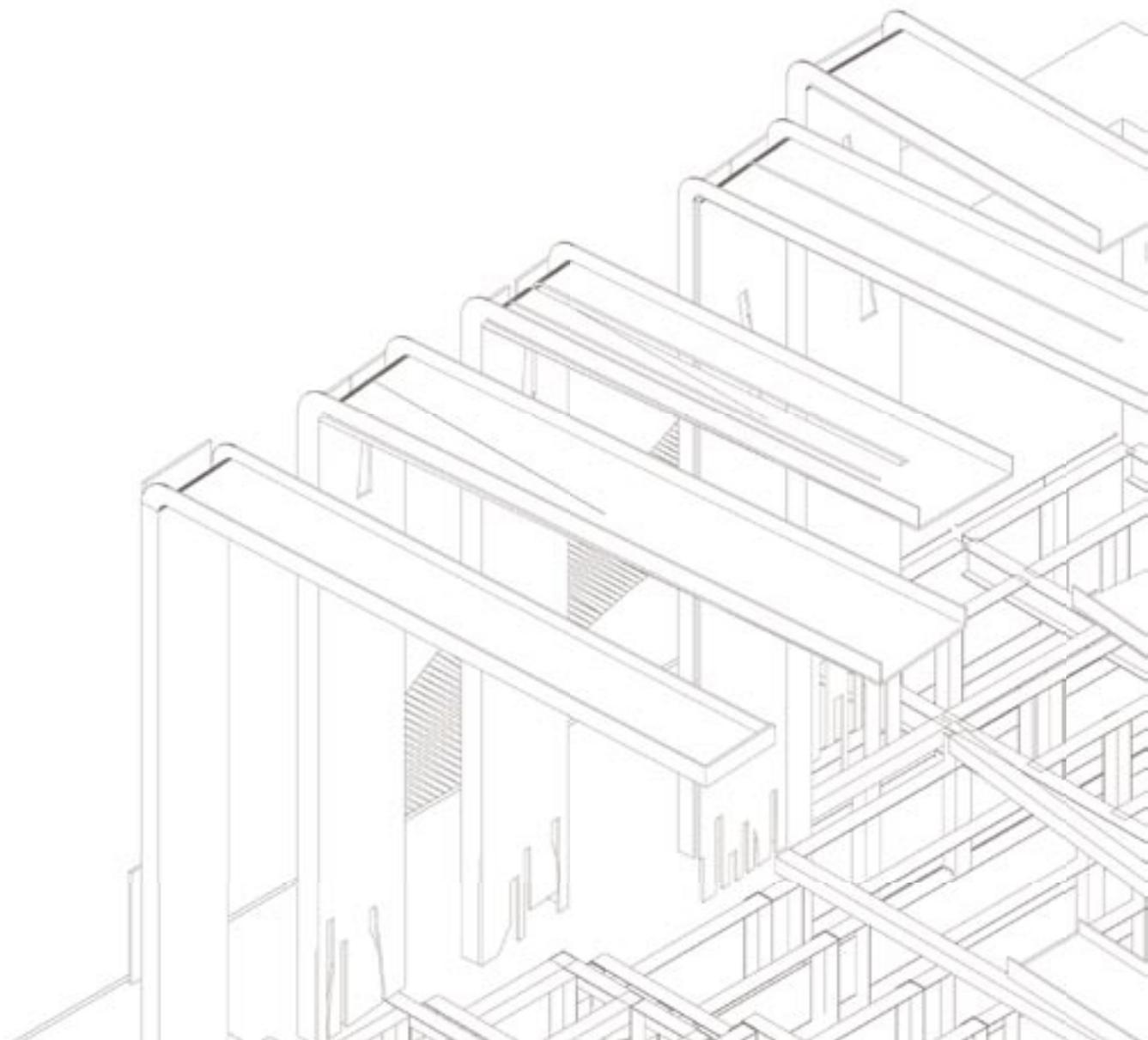
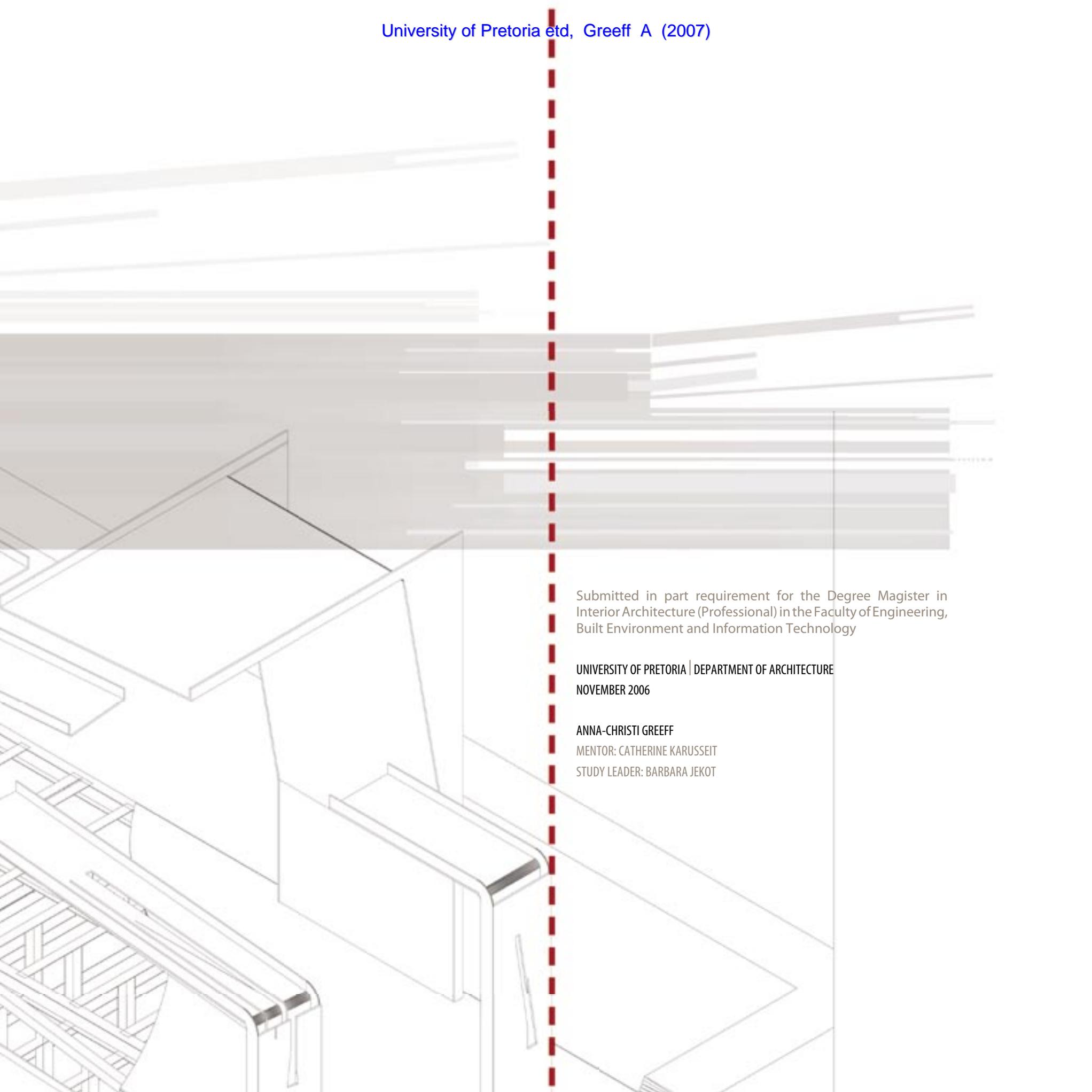


inter

**Active** Centre



The background of the page features a detailed architectural line drawing of a desk and chair. The desk is shown in a perspective view, with a curved front edge and a flat top surface. A chair is positioned in front of the desk, with its backrest and seat visible. The drawing is composed of thin black lines on a white background. A vertical red dashed line runs down the center of the page, partially overlapping the desk and chair drawing.

Submitted in part requirement for the Degree Magister in Interior Architecture (Professional) in the Faculty of Engineering, Built Environment and Information Technology

UNIVERSITY OF PRETORIA | DEPARTMENT OF ARCHITECTURE  
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# abstract

## Abstract

The Groenkloof Nature Reserve to the immediate south of the city is potentially an environmental treasure on Pretoria's doorstep. Apart from the indigenous flora and fauna and rich history of the reserve, there are existing but poorly-used facilities for recreation, education and adventure sports. At present the huge potential of this area is by no means fully realised. This ambitious design project aims to change this by creating an *Interactive Visitors Centre* in the reserve. Its objective is to design an exciting blueprint for enhancing existing facilities and introducing new ones. The focus of this bold, holistic approach is one of blending, and at times juxtaposing, elements of design in order to harmonise the interior and exterior architecture with the natural landscape.

## Opsomming

Die Groenkloof Natuurreservaat, geleë net suid van die stad, is 'n potensiële natuurlike pêrel op Pretoria se voorstoep. Afgesien van die inheemse plante- en diereryk, leen die geskiedenis van die reservaat homself ook tot moontlike, maar tans onderontwikkelde fasiliteite ten opsigte van ontspanning-, opvoeding- en avontuur vermaaklikhede. Die verborge potensiaal van die omgewing word tans nie ten volle ontgin nie. Hierdie projek poog om die interpretasie van die terrein te herdefinieer deur 'n *Interactive Besoekersentrum* in die reservaat daar te stel en te vestig. Die waagmoedige en holistiese aanslag op bestaande strukture is daarop gerig om deur samesmelting, en by tye jukstaposisie van ontwerpselemente, harmonie tussen binne- en buite argitektuur en die landskap te bewerkstellig.

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# glossary

## B: Glossary

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### *Conservation*

A term used in this research project as a collective term that refers to the safeguarding and upkeep of our cultural heritage resources, fauna and flora to ensure their continued existence for the enjoyment of many generations to come.

### *Cultural heritage resources*

A broad generic term that refers to ‘... physical and spiritual property with past and present human use or occupation of the environment, cultural activities and history ...’ (Küsel 2006: 4). The term includes sites or structures of archaeological, architectural or traditional importance to specific groups.

### *Edutainment*

Term used to describe a project or experience that has significant educational as well as entertainment value.

### *Footprint*

‘Ecological footprints provide a way to systematically measure the area of the Earth needed to sustain a nation’s annual consumption patterns’ (<http://www/ecologicalfootprint.org/>). Footprint size varies depending on how goods are made and how much we consume.

### *Green belt system*

The term generally used by the Tshwane Metro Municipality to describe the area of protected natural land that is situated between the urban residential areas and those demarcated for light industrial development to the south of Pretoria (Vermaak 2004: 3).

### *Green open spaces*

The *Tshwane Inner City Development and Regeneration Strategy* (2005:16), uses the term to refer to natural settings that are located within the built environment or a city context. Burgers Park and the Pretoria Zoo are examples of green open spaces in Pretoria.

### *Human space*

A term used in this research project to describe the space that a human body occupies and the space the body needs for free arm/ leg movement. This imaginary boundary is often referred to as *personal space*. An individual’s *human space* becomes the connection with his/ her environment.

### *Interactive*

This term, used frequently in this text, refers to the communication, interaction or interface between elements. The affiliation can be one of contrast or because of the proximity of the components. It may include visual elements (materials, context and spaces) or intellectual entities such as social, historical or cultural interaction.

### *Juxtapose*

The term is commonly used in discussions concerning art or architecture. In *The English Dictionary and Thesaurus* (1992:266), the synonyms for juxtapose are given as ‘put side by side’, ‘put together’ or ‘contrast’. In this project, the term refers to any two elements (colours, finishes or meanings) that are purposefully placed side by side to draw attention to their differences and/ or similarities.

BRIEF DOCUMENT

RELATE

ENHANCE

ACTIVE CENTRE

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## 1.1 Introduction

At the southern tip of Pretoria, a green belt system of protected natural vegetation forms a 'gateway' to Pretoria's Central Business District.<sup>1</sup> These green open spaces allow city dwellers the opportunity to experience the region's diverse fauna and flora within a few minutes' drive from where they live and work. Moreover, this part of Pretoria has a particularly rich cultural heritage; a number of monuments and artefacts in the area have made it a popular tourist destination. The Voortrekker Monument,<sup>2</sup> (Figures 2, 3), Fort Klapperkop,<sup>3</sup> and Fort Schanskop are nearby monuments that are visited frequently.

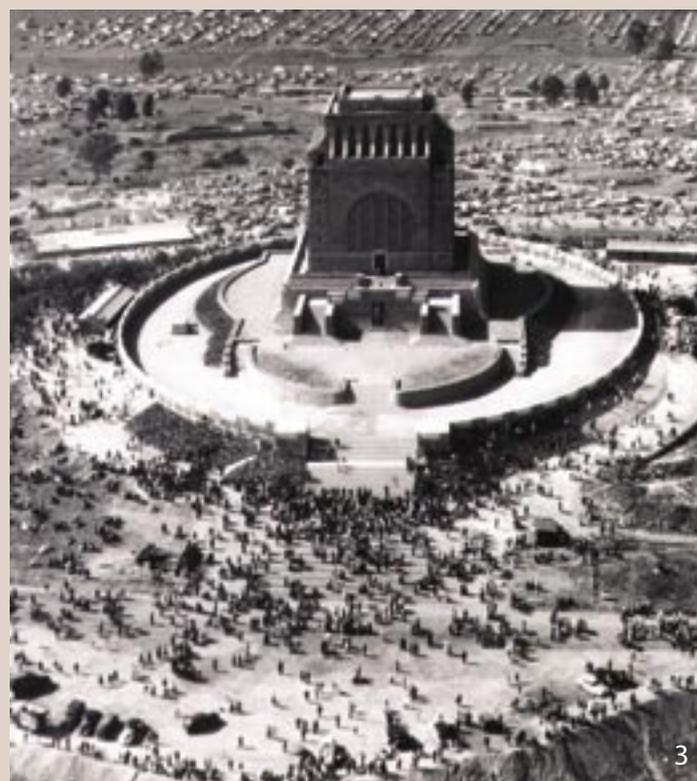
Between Monument Hill and Fort Klapperkop (Figure 1) lies the Fountains Valley, named after the two fountains that supplied Pretoria's water from as early as the latter part of the nineteenth century. To re-introduce the indigenous animals and exotic plant life that made this area so attractive to early settlers, the southern part (the red area shown in Figure 1) of Fountains Valley was declared a protected area in the late 1800s. This protected area is today known as the Groenkloof Nature Reserve (GNR) and it forms the macro site where this project is based.

The potential of Groenkloof Nature Reserve is currently under-realised by its user-group and by those who manage it from within the Tshwane Metro Municipality. Apart from its recreational uses, it could also play an important role in educating the youth of Pretoria about conservation. Such an endeavour could become an essential component in the continued existence of the natural environment and animal life close to our cities.

The dawning of the 20<sup>th</sup> century saw a shift of the collective consciousness worldwide, a determination to conserve the earth's natural and cultural heritage resources for future generations. South Africa's architecture and design industry, always slow to adapt to change, has only experienced this shift since the end of the apartheid era. This new approach is evident in the topics of discussion (see for example 'Responsible and relevant architecture', in *Opportunities for Relevance* by Marschall and Kearney: 2000), the widening

Figure 1: Map of southern Pretoria showing the macro site and surrounding natural areas

Figures 2 & 3: The Voortrekker Monument, located near the Interactive Centre, embodies the heritage of Afrikaner nationalism





range of materials and recyclable products used, as well as in recent projects such as Blue IQ's development of world heritage sites (cf. 3.1).

The chosen site within the GNR (Figure 1) is an ideal setting to study the effects of combining synthetic artefacts with a natural environment. The GNR attracts crowds of active young cyclists and groups of schoolchildren annually, which makes for an educated, enthusiastic target group in which to cultivate awareness. The *Interactive Centre* is a design proposal that show-cases the research undertaken. The purpose of the project is to explore a design that enhances the city-dweller's awareness and appreciation of a unique natural resource: Groenkloof Nature Reserve. The dynamics of this project lie in the juxtaposition of perceptions, styles and functions. Eco-friendly design and sports-design are combined to good effect, while conventional architecture is offset against new technology. In addition, the GNR as a whole is juxtaposed with the Pretoria CBD. The research and design of this project aim to prove that through design, contrasting elements can facilitate interaction between man and nature.

## 1.2 A real world problem

'The simple truism  
that we will never conserve what we do not love  
and that we will not love what we don't  
understand,  
and that we won't understand what we have not  
been taught,  
is as true today as it was decades ago ...'

Ian MacDonald, CEO of the World Wide Fund  
for Nature ([www.deltaenviro.org.za](http://www.deltaenviro.org.za))

The past century has seen the vast expansion of metropolitan areas worldwide and as a result, green open space in urban areas has diminished. While most city-dwellers only experience urban living, the need for a place of 'escape', to reverse the negative stimulation of the city, is always present. At the heart of this is the primitive desire for people to connect with nature. To satisfy this need, modern technology offers various avenues of escape such as television (Figure 4), animated games (Figure 5) and virtual imagery

provided in the interiors of buildings (Figures 6, 7). In this way, technology can replace some of nature's roles where no natural resources are available. These developments are especially helpful in a country like Japan where a high population density makes for a stressed and often poor quality of life.

In a country such as South Africa which is far less developed, technology serves a different purpose. Parents and teachers view television programmes and games as edutainment, thus justifying them as an effective tool to educate the youth. However, it is clear that this should not be the only means to teach the public of the wonders of nature. Digital representations pale in comparison to the personal experience of being at one with nature and among animals in their natural habitat.

The public needs to be made aware of how precious our green open spaces are. An educational centre such as the proposed *Interactive Centre*<sup>4</sup> is a contribution to this endeavour as it combines nature and technology to encourage awareness of a unique natural area. The Centre uses design principles to relate our city-environment to the surrounding natural setting. The Centre does not aim to find a solution to other international environmental concerns; its design is a site-specific investigation into facilitating interaction between the city-dweller and the nearby natural environment.

### 1.3 Problem statement

In line with international concerns for conservation (cf. 1.2), this project addresses the physical and design constraints of the chosen site. These constraints were identified after studying the site, conducting interviews with the users

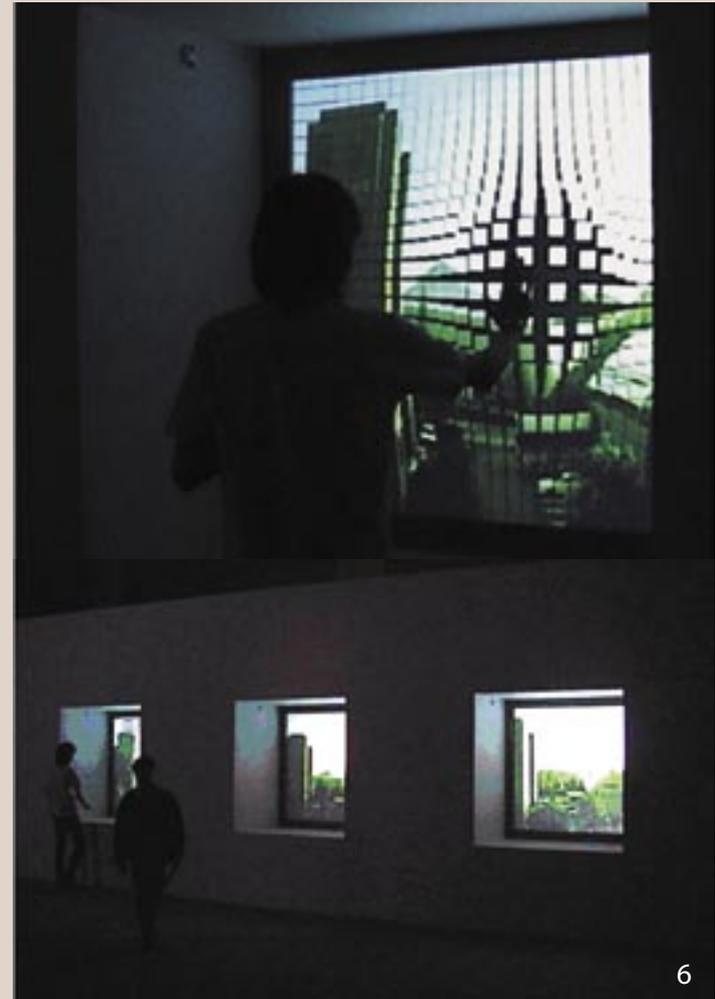
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Figure 4: The Discovery Channel website with information on television programmes dealing with environmental issues

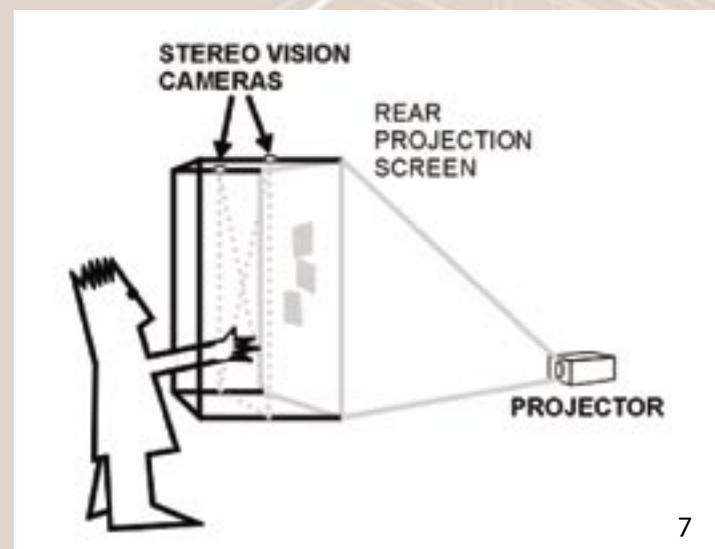
Figure 5: The Namco Playstation game, 'Soul Calibur', in which the user is involved as an action figure that explores super-real animations of ancient lands

Figure 6: The Extruded Window project at an exhibition hall of the Softopia Japan Centre in Gifu

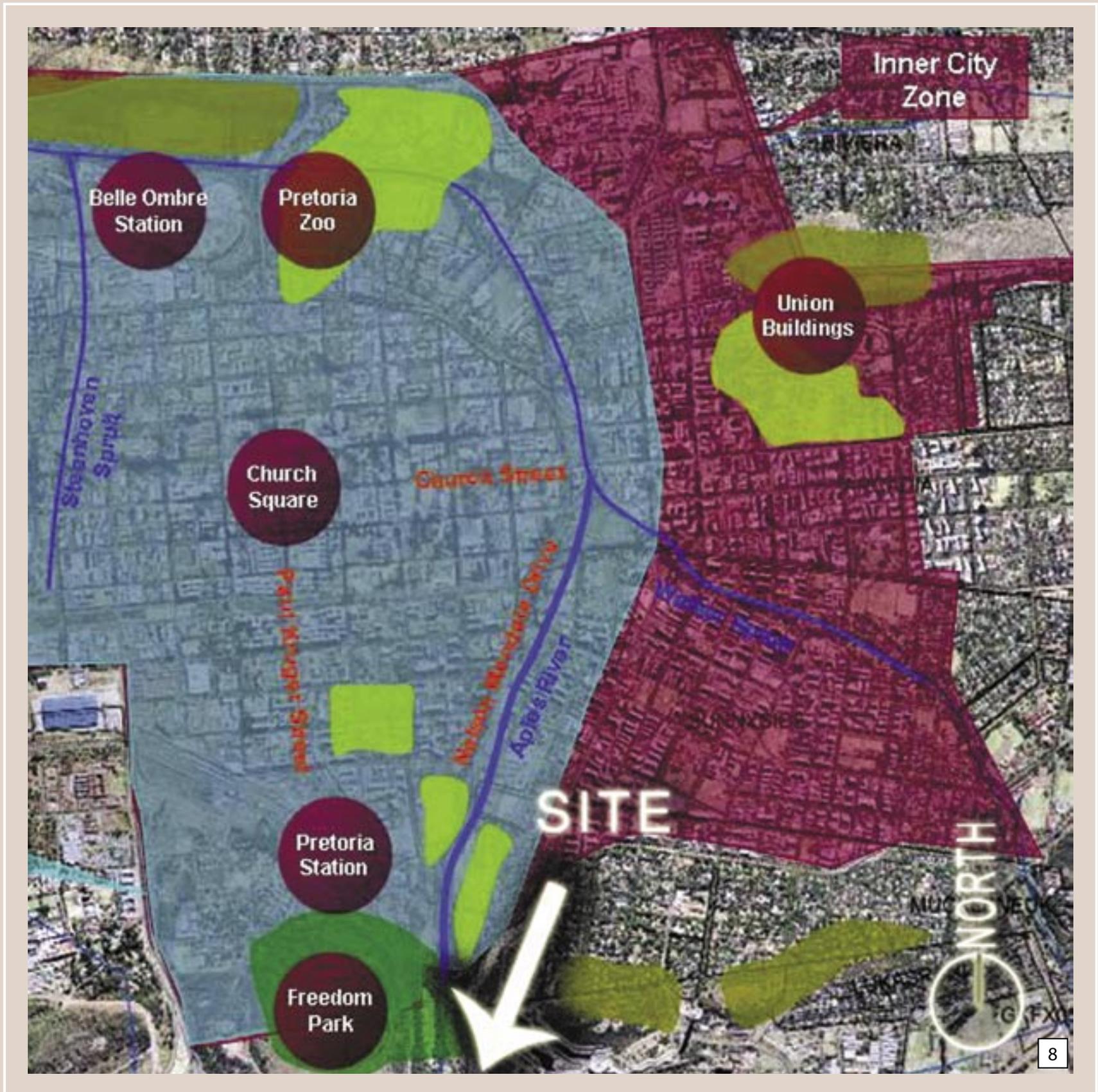
Figure 7: Cameras capturing the real image which is then projected onto screens to create the 'extruded windows' effect



6



7



and managers of the GNR, and collecting information on similar design projects both nationally and internationally (cf. 3.1-3.5).

### 1.3.1 PHYSICAL CONSTRAINTS

1.3.1.1 *The character of the GNR sets limitations such as the need to consider the sensitive fauna and flora*

1.3.1.2 *The public of Pretoria is under-utilising the GNR's recreational facilities seeing that the reserve has no marketing strategy in place.*

1.3.1.3 *The GNR, managed by the National Parks Board, is a non-profit organisation, thus the funding depends on the backing of the community and sponsors.*

### 1.3.2 DESIGN CONSTRAINTS

1.3.2.1 *The Interactive Centre is a project from inception, and the new functions of the Centre have to be suitably integrated with the existing infrastructures and design-ethos.*

1.3.2.2 *The challenge is to prove that through design, the user can feel a part of his/ her surroundings. This in turn will*

*make the user relate to and interact with the landscape. Ultimately, this interaction must lead to educating the user about conservation.*

1.3.2.3 *The Interactive Centre will be used by mountain bikers, hikers, learners and families alike, therefore the design must acknowledge the unique combination of ecological design as well as sports design.*

## 1.4 Project brief

The macro project

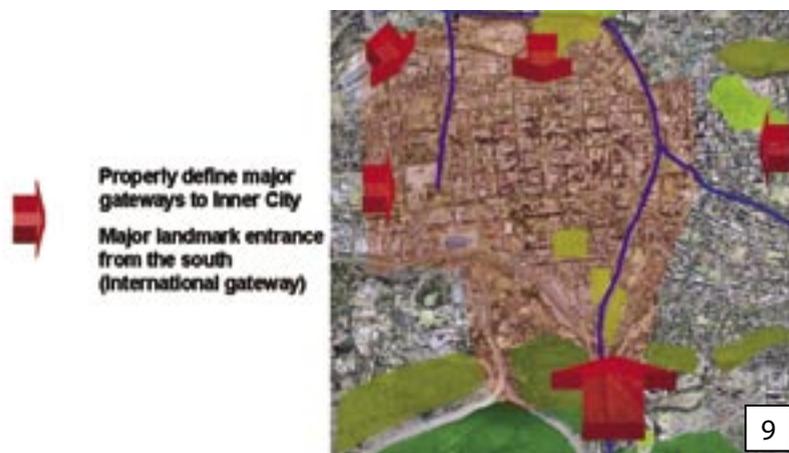
The City of Tshwane Metro Municipality plans to develop the green open spaces, including both the Groenkloof Nature Reserve and Fountains Valley, as the southern gateway to Pretoria CBD. This is in accordance with the *Tshwane Inner City Development and Regeneration Strategy*, a document that was compiled by the Municipality in 2005 to 'lay the foundation for the repositioning and regeneration of the Tshwane Inner City' (2005:4).

In the *Tshwane Inner City Development and Regeneration Strategy* (2005:16), it is argued that there is a need to establish the GNR as a sought-after destination within the southern gateway to Pretoria CBD. The Municipality sees the project of developing the area as an investment in the wildlife and habitat conservation of the protected green strip that also includes Klapperkop and Salvokop (Figures 9, 10). Part of the ambitious Tshwane strategy is to link these 'significant

Figure 8: A map of Pretoria CBD to define the focus areas of the Tshwane Inner City Development and Regeneration Strategy, edited to show the location of Groenkloof Nature Reserve

Figure 9: The Tshwane Regeneration Strategy's building block 1 is 'Defining the gateways' (p.17) to Pretoria CBD. Main gateway shown is the southern gateway, where Groenkloof Nature Reserve is located

Figure 10: Maps of Pretoria CBD to illustrate the southern gateway, and how the green open areas are linked



green open spaces in an impressive natural setting' within the next ten years (2005:16). According to David Boshoff, the GNR is to be linked with Klapperkop and Monument Hill by easily accessible underground tunnels, creating one great reserve. Apart from conserving natural and cultural heritage resources, the project serves as a possible income generator and a job creation prospect for veld guides, artisans, and various entrepreneurs. By empowering the community throughout the process of the project, the *Interactive* Centre becomes self-sustaining in each phase of its development.

## 1.5 The client brief

### The micro project

The brief is to design and develop a visitors' educational centre in accordance with the requirements of the GNR management and the Tshwane Metro Municipality. The Centre will be a point of orientation and provide visitors with after-cycling/ hiking activities and services. As part of the proposal, provision must also be made for the larger GNR (including game viewing areas) to optimise the potential of the GNR's resources.

The existing structures on the chosen site should be used as extensively as possible, as indigenous knowledge is vital in preserving the memory of the historical relevance of the area. In addition, all new proposals for the development of the Centre as well as the larger reserve must respond to the ecology in a manner that supports conservation of the natural and historic resources of the GNR.

The Centre is to have the following facilities:

#### 1.5.1 INFORMATION SERVICES:

These include an educational exhibition and an information 'front' desk where visitors will be provided with brochures on the various trails. A veld guide will also be available for groups of learners.

#### 1.5.2 RESTROOMS AND SHOWER FACILITIES:

Existing amenities will have to be upgraded and extended where necessary.

#### 1.5.3 LECTURING FACILITIES:

Facilities will be made available for formal and informal lectures, as well as gatherings/ meetings held by mountain bikers and the GNR staff. The provision of office space is optional.

#### 1.5.4 RECREATIONAL FACILITIES:

These include income-generating initiatives that will provide a supplementary income for the Centre. A refreshment stall and small curio shop could provide after-cycling/ hiking services and activities.

## 1.6 The site selection

### Site within the GNR

A study of the existing architecture within the GNR reveals that most of the buildings comprise conventional steel, brick or wooden-pole construction and that the only building of some historic and aesthetic value is a brick structure currently functioning as an overnight shelter (Figure 15: A, B). In this vicinity there is a degree of infrastructure, as opposed to the other buildings on the GNR that are in isolated parts of the reserve.

The appointed site is located in the southern part of the GNR (Figure 15). It currently serves as a recreational point where visitors meet before they hike, cycle or overnight at the Groenkloof Nature Reserve. The administration and managerial staff are located on the premises (Figure 15: marked B). The process of selecting an appropriate site within the GNR involved a study of the existing architecture, landscape, and the needs of the users (cf. 2.2 - 2.4).

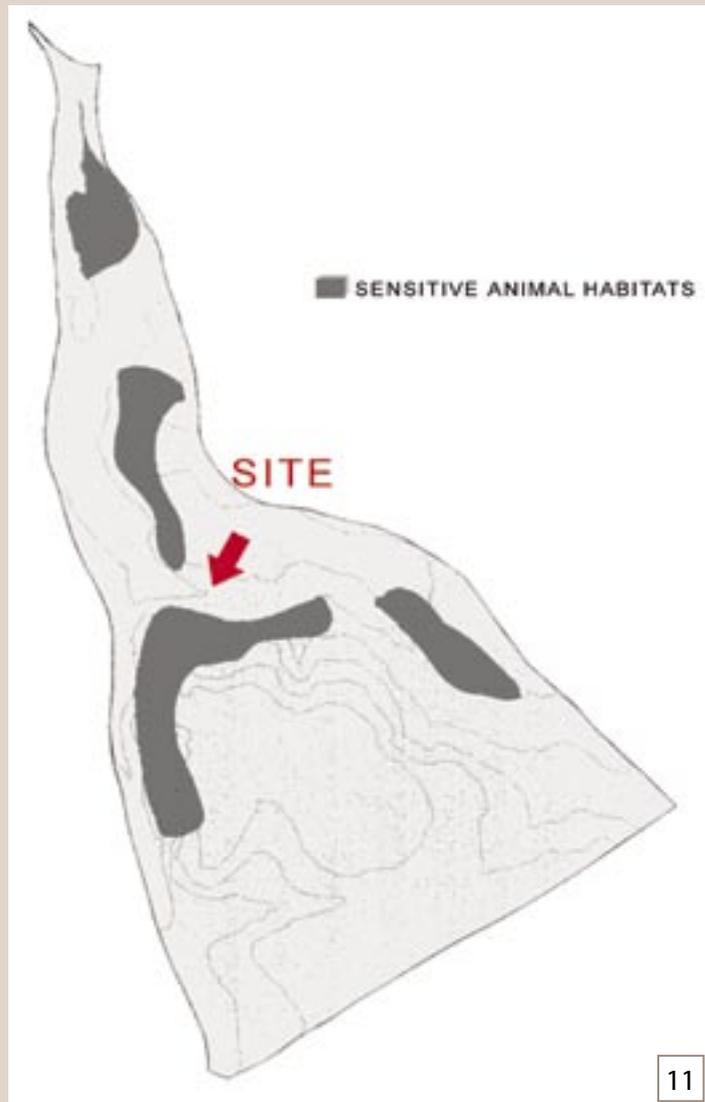
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Figure 11: Results of a study to identify sensitive animal habitats in the Groenkloof Nature Reserve

Figure 12: The face-brick building that currently functions as an overnight hut

Figure 13: Cyclists leaving through the secondary gate

Figure 14: View as one enters through the main gate upon arrival at the site





The landscape study revealed that the same area mentioned in the architectural study (Figure 15) is where most of the indigenous plant growth has been destroyed due to human and vehicle traffic. It is a 'disturbed grassveld' (Figure 11) landscape. This area is located opposite the overnight hut and is the point of arrival and departure for all the cycling, hiking and 4x4 trails (Figure 15: marked C). There are also two beautiful views to the south from this particular point (Figure 15: marked X).

A study of the users' needs (cf. 2.1) indicated that the facilities required in the proposed Centre would have an educational and recreational role to play within the GNR. This means that the location of the chosen site must be where visitors are most likely to need amenities and other facilities. The site also has to be visually attractive to create a lasting impression of the GNR.

*To summarise the findings of the research done, the location of the proposed Interactive Centre should be in the area where:*

- an intervention will have the minimal negative effect on the indigenous plant species
- movement of visitors to the GNR is highly concentrated
- the *Interactive Centre* is most likely to act as an enabler for visitors e.g. facilities for the cyclists and hikers before they commence their trails and upon arrival
- visitors are able to enjoy beautiful vistas of the surrounding area

Other factors that influenced the final decision on the location of the site, were the safety factor (the site is secured by a guarded entrance as well as wildlife fencing all along the perimeter) and the position of other buildings on the site (walking distance from the Youth Camp and the managerial offices marked B).

---

Figure 15: Diagrammatic map of the selected site to show existing functions

## 1.7 Design approach

'To dwell

between heaven and earth means to settle in the multifarious in-between

that is, to concretize the general situation as a man-made place ...

a study of man-made place therefore ought to have a natural basis:

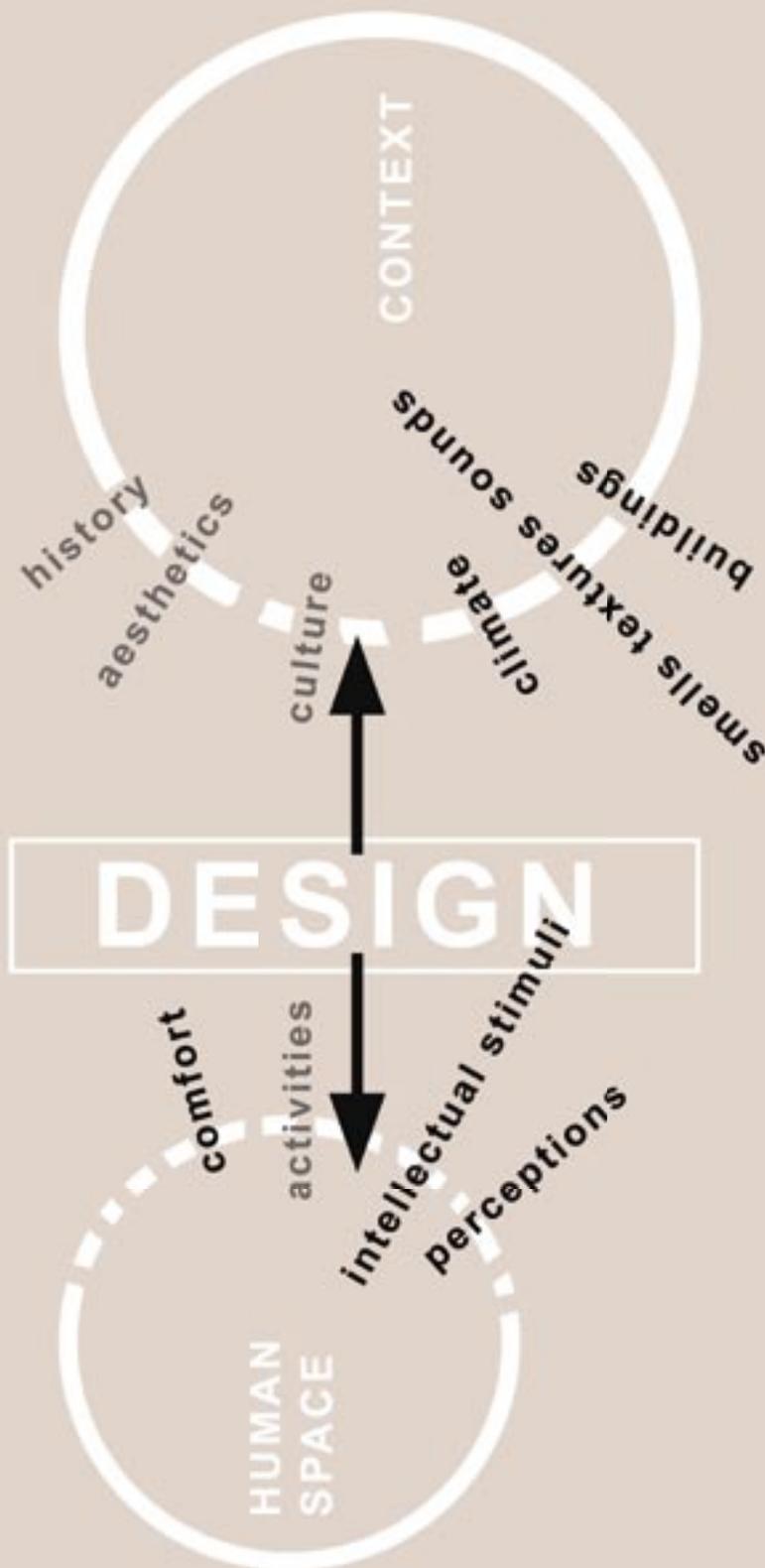
it should take the relationship to the natural environment as its point of departure.'

(Norberg-Schultz 1979:50)

In order to design a visitors centre within the given physical and design limitations (cf. 1.3) it is necessary to establish a framework on which to base decisions. The design philosophy, in other words, is shaped by the specific implications of the project and must respond directly to its context or site.

### 1.7.1 CONTEXTUALISM

The architect Jacques Blondel laid the foundations for a theoretical architectural trend known as contextualism. Blondel claims that '... architecture should be apprehended in its total setting or context ... contextualism bridges the gap between artistic feelings and human qualities and needs' (Lesnikowski: 1982, 49). This implies that a man-made artefact necessarily becomes an inseparable part of its surroundings and in responding to the context, the designed artefact responds to the needs of the users. This concept leads to the argument that interior architecture is an inseparable part of the 'total setting or context'. The Interior Architect focuses on problems pertaining to the function and quality of the interior environment (IFI General Assembly 1983) and of the intimate environment of a user (termed *human space* in this document). According to Kurtich and Eakin, quoted by Hildebrandt in *Design Intelligence* (2004:4), 'Often Interior Architecture is applied to the inside of a building as design elements that are carried to the exterior, establishing a holistic creation'. Interior architecture thus ensures that the interior environment relates harmoniously with the exterior environment, which makes for a building that responds in its totality to the context. The diagram (Figure 16) illustrates the



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areas in which *human space* (definition cf. B) interacts with the environment. John Dewey is of the opinion that to be human is already to be interacting, to be having experiences (Hook: 1995, 217).

### 1.7.2 DESIGN GUIDELINES

The primary aim of the *Interactive Centre* is to promote the education and awareness of conservation in the proximity of a city-context. The building and landscape development should enhance this central theme and visually communicate the Centre as an adventure-sport and eco-tourist facility. The design method is divided under two imperatives: to *Relate* and to *Enhance*. These two words encapsulate the guidelines for decision-making throughout the design process.

#### 1.7.2.1 *The need to relate*

The interior, exterior and landscape architecture must all relate to the surroundings both physically and functionally.

##### *Physical attributes*

The physical attributes of the architecture comprise the materials and technology used in the Centre and the way in which these relate to the natural area. The materials used throughout the Centre are designed to relate visually to the surroundings by responding to the historical relevance and indigenous knowledge imbedded in the GNR. A building does not necessarily need to imitate nature in order to co-exist in a natural environment. The architecture should be honest in the materials used. In addition, as the Centre is a responsible and responsive design intervention, it should tread sensitively on its natural context, both aesthetically and ecologically.

##### *Functional attributes*

For the Centre to relate to its surroundings through its functional attributes, the activities and facilities should consider the needs of the focus user groups (cf. 2.1).

##### *The centre must thus take into account:*

- Eco-tourism and the needs of eco-tourists.
- The unique diversity of users at the GNR, including the sports enthusiasts.

Figure 16: Human space connects with context by means of design

- The facilities needed by cyclists and hikers when they return to the Centre.
- The main educational theme of the Centre.
- The proximity of the Pretoria CBD.

#### 1.7.2.2 *The need to enhance*

While relating to its environment, the design method must also be aimed at enhancing and complementing the site, through its tangible and intangible attributes.

##### *Tangible attributes*

The existing structures on the site should be enhanced by using appropriate new architectural ‘add-ons’ to the old structures. The visual impression of the Centre should communicate an architectural intervention that complements the general style that already exists in the GNR. The design should therefore take cognisance of the indigenous knowledge of the area. The project includes various contrasting factors such as the new architecture that plays off against the natural background. By juxtaposing (definition cf. B) the contrasting elements with one another, a dynamic visual interplay is established: new and old, conventional and modern, and natural against synthetic.

To enhance the natural environment, the Centre should integrate the unique beauty of the flora of GNR into the project’s landscape development. The re-introduction of indigenous plant species to the chosen site (which is disturbed grassland) will enhance the ecosystem of the GNR.

##### *Intangible attributes*

Glen Murcutt addresses the proposition that ‘...architecture – built form – can act as cultural repository, triggering and enhancing awareness of local identity’ (Beck and Cooper 2002:30), a statement that indicates the possible intangible result of a synthetic artefact. By being aware, throughout the design process, of the intangible factors inherent in

the Centre, the final product will respond to the users’ perceptions of an educational visitors centre. The way in which the public currently perceives the GNR is a factor of which the Centre should take note. It is difficult to define such perceptions because they are intangible and involve the subjective opinions of individuals. Conducting research by means of interviews with frequent visitors to the GNR is useful in order to define the main perceptions of the reserve.

*To summarise the design approach as defined in areas of knowledge, the fields covered in this project are:*

- Human space and design requirements as determined by function and the interface where human space encounters a natural environment (Figure 16).
- Adventure sports and eco-tourism.
- Contemporary design approaches to working with historical exhibitions, focusing on education and awareness of the site while enhancing the experience of the spaces through systems and technology.

## End notes

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1 Hereafter, throughout this document, the Pretoria Central Business District is referred to as the Pretoria CBD.

2 The Voortrekker Monument is located on Monument Hill, Pretoria. It was built to commemorate the Great Trek and was inaugurated in December 1949.

3 The government of the old Zuid-Afrikaansche Republiek built a ring of forts, including Fort Klapperkop around the town in 1898. They were intended to defend Pretoria in the Anglo-Boer War (South African War) but the town was not defended and no shot was ever fired from the forts. Fort Klapperkop now displays armaments and military vehicles used during the war.

4 Hereafter, throughout this document, the word Centre is used to denote the *Interactive Visitors Centre*.



## 2: Context study

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## 2.1 The target user-group

Most of the visitors to the GNR are urban tourists, that is, visitors currently living in South Africa. Urban tourists are either day visitors (living in Pretoria or within an hour's drive) or overnight visitors (living elsewhere in the country, or alternatively, groups of learners on excursions). The process to identify user-groups involved conducting interviews with frequent visitors and with the management of the GNR. The different types of users are discussed below, arranged from the most frequent visitors to the least frequent.

### 2.1.1 SPORT ENTHUSIASTS

The type of user in this group visits the GNR for the purpose of partaking in adventure sports for the excitement experience, for training purposes or for socialising.

### 2.1.2 LEARNERS

Learners from the schools in Sunnyside, an underprivileged area of Pretoria, make up a portion of this group. Groups of learners undertake day or weekend excursions, and sleep at the Bamber camp (Figure 18: D). The groups include on average 60 to 80 learners and their activities comprise hiking, lectures and socialising.

### 2.1.3 FAMILIES

Parents or grandparents with one to three children are common visitors over weekends. These users generally come to the GNR for recreational reasons.

### 2.1.4 NATURE ENTHUSIASTS

Visitors who enjoy the solitude of nature and the escape from the hustle and bustle of the city are uninterested in the social and entertainment aspects that the site has to offer. They usually travel alone.

### 2.1.5 CORPORATE GROUPS

Business groups from Toyota and Fritz Pienaar's cycle shop frequently visit the GNR for corporate weekends and team-building initiatives. They go for 4x4 or mountain bike rides, then socialise and sleep over at the self-catering accommodation within the GNR.

### 2.2.6 PENSIONERS

Small groups of pensioners enjoy the peace and quiet that the GNR offers. These visitors mainly do bird-watching, relaxing in the picnic area and taking short walks around the reserve.



Identifying the target users is an integral part of this study. The type of user is to be targeted for the *Interactive Centre* are for the most part active nature enthusiasts who travel in groups of two to twenty people; their age is usually in the 18 to 35 years category. Typical examples are Ilze (25) and Riaan Lategan (35), mountain biking parents, who were interviewed for the purposes of this study.

## 2.2 The client

The primary client is Groenkloof Nature Reserve Management and therefore the proposal has to be approved by the City of Tshwane Metro Municipality and the National Parks' Board. The GNR and its facilities is a service that the National Parks' Board provides for the public of Tshwane. Apart from generating funds for maintenance and rehabilitation of the fauna and flora, the reserve is not currently a profit-driven organisation.

