0 per person
Offices	5.0 per person
Exhibition space	3.5 per person
Ablution	20 per person

fig. 179 [b] table of required ventilation rates

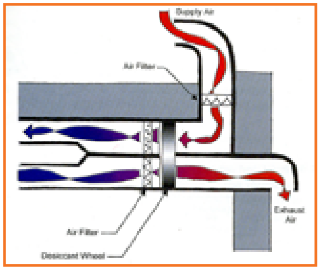


fig. 179 [c] heat exchanger

3 pm -

EXTREME CONDITIONS

during extreme hot conditions the building switch from pas-sive to active mode

flat plate collectors placed on the concrete roof act as heat source for the absorption chiller

hot water from central storage tank is circulated to the absorp-tion chiller unit situated in the basement

the water flows through a 4 stage process of evaporation - condensation - evaporation - absorption

the chilled air is then circulated through the suspended floors and cools the interior space

IN CASE OF A MAL-FUNCTIONING OF ANY SYSTEM IN PLACE

an HVAC system can be acti-vated

fig. 180 [a] heating strategy

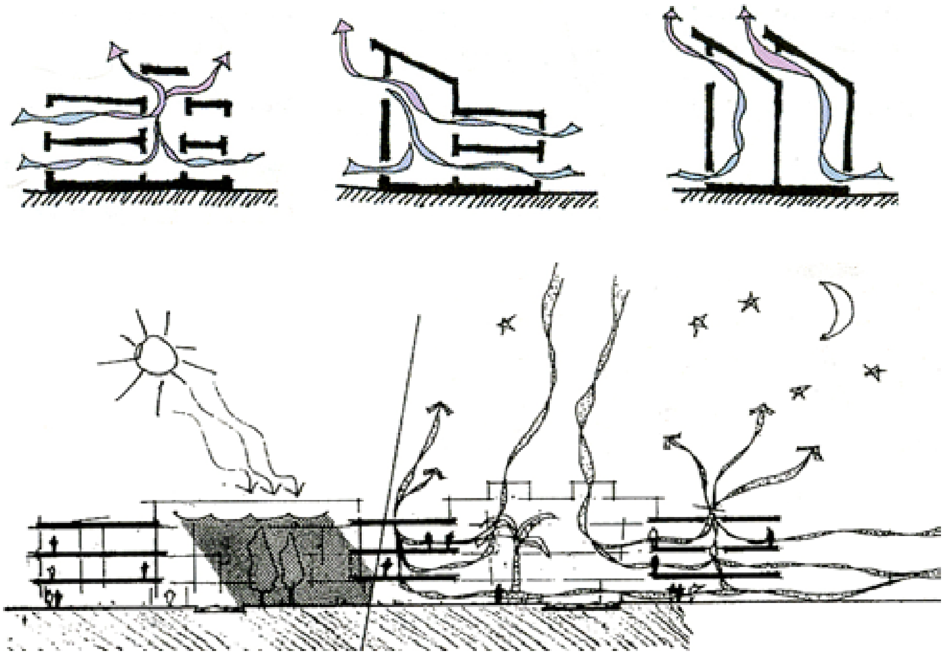


fig. 180 [b] schematic diagram of thermal heat gain

2 am - 6 am

THERMAL HEAT GAIN

the concrete structure has the capacity to function as a heat sink, radiating heat during the night, ensuring the space heats up before occupants arrive

6 am - 3 pm

OCCUPANTS ARRIVE

water heated by the solar water heaters is transferred to the water pipes cast in the concrete slabs

this will heat the concrete structure even further

100% fresh air is pumped through the floors, ensuring the air heats up before it enters the space

the warm air rises and exhaust through the exhaust plenums on the northern or western facade

shafts exhaust through the rooftop mounted wind turbines

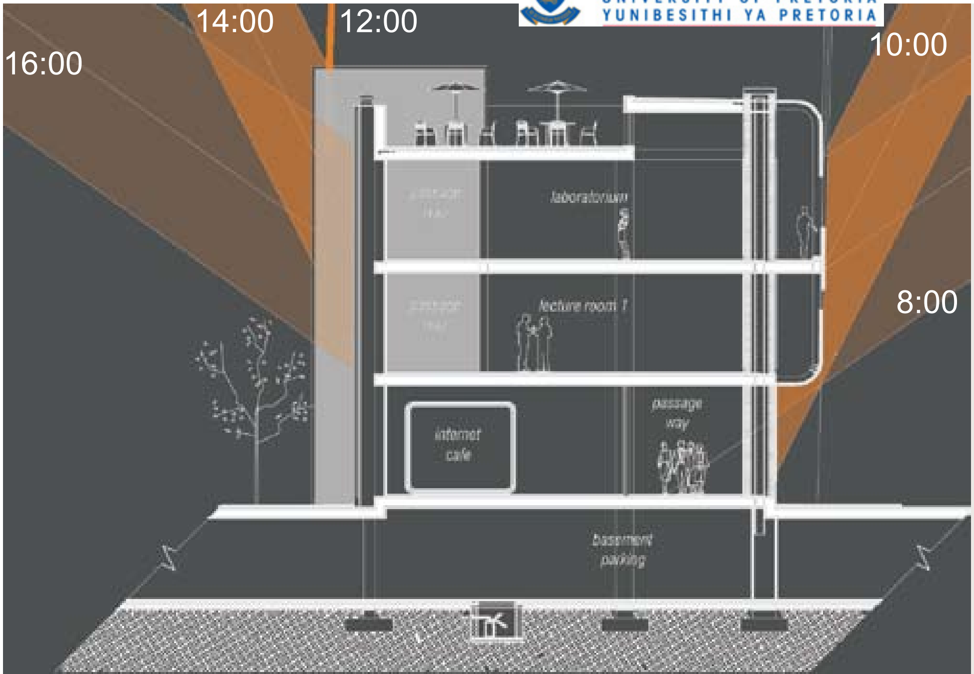


fig. 181 [a] north facade sun angles

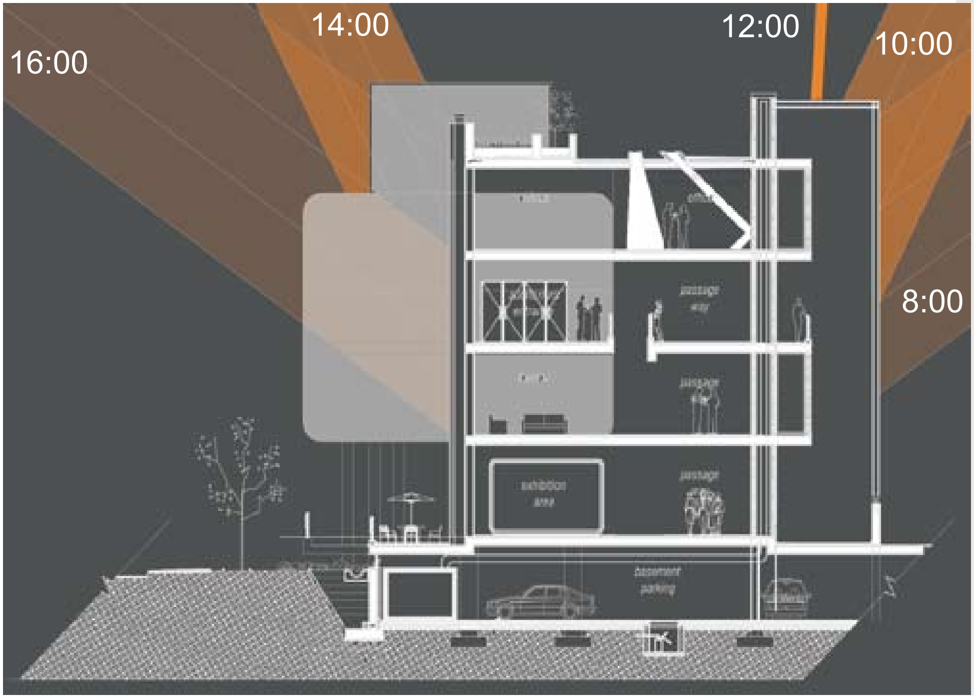


fig. 181 [b] west facade sun angles

_task lighting

Daylighting is the key to good energy performance and occupant satisfaction. Its the most sustainable source of light and should be used optimally. To allow occupants to regulate their light levels at their workstations is of extreme importance. Extra mechanisms can be added, blinds, adjustable louvers, screens, to adapt to the light intensity levels at a specific time of day. Top lighting, used in the central circulation spine, allows even levels of diffuse light to be distributed. It connects the user with life outside the building. Glare and unwanted optical illusion can be avoided by using lights placed in positions for adequate light levels.

_north facade [21 December; summer]

_west facade [21 December;summer]

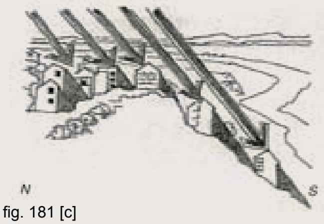


fig. 181 [c]

The artificial lighting system has high-frequency control equipment [reduce danger of nausea, headaches associated with fluorescent lighting], which can permit dimming, to be used on fluorescent luminaries for lower energy consumption. Automatic sensors can be added to control these lights for further energy savings. Theses sensors monitor movement and daylight, switch on-and-of accordingly.

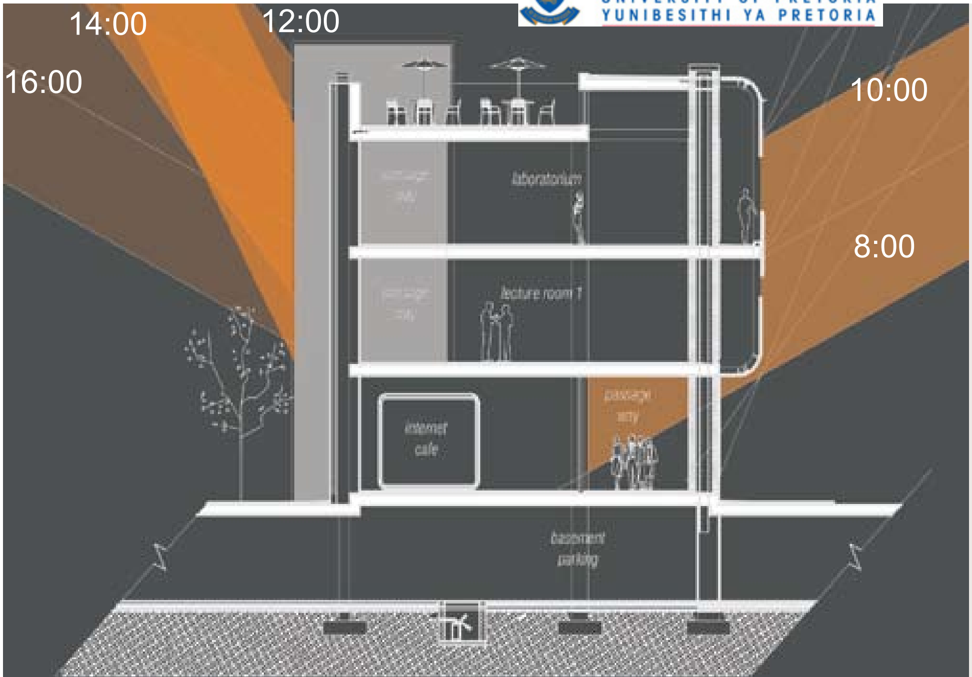


fig. 182 [a] north facade sun angles

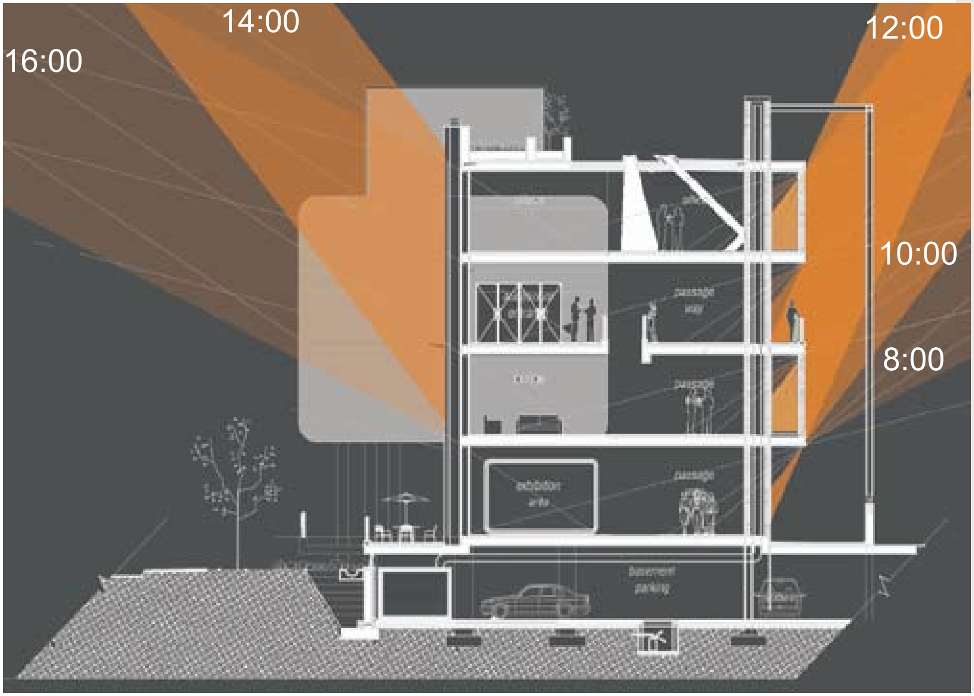
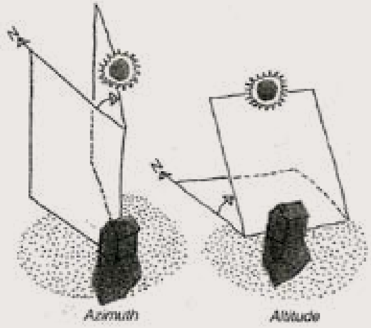


fig. 182 [b] west facade sun angles



_north facade [21 March/21 September; spring/autumn]

_west facade [21 March/21 September; spring/autumn]

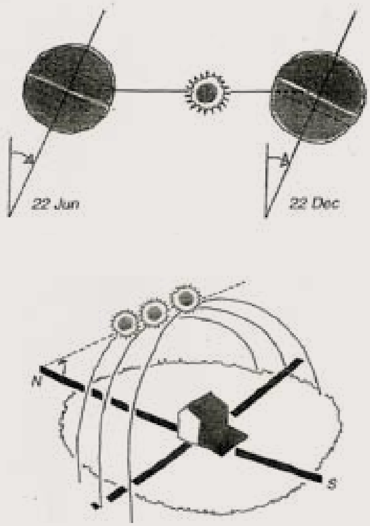


fig. 182 [c]

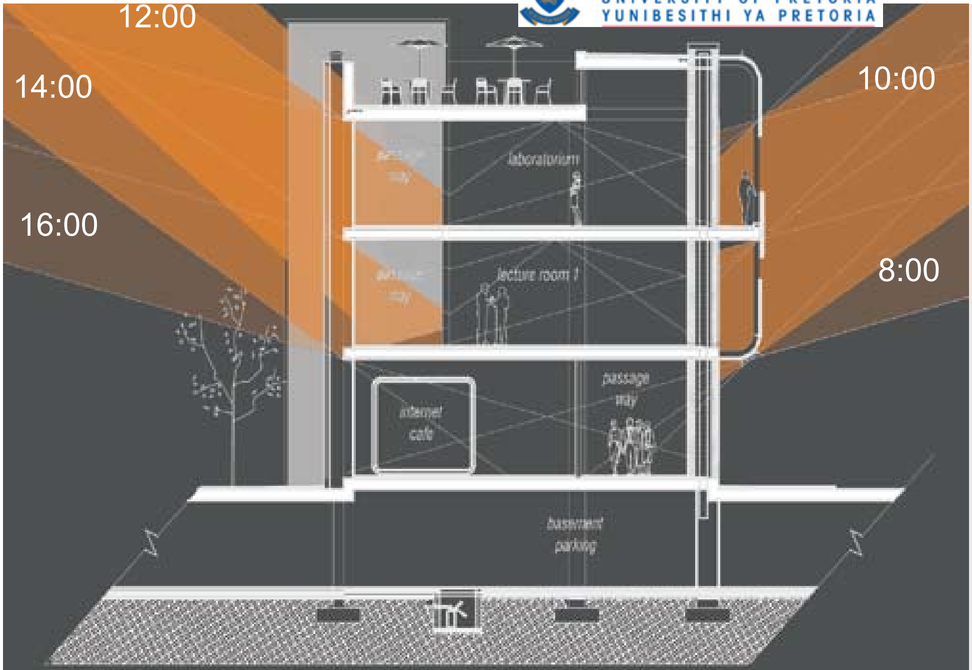
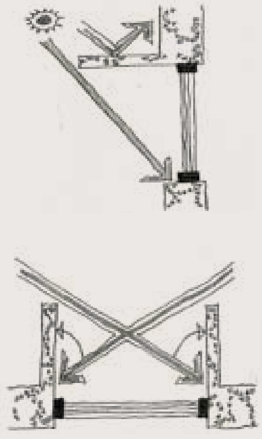
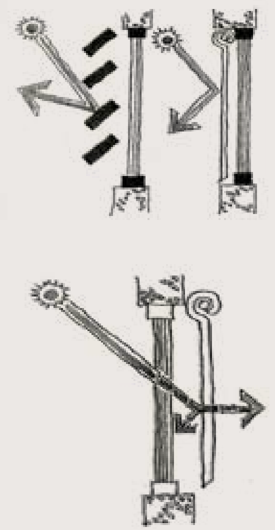


fig. 183 [a] north facade sun angles



_north facade [21 June; winter]

_west facade [21 June; winter]



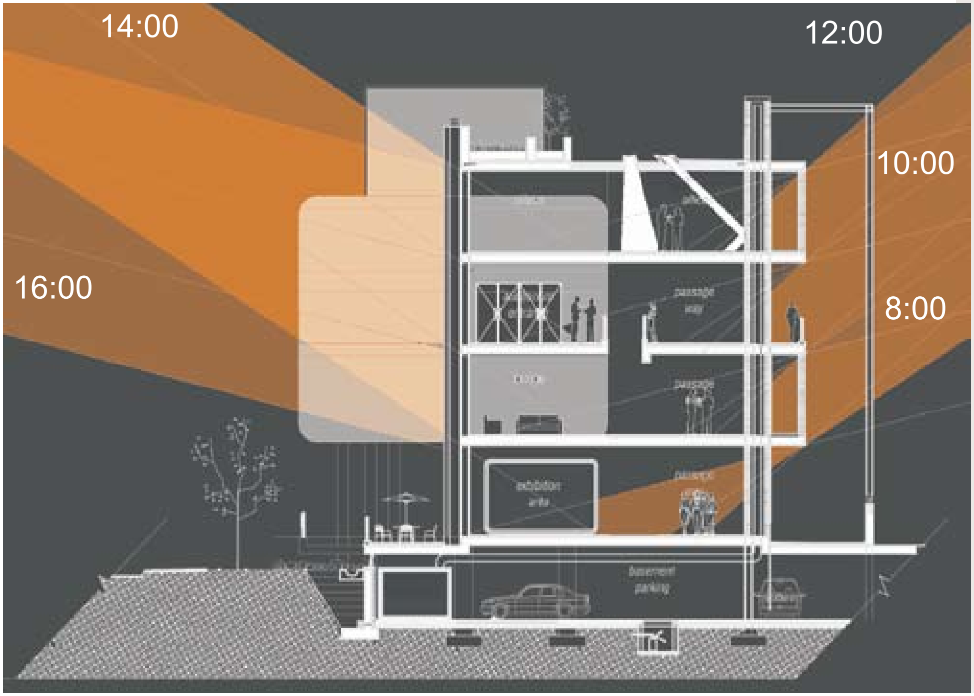


fig. 183 [b] west facade sun angles

fig. 183 [c] solar shading devices

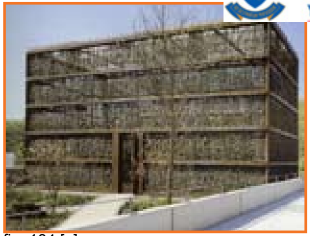
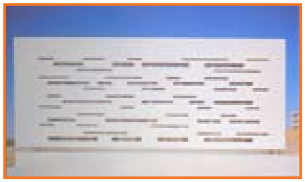


fig. 184 [a]

fig. 184 [b]



_north facade

The slab overhangs are adequate to prevent too much direct sunlight from entering the space in the summer months. The central walkway is placed on the northern facade, ensuring heat gain do not enter the occupant space. Light that does enter during winter, is absorbed by the clay tiles and released at night to heat the rooms. The stacking chimneys, creates a rhythm of thermal mass, released into the rooms at night. A planted screen covers the open windows between the stacking chimneys. These screens consists of a steel structure, covered by a steel mesh cladding screen for creepers to grow. This planted screen regulate the temperature of the building, functioning as a sun barrier during the summer, and allows sun to penetrate during winter months.

