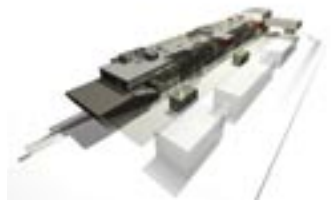
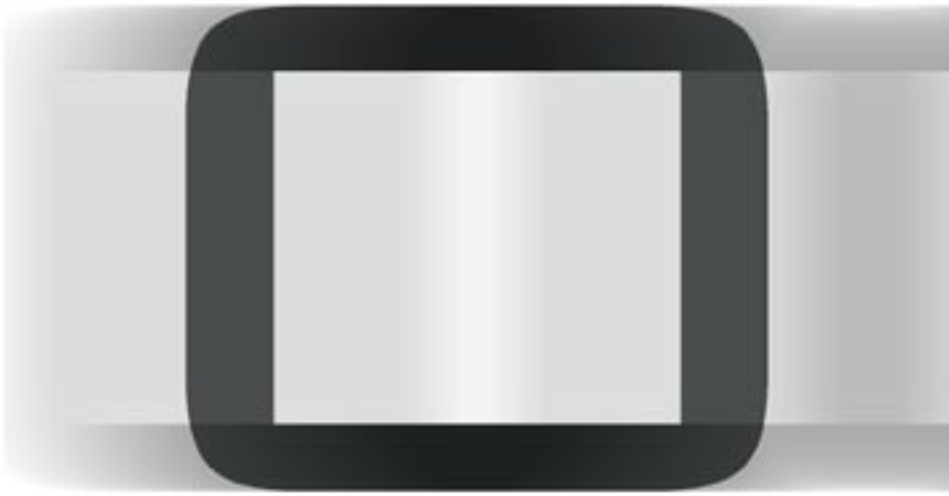




gerhardus petrus boer

Mentor:
Rudolph Van Rensburg

Submitted in partial fulfillment of the
requirements for the degree of
Magister in Architecture [Professional]
in the Faculty of Engineering, Built
Environment and Information Technology

University of Pretoria
Department of Architecture

04

SCHOOL FOR THE BUILT *ENVIRONMENT_UP*

The building for the school of the Built Environment focuses on the concept of time as form giver in architecture.

Time, a governing factor of existence, regulating simultaneously through a linear and cyclical pattern in its operation.

The aim of the discourse is to establish a parity between humankind and nature within an urban environment. The goal is to create an environment that acts as time-mediator between the metaphysical and physical city and its myriad users. The emphasis being on the user-interface on the project and its surroundings.

Thereby potentially establishing a platform where the city is continually challenged in terms of observing and being observed.

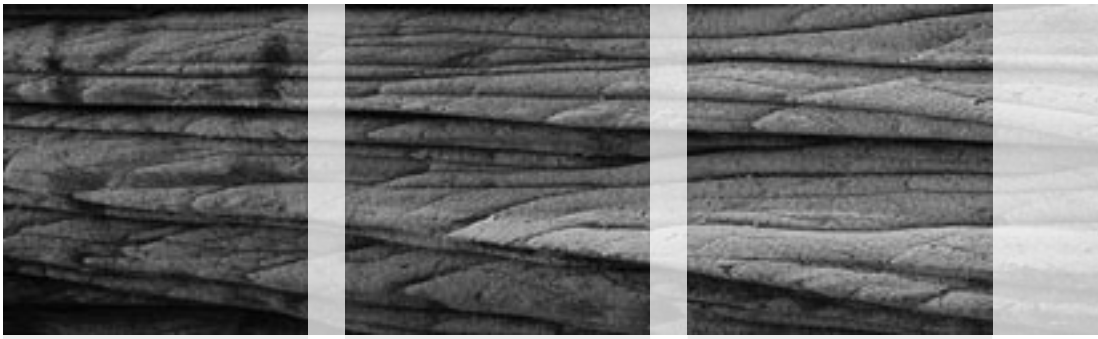
The architecture itself should provide an abridgement of moments in time.

The prominence of the proposed site opens up the possibility of investigating an iconic branding image for the campus.

This could be achieved in terms of potential visual resource and movement pattern.

Content

MOMENT 00.



MOMENT 01.

brief

MOMENT 02.

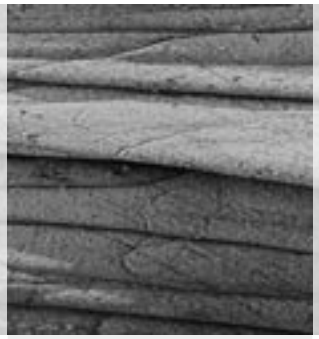
baseline study

MOMENT 03.

context study

MOMENT 04.

assimilate



MOMENT 05.

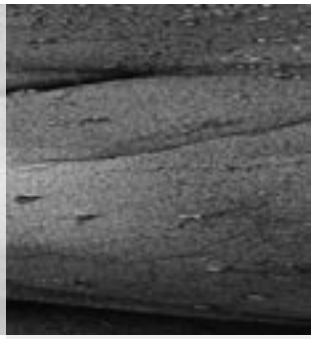
conceptual design

MOMENT 06.

design proposal

MOMENT 07.

technical investigation



MOMENT 08.

referred works

MOMENT 09.

addendum

Figures:

0.1. Book cover page: 3-D CAD models of design proposal over time.
0.2. Photomontage of the UP from Lynnwood road.
0.3. Scouring erosion lays bare the sinew and substance of earth. *[BELT, A. National Geographic, April 1997 vol. 191 no. 4]*

Moment 01:

From left to right:
1.1. Whirlpool Galaxy. 28 million light-years away. In effect looking back in time for 28 m light years (dependant on amount of magnification). *[National Geographic. February 2003.]*
1.2. Hurricane Gladys, spin in nature, *[A. B. C. Whipple. Planet Earth: Storm. 1982.]*
1.3. Scent in the microgravity of Space. *[Madere, J.]*
1.4. Goldfish symbolising new life in springtime, microcosm of nature. [*Avakian, A. National Geographic. 1999. vol 196.]*

1.5. Historical urbanism. *[Kostof, S. 1991. The city shaped. Italy: Thames & Hudson]*
1.6. Negative development-grain silo Standerton. Photograph: *Author.*
1.7. Corrugated sheet cladding. Refurbishment. Photo: *StudioMAS.*

From left to right:
1.8. Satellite data depicting El nino temperature and wind anomalies in May 1997. *[Jet Propulsion Laboratories, National Geographic, March, 1999 vol 195 no 3.]*
1.9. A constant rain of microscopic interplanetary dust particles delivers a variety of compounds, which almost surely contributed to the primordial soup of the substance of Earth. [Heisey, A. [*National Geographic, March, 1998 vol. 193 no. 3.]*
1.10. VW Pheatons gliding across a beauty queen promenade, a 25m long neon tunnel where the paint job is checked for blemishes. The finished cars are displayed in a glass parking lot. *[Champa, P. Surface, issue 43]*

1.11. Lalibela, pilgrimage site for Ethiopian Christians for 800 years. 12 Stone churches cut from volcanic tuff. *[Steinmetz, G. National Geogrpahic, July 2001.]*
1.12. Stark circle of rock measuring about 30 m in the Tenere desert below the masif Adrar Madet in Niger. Roughly 2 km away in each of the four cardinal directions arrows point away form the circle, whose origin, purpose, and age remain a mystery. *[Steinmetz, G. National Geographic, March, 1999 vol. 195 no.3]*
1.13. Towering ash plume from mount Ruapehu, New Zealand 17 June 1996. *[National Geographic, January, 1997 vol. 191 no. 1]*
1.14. Brisingid sea stars through a 'deep-sea-hubble', ecosystems such as these may hold a clue to early life on earth. *[Kristof, E. National Geographic, February 2003]*

1.15. Background image: Each part of the whole is dependant and self-contained. *[WOODS, L. 1992. The New City. Touchstone book. p. 11.]*

1.16. All things restless, changing in time and space. [*WOODS, L. 1992. The New City. Touchstone book.]*

1.17. Traffic jam. *[UN Studio: Move.]*

1.18. Advertisement logo for the University of Pretoria

1.19. Background image: Inverted photo of Jupiter amidst trees in silhouette. *[Author]*

1.20. The ephemeral nature of colour in the changing shades of seasons. *[Wolinsky, C. National Geographic, July 1999, vol. 196, no.1]*

Background image:
1.24. Abell 1689, light being bent due to gravitational pull from 1amassed galaxies. *[Cowen, R. National Geographic. February 2003.]*
From top to bottom:
1.22. Soft X-ray image of the sun *[Universal Records 2002, 3 doors down Away from the sun.]*
1.23. Burrowing through block modules. *[UN Studio: Move.]*
1.24. Part of a fly's eye. Transparency, semi-, or closed. *[UN Studio: Move.]*
1.25. Abell 1689, light being bent due to gravitational pull from amassed galaxies. *[Cowen, R. National Geographic. February 2003.]*
1.26. The farther out we look into space, the father back in time we see. Veil of fossil radiation dating 300 000 years after the big-bang that permeates space. This is the limit of our view when the universe emerged from a state of hot plasma and became transparent. *[National Geographic, October 1999, Vol. 196, no. 4]*

Moment 02:

Baseline study cover page. From left to right:
2.1. IBN-DLO building. [On Sustainable building: The green challenge. Archis 1999/2]
2.2. Wind turbines in Iowa, USA, tapping the resources of renewable energy. [*Time. April-May 2000. Vol.155 No.16A. p.60*]
2.3. Solar power generators. Ways to keep the earth from overheating. [Klein/ Hubert in *Time. April-May 2000. Vol.155 No.16A. p.2*]

2.4. Tree-branch structure / lightning patterns? Photo: *Author. 2003.*
2.5. Concept model 01, addition & subtraction / solid & void on >200m structure.

2.6. The worlds' tallest tree_126,5m Coastal Redwood. [NG, January1997, Vol 191, no.2]
2.7. Barragan's Towers of Satelite City_50.5m. Mexico City, 1957. [Ambasz 1976:52]

2.8. Concept model 01. Integrating the structure with the site to increase energy flow to and from the building.
2.9. Concept sketch of section through the structure.
2.10. Concept model 01, entrance / exit / accent.

2.11. Occupancy time-graph

2.12. The shaping of timber into wall-cladding. [Carter, B et. al. 2002. Office DA in All American: Innovation in American Architecture. London: Thames & Hudson]

Moment 03:

3.1. Context study cover page. Background image of scaffolding and crane, figure-ground / ground-figure stury of the UP campus

3.2. World map of location of Pretoria, South Africa. [Author]

3.3. Land use map of the Univeristy of Pretoria. [Author]

3.4. Development strategies of the UP as well as external influences and proposals. [Aerial photograph: UP Department of Geology and Municipality

of Tshwane]

3..5. Proposed Lynnwood and Roper street edge-development. [Aerial photograph: UP Department of Geology and Municipality of Tshwane]

3.6. Congregating busstops in Lynnwood street. [Aerial photograph: UP Geology department and Municipality of Tshwane]

3.7. View axis / movement corridors on and surrounding the UP campus. [Author]

3.8. Figure-ground / Ground-figure image of UP and surrounding areas. [Author]

3.9. Aerial photograph: UP Department of Geology and Municipality of Tshwane]

3.10. 'Iron curtain' of pallisade security fence on the periphery of the main campus of UP. [Author]
3.11. Concept sketch of the status quo of Lynnwood street pavement. [Author]

3.12. Windrose for the Pretoria region. [Adapted from Holm, D. 1996. Manual for energy concious design. Univerity of Pretoria]
3.13. Photograph of Academic Information Centre on the left and the Humanities building on the right hand side. [Author]
3.14. Vertical sun angles at 12:00 for Pretoria region.

3.15. Aerial photograph of the main campus of UP. [Geology department and Municipality of Thswane]

3.16. The farther out we look into space, the farther back in time we see. Veil of fossil radiation dating 300 000 years after the big-bang that permeates space. This is the limit of our view when the universe emerged from a state of hot plasma and became transparent. *[National Geographic, October 1999, Vol. 196, no. 4]*

3.17. Photosynthetic oxygen producing bacteria that is seen as an oxygen pioneer plant for primordial earth.
[Eward, K. National Geographic, March, 1998 vol. 913 no. 3]
3.18. The megaliths of Khufu- and Khafre pyramids. *[Reza, National Geographic, January, 1997 vol. 191 no.1]*

3.19. 24 hour earth rotation cycle on own axis. *[National Geographic, November 1999, vol.196, no.5]*
3.20. Time exposure of lightning crack. energy fields of nature resembling the structure of tree branches. *[Sartore, J. National Geogrpahic. November 1998, vol. 194 no.5]*

3.21. Tree-rings as time capturing mechanism giving a history of the growth cycles of a particular tree. [VISI, 2004 p. 171]

3.22. Early years of the University of Pretoria. [UP archive]

3.23. University of Pretoria historical development plan. [Author]
3.24. Aerial photograph of UP in 1943. [UP Archive].
3.25. Aerial photograph of UP, October 1945. [UP Archive].
3.26. Aerial photograph of UP, 1960. [UP Archive].

3.27. Artist impression of 'Transvaal University College' TUC 1911. [Photo: UP Archive].
3.28. Photo of the UP showing the Old Arts building. 1911. [Photo: UP Archive].
3.29. Eland sculpture on pillar at western vehicular entrance of UP, accessed from University street, aptly named Elandspoort to retain some of the site's heritage.
3.30-33. Series of aerial photographs of UP over time. [Photo: UP Archive].

Clockwise from top left:
3.34. Old Arts building, (1911).
3.35. Agriculture building, (1920).
3.36. Glass greenhouse designed by Struass Brink, added to Botany complex in 1956.
3.37. New Arts building [currently housing the Theology department] 1951.
3.38. Old Chemistry building (1911).
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3.39. Detail of Merensky Library (1938)
3.40. Merensky library designed by G. Moerdyk, (1938).

Clockwise from top left:
3.41.Amphitheatre, Musaion. (1960)
3.42. Administration building (1970)
3.43. Engineering building (1956-60)
3.44. Detail of façade, Aula and Student Centre. (1958)
3.45. Aula and Student Centre (1958)
3.46. Detail of external lighting, Botany building designed by Moerdyk. & Watson. (1940-59)

3.47. Background image: Engineering building (1956-60)

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3.48. Aerial photograph of Administration building,1970. [UP Archive]
3.49-51. Series of photographs on the main campus of the UP.
3.52. Photograph of Acedemic Information Centre on the left and the Humanities building on the right hand side. [Author]

3.53. Background image: Driving ambition, architect Gunter Henn designed the Volkswagen manufacturing facility on Strassburger platz, Dresden. Production site of the new vw Pheaton.
[Champa, P. Surface, issue 43]
3.54. The sacred city of the Inca, Machu Picchu. altering the landscape for centuries without destroying the balance of nature. *[Lanting, F. National Geographic. August 1999, vol.195 no.2]*
3.55. The megaliths of Khufu- and Khafre pyramids. *[Reza, National Geographic, January, 1997 vol. 191 no.1]*

MOMENT 04:
Assimilate cover page. From top to bottom:
4.1. The shaping of timber into wall-cladding. [Carter, B et. al. 2002. Office DA in All American: Innovation in American Architecture. London: Thames & Hudson]
4.2. Geographical barriers such as Robben Island's prison. 'The Island' as seen by the confluence of time and democracy into its current state as a World Heritage Site. Artist: P. Motloua. [Warren Siebrits Modern and Contemporary Art, Johannesburg. South Africa-Another Country: X27ap]
4.3. Faculty of Economics, Utrecht, the Netherlands. Mecanoo. [Cerver F. A. 1998. Selected Architecture: Public buildings / Private residence. New York: Whitney Library of Design. p.83]
4.4. Tulane University Centre, Louisiana. [Vincent James Associates in All

American p.136.]
4.5. The sculptural element of a wind barrier wall. [Bernado / Prat. 1997. Nuevos paisajes. New landscapes. Spain: Musea d'Art contemporani de Barcelona.]
4.6. Background image: Time exposure of lightning crack. energy fields of nature resembling the structure of tree branches. *[Sartore, J. National Geogrpahic. November 1998, vol. 194 no.5]*

4.7. Highway geometry in a Jaguar X-type advertisement. Surface Spring issue #46. Surface Publishing ISSN: 1091-806x. p 59.
4.8-10. Aerial perspective photographs of Stonehenge at Salisbury, England.
[http://witcombe.sbc.edu/earthmysteries/EMStonehenge.html. 17/05/2004]. Earth Mysteries: Stonehenge.]

4.11. Aerial photograph of the great pyramids at Giza, Egypt. [http://www.amtsgym.sdbg.dk/s/pyramid.htm]ournal/photogalleries/sphinx/photo.html]
4.12. Aerial view of setting sun symbolising death at Giza, Egypt. Ancient Egyptians believed the sun god Ra's birth occured at dawn and his death at the setting sun. [http://www.nationalgeographic.com/egyptjournal/photogalleries/sphinx/photo.html]

From left to right:
4.13. Temporal design in the American Cultural Centre, Paris, France. Building was dismantled in 1993. [Migayrou 2001]
4.14. American Cultural Centre, Paris. [Migayrou 2001]

From top to bottom:
4.15. Photo of School of Architecture model. Project based on two axes. A horizontal east-west orientation, and a vertical programme differentiation. , Deux Lions District, Tours, France. [Migayrou 2001]
4.16. Model of School of Architecture eastern elevation. [Migayrou 2001]
4.17. Model of School of Architecture southern elevation. [Migayrou 2001]
4.18. Model of School of Architecture. Different levels each embrace different programme themes. [Migayrou 2001]
4.19. Courtyard view of School of Architecture, Deux Lions District, Tours, France. [Migayrou 2001

4.20. The Carpenter Centre for the Visual Arts, Cambridge. 1959-63. Le Corbusier.

4.21. Prescott street elevation. Note the S-shaped ramp in the foreground. [Curtis 1986:218]
4.22. Level 3 presentation plan, Carpenter Centre. Le Corbusier. [Curtis 1986:218]
4.23. Project for Olivetti Research Centre, Milan. 1963. Le Corbusier. [Curtis 1986:216]

4.24. Sketch presentation of plan above freeway. [Migayrou 2001]

4.25. Model of West Coast Gateway, Los Angeles, depicting past and present layers inherent in any location. [Migayrou 2001]

4.26-28. Series of photographs featuring Barragan's 'The Towers of Satellite City' Mexico City 1957. The Towers reach a maximum height of 50.5m. [Ambasz 1976:52]

Moment 05:

Design development cover page. From top to bottom:
5.1. Three dimensional concept CAD model.
5.2. CAD model
5.3 Concept plan

5.4. The sculptural element of a wind barrier wall. [Bernado / Prat. 1997. Nuevos paisajes. New landscapes. Spain: Musea d'Art contemporani de Barcelona.]

5.5. Diagram sketch illustrating the relation between the theory of time and the construct.

5.6. Concept sketch showing the different ways of interpreting time and architecture.

5.7-35. Series of images of conceptual design time line.

From top to bottom:
5.8. Early concept sketch of façade as a growth structure for plants.
5.9. Concept sketch of the plan
5.10. Sectional concept with the sub-surface basement parking lot.
5.11-13. Photographs of concept model 01.
5.14. Understanding the urban scale of the site and existing buildings.

5.15-16. CAD model 01. The concourse level symbolic of linear time and the vertical servant cores of cyclic time.
5.17-18. Concept model 02.
5.19-20. Conceptual progression of plan.
5.21-27. CAD model 02
5.28-29. Technical documentation
5.30-36. 3-D CAD simulation 03.

5.37. Drawing depicting status quo of the site.
5.38. Drawing showing the extent of earthworks required for the design proposal. Earthworks limited due to the natural fall of four meters along the length of the site.
5.39-40. Drawing of the static, internal mould around which the steel structural systems oscillate.

5.41-46. Three dimensional CAD simulation of the structural / construction process.

5.47. Diagram illustrating the edge of the design proposal and the flow of pedestrian movement.

5.48. Photograph of *Parthenocissus quinquefolia* [virginia creeper] during active summer months.

From top to bottom:
5.49-50. CAD model of southern façade growth screen.
5.51-52. Rhythmic seasonal changes of the appearance of the southern façade.
5.53. Diagram illustrating the various permanent and adaptable areas of the building.

From top to bottom:
5.54. Background image: 3-D CAD detail of western façade wall.
5.55. Time as the silent agent of effect on timber.
5.56. The confluence of time and erosion on a concrete retaining wall.

5.57. Photograph of gabion basket wall 'cladding'. Photograph: studioMAS.
5.58. Photograph illustrating the visual texture of galvanised mild steel.
5.59. Atmospheric oxidation of exposed mild steel. Photograph: studioMAS.

MOMENT 06:
Design Proposal cover page:
6.1-15. Series of design proposal CAD model renderings .

6.16. Photomontage of CAD model plan perspective and the plan drawing.

From top to bottom:
6.17. Northern façade of CAD model.
6.18. Perspective of northern façade.
6.19. Perspective rendering of north-western façade.
6.20. Perspective of south-western façade.
6.21. Southern façade of CAD model.

6.22. Portal image of CAD model.
6.23. Perspective view of square.
6.24. Detail of southern façade.
6.25. Perspective view of a secondary entrance and media centre.

6.26. Bird's eye view of CAD model from the south-west of the building.
6.27. Human interface design / skin architecture.

6.28. Bird's eye view of CAD model from the north-west of the building.
6.29. Internal / external. View of CAD model showing the main entrance and portal.

From top to bottom:
6.30. Southern façade growth screen
6.31. Perspective view of growth screen CAD model.
6.32. Reinforce concrete staircase walls.
6.33. Northern view of staircase walls.

From top to bottom:
6.34. Front perspective image of northern façade sunscreen skin module.
6.35. Connection detail between steel sunscreen rib and reinforced concrete column.
6.36. Side perspective of sunscreen CAD model.

MOMENT 07:
Technical investigation cover page:
7.1. Electricity hub of Building management system. [http://www.online.kek.jp/belle.evbld/pictures.htm]

7.2. Detail drawing of northern façade sunscreen skin connection detail.
7.3-8. Series of CAD model structure.
7.9-15. Skin architecture.

From top to bottom:
7.16. Photograph of Centre Pompidou. [http://www.weltbilder.cc/detail.php?image_id=267, accessed 12 August]
7.17. Interior photograph of displacement ventilation ducting in Centre Pompidou. [http://www.architectureweed.com/2003/1203/building_1-2.html, accessed 12 August].
7.18. Sectional drawing of Centre Pompidou illustrating the externally located main displacement ventilation ducting. [http://www.architectureweed.com/2003/1203/building_1-2.html, accessed 12 August].
7.19. Model of Centre Pompidou. [http://www.jigsaw.w3.org/0004/000430-minifrance.html, accessed 2 August].

7.20. Drawing of fire exits and effective areas.

Clockwise from top:
7.21. Photograph of 'Gen 2' machineroomless elevator, manufactured by 'OTIS'. [Digital catalogue: Otis South Africa Products & services, Version 4].
7.22. Perspective view of portal with lift shaft o the left hand side. The lift shaft acts as a light well during night time, emitting filtered red light on the main access ramp. The daily usage of the elevator functions as a time modulator of its users' movement.
7.23. Western façade perspective view of CAD model with the lift shaft depicted in red.

1. Introduction

1.1 Cycles

Globally, cities form the 'natural' habitat for millions of people. Anthropocentric in design, the city is the culmination of the mechanistic paradigm. [Capra 1982]. City dwellers are dissociated with the cyclical processes of nature, not recognizing the interdependence of all phenomena. [Ibid].
Simmonds [1983] states that we are the victims of our mechanistic constructed surroundings.

The cycles of nature are in constant repetition, and is governed solely by the concept of time. In this discourse the concept of time will be employed as the structuring element of architecture, defining our current epoch in the time line of humankind. Architecture absorbs the entire life of a specific period or era, it stands as a withess and informant to the time of construction.

Mostly invisible to the uninformed, mankind is disconnected from nature, only ascribing a use-value thereto. The alienation from environmental values and cultural connections is more prominent in an urban society. The dependence on nature is largely taken for granted. [Young 2003]

001_Whirlpool galaxy, 28 million light years away. Space as seen in the past. *[National Geographic. February 2003.]*

002_Hurricane Gladys, *spin* in nature. *[A. B. C. Whipple. Planet Earth: Storm. 1982.]*

003_Scent in the microgravity of space. *[Madere, J.]*

004_Goldfish symbolising new life in springtime as microcosm of nature, Irak. *[Avakian, A. National Geographic. 1999. vol 196.]*

In re-establishing the man-nature connection, the evolving urban environment is the determining factor. [Simonot 2003]

According to Capra [1982], deep ecological awareness is ultimately a spiritual awareness were the individual is elevated to feeling part of the cosmos as a whole.

Spatial experience in cities is dictated by the existing built fabric. At a given moment, it is fixed and permanent, disregarding any adaptability or linkage with natural processes. In the aspect of linear time, a city is dynamic in its existence, perpetually in a state of becoming. [Dewar e.a. 1991]. The processes of a city could be described as a self-evolving entity that moves along in a historical continuum. The question that perpetrates itself is what essence is there to capture in architecture, what are future generations supposed to remember, represent and monumentalize. [Bouman 2003]

All buildings are a pinpoint of the time when constructed. It conveys the manner in which it was built as well as the stylistic expression. Every building is therefore a summation of time, or rather, a monument of its specific time. It is obvious that architects differ in their execution of the summation of time, or rather what to summarise. A monument of a specific epoch in architecture does not dwell on the design of historical stylistic impressions, but rather on an architecture of its own time. Architecture that is 'embedded in the deeper historical stratigraphy of human achievement as well'. [Brownlee 1997:89]

Architecture in reality represents or constitutes an organism in itself, with its own character and its own continuing life. [Giedion 1947]. The architecture of today is inseparably linked to town planning or urban design, because everything depends on the unified organization of life. Conscious planning is demanded. [Ibid].

The built environment stands in comparison to the individual as a time-capsule, constantly managing its daily [routine] existence. Every individual dwells at the centre of his or her experienced universe and knows its perceptual realities from its unique point of reference. [Woods 1992]

005_Historical Urbanism. *[Kostof, S. 1991. The city shaped. Italy: Thames & Hudson]*

006_Grainsilo, Standerton. [Photograph: *Author]*

007_Corrugated cladding, refurbishment, Johannesburg CBD. [Photo: *StudioMAS]*

The lives of urban dwellers are also dictated by the moment-by-moment adjustment to their environment. [Simmonds 1983]. In the continual evolving process of our cities, the emphasis ought to shift from an individual's personal adjustment to the continual adjustment of the constructed environment.

Contemporary architecture is defined by the virtual projection of the end product. The developer actively encourages the shortest possible project life-span to gain the maximum return on investment. Developers have become the dictators governing the expression of the current built environment. According to Van Berkel et al [2002:82], both capitalism and photography have conspired to force architects to freeze architecture in time and suppress the reality that *'..all buildings are the mothers of ruins'*.

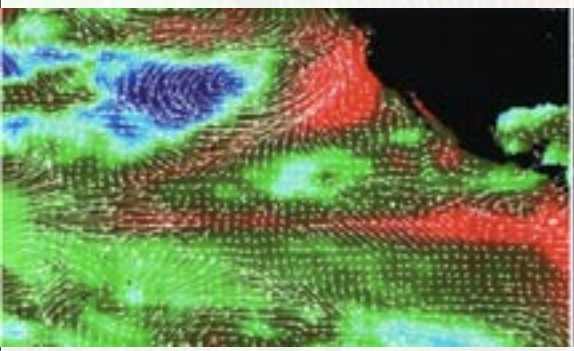
That one photograph-moment that captures the apparent essence of a project, both for developers and architects, signifying the end of the project phase and the beginning of the buildings'. [Bouman 2003]. In architecture, time is captured and stands still, disregarding the cyclical processes of nature or the ravages of time.

Architecture becomes the photomontage of delivery. [Ibid.]

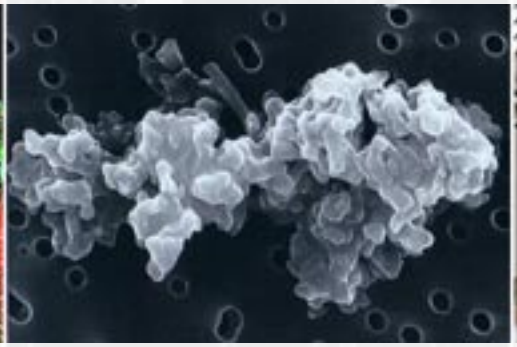
Time is collapsing, seconds become shorter, cycles seem to get ever closer. Time management is at the order of the day. How much more time may be claimed by traffic jams, or for a moment to take action. Social integration can only be established by respecting others' time and not only their culture.

This brings us to the notion of shared time and its significance in architecture. According to Bouman 2003, it is fundamental to repair the synchronicity, not of clock time, but of the experience of time. It is obvious that relaxed time is the deceleration of everyday time, not being dictated by pressing deadlines. In what manner can spatial perception decelerate time for the user? [Ibid].

The society of today is described as a culture that is based upon consumerism or 'bottom line' thinking. The syncronicity that Bouman proposes is what Woods establish with his new city. The parallels of centricity, synchronicity and synergy is the preamble situation of a future culture that is based upon the experiential. The living in the 'now'. [Brown 1992]



Satellite data depicting El nino temperature and wind anomalies in May 1997. *[Jet Propulsion Laboratories, National Geographic, March, 1999 vol 195 no 3.]*



A constant rain of microscopic interplanetary dust particles delivers a variety of compounds, which almost surely contributed to the primordial soup of the substance of Earth. [*National Geographic, March, 1998 vol. 193 no. 3.]*

VW Pheatons gliding across a beauty queen promenade, a 25m long neon tunnel where the paint job is checked for blemishes. The finished cars are displayed in a glass parcade. *[Champa, P. Surface, issue 43]*

This discourse is envisioned as a robust environment that is designed from the perspective of ever evolving requirements in future 'space time'.

1.2 TIME

The concept of time is usually believed to be a number and quantity that is continuous [Chronos]. According to Rahim 2001:31, the abstraction of quantifiable time should shift to the non determinate, qualitative duration of temporality where the past, present and future are simultaneous.
Rahim 2001:31 describes time through Newtonian science, whereby every event or happening in nature is predictable and predetermined by initial conditions.

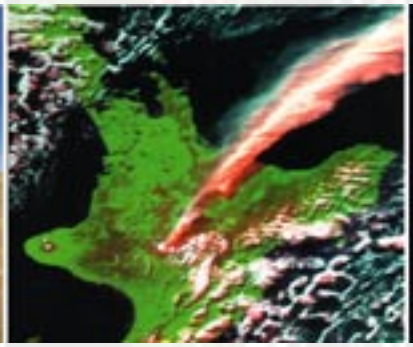
According to Kellerman 1989:30, time definition is dependent from individual to individual and also to a specific age group. It can be a myriad of different potentialities, for example an experience, a major dimension, an ordering framework or an event of biological significance.
Experiential time refers to an individual's time in terms of the duration of personalized images. The calendar and clock is our organizing mechanism of events.

Kellerman classifies inner perceptions of time as an uninterrupted duration and as a series of differentiated occurrences along past, present and future.

Time is also multivalent and can be either passive or active. Passive time is defined as clock, charts and history or as the silent agent as an effect. Active time on the other hand is that of time as a cause, it directs and generates.
One of the cornerstones of the time-space duality is the notion that time is a limited resource; it is finite and depends on the individual's life span. Societies on the other hand operates on an unlimited time-basis ithrough the accumulation of knowledge from generation to generation.

Lalibela, pilgrimage site for Ethiopian Christians for 800 years. 12 Stone churches cut from volcanic tuff. *[Steinmetz, G. NG, July 2001.]*

Stark circle of rock measuring about 30 m in the Tenere desert below the masif Adrar Madet in Niger. Roughly 2 km away in each of the four cardinal directions arrows point away form the circle, whose origin, purpose, and age remain a mystery. *[Steinmetz, G. NG, March, 1999]*

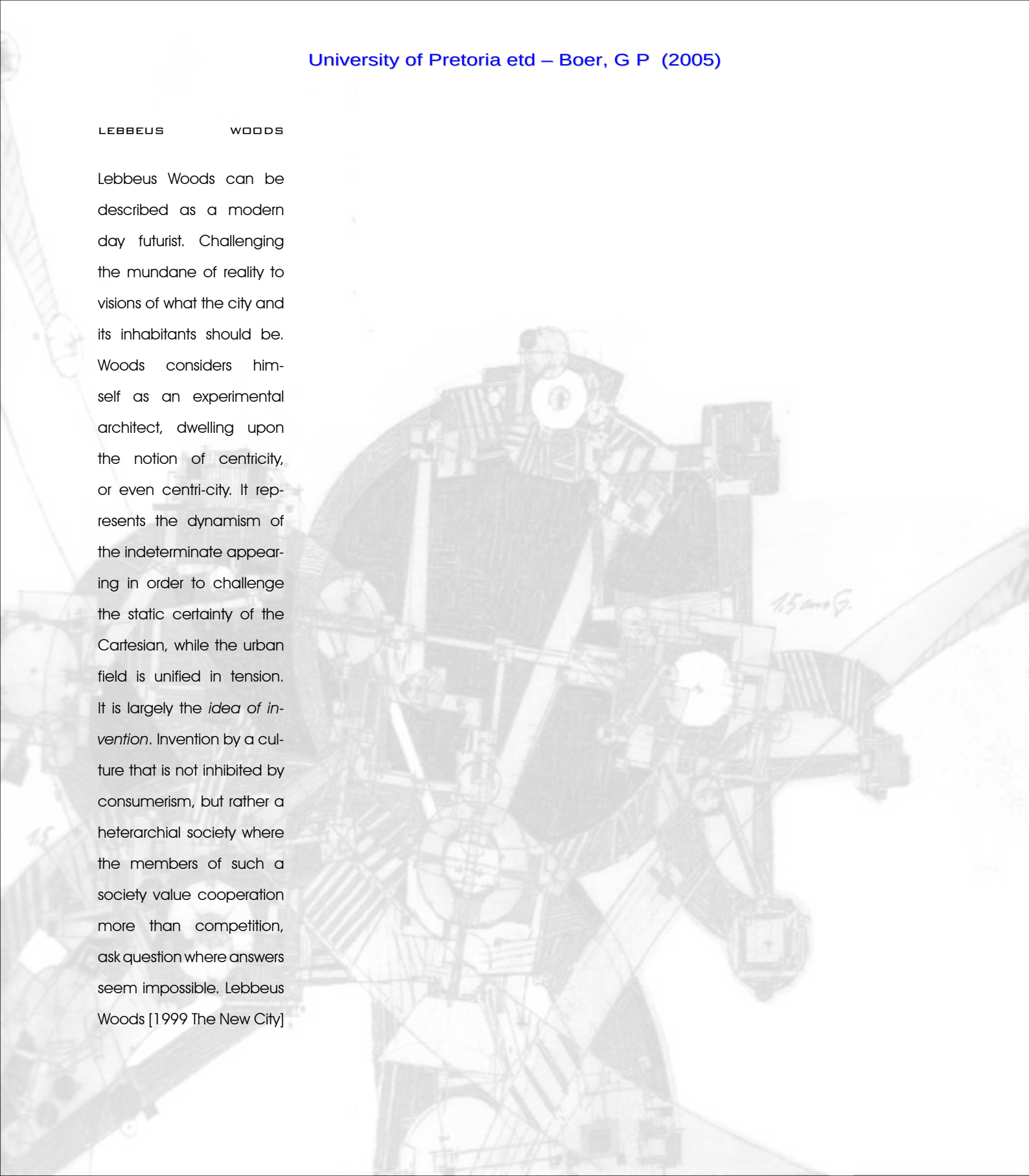


Towering ash plume from mount Ruapehu, New Zealand 17 June 1996. *[National Geographic, January, 1997 vol. 191 no. 1]*

Brisingid sea stars through a 'deep-sea-hubble', ecosystems such as these may hold a clue to early life on earth. *[Kristof, E. NG, February 2003]*

LEBBEUS WOODS

Lebbeus Woods can be described as a modern day futurist. Challenging the mundane of reality to visions of what the city and its inhabitants should be. Woods considers himself as an experimental architect, dwelling upon the notion of centricity, or even centri-city. It represents the dynamism of the indeterminate appearing in order to challenge the static certainty of the Cartesian, while the urban field is unified in tension. It is largely the *idea of invention*. Invention by a culture that is not inhibited by consumerism, but rather a heterarchial society where the members of such a society value cooperation more than competition, ask question where answers seem impossible. Lebbeus Woods [1999 The New City]



"Architecture more than ever clings to history and language for its origins. Visions of ethereal energies and exotic matter have not yet roused architects from their comfortable ruminations in the past. Only perhaps when the rest of the world is utterly transformed by new understandings of its substance and dynamics will architecture be released from questionable certitudes of an imagined history." Lebbeus Woods [1999 The New City]

All things restless; changing in time and space. Lebbeus Woods [1999 The New City]

1.3 Design exploration

The University of Pretoria [UP] exists as an island in a supposedly urban environment. The campus consists of a myriad different faculties each having its own agenda. The advent of the eco-systemic approach in society requires an integrated approach to education.

