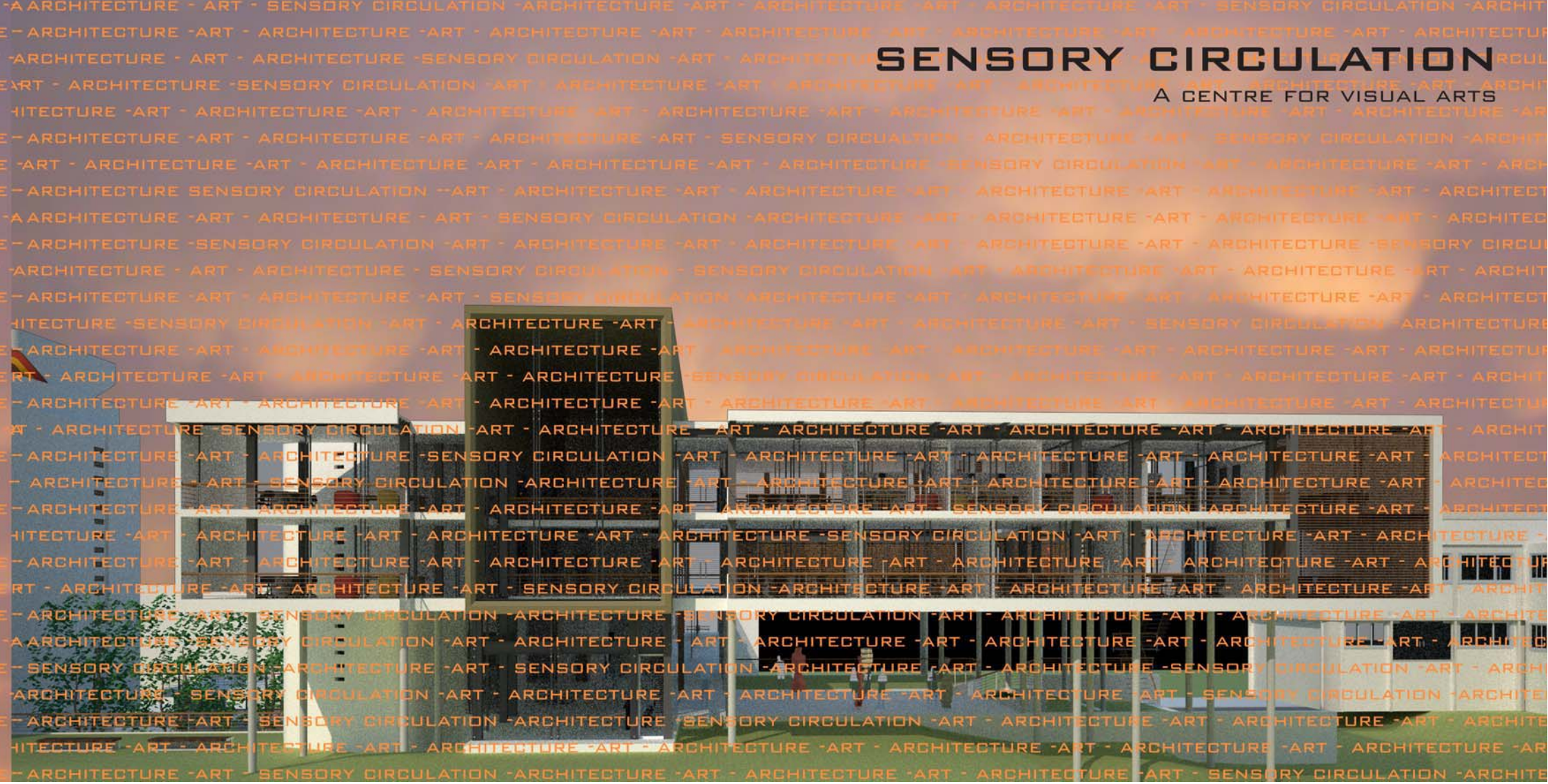
SENSORY CIRCULATION

A CENTRE FOR VISUAL ARTS



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A new centre for visual arts as part of the University of Pretoria's centenary celebrations

situated at

University of Pretoria main campus

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01

INTRODUCTION

Introduction

A building which grows from a proposed artistic epicentre of the University of Pretoria becomes a sanctuary for all those concerned with the disciplines of art and architecture. By occupying the vacant site at the historical southern entrance of the university, the proposed centre for visual arts becomes a vehicle which allows the main campus to spill over its boundaries and fuse itself onto the existing separated South Campus.

It is the aim of this dissertation to explore the ability of spaces inside this building typology to assist in inspiring and educating each of its occupants. The journey through the building becomes the narrator of spatial experiences whilst creating opportunities for artistic expression by providing facilities for the exhibition of art. By inspiring young minds with a symphony of experiences these spaces create the foundation for developing great artists.

Theoretical premise

Theories on the experience of space and how it has been present in architecture, ranging from ancient Greek civilisations to twenty first century architecture is investigated. The theories discuss the elements used to manipulate space and how these affect each of the human senses in order to create a sense of space.

By analyzing case studies, an understanding of the influence of spatial experience on learning activities is explored. These include social studies of proxemics and the effect of how different sensory stimuli affect the human condition.

Due to the nature of the site and building program, great emphasis is placed on circulation through the building as well as around it. One of the most important considerations during the design process was pedestrian routes intersecting at various points on the site. An in depth analysis of existing and proposed circulation on and around the site was done and this will be discussed in terms of the effect the proposed building will have on pedestrians on these routes.

Real world problem statement

Spaces in which students are educated in the disciplines of art and architecture, are not conducive to their creative development. By making students aware of inspirational environments, educational spaces can help to establish a solid foundation for artistic growth.

Sub-problems: (research questions)

1. How does the designer create spaces which make the user aware and receptive to his/her surroundings in order to inspire him/her in an artistic manner?

2. What type of space encourages learning in the different disciplines of art and how do the spaces need to be configured to create a Utopian scenario.

3. What does the exhibition of art involve? Why do artists exhibit their work and in which manner does student exhibitions differ from corporate exhibitions?

4. Why and how do you create common ground where interaction between all parties concerned with art is encouraged?

5. In what manner should the building function be programmed in order to make it cater for educational as well as corporate exhibition purposes?

6. How does the designer ensure that a building can grow and evolve over time in order to stay contextually appropriate in future?

fig 1.01

Client

The client is the University of Pretoria and more specifically the Departments of Art and Architecture. The specific requirements of the client will be discussed in more detail in the sections concerning the building program.

Context of problem

The vacant site at the southern end of the pedestrian link "Tukkielaan" is surrounded by the buildings which house the Departments of Art and Architecture respectively. As shown in figure 1.01 it is proposed that an art precinct be established which will try to solve programmatic problems whilst creating an appropriate end to "Tukkielaan". The site offers many opportunities in terms of exposure of the affected departments due to high density traffic on Lynnwood Road at its southern end.

With the current programmatic limitations of the visual arts building it has become necessary to address these problems in order to create suitable spaces for current lacks in program of the above mentioned building.

Definition of terms

In this document, *Common ground* is the term used to describe a place of interest for all people concerned with the disciplines of art and architecture

Interactive teaching methods include promoting the interaction between students and staff as well as the interaction between students from different disciplines and students in different year groups to maximize their exposure to a broader spectrum of

work.

Abbreviations

UP is the abbreviation used for the University of Pretoria.
CSIR is the abbreviated term for the Council for Scientific and Industrial Research.
APS is the abbreviation used for the Artist Proof Studio program and studios which is explained in the chapter dealing with building typology.

Delimitations

This dissertation does not delve into the studies on personal space and how it varies in different cultures. It excludes aspects of personal space concerning comfortable or intrusive distances between people of different cultures and rather concentrate on the habitat a person needs in order to grow academically.
The parties involved with the financing of the new developments and how funds will be allocated to different aspects of the project will not be discussed in detail.

Assumptions

The first assumption is that people concerned with the arts are very responsive to their environment and use the sensory stimuli around them for inspiration in their work.
Another assumption is that appropriate learning spaces will encourage improved growth in an artist.

02

BUILDING TYPOLOGY

Introduction

Through an investigation of various types of precedent and the national buildings regulations, this chapter discusses the norms and regulations concerning centres for visual art. It also looks at the role these centres play at a South African university.

Each part of the building is analysed separately in order to get a better understanding of the specific requirements of the building program.

02

The role of centres for visual art at South African universities

Through the study of art, students are encouraged to value and respond to their own perceptions, observations, emotions, and intuition. Arts Departments work to ensure that students not only build skills, but also become more comfortable and confident in expressing themselves in an artistic manner.

By improving skills in expressing their artistic talents, students discover a heightened sense of awareness by developing their sensory perception and the power of observation. This makes it critical that students be taught in an environment which will have a positive effect on their work. Through aesthetic education students find new ways to perceive their world. By teaching aesthetic literacy, students' awareness of the world and their relationship to it are expanded thereby making them more susceptible to inspiring environments.

In addition to teaching full time students at the university, the Departments of Visual Art in South Africa also make a great contribution in educating people from underprivileged communities. The "Artist Proof Studio" program which was founded in 1991 is one such project. (Bebber, 2008:17)

Art exhibition areas and galleries

The inclusion of art exhibition areas call for very specific requirements in terms of lighting, ventilation and fire protection.

It is important that all artefacts be protected against direct sunlight, fire, theft, damp, aridity and dust. (Neufert, 1980:359) Appropriate wall and floor areas should be provided to accommodate painting, multi-media and sculpture exhibitions.

Lighting and solar control:
Exhibition areas in the proposed building are divided into two categories: areas where natural light is present at all times and areas where natural light can be excluded totally. Exhibition spaces situated on the proposed bridge have long east and west facing facades and the exclusion of natural light from these directions are important to protect artworks and give unvarying light qualities throughout the day. A series of clerestory windows allow light to penetrate the spaces from the south.

The inclusion of artificial lighting and the option to exclude all natural light are important to accommodate exhibitions ranging from painting and sculpture to multimedia exhibitions. Various lighting arrangements will need to be addressed to make spaces multifunctional.

Art galleries are situated at the southern ends of the proposed building thus providing ample natural light without the risk of damage to light sensitive artworks. In some parts of the building (the bridge) this is not possible and special care has to be taken to shade artworks from harsh east and west sun.

Floor surfaces and ceilings:
For the exhibition of various types of artworks, floors need to be hard wearing and of a neutral colour palette. This allows for easy clean-

ing and provides a "blank canvas" which can accommodate any type of installation.
The use of castellated steel beams and lightweight floors and ceilings allow for the installation of lighting and services inside the floor and ceiling cavities.

Walls:
Walls should match floor colour and allow for the hanging of paintings and work from student exhibitions.

Exhibition and gallery spaces are left fairly unfurnished to accommodate a number of internal arrangements. These are made possible by the installation of display panels which are hung from support structures. This is especially useful in the bridge exhibition spaces since it needs to cater for a wider variety of installations.

Art Studios

Studio spaces should consist of large open space to accommodate a number of various furniture arrangements. This gives students the opportunity to organize spaces the way they prefer and provides each studio with a specific character. The sense of ownership created by the personalization of spaces will encourage students to use studios more regularly.

Lighting and solar control:
It is essential that studios have good natural light qualities. Between 25 and 30% window to floor area ratios (Neufert, 1980:137) should be allowed with light penetrating the space from the southern and eastern sides. Ancillary lighting should be provided by means of artificial lighting.

It is also essential that provision is made for solar control on all windows exposed to direct sunlight.

The installation of light shelves in studios makes it possible to provide a deep space with ample natural light penetrating at designated positions. In the proposed building these light shelves have the extra function of serving as seating on the vegetated roof of the studios.

Acoustics:
Although acoustic qualities are not an essential requirement, it is important that there is very little distraction by excess noise. If care is taken with acoustic qualities, the studio also lends itself to doubling as a classroom.

Wall, floor and surface finishes:
Finishes inside studios should be hard wearing to facilitate cleaning.
Walls need to be able to facilitate the hanging of students' work for inspection by studio masters.

Storage and restoration

Storage facilities are placed in close proximity to circulation routes. This provides visitors the opportunity to see artworks which are not on exhibition in the galleries. It also allows interaction between the students using the centre and professionals responsible for the restoration of artworks.

Lighting and solar control:
Natural light needs to be excluded as far as possible with only south light penetrating the storage spaces. Special care needs to be taken with the installation of artificial light sources. Only light fittings with diffusers specifically designed for art stores should be installed.

Walls and floors:
It is important to keep walls and floors dry and damp free at all times. Stored artworks should never be in direct contact with these surfaces and special storage racks should be

fig. 2.01_Laser restoration
(www.aestudios.com)

fig.2.03_Painting storage units
(www.samtamonicaart.com)

fig. 2.04_Artist stuio
(www.hangargalleries.com)

fig. 2.02_Rentable galleries
(www.hangargalleries.com)

installed to hang artworks.
Steel tracks should be provided in the floor surface to allow larger works to be moved in and out of storage and restoration areas without damaging the artworks or floors.

Services:
Fire protection in storage and restoration areas need to be in accordance with the specific requirements which will be discussed in chapter 09. Temperature and humidity should be controlled at all times with the respective measurements between 20 - 23degrees Celsius and 47 - 53% humidity. (*www.MidAmericaArtsAlliance.com*)

fig. 2.05_Art storage units
(www.reservevault.com)

Office design

Lighting:
Controlled lighting will be provided by overhead luminaires. Due to the position of the offices in the proposed building; natural light will be able to penetrate the building from both the north and south sides. North light is shaded by overhangs and south light enters the spaces through the central atrium inside the building.

Ventilation:
Natural cross ventilation is possible in the offices and boardrooms since both the northern and southern sides open to the outside.
Other services like electrical and electronic conduits will be installed inside floor and ceiling voids.

Interior design:
Offices will be designated to specific members of staff and the interior arrangements will be designed accordingly. Spaces for storage and filing of records will be provided with

a central electronic storage server room provided for the storage of all electronic data.

Restaurant design

The restaurant is designed to serve as a small eatery during every day operation. It will cater mostly for students and staff serving small meals with little preparation needed. The restaurant will however serve visitors to organised exhibitions and will have to be able to facilitate professional caterers.

Kitchen:
The kitchen provides facilities for preparing, cooking and serving food as well as washing and small temporary storage areas. Spaces for cooking and preparation of meals are combined and separated from the storage and washing areas.

The kitchen is served by a service elevator which is accessed from Lynnwood Road. This makes for easy delivery and refuse disposal. The kitchen is designed to have a floor area of more or less one third of the seating area in the restaurant.

Ventilation:
Because of the position of the restaurant it is possible to ventilate seating areas naturally. Although the kitchen can be ventilated naturally, mechanical ventilation will assist in the ventilation thereof.

Wall and floor surfaces:
All floor and wall surfaces to be easily maintained and washable to ensure a hygienic environment. Surfaces should be hard wearing to avoid abrasion due to high pedestrian traffic.

Courtyard design

Two courtyards are included in the proposed building. The first to serve as a spill out space for studios and workshops and the second to become an extension of the existing sculpture garden situated on the eastern side of the existing Department for Visual Arts.

Studio courtyard

This space is designed to facilitate interaction between students and will also be used to accommodate workshops with children from underprivileged communities.

Floor surfaces:
Surfaces covered in vegetation will be used in all areas except on designated circulation routes surrounding the central space. These help to promote student interaction.

Site furnishings:
Indigenous trees and benches is placed inside the courtyard. The trees serve as solar shading to the northern side of studios and workshops as well as providing shading inside the proposed courtyard.

Access:
Vehicular access to the courtyard is possible from Lynnwood Road. This allows for the delivery of machinery and materials to workshops and studios.
Pedestrian access is only possible through the proposed building.

Drainage:
Stormwater drainage is linked with the existing drainage systems. Catch pits allow water to drain and flow through an underground piping system which link up with the existing municipal stormwater pipelines.

Sculpture courtyard

As an extension of the sculpture garden on the eastern side of the existing Visual Arts building, this courtyard starts to extend the space into the proposed building.

At ground level the courtyard serves as a space which facilitates most of the pedestrian movement while serving as a spill out space from the foyer and restaurant. The definition of space is not made at ground level but rather on first floor level. This gives the observer the opportunity to experience space 'underneath' a building.
It could be argued that this is not in essence a courtyard but rather a combination between a courtyard and an atrium since the space is neither inside nor truly outside the building.

Surface treatment:
Due to the high density of pedestrian traffic and the nature of the sculpture garden it is necessary to have an inviting yet hard wearing surface.
A combination of grass and concrete blocks are used to get the desired effect.

Drainage:
Stormwater drainage is achieved by draining water into stormwater channels These are connected to stormwater storage tanks and the overflow from these run inside a central stormwater channel underneath the building. It then links up with municipal stormwater connections.

Lecture theatres and classrooms

Lecture theatres and classrooms designed for the proposed building are designed without special multimedia rooms. Due to the relatively small size of auditoriums in the proposed building, all multimedia controls are provided inside the lecture podium in the front auditoriums.

Wall, floor and ceiling surfaces:
A combination of absorption and reflection surfaces are installed in order to give the required acoustic qualities. This will be discussed in more detail in chapter 09.

Seating:
Classrooms are equipped with loose standing chairs and writing surfaces while lecture theatres have fixed seats and surfaces.
Storage spaces for chairs and tables are provide for classrooms and lecture theatres.

Multimedia rooms

Multimedia rooms and digital libraries are equipped with necessary audiovisual equipment. All conduits for electrical and electronic cabling are provided inside ceiling voids.

Surfaces:
Soft surfaces are provided on floors, walls and ceilings to avoid echo and noise pollution to neighbouring facilities.

Digital printing lab

A digital printing facility is proposed for use by students in the disciplines of art and architecture.
It is proposed that the facility specialises in large format printing and also have normal copying and printing facilities available.

A member of staff will handle administrative duties for this facility and although an designated office is not provided, it is proposed that filing and storage facilities be included in the furnishing of the space.

In the 12 years of existence, the Artist Proof Studio initiative has been focussed mainly on developing the principles of building capacity, professional practice, self-sustainability, and black leadership. Since 2003, Artist Proof Studio has offered several inter-related skills and empowerment programmes to under-served communities including learnerships, mentorship and outreach.

The Training and Professional Skills Development programmes run over a three year period with the opportunity to exit the course at the end of each year. The program has been developed in accordance with the specific needs of learners and the art industry. Learners accepted into Artist Proof Studio come from previously disadvantaged backgrounds. These training programmes are critically needed to further the growth and development of young artists and also to extend the income generation opportunities for the community arts sector as a whole.
The inclusion of a satellite studio for the APS initiative allows interaction between aspiring artists from all walks of life. This grants everyone the opportunity to benefit from the multitude of cultural influences in our diverse society.

fig. 2.06

03 PRECEDENT

Introduction

This chapter discusses precedents in terms of three groups which include: conceptual-, functional- and programmatic precedent. Structural typologies- and use of materials precedents will be discussed in the chapter 09.


fig. 3.01


fig. 3.02


fig. 3.03


fig. 3.04


fig. 3.05

UCT Sport centre - Rudolf Uytenboogaardt - 1978

The treatment of circulation routes sends the visitor through a number of sensory experiences and realizations. The merging of inside and outside spaces is experienced throughout the route and it makes the visitor aware of functions situated adjacent to it. Moving underneath the building at some points gives the visitors an even wider range of experiences on the route.

03

Carpenter Center - Le Corbusier

The Carpenter Center for the Visual Arts at Harvard University in Cambridge, Massachusetts is the only building by Le Corbusier in the United States. The building was completed in 1962. The building mass is built around a central circulation axis with all the accommodation facilitated in the lung shaped spaces adjacent to it. The project is relevant as a precedent due to the way in which it deals with circulation and how it exposes facilities surrounding it.

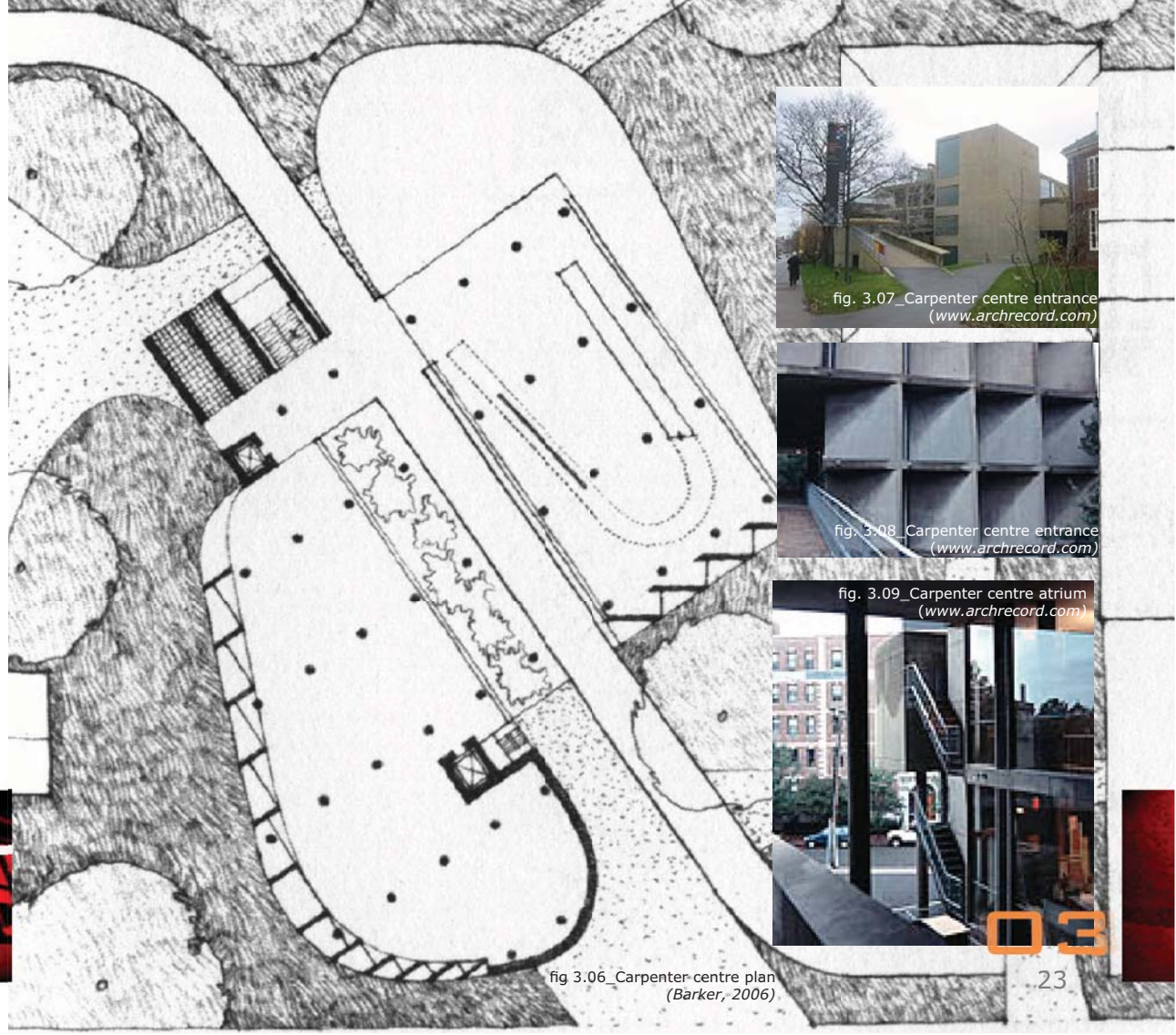


fig 3.06_Carpenter centre plan
(Barker, 2006)

fig. 3.07_Carpenter centre entrance
(www.archrecord.com)

fig. 3.08_Carpenter centre entrance
(www.archrecord.com)

fig. 3.09_Carpenter centre atrium
(www.archrecord.com)

03

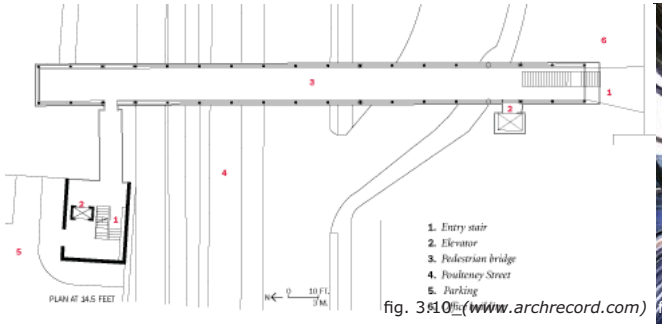


fig. 3.10_(www.archrecord.com)


fig. 3.11_(www.archrecord.com)


fig. 3.12_(www.archrecord.com)


fig. 3.13_(www.archrecord.com)

Houghton Park Pedestrian Skyway - Hascup/Lorenzi - May 2003

Constructed of two custom made Vierendeel trusses and clad with structural glazing, this pedestrian bridge stays true to its linearity even in the interior detailing. The 61meter long bridge extends over its access staircase in true Bauhaus style to give the impression of an ever extending path. Similar to the building proposed in this dissertation the bridge connects to a parking garage and leads the user across a road.


fig. 3.14_(www.designmag.co.uk)


fig. 3.15_(www.designmag.co.uk)


fig. 3.16_(www.designmag.co.uk)


fig. 3.17_(www.designmag.co.uk)


fig. 3.18_(www.designmag.co.uk)

Zaragoza Bridge Pavillion - Zaha Hadid - 2008

Great emphasis has been placed on the entrance and spatial qualities in this project. High ceilings with exposed structure gives the bridge an inviting feel. Scattered patterns of light provides the space with an ever changing array of shapes on the route. Although the bridge has a heavy imposing form it still gives an 'airy' feel to internal spaces. The bridge doubles as a exhibition space which makes it particularly relevant to this dissertation.