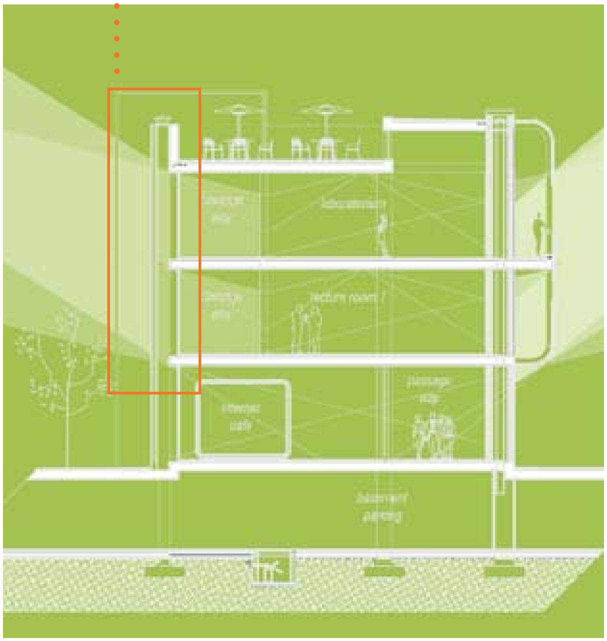


fig. 185

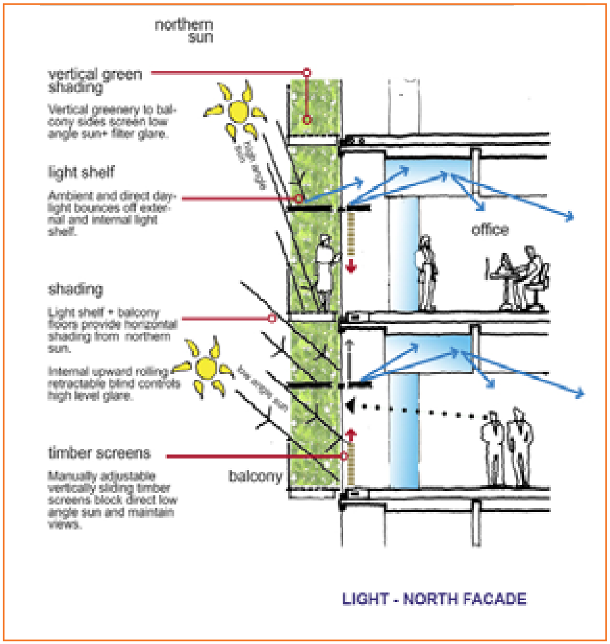


fig. 186

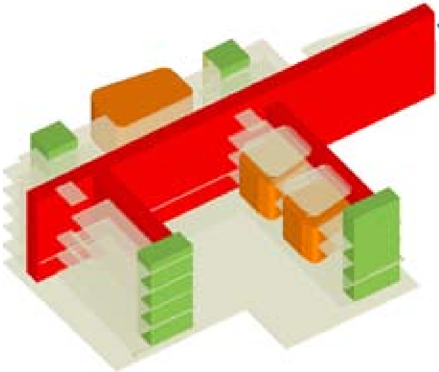


fig. 187 [a]

fig. 188

fig. 189

fig. 190

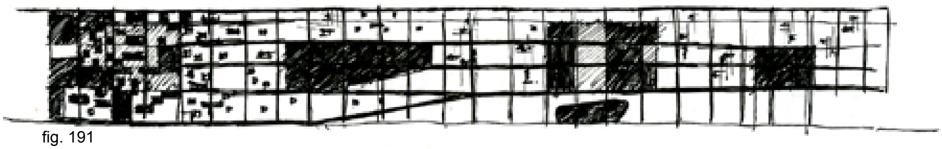


fig. 191

_east facade

_concept
The concept of this facade was to act as a transparent or translucent facade, showing the movement within the building and to enable the users of the building, to connect with nature, through view points [connecting the building with its existing context], pause areas or specific placed balconies. The facade becomes a linear pedestrian spine. As the back-bone of the building, it links the vertical and the horizontal circulation cores on all the floor levels.

The exterior cladding of the east facade, lets natural light through but limit early-morning sun radiation within the building. An I-beam steel frame construction covers the facade, cladded with an imprinted perforated steel screen, resembling the earth's life giving forms, water [blue], earth [brown], and nature [green]. This labyrinth of colours mimic an animal skin pattern, resembling the biomimicry principle, giving the building a dynamic edge.

The east facade of the two sub-wings host the vertical fire stairs and gives a solid edge to the building

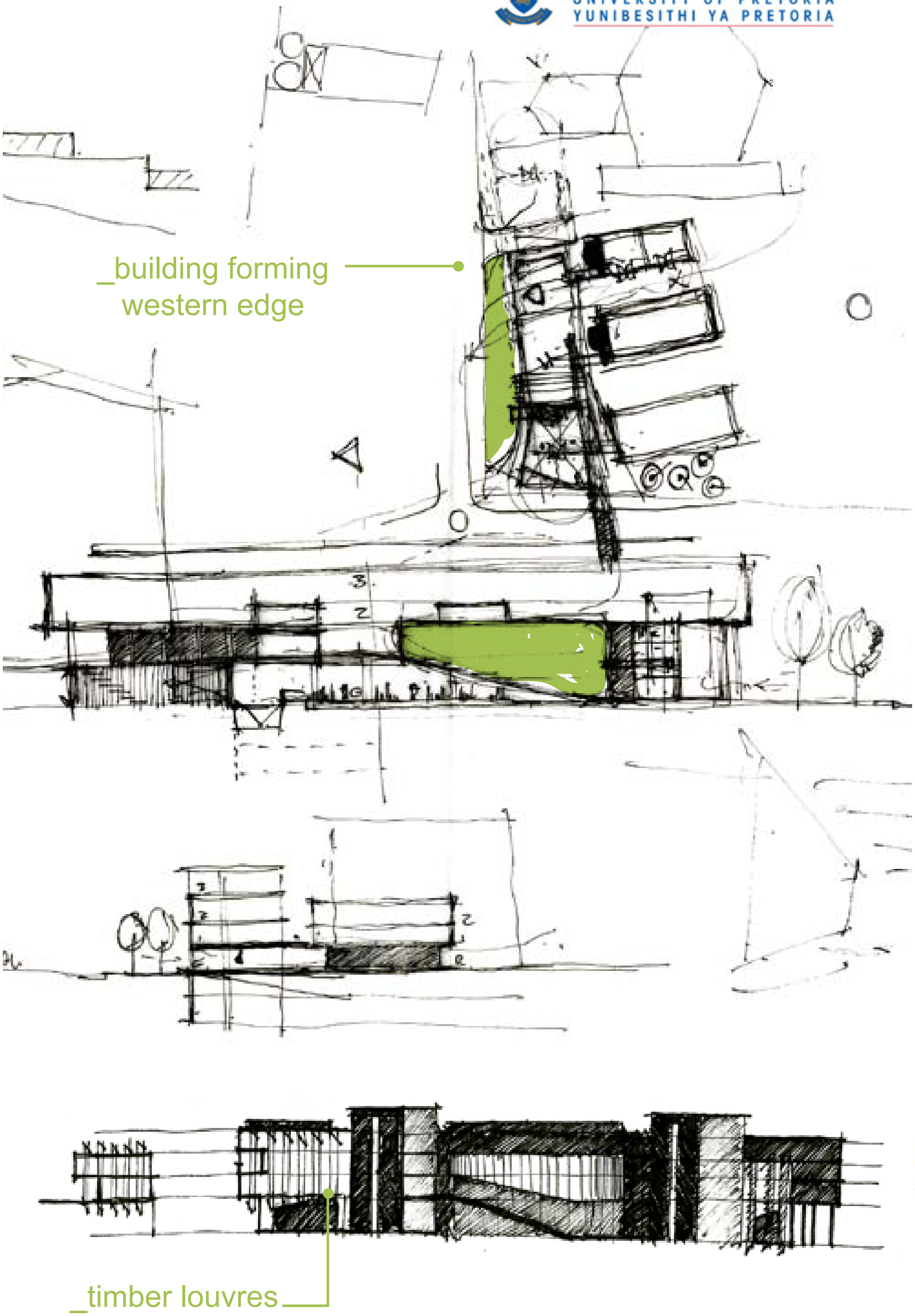
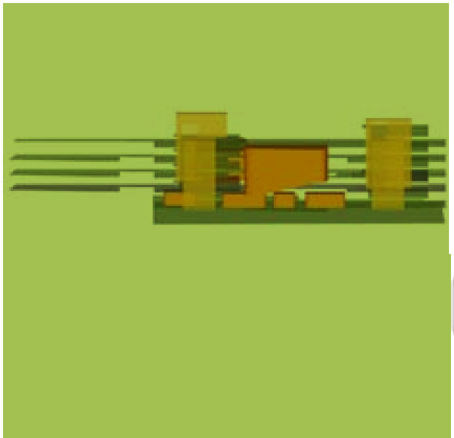


fig. 192 concept development of west facade

_west facade

The facade forms the edge alongside the ring road, creating a semi-public courtyard. It hosts the service cores and vertical circulation zones as well as the main auditorium, linking all the building functions to the heart of the building. The facade treatment differ, stacking chimneys at regular intervals, with wind turbines illustrate the ventilation system in place. These structures create a rhythm alongside the facade. Further facade treatment includes vertical louvres following the sun pattern, driven by solar power and made of a relatively new material on the market bamboo. The bamboo louvres are connected to a steel frame sub-structure, which is connected to horizontal placed I-beam structure, connected to the stacking chimneys by a fixing plate. These louvres allow the control of the micro-climate of the building and prevent latent heat gain during summer months. The facade becomes one of the buildings' dynamic features. Alternatives to bamboo louvres were investigated, depending on the clients' preference and its cost effectiveness.
_planted screen
_perforated steel
_solar panels
_recycled wood



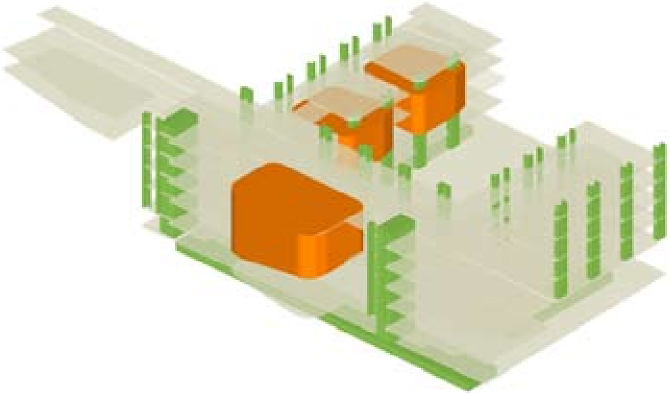
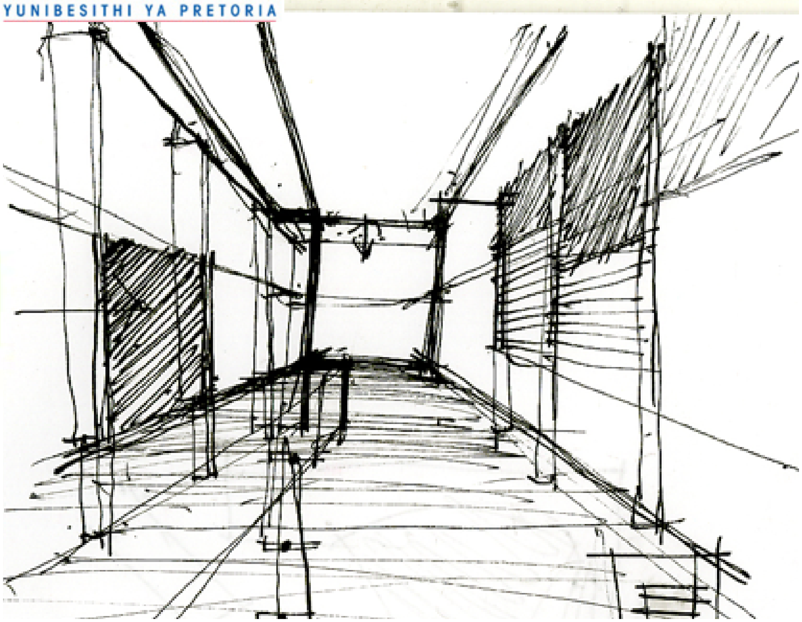


fig. 193 [a]



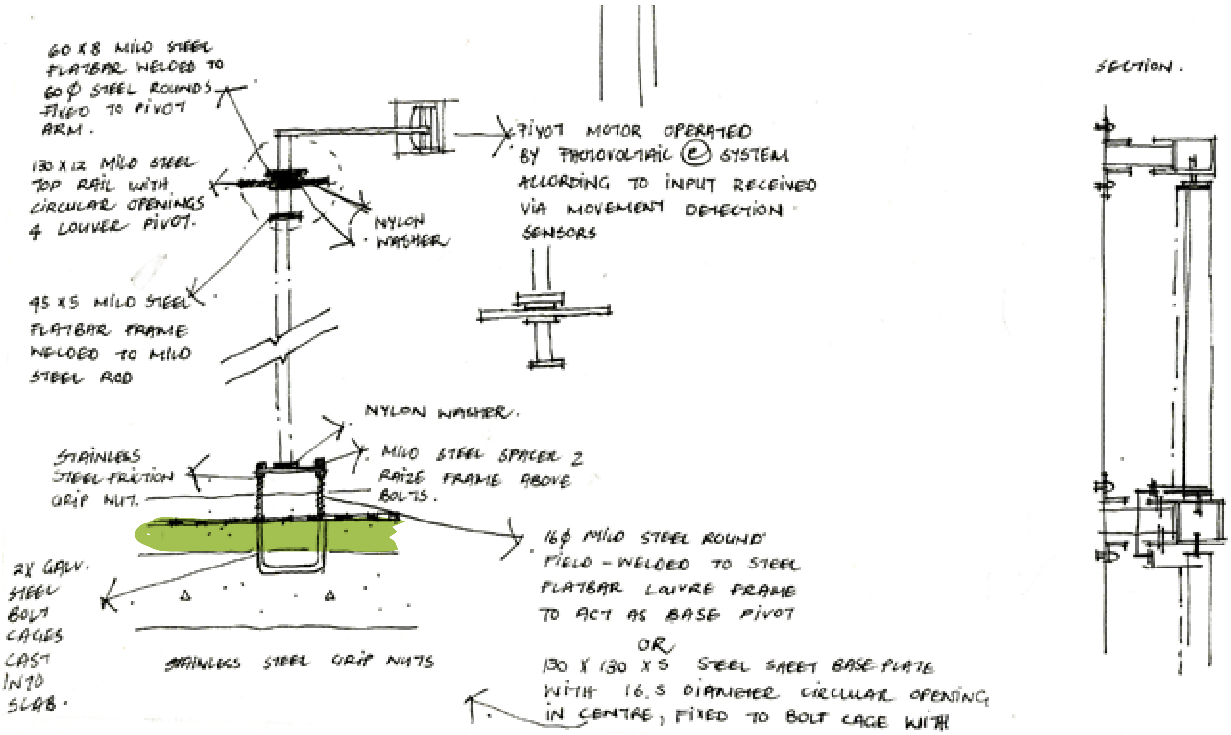


fig. 193 [b] concept construction details of west facade louvre system

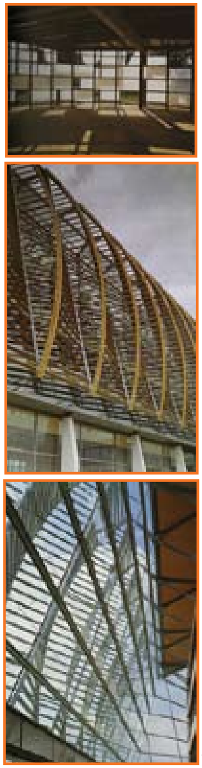


fig. 194 [a]

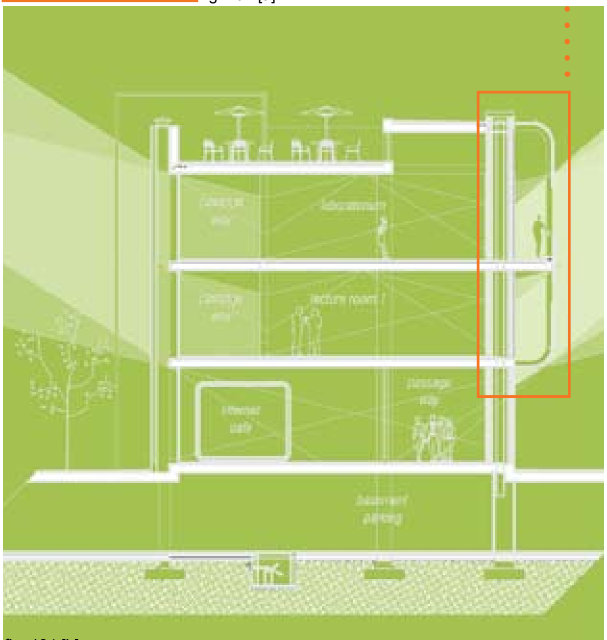


fig. 194 [b]

_south facade

The northern sub-wing, hosting the two lecture rooms, is screened on the southern facade, with balconies living out onto the courtyard. A small amount of southern light will penetrate directly into the lecture rooms, workshop and laboratory.
The southern sub-wing, offers views to the street and its famous fever trees. With the library and an office level at the top, the green corridor offers a tranquil feel, ideal for these functions. This facade has clerestory windows to allow light to enter the facilities.

_conclusion

The building is well insulated, with triple glazing windows, to ensure the micro-climate is stable, and the ventilation systems is functioning at optimum level. The main auditorium on the Western facade is well insulated, to prevent latent heat entering the building during evening functions. The building is still able to breathe through the passive stack ventilation, producing 100% fresh filtered air to the building. This would prevent sick building syndrome to occur and ensure a healthy micro-climate for the occupant. A closed-loop system, managed mechanically by the building itself, was opted for, since all of the building facilities are not occupied 24/7. This allows the building to save energy. The third floor office level, has specific placed windows for occupants to regulate according to their specific requirements.

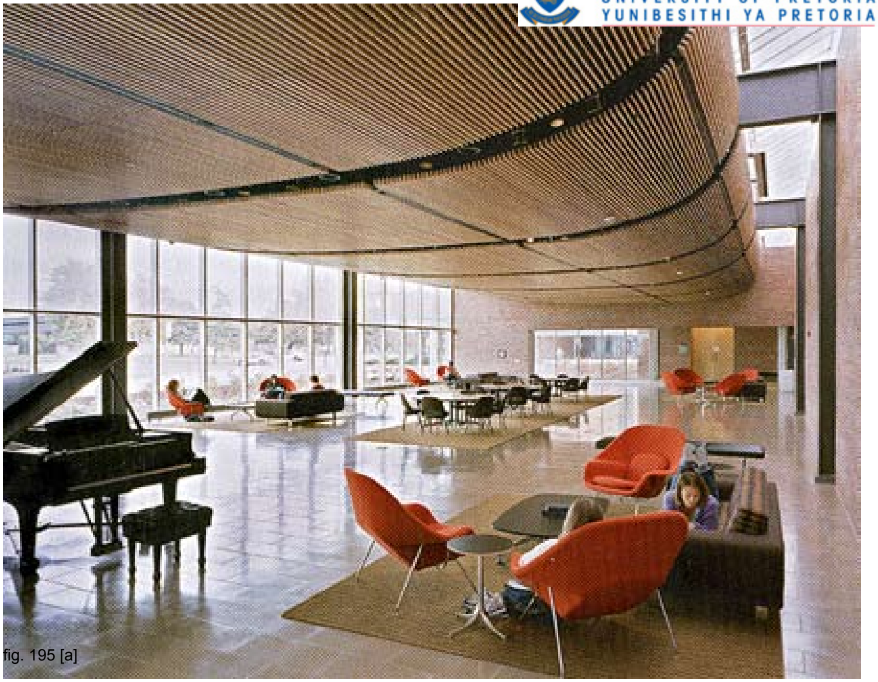


fig. 195 [a]

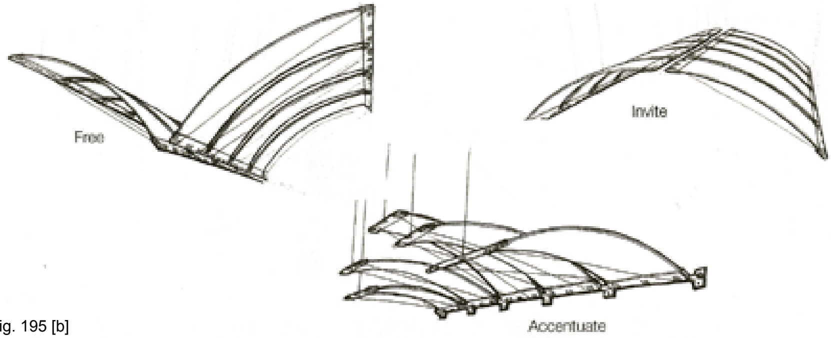


fig. 195 [b]


fig. 195 [c]

_acoustics

The noise levels on campus is relatively low, compared to noise levels in the CBD. The auditorium and lecture rooms, needing a sound-proof environment, is well insulated for this specific purpose.

_auditorium

A 220mm concrete wall, with 80mm mineral wool fibre under open spaces timber battens. The ceilings consists of specific placed acoustic panels, with soft seating and a carpet floor finish for further sound absorption.

_lecture rooms

A 220mm concrete wall, with 80mm mineral wool fibre under open spaces timber battens. Ceilings will assist in sound absorption.