The School for the Built Environment is currently largely disparate in its operation. The interaction, or personal network establishment, is solely hampered by the available facilities on campus.

The Department of Architecture is in need of alternative accommodation to suit the ever increasing number of prospective students, especially post-graduate students.

Ideally the exposure, education of and interaction with architecture will not be limited to the students of this department. Every person on the UP campus ought to be enriched, challenged or confronted by this interaction and exposure to design education.

The departments of Construction- Economics and Management moved from Boukunde to the South Campus of the UP in 2000 due to a lack of available accommodation. It is therefore proposed that both departments utilise the existing 'Boukunde building'.

The integration with other departments of the Built Environment School will be instrumental in providing graduates with a more rounded or systemic approach to knowledge and life.

The building will have a fourfold function as visitor centre, office, workshop and lecturing facility with the re-establishment of a studio culture.

Parking for staff and students remains to be a major cause of concern for the UP. The ever increasing student numbers intensify the problem. According to the Strategic Plan of the UP, the parking problem has become systemic in nature and will be addressed in a manner consistent with the scope of the problem. A sub problem of the thesis proposal will therefore be the provision of vehicular parking over and above the requirements of the building proposed.

1.4 Client

The University of Pretoria is established as principle client. According to the Strategic Plan of the University of Pretoria, it is a resource constrained institution that cannot admit more students than its resources allow it to serve. The University is subsequently developing a Growth Strategy by which it will manage the growth in student numbers. The preferred growth rate is 1 ½% per annum in student numbers. Over the past four years the growth in student numbers was 6% [Potgieter 2004]. The Growth Strategy will focus on the growth of the Universities' stature rather than its student numbers. It favours postgraduate enrolment over graduate enrolment.

1.4.1 requirements

The requirements of a project for the School of the Built Environment is envisioned as an integrated approach to a structure that should possess the ability to adapt to alternate future programmes. This establishes the notion of generic space that can be altered to changing needs over time.

The proposed project is a building for tertiary education, accommodating the University of Pretoria's departments of Architecture, Landscape Architecture, Interior Architecture and the future post-graduate courses of Urban Design and Industrial Design. Cognisance should be taken of the ever evolving nature of faculties, and their ever changing programme or requirements.

1.5 Exploration context

1.5.1 Urban exploration

The University of Pretoria exists as a fenced island in the midst of the greater urban environment. It is territorial in function, being homogenized internally and alienating externally.

The boundary of the campus is defined by an 'iron curtain' of palisade security fences that is interrupted by student access gates. [Potgieter 2004]. The issue of concern is the level of permeability of a campus with limited and controlled access points. Bentley et al [1985] describes permeability as the extent to which an environment allows the flow of people from place to place. This, in turn is the key measure of responsiveness. It is obvious that the permeability of the campus is affected by the imposition of the security measures.

The safety of people and property on and around the campus remains the most important objective for the UP. The security of a campus can be implemented in a manner that is not only a lackey to its pragmatic function, but also serve to enrich its 'urban' setting.

In the proposed project, the manifestation of permeability on the campus of UP will focus on eliminating the segregation between the campus and surrounding areas. This will both respond to as well as increase the level of activity around its periphery.

1.5.2 Theoretical exploration

Development trends are essentially focused on the design of static structures that can only accommodate a specific programme or use. The thesis proposal emphasizes the ephemeral nature of design, or rather moments in time-space that embody the cyclical pattern of nature governing our existence.

The 'moments' in space-time can only be communicated through a user's sense perception. The thesis will therefore dwell upon the sensory experience of movement through a structure.

The end-users of the thesis proposal will be the designers of the future built environment. As discussed in the introduction, a building can be seen as a photo image of time. It follows that designers, as 'time-regulators', can for their own designing life-span capture and question the prominence of time.

The physical manifestation of the thesis proposal will ultimately be in the designs of its users.

The metaphysical concept of time and the movement through space-time, will manifest through the cyclical or routine use of the structure from day to day.

The materials employed in the building should convey a recognition of nature to its historical reality, thereby promoting a pre-site context for the structure. [Juel Christiansen].

1.6 Design Philosophy

The thesis proposal, as any architectural endeavour, forms part of the external environment. The environment is the all encompassing rhythm of time in which we find our self in. The manner in which the project interrelates to buildings, man and the bio-physical environment will be investigated. Is the interaction merely fatuous and fickle, or is there a deeper meaning to what we as humans perceive to be our living environment? Within each setting a myriad of potentialities exist; the potential constantly shifting to reach a state of equilibrium. A very elusive state of equilibrium. A pendulum.

The designs' compass is set on time. Linear time, as personified in the different movement patterns of man and his interventions. The prominence and overlapping areas of these patterns are a definite guide to the design. The project will investigate the development of a current, global location that is site specific, but still linked with global networks. [Van Berkel, Bos 2002].

The ephemeral nature of colour in the changing shades of season. *[Wolinsky, C. National Geographic, July 1999, vol. 196, no.1]*

Globally, nature is actual and relevant in man's life. Mankind has achieved the greatest improvements by consciously striving for a harmonious integration with nature [Simonds 1983]. The understanding that man can possibly possess of the complex interrelated and interdependent abiotic and biotic elements are limited. The slightest change in the web of life has a ripple effect, so that a micro scale action can have a macro scale reaction. Unfortunately, our understanding of nature is coupled to a time frame that is larger than our lifespan.

The complexity increases.

The design philosophy for the School of the Built Environment will therefore focus on a mutual symbiotic integration with nature. Man and nature being in tune with each other.

1.7 Accommodation schedule

The accommodation schedule is perceived as a general design guideline and not as a fixed programme that has to be adhered to. The building will rather focus on the adaptability of a programme to suit the ephemerality of buildings.

The building will consist of :

Foyer/ reception

Information facility

Public exhibition space

Coffee shop

Galleries

Media centre / Bookshop 100m^2

Toilets

Copy centre

Vertical / Horizontal movement corridors

Social areas

External social areas [smoking areas]

6 Lecture halls

- Audio visual facility

Personnel room

Offices:

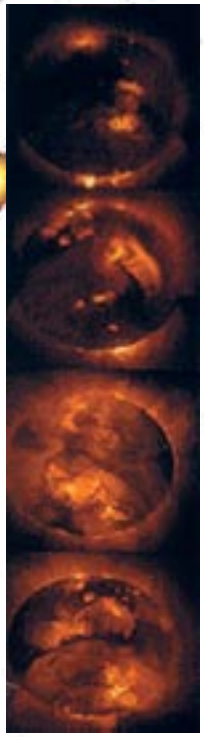
- The Head of Department
  - Secretary office
  - Safe
- 20 Lecturer offices
- Computer laboratories

Workshops

Archive storage

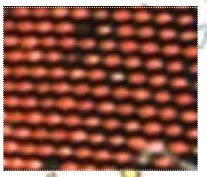
6 Studios

Parking



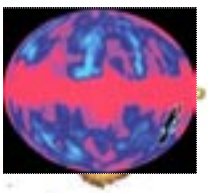
Soft X-ray image of the sun [Universal Records 2002]

Burrowing through block modules. [UN Studio: Move.]



Part of a fly's eye. Transparency, semi-, or closed. [UN Studio: Move.]

Abell 1689, light being bent due to gravitational pull from amassed galaxies. [Cowen, R. National Geographic. February 2003.]



The farther out we look into space, the father back in time we see. Veil of fossil radiation dating 300 000 years after the big-bang that permeates space. This is the limit of our view when the universe emerged from a state of hot plasma and became transparent. [National Geographic, October 1999, Vol. 196, no. 4]

1.7.1 FOYER

The foyer and permanent exhibition spaces will be combined to form a platform of an 'urban campus'. The building should be transparent enough in this area to be inviting to the public and visitors. Security control will also be simplified if the public arenas are situated in close proximity of the entrance. The reception desk can be used as secretarial / receptionist desk during the day and as security station at night.

The exhibition space is utilized as a platform for educating, becoming an informal space where exposure to design is the primary function. The coffee shop and restaurant can also be used for evening functions.

The coffee shop should provide an informal social l space for students and visitors, with a limited but basic menu. The kitchen should preferably have direct access to the outside.

The library and bookshop can also be incorporated into the public area, and should accommodate a large extent of shelving and also reading space.

1.7.2 ADMINISTRATIVE AND OFFICE AREAS.

The office areas should be designed with the idea of integration between lecturer and student and not as a separate area.

A personnel room should be provided with a small kitchen attached. Preferably the space should also have an external outside area.

1.7.3 GALLERIES

The number of galleries should be scattered throughout the building, providing 'soft light' and an acoustical measure for sound attenuation. The galleries should also function as social interaction spaces.

1.7.4 LECTURE HALLS

Lecture rooms should be acoustically sound and provide seating for a minimum of 100. Audio visual facilities should be incorporated into each lecture hall. Network services should be robust to allow ease of access.

Light being bent due to gravitational pull from amassed galaxies.
[Cowen, R. National Geographic. February 2003.]

UDY BASELINE STUDY BAS

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u r e

2. Baseline Study

One of the largest problems facing humanity today is the irrevocable harm being done to the ecosystem. The designer of the future will not be governed by aesthetics but by the responsiveness to ecological systems.

According to Wines 2000:32, the built environment has been a cause of the current ecological problems rather than a solution. The built environment consumes up to a quarter of the earths' fresh water supply and is therefore a major contributor to the ecological problems.

The baseline study conducted is seen as a design guideline only. The baseline study informs the design process prior to conceptualising. The study proposes a number of issues that the designer should be aware of. This will ensure an adaptive system where the building is not a static ensemble of elements but rather systems interacting with the advantage of continuous improvement. [Earthscan 2002]

The architectural issues that influence the climatological responsiveness of a building are the materials employed, the compatibility of the design with prevailing site-specific climatic conditions, energy usage and the environmental performance of the building. [Girardet 1997]. Amelioration measures shall thus focus on aspects of the above mentioned issues.

The baseline study can also be seen as the manifestation of the man-nature connection. The connection pertains solely to the systems that limit the impact of the built artifact on the environment. The man-nature connection per sé is not implied, because man and nature is not entities apart, but one and the same thing. The approach in 'connecting' 'man and nature' will therefore be the establishment of a building as a landscape.

Concept model 01. Subtraction and addition on > 200m structure.

2.1 South African green architecture

The concept of green architecture is ever more elusive to define. Locally, sustainability is rooted in an existing eco-systemic world view that is part of South Africa's pastoral and agriculturist heritage. [Castle 2001]. The principles of inter-connectedness and interdependence stems from the principles of the African philosophy of Ubuntu. It can also be related to the philosophy of Holism that General Jan Smuts advocated. [Du Plessis 2001]. Green architecture is an architecture that is sensitive to the interdependence of man and nature, the individual and the community.

2.2 Environmental issues

Issues to be considered are:

· Seasonal cycle of the natural landscape and its transitional role in the project.

· The use of recycled and renewable materials.

· Water catchment system

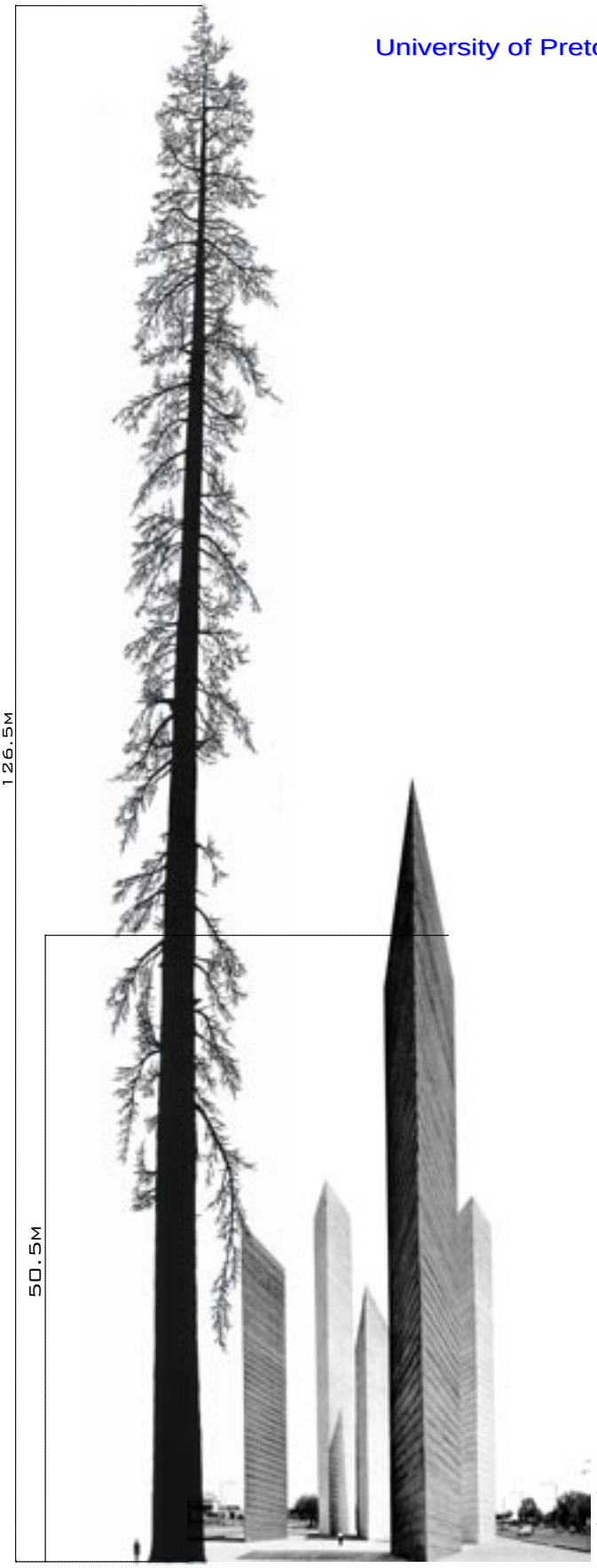
· Decreasing energy demand

- Solar orientation

· Specifying building materials with low embodied energy.

· Design components that can be manufactured by un-schooled labourers and or artisans. In the manufacturing of said components, a 'specialist' is promoted.

The amount of labour can be altered with differing degrees of mechanisation through phases in the project life cycle. [Gerneke 1992:5/6]



The worlds' tallest tree_126,5m Coastal Redwood. [NG, January1997, Vol 191, no.2]
vs.
Barragan's Towers of Satelite City_50.5m. Mexico City, 1957. [Ambasz 1976:52]

2.2. Social issues

2.2.1 Occupant comfort

The social-emotional condition is the principle aspect of a favourable learning situation and can be affected by the design of the school. A positive climate is affected by:

· Contentment; designing a challenging atmosphere where learning can also be un-intentional.

· Involvement; active participation rather than passive viewing of a static structure. [Schooling 1973]

· The building as an educational medium not only for the end user but also for each user of an visual resource.

A built environment should achieve the maximum of occupant comfort with the minimal cost to the natural environment. [Gibberd 2003]

-Lighting

The School for the Built Environment should utilise natural lighting as far as possible. This invariably induces a situation of using fenestration to admit solar incidence, while necessitating the need for sun screens.

Materials should be of a colour that limits the amount of glare in direct sunshine. Glare occurs mainly from viewing a bright source from an area in relative darkness. [Daniels 1998:72]. A white wall in direct sunshine will therefore constitute a high glare infraction.

All artificial lighting should be energy efficient and can also form part of an automation system whereby a movement

and or lux sensors determine which lights to switch on.
The entrance and or exits of the building should be designed as a transition zone in terms of illuminance.

-Noise

The adjacent M6 [Lynnwood road] to the proposed site location produces a great noise impact during peak traffic hours. The design should provide the necessary attenuation between external and internal areas where deemed necessary to acceptable noise levels. Devices used for sound attenuation should be designed in such a manner as to be multi-functional.

-Ventilation

The School for the Built Environment should be ventilated by natural means as far as possible. Investigate the critical dimension for adequate ventilation required.

-Thermal Comfort

The approach to the project as 'a building as a landscape' induces the notion of utilising, amongst others, plants to regulate internal temperatures.
Measures such as 'planting screens' and roof gardens will be employed in the structures to functionally regulate internal temperatures.

-Access to green outside

The design development should incorporate as much of the existing natural environment located on the site. Access and usage of green external spaces can be promulgated by locating them to function as transitions zones between internal and external areas. Green spaces should be incorporated into the structure itself.
The planters that occur throughout the building can be used as education medium by the Department of Landscape Architecture. Students in Landscape Architecture can be divided into groups that are responsible for maintaining a specific planter and or specie. The concept of a school consisting of areas demarcated to teaching and non-teaching is outdated and should extend throughout the school and beyond. The environment aimed to be created, ought to have a managed complexity accommodating varied activities. [Schooling 1973]
The extended linear structure [+160m] should provide a host of access points to ensure proper circulation within the structure. These access points create a number of connections between internal and external spaces.

2.2.2 Inclusive environments

-Transport

The main campus was pedestrian permeable prior to the construction of the palisade security fence. A number of bus stops were located in all the main arterials surrounding the campus. At present, most of the bus stops are obsolete due to the limited number of pedestrian access gates along the periphery of the campus. The site at the main entrance is ideally located to congregate all the existing bus stops into a specific point. A slipway from the M6 will improve traffic flow as the public transport vehicles currently stop in Lynnwood road, thereby adversely affecting traffic. Amelioration measures may include:

-The above mentioned slipway for vehicles travelling in a west-east direction.

-Upgrading shuttle services to and from student residential areas. It includes the Gautrain Rapid Rail station to be situated in Hatfield. The introduction of the 'Gautrain' will enhance the accessibility of the campus for people living as far as Johannesburg.

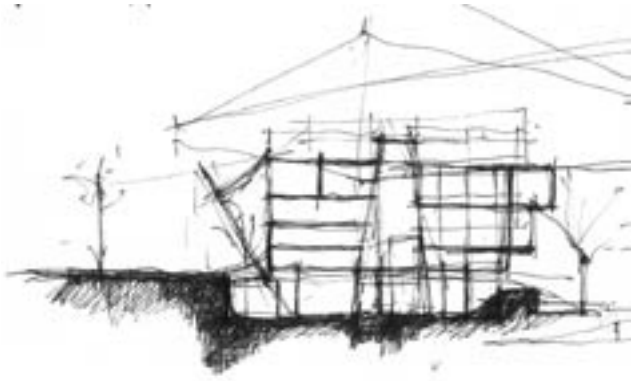
Introducing a slipway for traffic moving in a west-east direction.

Concept model 01. Subtraction and adition on > 200m structure. Integrating the structure with the site to increase energy flow to and from the building.

-Circulation

The School for the Built Environment is mainly a three storey building, with four storeys on its western extremity. Vertical circulation will therefore be largely provided by a series of stairwells and ramps. It is however necessary for mechanical vertical circulation from basement level to the four storeys on the western part.

Walkways entwine the internal and external spaces to bring both the building into nature and nature into the building. All routes between and within the building should have an even finish with no level changes to ease movement through the building and allow wheelchair moveability with ramps of 1:12 fall.



2.2.3 Access to facilities

Facilities to be considered should in the long term be for its primary user which is the student. Aspects dealt with will therefore be 'student-related'

-Banking

Secure banking facilities are located on the main campus of the University of Pretoria.

-Restaurants

A host of different restaurants and other eateries are also available on the main campus.

-Communications

All users of the School for the Built Environment will have permanent access to internet facilities.

2.2.4 Participation and control

-Environmental control

Users of the structure can control ventilation requirements by opening windows and adjusting blinds for optimum user comfort. External shading devices on the northern façade of the structure can be adjusted to control the level of solar incidence.

-Social spaces

A high level of social interaction spaces should be provided for students. These spaces should be placed

throughout the structure.

2.2.5 Education Health and Safety

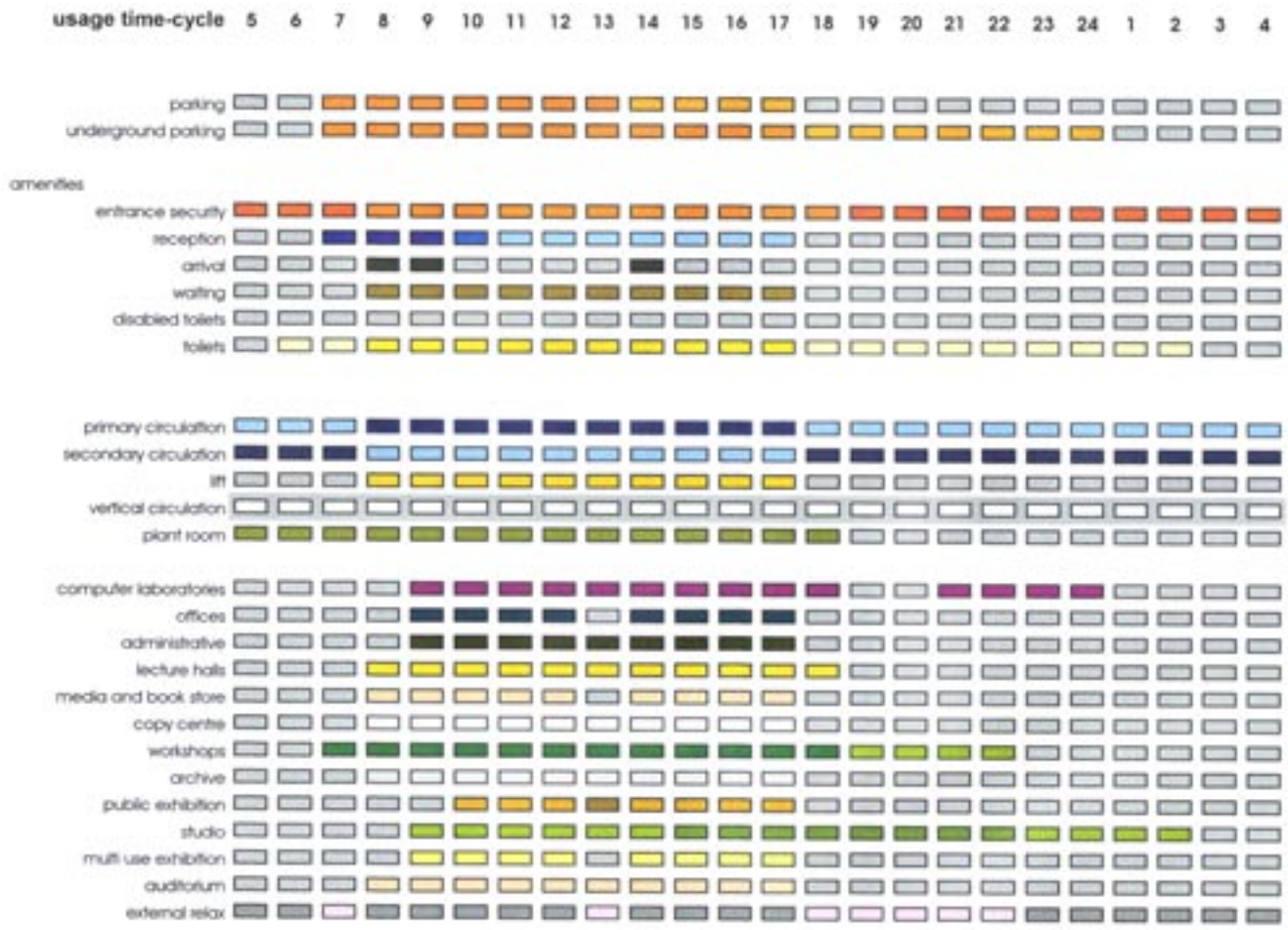
-Education

The project as such is a faculty building where education is its primary function. However, a series of notice boards on walkways and at social spaces can be used to explain aspects of systems within the building, such as the time line that runs the length of Lynnwood road.

2.2.6 Efficiency of use

-Occupancy

The structure is occupied almost daily / diurnally. The nature of the study courses located within the building is such that studio spaces are used extensively. A series of time-graphs generated from occupancy usage will inform the design. It is evident from the time-graph that occupancy far exceed a 40 hour usage per week in certain areas.



-Space usage

The structure should provide an adaptable plan with generic spaces that can be altered in future to changing requirements.

2.2.7 Adaptability and flexibility

-Vertical dimension

The vertical dimension of the building should be approximately 3.2m floor to ceiling height. The added vertical dimension acts as a thermal buffer as well as for occupant comfort.

-Internal partition

Generic space should be enclosed in a manner that allows ease of alteration. Non-load bearing internal walls can easily be altered if the need arises.

2.2.8 Local economy

-Local contractors & craftsman

The project will be built with contractors and work force that reside in the Pretoria region. Indirect support for the local economy stems from specifying products and materials that is manufactured or sourced from within the Pretoria region.

2.3 Economic issues

2.3.1 Capital Costs

The University of Pretoria as principle client will be responsible for the capital outlay. Although the initial investment will be high, the return on investment due to increased student numbers, and therefore the amount of subsidising received from Government, merit the project.

The project utilises a brownfield site on main campus. This leads to densification with limited new infrastructural requirements. Densification negates the buying of new properties, or the demolition of structures on said properties.

2.3.2 Construction and viability

The permanent concrete frame structure will be built on a grid to promote moduler dimensions of products that limit wastage.

2.3.3 Ongoing costs

-Maintenance

The concrete frame structure requires minimal maintenance.

Roofscaping requires maintenance that can be delegated to groups of Landscape Architecture students.

2.4 Environmental issues

2.4.1 Water

-Run-off

The vehicular parking on the campus of UP is characterized by large expanses of surface parking. It defines the grain of the campus, being the common denominator of the urban fabric. Apart from its visual and movement impacts, the parking areas constitutes a stormwater problem. The parking lots seal off any absorptive qualities that the soils may possess. Drainage systems associated with such parking areas are characterized by polluted run-off that invariably end up in river systems. The parking area will be designed to recharge the groundwater reserves, and limit the load on existing stormwater systems in each street. A series of linear retention basins, or rather 'bioswales', will be utilised to both filter run-off and to limit the amount thereof. In addition to the bioswales, rain water permeability can be increased by limiting the amount of impermeable surfaces. [Thompson 1996]

-Rainwater

The collection of rainwater from bioswales as well as from the roofs of the proposed structures into basins, will utilise the water for irrigation.

Amount of collected water:

=Collection area [m^2] x 0.7m/year

[Collection area still to be determined.]

Possible rain water collection from the site:

=12290m^2 x 0.7m/year

=8603 kl/year on average.

-Gray water

The waste that buildings produce increase their theoretical 'footprint'. In approaching a project one should strive not to subjugate nature, but to integrate the project with natural processes. Although mankind is a highly adaptable species, we cannot estimate the earth's capacity to provide us with the key survival elements of life, namely clean air, water and soil. [Du Plessis, 1999]. Urban growth is dependant on the availability of resources, as well as the earth's limited capacity to absorb waste; its sink limit. The sink limit therefore influences growth. [Ibid].

In the thesis, cognisance ought to be taken of the contextual impact of decisions, pertaining to their sphere of influence.

Sewage will preferably be collected at one point along the perimeter of the building. Wet core services should be limited to a maximum of two points.

-Landscaping

Specify endemic plants that are drought resistant to minimize the amount of water required for irrigation, such as *Acacia Xanthophlea* [Fever tree].

2.4.2 Energy

The energy efficiency of a building can be subdivided into two main influences. Firstly, an increased use of diverse energy sources, such as passive, wind, solar and water, determines the efficiency. Secondly, the construction of architecture in response to regional climates and contextual influences, contribute to the energy use. [Wines 2000:66].

The occupancy hours of a building also have an impact on its energy requirements.

The reception desk /security station should be fitted with an affordable building systems monitoring apparatus.

A time schedule should be established for general lighting conditions in various parts of the building. The time schedule can easily be used for an automation system for the building.

-Thermal energy

According to Holm 1996, thermal mass is effective for half the winter period and the entire summer.

-Solar control

The building should provide the users the opportunity to control their environment, through the level of ventilation and solar incidence.

-Heating, Ventilation and Air Conditioning system [HVAC]

Investigate the possibility of channelling cool air from 'green' shaded areas instead of from areas in close proximity to asphalt surfaces with high temperatures. Reduce the need for an HVAC system through employing passive ventilation principles. An HVAC system should only be employed in areas specifically requiring a constant temperature such as computer laboratories. To limit the amount of solar heat gain in summer, external materials and finishes with a light and or reflective colour should be specified.

-Recycle and re-use

· Paper. According to Wines 2000: 66, a single tree supplies enough oxygen for four people. The advent of the information age has fortunately limited the vast amount of paper used per person. It can be assumed that in time to come, this trend will hopefully lead to a largely 'paperless' society. Paper recycling is an established practise in South Africa with incentives such as 'Mondi Paper recycling'

· Glass

· Greywater

- Metal

-Site

The proposed project is situated on a brownfield site that is currently used as a parking lot. The parking area is finished with impermeable macadam that is detrimental to biodiversity. Amelioration measures include permeable paving to allow ground water recharge and the planting of endemic species as well as roofscaping.

2.4.3 Material and components

·Concrete

Concrete is possibly the structural material that is most commonly used. The production process of concrete is carbon [up to 3000 kg/tonne] intensive and uses limestone, a limited resource, as ingredient. [Smith 2003]

Concrete can successfully be employed as an agent for thermal massing, especially in conjunction with roof-gardens.

The recycling potential of concrete is limited, and can only be used as broken-down aggregate.

·Glass

Electrochromic glass functions by passing a low electrical voltage across a microscopically thin coating on the glass. This activates a tungsten bearing electrochromic layer that darkens. [Smith 2003]

Research the viability of using electrochromic glass in the South African context, coupled with a bank of PV cells as power supply.

·Smart materials

'Smart materials represents the epitome of the new paradigm of materials science whereby structural materials are being superseded by functional ones. Smart materials carry out their tasks as a result of their intrinsic properties. In many situations it will replace mechanical operations. We will see smart devices in which the materials themselves do the job of levers, gears and even electronic circuitry. There is even the prospect of a house built of bricks that change their thermal insulating properties depending on the outside temperature so as to maximise energy efficiency.' [Ball 1997]

-Steel

Steel is one of the primary structural components of the building. Steel can easily be recycled, thereby substantially decreasing its embodied energy. The main factor of consideration is however the decrease in construction time that can be gained from specifying steel components that can be pre-manufactured off-site and quickly assembled on-site.

2. 5 Design implications

Permeable landscape features should limit the amount of segregation between pedestrian and vehicular traffic routes.

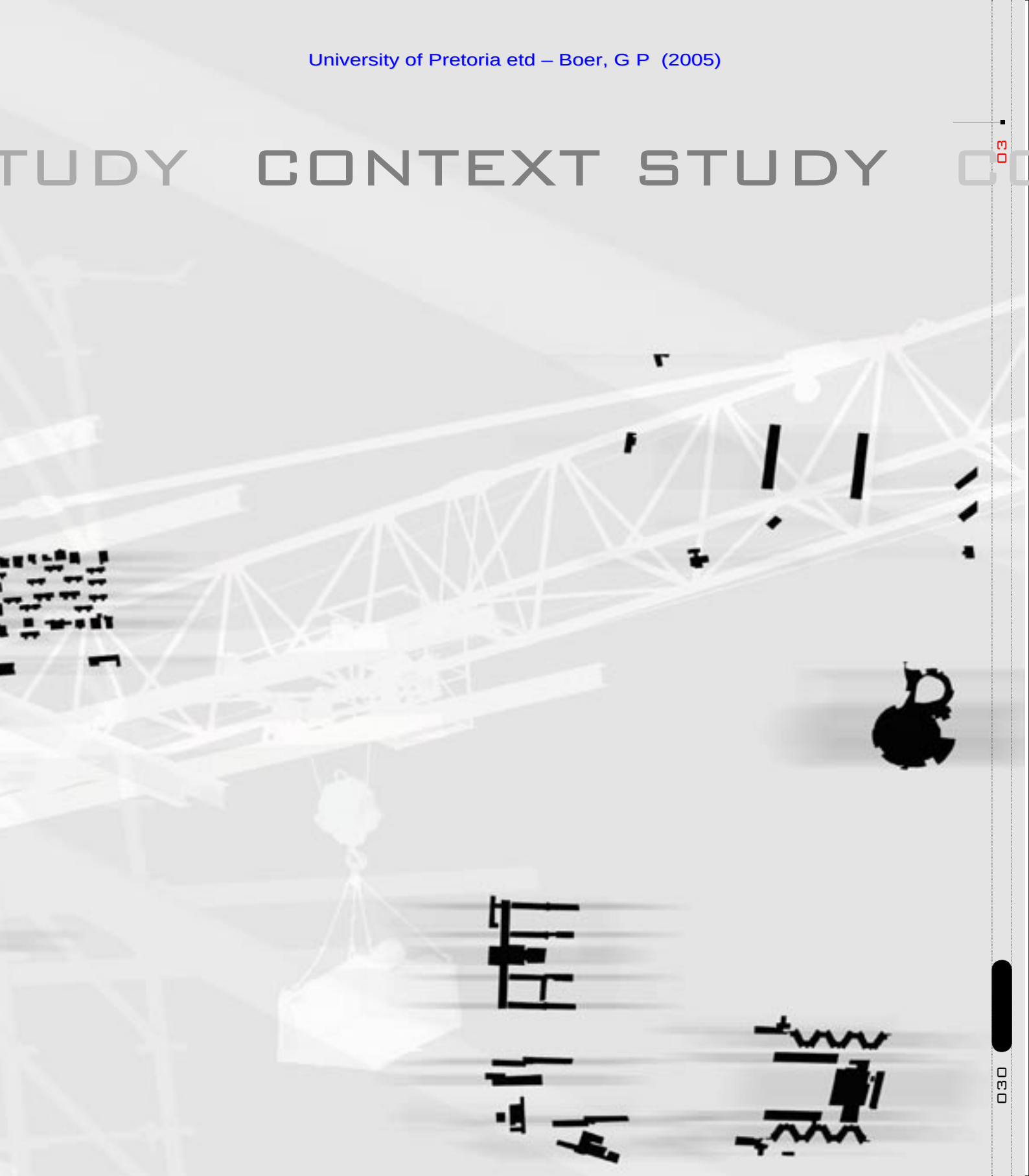
Special consideration should be given to fast moving vehicular traffic noise through the use of transitional spaces.