Lewis Glucksman Gallery - Cork, Ireland - O'Donnel and Tuomey

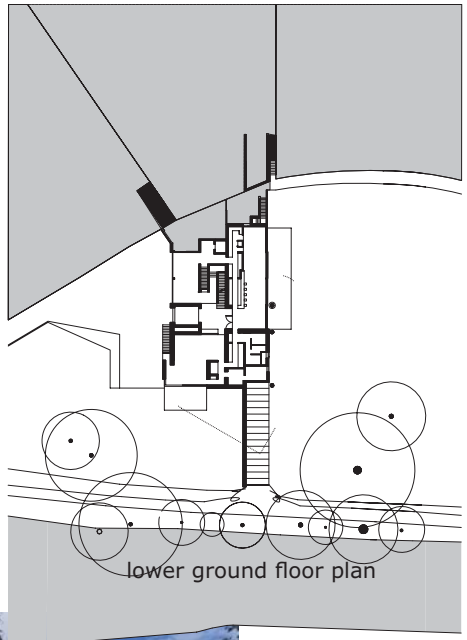
This building deals with the pedestrian circulation in a similar way to the proposed building in this dissertation. The visitor can choose to either pass underneath the building and becomes 'part' of building without entering it. Once the visitor enters the building he/she is taken on a journey through various exhibition spaces. The orientation of various galleries inside the structure provides the correct lighting qualities for the exhibition of art.

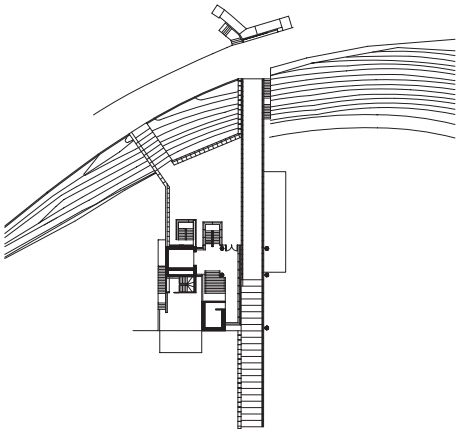
fig. 3.19_East elevation
(www.archrecord.com)

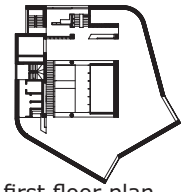
fig. 3.20_South elevation
(www.archrecord.com)

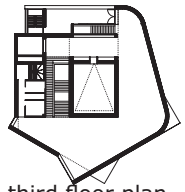
fig. 3.21_Entrance
(www.archrecord.com)

fig. 3.22_North elevation
(RIBA, 2005:33)









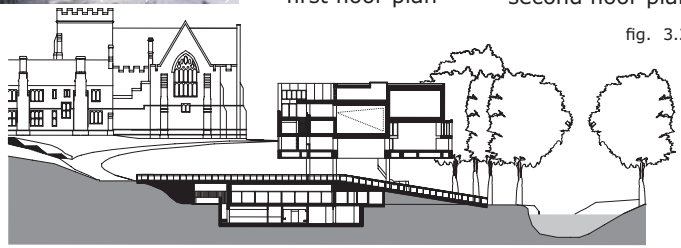


fig. 3.23_Diagrammatic plans and sections
(RIBA, 2005:33)

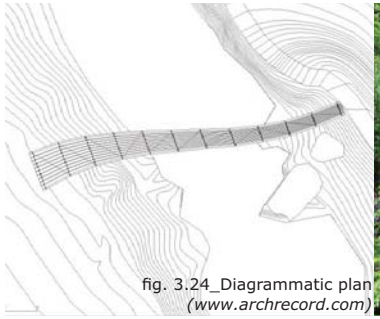


fig. 3.24_Diagrammatic plan
(www.archrecord.com)

fig. 3.25_Photograph showing lightweight structure
(www.archrecord.com)

fig. 3.26_Bridge entrance
(www.archrecord.com)

fig. 3.27_Light quality
(www.archrecord.com)

Passerelle on the Aureuse - Boudry, Switzerland - GD Architects - 2002
Spectacular light qualities are achieved by very simple timber cladding. This lets the structure imitate the scattered light through the trees of the surrounding forest. The bridge does not follow the conventional linear path but rather turns slightly and narrows to the end to enhance the perspective.

Museum for contemporary art - SANAA - New York - 2007
The use of expanded aluminium sheets fixed onto translucent poly carbonate backing gives the building a glow rather than the harsh reflection usually associated with metal clad facades. The changing light during the course of the day allows the building to change appearance in different conditions. The iconic nature of the building creates a landmark which will now be associated with contemporary art.

fig. 3.28_Reflection of light
(www.gsdmaterials.com)

fig. 3.29_Street elevation
(www.gsdmaterials.com)

fig. 3.30_Night view showing illuminated panels in facade
(www.gsdmaterials.com)

04 THEORETICAL INVESTIGATION

Introduction

This chapter looks at two guiding theories which helped shape the proposed building: firstly the experience of space and secondly the concept of bridging.

The experience of space is explained through an investigation of ancient Greek civilisations and how it impacts twenty first century architecture. It discusses elements used to manipulate space and how these affect each of the human senses in order to create a sense of space.

Through the analyses of case studies an understanding of the influence of spatial experience, on learning activities, was achieved and applied in the proposed building. These include social studies of proxemics and the effect of how different sensory stimuli affect the human condition.

The concept of bridging is investigated and explained in relation to published architectural theories.

"The visual impression, the image produced by differences of light and colour, is primary in our perception of a building. We empirically reinterpret this image into a conception of corporeality, and this defines the form of the space within...Once we have reinterpreted the optical image into a conception of space enclosed by mass, we read its purpose from its spatial form. We thus grasp...its content, its meaning."
PAUL FRANKL (Hillier, 1996:30)

The history of spatial investigation

Before delving into the different experiences of space and its effect on human behaviour one must look at where the making of space and how the geometries which constitute these spaces originated.

The geometry of space can be traced back to ancient Greek methodologies on setting out spaces. Systems like their "12-Part System" (Doxiadis, 1972:6) and golden section geometries were widely used in setting out of temples such as the Parthenon. All these systems were derived from the geometrical concept of the universe which was also greatly treasured by the ancient Greeks.

The earliest notions of the universe being divided into various geometric parts, however, come from the writings of Homer. (Doxiadis, 1972:16) An extension of these writings was developed and each of these geometric parts was related to the 5 elements of earth, water, fire, air and light. The five elements were then corresponded to the five human senses which in essence are how we experience space. (See Table below)

Cube	Earth	Touch
Pyramid	Water	Taste
Octahedron	Fire	Smell
Dodecahedron	Air	Hearing
Icosahedrons	Light	Sight

Table 4.01_Relationships between human senses and geometric shapes
(Doxiadis, 1972:17)

04

The experience of space

In writings about the experience of space, there are opinions which suggest that humans do not only experience space by using the five senses mentioned before. The question to ask now is whether this is true and humans do have another sense; the sense of space, or whether it is just a combination of the other five which facilitate the formation of a spatial sense.

According to Hillier, (1996:85) every moment of our experience, and that includes the experience of space, is unanalyzable as a whole and must be broken down into the analysis of some of its constituent parts in order to gain a deeper understanding.

This starts to suggest that the experience is a combination of senses or parts which are already known to us and that it is not a new sense which should be added to our list of five.
Herbert Norbert-Schultz explains (Pearson and Richards, 1994:2) that the human relationship to the built environment is rooted in the experience. People create their own mental image of their environment thus creating feelings of well-being, comfort, discomfort, etc.

These feelings are commonly related to an individual's personality or background and can be related to the functional or symbolic aspects of space. In addition to this one can add the writings of Vere Gordon Childe (Childe, 1956:76) which states that; "people gradually discover by experiment how things and persons can be arranged spatially, so defining an idea of space".

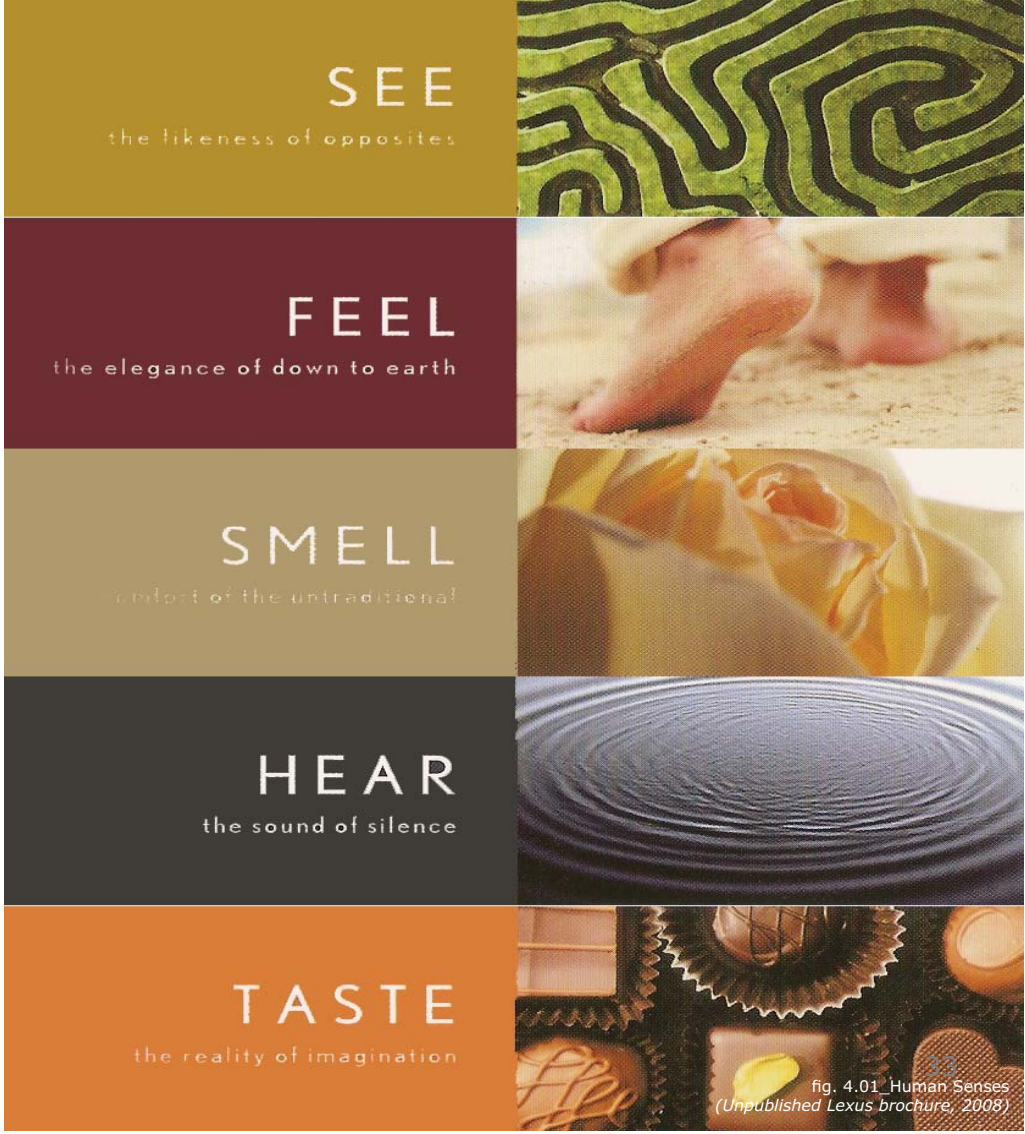


fig. 4.01_Human Senses
(Unpublished Lexus brochure, 2008)

The tools do we use to manipulate the experience of space

Sight

"In light, our sense of place is based on a physical reading of the environment; in the dark, it is conditioned by a more acute awareness of our bodily position" (Verges, 2007:221)

Although architecture needs to be experienced by a combination of all the senses *(Papanek, 1995:76)* it is our initial sensory perception of the object which intrigues human curiosity.
The contrast between light and dark, natural and artificial lighting and soft or hard lighting can enhance or detract from the experience of a space.

Hearing
Sounds from the environment can create a relation to the outside of the building without having a visual perception of the surrounding context. Wind howling and a gentle draught through a space has very different effects on the human condition. A feeling of isolation can be achieved by the hollow echo of footsteps in a blank hard space versus the feeling of proximity in a warm occupied space.

Feel
The sense of touch can be divided into various categories with two of the main categories being physical touch and emotional feeling. Physical touch can be manipulated with textures, cold and warm surfaces and the feeling of the elements on the human body.

Emotional feelings include the feelings of proximity(closeness)/isolation, being exposed or enclosed and emotions including happiness, fear, etc.

Taste
The experience of taste in architecture is difficult if not impossible to capture and it is therefor proposed that an association with taste is rather created. The proposed restaurant in the building could start to make this association.

Smell
A strong relationship between interior and exterior spaces can be used to draw aromas from plants, etc. from the surrounding environment by means of natural ventilation.
The sense of smell has a very strong relationship with memory and the smell of various materials used in the proposed building can create associations with various spaces or exhibitions experienced by the visitor.

The symbolism of space

Going back to ancient Greek writings, the symbolism of space can be seen in the writings about the male and female gods; Hermes and Hestia. Hermes, the male god of movement and communication, was known as the god of the external and public space and Hestia was the female goddess of the fixed, immovable, interior/domestic space. (Kent, 1990:105) The house or internal space was considered the domain of the woman whereas the man was supposed to spend his time outdoors. (Kent, 1990:104) A short poem by Homer (Kent, 1990:105) links Hermes and Hestia in a friendship between the interior and exterior.

Even in the exploration of gender specific symbolisms one starts to see elements which can influence the experience of space by its user. This relationship is evident in even good contemporary architecture where the relationship between inside and outside complements one another. The reason why it is considered good architecture might lie in the uncertainty it creates of whether the user is inside or outside, comfortable or uncomfortable.

The use of space

The use of architectural space could be discussed in terms of two schools of thought:

1) architecture dictates the way in which people use space

2) the way people use space dictates the architecture. (Kent, 1990:2)

Architecture dictates the way in which people use space

The way in which spaces are set out has a direct effect on the social existence of a group of people in it. Architects very seldom design buildings which are not for human use so it can therefor be expected that the relationship between people and space will be found when looking at the elements which contains a space. We can now derive that the way in which people use space is directly affected by the configuration of the elements containing the space and the arrangement of elements inside the space.

Evident in the headings of this chapter; the common notions of space mostly try to explain space by referring to entities which relate to things which are not space itself. In the architectural field research is commonly concerned with; the use of space, the perception of space or the production of space. Architecture does however sometimes detach space from its human component in the study of spatial hierarchies and spatial scale. Space is very seldom researched as an entity on its own but rather something which conforms to principles in architectural or social science fields.

The way people use space dictates the architecture

The way people use space constitutes spatial patterns. It does not only consist of a neutral framework for social and cultural forms. Human nature has its own spatial forms and it is the way in which we as humans interact with, congregate in, avoid and dwell in space that adds to the unique character of a space. (Hillier, 1996:29)

The use of space also has a very close relationship to the culture of the people using it. In our multicultural society this becomes a very important consideration when designing spaces for multi-cultural users. Culture in this case should be looked at more holistically rather than breaking it up into various segments like; technology, symbolism and world view, economics, social structure and political organization. (Kent, 1990:2) Another way to create cultural unity is to create a new culture where discrepancies of race, gender and religion are eliminated. This new culture becomes the 'common ground' which should enable the designer to create spaces suitable for everyone concerned with Art and Architecture.

According to Roger Scruton space is something which cannot stand as an entity on its own but it is rather the "...obverse side of the physical object." (Hillier, 1996:28) He argues that the space in a field and that inside a cathedral is exactly the same, but for the enclosure which makes the one space appear to have distinctive properties of its own.

Although Scruton seems oblivious to the symbolic meaning and sensory experience of space, he does however touch on something which gives us clues into the experience of space. If space is seen as such a physical entity, which exists whether it enclosed or not one can ask the questions: Can a space contained by specific boundaries be taken out of its enclosure, or does the space 'leak' out if one or more of the boundaries are removed? According to Descartes; (Hillier, 1996:29) space stays the same even if its constraints are removed. What does change however is the perception of space and it is this perception which is of utmost importance in this dissertation.

This one dimensional view on space is dangerous and might make one oblivious to the role the perception of space plays in human interac-

tion.
Out of these two arguments a new argument arises and looks at a combination of both how people influence architecture and how architecture influences people.

Winston Churchill said (Pearson and Richards, 1994:3) that first we shape our buildings and afterwards our buildings shape us. This reiterates that the process is never just a one way flow of influences. It is rather a process which is a constant exchange of influences between our built environment and our social activities. In other words our buildings grow with us over time.

To reiterate the previous statement one can now look the extremes of sensory experience in architecture. In monumental buildings the spatial experience is forced onto the user and no doubt is left about the statement made by its presence. In contextually more sensitive architectures the sensory experiences are rather left for the more receptive observers to enjoy. These experiences would however not be possible without the interaction between the building and its user. The monument will become a desolate white elephant and the quiet architectural intervention will most probably go unnoticed by passersby.

Bridging as a conceptual idea

Bridging and gluing

In an ever expanding institution, such as the University of Pretoria, it becomes necessary to sometimes include areas which fall outside the existing boundaries of a site. The integration of such areas has to be done with great sensitivity and great conviction in order for the new precinct to act as a whole. The notions of bridging and gluing are two solutions to the same problem and should, in effect, have the same outcome.
When one considers bridging it is evident that there is a separating element which has to be crossed in order to merge two adjacent areas. The bridge as an element is the catalyst for the creation of embankments or pavilions on either side of the divide. This creates the opportunity for the rejuvenation of the existing edges. Without the bridge these embankments cannot not exist.

Gluing areas together involves the act of physically bringing two sides in contact with each other and although the same integration of areas are achieved, a very different philosophy is adopted. In this case the dividing element might become the bridge and the two sides is drawn towards each other in order to merge underneath the new bridge.

Bridging and gluing are ways to join different things and elements of these things should be allowed to flow into each other's realms sothat the character of the transition space becomes something new which is representative of both sides.

The Bridge

"A bridge is a construction in both the technical meaning of the word, thus being a term, and in its etymological meaning – it is a constructed path. A bridge is a construction that ensures the unbreakable continuation of a road or a path across a body of water, across another road, across a chasm, a mountain pass or

some other obstacle. As such, the bridge is, above all, a part of the road. At the same time, it alters the character of the road, it brings the vertical dimension into the landscape and it can be perceived as a special place on the road. Two main structural elements of man's existential space – a road and a place – are united in the bridge. The bridge is both a road and a place. The bridge is an artefact, which has been loaded with aesthetical value and symbolic meaning, being used as a worn-out metaphor to describe all kinds of connections in a very wide range of spheres of life."

Lehari, 2004

As explained by Kaia Leihari in her article 'A winter landscape with a bridge' she explains how the the bridge symbolizes the expansion of our will over space. For human beings the riverbanks are not only apart, but also 'separated' from each other. It is the realization of this separation that drives us as human beings 'to bridge'.

Leihari's analysis of Georg Simmel's article 'A Bridge and a Door' brings forward the conclusion that: firstly, a bridge connects, thereby creating a feeling of security, secondly, a bridge expresses frozen movement and thirdly, a bridge emphasizes, supports and creates a landscape. This landscape can be observed as a work of art.

Similarly to Simmel's view on a bridge, Martin Heidegger explains *(1996:152)* that a bridge becomes a place or dwelling and that allows us to experience the uniqueness and unity of space in two ways: first, it creates the feeling that we belong to the place on the other side of the separation, and second, it allows us to enter that place.

Heidegger's theory of how the bridge becomes part and entrance to places on either side of the divide illustrates how the bridge is representative of both sides. It has its own unique character but still relates to both embankments.

"The bridge swings over the stream with case and power. It does not just connect banks that are already there. The banks emerge as banks only as the bridge crosses the stream. The bridge designedly causes them to lie across from each other. One side is set off against the other by the bridge. Nor do the banks stretch along the stream as indifferent border strips of the dry land. With the banks, the bridge brings to the stream the one and the other expanse of the landscape lying behind them. It brings stream and bank and land into each other's neighbourhood. The bridge gathers the earth as landscape around the stream. Thus it guides and attends the stream through the meadows. Resting upright in the stream's bed, the bridge-piers bear the swing of the arches that leave the stream's waters to run their course. The waters may wander on quiet and gay, the sky's floods from storm or thaw may shoot past the piers in torrential waves-the bridge is ready for the sky's weather and its fickle nature. Even where the bridge covers the stream, it holds its flow up to the sky by taking it for a moment under the vaulted gateway and then setting it free once more.

The bridge lets the stream run its course and at the same time grants their way to mortals so that they may come and go from shore to shore."

Heidegger, 1996

Introduction

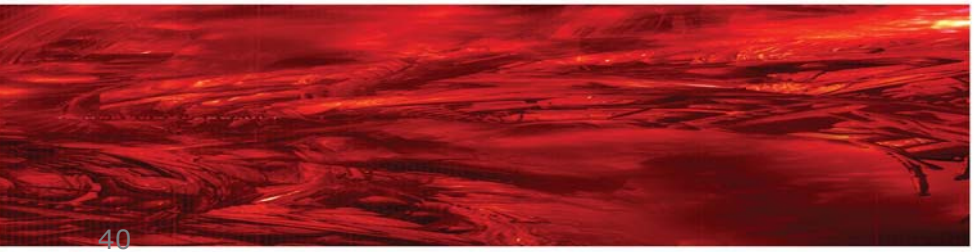
After careful consideration of the needs of the Department of Art and investigation of the site and precinct requirements, the following schedule of accommodation is proposed:

05

ACCOMMODATION SCHEDULE

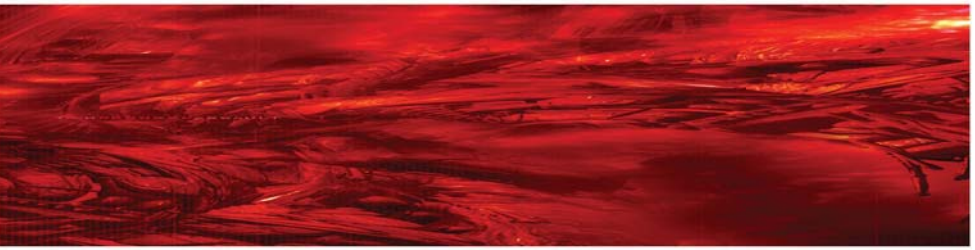
LOWER GROUND FLOOR			
			Total
Post-graduate studios	107m²	53m²	160m²
Workshop			58m²
Meeting rooms	22.5m²	22.5m²	45m²
Digital printing lab.			69m²
Media conservation & media library			38m²
Digital library			24m²
Lecture theatre (250seats)			246m²
Classroom (170seats)			190m²
Art storage & restoration			245m²
Store room			17m²
Ablution			45m²
Plant room			66m²

GROUND FLOOR	
Entrance foyer including lift lobby & stairs	190m²
Exhibition area (bridge)	425m²
Informal seating area (bridge)	170m²
Restaurant (inside)	110m²
Restaurant (outside)	100m²
Restaurant kitchen	67m²
Ablution	45m²



FIRST FLOOR	
Gallery 1	163m²
Gallery 2	124m²
Special collections gallery	66m²
Artist Proof Studio printing lab	216m²
(including etching area, developing area solvent room, equipment store, paper hallway and press areas)	
Open sculpture exhibition area	110m²
Crit rooms and conference rooms	278m²
(includes 4crit rooms & 2conference rooms)	
Ablution	45m²

SECOND FLOOR	
Exhibition area	116m²
Special collections gallery	66m²
Print exhibition area	142m²
Offices and boardrooms	278m²
Ablution	45m²



06 CONTEXT ANALYSIS

fig. 6.01_Pretoria figure ground

Introduction

This chapter will look at the site; starting with a historical overview of relevant buildings and other elements before delving into the site data which influenced the design process.

