

# Technical Development

In reaction to the urban decay prevalent in the city, the technical development aims to remodel the Extramural Building in an attempt to retain its inherent value. Technical issues are explored as tools to regenerate and unlock the latent potential and further develop the design of the building. The development will focus on the resource centre while incorporating the existing building into a holistic strategy for its redevelopment. The technical issues explored include the application of the theoretical framework, the structural composition of the building, its materiality, and the building climate it produces.

The technical development of the project builds on the theoretical framework that investigates the combination of the theories of adaptation and heritage practice, examining the needs of each portion of the existing building through the lens of Brand's concept of shearing layers of change and Robert's seven principles. The technical strategy culminates in a series of diagrams that explain the level of change to and engagement with the various layers of each portion of the existing building (Figure 89). These conservation practice diagrams enable an immediate understanding of the physical actions that need to be taken to regenerate the existing building. The redevelopment strategy is expanded by introducing a new building, the Resource Centre, within the theoretical practice of 'the building around'. The palimpsestic approach views the building as an existing structural language. The base of the Resource Centre is viewed as a reinterpretation of the existing language, and the top portion of the building is viewed as a new language (Figure 90).

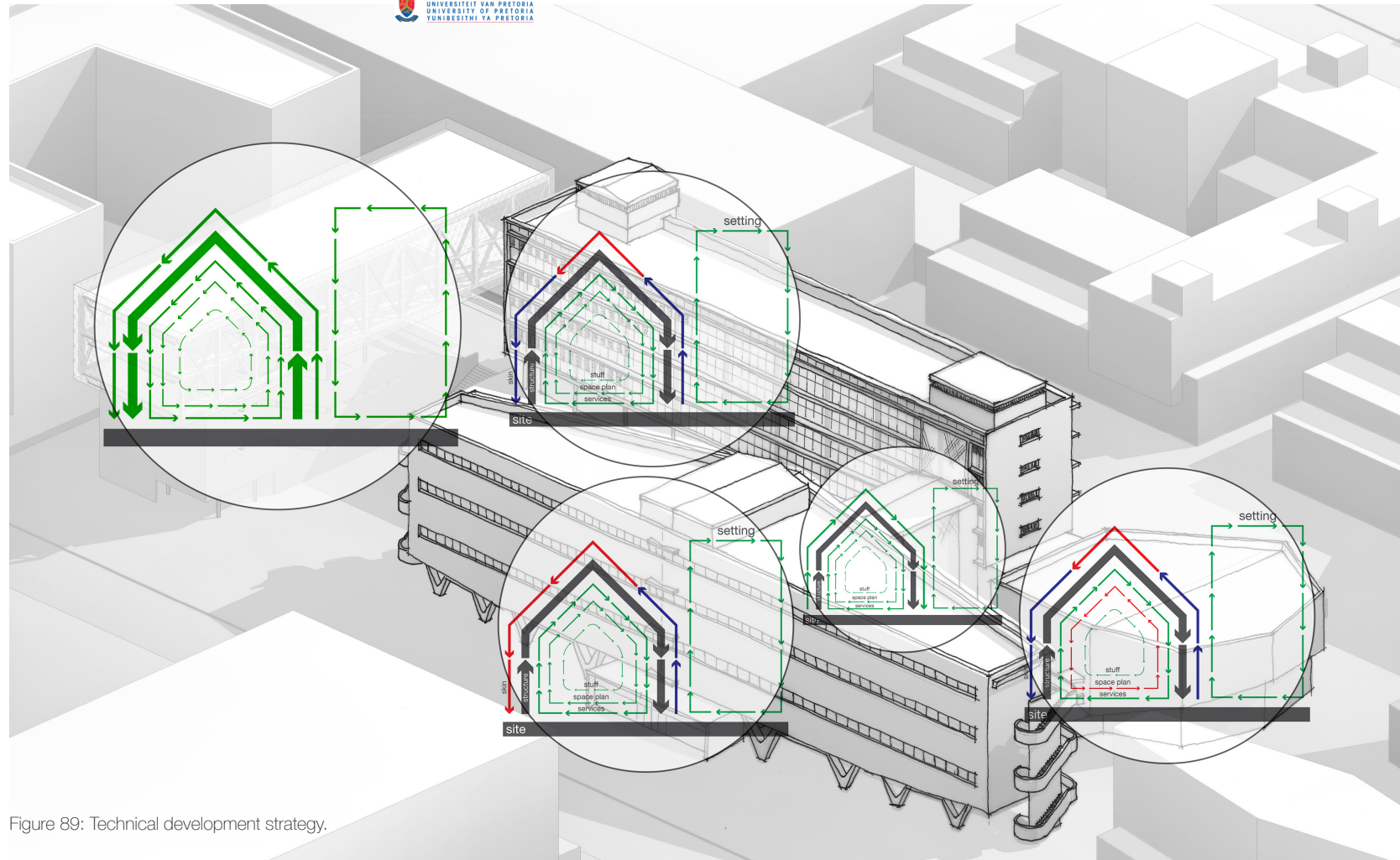


Figure 89: Technical development strategy.

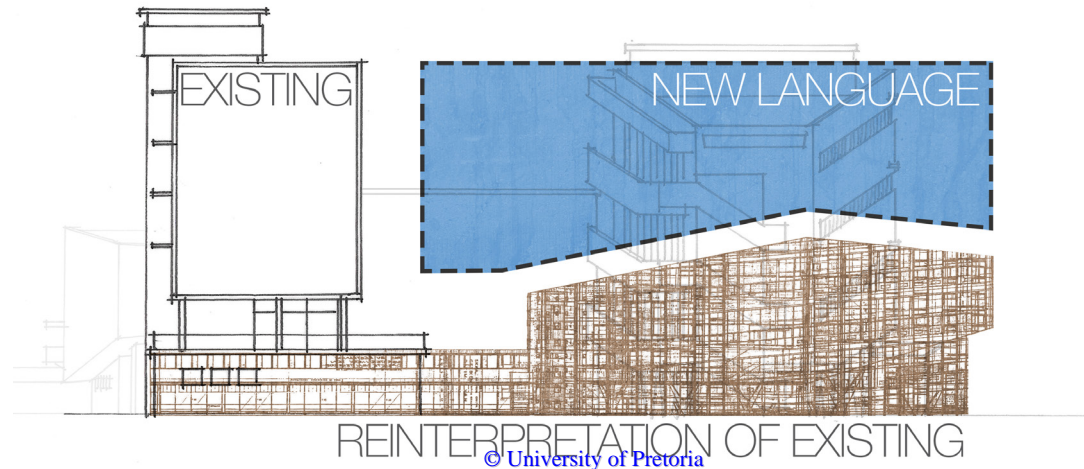


Figure 90: Technical concept.

## Structural Systems

The structure of the building is made up of three parts: a structural core, a cantilevered frame and a skin. The primary structure consists of concrete columns, beams and floor slabs that form the structural core of the building. The core functions as a weighted base to allow the secondary structure to achieve a large cantilever over the public lecture hall. The secondary structure consists of two steel beams, connected to one another to form a portal frame that attaches to the structural core. A concrete floor and roof are cast on permanent shuttering that rests on a series of lattice joists. The framework is covered with a double-skin system – an internal skin of glazing, and an exterior skin that modulates the amount of natural light that is allowed into the spaces (Figure 92).