Recommended sound levels:

Room	DB
Reception	45-55
Lecture rooms	30-35
Exhibition space	40-45
Kitchen	45-50
Restaurant	40-50
Auditorium	30-35
Office	35-40
Library	35-40

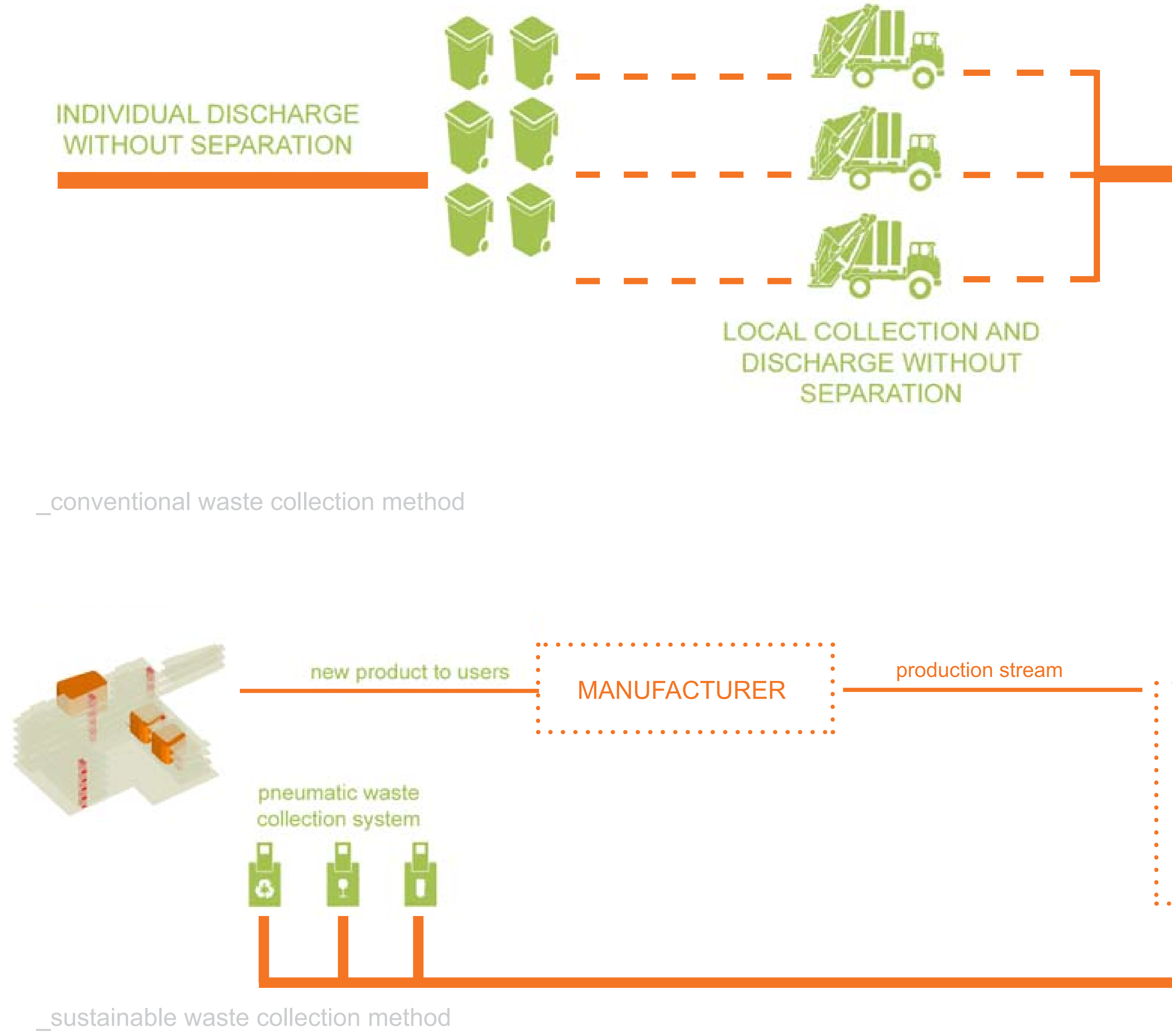
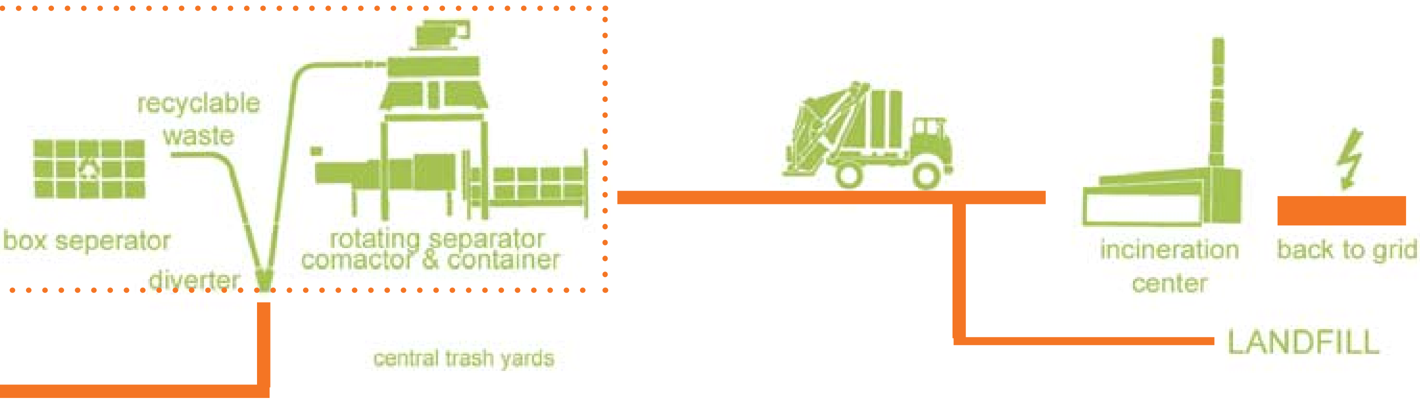
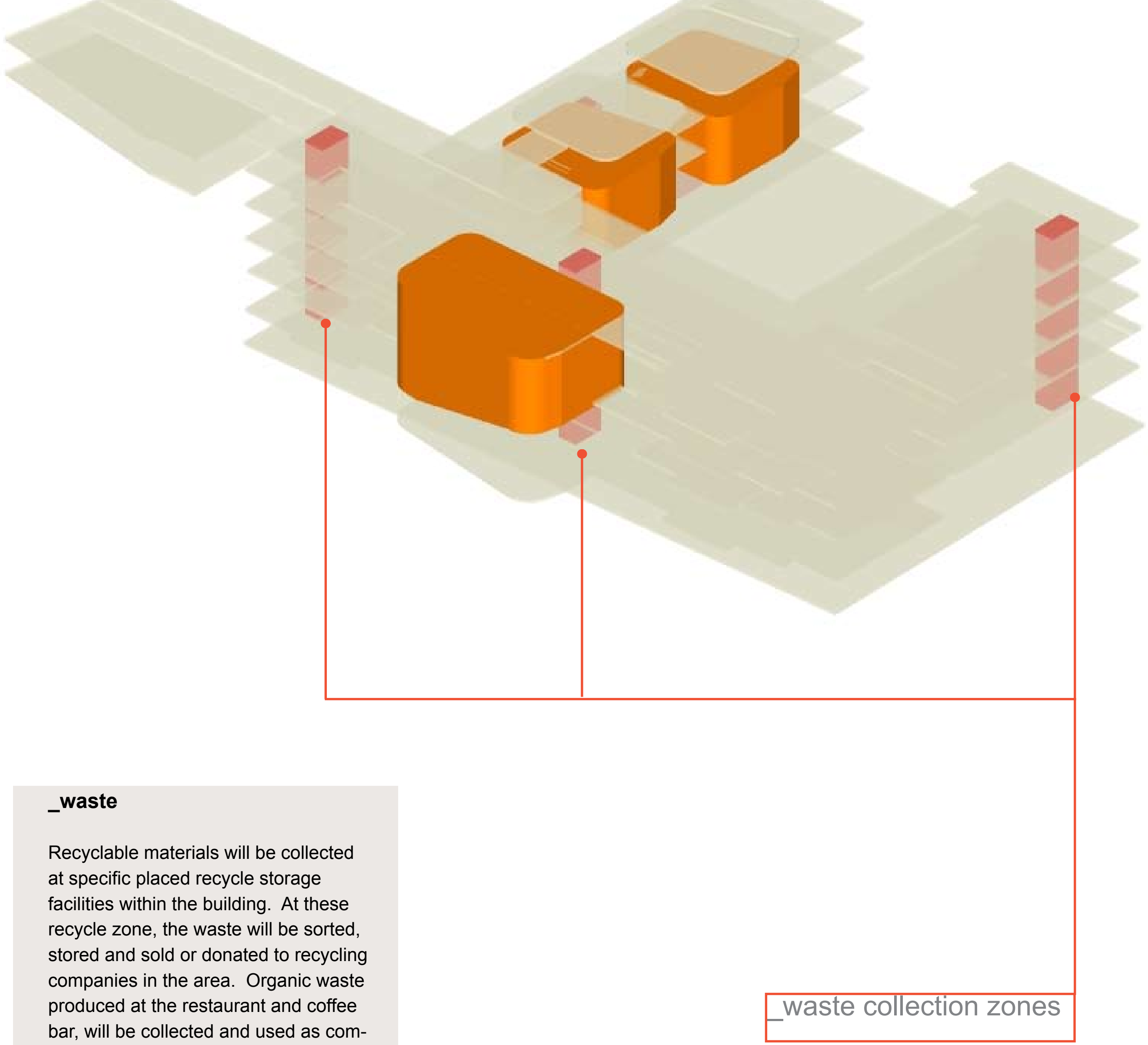


fig 196 [a] schematic diagram illustrating waste collection methods


local waste collection center
LANDFILL

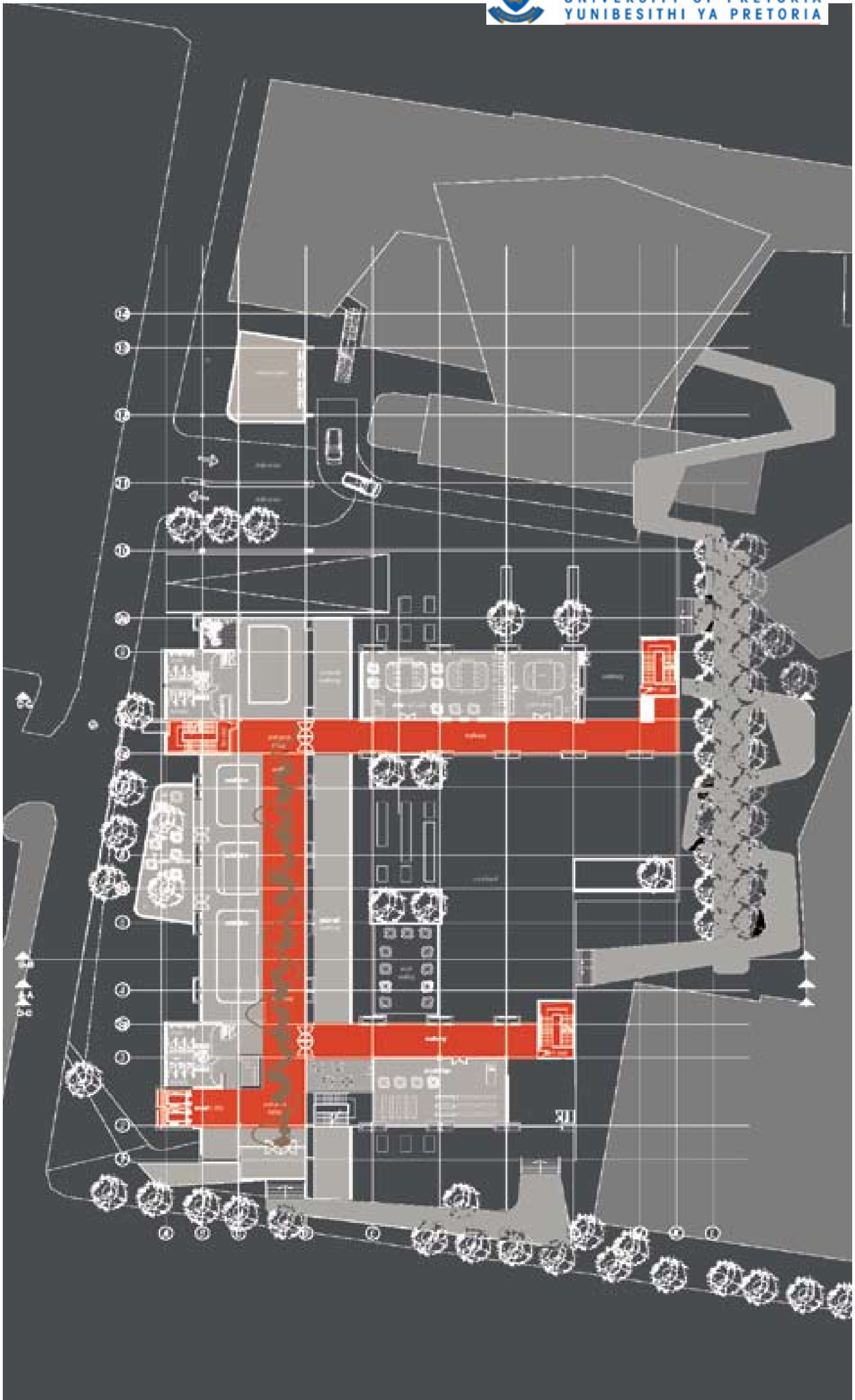

recyclable waste
box seperator
diverter
rotating separator
comactor & container
central trash yards
incineration center
back to grid
LANDFILL



_waste

Recyclable materials will be collected at specific placed recycle storage facilities within the building. At these recycle zone, the waste will be sorted, stored and sold or donated to recycling companies in the area. Organic waste produced at the restaurant and coffee bar, will be collected and used as compost for landscaping and student experiments, planted in the roof garden.

fig. 196 [b] model view of facility's waste collection

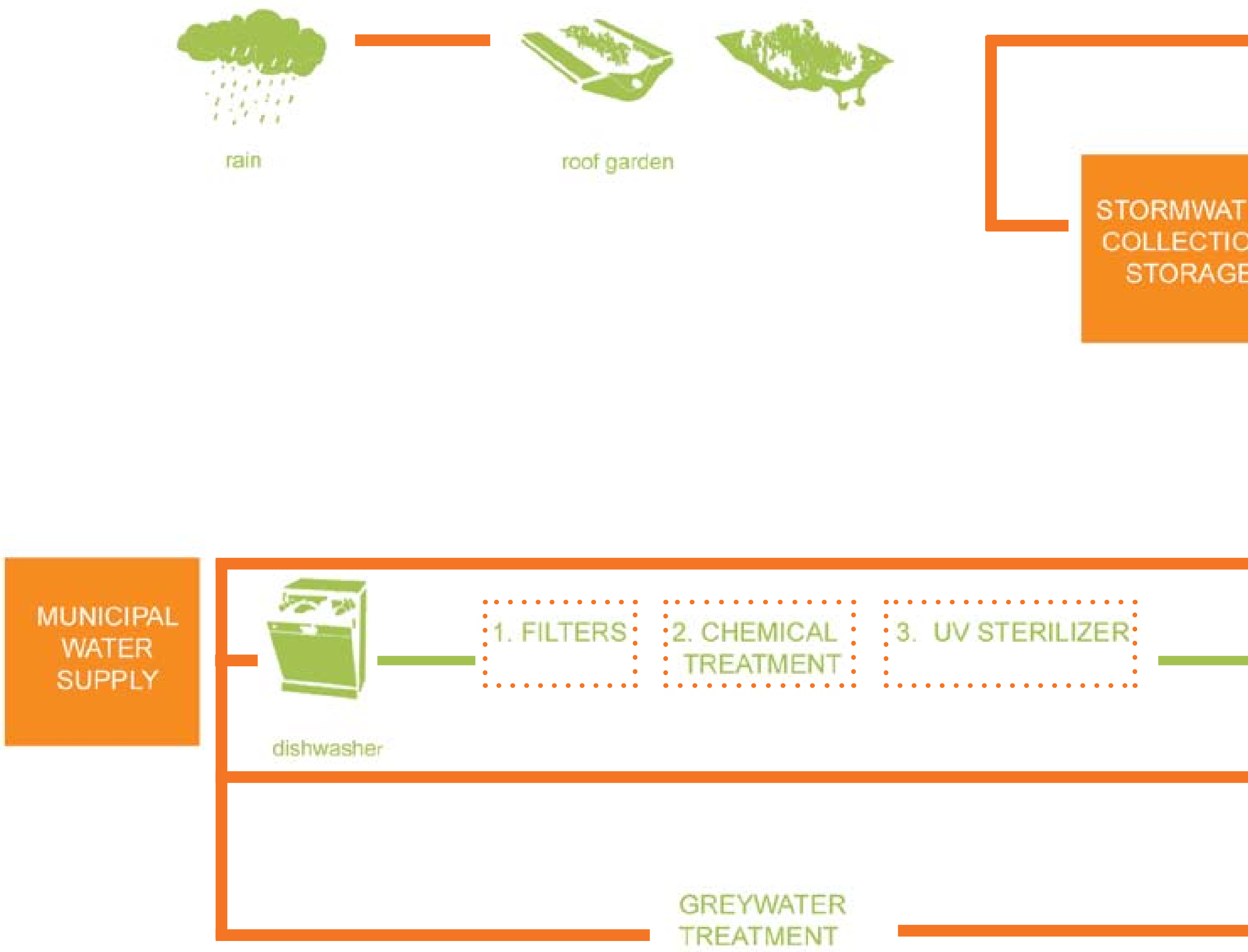


_fire

The escape routes are in accordance with part T of the National Building Regulations, specifying that an escape route may not exceed 45m. A fire detection and sprinkler system, with smoke detectors within the rooms will be installed according to suppliers' specifications. Fire Hose reels are supplied at 30m intervals. These are place in appropriate positions to prevent obstruction from circulation spaces. The fire hose reels and extinguishers are marked clearly with appropriate signage. Emergency exits will be allocated on either side of the building. Lift shafts as well as lift doors will be fire resistant, to prevent fire entering the building from the basement or spreading to other floors.

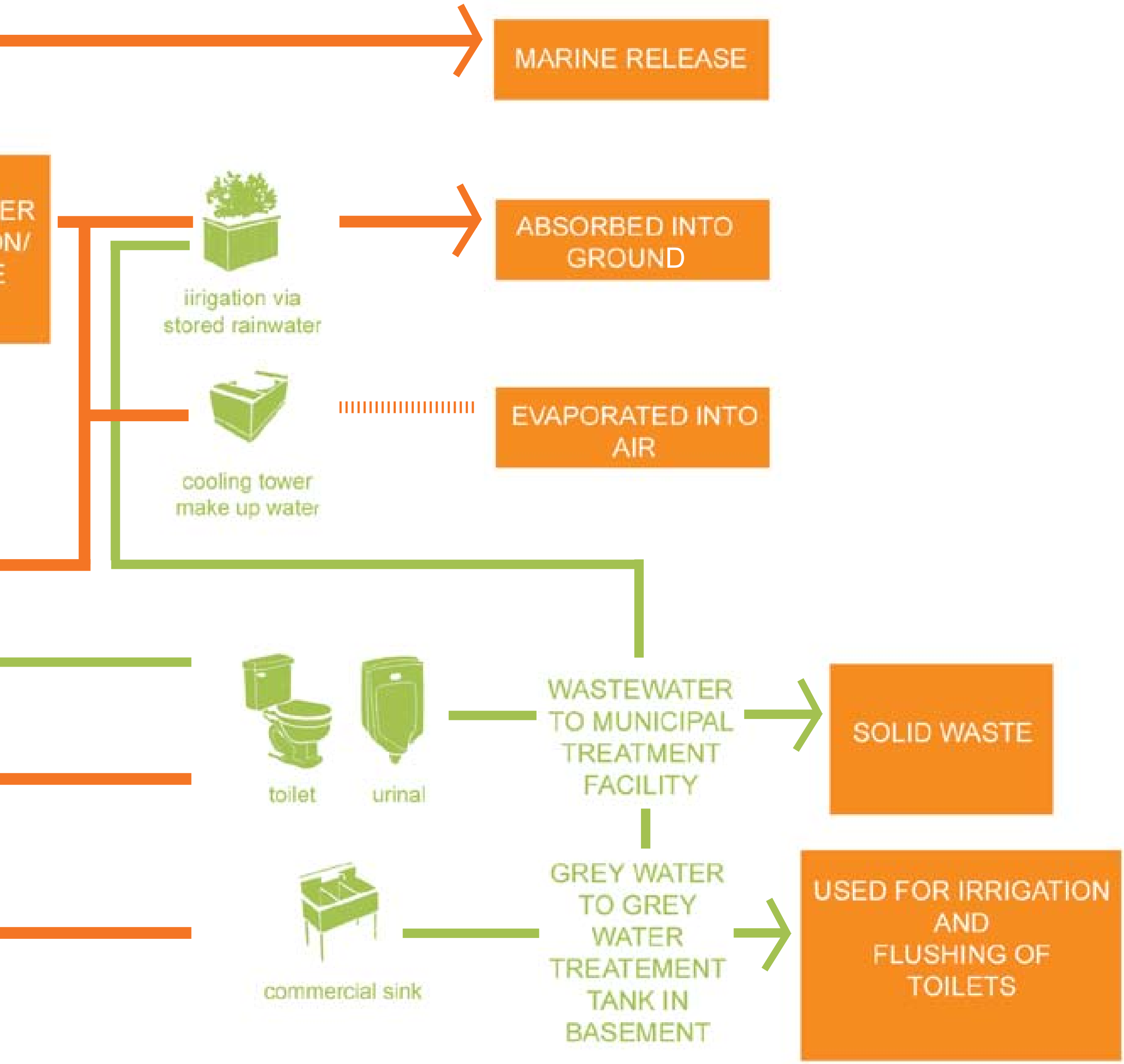
_security

The building will have controlled access at certain points, the library, auditorium, lecture rooms, workshop, laboratory, fire stairs [access from outside], and the office floor level. These specific control points are needed, since most of the building, [ground floor level and first floor level], is used by all campus students.



