# 06

# TECHNICAL INVESTIGATION

*In this chapter, a technical concept is developed, which relates to each part of the project as set out in the design discourse.*

## INDEX

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Denkleiers • Leading Minds • Dikgopolo tša Dihlalefi



## 6.1 TECHNICAL CONCEPT

A technical concept is derived from the main design concept of a membrane, that through insertion, forms new spaces inside an existing shell or structure. This new membrane is understood as a separate entity, in the way it intersects and responds to the existing building on various levels. This interaction responds to the existing building fabric lightly. Wherever it touches the fabric, it does so very lightly and honestly, as a separate intervention.

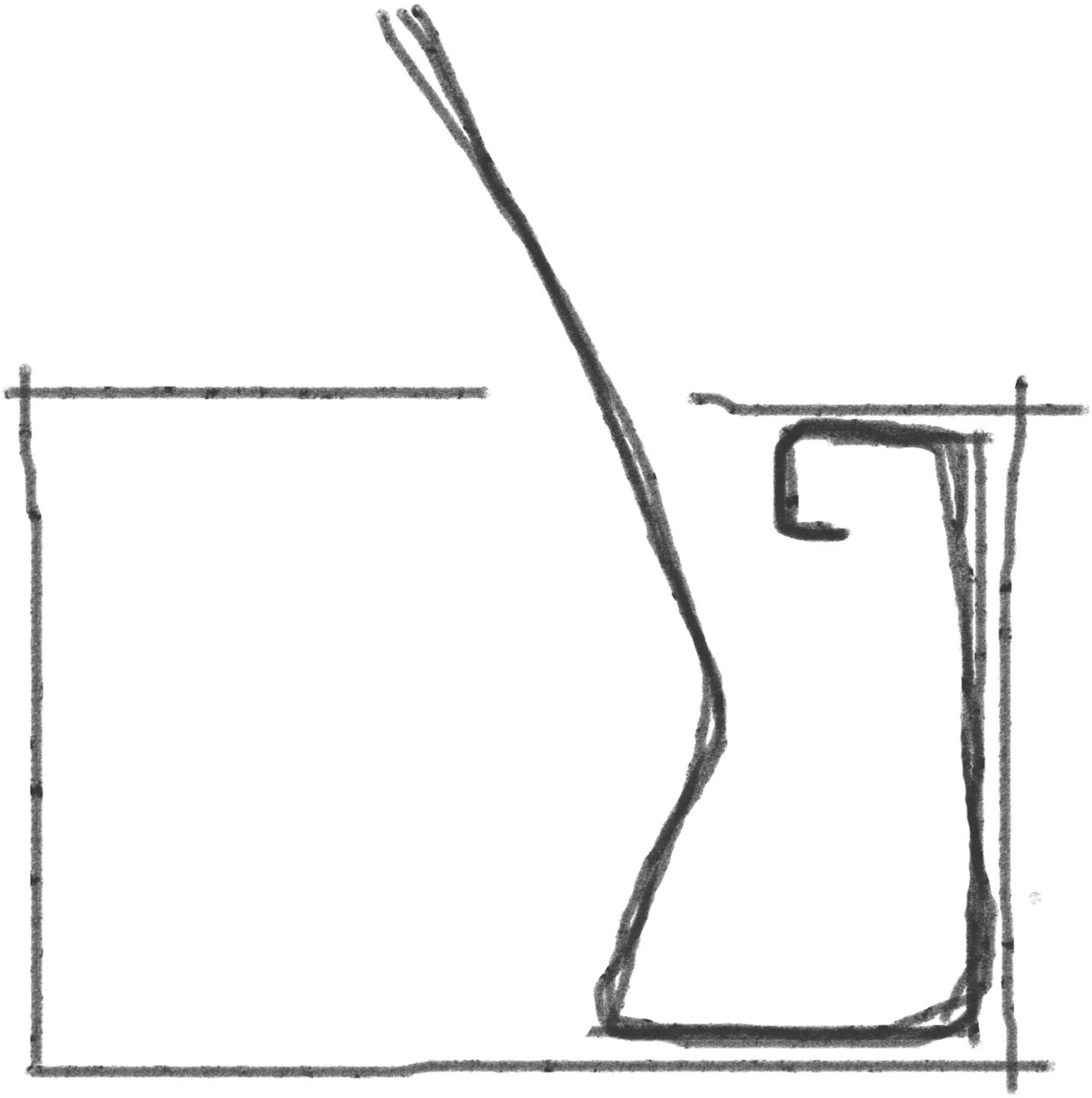


*Figure 6.1 Parti diagram*

## 6.2 TECHNICAL RESOLUTION

### 6.2.1 Plinth

Even though the plinth grows out of the landscape, it is still partially a monolithic structure, that creates an elevated platform for the Staatsmuseum. The monolithic nature of a plinth is however, placed subject to the technical concept. The plinth forms the first part of the membrane that is inserted, or responds to the building in a certain way. The plinth is also respectful, where it touches the building as an honest separate entity. A person is made aware of the fact that the plinth is not the natural ground level, and is an insertion or addition, at various different points.

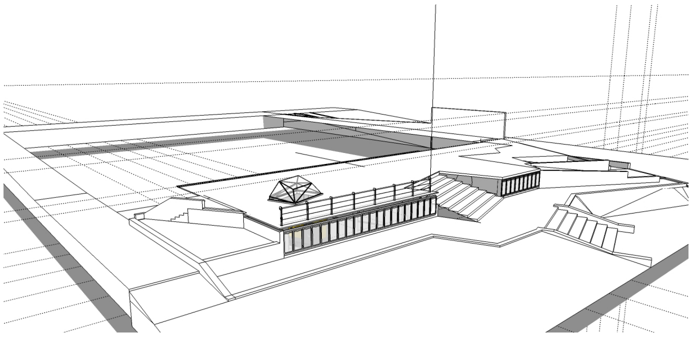


*Figure 6.2 Plinth*

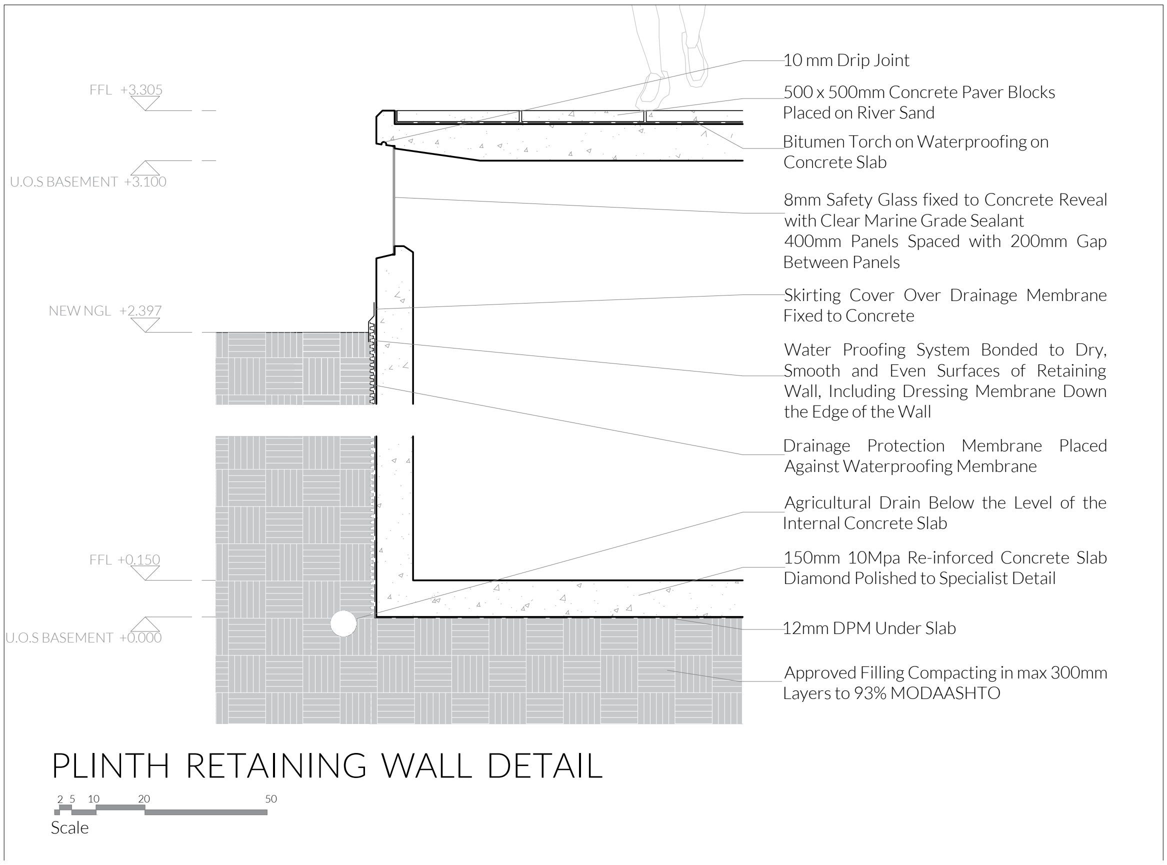



*Figure 6.3 Detailed section through plinth and retaining wall NTS*

## 6.2.2 Entrance

A structural system is created, that relates to the concept of the new intervention, not only being an insertion or a form of parasitic intervention, but also embodying the character of the new intervention as an entity on its own. A structural system is developed that allows the new membrane to be structure and skin simultaneously, thereby supporting itself.