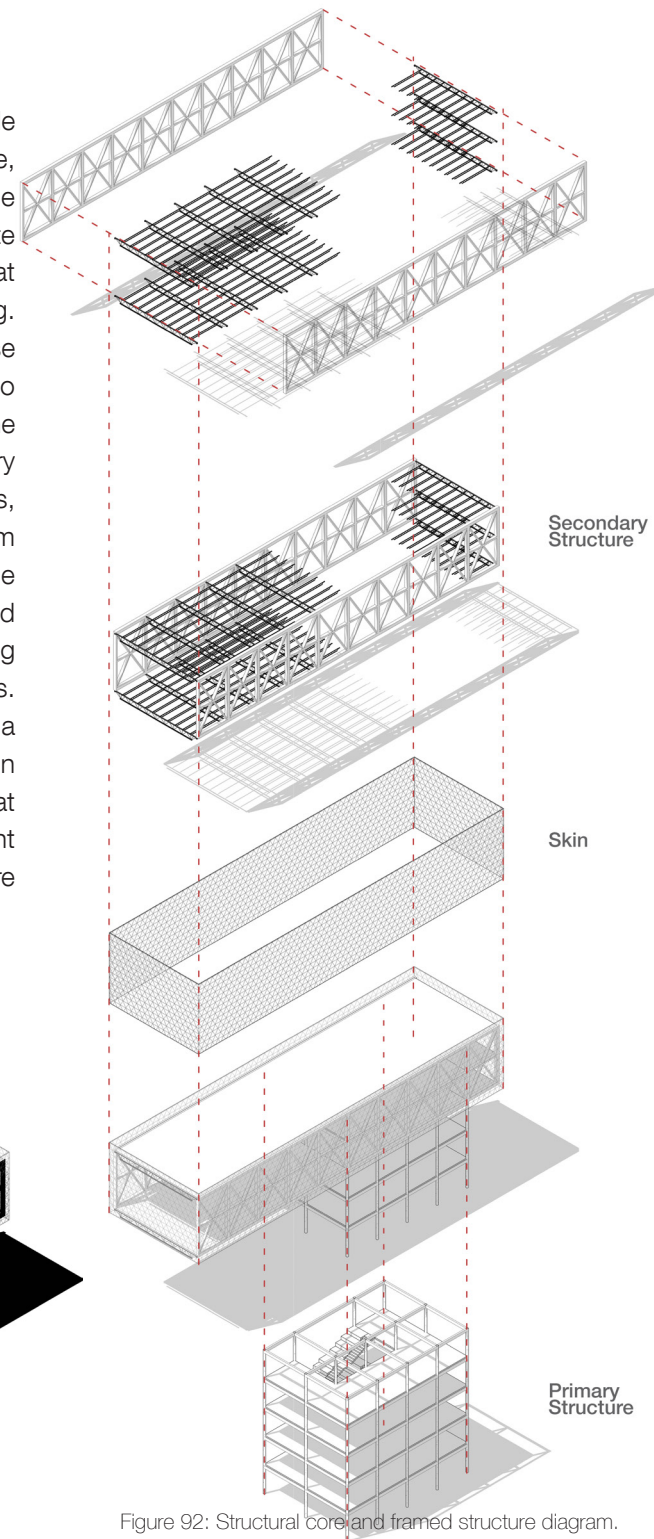
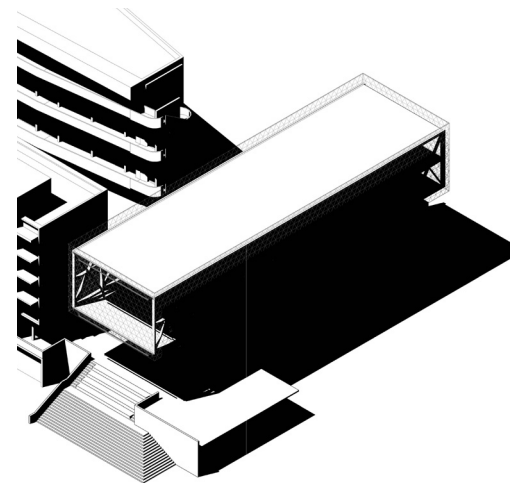
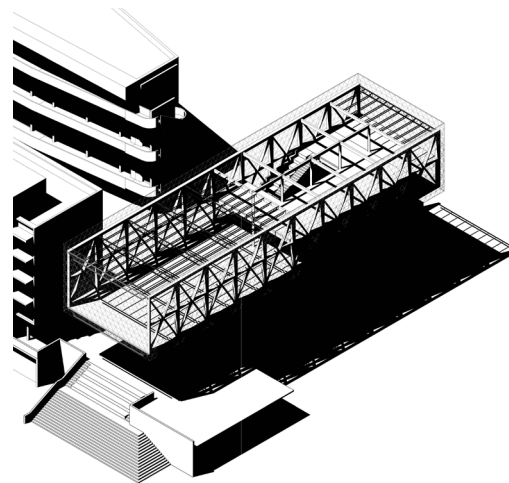
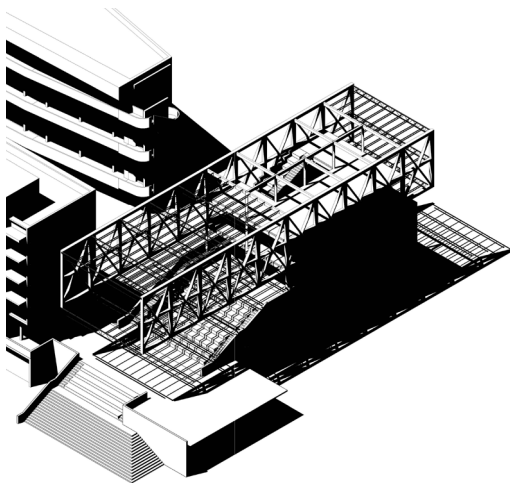
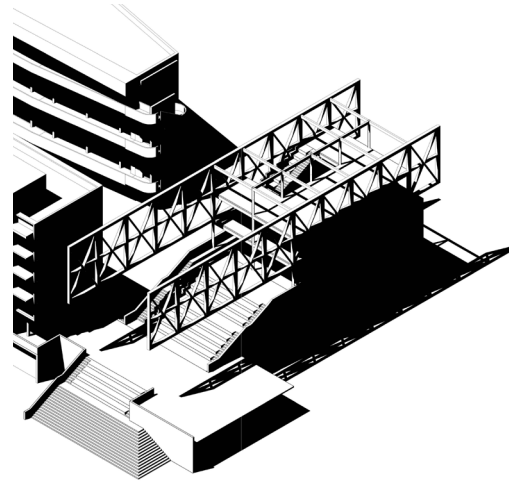
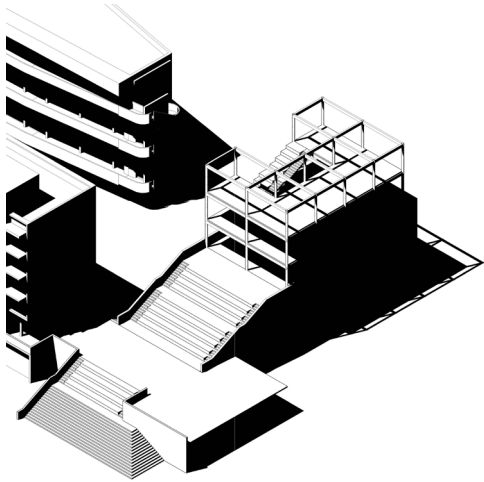
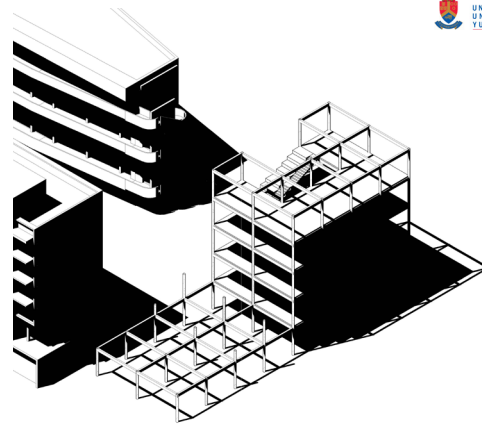
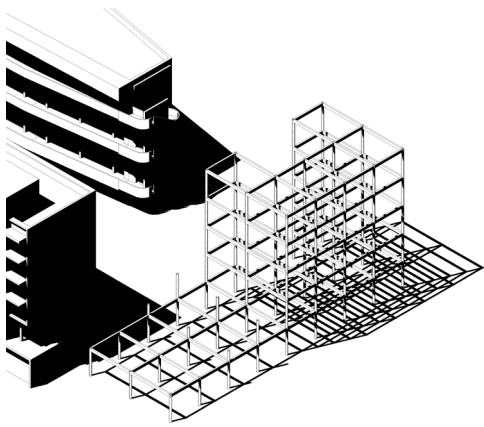


Figure 91: Unpacking the structure

Figure 92: Structural core and framed structure diagram.

# First building iteration.

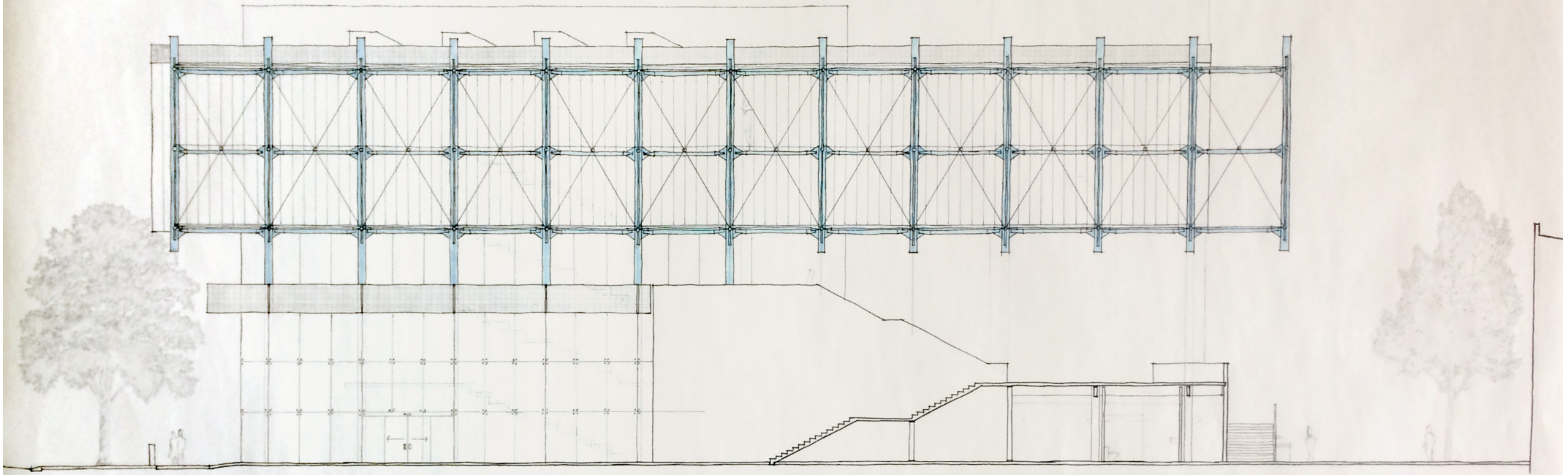


Figure 93: East elevation expressing an exposed structural frame.