_water harvesting

fig. 198 schematic diagram illustrating the water harvesting method


ER
ON/
E
MARINE RELEASE
iirigation via
stored rainwater
ABSORBED INTO GROUND
cooling tower
make up water
EVAPORATED INTO AIR
toilet
urinal
WASTEWATER TO MUNICIPAL TREATMENT FACILITY
SOLID WASTE
commercial sink
GREY WATER TO GREY WATER TREATEMENT TANK IN BASEMENT
USED FOR IRRIGATION AND FLUSHING OF TOILETS

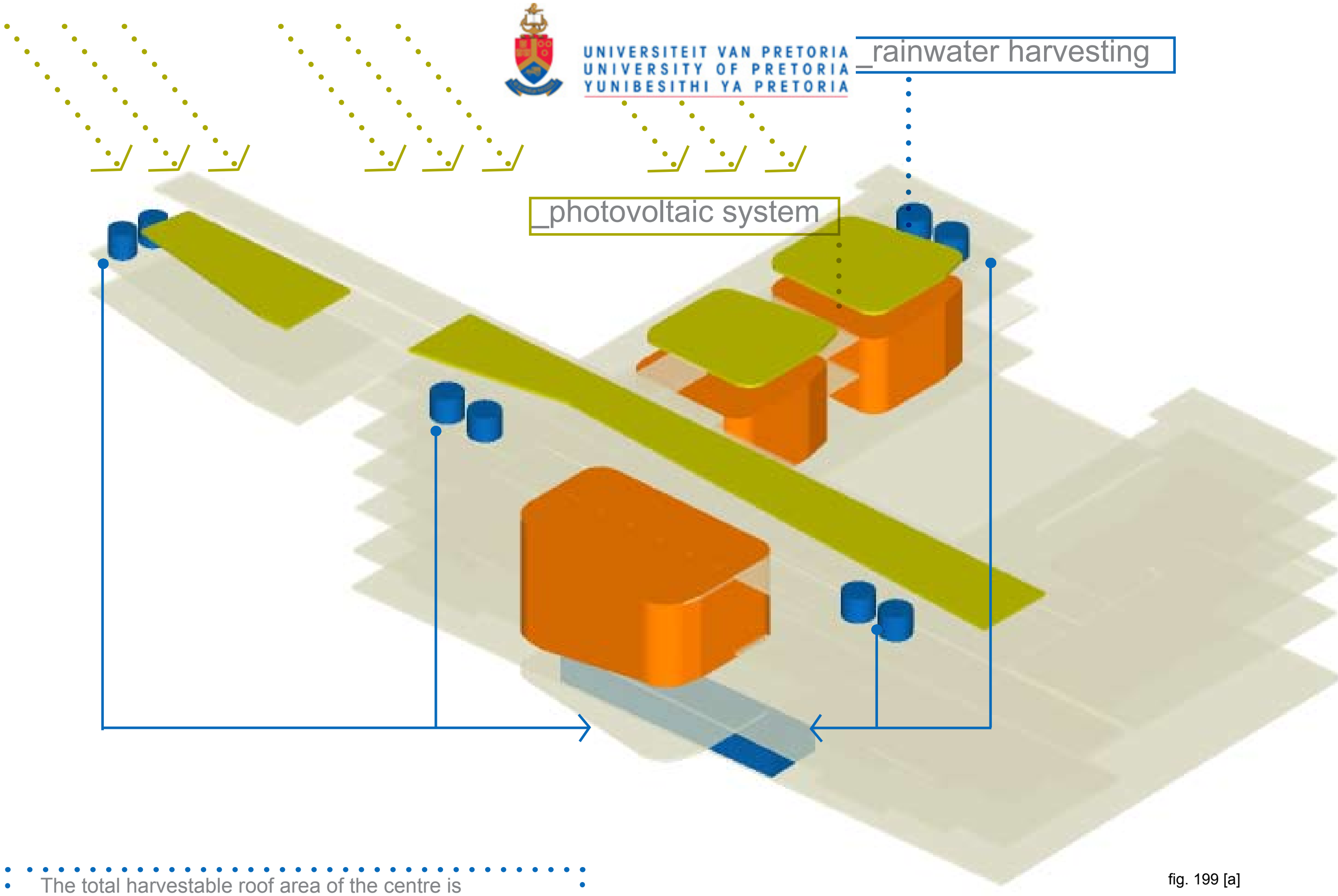


fig. 199 [a]

The total harvestable roof area of the centre is 1244m2. The possible annual savings by using the grey water for flushing of WC's and for irrigation is:

_potential annual rainwater harvesting volume:

Total roof area	= 1244m2
Approximate annual rainfall	= 745.25mm
	= 1244 x 0.74525
	= 927.091m3
	= 927 274 l

_highest monthly rainfall [November] harvesting for sizing of water storage:

Total roof area	= 1244m2
Approximate annual rainfall	= 168.8mm
	= 1244 x 0.1688
	= 209.9872m3
	= 209 9872 l

_harvested rainwater volume = 923.3 m3
_current cost per 1 m3 = R10
_possible annual savings = R9 233

	Aggregate rainfall in mm/ month for the Pretoria area:	Total water harvesting area = 1244m2 Total amount of water harvested [kl]
January	101.3	126
February	108.8	134
March	63.8	79
April	37.5	47
May	48.4	60
June	3.8	4.7
July	2.3	2.8
August	2.3	2.8
September	11.3	14
October	82.5	103
November	168.8	210
December	112.5	140
	745.27 mm	923.3 kl

fig. 199 [b] table of water storage requirements

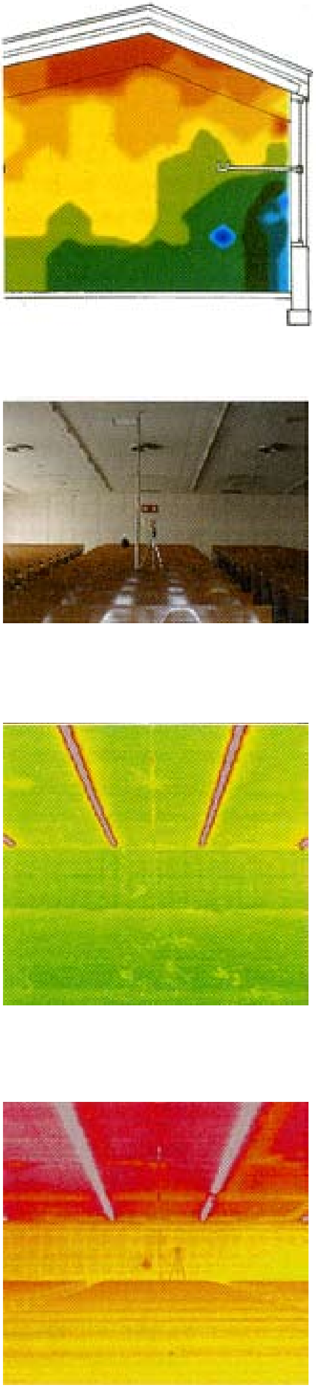


fig. 200 [a]

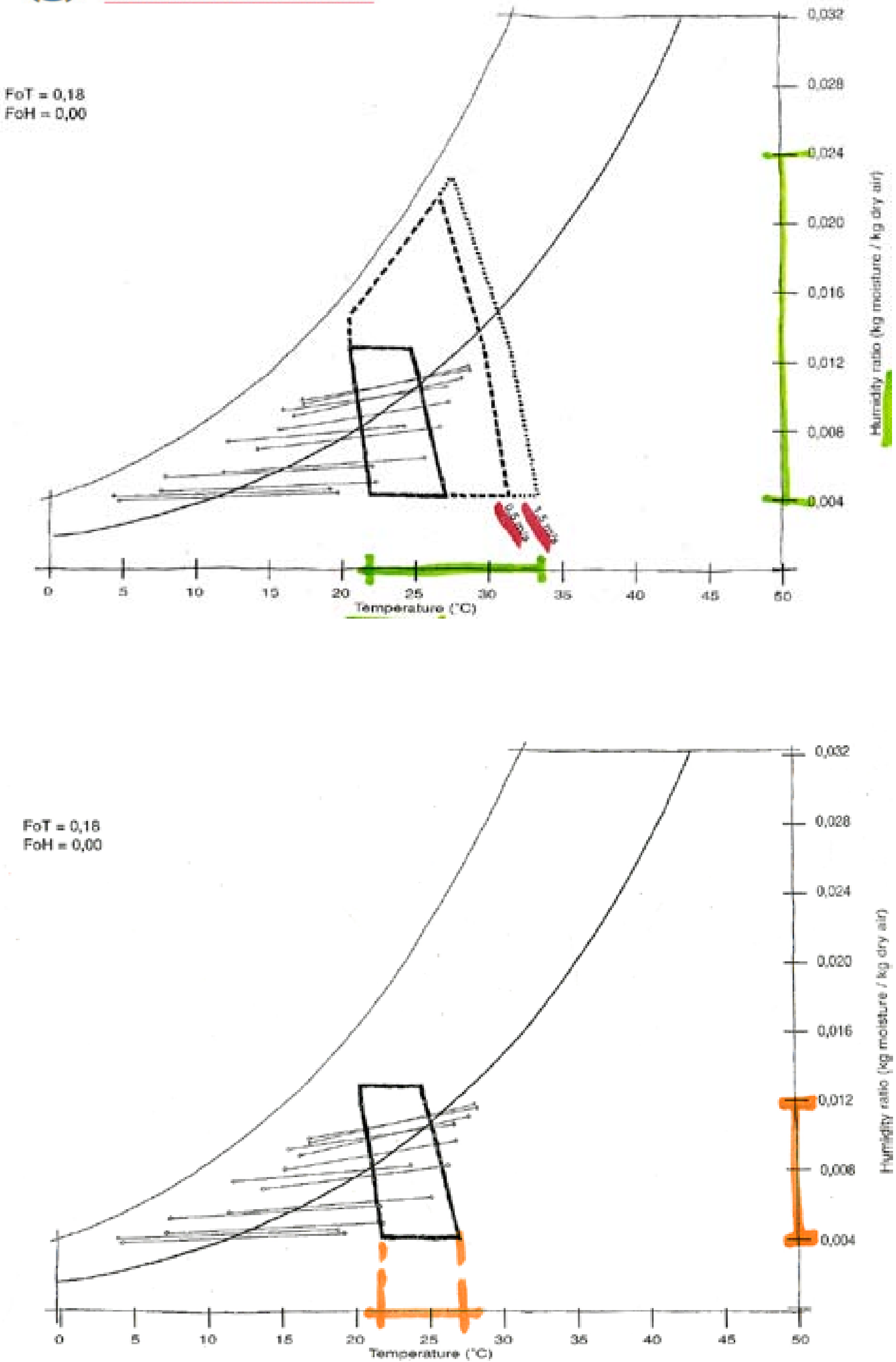


fig. 200 [b]

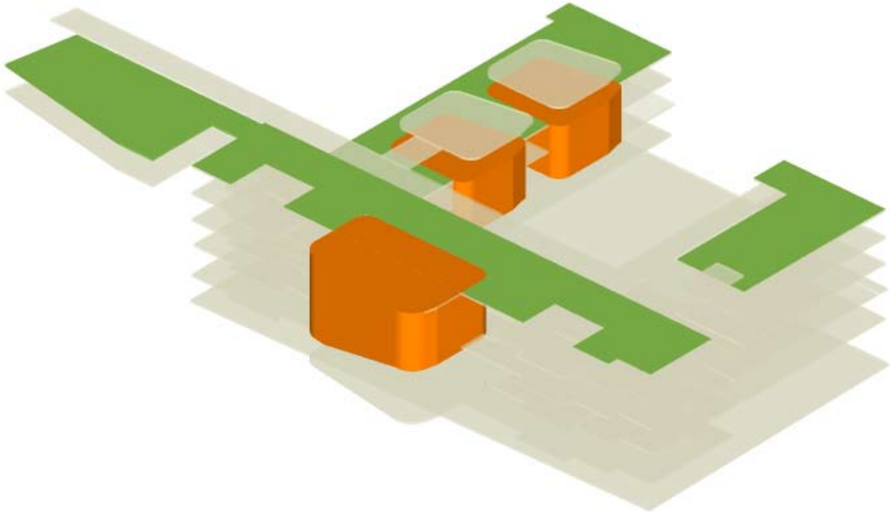


fig. 200 [c]

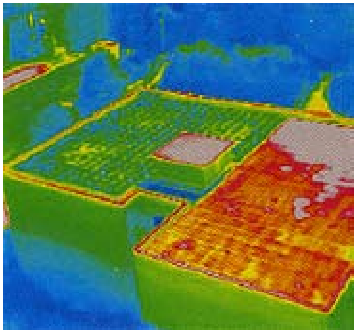


fig. 200 [d]

The roof [1244 m2], will be used as a roof garden and further utilized for rainwater harvesting. To reduce water consumption, rainwater from the roof as well as greywater from basins and air-conditioning cooler units is camputered and stored in a concrete tank, sealed with epoxy, placed in the basement. Low flushing toilets, waterless urinals and taps with sensors to limit water consumption.

The roof garden will function as the fifth elevation of the building. It has a high insulation value, filtrate rainwater for water storage, allow recreational activities to take place, can be utilized for experimental purposes and host solar panels for solar water heating.

Photovoltaic panels [1.7 x 2.3m] will be used to heat water for the absorption chillers. The water will be stored in central placed hot water storage tanks and from there distributed to the restaurant kitechen, to the absorption chiller plant within the basement and during winter months to the water pipes within the concrete floor slabs.

The panels will also be used as an electricity source to rotate the western facades' vertical louvre system.

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technical drawings

01___vehicular entrance
02___chiller plant
03___water storage tank
04___service core
05___lift lobby
06___fire stair
07___fire stair

_level -01: basement


01
02
04
03
05
D
E
F
G
H
J
K
L

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01___entrance foyer
02___toilets
03___exhibition space
04___outside seating deck
05___event space
06___coffee bar
07___internet cafe
08___print shop
09___fire stairs
10___outside seating deck
11___book shop
12___service and delivery yard
13___the aula
14___the amfi-theatre
15___the musaion
16___micro-electronic faculty
17___engineer warehouse

_level 00: ground floor

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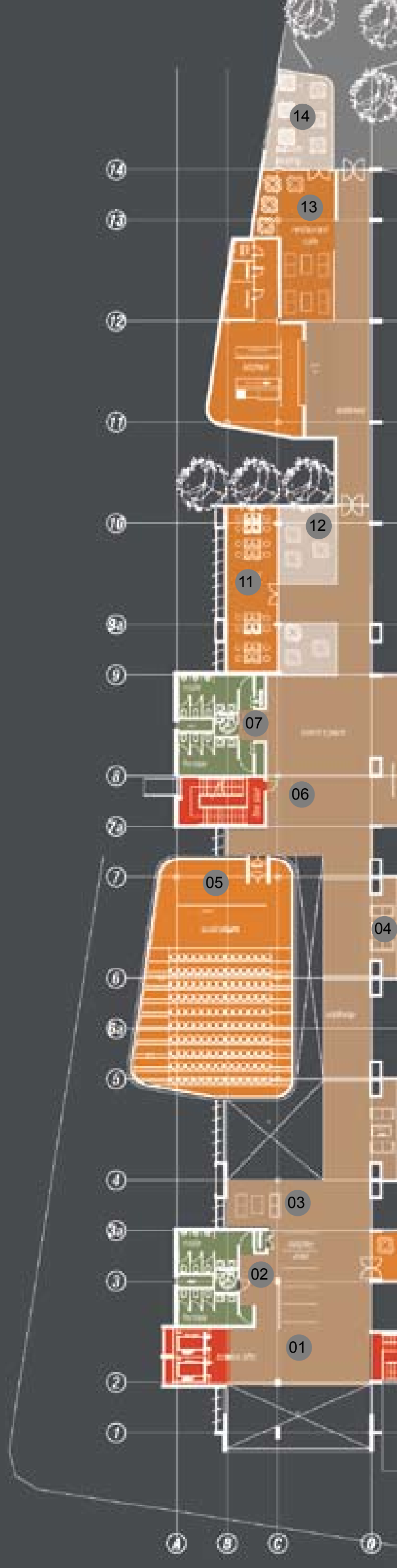
01___entrance foyer
02___toilets
03___lounge area
04___pause area
05___auditorium
06___event space
07___toilets
08___lecture room
09___lecture room
10___event space
11___digital lab
12___seating
13___restaurant
14___outside seating deck
15___library



_level 01: first floor

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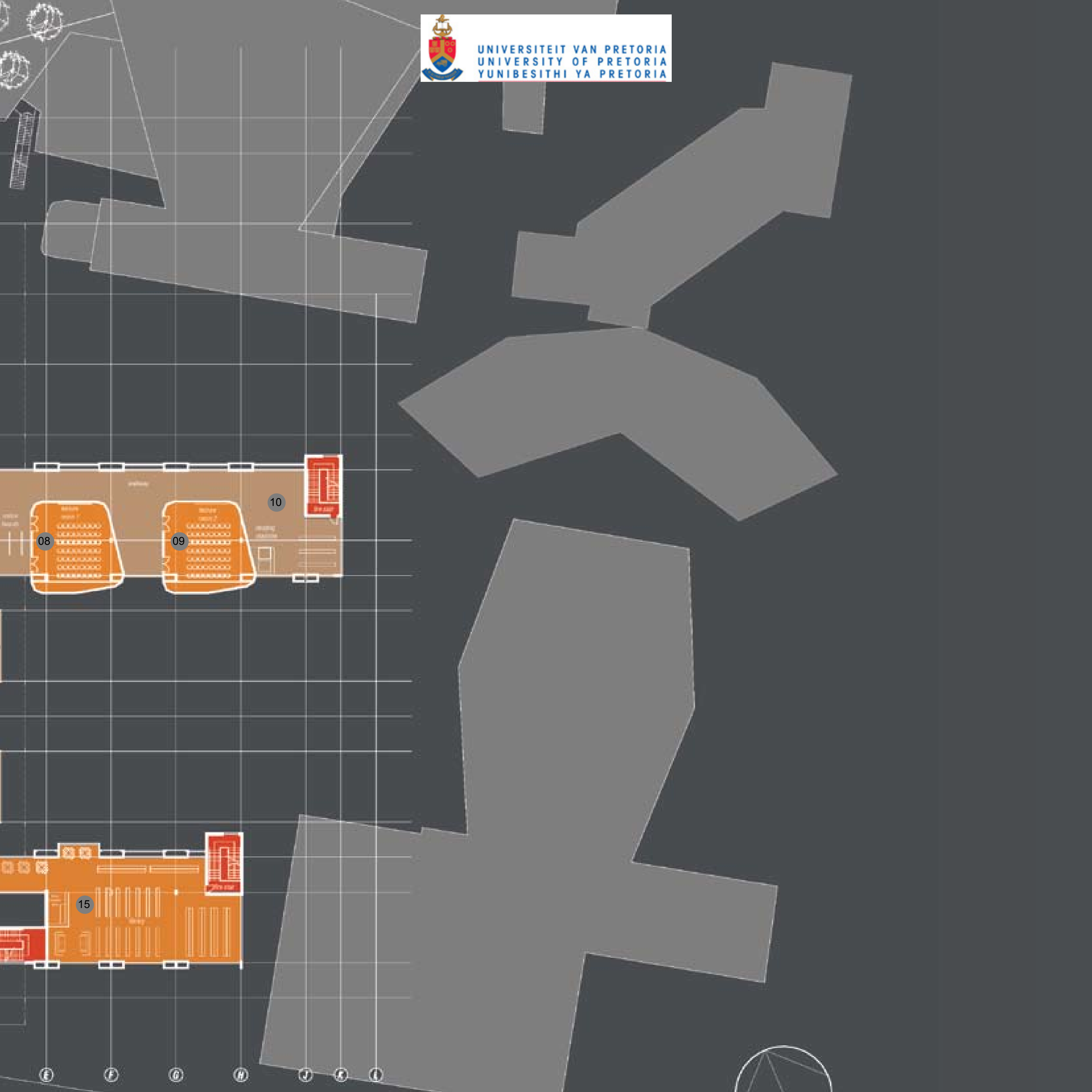

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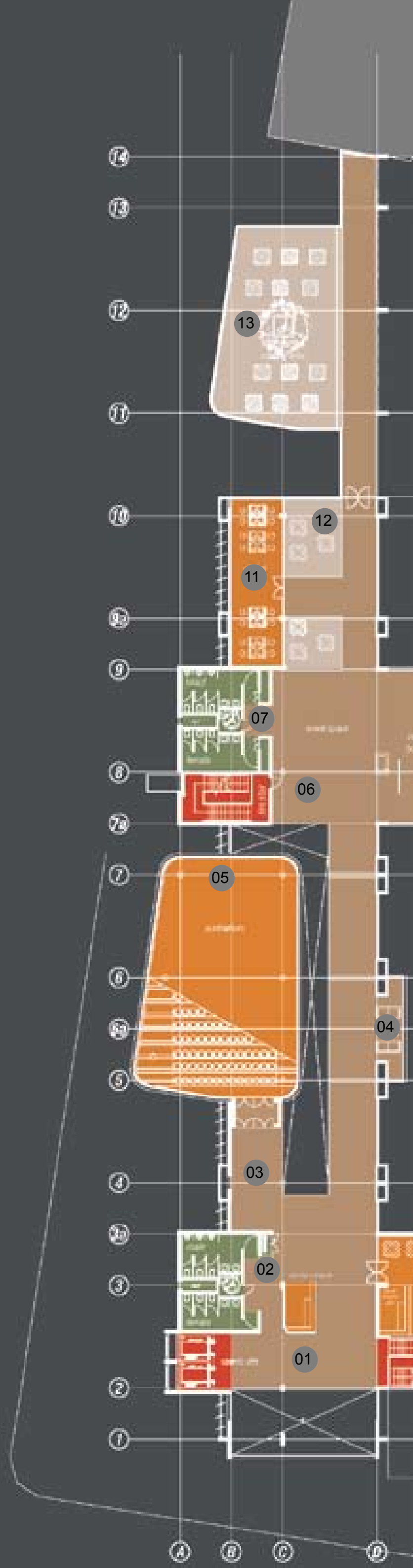
01___snack bar
02___toilets
03___auditorium lobby
04___pause area
05___auditorium
06___event space
07___toilets
08___laboratory
09___workshop
10___event space
11___digital lab
12___seating
13___restaurant outside seating
14___library

