approach to the hydroponic factory to the market

chapter seven

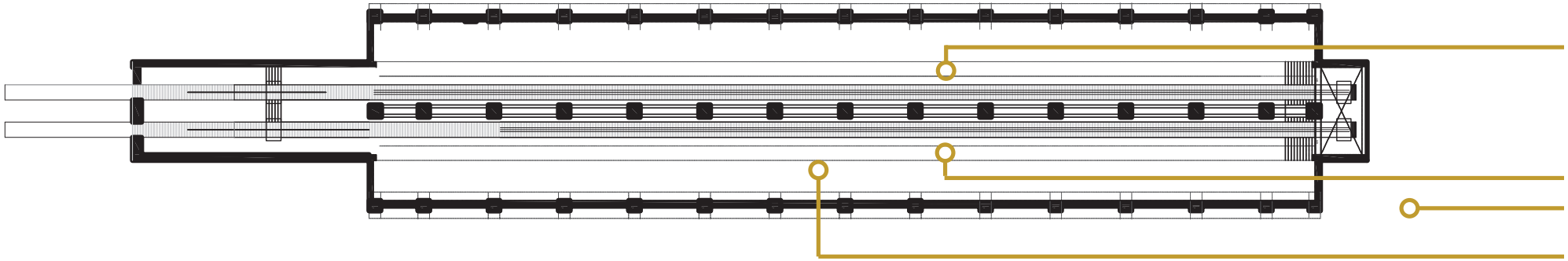
design conclusions

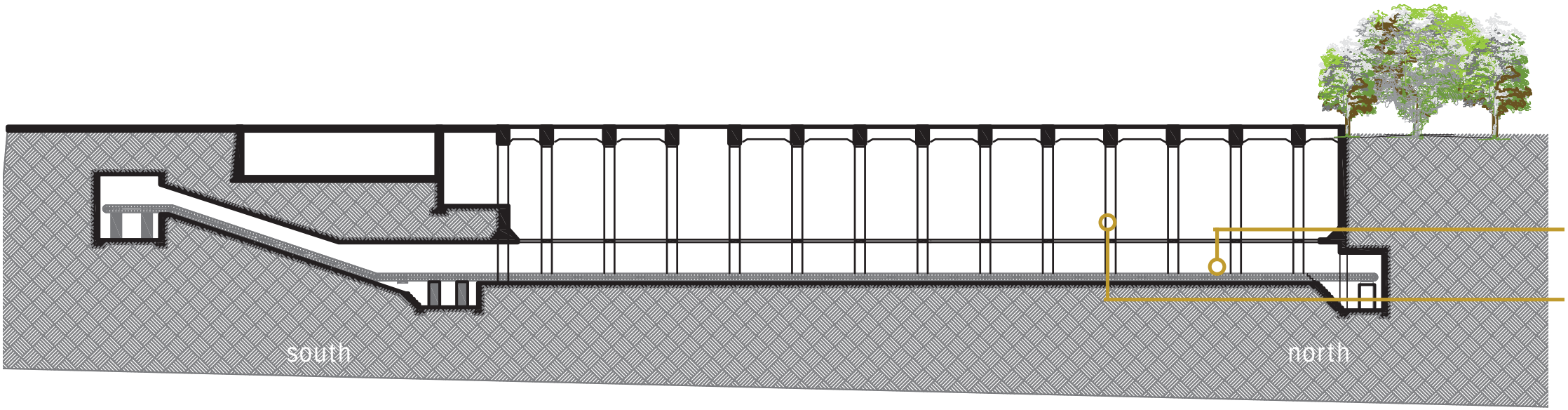
The new design fulfills the principle aim of the project: it creates an interface that closes the proximity between industry and the urban environment. Because of this, the design aids in the development of a sustainable, resource-efficient and productive culture for Pretoria West and the greater Pretoria also. This aim is fulfilled by drawing closer the legacy of 20th century autonomous industry to the future of 21st century hybrid urban industry through the program of vertical and urban agriculture. The design is also prototypical in program and use of new materials.

There is great opportunity in the further development of this project, in many fields of specialisation - from engineering, building energy design to new building technology for South Africa. This project aims to be a starting point for debate, research and innovation.

Through the new role of architecture as producer, the new design illustrates the harmony of a social urban landscape, industry or productive process and the natural environment - one building illustrating the proximate conditions needed between man, technology and the environment to develop a positive, evolved urban society for the 21st century.

Figures 142: productive urban landscapes
[author, 2010]




north
south
north

existing underground

Figure 143: Typical lowest level of the bunker [author, 2010].

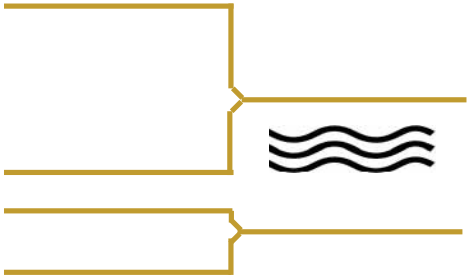
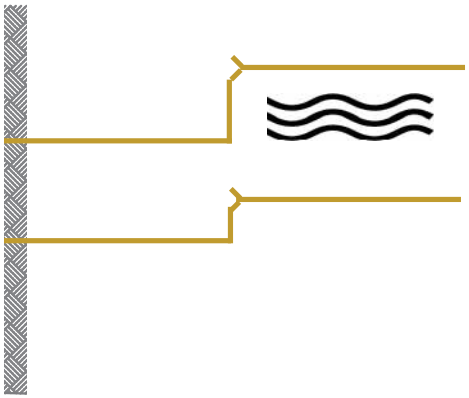
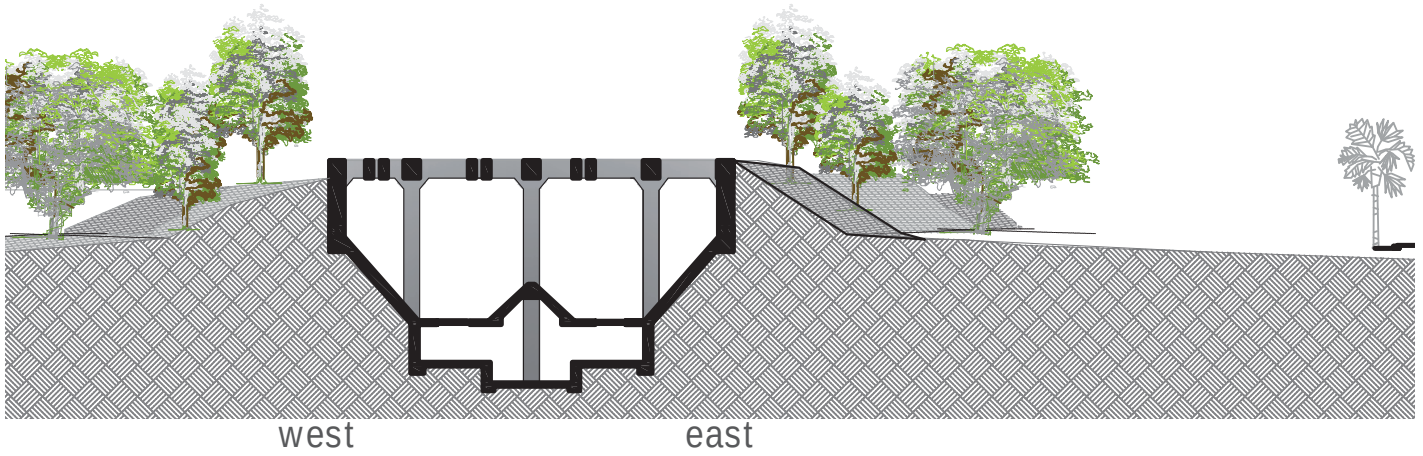
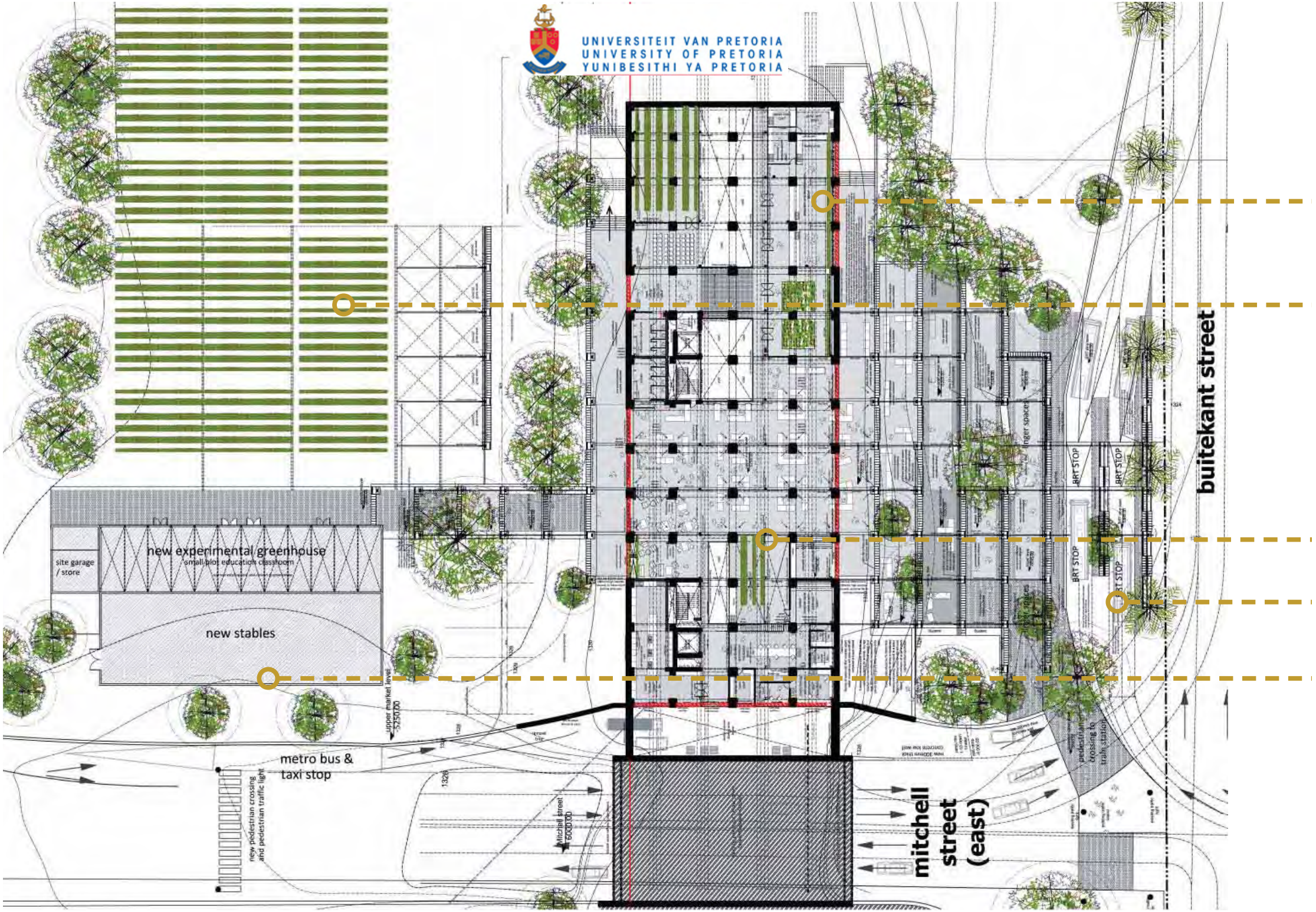


Figure 144 (opposite) & 145 (right): typical section of the bunker [author, 2010].



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new experimental greenhouse
small plot education classroom
site garage / store
new stables
upper market level 525000
metro bus & taxi stop
new pedestrian crossing and pedestrian traffic light
mitchell street 600000
mitchell street (east)
buitekant street
BRT STOP
BRT STOP
BRT STOP
BRT STOP
finger spaces
pedestrian crossing to train station

