



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

## **Chapter 8** \_Technical Investigation

## 8.1 Introduction

The issues of accommodating programme integration and public participation are at the core of the design process. These particular issues become progressively more complicated as building functions vary, as there are varying appropriate solutions to the contrasting building uses. As stated in the problem statements the proposal is to act as physical manifestation of reintegration, as apposed to the current alienated appearance of the University as institution.

## 8.2 Design Summary

The project is a multi functional building located on the University Main Campus, with its core activity being a School of Hospitality Management. The building consists of three wings, namely the Hotel to the north, the School to the south, with the binding wing being the administrative and conference facilities to the east.

The generator for the project is one of context, where the design intent is a process of overlapping the various contextual layers such as structure, spatial perception, function and access. The objective at completion is to produce a considerate and site specific project which offers flexibility through structure to its users whilst not compromising the integrity of Campus security.

The site is an underutilized land parcel as a result of its present use, which is used as student parking, however as stated in the contextual analysis there are provisional plans to accommodate the student parking at the corner of Herold and Lynwood Streets.

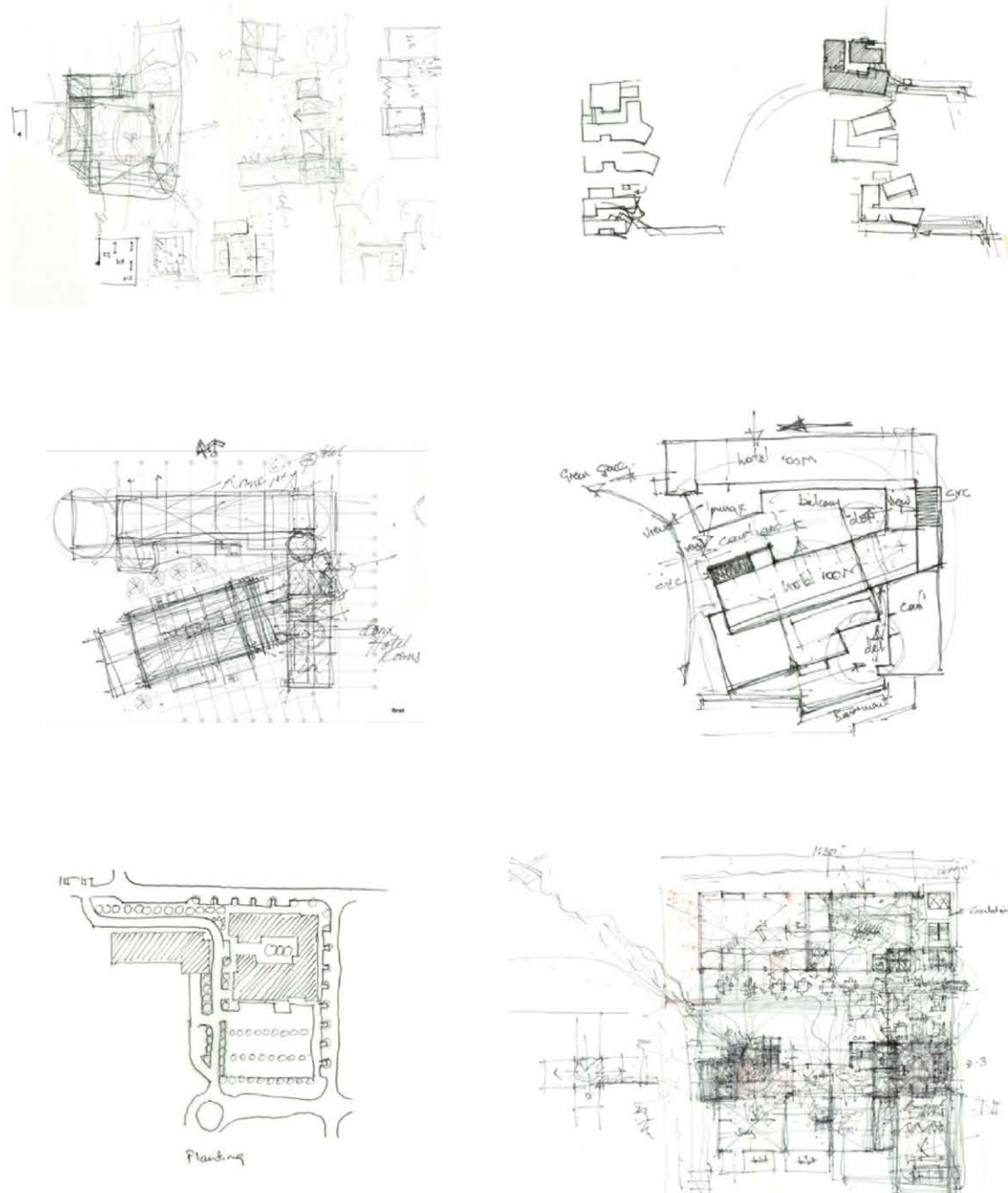


Fig. 8.1: Design Development

### 8.3 Structure

A concrete structure is selected due to economic factors, as well as being representative of the University and surrounding architecture. The material properties of concrete are further exploited through the versatility and plasticity of the medium. The concrete together with brick infill increases the building mass which has a positive effect in terms of robust design and passive climate systems as it reduces the amplitude of the heat gain cycle.

Concrete columns are used extensively throughout the building, with 110mm diameter rainwater down pipes cast into the bulk of those columns placed at the outermost fringe of the building. The grid spacing is 5.5m x 7.5m, which was decided upon as a result of the basement parking layout.