_level 02: second floor



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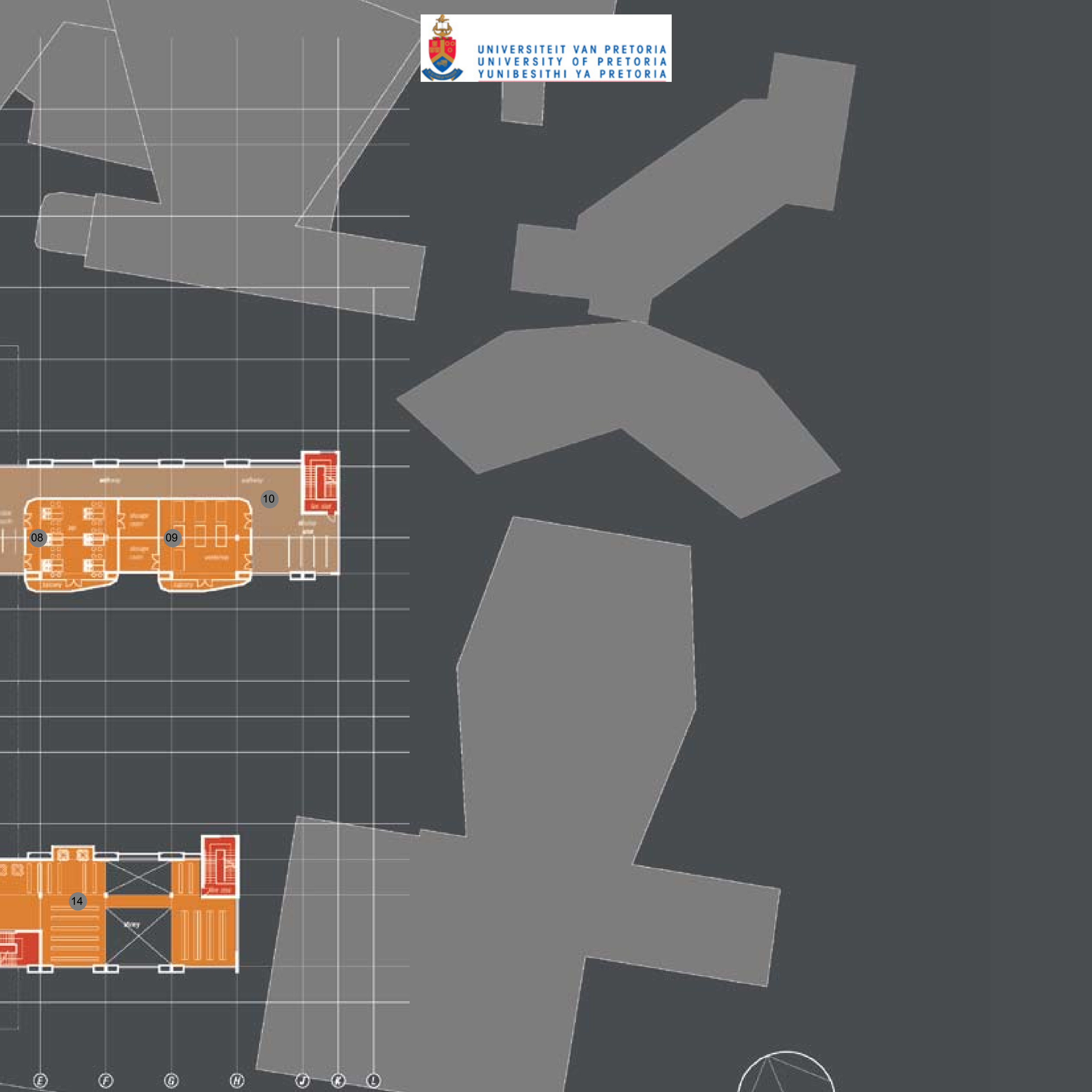

01___pause area
02___toilets
03___offices
04___meeting room
05___auditorium
06___lobby area
07___toilets
08___tea room
09___outside seating
10___roof garden
11___offices
12___offices

_level 03: third floor

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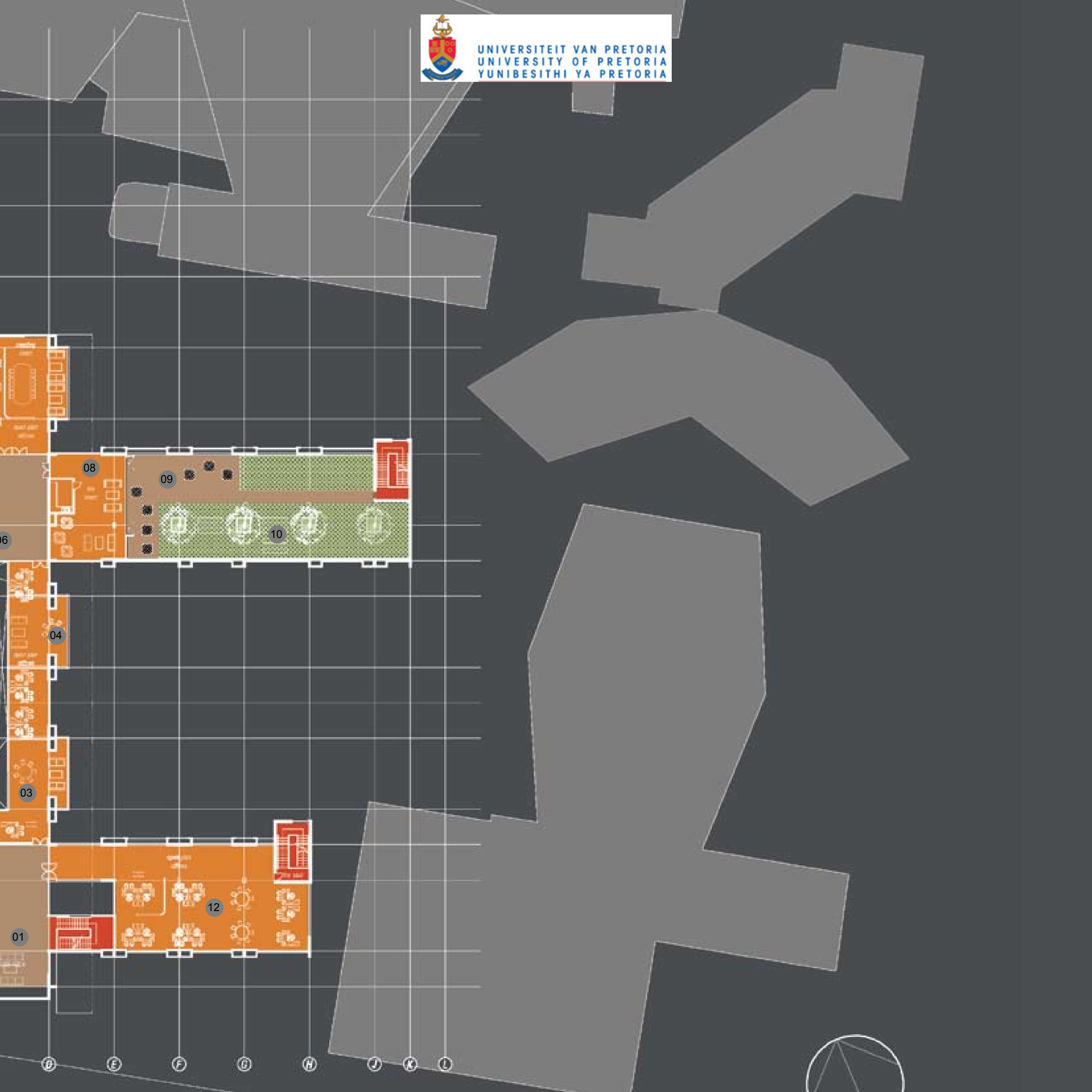
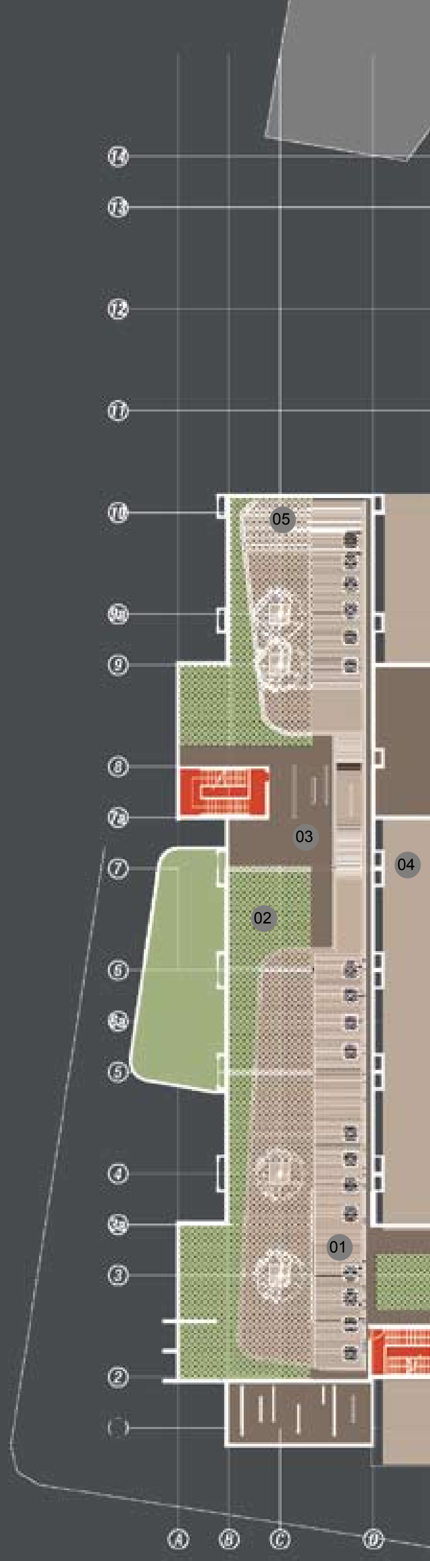


01___solar panels
02___green roof
03___skylights
04___external walkway roof
05___solar panels
06___green roof



_level 04: roof

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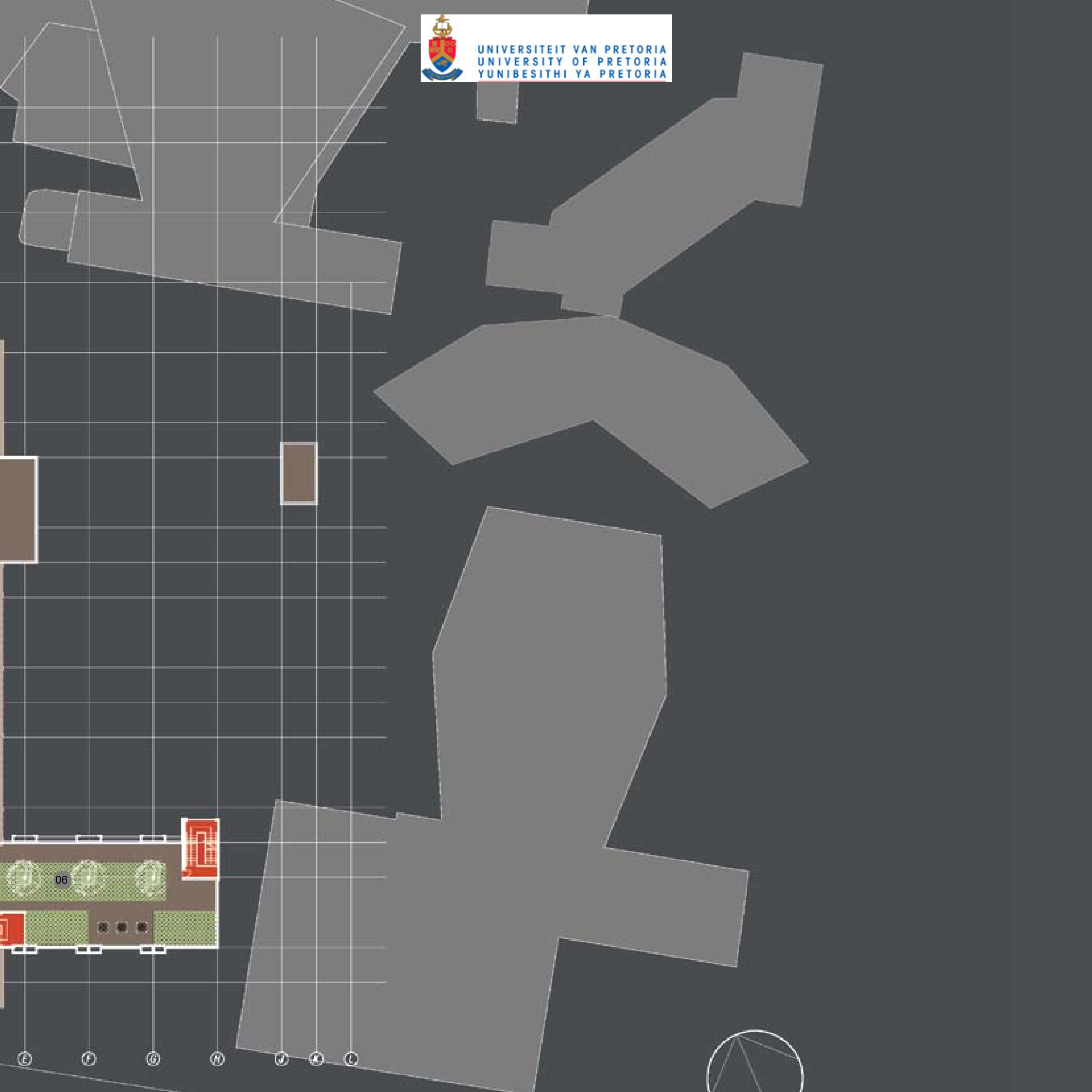
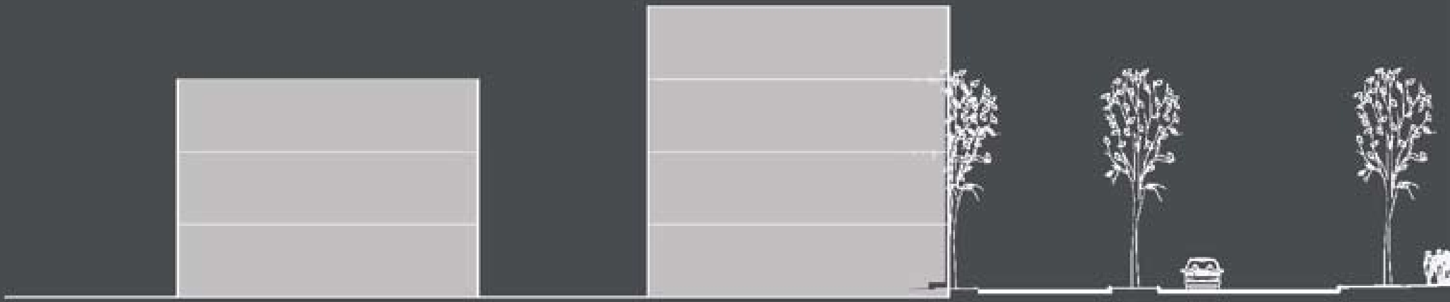
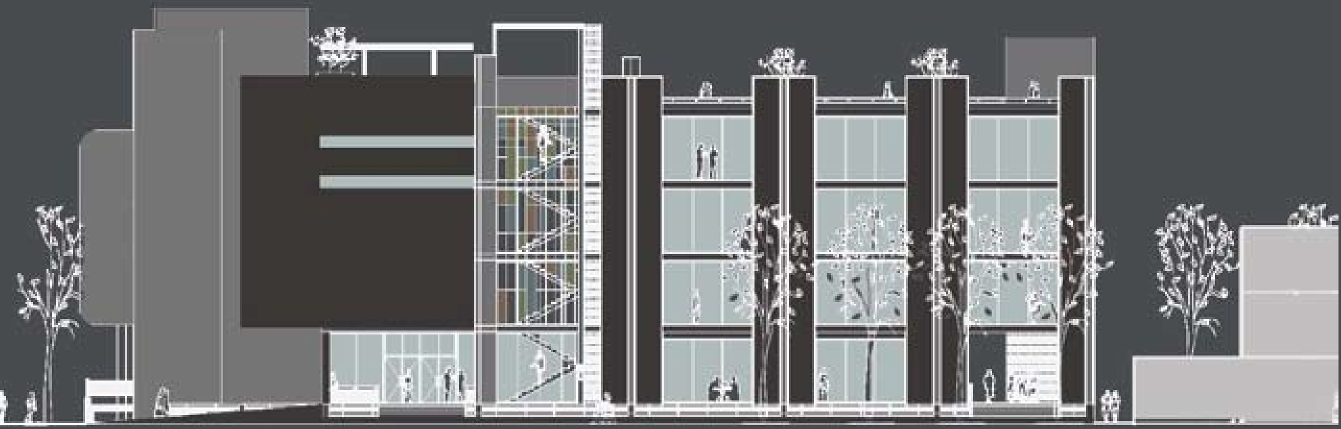
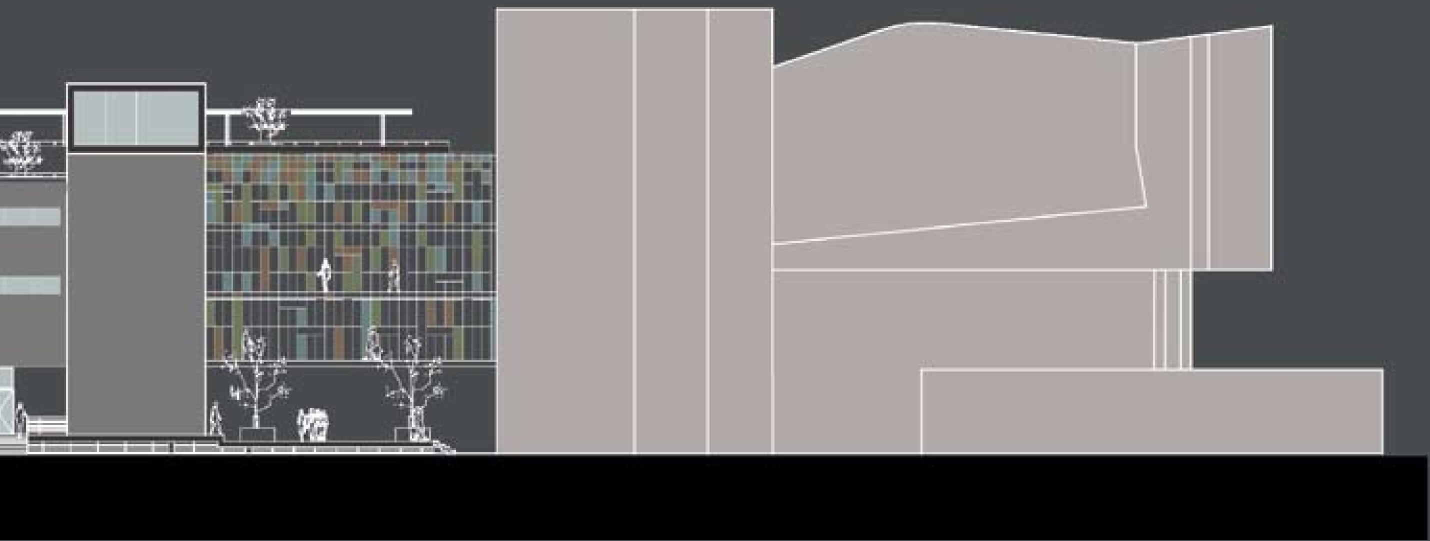