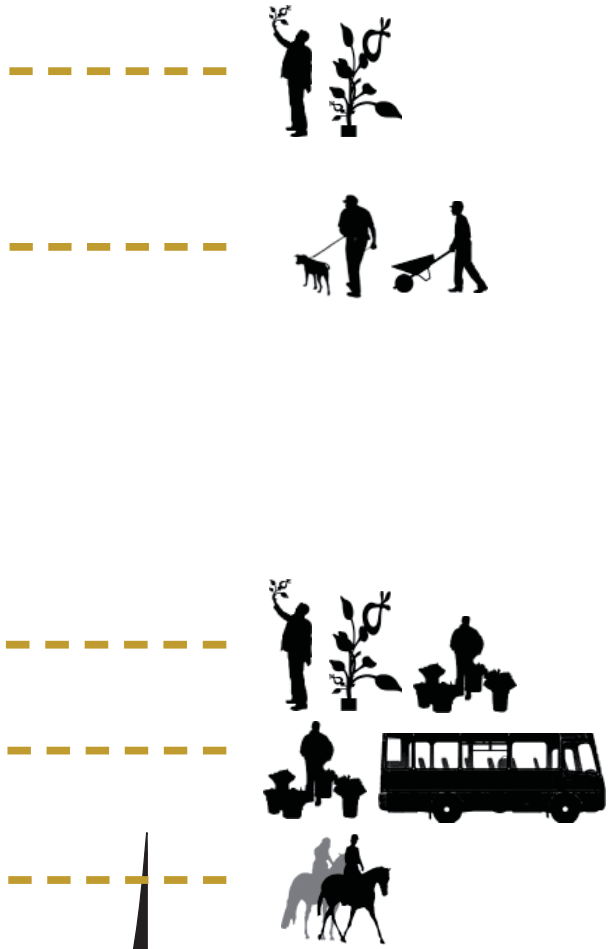
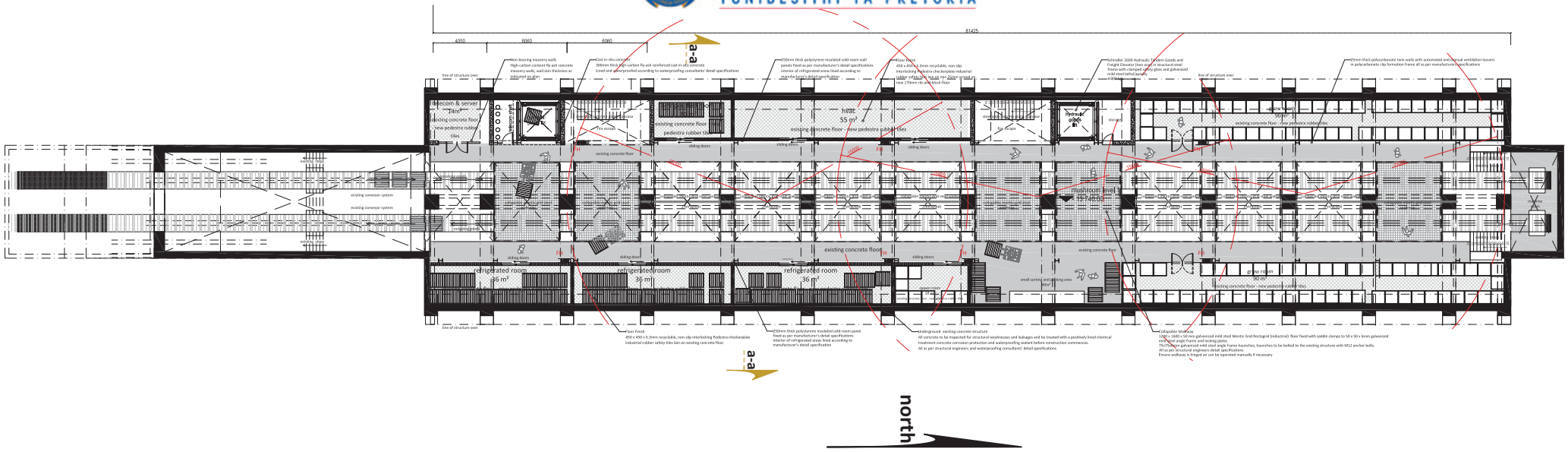
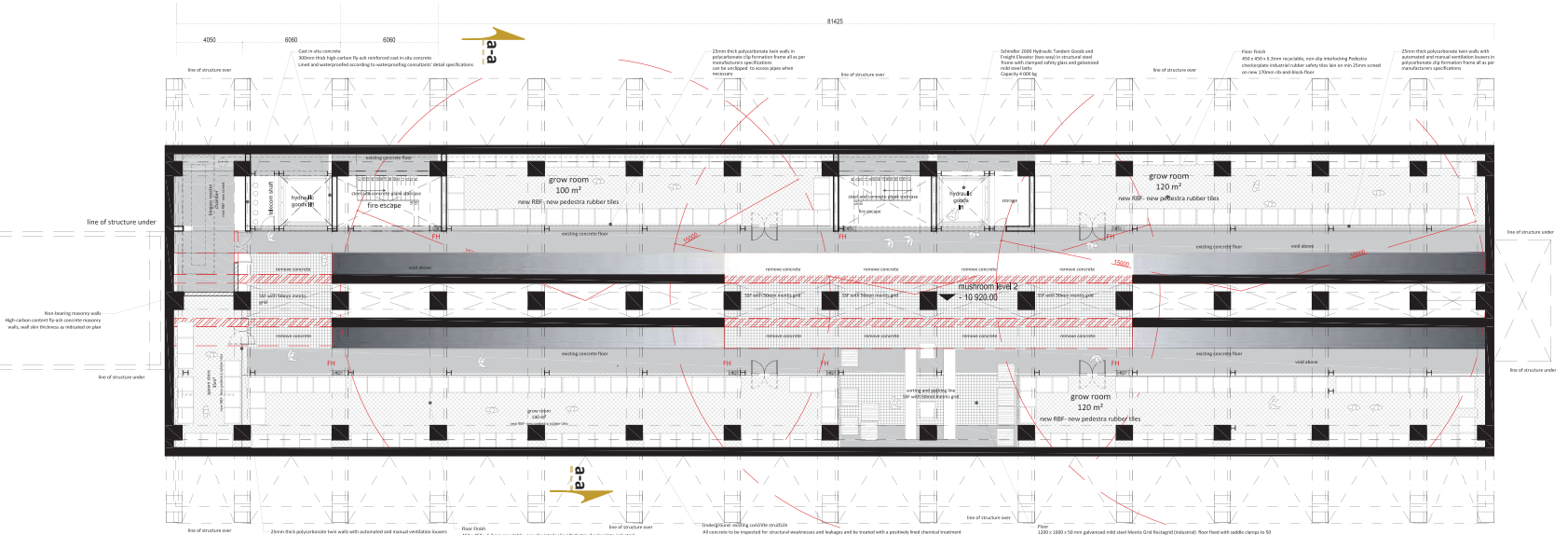
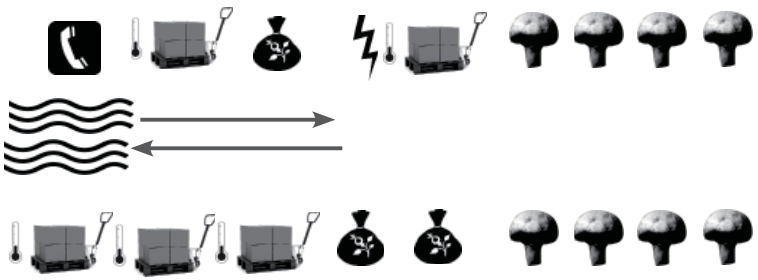


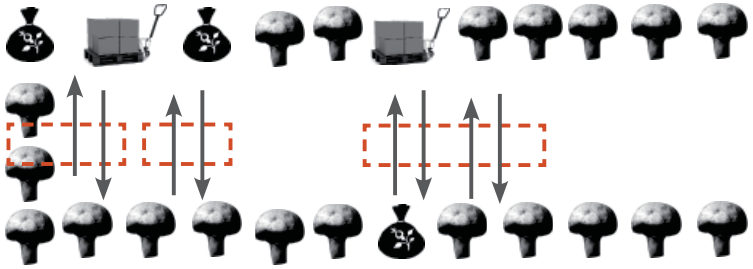
Figure 146: Greater site plan [author, 2010].


81425
4050
6060
6060
a-a
mushroom level 1
- 10 420.00
refrigerated room
36 m²
refrigerated room
36 m²
refrigerated room
36 m²
existing concrete floor
grow room
30 m²
existing concrete floor - new pedestra rubber tiles
north


81425
4050
6060
6060
a-a
grow room
100 m²
new RBF- new pedestra rubber tiles
grow room
120 m²
new RBF- new pedestra rubber tiles
mushroom level 2
- 10 920.00
grow room
120 m²
new RBF- new pedestra rubber tiles
line of structure under
line of structure under

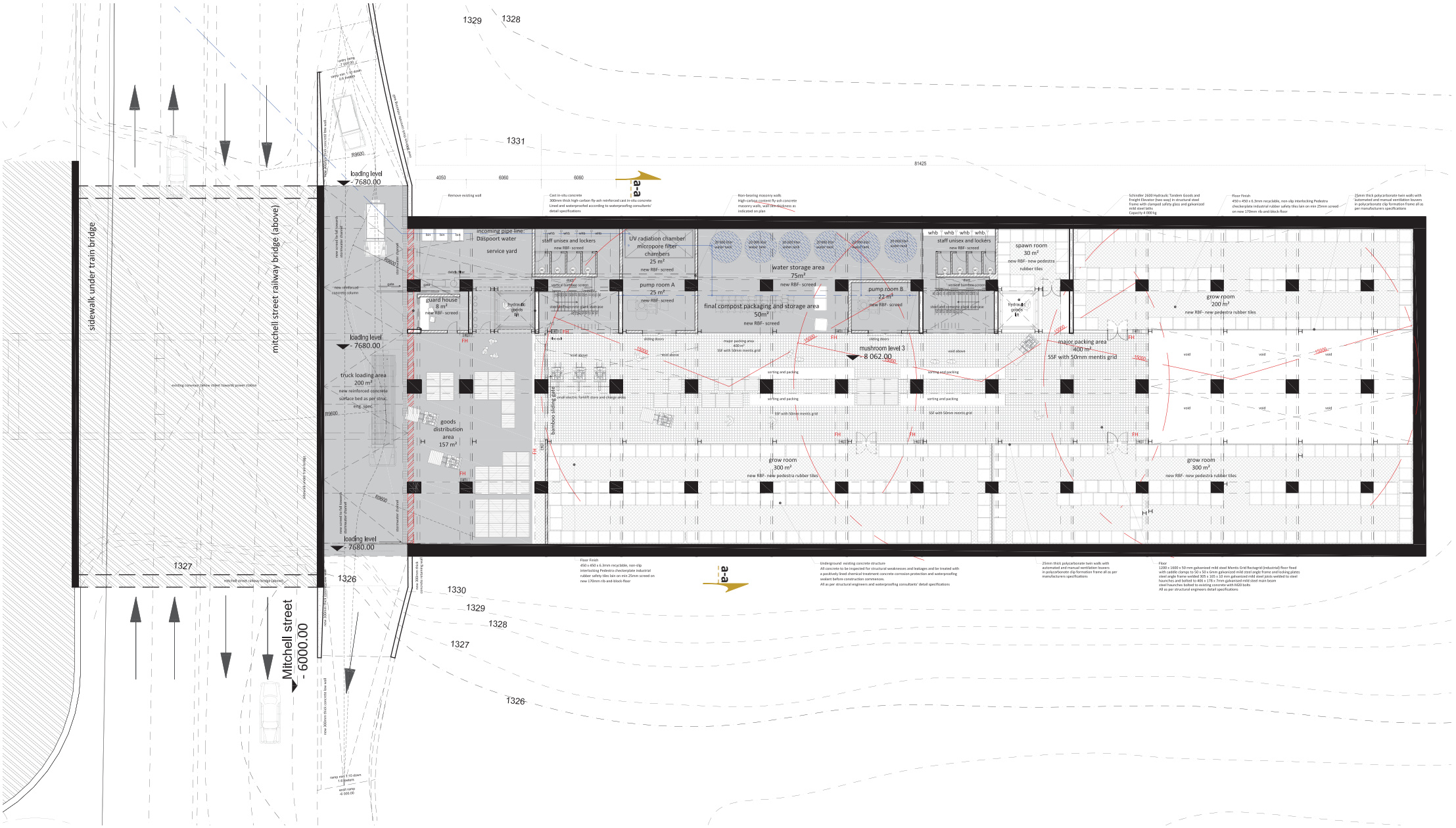


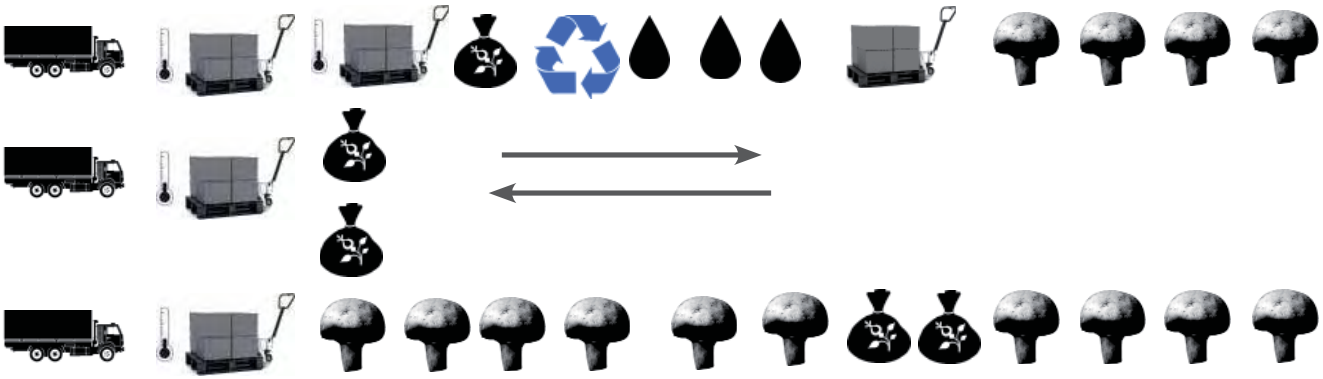
mushroom level one
n.t.s.



mushroom level two
n.t.s.

Figure 147: Basement plans part one [author, 2010].