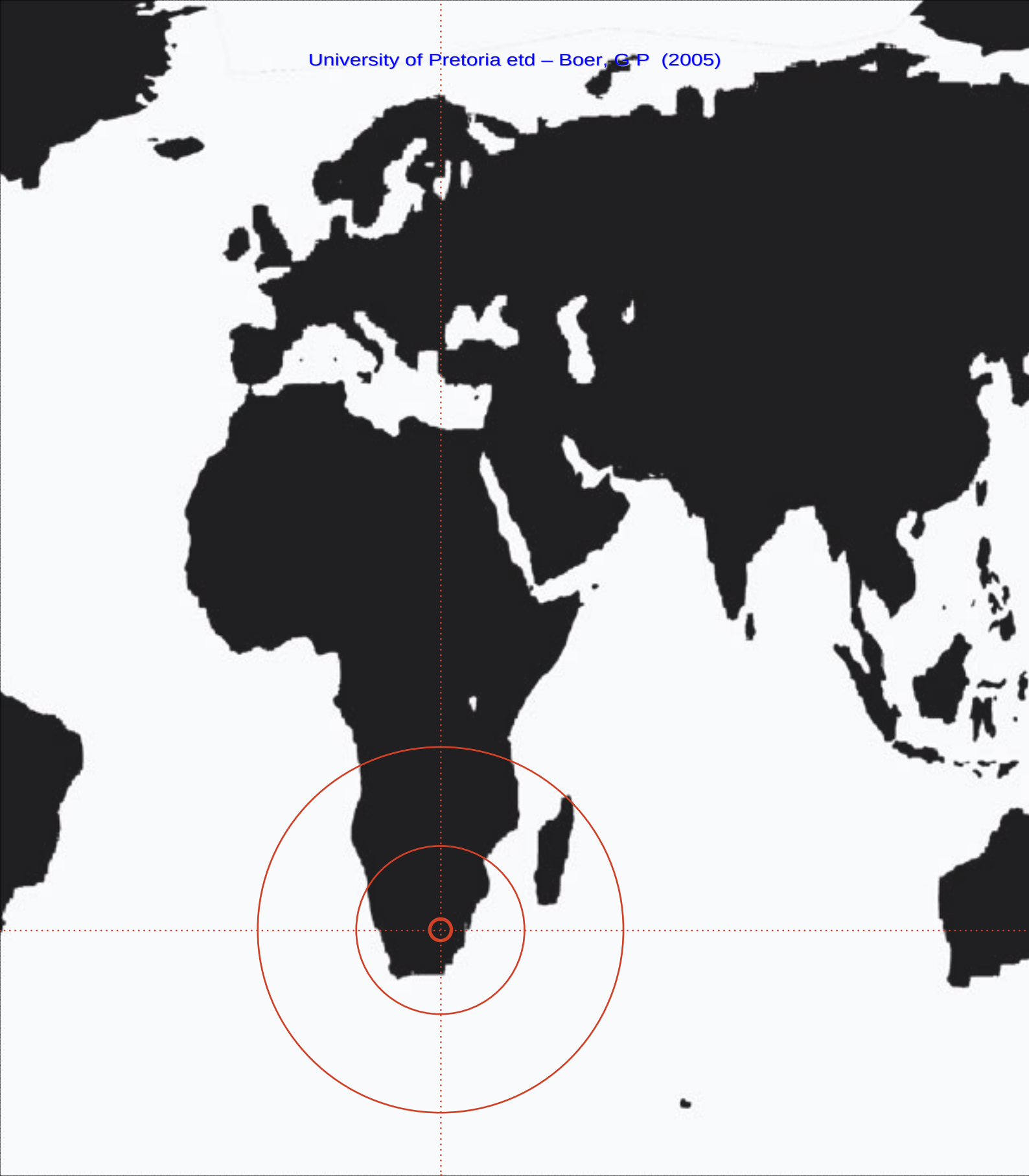
Transitional spaces

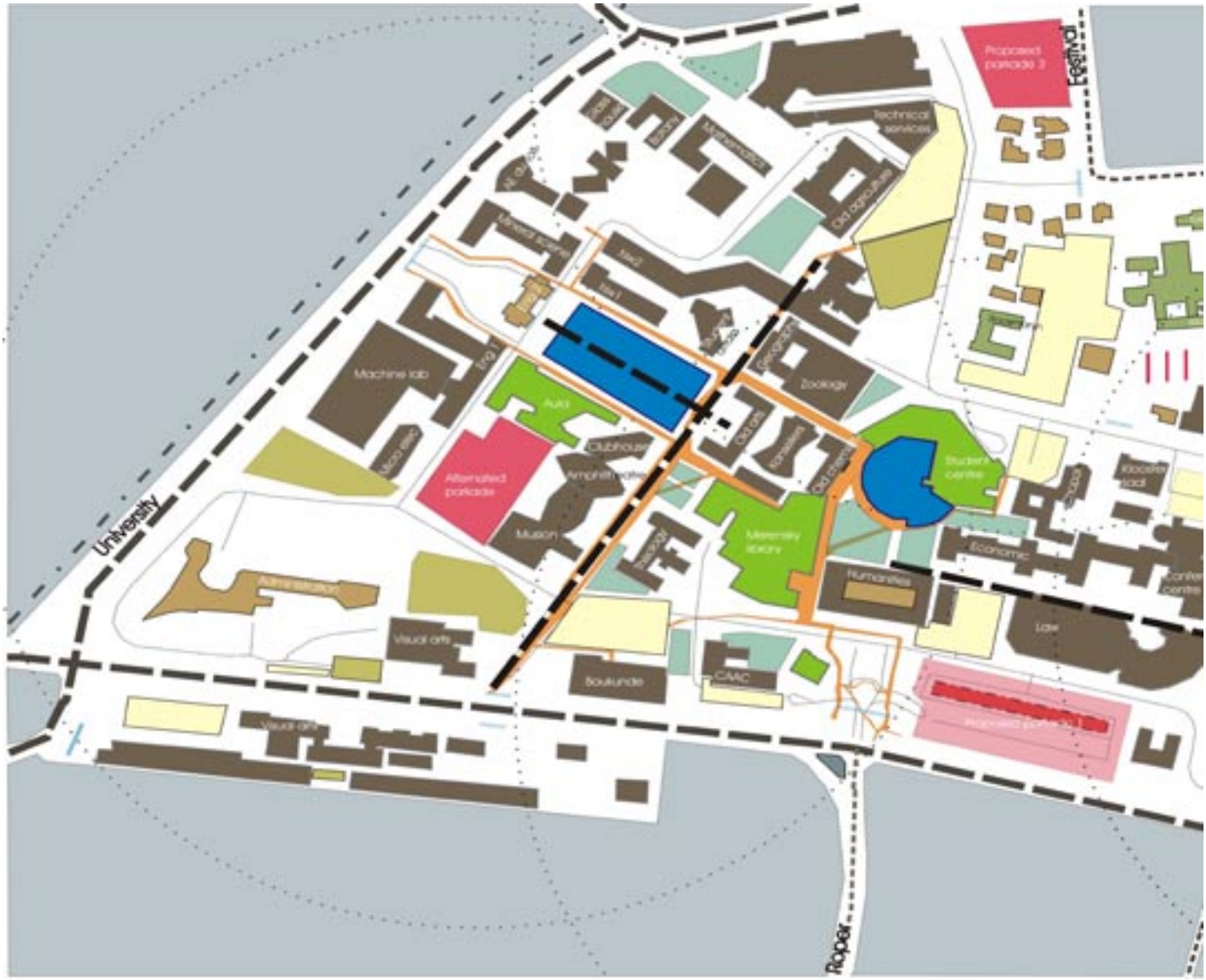
The building should be designed to an accessible human scale. This can be achieved on ground floor through a tactile approach, signifying the sense of touch. Different textures and colours interweave to provide the user with a sense of connection on a human scale.

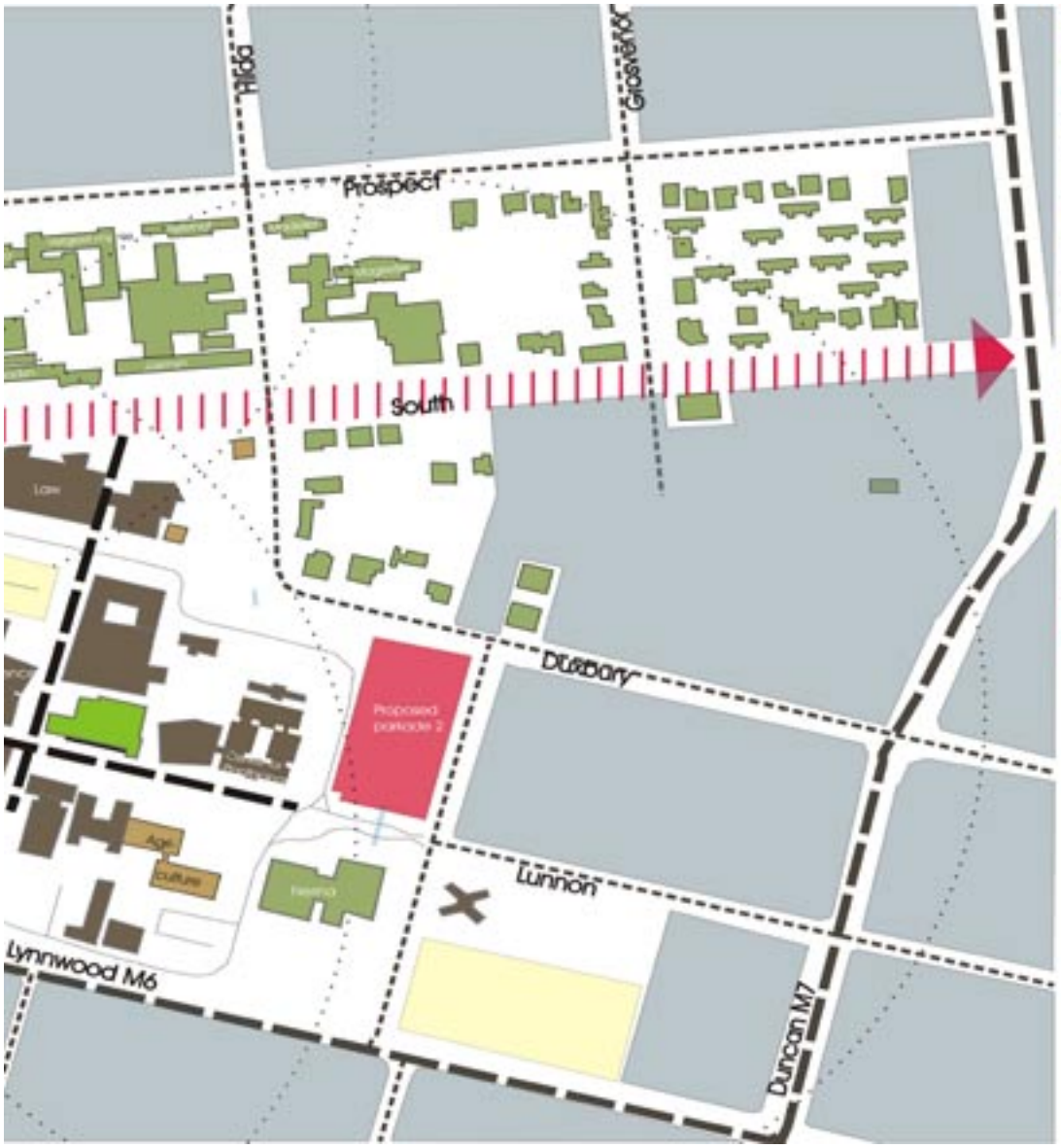
- Limit fenestration to a maximum of 20% on east and west facades.
- Avoid the use of white paint on external façades that receive direct solar exposure to reduce reflected glare.
- The legibility of the building should extend into surrounding areas, including appropriate street furniture.
- The structure and façades should provide a high degree of visual stimulation due to the prominence of the site in terms of passers-by.
- The specific microclimate of the site and surroundings should be investigated to respond to the needs.

NTEXT STUDY CONTEXT ST




University of Pretoria etd – Boer, C P (2005)


Proposed parkade 3
Technical services
Old agriculture
Machine lab
Auditorium
Zoology
Clubhouse
Student centre
Alternated parkade
Musion
Humanities
Economic
Law
Visual arts
Boulonde
CAAC
University
Roper



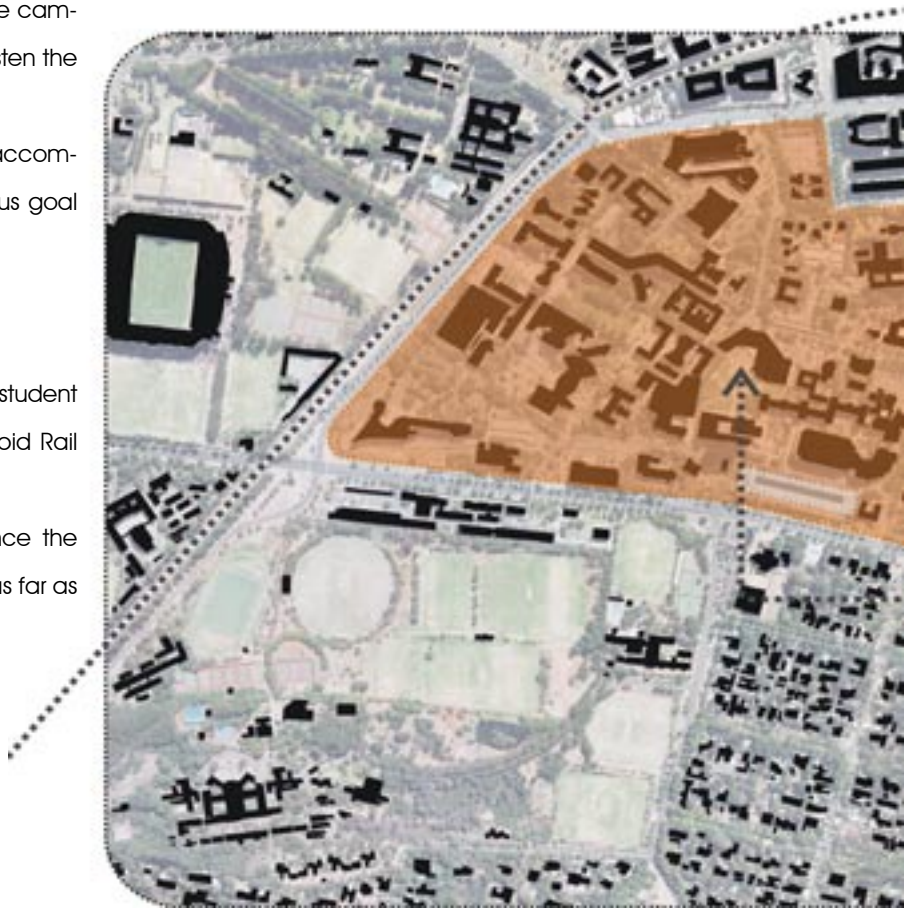
Student Squares and places to Stage periodic events
Major soft green scape
Major paths and or view-lines
Educational facilities
Predominantly office
Vehicular and or pedestrian entrances
Major parking areas
Covered parking areas
UP parkade development proposal
Main pedestrian movement
Student amenities
UP Hostel & residence
UP South str development proposal

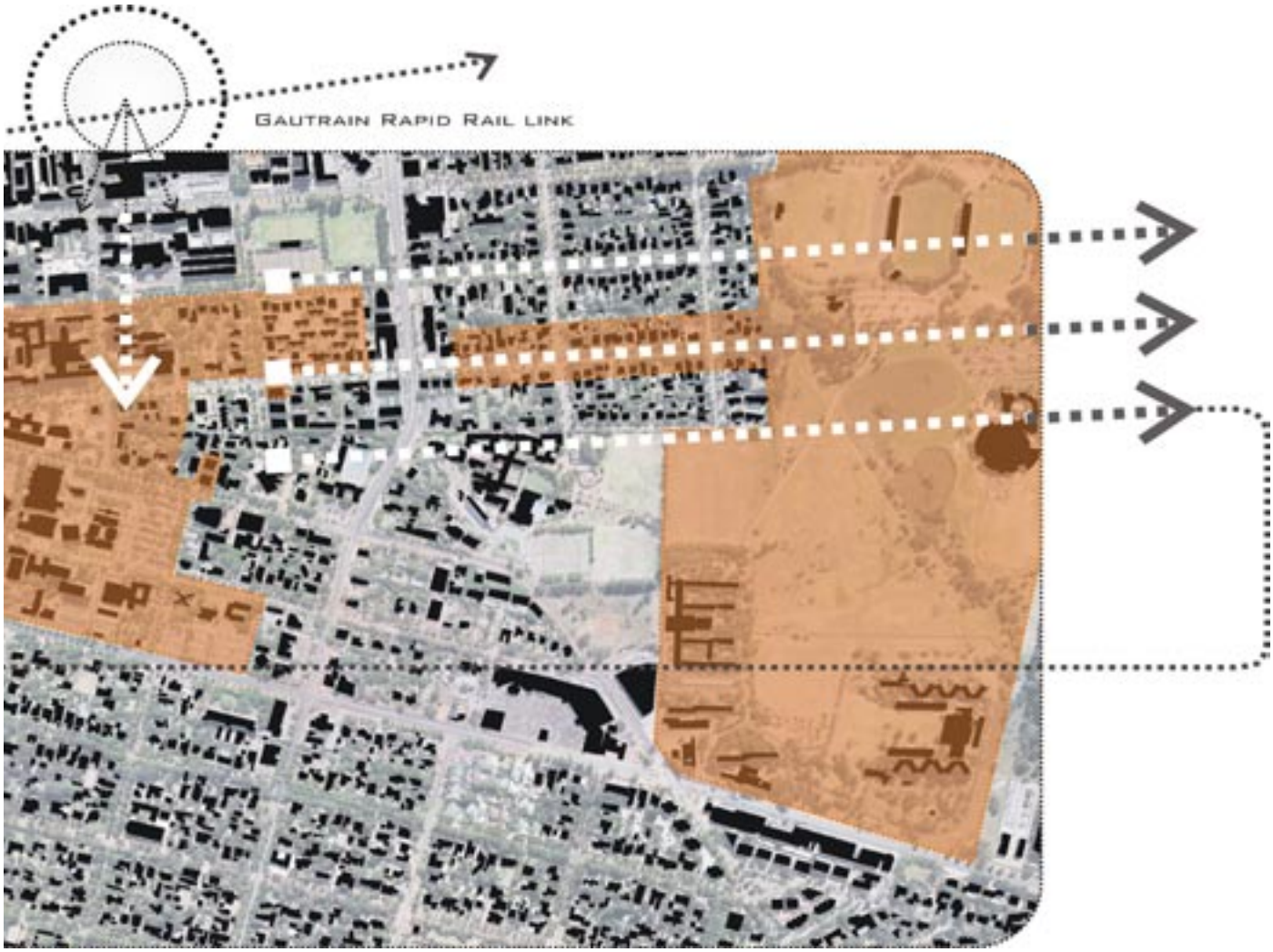
3.1 Development strategies

Current development strategies of the University of Pretoria focus on the expansion of the main campus in an easterly direction. The aftermath of such a decision is the development of a fragmented campus that in future could become a functional west - east campus.

The parking problem of the University of Pretoria's main campus will only escalate if the built fabric continuous to defragment opposed to its densification.
A series of proposed car parks surrounding the campus will alleviate the parking problem, but hasten the eastern expansion of the campus facilities.
The concern of a campus should not be the accommodation of vehicles, but rather the conscious goal of pedestrianising its facilities.

Amelioration measures include:
- Upgrading shuttle services to and from student residential areas. It includes the Gautrain Rapid Rail station to be situated in Hatfield.
The introduction of the 'Gautrain' will enhance the accessibility of the campus for people living as far as Johannesburg.





3.2 Urban proposals

The University of Pretoria is located in a suburban area of greater Pretoria.

The Municipality of Pretoria has conceded the densification of both Lynnwood- and Roper street. The vision for their development is of four to five storey buildings defining these arterials. The economic potential of this proposal will invariably lead to a more 'urban' character for the campus and surrounding areas.

Lynnwood- and Roper street will become both the definition and also the edge between the campus and residential outlying areas.
The School for the Built Environment should respond to the periphery of the current and future circumstances.

3.2.1 Public transport

The main campus was permeable to pedestrians prior to the construction of the palisade security fence. A number of bus stops were located in all the main arterials surrounding the campus. At present, most of the bus stops are obsolete due to the limited number of pedestrian access gates along the periphery of the campus. The site is ideally located at the main entrance to congregate all the existing bus stops into a specific point. A slipway from the M6 will improve traffic flow as the public transport vehicles currently stop in Lynnwood road, thereby adversely affecting traffic. Amelioration measures may include:

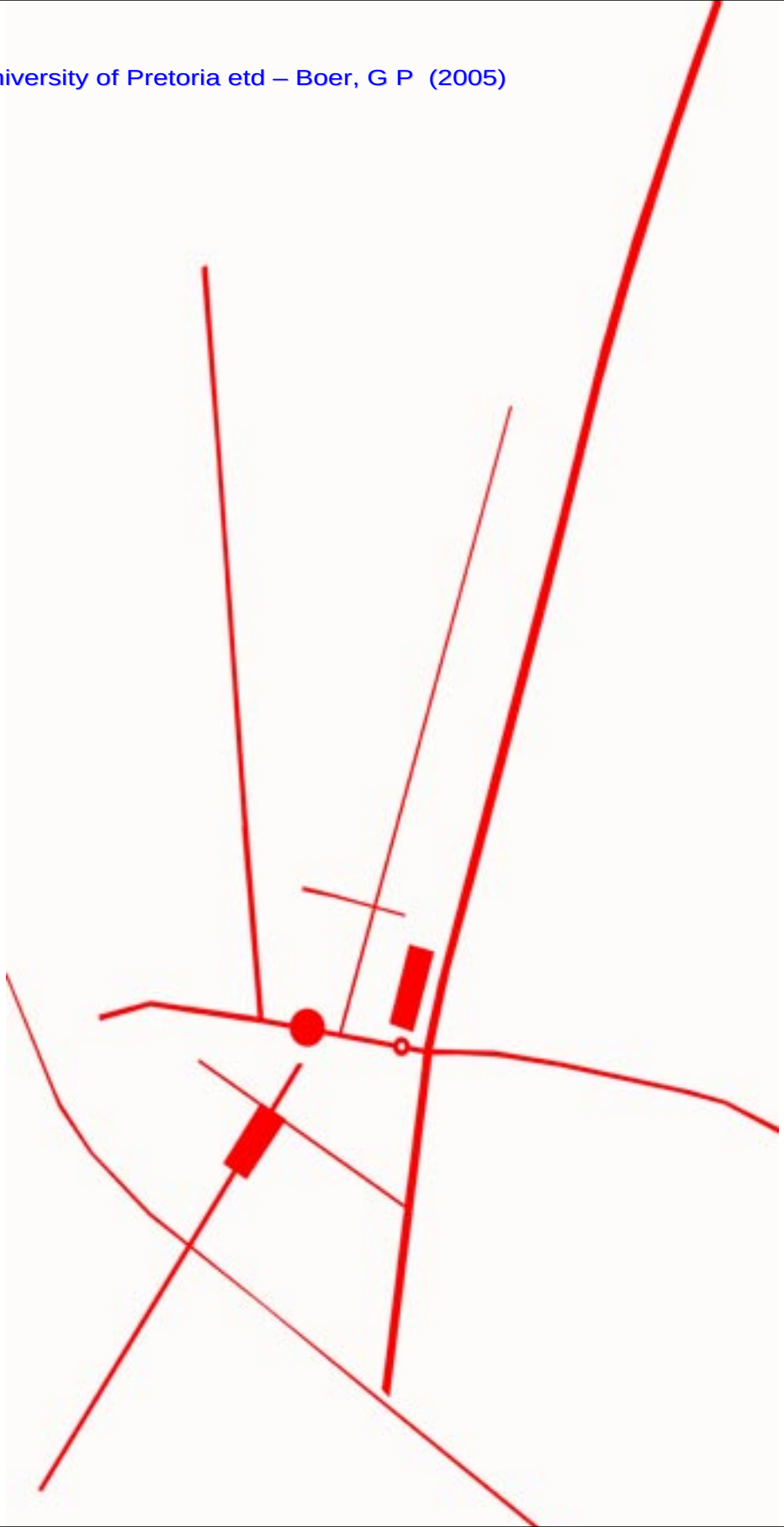
- The above mentioned slipway for vehicles travelling in a west-east direction.

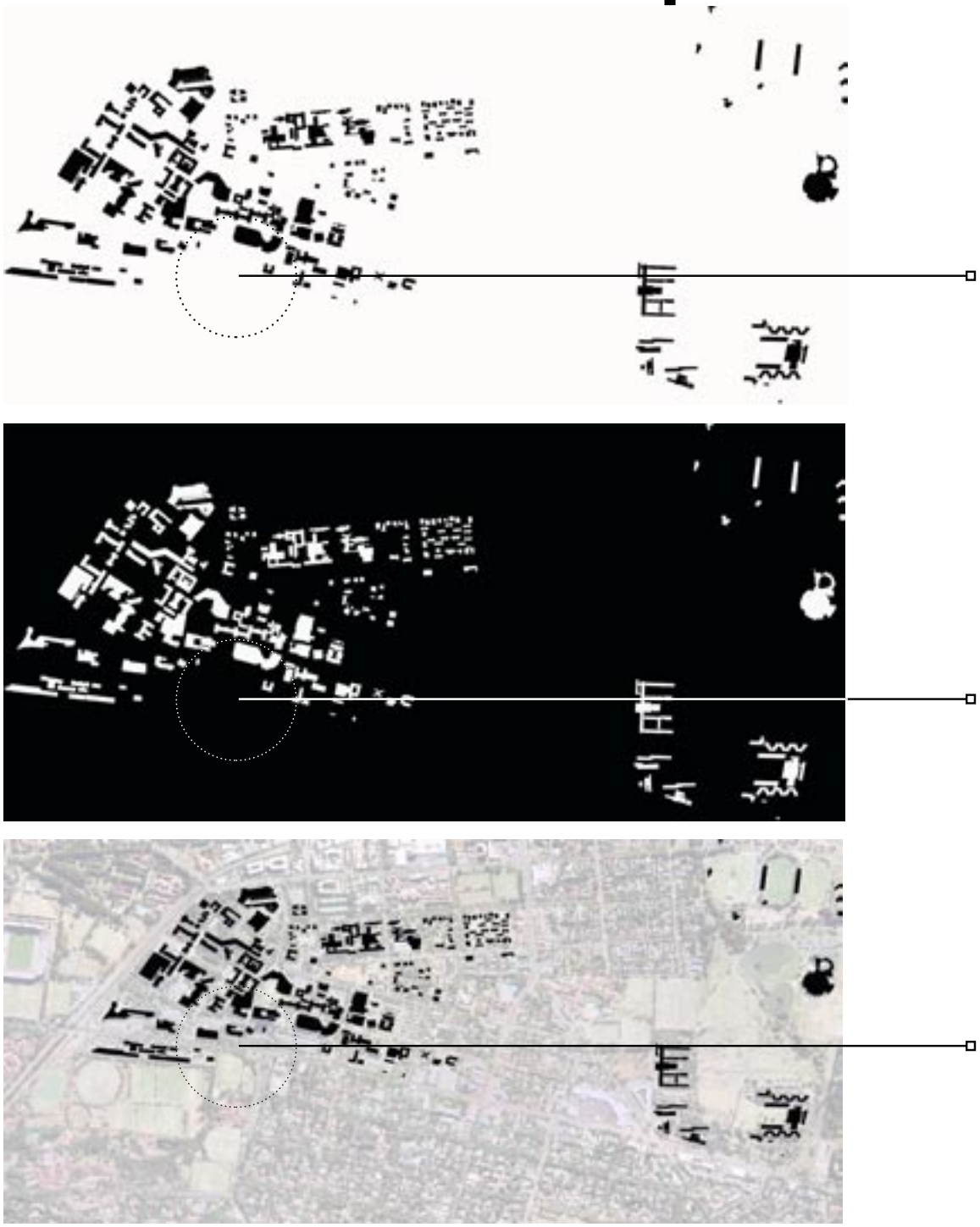
- Upgrading shuttle services to and from student residential areas. It includes the Gautrain Rapid Rail station to be situated in Hatfield. The introduction of the 'Gautrain' will enhance the accessibility of the campus for people living as far as Johannesburg.

3.3 FIGURE-GROUND STUDY

The study depicts the density of district developments. The defragmented nature of development stems from the educational hub consisting of the UP and myriad schools. Sports grounds surround the educational facilities and lends the area a more 'rural' character in terms of open space. Unfortunately, these open green spaces are not an integration of nature into the city, but only visual amenities. City parks are the by-product of the expanding metropolis since the nineteenth century. It is the manner in which the relationship to the landscape is portrayed. [Leupen et al 1997:174). The landscape can also be viewed as a societal phenomenon which can be compared to language. The comparison to language, as the epitome of communication, is made to explain the manner in which a visual resource can be read and understood. The analogy is comparable only if its meaning can be discerned. (Nuevos Paisajes 1997)

Despite the east-west character of the UP, there exists a limited functional axis between places with an undefined spatial sequencing. It is an axis governed mainly by the automobile.





3.4 Site context

3.4.1 Location_

25° south, 28° east.

A faculty building for the UP presupposes a site on the campus itself. As such, the site is located adjacent to the main vehicular / pedestrian entrance.

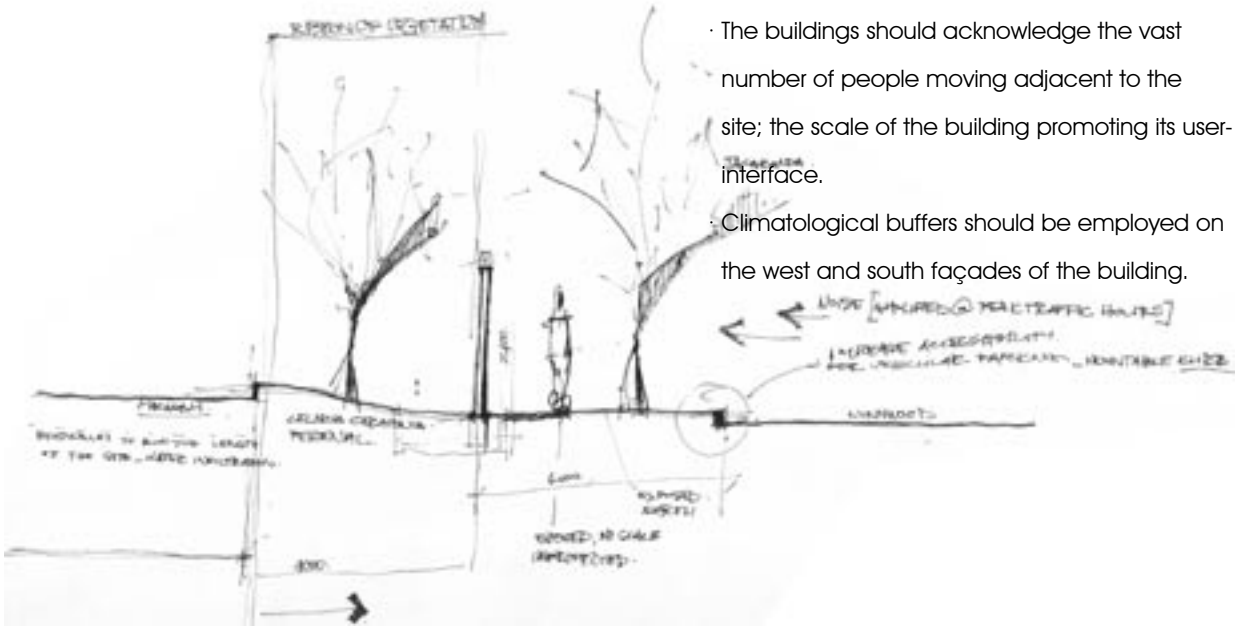
3.4.2 Street address_

North-eastern cnr of Lynnwood and Roper street.

3.4.3 Quandary site selection

Criteria for site_

- The new building should endeavour to enrich the site and contribute in establishing an edge to Lynnwood road.
- Existing vegetation forms part of the historical makings of any locality and should be accommodated as far as possible.
- The site can be seen as a transition zone between the 'outside' and 'inside' of the campus.
- The buildings should acknowledge the vast number of people moving adjacent to the site; the scale of the building promoting its user-interface.
- Climatological buffers should be employed on the west and south façades of the building.



3.5 Macroclimate

Pretoria is situated in the Northern Steppe climatic zone.

3.5.1 Temperature_

The maximum diurnal variation occurs during July.