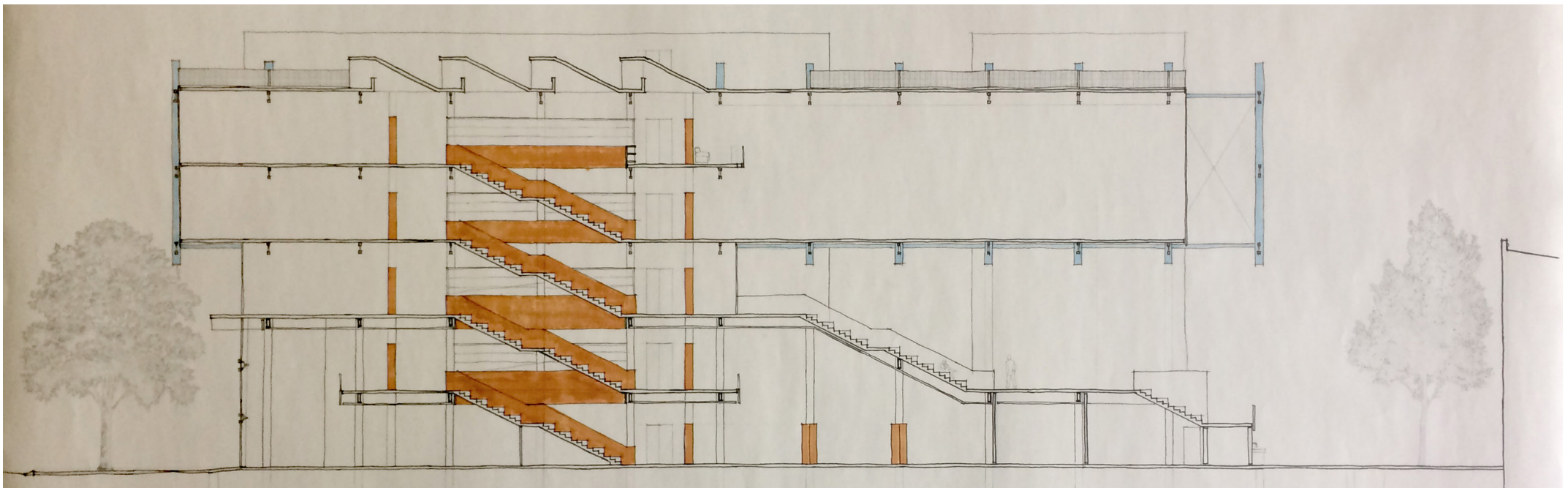


Figure 94: Long section through public lecture hall and vertical circulation.

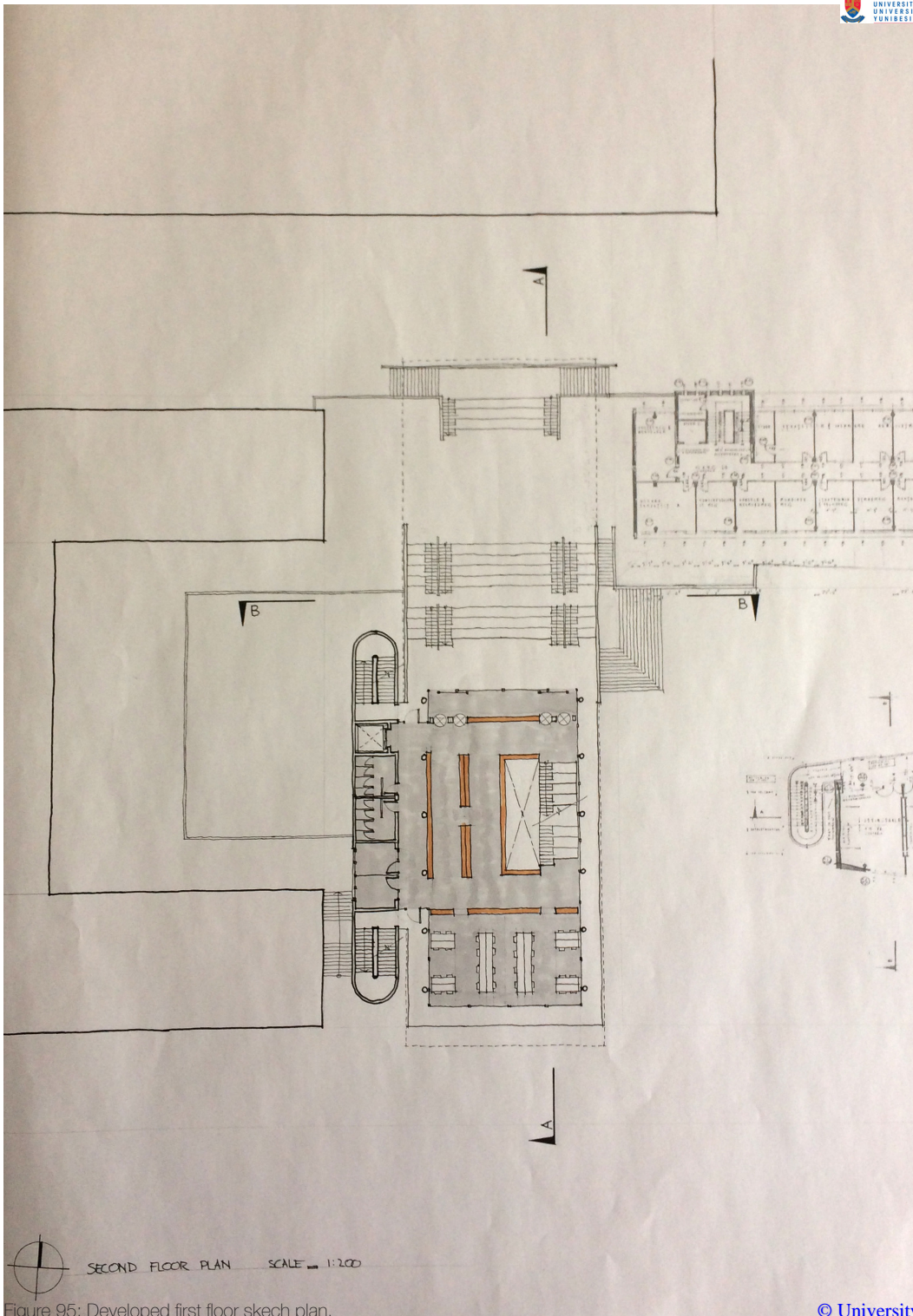


Figure 95: Developed first floor sketch plan.