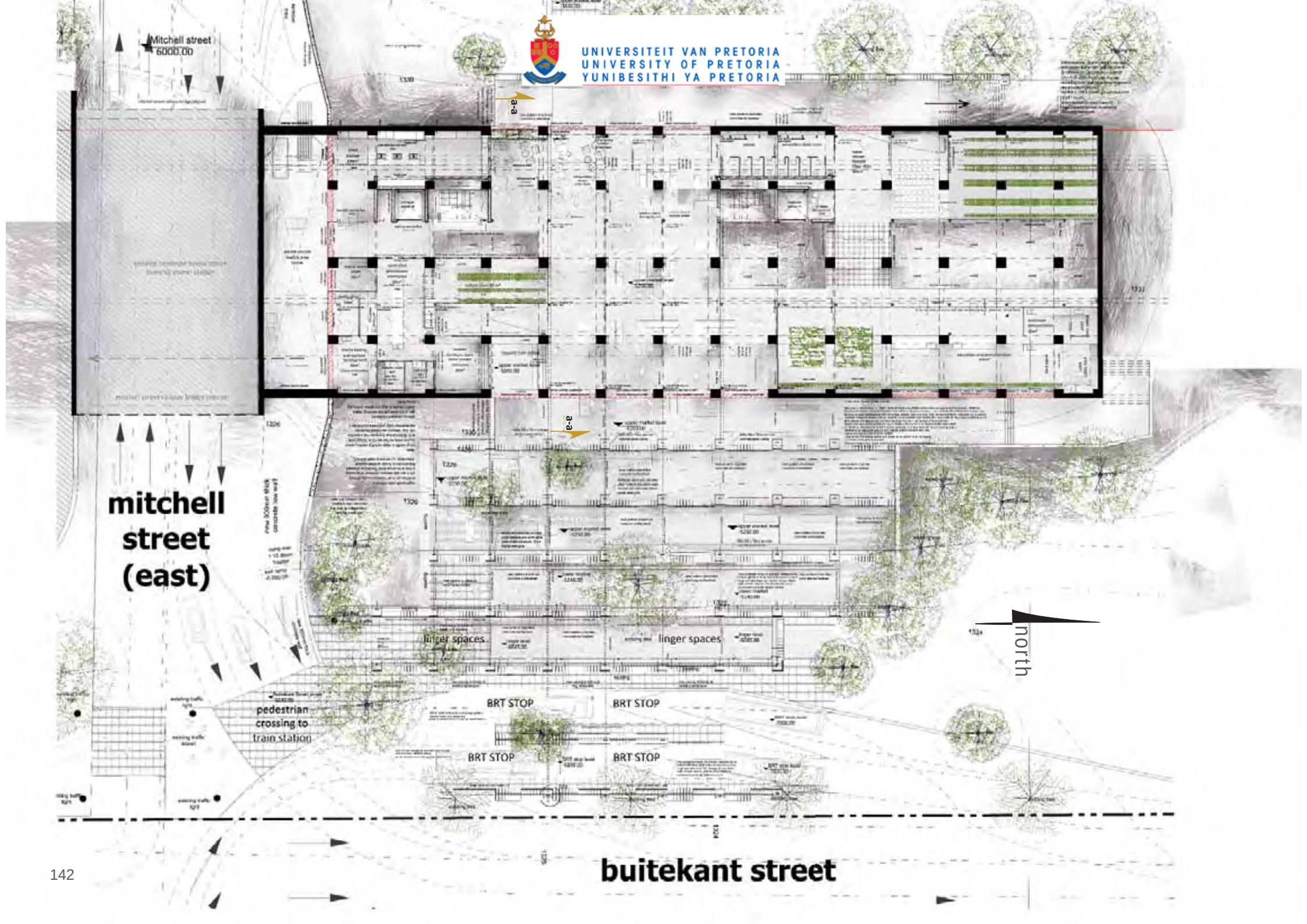

sidewalk under train bridge
mitchell street railway bridge (above)
Mitchell street
- 6000.00
loading level
- 7680.00
loading level
- 7680.00
loading level
- 7680.00
incoming pipe line:
Daspoort water
service yard
staff unisex and lockers
new RBF- screed
UV radiation chamber
micropore filter
chambers
25 m²
new RBF- screed
water storage area
75m²
new RBF- screed
staff unisex and lockers
new RBF- screed
spawn room
30 m²
new RBF- new pedestra
rubber tiles
guard house
8 m²
new RBF- screed
pump room A
25 m²
new RBF- screed
final compost packaging and storage area
50m²
new RBF- screed
pump room B
22 m²
new RBF- screed
mushroom level 3
- 8 062.00
grow room
200 m²
new RBF- new pedestra rubber tiles
truck loading area
200 m²
new reinforced concrete
surface bed as per struc.
eng. spec
goods
distribution
area
157 m²
major packing area
400 m²
SSF with 50mm mentis grid
grow room
300 m²
new RBF- new pedestra rubber tiles
grow room
300 m²
new RBF- new pedestra rubber tiles
a-a
a-a
1329
1328
1331
1327
1326
1330
1329
1328
1327
1326



mushroom level three

n.t.s.

Figure 148: Basement plans part two [author, 2010].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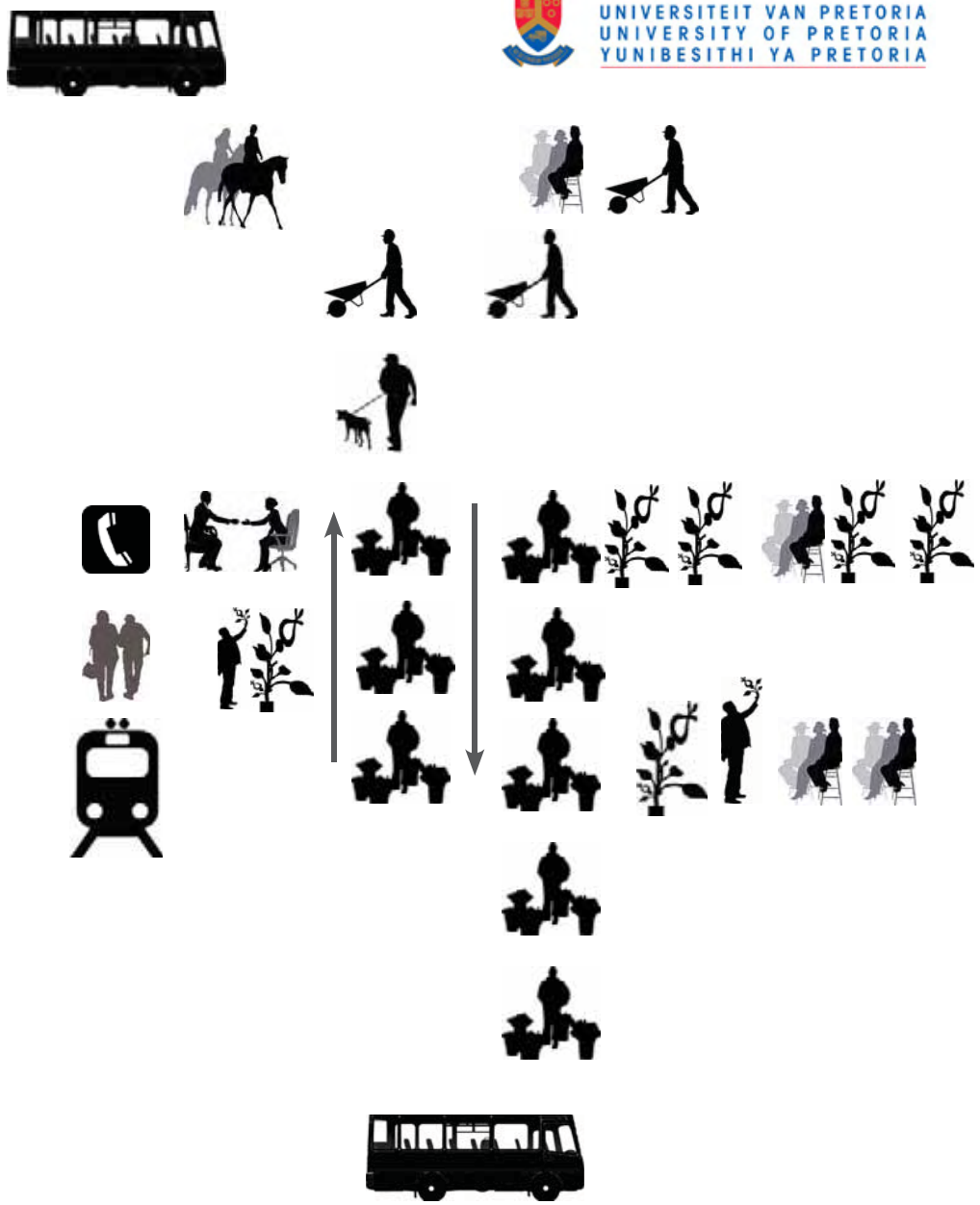
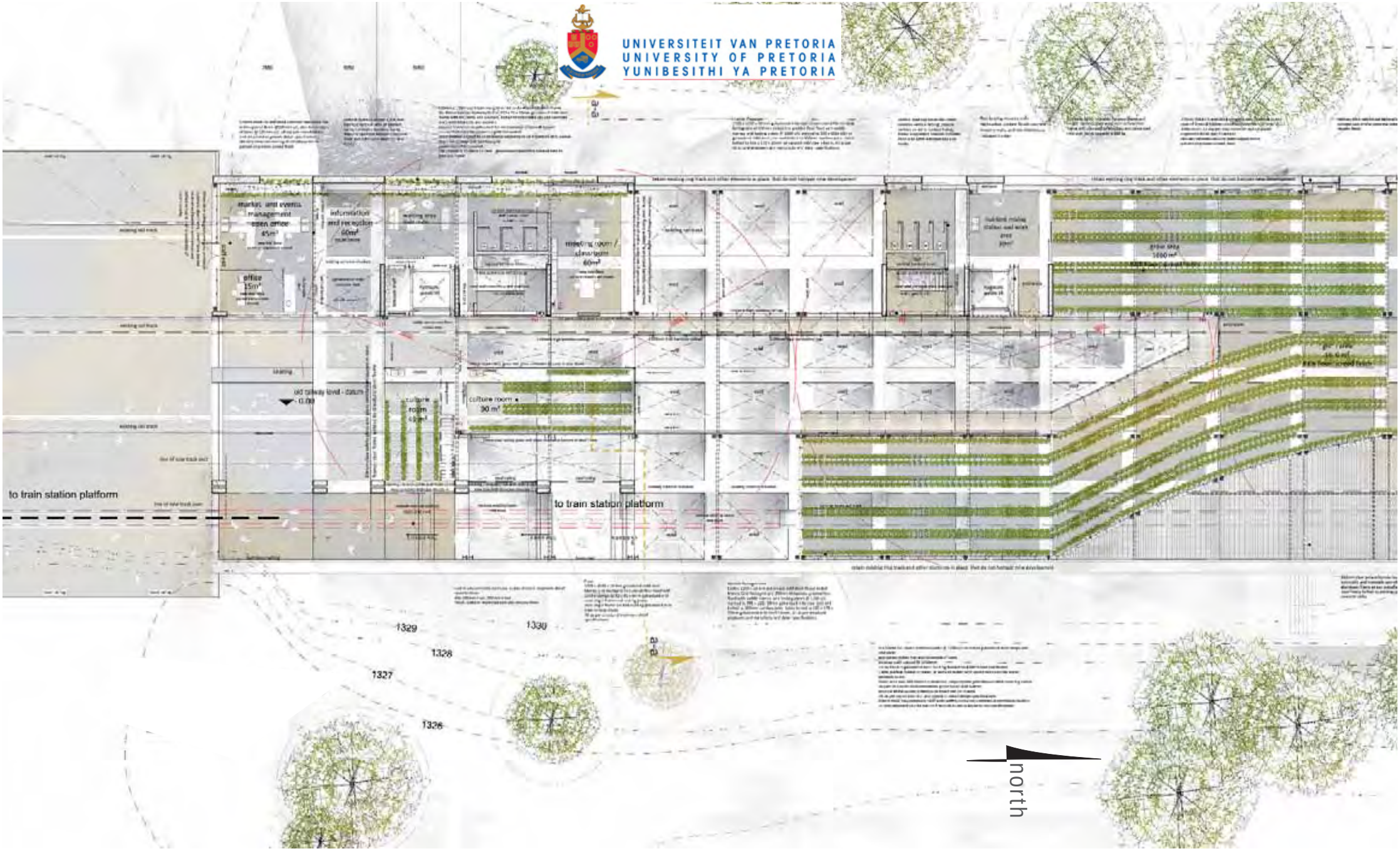
Mitchell street
6000.00
a-a
a-a
mitchell
street
(east)
linger spaces
linger spaces
north
pedestrian
crossing to
train station
BRT STOP
BRT STOP
BRT STOP
BRT STOP
buitekant street



market level

n.t.s.

Figure 149: Public plane [author, 2010].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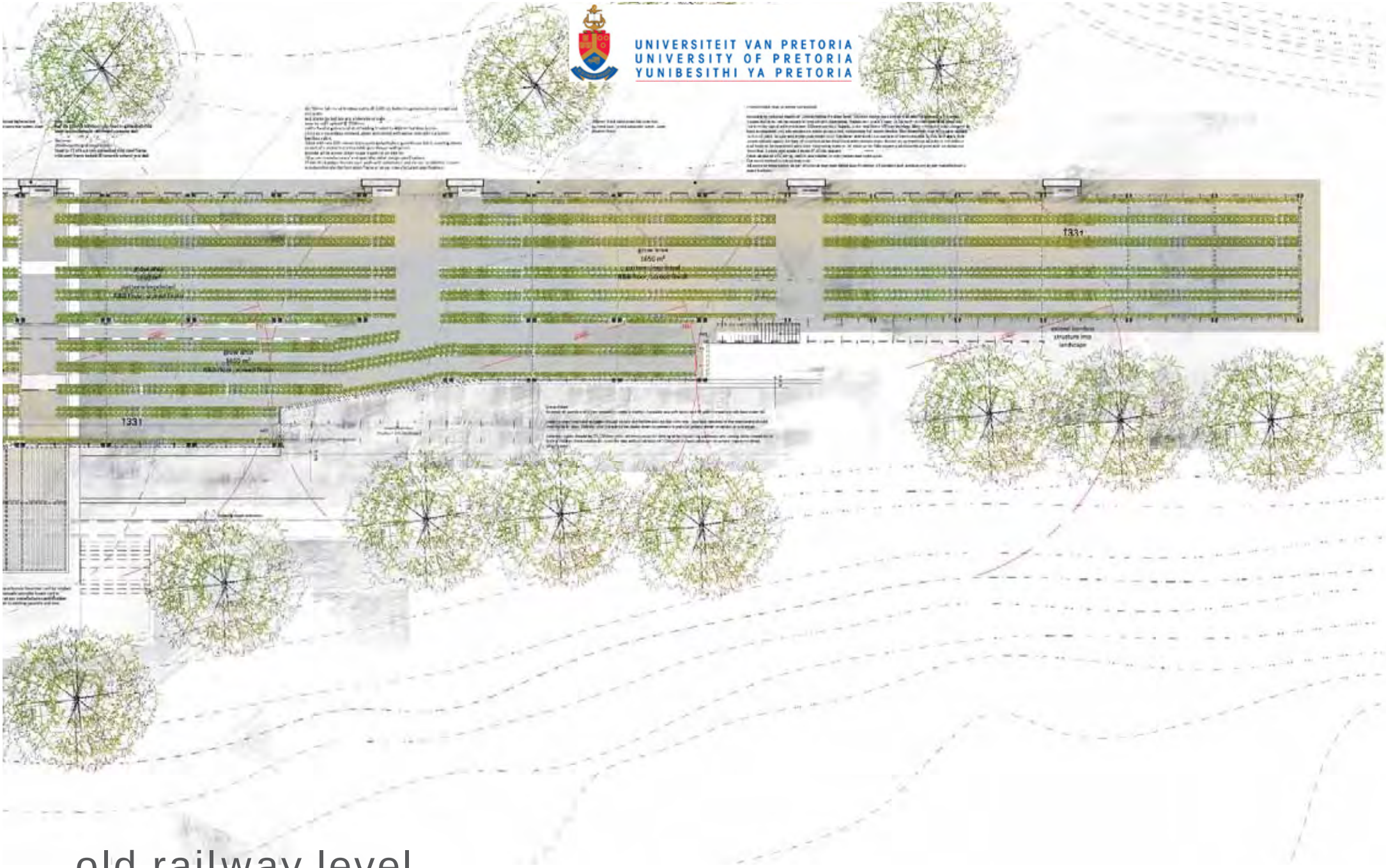
to train station platform
to train station platform
1329
1330
1328
1327
1326
north