06

National analysis

As the nation's capital, Pretoria stands as an ambassador of South Africa to the rest of the world. Pretoria boasts with a number of foreign embassies and thereby has strong relations with the rest of the world. Pretoria stands at the brink of becoming the capital of the African continent and with that being the first place of interest for foreign visitors.
The University of Pretoria stands as a leading tertiary institution not only in the Province but also in the country. It is therefor important that the leading research facility in the country also stand as an ambassador for South Africa.

Metropolitan analysis

As previously mentioned, the University of Pretoria stands at the forefront of research in South Africa. The establishment of a centre for visual art which can match the esteem of an internationally recognised research facility will help to improve the university as a whole. The city of Pretoria and more specifically the University of Pretoria provides an invaluable role in providing community upliftment programs to help establish a city which can be compared with the best in the world. Pretoria sits at the heart of a number of lower income settlements including Soshanguve, Mamelodi and Atteridgeville. This makes it particularly well positioned for social and educational upliftment.
Pretoria also sits on the main route into northern Africa and acts as a gateway into the rest of Africa.

Local analysis

The University of Pretoria is situated between the city centre and the rapidly expanding eastern suburbs. The high density traffic on Lynnwood Road which carries up to 3000 vehicles per hour gives excellent exposure to the university. Further analysis on site specific issues are addressed in the sections to follow.

Buildings along the pedestrian axis "Tukkielaan" which impacted design decisions and site selection

"Tukkielaan" becomes an important axis in the design of a centre for visual arts. Surrounding this axis are various facilities concerned with arts and culture.

The facilities which form part of a whole new artistic precinct was one of the main motivations in the selection of the site and building program.

Each of the different buildings on the axis creates an activity space in front of it which spills out onto "Tukkielaan" thereby activating this spine.

The "Tukkielaan" spine is now proposed to become the new connection point between Main Campus and South Campus which also house a number of facilities concerned with the arts.

fig. 6.02

6.10. The Aula

6.11. The "Ou Lettere" building

6.08. Amphitheater

6.09. Merensky Library

6.06. Musaion

6.07. Theology

6.03. Town and regional planning

6.04. Visual Arts

6.05. Built environment

06

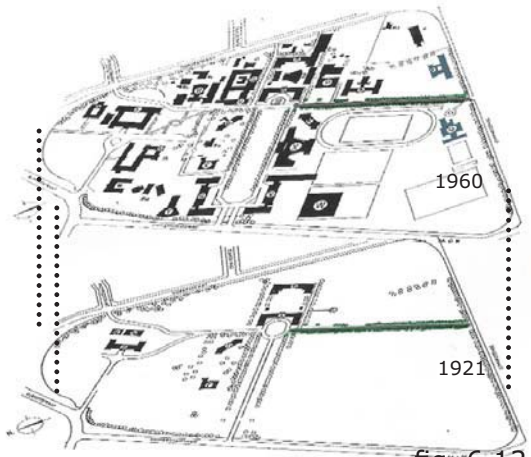


fig. 6.12

1930 - proposal for new entrance gates to Tukkielaan by Gordon Leith

1950 - Tukkielaan from the "Ou Lettere" building to Lynnwood Road

1987 - Tukkielaan entrance from Lynnwood Raod

Tukkielaan acts as one of the main pedestrian links from Lynnwood Road towards the "Ou Lettere" building which was the first building constructed on the main campus of the University of Pretoria. This link is populated on either side by amenities concerned with the arts. These include the Departments of Architecture, Fine art, Music, the Aula and the Merensky Library, which currently houses the Eduardo Villa museum, before it intersects with the historical grid in front of the "Ou Lettere" building.

TUKKIELAAN 06

fig. 6.13

Department of Visual Arts

The Department of Visual Arts which currently houses the study fields of Graphic Design and Fine Arts was designed by Meiring, Naude and Burg, Lodge & Burg Architects. It was opened as the Physical Education building on 8 October 1948 and used for that purpose until 17 February 1987 when it was reopened by Dr. D.M. Joubert to house the Department of Visual Arts.

The fact that the building was not designed specifically to house this department meant that there was no allowance for exhibition of students' work or for proper lecture theatres and studios. The conversion of gymnasium areas to serve as studios and lecture rooms led to unsuitable lighting, audio and other requirements for their current use and students are currently forced to have their examination exhibitions at the university's Groenkloof Campus. Due to these factors it is proposed that areas with very detailed specifications be relocated into a new building which meets the requirements. (Ad Destinatum, 1960:141)

fig. 6.14_Photographs showing the Department of Visual Arts in context

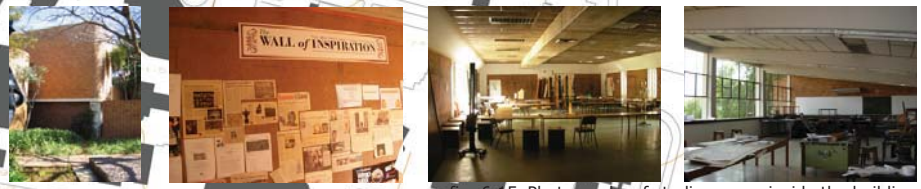


fig. 6.15_Photographs of studio spaces inside the building

fig. 6.16_Location diagram of the Department of Visual Arts

Boukunde

Architecture at the University of Pretoria started in 1929 and has a history of moving around the city going from the "Klubsaal" to Vermeulen Street, the Kerry building, the engineering building in 1957, back to the "Klubsaal" in 1958 before settling in its current location in 1960. Because of its nomadic history it might be appropriate that it be the catalyst for linking the university's main and south campuses across Lynnwood Road. (Ad Destinatum, 1960:123)

The building was renovated by architecture lecturers and professionals in the department and this gives clues to the close proximity in which architectural professionals and students live to their immediate living and learning environments.

The building has a number of lecture theatres, classrooms and studios, but as with the visual arts building there is not sufficient space for exhibition of students' work.

fig. 6.17_Aerial photograph of the Boukunde building

fig. 6.18_Aerial photograph of the Boukunde building

fig. 6.19_South elevation

fig. 6.20_West elevation

fig. 6.21_South elevation and view down Lynnwood Road

fig. 6.22_Location diagram of showing the Boukunde building in context

Lynnwood Road

Lynnwood Road is a very important entity in the investigation of the physical elements of the site. It is an arterial road which feeds traffic from the east of Pretoria into the city centre. This road, at the time of publication of this document, carries an average of 1800 to 3000 cars per hour in peak and off-peak times respectively. It forms a divide between the main and south campuses of the University of Pretoria and on a more local scale, a divide through the proposed art and architecture precinct.

Lynnwood Road which was previously called College Avenue and "Strubenpad", was the only route for horse drawn carts between the current Park Street crossing and the farm Hartbeespoort which belonged to Captain Struben. (Ad Destinatum, 1960:87)

Traffic noise from Lynnwood Road is of great concern for educational facilities adjacent to it. Traffic noise calculations have been done in order to establish the extent to which acoustic properties of the proposed building had to be resolved. This is further discussed in figures 6.29-6.31 and chapter 09, fig. 9.15.

Figures 6.23 - 6.25 shows Lynnwood Road in its current state. The use of pavements for parking slows down traffic immensely. This is mostly due to vehicles moving in and out of informal parking areas.

fig. 6.23_Photograph of cars parked on Lynnwood Road

fig. 6.24_Lynnwood Road in context

fig. 6.25_Photograph of cars parked on Lynnwood Road

fig. 6.26_Location diagram of Lynnwood Road

South Campus

South Campus is made up of two parts of the farm previously known as Elandspoort, which also included the area on which main campus is situated. Before it was taken over by the University in 1989 , the area now known as South Campus, was the property of the CSIR and used as the Fossil Fuel Research Institute and the division for energy technologies.(Ad Destinatum, 1960:56)

South Campus now comprises of a number of facilities including buildings which house the Departments of Town and Regional Planning, Performing arts, Construction economics, Hydro engineering and University of Pretoria Printing. South Campus houses various facilities concerned with the arts. It is therefor appropriate to extend an arts precinct across Lynnwood Road onto South Campus. The inclusion of South Campus into this new precinct will help to bridge the gap between the main campus and South Campus of the University of Pretoria.

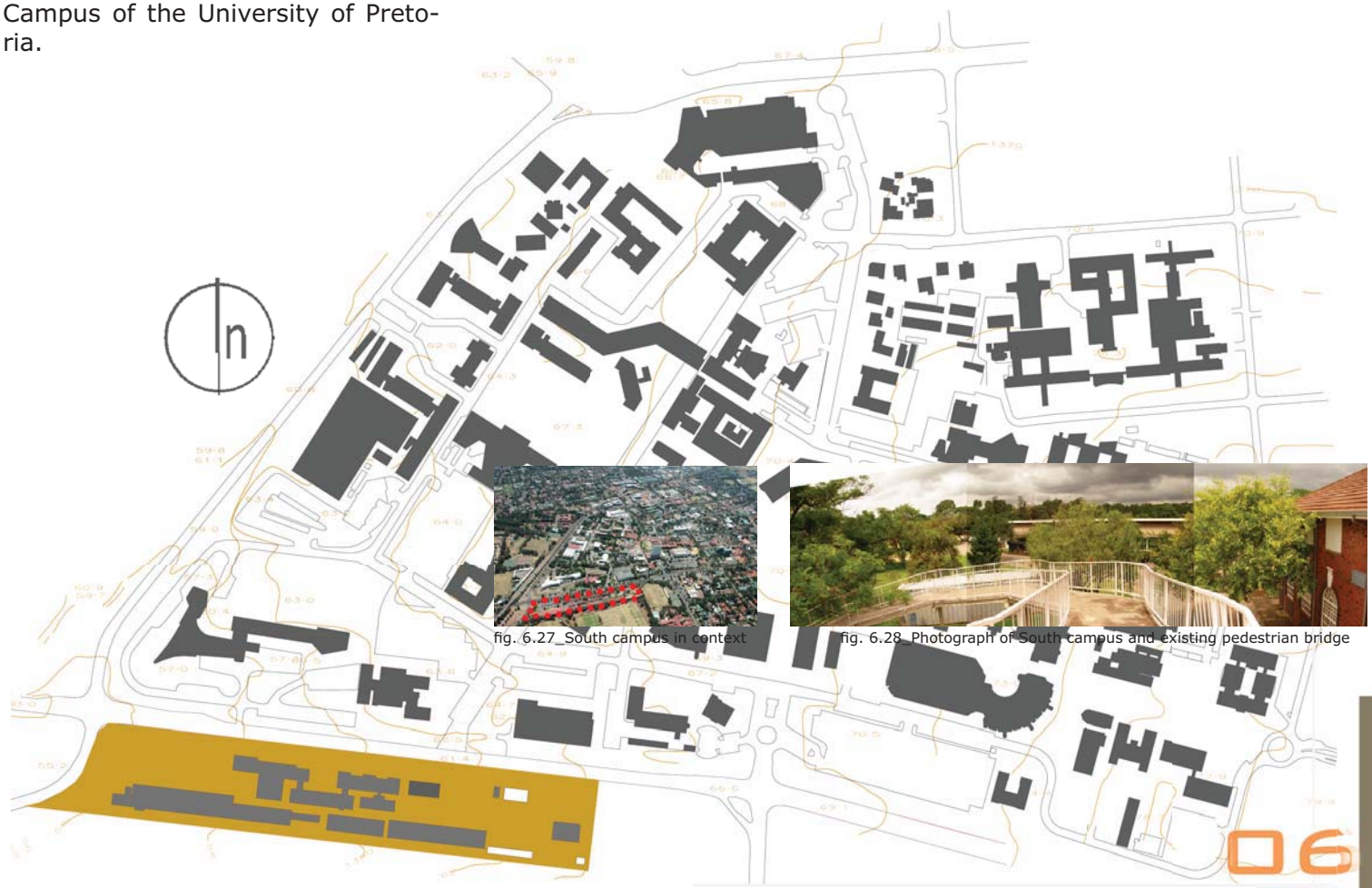


fig. 6.27_South campus in context

fig. 6.28_Photograph of South campus and existing pedestrian bridge

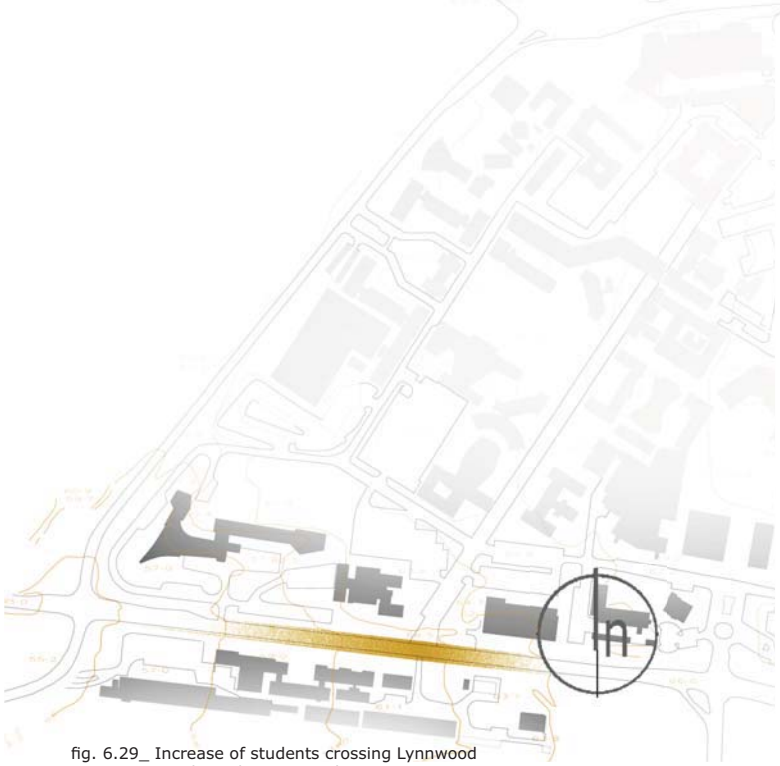


fig. 6.29_ Increase of students crossing Lynnwood Road in relation to pedestrian entrance

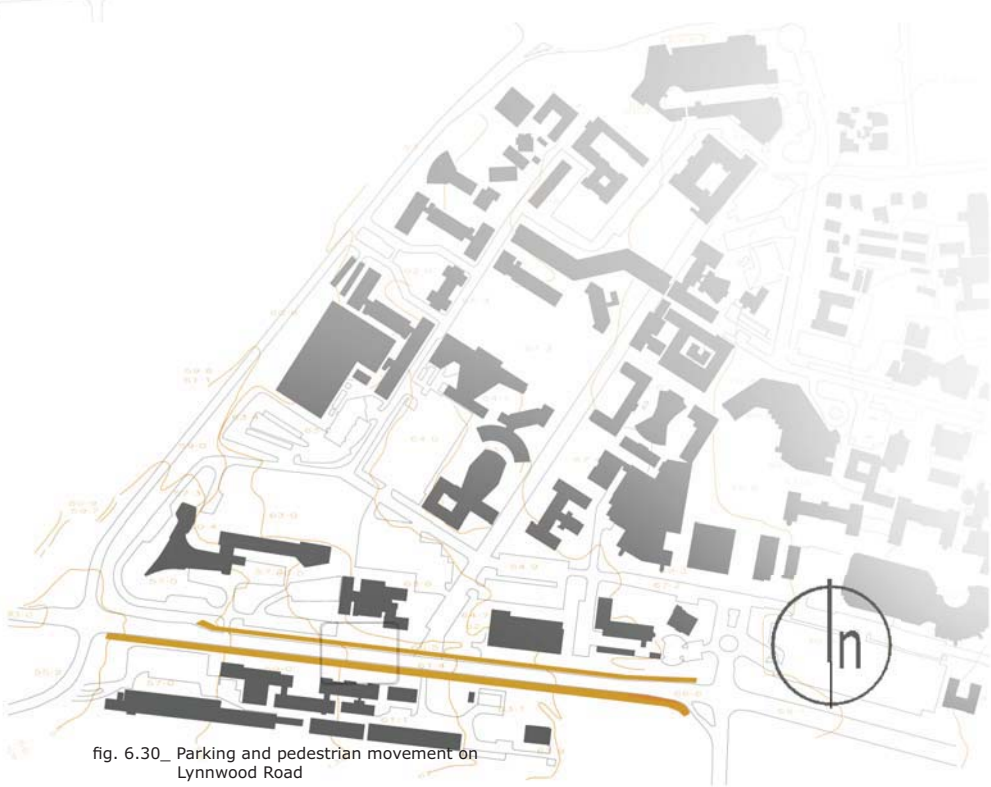
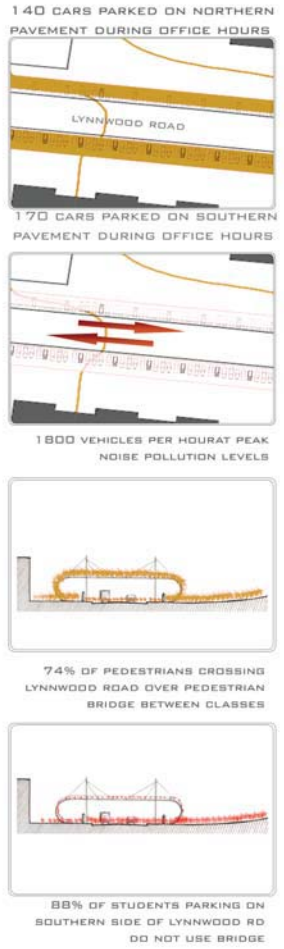


fig. 6.30_ Parking and pedestrian movement on Lynnwood Road



As previously discussed, the number of vehicles on Lynnwood Road cause many problems. Due to the lack of formal parking areas around the University, students are forced to use pavements on either side of Lynnwood Road for parking. This not only cause a great increase in traffic congestion but also cause pedestrians to cross Lynnwood Road close pedestrian entrances to the University. (fig. 6.29) Although most pedestrians moving between Main Campus and South Campus use the existing pedestrian bridge, most students who park on Lynnwood Road cross it on foot causing danger to students and motorists. Noise pollution due to high traffic density will be discussed in chapter 09.

fig. 6.31_ Lynnwood Road vehicle speeds

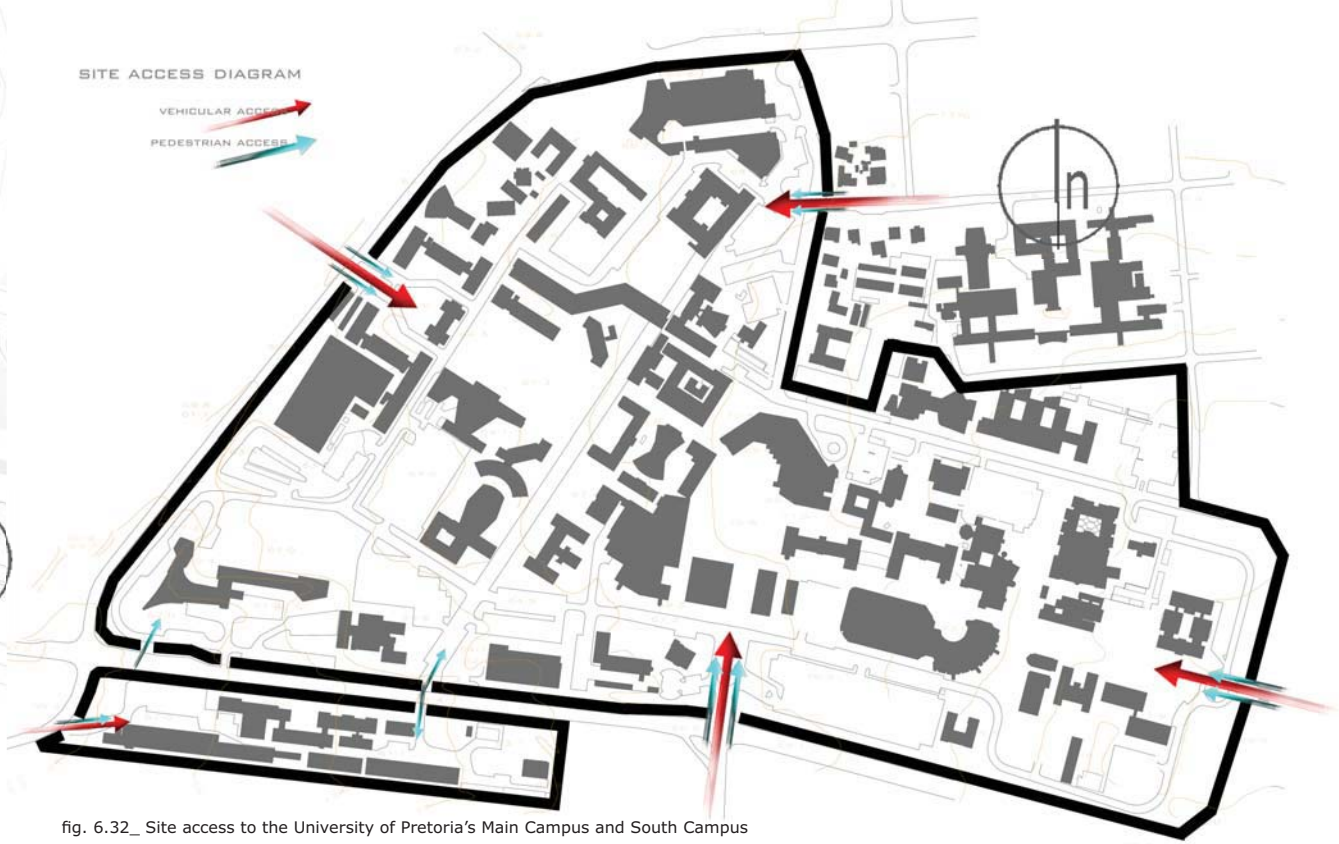


fig. 6.32_ Site access to the University of Pretoria's Main Campus and South Campus

Figure 6.31 shows vehicle speeds at various points between the Roper Street and University Road intersections. It is important to note that the maximum speed of vehicles is at the pedestrian entrances to Main Campus and South Campus. This is also the area where most pedestrians cross Lynnwood Road. The combination of vehicle speed and increased pedestrian movement make the situations even more dangerous. Figure 6.32 indicates pedestrian and vehicular entrances to Main Campus and South Campus. Three entrances to Main Campus and only one to South Campus exist on Lynnwood Road. The building proposed in this dissertation is situated at the place where the Main Campus and the South Campus entrances sit across from one another. This provides the opportunity to fuse the two campuses together, at this point, by using pedestrian movement across Lynnwood Road.