The resources available to government-owned institutions are often limited and therefore it is proposed that external investors should serve as profit-driven tenants on the

reserve's property. The most popular activities in the reserve are mountain biking, hiking and family-outings but there are inadequate facilities provided for these activities.

*The following sub-clients have therefore been selected to fill the growing need to attract families and adventure-sport enthusiasts to the GNR:*

- a Fritz Pienaar cycling shop
- a small eatery and coffee shop, similar to the Seattle franchise outlets
- a curio shop that promotes local arts and crafts

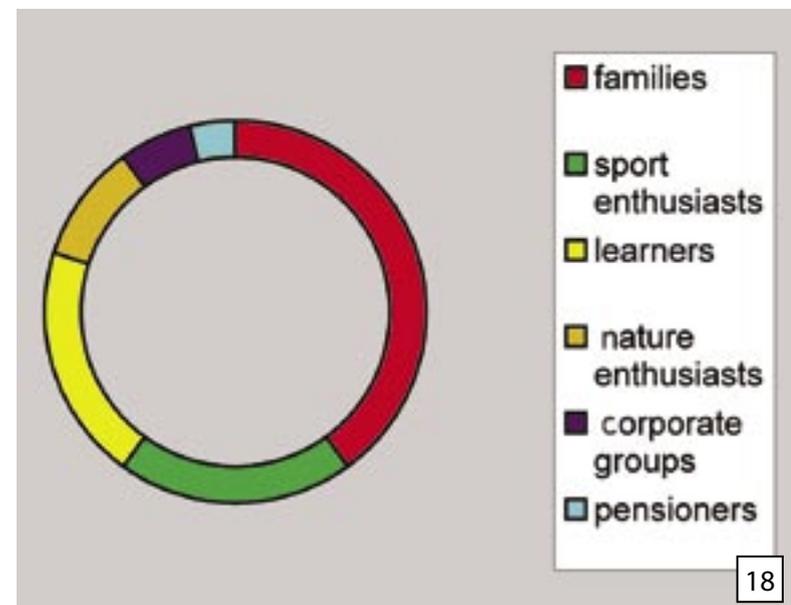
These independent commercial ventures will become part of the *Interactive Centre*, and serve as a catalyst for possible future development of the Centre.



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Figure 17: The Centre has a multidimensional user profile

Figure 18: The segments of the chart show the percentages of certain categories of visitors to the reserve



18



## 2.3 History of the Groenkloof Nature Reserve

Recent research carried out to justify the name change from Pretoria to Tshwane has established beyond doubt that indigenous black communities lived in the vicinity of the present city for many years before the arrival of the white pioneers. The powerful leader of the Ndebele, Mzilikazi is known to have established his headquarters in the area in the 1830s. However, because of the lack of documentary evidence about these early residents the arrival of the whites in what is now the GNR is often seen as the first settlement of the region.

The Bronkhorst brothers were the first white families in the area and in 1855, with more pioneers arriving, the town of Pretoria was established. According to information available at the GNR, 'From old records at the deeds office, it is evident that the Bronkhorst brothers lived in the Fountains Valley. "Now I have trekked far enough, this poort is now my home" is a rough translation of the words uttered by Lukas Bronkhorst who in all probability refused, with a shake of his head, to go along with the other Trekkers to Orighstad after he rested along the Apies River for the first time' (*Groenkloof 4x4 nature trail, interpretation booklet 1999:5*).

The Bronkhorsts (Figure 21) and other early settlers in the Fountains Valley must have hunted the wide variety of game for their livelihood. This led to trophy hunting and a flourishing trade in ivory, horns and hides. For this reason, the then president of the Transvaal, Paul Kruger, declared the valley a protected area on 25 February 1895. According to the *Groenkloof interpretation booklet (1999:5)*, portions of the farms Groenkloof and Elandspoor were then leased to the Union Government's agriculture and Forestry Department in the 1900s for the establishment of a commercial wood plantation. With the rationalisation of the forest reserves during the late 1960s, the area was returned to the City Council. In the 1970s it was decided to create a hiking trail in the valley and this led to the thinning out and rehabilitation of the area.

In the 1990s the Nature Conservation department of the Pretoria City Council started to rehabilitate the area's vegetation and systematically reintroduced game to the reserve. "Today much game is found in the reserve including Impala, Blesbuck, Red-hartebeest, Blue Wildebeest, Zebra, Giraffe, Kudu and various smaller game species. This rich

diversity of fauna and flora makes Groenkloof Nature Reserve a must for visitors; it is situated only 5km from Church Square as the crow flies' (*Groenkloof interpretative booklet 1999:5*).

Until 1930, the Fountains Valley supplied all Pretoria's water '... it still forms a large portion (8%) of the total use of water' (Küsel: 2006, 5). A monolith-shaped stone (Figure 20) exists to this day to commemorate the importance of the first source of water for Pretoria. The 'old pump' (Figure 19), a remnant of Fountains Valley during the first 75 years of occupation is another monument nearby.

A sound heritage management plan would be invaluable to assist with the maintenance and conservation of the original water supply systems, pioneer architecture and other historic material. All the relevant monuments should be included in the proposed heritage-hiking trail (cf. 4.2) to expose visitors to the history of the Fountains Valley and the GNR.

## 2.4 The site

### *Hiking and mountain bike trails*

There is an established 4x4 trail starting at the selected site (Figure 24). The initial idea of the trail was that it should have certain marked features and lookout points that correspond to the information in an interpretation booklet that the driver receives upon entrance to the GNR. This booklet was devised to orientate the driver on the various routes and to explain significant views. However, the execution of the system has not proved successful because over time the handout at the entrance has been discontinued.

The mountain biking (approximately 35km) and hiking routes on the reserve vary from easy (light exercise) to



Figure 19: The 'old pump', located in the Fountains Valley Resort. The pump will be protected as one of the monuments the visitor can view on the proposed historical trail

Figure 20: The monument indicating the site of the two original fountains in Fountains Valley. The plaque reads: '*Fontes origo Praetoriae 1855-1955*'

Figure 21: The remains of the Bronkhorst house in the Groenkloof Nature Reserve. The area has been fenced off to commemorate the arrival of the first white pioneers in Pretoria



difficult (strenuous). The routes (Figure 23) all start from the same area, which is the selected site for the Interactive Centre ■. Frequent visitors to the area know the trails well, but new cyclists or hikers have no way of knowing which of the trails they follow. This problem is solved at the Interactive Centre's information desk where the cyclists receive the relevant maps.

#### *Day visitors' picnic area*

This recreational area with ablution facilities is located beside the Apies River (Figure 15: C). It is an ideal spot for weekend cyclists to rest after returning from a trail. Large groups for informal functions can rent one or both of the two lapas. The one lapa is situated next to the ablution building and the other is near the Youth Camp (Figure 15: D).

#### *Overnight facilities*

An overnight hut that can accommodate 12 people is located opposite the lapa (Figure 22). This facility is used primarily by hikers or for informal overnight functions. On the opposite side of the Apies, hidden from view, is a youth camp used for school excursions. Two separate buildings accommodate the boys and girls respectively. Up to 80 learners can be accommodated simultaneously.

Figure 22: Sketch of selected site to show the existing buildings and layout in relation to the Apies River

Figure 23: Map of the GNR showing the available trails for hiking and for mountain biking in the reserve. The chosen site for this study project is indicated by the symbol ■

Figure 24: A map of the GNR taken from the *Groenkloof interpretation booklet*

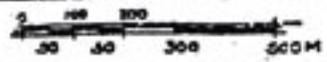
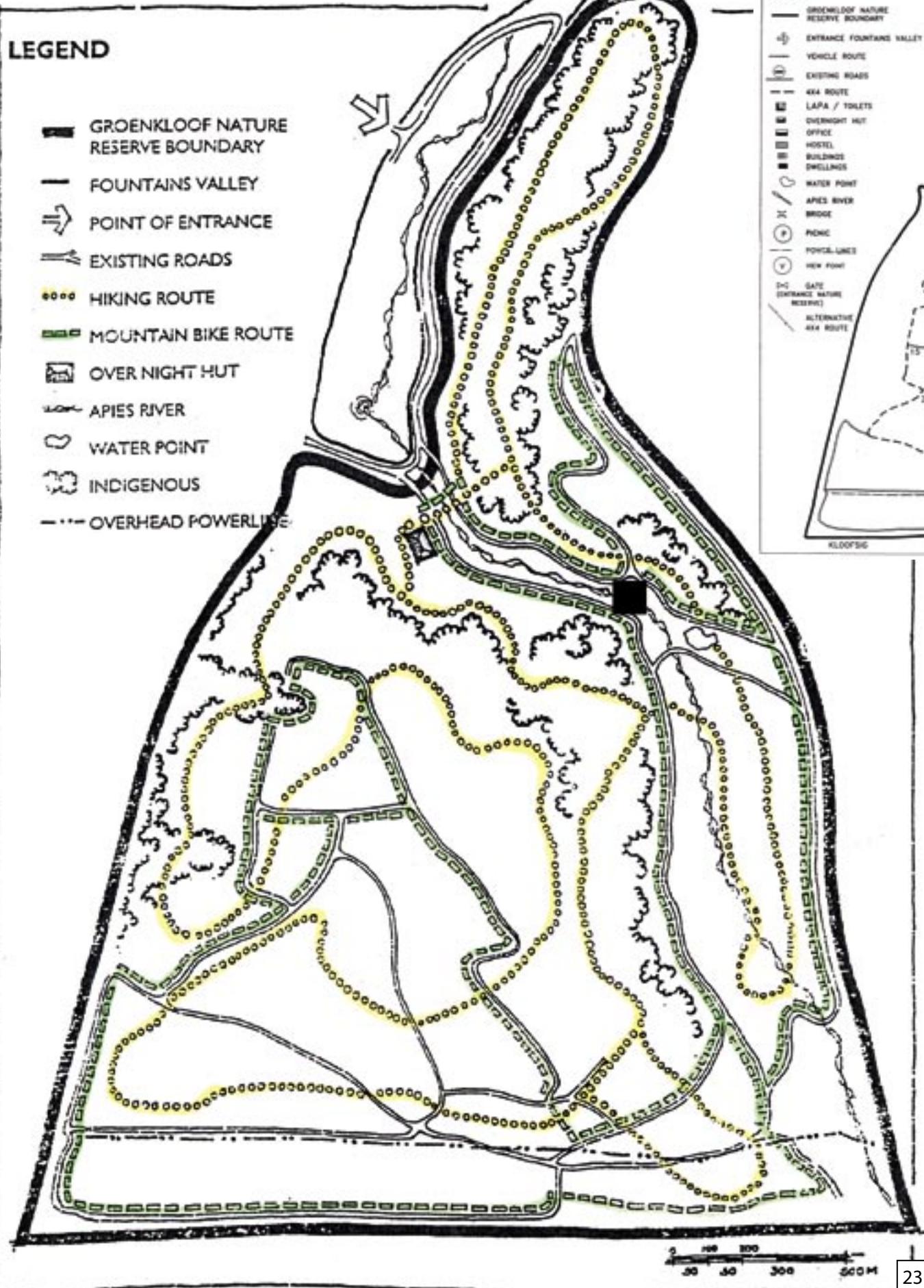
**LEGEND**

-  GROENKLOOF NATURE RESERVE BOUNDARY
-  FOUNTAINS VALLEY
-  POINT OF ENTRANCE
-  EXISTING ROADS
-  HIKING ROUTE
-  MOUNTAIN BIKE ROUTE
-  OVER NIGHT HUT
-  APIES RIVER
-  WATER POINT
-  INDIGENOUS
-  OVERHEAD POWERLINE

- LEGEND**
-  GROENKLOOF NATURE RESERVE BOUNDARY
  -  ENTRANCE FOUNTAINS VALLEY
  -  VEHICLE ROUTE
  -  EXISTING ROADS
  -  4x4 ROUTE
  -  LAPA / TOILETS
  -  OVERNIGHT HUT
  -  OFFICE
  -  HOSTEL
  -  BUILDINGS
  -  DWELLINGS
  -  WATER POINT
  -  APIES RIVER
  -  BRIDGE
  -  POND
  -  POTCH/LINE
  -  NEW FISH
  -  GATE (ENTRANCE NATURE RESERVE)
  -  ALTERNATIVE 4x4 ROUTE



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## 3: Precedent study

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Studying similar projects in which the landscape has been successfully blended or contrasted with the buildings can be illuminating when embarking on a project such as the *Interactive* Centre in the GNR. By observing the design features, external and internal architectural techniques applied and facilities provided, there is much to be learnt from the work of established practitioners. The examples studied below show how the buildings and the landscape have been harmonised and the needs of the users catered for with flair, often juxtaposing the old and the new. The precedents offer valuable solutions and principles that can be effectively applied in the *Interactive* Centre.



### 3.1 The Sterkfontein Pavilion and Maropeng Visitors Centre

**Location:** The Cradle of Humankind, North-west Gauteng, South Africa

**Architects:** GAPP Architects and MMA Architects Interior  
Designers: Artwood Interiors

**Source:** 2006 May/June issue of *Architecture: Journal of the SAIA*

President Thabo Mbeki officially opened the Sterkfontein and Maropeng Visitors Centres at the Cradle of Humankind, in 2005. At the opening ceremony of the Centre, the president explained that that the Centre represented ‘...our own 21st century humble contribution to record for posterity the story of evolutionary human biology and geography as it unfolds’. About 40 per cent of the entire world’s human ancestor fossils were found at the cradle, which was declared a world heritage site in 1999. Development of the entire area, including infrastructure, is a R347 million Blue IQ project. The development is managed by Maropeng a’Afrika Leisure. A public-private partnership, the project also involves the University of the Witwatersrand and the Gauteng province. The national government contributed land and money for the Cradle of Humankind development and in return receives a share of the annual profits.

The landscape near the Sterkfontein caves is charged with the memory of ancient civilisations. The two new complexes assume contrasting roles within this land that cradled humankind. The Sterkfontein entrance pavilion (Figure 26, 28) is a shed-like, single storey, face-brick structure that hovers above the landscape on concrete columns and gives the impression of treading lightly on the earth. It houses the hominid exhibition hall with interactive exhibits, a restaurant, ticket office, souvenir shop and auditorium. The pavilion serves as an orientation point and it is here that the guided walks through the caves begin (Figure 25). This building ‘imagines itself as part of its landscape ...’ (Bremner 2006:12) whilst remaining architecturally and culturally neutral.

The Maropeng Visitors Centre, in contrast, makes use of the dynamic interaction between ancientness and a world of hyper-modernity. It transforms the landscape with

the centrepiece of the complex – the Tumulus building (Figure 27). The latest technology simulates the history of humankind in an underground sensory display, which educates the visitor by means of entertainment. In combining the sacredness of human origin and 20<sup>th</sup> century Africa, this project has made the Cradle of Humankind an essential destination for tourists.

The natural and artificial contrasts are very evident in the design of the Sterkfontein Pavilion and Maropeng Visitors Centre. These contrasts place emphasis on what the visitor has come to see: the artefacts of human evolution. This bold technique, along with the use of technology in the interactive exhibits, enhances the visitor's experience of the intangible awe of an age-old site.

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Figure 25: View of the entrance to the cave

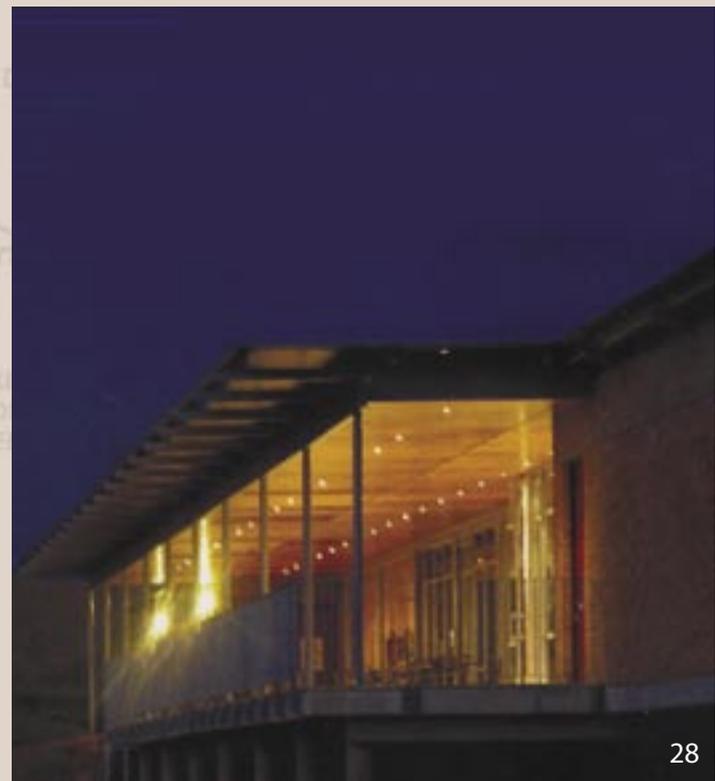
Figure 26: The pavilion with its marine-ply ceiling frames the view to the landscape beyond

Figure 27: The completed tumulus above an underground lake

Figure 28: The pavilion becomes a transparent glowing box at night



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## 3.2 Dome Rock: Thabapaswa Game Farm

**Location:** Limpopo province, South Africa  
**Architect:** Heinrich Kammeyer  
**Source:** Visited in March 2006

Designed for Deon and Ankie Richter, this farm is a popular getaway for city-dwellers as it is an inexpensive way to get back to nature just three hours out of Johannesburg (where you will assuredly not find a building turned inside out!). Designed with a delicate yet meaningful symbiotic relationship to the context, the architect used rocks from the site to create pathways (Figure 31), visual barriers and walls; hence the name of the camp: Dome Rock.

The architectural team worked on this project from an office in Johannesburg, but there was always someone on site to consider the context as the design process unfolded. Great care, for instance, has been taken to frame specific verandas as a guest moves from one enclosed space to another. Even from the toilets there is a picturesque view through the reed enclosures (Figure 30) into the bush. The shower and ablution area is a great adventure, with custom designed steel fixtures (designed by the architect) in the open-air showers. The sleeping areas comprise a glass box (Figure 29) with a stone wall on one side, blurring the lines between the interior and the outside (Figure 32).

The simple accommodation units at the Dome Rock Camp have made use of materials and resolutions to minimize the ecological footprint of the buildings. The use of materials like rock taken from the site makes the visitor feel completely at one with nature. In this way, the boundary between synthetic and natural becomes a blurred and subtle differentiation in Heinrich Kammeyer's unique design.

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Figure 29: The glass-enclosed bedrooms allow natural light to enter and provide scenic views of the surrounding bushveld

Figure 30: The open-air toilets have a view through the reed enclosure

Figure 31: Elaborate stone detailing at the base of the bluegum poles

Figure 32: The accommodation units allow uninterrupted visual interaction between the resident and the bushveld





### 3.3. Koeberg Visitors Centre

**Location:** 30 km north of Cape Town, South Africa  
**Architect:** Unknown  
**Source:** [www.Eskom.co.za](http://www.Eskom.co.za)

The Koeberg Nuclear Power Station provides power to most of the Western Cape and supplies approximately 6,5 per cent of South Africa's total electricity needs. A Visitors Centre located near the plant within Koeberg Nature Reserve offers facilities to educate the public and make them aware of nuclear power. The Centre has a well-equipped auditorium, where lectures and presentations are held to inform visitors about Eskom and the workings of the power plant. The visual exhibition area hosts a number of interactive models and displays (Figure 36).

The outdoor education programme encourages visitors to hike through the Koeberg Nature Reserve. The hiking trails and mountain bike trails are specifically designed to traverse the two naturally-occurring veld types in the area: sandveld and strandveld. There are also beaches and dunes to enjoy and the outdoor enthusiasts can experience a first-hand glimpse of the power plant and view the animal life in the reserve.

The planned *Interactive Centre* has similar typology to the Koeberg Visitors Centre in that the educational facilities and context of the two projects correlate. In contrast with the Koeberg Centre, however, the design approach of the *Interactive Centre* is to allow natural light into the interiors of the buildings and to use translucent and transparent materials to establish interaction between these and the context.

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Figure 33: An aerial photo shows the Visitors Centre and power plant dominating the coastline, and Koeberg Nature Reserve

Figure 34: The impression of the Visitors Centre is of a building that is in contrast with the environment

Figure 35: The reception area of the Centre allows little natural light in so that the use of artificial lighting is accentuated

Figure 36 a, b & c: The dark interior with strategic 'starlight' down lighters highlights the computer screens as part of an interactive exhibition space



35



36a



36b



36c



37

### 3.4 XING

**Location:** Manhattan, New York, U.S.A  
**Architect:** Lewis. Tsurumaki. Lewis  
**Source:** *Architectural Record*, March 2003

The Pan-Asian Xing restaurant in Manhattan, New York, is an eatery designed by Lewis. Tsurumaki. Lewis. It was selected as one of *Architectural Record's* emerging vanguard architecture firms in 2000.

The restaurant is a bright, modern space, filled with contrasting textures and crisp detail. The owners wanted to retain an open ambience that could accommodate a prominent bar (Figure 39). 'The floor plan, typical in New York, was barbell-shaped (Figure 38), in which the middle is a bottleneck resulting from light wells placed on each side of the tenement building', explains design partner David Lewis. 'Rather than force a design that would hide the distinction between the front and back, the approach was to accentuate the unique nature of each space' (2003:198). Employing a collage-like technique of juxtaposing disparate materials, the architects used tactile surfaces such as bamboo panels (Figure 37), stone, and velvet, threaded with colourful acrylic forms that capture the light.

The unique use of materials makes this design an inspiring precedent for the GNR project. The contexts of the two projects differ in that the Xing eatery is in a decrepit, run-down part of Manhattan while the *Interactive Centre* rests within a beautiful Nature Reserve. But like the Xing bar the Centre makes use of the technique of juxtaposing materials with different textures, transparencies and colour to produce sleek interiors in stark contrast with the natural context.

### 3.5 Design influence

It is common knowledge that the progress and expansion of the human race influences our natural ecosystems. The size of the ecological footprint (cf B: glossary) that is left behind depends on the magnitude and duration of our intervention (for example, a shopping centre erected in a wetland or increased human activity in a public place). This constant conflict between the natural and artificial is what makes

for dynamic design decisions. This is well illustrated in the precedents discussed above.

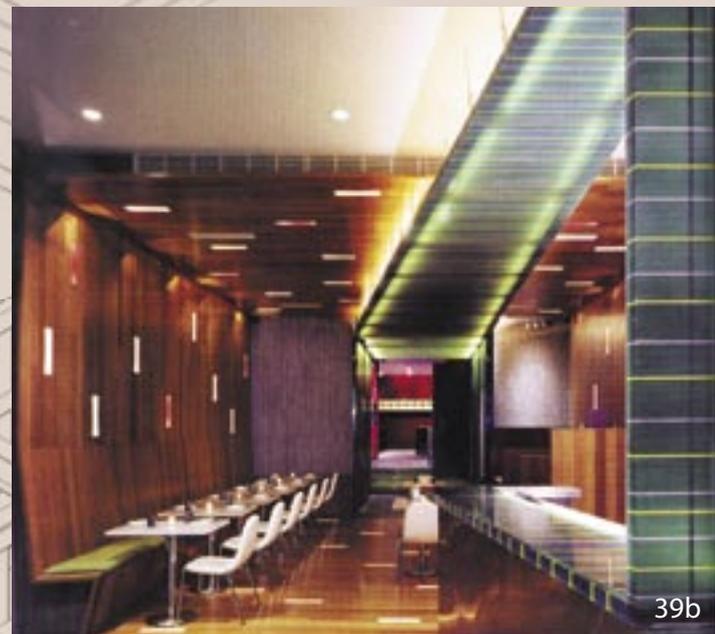
The precedents offer valuable principles that can be adapted to apply in the *Interactive Centre*. The spatial relationships, transparency, response to environment and lighting are key factors. The precedents are successful in their respective contexts by responding to the project brief with a clear cognisance of the environment.

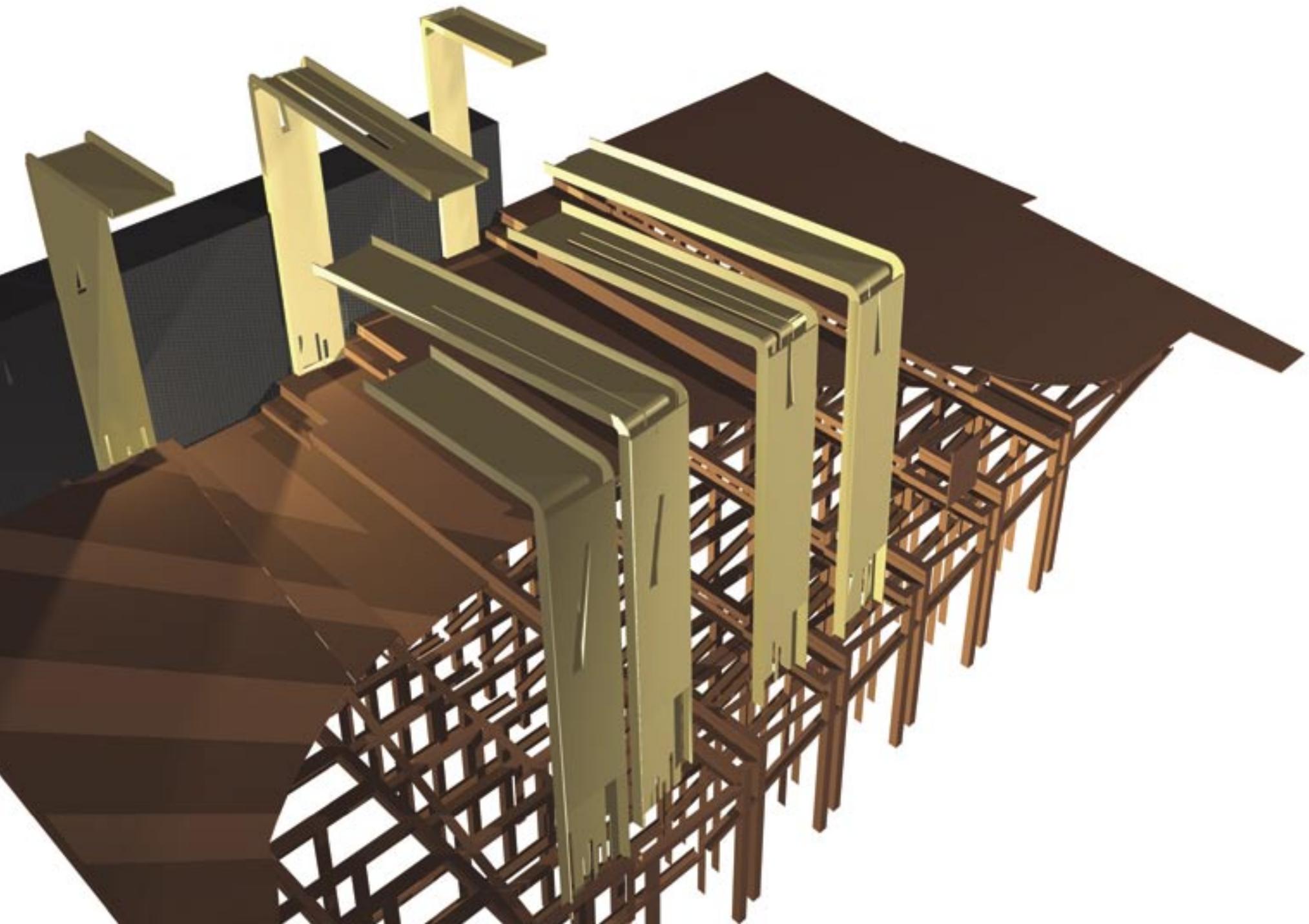
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Figure 37: The wall, floor and custom banquettes are of bamboo panels. This material is used, as it is inexpensive yet attractive

Figure 38: The restaurant as it appears from the street

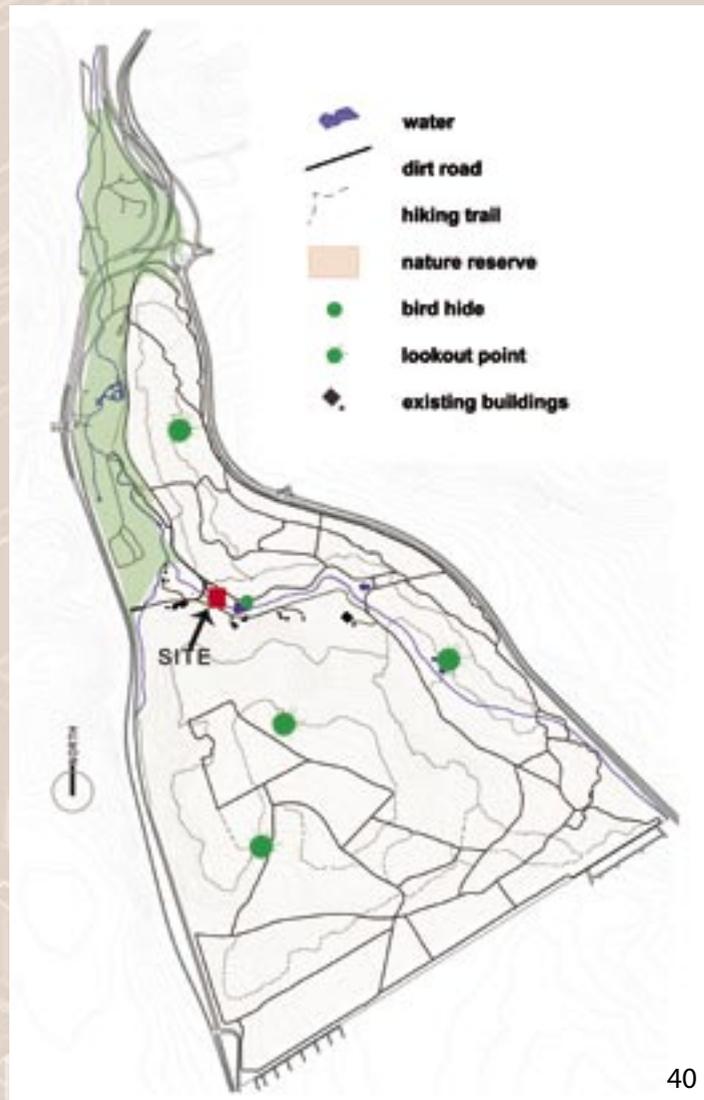
Figure 39 a & b: The combination of illuminated acrylic panels and stainless steel creates a prominent bar against vertical strips of dusky grey stone





# 4: Design discourse

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## 4.1 The design intervention

Humanity is becoming increasingly aware of the earth's finite support capacity and so all fields of design have turned their focus to the preservation and appreciation of our natural surroundings. The interaction between nature and human development is a struggle frequently confronted by designers, and attempts to effect a balance between the two are very evident in modern architecture. Although there are many schools of thought on this issue, the ideal solution remains elusive.

Contemporary literature on this interface and the research undertaken into significant precedents has laid the basis for the concept and development of the *Interactive Visitors Centre*. The two driving questions behind the project are whether manufactured artefacts should mimic nature in order to blend into the natural landscape, or if a new architectural language would serve to promote awareness of conservation by way of its interaction with, and contrast to, the natural setting.

In the decision-making process, two essential factors determined the outcome of the design. These imperatives are based on the dynamics that typically occur in a visitors centre. The users' needs are the primary concern. Secondly, the interaction of the physical context with the *Interactive Centre* must be considered. This interaction takes into account the tangible and intangible attributes of the design (cf. 1.7).

## 4.2 Macro site development

A proposal for the entire Groenkloof Nature Reserve forms an important part of this project. This proposal should reflect the same design principles that apply to the Centre and focus on the conservation of the landscape.

### 4.2.1 STRUCTURE

The concept behind the decision to construct new bird hides and lookout points in the reserve is that the visitor's attention is focused on the fauna and flora around him/ her and that this is experienced as pleasant and relaxing. The location of the structures (Figure 40) was identified by the author

after conducting interviews with frequent visitors to the GNR. Lookout points are shaded resting points for cyclists and hikers and need to be well sign-posted to orientate the visitors. To protect the plant species that are presently being rehabilitated and the newly introduced wildlife, lookout points and bird hides within the reserve should be designed with minimal ecological footprint and the least possible hindrance to the game. With this in mind the enclosures should as far as possible be constructed out of recyclable materials that are readily found in the area; these will merge visually with the environment. This approach has proved valuable for educational purposes, as the wildlife remains undisturbed in its natural habitat while being viewed unnoticed through permeable visual barriers between the animal and the visitor.

#### 4.2.2 SIGNAGE

Comprehensive maps are necessary at the identified points in the reserve (Figure 40). These points are strategically positioned in elevated parts of the reserve to provide the visitor with striking views of the surrounding countryside. Among the other lookout-point structures, suitable signage should enrich the visitor's experience and understanding of the GNR by providing useful information (Figure 41).

#### 4.2.3 HERITAGE-HIKING TRAIL

A heritage-hiking trail, also proposed by Küsel (2006:15) is to be implemented as a part of the *Interactive Centre* macro site development. The trail will start at the Centre and will include all the relevant monuments in the Fountains Resort and GNR. Pertinent lookout points, that offer a view of the Voortrekker Monument and Fort Klapperkop, should be included in the trail.

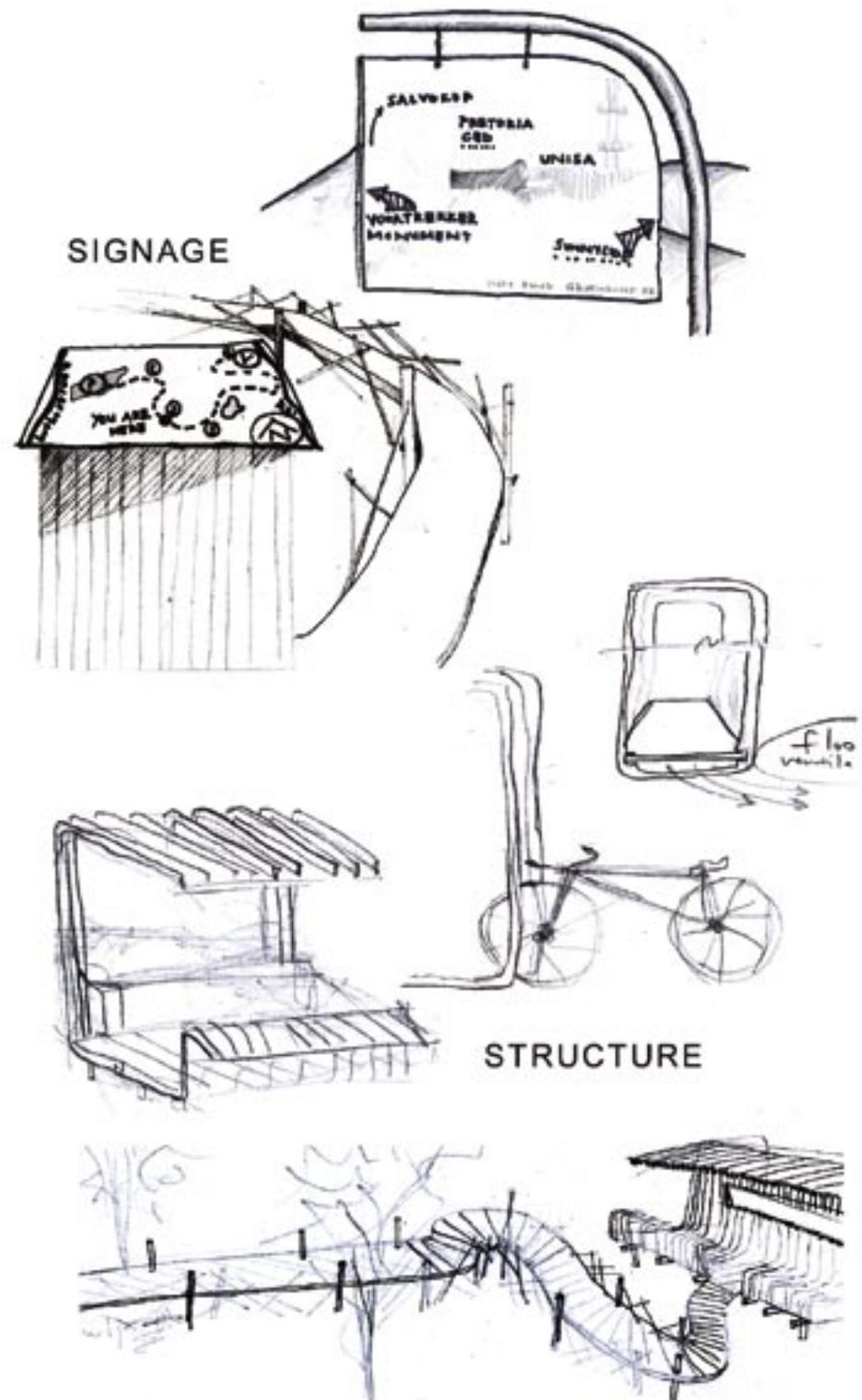
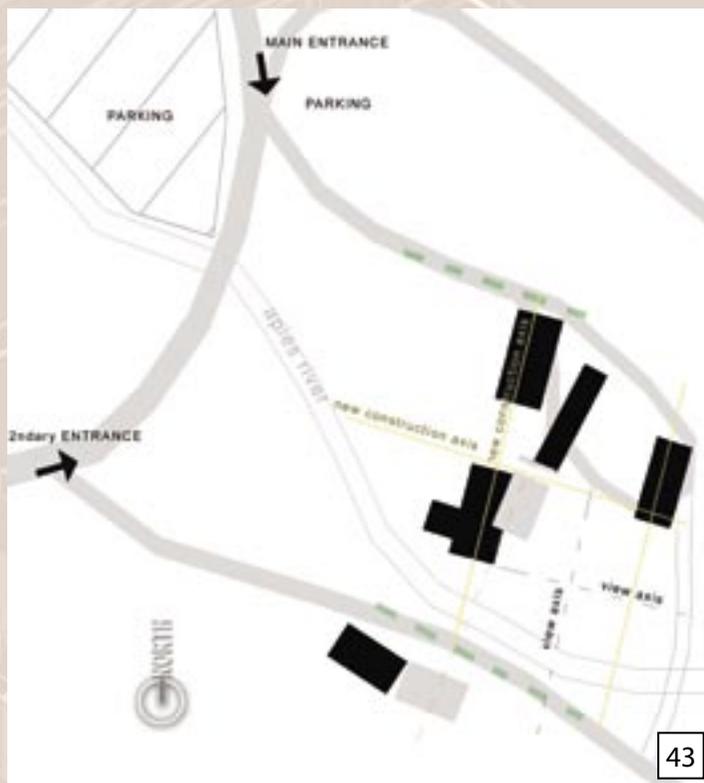
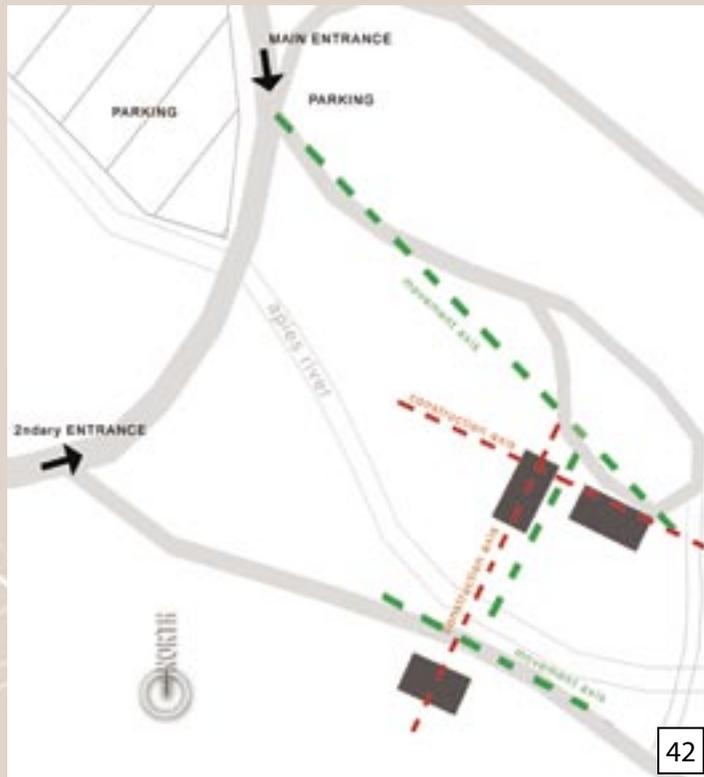


Figure 40: Contour map of Groenkloof Nature Reserve indicating the location of the new bird hide and lookout points

Figure 41: Design concept for proposed signage and lookout points in the reserve



## 4.3 Micro site development

### 4.3.1 ARCHITECTURAL DEVELOPMENT

In order to design a sustainable *Interactive* Visitors Centre, the design should be inclusive and consider all the needs of the user. Furthermore, the main criteria used in the decision-making process for the interior architecture are also to be carried through to the architectural design and the landscape architecture.

As the building envelope of the Centre was non-existent, an investigation into the expected circulation and movement of visitors was done to develop a diagrammatic structure in which to work. Various alternatives were considered and when a suitable option was selected, the detail was developed. A preliminary layout and zoning were proposed and then refined in order to explore the design concept of the *Interactive* Visitors Centre.

### 4.3.2 CENTRE ENVELOPE

The circulation on the site formed a starting point to develop the layout of the new structure. The movement through the site and the existing buildings form strong perpendicular axes that were used in the development of the new architecture (Figures 42, 43). The architecture is organised to form an 'H' shape on plan. This creates transitional spaces between the interior spaces and allows an optimal view of the two important vistas that can be seen from the site (Figure 43).

The rectangular shapes that are common in the shed-like structures found in the GNR and Fountains Valley are repeated in the rectangular layout (Figure 44 b, c) of the Centre. This establishes a certain familiarity in the design, so that the visitor sees the Centre as a part of the reserve.

The various functions of the proposed Centre contributed to the development of the layout (Figure 44 a). This particular

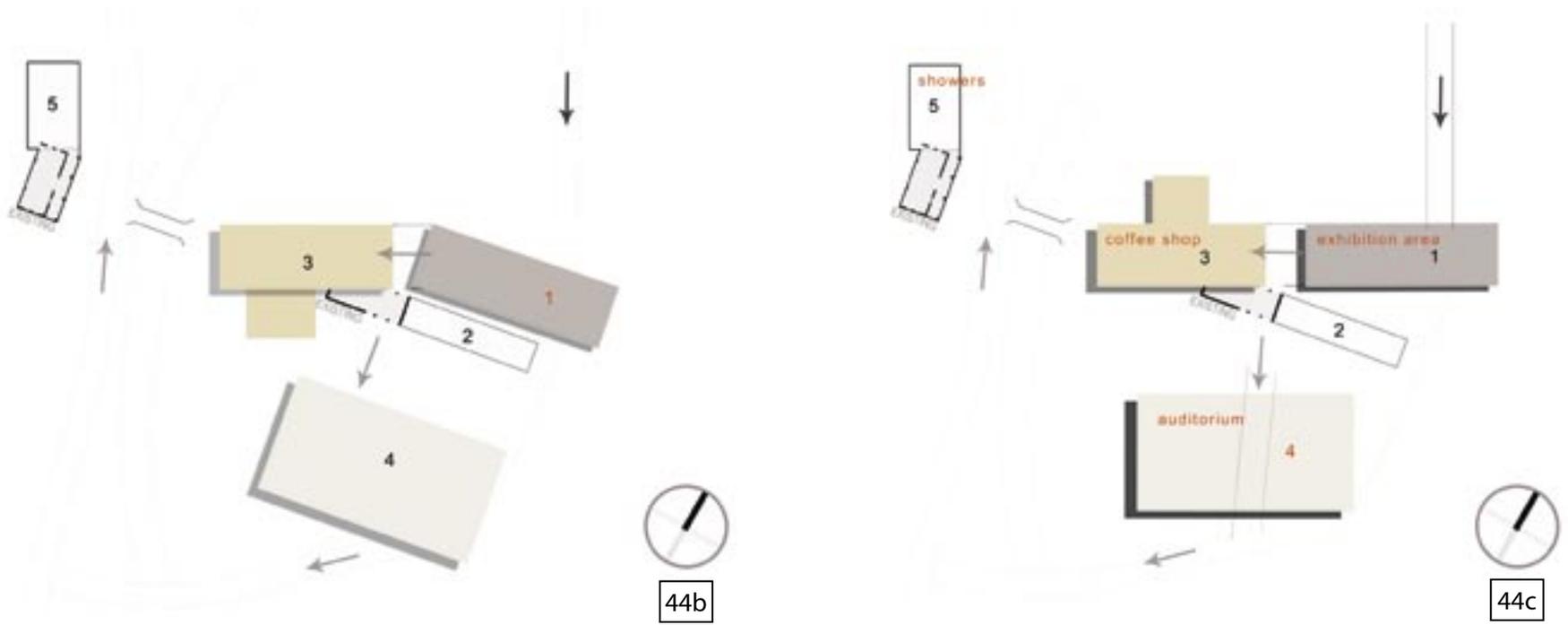
Figure 42: The movement and construction axes that exist on the site

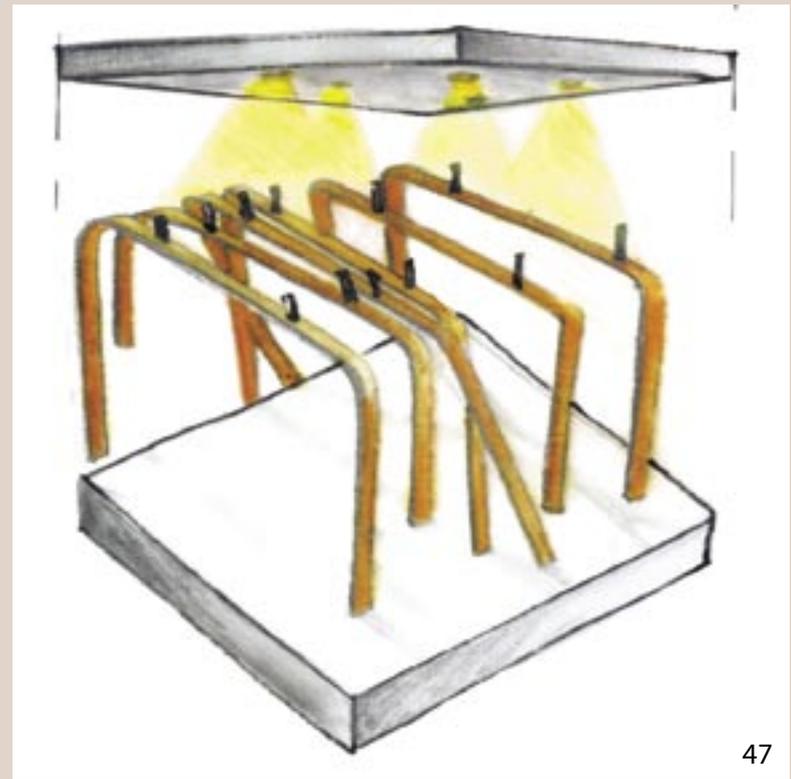
Figure 43: The proposed new construction axes on the site

Figure 44 a: Colour coded exploration of the functional layout and movement within the *Interactive* Centre (April 2006)

Figure 44 b: Exploration of the interaction between spaces in the centre (July 2006)

Figure 44 c: Final layout of the *Interactive* Centre (August 2006)





choice was made because it allows for an interactive relationship between the context and the interior spaces of the Centre.