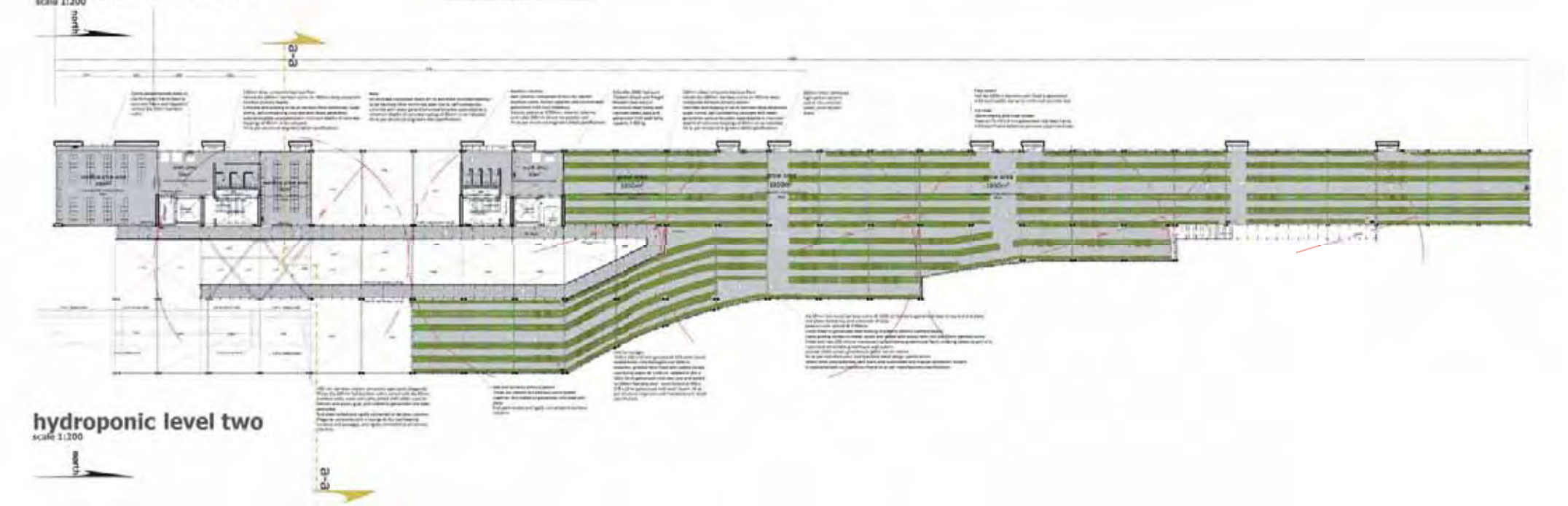


old railway level

n.t.s.

Figure 150: New plane part one. [Author, 2010].

hydroponic level one
scale 1:200



hydroponic level two
scale 1:200

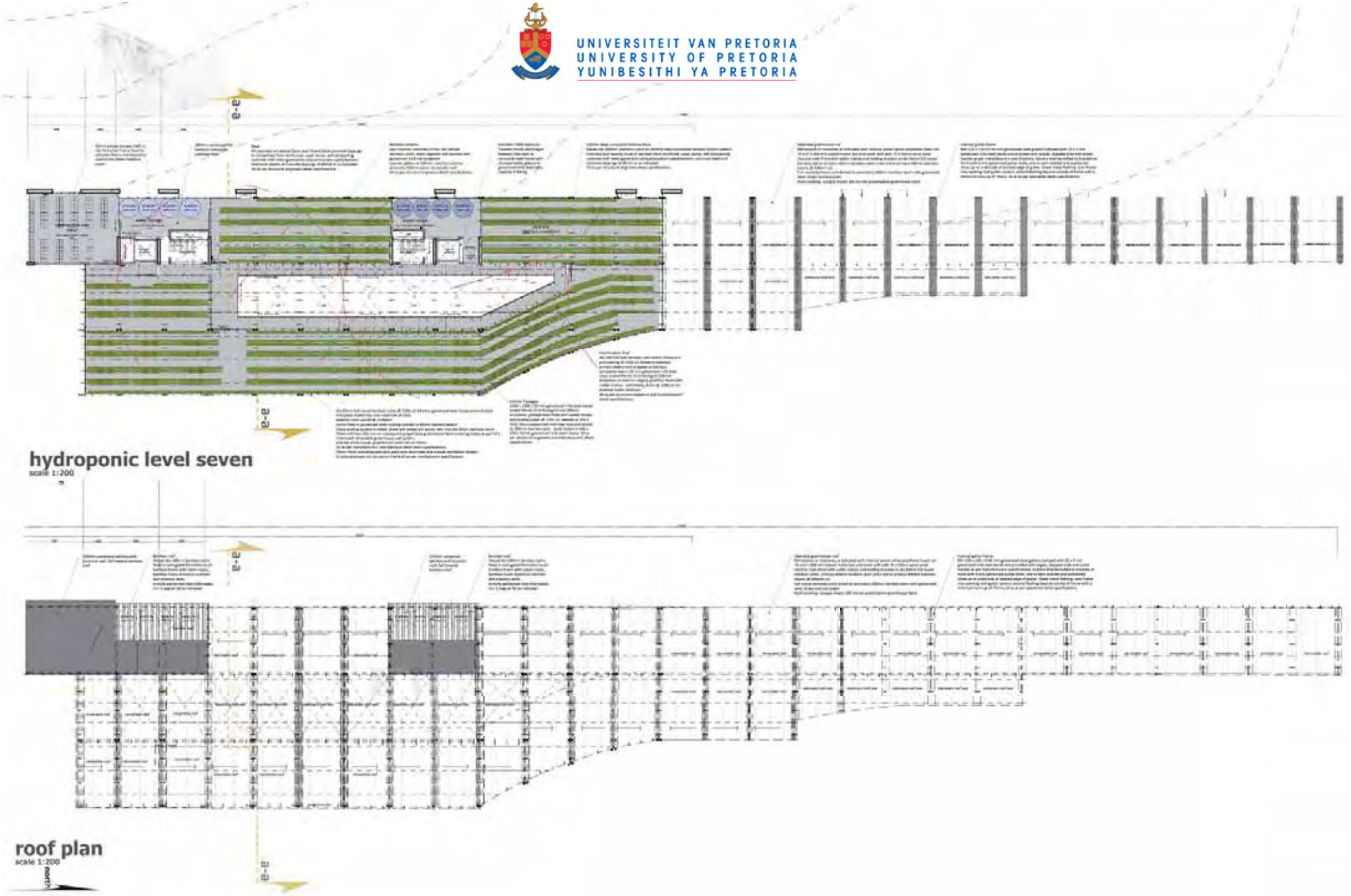


Figure 151a, 151b (opposite) and 152a, 152b (above): New plane part two. [Author, 2010].

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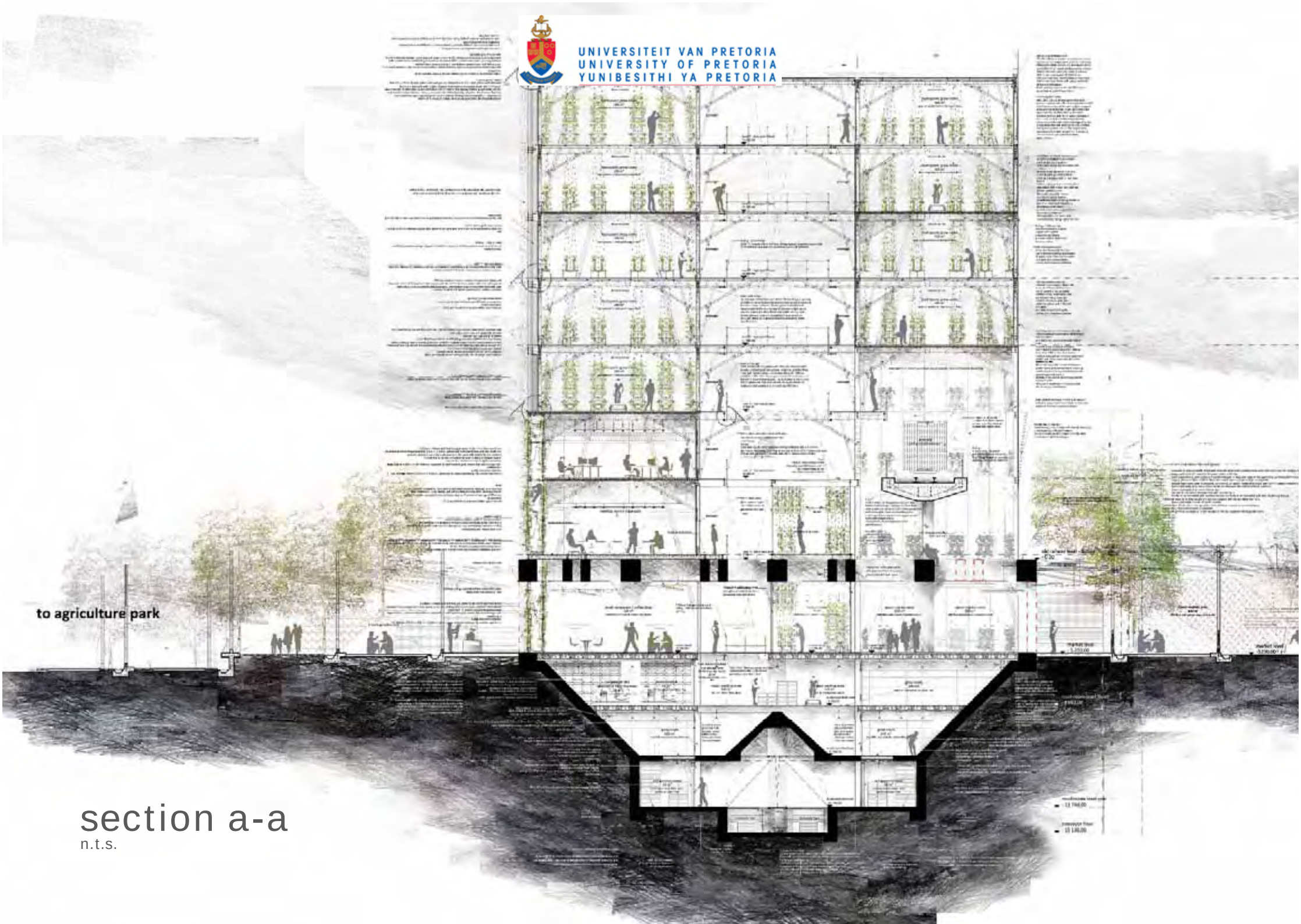

section a-a

n.t.s.