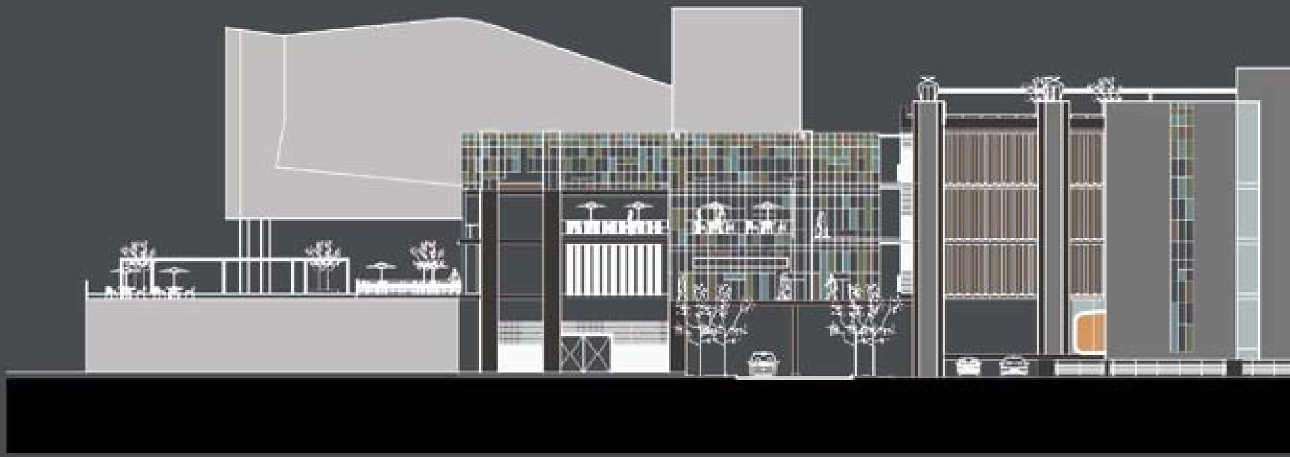


_south elevation

_east elevation







_west elevation

_north elevation

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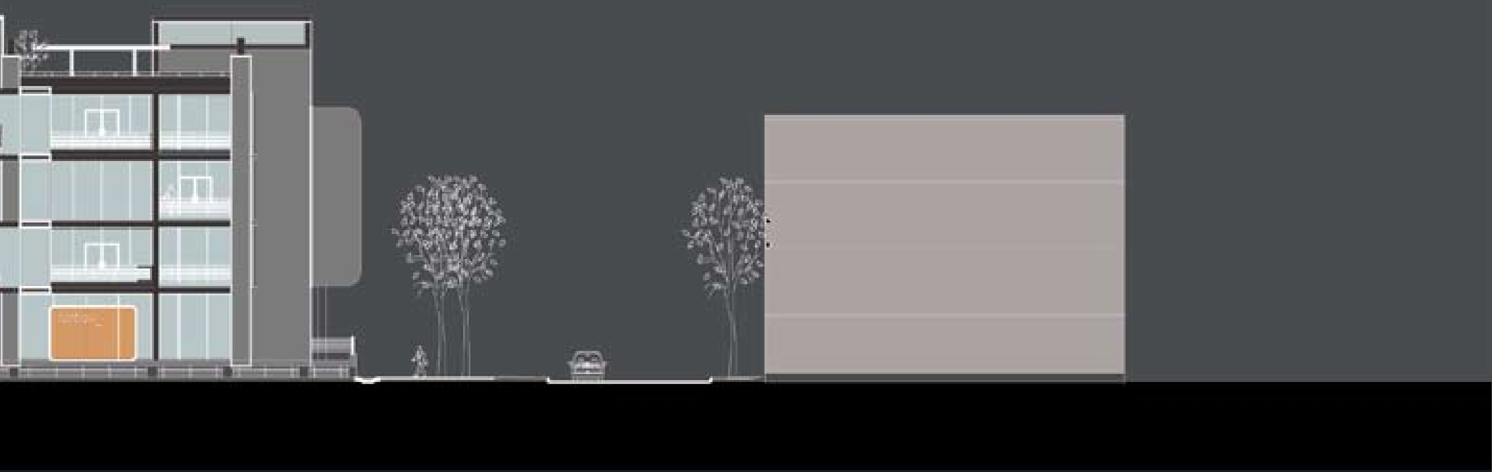
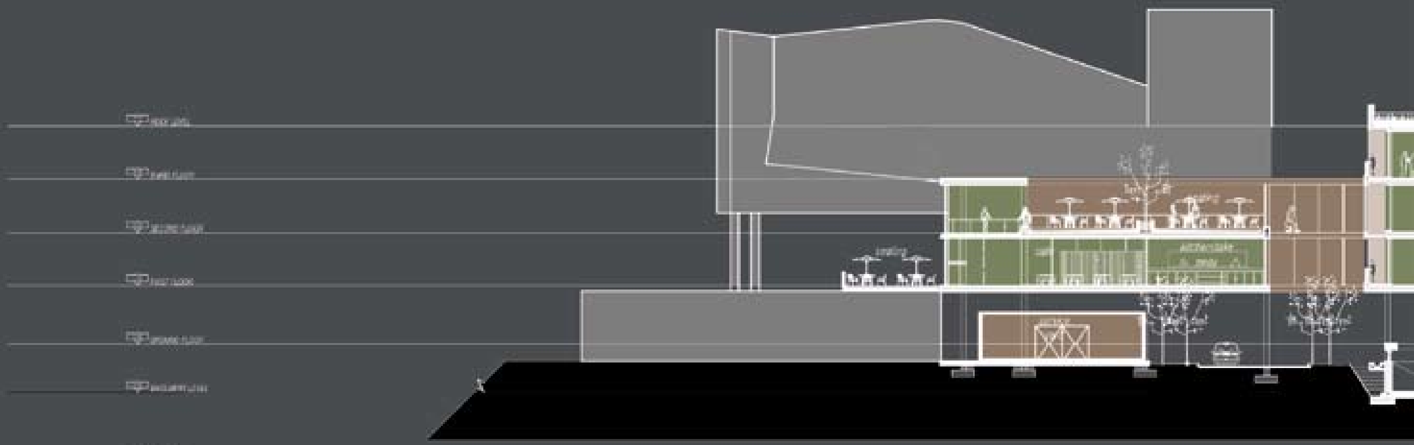
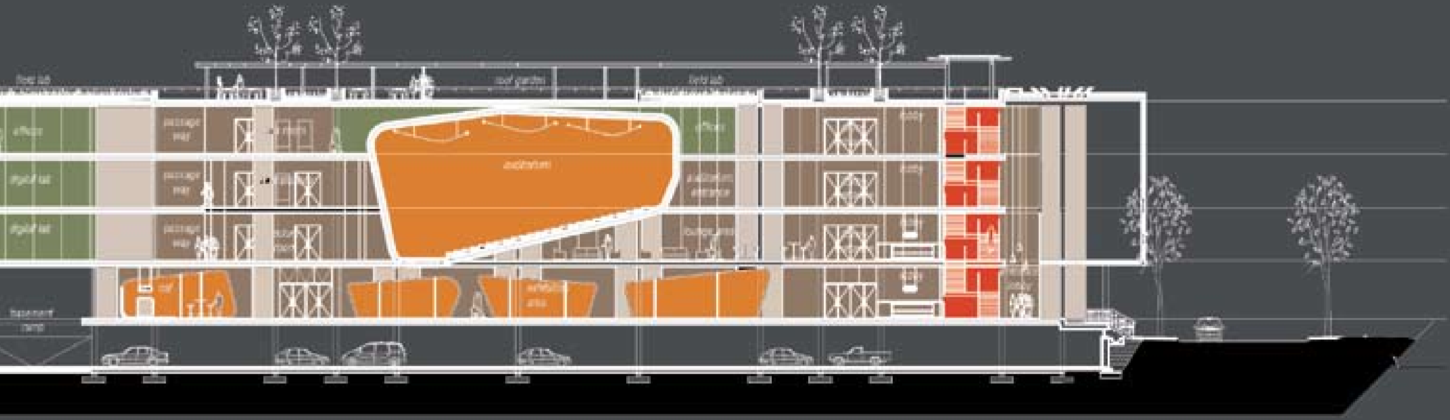
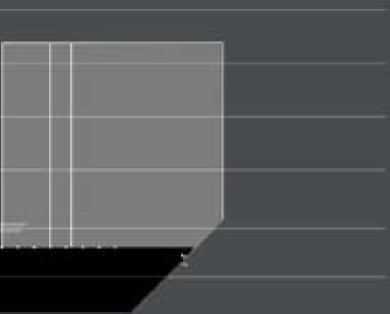


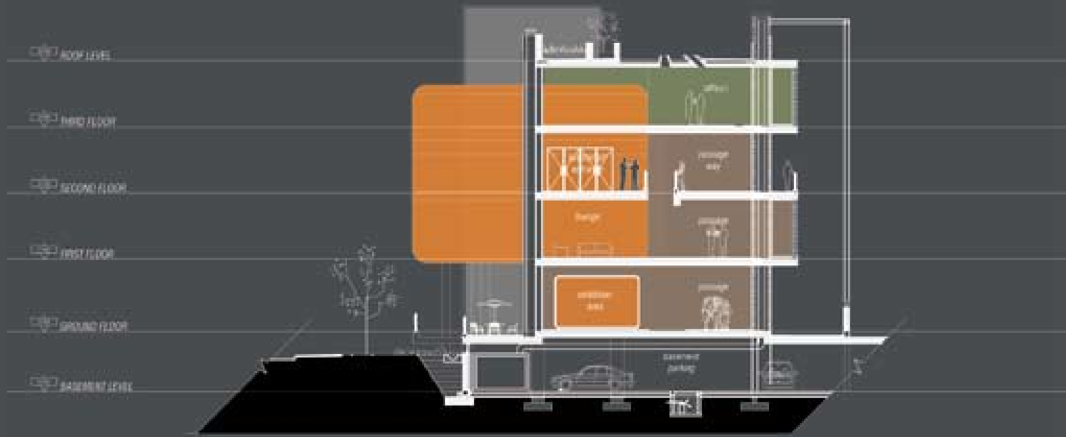


SECTION
C-C

SECTION
C-C



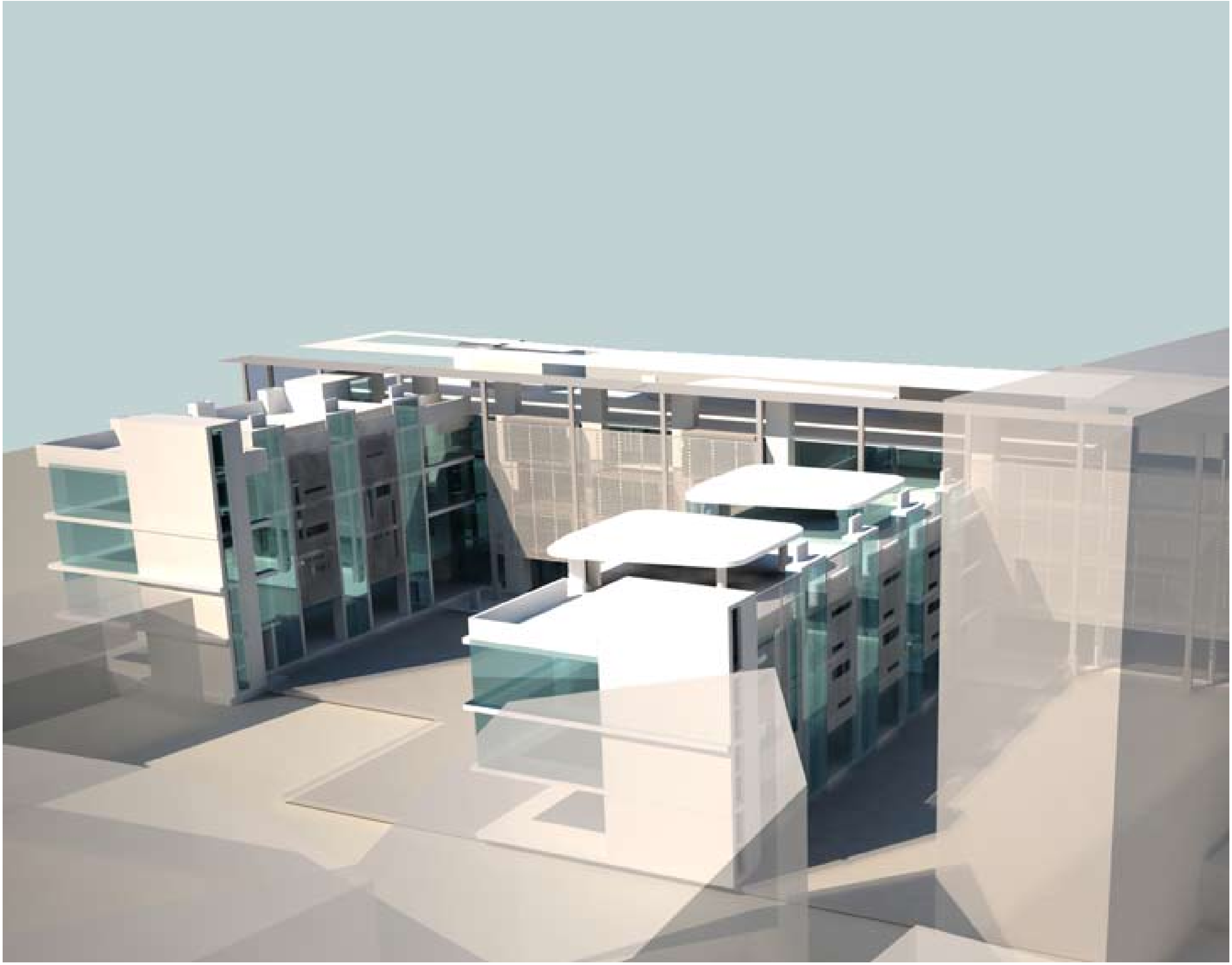



ROOF LEVEL
THIRD FLOOR
SECOND FLOOR
FIRST FLOOR
GROUND FLOOR
BASEMENT LEVEL

_western entrance

_west facade

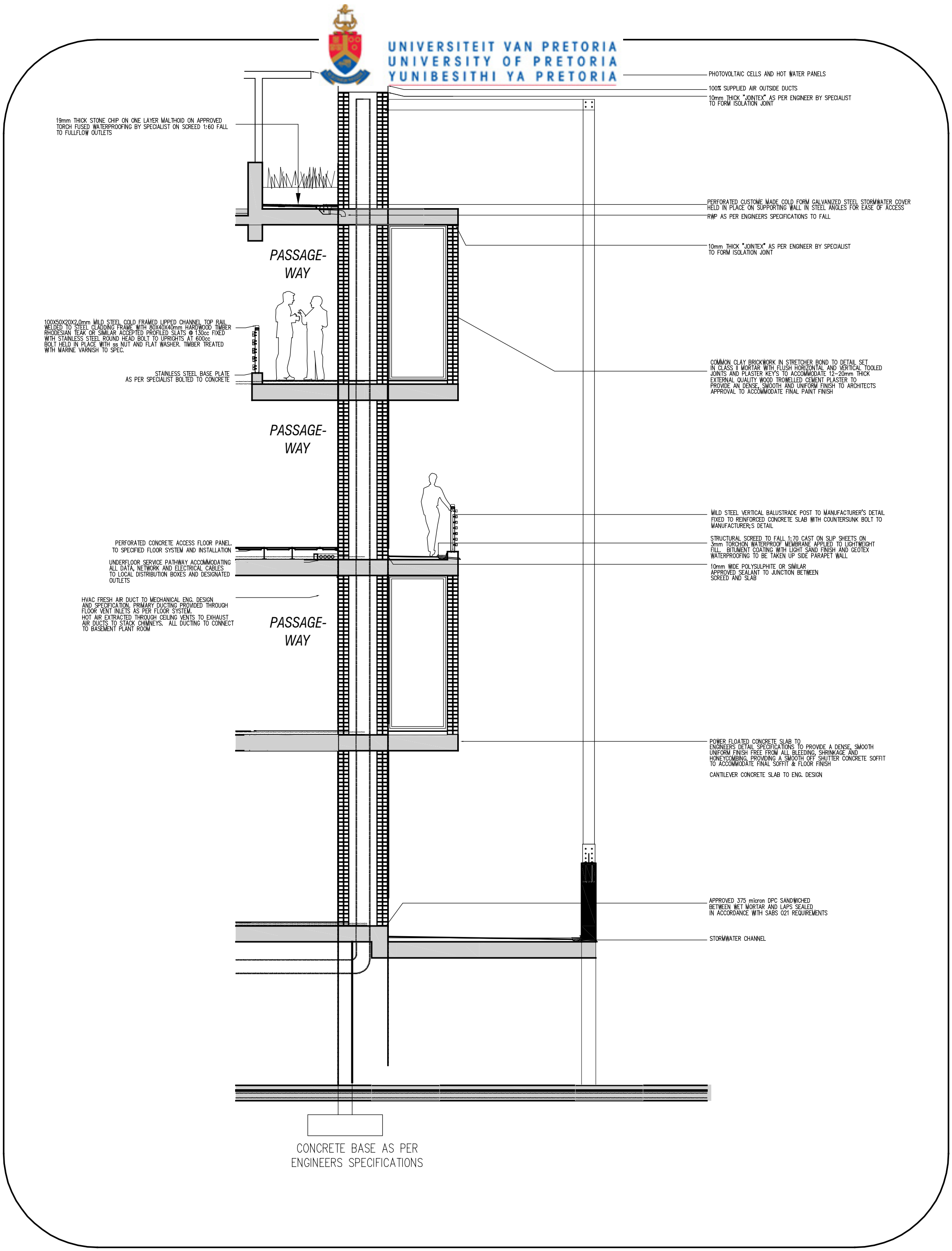
_south-eastern facade



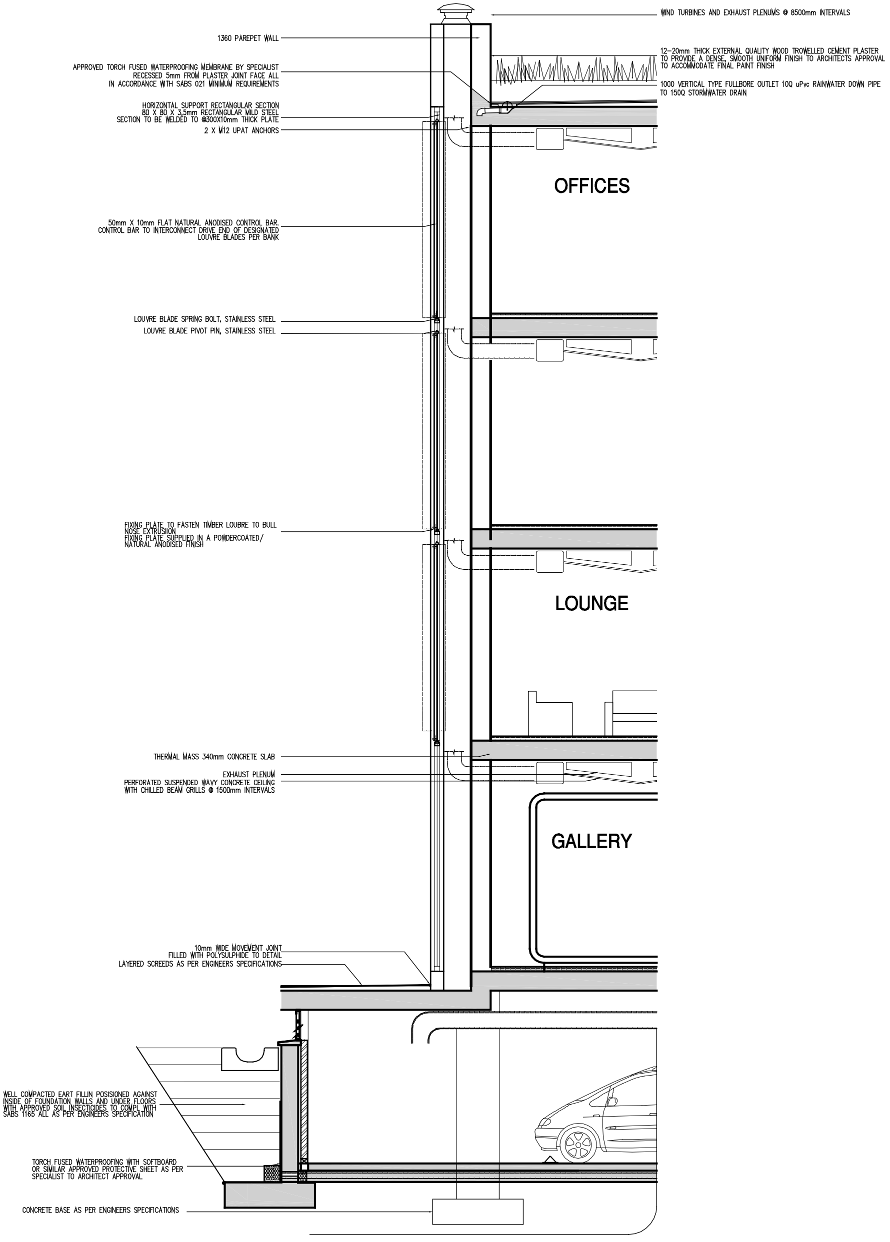
_north-eastern facade

_southern facade

_courtyard



_eastern facade detail



_western facade detail

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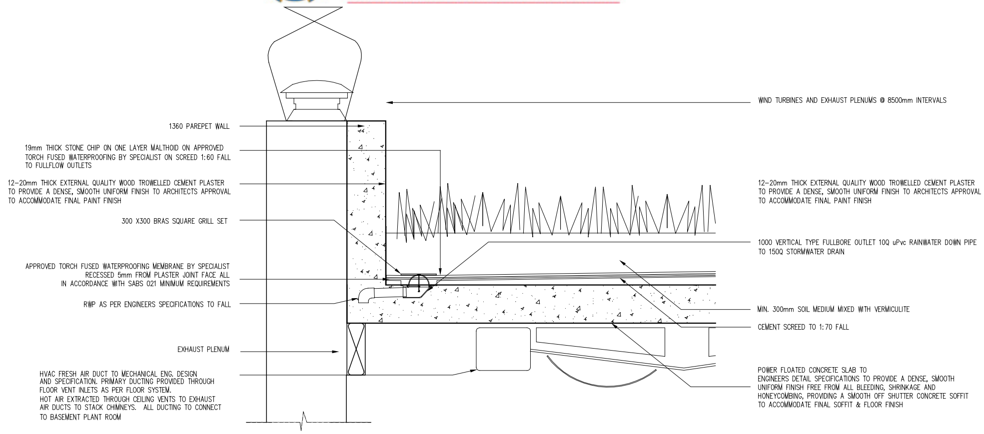
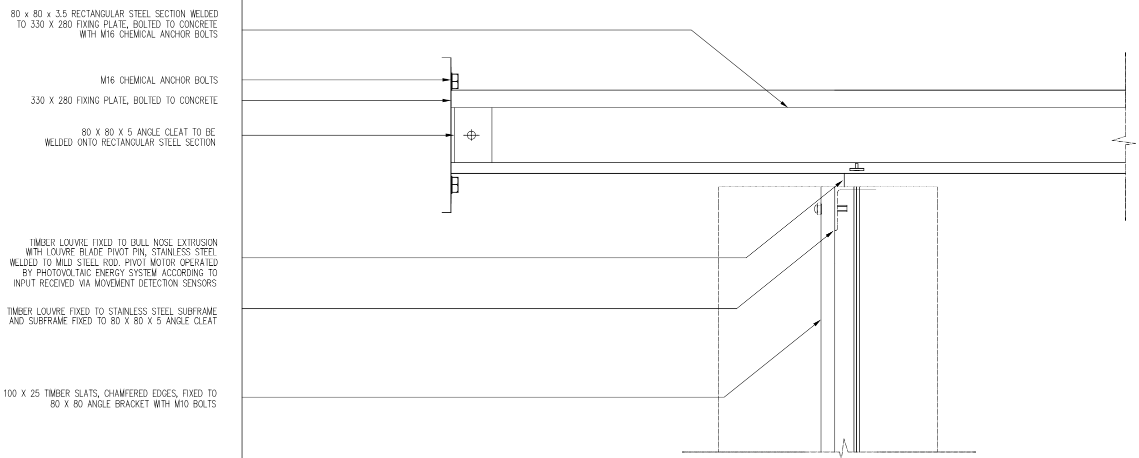
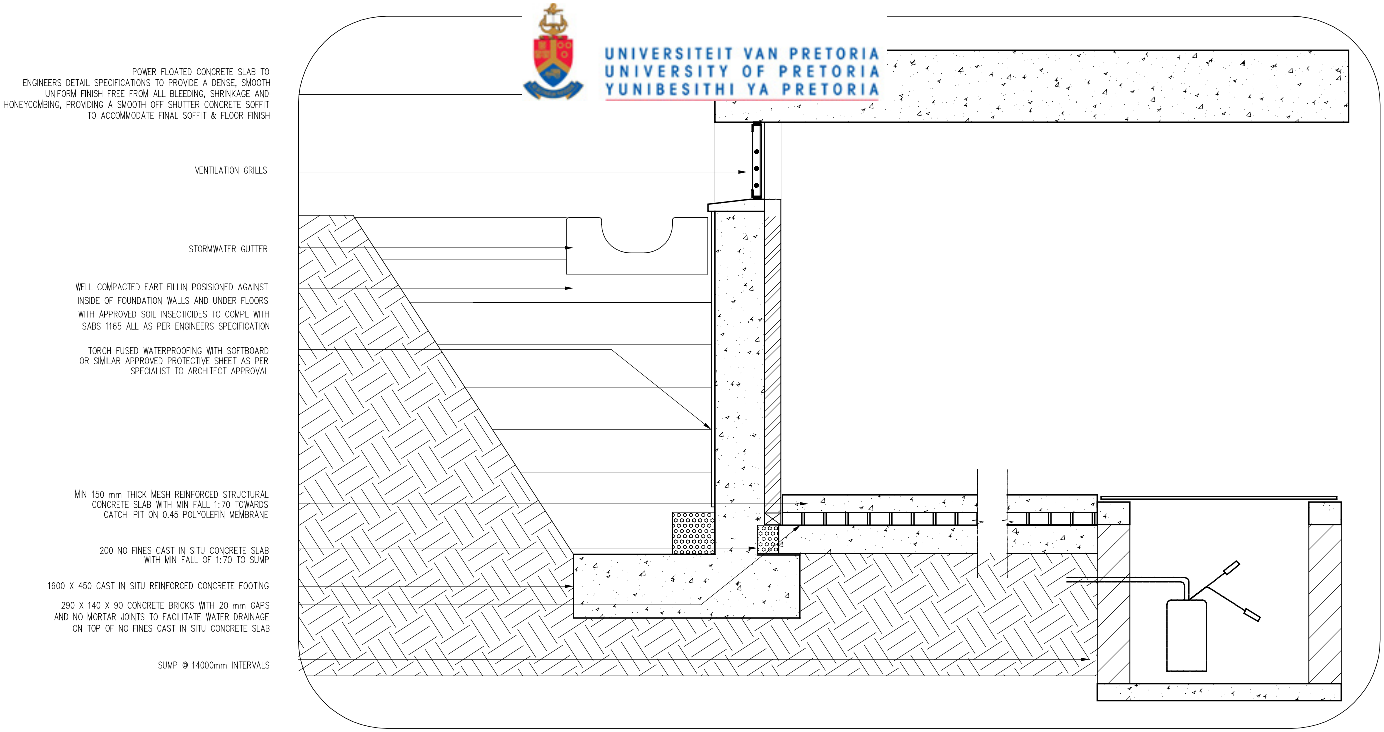


