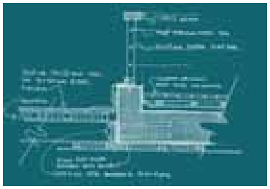
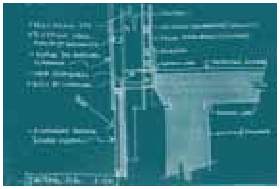
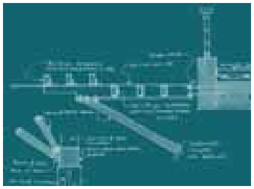
Chapter 07

Conceptualizing Technology







7.1 Introduction

The aim of this section is to explain how the technology is used to reinforce the conceptual idea. In order to explain this relationship three questions are answered. The first is the answer to the question of a structural system and a technological system promoting the conceptual idea. The second is a question about materiality and the use of materials with some related to the context and some in contrast with existing materials. A third question explores possible responses to environmental systems in the form of natural systems, artificial systems and hybrid systems.

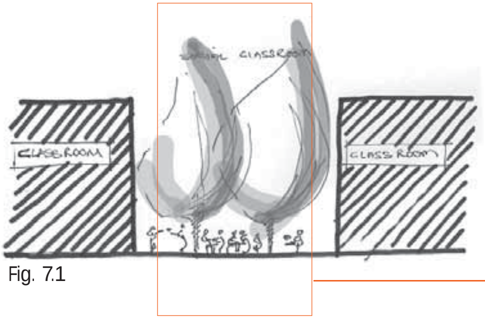


Fig. 7.1

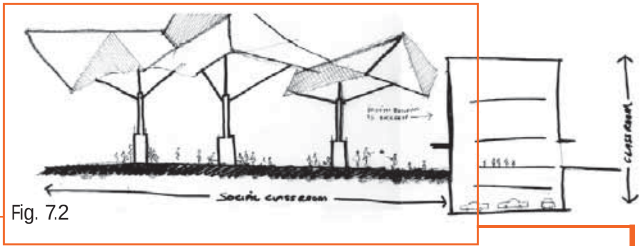


Fig. 7.2

A – Canopy: Solar energy converter (photosynthesis)
- Photovoltaic panels
- Water distribution
- Solar water heating
- Solar control
- Spatial configuration
- Rain cover

B – Branches:
- Structural support for canopy
- Service runs downpipes etc.
- Spatial definition
- Organic nature while ordered

C – Trunk:
- Main structural element
- Spatial definition
- Vertical service runs

D – Base:
- Edge definition: Gathering edge vs. Movement edge

E – Roots:
- Foundations
- Horizontal service runs
- Water, electricity.

Sustainability component

electricity for night illumination
stormwater down pipes to storage facility.
(kitchens and ablution)
socially sustainable interior spaces
diffused light
shade away rain visibly

Performance:

increase distance between columns by 4m
Hidden within structural components
ambiguous relationship between inside and out.
plasticity of structure – organic in form

decrease in size to top
square indicative of circulation round - gathering
housed within columns

connection of column to ground

rooting the structure to the earth
provision for service runs

Fig. 7.3

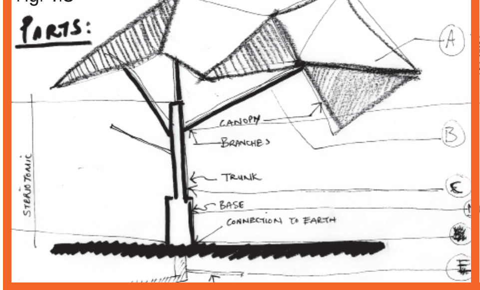
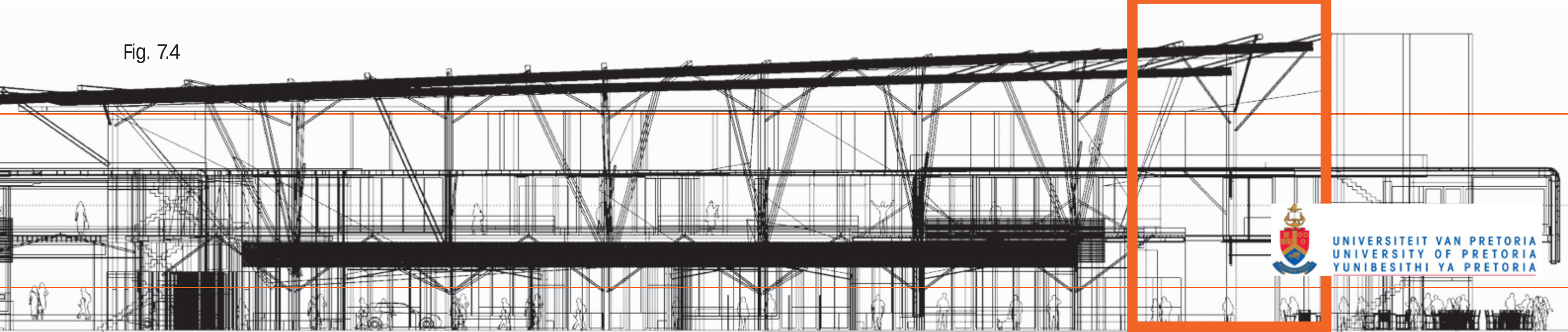


Fig. 7.4



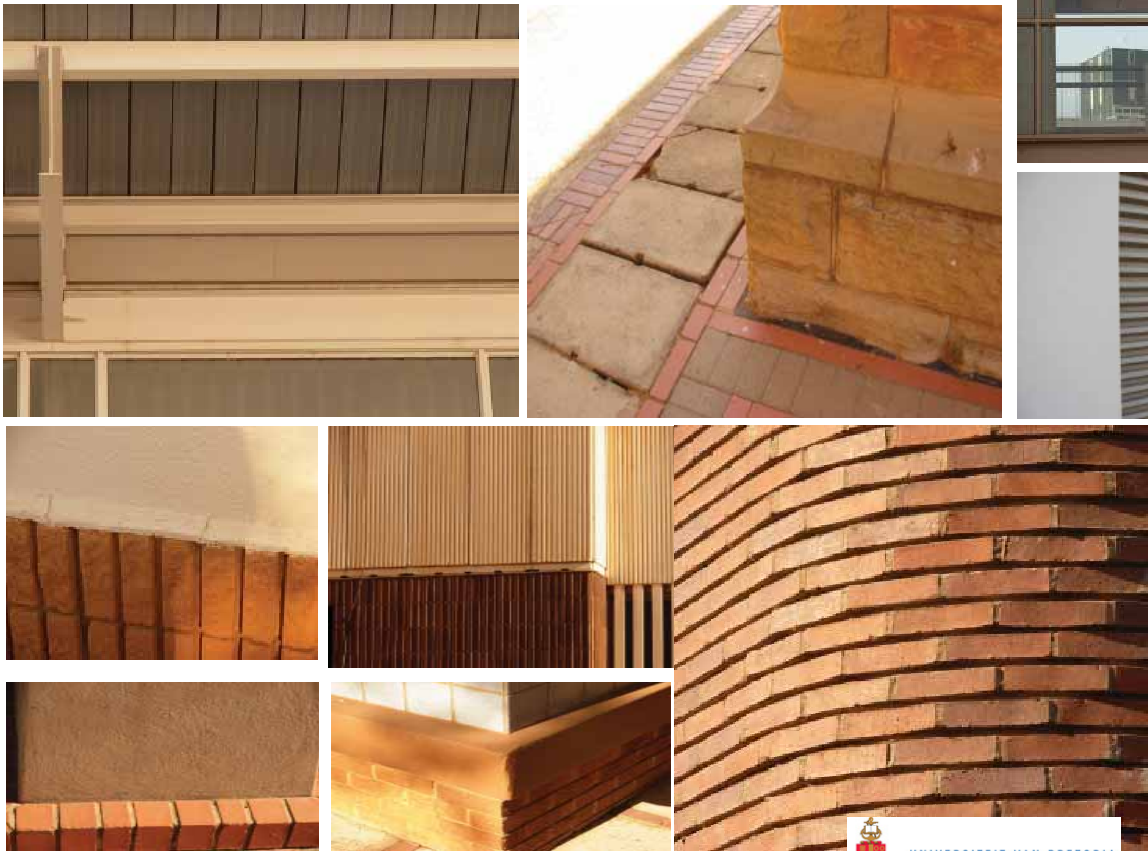
7.2 Composition

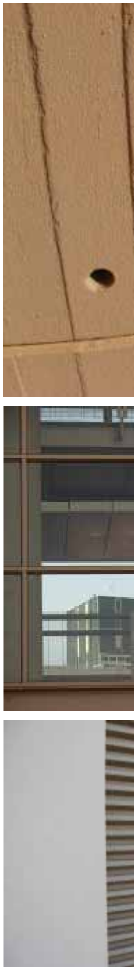
Fig. 7.5-7.23: Existing materials used on campus.

7.2.1 Materiality

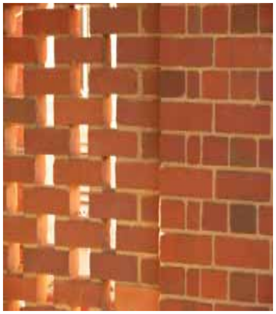
According to the conceptual programme the proposed intervention must generate spatial configurations that are very different from the ordinary everyday classroom. The intervention responds to a modern environment with solid load bearing buildings featuring very specific wall to window relationships. These buildings define inside and outside by only a door sill or opening in the wall.

The new social classroom contradicts and questions these issues by a light tectonic response

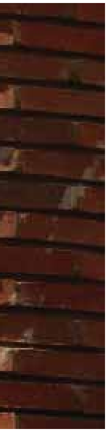










creating an ambiguous inside-outside relationship. This will be achieved by the use of a light organic skin wrapped over a stereotomic edifice. This edifice grows out of a plinth and becomes lighter and more tectonic up to the point where skin meets structure. The lightness of construction give the building its industrial character and is exploited down to service delivery by exposing service runs and the use of off-shutter concrete.

Slabs were thickened to avoid the use of down-stand beams in order to allow service runs the freedom of the ceiling. In some instances materials from the surrounding are used in the construction in order to facilitate a character relationship.

When viewed in relation to existing buildings the proposed intervention will read very different but uses the surrounding buildings as backdrop for this newly prepared, characterized and programmed environment.

Fig. 7.24: (below) Southern facade.
Fig. 7.25: (far below) western facade.

Fig. 7.24

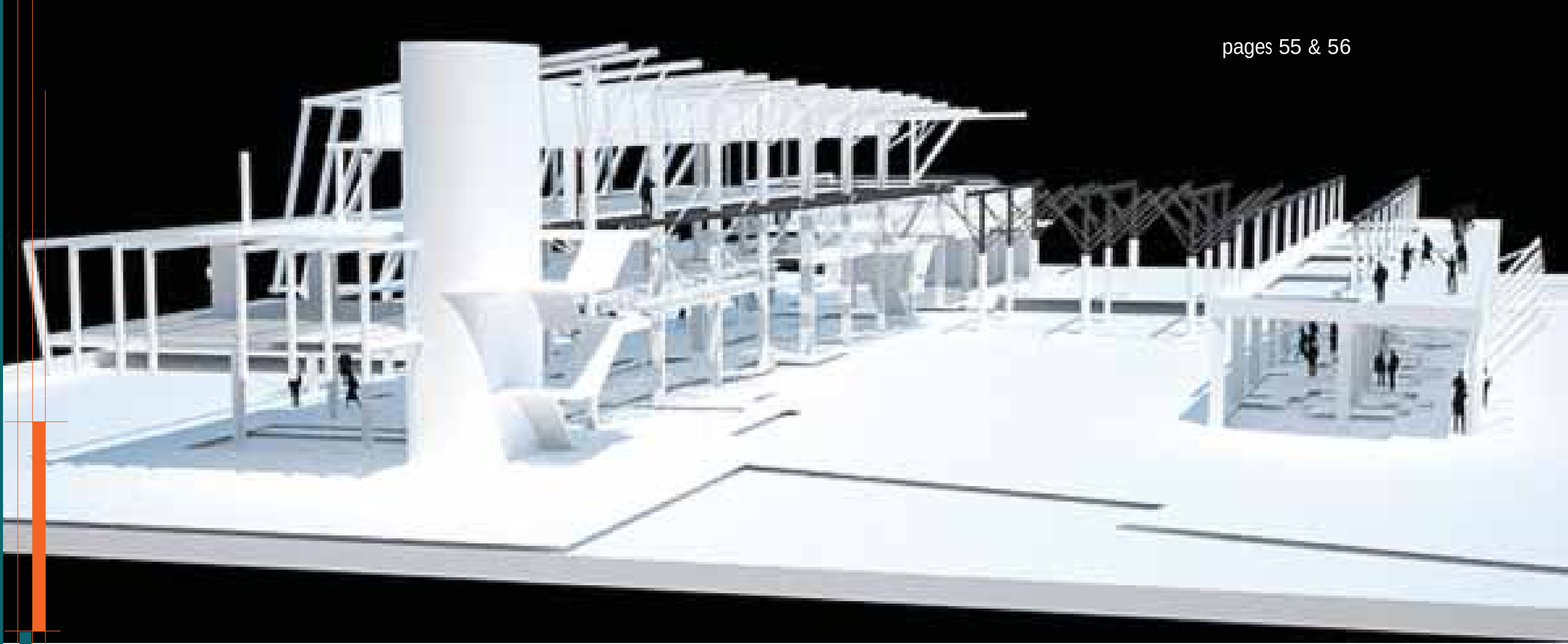


Fig. 7.26: (left) Structural model.
Fig. 7.27 (right) Ground floor plan and structural grid. 1:550