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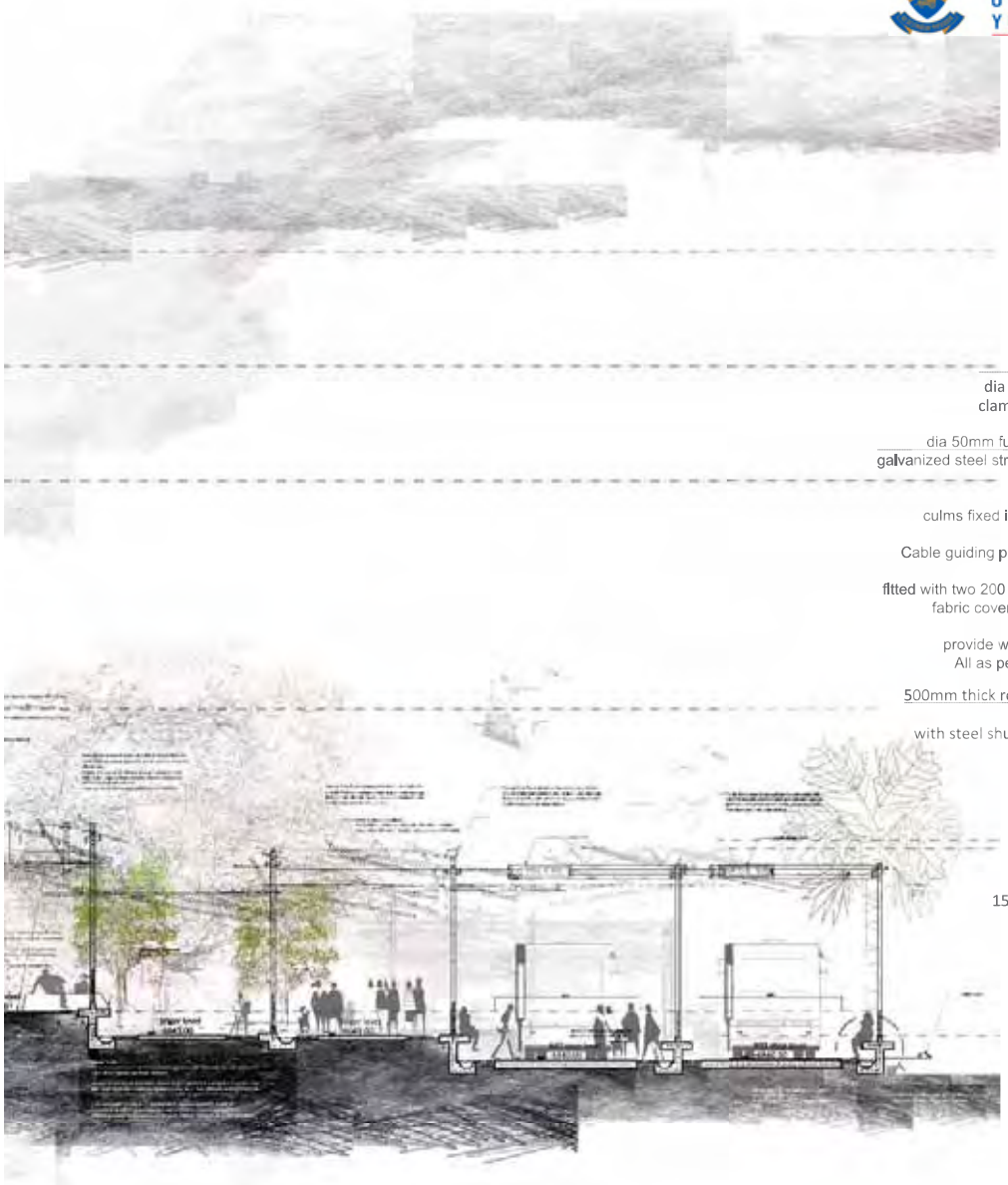
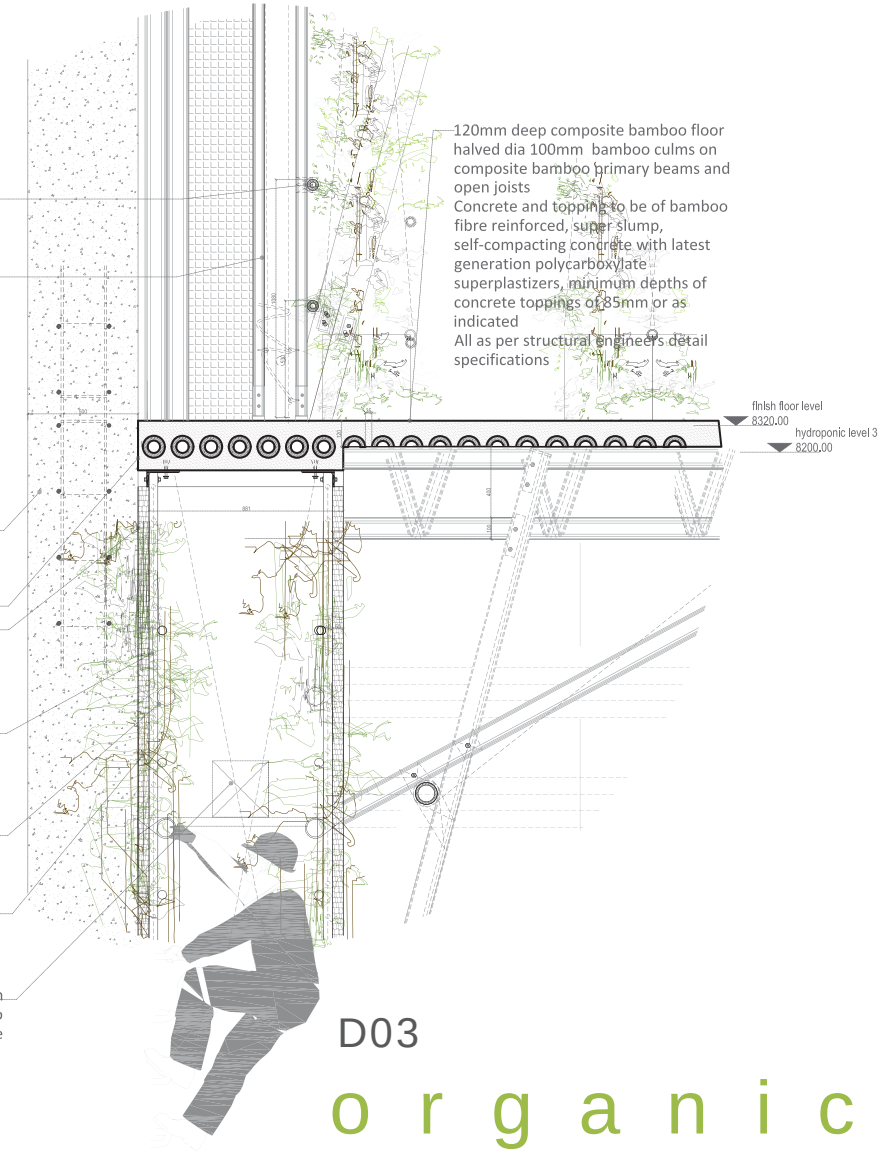
living building





Railing - 1100mm high
dia 50mm bamboo railings clipped with saddle clamps to dia 50mm bamboo vertical full round bamboo culms
dia 50mm full round bamboo culms @ 1200 c/c bolted to galvanized steel straps and end plate, end plates bolted top and underside of slabs
exterior culm spliced @ 3700mm
culms fixed in galvanized steel holding bracket to 400mm bamboo beams
Cable guiding pulleys screwed, glued and sealed with epoxy resin into dia 50mm bamboo culms
fitted with two 200 micron translucent polyethylene greenhouse fabric covering sheets as part of a motorized retractable greenhouse wall system
provide white woven greenhouse insect net on interior
All as per manufacturers' and specialist detail design specifications
500mm thick reinforced high-carbon content fly-ash cast in-situ concrete wall
with steel shuttering finish all as per structural engineer detail specification
225mm full bamboo composite floor edge
dia 40mm bamboo frame bolted to 150 x 75 x 10mm galvanized mild steel frame with M12 bolts and washers, bolted to concrete slabs and concrete walls with M16 bolts and washers
150mm x 150mm split bamboo grid wired to interior frame can be unhooked for maintenance of biowall system
ensure that entire structure is rigidly connected
dia 80mm bamboo ladders
strap 150mm x 50mm thick rockwool segments to split bamboo grid, weave drip lines through split bamboo grid
plants rooted to rockwool
clip 160mm. 225mm x 225mm x 112mm greenhouse reversible exhaust fans to bamboo frame

120mm deep composite bamboo floor halved dia 100mm bamboo culms on composite bamboo primary beams and open joists
Concrete and topping to be of bamboo fibre reinforced, super slump, self-compacting concrete with latest generation polycarboxylate superplastizers, minimum depths of concrete toppings of 85mm or as indicated
All as per structural engineers detail specifications

D03

organic technology

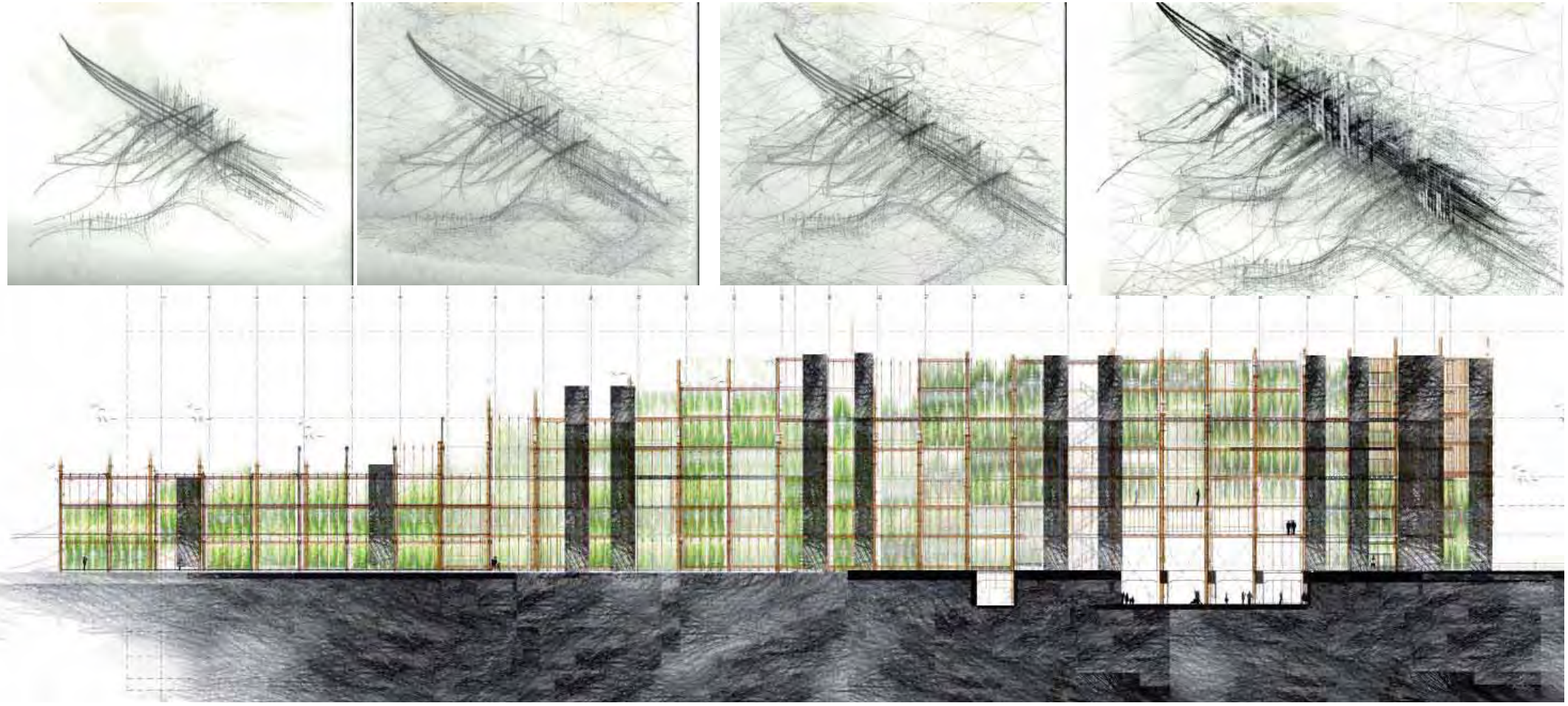


Figure 154 (top) and Figure 155 (middle): From concepts to result [author, 2010].

Development on the concept of the living building towards the resulting concrete expression of the research investigation and a singular form of architecture - the hydroponic food factory. Drawing above shows the heavier western facade.

conceptual development

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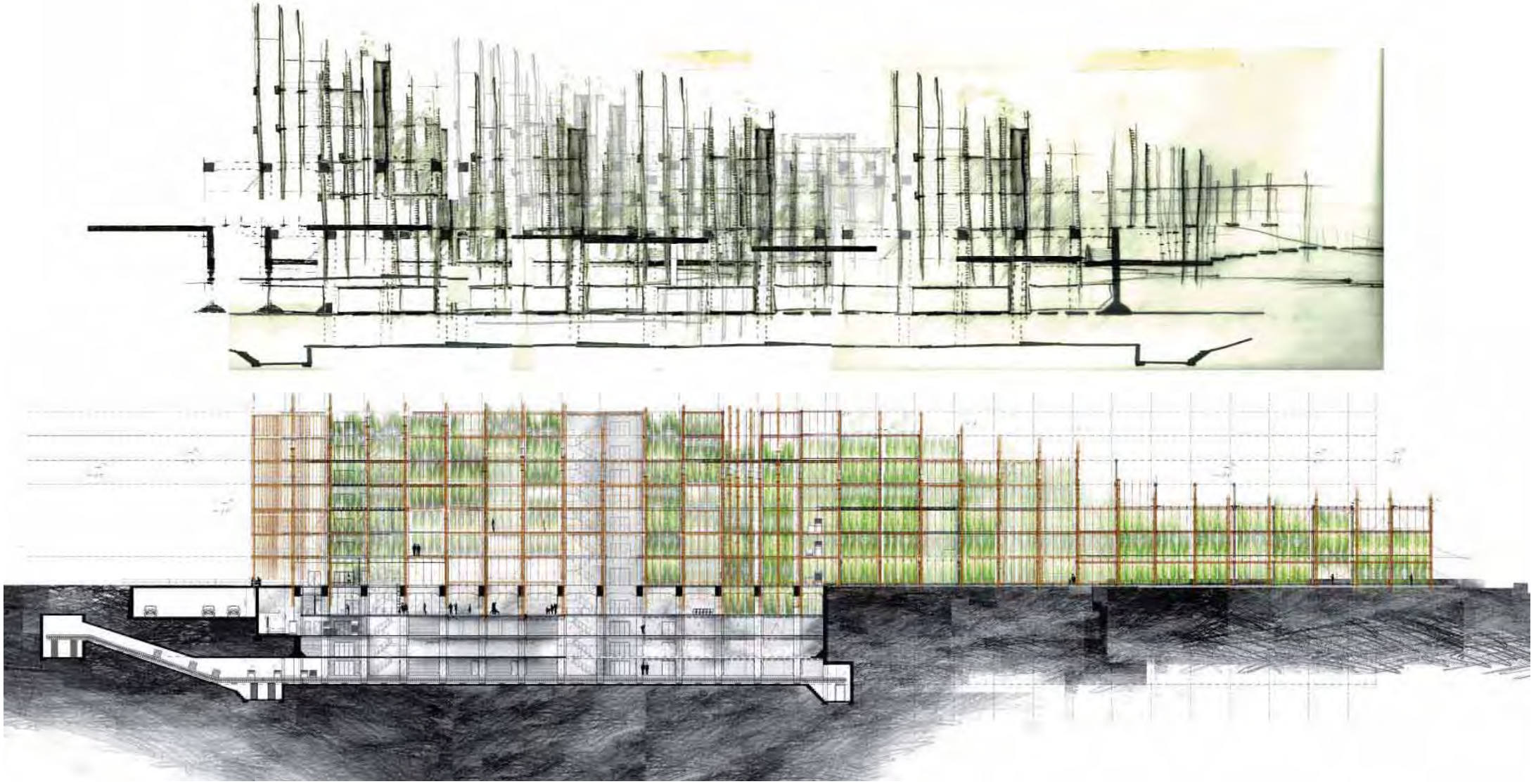
retractable skins



concrete results

Figure 156 (top) and Figure 157 (middle): From concept to result [author, 2010].