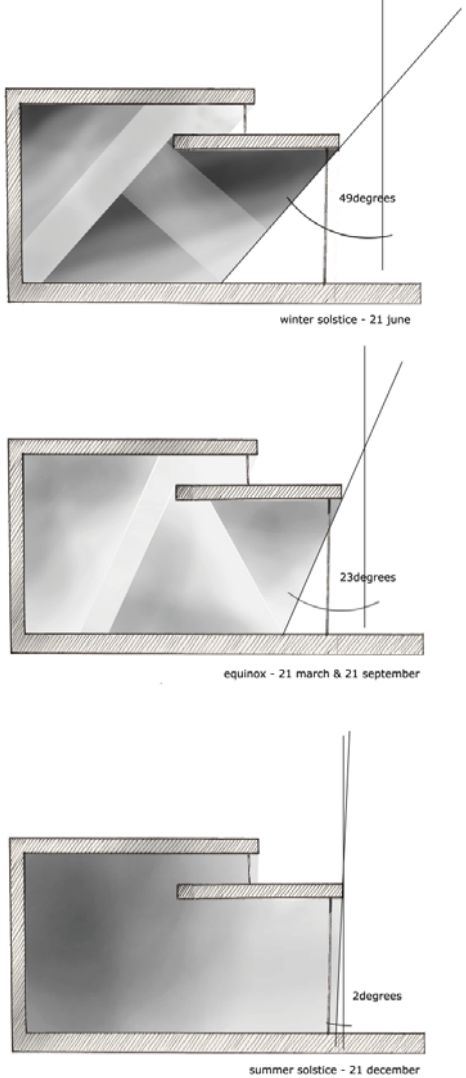


fig. 6.33_ Solar Angles at soltices and equinox

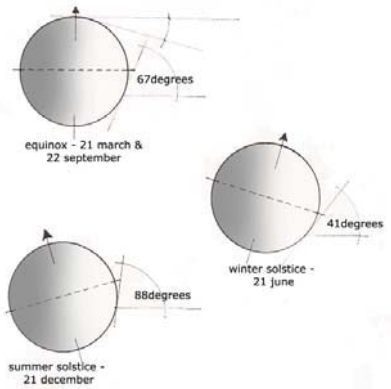
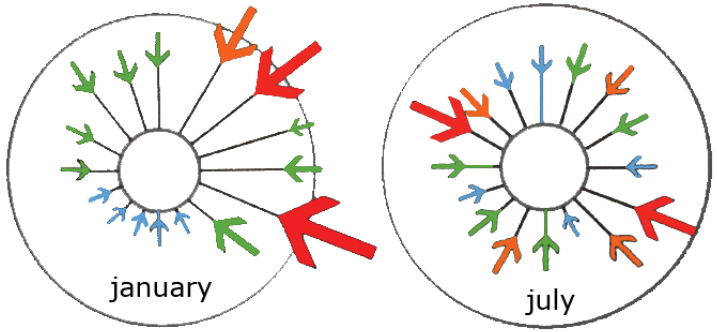


fig. 6.34_ Solar Angles at soltices and equinox

Month	Temperature (°C)				Precipitation		
	Highest Recorded	Average Daily Maximum	Average Daily Minimum	Lowest Recorded	Average Monthly	Average Number of Days with ≥mm	Highest 24h Rainfall (mm)
January	36	29	18	8	136	14	160
February	36	28	17	11	75	11	95
March	35	27	16	6	82	10	84
April	33	24	12	3	51	7	72
May	29	22	8	-1	13	3	40
June	25	19	5	-6	7	1	32
July	26	20	5	-4	3	1	18
August	31	22	8	-1	6	2	15
September	34	26	12	2	22	3	43
October	36	27	14	4	71	9	108
November	36	27	16	7	98	12	67
December	35	28	17	7	110	15	50

Table 6.01_ Temperature and precipitation
(www.weathersa.co.za)



Summer
South east - north east

Winter:
South east - north west

fig. 6.35_ Prevailing wind directions

Site Data	
Municipal data:	
Building lines:	4.5m on sides of erfs
	3.5m from street
Height:	Zone 5 – 19m
Coverage:	Zone 5 – Parking 80%,
	Other 60%
FSR:	Zone 5 - 2
Climatic data:	
Position:	25°44'S 28°11'E
Height:	1330m

Table 6.02_ Municipal data

07

URBAN DESIGN DEVELOPMENT

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

"The axis is perhaps the first human manifestation; it is the means of every human act. The toddling child moves along an axis, the man striving in the tempest of life traces for himself an axis. The axis is the regulator of architecture."
Le Corbusier - (Kent, 1990:104)

"Places do not make cities. It is cities that make places."
Hillier - (Hillier, 1996:16)

Introduction

The urban design strategies is explained in broad terms before focusing on the specific vision for the university of Pretoria which was proposed by students working within the study area.

Urban design strategies

What makes successful cities? According to Uytenbogaardt and Dewar *(Dewar and Uytenbogaardt, 1991:25)* successful cities have to conform to performance criteria which are listed below and briefly discussed in the pages to follow.

Needs
- Urban generation
- Access
- Promotion of collective activities and contact
- Individual needs

Programme
- Balance
- Freedom
- Equity
- Intensity, diversity and necessary complexity
- Integration and community

Need

As explained by Uytenbogaardt and Dewar, the three needs of; "urban generation, access and promotion of collective activities" deal with the reason why cities exist and why they work or not. The fourth need is based more on the personal needs of people living in the cities.
Although this dissertation is concerned more with the way in which people are affected by - and experience space, it cannot be viewed in isolation and needs to be related to the other needs as specified.

In a very pragmatic way of looking at cities one can say that cities are made up of a collection of buildings, and the spaces and infrastructure which link them.

In other words; a number of physical/ formal elements which are the **means** to provide social, economical, cultural and environmental **ends**/ functions.
The relation of the physical city (means) and the functional city (ends) is what makes cities successful or not and it is this with which we should be most concerned when designing cities. (Hillier, 1996:149)
A "two line- logic" (Hillier, 1996:158) of buildings opening into open spaces and open spaces bleeding into buildings is created by the interaction of formal elements (buildings) and functional elements.

The way in which buildings relate to the open spaces surrounding them are closely linked to how people use the system from inside the buildings and from the spaces surrounding them. Similar to how people inside the building relate to people outside the building, people outside the building relate to people passing by the building.
This creates an opportunity to interact with the building or the open space without forcing this interaction.
The physical city however cannot be detached from the functional city and the relationships between them come up when one begins to investigate how humans operate in space.

Natural geometries emerge from these movement patterns:

At its simplest form; people move on lines or axes, (fig. 7.02) but when people stop to converse with others they will collectively define a space in which the people inside the space can all see each other. (fig. 7.03) Now when one looks at figure 7.04, it defines all the people in the space and includes the potential people who could see the people in the space and visa versa. This diagram is called an isovist and is key to understanding how we experience spaces in cities.

The isovist helps us to describe the relationship between the formal description of space and how people use it. Hillier states that the proper way to formulate the relation is to say that: "...space is given to us as a set of potentials, and that we exploit these potentials as individuals and collectives in using space." (Hillier, 1996:154)

This view on how space is transformed by the way people use it is part of the solution to a bigger problem. This is not only concerned with the way people use space currently, but how space will be used after new interventions have been made and a new form is given to existing contexts.
This leads us into a thought process of how to design cities and spaces to provide opportunity for growth without taking away characteristics like legibility and connectivity between centres of the whole.

The physical aspects of cities changes slowly over time while the function changes much quicker. This emphasizes the argument that buildings should not be designed to be contextually responsive only for the current situation, but that great consideration, in this regard, should be given to the entire life span of the building.

fig. 7.02_Line/axis of movement

figure 7.03_Defined space diagram

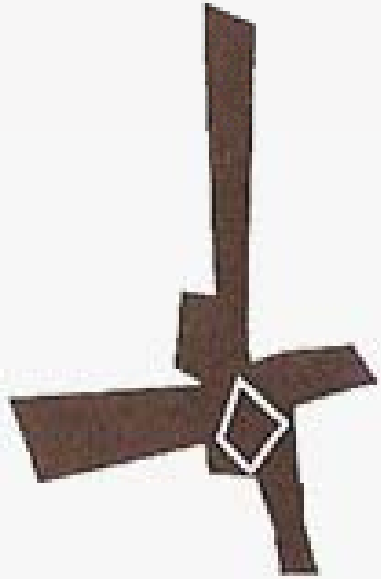


figure 7.04_Isovist

(Hillier, 1996:154)

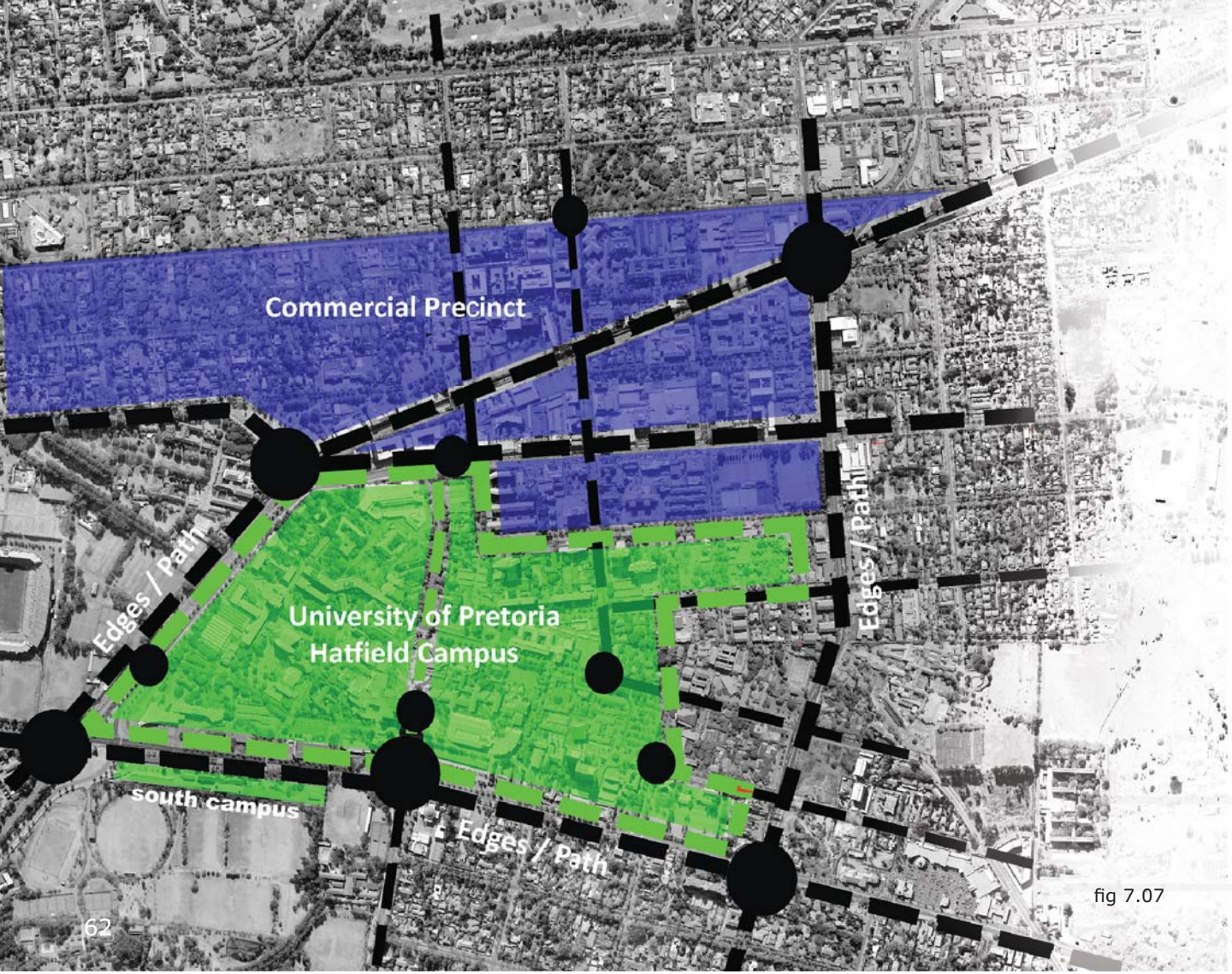


fig 7.07

Pecincts, edges and paths

The investigated area has been divided into various precincts to make sense of the Hatfield area as a whole. Various proposed projects are situated in the areas highlighted in fig7.07. To make a connection between the three highlighted areas, various methods are employed to ensure smooth transitions between these. Educational facilities are included in projects situated on the commercial boundary of the university precinct.
The transition from commercial to university precincts are also strengthened by introducing more commercial functions in the university precinct. These include shops and restaurants in the proposed student centre.

South Campus and Main Campus are linked by crossing the Lynnwood Road edge and establishing an arts precinct by involving all the existing amenities concerned with the arts.

Gateways, urban doorways and thresholds

A series of urban gateways into the existing university precinct have been recognised. These serve as points around the university campus where the urban fabric starts to change. These transition zones also serve to merge the various precincts.

Figure 7.08 also shows the various doors and side doors into the university and points out the different functions facilitated at the points.

By crossing and merging areas on either side of the illustrated thresholds the university starts merging into the surrounding precincts thereby making it more integrated and contributes to public interaction.

The illustrated paths also serve to activate spaces surrounding them.

fig 7.08

08

DESIGN DEVELOPMENT

Introduction

This chapter deals with the design conclusion for the proposed building. Aspects concerning contextual, formal, technological and functional responses will be discussed to explain design outcomes. Design process drawings and models are not illustrated in this chapter, but are included as addenda.

08

Conceptual development

Development of the concept of bridging a urban divide is illustrated in figures 8.01 to 8.05.

In figure 8.01 the natural gradient of the site is shown in a sectional diagram. This shows Lynnwood Road carving through the landscape and creating a boundary which separates Main campus from South campus.
Figure 8.02 shows the construction of embankments on either side of Lynnwood Road. These create platforms which facilitate movement across the road without disrupting normal vehicular traffic. These embankments will make up the stereotomic component of the proposed building and house all facilities which require little or no natural light.

Figure 8.03 illustrates the bridging element which is supported by the stereotomic 'embankments'. The bridge forms the first techtonic component of the proposed building.

Since this is an element with its own functional and structural integrity, it is separated from the other elements rather than 'growing' out of them.
Figure 8.04 illustrates elements which 'hold' the bridge on either side and facilitate movement from it and onto it. For the bridge to keep its integrity both these elements are conceptually separated from the bridge. The stramp on the southern side acts as a stereotomic 'anchor' which holds the bridge to the ground whilst techtonic building elements on the northern side straddle the bridge.

Figure 8.05 illustrates columns / pilotis holding building elements off the ground thus separating stereotomic and techtonic allowing each of the parts to stand as an element on its own and with its own integrity.

fig. 8.01_Cross section through site and Lynnwood Road

fig. 8.02_Cross section through site showing proposed embankments

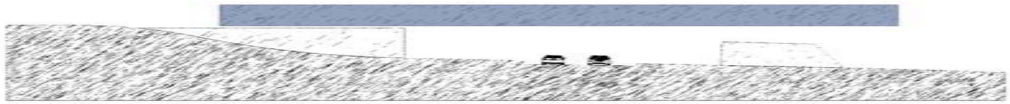


fig. 8.03_Sectional diagram showing proposed bridge on embankments

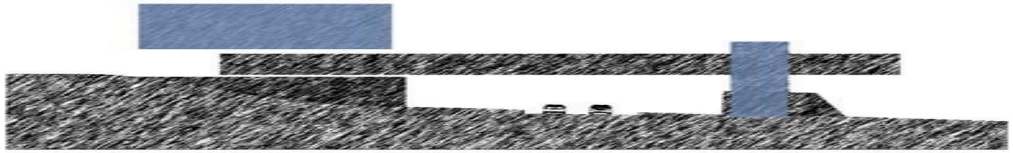


fig. 8.04_Proposed building elements supporting bridge

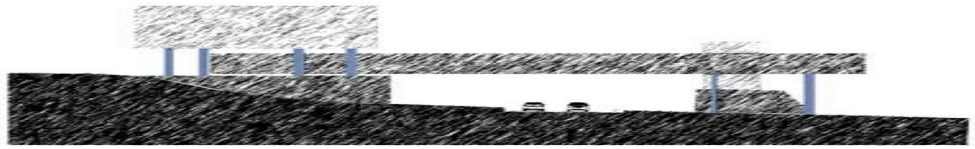


fig. 8.05_Columns separating tectonic and stereotomic elements

Contextual responses

Contextual responses are discussed in terms of formal and spatial responses. The location of the proposed buildings puts it in close proximity to buildings of architectural merit and although formal responses cannot be translated literally, some elements are used to give reference to existing buildings.

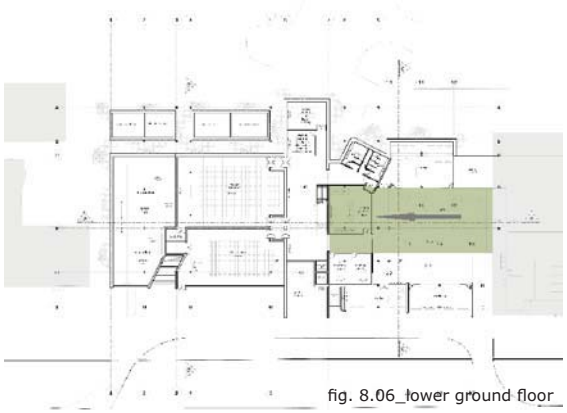


fig. 8.06_lower ground floor

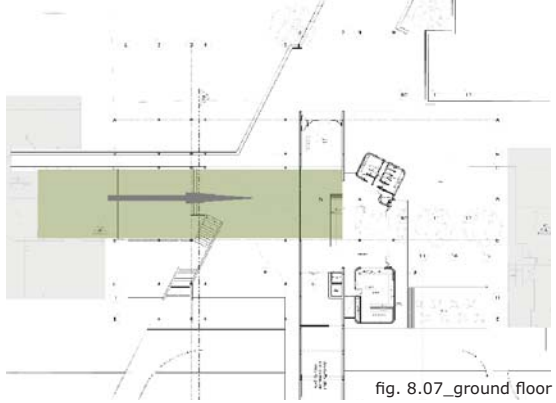


fig. 8.07_ground floor

The greatest responses made however, are responses to spatial characteristics of neighbouring buildings. Figure 8.06 - 8.08 shows **spatial responses** in the proposed building.

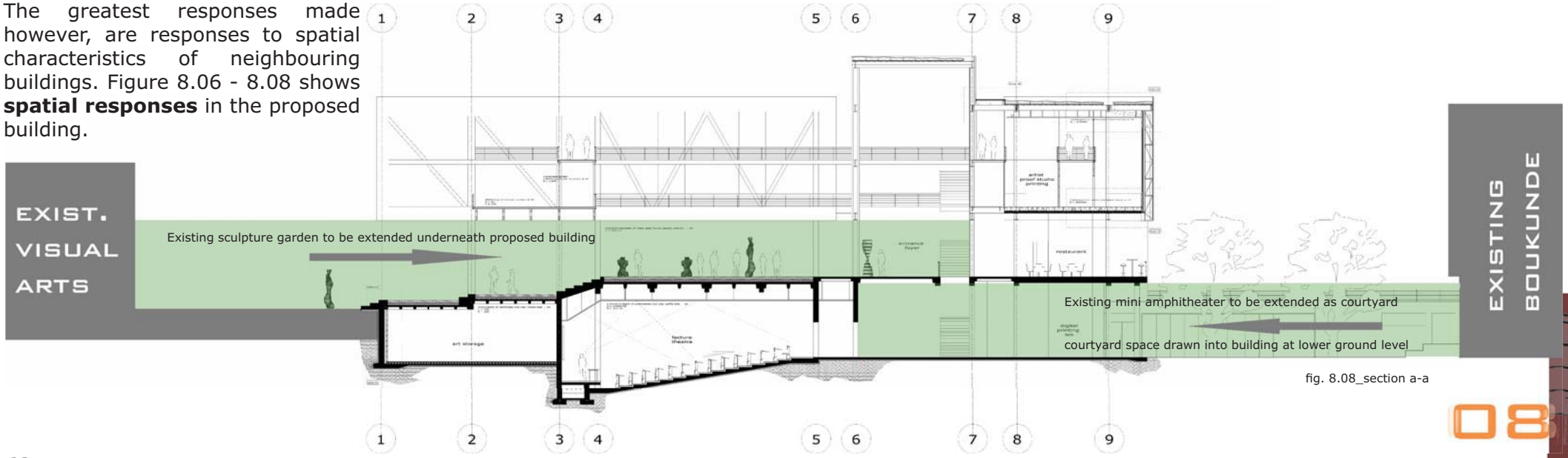


fig. 8.08_section a-a

Formal responses

As previously discussed formal responses have been limited in order to allow the building to be contemporary and represent the year 2008 rather than trying to copy existing buildings and follow a stylistic approach in decorating the proposed building.
Some elements have however been translated to show responses to existing structures. This is discussed through the series of pictures and drawings to follow.

fig. 8.09_existing boukunde building

fig. 8.10_view of ablution with horisontal punctures in external envelope for solar penetration and ventilation

Responses to proposed building elements

The proposed building has a very strong linear orientation. This leads to the arrangement of elements around these linear elements to strengthen the overall form of the building. The accommodated bridge serves as a guiding element in the placement of other amenities.
Separating other building elements from the proposed bridge structure serves to give prominance to its strong linear form.
The linearity of the bridge is echoed in upper levels with the separation of elements happening between the main structure and adjoining amenities.

Filleted corners in the ablution facilities and restaurant kitchen is a direct formal response to the neighbouring Boukunde and Visual Arts buildings. This also makes these facilities read as separate entities to the bridge.

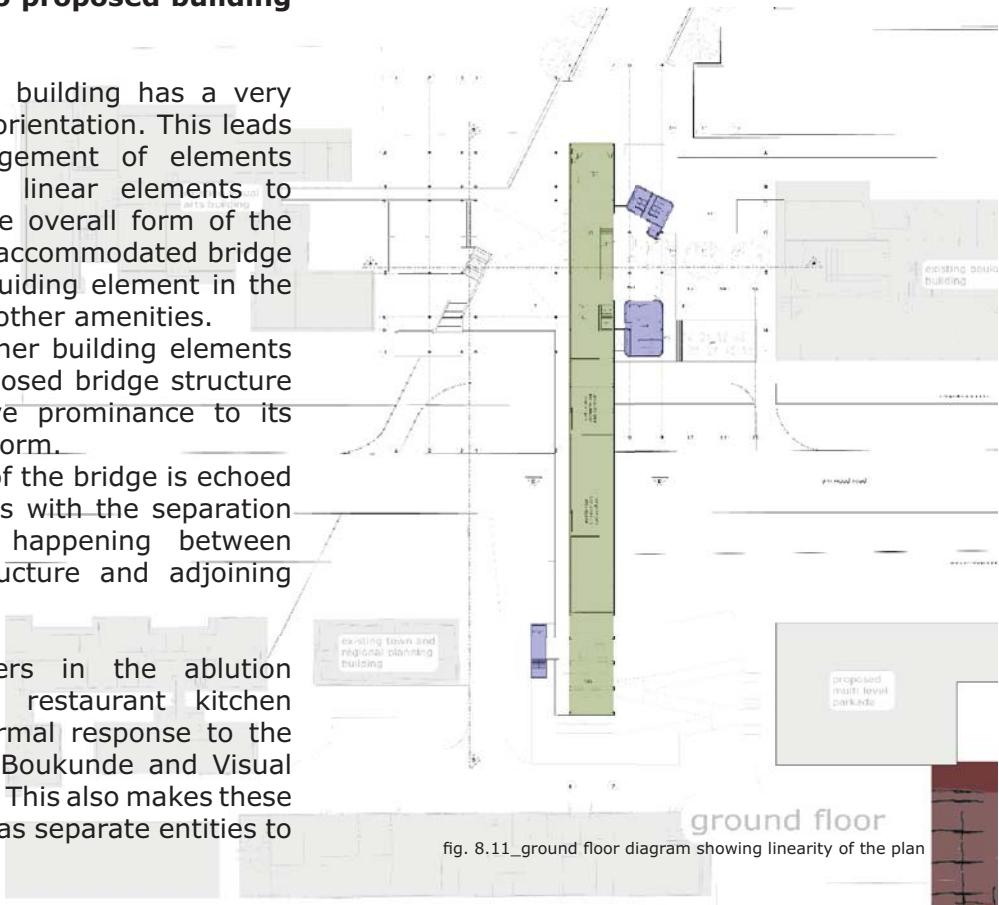


fig. 8.11_ground floor diagram showing linearity of the plan

Circulation

Circulation is one of the most important guiding elements in the design conclusion of the proposed building. Before considering any of the programmatic issues the circulation of pedestrians, vehicles and services had to be sorted out. Since Tukkielaan acts as one of the main pedestrian entrances to the university, pedestrian movement was the first priority.

Pedestrian movement

Pedestrian movement is divided into categories relating to users of the building and pedestrian movement passing through the site but not entering the proposed building.