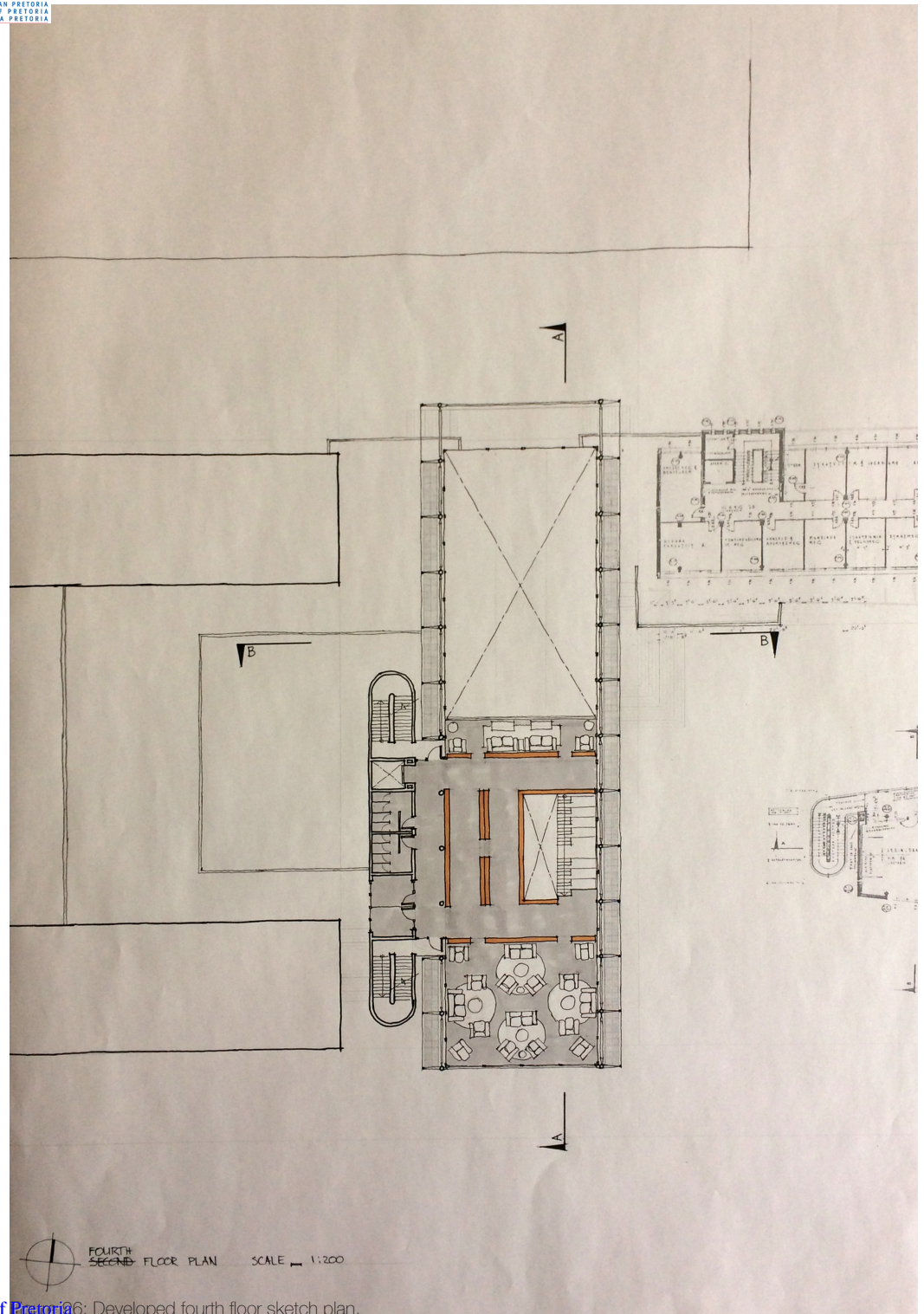


Figure 96: Developed fourth floor sketch plan.



## Materiality

The building displays an existing palette of materials. A fair amount of reconstruction has to take place as a result of the condition of the building, which would introduce new materials without changing the palette. The facades of the existing building are treated in a variety of ways. These include exposed face brick, plastered, tiled, fully glazed and clad with steel panels.

For the Resource Centre the existing material palette is used for the base and some new materials are introduced (Figure 97).

Figure 97: Existing building material palette.

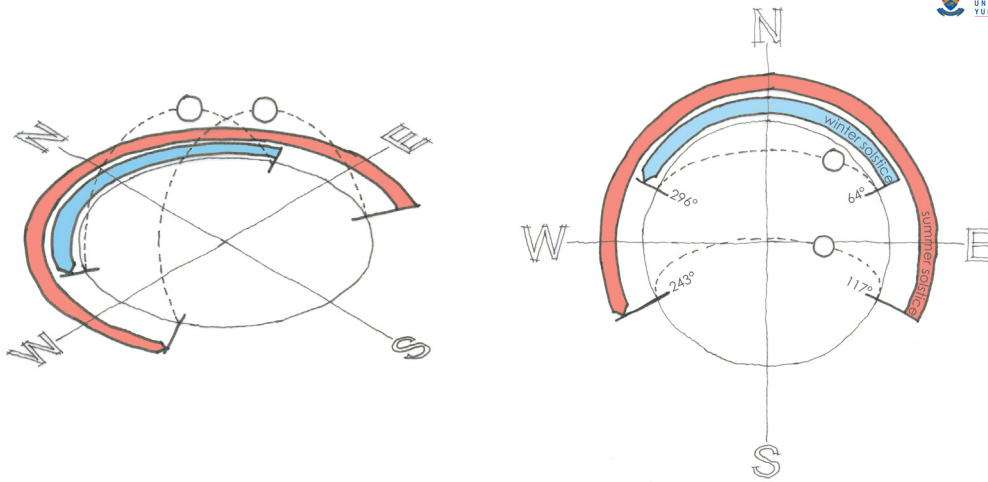


Figure 98: Solar movement.

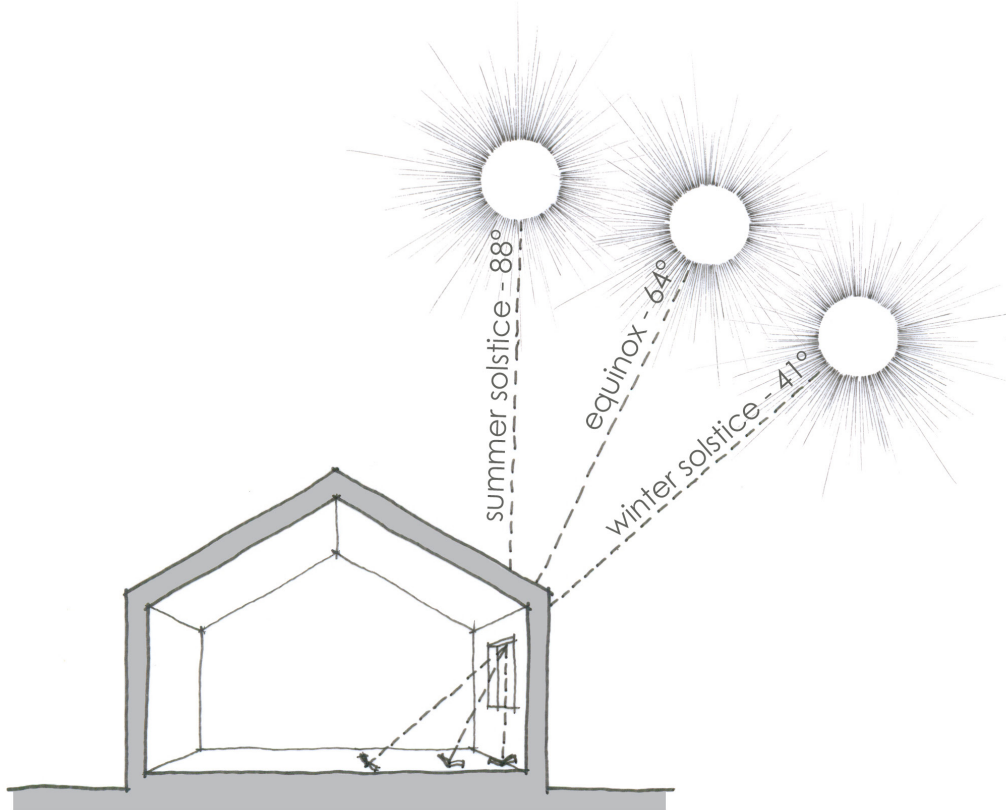


Figure 99: Solar angle at solstice and equinox.

The bioclimatic chart is often used as a guide to achieve and describe thermal comfort within a building. This chart augments the psychrometric chart to indicate the different climatic zones. It expresses what is considered to be a comfort zone and various strategies to achieve thermal comfort. The comfort zone is expressed as between 20 and 27 °C and between 20 and 80% relative humidity (Joubert, 2010: 56).

In order to maintain thermal comfort, the technical development focuses on the use of passive thermal comfort strategies that are appropriate for Pretoria. The appropriate strategies are: sun shading for windows, fan-forced ventilation, internal heat gain, direct passive solar gain, low/high mass, and heating. These strategies form a complete system in which all of the strategies are effective at different times of the day and year, working together to maintain thermal comfort throughout the year (Conradie, 2012: 105).

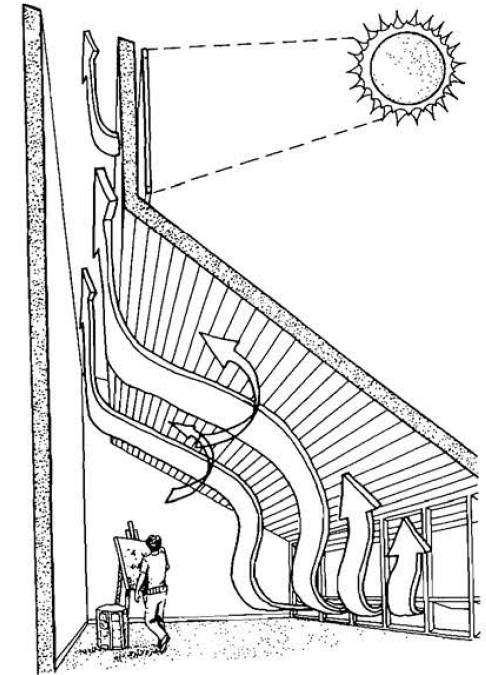


Figure 101: Solar chimney. (Bradshaw, V. 2006:224)

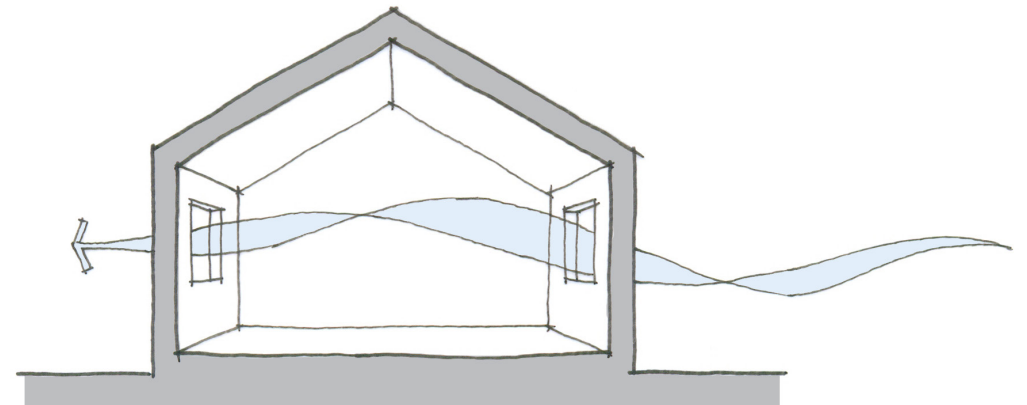


Figure 100: Cross ventilation.