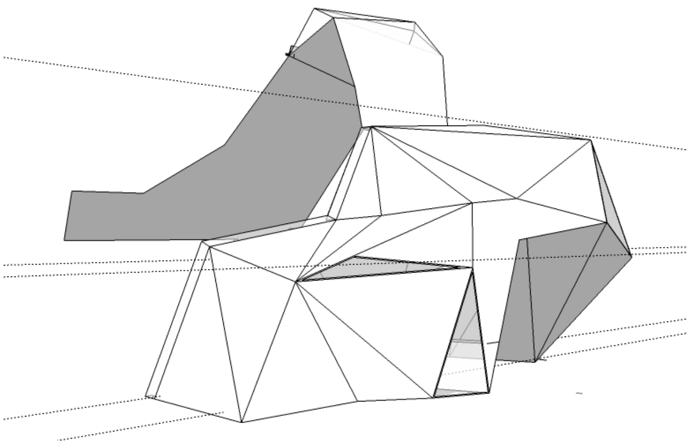


*Figure 6.4 Entrance*

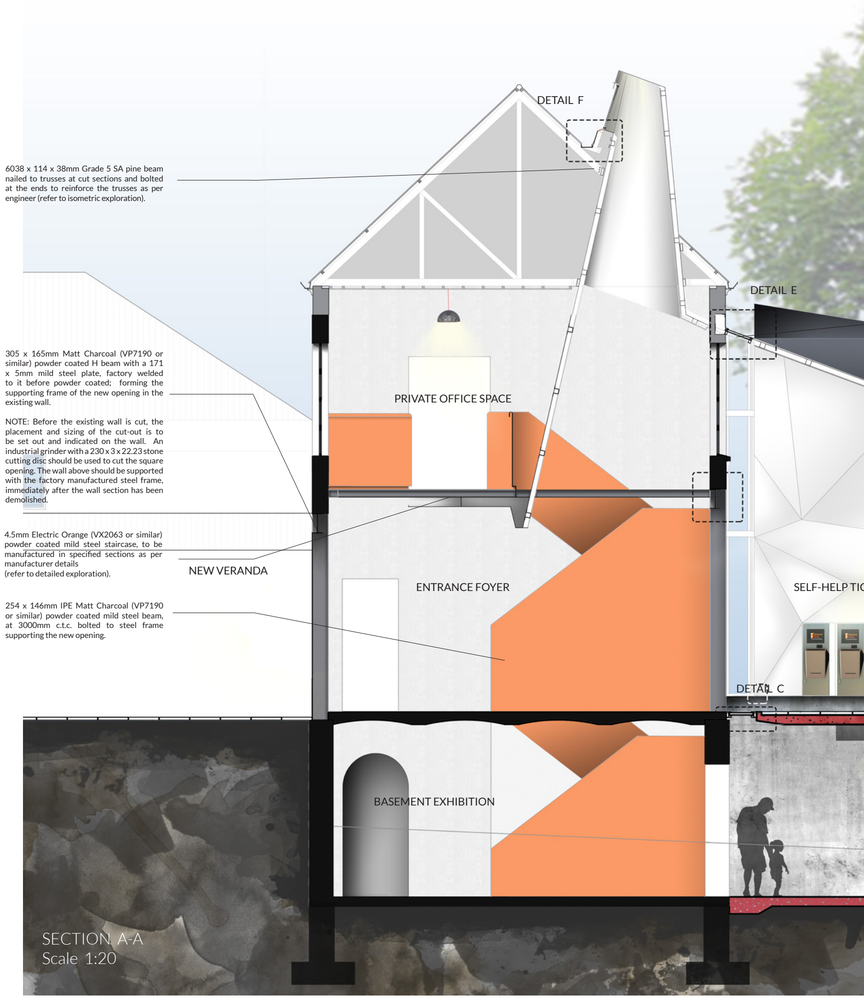
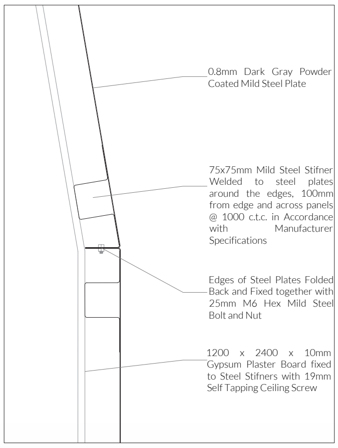


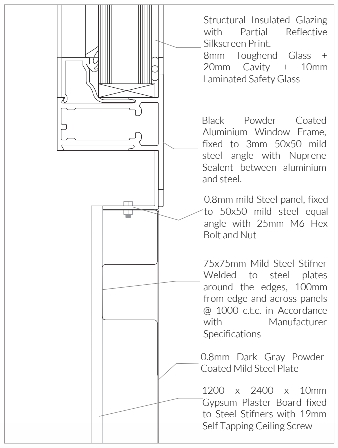

*Figure 6.5 Isometric section NTS*

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Denkleiers • Leading Minds • Dikgopolo tša Dihlalefi

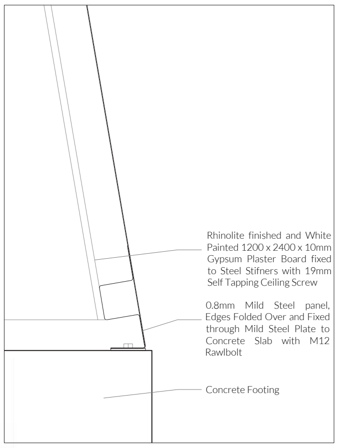
# TECHNICAL INVESTIGATION



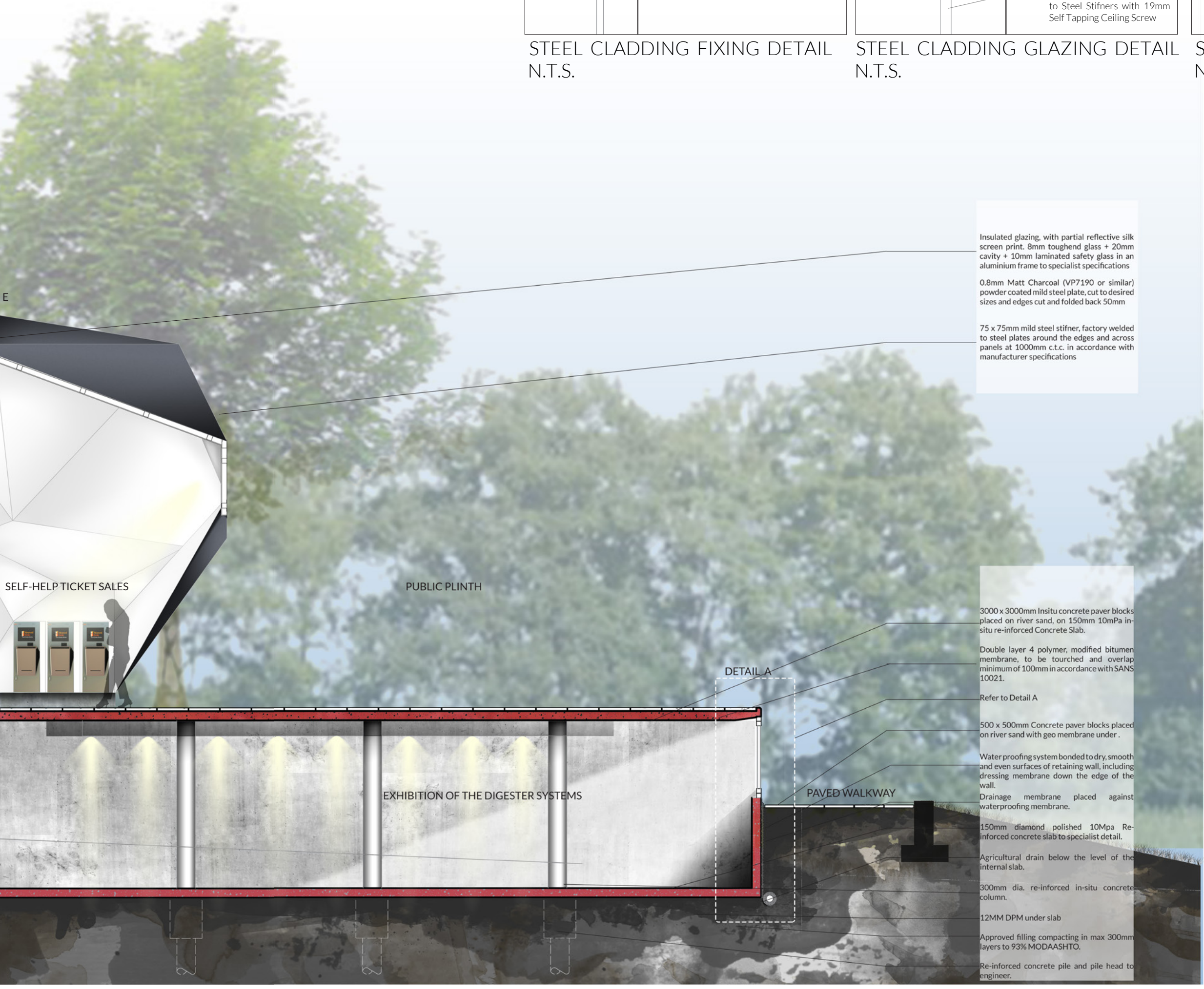

STEEL CLADDING FIXING DETAIL
N.T.S.




STEEL CLADDING GLAZING DETAIL
N.T.S.




STEEL CLADDING FIXING DETAIL
N.T.S.



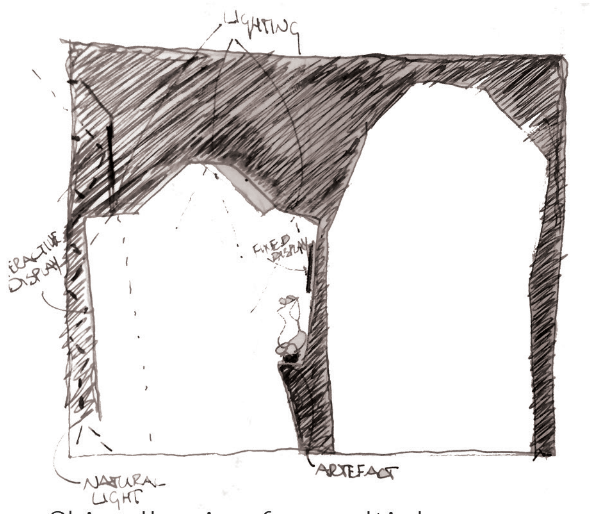
### 6.2.3 Interior

A new interior shell is inserted throughout the eastern wing of the *Staatsmuseum*. This shell is designed and understood as being apart from the existing structure, and reads as one membrane that morphs through the spaces. To achieve this, a light gauge steel sub-frame is built to accommodate faceted panels to be attached to the structure. The panels will mostly be gypsum plaster board with plywood infill.

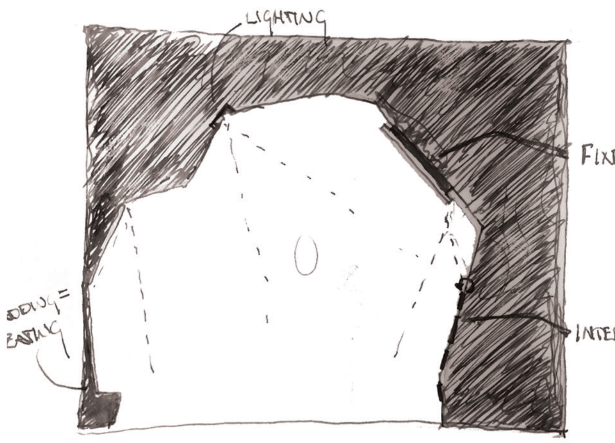

*Figure 6.6 East west section indicating new intervention as well as restored wing NTS*

*Figure 6.7 Detail section of cladding material fixing*


Figure 6.9 Section through exhibition installation explaining each part of exhibition part 1