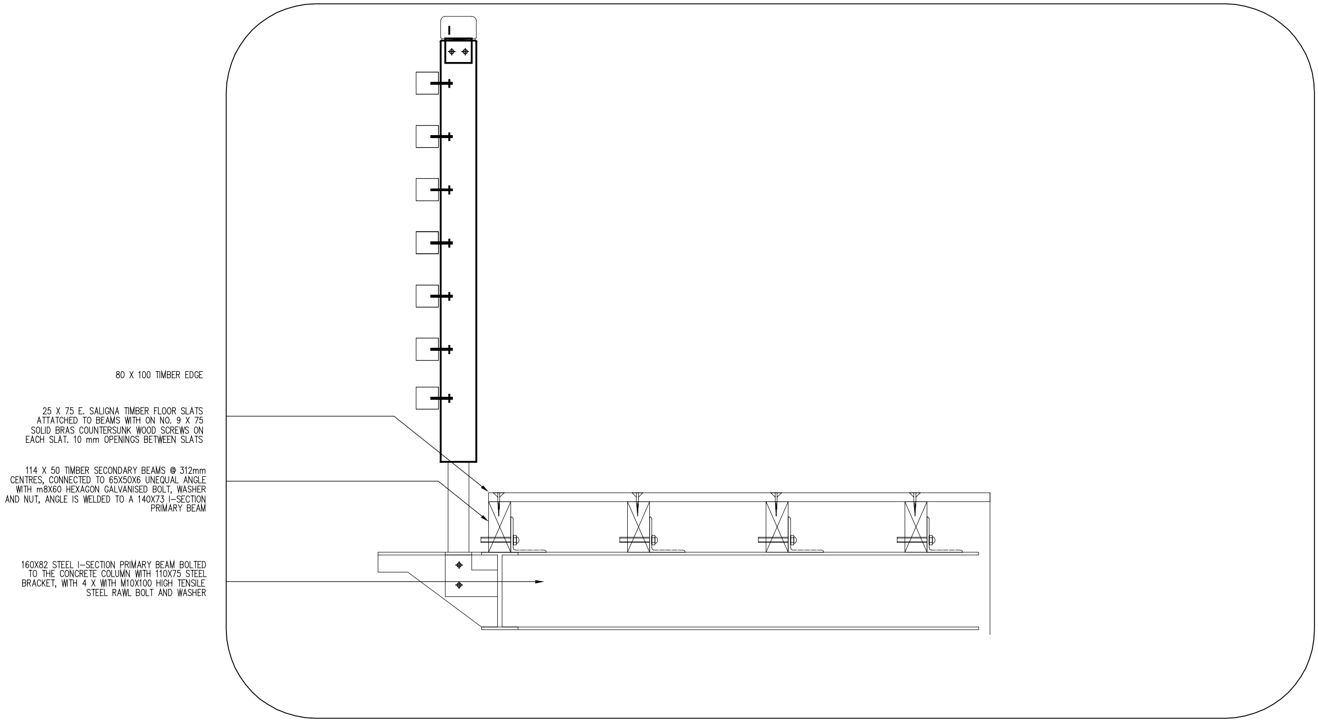
_roof detail



_louvre detail



_basement detail



_timber deck detail

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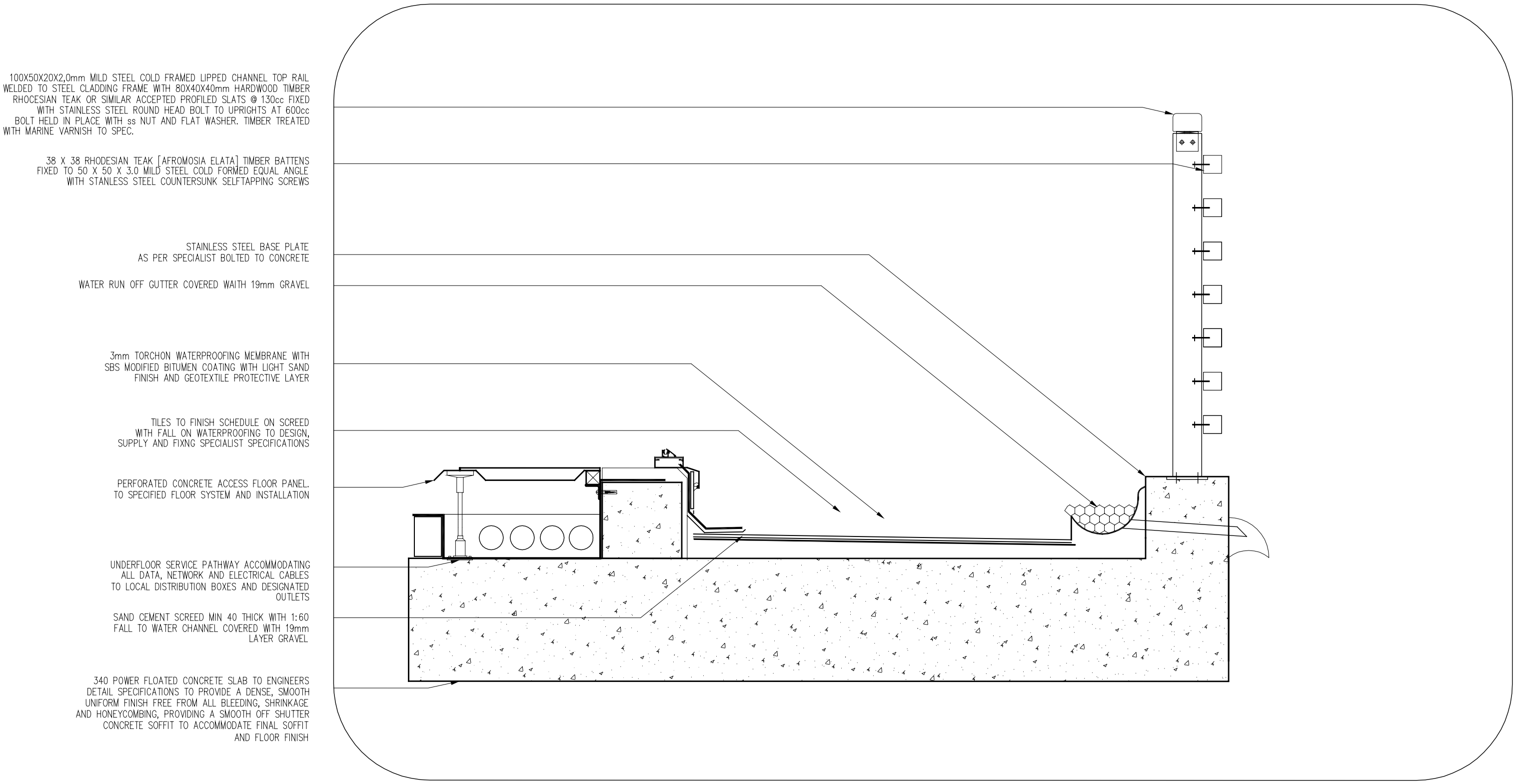
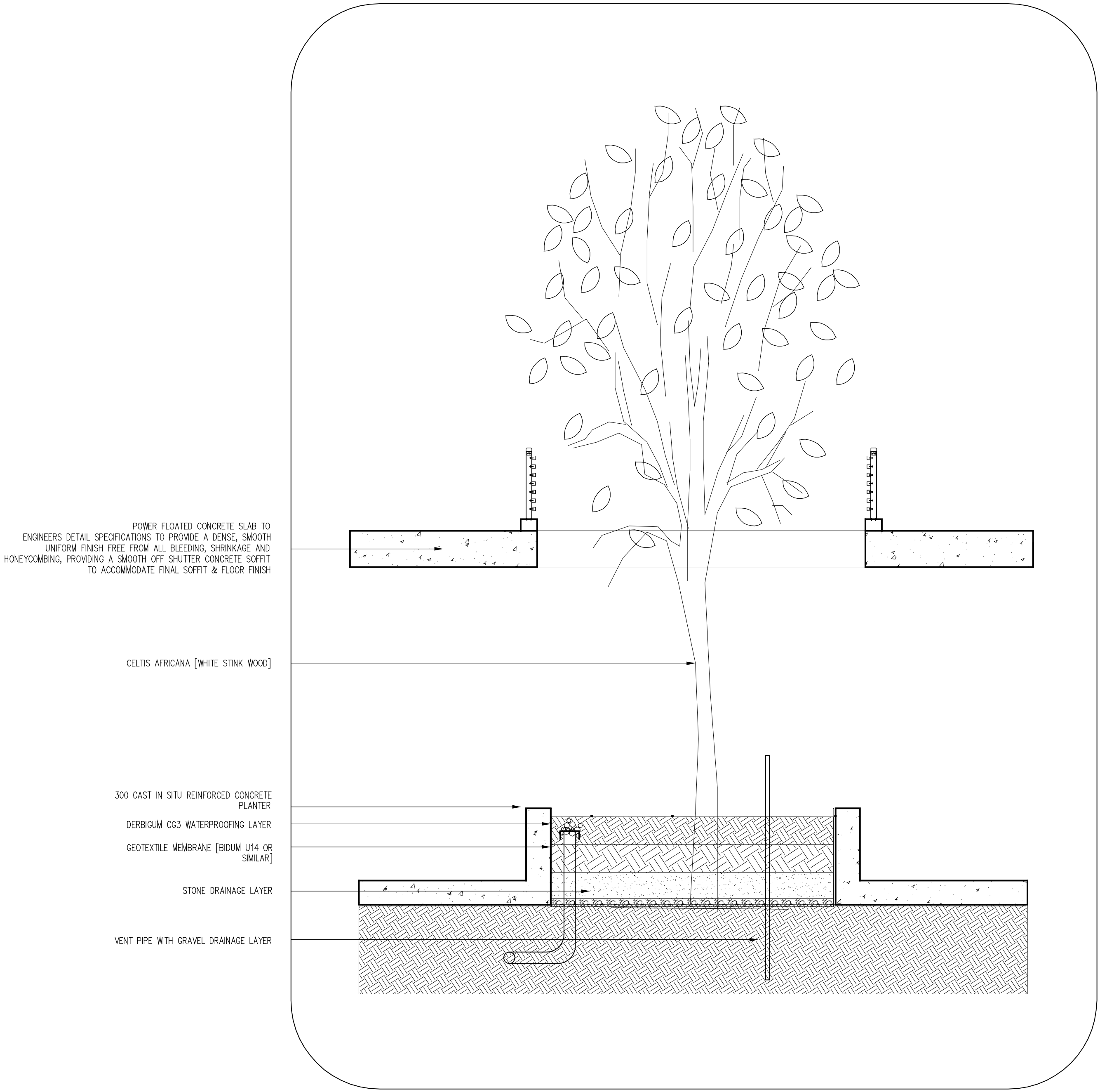


_balcony detail



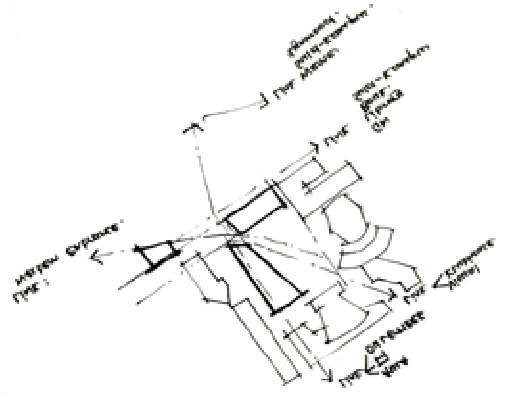
_basement tree detail

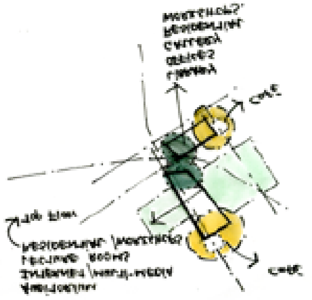
con-clusion

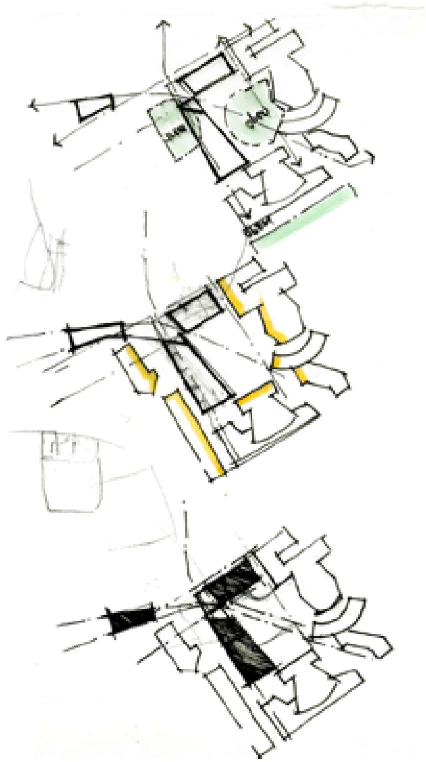
This dissertation has offered me the opportunity to develop a sense of ownership, being part and partial of the twenty-first post-carbon society, exposed to the energy crises and the recent fall of the global economy, one realize how vulnerable our human nature is within the greater scheme of things. We have evolved into a society, knowing no alternative to fossil fueled energy. A frightening reality with no instant remedy , something we have to face now and in the near future. However, to contribute to this cause, revealing the significance of the crises, and aiming to change opinions, we can steer society into a resource efficient direction.

Green architecture, offers many solutions, backed by several theories and loaded with opinions. However, the trick to successful sustainable living, lies in the efficient conveying of the ‘green’ message to the target market. To become acquainted with this knowledge field and as designers, aiming to alter perceptions, conform to the know-how and the will to transform towards a ‘greener’ society. The dissertation aim to investigate the possibility to create a learning facility, with a carbon minus footprint [to produce more energy than what is used]. The conclusion; its a possible but quite difficult mark to achieve. For the facility to act as an awareness component, functioning as a facilitator of social sustainability and offer the opportunity to grow towards futuristic buildings with a carbon minus footprint, is well in our grasp. Therefor, a facility of this nature, could be effective and sustainale to a certain extent towards its cause.

appendix







The research precinct - group framework:

- Permeability move and connect
- Vitality exciting places
- Variety diversity ‘the spice of life’
- Legibility where am I? How do I get there?
- Robustness change and adapt as required

Good qualities in urban design are achieved through urban design principles

Permeability - A desirable characteristic of a place is the ease with which one can move through and get to other locations. Such places are therefore integrated physically or connected to their surrounding areas.

Vitality - Places that are vibrant, safe, comfortable, varied, fun, and active.

Variety - A successful place also offers a mix of activities to the widest range of possible users.

Legibility - A successful and legible development is a place that has a clear image and is easy to understand.(Lynch)

Robustness - A desirable quality of a development is to create a place which can be used for many different purposes by different people and can change and adapt for different uses.

Rules:
Urban design qualities are abstract theoretical concepts. Designing to ensure the inclusion of a particular quality means adopting some kind of rule or ‘urban design principle’.
When applying design principles to a particular part of town we must always place them in the broader context of that town.
The principles are not rigid and are not to be followed slavishly. In real situations some may have to be adjusted in order to benefit the largest number of people.
Good design results from a consideration of the widest range of concerns and issues - imaginative, creative resolution of potential conflicts.

Successful streets, spaces, villages, towns and cities tend to have qualities in common. The fundamental qualities of successful places, which all development must contribute to, are outlined below.

1 Character
Sense of place and history
A place that responds to and reinforces locally distinctive patterns of development and landscape

- Distinctive landscapes
- Natural features
- Locally distinctive buildings
- Streets and street patterns
- Special spaces
- Skylines and roofscapes
- Building materials
- Local culture and traditions
- Avoiding standard solutions

2Continuity and enclosure
Clarity of form
A place where public and private space are clearly distinguished

- Streets, footpaths and open spaces overlooked by buildings
- Clear distinction between public and private space
- Avoiding gaps in the line of buildings
- Enclosing streets and other spaces by buildings and trees of a scale that feels comfortable and appropriate to the character of the space
- No leftover spaces unused and uncared for

3 Quality of the public realm
Sense of wellbeing and amenity
A place with public spaces and routes that are lively and pleasant to use

- A feeling of safety and security
- Uncluttered and easily maintained
- Carefully detailed with integrated public art
- Suited to the needs of everyone, including disabled and elderly people
- Well-designed lighting and street furniture
- Attractive and robust planting

4 Ease of movement
Connectivity and permeability
A place that is easy to get to and move through

- Density highest where access to public transport is best
- Roads, footpaths and public spaces connected into well-used routes
- Easy accessibility
- Direct routes that lead to where people want to go
- A choice of safe, high quality routes

5 Legibility
Ease of understanding
A place that has a clear image and is easy to understand

- Landmarks and focal points
- Views
- Clear and easily navigable routes
- Gateways to particular areas
- Lighting
- Works of art and craft
- Signage and waymarkers

6 Adaptability
Ease of change
A place that can change easily

- Flexible uses
- Possibilities for gradual change
- Buildings and areas adaptable to a variety of present and future uses
- Reuse of important historic buildings

7 Diversity
Ease of choice
A place with variety and mixed uses

- A mix of compatible uses and tenures
- Variety of layout and building form
- Diverse communities and cultures
- Variety of architectural styles
- Biodiversity

The form of development is the physical expression of urban design. It consists of the relationships, shape and size of buildings, structures and spaces. It will influence the user's activity and movement in a place and so is fundamental to the success of a place. The most important elements of development form are listed here. Each of these elements are informed by the seven urban design qualities described in section 01 to create the physical components of a plan.

1 Urban structure
The essential diagram of a place showing:

- The relationship between new development and nature, land form and existing buildings
- The framework of routes and spaces that connect locally and more widely, and the way developments, routes, open spaces and precincts relate to one another

2 Urban grain
The nature and extent of the subdivision of the area into smaller development parcels showing:

- The pattern and scale of streets, blocks and plots
- The rhythm of building frontages along the street as a reflection of the plot subdivision

3 Density and mix
The amount of development and the range of uses this influences, to include:

- The intensity of activity relative to a place's accessibility
- The place's vitality relative to the proximity and range of useS
- The development's viability

4 Height and massing
The scale of a building in relation to:

- The arrangement, volume and shape of a building or group of buildings in relation to other buildings and spaces

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• The size of parts of a building and its details, particularly in relation to the size of a person
• The impact on views, vistas and skylines
5 Building type
• The size of the building floorplate its storey heights and means and location of access
• The relationship of the building toadjacent buildings and how it relates to external space at ground floor level
• The nature and extent of the building's setback at upper floors and roof treatment
6 Facade and interface
The relationship of the building to the street:
• The rhythm, pattern and harmony of its openings relative to its enclosure
• The nature of the setback, boundary treatment and its frontage condition at street level
• The architectural expression of its entrances, corners, roofscape and projections
7 Details and materials
The appearance of the building in relation to:
• The art, craftsmanship, building techniques and detail of the various building components true to local context
• The texture, colour, pattern, durability and treatment of its materials
• Materials sourced from local and/or sustainable sources, including recycled materials where possible
• The lighting, signage and treatment of shopfronts, entrances and building security
8 Streetscape and landscape
The design of route and spaces, their microclimate, ecology and biodiversity to include:

• Paving, planting and street furniture
• The integration of public art, lighting, signing and waymarkers
• The treatment of parks, play areas, natural features and recreation areas
• Consideration of long term management and maintenance issues
Case Study

CHARACTER
Transforming the image and perceptions of a stigmatised estate by adopting characteristics of the surrounding terraces but without stylistic pastiche.