Development on the concept of a building of light and frame and the resulting concrete expression of the research investigation on new building technologies into a singular form of architecture. Drawing above shows a typical section and the lighter eastern facade.

filter east

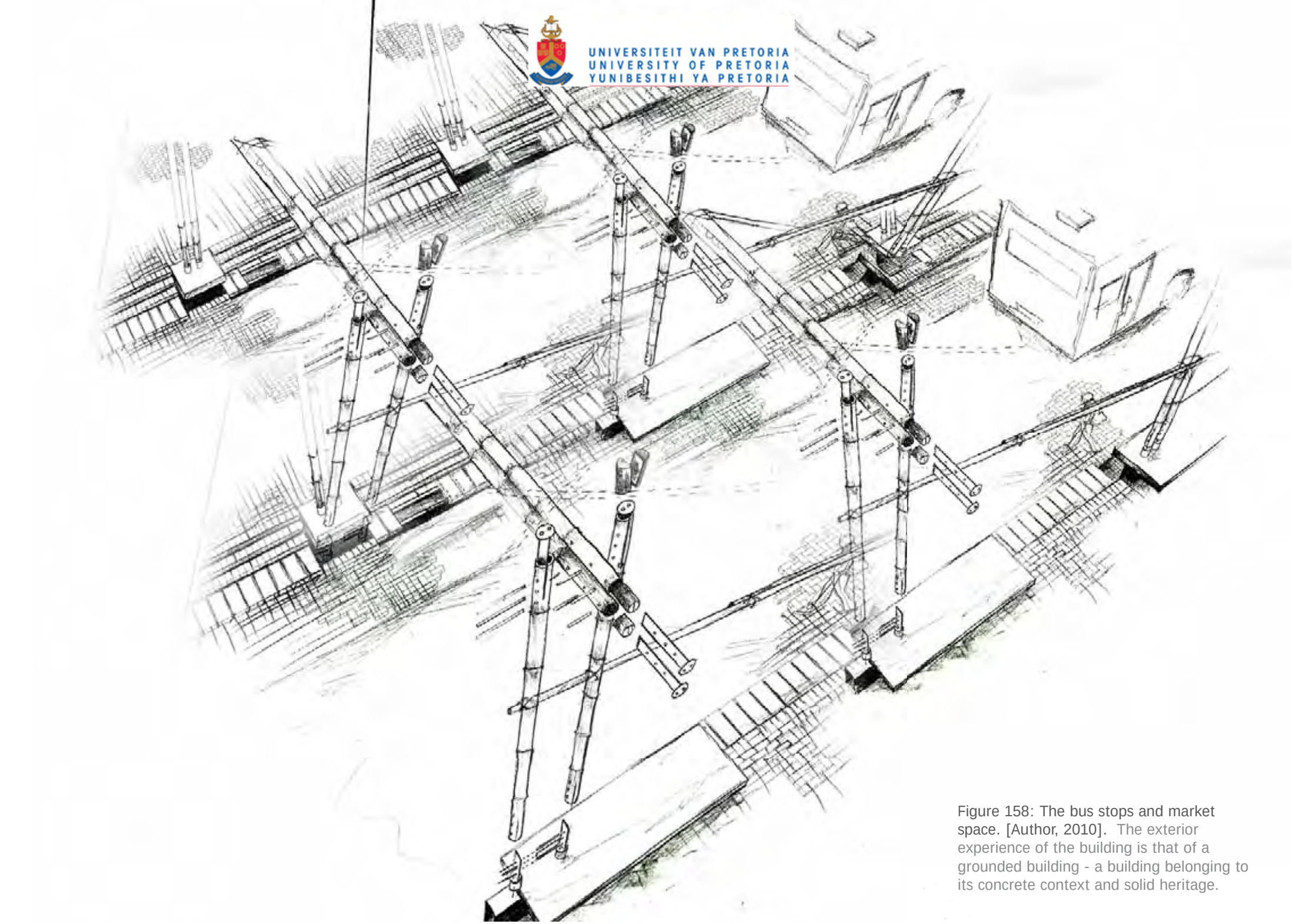


Figure 158: The bus stops and market space. [Author, 2010]. The exterior experience of the building is that of a grounded building - a building belonging to its concrete context and solid heritage.

suspended inside

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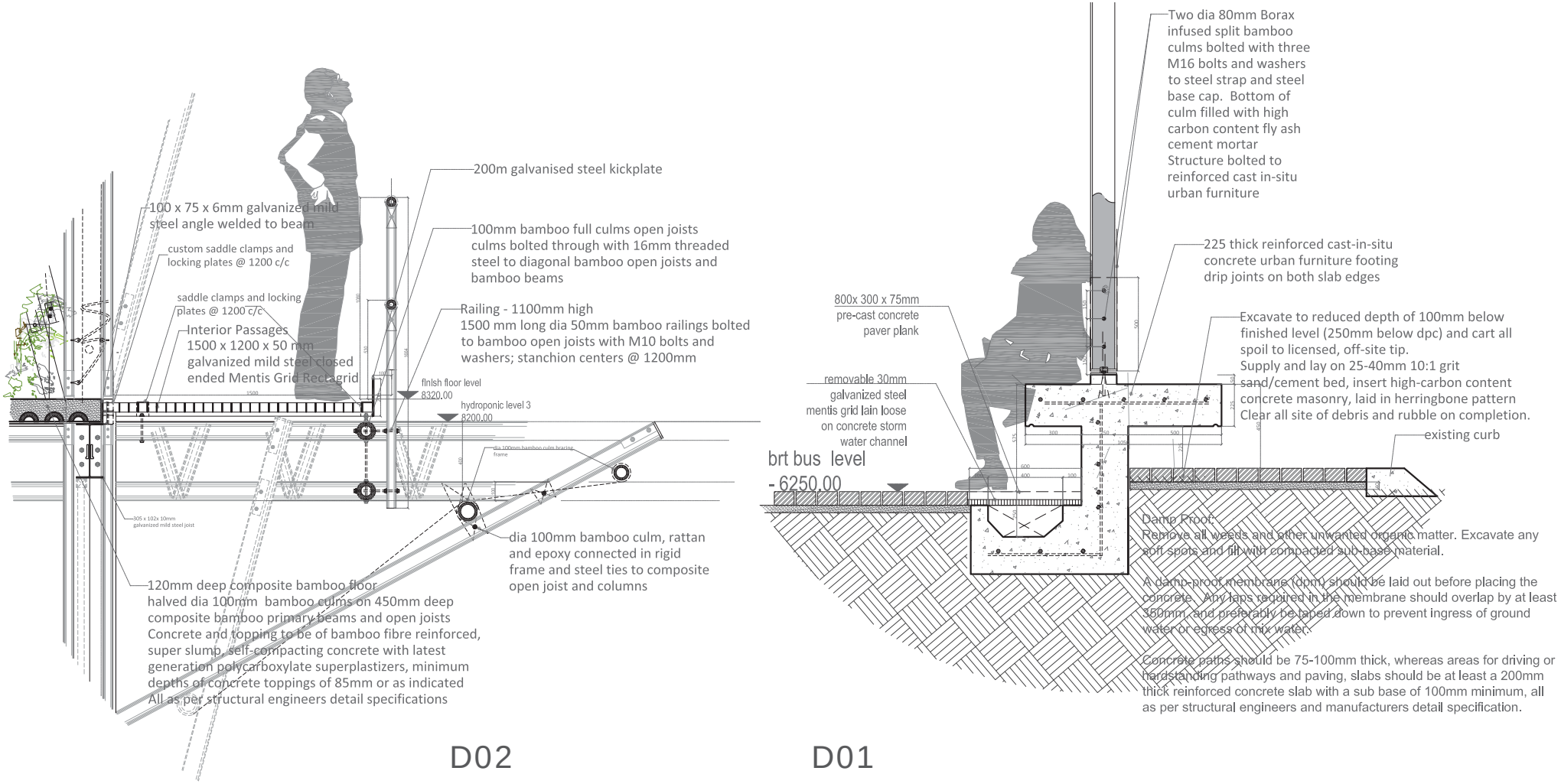
grounded outside



D02 D01

experience verticality

Figure 159 (left) and 160 (right): Typical details expressing experiences of verticality and assembly of the new living building [author, 2010]. The building interior is an experience of verticality and of suspension through a new building material: structural bamboo.

experience assembly

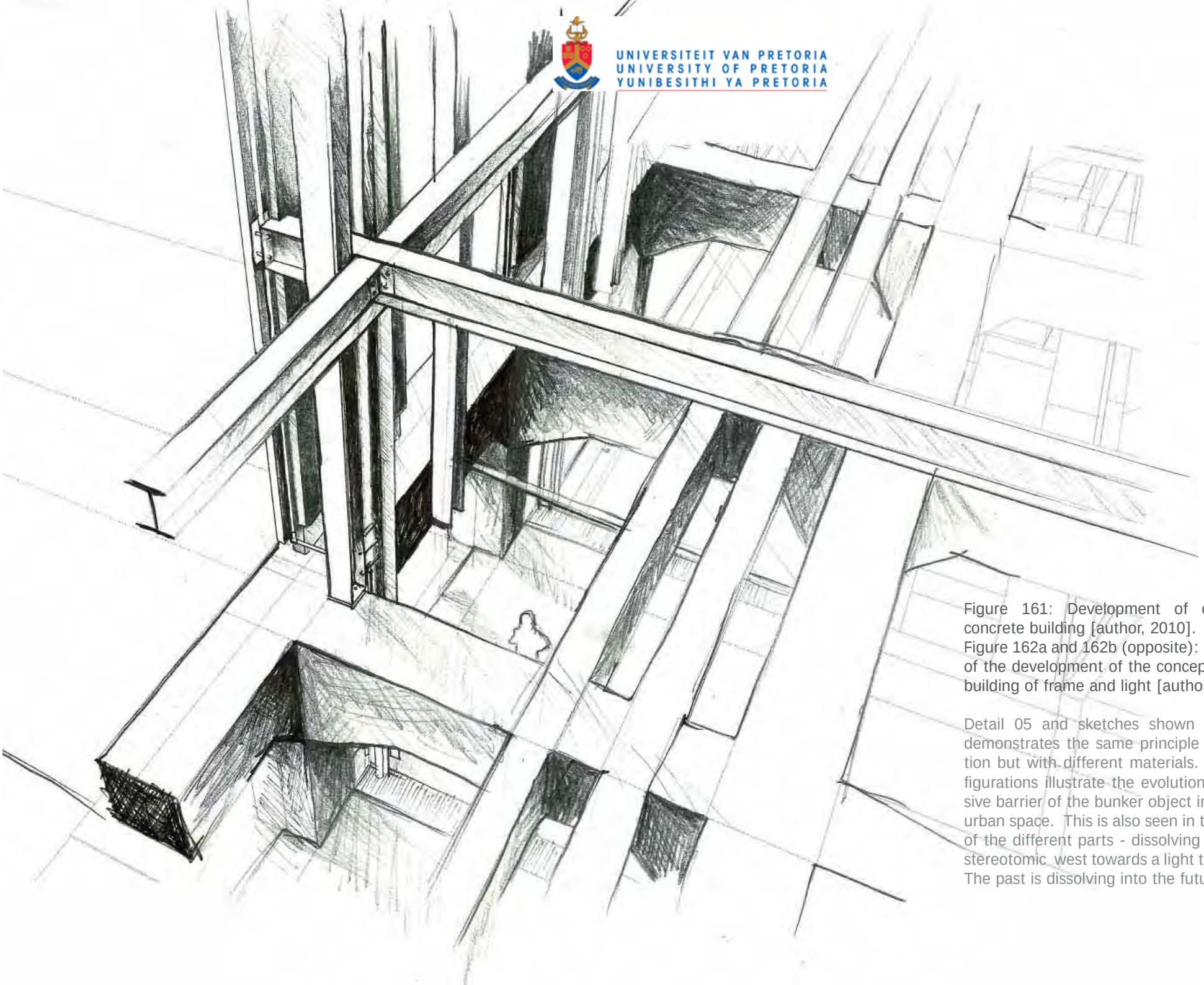


Figure 161: Development of concepts to concrete building [author, 2010].
Figure 162a and 162b (opposite): Photographs of the development of the concept model - a building of frame and light [author, 2010].

Detail 05 and sketches shown here (steel) demonstrates the same principle of construction but with different materials. These configurations illustrate the evolution of the passive barrier of the bunker object into an active urban space. This is also seen in the assembly of the different parts - dissolving from a solid stereotomic west towards a light tectonic east. The past is dissolving into the future.