#### 4.3.3 VISUAL IMPRESSION OF THE PROPOSED BUILDING IN ITS LANDSCAPE

The external impression of the building was explored by using conceptual volumes (Figure 46 a, b), while the vistas of the surrounding natural area also had a direct impact on the final choice. The auditorium required a specific vertical volume, which, if above the ground, would obscure the scenery beyond (Figure 46 a). To avoid this, the design of the auditorium requires an excavation 1.6m deep.

As one enters the site from the north-western side (Figure 47) the Centre is visible through the massive old oak (*Quercus robur*) and *Celtis africana* trees. With the rough textures of

the bagged walls, rock cladding and timber ribs, the Centre sits comfortably in its natural surroundings. The coffee shop's solid flat roof and floor to the southern end seem to hover above the ground, giving the visual impression that the building treads lightly on the natural environment.

## 4.4 The interior design development

### 4.4.1 TRADEMARKS

Rib-like structures with varying functions, materials and sizes are repeated throughout the Centre; these create continuity as the visitor moves from one space within a space, to another. These structures send an unequivocal message to the public: that the Centre represents the interaction between man and nature.

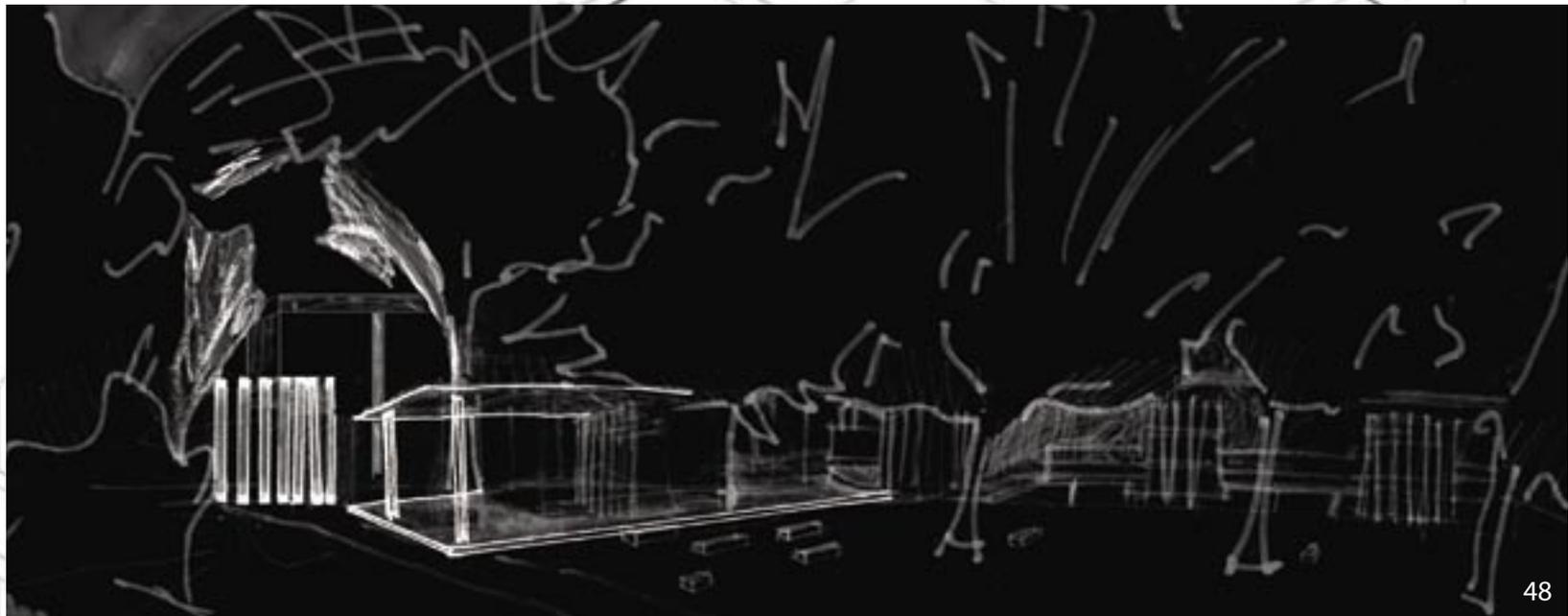
The rib-like structures (cf. 4.4.10.4 and 4.4.10.5) are lightweight, floating features that aid the visitor in identifying points of importance – the exhibition area (Figure 48, 50), coffee shop and external areas – while there are heavier, solid-looking screens in the semi-public auditorium. The fragmented and transparent effect of the ribs conveys a visual message of interconnectedness between the space enclosed in

Figure 45: Concept of the entrance to the Interactive Centre (April 2006)

Figure 46: Exploration of the effect of the auditorium as a double-volume space (a) as opposed to sunk into the earth (b)

Figure 47: Impression of the Interactive Centre seen from the main entrance or from the north-western side of the site (August 2006)

Figure 48: Concept of the interactive unit



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the structure and the space surrounding it. This is because the thin rib-like elements do not obscure the visitor's view of the vistas around him/ her.

Through the repetition of these structures, a visual trademark is created that the public will begin to associate with the *Interactive Centre*. This distinctive trademark or brand will also form part of a strategy to advertise the Centre.

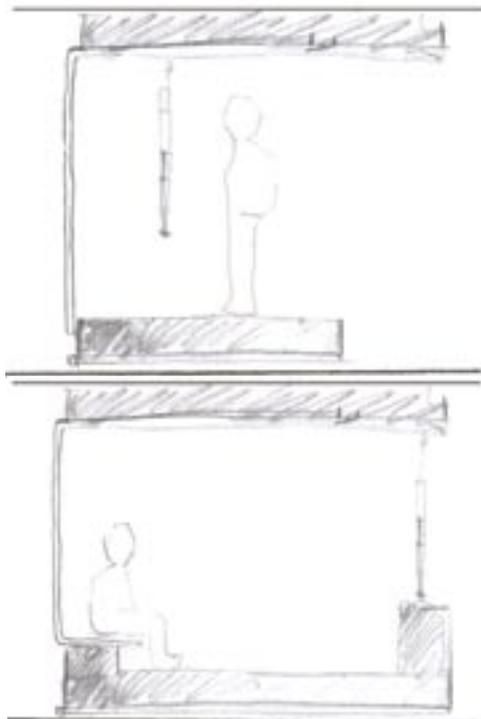
#### 4.4.2 EXHIBITION AREA

The exhibition space is the first port of call on the visitor's path through the Centre. Beyond the pivoting corrugated metal doors with elegant wooden fins filling the space, the background appears fragmented as if one is looking up through the foliage of a tree. The first unit enclosed by these wooden fins is the information counter (Figure 71) where an attendant directs the visitor and provides maps of the cycling and hiking routes in the GNR. The visitor then views the various interactive exhibition units.

The interactive exhibition units allow the individual to engage with the natural surroundings through computers, a medium that city-dwellers are particularly comfortable

with. Each unit has two touch-screen computers, a large flat screen and seats. By slight alteration of the layout and size (Figure 49), the units can exhibit printed media like posters and photographs. The function of these units is to not only house permanent exhibits of the history and wild animal species of the GNR, but also to be used by education and conservation-oriented corporate bodies to display the visual media necessary when presenting a lecture in the auditorium. The concept behind these units (Figure 48) is to create a seemingly floating 'space within a space' surrounded by elegant plywood fins. To accentuate the weightlessness of the fins and to give the effect that the interactive exhibition unit is a separate entity within the space, the base and bulkhead to which the fins are attached are solid and box-like.

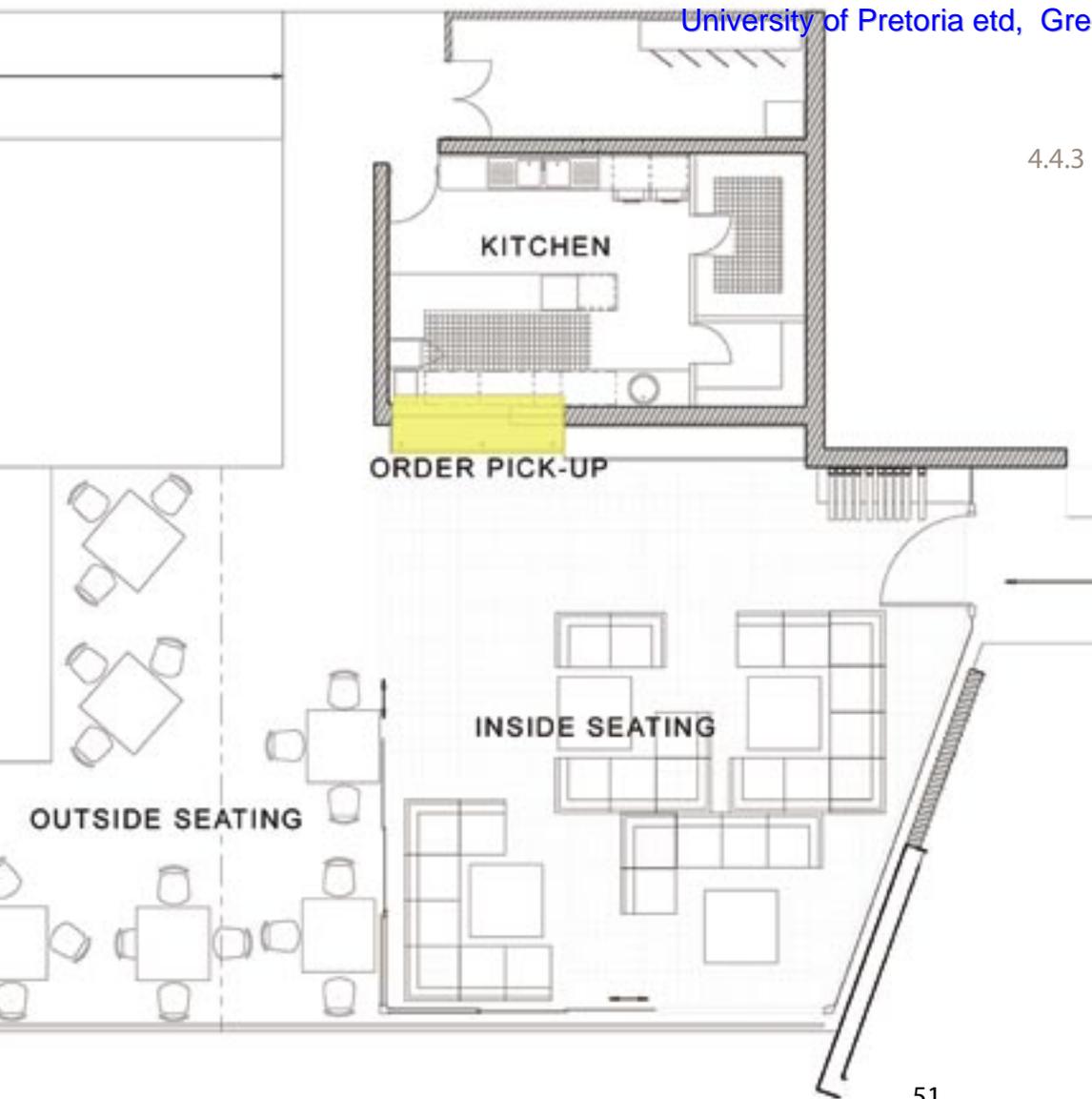
The artificial lighting fixtures used for each unit are adapted to suit the intensity of light (lux) needed for the medium on display. As one moves through the exhibition units, the existing face-brick building (which is to be retained) is visible on the hill beyond a coffee shop (Figure 53). This places the Centre within its historical context; it reminds the visitor of the era when the GNR was first established.



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#### 4.4.3 COFFEE SHOP

The coffee shop offers a variety of beverages (alcoholic as well as non-alcoholic), including wines, teas and coffees. It serves snacks as well as light meals. Snacks such as sandwiches and home-grown salads from the vegetable garden, are prepared entirely in the coffee shop's kitchen, while other meals such as pies, pasta dishes, pastries, cakes and desserts are sourced daily in a fresh but pre-prepared format, from nearby suppliers. The sourced foods are then either stored in the cold room or dry storeroom, or heated and prepared for serving from the order pick-up counter (Figure 51).

Customers enter the coffee shop after moving up a concrete ramp and through glass doors with text and images to illustrate the mood and menu of the shop. Configurations of comfortable olive green sofas (Figure 52), coffee tables and mobile ottomans make up the inside seating area. The inside seating area can open up by means of retractable, frameless glass doors on each side. The outside seating area faces out towards the existing brick building (Figure 53) and the impressive natural surroundings. The outside area includes bent steel and plywood seats and the tables are of laminated beams.

The coffee shop's kitchen is located on the north-western side of the eatery to provide easy access for deliveries and garbage disposal. The kitchen comprises a wash-up area, an area for preparation of snacks and drinks, a cold room and storage space for dry goods. The kitchen and coffee shop interior is separated by a pick-up nook directly behind the glass fridge display. A translucent acrylic panel suspended from the ceiling of the kitchen obliterates the customer's view of the wash-up area.

The restrooms (4.4.9.1) are situated near the entrance to the coffee shop. Translucent acrylic panels act as the screens around this area but also provide signage information.



Figure 49: Concept development of the interactive unit to form a unit suitable for displaying printed media

Figure 50: The interactive exhibition units as they appear within the exhibition area

Figure 51: The layout plan of the coffee shop

Figure 52: Sofa and coffee table configuration for the inside seating area of the coffee shop



#### 4.4.4 CYCLING AND CURIO SHOP

Located between the exhibition area and auditorium, is a curio shop and Fritz Pienaar cycling shop. The designs of the shops are to be aligned with the rest of the Centre, yet with a more commercial approach. The concept is to integrate the activities that visitors to the reserve take part in, with the design of the shop (Figure 56) such as using mountain climber's equipment as fixtures. This is to be taken further and developed by the tenants of the respective shops. An exemplary shop design is that of Due South, in Woodlands Boulevard, Pretoria. This outdoor shop makes use of synthetic and natural materials (Figure 54) that suggests the activities of hiking, mountain climbing (Figure 55) and cycling. This method gives the shop a very specific identity.

Figure 53: The existing brick building visible beyond the proposed coffee shop

Figure 54: Timber and steel stools within the Due South shop

Figure 55: Clothing display within the Due South shop. Units are suspended from mountain climber's rope

Figure 56: Concept of the cycling shop window display



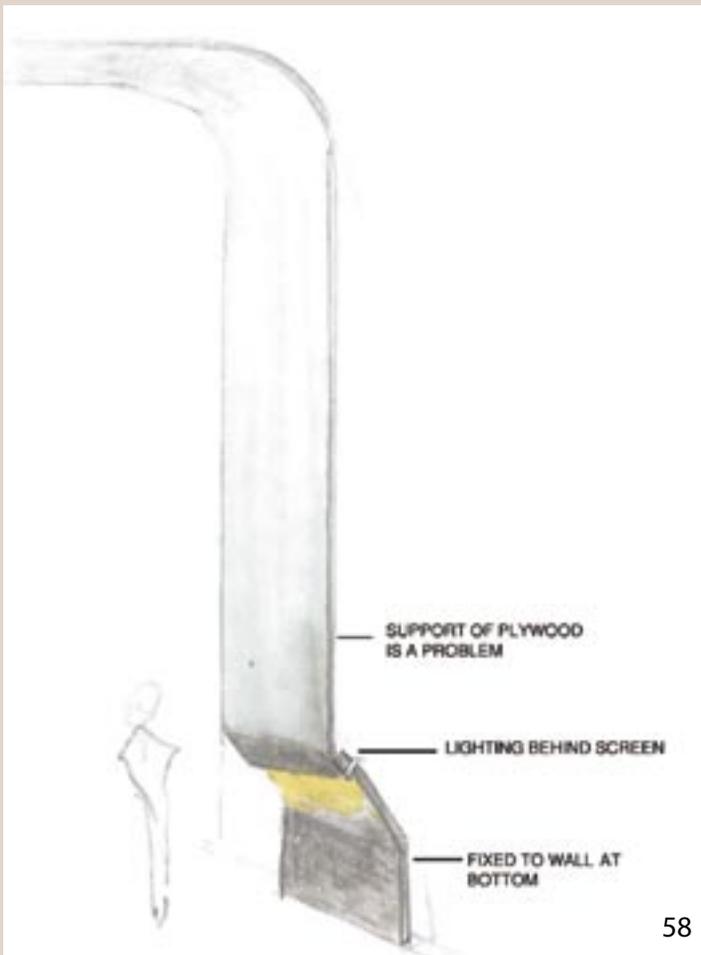
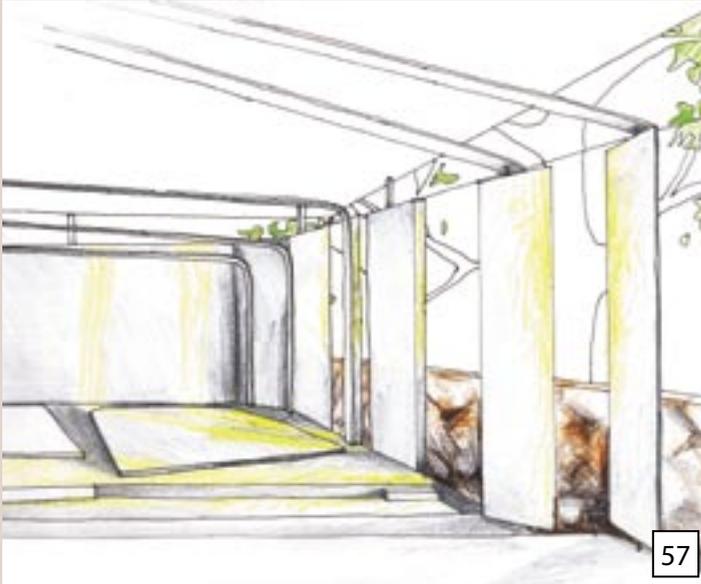
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#### 4.4.5 AUDITORIUM CONCEPT

The auditorium provides the climax of a visit to the *Interactive Centre*, both in regard to its design and function. A progression in the relative importance of the spaces in the holistic design provides a sense of hierarchy in the Centre; this is important in the orientation of the visitor. Listed below are several aspects that contribute to establishing this hierarchy in the design aura of the auditorium.

##### *Design-linked aspects:*

- the seemingly weightless plywood ribs throughout the coffee shop and exhibition areas become the dominant feature of the auditorium: the auditorium screens (Figures 57-60)
- the design detail reaches a high point in the auditorium in the considered application of advanced technologies: acoustics, ventilation and ergonomics
- the individual visitor has final control over his or her thermal comfort by adjusting the pivoting doors and glass louvres along each side of the auditorium
- the eastern and western facades have retractable doors to create an interaction between visitors and the context by means of the surrounding views

##### *Functional aspects:*

- after examining the various exhibits, the visitor may choose to attend a lecture or conference that may be held in the auditorium or adjacent boardroom; these add to the visual stimulation that is awakened by the interactive exhibits
- the auditorium is situated within the semi-private zone of the *Interactive Visitors Centre* and the visitor becomes aware of this change in zoning due to the courtyards that separate the auditorium, office and boardroom from the cycling shop, coffee shop and exhibition area
- the auditorium is also the final destination for groups of learners before they are guided through the reserve to view the wildlife

#### 4.4.6 AUDITORIUM DESIGN

The auditorium comprises a seating and stage area in the public zone and a control room in the private zone, separated by safety glass. The visitor may choose to enter the auditorium and listen to the speaker from the balcony area; if he or she decides to enter and take a seat while a lecture is in progress, the wide steps of the seating structure allow for easy access.

Ergonomics and acoustic quality played a major role in developing the auditorium interior. The user is able to control his or her environment by activating the adjustable doors on the sides of the auditorium. The plywood screens are suspended from the concrete roof slab and envelope the audience. This establishes a 'space within a space' and sets the auditorium space apart from all others in the Centre. The plywood screens aid in the reflection of sound (Figure 81) and they also screen off the western sun when the rotating doors are open. Where the screens meet the side walls light fittings are fixed behind the plywood, hidden from view. Light floods down on the stairs (Figure 59, 60) to ensure safety and this creates a pleasing ambience in the auditorium.

The seating structure is a raked steel construction with a lapped-nose detail (Figure 61) to allow for ventilation of the void underneath the seating (cf. 5.3). The upholstered seats are clipped to the structure of each step, can be swivelled and are removable if the particular function or lecture requires more seating space.

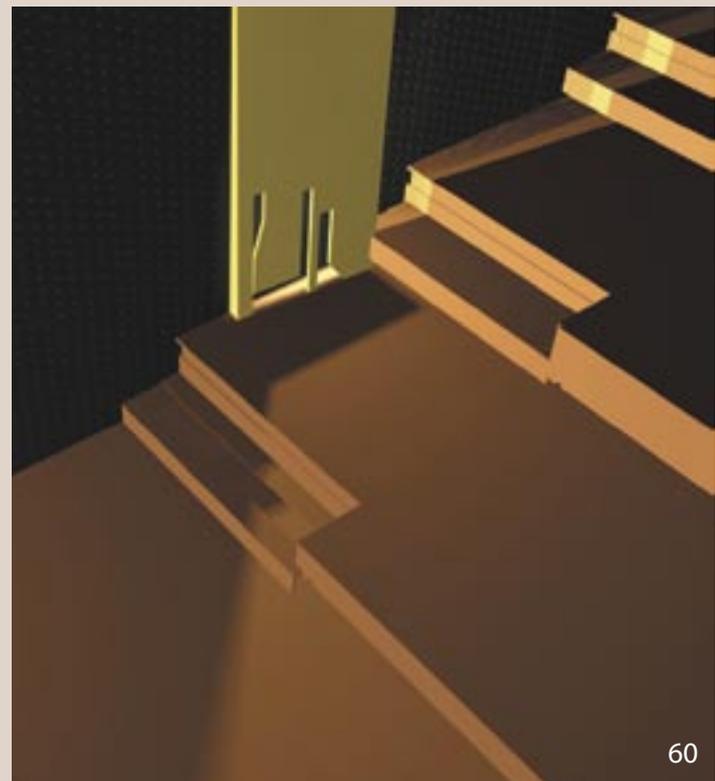
The visitor is also able to enjoy the impressive vistas of the natural surroundings when the rotating doors of the eastern facade are opened. The facade opens out to a stepped water feature and allows a cool breeze into the auditorium.

Figure 57: Design concept of the auditorium interior (April 2006)

Figure 58: Auditorium screen resolution (April 2006)

Figure 59: The plywood screens concept with light spilling down onto the steps as a safety and aesthetic feature (June 2006)

Figure 60: Detail on the plywood screens and their relation to the auditorium steps with artificial lighting (September 2006)



#### 4.4.7 OFFICES

Adjacent to the auditorium is a boardroom and offices/consultation room. The boardroom doubles as a lecture room and private function area as a kitchenette is included behind a translucent glass screen. Both the boardroom and office area can open up by means of the retractable glass doors that surround the spaces, to accommodate large groups of visitors and to make most of the scenery on the southern end of the site.

#### 4.4.8 SIGNAGE

One of the current problems at the GNR is the lack of direction-giving signage. With this in mind the signage of the Centre forms an integral part of the design strategy.

The initial signage concept (Figure 62 a, b) tended to dominate the interior spaces and was subsequently discarded. Instead it now utilises transparent and metal components for a refined architectural expression. The signage system makes a distinction between signs that indicate general direction (such as the restrooms, auditorium, coffee shop, and showers) and those that provide information on specific activities in the Centre, such as the information desk and the take-away counter in the eatery.

The general direction signage (Figure 64) is an illuminated box of translucent acrylic panels set into stainless steel fixtures. The panels are backlit and suspended from bulkheads at two main orientation points in the Centre. The signage for specific activities (Figure 63) consists of laser-cut stainless steel letters fixed individually to a solid substrate. The metal letters are artificially illuminated from above by means of ceiling-down lighters.

#### 4.4.9 SERVICES

Restroom and showering facilities are services that visitors can reasonably expect at the GNR because many of them explore the reserve on foot or on bicycles. The showering facilities are placed separately from the Centre to provide privacy for ablutions before the guests enjoy relaxing activities in the public zones of the Centre. There are restrooms located at the coffee shop and the auditorium.

##### 4.4.9.1 Restrooms

The restrooms are designed with service ducts that ensure flexibility in design and easy access for maintenance.

Because they are exposed to a constant flow of users, the material finishes and fittings of the restrooms have to simplify and minimise the required maintenance. The cubicle doors and sanitary fixtures have a stainless steel finish. The high cost of this material is justified by its corrosion resistance, ease of fabrication, hygiene and low toxicity. The external enclosure of the restrooms (Figure 66) is brightly coloured translucent acrylic panelling (Figures 65, 67) fixed to pedestals to make the facilities easy to locate. Acrylic or PMMA (polymethylmethacrylate) sheets, blended with PVC, are non-toxic, recyclable and durable. Solid Surrinno surfacing is used for the hand washbasin troughs and importantly this is heat and scratch resistant. Surrinno joins seamlessly which makes for a hygienic and easy-to-clean finish. Surinno surfacing and acrylic sheeting are unconventional materials for restrooms; this surface contrasts boldly with the face-brick walls of the existing building that forms part of the restroom complex near the entrance to the coffee shop.

*The integration of unisex toilet facilities poses the risk of sexual crime, but there are certain factors that minimise this risk as far as the GNR is concerned:*

- visitors to the GNR pay an entrance fee of R30
- entry to the reserve is controlled by guards at the main gate
- the reserve is closed off with high-security wildlife fencing
- the attractions of the activities at GNR draw a selected group of users

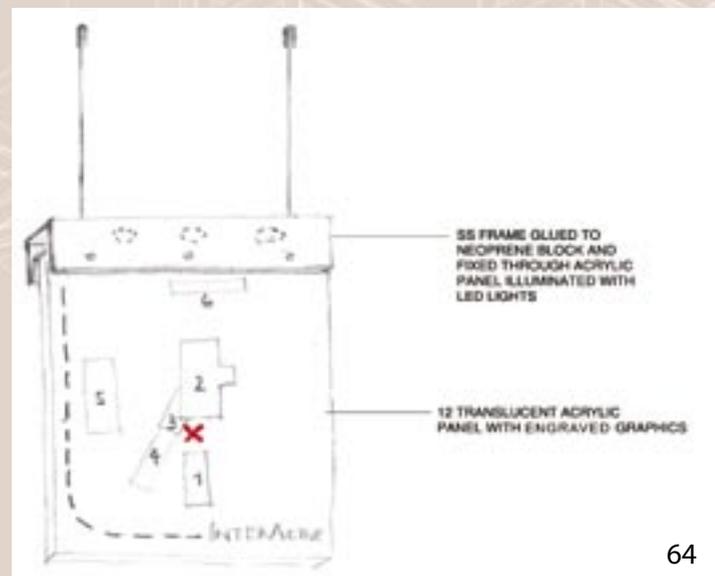
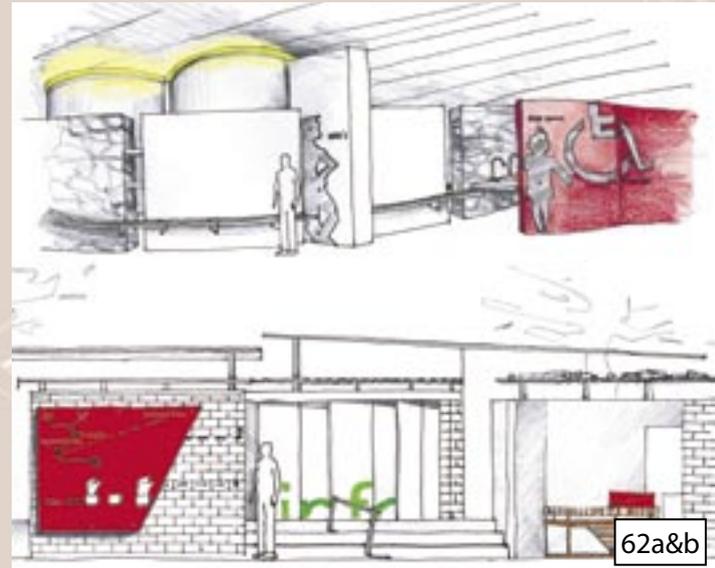


Figure 61: Final resolution of the ventilation gap in the nose of the auditorium seating and steps

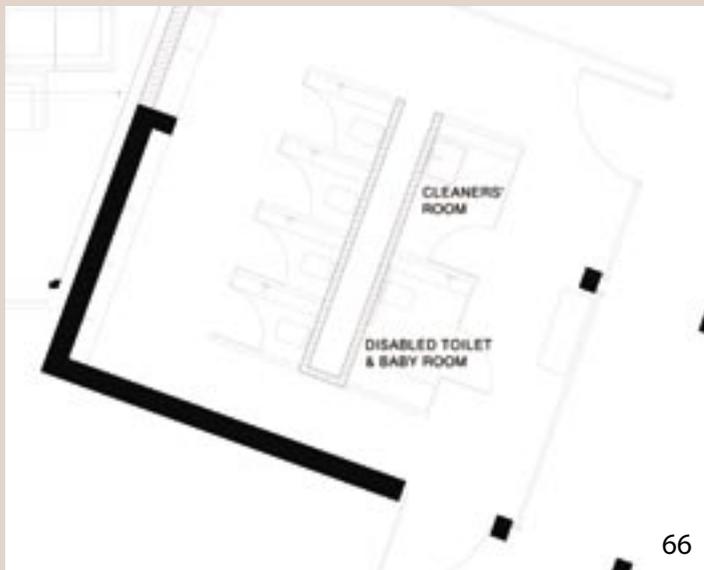
Figure 62 a & b: The initial signage concept (April 2006) that was subsequently discarded in favour of a more refined architectural expression

Figure 63: Signage attached to a wall to indicate specific activities

Figure 64: Signage concept for indicating general direction



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The design nevertheless deals with this potential risk by integrating translucent materials into the design and positioning the restrooms at central points in the Centre, close to where the permanent staff (information desk and offices/boardroom) would normally be stationed.

#### 4.4.9.2 Shower facilities

A semi-mobile shower or toilet unit forms part of the proposal for the reserve as a whole. The unit components are to be pre-fabricated and assembled on site, be it within the Centre or out in the far reaches of the reserve and at the lookout points (cf. 4.2).

The shower facilities consist of individual shower units and the existing red face-brick house (Figure 51) will be converted into a locker room. There are two types of shower units; the one contains a shower only while the other has a shower, water closet and hand washbasin.

The materials used in the construction of the separate shower units have to be hardy enough to withstand the elements, because they are to be used throughout the reserve at the proposed lookout points. A timber envelope is suggested as a secondary layer over aged steel sheeting. The timber envelope provides privacy for the user when inside the shower unit, while also allowing a view out to the surroundings (Figure 69). Galvanised steel sheeting is used as primary dry-walling of the shower unit as it provides mass, stability and can be treated to weather attractively. A pre-fabricated interior component contains the toilet, toilet-roll holder, hand washbasin and tap. The shower is fitted separately and is closed off with a toughened glass panel.

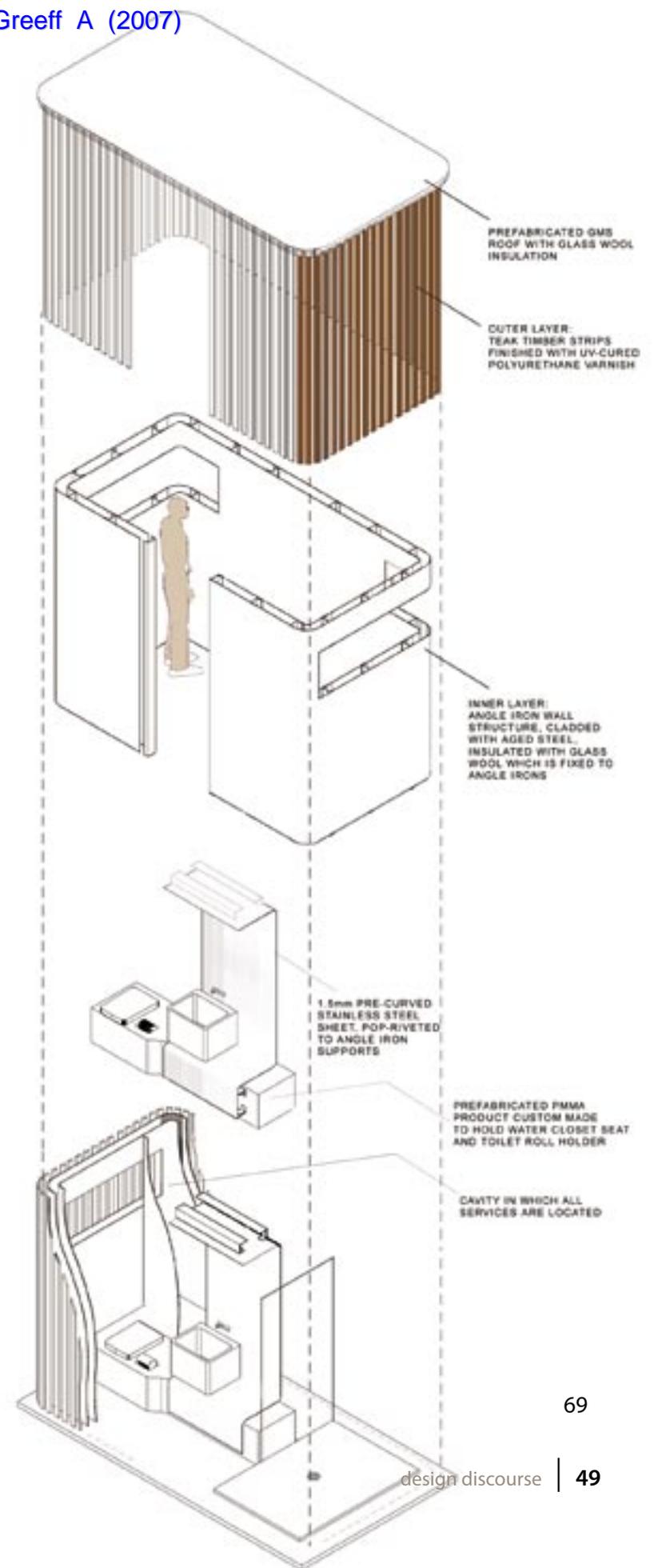
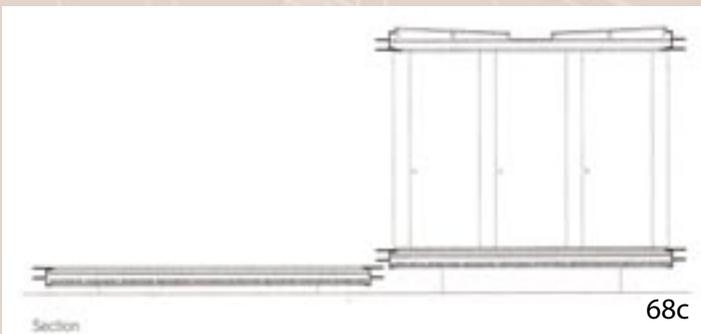
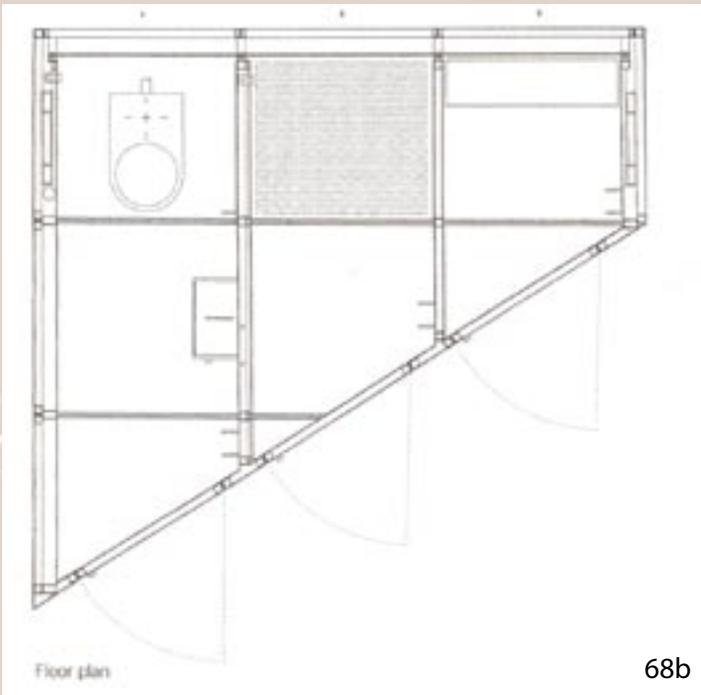
Figure 65: An influence on the proposed design of the restrooms: '2x4 Bathroom' by Rem Koolhaas

Figure 66: The layout plan of the restrooms adjoining the coffee shop

Figure 67: The 'Brain POP office' restrooms designed by 4pli, showing decorative logos on acrylic sheeting

Figure 68 a, b & c: An influence on the proposed design of the shower units: 'Public Toilets in the forest' by Aranda Pigem Vilalta Architects in Olot, Spain. Plan and section not to scale

Figure 69: Resolution of the shower facilities



#### 4.4.10 PRODUCT DESIGN

##### 4.4.10.1 *Information counter*

The information counter is the visitor's first port of call in the *Interactive Centre* and is therefore part of the first impression that the visitor forms of the Centre. For this reason, the counter is an essential design component. The information counter is positioned on a black powder coated steel plinth as you step into the exhibition area. A full-time attendant is in charge of the counter to assist visitors to the Centre and to manage bookings for the self-catering guest houses, auditorium, coffee shop and heritage-hiking trail. The counter serves as a workstation for the appointed attendant as well as a point of orientation for the visitor. From this point in the exhibition area, the visitor can choose to either browse through the cycling and curio shop, to enjoy refreshments at the coffee shop or to attend a lecture in the auditorium.

The concept of the counter is to create a striking visual feature that conveys the same aesthetic as the rest of the Centre. Therefore, a combination of natural and synthetic materials is used to accentuate the curved lines and signage that form part of the design. The materials used are laminated glass, saligna laminated beams and stainless steel. Laser-cut stainless steel letters are mounted to the front of the counter in a corresponding style to the signage throughout the Centre (Figure 63). The information desk accommodates wheelchair-users and children by having a partly lowered counter to the one side (Figure 71).

##### 4.4.10.2 *Balustrade*

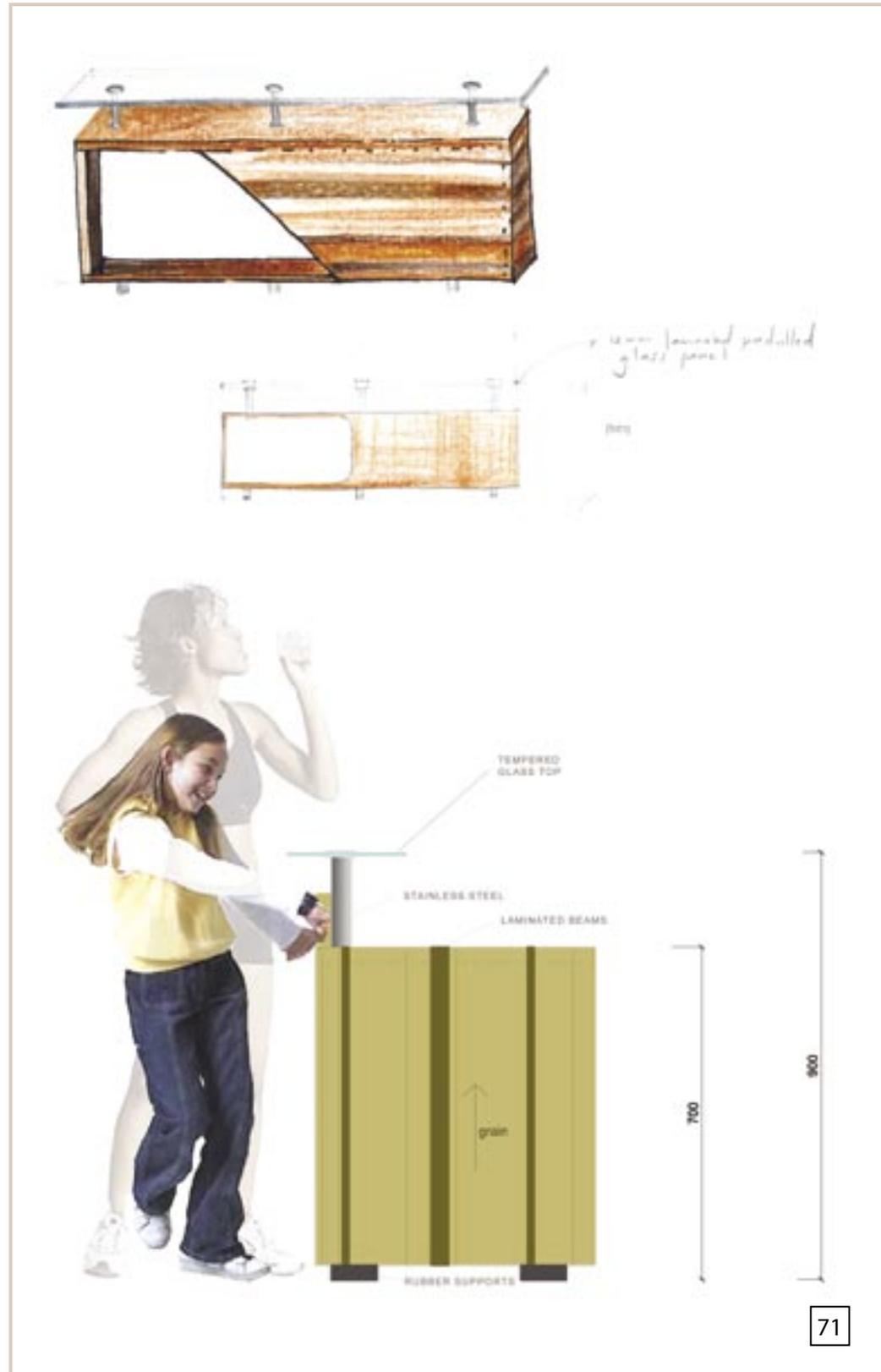
The balustrade is an important element of the inclusive design strategy (Figure 72 a) of the *Interactive Centre* as it considers the safety of children, the visually and physically disabled and elderly visitors to the Centre. The balustrade is located at all points throughout the main building where there is a change in level eg. stairs and ramps, as specified by the SABS 0246.

The concept of the balustrade (Figure 72 b, c) is of curved, diagonal vertical elements, connected by a continuous handrail. The diagonal lines and curve of the vertical



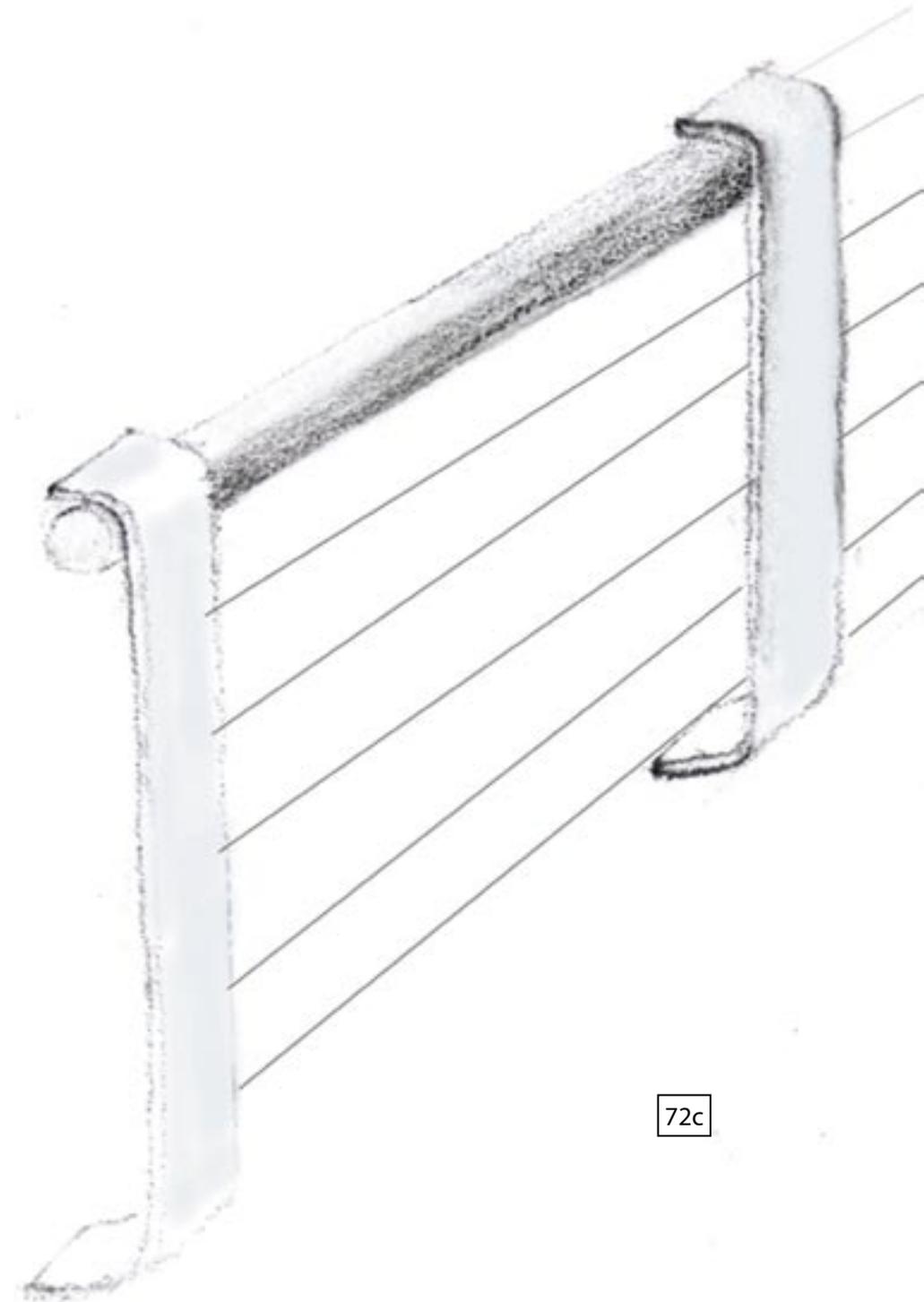
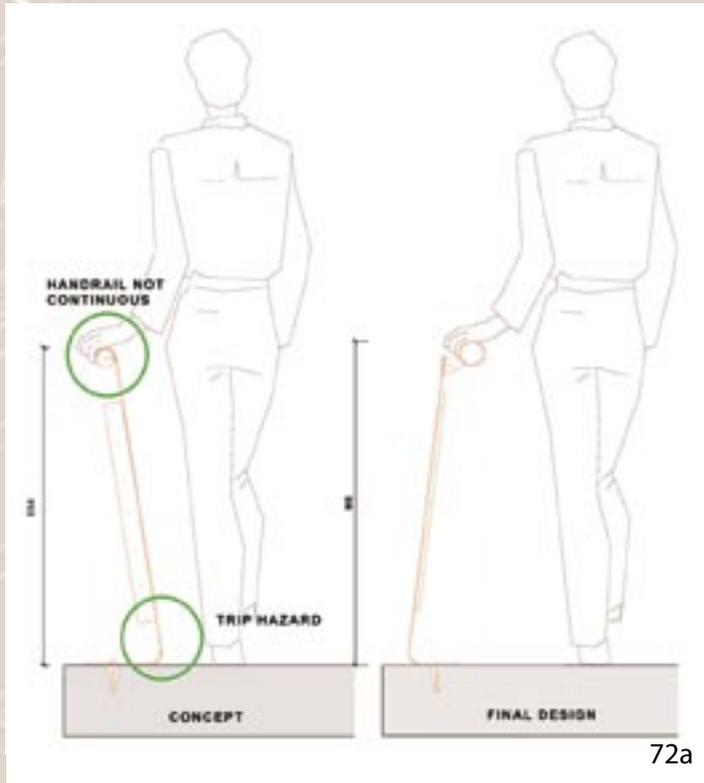
Figure 70: Information counter concept

Figure 71: Detail of the information counter; the first port of call in the *Interactive Centre*



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elements contribute to the simple, yet striking aesthetic of the Centre and adds quality and meaning to a product that, in most cases, is designed strictly for function.