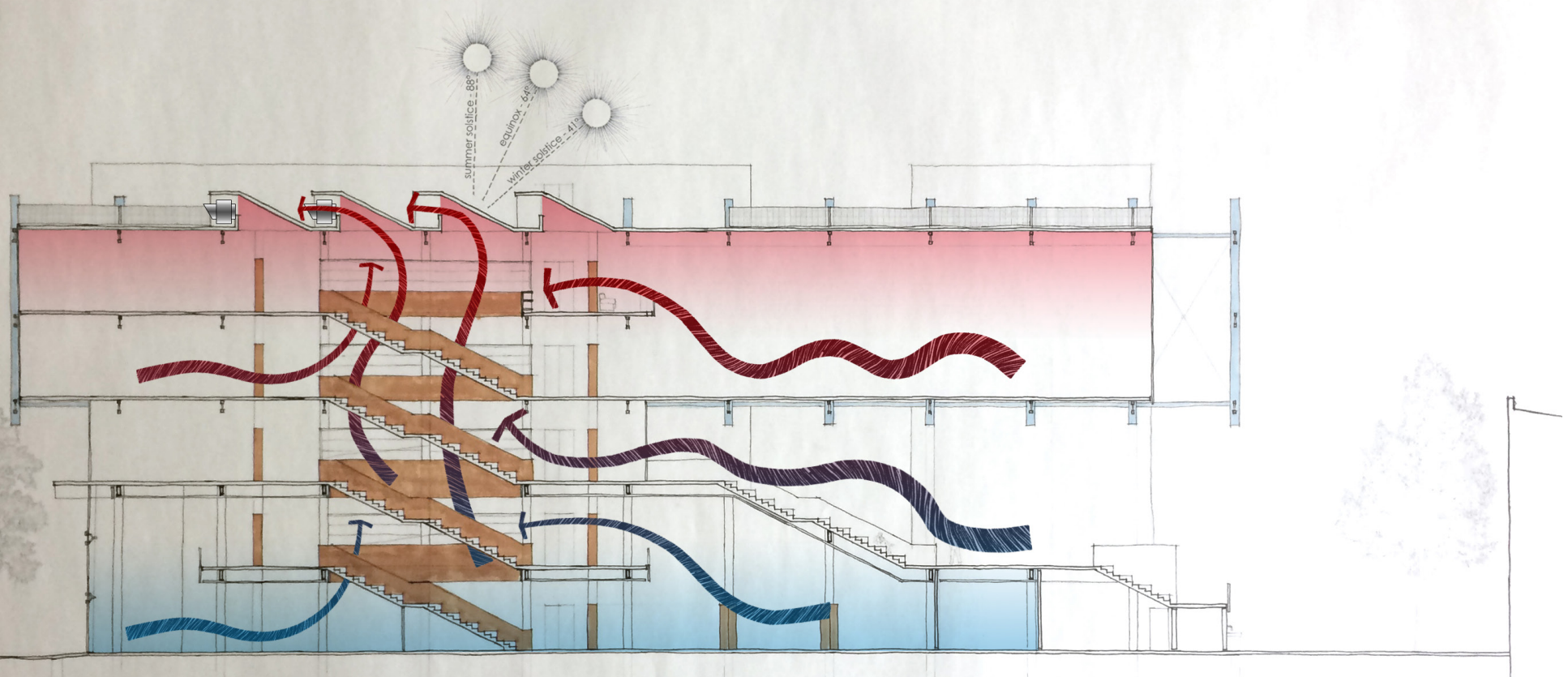


Figure 102: Hybrid ventilation strategy.

Cross ventilation is only effective if a space is no deeper than five times its height (Joubert, 2010: 74). This form of ventilation is not very effective in Pretoria and strategies to aid ventilation should be introduced. A hybrid system of fan-forced ventilation combined with a solar chimney will address the ventilation of the building.

The movement of the earth around the sun results in a variety of complex sun angles. These are explored in diagrammatic form to aid in the design of shading devices (Figure 102). The skin of the building acts as the primary solar shading device.



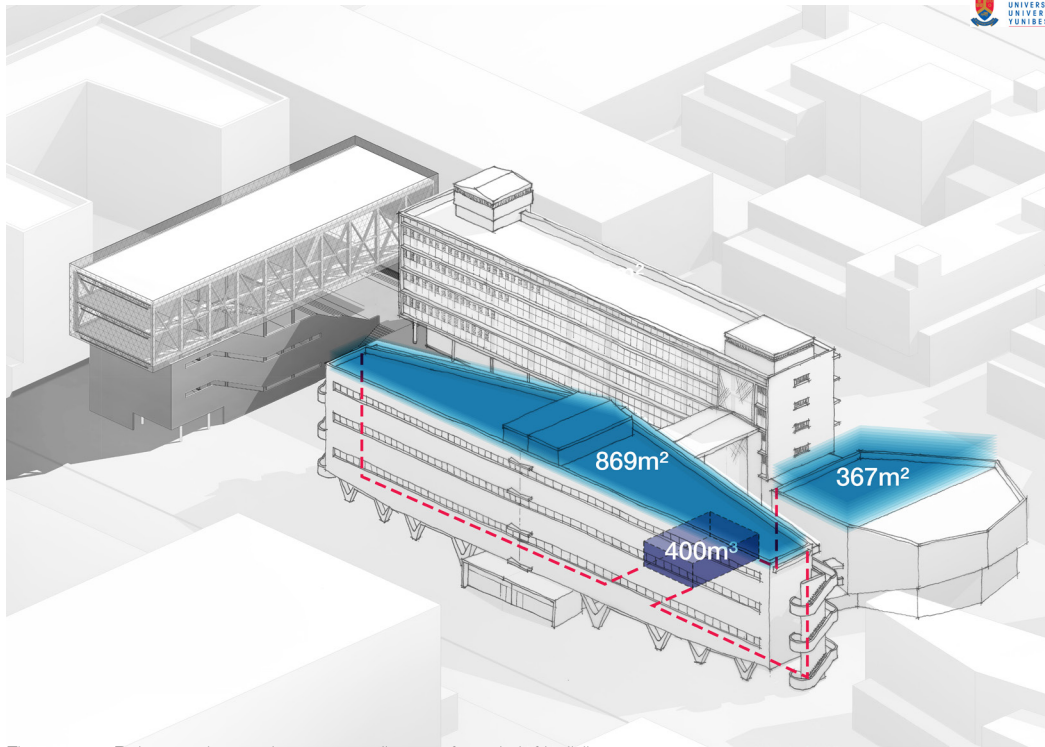


Figure 103: Rainwater harvesting system diagram for existing building.

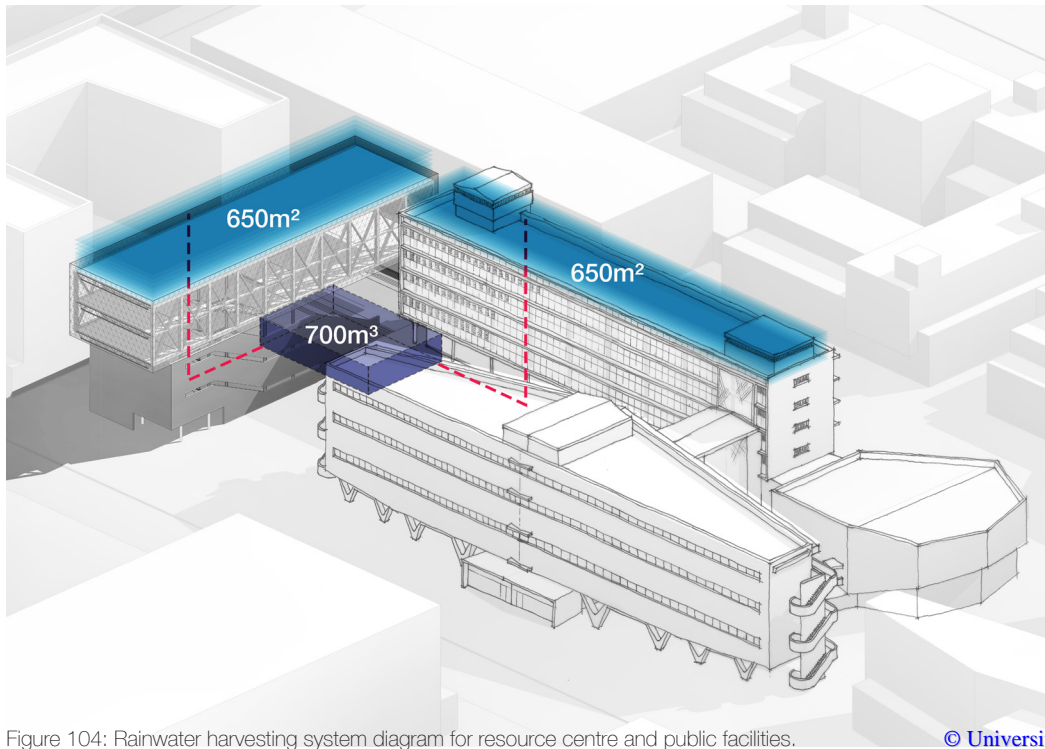


Figure 104: Rainwater harvesting system diagram for resource centre and public facilities.