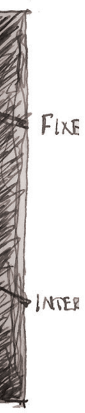



Skin allowing for multiple spaces and becommimg exhibition platform

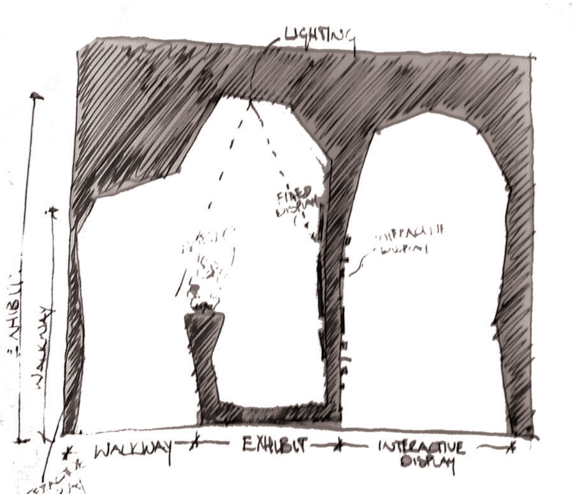



Skin allowing for various exhibition planes and can also become seating

Figure 6.10 Explorative Sections

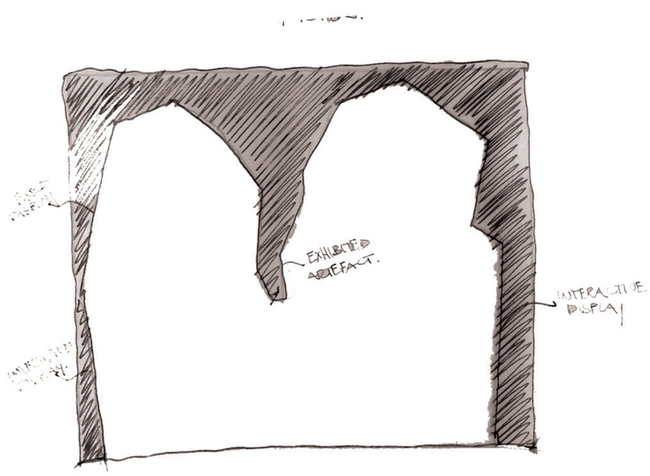




tion

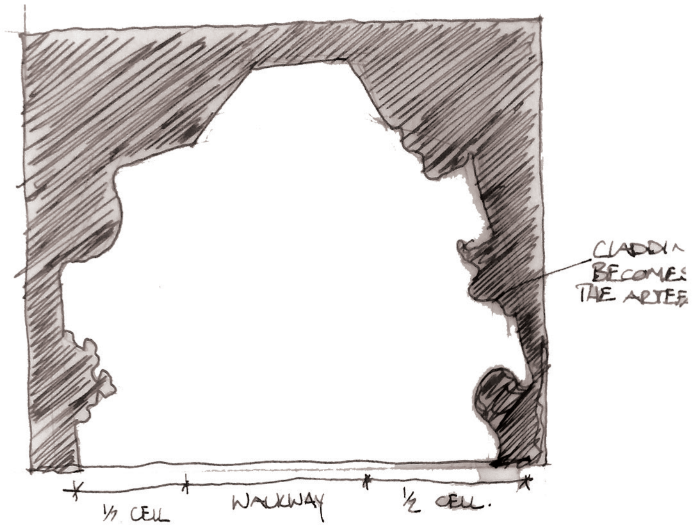



Skin becommimg platform and walkway


*Figure 6.11 Section through exhibition installation explaining each part of exhibition part 2*

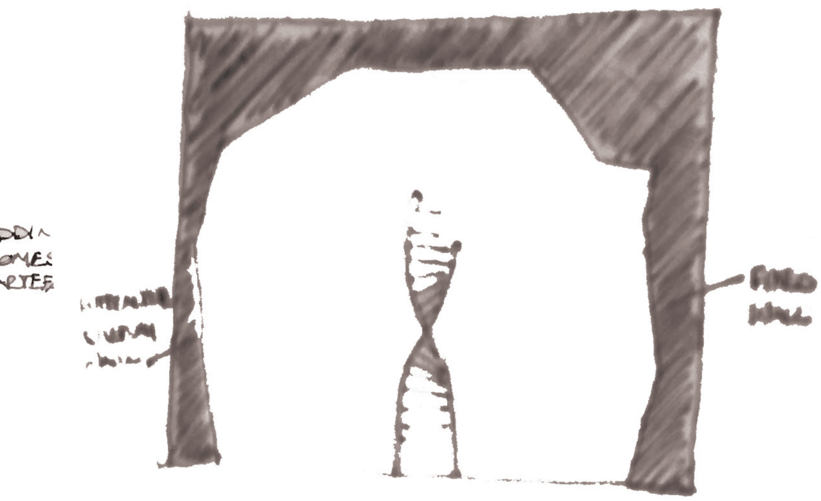



Skin Allowing for different perspective




Skin being manipulated to become the artefact

*Figure 6.12 Explorative Sections*



Artefact in center of space being
the focus point

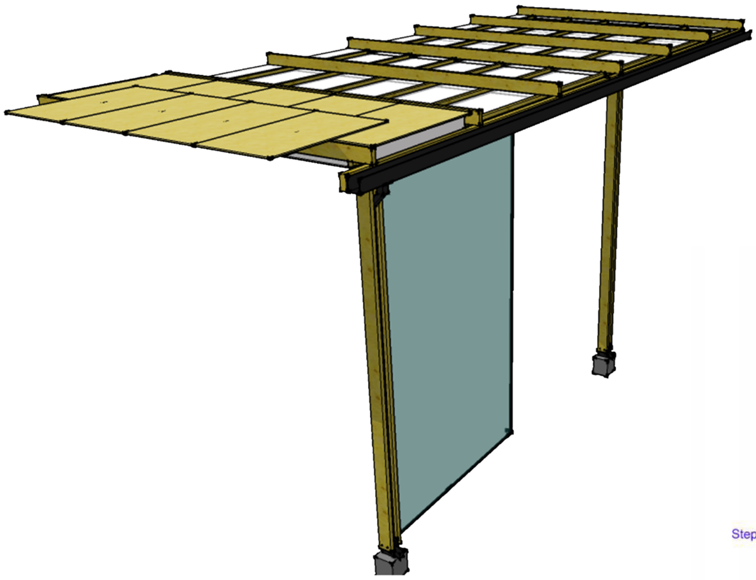
UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



## 6.2.4 Courtyard

The new courtyard veranda roof is designed to be a flat floating roof, guiding the user visually, as horizontal plane.

The roof is made up of a timber support structure, with plywood roofing, which is waterproofed with torch-on Bitumen water proofing and finished with steel profile sheeting over.



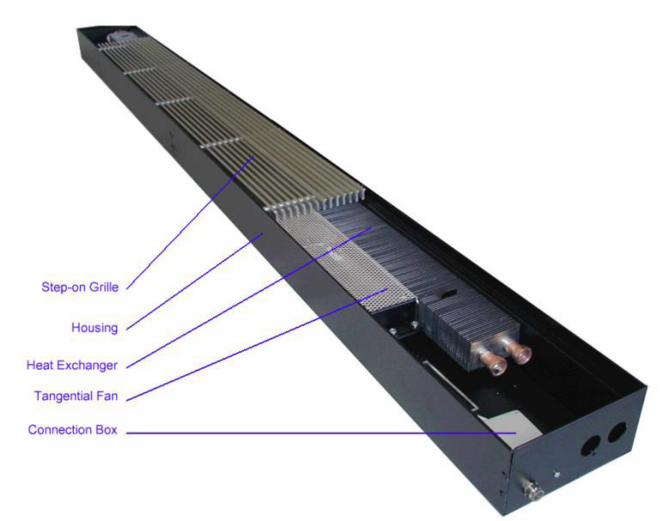
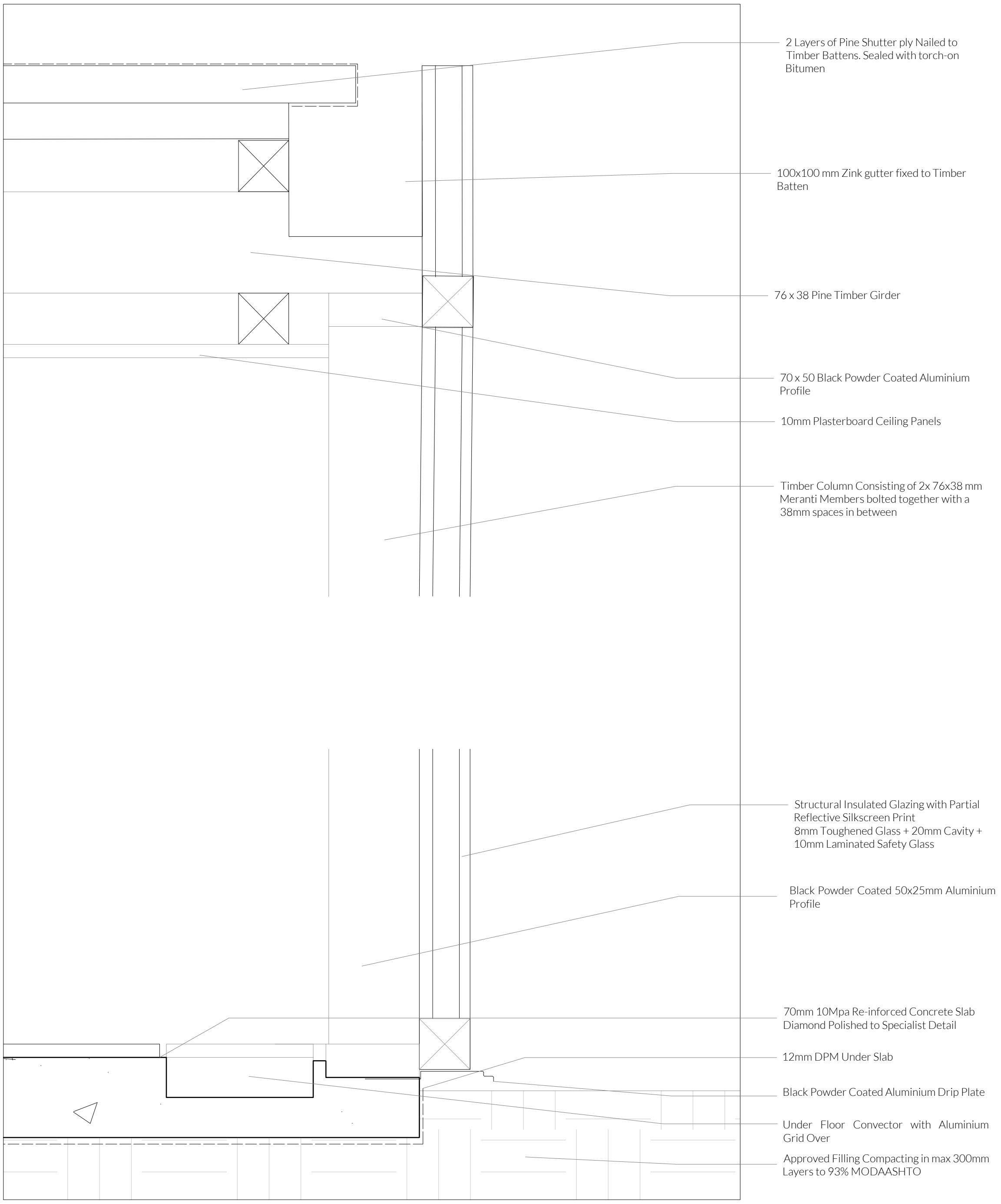



*Figure 6.13 Isometric of the new roof addition of the courtyard*




COURTYARD FLOOR AND GLAZING AND ROOF DETAIL
N.T.S.

*Figure 6.14 Detailed section of the new addition of the courtyard*

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Denkleiers • Leading Minds • Dikgopolo tša Dihlalefi


## 6.3 SERVICE SYSTEMS

The manipulation of light in the new exhibition area, will form the main service system in the building. Conceptually, people move from light point to light point and will move faster through darker and smaller spaces. The intention is to manipulate and use light in such a manner, that it will roughly dictate people's movement through the building.