The balustrade is made of stainless steel, a durable, rust-free material that will perform well when exposed to the elements. The railing is of a continuous stainless steel tube as per SABS 0246. Nanotubes form the horizontal part of the balustrade (Figure 72 c) and are spaced at 100mm c/c as per SABS 0246.

#### 4.4.10.3 Auditorium swivel chair

As the users of the auditorium will range from small corporate groups to large groups of learners, it has to be adaptable for different needs and situations. The requirements for a group of learners, for example will be very different from those of corporate groups. The auditorium seats are removable to allow children to sit on the auditorium steps.

The chairs comprise a polymer base, upholstered with polyurethane fabric (Figure 73). They are bright green and contrast pleasingly with the auditorium's natural bamboo flooring. The chairs slide into the auditorium steps by means of a snap-fit fixture in the flooring panels. The fittings are to be designed almost flush with the floor finish, so that it is comfortable to sit on the floor when the chairs have been removed.

#### 4.4.10.4 Product A

The rib-like structures used throughout the Centre as a trademark (cf. 4.4.1) will assist the visitor to identify points of importance (exhibition area, coffee shop and key external areas). Product A (Figure 75) was the primary concept from which product C, product B (the interactive exhibition unit) and product D (the auditorium screens), were developed.

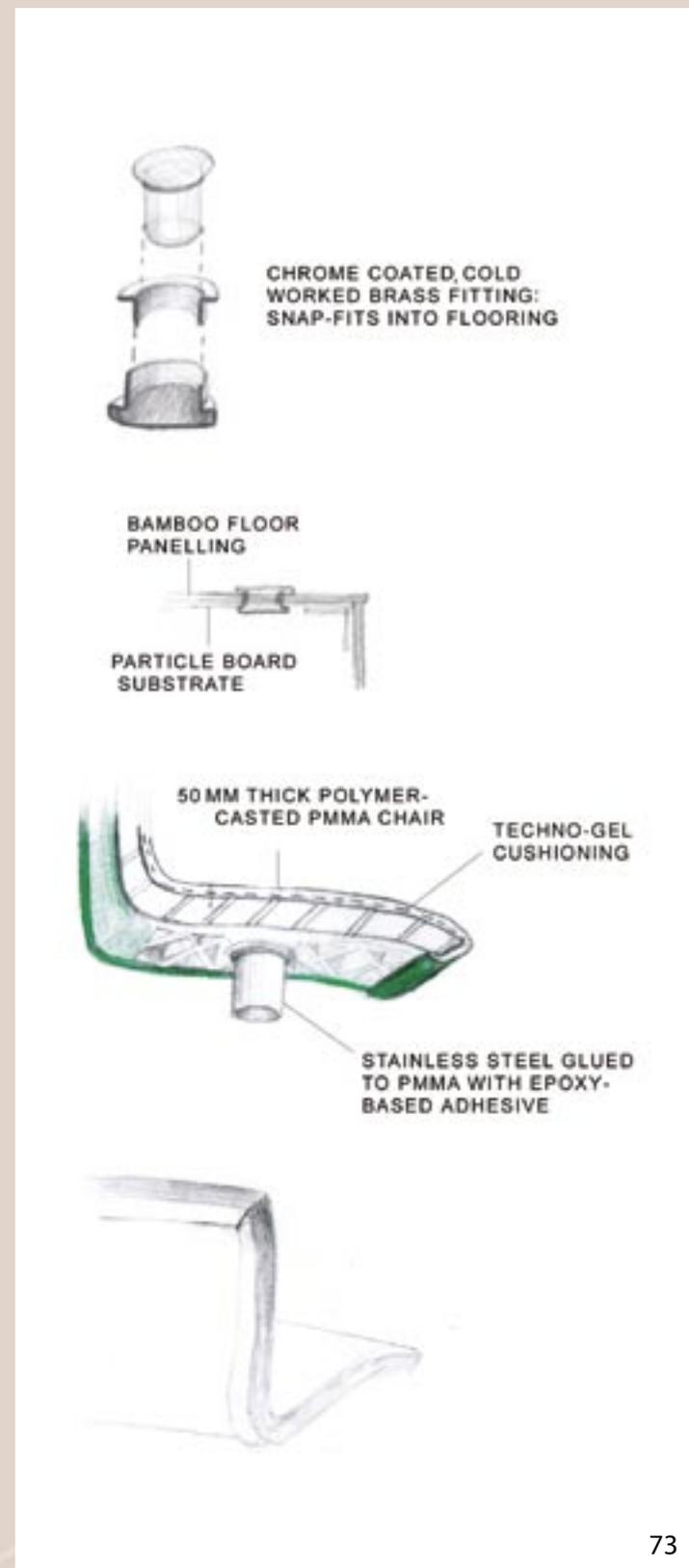
This product comprises a series of rib-like curved plywood panels that are suspended from a bulkhead. Product A, as with product B (cf. 4.4.2) , creates a 'space within a space' and accentuates the natural surroundings by providing a fragmented image of the vistas beyond. The function of

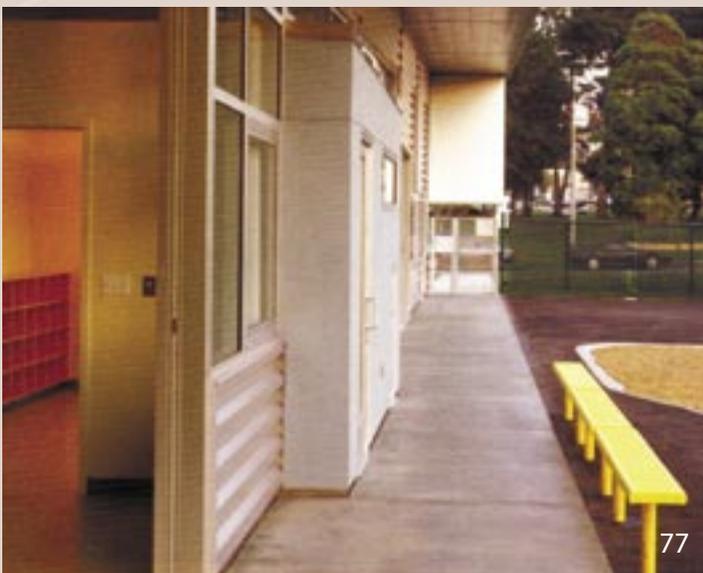
Figure 72 a: The initial balustrade design was exchanged for an inclusive design

Figure 72 b: Detail resolution of balustrade materials (August 2006)

Figure 72 c: Initial concept of nanotubes that form part of the balustrade

Figure 73: Detail resolution of the auditorium swivel chair components





the product is to serve as a trademark feature and point of orientation; it is also used for seating in the locker room and coffee shop. Signage can also be integrated with the product.

The ribs are made of pre-curved plywood sections (Figure 74) that are assembled on site with dome nuts, threaded rods and washers. The ribs are then hung from the installed bulkhead to the height needed for the specific space. The ribs hang on a rope, attached to stainless steel hooks. The ribs can be adapted to fit between any finished floor level and ceiling from 1.7m to 2.1 m from one another.

#### 4.4.10.5 Product C

Throughout the Centre, there are external units where a visitor may leave a bicycle while attending a lecture or drinking coffee. These units look similar to product A, but are made of treated curved steel ribs, bolted to the respective concrete slab, with reeds and polycarbonate sheeting as infill material to create a pergola.

Product C serves as a shading mechanism (over the external seating of the coffee shop), a storage device for bicycles (Figure 76) and can be integrated with signage to orientate visitors to the Centre.

#### 4.4.10.6 Door type A

The pivoting door is located along the auditorium facades and on the western facade of the exhibition area. The doors' design concept is to be adaptable to the needs of the users. The doors can either be used to screen off sun and light, or a hinged steel mesh panel can be opened to allow light into a space. The doors consist of corrugated steel sheets in a profile, with insulation material in the cavity (Figure 78). The doors are installed to run on a steel wheel in a track. The tracks are to be inlaid into the concrete flooring to ensure they do not become a trip hazard for visitors.

Corrugated metal sheeting (Figure 77) is widely used for roof construction in the reserve, Fountains Valley and the rest of Pretoria. By using the material in door type A, there is an interesting contrast with the smooth textures of glass and concrete in the auditorium.

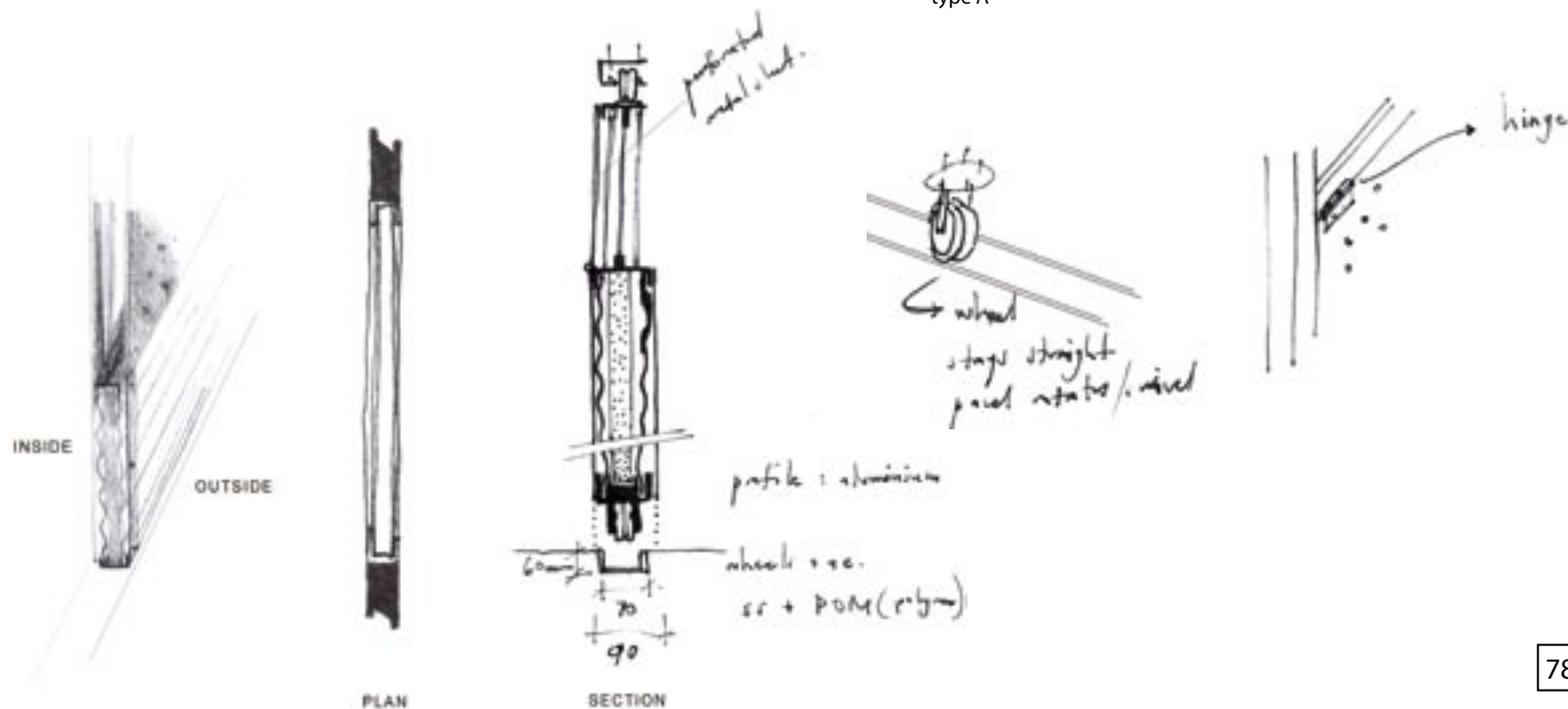
Figure 74: A coffee table of 32mm curved plywood that influenced the design resolution and material choice of Product A

Figure 75: A single rib, forming part of Product A

Figure 76: Product C used for storage of visitors' mountain bikes

Figure 77: IBR metal sheeting used as external wall cladding on a building, which influenced the design of pivoting door type A

Figure 78: Technical resolution of the materials used in the pivoting door type A





# 1 Technical

## 5: Technical Resolution

5.1	Sustainability: Baseline document	72
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'I'm very interested in buildings that adapt to changes in climatic conditions according to the seasons ... I am concerned about the exploitation of the natural environment in order to modify the internal climate of buildings. Architects must confront the perennial issues of light, heat, and humidity control yet take responsibility for the method and the materials by which, and out of which, a building is made. The considerations, context, and the landscape are some of the factors that are constantly at work in my architecture.'

Glenn Murcutt, quoted in Jensen & Walker, 2002. *Glen Murcutt: A Singular Architectural Practice*, p 33)

## 5.1 Sustainability: Baseline document

The Sustainable Building Assessment Tool (SBAT) was developed to assess the sustainability of a building according to certain economic, social and environmental criteria. The Sustainable Buildings Group of the division of Building and Construction technology, CSIR, Pretoria, designed this device. It was developed for use in third world countries and includes aspects such as the impact of the building on the local economy. The application of SBAT is not building-type specific, and it can be used for assessment of offices, factories, clinics, housing etc. (Gibberd: 2002).

For the *Interactive* Centre to provide a safe, healthy and inclusive environment, the design must conform to the recommended sustainable measures. The objectives that apply to this project are set out below; these parameters are based on SBAT and the National Building Regulations (NBR).

### 5.1.1 BASELINE OBJECTIVES

The baseline objectives serve as a guide for design decisions and technical resolutions by prioritising certain qualities of the Centre. For example, as the context of the project is a Nature Reserve, the environmental performance is more important than the economic performance (Figure 79).

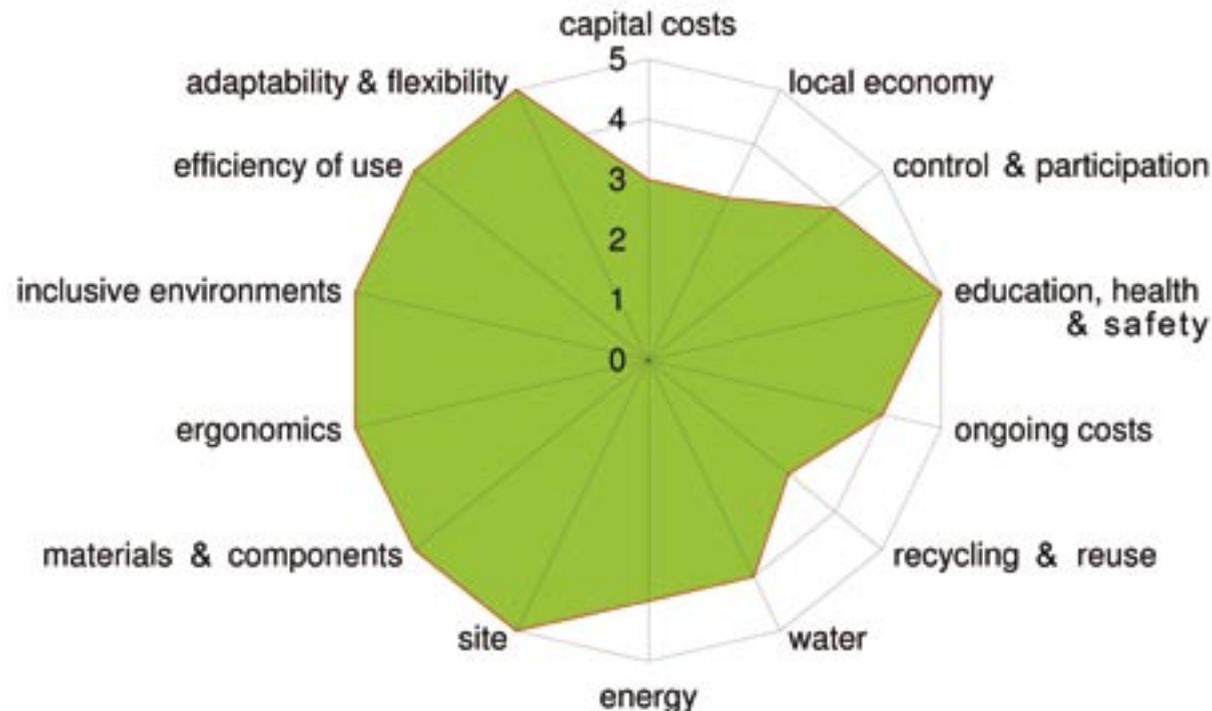
### 5.1.2 SOCIAL CRITERIA

#### 5.1.2.1 Ergonomics & inclusive environments

The Centre should be accessible to all users to ensure an inclusive environment. The design should provide for easy access and use by disabled persons, the elderly and children. As the Centre has a multidimensional user profile (Figure 17), the design must be adaptable and provide solutions that are not restricted to a single group of users.

The safety and accessibility requirements of the SABS 0246 were met, especially with regard to level changes. Ramps of 1:12 fall are to be provided at all level changes and should have balustrades on both sides. According to SABS 0246 p 7, the minimum clear opening of all doorways for use by disabled individuals is 750mm. Throughout the Centre the minimum width (Figure 80, X) of corridors and door openings is 900mm to make it comfortable for cyclists to steer their bicycles through the necessary points to reach the bicycle stands (cf 4.4.8.4).

Slippery floors are hazardous for people whose sight is impaired therefore the use of non-slip floor materials should be used where possible. Contrasting textures and colours in floor materials should be incorporated to help people with impaired vision distinguish between changes in floor levels,



changes in direction (balustrades) and areas with different functions.

Throughout the Centre there are points where a mountain biker can leave a bicycle while attending a lecture, drinking coffee, viewing the exhibitions or browsing in the shops. This implies that the exterior as well as interior floor finishes have to be as accessible as possible. To propel a bicycle or wheelchair, for example, over thick pile carpets, loose sand or stone aggregate is extremely difficult and therefore these finishes should be avoided.

Providing facilities for the disabled is an important aspect of inclusive design. Catering for the physically impaired and wheelchair users includes the provision of well-designed, flush-valve toilet facilities as well as lowered counters and information desks. Provision for the visually impaired also means allowing guide dogs into the Centre and if required, providing water bowls. Guide dogs have to be prohibited from entering the reserve outside the Centre, however, as they may disturb the wildlife.

#### 5.1.2.2 Occupant comfort

Noise from the R21 highway is at times audible within the reserve and can distract the visitors especially when a lecture is in progress in the auditorium. The water feature on the eastern side of the auditorium addresses this issue, along with the use of sound-absorbing materials and materials with high mass. An acoustic engineer's assistance is required to resolve all matters in this regard.

Thermal comfort and ventilation in the Centre are vital in creating a healthy and comfortable environment. With Pretoria's low average humidity, a constant temperature of between 22°C and 24°C is ideal. Mechanical heating and cooling does not provide an energy-efficient solution and is unnecessary if the spaces can be passively ventilated. If possible, mechanical ventilation should be limited to the coffee shop kitchen and the public toilets.

#### 5.1.2.3 Safety & Fire Protection

Security guards at the gates control access to the reserve. The fee that is charged upon entrance is by way of a security measure and added to this the personnel at the point of entry within the Centre (exhibition area) monitor the inflow of visitors.

Signage that indicates fire equipment in the Centre should be clear and visible as according to SABS 1186. Installation of fire hose reels are to comply with SABS 543. All fire escape doors are to open in the direction of escape and escape routes are to be at least 800mm wide.

#### 5.1.2.4 Education

The visitors to the Centre include families and learners. The youth, in particular, must be made aware of environmental issues and civic pride. This educative process can be achieved by means of audio-visual exhibitions, posters and suitable lectures.

### 5.1.3 ENVIRONMENTAL ISSUES

#### 5.1.3.1 Energy

The choice of lamps in the Centre should be influenced by cost (capital and running cost), and quality of light in terms of colour rendering and glare. The use of lamps with a long life span will minimize the running cost and maintenance of the Centre and will use less energy, which is a part of an environmentally responsible design.

Passive ventilation as opposed to a mechanical ventilation system as well as good maintenance and management of the systems of the Centre (sound, lighting, services) will decrease the energy use of the Centre.

#### 5.1.3.2 Waste management & deliveries

An area is allocated in the Centre where all waste is to be sorted. This area is at the back of the coffee shop kitchen

Figure 79: The baseline objectives are prioritised in the Interactive Centre

Figure 80: Clear width of doorways in the Centre



80

(Figure 51). Organic waste like leftover food from the eatery can perhaps be exchanged for compost with a local farmer. Glass, paper and tin are to be separated and recycled.

The same area serves as the point where goods are delivered to the coffee shop. The access roads to the delivery area are not to be obstructed by sign boards, cars or bicycles. Deliveries are not to be made at the main entrance of the Centre, as this will disturb visitors.

Stainless steel waste and garbage bins are situated in combination with signage throughout the Centre and are to be emptied daily.

### 5.1.3.3 *Recycling and re-use of materials*

In 'Concepts for Recycling Construction/ Demolition Materials', in *Sustainable Construction* (1994:269), Lozar comments 'There is now a groundswell of interest in the design of buildings and the choice of their materials and construction so that they may be readily deconstructed. Thus, the full lifecycle of the material is considered and used in such a way as to facilitate use and re-use'.

The use of recyclable materials minimises the building's ecological footprint so as far as possible materials should be chosen that can be re-used or recycled and have a low embodied energy.

*The following are examples of re-useable materials in the design of the Centre:*

- reeds available within the reserve are used in Product C
- the open-air classroom seating makes use of old railway sleepers
- the corrugated sheeting of the existing lapa is re-used as roofing material

Concrete is used as roofing material and for flooring throughout the Centre.

*According to the Portland Cement Association and the Environmental Council of Concrete Organisations, concrete is a sustainable material because*

- it causes minimal waste as it is produced in the exact quantities needed for the project
- it is cast on site and is therefore labour intensive and creates job opportunities

- it is durable and gives the building thermal mass
- it reflects natural light for effective day lighting
- it retains storm water

Bamboo flooring panels is used in the auditorium and apart from the aesthetic and acoustic (cf. 5.2.3) value of the material, the material has several environmental advantages.

*Bamboo is:*

- a rapidly renewable resource
- harvested with virtually no impact on its natural environment
- a low-emitting material if not finished with formaldehyde

Ecostrong bamboo flooring is a South African supplier, which is specified for the auditorium. Their product is 30 % harder than oak timber flooring, minimizing the wear that occurs due to furniture, shoes and bicycles.

## 5.1.4 ECONOMIC ISSUES

### 5.1.4.1 *Local economy*

The use of scarce materials should be avoided. The use of South African manufactured or supplied products supports the local economy and this has been recognised in the project.

*To name a few South African products specified for the Centre:*

- Ecostrong bamboo flooring
- Matco PVC tiles
- Dykor ceramic tiles
- Maizey's acrylic panels
- PG Bison chipboard and Surinno solid surfacing
- Rondo kitchenware
- Floor Crete/ Flexi bond concrete finishes

Local labour and the use of indigenous materials (brickwork, concrete, stone, reeds and timber) are to be used for construction, shop-fitting and product manufacturing.

The employment and training of local workers for catering, maintenance and as veld guides is to be encouraged. By

incorporating an arts and crafts shop local entrepreneurs can be empowered and supported.

#### 5.1.4.2 Adaptability and flexibility

The Centre represents a large investment by private and governmental bodies, which makes it unlikely that the structure will change to alter the function of the building within the first 5 years. More structures may well be added over time so the lifespan of materials and commercial ventures should be taken into consideration along with recycling and re-use possibilities. Installations and fittings are to be flexible, easy to assemble, remove and re-use.

#### 5.1.4.3 Ongoing costs

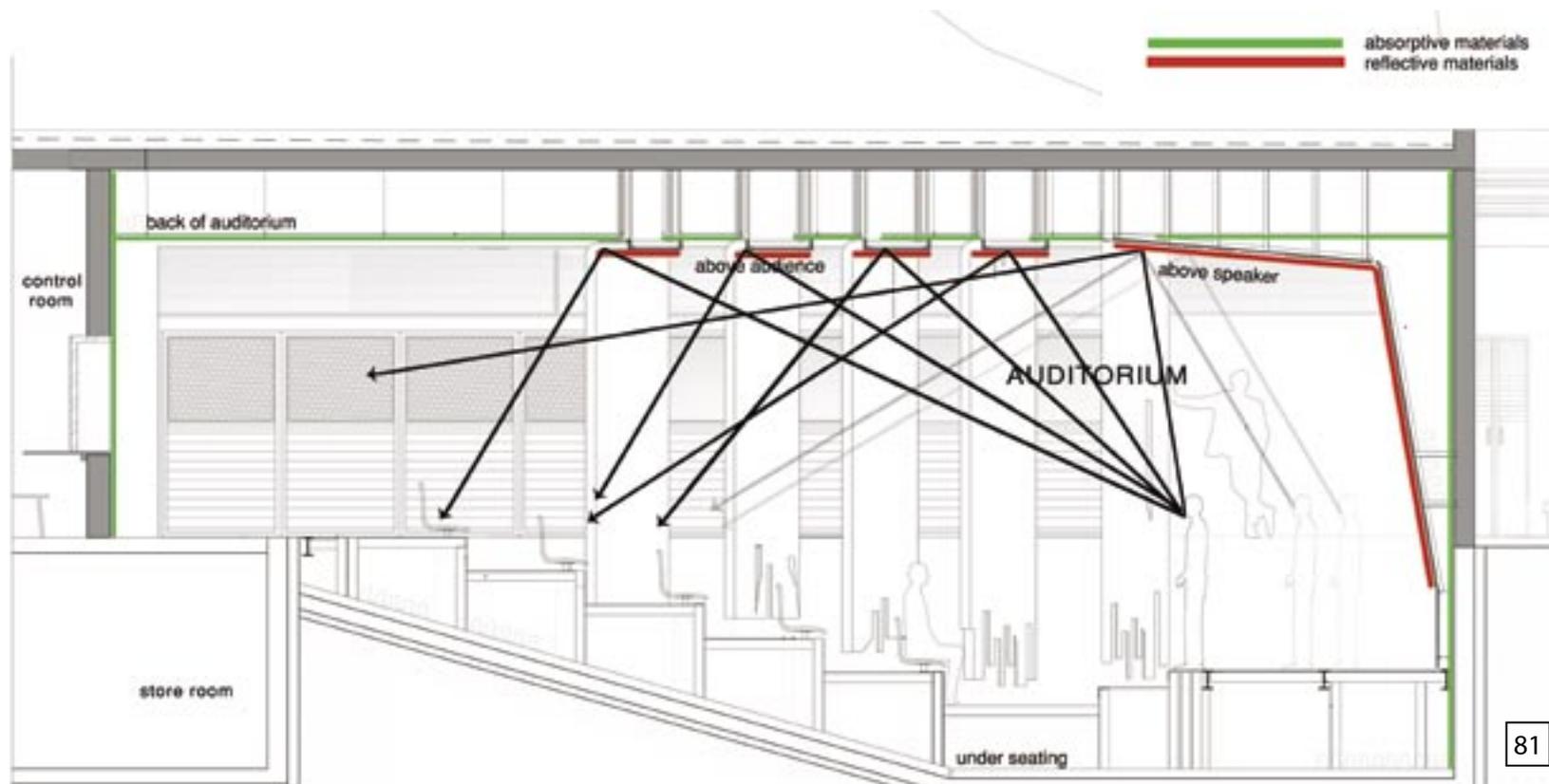
The building manager should take care that regular inspections are made of the fixtures and services at the Centre. Through correct maintenance and control of the building lighting, sound and computer systems, the need for repairs can be limited, which will minimise ongoing costs.

The Centre should be equipped with water-saving components for flushing toilets, taps and showers. By planting indigenous trees like the *Celtis africana* in the landscape, the long-term cost of sprinkler systems can be minimised.

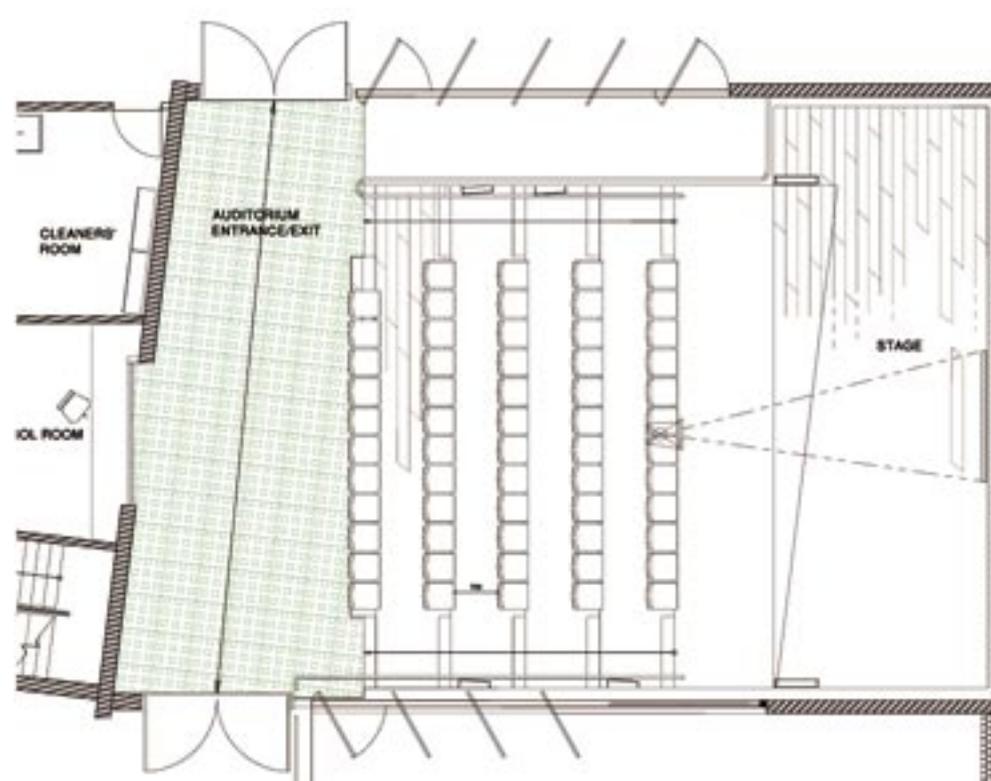
## 5.2 Acoustics

It was vital that the acoustic performance of the auditorium be highly efficient and this requirement had a direct bearing on its interior design. The auditorium facilitates educational programmes, lectures, conferences, informal talks, other gatherings and social activities. Users may include learners, cycling and hiking clubs or corporate groups. The design used here challenges the conventional auditorium, the so-called 'black box'; instead it allows the facades to open, while ensuring that formal lectures with projectors and other high-tech equipment can be used when necessary. The shape of the auditorium and the materials used illustrate how an innovative design is able to optimise the acoustics.

Figure 81: Reflection of sound in the auditorium



81



82

### 5.2.2 SHAPE

The slight deformity of the rectangular space of the auditorium is to prevent unwanted flutter echoes from forming between the parallel surfaces in the space. The back wall (next to the control room), (Figure 82) is at an angle of seven degrees to the front wall (at the back of the stage) and the curved plywood screens are rotated five degrees away from the side walls.

The shape of the interior space is between 1.2 and 2 times as long as it is wide, which is the accepted proportion for auditoria. The raked seating puts all listeners into the direct sound path of the speaker on the stage and avoids sound shadows being cast by the person sitting in front of another member of the audience. The plywood screens that curve to become reflective ceiling elements also enhance the reflection of the speaker's voice (Figure 81). They also allow viewers on the balcony to see the person who is addressing the audience from the stage.

### 5.2.3 MATERIALS

For good sound enhancement, the screens on the sides of the auditorium consist of 32mm plywood. This a material

that reflects the high frequencies that carry information to the audience while absorbing low base sounds that generate noise. The addition of glass wool in the cavity between the two layers of plywood enhances the low frequency absorption. The sides of the auditorium have retractable pivot doors that comprised two corrugated iron sheets with medium density fibreglass between them, resulting in the following properties:

- the corrugations of the metal reflect a well-spread diffuse sound
- the fibreglass absorbs unwanted low frequency sounds

The concrete back and front walls are clad with 40mm thick, 40 kg/m<sup>3</sup> Fibretone (perforated vinyl facing) sheets to absorb sound at all frequencies and avoid the sound in the auditorium from reaching the offices.

The flooring of the auditorium is commercial grade 8mm treated bamboo planks on a particleboard substrate. At the entrance (Figure 82), however, a non-slip, durable floor material is needed as this area is exposed to heavy pedestrian traffic as well as sun radiation and moisture in rainy weather.

Absorption Co-efficients:		room: 13.4 x 9.6 x 4.8			
Frequency	(Hz)	250	500	1k	2k
Floor:		0.16	0.28	0.3	0.28
Walls (Fibreton):		0.24	0.66	1.12	1
Walls (Plywood):		0.25	0.15	0.09	0.05
Ceiling (Acoustone):		0.2	0.3	0.44	0.55
Ceiling (Plywood):		0.25	0.15	0.09	0.05
Doors:		0.06	0.06	0.06	0.06
Windows:		0.25	0.18	0.12	0.07
Seats occupied 90% (per seat)		0.32	0.38	0.35	0.38
Air (per m <sup>3</sup> )		0.001	0.003	0.006	0.011
Absorption	(m <sup>2</sup> )	250	500	1k	2k
Floor:	130	20.8	36.4	39	36.4
Walls (Fibreton):	25	6	16.5	28	25
Walls (Plywood):	42.5	10.625	6.375	3.825	2.125
Ceiling (Acoustone):	105	21	31.5	46.2	57.75
Ceiling (Plywood):	23	5.75	3.45	2.07	1.15
Doors:	42.5		2.55		
Windows:	20		3.6		
Seats occupied	72 people		30.4		
Air	650 m <sup>3</sup>		1.95		
<b>Total Absorption in room (A)</b>		<b>135.7</b>			
Room total surface (S)		388m <sup>2</sup>			
Average absorption Co-efficient (α) (1)		0.4			
Reverberation time (T60) (2)		0.6			
1	$\alpha = \frac{A}{S}$				
2. T60 =	$\frac{0.161V}{-2.3 S \log (1 - \alpha)}$				
		V = Volume of room (m <sup>3</sup> )			
		S = Total surface area (m <sup>2</sup> )			
		α = Average absorption coefficient			

83

Heavy-duty commercial carpet tiles and safety PVC flooring is specified for this area. Thick absorbent carpet flooring dampens the sound of footsteps and this is important as people tend to filter into the auditorium after a lecture has commenced. The chair surfaces are of a spongy material to ensure a constant level of sound absorption whether the auditorium is full or empty, thus limiting the effect on sound quality.

#### 5.2.4 REVERBERATION TIME

To determine how well a space performs acoustically, the reverberation time (the time for sound to travel from speaker to audience) is calculated (Figure 83):

Figure 82: Floor materials in the auditorium

Figure 83: Calculation of the reverberation time in the auditorium

<i>Room:</i>	13.4m x 9.6m x 4.8m
<i>Floor:</i>	150mm concrete floor with 20mm particleboard underlay on steel joints at 600 c/c spacing with 190mm bamboo flooring planks. Average air gap of 80mm with 50mm glass wool.
<i>Ceiling:</i>	82% 15mm Acoustone on T-hangers with 500mm air space and 50mm glass wool. 17% 20mm laminated plywood, 100mm average air gap with 50mm glass wool.
<i>Walls:</i>	25mm Fibretone against concrete and 20mm laminated plywood, 100mm average air gap with 50mm glass wool.
<i>Doors:</i>	Steel frame pivoting doors with galvanised sheeting, 50mm air gap with glass wool and seal.
<i>Windows:</i>	4mm glazing

The accepted reverberation time for speech purposes is one second or less; a musical performance requires a longer reverberation time. By scrutinising the calculations (Figure 83) it can be seen that the calculated reverberation time is 0.6 seconds with the suggested materials. The amount

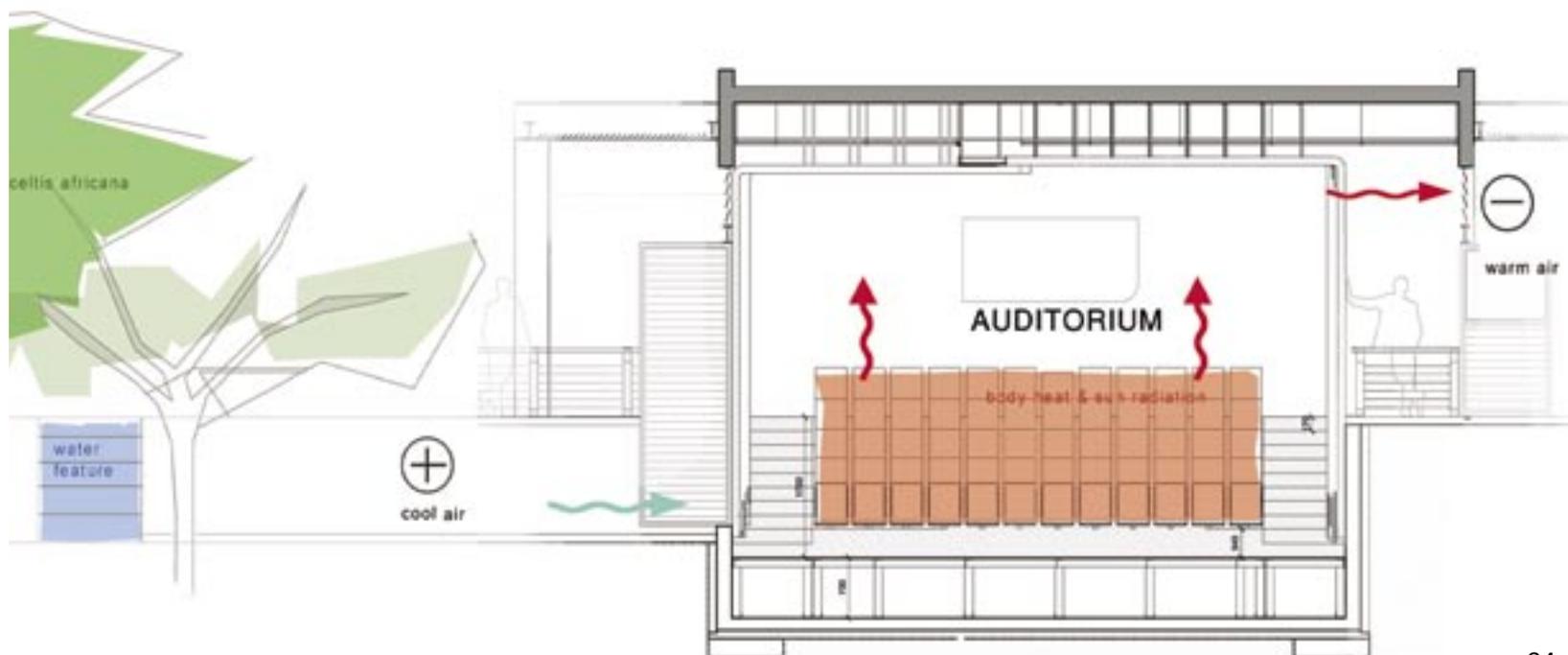
of absorption in the auditorium is thus estimated to be sufficient. To optimise speech intelligibility, however, care should be taken that there are always doors open; an open door aids absorption in a space.

#### References for this section

1. J.P. Nel, Unpublished notes compiled for Earth Sciences 210, 2002, UP Department of Architecture: 'Acoustic Notes and Thermal Performance of Buildings.'
2. Personal interview, J.P. Nel. Mechanical Engineer, 10 August 2006.

### 5.3 Ventilation

Although the Centre is ventilated by means of passive ventilation methods, sufficient ceiling space forms part of the design, making it possible to install additional HVAC (heating, ventilation and air-conditioning) systems. By including the additional HVAC systems into the design consideration, the building can readily adapt to any changes made to the interiors and this will ensure the thermal comfort of the users over the lifespan of the Centre.



### 5.3.1 NATURAL VENTILATION

Natural ventilation is only efficient if proper cross-ventilation can occur; both the path and the distance of airflow influence cross ventilation. Throughout the Centre, the depth of the spaces has been kept to a minimum (an average depth of 7 metres) to create opportunity for cross-ventilation to occur.

### 5.3.2 AUDITORIUM

The principles of passive ventilation that have been applied in the auditorium attempt to take advantage of Pretoria's climate that is seldom extreme. The interiors can open out to the landscape and allow visitors to enjoy the scenery while they are in the comfort of a building.

The prevailing winds in the Pretoria area are south-easterly, therefore the auditorium is oriented parallel to the windward direction. This allows for effective passive ventilation of the auditorium. Air moves over the water feature and cools off further as it moves through the shade of the *Celtis africana* trees planted on the eastern side of the auditorium. The cool air creates a positive pressure on the eastern side of the auditorium. Warm air generated in the auditorium from body heat (and the small amount of solar radiation that penetrates the facade) cause negatively charged air in the ceiling (warm air rises) of the auditorium. The difference in charged air causes effective passive ventilation of the auditorium. The grills in the eastern wall (Figure 84) allow cool air into the auditorium from beneath the seating structure. The warm air rises due to this change in charge (warm air negative, cold air positive) and then exits through the glass louvres at the top of the western facade.

#### References for this section

1. J.P. Nel, Unpublished notes compiled for Earth Sciences 210, 2002, UP Department of Architecture: 'Acoustic Notes and Thermal Performance of Buildings.'

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Figure 84: Passive ventilation of the auditorium

## 5.4 Lighting

Although the Centre will be used for the most part during the day when minimal artificial lighting is required, there will be private functions and exhibitions held in the evenings, especially over weekends. For artificial lighting in the Centre low voltage dichroic halogen lamps, tungsten halogen lamps, LED lamps and fluorescent lamps are used.

Clustered LED lamps are used in the general signage of the Centre and in the auditorium. The advantages of LED lamps are that they can be grouped, produce a diffuse light, generate very little heat and have a life span of 100 000 hours. LED lamps are expensive however, but initial high cost is outweighed by the energy costs saved over the building's life span.

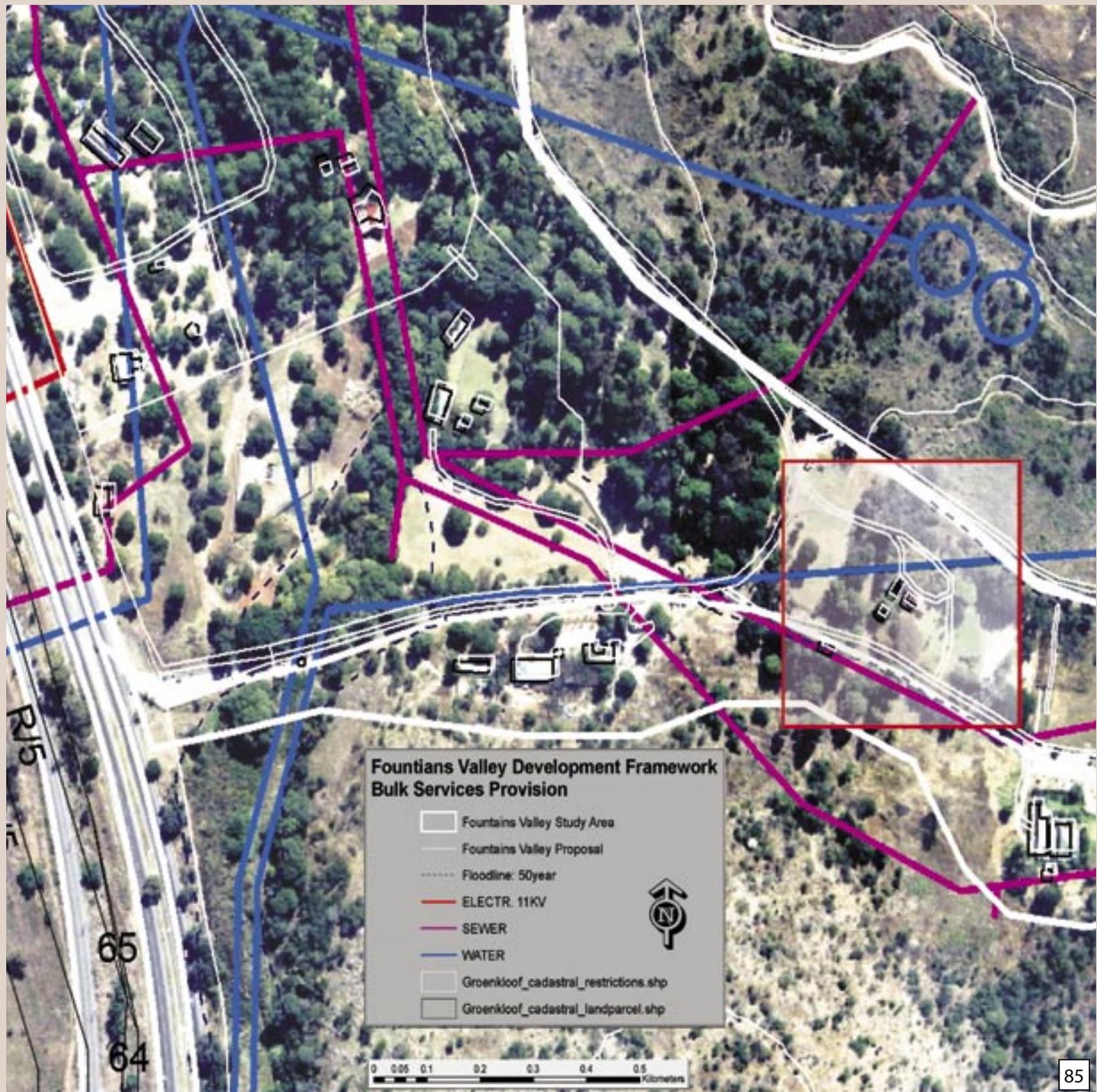
Phillips batten Fluorescent lamps are specified in the auditorium and exhibition area. Fluorescent lamps have a long lifespan, although less than LED lamps. Fluorescent batten lamps are used to illuminate the auditorium screens (Figure 59, 60) as they are simple to mount, easy to replace and supply a continuous diffuse beam of light.

Low voltage and tungsten halogen lamps are specified for the exhibition area as these lamps give a space good quality light and colour rendering. Low volt (12V) tungsten halogen lamps with dichromatic reflectors give a cool beam and have a 2000-4000hour life span. Halogen lamps are not as energy efficient as fluorescent and LED light, yet the quality of the visitors' experience justifies this more expensive choice.

## 5.5 Fire protection

The Groenkloof Nature Reserve is protected by the National Parks of South Africa and contains valuable wildlife and exotic plant species. Management has a required system in place to monitor the reserve and to react swiftly if fire should break out.

Preventative measures and fire equipment should, however, be included in the design of the *Interactive Centre*. Two sets of fire hose reels and portable fire extinguishers are provided at strategic points in the Centre and are visible to visitors by means of signage. The portable fire extinguishers are the



4.5kg carbon dioxide-type and the fire hose reels have to comply with SABS 543. A sprinkler system is to be installed in the auditorium as a preventative measure, as the interior finishes of the auditorium contains natural materials such as plywood and bamboo planks. All materials in the Centre are to have a minimum fire stability of one hour.

## 5.4 Water and sewage

A main water supply runs through the site on which the Centre is to be constructed (Figure 85). The shower units and all taps in the Centre are to be connected to this system.