7.2.2

Structural & Technological Systems

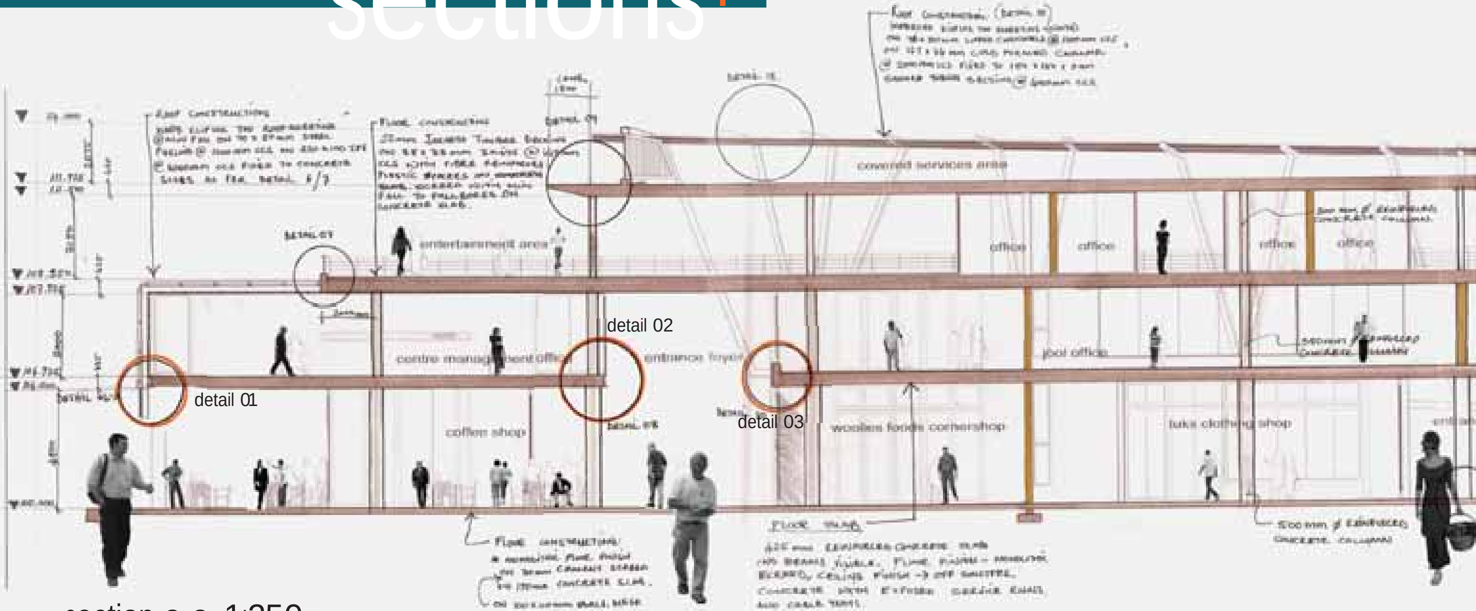
The structural system can be described as a system ranging from a highly stereotomic character up to a delicate tectonic disposition. Conceptually derived from the tree as analogy, the structure consists of a few different tree like columns primarily there to make the building structurally sound but fulfilling a host of other important functions. On plan the columns are formally indicative of either movement (rectangular shape) or of a space dedicated for a programme that allows gathering at that point. Column sizes range from 500mm dia. (ground floor) to 400mm dia. (1st floor) down to 300mm dia. on the top floor.

The structural grid has been designed at 8m c/c in an east west orientation due to the buildings filter function from north to south. The spacings over the north south axis has been established at an economical 5.5m allowing a floor slab, with integrated beams, of a nominal 425mm thickness. This arrangement allows the services to be attached to a flat ceiling and exploit the freedom thereof in order to compliment the industrial character of the proposed building. This slab thickness also accommodates a crucial cantilevering possibility of 2.5 to 3m.

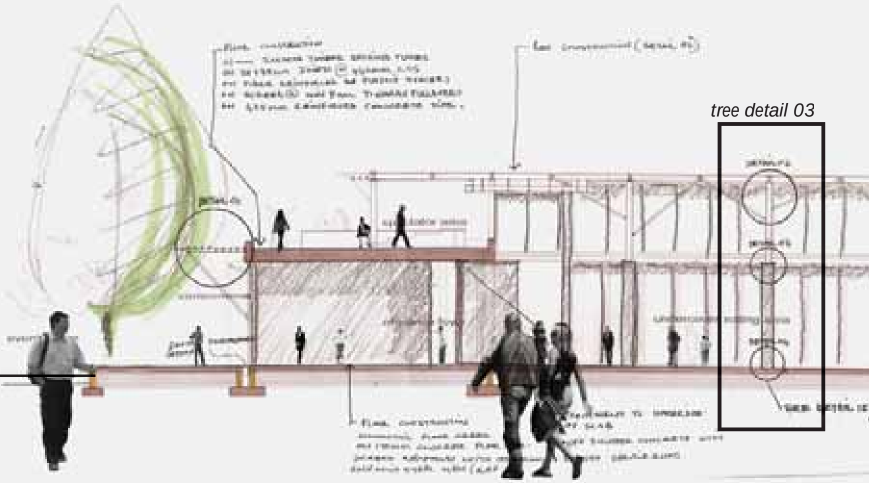
The slab thickness stays the same for both hanging floors and roof slab and to adhere to the concept slabs will be tectonically adjusted to be visually thinner and lighter. The 1st floor slab is presented as much thicker by using an up-stand beam while this also connects the two buildings in character across the square.