Through consultation with an engineer, it was decided to use 255mm deep reinforced concrete slabs with the exception being the balconies which would be stepped down to a depth of 170mm. All of the slabs will be cast in situ with reinforcement acting in two or more directions. The relatively short spanning distances allow more flexibility in terms of spatial configuration and future adaptability as well as eliminating the need for concrete beams.

An exposed structural steel frame is used at the main entrance of the School as well as the Hotel, with large glazed surfaces resulting in a more lightweight appearance to a building that has a predominantly bulky mass.

The vertical enclosure consists of glazing, face brick or concrete infill; however the design intention was to allow for passive surveillance and active interaction, which requires that the users and public alike could be participants of visual contact through the intervention. It is for this reason that the majority of non permeable vertical enclosure occurs on the more private elevations such as the western and southern facades, whereas the northern elevations have enclosures which are set back in order to allow an intermediate zone where the user experiences the manipulation of interior and exterior space.



Fig. 8.2: Spatial and structural composition

## 8.4 Materials

The materials used in the construction of the building occur frequently within the context of the Pretoria vernacular. All of the chosen materials and labour will be sourced locally.

### Reinforced concrete

The versatile nature of concrete makes it easy to mould and form. It is a stout and conventional building material in South Africa for which skilled workers are readily available. The medium offers considerable mass to a building which can be useful when generating a design that utilizes the passive climate systems, as it greatly reduces the amplitude of the heat gain cycle.

The structure is reinforced concrete, it is therefore essential that the exposed material be finished and shuttered at a high degree of quality. A variety of finishes are used throughout the building therefore reusable shuttering is to be thoroughly cleaned before reuse. Shuttering panels are to be steel plate or wood where complex forms are used, such as the auditorium and overhangs.