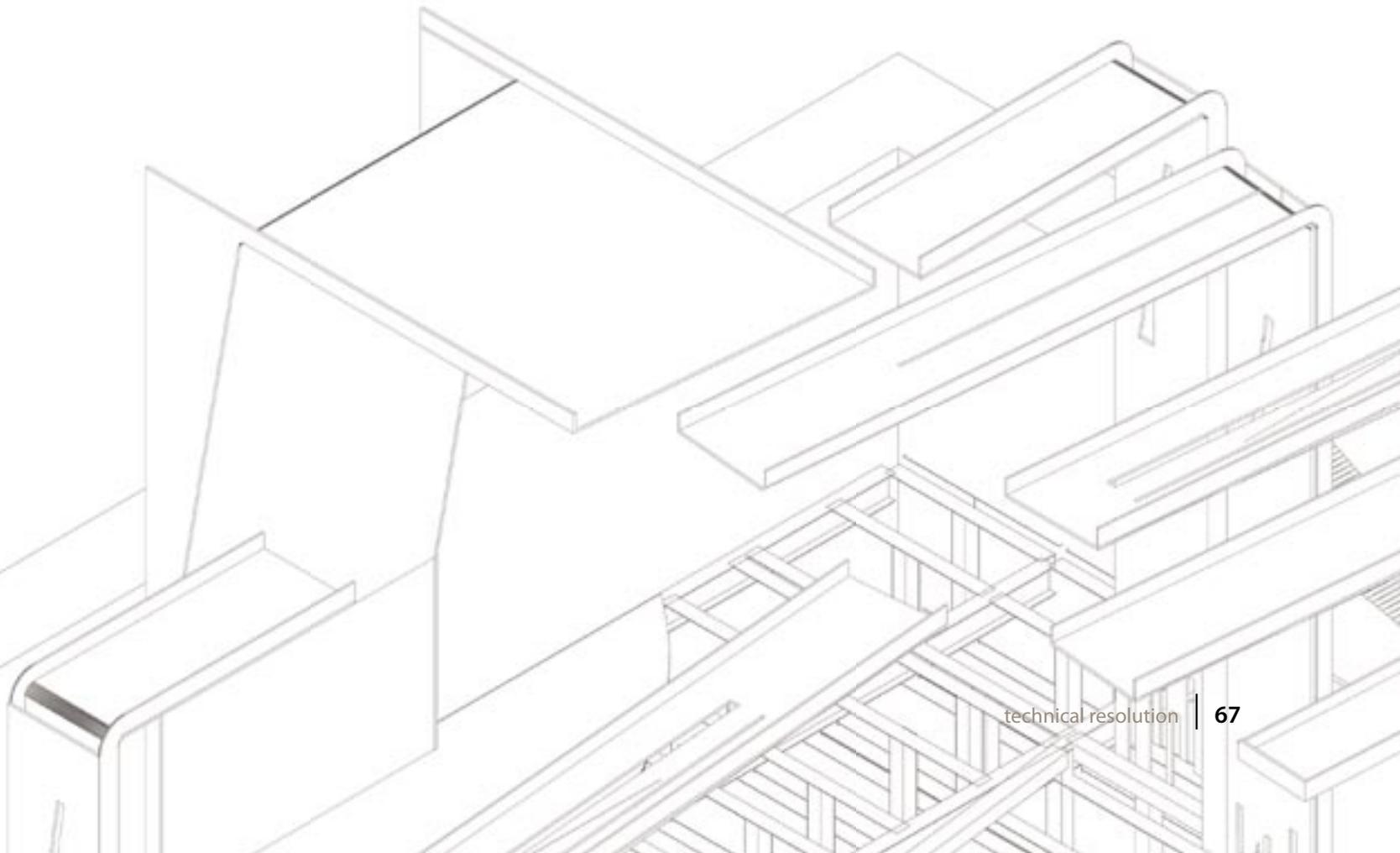
According to Adriaan Kurtz, manager of the department of water and sewage at the City of Tshwane Metro Municipality, '... a main sewer runs through the Fountain Valley and is

in the process of being upgraded. All planned sewer lines must be linked to this existing sewer system.' Based on this fact and the water and sewage plan supplied by the City of Tshwane Metro Municipality (Figure 85), the sub-stacks of new water closets will be connected to the main sewer that runs through the site (C: Design drawing no. 2).

By making use of the existing water and sewer lines as far as possible, the impact on the environment is kept to a minimum, ensuring that the *Interactive Centre* is a sustainable development.

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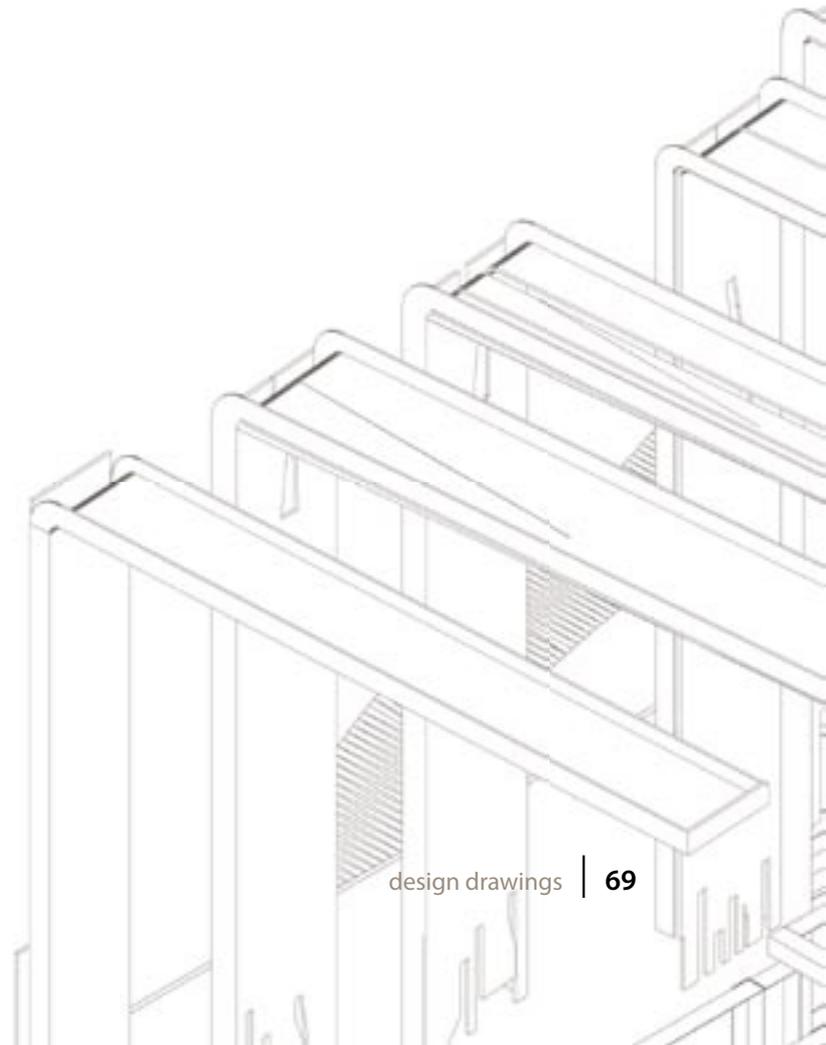
Figure 85: Aerial photo from the Tshwane Metro Municipality with the sewage, water and electrical layout indicated in the Fountains Valley. The site of the *Interactive Centre* is highlighted

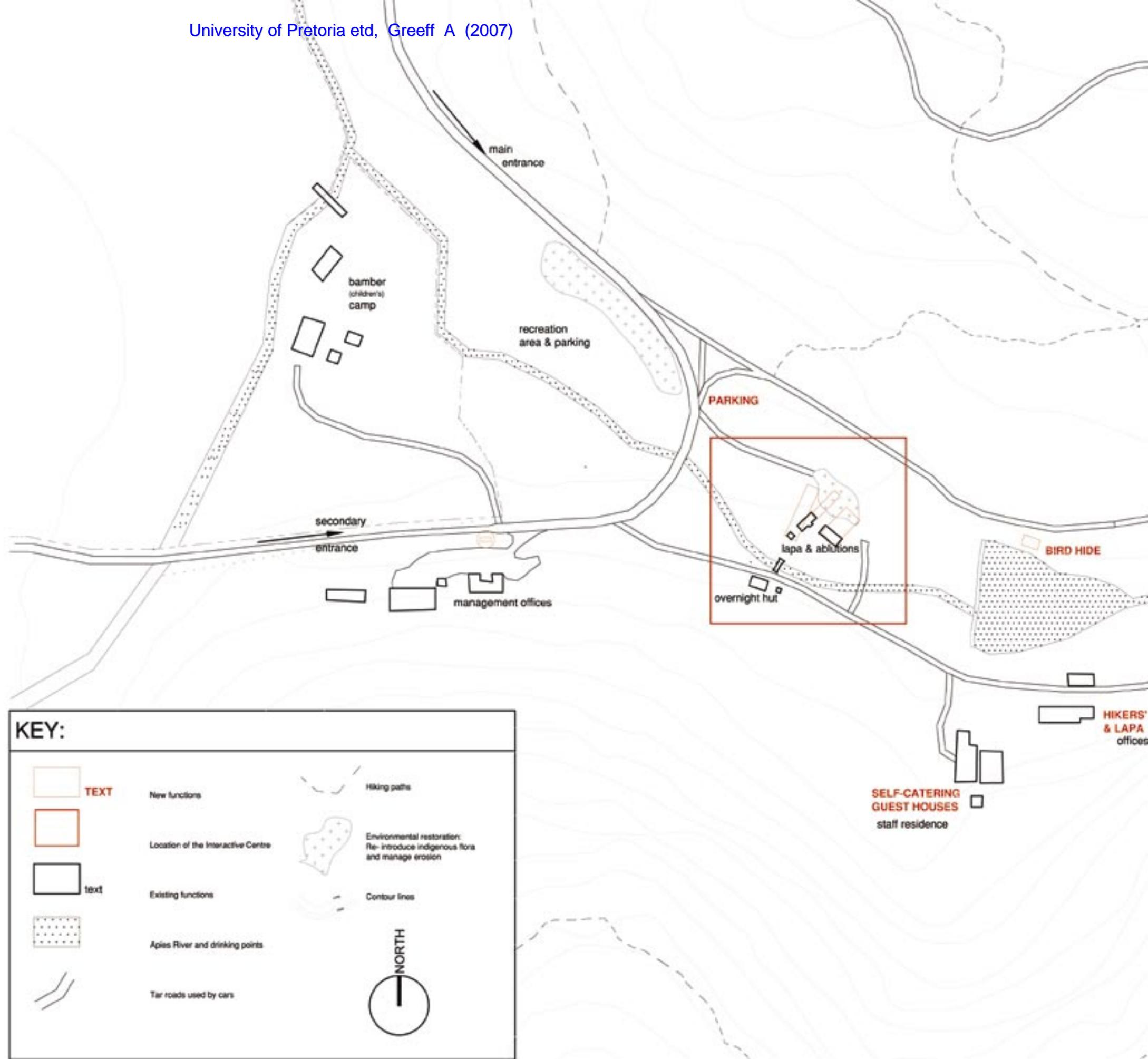


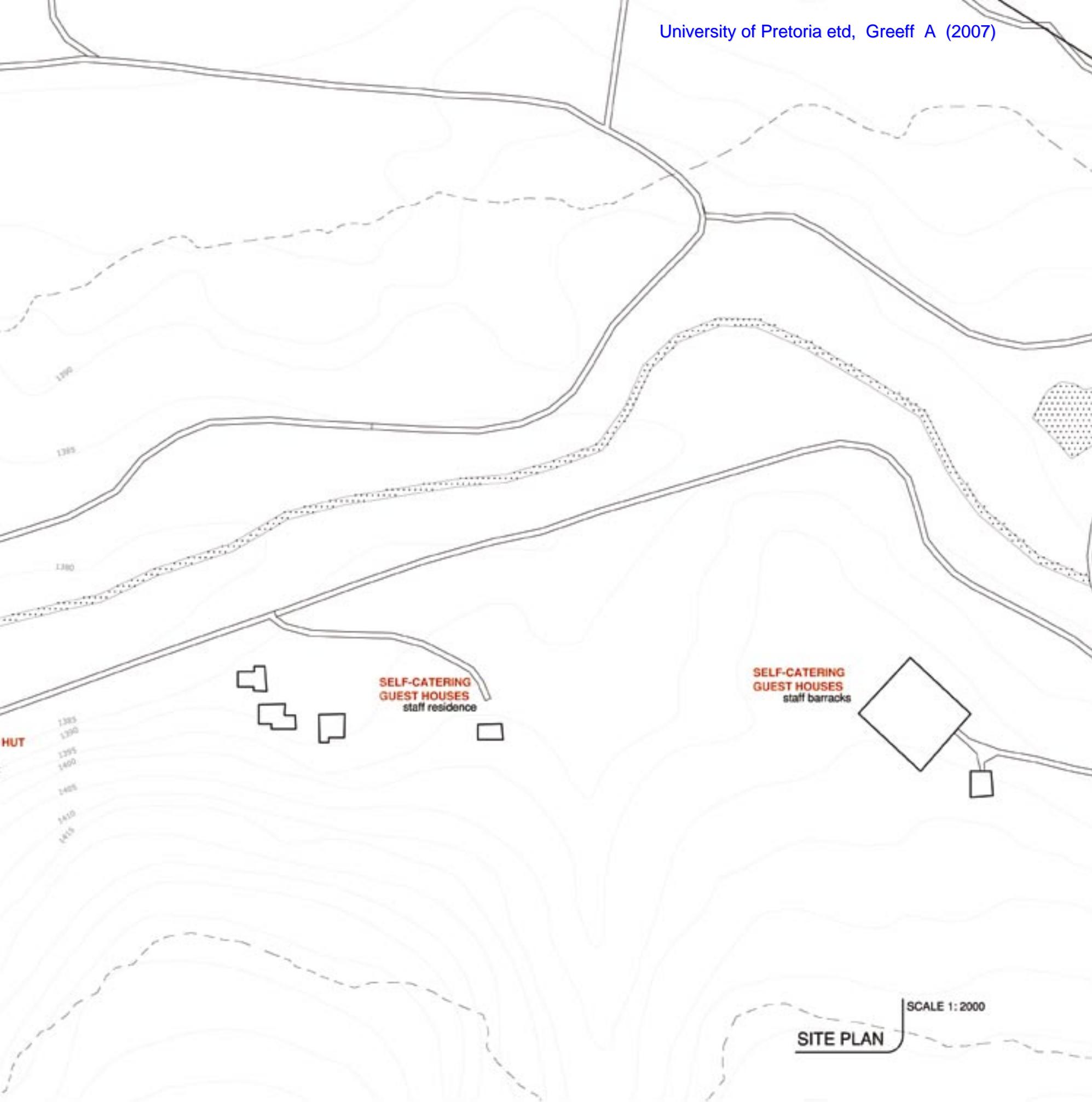
# drawings

## C: Design drawings

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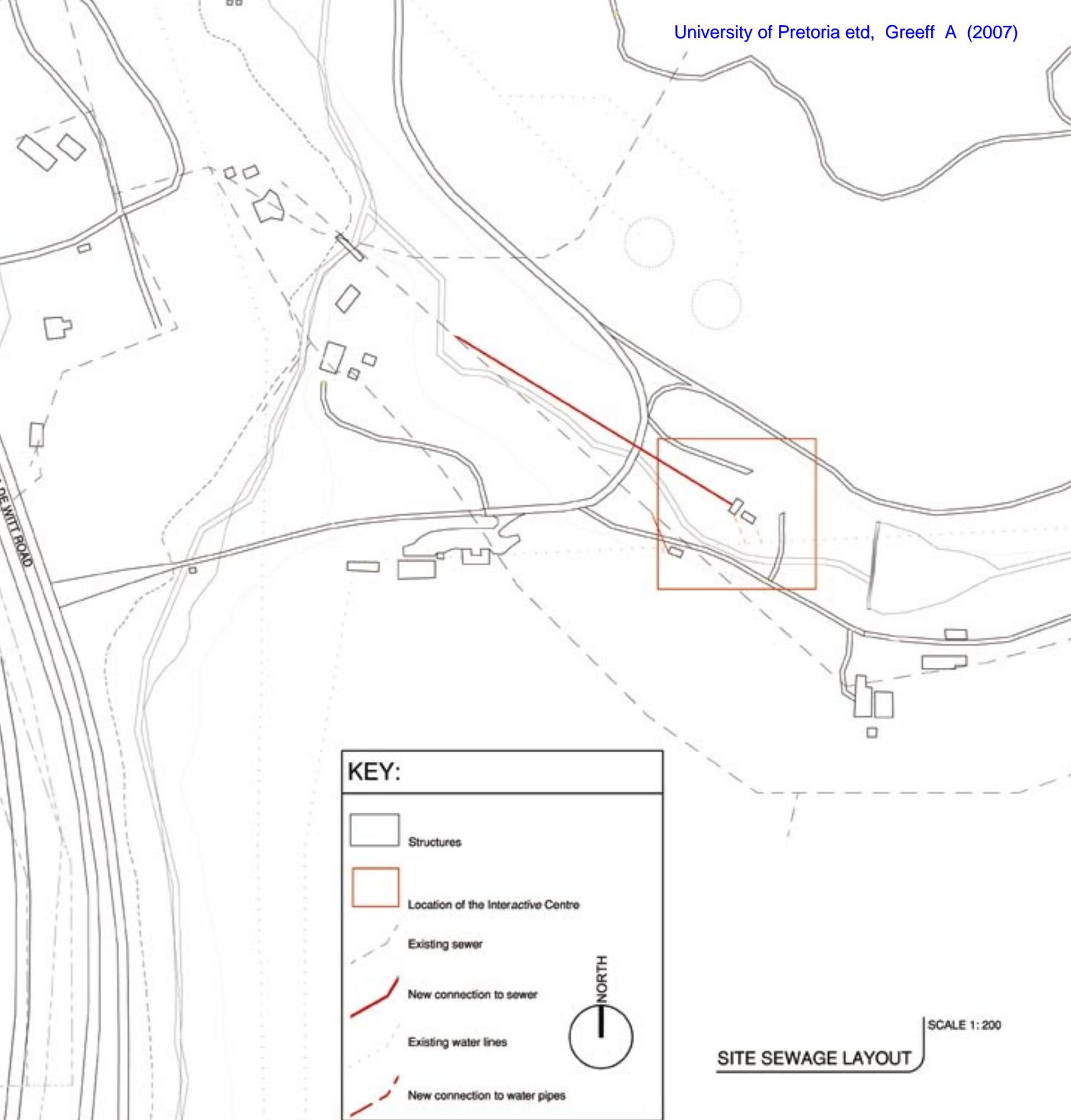


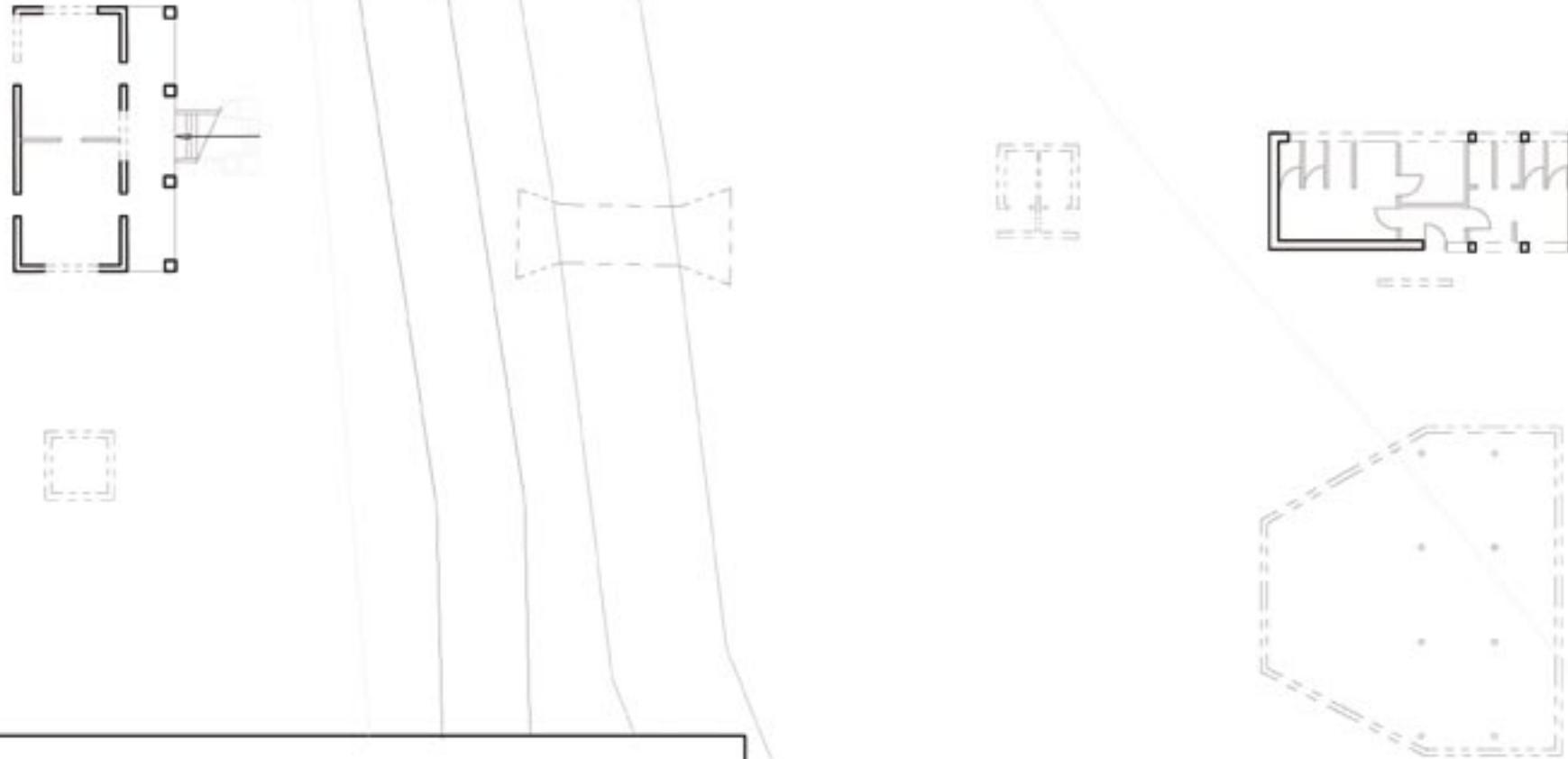




DRAWING NO. 1  
SITE PLAN







**KEY:**

 Structure to be demolished	 Tar roads used by cars
 Existing structures	 Contour lines
 Existing interior walls to be demolished	
 Apies River and drinking points	

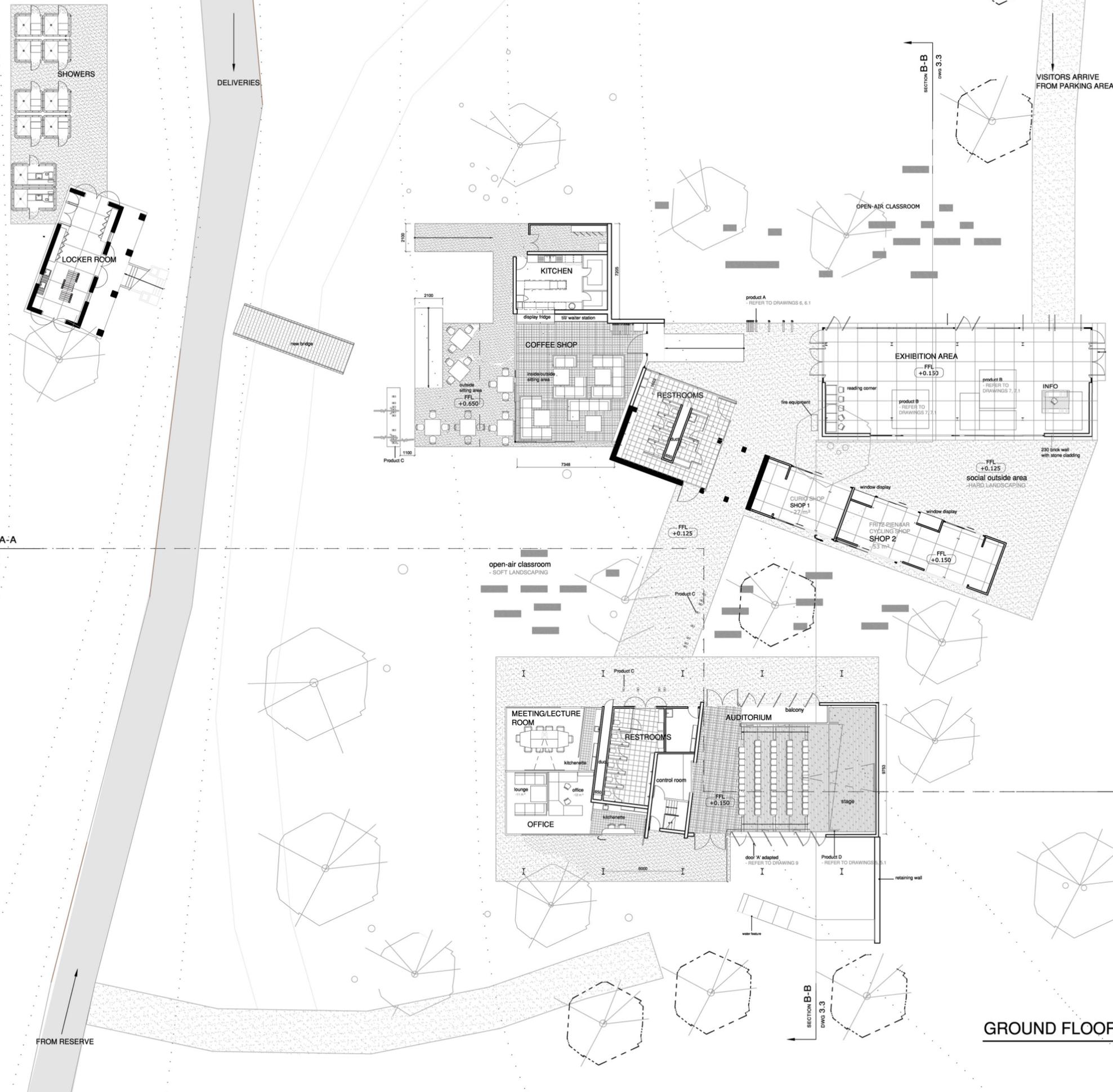
**NOTES:**  
Bricks and concrete rubble to be re-used in Gabion walls  
Laga Roof sheeting to be re-used where possible

 NORTH

**DEMOLITION PLAN**

SCALE 1: 250

DRAWING NO. 3  
DEMOLITION PLAN



**KEY:**

- Existing structure
- New structures
- External concrete paved area
- Existing full grown trees on site- to be retained
- Existing immature trees on site- to be retained
- New indigenous trees
- Benches from railway sleepers for open-air class rooms

NORTH

SCALE 1: 300

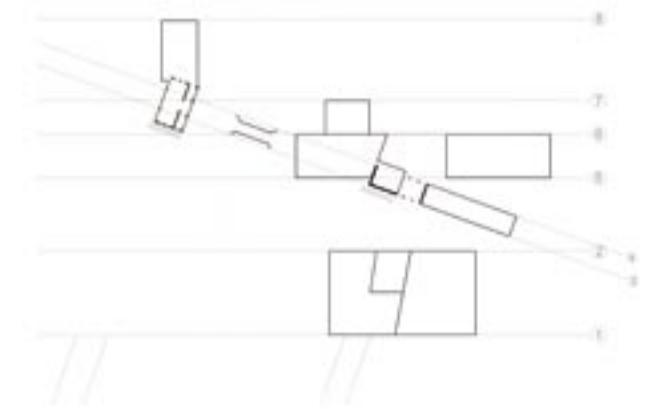
GROUND FLOOR LAYOUT

SECTION A-A  
dwg 3.2

SECTION A-A  
dwg 3.2

SECTION B-B  
dwg 3.3

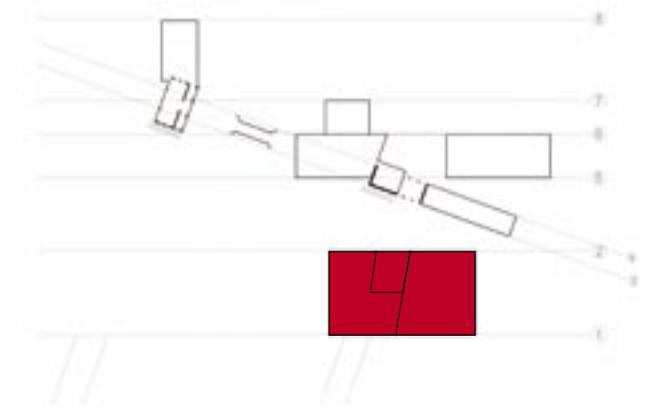
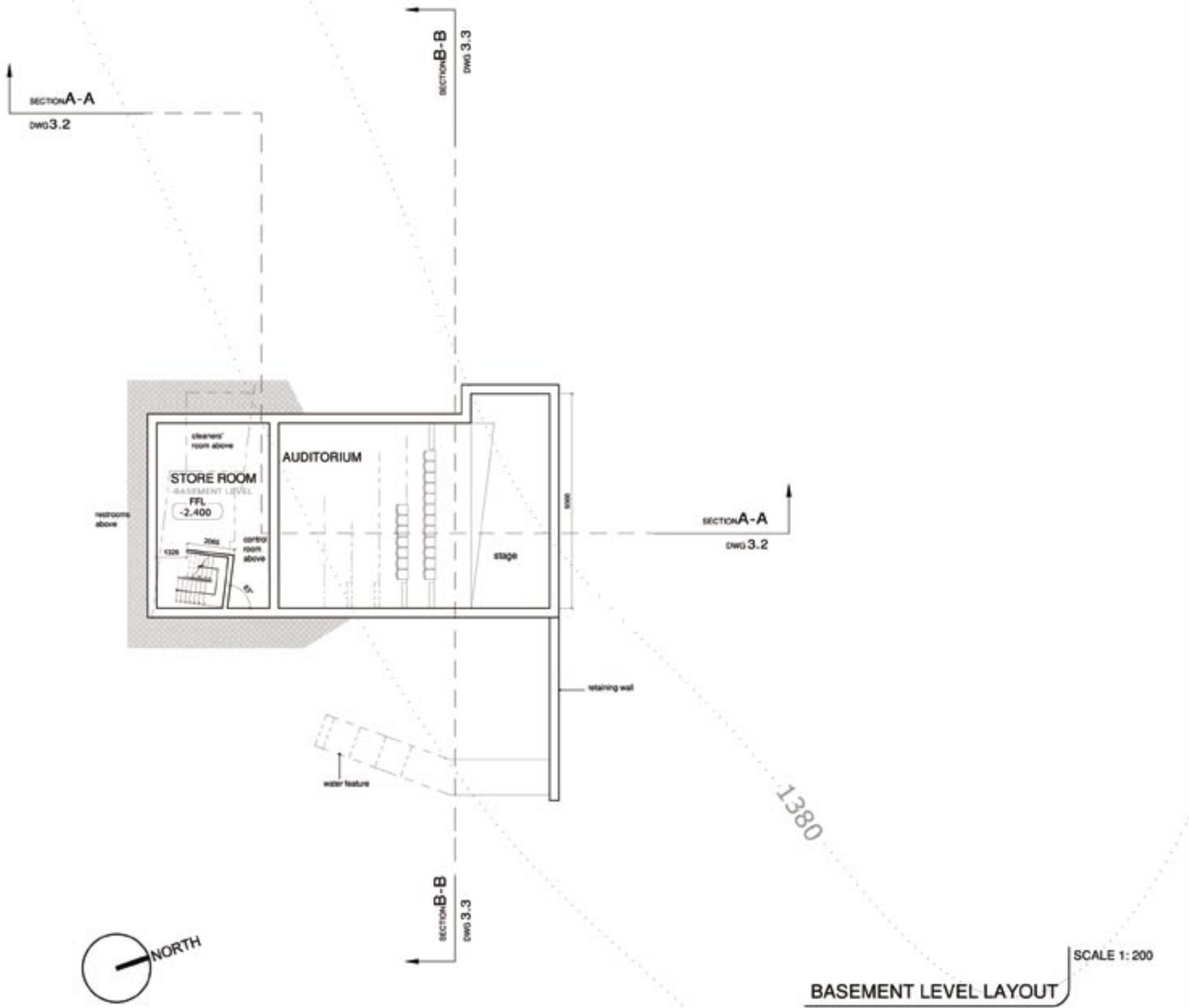
SECTION B-B  
dwg 3.3



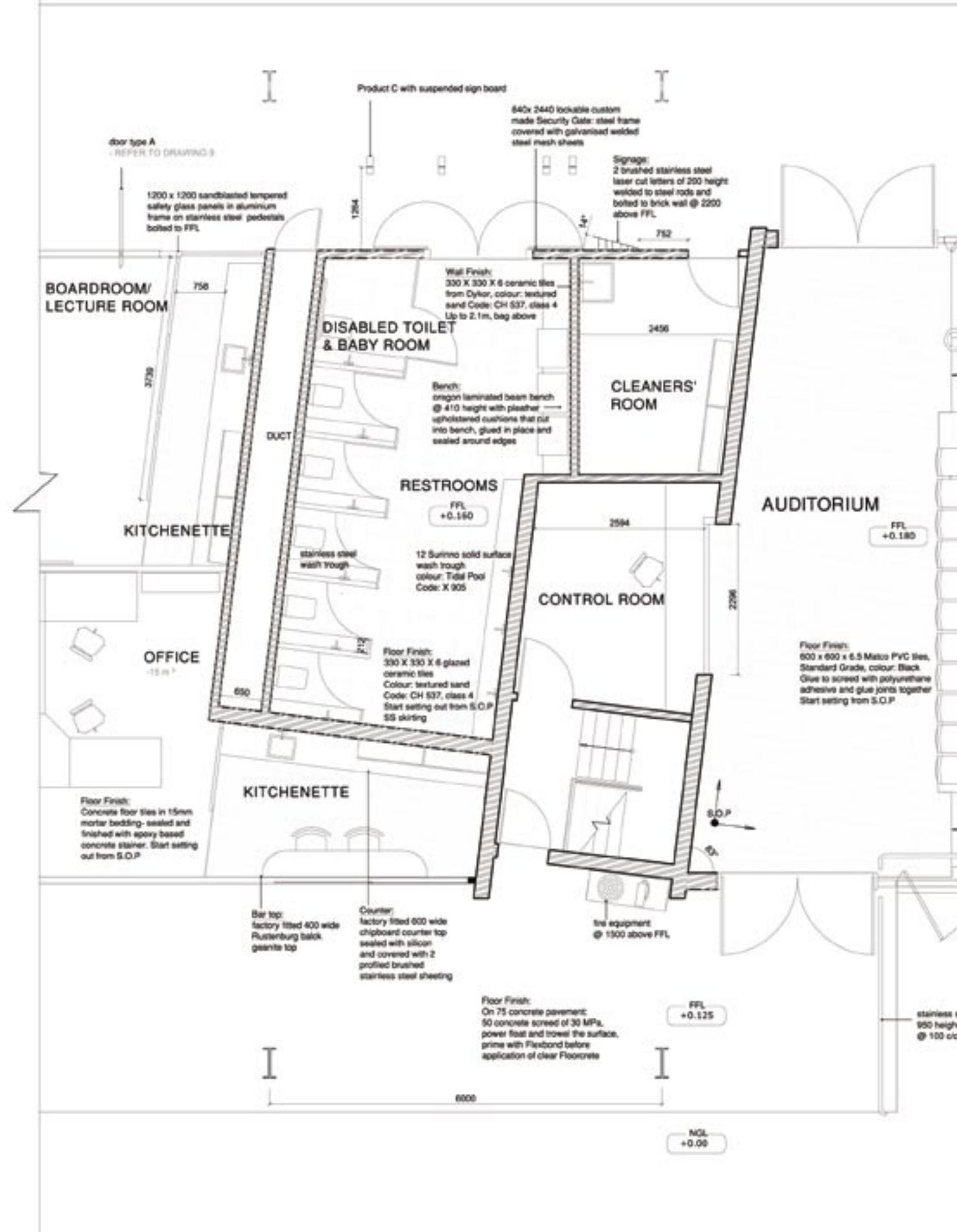
DRAWING NO. 3.1 A

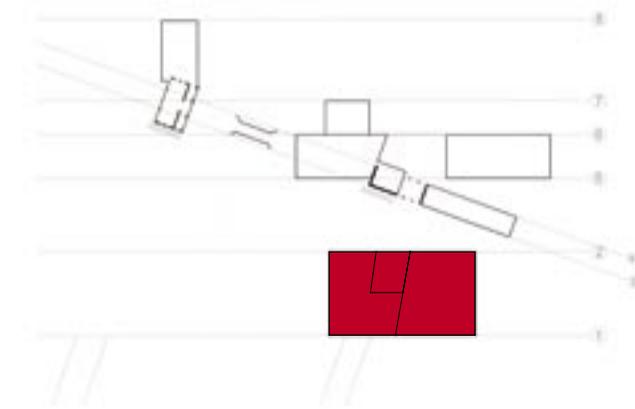
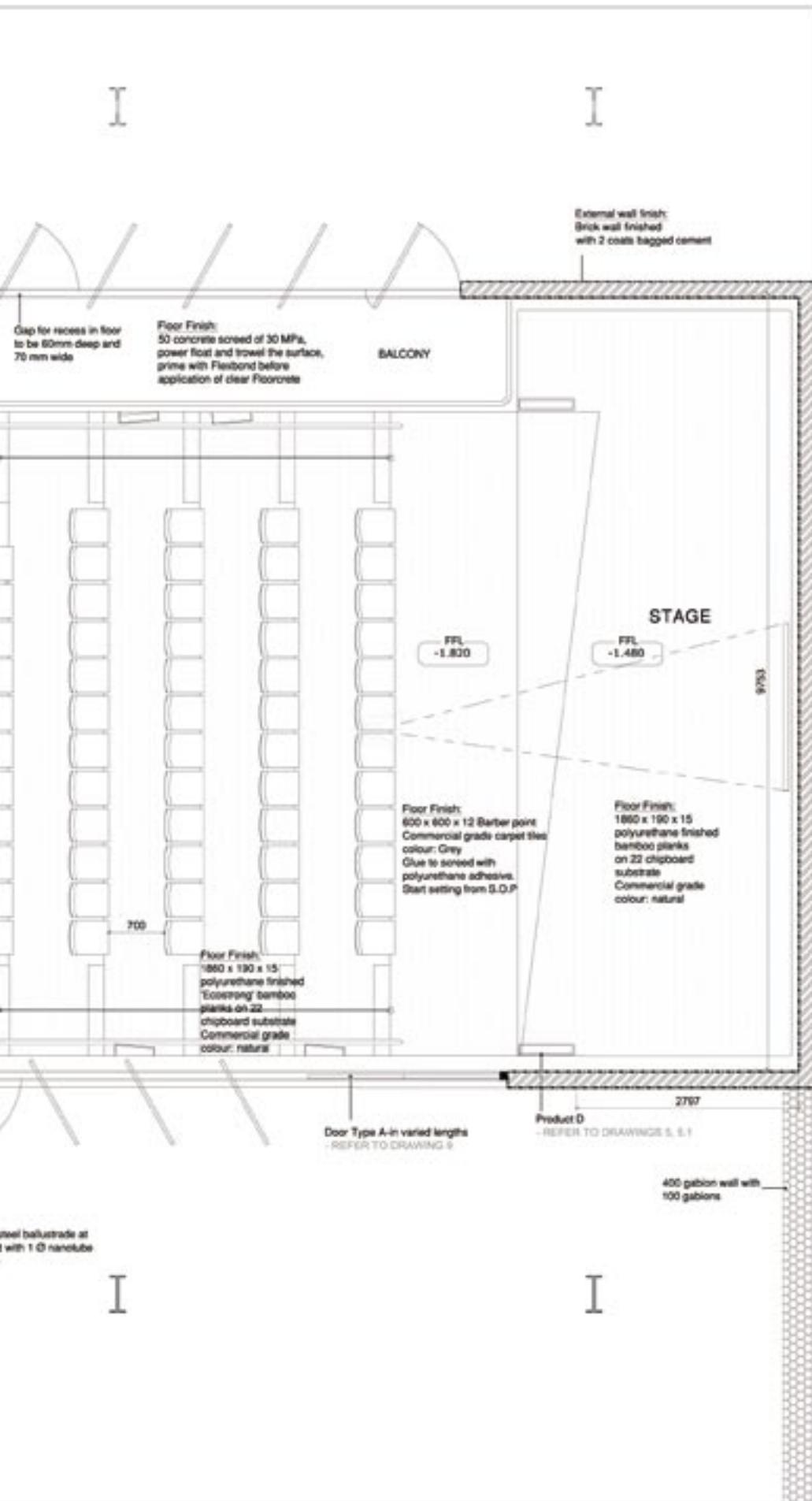
LAYOUT PLAN:

GROUND FLOOR LEVEL



DRAWING NO. 3.1 B  
LAYOUT PLAN:  
BASEMENT LEVEL





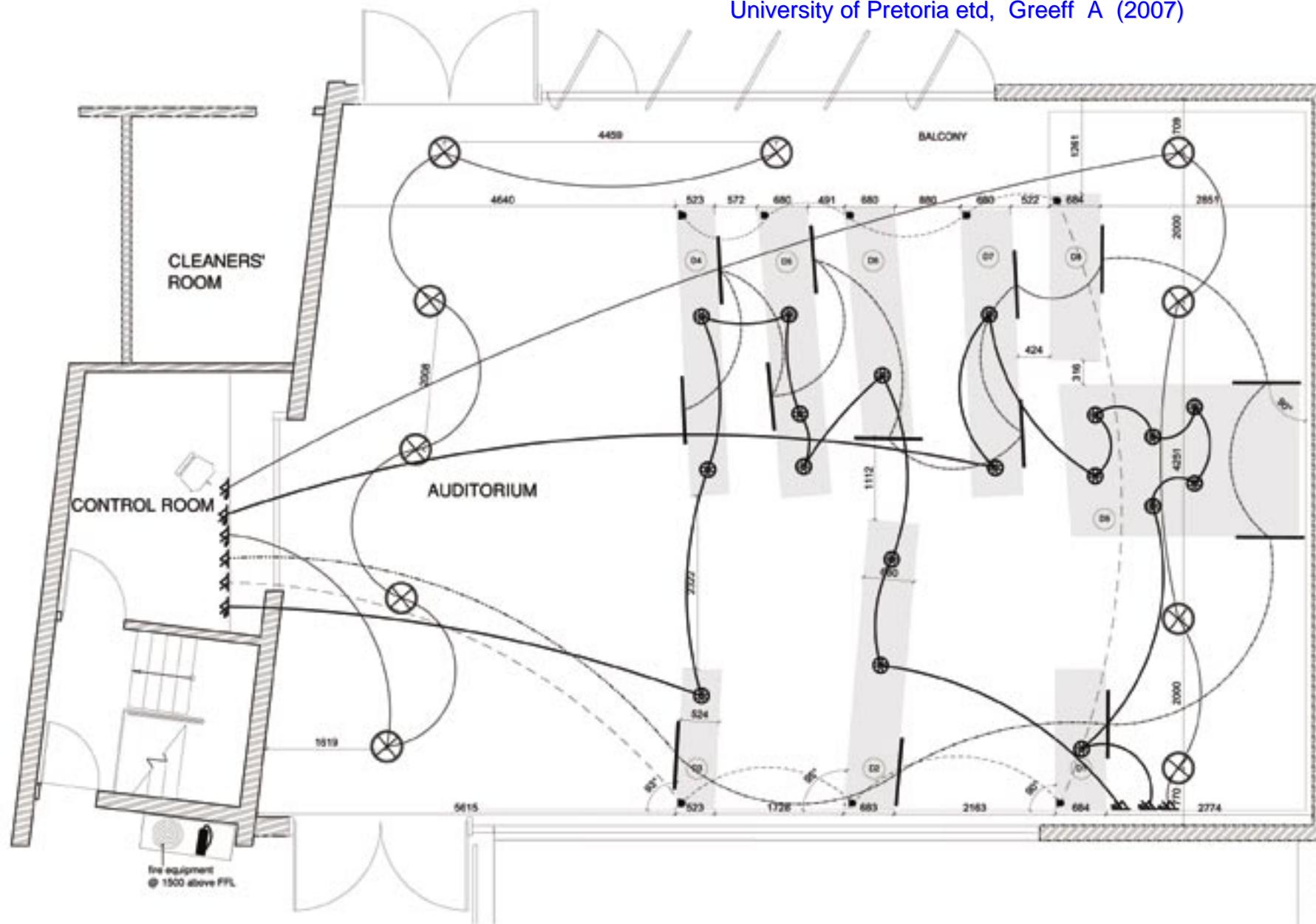
DRAWING NO. 3.1.1

AUDITORIUM:

FLOOR FINISH & LAYOUT PLAN

SCALE 1: 75

**FLOOR FINISH AND LAYOUT PLAN**

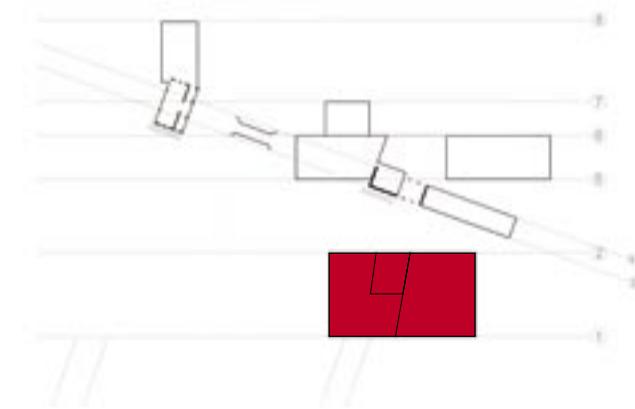


**KEY:**

- |  |  |  |  |
|--|--|--|--|
|  | Product D fixed to concrete wall and soffit  |  | Tumbler light switch: 1500 above FFL on stage<br>300 above FFL in control room |
|  | 120V LED cluster lamp to be connected to main power supply<br>Lamp colour: Cool white<br>Luminaire: Chrome finish flush with bulkhead<br>Hole to be cut out of plywood: Ø 106          |  | Dimmer light switch: 1500 above FFL<br>on stage 300 above FFL in control room  |
|  | 150W Tungsten Halogen lamp with E27 screw base<br>Luminaire: Cap-3 hie power downlight with acrylic glass reflector suspended from ceiling with wire cable to height of 2700 above FFL |  | Distribution box   |
|  | 1200 Fluorescent tube lamp 40W in Philips TMS012 batters fixed to side of product B  |  |  |