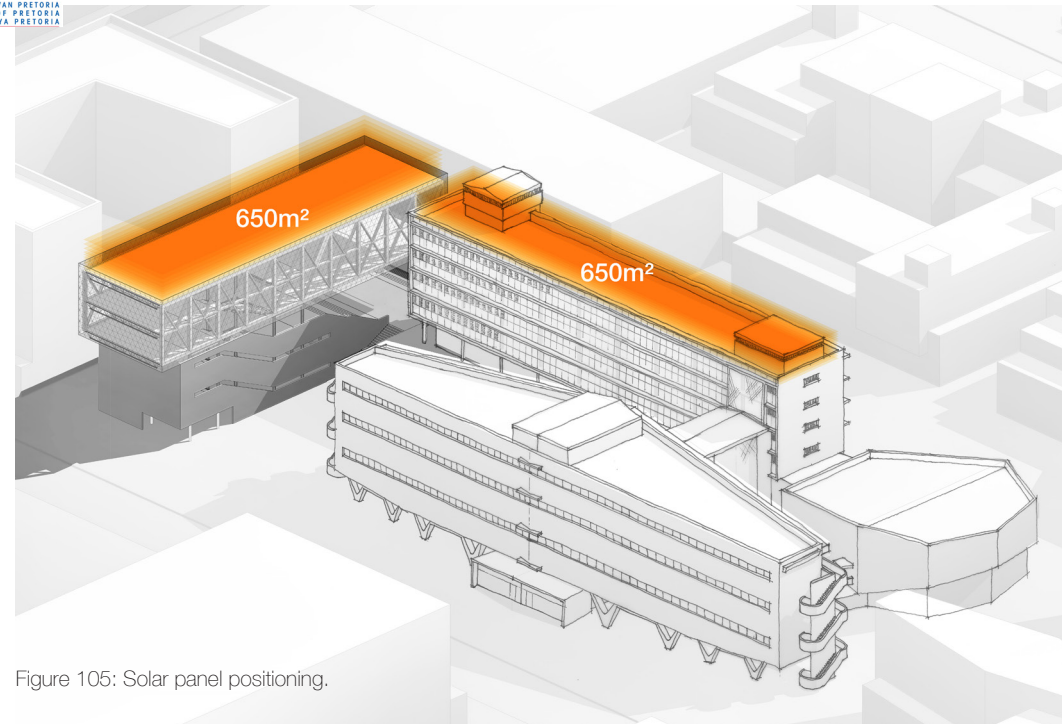


Figure 105: Solar panel positioning.

## Rainwater harvesting

A rainwater harvesting strategy is developed to supply the site with enough water to satisfy the demands of staff, students and public. This strategy is separated into two systems, one that services the ablution facilities of the B-block (Figure 103), and a separate system that services the Resource Centre and public restrooms (Figure 104).

Water management calculations were done for each system. These calculations were based on the average annual rainfall of Pretoria, the available catchment area, and the design populations of the buildings. The system on the existing building can accommodate the needs of 80 staff members and 100 students (Figure 103), while the other can cater for 42 staff members and 600 pedestrians (Figure 104).

## Solar installation

The roof space available for a photovoltaic system has an area of 1190m<sup>2</sup> (Figure 105). With a panel size of 1.94m<sup>2</sup> (992x1956mm) a maximum of 600 72-cell modules can be installed. Each panel can produce 300-320 Wp for a total of 180 000 Wp to provide the entire 8210m<sup>2</sup> campus with 21Wp/m<sup>2</sup> of electricity.

# SBAT rating

The Sustainable Building Analysis Tool was used to analyse the Resource Centre (Figure 106), and it revealed both positive and negative aspects of the building. The tool showed that the social integration of the building initiated by the urban framework has a positive effect on its overall rating.

The three performance sections are environmental, economic and social. The most notable areas that can improve the environmental score of the building include energy, water and waste. To increase the economic rating of the building, focus should be placed on management, the local economy, and the use of resources. The social cohesion and health aspects of the building can help to improve the overall social rating.

A second SBAT analysis was performed on the final iteration of the building and resulted in an improved overall score (Figure 107).

## SB SBAT REPORT

Achieved  
3.0

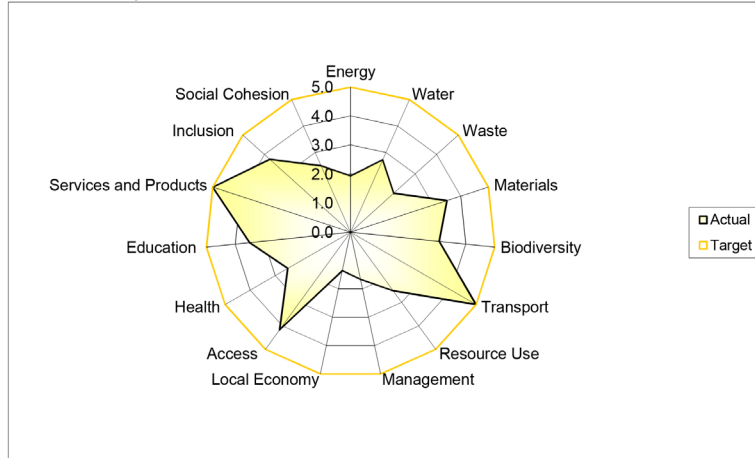
### SB1 Project

Justice College Resource Centre

### SB2 Address

332 Johannes Ramokhoase Street

### SB3 SBAT Graph



### SB4 Environmental, Social and Economic Performance

Category	Score
Environmental	2.6
Economic	2.9
Social	3.5
SBAT Rating	3.0

	Target	Achieved
BI Building Information	5.0	3.0

### BI 1 Building Targets

Code	Category	Target	Achieved
EN	Energy	5.0	1.9
WA	Water	5.0	2.7
WE	Waste	5.0	2.0
MA	Materials	5.0	3.5
BI	Biodiversity	5.0	3.1
TR	Transport	5.0	5.0
LE	Local Economy	5.0	2.5
MN	Management	5.0	1.7
RE	Resources	5.0	1.4
SP	Services and Products	5.0	4.2
AC	Access	5.0	2.5
HE	Health	5.0	3.5
ED	Education	5.0	5.0
IN	Inclusion	5.0	3.8
SC	Social Cohesion	5.0	2.5

### BI 2 Priority Key (Not Performance Key)

Code	Priority	Target	Achieved
VH	Very High	5.0	
HI	High	4.0	
ME	Medium	3.0	
LO	Low	2.0	
VL	Very Low	1.0	
NA	None / Not Applicable	0.0	

### BI 3 Project Name

Justice College Resource Centre

### BI 4 Address

332 Johannes Ramokhoase Street

BI 5 Site Area	8697 m <sup>2</sup>
BI 6 Gross Floor Area (GFA)	3662 m <sup>2</sup>
BI 7 Gross Internal Area (GIA)	9210 m <sup>2</sup>