Pedestrian movement passing by the building consists of the following categories. People using the proposed parking garage and crossing the proposed bridge to get to the main campus and pedestrians who use the pedestrian entrance from Lynnwood Road.

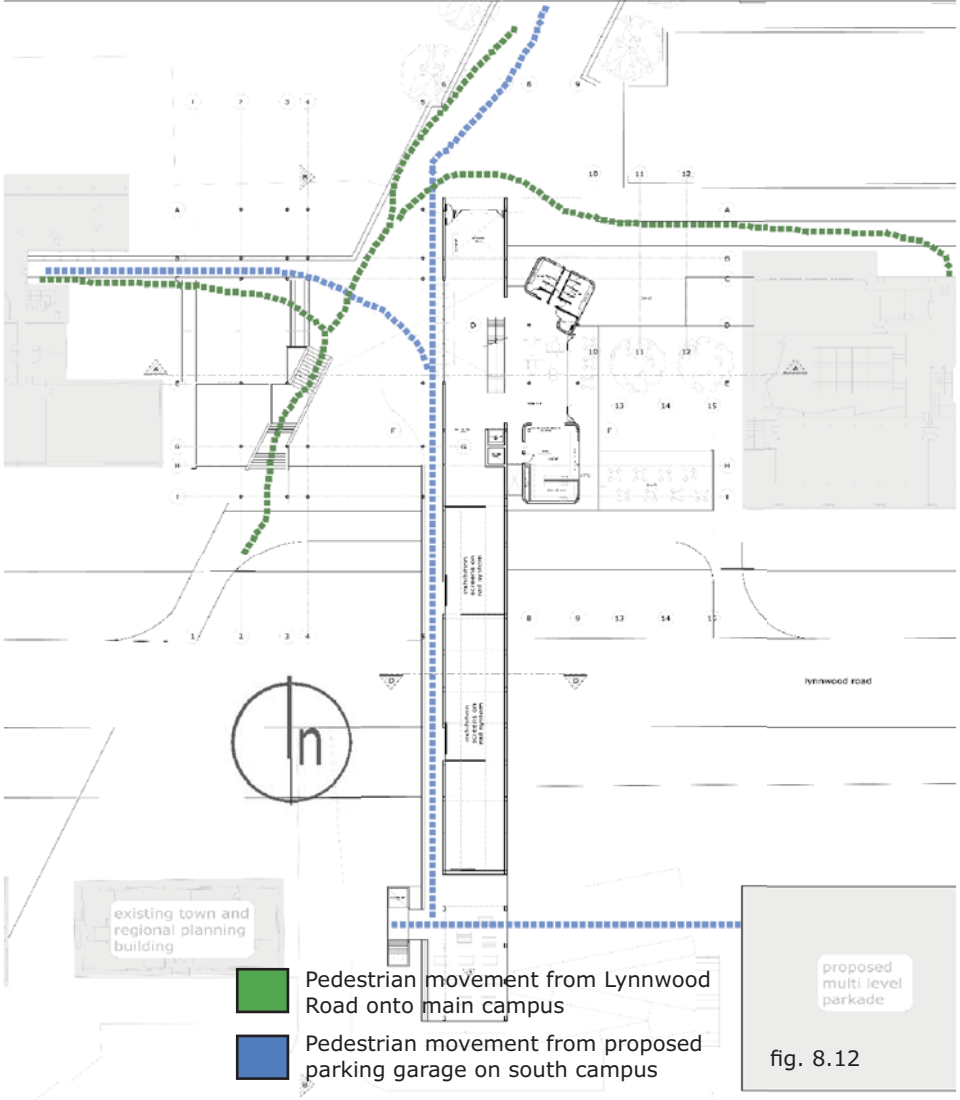


fig. 8.12

The proposed building has facilities which cater for a wide variety of users. Building users can be divided into the following categories:

- UP Students,
- students visiting APS,
- staff,
- visitors to corporate exhibitions,
- visitors to periodical gallery exhibitions,
- restaurant customers and
- service contractors
-

Figures 8.13 to 8.16 illustrate the movement of the various building users. These diagrams also show how the building is divided into public and more private areas. More private functions like offices boardrooms and critrooms are located on the northern side of the proposed building. More public functions, like galleries and exhibition spaces are located on the southern side. Since south light is a prerequisite for galleries it makes sense to locate these spaces at the southern end.

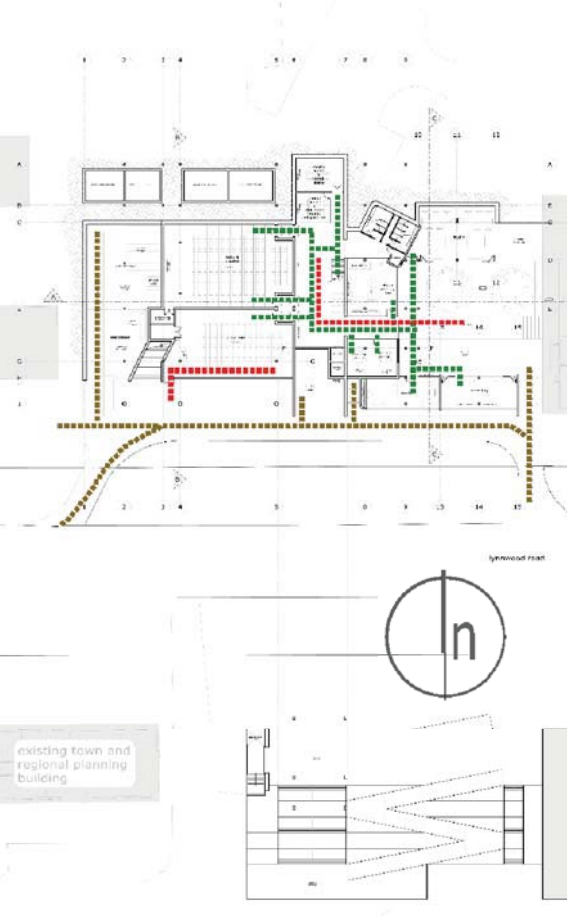


fig. 8.13

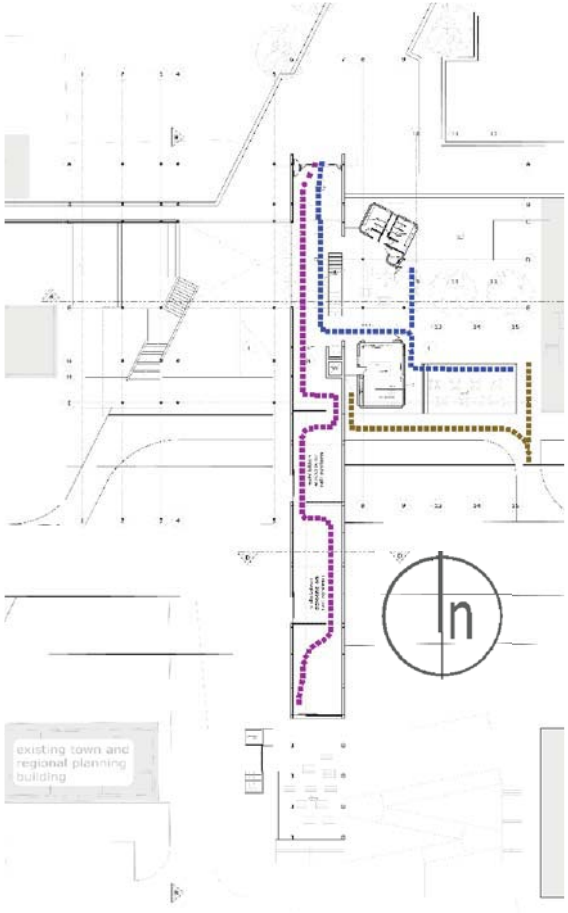


fig. 8.14

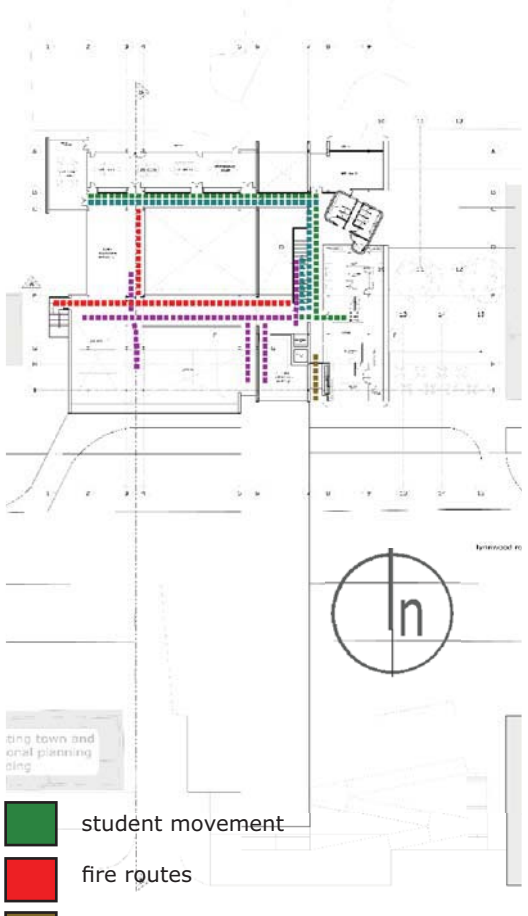


fig. 8.15

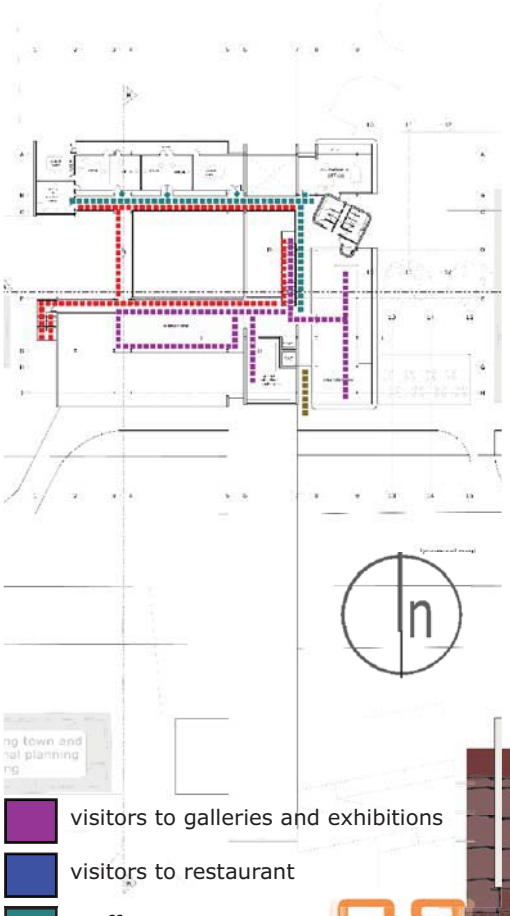


fig. 8.16

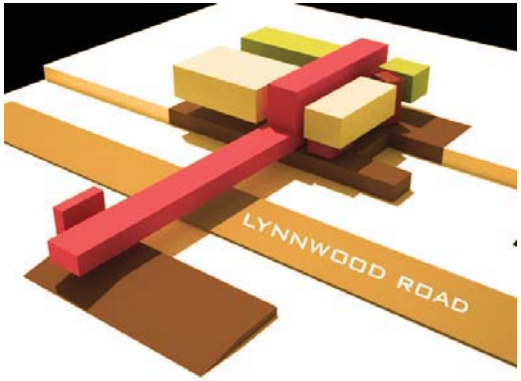


fig. 8.17_south-east perspective view

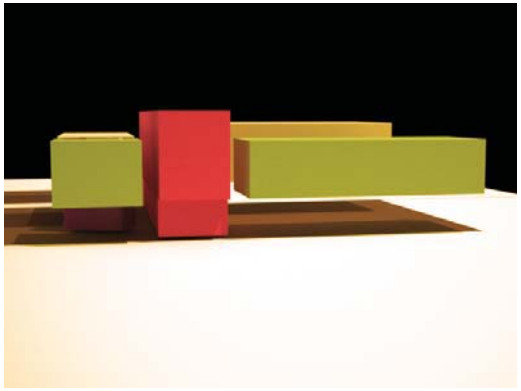


fig. 8.18_north perspective elevation

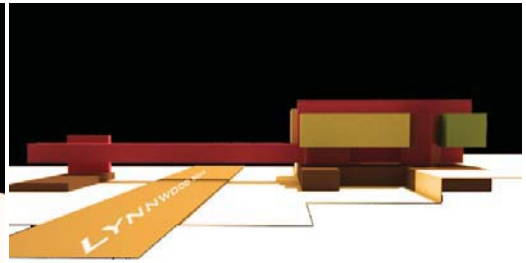


fig. 8.19_east perspective view

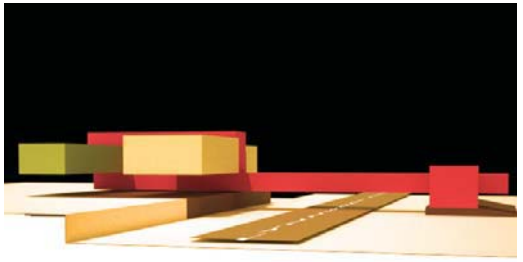


fig. 8.20_west perspective view

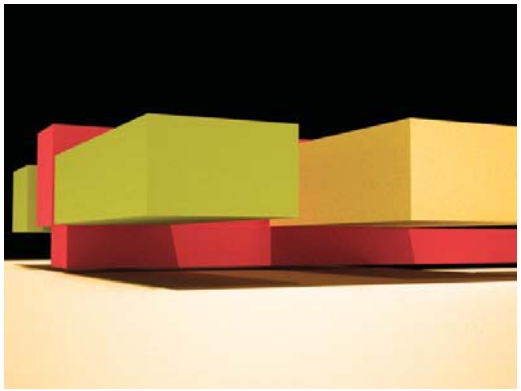


fig. 8.21_western perspective of office and gallery blocks

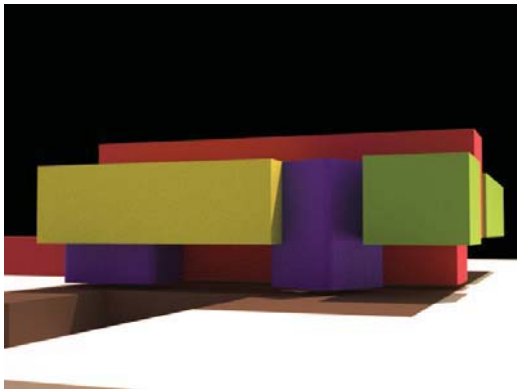


fig. 8.22_western perspective showing ablution and kitchen blocks

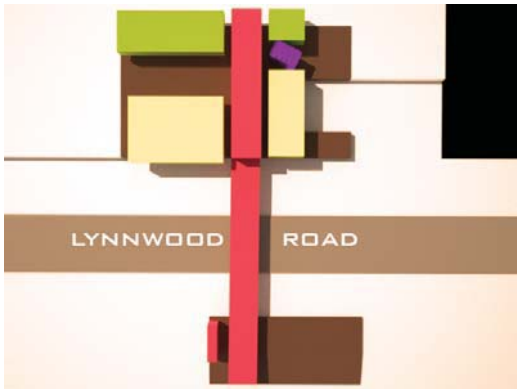


fig. 8.23_roof plan diagram

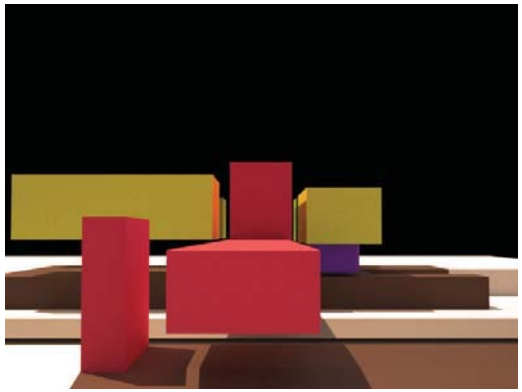


fig. 8.24_south elevational perspective

Massing models showing built mass in relation to each other and Lynnwood Road

Vegetation

External courtyards are very important elements in the design of the proposed building. By extending the adjacent sculpture garden and amphitheatre into and underneath the building, a very strong inside outside relationship is created. It is therefor important to select appropriate types of vegetation to occupy these spaces.

The existing sculpture garden on the western side of the proposed building is extended eastward at ground level. (fig. 8.25) It is proposed that 'Bermuda grass'(*Cynodon dactylon) (fig. 8.26)* also known as 'Kweekgras' be planted on vegetated lower ground floor roofs. The introduction of vegetation into the proposed courtyard should create a more inviting space.

Cynodon dactylon is a highly fertile grass and consumes less water than alien species commonly used in South Africa. Although watering is required in winter it is a hardy plant and dry roots will produce new shoots during the beginning of spring.

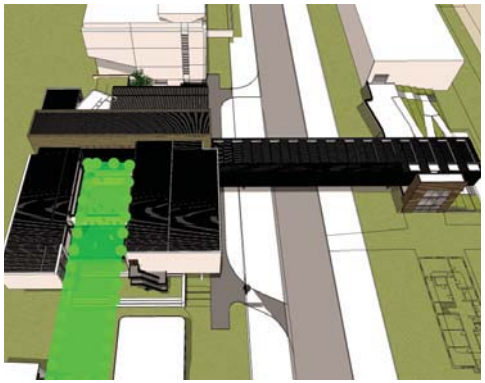


fig 8.25

fig 8.26_Cynodon dactylon (www.plantzafrica.co.za)

It is proposed that the existing amphitheatre on the eastern side of the proposed building be demolished. A new courtyard is proposed in its place and indigenous vegetation introduced. (fig. 8.27 and 8.28)

fig 8.27

fig 8.28

Bermuda grass is used for grass surfaces and Coral trees (*Erythrina lysistemon)* are introduced in the proposed courtyard.

Coral trees are deciduous and allows winter sun to penetrate studios and workshops during winter months. It is medium sized, hardy tree with a spreading crown and brilliant red flowers. *(www.plantzafrica.co.za)*

fig 8.29_Erythrina lysistemon (www.plantzafrica.co.za)

fig 8.30_Erythrina lysistemon (www.plantzafrica.co.za)

fig 8.31_Erythrina lysistemon (www.plantzafrica.co.za)

fig 8.34

fig 8.32

fig 8.33

diagrams illustrating the building user's relationship to external spaces

south east perspective

fig 8.34

fig 8.35

south elevation

eastern courtyard perspective

fig 8.36

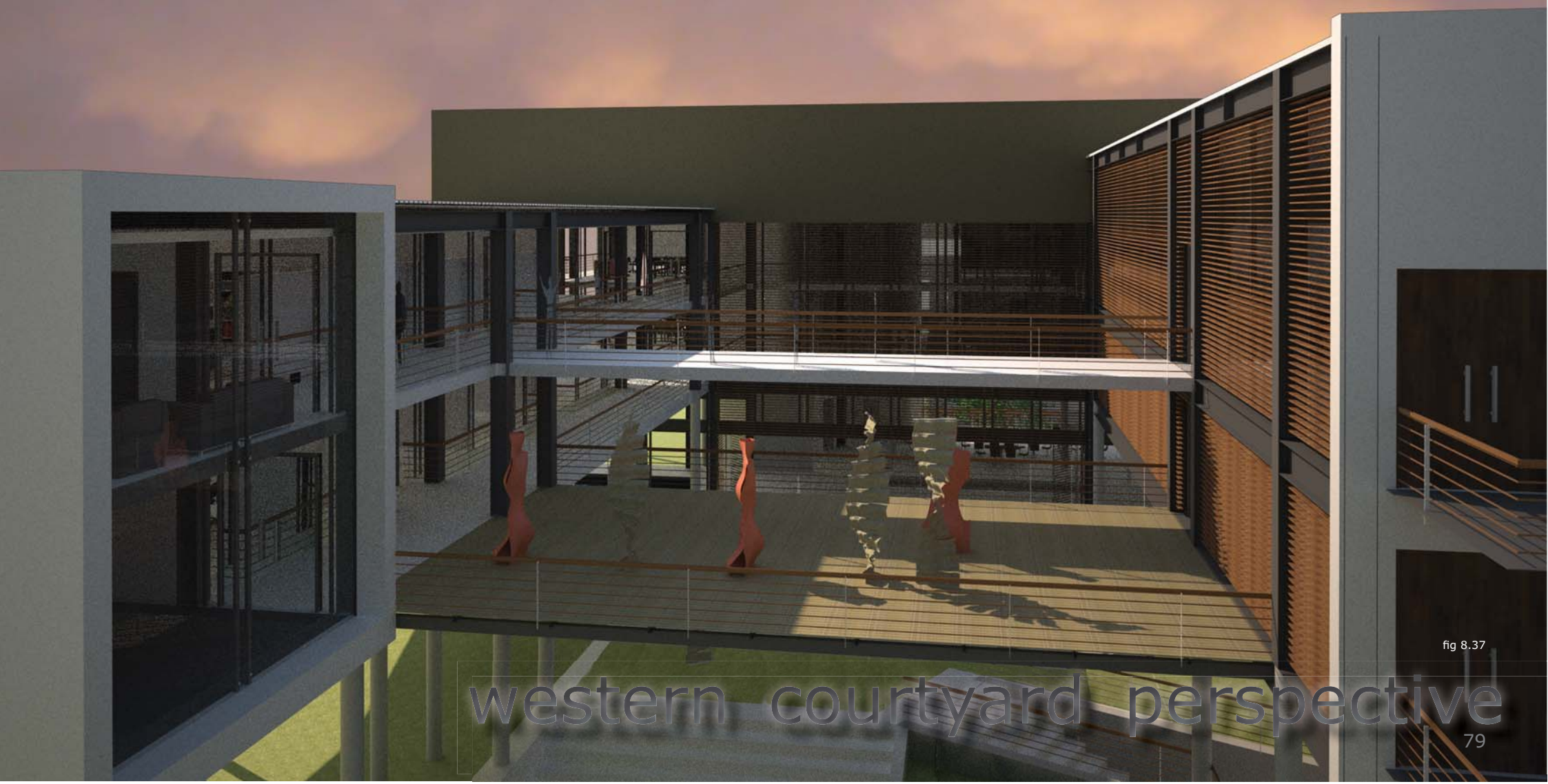


fig 8.37

western courtyard perspective

fig 8.38

south west perspective

09 TECHNICAL INVESTIGATION

Introduction

Research into thermal comfort, light qualities and noise levels of each part of the building is discussed in order to get a better understanding of how the most desirable conditions would be achieved.