Maximum monthly average is 28,6°C in January

Minimum monthly average is 4.5°C in Jun/July

3.5.2 Humidity_

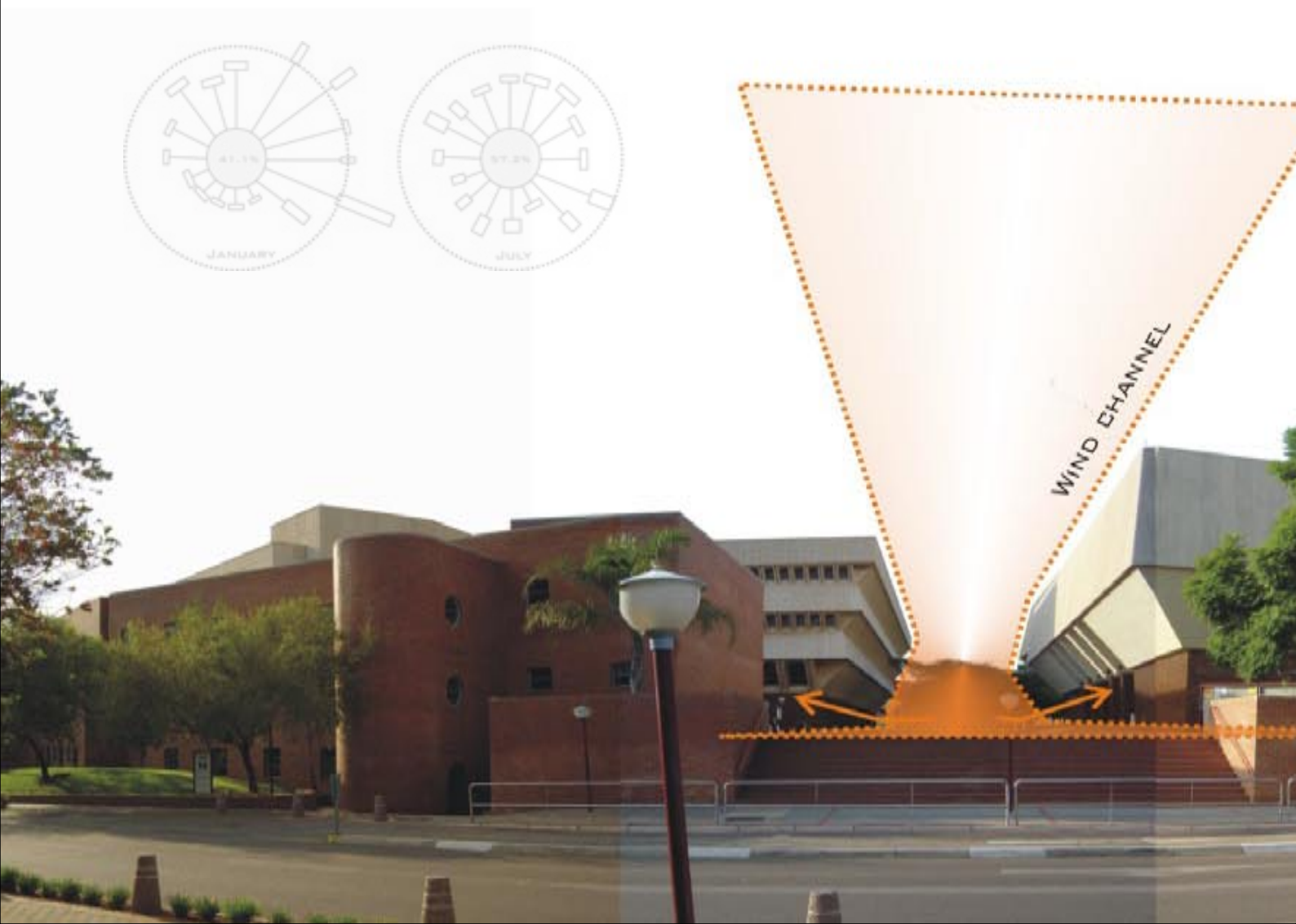
Average monthly humidity is 59%

3.5.3 Winds_

Summer: east-north-easterly wind direction to east-south easterly

Winter: south-westerly and north-east.

The density of the built fabric surrounding the site forms wind channels that alters micro scale atmospheric pressure, increasing wind velocity. The area between the Academic Information Centre and the Humanities building is an intense wind channel during late winter time.

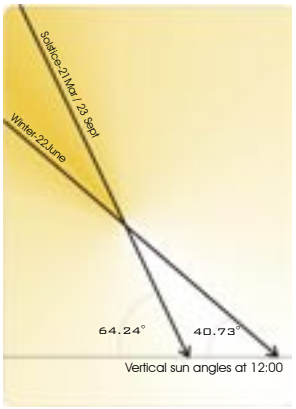


3.5.4 Vertical sun angles_

Summer solstice [21 March / 23 September] _ 64.24°

Winter solstice [22 June] _ 40.73°

Solar incidence is high in the Pretoria region with a maximum of 80% sunshine in summer, and a minimum of 67% sunshine in winter. The percentages translate into solar radiation energy as 8Whr/m²/day in summer and 4.5Whr/m²/day in winter. [AAL 310, 2002:19].



3.6 Micro climate

The existing built-fabric surrounding the site dictates the site-specific micro climate.

3.6.1 Vegetation

According to Ad Destinatum 1910-60, the vegetation existing in 1910 on the future campus-site, was primarily thorn trees [presumably various *Acacia*-species] and *Rhus Lancea.*

The existing vegetation is primarily perennial shade trees for the current parking area. The parking area is lined with *Seliqua ceretonia* [Carob] trees.

3.7 User groups & Activities

The School for the Built Environment is a faculty building that accommodates various departments. Being an educational facility, its primary users are invariably its students and their lecturers. The building accommodates the needs associated with the process of teaching.

3.8 Statutory regulations

Legal regulations

The Floor Area Ratio for developments on campus is 2.5, with a height restriction of six storeys [±18m]. If developments occur on existing parking areas, alternative parking should be provided.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3.9 Context_historical

POINT OF INFINITE DENSITY _ SINGULARITY

±12 billion years ago

Big Bang theory

<10n of a second after bang where n=-43

Science unable to prove theories of genesis moment before critical point.

>10n of a second after bang where n=-43

Planck time, or 10 to the minus 43. First fraction of a second in which known laws of physics apply. [National Geographic Oct 1999:25]

1 milisecond after expansion began

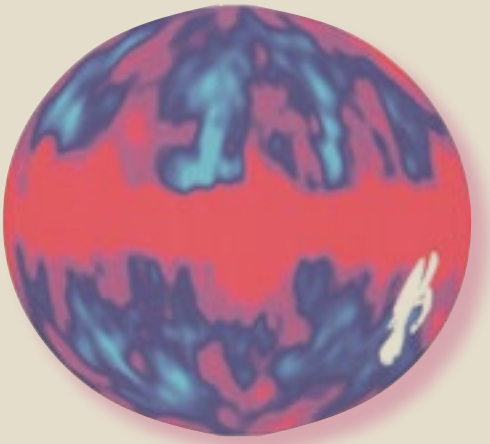
Featureless fireball_30 million times denser than the sun and 50 billion times denser than lead. [National Geographic Oct 1999:20]

1 second after expansion began

Physical space expanded and thinned by 20 light years. [National Geographic Oct 1999:20]

300 000 years after expansion began

Expanding fireball cool and thin enough to become transparent to light.



The farther out we look into space, the farther-back in time we see. Veil of fossil radiation dating 300 000 years after the big bang that permeates space. This is the limit of our view when the universe emerged from a state of hot plasma and became transparent. [National Geographic Oct 1999:30]

Primordial earth [National Geographic 1998]

4.5 billion — Origins of Microbial life [Ibid.]

3.5 billion — Global gas warfare. Stromatolite reefs with O2 producing photosynthetic cyanobacteria.

[National Geographic 1998 vol.913 no.3]

440 million — First great mass extinction of animal occurs. [National Geographic Feb 1999]

410-130 million — Insects appear on land. [Ibid.]
Reptiles evolve. [Ibid.]
First dinosaurs appear. [Ibid.]
First birds appear. [Ibid.]
Flowering plants appear. [Ibid.]

65 million — Meteorite impact wipes out dinosaurs, mammals proliferate. [Ibid.]

4 million - 250k years — Hominids arise in Africa. [Ibid.]
Australopithecus afarensis
Pleistocene Age
Homo habilis
Homo erectus
Homo sapiens

200 k years — Meteorite slams into earth north of Pretoria [Tshwane] at Tswaing impact crater [Gauteng Tourism Authority]

100 k — *Homo sapiens sapiens*

4241 — *Egypt: FIRST exactly dated year, 365 day calendar; 12 months of 30 days each with 5 festival days at the end of the year.* [Pascoe, L. C. et al. 1991]

3200 — Mesopotamian Cuneiform, impressions made in damp clay with a reed. [National Geographic August 1999]
Egyptian Hieroglyphs [Ibid.]

2700 — Egypt: erection of pyramids [Pascoe, L. C. et al. 1991]:
Khufu [Cheops]
Khafre
Men-kau-re

[National Geographic, January1997, vol.191 no.1]

2000 — Egypt: alphabet of 24 signs. [Pascoe, L. C. et al. 1991]

1860 — Egypt: medical contraceptive method. [Pascoe, L. C. et al. 1991]

1500 — *shadow clock in use, sand-glass*
Lerantine alphabets, created by Phoenicians and is the roots of modern day Hebrew, Arabic, Greek and Latin. [National Geographic August 1999]

738 — *Romulus [founder of Rome] divided year into 10 months.* [Pascoe, L. C. et al. 1991]

560 — Nebudchadnezer: hanging gardens of Babylon [Pascoe, L. C. et al. 1991]

300 Clepsydra [water-clock] used in Greece. [Pascoe, L. C. et al. 1991]

250 Ctesibius constructed water-clocks at Alexandria
Maya Hieroglyphs, wrote dates in symbolic figures.
[Ibid.]

239 *Egypt: introduction of leap year into calendar.*
[Ibid].

133 Posidonius, who observed relationship between tides and moon.

4 - 30 A. D. Jesus Christ born in Bethlehem
Crucifixion

150 Ptolemy: Amalgest; an astronomical work where earth is placed at the centre of the universe

850 Acropolis of Zimbabwe
Foundation of Salerno University [earliest known university]

870 *England: calibrated candles used to measure time*

963 Al Süfi: Book of the Fixed Stars containing earliest record of a nebula [Andromeda]

1054 China: Observed supernova in Taurus

1090 Peking: water-driven mechanical clock

1150 *Solomon Jarchus: earliest known almanac*
Europe: first appearance of mechanical clock

1400 Intercontinental exploration hasten exhange in animals, plants and microbes.
[National Geographic Feb 1999.]

1473 *Nicolas Copernicus: 24 hour earth rotation cycle and refute idea that the earth is at the centre of the universe*

[National Geographic, November 1999, vol.196, no.5]

1609 Galileo constructed a telescope with 30 times magnification to see the moon's craters in 1609 and satelites of Jupiter in 1610.
Kepler establish laws of planetary motion

1752 Franklin: proves that lightning is electricity in 1752 by flying a kite connected to a key

[National Geogrpahic, November 1998, vol.194, no.5]

1753 Carl Linnaeus: 'Philosophical Botanica' followed by 'Species Plantarium' - nomenclature of plants

1797 *William Smith: laid the foundation for geological eras.*

1859 Charles Darwin: 'Origin of Species'
Mendel: genetic laws of heredity.

1867 *Pokorny: dated trees by ring-markings*

[VISI, 2004 p. 171]

1876 Standerton established

1887 Johannesburg Stock Exchange opened
[Gauteng Tourism Authority]

1908 Pretoria Boys'-High school.

1909 Establishment of 'Transvaal Universiteit Kollege'
T. U. K.

[Photo of T. U. K., UP Archive]

1915 Einstein: General theory of Relativity

1952 Contraceptive pill first manufactured [refer 1860 BC.]

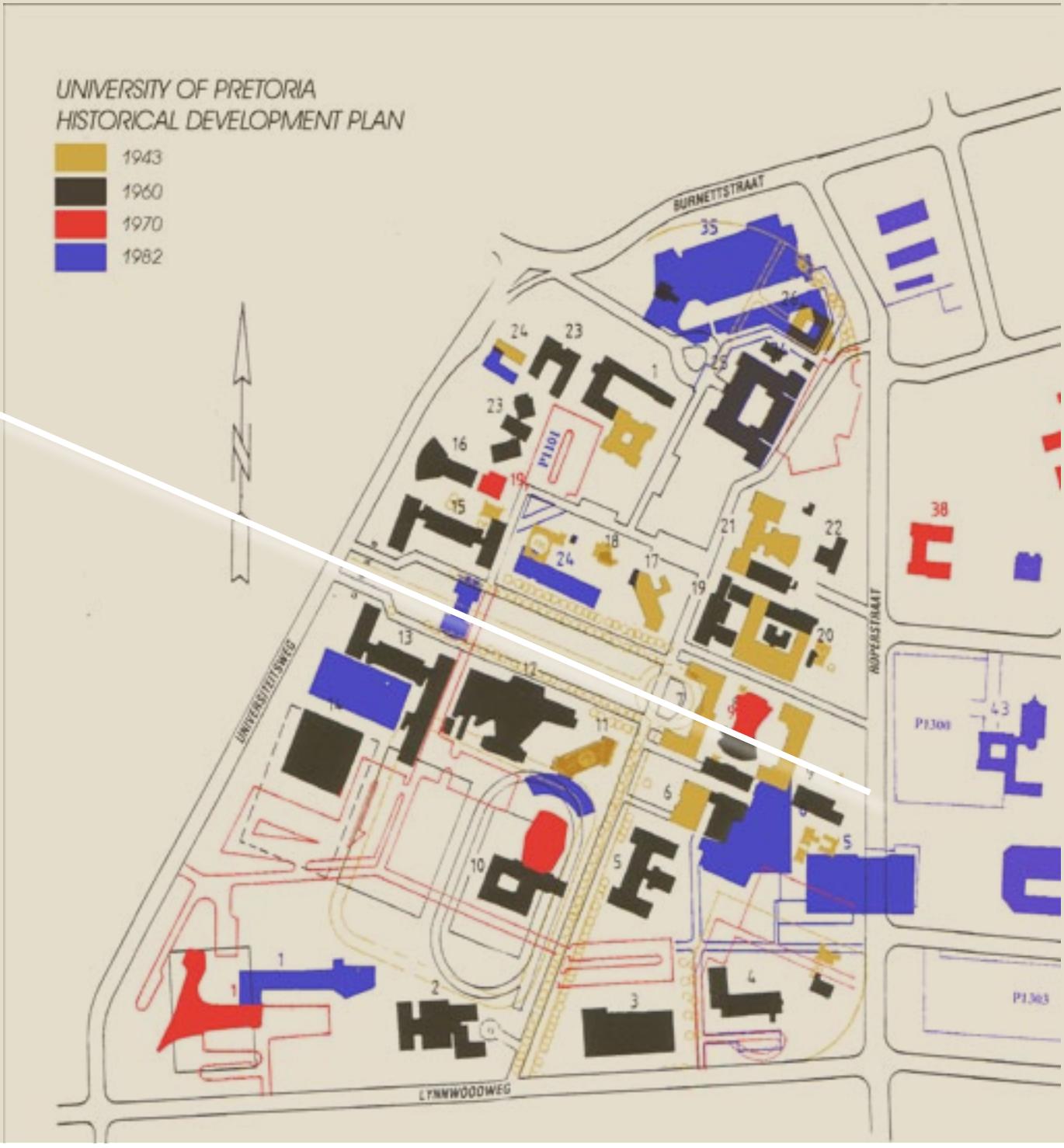
1954 Total eclipse of the sun [next occurrence 2115]

1958 Electronic computers introduced

1980 Growth of 'Green' and 'Ecological' parties in Britain

PRESENT The planet's sixth great extinction is already in progress.

[All dates and events: Pascoe, L. C. et al. 1991, except where otherwise indicated.]


UNIVERSITY OF PRETORIA
HISTORICAL DEVELOPMENT PLAN
1943
1960
1970
1982
BURNETTSTRAAT
LYNNWOODWEG
KUPELSTRAAT
P1301
P1300
P1303

Aerial photograph of UP_1948

Aerial photograph of UP_oct 1945

Aerial photograph of UP_1960

Artist impression of Transvaal University College (TUC) 1911.[Photo: UP Archive]

Photo of University of Pretoria 1943. [Photo: UP Archive]

The UP is located on the previous farm 'Eland-spoort'. Eland sculpture on pillar at the western vehicular entrance of UP aptly named Eland-spoort to retain some of the site's heritage.

History

Time stands still.

History is captured.

These phrases describe the status quo of the buildings on the campus. Except minor alterations, the buildings remain true to their original design through continual maintenance.

General Jan Smuts was one of the founding fathers of the University of Pretoria. In 1907 Smuts advocated the idea of a campus in Pretoria, separate from the old Transvaal University College in Johannesburg. [Fisher 1998:E2]. In its inception, the Transvaal University College fell under the British colonial rule. It converted to an Afrikaans-language institution only in 1930 under the influences of Gerard Moerdyk. From then onwards the architects of projects on the campus of the University fell under the authorship of Afrikaans-speaking architects. [Ibid]. Buildings on the campus of UP thus not only represent a summation of their individual specific time, but also of the Afrikaner culture.

architecture of main campus_UP

Historically, the site on which the main campus of the 'Transvaal University College', the progenitor of the University of Pretoria, is currently situated, formed part of the farm 'Elandspoort'. The farm included the whole are on which the current campus is situated up to the east of the Apies-river. Gert Bronkhorst owned Elandspoort until 1857 when it was sold to Jan Schutte. In 1875 it was appropriated by James Mears. [Ad Destinatum 1910-60:264].

At this time the farm stretched between the current Roper- and University streets, and Burnett street in the north towards the Pretoria Boys High school in the south. The farm was divided in two by an ox-wagon trail running from east to west - later known as College Avenue and currently as Lynnwood road.

In 1940, Gerard Moerdyk was responsible for a site layout plan for the campus. The idea for the quadrangle in front of the Old Arts building began to take shape. There exisedt a marked haphazard approach to buildings' placement prior to the 1950's. In 1953 Prof. A. L. Meiring defined the edge of the quadrangle by locating buildings around the periphery. He consciously strove to implement a more orderly campus plan, to facilitate place making. [Ad Destinatum 1910-60:272.]

Growth of the main campus

Prior to the 1970's the buildings on campus remained relatively horizontal in character. The verticality associated with some buildings on campus commenced from the 1970's onward. [Ad Destinatum II:225].

The continual growth in student numbers required an ever increasing number of facilities to accommodate them. In a report done in 1965 by Brian Sandrock, it was proposed that the campus expand eastwards. The aim of the proposal was a campus that stretched from the western extremity of University avenue to incorporate everything up to and including the Research farm. The campus would consist of an eastern and western part with the central area defined by the intersection of Roper and Lynnwood streets. [Ad Destinatum II:225].

Old arts building 1911

Agriculture building 1920

Merensky building 1938

1911_Old Chemistry building

The Old Chemistry building was the first building on the old Transvaal University College campus. It was completed in 1911. The typology of the building is of a simplified Renaissance style. [Fisher 2004]

1911_Old Arts building

The credit for the design of the Old Art building is given to P. Eagle of the Public Works Department. In addition, credit has also been given to both G. Leith and J. S. Cleland also of the PWD. [Keith 1998:79]. The building is described as the most Bakerish of all the Baker School. [Ibid]. Elements which characterize the Baker School of design can be seen in the recessed centre in which the gable is situated topped by the tower and cupola. [Ibid]. The projecting flanking gables are adorned with Venetion windows. [Ibid.] The main influence on the typology of the building stems from the Late-Renaissance era in France. [Ad Destinatum 1910-60: 275]. The Old Arts building is contemporary with the Union Building in Pretoria, and Frank Lloyd Wright's Robie House, Chicago.

1920_Agriculture building

The building was designed by J. Dey of the PWD in the Baker school tradition. It is a Cape Dutch Revival building, especially concerning the front gable. [Ad Destinatum 1910-60: 276].

1931_Old Administration building.

The Old Administration building was designed by Gordon Leith with influences related to the French Mannerism of Thibault. It is contemporary with the Virginia Campus by Thomas Jefferson. [Fisher 2004]

1930_Weather bureau

The erstwhile Weather bureau was designed by Bauhaus trained, W. Fleischmann, in red-brick finished modern style. It currently accommodates The Centre for Augmentative speech.

1938_Merensky library

The Merensky library was designed by Gerhard Moerdyk. The building was a first in a series of projects done by Moerdyk which is greatly symbolic. He consciously strove to 'Africanize' his architecture through the use of local materials and also through native African motifs and symbols. [Fisher 1998:E2]. Symbolic in the Merensky library is the indigenous granite hinting to great age of the African soil. [Ibid]. The zigzag stonework band symbolizes the archetypal symbol of water and fertility found in the native African cultures. The curving walls to the entrance is symbolic of an open Bible which reveals knowledge. [Fisher 1998:E2]. In its original form, a Foucalt pendulum swung from the dome and inscribed its path in the central cut-out to the basement lending the building a *'universal even cosmic dimension'*. [Fisher 1998:E2]

1943-59_Chemistry building

The new Chemistry building was designed by Moerdyk and Watson in the modern style, and finished with brick..

Administration building 1970

Amphitheatre, Musaion 1960

Detail of external lighting, Botany building 1940-59

Engineering building 1956-60

Aula and Student Centre 1958

[Ad Destinatum 1910-60:278]. In 1956 a southern wing, designed by Carl Gerneke, was added to the chemistry building. Gerneke introduced the first cantilevered concrete staircase in South Africa on the eastern side of the building. [Fisher 2004].

1940-59_Botany building

The Botany building was also designed by Moerdyk and Watson on an L-shaped plan form. In 1956 a glass nursery designed by Strauss Brink was added to the Botany complex. [Ad Destinatum 1910-60:279]. Of interest is the Wagon-wheel ceiling in the main foyer.

1946_Physical Education building

The Department of Physical Education was designed by Basil South of Meiring Naudé with Burg, Lodge and Burg architects. It was executed in brown-yellow face brick and mono-pitched corrugated iron roof, with standard steel windows. The building has suffered numerous alteration but the simple detailing and essence still exists in its current state. [Fisher 1998:E2].

1951_New Arts building

The new Arts building [the current Theology building] was designed by the architects Burg, Lodge and Burg. Although the building is more modern it sympathizes with the adjacent Old Arts building in its style and materials employed. [Ad Destinatum 1910-60:281].

1956-60 Engineering building

The engineering building was designed by the architects Meiring and Naudé. [Ad Destinatum 1910-60:282].

1957_A. E. du Toit Auditorium

The A. E. du Toit Auditorium was designed by A. L. Meiring. It addresses the issue of noise ingress from the adjacent railway line and University Avenue by omitting fenestration. It accommodates a maximum of 700 and 250 people in the two auditoriums. The sculpture by Zoltan Borberéki on the southern wing was donated by prof. Meiring [Ad Destinatum 1910-60:283].

1958_ Aula and student centre.

The Aula was designed by Karel Jooste in the architectural firm of Philip Nel. It boasted the first free-standing ribbon chair in South Africa as well as several other devices.

1960_ Musaion

Brian Sandrock was responsible for the design of the new 'Toonkuns akademie'. The complex consists of three parts where one is used as lecturing facility, one as auditorium and an open air amphitheatre.

1960_Architecture and Quantity Surveying building

The building was designed by the architecture staff adjacent to Lynnwood road. A requirement for draughting is 'soft' lighting mainly gained from indirect sunlight. Concurrently the whole southern façade was fenestrated despite

the occasional hale storm. The building employed the concept coined by Le Corbusier as 'free façade' to allow strip windows along its external walls. [Ad Destinatum 1910-60:283].

1969-75_New Merensky library

The firm Louw, Marais Marquard and Kuhn was responsible for the design of the extension of the original Merensky library. The building consists of five levels, with a double volume at its entrance on ground floor. [Ad Destinatum II: 224].

1970_Administration building

The iconic design of the administration building is credited to one of the campus' main architects, Brian Sandrock. The building is known as 'Die Skip' or rather the Ship. Textures and relief patterns lend an interesting composition to the north-western curtain wall, also interesting is the suspension of the western concrete-wall on rubber blocks to allow differential expansion and contraction. The building consist of four levels accommodating various functions, one which is the Senate of the University. [Ad Destinatum II:226].

1970_Engineering Tower block

The Engineering Tower was the first vertical development on the campus of University. It is situated on the western extremity of the quadrangle and defines the spaces in terms of both distance and height. [Ad Destinatum II:228].

1977_Humanities building

The unconventional building consists of lecturing facilities in the base which stretched over the previous Roper street, and 17 storeys of office space on top of the base. Influences in the design could be related to the adjacent New Merensky building. The remarkable appearance of the building lends an iconic image to the campus. [Ad Destinatum II:228].

1972_Agricultural Sciences building

The building consists of two wings each of which is nine storeys high.

1973_Educational building

The Educational Building was designed by the firm Louw, Marquard and Kuhn, and is situated adjacent to the Humanities building. The typology of the building is similar to the nearby Merensky and Humanity buildings. [Ad Destinatum II:229].

[Reza, National Geographic, January, 1997 vol. 191 no.1]]

Futurism

The movement of Futurism inspires the imagination of the masses. Cinematic projections of the future such as 'Starwars' or 'Minority Report' extrapolate the 'what is' into 'what it may become', and thus influence societies perception of the world. As such, the concept of futurism can be seen as a time accelerator.

Time can be viewed either as a static entity defined by numbers, or time as experienced by an individual.

In the latter case, time exists because of the reality of an individual and becomes a non-entity without the individual. The future is therefore inherently void of the reality of the past and the present, and also that the future comes into being or evolves as time passes. [Bergson 1911:5-6]

Van Eyck 1969:171, proclaimes that the only way for the present to lose its instantaneity is by aquiring temporal depth. Temporal depth can be explained by the past being gathered into the present and through the gathering body of experience that every individual possesses.
This is time rendered transparent.
The experience of an individual that Van Eyck professes is connected to the its specific past. Only by relating the past, including all the cumulative knowledge of mankind, can the present be understood.
It is "being aware of what 'exists' in the present - what has travelled into it: the projection of the past in the future via the created present" [Van Eyck 1969:171].
It is therefor impossible to sever the future of society, or rather architecture, from the past without rendering the present without temporal depth. The crux of Van Eyck's essay is in the notion of the unchanging condition of mankind in the light of change.

4.1. The shaping of timber into wall-claddinf. [Carter, B et. al. 2002. Office DA in All American: Innovation in American Architecture. London: Thames & Hudson]

4.2. Geographical barriers such as Robben Islands' prison. 'The Island' as seen by the confluence of time and democracy into its current state as a World Heritage Site. Artist: P. Motloua. [Warren Siebrits Modern and Contemporary Art, Johannesburg. South Afirca-Another Country: X27ap]

4.3. Faculty of Economics, Utrecht, the Netherlands. Mecanoo. [Cerver F. A. 1998. Selected Architecture: Public buildings / Private residence. New York: Whitney Library of Design. p.83]

4.4. Tulane University Centre, Louisiana. [Vincent James Associates in All American p.136.]

4.5. The sculptural element of a wind barrier wall. [Bernado / Prat. 1997. Nuevos paisajes. New landscapes. Spain: Musea d'Art contemporani de Barcelona.]



STONEHENGE, Salisbury_England.

2750 - 1500 B.C.

Stonehenge consists of a series of earth, timber, and stone structures during a three phased construction period lasting 1400 years. [Witcombe 2004].

The design centres, amongst others, on three concentric circles that are orientated precisely to the relative position of the sun at dawn in the beginning of the summer solstice. [Flemming 1991:3]

In recent times Gerald Hawkins has argued that Stonehenge is not only aligned with solar and

Aerial perspective photograph of Stonehenge at Salisbury, England.
[http://witcombe.sbc.edu/earthmysteries/EMStonehenge.html. 17/05/2004]. Earth Mysteries: Stonehenge.]

astronomical events, but could also have been used as an astronomical calculator that could predict, measure and be a basis for viewing of astronomical events. [Witcombe 2:2004].

Stonehenge is the physical manifestation of the relationship that exists between man and time and our yearning to relate to the cosmos.

A line has a beginning and an end which is symbolic of the transient / ephemeral nature of life. [Ibid]

Cyclical time is manifested in the concentric rings of massive stone columns and beams. The circle has no beginning or end, which symbolises the static permanence of the construct. [Du Plessis 1997:20].

Linear time is defined by the route to the centre of the concentric rings.

THE GREAT PYRAMIDS, Giza_Egypt.

The cyclical processes associated with nature are arguably nowhere better captured than by the Pyramids at Giza, Egypt.

The pharaoh was believed to be a direct descendant of the sun-god Ra, with everything planned according to the path of the sun and seasonal cycles.

000_Aerial photograph of the great pyramids at Giza, Egypt. [http://www.amtsgym.sdbg.dk/s/pyramid.htm]

The pyramid of Khufu [Cheops] is the largest funery monument and is destined to last for an unimaginable period of time. It was constructed from 2300 000 blocks of stone, each weighing 2500 kilograms. Each of the 299m sides line exactly with the four cardinal points of the compass. [Fleming 1991:10]. The planes culminates in a point, reaching to the upward heaven. This is the physical manifestation of the earth-cosmos connection in the pyramids.

The Sphinx is the guardian of the city of the dead. It combines the body of a lion with a human head and faces due east in the direction of the rising sun. [Fleming 1991:10]

The cycles of nature inherent in the location of the pyramids, were the seasonal flow of the Nile river and the path of the sun across the sky denoting life and death.

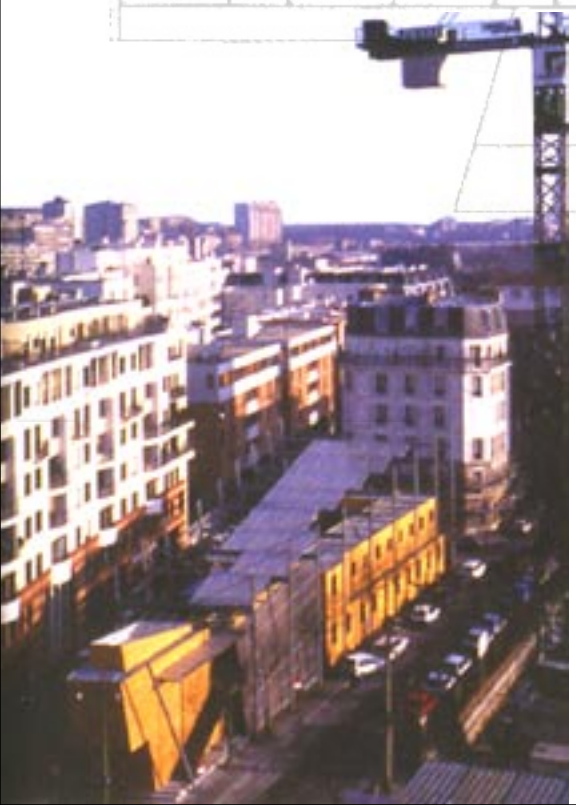
000_ Aerial view of setting sun symbolising death. [http://www.nationalgeographic.com/egyptjournal/photogalleries/sphinx/photo.html]

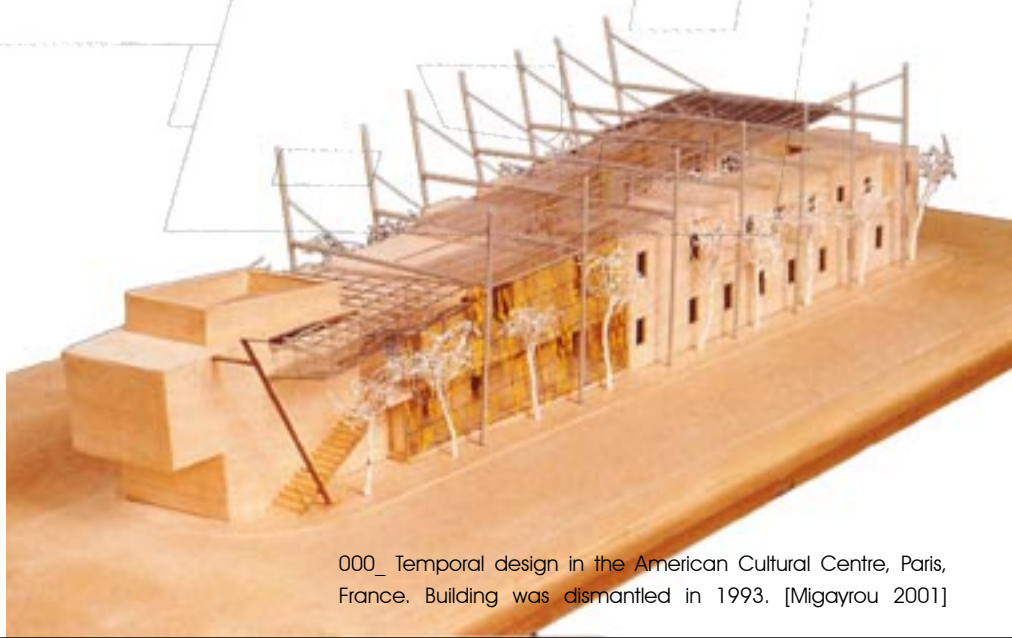
Atelier Seraji

Atelier Seraji, consisting of Nasrine Seraji and Andres Atela, advocates an architecture with a particular line of thinking about space. Space that is defined by its treatment as an unfamiliar sensory experience and 'the fragmentation of the cognitive grasp of form'. [Migayrou 2001]

American Cultural Centre, Paris, France. 1991.

The American Cultural Centre was a temporary building, housing offices, language laboratories and exhibition rooms, pending the completion of the permanent Centre designed by Frank Gehry. It was designed and built on a very limited budget on a small triangular site adjacent to the permanent Centre. The design accentuates the dichotomy existing between the semi- and more permanent materials. Existing trees were incorporated in the building inside the atria were they relayed the building's temporary





000_ Temporal design in the American Cultural Centre, Paris, France. Building was dismantled in 1993. [Migayrou 2001]

nature. [Migayrou 2001]

The Centre was constructed from reconstituted wood as semi-permanent material. The centre's temporal nature defined a degree of the lightness of its volumes resembling the playful stage of a theatre rather than a static monument. [Migayrou 2001]

000_ Project based on two axes. A horizontal east-west orientation, and a vertical programme differentiation. , Deux Lions District, Tours, France. [Migayrou 2001]

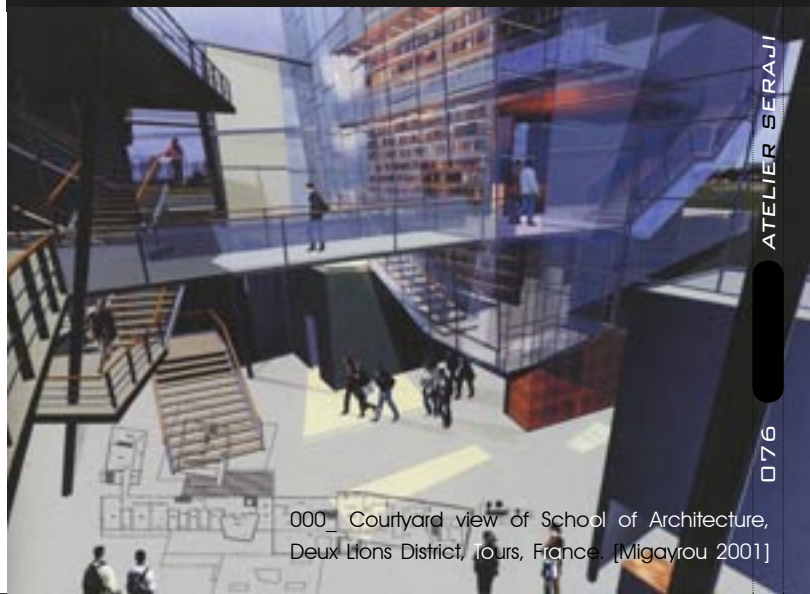
000_ Model of School of Architecture. Different levels each embrace different programme themes. [Migayrou 2001]

School of Architecture, Tours, France. Competition 1997.

In this School of Architecture the brief called for a building typology as a landmark in the Deux Lions District. The project is arranged on two axes: the plan form from east to west, and in the vertical dimension from bottom to top with the different programmes.