section b-b
section

sections



section a-a 1:250



section b-b 1:250

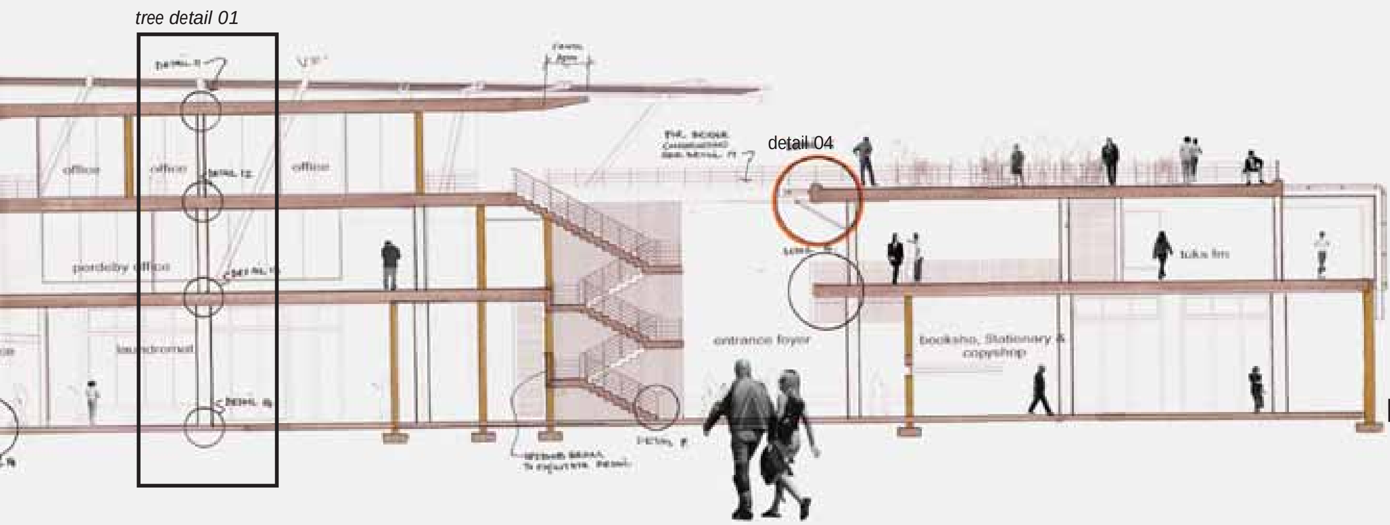


Fig. 7.28

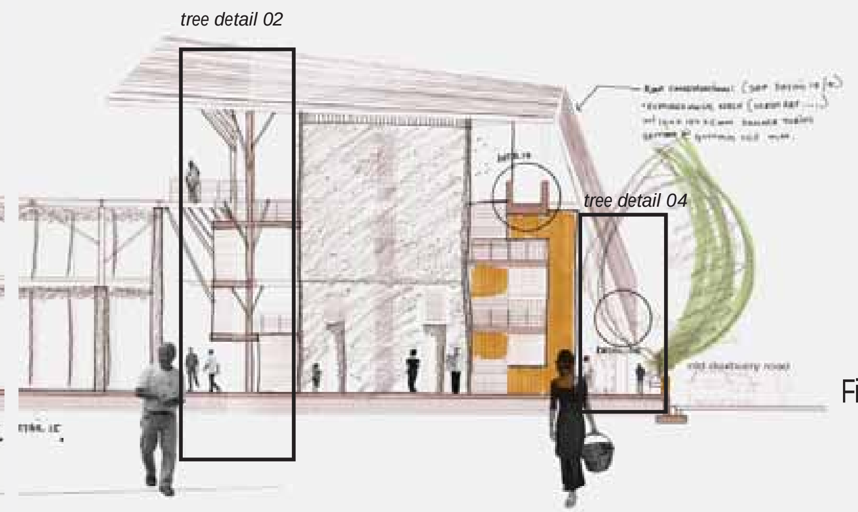


Fig. 7.29

tree detail 01 (main building) 1:60

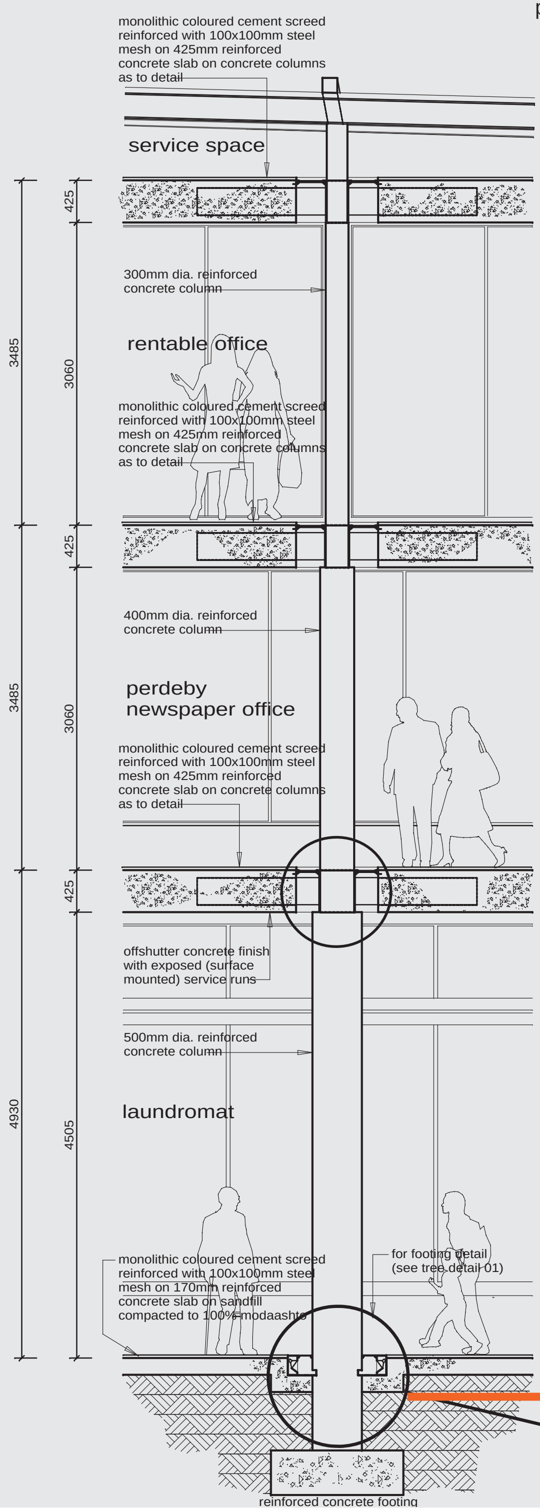


Fig. 7.30

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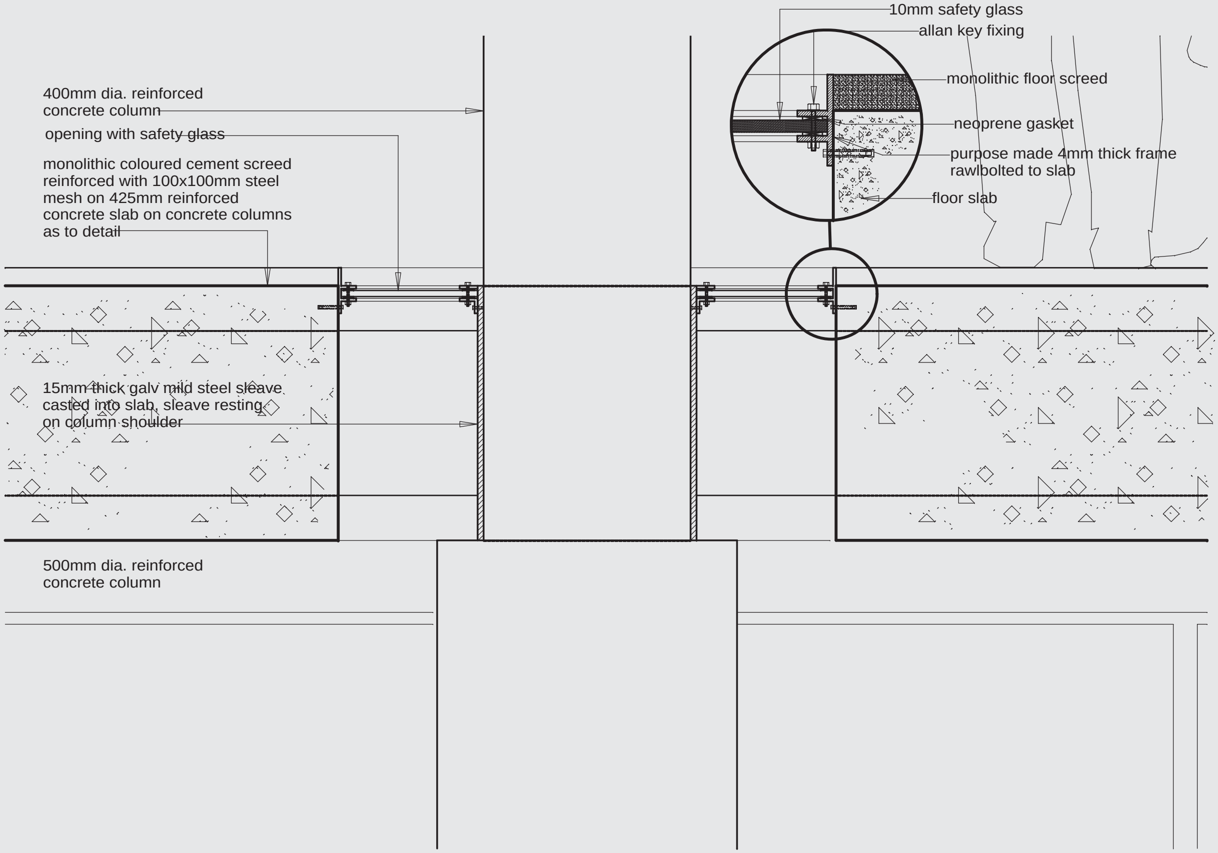

tree detail 01 1:20
(column-slab connection)

Fig. 7.31

tree detail 02 (main building) 1:60

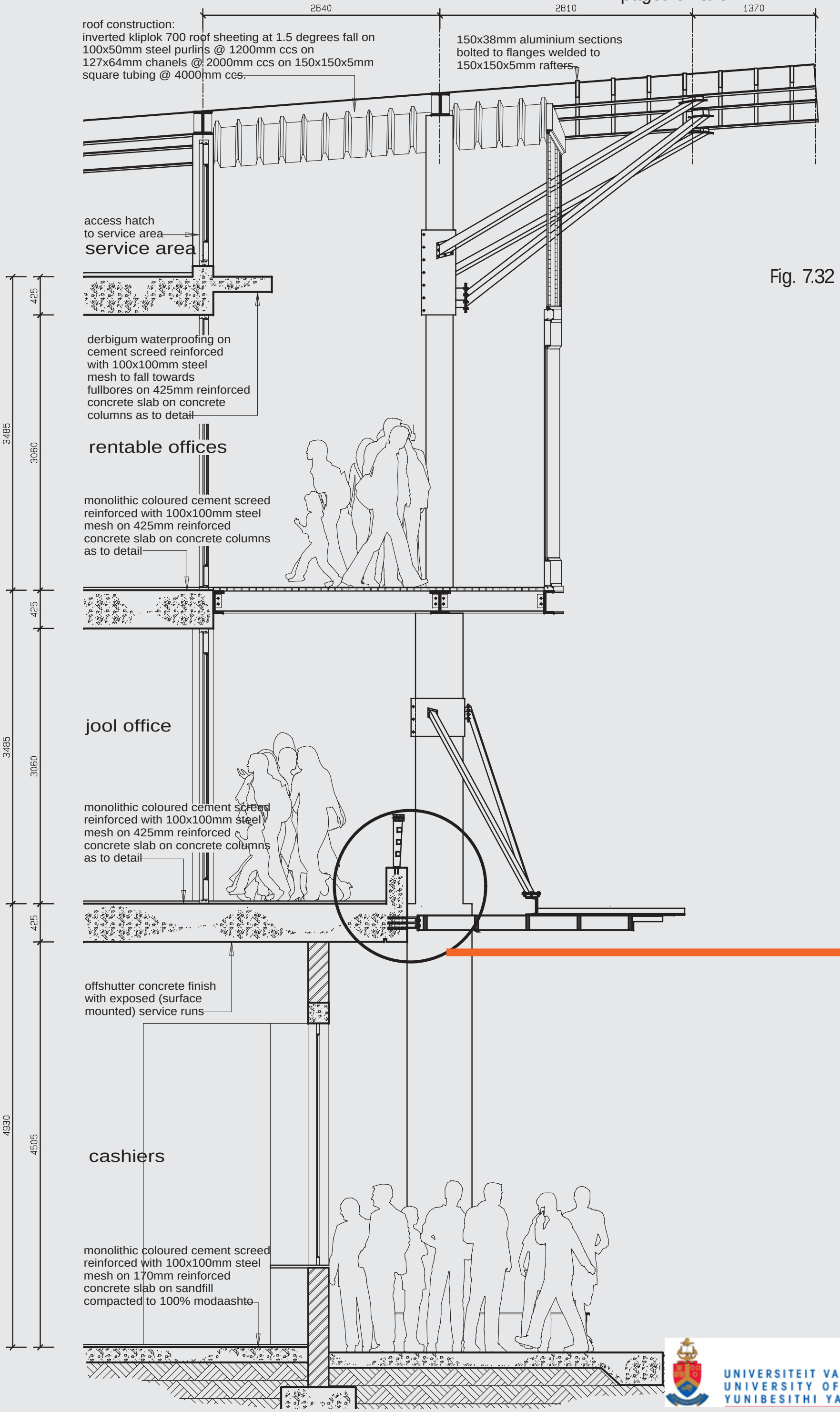

Fig. 7.32

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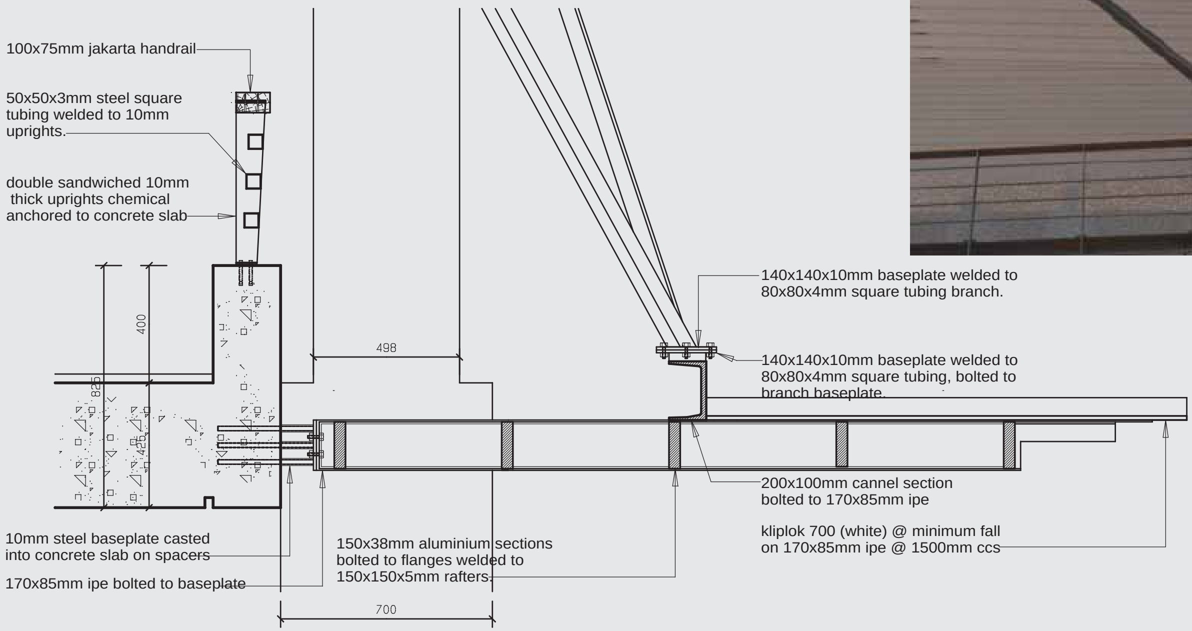
Fig. 7.33

Fig. 7.34



tree detail 02 1:20 (canopy & balustrade)

Fig. 7.35

Fig. 7.34: (above right) Branch/canopy detail
Fig. 7.35: (right) Branch/trunk detail