09

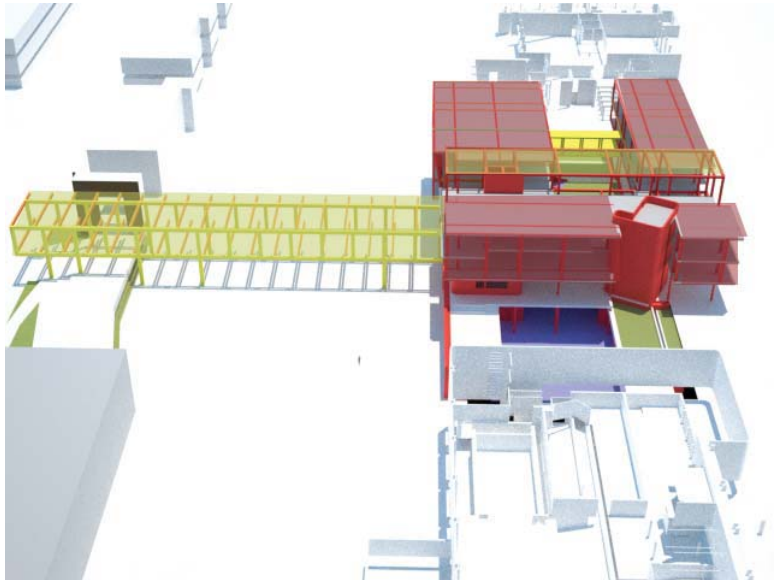


fig. 9.01_Structural model showing the main structural elements

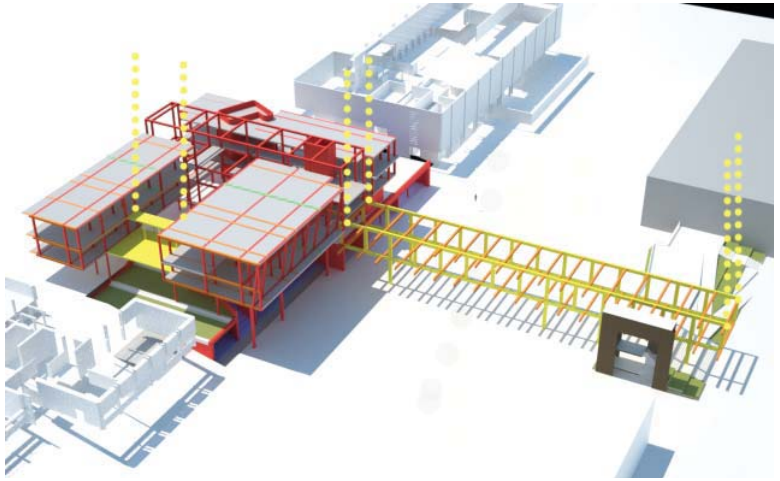


fig.9.02_Vierendeel trusses used on bridge structures in the north - south orientation

main structural components

09

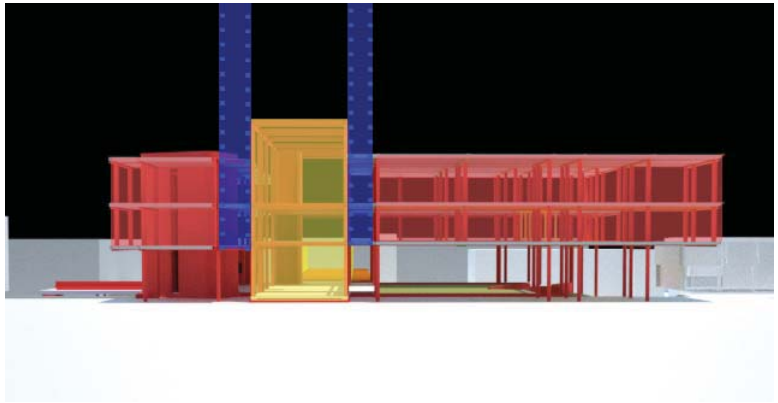


fig. 9.03_Separation of main bridge structure and ancillary accommodation by main circulation routes

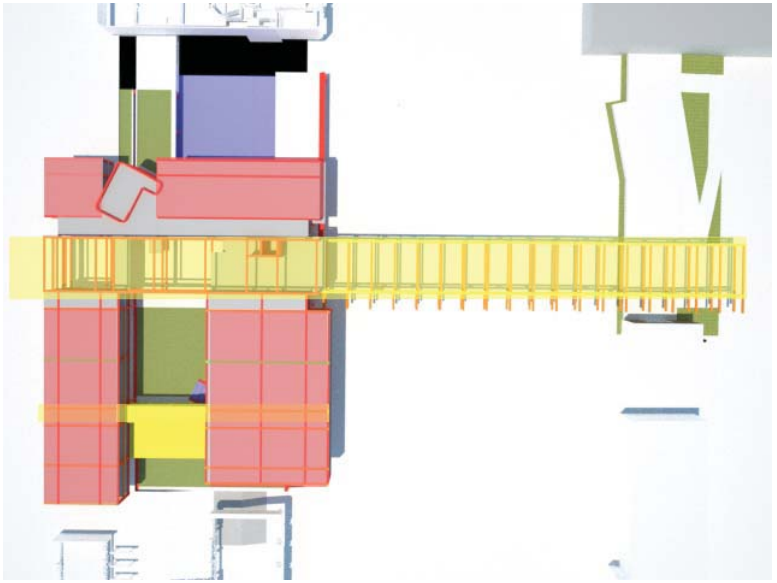


fig. 9.04_Galleries and offices set apart from main bridge structure - main circulation routes separating two typologies

main structural components

09

Material study

Material selection is done to reinforce the conceptual ideas involved in the proposed building. The contrast between heavy and light materials are played off against each other in order to illustrate the difference between parts of the building belonging to the ground and those which are conceptually separated from it.

Concrete:
Reinforced concrete is used to emphasize the heavy appearance of stereotomic elements. It is mostly used in the construction of the lower ground floor. As illustrated in the construction details, reinforced concrete retaining walls are used in conjunction with sufficient waterproofing to ensure a damp proof structural member.

The combination of concrete and permanent shuttering are used as supporting structure for the first and second floor raised floors.

Fire resistance
All reinforced concrete supports are required to have a fire rating of at least 120minutes to provide adequate time for occupants to escape without structural failure of the building. All reinforcing steel should have a minimum of 50mm concrete cover.

Reinforcing
Mild steel reinforcing cages can be manufactured off site to speed up construction and to avoid rust collecting on steel surfaces.

Construction
Special care needs to be taken with the inclusion of expansion joints during construction. It is proposed that expansion joints be constructed at 18 - 25m intervals. Expansion joints are located at column and slab junctions where possible to allow for different curing times in constituent structural parts.

Finish
Off shutter finishes are proposed for all concrete construction. Special care needs to be taken to ensure a smooth finish where concrete walls and columns are not covered by acoustic or other finishes.

Glass:
Structural glazing with safety ratings for impact and burglar proofing are used for all glass surfaces which exceed 0.25m^2. Laminated glass specified to comply with class 2 safety ratings is made up of two layers of 6mm clear float glass with a 0.76mm PVB interleave.

Sizes
Laminated glass is available in maximum sizes of 2400mm x 3200mm. Thicknesses are available in intervals of 2mm up to 10mm.
Vertical structural glazing will be comprised of 2 x 6mm thick clear float glass panes.

Fire resistance
The PVB layer used in the manufacture of laminated glass acts as a bonding material. This provides additional structural strength in case of a fire.

Steel:
Structural steel is used in parts of the building classified as stereotomic. Although steel is not technically a light material it does provide a slender appearance. It allows the use of thin members due to its high tensile strength.

Treatment
All structural steel should be treated with intumescent paint to ensure structural stability in case of a fire.

Expanded aluminium
Although aluminium is not very cost effective, the process of manufacturing expanded metal allows a relatively small piece of material to be 'stretched' to cover a large area. There is no material waste as is the case with perforated metal sheets and it is maintenance free.
One of the most important design decisions which led to the selection of expanded aluminium panels was the quality of light achieved inside the building through the filtering of light through the diamond shaped openings. The following section dealing with the double skin facade

Double skin facade

Due to the building's and the especially the bridge's north - south orientation it is important to filter light into spaces on the eastern and western facades of the building. Another concern was that of noise pollution from Lynnwood Road. Although the expanded aluminium mesh provides little sound absorption on its own, in conjunction with the vitrex panels and the air gap inside the double skin facade provides substantial noise reduction.

The double skin also provides the opportunity to hide the building services. Rainwater downpipes and ventilation ducting are housed inside the skin thus eliminating the need for extra space allowance for it inside the building.

The combination of translucent and opaque panels supporting the expanded aluminium mesh allows diffused light to enter the building during the day and gives the building a esoteric glow at night.

The expanded aluminium also reflects light in a haphazard manner thus minimizing glare off the sides of the building.

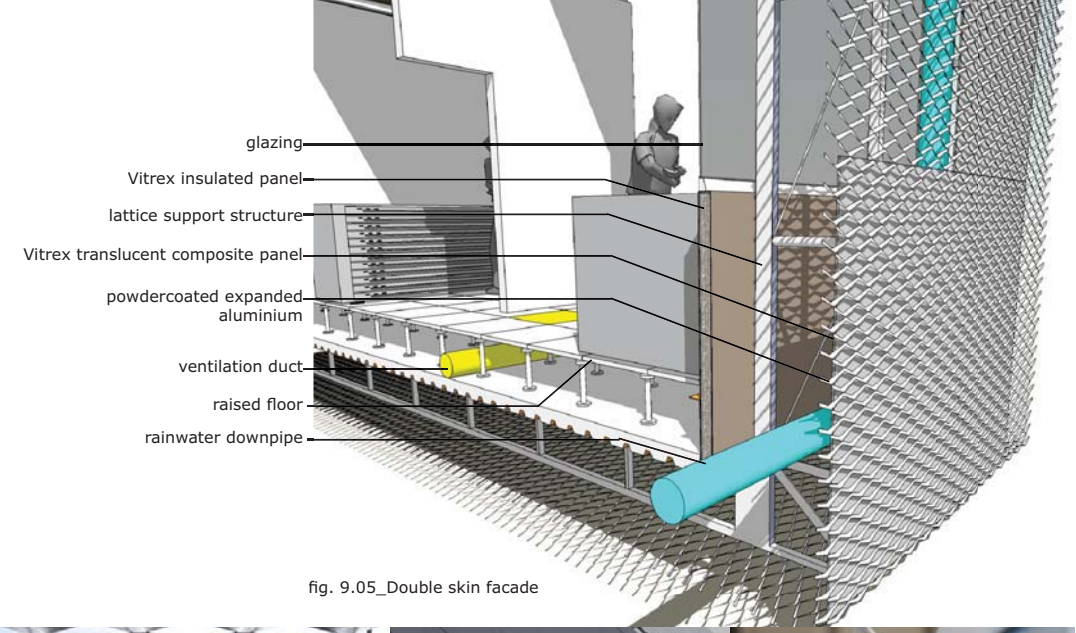
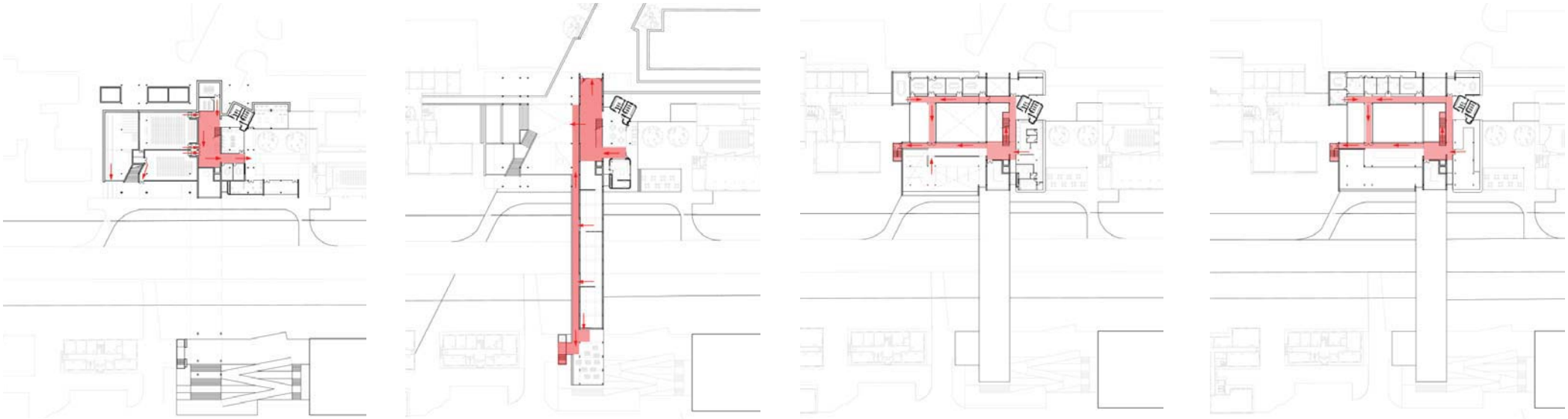


fig. 9.05_Double skin facade

fig. 9.06_Expanded aluminium *(www.gsdmaterials.com)*



lower ground floor layout

ground floor layout

first floor layout

second floor layout

fig. 9.07_Fire routes

Emergency routes

All accommodated spaces are situated to ensure that travel distances to the nearest emergency door do not exceed 45m. The width of emergency exit are in excess of 800mm. Both the classroom and auditorium are provided with 2 exit doors. All walls, ceilings and floors enclosing emergency routes have fire resistance of not less than 120 minutes. All emergency routes are sufficiently illuminated and demarcated in accordance with regulations stipulated in part TT29 of the SABS 0400. All ventilation and service shafts are constructed as to not promote the spread of combustible materials and gases between spaces. No firemen's lift is necessary due to the total building height not exceeding 30meters. Figure 9.07 indicates the emergency routes in the proposed building.

Occupancies and structural stability

According to the SABS 0400 the table below provides occupancies in the proposed building and the time structural components need to be stable in case of a fire.

Occupancy	Class of occupancy	3 – 10 storey building	Basement
Places of instruction	A3	90mins	120mins
Exhibition hall	C1	120mins	
Museum	C2	90mins	
Plant room	D4		120mins
Offices	G1	60mins	
Moderate risk storage	J2		180mins
Low risk storage	J3	90mins	120mins
Parking garage	J4	60mins	120mins

Table 9.08

All structural steel components shall be treated with an intumescent paint application to have a fire resistance of not less than 120minutes.

Auditoriums and lecture theatres:

The proposed lecture theater and classroom shall comply with SABS 0400 part TT50.

Portable extinguishers:

Occupancy	Class of occupancy	Number of portable extinguishers
Places of instruction	A3	1 per 200m²
Exhibition hall	C1	1 per 200m²
Museum	C2	1 per 200m²
Plant room	D4	1 per 400m²
Offices	G1	1 per 200m²
Moderate risk storage	J2	1 per 100m²
Low risk storage	J3	1 per 100m²
Parking garage	J4	1 per 400m²

Table 9.09

fig. 9.10

Inert gas fire extinguishing system

Composition

The inert gas is made up of natural gases that exist in our atmosphere. Inert gas is not harmful when inhaled and people trapped in an area where the gas is present will be able to escape without suffocating.

The gas consists of the following elements: Nitrogen, Helium, Neon, Argon and carbon dioxide as a secondary agent.

Objectives of system

The main purpose of the gas is to reduce oxygen levels in the air to a level which will not sustain a fire rated in the classes A, B or C.[1] Oxygen levels are reduced to a level which can still sustain human life at a low level of activity.

Disadvantages of inert gas system

Although the system is excellent in replacing its predecessor Halon, it has some disadvantages. High pressure operation causes regular maintenance checks. The area protected by the system must to some extent be contained in a room with minimal openings at the time of discharge. The system does not protect the building structure so all structural components need to be protected separately. The high pressure release during discharge might cause small items to be blown around the room.

In addition to the inert gas system used in art storage, restoration and galleries, handheld extinguishers and a fire hose reels will be provided in areas as indicated on the fire protection layout plans. All gypsum dry walling should have a fire rating of at least one hour.

Installation and operation

All piping must run no closer than 200mm from electrical conduits. All parts of the system must be painted in accordance to the regulations specified by the SABS 0140-3.

Piping shall consist of seamless carbon steel pipes, tested at 120Bar for 4 hours. The system should be under enough pressure to discharge at least 95% of its content within the first 40 seconds of activation.

Maximum hanger spans for piping shall be as follows:

Pipe diameter	Maximum span
< 25mm	1500mm
<40mm	2500mm
<65mm	3000mm
>65mm	3500mm

Cylinder storage

Cylinders should not be stacked more than three levels unless access from both sides are provided. Cylinders should be housed in a designated room to allow access only to fire personnel. If this is not possible dedicated steel enclosures should be constructed to house the cylinders.

Smoke and heat detectors shall be provided in each space and be in compliance with requirements for the specific accommodation.

Doors and door equipment

Any doors enclosing a space protected by inert gas systems shall have automatic closers which will activated before the gas is discharged. Escape doors shall be fitted with alarms and all doors shall be fitted with approved locks.

Breathing apparatus

All areas protected by inert gas fire protection systems shall be supplied with breathing apparatus which will allow occupants at least ten minutes of continuous use. These will be installed at every exit door.

1 Fire classifications: Class A – Surface fires or deep seated fires, Class B – Flammable liquids, Class C, Electrical equipment fires.

Maintenance

Maintenance shall be carried out in accordance with specific requirements as supplied by manufacturer.

Water supply to additional fire protection

A fire hydrant which is accessible from Lynnwood Road should be supplied in addition to the inert gas and portable fire protection systems. The supply of water to the hydrant will be discussed later in the document.

Alternative fire protection system: Water mist fire protection system

This system consist of a high pressure water storage unit which, on activation, releases a fine mist spray which acts in much the same way as the conventional water sprinkler systems currently used. The advantage of this system over conventional systems is that it releases only 35% of the volume of water compared to the conventional system. This makes it suitable for galleries where works of art are exhibited. Most of the water discharged by the high pressure nozzles evaporates on contact with higher temperatures which decreases the total amount of water left on surfaces after discharge.

Some of the disadvantages of the system are the high cost of installation and operation. This is mostly due to water storage tanks having to be kept under high pressure at all times and the limited number of manufacturers of the constituent parts of the system.

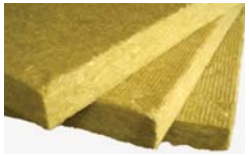
This system was successfully installed at the National Gallery of Art in Washington D.C. but due to considerable costs involved in installation and operation, was not selected for this project.

fig. 9.11_Inert gas nozzle *(www.wormaldfire.co.uk)*

fig. 9.12_Inert gas storage units (www.wormaldfire.co.uk)

Acoustics

Sound is measured in decibels (dBA) and an increase of 10dBA gives an approximate doubling in loudness and although the measurement in decibels might be the same in two instances the perceived sound disturbance might differ because of the difference in frequency. It is therefore important to measure acoustic performance of enclosures in terms of the whole range of frequencies audible to the human ear.



Porous sound absorber

Panel sound absorber

fig. 9.13 *(www.engineeringtoolbox.com)*

acoustic control

Sound absorption materials

Sound absorption materials can be classified into three categories:

1. Porous materials – absorb sound over the whole frequency range and the efficiency depends on the thickness of the element

2. Panel absorbers – absorbs sound over a narrow frequency range and the effectiveness depends on the weight and airspace depth of the panel. It is very useful in low frequency absorption i.e. road noise interferences.

3. Cavity resonators can be "tuned" to give selective absorption over a small frequency range. Cavity resonators can be made up of a combination of category 1 and 2 to give good sound absorption and reflection. The following table shows the maximum intrusive noise levels allowing reliable conversation:

Type of space and task	Noise level (dB)
Auditoriums requiring very good listening conditions	20 – 30
Small auditorium, lecture room and conference room	30 – 35
Small office, classroom and media centre and studio	40 – 45
Large office, restaurant	45 – 50
Workshop, machine room	50 - 55

Table 9.14

09

Noise levels calculated at position of proposed building:

Vehicles per hour average - 1800
Speed of vehicles perpendicular to vantage point - 55km/h
Distance from centre of road - 25metres
Height of observer - 4metres above road level
View angle - 127degrees
Distance to closest intersection in road - 170metres

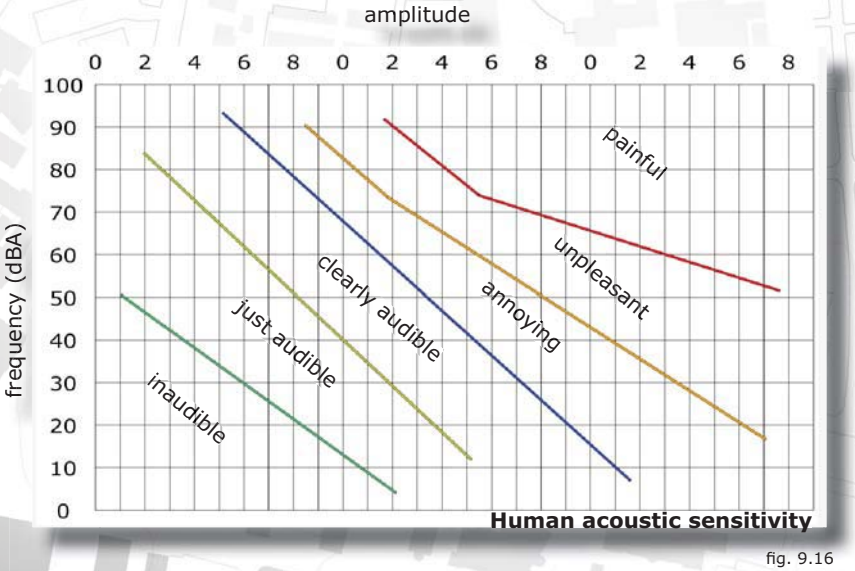


fig. 9.16

Noise concentrating on site due to traffic

fig. 9.15

Drainage, water supply and stormwater drainage

Normal supply and supply for fire protection

Potable water supply should be linked to the existing supply grid of the University of Pretoria's main campus. A fire hydrant should be supplied and be accessible from Lynnwood Road. The fire protection supply should be on a dedicated water supply system and not linked to the normal water supply network.

In addition to potable water supply to kitchens, ablution facilities and workshops, a 25mm diameter cold water supply pipe should be provided to serve the air conditioning units inside the plant room.

Hot water should only be supplied to the kitchen, workshop and printing studio.

Cold water conservancy tanks should be provided for buildings which exceed two storeys in height. These can be used to supplement normal water supply or supply for fire protection.

Stormwater drainage

Guides for the sizing of downpipes and gutters are provided SABS 0400 part RR3.1. The relevant data in Table 9.17 has been reproduced for use in the proposed building.

Rainwater downpipes shall have a cross section of no less than 100mm² for every 1m² of roof plan area which it serves. And at no time be less than 4400mm²

All stormwater runoff should be piped and linked to the existing stormwater system which links up with the main stormwater channels in Lynnwood Road.