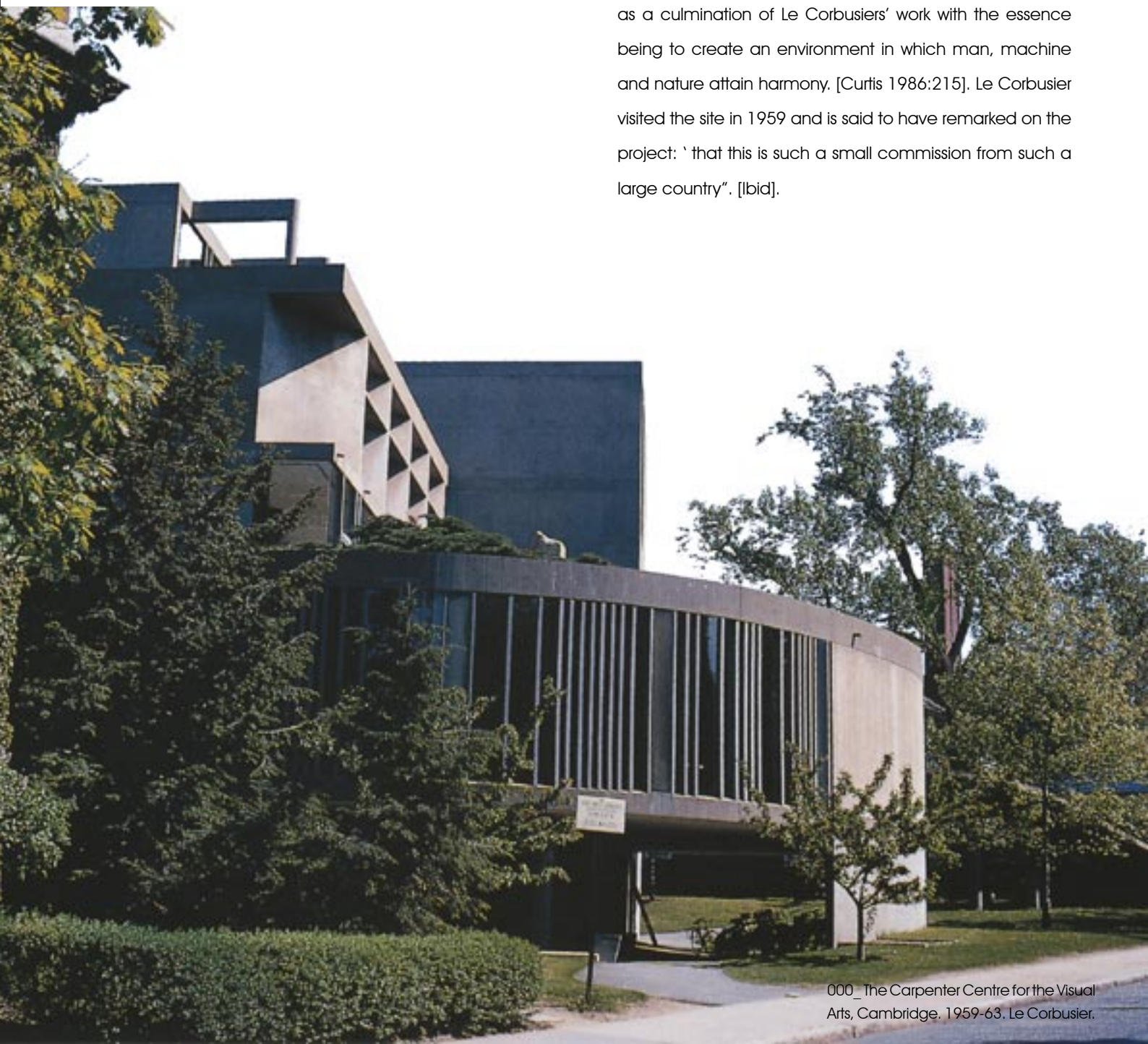
The school's public and specific functions are housed on different levels that enable different types of spaces. On the ground floor where movement is the primary form-giver, the school's public and specific functions are housed.

The first floor houses the administrative functions in a regular layout, while the second floor houses the library workshops and studios arranged in a dynamic plan. The third floor's studio is arranged in an open-plan with the open top floor



000_ Courtyard view of School of Architecture, Deux Lions District, Tours, France. [Migayrou 2001]

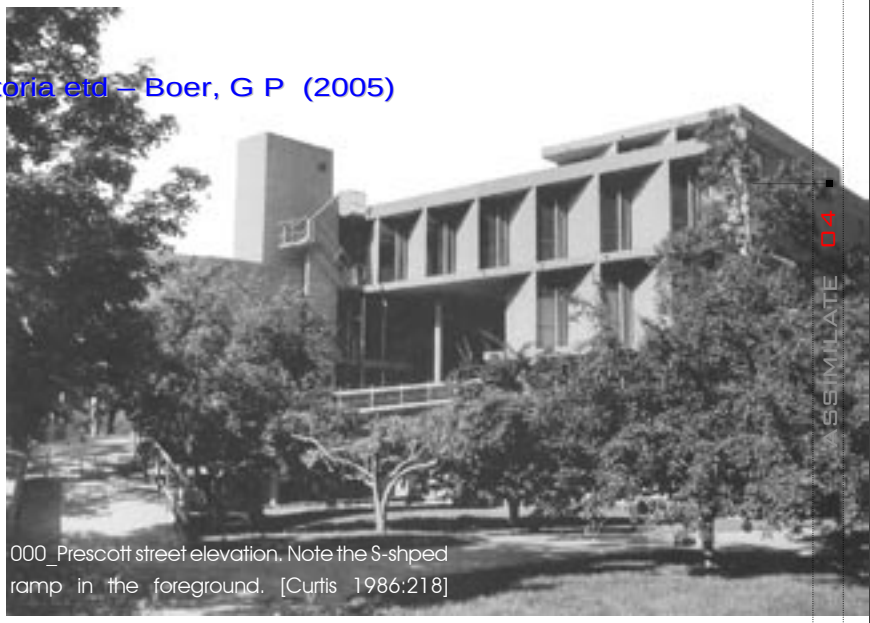
THE CARPENTER CENTRE for the Visual Arts at Harvard University [1959-63] was one of Le Corbusiers last buildings to be constructed in his lifetime. It is also his only building to be completed in the United States of America. It is seen as a culmination of Le Corbusiers' work with the essence being to create an environment in which man, machine and nature attain harmony. [Curtis 1986:215]. Le Corbusier visited the site in 1959 and is said to have remarked on the project: ' that this is such a small commission from such a large country". [Ibid].



000_ The Carpenter Centre for the Visual Arts, Cambridge. 1959-63. Le Corbusier.

At the heart of the Carpenter Centre is a cubic volume defined by curved studios. The volumes are connected by an S-shaped ramp which ascends from street level and descends to another.

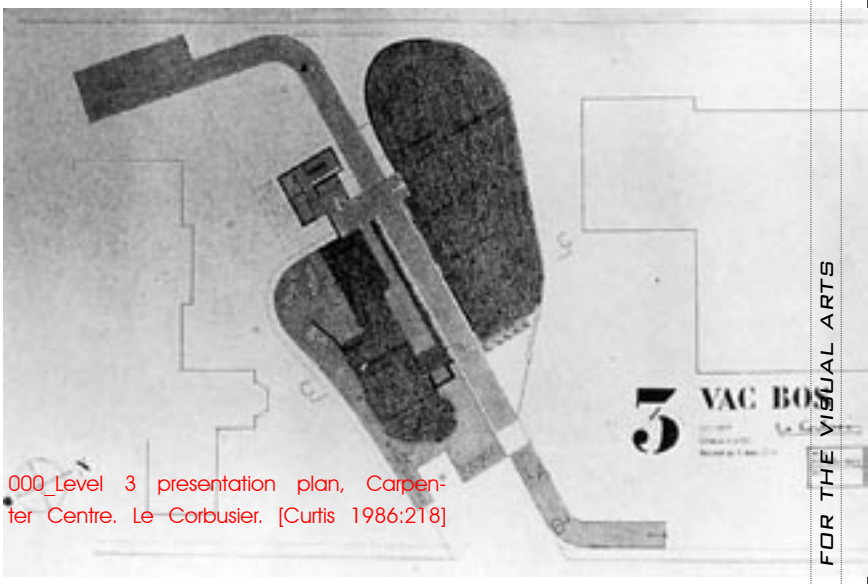
The S-shaped ramp improved connectivity between two disparate areas of the campus with intense pedestrian movement. The S-shaped ramp stems from one of Le Corbusiers' fund of cosmic sings, in this instance symbolising the rise and fall of the sun which is the basic natural rhythm. [Curtis 1986:218].



000_Prescott street elevation. Note the S-shped ramp in the foreground. [Curtis 1986:218]

The Centre, and also many of Le Corbusiers later works echo the 'Five Points' in architecture with the evolution of curved elements projecting outwards from the grid to become part of the landscape or traffic circulation sculptures. [Curtis 1986:215].

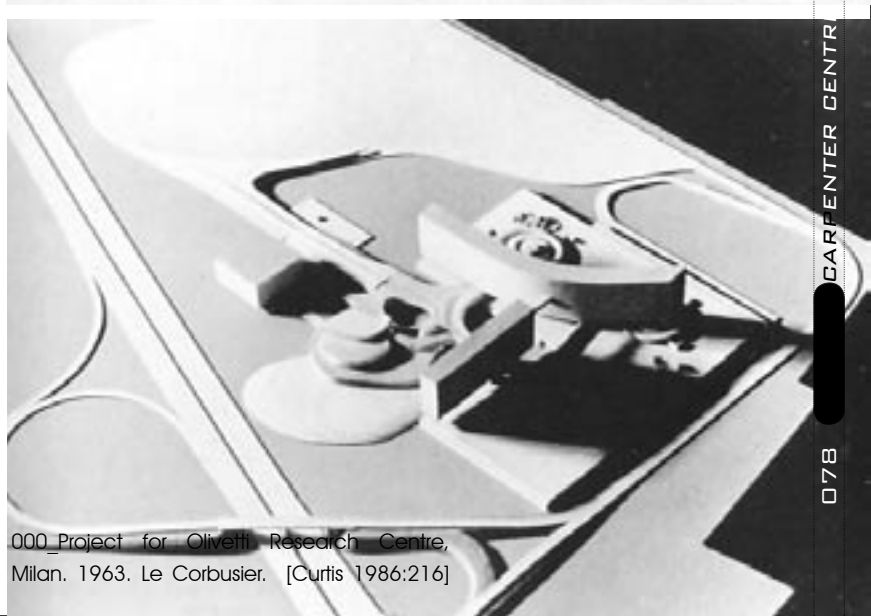
The ramp ensures a *promenade architecturale* with a sequence of spatial events relating the interior and exterior of the building.



000_Level 3 presentation plan, Carpenter Centre. Le Corbusier. [Curtis 1986:218]

The Carpenter Centre's plan form is an analogy of lungs that had the metaphorical relevance of implied liberation of towns, the provision of greenery and the function to 'breathe'. [Curtis 1986:218].

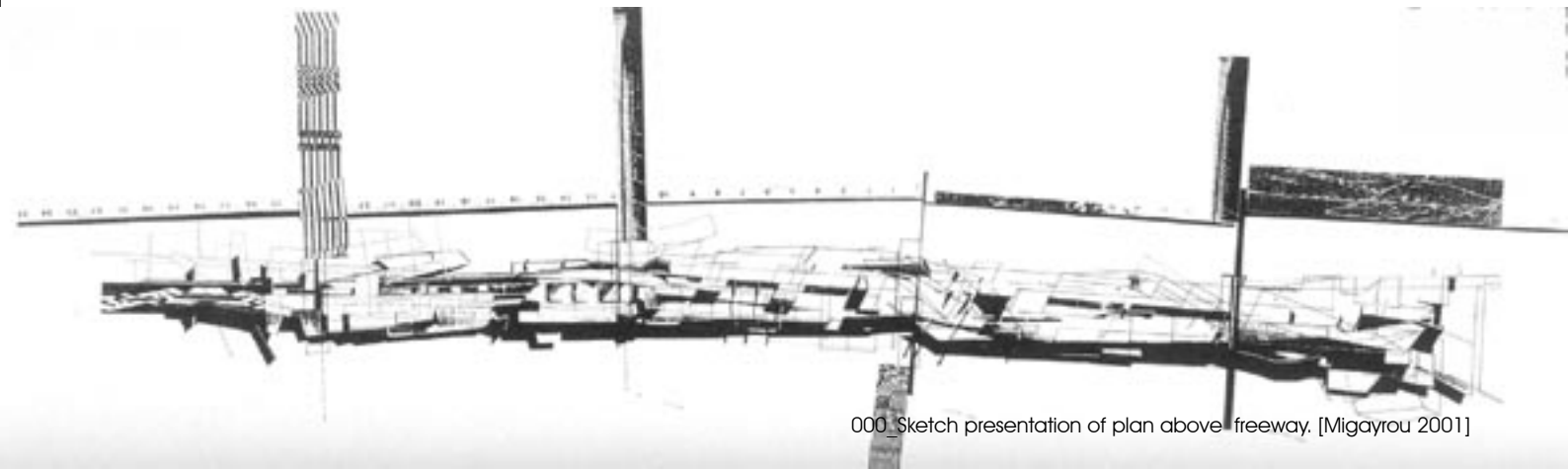
'The S, the cube, the lung-shaped curves supporting greenery, are surely a metaphor for an old urban dream in which man, machine and nature were to live in harmony' [Curtis 1986:215].



000_Project for Olivetti Research Centre, Milan. 1963. Le Corbusier. [Curtis 1986:216]

Dagmar Richter, the founding principle of Richter Studio advocates the idea of an architecture that should transform found spatial structure. Richter designs 'future architecture' that question the direction fluid spatial realities will take. She believes in an architecture that is appropriations of various media and influence. [Migayrou 2001]

"Any act of reading is simultaneously an act of appropriation and the selection of reading material that is crucial in order to arrive at a relevant spatial representation. The art of architecture is then defined as a strategy of appropriation, trickery and rhetoric of use. It is an art of copy, appropriation and recombination. A space occurs, when directional vectors of speed and variables of time are interwoven. This space can influence action but never define it. The architect, a strategist, will always attempt to create something of his own, which acts as a normative; the user will always transform it through a tactic of use and appropriation.' [Migayrou 2001]



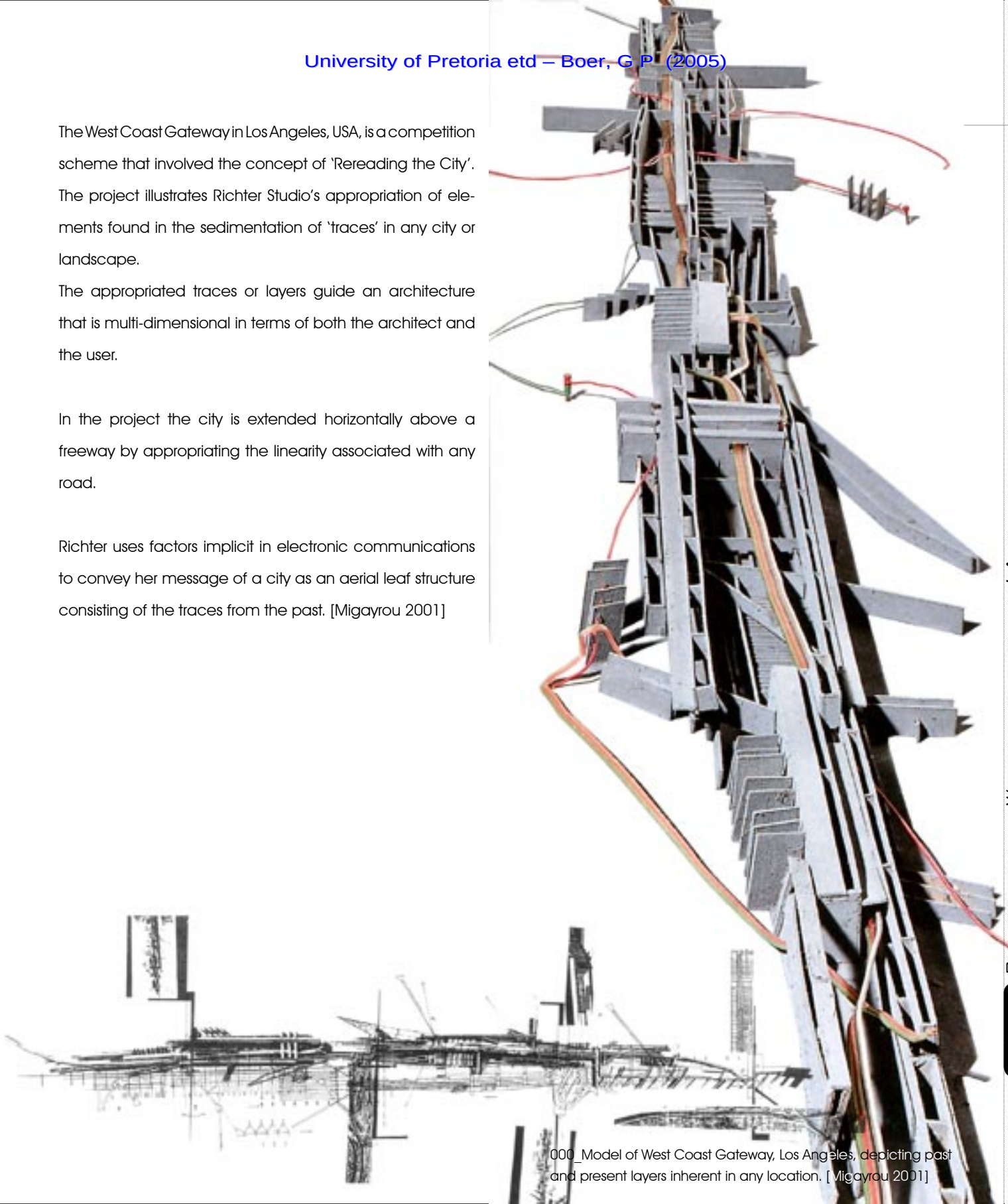
000_Sketch presentation of plan above freeway. [Migayrou 2001]

The West Coast Gateway in Los Angeles, USA, is a competition scheme that involved the concept of 'Rereading the City'. The project illustrates Richter Studio's appropriation of elements found in the sedimentation of 'traces' in any city or landscape.

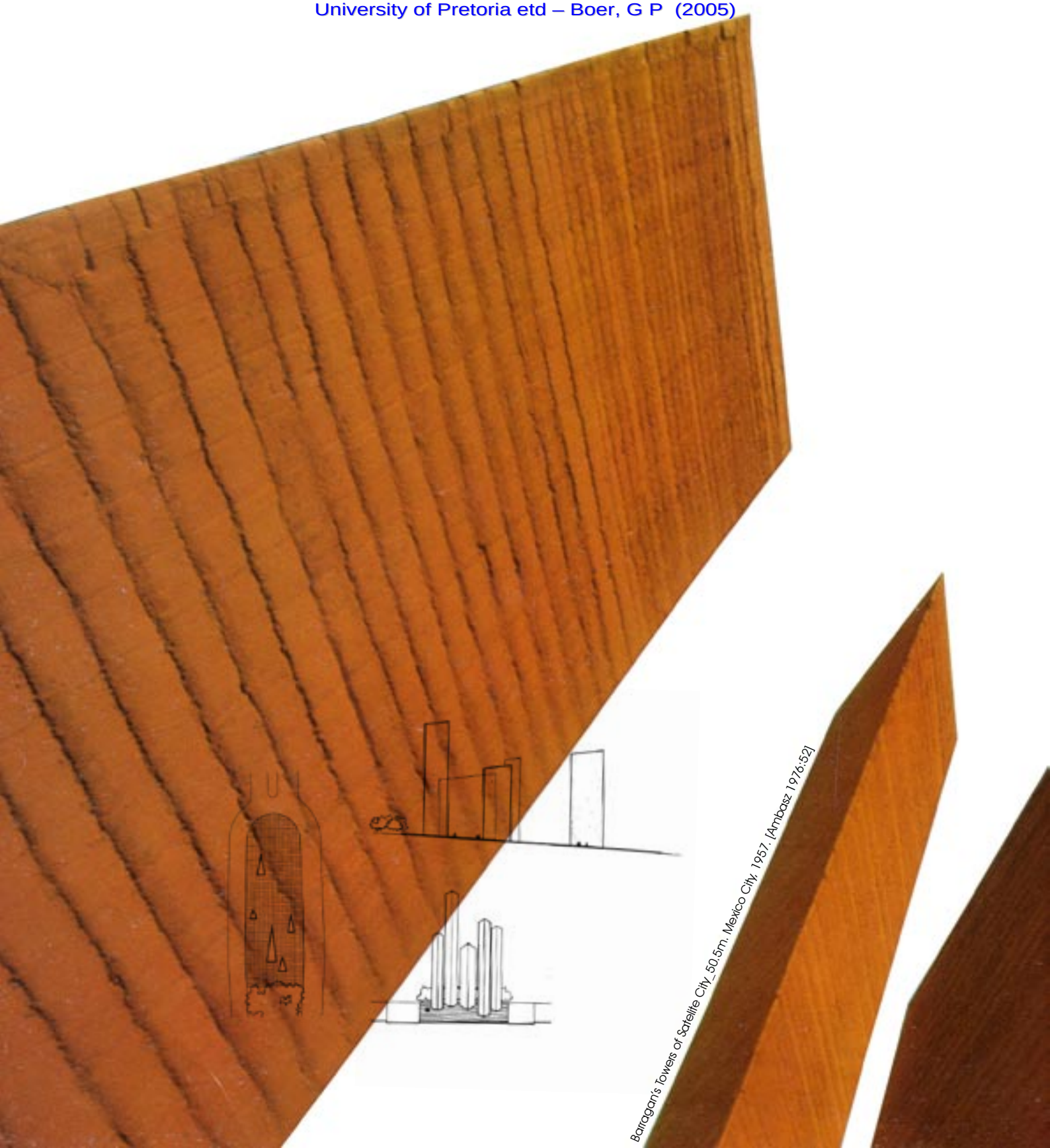
The appropriated traces or layers guide an architecture that is multi-dimensional in terms of both the architect and the user.

In the project the city is extended horizontally above a freeway by appropriating the linearity associated with any road.

Richter uses factors implicit in electronic communications to convey her message of a city as an aerial leaf structure consisting of the traces from the past. [Migayrou 2001]



000_Model of West Coast Gateway, Los Angeles, depicting past and present layers inherent in any location. [Migayrou 2001]

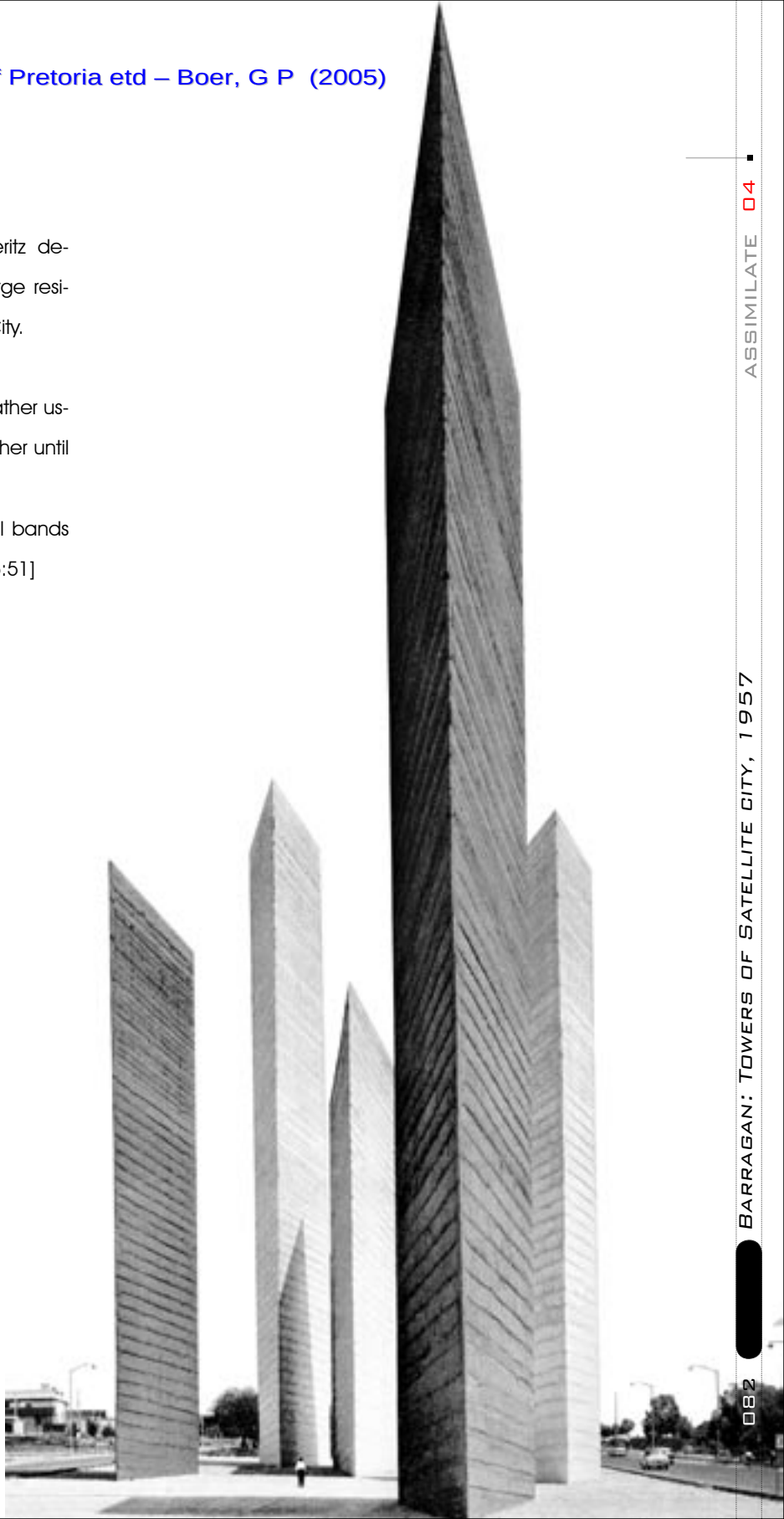


Barragan's Towers of Satellite City_50.5m. Mexico City. 1957. [Ambasz 1976:52]

The Towers of Satellite City, Mexico City. 1957.

Luis Barragan in collaboration with Mathias Goeritz designed five large abstract towers to signify the large residential area on the northern periphery of Mexico City.

The towers were constructed without scaffolding, rather using metal moulds which climbed one upon the other until complete.
The construction process is visible in the horizontal bands giving texture to the abstract towers. [Ambasz 1976:51]



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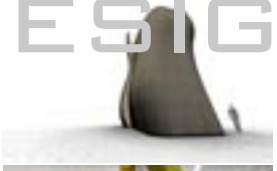

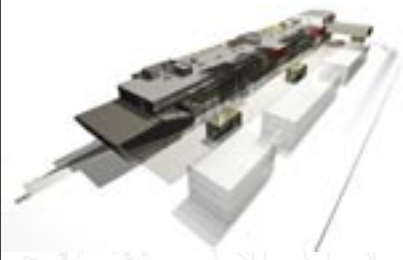

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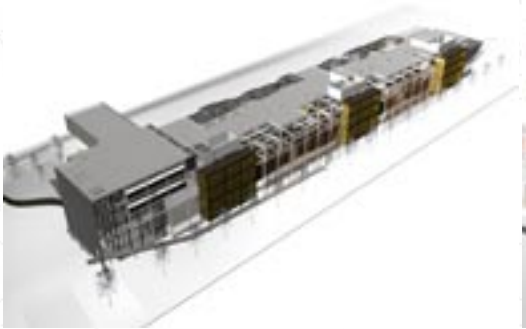
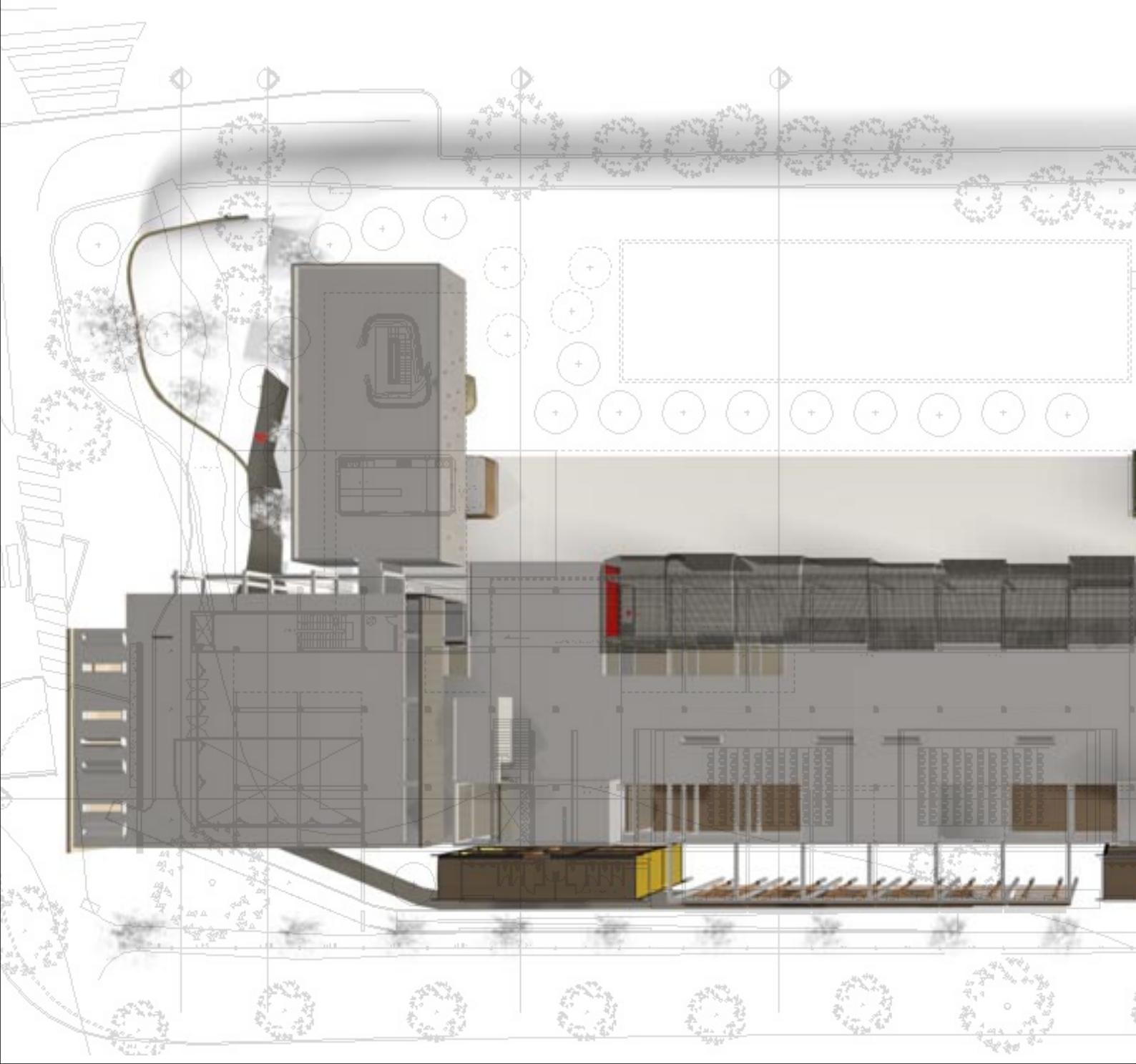
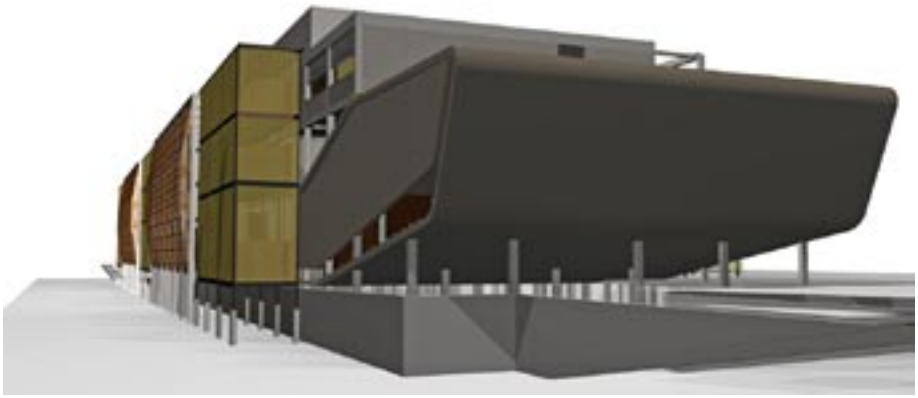




NORTHERN FAÇADE

PERSPECTIVE NORTHERN FAÇADE

PERSPECTIVE NORTH WESTERN FAÇADE



PERSPECTIVE SOUTH WESTERN FAÇADE

SOUTHERN FAÇADE

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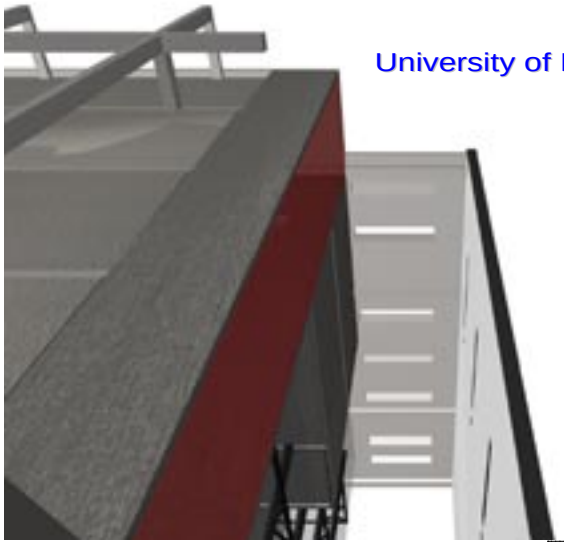
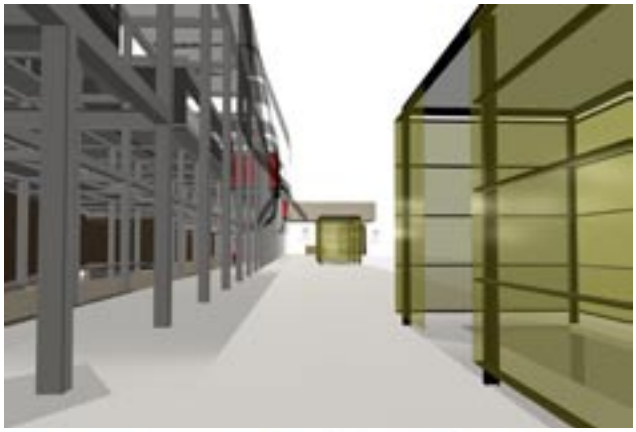
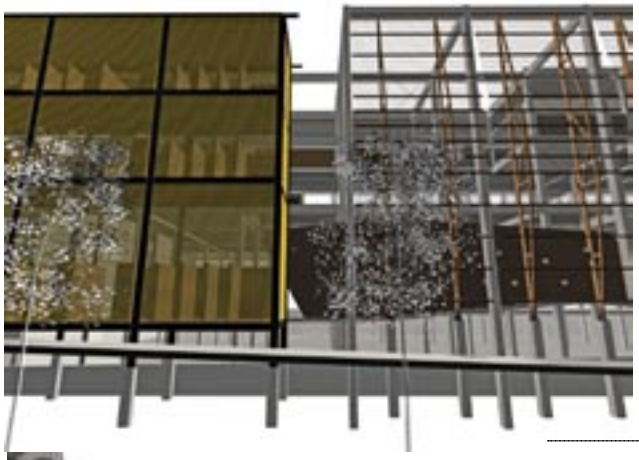


