Technical investigation
According to Gottfried Semper the building crafts can be classified into two fundamental procedures; namely "the stereotomics of the earthwork, the repetitions piling up of massive elements to compose volume; and the tectonics of the frame, lightweight components composed to define a spatial matrix." [Frampton, 1996:5] These two forms play a strong metaphorical role in the relationship between architecture and nature. "The tectonic or frame component has an affinity to the sky, where as the stereotomic has an affinity to the earth, dissolving there in." [Frampton, 1996:7]

Both components are further discussed in the technical investigation, with the primary focus on the tectonic component as defining character of the project.

Stereotomic
A mass concrete structure was chosen as the load bearing component of the project. Concrete is a regionally recognised material and the raw beauty of the unfinished material makes it a very expressive architectural component. The dense mass of concrete allows for a passive climate control within the building minimising energy requirements in that respect. The structure forms a skeleton framework, within which a non-load bearing internal layout can be erected as spatial requirements stipulate. The internal spaces are made more accommodating by incorporating
access floors and suspended ceilings.

The building’s structural component originates from the basement. The basement provides vehicular parking and houses the building’s plant room and respected service rooms.

The basement employs a combination tanked and infiltration system against horizontal and vertical ground water pressure. [see detail] The infiltrated water is drained to mechanical sumps, placed at selected points, and pumped into water catchment tanks to be used in irrigation. The Northern third of the basement is naturally ventilated through the perforated Western and Eastern façades.

Strategically placed extraction fan system installed along the Southern retaining wall draws fresh air from the Northern third of the basement. Water infiltration from the public square is managed via a system of drip trays, ultimately draining the water to water catchment tanks. Planters on the ground level are placed strategically above columns to carry extra load as well as allow for natural migration tendencies of the public square users.

The basement is designed to have a floor-to-ceiling height of 5,1m allowing for services to run overhead leaving a clearance height of 4,5m to admit service and emergency vehicles into the basement, as it provides facilities for deliveries and waste removal.

The entrance to the basement is on the Northern boundary of the site from Vermeulen Street. Access is governed
by security booms at the entrance to the basement. Access to the building are provided by lift and stair shafts that continue through to the various levels above.

The column grid was influenced by the interplay between the rigid grid of the city and the natural grid of the Apies River. A primary grid spacing of 8.4m x 5m x 7.5m is chosen to provide space for an economical parking layout. A 230mm x 460mm reinforced concrete column is recommended by Carl von Geyso [structural engineer, during interview with the author], as the column size meets load bearing requirements but still creates the feeling of a light connection. The reinforced two-way coffer slab has a depth of 510mm, the deeper slab is favoured to reduce the amount of steel reinforcing required.

The exhibition building being raised from the ground floor level led to the metaphorical use of a 'forest' floor with tree trunks punching through the ground carrying the canopy above. Reinforced concrete columns with a 300mm diameter is chosen for the 'concrete forest'.

The flat roof construction allows for future vertical expansion, hopefully increasing the building's overall life span. It also allows for a roof garden on the third level with a tower element punching through the floor. The large expanse of the flat roof accommodate even more water harvesting for irrigation.

Each component of the building has a dedicated service shaft with the major part of the services running within the suspended ceiling void. Passive ventilation alone in such a large building cannot create a comfortable environment for its users thus a sealed system consists of double glazed windows sealing the interior workspace with an ice pack chiller system cooling incoming fresh air. Each floor has two sub chillers one dedicated to the East half of the workspace and the other to the West. The ventilation system used for the toilets can be reversed at night to draw cold night air into the buildings ceiling voids through the use of timer controlled vents, cooling the buildings structure throughout. Reducing the amount of energy required to climatise the building during the day.
The primary focus of the tectonic investigation is the vegetated walls of the auditorium, exhibition tower and kitchen. The 'Vegetal Wall' patented by French Botanist, Patrick Blanc is investigated and an adaption of his system for our climate is proposed. The plant selection for these vegetated walls is also included in the investigation. These vegetated walls defines the projects character and is the literal interpretation of the relationship between architecture and nature.

Patrick Blanc has worked with many prominent architects; Jean Nouvel, Herzog & de Meuron to name a couple. His work can be found all over the globe. He says that plants does not soil to grow, it is purely a mechanical support. Plants only need water and the minerals that are dissolved therein, coupled with light and carbon dioxide to conduct photosynthesis.

The system Blanc employs is very simplistic in its composition. A metal frame is fixed to a structural wall, followed by a 10mm thick sheet PVC riveted to the metal frame to make the system rigid and act as the waterproofing. Two layers of rot proof nylon felt is stapled to the PVC layer. The capillary qualities of the felt allows water to travel effectively throughout the installation. The water is supplied from the top of the installation via a drip system. A carefully calculated amount of minerals and nutrients is injected into the water supply at regular intervals. The excess water drains into a trough and is pumped back to the top. Blanc places plants that are more drought hardy at the top of his installations while placing pants that enjoy more shade and moisture at the bottom. If the plant selection is done properly Blanc says that maintenance only needs to be done every two months. The cost of the installation runs at approximately R 1450.00 p/m² excluding plant selection and labour.
The proposed adaptation of Blanc's 'Vegetal Wall' has the following additions:

- The PVC sheet is reduced to a 5mm thickness, effectively halving the cost and weight of the installation.
- A coarse weave nylon shade netting is sandwiched in between the two nylon felt layers to accommodate a thicker rooted plant selection.