Gutter and downpipe calculations

Rainfall region	Internal cross sectional area of valley or gutter per m² of roof plan area served
Summer rainfall region	140mm²

Table 9.17

stormwater disposal

09

Storm water storage tanks	
Volume of storage tanks (proposed)	304m³
Volume of storage tanks (proposed)	304000litres
Total roof catchment area	1632m²
Precipitation per day (maximum average)	14mm
Roof area X precipitation	22.848m³
Volume of storm water/day	22848litres
Volume of grey water used in sanitary appliances per day	262litres
Total rainwater available for irrigation per day	22586litres

Table 9.18

Grey-water use in proposed building per day		
	WC's	**Urinals**
Male	1litre/50students	1litre/50students
Female	1litre/30students	n/a

Number of students in building (approximated maximum)	
Male	300
Female	300

Water usage per day		
	WC	**Urinals**
Male	6litres/wc	6litres/urinal
Female	10litres/wc	n/a
Number of sanitary appliances		
Male	8 + 1 disabled	8
Female	16	n/a
Male	54litres/day	48litres/day
Female	160litres/day	n/a
Total usage per day		**262litres/day**

Table 9.19

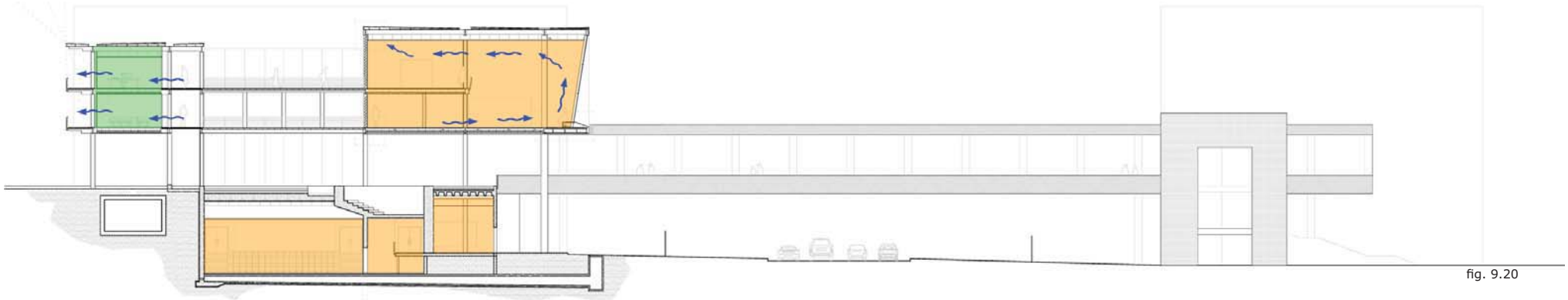


fig. 9.20

galleries, lecture theatres and classrooms to be air conditioned with humidity control in galleries art storage and restoration spaces

natural cross ventilation in offices and crit rooms on northern side of proposed building

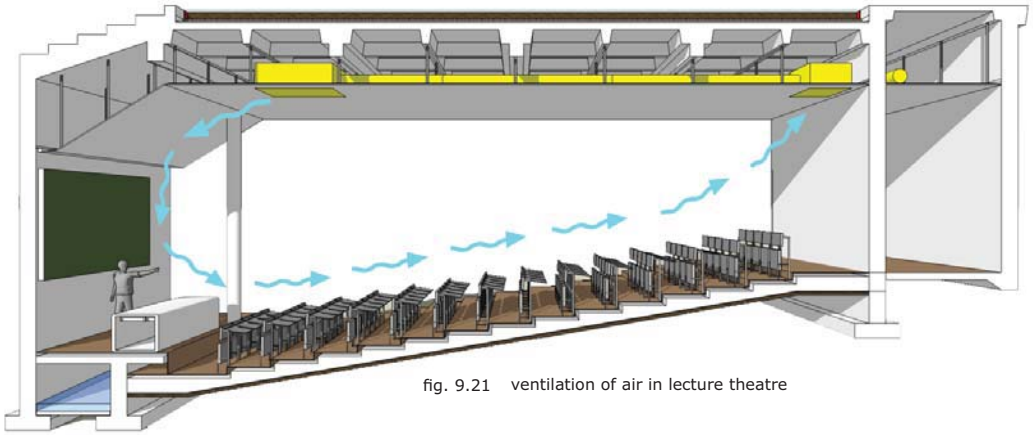


fig. 9.21 ventilation of air in lecture theatre

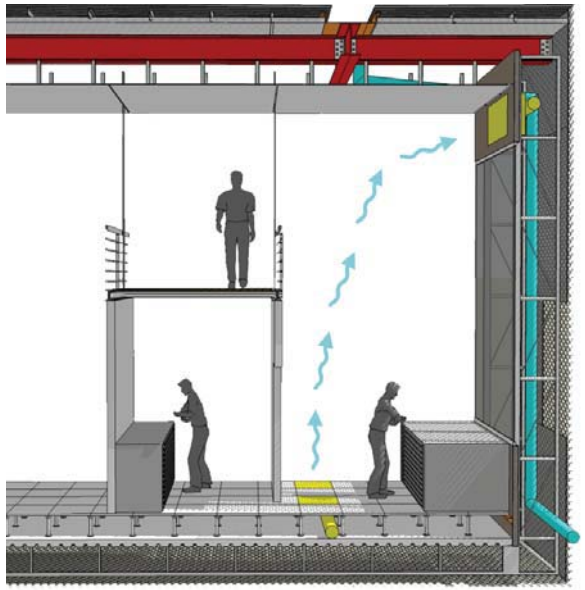


fig. 9.22 mechanical ventilation in workshop allows dusty air to be drawn into ducting inside the double skin facade

ventilation

09

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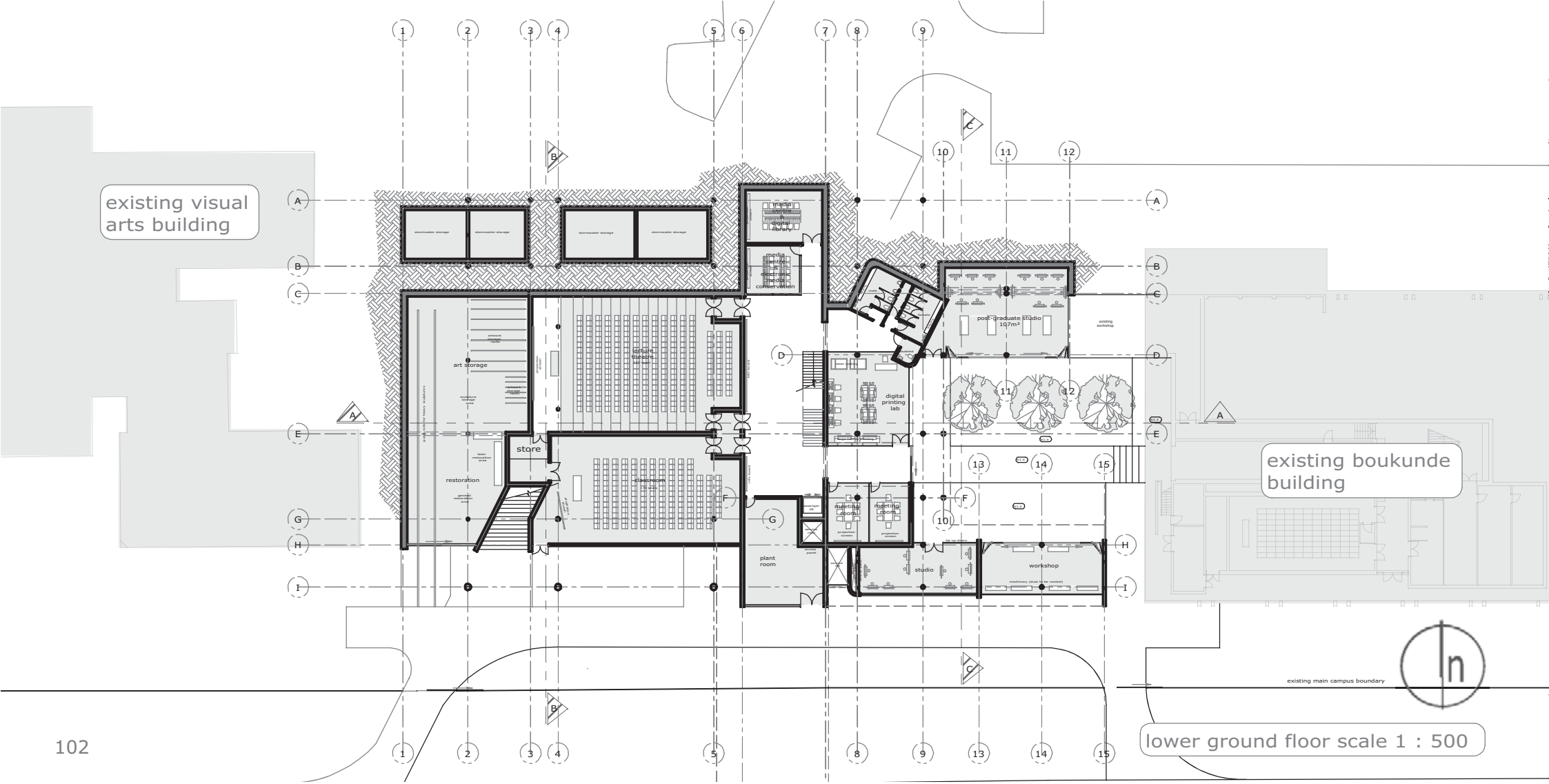

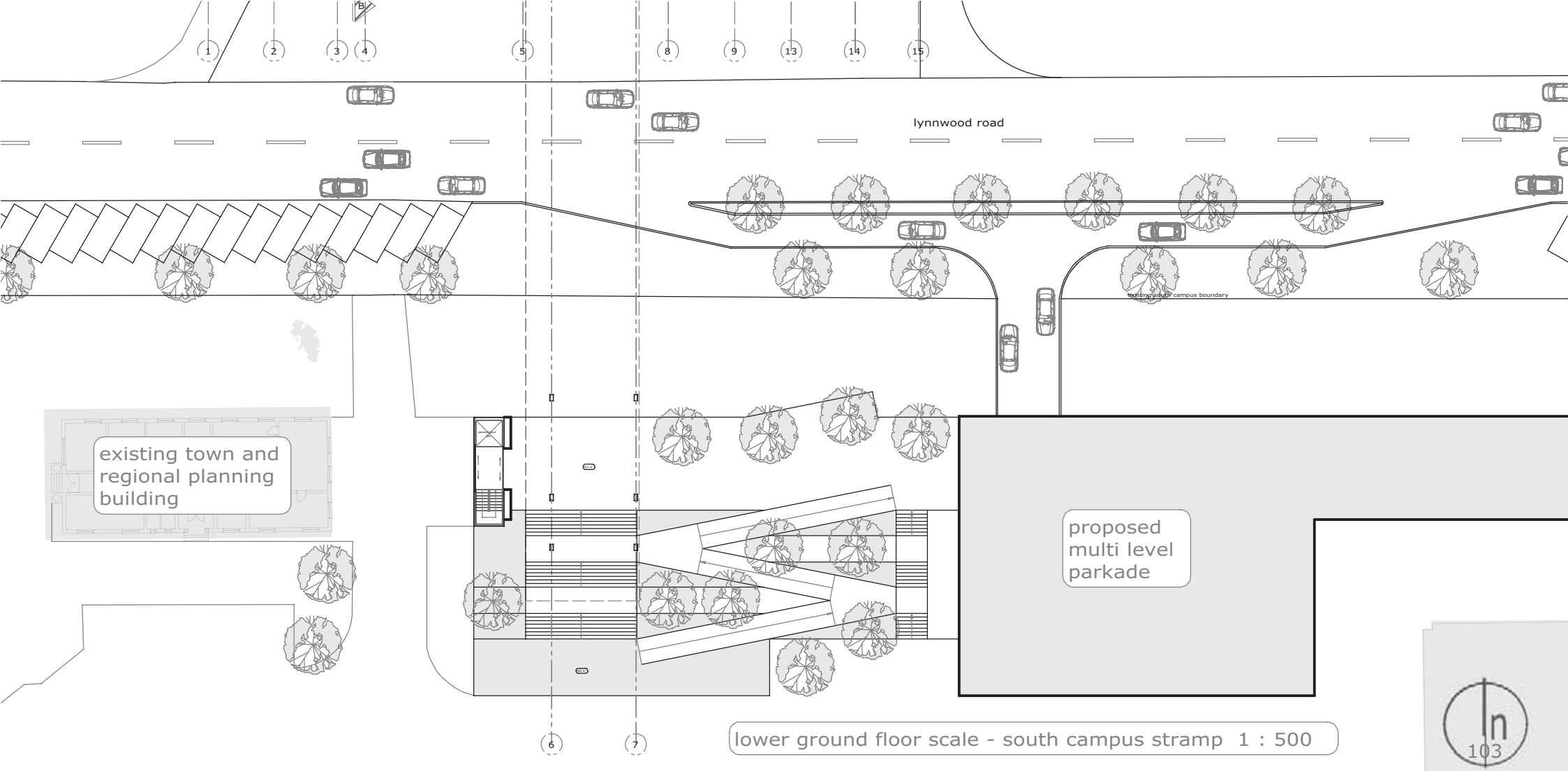

lower ground floor scale - south campus stramp 1 : 500

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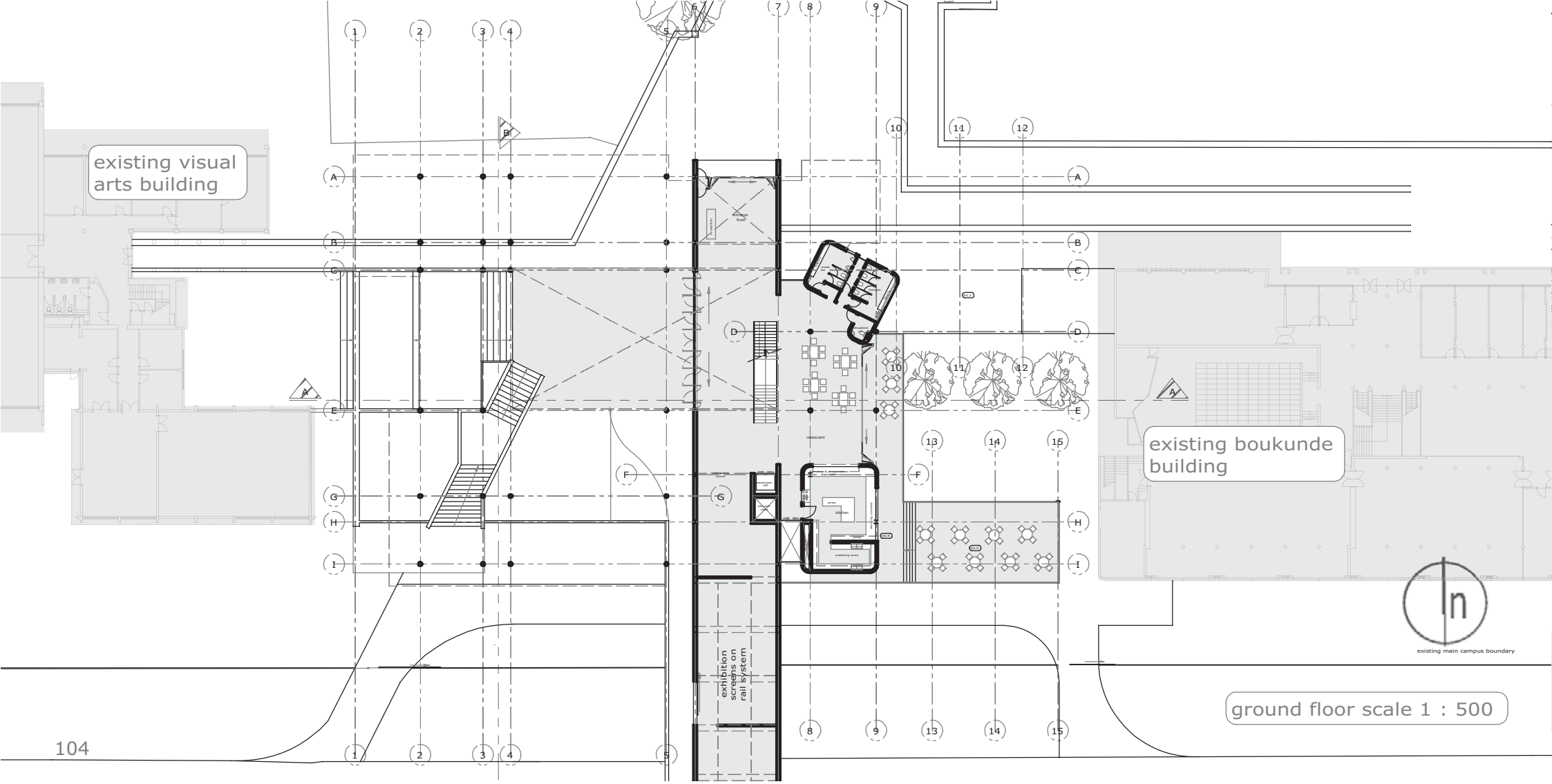

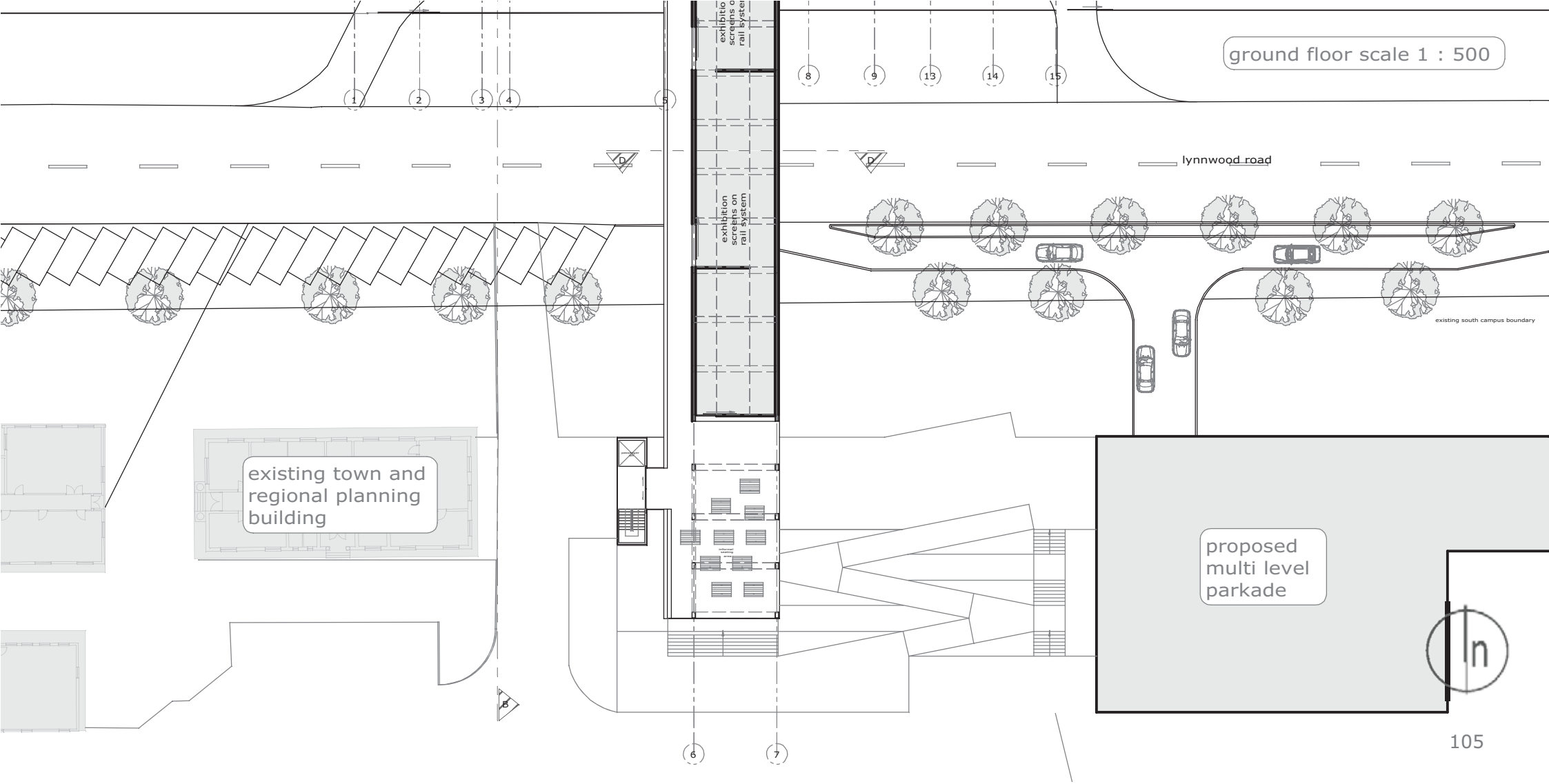

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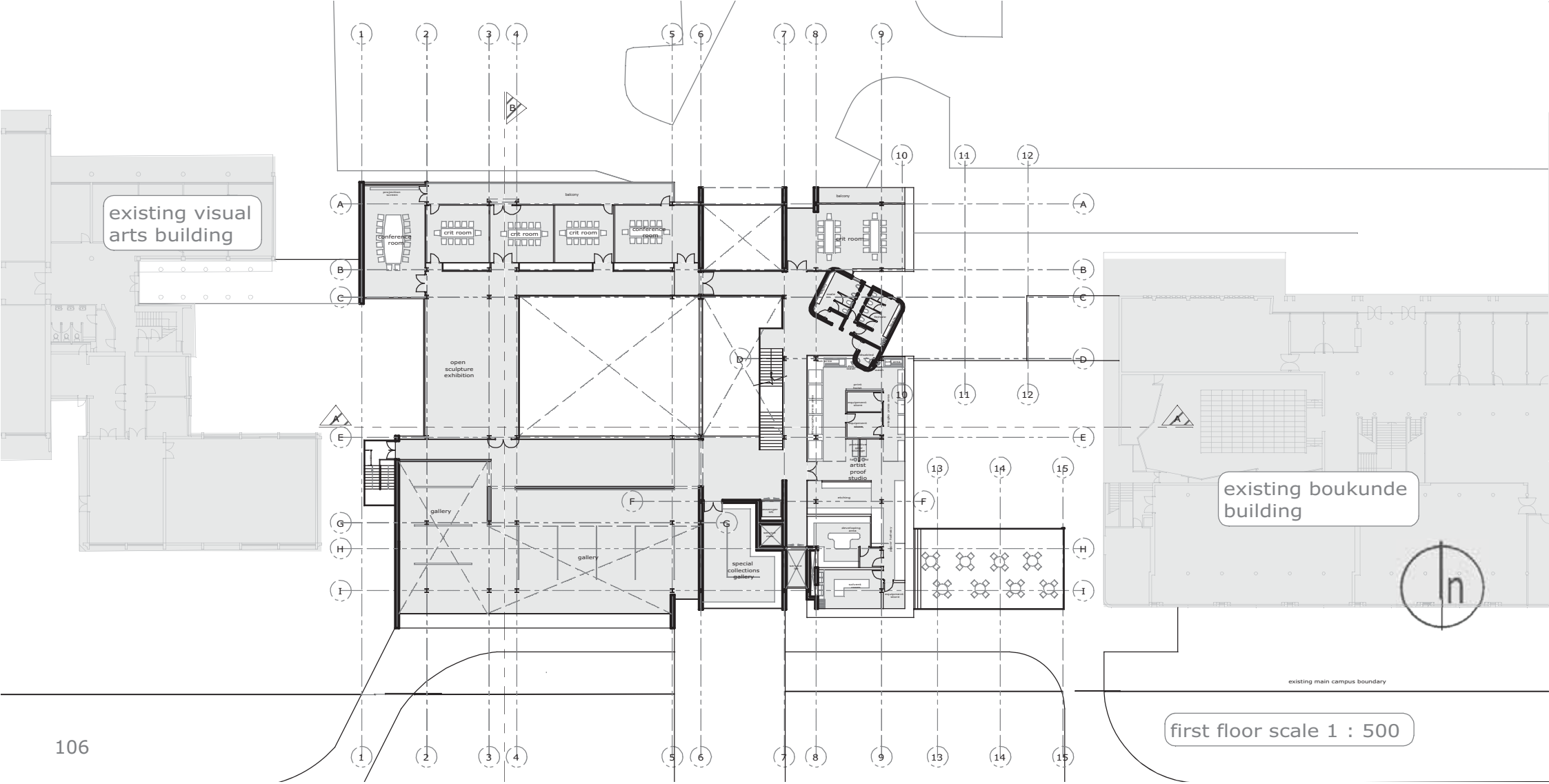

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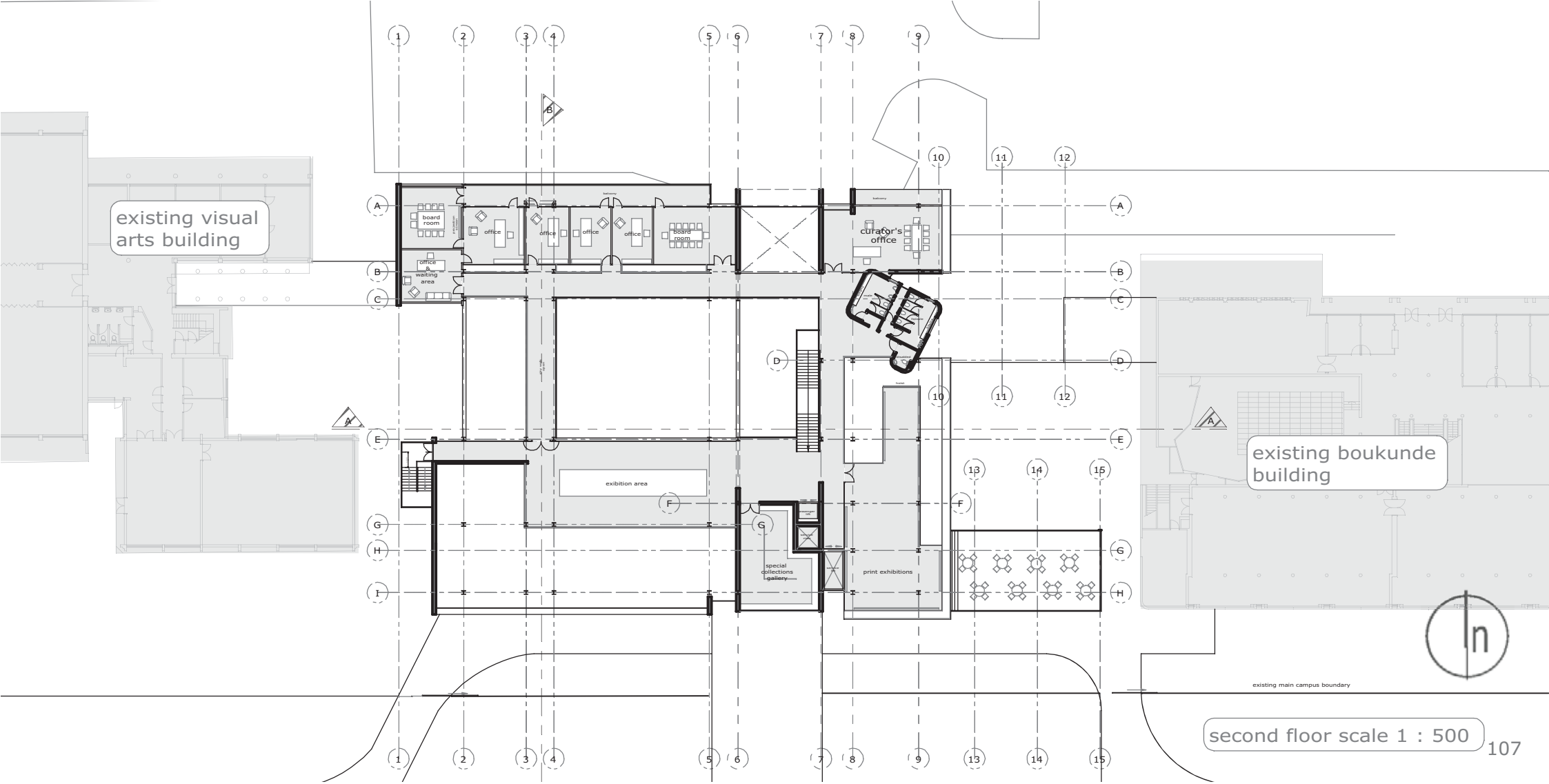