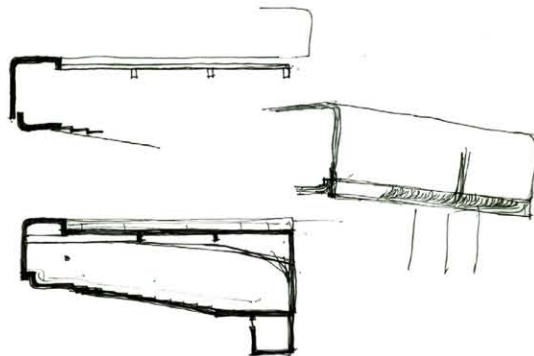


Fig. 8.3: Exploration of Auditorium form

### Brick

The extensive use of red brick places the building firmly in its context, since these bricks are a commonplace within Pretoria, particularly with regards to the older buildings situated on Campus and surrounds. Although the face bricks are more costly than stock bricks the benefits outweigh the higher price in terms of lower maintenance, increased load bearing capacity, higher durability, thermal mass and its resistance to fire.

### Glazing

Glass is used extensively to allow natural light into the building, exhibit its interior to the outside and to project through and onto the facades. The concept of merging public and private spaces provided the opportunity of using glazing to visually connect and optimise interaction between public and private domains.

Laminated glass is used throughout the building because of the inherent qualities of the medium. These include its strength and acoustic insulation properties which are used on the east and west facades as well as the thermal barriers which are used on the northern façade.

The concept of enabling interaction between building user and urban dweller is a primary design objective; this is achieved through the extensive use of floor to ceiling glazing, which allows ample natural light into the building.

The transparent nature of the material enables the ability to create layers within the city fabric, to exhibit the building interior, particularly the kitchens to the public and effectively merge the public and private spaces. Central to the concept of the design is the celebration of the kitchen. The use of glass on street level allows for full visual access through the building from the street into the School Skills Kitchen, whilst restricting physical access.



Fig. 8.4: Steel component and glazing at Hotel entrance

### Timber

Aesthetically the material provides psychological warmth to the intervention however; due to the relatively high maintenance, regardless of treatment the use of wood is limited in the project. Treated Meranti hardwood has been used in the

construction of the horizontal external louvers within the courtyard since it is an abundant renewable resource and it offers a natural aesthetic to the users of the courtyard space. All wood that is exposed will be finished with 500 grit sand paper, stained and alkyd varnish applied in order to accentuate its natural grain.

### Steel

The tensile and compressive properties of steel are essential in the building. Steel sections are used as structural members with exposed steel components being treated to prevent rust stain from occurring on the walls. All steel sections are to be painted. Most steel elements used are pre fabricated, therefore they must be pre painted with anti corrosive primer. After onsite assembly it is to be painted with enamel finishing.