## SB SBAT REPORT

Achieved  
3.6

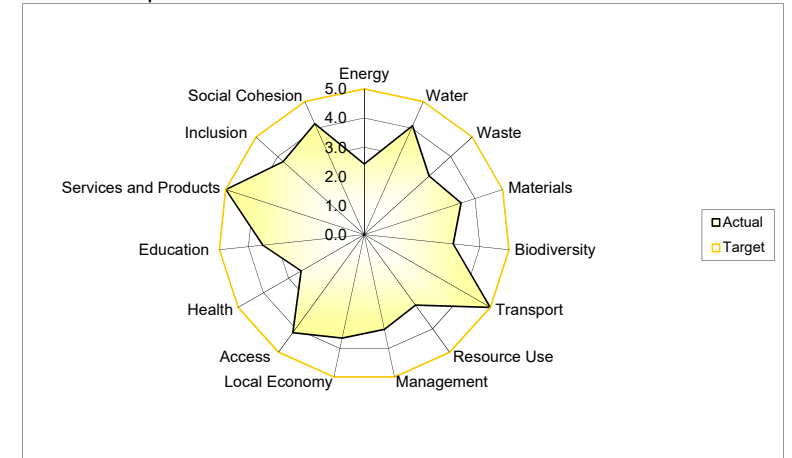
### SB1 Project

Justice College Resource Centre

### SB2 Address

332 Johannes Ramokhoase Street

### SB3 SBAT Graph



### SB4 Environmental, Social and Economic Performance

Category	Score
Environmental	3.2
Economic	3.8
Social	3.8
SBAT Rating	3.6

	Target	Achieved
BI Building Information	5.0	3.6

### BI 1 Building Targets

Code	Category	Target	Achieved
EN	Energy	5.0	2.4
WA	Water	5.0	4.1
WE	Waste	5.0	3.0
MA	Materials	5.0	3.5
BI	Biodiversity	5.0	3.1
TR	Transport	5.0	5.0
LE	Local Economy	5.0	3.0
MN	Management	5.0	3.3
RE	Resources	5.0	3.6
SP	Services and Products	5.0	4.2
AC	Access	5.0	2.5
HE	Health	5.0	3.5
ED	Education	5.0	5.0
IN	Inclusion	5.0	3.8
SC	Social Cohesion	5.0	4.2

### BI 2 Priority Key (Not Performance Key)

Code	Priority	Target	Achieved
VH	Very High	5.0	
HI	High	4.0	
ME	Medium	3.0	
LO	Low	2.0	
VL	Very Low	1.0	
NA	None / Not Applicable	0.0	

### BI 3 Project Name

Justice College Resource Centre

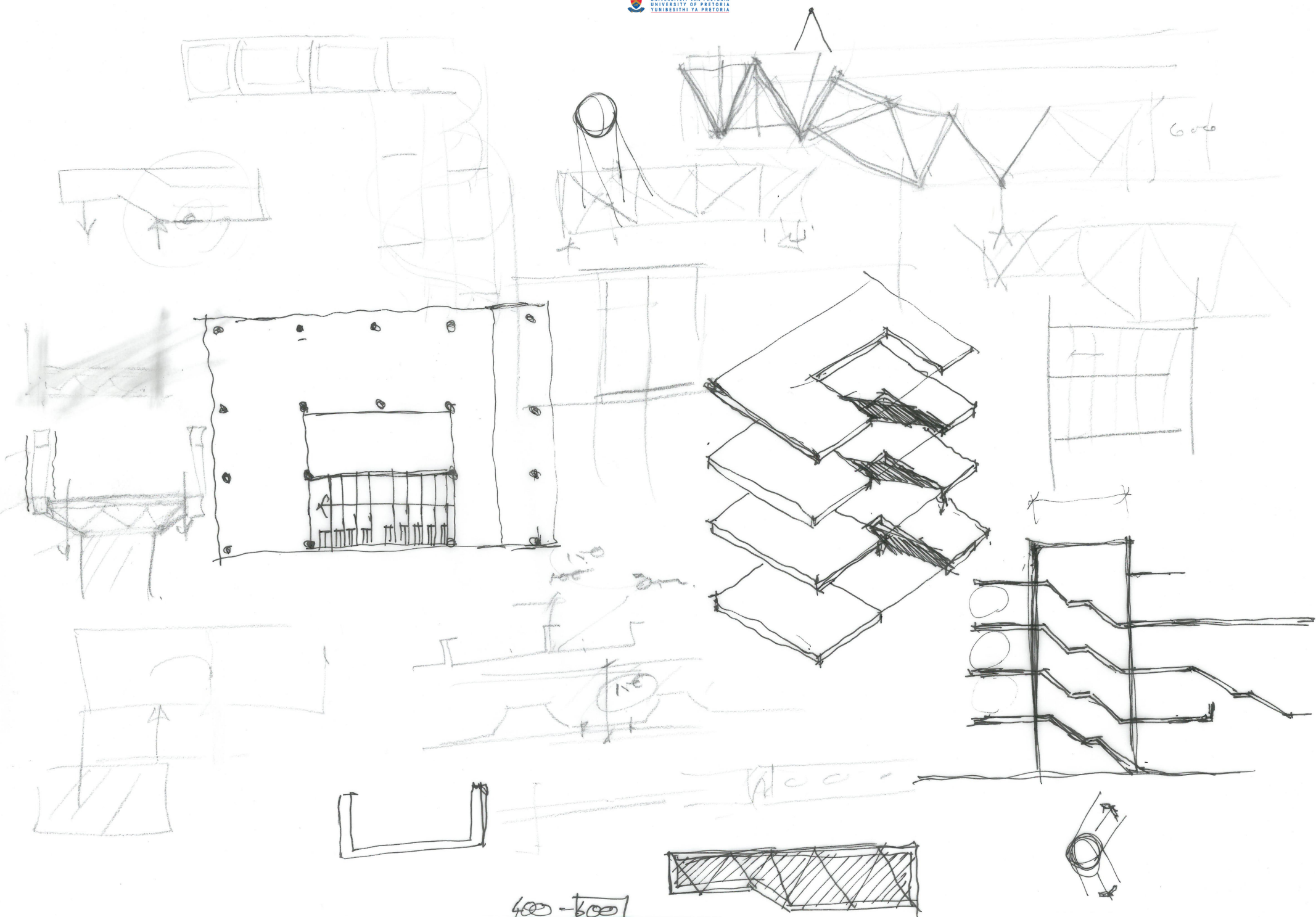
### BI 4 Address

332 Johannes Ramokhoase Street

BI 5 Site Area	8697 m <sup>2</sup>
BI 6 Gross Floor Area (GFA)	3662 m <sup>2</sup>
BI 7 Gross Internal Area (GIA)	9210 m <sup>2</sup>

Figure 106: SBAT report, first iteration.

Figure 107: SBAT report, second iteration.



400 - 600

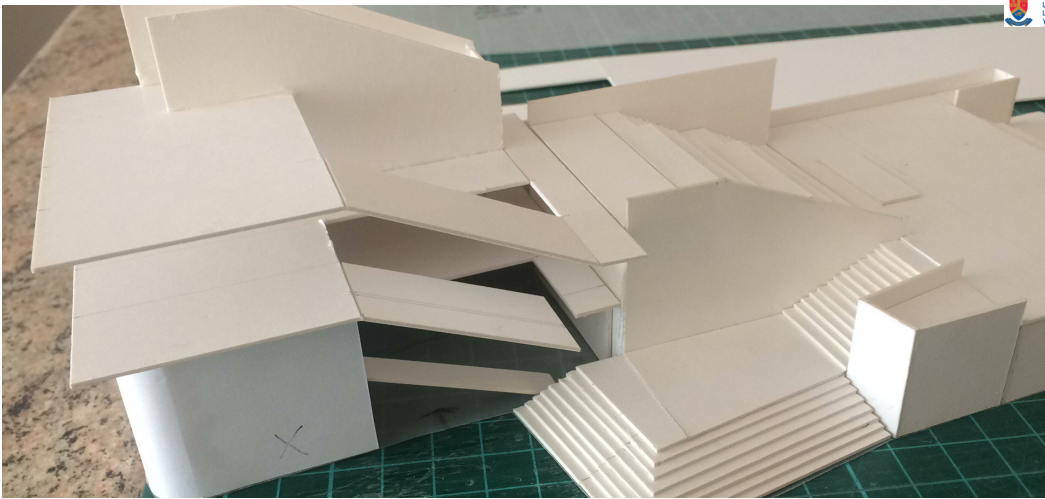


Figure 108: Model in progress showing atrium and vertical circulation.

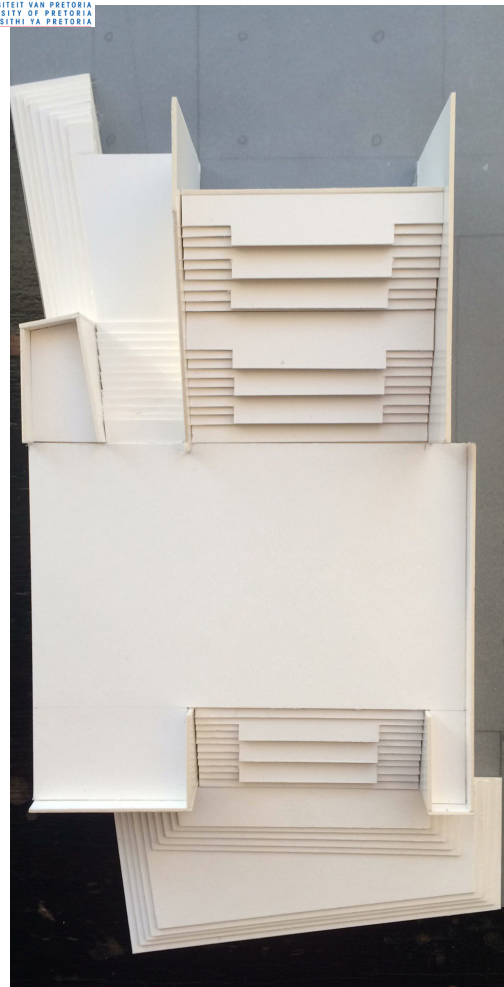


Figure 111: Model showing plinth and public lecture hall.