Light has been investigated as part of the design discourse. Natural lighting in the east wing will be controlled very specifically, through allowing the light to bounce of different panels (behind the new exhibition structure), and to be revealed as a more focused light source in open gathering spaces or along pathways, as a means of way finding and guiding the user.

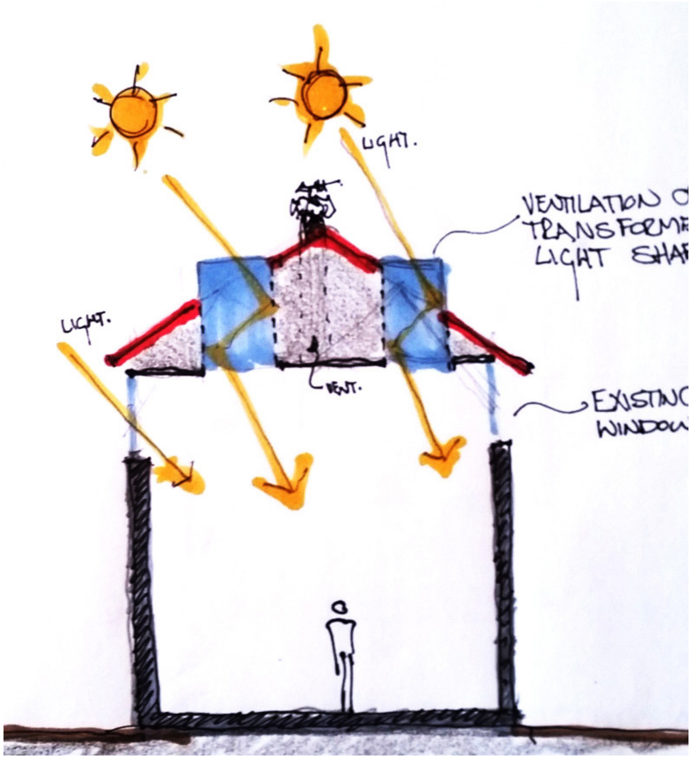



*Figure 6.15 Isometric section of the use of light*

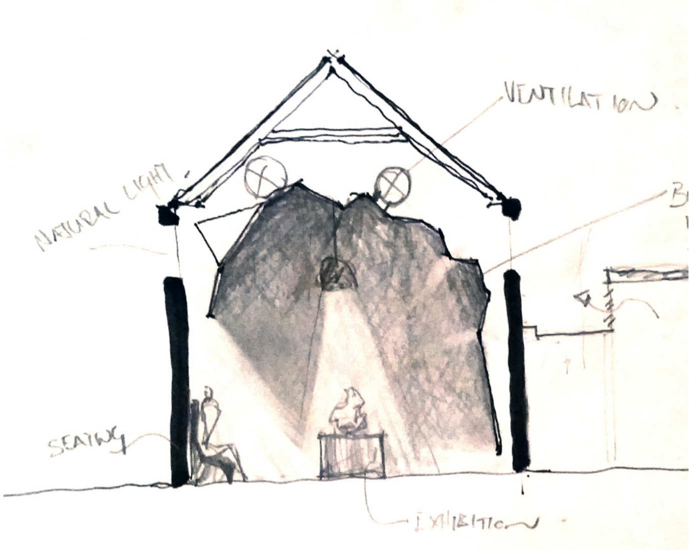
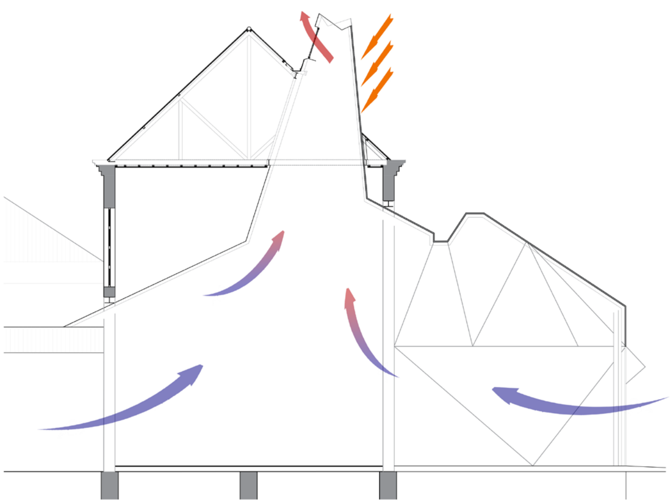



*Figure 6.16 Control over natural light*

## 6.3.1 Ventilation: Heat Stack

Ventilation

The new entrance structure's design is done in such a way that it will create a heat stack. The heat stack will be heated by means of solar radiation at the top part, which penetrates the existing roof.

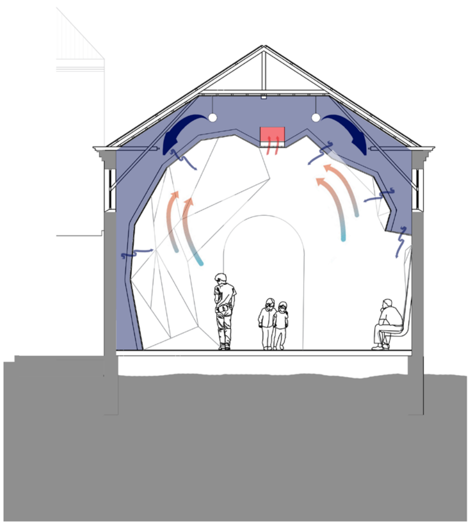


### Natural Ventilation

The new entrance of the building is open to the zoo and open to the internal courtyard.
This addition to the building penetrates through the existing roof, allowing for a heat stack to form.
No insulation will be installed on the protruding part of the installation, allowing the sun to heat up the space at the top of the protruding structure.
By installing aluminium louvres on the south of this tower, one allows for the hot air to escape. This creates a negative pressure inside the space, which in turn pulls up more air into this space. This system creates air movement and will allow for the entrance foyer space to be well ventilated naturally.

*Figure 6.18 Natural Ventilation System*

## 6.3.2 Ventilation: Mechanical System



### HVAC System

A mechanical heating, ventilation and cooling system will be installed due to the high volumes of people that will occupy each exhibition space.

This system is based on sealing and pressurising the voids behind the exhibition panels and introduce fresh and cool/hot air to these void spaces.
By installing perforated panels in between the exhibition panels, the cool air is forced to slowly move through the panels and into the space.

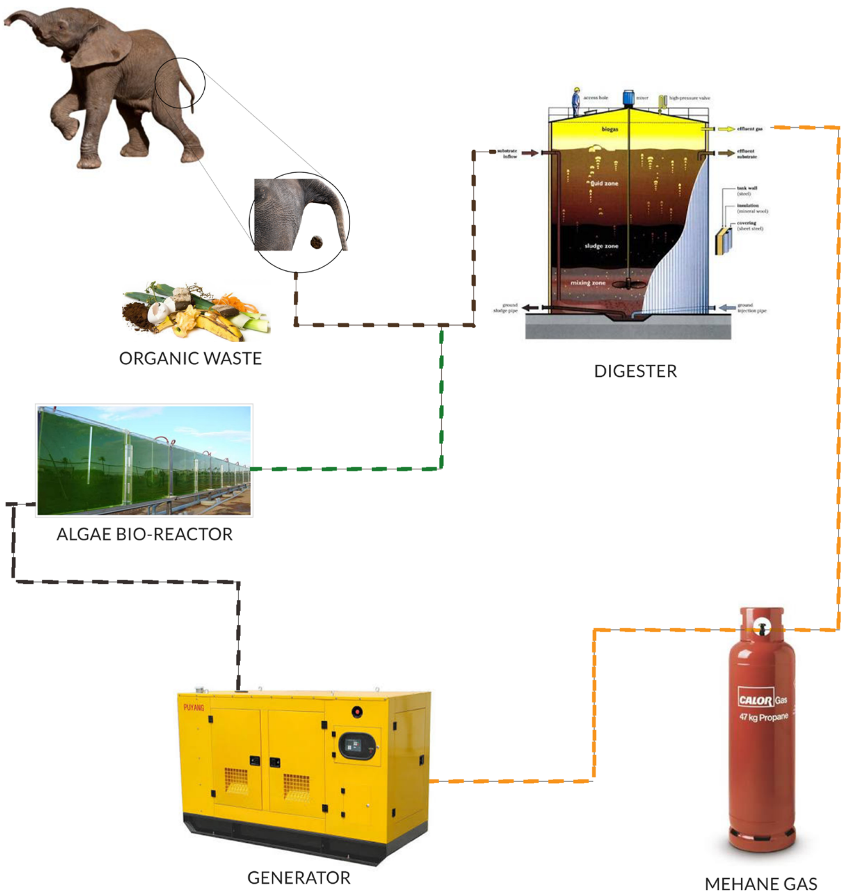
Hot air will naturally rise and accumulate at the highest point in the space. An extraction system will be installed along the highest points to extract hot air by means of a pumped duct system with diffusers.

*Figure 6.17 Section of mechanical ventilation system*

## 6.4 ENVIRONMENTAL RESPONSE

The environmental systems, that allow the building, to function as a self-sustaining entity, will be placed in the plinth and will be accessible to the public. The main system is a digester system that makes use of organic waste material, gathered from the NZG, which is grained and added to a digester system. The digester decomposes the waste and generates methane gas. The methane gas is collected in a container off site, to be burned in an electrical generator. The $CO_2$ gas produced by the generator, will be driven through algae bio reactors which converts the gas to $O_2$ and generates heat, that can be used for space heating inside the building.