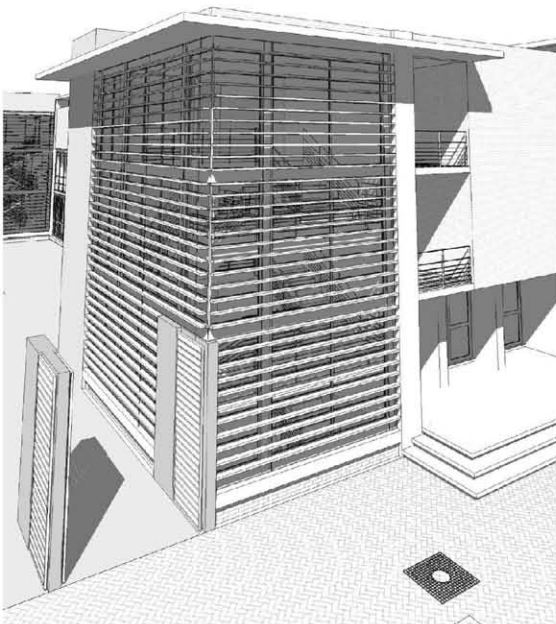
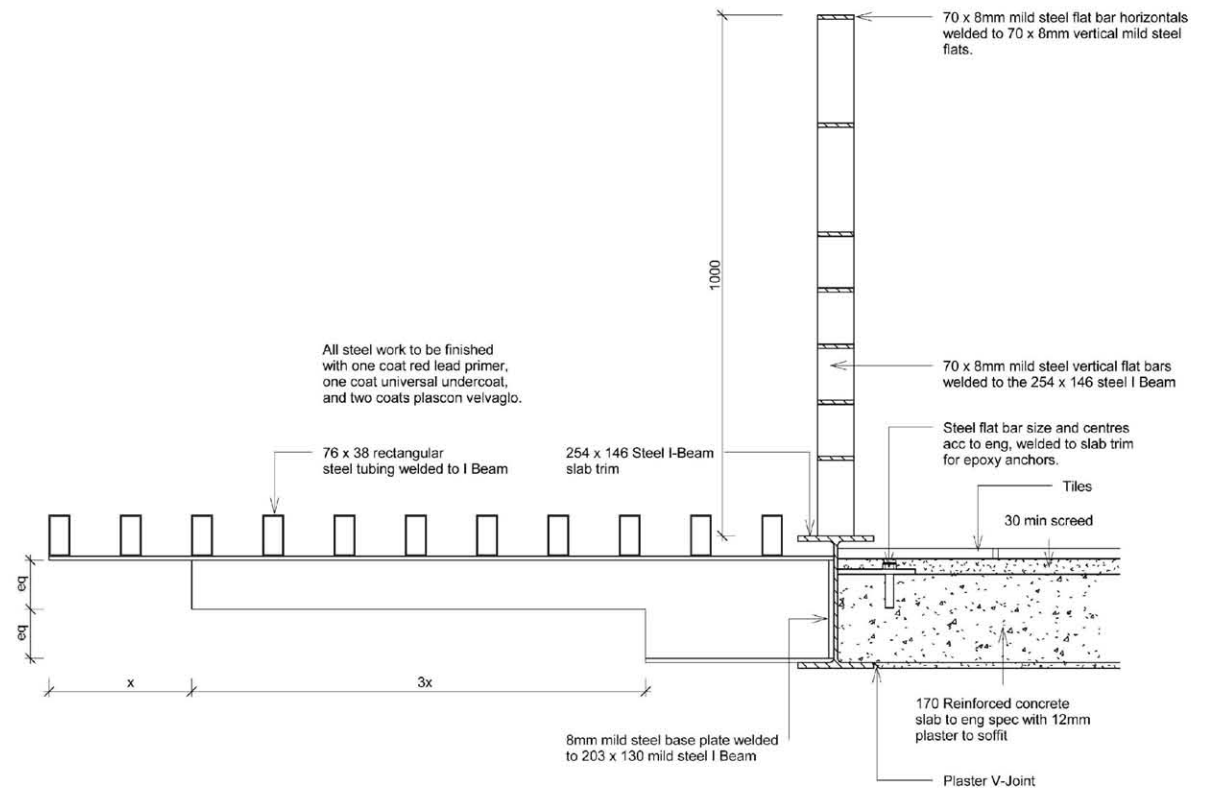


Fig. 8.5: Use of timber to soften building edge and provide shading



HORIZONTAL STEEL LOUVRE AND BALLUSTRADE DETAIL 1:10

Fig. 8.6: Steel component detail

## 8.5 Passive climate control

Pretoria has a moderate climate, it therefore offers a reasonable level of comfort to the user during the summer months, however during the winter additional heating is often required.

The passive systems used are designed to reduce heat gain of the building in summer and expose the building to sunshine during the winter in order to store heat in mass. It is therefore important to have a well insulated building in order to achieve the desired results, which would lighten the loads placed on the mechanical air conditioning systems. The placement of the double volume gallery adjacent to the Skills Kitchen will stimulate airflow by creating an air pressure differential which would reduce the load placed on mechanical ventilation.

## 8.6 Passive systems

### Orientation

Due to the design intentions the building is predominantly orientated west-east. This allows for maximum northern exposure.

- The deep overhangs on the north shield the building from direct heat gain whilst allowing for natural lighting.
- The higher thermal mass to the west for heat storage and slow release.

Of particular importance to the design are the factors of maintaining the views, allowing natural light to filter into the building as well as allowing for the necessary cross ventilation required.