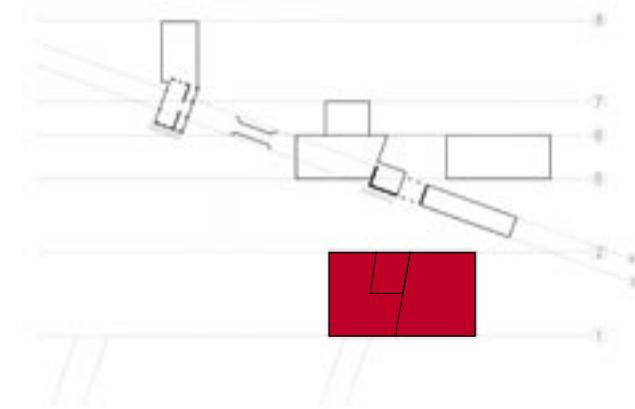
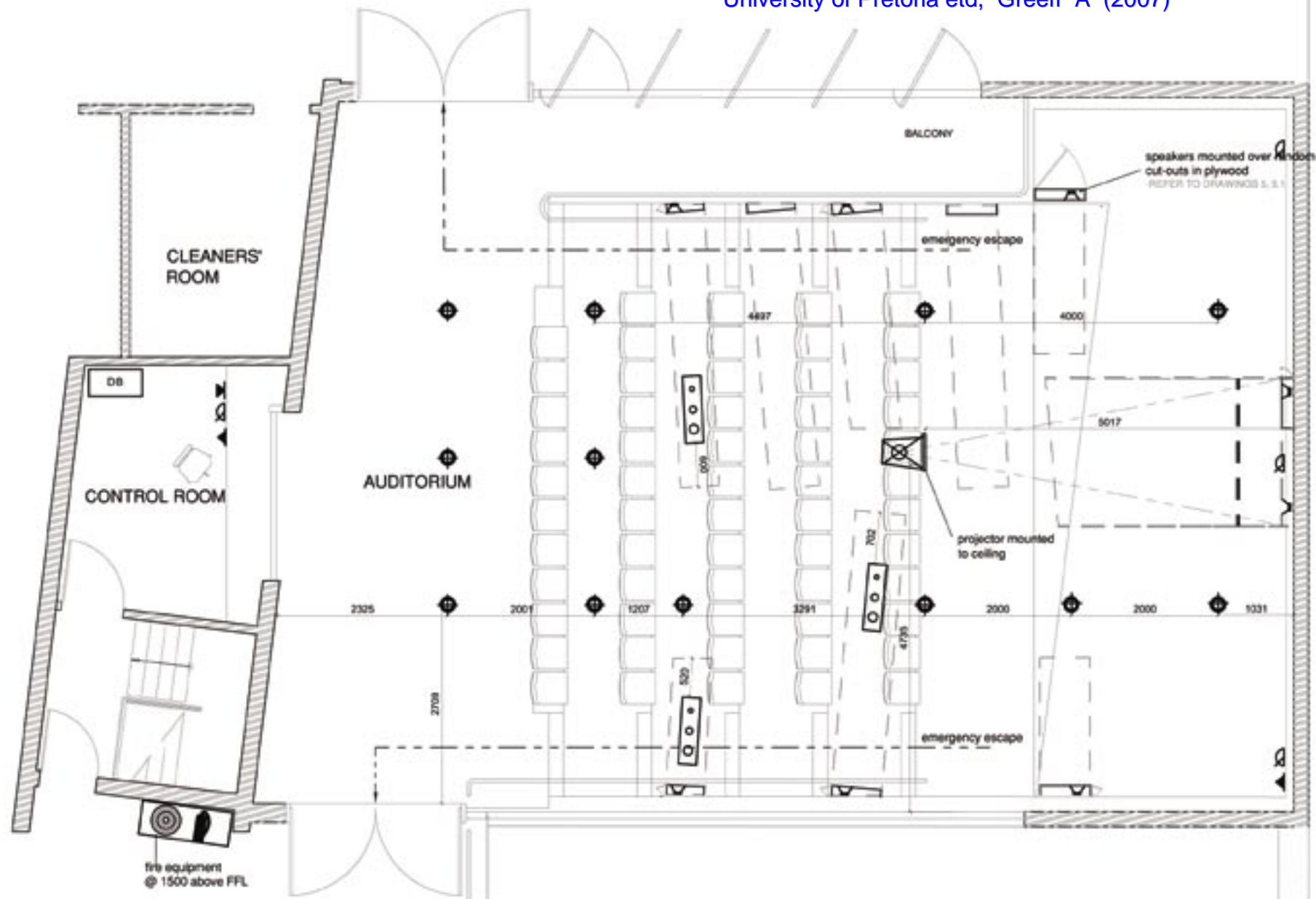
**LIGHTING AND CEILING LAYOUT**

SCALE 1: 75



DRAWING NO. 3.1.1 A

AUDITORIUM:  
LIGHTING & CEILING LAYOUT



**KEY:**

	Product D above, fixed to concrete wall and soffit		Double switch sockets- 3 PIN 16 Ampers @ 300 above FFL
	Emergency escape route to be $\geq 1100$ wide all along route according to SABS400		Tel jack: 300 above FFL
	Fire equipment: - 4.5kg CO <sub>2</sub> type mobile fire extinguisher - fire hose reel to comply with SABS 543 fixed to wall in container with shatterproof glass		Clean power socket @ 300 above FFL
	Sprinkler to be fitted by specialist flush with ceiling		
	Speakers mounted over random cut-outs in plywood screens. All sound equipment to be specified and installed by specialist		

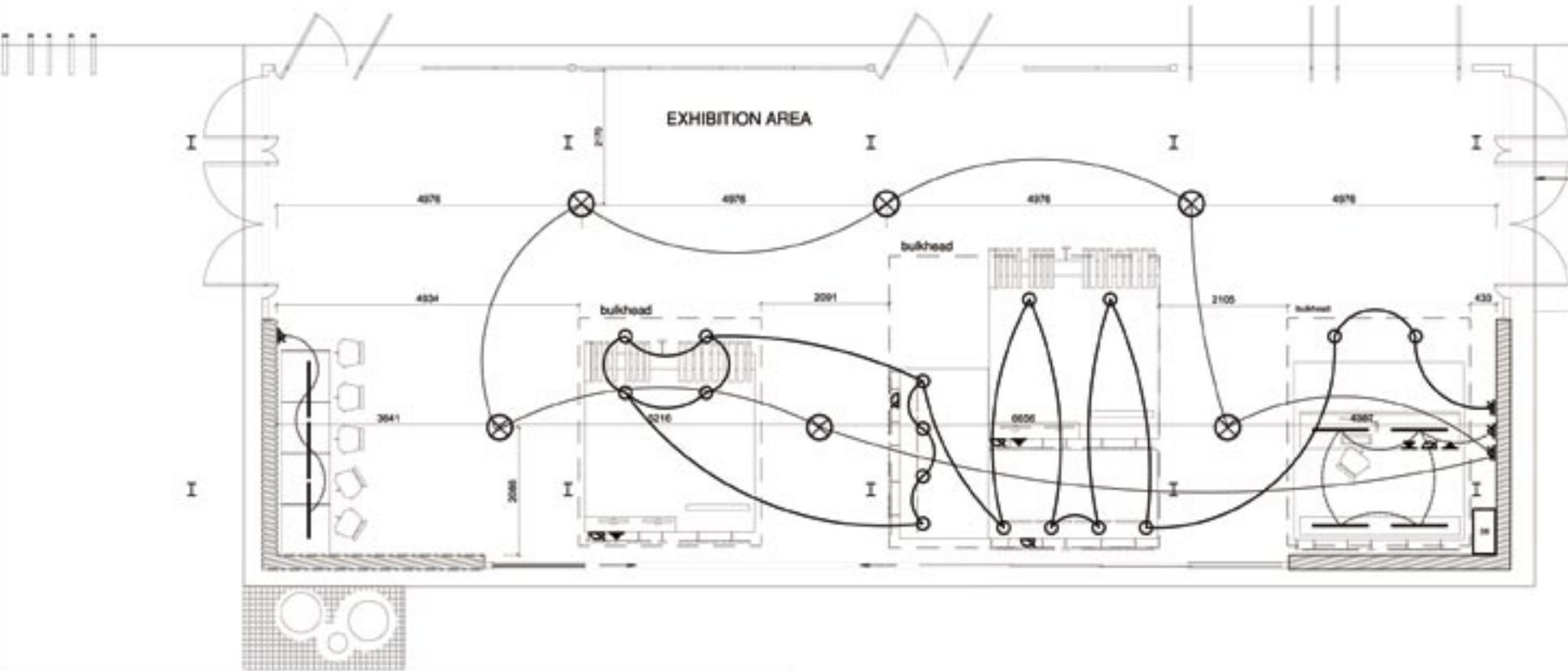
**ELECTRICAL AND FIRE LAYOUT**

SCALE 1: 75

DRAWING NO. 3.1.1 B

AUDITORIUM:  
ELECTRICAL & FIRE LAYOUT



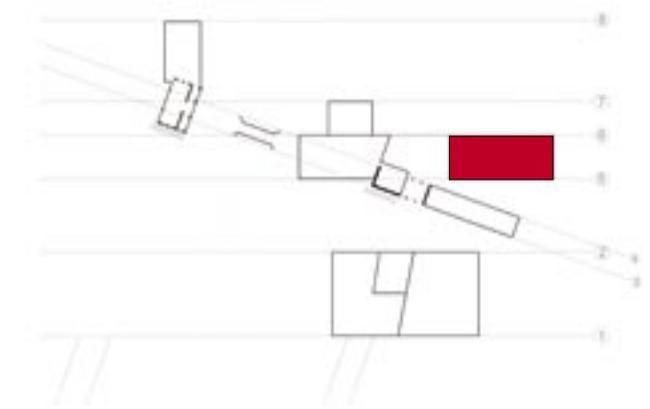


**KEY:**

	Closed dichroic halogen 12V/50W lamp with transformer for every 5 lamps Luminaire: Chrome finish flush with bulkhead Socket: GX5.3/GU5.3 Hole to be cut out of bulkhead: Ø 100		Tumbler light switch: 1500 above FFL
	150W Tungsten Halogen lamp with E27 screw base Luminaire: Cap- 3 hie power downlight with acrylic glass reflector suspended from ceiling with wire cable to height of 1600 above FFL		Dimmer light switch: 1500 above FFL
	1200 Fluorescent tube lamp 40W in Philips TMS012 battens fixed to ceiling/bulkhead		Telephone jack: 300 above FFL
	Data power socket: 300 above FFL		Double switch sockets- 3 PIN 16 Ampere 300 above FFL
	Telephone jack: 300 above FFL		NORTH

**LIGHTING & ELECTRICAL LAYOUT**

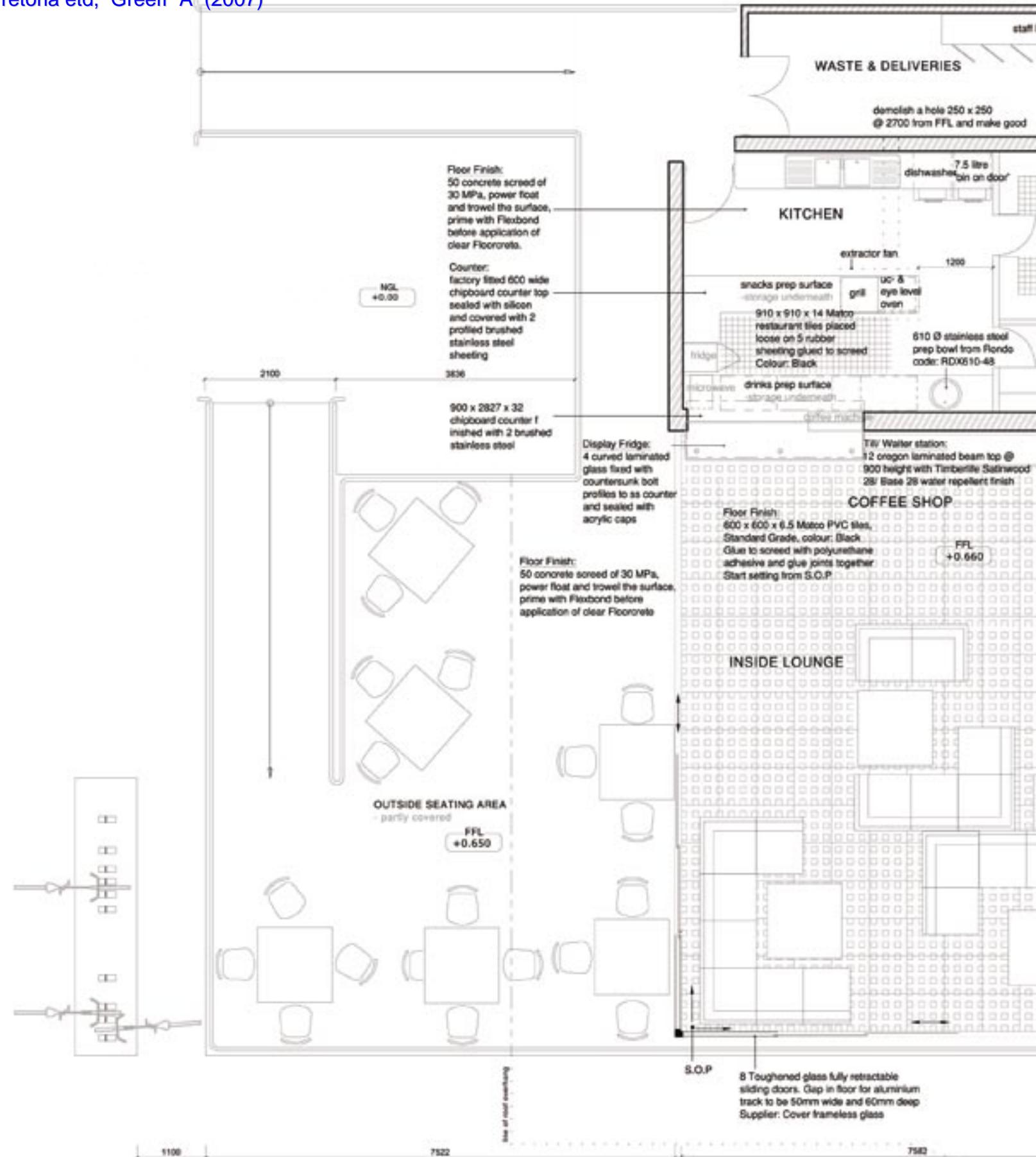
SCALE 1: 100

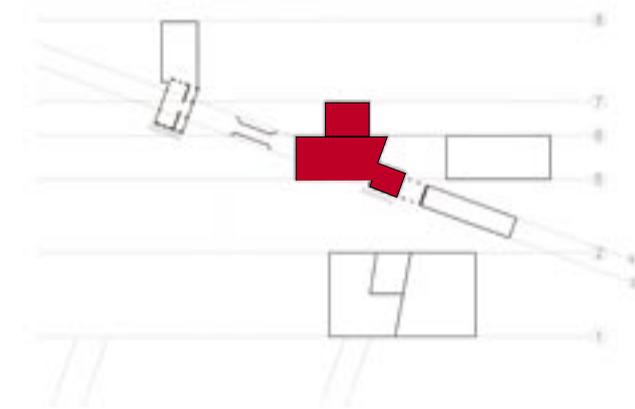
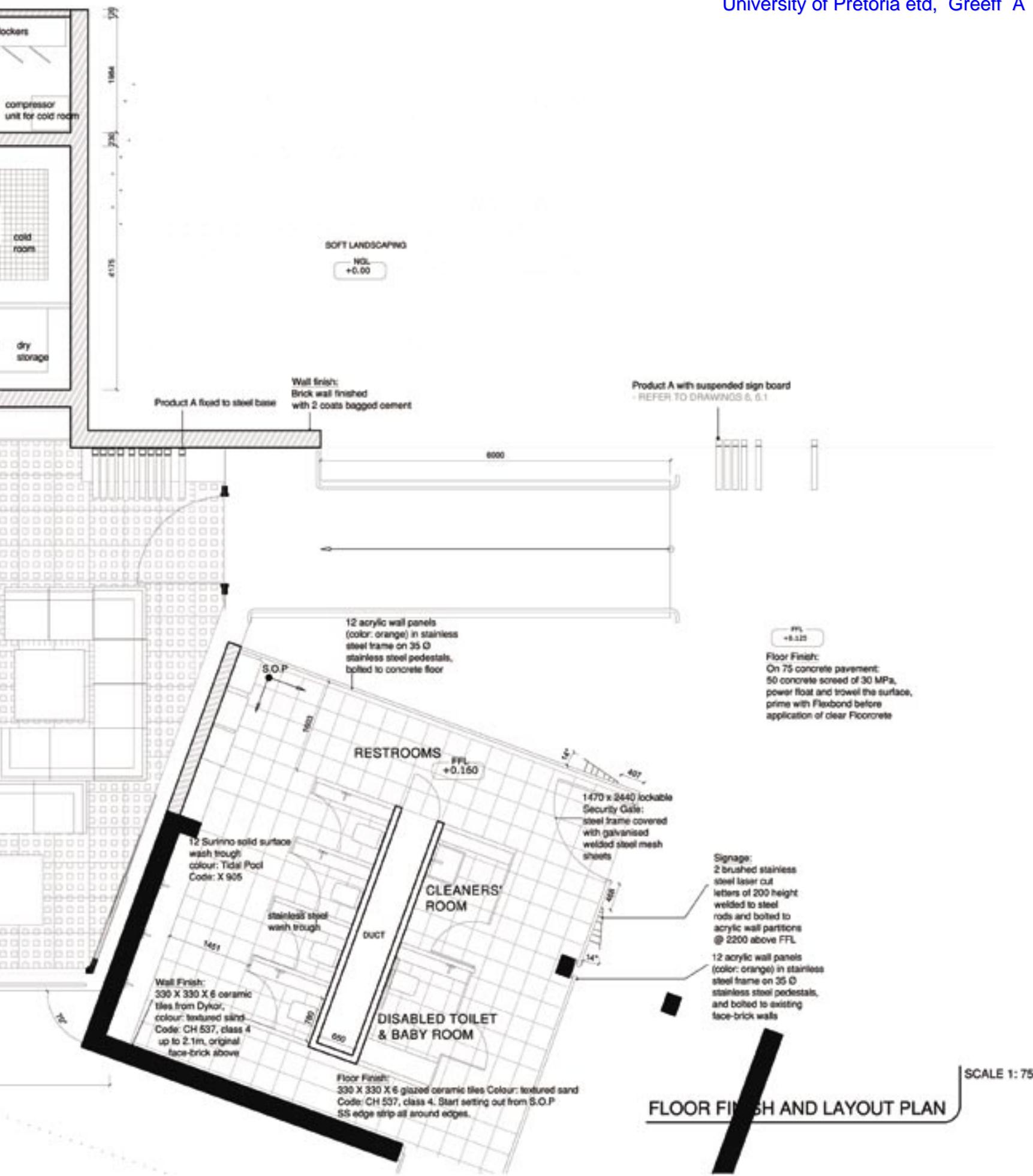


DRAWING NO. 3.1.2 A

EXHIBITION AREA:

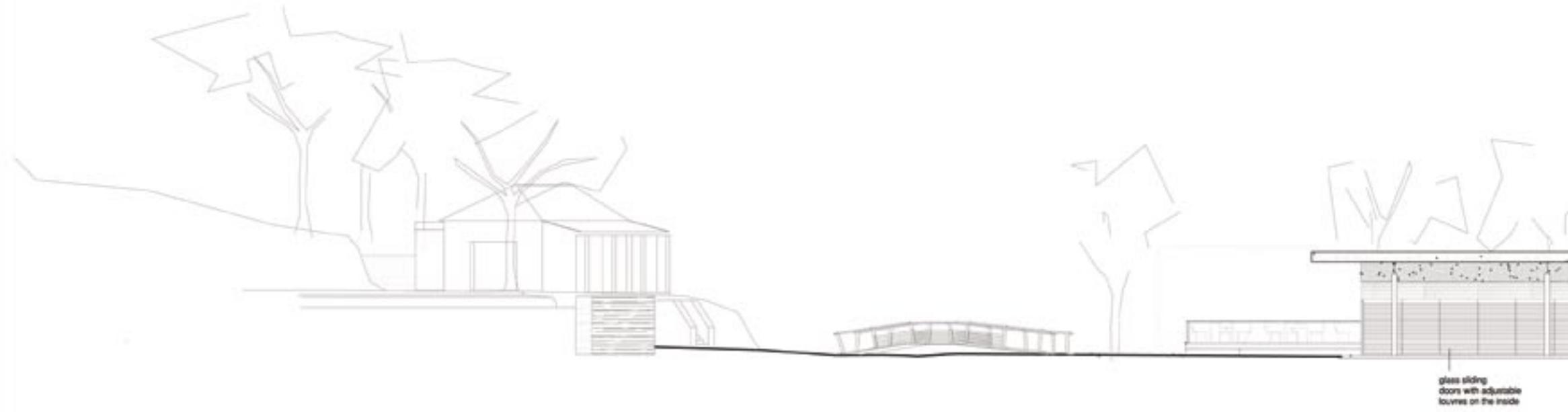
LIGHTING & ELECTRICAL LAYOUT

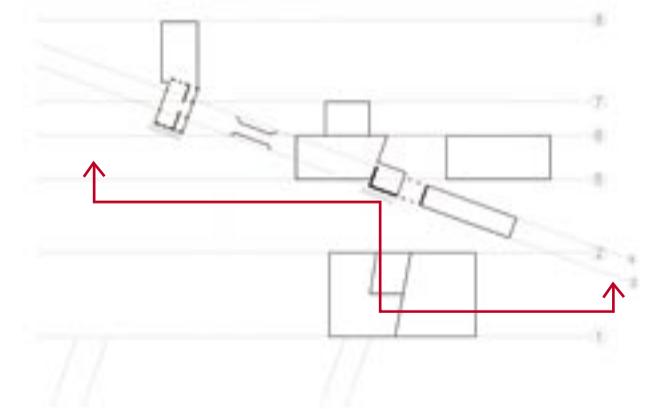
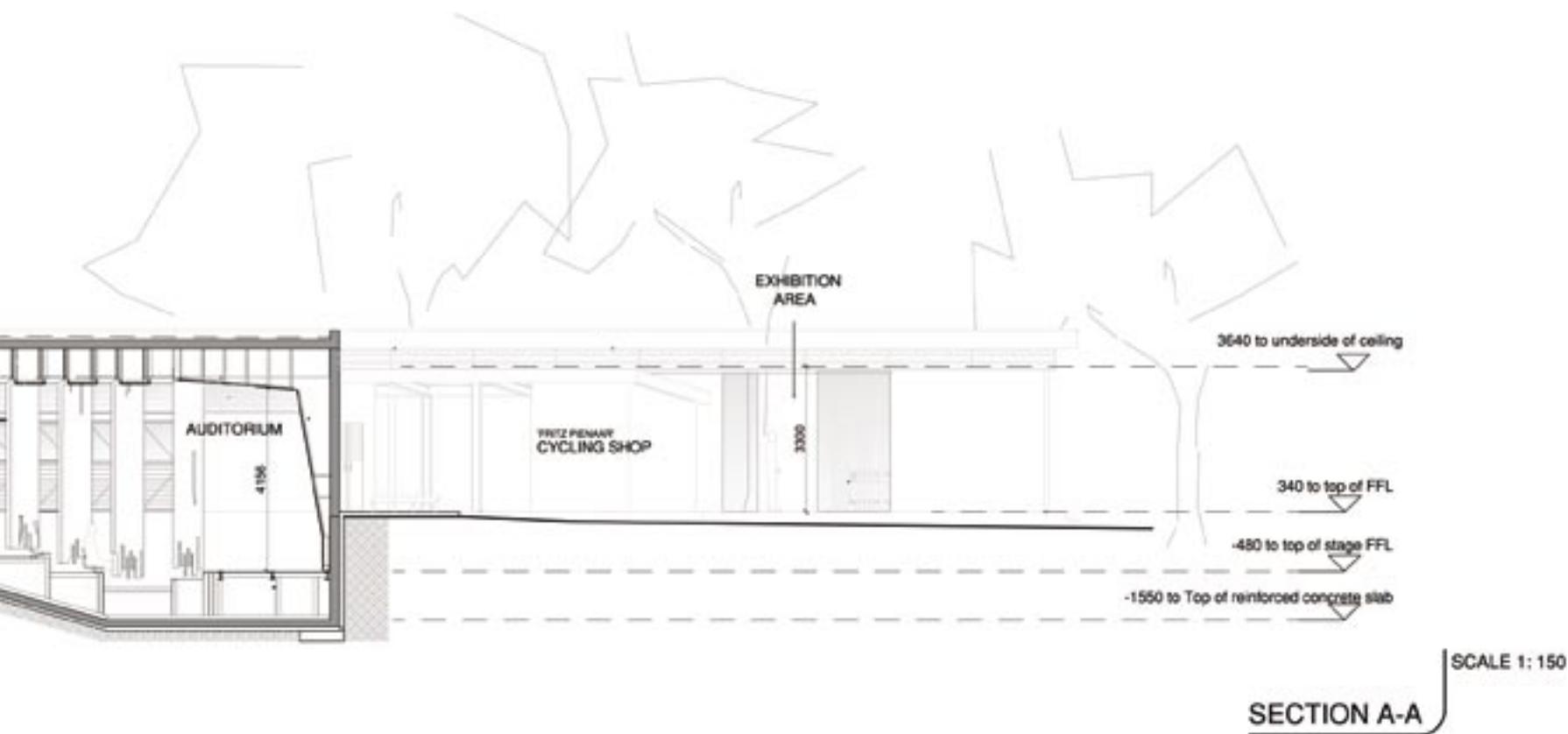
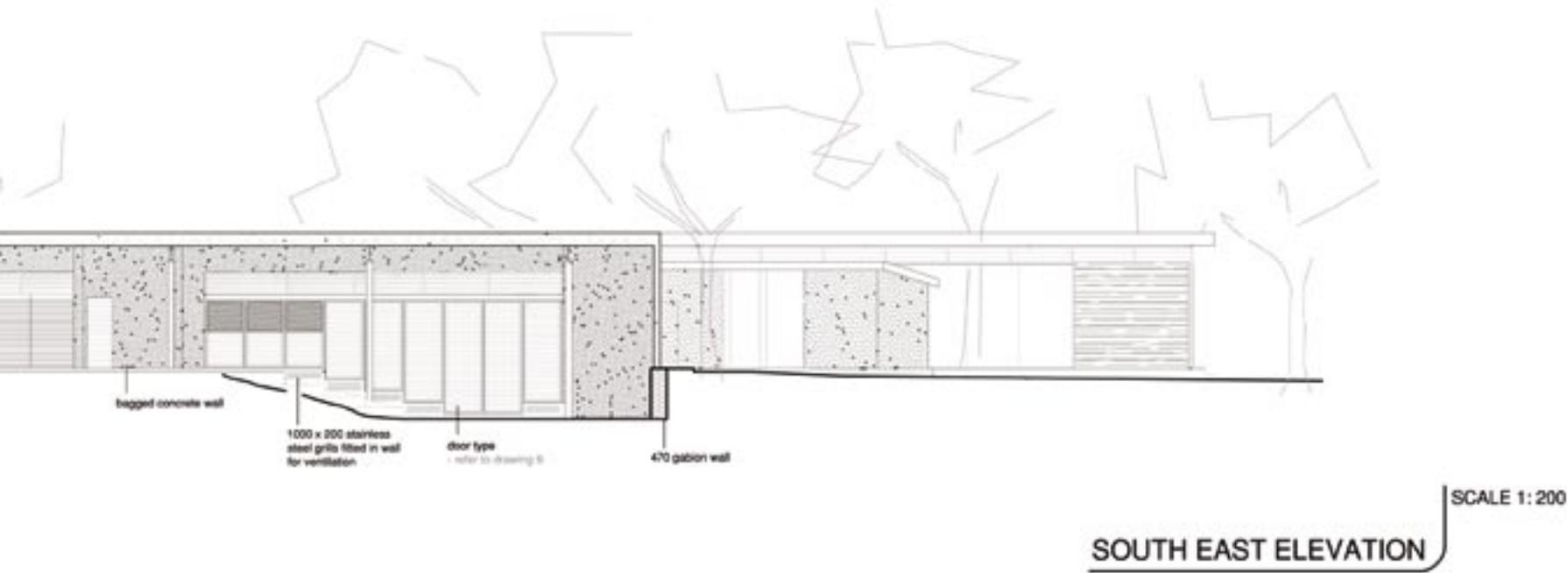




DRAWING NO. 3.1.3

COFFEE SHOP:  
FLOOR FINISH & LAYOUT PLAN





DRAWING NO. 3.2  
SECTION A-A & SOUTH-EAST ELEVATION

150W Tungsten Halogen lamp with E27 screw base  
Luminaire: Cap- 3 hie power downlight with acrylic glass reflector suspended from ceiling with wire cable to height of 2700 above FFL

500  
1200 x 600 x 12.5 Acoustone acoustic ceiling panels on Donn T-hangers to form 500 ceiling space filled with 100 glass wool - ceiling fills in between PRODUCT D plywood elements

3166

Door Type A  
- REFER TO DRAWING B

AUDITORIUM

3500

3713

4051

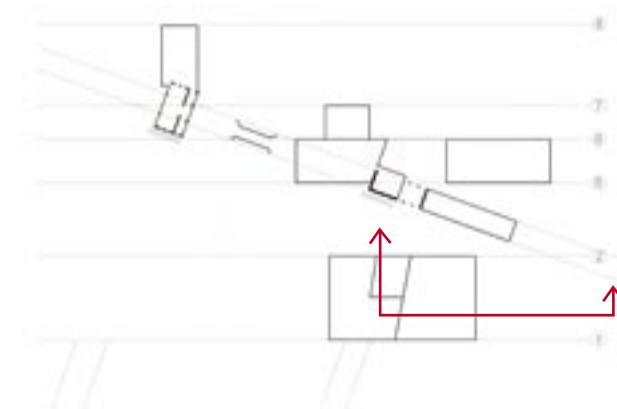
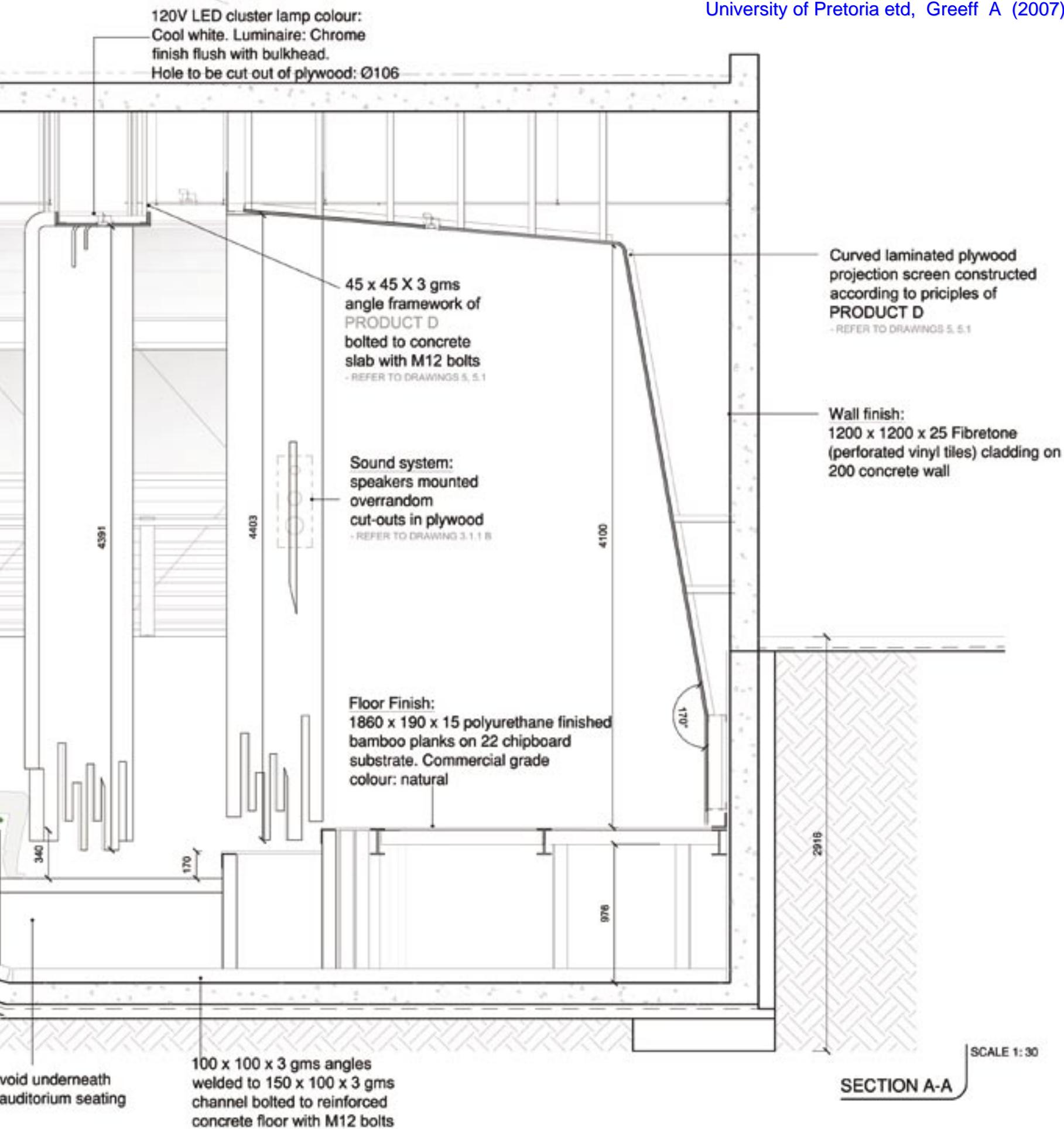
DPC layer to seal auditorium tank system construction

2174

STORE ROOM

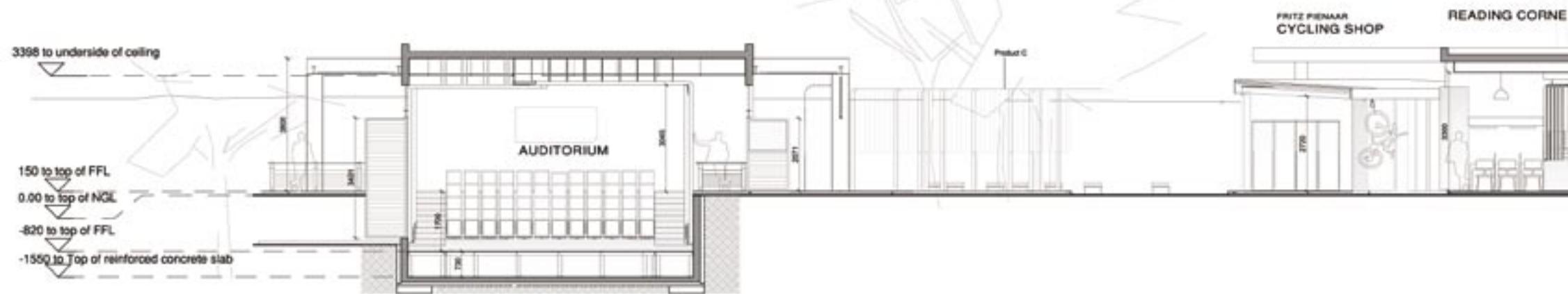
Ballustrade:  
50 Ø solid stainless steel tube glued to 4 stainledd steel sheets- bolted to concrete pavement. 1Ø metallic carbon nanotubes @ 100 c/c form the ballustrade  
- REFER TO DRAWING B

50 thick polymer-casted PMMA chair with technogel padding upholstered with green polyurethane fabric. Chair is removable and is fixed to a stainless steel tube that slides out of fitting snap-fitted into in the stair surface



DRAWING NO. 3.2.1

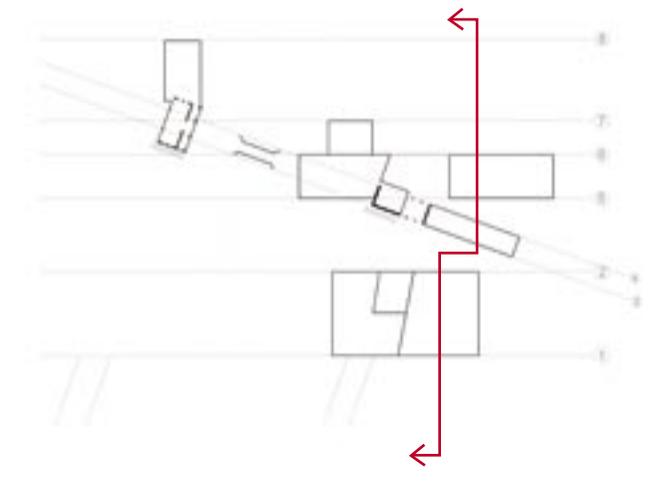
SECTION A-A DETAIL





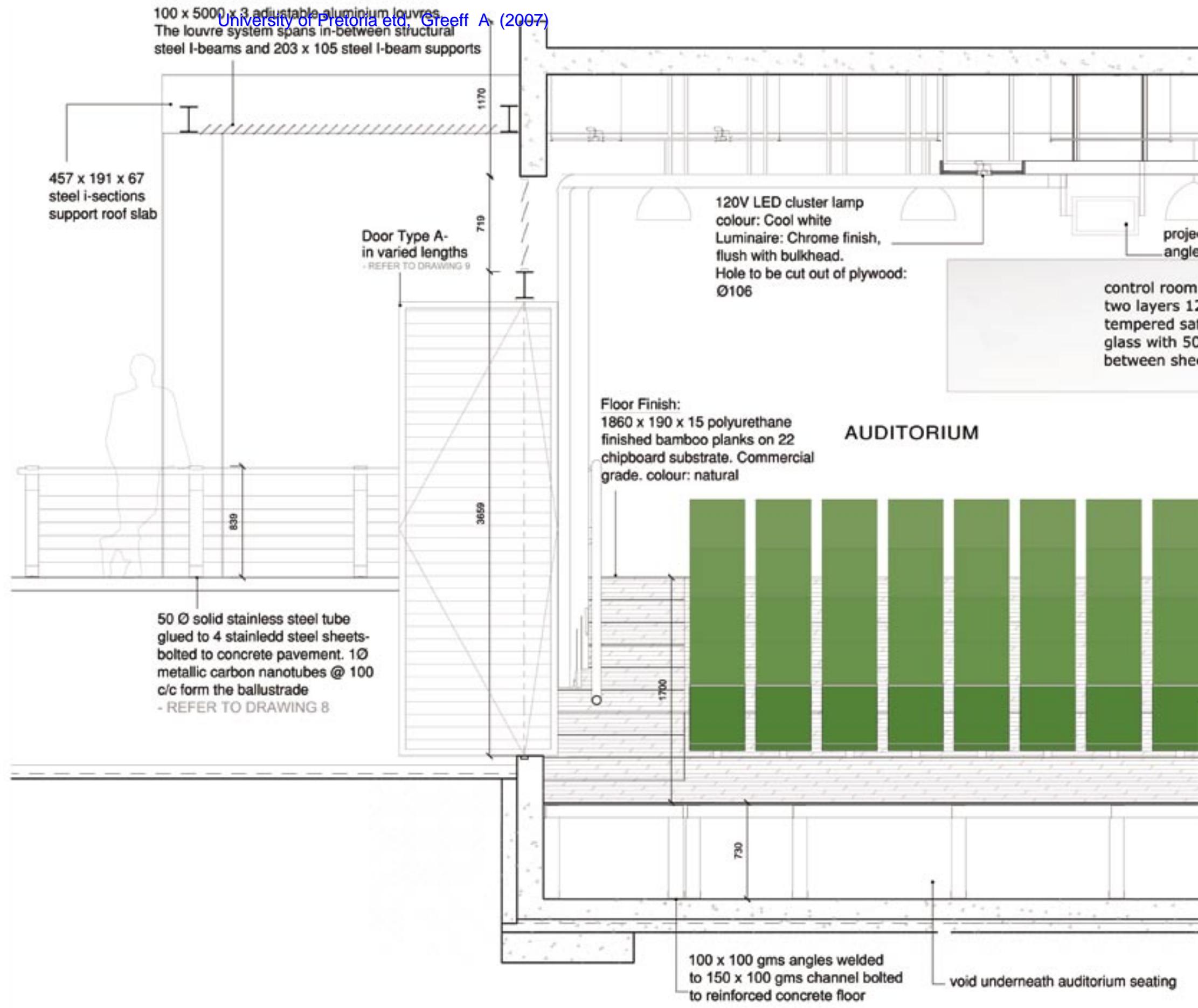
SECTION B-B

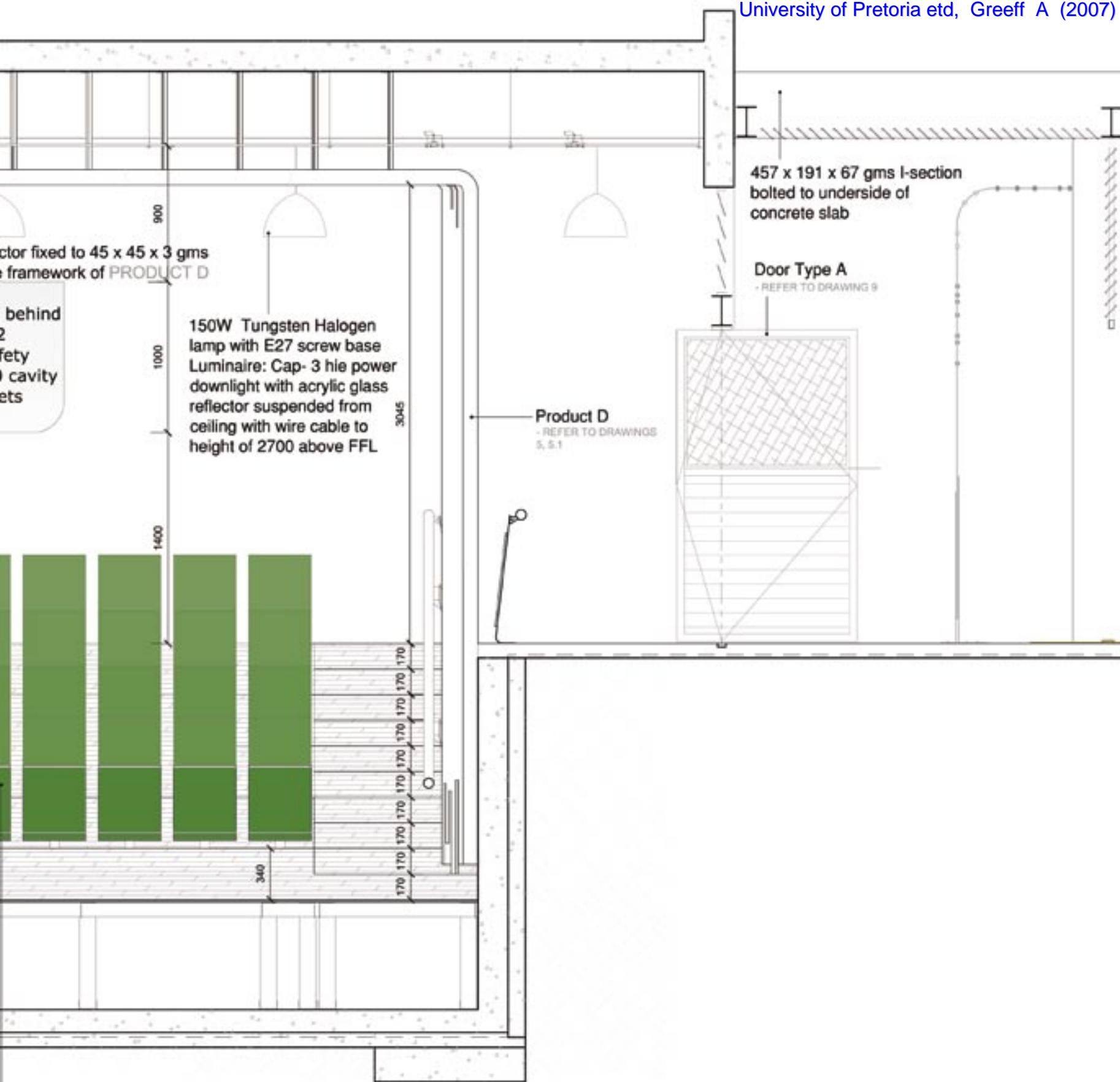
SCALE 1:150



DRAWING NO. 3.3

SECTION B-B

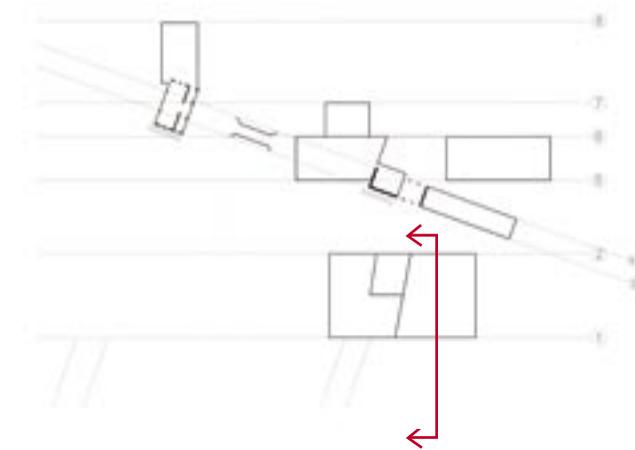




50 thick polymer-casted PMMA chair with technogel padding upholstered with green polyurethane fabric. Chair is removable and is fixed to a stainless steel tube that slides out of fitting snap-fitted into in the stair surface