*Figure 6.19 Algae bioreactor glass*




### Digesting System

All organic waste of the zoo will be ground up an put into a digesting tank.
In a digesting tank micro-organisms further digest waste material and as a result of this process gives off methane gas. The gas is stored in a safe gas canister away from the public realm. Once enough gas has been stored the gas is burned through an electric generator. This generator converts the gas into electricity that can be used to supply the building with electricity.
The $CO_2$ emitted by the generator is fed through algae bio-reactors.
The algae lives from the $CO_2$ and emits $O_2$, which is let out into the air.
Once the algae becomes mature and forms an overgrown patch in the reactor, the algae water is flushed into the digester.
All solid waste taken from the digester can be used as fertiliser for the gardens

*Figure 6.20 Diagrammatic exploration of a typical digester system panels*

### 6.4.1 Digester System

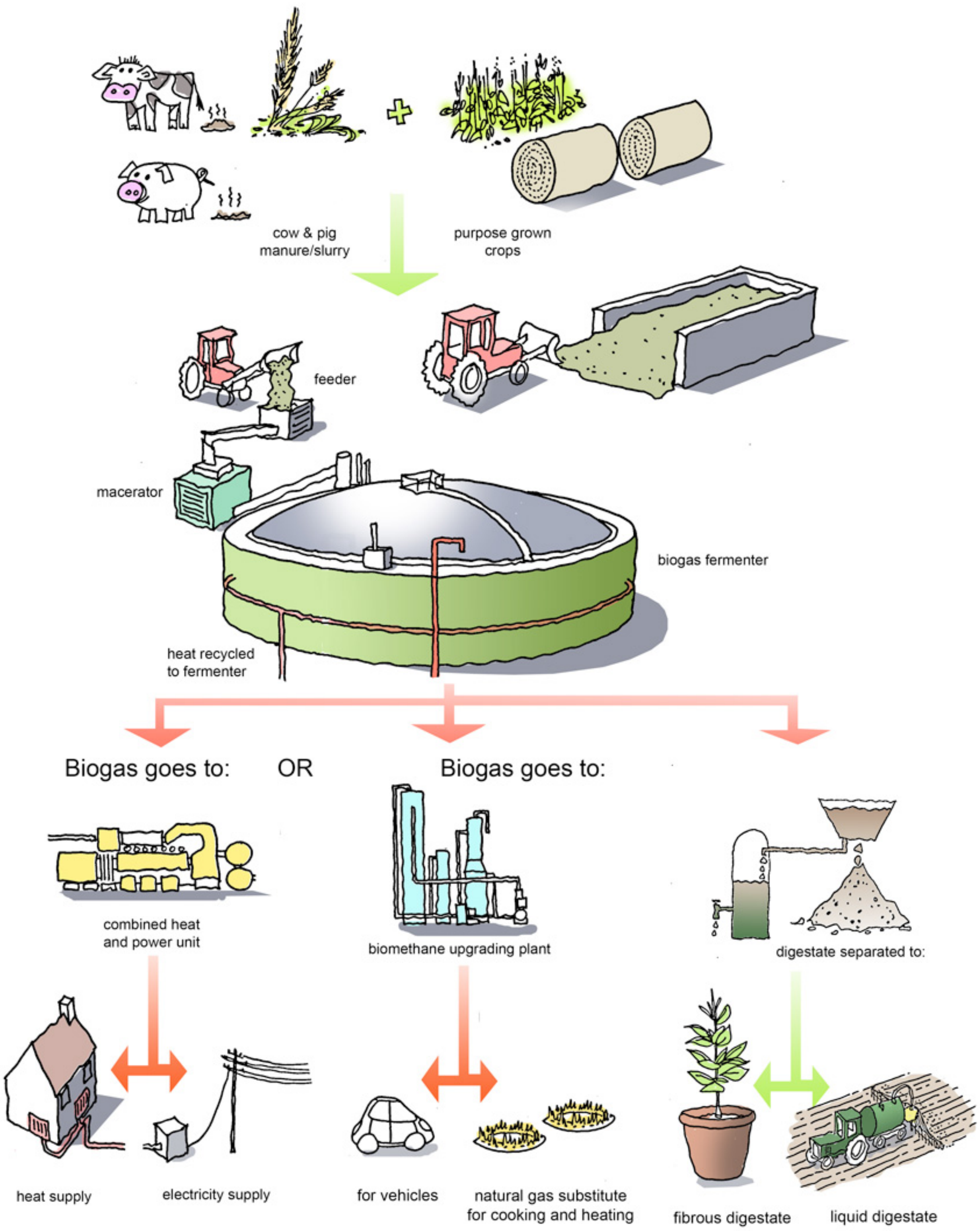



*Figure 6.21 Organic digester*

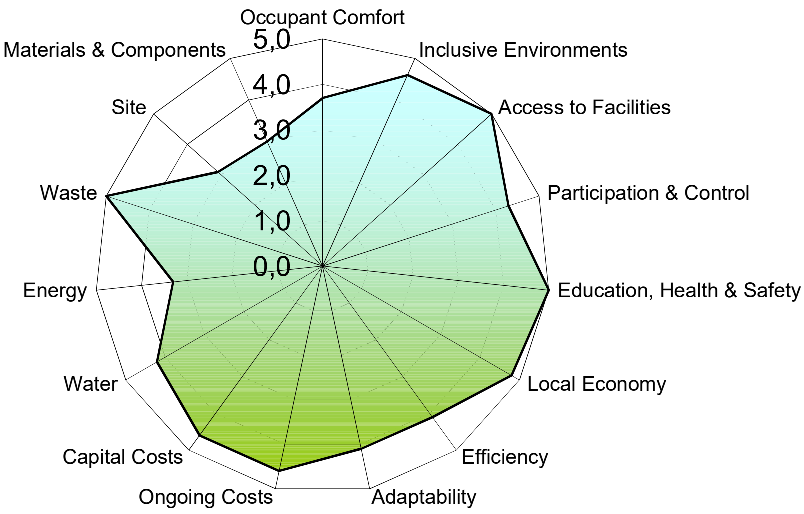
UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Denkleiers • Leading Minds • Dikgopolo tša Dihlalefi


## 6.5 ENERGY RATING - SBAT

The SBAT analysis that has been carried out on the project has scored the following:

| | |
|---|---|
| Social: | 4.5 |
| Economic: | 4.4 |
| Environmental: | 3.7 |
| Over All: | 4.2 |

This is a good indication of the influence this project will have on the social, economic and environmental spheres in the city. The analysis indicates clearly that more focus can be given to environmental responses to ensure the best possible result is gained with the least negative influence.



# 07

# CONCLUSION

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Denkleiers • Leading Minds • Dikgopolo tša Dihlalefi


## 7.1 CONCLUSION

This study is aimed at making buildings with historical significance that has lost relevance and dignity, relevant in its context once again through adaptive re-use.

Specific focus is given to an example of such a building in Pretoria; the old ZAR Staaatsmuseum. The building was designed to sit in, and react to its context in a specific way. The development of its direct context over a period of 120years, together with the rapid expansion of the museum's collection has led to the museum being stripped of its worth as a building contributing to the city.

Through creating a new urban context, with specific focus on the National Zoological Gardens, and the possible relationship between the zoo and the museum, this study sets out to make the Staaatsmuseum relevant once again.

The topography of the site and the relationship between the museum and one of the open spaces within the zoo proves vital in creating a new context and design driver for the study in response to the museum.

By responding to the museum at the hand of a new context, this study identifies different parts of intervention flowing from one concept. This concept is to create a new intervention in the building that originates in the landscape, and penetrates the building in various ways.

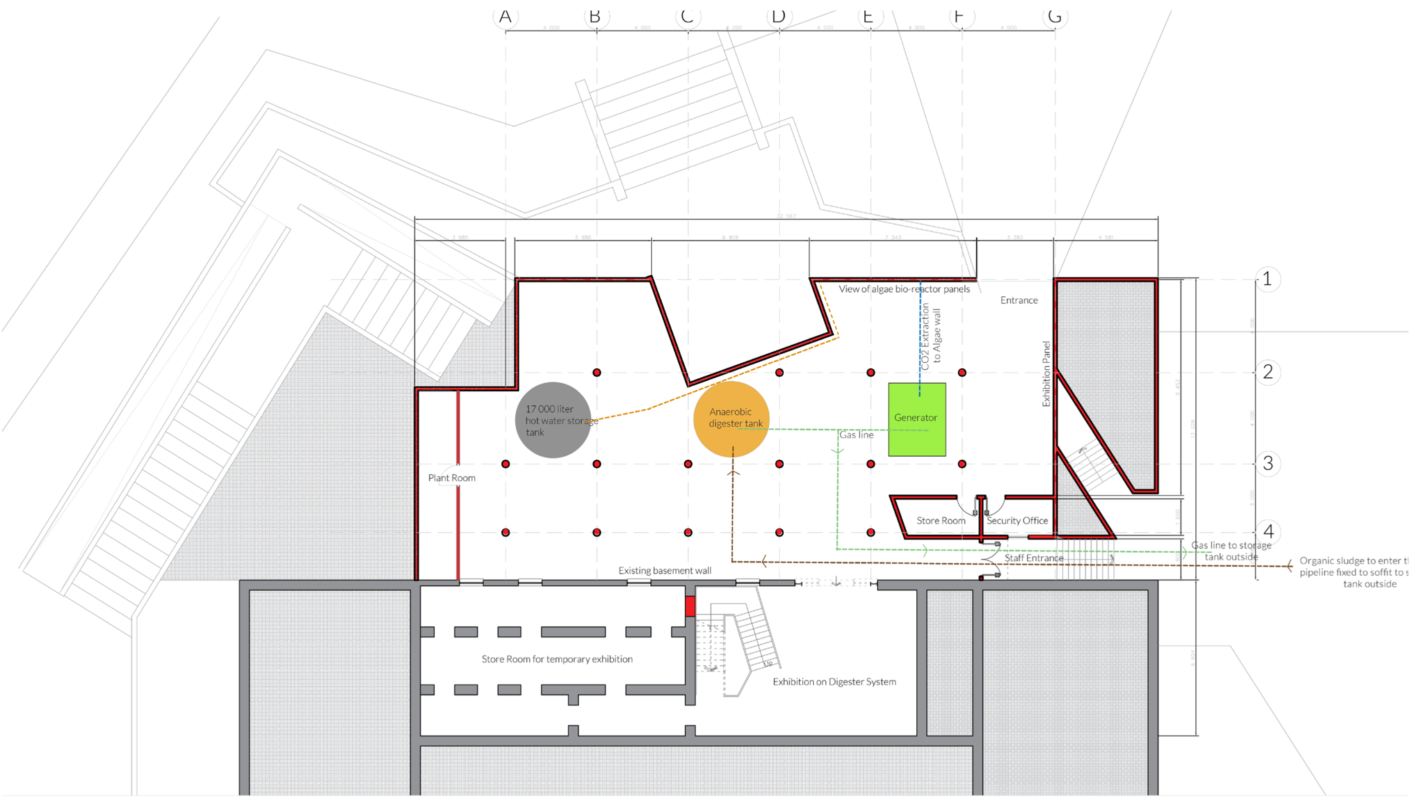
This new approach to the building is a breath of fresh air to the building. It allows the building to once again be relevant not only in the way it sits in the landscape but also in the way it plays a contributing role to the urban context once again.