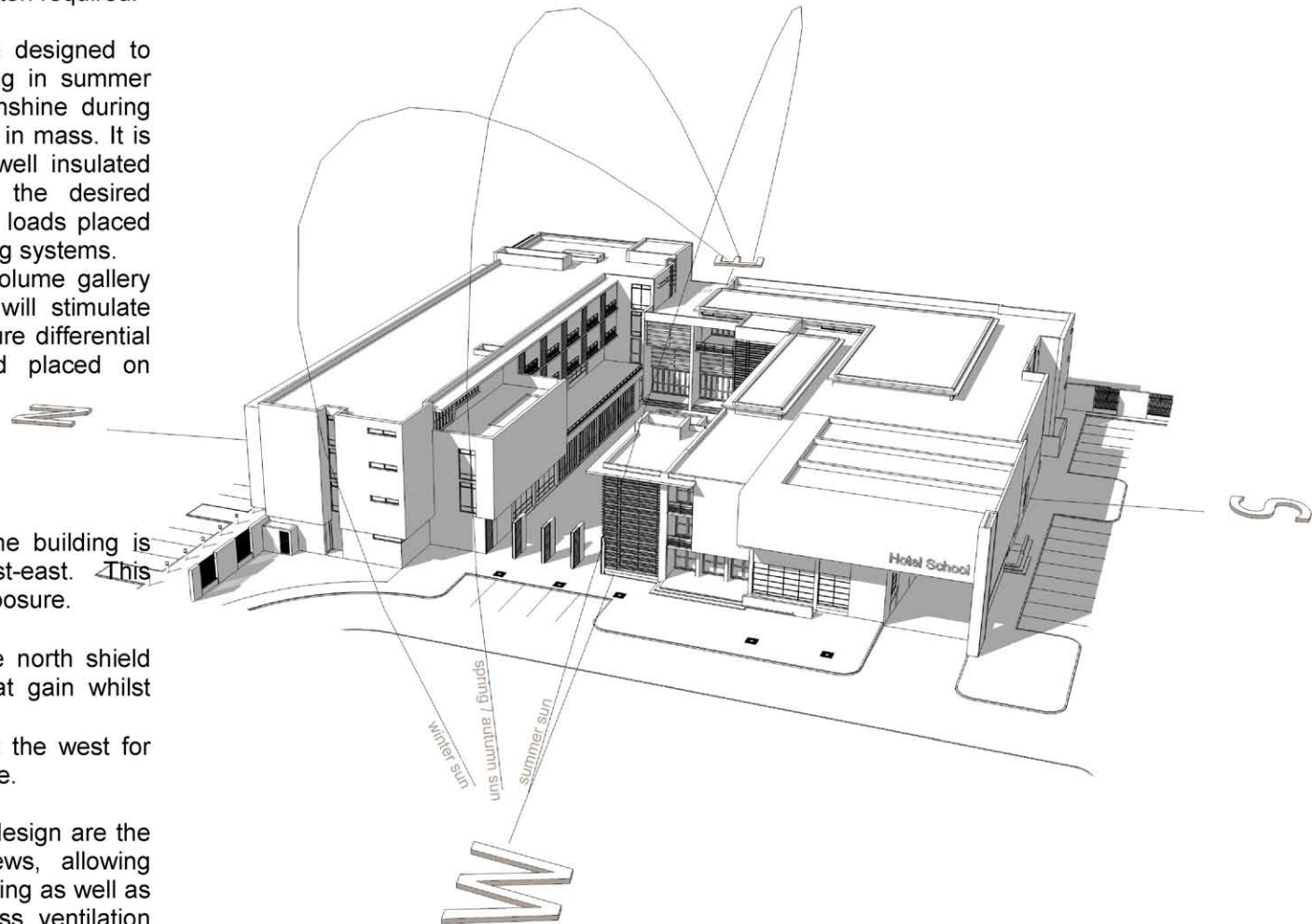


Fig. 8.7: Seasonal sun paths

## Passive heating

Passive heating is a system that collects solar heat, without the use of external mechanical power to distribute it. Solar collection may be either direct (solar radiation entering directly into a space) or indirect (solar radiation heats an area which then continues to heat the area when the solar exposure has passed).