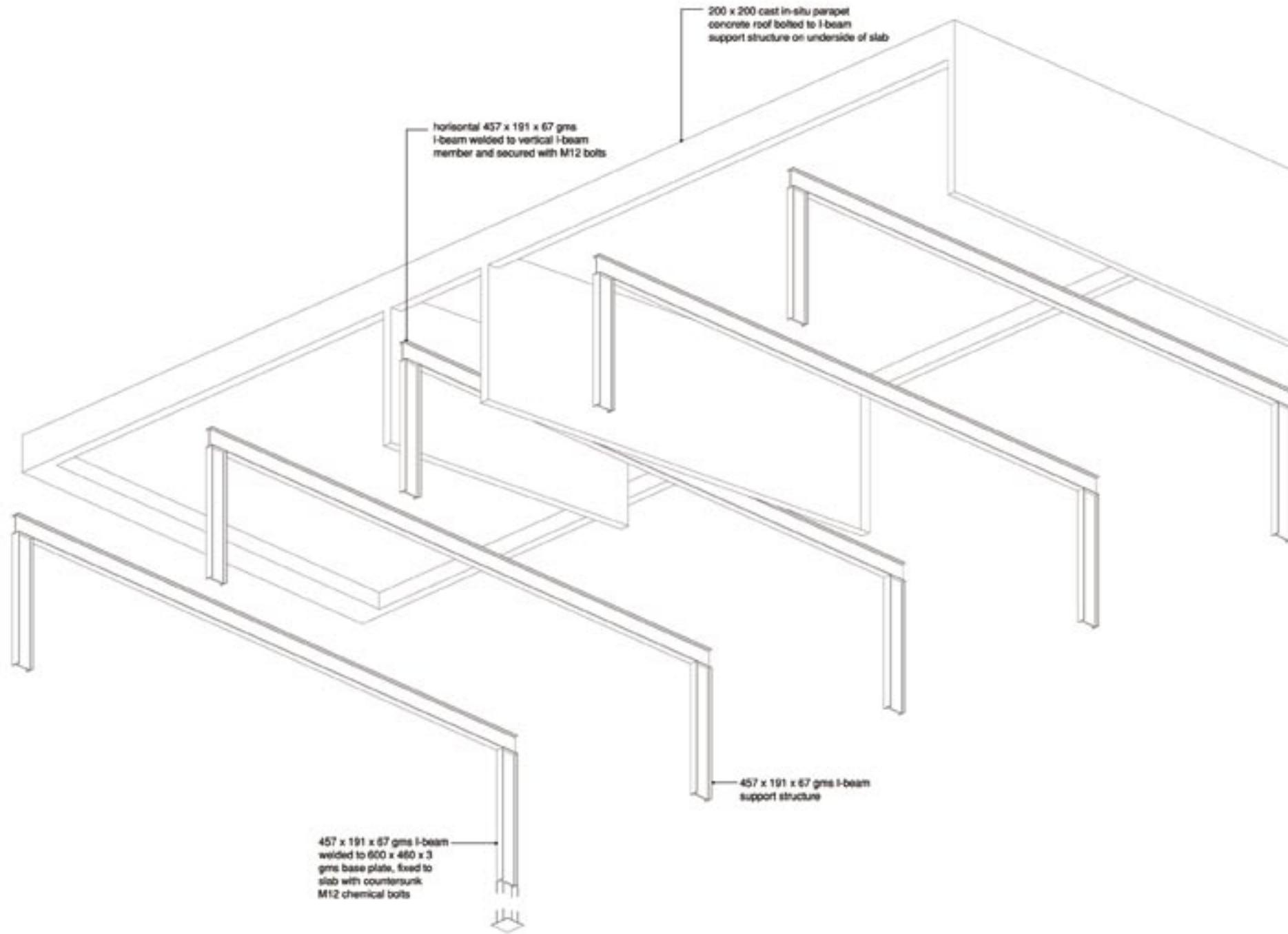
SECTION B-B

SCALE 1:30



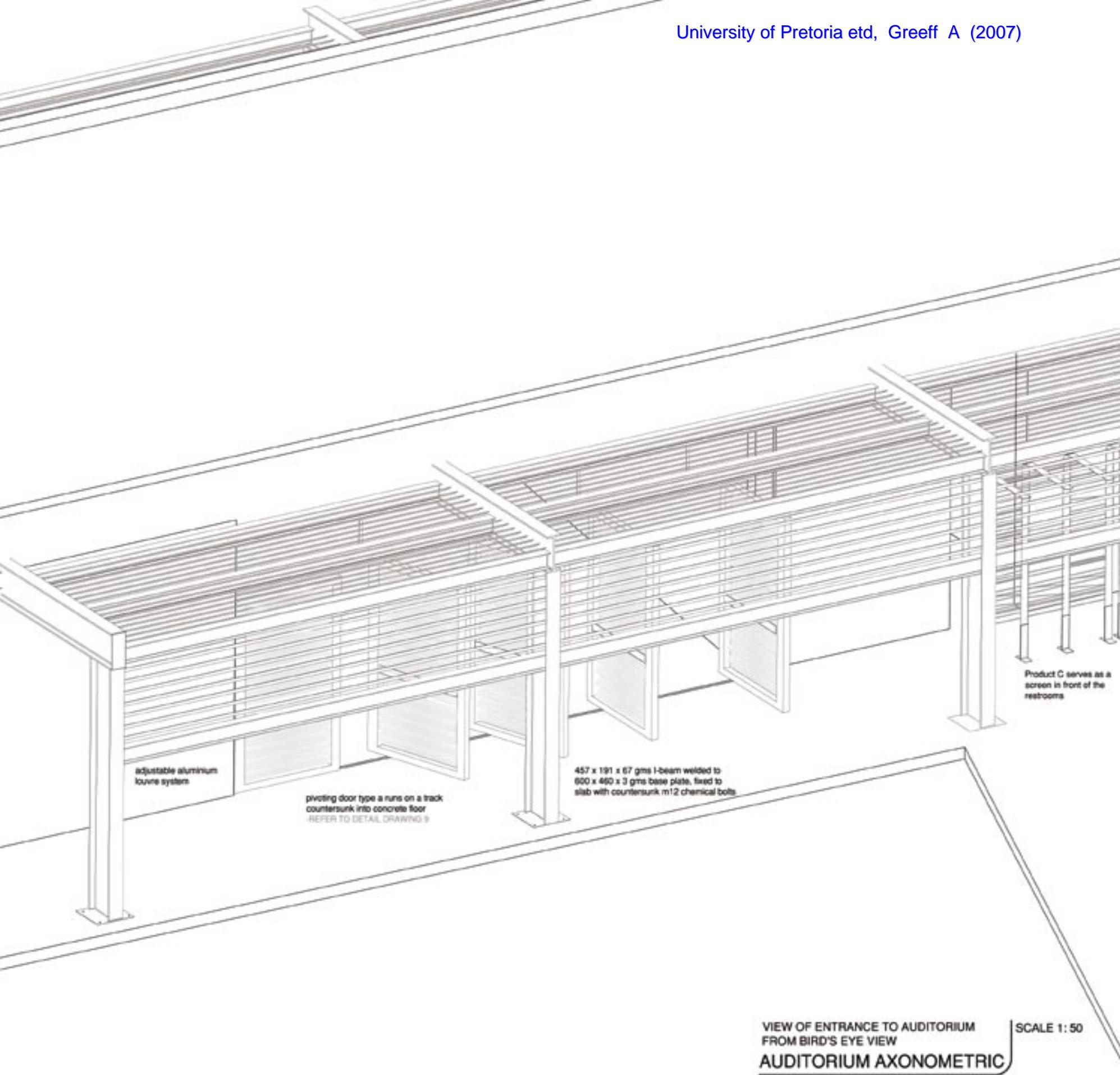
DRAWING NO. 3.3.1

SECTION B-B DETAIL



AUDITORIUM STRUCTURE AS IF SEEN FROM UNDERGROUND N.T.S  
LOW ANGLE VIEW

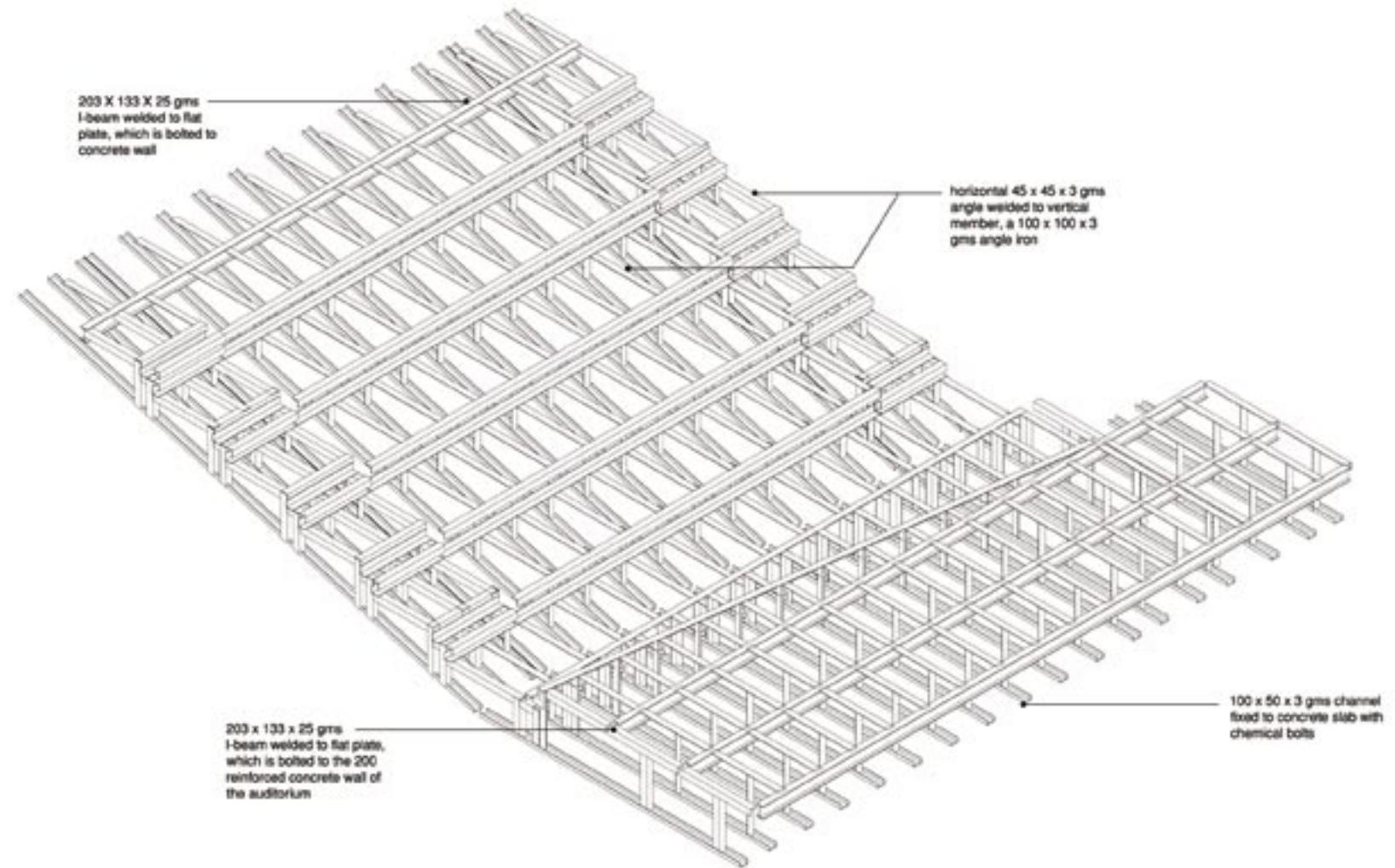
DRAWING NO. 4  
EXPLODED AXONOMETRIC:  
STRUCTURAL SUPPORT OF AUDITORIUM



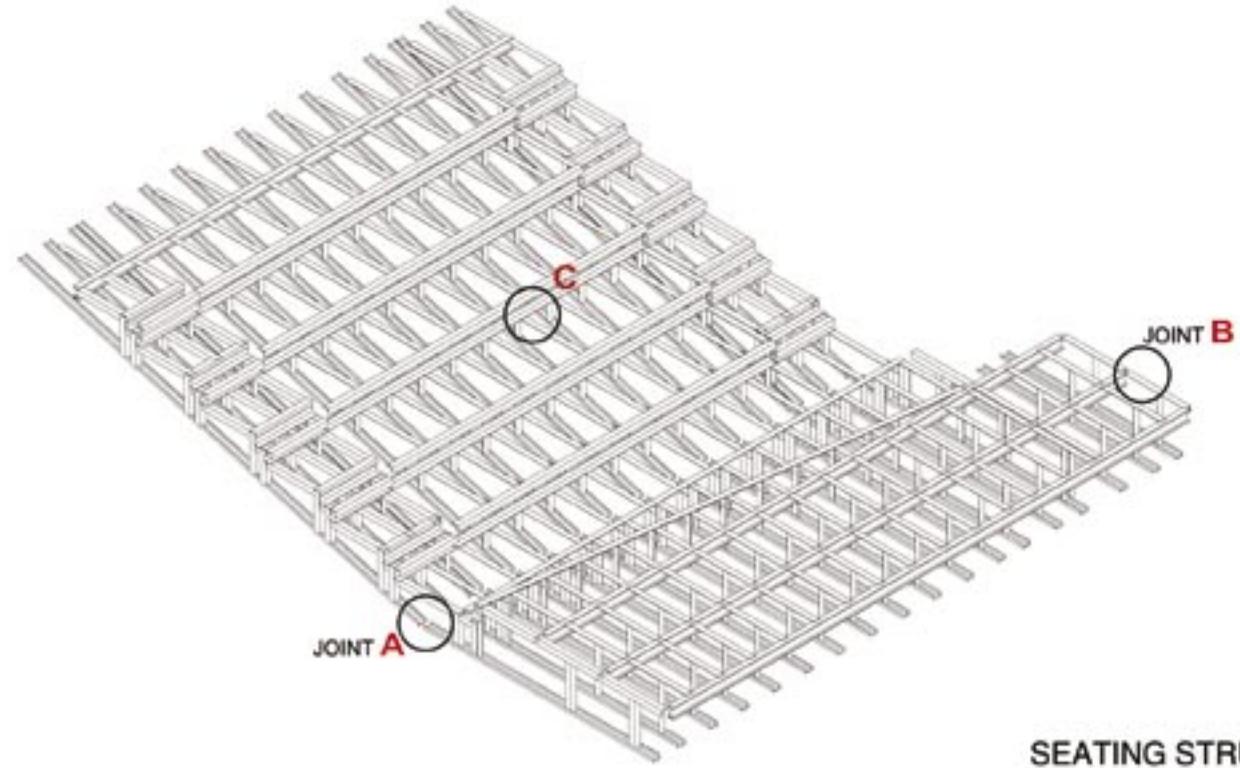
DRAWING NO. 4.1

AXONOMETRIC:

AUDITORIUM THRESHOLD

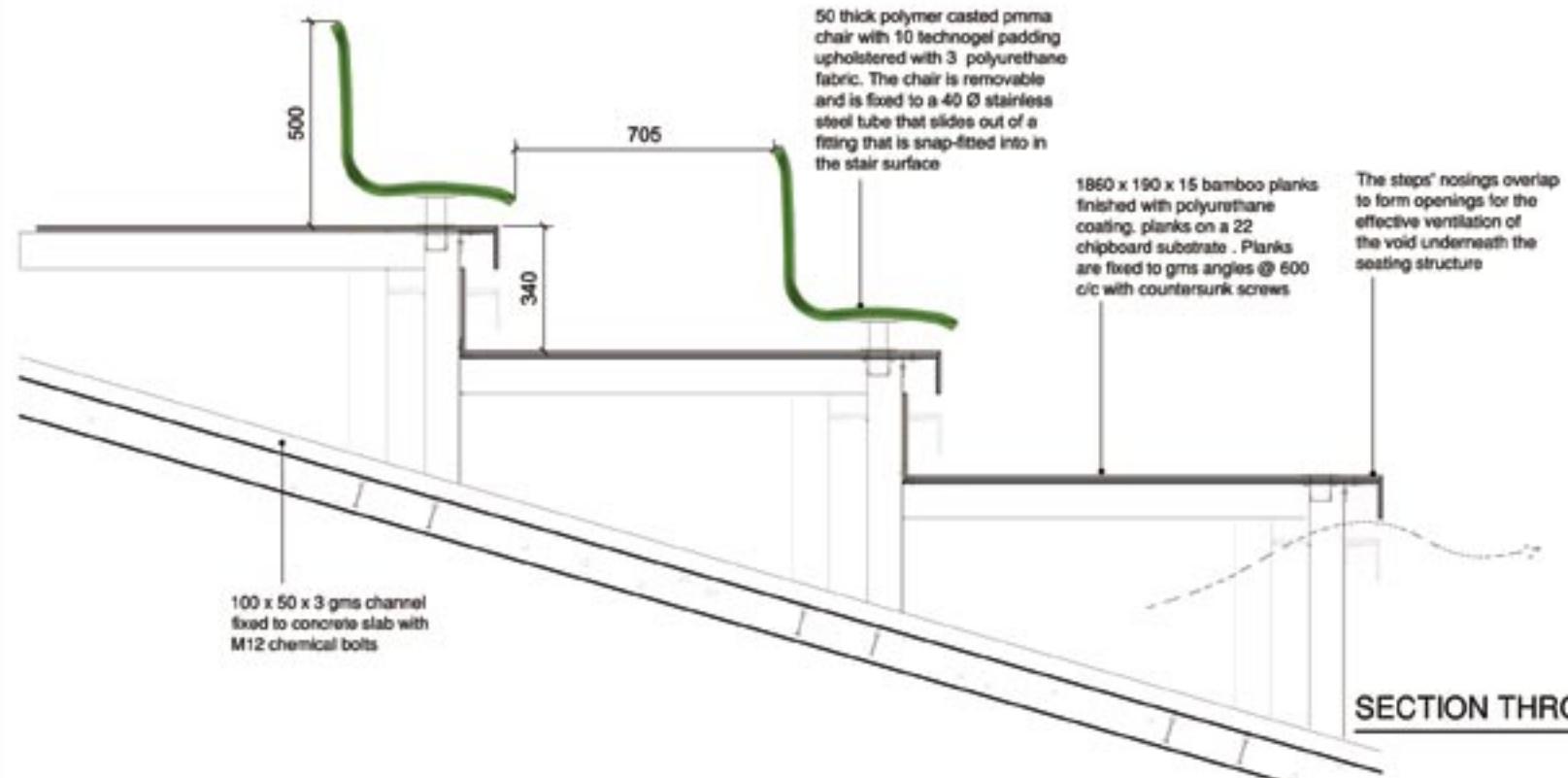






SCALE 1:100

SEATING STRUCTURE

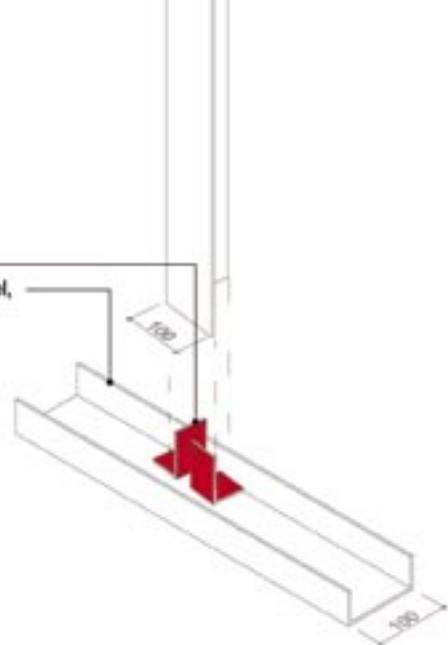


SCALE 1:20

SECTION THROUGH SEATING

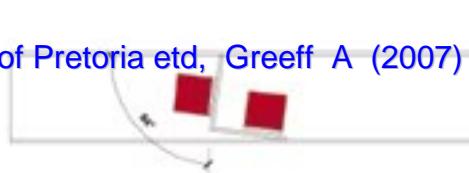
**JOINT A**

two 45 x 45 x 3 gms angles welded to the 100 x 50 x 3 gms channel, which is fixed to the auditorium floor with chemical bolts



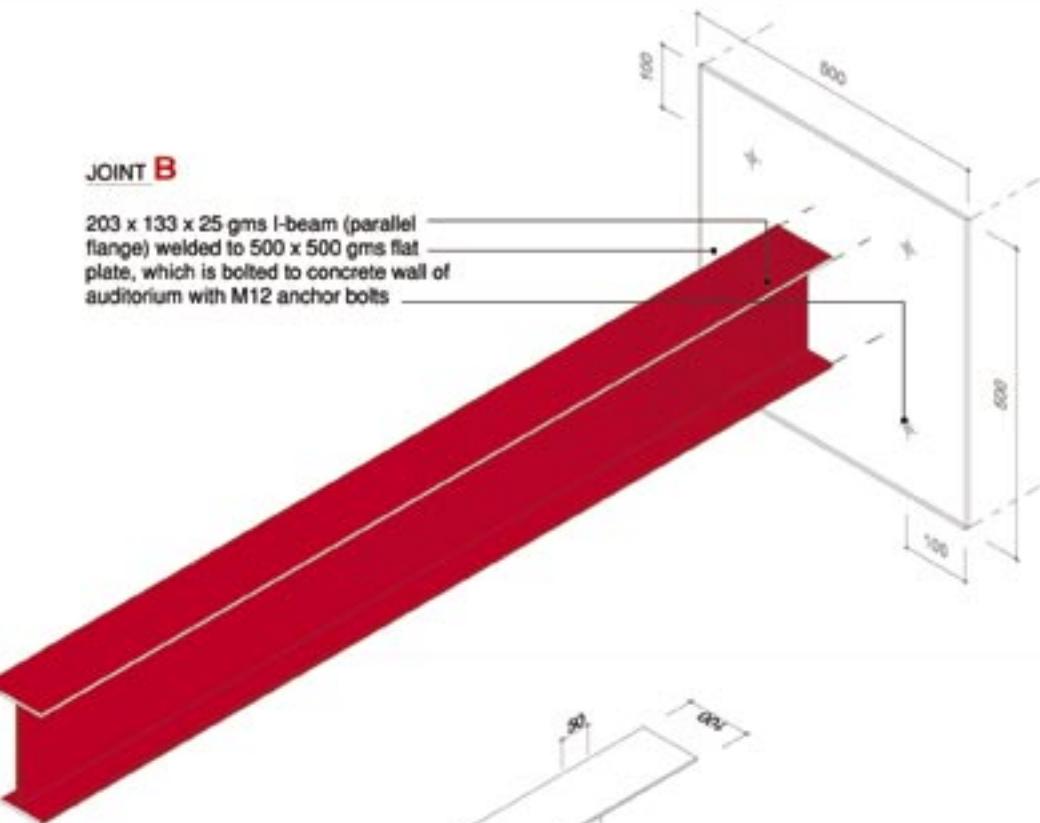
**PLAN OF JOINT A**

Shows the angle at which the vertical member is welded to the 100 x 50 x 3 gms channel



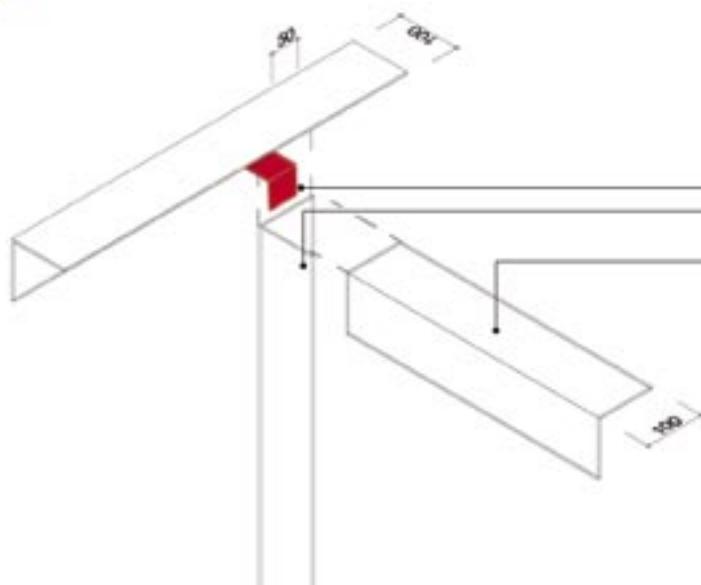
**JOINT B**

203 x 133 x 25 gms I-beam (parallel flange) welded to 500 x 500 gms flat plate, which is bolted to concrete wall of auditorium with M12 anchor bolts



**JOINT C**

45 x 45 x 3 gms angles welded to vertical member, a 100 x 100 x 3 gms angle iron, which is welded to horizontal member, a 100 x 100 x 3 gms angle iron



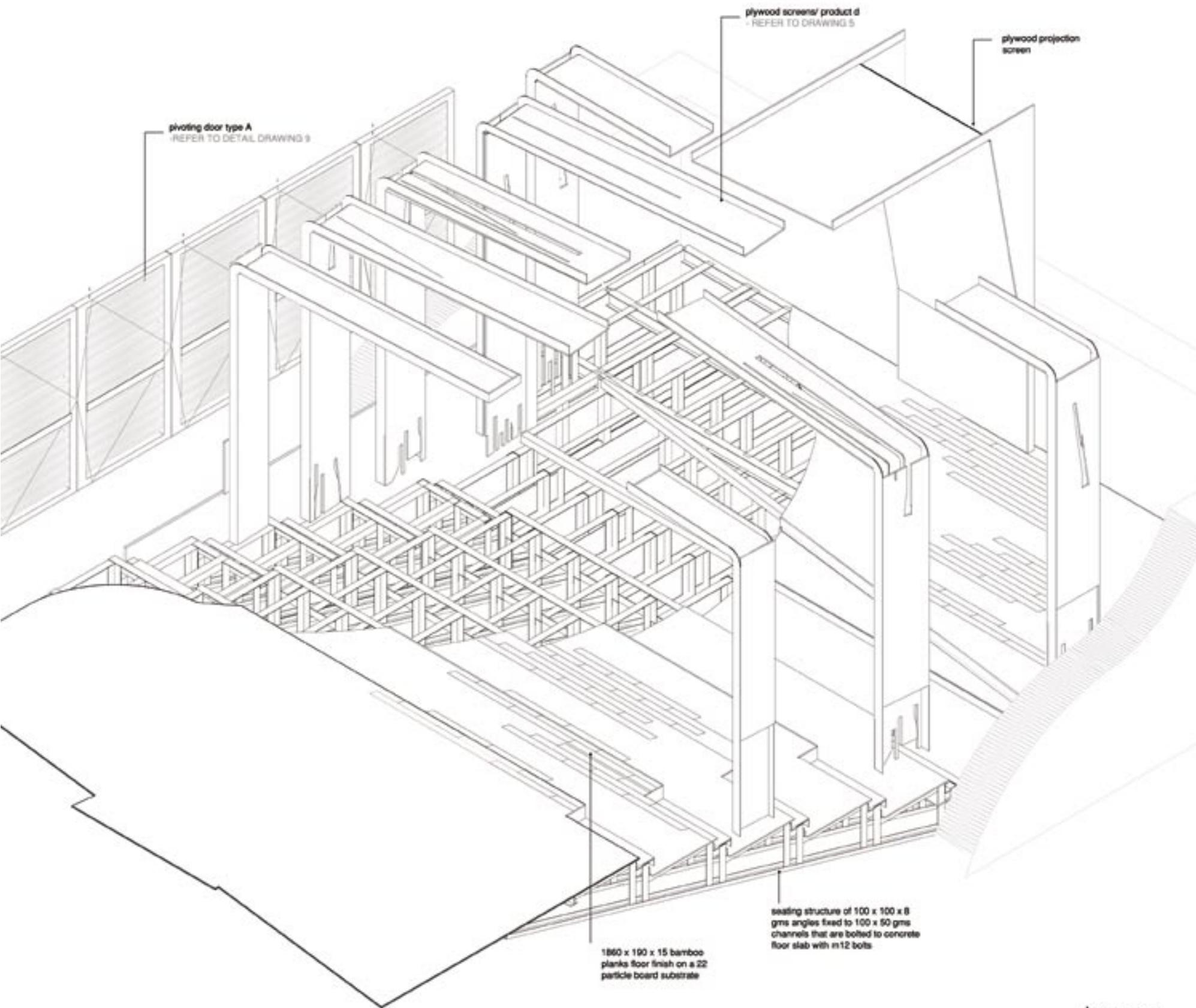
SCALE 1: 10

JOINTS

DRAWING NO. 4.3

AUDITORIUM:

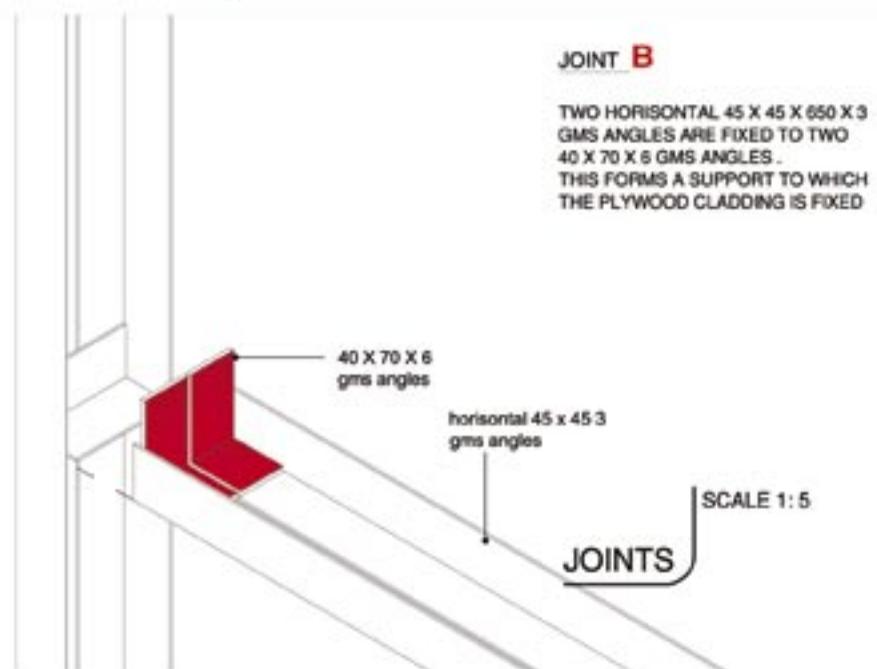
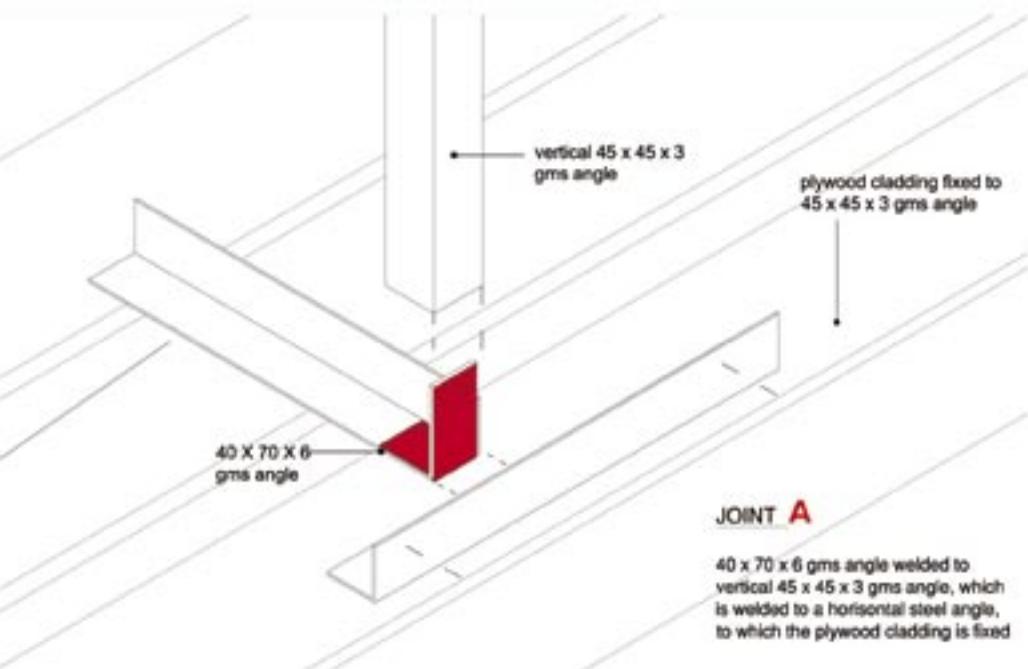
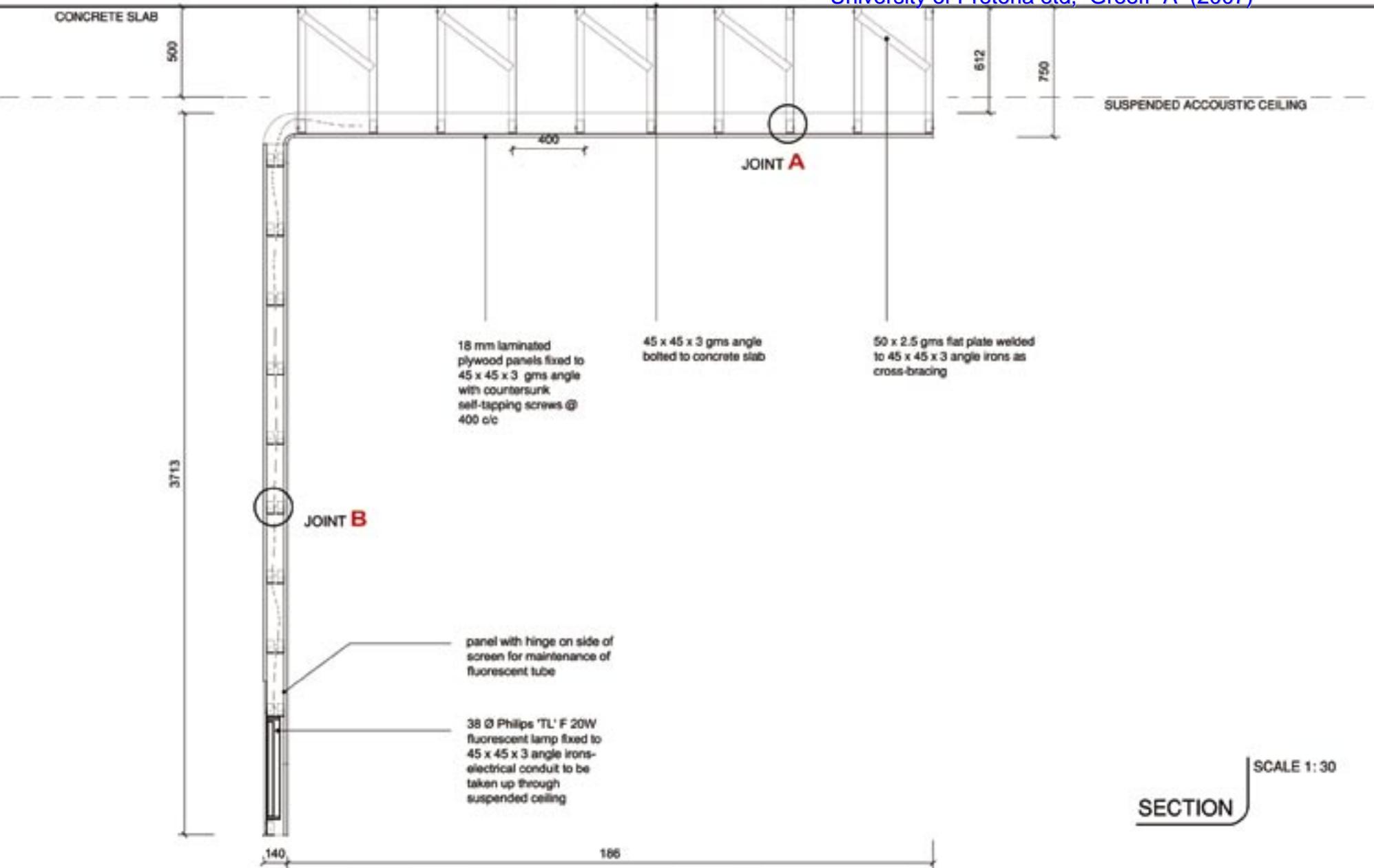
DETAILS OF SEATING STRUCTURE



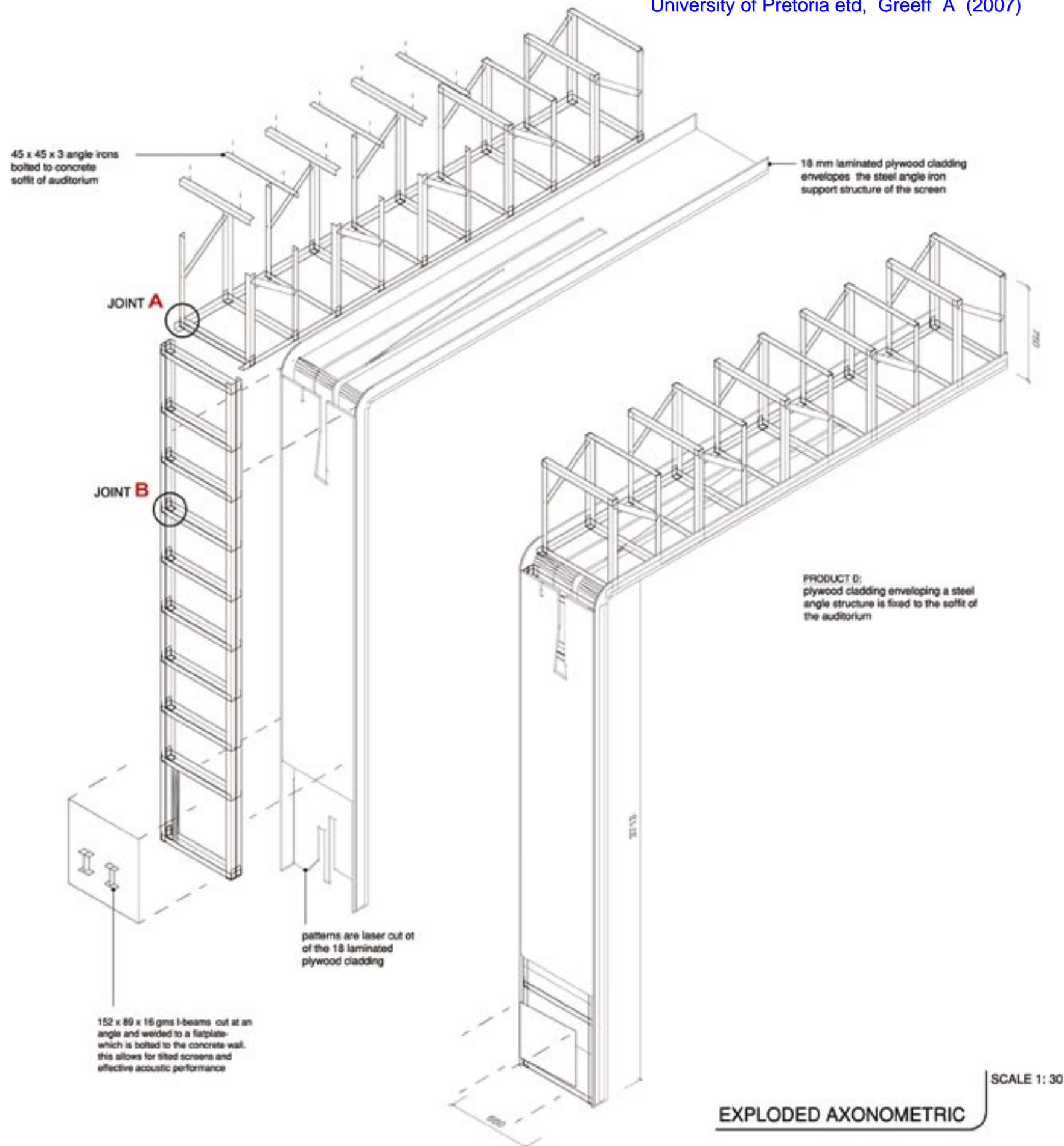
DRAWING NO. 4.4  
AUDITORIUM:  
INTERIOR AXONOMETRIC

INTERIOR AXONOMETRIC

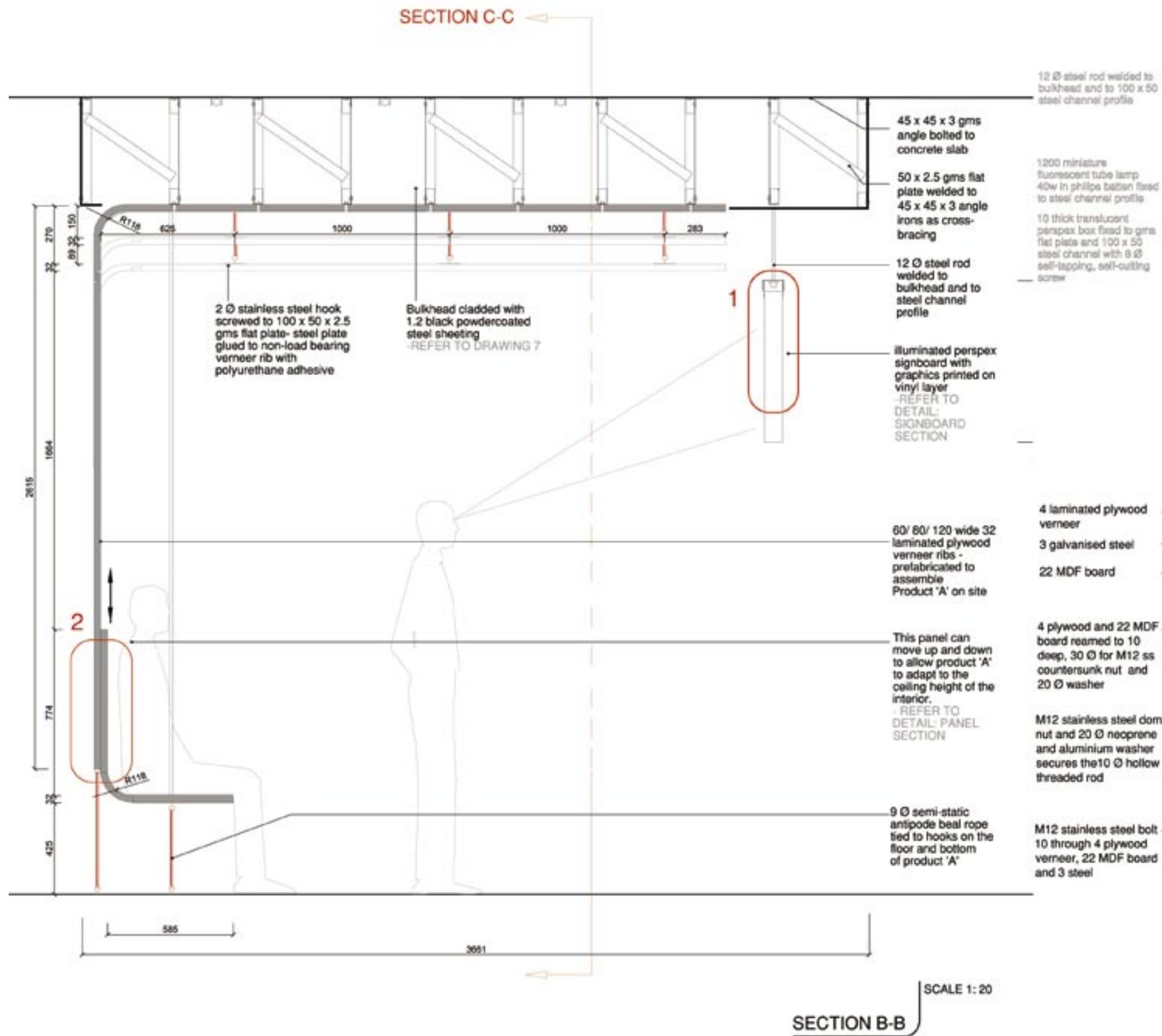
SCALE 1: 50

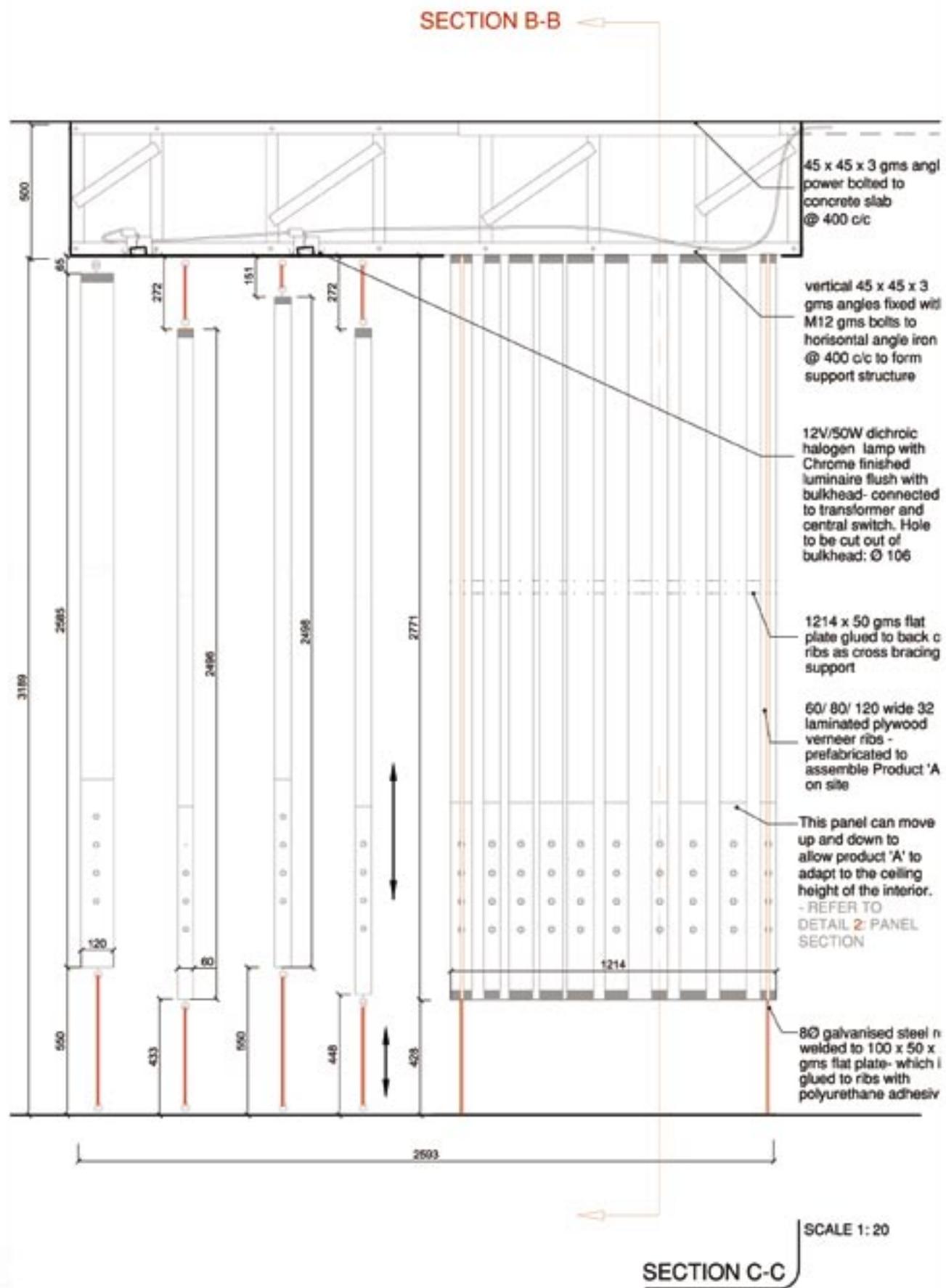
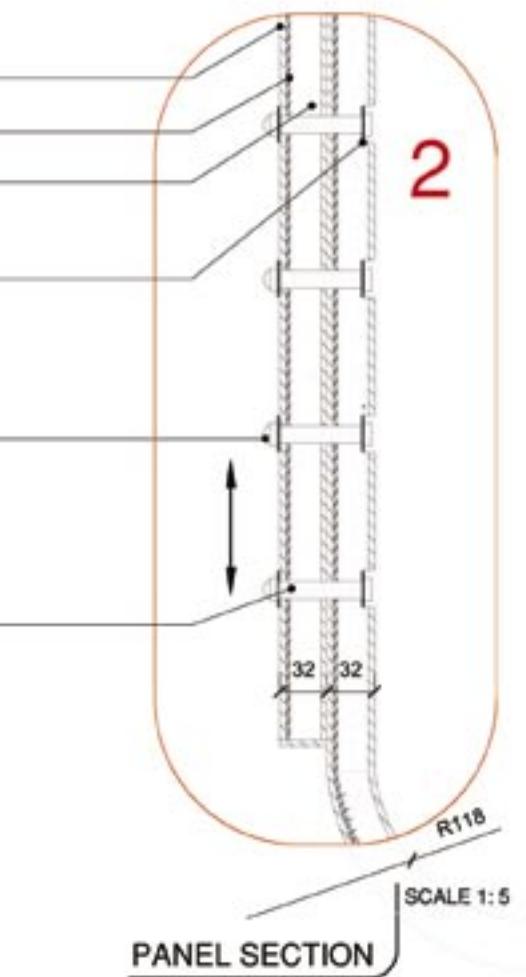
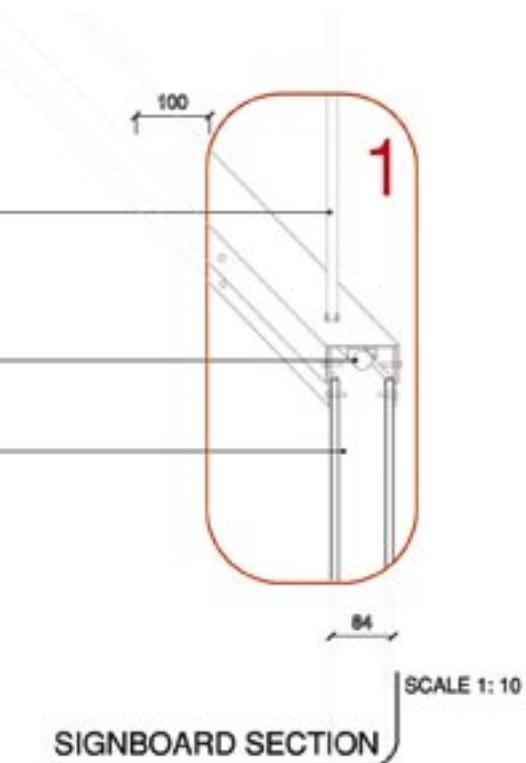