tree detail 03 (eating area) 1:60

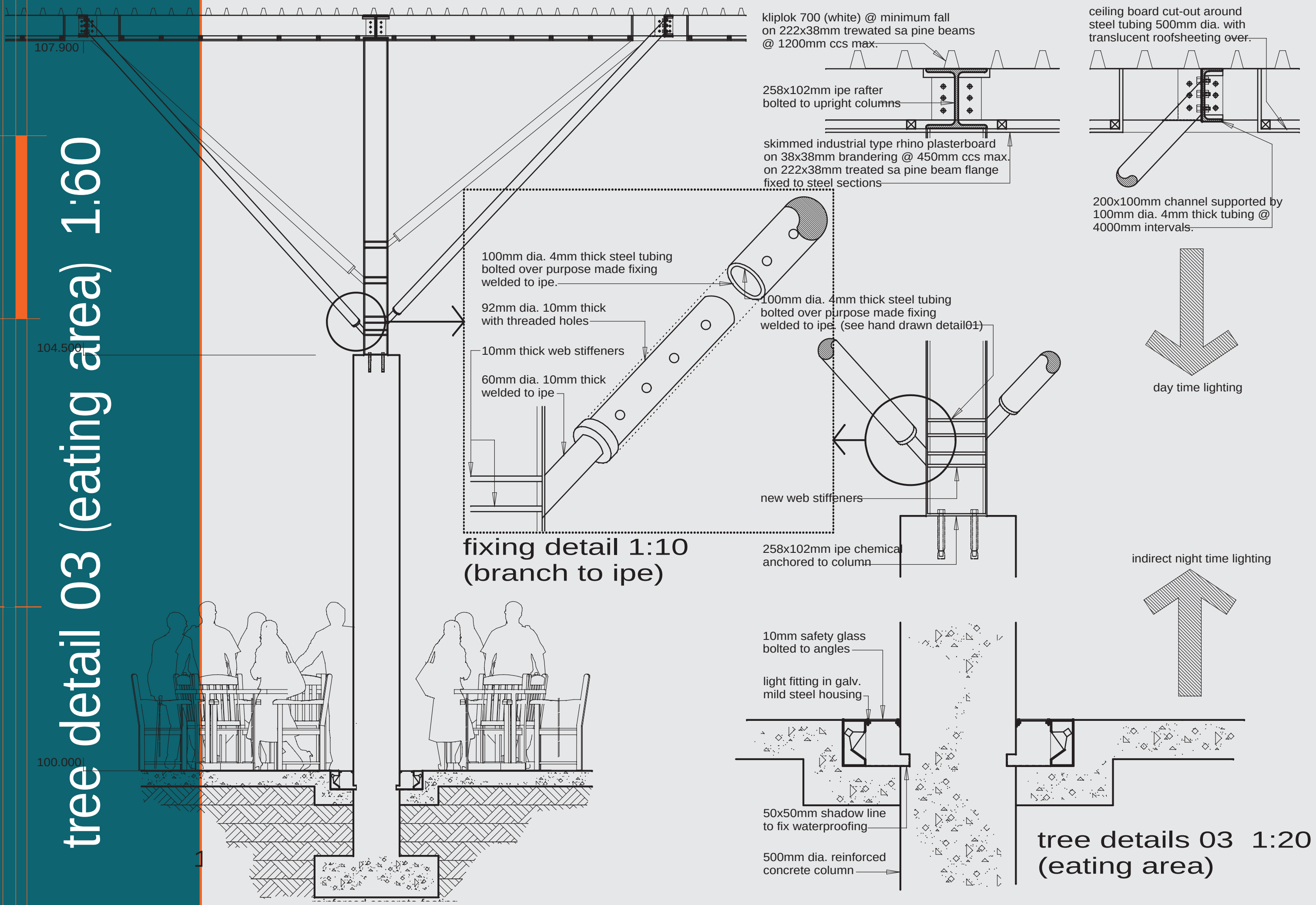


Fig. 7.32


Fig. 7.37

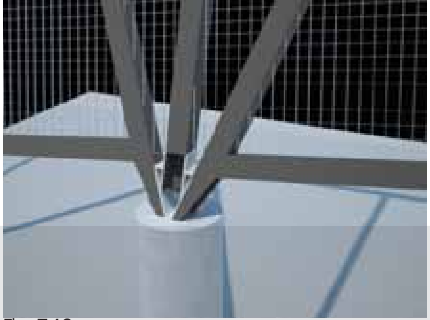


Fig. 7.40


Fig. 7.41

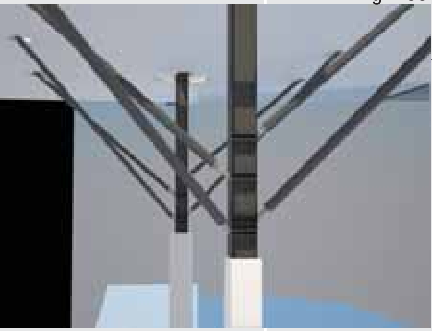


Fig. 7.38

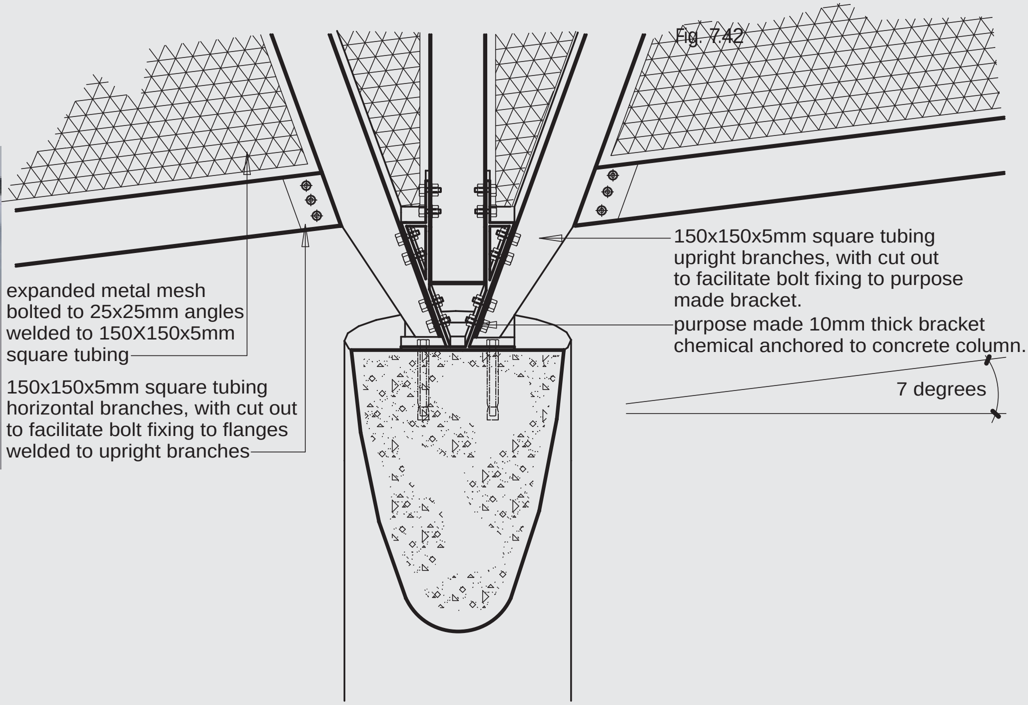


Fig. 7.42

tree detail 04 1:20
(old duxburry rd. edge)

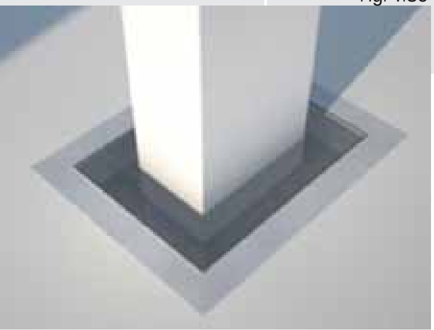


Fig. 7.39

Fig. 7.37: (above left) Branch/ceiling detail
Fig. 7.38: (middle left) Branch/trunk detail
Fig. 7.39: (left) Trunk/floor detail
Fig. 7.41: (above middle) Branch/trunk detail
Fig. 7.42 (above right) Branch/trunk detail
Fig. 7.43: (right) Expanded mesh detail

Fig. 7.43


Hand drawn concept details

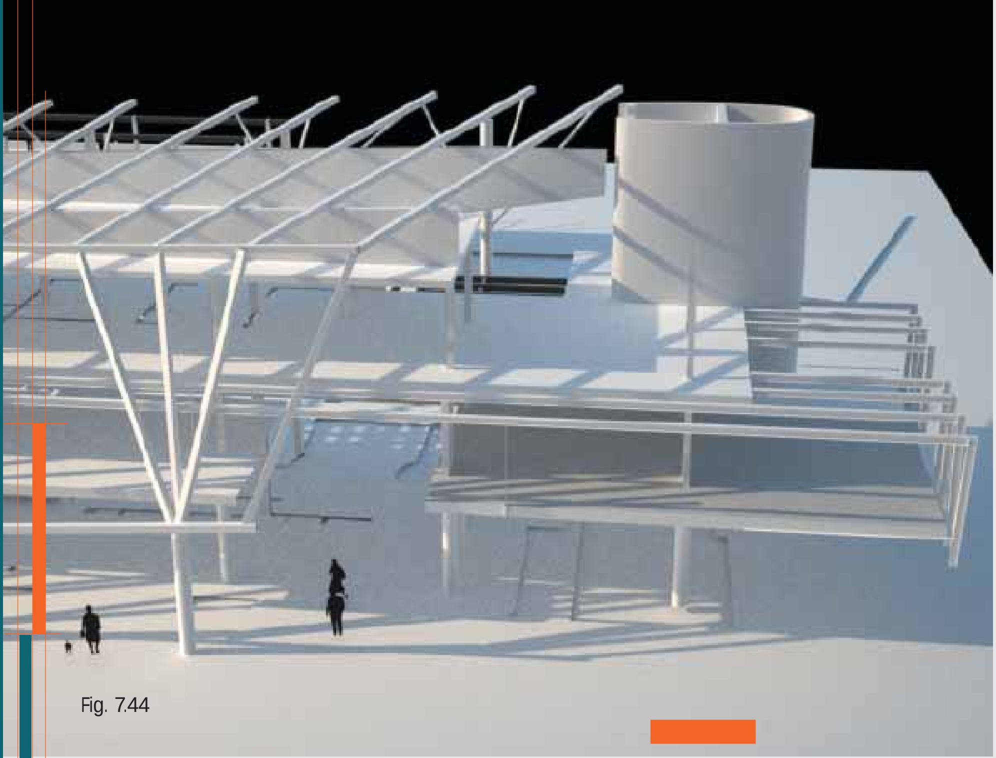


Fig. 7.44

Fig. 7.44: (above) Structural model
Fig. 7.45: (below) Column/floor detail
Fig. 7.46-7.50: (right) Details

Fig. 7.45

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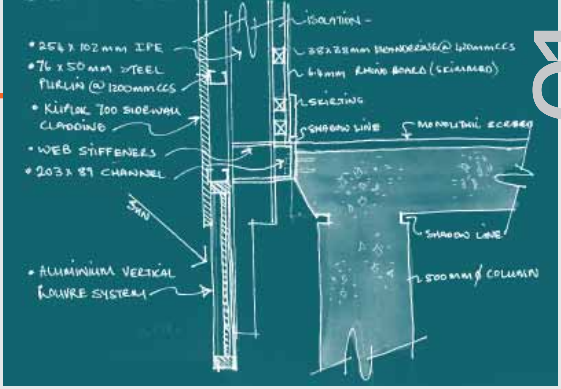
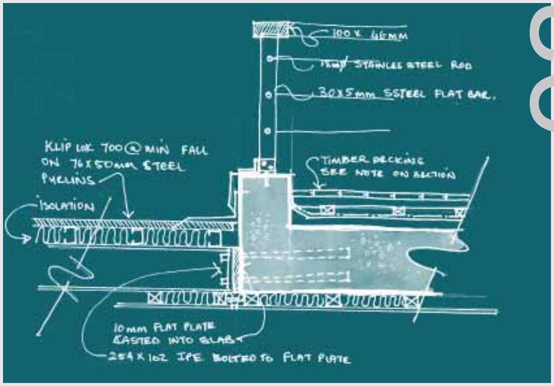
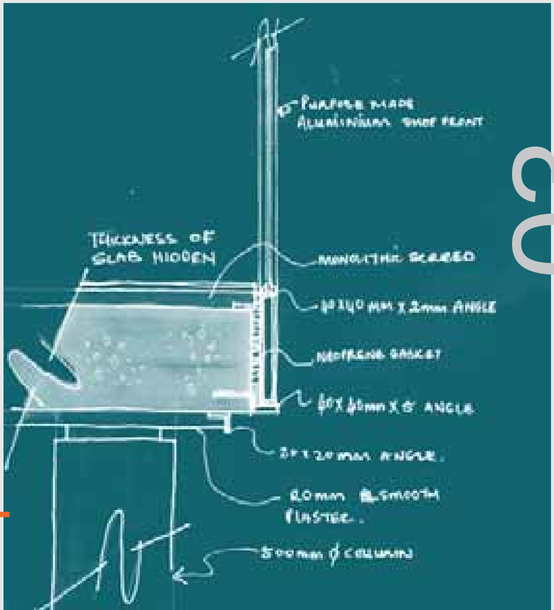
detail 01



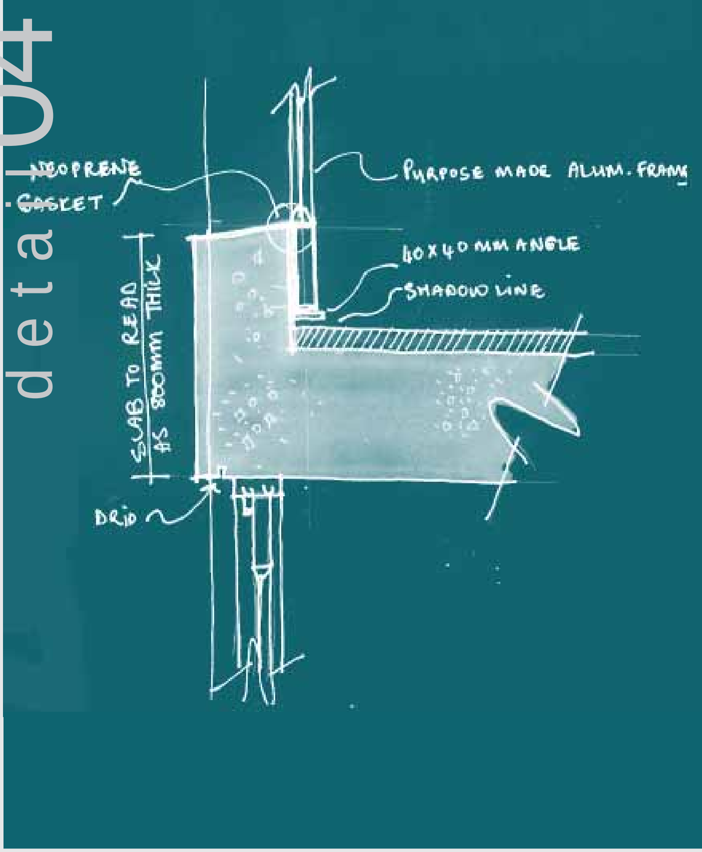
detail 02



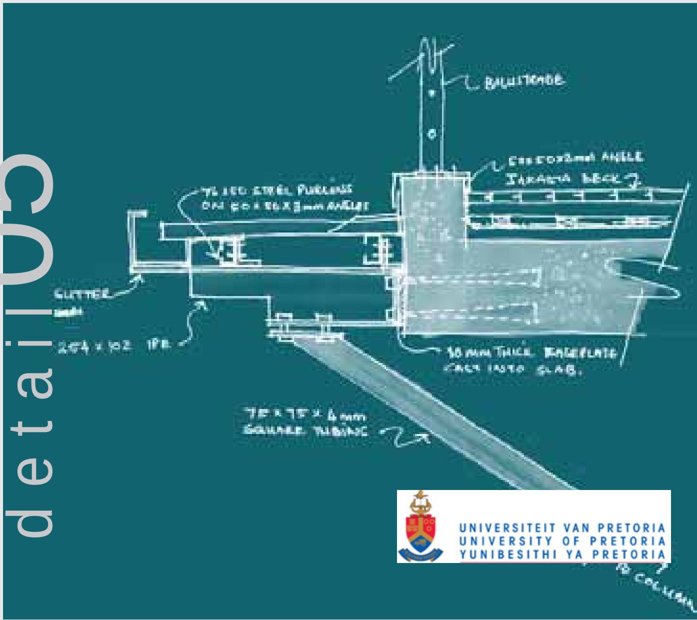
detail 03



detail 04



detail 05



7.3 Environmental systems

7.3.1 Natural systems

Sun Study and Shading Devices

7.3.1.1

The east west orientation of the building provides the ideal opportunity to make use of passive solar control. The sunscreen on the northern side is cladded with a Mentis product (see: tree detail 04) that has angled blade sections. This expanded metal mesh is treated with a mat textured epoxy coat to avoid any glare during summertime. The device eliminates direct summer sun, only allowing reflected light to enter the building while winter sun is allowed entry.

The south facing side enjoys south light ideal for office practice and usually glare free. The east and western facades of the building is limited to minimal surface areas and openings are treated with vertical louvers (east & west).