dissolving materiality

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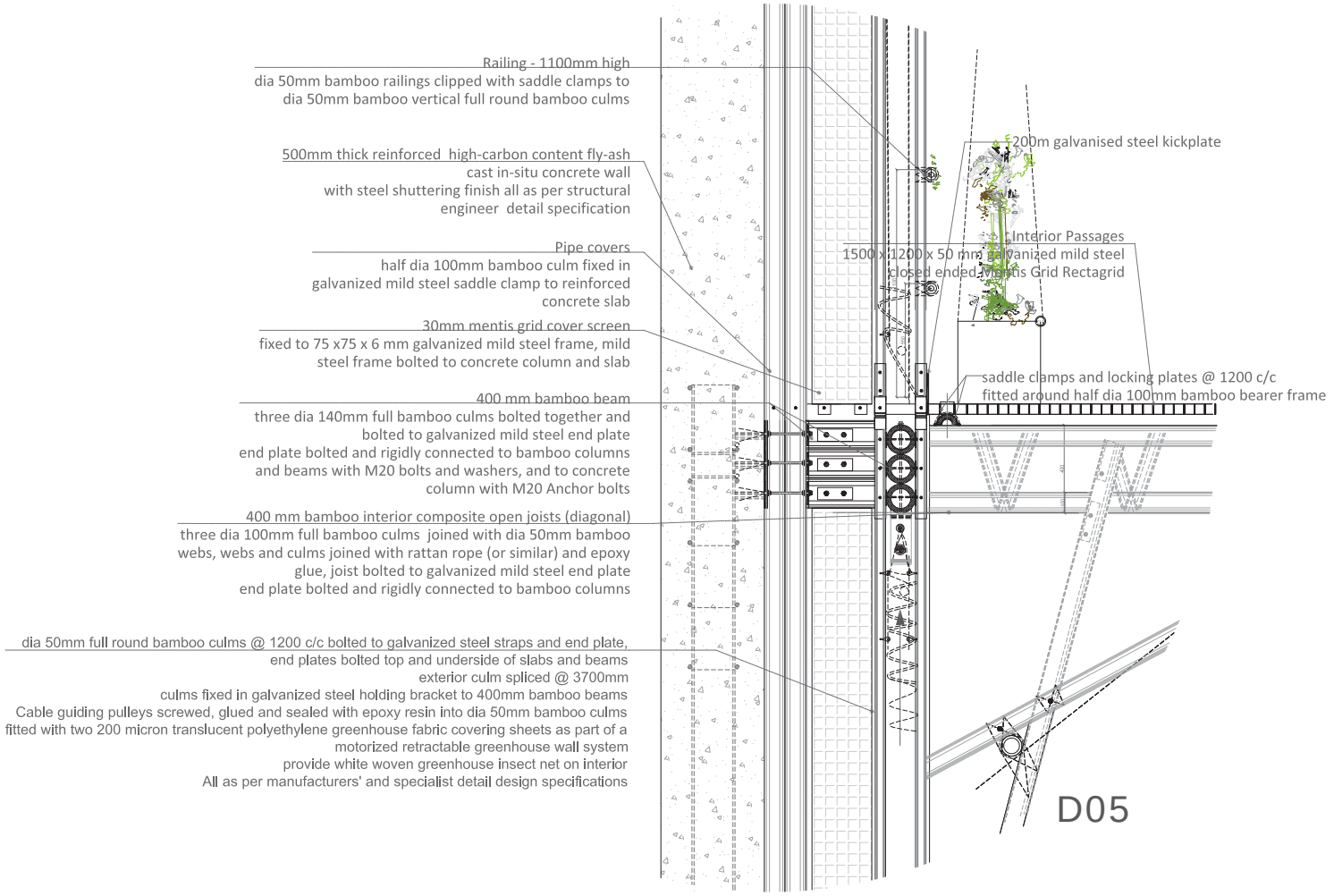
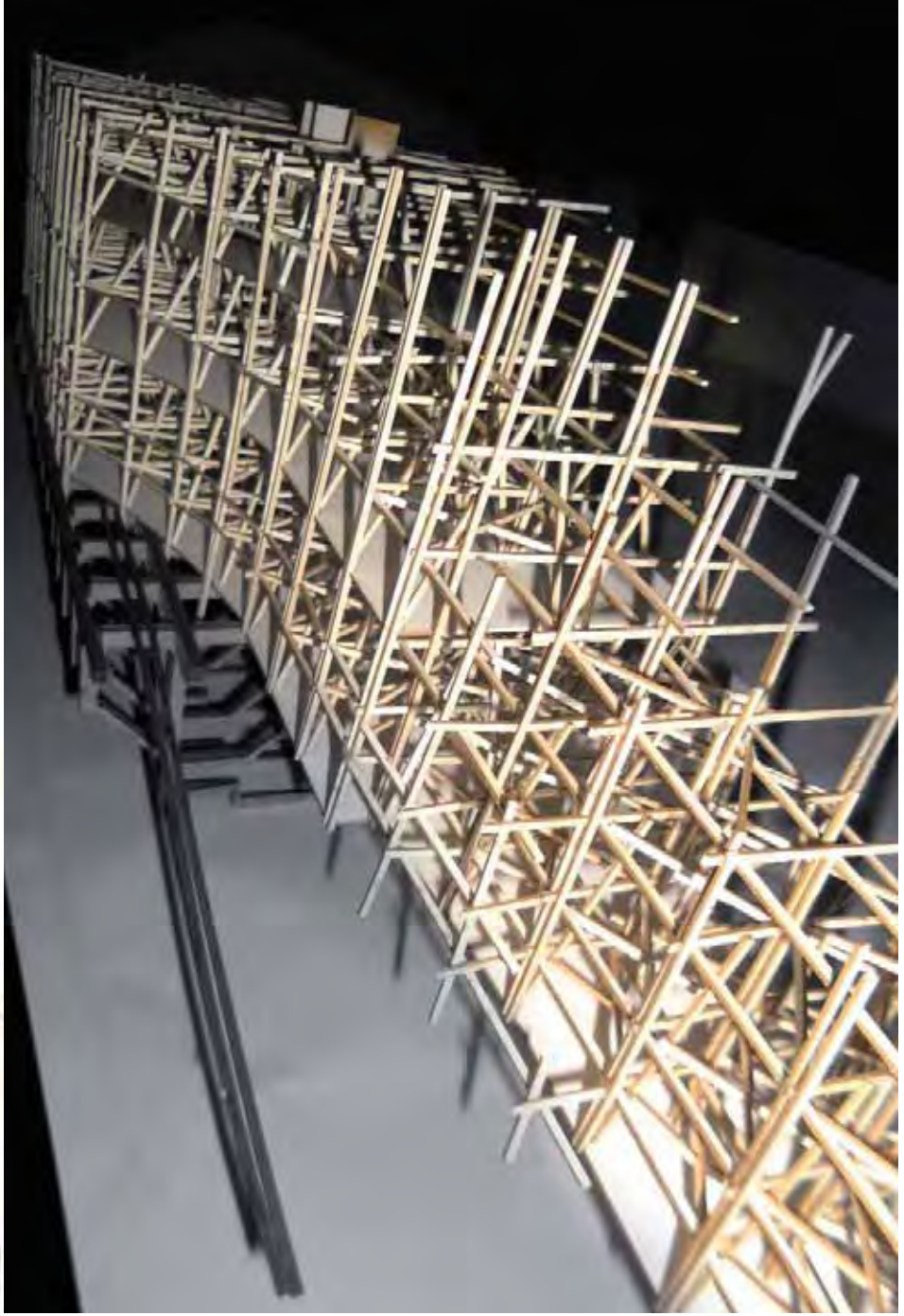


experience earth

Figure 163: Typical details expressing experiences of dissolving materials - elements of mass moving towards elements of light [author, 2010].
The dissolving elements of mass to elements of light enhances the experience of the underground sunken structure of the concrete bunker and the above ground suspended character of the bamboo in the hydroponic food factory. This shows the evolution of the bunker as a closed, introverted object into a open space of light and air.



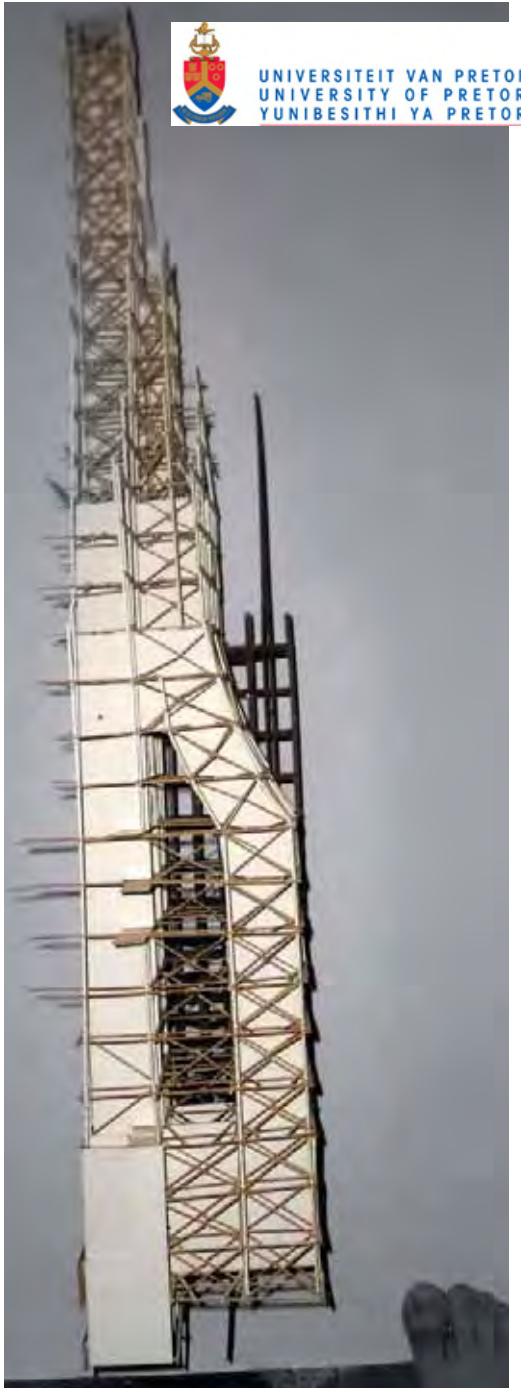
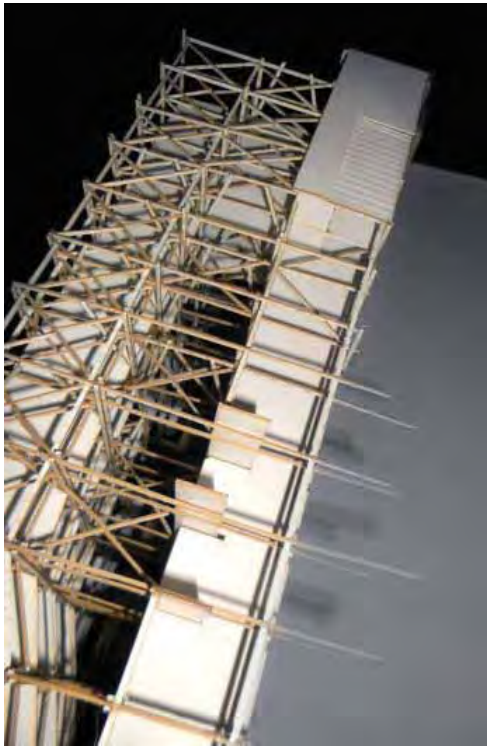
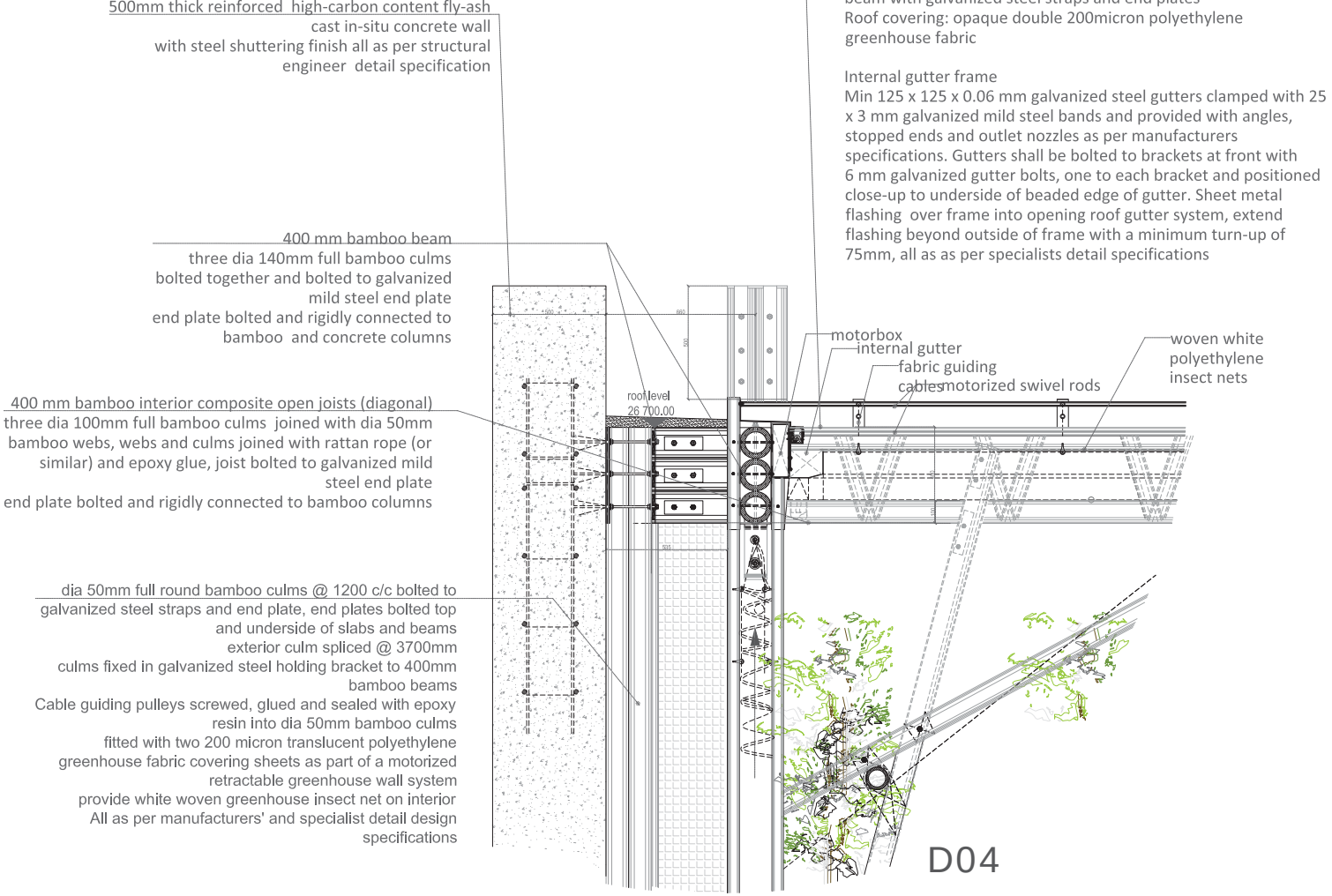


Figure 164 (left): Photograph of the working model [author, 2010].
Figure 165 (centre): Frame and construction of final model [author, 2010].
Figure 166 (right): Unfinished final model from above [author, 2010].

The agriculture program requires as much natural ventilation as possible, and retractable greenhouse walls and retractable greenhouse roofs are proposed. This further encourages the development of an open frame building - with moving, opening walls, translucent and transparent skin and an experience of edgelessness. The photos show the development of the models from the working model to the final design proposal.