DRAWING NO. 5  
AUDITORIUM SCREENS:  
DETAILS OF PRODUCT D

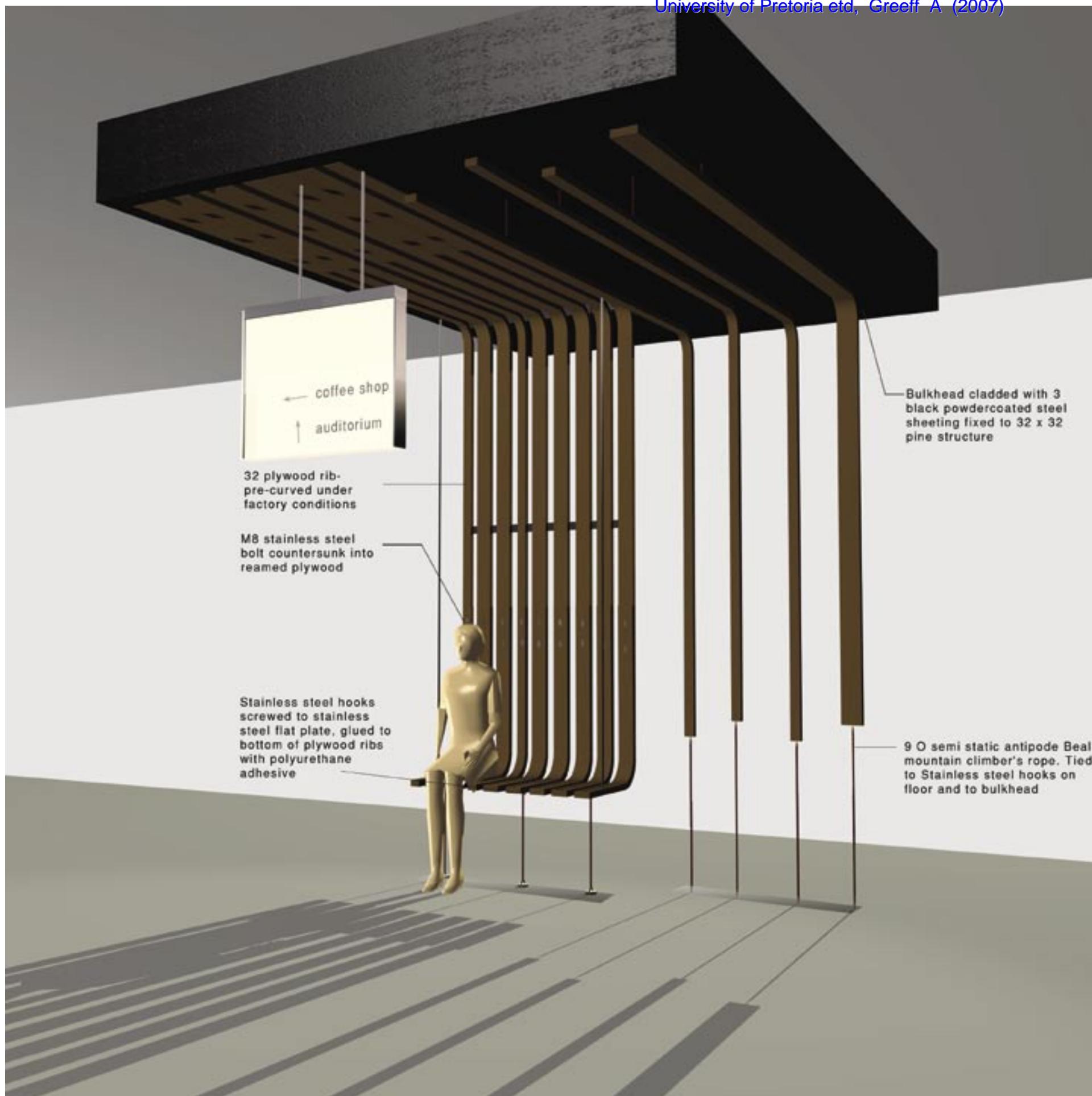


DRAWING NO. 5.1  
AUDITORIUM SCREENS:  
AXONOMETRIC OF PRODUCT D\*





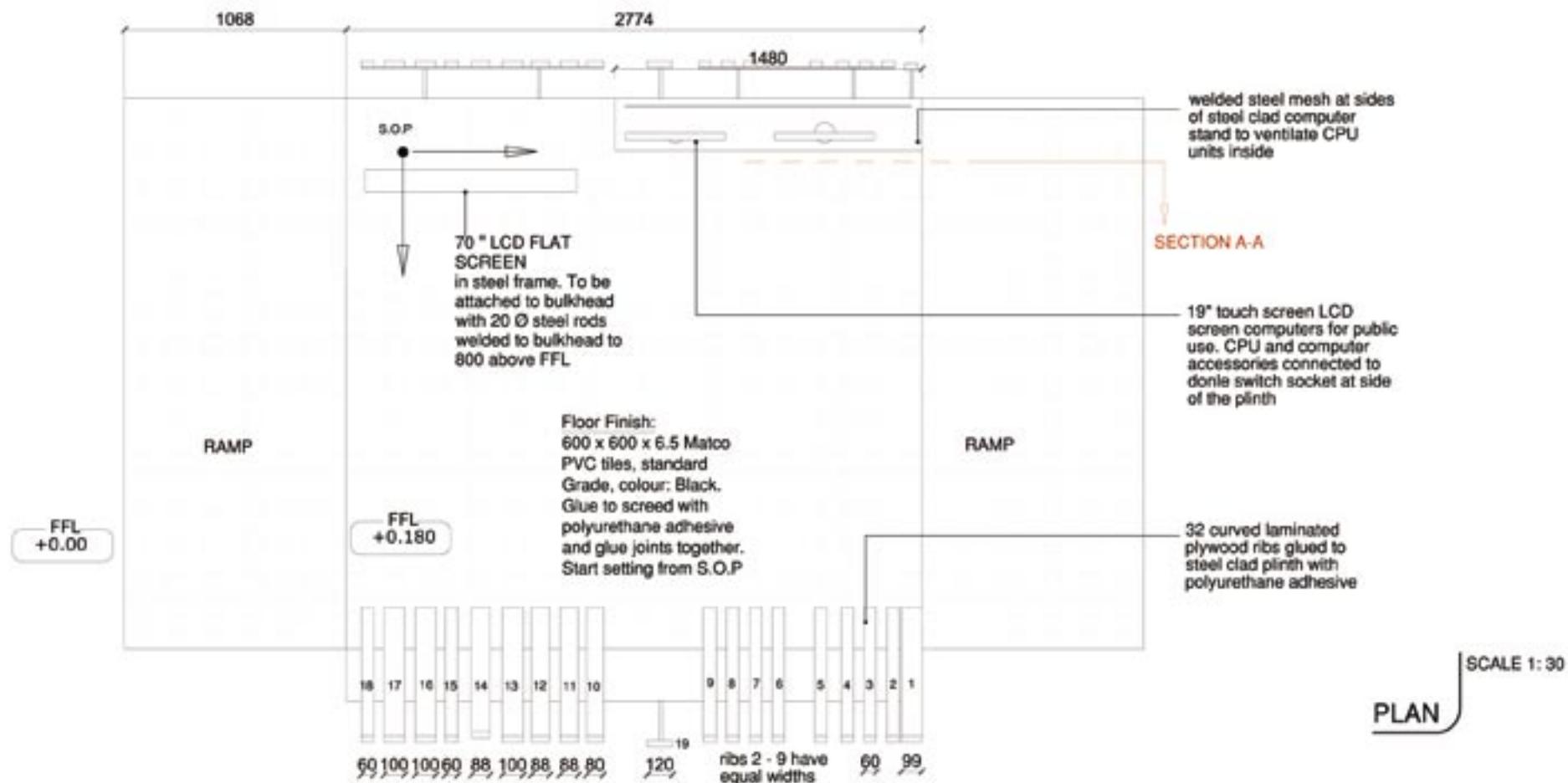
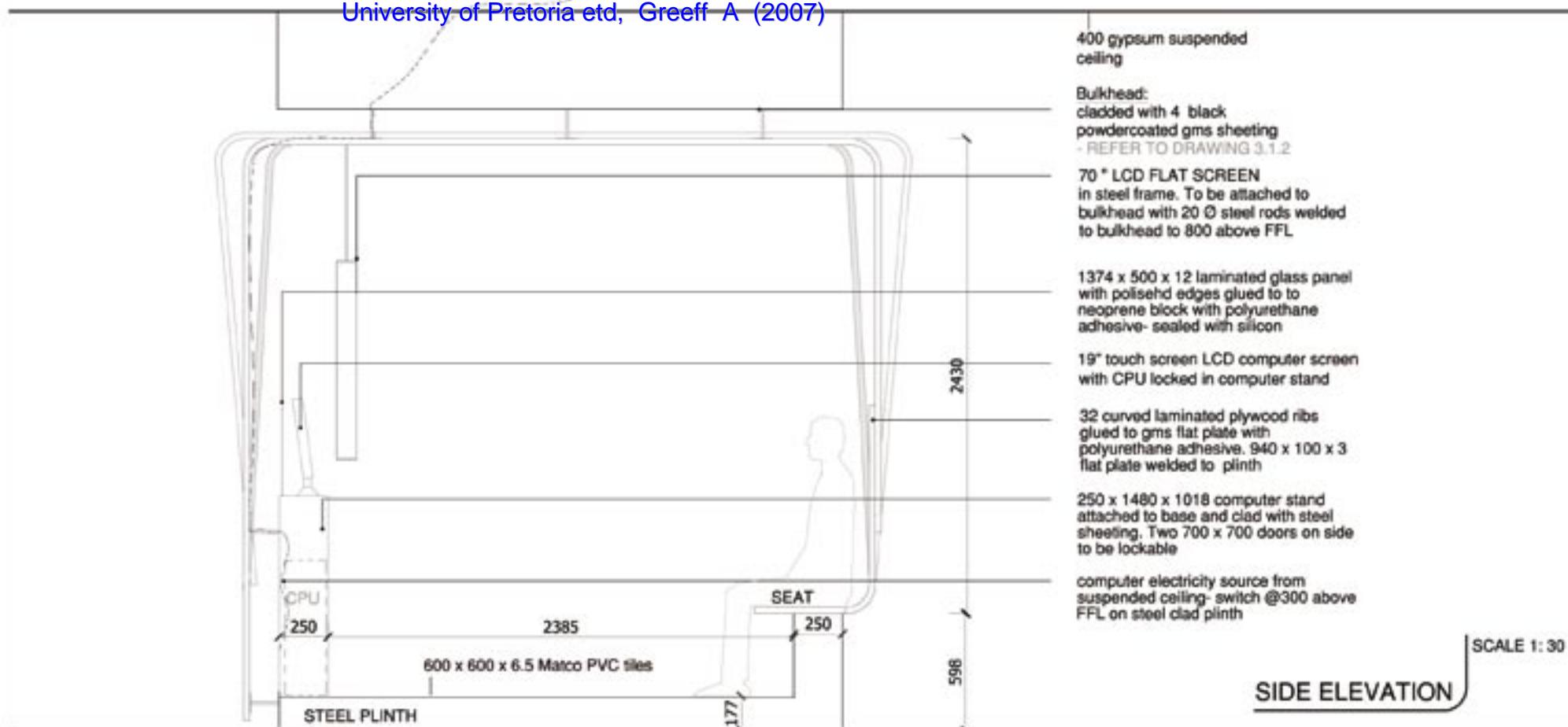
DRAWING NO. 6  
PRODUCT A:  
DETAIL DRAWINGS

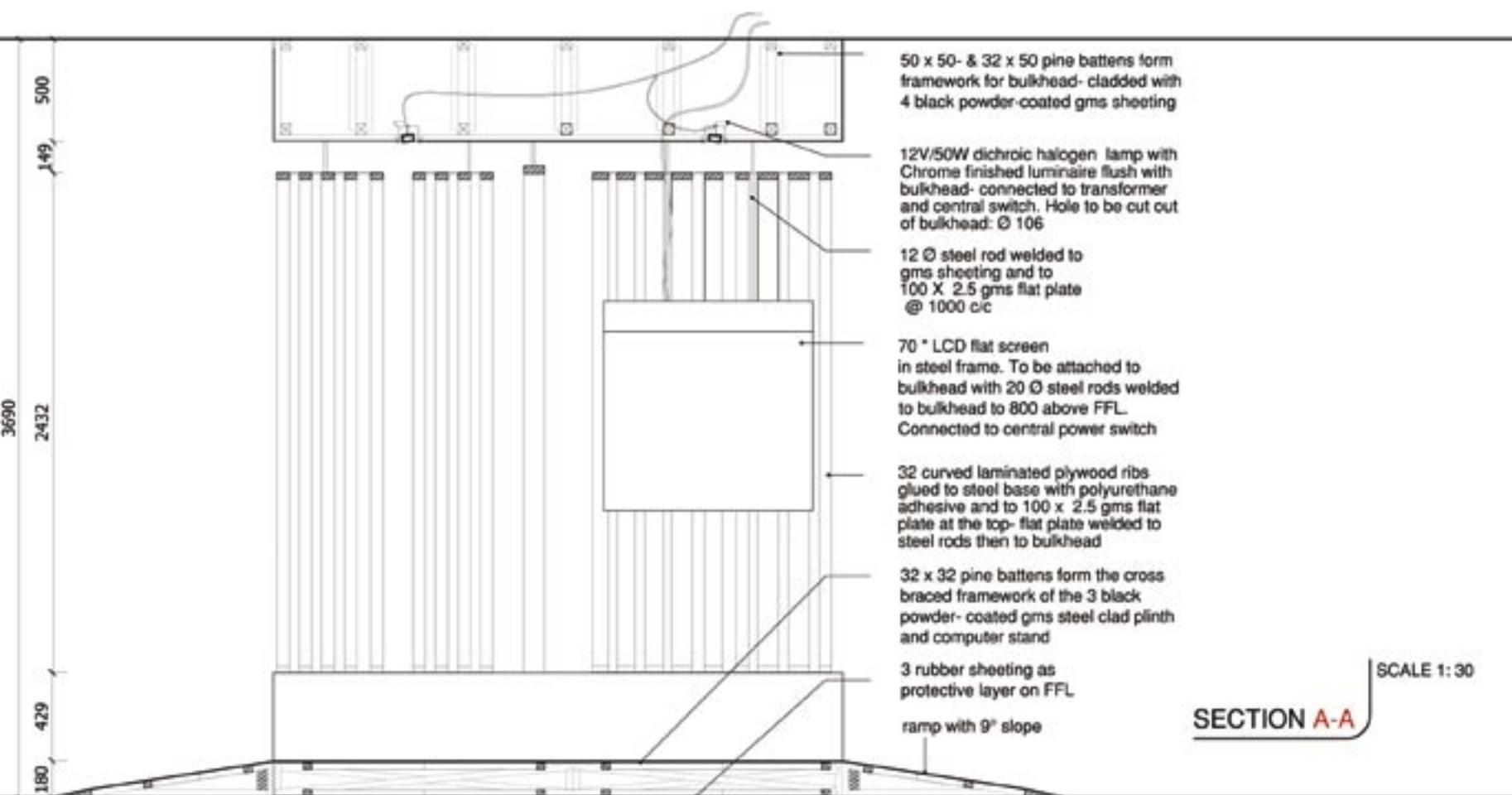
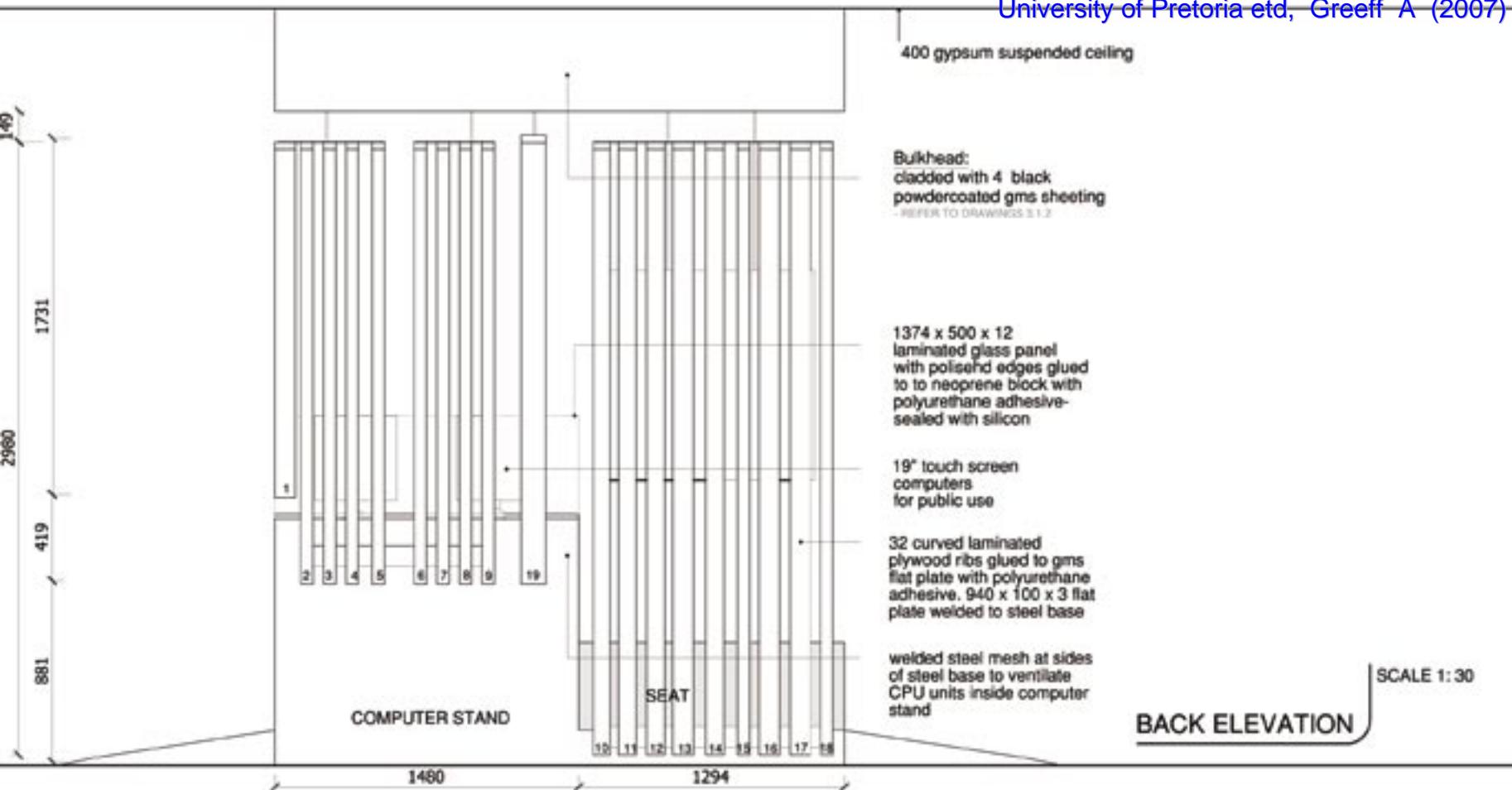


DRAWING NO. 6.1

PRODUCT A:

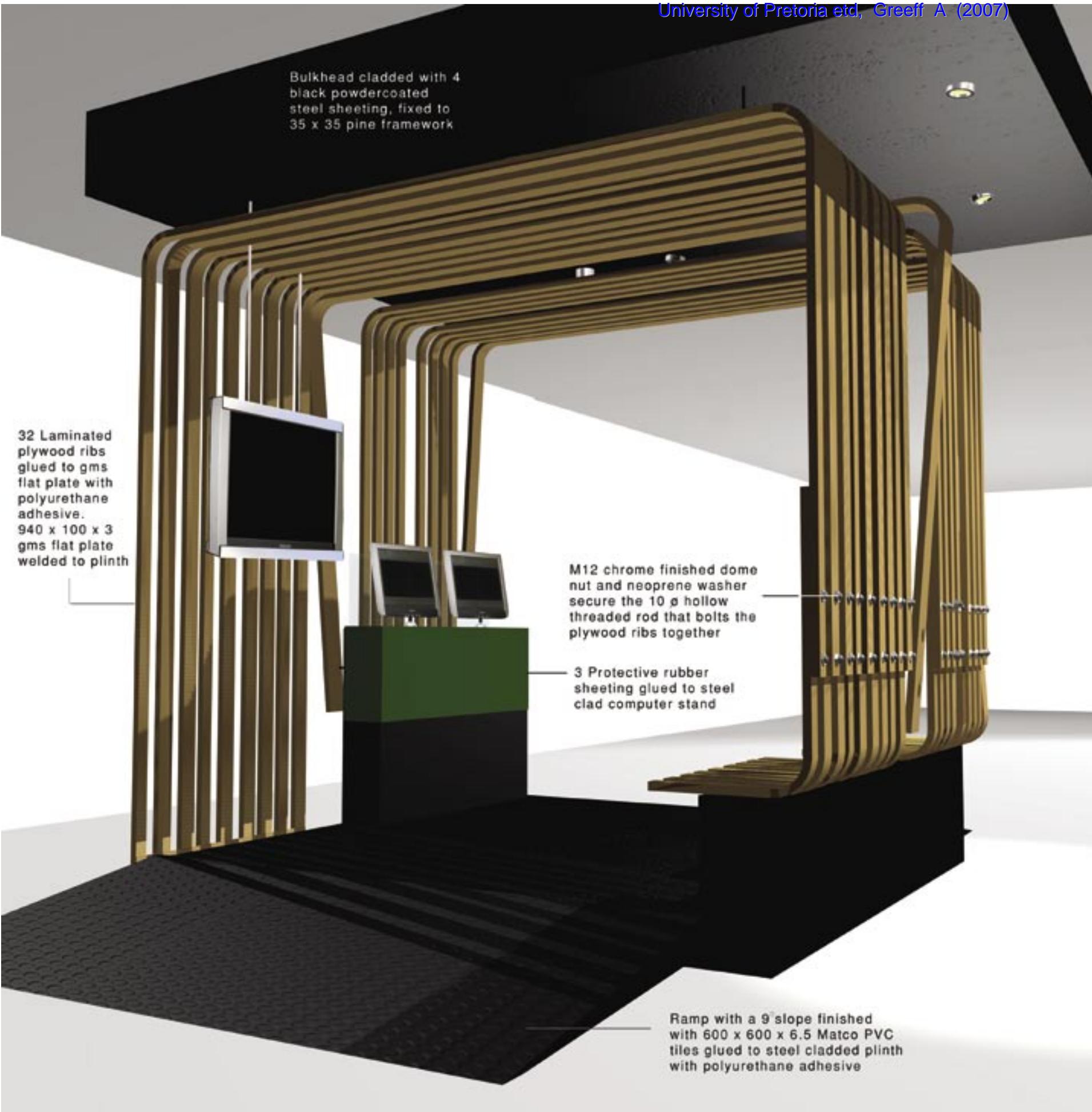
PERSPECTIVE VIEW





DRAWING NO. 7  
PRODUCT B:  
DETAIL DRAWINGS



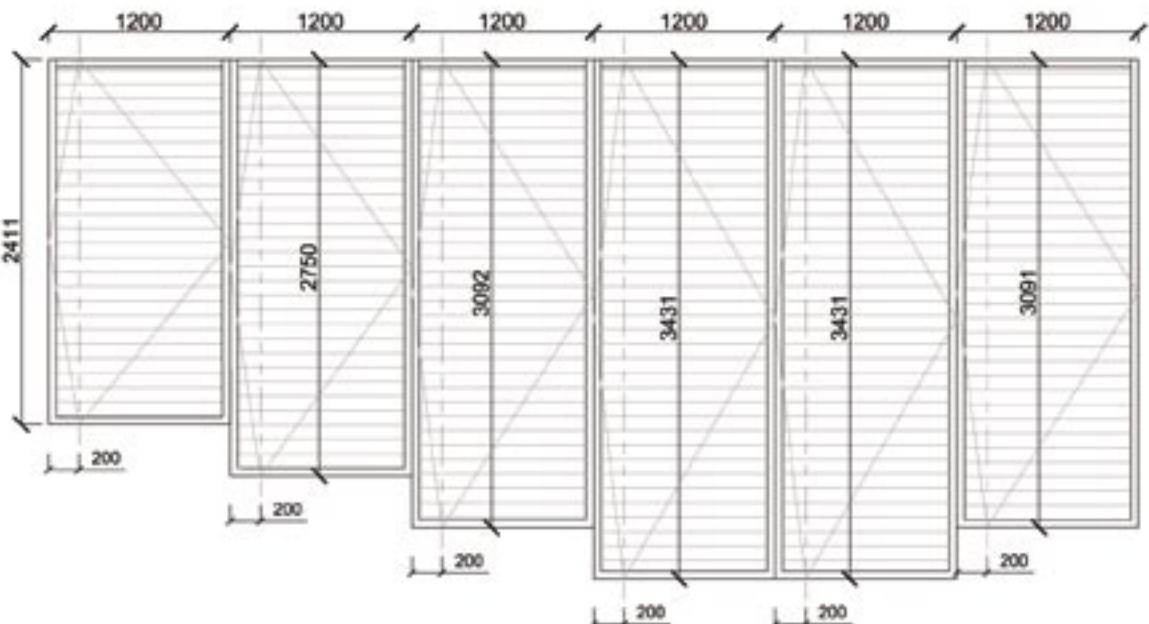
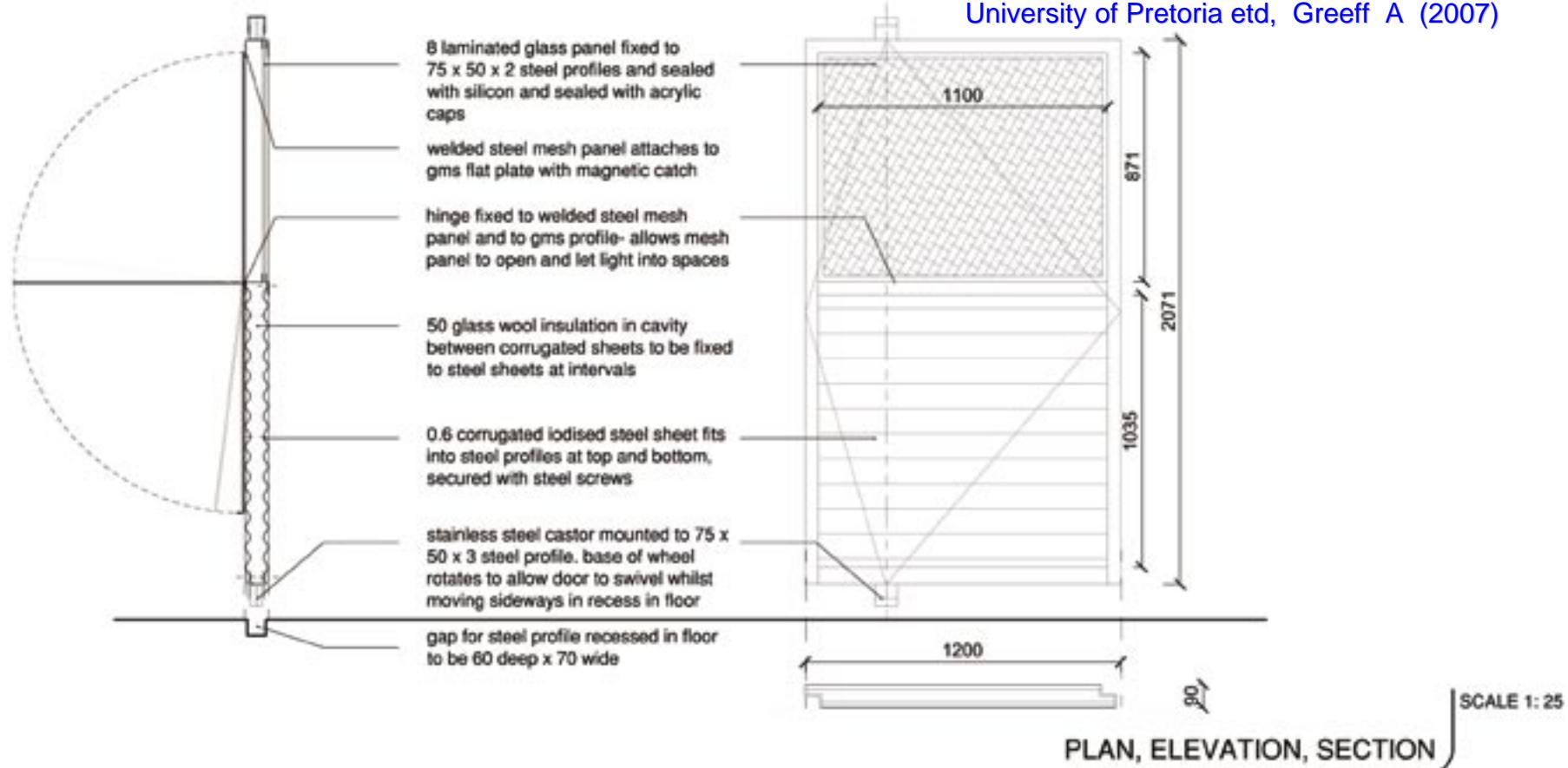


DRAWING NO. 7.1

PRODUCT B:

PERSPECTIVE VIEW





DOOR TYPE 'A' ADAPTED FOR AUDITORIUM:

1. PANELS SHOWN IN ARRANGEMENT AS SPECIFIED FOR AUDITORIUM EASTERN FACADE.
2. THESE DOORS DO NOT HAVE AN OPENABLE STEEL MESH PANEL OR WINDOW, ONLY CORRUGATED SHEETING IN THE WHOLE LENGTH OF THE DOOR
3. THESE DOORS CAN PIVOT, BUT NOT SLIDE SIDWAYS LIKE DOOR TYPE 'A'

SCALE 1: 50

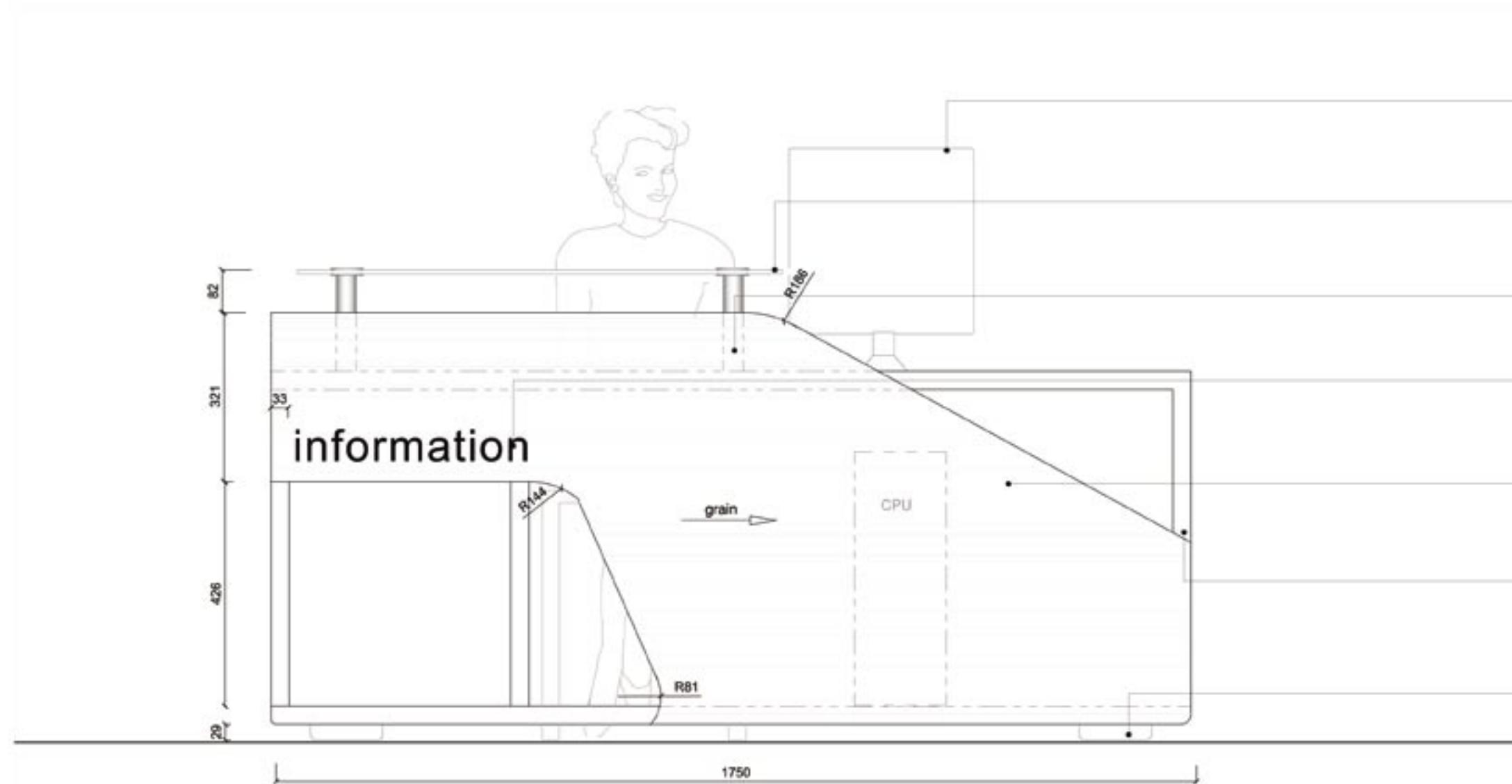
FRONT ELEVATION

DRAWING NO. 9

PRODUCT:

DOOR TYPE A





flatscreen computer screen and CPU connected to double switch socket installed on side of counter @300 above FFL  
-REFER TO DRAWING 3.1.2 A

8 laminated glass panel with polished edges- fixed with countersunk bolt profiles and sealed with acrylic caps

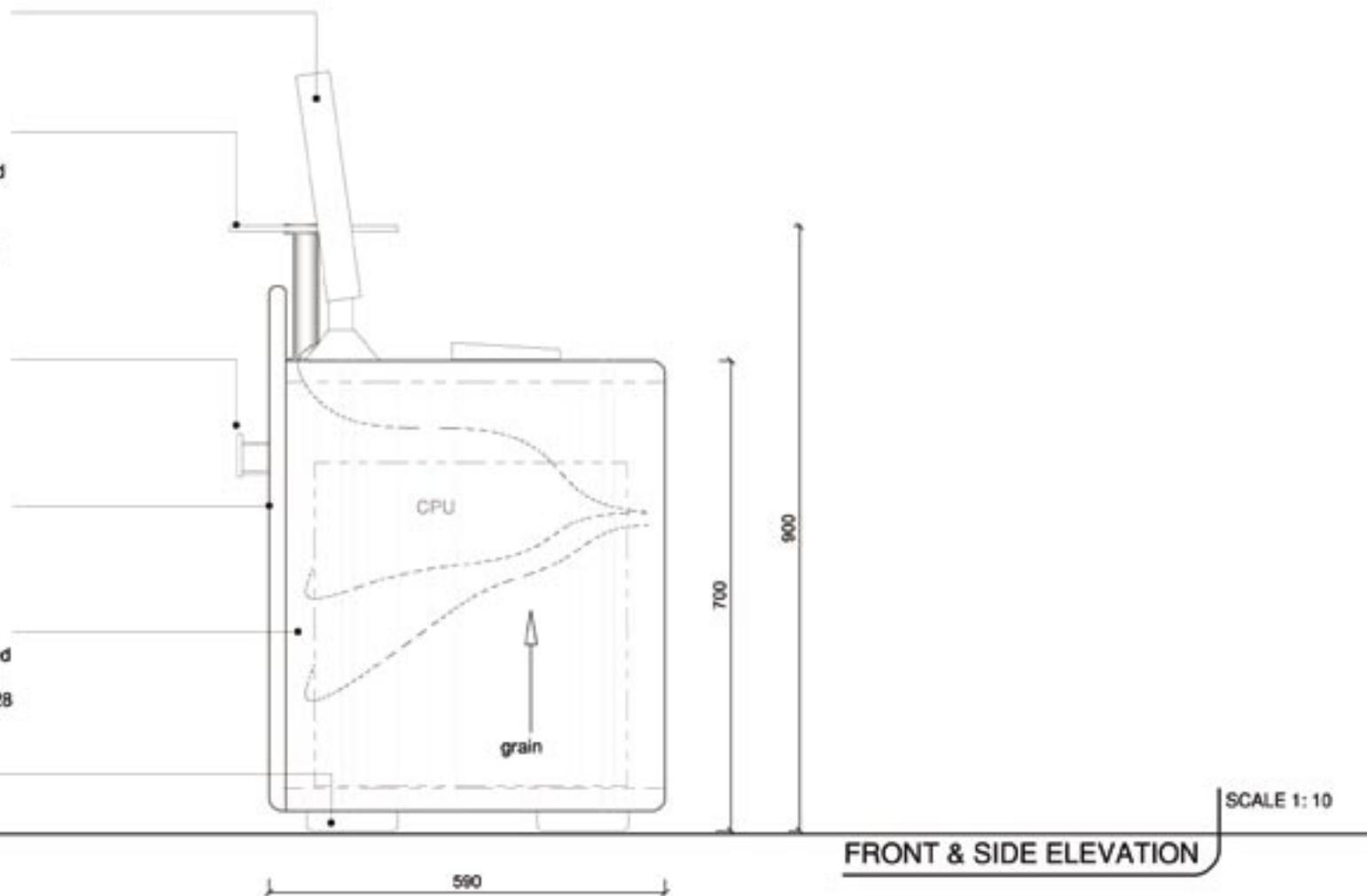
38 Ø stainless steel tube pedestals support glass top and is fixed to counter top with 8 x 20 stainless steel screws

Signage:  
2 brushed stainless steel laser cut letters of 60 mm height welded to steel rods and bolted to laminated beam panel in position indicated on drawing

1750 x 600 x 22 oregon laminated beam panel pre-cut and treated with Timberlife Satinwood 28 water-repellent finish

counter top and carcass of 35 oregon laminated beam panels fixed with self tapping wood screws and treated with Timberlife Satinwood 28 water-repellent finish

140 x 140 x 30 black acrylic supports screwed to bottom of laminated beam carcass



DRAWING NO. 10

PRODUCT:

DETAILS OF INFORMATION COUNTER



ss  
d to  
ed to the 22 thick  
beam counter as

ormation

500 x 500  
acrylic drawers  
on stainless steel runners  
display the various

brochures available to visitors  
to the Interactive Centre

counter of 22 laminated saligna beam sheets, front panel  
to be pre-cut and treated with Timberlife Satinwood 28 water  
repellent finish

---

DRAWING NO. 10.1

PRODUCT:

PERSPECTIVE VIEW OF INFORMATION COUNTER

# conclusion

## D: Conclusion

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The *Interactive* Centre formed the ideal prototype for the 'relate and enhance' methodology that was formulated at the outset of this project. The Centre highlights important principles that can be applied to other scenarios to achieve similar qualities. The project outcome, therefore, is to serve as the means through which a design approach is explored. This approach results in design that enhances the physical and metaphysical aspects of its context and enables the user to relate to his/ her context as an outcome of the design experience.

The design delivers an interior environment that interacts and reacts with a sensitive yet crude external environment. It aims to achieve spatial clarity, which is provided by relationships that form between the 'spaces within space', the spaces and the visitor, and the Centre as a whole in its environment. The 'spaces within space' refer to the rib-

like trademark that is used to good effect throughout the Centre.

This investigation substantiates the importance of considering the context in which a design project is based. The *Interactive* Centre, in this way, serves as a catalyst in the field of design, to enhance the South African public's awareness of conservation by educating them through entertainment. Further research in this field can be of inestimable value to develop interior architecture that harmonises with the exterior environment. The strategic integration of a new design language with the existing aesthetic provides the opportunity to create a safe, interactive, inclusive and appealing Visitors' Centre that will attract visitors to Groenkloof Nature Reserve. The design allows the reserve to become a destination in its own right.

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# credits

## F: Illustration credits

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*All photos, illustrations and renderings in this dissertation are original work by the author, unless listed below.*

Figure 1: Map of Pretoria. 2005. African EPA

Figure 2, 3: Pauw. S.1949. Inauguration of the Voortrekker Monument.

Figure 4: *Animal Planet*. www.discovery.com Accessed on 3 August 2006.

Figure 5: <http://acolin4.free.fr/jeux%20video.html> Accessed on 8 April 2006.

Figures 6, 7: Keays, B. 2003. *Extruded Window*. www.billkeays.com/ExtrudedWindowInfosheet1.pdf Accessed on 7 April 2006.

Figures 8, 9: *Tshwane Inner City Development and Regeneration Strategy*. City of Tshwane Metro Municipality. 2005, p 16-20.

Figure 11: Sensitivity Study. 2005. African EPA.

Figure 17: <http://www.gettyimages.com>

Figure 20, 21: Küsel, U.S. 2006. *Cultural Heritage Impact Assessment of the Fountains Valley*. Pretoria: African Heritage Consultants, pp 6, 7.

Figures 23, 24: *Groenkloof 4x4 Nature Trail: Interpretation Booklet*. City of Tshwane Metro Municipality. Undated.

Figures 25-28: Bremner, L. 'Imaging Humankind,' in *Architecture Journal of the South African Institute of Architects*, May/ June 2006.

Figures 33-37: *Koeberg Power Station*. www.eskom.co.za Accessed on 8 September 2006.

Figures 38-40: Weathersby, W. 'Xing', in *Architectural Record*, March 2006, p 198-200.

Figure 65: Bathroom at IIT Student Center by OMA. <http://www.archinect.com/gallery> Accessed on 6 April 2006.

Figure 67: BrainPOP office. <http://www.archinect.com/gallery> Accessed on 6 April 2006.

Figure 68 a, b & c: Del Valle Schuster, C. 2005. *Public Toilet design*. Ontario: Firefly Books. pp 244-245.

Figure 74: Sayers, G. 'Mod Understated,' in *South African Interior Design*. vol. 8, no. 1, 2003, p 41.

Figure 77: Woodbridge, S. 'Kids on the Block,' in *Architecture*, April 2006, p 71.

Figure 85: Fountains Valley Bulk Services Provision. 2006. African EPA.

# appendices

## G: Appendices

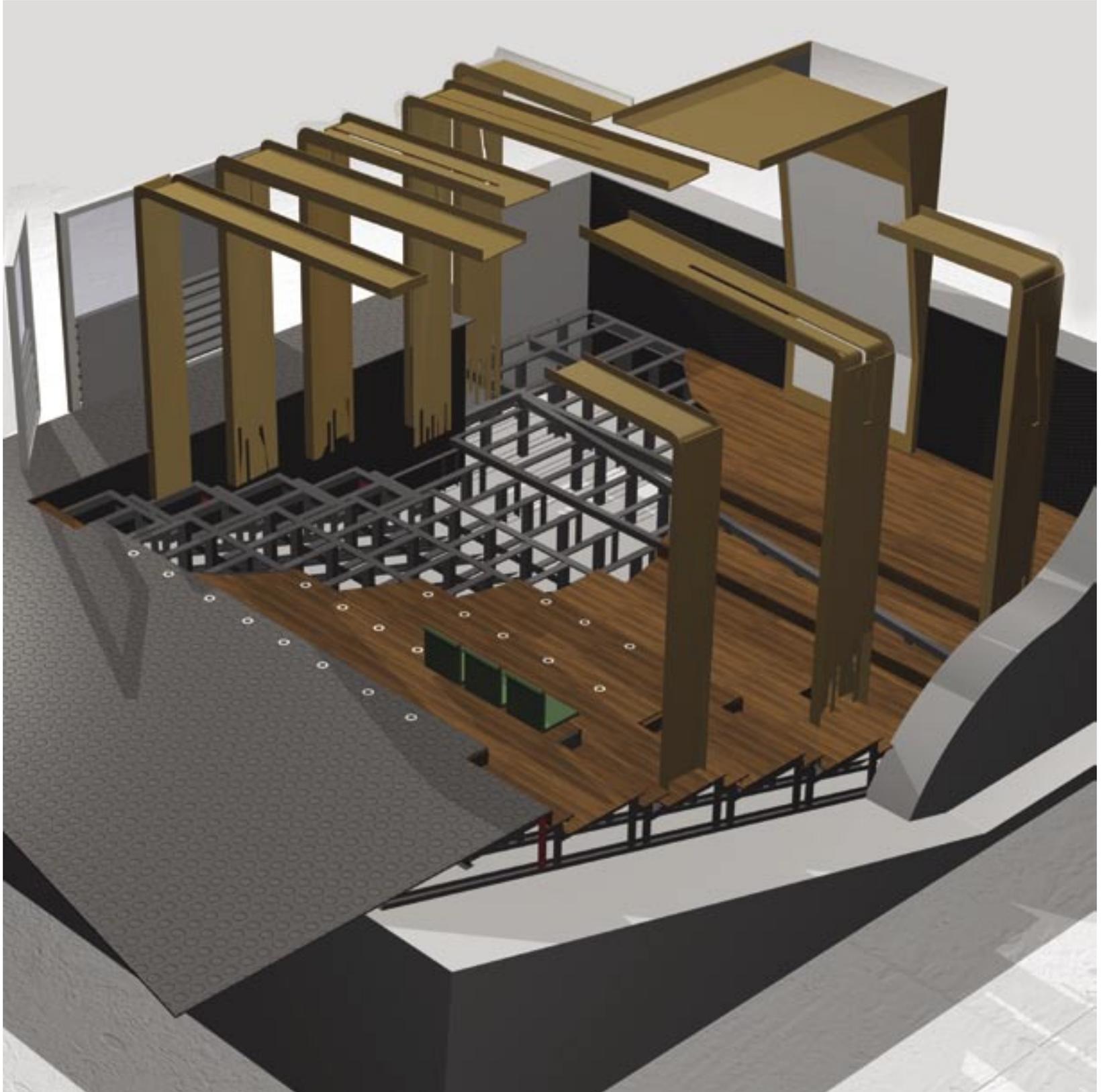
### SCHEDULE OF ACCOMMODATION

Application (reference)	Zone	Occupancy (SABS 0400)	Area (SABS 0400)		Lighting	Air requirements (SABS 0400)
			Maximum number of people	Area in m <sup>2</sup>		
<b>VISITORS CENTRE</b>	Public/ Semi- Private	Occupancy Class			Illumination in lux	Minimum in l/s
<b>EXHIBITION AREA</b>	Public	C1	16	160	200	3.5
<b>AUDITORIUM</b>	Private/ Semi-private			139		
<b>Control room</b>	Private	A3	1	10	300	5.0
<b>Seating, balcony &amp; stage area</b>	Semi-private	A3	80	129	200	7.5
<b>COFFEE SHOP</b>	Public			187		
<b>Seating area</b>	Public	A1	50	145	200	5.0
<b>Kitchen and delivery/ waste Area</b>	Private	B3	3	42	500	17.5

Application (reference)	Zone	Occupancy (SABS 0400)	Area (SABS 0400)		Lighting	Air requirements (SABS 0400)
<b>VISITORS CENTRE</b>	Public/ Semi- Private	Occupancy Class	Maximum number of people	Area in m <sup>2</sup>	Illumination in lux	Minimum in l/s
<b>ADMINISTRATION</b>	Private			70.2		
<b>Office: guide &amp; coordinator</b>	Private	G1	2	37	300	5.0
<b>Boardroom</b>	Private	G1	10	33.2	300	5.0
<b>SHOPS</b>	Public			75		
<b>Fritz Pienaar Cycling Shop</b>	Public	F2	5	48	300	7.5
<b>Curio shop</b>	Public	F2	3	27	300	7.5
<b>WATER CLOSET FACILITIES</b>	Public/ Private					
<b>Toilets</b>	Public	X	120	13 toilets	100	20.0
<b>Cleaner's room</b>	Public	X	2	15	300	1.0
<b>Locker room</b>	Public	X	3	34.4	100	7.5
<b>Shower units</b>	Public	X	1	15.6	100	20.0
<b>Shower &amp; toilet units</b>	Public	X	1	8.6	100	20.0











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