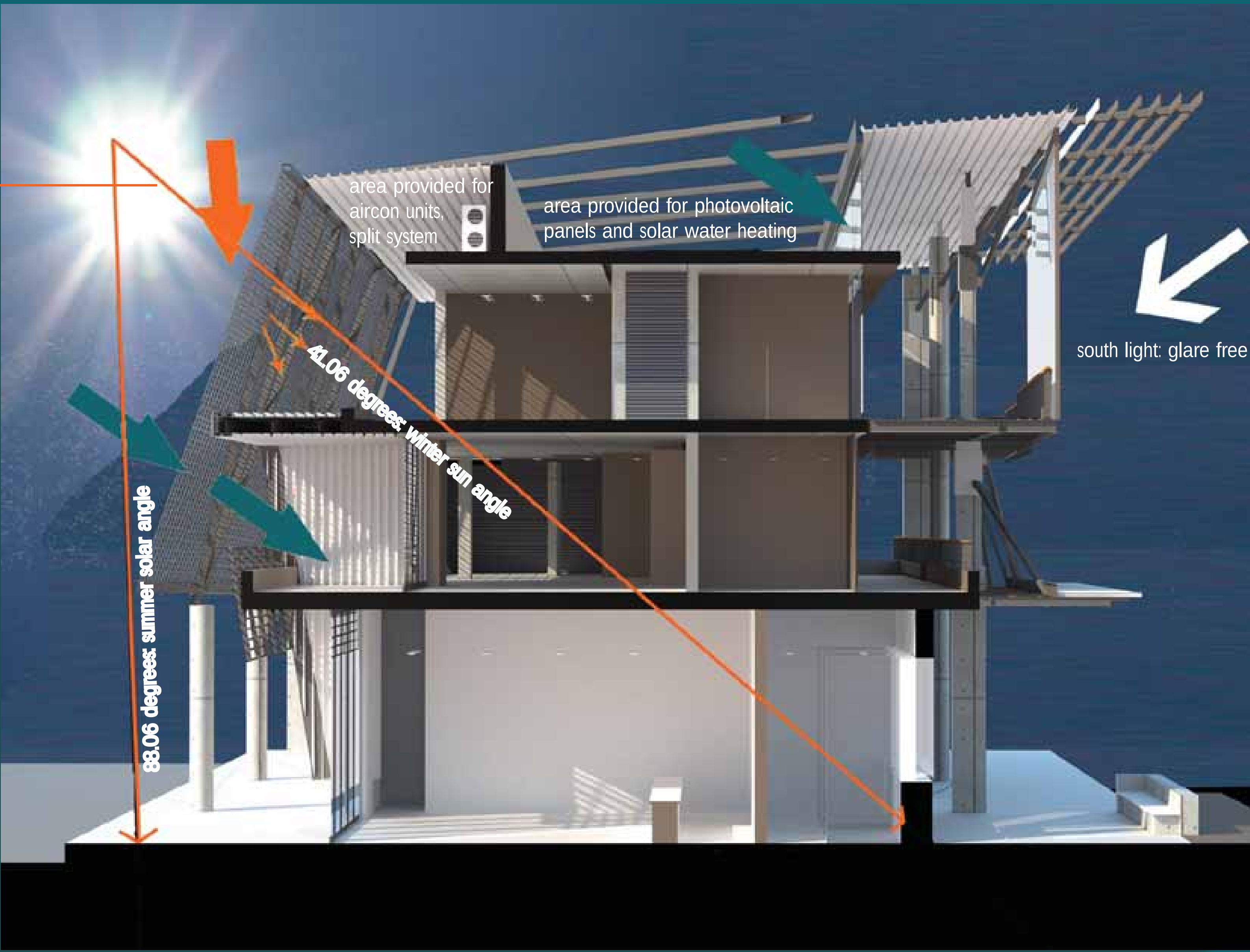

area provided for
aircon units,
split system
area provided for photovoltaic
panels and solar water heating
south light: glare free
41.06 degrees: winter sun angle
88.06 degrees: summer solar angle

Fig. 7.51

Fig. 7.52: 21 January 12pm

Fig. 7.53: 21 February 12pm

Fig. 7.54: 21 March 12pm

Fig. 7.55: 21 April 12pm

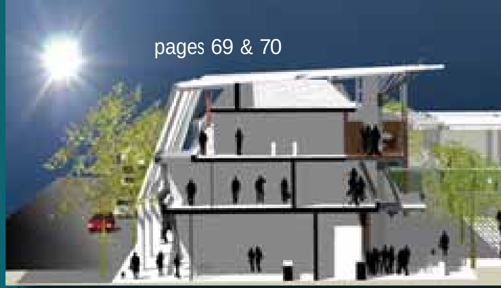


Fig. 7.56: 21 May 12pm

Fig. 7.57: 21 June 12pm

Fig. 7.58: 21 July 12pm

Fig. 7.59: 21 August 12pm

The following twelve images forms part of an annual sun study. This study was undertaken in order to make decisions as to the optimization of microclimate with focus on the external space between the buildings. The square has been designed to provide choice as to sunny spaces and shaded spaces. A 200x200mm by 50mm thick cobble paving will provide heat during night time by means of radiation. The study was undertaken at the 21st of each month @ 12:00pm.

Fig. 7.60: 21 September 12pm

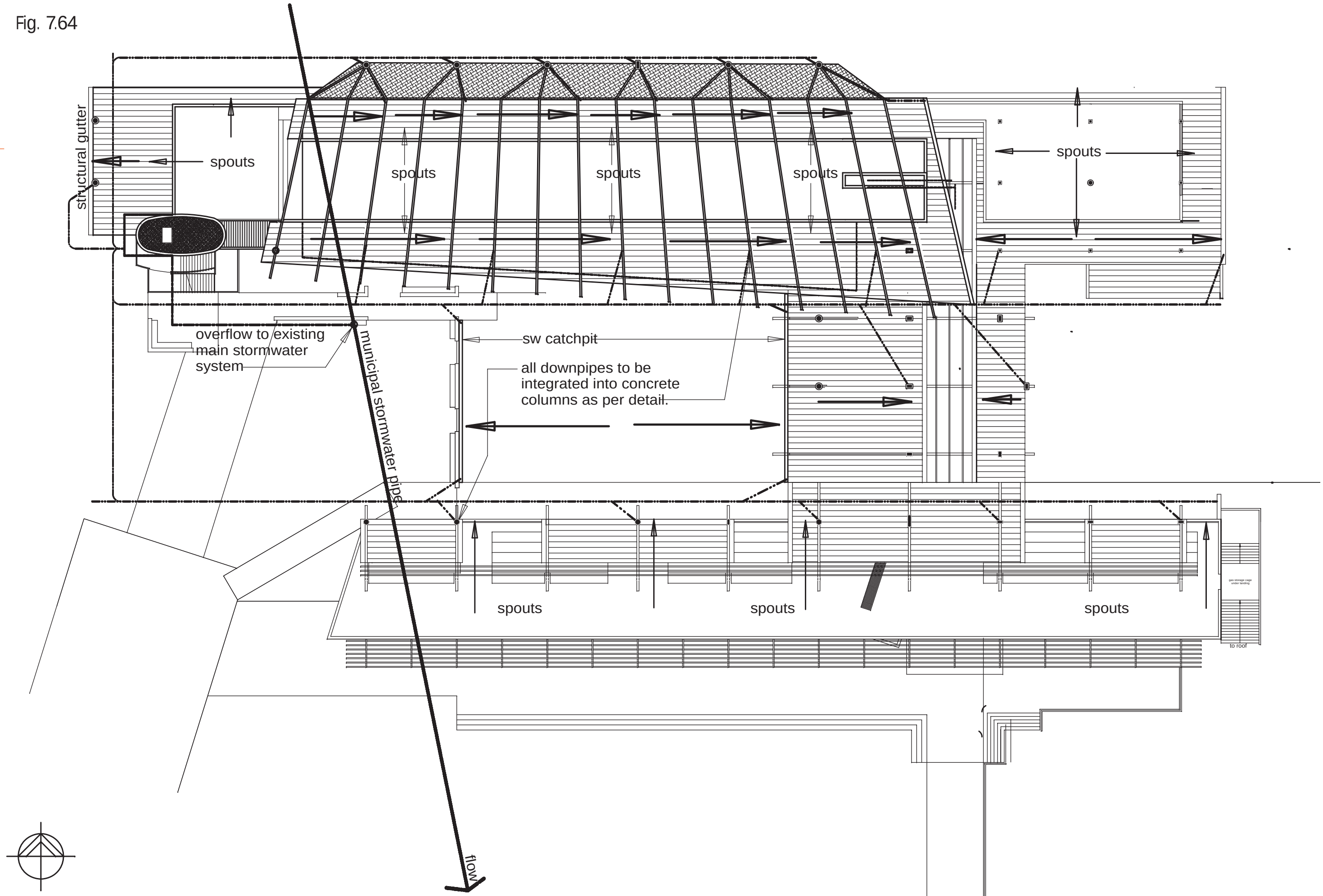
Fig. 7.61: 21 October 12pm

Fig. 7.62: 21 November 12pm

Fig. 7.63: 21 December 12pm

7.3.1.2 Rainwater harvesting and storage

Fig. 7.64



stormwater lay-out plan (scale 1:550)

Rainwater storage

Due to this natural supply of fresh water, the proposed building is adapted to make use of stored rainwater and use most surfaces to collect stormwater. The hard surfaces (i.e. the student square) are serviced by stormwater catch pits while all other surfaces are permeable to allow for ground penetration.

Stormwater is collected in a holding tank below ground level on the western side of the building. When this 35.64cubic metre tank reaches two thirds of its capacity a fully submersible pump (driven by solar energy) pumps the water into a storage tank situated directly above. This tank forms a tower that provides the necessary head pressure and doubles up as a landmark and orientation beacon.

After passing through a filter system the stormwater will service all water closets and refuse rooms while being used in an evaporative cooling system (fine spray over entertainment areas) during peak summer times. Surplus water will be used to water the greenery around the intervention while during heavy showers an overflow is provided to the municipal stormwater system to prevent flooding. The storage tank is connected to municipal water supply in order to discharge daily demands.

- Rainwater calculations: -

Roof areas:

Main building: 1363 sqm
Fast food building: 800 sqm
Eating area: 542 sqm
Total catchment area: 2705 sqm

Tank sizes:

Holding tank: 35 640 l
Storage tank: 108 500 l
Total storage potential: 144 140 l

Capacity design population +/- 3000 persons/day
Wc usage 2650x8 l = 21 200 l x 20(weekdays) = 424 000 l
Precipitation:
Max monthly (January) 136mm = 0.136x2705=367880 l x 0.85 (15% evaporation) = 312 698 l
Min monthly (July) 3mm = 0.003x2705=8 115 l x 0.85 (15% evaporation) = 6 897 l
Thus @ maximum rainfall there is a shortfall of 111 302 l
@ Minimum rainfall there is a shortfall of 417 103 l

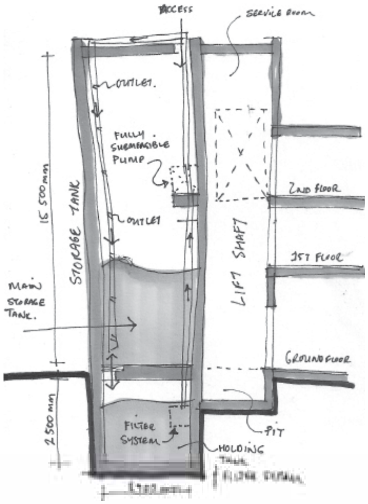
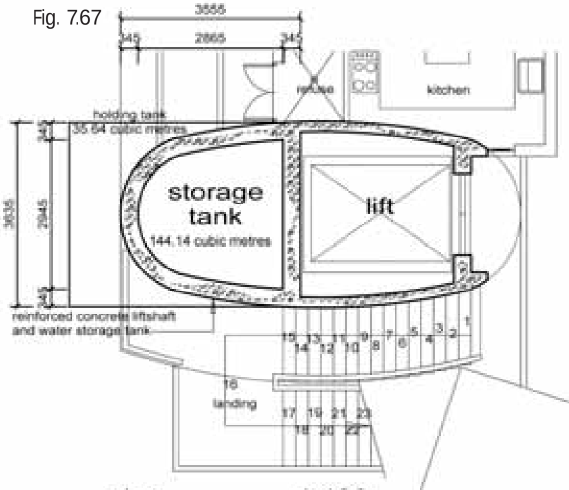


Fig. 7.66

Fig. 7.67



plan 1:100
(water storage tank)

Month	Temperature (° C)				Precipitation		
	Highest Recorded	Average Daily Maximum	Average Daily Minimum	Lowest Recorded	Average Monthly (mm)	Average Number of days with >= 1mm	Highest 24 Hour Rainfall (mm)
January	36	29	18	8	136	14	160
February	36	28	17	11	75	11	95
March	35	27	16	6	82	10	84
April	33	24	12	3	51	7	72
May	29	22	8	-1	13	3	40
June	25	19	5	-6	7	1	32
July	26	20	5	-4	3	1	18
August	31	22	8	-1	6	2	15
September	34	26	12	2	22	3	43
October	36	27	14	4	71	9	108
November	36	27	16	7	98	12	67
December	35	28	17	7	110	[illegible]	[illegible]
Year	**36**	**25**	**12**	**-6**	**674**	[illegible]	[illegible]

Fig. 7.65 Thirty year ave. as per South African Weather Service.

7.3.2 Artificial systems

7.3.2.1 Refuse

Due to the absence of a basement level shops are provided with small temporary refuse rooms cleaned every morning before business commences. These refuse are gathered and kept in the main refuse area where it is removed twice weekly.