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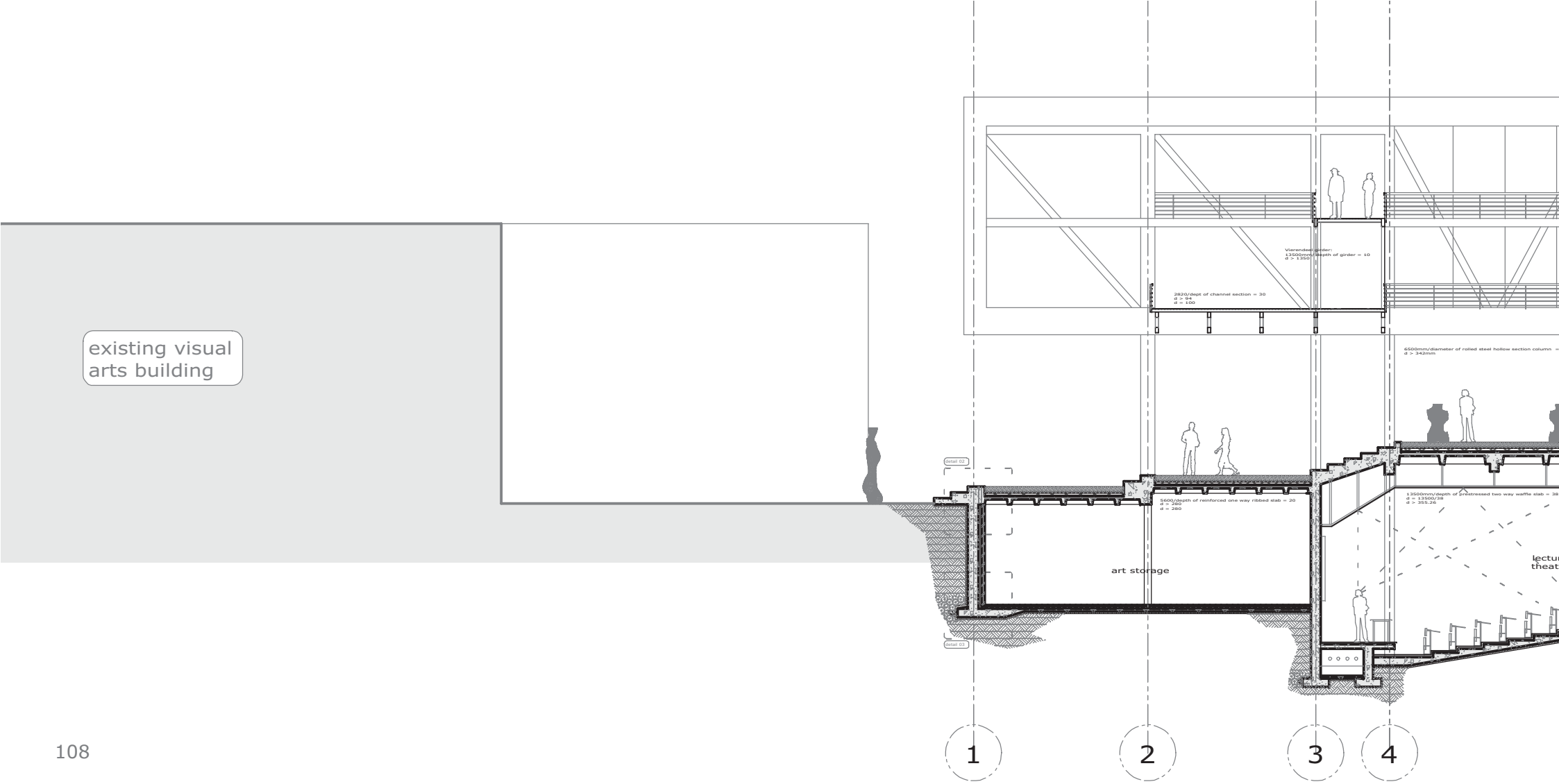
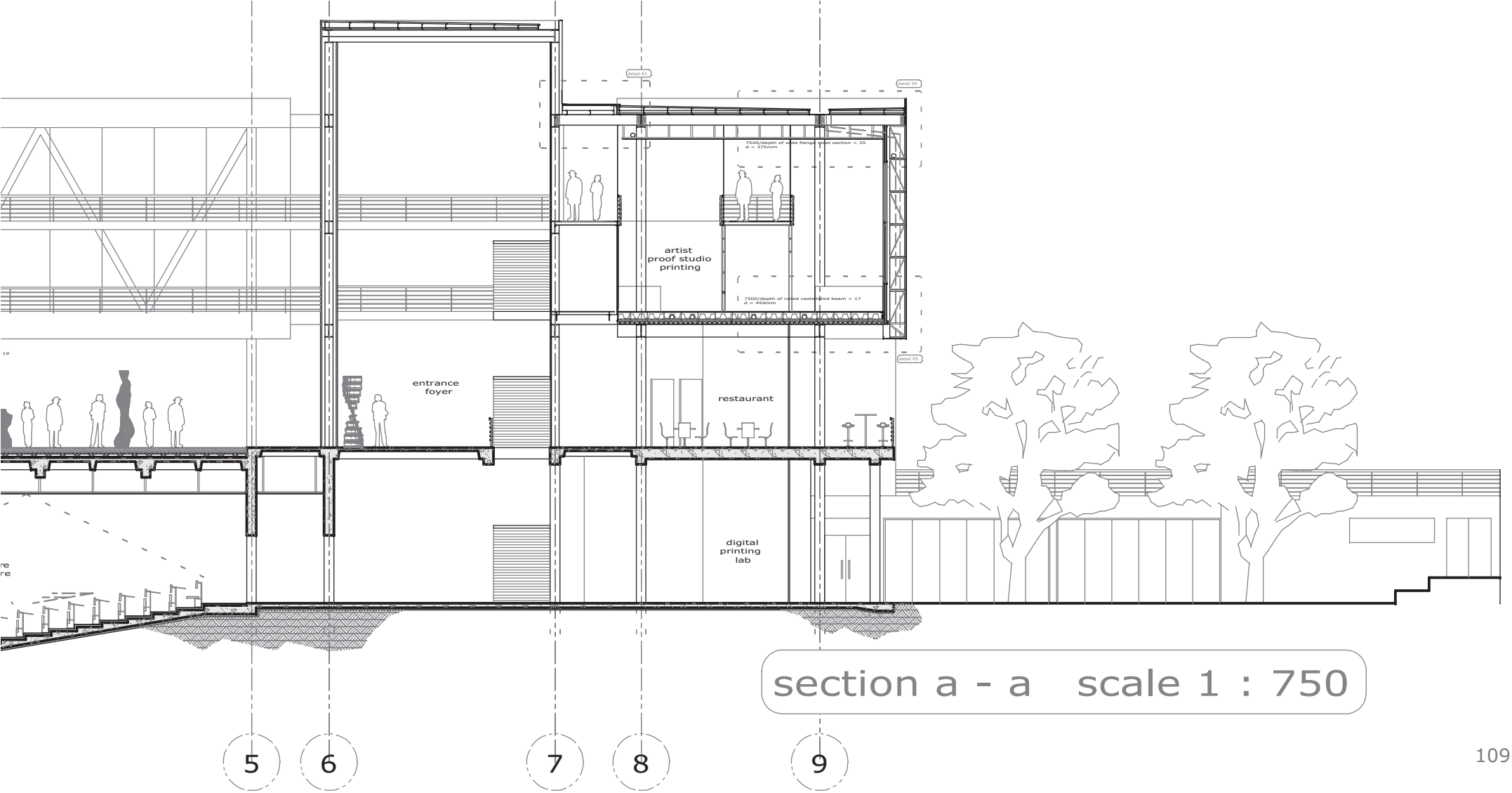
existing visual arts building





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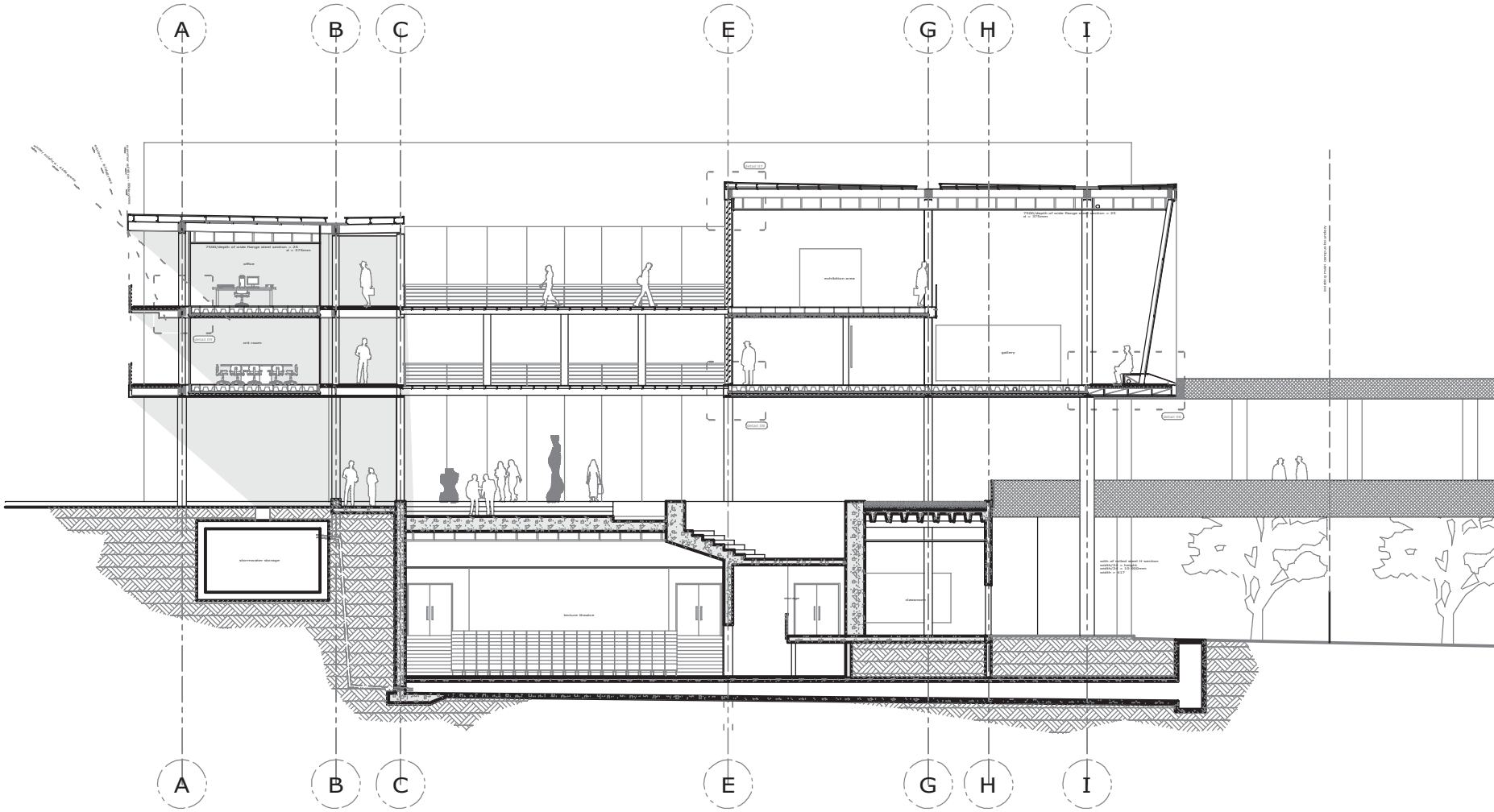

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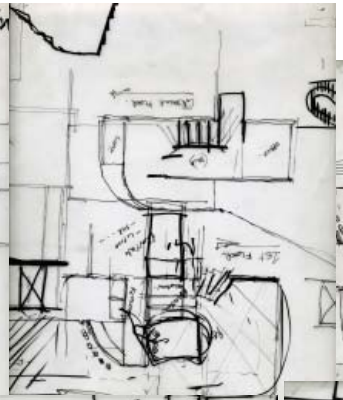
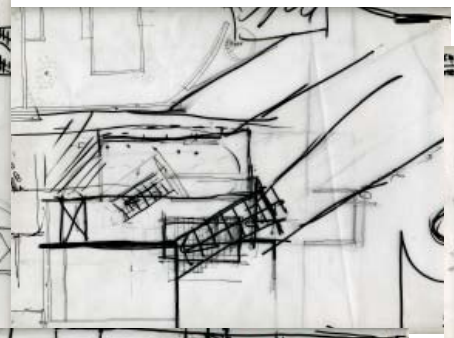
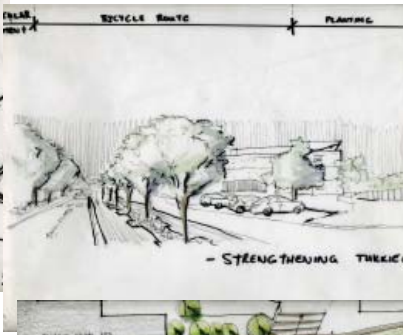
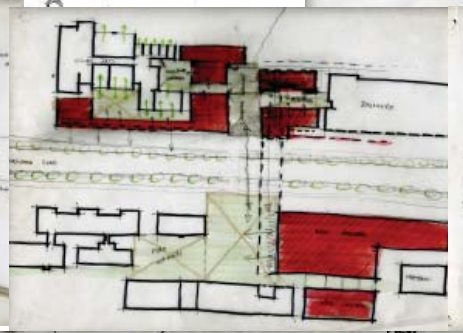
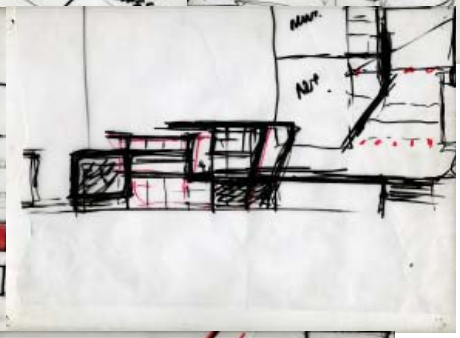
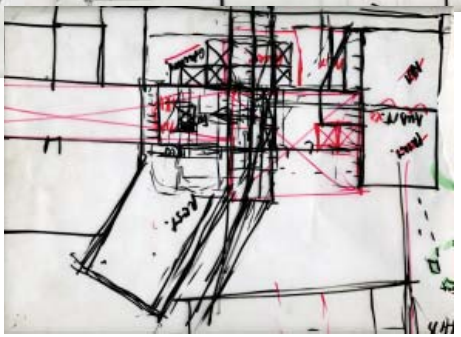
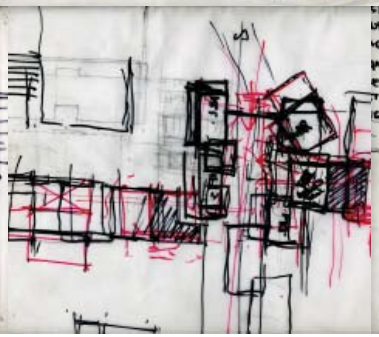
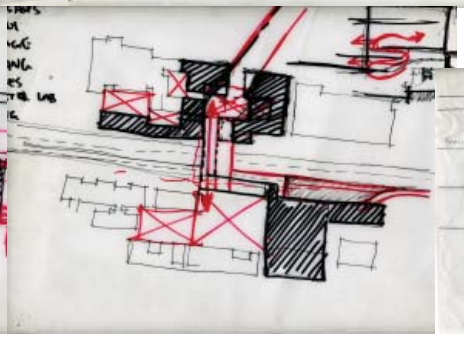
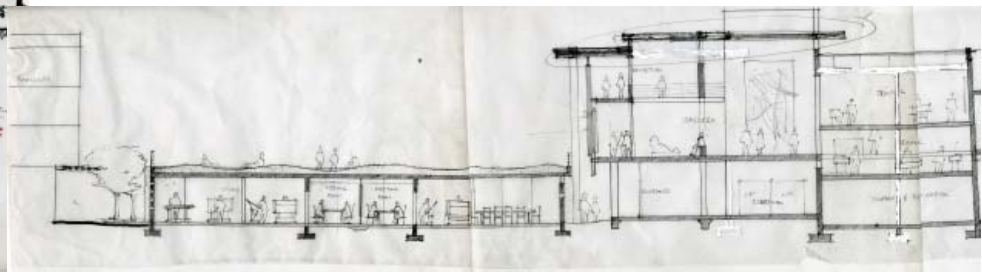
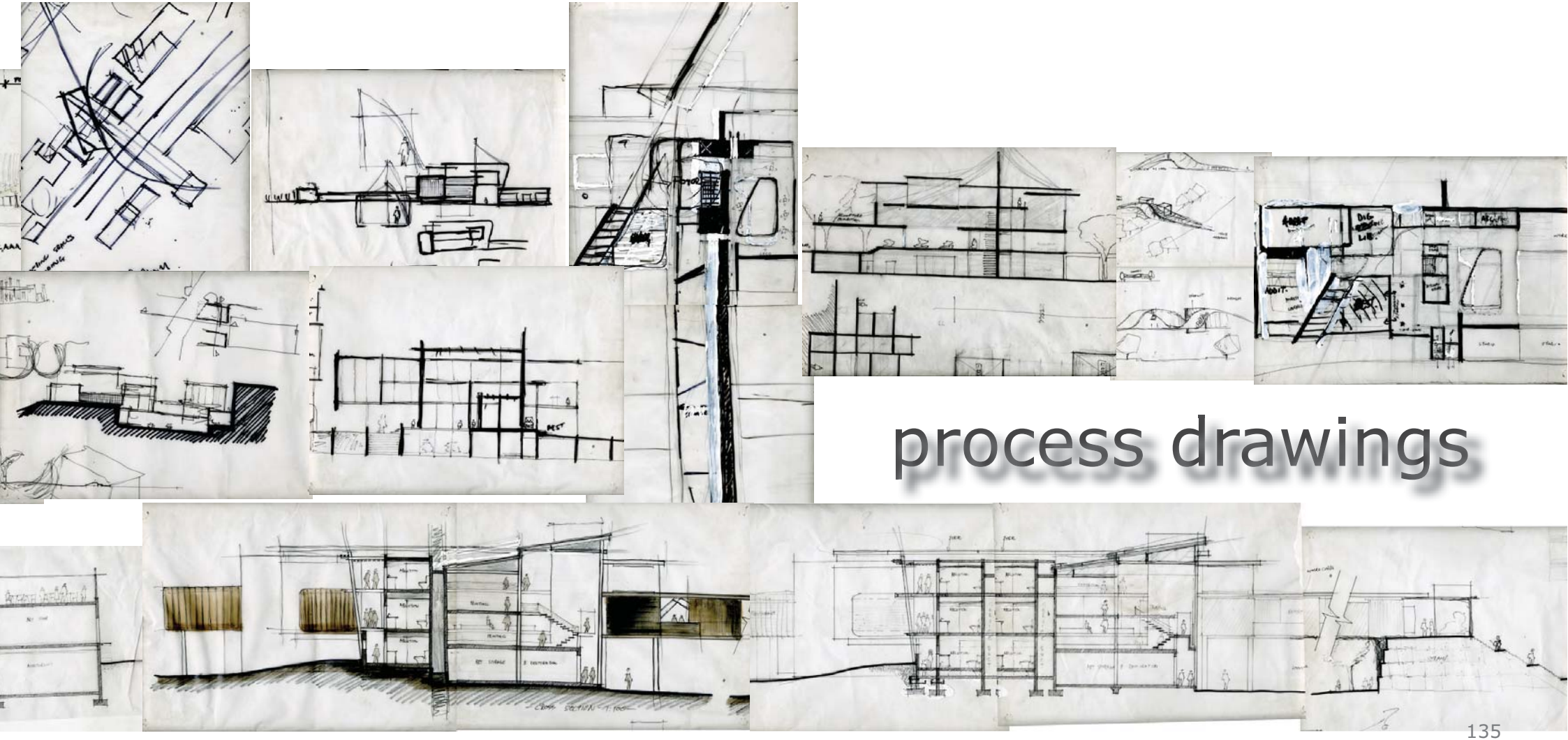
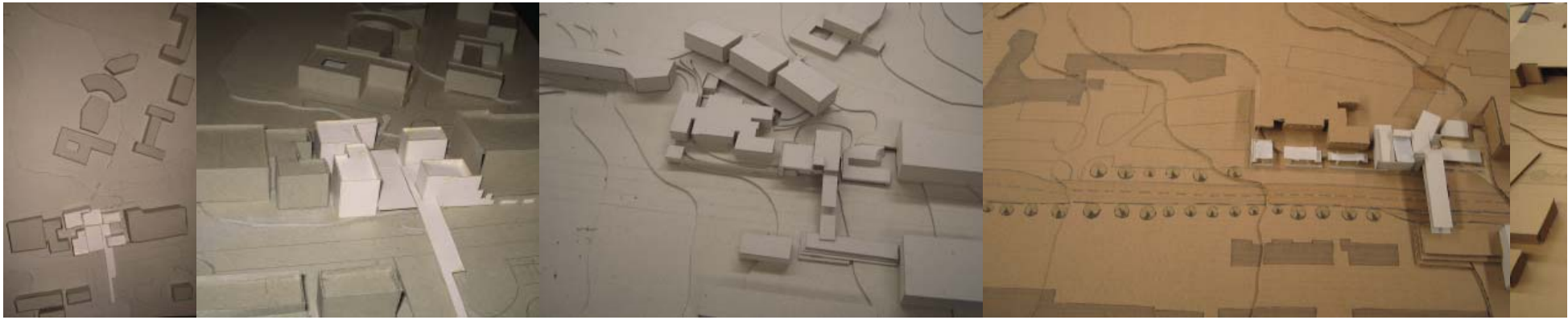




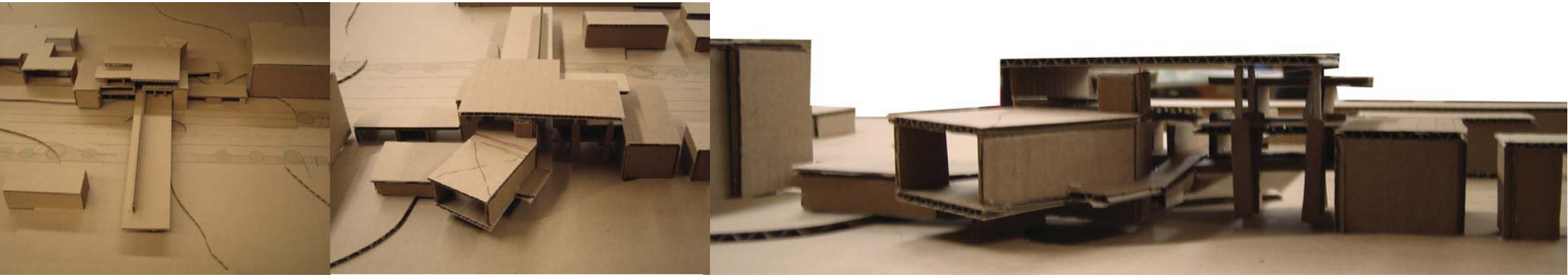






process drawings





physical process models

digital process models