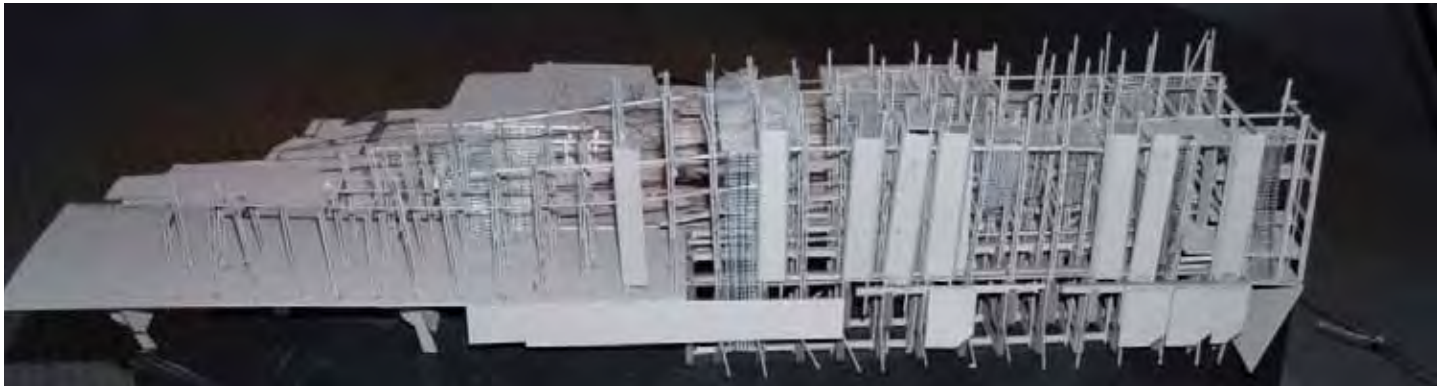
o p e n
b u i l d i n g





e x p e r i e n c e
a i r

Figure 167a (top), 167b (middle) and 167c (bottom): Photographs of the construction of the final model [author, 2010]
Figure 168: Typical details of the new living building [author, 2010].
The building roofs are operable greenhouse screen roofs, allowing maximum air and light for crop production.



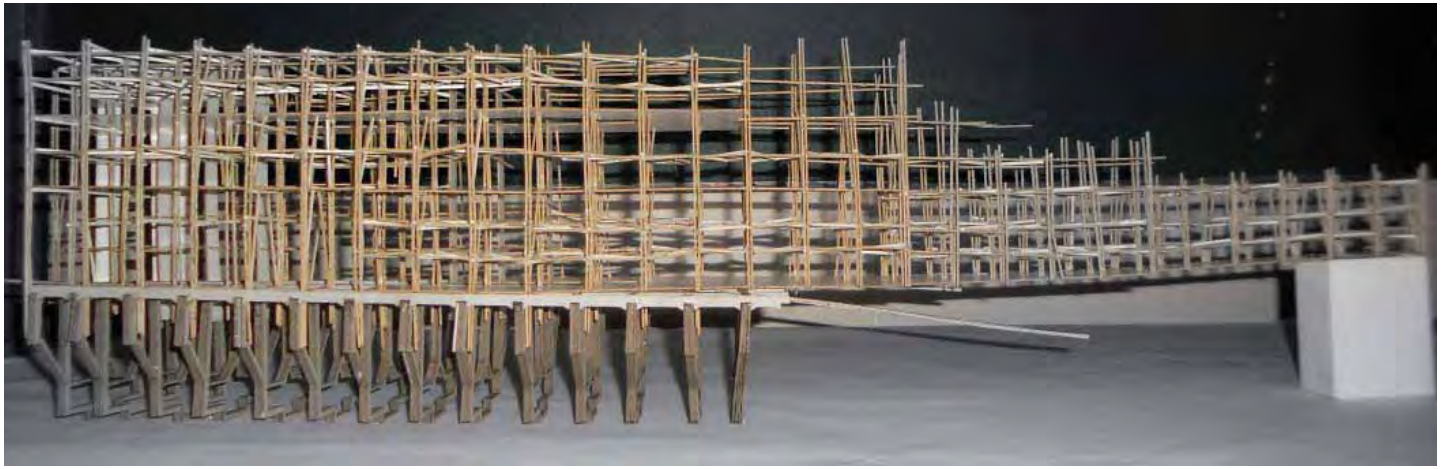


Figure 169a (top left), 169b (top middle) and 169c (bottom left): Working models [author, 2010].
The photographs show the evolution of the concept into the final building through physical models.

Figure 170 (below): Collection of photographs of the construction of the final model [author, 2010].
The images show the construction of the final model, illustrating the bamboo structure, concrete massing elements, open and closed retractable walls and roofs, concrete floors stopping short of each other and semi-transparent intermediate gridded floors - a dissolving, open, organic building.

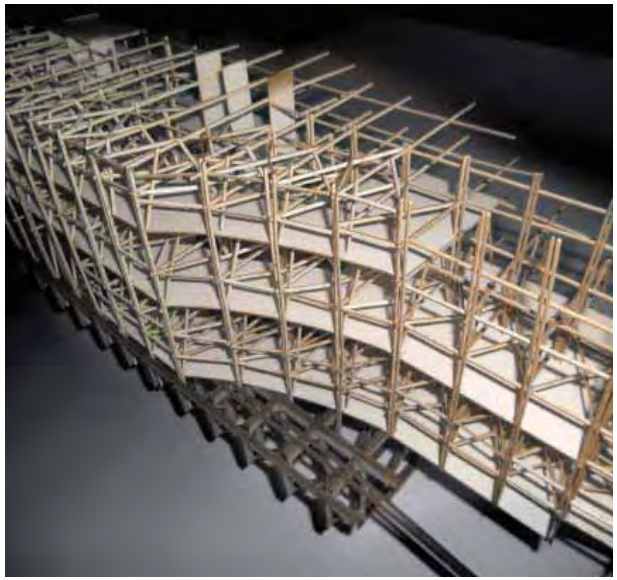


Figure 171 (top): Finished final model eastern elevation [author, 2010].

Figure 172 (far left): Finished final model western elevation [author, 2010].

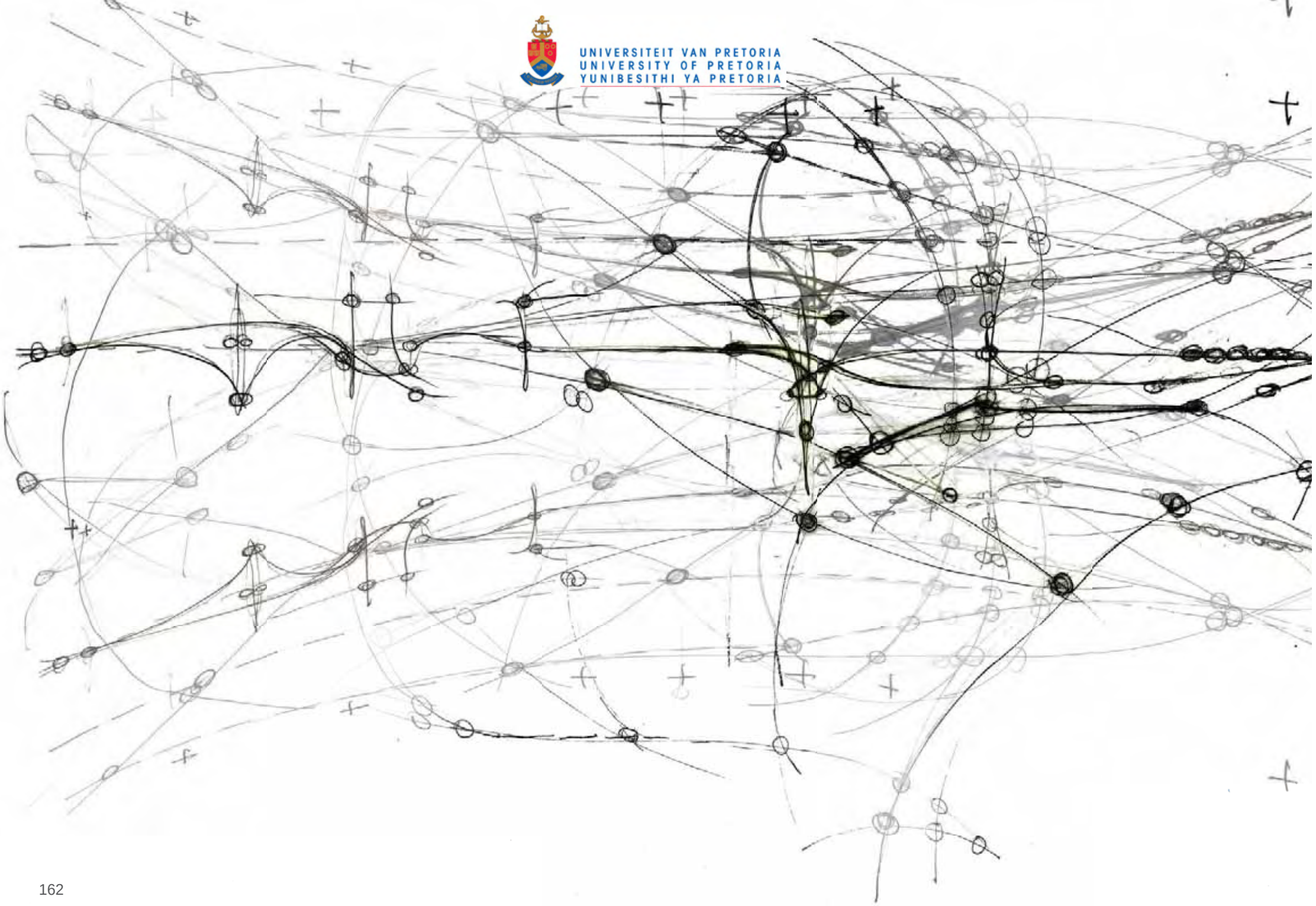
Figure 173 (left): Finished final model - view towards station [author, 2010].

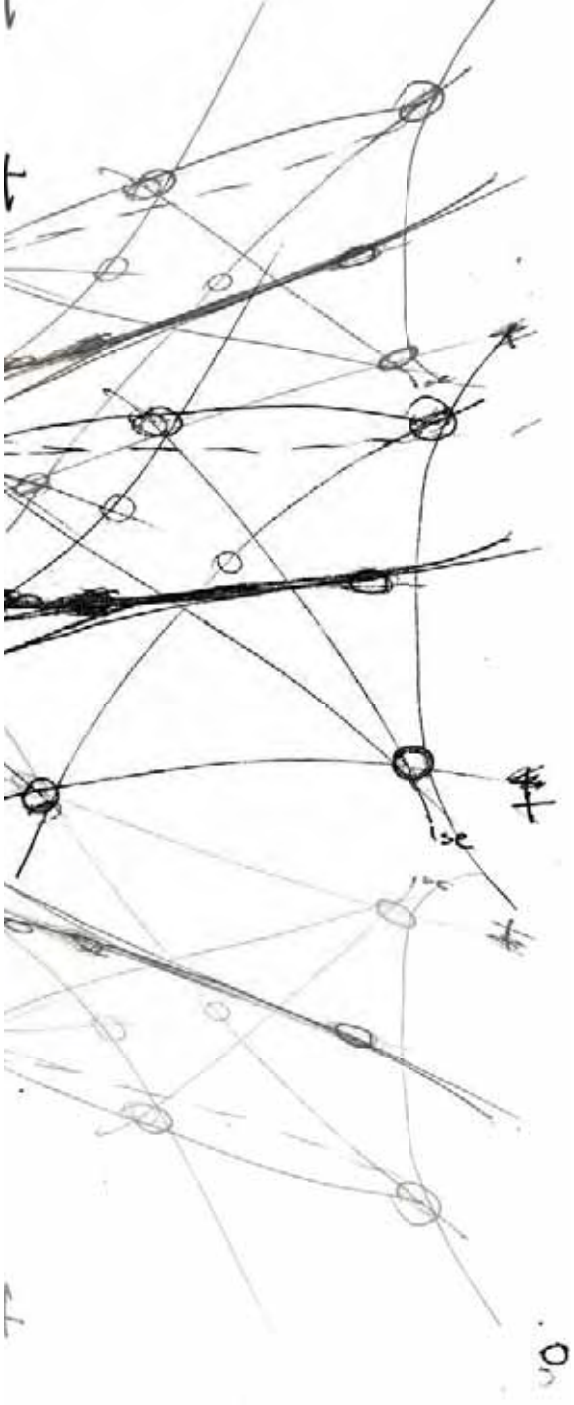
Figure 174 (right): Introducing new ideas - exhibition night 25th November 2010 [author, 2010].
Explaining to visitors the innovation potential in new materials and programs for 21st century architecture.

Figure 175 (below left) and 176 (below right): Collection of photographs of the group model - exhibition night, 25th November 2010 [author, 2010].
The photographs show the development potential of the site and the place of the hydroponic factory in the larger scheme. The hydroponic factory is a conceptual and literal acknowledgment of the legacy of the site, and now advocates the evolution of the 21st century building and urban environment by taking progressive steps towards the future. The industrial heritage of the site is now its productive future. The exhibition night drew attention to the new role of architecture in productive urban environments and new, resource-efficient building technologies. There was a great public interest in the concept and execution of vertical agriculture and bamboo technology for South Africa.

Figure 177 (opposite left), 178 (opposite right): Interest in Pretoria West [author, 2010]. A new public interest was created in the redevelopment of the Old Pretoria West Power Station and an awareness was created for the value of industrial heritage and industrial sites.

Figure 179 (opposite, middle), 180 (opposite right): Hydroponic food factory in context [author, 2010].





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reflection

This thesis is an architectural response to the research topic and investigation and should be read as such. The calculations and estimates should be considered as a base and platform for development of the total project in all its various specialists fields. The resulting building of the research presented in this document is a conceptual model for vertical agriculture on the Old Pretoria West Power Station, Pretoria, South Africa. The project provides insight into the viability, probability and possibility of the concept of vertical agriculture - giving realistic direction for not only the global 21st century urban development, building typologies or programs, but more importantly, the project gives realistic direction in the application of future-orientated concepts and technologies in a local context for South Africa. The total project is ready for further research, exploration and resolution.

Let us learn not only from what we know already, but from what have yet to discover.

Figure 181 (opposite): Creating our future - looking towards a new legacy [author, 2010].