Refuse rooms are all supplied with floor traps and taps while the doors are rodent proof.

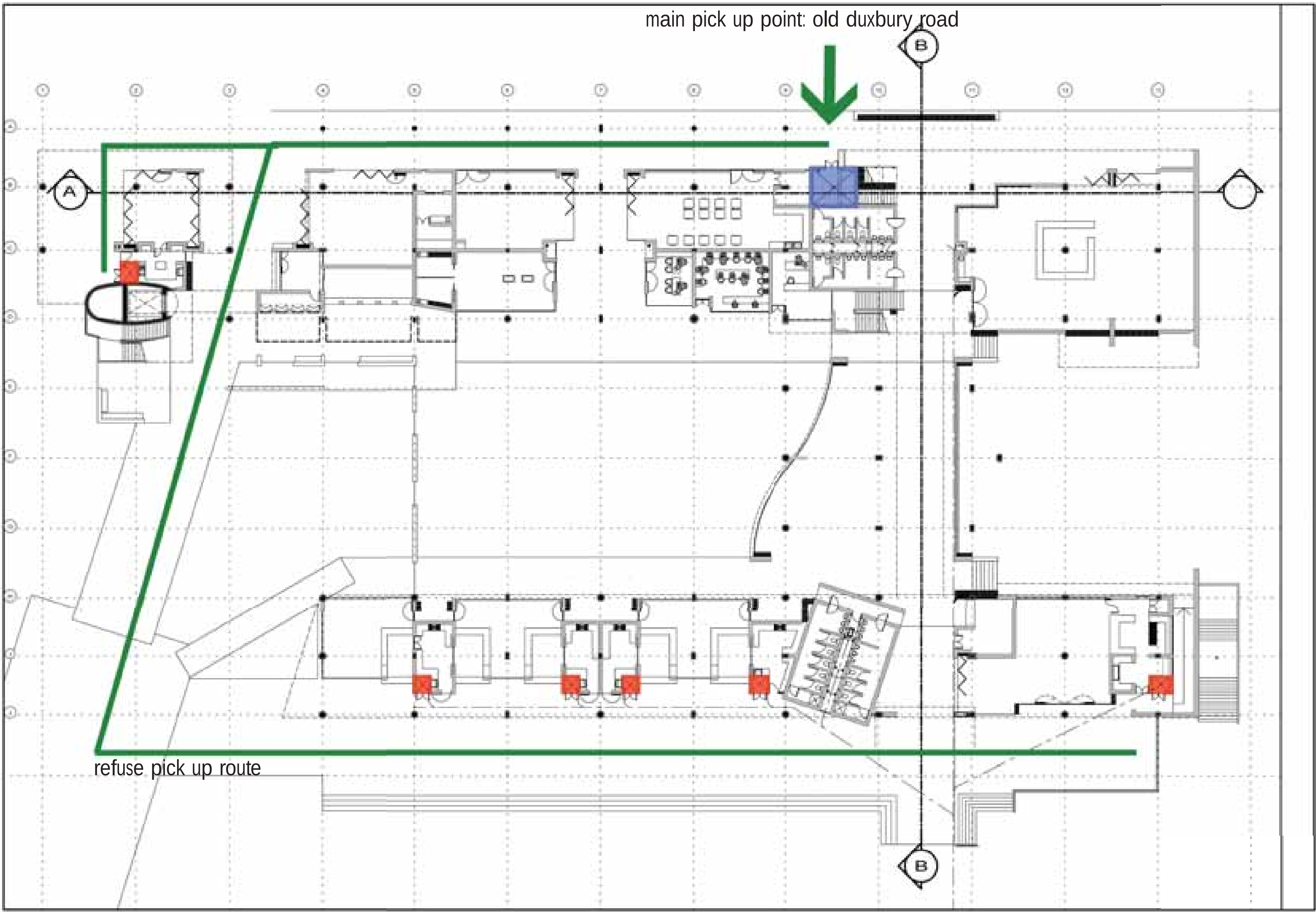


Fig. 7.68 Refuse strategy plan 1:550

7.3.2.2 Fire protection:

The following will form part of section 3 in compliance with SANS 0400 Part T.

The proposed building is non-smoking and no smoking will be permitted even on balcony areas. Safety distances to other buildings: Western side: 15 400mm Eastern side: 16 300mm. Structural members to have a fire rating of 120minutes with all structural steel treated with min. 38mm Pearlite spray on plaster to comply with Part TT7.

Emergency route lighting to be 0.3 to 0.5 lux.

The building is provided with an alarm system that can be manually operated and automatic smoke detector alarms.

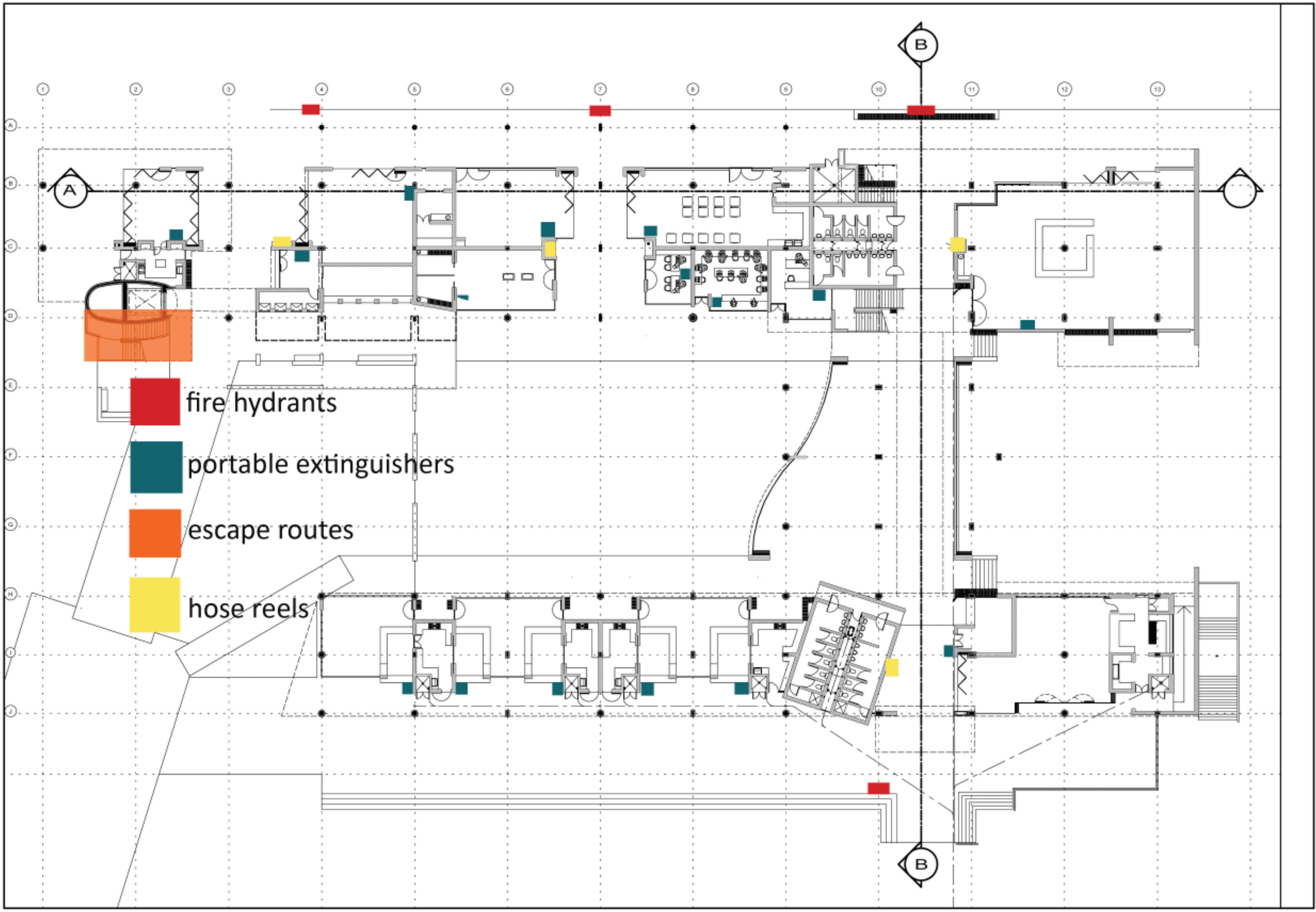


Fig. 7.69: Fire plan (ground floor 1:550)

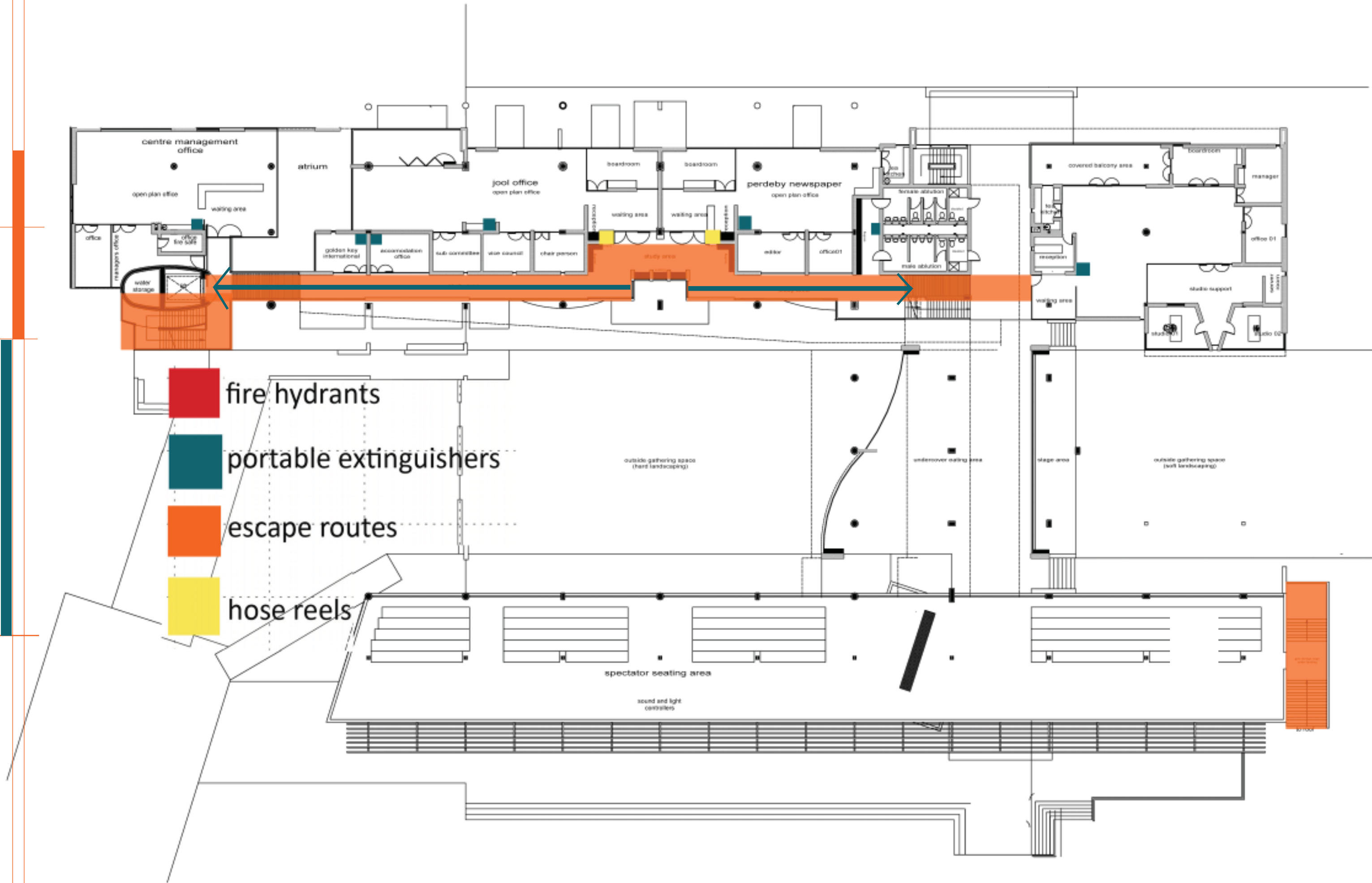


Fig. 7.70: Fire plan (1st floor 1:550)