Due to the building programme, users will be present at varying times throughout the day. Students will occupy the school during the day only, whereas the hotel guest will be present during the evening. Thus both systems are appropriate, however the approach to the system will vary.

The overhangs are designed to allow winter sun to enter directly into the building, while keeping summer sun out. This causes the interior of the building to be heated in winter by the sun's energy, while remaining cool during the summer.

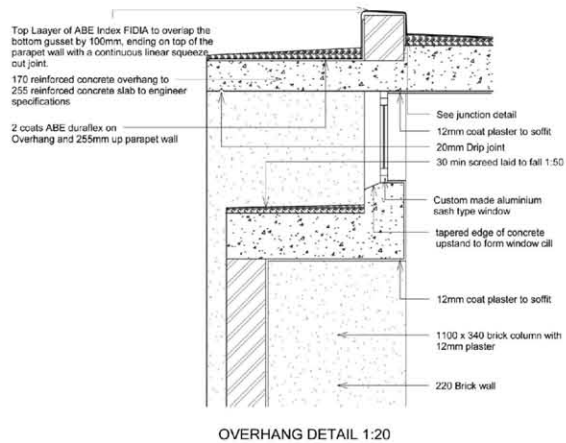
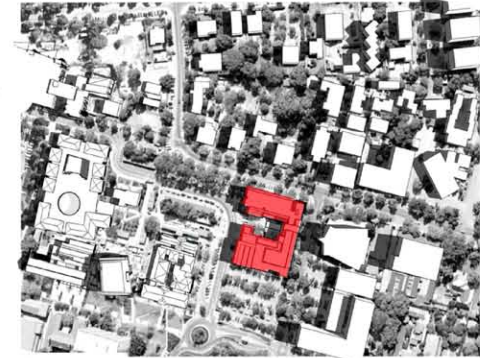