Figure 113: Medley of concept models.



Figure 109: Model in context as viewed from the street.

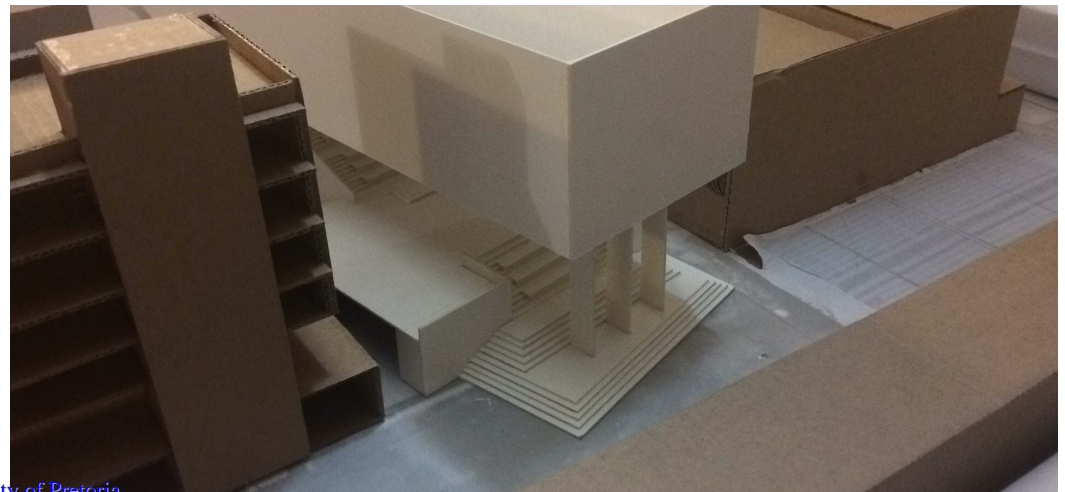
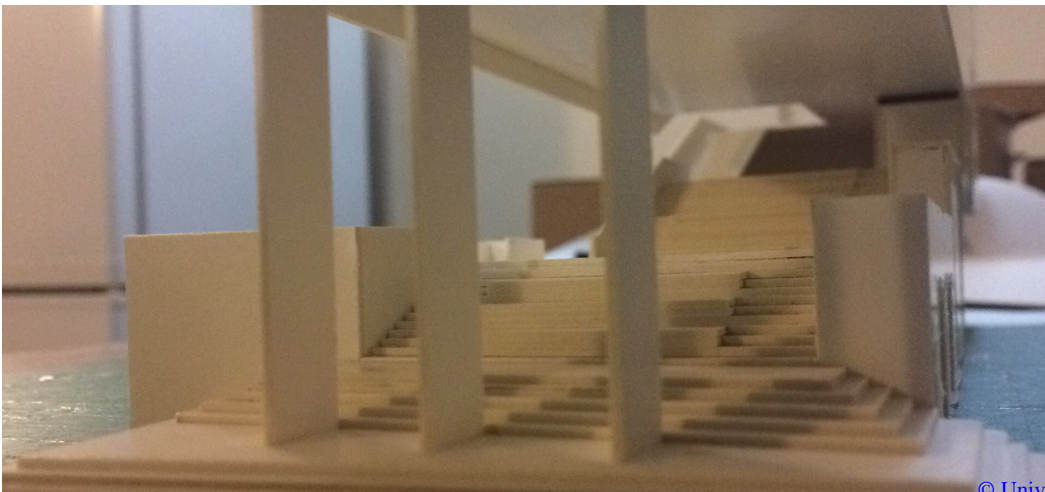


Figure 112: Model showing formal relationship to existing.

## Conclusion of Part Two

The expression of the project dealt with the development of a concept that stems from a palimpsestic understanding of old buildings as context. The continuous urban surface conceptually connects the theoretical framework and historical and physical contexts, and aids in the overall intention of regenerating the Extramural Building.

The design development responded to the issues that arise from the theoretical framework, historical context, urban framework, programmatic intentions and

conceptual ideas. None of these can be viewed in isolation as they often overlap and influence one another, as explored through a series of maquettes to find an appropriate design solution.

The technical development was aimed at remodelling the Extramural Building in an attempt to retain its inherent value and is seen as an integrated part of the design process. Technical issues were explored as tools to regenerate and unlock the building's latent potential and further

develop its design. A holistic strategy was developed for the site that makes use of the theoretical framework. This resulted in a diagrammatic remodelling strategy that describes what physical conservation or adaptation practices that are applied to the existing building. The palimpsestic argument of the project was expanded into a technical concept that aided in the development the aesthetic and construction vocabulary of the resource centre. Appropriate thermal comfort strategies were discussed and illustrated and resulted in the adoption of a

passive approach to controlling the building climate through the use of a combination of cross ventilation and fan assisted ventilation. The skin of the building was conceptualised as a solar shading device for the control of climate by only allowing a certain percentage of sunlight into the building. Finally the The Sustainable Building Analysis Tool was used to assess the first and second iteration of the building and lead to the incorporation of a rainwater harvesting systems and a photovoltaic system as a means to reduce the environmental impact of the project.

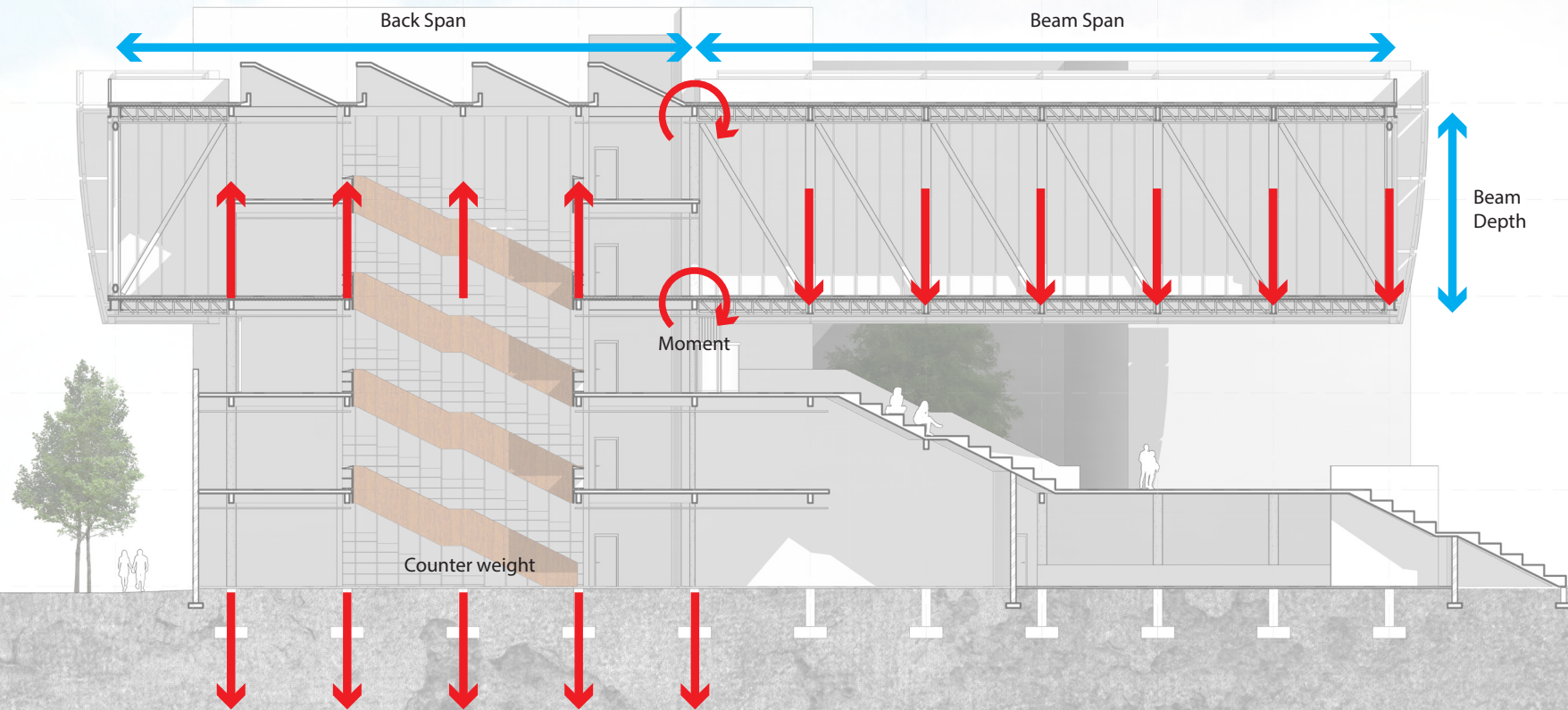


Figure 114: Forces diagram.