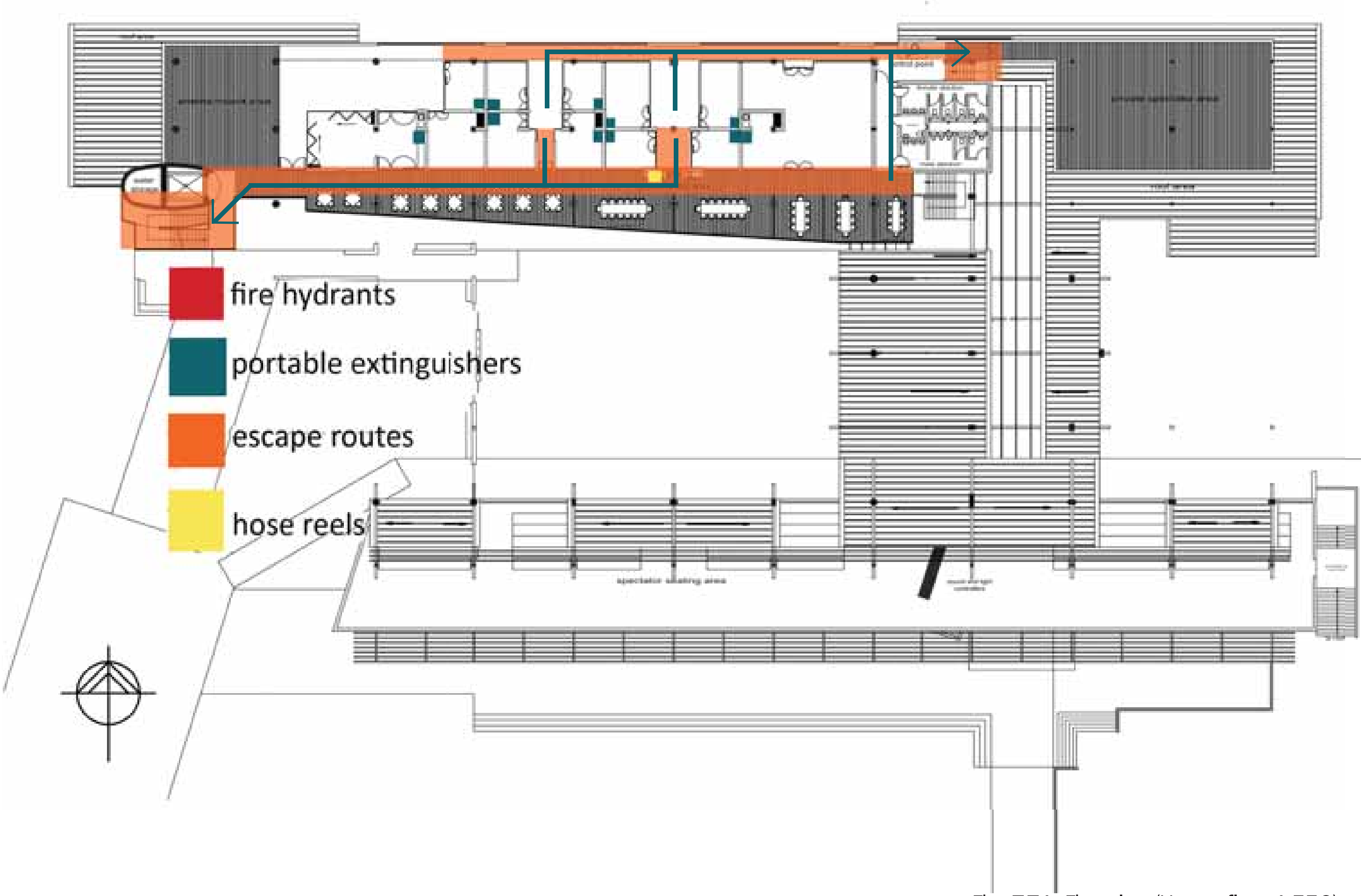


Fig. 7.71: Fire plan (Upper floor 1:550)

7.3.2.3 Drainage

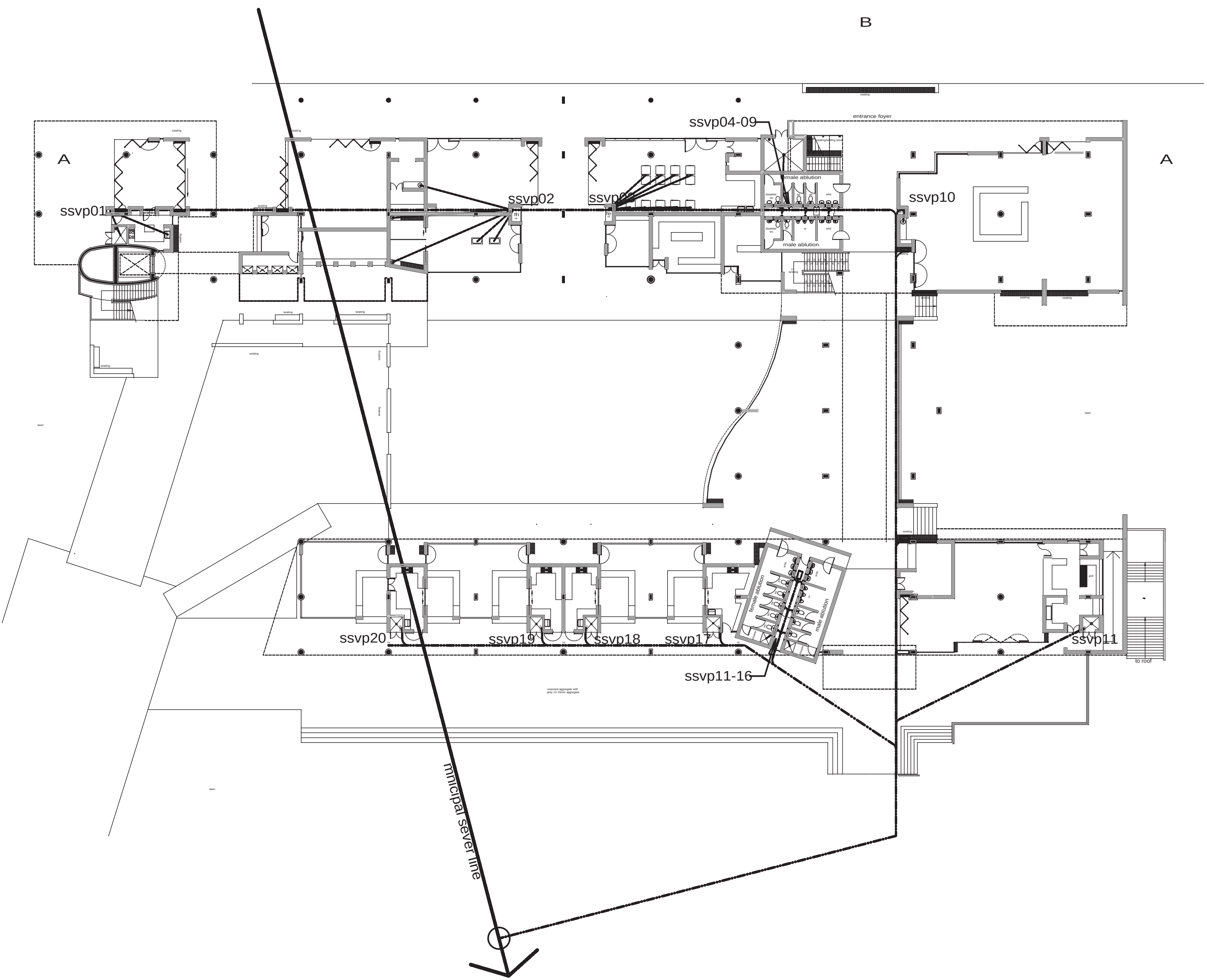


Fig. 7.72: drainage lay-out (

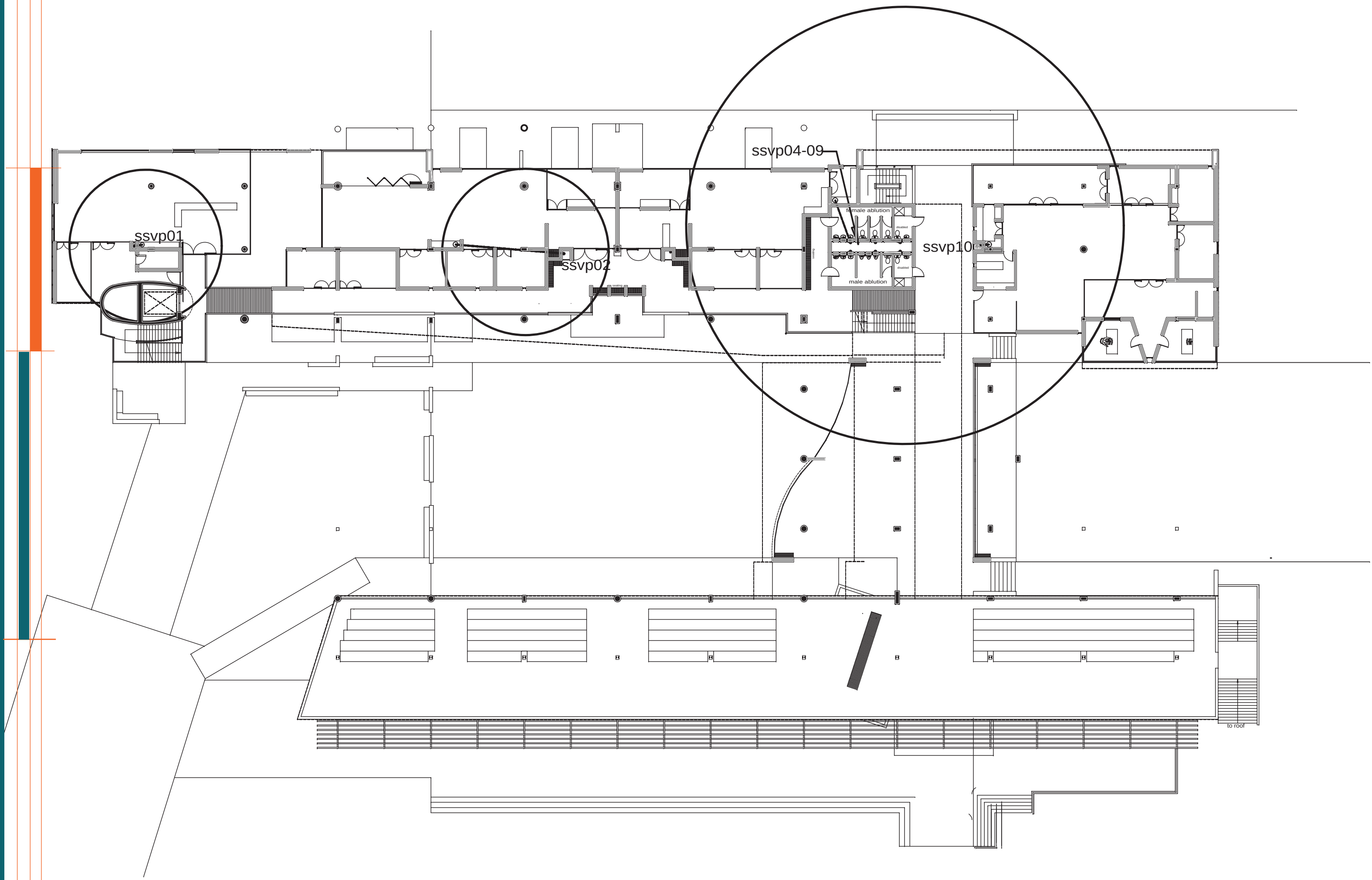


Fig. 7.73: drainage lay-out (1st floor 1:550)

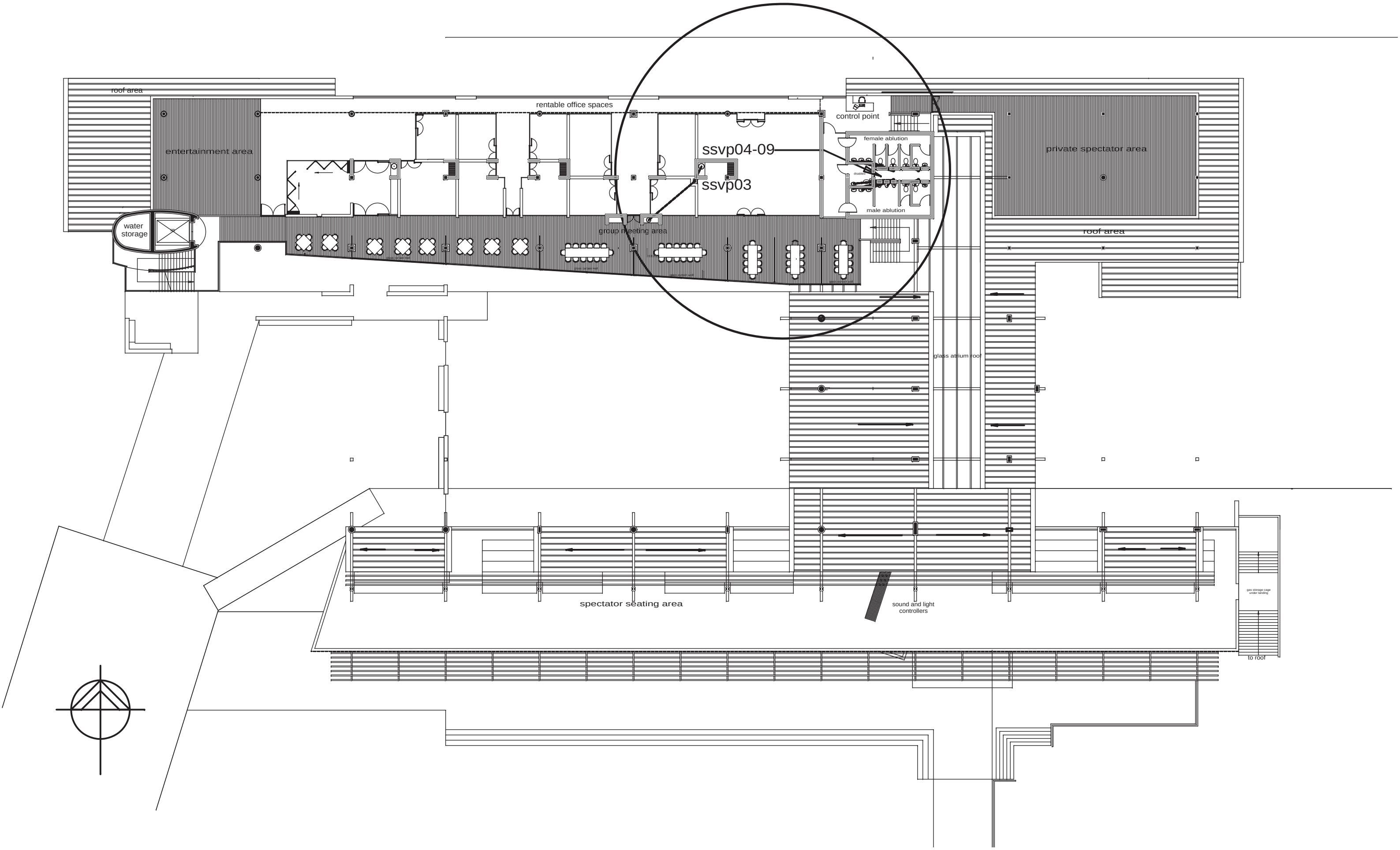


Fig. 7.74: drainage lay-out (Upper floor 1:550)

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7.3.3 Hybrid systems

7.3.3.1 Photovoltaic Photosynthesis:

pages 83 & 84

The term "hybrid systems" refer to systems that make use of natural conditions to supply artificial systems. Systems like photovoltaic panels and solar water heating are discussed.