# 08

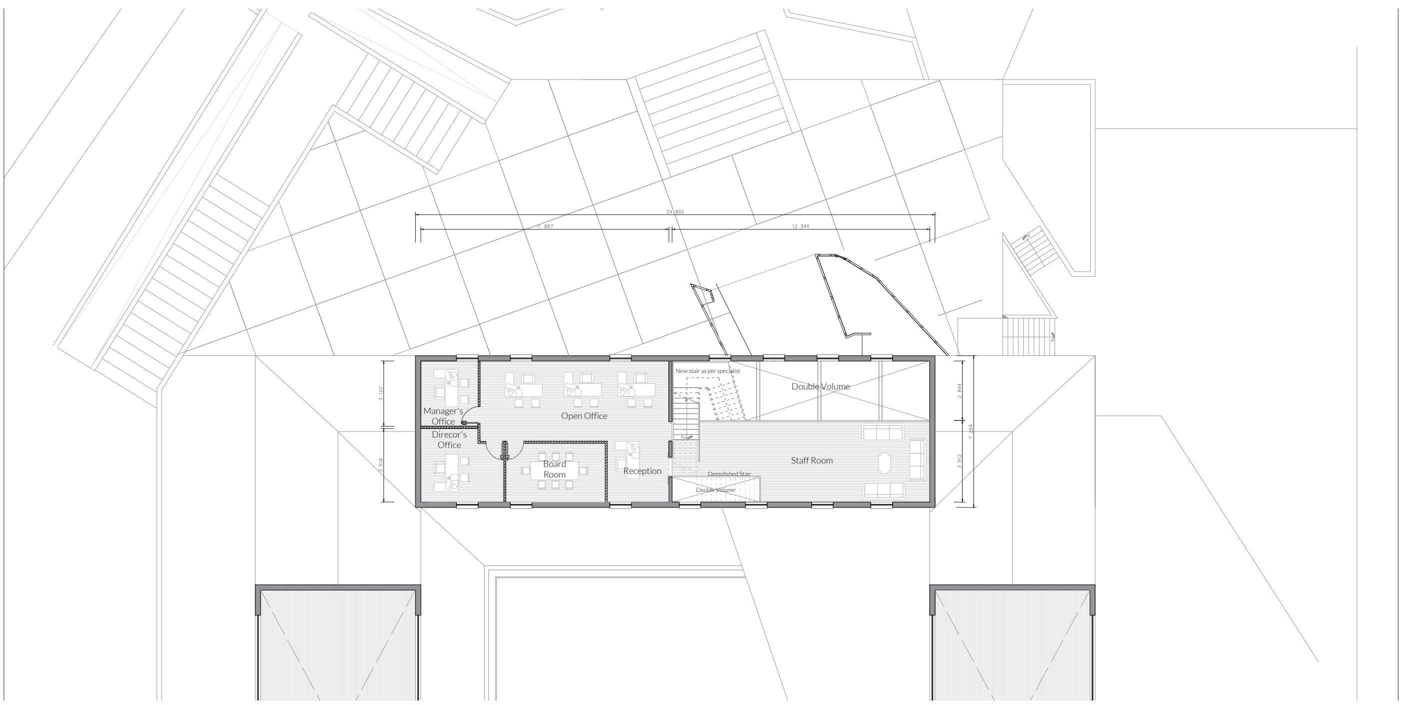
# APPENDIX A

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA


# APPENDIX A



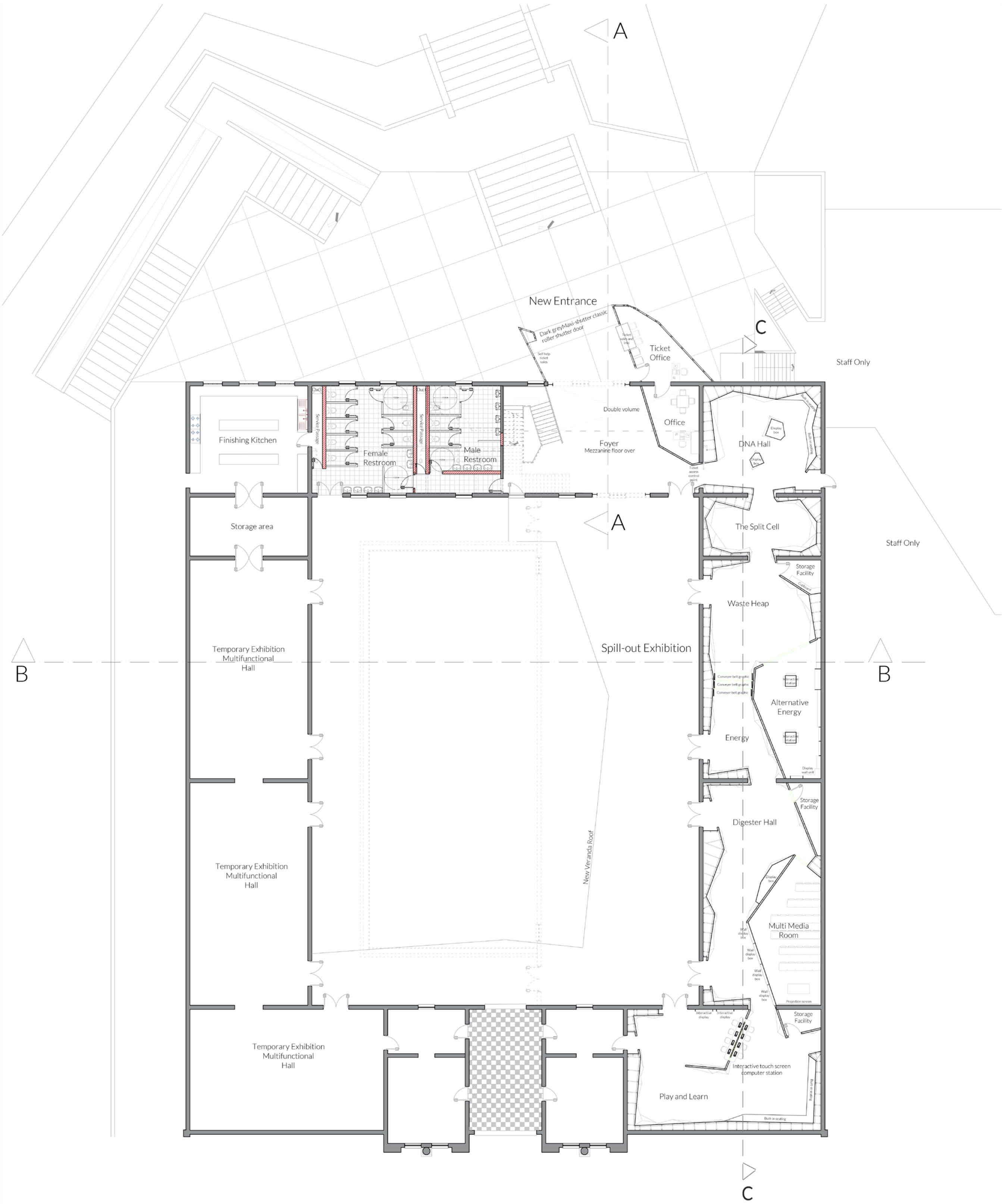

*Basement Plan*




*First Floor Plan*

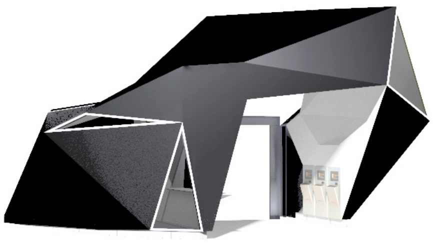
UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Denkleiers • Leading Minds • Dikgopolo tša Dihlalefi