PORTAL

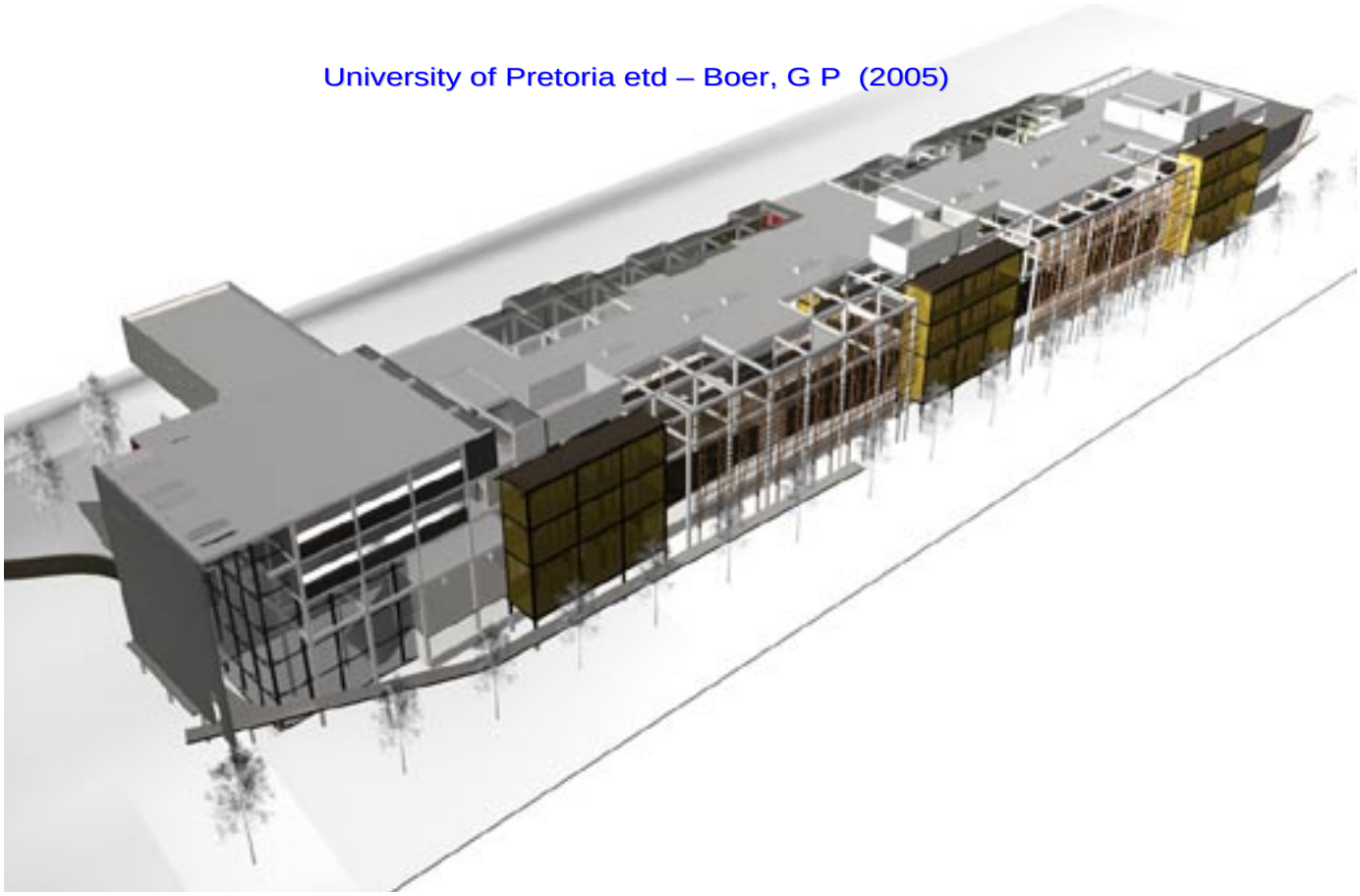


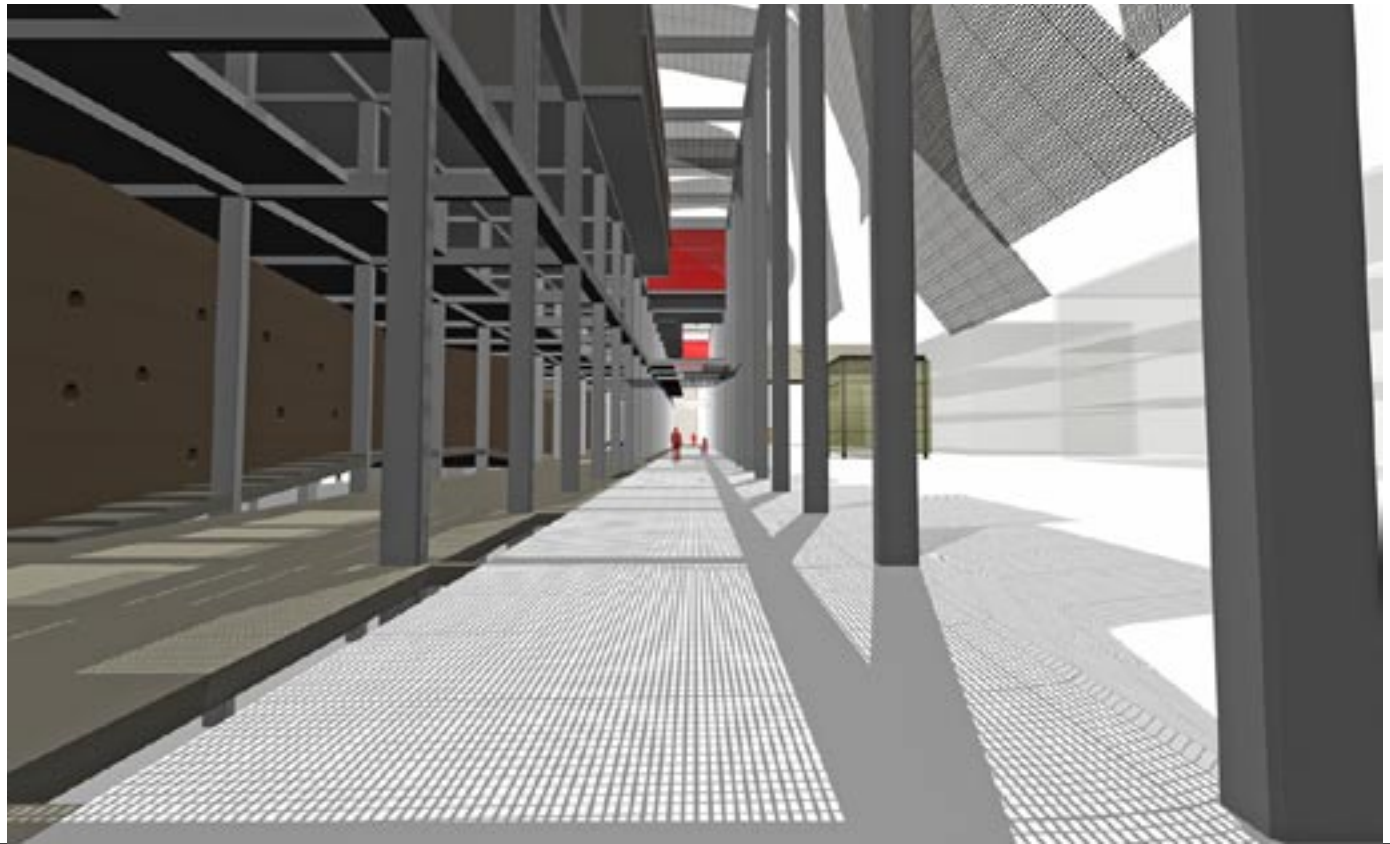
SQUARE

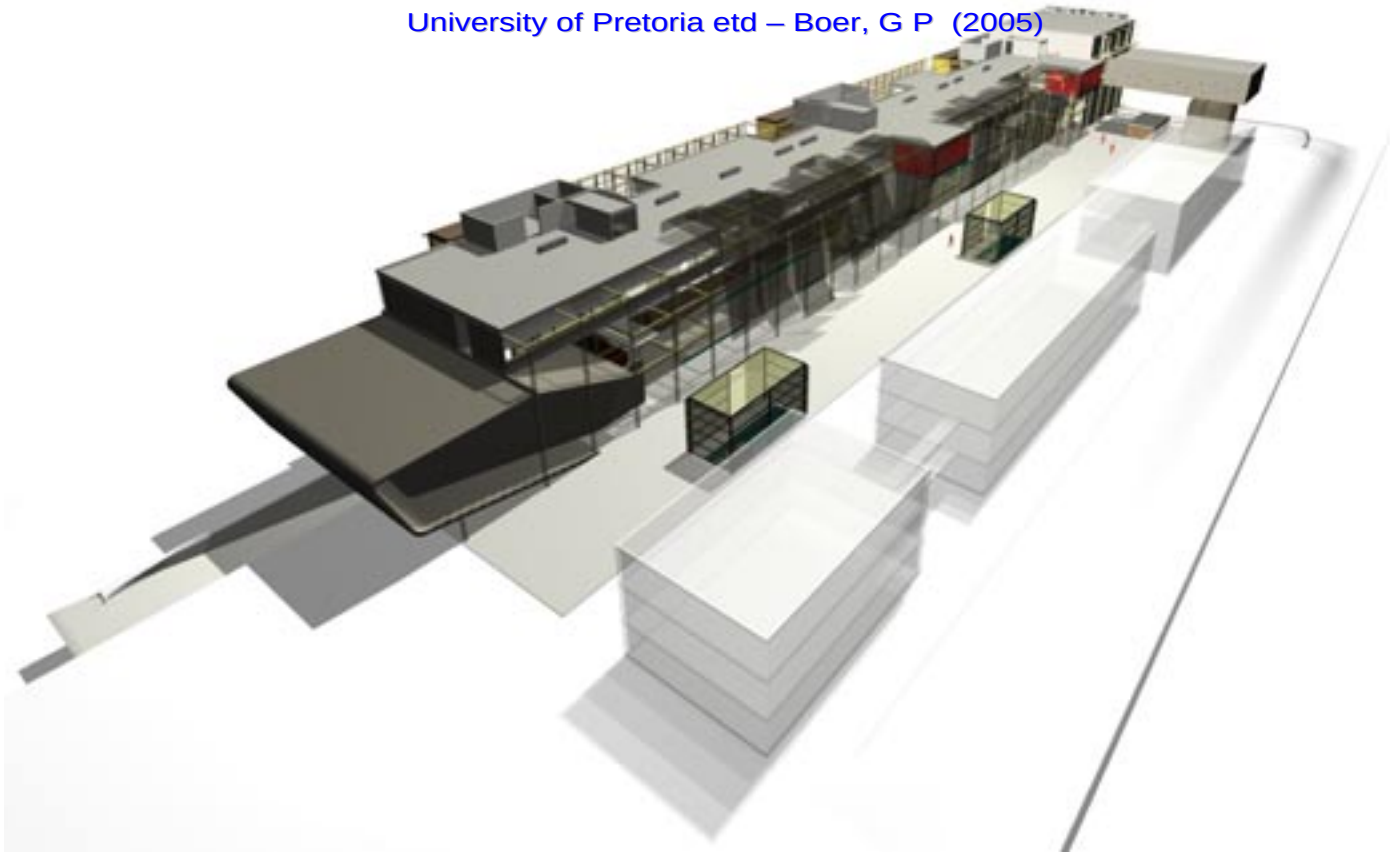


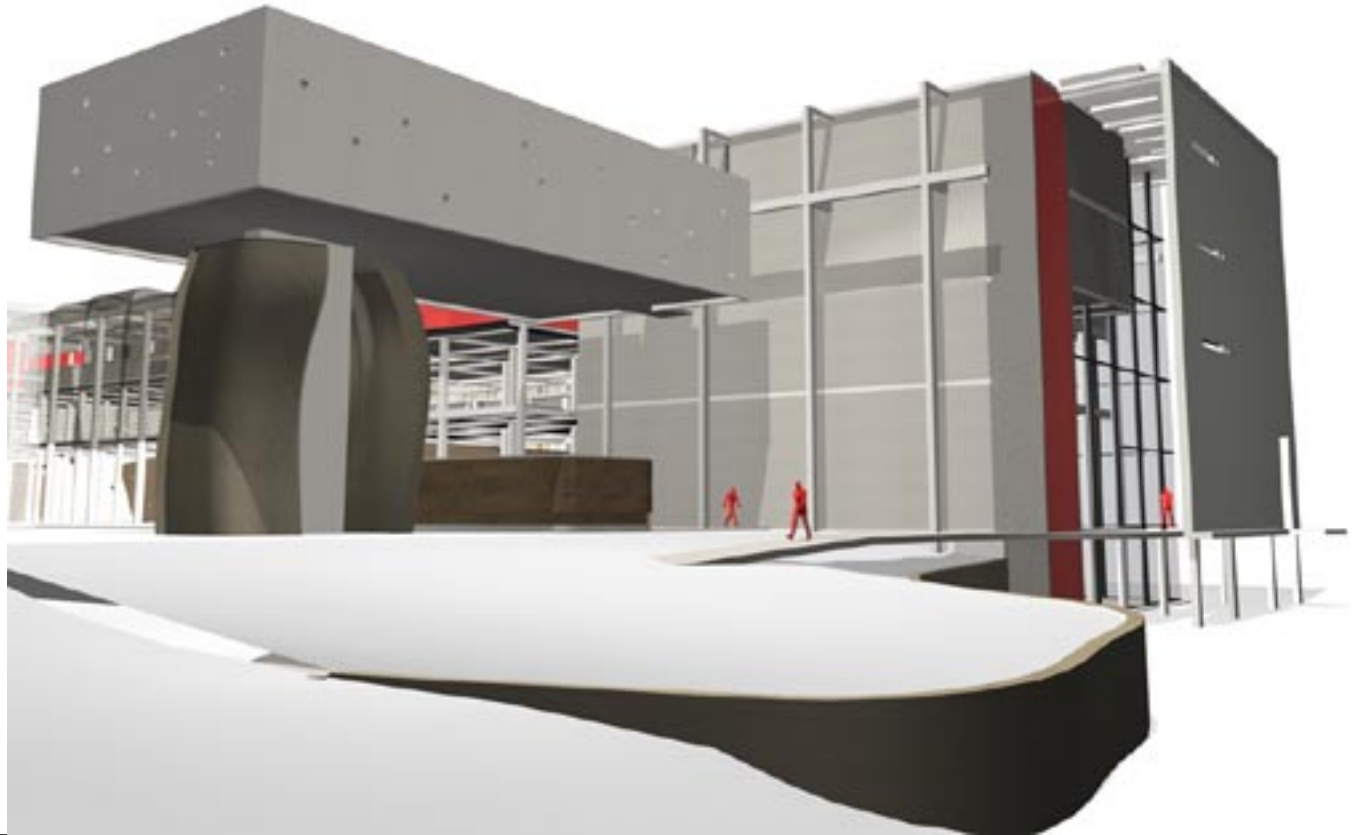
DETAIL SOUTHERN FAÇADE

SECONDARY ENTRANCE, MEDIA CENTRE







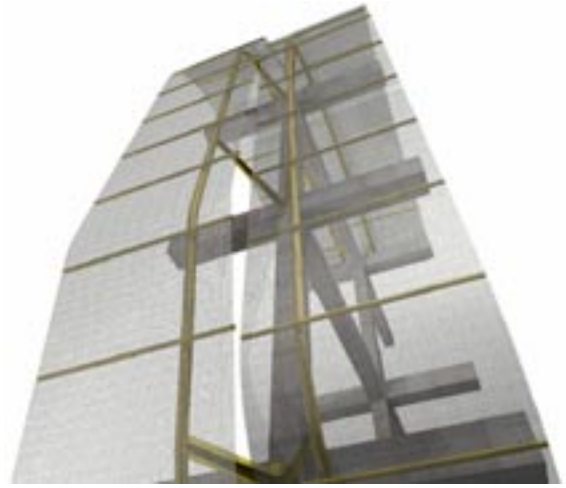


SOUTHERN FAÇADE GROWTH SCREEN

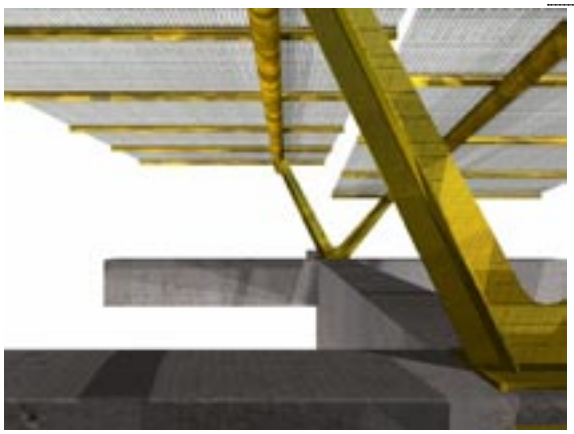
PERSPECTIVE VIEW OF GROWTH SCREEN

REINFORCED CONCRETE STAIRCASE WALLS

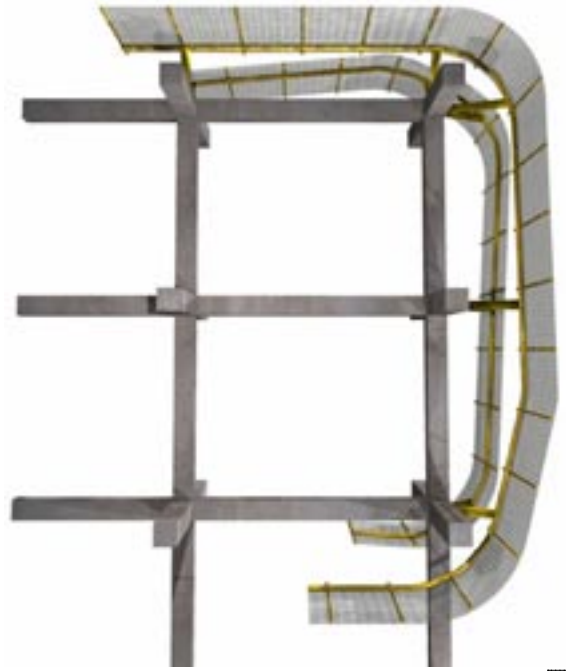
NORTHERN VIEW OF STAIRCASE WALLS



FRONT PERSPECTIVE SUNSCREEN



CONNECTION DETAIL



SIDE PERSPECTIVE

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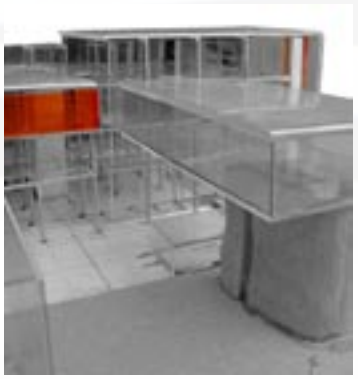

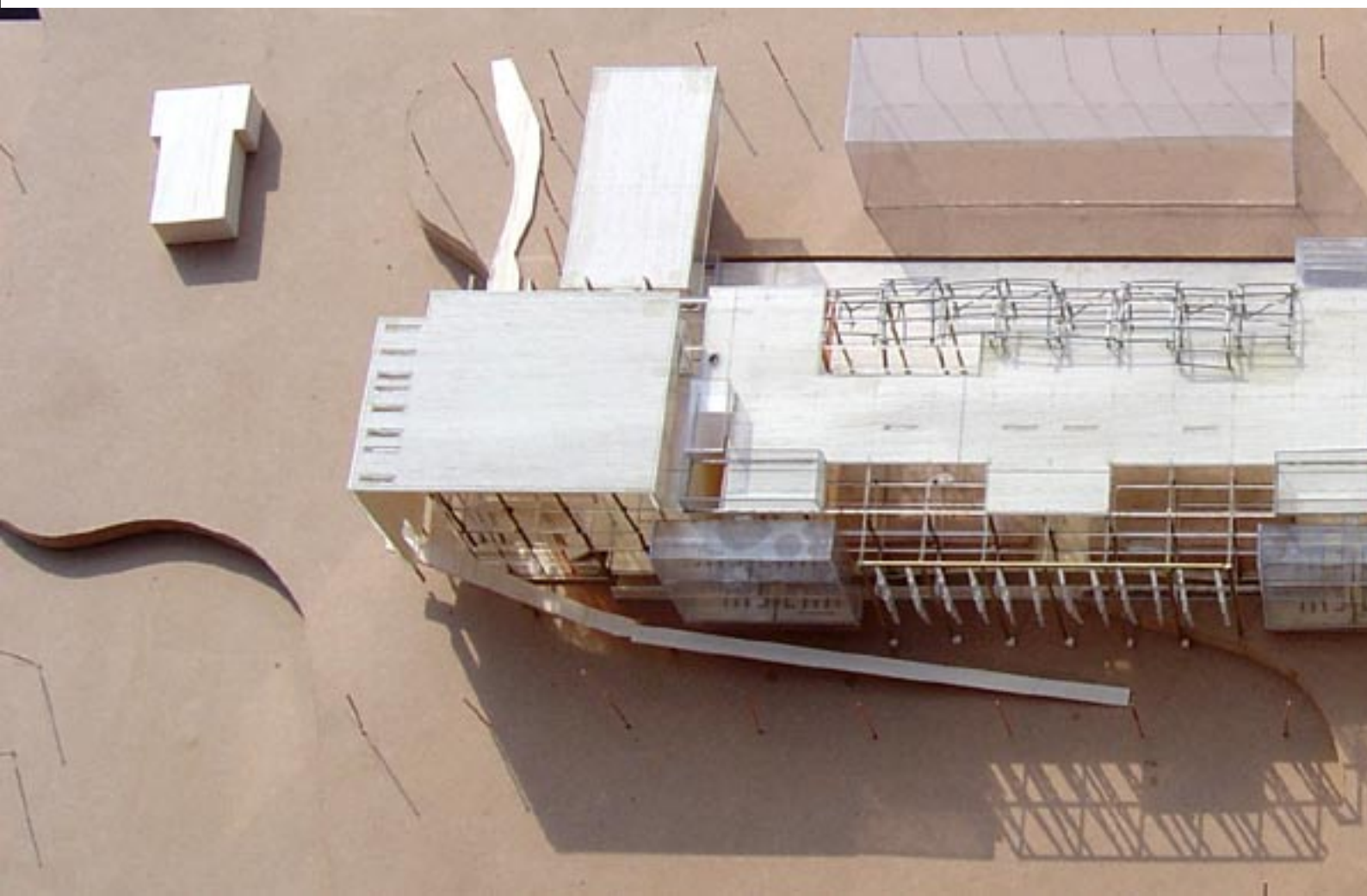




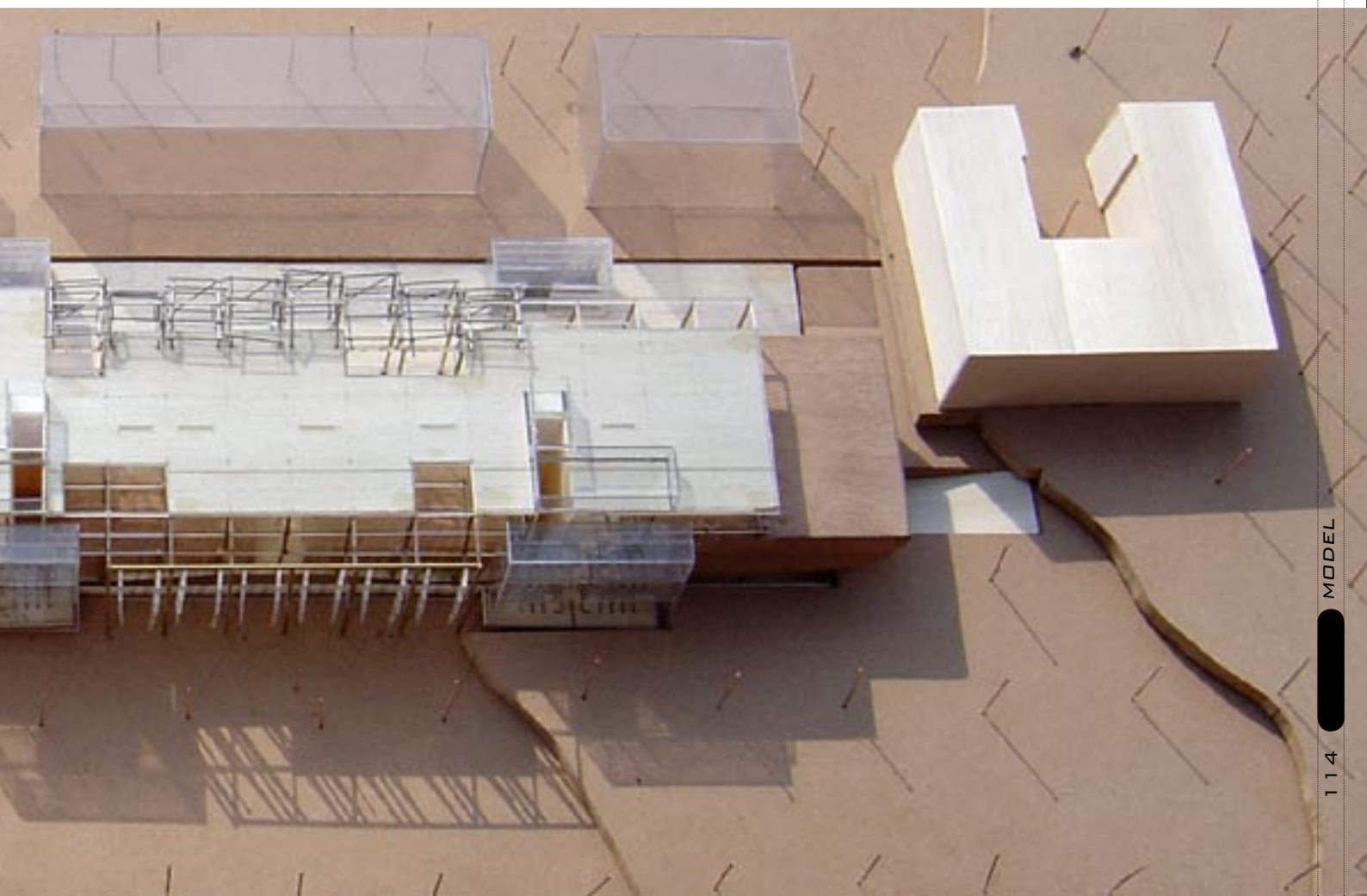

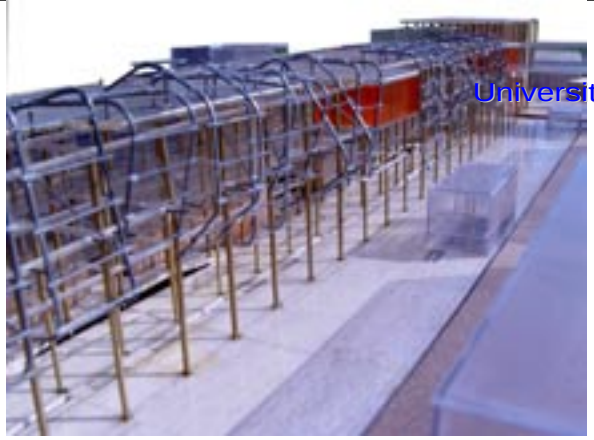

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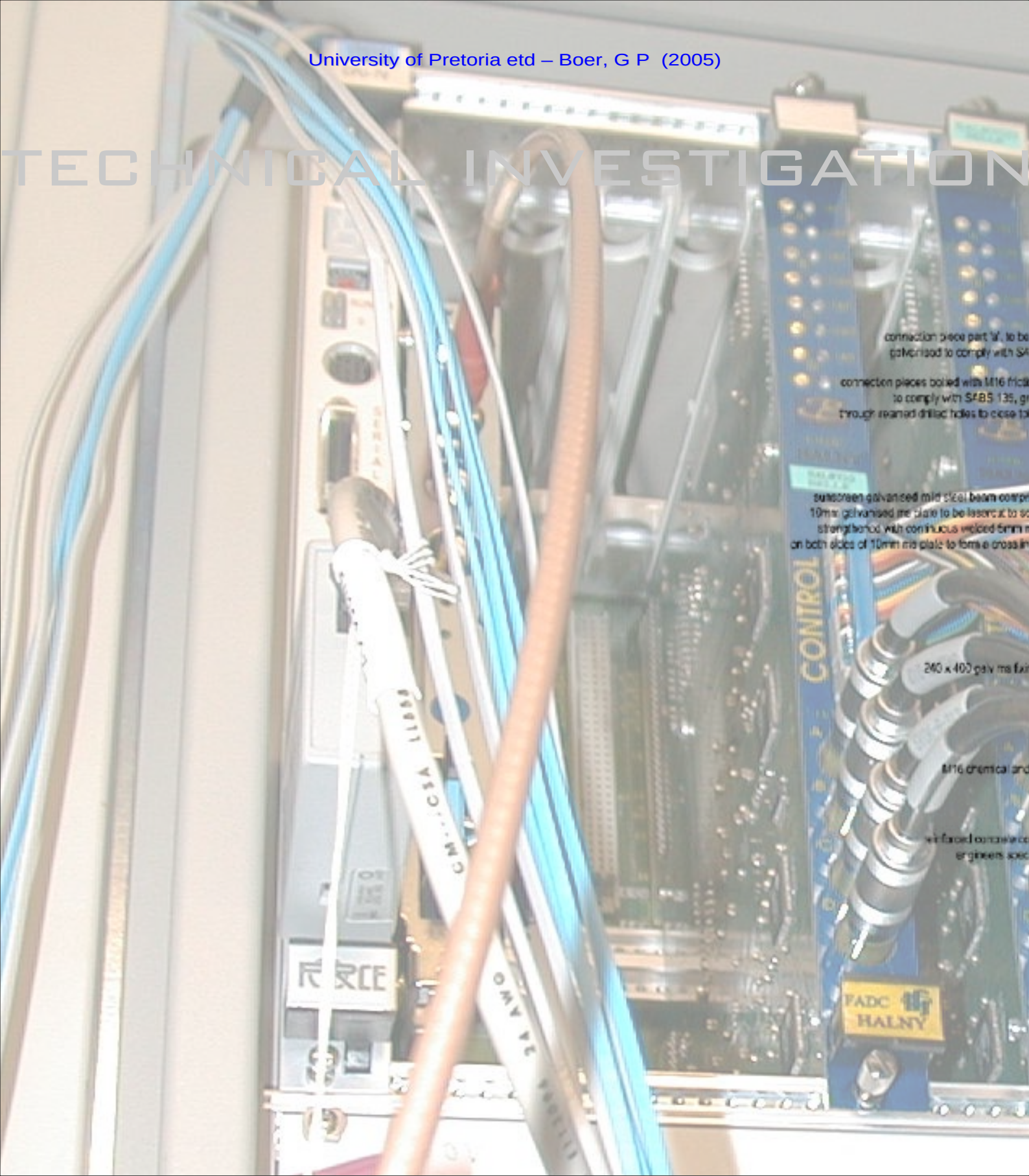
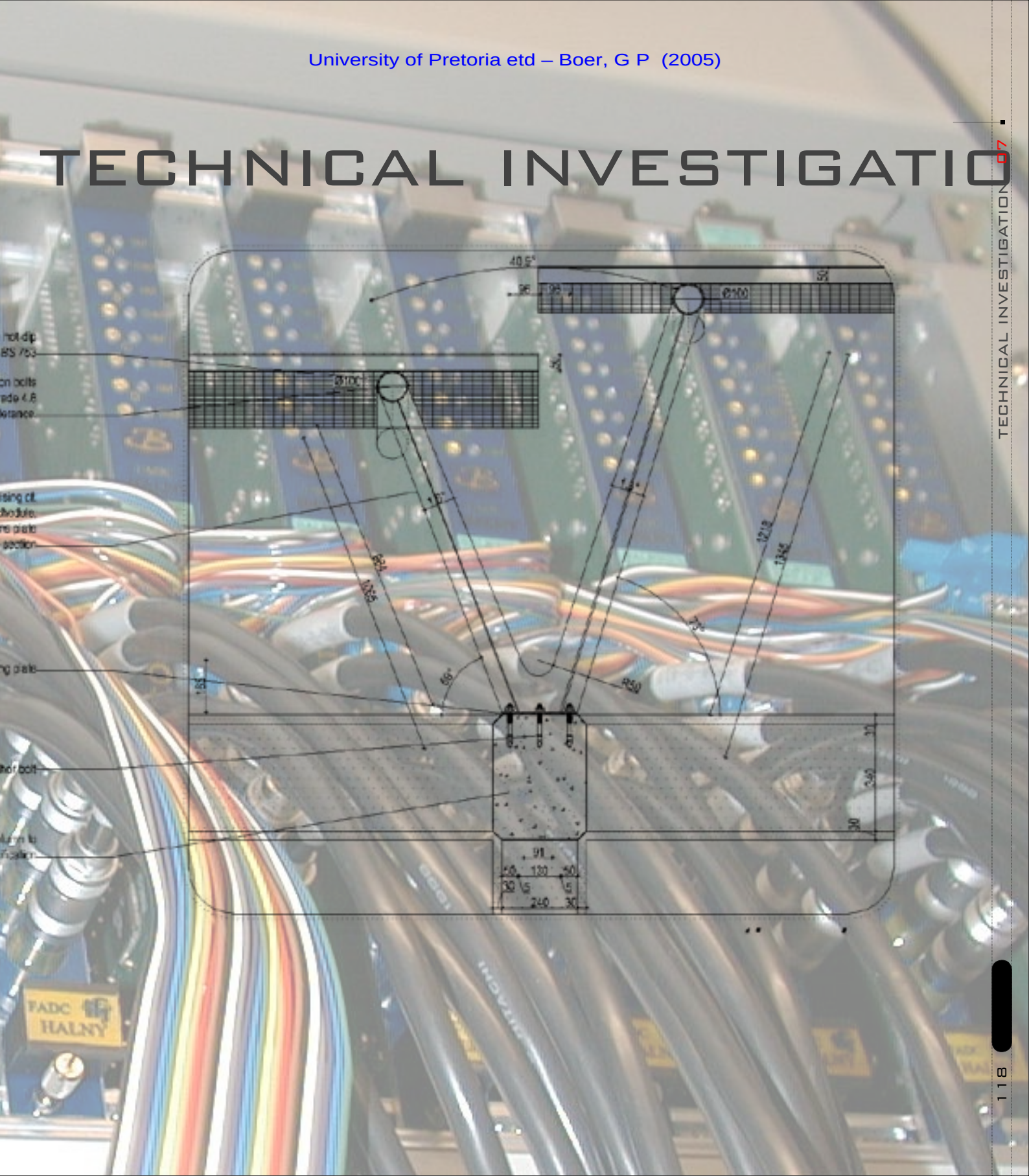


TECHNICAL INVESTIGATIO



8.1 Introduction

In the time frame of earth, even mankind, buildings have a limited life span of say 50 years. Considering the vast amount of materials that the construction sector consumes, designers should be cognizant of decisions that adversely impact the biosphere. Apart from the materials employed in a building, extensive maintenance and or replacement throughout the life cycle of a building is required.

In the design proposal for the School for the Built Environment, the manner in which the building may accommodate change is investigated. Continually evolving to adapt to its users' requirements, the level of adaptability will invariably determine its life-cycle, and ultimately its ruin.

A study of time presupposes a construct that dwells upon the transitory nature of both the pragmatic, as well as materials employed. The manner and ease of reconfiguration in the construct affects its adaptability. The design is therefore a study in the manner in which these changes can be accommodated.

The building consists of a definite beginning and end, symbolising the beginning and end of time for users moving in and along the construct.