Fig. 8.8: Detail of clerestory box window



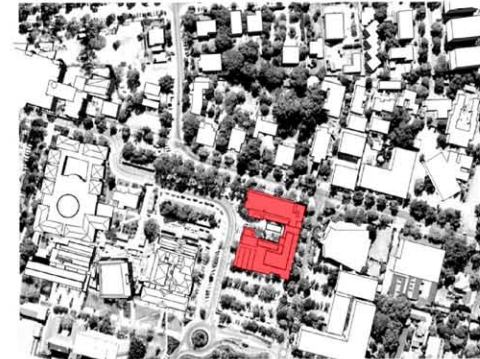
Winter 08:00



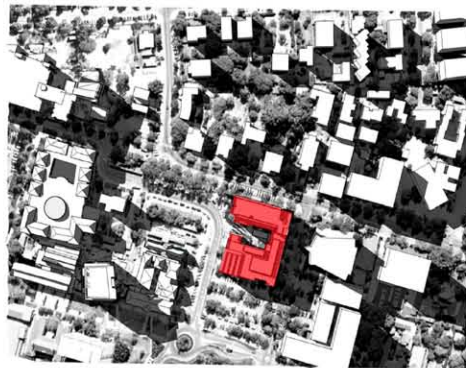
Summer 08:00



Winter 12:00



Summer 12:00



Winter 16:00

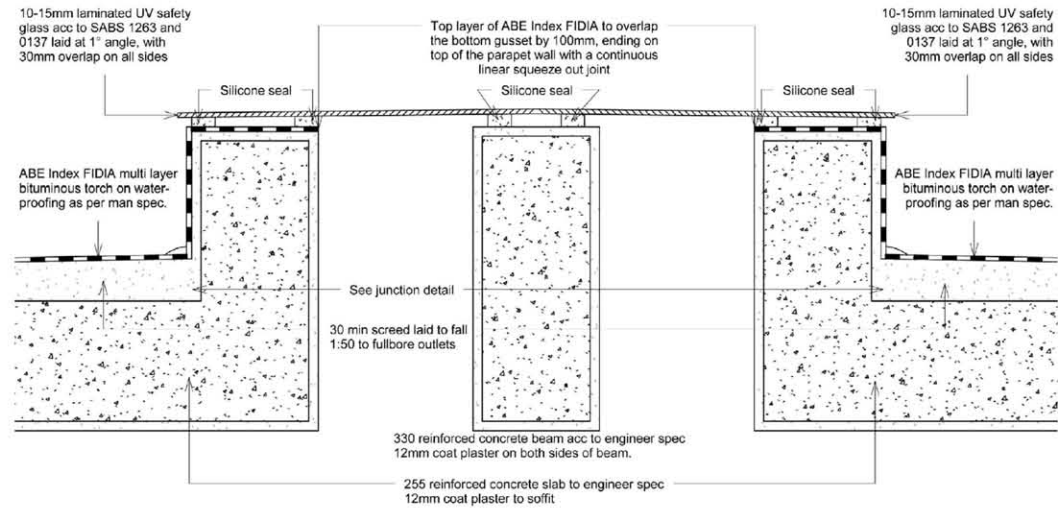


Summer 16:00

Fig. 8.9: Shadow study

## 8.7 Lighting

The strategy for lighting the building interior is predominantly by daylight which would be supplemented by artificial lighting when necessary. The courtyard layout offers good natural lighting, however direct natural lighting is not desired for the school as it creates glare, it is therefore necessary to maximise diffused light entry. Where the building depth becomes too deep such as the larger class rooms on the first and second floors natural lighting is supplemented by clerestory windows. The eastern, western and northern windows are controlled for reasonable day lighting solutions whilst the and south facing windows provide a uniform light source.