# APPENDIX A

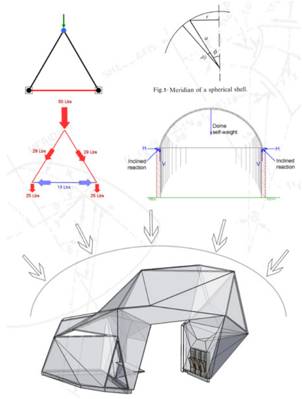



*Ground Floor Plan*

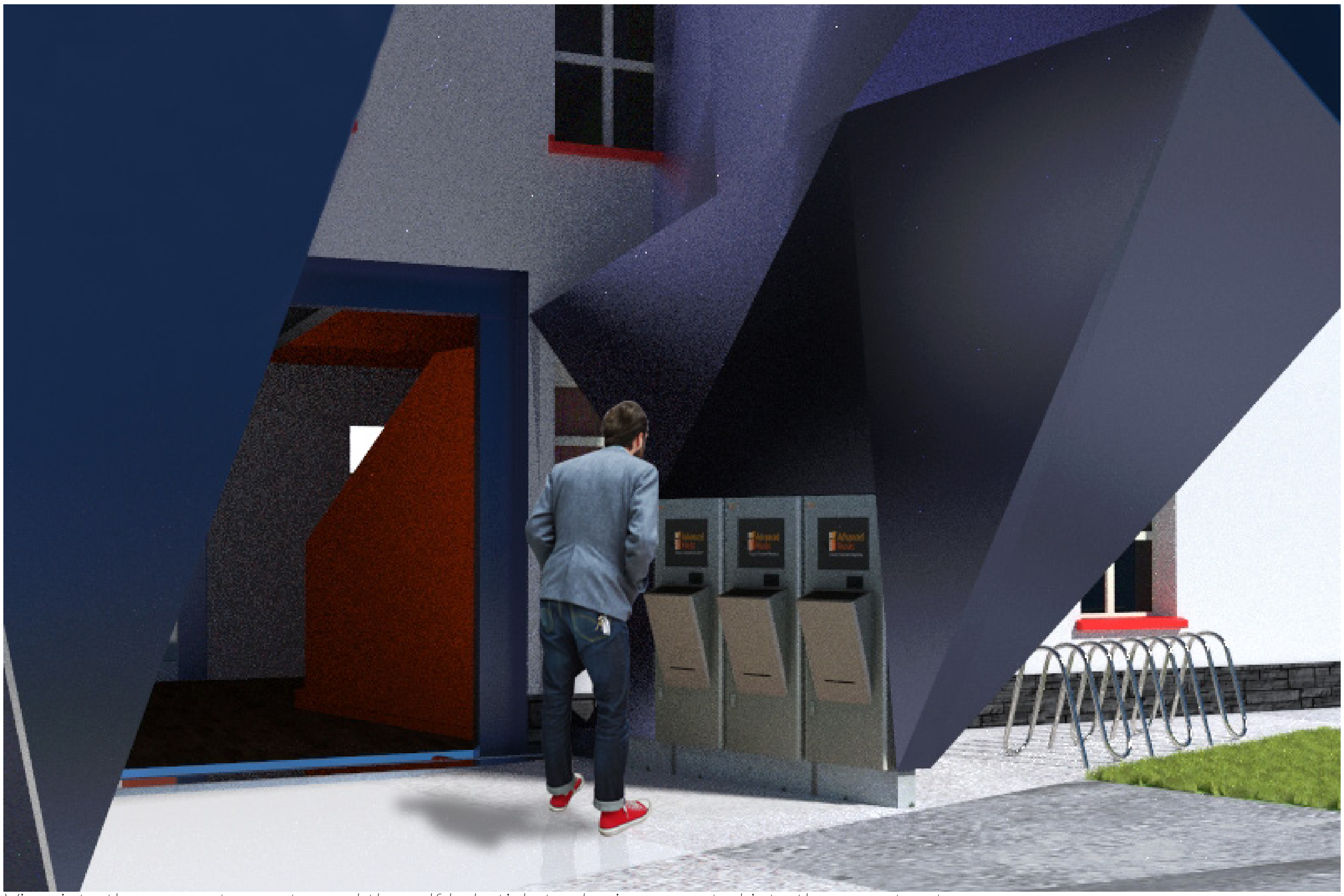
# NEW ENTRANCE



New entrance structure as a entity on its own

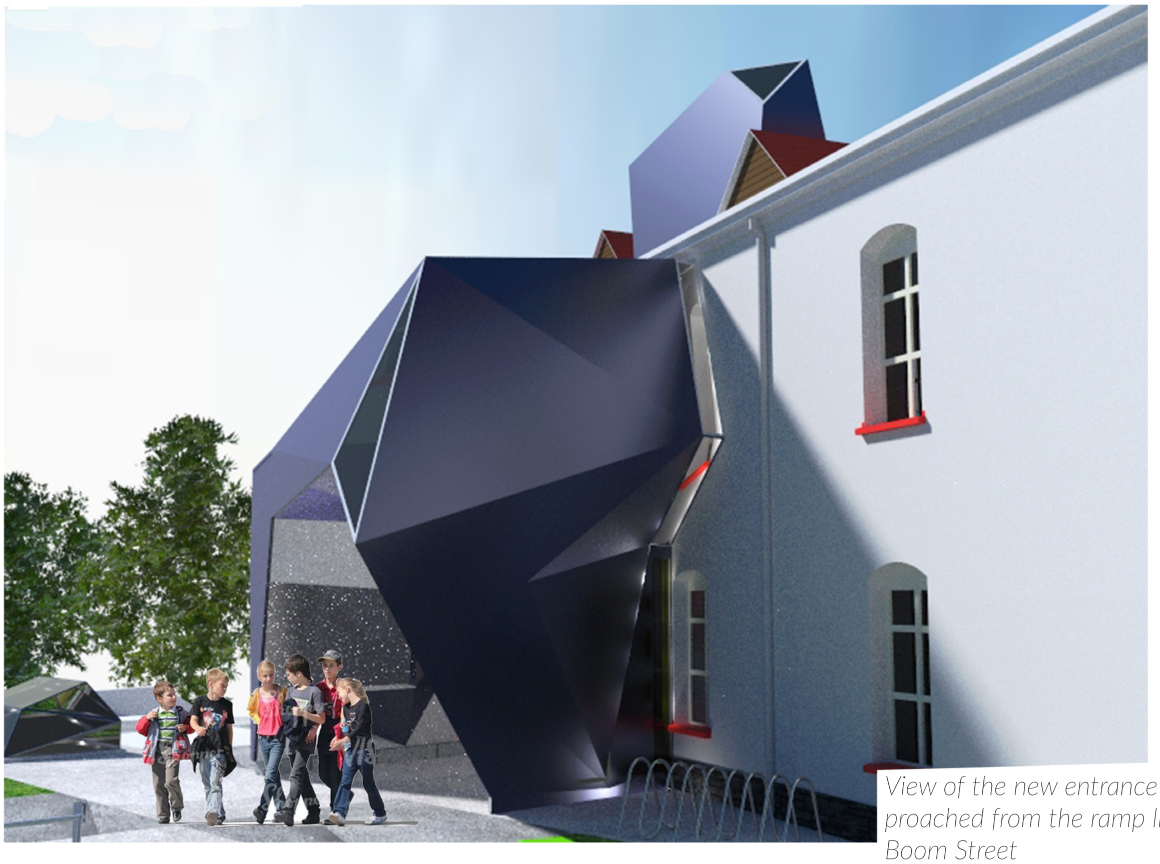



Exploration of the dome structure



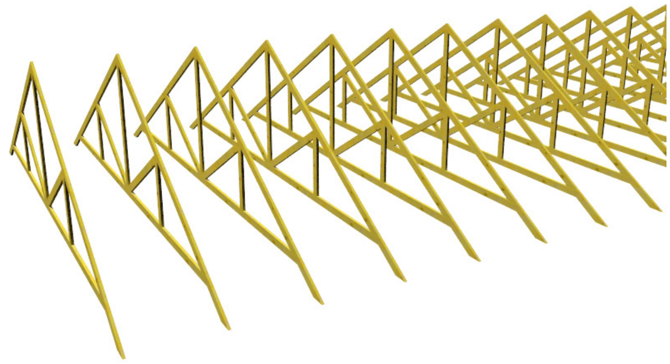
View into the new entrance toward the self help ticket sales incorporated into the new structure

*View of new entrance over the plinth and the skylight allowing views into the basement*

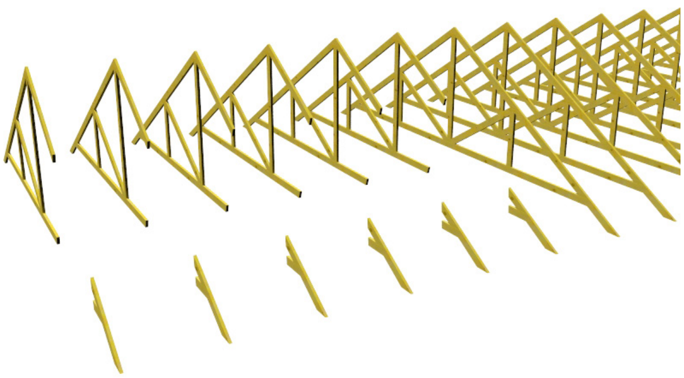


*View of the new entrance as approached from the ramp linking from Boom Street*

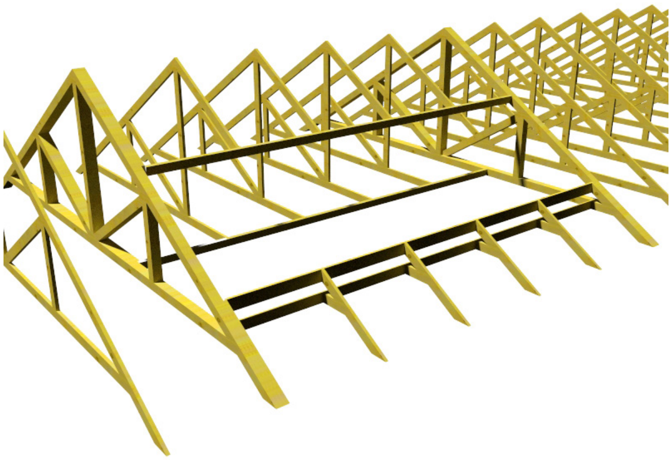
# ROOF SECTION DETAIL



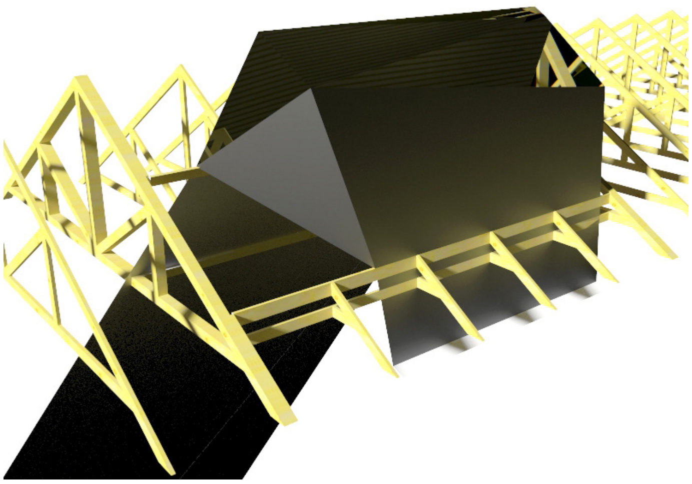
Existing roof trusses. 114 x 38 Pine trusses at 900 centres



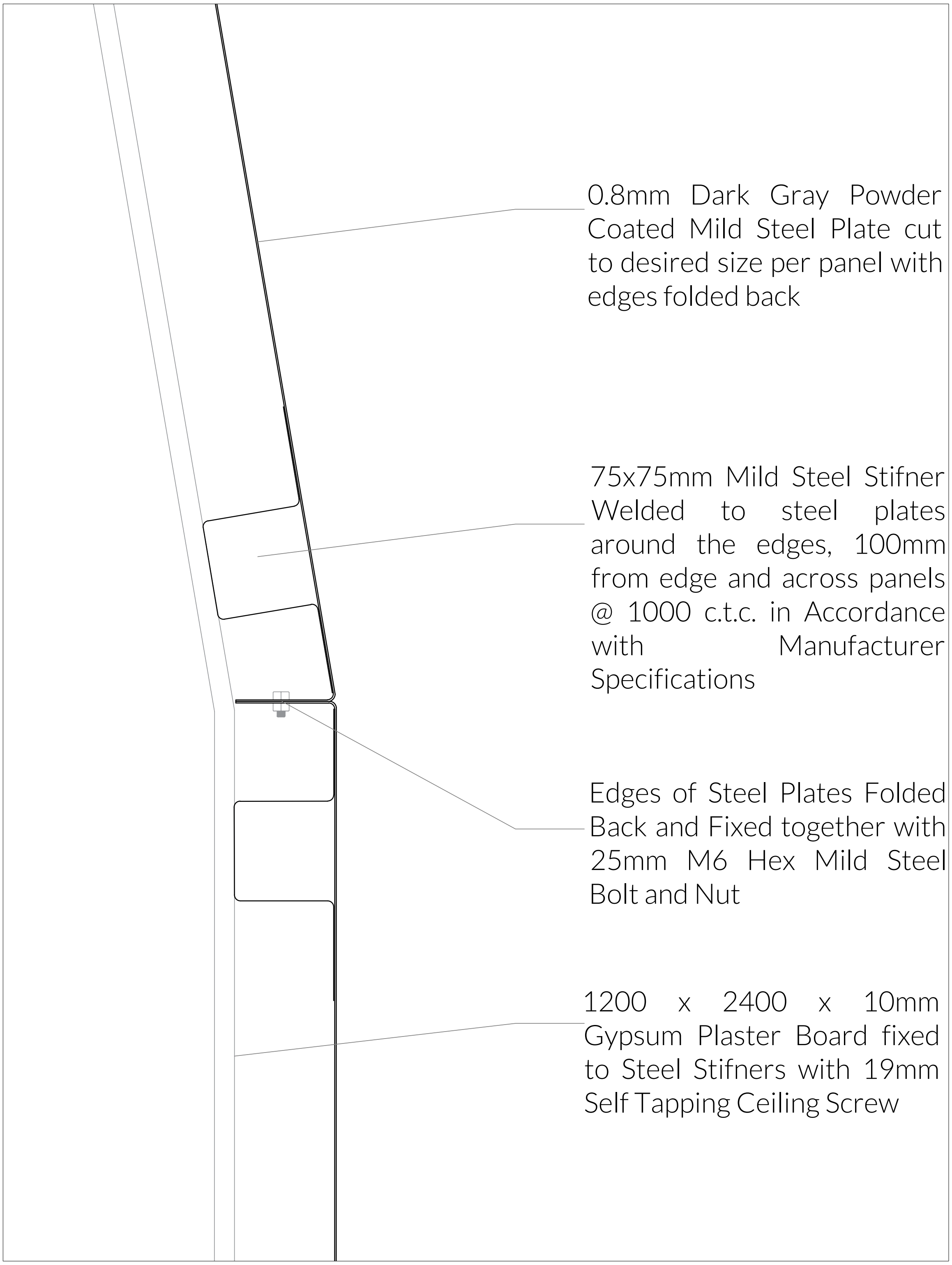
Cut trusses where new intervention is to be made



Insert 114x38 mm SA Pine strengthner beams accross section cut. One truss is added for each cut truss to carry the roof load