The building is divided in a series alternating between the permanent and ephemeral.

Structure

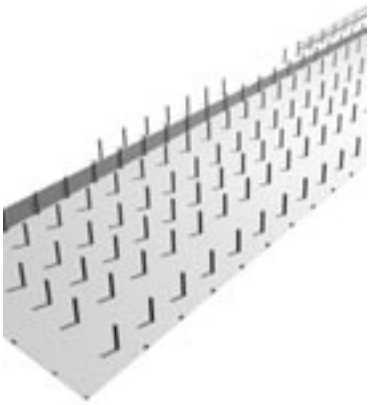
The structural system is discussed in the design development chapter. The following is therefore an extract of the discussion.

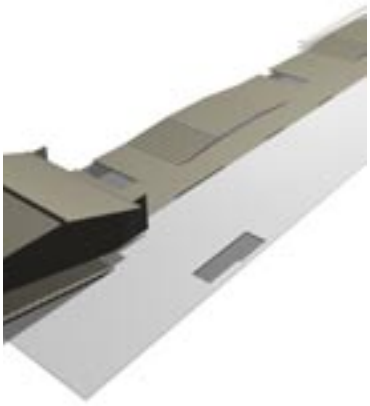
The structural system used in the proposal is primarily of steel and concrete. The choice of concrete, as a permanent material that is only pliable during its construction, forms the static, internal mould around which the steel structural systems oscillate.

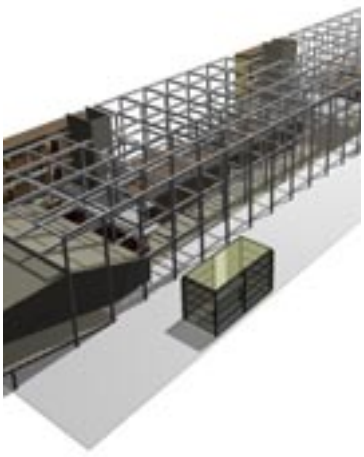
The three service cores along the length of the building is the permanent, non-programmeable spaces that will remain static in its configuration over the life span of the building.

On the other hand, the infill between these vertical cores is the ephemeral component of the structure.
Concrete is used as the permanent 3-D grid material, as organisational architecture element, around which evolution of the building programme may take effect. Column and beam construction is used throughout the building, being stiffened by slabs as well as the various vertical service cores.

STATIC CONCRETE STRUCTURE







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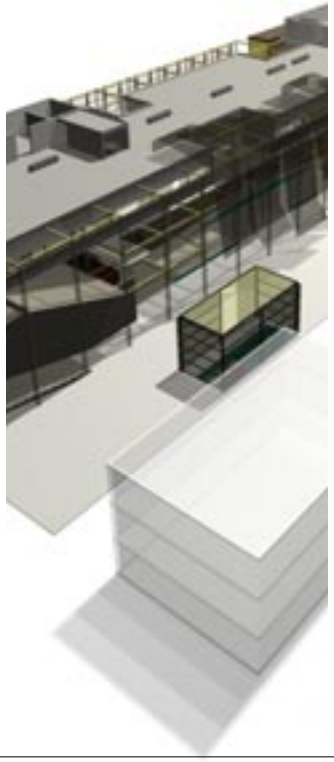
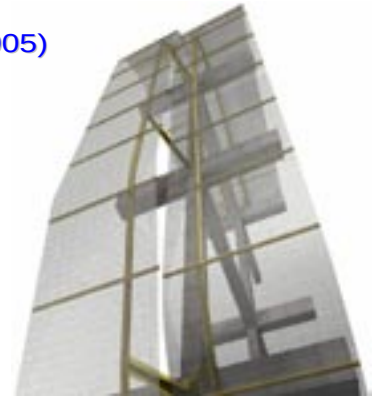
SERVICE SHAFTS, SLABS



SKIN



Ventilation

The purpose of any building is to create a manipulated climate, where man is protected from extreme fluctuations of the external climate. The type of ventilation system used in a building determines the amount of energy usage over its life-cycle.

A combination of both mechanical and passive ventilation systems are used in the School for the Built Environment.

Passive ventilation system:

Natural ventilation is only efficient if proper cross ventilation can occur. Cross ventilation, or rather the pressure differential, is dependant on the path of flowing air, as well as its distance. The proposed building is 20m wide, which is more than the critical distance for effective natural ventilation to occur. The adaptable floor and facade components should be configured with natural ventilation in mind. Limiting overall width to 3 modules of the three dimensional concrete column and beam structure, should allow for ample natural ventilation.

Birrer [1979] states that the most significant design considerations for creating an energy efficient building are form, fabric (materials), fenestration and orientation.

Form & orientation_

The School for the Built Environment is orientated at 15° east of north, allowing ample solar incidence. This orientation follows the existing campus grid, and accentuates 'filtered' eastern solar incidence during morning hours.

Fabric_

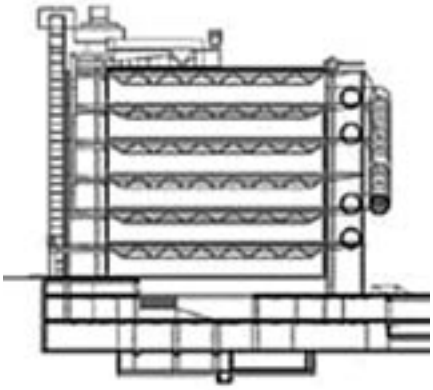
The use of concrete, with high thermal storing capacity aids in regulating internal ambient temperatures. The sunscreen 'skin' over the building proper generates a climatological transition zone between internal and external areas.

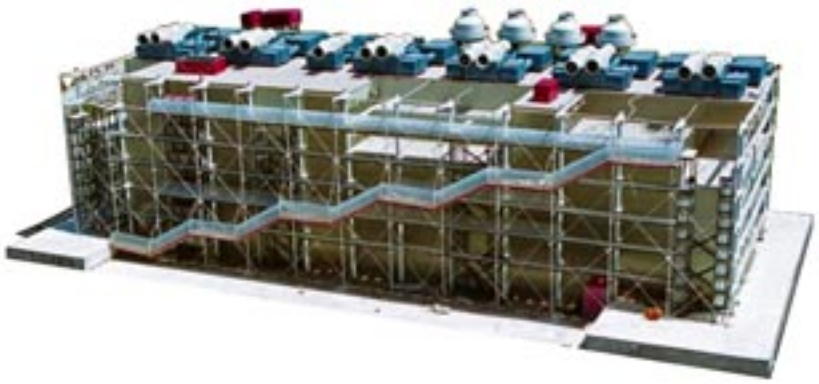
Fenestration_

Northern and southern façade fenestration are filtered by sunscreen components. The façades are adjustable in terms of openable windows; louvres and or sliding doors.

Mechanical ventilation system

The HVAC plant rooms are located on the roof adjacent to the vertical service core shafts. The shafts are open to the southern façade, allowing ease of access. Primary ducts are located in these vertical shafts with branching on different floor levels as required. Mechanical ventilation is required in areas such as the auditoriums, which use displacement ventilation from the floor upwards. A multi-zone constant air volume HVAC plant is proposed for required areas. According to Kohler [2004] the most adaptable mechanical HVAC system suitable for the proposed structure is the use of chilled-water fan-coil units which only require a 25mm pressurised galvanised mild steel circular hollow section pipe. These units can easily be incorporated into the ceilings recess. However, fan-coil units only regulate internal temperatures, and do not supply any displacement ventilation.



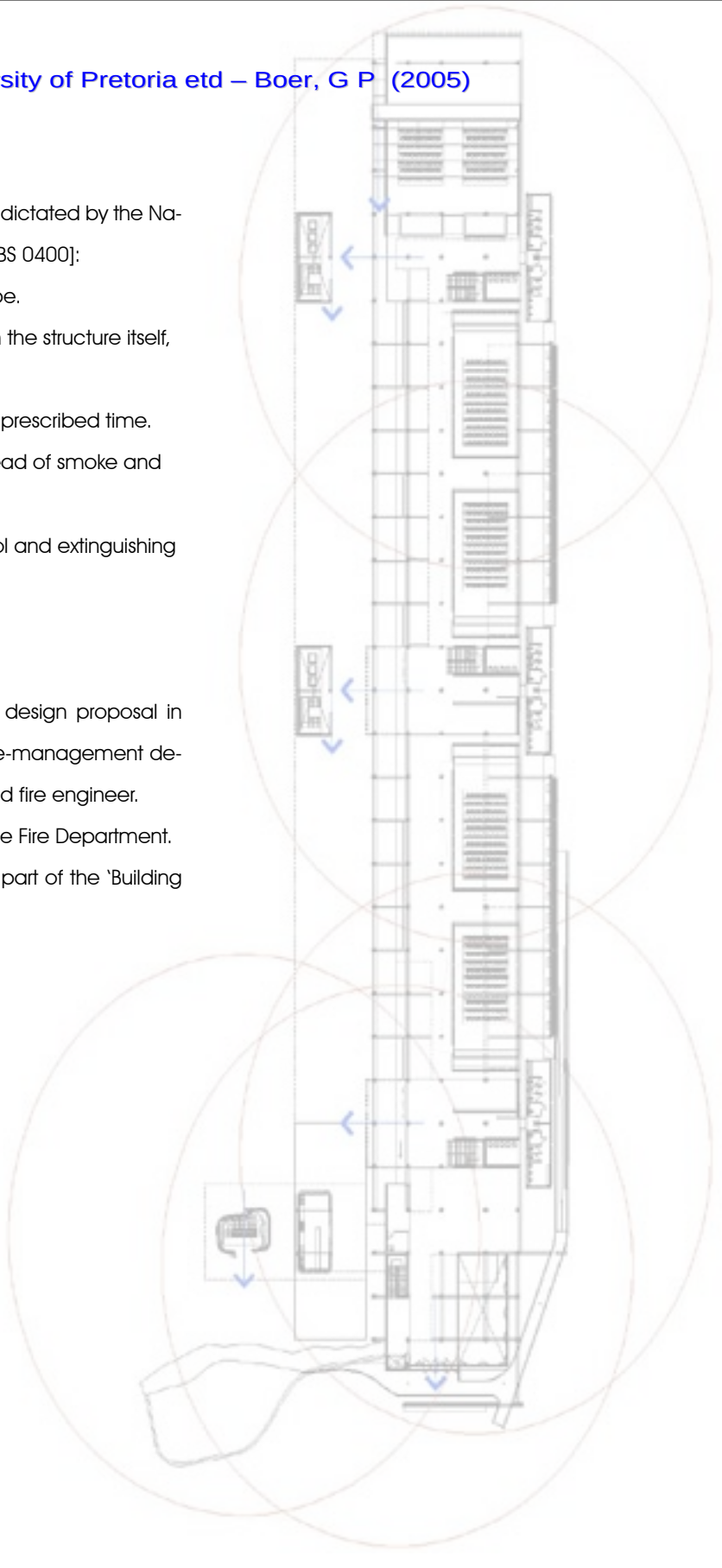


Fire management

The guidelines for fire management as dictated by the National Building Regulations [Part N of SABS 0400]:

- Life safety and the provision for escape.
- Minimize the spread of fire both within the structure itself, as well as from building to building.
- Provision for structural stability within a prescribed time.
- Detection, and prevention of the spread of smoke and heat.
- Provision for detection devices, control and extinguishing equipment.
- limiting the destruction of property.

Due to the vertical complexity of the design proposal in terms of vertical volumes, a rational fire-management design should be conducted by a certified fire engineer.
All building plans to be approved by the Fire Department.
Fire detection equipment should form part of the 'Building Management System'.



Vertical circulation

The School for the Built Environment is mainly a three storey building, with four storeys on its western extremity. Vertical circulation is concentrated at the non-programmeable service cores in the form of stairwells.

An elevator should be installed in the entrance lift lobby for disabled access requiring a high levelling accuracy. The elevator should have the minimum impact on the environment.

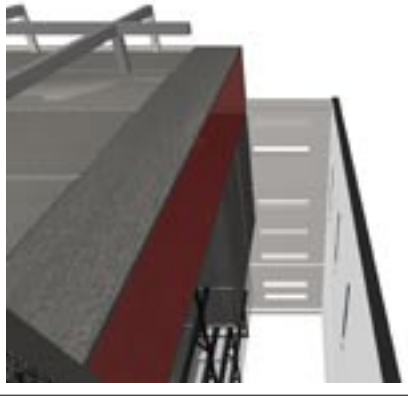
The 'Gen 2' machine-room-less elevator, manufactured by 'OTIS', has the advantages of:

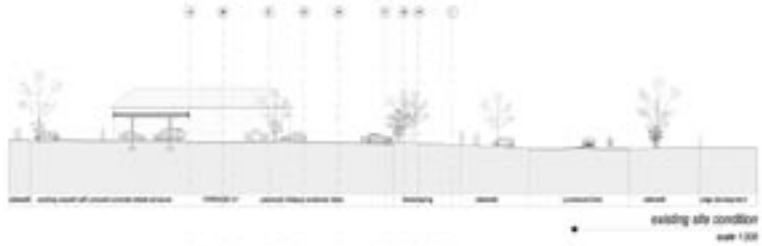
- Lower operating costs through the innovation of energy efficient machines and 'flat belt' technology. The flat belt wraps a flexible polyurethane skin around steel cords, that is lighter than conventional ropes, thereby reducing inertia.
- The flat belts have a larger surface area resulting in greater traction and also decreasing sheave wear. The belt requires no oil-based lubricants as it is gearless and is installed with sealed bearings.
- An electromagnetic filter eliminates interference with the buildings' electrical system.
- The machine room requires a small space, measuring 25 x 100 cm.

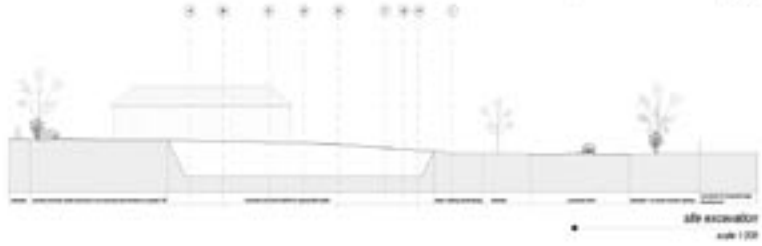
All mechanical components of the lift, as well as installation and maintenance to comply with SABS 1545.

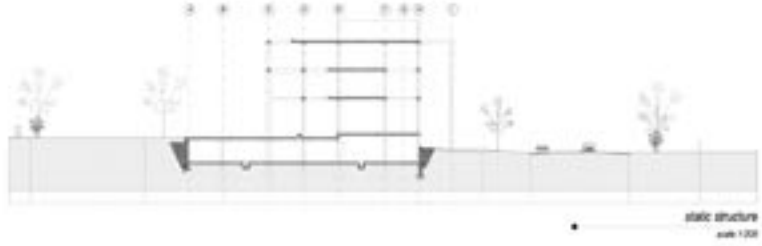
In the School for the Built Environment, the lift shaft is glazed with red structural glass. People moving along the main access ramp and vehicular traffic in the main entrance of the campus will see both the level and operation of the elevator housed inside. The lift shaft acts as a light well during night time, emitting filtered red light on the main access ramp. The daily usage of the elevator functions as a time modulator of its users' movement.

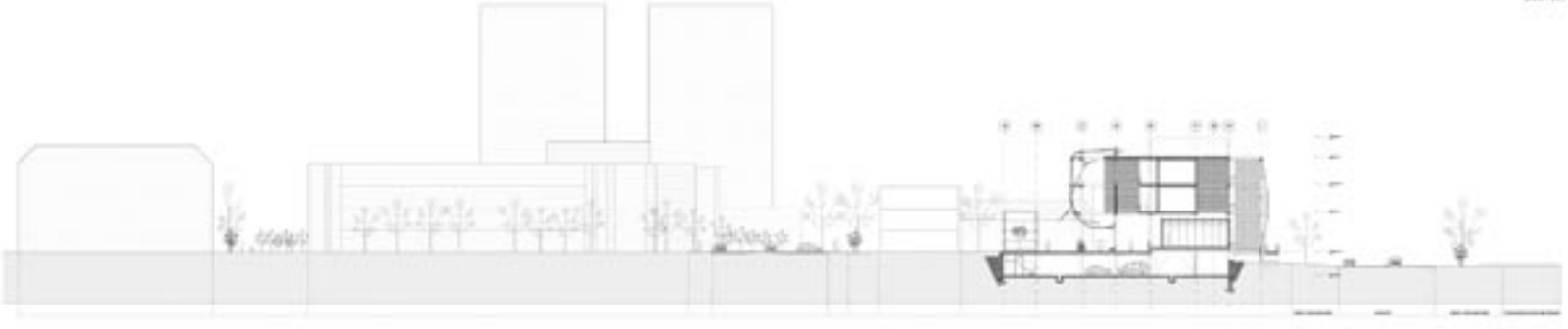
GEN 2 MACHINE-ROOM-LESS ELEVATOR. 'OTIS'