SKY LIGHT DETAIL 1:10

Fig. 8.10: Sky light detail

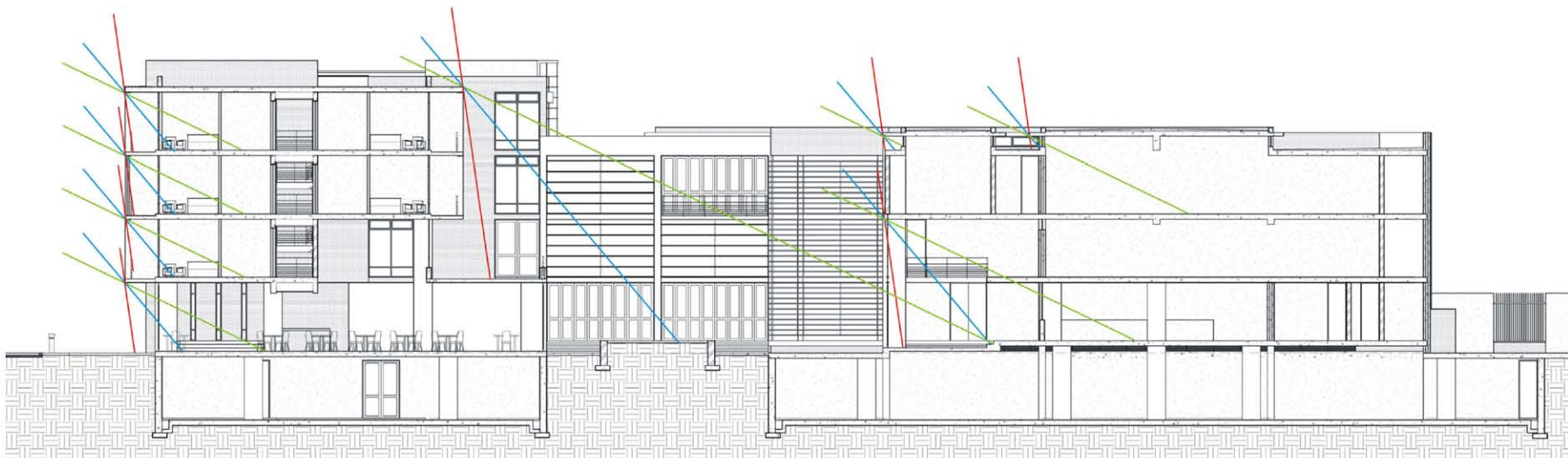


Fig. 8.11: Vertical sun angle penetration



## 8.8 Air-conditioning systems

Multi system mid wall type air conditioning units will be used throughout the majority of the building with the compressor unit installed on the roof. The system reduces unnecessary energy consumption by allowing user control over individual rooms or suites. The auditorium will use a similar higher capacity system, with the compressor unit located in the basement.

## 8.9 Water catchment and re-use

Rainwater harvesting will be feasible, due to the large roof area of the development, however the water harvested will not be used for human consumption.

Average monthly Rainfall :  
36mm

Total roof area:  
2666 m<sup>2</sup>

Total harvested rainwater:  
95m<sup>3</sup>/ month = 95 kilolitres

Cost of R3 / KL of water / annum :  
R3420 / Annum

Water use in toilets:

20 x flush / toilet / day at 8 litres / flush

The water used for flushing 30 latrines of the School Faculty alone amounts to 4800 litres / day.

Total harvested = 95000 Litres / month

Total required = 144000 Litres / month

Therefore 20 days worth of flushing requirements will be catered for by the capacity of the rainwater harvesting system.

## Storage

10 x 9000 litre water storage tanks are required in basement level. In the event of inadequate rainwater storage, the municipal water supply would supplement the flushing requirements by means of a switch valve. All water tanks to be equipped with overflow valves that direct excess water to municipal connections.

## 8.10 Landscaping

Although the site is currently in a state of neglect it is softened by the existing established trees. The indigenous trees that are disturbed during the construction phase will be transplanted to the interior periphery of the site in order to soften the Ring Road edge as well as offer natural shading during the summer months. Although the *Pinus patula* (Pine trees) trees on Duxbury Street sidewalk are exotic, their size and historical significance contributes to the pedestrian sense of experience.

The courtyard area acts as visual and physical link between the building wings, it is therefore necessary to use sculptural trees which would act as central focus as well as influence the micro climate of the yard. The *Combretum erythrophyllum* trees will counteract heat radiated from hard landscaped surfaces by means of transpiration.

## Surfaces

Public areas around the building cater for a high degree of pedestrian usage, it is therefore crucial that durability and comfort be considered. The ground surface surrounding the building will be a combination of pre-cast concrete blocks of an exposed aggregate medium in colour as well as clay paving bricks.

Where a more intimate scale is required, the application of varying textures and the use of smaller units will further define the public spaces, such as the northern and eastern sidewalks.

## 8.11 Services

The integration of internal and external service shafts have been incorporated into the design.

- The plant room for the auditorium is located in the basement with a dedicated ventilation shaft.
- Separate data, Telkom and electrical services are located within the lift shaft.
- The hotel suites above are serviced by a dumb waiter situated between the bar and kitchen on ground floor.
- The Restaurant kitchen has a dedicated ventilation and extraction shaft.
- The Restaurant receives stock using a hydraulic service elevator from the basement below where receiving, storage and staff ablution facilities are located.
- The skills kitchens for the Hotel school receive goods from the south of the site via the receiving area which is accessed from Ring road, as this allows for more efficient utilisation of space in the public areas without interference of back of house activities.

## 8.12 Fire strategy

### Escape routes

According to SABS 0040 section TT16, emergency escape routes are not required where the travel distance measured to the nearest escape door is not more than 45m provided such building is not more than two storeys high.