CONTINUITY
AND ENCLOSURE
Legible block and street-based layout enclosed by vertically proportioned modern terraces.

QUALITY OF THE
PUBLIC REALM
Positive public spaces faced by buildings, greater public safety and security, new five-a-side pitch.

EASE OF MOVEMENT
New route created across the estate linking to bus services and school, interconnecting network of streets and mews providing a choice of routes.

LEGIBILITY
Corners and mews access are given architectural emphasis, there is a clear and easily understandable grid of streets that are better connected into the surrounding street pattern.

ADAPTABILITY
Existing buildings have been adapted to introduce new uses and provide modern accommodation standards. All homes are designed to Lifetime Homes standard to facilitate future adaptation to residents' needs.

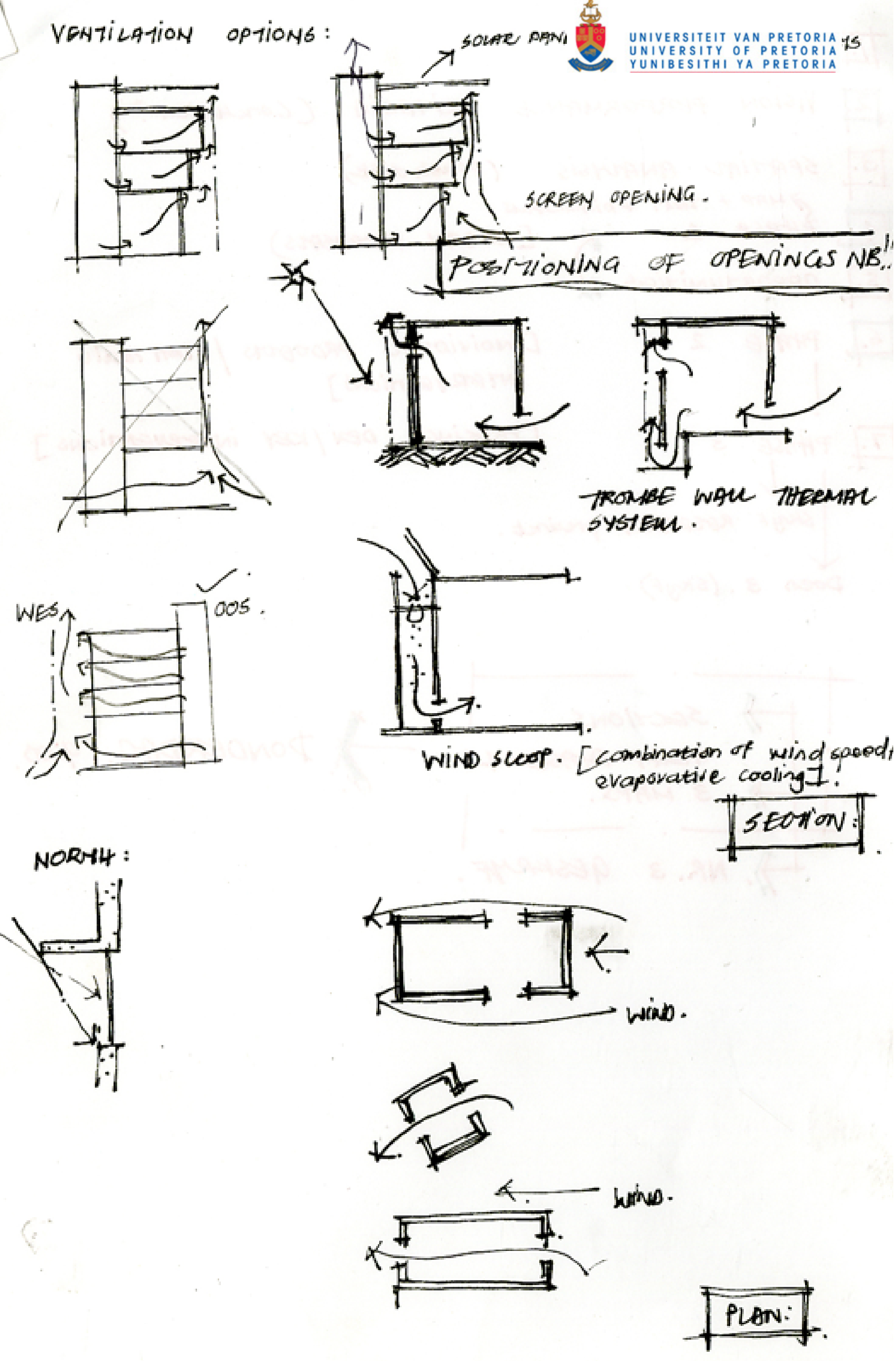
DIVERSITY
New development provides a mix of residential tenure and introduces new commercial and community uses.

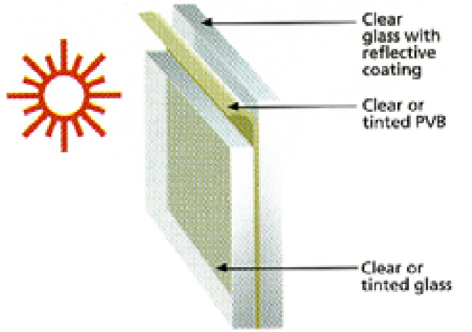
CAA Commonwealth Association of Architects

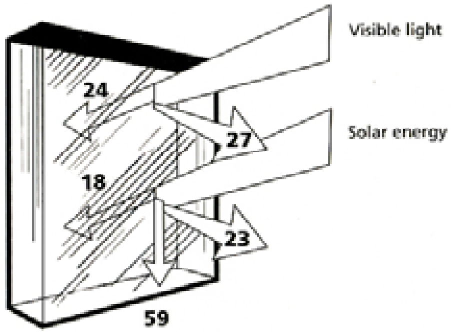
An Architect's Guide to Designing for Sustainability

A Joint Commonwealth Foundation/Commonwealth Association of Architects Developmental Study

Prepared by:
CSIR
Built Environment Unit
Pretoria
South Africa
November 2006

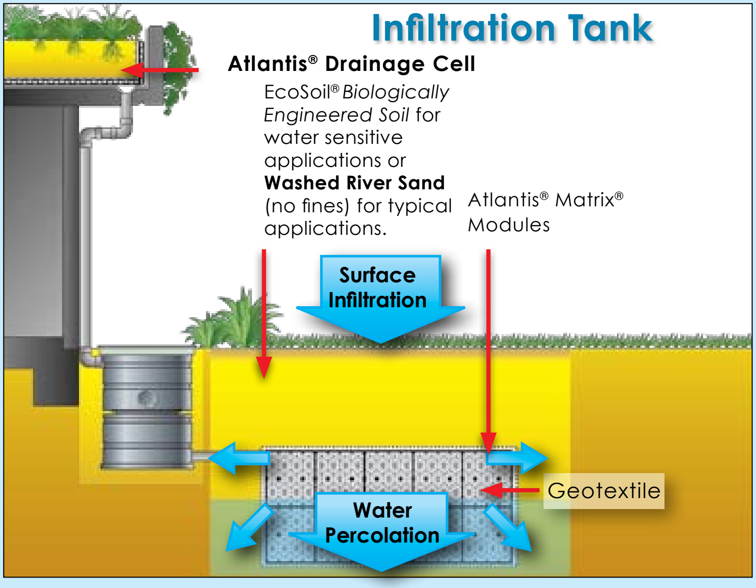






Solarshield 520 Silver

Atlantis® Matrix® Modules



The infiltration tank system is the ideal way to manage stormwater runoff in permeable or semi-permeable soil conditions.

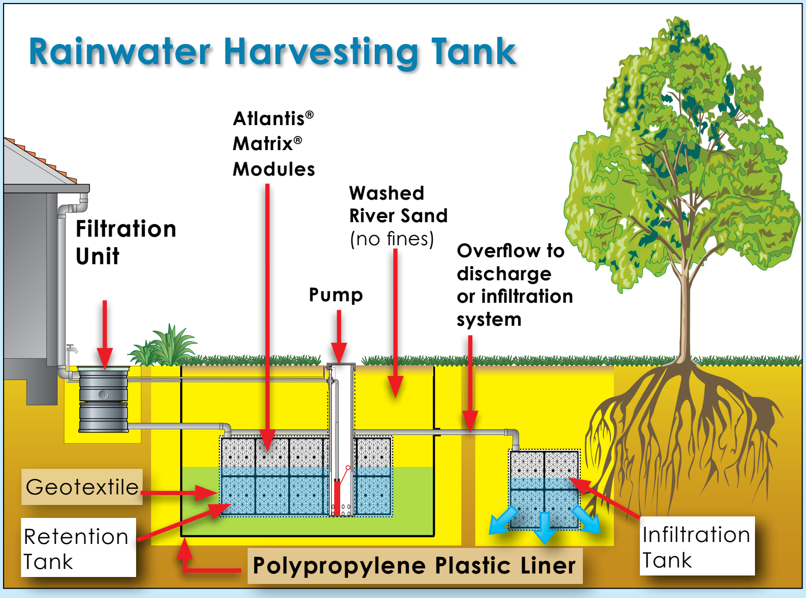
How It Works!
The system is designed to capture surface water through infiltration, and then clean and filter the water before it is allowed to recharge the water table providing moisture for surrounding vegetation.

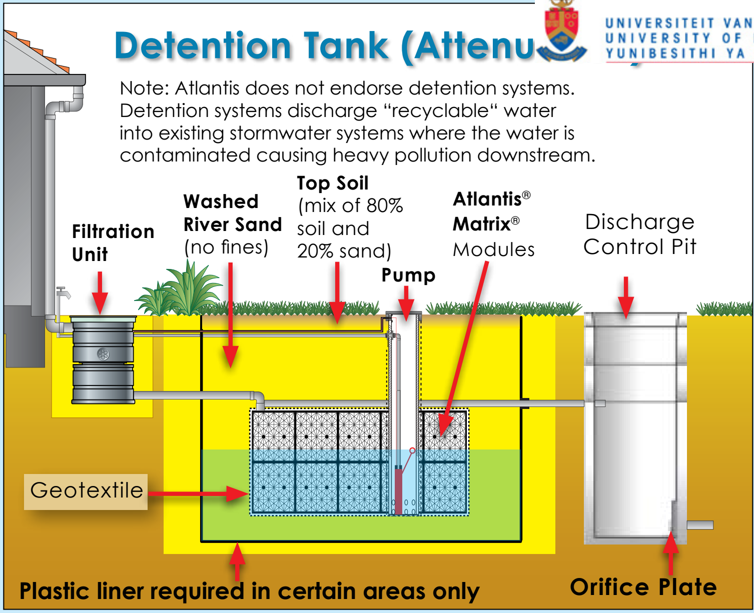
Applications: New developments required to meet water sensitive urban design standards.

The **Atlantis® Re-use System** has proven effective in providing a regular clean water supply for domestic and commercial applications.

How It Works!
The system captures water from both landscaped areas through surface infiltration and from roof areas. Clean water is retained within the storage area away from harmful U.V. light and heat remaining cool underground readily available for re-use.

Applications: Typical applications include flushing toilets, in washing machines, watering gardens and washing cars.



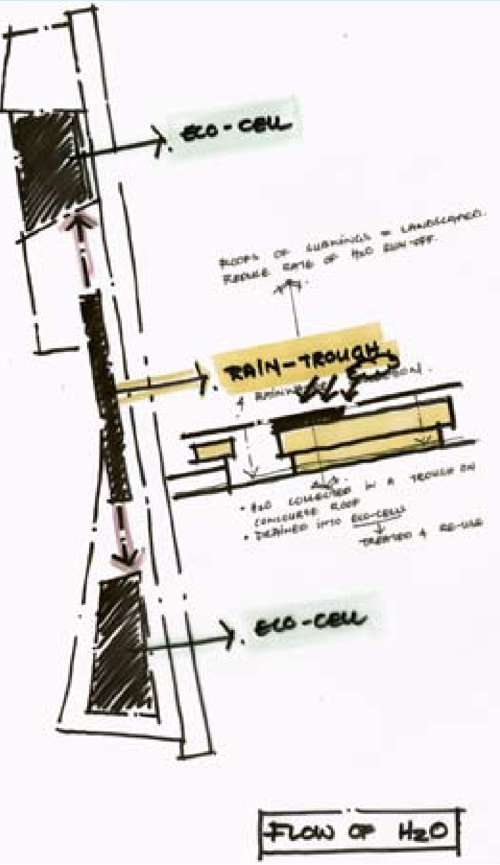


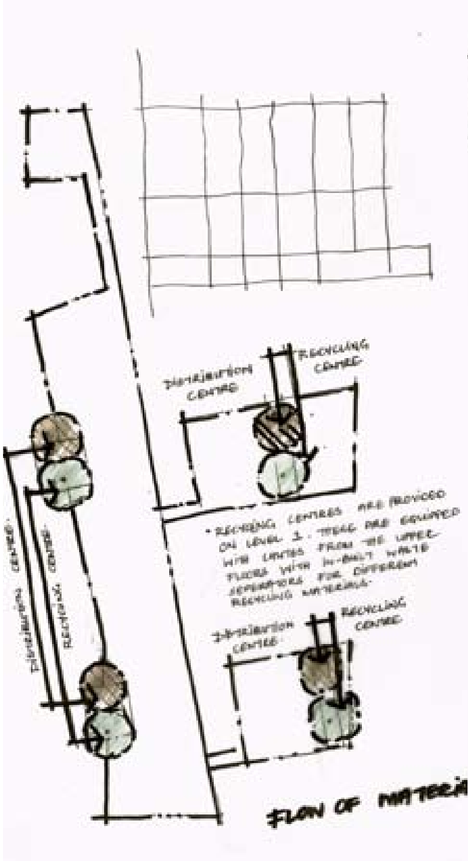
The system offers flexible design options, saving installation time and delays to site access.

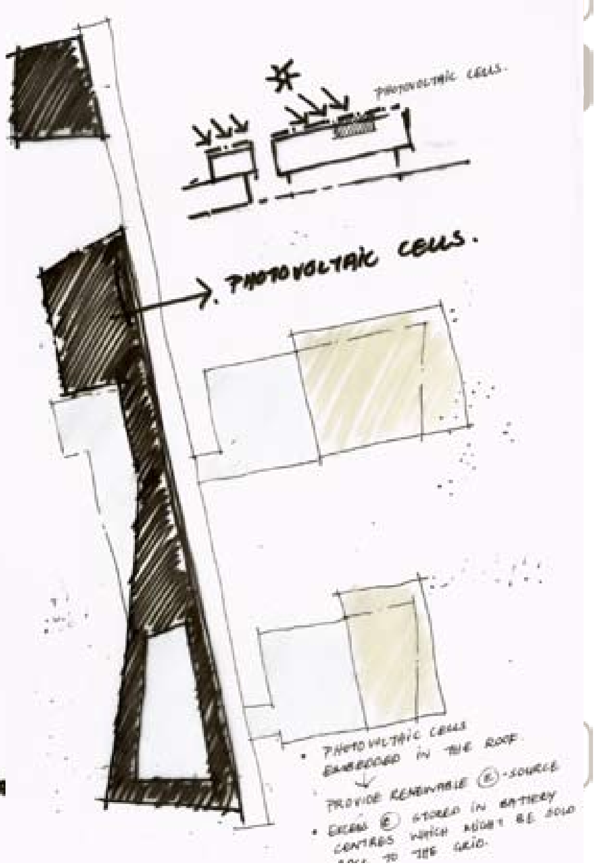
How It Works!
Water captured from roof and paved areas are filtered before entering the storage area (Atlantis® Matrix® Modules). Water is then slowly released through the discharge control unit (DCU).

Applications: Developments that need to meet Local Council Stormwater requirements.

Note: Atlantis **does not endorse** detention systems. Detention systems discharge "recyclable" water into existing stormwater systems where the water is contaminated causing heavy pollution downstream.







GE
Water & Process Technologies
ZENON Membrane Solutions

Packaged Plants for Water and Wastewater Treatment

ZeeWeed packaged plants provide large-scale performance in a compact pre-assembled system

Incorporating a simple and expandable building-block design, ZENON packaged plants can be quickly set up in virtually any location and feature scalable treatment capacity that can be increased as demand grows. These highly automated, plug-and-play UF systems outperform conventional treatment alternatives in all categories, offering superior treated water quality that meets or exceeds regulatory requirements, reduced operating costs, smaller plant footprints, and highly reliable performance—at a price that is comparable to conventional systems.

Pre-assembled and factory tested systems offer:

- Reduced on-site construction costs with less interconnecting requirements;
- Quick delivery with complete engineering package already completed;
- Cost-effective solutions for virtually all water and wastewater treatment applications;
- Comprehensive cleaning capability for peak system performance;

Municipal Drinking Water
Township of Tay, ON - 70,000 gpd (265 m³/d)
Z-BOX M

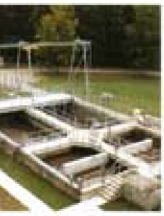
Municipal Wastewate
Huntsville, TN - 300,000 g
Packaged Equipment Skid

* Average Daily Flow

How Membranes Work

Membranes are based on filtration methods found throughout nature. ZeeWeed membranes are hollow polymer fibers with billions of microscopic pores on the surface. The pores are much smaller in size than common contaminants, bacteria and viruses. This physical barrier only allows clean water to pass through while rejecting impurities—guaranteeing an exceptional water quality and clarity on a continuous basis. A slight vacuum is all that is required to draw water into the membrane fiber and filter out impurities.

- Simple and highly automated operation and in-situ membrane cleaning;
- Modular building-block design;
- Simplified start up with minimal installation time;
- Compact footprint with flexible layout options;
- Greenfield or retrofit solutions.



r Treatment
pd (1.136 m³/d) ADF*
s Z-MOD L

Decentralized Treatment
Office Park, Oakville, ON - 17,300 gpd (66 m³/d) ADF*
Z-MOD S

Innovative louvre system facilitates energy efficiency

The Green House in Parkwood, Johannesburg, has been designed by Enrico Daffonchio of Daffonchio & Associates Architects. The building serves as the head office of McNab's and boasts a custom-made, sun-protecting louvre system to control the indoor climate. So effective is this sunscreen system that the building does not need any energy-intensive air-conditioners.

In a departure from the normal notion of facing a building north, the façades of the Green House face mostly east and west in order to exploit the natural heat of the sun for indoor heating. The building also boasts an underfloor heating system making use of solar panels on the roof.

According to Daffonchio, the green building design approach focused on three aspects: energy consumption, water consumption and choice of materials. "The correct combination of these three elements enables an architect to reduce the carbon footprint of a building," he tells *Urban Green File*.

Rupert McKerron, CEO of McNab's tells *Urban Green File*, although the building is visually appealing and innovative, the basic structure is actually quite simple and inexpensive. "We have saved money on the structure and this allowed us to spend on technology, such as the sunscreen louvre system."

— *An in-depth feature article on this building will be published in the August 2008 edition of* Urban Green File.

Gerald Garner

Rupert McKerron of McNab's (left) and architect Enrico Daffonchio at the Jozi O Green House. The building boasts innovative sunscreens on the northern façade (pictured) and a louvre system on the eastern and western façades.

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Tuks se amptelike studentekoerant / Official Tuks student newspaper

13October2008 year70issue17

UP destroys 130 trees a month on paper.

Photo: Arthur Horn

Environmentally unfriendly

ARTHUR HORN

One of the most essential pieces of equipment for the survival of a student is a photocopying machine, the beast of equipment churning out sheet after sheet for tests and assignments. But do we think of the effects of our mass-reproducing ways? And is the use of paper on campus reduced where possible for the sake of our environment rather than our pockets?

Apparently not. According to Otto Trollip of the library's Minolta branch, Minolta at Tuks use more than 2200 reams of paper per month. This means that, at 500 sheets of paper per ream, over a million sheets are used per month. The university has no recycling programme to compensate for its large usage, but Trollip states that he gives paper that has already been printed on to students for scrap and study purposes.

Black and white photocopies cost 29c each at the library, the smallest photocopying-fee that Minolta charges. Following from that, students spend a minimum of R319 000 on paper per month, though the actual figure is higher. And as expensive as that may be, the cost on the environment is far greater. A single tree can provide between 16 and 17 reams of typical office paper. At its current rate, campus Minolta alone is responsible for the destruction of 130 trees, all for printing and photocopying.

Local company Remade Recycling supplies recyclable materials to the Sappi Waste Paper group. According to Francois Marais, the manager of Remade Recycling's Pretoria branch, the company was approached by Tuks several months ago to help clean up the office areas at Tuks. Though this is not a service provided by Remade Recycling, it is encouraging that the university is pursuing possible avenues for waste reduction. However, Marais advises that if the university decides to seriously pursue paper-recycling on campus, they will need to set up various collection points which companies could use. In recent months, several of these collection points have indeed appeared on campus, though whether these are enough to combat the enormous amounts of paper wastage by photocopying students is debatable.

Jan Reynecke, Advisor to the Principal, has previously told *Perdeby* that the library is moving away from buying books, and focusing instead on electronic journals in the interest of cutting costs and saving paper. This may save the library money, but does little other than boost the printing requirements of students. And with a million sheets of paper leaving campus every month and no centralised recycling plan on campus to curb wastage, it is a problem the university needs to start considering more seriously.

[an article from the local campus newspaper]

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