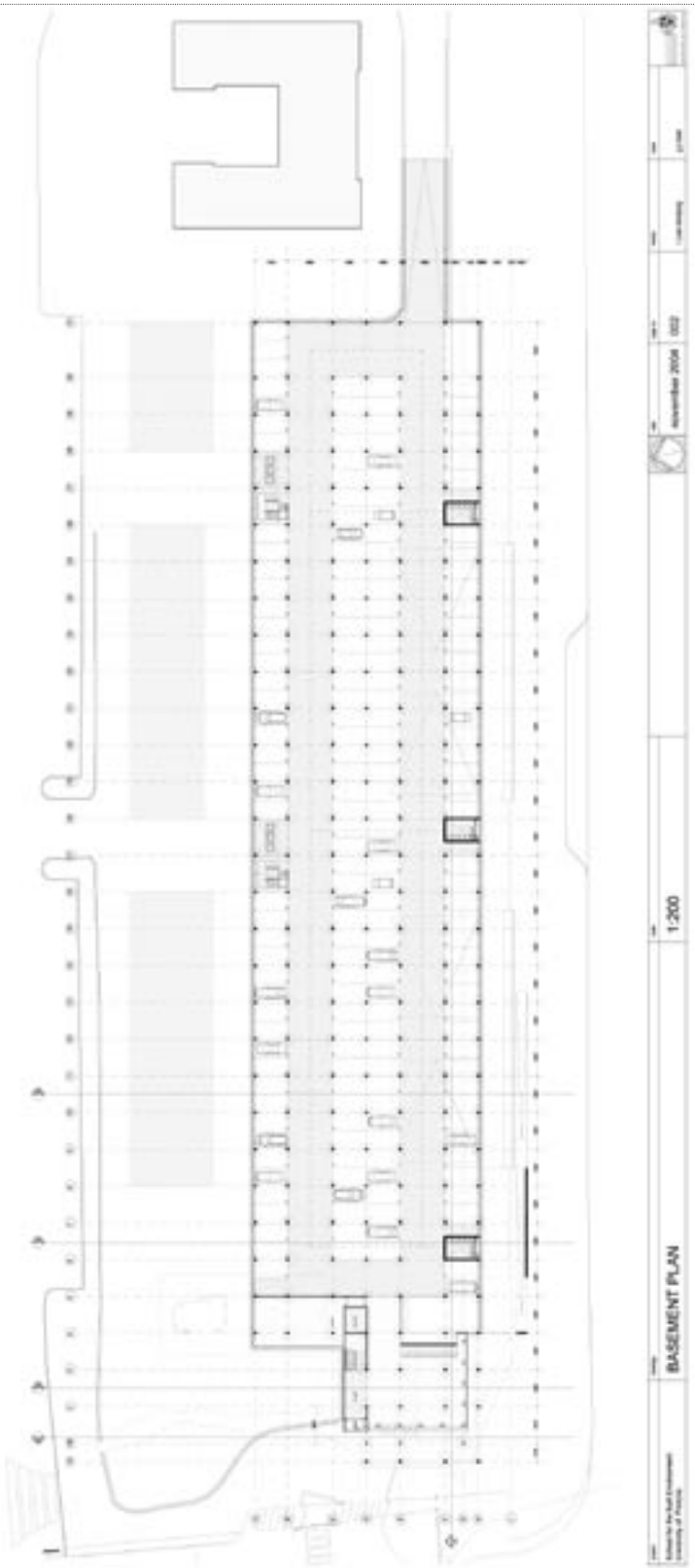


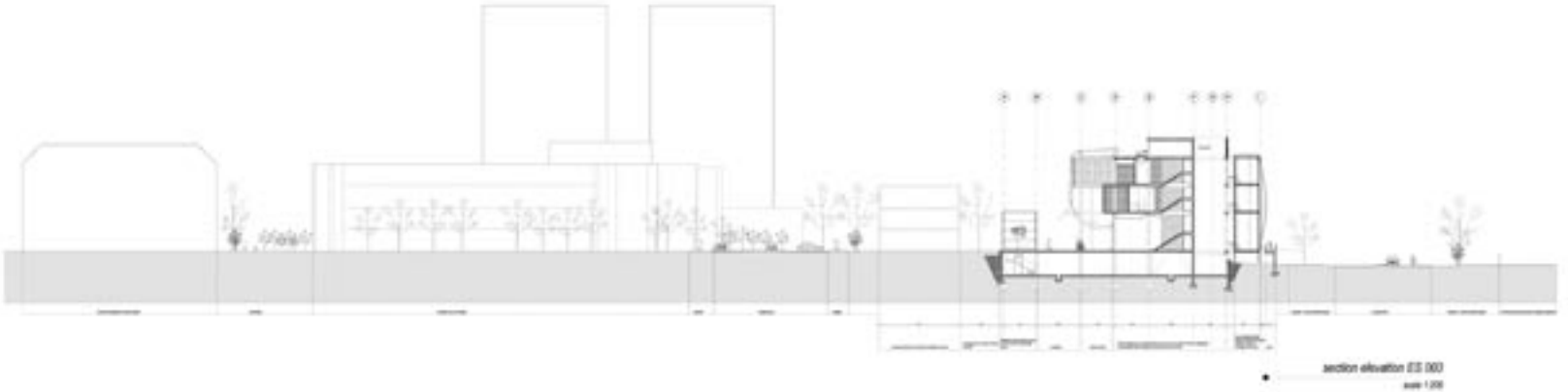




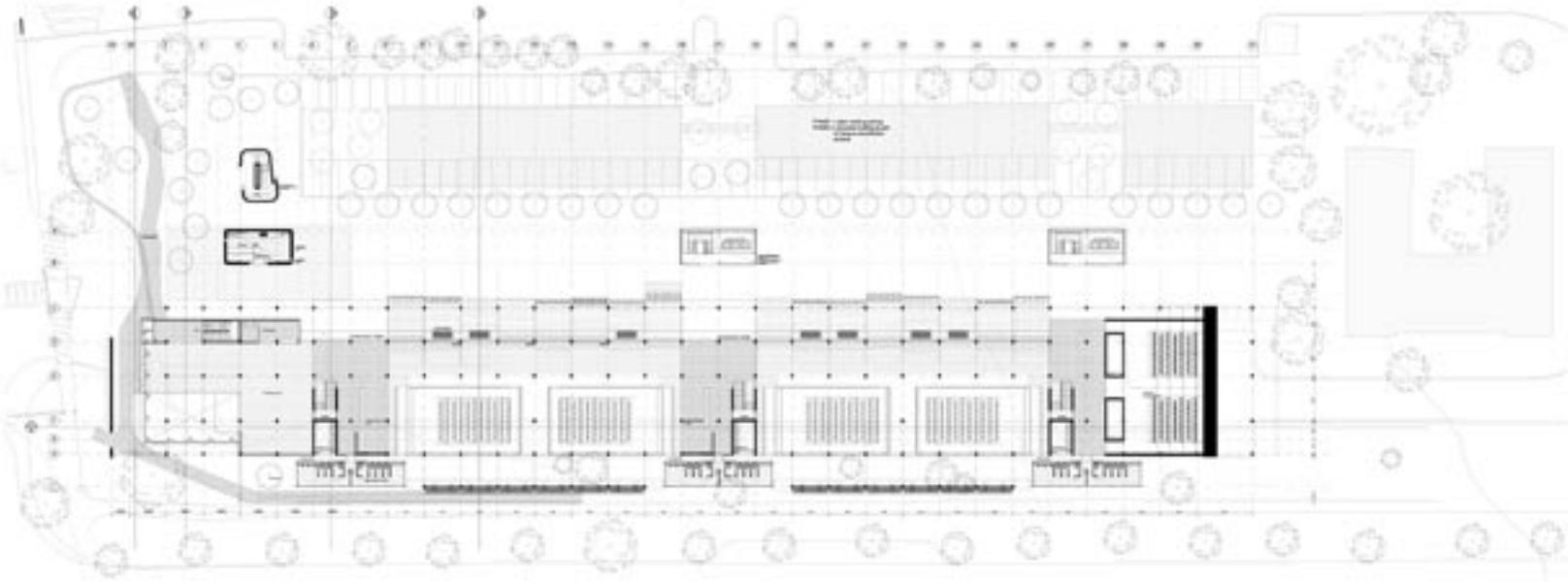


	SITE TIMELINE PROCESS	1:200			november 2004	001		

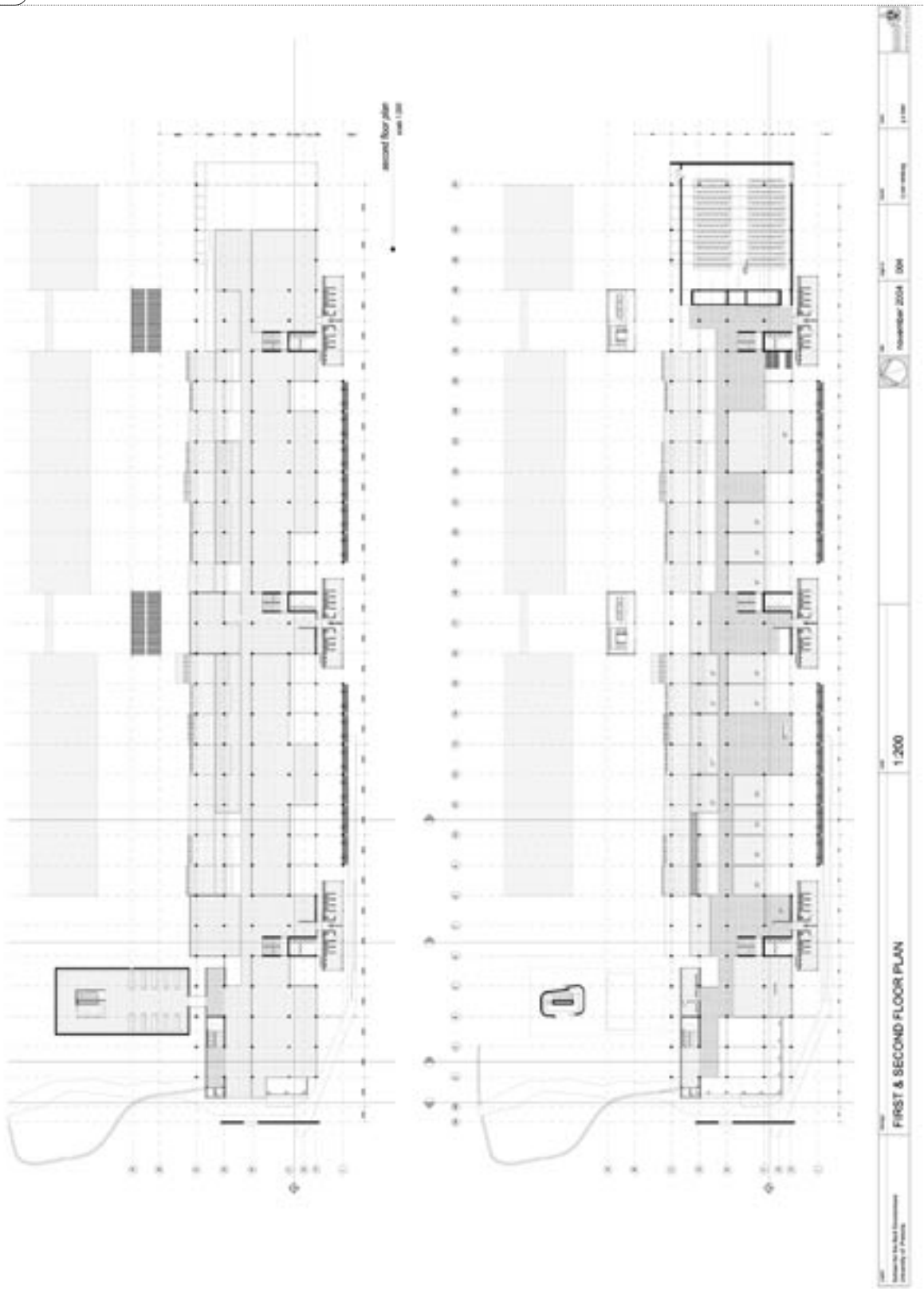


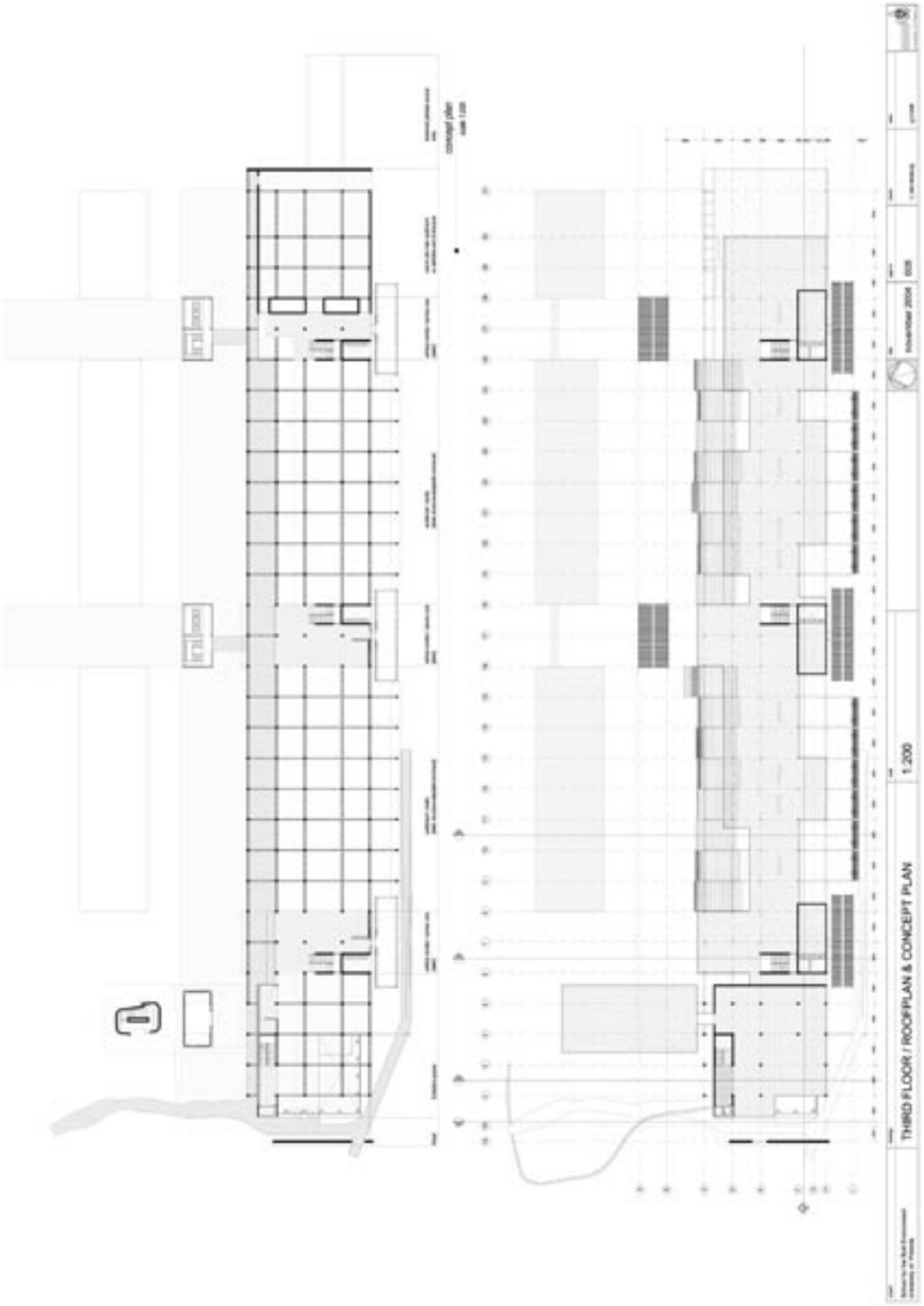


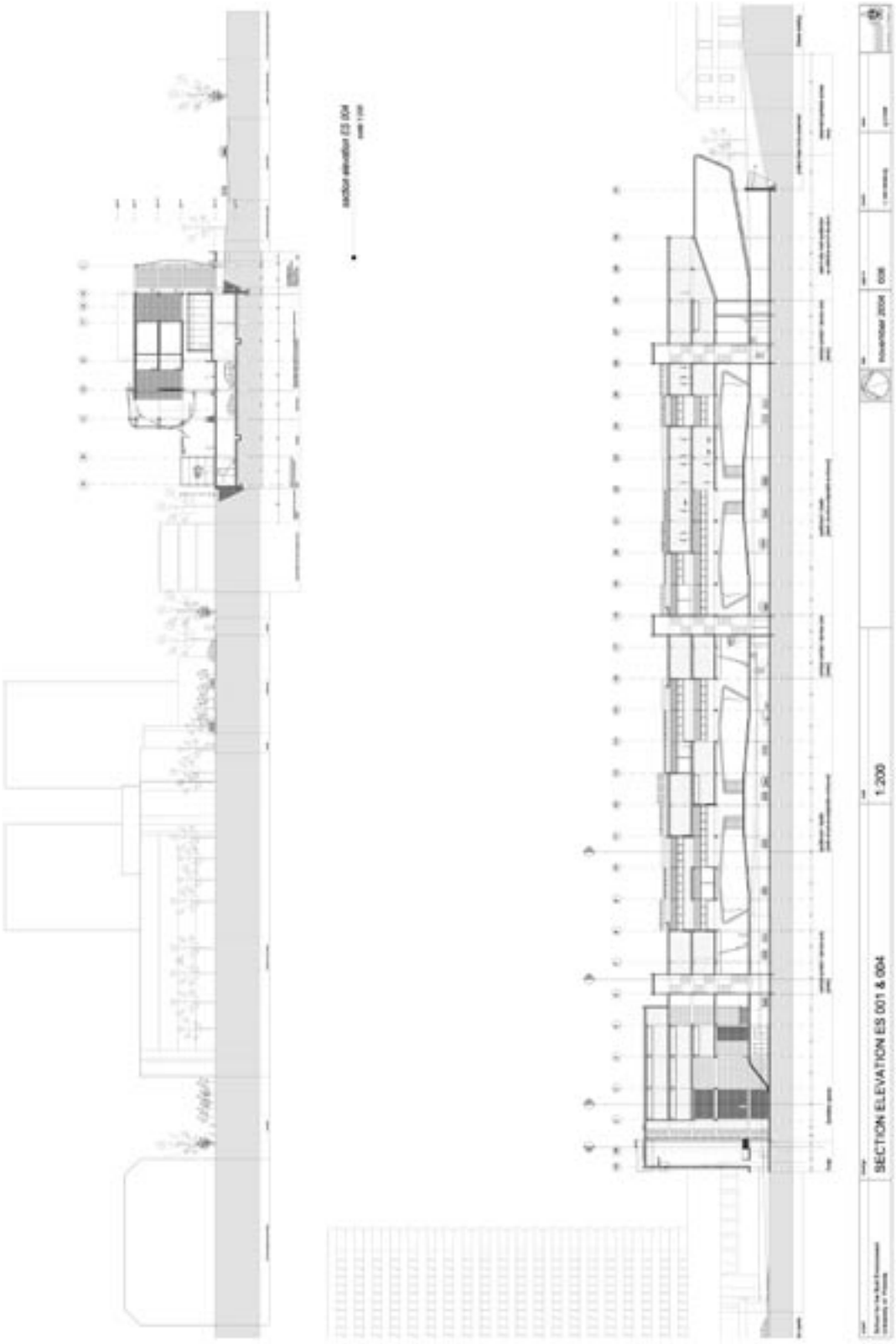
section elevation ES 003
scale 1:200

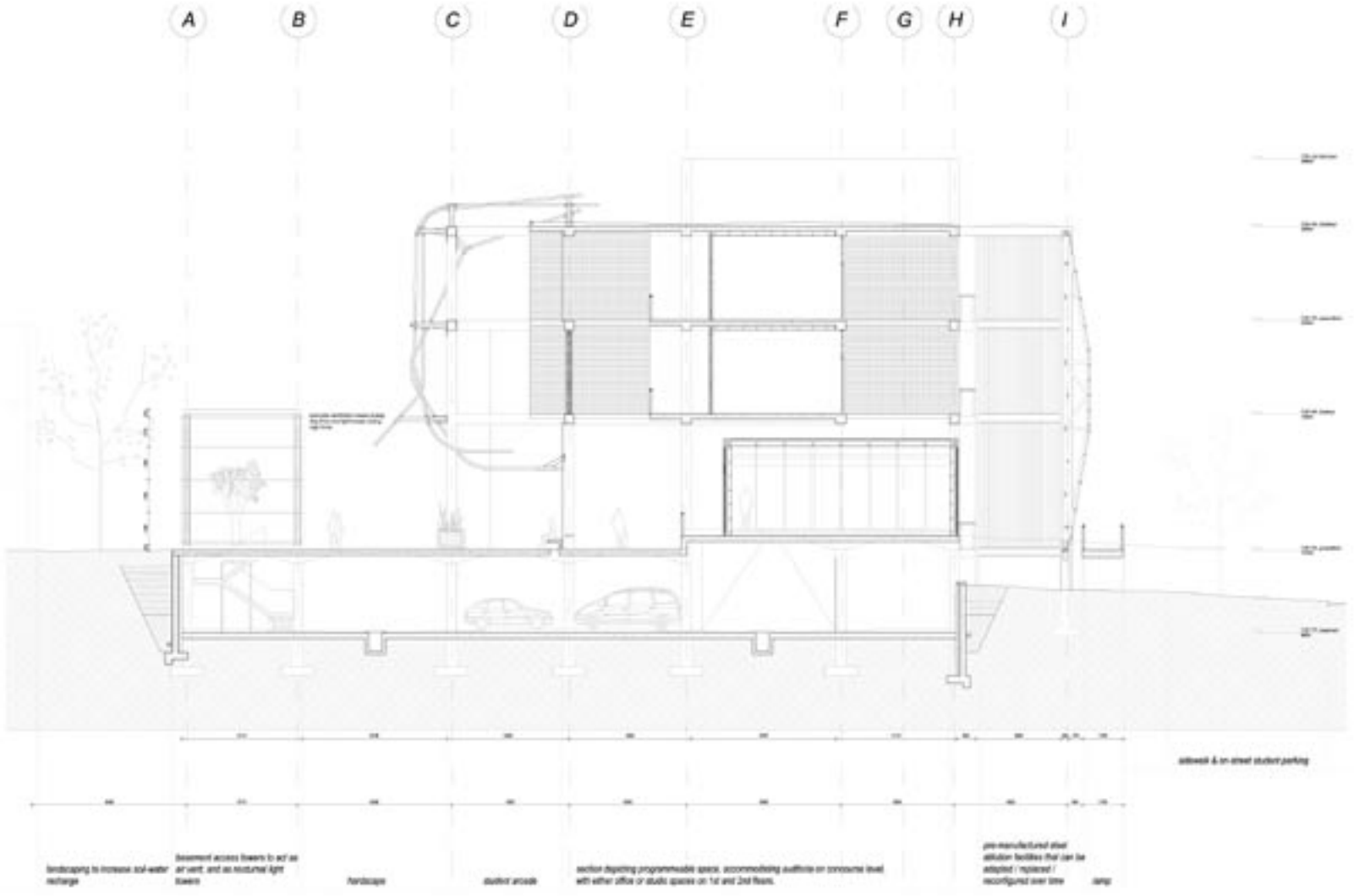


	GROUND FLOOR PLAN & ES 003	1:200			november 2004	003		

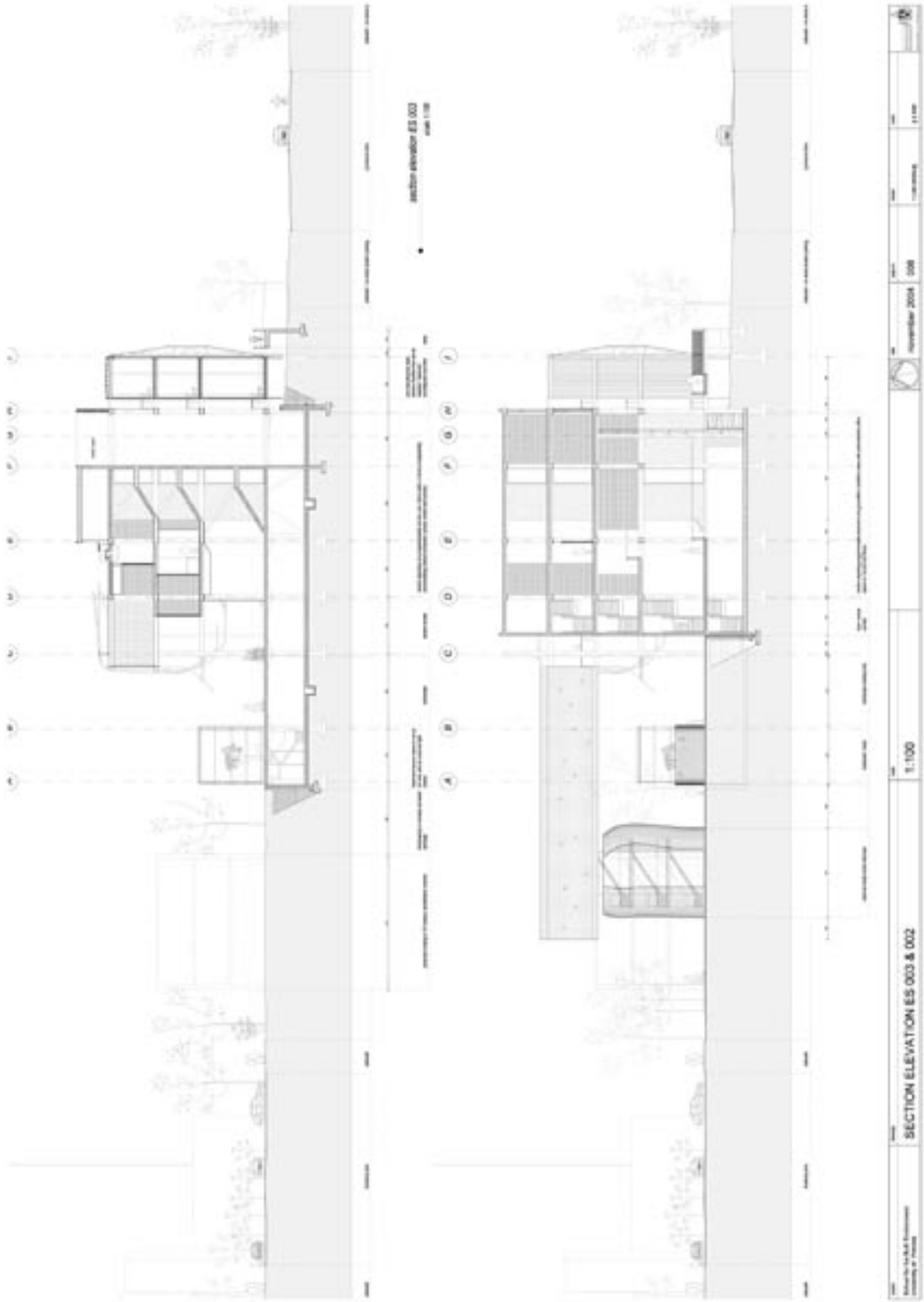


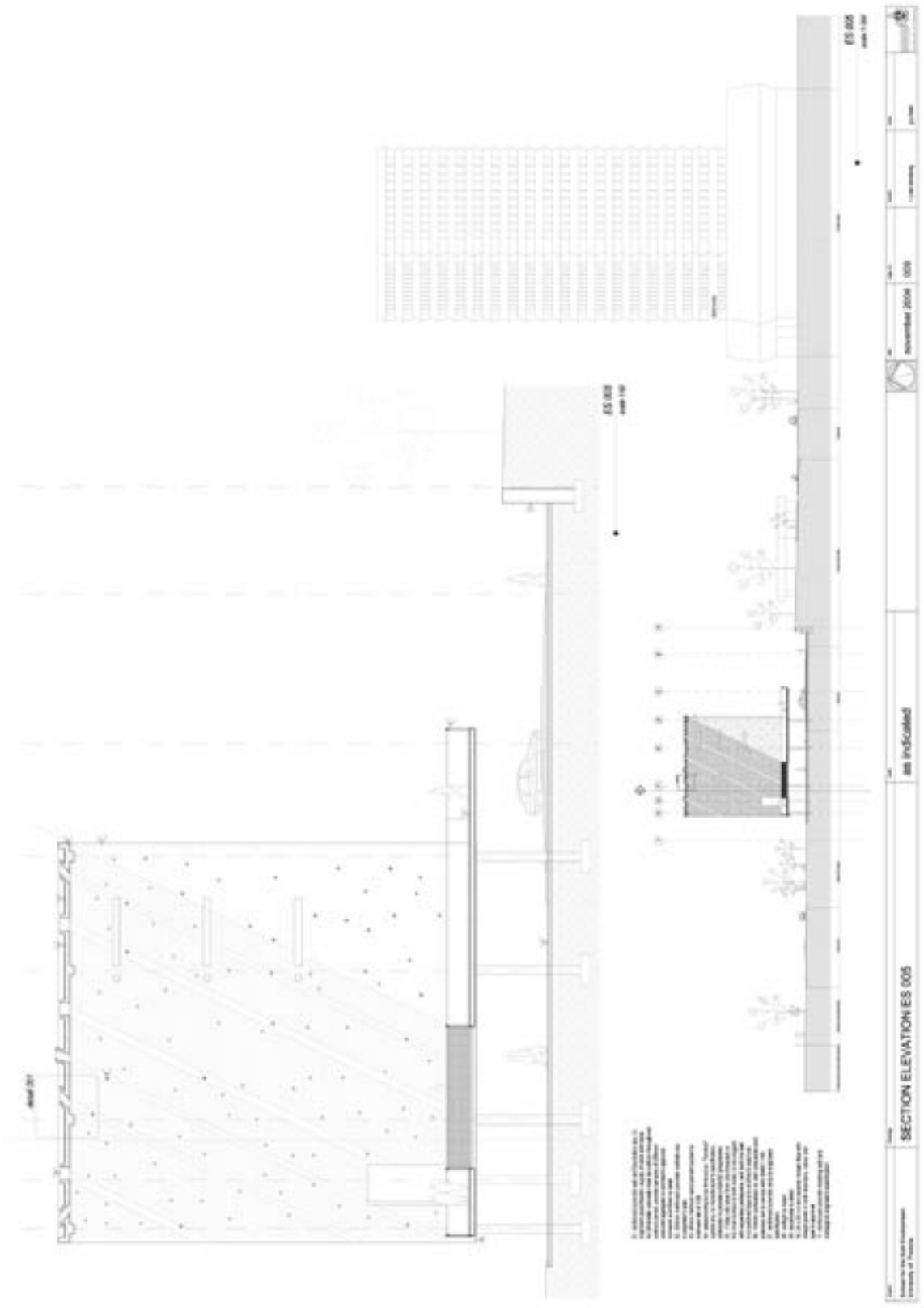

THIRD FLOOR / ROOFPLAN & CONCEPT PLAN
1:200

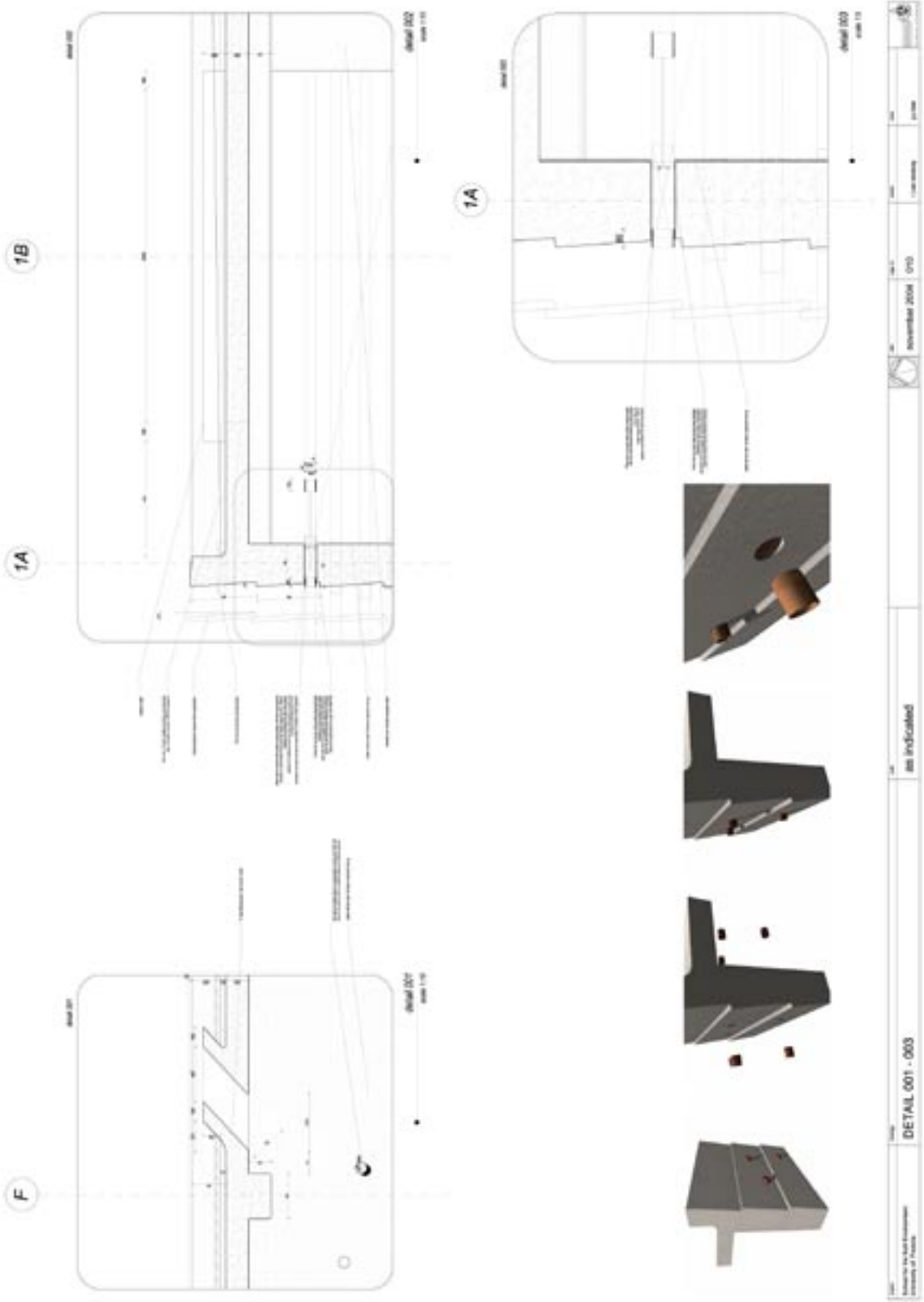


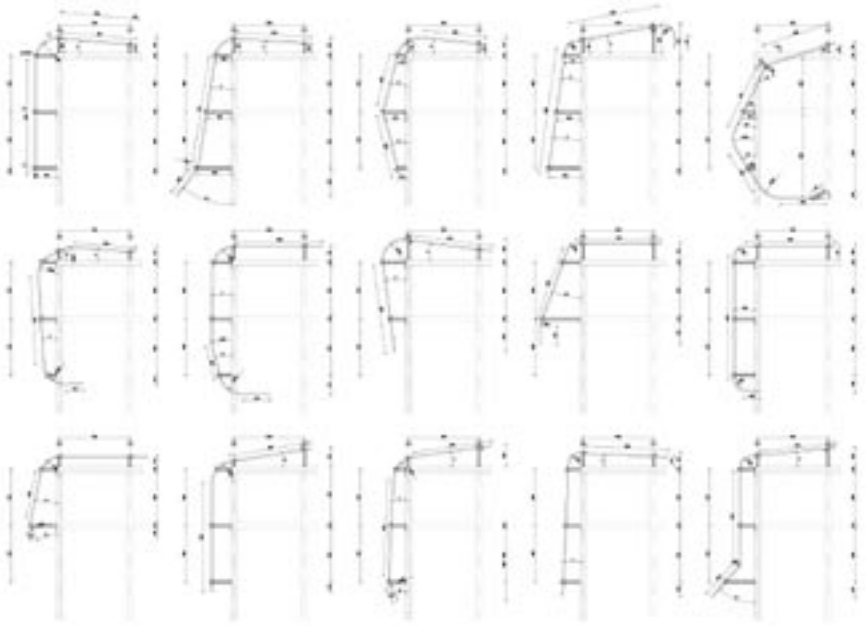


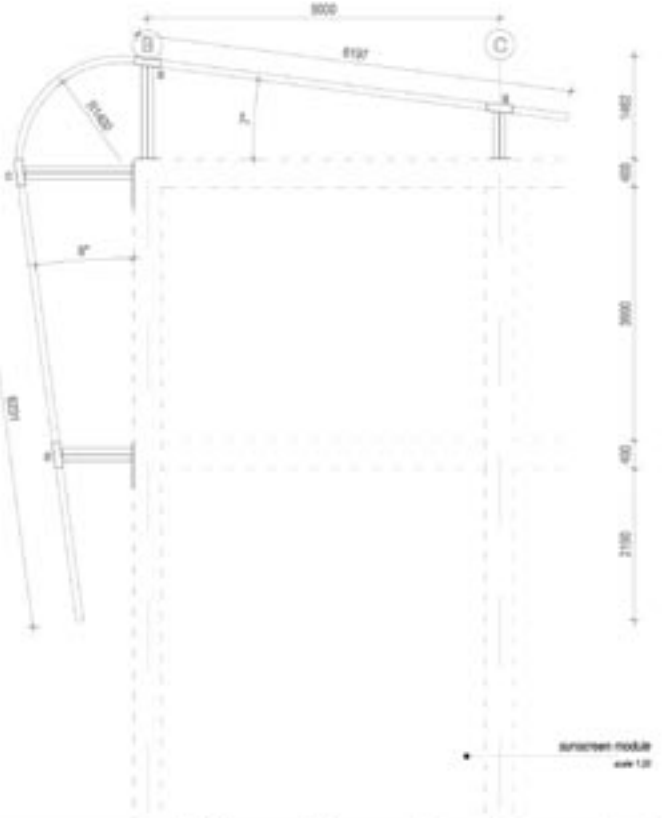
	SECTION ELEVATION ES 004	scale 1:50			november 2004	007	




SECTION ELEVATION ES 005
as indicated
november 2004



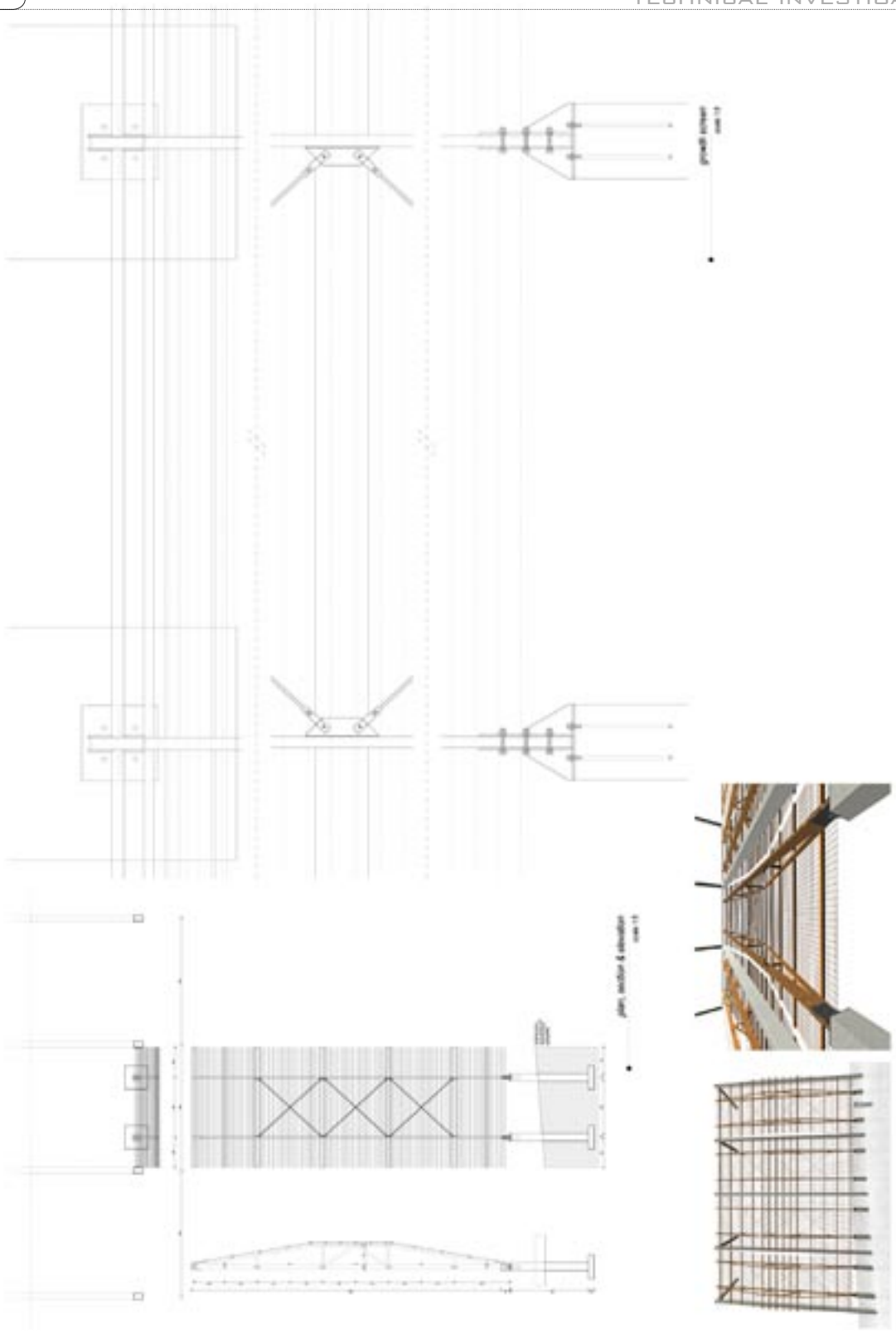


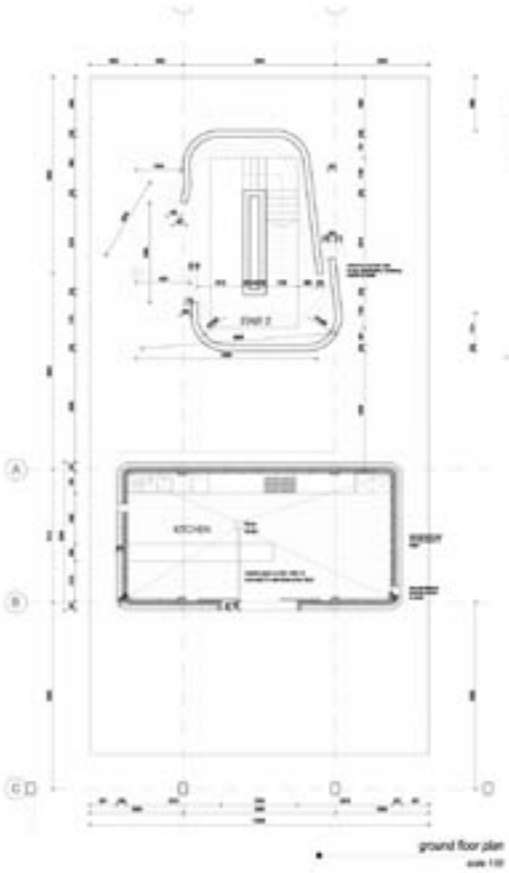


sunscreen module
scale 1:50

sunscreen module
scale 1:20

	NORTHERN FACADE SUNSCREENS	as indicated			november 2004	011	





ground floor plan

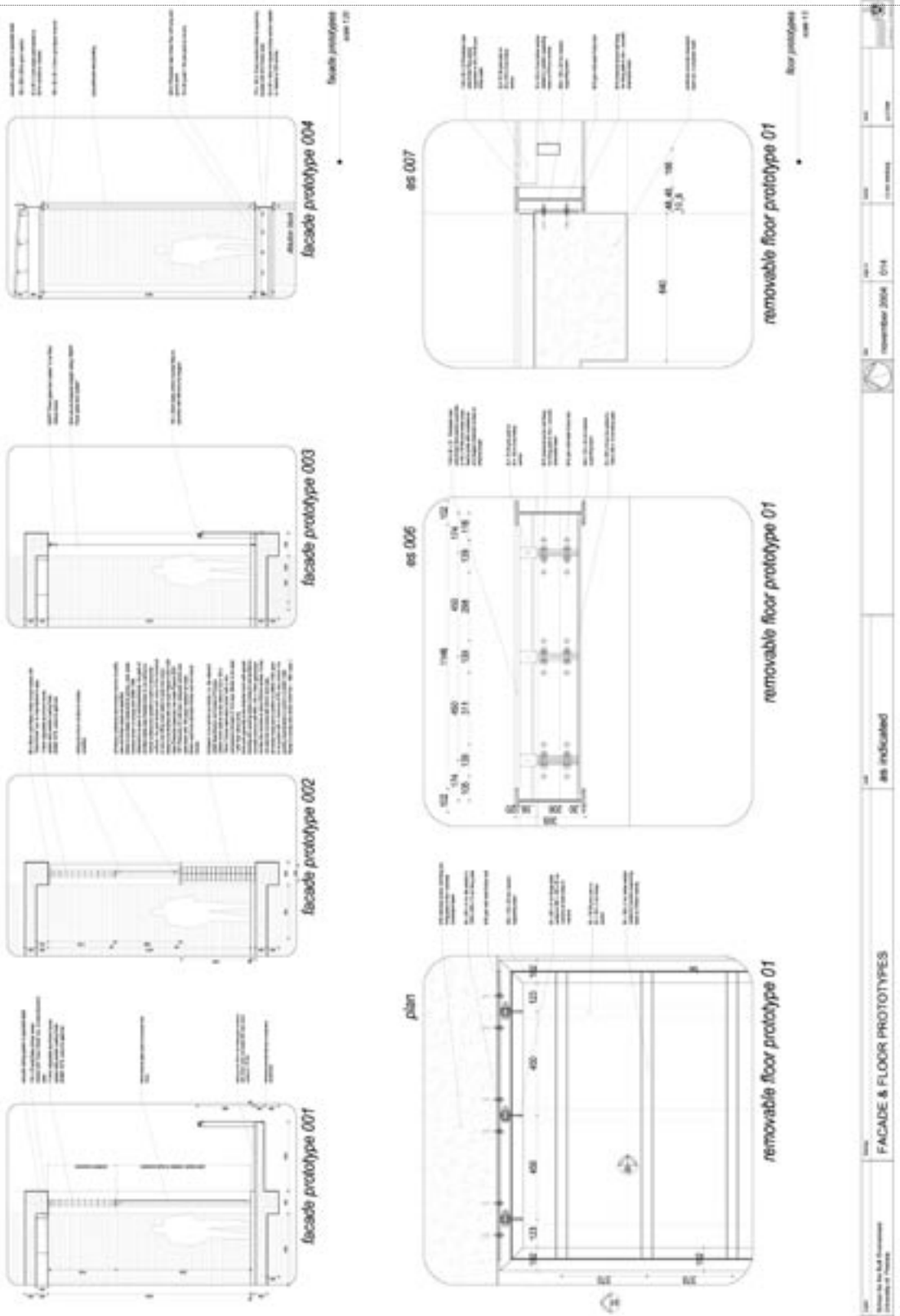
southern elevation

eastern elevation

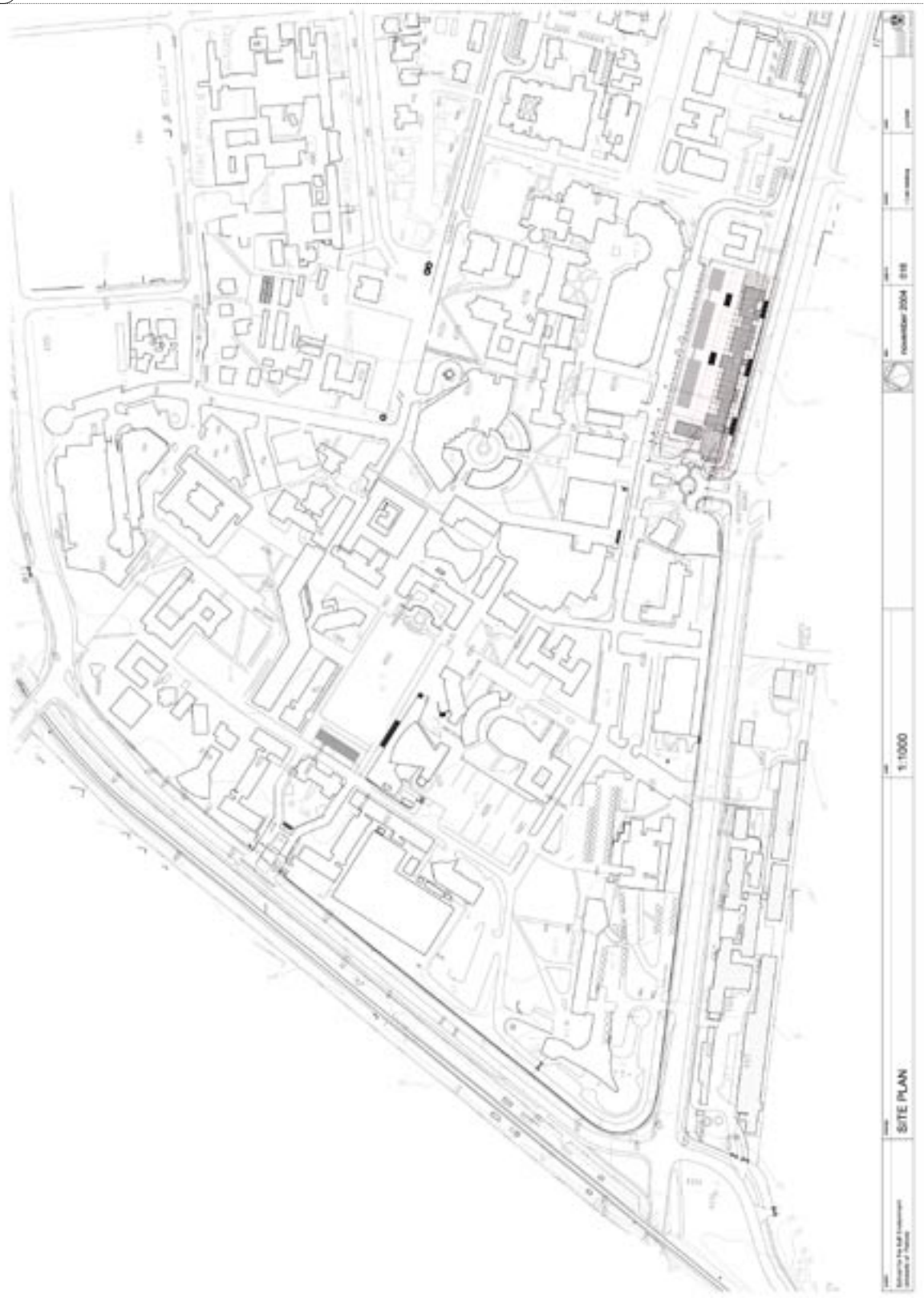
northern elevation

plan view

	STAIRCASE WALLS	as indicated			november 2004	013		




sunscreen connection plan
section elevation detail of sunscreen module
as indicated
SUNSCREEN DETAIL



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Name of area	*FOYER*	
Area required	*80m²*	
Description	The foyer and permanent exhibition spaces will be combined to form a platform of a more 'urban campus'. The building should be transparent enough in these areas to be inviting to the public and or visitors. Security control will also be easier if the public arenas are situated in close proximity to the entrance. The reception desk can be used as secretarial desk during the day, and as security station at night.	
Facilities required	*Services*	*Furniture*
Entrance	Information Map / Signage Security control	Benches
Reception Desk / Security Station	IT services	Desk Chairs Storage units
Double Volume		Exhibition boards

Name of area	*COFFEE SHOP*	
Area required	*70m²*	
Description	The coffee shop should provide an informal social space for students and visitors, with a limited but basic menu. The kitchen should preferable have direct access to the outside. The coffee shop should preferably have an external area to accomodate smokers as well.	
Facilities required	*Services*	*Furniture*
	Desk counter	Chairs & Tables
Kitchen	Appliances Cisterns	Refrigeration Cooking Facilities Preparation area

Name of area	*CIRCULATION*	
Area required	150m²	
Description	The circulation or movement patterns of the building will be detrimental in communicating the conceptual idea of time-experience. Horizontal and vertical movement corridors should be solely designated to their function, with social interaction areas determined as moments in time.	
Facilities required	*Services*	*Furniture*
	Lighting Balustrades Signage	Seating in social area

Name of area	*EXHIBITION SPACES*	
Area required	4 spaces with a minimum of 100m² each.	
Description	The exhibition spaces accommodate permanent and non-static works. It is envisioned that these spaces communicate the essence of design to a larger public arena.	
Facilities required	*Services*	*Furniture*
	Electrical points for multimedia presentations	Exhibition boards, investigate the horizontal and vertical installation platform
		Contemplation seating

Name of area	*LECTURE HALLS / AUDITORIUMS*	
Area required	4 spaces with a minimum of 100m² each.	
Description	Lecture rooms should be acoustically sound and provide seating for a minimum of 100	
Facilities required	*Services*	*Furniture*
	Electrical points for multimedia presentations	Seating for required amount of people
	RGB projector	Presentation desk
	Motorized screen	
	Sound installation with microphones	
	Video / dvd machine	
	Slide projector	
	Laptop computer	

" .. perhaps time is a form of currency in life. It is not only how much you have, but how you invest it in order to acquire the make up of a lifetime." J. Novellie