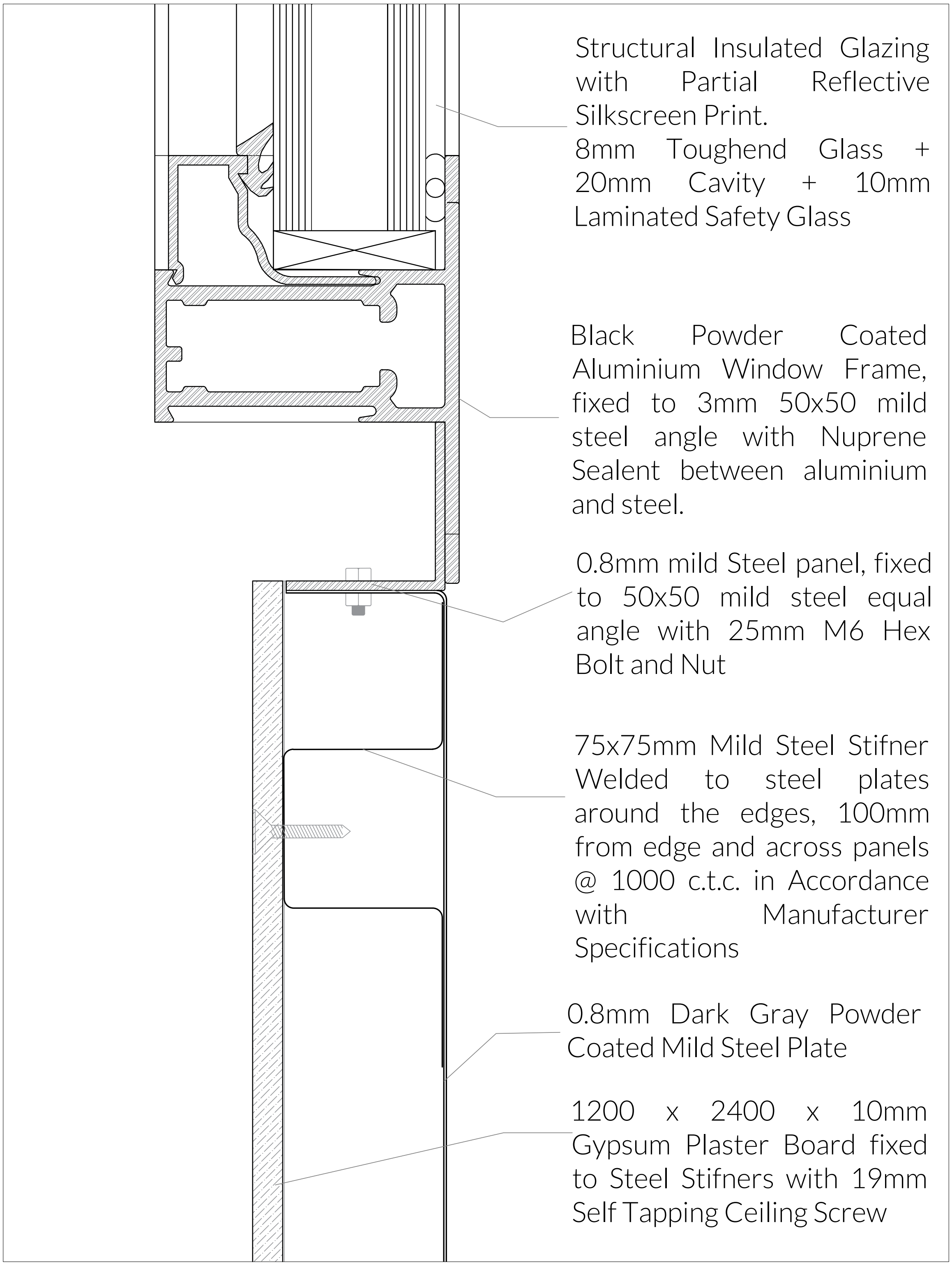


The new intervention is added without having to rely on the existing roof structure for support

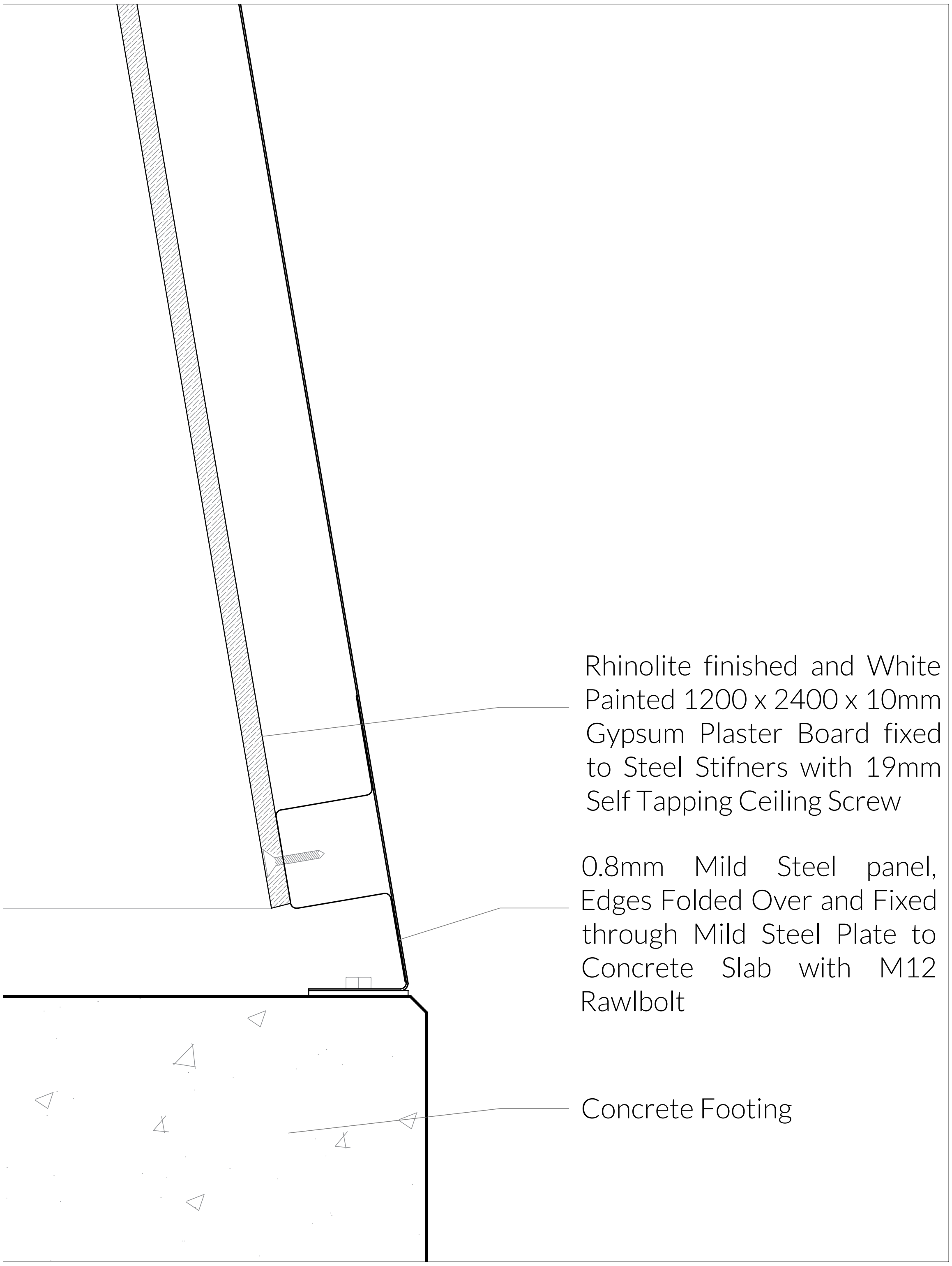



STEEL CLADDING FIXING DETAIL

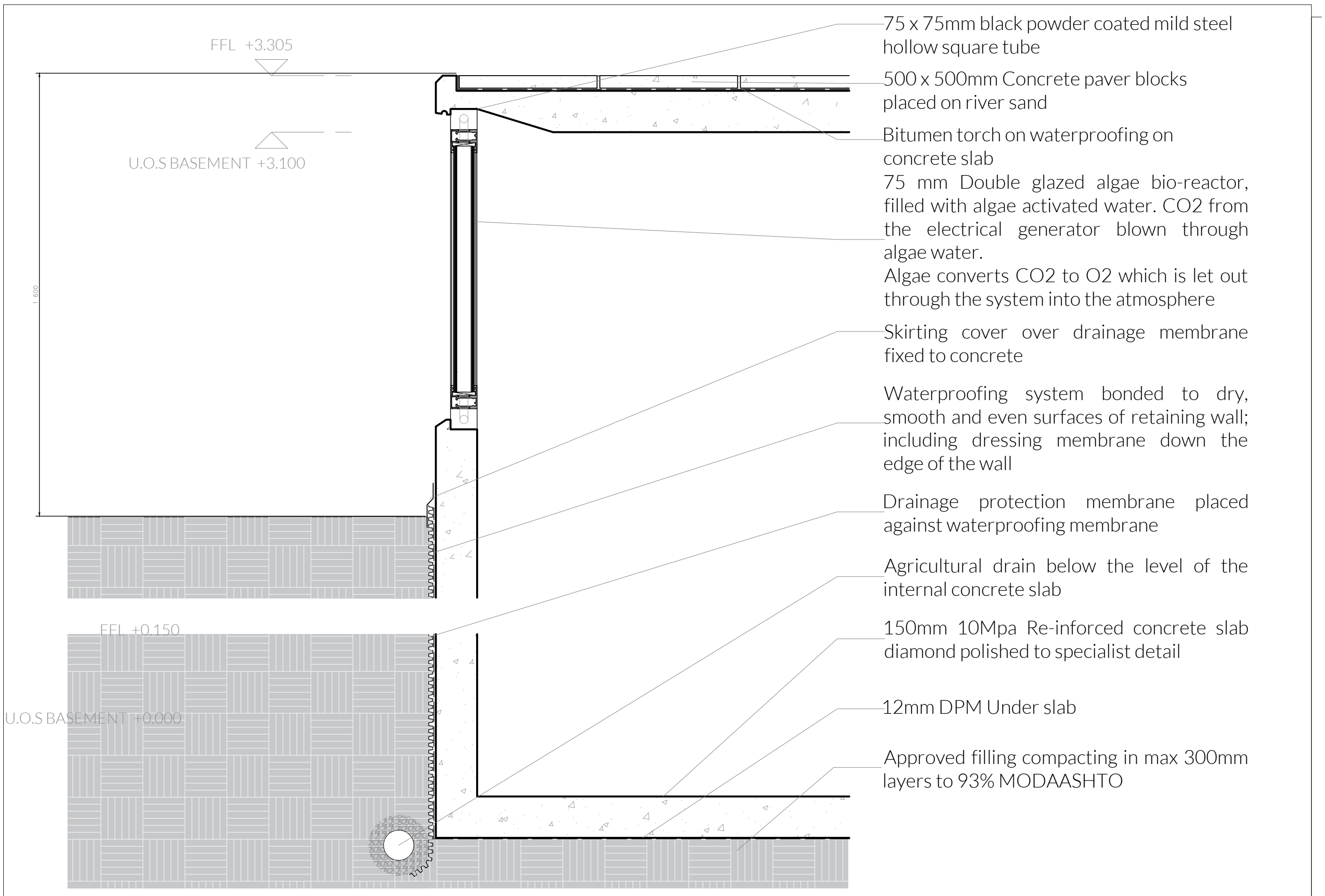
# APPENDIX A




## STEEL CLADDING GLAZING DETAIL




# STEEL CLADDING FIXING DETAIL




A ALGAE RETAINING WALL DETAIL

Scale 1:10

# INTERIOR SECTION DETAIL