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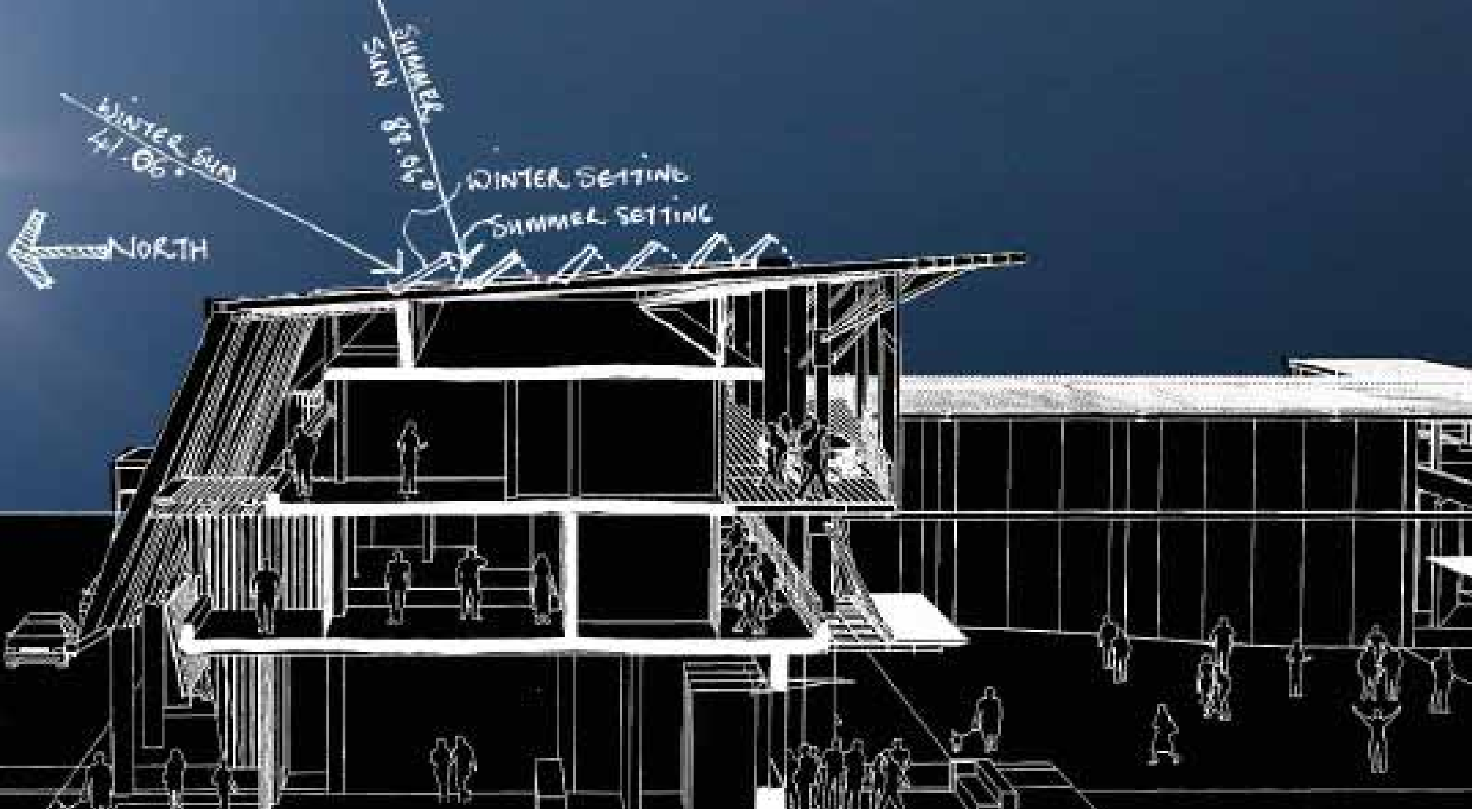

Fig. 7.75

The chosen photovoltaic system is a "Dual Axis Photovoltaic-Grid Intertie". This system makes use of an array of panels 1000x2200mm (capable of converting 170W) that is manually set to one of two settings. The first is flat on the roof of the main building (@ 3 degrees) as a summer setting and at 48.94% normal to the rays of the winter sun.

The panels are mounted on the roof structure of the main building between every second bay to allow sun to heat up the roof slab underneath to provide the top floor of the building with passive heating. This arrangement allows for about 100 panels. Where 18 panels is sufficient to supply a medium sized house, 100 panels are equivalent to about 5.5 medium sized houses (Ryker, 2007:55).

The use of a battery bank was considered but due to its limited lifespan and high maintenance costs it was decided to use the municipal grid as a storage device. This means that the energy converted by the panels will always be placed back into the grid and energy used will only be provided by the grid (Ryker, 2007:55).

The energy generated will mainly be applied to drive the pumps filling the stormwater tanks and night lighting, which is very important considering a socially sustainable intervention.

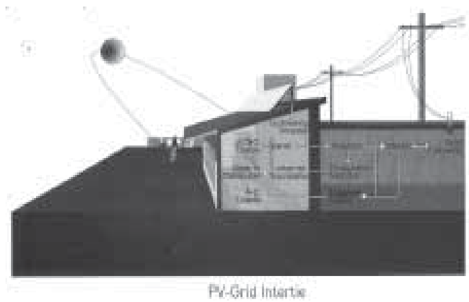

Fig: 7.76: PV-Grid Intertie

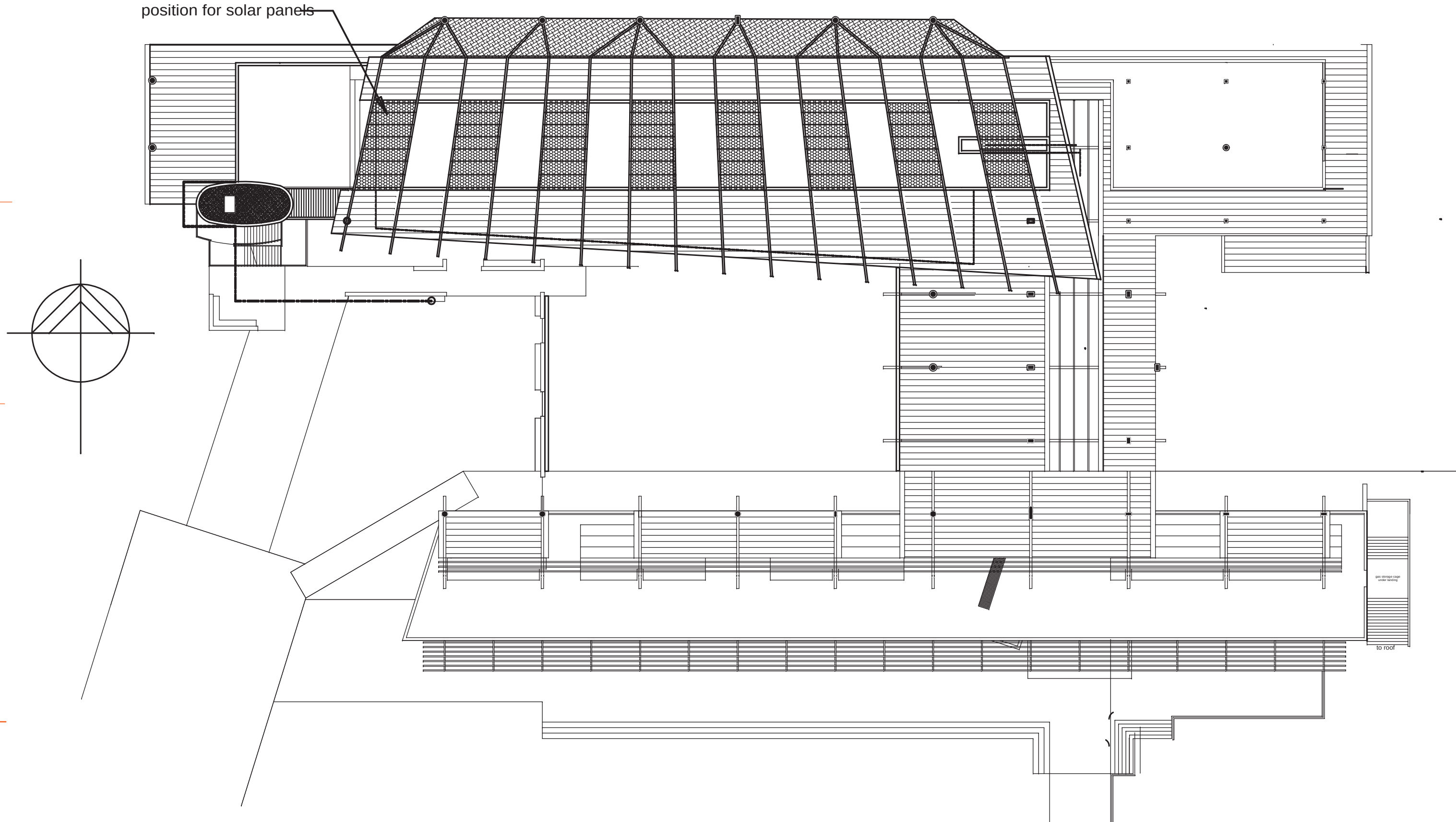

Fig. 7.77: Roofplan (position of Solar Panels) 1:550

Fig. 7.78: Night lighting: Student Square

Fig. 7.79: Night lighting: Northern side.

7.3.3.2 Solar water heating

Fig. 7.80: Direct active system.

This energy conversion method is the most cost effective and successful up to date. (Ryker, 2007:71)

It is proposed to use a Direct Active System where water is pumped using a solar powered pump. Due to heat loss it is also proposed that the system span the length of the main building roof (northern side) in order to establish different tapping points close to the areas where it is needed. The system is therefore treated as a storage system in itself although hot water heaters can be installed in line as the demand grows.

The roofs over the spectator area to the south will also be used to provide hot water to the kitchens below.

7.4 Technical Precedent

Fig. 7.81

Fig. 7.82

Fig. 7.83

Fig. 7.84

Fig. 7.85

Tree House, Higovale, Cape Town By: Van der Merwe Mizevski Architects.

Tree House

Fig. 7.86

Fig. 7.87

Fig. 7.88

This example portrays the technological mimicking of a tree and it's branched in an abstract way. Attention was also given to the detailing of the connections between branch and trunk.

QC Laboritory for the Biovac Institute, Pinelands, Cape Town
By: studioMAS Architects.

In this project the designers explored skin as a separate membrane with many different functions. The perforations investigate shading patterns while the skin hide randomly placed openings behind it. Openings are cut into the skin allowing views and direct sun light. The project is a front-runner of skinned buildings in the South African context, build with profound budget constraints.

QC Laboritory

Fig. 7.89

Nashua Kopano

Nashua Kopano Head Office, Woodmead North Office Park, Johannesburg By: Paragon Architects.

This precedent was chosen only for its intricate detailing. Column details were considered.

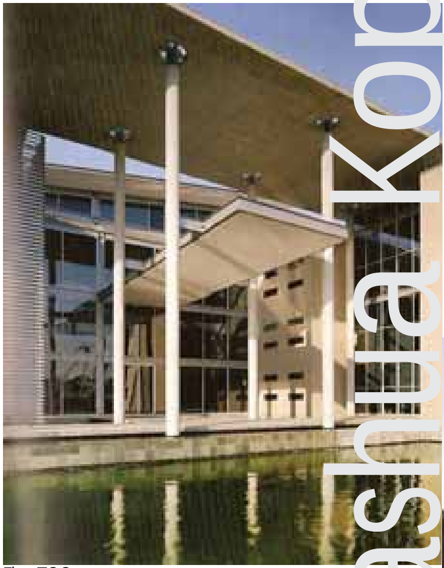

Fig. 7.90

Proud Heritage Campus

Proud Heritage Clothing Campus, Durban By SoundSpaceDesign Architects

These two projects questioned the paradigm of an assembled architecture and came up with two buildings taking the industrial character to new heights. The use of materials forms and the play between solid and light were studied. ■

Fig. 7.91

Fig. 7.92