These proposed additions to Blanc's system should make habitation for the plant selection in the South African climate more manageable.

Fig. 107 top detail of green wall not too scale
Fig. 108 bottom detail of green wall not too scale
Fig. 109 prototype and exploded axo of green wall system layers
Fig. 110 plant selection for green walls: (top l to r)
  - south facing and interior walls: adiantum capillus-veneris, maidenhair fern, pteris vittata, banded fern, clivia miniata, clivia imperatiens, hochstetteri, subsp. hochstetteri, wild impatiens, zantedeschia aethiopica, white arum lily, plectranthus fruticosus, forest spurflower
  - north, east and west facing walls: dimorphotheca cuneata, bride's bouquet, lampranthus coccineus, red vygie, helichrysum splendidum, cape gold, drosanthemum speciosum, red ice-plant, archthotheca calendula, cape marigold, carpobrotus edulis, sour fig, asparagus densiflorus 'sprengeri', emerald fern.
The plant selection for the vegetated walls need to be made carefully, taking into consideration the orientation, water and sunlight requirements. Only indigenous plants have been considered for the plant selection. The following plants are recommended by De Wet Louw [landscape architect, during interview with the author];

The North and East facing walls need plants with a tolerance for direct sunlight and that require little to moderate watering are selected.

The West facing walls need plants that can survive the harsh heat of the afternoon sun.

The South facing and interior walls are ideal for plants that require more water and less sunlight.
Materials

The material choices for the project are influenced by the colours and textures of the site as well as the need for the materials to be hard wearing and require low maintenance.

Concrete

Concrete denotes permanence. An unfinished off-shutter finish allows the material to manifest in a natural, raw state. This heavy, dense material forms a strong metaphorical bond with the earth, anchoring the building firmly to the ground.

ECOwood

ECOwood is a wood composite material and is manufactured from a recycled polymer, such as PVC and scrap wood shavings. The end product looks like wood but it lasts longer and needs no maintenance. The product can be bent on site, considering the radius is not too small, by heating the planks with a gas oven to 80°C.

Fig. 111 colours and textures of the site
Glazed ceramic blocks

The purpose made glazed ceramic block façade pays homage to Norman Eaten, mirroring his perforated brick façade of The Technical University of Tshwane’s science campus. The glazing on the faces of the blocks creates an impermeable surface, making the blocks hard wearing requiring little maintenance and adding an attractive sheen to the block’s base colour.

Stainless steel mesh

Stainless steel mesh manufactured by the GKD group is used as an attractive solar screen on the Northern and Western façades. The mesh has a 40% opening ratio adding to the solid appeal of the building during the day and illuminating the exterior at night.
Technical documentation
Fig. 112 basement parking not too scale

Fig. 113 detail a not too scale
Fig. 114 ground floor not too scale

- purpose made stainless steel support bolted to concrete slab
- 800 x 800mm pre-cast concrete block placed on 100mm thick rubber deck
- min 25mm concrete floor with HBE waterproofing or any other approved waterproofing, tail to fallers
- 100mm in-situ concrete surfac slab as per engineer
- GRC, coated solar screen fixed to stainless steel angle
- stainless steel angle fixed to stainless steel support
- stainless steel support bolted to concrete slab
- aluminium clad panel for ventilation
- double glazed curtain wall

Fig. 115 detail b not too scale
Fig. 116 first floor not too scale

Fig. 117 detail c not too scale
Fig. 118 detail d not too scale
stainless steel cable tensioners
5mm thick nautical cable
purpose made steel column coated with zinc oxide and finished with 3 x coats of weatherproof paint
double glazed aluminium window frame
EARTHBOX
ECOWOOD decking riveted to 100 x 50mm rectangular tubing

Fig. 119 second floor not too scale

Fig. 120 detail e not too scale
Fig. 121 third floor not too scale

Fig. 122 detail f not too scale
Fig. 123 roof plan not too scale

Fig. 124 axonometric of ceramic blocks not too scale
Fig. 125 north & south elevations not too scale

Fig. 126 detail g not too scale
Fig. 127 axonometric of screen not too scale
Fig. 132 section aa not too scale
Fig. 133 detail k not too scale
Fig. 134 axonometric of vegetal wall not too scale
Fig. 137 section cc not too scale

Fig. 138 detail m not too scale
Fig. 139 section dd not too scale

Fig. 140 detail n not too scale
Fig. 141 section ee not too scale

Fig. 142 detail p not too scale
510mm in-situ concrete coffer slab as per engineer

Ceiling boards skimmed with RHINOLITE, and finished with a coat of universal undercoat and 3x coats PLASCON DOUBLE VELVET, or any other approved

Ceiling ties fixed to concrete slab

12mm thick NUTECH ceiling board

Warm white neon strip lighting

Ceiling boards skimmed with RHINOLITE, and finished with a coat of universal undercoat and 3x coats PLASCON DOUBLE VELVET, or any other approved

Double glazed aluminium window frame

Fig. 143 section ff not too scale

Fig. 144 detail q not too scale
Fig. 145 section gg not too scale